

USER GUIDE  
UGH036-0922



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# EP1 Series Portable Chillers

**Air-Cooled** Models EP1A-01, EP1A-02, EP1A-03

**Water-Cooled** Models EP1W-02, EP1W-03

**Remote Condenser** Model EP1R-03



Thank you for purchasing Conair equipment. This manual is addressed to operators and **qualified technicians** to ensure correct use of this Conair equipment.

Ⓢ **IMPORTANT:** THIS MANUAL MUST BE READ BEFORE INSTALLATION. KEEP THIS MANUAL IN A PLACE ACCESSIBLE FOR ALL OPERATORS.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this user guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date: _____
Manual Number: <u>  UGH036-0922  </u>
Serial Number(s): _____
Model Number(s): _____
Software Version: _____

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## Foreword

The portable chiller is a packaged unit that typically includes a refrigeration circuit, coolant reservoir, and pumping system in a cabinet. The purpose is to provide cooling water or coolant.

This manual is to serve as a guide for installing, operating, and maintaining the equipment. Improper installation, operation, and maintenance can lead to poor performance and/or equipment damage. Use qualified installers and service technicians for all installation and maintenance of this equipment.

This manual is for our standard product. The information in this manual is general in nature. Unit-specific drawings and supplemental documents are included with the equipment as needed. Additional copies of documents are available upon request.

Due to the ever-changing nature of applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment, we do not reference them in this manual.

The equipment uses a hydrofluorocarbon (HFC), trade named R-407c, as a chemical refrigerant for heat transfer purposes. This chemical is sealed and tested in a pressurized system containing ASME coded vessels; however, a system failure will release it. Refrigerant gas can cause toxic fumes if exposed to fire. Place these units in a well-ventilated area, especially if open flames are present. Failure to follow these instructions could result in a hazardous condition. We recommend the use of a refrigerant management program to document the type and quantity of refrigerant in the equipment. In addition, we recommend only licensed and EPA certified service technicians work on our refrigeration circuits.

## Safety Guidelines

Observe all safety precautions during installation, start-up, and service of this equipment. The following is a list of symbols used in this manual and their meaning.



*General Warning*



*Electricity Warning*



*Sharp Element Warning*



*Hot Surface Warning*



*Flammable Material Warning*



*Explosive Material Warning*



*General Mandatory Action*



*Wear Eye Protection*



*Wear Protective Gloves*



*Wear Ear Protection*



*Disconnect Before Carrying Out Maintenance or Repair*



*Connect an Earth Terminal to Ground*

Only qualified personnel should install, start-up, and service this equipment. When working on this equipment, observe precautions in this manual as well as tags, stickers, and labels on the equipment.



*WARNING: Any use or misuse of this equipment outside of the design intent may cause injury or harm.*



*WARNING: Vent all refrigerant relief valves in accordance to ANSI/ASHRAE Standard 15, Safety Code for Mechanical Refrigeration. Locate this equipment in a well-ventilated area. Inhalation of refrigerant can be hazardous to your health and the accumulation of refrigerant within an enclosed space can displace oxygen and cause suffocation.*



*WARNING: This equipment contains hazardous voltages that can cause severe injury or death.*



*WARNING: This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.*



*WARNING: This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.*



*WARNING: The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.*



*CAUTION: Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Shut off the electric power at the main disconnect before opening access panels for repair or maintenance.*



*CAUTION: Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.*



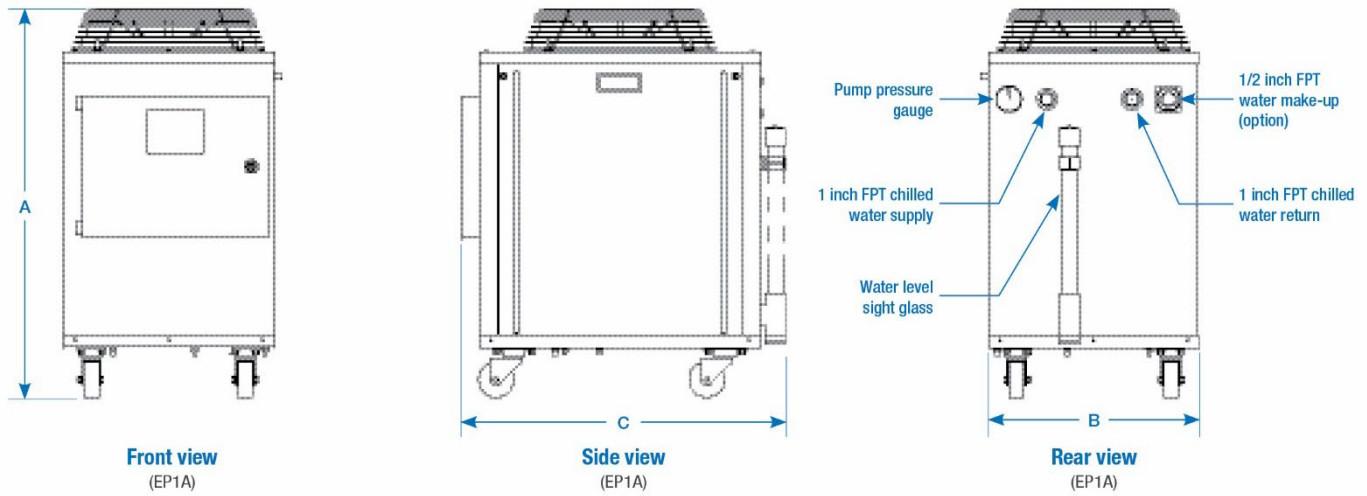
*CAUTION: The equipment will exceed 70 dBA sound pressure at 1 meter distance and 1 meter elevation when operating. Wear ear protection as required for personal comfort when operating or working in close proximity to the chiller.*



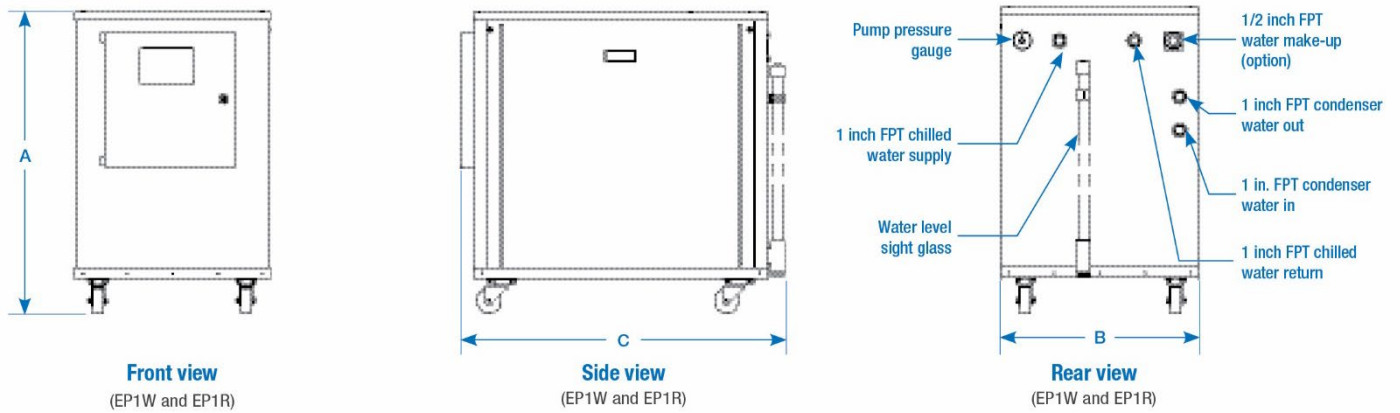
*CAUTION: Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.*

# Specifications

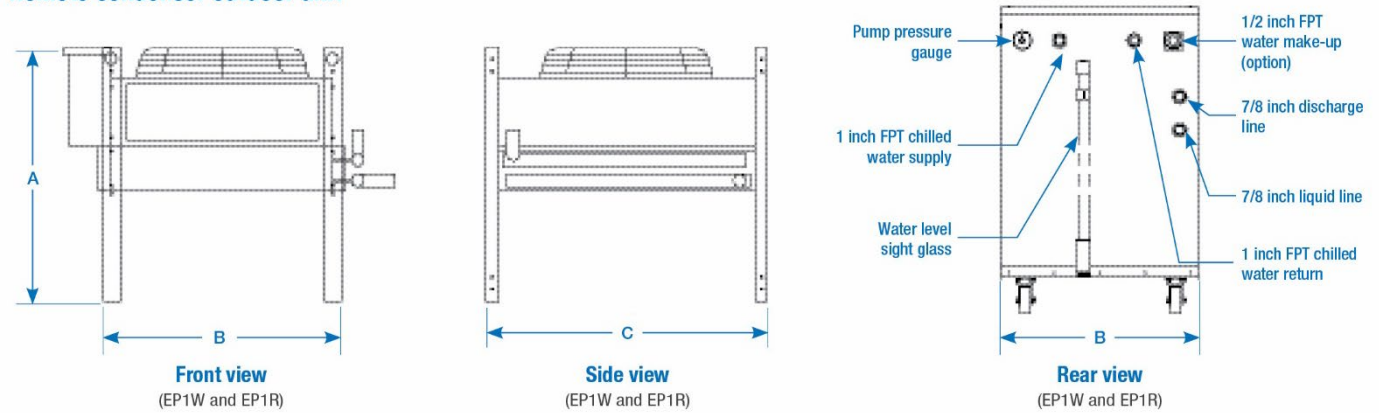
## Air cooled



## Water cooled / remote condenser indoor unit



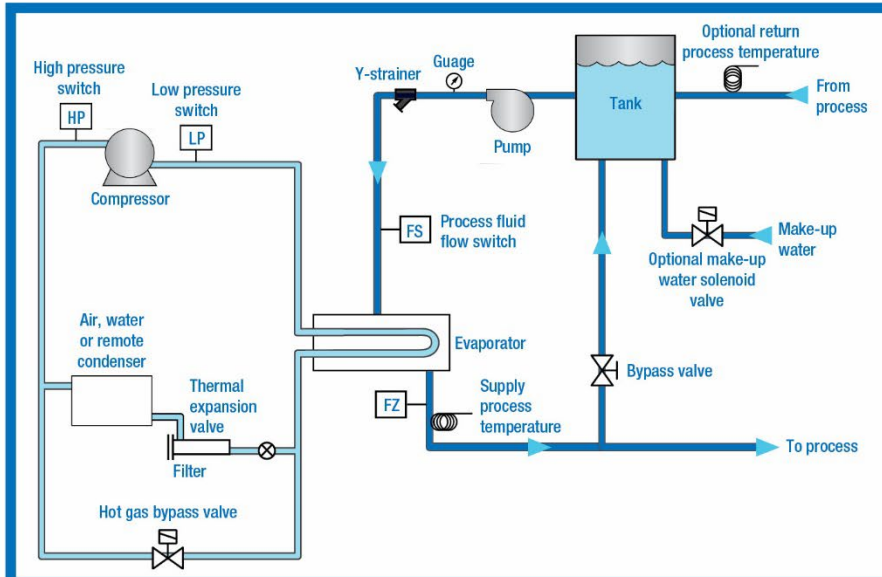
## Remote condenser outdoor unit



# Specifications

Models	EP1A-01	EP1A-02	EP1A-03	EP1W-02	EP1W-03	EP1R-03 (Indoor unit)†	EP1R-03 (Outdoor unit)‡	
<b>Condenser</b>	Air cooled			Water cooled		Remote		
<b>Performance characteristics</b>								
Cooling capacity tons*	1.0	2.0	3.0	2.2	3.3	3.0	N/A	
Setpoint range °F {°C} †	20 to 65 {-7 to 18}						N/A	
Refrigerant	R407C							
Air flow ft³/min	1110	1585	2470	N/A		6750		
Condensed water flow gpm {l/min}	N/A		7 {27}		10 {38}	N/A		
Reservoir holding capacity gal. {l}	3 {11}	11 {42}			N/A			
Condenser fan Hp {kW}	N/A						0.50 {0.40}	
<b>Pump performance</b>								
Pump motor size Hp {kW}	0.25 {0.18}	1 {0.75}			N/A			
Pump flow gpm {l/min}	2 {7.5}	5 {18.9}	7 {26.4}	5 {18.9}	8 {30.2}	7 {26.5}	N/A	
Pump pressure psi {bar}	80 {5.5}	39 {2.68}	38 {2.62}	39 {2.68}	37 {2.55}	38 {2.6}	N/A	
<b>Dimensions inches {mm}</b>								
A - Height	30.00 {762}	44.00 {1118}		36.00 {914}				
B - Width	19.00 {483}	24.00 {610}						
C - Depth	28.00 {711}	40.00 {1016}						
<b>Voltages MCA</b>								
230/1 phase/60 Hz	11.8	N/A			3.0			
230/3 phase/60 Hz	N/A	17.0	21.5	15.4	18.9		N/A	
460/3 phase/60 Hz	N/A	9.0	11.9	8.2	10.6		N/A	
575/3 phase/60 Hz	N/A	7.2	9.6	6.6	8.5		N/A	
<b>Weight lb {kg}</b>								
Shipping	255 {116}	420 {191}	430 {195}	420 {191}	430 {195}	565 {256}		
<b>Specification Notes</b>								
<p>* Based on the 50°F {10°C} water to the process, single pump selections, a maximum of 95°F {35°C} ambient air and 60 Hz. Adjust capacities up 2% per degree above 50°F {10°C} to a maximum of 65°F {18°C}. Adjust capacities down 2% per degree below 50°F {10°C} to a minimum of 20°F {-7°C}. Capacities are ± 5% based on the compressor manufacturer's ratings and are subject to change without notice. Consult with a Conair representative for other conditions. Capacities change depending on selected options.</p> <p>† Standard set point range is 20°F to 65°F {-7 to 18°C}. To extend range to 20°F to 80°F {-7 to 27°C} the CPR valve option is required.</p> <p>‡ Remote condenser operation requires both indoor and outdoor unit.</p> <p>Specifications may change without notice. Consult a Conair representative for the most current information.</p>								

# How it Works



**Process circulation:**  
 Process fluid enters through the “From process” connection to the reservoir tank. The pump draws water from the tank and moves it through the evaporator. Fluid is chilled and exits through the “To process” connection.

**Refrigerant circulation:**  
 The evaporator extracts heat from the process fluid. Vaporized refrigerant travels from the evaporator to the compressor, where it is compressed. The high-pressure vapor travels to the condenser. Air or water removes heat from the vapor, condensing it to liquid. This liquid is metered back to the evaporator by the expansion valve (TXV).

## Pre-Installation

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### Receiving Inspection

When the unit arrives, verify the information on the unit nameplate agrees with the order acknowledgement and shipping papers. Inspect the equipment for any visible damage and verify all items shown on the bill of lading are present. If damage is evident, document it on the delivery receipt by clearly marking any item with damage as "unit damage" and notify the carrier. In addition, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage claim is the responsibility of the receiving party. Do not install damaged equipment without getting the equipment repaired.

Shipping damage is the responsibility of the carrier. To protect against possible loss due to damage incurred during shipping and to expedite payment for damages, it is important to follow proper procedures and keep records. Photographs of damaged equipment are excellent documentation for your records.

Start unpacking the unit, inspect for concealed damage, and take photos of any damage found. Once received, equipment owners have the responsibility to provide reasonable evidence that the damage did not occur after delivery. Photos of the equipment damage while the equipment is still partially packed will help in this regard. Refrigerant lines can be susceptible to damage in transit. Check for broken lines, oil leaks, damaged controls, or any other major component torn loose from its mounting point.

Record any signs of concealed damage and file a shipping damage claim immediately with the shipping company. Most carriers require concealed damages be reported within 15 days of receipt of the equipment. In addition, notify our Customer Service Department and they will provide assistance with preparing and filing freight damage claims, including arranging for an estimate on repair costs; however, filing the shipping damage claim is the responsibility of the receiving party.

Chillers with an integral water-cooled or air-cooled condenser ship with a full refrigerant charge. Chillers designed for use with a remote air-cooled condenser and the remote condensers themselves ship with a nitrogen holding charge. Check the remote condenser for signs of leaks prior to rigging. This will ensure no coil damage has occurred after the unit left the factory. The condenser ships with the legs removed. Mount the legs to the condenser using the provided nuts, bolts, and washers.

### Unit Storage

When storing the unit it is important to protect it from damage. Blow out any water from the unit; cover it to keep dirt and debris from accumulating or getting in, and store in an indoor sheltered area that does not exceed 145°F.

## Installation - Chiller

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### Foundation

Install the unit on a rigid, non-warping mounting pad, concrete foundation, or level floor suitable to support the full operating weight of the equipment. When installed the equipment must be level within ¼ inch over its length and width.

### Unit Location

The unit is available in many different configurations for various environments. Refer to the proposal and order acknowledgement document for the equipment to verify the specific design conditions in which it can operate.

To ensure proper airflow and clearance space for proper operation and maintenance allow a minimum of 36 inches of clearance between the sides of the equipment and any walls or obstructions. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service. In addition, ensure the condenser and evaporator refrigerant pressure relief valves can vent in accordance with all local and national codes.

Air-cooled chillers use the surrounding air for cooling the condenser and require free passage of air in and out of the chiller and provision for removal of the warm air from the area.

## Rigging

The chiller has a frame to facilitate easy movement and positioning with a crane or forklift. Follow proper rigging methods to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the chiller. Use pads where abrasive surface contact may occur.

## Chilled Process Fluid Piping

Proper insulation of chilled process fluid piping is crucial to prevent condensation. The formation of condensation adds a substantial heat load to the chiller.

The importance of properly sized piping cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping out to the process and reduce pipe size at connections as needed. One of the most common causes of unsatisfactory chiller performance is poor piping system design. Avoid long lengths of hoses, quick disconnect fittings, and manifolds wherever possible as they offer high resistance to water flow. When manifolds are required, install them as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system. Typically, when piping is overhead with a total run over 90 feet, there should be a check valve in the supply line and an inverted P trap with a vacuum break valve installed 12 inches above the highest point in the system.

All standard portable chillers include an internal coolant pump and reservoir. Nominal coolant flow rates assume a 10°F rise across the evaporator at 50°F set point and 85°F entering condenser water for water-cooled chillers or 95°F entering air for integral air-cooled or remote air-cooled condenser chillers.

## Condenser Water Piping

(Water-Cooled Condenser Units Only)

The performance of a water-cooled condenser is dependent on the flow and temperature of the cooling water used. Insufficient cooling of the condenser will result in the reduction of cooling capacity of the chiller and under extreme conditions may result in the chiller shutting down due to high refrigerant pressure. Allowing the condenser to plug up from contaminants in the condenser water

stream adversely affects performance. In order to reduce maintenance costs and chiller downtime, a water treatment program is highly recommended for the condenser cooling water. Contact our Customer Service Department for assistance in the proper procedure for cleaning out any plugged condenser.

The nominal water-cooled condenser is design for 85°F condenser cooling water supply. Under normal operation there will be about a 10°F rise through the condenser resulting in 95°F exiting water. To ensure proper water flow through the condenser, ensure the condenser water pump provides at least 25 psi or water at a flow rate of 3 gpm per ton of chiller capacity.

Each condenser has a two-way condenser water-regulating valve. The condenser water-regulating valve controls the amount of water allowed to pass through the condenser in order to maintain proper refrigeration pressures in the circuit.

To prevent damage to the condenser and/or water-regulating valve, the water pressure should not exceed 150 psig.

## Installation – Remote Condenser

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Chillers designed for use with a remote air-cooled condenser include a factory-selected remote condenser. The remote air-cooled condenser typically ships separately from a different location than the chiller.

### Location

The remote air-cooled condenser is for outdoor use. Locate the remote condenser in an accessible area. The vertical air discharge must be unobstructed. Allow a minimum of 48 inches of clearance between the sides and ends of the condenser and any walls or obstructions. For installations with multiple condensers, allow a minimum of 96 inches between condensers placed side-by-side or 48 inches for condensers placed end-to-end.

When locating the condenser it is important to consider access to the components to allow for proper maintenance and servicing of the unit. Avoid locating piping or conduit over the unit to ensure easy access with an overhead crane or lift to lift out heavier components during replacement or service.

Proper ventilation is another important consideration when locating the condenser. In general, locate the unit in an area that will not rise above 110°F.

Install the unit on a firm, level base no closer than its width from walls or other condensers. Avoid locations near exhaust fans, plumbing vents, flues, or chimneys. Fasten the mounting legs at their base to the steel or concrete of the supporting structure. For units mounted on a roof structure, the steel support base holding the condenser should be elevated above the roof and attached to the building.

Avoid areas that can create a “micro-climate” such as an alcove with east, north, and west walls that can be significantly warmer than surrounding areas. The condenser needs to have unrestricted airways so it can easily move cool air in and heated air away. Consider locating the condenser where fan noise and vibration transmission into nearby workspaces is unlikely.

The unit ships on its side with the legs removed to reduce shipping dimensions and provide more protection to the coil from possible damage caused by impact loading over rough roads and transit conditions.

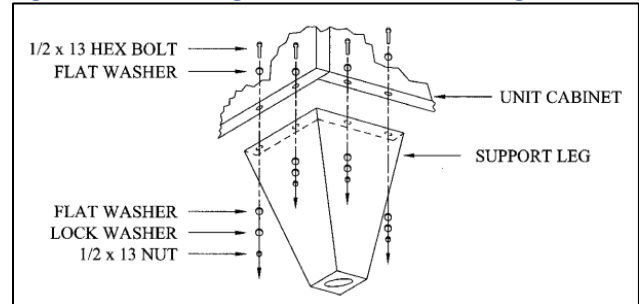
### Lifting

Use only qualified personnel using the proper equipment when lifting and positioning the condenser. Lifting brackets or holes are at the corners for attaching lifting slings. Use spreader bars when lifting to apply the lifting force vertically. Under no circumstances use the coil headers or return bends in the lifting or moving of the condenser.

### Mounting Legs

Assemble the corner legs to the bottom flanges on the unit side panels and end panels using the hardware provided and the matching mounting hole-patterns. All corner legs are the same.

Figure 1 - Mounting Remote Condenser Legs



### Interconnecting Refrigerant Piping

The chiller and remote condenser ship with a nitrogen holding charge. Evacuation of this charge is required before charging with refrigerant. The chiller is for use only with the air-cooled condenser provided with the unit. The following section covers the required piping between the chiller and the provided air-cooled condenser.

The discharge and liquid lines leaving the chiller have caps. These line sizes do not necessarily reflect the actual line sizes required for the piping between the chiller and the air-cooled condenser.

Refrigerant piping size and piping design have a significant impact on system performance and reliability. All piping should conform to the applicable local and state codes.



**CAUTION:** Use refrigerant grade copper tubing ASTM B280 only and isolate the refrigeration lines from building structures to prevent transfer of vibration. All copper tubing must have a pressure rating suitable for R-407c; tubing that is 3/4" OD or larger must be Type K rigid tubing. ACR annealed tubing coil may be used for sizes 5/8" ODS or smaller.

Do not use a saw to remove end caps. This might allow copper chips to contaminate the system. Use a tube cutter or heat to remove the caps. When sweating copper joints it is important to evacuate all refrigerant present and flow dry nitrogen through the system. This prevents the formation of toxic gases, corrosive acids, and scale.



**CAUTION:** Do not use soft solders. For copper-to-copper joints use a copper-phosphorus braze alloy (BCuP per the American Welding Society) with 5% (BCuP-3) to 15% (BCuP-5) silver content. Only use a high silver content brazing alloy (BAg per AWS) for copper-to-brass or copper-to-steel joints such as a 45% (BAg-5) silver content. Only use oxy-acetylene brazing.



**WARNING:** The POE oil contained within the compressor is hygroscopic and has the ability to absorb water vapor from the atmosphere. Take necessary steps to prevent an open system from exposure to the atmosphere for extended periods while installing the interconnecting refrigerant tubing.

## Refrigeration Piping Design

The system is configurable in any of the arrangements as shown in Figure 2, Figure 3 and Figure 4. The configuration and its associated elevation, along with the total distance between the chiller and the air-cooled condenser are important factors in determining the liquid line and discharge line sizes. This will also affect the field refrigerant charges. Consequently, it is important to adhere to certain physical limitations to ensure the system operates as designed.

### General design considerations are:

1. The total distance between the chiller and the air-cooled condenser must not exceed 200 actual feet or 300 equivalent feet. Keep the distance as short as possible.
2. Liquid line risers must not exceed 15 feet in height from the condenser liquid line connection.
3. Discharge line risers cannot exceed an elevation difference greater than 100 actual feet without a minimum of 2% efficiency decrease.
4. To form a proper liquid seal at the condenser, immediately drop at least 15 inches down from the liquid outlet before routing the piping to the chiller. Make the drop leg before any bends or angles connecting to the remainder of the liquid connection piping.

Figure 2 – Condenser Located at Chiller Level

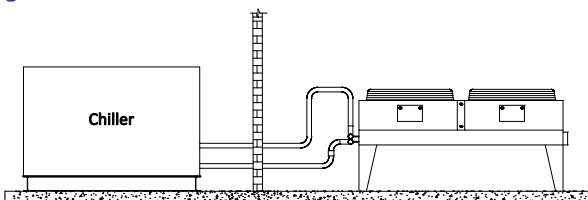


Figure 3 – Condenser Located Above Chiller Unit

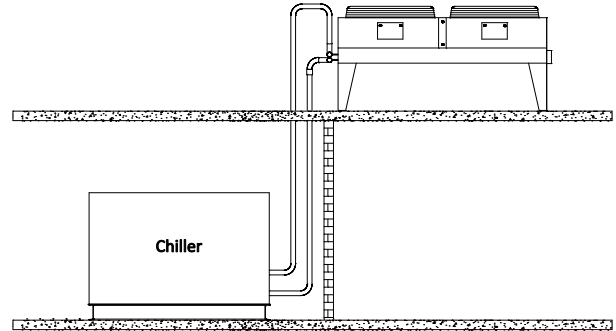
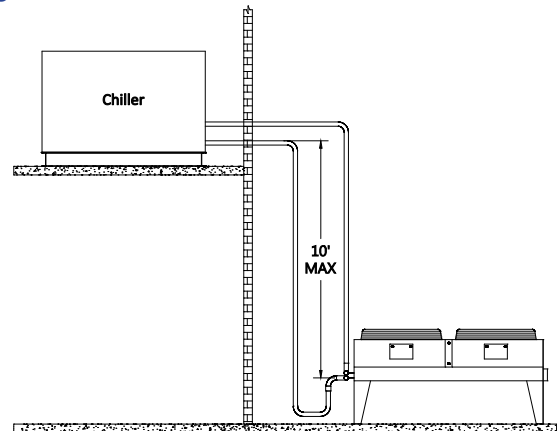


Figure 4 - Condenser Located Below Chiller Unit



**Caution:** Liquid line sizing for each chiller capacity are in Table 2. These line sizes are listed per circuit and apply where leaving water temperature (LWT) is 40°F or higher. For applications where the LWT is below 40°F, size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.

## Determining Equivalent Line Length

To determine the appropriate size for field installed liquid and discharge lines, it is first necessary to establish the equivalent length of pipe for each line. The equivalent length is the approximate friction loss from the combined linear run of pipe and the equivalent feet of elbows, valves, and other components in the refrigeration piping. The sum total is the equivalent length of pipe that would have the same pressure loss. See the ASHRAE Refrigeration Handbook for more information.

### Follow these steps when calculating line size:

1. Start with an initial approximation of equivalent length by assuming that the equivalent length of pipe is 1.5 times the actual pipe length.

2. Determine approximate line sizes by referring to Table 2 for liquid lines, Table 3 and Table 4 for the discharge lines.
3. Check the line size by calculating the actual equivalent length using the equivalent lengths as shown in Table 5.



*CAUTION: When calculating the equivalent length, do not include piping of the chiller unit. Only field piping must be considered.*

Table 1 – Equivalent Lengths of Elbows

Line Size OD (in)	Equivalent Lengths of Refrigerant Pipe (feet)				
	90° Standard	90° Long Radius	90° Street	45° Standard	45° Street
1/2	1.4	0.9	2.3	0.7	1.1
5/8	1.6	1.0	2.5	0.8	1.3
7/8	2.0	1.4	3.2	0.9	1.6

## Liquid Line Sizing

The liquid line diameter should be as small as possible while maintaining acceptable pressure drop. This is necessary to minimize refrigerant charge. The total length between the chiller unit and the air-cooled condenser must not exceed 200 actual feet or 300 equivalent feet. It is best to pipe the liquid line so that there is an immediate drop of at least 15 inches at the condenser outlets to make a liquid seal.

Liquid line risers in the system will require an additional 0.5 psig pressure drop per foot of vertical rise. When it is necessary to have a liquid line riser, make the vertical run immediately after the condenser before any additional restrictions. The liquid line risers must not exceed 10 feet in height from the condenser liquid line connection. The liquid line does not require pitching. Install a pressure tap valve at the condenser to facilitate measuring pressure for service.

Liquid lines do not typically require insulation. However, if exposing the lines to solar heat gain or temperatures exceeding 110 °F, there is a negative effect on sub-cooling. In these situations, insulate the liquid lines.

Table 2 – Liquid Line Sizes for R407c

3 Ton Circuit (R407c) Liquid Line Size (Inch OD)				
Equivalent Length (Ft)	Horizontal or Down Flow	Up Flow (Feet of Run)		
		0 to 5	6 to 10	11 to 15
25	1/2	1/2	1/2	1/2
50	1/2	1/2	1/2	1/2
75	1/2	1/2	1/2	1/2
100	1/2	1/2	1/2	3/4
125	1/2	1/2	1/2	5/8
150	1/2	1/2	5/8	5/8
175	1/2	5/8	5/8	5/8
200	1/2	5/8	5/8	5/8
225	5/8	5/8	5/8	5/8
250	5/8	5/8	5/8	5/8
275	5/8	5/8	5/8	5/8
300	5/8	5/8	5/8	5/8

### Discharge (Hot Gas) Line Sizing

Discharge line sizes depend on the velocity needed to obtain sufficient oil return. It is very important to minimize line length and restrictions to reduce pressure drop and maximize capacity.

Upflow hot gas risers require a trap at the bottom and reverse trap at the top as well as every 15 feet in the rise for oil management (see Figure 5).

Pitch the discharge lines downward, in the direction of the hot gas flow, at the rate of 1/2 inch per each 10 foot of horizontal run. If the chiller unit is below the condenser, loop the discharge line to at least 1 inch above the top of the condenser. Install a pressure tap valve at the condenser to facilitate measuring pressure for service. Take careful consideration in the design of the discharge gas riser.

Check the oil-level sight glass in the compressor to ensure it is at the appropriate level to verify there is no trapping of oil in the piping. The chiller uses hot-gas bypass for capacity control and when the chiller is fully unload the gas in the upflow discharge lines may have problems moving the oil against gravity if a single rise system is used. We recommend a double riser system to ensure proper oil return under low load operation. See Figure 6 for double riser constructions.

Figure 5 – Vertical Riser Traps

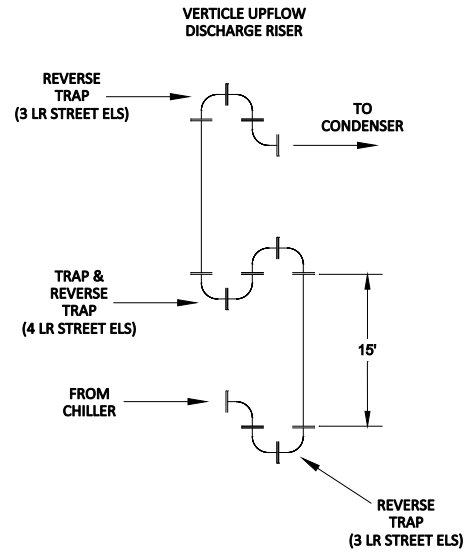
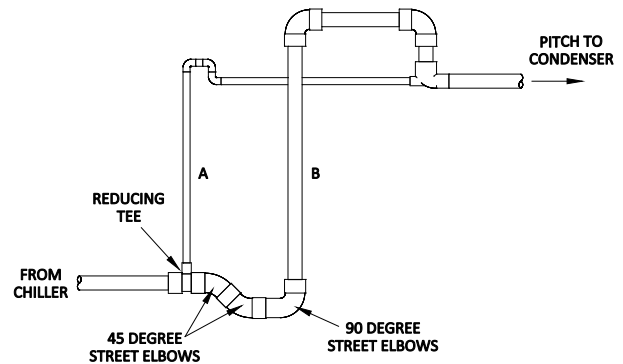


Figure 6 - Double Discharge Riser



Note: Discharge line sizing shown in Table 3 and Table 4 apply when leaving water temperature (LWT) is 40°F or higher. For applications where LWT is below 40°F, size lines using the ASHRAE Refrigeration Handbook or other suitable design guide.

Table 3 – Horizontal/Downflow Discharge Line Sizes

3-Ton R-407c Circuit (inches OD) Total Equivalent Length (Ft)											
25	50	75	100	125	150	175	200	225	250	275	300
5/8	5/8	3/4	3/4	3/4	3/4	7/8	7/8	7/8	7/8	7/8	7/8

Table 4 - Upflow Discharge Line Sizes

3-ton R-407c Circuit (inches OD) Total Equivalent Length (Ft)											
25	50	75	100	125	150	175	200	225	250	275	300
A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8	A 3/8
B 1/2	B 1/2	B 5/8	B 5/8	B 5/8	B 5/8	B 3/4	B 3/4	B 3/4	B 3/4	B 3/4	B 3/4

## Calculating Refrigerant and Oil Charge

To determine the approximate charge, assume a combined chiller and remote condenser summer refrigerant charge of 4.6 Lbs. of R-407c then refer to Table 5 to determine the charge required for the field-installed piping. The approximate charge per circuit is therefore the sum 4.6 and the value from Table 5.

Table 5 - Field Piping R-407c Refrigerant Charges

Line Size OD (inches)	Discharge Line (Lbs./100' run)	Liquid Line (Lbs./100' run)
3/8	0.4	3.7
1/2	0.7	6.8
5/8	1.1	11.0
3/4	1.6	16.4
7/8	2.2	22.8

## Oil Charge Determination

The chiller is factory charged with the amount of oil required by the chiller only and not the total system. The amount of oil required is dependent upon the amount of refrigerant added to the system for the field-installed piping. Use the following to determine the amount of oil needed for the system.

Pints of Oil = Pounds of refrigerant in system / 100

Check the oil level after the chiller has run for 15 minutes.

## Setting Condenser Fan Controls

The remote condenser has one fan and the fan pressure setting should be set to turn on at 220 psig and off at 180 psig. It is important that these settings be correct in order to maintain proper capacity control and operation of the system.

## Installation - Electrical

All wiring must comply with local codes and the National Electric Code. Minimum circuit amps (MCA) and other unit electrical data are on the unit nameplate. A unit specific electrical schematic ships with the unit. Measure each leg of the main power supply voltage at the main power source. Voltage must be within the voltage utilization range given on the drawings included with the unit. If the measured voltage on any leg is not within the specified range, notify the supplier and correct before operating the unit. Voltage imbalance must not exceed 2%.

When installing any unit to 3-phase power, check the electrical phase sequence at installation and prior to start-up. Operation of the compressor with incorrect electrical phase sequencing will result in mechanical damage to the compressor. Check the phasing with a phase sequence meter prior to applying power. The proper sequence should read "ABC" on the meter. If the meter reads "CBA", open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). Do not interchange any load leads that are from the unit contactors or the motor terminals.



**WARNING:** This equipment contains hazardous voltages that can cause severe injury or death.



**WARNING:** This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.



**WARNING:** This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.



**WARNING:** The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.



**CAUTION:** Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.



**CAUTION:** Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wire the unit ground in compliance with local and national codes.



**CAUTION:** The unit requires the main power to remain connected during off-hours to energize the compressor's crankcase heater. Disconnect main power only when servicing the chiller. The crankcase heater should remain on when the compressor is off to ensure liquid refrigerant does not accumulate in the compressor crankcase. Connect main power at least 24 hours prior to initial startup.

## Standard Controller Operation

The chiller includes a controller to perform all control functions directly from the front panel. When power is applied the controller lights up and "Loading . . ." appears on the display for a few seconds while the controller boots up. The controller then displays the software version and after 10 seconds, the controller is ready for operation.

After power is applied and the controller has gone through its initial start-up, the default main screen will look similar to the screen shown below.



The interface has six buttons that allow for various functions and adjustments. See Table 6 for details of the button functions.




Table 6 - Operating Buttons – Soft Buttons

Button	Symbol	Description of Operation
Alarm Button		Touch the alarm button to display the list of active alarms. In addition, this button allows reset of the alarms manually, silences the optional alarm horn, and opens the optional remote alarm contact.
PRG Button		Press the programming key to access the password entry screen for access to the Main Menu.
ESC Button		This button returns to the previous screen.
Up/Down Button		On the main screen, the UP and DOWN buttons allow for scrolling through the functions. Also, the up and down buttons are used to raise or decrease the temperature, and for selecting items in various menus.
Enter Button		The enter button is used to confirm a temperature or parameter adjustment in various menus.

The main screen displays the control probe, setpoint and the status of the unit:

- Stand by (unit is on and compressor is off)
- Off by alarm
- Off by Modbus (only if the Modbus option is present and enabled)
- Off by DI (only if the remote start/stop is enabled)
- Off by keyboard
- Comp On (compressor is running)

## User Menu

On the main screen, the Up  and Down  buttons are used to scroll through the functions and the Enter  button is used to select the function. No password is required to access and edit these parameters. (See Table 7)

## User Menu – ON-OFF

Use the user menu to turn the unit on and off as well as to display the status.




## User Menu – Info

This menu shows the status and run-hours of the compressor, fan and pump, also displays the physical status of the inputs, device outputs, and probes.

## User Menu – SET


This menu allows modification of the Setpoint and enablement of the Remote Start/Stop function, Modbus control, and autostart.

## Changing Setpoint Temperature

Changing the setpoint temperature requires the unit display shown on the User Menu Screen. Use the increase  or decrease  buttons to change the temperature shown until the desired new set point temperature shows on the screen. Once the desired temperature shows, press the enter button  to enter the new set point temperature, the value should match with the Actual Setpoint.

If the Modbus control is enabled, the setpoint can be written only through communication.

## Main Menu

The main menu access is through the PRG Button .

If needing to change a setting, one must enter the proper password. However, all menu screens are visible for all security levels. User Level requires password 9999 and Service level is 7720. (See Table 8)

## Main Menu – Process

This menu shows the unit configuration: unit type, options, communication settings, and temperature and delays limits.

## Main Menu – HGBP

HGBP has the parameters for the hot gas bypass valve.

## Main Menu – Alarm Logs

Alarm logs accesses the functions for downloading the alarm log to internal memory or USB memory. This menu also shows the alarms logs on the screen.

## Main Menu – Settings

Settings include the following parameters.

*Time/Date Setting* – allows for adjustment of the time and date.

*UoM (unit of measure)* – allows for adjustment of the temperature units of measure between °F or °C. The default unit of measure is °F.

*Serial Port* – allows for adjustment of the Modbus RTU parameters. The default settings are as follows: Baudrate 57600, Parity Odd, Stop-bit 1, Data length 8. If the controller uses Modbus TCP/IP this option is not enabled.

Table 7 – User Menu Parameters







Category	Screen	Description
Start/Stop 	Start/Stop	Using the Up/Down buttons the unit can be turned On/Off in Local mode. This screen also displays the status of the unit using the Remote mode (Digital input Start/Stop or Modbus). When the unit is running in this mode, it can be turned off with the Off button on the screen as well as the Digital input (universal I/O U4) or Modbus Start/Stopregister.
General Information 	Compressor Status	Displays the compressor status, indicating, if necessary, the remaining time before restarting
	HGBP	Shows the valve opening percentage, valve steps, status, setpoint and process temperature. To change the PID parameters it is necessary to login as a service level or level 2.
	Fan Condenser	This screen is only visible for Air-Cooled units and shows the fan status.
	Process	This screen shows the status of the Flow Switch, Pump, Supply Fluid Temperature, Return Fluid Temperatures, and the Setpoint Temperature.
	Universal I/O	This screen shows the status of each Universal I/O. Not all inputs are active on all units; however, the below defines all I/O possible. <ul style="list-style-type: none"> <li>- U1: Supply Fluid Temperature (the default temperature is °F)</li> <li>- U2: Return Fluid Temperature</li> <li>- U3: Low Low Pressure Switch</li> <li>- U4: Remote Start/Stop</li> <li>- U5: Tank Low Level Switch</li> <li>- U6: Tank High Level Switch</li> <li>- U7: High Refrigerant Pressure Switch</li> <li>- U8: Low Refrigerant Pressure Switch</li> <li>- U9: Phase Monitor Relay</li> <li>- U10: Low Flow Switch</li> </ul>
	Inputs/Outputs	This screen shows the status of each Digital I/O. Not all I/O are active on all units; however, the below defines all I/O possible. <ul style="list-style-type: none"> <li>- ID1: Fan Overload</li> <li>- ID2: Pump Overload</li> <li>- NO1: Compressor Enable</li> <li>- NO2: Process Pump Enable</li> <li>- NO3: Condenser Fan Enable</li> <li>- NO4: Fluid Makeup Valve / Liquid Line Solenoid Valve</li> <li>- NO5: Alarm Horn</li> <li>- NO/NC6: Remote alarm contacts – Normally open, normally close contacts</li> </ul> This screen also shows the analog outputs. <ul style="list-style-type: none"> <li>- Y1: EC fan control (0-10V)</li> <li>- Y2: Supply Fluid Temperature retransmit (0-10V)</li> </ul>
	Running Hours	Shows the running hours related to the compressor, pump and condenser fan.
Set 	Setpoint	Pushing the  or  keys, the setpoint value can be modified, to confirm the value it is necessary press the enter key  . In addition, this screen shows the current setpoint before any change.
	Remote Start/Stop	This screen allows for the enabling or disabling of the Remote Start/Stop I/O (Universal I/O U4). When this feature is enabled the unit can be turned off with both the Off button on the screen as well as the remote On/Off input at Universal I/O U4. If this feature is disabled the unit can only be turned on and off with the button on the main screen.
	Remote Setpoint	The Remote Setpoint feature is only visible when the Remote Setpoint is enabled from the Main Menu - Process, this option requires an expansion module to the main controllers and allows the use of a 0 to 10 VDC input for adjustment of the setpoint temperature. This screen allows for the enabling or disabling of the Remote Setpoint input.
	Modbus	This screen allows for the enabling or disabling of the Modbus feature of the controller.
	Power On AutoStart	This screen allows for the enabling or disabling the Autostart option. If the Autostart feature is enabled the Autostart signal will have precedence over the Start Button, Digital Start/Stop signal or Modbus Start/Stop.

Table 8 - Main Menu Setup

Category	Level Security	Screen	Range	Default Valve	Description
A. Process	User	Antifreeze Setpoint	10 to 50 °F	38	This allows for changing the antifreeze setpoint value. If the supply water temperature drops below this limit, the system will alert the user and will stop the unit.
	Manufacturer	Condenser Type	Water-Cooled Air-Cooled Remote Condenser		This defines the condenser type.
	Manufacturer	Enable Return Fluid Temperature	No or Yes	No	This enables the Return Fluid Temperature option.
	Manufacturer	Air Cooled Fan Overload	No or Yes	No	This enabled the Fan Overload option.
	Manufacturer	Enable Phase Monitor	No or Yes	No	This allows for enabling or disabling of the Phase Monitor option. When enabled an open condition at Universal I/O U9 triggers a Phase Loss Alarm.
	Manufacturer	Alarms Options	No or Yes	No	This screen allows for enabling or disabling the alarm horn and/or alarm contacts outputs.
	Manufacturer	Enable Tank Low Level Alarm	No or Yes	No	This allows for enabling or disabling of the Tank Low Level Alarm option. When enabled an open condition at Universal I/O U5 triggers a Low Level Alarm.
	Manufacturer	Enable Fluid Makeup	No or Yes	No	This allows for enabling or disabling of the Auto Water Makeup option. This is only viewable if the Integral Tank option is enabled.
	Manufacturer	Process Return Fluid Temp Control	No or Yes	No	If the Return Fluid sensor is an option, this feature allows to change the process temperature control using the Return Fluid Temperature.
	Manufacturer	Remote Setpoint	No or Yes	No	This allows for enabling or disabling of the Remote Setpoint option.
	Service	Supply Fluid	High Fault: 20 to 140 °F	100	This is the setpoint for the Supply High Temperature Alarm.
			High Fault Delay: 0 to 600 seconds	180	This is the time after a unit start before the Supply High Temperature Alarm becomes active. The purpose of this time delay is to allow the unit to start and bring the temperature of the process fluid down to proper operating temperatures prior to triggering an alarm. This allows the unit to start warm and not cause an instant fault on start-up.
			Low Fault: -40 to 80 °F	10	This is the setpoint for the Supply Low Temperature Alarm.
			HI temp: alm & shtdwn or alarm	Alrm & shtdwn	Once the High Temperature is triggered, this option will alarm and stop the unit, or just alarm.
	Service	Return Fluid	High Fault: 20 to 140 °F	100	This is the setpoint for the Return High Temperature Alarm.
High Fault Delay: 0 to 600 s			180	This is the time after a unit start before the Return High Temperature Alarm becomes active. The purpose of this time delay is to allow the unit to start and bring the temperature of the process fluid down to proper operating temperatures prior to triggering an alarm. This allows the unit to start warm and not cause an instant fault on start-up.	
Low Fault: -40 to 80 °F			10	This is the setpoint for the Return Low Temperature Alarm.	

Table 8 - Main Menu Setup (continued)

Category	Level Security	Screen	Range	Default Valve	Description
A. Process	Service	Flow / Tank	Low Flow Alarm Delay: 0 to 30 s	5	This is the time after a unit start before the Low Flow Alarm becomes active. The purpose of this delay is to allow the system to come up to a full flow condition before enabling the alarm. This time delay helps eliminate unwanted nuisance alarms at start-up.
			Tank Low Level Alarm Delay: 0 to 100 s	10	This is the time after a unit start before the Low Level Alarm becomes active. The purpose of this delay is to allow the system to come up to a full flow condition before enabling the alarm. This time delay helps eliminate unwanted nuisance alarms at start-up.
	Service	Setpoint Limits	Min: 20 to 80 °F	20	This is the minimum permitted machine setpoint.
			Max: 20 to 80 °F	65	This is the maximum permitted machine setpoint.
	Service	Compressor RunHours	Reset hours: No or Yes		This screen allows reset the run hours counter, this screen also shows the current run hours and status.
	Service	Process Pump RunHours	Reset hours: No or Yes		This screen allows reset the run hours counter, this screen also shows the current run hours and status.
Service	Condenser Fan RunHours	Reset hours: No or Yes		This screen allows reset the run hours counter, this screen also shows the current run hours and status.	
B. HGBP	Service	Hot Gas Bypass	Manual or Automatic	Automatic	This allows for changing the mode of Hot Gas Bypass control from automatic to manual mode.
			Position: 0 to 480 steps	0	When in the Manual mode it is possible to change the valve position. 0 step is equal to 0% (minimum valve percent), and 480 steps is equivalent to 100% (maximum valve percent).
	Service	Chiller HGBP PID	HGBP Set	Process Setpoint	This shows the Hot Gas Bypass setpoint.
			Set Margin: 0 to 10 °F	0	This allows for adjustment of the deviation for the Hot Gas Bypass setpoint.
			Prop. Gain Kp: 1 to 800	450	This allows for adjustment of the Proportional PID value.
			Integral Ti: 0 to 1000 s	150	This allows for adjustment of the Integral PID value.
Derivat. Td: 0 to 800 s	1.0	This allows for adjustment of the Derivative PID value.			
C. Alarm logs	Service	Alarm exports			Alarm log accesses the functions for downloading the alarm log, to the internal memory or USB memory. It is necessary to confirm "Yes" to export successfully the log.
D. Settings	User	Date/Time	---		Allows change the Date/Time settings.
		UoM	---		Allows change the unit of measure shown on the display.
	Service	Serial Port			Allows change the Modbus RTU settings.
	Manufacturer	Initialization	---		Allows delete the alarm log, enable alarm buzzer, export and import parameters, download the historical logs.
E. Logout	---	---	---		Logout is active to exit the set password.


## Modbus RTU Communications

The standard controller has Modbus RTU communications enabled with the following default setup: Baud rate = 57,600, data length = 8 bits, parity = odd, and stop bit = 1.


Table 9 – Modbus Parameters

Register	Format	Parameter	Data	Access Level	Comment
00000	BOOL	UNIT START/STOP	BIT	R/W	UNIT ON/OFF BY MODBUS
10000	BOOL	SYSTEM RUNNING	BIT	R	
10001	BOOL	REMOTE MODE	BIT	R	REMOTE MODE ENABLE/DISABLE
10002	BOOL	COMPRESSOR ENABLE	BIT	R	
10003	BOOL	PUMP ENABLE	BIT	R	
10004	BOOL	FAN ENABLE	BIT	R	
10005	BOOL	CONDENSER ENABLE	BIT	R	
10006	BOOL	AUTO FLUID MAKEUP VALVE	BIT	R	
10007	BOOL	LIQUID LINE SOLENOID VALVE	BIT	R	
10008	BOOL	TANK LOW LEVEL ALARM	BIT	R	
10009	BOOL	PHASE LOSS ALARM	BIT	R	
10010	BOOL	PUMP OVERLOAD ALARM	BIT	R	
10011	BOOL	FAN OVERLOAD ALARM	BIT	R	
10012	BOOL	LOW FLOW ALARM	BIT	R	
10013	BOOL	HIGH SUPPLY FLUID TEMPERATURE ALARM	BIT	R	
10014	BOOL	HIGH RETURN FLUID TEMPERATURE WARNING	BIT	R	
10015	BOOL	LOW SUPPLY FLUID TEMPERATURE ALARM	BIT	R	
10016	BOOL	LOW RETURN FLUID TEMPERATURE WARNING	BIT	R	
10017	BOOL	SUPPLY FLUID TEMPERATURE SENSOR ALARM	BIT	R	
10018	BOOL	RETURN FLUID TEMPERATURE SENSOR ALARM	BIT	R	
10019	BOOL	FREEZESTAT ALARM	BIT	R	
10020	BOOL	HIGH REFRIGERANT PRESSURE ALARM	BIT	R	
10021	BOOL	LOW REFRIGERANT PRESSURE ALARM	BIT	R	
10022	BOOL	LOW LOW REFRIGERANT PRESSURE ALARM	BIT	R	
30000	UINT	COOLING TYPE	1	R	0 = AIR COOLED 1 = REMOTE COOLED 2 = WATER COOLED
30001	REAL	PROCESS SETPOINT °F	2	R	
30003	REAL	SUPPLY FLUID TEMPERATURE °F	2	R	
30005	REAL	RETURN FLUID TEMPERATURE °F	2	R	
30007	REAL	HOT GAS BYPASS VALVE %	2	R	
30009	REAL	SOFTWARE VERSION	2	R	
30011	UDINT	COMPRESSOR RUN HOURS	2	R	
30013	UDINT	PUMP RUN HOURS	2	R	
30015	UDINT	FAN RUN HOURS	2	R	
40000	REAL	TARGET SETPOINT °F	2	R/W	TARGET TEMPERATURE °F

## Alarms

If there is no alarm active and the alarm key  is pressed, the screen shows "NO ALARMS". Under no alarm condition, the LED under the alarm button is OFF.

If there is at least one alarm active, the screen displays the information needed to understand the cause of every alarm. If the LED under the alarm button is flashing, there is at least one active alarm and the display shows a screen that is not part of the alarms loop. If the LED stays ON, there is at least one active alarm and a screen that is part of the alarms loop displays.

Also, the alarm screen allows to access to the alarms log using the Enter key .

The controller has the memory capacity to store approximately 65 events. Once the memory is full, the controller erases the oldest alarm to make room to store the new alarm.

**Table 10 – Alarms and Fault Logic**

Alarm	Type (Default Condition)	Compressor Stop	Pump Stop	Unit Stop	Reset Location	Reset Type
Return Fluid temperature probe error	Warning *	•	•	•	-	Auto Reset
Supply fluid temperature probe error	Critical Fault *	•	•	•	-	Auto Reset
Pump Motor Overload	Critical Fault	•	•	•	Controller	User Reset
Low Flow	Critical Fault	•	•	•	Controller	User Reset
Tank Low Water Level	Critical Fault	•	•	•	Controller	User Reset
Fan Motor Overload	Critical Fault	•	•	•	Controller	User Reset
Phase Loss	Critical Fault	•	•	•	Controller	User Reset
High Supply Fluid Temperature	Warning				Controller	User Reset
Low Supply Fluid Temperature	Critical Fault	•	•	•	Controller	User Reset
Tank Low Water Level	Warning				-	Auto Reset
High Return Fluid Temperature	Warning				Controller	User Reset
Low Return Fluid Temperature	Warning				Controller	Auto Reset
Freeze Temp Fault	Critical Fault	•	•	•	Controller	User Reset
High Refrigerant Pressure	Refrigeration Fault	•			On sensor / Controller	User Reset
Low Refrigerant Pressure	Refrigeration Fault	•			Controller	User Reset
Low Low Refrigerant Pressure	Refrigeration Fault	•			Controller	User Reset
High Temperature	Critical Fault **	•	•	•	Controller	User Reset
Process Sensor Fault	Critical Fault	•	•	•	Controller	User Reset
Expansion device c.pCOe offline	Warning				-	Auto Reset

\* If the Return Fluid Temperature is selected as the Process Temperature to control the unit, the Return Fluid temperature probe error will be a Critical Fault, and the Supply Fluid temperature probe error will be a Warning.

\*\* The High Temperature could be a Critical Fault or Warning depending of the settings.

# Start-Up

Every unit is factory set to deliver chilled water in accordance with the standard operating specifications for that particular chiller. Due to variables involved with different applications and different installations, minor adjustments may be required during the initial start-up to ensure proper operation. Use a qualified refrigeration technician to perform the start-up procedure in sequence. The following serves as a checklist for the initial start-up and for subsequent start-ups if the chiller is out of service for a prolonged time.



**WARNING:** This equipment contains hazardous voltages that can cause severe injury or death.



**WARNING:** This equipment contains refrigerant under pressure. Accidental release of refrigerant under pressure can cause personal injury and or property damage.



**WARNING:** This equipment may contain fan blades or other sharp edges. Make sure all fan guards and other protective shields are securely in place.



**WARNING:** The exposed surfaces of motors, refrigerant piping, and other fluid circuit components can be very hot and can cause burns if touched with unprotected hands.



**CAUTION:** Disconnect and lock out incoming power before installing, servicing, or maintaining the equipment. Connecting power to the main terminal block energizes the entire electric circuitry of the unit. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance.



**CAUTION:** Wear eye protection when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** Wear protective gloves when installing, maintaining, or repairing the equipment to protect against any sparks, debris, or fluid leaks.



**CAUTION:** The unit requires the main power to remain connected during off-hours to energize the compressor's crankcase heater. Disconnect main power only when servicing the chiller. The crankcase heater should remain on when the compressor is off to ensure liquid refrigerant does not accumulate in the compressor crankcase. Connect main power at least 24 hours prior to initial start-up.



**CAUTION:** Wire the unit ground in compliance with local and national codes.

## Step 1 - Connect Main Power

Connect main power properly ensuring it matches the voltage shown on the nameplate of the unit. Check the electrical phase sequence prior to start-up. Operation of the compressor with incorrect electrical phase sequencing will cause damage to the compressors. Check the phasing prior to applying power. The proper sequence is "ABC." If the phasing is incorrect, open the main power disconnect and switch two line leads on the main power terminal blocks (or the unit mounted disconnect). All electrical components are in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals. After making proper power connection and grounding, turn the main power on.

## Step 2 - Fill Coolant Circuit

Check to make sure all process chilled-water piping connections are secure. Open the chiller cabinet and fill the coolant reservoir with the proper water or water/glycol solution following the guidelines shown below. When using a glycol solution only use glycol with a corrosion inhibitor.

## System Fill Water Chemistry Requirements

The properties of water make it ideal for heat transfer applications. It is safe, non-flammable, non-poisonous, easy to handle, widely available, and inexpensive in most industrialized areas.

When using water as a heat transfer fluid it is important to keep it within certain chemistry limits to avoid unwanted side effects. Water is a "universal solvent" because it can dissolve many solid substances and absorb gases. As a result, water can cause the corrosion of metals used in a cooling system. Often water is in an open system (exposed to air) and when the water evaporates, the dissolved minerals remain in the process fluid. When the concentration exceeds the solubility of some minerals, scale forms. The life giving properties of water can also encourage biological growth that can foul heat transfer surfaces.

To avoid the unwanted side effects associated with water cooling, proper chemical treatment and preventive maintenance is required for continuous plant productivity.

*Unwanted Side Effects of Improper Water Quality*

- Corrosion
- Scale
- Fouling
- Biological Contamination

*Cooling Water Chemistry Properties*

- Electrical Conductivity
- pH
- Alkalinity
- Total Hardness
- Dissolved gases

Chillers at their simplest have two main heat exchangers: one that absorbs the heat from the process (evaporator) and one that removes the heat from the chiller (condenser). All our chillers use stainless steel brazed plate evaporators. Our air-cooled chillers use air to remove heat from the chiller; however, our water-cooled chillers use either a tube-in-tube or shell-in-tube condenser which has copper refrigerant tubes and a steel shell. These, as are all heat exchangers, are susceptible to fouling of heat transfer surfaces due to scale or debris. Fouling of these surfaces reduces the heat-transfer surface area while increasing the fluid velocities and pressure drop through the heat exchanger. All of these effects reduce the heat transfer and affect the efficiency of the chiller.

The complex nature of water chemistry requires a specialist to evaluate and implement appropriate sensing, measurement and treatment needed for satisfactory performance and life. The recommendations of the specialist may include filtration, monitoring, treatment and control devices. With the ever-changing regulations on water usage and treatment chemicals, the information is usually up-to-date when a specialist in the industry is involved. Table 11 shows the list of water characteristics and quality limitations.

**Table 11 – Fill Water Chemistry Requirements**

Water Characteristic	Quality Limitation
Alkalinity (HCO <sub>3</sub> <sup>-</sup> )	70-300 ppm
Aluminum (Al)	Less than 0.2 ppm
Ammonium (NH <sub>3</sub> )	Less than 2 ppm
Chlorides (Cl <sup>-</sup> )	Less than 300 ppm
Electrical Conductivity	10-500µS/cm
Free (aggressive) Carbon Dioxide (CO <sub>2</sub> ) <sup>†</sup>	Less than 5 ppm
Free Chlorine(Cl <sub>2</sub> )	Less than 1 PPM
HCO <sub>3</sub> <sup>-</sup> /SO <sub>4</sub> <sup>2-</sup>	Greater than 1.0
Hydrogen Sulfide (H <sub>2</sub> S)	Less than 0.05 ppm
Iron (Fe)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm
Nitrate (NO <sub>3</sub> )	Less than 100 ppm
pH	7.5-9.0
Sulfate (SO <sub>4</sub> <sup>2-</sup> )	Less than 70 ppm
Total Hardness (dH)k	4.0-8.5

<sup>†</sup> Dissolved carbon dioxide calculation is from the pH and total alkalinity values shown below or measured on the site using a test kit. Dissolved Carbon Dioxide, PPM = TA x 2<sup>[(6.3-pH)/0.3]</sup> where TA = Total Alkalinity, PPM as CaCO<sub>3</sub>

**Table 12 - Recommended Glycol Solutions**

Chilled Water Temperature	Percent Glycol By Volume
50°F (10°C)	Not required
45°F (7.2°C)	5 %
40°F (4.4°C)	10 %
35°F (1.7°C)	15 %
30°F (-1.1°C)	20 %
25°F (-3.9°C)	25 %
20°F (-6.7°C)	30 %



**CAUTION:** When your application requires the use of glycol, use industrial grade glycol specifically designed for heat transfer systems and equipment. Never use glycol designed for automotive applications. Automotive glycols typically have additives engineered to benefit the materials and conditions found in an automotive engine; however, these additives can gel and foul heat exchange surfaces and result in loss of performance or even failure of the chiller. In addition, these additives can react with the materials of the pump shaft seals resulting in leaks or premature pump failures.



**WARNING:** Ethylene Glycol is flammable at higher temperatures in a vapor state. Carefully handle this material and keep away from open flames or other possible ignition sources.

### Step 3 - Check Condenser

There are three possible types of condensers present in the chiller: Integral air-cooled, water-cooled, or remote air-cooled. It is important to verify the chiller will have adequate condenser cooling for proper chiller operation.

#### Integral Air-Cooled Condenser Check

Make sure the chiller installation is as described in the mechanical installation section of this manual. Check to make sure the chiller condenser is clear of obstructions and has at least 36 inches of open air on the air inlet and outlets for proper airflow.

#### Water-Cooled Condenser Check

Check the condenser water lines to make sure all connections are secure. Make sure sufficient condenser water flow and pressure are available and all shut-off valves are open.

#### Remote Air-Cooled Condenser Check

Check the refrigerant lines to make sure all connections are secure and that a proper evacuation of the chiller, the field piping, and the remote condenser has occurred. Verify the refrigeration piping installation is as described in the installation section of this manual. Check the remote condenser main power and control wiring to ensure all connections are secure.

### Step 4 – Check Refrigerant Valves

It is possible valves were closed during shipment or installation. Verify that all refrigerant valves are open.



*CAUTION: Do not operate the unit with the compressor, oil line, or liquid line service valves "CLOSED." Failure to have these "OPEN" may cause serious compressor damage.*

### Step 5 – Verify Freezestat Setting

Make sure the Freezestat setting is appropriate for the operating conditions of the chiller. It should be set at 10°F below the minimum chilled water temperature setting that the chiller will be operating. Reference Table 12 to be sure the coolant solution has sufficient freeze protection (glycol) to handle at least 5°F below the Freezestat setting. All chillers ship from the factory with the Freezestat set at 38°F to protect against a possible freeze-up if no glycol is in the coolant. Once the proper glycol solution is

present, adjust the Freezestat to the appropriate setting.



*CAUTION: The manufacturer's warranty does not cover the evaporator from freezing. It is vital that the Freezestat is set properly.*

### Step 6 – Turn On Control Power

Some chillers may have a control power switch. If present, turn the control power switch on. If not present, turning the main power on should turn the control power on. When the control power is on, the panel displays are illuminated. Due to extreme ambient temperatures that may occur during shipment, the High Refrigerant Pressure switch may have tripped. If this is the case, disconnect the main power and reset the High Refrigerant Pressure by depressing the manual reset button located on the switch. Reconnect the main power, turn the control power on, and clear the alarm condition by pressing the Alarm Reset button.

### Step 7 – Establish Coolant Flow

Standard units have an internal pump. To energize the pump press the Start button. If the unit does not have an internal pump, energize the external pump to establish flow through the chiller.

*Note: The compressor will not start as long as the flow switch is open. A positive flow through the evaporator is required before the compressor can operate.*

Set water flow using a discharge throttling valve or flow control valve (by others). The valve should be the same size as the To Process connection of the chiller. Standard chillers require approximately 2.4 gpm/ton of nominal capacity. A significant increase in flow beyond this in a standard chiller may result in excessive pressure loss, which can negatively affect chiller efficiency and in extreme cases may cause premature wear or damage of internal components.

### Step 8 – Initial Unit Operation

Enter the desired leaving fluid temperature on the control panel. Unless otherwise specified, the chiller is factory set to deliver coolant at 50°F. Adjust to the desired operating temperature. The chiller should now be controlling to the selected temperature. Please note that if there is insufficient load the compressor may cycle on and off causing swings in temperature.



**WARNING:** Never deactivate the High Refrigerant Pressure or the Low Compressor Pressure switch. Failure to heed this warning can cause serious compressor damage, severe personal injury, or death.

Operate the system for approximately 30 minutes. Check the liquid line sight glass. The refrigerant flow past the sight glass should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line. Indications of a shortage of refrigerant are low operating pressures and subcooling. Normal subcooling ranges are from 10°F to 20°F. If it is not, check the superheat and adjust if required. The superheat should be approximately 10°F. If the operating pressures, sight glass, superheat, and subcooling readings indicate a refrigerant shortage, charge refrigerant as required. With the unit running, add refrigerant using industry best practices until operating conditions become normal.



**CAUTION:** A clear sight glass alone does not mean that the system is properly charged. Also, check system superheat, sub-cooling, and unit operating pressures. If both suction and discharge pressures are low but sub-cooling is normal, a problem other than a refrigerant shortage exists. Do not add refrigerant, as this may result in overcharging the circuit.

After achieving proper flows and temperatures, press the Stop button. The unit is now ready for service.

## Preventive Maintenance

The importance of a properly established preventive maintenance program cannot be overemphasized. Taking the time to follow the following procedures will result in substantially reduced downtime, reduced repair costs, and an extended useful lifetime for the chiller. To assist with maintenance it is important to keep an accurate machine record to log and keep track of maintenance and repairs.

### Once a Week

1. (Air-Cooled Units Only) Check the surface of the air-cooled condenser coil for dirt and debris. To clean, rinse thoroughly with water and use a mild detergent to remove smoke and or grease stains.
2. Check to make sure that the To Process temperature is reasonably close to the Set Point

temperature. If the temperature stays more than 5°F away from the set point, there may be a problem with the chiller. If this is the case, refer to the Troubleshooting Chart or contact the Customer Service Department.

3. Check the pump discharge pressure on the gauge on the back panel of the chiller. Investigate further if the pressure starts to stray away from the normal operating pressure.
4. Check the coolant level in the reservoir. Replenish if necessary making sure to take proper precautions to maintain the appropriate glycol concentration.
5. Check coolant circulation pump for leaks in the seal area. Replace pump seal if necessary.
6. Check refrigerant sight glass for air bubbles or moisture indication. If the sight glass indicates that there is a refrigeration problem, have the unit serviced as soon as possible.

### Once a Month

7. With the main disconnect shut off and locked out, check the condition of electrical connections at all contactors, starters and controls. Check for loose or frayed wires.
8. Check the incoming voltage to make sure it is within 10% of the design voltage for the chiller.
9. Check the amp draws to each leg of the compressor (fans or blowers on air-cooled units) and pump to confirm that they are drawing the proper current.

### Every Three Months

10. Units are equipped with a Y-strainer between the return connection and the evaporator inlet. Remove and clean the strainer basket if necessary.
11. Have a qualified refrigeration technician inspect the operation of the entire unit to ensure that everything is operating properly. Have condenser cleaned out if necessary.

# General Troubleshooting

Problem	Possible Cause	Remedy
Compressor will not start	Compressor overload	Check supply voltage, amperage of each leg, contactor and wiring, and overload set point
	Compressor contactor	Replace if faulty
	Compressor failure	Contact Customer Service for assistance
Pump will not start	Pump overload	Check supply voltage, amperage of each leg, contactor and wiring, and overload set point
	Pump contactor	Replace if faulty
	Pump failure	Replace if faulty
Low refrigerant pressure	Low refrigerant charge	Contact refrigeration service technician
	Refrigerant leak	Contact refrigeration service technician
	Low refrigeration pressure sensor	Check for proper range, replace if faulty
High refrigerant pressure	Dirty air filters (air-cooled units only)	Clean filters
	Air flow obstruction (air-cooled units only)	Make sure chiller is installed in accordance with recommendations in this manual
	High ambient air temperature (air-cooled units only)	Ambient temperature must be reduced below 110°F
	Condenser fan motor (air-cooled units only)	Replace if faulty
	Condenser fan cycling control (air-cooled units only)	Confirm proper operation, replace if faulty
	Plugged condenser (water-cooled units only)	Clean out tubes
	Insufficient condenser water flow (water-cooled units only)	Make sure chiller is installed in accordance with the recommendations of this manual
	High condenser water temperature (water-cooled units only)	Condenser water temperature must be reduced below 100°F
	Condenser water regulating valve	Check setting, replace if faulty
	Refrigerant circuit overcharged	Contact refrigeration service technician
	High refrigerant pressure sensor	Replace if faulty
Freezestat	Low flow through evaporator	Adjust flow to proper level
	Freezestat control module	Check for proper setting (Protected Setting)
	Freezestat sensor	Replace if faulty
Low pump discharge pressure	Pump running backwards	Switch 2 legs of the incoming power
	Pump pressure gauge	Replace if faulty
	Pump failure	Replace if faulty
	Excessive flow	Reduce flow
High pump discharge pressure	Closed valves in process piping	Open valves
	Obstruction in piping or process	Remove obstruction
	Clogged Y-strainer	Clean strainer
	Pressure gauge	Replace if faulty
Erratic temperature control	Low coolant flow through evaporator	Adjust flow to proper level
	Intermittent overloading of chiller capacity	Check to make sure chiller is properly sized for process load
	Hot gas bypass valve	Contact refrigeration service technician
	Temperature sensor	Replace if faulty

## General Troubleshooting (continued)

Problem	Possible Cause	Remedy
Insufficient cooling (temperature continues to rise above set point)	Process load too high	Check to make sure chiller is properly sized for process load
	Coolant flow through evaporator too high or low	Adjust flow to proper level
	Insufficient condenser cooling	See "High Refrigerant Pressure"
	Hot gas bypass valve stuck open	Contact refrigeration service technician
	Refrigeration circuit problem	Contact refrigeration service technician
	Temperature sensor	Replace if faulty

## Drawings

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We have prepared a custom set of drawings for your unit and placed them inside the control panel prior to shipment. Please refer to these drawings when troubleshooting, servicing, and installing the unit. If you cannot find these drawings or wish to have additional copies, please contact our Customer Service Department and reference the serial number of your unit.

## Notes

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## We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

## How to Contact Customer Service

To contact Customer Service personnel, call:



**NOTE:** Normal operating hours are 8:00 am - 5:00 pm (EST). After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

## Before You Call...

**If you do have a problem, please complete the following checklist before calling Conair:**

- Make sure you have all model, control type from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

## Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

## Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

## Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.