User Guide

Portable Chillers

VL Series Air-Cooled and Water-Cooled with Capacities from 2 to 40 tons

Installation

Maintenance

Operation

Troubleshooting

CONAIR™

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UGH021/0301

⚠ **WARNING - Reliance on this Manual Could Result in Severe Bodily Injury or Death!**

This manual is out-of-date and is provided only for its technical information, data and capacities. Portions of this manual detailing procedures or precautions in the operation, inspection, maintenance and repair of the product forming the subject matter of this manual may be inadequate, inaccurate, and/or incomplete and cannot be used, followed, or relied upon. Contact Conair at info@conairgroup.com or 1-800-654-6661 for more current information, warnings, and materials about more recent product manuals containing warnings, information, precautions, and procedures that may be more adequate than those contained in this out-of-date manual.

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

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: UGH021/0301
Serial number(s):
Model number(s):

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TABLE OF CONTENTS

1.0 GENERAL

1.1 INTRODUCTION

A. This manual covers most 'VL' series portable chiller models. Most 'VL' series portable chillers are basically identical with exception of the type of condenser (air cooled or water cooled).

B. All instructions in this manual apply to most 'VL' series portable chiller models regardless of the type of condenser or instrumentation. Specific instructions relating only to air cooled condensers, water cooled condenser, or instrumentation are identified and should be noted by the operator.

C. When calling for assistance from the **Conair** Service Department, it is important to know the model and serial number of the particular unit. The model number encodes critical unit information which is helpful in any attempt to troubleshoot operating difficulties. The serial number allows the service team to locate manufacturing and testing records which can have additional information relating to a particular unit.

1.2 UNIT LOCATION FOR AIR COOLED MODELS

A. The **'VL'** air cooled portable chiller is designed for indoor use only. For most efficient operation, locate the chiller in a clean, dry and well ventilated environment.

B. The **'VL'** air cooled portable chiller has an air cooled refrigerant condenser. For air cooled condensers, a motor driven fan (on models from 2 to 10 tons) or a centrifugal blower (on models from 15 to 30 tons) generates air flow through the condenser to remove heat from the refrigerant system. The air cooled condenser on the **'VL'** portable chiller will discharge a maximum of 15,000 BTU's per hour per ton of cooling.

C. The **'VL'** air cooled portable chiller must have a minimum entering air temperature of 60°F and a maximum entering air temperature of 95°F for efficient operation.

D. The **'VL'** air cooled portable chiller must have a minimum of two feet clearance at the air intake and six feet at the vertical exhaust air discharge.

1.3 UNIT LOCATION FOR WATER COOLED MODELS

A. The **'VL'** water cooled portable chiller is designed for indoor use only. For most efficient operation, locate the chiller in a clean, dry and well ventilated environment.

1.4 EFFICIENCY

A. Long term efficiency of operation is largely determined by proper maintenance of the mechanical parts of the unit and the water

quality. **Conair** recommends filtering where required to prevent solids from plugging critical parts (pumps, heaters, seals for example). **Conair** highly recommends the services of a competent water treatment specialist be obtained and his recommendations followed. **Conair** accepts no responsibility for inefficient operation, or damage caused by foreign materials or failure to use adequate water treatment.

1.5 SAFETY

A. It is important to become thoroughly familiar with this manual and the operating characteristics of the **Conair 'VL'** series portable chiller.

B. It is the owner's responsibility to assure proper operator training, installation, operation, and maintenance of the **Conair 'VL'** series portable chiller.

C. Observe all warning and safety placards applied to the chiller. Failure to observe all warnings can result in serious injury or death to the operator and severe mechanical damage to the unit.

1.6 CLEAN AIR ACT

A. The **'VL'** series portable chiller contains HVLC-22 (chlorodifloromethane). This is a class 2 substance.

B. Effective July 1, 1992, it is unlawful for any person in the course of maintaining, servicing, repairing, or disposing of refrigeration equipment to knowingly vent or otherwise dispose of any class 2 substance used as a refrigerant in the manner which permits such substance to enter the atmosphere.

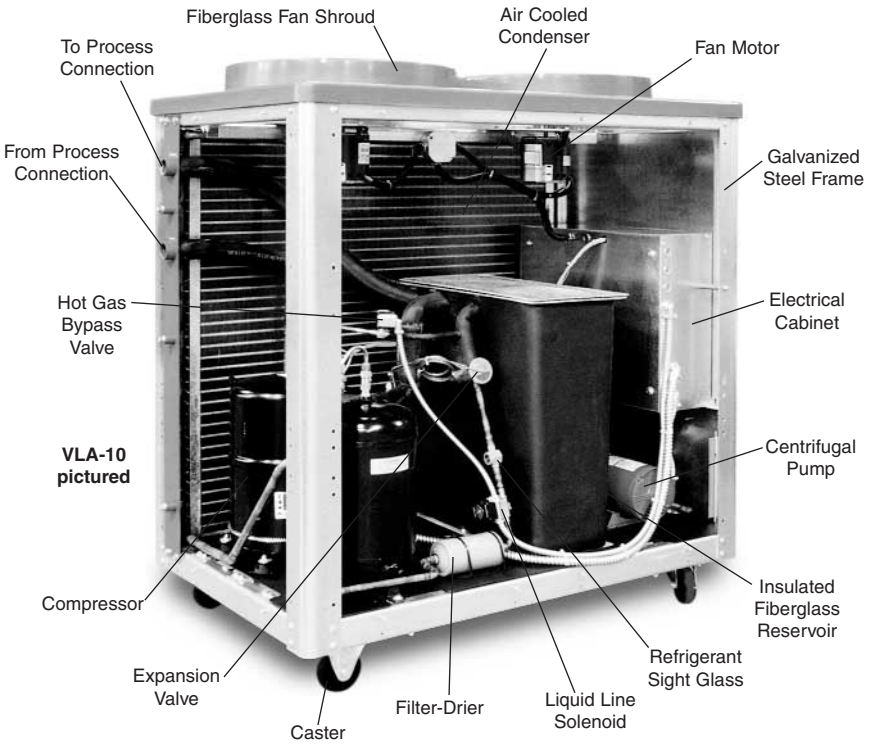
C. De minimis releases associated with good faith attempts to recapture, reclaim or recycle such substance shall not be subject to the prohibition set forth in the preceding paragraph.

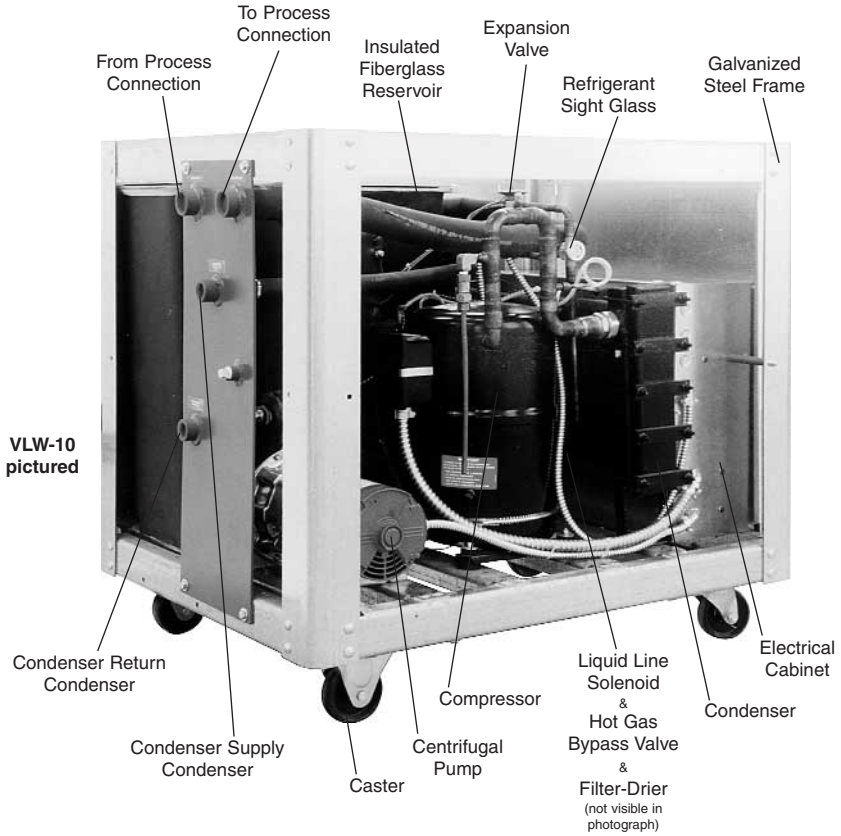
1.7 MISCELLANEOUS

A. The **'VL'** series portable chiller is designed to circulate temperature stabilized fluid through the process resulting in process temperature control.

B. The ability of the **'VL'** series portable chiller to maintain process temperature control is significantly affected by the method of installation as outline in section 2 of this manual.

C. If the operator has any questions concerning the location and operation of the **'VL'** series portable chiller, contact the **Conair** Service Department at 800-458-1960 or 814-437-6861.


Fiberglass Fan Shroud
Air Cooled Condenser
To Process Connection
Fan Motor
From Process Connection
Galvanized Steel Frame
Hot Gas Bypass Valve
Electrical Cabinet
VLA-10 pictured
Centrifugal Pump
Compressor
Insulated Fiberglass Reservoir
Refrigerant Sight Glass
Expansion Valve
Filter-Drier
Liquid Line Solenoid
Caster


To Process Connection
From Process Connection
Insulated Fiberglass Reservoir
Expansion Valve
Refrigerant Sight Glass
Galvanized Steel Frame
VLW-10 pictured
Condenser Return Condenser
Electrical Cabinet
Liquid Line Solenoid & Hot Gas Bypass Valve & Filter-Drier (not visible in photograph)
Compressor
Condenser
Condenser Supply Condenser
Centrifugal Pump
Caster

2.0 INSTALLATION

2.1 GENERAL

A. All process piping materials (such as hose, rigid piping, valves or filters) used in process water piping circuitry must be rated for 100°F minimum temperature and 100 PSI minimum pressure.

B. All such materials must have the equivalent or larger diameter of the particular process connection that length of process water piping is connected to.

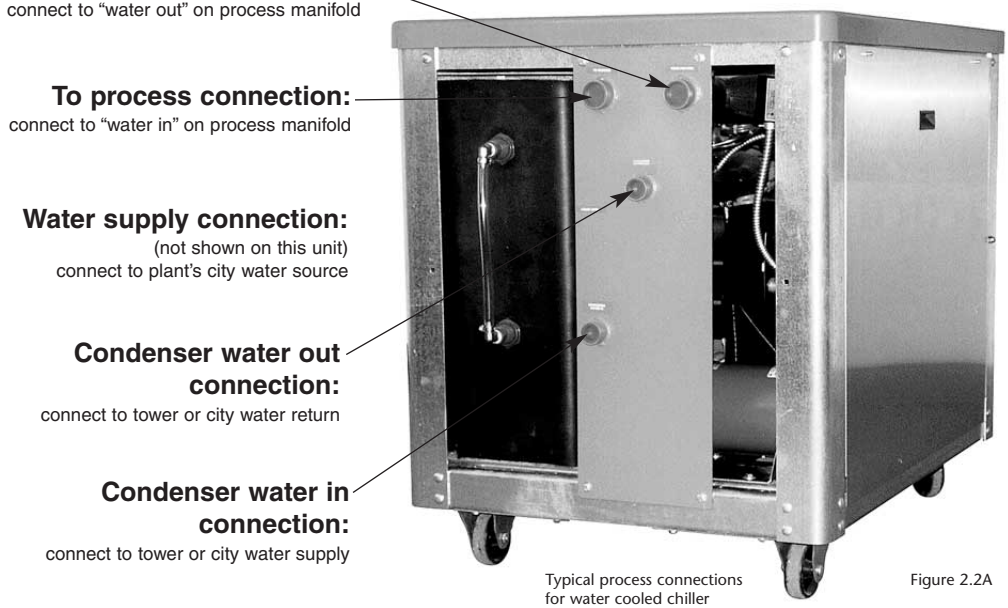
2.2 TO AND FROM PROCESS CONNECTIONS (see figures 2.2A & 2.2B)

A. Connect the **'TO PROCESS'** to the 'water in' manifold on the mold or process.

B. Connect the **'FROM PROCESS'** port to the 'water out' port on the process manifold.

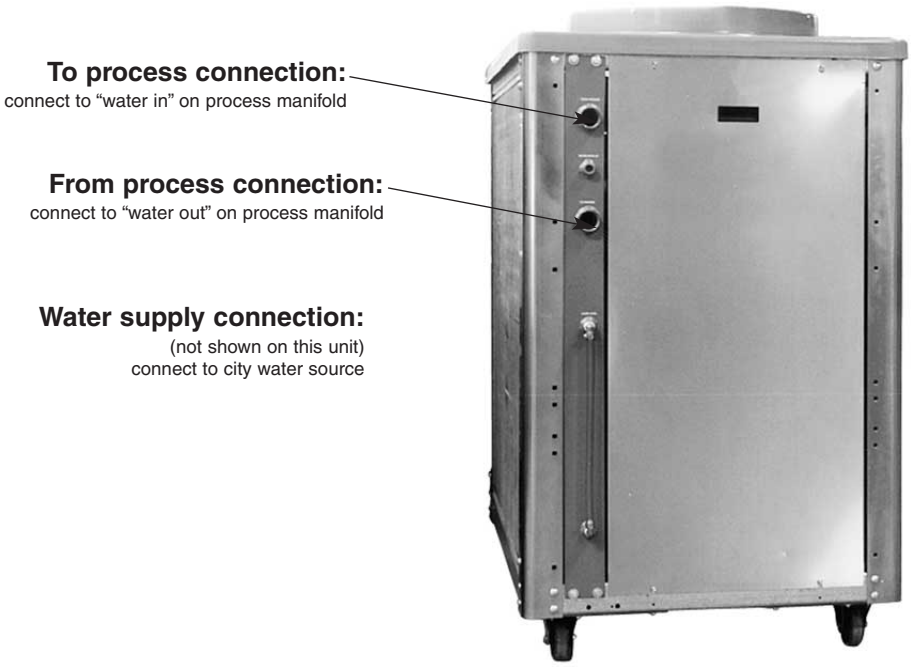
C. Process water piping circuitry should be designed to avoid an excessive use of elbows and/or lengths of pipe or hose. If hose is the material of choice, avoid tight twists or curls and excessive lengths.

D. Valves and filters may be installed in the process water piping circuitry to facilitate service and maintenance provided that such devices maintain the full inside diameter of the process connection. If installed, all such devices must be open and clean during unit operation.



Typical process connections for water cooled chiller

Figure 2.2A



Typical process connections for air cooled chiller — Figure 2.2B

2.3 WATER SUPPLY CONNECTION

A. The automatic water supply make-up system continually monitors the reservoir tank and fills it when needed. Connect as follows:

1. Connect the chiller’s **‘WATER SUPPLY’** port to the plant’s city water source.

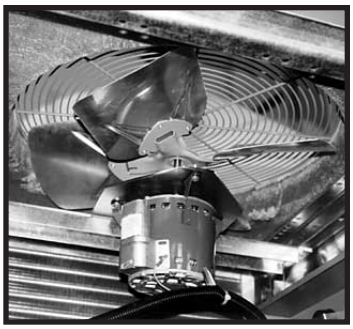
2. Minimum water supply pressure requirement is identified on the equipment data plate. This is normally 20 psi.

3. Be certain to use a water supply line equipped with a back flow prevention device to prevent contamination of potable water.

2.4 AIR COOLED CONDENSER

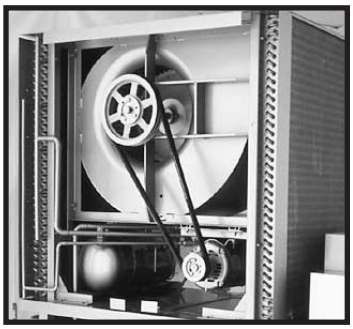
A. Air cooled condensers require ambient air temperatures between 60°F and 95°F for efficient operation. Operating above above 95°F may result in elevated condensing pressures and eventual shut-down on the high pressure safety switch. In such cases, a water assist unit may be necessary for operations. Air temperatures below 60°F may result in below normal condensing pressures and poor condensing. In such cases, a low-ambient damper assembly is required. Check with the **Conair** service department for more information on operating with ambients air temperatures above 95°F or below 60°F.

B. Air flow is generated by the motor driven fans (figure 2.4A) or centrifugal blowers (figure 2.4B). Air flow is from the outside of the chiller, through the condenser and exhausted through the top of the unit. On centrifugal blowers models, exhaust air can be ducted outside of the plant's interior environment. Special duct work is required and a HVAC contractor should be consulted for sizing and material specifications. Exhaust air can not be ducted on motor driven fan models.



Typical fan assembly Figure 2.4A

C. A free air space of at least two (2) feet is required at the condenser intake and six (6) feet at the condenser discharge to allow for proper air flow.



Typical blower assembly Figure 2.4B

D. At full load, the chiller will discharge approximately 15,000 BTU's per hour per ton of cooling.

E. On blower units, air discharge duct work should be sized by a qualified HVAC engineer. Sizing shall be according to rated VLM at the static pressure of .90 inches of water. See figure 2.4C at right.

CFM RATINGS

MODEL	CFM
VLA-15	15,000
VLA-20	20,000
VLA-25	25,000
VLA-30	30,000

Figure 2.4C

F. On blower units, a damper control assembly is required in low ambient temperature areas or when outdoor air make-up is used. The assembly works in conjunction with refrigerant head pressure to regulate air flow to maintain proper refrigerant head pressure when condenser intake air temperature will be less than 60°F. See figure 2.4D to the right.

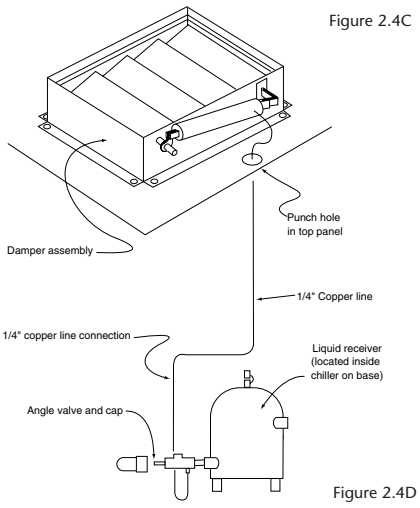


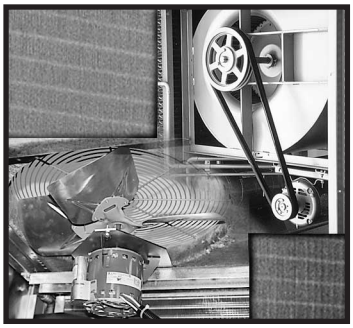
Figure 2.4D

2.5 WATER COOLED CONDENSER CONNECTION

A. Connect the '**CONDENSER WATER IN**' port to the plant's city water supply or tower system supply.

1. Required consumption from a city water source is 1.5 gpm at 65°F per ton of rated capacity.

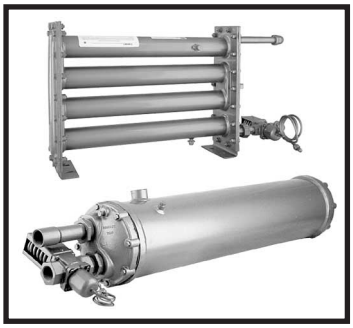
2. Required consumption for a tower water source is 3 gpm at 85°F per ton of rated capacity.



Condenser connections - 30 ton unit - optional regulator valve shown — Figure 2.5A

B. Connect the chiller's '**CONDENSER WATER OUT**' port to the plant's drain or tower system return.

1. **Note:** if dumping to the plant's open drain, drainage shall be done according to local codes.



Condenser connections - 10 ton unit- optional regulator valve shown — Figure 2.5B

C. The pressure differential requirement between the condenser "water in" and the condenser "water out" lines must be 30 psi for adequate efficiency.

D. The installation of a strainer in the condenser "water in" line is recommended. This removes solids from the water supply and serves to protect the water saver (regulator) valve.

E. An optional water saver (regulator) valve may be installed in the condenser "water in" line. During winter months, or cold seasons, the valve will throttle the water flow through the condenser. The amount of flow is based on the refrigerant head pressure and the regulator will modulate the valve's orifice to maintain a head pressure of 210 psig for best efficiency.

2.6 ELECTRICAL CONNECTION

A. NEMA 1 MODELS

1. Electrical power supply requirements for Nema 1 units are identified on the equipment data plate. Determine the plant's voltage supply is the same as the unit's voltage requirements. **WARNING: Do not connect the unit to a voltage supply not equal to the unit's voltage requirements as specified on the unit's data plate. Use of incorrect voltage will void the unit's warranty and**

cause a significant hazard that may result in serious personal injury and unit damage.

2. A customer supplied, four conductor cable is required for connection to a customer supplied fused disconnecting means. The fused disconnecting means shall be sized and installed according to the unit's power supply requirements and local electrical codes. See figure 2.5A (next page) for details on water cooled power cable routing.

3. Connect the four conductor power cable to power entry terminal block on the unit's electrical panel. Then connect the power cable to the fused disconnect switch.

B. NEMA 12 MODELS

1. NEMA 12 units are constructed with a dust tight electrical enclosure and branch circuit fusing. Electrical power supply requirements are identified on the equipment data plate. Determine the plant's voltage supply is the same as the unit's voltage requirements. **WARNING: Do not connect the unit to a voltage supply source not equal to the unit's voltage requirements as specified on the unit's data plate. Use of incorrect voltage will void the unit's warranty and cause a significant hazard that may result in serious personal injury and unit damage.**

2. Appropriate conduit and fittings should be selected which will maintain the integrity of the cabinet.

3. Supply a power conductor sized according to the unit's power supply requirements. Connect the power conductor to the unit's power supply entry terminal block or the fused disconnect switch. Some Nema 12 models may be supplied with an optional disconnect switch. The owner supplied fused disconnecting means shall be sized and installed according to the unit's power supply requirements and local electrical codes.

C. CONTROL CIRCUIT WIRING

1. The unit's supplied control circuit is 110 volt, 1 phase, 60 cycle. The control circuit is supplied by the factory installed transformer. An inline control circuit fuse is provided.

D. GENERAL

1. Make certain all ground connections to the unit are properly affixed.

2. Make certain power conductor, disconnecting means, and fusing are properly sized according to the unit's power supply requirements.

3. Make certain all electrical connections are tightly affixed. Any loose wiring connections must be tighten before engaging the power supply.

4. Make certain no moisture or standing water is present inside the electrical cabinet (figure 2.5B).

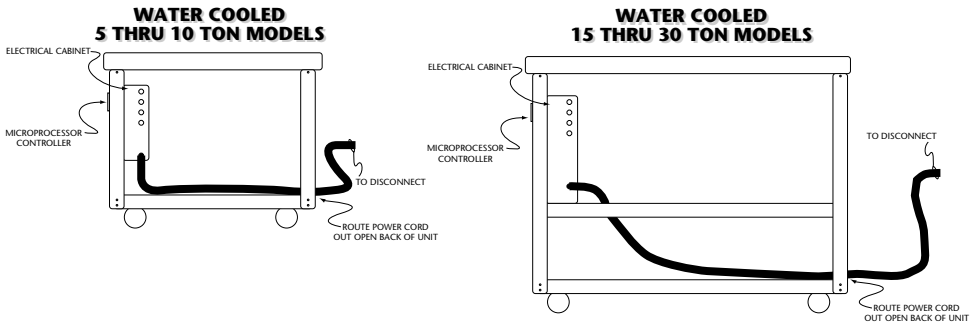


Figure 2.6A

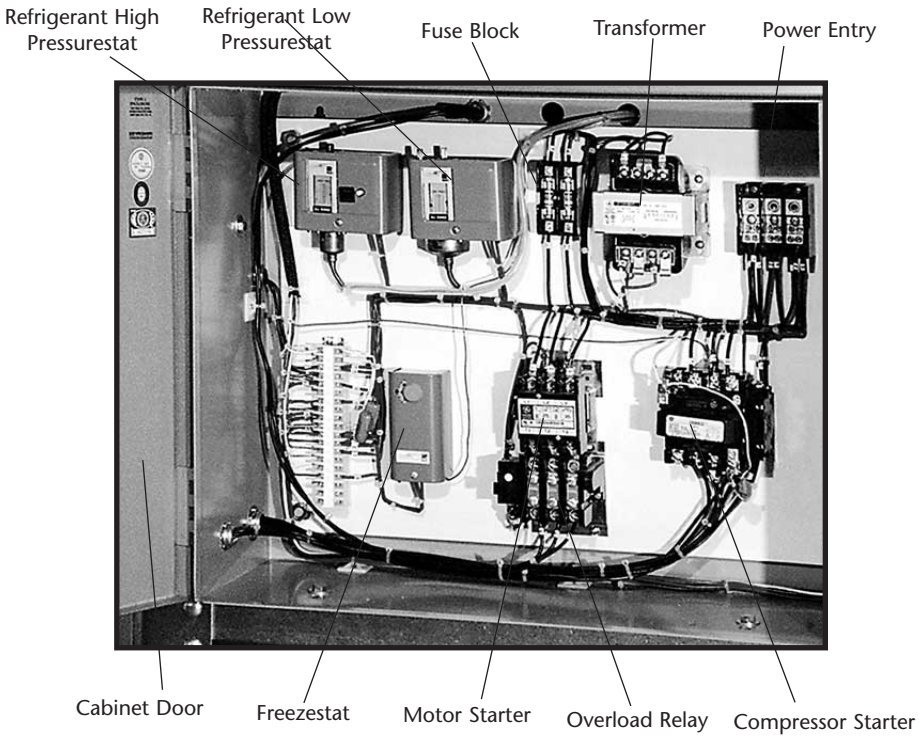


Figure 2.6B Typical electrical cabinet detail.

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3.0 OPERATIONS

3.1 GENERAL

A. Failure to follow the factory required operations procedure may adversely affect the unit's ability to adequately control process temperature and may create a hazardous operating condition which may result in serious operator injury and/or unit damage.

B. **IMPORTANT:** each chiller is equipped with a crankcase heater on the compressor. While the compressor is idle, the crankcase heater prevents freon vapor from migrating to and condensing in the compressor crankcase. If freon is allowed to condense in the crankcase, it can be drawn into the cylinders upon start up. This can cause catastrophic damage to the connecting rods, pistons, and valve plates. To avoid this, **BEFORE THE UNIT IS STARTED, THE POWER SUPPLY SHOULD BE APPLIED TO THE UNIT FOR AT LEAST 12 HOURS, OR UNTIL THE BOTTOM OF THE COMPRESSOR IS WARM TO THE TOUCH.** If the power has been disconnected more than two hours, the power should be applied for six hours before restarting. Power should be applied to the unit continuously, except for service purposes. The crankcase heater should be checked for proper operation on a regular basis.

C. The OPERATIONS segment of this manual is divided into the following sections:

3.2 **Start up/operations** - follow this segment to start the unit after the initial install to the process system or to restart the unit after reinstallation to the same or different process system. This section includes information on system fill, electric motor phasing (pump rotation) and process flow adjustments.

3.3 **Instrument** - follow this segment to start up and operate the instrument. This section includes information on setpoint selection and adjustment, and feature explanations.

3.4 **Shut down procedure** - follow this segment to shut down the unit. This segment includes information on system shut down, electrical power supply precautions, and disconnection from system.

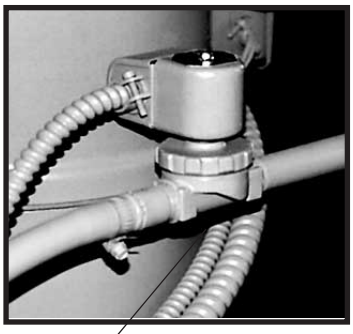
3.2 START UP/OPERATION PROCEDURE

A. SYSTEM FILL

1. The **VL** series portable chiller has an internal reservoir which must be filled and maintained for proper operation. All **VL** series chillers have a level switch mounted at the proper water level in the reservoir.

2. **Conair** recommends the addition of 20% inhibited propylene glycol to the process fluid. This should help prevent the process fluid from freezing and internal components from rusting. A biocide must be added to the water to prevent organism growth in the chilled water system. See water treatment section in **section 8** of this manual for more information.

3. **FOR AUTOMATIC FILL (IF EQUIPPED):** engage the water supply to unit. The level switch will activate the make-up solenoid (figure 3.2A), which will open and the water supply will fill the reservoir tank. During operations, with the water supply source "on", the unit will automatically maintain the correct reservoir level.



Typical make-up solenoid valve Figure 3.2A

4. **MANUAL FILL:** disconnect the electrical power supply and remove all necessary cover panels to access the reservoir tank. Add fluid directly to the reservoir tank. When the pump is first started, as process lines are filled and air is purged, additional fluid may be required to restore the reservoir to the correct level.

B. ELECTRIC MOTOR PHASING (PUMP ROTATION)

1. The operator must determine the unit is phased correctly. This is done by visually inspecting the rotation of the pump motor shaft and is outlined below. Incorrect phasing results in poor operation and eventual damage to the unit.

   a. Supply electrical power to the unit by engaging the unit's disconnect switch. Once the correct voltage is supplied to the unit, the **POWER** light on the unit's instrument display will illuminate.

   b. Remove the necessary covers panel to access the pump motor. **Note that electrical power is engaged at this point and caution must be observed while the electrical supply is engaged and cover panels are removed.**

   c. Locate the electric motor (figure 3.2B) The operator must identify the motor shaft inside the electric motor housing. The motor shaft can be seen through the vent slots in the motor housing or by removing the shaft cover (figure 3.2C).

d. Toggle the CHILLER ON switch. This will quickly cycle the electrical motor "on" and then "off".

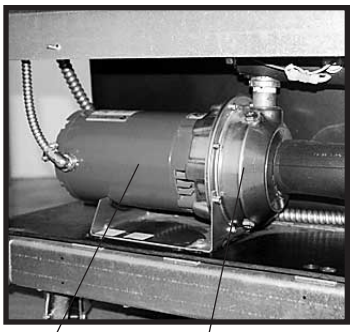


Figure 3.2B

e. Observe the motor shaft. When the CHILLER ON switch is turned "on", the motor shaft will rotate. When the CHILLER ON switch is turned "off", the motor shaft will slowly "coast" to a stop. As the shaft slows to a stop, the operator must identify its rotation. Correct rotation (correct phase) is "clockwise", when viewed from the rear of the motor. Incorrect rotation is "counter-clockwise" (incorrect phase) when viewed from the rear of the motor. If the shaft does not rotate when the PUMP switch is toggled, the operator must identify the cause as outlined in this manual's troubleshooting and repair section.

Figure 3.2C

f. If the motor shaft is phased correctly (shaft turns in a clockwise direction), continue with **step C**. If the motor shaft is **NOT** phased correctly (shaft turns in a counter-clockwise direction), continue the procedure with **step 2**.

2. If the motor shaft is **NOT** phased correctly, the operator must:

a. Disengage the electrical power supply to the unit at the disconnect switch. Follow proper lockout procedures before proceeding. Verify the POWER light on the instrument display is off.

b. With the electrical power supply is disengaged, reverse any two power leads of the power cord at the disconnect terminals.

c. **Note:** reversing any two power leads of the power cord will correctly phase an incorrectly phased

power supply. **The operator must reverse the power leads at the disconnect switch only and *NOT* at the power entry terminals on the unit's electrical panel.** The unit's internal electrical system wiring is phased correctly at the factory and must not be altered in the field.

d. Visually inspect the rotation of the motor as outlined **step 1** to determine the unit is phased correctly.

C. PROCESS FLOW ADJUSTMENTS

1. The operator must determine and set proper water flow rate for the most efficient and trouble free operation.

a. Water flow rate through the process is determined by the pressure losses in the process loop. Generally, higher flow rates result in turbulent flow achieving maximum temperature control and lower maintenance. Since the evaporator in most liquid chillers is flow sensitive, the efficiency of operation is directly related to the flow of liquid.

b. Maximum chiller efficiency is obtained at approximately 2.4 gpm per ton of rated capacity. Low liquid flow can reduce efficiency and in some cases allow ice to form in the evaporator which can damage the evaporator. Excessive flow will trip the motor overload protection circuit.

2. Activate the CHILLER ON rocker switch on the display to activate the process pump. Wait a few moments to allow air to be purge from system. Two items the operator must look for are low or excessive flow conditions.

3. ***LOW FLOW...*** to allow operation under a low flow condition, it is necessary to install a flow bypass system in the process circuitry. This will allow a portion of the flow to bypass the process and return directly to the chiller. This keeps the total flow above the cutoff point. Figure 3.2D illustrates a typical bypass loop.

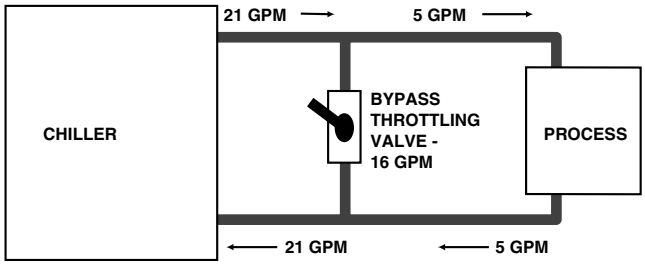


Figure 3.2D Typical low flow by-pass loop

4. ***EXCESSIVE FLOW...*** excessive flow can overload the process pump motor and cause eventual failure. This is a result of the process loop's ability to flow water at a great rate than can be provided by the process pump. This eventually results in tripping the thermal motor overload relay (overload relays open) and the unit will shut down.

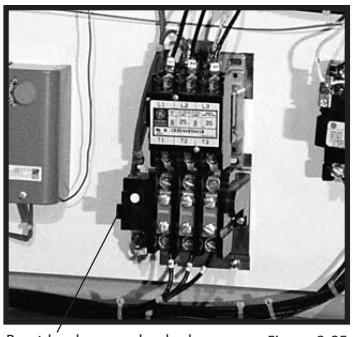


Figure 3.2E

a. If an excessive flow situation is encountered and the motor overload circuit has tripped, the operator must manually reset the overload relay (figure 3.2E) before operations can continue. This is done by opening the electrical panel cover, identifying the reset lever on the overload relay, and pushing the reset lever "in" until the overloads are reset (evidenced by a "clicking" sound as the overloads reset).

5. To overcome an excessive flow condition, the operator should set the process flow rate according to the motor amperage:

a. Remove electrical cover panel. **Note that the electrical power is engaged at this point and caution must be observed while the cabinet panel is open.**

b. Identify the motor starter block. This block consists of the motor starter contactor and the overload relay.

c. Place an amp meter on a single power lead emanating from the overload relay.

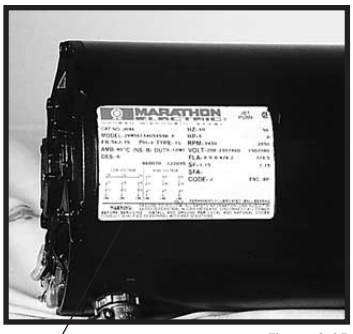


Figure 3.2F

d. Locate the electric pump motor. Identify the motor name plate on the motor housing (figure 3.2F). The full load amp rating for the motor is listed on the name plate.

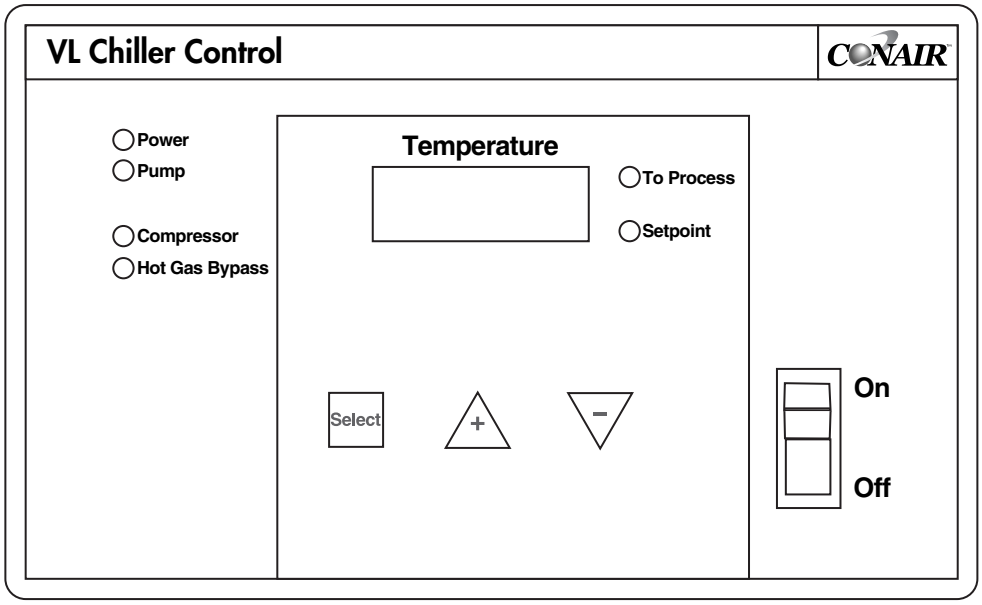
e. Engage the electrical power supply and start the motor by switching 'on' the CHILLER ON rocker switch.

f. The amp meter will display the motor amps. Compare the actual motor amps as displayed on the amp meter to the full load amp rating as listed on the motor name plate.

g. If the amp draw is excessive (higher than the listed name plate amp rating), a throttling valve must be installed in the "from process" circuit line. The preferred throttling valve is a ball valve.

h. With the throttling valve installed, fully close the valve and then engage the pump. Slowly open the throttling valve and monitor the motor amps as displayed on the amp meter until the actual motor amps equals the listed full load amp rating of the motor.

3.3 INSTRUMENT OPERATION



A. INSTRUMENT START-UP

1. When the correct electrical power and adequate water supply pressure are supplied to the unit, it is possible to start the unit for temperature control duty.

2. When the electrical power supply is engaged to the unit, the instrument (figure 3.3A) will momentarily illuminate all indicating lights and digits on the display head. After a short delay, the instrument will display the software version number. At this time, the operator can verify that all lights and digits are functioning properly. If the operator

determines an indicating light or digit does not illuminate, the instrument must be removed and sent to the factory for repair. When power is supplied to the unit, the POWER light will illuminated.

3. Toggle 'on' the CHILLER ON rocker switch to activate the chiller. The operator can stop process operations (refrigerant and coolant circuits) by switching 'off' the CHILLER ON switch.

4. To select the operating setpoint, use the SELECT key to index through the TO PROCESS and SET POINT temperature functions until the SET POINT light is illuminated.

5. When the SET POINT light is illuminated, the setpoint temperature is shown in the temperature display window. Use the UP and DOWN ARROW keys to change the setpoint temperature.

6. **PRECAUTIONS:** the instrument is programmed from the factory with a setpoint range of 48° to 70°F. To operate below 48°F, the addition of inhibited propylene glycol and modification of the safety control settings are required. Diligent monitoring of the water/glycol solution is mandatory to prevent freezing of the evaporator. Freezing may cause the evaporator to rupture allowing water and freon to mix which will cause major damage to the refrigeration system. Operating above 70°F requires the addition of a refrigerant crankcase pressure regulating (CPR) valve. The CPR valve is necessary to prevent overloading of the compressor which can cause premature failure. Contact your local refrigeration contractor or the factory for further information. The operating range of the instrument may be changed to 20°F - 90°F by adjustment of the CPU DIP switch. Refer to the technical section of this manual for more information. The instrument is set up from the factory to give an alarm light and a 115 volt alarm output if the temperature to process deviates more than 10° from the setpoint.

7. After selecting the setpoint temperature, the operator may leave the display in the SET POINT state. The display will automatically return to the TO PROCESS temperature state after twenty seconds of inactivity.

8. The operator can stop operations by switching 'off' the CHILLER ON rocker switch. This will disengage the refrigerant and coolant circuits.

B. INSTRUMENT OPERATION

1. When the CHILLER ON rocker switch is toggled on, the instrument will begin temperature control operations and the 'to process' temperature will begin to drop.

2. When the 'to process' temperature drops 1° below the setpoint, the instrument will activate the capacity control system to match the cooling capacity to the present load, as indicated by the HOT GAS BYPASS light (figure 3.3A).

3. If the load is less than the minimum capacity of the chiller, the 'to process' temperature will continue to drop. At 3° below setpoint the compressor will stop and enter a three minute time delay period before restarting at 1° above setpoint. The time delay is to prevent short cycling damage to the compressor.

C. INSTRUMENT CONTROLS

1. **CHILLER ON SWITCH**: this rocker switch engages/disengages electrical supply to the compressor and pump circuit.

2. **SELECT:** depress to index through the TO PROCESS and SET POINT temperatures.

3. **UP ARROW**: depress and hold this push button to increase the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

4. **DOWN ARROW**: depress and hold this push button to decrease the setpoint temperature. If this push button is pressed momentarily the setpoint value is incremented by one degree. If the push button is held down for more than one second, the setpoint will increase slowly at first and then faster after about two seconds.

D. INSTRUMENT STATUS DISPLAY

1. **POWER**: illuminates when the proper supply of electrical power is applied to the unit.

2. **PUMP**: illuminates when the CHILLER ON rocker switch is turned on and the pump is operating. Even with the CHILLER ON rocker switch on, the PUMP light will not illuminate if a safety fault condition exists.

3. **COMPRESSOR**: illuminates when the instrument engages

the compressor contactor. Engaging the compressor contactor supplies electrical current to the compressor. This action will decrease process water temperature.

4. **CAPACITY CONTROL**: illuminates when the instrument has engaged the capacity control system.

E. TEMPERATURE DISPLAY

1. A three digit display window indicates the appropriate temperature in **Fahrenheit**. The window also displays the numeric value for the setpoint temperature. A red light will illuminate beside the parameter currently being displayed.

   a. **TO PROCESS:** indicates liquid temperature being delivered from the chiller.

   b. **SETPOINT:** indicates selected temperature control point.

3.4 SHUT DOWN/DISCONNECT SEQUENCE

A. PRECAUTIONS/WARNINGS

1. The operator must precisely follow all shut down procedures outlined in this manual. If the operator fails to follow precisely all procedures outlined in this manual, an unsafe condition can develop resulting in damage to the unit or personal injury.

B. UNIT SHUT DOWN

1. **To shut down the unit:** toggle off the CHILLER ON rocker switch. Maintain electrical power to the unit at all times except for service purposes. If the unit is to be disconnected from the process, disengage the voltage supply before removing power cord and process lines.

4.0 TROUBLESHOOTING

4.1 SENSORS

A. The sensor is a solid state temperature transducer which converts temperature input to proportional current output.

B. To quickly test for a defective probe, switch connections between the defective probe and a probe known to be working properly.

4.2 PROCESS PUMP

A. The centrifugal pump is designed to operate at a specific flow and pressure at the maximum run load amp draw of the motor. Too much flow can overload the motor and cause the overload circuit to open and stop the pump.

B. If the overload trips, check for electrical shorts, loose wires, or blown fuses. If these check OK, reset the overload circuit and restart the chiller.

C. Check the amperage and if excessive, partially close the 'from process' valve until the amperage is reduced to the proper level.

4.3 COMPRESSOR

A. Semi-hermetic compressors are protected by an external overload device (Klixon switch, solid state module, etc.). If the safety switch opens, this indicates an overload condition exists.

B. Check for electrical shorts, loose wires, bad fuses, or bad motor starter contacts. If these check ok, check for a defective protection device.

C. Hermetic compressors have internal protection.

4.4 BLOWER/FAN

A. Check for an electrical short, loose wires, bad fuses, or bad motor starter contacts.

B. Check the blower for defective bearings or other forms of drag on the blower wheel.

4.5 LOW FLOW

A. One pump chillers require 100% of the process flow to circulate through the evaporator.

B. In some process conditions the minimum flow required cannot be maintained making it necessary to install a bypass line between the to and from process lines.

4.6 HIGH PRESSURE

A. If the refrigerant high pressure safety switch has opened, this switch must be manually reset after the problem has been resolved.

B. Refrigerant high pressure will vary with ambient temperature from a minimum of 190 psi to as high as 280 psi. Check for restricted filters, broken or loose blower drive belts, restricted air flow.

C. On air-cooled models: maintain at least four feet of clearance for each condenser intake.

D. On air-cooled models: check if the discharge duct work (if installed) is undersized and restricting air flow.

4.7 LOW PRESSURE

A. If the refrigerant low pressure safety switch has opened, the cause of the problem must isolated and resolved.

B. The switch will automatically reset when the pressure rises above the cut-in pressure. If this does not occur contact the **Conair** service department for instructions.

C. The low pressure switch is set to cut-out at 58 psi and cut-in at 63 psi. If a low pressure condition exists for more than five seconds the compressor will stop and a "L-P" fault will appear in the display window.

D. After the refrigerant pressure rises above the cut-in pressure, a three minute time delay will occur before the compressor restarts. This will protect the evaporator and compressor from damage should a problem occur in the refrigeration system or if the chiller is operated under circumstances which could cause damage to the refrigeration system.

E. If a low pressure fault occurs, check for blockage in the evaporator water inlet. If a blockage is found, back flush the evaporator and flush complete process water system.

F. Check for low freon. The refrigerant sight glass should appear clear when the unit is operating at 100% cooling capacity. Constant foam or bubbles indicate a loss of freon.

G. Check to see if the condensing media is too cold. On air condensed units, the ambient air at the condenser intake must be at least 60°F. If this is not possible, a damper control assembly package may be required.

4.8 FREEZESTAT

A. The freezestat sensor bulb is located at the evaporator water outlet

port. If the water out temperature of the evaporator reaches the freezestat setting the switch will open and stop the refrigeration compressor.

B. Check for restricted water flow and add a bypass line if necessary.

C. The setpoint is adjusted too low for the safety switch settings.

D. The freezestat is adjusted incorrectly or is defective.

4.9 OIL PRESSURE (Semi-hermetic Compressors)

A. This switch must be manually reset after the problem is resolved.

B. Check for low oil level in the compressor crankcase or insufficient compressor warm up before start-up.

C. Defective crankcase heater, internal compressor damage causing the compressor to pump too much oil through the system, defective oil pump, or plugged pick up screen in compressor oil sump. **Note:** only semi-hermetic compressors 15-30 tons have an oil pressure safety switch.

4.10 CRANKCASE HEATER (Semi-hermetic Compressors)

A. If the crankcase heater is not drawing current during the compressor off cycle, check for a defective crankcase heater, defective fuses or defective interlock on the compressor starter.

4.11 ELECTRONICS

A. The Display/CPU is used for all normal set ups, diagnostics, temperature readout and operational information. This is not normally a field repairable part. It is designed to be easily removed and replaced if a problem arises.

5.0 MAINTENANCE

5.1 WARRANTY SERVICE PROCEDURE

A. In the event of a problem with a chiller that can not be resolved by normal troubleshooting procedures, the customer is invited to consult the **Conair** service department for assistance. The correct model number and serial number of the chiller must be available. The service department will attempt to isolate the problem and advise repair procedures. Often times, with the customer's input and with the machine diagnostics, problems can be determined with "over-the-phone" consultation.

B. If the problem is beyond the scope of "over-the-phone" consultation, and if the warranty status of the machine is valid, **Conair** will contact the nearest authorized service contractor and provide authorization to conduct an "on-site" inspection of the unit in order to determine the course of repair. If the chiller is not covered by the warranty, **Conair** will advise on the repair and recommend available service contractors.

C. **Conair** manufactures a complete line of heat transfer equipment. It is of the utmost importance that **Conair** have the correct model number and serial number of the machine in question. This will allow **Conair** to obtain the correct manufacturing records which will help the service department to properly troubleshoot the problem and obtain the proper replacement parts when they are required. This information is stamped on the metal data tag that is attached to the machine.

D. The **Conair** service department must be notified prior to any repair or service of a warranty nature. Warranty claims will not be honored without prior authorization.

5.2 PERIODIC PREVENTATIVE MAINTENANCE

A. Lubricate all motors. Note that some motors are supplied with sealed bearings.

B. Tighten all wire terminals.

C. Clean and check motor starter and contactor contacts.

D. Check safety switch settings.

E. Clean condenser fins of dust and dirt.

F. Back flush evaporator.

G. Check glycol/water solution ratio for operating temperature.

H. Check system for leaks.

I. Refrigerant sight glass: check for bubbles when compressor is operating at 100%. Check the moisture indicator for a color other than green.

J. Clean unit.

5.3 SPECIAL MAINTENANCE

A. Any service of the refrigeration system must be accomplished by a certified refrigeration technician.

1. Vacuum check compressor.

2. Addition of compressor oil.

3. Addition of refrigerant.

4. Repair of a refrigerant leak.

5. Adjustment of super heat.

6. Changing of filter-drier or drier core.

7. Repair of a refrigeration solenoid.

8. Valve plate replacement on compressor. (Semi-hermetic compressors only)

5.4 SOLENOID VALVE SERVICE

A. **VLA** units with the water make-up system use a solenoid valve (figure 5.4A) to regulate the level in the reservoir tank. The solenoid valve is controlled by the float switch.

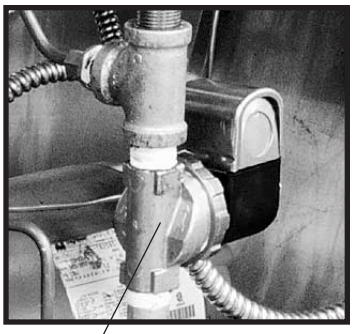


Figure 5.4A

B. Generally, solenoid valves fail due to poor water quality, low water flow, or defective valve elements.

C. The operator should follow this procedure to service the make-up solenoid valve:

1. Disengage process operations according to the procedure outlined in **section 3.4**. The operator must be certain process fluid temperature is under 100°F and pressure is relieved (pressure gauge reads "0") and water system flow is shut off and all pressure relieved.

2. Disengage main power supply. The operator must verify the POWER light on the display is "off".

3. Remove or open any access cover panel and set aside to gain access to the solenoid valve.

4. The operator must be certain all water supply system pressure is relieved.

5. Identify the retaining screw (figure 5.4B) on the solenoid valve coil. Remove the screw. Keeping all electrical connections intact, lift the coil off of the enclosure tube and set aside.

6. Use a pair of channel lock pliers or a pipe wrench to separate the bonnet assembly from the valve body. The plunger is "loose" inside the enclosing tube. Be certain it is retained in the enclosure tube as the bonnet is removed (figure 5.4C).

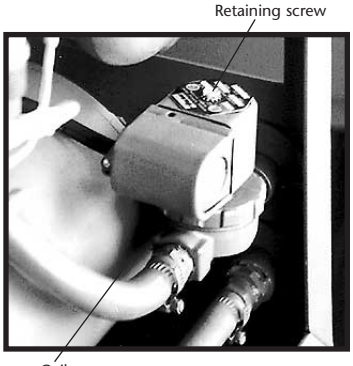


Figure 5.4B

7. Identify the diaphragm assembly. Gently remove the assembly from the valve body (figure 5.4D).

8. Identify the mesh screen. Gently removed the mesh

screen and clean or replace as necessary.

9. Clean the valve body.

10. Reset the mesh screen into the valve body.

11. If a new diaphragm assembly was obtained, continue with step 12. If not, disassemble the diaphragm assembly and note component order (figure 5.4E). Clean the valve port, plate, collar and O-ring. Once cleaned, reassemble the diaphragm.

12. Set the reassembled diaphragm assembly or the new assembly back into the valve body. The stem should be facing out of the valve body.

13. Inset the plunger with spring first into the enclosing tube of the top bonnet (figure 5.4F). Holding the plunger in the enclosure tube, set the top bonnet onto the valve body and tighten.

14. Place the coil onto the top bonnet and replace the retaining screw.

15. Open the water supply to circulate water to the make-up system. Check the solenoid valve for leakage. Restart the unit as outlined in **section 3.**

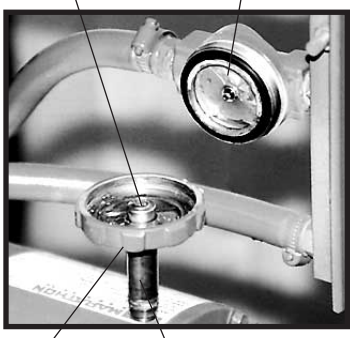


Figure 5.4C

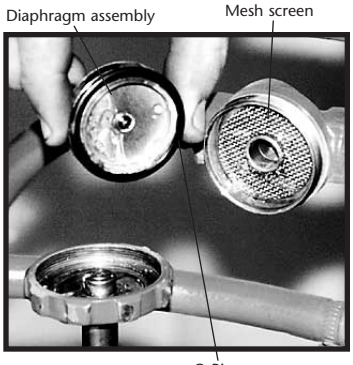


Figure 5.4D

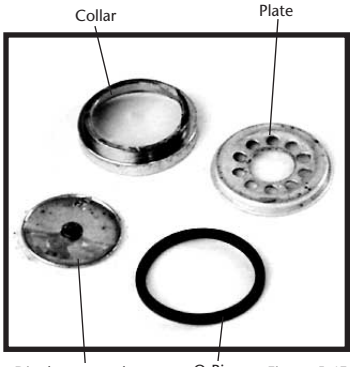


Figure 5.4E

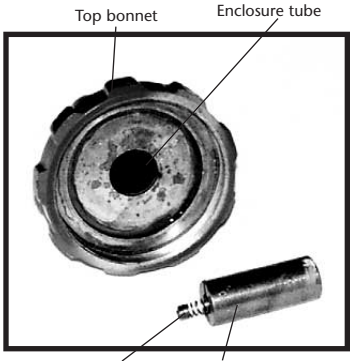


Figure 5.4F

5.5 PUMP SEAL SERVICE

A. The **VLA** unit pump seal is a carbon/niresist shaft seal assembly including a stationary member, rotating member and tension spring (figure 5.5A).

B. The operator can determine the pump seal is leaking when fluid is identified leaking from the pump case adapter. Generally, a pump seal will leak due to inadequate unit pressure, excessive flow and poor fluid quality.

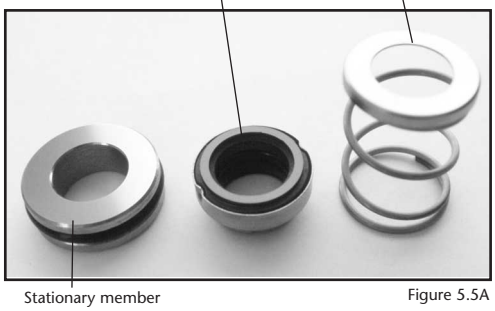


Figure 5.5A

C. The operator should follow this procedure to replace the pump seal:

1. Disengage process operations according to the procedure outlined in **section 3.4**. The operator must be certain process fluid temperature is under 100°F and water make-up flow is shut off and all pressure relieved.

2. Disengage main power supply. The operator must verify the POWER light on the display is "off".

3. Access the pump motor by opening or removing any cover panels as necessary (figure 5.5B).

Figure 5.5B

4. Drain machine. Drain fluid into a suitable container for reuse or disposal according to manufacturer's instructions (if a glycol solution is used).

5. Locate and remove the three motor wire leads from the motor wiring terminals. The operator should "map" the wire terminal locations to ensure correct rewiring. The power cord should be removed from the motor housing (figure 5.5C).

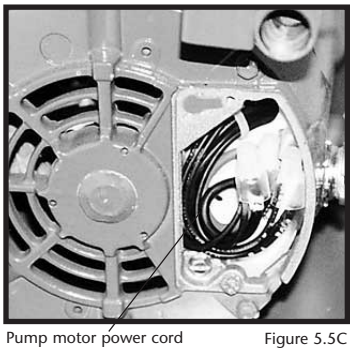


Figure 5.5C

6. Locate and remove the pump casing bolts. These bolts secure the motor and motor adapter to the pump casing (figure 5.5D).

7. Separate the motor and motor adapter from the pump casing to expose the pump impeller (figure 5.5E). Remove the motor and motor adapter from the unit and place on a workbench to continue the procedure.

8. Locate and remove the dust cap from motor end to expose slotted motor shaft. The motor shaft is free to rotate, but must be secured to remove the impeller. To secure the motor shaft, insert a flat bladed screw driver in slot to hold the shaft stationary (Figure 5.5F).

9. Locate and remove the impeller locking screw (Figure 5.5G). Using a socket and ratchet, the impeller retaining screw can be removed. Once the retaining screw is removed, the impeller can be "unthreaded" from the motor shaft to expose the pump seal assembly.

10. Remove all seal parts (Figure 5.5H). Note seal component arrangement to facilitate reassembly.

11. Clean motor shaft and lubricate with a mild soap solution.

12. Install new stationary seal member in the pump casing cavity (figure 5.5I).

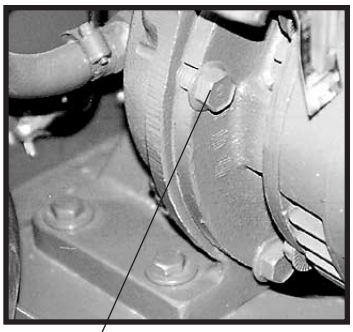


Figure 5.5D

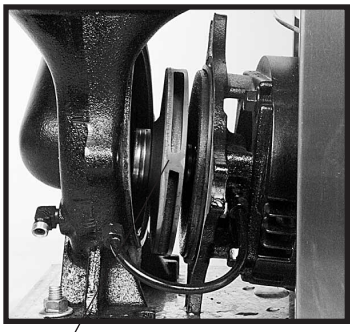


Figure 5.5E

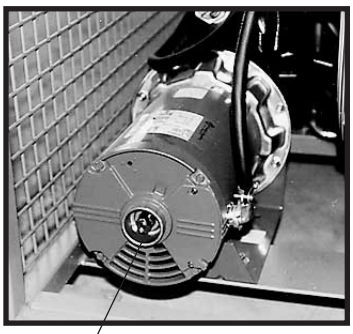


Figure 5.5F

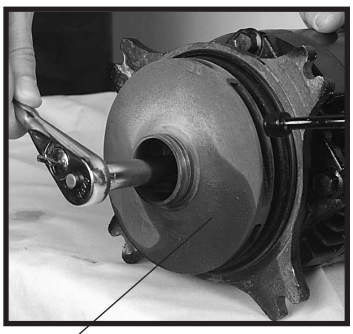


Figure 5.5G

The operator must be certain the stationary seal member is fully squared and seated in cavity.

13. Slide the rotating member onto the lubricated pump shaft (figure 5.5J). The operator must be certain not to damage or tear rubber bellows assembly.

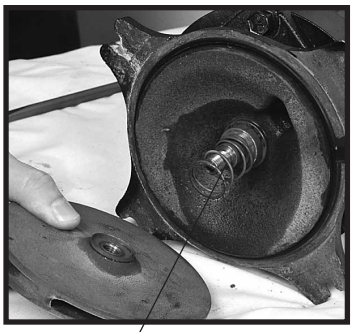


Figure 5.5H

14. Place the spring onto the rotating member.

15. Align the impeller, spring and rotating member before reinstalling the impeller (figure 5.5K). The operator must be certain the spring and rotating member are aligned before the impeller is fully tighten and the impeller retaining screw is reinstalled.

Figure 5.5I

16. Clean pump casing, cavities, impeller and O-ring before reassembly.

17. Mate the motor and motor adapter to the pump casing. Reinstall the pump casing bolts.

18. Reconnect the motor power cord and leads.

Figure 5.5J

19. Restore all cover panels as were removed.

E. When the pump seal replacement procedure is complete, the operator should check for leaks before restarting the unit according the **section 3**.

Figure 5.5K

5.6 CHECKING THE REFRIGERANT CHARGE

A. All standard **Conair** chillers are manufactured with thermostatic expansion valves as the metering device to the evaporator.

B. All **Conair** chillers have a refrigerant sight glass with a moisture indicator. To check the refrigerant charge under normal operating conditions:

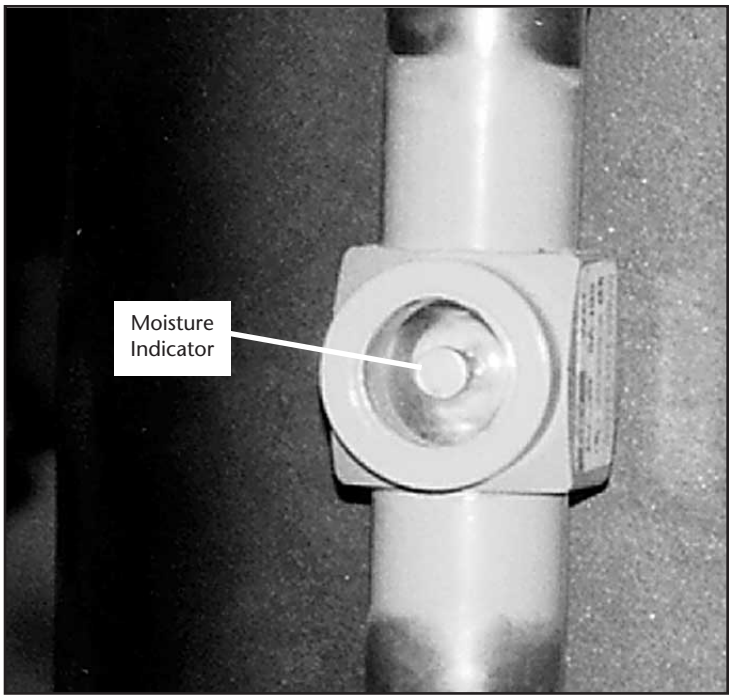
1. Remove the plastic cap covering the sight glass, if installed.

2. Start the chiller and allow system pressures and temperatures to stabilize.

3. With the unit operating at 100% capacity (not in the "hot gas bypass" mode) the sight glass should appear clear with no foam or bubbles evident. If foam or bubbles are evident, the chiller has suffered from a loss of refrigerant and should be checked by a qualified refrigeration technician.

4. The "dot" in the middle of the sight glass is the moisture indicator. It should appear green at all times. A white or yellow color indicates moisture has invaded the refrigeration system, which is detrimental to the life of the compressor. The filter-drier should be replaced by a qualified refrigeration technician.

Typical refrigerant sight glass (cap removed) Figure 5.6A

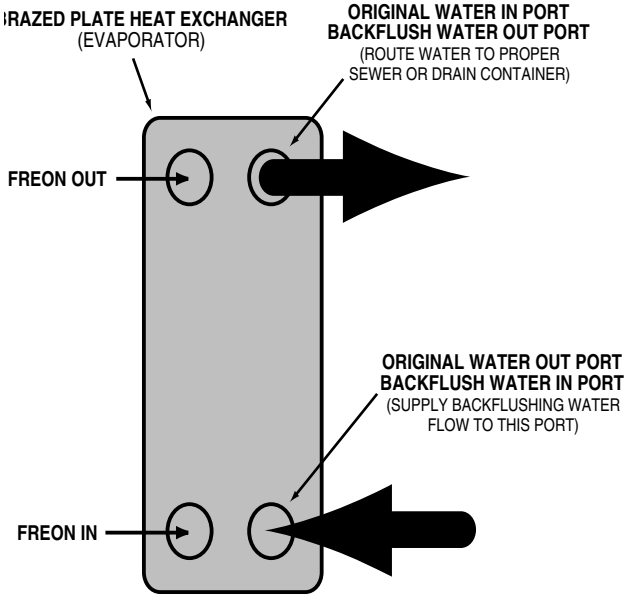


5.7 PROPER CLEANING PROCEDURE FOR BRAZED PLATE EVAPORATORS

A. The brazed plate evaporator is made of stamped stainless steel plates, furnace brazed together with copper based joints. The complex geometry of the flow passages promotes turbulent flow which gives high efficiency and reduces fouling by mineral deposits. Large solids such as plastic pellets or chunks of mineral deposits will collect at the water inlet port at the evaporator and restrict flow through some of the passages. If this possibility exists, **Conair** recommends filters or strainers be added to the "from process" line. If the evaporator becomes fouled there are a couple of methods for cleaning.

Typical evaporator installation Figure 5.7A

B. To begin, remove the piping to the "water in" port at the evaporator. Remove any solids that have collected at this point. Then backflush the evaporator to remove any solids that may be trapped between the plates (see backflush procedure next page). If there are mineral deposits adhered to the plates, the evaporator must be backflushed with a mild acid solution (5% phosphoric or 5% oxalic acid is recommended.) After cleaning rinse with clear water before returning to service. Continue with step C on next page.



C. Backflushing procedure:

1. Turn off all power to the machine. For chillers with a reservoir tank, drain the tank to below the evaporator outlet. For chillers without a reservoir tank, drain total unit.

2. Connect a water supply hose to the evaporator water outlet. If acid cleaning, connect the discharge hose from the acid pump to the evaporator outlet port.

3. Connect a hose to the evaporator water supply port and to an appropriate containment vessel. If acid cleaning, connect the evaporator water inlet port to an acid solution reservoir tank. Dispose of all backflush fluid according to local codes.

4. The cleaning fluid source should have at least 20 psi available. If acid cleaning, follow the instructions supplied with the acid solution carefully.

5. When the procedure is complete, reinstall all water lines to original factory orientation. Restart the unit and check for proper operation.

6. **Note:** this procedure is not normal maintenance. Maintaining proper water quality and filtration will minimize the need to backflush the evaporator.

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6.0 COMPONENTS

6.1 WATER SYSTEM

6.2 REFRIGERATION SYSTEM

6.1 WATER SYSTEM

A. MOTOR/PUMP ASSEMBLY: the motor/pump assembly circulates chilled fluid to the process loop. The pump assembly is built of total stainless steel to maintain water quality (figure 6.1A).

B. FREEZESTAT: the freezestat aids in protecting the evaporator from potential freezing. The freezestat is factory adjusted to 40°F. The freezestat must be field adjusted for operating with setpoints below 48°F (figure 6.1B).

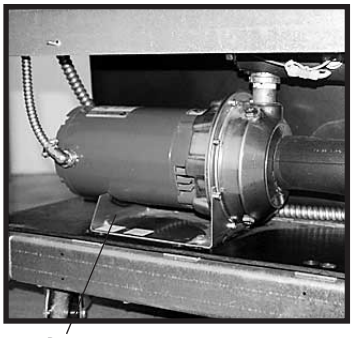


Figure 6.1A

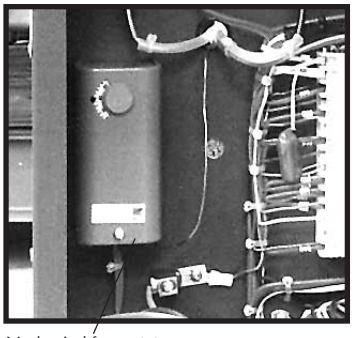


Figure 6.1B

6.2 REFRIGERATION SYSTEM

A. COMPRESSOR: hermetic or semi-hermetic compressors take low pressure/low temperature refrigerant gas and compress the gas into high pressure/high temperature gas (figure 6.2A).

B1. WATER COOLED CONDENSER: the water cooled condenser removes BTU's (heat) from the compressed refrigerant gas. As the heat is removed, the gas "condenses" into a liquid state, still under high pressure. Tube-in-shell condensers are used on 15-30 ton models. Tube-in-tube condensers are used on 5-10 ton models. Water regulator valves are used on all models to control the refrigerant head pressure by modulating the condenser water flow (figure 6.2B1).

B2. AIR COOLED CONDENSER: the air cooled condenser removes BTU's from the compressor refrigerant gas. The action causes the gas to "condense" into a liquid state still under high pressure. Air flow across the condenser is achieved via a motor driven fan assembly or centrifugal blower (figure 6.2B2).

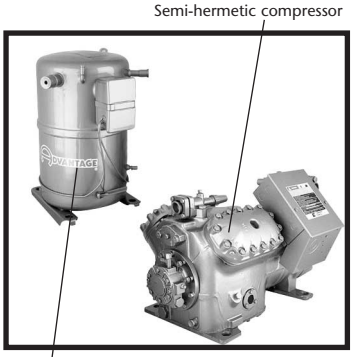


Figure 6.2A

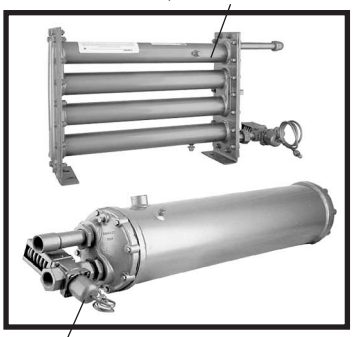


Figure 6.2B1

C. **FILTER-DRIER:** the filter-drier removes contaminants and moisture from the liquid refrigerant (figure 6.2C).

D. **LIQUID LINE SOLENOID VALVE:** controlled by the instrument, this valve closes when the compressor cycles off to prevent refrigerant liquid from migrating to the evaporator. The valve opens when the compressor cycles on (figure 6.2D).

E. **REFRIGERANT SIGHT GLASS:** the refrigerant sight glass indicates refrigerant charge and moisture content. Refrigerant charge is determined by a clear liquid flow. Bubbles indicate low refrigerant. Moisture content is indicated by the color of the element. Element color is normally green. If the color of the element is chartreuse or yellow, the system has been contaminated with moisture. In such case, the filter-drier must be replaced. The replacement of the filter-drier must be completed by a qualified refrigerant service technician (figure 6.2E).

E. **EXPANSION VALVE:** the expansion valve throttles flow of refrigerant liquid into the evaporator and creates a pressure drop in the refrigerant system that allows the liquid refrigerant to "boil off" inside the evaporator (figure 6.2F).

F. **EVAPORATOR:** the evaporator is a brazed plate heat exchanger where the refrigerant liquid is allowed to evaporate (boil off) to absorb heat (BTU) from the process fluid. As the heat is absorbed, the process fluid is chilled (figure 6.2G).

G. **HOT GAS BY-PASS SOLENOID:** the hot gas by-pass solenoid prevents short cycling of the compressor by reducing the capacity by 50% when the process fluid temperature nears the setpoint (figure 6.2H).

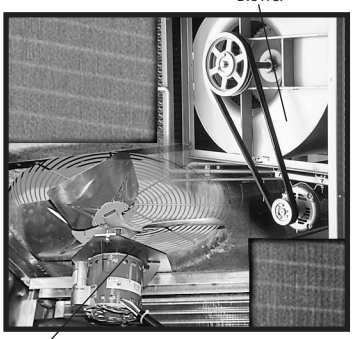


Figure 6.2B2

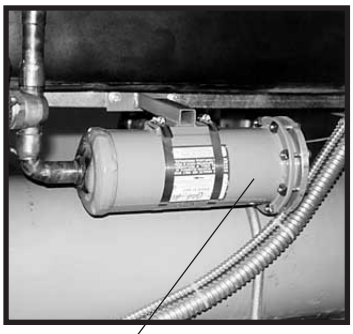


Figure 6.2C

Figure 6.2D

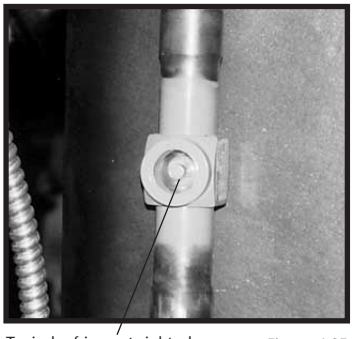


Figure 6.2E

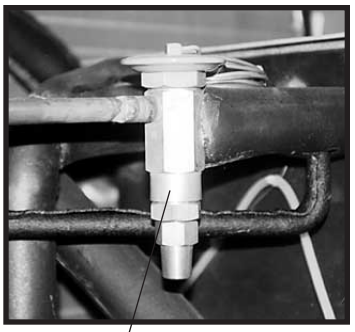
H. **HIGH/LOW PRESSURESTATS:** the high/low pressurestats protect the refrigeration system from unsafe operating levels. The **high pressure switch** is factory set to open at 325 psi and protects the refrigeration components and personnel from potential damage of injury from excessive high pressure. The high pressure safety must not be altered in the field for any reason. The **low pressure switch** is factory set to open at 58 psi and to close at 63 psi. The low pressure switch protects the chillers from possible damage due to low operating pressure. The low pressure switch is field adjustable for setpoints below 48°F (figure 6.2I).

I. **Liquid receiver:** located after the condenser, this component receives and stores liquid refrigerant leaving the condenser.

J. **Service valves:** have been provided throughout the system. Only a qualified refrigeration service technician shall operate these valves.

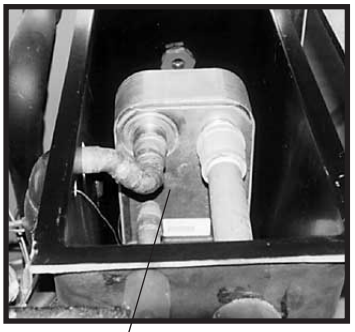
K. **Crankcase heater:** insures that freon and compressor crankcase oil do not mix during the compressor's 'off' cycles. (Semi-hermetic only)

L. **Oil pressure safety switch:** protects the compressor from lubrication failure. (Semi-hermetic only)



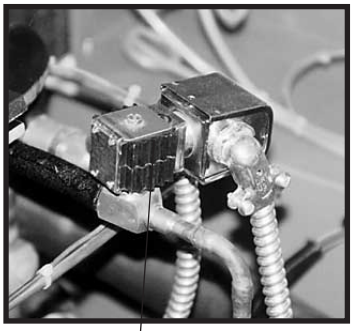
Typical expansion valve

Figure 6.2F



Typical evaporator

Figure 6.2G



Typical hot gas bypass valve

Figure 6.2H

High pressurestat

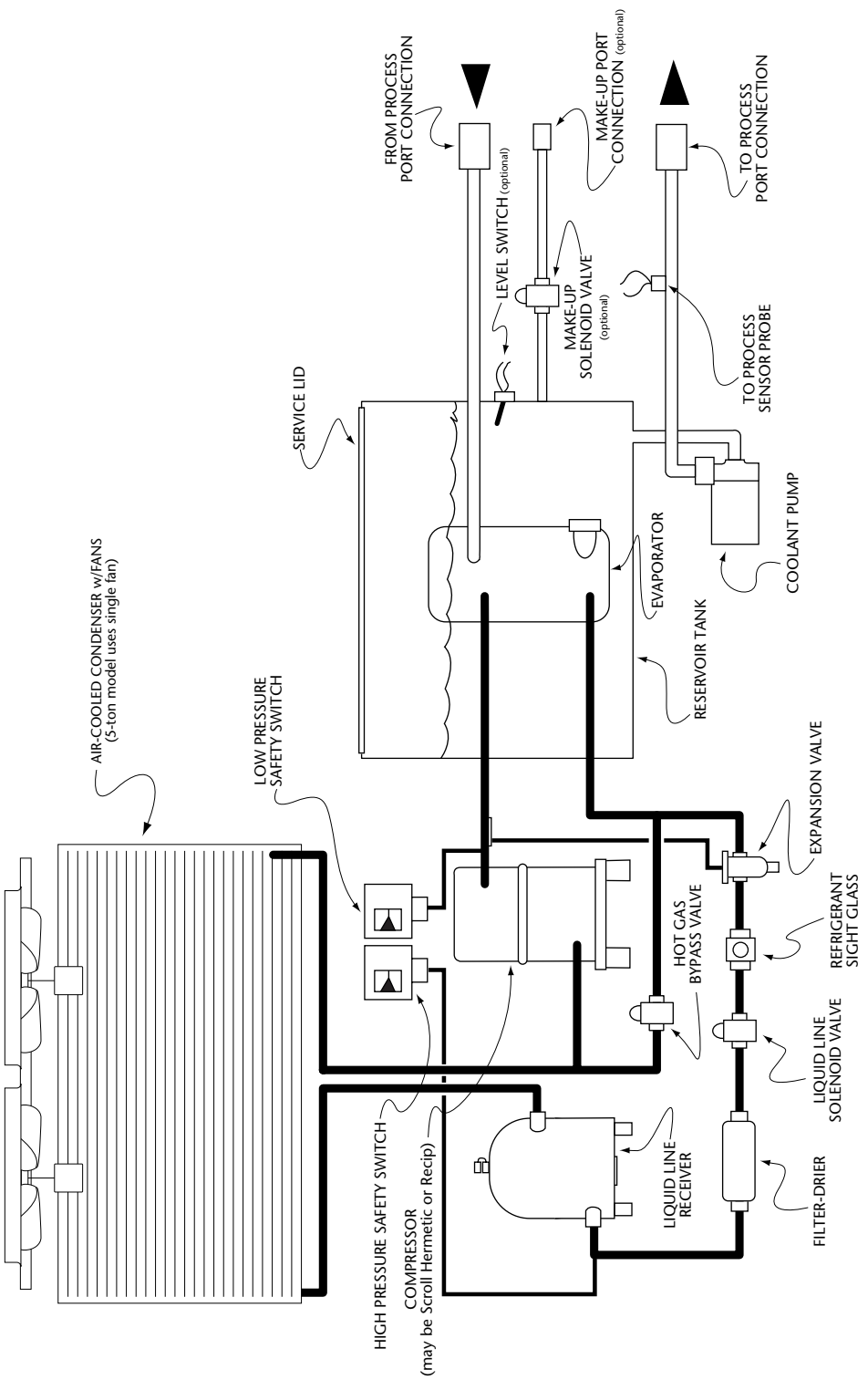
Low pressurestat

Figure 6.2I

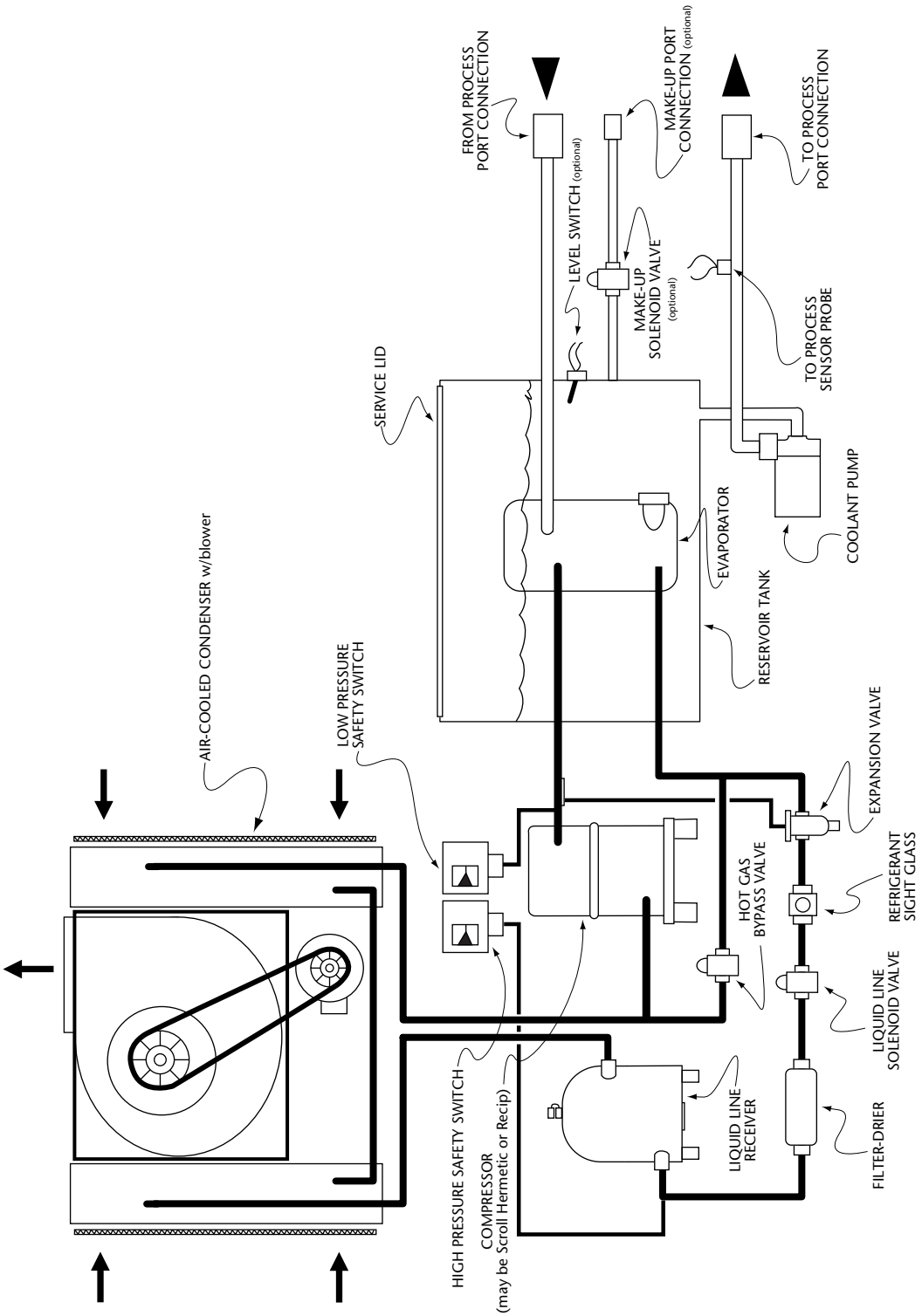
7.0 RELATED DRAWINGS

7.1 VLA-5/7.5/10 MECHANICAL SCHEMATIC
7.2 VLA-15/20/25/30 MECHANICAL SCHEMATIC
7.3 VLA-5A PHYSICAL
7.4 VLA-7.5/10 PHYSICAL
7.5 VLA-15/20/25/30 PHYSICAL
7.6 DUCT SCHEMATIC FOR AIR COOLED CHILLERS
7.7 VLA-5A/7.5/10 ELECTRICAL
7.8 VLA-15/20/25/30 ELECTRICAL
7.9 VLW-5/7.5/10 MECHANICAL SCHEMATIC
7.10 VLW-15/20/25/30 MECHANICAL SCHEMATIC
7.11 VLW-5/7.5/10 PHYSICAL
7.12 VLW-15/20/25/30/40 PHYSICAL
7.13 VLW-5/7.5/10 ELECTRICAL
7.14 VLW-15/20/25/30 ELECTRICAL

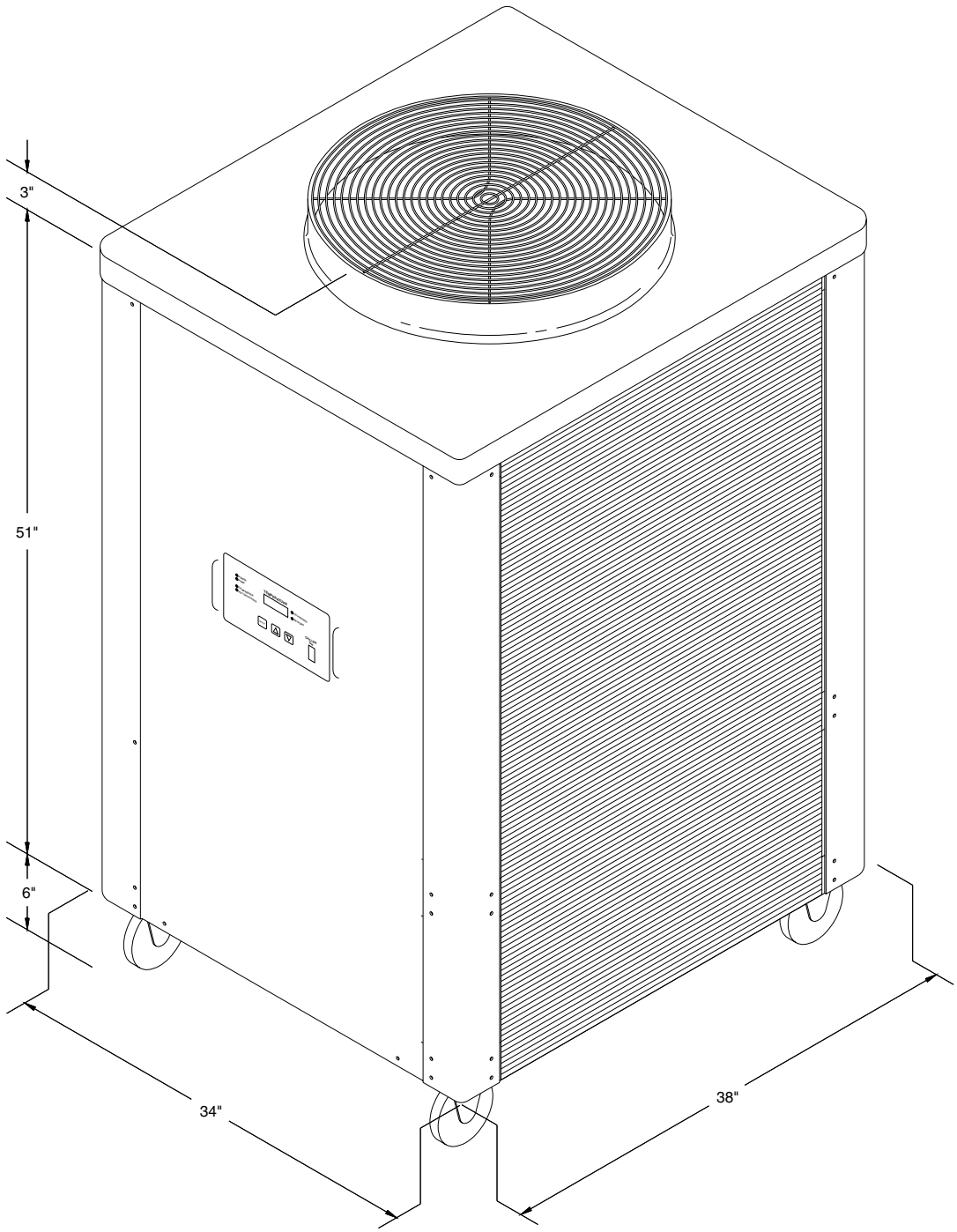
7.1 VLA-5/7.5/10 MECHANICAL SCHEMATIC



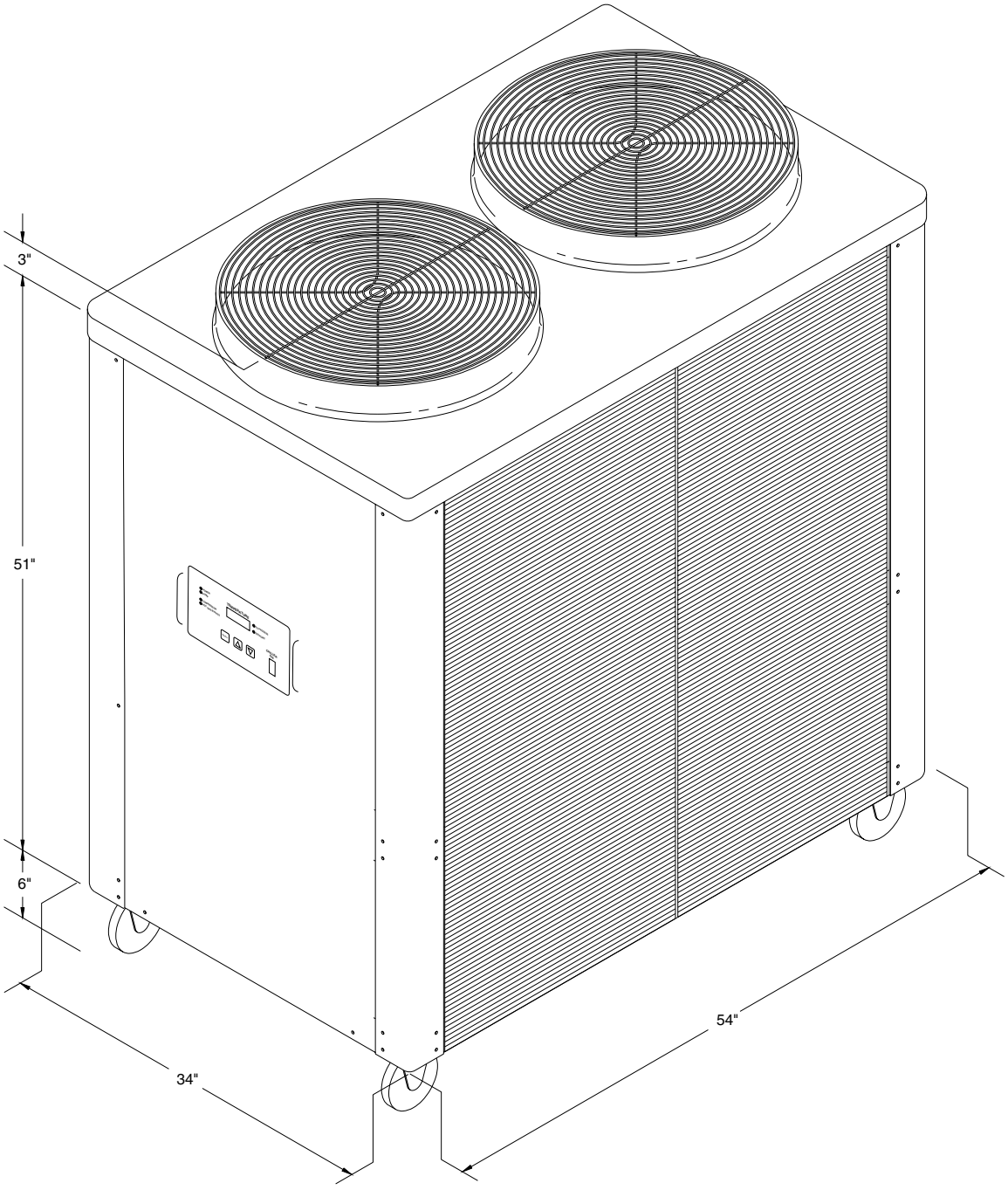
7.2 VLA-15/20/25/30 MECHANICAL SCHEMATIC



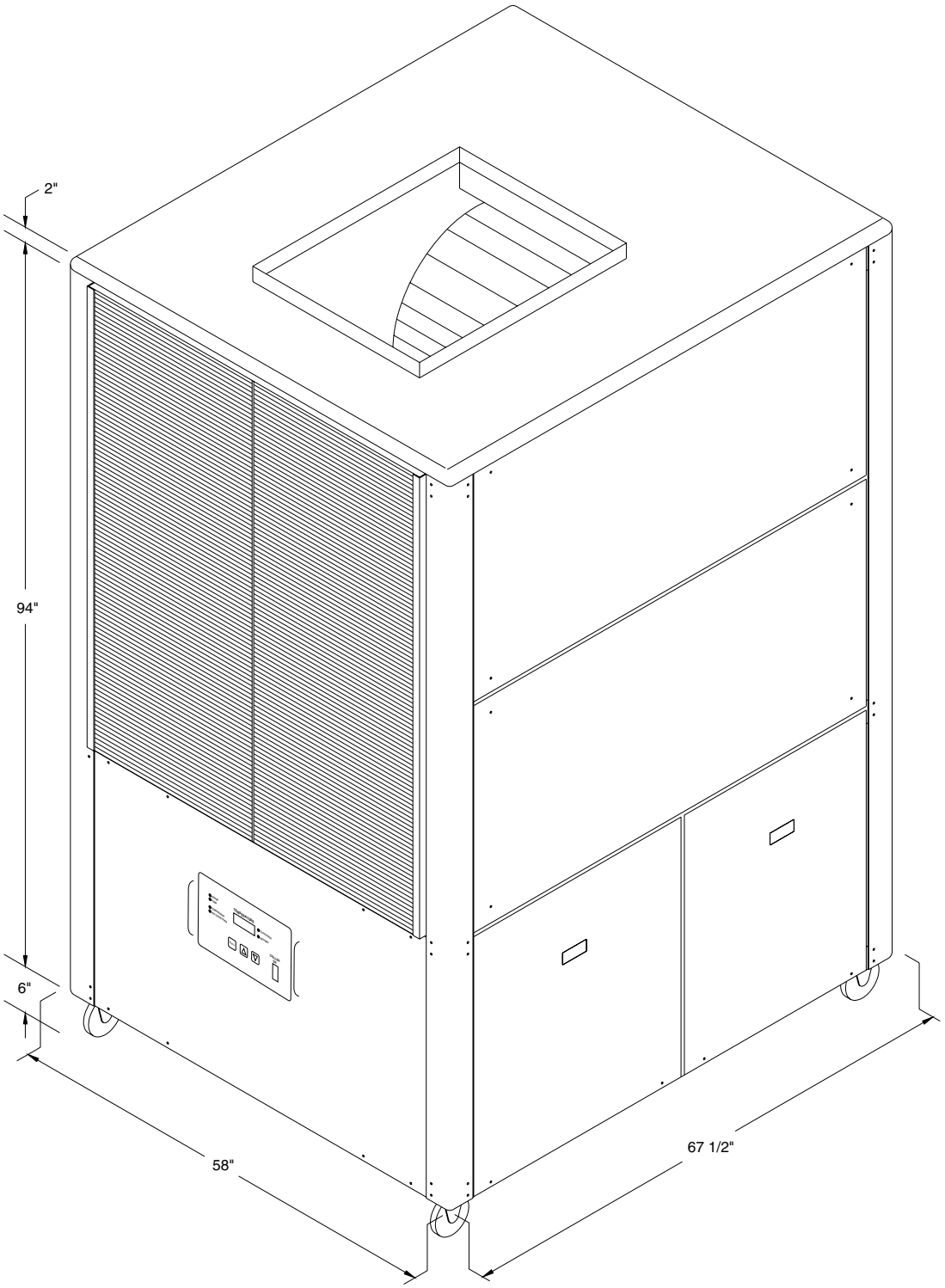
7.3 VLA-5 PHYSICAL



7.4 VLA-7.5/10 PHYSICAL

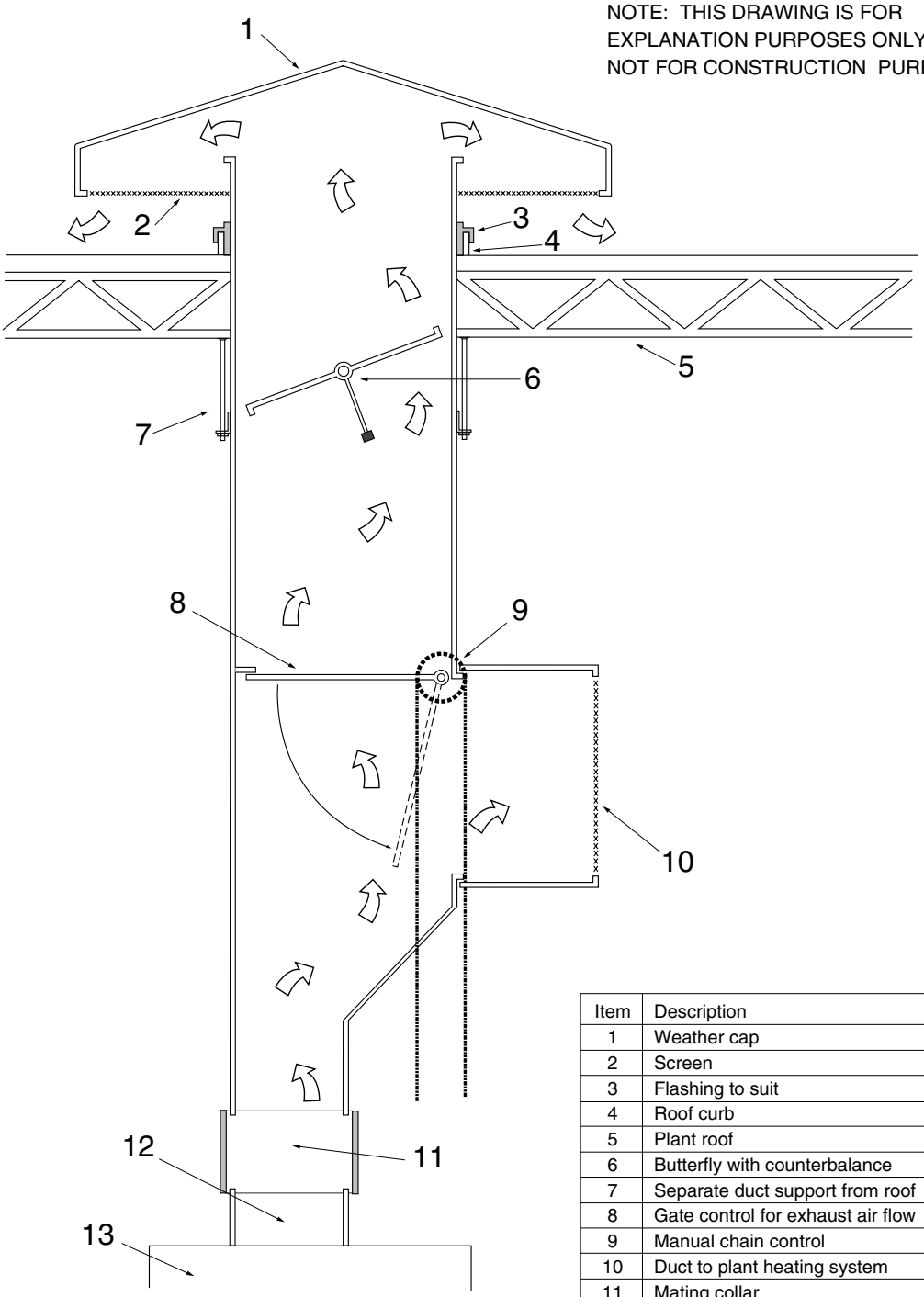


7.5 VLA-15/20/25/30 PHYSICAL



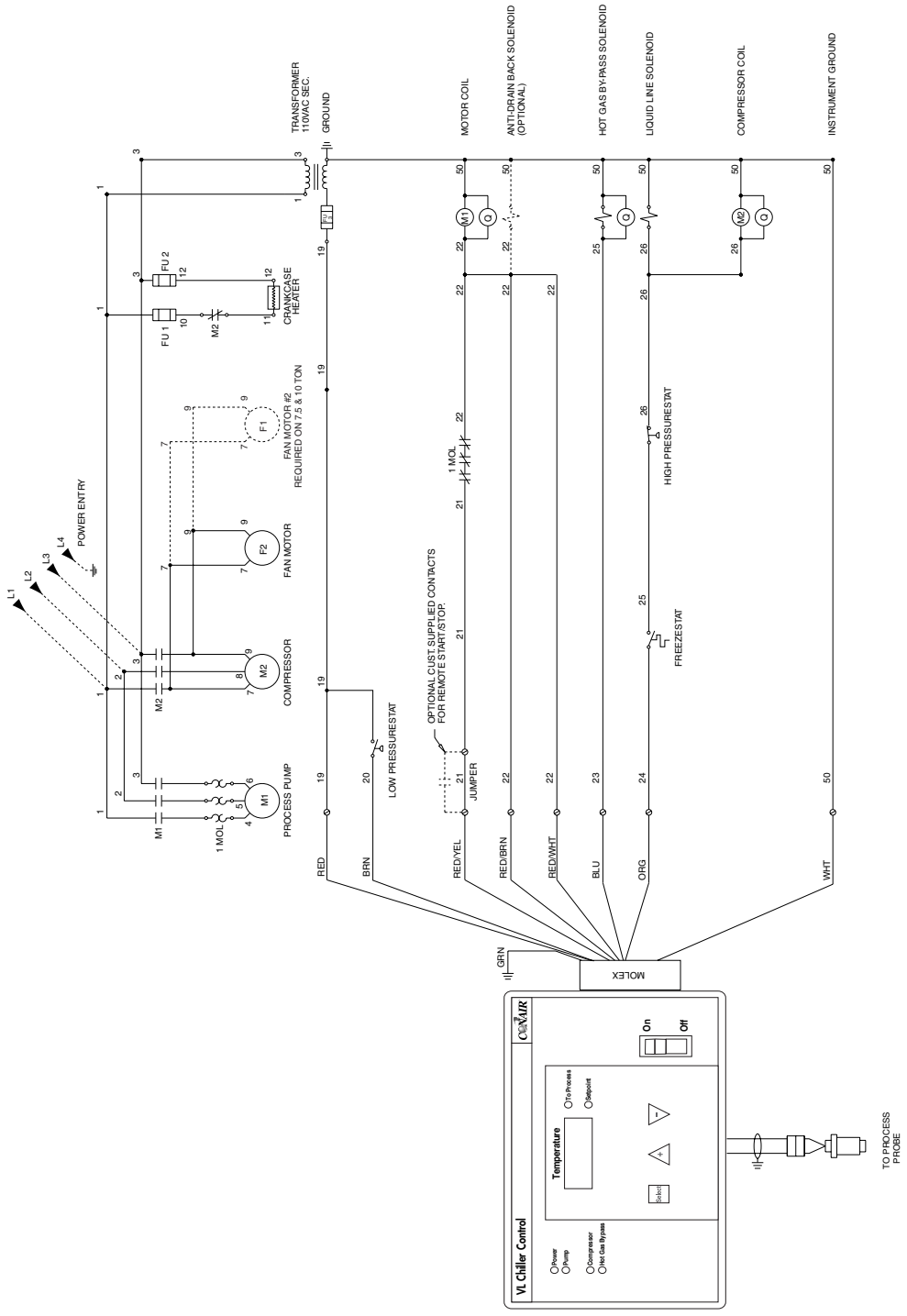
7.6 DUCT SCHEMATIC FOR AIR COOLED CHILLERS

NOTE: THIS DRAWING IS FOR EXPLANATION PURPOSES ONLY, NOT FOR CONSTRUCTION PURPOSES



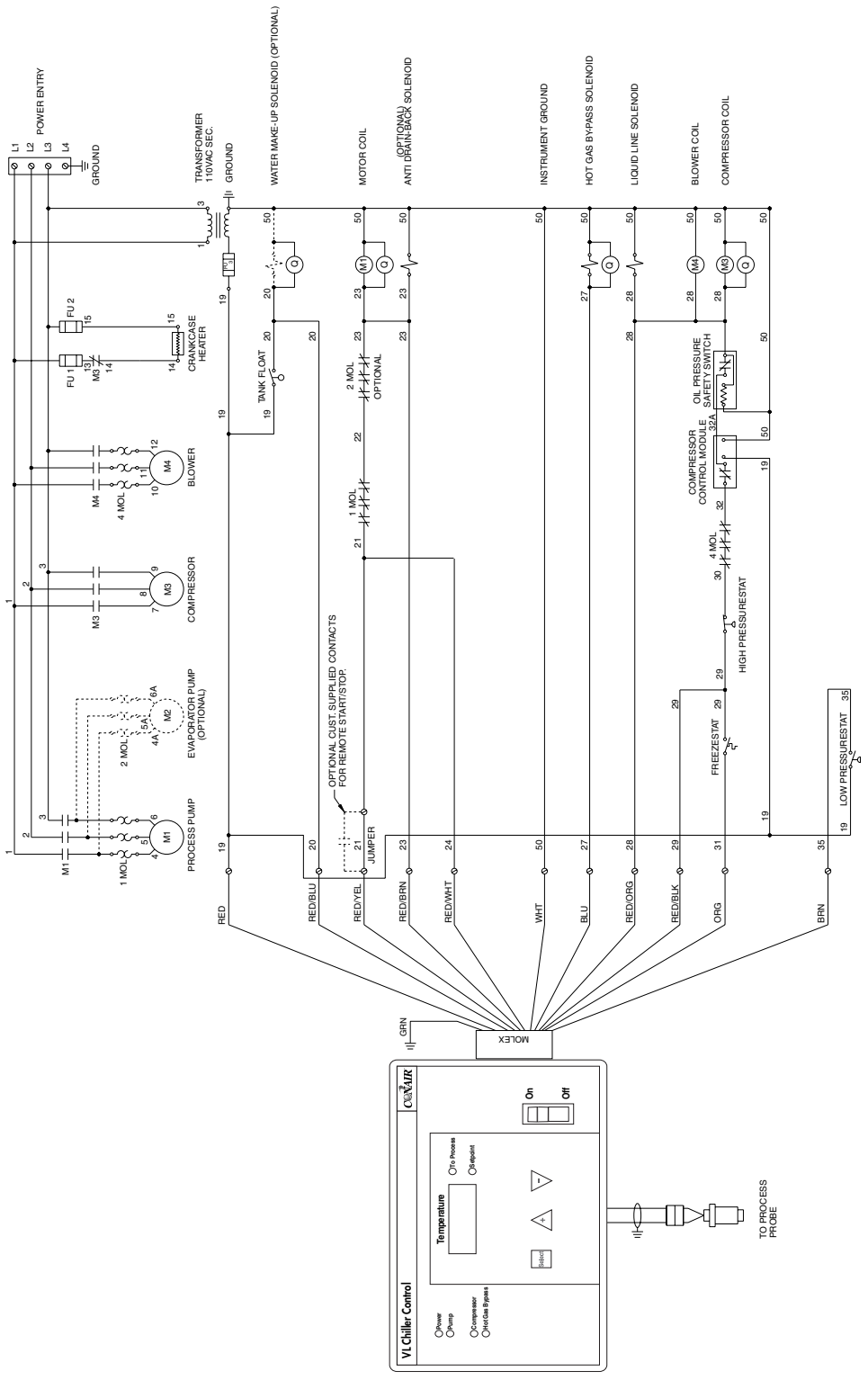
Item	Description
1	Weather cap
2	Screen
3	Flashing to suit
4	Roof curb
5	Plant roof
6	Butterfly with counterbalance
7	Separate duct support from roof
8	Gate control for exhaust air flow
9	Manual chain control
10	Duct to plant heating system
11	Mating collar
12	Chiller air exhaust port
13	Air cooled chiller

7.7 VLA-5/7.5/10 ELECTRICAL



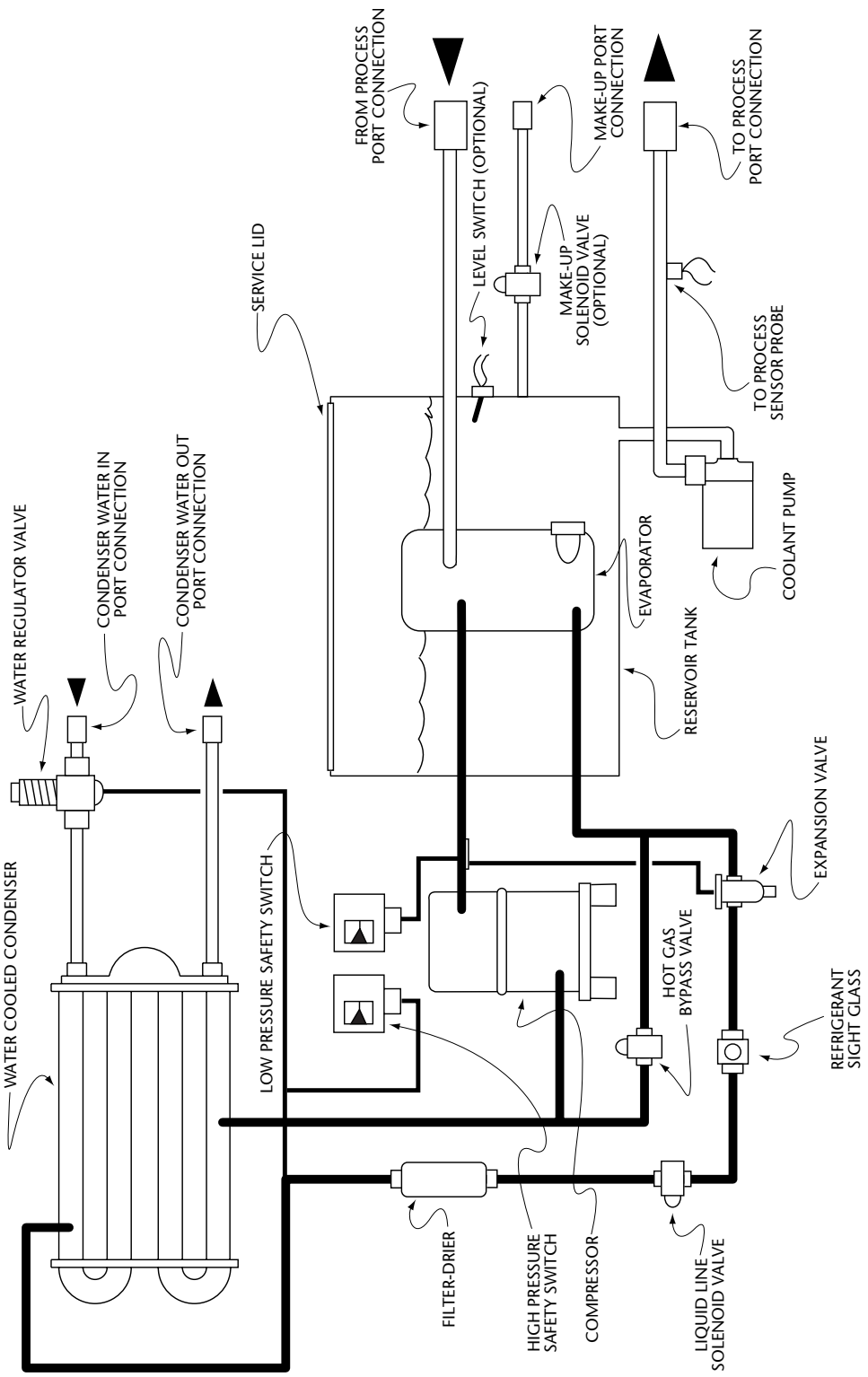
This electrical drawing is presented for illustration purposes only.
For exact details, consult the electrical drawing supplied with your machine.

7.8 VLA-15/20/25/30 ELECTRICAL

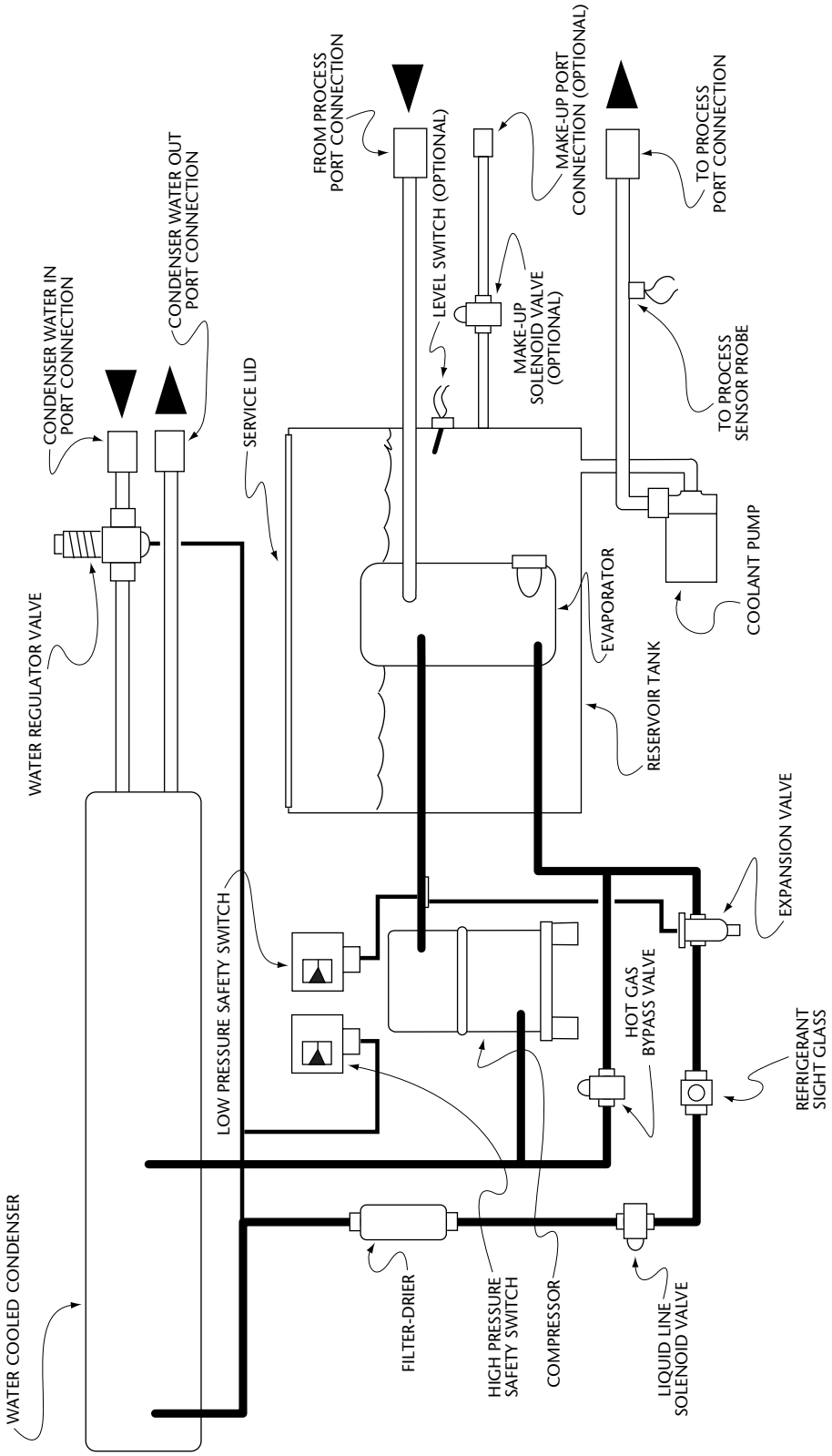


This electrical drawing is presented for illustration purposes only.
For exact details, consult the electrical drawing supplied with your machine.

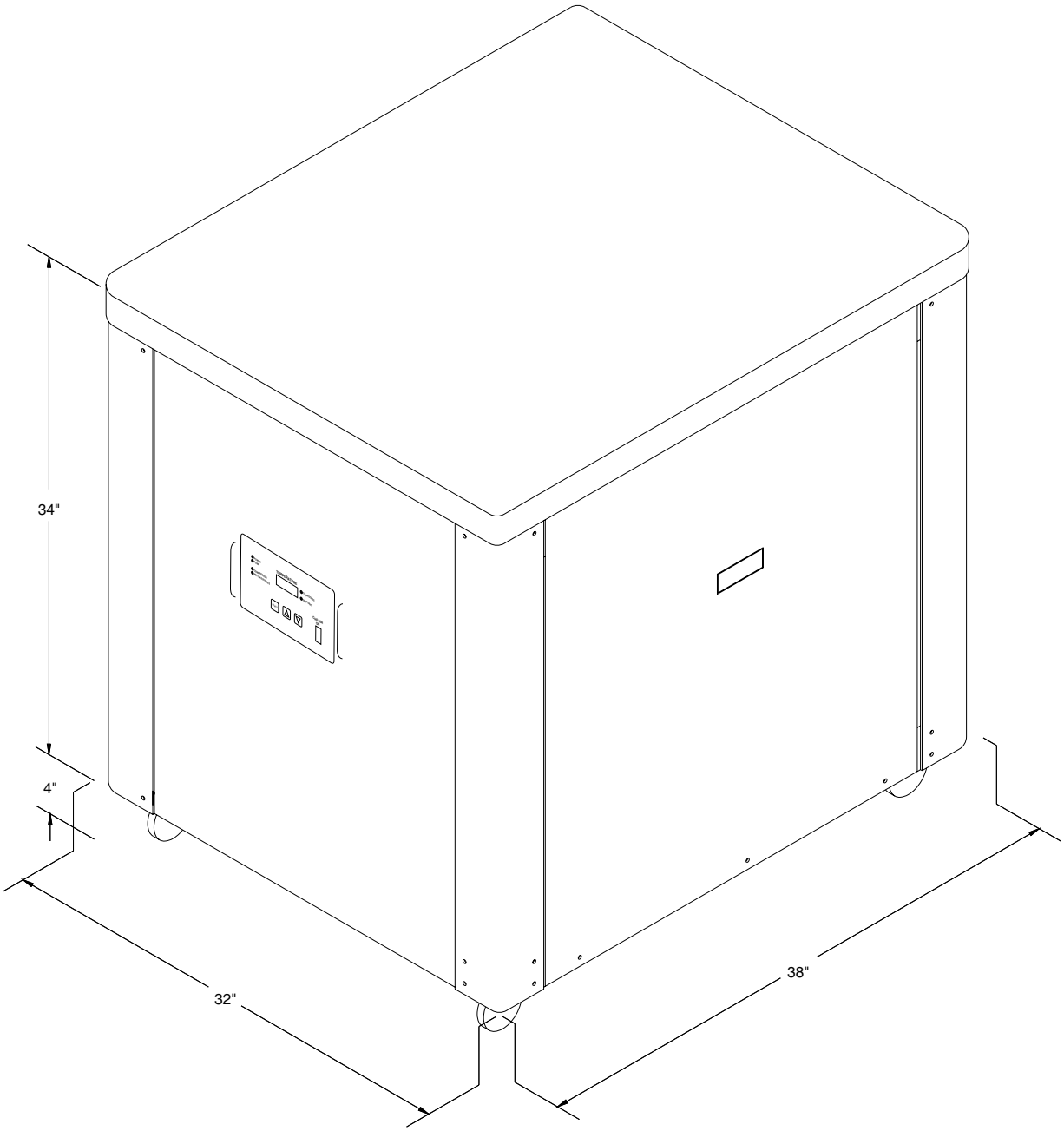
7.9 VLW-5/7.5/10 TON MECHANICAL SCHEMATIC



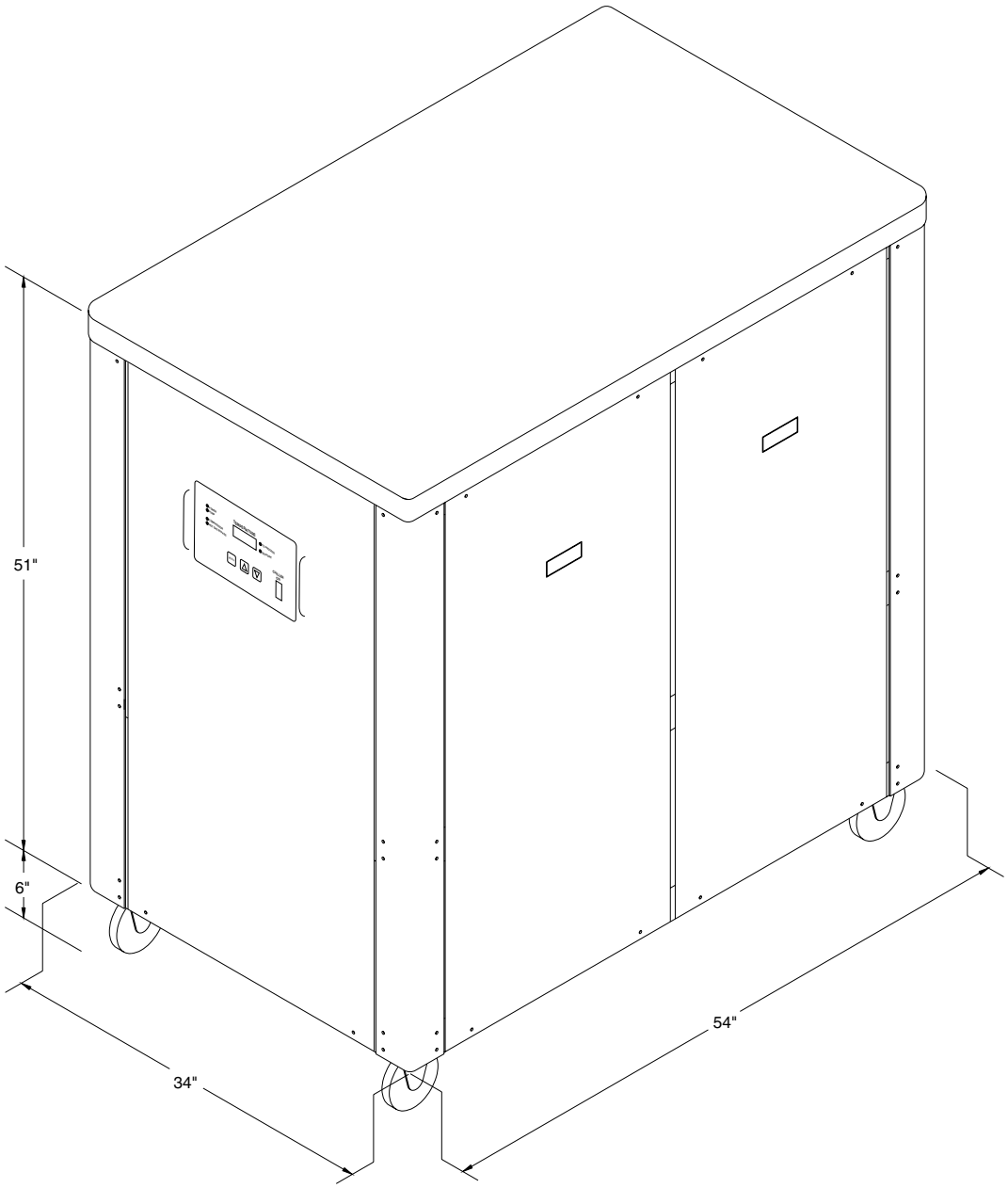
7.10 VLW-15/20/25/30 TON MECHANICAL SCHEMATIC



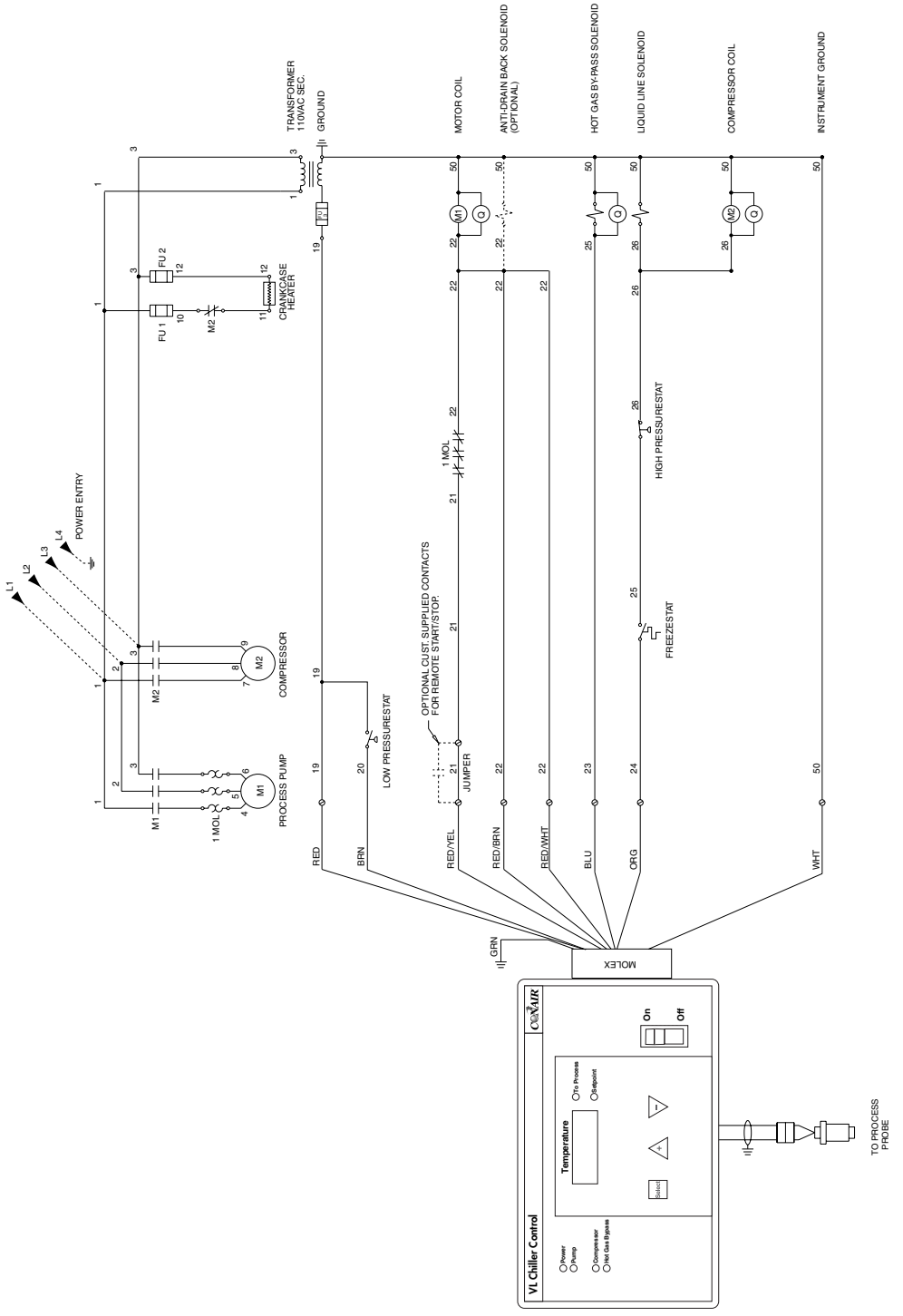
7.11 VLW 5/7.5/10 TON PHYSICAL



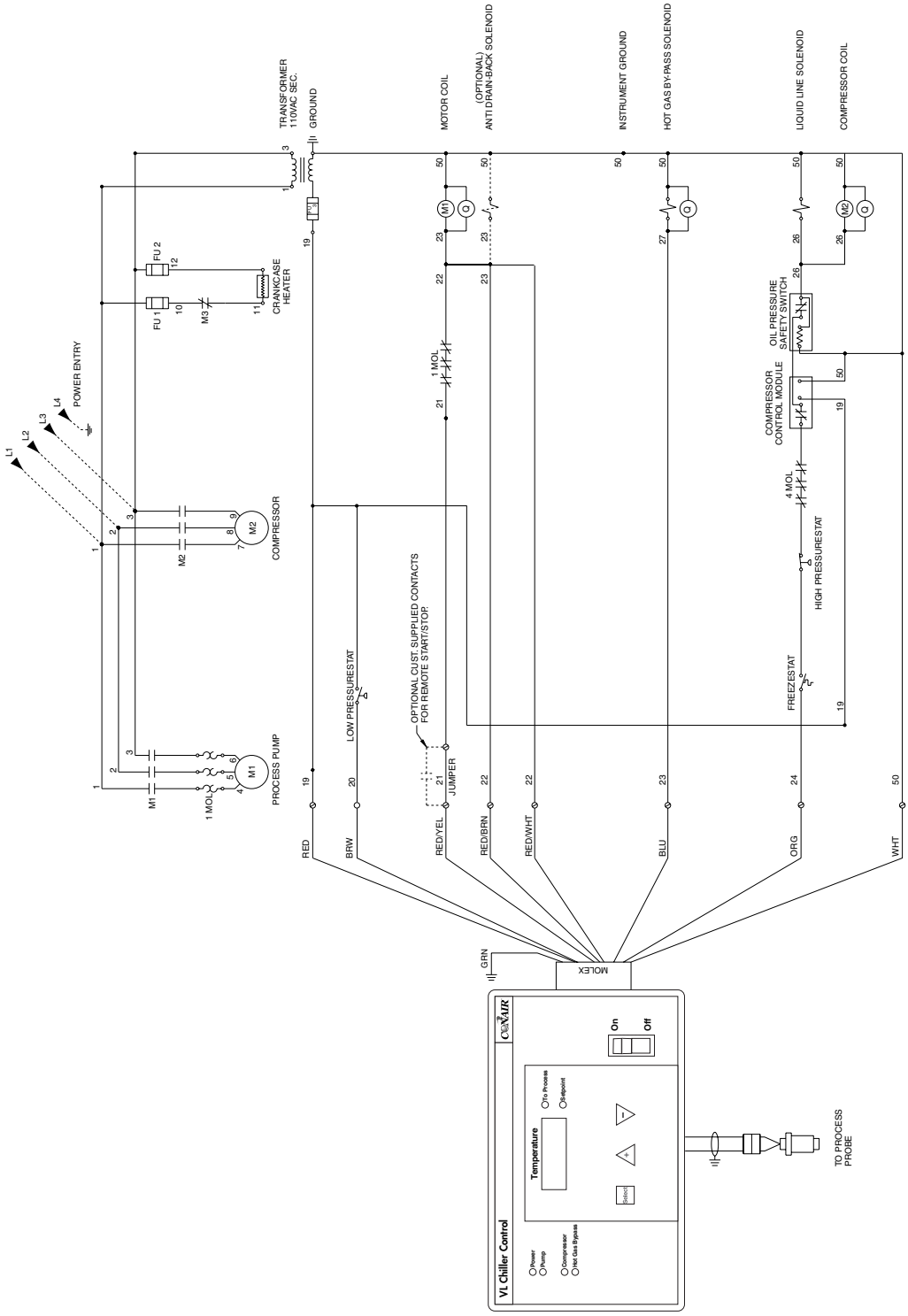
7.12 VLW 15/20/25/30 TON PHYSICAL



7.13 VLW 5/7.5/10 TON ELECTRICAL



7.14 VLW 15/20/25/30 TON ELECTRICAL



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8.0 APPENDIX

8.1 SPECIFICATIONS

VLA MODELS, 2 TO 30 TONS

MODEL	VLA-2		VLA-4		VLA-5		VLA-7.5		VLA-10		VLA-15		VLA-20		VLA-25		VLA-30	
Performance characteristics																		
Capacity* ton	2		4		5		7.5		10		15		18		24		26	
Compressor Hp {kW}†	2 {1.5}		4 {2.9}		5 {3.7}		7.5 {5.6}		10 {7.5}		15 {11}		2x10 {15}		2x13 {19}		2x15 {22}	
Pump Hp {kW}	0.75 {5.6}		0.75 {5.6}		2 {1.5}		2 {1.5}		2 {1.5}		3 {2.2}		3 {2.2}		5 {3.7}		5 {3.7}	
Process flow‡ gpm {lpm}	4.8 {18}		8.4 {32}		12 {45}		18 {68}		24 {90}		36 {136}		48 {182}		60 {227}		72 {273}	
Process pressure§ psi {bar}	40 {2.76}		38 {2.62}		63 {4.34}		58 {4.0}		57 {3.9}		45 {3.1}		41 {2.83}		59 {4.07}		57 {3.93}	
Reservoir capacity gal {liters}	15 {57}		25 {95}		25 {95}		25 {95}		25 {95}		65 {246}		65 {246}		65 {246}		65 {246}	
Condenser assembly type	Fan		Fan		Fan		Fan		Fan		Blower		Blower		Blower		Blower	
Condenser fan power Hp {kW}	0.33 {0.25}		0.75 {5.6}		0.75 {5.6}		1.5 {1.1}		1.5 {1.1}		7.5 {5.6}		10 {7.5}		15 {11}		20 {15}	
Condenser air flow ft³/min	2,000		5,000		5,000		10,000		10,000		15,000		20,000		25,000		30,000	
{liters/min}	{56,634}		{141,584}		{141,584}		{283,168}		{283,168}		{424,752}		{566,337}		{707,921}		{849,505}	
Condenser static pressure, in. H_20	—		—		—		—		—		1.35		1.35		1.30		1.30	
Dimensions in {mm}																		
Height	30 {762}		60 {1524}		60 {1524}		60 {1524}		60 {1524}		96 {2438}		96 {2438}		96 {2438}		96 {2438}	
Width	24 {610}		34 {864}		34 {864}		34 {864}		34 {864}		58 {1473}		58 {1473}		58 {1473}		58 {1473}	
Depth	37 {940}		40 {1016}		40 {1016}		56 {1422}		56 {1422}		70 {1778}		70 {1778}		70 {1778}		70 {1778}	
Pipe size NPT in.																		
Process (to and from)	0.75		1.0		1.25		1.25		1.25		1.5		1.5		2.0		2.0	
Make-up (optional)	0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5	
Weight lb {kg}																		
Shipping	415 {188}		600 {272}		700 {318}		1250 {567}		1300 {590}		1790 {812}		2100 {953}		2300 {1043}		2300 {1043}	
Voltage running/full load amps**	run	full	run	full	run	full	run	full	run	full	run	full	run	full	run	full	run	full
230V/3 phase/60hz	15	15	25	25	26	30	36	45	42	45	78	90	88	100	122	138	148	168
460V/3 phase/60hz	7	7	12	12	13	15	18	23	21	26	39	45	44	50	61	69	74	84
575V/3 phase/60hz	—	—	10	10	11	12	15	19	17	21	32	36	36	40	49	56	60	68
Refrigerant	HCFC-22																	

SPECIFICATION NOTES

* Ton capacity at 12,000 BTU/ton @ 50°F LWT @ 115°F condensing temperature. Consult factory for other conditions. Capacity ratings are ± 5% based on compressor manufacturer's ratings and are subject to change without notice. Capacity multipliers are: 50°F - 1.00; 40°F - 0.80; 30°F - 0.60; 20°F - 0.40.

† Hermetic scroll compressor.

‡ Based on 50°F (10°C) water temperature leaving the chiller and 60°F (16°C) water temperature returning to the chiller.

§ Pressure at pump discharge. Consult pump curve for exact characteristics.

** Standard voltage is 208-230V/3 phase/60Hz. All others are optional. No allowance for inrush. Service disconnect by owner. Full load amps must be used to size disconnects and supply conductors.

Specifications can change at any time. Contact your Conair representative for the most current information.

VLW MODELS, 2 TO 40 TONS

MODEL	VLW-2		VLW-3	
Performance characteristics				
Capacity* ton	2		3	
Compressor Hp {kW}	2 {1.5}		3 {22}	
Pump Hp {kW}	0.75 {0.56}		0.75 {0.56}	
Chilled water flow† gpm {lpm}	4.8 {18}		7.2 {27}	
Chilled water pressure† psi {bar}	40 {2.76}		39 {2.69}	
Reservoir capacity gal {liters}	15 {56.8}		15 {56.8}	
Compressor type	Hermetic		Hermetic	
Condenser water requirements ‡				
City gpm {lpm}	6 {23}		9 {34}	
Tower gpm {lpm}	3 {11}		4.5 {17}	
Dimensions in {mm}				
Height	30 {762}		30 {762}	
Width	24 {610}		24 {610}	
Depth	37 {940}		37 {940}	
Pipe size NPT in.				
Process (to and from)	0.75		0.75	
Make-up (optional)	0.5		0.5	
Condensing	0.5		0.5	
Weight lb {kg}				
Shipping	445 {202}		470 {213}	
Voltages running/full load amps§	run	full	run	full
230V/3 phase/60hz	12	12	17	17
460V/3 phase/60hz	6	6	8	8
575V/3 phase/60hz	—	—	—	—
Refrigerant Type	HCFC-22			

SPECIFICATION NOTES

* Ton capacity at 12,000 BTU/ton @ 50°F LWT @ 115°F condensing temperature. Capacities may be ± 5% as reserved by the compressor manufacturer. Capacity multipliers are: 50°F - 1.00; 40°F - 0.80; 30°F - 0.60; 20°F - 0.40.

† Consult pump curve for exact characteristics.

‡ Flow (GPM) rate is based on 60°F city water, 85°F tower water at 20 PSI with a clean condenser.

§ No allowance for inrush. Service disconnect by owner. Full load amps must be used to size disconnects and supply conductors.

Specifications can change at any time. Contact your Conair representative for the most current information.

MODEL	VLW-5		VLW-7.5		VLW-10		VLW-15		VLW-20		VLW-25		VLW-30		VLW-40	
Performance characteristics																
Capacity* ton	5.1		9.1		11.5		15		19		24		27		40	
Compressor number x Hp {kW}	5 {3.7}		7.5 {5.6}		10 {7.5}		15 {11}		2x10 {15}		2x13 {19}		2x15{22}		40 {29}	
Pump Hp {kW}	2 {1.5}		2 {1.5}		2 {1.5}		3 {2.2}		3 {2.2}		5 {3.7}		5 {3.7}		7.5 {5.6}	
Chilled water flow† gpm {lpm}	12{45}		22 {83}		28 {106}		36 {136}		48 {182}		60 {227}		72 {273}		92 {348}	
Chilled water pressure† psi {bar}	63 {4.34}		58 {4}		57 {3.9}		45{3.1}		41 {2.83}		59 {4.07}		57 {3.93}		61 {4.2}	
Reservoir capacity gal {liters}	25 {95}		25 {95}		25 {95}		65 {246}		65 {246}		65 {246}		65 {246}		65 {246}	
Compressor type	Scroll		Scroll		Scroll		Scroll		Scroll		Scroll		Scroll		Semi-hermetic	
Condenser water requirements‡																
City gpm {lpm}	7 {26}		14 {53}		17 {64}		23 {87}		30 {114}		38 {106}		45 {170}		60 {227}	
Tower gpm {lpm}	15 {57}		28 {106}		35 {132}		45 {170]		60 {227}		75 {284}		90 {341}		170 {644}	
Dimensions in {mm}																
Height	40 {102}		40 {102}		40 {102}		57 {1448}		57 {1448}		57 {1448}		57 {1448}		57 {1448}	
Width	32 {813}		32 {813}		32 {813}		34 {864}		34 {864}		34 {864}		34 {864}		34 {864}	
Depth	40 {102}		40 {102}		40 {102}		40 {102}		56 {1422}		80 {2032}		80 {2032}		80 {2032}	
Pipe size NPT in.																
Process (to and from)	1.25		1.25		1.25		1.5		1.5		2.0		2.0		2.5	
Make-up (optional)	0.5		0.5		0.5		0.5		0.5		0.5		0.5		0.5	
Condensing	0.75		1.0		1.0		1.25		1.25		1.25		1.5		2.0	
Weight lb {kg}																
Shipping	550 {249}		600 {318}		625 {283}		1500 {680}		1900 {862}		2100 {953}		2200 {998}		2500 {1134}	
Voltages running/full load amps§	run	full	run	full	run	full	run	full	run	full	run	full	run	full	run	full
230V/3 phase/60hz	22	26	32	40	38	48	54	68	58	72	58	72	90	114	126	166
460V/3 phase/60hz	11	13	16	20	19	24	27	34	29	36	29	36	45	57	63	83
575V/3 phase/60hz	9	9	13	16	16	19	22	22	24	24	24	24	36	36	5	5
Refrigerant Type	HCFC-22															

8.2 OPERATION BELOW 48°F

A. A chiller typically operates with a setpoint of 50°F or higher. However, if setpoints between 20° - 48°F are required, special precautions must be taken to prevent freezing and possible damage. Attention must be given to freeze protection, water supply and safety adjustments.

B. FREEZE PROTECTION

1. It is understood that untreated water freezes at 32°F. Therefore, an inhibited propylene glycol and water solution must be used in lieu of ordinary water. Prescribed amounts are listed in figure 8.2A.

OPERATING TEMPERATURE	ANTI-FREEZE MIXTURE GLYCOL	WATER
40°F	20%	80%
25°F	25%	75%
30°F	30%	70%

Figure 8.2A

2. On initial installation of the unit, the water/glycol solution should be premixed, then added to the reservoir. After the pump has been started, water lines filled and air purged, it may be necessary to add more water/glycol solution to maintain the recommended reservoir level. **Note:** a hygrometer should be used on a regular basis to determine the mixture strength according to freeze point. The freeze point temperature should be 25° below the lowest required setpoint. Water will evaporate from the mixture, and if you continue to add a premixed solution eventually you will have too much glycol. It is necessary to add water or glycol to maintain proper freeze point temperature.

3. **PLEASE NOTE THAT A CHILLER IS NOT DESIGNED TO ACCOMMODATE AUTOMOTIVE TYPE ANTI-FREEZE.** This is due to the fact that automotive type anti-freeze contains silicates that adhere to heat transfer surfaces of the system preventing maximum heat transfer. Also, improper portions of inhibited propylene glycol to water inhibits effective heat transfer. Consult the chiller's operating manual for specific details.

C. WATER SUPPLY

1. The automatic water supply (if equipped) restores the reservoir water level as needed. However, if untreated water is added to an water/glycol solution, dilution will occur

decreasing the freeze protecting ability of the solution. Therefore, the water supply source must be disconnected and the connection capped. The operator must monitor the water/glycol level and manually make-up to maintain proper reservoir level.

D. SAFETY ADJUSTMENTS

1. To ensure safe and efficient operations at lower setpoints, adjustments of the freezestat and low pressurestat factory settings are required. Figure 8.2B lists the appropriate settings.

OPERATING TEMPERATURE	LOW CUT IN	LOW CUT OUT	FREEZESTAT SETTING
48°F	55#	40#	38°F
40°F	50#	35#	30°F
35°F	45#	30#	25°F
30°F	40#	25#	20°F

Figure 8.2B

2. The freezestat serves as the mainline defense against freezing in that it shuts down the chiller if the coolant temperature ever decreases to its setting. For mechanical freezestats, adjustments are made by removing the cover and rotating the selector dial with a screwdriver. Electronic freezestats are adjusted through the setup parameters via the instrument control panel.

3. The low pressurestat serves to protect the compressor from unsafe suction pressures. Suction pressures decrease with lower operating setpoints. To prevent short cycling of the compressor, the low pressurestat must be adjusted to accommodate the lower setpoint. Adjustments to the low pressurestat are made by rotating the adjusting screws on top of the control and observing the movement of the pointers in the control window until the prescribed setting is determined.

E. PRECAUTIONS

1. At any setpoint, the possibility of freezing exists and it is the operator's responsibility to take necessary action to prevent freezing at all times.

8.3 WATER QUALITY CONTROL

A. Lack of, as well as, improper water treatment can damage the chilling unit. The services of a competent water treatment specialist should be obtained and their recommendations followed. It is the equipment owner's responsibility to prevent damage from foreign material or inadequate water treatment.

B. The two main things to consider for water treatment in chillers are corrosion and organism growth. Proper chemical treatment can control PH levels and algae growth. An alternative to chemical treatment is the addition of 20% inhibited propylene glycol to the water. This will help prevent organism growth and coat the heat transfer surfaces with corrosion inhibitor.

8.4 INHIBITED PROPYLENE GLYCOL

A. The use of a water-glycol mixture is needed when the operator desires a process temperature below 48°F. Freeze protection is required so ice crystals do not form and cause severe damage to both the water and refrigeration system.

FREEZING POINTS FOR WATER/PROPYLENE GLYCOL SOLUTIONS

PERCENTAGE OF GLYCOL*	PERCENTAGE OF WATER	FREEZE POINT °F	FREEZE POINT °C
0	100	32	0
10	90	25	-3.9
20	80	10	-12.2
30	70	0	-17.8
40	60	-10	-23.3
50	50	-30	-34.4
60	40	-60	-51.4

*PROPLYLENE GLYCOL

NOTE: GLYCOL FREEZE POINT MUST BE 25˚F BELOW LOWEST SETPOINT

B. CHOOSING THE PROPER GLYCOL:

1. For getting the most efficiency from your system, a propylene glycol such as "DowFrost" is a must. DowFrost contains special corrosion inhibitors for low system maintenance and better transfer capabilities than normal glycols. It also has a much longer fluid life up, to 20 years in some cases.

2. **SOURCES OF INHIBITED PROPYLENE GLYCOLS:** for a complete literature package, material, safety data sheets and purchasing information, contact the following:

DOW CHEMICAL 1-800-447-4369
(Canada 1-800-363-6250)
Dowfrost inhibited propylene glycol

MONSANTO CHEMICAL 1-800-459-2665
Monsanto FS inhibited propylene glycol

C. USE OF PLAIN GLYCOL:

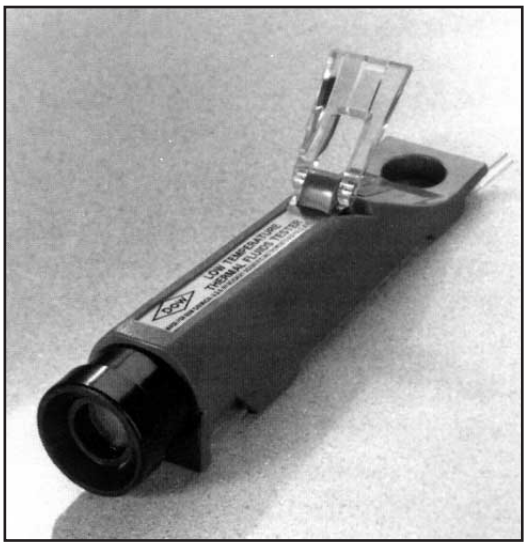
1. Even through they do lower the freeze point, plain glycols are even more corrosive than water. The corrosion rate of plain ethylene glycol on iron, for example, is more than 2.5 times faster than plain water. On steel, it is 4.5 times faster.

D. AUTOMOTIVE BASED ANTIFREEZE:

1. **SHOULD NEVER BE USED!** Automotive antifreeze contains silicate based inhibitors, which are compatible with automotive components. In an industrial application, the silicates will leach out and form a gel-like substance on the heat transfer surfaces and reduce cooling efficiency of the system. These silicates have shown to significantly reduce the lifetime of pump seals.

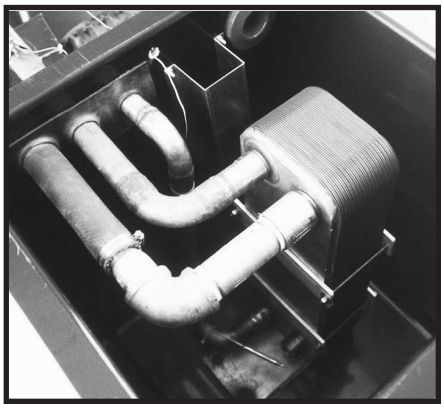
E. MAINTENANCE RESPONSIBILITY:

1. A hygrometer should be used on a regular basis to determine the mixture strength according to freeze point. The freeze point temperature should be 25°F below the lowest required setpoint (see chart on page 59). Water will evaporate from the mixture, and if you continue to add a premixed solution, eventually you will have too much glycol. It is necessary to add water or glycol to maintain proper freeze point temperature. The device pictured is by far the most accurate and easy to use for maintaining and checking for proper glycol levels.reduction in cooling capacity and is virtually impossible to remove.



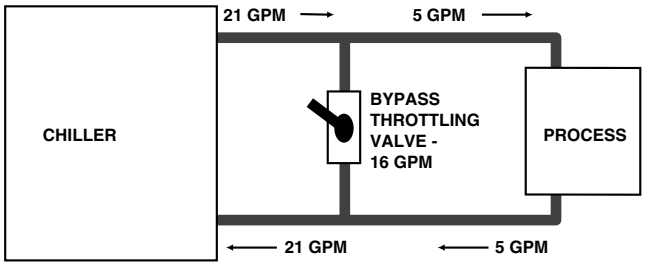
8.5 MAINTAINING PROPER WATER FLOW

A. The evaporator in a typical water chiller is flow sensitive. That is, the efficiency of operation is directly related to the flow of liquid. Maximum efficiency is obtained at approximately 2.4gpm per ton of rated capacity. Low liquid flow can reduce efficiency and in some cases allow ice to form in the evaporator which can damage the evaporator.



The evaporator is the heat exchanger where in the refrigeration circuit that allows the liquid refrigerant to absorb heat from the water. As the heat is absorbed, the liquid refrigerant changes state from liquid to vapor, and the water is chilled.

B. The **Conair** one pump chiller system is designed so that all process flow must pass through the evaporator. If the process flow is less than the 2.4 gpm required, then it will be necessary to install a low flow bypass system in the process lines (see section 8.6). This will allow a portion of the process flow to bypass the process and return directly to the chiller to keep the total flow above the 2.4 gpm per ton requirement.



C. To assure proper flow on central chillers. **Conair** installs a low flow safety switch to stop the refrigeration system if the liquid flow falls to approximately 33% of full flow. This is a paddle type flow switch which is mounted directly in the water stream.

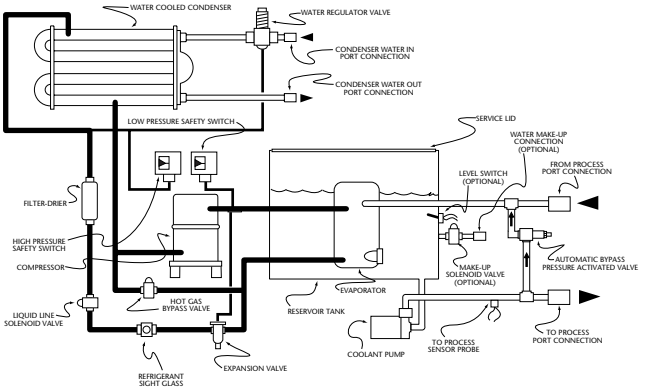
8.6 LOW FLOW BYPASS CIRCUITS

A. In cases of restricted flow or reduced capacity conditions, as an option **Conair** supplies manual or automatic low flow bypass circuits on water cooled or air cooled portable chillers. It is recommended that where low flow conditions exist, a bypass system be installed either in the field or by **Conair**. It is the ultimate responsibility of the user to make sure adequate flow through the evaporator is achieved.

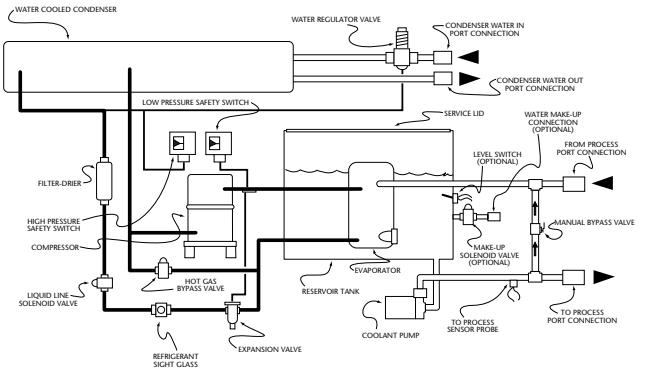
B. The low flow bypass circuit, whether automatic or manual, is designed to provide the chiller with the proper amount of flow through the chiller's evaporator continually. This prevents default on the low flow safety switch in times of restricted flow or reduced capacity.

C. **AUTOMATIC** low flow bypass circuits place a pressure actuated valve between the from process and to process lines. **Conair** presets the valve to open at the pump's dead head pressure to prevent overloading and to provide proper flow to the evaporator at all times.

D. **MANUAL** low flow bypass circuits place a ball valve between the from process and to process lines. The valve is shipped in the closed position. The valve is then field adjusted based on process requirements.



AUTOMATIC BYPASS DIAGRAM



MANUAL BYPASS DIAGRAM

8.7 OVERHEAD PIPING KIT

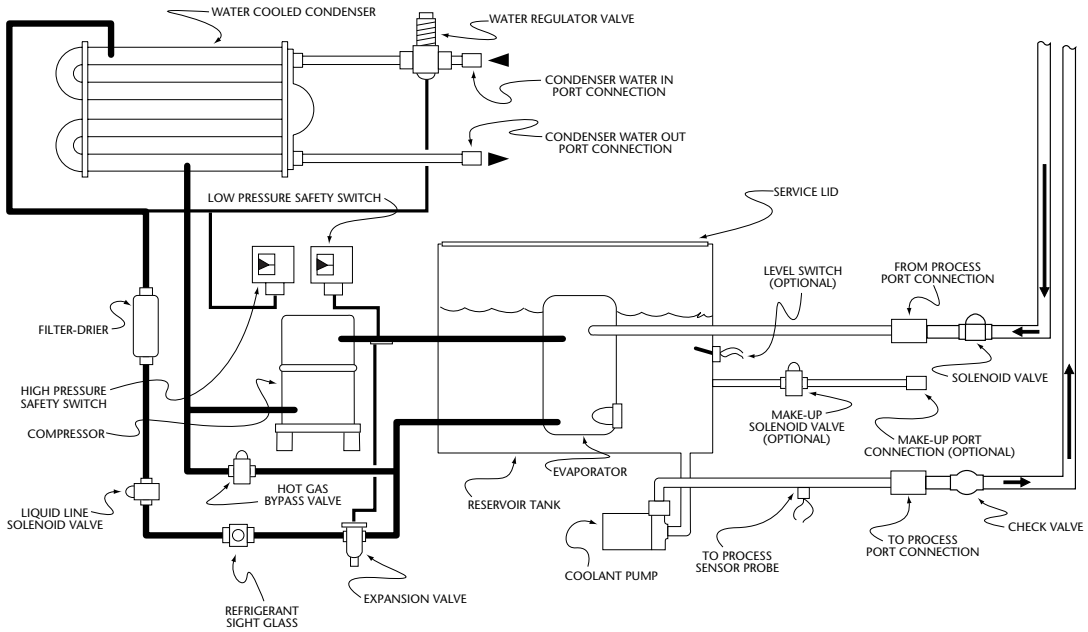
A. **Conair** portable chillers have between a 4.5 to 60 gallon reservoir capacity (depending on chiller size). When a **Conair** portable chiller is used with overhead piping, the chiller tank will overflow upon shut-down due to the drainback of water volume ***from the overhead piping system*** (which exceeds the tank capacity of the chiller). If the piping arrangement is not above the chiller tank level, then this problem will not exist.

B. To prevent tank overflow, an overhead piping kit should be installed. This kit is available from **Conair** as an option and factory installed, or can be field retrofitted.

C. The overhead piping kit places a solenoid valve on the **FROM PROCESS** line and a check valve on the **TO PROCESS** line. The solenoid valve is activated by an auxiliary contact on the process pump motor starter.

D. During operation, when the pump is on, the solenoid valve on the **FROM PROCESS** line opens to allow flow to the chiller. The check will open due to the flow generated by the pump on the **TO PROCESS** line.

E. During shut down, the solenoid valve will close preventing flow to the tank. The check valve will close as well. With both valves closed, water in the overhead piping system can not flow back to the chiller causing the chiller to overflow.



8.8 CHILLER CAPACITY AND DERATE CHART

Standard chiller rating is at 50°F. For all other temperature settings, output tonnage is altered as follows:

OUTPUT TEMPERATURE °F	FULL AVAILABLE % CAPACITY
60	105%
50	100%
45	90%
40	80%
35	70%
30	60%
25	50%
20	40%
15	30% *
10	22% *
5	15% *
0	9% *
-5	5% *

NOTES:

If operation of the chiller at less than 48°F is required, an inhibited propylene glycol solution is required.

Consult factory for chiller operation below 20°F.

Ambient conditions affect air cooled chiller operation and capacity. Standard rating is at 95°F entering air temperature. For ambient air conditions greater than 95°F, chiller derating will occur. For ambients of 95-105°F, select the next larger capacity chiller. For ambients over 105°F, consult factory.

* These ranges require special options.

8.9 PRESSURE-TEMPERATURE CHART FOR R-22 REFRIGERANT

SATURATED TEMPERATURE	FREON PRESSURE
40°F	68
45°F	76
50°F	84
55°F	93
60°F	100
65°F	112
70°F	122
75°F	132
80°F	144
85°F	156
90°F	168
95°F	182
100°F	196

THESE PRESSURE/TEMPERATURE RELATIONSHIPS ARE IN AN AT-REST, SATURATED CONDITION. FOR EXAMPLE, IF THE UNIT HAS BEEN IN A WAREHOUSE AT 40° AND IS BROUGHT INTO A ROOM WHERE IT IS 80°, IT MAY TAKE A COUPLE OF HOURS FOR THE UNIT TO WARM UP AND THE PRESSURE TO RISE TO THE SURROUNDING AMBIENT CONDITIONS.

8.10 ENGINEERING FORMULAS

1 ton = 12,000 btu
BTU = Material (lbs) X material 's specific heat X temperature difference
1 BTU = .293 watts
1 watt = 3.42 BTU
1 KW = 1000 watts
1 KW = 3420 BTUs
BTU/hr = GPM X T (for water cooled condensers)

$$\text{TONS} = \frac{\text{GPM (water) X 8.34 X 60 X temperature difference X specific heat}}{12{,}000}$$

$$\text{TONS} = \frac{\text{GPM (water) X T}}{12{,}000}$$

1 Gallon of Water = 8.34 lbs
= 231 cubic inch
= .1337 cubic feet
= 3.785 liters
= 4 quarts
1 Pound of Water = .1198 gallon
1 Cubic foot of Water = 7.481 gallons
= 62.37 pounds

1 HP = 2546.5 BTU/hr
= 745.7 watts
= 42.442 BTU/min

$$1\text{ HP} = \frac{\text{PSI X GPM}}{1199}$$

$$1\text{ HP} = \frac{\text{Feet of Head X GPM x Specific Gravity}}{2772}$$

PSI = .4331 X Feet of Head

$$\text{PSI} = \frac{\text{Feet of Head}}{2.3}$$

1 Foot of Head = .4332 PSI
Feet of Head = PSI X 2.3

Watts = Amps X Volts (single phase)
= Amps X Volts X 1.73 (three phase)
Volts = Ohms X Amps

$$\text{Volts} = \frac{\text{Watts}}{\text{Amps}}$$

$$\text{Volts} = \sqrt{\text{Watts X Ohms}}$$

$$1\text{ KVA} = \frac{\text{Amps X Volts X 1.73}}{1000} \quad \text{(three phase)}$$

$$1\text{ KVA} = \frac{\text{Amps X Volts}}{1000} \quad \text{(single phase)}$$

$$\text{CFM} = \frac{\text{KW X 300}}{\text{Temperature Difference}}$$

$$\text{CFM} = \frac{\text{Tons X 10530}}{\text{Temperature Difference}}$$

$$\text{KW} = \frac{\text{CFM X Temperature Difference}}{3000}$$

F = (9/5 X C) +32
C = 5/9 X (F - 32)
Volume of Cylinder = π X R^2 X L
Circumference of Circle = Diameter of Circle X π
Diameter of Circle = Circumference X .3183
Area of Circle = π X R^2 X L
= D^2 X .7854
1 Gram = .0353 oz
1 Foot = 30.48 centimeter
454 Gram = 1 lb
1 Oz = 28.35 grams
1 Kilogram-calorie = BTUH X .252
1 Millimeter = inches X 25.4
1 Kilogram = Lbs X .454
1 Square Centimeter = .155 square inch
1 Square Inch = 6.452 sqaure centimeter

METRIC CONVERSION TABLE

FROM	TO	Multiply by:
UNIT VOLUME		
US GPM	liters/min	3.785
US GPM	cum/hr	.2271
CFM	liters/min	28.317
CFM	cum/hr	1.6992
UNIT WEIGHT		
Lbs/sq in	gr/sq cm	70.31
Lbs/sq in	kPA	6.894
Lbs/sq in	kg/sq cm	.07031
Lbs/cu in	gr/cu cm	27.68
LENGTH		
Inches	cm	2.540
Feet	meters	.3048
Yards	meters	.9144
Miles	km	1.609
VOLUME		
Cu inches	cu cm	16.387
Cu inches	liters	.01639
Cu feet	cu meters	.02832
Cu feet	liters	28.317
Cu years	cu meters	.7646
Fl ounces	cu cm	29.57
US gal	liters	3.785

FROM	TO	Multiply by:
POWER		
FT/LB/SEC	watts	1.356
KW	BTUH	3420
Boiler HP	BTUH	33475
HP	BTUH	2545
HP	kw	.7457
HEAT		
BTU	kg-cal	.252
BTU/LB	kg-cal	.5556
BTU/SQ FT	gr-cal/sq cm	.2713
BTU/CU FT	kg-cal/cum	8.899
WEIGHT		
Grains	grams	.0648
Ounces*	grams	28.350
Pounds*	kg	.4536
US tons	lg	907.2
US tons	tonnes	.9072
Long tons	kg	1016
AREA		
Sq inches	sq cm	6.452
Sq years	sq meters	.8361
Sq miles	sq km	2.590

*Auoirdupois pounds and ounces

TEMPERATURE

F	C	F	C
0	-17.8	35	1.7
5	-15	40	4.4
10	-12.2	45	7.2
15	-9.4	50	10.0
20	-6.7	55	12.8
30	1.1	60	15.6

F to C = (F - 32) x .55 = C
C to F = (C x 1.8) + 32 = F

ABBREVIATIONS, EQUIVALENTS & FORMULAS

PSI = Pounds Per Square Inch
GPM = Gallons Per Minute
EWT = Entering Water Temperature
LWT = Leaving Water Temperature
BTU = British Thermal Unit
BTU/HR = GPM x 500 x ΔT (water)
FT. H.D. = PSI x 2.31
1 COOLING TOWER TON = 15,000BTU/HR
1 REFRIGERANT TON = 12,000 BTU/HR
1 GALLON = 8.33 lbs (water)
1 CUBIC FOOT = 7.48 gallons
TOWER CELL EVAPORATION RATE = 2 gal. per ton per hour

NOMINAL DESIGN FLOW

COOLING TOWER = 3 GPM PER TON
CHILLING = 2.4 GPM PER TON

WEIGHED WATER TESTS

$$\text{CHILLER TON} = \frac{\text{GPM x } \Delta T}{24} \qquad \text{TOWER TON} = \frac{\text{GPM x } \Delta T}{30}$$

$$\text{CHILLER TON} = \frac{\text{\#/min x } \Delta T}{200} \qquad \text{TOWER TON} = \frac{\text{\#/min x } \Delta T}{250}$$

CHILLER SIZING

INJECTION MOLDING	
30#/hr H.D. Polyethylene	= 1 ton
35#/hr L.D. Polyethylene	= 1 ton
35#/hr Polypropylene	= 1 ton
75#/hr PVC	= 1 ton
50#/hr ABS	= 1 ton
50#/hr Polystyrene	= 1 ton
40#/hr Nylon	= 1 ton
35#/hr Acrylic	= 1 ton
40#/hr Polyurethane	= 1 ton
50#/hr Acetal	= 1 ton
40#/hr PPO	= 1 ton
40#/hr PET	= 1 ton
50#/hr Polycarb	= 1 ton

EXTRUSION	
45#/hr H.D. Polyethylene	= 1 ton
45#/hr L.D. Polyethylene	= 1 ton
45#/hr Polypropylene	= 1 ton
75#/hr Polystyrene	= 1 ton
70#/hr PVC	= 1 ton
BLOWN FILM	
105 CFM (50 F air @ 78 F WBT)	= 1 ton
BLOW MOLDING	
40#/hr Polyolefins	= 1 ton

OTHER EQUIPMENT

AIR COMPRESSOR w/no aft cooler = .1 TON/HP
AIR COMPRESSOR w/aft cooler = .2 TON/HP
VACUUM PUMP = .1 TON/HP
HYDRAULIC COOLING = .1 TON/HP
BARREL COOLING = 1 TON/IN SCREW DIA.

CHILLER CAPACITY LOSS = 2% for each 1 F below 50 F LWT

PIPE SIZING GUIDE (based on 5'-7' feet/second velocity)

1/2"	= 6 GPM	2 1/2"	= 100 GPM
3/4"	= 10 GPM	3"	= 150 GPM
1"	= 15 GPM	4"	= 275 GPM
1 1/4"	= 30 GPM	6"	= 600 GPM
1 1/2"	= 40 GPM	8"	= 1,000 GPM
2"	= 70 GPM		

8.11 SPARE PARTS LIST - WATER COOLED MODELS

PART #	DESCRIPTION
820000	Caster 4" Swivel
830000	Caster 4" Rigid
1197000	Compressor BRH2-1000-TFD-219
1515500	Condenser 45" x 46½"
1733700	Auxiliary Contact CR305X200B (nc)
1825020	Contactor CR305D002
2190000	Filter Drier C-415S
2900006	Evaporator 75-30H 10ton
2940000	Expansion valve PVE-11 CP100
2996009	Fan F10S08A2230-5
3190000	Freezestat A19ABC-24
3400000	Fuse block Gould #30352
3708505	Plastic Handle P2-41
4341886	Instrument Kit #213400 Flat display 'VL'
4341879	Instrument only #246100 Flat display 'VL'
6205500	Temperature sensor #902300
7163580	Electronic filter 'quench arc' #933400
4714403	Fan motor 3/4hp 1075 RPM
6210600	Motor/pump assembly 1ST1G200 G&L 2HP
433	Adapter #1L87
4310513	Impeller #2L46 6⅛"
5404000	Lock nut (impeller) #13K6
6495035	Pump seal kit #RPK1ST G&L
9117700	Volute #1L81
6900000	See-All SA-15S
7180000	Solenoid Valve B6S1
1163300	Coil #MKC-1
7200000	Solenoid Valve B10S2
1163000	Coil #MKC-2
7370000	Motor starter CR354AB3AA1B
1733456	Auxiliary contact kit
7558000	Low pressure safety P70AB-2
7558500	High pressure safety P70DA-1
8067600	Terminal block PWR DIST #1423570
8244000	Transformer 9T58B43
8837515	Bypass valve 2P072 ¾"
8990000	Relief valve 400 PSI

8.12 SPARE PARTS LIST - AIR COOLED MODELS

PART #	DESCRIPTION
820000	Caster 4" Swivel
830000	Caster 4" Rigid
1197000	Compressor BRH2-1000-TFD-219
1515500	Condenser 45" x 46½"
1733700	Auxiliary Contact CR305X200B (nc)
1825020	Contactor CR305D002
2190000	Filter Drier C-415S
2900006	Evaporator 75-30H 10ton
2940000	Expansion valve PVE-11 CP100
2996009	Fan F10S08A2230-5
3190000	Freezestat A19ABC-24
3400000	Fuse block Gould #30352
3708505	Plastic Handle P2-41
4341886	Instrument Kit #213400 Flat display 'VL'
4341879	Instrument only #246100 Flat display 'VL'
6205500	Temperature sensor #902300
7163580	Electronic filter 'quench arc' #933400
4714403	Fan motor 3/4hp 1075 RPM
6210600	Motor/pump assembly 1ST1G200 G&L 2HP
433	Adapter #1L87
4310513	Impeller #2L46 6⅛"
5404000	Lock nut (impeller) #13K6
6495035	Pump seal kit #RPK1ST G&L
9117700	Volute #1L81
6900000	See-All SA-15S
7180000	Solenoid Valve B6S1
1163300	Coil #MKC-1
7200000	Solenoid Valve B10S2
1163000	Coil #MKC-2
7370000	Motor starter CR354AB3AA1B
1733456	Auxiliary contact kit
7558000	Low pressure safety P70AB-2
7558500	High pressure safety P70DA-1
8067600	Terminal block PWR DIST #1423570
8244000	Transformer 9T58B43
8837515	Bypass valve 2P072 ¾"
8990000	Relief valve 400 PSI

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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:

PARTS & SERVICE 800 458 1960
Instant Access CONAIR
24 HOURS A DAY • 7 DAYS A WEEK

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, serial 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.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Departments for a nominal fee.

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.