IMS Industrial Equipment

Installation, Operation and Maintenance Manual

Hydra **EQ Series**

Portable Chillers
1 to 3 Tons

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Foreword

The intent of this manual is to serve as a guide for placing your portable chiller in service and operating and maintaining it properly. This manual is supplemented as required to accommodate any special items that may have been provided for a specific application. The written information contained in this manual, as well as various drawings, are intended to be general in nature. The schematics included in this manual are typical only. Actual schematics are included in the electrical enclosure of the chiller and should be referred to for troubleshooting and servicing of the unit. Additional copies of wiring diagrams are available upon request. We strive to maintain an accurate record of all equipment during the course of its useful life. While every effort is made to standardize the design features of these chillers, the various options may make it necessary to rearrange some of the components; therefore, some of the general drawings in this manual may differ from your specific unit.

Specific references to current applicable codes, ordinances, and other local laws pertaining to the use and operation of this equipment are avoided due to their ever-changing nature. There is no substitute for common sense and good operating practices when placing any mechanical equipment into operation. We encourage all personnel to familiarize themselves with this manual's contents. Failure to do so may unnecessarily prolong equipment down time.

The chilling equipment uses chemical refrigerants for heat transfer purposes. This chemical is sealed and tested in a pressurized system containing ASME coded vessels; however, refrigerant gas can be released if there is a system failure. Refrigerant gas can cause toxic fumes if it is exposed to fire. These units must be placed in a well-ventilated area, especially if open flames are present.

Failure to follow these instructions could result in a hazardous condition. Consult the unit serial tag for information about the refrigerant type and charge amount. Customers are advised to immediately implement a refrigerant management program including a survey of all equipment to document the type and quantity of refrigerant in each machine. All refrigeration service technicians must be certified by an EPA approved organization. It is recommended that good piping practices are followed and that the information in this manual is adhered to. We cannot be held responsible for liabilities created by substandard piping methods and installation practices external to the chiller.

We trust your equipment will have a long and useful life. If you should have any questions, please contact our Customer Service Department specifying the serial number and model number of the unit as indicated on the nameplate.

Installation

Receiving Inspection

Each unit is skid mounted and boxed or crated to protect it during shipping. If the chiller has a remote air-cooled condenser, the chiller and the condenser will ship skid mounted and will contain a holding charge of nitrogen. Before accepting delivery, check the box or crate for visible damage. If damage is evident, it should be properly documented on the delivery receipt and the box or crate should be immediately removed to allow for detailed inspection of the unit. Check for broken refrigerant lines, oil leaks, damaged controls, or any other major component torn loose from its mounting point. Any sign of damage should be recorded and a claim filed immediately with the shipping company. In order to expedite payment for damages it is important to record and document damage. An excellent way to do this is by taking pictures. Our Customer Service Department will provide assistance with the preparation and filing of your claims, including arranging for an estimate and quotation on repairs.

Rigging, Handling, and Locating Equipment

Proper rigging methods must be followed to prevent damage to components. Avoid impact loading caused by sudden jerking when lifting or lowering the chiller. Use pads where abrasive surface contact is anticipated.

The unit is designed for indoor use. If it is necessary to store the chiller in an unheated area when not in use, be sure that all water is drained or that an adequate amount of antifreeze is added to prevent freeze-up of the unit. A primary concern when designing your unit was serviceability, therefore, the chiller should be located in an accessible area.

Electrical Power

All wiring must comply with local codes and the National Electric Code. Minimum circuit ampacities and other unit electrical data are on the unit nameplate and are shown in the Electrical Specification section at the back of this manual. A

specific electrical schematic is shipped with the unit. Measure each leg of the main power supply voltage at the main power source. Voltage must be within the voltage utilization range given in Table 1.

Table 1 - Voltage Utilization Range

Rated Voltage	Utilization Range
230	208 to 254
460	414 to 506
575	516 to 633

If the measured voltage on any leg is not within the specified range, notify the supplier and correct before operating the unit. Voltage imbalance for three-phase systems must not exceed two percent. Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. Voltage imbalance is determined using the following calculations:

% Imbalance = $(V_{avg} – V_x) \times 100 / V_{avg}$

$V_{avg} = (V_1 + V_2 + V_3) / 3$

V_x = phase with greatest difference from V_{avg}

For example, if the three measured voltages were 442, 460, and 454 volts, the average would be:

(442 + 460 + 454) / 3 = 452

The percentage of imbalance is then:

(452 – 442) x 100 / 452 = 2.2 %

This exceeds the maximum allowable of 2%.

A terminal block is provided for main power connection to the main power source. The main power source should be connected to the terminal block through an appropriate disconnect switch. A separate lug for grounding the unit is also provided in the main control panel. Electrical phase sequence must be checked at installation and prior to start-up for all three-phase systems. Operation of the compressor with incorrect electrical phase sequencing will result in mechanical damage to the compressors. The phasing must be checked with a phase sequence meter prior to applying power. The proper sequence should read “ABC” on the meter. If the meter reads “CBA”, open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). All components requiring electric power are wired in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals.

WARNING: It is imperative that L1-L2-L3 are connected in the A-B-C phase sequence to prevent equipment damage due to reverse rotation.

CAUTION: The unit requires the main power to remain connected during off-hours to energize the compressor’s crankcase heater if equipped. Disconnect main power only when servicing the chiller. The crankcase heater should remain on when the compressor is off to ensure liquid refrigerant does not accumulate in the compressor crankcase.

WARNING: The control panel and safeties are wired such that connecting the appropriate power source to the main terminal block energizes the entire electric circuitry of the chiller. A control transformer has been factory wired to step down the incoming power to the 115-volt control power. Electric power at the main disconnect should be shut off before opening access panels for repair or maintenance. The unit must be properly grounded in compliance with local and national codes.

Water Cooled Condenser Lines
(Water Cooled Units Only)

The performance of the condenser is dependent on maintaining the proper flow and temperature of water through the heat exchanger. Insufficient water flow or high condenser water supply temperatures will result in the reduction of cooling capacity of the chiller. Extreme conditions will eventually result in the chiller shutting down due to high refrigerant pressure. Performance can be adversely affected if the condenser is allowed to plug up from contaminants in the condenser water stream. In order to reduce maintenance costs and chiller downtime, a water treatment program is highly recommended for the condenser cooling water. If any condenser does become plugged, contact our Customer Service Department for assistance in the proper procedure for cleaning out the condenser.

The standard cooling capacity is based upon 85°F (29°C) condenser cooling water supply. Under normal operating conditions there will be a 10°F (6°C) rise through the condenser resulting in 95°F (35°C) exiting water temperature from the condenser. To ensure proper water flow through the condenser, the condenser water pump should be able to handle up to 25 PSI (172 kPa) pressure drop through the condenser. While the design pressure loss is much lower than 25 PSI (172 kPa), we recommend the pumping system be sized for this loss to ensure there will be sufficient supply pressure to the condensers. To prevent damage to the condenser or regulating valve, the condenser water pressure should not exceed 150 PSIG (1034 kPa). The condenser water regulating valve controls the condenser water flow. The chiller loading and condenser water inlet temperature will determine the actual flow. Table 2 shows minimum condenser water flow requirements for the different size chillers at different supply temperatures under fully loaded conditions.

Table 2 - Condenser Water Flow Requirements

Model Number	GPM (L/min) @ 70°F (21°C)	GPM (L/min) @ 75°F (24°C)	GPM (L/min) @ 80°F (27°C)	GPM (L/min) @ 85°F (29°C)	GPM (L/min) @ 90°F (32°C)
EQ2W02	2.2 (8.3)	3 (11.3)	4.2 (15.9)	6.4 (24.2)	Call Factory
EQ2W03	3 (11.3)	3.8 (14.3)	5.4 (20.4)	8.2 (31)	Call Factory

The minimum flows are determined using the condenser water regulating valve setting of 210 PSI (1.45 Mpa) for a given supply temperature. The supply temperature range is from 40°F (4.4°C) to 90°F (32°C). Supply temperatures beyond this range are not recommended and may lead to improper chiller operation.

Air Cooled Chillers Condenser Air
(Air Cooled Units Only)

In order to accommodate the air-cooled condenser, the chiller must be located in a well-ventilated area. A minimum of three feet of clearance is recommended at both the condenser air inlet and condenser air discharge. The air cooled chillers were not designed to have the condenser air discharge ducted. Improper clearance or poor ventilation will reduce the cooling capacity of the chiller and may cause high refrigerant pressure problems. The condenser air inlet temperature should be maintained above 50°F (15°C) in order to avoid possible low refrigerant pressure safety trips during start-up.

Chilled Water Lines

All chilled water piping should be adequately insulated to prevent condensation. If water is allowed to condense on the piping, the state change of the water from gas to liquid will result in a substantial heat load that becomes an additional burden for the chiller. Standard portable chillers have been designed to provide 50°F (10°C) coolant to the process. Under normal operating conditions there will be a 10°F (6°C) rise through the process resulting in 60°F (16°C) return coolant temperature to the chiller.

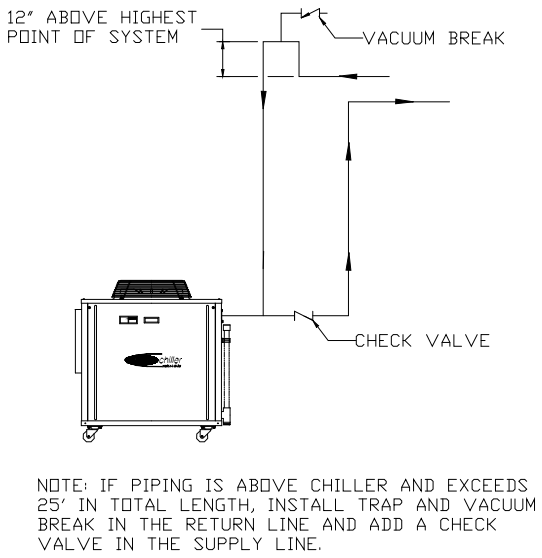
Table 3 - EQ Series Chilled Water Flow Requirements

Model	Nominal Flow GPM (L/min)	Pressure Drop PSI (kPa)
EQ3A01	2.4 (9)	1 (6.89)
EQ2A02	4.8 (18.1)	3 (20.68)
EQ2A03	7.2 (27.2)	5 (34.47)
EQ2W02	4.8 (18.1)	3 (20.68)
EQ2W03	7.2 (27.2)	5 (34.47)

The importance of properly sized piping between the chiller and process cannot be overemphasized. See the ASHRAE Handbook or other suitable design guide for proper pipe sizing. In general, run full size piping out to the process and then reduce the pipe size to match the connections on the process equipment. One of the most common causes of unsatisfactory chiller performance is poorly designed piping. Avoid unnecessarily long lengths of hoses or quick disconnect fittings that offer high resistance to water flow. When manifolds are required for water distribution, they should be

installed as close to the use point as possible. Provide flow-balancing valves at each machine to assure adequate water distribution in the entire system. The connection labeled “Chilled Water Supply” delivers fluid to the process and the connection labeled “Chilled Water Return” receives water back from the process. Typically when piping is overhead with a total run length over 25 feet (8 M) there should be a check valve in the supply line and an inverted P trap with a vacuum break valve installed as shown in Figure 1. The height of the return line must not exceed 25 feet (8 M) when using an inverted P trap configuration. If a vertical rise greater than 25 feet (8 M) is required, a solenoid valve must be installed in the return line at the chiller instead of inverted P trap with vacuum break.

Figure 1 - Recommended Overhead Piping



Interconnecting Refrigerant Piping

(EQR Models Only) The chiller unit is shipped with a nitrogen holding charge and has a full charge of oil, excluding the additional charge for field piping. Proper evacuation is required prior to charging with refrigerant. The chiller is for use only with the air-cooled condenser provided with the unit. The following section covers the required piping between the chiller and the provided air-cooled condenser.

Caps are located on the discharge and liquid lines. These line sizes do not necessarily reflect the actual line sizes required for the piping between the chiller and the air-cooled condenser. The installing contractor need only provide the interconnecting piping between the chiller and the air-cooled condenser.

Refrigerant piping size and piping design has a significant effect on system performance and reliability. For specific pipe sizing and configuration, refer to the EQR Series Chiller Remote Air Cooled Condenser Installation Guidelines Manual. All piping should conform to the applicable local and state codes. Use refrigerant grade copper tubing only and isolate the refrigeration lines from building structures to prevent transfer of vibration. Do not use a saw to remove end caps. This might allow copper chips to contaminate the system. Use a tube cutter or heat to remove the caps. When sweating copper joints it is important to flow dry nitrogen through the system. This prevents scale formation. Do not use soft solders. For copper-to-copper joints use a phos-copper solder with 6% to 8% silver content. Use a high silver content brazing rod for copper-to-brass or copper-to-steel joints. Only use oxy-acetylene brazing.

Start-Up

Every unit is factory set to deliver chilled water in accordance with the standard operating specifications for that particular chiller. Due to variables involved with different applications and different installations, minor adjustments may be required during the initial start-up to ensure proper operation. The following start-up procedure should be followed in sequence. If trouble is encountered during start-up, the fault can usually be traced to one of the control or safety devices. This outline can be used as a checklist for the initial start-up and for subsequent start-ups if the chiller is taken out of service for a prolonged period of time.

1. Assure the main power source is connected properly, that it matches the voltage shown on the nameplate of the unit, and that it is within the voltage utilization range given in Table 1. Electrical phase sequence must be checked at installation and prior to start-up for three-phase systems. Operation of the compressor with incorrect electrical phase sequencing will result in mechanical damage to the compressors. The phasing must be checked with a phase sequence meter prior to applying power. The proper sequence should read "ABC" on the meter. If the meter reads "CBA", open the main power disconnect and switch two line leads on the line power terminal blocks (or the unit mounted disconnect). All components requiring electric power are wired in-phase at the factory. Do not interchange any load leads that are from the unit contactors or the motor terminals. Once proper power connection and grounding have been confirmed, turn the main power on.

WARNING: Disconnect main power while working inside electrical enclosure or cabinet. Electrical shock or sudden start of mechanical components may result in severe injury or death.

WARNING: It is imperative that L1-L2-L3 are connected in the A-B-C phase sequence to prevent equipment damage due to reverse rotation.

Note: If chiller is equipped with a compressor crankcase heater, the main power must be on for 24 hours prior to starting the compressor to allow the crankcase heater to sufficiently vaporize any liquid refrigerant that may be present in the compressor.

2. Check to make sure that all process chilled water piping connections are secure. Open the cabinet and fill the chilled water reservoir with the proper water or water/glycol solution. See Table 4 for recommended glycol solutions. 25% glycol is recommended even if running at temperatures higher than 25°F to help protect the evaporator from potential freezing. Use glycol with a corrosion inhibitor only. The external sight glass located at back of unit may also be used to fill or drain tank.

Table 4 - Recommended Glycol Solutions

Chilled Water Temperature	Percent Glycol By Volume
50°F (10°C)	Not required
45°F (7.2°C)	5 %
40°F (4.4°C)	10 %
35°F (1.7°C)	15 %
30°F (-1.1°C)	20 %
25°F (-3.9°C)	25 %
20°F (-6.7°C)	30 %
15°F (-9.4°C)	35 %
10°F (-12.2°C)	35 %
5°F (-15°C)	40 %
0°F (-17.8°C)	40 %

3. (EQ2W02 and EQ2W03 only) Check the condenser water lines to make sure all connections are secure. Make sure sufficient condenser water flow and pressure are available, the condenser water supply is turned on, and all shut-off valves are opened.

4. (EQR Models Only) Check the refrigerant lines to make sure all connections are secure and that a proper evacuation of the chiller, the field piping, and the remote condenser has occured.

5. Charge the chiller with refrigerant. For EQR chillers, please refer to the EQR Series Chiller Remote Air-Cooled Condenser Installation Guidelines Manual to determine the required refrigerant charge. EQA and EQW chillers come factory charged and should require no additional refrigerant.

6. (EQR Models Only) Check the remote condenser main power and control wiring to ensure all connections are secure.

7. Verify that any existing refrigerant valves are open. Most units as standard contain no refrigerant valves.

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

8. (EQ2 series only) Make sure the Freezestat is set appropriately for the operating conditions of the chiller. The Freezestat is located inside the main electrical control panel. It should be set at 10°F (5°C) below the minimum chilled water temperature setting that the chiller will be operating. Reference Table 4 to be sure the coolant solution has sufficient freeze protection (glycol) to handle at least 10°F (2.8°C) below the Freezestat setting. All chillers are shipped from the factory with the Freezestat set at 38°F (3°C). This is done to protect against a possible freeze-up if no glycol has been added to the coolant. Once the proper glycol solution has been added, the Freezestat can be adjusted to the appropriate setting.

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

9. Turn on the control power by pressing the Power button located on front display panel. The panel displays should now be illuminated.

10. Due to extreme ambient temperatures that the unit may be exposed to during shipment, the High Refrigerant Pressure switch may have tripped. If this is the case, disconnect the main power and reset the High Refrigerant Pressure by depressing the manual reset button located on the switch. Reconnect the main power and turn the control power on by pressing the Power button.

WARNING: Under no circumstance should the High Refrigerant Pressure or the Low Compressor Pressure switch be deactivated. Failure to heed this warning can cause serious compressor damage, severe personal injury or death.

11. Establish flow through the evaporator. Standard units are provided with an internal pump and a coolant bypass to help protect pump from dead-heading and the evaporator from freezing. The EQ3A01 contains an automatic pressure actuated bypass which requires no adjustment under normal operating conditions. On all other models, the bypass must be throttled open to accommodate a "no flow to process" situation. The internal pump can be energized by pressing the Start button. If the unit has been customized and does not have an internal pump, the external pump should be energized to establish flow through the evaporator.

Note: The compressor will not start as long as the coolant pressure switch is open. A positive flow must be established through the evaporator before the compressor can operate. Under certain conditions the pressure loss in process lines may not be great enough to allow the pressure switch to close. A process throttling valve must be installed to regulate process pressure if this condition appears.

12. Set water flow through the evaporator as indicated in Table 3. A significant increase in flow beyond the recommended rate may damage the evaporator and create excessive pressure drops that influence the overall efficiency of the system.

13. Set the desired leaving water temperature on the control panel using the Up and Down buttons. The chiller should now be controlling to the selected temperature. Please note that if there is insufficient load the compressor may cycle on and off causing swings in temperature.

14. Regulation of the chiller temperature is based on leaving water temperature. Unless otherwise specified, it is factory set to deliver coolant at 50°F (10°C). Adjust to the desired operating temperature. Resetting the temperature will change the operating conditions of the chiller. Any lower readjustment of the controller must be done only after referencing Table 4 to ensure that the coolant has adequate antifreeze protection.

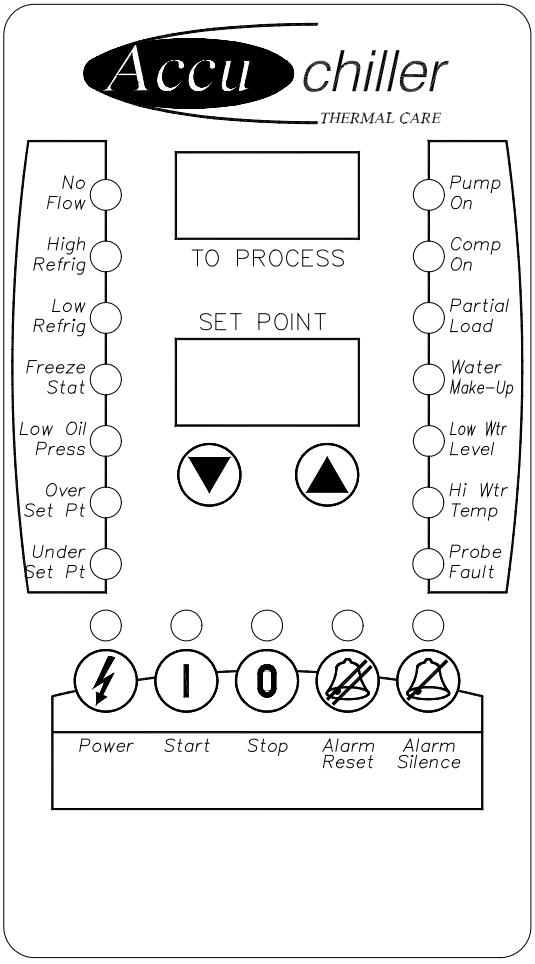
15. Operate the system for approximately 30 minutes. Check the liquid line sight glass. The refrigerant flow past the sight glass should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line. A shortage of refrigerant is indicated if operating pressures are low and subcooling is low. Normal subcooling ranges are from 10°F (5.5°F) to 20°F (11°C). If subcooling is not within this range, check the superheat and

adjust if required. The superheat should be approximately 10°F (5.5°C). Since the unit is factory charged, adding or removing refrigerant charge should not be necessary. If the operating pressures, sight glass, superheat, and subcooling readings indicate a refrigerant shortage, gas-charge refrigerant as required. With the unit running, add refrigerant vapor by connecting the charging line to the suction service valve and charging until operating conditions become normal.

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

Once proper flow and temperature are achieved, press the Stop button. The unit is now ready to be placed into service.

Controller Operation



The chiller includes a microprocessor controller designed to perform all control functions directly from the front panel. When a button is depressed, a click will be felt and the corresponding LED will be energized. Only one button should be pressed at a time. Table 5 shows the basic control fault logic for the microprocessor controller.

Table 5 - Microprocessor Control Fault Logic

Fault	Alarm Indication	Compressor Shutdown	Pump Shut Off	Alarm Reset Required[1]	Manual Reset Required[2]	Remote Alarm Activated[3]
No Flow	LED	Yes	Yes	No	No	Yes
High Refrigerant Pressure	LED	Yes	Yes	Yes	Yes	Yes
Low Refrigerant Pressure	LED	Yes	No	Yes	No	Yes
Freezestat	LED	Yes	No	Yes	No	Yes
Low Oil Pressure	LED	Yes	Yes	Yes	Yes	Yes
Over Set Point	LED	No	No	No	No	Yes
Under Set Point	LED	Yes	No	Yes	No	Yes
Low Water Level	LED	No	No	No	No	No
High Water Temperature	LED	No	No	No	No	No
Probe Fault	LED	Yes	Yes	Yes	No	Yes
Low Power	Pr OFF	Yes	Yes	Yes	No	Yes
Pump Overload	Err 126	Yes	Yes	Yes	Yes	Yes
Compressor Overload	Err 127	Yes	Yes	Yes	No	Yes
High Temperature Safety	Err 128	Yes	Yes	Yes	No	Yes

[1] Alarm Reset button or Stop button on control panel must be pressed.
[2] Safety control must be manually reset before the controller can be reset.
[3] Activates the alarm horn (if included) and closes the alarm contact (if included).

Power 

Depressing the Power button will switch the control power on or off. Control power must be initiated before either the Start button or remote on/off contacts can start the chiller.

Start 

Depressing the Start button will start the pump and enable the compressor. The compressor (and condenser fans or blowers if the chiller is air cooled) will start only if the microprocessor is calling for cooling because the actual To Process temperature is higher than the Set Point temperature.

Note: Once the compressor has cycled off, it will not restart for 2.5 minutes because of an internal anti-cycle time delay.

Stop 

Depressing the Stop button will shut off the compressor, pump, condenser fans or blowers (if the chiller is air cooled), and clear all fault signals.

Alarm Reset 

Depressing the Alarm Reset button will reset any fault indicator that has been activated on the control board. This includes any LED indicators or alarm codes. The High Refrigerant Pressure, Low Oil Pressure, and Pump Overload require a mechanical safety to be manually reset before the control board can be reset.

Note: If the condition still exists that originally caused the alarm indication, the alarm may be reactivated as soon as it is reset.

Alarm Silence 

The Alarm Silence button is only functional if the Alarm Horn option and/or Remote Alarm Contact option has been purchased. If the Alarm Horn option has been purchased, depressing the Alarm Silence button will disable the horn. The horn will not reactivate until the alarm has been reset and a subsequent alarm has been triggered. If the Remote Alarm contacts option has been purchased, depressing the Alarm Silence button will open the contact that was closed when the alarm occurred. The contact will not close again until the alarm has been reset and a subsequent alarm has been triggered.

Lower Set Point Temperature 

Each time the Lower Set Point Temperature button is depressed and released the Set Point temperature will decreased by 1°F (or 1°C). If the Lower Set Point Temperature button is held down, the Set Point temperature will continue to decrease until the button is released.

Raise Set Point Temperature 

Each time the Raise Set Point Temperature button is depressed and released the Set Point temperature will increased by 1°F (or 1°C). If the Raise Set Point Temperature button is held down, the Set Point temperature will continue to increase until the button is released.

No Flow 

The No Flow LED will be illuminated if the flow through the chiller is interupted. The pressure switch communicates to the controller the status of coolant flow. When the Start button is depressed, this safety is defeated for a period of 20 seconds in order for the pump to establish flow. The No Flow LED may remain illuminated during this 20 second period. This safety will shut off the pump and the compressor. If the chiller has been shut down by the No Flow safety, the Start button must be depressed in order to restart the pump and reset the 20 second time delay.

High Refrigerant Pressure 

If the compressor discharge refrigerant pressure exceeds the setting on the high refrigerant pressure safety, the compressor and pump will shut off and the High Refrigerant Pressure LED will be illuminated. Pressing the Alarm Reset button will reset the High Refrigerant Pressure fault, as long as the High Refrigerant Pressure switch located at the discharge of the compressor has been manually reset.

Low Refrigerant Pressure 

If the compressor suction pressure drops below the setting on the low refrigerant pressure safety, the compressor will shut off, the pump will remain running, and the Low Refrigerant Pressure LED will be illuminated. Pressing the Alarm Reset button will reset the Low Refrigerant Pressure fault, as long as the refrigerant pressure has risen back up above the safety's cutout level.

Freezestat 

(EQ2 series only) If the coolant temperature being delivered to the process drops below the setting on the Freezestat, the compressor will shut off, the pump will remain running, and the Freezestat LED will be illuminated. The Freezestat should be set 10°F (5°C) above the freezing point of the glycol solution and 10°F (5°C) below the minimum operating temperature. The Freezestat is factory set at 38°F (3°C). In order to reset the Freezestat fault press the Alarm Reset button on front control interface.

Low Oil Pressure 

This LED is nonfunctional on standard units and will be activated only if the unit has been modified to include a low oil pressure sensor (typical for semi-hermetic reciprocating compressor units). If the unit has a low oil pressure sensor and the oil pressure in the compressor crankcase drops below the factory set level on the oil pressure switch, the compressor and pump will shut off, and the Low Oil Pressure LED will be illuminated. In order to reset the Low Oil Pressure fault, press the Alarm Reset button after resetting the mechanical pressure switch located inside of the cabinet near the compressor.

Over Set Point 

The Over Set Point LED will be illuminated if the To Process temperature exceeds the Set Point temperature by more than 5°F (3°C). This fault causes only an alarm indication (horn and/or remote contact) and the chiller will continue to operate. Although the Over Set Point LED will turn on immediately whenever the temperature is out of range, the alarm relay is disabled for 30 minutes after start-up or after a change in set point. The alarm will automatically clear when the To Process temperature is no more that 5°F (3°C) above the Set Point temperature.

Under Set Point 

The Under Set Point LED will be illuminated if the To Process temperature drops below the Set Point temperature by more than 10°F (5°C). This fault will shut off the compressor, but the pump will continue to run. Although the Under Set Point LED will turn on immediately whenever the temperature is out of range, the alarm relay is disabled for 30 minutes after start-up or after a change in set point. Pressing the Alarm Reset button will reset this fault.

Pump On 

The Pump On LED will be illuminated whenever the pump is running. If the pump is shut off due to a safety, the Pump On LED will turn off. The Start button must be pressed in order to restart the pump.

Compressor On

The Compressor On LED will be illuminated whenever the compressor is running. The Compressor On LED will cycle on and off with the compressor. The compressor will not come on unless the pump is already running and the To Process temperature is above the Set Point temperature.

Note: During normal operation, the compressor may cycle on and off. An internal anti-cycle time delay will not allow the compressor to restart for 2.5 minutes after it has cycled off. For air cooled units the fans will cycle off with the compressor.

Partial Load

The Partial Load LED will be illuminated whenever the microprocessor energizes the hot gas bypass solenoid valve. This valve is cycled in order for the chiller to maintain a constant To Process temperature even when there is only a partial load. The longer that this LED stays on, the more unused excess capacity is available from the chiller. If the Partial Load LED stays off, the chiller is fully loaded by the heat from the process. If the Partial Load LED stays on, the chiller has a very small load on it from the process. If this low load condition persists, the To Process temperature may begin to drop below the Set Point temperature, and when it reaches 7°F (3°C) below the Set Point temperature, the compressor will cycle off. The compressor will come back on when the To Process temperature rises back up to the Set Point temperature and the anti-cycle 2.5 minute time delay relay has timed out.

Water Make-Up

This LED is nonfunctional on standard units and will be active only if the Water Make-Up option has been purchased. When the water level in the reservoir drops below the lower limit of the float switch, the water make-up solenoid valve is opened and the Water Make-Up LED is illuminated. When the water level rises to the upper limit of the float switch, the water make-up solenoid is closed and the Water Make-Up LED turns off. The microprocessor will also close the water make-up solenoid valve if it has been open for 10 minutes. This is done to help prevent further problems if a water leak has developed in the system. If this occurs, the Water Make-Up LED turns off and the Low Water Level LED remains illuminated.

Low Water Level

This LED is nonfunctional on standard units and will only be active if the Low Water Level option or the Water Make-Up option has been purchased. When the water level in the reservoir drops below the lower limit of the float switch, the Low Water Level LED is illuminated. When the water level rises to the upper limit of the float switch, the Low Water Level LED will shut off.

High Water Temperature

The High Water Temperature LED will be illuminated if the To Process temperature rises more than 10°F (or 5°C) above the Set Point temperature. The High Water Temperature LED will turn off when the water temperature is less than 10°F (or 5°C) above the Set Point temperature. This fault will not stop operation of the chiller.

Probe Fault

The Probe Fault LED will illuminate if the signal from the thermocouple is out of tolerance. This fault will also shut off the compressor and the pump. Pressing the Alarm Reset button will reset this alarm.

Changing Temperature Display Scale

This unit was shipped to display temperatures in either °F or °C. The step below can be followed to determine what temperature scale is in use and will provide instructions as to how to change from one scale to another.

1. With the power connected and the control power off, hold down the Stop button. While holding the Stop button down, press the Power button. When the controller illuminates, release both buttons.

2. The To Process display will read "Unt". The Set Point display will show either "F" or "C" depending on the current display units selected. If "F" is displayed the temperature display is in °F mode. If "C" is displayed the temperature display is in °C mode.

3. To change from °F to °C press the Lower Set Point Temperature button. To change from °C to °F press the Raise Set Point Temperature button.

4. The Set Point display now indicates the desired display units.

5. Press and release the Start button to store the new selection into the controller memory.

6. Press and release the Power button once to exit the function. Press and release the Power button again to restore controller power.

Diagnostic Error Codes

Several different error codes may be displayed on the digital readouts labeled To Process and Set Point. Most of the possible error codes indicate some type of failure in the microprocessor controller. Below is a list of the error codes. If there are any error codes other than the one listed below, try to reset the unit by shutting the power off and then turning it back on. If this does not work, make a note of the error code and contact our Customer Service Department for further assistance.

Table 6 - Diagnostic Error Codes

Error	Description	Cause/Corrective Action
Pr Off	Brown Out Indication	The Pr Off code will be indicated on the display if the chiller is running and main power is discontinued or drops more than 10% below the normal operating voltage, the unit will shut down and the Pr OFF fault will be indicated on the digital displays. Pressing the Power button will clear this fault condition.
101	EEPROM Failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
102	A/D Converter Failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
103	Controller serial bus failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
105	CJC Error	Controller requires servicing. Contact Manufacturer for repair or replacement.
109	Unused memory byte changed	Controller requires servicing. Contact Manufacturer for repair or replacement.
110	Device or communication configuration change or invalid	Controller requires servicing. Contact Manufacturer for repair or replacement.
111	Fixed parameter associated with range invalid	Controller requires servicing. Contact Manufacturer for repair or replacement.
112	Setpoint out of temperature range	Controller requires servicing. Contact Manufacturer for repair or replacement.
113	RAM hardware failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
114	Invalid device configuration	Controller requires servicing. Contact Manufacturer for repair or replacement.
117	Invalid program counter	Controller requires servicing. Contact Manufacturer for repair or replacement.
118	Infinite software loop detect	Controller requires servicing. Contact Manufacturer for repair or replacement.
119	Data direction register failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
120	Communication data register failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
121	Timer data register failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
122	Hardware watchdog data register failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
123	Option data register failure	Controller requires servicing. Contact Manufacturer for repair or replacement.
125	Jumper for temperature controller missing	The Err 125 fault code will be indicated on the digital displays if the jumper is loose or missing on the control circuit board.
126	Pump overload on chiller	The Err 126 fault code will be indicated on the digital displays if the pump overload has tripped. In order to reset this fault; press the Alarm Reset button after resetting the pump overload inside the electrical enclosure.
127	Compressor overload on chiller	The Err 127 fault code will be indicated on the digital display if the internal compressor motor winding thermostat or the external compressor motor overload has tripped. This fault will also shut off the pump. The internal compressor motor winding thermostat will automatically reset when the temperature drops back into the normal operating range. The external compressor motor overload must be manually reset. The compressor motor overload is located inside the electrical enclosure. Once the internal compressor motor winding thermostat resets and/or the external compressor overload has been reset, press the Alarm Reset button to reset the fault.
128	Chiller high temperature safety	The Err 128 fault code will be indicated on the digital displays if the chiller has been shut off due to the high temperature safety. This safety will shut off both the pump and compressor. This safety is triggered if the To Process temperature rises more than 10°F (5.5°C) above the maximum operating temperature for that particular chiller. The maximum operating temperature for each chiller is noted on the nameplate. The To Process temperature must be over the limit for three minutes before this safety will be triggered, and the fault is defeated for a period of thirty minutes from the time the Start button is pressed or the Set Point temperature is changed. Pressing the Alarm Reset button will reset this fault.
129	Input Contact Chatter	

Control Options

Return Water Temperature Display

This option allows the To Process digital display to indicate To Process or Return Water Temperatures. To view the Return Water Temperature, hold down the Lower Set Point Temperature and Raise Set Point Temperature buttons simultaneously. Once the buttons are released, the display will return to the To Process temperature.

Remote On/Off Contacts

This option allows the unit to be turned on and off via a remote contact closure. Two terminals are provided in the control panel to be wired to a remote contact closure device. Switching the contacts from open to closed simulates pressing the Start button on the control panel. Switching the contacts from closed to open simulates pressing the Stop button. Please note that the Remote On/Off contacts are nonfunctional until the Power button has been depressed and the control circuit has been energized. This option also includes a remote/local toggle switch that allows the operator to disable the remote contacts for safety purposes while the unit is being serviced.

Note: Do not introduce any external voltage to these contacts as this will result in damage to the microprocessor, which will not be covered by the warranty.

Remote Alarm Contacts

This option includes a set of dry (no voltage induced by chiller), normally open contacts that will close when there is an alarm condition. Refer to Table 5 for the Microprocessor Control Fault Logic to determine which faults will trigger the Remote Alarm contacts. The contacts will reopen by clearing the fault or by pressing the Alarm Silence button.

Alarm Horn

This option includes an alarm horn that will be activated by certain faults. Refer to Table 5 for the Microprocessor Control Fault Logic to determine which faults will trigger the Alarm Horn. The Alarm Horn will be silenced by clearing the fault or by pressing the Alarm Silence button. If this option is selected in conjunction with the remote control panel, the Alarm Horn will be mounted on the chiller and not the remote control panel.

Remote Control Panel

This option removes the display and control buttons from the chiller and places them in a small hand-held NEMA 1 enclosure. Included with this option is a 50 foot (15 M) cable to connect the controller and the chiller. All control functions are available to the operator at the location of the remote panel and no control functions are available at the location of the chiller.

SPI Communications

This option provides an RS-485 communication port located below the control panel on the front of the chiller. The serial communications will be multi-drop, half duplex, SPI 3.01 compatible and will allows the unit to communicate with another piece of equipment that also has SPI protocol capabilities.

The following SPI communications are supported by the microprocessor.

Process Temperature Set Point
High Temperature Deviation
Low Temperature Deviation
Process Status
To Process Temperature

The microprocessor is designed to accept inputs and deliver outputs according to SPI protocol. There must also be a computer or another piece of equipment that is equipped with the SPI protocol in order for the communications from the chiller to be of any use. The programming of this computer and/or other equipment is not the responsibility of the manufacturer.

Note: The manufacturer is not responsible for SPI protocol programming beyond what is included in the microprocessor controller.

When the SPI option is purchased, there is a second set of DIP switches included on the back of the main control panel. This set of DIP switches is labeled "COMM". All DIP switch adjustments that follow are to be made on the COMM set. Do not adjust any DIP switches on the CONFIG set.

Note: All DIP switch changes must be made with power disconnected.

In order to activate the SPI protocol, DIP switch #8 must be set to the "On" position. To deactivate the SPI communication, set DIP switch #8 to the "Off" position.

If more than one piece of equipment is going to be on the same communications network, the base address will have to be changed so that each unit has a unique address. This is done by changing one or more of the DIP switches to the "Off" position. The base address is 32 decimal. Changing these switches causes the following address change.

DIP Switch 1 OFF adds one to base address
DIP Switch 2 OFF adds two to base address
DIP Switch 3 OFF adds four to base address
DIP Switch 4 OFF adds eight to base address
DIP Switch 5 OFF adds sixteen to base address

The BAUD rate can be adjusted to the appropriate setting by using the information found in Table 7.

Table 7 - SPI Baud Rate Adjustment

BAUD Rate	DIP Switch #6	DIP Switch #7
1200	ON	ON
2400	OFF	ON
4800	ON	OFF
9600	OFF	OFF

Chiller Operation

Coolant Circuit

The pump draws coolant from the reservoir and delivers it to the evaporator. Before entering the evaporator, the coolant passes the pressure switch, a safety control device, which communicates the status of coolant flow through the evaporator to the microprocessor. It is in the evaporator where the heat is transferred from the coolant to the refrigerant. The temperature of the coolant being delivered to the process is controlled by adjusting the amount of heat transferred in the evaporator.

After leaving the evaporator, the coolant passes the Freezestat and thermocouple. The Freezestat (only on EQ2 series) is a safety control that is connected to the microprocessor. The thermocouple senses the temperature of the coolant being delivered to process and communicates this temperature to the microprocessor.

The coolant then exits the unit through the process water supply connection on the back of the chiller. It is delivered out to the process where it picks up heat and returns to the process return connection. From this connection, the coolant returns to the reservoir thereby completing the cycle.

A small coolant bypass line runs between the supply connection and reservoir. This bypass allows the chiller to operate with sufficient flow through the evaporator even if the flow is restricted or completely shut off through the process. On the EQ3A01, a pressure actuated bypass valve is supplied and is designed to open in the event that the process flow becomes restricted. This valve need not be adjusted under normal operating conditions. On other chiller models, there is a ball valve located in this line where it tees into the supply line. This valve can be adjusted depending on how much flow is required to process, but must remain throttled partially open at all times.

Note: Closing this valve off too far may result in a situation that could damage components in the chiller. The main purpose of the bypass line is to avoid deadheading of the pump and reduce the possibility of an evaporator freeze-up.

Refrigerant Circuit

The heat that is transferred in the evaporator from the coolant to the refrigerant is used to change the state of the refrigerant from a liquid to a gas. After leaving the evaporator, the refrigerant passes to the compressor.

The compressor is the heart of the refrigeration circuit. It takes the cool, low-pressure gas entering the compressor and compresses it, which creates the hot, high-pressure gas that exits the compressor. Since the compressor is not 100% efficient, some extra heat is added to the refrigerant as it is being compressed.

The hot, high-pressure gas that exits the compressor is delivered to the condenser. In the condenser, the heat is transferred from the refrigerant into the air or water that is passing through the condenser. As the heat is transferred, the refrigerant changes from a gas to a liquid. The condenser has been sized to remove the heat from the process load and the heat that was added by the compressor.

After leaving the condenser, the liquid refrigerant passes through the filter drier and sight glass. The filter drier removes any particles or moisture from the refrigerant. The sight glass is used to monitor the stream of liquid refrigerant. The liquid refrigerant then passes through the thermal expansion valve (TXV) which meters the flow into the evaporator where the process starts all over again.

Capacity and temperature control is accomplished with a hot gas bypass system. If the chiller were catering to a partial load from the process, the coolant supply temperature would normally tend to drop. The microprocessor senses this drop in temperature, and opens the hot gas bypass solenoid valve. When this valve is open, some of the hot compressor discharge gas is directed to the inlet of the evaporator instead of going through the condenser. This reduces the chillers cooling capacity and puts an additional heat load on the evaporator, which brings the coolant temperature back up to set point. The microprocessor cycles the hot gas solenoid valve as is needed to maintain the coolant temperature to within 1°F (1°C) of the set point even with loads as low as 10% to 25% of full capacity.

If the process heat load is extremely low, or even nonexistent, the hot gas bypass system may not be able to put enough of a load on the evaporator, and the coolant temperature will begin to drop. When the coolant temperature drops 7°F (3°C) below the set point temperature, the controller will shut the compressor off. When the coolant temperature rises back to the set point temperature, the compressor comes back on. The compressor will remain off for at least two and one half minutes to prevent short cycling.

Chiller Construction

Compressor

The chiller is equipped with either a hermetic rotary vein or scroll compressor. Both the compressor and the motor are encased together and solidly mounted in the cabinet. The compressor is unidirectional, so it is important to have power phased correctly when operating on a three-phase power supply. The cool refrigerant suction gas cools the motor windings, and there is an internal thermal overload to protect the windings from overheating. The compressor is lubricated with oil that travels throughout the system with the refrigerant.

Air Cooled Condenser (Air Cooled Units Only)

The condenser is constructed of heavy gauge copper tubing and aluminum fins for maximum heat transfer capabilities. The condenser has been generously sized so the chiller can operate with full cooling capacities in ambient air temperatures of up to 95°F (35°C). When the ambient air temperatures are above 95°F (35°C) the chiller will lose approximately 1% of its cooling capacity per 1°F (0.5°C) above 95°F (35°C). The chiller is capable of operating in ambient temperatures of up to 105°F (40.5°C).

The fan draws cool air through the condenser and discharges warm air out the top of the cabinet. The unit is designed to draw sufficient air through the chiller as long as there are no obstructions. The fans are not designed to draw air through ductwork or discharge air through ductwork. The discharge air will be approximately 20°F (12°C) warmer than the intake air.

Water Cooled Condenser
(Water Cooled Units Only)

The condenser is a coaxial tube-in-tube type heat exchanger constructed of a steel outer tube with copper inner tubes. The condenser water passes through the copper inner tubes, while the refrigerant passes around the tubes, in the outer steel tube.

Condenser Water Regulating Valve (Water Cooled Units Only)

A condenser water regulating valve is provided as standard. This valve is located in the condenser water piping at the outlet of the condenser. It regulates the flow of water through the condenser in order to maintain the high-pressure side of the refrigeration circuit. This valve is set at the factory and should only be adjusted by a qualified refrigeration technician. The valve only passes as much water as is required to maintain the refrigerant pressure, so less water will be required if the water temperature is lower than the design 85°F (29°C). Refer to Table 2 for minimum condenser water flow requirements for different supply water temperatures.

Note: The condenser water regulating valve may not completely shut-off water flow when the chiller is not operating. If flow must be completely stopped for any reason, a shut-off valve (manufactured by others) must be used. Make sure the shut-off valve is reopened before restarting the chiller.

Condenser Remote Air-Cooled

(EQR Models Only) The remote air-cooled condenser has a copper tube and aluminum fin coil with fan(s). The refrigerant passes through the copper tubes, while the air passes over the fins. The condenser supplied is equipped to vary the header fan(s) speed and operate the remaining fans (if present) as needed to control the refrigerant discharge pressure under varying ambient and chiller loading conditions. Please see the air-cooled remote condenser installation instructions for proper mounting and connection of the condenser.

Evaporator

The evaporator is constructed of stainless steel plates and copper brazing. The refrigerant passes between every other set of plates, while the coolant flows on the other side of the plates in the opposite direction.

Thermostatic Expansion Valve (TXV)

The TXV separates the high pressure/high temperature side of the refrigeration circuit (the condenser side) from the low pressure/low temperature side of the refrigeration circuit (the evaporator side). The TXV maintains constant superheat at the evaporator outlet, regardless of process load, by precisely metering the amount of refrigerant into the evaporator. Superheat is the difference between the saturated evaporative temperature and the actual measured temperature at the TXV sensor bulb. The superheat is factory set for 10°F to 12°F (5°C to 6°C) and should never exceed 15°F (8°C). Only a trained refrigeration technician should adjust this valve.

Refrigerant Sight Glass

The refrigerant sight glass is located in the liquid line immediately ahead of the expansion valve. It allows the operator or service technician to observe the flow of liquid refrigerant. Prolonged periods of foaming in the sight glass may indicate a low refrigerant condition or a restriction in the liquid line.

Note: Occasional bubbling in the sight glass may occur at a time when load conditions are changing and the thermostatic expansion valve is adjusting to the new conditions. This momentary occurrence is a result of normal chiller operation.

The sight glass can also be used to check if there is moisture in the refrigeration system. If there is moisture in the system, the green dot in the center of the sight glass will turn yellow. If this occurs, the chiller should be serviced immediately.

Refrigerant Filter Drier

The filter drier is located in the liquid line between the condenser and the refrigerant sight glass. It is designed to remove any moisture and/or foreign matter that may have gotten into the refrigerant stream. Moisture and foreign matter can cause serious damage to the components of a refrigeration system. For this reason, it is important that the chiller be equipped with a clean filter drier. Replace the filter drier if any of the following conditions occur.

1. The refrigeration system is opened to the atmosphere for repairs or maintenance.
2. Moisture is indicated in the sight glass (the green dot has changed to yellow).

3. An excessive pressure drop develops across the filter drier. This is indicated by a significant temperature difference between the filter inlet and outlet.

Hot Gas Bypass Valve

This valve is located in the refrigerant line that runs from the compressor discharge to the evaporator inlet. It is designed to artificially load the chiller when the chiller is catering to a partial load from the process. This is accomplished by directing some of the hot compressor discharge gas directly back into the evaporator instead of going through the condenser. The microprocessor controller controls the amount of hot gas used. Eliminating cycling of the compressor is extremely desirable as it significantly extends its lifetime expectancy.

Reservoir

The reservoir is mounted to the inside of the cabinet. The reservoir is made of polyethylene and is fully insulated. A sight glass is included so the coolant level can be observed from the back of the chiller. The sight glass can also be used to fill or drain the reservoir. There is also a removable cover on the top of the reservoir. During chiller operation the reservoir should be at least half full. For most installations the reservoir has sufficient capacity to handle coolant drain back from the process equipment which occurs during chiller shut down. For installations with overhead piping runs of over 25 feet (8 M) special precautions will have to be made during installation (see Installation Section, Diagram 1).

Note: The reservoir cannot be pressurized. Modifications to the chiller that would result in pressurization of the reservoir will void the warranty.

Coolant Pump

The EQ3A01 is equipped with a close coupled postive displacement rotary vein pump while the other models are equipped with a close-coupled centrifugal pump. All pumps have a mechanical seal and are constructed of nonferrous material. The pump is factory tested for the specified operating conditions. The pump motor meets NEMA specifications and industry standards.

Pressure Gauge

A pressure gauge is mounted on the back panel of the chiller. This gauge displays the pressure of the coolant at the discharge of the pump. It can be used to determine the approximate point on the pump curve in which the pump is operating.

Y-Strainer

A Y-strainer with a 20-mesh screen is installed in the water line on EQ2 series chillers to help protect the evaporator passages from becoming clogged. This strainer is shipped loose on EQ3A01 and should be installed external to the cabinet on the return from process line.

High Refrigerant Pressure Switch

The High Refrigerant Pressure switch is designed to limit the compressor discharge pressure within the design parameters of the compressor. The switch is located on the discharge side of the compressor and can be reset by first pressing the manual reset button located on the High Refrigerant Pressure safety switch and then by pressing the Alarm Reset button on the control panel. The setting on this switch is set to cut out at 375 PSIG (2.59 MPa) for air cooled units or 300 PSIG (2.07 MPa) for water cooled units.

Low Refrigerant Pressure Switch

The Low Refrigerant Pressure switch is designed to limit the compressor suction pressure to within the designed parameters of the compressor. The switch is located in the suction side of the compressor and can be reset by pressing the Alarm Reset button on the control panel. The setting on this switch is set to cut out at 10 PSIG (69 kPa) and cut in at 40 PSIG (276 kPa) for EQ3A01. On all other models the switch is set to cut out at 25 PSIG (172 kPa) and cut in at 55 PSIG (379 kPa).

Freezestat

(EQ2 series only) The freezestat control is an electronic thermostat that senses the coolant temperature separately from the microprocessor controller. This safety is designed to limit the temperature of the coolant leaving the evaporator and prevent possible freeze-up situations. This control should be set 10°F (5°C) below the minimum coolant supply temperature, and there should be a sufficient glycol concentration for 10°F (5°C) below the freezestat setting.

Note: It is critical that the freezestat is set properly and that there is sufficient glycol in the system to correspond with the freezestat setting. Freeze-ups can cause extensive damage to several components in the chiller, and the warranty does not cover repairs required due to a freeze-up.

The Freezestat is located inside the main electrical enclosure. If the chiller shuts down due to the Freezestat, the Alarm Reset button on the control panel must be pressed before the chiller can be restarted.

Coolant Pressure Switch

This switch is located in the water piping at the inlet of the evaporator. It is designed to shut the unit down if there is insufficient coolant pressure at the evaporator and hence coolant flow through the evaporator. The switch is adjustable; however, no adjustments should be made without prior approval from the factory. If the chiller shuts down due to low coolant flow, pressing the Start button on the control panel can restart it. This switch is disabled for 20 seconds after the Start button is pressed so that the pump can develop adequate pressure to make the switch.

Automatic Water Make-Up (Optional)

With this option, a water supply can be connected to the chiller so that the water level in the reservoir is automatically maintained. When the water level in the reservoir drops below the low level on the float switch, a solenoid valve will be opened to allow fresh water into the system. When the water level reaches the high level on the float switch, the solenoid valve is closed.

Note: This option is not normally recommended for systems that depend on a glycol solution to prevent freeze-ups. Automatic water make-up may cause reduction of the glycol concentration, which may result in an evaporator freeze-up.

Upgraded Pumps (Optional)

The standard pumps that have been selected for each size chiller will meet the requirements of most applications; however, in certain instances, larger pumps may be required to provide the desired flow and pressure for a specific application. The horsepower of the pump will be indicated on the chiller nameplate.

Preventive Maintenance

Once your portable chiller has been placed into service, the following maintenance procedures should be adhered to as closely as possible. The importance of a properly established preventive maintenance program cannot be overemphasized. Taking the time to follow these simple procedures will result in substantially reduced downtime, reduced repair costs, and an extended useful lifetime for the chiller. Any monetary costs of implementing these procedures will almost always more than pay for it.

To make this as simple as possible, a checklist should be prepared which lists the recommended service operations and the times at which they are to be performed. At the end of this section we have included a checklist that can be used for this purpose. Notice that there are locations for voltage readings, amperages, etc. so that they can be monitored over time. With this information, maintenance personnel may be able to correct a potential problem before it causes any downtime. For best results, these readings should be taken with a full heat load from process, preferably with similar operating conditions each time. The following is a list of suggested periodic maintenance.

Once a Week

1. (Air Cooled Units Only) Check the surface of the air cooled condenser filter (if so equiped) and coil for dirt and debris. To clean, rinse thoroughly with water. Mild detergent can be used to remove smoke and or grease stains.

2. Check to make sure that the To Process temperature is maintained reasonably close to the Set Point temperature. If the temperature varies more than 5°F (3°C) from the set point, there may be a problem with the chiller. If this is the case, refer to the Troubleshooting Chart or contact the Customer Service Department.

3. Check the pump discharge pressure on the gauge on the back panel of the chiller. Investigate further if the pressure starts to stray away from the normal operating pressure.

4. Check the coolant level in the reservoir. Replenish if necessary making sure to take proper precautions to maintain the appropriate glycol concentration.

5. Check coolant circulation pump for leaks in the seal area. Replace pump seal if necessary.

6. Check refrigerant sight glass for air bubbles or moisture indication. If the sight glass indicates that there is a refrigeration problem, have the unit serviced as soon as possible.

Once a Month

Repeat items 1 through 6 as listed above and continue with the following.

7. With the main disconnect shut off and locked out, check the condition of electrical connections at all contactors, starters and controls. Check for loose or frayed wires.

8. Check the incoming voltage to make sure it is within 10% of the design voltage for the chiller.

9. Check the amp draws to each leg of the compressor (fans or blowers on air cooled units) and pump to confirm that they are drawing the proper current.

Every Three Months

Repeat items 1 through 9 listed above and continue with the following.

10. The Y-strainer basket should be removed and cleaned if necessary. This may be required more often if contaminants can easily get into the process water.

11. Have a qualified refrigeration technician inspect the operation of the entire unit to ensure that everything is operating properly. Have the condenser cleaned out if necessary.

Preventive Maintenance Checklist

Model # _____
Serial # _____

Maintenance Activity	Week Number												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Date													
Clean Condenser Coil and Inlet Filter (air cooled units)													
Temperature Control													
Pump Discharge Pressure													
Coolant Level													
Glycol Concentration													
Pump Seal													
Refrigerant Sight Glass													
Electrical Connections													
Incoming Voltage													
Compressor L1 Amps													
Compressor L2 Amps													
Compressor L3 Amps													
Pump L1 Amps													
Pump L2 Amps													
Pump L3 Amps													
Fan L1 Amps													
Fan L2 Amps													
Fan L3 Amps													
Clean Y-Strainer													
Refrigerant Circuit Check													
Refrigerant Suction Pressure													
Refrigerant Discharge Pressure													
Refrigerant Superheat													

Troubleshooting

Problem	Possible Cause	Remedy
Compressor will not start	Compressor overload	Check supply voltage, start components (single phase), and wiring
	Run capacitor (single phase units only)	Measure capacitance and replace if faulty
	Start capacitor (single phase units only)	Measure capacitance and replace if faulty
	Start relay (single phase units only)	Check for contiuity between 2,5 and 1,2. Replace if no continuity
	Compressor contactor	Replace if faulty
	Microprocessor control board	Replace if faulty
	Compressor failure	Contact Customer Service Department for assistance
Pump will not start	Pump overload	Check supply voltage, wiring, overload set point (external overload)
	Pump contactor	Replace if faulty
	Microprocessor control board	Replace if faulty
	Pump motor failure	Check motor windings and replace if faulty
Low refrigerant pressure	Low refrigerant charge	Contact refrigeration service technician
	Refrigerant leak	Contact refrigeration service technician
	Low refrigeration pressure sensor	Check for proper range, replace if faulty
	Microprocessor control board	Replace if faulty
High refrigerant pressure	Dirty air filters (air cooled units only)	Clean filters
	Air flow obstruction (air cooled units only)	Make sure chiller is installed in accordance with recommendations in this manual
	High ambient air temperature (air cooled units only)	Ambient temperature must be reduced below 105°F (40.5°C)
	Condenser fan motor (air cooled units only)	Check start compents and motor windings for failure and replace if faulty
	Condenser fan cycling control (air cooled units only)	Confirm proper operation, replace if faulty
	Plugged condenser (water cooled units only)	Clean out tubes
	Insufficient condenser water flow (water cooled units only)	Make sure chiller is installed in accordance with the recommendations of this manual
	High condenser water temperature (water cooled units only)	Condenser water temperature must be reduced below 90°F (38°C)
	Condenser water regulating valve	Check setting, replace if faulty
	Refrigerant circuit overcharged	Contact refrigeration service technician
	High refrigerant pressure sensor	Replace if faulty
	Microprocessor control board	Replace if faulty

Problem	Possible Cause	Remedy
Freezestat	Low flow through evaporator	Adjust flow to proper level
	Freezestat control module	Check for proper setting, replace if faulty
	Microprocessor control board	Replace if faulty
	Freezestat sensor	Replace if faulty
Low pump discharge pressure	Pump running backwards (three-phase pumps only)	Switch two legs of the incoming power
	Pump pressure gauge	Replace if faulty
	Pump failure	Replace if faulty
	Excessive flow	Reduce flow
High pump discharge pressure	Closed valves in process piping	Open valves
	Obstruction in piping or process	Remove obstruction
	Clogged Y-strainer	Clean strainer
	Pressure gauge	Replace if faulty
Erratic temperature control	Low coolant flow through evaporator	Adjust flow to proper level
	Intermittent overloading of chiller capacity	Check to make sure chiller is properly sized for process load
	Hot gas bypass valve	Contact refrigeration service technician
	Microprocessor control board	Replace if faulty
	Thermocouple	Replace if faulty
Insufficient cooling (temperature continues to rise above set point)	Process load too high	Check to make sure chiller is properly sized for process load
	Coolant flow through evaporator too high or too low	Adjust flow to proper level
	Insufficient condenser cooling	See “High Refrigerant Pressure”
	Hot gas bypass valve stuck open	Contact refrigeration service technician
	Refrigeration circuit problem	Contact refrigeration service technician
	Microprocessor control board	Replace if faulty
	Thermocouple	Replace if faulty

Charts and Drawings

Table 8 - EQ Air Cooled Chiller Electrical Specifications

Model	Voltage	Compressor	Pump		Condenser Fan		Control Circuit	Unit MCA[2]
		RLA[1]	Power (HP)	FLA	Power (HP)	FLA	FLA	
EQ3A01	208/1/60	5.9	¼ (.186 kW)	2.7	1/4 (.186 kW)	1.7	0.24	12.8
	230/1/60	5.4		2.4		1.6	0.22	11.8
EQ2A02	208/3/60	9.5	1 (.745 kW)	3.9	1/4 (.186 kW) (single phase)	1.7	0.24	18.5
	230/3/60	8.6		3.6		1.6	0.22	17.0
	460/3/60	4.3		1.8		0.8	0.11	9.0
	208/3/60	9.5	2 (1.49 kW)	7.5		1.7	0.24	22.1
	230/3/60	8.6		6.8		1.6	0.22	20.2
	460/3/60	4.3		3.4		0.8	0.11	10.6
	208/3/60	9.5	3 (2.24 kW)	10.6		1.7	0.24	25.2
	230/3/60	8.6		9.6		1.6	0.22	23.0
	460/3/60	4.3		4.8		0.8	0.11	12.0
	208/3/60	9.5	2 (1.49 kW) 2-stg	8.8		1.7	0.24	23.4
	230/3/60	8.6		8.0		1.6	0.22	21.4
	460/3/60	4.3		3.7		0.8	0.11	10.9
EQ2A03	208/3/60	12.6	1 (.745 kW)	3.9	½ (.372 kW) (single phase)	3.0	0.24	23.6
	230/3/60	11.4		3.6		2.9	0.22	21.5
	460/3/60	6.2		1.8		1.5	0.11	11.9
	208/3/60	12.6	2 (1.49 kW)	7.5		3.0	0.24	27.3
	230/3/60	11.4		6.8		2.9	0.22	25.0
	460/3/60	6.2		3.4		1.5	0.11	13.7
	208/3/60	12.6	3 (2.24 kW)	10.6		3.0	0.24	30.4
	230/3/60	11.4		9.6		2.9	0.22	27.8
	460/3/60	6.2		4.8		1.5	0.11	15.1
	208/3/60	12.6	2 (1.49 kW) 2-stg	8.8		3.0	0.24	28.6
	230/3/60	11.4		8.0		2.9	0.22	26.2
	460/3/60	6.2		3.7		1.5	0.11	14.0

Notes:
RLA (Rated Load Amps) based on a percentage of the MMTC (Maximum Must Trip Current) as established by the manufacturer in accordance with UL Standard 465.
MCA (Minimum Circuit Ampacity) based on 125% of the compressor RLA plus 100% of remaining components FLA in accordance with NEC 440-33. MCA shown also include 1 amp value for the control circuit.
Voltage Utilization range is: 208 (187 to 229), 230 (187 to 254), and 460 (414 to 506).

Table 9 - EQ Water Cooled Chiller Electrical Specifications

Model	Voltage	Compressor	Pump		Control Circuit	Unit MCA[2]
		RLA[1]	Power (HP)	FLA	FLA	
EQ2W02	208/3/60	9.5	1 (.745 kW)	3.9	0.24	16.8
	230/3/60	8.6		3.6	0.22	15.4
	460/3/60	4.3		1.8	0.11	8.2
	208/3/60	9.5	2 (1.49 kW)	7.5	0.24	20.4
	230/3/60	8.6		6.8	0.22	18.6
	460/3/60	4.3		3.4	0.11	9.8
	208/3/60	9.5	3 (2.24 kW)	10.6	0.24	23.5
	230/3/60	8.6		9.6	0.22	21.4
	460/3/60	4.3		4.8	0.11	11.2
	208/3/60	9.5	2 (1.49 kW) 2-stg	8.8	0.24	21.7
	230/3/60	8.6		8	0.22	19.8
	460/3/60	4.3		3.7	0.11	10.1
EQ2W03	208/3/60	12.6	1 (.745 kW)	3.9	0.24	20.7
	230/3/60	11.4		3.6	0.22	18.9
	460/3/60	6.2		1.8	0.11	10.6
	208/3/60	12.6	2 (1.49 kW)	7.5	0.24	24.3
	230/3/60	11.4		6.8	0.22	22.1
	460/3/60	6.2		3.4	0.11	12.2
	208/3/60	12.6	3 (2.24 kW)	10.6	0.24	27.4
	230/3/60	11.4		9.6	0.22	24.9
	460/3/60	6.2		4.8	0.11	13.6
	208/3/60	12.6	2 (1.49 kW) 2-stg	8.8	0.24	25.6
	230/3/60	11.4		8	0.22	23.3
	460/3/60	6.2		3.7	0.11	12.5

Notes:
RLA (Rated Load Amps) based on a percentage of the MMTC (Maximum Must Trip Current) as established by the manufacturer in accordance with UL Standard 465.
MCA (Minimum Circuit Ampacity) based on 125% of the compressor RLA plus 100% of remaining components FLA in accordance with NEC 440-33. MCA shown also include 1 amp value for the control circuit.
Voltage Utilization range is: 208 (187 to 229), 230 (207 to 254), and 460 (414 to 506).

Figure 2 - 60 Hz Pump Curves (water)

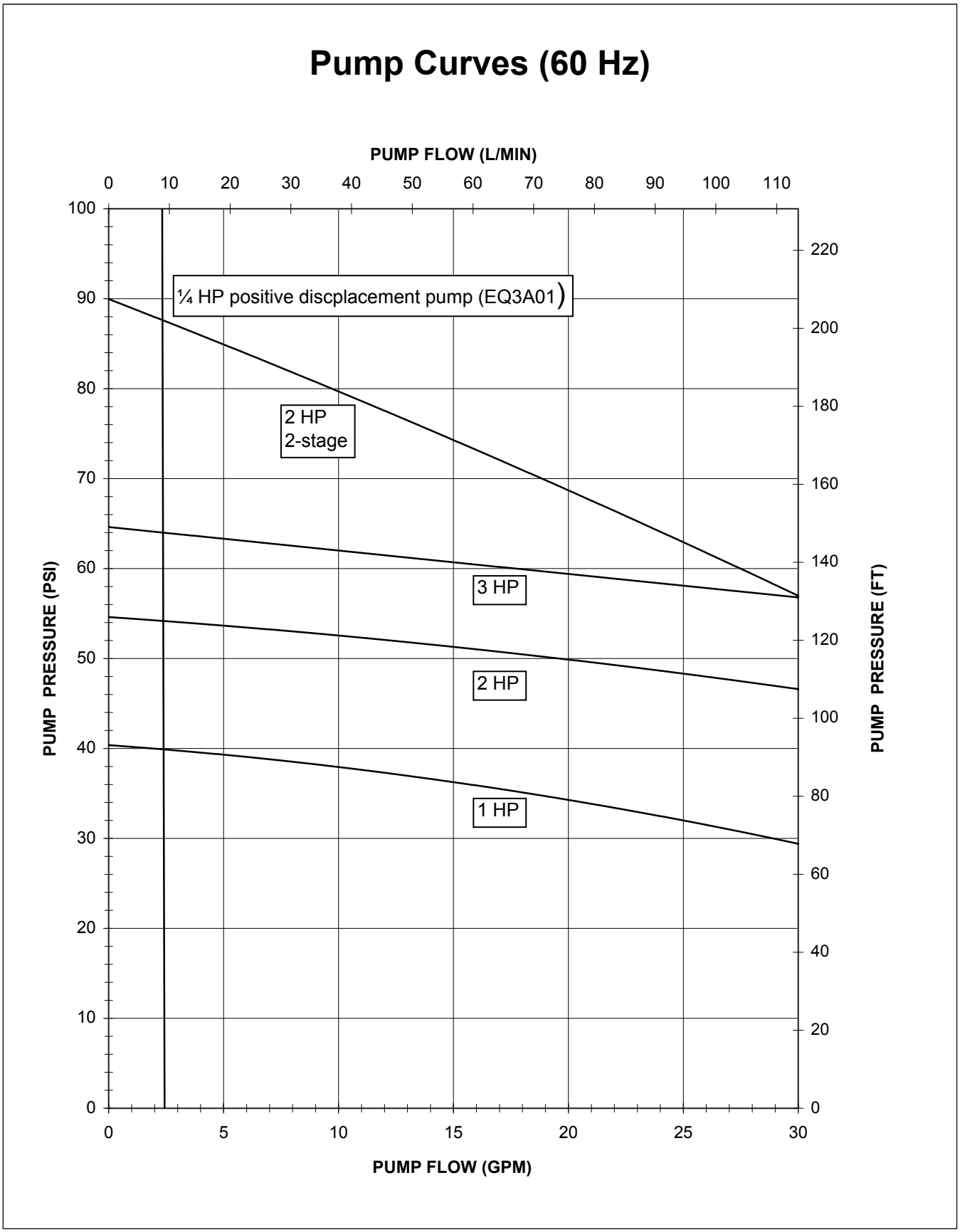
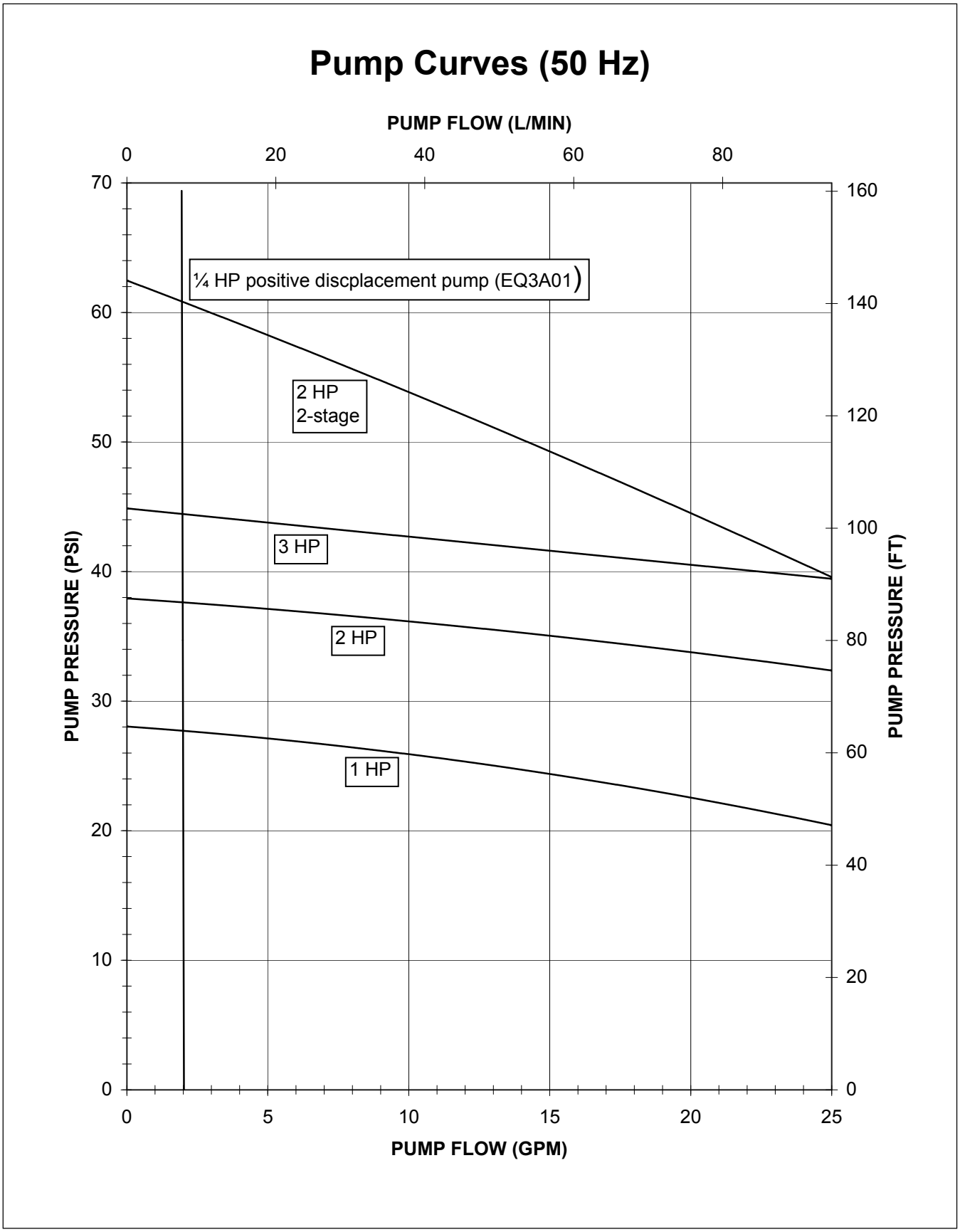


Figure 3 - 50 Hz Pump Curves (water)



Notes