

**HX-1000 & HX-2000  
Recirculating Chiller  
TC-400 Controller**

Thermo Thermo NESLAB Manual P/N U00413  
Rev. 05/09/00

**Instruction and Site Preparation Manual**



# HX-1000 & HX-2000 Recirculating Chiller

## Table of Contents

<b>Preface</b>	
Compliance .....	2
Unpacking .....	2
Lift Points .....	2
Pre-Start Up .....	3
Warranty .....	3
After-Sale Support .....	3
<b>SECTION I</b>	
<b>Safety</b>	
Warnings .....	4
<b>SECTION II</b>	
<b>General Information</b>	
Description .....	5
Specifications .....	5
<b>SECTION III</b>	
<b>Installation</b>	
Site .....	7
Pre-Start Up .....	8
Electrical Requirements .....	8
Electrical Connections .....	9
Remote Electrical Connections .....	10
Plumbing Requirements .....	11
Fluid .....	12
Filling Requirements .....	13
<b>SECTION IV</b>	
<b>Operation</b>	
Start Up .....	15
Shut Down .....	16
Unit Controller .....	16
Status LEDs .....	17
Changing a Value .....	18
Controller Displays .....	19
Remote Operation .....	21
Flow Rate .....	22
High and Low Temperature Cutout .....	22
High and Low Pressure Cutout .....	22
Phase Rotation & Voltage Monitor Device .....	22
Oil Pressure Cutout .....	23
<b>SECTION V</b>	
<b>Safety Features</b>	
Safety Features .....	24
Low Fluid Level .....	24
Pump .....	24
Refrigeration .....	24
<b>SECTION VI</b>	
<b>Maintenance</b>	
Service Contracts .....	25
Displaying Software Version .....	25
Compressor Oil .....	25
Cleaning .....	25
Refrigeration Data .....	25
Parts List .....	26

# Preface

## Compliance

Products tested and found to be in compliance with the requirements defined in the EMC standards defined by 89/336/EEC as well as Low Voltage Directive (LVD) 73/23/EEC can be identified by the CE label on the rear of the unit. The testing has demonstrated compliance with the following directives:

LVD, 73/23/EEC	Complies with UL 3101-1:93
EMC, 89/336/EEC	EN 55011, Class A Verification
	EN 50082-1:1992
	IEC 1000-4-2:1995
	IEC 1000-4-3:1994
	IEC 1000-4-4:1995

For any additional information refer to the Letter of Compliance that shipped with the unit (Declaration of Conformity).

## Unpacking

Retain all cartons and packing material until the unit is operated and found to be in good condition. If the unit shows external or internal damage, or does not operate properly, contact the transportation company and file a damage claim. Under ICC regulations, this is your responsibility.

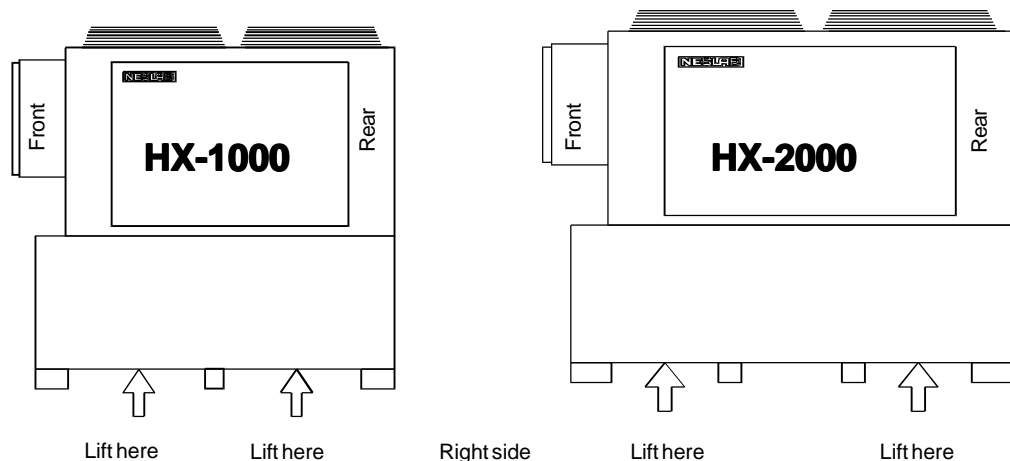
Units sold in North America are shipped on a wooden pallet and wrapped in protective plastic. Do not remove the banding or protective plastic until the unit is in its final location.

Units sold outside North America are shipped in a wooden crate. Do not disassemble the crate until the unit is in its final location.

The unit is secured to the pallet by lag bolts. HX-1000 units have 10 bolts, HX-2000 units have 12. Remove the lag bolts and the pallet before placing the unit on the foundation.

## Lift Points

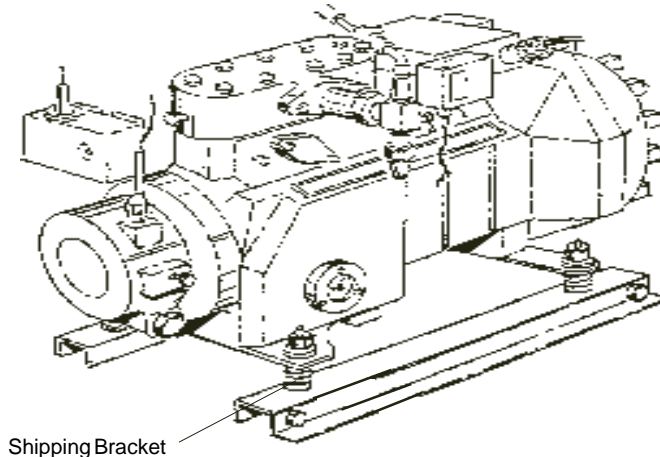
The unit is constructed on 4 inch (10.16 centimeter) high feet, each made of 14 gauge steel. HX-1000 units have 6 feet, HX-2000 units have 8. The unit construction provides a 4 inch clearance from the ground. Use a fork lift truck to lift and move the unit. Insert the forks as shown.



## Pre-Start Up

Remove the panels to access the compressor area.

Loosen the four compressor mounting nuts until there is approximately 1/8" clearance between each compression mounting foot and the shipping bracket. This allows the compressor to "float" on the mounting rings.



**To avoid damage to the compressor, tighten the mounting nuts before moving the unit.**

## Warranty

The unit has a warranty against defective parts and workmanship is for one full year from date of shipment. See back page for more details.

## After-Sale Support

Thermo NESLAB is committed to customer service both during and after the sale. If you have questions concerning the operation of your unit, please contact our Sales Department. If your unit fails to operate properly, or if you have questions concerning spare parts or Service Contracts, please contact our Customer Service Department.

Before calling, *please* refer to the serial number label in the electrical enclosure to obtain the following information:

- BOM number \_\_\_\_\_

- Serial number \_\_\_\_\_

- Software version (see page 25) \_\_\_\_\_

## Section I Safety

### Warnings

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your unit. If you have any questions concerning the operation of your unit or the information in this manual, contact our Sales Department.

**Transport the unit with care. Sudden jolts or drops can damage the refrigeration lines.**

**Never operate the unit without cooling fluid.**

**Observe all warning labels.**

**Never remove warning labels.**

**Never operate damaged or leaking equipment.**

**Always turn off the unit and disconnect from the line cord before performing any service or maintenance procedures.**

**Never operate equipment with damaged line cords.**

In addition to the safety warnings listed above, warnings are posted throughout the manual. These warnings are designated by an exclamation mark inside an equilateral triangle with text highlighted in bold. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, or personal injury or death.

## Section II General Information

### Description

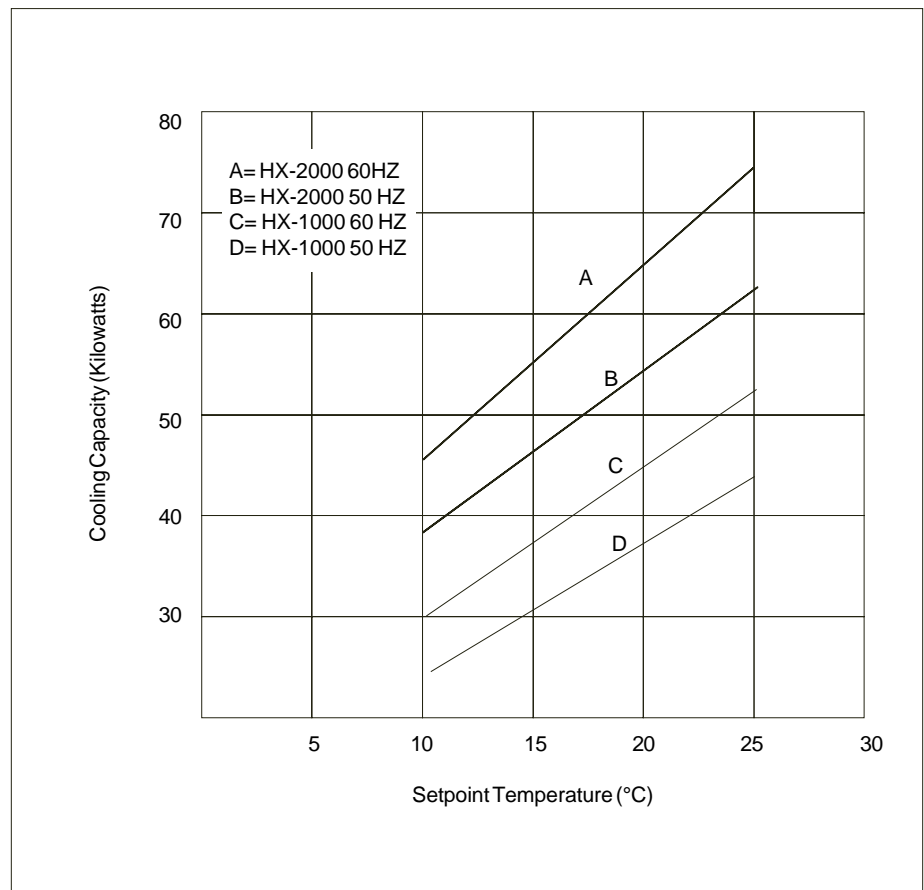
Your HX Recirculating Chiller is designed to provide a continuous flow of cooling fluid at a constant temperature and pressure.

The unit consists of a reservoir, circulating pump, air-cooled refrigeration system, and a digital temperature controller. The unit can run from a remote monitoring/controlling device.

The unit is designed for all-weather use. This allows heat produced by the instrument being cooled to be discharged outdoors. The high capacity pump allows the unit to be located a great distance from the instrument being cooled. The pump flow is adjustable at the unit.

### Specifications

#### Cooling Capacity



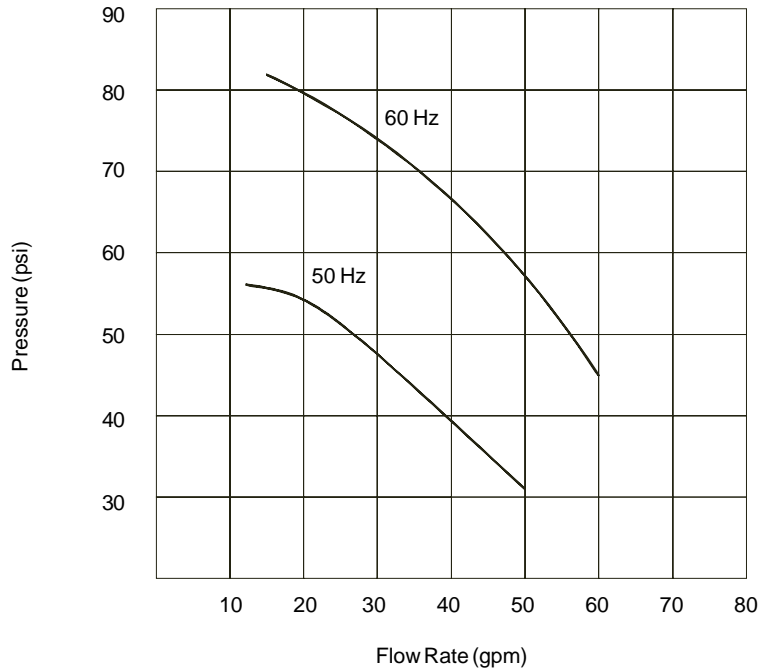
**Temperature Range**

+10°C to +25°C

**Temperature Stability<sup>1</sup>**

±1.0°C

**Pump Capacity**



	<b>HX-1000</b>	<b>HX-2000</b>
<b>Compressor</b>	10 hp	20 hp
<b>Dimensions (H x W x D)</b>		
Inches	73½ X 58 X 30	76 x 67¼ x 34
Centimeters	186.7 x 147.3 x 76.2	193.0 X 170.8 X 86.4
<b>Shipping Weight</b>		
Pounds	1612	2061
Kilograms	731	945

1. Specifications listed for units under full load circulating at 25°C, ambient 21°C, with 50% water and 50% Ethylene Glycol as coolant. Specifications will be affected by changes in temperature, ambient, or fluids. Specifications subject to change.

## Section III Installation

### Site

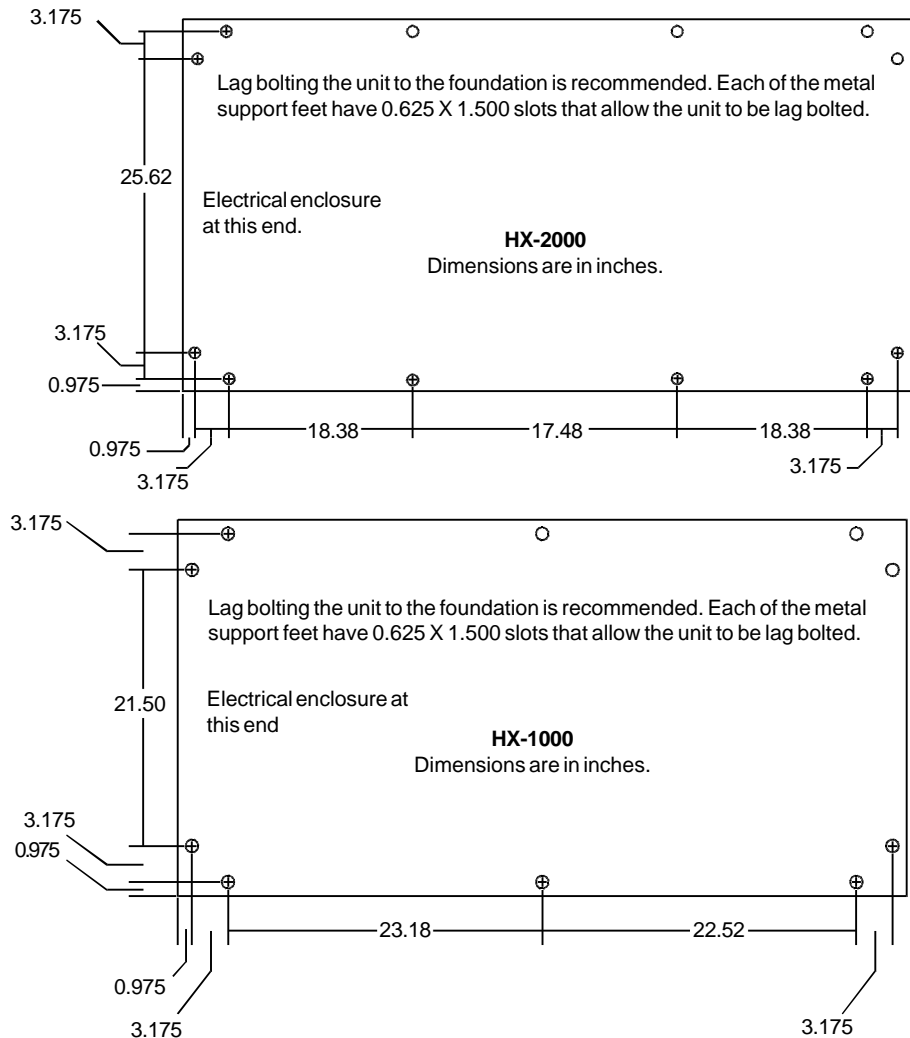
Install the unit on a well-constructed level surface, able to withstand a distributed load of 3000 pounds (1360 kilograms) for HX-2000 units, 1700 pounds (770 kilograms) for HX-1000 units.

The unit has an air-cooled refrigeration system. Air is drawn through the slotted metal grilles on either side of the unit, and exhausted through the fans on top of the unit. Air flow through the fans is 12300 feet<sup>3</sup>/minute for HX-2000 units, 6500 feet<sup>3</sup>/minute for HX-1000 units.

The unit should be placed in an area where the air intake and discharge are not impeded. A minimum clearance of 3.5 feet (1 meter) on all four sides and 7 feet (2 meters) above the unit is necessary for adequate air flow and easy access to the side panels for service and maintenance.

The ambient range of the unit is -10°F to +110°F (-22°C to +43°C).

**NOTE:** If the chiller is subject to high-ambient temperatures (above 100°F), Thermo Thermo NESLAB recommends providing it as much shade as possible. High-ambient temperatures and direct sunlight can generate high-refrigerant pressures capable of shutting down the unit.





## Pre-Start Up

Remove the two side access panels and the rear access panel (opposite end from the electrical enclosure) to access the compressor area. Check the compressor oil level through the sight glass on the compressor crankcase. It is identified as the glass port hole in the compressor wall. The oil level should be no less than  $\frac{1}{2}$  full. If the oil is below  $\frac{1}{2}$ , contact Thermo Thermo NESLAB Service.

Check the refrigerant sightglass. If the dot in the middle of the sightglass is green, the refrigerant is normal. If the dot is yellow, the refrigerant is contaminated. Contact our Service Department for assistance.

Close the COOLING WATER INLET and OUTLET by turning the valve handles fully clockwise.

Make sure the grilles on the sides of the unit (covering condensers) and the fans on the top of the unit are free of obstructions.

After all electrical and plumbing connections have been completed, close the enclosure door and secure the door latch arm (disconnect).

The unit is equipped with a set of valves on the tank inlet and outlet which prevent the tank from overflowing when the pump is off.

The unit has an automatic compressor crankcase heater. The crankcase heater warms the oil in the compressor and prevents refrigerant and the crankcase oil from mixing. Before initial start up, or after storage, the unit must be connected to the power source for at least 12 hours before turning the unit on. This will allow time for the crankcase oil to be heated and the refrigerant to separate from the oil.

For HX-2000 units, apply power to the unit for a minimum of three minutes before starting. This allows the compressor motor overload timer to complete cycling. If the START button is pressed too early, the compressor will not start until the timer has finished its cycle. On some units this may trigger a compressor fault and a shutdown cycle. In this case, wait approximately another three minutes then clear all alarms. Restart the unit.

## Electrical Requirements

Refer to the serial number label on the inside of the electrical enclosure for the specific electrical requirements of your unit. Also on the inside of the enclosure, ensure the voltage setting on the phase monitor voltage arrow is correct.

## Electrical Connections



**For personal safety and equipment reliability, this procedure should be performed by a qualified service technician familiar with the safety procedures required for working inside an energized disconnect box.**

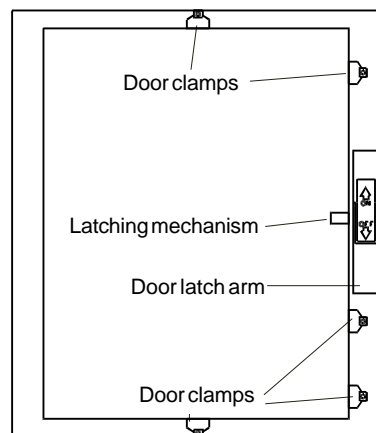
A unit wiring diagram is located in the document sleeve inside the door of the electrical enclosure. Wire the unit in conformance to local, state and federal electrical codes. Check all wiring to make sure it is properly connected and protected from the elements.

Install a conduit connector in the wall of the electrical enclosure; a hole must be drilled in the enclosure to accommodate the connector. The location of the hole is user-defined; the hole can be drilled in any of the four enclosure wall (except the upper left side wall, where the control panel is located). This allows the power supply to be installed in the enclosure at a point that is convenient for the user.

Use four-wire cable to connect the appropriate power supply (see Electrical Requirements) to the main circuit breaker located on the right side of the enclosure. For ground, use the copper terminal board on the bottom of the enclosure. Install a second circuit breaker at the power source. This second circuit breaker prevents exposure to “live” wires during installation.

The door latch arm on the enclosure activates the main disconnect for the power supply to the unit. When the door is closed, the disconnect is engaged when the latch arm is pulled up to the ON position. The POWER ON lamp on the control panel indicates the status of the disconnect.

The five door clamps must be secured for the enclosure to be weather-tight.



Electrical enclosure (the door has been omitted for clarity)

## Remote Box Electrical Connections

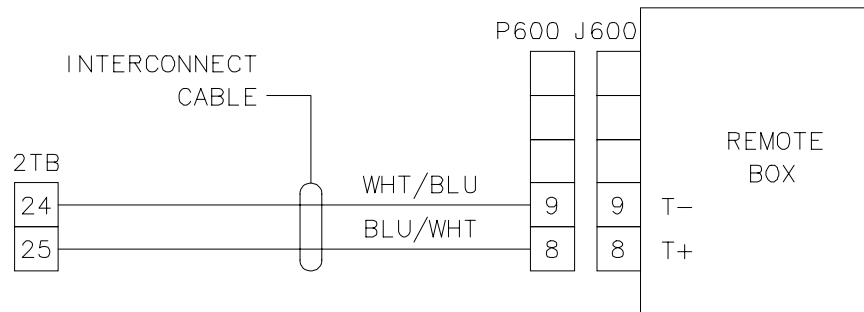


**For personal safety and equipment reliability, this procedure must be performed by a qualified service technician familiar with the safety procedures required for working inside an energized disconnect box.**

Wiring diagrams are located inside the document sleeve inside the electrical enclosure. Wire the unit in conformance to all local, state and federal electrical codes. Check all wiring and make sure it is properly connected and protected from the elements.

Install a conduit connector in the wall of the unit's electrical enclosure. A hole must be drilled in the electrical enclosure to accommodate the connectors. The location of the hole is user-defined; this allows the connecting cable to be installed in the electrical enclosure at a point that is convenient to the user. The hole can be drilled in any of the four enclosure walls.

Wire the connections for the remote box as shown. 2TB is located inside the electrical enclosure, on the left-hand side.



## Plumbing Requirements

The inlet and outlet of the unit are labelled COOLING WATER INLET and OUTLET. These connections are 1¼ inch FPT.

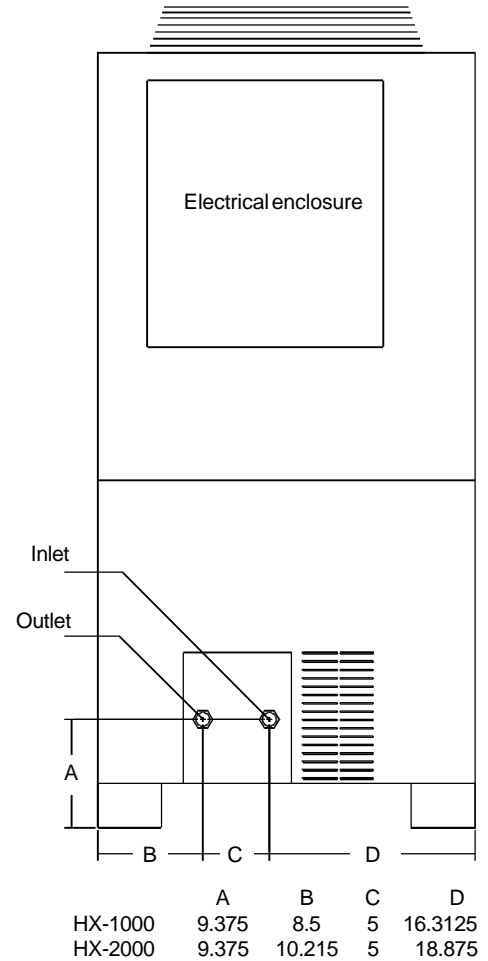
Follow good plumbing practices to minimize unnecessary bends and restrictions that will increase the pressure drop through the circulating lines. Refer to Pressure Drop Chart on the next page to estimate the pressure drop through various diameter tube lengths.

Insulate all tubes and fittings to minimize loss of cooling capacity. This is extremely important in areas of ambient extremes or when the unit is located a great distance from the instrument being cooled. All tubing and fittings should be weather resistant, able to endure high and low ambient conditions, and able to withstand a maximum pressure of 120 psi.

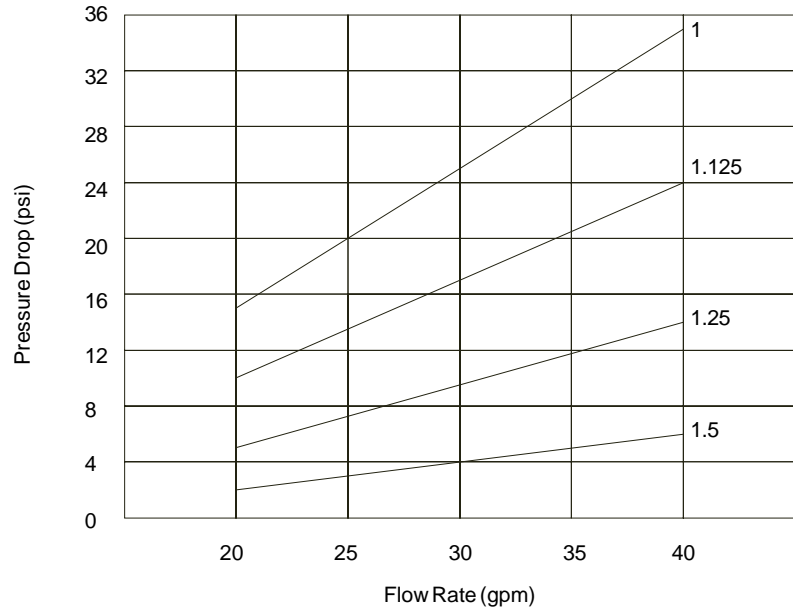
Insulating hose is available from Thermo Thermo NESLAB. Contact our Sales Department for more information.

Use the Pump Capacity Chart (see Specifications) and the Pressure Drop Chart to calculate the maximum distance you can locate the unit from the system being cooled. Find the point on the Pump Capacity Chart that matches the flow and pressure requirements of the system being cooled. From that point, estimate the pressure difference between the pump performance line, and the point you have chosen on the graph. This net pressure value, used with the Pressure Drop Chart, will help determine the maximum distance from the chiller to the system being cooled and the tubing diameter (ID).

**NOTE:** The unit is equipped with a set of valves on the tank inlet and outlet which prevent the tank from overflowing when the pump is off.



Dimensions of the inlet and outlet.  
Dimensions are in inches.



Material: 100 feet copper tubing. Dimensions are inside diameter (ID), measured in inches.

## Fluid

A non-freezing fluid is required for operation at any recirculating or ambient temperature. The selected fluid must have a viscosity of 50 centistokes or less at the lowest operating temperature.

**Due to the physical nature of a plate heat exchanger, and its response to temperature changes, 100% water must not be used as a circulating fluid. Using 100% water may cause the plate heat exchanger to rupture.**



**Never use corrosive or flammable fluids with this unit.**

**Never use automotive antifreeze. Commercial antifreeze contains silicates that can cause permanent damage to the pump seals.**

Noncompliance with the statements in the section can result in damage to the unit and will void the manufacturer's warranty. For more information contact our Sales Department (see Preface, After-sale Support).

The wetted parts are:

- *Stainless steel*
- *Bronze*
- *Brass*
- *Copper*
- *PVC Plastic*

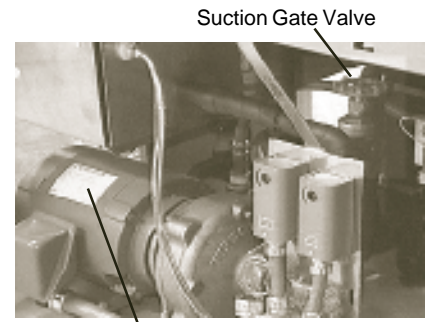
## Filling Requirements

Ensure the INLET and OUTLET valves on the front of the outside of the unit are closed.

Open the unit's lower-right hand side panel and locate the 1¼" suction gate valve. (It is the largest valve in the unit and is located between the reservoir and compressor.)

Ensure the suction gate valve is fully closed.

The unit is equipped with a low flow cutout. While filling the unit it is important to ensure that the cutout senses a minimum of 10 gpm through the return line, and that the reservoir does not run dry.



Pump Motor Label



**Running the reservoir dry may permanently damage the pump seals.**

Three possible options for filling the lines without running the reservoir dry or causing the unit to cut out on low flow are:

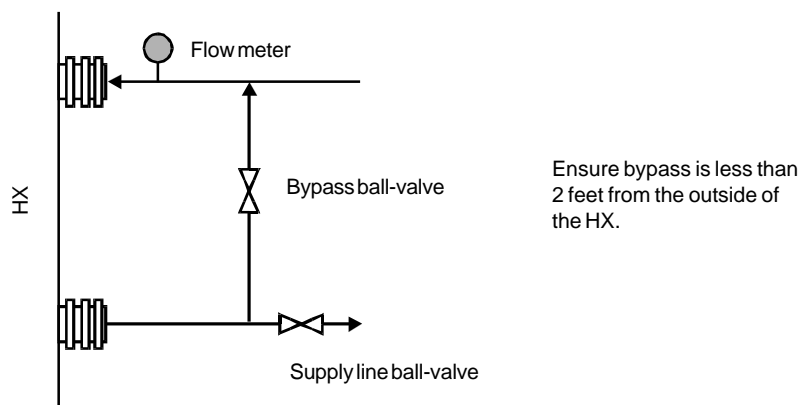
### Option #1

1. Connect the INLET/OUTLET recirculation lines from the HX to your application.
2. Pre-fill the circulation lines with the appropriate mixture of a non-freezing fluid.
3. Remove the reservoir cover located under the electrical enclosure. Fill the reservoir approximately  $\frac{3}{4}$  full. Start the unit and allow it to run 15 - 20 minutes.
4. Slowly open the OUTLET valve. **Opening the valve too quickly will cause water-hammering.**
5. Keep the reservoir topped off to within one inch of the top. (There could be some substantial splashing from the reservoir as air is purged from the lines.)
6. Your application may be started at this time.
7. As the recirculation lines continue to fill, keep topping off the reservoir.
8. When the reservoir no longer needs additional fluid, fully open the suction gate valve.
9. Allow the unit to run 10 to 15 minutes to purge any remaining air.
10. Ensure the reservoir is filled to within one inch of the top.
11. Close the reservoir cover.
12. Install the unit's lower right-hand side panel.

### Option # 2

Refer to the diagram below and install a bypass assembly with two ball-valves and a flow meter in the circulation lines.

1. Ensure both ball-valves are closed.
2. Remove the reservoir cover located under the electrical enclosure. Fill the reservoir approximately  $\frac{3}{4}$  full. Start the unit and allow it to run 15-20 minutes.
3. Slowly open the OUTLET valve. **Opening the valve too quickly will cause water-hammering.**
4. Slowly open the bypass ball-valve so the flow on the return line is 20 gpm.
5. Slowly open the supply line ball-valve. A reservoir fluid loss will occur as the lines start to fill, continually fill the reservoir as the fluid level drops. Open the supply line ball-valve to a point where there is enough flow to fill the lines in a reasonable amount of time, and at a flow rate equal to the ability to replenish the reservoir fluid. **If the flow drops below 10 gpm the low-flow cutout will trip.**
6. Ensure all the circulation lines are full and free of air, and that the reservoir is filled to within 1 inch of the top. If desired, calculate the total amount of fluid required to fill the lines and stop filling when that amount is consumed. It will take some time to bleed air from the system.
7. Your application may be started at this time.
8. Fully open the supply line ball-valve.
9. Slowly close the bypass ball-valve. Ensure the flow rate does not drop below 10 gpm.
10. When the reservoir no longer needs additional fluid, fully open the suction gate valve.
11. Close the reservoir cover.



12. Install the unit's lower right-hand side panel.

### Option 3

Arrange for a Thermo Thermo NESLAB service technician to be on-site in order to perform an installation inspection and assist with starting the unit.

## Section IV Operation

### Start Up

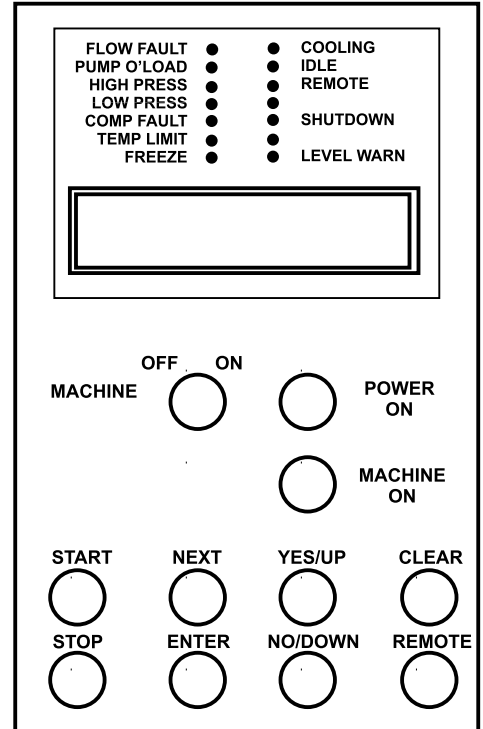
Ensure the door latch arm (disconnect) has been on with the POWER ON lamp lit for at least 12 hours. This will allow time for the crankcase oil to be heated and the refrigerant to separate from the oil.

Review the filling requirements given on the previous page.

Partially open the COOLING WATER INLET and OUTLET by turning the valve handles counterclockwise.

Turn the MACHINE OFF/ON switch to the ON position. The MACHINE ON lamp will light. Press the START button. The display will flash STARTING for approximately two minutes.

**NOTE:** For HX-2000 units, leave the MACHINE ON/OFF switch in the ON position for a minimum of three minutes before starting. This allows the compressor motor overload timer to complete cycling. If the START button is pressed too early, the compressor will not start until the timer has finished its cycle. On some units this may trigger a COMPRESSOR FAULT and a SHUTDOWN cycle. In this case, wait approximately another three minutes then CLEAR all alarms.



**NOTE:** On starting, if the reservoir fluid temperature is outside the unit's temperature range the unit will run but the TEMP LIMIT LED will flash until the fluid temperature is within the limits.



## Shut Down

When the unit is manually shut down using the STOP button, a time delay is activated that allows the refrigeration system and the pump to continue to operate. The system will run in the shutdown mode for 30 seconds. This additional run time allows all refrigerant to be removed from the heat exchanger and for the heat exchanger to warm up.

**NOTE:** The unit is equipped with a set of valves on the tank inlet and outlet designed to prevent the tank from overflowing when the pump is off.

Shutting the unit off using the MACHINE OFF button, a circuit breaker or other device on the line side of the relay will defeat the purpose of the off cycle and is not recommended. Implement remote on/off control through the controller's serial port.

## Unit Controller

### **MACHINE ON**

Energizes the control circuits in preparation for operation.

### **MACHINE OFF**

Immediately de-energizes the control circuits. Do not use this button for normal on/off control, use the STOP button. MACHINE OFF will stop all motors immediately and defeat the normal shut down sequence.

### **START**

Starts the pump, compressor, and heater.

### **STOP**

Initiates shut down sequence.

### **NEXT**

Scrolls through the menus.

### **ENTER**

Confirms entry of numeric values.

### **YES**

Answers Yes to Y/N questions, increments numerical values.

### **NO**

Answers NO to Y/N questions, decrements numerical values.

### **CLEAR**

Clears alarm indications after fault condition has been corrected. Alarm LEDs will remain lit after problem is eliminated to provide indication of problem cause. CLEAR removes these indicators, see Corrective Action on the next page.

### **REMOTE**

Toggles the unit between local and remote operation.

## Status LEDs

LED	Indication	Response	Corrective Action
FLOW FAULT	Flow through heat exchanger is low. Pressure drop across exchanger too high (blocked) or flow rate is too low.	Pump and refrigeration stops.	Check recirculating system for flow blocked, frozen exchanger. Press CLEAR, START.
PUMP O'LOAD	Pump motor overload. Overload protector tripped.	Pump and refrigeration stops.	Check supply voltage, pump bearings. Reset motor protector, press CLEAR, START.
HIGH PRESS	Refrigeration high pressure condition. High pressure switch opened.	Refrigeration stops.	Check condenser air flow, dirty condenser. Press CLEAR, START.
LOW PRESS	Refrigeration low pressure condition. Low pressure switch open.	Refrigeration stops.	Check control malfunction, refrigerant leak. Press CLEAR, START.
COMP FAULT	Compressor oil pressure low or motor overload. Oil pressure switch open, motor overload protector trips.	Refrigeration stops.	Check oil sight glass, line voltage. Reset oil pressure switch, press CLEAR, START.
TEMP LIMIT	Temperature has exceeded high or low limit settings. Measured temperature is abnormal. The LED may flash during start up, this is normal.	Pump and refrigeration stops.	Check measurement and control systems. LED goes out when temperature is within limits.
FREEZE	Flow through heat exchanger is low and pressure is increasing.	Unit shuts down.	Check fluid mixture for optimum freeze point.
COOLING	Refrigeration active.	Normal operation.	NA
IDLE	Heating active.	Normal Operation.	NA

LED	Indication	Response	Corrective Action
REMOTE	Remote control is selected. Normal operation.	Unit uses remote commands, settings.	NA. Press REMOTE to cancel.
SHUTDOWN	System is in shutdown sequence. Normal operation, motors will stop after ~30 seconds.	Normal shutdown sequence.	NA.
LEVEL WARN	Fluid level is low. Reservoir upper level switch is open.	Normally, pump and refrigeration stops. Unit can be configured to keep running.	Fill reservoir.

### Changing a Value

The **YES** key increments the value. The **NO** key decrements the value.

The display will flash as soon as either key is depressed, and will continue to flash until the **ENTER** key is pressed to accept the new value.

The new value will not be used by the controller until the **ENTER** key is depressed and the display stops flashing.

If the **NEXT** key is pressed while the value is flashing, the new value will not be accepted. The display will stop flashing and the original value will be displayed. In this case the **NEXT** key can be used to abort data entry. The display will not sequence unless the **NEXT** key is depress again.

For large values the display can be changed by manipulating the individual digits. Press the **YES** key and the **NO** key at the same time. The most significant digit will start to flash. The **YES** key increments or the **NO** key decrements the digit. Press the **ENTER** key to accept the digit and to move to the next most significant digit. Repeat until all digits are entered. Pressing the **NEXT** key before all digit are entered will abort the procedure and return the display to the original value.

The controller will not allow you to enter a value above the maximum (+40°C) or below the minimum (0°C). If you try to enter an illegal value outside the operating range, the display will revert to its original value.

# Controller Displays

An alphanumeric display presents numeric readings of various operating conditions within the chiller. Display function is selected by pressing the appropriate keys to move through a menu of available information.

## Operator's Loop

When the controller is first powered it goes through a short self-test and then enters the Operator's Loop, displaying the reservoir fluid temperature.

By pressing the NEXT key the controller will step through the menu shown below.

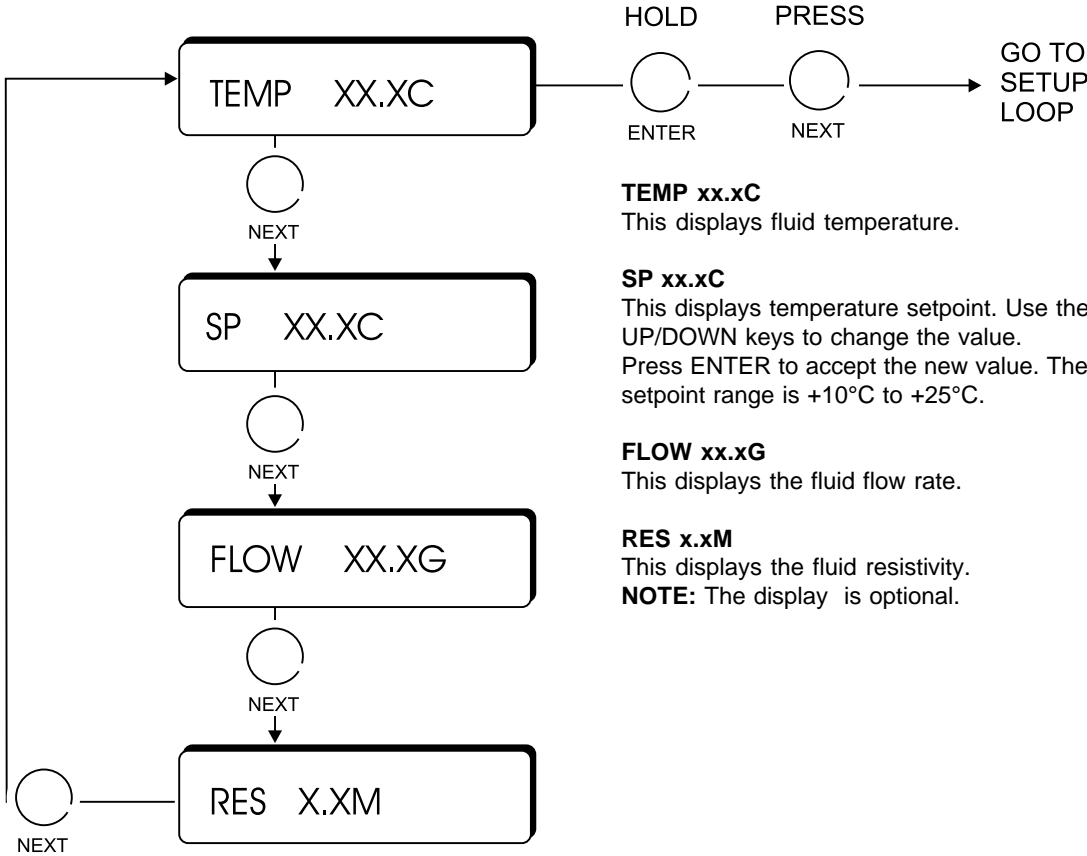


Figure 1 Operator's Loop

### Setup Loop

The Setup Loop allows the operator to change the temperature fault setpoints, low flow rate (10 GPM minimum), the controller's COOL PID parameters, and to select a low level condition to act as a fault or warning. **NOTE:** Thermo Thermo NESLAB recommends configuring the unit to fault; after a power lose the unit will automatically default to the fault mode.

To enter this loop you must be in the Operator's Loop and displaying the reservoir fluid temperature. Depress and hold the ENTER key then press NEXT. Adjust values with the UP and DOWN keys. Press ENTER for the controller to accept each new entry.

**NOTE:** Should you desire to return to the supply line temperature display and abort any changes, keep pressing the NEXT until the display reads **SAVE?** then press NO.

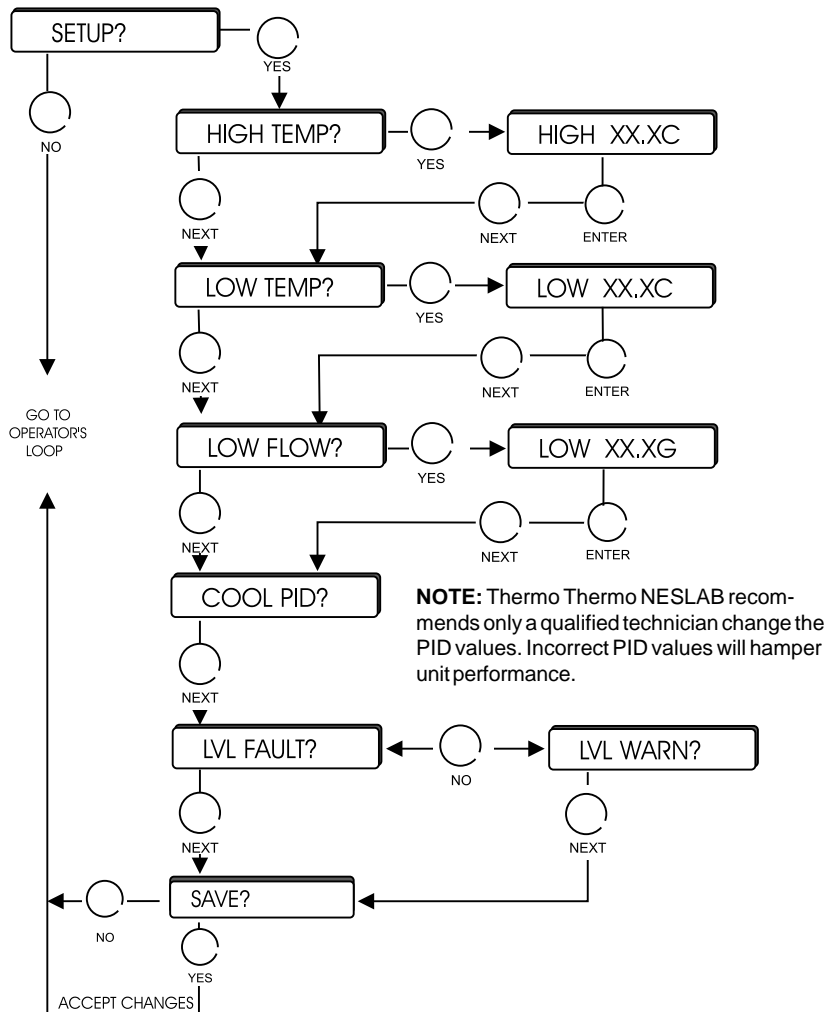


Figure 2 Setup Loop

## Remote Operation

Follow the safety precautions and installation procedures outlined in Electrical Connections for the proper remote box installation instructions.

To start the unit the MACHINE ON lamp must be energized.

To operate using the remote box press the REMOTE button on the local controller. The remote box will momentarily display ##### and then display the current reservoir temperature. ##### indicates that communication is not yet established between the local unit and the remote box. If the ##### display does not extinguish check the connections and then toggle the power to the unit. The REMOTE ENABLED LED on the remote box and the REMOTE LED on the local controller will both illuminate.

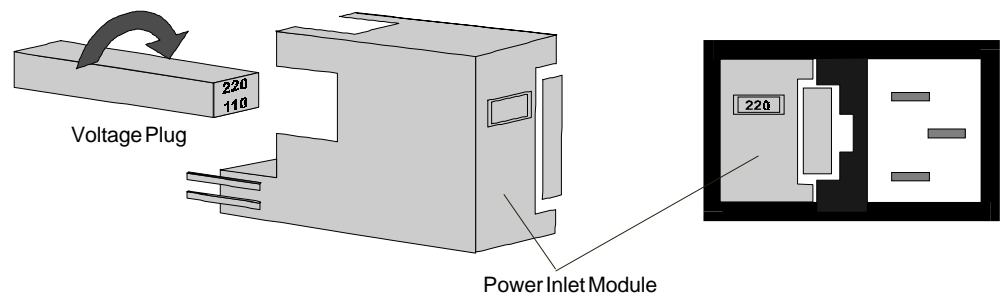
**NOTE:** If you press STOP on the remote box, you cannot re-enable the remote mode from the remote box.

While in the remote mode, the local controller only mirrors the remote controller's display. However, you can use the local controller to return to the local mode. Press REMOTE, the REMOTE LED will turn off.

The remote box also has a 15-pin connector for standard 10mV/°C temperature output (between pin 7 and referenced to pin 6). It can be used for a chart recorder or other recording device. An optional 0 - 10VDC signal is available.

### Configuration

The remote box can be configured for 110V or 220V operation. The voltage is displayed on the power inlet module located on the rear of the remote box. To change the voltage pry the module out from the power connection. Remove the voltage plug from the module and rotate it 180°. Reinstall the plug. The desired voltage should be displayed. Reinstall the inlet module.



## Flow Rate

Adjust the flow rate to the system being cooled by turning the COOLING WATER OUTLET valve. Use a flow meter on the COOLING WATER OUTLET to adjust the desired flow rate.

## High and Low Temperature Cutout

The High and Low Temperature Cutouts (HTC/LTC) monitor the cooling fluid temperature as it exits the heat exchanger. They prevent the cooling fluid from reaching excessively high or low temperatures that can damage the unit.

In the event of a high temperature fault, the TEMP LIMIT LED will illuminate, and the unit will enter the shut down mode. The unit will remain off and must be manually restarted.

In the event of a low temperature fault, the TEMP LIMIT LED will illuminate and the compressor will shut down. The compressor will remain off until the cooling fluid temperature rises above the cut off point.

The HTC is set at +80°F (+27°C). The LTC is set at +25°F (-6°C). If adjustments are needed, contact our Customer Service Department for assistance.

## High and Low Pressure Cutout

The High and Low Pressure Cutouts (HPC/LPC) monitor the refrigeration pressure at the compressor. They prevent excessively high or low pressures that can damage the unit. In the event of a high pressure fault, the HIGH PRESS LED will illuminate and the unit will enter the shut down mode until the refrigeration pressure drops below the cut in point.

During a low pressure fault, the LOW PRESS LED will illuminate and the compressor and discharge fans shut down until the refrigeration pressure rises above the cut in point.

When either condition is identified and corrected, press the CLEAR key before restarting the unit.

## Phase Rotation & Voltage Monitor Device

If the POWER ON light is on but the MACHINE ON light is not when the MACHINE ON button is pressed, the input power phase rotation is reversed. This condition may occur at installation. If rotation is reversed, remove power, swap any two line leads at the power entry and then restore power. This should correct a rotation fault.

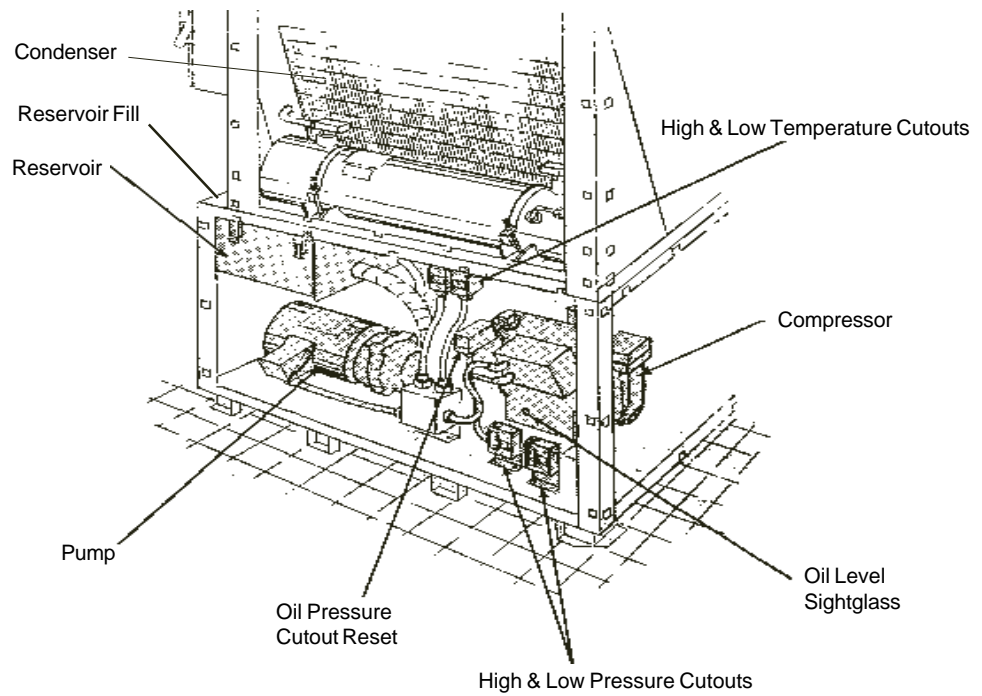
**NOTE:** With the POWER ON lamp lit, if the red light on the phase voltage monitor located in the electrical enclosure is also lit, the phase rotation is correct.

## Oil Pressure Cutout

In the event of low compressor oil pressure, the Oil Pressure Cutout will shut down the compressor and the discharge fans.

After the failure has been corrected, the cut out must be reset. Push the Oil Pressure Cutout Reset button located next to the compressor.

Press the CLEAR button before restarting the unit.



NOTE: Refrigerant sightglass is located on the other side of the unit (opposite to the compressor).



## Section VI Safety Features

### Safety Features

The unit is equipped with the following safety features designed to protect the unit in case of failure. LED lamps are mounted on the control panel on the electrical enclosure, and indicate operational status.

### Low Fluid Level

The low fluid level monitor is connected to a float switch in the reservoir. If the reservoir level drops below a safe operating level, the LEVEL WARN LED will light. The unit's reaction will depend on how it is configured in the Setup Loop.

### Pump

In the event of any of the following conditions, the PUMP O'LOAD LED will illuminate and the unit will shut down. The failure must be identified and corrected before the unit can be restarted.

- *Loss of circulating flow, in the event of pump failure or ruptured pump lines.*
- *Pump motor thermal overload.*
- *High cooling fluid temperature (adjustable).*
- *High refrigeration pressure.*

### Refrigeration

In the event of any of the following conditions, the COMP FAULT will illuminate and the compressor and discharge fans will shut down. The pump/circulating system will remain operating until the STOP button is depressed, or until the operating temperature reaches the High Temperature Cutout setting. This allows a temporary supply of cooling fluid to the instrument being cooled until the instrument being cooled can safely be turned off.

- *Low compressor oil pressure.*
- *Low refrigeration pressure.*
- *Low cooling fluid temperature (adjustable).*
- *Compressor motor thermal overload.*

In the event of any of the following conditions, the COMP FAULT LED will illuminate and the unit will shut down:

- *High refrigeration pressure.*
- *High cooling fluid temperature (adjustable).*

If your unit fails to operate properly, contact our Customer Service Department for assistance.

## Section VII Maintenance

### Service Contracts

Thermo Thermo NESLAB offers on-site Service Contracts that are designed to provide extended life and minimal down time for your unit. For more information, contact our Customer Service Department.

### Displaying Software Version

To display the software version ensure the controller is in the Operator's Loop and displaying the reservoir fluid temperature. Depress and hold the ENTER key. Press the YES NO YES keys and the display will indicate CALIBRATE? While continuing to hold the ENTER key press the YES NO YES keys again. The display will now indicate the software version, for example 000550.64B.

Press NO and the display will return to the Operator's Loop.

### Compressor Oil

Check the compressor oil level after 24 hours of operation. The minimum oil level is ½ full. If the level is lower, contact our Customer Service Department.

### Cleaning

A build up of dust and debris on the condenser can cause a loss of cooling capacity. Periodically clean the condensers by removing the expanded metal grilles and blowing compressed air through the condensers or by hosing them down with water. The frequency of cleaning depends on the operating environment.

### Refrigeration Data

Set High pressure switch: cut out 390 psi / cut in 250 psi.

Set Low pressure switch: cut out 5 psi / cut in 40 psi.

Charge unit with R-22 refrigerant as shown in the table. Run unit with recirculating fluid maintained at 27°C. Adjust pressures to conform:

	<b>US measure</b>	<b>Metric measure</b>
Amount	75 pounds	34 kg
Hot gas valve	60 PSIG	415 kPa
Suction pressure	68 - 85 PSIG	470 - 586 kPa
Discharge pressure	280 - 320 PSIG	1930 - 2200 kPa
Speed check	not specified	not specified

Hot Gas setting is observed on the suction gauge when the unit is in the heat/idle cycle.

## Parts List

Our Customer Service Department can provide you with a complete list of spare parts for your unit. Phone numbers and addresses for all our Thermo Thermo NESLAB Sales Centers are located in the front of this manual (see Preface, After-sale Support). Before calling, *please* obtain the following information:

*BOM number*

*Serial number*

*Software version*

## WARRANTY

Thermo NESLAB Instruments, Inc. warrants for 12 months from date of shipment any Thermo NESLAB unit according to the following terms.

Any part of the unit manufactured or supplied by Thermo NESLAB and found in the reasonable judgment of Thermo NESLAB to be defective in material or workmanship will be repaired at an authorized Thermo NESLAB Repair Depot without charge for parts or labor. The unit, including any defective part must be returned to an authorized Thermo NESLAB Repair Depot within the warranty period. The expense of returning the unit to the authorized Thermo NESLAB Repair Depot for warranty service will be paid for by the buyer. Thermo NESLAB's responsibility in respect to warranty claims is limited to performing the required repairs or replacements, and no claim of breach of warranty shall be cause for cancellation or rescission of the contract of sales of any unit. With respect to units that qualify for field service repairs, Thermo NESLAB's responsibility is limited to the component parts necessary for the repair and the labor that is required on site to perform the repair. Any travel labor or mileage charges are the financial responsibility of the buyer.

The buyer shall be responsible for any evaluation or warranty service call (including labor charges) if no defects are found with the Thermo NESLAB product.

This warranty does not cover any unit that has been subject to misuse, neglect, or accident. This warranty does not apply to any damage to the unit that is the result of improper installation or maintenance, or to any unit that has been operated or maintained in any way contrary to the operating or maintenance instructions specified in Thermo NESLAB's Instruction and Operation Manual. This warranty does not cover any unit that has been altered or modified so as to change its intended use.

In addition, this warranty does not extend to repairs made by the use of parts, accessories, or fluids which are either incompatible with the unit or adversely affect its operation, performance, or durability.

Thermo NESLAB reserves the right to change or improve the design of any unit without assuming any obligation to modify any unit previously manufactured.

THE FOREGOING EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Thermo NESLAB'S OBLIGATION UNDER THIS WARRANTY IS STRICTLY AND EXCLUSIVELY LIMITED TO THE REPAIR OR REPLACEMENT OF DEFECTIVE COMPONENT PARTS AND Thermo NESLAB DOES NOT ASSUME OR AUTHORIZE ANYONE TO ASSUME FOR IT ANY OTHER OBLIGATION.

Thermo NESLAB ASSUMES NO RESPONSIBILITY FOR INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES INCLUDING, BUT NOT LIMITED TO LOSS OR DAMAGE TO PROPERTY, LOSS OF PROFITS OR REVENUE, LOSS OF THE UNIT, LOSS OF TIME, OR INCONVENIENCE.

This warranty applies to units sold in the United States. Any units sold elsewhere are warranted by the affiliated marketing company of Thermo NESLAB Instruments, Inc. This warranty and all matters arising pursuant to it shall be governed by the law of the State of New Hampshire, United States. All legal actions brought in relation hereto shall be filed in the appropriate state or federal courts in New Hampshire, unless waived by Thermo NESLAB.