I.O.M. #058 1/03

INSTRUCTION MANUAL • INSTALLATION • OPERATION • MAINTENANCE

MAXIMUM

PORTABLE CHILLER

TM

"MK" Series

Covering
Air-Cooled models
from 5 to 30 tons
with 'HE' Instruments

ADVANTAGE®
MAKING WATER WORK™

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1.0 GENERAL

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1.1 INTRODUCTION

A. This manual covers most 'MK' series portable chillers with air-cooled condensers, from 5 to 30 tons.

B. When calling for assistance from the **ADVANTAGE** 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

A. The unit is designed for indoor use only. For most efficient operation, locate the chiller in a clean, dry and well ventilated environment.

B. The unit has an air cooled refrigerant condenser. For air cooled condensers, a motor driven fan (on models from 5 to 15 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 unit will discharge a maximum of 15,000 BTU's per hour per ton of cooling.

C. The unit must have a minimum entering air temperature of 60°F and a maximum entering air temperature of 95°F for efficient operation.

D. The unit must have a minimum of two feet clearance at the air intake and six feet at the vertical exhaust air discharge.

E. The unit must have all enclosure panels in place before operating compressor. Air will not be drawn through the condenser coil if they are not in place. This will cause the compressor to lockout on the high pressure safety fault.

1.3 EFFICIENCY

A. Long term efficiency of operation is largely determined by proper maintenance of the mechanical parts of the unit and the water quality. **ADVANTAGE** recommends filtering where required to prevent solids from plugging critical parts (pumps, heaters, seals for example). **ADVANTAGE** highly recommends the services of a competent water treatment specialist be obtained and his recommendations followed. **ADVANTAGE** accepts no responsibility for inefficient operation, or damage caused by foreign materials or failure to use adequate water treatment.

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1.4 SAFETY

A. It is important to become thoroughly familiar with this manual and the operating characteristics of the unit.

B. It is the owner's responsibility to assure proper operator training, installation, operation, and maintenance of the unit.

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.

1.5 CLEAN AIR ACT

A. The unit contains HCFC-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.

1.6 MISCELLANEOUS

A. The unit is designed to circulate temperature stabilized fluid through the process resulting in process temperature control.

B. The ability of the unit 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 unit, contact the **ADVANTAGE** Service Department at 317-887-0729.

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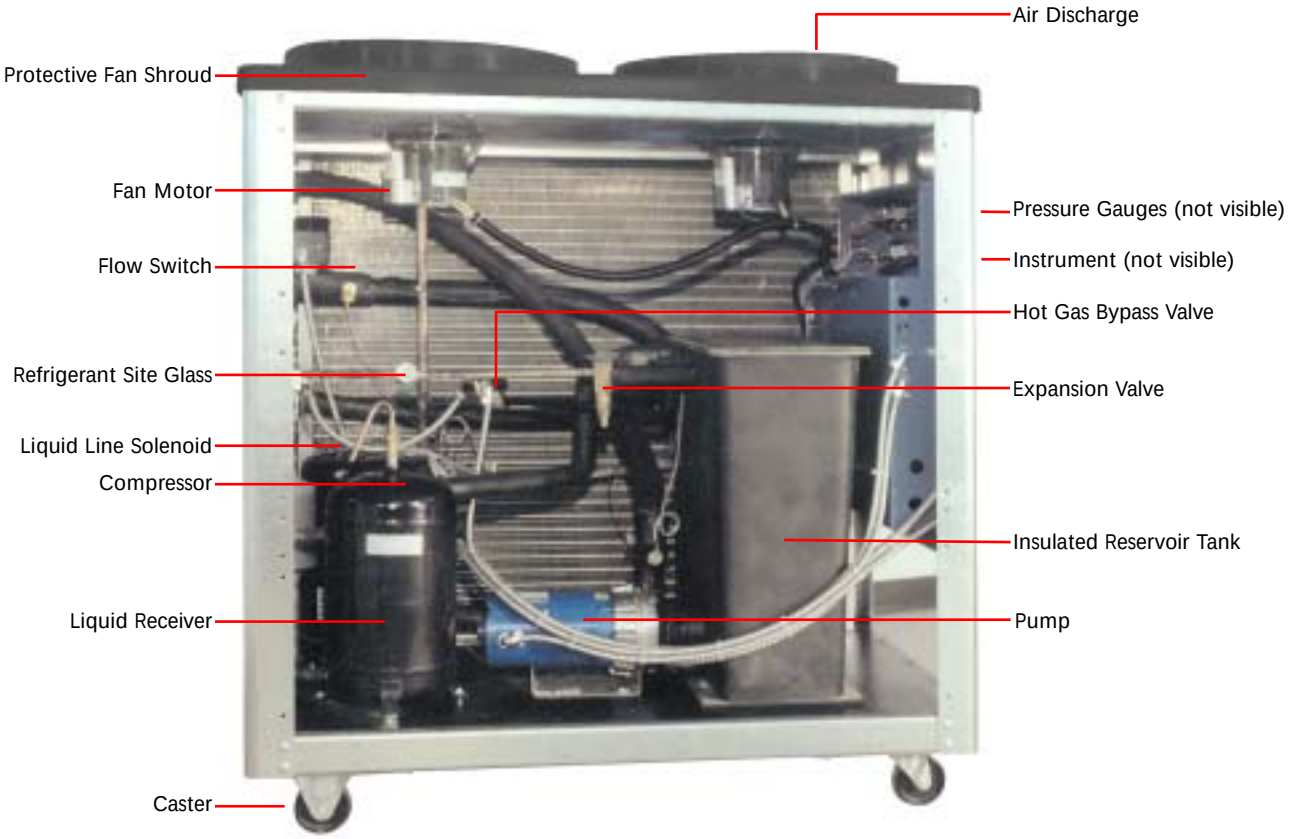

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2.0 INSTALLATION

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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

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.

MK-10A shown

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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 **ADVANTAGE** service department for more information on operating with ambients air temperatures above 95°F or below 60°F.

Typical fan assembly Figure 2.4A

Typical blower assembly Figure 2.4B

B. Air flow is generated by the motor mounted 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 mounted fan models.

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.

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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 CFM at the static pressure of .90 inches of water. See figure 2.4C at right.

CFM RATININGS

MODEL	CFM
MK-15A	15,000
MK-20A	20,000
MK-25A	25,000
MK-30A	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.

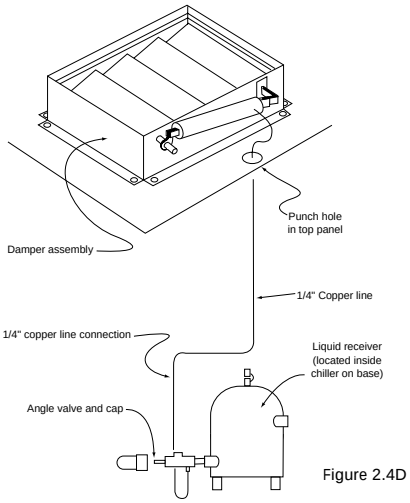

Figure 2.4D

G. All air cooled units must have all enclosure panels in place before operating compressor. Air will not be drawn through the condenser coil if they are not in place. This will cause the compressor to lockout on the high pressure safety fault.

2.5 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.

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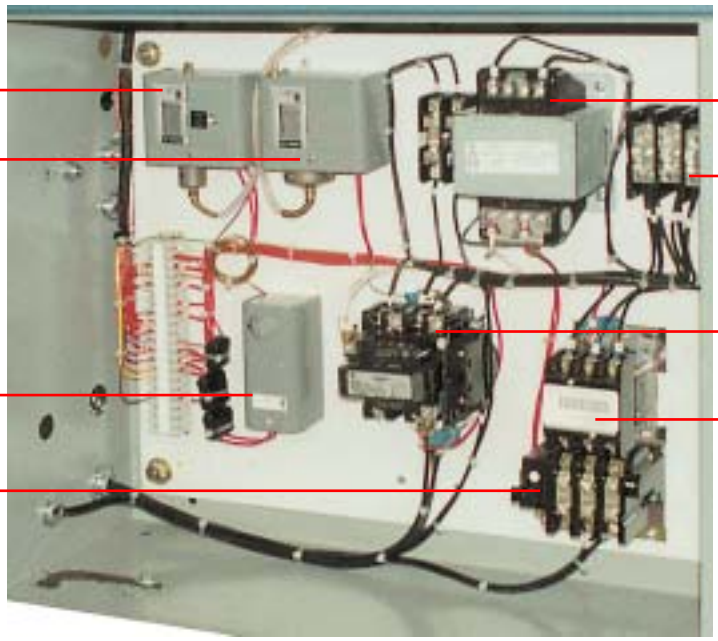

Figure 2.5A Typical electrical panel

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.

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

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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.

E. INFORMATION REGARDING 'PHASING' OF SCROLL COMPRESSORS

1. All portable chillers that have pumps, the compressor(s) will be set in phase with the pump during the testing process at the factory.

2. After installation, on units with an 'LE' controller, the phase status must be checked by observing the pump motor shaft on the end of the pump and comparing its rotation to the directional arrow on the motor. In either case, if the phase needs to be altered, it should be done at the main power entry.

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3.0 OPERATIONS

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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:** if this unit contains a hermetic or semi-hermetic reciprocating compressor it 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.

UNITS WITH SCROLL COMPRESSORS DO NOT HAVE A CRANKCASE HEATER AND THIS PROCEDURE IS NOT NECESSARY.

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.

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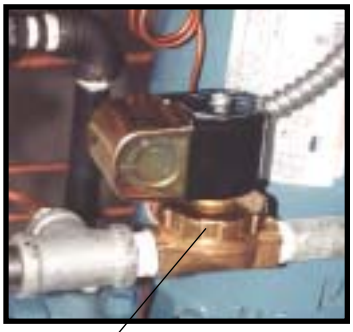
3.2 START UP / OPERATION PROCEDURE

A. SYSTEM FILL

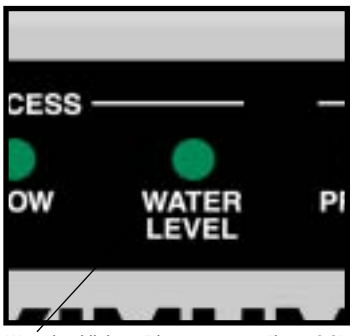
1. The unit has an internal reservoir which must be filled and maintained for proper operation. The unit has a level switch mounted at the proper water level in the reservoir.

2. **WATER QUALITY CONTROL.** Lack of, as well as, improper water treatment can damage the chilling unit. The services of 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. See water treatment section in **section 8** of this manual for more information.

3. **FOR AUTOMATIC FILL**: 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. The WATER LEVEL light (figure 3.2B) on the instrument will flash red while the make-up solenoid valve is open. When the reservoir tank is filled, the WATER LEVEL light will illuminate green. During operations, with the water supply source "on", the unit will automatically maintain the correct reservoir level.

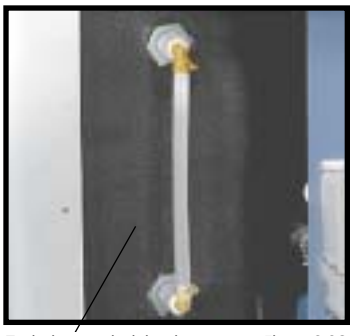


Make-up solenoid valve Figure 3.2A



Water level light - LE instruments Figure 3.2B

4. **MANUAL FILL:** disconnect the electrical power supply and remove all necessary cover panels to access the reservoir. Add fluid directly to the reservoir. 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 as indicated by a flashing red RESERVOIR LEVEL light. During operations, when the



Typical reservoir sight glass Figure 3.2C

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RESERVOIR LEVEL light flashes red, the operator must add fluid to the reservoir. Verify reservoir level via the coolant sight glass (figure 3.2C).

B. ELECTRIC MOTOR PHASING (PUMP ROTATION)

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

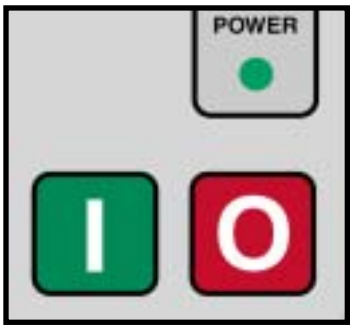
a. Supply electrical power to the unit. Once the correct voltage is supplied to the unit, the POWER light on the unit's control panel will illuminate. Adjust the setpoint to 70°F to prevent the compressor from activating during this procedure.

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

c. Locate the electric motor (figure 3.2D). The electric motor can be identified when the electrical panel cover is open. 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.

Electric motor Figure 3.2D

d. Toggle the unit's START and STOP keys (figure 3.2E). This will quickly cycle the pump motor "on" and then "off".



Start/Stop push buttons - LE instrument Figure 3.2E

e. Observe the motor shaft. When the START key is pressed, the motor shaft will rotate. When the STOP key is pressed, the shaft will slowly "coast" to a stop. As the shaft slows, the operator can identify

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the rotation of the motor shaft. 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 START key is pressed, the operator must identify the cause as outlined in the troubleshooting and repair section.

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), correct as outlined in **step 2**.

2. If the unit is phased **incorrectly**, the operator must:

a. Disengage the electrical power supply to the unit at the unit’s disconnect switch. Follow proper lockout procedures before proceeding.

b. Once 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 the power supply to the unit. **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.

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 develop in the evaporator which can damage the evaporator. Excessive liquid flow will trip the motor overload protection circuit.

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c. A **low coolant flow safety switch** is supplied (figure 3.2F) to stop the unit 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.

Figure 3.2F

2. Press the START key on the display to activate the process pump. Wait a few moments to allow air to be purge from system. Observe the COOLANT pressure gauge for steady readout. Two items the operator for look for are low flow or excessive flow conditions.

3. ***LOW FLOW:*** If the LOW FLOW light (figure 3.2G) is 'flashing red' be sure all process valves are open. If all process valves are open, then a low flow condition exists.

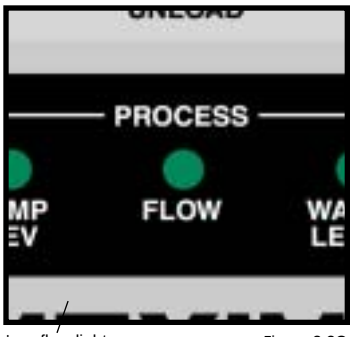

Figure 3.2G

a. To operate 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. Figure 3.2H illustrates a typical bypass loop.

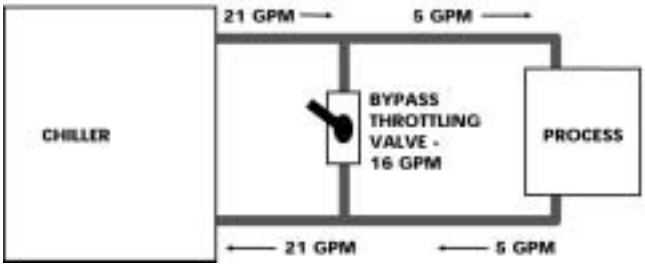

Figure 3.2H Typical low flow by-pass loop

b. Some models may have a factory installed bypass. Adjust the valve accordingly.

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4. ***EXCESSIVE FLOW:*** if the flow rate exceeds the motor HP capacity, the electric motor will draw excessive amps. This is a result of the process loop's ability to flow water at a greater rate than can be provided by the pump. This eventually results in tripping the thermal motor overload relay (overload relays open) and the unit will shut down and illuminate red the LOW FLOW light on the display.

a. If an excessive flow situation is encountered and the motor overload circuit has tripped, the operator must manually reset the overload relay (figure 3.2I) 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).

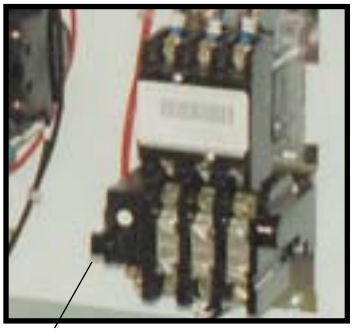

Figure 3.2I

4. The instrument displays the process flow rate in the FLOW display window (figure 3.2J). To adjust the process flow rate, continue with **step 5**.

Figure 3.2J

5. To set the process flow rate via the digital flow meter:

a. Determine the pump's HP rating and maximum GPM flow rate. Standard models are listed in the specifications chart (figure 3.2K). The displayed flow rate should not exceed the maximum flow rate during operations. If the maximum flow rate is exceeded, a possible overload

MODEL	HP	GPM
MK-5A	2	12
MK-7.5A	2	22
MK-10A	2	28
MK-15A	3	36
MK-20A	3	48
MK-25A	5	60
MK-30A	5	72

This chart is for standard models only. Consult with the factory if optional pump motors are installed.

Motor HP and GPM chart
Figure 3.2K

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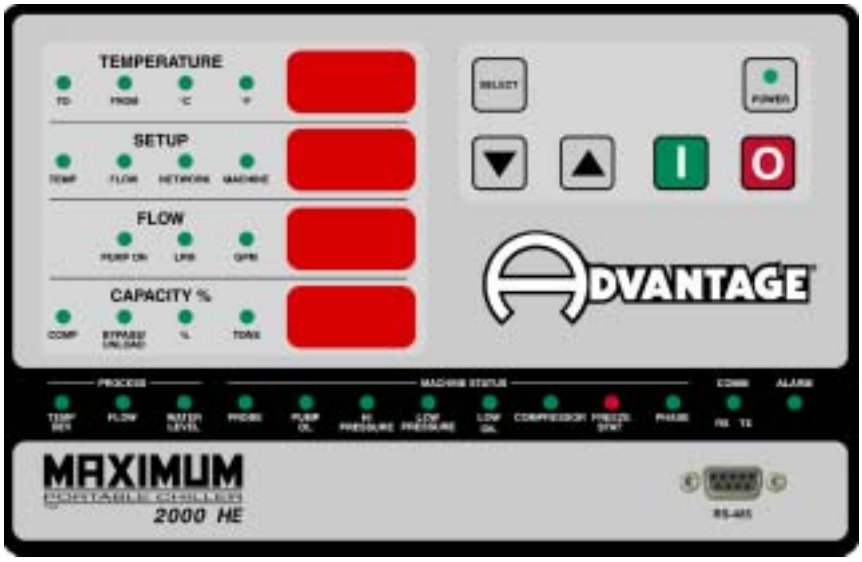
condition may develop. Refer to section 8.1 for additional information on the unit's pump.

b. Start the unit and observe the indicated flow rate (see **section 3.3** of this manual for instrument operation instructions). If the indicated flow is higher than the maximum flow rate for the unit, a throttling valve must be installed in the "from process" water line. The preferred throttling valve is a manual activated ball valve. If necessary, follow proper shut down and disconnect procedures to install a throttling valve.

c. With the throttling valve installed, fully close the valve and then engage the pump motor. Slowly open the throttling valve and monitor the indicated flow rate until the flow rate is below the pump's maximum flow rate. At this point, the process flow is now correctly adjusted. The valve should remain in the position during operations.

3.3 INSTRUMENT/OPERATION



LE instrument display

Figure 3.4A

A. INSTRUMENT START-UP

1. When the correct electrical power is e supplied to the unit, it is possible to start the unit for temperature control duty.

2. When the electrical power supply is supplied 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 controller

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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.

3. With electrical power supplied to the unit, the POWER light will illuminate. The display will remain dark with exception of the WATER LEVEL, PROBE and PHASE lights which will be 'solid green' if those conditions are 'ok'. The FLOW light will 'flash red' to indicate that the pump is not on (not generating flow). This is the normal "stop" state of the instrument. If the operator determines the WATER LEVEL, PROBE and PHASE lights are 'flashing red', the operator must determine the reason and correct:

a. **Water level**: when the reservoir water level is below the level switch mount, the automatic water make-up system is activated in an effort to restore the reservoir to the proper operating level. If the reservoir does not fill in a reasonable amount of time, check the operation of the make-up solenoid valve or determine in the water supply valve (customer supplied) is fully open. The water level sight glass is provided to visually check the reservoir level.

b. **Probe:** a possible cause of a probe error is the probe service connection is wet. Locate the 2 pin (white plug) service connection, open and dry with compressed air. If this action does not remove the error indication, inspect the probe wiring, which could be incorrect or damaged. Probe connections are at the instrument panel. Correct wiring is (from top to bottom) 'white' - 'black' - 'white' - 'black' - 'red' - 'red'. If the probe connections are correct, the probe may be faulty and should be replaced.

c. **Phase:** follow the procedure outline in section 3.2 paragraph B 'Electric Motor Phasing' to clear a phase error. If a phase error can not be cleared even through the pump motor is rotating correctly, the three phase monitor is defective and should be replaced. Disconnect the unit until a replacement is obtained.

4. After a 'flashing red' indication is diagnosed and repaired, the 'flashing red' indication will turn 'solid red'. The operator can clear a 'solid red' fault indication by pressing the START key.

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5. When the START key is pressed, the instrument will immediately check the status of the motor overload switch (PUMP OL light), the high pressure safety switch (HI PRESSURE light), the low pressure safety switch (LOW PRESSURE light), the low oil pressure safety switch (LOW OIL light), and the freezestat safety switch (FREEZESTAT light) for acceptable operating conditions. If these systems are found to be 'ok', the lights will be 'solid green' and the unit will begin process operations. If a system is not found to be 'ok', the light will 'flash red' and the instrument will prevent operation (check the troubleshooting section of this manual for more information):

a. **Motor overload switch open:** a 'flashing red' PUMP O/L light indicates the electric pump motor overload relay is open. The pump motor is protected from overload conditions (excessive flow) by a set of thermal overload relays which open (trip) with excessive amperage and prevent electric power from reaching the electric motor. If the overload relay is open, the overload relay must be reset before operations can continue. An excessive flow condition must be corrected immediately.

b. **High pressure switch open:** a 'flashing red' HI PRESSURE light indicates the refrigerant high pressure switch is open. This normally occurs when condensing pressures exceed normal parameters. To continue operations, the operator must reset the safety switch by pressing in the reset lever. An high pressure condition must be corrected immediately.

c. **Low pressure switch open:** a 'flashing red' LOW PRESSURE light indicates the low pressure safety switch is open. Chiller operations stop when the refrigerant suction pressure drops below 58 PSI. While the compressor is inactive, the pressure normally builds back up to the cut-in pressure of 63 PSI, at which point the low pressure safety switch automatically resets, and a 3 minute time delay cycle begins (to prevent compressor short-cycling). If the low pressure safety switch does not reset, operations are prevented. Contact the service department for further instructions.

d. **Low oil pressure switch open:** a 'flashing red' LOW OIL light indicates the oil pressure safety switch is open. The oil pressure safety switch is found on 15 to 30 ton semi-hermetic compressors. Normally, the switch will open if there is insufficient oil in the compressor crankcase or due to lack of sufficient compressor warn up before operations

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start. This switch must be manually reset before operations can continue.

e. **Freezestat safety switch open:** a 'flashing red' FREEZESTAT light indicates the freezestat safety switch is open. This normally occurs when the 'to process' temperature is below the freezestat setting. The typical freezestat setting is 38°F for setpoint temperatures from 48° to 70°F. If the 'to process' temperature is higher than the freezestat setting, check for proper operation of the freezestat safety switch.

B. INSTRUMENT OPERATION

1. When the START key is pressed, the instrument will activate all displays and begin operations.

2. Use the SELECT key to index through the temperature and set up functions until the TEMP light is illuminated. The operator can push and hold the SELECT key to automatically index through each function.

3. When the TEMP light is illuminated, the setpoint temperature is displayed in the TEMPERATURE DISPLAY window. Use the UP and DOWN ARROW keys to change the setpoint temperature.

4. **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 service department for further information. The operating range of the instrument may be changed to 20°F - 90°F by adjustment of the CPU DIP switches. Refer to the technical section of this manual for more information.

5. After selecting the setpoint temperature, the operator may leave the display in the that state. The display will automatically return to the TO PROCESS temperature state after 10 seconds. If the operator leaves the display in any state other than the TO PROCESS state, the display will automatically revert after 10 seconds of inactivity.

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6. During operations, if 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 BYPASS/UNLOAD light.

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

C. INSTRUMENT CONTROLS (figures 3.3B)

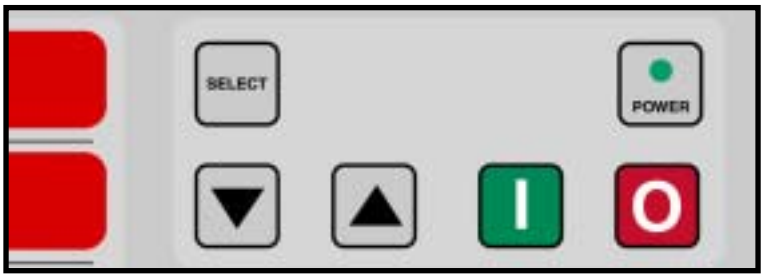

Figure 3.3B

1. **SELECT:** depress to index through the 'to', 'from' and 'set point' temperatures.

2. **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.

3. **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.

4. **START**: starts the coolant and refrigerant circuits. The refrigerant circuit is prevented from operation without the coolant circulating pump operating.

5. **STOP:** disengages the coolant pump and the refrigerant system.

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D. TEMPERATURE DISPLAY (figure 3.3C)

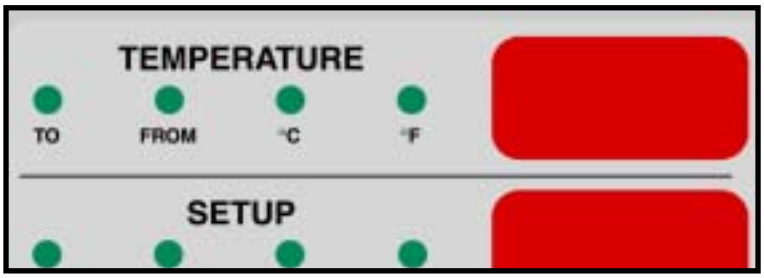

Figure 3.3C

1. **TO:** illuminates when the 'to process' water temperature displayed. TO is the default setting of the TEMPERATURE DISPLAY window.

2. **FROM:** illuminates when the 'from process' water temperature is selected. Note: the instrument will revert back to the TO process temperature display after 10 seconds if the FROM process temperature display was selected and left in that state.

   a. Use the SELECT key to index to the FROM indication lights. The 'from process' temperature will be displayed in the TEMPERATURE DISPLAY window.

3. **°C:** illuminates when the °C (Celsius) temperature display parameter is selected.

4. **°F:** illuminates when the °F (Fahrenheit) temperature display parameter is selected. °F is the default setting of the instrument.

E. SETUP DISPLAY (figure 3.3D)

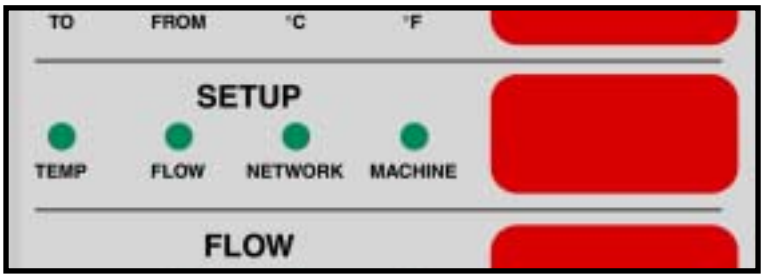

Figure 3.3D

1. When the SELECT key is pressed, the display will cycle forward through all available setup parameters. **The selected setup parameter is indicated in the TEMPERATURE DISPLAY (i.e. 'SP' for setpoint, 'tON' for tons) and the parameter value is displayed in the SETUP DISPLAY window.** Values are selected with the Up and DOWN arrows keys.

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a. The available parameters are listed here and are explained in detail in the following paragraphs:

NORMAL DISPLAY MODE

SP - setpoint temperature
tON - tonnage display in CAPACITY window
PCt - percent display in CAPACITY window
HI - high temperature deviation limit
Lo - low temperature deviation limit
LoF - low flow limit
Pro - protocol selection
Adr - protocol address selection
rAt - protocol baud rate selection
Unt - temperature/flow unit selection

EXTENDED DISPLAY MODE:

AFL - alternate flow sensor selection
int - internal small flow sensor selected
ALT - large flow sensor selected
ton - chillers size in tons
CAP - capacity display selection
Prb - from process probe calibration
LPt - low pressure time delay

2. **TEMP:** illuminates when the following parameters are selected:

SP - setpoint temperature
tON - tonnage display in CAPACITY window
PCt - percent display in CAPACITY window
HI - high temperature deviation limit
Lo - low temperature deviation limit

a. **'SP':** indicates the setpoint temperature can be adjusted. Adjust the setpoint temperature by:

1. Use the SELECT key to index to the 'SP' display in the TEMPERATURE DISPLAY window (the TEMP light is illuminated). The setpoint temperature value is displayed in the SETUP DISPLAY window. Use the UP arrow or DOWN arrow keys to select the setpoint temperature value.

2. When the instrument is in the default state (TO process temperature display), the operator may adjust the setpoint temperature with the UP arrow or DOWN arrow keys without first using the select key. However, if the instrument is in any

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other state (i.e. the NETWORK parameter state) the operator must use the SELECT key to index to the TEMP indication to adjust the setpoint.

b. **tON:** programs the display of capacity tons in the CAPACITY DISPLAY window. Use the UP arrow or DOWN arrow keys to select 'yes' or 'no'. Note: the TONS light will illuminate if this is selected.

c. **PCt:** programs the display of capacity percent in the CAPACITY DISPLAY window. Use the UP arrow or DOWN arrow keys to select 'yes' or 'no'. Note: the % light will illuminate if this is selected.

d. **Hi:** programs the high alarm temperature deviation limit. This is the high temperature setting at which an alarm is activated if the 'to process' temperature reaches it. 1 - 30 units selectable.

e. **Lo:** programs the low alarm temperature deviation limit. This is the low temperature setting at which an alarm is activated if the 'to process' temperature decreases to it. 1 - 30 units selectable.

2. **FLOW:** illuminates when the following parameters are selected:

LoF - low flow limit

a. **LoF:** programs the low flow value. During operations, if the flow decreases to the selected value an alarm is activated. Note: 30 seconds of flow stability must be maintained before the instrument will set the flow alarm. 0 - 999 units selectable.

3. **NETWORK:** illuminates when the following parameters are selected:

Pro - protocol selection
Adr - protocol address selection
rAt - protocol baud rate selection

a. **Pro:** programs the protocol selection. The protocol is the data format for communications between the unit and the host computer. SPI (standard Society or Plastics Industry) or CAC (standard used of older CMI machines) protocols selectable.

b. **Adr:** programs the communication address. This is the number assigned to the unit in a network. 1 - 99 units selectable.

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c. **rAt:** programs the baud rate. The baud rate is the data transfer rate between the unit and the host computer. 1200, 2400, 4800, 9600 units selectable.

4. **MACHINE:** illuminates when the following parameters are selected:

NORMAL DISPLAY MODE

Unt - temperature/flow unit selection

EXTENDED DISPLAY MODE:

AFL - alternate flow sensor selection
int - internal small flow sensor selected
ALT - large flow sensor selected
ton - chillers size in tons
CAP - capacity display selection
Prb - from process probe calibration
LPt - low pressure time delay

a. **Unt:** programs temperature/flow display. Select 'F' for Fahrenheit temperature display with GPM (gallons per minute) flow display or select 'C' for Celsius temperature display with LPM (liters per minute) flow display.

b. To show the parameters in the extended display mode, the #3 DIP switch must be toggled. Refer to section 5.8 for more details.

c. **AFL:** programs the alternate flow sensor selection. A 'YES' will set the instrument to the internal flow sensor. A 'NO' will set the instrument to the external flow sensor. Typically the instrument is programmed for the correct flow sensor from the factory.

d. **int:** a 'NO' selection for the 'AFL' parameter will activate the internal flow sensor. The 'int' parameter will allow a calibration factor for the small flow sensor.

e. **ALT**: a 'YES' selection for the 'AFL parameter will activate the external flow sensor. The 'ALT' parameter will allow a calibration factor for the larger flow sensor.

f. **ton:** programs the chiller size in tons.

g. **CAP:** programs the CAPACITY DISPLAY selection. A 'ton' display will activate a continuous tonnage display. A 'PCt' display will activate a continuous percent display. A 'ALT' display will activate a alternating display between tons and percent with a 8 second cycle.

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h. **Prb:** programs the 'from process' probe calibration. Use this to fine tune the 'from process' probe to display the same temperature as the 'to process' probe, assuming a temperature equilibrium.

i. **LPt:** programs the low pressure time delay. This can avoid nuisance defaults on the low pressure switch when the compressor is unable to rebuild pressure within the time delay. Check with the factory service department before altering this parameter.

F. FLOW DISPLAY (figure 3.3E)

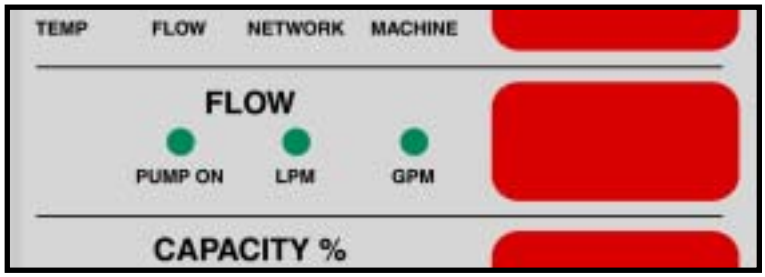

Figure 3.3E

1. The FLOW display shows information concerning the pump generated flow. The flow measuring mechanism is installed in the 'from process' water line. Typically, an internal flow sensor is provided with the chiller. In some cases, a larger external flow sensor is provided.

a. **PUMP ON:** illuminates when the pump is operating.

b. **LPM:** illuminates to indicate flow display in ***liters per minute***. This light illuminates when the 'Unt' parameter was toggled to 'C'.

c. **GPM:** illuminates to indicate flow display in ***gallons per minute***. This light illuminates when the 'Unt' parameter was toggled to 'F'.

G. CAPACITY % DISPLAY (figure 3.3F)

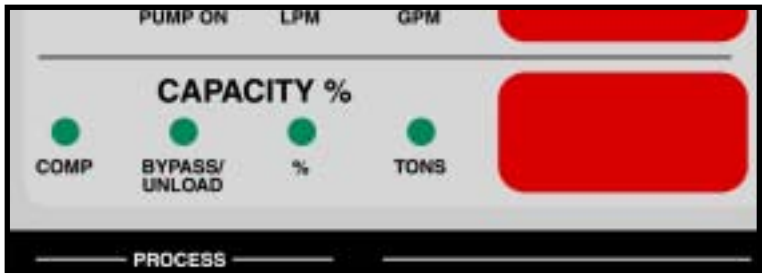

Figure 3.3F

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1. The CAPACITY % display shows information concerning the 'in use' capacity of the unit.

a. **COMP:** a 'solid red' light indicates the 'to process' temperature is below setpoint and the compressor is off and in the 3 minute time delay mode. A 'flashing red' light indicates the 'to process' temperature is above the setpoint, but the compressor is still off and in the three minute time delay cycle.

b. **BYPASS/UNLOAD:** illuminates when the hot gas bypass capacity system is on.

c. **%:** illuminates to indicate percent of capacity display. This display is a percent of the chiller's total capacity in current use. The % display is continuous when the 'CAP' parameter is toggled to the 'PCt' selection. The % and TONS display will alternate on a 8 second cycle when the 'CAP' parameter is toggled to the 'ALT' selection.

d. **TONS:** illuminates to indicates tonnage display. This display is a numeric indication of the chiller's current capacity in use. The TONS display is continuous when the 'CAP' parameter is toggled to the 'ton' selection. The % and TONS display will alternate on a 8 second cycle when the 'CAP' parameter is toggled to the 'ALT' selection.

H. PROCESS DISPLAY (figure 3.3G)

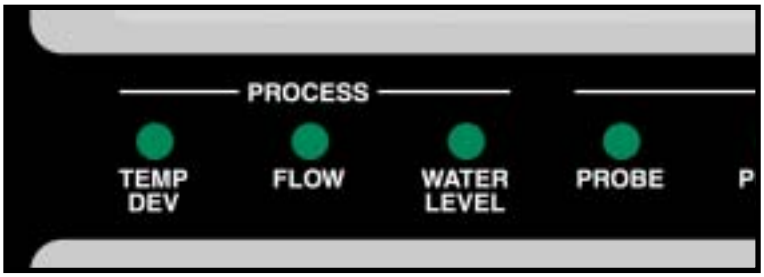

Figure 3.3G

1. The process display is an alarm indication for the temperature deviation, flow and water level.

a. **TEMP DEV:** illuminates according to the current state of temperature deviation:

1. **SOLID GREEN:** when the process temperature is within the programmed parameters.

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2. **SOLID YELLOW:** if the process temperature deviates outside the programmed setting.

3. **FLASHING RED:** If the temperature remains out of band for 90 seconds or more. The alarm circuit is activated.

b. **FLOW:** illuminates according to the current state of flow:

1. **SOLID GREEN:** the process flow is within the programmed parameters.

2. **FLASHING RED:** if the flow deviates beyond the programmed parameters.

3. **SOLID RED:** if the flow had once deviated but is now within the programmed parameter.

c. **WATER LEVEL:**

1. **SOLID GREEN:** the reservoir water level is at proper operating level.

2. **FLASHING RED:** the reservoir water level has dropped below the proper operating level. The automatic water make-up system has activated to restore the water level.

I. MACHINE STATE DISPLAY (figure 3.3H)

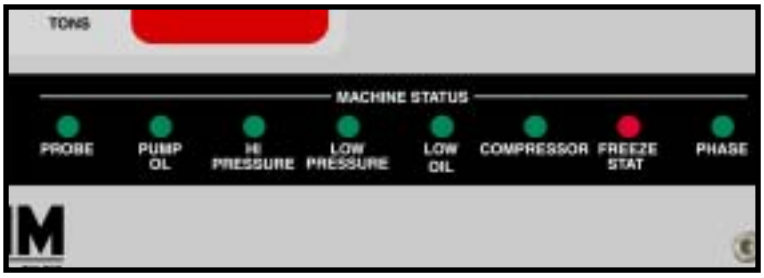

Figure 3.3H

1. Machine status lights indicate the operating status of several machine components. Further operational information for each component is located in section 6.0 Consult the section 4.0 for troubleshooting information. For each component:

a. **SOLID GREEN:** indicates the component is currently at an acceptable run condition.

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b. **FLASHING RED:** indicates the component is currently at an unacceptable run condition.

c. **SOLID RED:** indicates the component had once been at an unacceptable run condition but is now at an acceptable run condition. A 'solid red' light can be cleared to a 'solid green' light by pressing the START key.

2. **PROBE:** indicates the status of the 'to process' and 'from process' sensor probes.

3. **PUMP O/L:** indicates the status of the pump motor overload relay. See section 3.2 paragraph C 2 for more proper operation of the pump overload relay.

4. **HI PRESSURE:** indicates the status of the refrigerant high pressure safety switch.

5. **LO PRESSURE:** indicates the status of the refrigerant low pressure safety switch.

6. **LOW OIL:** indicates the status of the low oil pressure safety switch. This light activates on models with a 15 - 30 ton semi-hermetic compressor.

7. **COMPRESSOR:** indicates the operating status of the compressor.

8. **FREEZESTAT:** indicates the status of the freezestat safety switch.

9. **PHASE:** indicates the status of the electrical phasing of the unit. See section 3.2 paragraph B for more information on correct unit phasing

H. COMMUNICATIONS DISPLAY (figure 3.3I)

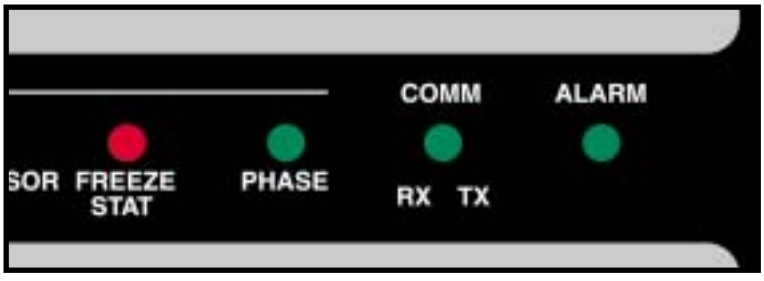

Figure 3.3I

1. The communication display indicates the kind of exchange between the host computer and the unit. A single light is used:

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a. **GREEN FLASH:** indicates the unit is sending information to the host computer.

b. **YELLOW FLASH:** indicates the host computer is sending information to the unit.

c. **RED FLASH:** indicates a communications fault.

I. ALARM DISPLAY **(figure 3.3I)**

1. **ALARM:** when this light illuminates 'solid red', an unacceptable condition has developed, at which time a 115 volt alarm output is generated for an external (factory or customer installed) alarm beacon or buzzer. The visual and/or audible alarm signal can be silenced by pressing the START key.

J. PRESSURE GAUGES **(figure 3.4F)**

1. **PROCESS PRESSURE GAUGE:** indicates process pump pressure.

Pressure gauges Figure 3.3E

2. **REFRIGERANT HEAD PRESSURE GAUGE:** indicates refrigerant pressure on the discharge side of the compressor. The refrigerant head pressure is also the condensing pressure which is critical to equipment efficiency. Head pressure on air condensed units will vary with ambient temperature between 190-290 psi.

3. **LOW PRESSURE GAUGE:** indicates refrigerant pressure on the suction side of the compressor. This pressure will fluctuate with the operating temperature.

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.

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B. UNIT SHUT DOWN

1. **To shut down the unit without disconnecting from the process:** Press the stop button. Maintain electrical power to the unit at all times except for service purposes.
2. **To shut down the unit and disconnect from the process:**

   a. Press the stop button.

   b. Disengage the electrical supply to the chiller at the disconnecting device.

   c. Disconnect all process lines.

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4.0 TROUBLESHOOTING

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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/EVAPORATOR 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 amp draw and if overloaded, partially close the from process line valve until the amp draw drops 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 LOW FLOW

A. Two pump chillers have a pump dedicated to the evaporator. The flow safety switch is located in the evaporator circuit and does not sense process flow.

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

C. 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.

4.5 THREE PHASE SUPPLY

A. On HE instruments, this Indicates the three phase power supply has been connected out of phase with the chiller. Disconnect the power supply and reverse any two wires.

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4.6 LOW FLOW FAULT

A. Indicates low flow through the evaporator.

B. Two pump chillers have a pump dedicated to the evaporator. The flow safety switch is located in the evaporator circuit and does not sense process flow.

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

D. In some process conditions the minimum flow required cannot be maintained at all time making it necessary to install a bypass line between the “to” and from process lines to maintain the minimum flow at all times.

4.7 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 condensing water supply and return lines, defective regulator valve on water cooled models or restricted air flow on air cooled models.

4.8 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 **ADVANTAGE** 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

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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.

4.9 WATER LEVEL

A. The automatic make up solenoid valve will open and fill the reservoir. If the solenoid is activated but the reservoir is not filling check the solenoid for proper operation.

B. If the automatic makeup is not being used, manually fill the unit. Use the indicator light to determine when the reservoir is properly filled.

4.10 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.

4.11 OIL PRESSURE

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.

4.12 CRANKCASE HEATER

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.

B. Scroll compressors do not have a crankcase heater.

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4.13 ELECTRONICS

A. The display is used for all normal set ups, diagnostics, temperature readout, and operational information. **Note:** the display is not a field repairable part. It is designed to be easily removed and replaced if a problem arises.

B. The CPU is mounted inside the electrical enclosure, this contains the software and various electronic components which make the **HE** instrument work. **Note:** the CPU is not a field repairable part. It is designed to be easily removed and replaced if a problem arises. Do not attempt to open the enclosure box as this will void the warranty. The three phase module interprets the incoming power supply and sends the information to the CPU. **Note:** the 3 phase module is not a field repairable part. It is designed to be easily removed and replaced if a problem arises.

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5.0 MAINTENANCE

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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 **ADVANTAGE** 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, **ADVANTAGE** 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, **ADVANTAGE** will advise on the repair and recommend available service contractors.

C. **ADVANTAGE** manufactures a complete line of heat transfer equipment. It is of the utmost importance that **ADVANTAGE** have the correct model number and serial number of the machine in question. This will allow **ADVANTAGE** 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 electrical enclosure of each machine.

D. The **ADVANTAGE** 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 (air cooled models only).

F. Back flush evaporator.

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

H. Check system for leaks.

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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.

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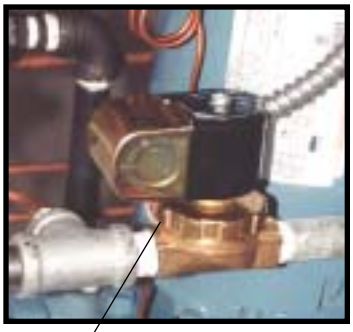
5.4 SOLENOID VALVE SERVICE

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



Typical water make-up solenoid valve

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 **Maximum** display is “off”.

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

4. The operator must be certain all water system pressure is relieved. Use the pressure relief valve mounted in the drain manifold to relieve all pressure.

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.

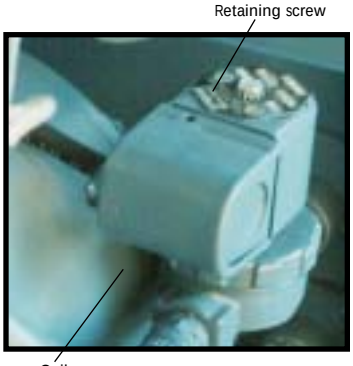


Figure 5.4B

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).

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

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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 and drain valves (if installed) to circulate water through the supply and drain manifolds. Check the solenoid valve for leakage. Restart the unit as outlined in **section 3.**

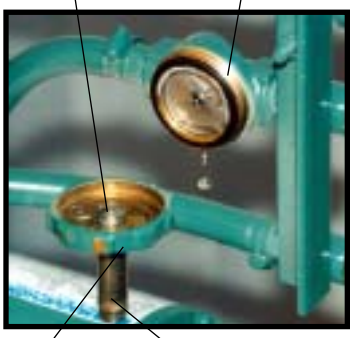

Figure 5.4C

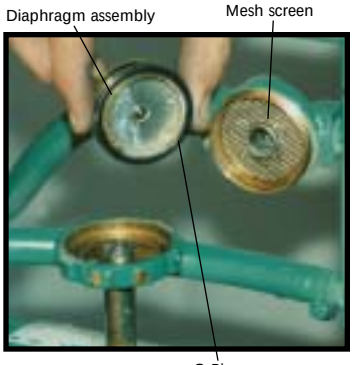

Figure 5.4D

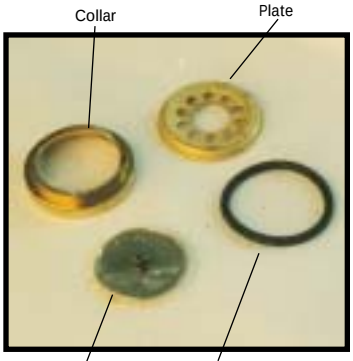

Figure 5.4E

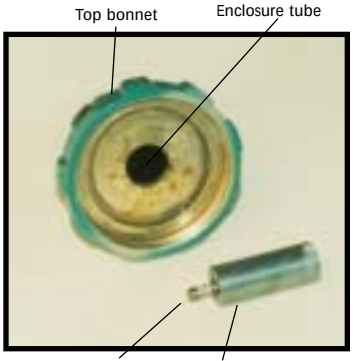

Figure 5.4F

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5.5 PUMP SEAL SERVICE

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

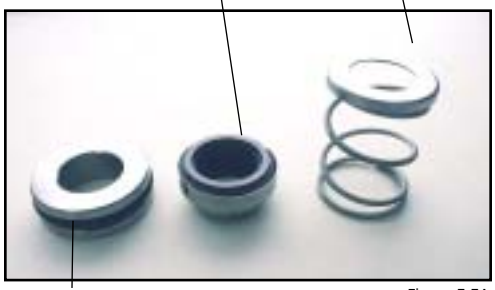

Figure 5.5A

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.

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 pressure is relieved (COOLANT pressure gauge reads “0”) 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. The machine can be drained by using the drain valve located on the pump case. 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

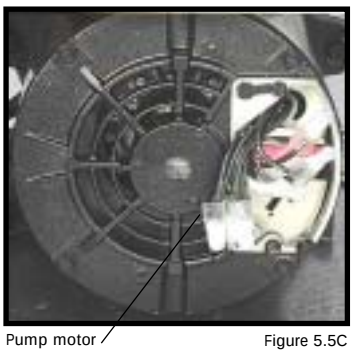

Figure 5.5C

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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).

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

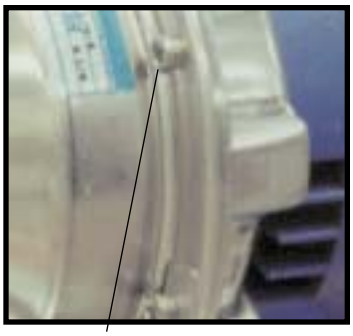

Figure 5.5D

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.

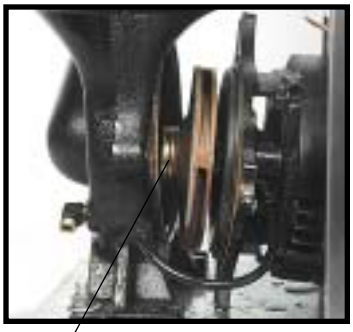

Figure 5.5E

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).

Figure 5.5F

9. Locate and remove 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.

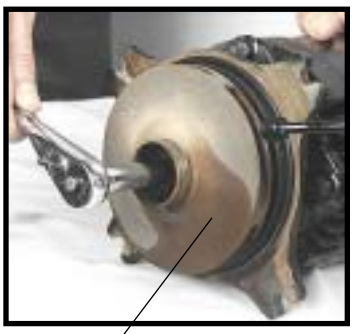

Figure 5.5G

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

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

12. Install new stationary seal member in pump casing cavity (figure 5.5I). The operator must be certain the stationary seal member is fully squared and seated in cavity.

Figure 5.5H

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

14. Place the spring onto the rotating member.

Figure 5.5I

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.

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

Figure 5.5J

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

18. Reconnect the motor power cord and leads.

19. Restore all cover panels as were removed.

Figure 5.5K

E. When the pump seal replacement procedure is complete, the operator may restart the unit according the **section 3**.

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5.6 CHECKING THE REFRIGERANT CHARGE

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

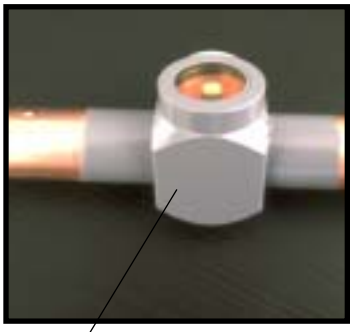

Figure 5.6A

B. All **ADVANTAGE** chillers have a refrigerant sight glass (figure 5.6A) with a moisture indicator. To check the refrigerant charge under normal operating conditions:

1. Remove the plastic cap covering the sight glass.

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

3. With the unit operating at 100% capacity (not in the "capacity control" 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.

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, **ADVANTAGE** recommends filters or strainers be added to the "from process" line. If the evaporator becomes fouled there are a couple of methods for cleaning.

Figure 5.6A

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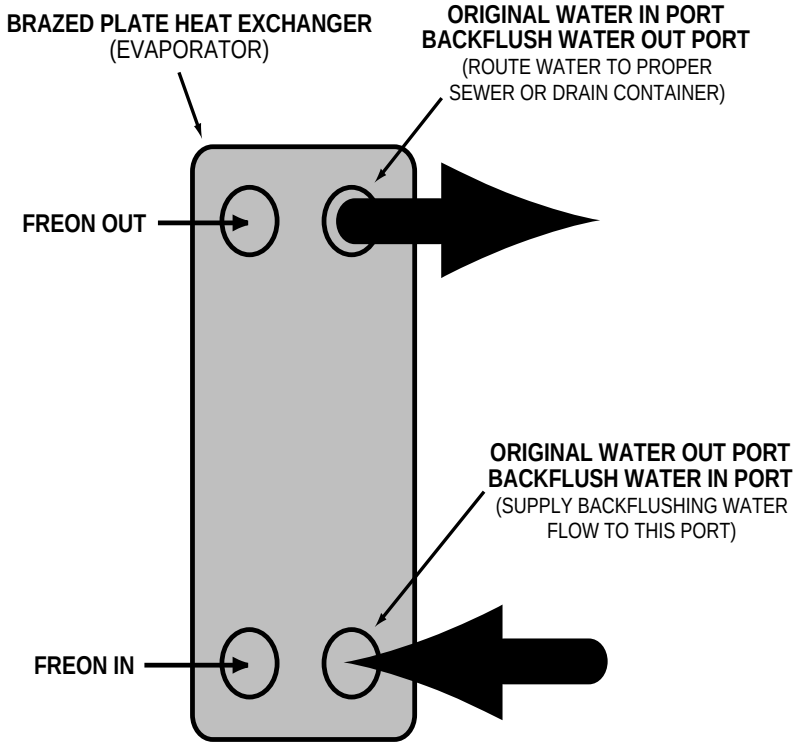
B. To begin, remove the piping to the "water in" port at the evaporator. Remove any solids that have collected at this point. Then back flush the evaporator to remove any solids that may be trapped between the plates (see back flush procedure below). If there are mineral deposits adhered to the plates, the evaporator must be back flushed 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 the next page.

C. Back flushing 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 back flush fluid according to local codes.



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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.

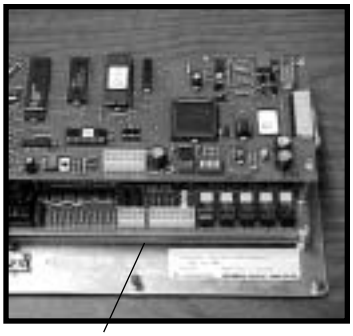
6. **Note:** this procedure is not normal maintenance. Maintaining proper water quality and filtration will minimize the need to back flush the evaporator.

5.8 DIP SWITCH ADJUSTMENT

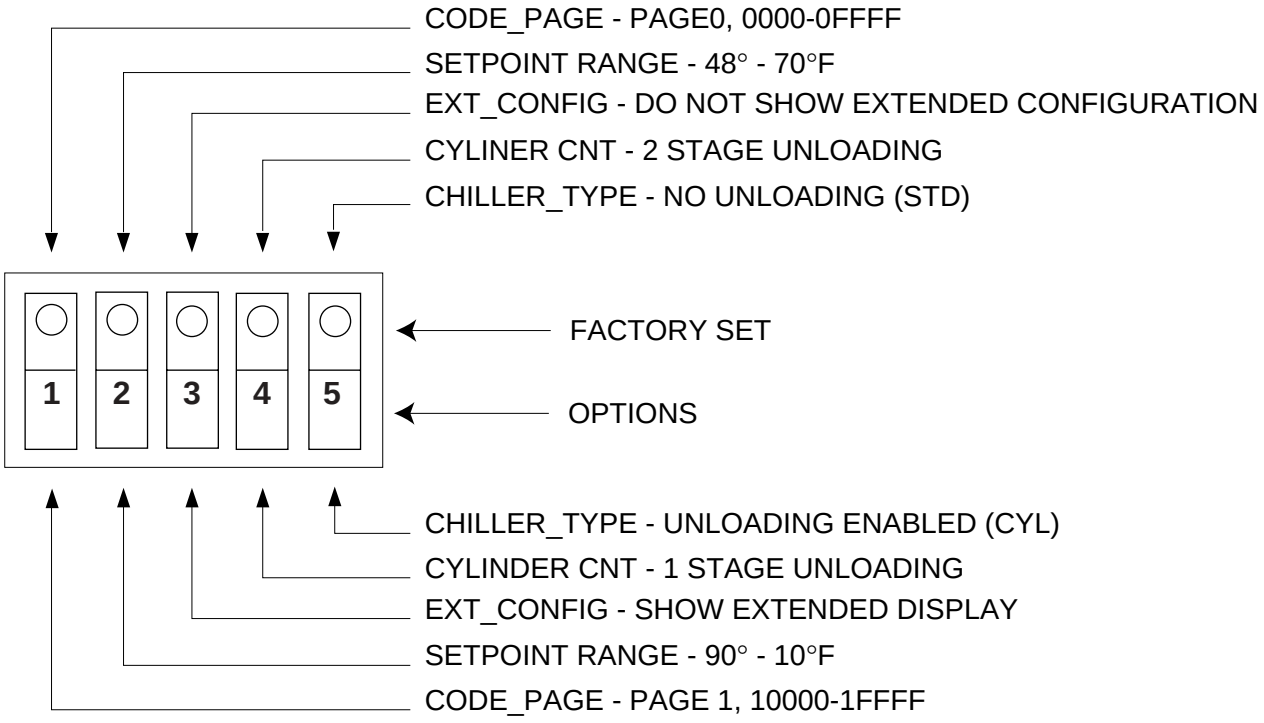
The 5 position DIP switch is located on the lower right side of the CPU board (figure 5.8A).

B. The switches are used to set options for machine operation.

C. The switches should only be changed when the instrument is turned OFF.



Typical DIP switch location Figure 5.8A



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D. Definition of the DIP switches are as follows:

SW1 - code page for EPROM:
ON - (default) code page 0 is active.
OFF - code page 1 is active.

SW2 - Setpoint range:
ON - (default) setpoint range is 70° to 48° F.
OFF - setpoint range is 90° to 10° F.

SW3 - Extended configuration:
ON - (default) extended configuration is DISABLED, the display will not show additional information.
OFF - extended configuration is ENABLED, the display will show the following after "CAP":
ALT - alternate flow selection.
ton - chiller size in TONs.
Prb - from process probe calibration.
LPt - low pressure alarm delay.

SW4 - Cylinder count select, valid ONLY when SW5 is OFF:
ON - (default) 2 stages of unloading
OFF - 1 stage of unloading

SW5 - Chiller Type:
ON - (default) standard, no cylinder unloading.
OFF - cylinder unloading enabled, see SW4.

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5.9 DISPLAY / KEYBOARD OPERATION

A. When the instrument powers up, the display will go through a "WOW" mode where ALL LEDs are turned ON for approximately 4 seconds. The version # of the instrument will scroll from right to left in the first (top) and second display windows. The display will then go into a STOP mode where all displays are OFF, except the Flow, Water Level, Probe, Phase and Power LEDs. When the START key is pressed, the instrument will enter the NORMAL RUN mode display as described below:

RUN mode display:

1. "TTT" - TO process temperature
2. "SSS" - SETPOINT temperature
3. "FFF" - FLOW
4. "CCC" - CAPACITY, TONS and/or PERCENT

B. When the SELECT key is pressed, the 1 and 2 displays will cycle through the following combinations. Display 3 and 4 will remain FLOW and CAPACITY as above. Where indicated with " + - ", the value of the Display 2 can be modified by pressing the UP and DOWN ARROW keys. If no keys are pressed within 10 seconds, the display will return back to the NORMAL, TO process display:

NORMAL DISPLAY MODE:

1. "TTT" - TO process temperature

\+ - 2. "SSS" - SETPOINT temperature adjust

1. "FFF" - FROM process temperature

\+ - 2. "SSS" - SETPOINT temperature adjust

1. "SP " - Setpoint

\+ - 2. "SSS" - SETPOINT temperature adjust

1. "Hi " - High temperature deviation limit

\+ - 2. "HHH" - limit adjust

1. "Lo " - Low temperature deviation limit

\+ - 2. "LLL" - limit adjust

1. "LoF " - Low flow limit

\+ - 2. "FFF" - limit adjust

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6.0 COMPONENTS

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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).

Figure 6.1A

B. FLOW SWITCH: the flow switch is a paddle-type switch mounted in the from process water line. The primary function of the flow switch is to monitor water flow. If the flow drops 33%, the switch will stop the refrigerant circuit. This protects the evaporator from freezing due to low flow (figure 6.1B).

Figure 6.1B

C. 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 6.1C).

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).

Figure 6.1C

B. AIR COOLED CONDENSER: the air cooled condenser removes BTU's from the compressed 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 6.2B).

Figure 6.2A

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

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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 6.2B

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 6.2D).

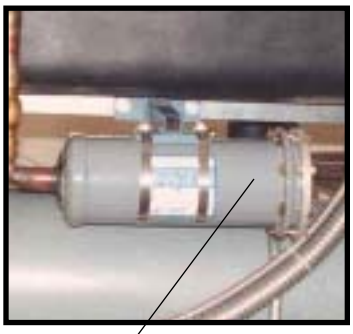

Figure 6.2C

F. **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 6.2E).


Refrigerant sight glass
Figure 6.2D

G. **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 6.2F).

H. **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.


Expansion Valve
Figure 6.2E

I. **HIGH/LOW PRESSURESTATS:** the high/low pressurestats protect the refrigeration system from unsafe operating levels. The **high**

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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.

Typical hot gas bypass valve Figure 6.2H

NEVER LOWER THE CUT OUT SETTING WITHOUT ADDING GLYCOL TO THE CIRCULATING SYSTEM. EVAPORATOR DAMAGE WILL RESULT AND WILL NOT BE COVERED BY THE WARRANTY.

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

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

L. **Crankcase heater:** insures that freon and compressor crankcase oil do not mix during the compressor's "off" cycles. Power must be applied to the chiller previous to startup.

M. **Oil pressure safety switch:** protects the compressor from lubrication failure.

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7.0 RELATED DRAWINGS

7.1 MECHANICAL SCHEMATIC - 5 / 7.5 / 10 ton models
7.2 MECHANICAL SCHEMATIC - 15 / 20 / 25 / 30 ton models
7.3 PHYSICAL - 5 ton models
7.4 PHYSICAL - 7.5 / 10 ton models
7.5 PHYSICAL - 15 / 20 / 25 / 30 ton models
7.6 DUCT SCHEMATIC FOR AIR COOLED CHILLERS
7.7 ELECTRICAL

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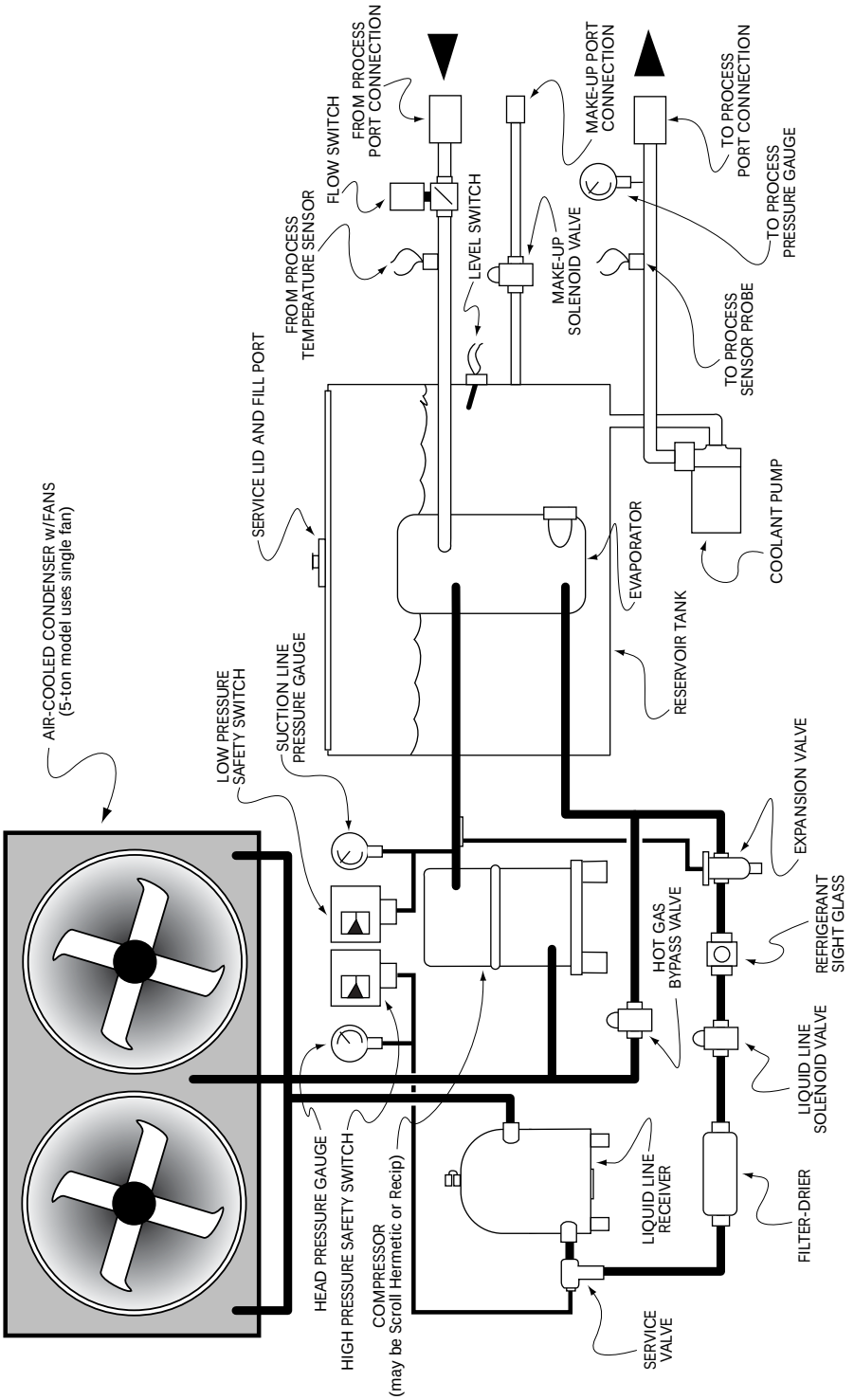
7.1 MECHANICAL SCHEMATIC - 5 / 7.5 / 10 TON MODELS



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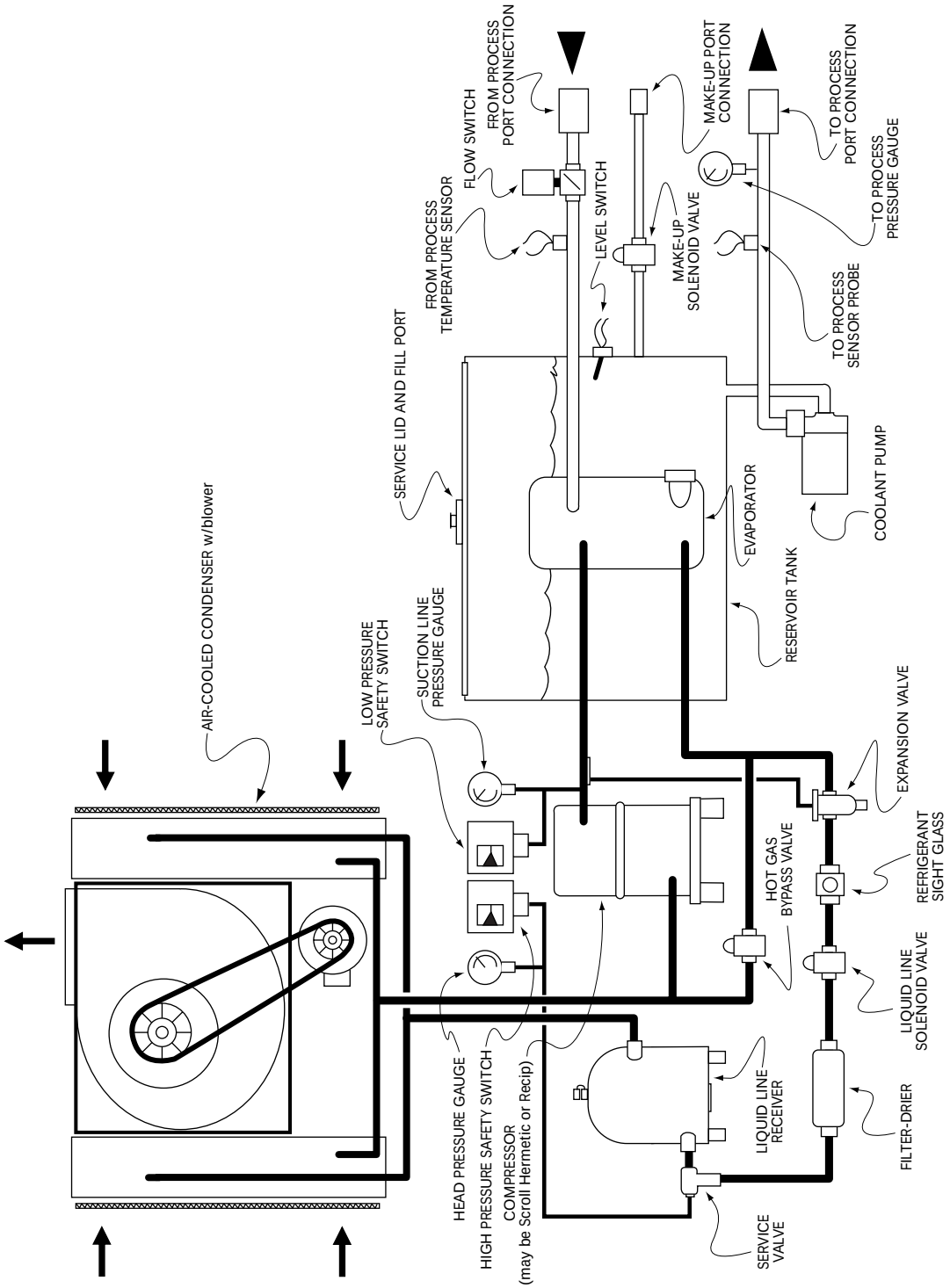
7.2 MECHANICAL SCHEMATIC - 15 / 20 / 25 / 30 TON MODELS



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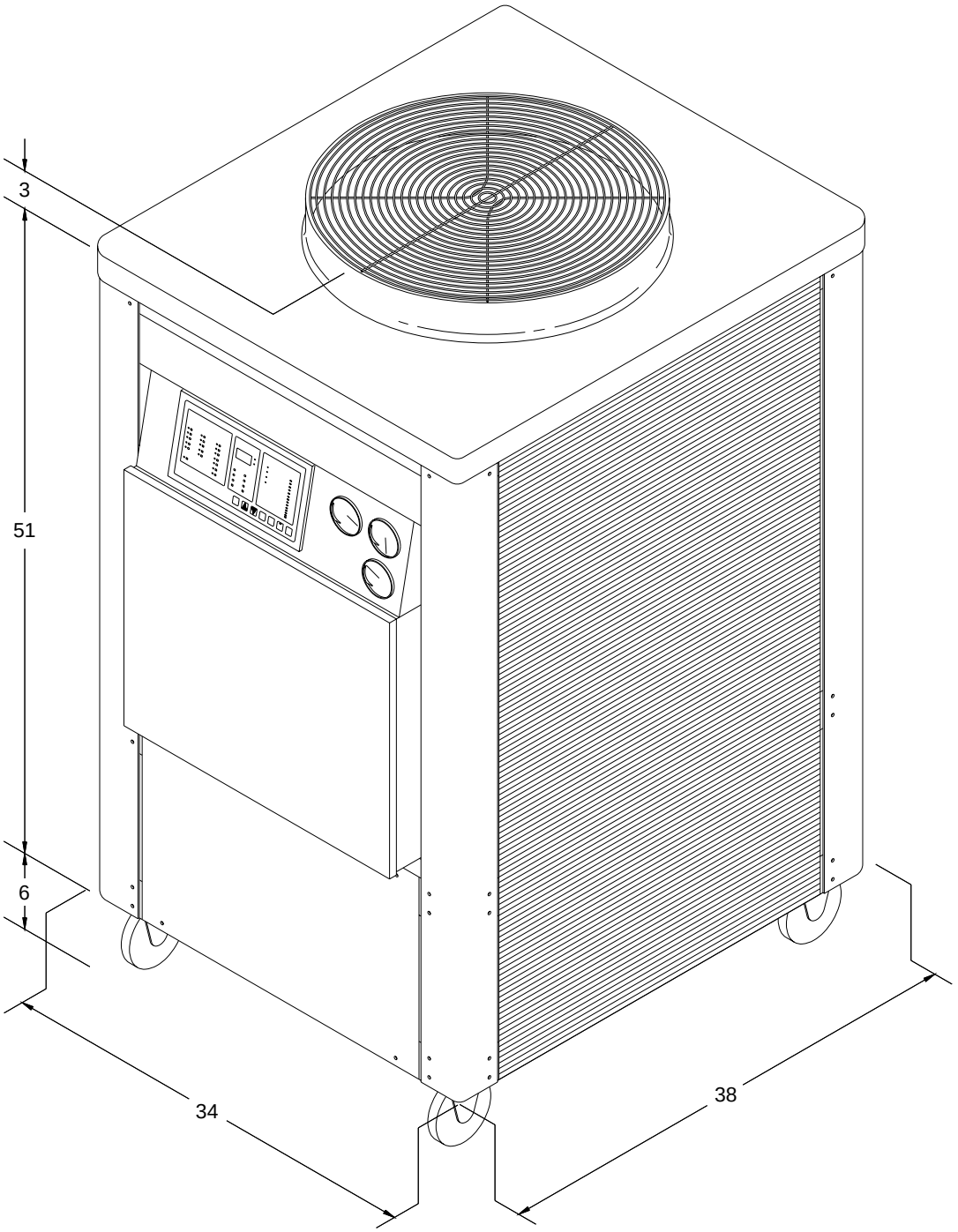
7.3 PHYSICAL - 5 TON MODELS



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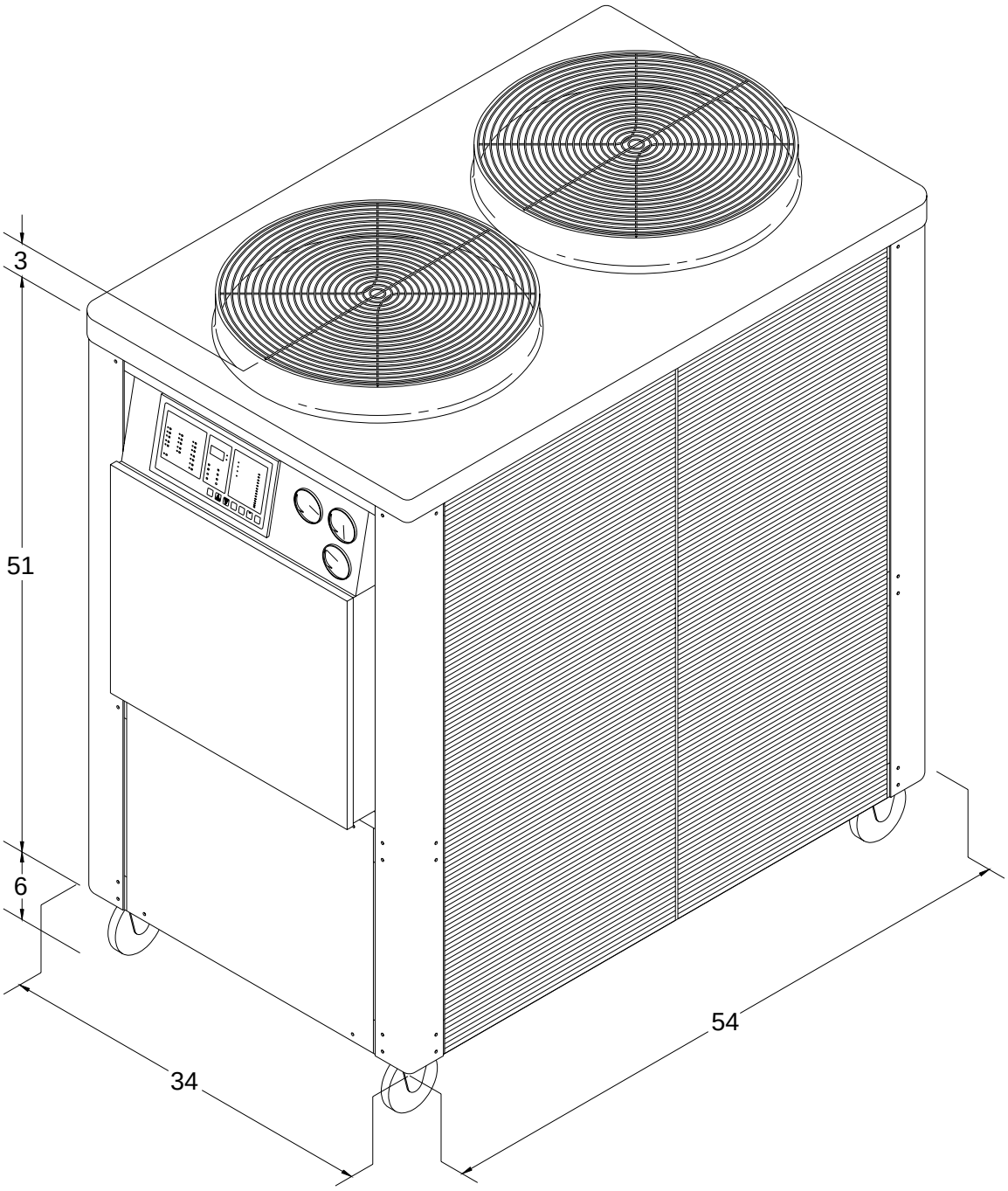
7.4 PHYSICAL - 7.5 / 10 TON MODELS



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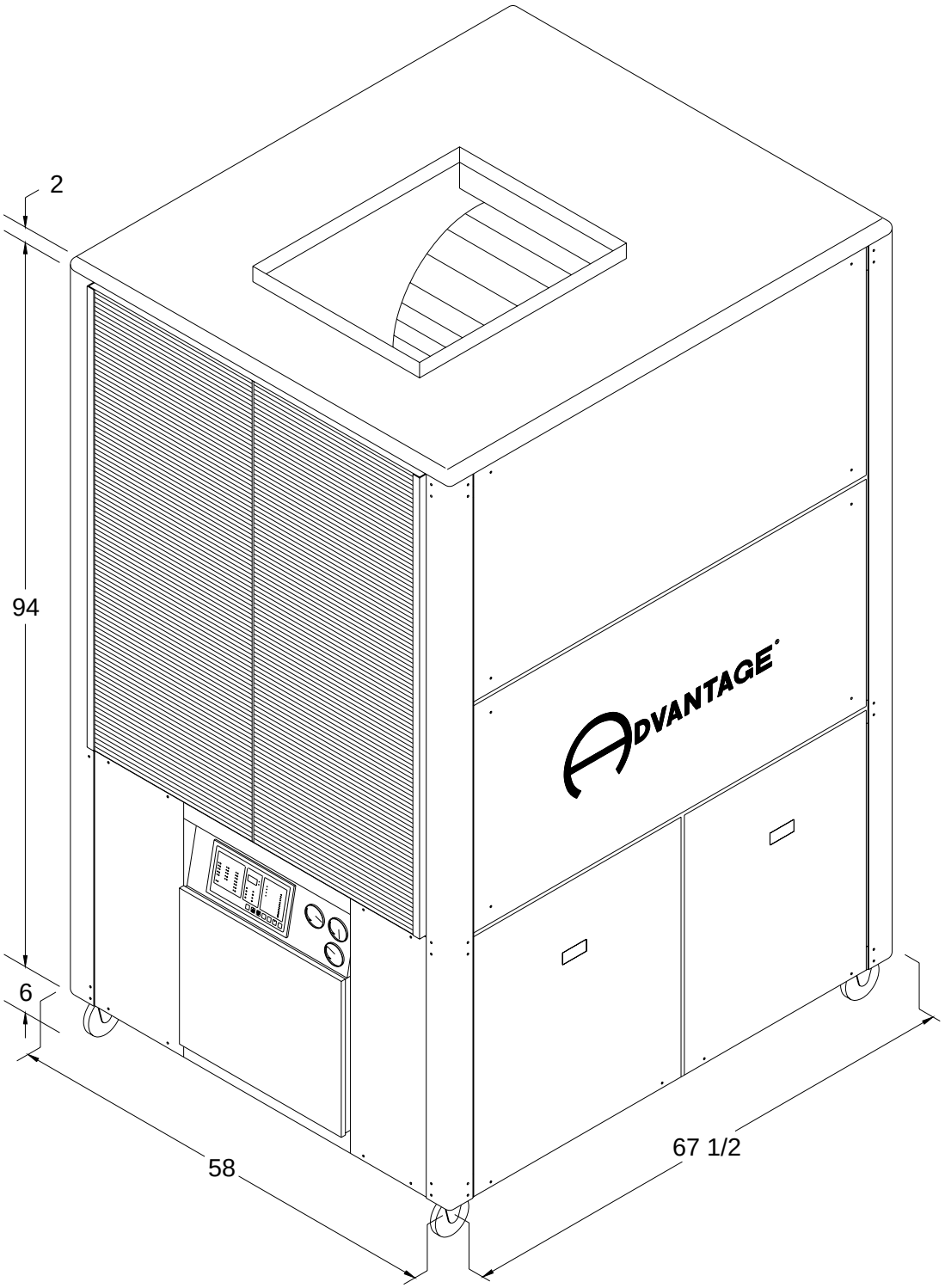
7.5 PHYSICAL - 15 20 / 25 / 30 TON MODELS



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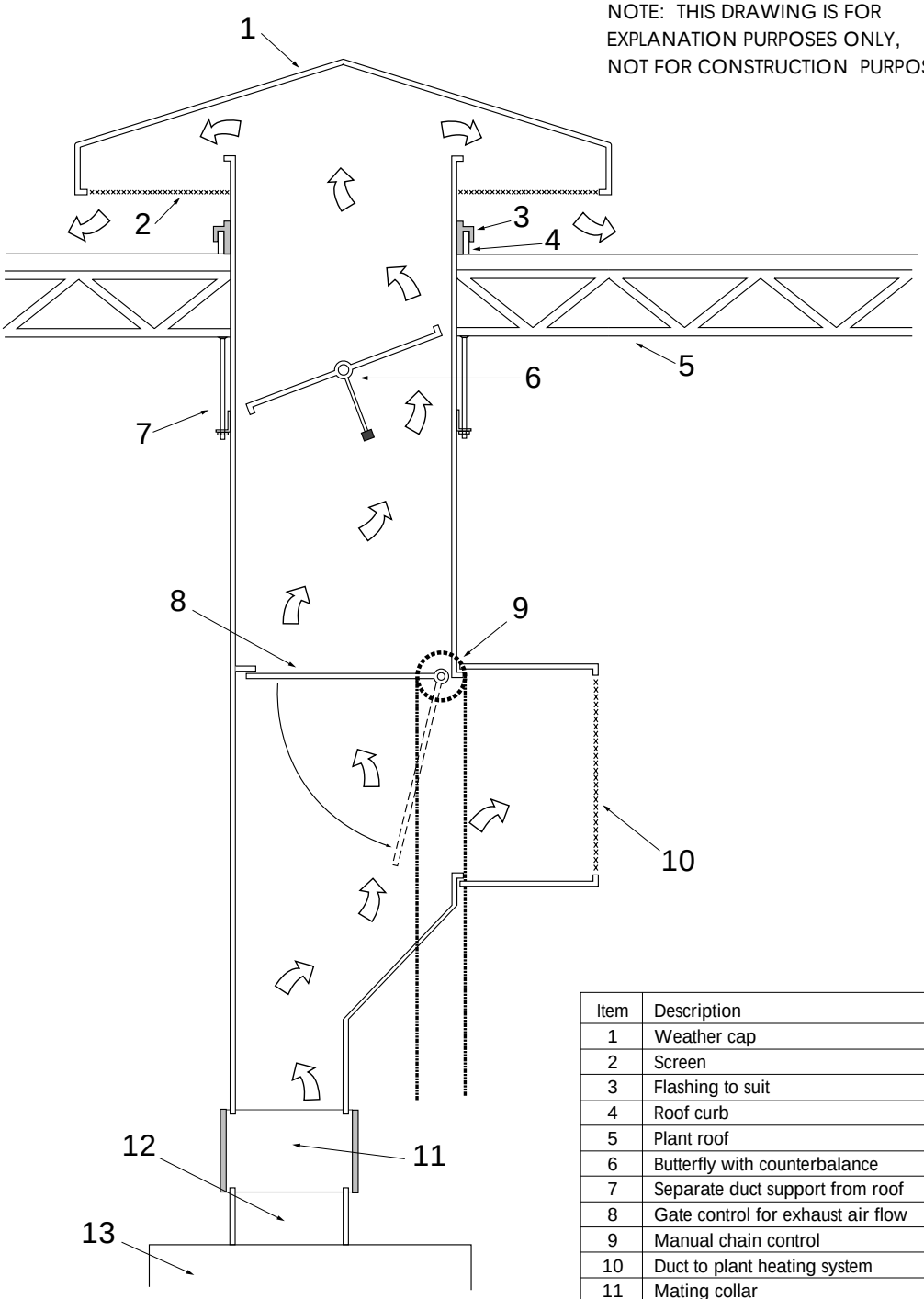
7.6 DUCT SCHEMATIC FOR AIR COOLED CHILLERS

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

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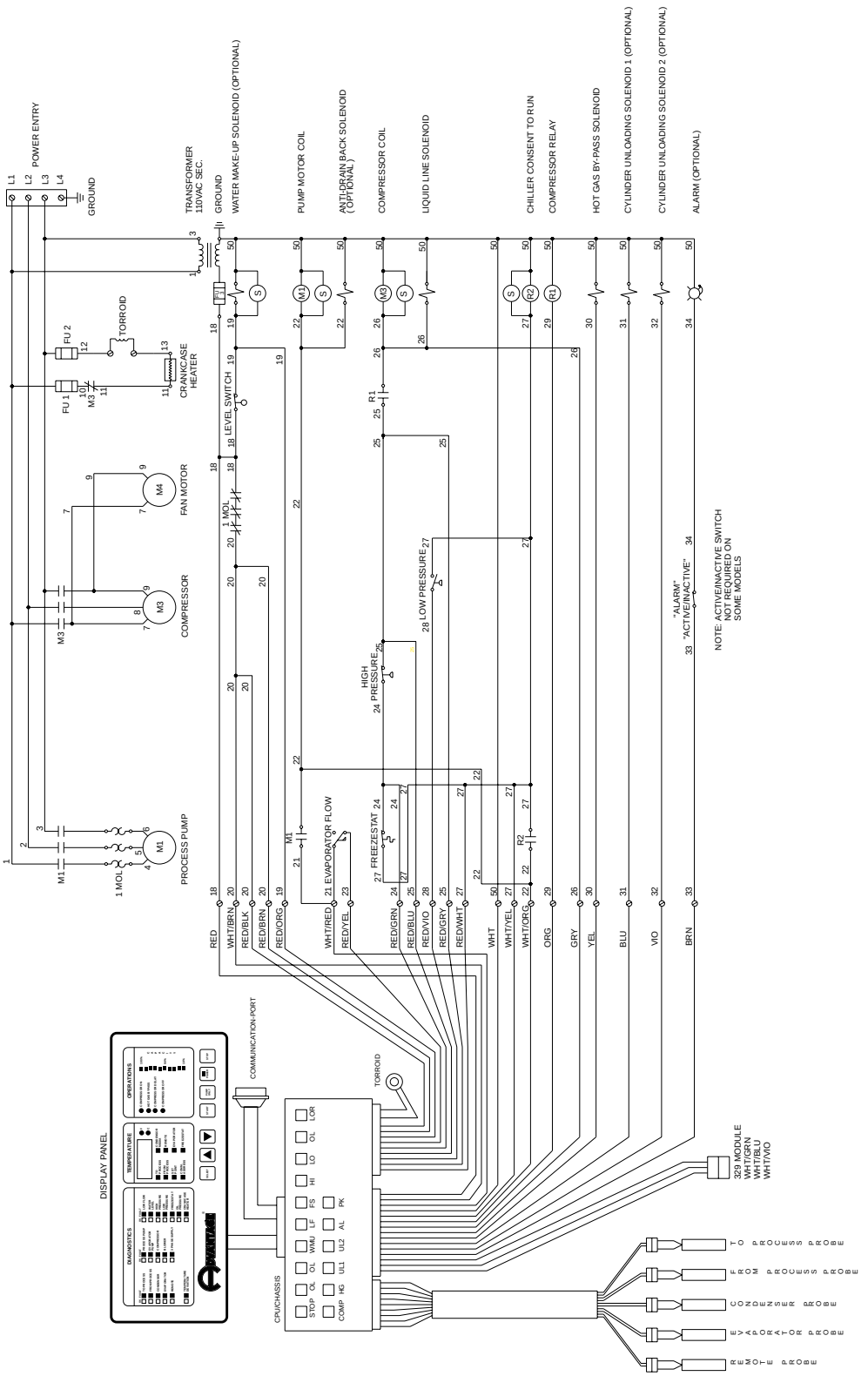
7.7 ELECTRICAL



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

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8.0 APPENDIX

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8.1 SPECIFICATIONS

MAXIMUM 'MK-A' SPECIFICATIONS		*5A*	*7.5A*	*10A*	*15A*	*15A*	*20A*	*20A*	*25A*	*30A*
COMPRESSOR	Capacity[4]	5	7 1/2	10	15	15	20	20	25	30
	HP	5	7 1/2	10	15	15	(2)10	(2)10	(2)13	(2)15
	Type[5]	H	H	H	H	H	H	H	H	H
PROCESS PUMPS[1]	HP	2	2	2	3	3	3	3	5	5
	GPM	12	18	24	36	36	48	48	60	72
	PSI	52	50	48	58	58	55	55	59	57
CONNECTION SIZES	Process (to/from)	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	2	2
(inches NPT)	Make-Up	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
AIR-COOLED	Condenser Type [6]	F	F	F	F	B	F	B	B	B
CONDENSER	Motor Quantity	1	2	2	1	1	1	1	1	1
	Motor HP	3/4	3/4	3/4	3	7 1/2	5	10	15	20
	CFM x 1000	5	10	10	15	15	20	20	25	30
	S.P.[7]	n/a	n/a	n/a	n/a	1.35	n/a	1.35	1.35	1.35
FULL LOAD[2]	230 volt	30	45	52	74	90	102	114	158	178
AMPERAGE@3ø/60hz[3]	460 volt	15	23	26	37	45	51	57	79	89
	575 volt	12	19	21	30	36	41	46	64	72
REFRIGERANT (HCFC)	Type	22	22	22	22	22	22	22	22	22
TANK CAPACITY (gallons)	Holding	25	25	25	65	65	65	65	65	65
DIMENSIONS (inches)	Height	60	60	60	96	96	96	96	96	96
	Width	34	34	34	58	58	58	58	58	58
	Depth	40	56	56	70	70	70	70	70	70
WEIGHTS (pounds)	Shipping [8]	700	1,250	1,300	1,790	1,790	2,100	2,100	2,300	2,400

1. Refer to FYI #3-C-36 for exact characteristics relating to pump curves. **2.** Full load amps are higher than run load amps and must be used for sizing disconnects and supply wiring. **3.** Consult factory for 50hz operation. **4.** Tons 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 -.80; 30°F -.60; 20°F - .40. The minimum recommended operating temperature when no glycol is used is 48°F.
5. H - hermetic scroll compressor used on this model. **6.** F - fan type; B - blower type. **7.** Static pressure in inches of water.
8. Approximate unit weight crated for shipment.

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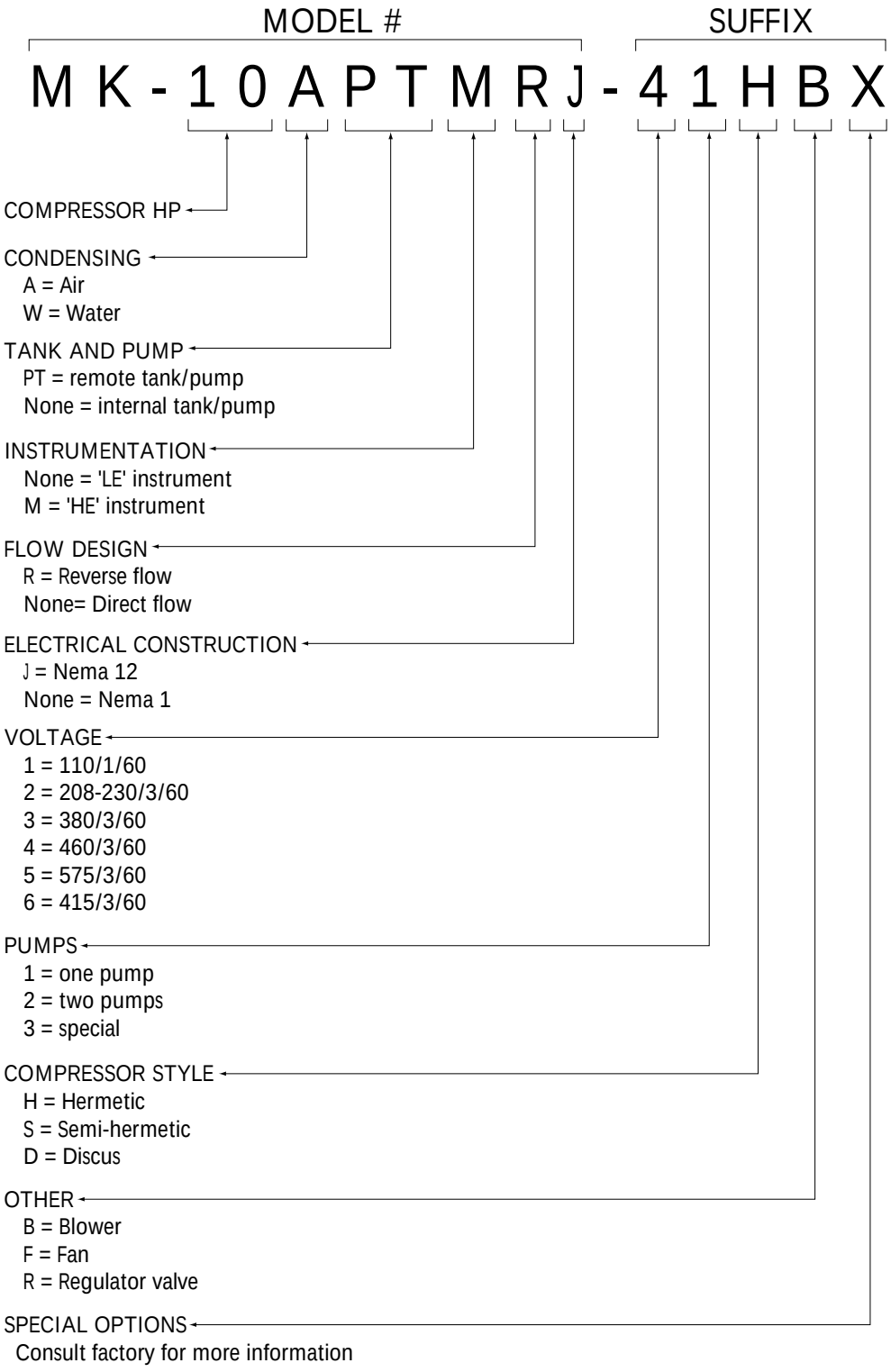
8.2 SPECIFICATIONS



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8.3 OPERATIONS BELOW 48°F

A. Chillers supplied with the automatic water supply system, the water supply connection must be plugged when operating below 48°F or anytime the system utilizes a water/inhibited propylene glycol solution. The system must be manually filled and the mix shall be checked for the proper ratio on a regular basis.

B. Addition of an inhibited propylene glycol solution is required. The ration shall be according to **figure 8.3A**. Too much glycol can cause capacity and control problems. Under no circumstances shall an automotive type antifreeze be used in the chilling unit.

C. The freezestat and low pressurestat settings must be field adjusted according to figure 8.3B.

NEVER LOWER THE CUT OUT SETTING WITHOUT ADDING GLYCOL TO THE CIRCULATING SYSTEM. EVAPORATOR DAMAGE WILL RESULT AND WILL NOT BE COVERED BY THE WARRANTY.

OPERATING TEMPERATURE	ANTI-FREEZE MIXTURE	
	GLYCOL	WATER
40°F	20%	80%
35°F	25%	75%
30°F	30%	70%

Figure 8.3A

OPERATING TEMPERATURE	LOW CUT IN	LOW CUT OUT	FREEZESTAT SETTING
48°F	63#	58#	38°F
40°F	50#	35#	30°F
35°F	45#	30#	25°F
30°F	40#	25#	20°F

Figure 8.3B

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8.4 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.

8.5 INHIBITED PROPYLENE GLYCOL

A. To operate liquid chillers below 48°F, it is necessary to add **inhibited propylene glycol** to the circulating system to lower the freeze point and prevent damage to the cooling system. Inhibited propylene glycol contains corrosion inhibitors which are compatible with most industrial heat transfer surfaces. Inhibited propylene glycol is manufactured by:

- Dow Chemical - "DowFrost" (1-800-258-2436)
- Monsanto "Therminol FS" (1-800-459-2665)
- Advantage Engineering "Thermofluid" (1-317-887-0729)

B. Automotive anti-freeze must never be used in industrial heat transfer applications. Automotive anti-freeze contains silicate type corrosion inhibitors designed to be compatible with automotive components. In an industrial application, the silicates will form a gel on the heat transfer surface which will result in substantial reduction in cooling capacity and is virtually impossible to remove.

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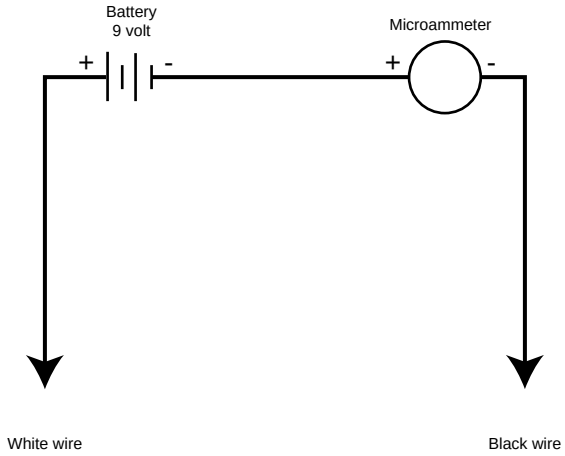
8.6 SENSOR CURRENT VS TEMPERATURE

-20°F	= 243.86	A
-10°F	= 249.43	A
0°F	= 255.00	A
10°F	= 260.57	A
20°F	= 266.14	A
30°F	= 271.71	A
40°F	= 277.27	A
50°F	= 282.84	A
60°F	= 288.41	A
70°F	= 293.98	A
80°F	= 299.55	A
90°F	= 305.12	A
100°F	= 310.69	A
110°F	= 316.26	A
120°F	= 321.82	A
130°F	= 327.39	A
140°F	= 332.96	A
150°F	= 338.53	A
160°F	= 344.10	A
170°F	= 349.67	A
180°F	= 355.24	A
190°F	= 360.80	A
200°F	= 366.37	A
210°F	= 371.64	A
220°F	= 377.51	A
230°F	= 383.08	A
240°F	= 388.65	A
250°F	= 394.22	A

Formula:

- 1 u A = (556.8627 x 10 x °F) = (255 x 10)
- °F = (1 u A - 255 x 10) + (556.8627 x 10)



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8.7 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.

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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.

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