Tranquility® Compact Belt Drive (TC_L) Series

Commmercial Horizontal and Vertical Packaged Water-Source Heat Pump - 50Hz

Installation, Operation & Maintenance

97B0075N04
Revised: 24 January, 2023

CLIMATEMASTER®
A NIBE GROUP MEMBER

Table of Contents

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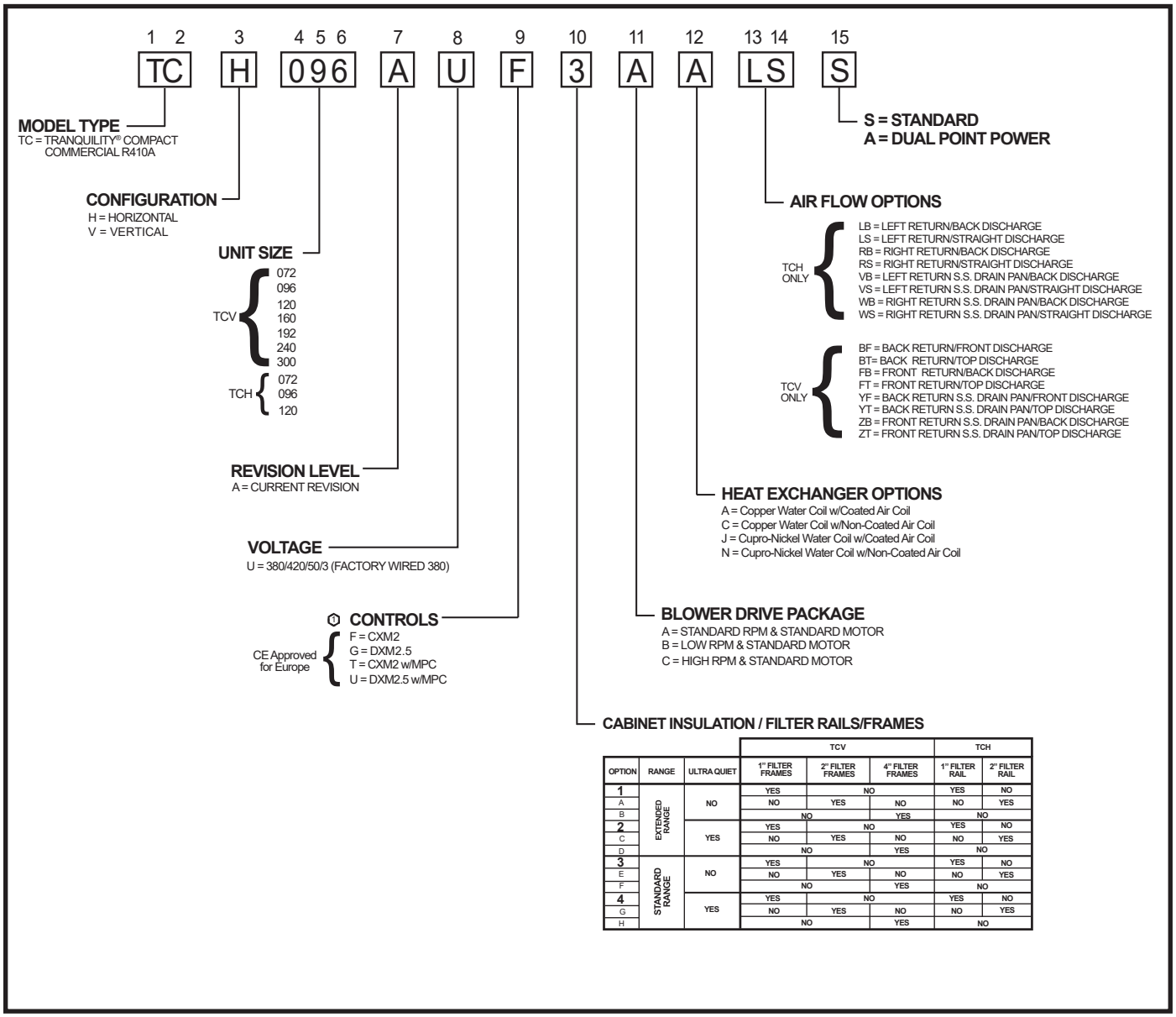
Model Nomenclature



OPTION	RANGE	ULTRA QUIET	TCV			TCH	
			1" FILTER FRAMES	2" FILTER FRAMES	4" FILTER FRAMES	1" FILTER RAIL	2" FILTER RAIL
1	EXTENDED RANGE	NO	YES	NO		YES	NO
A			NO	YES	NO	NO	YES
B			NO		YES	NO	
2		YES	YES	NO		YES	NO
C			NO	YES	NO	NO	YES
D			NO		YES	NO	
3	STANDARD RANGE	NO	YES	NO		YES	NO
E			NO	YES	NO	NO	YES
F			NO		YES	NO	
4		YES	YES	NO		YES	NO
G			NO	YES	NO	NO	YES
H			NO		YES	NO	

General Information

Safety
Warnings, cautions and notices appear throughout this manual. Read these items carefully before attempting any installation, service or troubleshooting of the equipment.

DANGER: Indicates an immediate hazardous situation, which if not avoided will result in death or serious injury. DANGER labels on unit access panels must be observed.

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation or an unsafe practice, which, if not avoided, could result in minor or moderate injury or product or property damage.

NOTICE: Notification of installation, operation or maintenance information, which is important, but which is not hazard-related.

⚠ WARNING! ⚠

WARNING! The EarthPure® Application and Service Manual should be read and understood before attempting to service refrigerant circuits with HFC-410A.

⚠ WARNING! ⚠

WARNING! To avoid the release of refrigerant into the atmosphere, the refrigerant circuit of this unit must be serviced only by technicians who meet local, state, and federal proficiency requirements.

⚠ CAUTION! ⚠

CAUTION! To avoid equipment damage, DO NOT use these units as a source of heating or cooling during the construction process. The mechanical components and filters can quickly become clogged with construction dirt and debris, which may cause system damage and void product warranty.

⚠ WARNING! ⚠

WARNING! The installation of water-source heat pumps and all associated components, parts, and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ WARNING! ⚠

WARNING! All refrigerant discharged from this unit must be recovered WITHOUT EXCEPTION. Technicians must follow industry accepted guidelines and all local, state, and federal statutes for the recovery and disposal of refrigerants. If a compressor is removed from this unit, refrigerant circuit oil will remain in the compressor. To avoid leakage of compressor oil, refrigerant lines of the compressor must be sealed after it is removed.

Inspection - Upon receipt of the equipment, carefully check the shipment against the bill of lading. Make sure all units have been received. Inspect the packaging of each unit, and inspect each unit for damage. Ensure that the carrier makes proper notation of any shortages or damage on all copies of the freight bill and completes a common carrier inspection report. Concealed damage not discovered during unloading must be reported to the carrier within 15 days of receipt of shipment. If not filed within 15 days, the freight company can deny the claim without recourse. Note: It is the responsibility of the purchaser to file all necessary claims with the carrier. Notify your equipment supplier of all damage within fifteen (15) days of shipment.

Storage - Equipment should be stored in its original packaging in a clean, dry area. Store units in an upright position at all times.

Unit Protection - Cover units on the job site with either the original packaging or an equivalent protective covering. Cap the open ends of pipes stored on the job site. In areas where painting, plastering, and/or spraying has not been completed, all due precautions must be taken to avoid physical damage to the units and contamination by foreign material. Physical damage and contamination may prevent proper start-up and may result in costly equipment clean-up.

Examine all pipes, fittings, and valves before installing any of the system components. Remove any dirt or debris found in or on these components.

Pre-Installation - Installation, Operation, and Maintenance instructions are provided with each unit. Horizontal equipment is designed for installation above false ceiling or in a ceiling plenum. Other unit configurations are typically installed in a mechanical room. The installation site chosen should include adequate service clearance around the unit. Before unit start-up, read all manuals and become familiar with the unit and its operation. Thoroughly check the system before operation.

Prepare units for installation as follows:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Keep the cabinet covered with the original packaging until installation is complete and all plastering, painting, etc. is finished.
3. Verify refrigerant tubing is free of kinks or dents and that it does not touch other unit components.
4. Inspect all electrical connections. Connections must be clean and tight at the terminals.
5. Some airflow patterns and some control box locations are field convertible. Locate the conversion section of this IOM.

⚠ CAUTION! ⚠

CAUTION! All three phase scroll compressors must have direction of rotation verified at start-up. Verification is achieved by checking compressor Amp draw. Amp draw will be substantially lower compared to nameplate values. Additionally, reverse rotation results in an elevated sound level compared to correct rotation. Reverse rotation will result in compressor internal overload trip within several minutes. Verify compressor type before proceeding.

⚠ CAUTION! ⚠

CAUTION! DO NOT store or install units in corrosive environments or in locations subject to temperature or humidity extremes (e.g., attics, garages, rooftops, etc.). Corrosive conditions and high temperature or humidity can significantly reduce performance, reliability, and service life. Always move and store units in an upright position. Tilting units on their sides will cause equipment damage.

⚠ CAUTION! ⚠

CAUTION! CUT HAZARD - Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing heat pumps.

Tranquility® Compact Belt Drive (TC_L) Series

Rev.: 24 January, 2023

Unit Physical Data

Model	072	096	120
Compressor	Scroll		
Number of Circuits (Compressors)	2		
Factory Charge HFC-410a (oz) [kg] per circuit	1.7	2.15	2.27
Blower Motor			
Blower Motor Quantity	1		
Standard Motor kW	.75	1.12	2.23
Blower			
No. of Blowers	1		
Blower Wheel Size D x W cm	30.48 x 30.48		
Water Connection Size			
FPT (in) [mm]	1-1/4" [31.8]		1-1/2" [38.1]
Coax Volume			
Volume liters	6.13	6.85	9.08
Condensate Connection Size			
FPT (in) [mm]	3/4" [19.1]		
Air Coil Data			
Air Coil Dimensions H x W cm	81.28 x 86.36	91.44 x 91.44	
Air Coil Total Face Area (m^2)	7.6 0.71	9.0 0.84	
Air Coil Tube Size (cm)	0.953		
Air Coil Fin Spacing (fins per cm)	5.5		
Air Coil Number of Rows	3		
Miscellaneous Data			
Filter Standard - 25.4mm Throwaway (qty) cm	(QTY.3) 40.6 x 50.8 & (QTY.1) 50.8 x 50.8		
Weight - Operating kg	265.8	292.1	316.6
Weight - Packaged kg	283.9	310.3	334.8

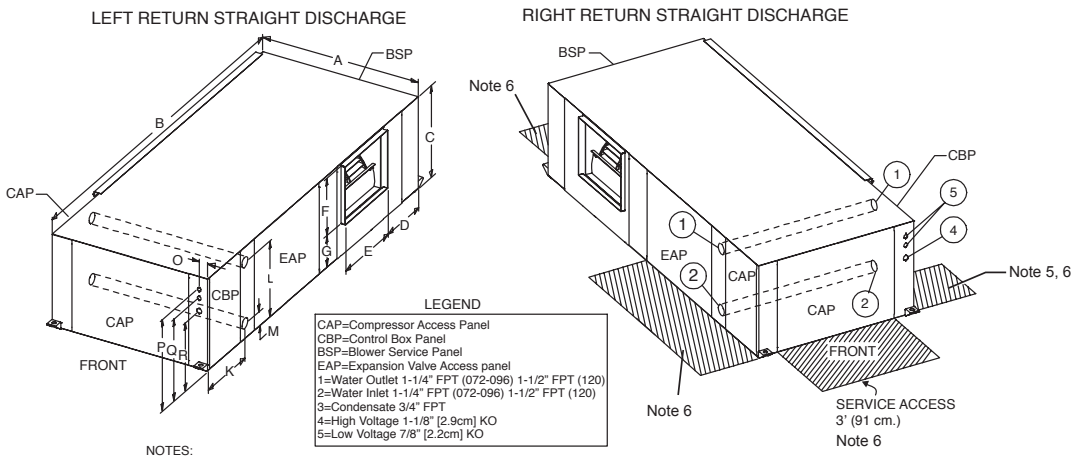
All units have grommet compressor mountings, and 2.2cm & 2.9cm electrical knockouts.

Unit Maximum Water Working Pressure	Max Pressure [kPa]
Base Unit	3447

TCH072-120 Corner Weights

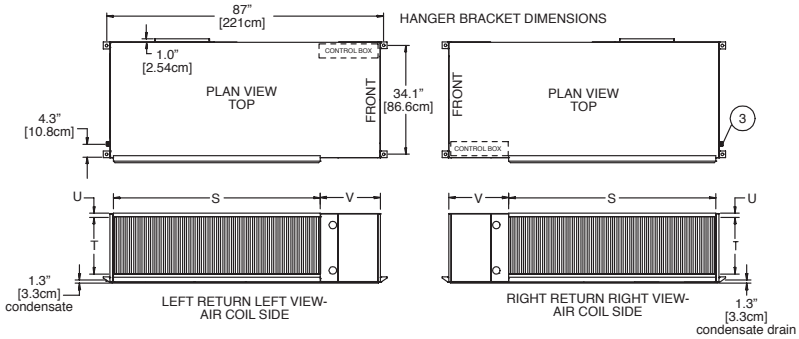
	TC_LH072	TC_LH096	TC_LH120
Weight - Operating (lbs) [kg]	586 [265.8]	644 [292.1]	698 [316.6]
Weight - Packaged (lbs) [kg]	626 [283.9]	684 [310.3]	738 [334.8]
Weight - Corner - Control box/ Compressor side (lbs) [kg]	235 [106.6]	254 [115.2]	271 [122.9]
Weight - Corner - Compressor side (lbs) [kg]	101 [45.8]	120 [54.4]	137 [62.1]
Weight - Corner - Blower side (lbs) [kg]	180 [81.6]	190 [86.2]	200 [90.7]
Weight - Corner - Air Coil side (lbs) [kg]	70 [31.8]	80 [36.3]	90 [40.8]

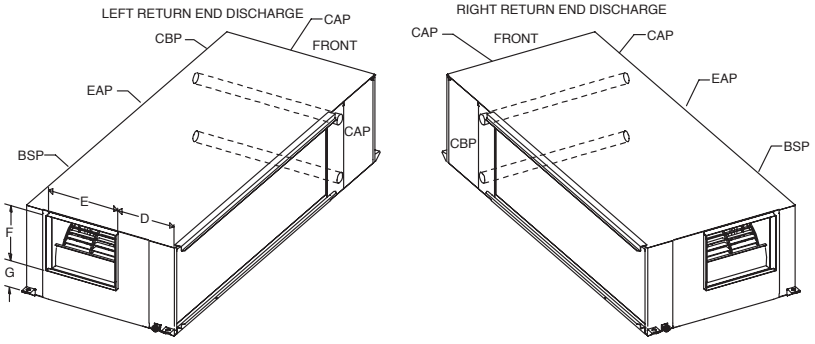
TCH072-120 Dimensional Data



NOTES:
- All dimensions in table are inches (cm).

1. Service access is required for all removable panels and installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Water inlet and water outlet connections are available on either side (left or right) of the unit. Qty (2x) MPT Plugs are shipped loose in a plastic bag tied to the water leg in front of the unit. Installer must plug water inlet/outlet side not being connected to.
3. Condensate drain is 3/4" FPT and is located on cabinet end opposite the compressor.
4. Electrical access is available on either side (left or right) of the front.
5. Electric box is on right side. It can be field converted to left side. Conversion should only be attempted by qualified service technician. If electric box relocated to opposite side, and water connected to opposite side, then this access is not required.
6. Units require 3' (9.1 cm) clearance for water connections, CAP, CBP, EAP and BSP service access.
7. Overall cabinet width dimensions does not include filter rail and duct flange.
8. Units are shipped with air filter rails that are not suitable for supporting return air ductwork. An air filter frame with duct mounting collar is available as an accessory.





TCH072-120 Dimensional

Model		Overall Cabinet			Discharge Connections Duct Flange				Water Connections			Electrical Knockouts				Return Air Connections Using Return Air Opening			
		A	B	C	D	E	F	G	K	L	M	O	P	Q	R	S	T	U	V
		Depth	Width	Height		Supply Depth	Supply Width	Supply Height		1 Water Outlet	2 Water Inlet					Return Depth	Return Height		
072-120	cm.	92.2	215.6	54.9	35.6	43.2	34.3	19.8	38.1	21.1	10.2	5.1	47.8	42.7	35.1	165.1	45.7	2.5	48.0

TCV Physical Data

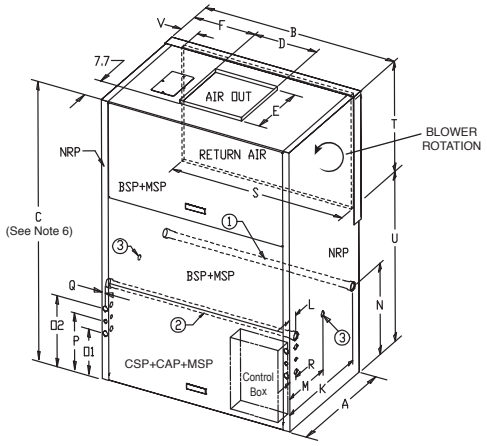
Model	072	096	120	160	192	240	300
Compressor	Scroll						
Number of Circuits (Compressors)	2						
Factory Charge HFC-410a - (oz) [kg] per circuit	60 [1.70]	76 [2.15]	80 [2.27]	112 [3.18]	136 [3.86]	196 [5.56]	224 [6.35]
Blower Motor							
Blower Motor Quantity	1						
Standard Motor (hp) [kw]	1 [.75]	2 [1.49]	3 [2.23]	3 [2.24]	3 [2.24]	5 [3.73]	7.5 [5.60]
*Optional Large Motor (hp) [kw]	2 [1.49]	3 [2.24]	5 [3.73]	5 [3.73]	5 [3.73]	7.5 [5.59]	10 [7.46]
Blower							
No. of Blowers	1			2			3
Blower Wheel Size D x W (in) [cm]	12 x 12 [30.48 x 30.48]						
Water Connection Size							
FPT (in) [mm]	1-1/4" [31.8]		1-1/2" [38.1]	2" [50.8]			2-1/2" [63.5]
Coax Volume							
Volume (US Gallons) [liters]	1.62 [6.13]	1.81 [6.85]	2.40 [9.08]	3.62 [13.70]	4.83 [18.28]	4.90 [18.55]	7.39 [27.98]
Condensate Connection Size							
FPT (in) [mm]	1" [25.4]						
Air Coil Data							
Air Coil Dimensions H x W (in) [cm]	32 x 34 [81.28 x 86.36]	36 x 36 [91.44 x 91.44]		36 x 76 [91.44 x 193.04]			
Air Coil Total Face Area (ft^2) [m^2]	7.6 [0.71]	9.0 [0.84]		19 [1.77]			
Air Coil Tube Size (in) [cm]	3/8" [0.953]						
Air Coil Fin Spacing (fpi) [fins per cm]	14 [5.5]						12 [4.72]
Air Coil Number of Rows	3			2	3		4
Miscellaneous Data							
Filter Standard - 1" [25.4mm] Throwaway (qty) (in) [cm]	(QTY.4) 20 x 20 [50.8 x 50.8]			(QTY.4) 20 x 25 [50.80 x 63.5] (QTY.2) 20 x 30 [50.80 x 76.2]			
Weight - Operating (lbs) [kg]	586 [265.8]	644 [292.1]	698 [316.6]	1069 [484.9]	1164 [528.0]	1184 [537.1]	1297 [588.3]
Weight - Packaged (lbs) [kg]	626 [283.9]	684 [310.3]	738 [334.8]	1149 [521.2]	1244 [564.3]	1264 [573.3]	1377 [624.6]

***Unit with "F" Blower Drive Package is always Large Motor.**

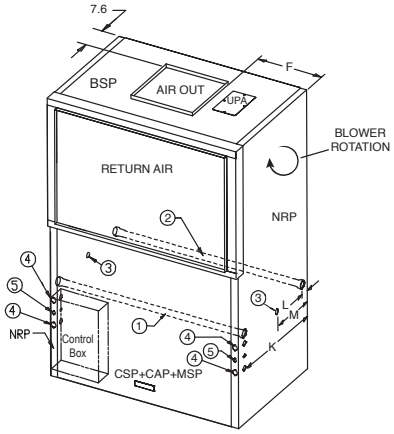
Unit Maximum Water Working Pressure	Max Pressure [kPa]
Base Unit	3447

TCV072-120 Dimensional Data

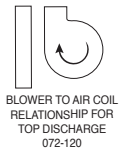
ALL CONFIGURATIONS REQUIRE SERVICE ACCESS AREA DESCRIBED IN NOTES 7, 8, and 9



REAR RETURN TOP DISCHARGE (RR/TD)

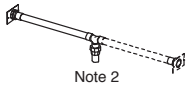


FRONT RETURN TOP DISCHARGE (FR/TD)

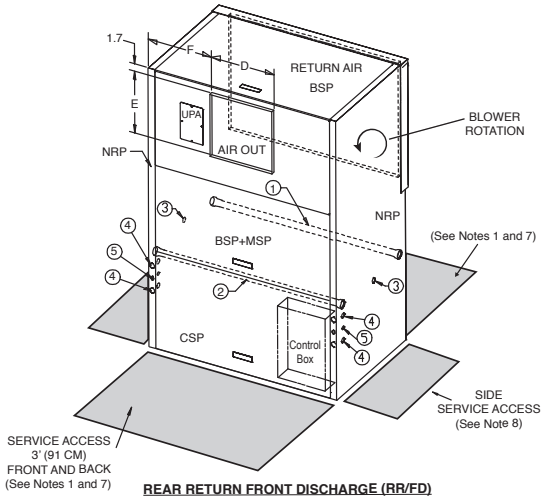


LEGEND	TCV072-096	TCV120
① Water Inlet (See Note 2)	1-1/4" FPT	1-1/2" FPT
② Water Outlet (See Note 2)	1-1/4" FPT	1-1/2" FPT
③ Condensate Drain (See Note 3)	1" FPT	
④ High Voltage Access (See Note 4)	1-3/8" [3.49 CM]	
⑤ Low Voltage Access (See Note 4)	7/8" [2.2 CM]	
BSP - Blower Service Panel CAP - Control Access Panel CSP - Compressor Access Panel MSP - Motor Service Panel NRP - Non Removable Panel UPA - Upper Pulley Access		

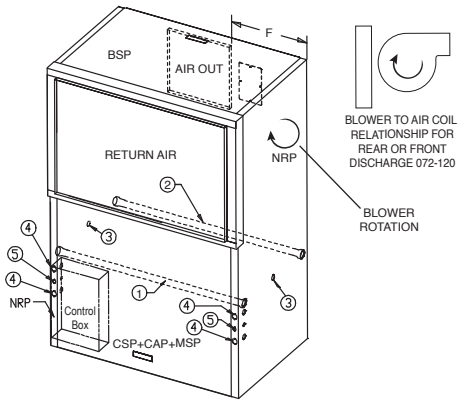
NOTES:
All dimensions in table are inches (cm)
1. While access to all removable panels may not be required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Water inlet and water outlet connections are factory shipped on the left side. Union allows field conversion to right side.
3. Condensate drain is available on either side (left or right) of unit. Drain hose and drain connection will be tied inside the unit. Installer will untie the drain hose, form trap, and connect to the condensate drain hole of installer's choice.
4. Electrical access is available on either side (left or right) of unit and is also available in the front on the left or right side of the unit.
5. Overall width - Add 3.12" (8cm) for 1" (2.5cm) or 2" (5cm) Filter Frame; or 5.12" (13cm) for 4" (10.2cm) and for front or rear supply add additional 1.06" (2.7cm) for supply duct collar.
6. Overall cabinet height dimension does not include duct flange for top discharge configuration.
7. Units require 3 feet(91 cm) clearance, CAP, CSP, MSP and BSP service access.
8. Side service access must be 2 feet (9.4cm) on any side that connections are made.
9. Filter removal is from right or left side of filter frame, allow 2 feet (9.4cm) access for servicing.



ALL CONFIGURATIONS



REAR RETURN FRONT DISCHARGE (RR/FD)

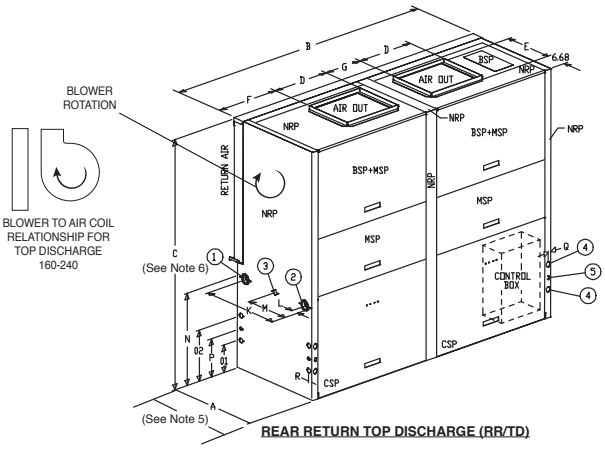


FRONT RETURN REAR DISCHARGE (FR/RD)

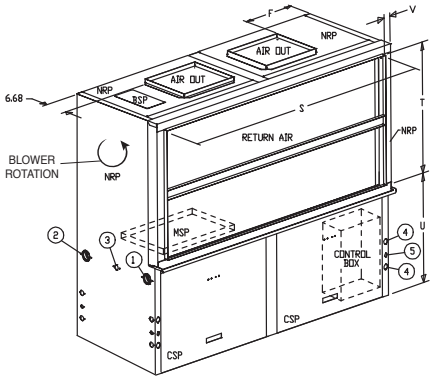
Model		Overall Cabinet			Discharge Connection Duct Flange			Water Connections				Electric Knockouts					Return Air Connections Using Return Air Opening			
		A Depth	B Width	C Height	D Supply Width	E Supply Depth	F	K 1 Water Inlet	L 2 Water Outlet	M 3 Conden-sate	N	O1	O2	P	Q	R	S Return Depth	T Return Height	U	V
072-120	cm.	73.7	104.1	177.2	44.5	37.5	30.2	55.9	18.4	36.8	54.0	20.3	38.1	28.6	2.5	3.8	96.2	74.7	77.8	6.9

TCV160-240 Dimensional Data

ALL CONFIGURATIONS REQUIRE SERVICE ACCESS AREA DESCRIBED IN NOTES 7, 8, and 9

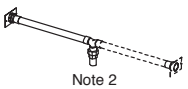


REAR RETURN TOP DISCHARGE (RR/TD)



FRONT RETURN TOP DISCHARGE (FR/TD)

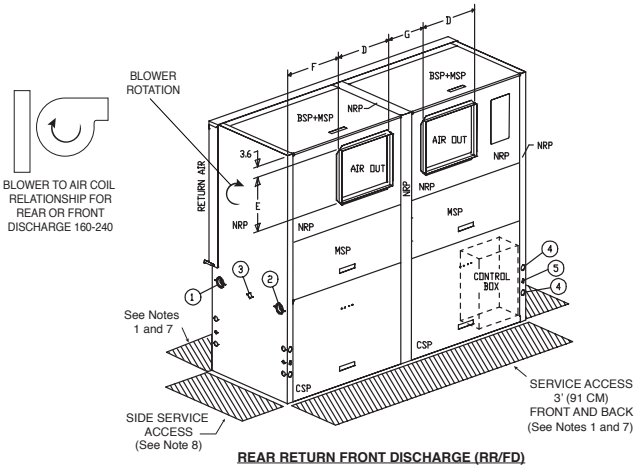
LEGEND	TCV160-240
① WATER INLET (SEE NOTE 2)	2" FPT
② WATER OUTLET (SEE NOTE 2)	2" FPT
③ CONDENSATE DRAIN (SEE NOTE 3)	1" FPT
④ HIGH VOLTAGE ACCESS (SEE NOTE 4)	1-3/8" [3.49 CM]
⑤ LOW VOLTAGE ACCESS (SEE NOTE 4)	7/8" [2.2 CM]
BSP - BLOWER SERVICE PANEL	
CAP - CONTROL ACCESS PANEL	
CSP - COMPRESSOR ACCESS PANEL	
MSP - MOTOR SERVICE PANEL	
NRP - NON REMOVABLE PANEL	



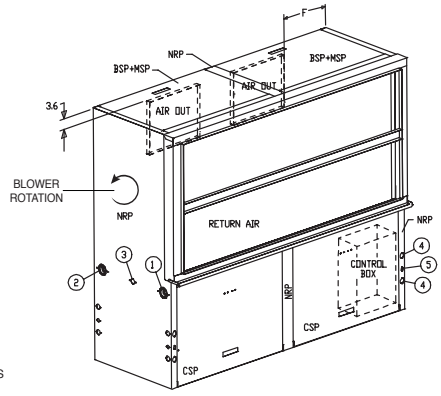
ALL CONFIGURATIONS

NOTES:
All dimensions in table are inches (cm)

1. While access to all removable panels may not be required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Water inlet and water outlet connections are factory shipped on the left side. Union allows field conversion to right side.
3. Condensate drain is available on either side (left or right) of unit. Drain hose and drain connection will be tied inside the unit. Installer will untie the drain hose, form trap, and connect to the condensate drain hole of installer's choice.
4. Electrical access is available on either side (left or right) of unit and is also available in the front on the left or right side of the unit.
5. Overall width - Add 3.12" (8cm) for 1" (2.5cm) or 2" (5cm) Filter Frame; or 5.12" (13cm) for 4" (10.2cm) and for front or rear supply add additional 1.06" (2.7cm) for supply duct collar.
6. Overall cabinet height dimension does not include duct flange for top discharge configuration.
7. Units require 3 feet(91 cm) clearance, CAP, CSP, MSP and BSP service access.
8. Side service access must be 2 feet (9.4cm) on any side that connections are made.
9. Filter removal is from right or left side of filter frame, allow 2 feet (9.4cm) access for servicing.



REAR RETURN FRONT DISCHARGE (RR/FD)

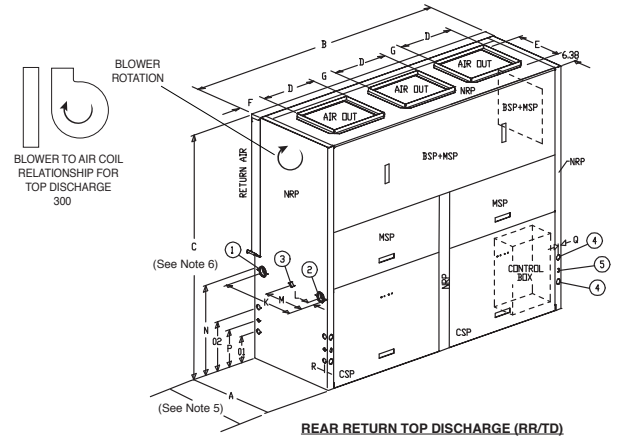


FRONT RETURN REAR DISCHARGE (FR/RD)

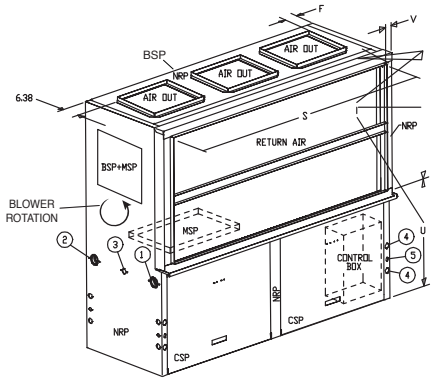
Model		Overall Cabinet			Discharge Connection Duct Flange				Water Connections				Electrical Knockouts					Return Air Connections Using Return Air Opening			
		A	B	C	D	E	F	G	K	L	M	N	O1	O2	P	Q	R	S	T	U	V
		Depth	Width	Height	Supply Width	Supply Depth	Supply Width	Supply Depth	Water Inlet	Water Outlet	Conden-sate							Return Depth	Return Height		
160-240	cm.	73.7	208.3	177.2	44.5	37.5	45.4	29.3	66.3	7.9	36.8	65.5	20.3	38.1	28.6	2.5	3.8	195.6	90.8	80.5	6.7

TCV300 Dimensional Data

ALL CONFIGURATIONS REQUIRE SERVICE ACCESS AREA DESCRIBED IN NOTES 7, 8, and 9

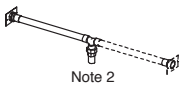


REAR RETURN TOP DISCHARGE (RR/TD)



FRONT RETURN TOP DISCHARGE (FR/TD)

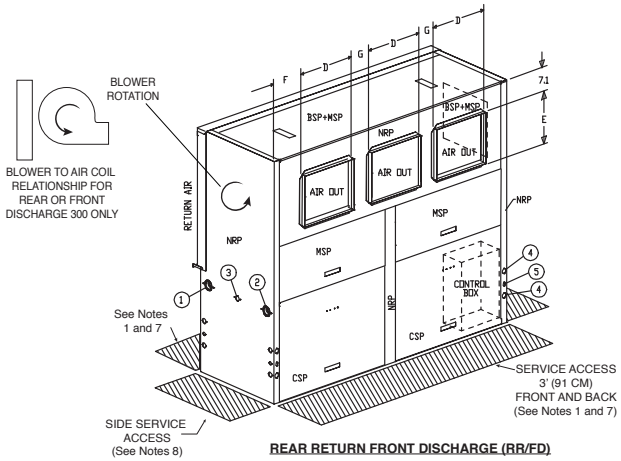
LEGEND	TCV300
① WATER INLET (SEE NOTE 2)	2-1/2" FPT
② WATER OUTLET (SEE NOTE 2)	2-1/2" FPT
③ CONDENSATE DRAIN (SEE NOTE 3)	1" FPT
④ HIGH VOLTAGE ACCESS (SEE NOTE 4)	1-3/8" [3.49 CM]
⑤ LOW VOLTAGE ACCESS (SEE NOTE 4)	7/8" [2.2 CM]
BSP - BLOWER SERVICE PANEL	
CAP - CONTROL ACCESS PANEL	
CSP - COMPRESSOR ACCESS PANEL	
MSP - MOTOR SERVICE PANEL	
NRP - NON REMOVABLE PANEL	



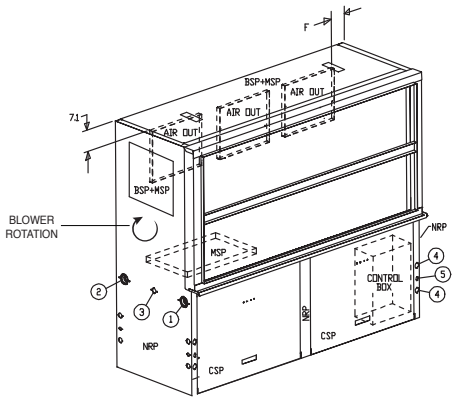
ALL CONFIGURATIONS

NOTES:
All dimensions in table are inches (cm)

1. While access to all removable panels may not be required, installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Water inlet and water outlet connections are factory shipped on the left side. Union allows field conversion to right side.
3. Condensate drain is available on either side (left or right) of unit. Drain hose and drain connection will be tied inside the unit. Installer will untie the drain hose, form trap, and connect to the condensate drain hole of installer's choice.
4. Electrical access is available on either side (left or right) of unit and is also available in the front on the left or right side of the unit.
5. Overall width - Add 3.12" (8cm) for 1" (2.5cm) or 2" (5cm) Filter Frame; or 5.12" (13cm) for 4" (10.2cm) and for front or rear supply add additional 1.06" (2.7cm) for supply duct collar.
6. Overall cabinet height dimension does not include duct flange for top discharge configuration.
7. Units require 3 feet(91 cm) clearance, CAP, CSP, MSP and BSP service access.
8. Side service access must be 2 feet (9.4cm) on any side that connections are made.
9. Filter removal is from right or left side of filter frame, allow 2 feet (9.4cm) access for servicing.



REAR RETURN FRONT DISCHARGE (RR/FD)



FRONT RETURN REAR DISCHARGE (FR/RD)

Model		Overall Cabinet			Discharge Connection Duct Flange				Water Connections				Electrical Knockouts					Return Air Connections Using Return Air Opening			
		A	B	C	D	E	F	G	K	L	M	N	O1	O2	P	Q	R	S	T	U	V
		Depth	Width	Height	Supply Width	Supply Depth	Supply Width	Supply Depth	Water Inlet	Water Outlet	Conden-sate							Return Depth	Return Height		
300	in.	29.0	82.0	69.8	17.5	14.8	6.3	8.6	25.7	3.1	14.5	25.8	8.0	15.0	11.3	1.0	1.5	77.0	35.8	31.7	2.6
	cm.	73.7	208.3	177.2	44.5	37.5	16.0	21.8	65.3	7.9	36.8	65.5	20.3	38.1	28.6	2.5	3.8	195.6	90.9	80.5	6.7

Horizontal Installation

Horizontal Unit Location - Units are not designed for outdoor installation. Locate the unit in an INDOOR area that allows enough space for service personnel to perform typical maintenance or repairs without removing unit from the ceiling. Horizontal units are typically installed above a false ceiling or in a ceiling plenum. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air). Consideration should be given to access for easy removal of the fi lter and access panels. Provide suffi cient room to make water, electrical, and duct connection(s). Allow 91 cm clearance for servicing unit through all access panels.

If the unit is located in a confi ned space, such as a closet, provisions must be made for return air to freely enter the space by means of a louvered door, etc. Any access panel screws that would be diffi cult to remove after the unit is installed should be removed prior to setting the unit. Refer to Figure 3 for an illustration of a typical installation. Refer to unit submittal data or engineering design guide for dimensional data.

Conform to the following guidelines when selecting unit location:

1. Provide a hinged access door in concealed-spline or plaster ceilings. Provide removable ceiling tiles in T-bar or lay-in ceilings. Refer to horizontal unit dimensions for specifi c series and model in unit submittal data. Size the access opening to accommodate the service technician during the removal or replacement of the compressor and the removal or installation of the unit itself.
2. Provide access to hanger brackets, water valves and fi ttings. Provide screwdriver clearance to access panels, discharge collars and all electrical connections.
3. DO NOT obstruct the space beneath the unit with piping, electrical cables and other items that prohibit future removal of components or the unit itself.
4. Use a manual portable jack/lift to lift and support the weight of the unit during installation and servicing.

The installation of water source heat pump units and all associated components, parts and accessories which make up the installation shall be in accordance with the regulations of ALL authorities having jurisdiction and MUST conform to all applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

Mounting Horizontal Units
Horizontal units have 4 hanger brackets partially attached at the factory, one at each corner. Enclosed within the unit there is a hanger kit hardware bag containing vibration isolation grommets, washers, screws and a hanger installation instruction page. One additional screw from the hardware bag must be added to each hanger bracket before unit installation.Tighten each screw to 75 in-lbs (8.5 Nm). See Figure 1. Refer to the hanger installation instruction page contained in the hardware bag for details of fi nal hanger bracket attachment and unit suspension. See Figure 1a.

Use four (4) fi eld supplied threaded rods and factory provided vibration isolators to suspend the unit. Safely lift the unit into position supporting the bottom of the unit. Ensure the top of the unit is not in contact with any external objects. Connect the top end of the 4 all-thread rods, slide rods through the brackets and grommet then assemble washers and double nuts at each rod. Ensure that the unit is approximately level and that the threaded rod extends past the nuts.

Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. On small units (less than 8.8 kW) ensure that unit pitch does not cause condensate leaks inside the cabinet.

Figure 1: Hanger Bracket

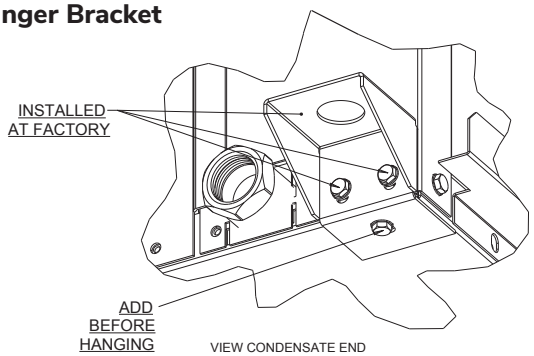
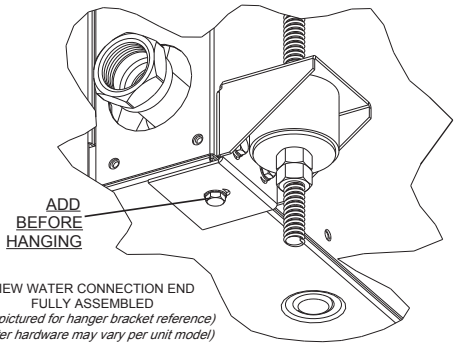


Figure 1a:



Horizontal Installation (continued)

Figure 2: Horizontal Unit Pitch

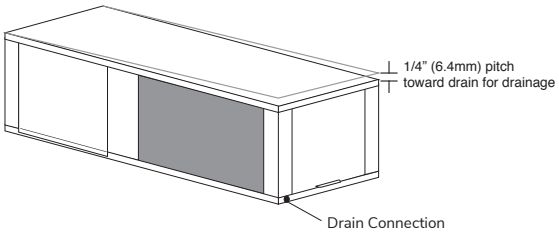
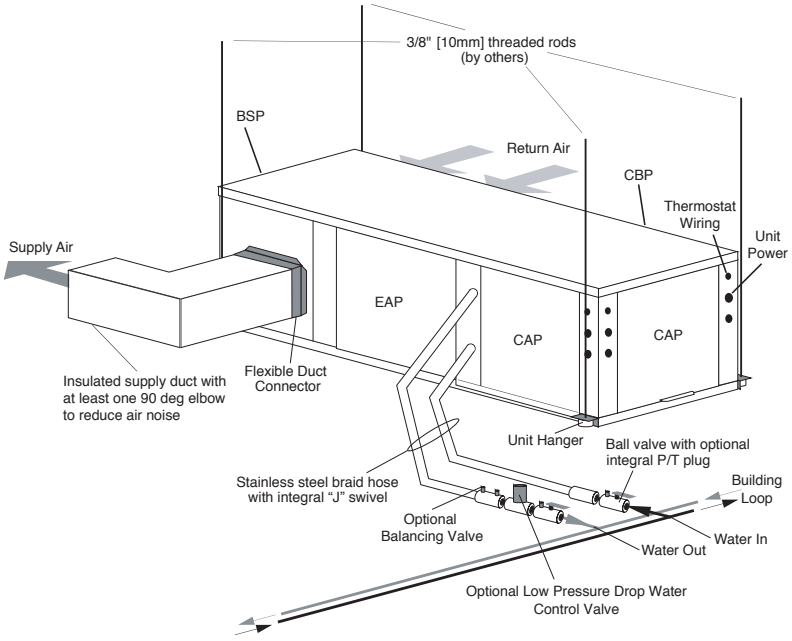


Figure 3: Typical Horizontal Unit Installation



LEGEND

CAP=Compressor Access Panel
CBP=Control Box Panel
BSP=Blower Service Panel
EAP=Expansion Valve Access panel
1=Water Outlet 1-1/4" FPT (072-096) 1-1/2" FPT (120)
2=Water Inlet 1-1/4" FPT (072-096) 1-1/2" FPT (120)
3=Condensate 3/4" FPT
4=High Voltage 1-1/8" [2.9cm] KO
5=Low Voltage 7/8" [2.2cm] KO

NOTES:
- All dimensions in table are inches (cm).

1. Service access is required for all removable panels and installer should take care to comply with all building codes and allow adequate clearance for future field service.
2. Water inlet and water outlet connections are available on either side (left or right) of the unit. Qty (2x) MPT Plugs are shipped loose in a plastic bag tied to the water leg in front of the unit. Installer must plug water inlet/outlet side not being connected to.
3. Condensate drain is 3/4" FPT and is located on cabinet end opposite the compressor.
4. Electrical access is available on either side (left or right) of the front.
5. Electric box is on right side. It can be field converted to left side. Conversion should only be attempted by qualified service technician. If electric box relocated to opposite side, and water connected to opposite side, then this access is not required.
6. Units require 3' (9.1 cm) clearance for water connections, CAP, CBP, EAP and BSP service access.
7. Overall cabinet width dimensions does not include filter rail and duct flange.
8. Units are shipped with air filter rails that are not suitable for supporting return air ductwork. An air filter frame with duct mounting collar is available as an accessory.

Air Coil - To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended for both sides of the coil. A thorough water rinse should follow. **UV based anti-bacterial systems may damage coated air coils.**

Notice! Installation Note - Ducted Return: Many horizontal WSHPs are installed in a return air ceiling plenum application (above ceiling). Vertical WSHPs are commonly installed in a mechanical room with free return (e.g. louvered door). Therefore, filter rails are the industry standard and are included on ClimateMaster commercial heat pumps for the purposes of holding the filter only. For ducted return applications, the filter rail must be removed and replaced with a duct flange or filter frame. Canvas or flexible connectors should also be used to minimize vibration between the unit and ductwork.

TCH Field Conversion of Air Discharge

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation or conversion.

Overview - Horizontal units can be field converted between straight (side) and back (end) discharge using the instructions below.

Note: It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes.

Preparation - Field conversion must be completed on the ground. If the unit is already hung it should be taken down for the field conversion. Place in a well-lighted area. Conversion should only be attempted by a qualified service technician.

Side to Back Discharge Conversion

1. Remove back panel and side access panel
2. Loosen 2 motor slide nuts, raise motor slide assembly and remove belt and motor sheave.
3. Remove blower sheave. Remove motor bolts and carefully remove motor.
4. Remove 2 motor clips and reattach to opposite side.
5. Unbolt (3 per side) complete housing assembly.
6. Rotate complete assembly into new position. Locate over mounting holes in base, reattach using 3 bolts per side.
7. Mount motor, motor sheave, blower sheave and belt. Make sure wires are not pinched and not over sharp edges. Adjust motor downward to tighten belt. Raise or lower motor slide assembly with adjusting bolt and retighten 2 slide nuts. Check for correct tension (See Tensioning V-Belt Drives page). Rewire motor (at contactor) for correct rotation. Spin blower wheel to ensure wheel is not obstructed.
8. Replace 2 panels.

Back to Side Discharge Conversion - If the discharge is changed from back to side, use above instruction noting that illustrations will be reversed.

Left vs. Right Return - It is not possible to field convert return air between left or right return models due to the necessity of refrigeration copper piping changes. However, the conversion process of side to back or back to side discharge for either right or left return configuration is the same. In some cases, it may be possible to rotate the entire unit 180 degrees if the return air connection needs to be on the opposite side. Note that rotating the unit will move the piping to the other end of the unit.

Figure 4: Left Return Side Discharge to Back

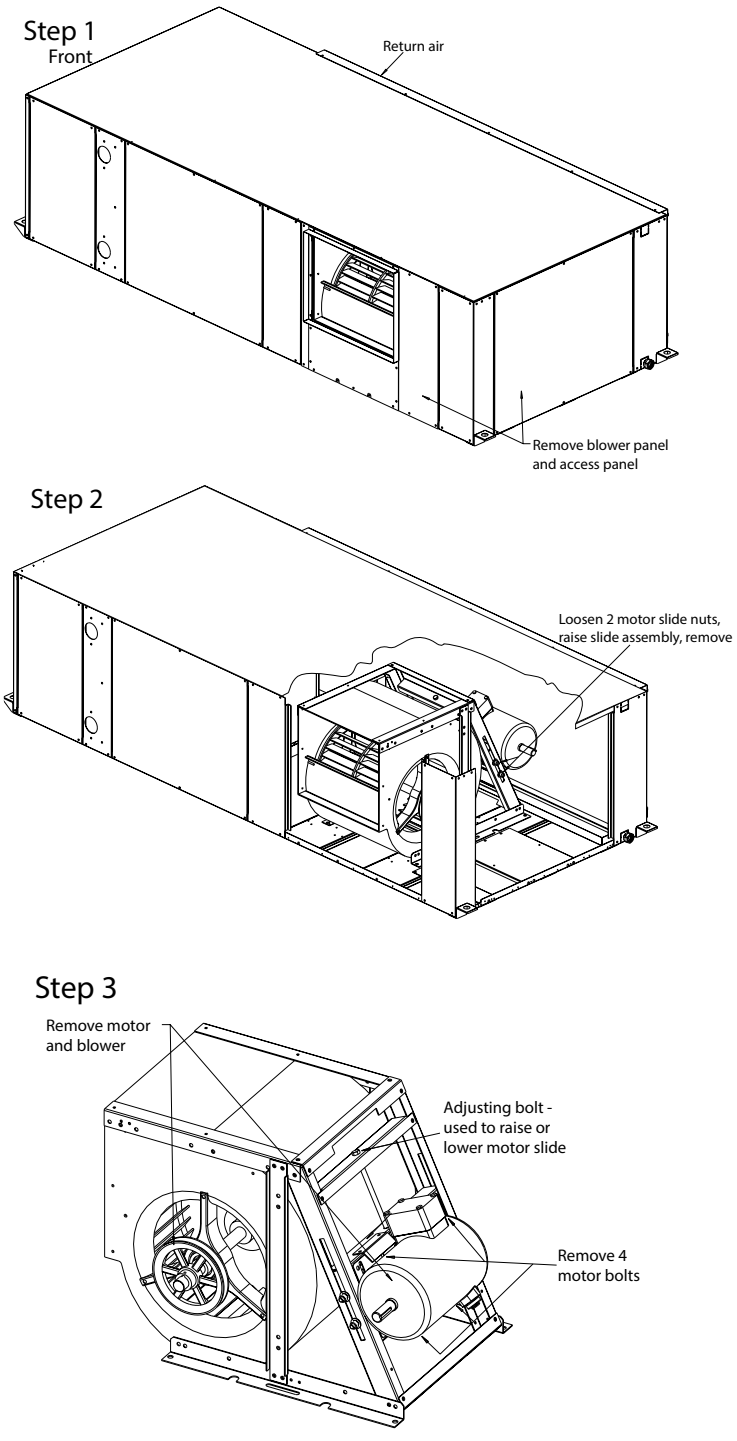
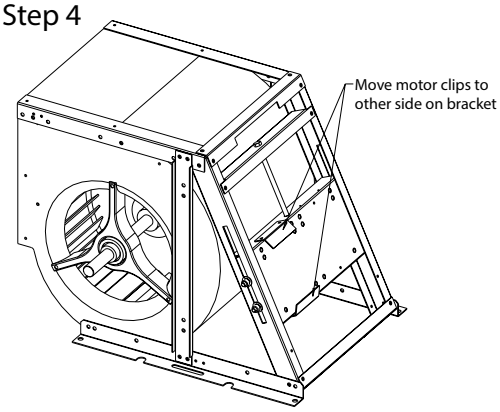


Figure 4 Continued on Following Page

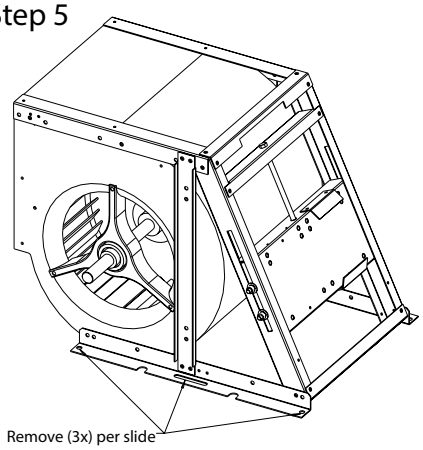
TCH Field Conversion of Air Discharge (Continued)

Figure 4 Continued: Left Return Side Discharge to Back

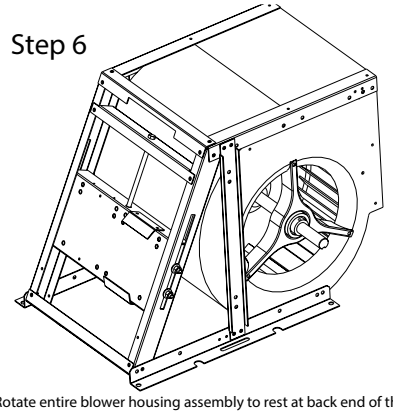
Step 4



Step 5

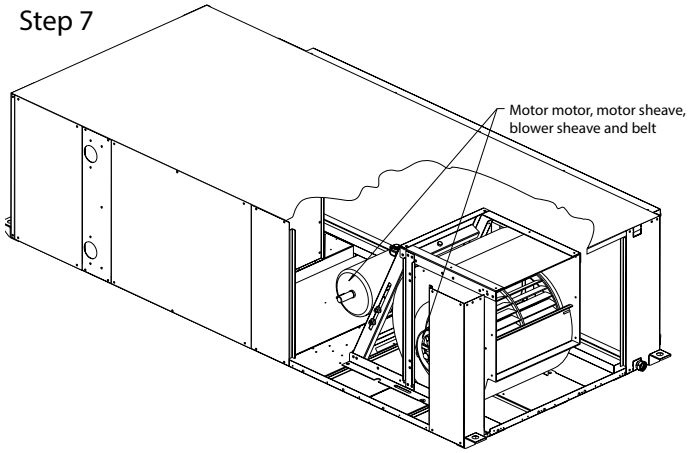


Step 6

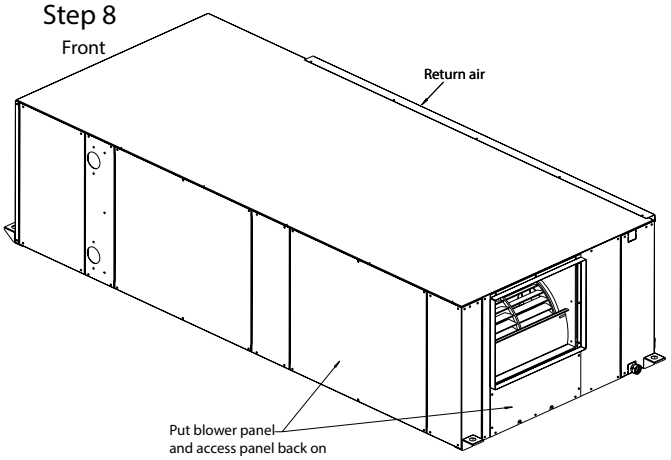


Rotate entire blower housing assembly to rest at back end of the unit. Locate housing holes and bolt down using previous 1/4-20 UNC bolts (3x) ea. side.

Step 7

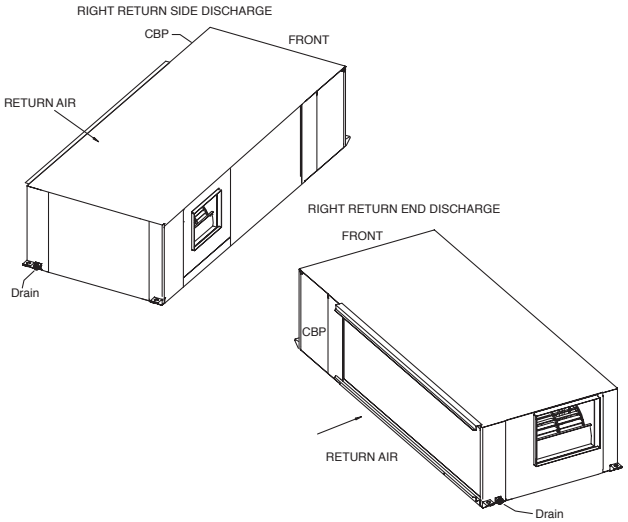


Step 8



Horizontal Installation

Figure 5: Right Return Side Discharge to Back



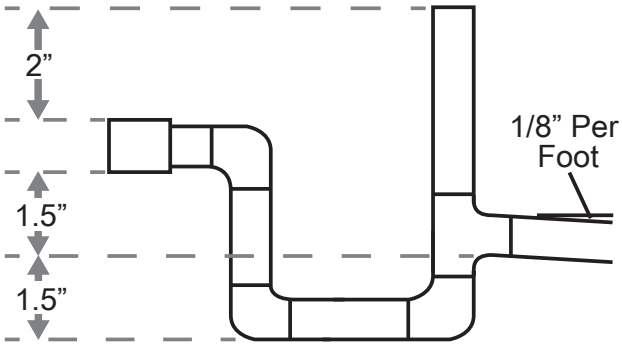
Horizontal Units Condensate Piping - Pitch the unit toward the drain as shown in Figure 2 to improve the condensate drainage. Ensure that unit pitch does not cause condensate leaks inside the cabinet.

Install condensate trap at each unit with the top of the trap positioned below the unit condensate drain connection as shown in Figure 6. Design the depth of the trap (water-seal) based upon the amount of ESP capability of the blower (where 2 inches [51mm] of ESP capability requires 2 inches [51mm] of trap depth). As a general rule, 1-1/2 inch [38mm] trap depth is the minimum.

Each unit must be installed with its own individual trap and connection to the condensate line (main) or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and/or vent.

Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. **WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW.**

Figure 6: Horizontal Condensate Connection



* Some units include a painted drain connection. Using a threaded pipe or similar device to clear any excess paint accumulated inside this fitting may ease final drain line installation.

⚠ CAUTION! ⚠

CAUTION! Ensure condensate line is pitched toward drain 1/8 inch per ft [11 mm per m] of run.

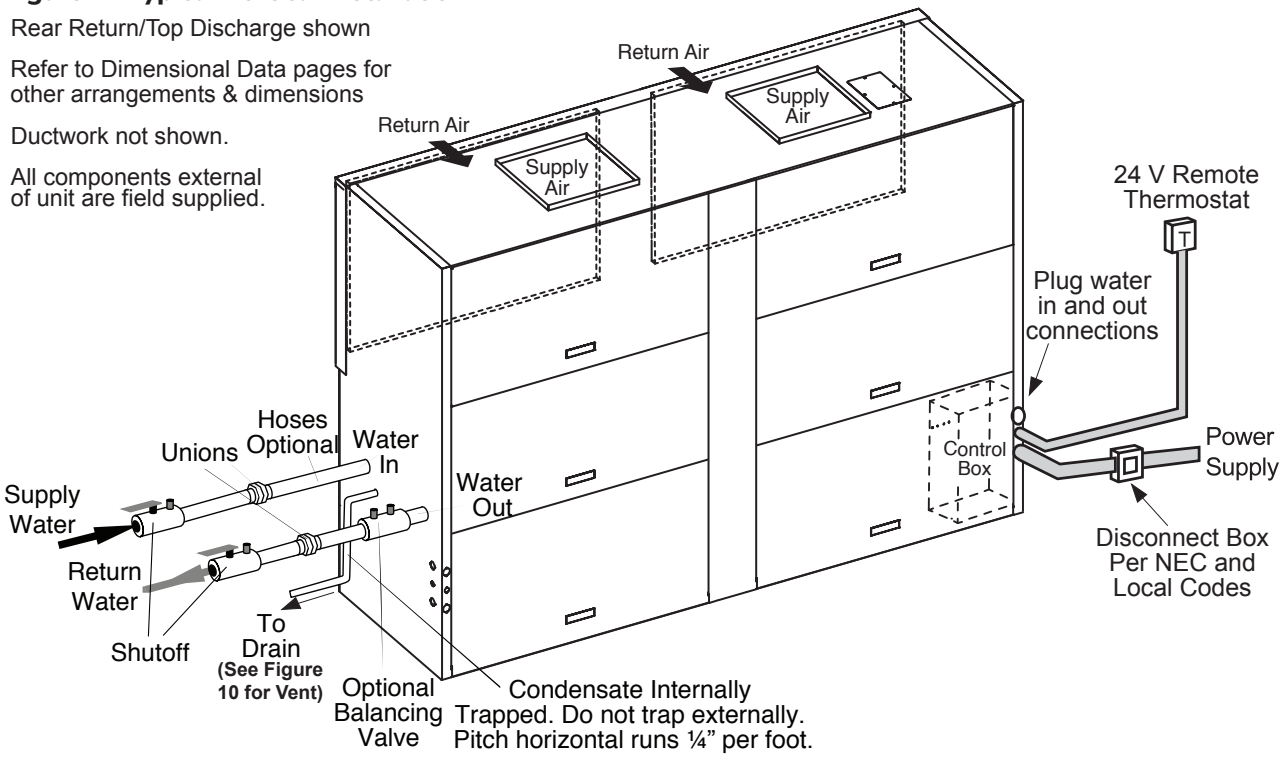
Duct System Installation - Proper duct sizing and design is critical to the performance of the unit. The duct system should be designed to allow adequate and even airflow through the unit during operation. Air flow through the unit MUST be at or above the minimum stated airflow for the unit to avoid equipment damage. Duct systems should be designed for quiet operation. Refer to Figure 3 for horizontal duct system details or Figure 8 for vertical duct system details. A flexible connector is recommended for both discharge and return air duct connections on metal duct systems to eliminate the transfer of vibration to the duct system. To maximize sound attenuation of the unit blower, the supply and return plenums should include internal fiberglass duct liner or be constructed from ductboard for the first few feet. Application of the unit to uninsulated ductwork in an unconditioned space is not recommended, as the unit's performance may be adversely affected.

At least one 90° elbow should be included in the supply duct to reduce air noise. If air noise or excessive air flow is a problem, the blower speed can be changed. For airflow charts, consult submittal data for the series and model of the specific unit.

If the unit is connected to existing ductwork, a previous check should have been made to ensure that the ductwork has the capacity to handle the airflow required for the unit. If ducting is too small, as in the replacement of a heating only system, larger ductwork should be installed. All existing ductwork should be checked for leaks and repaired as necessary.

Vertical Installation

Figure 7: Typical Vertical Installation



Vertical Location and Access

TC units are not designed for outdoor installation. Locate the unit in an indoor area that allows enough space for installation and for service personnel to perform typical maintenance or repairs. TC units are typically installed in a floor level closet or in a small mechanical room. Refer to Figure 7 for an illustration of a typical installation. Install units with adequate clearance to allow maintenance and servicing. Conform to the following guidelines when selecting unit location:

- Provide adequate clearance for filter replacement and drain pan cleaning. DO NOT block filter access with piping, conduit or other materials. Refer to submittal drawing for Vertical Unit Dimensions.
- Provide access for fan and fan motor maintenance and for servicing of the compressor and coils without removal of the unit.
- Provide an unobstructed path to the unit within the closet or mechanical room to enable removal of the unit if necessary.
- Provide access to water valves and fittings, and screwdriver access to the unit side panels, discharge collar and all electrical connections

Duct System Design & Installation Guidelines

The following application guidelines must be used when installing TC units. Failure to follow these guidelines could result in unsatisfactory unit performance and/or premature failure of some unit components. ClimateMaster will not warrant, or accept responsibility for products which fail, have defects, damage or insufficient performance as a result of improper application.

- The duct system must be sized to handle the airflow quietly and must not exceed the maximum allowable External Static Pressure. To maximize sound attenuation metal supply and return ducts should include internal insulation or be of duct board construction for the first 10 feet or end of first full-sized elbow.
- Install a flexible connector in all supply and return air ducts close to the unit to inhibit sound transfer to the ducts.
- Do not install uninsulated duct in an unconditioned space. The unit performance will be adversely affected and damage from condensate can occur.

TCV Field Conversion of Air Discharge

⚠ WARNING! ⚠

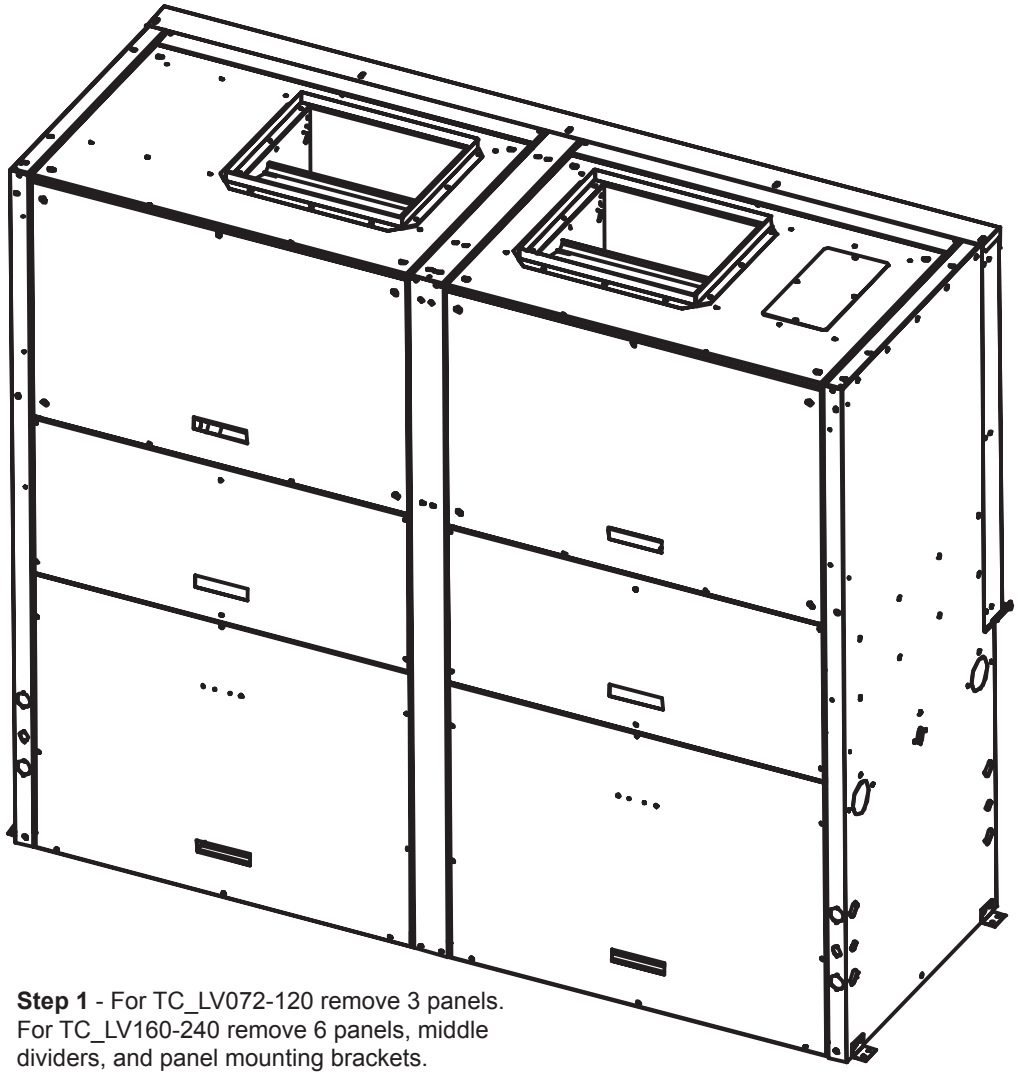
WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation or conversion.

Overview - Vertical units can be field converted between top and straight (side) and back (end) discharge using the instructions below.

Preparation - Place in a well-lighted area. Conversion should only be attempted by qualified service technicians.

TCV072-240 Field Conversion of Air Discharge

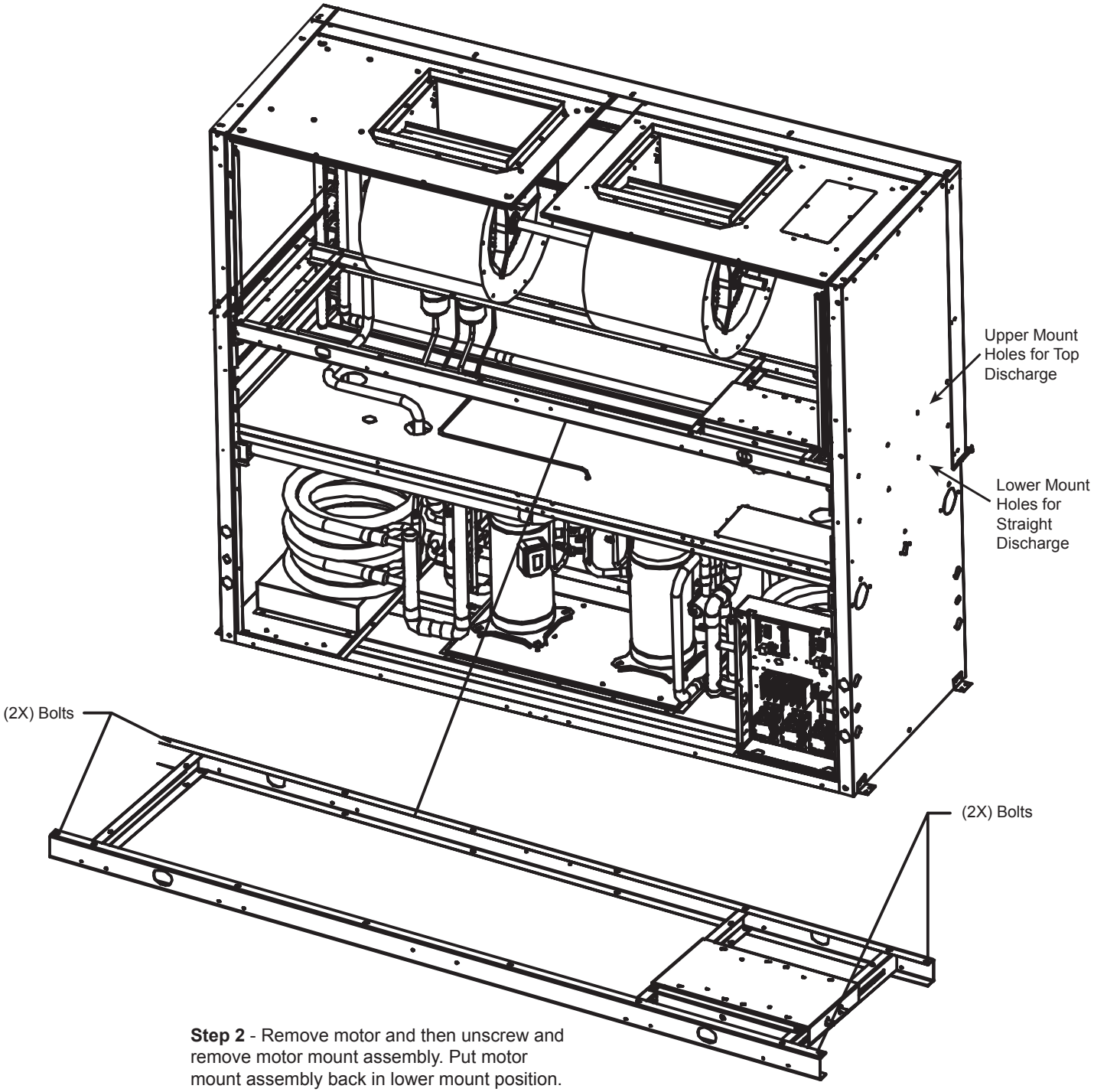
Figure 8: TCV072 - 120 and TCV160-240 Pictorally Shown Top Discharge Steps to Convert to Straight Discharge



Step 1 - For TC_LV072-120 remove 3 panels. For TC_LV160-240 remove 6 panels, middle dividers, and panel mounting brackets.

Figure 8 Continued on Following Page

TCV072-240 Field Conversion of Air Discharge (continued)

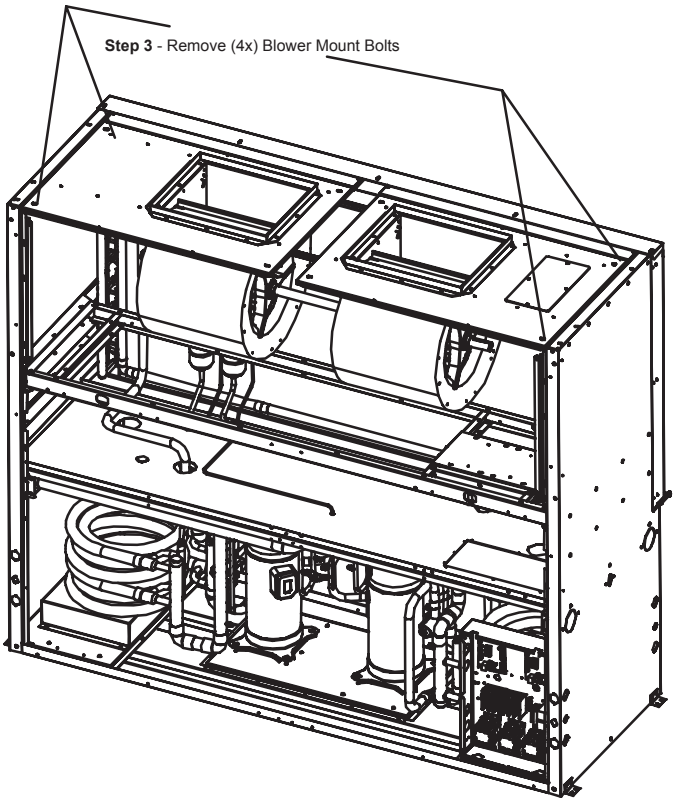


Step 2 - Remove motor and then unscrew and remove motor mount assembly. Put motor mount assembly back in lower mount position.

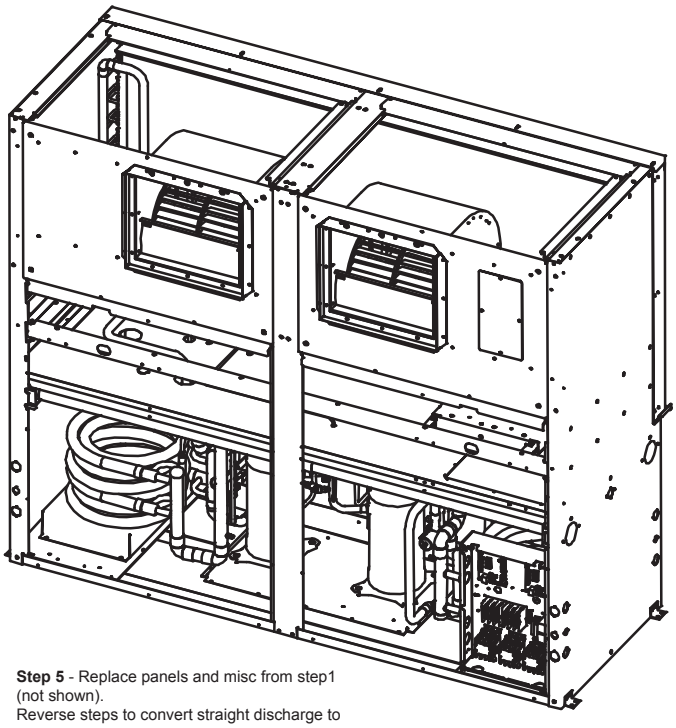
Figure 8 Continued on Following Page

TCV072-240 Field Conversion of Air Discharge (continued)

Step 3 - Remove (4x) Blower Mount Bolts

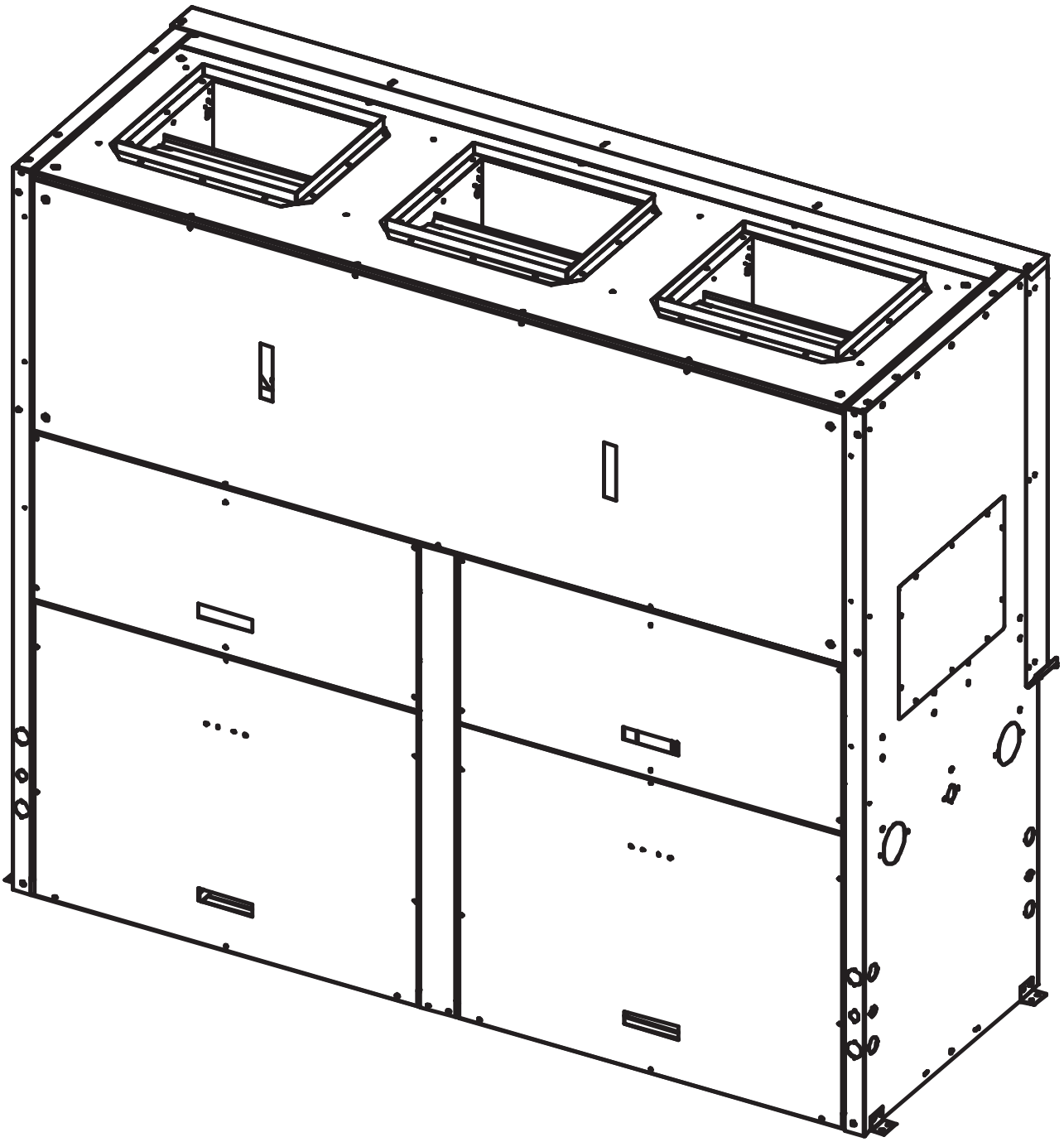


Step 4 - Rotate blower assembly 90 degrees. Reattach blower assembly to front of unit as shown. Put belt on and retighten.



Step 5 - Replace panels and misc from step1 (not shown).
Reverse steps to convert straight discharge to top discharge.

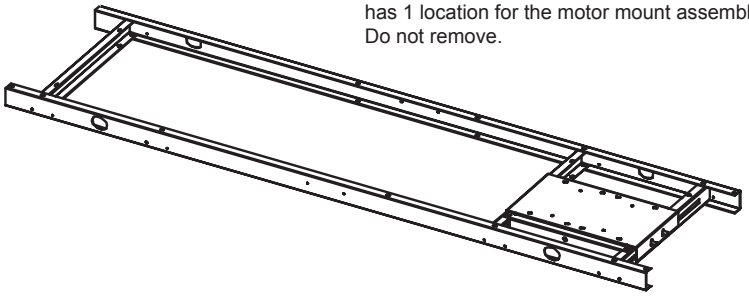
TCV300 Field Conversion of Air Discharge



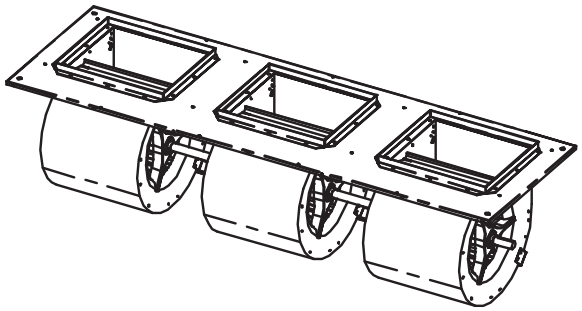
Step 1 - Remove 5 panels, dividers, and panel mount brackets.

TCV300 Field Conversion of Air Discharge

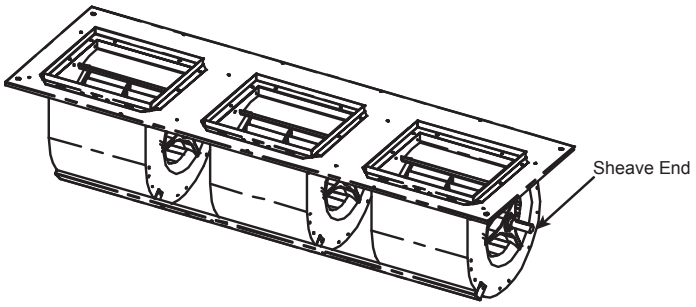
Note: Unlike the 160-240, the TC_LV300 only has 1 location for the motor mount assembly. Do not remove.



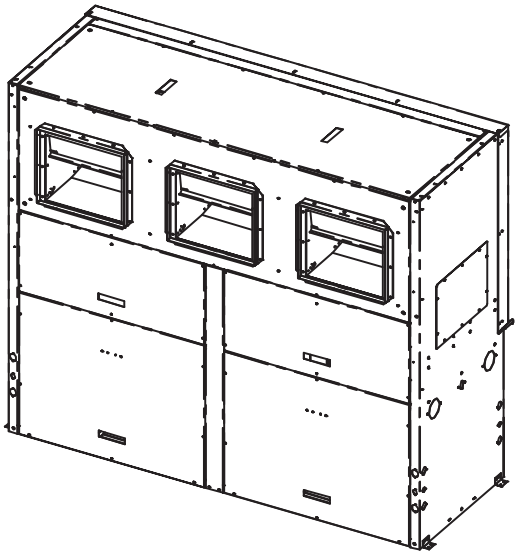
Step 2 - Unattach and lift entire 3 blower sub assembly out of the unit.



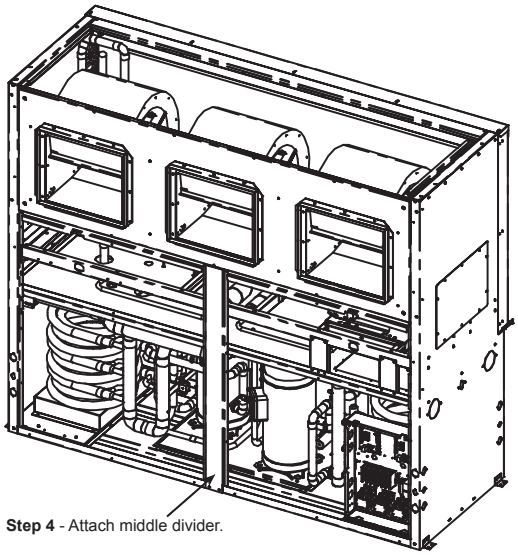
Step 3 - Rotate blower assembly 180 degrees. Remove blower sheave and put on opposite side.



TCV300 Field Conversion of Air Discharge



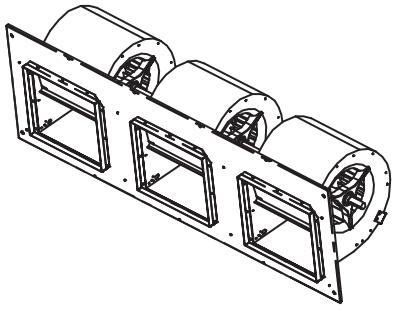
Step 7 - Replace brackets and 5 panels.
Reverse steps to convert straight discharge to top discharge.



Step 4 - Attach middle divider.

Step 6 - Reattach blower assembly to the front of the unit. Put belt on and retighten.

Step 5 - Rotate the blower assembly 90 degrees counter clockwise. The belly of the blowers should be facing upward.



TCV Field Conversion of Control Box

⚠ WARNING! ⚠

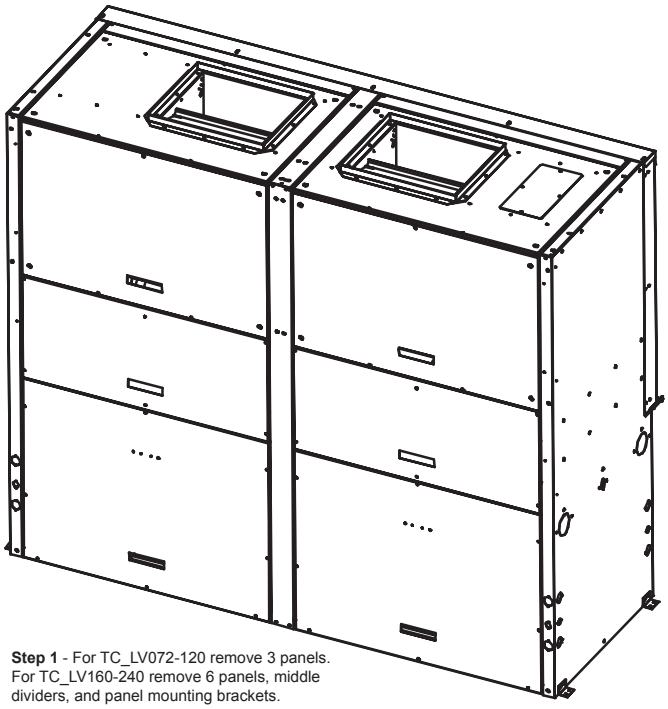
WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation or conversion.

Overview - Vertical unit control box can be field converted from front to any other corner for 160-300 or opposite corner (water coil side) for 072-120.

Preparation - Place in a well-lighted area. Conversion should only be attempted by a qualified service technician.

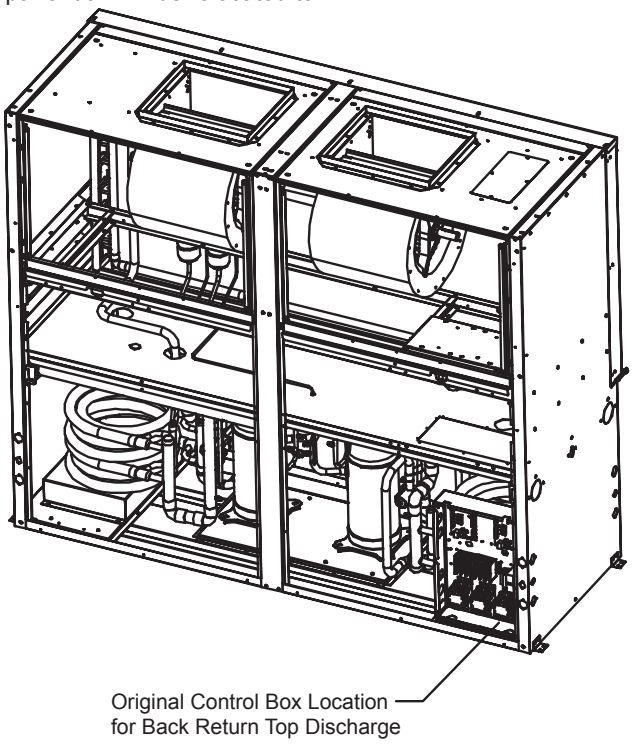
Figure 9: TCV160-240 Shown, Typical All TCV Models

Note: Must provide 3 feet (or code requirement) service access for new control box location.



Step 1 - For TC_LV072-120 remove 3 panels. For TC_LV160-240 remove 6 panels, middle dividers, and panel mounting brackets.

Step 1 - Remove control box access panel and panel box will be relocated to.



Step 2: Unattach all wires from components, remove the control box, tag wires. Pull wires out of box.

Step 3: Attach box to new location.

Step 4: Reroute wires. (Note: Keep wires away from hot lines and sharp edges).

Step 5: Reattach wires. (Note: Models with 2 compressors, rewire circuit 1 to same compressor. (I.E., compressor configuration does not change. Only location of control box changes.

Step 6: Check wiring is per wire diagram.

Step 7: Replace panels.

TCV Field Conversion of Water Connections

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation or conversion.

Overview - All models the water connection can be field converted to opposite side. Connections can be both left, right, or 1 each side.

Preparation - Field conversion must be completed on the ground. If the unit is already hung it should be taken down for the field conversion. Place in a well-lighted area. Conversion should only be attempted by a qualified service technician.

Side to Back Discharge Conversion

Step 1: Remove panels needed for access to water connections.

Step 2: Remove screws from side panels. Loosen (4x) screws in slots but do not remove.

Step 3: Both water in and out have a union centered in the middle of the unit. Undo both unions, rotate the water legs for opposite configuration retighten unions, reattach connection flanges to wrappers. Use slots to adjust and retighten screws in slots.

Step 4: Replace panels.

Step 5: Check wiring is per wire diagram.

Step 6: Replace panels

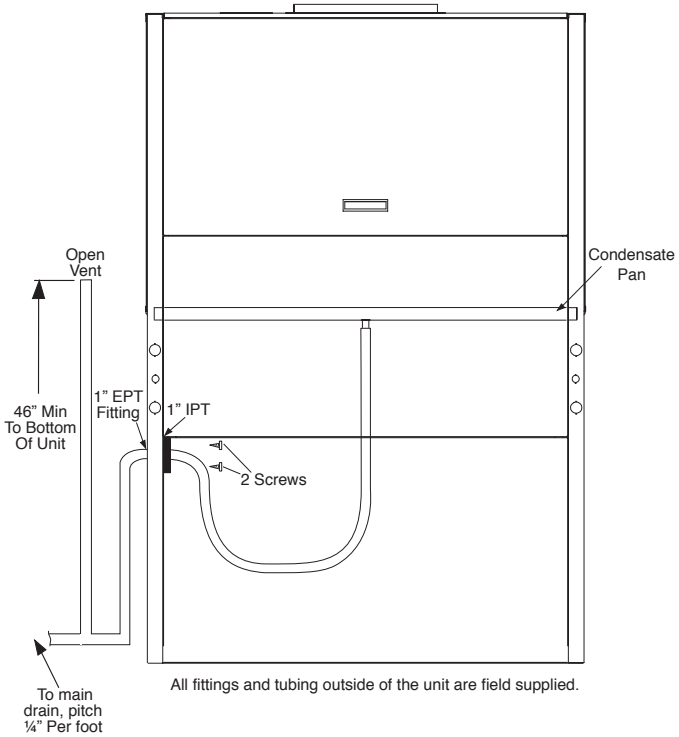
Vertical Condensate Installation

Condensate Piping - TCV - Remove KO on side that drain will be connected. Remove access panels. Inside of unit, untie and uncoil drain hose. Form trap in hose, make sure hose is not kinked or deformed. Connect plate assembly to side frame with 2 screws.

Outside of unit, connect 1" MPT fitting to plate assembly. Run line to building drain. Horizontal runs must be pitched ¼" per foot (10 mm per 46 cm) toward drain. Do not trap externally.

Figure 10 illustrates a typical trap and vent used with TCV series equipment.

Figure 10: TCV



Each unit must be installed with its own individual line to the building main condensate drain line or riser. Provide a means to flush or blow out the condensate line. DO NOT install units with a common trap and or vent. Always vent the condensate line when dirt or air can collect in the line or a long horizontal drain line is required. Also vent when large units are working against higher external static pressure than other units connected to the same condensate main since this may cause poor drainage for all units on the line. WHEN A VENT IS INSTALLED IN THE DRAIN LINE, IT MUST BE LOCATED AFTER THE TRAP IN THE DIRECTION OF THE CONDENSATE FLOW and opening 46" (117 cm) minimum from bottom of unit. (Vent per code)

⚠ WARNING! ⚠

WARNING! Ensure condensate line is pitched toward drain 1/4" per foot [10mm per 46cm] of run.

Horizontal and Vertical Installations - Drain main or riser must be sized for all units connected to it.

Pipe Size	Connected Tons	Connected kW
3/4" [19mm]	<4	<14
1" [25mm]	<6	<21
1-1/4" [32mm]	<30	<105
1-1/2" [38mm]	<50	<175
2" [51mm]	<150	<527
3" [76mm]	<300	<1055
4" [102mm]	<500	<1758

*** Make sure all connections are secure and water tight.**

After drain is connected to main and all drain connections are secure and water tight, pour 1 gallon of water into condensate pan. Water should drain out freely. Repair any leaks.

- On units with multiple fan outlets a "pair of pants" duct connection must be used for proper air balance and distribution and to prevent fan oscillation.
- Include at least one 90-degree turn in supply air ducts to reduce noise transmission.
- Existing ducts must be checked to ensure proper size and configuration prior to installation of any replacement unit. Also inspect for and repair all air leaks in existing ducts.
- Units may only be connected to a dedicated duct system. Consult the factory BEFORE connecting multiple units to a common duct system.
- Never connect a unit to a duct system with automatic or modulating dampers, VAV boxes, etc. in the supply air system. Never allow a situation where the total unit CFM can drop below the minimum required for proper unit operation.
- Never connect a bypass damper from the supply air duct to the return air duct. Never allow the return air temperature to drop below the minimum allowable normal temperature for proper unit operation.
- Do not use TC units for 100% outdoor air treatment. Do not add hot-gas-bypass to "convert" a unit for outdoor air treatment. Always use a dedicated outdoor air unit for outdoor air treatment.
- Do not exceed 10% of the total unit CFM with untreated outdoor air.

Piping Installation

Installation of Supply and Return Piping
Follow these piping guidelines:

1. Install a drain valve at the base of each supply and return riser to facilitate system flushing.
2. Install shut-off / balancing valves and unions at each unit to permit unit removal for servicing.
3. Place strainers at the inlet of each system circulating pump.
4. Select the proper hose length to allow slack between connection points. Hoses may vary in length by +2% to -4% under pressure.
5. Refer to Table 1. Do not exceed the minimum bend radius for the hose selected. Exceeding the minimum bend radius may cause the hose to collapse, which reduces water flow rate. Install an angle adapter to avoid sharp bends in the hose when the radius falls below the required minimum.

Insulation is not required on loop water piping except where the piping runs through unheated areas, outside the building or when the loop water temperature is below the minimum expected dew point of the pipe ambient conditions. Insulation is required if loop water temperature drops below the dew point (insulation is required for ground loop applications in most climates).

Pipe joint compound is not necessary when Teflon® thread tape is pre-applied to hose assemblies or when flared-end connections are used. If pipe joint compound is preferred, use compound only in small amounts on the external pipe threads of the fitting adapters. Prevent sealant from reaching the flared surfaces of the joint.

Note: When antifreeze is used in the loop, ensure that it is compatible with the Teflon® tape or pipe joint compound that is applied.

Maximum allowable torque for brass fittings is 30 ft-lbs [41 N-m]. If a torque wrench is not available, tighten finger-tight plus one quarter turn. Tighten steel fittings as necessary.

Optional pressure-rated hose assemblies designed specifically for use with ClimateMaster units are available. Similar hoses can be obtained from alternate suppliers. Supply and return hoses are fitted with swivel-joint fittings at one end to prevent kinking during installation.

Refer to Figure 12 for an illustration of a typical supply/return hose kit. Adapters secure hose assemblies to the unit and risers. Install hose assemblies properly and check regularly to avoid system failure and reduced service life.

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

⚠ CAUTION! ⚠

CAUTION! Corrosive system water requires corrosion resistant fittings and hoses, and may require water treatment.

⚠ CAUTION! ⚠

CAUTION! Do not bend or kink supply lines or hoses.

⚠ CAUTION! ⚠

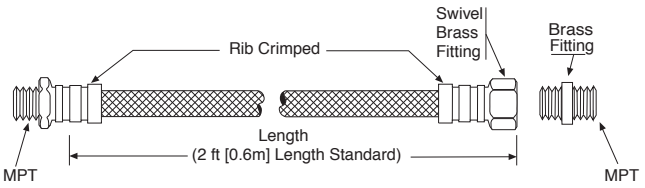
CAUTION! Piping must comply with all applicable codes.

Table 1: Metal Hose Minimum Bend Radii

Hose Diameter	Minimum Bend Radii
1/2" [12.7mm]	2-1/2" [6.4cm]
3/4" [19.1mm]	4" [10.2cm]
1" [25.4mm]	5-1/2" [14cm]
1-1/4" [31.8mm]	6-3/4" [17.1cm]
1-1/2" [38.1mm]	8.5" [21.6cm]

NOTICE! Do not allow hoses to rest against structural building components. Compressor vibration may be transmitted through the hoses to the structure, causing unnecessary noise complaints.

Figure 7 : Supply/Return Hose Kit



Water-Loop Heat Pump Applications

Commercial Water Loop Applications - Commercial systems typically include a number of units connected to a common piping system. Any unit plumbing maintenance work can introduce air into the piping system; therefore air elimination equipment is a major portion of the mechanical room plumbing. In piping systems expected to utilize water temperatures below 50°F [10°C], 1/2" (13mm) closed cell insulation is required on all piping surfaces to eliminate condensation (extended range units required). Metal to plastic threaded joints should never be used due to their tendency to leak over time.

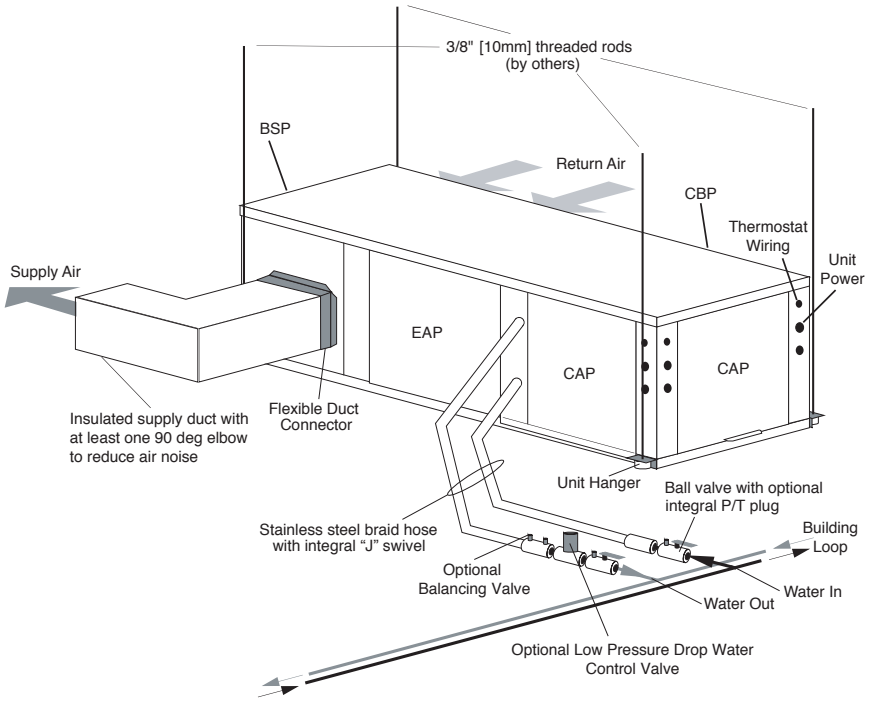
Teflon tape thread sealant is recommended to minimize internal fouling of the heat exchanger. Do not over tighten connections and route piping so as not to interfere with service or maintenance access. Hose kits are available from ClimateMaster in different configurations as shown in Figure 13 for connection between the unit and the piping system. Depending upon selection, hose kits may include shut off valves, P/T plugs for performance measurement, high pressure stainless steel braided hose, "Y" type strainer with blow down valve, and/or "J" type swivel connection. Balancing valves and an external low pressure drop solenoid valve for use in variable speed pumping systems may also be included in the hose kit.

The piping system should be flushed to remove dirt, piping chips, and other foreign material prior to operation (see "Piping System Cleaning and Flushing Procedures" in this manual). The flow rate is usually set between 2.25 and 3.5 gpm per ton [2.9 and 4.5 l/m per kW] of cooling capacity. ClimateMaster recommends 3 gpm per ton [3.9 l/m per kW] for most applications of water loop heat pumps. To ensure proper maintenance and servicing, P/T ports are imperative for temperature and flow verification, as well as performance checks.

Water loop heat pump (cooling tower/boiler) systems typically utilize a common loop, maintained between 60 - 90°F [16 - 32°C]. The use of a closed circuit evaporative cooling tower with a secondary heat exchanger between the tower and the water loop is recommended. If an open type cooling tower is used continuously, chemical treatment and filtering will be necessary.

Low Water Temperature Cutout Setting CXM2 - When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

Figure 8: Typical Water-Loop Application



Ground-Loop Heat Pump Applications

⚠ CAUTION! ⚠

CAUTION! The following instructions represent industry accepted installation practices for closed loop earth coupled heat pump systems. Instructions are provided to assist the contractor in installing trouble free ground loops. These instructions are recommendations only. State/provincial and local codes MUST be followed and installation MUST conform to ALL applicable codes. It is the responsibility of the installing contractor to determine and comply with ALL applicable codes and regulations.

⚠ CAUTION! ⚠

CAUTION! Ground loop applications require extended range equipment and optional refrigerant/water circuit insulation.

Pre-Installation - Prior to installation, locate and mark all existing underground utilities, piping, etc. Install loops for new construction before sidewalks, patios, driveways, and other construction has begun. During construction, accurately mark all ground loop piping on the plot plan as an aid in avoiding potential future damage to the installation.

Piping Installation - The typical closed loop ground source system is shown in Figure 14. All earth loop piping materials should be limited to polyethylene fusion only for in-ground sections of the loop. Galvanized or steel fittings should not be used at any time due to their tendency to corrode. All plastic to metal threaded fittings should be avoided due to their potential to leak in earth coupled applications. A flanged fitting should be substituted. P/T plugs should be used so that flow can be measured using the pressure drop of the unit heat exchanger.

Earth loop temperatures can range between 25 and 110°F [-4 to 43°C]. Flow rates between 2.25 and 3 gpm per ton [2.41 to 3.23 l/m per kW] of cooling capacity is recommended in these applications. Test individual horizontal loop circuits before backfilling. Test vertical U-bends and pond loop assemblies prior to installation. Pressures of at least 100 psi [689 kPa] should be used when testing. Do not exceed the pipe pressure rating. Test entire system when all loops are assembled.

Flushing the Earth Loop - Upon completion of system installation and testing, flush the system to remove all foreign objects and purge to remove all air.

Antifreeze - In areas where minimum entering loop temperatures drop below 40°F [5°C] or where piping will be routed through areas subject to freezing, antifreeze is required. Alcohols and glycols are commonly used as antifreeze; however your local sales manager should be consulted for the antifreeze best suited to your area. Low temperature protection should be maintained to 15°F [9°C] below the lowest expected entering loop temperature. For example, if 30°F [-1°C] is the minimum expected entering loop temperature, the leaving loop temperature would be 25 to 22°F [-4 to -6°C] and low temperature protection should be at 15°F [-10°C]. Calculation is as follows:
30°F - 15°F = 15°F [-1°C - 9°C = -10°C].

All alcohols should be premixed and pumped from a reservoir outside of the building when possible or introduced under the water level to prevent fumes. Calculate the total volume of fluid in the piping system. Then use the percentage by volume shown in table 2 for the amount of antifreeze needed. Antifreeze concentration should be checked from a well mixed sample using a hydrometer to measure specific gravity.

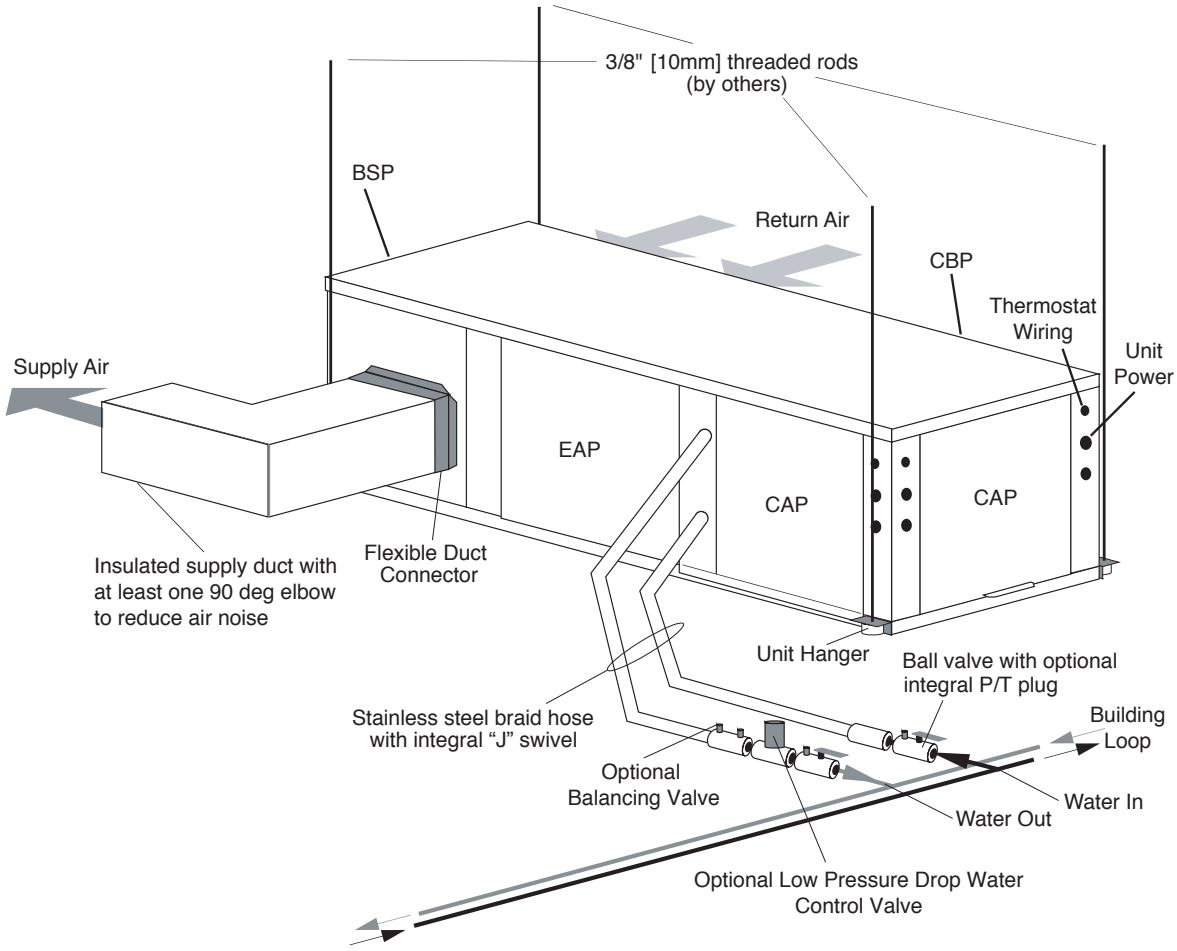
Low Water Temperature Cutout Setting CXM2 - When antifreeze is selected, the LT1 jumper (JW3) should be clipped to select the low temperature (antifreeze 10.0°F [-12.2°C]) setpoint and avoid nuisance faults (see "Low Water Temperature Cutout Selection" in this manual). **Note: Low water temperature operation requires extended range equipment.**

Table 2: Antifreeze Percentages by Volume

Type	Minimum Temperature for Low Temperature Protection			
	10°F [-12.2°C]	15°F [-9.4°C]	20°F [-6.7°C]	25°F [-3.9°C]
Methanol	25%	21%	16%	10%
100% USP food grade Propylene Glycol	38%	25%	22%	15%
Ethanol*	29%	25%	20%	14%

*** Must not be denatured with any petroleum based product**

Figure 9: Typical Ground-Loop Application



Ground-Water Heat Pump Applications

Open Loop - Ground Water Systems - Typical open loop piping is shown in Figure 15. Shut off valves should be included for ease of servicing. Boiler drains or other valves should be "tee'd" into the lines to allow acid flushing of the heat exchanger. Shut off valves should be positioned to allow flow through the coax via the boiler drains without allowing flow into the piping system. P/T plugs should be used so that pressure drop and temperature can be measured.

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

Water quantity should be plentiful and of good quality. Consult table 3 for water quality guidelines. The unit can be ordered with either a copper or cupro-nickel water heat exchanger. Consult Table 3 for recommendations. Copper is recommended for closed loop systems and open loop ground water systems that are not high in mineral content or corrosiveness. In conditions anticipating heavy scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In ground water situations where scaling could be heavy or where biological growth such as iron bacteria will be present, an open loop system is not recommended. Heat exchanger coils may over time lose heat exchange capabilities due to build up of mineral deposits. Heat exchangers must only be serviced by a qualified technician, as acid and special pumping equipment is required. Desuperheater coils can likewise become scaled and possibly plugged. In areas with extremely hard water, the owner should be informed that the heat exchanger may require occasional acid flushing. In some cases, the desuperheater option should not be recommended due to hard water conditions and additional maintenance required.

Water Quality Requirements - Table 3 should be consulted for water quality requirements. Scaling potential should be assessed using the pH/Calcium hardness method. If the pH <7.5 and the calcium hardness is less than 100 ppm, scaling potential is low. If this method yields numbers out of range of those listed, the Ryznar Stability and Langelier Saturation indecies should be calculated. Use the appropriate scaling surface temperature for the application, 150°F [66°C] for direct use (well water/open loop) and DHW (desuperheater); 90°F [32°F] for indirect use. A monitoring plan should be implemented in these probable scaling situations. Other water quality issues such as iron fouling, corrosion prevention and erosion and clogging should be referenced in Table 3.

Expansion Tank and Pump - Use a closed, bladder-type expansion tank to minimize mineral formation due to air exposure. The expansion tank should be sized to provide at least one minute continuous run time of the pump using its drawdown capacity rating to prevent pump short cycling. Discharge water from the unit is not contaminated in any manner and can be disposed of in various ways, depending on local building codes (e.g. recharge well, storm sewer, drain field, adjacent stream or pond, etc.). Most local codes forbid the use of sanitary sewer for disposal. Consult your local building and zoning department to assure compliance in your area.

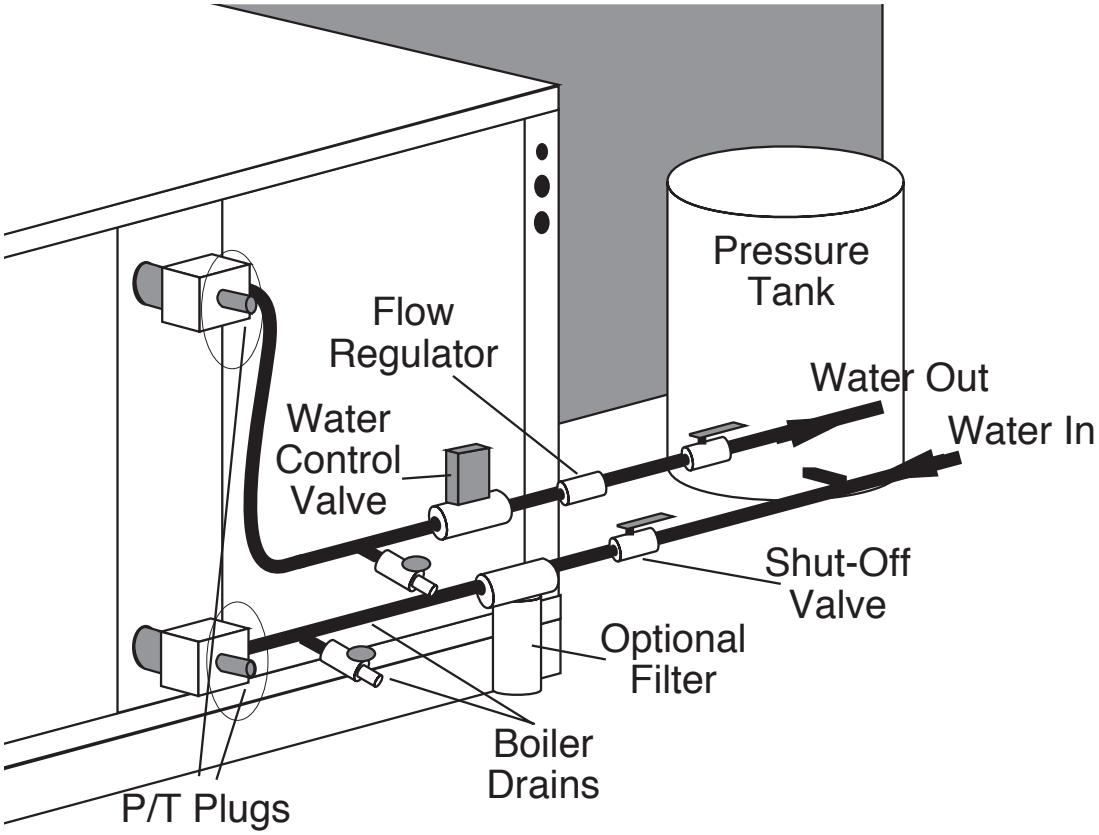
Water Control Valve - Note the placement of the water control valve in Figure 15. Always maintain water pressure in the heat exchanger by placing the water control valve(s) on the discharge line to prevent mineral precipitation during the off-cycle. Pilot operated slow closing valves are recommended to reduce water hammer. If water hammer persists, a mini-expansion tank can be mounted on the piping to help absorb the excess hammer shock. Ensure that the total 'VA' draw of the valve can be supplied by the unit transformer. For instance, a slow closing valve can draw up to 35VA. This can overload smaller 40 or 50 VA transformers depending on the other controls in the circuit. A typical pilot operated solenoid valve draws approximately 15VA (see Figure 18). Note the special wiring diagrams for slow closing valves (Figures 19 & 20).

Flow Regulation - Flow regulation can be accomplished by two methods. One method of flow regulation involves simply adjusting the ball valve or water control valve on the discharge line. Measure the pressure drop through the unit heat exchanger, and determine flow rate from Tables 8a through 8e. Since the pressure is constantly varying, two pressure gauges may be needed. Adjust the valve until the desired flow of 1.5 to 2 gpm per ton [2.0 to 2.6 l/m per kW] is achieved. A second method of flow control requires a flow control device mounted on the outlet of the water control valve. The device is typically a brass fitting with an orifice of rubber or plastic material that is designed to allow a specified flow rate. On occasion, flow control devices may produce velocity noise that can be reduced by applying some back pressure from the ball valve located on the discharge line. Slightly

closing the valve will spread the pressure drop over both devices, lessening the velocity noise. **NOTE: When EWT is below 50°F [10°C], 2 gpm per ton (2.6 l/m per kW) is required.**

Water Coil Low Temperature Limit Setting - For all open loop systems the 30°F [-1.1°C] FP1 setting (factory setting-water) should be used to avoid freeze damage to the unit. See "Low Water Temperature Cutout Selection" in this manual for details on the low limit setting.

Figure 10: Typical Open Loop/Well Application



Water Quality Requirements

Table 3: Water Quality Requirements

Clean water is essential to the performance and life span of water source heat pumps. Contaminants, chemicals, and minerals all have the potential to cause damage to the water heat heat exchanger if not treated properly. All closed water loop systems should undergo water quality testing and be maintained to the water quality standards listed in this table.

WATER QUALITY REQUIREMENTS

For Closed-Loop and Open-Loop Systems

				Heat Exchanger Type			
				Closed Loop Recirculating	Open Loop, Tower, Ground Source Well		
	Description	Symbol	Units	All Heat Exchanger Types	COAXIAL HX Copper Tube in Tube	COAXIAL HX Cupronickel	Brazed Plate HX 316 SS
Scaling Potential	pH - Chilled Water <85°F			7.0 to 9.0	7.0 to 9.0	7.0 to 9.0	7.0 to 9.0
	pH - Heated Water >85°F			8.0 to 10.0	8.0 to 10.0	8.0 to 10.0	8.0 to 10.0
	Alkalinity	($HCO3^-$)	ppm - $CaCO_3$ equiv.	50 to 500	50 to 500	50 to 500	50 to 500
	Calcium	(Ca)	ppm	<100	<100	<100	<100
	Magnesium	(Mg)	ppm	<100	<100	<100	<100
	Total Hardness	(CaCO3)	ppm - CaCO3 equiv.	30 to 150	150 to 450	150 to 450	150 to 450
	Langelier Saturation Index	LSI		-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5	-0.5 to +0.5
	Ryznar Stability Index	RSI		6.5 to 8.0	6.5 to 8.0	6.5 to 8.0	6.5 to 8.0
Corrosion Prevention	Total Dissolved Solids	(TDS)	ppm - $CaCO_3$ equiv.	<1000	<1000	<1000	<1500
	Sulfate	(SO_4^{2-})	ppm	<200	<200	<200	<200
	Nitrate	(NO_3^-)	ppm	<100	<100	<100	<100
	Chlorine (free)	(Cl)	ppm	<0.5	<0.5	<0.5	<0.5
	Chloride (water < 80°F)	(Cl^-)	ppm	<20	<20	<150	<150
	Chloride (water > 120°F)		ppm	<20	<20	<125	<125
	Hydrogen Sulfide[α]	(H_2S)	ppb	<0.5	<0.5	<0.5	<0.5
	Carbon Dioxide	(CO_2)	ppm	0	<50	10 to 50	10 to 50
	Iron Oxide	(Fe)	ppm	<1.0	<1.0	<1.0	<0.2
	Manganese	(Mn)	ppm	< 0.4	<0.4	<0.4	<0.4
	Ammonia	(NH_3)	ppm	<0.05	<0.1	<0.1	<0.1
	Chloramine	(NH_2CL)	ppm	0	0	0	0
Fouling & Biological	Iron Bacteria		cells/mL	0	0	0	0
	Slime Forming Bacteria		cells/mL	0	0	0	0
	Sulfate reducing bacteria		cells/mL	0	0	0	0
	Suspended Solids[β]	(TSS)	ppm	<10	<10	<10	<10
Electrolysis All HX types	Earth Ground Resistance[χ]		Ohms	0	Consult NEC & local electrical codes for grounding requirements		
	Electrolysis Voltage[δ]		mV	<300	Measure voltage internal water loop to HP ground		
	Leakage Current[δ]		mA	<15	Measure current in water loop pipe		

Building Primary Electrical Ground to unit, must meet local diameter and penetration length requirements

Do not connect heat pump to steel pipe unless dissimilar materials are separated by using Di-electric unions. Galvanic corrosion of heat pump water pipe will occur.

Water Quality Requirements, Cont'd.

1. The ClimateMaster Water Quality Table provides water quality requirements for coaxial & brazed plate heat exchangers.
2. The water must be evaluated by an independent testing facility comparing site samples against this table. When water properties are outside of these parameters, the water must either be treated by a professional water treatment specialist to bring the water quality within the boundaries of this specification, or an external secondary heat exchanger must be used to isolate the heat pump water system from the unsuitable water. Failure to do so will void the warranty of the heat pump system and will limit liability for damage caused by leaks or system failure.
3. Regular sampling, testing and treatment of the water is necessary to assure that the water quality remains within acceptable levels thereby allowing the heat pump to operate at optimum levels.
4. If closed-loop systems are turned off for extended periods, water samples must be tested prior to operating the system.
5. For optimal performance, it is recommended that the closed-loop piping systems are initially filled with de-ionized water.
6. Well water with chemistry outside of these boundaries, and salt water or brackish water requires an external secondary heat exchanger. Surface/Pond water should not be used.
7. If water temperature is expected to fall below 40°F, antifreeze is required. Refer to the heat pump IOM for the correct solution ratios to prevent freezing.

Strainer / Filter Sizing			
Mesh Size	Particle Size		
	Microns	MM	Inch
20	840	0.840	0.0340
30	533	0.533	0.0210
60	250	0.250	0.0100
100	149	0.149	0.0060
150	100	0.100	0.0040
200	74	0.074	0.0029

ppm = parts per million
ppb = parts per billion

α Hydrogen Sulfide has an odor of rotten eggs. If one detects this smell, a test for H2S must be performed. If H2S is detected above the limit indicated, remediation is necessary (Consult with your Water Testing/Treatment Professional) or a secondary heat exchanger is required using appropriate materials as recommended by the heat exchanger supplier.

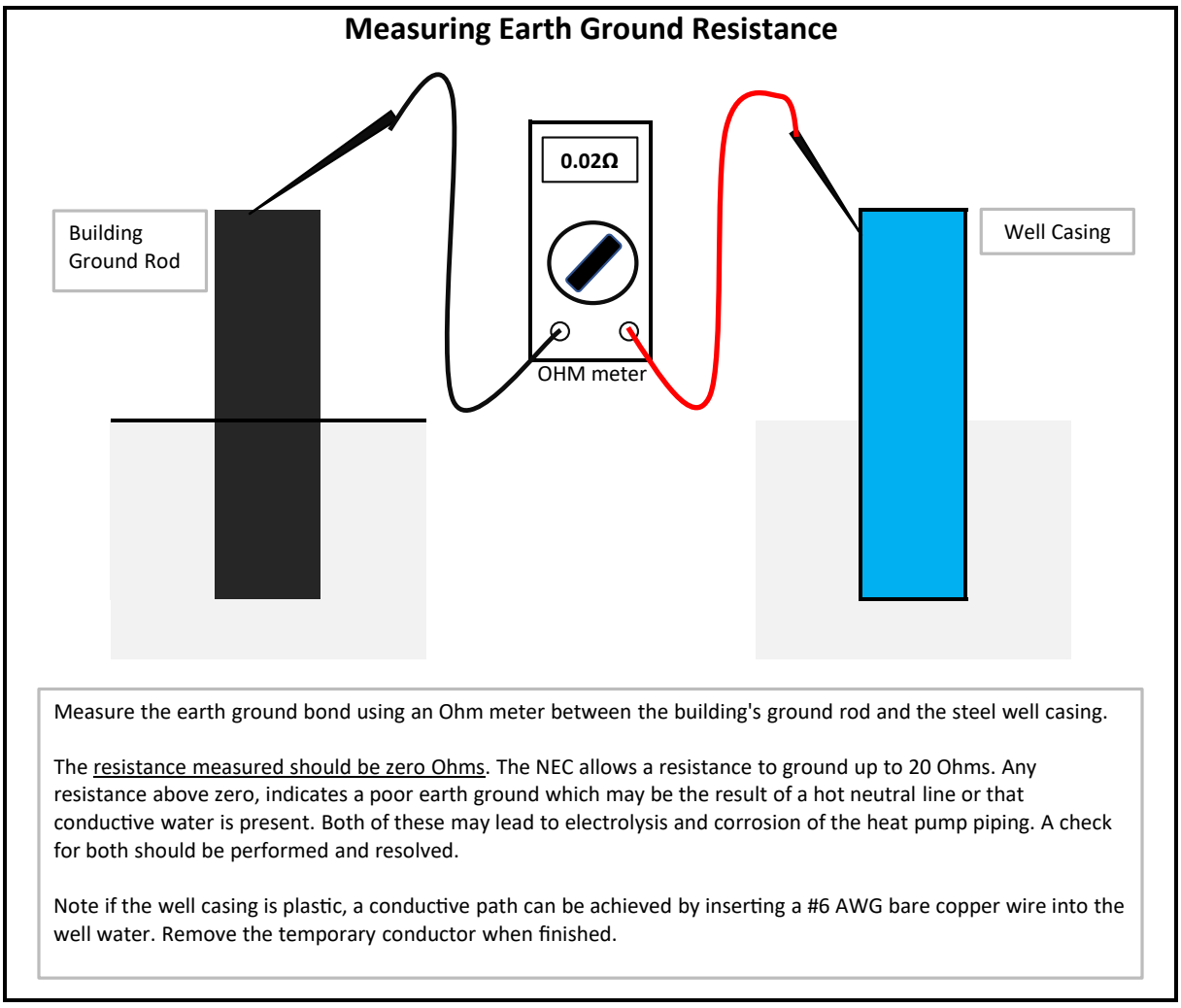
β Suspended solids and particulates must be filtered to prevent fouling and failure of heat exchangers. Strainers or particulate filters must be installed to provide a maximum particle size of 600 micron (0.60 mm, 0.023 in.) using a 20 to 30 mesh screen size. When a loop is installed in areas with fine material such as sand or clay, further filtration is required to a maximum of 100 micron. Refer to the Strainer / Filter Sizing Chart to capture the particle sizes encountered on the site.

χ An electrical grounding system using a dedicated ground rod meeting NEC and Local Electrical codes must be installed. Building Ground must not be connected the WSHP piping system or other plumbing pipes.

δ Refer to IOM for instructions on measuring resistance and leakage currents within water loops.

Do not use PVC pipe for water loop (compressor POE oil and glycols damage PVC) use of HDPE pipe is recommended.

Water Quality Requirements, Cont'd.



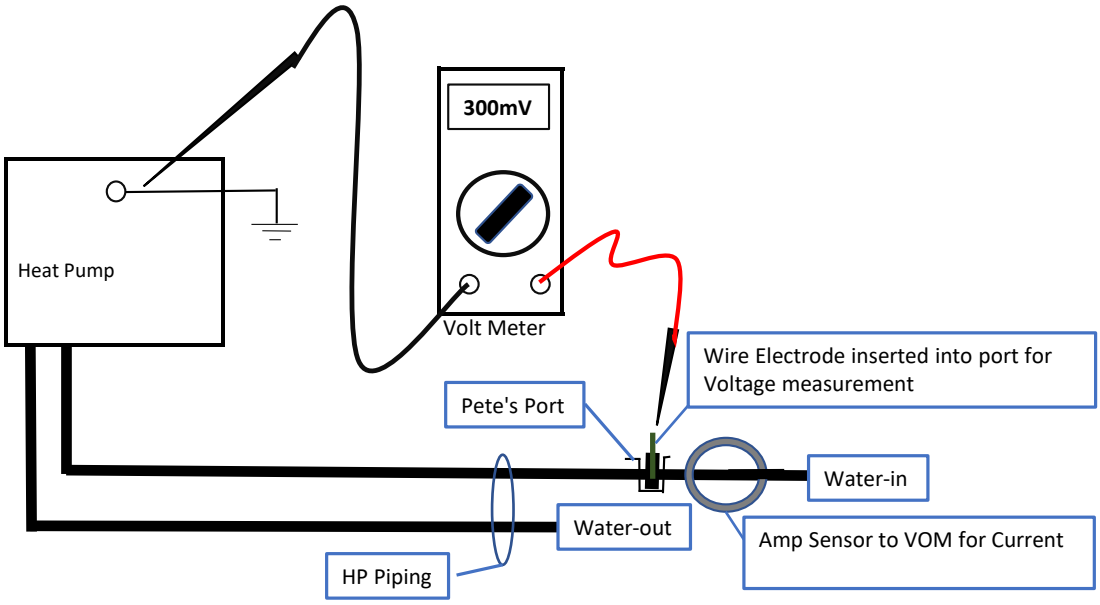
Measure the earth ground bond using an Ohm meter between the building's ground rod and the steel well casing.

The resistance measured should be zero Ohms. The NEC allows a resistance to ground up to 20 Ohms. Any resistance above zero, indicates a poor earth ground which may be the result of a hot neutral line or that conductive water is present. Both of these may lead to electrolysis and corrosion of the heat pump piping. A check for both should be performed and resolved.

Note if the well casing is plastic, a conductive path can be achieved by inserting a #6 AWG bare copper wire into the well water. Remove the temporary conductor when finished.

Water Quality Requirements, Cont'd.

Measuring Electrolysis Voltage and Current



Measure the electrolysis voltage using a volt meter between the heat pump ground and a #14 AWG solid copper wire electrode inserted into the water using a Pete's style access port.

The HP must be operating and the water stream flowing.

The voltage measured should be less than 300mV (0.300 V). If higher than 500mV electrolysis will occure and corrosion will result.

If voltage is measured, the cause is a high resistance earth ground or current on the neutral conductor. Remedial measures should be performed.

Measure the current flowing through the piping system by using an amp clamp probe on the water-in line. The HP must be operating and the water stream flowing.

There should be zero amps measured. If current is present, there is leakage current to the plumbing system and it must be rectified to prevent pipe corrosion.

Electrical - Line Voltage

Electrical – Line Voltage - All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

General Line Voltage Wiring - Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Transformer - All 208/230 voltage units are factory wired for 208 volt. If supply voltage is 230 volt, installer must rewire transformer. See wire diagram for connections.

⚠ WARNING! ⚠

WARNING! To avoid possible injury or death due to electrical shock, open the power supply disconnect switch and secure it in an open position during installation.

⚠ CAUTION! ⚠

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

Table 4a: Tranquility® Compact (TC_L) Series Electrical Data - (Standard 50Hz Units)

Model	Voltage Code	Voltage	Min/Max Voltage	Blower Option	Compressor			Fan Motor FLA	Total Unit FLA	Min Circuit Amp	Max Fuse/ HACR
					QTY	RLA	LRA				
TC_L072	U	380/420/50/3	360/440	A, B, C	2	5.4	38.0	1.8	12.6	14.0	15
TC_L096	U	380/420/50/3	360/440	A, B, C	2	6.1	43.0	3.4	15.6	17.1	20
TC_L120	U	380/420/50/3	360/440	A, B, C	2	7.8	51.5	4.9	20.5	22.5	30
TCV160	U	380/420/50/3	360/440	A, B, C	2	11.2	75.0	4.9	27.3	30.1	40
TCV192	U	380/420/50/3	360/440	A, B, C	2	12.2	101.0	4.9	29.3	32.4	40
TCV240	U	380/420/50/3	360/440	A, B, C	2	16.7	111.0	7.8	41.2	45.4	60
TCV300	U	380/420/50/3	360/440	A, B, C	2	18.6	118.0	21.0	58.2	62.9	80

Table 4b: Tranquility® Compact (TC_L) Series Electrical Data - (Dual Point Power 50Hz Units)

Model	Voltage Code	Voltage	Min/ Max Voltage	Blower Option	Compressor Power Supply						Emergency Power Supply		
					QTY	RLA	LRA	Total Comp FLA	Comp MCA	Comp Max Fuse/ HACR	Fan Motor FLA	Fan MCA	Fan Max Fuse/ HACR
TC_ L072	U	380/420/50/3	360/440	A, B, C	2	5.4	38.0	10.8	12.2	15	1.8	2.2	15
TC_ L096	U	380/420/50/3	360/440	A, B, C	2	6.1	43.0	12.2	13.7	15	3.4	4.3	15
TC_ L120	U	380/420/50/3	360/440	A, B, C	2	7.8	51.5	15.6	17.6	25	4.9	6.1	15
TCV160	U	380/420/50/3	360/440	A, B, C	2	11.2	75.0	22.4	25.2	35	4.9	6.1	15
TCV192	U	380/420/50/3	360/440	A, B, C	2	12.2	101.0	24.4	27.4	35	4.9	6.1	15
TCV240	U	380/420/50/3	360/440	A, B, C	2	16.7	111.0	33.4	37.6	50	7.8	9.8	15
TCV300	U	380/420/50/3	360/440	A, B, C	2	18.6	118.0	37.2	41.9	60	21.0	26.3	15

Electrical - Power Wiring

⚠ WARNING! ⚠

WARNING! Disconnect electrical power source to prevent injury or death from electrical shock.

⚠ CAUTION! ⚠

CAUTION! Use only copper conductors for field installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

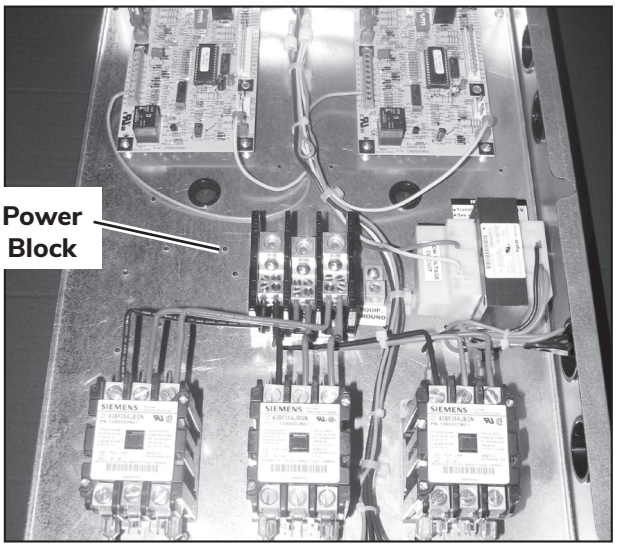
Electrical – Line Voltage - All field installed wiring, including electrical ground, must comply with the National Electrical Code as well as all applicable local codes. Refer to the unit electrical data for fuse sizes. Consult wiring diagram for field connections that must be made by the installing (or electrical) contractor. All final electrical connections must be made with a length of flexible conduit to minimize vibration and sound transmission to the building.

General Line Voltage Wiring - Be sure the available power is the same voltage and phase shown on the unit serial plate. Line and low voltage wiring must be done in accordance with local codes or the National Electric Code, whichever is applicable.

Power Connection - Line voltage connection is made by connecting the incoming line voltage wires to the "L" side of the power block as shown in Figure 11. Consult electrical data tables for correct fuse size.

Transformer - All 208/230 voltage units are factory wired for 380 volt. If supply voltage is 420 volt, installer must rewire transformer. See wire diagram for connections.

Figure 11: TCH 072-120 Line Voltage Wiring



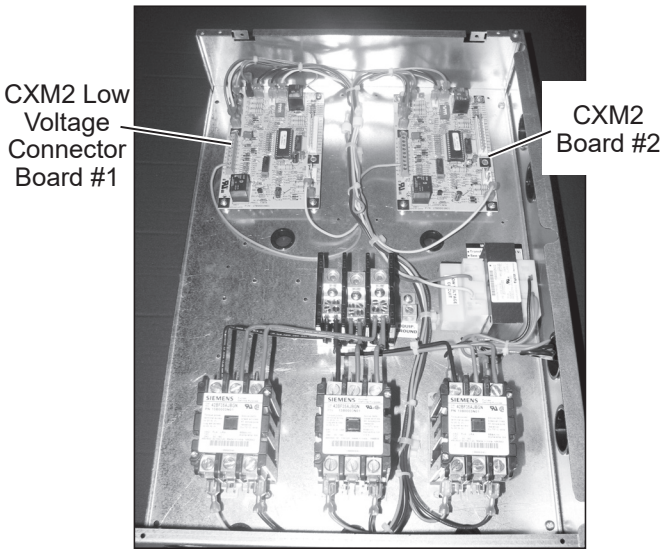
ELECTRICAL - LOW VOLTAGE WIRING

Thermostat Connections - The thermostat should be wired directly to the CXM2 or DXM2.5 board. Figure 17 shows wiring for TC units. See "Electrical – Thermostat" (Figure 21) for specific terminal connections. Review the appropriate AOM (Application, Operation and Maintenance) manual for units with DDC controls.

Low Water Temperature Cutout Selection - The CXM2/DXM2.5 control allows the field selection of low water (or water-antifreeze solution) temperature limit by clipping jumper JW3, which changes the sensing temperature associated with thermistor LT1. Note that the LT1 thermistor is located on the refrigerant line between the coaxial heat exchanger and expansion device (TXV or cap tube). Therefore, LT1 is sensing refrigerant temperature, not water temperature, which is a better indication of how water flow rate/temperature is affecting the refrigeration circuit.

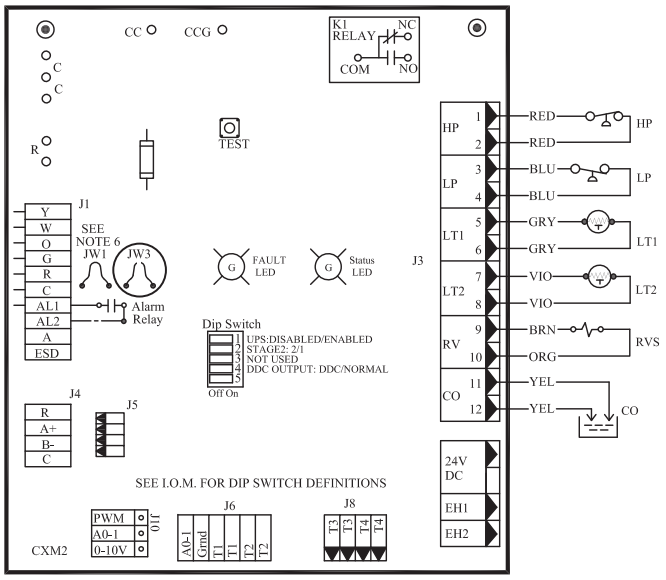
The factory setting for FP1 is for systems using water -1.1°C refrigerant temperature). In low water temperature (extended range) applications with antifreeze (most ground loops), jumper JW3 should be clipped as shown in Figure 13 to change the setting to -12.2°C refrigerant temperature, a more suitable temperature when using an antifreeze solution. All ClimateMaster units operating with entering water temperatures below 15°C must include the optional water/refrigerant circuit insulation package to prevent internal condensation.

Figure 12: TCH 072-120 Low Voltage Field Wiring (CXM2 Shown) NOTE: For DXM2.5, Y2 wiring at DXM2.5 Board 1



Electrical - Power & Low Voltage Wiring

Figure 13: LT1 Limit Setting



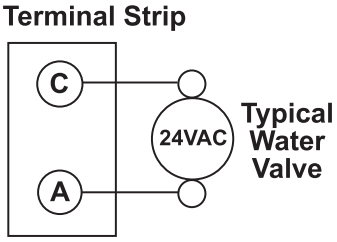
Accessory Connections - A terminal paralleling the compressor contactor coil has been provided on the CXM2/DXM2.5 control. Terminal "A" is designed to control accessory devices, such as water valves. Note: This terminal should be used only with 24 Volt signals and not line voltage. Terminal "A" is energized with the compressor contactor. See the specific unit wiring diagram for details.

Low Voltage VA Ratings

Components In Unit	VA
Typical Blower Contactor	6 - 9
Typical Reversing Valve Solenoid (2)	8 - 12
30A Compressor Contactor (2)	12 - 18
CXM2 board (2)	10 - 18
DXM2.5 board (2)	16 - 24
Units with CXM2 Remaing VA for Accessories	39 - 18
Units with DXM2.5 Remaing VA for Accessories	33 - 12

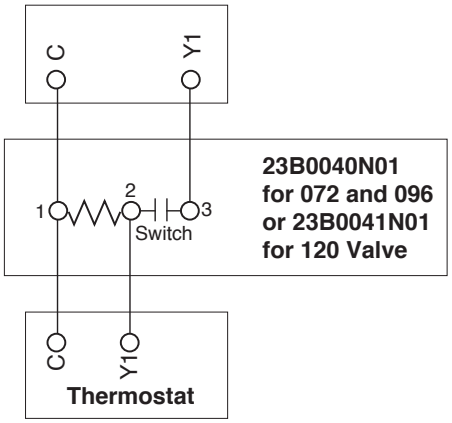
Standard transformer is 75VA.

Figure 14 : Accessory Wiring



Electrical - Low Voltage Wiring

Figure 15: Optional Motorized Water Valve Wiring



Water Solenoid Valves - An external solenoid valve(s) should be used on ground water installations to shut off flow to the unit when the compressor is not operating. A slow closing valve may be required to help reduce water hammer. Figure 14 shows typical wiring for a 24VAC external solenoid valve. This wiring should only be used if valve fully opens in 15 second. Figure 20 illustrates a typical slow closing water control valve wiring for Belimo valves. Slow closing valves take approximately 60 seconds to open (very little water will flow before 45 seconds). Once fully open, an end switch allows the compressor to be energized. Only relay or triac based electronic thermostats should be used with slow closing valves. When wired as shown, the slow closing valve will operate properly with the following notations:

1. The valve will remain open during a unit lockout.
2. The valve will draw approximately 25-35 VA through the “Y” signal of the thermostat.

Note: This valve can overheat the anticipator of an electromechanical thermostat. Therefore, only relay or triac based thermostats should be used.

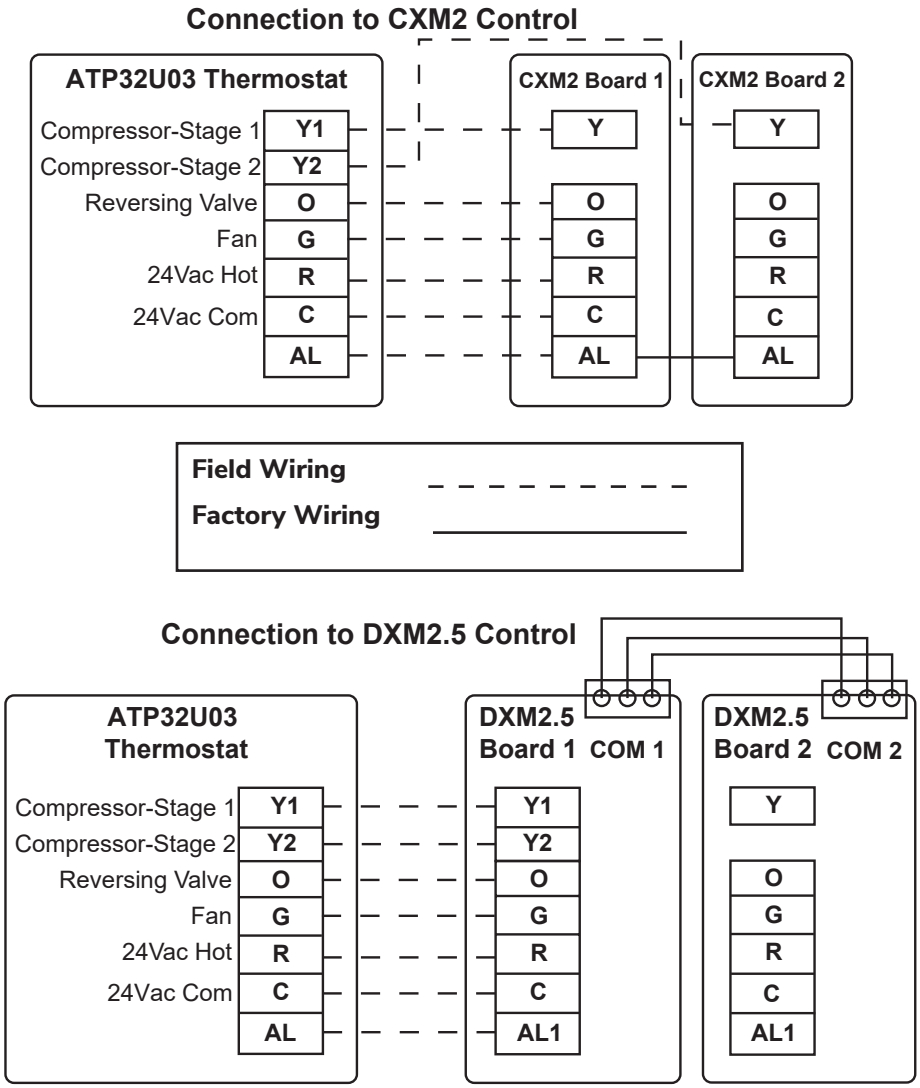
⚠ CAUTION! ⚠

CAUTION! Many units are installed with a factory or field supplied manual or electric shut-off valve. DAMAGE WILL OCCUR if shut-off valve is closed during unit operation. A high pressure switch must be installed on the heat pump side of any field provided shut-off valves and connected to the heat pump controls in series with the built-in refrigerant circuit high pressure switch to disable compressor operation if water pressure exceeds pressure switch setting. The field installed high pressure switch shall have a cut-out pressure of 300 psig and a cut-in pressure of 250 psig. This pressure switch can be ordered from ClimateMaster with a 1/4” internal flare connection as part number 39B0005N02.

Electrical - Thermostat Wiring

Thermostat Installation - The thermostat should be located on an interior wall in a larger room, away from supply duct drafts. DO NOT locate the thermostat in areas subject to sunlight, drafts or on external walls. The wire access hole behind the thermostat may in certain cases need to be sealed to prevent erroneous temperature measurement. Position the thermostat back plate against the wall so that it appears level and so the thermostat wires protrude through the middle of the back plate. Mark the position of the back plate mounting holes and drill holes with a 3/16" (5mm) bit. Install supplied anchors and secure plate to the wall. Thermostat wire must be 18 AWG wire. Wire the appropriate thermostat as shown in Figure 20 to the low voltage terminal strip on the CXM2 or DXM2.5 control board. Practically any heat pump thermostat will work with ClimateMaster units, provided it has the correct number of heating and cooling stages.

Figure 16: Thermostat Connection



Controls – CXM2 and DXM2.5

CXM2 Controls

For detailed controller information, see the CXM2 Application, Operation, and Maintenance (AOM) manual (part # 97B0137N01). To confirm the controller type of your particular unit, refer to digit 9 on the unit model number and the unit nomenclature diagram found on page 3 of this manual.

DXM2.5 Controls

For detailed controller information, see the DXM2.5 Application, Operation, and Maintenance (AOM) manual (part # 97B0142N01). To confirm the controller type of your particular unit, refer to digit 9 on the unit model number and the unit nomenclature diagram found on page 3 of this manual.

Blower Adjustment

⚠ CAUTION! ⚠

CAUTION! Always disconnect all power supply(s) to unit prior to making belt or sheave adjustments. Inadvertently starting of the motor can cause damage to the equipment and personal injury.

Airflow and External Static Pressure Selection Adjustment - The TC_L Series is available with standard, low, and high static options. These options will substitute a different blower drive sheave for each static range. In addition certain static ranges (bold print in Tables 5a through 5k) may require the optional large fan motor. Please specify static range and motor horsepower when ordering. See model nomenclature.

Sheave Adjustment - The TC_L Series is supplied with variable sheave drive on the fan motor to adjust for differing airflows at various ESP conditions. Select an airflow requirement on the left side of the table, then move horizontally to right under the required ESP. Note the sheave turns open, rpm and horsepower for that condition. Fully closed the sheave will produce the highest static capability (higher rpm). To adjust sheave position: loosen belt tension and remove belt, loosen set screw on variable sheave (on fan motor) and open sheave to desired position. Retighten set screw and replace belt and set belt tension as below.

Sheave and Pulley Alignment - Verify belt is straight; misalignment will cause premature belt failure. Adjust sheave if needed.

Belt Tensioning - An overly loose belt will, upon motor start, produce a slippage 'squeel' and cause premature belt failure and or intermittent airflow. An overly tight belt can cause premature motor or blower bearing failure.

Belt Tensioning Procedure - TC_L

1. Remove belt from motor sheave
2. Lift motor assembly
3. Loosen the 5/16" hex nuts on the grommet motor adjustment bolts (2 per bolt). To increase the belt tension loosen the top hex nut. To decrease the belt tension loosen the bottom hex nut.
4. Turn the bolts by hand to the desired position then tighten the 5/16" hex nuts (2 per bolt).
5. Lower the motor assembly
6. Install the belt
7. The belt should be tensioned tensioning gauge method such as the Browning Belt Tensioner to set proper belt tension (See next page).

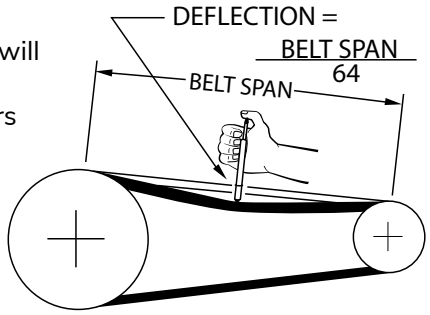
Notes:

- **Motor position should not need adjustment.**
- **Motor sheave position is at mid position of each sheave. Thus the motor sheave is typically 2.5 turns open on a 5 turn sheave.**

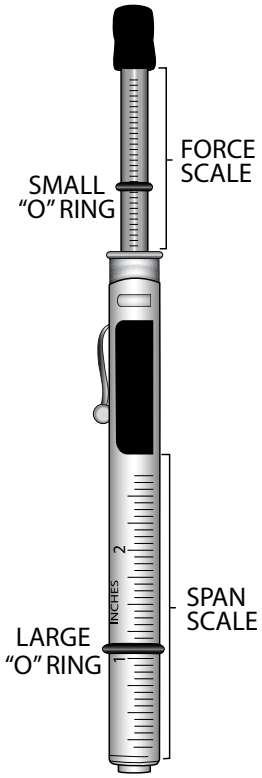
Tensioning V-Belt Drives

Figure 22: Tensioning V-Belt Drives

General Rules of Tensioning



1. Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over tensioning shortens belt and bearing life.
4. Keep belts free from foreign material which may cause slip.
5. Make V-drive inspection on periodic basis. Tension when slipping. Never apply belt dressing as this will damage the belt and cause early failure.



Tension Measurement Procedure

1. Measure the belt span (see sketch).
2. Position bottom of the large "O" ring on the span scale at the measured belt span.
3. Set the small "O" ring on the deflection force scale to zero.
4. Place the tension checker squarely on one belt at the center of the belt span. Apply a force on the plunger and perpendicular to the belt span until the bottom of the large "O" ring is even with the top of the next belt or with the bottom of a straight edge laid across the sheaves.
5. Remove the tension checker and read the forct applied from the bottom of the small "O" ring on the deflection force scale.
6. Compare the force you have applied with the values given in the table below. The force should be between the minimum and maximum shown. The maximum value is shown for "New Belt" and new belts should be tensioned at this value to allow for expected tension loss. Used belts should be maintained at the minimum value as indicated in the table below.

NOTE: The ratio of deflection to belt span is 1:64.

			Belt Deflection Force			
			Super Gripbelts and Unnotched Gripbands		Gripnotch Belts and Notched Gripbands	
Cross Section	Smallest Sheave Diameter Range	RPM Range	Used Belt	New Belt	Used Belt	New Belt
A, AX	7.6 - 9.1	1000 - 2500	16.458	24.464	18.237	27.133
		2501 - 4000	12.454	18.682	15.123	22.240
	9.6 - 12.2	1000 - 2500	20.016	30.246	22.240	32.915
		2501 - 4000	16.902	25.354	19.126	28.467
	12.7 - 17.8	1000 - 2500	24.019	35.584	25.354	41.811
		2501 - 4000	20.906	31.136	22.685	33.805
B, BX	8.6 - 10.7	860- 2500	-	-	21.795	32.026
		2501 - 4000	-	-	18.682	27.578
	11.2 - 14.2	860- 2500	23.574	35.139	36.029	46.704
		2501 - 4000	20.016	29.802	31.581	40.477
	14.7 - 21.8	860- 2500	28.022	41.811	37.808	56.045
		2501 - 4000	26.688	39.587	32.470	48.483

Blower Sheave Information

Table 8: TC_L Blower Sheave and Belt Information

Model	Configuration Return/Supply	Component	Drive Package				
			A	B	C	D	E
72	Front or Back/ Top	Blower Sheave	BK67 X 1"	BK85 X 1"	BK67 X 1"	BK67 X 1"	BK67 X 1"
		Motor Sheave	1VP34 X 7/8"	1VP34 X 7/8"	1VP44 X 7/8"	1VP34 X 7/8"	1VP44 X 7/8"
		Motor	1HP	1HP	1HP	2HP	2HP
		Belt (Qty. 1)	BX46	BX48	BX48	BX46	BX47
96		Blower Sheave	BK67 X 1"	BK77 X 1"	BK62 X 1"	BK67 X 1"	BK62 X 1"
		Motor Sheave	1VP40 X 7/8"	1VP34 X 7/8"	1VP44 X 7/8"	1VP40 X 7/8"	1VP44 X 7/8"
		Motor	2HP	2HP	2HP	3HP	3HP
		Belt (Qty. 1)	BX46	BX47	BX46	BX46	BX46
120		Blower Sheave	BK67 X 1"	BK67 X 1"	BK67 X 1"	BK67 X 1"	BK67 X 1"
		Motor Sheave	1VP44 X 7/8"	1VP34 X 7/8"	1VP50 X 7/8"	1VP44 X 1-1/8"	1VP50 X 1-1/8"
		Motor	3HP	3HP	3HP	5HP	5HP
		Belt (Qty. 1)	BX46	BX46	BX46	BX46	BX47
160		Blower Sheave	BK80H	BK80H	BK80H	BK80H	BK80H
		Motor Sheave	1VP44 X 7/8"	1VP40 X 7/8"	1VP50 X 7/8"	1VP44 X 1-1/8"	1VP50 X 1-1/8"
		Motor	3HP	3HP	3HP	5HP	5HP
		Belt (Qty. 1)	BX42	B41	BX42	BX42	BX42
192		Blower Sheave	BK77H	BK95H	BK70H	BK77H	BK70H
		Motor Sheave	1VP44 X 7/8"	1VP44 X 7/8"	1VP50 X 7/8"	1VP44 X 1-1/8"	1VP50 X 1-1/8"
		Motor	3HP	3HP	3HP	5HP	5HP
		Belt (Qty. 1)	B41	B45	B41	B41	B41
240		Blower Sheave	BK90H	BK90H	BK80H	BK90H	2BK80H
		Motor Sheave	1VP60 X 1-1/8"	1VP50 X 1-1/8"	1VP60 X 1-1/8"	1VP60 X 1-3/8"	2VP60 X 1-3/8"
		Motor	5HP	5HP	5HP	7.5HP	7.5HP
		Belt (Qty. 1)	B45	B44	B44	B44	BX42
300		Blower Sheave	2BK80H	BK95H	2BK80H	N/A	2BK80H
		Motor Sheave	2VP60 X 1-3/8"	1VP60 X 1-3/8"	2VP62 X 1-3/8"		2VP62 X 1-3/8"
		Motor	7.5HP	7.5HP	7.5HP		10HP
		Belt (Qty. 2)	BX55	BX57	BX55		BX55

TC_L 072 Blower Performance

All Data is Wet Coil

Airflow in l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
614	BkW			0.09	0.12	0.14	0.17	0.19	0.21	0.24	0.25	0.27	0.29	0.31	0.32	0.34	0.35
	Sheave/Mtr			B	A	A	A	A	A	C	C	C	C	C	C	C	C
	RPM			505	563	615	655	695	730	765	790	815	840	870	890	910	925
	Turns Open			3	5	3.5	3	2	1	5	4.5	4	3.5	2.5	2.5	2	1.5
661	BkW			0.12	0.14	0.17	0.19	0.22	0.24	0.26	0.29	0.30	0.33	0.34	0.36	0.38	0.40
	Sheave/Mtr			B	A	A	A	A	C	C	C	C	C	C	C	C	C
	RPM			526	578	635	675	715	755	785	815	840	870	890	910	930	950
	Turns Open			2	4.5	3	2.5	1.5	5	4.5	4	3.5	3	2	2	1.5	1
708	BkW		0.12	0.14	0.17	0.19	0.22	0.25	0.27	0.29	0.32	0.34	0.36	0.38	0.41	0.43	
	Sheave/Mtr		B	B	A	A	A	A	C	C	C	C	C	C	C	C	
	RPM		500	547	604	650	695	735	775	805	835	865	890	915	940	960	
	Turns Open		3	1.5	4	3	2	1	4.5	4	3.5	3	2.5	2	1.5	1	
755	BkW		0.14	0.17	0.19	0.22	0.25	0.27	0.29	0.32	0.34	0.37	0.39	0.41	0.44		
	Sheave/Mtr		B	B	A	A	A	A	C	C	C	C	C	C	C		
	RPM		510	568	620	665	710	750	785	820	855	885	910	935	960		
	Turns Open		2.5	1	3.5	2.5	1.5	1	4.5	3.5	3	2.5	2	1.5	1		
802	BkW		0.16	0.19	0.22	0.24	0.27	0.29	0.32	0.34	0.36	0.39	0.42	0.44			
	Sheave/Mtr		B	A	A	A	A	C	C	C	C	C	C	C			
	RPM		531	583	635	680	720	765	800	835	870	900	925	950			
	Turns Open		2	4.5	3.5	2.5	1.5	5	4	3.5	2.5	2	1.5	1			
850	BkW	0.15	0.18	0.21	0.24	0.26	0.29	0.31	0.34	0.36	0.39	0.42	0.45				
	Sheave/Mtr	B	B	A	A	A	A	C	C	C	C	C	C				
	RPM	500	547	599	645	690	735	775	815	850	885	910	940				
	Turns Open	3	1.5	4	3	2	1	5	4	3	2.5	2	1.5				
897	BkW	0.18	0.21	0.23	0.27	0.30	0.33	0.36	0.40	0.43	0.46	0.49	0.52				
	Sheave/Mtr	B	B	A	A	A	A	C	C	C	C	C	C				
	RPM	510	557	604	655	695	740	780	820	855	890	920	950				
	Turns Open	2.5	1.5	4	3	2	1	4.5	3.5	3	2	1.5	1				
944	BkW	0.21	0.23	0.26	0.29	0.33	0.37	0.41	0.44	0.48	0.50	0.54	0.56				
	Sheave/Mtr	B	B	A	A	A	C	C	C	C	C	C	C				
	RPM	521	568	615	660	705	750	785	825	865	895	930	960				
	Turns Open	2.5	1	3.5	2.5	1.5	5.5	4.5	3.5	2.5	2	1.5	1				
991	BkW	0.25	0.28	0.32	0.34	0.37	0.40	0.44	0.48	0.52	0.55	0.58					
	Sheave/Mtr	B	A	A	A	A	C	C	C	C	C	C					
	RPM	536	583	630	670	715	755	795	835	875	905	940					
	Turns Open	2	4.5	3.5	2.5	1.5	5	4	3.5	2.5	2	1					
1038	BkW	0.28	0.30	0.34	0.37	0.41	0.45	0.48	0.52	0.56	0.59	0.62					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	557	599	645	685	730	770	810	850	885	915	950					
	Turns Open	5	4	3	2	1	5	4	3	2.5	1.5	1					
1086	BkW	0.32	0.35	0.38	0.42	0.45	0.48	0.52	0.56	0.60	0.63	0.67					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	573	620	660	705	745	785	820	860	895	925	960					
	Turns Open	4.5	3.5	3	1.5	1	4.5	3.5	3	2	1.5	1					
1133	BkW	0.36	0.39	0.43	0.46	0.49	0.54	0.58	0.62	0.65	0.69						
	Sheave/Mtr	A	A	A	A	C	C	C	C	C	C						
	RPM	609	645	690	730	765	805	845	880	910	945						
	Turns Open	4	3	2.5	1.5	5	4	3	2.5	2	1						
1180	BkW	0.39	0.42	0.46	0.49	0.54	0.58	0.62	0.66	0.70	0.73						
	Sheave/Mtr	A	A	A	A	C	C	C	C	C	C						
	RPM	620	660	700	740	780	815	850	885	920	950						
	Turns Open	3.5	3	2	1	4.5	4	3	2.5	1.5	1						

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 380V for 380-420V units.

Tranquility® Compact Belt Drive (TC_L) Series

Rev.: 24 January, 2023

TC_L 096 Blower Performance

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
850	BkW		0.15	0.18	0.21	0.24	0.27	0.30	0.32	0.34	0.36	0.39	0.42	0.46	0.49	0.52	0.55
	Sheave/Mtr		B	B	B	A	A	A	A	A	A	C	C	C	C	C	C
	RPM		500	552	604	655	700	745	780	820	855	890	915	945	970	995	1020
	Turns Open		4.5	3	1.5	5.5	4.5	3.5	2.5	2	1	4	3.5	3	2.5	2	1.5
897	BkW		0.19	0.21	0.24	0.28	0.31	0.34	0.38	0.41	0.44	0.47	0.50	0.53	0.55	0.58	0.61
	Sheave/Mtr		B	B	A	A	A	A	A	A	A	C	C	C	C	C	C
	RPM		521	573	625	670	710	755	795	830	870	900	930	960	990	1015	1040
	Turns Open		4	2.5	6	5	4	3	2.5	1.5	1	3.5	3	2.5	2	1.5	1
944	BkW	0.20	0.22	0.25	0.28	0.32	0.36	0.39	0.42	0.46	0.49	0.52	0.55	0.58	0.60	0.63	
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	C	C	C	C	C	C	
	RPM	500	542	594	640	685	730	770	805	845	880	915	945	975	1005	1030	
	Turns Open	4.5	3.5	2	5.5	4.5	3.5	3	2	1	4	3.5	2.5	2	1.5	1	
991	BkW	0.24	0.27	0.30	0.33	0.36	0.39	0.43	0.47	0.51	0.54	0.57	0.60	0.63	0.66	0.69	
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	C	C	C	C	C	C	
	RPM	516	563	615	655	700	740	780	820	860	895	925	960	990	1020	1045	
	Turns Open	4	3	1.5	5.5	4.5	3.5	2.5	2	1	4	3	2.5	2	1	1	
1038	BkW	0.26	0.29	0.32	0.36	0.40	0.43	0.47	0.51	0.54	0.58	0.61	0.64	0.67	0.71		
	Sheave/Mtr	B	B	A	A	A	A	A	A	C	C	C	C	C	C		
	RPM	536	583	630	670	715	755	795	835	870	905	935	970	1000	1030		
	Turns Open	3.5	2.5	6	5	4	3	2.5	1.5	4	3.5	3	2	1.5	1		
1086	BkW	0.30	0.34	0.37	0.40	0.43	0.47	0.51	0.55	0.59	0.62	0.66	0.69	0.73	0.77		
	Sheave/Mtr	B	B	A	A	A	A	A	A	C	C	C	C	C	C		
	RPM	557	604	650	690	730	770	810	845	885	915	950	980	1010	1040		
	Turns Open	3	2	5.5	4.5	3.5	3	2	1	4	3.5	2.5	2	1.5	1		
1133	BkW	0.34	0.37	0.41	0.44	0.47	0.51	0.56	0.60	0.64	0.67	0.71	0.74	0.78			
	Sheave/Mtr	B	A	A	A	A	A	A	A	C	C	C	C	C			
	RPM	583	625	665	705	745	785	825	860	895	925	960	990	1020			
	Turns Open	2.5	6	5	4	3.5	2.5	1.5	1	4	3	2.5	2	1			
1180	BkW	0.38	0.41	0.44	0.48	0.52	0.56	0.61	0.65	0.69	0.72	0.75	0.79	0.83			
	Sheave/Mtr	B	A	A	A	A	A	A	C	C	C	C	C	C			
	RPM	604	645	685	725	765	800	835	875	905	940	970	1005	1030			
	Turns Open	2	5.5	4.5	4	3	2	1.5	4	3.5	3	2	1.5	1			
1227	BkW	0.41	0.45	0.48	0.51	0.55	0.60	0.64	0.69	0.72	0.76	0.80	0.85				
	Sheave/Mtr	A	A	A	A	A	A	A	C	C	C	C	C				
	RPM	625	665	700	740	775	815	850	885	915	950	985	1015				
	Turns Open	6	5	4.5	3.5	3	2	1	4	3.5	2.5	2	1.5				
1274	BkW	0.45	0.49	0.52	0.56	0.60	0.64	0.68	0.73	0.77	0.81	0.85	0.90				
	Sheave/Mtr	A	A	A	A	A	A	A	C	C	C	C	C				
	RPM	645	685	720	760	795	830	865	900	930	960	995	1025				
	Turns Open	5.5	4.5	4	3	2.5	1.5	1	3.5	3	2.5	1.5	1				
1322	BkW	0.49	0.53	0.57	0.61	0.65	0.69	0.74	0.78	0.82	0.86	0.91	0.96				
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C	C				
	RPM	665	705	745	780	810	845	880	910	945	975	1005	1035				
	Turns Open	5	4	3.5	2.5	2	1	4	3.5	2.5	2	1.5	1				
1369	BkW	0.53	0.57	0.61	0.65	0.69	0.73	0.77	0.82	0.87	0.91	0.96	1.02				
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C	C				
	RPM	685	720	760	795	825	860	890	920	955	985	1015	1045				
	Turns Open	4.5	4	3	2.5	1.5	1	4	3	2.5	2	1.5	1				
1416	BkW	0.58	0.62	0.67	0.71	0.75	0.79	0.84	0.88	0.93	0.97	1.03					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	700	735	775	810	845	875	910	940	970	1000	1030					
	Turns Open	4.5	3.5	2.5	2	1	4	3.5	3	2	1.5	1					
1463	BkW	0.64	0.68	0.72	0.76	0.80	0.85	0.90	0.97	1.02	1.07	1.12					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	720	755	790	825	860	890	920	955	985	1015	1040					
	Turns Open	4	3	2.5	1.5	1	4	3	2.5	2	1.5	1					
1510	BkW	0.70	0.75	0.80	0.85	0.90	0.94	0.99	1.03	1.08	1.13						
	Sheave/Mtr	A	A	A	A	C	C	C	C	C	C						
	RPM	740	775	810	840	875	905	935	965	995	1025						
	Turns Open	3.5	2.5	2	1.5	4	3.5	3	2.5	1.5	1						
1558	BkW	0.76	0.81	0.86	0.91	0.96	1.00	1.05	1.09	1.14	1.18						
	Sheave/Mtr	A	A	A	A	C	C	C	C	C	C						
	RPM	760	790	825	860	890	920	950	980	1010	1035						
	Turns Open	3	2.5	1.5	1	4	3	2.5	2	1.5	1						
1605	BkW	0.82	0.88	0.92	0.97	1.02	1.06	1.11	1.15	1.21							
	Sheave/Mtr	A	A	A	C	C	C	C	C	C							
	RPM	775	810	840	875	905	935	965	995	1025							
	Turns Open	3	2	1.5	4	3.5	3	2.5	2	1							
1652	BkW	0.89	0.94	0.99	1.03	1.08	1.12	1.17	1.21	1.26							
	Sheave/Mtr	A	A	A	C	C	C	C	C	C							
	RPM	795	825	860	890	920	950	980	1010	1035							
	Turns Open	2.5	1.5	1	4	3	2.5	2	1.5	1							

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 380V for 380-420V units.

TC_L 120 Blower Performance

Airflow is l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
1038	BkW		0.29	0.31	0.35	0.39	0.42	0.46	0.50	0.54	0.57	0.60	0.63	0.67	0.70	0.73	0.76
	Sheave/Mtr		B	B	B	B	A	A	A	A	A	A	C	C	C	C	C
	RPM		573	620	665	705	745	785	825	865	900	930	960	995	1020	1050	1075
	Turns Open		4.5	3.5	2.5	1.5	5.5	4.5	3.5	3	2	1.5	3.5	3	2.5	2	1.5
1086	BkW	0.30	0.33	0.37	0.40	0.43	0.46	0.50	0.54	0.58	0.61	0.65	0.68	0.72	0.76	0.80	0.85
	Sheave/Mtr	B	B	B	B	A	A	A	A	A	A	A	C	C	C	C	C
	RPM	547	594	640	680	720	760	800	840	875	910	940	975	1005	1035	1060	1090
	Turns Open	5	4	3	2	6	5	4	3.5	2.5	2	1.5	3.5	3	2	1.5	1
1133	BkW	0.34	0.37	0.40	0.43	0.47	0.50	0.55	0.59	0.63	0.66	0.70	0.73	0.77	0.82	0.86	
	Sheave/Mtr	B	B	B	B	A	A	A	A	A	A	A	C	C	C	C	
	RPM	573	615	660	700	740	775	815	855	890	920	955	985	1015	1045	1075	
	Turns Open	4.5	3.5	2.5	2	5.5	4.5	4	3	2.5	1.5	1	3	2.5	2	1.5	
1180	BkW	0.37	0.40	0.44	0.47	0.51	0.55	0.60	0.64	0.68	0.71	0.75	0.78	0.82	0.87	0.91	
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	A	C	C	C	C	C	
	RPM	594	635	675	715	755	790	830	865	900	930	965	995	1025	1055	1085	
	Turns Open	4	3	2.5	6	5	4.5	3.5	3	2	1.5	3.5	3	2.5	1.5	1	
1227	BkW	0.40	0.44	0.47	0.51	0.55	0.59	0.63	0.67	0.72	0.75	0.79	0.83	0.88	0.92	0.96	
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	A	C	C	C	C	C	
	RPM	615	655	690	730	770	805	840	875	910	940	975	1005	1035	1065	1095	
	Turns Open	3.5	3	2	5.5	5	4	3.5	2.5	2	1	3.5	3	2	1.5	1	
1274	BkW	0.44	0.47	0.51	0.55	0.59	0.63	0.67	0.71	0.75	0.79	0.84	0.88	0.93	0.97		
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	A	C	C	C	C		
	RPM	635	670	710	750	785	820	855	885	920	950	985	1015	1045	1075		
	Turns Open	3	2.5	1.5	5	4.5	3.5	3	2.5	1.5	1	3	2.5	2	1.5		
1322	BkW	0.47	0.51	0.55	0.59	0.64	0.67	0.72	0.76	0.80	0.84	0.89	0.94	1.00	1.05		
	Sheave/Mtr	B	B	A	A	A	A	A	A	A	C	C	C	C	C		
	RPM	650	690	725	765	800	830	865	900	930	960	995	1025	1055	1085		
	Turns Open	3	2	6	5	4	3.5	3	2	1.5	3.5	3	2.5	1.5	1		
1369	BkW	0.52	0.55	0.59	0.63	0.67	0.71	0.75	0.80	0.85	0.89	0.94	0.99	1.04	1.10		
	Sheave/Mtr	B	B	A	A	A	A	A	A	A	C	C	C	C	C		
	RPM	670	705	745	780	810	845	875	910	940	970	1000	1030	1060	1090		
	Turns Open	2.5	1.5	5.5	4.5	4	3	2.5	2	1	3.5	3	2	1.5	1		
1416	BkW	0.57	0.60	0.65	0.68	0.73	0.77	0.82	0.86	0.91	0.95	1.00	1.05	1.11			
	Sheave/Mtr	B	A	A	A	A	A	A	A	A	C	C	C	C			
	RPM	685	720	760	790	825	860	895	925	955	985	1015	1045	1075			
	Turns Open	2	6	5	4.5	3.5	3	2	1.5	1	3	2.5	2	1.5			
1463	BkW	0.61	0.66	0.70	0.75	0.79	0.82	0.89	0.94	0.99	1.05	1.09	1.15	1.20			
	Sheave/Mtr	B	A	A	A	A	A	A	A	C	C	C	C	C			
	RPM	700	735	775	810	845	875	910	940	970	1000	1025	1055	1085			
	Turns Open	2	5.5	4.5	4	3	2.5	2	1.5	3.5	3	2.5	1.5	1			
1510	BkW	0.68	0.73	0.77	0.82	0.88	0.92	0.96	1.01	1.05	1.10	1.16	1.20	1.26			
	Sheave/Mtr	A	A	A	A	A	A	A	A	C	C	C	C	C			
	RPM	725	760	790	825	860	890	920	950	980	1010	1040	1065	1095			
	Turns Open	6	5	4.5	3.5	3	2	1.5	1	3.5	2.5	2	1.5	1			
1558	BkW	0.74	0.79	0.83	0.88	0.94	0.98	1.02	1.07	1.11	1.16	1.21	1.26				
	Sheave/Mtr	A	A	A	A	A	A	A	C	C	C	C	C				
	RPM	740	775	805	840	875	905	935	965	995	1020	1050	1075				
	Turns Open	5.5	4.5	4	3.5	2.5	2	1.5	3.5	3	2.5	2	1.5				
1605	BkW	0.79	0.85	0.89	0.94	0.99	1.04	1.08	1.12	1.17	1.23	1.29	1.35				
	Sheave/Mtr	A	A	A	A	A	A	A	C	C	C	C	C				
	RPM	755	790	820	855	890	920	945	975	1005	1035	1060	1090				
	Turns Open	5	4.5	3.5	3	2	1.5	1	3.5	3	2	1.5	1				
1652	BkW	0.87	0.91	0.96	1.02	1.06	1.11	1.15	1.20	1.24	1.29	1.34					
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C					
	RPM	780	810	845	880	910	940	970	1000	1025	1050	1080					
	Turns Open	4.5	4	3	2.5	2	1	3.5	3	2.5	2	1					
1699	BkW	0.94	0.99	1.04	1.09	1.15	1.20	1.25	1.30	1.35	1.40	1.45					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	805	835	870	900	930	960	990	1015	1045	1070	1100					
	Turns Open	4	3.5	2.5	2	1.5	3.5	3	2.5	2	1.5	1					
1746	BkW	1.01	1.05	1.10	1.16	1.21	1.26	1.32	1.37	1.43	1.49						
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C						
	RPM	825	855	885	915	945	975	1005	1030	1060	1085						
	Turns Open	3.5	3	2.5	1.5	1	3.5	3	2	1.5	1						
1794	BkW	1.07	1.11	1.17	1.22	1.27	1.33	1.38	1.45	1.51	1.57						
	Sheave/Mtr	A	A	A	A	C	C	C	C	C	C						
	RPM	840	870	900	930	960	990	1015	1045	1070	1095						
	Turns Open	3.5	2.5	2	1.5	3.5	3	2.5	2	1.5	1						
1841	BkW	1.17	1.21	1.27	1.32	1.38	1.43	1.49	1.55	1.62							
	Sheave/Mtr	A	A	A	A	C	C	C	C	C							
	RPM	860	885	915	945	975	1005	1030	1055	1085							
	Turns Open	3	2.5	1.5	1	3.5	3	2	1.5	1							
1888	BkW	1.23	1.29	1.35	1.41	1.48	1.53	1.60	1.66	1.72							
	Sheave/Mtr	A	A	A	C	C	C	C	C	C							
	RPM	875	900	930	960	990	1015	1045	1070	1095							
	Turns Open	2.5	2	1.5	3.5	3	2.5	2	1.5	1							

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor, D = Standard Static/Large Motor, E = High Static/Large Motor Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow in rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

Blower Performance Data – TCV160 Standard Unit

Airflow is l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300
1416	BkW				0.28	0.33	0.38	0.43	0.48	0.54	0.58	0.62	0.67	0.72
	Sheave/Mtr				B	B	A	A	A	A	C	C	C	C
	RPM				542	594	645	685	730	770	800	830	860	890
	Turns Open				2.5	1	4.5	3.5	3	1.5	3.5	3	2	1
1510	BkW			0.26	0.31	0.37	0.42	0.47	0.53	0.57	0.62	0.67	0.72	0.77
	Sheave/Mtr			B	B	B	A	A	A	A	C	C	C	C
	RPM			500	552	609	655	695	740	775	810	845	880	905
	Turns Open			4	2	5.5	4.5	3.5	2.5	1	3.5	2.5	1.5	1
1605	BkW			0.29	0.35	0.41	0.47	0.52	0.57	0.62	0.66	0.71	0.76	
	Sheave/Mtr			B	B	A	A	A	A	A	C	C	C	
	RPM			510	568	620	665	710	750	790	825	860	890	
	Turns Open			3.5	1.5	5.5	4	3	2	1	3	2	1	
1699	BkW			0.33	0.39	0.45	0.51	0.56	0.61	0.66	0.70	0.74	0.81	
	Sheave/Mtr			B	B	A	A	A	A	C	C	C	C	
	RPM			526	578	630	675	720	760	800	835	870	900	
	Turns Open			3	1.5	5	4	3	1.5	3.5	2.5	2	1	
1794	BkW			0.39	0.45	0.51	0.57	0.64	0.70	0.77	0.84	0.91		
	Sheave/Mtr			B	B	A	A	A	A	C	C	C		
	RPM			536	589	640	680	725	765	805	845	880		
	Turns Open			2.5	1	4.5	4	2.5	1.5	3.5	2.5	1.5		
1888	BkW		0.41	0.45	0.50	0.57	0.65	0.72	0.79	0.86	0.93	1.00		
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C		
	RPM		505	552	604	650	695	735	775	815	850	890		
	Turns Open		3.5	2	6	4.5	3.5	2.5	1	3	2	1.5		
1982	BkW		0.48	0.54	0.62	0.67	0.73	0.79	0.87	0.95	1.02	1.08		
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C		
	RPM		521	568	620	660	705	745	785	825	860	895		
	Turns Open		3	1.5	5.5	4	3	2	1	3	2	1		
2077	BkW		0.53	0.59	0.64	0.72	0.79	0.86	0.94	1.02	1.10	1.16		
	Sheave/Mtr		B	B	A	A	A	A	C	C	C	C		
	RPM		536	583	630	675	715	755	795	835	875	905		
	Turns Open		2.5	1.5	5	4	3	2	3.5	2.5	1.5	1		
2171	BkW	0.52	0.60	0.67	0.74	0.80	0.86	0.93	1.01	1.09	1.16			
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C			
	RPM	500	552	599	645	685	725	765	805	845	880			
	Turns Open	4	2	6	4.5	3.5	2.5	1.5	3.5	2.5	1.5			
2266	BkW	0.59	0.66	0.73	0.80	0.87	0.93	1.00	1.10	1.19	1.27			
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C			
	RPM	521	568	615	660	700	740	775	815	855	890			
	Turns Open	3	1.5	5.5	4	3.5	2.5	1.5	3	2	1			
2360	BkW	0.66	0.72	0.79	0.86	0.94	1.01	1.10	1.19	1.27	1.35			
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C			
	RPM	542	583	630	670	715	755	790	825	860	895			
	Turns Open	2.5	1.5	5	4	3	2	1	3	2	1			

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

Blower Performance Data – TCV192 Standard Unit

Airflow is l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
1510	BkW		0.28	0.33	0.39	0.44	0.49	0.55	0.59	0.63	0.68	0.73	0.78	0.83	0.88	0.93	0.97
	Sheave/Mtr		B	B	A	A	A	A	A	A	C	C	C	C	C	C	C
	RPM		516	568	625	665	710	755	785	820	855	885	910	935	960	985	1005
	Turns Open		5	3.5	6	5	4	2.5	2	1	5.5	4.5	4	3.5	3	2.5	1.5
1605	BkW		0.30	0.37	0.42	0.48	0.53	0.58	0.63	0.67	0.71	0.77	0.82	0.88	0.94	0.99	1.03
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C	C	C	C	C	C
	RPM		521	578	630	675	715	760	795	830	865	895	920	950	975	1000	1020
	Turns Open		5	3.5	5.5	4.5	3.5	2.5	1.5	6	5	4.5	3.5	3	2.5	2	1.5
1699	BkW		0.34	0.40	0.46	0.51	0.57	0.62	0.66	0.71	0.75	0.82	0.88	0.94	1.01	1.07	1.12
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C	C	C	C	C	C
	RPM		531	583	635	680	725	765	800	840	875	905	930	955	985	1010	1030
	Turns Open		4.5	3	5.5	4.5	3.5	2.5	1.5	5.5	5	4	3.5	3	2.5	1.5	1
1794	BkW		0.39	0.45	0.51	0.57	0.64	0.70	0.77	0.84	0.91	0.96	1.01	1.07	1.12	1.17	1.23
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C	C	C	C	C	C
	RPM		536	589	640	680	725	765	805	845	880	910	940	970	1000	1020	1045
	Turns Open		4.5	3	5	4.5	3	2	1.5	5.5	4.5	4	3	2.5	2	1.5	1
1888	BkW	0.40	0.45	0.50	0.56	0.64	0.72	0.79	0.86	0.93	0.99	1.04	1.11	1.16	1.22	1.28	
	Sheave/Mtr	B	B	B	A	A	A	A	A	C	C	C	C	C	C	C	
	RPM	500	547	599	645	690	735	775	810	850	885	915	950	980	1010	1035	
	Turns Open	6	4	2.5	5	4	3	2	1	5	4.5	3.5	3	2.5	1.5	1	
1982	BkW	0.46	0.53	0.60	0.67	0.72	0.78	0.85	0.93	1.01	1.07	1.14	1.19	1.24	1.31	1.37	
	Sheave/Mtr	B	B	B	A	A	A	A	A	C	C	C	C	C	C	C	
	RPM	510	557	609	655	695	735	775	815	855	890	925	955	985	1015	1040	
	Turns Open	5.5	4	2.5	5	4	3	2	1	5	4.5	3	3	2	1.5	1	
2077	BkW	0.51	0.57	0.62	0.70	0.77	0.84	0.91	0.99	1.07	1.14	1.21	1.27	1.33	1.39	1.45	
	Sheave/Mtr	B	B	B	A	A	A	A	A	C	C	C	C	C	C	C	
	RPM	521	568	615	660	700	745	780	820	860	895	930	960	990	1020	1045	
	Turns Open	5	3.5	2	4.5	3.5	2.5	2	1	5	4	3	2.5	2	1.5	1	
2171	BkW	0.58	0.65	0.73	0.79	0.85	0.91	0.99	1.06	1.14	1.22	1.28	1.36	1.42	1.51		
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C	C	C	C	C		
	RPM	536	583	635	675	715	755	795	830	870	905	935	970	1000	1030		
	Turns Open	4.5	3	5.5	4.5	3.5	2.5	1.5	6	4.5	4	3	2.5	2	1		
2266	BkW	0.65	0.72	0.78	0.85	0.92	0.98	1.07	1.17	1.24	1.31	1.38	1.44	1.53	1.60		
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C	C	C	C	C		
	RPM	557	604	645	690	730	765	805	845	880	910	945	975	1010	1035		
	Turns Open	4	2.5	5	4	3	2.5	1.5	5.5	4.5	4	2.5	2.5	1.5	1		
2360	BkW	0.71	0.78	0.85	0.92	0.99	1.08	1.17	1.26	1.34	1.40	1.48	1.54	1.62	1.71		
	Sheave/Mtr	B	A	A	A	A	A	A	C	C	C	C	C	C	C		
	RPM	573	620	660	705	745	780	820	855	890	920	955	985	1015	1045		
	Turns Open	3.5	6	5	4	3	2	1	5	4.5	3.5	2.5	2	1.5	1		
2454	BkW	0.78	0.85	0.92	0.99	1.06	1.14	1.24	1.32	1.41	1.48	1.56	1.63	1.72			
	Sheave/Mtr	B	A	A	A	A	A	C	C	C	C	C	C	C			
	RPM	599	640	680	720	755	790	830	865	900	930	965	995	1025			
	Turns Open	3	5.5	4.5	3.5	2.5	1.5	6	5	4	3.5	2	2	1.5			
2549	BkW	0.84	0.92	0.99	1.07	1.14	1.22	1.30	1.38	1.46	1.56	1.64	1.74	1.83			
	Sheave/Mtr	B	A	A	A	A	A	C	C	C	C	C	C	C			
	RPM	615	655	695	735	770	805	840	875	905	940	970	1005	1035			
	Turns Open	2.5	5	4	3	2	1.5	5.5	4.5	3.5	3	2	2	1			
2643	BkW	0.92	0.99	1.07	1.15	1.24	1.32	1.40	1.49	1.57	1.66	1.74	1.85	1.94			
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C	C	C			
	RPM	635	670	710	750	785	820	850	885	915	950	980	1015	1040			
	Turns Open	5.5	4.5	3.5	2.5	2	1	5	4.5	3.5	3	2	1.5	1			
2738	BkW	1.00	1.08	1.15	1.23	1.30	1.39	1.47	1.56	1.65	1.74	1.84	1.94	2.05			
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C	C	C			
	RPM	650	690	725	765	795	830	865	895	925	955	990	1020	1050			
	Turns Open	5	4	3	2.5	1.5	6	4.5	4	3	3	1.5	1.5	1			

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

Blower Performance Data – TCV240 Standard Unit

Airflow is l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375
1888	BkW				0.57	0.65	0.73	0.80	0.86	0.94	1.00	1.05	1.12	1.17	1.23	1.28	1.34
	Sheave/Mtr				B	B	A	A	A	A	A	C	C	C	C	C	C
	RPM				650	695	740	780	815	855	890	920	955	985	1015	1035	1060
	Turns Open				5	3.5	6	4.5	3.5	2	1.5	3.5	2.5	2	1	0.5	0
1982	BkW				0.68	0.73	0.79	0.87	0.95	1.03	1.09	1.15	1.21	1.26	1.32	1.38	
	Sheave/Mtr				B	B	A	A	A	A	A	C	C	C	C	C	
	RPM				665	705	745	785	825	865	900	930	965	995	1020	1045	
	Turns Open				4.5	3.5	5.5	4	3	2	1	3.5	2.5	1.5	0.5	0.5	
2077	BkW			0.64	0.72	0.79	0.86	0.94	1.02	1.10	1.16	1.23	1.29	1.35	1.42	1.48	
	Sheave/Mtr			B	B	B	A	A	A	A	C	C	C	C	C	C	
	RPM			630	675	715	755	795	835	875	905	940	970	1000	1030	1055	
	Turns Open			6	4.5	3	5	4	3	1.5	4	3	2	1.5	0.5	0	
2171	BkW			0.74	0.80	0.86	0.93	1.01	1.08	1.16	1.24	1.30	1.38	1.45	1.53	1.62	
	Sheave/Mtr			B	B	B	A	A	A	A	C	C	C	C	C	C	
	RPM			645	685	725	765	805	840	880	915	945	980	1010	1035	1065	
	Turns Open			5.5	4	3	5	3.5	2.5	1.5	4	3	2	1	0.5	0	
2266	BkW			0.80	0.86	0.92	1.00	1.08	1.18	1.26	1.33	1.39	1.46	1.54	1.63		
	Sheave/Mtr			B	B	A	A	A	A	A	C	C	C	C	C		
	RPM			655	695	735	775	810	850	885	920	950	985	1015	1045		
	Turns Open			5	3.5	6	4.5	3.5	2.5	1	3.5	2.5	2	1	0		
2360	BkW		0.79	0.85	0.93	1.00	1.09	1.17	1.27	1.35	1.41	1.49	1.55	1.63	1.72		
	Sheave/Mtr		B	B	B	A	A	A	A	A	C	C	C	C	C		
	RPM		625	665	710	750	785	820	860	895	925	960	990	1020	1050		
	Turns Open		6	5	3.5	5.5	4.5	3	2	1	3.5	2.5	1.5	1	0		
2454	BkW		0.85	0.92	0.99	1.07	1.15	1.24	1.32	1.41	1.48	1.56	1.65	1.72	1.81		
	Sheave/Mtr		B	B	B	A	A	A	A	A	C	C	C	C	C		
	RPM		640	680	720	760	795	830	865	900	930	965	1000	1025	1055		
	Turns Open		5.5	4.5	3	5	4	3	2	1	3	2	1.5	0.5	0		
2549	BkW		0.92	0.99	1.07	1.14	1.22	1.30	1.38	1.46	1.56	1.64	1.72	1.81	1.90		
	Sheave/Mtr		B	B	A	A	A	A	A	C	C	C	C	C	C		
	RPM		655	695	735	770	805	840	875	905	940	970	1000	1030	1060		
	Turns Open		5	4	6	4.5	3.5	2.5	1.5	4	3	2	1.5	0.5	0		
2643	BkW	0.91	0.99	1.07	1.15	1.24	1.31	1.40	1.49	1.57	1.66	1.74	1.83	1.94			
	Sheave/Mtr	B	B	B	A	A	A	A	A	C	C	C	C	C			
	RPM	630	670	710	750	785	815	850	885	915	950	980	1010	1040			
	Turns Open	6	4.5	3.5	5.5	4	3.5	2.5	1.5	3.5	2.5	2	1	0.5			
2738	BkW	0.99	1.07	1.15	1.22	1.30	1.39	1.46	1.56	1.65	1.74	1.83	1.92	2.03			
	Sheave/Mtr	B	B	B	A	A	A	A	A	C	C	C	C	C			
	RPM	645	685	725	760	795	830	860	895	925	955	985	1015	1045			
	Turns Open	5.5	4	3	5	4	3	2	1	3.5	2.5	1.5	1	0			
2832	BkW	1.08	1.16	1.24	1.33	1.42	1.50	1.57	1.68	1.77	1.86	1.94	2.05	2.14			
	Sheave/Mtr	B	B	B	A	A	A	A	C	C	C	C	C	C			
	RPM	660	700	735	775	810	845	875	910	940	970	1000	1030	1055			
	Turns Open	5	3.5	3	4.5	3.5	2.5	1.5	4	3	2	1.5	0.5	0			
2926	BkW	1.17	1.26	1.35	1.43	1.51	1.60	1.70	1.81	1.91	2.02	2.13	2.24	2.33			
	Sheave/Mtr	B	B	A	A	A	A	A	C	C	C	C	C	C			
	RPM	675	715	750	785	820	855	890	920	950	980	1010	1040	1065			
	Turns Open	4.5	3	5.5	4	3	2	1	3.5	2.5	2	1	0.5	0			
3021	BkW	1.29	1.39	1.48	1.59	1.68	1.78	1.87	1.96	2.05	2.14	2.24	2.35				
	Sheave/Mtr	B	A	A	A	A	A	C	C	C	C	C	C				
	RPM	695	735	770	805	835	870	900	930	960	990	1020	1050				
	Turns Open	4	6	5	3.5	3	2	4	3	2.5	1.5	1	0.5				
3115	BkW	1.41	1.50	1.60	1.69	1.80	1.90	1.99	2.08	2.17	2.24	2.35	2.44				
	Sheave/Mtr	B	A	A	A	A	A	C	C	C	C	C	C				
	RPM	715	750	785	815	850	885	915	945	975	1000	1030	1055				
	Turns Open	3.5	5.5	4.5	3.5	2.5	1.5	3.5	3	2.5	1.5	0.5	0				
3210	BkW	1.52	1.60	1.71	1.81	1.91	2.00	2.09	2.18	2.27	2.38	2.49	2.59				
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C	C				
	RPM	730	760	795	830	865	895	925	955	985	1015	1040	1065				
	Turns Open	6	5	4	3	2	1	3	2.5	2	1	0.5	0				
3304	BkW	1.63	1.72	1.83	1.93	2.02	2.11	2.20	2.29	2.38	2.48	2.57					
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C	C					
	RPM	745	775	810	845	875	905	935	965	995	1025	1050					
	Turns Open	5.5	4.5	3.5	2.5	1.5	4	2.5	2	2	1	0					

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

Blower Performance Data – TCV300 Standard Unit

Airflow is l/s with wet coil and clean filter

l/s	Pa	0	25	50	75	100	125	150	175	200	225	250	275	300	325	35	375
2832	BkW	0.91	1.03	1.14	1.24	1.34	1.45	1.53	1.62	1.70	1.78	1.87	1.96	2.05	2.14	2.23	2.31
	Sheave/Mtr	B	B	B	B	A	A	A	A	A	A	A	C	C	C	C	C
	RPM	670	715	755	795	830	870	900	1	965	995	1020	1045	1070	1095	1120	1140
	Turns Open	6	5	3.5	2.5	5.5	5	4	3	2	1.5	1	3.5	2.5	2	1	1
2974	BkW	1.08	1.16	1.27	1.39	1.51	1.61	1.71	1.79	1.87	1.96	2.05	2.14	2.23	2.32	2.42	
	Sheave/Mtr	B	B	B	B	A	A	A	A	A	A	C	C	C	C	C	
	RPM	695	735	775	815	855	890	925	955	985	1015	1040	1065	1090	1115	1140	
	Turns Open	5.5	4.5	3	2	5	4	3.5	2.5	1.5	1	3.5	3	2	1.5	1	
3115	BkW	1.20	1.31	1.43	1.53	1.64	1.75	1.84	1.93	2.04	2.13	2.22	2.32	2.41	2.51		
	Sheave/Mtr	B	B	B	A	A	A	A	A	A	A	C	C	C	C		
	RPM	720	760	800	835	875	910	940	970	1005	1030	1055	1085	1110	1135		
	Turns Open	5	3.5	2.5	5.5	4.5	3.5	3	2	1.5	0.5	3	2.5	1.5	1		
3257	BkW	1.32	1.44	1.56	1.68	1.79	1.89	2.00	2.12	2.22	2.36	2.47	2.60	2.71			
	Sheave/Mtr	B	B	A	A	A	A	A	A	A	C	C	C	C			
	RPM	740	780	820	860	895	925	960	995	1020	1050	1075	1105	1130			
	Turns Open	4	3	6	5	4	3.5	2.5	1.5	1	3	2.5	1.5	1			
3398	BkW	1.47	1.61	1.73	1.87	1.96	2.07	2.17	2.27	2.40	2.54	2.67	2.81	2.89			
	Sheave/Mtr	B	B	A	A	A	A	A	A	C	C	C	C	C			
	RPM	765	805	840	880	910	945	975	1005	1035	1065	1095	1125	1145			
	Turns Open	3.5	2	5.5	4.5	3.5	3	2	1	3.5	2.5	2	1	1			
3540	BkW	1.65	1.78	1.91	2.03	2.14	2.23	2.34	2.47	2.58	2.72	2.85	2.96				
	Sheave/Mtr	B	A	A	A	A	A	A	A	C	C	C	C				
	RPM	790	825	860	895	930	960	995	1025	1050	1080	1110	1135				
	Turns Open	2.5	6	5	4	3.5	2.5	1.5	0.5	3	2	1.5	1				
3682	BkW	1.79	1.91	2.04	2.16	2.27	2.40	2.51	2.65	2.78	2.92	3.05					
	Sheave/Mtr	B	A	A	A	A	A	A	C	C	C	C					
	RPM	810	845	880	915	945	980	1010	1040	1070	1100	1130					
	Turns Open	2	5.5	4.5	3.5	3	2	1	3.5	2.5	1.5	1					
3823	BkW	1.99	2.12	2.24	2.36	2.50	2.63	2.76	2.89	3.03	3.17	3.30					
	Sheave/Mtr	A	A	A	A	A	A	C	C	C	C	C					
	RPM	850	885	915	945	980	1010	1040	1070	1100	1130	1155					
	Turns Open	5.5	4.5	3.5	3	2	1	3.5	2.5	1.5	1	1					
3965	BkW	2.21	2.33	2.47	2.59	2.75	2.88	3.04	3.20	3.37	3.50						
	Sheave/Mtr	A	A	A	A	A	C	C	C	C	C						
	RPM	880	910	945	975	1010	1035	1065	1095	1125	1150						
	Turns Open	5	3.5	3	2	1	3.5	2.5	2	1	1						
4106	BkW	2.40	2.54	2.67	2.81	2.97	3.13	3.29	3.45	3.59							
	Sheave/Mtr	A	A	A	A	C	C	C	C	C							
	RPM	910	940	970	1000	1030	1060	1090	1120	1145							
	Turns Open	4	3	2	1.5	3.5	2.5	2	1.5	1							
4248	BkW	2.65	2.78	2.92	3.08	3.24	3.40	3.54	3.70								
	Sheave/Mtr	A	A	A	C	C	C	C	C								
	RPM	940	970	1000	1030	1060	1090	1115	1145								
	Turns Open	3	2	1.5	3.5	2.5	2	1.5	1								
4390	BkW	2.98	3.14	3.30	3.46	3.60	3.76	3.90									
	Sheave/Mtr	A	A	C	C	C	C	C									
	RPM	970	1000	1030	1060	1085	1115	1140									
	Turns Open	2	1.5	3.5	2.5	1.5	1.5	1									
4531	BkW	3.25	3.42	3.55	3.71	3.85	4.02										
	Sheave/Mtr	A	C	C	C	C	C										
	RPM	1000	1030	1055	1085	1110	1140										
	Turns Open	1.5	3	3	1.5	1	1										
4673	BkW	3.50	3.66	3.80	3.96	4.10	4.26										
	Sheave/Mtr	A	C	C	C	C	C										
	RPM	1025	1055	1080	1110	1135	1160										
	Turns Open	1	2.5	2.5	1	1	1										
4814	BkW	3.95	4.14	4.29	4.43												
	Sheave/Mtr	C	C	C	C												
	RPM	1075	1105	1130	1155												
	Turns Open	2.5	1.5	1.5	1												

A = Standard Static/Standard Motor, B = Low Static/Standard Motor, C = High Static/Standard Motor.
Unit factory shipped with standard static sheave and drive at 2.5 turns open. Other speed require field selection.
For applications requiring higher static pressures, contact your local representative. Performance data does not include drive losses and is based on sea level conditions.
Do not operate in black regions. All airflow is rated at lowest Voltage if unit is dual Voltage rated, i.e. 208V for 208-230V units.

Unit Starting and Operating Limits

Operating Limits
Environment – Units are designed for indoor installation only. Never install units in areas subject to freezing or where humidity levels could cause cabinet condensation (such as unconditioned spaces subject to 100% outside air).

Power Supply – A voltage variation of +/– 10% of nameplate utilization voltage is acceptable.

Determination of operating limits is dependent primarily upon three factors: 1) return air temperature. 2) water temperature, and 3) ambient temperature. When any one of these factors is at minimum or maximum levels, the other two factors should be at normal levels to ensure proper unit operation. Extreme variations in temperature and humidity and/or corrosive water or air will adversely affect unit performance, reliability, and service life. Consult Table 4 for operating limits.

Commissioning Limits
Starting conditions are based upon the following notes:

Notes:
1. Limits in Table 5 are not normal or continuous operating limits. Minimum/maximum limits are start-up limits to bring the building space up to occupancy temperatures. Units are not designed to operate under these limits on a regular basis.
2. Voltage utilization range complies with AHRI Standard 110.

Table 9a: Operating Limits

Operating Limits	TC_LH/TC_LV	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	110ºF [43ºC]	85ºF [29ºC]
Min. entering air, DB/WB	60/50ºF [16/10ºC]	50ºF [10ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	95/75ºF [35/24ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Table 9b: Commissioning Limits

Commissioning Limits	TC_LH/TC_LV	
	Cooling	Heating
Air Limits		
Min. ambient air, DB	45ºF [7ºC]	39ºF [4ºC]
Rated ambient air, DB	80.6ºF [27ºC]	68ºF [20ºC]
Max. ambient air, DB	110ºF [43ºC]	85ºF [29ºC]
Min. entering air, DB/WB	50/45ºF [10/7ºC]	40ºF [4.5ºC]
Rated entering air, DB/WB	80.6/66.2ºF [27/19ºC]	68ºF [20ºC]
Max. entering air, DB/WB	110/83ºF [43/28ºC]	80ºF [27ºC]
Water Limits		
Min. entering water	30ºF [-1ºC]	20ºF [-6.7ºC]
Normal entering water	50-110ºF [10-43ºC]	30-70ºF [-1 to 21ºC]
Max. entering water	120ºF [49ºC]	90ºF [32ºC]
Normal Water Flow	1.5 to 3.0 gpm / ton [1.6 to 3.2 l/m per kW]	

Piping System Cleaning and Flushing

Cleaning and flushing the WLHP piping system is the single most important step to ensure proper start-up and continued efficient operation of the system.

Follow the instructions below to properly clean and flush the system:

1. Ensure that electrical power to the unit is disconnected.
2. Install the system with the supply hose connected directly to the return riser valve. Use a single length of flexible hose.
3. Fill the system with water. DO NOT allow system to overflow. Bleed all air from the system. Pressurize and check the system for leaks and repair as appropriate. Models with Waterside Economizer also manually open economizer valve and coil air vents (2) to bleed air from coil.
4. Verify that all strainers are in place (ClimateMaster recommends a strainer with a #20 stainless steel wire mesh). Start the pumps, and systematically check each vent to ensure that all air is bled from the system.
5. Verify that make-up water is available. Adjust make-up water as required to replace the air which was bled from the system. Check and adjust the water/air level in the expansion tank.
6. Set the boiler to raise the loop temperature to approximately 86°F [30°C]. Open a drain at the lowest point in the system. Adjust the make-up water replacement rate to equal the rate of bleed.
7. Refill the system and add trisodium phosphate in a proportion of approximately one pound per 150 gallons (.8 kg per 1000 l) of water (or other equivalent approved cleaning agent) Reset the boiler to raise the loop temperature to 100°F [38°C]. Circulate the solution for a minimum of 8 to 24 hours. At the end of this period, shut off the circulating pump and drain the solution. Repeat system cleaning if desired.
8. When the cleaning process is complete, remove the short-circuited hoses. Reconnect the hoses to the proper supply, and return the connections to each of the units. Refill the system and bleed off all air.
9. Test the system pH with litmus paper. The system water should be in the range of pH 6.0 - 8.5 (see table 3). Add chemicals, as appropriate to maintain neutral pH levels.
10. When the system is successfully cleaned, flushed, refilled and bled, check the main system panels, safety cutouts and alarms. Set the controls to properly maintain loop temperatures.

DO NOT use “Stop Leak” or similar chemical agent in this system. Addition of chemicals of this type to the loop water will foul the heat exchanger and inhibit unit operation.

Note: The manufacturer strongly recommends all piping connections, both internal and external to the unit, be pressure tested by an appropriate method prior to any finishing of the interior space or before access to all connections is limited. Test pressure may not exceed the maximum allowable pressure for the unit and all components within the water system. The manufacturer will not be responsible or liable for damages from water leaks due to inadequate or lack of a pressurized leak test, or damages caused by exceeding the maximum pressure rating during installation.

Unit Starting and Operating Limits

⚠ WARNING! ⚠

WARNING! Polyolester Oil, commonly known as POE oil, is a synthetic oil used in many refrigeration systems including those with HFC-410A refrigerant. POE oil, if it ever comes in contact with PVC or CPVC piping, may cause failure of the PVC/CPVC. PVC/CPVC piping should never be used as supply or return water piping with water source heat pump products containing HFC-410A as system failures and property damage may result.

BEFORE POWERING SYSTEM, please check the following:

UNIT CHECKOUT

- ❑ Line voltage and wiring: Verify that voltage is within an acceptable range for the unit and wiring and fuses/ breakers are properly sized. Verify that low voltage wiring is complete.
- ❑ Unit control transformer: Ensure that transformer has the properly selected voltage tap. Commercial 380-420V units are factory wired for 380V operation unless specified otherwise.
- ❑ Balancing/shutoff valves: Ensure that all isolation valves are open (after system flushing - see System Checkout) and water control valves are wired.
- ❑ Entering water and air: Ensure that entering water and air temperatures are within operating limits of Table 9.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out on the CXM2/DXM2.5 control is properly set.
- ❑ Unit blower wheel: Manually rotate blower wheel to verify free rotation and ensure that all blower wheels are secured to the blower motor shaft and centered in housing.
- ❑ Blower motor: Verify motor bolts are tight. DO NOT oil motors upon start-up. Fan motors are pre-oiled at the factory.
- ❑ Check shaft pillow blocks, sheave and pulley are tight
- ❑ Verify sheave has been set to turns in design requirement. Record turns on start up log sheet.
- ❑ Verify belt is straight and proper tension
- ❑ Condensate line: Verify that condensate line is open, trapped, vented and properly pitched toward drain.
- ❑ Water flow balancing: Record inlet and outlet water temperatures for each heat pump upon startup. This check can eliminate nuisance trip outs and high velocity water flow that could erode heat exchangers.
- ❑ Unit air coil and filters: Ensure that filter is clean and accessible. Clean air coil of all manufacturing oils.
- ❑ Unit controls: Verify that CXM2 or DXM2.5 field selection options are properly set.

SYSTEM CHECKOUT

- ❑ System water temperature: Check water temperature for proper range and also verify heating and cooling setpoints for proper operation.
- ❑ System pH: Check and adjust water pH if necessary to maintain a level between 6 and 8.5. Proper pH promotes longevity of hoses and fittings (see table 3).
- ❑ System flushing: Verify that all hoses are connected end to end when flushing to ensure that debris bypasses the unit heat exchanger, water valves and other components. Water used in the system must be potable quality initially and clean of dirt, piping slag, and strong chemical cleaning agents. Verify that all air is purged from the system. Air in the system can cause poor operation or system corrosion.
- ❑ Cooling tower/boiler: Check equipment for proper setpoints and operation.
- ❑ Standby pumps: Verify that the standby pump is properly installed and in operating condition.
- ❑ System controls: Verify that system controls function and operate in the proper sequence.
- ❑ Low water temperature cutout: Verify that low water temperature cut-out controls are provided for the outdoor portion of the loop. Otherwise, operating problems may occur.
- ❑ System control center: Verify that the control center and alarm panel have appropriate setpoints and are operating as designed.
- ❑ Miscellaneous: Note any questionable aspects of the installation.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water fl ow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

⚠ CAUTION! ⚠

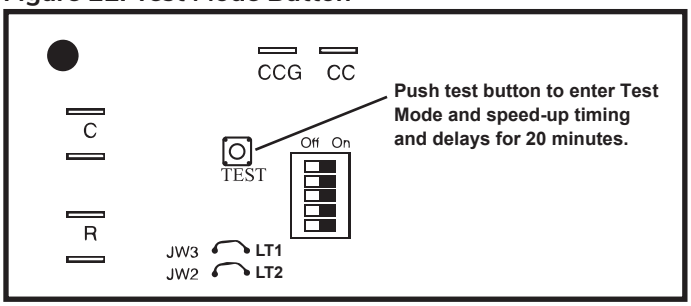
CAUTION! To avoid equipment damage, DO NOT leave system filled in a building without heat during the winter unless antifreeze is added to the water loop. Heat exchangers never fully drain by themselves and will freeze unless winterized with antifreeze.

Unit Start-Up Procedure

1. Turn the thermostat fan position to “ON”. Blower should start.
2. Balance air flow at registers.
3. Adjust all valves to their full open positions. Turn on the line power to all heat pumps.
4. Room temperature should be within the minimum-maximum ranges of table 9. During start-up checks, loop water temperature entering the heat pump should be between 60°F [16°C] and 95°F [35°C].
5. Two factors determine the operating limits of ClimateMaster heat pumps, (a) return air temperature, and (b) water temperature. When any one of these factors is at a minimum or maximum level, the other factor must be at normal level to ensure proper unit operation.
    a. Adjust the unit thermostat to the warmest setting. Place the thermostat mode switch in the “COOL” position. Slowly reduce thermostat setting until the compressor activates.
    b. Check for cool air delivery at the unit grille within a few minutes after the unit has begun to operate.
    c. Note: Units have a five minute time delay in the control circuit that can be eliminated on the CXM2/DXM2.5 control board as shown below in Figure 22. See controls description for details.
    d. Verify that the compressor is on and that the water flow rate is correct by measuring pressure drop through the heat exchanger using the P/T plugs and comparing to tables 10a through 10e.
    e. Check the elevation and cleanliness of the condensate lines. Dripping may be a sign of a blocked line. Check that the condensate trap is filled to provide a water seal. Check the temperature of both entering and leaving water. If temperature is within range table, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to tables 12 through 15. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in tables 10a through 10e. Heat of rejection (HR) can be calculated and compared to submittal data capacity pages. The formula for HR for systems with water is as follows:
    HR (Btuh) = TD x GPM x 500, where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to tables 8a through 8e. In S-I units, the formula is as follows:
    HR (kW) = TD x l/s x 4.18.
    f. Check air temperature drop across the air coil when compressor is operating. Air temperature drop should be between 15°F and 25°F [8°C and 14°C].
    g. Turn thermostat to “OFF” position. A hissing noise indicates proper functioning of the reversing valve.
6. Allow five (5) minutes between tests for pressure to equalize before beginning heating test.
    a. Adjust the thermostat to the lowest setting. Place the thermostat mode switch in the “HEAT” position.
    b. Slowly raise the thermostat to a higher temperature until the compressor activates.
    c. Check for warm air delivery within a few minutes after the unit has begun to operate.
    d. Refer to table 17. Check the temperature of both entering and leaving water. If temperature is within range, proceed with the test. If temperature is outside of the operating range, check refrigerant pressures and compare to tables 11 through 16. Verify correct water flow by comparing unit pressure drop across the heat exchanger versus the data in tables 10a through 10e. Heat of extraction (HE) can be calculated and compared to submittal data capacity pages. The formula for HE for systems with water is as follows: HE (Btuh) = TD x GPM x 500, where TD is the temperature difference between the entering and leaving water, and GPM is the flow rate in U.S. GPM, determined by comparing the pressure drop across the heat exchanger to tables 10a through 10e.
    e. In S-I units, Check air temperature rise across the air coil when compressor is operating. Air temperature rise should be between 20°F and 30°F [11°C and 17°C].
    f. Check for vibration, noise, and water leaks.
7. If unit fails to operate, perform troubleshooting analysis (see troubleshooting section). If the check described fails to reveal the problem and the unit still does not operate, contact a trained service technician to ensure proper diagnosis and repair of the equipment.
8. When testing is complete, set system to maintain desired comfort level.
9. BE CERTAIN TO FILL OUT AND FORWARD ALL WARRANTY REGISTRATION PAPERS TO CLIMATEMASTER.

Note: If performance during any mode appears abnormal, refer to the CXM2/DXM2.5 section or troubleshooting section of this manual. To obtain maximum performance, the air coil should be cleaned before start-up. A 10% solution of dishwasher detergent and water is recommended.

Figure 22: Test Mode Button



⚠ WARNING! ⚠

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.

⚠ CAUTION! ⚠

CAUTION! Verify that ALL water control valves are open and allow water flow prior to engaging the compressor. Freezing of the coax or water lines can permanently damage the heat pump.

UNIT OPERATING CONDITIONS

Table 10a: TC Coax Weater Pressure Drop

Model	U.S. GPM	l/s	l/m	Pressure Drop, psi [kPa]*			
				0°C	10°C	20°C	30°C
TC_L072	10	0.631	37.85	8.3	6.2	3.4	2.1
	15	0.946	56.781	22.8	19.1	14.5	12.4
	20	1.262	75.708	42.7	36.5	29.0	26.2
TC_L096	12	0.757	45.425	14.5	11.7	9.0	7.6
	18	1.136	68.137	36.5	31.0	24.8	22.8
	24	1.514	90.85	64.1	54.5	45.5	42.1
TC_L120	15	0.946	56.781	27.6	22.1	15.2	13.8
	22.5	1.42	85.172	59.3	49.6	37.9	35.2
	30	1.893	113.562	100.0	83.4	67.6	63.4
TCV160	21.0	1.32	79.20	52.5	30.3	27.6	26.3
	31.5	1.99	119.40	98.8	62.9	58.02	54.6
	42.0	2.65	159.00	154.0	105.0	97.4	89.8
TCV192	24.0	1.51	90.60	69.8	52.5	42.8	40.8
	36.0	2.27	136.20	128.5	87.0	80.1	76.7
	48.0	3.03	181.80	198.2	139.5	129.9	122.3
TCV240	30.0	1.89	113.40	57.3	45.6	38.7	36.6
	45.0	2.84	170.40	107.1	76.7	71.8	68.4
	60.0	3.79	227.40	168.5	122.9	116.0	109.8
TCV300	37.5	2.37	142.20	80.1	54.6	44.2	40.8
	56.3	3.55	213.00	147.1	93.9	87.0	81.5
	750.0	4.73	283.80	227.2	154.0	143.6	135.4

***Note: To convert kPa to millibars, multiply by 10**

Unit Operating Conditions

Table 11: TC Series Typical Unit Operating Pressures and Temperatures (50Hz - S-I Units)

TC_L072 - 120

Entering Water Temp °C	Water Flow l/s per kW	Cooling												Heating											
		Suction Pressure kPa		Discharge Pressure kPa		Super-heat °C		Sub-cooling °C		Water Temp Rise °C		Air Temp Drop °C DB		Suction Pressure kPa		Discharge Pressure kPa		Super-heat °C		Sub-cooling °C		Water Temp Drop °C		Air Temp Rise °C DB	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
-5.0	0.10																								
	0.15																								
	0.20													423	443	2001	2120	5	7	5	10	2	2	11	12
0.0	0.10	845	867	1387	1439	7	9	8	11	11	13	12	13	482	511	2071	2198	6	7	5	10	5	5	13	13
	0.15	803	828	1248	1302	9	10	8	10	7	9	12	12	512	539	2100	2239	6	7	6	11	3	4	13	14
	0.20	777	802	1186	1227	10	12	8	10	6	7	12	12	533	555	2115	2257	6	7	6	11	2	3	13	14
10.0	0.10	882	923	1654	1736	6	8	7	9	11	12	12	12	668	703	2294	2446	5	6	7	12	6	7	16	17
	0.15	841	903	1509	1605	7	9	7	9	7	8	12	12	717	744	2336	2487	5	6	7	12	4	5	17	17
	0.20	820	889	1440	1543	7	10	6	8	6	6	12	12	737	841	2356	2542	5	6	7	11	3	4	17	18
20.0	0.10	907	954	2094	2214	5	7	7	8	11	12	11	12	873	907	2505	2675	5	6	7	12	8	9	19	20
	0.15	896	940	1931	2058	6	7	6	7	7	8	11	12	934	967	2559	2742	6	6	7	11	5	7	20	21
	0.20	894	932	1849	1977	6	8	5	6	5	6	11	12	973	1008	2592	2778	6	6	7	11	4	5	21	21
30.0	0.10	937	985	2633	2768	5	6	7	9	11	11	11	11	1083	1118	2716	2910	5	7	7	10	10	11	22	23
	0.15	925	971	2451	2599	5	6	6	7	7	8	11	11	1156	1180	577	2990	6	8	8	10	6	8	23	24
	0.20	925	965	2358	2516	5	7	5	6	5	6	11	11	1186	1236	2811	3069	7	9	8	9	5	6	24	25
40.0	0.10	965	1021	3226	3331	4	5	7	9	10	11	10	10												
	0.15	955	1011	2972	3149	4	5	6	7	7	7	10	10												
	0.20	955	1010	2869	3059	4	5	6	6	5	6	10	10												
45.0	0.10	980	1040	3539	3523	4	5	8	9	10	11	10	10												
	0.15	973	1037	3364	3568	4	5	6	8	6	7	10	10												
	0.20	973	1033	3265	3474	4	5	6	7	5	6	10	10												

TC_L160 - 300

Entering Water Temp °C	Water Flow l/s per kW	Cooling												Heating											
		Suction Pressure kPa		Discharge Pressure kPa		Super-heat °C		Sub-cooling °C		Water Temp Rise °C		Air Temp Drop °C DB		Suction Pressure kPa		Discharge Pressure kPa		Super-heat °C		Sub-cooling °C		Water Temp Drop °C		Air Temp Rise °C DB	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
-5.0	0.10																								
	0.15																								
	0.20													380	522	1937	2093	3	10	5	11	2	4	10	13
0.0	0.10	819	843	1189	1392	6	11	8	13	5	13	9	13	424	475	1984	2152	3	7	6	12	2	6	11	13
	0.15	760	830	1103	1193	7	12	7	13	5	13	9	13	464	506	2015	2204	3	9	6	9	2	6	11	13
	0.20	728	816	1153	1180	9	13	6	13	5	13	9	13	477	527	2035	2230	3	9	5	9	2	6	11	13
10.0	0.10	875	930	1598	1702	4	7	6	11	5	13	9	13	586	661	2170	2356	4	7	6	14	3	7	13	17
	0.15	841	916	1481	1571	6	9	6	11	5	13	9	13	668	717	2225	2446	4	7	7	14	3	7	13	17
	0.20	834	903	1419	1502	6	9	5	10	5	13	9	13	682	744	2239	2460	4	7	7	14	3	7	13	17
20.0	0.10	894	955	2045	2136	3	6	6	9	6	13	9	13	809	878	2412	2635	4	7	6	14	4	9	17	21
	0.15	878	954	1909	1986	4	6	4	8	6	12	9	13	885	940	2474	2713	4	7	7	15	4	9	17	21
	0.20	871	946	1829	1911	4	7	4	7	6	12	9	13	918	998	2543	2838	4	10	7	15	4	9	17	21
30.0	0.10	929	991	2646	2752	2	6	4	8	6	12	9	12	1038	1107	2615	2892	5	9	4	13	5	11	20	24
	0.15	915	980	2491	2644	3	6	3	7	6	12	9	12	1135	1196	2705	2979	5	9	4	13	5	11	20	24
	0.20	908	973	2409	2552	3	7	3	7	6	12	9	12	1153	1253	2748	3029	6	10	4	13	5	11	20	24
40.0	0.10	949	1014	3132	3193	2	5	3	8	4	11	9	12												
	0.15	934	1004	2882	3007	3	5	2	7	4	11	9	12												
	0.20	927	996	2800	2812	3	5	2	6	4	11	9	12												
45.0	0.10	962	1033	3452	3478	2	5	3	7	4	11	9	11												
	0.15	953	1026	3274	3403	3	5	2	6	4	11	9	11												
	0.20	946	1015	3192	3268	3	5	2	6	4	11	9	11												

Table 12: Water Temperature Change Through Heat Exchanger

Water Flow, l/m	Rise, Cooling °C	Drop, Heating °C
For Closed Loop: Ground Source or Closed Loop Systems at 3.2 l/m per kW	5 - 6.7	2.2 - 4.4
For Open Loop: Ground Water Systems at 1.6 l/m per kW	11.1 - 14.4	5.6 - 9.4

Operating Pressure/Temperature tables include the following notes:

- Airflow is at nominal (rated) conditions;
- Entering air is based upon 21°C DB in heating and 27/19°C in cooling;
- Subcooling is based upon head pressure at compressor service port;
- Cooling air and water values can vary greatly with changes in humidity level.

Start-Up Log Sheet

Installer: Complete unit and system checkout and follow unit start-up procedures in the IOM. Use this form to record unit information, temperatures and pressures during start-up. Keep this form for future reference.

Job Name:_____ **Street Address:**_____

Model Number:_____ **Serial Number:**_____

Unit Location in Building:_____

Date:_____ **Sales Order No:**_____

In order to minimize troubleshooting and costly system failures, complete the following checks and data entries before the system is put into full operation.

External Static:_____

Sheave Setting:_____ **Turns Open**

Temperatures: F or C **Antifreeze:**_____**%**

Pressures: PSIG or kPa **Type:**_____

	Cooling Mode		**Heating Mode**	
Return-Air Temperature	DB	WB	DB	**WB**
Supply-Air Temperature	DB	WB	DB	**WB**
Temperature Differential				
Entering Fluid Temperature				
Leaving Fluid Temperature				
Temperature Differential				
Water Coil Heat Exchanger (Water Pressure IN)				
Water Coil Heat Exchanger (Water Pressure OUT)				
Pressure Differential				
Flow Rate GPM (l/s)				
Compressor				
Amps				
Volts				
Discharge Line Temperature				
Motor				
Amps				
Volts				

Allow unit to run 15 minutes in each mode before taking data.

Do not connect gauge lines

Preventive Maintenance

Water Coil Maintenance -
(Direct ground water applications only)
If the system is installed in an area with a known high mineral content (125 P.P.M. or greater) in the water, it is best to establish a periodic maintenance schedule with the owner so the coil can be checked regularly. Consult the well water applications section of this manual for a more detailed water coil material selection. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. Therefore, 1.5 gpm per ton [1.6 l/m per kW] is recommended as a minimum flow. Minimum flow rate for entering water temperatures below 50°F [10°C] is 2.0 gpm per ton [2.2 l/m per kW].

Water Coil Maintenance -
(All other water loop applications)
Generally water coil maintenance is not needed for closed loop systems. However, if the piping is known to have high dirt or debris content, it is best to establish a periodic maintenance schedule with the owner so the water coil can be checked regularly. Dirty installations are typically the result of deterioration of iron or galvanized piping or components in the system. Open cooling towers requiring heavy chemical treatment and mineral buildup through water use can also contribute to higher maintenance. Should periodic coil cleaning be necessary, use standard coil cleaning procedures, which are compatible with both the heat exchanger material and copper water lines. Generally, the more water flowing through the unit, the less chance for scaling. However, flow rates over 3 gpm per ton (3.9 l/m per kW) can produce water (or debris) velocities that can erode the heat exchanger wall and ultimately produce leaks.

Filters - Filters must be clean to obtain maximum performance. Filters should be inspected every month under normal operating conditions and be replaced when necessary. Units should never be operated without a filter.

Washable, high efficiency, electrostatic filters, when dirty, can exhibit a very high pressure drop for the fan motor and reduce air flow, resulting in poor performance. It is especially important to provide consistent washing of these filters (in the opposite direction of the normal air flow) once per month using a high pressure wash similar to those found at self-serve car washes.

Condensate Drain - In areas where airborne bacteria may produce a “slimy” substance in the drain pan, it may be necessary to treat the drain pan chemically with an algaecide approximately every three months to minimize the problem. The condensate pan may also need to be cleaned periodically to ensure indoor air quality. The condensate drain can pick up lint and dirt, especially with dirty filters. Inspect the drain twice a year to avoid the possibility of plugging and eventual overflow.

Compressor - Conduct annual amperage checks to ensure that amp draw is no more than 10% greater than indicated on the serial plate data.

Fan Motors - All units have lubricated fan motors. Fan motors should never be lubricated unless obvious, dry operation is suspected. Periodic maintenance oiling is not recommended, as it will result in dirt accumulating in the excess oil and cause eventual motor failure. Conduct annual dry operation check and amperage check to ensure amp draw is no more than 10% greater than indicated on serial plate data.

Belt - Check that the belt is tight. Retighten if needed. Replace if it is split or cracked.

Air Coil - The air coil must be cleaned to obtain maximum performance. Check once a year under normal operating conditions and, if dirty, brush or vacuum clean. Care must be taken not to damage the aluminum fins while cleaning. **CAUTION: Fin edges are sharp.**

Refrigerant System - To maintain sealed circuit integrity, do not install service gauges unless unit operation appears abnormal. Reference the operating charts for pressures and temperatures. Verify that air and water flow rates are at proper levels before servicing the refrigerant circuit.

Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM2/DXM2.5
				Check primary/secondary voltage on transformer.
HP Fault Code 2 **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil - construction dust etc.
				Too high of external static. Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks
	X		Compressor pump down at start-up	Check charge and start-up water flow.
LT1 Fault Code 4 **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace..
				Check water flow adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart
LT2 Fault Code 5 **Air coil low temperature limit**		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting? Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	x	X	Restricted Return Airflow	Find and eliminate restriction. Increase return duct and/or grille size.
Over/Under Voltage Code 7 **(Auto resetting)**	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer. Tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode LT2>125°F [52°C]	Check for poor airflow or overcharged unit.
		X	Cooling Mode LT1>125°F [52°C] OR LT2< 40ºF [4ºC])	Check for poor water flow, or airflow.
Swapped Thermistor Code 9	X	X	LT1 and LT2 swapped	Reverse position of thermistors

Functional Troubleshooting

Fault	Htg	Clg	Possible Cause	Solution
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM2/DXM2.5 board.
				If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X	Thermostat wiring	Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Symptom	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
		X	Reduced or no airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static? Check static vs blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no airflow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static? Check static vs blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter? Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range	Bring water temperature within design parameters.
		X	Reduced airflow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static? Check static vs blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of airflow	Check fan motor speed selection and airflow chart.
	X		Poor performance	See ‘Insufficient Capacity’.
High humidity		X	Too high of airflow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible cooling load and heat pump capacity.

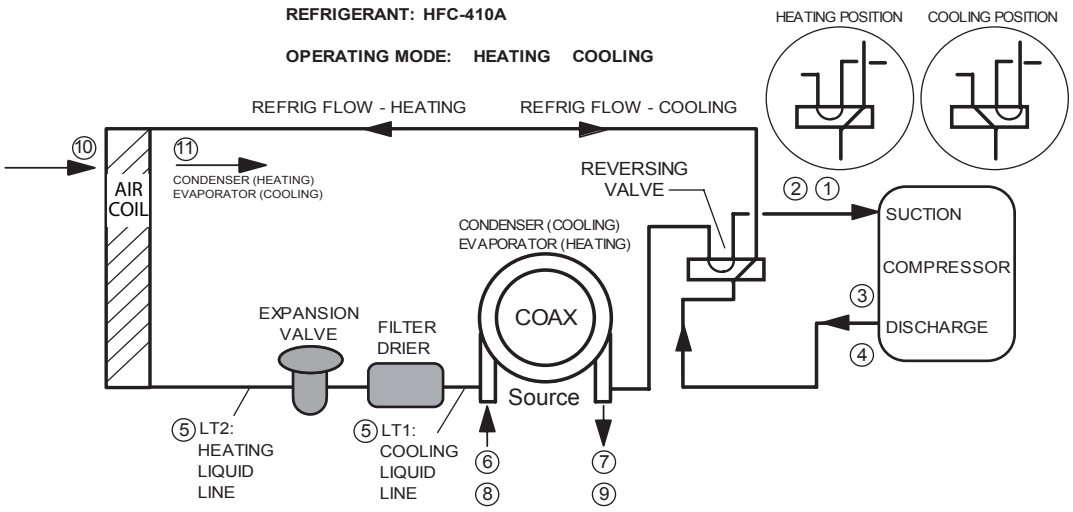
Functional Troubleshooting - I-P Units

Water-to-Air Units

Customer: _____ Loop Type: _____ Startup Date: _____

Model #: _____ Serial #: _____ Antifreeze Type & %: _____

Complaint: _____



Description	Heating	Cooling	Notes
Voltage			
Compressor Amps			
1 Suction Temp			
2 Suction Press			
2a Saturation Temp			
2b Superheat			
3 Discharge Temp			
4 Discharge Press			
4a Saturation Temp			
4b Subcooling			
5 Liquid Line Temp			
6 Source Water In Tmp			
7 Source Water Out Tmp			Temp Diff. =
8 Source Water In Pres			
9 Source Water Out Pres			
9a Press Drop			
9b Flow Rate			
10 Return Air Temp			
11 Supply Air Temp			

Heat of Extraction (Absorption) or Heat of Rejection:

HE or HR =

Fluid Factor: (for Btuh)	Fluid Factor: (for kW)
500 (Water); 485 (Antifreeze)	4.18 (Water); 4.05 (Antifreeze)

_____ Flow Rate x _____ Temp. Diff x _____ Fluid Factor

Superheat = Suction temperature - suction saturation temp. = _____ (deg F)

Subcooling = Discharge saturation temp. - liquid line temp. = _____ (deg F)

Note: Never connect refrigerant gauges during startup procedures. Conduct water-side analysis using P/T ports to determine water flow and temperature difference. If water-side analysis shows poor performance, refrigerant troubleshooting may be required. Connect refrigerant gauges as a last resort.

Warranty (International)

ClimateMaster®
Geothermal Heat Pump Systems

CLIMATE MASTER, INC.
LIMITED EXPRESS WARRANTY /LIMITATION OF REMEDIES AND LIABILITY
(FOR INTERNATIONAL CLASS PRODUCTS)

Disclaimer: It is expressly understood that unless a statement is specifically identified as a warranty, statements made by Climate Master, Inc., a Delaware corporation, U. S. A. ("CM") or its representatives, relating to CM's products, whether oral, written or contained in any sales literature, catalog, this or any other agreement or other materials, are not express warranties and do not form a part of the basis of the bargain, but are merely CM's opinion or commendation of CM's products. **EXCEPT AS SPECIFICALLY SET FORTH HEREIN AND TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CM MAKES NO WARRANTY AS TO ANY OF CM'S PRODUCTS, AND CM MAKES NO WARRANTY AGAINST LATENT DEFECTS OR ANY WARRANTY OF MERCHANTABILITY OF THE GOODS OR OF THE FITNESS OF THE GOODS FOR ANY PARTICULAR PURPOSE.**

GRANT OF LIMITED EXPRESS WARRANTY
CM warrants CM products purchased and installed outside the United States of America ("U.S.A.") and Canada to be free from material defects in materials and workmanship under normal use and maintenance as follows: (1) All complete air conditioning, heating or heat pump units built or sold by CM for twelve (12) months from date of unit start-up or eighteen (18) months from date of shipment (from CM's factory), whichever comes first; and, (2) Repair and replacement parts, which are not supplied under warranty, for ninety (90) days from date of shipment (from factory).

Warranty parts shall be furnished by CM if ordered through an authorized sales representative of CM ("Representative") within sixty (60) days after the failure of the part. If CM determines that a parts order qualifies for replacement under CM's warranty, such parts shall be shipped freight prepaid to the Representative or the ultimate user, as requested by Representative. All duties, taxes and other fees shall be paid by the ultimate user through the Representative.

If requested by CM, all defective parts shall be returned to CM's factory in Oklahoma City, Oklahoma, U.S.A, freight and duty prepaid, not later than sixty (60) days after the date of the request. If the defective part is not timely returned or if CM determines the part to not be defective or otherwise not to qualify under CM's Limited Express Warranty, CM shall invoice Customer the costs for the parts furnished, including freight. The warranty on any part repaired or replaced under warranty expires at the end of the original warranty period.

This warranty does not cover and does not apply to: (1) Air filters, fuses, refrigerant, fluids, oil; (2) Products relocated after initial installation; (3) Any portion or component of any system that is not supplied by CM, regardless of the cause of the failure of such portion or component; (4) Products on which the unit identification tags or labels have been removed or defaced; (5) Products on which payment by Customer to CM or its distributors or Representatives, or the Customer's seller is in default; (6) Products which have defects or damage which result from improper installation, wiring, electrical imbalance characteristics or maintenance; or from parts or components manufactured by others; or are caused by accident, misuse, negligence, abuse, fire, flood, lightning, alteration or misapplication of the product; (7) Products which have defects or damage which result from a contaminated or corrosive air or liquid supply, operation at abnormal temperatures or flow rates, or unauthorized opening of the refrigerant circuit; (8) Mold, fungus or bacteria damages; (9) Products subjected to corrosion or abrasion; (10) Products, parts or components manufactured or supplied by others; (11) Products which have been subjected to misuse, negligence or accidents; (12) Products which have been operated in a manner contrary to CM's printed instructions; (13) Products which have defects, damage or insufficient performance as a result of insufficient or incorrect system design or the improper application, installation, or use of CM's products; or (14) Electricity or fuel costs, or any increases or unrealized savings in same, for any reason.

CM is not responsible for: (1) The cost of any fluids, refrigerant or other system components, or the associated labor to repair or replace the same, which is incurred as a result of a defective part covered by CM's Limited Express Warranty; (2) The cost of labor, refrigerant, materials or service incurred in diagnosis and removal of the defective part, or in obtaining and replacing the new or repaired part; (3) Transportation costs of the defective part from the installation site to CM or of the return of any part not covered by CM's Limited Express Warranty; or (4) The costs of normal maintenance.

Limitation: This Limited Express Warranty is given in lieu of all other warranties. If, notwithstanding the disclaimers contained herein, it is determined by a court or other qualified judicial body that other warranties exist, any such warranty, including without limitation any express warranty or any implied warranty of fitness for particular purpose and merchantability, shall be limited to the duration of the Limited Express Warranty. This Limited Express Warranty does not exclude any warranty that is mandatory and that may not be excluded under applicable imperative law.

LIMITATION OF REMEDIES
In the event of a breach of this Limited Express Warranty or any warranty that is mandatory under applicable imperative law, CM will only be obligated at CM's option to either repair the failed part or unit or to furnish a new or rebuilt part or unit in exchange for the part or unit which has failed. If after written notice to CM's factory in Oklahoma City, Oklahoma, U.S.A. of each defect, malfunction or other failure and a reasonable number of attempts by CM to correct the defect, malfunction or other failure and the remedy fails of its essential purpose, CM shall refund the purchase price paid to CM in exchange for the return of the sold good(s). Said refund shall be the maximum liability of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, THIS REMEDY IS THE SOLE AND EXCLUSIVE REMEDY OF THE CUSTOMER AGAINST CM FOR BREACH OF CONTRACT, FOR THE BREACH OF ANY WARRANTY OR FOR CM'S NEGLIGENCE OR IN STRICT LIABILITY.**

LIMITATION OF LIABILITY
CM shall have no liability for any damages if CM's performance is delayed for any reason or is prevented to any extent by any event such as, but not limited to: any war, civil unrest, government restrictions or restraints, strikes, or work stoppages, fire, flood, accident, allocation, shortages of transportation, fuel, materials, or labor, acts of God or any other reason beyond the sole control of CM. **TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO THE NEXT SENTENCE, CM EXPRESSLY DISCLAIMS AND EXCLUDES ANY LIABILITY FOR LOSS OF PROFITS, LOSS OF BUSINESS OR GOODWILL, CONSEQUENTIAL, INCIDENTAL, SPECIAL, LIQUIDATED, OR PUNITIVE DAMAGE IN CONTRACT, FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, OR IN TORT, WHETHER FOR CM's NEGLIGENCE OR AS STRICT LIABILITY.** Nothing in this Agreement is intended to exclude CM's liability for death, personal injury or fraud.

OBTAINING WARRANTY PERFORMANCE
Normally, the contractor or service organization who installed the products will provide warranty performance for the owner. Should the installer be unavailable, contact any CM recognized Representative. If assistance is required in obtaining warranty performance, write or call:

Climate Master, Inc. • Customer Service • 7300 S.W. 44th Street • Oklahoma City, Oklahoma, U.S.A. 73179 • (405) 745-6000 • FAX (405) 745-6068

NOTE: Some countries do not allow limitations on how long an implied warranty lasts, or the limitation or exclusions of consequential or incidental damages, so the foregoing exclusions and limitations may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state and country to country.

Please refer to the CM Installation, Operation and Maintenance Manual for operating and maintenance instructions.

Rev.: 10/09

LC079

Notes

Tranquility® Compact Belt Drive (TC_L) Series

Rev.: 24 January, 2023

Revision History

Date:	Item:	Action:
24 January, 2023	All	Updated CXM to CXM2 and DXM to DXM2.5
25 July, 2017	Page 7	Hanger and mounting details
28 October, 2015	Page 4	Added safety warning
29 May, 2015	All	Misc. Edits
02 January, 2013	POE Oil Warning	Added
03 December, 2013	TCV072-120 Dimensional Data Typical Vertical Installation Illustration	Updated
05 November, 2013	Circuit Diagram with Safety Devices	Removed
13 August, 2012	Circuit Diagram with Safety Devices	Added
	General Information Vertical Installation	Updated
09 August, 2011	Unit Maximum Working Water Pressure	Updated to Reflect New Safeties
20 August, 2010	Created	

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