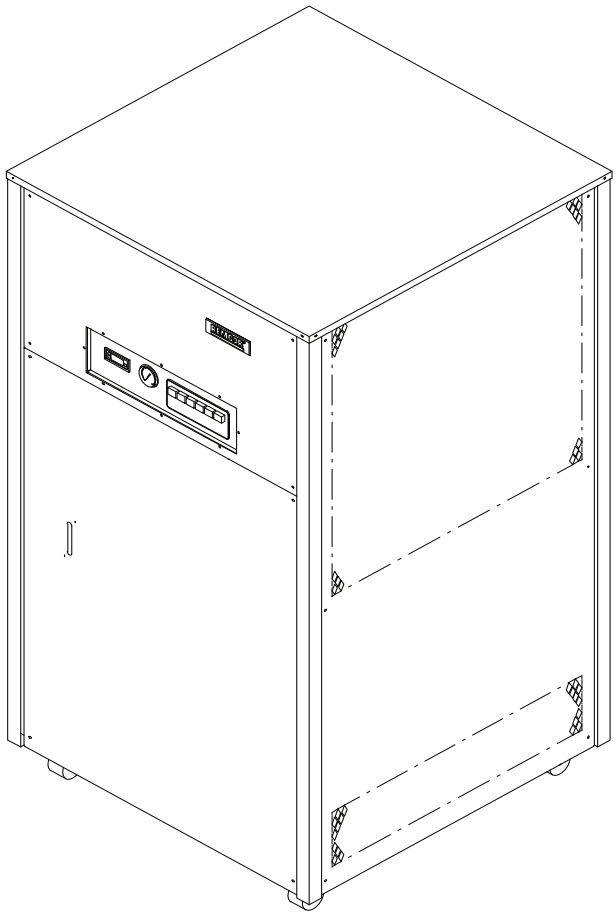
CHILLER MODEL: CH1500, 2000 AND 3000

Operator's & Installation Manual



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Revision: E

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The products, technical information, and instructions contained in this manual are subject to change without notice.

These instructions are not intended to cover all details or variations of the equipment, nor to provide for every possible contingency in the installation, operation or maintenance of this equipment. This manual assumes that the person(s) working on the equipment have been trained and are skilled in working with electrical, plumbing, pneumatic, and mechanical equipment. It is assumed that appropriate safety precautions are taken and that all local safety and construction requirements are being met, in addition to the information contained in this manual.

This Product is warranted only as provided in Cornelius' Commercial Warrant applicable to this Product and is subject to all of the restrictions and limitations contained in the Commercial Warranty.

Cornelius will not be responsible for any repair, replacement or other service required by or loss or damage resulting from any of the following occurrences, including but not limited to, (1) other than normal and proper use and normal service conditions with respect to the Product, (2) improper voltage, (3) inadequate wiring, (4) abuse, (5) accident, (6) alteration, (7) misuse, (8) neglect, (9) unauthorized repair or the failure to utilize suitably qualified and trained persons to perform service and/or repair of the Product, (10) improper cleaning, (11) failure to follow installation, operating, cleaning or maintenance instructions, (12) use of "non-authorized" parts (i.e., parts that are not 100% compatible with the Product) which use voids the entire warranty, (13) Product parts in contact with water or the product dispensed which are adversely impacted by changes in liquid scale or chemical composition.

Contact Information:

To inquire about current revisions of this and other documentation or for assistance with any Cornelius product contact:

www.cornelius-usa.com

800-238-3600

Trademarks and Copyrights:

This document contains the original instructions for the unit described.

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Printed in U.S.A.

TABLE OF CONTENTS

SAFETY INSTRUCTIONS

READ AND FOLLOW ALL SAFETY INSTRUCTIONS

Safety Overview

- Read and follow **ALL SAFETY INSTRUCTIONS** in this manual and any warning/caution labels on the unit (decals, labels or laminated cards).
- Read and understand ALL applicable OSHA (Occupational Safety and Health Administration) safety regulations before operating this unit.

Recognition

Recognize Safety Alerts

This is the safety alert symbol. When you see it in this manual or on the unit, be alert to the potential of personal injury or damage to the unit.

DIFFERENT TYPES OF ALERTS

DANGER:
Indicates an immediate hazardous situation which if not avoided **WILL** result in serious injury, death or equipment damage.

WARNING:
Indicates a potentially hazardous situation which, if not avoided, **COULD** result in serious injury, death, or equipment damage.

CAUTION:
Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury or equipment damage.

SAFETY TIPS

- Carefully read and follow all safety messages in this manual and safety signs on the unit.
- Keep safety signs in good condition and replace missing or damaged items.
- Learn how to operate the unit and how to use the controls properly.
- **Do not** let anyone operate the unit without proper training. This appliance is **not** intended for use by very young children or infirm persons without supervision. Young children should be supervised to ensure that they do not play with the appliance.
- Keep your unit in proper working condition and do not allow unauthorized modifications to the unit.

QUALIFIED SERVICE PERSONNEL

WARNING:
Only trained and certified electrical, plumbing and refrigeration technicians should service this unit. **ALL WIRING AND PLUMBING MUST CONFORM TO NATIONAL AND LOCAL CODES. FAILURE TO COMPLY COULD RESULT IN SERIOUS INJURY, DEATH OR EQUIPMENT DAMAGE.**

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Safety Precautions

This unit has been specifically designed to provide protection against personal injury. To ensure continued protection observe the following:

WARNING:
Disconnect power to the unit before servicing following all lock out/tag out procedures established by the user. Verify all of the power is off to the unit before any work is performed.

Failure to disconnect the power could result in serious injury, death or equipment damage.

CAUTION:
Always be sure to keep area around the unit clean and free of clutter. Failure to keep this area clean may result in injury or equipment damage.

Shipping And Storage

CAUTION:
Before shipping, storing, or relocating the unit, the unit must be sanitized and all sanitizing solution must be drained from the system. A freezing ambient environment will cause residual sanitizing solution or water remaining inside the unit to freeze resulting in damage to internal components.

GENERAL INFORMATION

INTRODUCTION

Cornelius CH Series, Refrigerated Recirculating Water Chillers are designed to provide a continuous flow of clean cooling water at a constant temperature and to handle a variety of closed loop and tank cooling applications.

The CH Series consists of a refrigeration system with associated operating controls housed in a sturdy sheet metal cabinet. A standard pump and reservoir package provides a complete self-contained water cooling and circulating system.

CH Series Chillers are designed to operate in a clean laboratory or industrial environment where ambient temperatures range from 50° F to 100° F. Once properly installed, CH Series Chillers run virtually maintenance free and provide a constant supply of cooling liquid to the application.

Specifications

The CH Series specifications are shown in Table 1.

Table 1.

Model	CH1500	CH2000	CH3000
Cooling capacity, Watts/BTU/hr	5861/20000	7033/24000	9964/34000
Compressor	1.5 HP	2 HP	3 HP
Condenser	Air Cooled		
Temperature Controller	Digital Display 40° -100° F		
Pump	1CS (10 GPM @ 35 PSI)	2CS (12 GPM @ 50 PSI)	
Reservoir (Capacity)	10 Gallons		
Voltage (Full Load Amps)	CH1502A 230/60/3 (10)	CH2002A 230/60/3 (14)	CH3002A 230/60/3 (18)
	CH1503A 460/60/3 (5)	CH2003A 460/60/3 (7)	CH3003A 460/60/3 (9)
Dimensions W x D x H (inches)	28 x 28 x 41		
Inlet/Outlet Fitting Size	3/4-inch		

Specification Notes

1. The figures for power and cooling capacity are listed for air-cooled units with a circulation temperature of 68° F and ambient temperature of 80° F and standard pump.
2. Cooling capacity will be affected as follows: Derate 17% for 50 Hz operation. Derate 1% for each degree Fahrenheit drop in recirculating temperature. Derate 0.5% for each degree Far en he it increase in ambient temperature.
3. The operating water temperature range for water is 50°F (10° C) to 100°F (38°F). If uses of other fluids or temperatures are required, the Technical Service Department must be contacted so the appropriate ranges can be set.
4. All CH Series Chillers are thoroughly tested before leaving the factory to ensure that each unit meets these specifications prior to shipment.

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LOCATION

Install the Chiller indoors in a well ventilated area where ambient temperatures will never fall below 50° F or rise above 110° F. To obtain optimum cooling capacity, the ambient temperature should be 80° F or below.

Standard CH Chillers have air-cooled condensers. On air-cooled units it is important that the air intake and discharge are not obstructed. Avoid hot air discharge from other equipment or enclosed areas where heat build-up could cause a significant rise in ambient temperatures. A minimum of two feet of space on all four sides of the Chiller will be sufficient to prevent obstruction.

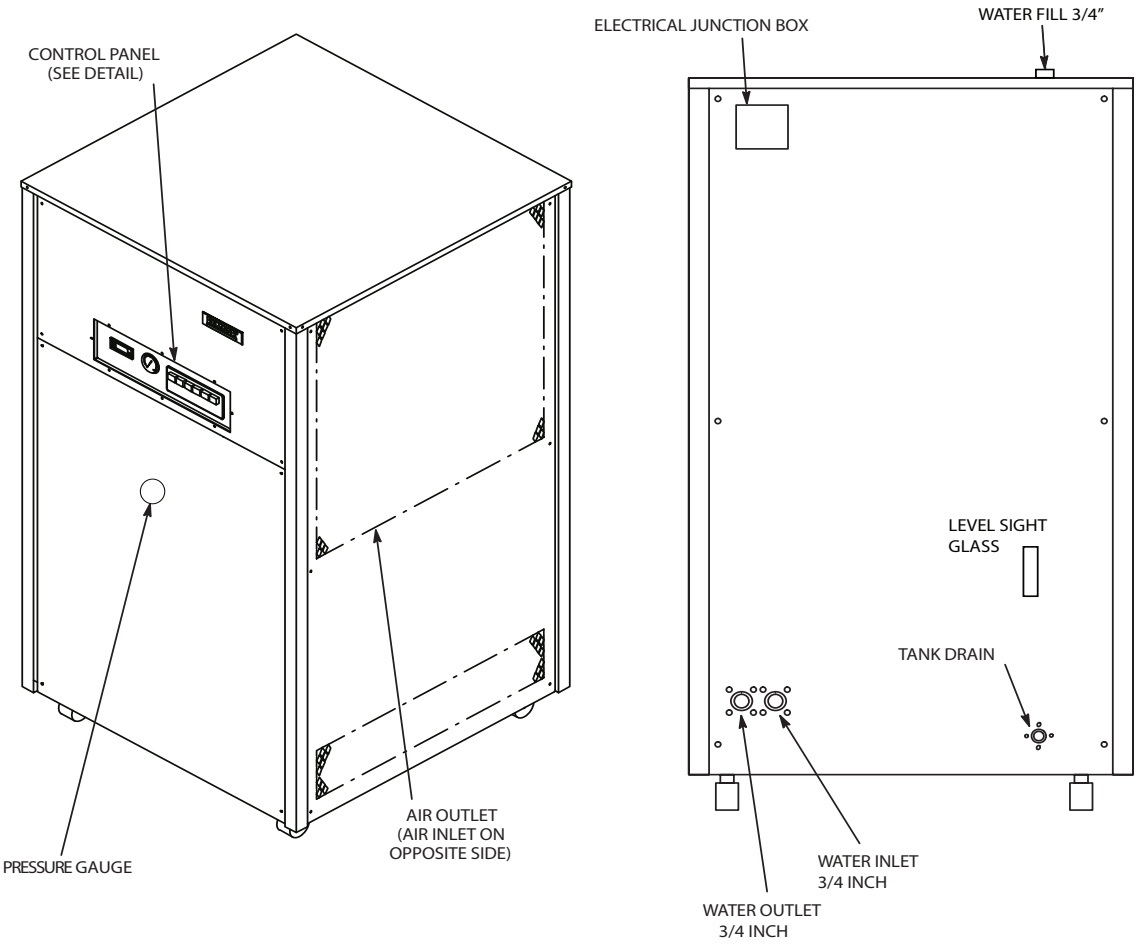

Figure 1. Installation Details

ELECTRICAL

All wiring must conform to the National Electric Code and any applicable local codes. The chiller must be PERMANENTLY wired by means of electrical conduit to a properly fused disconnect of proper amperage or wired to a properly rated power cord and plugged into an outlet with the appropriate disconnect and amperage rating. The electrical junction box located on the upper rear of the chiller, includes a four-terminal strip for power supply connections The DATA PLATE, located beside the junction box, indicates the actual phase, voltage and amperage for each chiller.

⚠ CAUTION:

On 3-phase applications, it is important that the rotation of the pump, when supplied, is correct. Running the pump in reverse for more than a few seconds will result in permanent pump damage. When the pump is running, shaft rotation must match the direction indicated on the pump housing. If the rotation is incorrect, reverse two of the three incoming power supply leads. The Phase Protection/3-Phase Monitor Option prevents the pump from operating backwards. See the option description.

PLUMBING

Follow standard plumbing practices and local codes in making water connections. The chiller inlet and outlet connections are 3/4 inch. Flexible hoses and fittings are recommended for plumbing the system. A No. 20 mesh strainer should be installed on the chiller inlet to prevent foreign particles from entering the system and should be cleaned monthly (field installation, not provided with chiller). Lines should be routed with as few bends as possible. Prevent lines from running near radiators, hot water pipes, etc. Any lengths of tubing that are exposed to high ambient temperatures should be insulated to prevent condensation and/or significant liquid heat loss.

Chiller with Reservoir

The reservoir can be filled by removing the water fill cap located on the upper rear of the Chiller (See Fluid Recommendations). After ensuring that the drain valve is closed, fill the reservoir via the full port with clean water until the water level sight glass on the front of the unit indicates "FULL" the fill cap should then be reinstalled before operation begins.

Chiller without Reservoir

The chiller and system piping should be filled with clean water or proper fluid ensuring that all air is purged from the system.

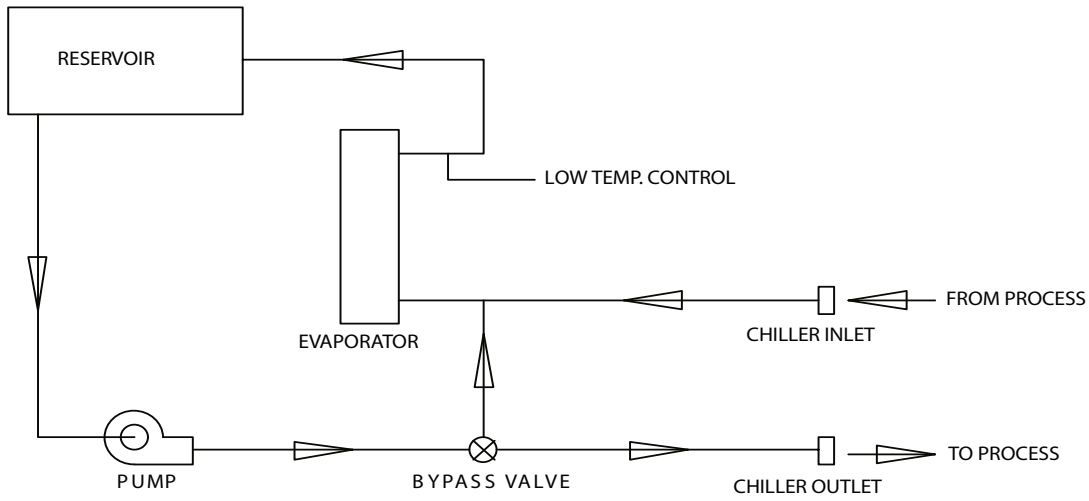

Figure 2. Chiller Plumbing Schematic with Pump and Tank (Standard)

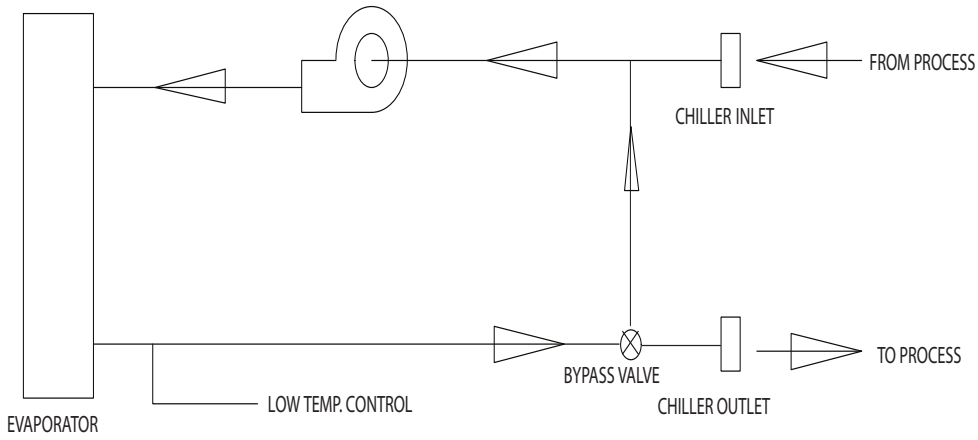

Figure 3. Chiller Plumbing Schematic, no Tank (Option)

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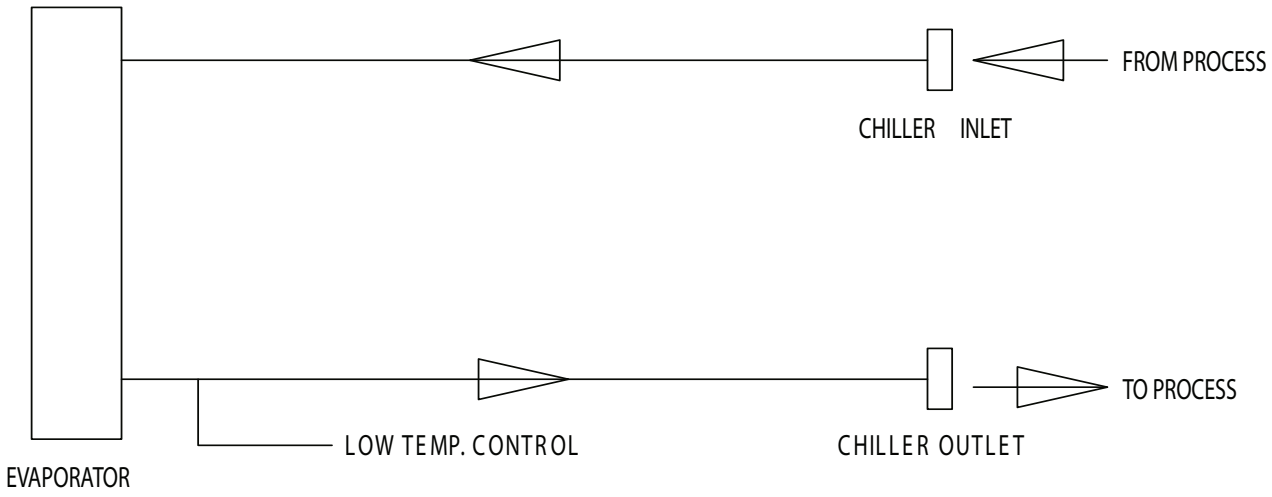

Figure 4. Chiller Plumbing Schematic, no Pump, no Tank (Option)

START UP

WATER FLOW START UP

Chiller with Pump

It is important to check the pump rotation on the three phase units. Remove the lower side panel to expose the pump. Turn the pump power switch to the "ON" position for a few seconds. Observe the motor shaft to ensure that it is turning in the direction indicated by the arrow located on the pump housing. If the rotation is incorrect, reverse two of the three incoming power supply leads at the terminal strip. After changing the leads, check the pump rotation again.

NOTE: Running the pump in reverse for more than a few seconds will result in permanent pump damage.

After ensuring that the system piping is free from obstruction and that all valves are open, turn the pump power switch to the "ON" position (press in). The pump power indicator should illuminate, indicating that the pump is operating.

All chillers with pumps are provided with a pressure regulating valve on the pump discharge. This valve is preset at the factory to ensure that system pressure does not exceed the capabilities of the pump motor and/or piping.

If this valve requires adjustment, please contact the factory for proper setting procedure and pressures. A flow meter and throttling valve can be added in the chiller inlet line in order to monitor and/or adjust the flow rate through the chiller.

Once the flow has been established, the thermostat can be adjusted to the desired set-point.

Chiller without Pump

A flow meter and throttling valve can be added in the chiller inlet line in order to monitor and/or adjust the flow rate through the chiller.

Once the flow has been established, the thermostat can be adjusted to the desired set-point. See thermostat adjustment.

THERMOSTAT

(Temperature Controller)

Standard Thermostat Eliwell IC902

The following procedure should be followed to adjust the Eliwell IC902 thermostat temperature setting:

1. To set the "SET POINT", press and release the "SET" button, "set" will display.
2. Press the "set" button again, the current "SET POINT" will display. Press the "UP" or "DOWN" button to change the "SET POINT" to the desired temperature.
3. Press the "fnc" button twice to exit the program; the current liquid temperature will be displayed.

The thermostat has a range that has been preset at the factory. The range is 40º F (5º C) to 100º F (38º C). If operation outside of this range is required, please contact the Technical Service Department.

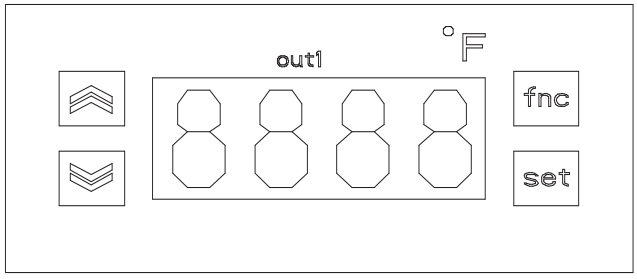

Figure 5. Eliwell IC902 Standard Thermostat

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THERMOSTAT (DUAL SET POINT)

Dual Point Adjustment

1. To set the "SET POINT" for Level 1, press and release the "SET" button, Re1 should be displayed.
2. Press the "SET" button again, the current SET POINT TEMPERATURE should be displayed. Press the UP or DOWN button to change the SET POINT.
3. To set the "SET POINT" for Level 2, press and release the "SET" button. Re2 should be displayed.
4. Press the "SET" button, the current SET POINT TEMPERATURE should be displayed. Press the UP or DOWN button to change the SET POINT.
5. Press the fnc button to exit the program.

The thermostat has a range that has been preset at the factory. The range is 40° F (5° C) to 100° F (38° C). If operation outside of this range is required, please contact the Technical Service Department.

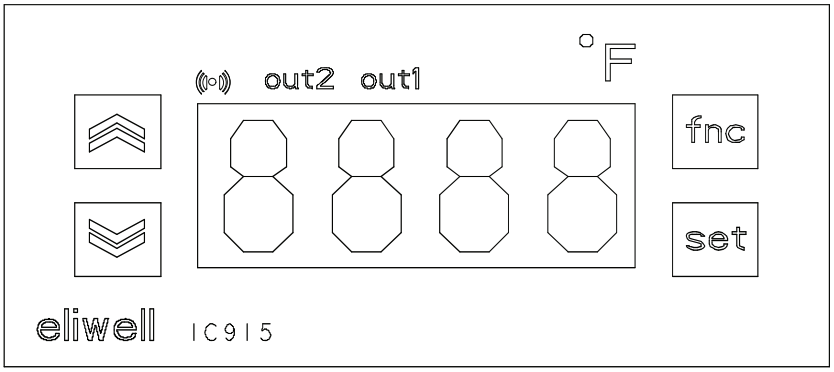

Figure 6. Eliwel IC 915 Dual Point Thermostat

COOLING START UP

Once flow is established and the thermostat is set to the desired set-point, turn the control power switch to "ON" (press in). All alarm indicators should be extinguished and the Chiller refrigeration system will cycle in order to maintain the established set-point.

The refrigeration system is furnished with a Hot Gas Bypass system that maintains the set-point within 1° F temperature tolerance by cycling the Hot Gas Bypass Solenoid (Compressor, Fan Motor and Circulating pump run continuously).

Re-check the reservoir level to ensure that it is "FULL" (if so equipped) and add water or proper fluid if necessary.

The chiller is now ready for normal operation.

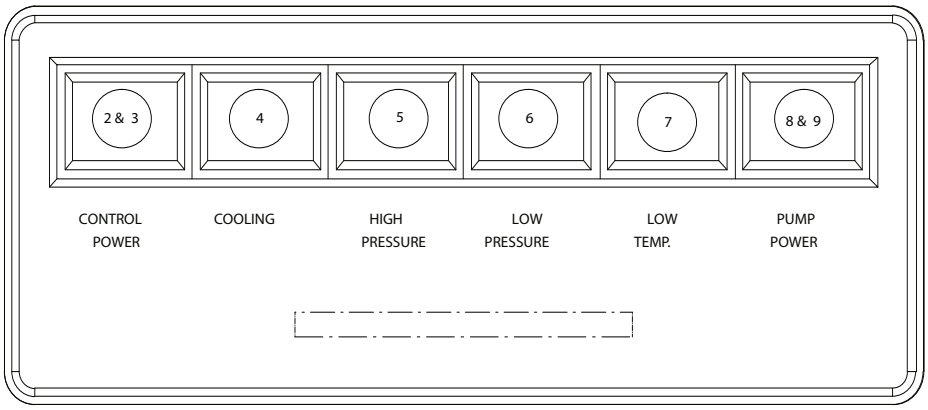

Figure 7.

CONTROL PANEL

1. **TEMPERATURE INDICATOR/CONTROLLER (Thermostat)** - Combines a precise temperature control and accurate set ability with a convenient LED temperature readout that indicates system liquid temperature.
2. **CONTROL POWER SWITCH -** A simple (Push Button) switch with light indicator that switches power to the control circuit (White). This switch must be "pressed in" for the Chiller to operate.
3. **COOLING LIGHT -** A green light that indicates refrigeration system operation. This light cycles on and off in response to the thermostat.
4. **HIGH PRESSURE ALARM LIGHT -** A red light that indicates high refrigeration pressure.
5. **LOW PRESSURE ALARM LIGHT -** A red light that indicates low refrigeration pressure.
6. **LOW TEMPERATURE ALARM LIGHT -** A red light that indicates and abnormally low system fluid temperature.
7. **PUMP POWER SWITCH (OPTIONAL) -** A simple (Push Button) switch with a light indicator that switches power to the chiller pump (White). This switch must be "pressed in" for the chiller to operate.

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MAINTENANCE

WARNING:
Disconnect power to the unit before servicing. Follow all lock out/tag out procedures established by the user. Verify all power is off to the unit before performing any work.

Failure to comply could result in serious injury, death or damage to the equipment.

The chiller requires very little normal maintenance.

1 On air-cooled chillers, the condenser fins should be cleaned by blowing compressed air through the condenser from the fan side as required to eliminate any dirt or debris that may accumulate over time. This can severely reduce the performance of the chiller. Cleanable air filters are available as an option. Contact the Technical Service Department for information.
2 On AIR-COOLED Chillers the condenser fan motor should be lubricated every 6–month with a few drops of SAE10 oil.
3 The circulation system should be drained and flushed periodically to avoid build-up and possible restriction of flow by contaminates.
4 The strainer at the Chiller inlet should be removed and cleaned monthly (field installed).

FLUID RECOMMENDATIONS

Chillers are designed to operate with water to provide maximum performance for temperatures of 50° F – 100° F.

Table 2.

Distilled Water	Acceptable
De-Ionized Water (1-5 MEG/OHMS)	Acceptable
De-Ionized Water (5+ MEG/OHMS)	Acceptable with Stainless Steel & PVC only *No Copper or Brass
Propylene Glycol (Lab & Industrial Grade)	Acceptable - 30% Glycol/70% Water *For Applications with temperatures below 40° F
Lab & Industrial Grade Ethylene Glycol	Acceptable - 30% Glycol/70% Water *For Applications with temperatures below 40° F
Mineral/Hydraulic Oils (Viscosity < 50 Centistrokes)	Acceptable
Ethylene Glycol **(Commercial/Automotive Anti-freeze)**	**NOT Acceptable** ***Silicate Rust Inhibitors in automotive/commercial anti-freeze damages pump seals and housing which lead to failure.**
Acidic/Basic Solutions (Above & below 6 PH)	Not Acceptable
Mineral/Hydraulic Oils (Viscosity > 50 Centistrokes)	Not Acceptable

For questions regarding special or other fluids contact Cornelius at 800-238-3600

To purchase lab or industrial glycol contact: Cornelius (800) 551-4423 - Part # 111521000, 5 Gal.

SAFETY CONTROLS

Each chiller is provided with three standard safety controls. There controls are arranged in series in the control circuit to automatically shut down the unit in the event that a condition exists which could be harmful to the refrigeration system components.

High Pressure Control (HPC)

This control prevents system operation in the event that the high side pressure exceeds 250 PSIG. If this occurs, check the following:

1 That the condenser and condenser air filter are clean and that the air inlets and outlets are unobstructed.

2 That the ambient temperature at the chiller location is below 110^{o} F.

3 That the fan blade is rotating.
Press the reset button located on the front of the High Pressure Control to restart the chiller. This control is mounted in the lower left hand corner of the electrical box. If the control opens again, check the control setting with refrigeration gauges. If the setting is correct, contact the Technical Service Department.

Low Temperature Control (LTC)

This control prevents system operation in the event that the fluid inside the evaporator falls below 35^{o} F. If this occurs, check the following:

1 That the thermostat set point is set at 40^{o} F or greater.

2 That the flow through the system is greater than two gallons per minute.
This control is mounted in the lower left hand corner of the electrical box. It automatically resets itself once the water temperature is restored to 38°F. The low temperature control may be adjusted for lower temperatures if a glycol solution is used. Contact the Technical Service Department for temperatures below those stated here. Also see Fluid Recommendations on page .

Low Pressure Control (LPC)

This control prevents system operation in the event that the low side pressure falls below 21 PSI. If this occurs, check the following:

1 That the thermostat set point is set at 40^{o} F or greater.

2 That the flow through the system is greater than two gallons per minute.

3 That no bubbles are present in the sight glass.

4 That the water bypass valve allows flow through the chiller in a "dead head" situation.
This control is located to the right of the high pressure control in the electrical box. It automatically resets itself once the low side pressure rises to approximately 41 PSI. If the control opens again, check the control setting with refrigeration gauges. If setting is correct, contact the Technical Service Department.

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TROUBLESHOOTING

IMPORTANT: Only qualified personnel should service internal components or electrical wiring.

WARNING:
Disconnect power to the unit before servicing. Follow all lock out/tag out procedures established by the user. Verify all power is off to the unit before performing any work.

Failure to comply could result in serious injury, death or damage to the equipment.

Trouble	Probable Cause	Remedy
Chiller does not operate, Control Power Light OFF.	A. Control Power Switch "OFF".	A. Turn the Control Power Switch to the "ON" position.
	B. No power.	B. Check the fuse or circuit breaker.
	C. Defective power supply connection.	C. Check wiring and correct loose or poor connections.
	D. Defective Control Power Switch	D. Replace the switch.
	E. Defective Control Transformer	E. Replace the transformer.
Pump does not operate. Pump power light "OFF".	A. Pump power switch "OFF".	A. Turn the pump power switch to the "ON" position.
	B. Defective pump power switch.	B. Replace the switch.
	C. Defective control transformer.	C. Replace the transformer.
Pump does not operate. Pump power light "ON".	A. No water in reservoir.	A. Fill reservoir.
	B. Restriction in the line to or from the chiller.	B. Remove restriction.
	C. Open or defective pump overload relay.	C. Manually reset the relay or replace if necessary and check amp setting on overload.
	D. Defective pump contactor.	D. Replace the pump contactor.
	E. Defective pump motor or damaged impeller.	E. Replace the pump or impeller.
Chiller does not cool. Cooling light "OFF"	A. Defective thermostat	A. Replace thermostat
Chiller does not operate. Cooling light "ON". (low pressure alarm light cycles on/off)	A. Process water too cold	A. Increase the thermostat setting.
	B. Low process water flow.	B. Ensure that there is adequate flow through the process piping.
	C. Defective expansion valve.	C. Replace the expansion valve.
	D. Refrigerant loss.	D. Check the sight glass. If bubbles are seen flowing through it, the chiller needs to be leak tested and recharged with refrigerant.
	E. Water bypass valve failed.	E. Consult technical service department.
	F. Defective pump.	F. Replace pump.

High pressure alarm light "ON". (Low pressure alarm light cycles ON/OFF).	A. Restricted condenser airflow.	A. Clean the fins of the condenser and ensure that the air flow is not restricted.
	B. Defective condenser fan and/or motor.	B. Check to ensure that the fan blade is not blocked. Replace the fan motor, if necessary.
	C. Defective expansion valve.	C. Replace the expansion valve.
	D. Low or no condenser water flow.	D. Ensure that there is adequate flow through piping to condenser.
High pressure alarm light is "ON".	A. Restricted condenser airflow.	A. Clean the fins of the condenser and ensure that the air flow is not restricted.
	B. Defective condenser fan and/or motor.	B. Check to ensure that the fan blade is not blocked. Replace the fan motor, if necessary.
	C. Defective expansion valve.	C. Replace the expansion valve.
	D. Low or no condenser water flow.	D. Ensure that there is adequate flow through piping to condenser.
Low temperature alarm.	A. Low or no process liquid flow.	A. Ensure that there is adequate flow through the process piping.
	B. Defective thermostat.	B. Replace the thermostat.
	C. Process water too cold, below 35° F	C. Increase the thermostat setting.

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SERVICE

When servicing this Chiller, it is important to note the information contained on the data plate located in the upper rear of the unit.

If technical assistance is needed, the phone technician will need the Model and Serial Number of your chiller. That information is found on the data plate.

The Model and Serial Number are also needed when ordering replacement parts.

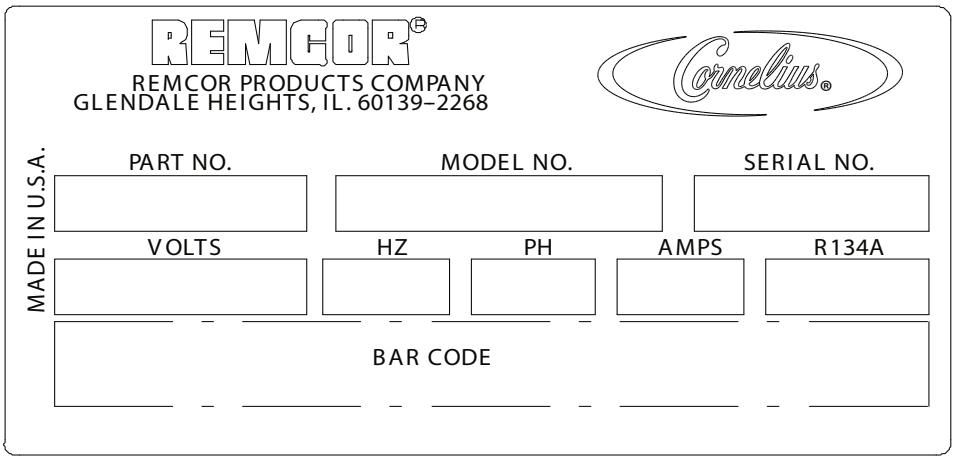

Figure 7. Unit Data Label

REFRIGERATION DIAGRAM

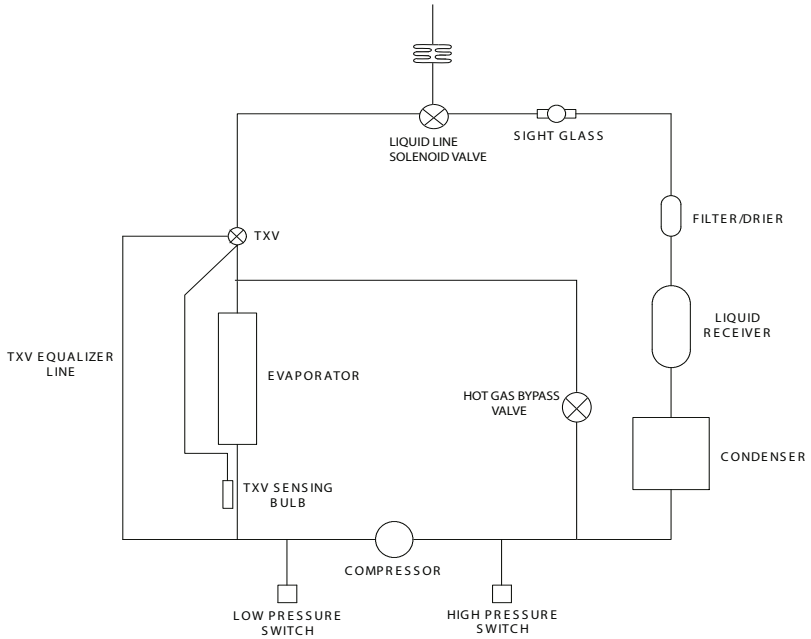

Figure 8. Refrigeration Piping Schematic with Hot Gas Bypass

CHILLER ASSEMBLY

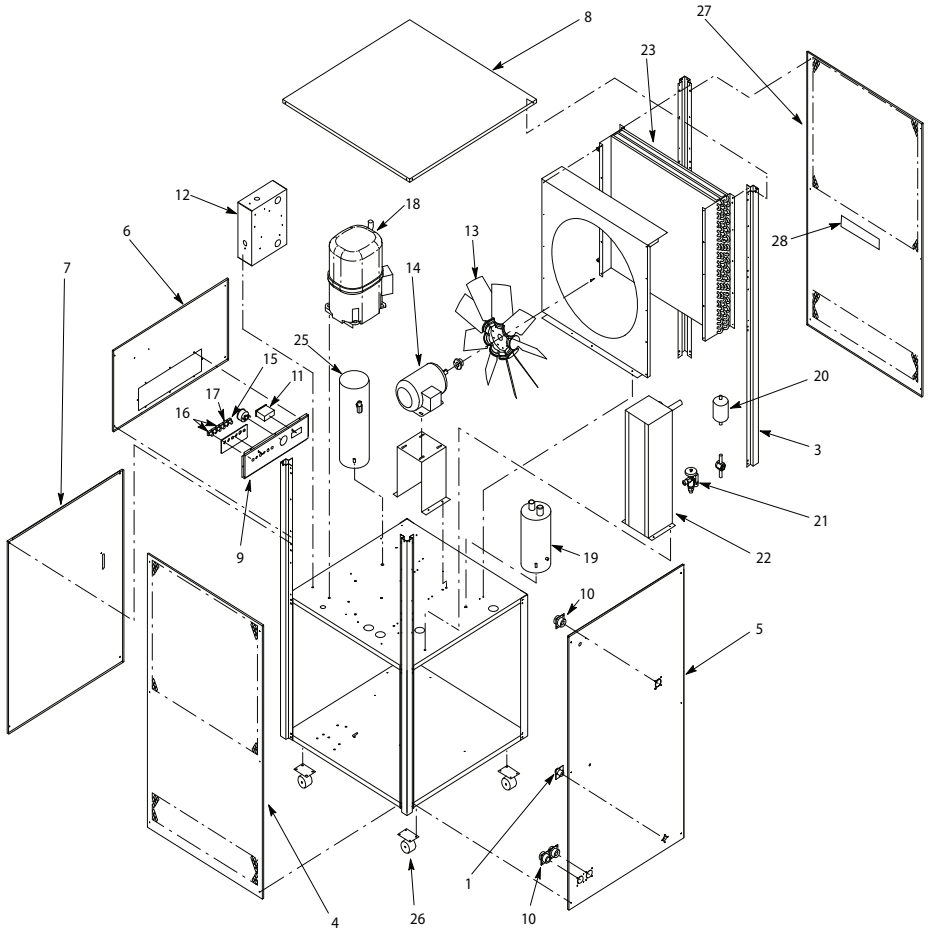

Figure 10. Chiller Exploded View

Item No.	Part No.	Name
1	22949	1/2" FPT Coupling
2	27866	Thermowell, Low Temp. Thermostat (Not Shown)
3	28320	Dual Gray Cover
4	620049516	Side Panel Left
5	28321R	Rear Panel
6	620049514	Upper Front Panel
7	28282R	Lower Front Panel
8	6200498515	Lid
9	27585R	Control Panel
10	22870	FPT Coupling
11	32386	Digital Thermostat
	33319	Control Temp Dual Set Point
12	32989	Electric Box Assembly
13	31299	Fan

Item No.	Part No.	Name
14	31298	Motor Fan 230Volt
	31698	Motor Fan 460Volt CH3000
15	620311601	Switch Push Button
16	620311605	Red Indicator
17	620311606	Green Indicator
18	620049520	Comp Danfoss MTZ 028 1.5HP CH1500
	620049393	Comp- Danfoss MTZ 032 2HP CH2000
	620050959	Comp 3HP 230 Volts CH3000
	620054174	COMP- 3HP 460Volts CH3000
19	325577010	Accumulator
20	60686	Filter/Drier
21	620049394	Valve TXV For Chillers CH1500
	620050960	Valve TXV (TUBE #8) Danfoss CH3000

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Item No.	Part No.	Name
22	61083	Evapr Asy CH1500
	60985	Evap Asy Foamed CH2000
	61085	Evap Asy CH3000
23	61089	Condenser
	60983	Cond CH2000
	61090	Cond CH3000 Air Cool
25	60685	Receiver
26	70893	Caster
27	620049517	Panel Right Side
28	70923	Handle Removable Panel
NS	61083Q9171	Cond-Asy Foamed CH1500
	60985	Evap Asy Foamed CH2000
	61085	Evap Asy Foamed CH3000
NS	40122	Valve Water Reg
	40199	Valve Water Regulating CH3000

*** Call the Technical Service Department for proper panel.**

PUMP & TANK ASSEMBLY

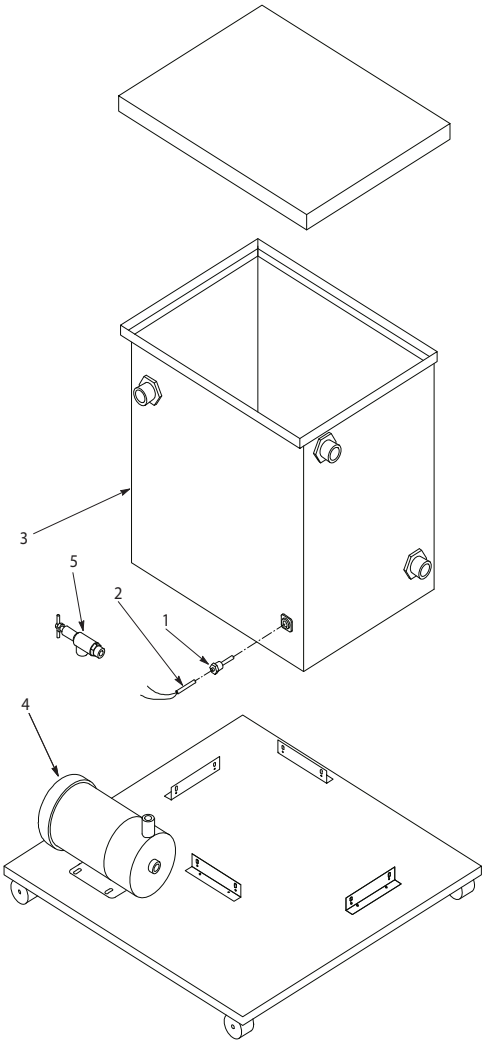

Figure 11. Pump & Tank Exploded View

Table 4. Pump & Tank Components

Item No.	Part No.	Name
1	15404R	Thermowell, Temperature Control
2	32589	Temperature Probe
3	51096	Tank Assembly
4	620408104	Pump
	620710601	Pump CH2000, CH3000
5	40646	Valve By-Pass
*** Call the Service Dept. for proper pump identification.**		

ELECTRICAL BOX ASSEMBLY

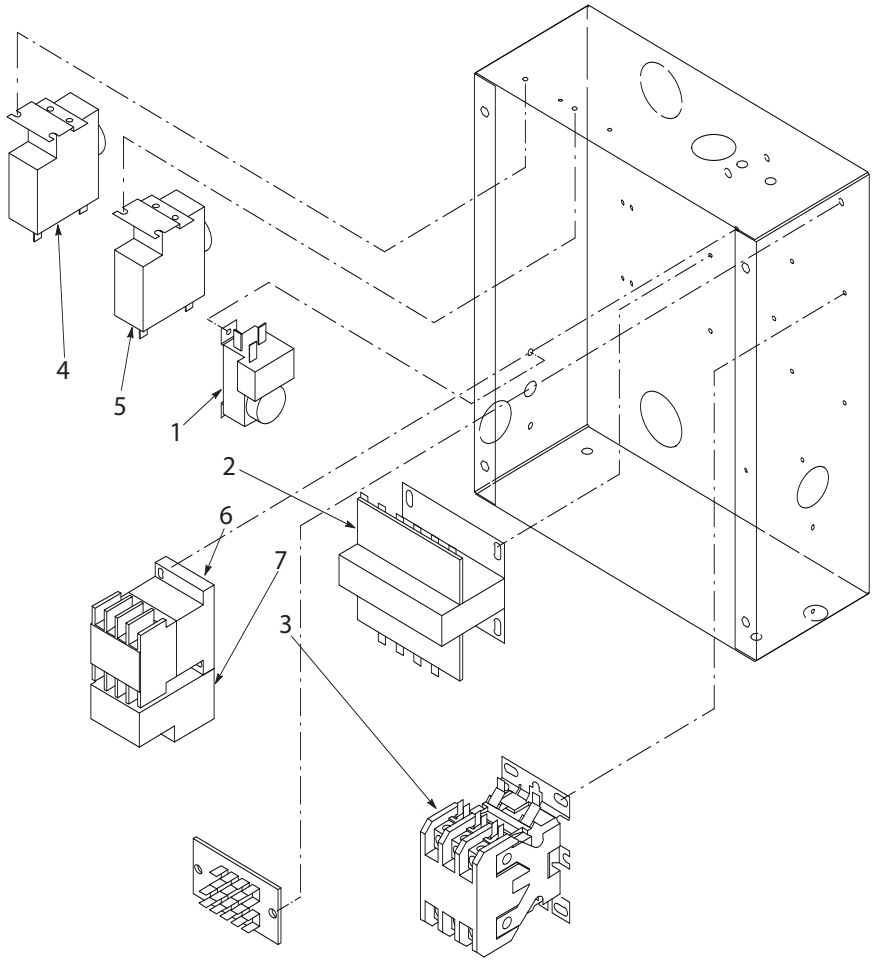

Figure 12. Electrical Box Assemby, Exploded View

Table 6. Electrical Box Assembly

Item No.	Part No.	Name
1	31001	Low Temperature Thermostat
2	32804	Control Transformer
3	32992	Contactor, Compressor
4	60501	High Pressure Control
5	60502	Low Pressure Control
6	620314008	Contactor, Pump
7	620314002	Overload Relay, 1.0 to 1.4A
	620314003	Overload Relay, 1.3 to 1.8A
	620314005	Overload Relay, 2.2 to 3.1A
	620314006	Overload Relay, 2.8 to 4.0A
	620314007	Overload Relay, 4.5 to 6.5A

WIRING DIAGRAM

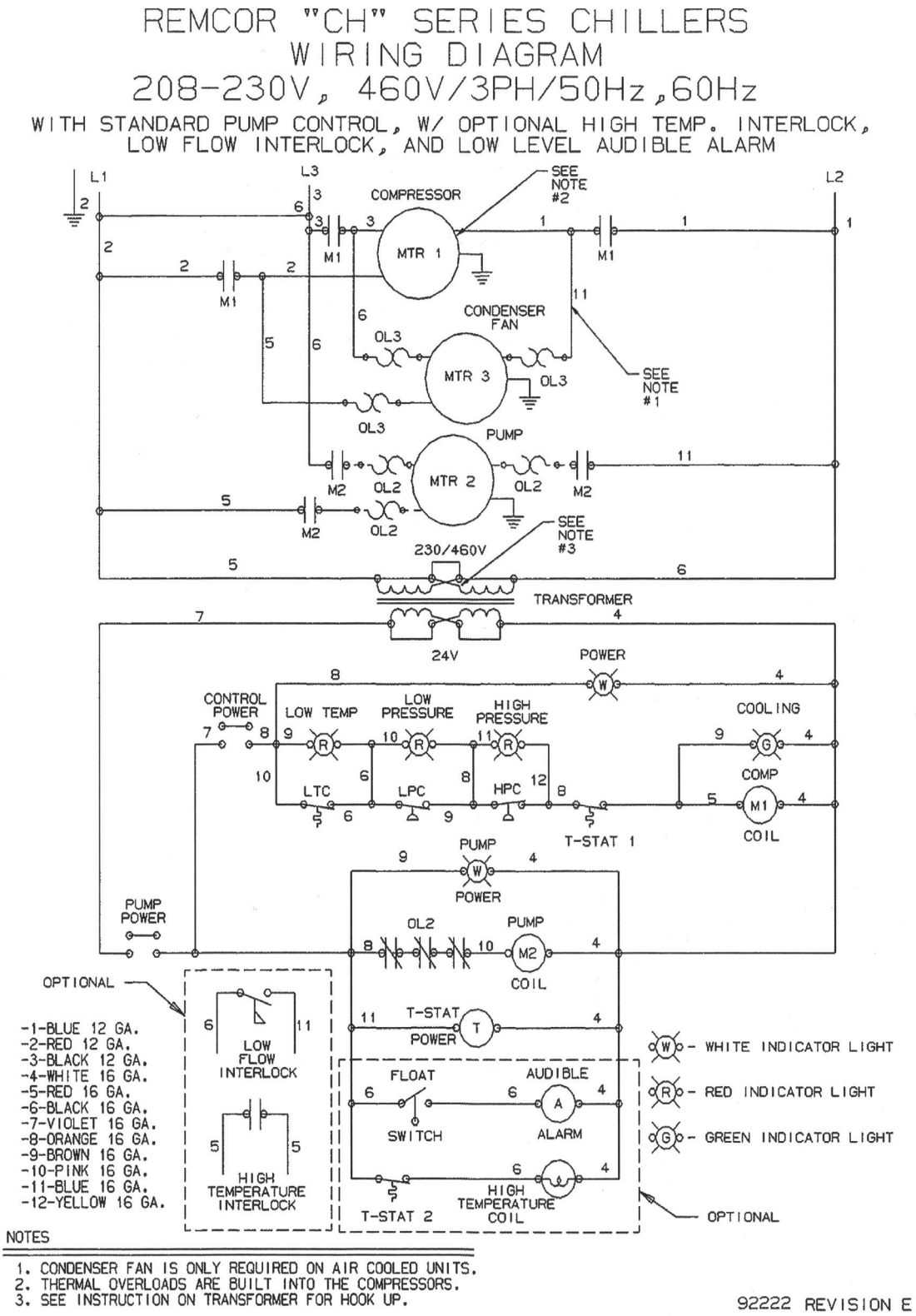

Figure 10.

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