HX Series II Recirculating Chiller
Installation, Operation, and Maintenance Manual

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Installation
Position the unit so the intake and discharge are not impeded. Inadequate ventilation will cause a reduction in cooling capacity and, in extreme cases, compressor failure.

Avoid excessively dusty areas and institute a periodic cleaning schedule. For proper operation, the unit needs to pull substantial amounts of air through a condenser. A build up of dust or debris on the fins of the condenser will lead to a loss of cooling capacity.

The unit will retain its full rated capacity in ambient temperatures up to approximately +24°C.

Ensure the voltage of the power source meets the specified voltage, ±10%.

The plumbing connections are located on the rear of the unit and are labelled SUPPLY and RETURN. These connections are ¾ inch FPT. Remove the plastic protective plugs from both plumbing connections. Connect the SUPPLY fitting to the inlet of your application. Connect the RETURN fitting to the outlet of your application.

To fill the reservoir open the access panel on the left rear corner of the case top and remove the reservoir cover by unscrewing the thumbscrews. Fill the reservoir to within one inch of the top. If the fluid capacity of your application and recirculation lines are significant, have extra fluid on hand.

Tap water is the recommended fluid for operation from +8°C to +80°C. Below +8°C, a non-freezing fluid must be used. A mixture of tap water and laboratory grade ethylene glycol is suggested.

Operation
Before starting the unit, double check all electrical and plumbing connections. Make sure the circulating system has been filled with cooling fluid.

On models HX-200 through HX-750, the unit must be connected to the power source for at least 12 hours to allow the oil to be heated and separated from the refrigerant

To start the unit, place the Power Switch to the ON position. The Cool and Idle LEDs on the front panel indicate the status of the refrigeration system. Cool is on when the unit is removing heat from the cooling fluid, Heat is on when the unit is in the hot gas by-pass mode. As the operating temperature approaches the setpoint, the LEDs cycle.

When the unit is shut off, wait five minutes before restarting to allow time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle and no cooling will occur.

Temperature Adjustment
To display the temperature setpoint, press and hold the Setpoint switch. To adjust the temperature setpoint, press and hold the Setpoint switch and turn the adjust knob until the desired temperature setpoint is indicated on the digital display. Once the setpoint is adjusted, release the Setpoint switch. The display will now indicate the temperature of the fluid in the reservoir.

Flow Control
The RECIRCULATING FLOW CONTROL handle controls the flow rate to your application. In the “+” position you receive full flow, the “-” position is no flow.

Periodic Maintenance
Periodically inspect the reservoir fluid. If cleaning is necessary, flush the reservoir with a cleaning fluid compatible with the circulating system and the cooling fluid.

The cooling fluid should be replaced periodically. When operating at low temperatures, the concentration of water in the cooling fluid will increase over time, leading to a loss of cooling capacity.

Periodic vacuuming of the condenser fins is necessary. The frequency of cleaning depends on the operating environment. We recommend a visual inspection of the condenser be made monthly after initial installation. After several months, the cleaning frequency will be established.

Units with PD and TU pumps have a strainer. If debris is in the system, the strainer will prevent the material from being drawn into the pump and damaging the pump vanes.

After initial installation, the strainer may become clogged. The strainer must be cleaned after the first week of installation. After this first cleaning, a monthly visual inspection is recommended. After several months, the frequency of cleaning will be established.

Before cleaning the strainer, disconnect the power cord from the power source and drain the reservoir.

Installation
Position the unit in a clean environment with easy access to facility cooling water and a drain. The facility water requirements must meet those specified in the instruction or unit performance will be derated.

Ensure the voltage of the power source meets the specified voltage, ±10%.

The plumbing connections are located on the rear of the unit and are labelled TAP WATER, DRAIN, SUPPLY and RETURN. Remove the plastic protective plugs from all the plumbing connections. Connect the TAP WATER fitting to the facility cooling water and the DRAIN fitting to a drain. Connect the SUPPLY fitting to the inlet of your application and the RETURN fitting to the outlet of your application.

To fill the reservoir open the access panel on the left rear corner of the case top and remove the reservoir cover by unscrewing the thumbscrews. Fill the reservoir to within one inch of the top. If the fluid capacity of your application and recirculation lines are significant, have extra fluid on hand.

Tap water is the recommended fluid for operation from +8°C to +80°C. Below +8°C, a non-freezing fluid must be used. A mixture of tap water and laboratory grade ethylene glycol is suggested.

Operation
Before starting the unit, double check all electrical and plumbing connections. Make sure the circulating system has been filled with cooling fluid.

Ensure the facility water is turned on.

On models HX-200 through HX-750, the unit must be connected to the power source for at least 12 hours to allow the oil to be heated and separated from the refrigerant

To start the unit, place the Power Switch to the ON position. The Cool and Idle LEDs on the front panel indicate the status of the refrigeration system. Cool is on when the unit is removing heat from the cooling fluid, Heat is on when the unit is in the hot gas by-pass mode. As the operating temperature approaches the setpoint, the LEDs cycle.

When the unit is shut off, wait five minutes before restarting to allow time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle and no cooling will occur.

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To display the temperature setpoint, press and hold the Setpoint switch. To adjust the temperature setpoint, press and hold the Setpoint switch and turn the adjust knob until the desired temperature setpoint is indicated on the digital display. Once the setpoint is adjusted, release the Setpoint switch. The display will now indicate the temperature of the fluid in the reservoir.

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The RECIRCULATING FLOW CONTROL handle controls the flow rate to your application. In the “+” position you receive full flow, the “-” position is no flow.

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Periodically inspect the reservoir fluid. If cleaning is necessary, flush the reservoir with a cleaning fluid compatible with the circulating system and the cooling fluid.

The cooling fluid should be replaced periodically. When operating at low temperatures, the concentration of water in the cooling fluid will increase over time, leading to a loss of cooling capacity.

Periodic vacuuming of the condenser fins is necessary. The frequency of cleaning depends on the operating environment. We recommend a visual inspection of the condenser be made monthly after initial installation. After several months, the cleaning frequency will be established.

Units with PD and TU pumps have a strainer. If debris is in the system, the strainer will prevent the material from being drawn into the pump and damaging the pump vanes.

After initial installation, the strainer may become clogged. The strainer must be cleaned after the first week of installation. After this first cleaning, a monthly visual inspection is recommended. After several months, the frequency of cleaning will be established.

Before cleaning the strainer, disconnect the power cord from the power source and drain the reservoir.

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.

On units with a remote control box, the box is packed in a separate carton. Be sure to locate this separate carton; do not dispose of it by mistake.

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.

Warranty

The unit has a warranty against defective parts and workmanship for one full year from date of shipment. Refer to the last page of this manual for complete warranty details.

After-sale Support

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

Before calling, please refer to the serial number label on the rear of the case top to obtain the following information (see Section II, Description for the serial number label location):

*- BOM number*_____

- Serial number _____

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 for assistance (see Preface, After-sale Support).

Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.

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

Do not attempt to defeat any of the interlock switches or safety features built into the unit.

Observe all warning labels.

Never remove warning label.

Never operate damaged or leaking equipment.

Never operate the unit without cooling fluid in the fluid reservoir.

Make sure the unit is off before connecting or disconnecting the power cord or other cables.

Always turn off the unit and disconnect the power cord from the power source before performing any service or maintenance procedures, or before moving the unit.

Always empty the fluid reservoir before moving the unit.

Never operate equipment with damaged power cords.

Refer service and repairs to a qualified NESLAB technician.

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

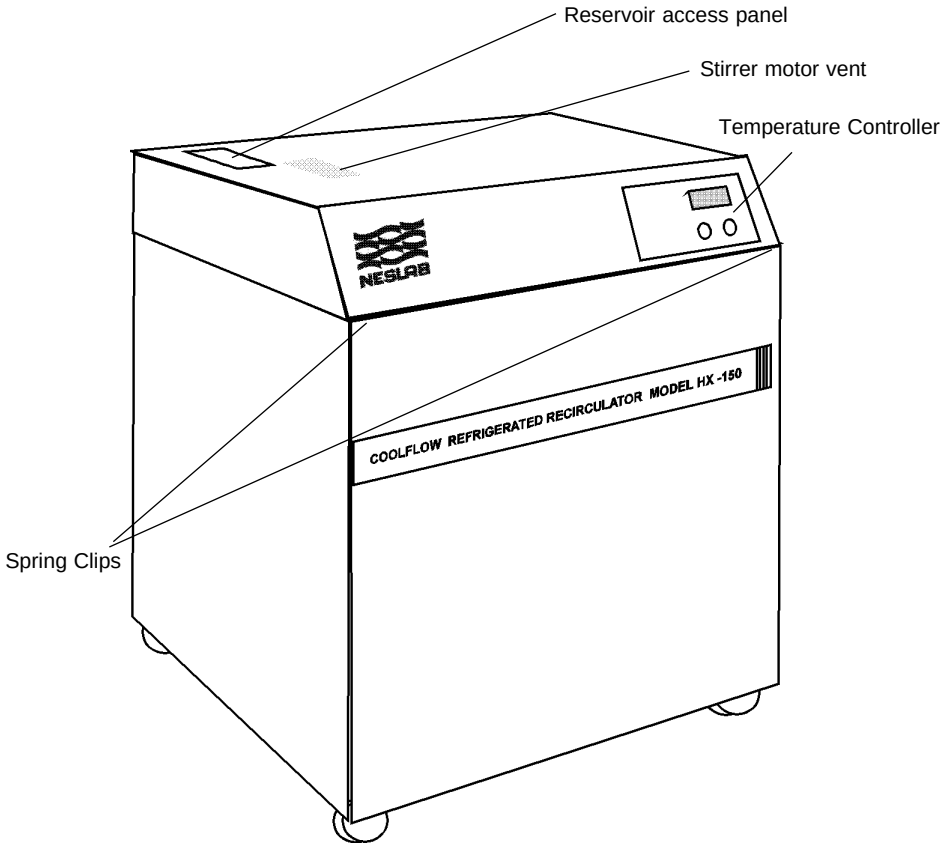
Description

The HX Series II Recirculating Chiller is designed to provide a continuous flow of cooling fluid at a constant temperature and volume.

The unit consists of an air-cooled or water-cooled refrigeration system, a fluid reservoir, a fluid recirculation pump, and a temperature controller.

HX units are available with a large number of options. This manual explains how to install, operate, and maintain a “standard” HX unit. This manual also explains some of the available options. Supplemental manuals are supplied with units equipped with options not covered in this manual.

Throughout the manual, you will be asked to consult the unit’s serial number label, or the pump identification label, or both, for specific information. Both labels are located on the rear of the case top.



Specifications

	HX-75	HX-100	HX-150
Temperature Range	+5°C to +35°C		
Temperature Stability	±0.1°C		
Unit Dimensions (H x W x D)			
Inches	35 ¾ x 23 ¼ x 18 ¾	39 5/8 x 26 ¼ x 21 1/8	
Centimeters	90.8 x 59.0 x 47.6	100.6 x 66.6 x 53.6	
Reservoir Volume			
Gallons	5.0	8.0	
Liters	19.0	30.3	
Shipping Weight			
Pounds	261	300	320
Kilograms	118	136	145

	HX-200	HX-300	HX-500	HX-750
Temperature Range	+5°C to +35°C			
Temperature Stability	±0.1°C			
Unit Dimensions[1] (H x W x D)				
Inches	45 7/8 x 33 ¾ x 25 ¼		50 5/8 x 46 x 28 ¾	63 ¾ x 46 x 29
Centimeters	116.5 x 85.7 x 64.1		128.3 x 116.8 x 73.0	162.0 x 116.8 x 73.6
Reservoir Volume				
Gallons	15.0		28.0	40.0
Liters	56.8		106.0	151.0
Shipping Weight				
Pounds	471	531	746	971
Kilograms	214	241	338	440

1. The model HX-750 with a water-cooled refrigeration system has the same dimensions as the HX-500. For additional dimensions see page 46.

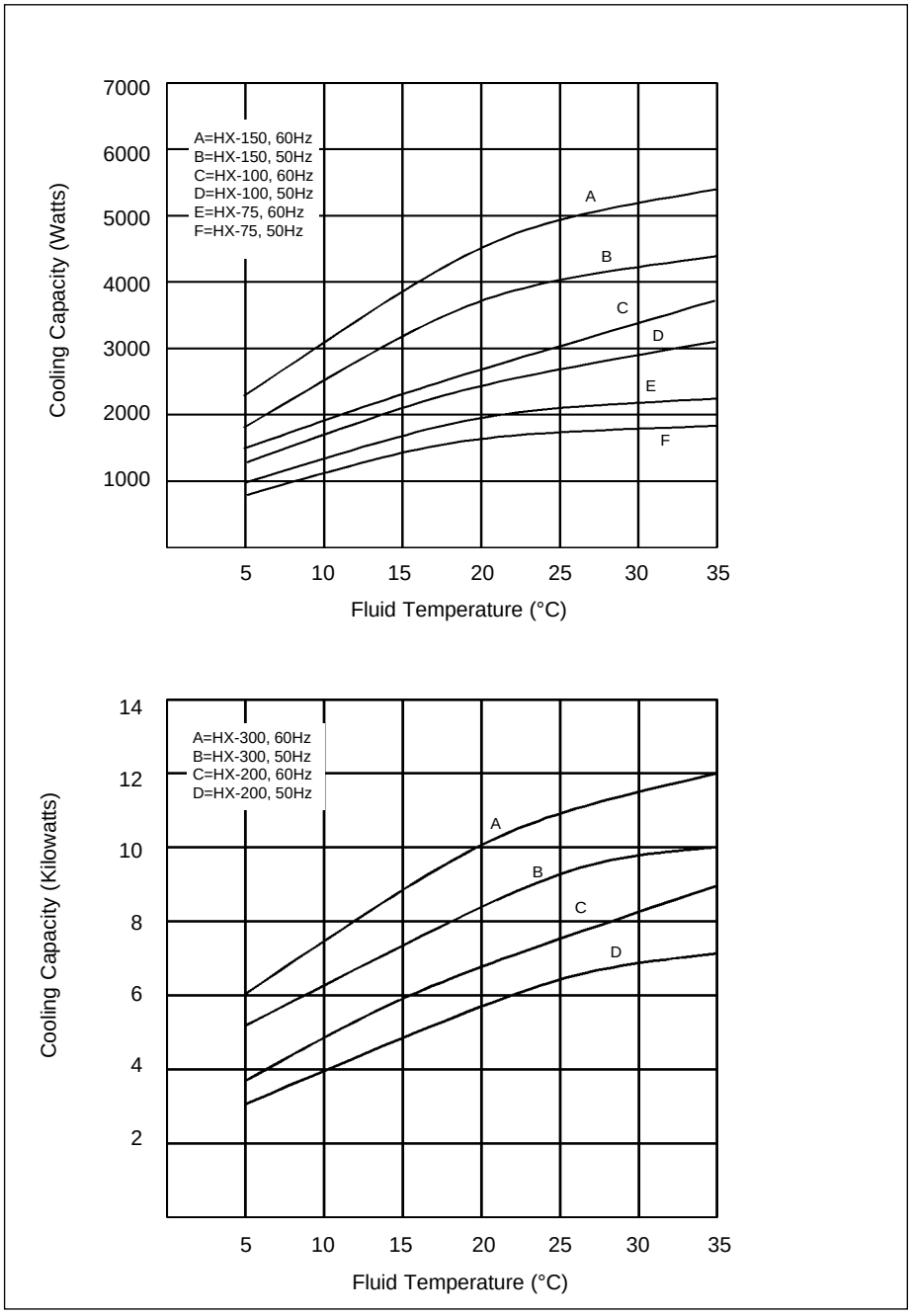
Cooling Capacity

Cooling capacity will vary depending on fluid temperature, ambient temperature, and cooling fluid.

Cooling capacities for models HX-75 through HX-750 were obtained under the following conditions:

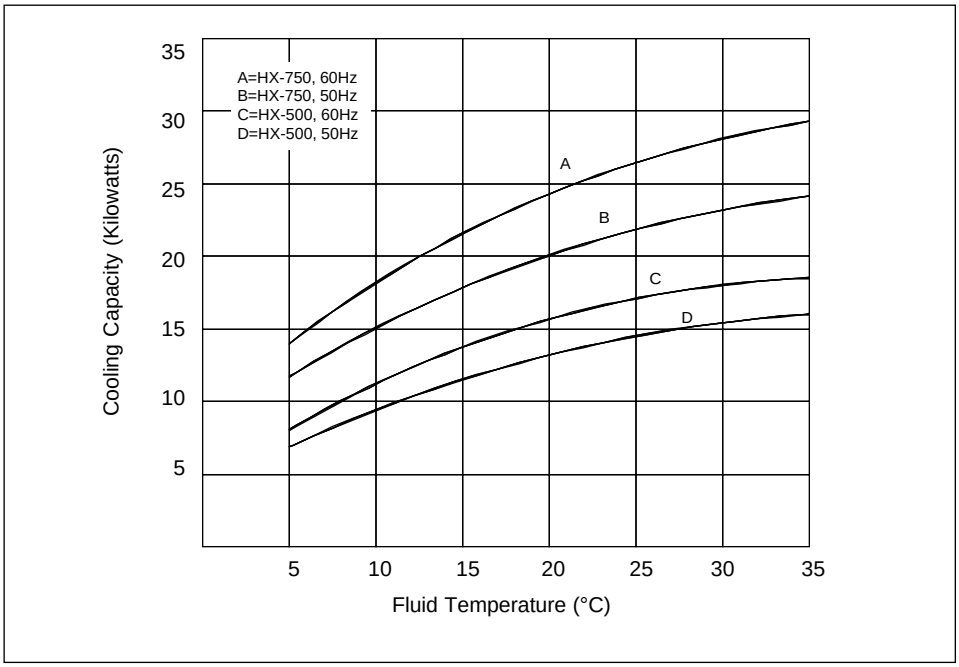
1. *air-cooled unit operating at +20°C (+68°F) ambient temperature.*
2. *cooling fluid with specific heat of 1.0 was used for fluid temperatures from +5°C to +35°C.*

HX-75, 100, & 150



HX-200 & 300

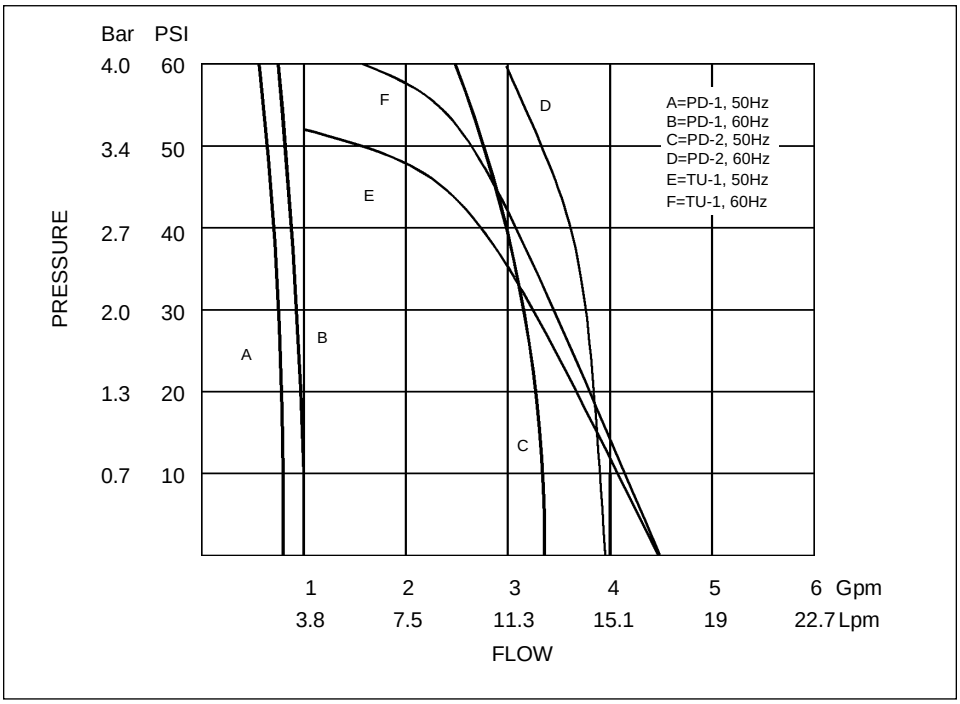
HX-500 & 750



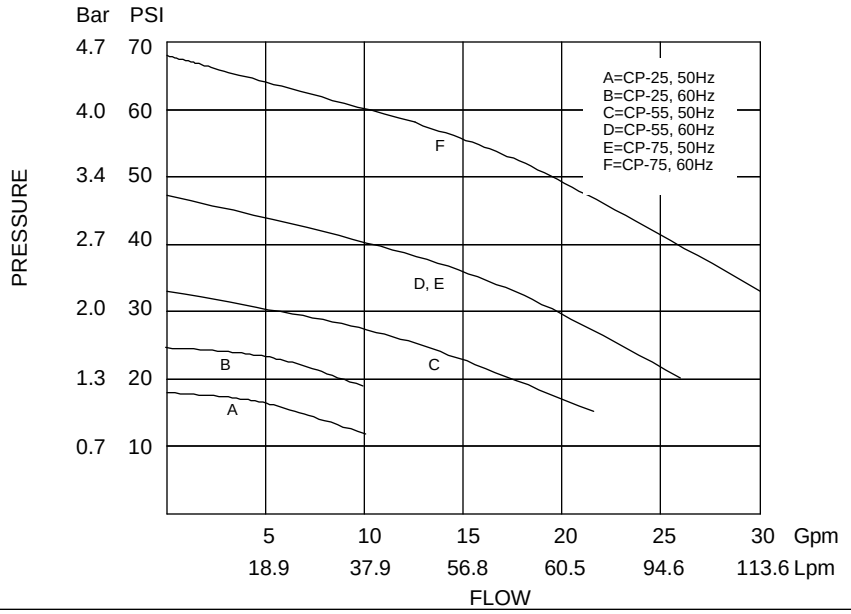
Pump Capacity

HX units are available with one of three standard pump types: positive displacement (PD), centrifugal (CP), and turbine (TU). Refer to the pump identification label on the rear of the case top or rear of analog temperature controller to identify the specific pump in your unit.

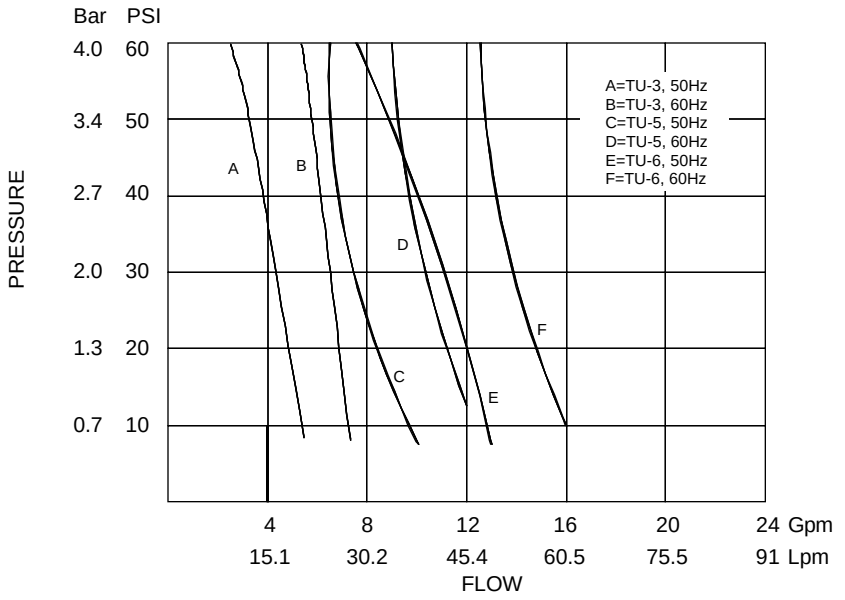
PD1, PD2 & TU1



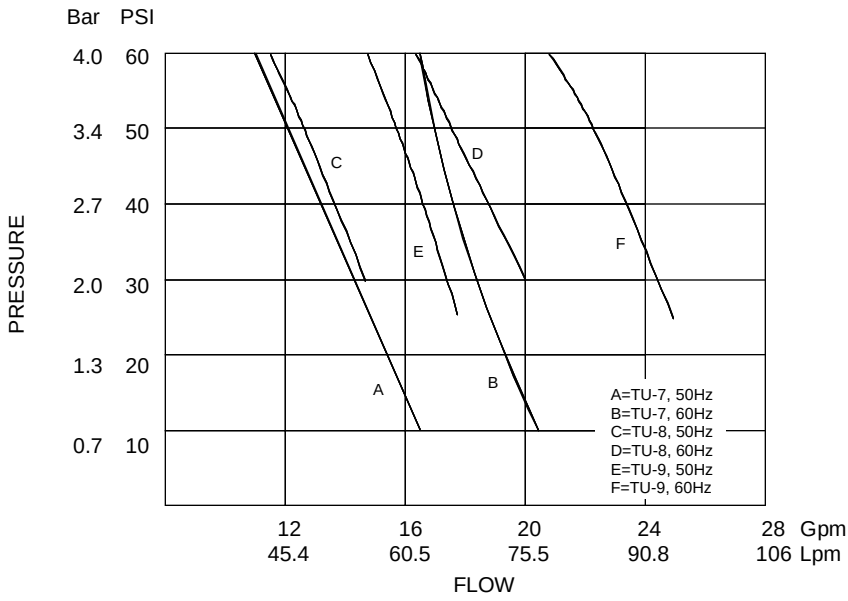
CP



TU-3, 5 & 6



TU-7, 8 & 9



Section III Installation

Site (Air-cooled Units)

The unit should be located in a laboratory or clean industrial environment where ambient temperatures are inside the range of +55°F to +95°F (+13°C to +35°C).

The unit will retain its full rated capacity in ambient temperatures to approximately +75°F (+24°C). Above +75°F, derate the cooling capacity 1% for every 1°F above +75°F, to a maximum ambient temperature of +95°F. In degrees Celsius, derate the cooling capacity 1% for every 0.5°C above +24°C, to a maximum ambient temperature of +35°C.

Never place the unit in a location where excessive heat, moisture, or corrosive materials are present.

The unit has an air-cooled refrigeration system. It must be positioned so the air intake and discharge are not impeded.

On models HX-75 through HX-150, air is drawn through the left side of the unit and discharged through the right and rear. A minimum clearance of 2 feet (0.6 meter) on these three sides is necessary for adequate ventilation.

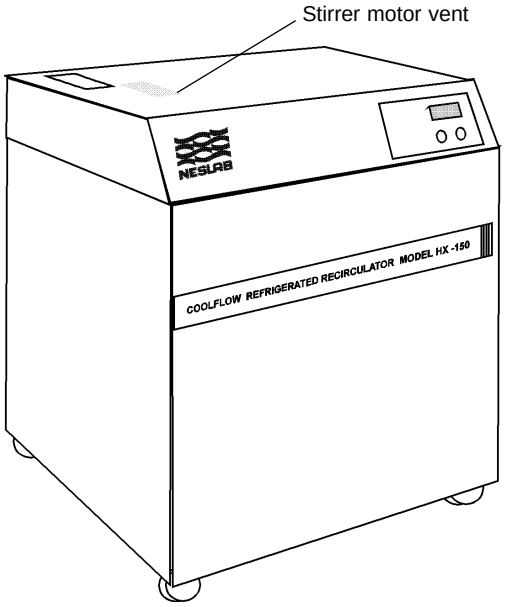
On models HX-200 through HX-750, air is drawn through the front of the unit and discharged through the side and rear panels. A minimum of 5 feet (1.5 meters) on all four sides of the unit is necessary for ventilation.

In some applications where space is at a premium, the minimum ventilation clearance can be compromised. However, consult our Sales Department before positioning the unit in a location with less minimum clearance than listed above. Inadequate ventilation will cause a reduction in cooling capacity and, in extreme cases, compressor failure.

Excessively dusty areas should be avoided and a periodic cleaning schedule should be instituted (see Section VII, Condenser Cleaning).

On models HX-100 through HX-750 the stirrer motor is located under the case top. (Models HX-500 and HX-750 have two stirrer motors.) Heat generated by the stirrer motor is discharged through vents in the case top. Do not block the vents. A minimum clearance of 2 inches (5 centimeters) is necessary for adequate ventilation. See illustration on page 7.

NOTE: Units with plate heat exchangers do not have stirrer motors.



NOTE: The HX-750 380/480V model contains a three phase condenser fan motor. It is possible to misconnect the main power and have the motor turn in the wrong direction resulting in incorrect airflow over the condenser. Proper airflow is achieved by exchanging any two main power connectors.

Refer to the table below to determine the approximate amount of air intake required for the unit to retain its full rated capacity. If the air intake does not meet these standards, cooling capacity will be derated.

	HX-75	HX-100	HX-150	HX-200
Air Intake				
Cubic feet per minute	600	710	1050	2000
Liters per minute	17000	20100	29730	56640

	HX-300	HX-500	HX-750
Air Intake			
Cubic feet per minute	1900	5000	5600
Liters per minute	53800	141750	158800

Site (Water-cooled units)

The unit should be located in a laboratory or clean industrial environment with easy access to a facility cooling water supply and a drain.

All units are equipped with castors for easy movement. This allows the unit to be placed in a small area, as long as there is ample space for the unit to be moved for access on all four sides. A minimum access clearance of 3 feet (1 meter) on two adjacent sides is recommended.

The facility cooling water supply must meet or exceed the requirements listed in the table shown on the next page for the unit to operate at its full rated capacity. If the facility cooling water does not meet these standards, the cooling capacity will be derated.

As the temperature of the cooling water supply increases, the required flow rate and pressure of the cooling water supply increases.

For example, with a model HX-150, if the temperature of the cooling water supply is +65°F, the flow rate must be at least 1.5 gallons per minute, with a pressure differential of at least 3.5 PSI. However, if the temperature of the cooling water supply is +85°F, the flow rate must be at least 4.0 gallons per minute, with a pressure differential of at least 10 PSI.

If the unit is being used with a building water supply, the back pressure of the drain must be less than the supply pressure.

A water regulating valve, located in the TAP WATER line, regulates the flow rate of the cooling water supply as it enters the unit. The valve regulates the flow rate based on the heat load. Flow through the unit stops automatically when the unit is shut off.

On models HX-100 through HX-750 the stirrer motor is located under the case top. (Models HX-500 and HX-750 have two stirrer motors.) Heat generated by the stirrer motor is discharged through vents in the case top. Do not block the vents. A minimum clearance of 2 inches (5 centimeters) is necessary for adequate ventilation. See illustration on page 7.

NOTE: Units with plate heat exchangers do not have stirrer motors.

	Temperature of cooling water supply			
	+55°F (+13°C)	**+65°F (+18°C)**	**+75°F (+24°C)**	**+85°F (+29°C)**
HX-75				
Flow Rate				
Gallons per minute	0.75*	1.0	1.5	3.0
Liters per minute	2.8*	3.7	5.7	11.4
Pressure Drop				
PSI	1.5*	2.0	3.5	8.0
Bar	0.10*	0.13	0.24	0.55
HX-100				
Flow Rate				
Gallons per minute	1.0*	1.5	2.0	3.5
Liters per minute	3.8*	5.7	7.6	13.2
Pressure Drop				
PSI	2.0*	3.5	5.0	10.0
Bar	0.13*	0.24	0.34	0.69
HX-150				
Flow Rate				
Gallons per minute	1.0*	1.5	2.5	4.0
Liters per minute	3.8*	5.7	9.5	15.1
Pressure Drop				
PSI	2.0*	3.5	6.0	10.0
Bar	0.13*	0.24	0.41	0.69
HX-200				
Flow Rate				
Gallons per minute	1.8*	2.5	3.5	6.0
Liters per minute	6.8*	9.5	13.2	22.7
Pressure Drop				
PSI	5.0*	6.0	7.0	18.0
Bar	0.34*	0.41	0.48	1.24
HX-300				
Flow Rate				
Gallons per minute	2.5*	4.0	6.5	11.0
Liters per minute	9.5*	15.1	24.6	41.6
Pressure Drop				
PSI	6.0*	8.0	13.5	25.0
Bar	0.41*	0.55	0.93	1.72
HX-500				
Flow Rate				
Gallons per minute	3.5	5.0	8.0	16.0
Liters per minute	13.2	18.9	30.3	60.6
Pressure Drop				
PSI	13.0	17.0	23.0	57.0
Bar	0.89	1.17	1.58	3.93
HX-750				
Flow Rate				
Gallons per minute	6.0	8.0	12.5	16.6
Liters per minute	22.7	30.3	47.3	62.8
Pressure Drop				
PSI	14.0	20.0	28.5	40.0
Bar	0.96	1.38	1.96	2.76

*Estimater Value

Electrical Requirements

Refer to the table below to determine the unit's electrical requirements. Verify the requirements by reviewing the ratings listed on the serial number label on the rear of the case top or rear of analog temperature controller.

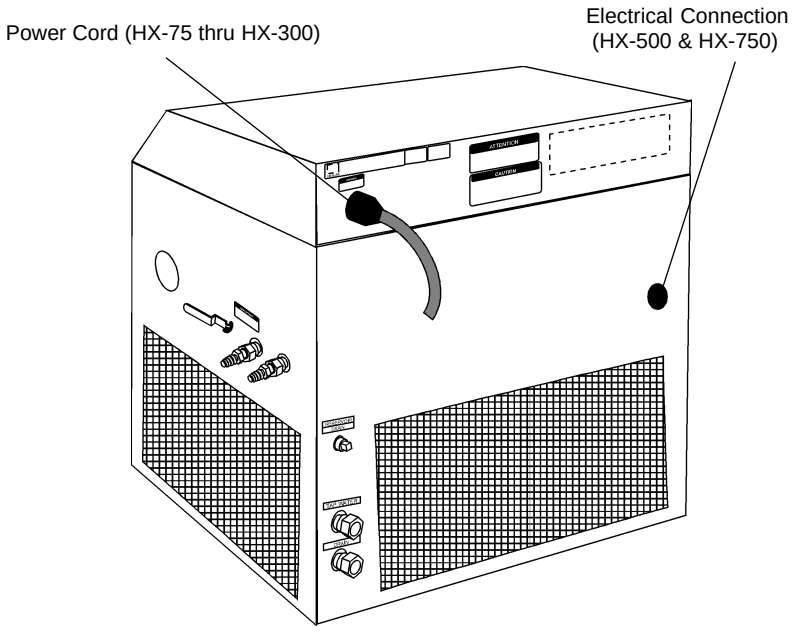
	HX-75	HX-100	HX-150
Volts	208/230 220/240		
Hertz	60 50		
Phase	1 1		
Plug	NEMA L6-30P or L6-20P		

	HX-200	HX-300	HX-500	HX-750
Volts	208/230 200/220	380/420	208/230	380/420
Hertz	60 50	50	60	50
Phase	3 3	3	3	3
Plug	NEMA L15-30P or L16-20P		N/A	

Make sure the voltage of the power source agrees with the unit's voltage and frequency rating. The unit is designed to tolerate deviations of ±10% from the rated line voltage.

Models HX-75 through HX-300 have an 8 foot (2.4 meter) power cord installed on the unit at the time of shipment.

NOTE: Custom units equipped with heaters may not have a power cord. See Section VI, Special Features.



The unit construction provides extra protection against the risk of electric shock by grounding appropriate metal parts. The extra protection may not function unless the power cord is connected to a properly grounded outlet. It is the user's responsibility to assure a proper ground connection is provided.

Models HX-500 and HX-750 are not equipped with a power cable. Installation of the cable is the user's responsibility. Wire the unit in conformance to local, state, and federal electrical codes. Double check all wiring to make sure it is properly connected and protected from the elements.

Models HX-200 through HX-750 are equipped with a compressor crankcase heater. The crankcase heater warms the oil in the compressor and prevents refrigerant from mixing with the oil. Before start up, the unit must be connected to its power source for at least 12 hours. This allows time for the oil to be heated and separate from the refrigerant.

Plumbing Requirements

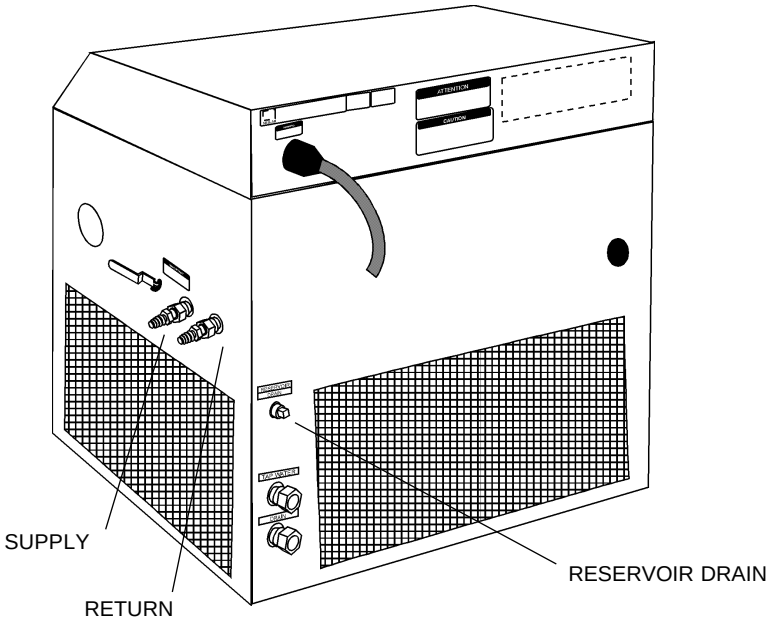
Air-cooled and water-cooled units

Before installing the unit to an instrument that previously used tap water as a cooling fluid, flush the instrument several times to remove any rust or scale that has built up. Consult the manufacturer of the instrument for a cleaning fluid recommendation.

The plumbing fittings used to connect the HX to the instrument being cooled are located on the right side of the unit (labelled SUPPLY and RETURN). These connections are ¾ inch FPT.

Remove the protective plugs from the SUPPLY and RETURN connections. Connect the SUPPLY fitting to the inlet of the instrument being cooled. Connect the RETURN fitting to the outlet of the instrument being cooled.

The RESERVOIR DRAIN connection, located on the rear of the unit, is a ½ inch FPT fitting connected internally to the unit's fluid reservoir. This fitting is for draining the reservoir. The unit is shipped with a ½ inch MPT plug installed in this fitting. Remove the plug to drain the reservoir.



Two plumbing adapters (¾ inch MPT x 5/8 inch hose) are included with the unit. If the unit is being plumbed to the instrument being cooled using flexible tubing, install the adapters in the SUPPLY and RETURN plumbing ports. To prevent leaking, wrap the threads of the adapters with Teflon® sealing tape before installing them in the plumbing ports. The adapters will accept ½ or 5/8 inch ID flexible tubing.

If the unit is "hard plumbed" to the instrument being cooled or to the cooling water supply, damage can occur if the unit is bumped or jolted from its site. Provisions should be made to prevent the unit from being moved after installation. Once the unit is plumbed, secure the locking castors on the unit's base. If the unit is located in a heavy traffic area where the possibility of collision is imminent, it may be necessary to secure the unit to the site using blocks or mounting brackets.

Flexible tubing, if used, should be heavy wall or reinforced construction. All tubing should be rated to withstand 110 psi at +35°C. Make sure all tubing connections are securely clamped. Avoid running tubing near radiators, hot water pipes, etc. If substantial lengths of tubing are necessary, insulation may be required to prevent loss of cooling capacity.

Tubing and insulation are available from NESLAB. Contact our Sales Department for more information (see Preface, After-sale Support).

It is important to keep the distance between the unit and the instrument being cooled as short as possible, and to use the largest diameter tubing practical. Tubing should be straight and without bends. If diameter

reductions must be made, they should be made at the inlet and outlet of the instrument being cooled, not at the HX.

If substantial lengths of connecting tubing are required, they should be pre-filled with cooling fluid before connecting them to the unit.

Water-cooled units
The plumbing connections used to connect the water-cooled condenser in the HX to the facility cooling water supply are located at the rear of the unit (labelled TAP WATER and DRAIN). On models HX-75 through HX-300, these fittings are ½ inch FPT. On models HX-500 and HX-750, these fittings are 1 inch FPT.

Remove the plastic protective plugs from the TAP WATER and DRAIN connections. Connect the TAP WATER fitting to the facility cooling water supply. Connect the DRAIN fitting to a drain.

Fluids

The selected cooling fluid must have a viscosity of 50 centistokes or less at the lowest operating temperature.

If your unit is equipped with a plate heat exchanger, do not use 100% water as a recirculating fluid. Due to the physical nature of a plate heat exchanger, and its response to temperature changes, using 100% water may cause the plate heat exchanger to rupture.

Never use flammable or corrosive fluids with this unit. Distilled and deionized water may be aggressive and cause material corrosion. Please contact NESLAB before subjecting this unit to prolonged exposure to distilled or deionized water.

Tap water is the recommended fluid for operation from +8°C to +35°C.

Below +8°C, a non-freezing solution is required. A 50/50 mixture, by volume, of water and laboratory grade ethylene glycol is suggested.

Do not use automobile anti-freeze. Commercial anti-freeze contains silicates that can damage the pump seals. Use of automobile anti-freeze will void the manufacturer's warranty.

For units with extended temperature ranges above +35°C, tap water is the recommended fluid up to +80°C. Above +80°C, the user is responsible for the fluid(s) used.

Water Quality Recommendations

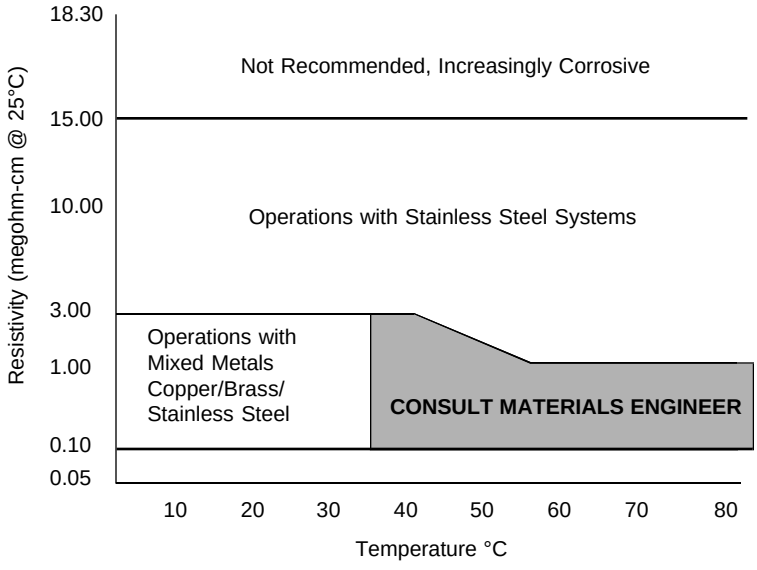
Unfavorably high total ionized solids (TIS) can accelerate the rate of galvanic corrosion. These contaminants can function as electrolytes which increase the potential for galvanic cell corrosion and lead to localized corrosion such as pitting which can be observed at the studs and on the outside surface of cooling coils. Eventually, the pitting will become so extensive that the coil will leak refrigerant into the water reservoir.

As an example, raw water in the United States averages 171 ppm (as NaCl). The recommended level for use in a water system is between 0.5 to 5.0 ppm (as NaCl).

Recommendation: Initially fill the tank with distilled/deionized water. Do not use untreated tap water as the total ionized solids level may be too high.

Maintain this water quality at a resistivity of between 1 to 10 megohm-cm (compensated at 25°C) by using a purification system. Although the initial fill may be as high as 10 megohm-cm (compensated at 25°C), the desired level for long time usage is 1 to 3 megohm-cm (compensated at 25°C).

The above two recommendations will reduce the electrolytic potential of the water and prevent or reduce the galvanic corrosion observed.



Water Quality Considerations

Filling Requirements

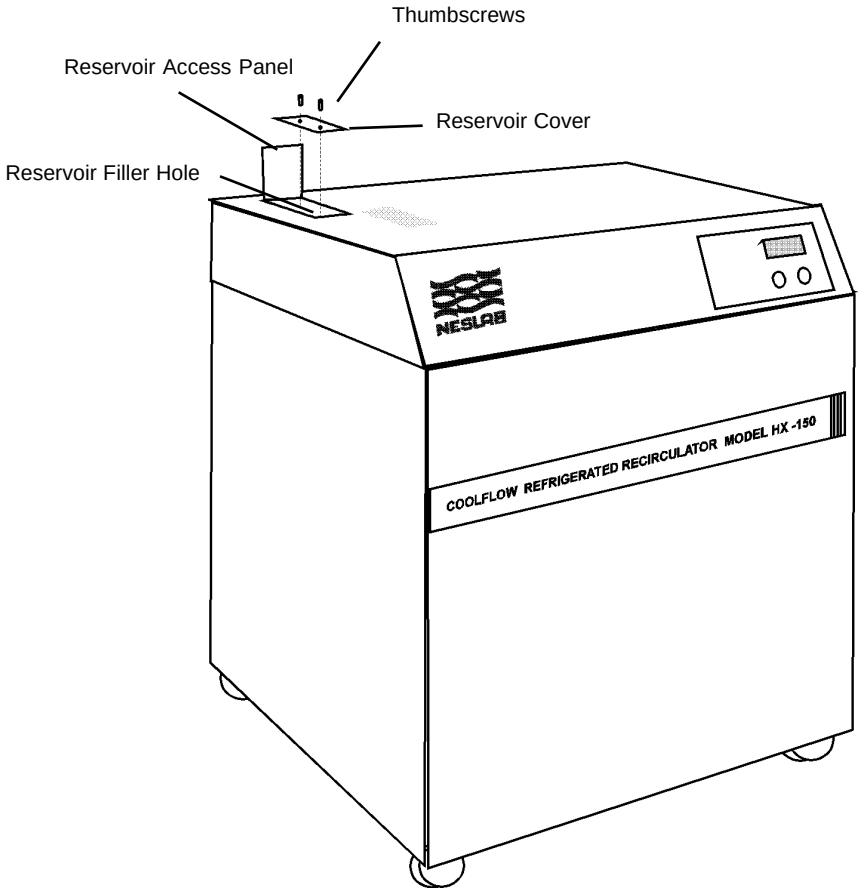
The reservoir access panel is located at the left rear corner of the case top. To open the access panel, slide the latch back (towards the rear of the unit) and lift.

The reservoir cover is located below the access panel. Loosen the thumbscrews and remove the reservoir cover.

Fill the fluid reservoir with cooling fluid to within 1 inch of the top.

The fluid capacity of the instrument being cooled and the recirculation lines may be significant. To prevent the lowering of the fluid level in the reservoir below the operating level, have extra cooling fluid on hand to keep the reservoir filled to within 1 inch of the top.

When the recirculating system is full, replace the reservoir cover and the access panel.



Section IV Temperature Controllers

Temperature Controllers

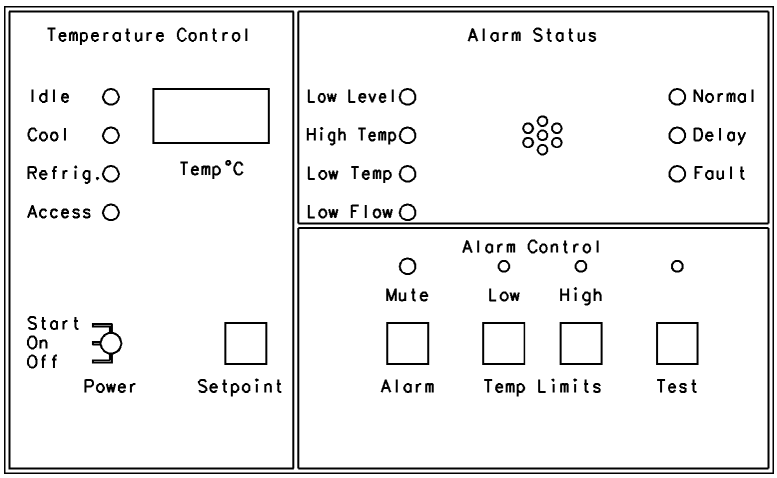
The temperature controller supplied with your unit is the Series II. This section explains the operation of the controller.

Refrigeration Control

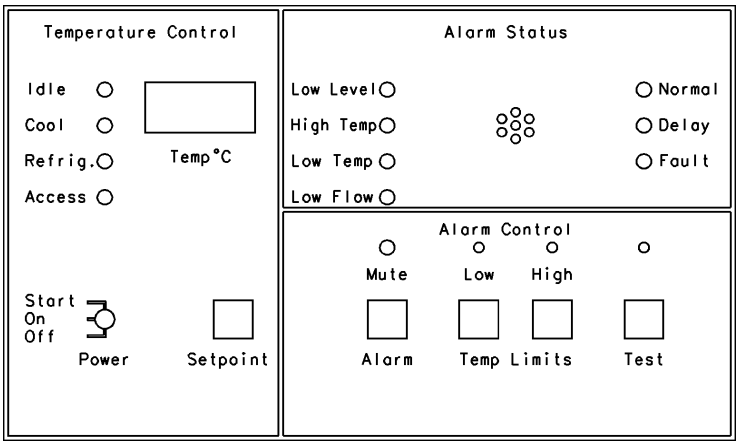
On “standard” units, the refrigeration compressor runs continuously, unless the fluid temperature exceeds +40°C. However, on some “custom” units equipped with an extended temperature range, the compressor may operate at higher temperatures. A hot gas by-pass system, designed to eliminate compressor cycling and premature wear, is used to maintain constant temperature in all units.

The Cool and Idle indicators, located on the control panel, indicate the status of the refrigeration system. The Idle indicator is lit when the unit is in the hot gas by-pass mode. The Cool indicator is lit when the refrigeration system is removing heat from the cooling fluid. As the fluid temperature approaches the temperature setpoint, the indicators cycle on and off to indicate the duty cycle of the system. The unit can be in the Cool or the Idle mode, but never both at the same time. A balance between Cool and Idle is needed to control temperature.

When the unit is shut off, wait approximately 5 minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.



Series II Temperature Controller



Series II Temperature Controller

Series II

Description

The Series II temperature controller features are divided into four sections. Three are mounted on the operator panel on the front of the case top: Temperature Control, Alarm Control, and Alarm Status. The fourth section, the Interface Access. panel is mounted on the rear of the case top and is covered with a removable protective metal plate.

The four controller sections all work together, but for ease of explanation, are described separately.

The Series II temperature controller is also available without the alarm circuitry installed. Controllers with this option are equipped with only two of the four Series II sections: Temperature Control and the Interface Access. panel.

Temperature Control

This section of the temperature controller turns the unit on and off, adjusts and displays the fluid and setpoint temperatures, and indicates general refrigeration status.

Before starting the unit, double check all electrical and plumbing connections and make sure the recirculating system (the HX, the instrument being cooled, and the tubing that connects them) has been properly filled with cooling fluid. Open the flow control valve to allow slightly more than 0.3 gallons per minute (1.0 liters per minute) of flow through the recirculation lines (see Section V, Flow Control).

NOTE: For water-cooled units ensure the facility water is turned on.

A three position toggle switch controls the Off/On/Start functions. To start the unit, momentarily hold the Off/On/Start switch in the Start position. Normal running position is On. To shut the unit off, place the Off/On/Start switch in the Off position.

To display the temperature setpoint, press and hold the Setpoint button. To adjust the temperature setpoint, press and hold the Setpoint button and turn the dial located directly above the Setpoint button until the desired temperature setpoint is indicated on the Temp°C LED display. Once the setpoint is adjusted, release the Setpoint button. The Temp°C LED display will indicate the fluid temperature.

Inadvertent movement of the Setpoint dial will result in a change in the setpoint. The change will not be immediately reflected on the Temp°C LED display unless the Setpoint button is pressed. The display will eventually change as the unit responds to the new setpoint.

The Temperature Control section is equipped with four indicators: Idle, Cool, Refrig. (refrigeration), and Access. (accessory). The Idle and Cool indicators are explained in Section IV, Refrigeration Control.

The Refrig. indicator displays the status of the refrigeration compressor. The indicator is lit when the compressor is running.

The Access. indicator displays the status of the ACCESS. ENABLE/DISABLE switch on the Interface Access. panel. The indicator is lit when the switch is in the ENABLE position. See Interface Access. panel for more information.

Alarm Control

The Alarm Control section adjusts the high and low temperature limits of the alarm, tests the alarm, and activates/de-activates the audible alarm.

To display the high or low temperature limit, press the corresponding button. When the button is pressed, the limit is indicated on the Temp°C display.

To adjust either temperature limit, press the corresponding button and turn the slotted potentiometer located directly above the button (a small screwdriver is required). The high and low values must be at least 4°C apart for the unit to operate.

The Test button simulates high and low temperature conditions to test the temperature limits.

To test the temperature limits, press the Test button and turn the dial located directly above the button. The simulated temperature will appear on the Temp°C display. When the temperature limits are exceeded on the display, the alarm will sound, and the corresponding indicator in the Alarm Status section will light indicating which limit has been exceeded.

The alarm will only sound when a fault occurs. The Alarm button alternately activates and mutes the audible alarm as indicated by the Mute indicator. When the alarm is muted, it will remain muted until the Alarm button is pressed; the alarm does not reset after a fault condition has been corrected.

Alarm Status

Alarm Status section indicates the status of the fault monitors. Four amber indicators display the status of the Low Level, High Temperature, Low Temperature, and Low Flow fault monitors. In the event of a fault, the cause of the fault must be identified and corrected before the unit can be restarted.

The Low Level indicator is connected to a float switch in the reservoir. If a low cooling fluid level condition is detected, the Low Level indicator will light and the Delay indicator will flash. If the condition is not corrected within 30 seconds, the Delay and Normal indicators turn off, the Fault indicator turns on, and the audible alarm will sound. After 50 seconds (total elapsed time), the unit will shut down and a set of relay contacts will open (the status of the relay contacts can be monitored using pins 14 and 15 of the REMOTE CONT. receptacle on the Interface Access. panel).

The Low Flow indicator is connected to a flow switch in the RETURN line. A low flow fault occurs when the flow rate of the returning cooling fluid drops below 0.3 gallons per minute (1.0 liters per minute). If a low flow condition is detected, the Low Flow indicator will light and the Delay indicator will flash. If the condition is not corrected within 5 seconds, the Delay and Normal indicators turn off, the Fault indicator turns on, and the audible alarm will sound. After 30 seconds (total elapsed time), the unit will shut down and the relay contacts will open.

The High/Low Temp indicators are connected to sensors that monitor the temperature of the cooling fluid as it exits the reservoir. The monitors protect the system from exposure to excessively hot or cold cooling fluid. A temperature fault occurs when the cooling fluid temperature exceeds the set temperature limit. In the event of a high or low temperature fault, the unit will shut down, the corresponding indicator will light, the audible alarm will sound, and the set of relay contacts will open.

The Normal, Delay, and Fault indicators, also mounted in the Alarm Status section, monitor the status of a fault.

Normal (green) indicates that no fault is present and the unit is operating normally.

Delay (amber) indicates an initial condition out of desired range.

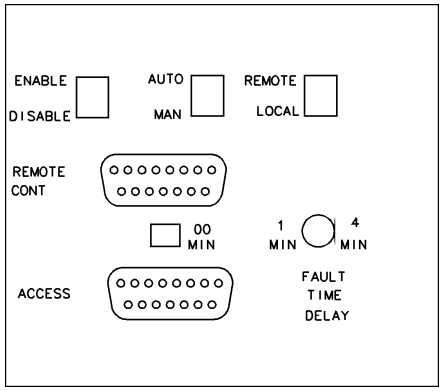
The Delay indicator will flash:

1. *during the 30 second low fluid level condition delay period.*
2. *during the 5 second low flow condition delay period.*
3. *while the fluid temperature is reaching the high and low temperature conditions following a power up. Once the fluid temperature satisfies the high and low limit conditions, the temperature alarm is armed and a fault will occur if the temperature goes outside of the limits.*

The Delay indicator turns off after these conditions are met.

The Fault indicator (red) indicates a fault has occurred. During a fault, the audible alarm will sound (unless muted), and the status indicator will displaythe cndition(s) causing the fault.

Interface Access. Panel



Interface Access panel (rear of case top)

The Interface Access. panel allows the Series II temperature controller to be controlled and monitored with various electronic accessories.

The ACCESS. ENABLE/DISABLE switch allows the user to select the source of temperature setpoint adjustment. When the switch is in the ENABLE position, the setpoint is derived from the ACCESS receptacle (pins 6 and 15, 10mV/°C). When the switch is in the Disable position, the setpoint is derived from the Setpoint dial in the Temperature Control section on the operator panel.

The RESTART AUTO/MAN switch controls the operation of the controller's START switch. If the switch is in the MAN position, the START switch is "open" and the unit must be manually restarted when power is restored following an outage. In the AUTO position, the START switch is "closed" and the unit will automatically restart when power is restored following an outage. See ON/OFF/START Logic for more information.

The START/STOP REMOTE/LOCAL switch selects the location where the unit is turned on: from the operator panel ON/OFF/START switch or from an external switch. See ON/OFF/START Logic for more information.

The FAULT TIME DELAY potentiometer allows adjustment of the delay period following an initial "out of limits" condition. The time adjustment is in addition to the delays described in the Alarm Status section. For example, if the cooling fluid in the reservoir drops below the operating level, there is a 30 second delay period before a fault occurs. If the FAULT TIME DELAY is adjusted to 1 minute, the delay period for a low level condition would be 1 minute, 30 seconds. See the Alarm Status section for more information.

The oo MIN receptacle allows the controller to be configured so the unit will continue to run if a fault occurs. This option is available for customers who are willing to accept the risk of damage to the unit in order to continue to provide all available cooling fluid to the instrument being cooled. Contact our Service Department for more information.

The power receptacle located next to the Interface Access. panel is a NEMA 5-15R receptacle rated for 125V, 0.25A maximum. It is typically used to power a deionizer LED.

Section V Operation

Flow Control

The RECIRCULATING FLOW CONTROL handle, located on the right-hand side of your unit, is connected to a valve that controls the flow rate of the cooling fluid to the instrument being cooled.

When the handle is in the “+” position, the valve is open and all possible cooling fluid is supplied to the instrument being cooled. When the handle is in the “-” position, the valve is closed and no cooling fluid is supplied to the instrument being cooled. When the handle is between these two positions, the flow rate of the cooling fluid is between full flow and no flow. Use a flow meter on the SUPPLY line to adjust the desired flow rate.

The flow control valve must be opened slightly to allow fluid to circulate through the flow switch that monitors the flow rate. A flow rate of more than 0.3 gallons per minute (1.0 liters per minute) is necessary. If the flow is completely shut off, or if the flow is not adequate, a low flow fault will occur and the unit will not start.

Never “crank” the valve wide open from the closed or slightly open position.

Start Up

For CE Mark units check the circuit breaker setting on the side of the bonnet.

Models HX-200 through HX-750 are equipped with a compressor crankcase heater. The crankcase heater warms the oil in the compressor and prevents refrigerant from mixing with the oil. Before start up, the unit must be connected to its power source for at least 12 hours. This allows time for the oil to be heated and separate from the refrigerant.

On water-cooled units, ensure the facility water is on and make sure the cooling water supply is connected to the TAP WATER connection, not the DRAIN connection.

A three position toggle switch controls the Off/On/Start functions. To start the unit, momentarily hold the Off/On/Start switch in the Start position. Normal running position is On. To shut the unit off, place the Off/On/Start switch in the Off position.

When the unit is shut off, wait approximately 5 minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.

Pressure Gauge

The RECIRCULATING PRESSURE gauge is located next to the flow control handle. The gauge indicates the operating pressure of the system.

Pressure Relief Valve
(PD and TU Pumps Only)

Units with a PD-1, PD-2, or any TU type pump have an adjustable pressure relief valve. Refer to the pump identification label on the rear of the case top or rear of analog controller to identify the specific pump in your unit.

The pressure relief valve establishes the maximum operating pressure of the unit. If the pressure of the fluid leaving the pump exceeds the valve setting, the relief valve will bypass the fluid within the unit to relieve the pressure. The valve does not determine the actual operating pressure; the operating pressure of the system is determined by the back pressure of the connected equipment and the setting of the flow control valve. If adjustment seems necessary, consult our Service Department for assistance.

Before calling, refer to the serial number label on the rear of the case top to obtain the following:

- *BOM number*
- *Serial number*

High Pressure Cutout
(Water-Cooled Units Only)

Should the unit's refrigeration discharge pressure become too high the high pressure cutout will activate and shut down the unit. High pressures can be caused by a lack of cooling water to the compressor or debris in the refrigeration lines.

Once the cause of the problem has been identified and corrected you must manually reset the cutout. The cutout location depends on the size of your unit. On the HX-75, it is behind the right side panel, on the HX-100 and HX-150 it is behind the left side panel, and on the HX-200 through HX-750 it is behind the rear panel.

Locate the white reset switch on the high pressure cutout. Press in on the switch until a "click" is heard. If the reset does not "click" the cutout was not activated and the unit shut down occurred for another reason.

Section VI Special Features

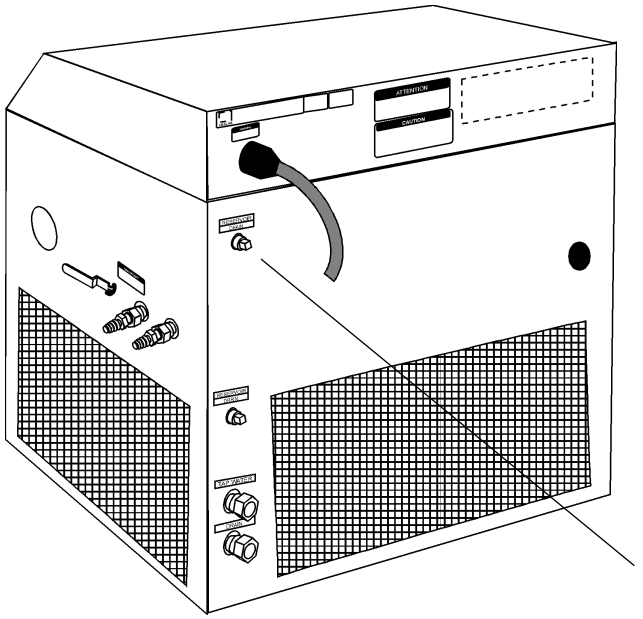
Automatic Refill Device (Optional)

The automatic refill device is designed to maintain the correct level of cooling fluid in the reservoir. The device consists of a float switch in the reservoir and a solenoid valve on top of the reservoir. If the cooling fluid level falls, the float switch will drop, opening the solenoid valve and allowing make-up fluid to fill the reservoir. Once the cooling fluid level reaches the proper level, the float switch will rise and the solenoid valve will close.

The plumbing connection for the refill device is located at the right rear corner of the unit and is labelled AUTO REFILL. This connection is a $^{3}/_{8}$ inch OD stainless steel barbed fitting.

Connect this fitting to a make-up fluid source using $^{5}/_{16}$ or $^{3}/_{8}$ inch ID flexible tubing. Make sure all tubing connections are securely clamped.

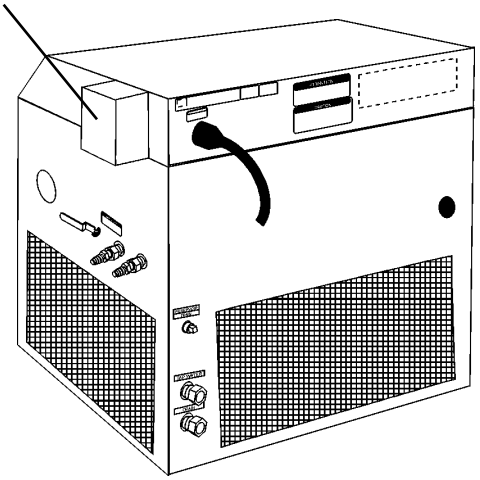
Tubing is available from NESLAB. Contact our Sales Department for more information (see Preface, After-sale Support).



Heater Package (Optional)

The heater package option consists of an immersion heater in the unit's fluid reservoir, a high temperature limit device, a solid state zero-crossing relay, a heater ENABLE/DISABLE switch and a FAULT indicator. The ENABLE/DISABLE switch and the FAULT indicator are located on a small control box appended to the right side of the case top. The FAULT indicator will light if the high temperature limit device is tripped. The high temperature limit device will disconnect power to the heater if the heater surface temperature exceeds a preset limit.

Heater Package Control Box (Typical)



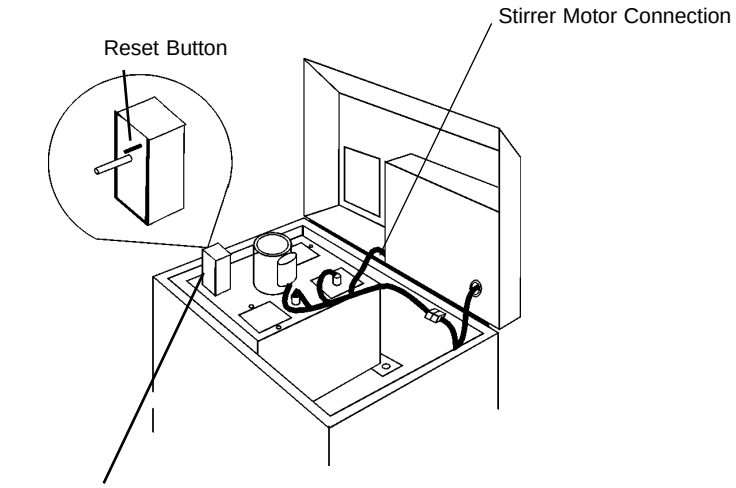
With the ENABLE/DISABLE switch set to ENABLE, the heater will cycle on and off under the control of the temperature controller. With the switch in the DISABLE position, the heater will remain off.

The heater high temperature limit device senses the surface temperature of the heater. If the heater temperature becomes too high, the limit device opens a mechanical relay to remove power from the heater.

The heater surface temperature may operate several degrees higher than the reservoir fluid. The limit device is factory set to a temperature above the upper limit of the temperature controller's range.

For personal safety and equipment reliability, the following procedure must only be performed by a qualified technician. Contact our Service Department for assistance (see Preface, After-sale Support).

To reset a tripped temperature limit device, lift and open the case top. The case top is secured to the unit base by a hinge between the case top and the base (along the rear of the unit), and by two spring clips located at the front corners. To gain access to the temperature limit device, disengage the spring clips with a flat bladed screw driver and lift the front of the case top and tilt it back. A support brace, located on the right side of the inner case, will stop and support the case top.



You must identify and correct the fault before restarting the unit.

The protection device and the heater power connections are located in a small stainless steel box on top of the fluid reservoir. The protection device has a reset button and a temperature limit adjustment shaft. Press the reset button to restore operation.

Some units equipped with heaters do not have a power cable. Installation of the cable is your responsibility. Wire the unit in conformance to local, state and federal electrical codes. Double check all wiring to make sure it is properly connected and protected from the elements.

The unit construction provides extra protection against the risk of electric shock by grounding appropriate metal parts. The extra protection may not function unless the power cord is connected to a properly grounded outlet. It is your responsibility to assure a proper ground connection is provided. For personal safety and equipment reliability, the following procedure should only be performed by a qualified technician.

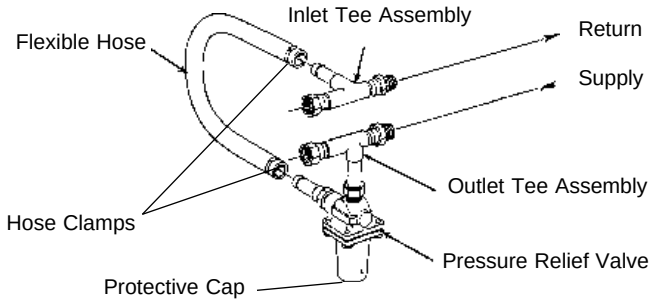
To access the power cable connection box and install the cable:

- Lift the unit's bonnet.
- Remove the panel under the right half of the bonnet by removing the screws and the stirrer motor connection. (The stirrer motor connection is located at the lower left corner of the bonnet, see illustration above.)
- Remove the plastic plug on the rear of the bonnet. We recommend that you install an electrical conduit in place of the plastic plug.
- Insert your cable through the conduit.
- Locate the connection box and connect your cable to L1 and L2 (both connections are labeled) and to the ground stud (not labeled).
- Replace the panel and stirrer motor connection.

External Pressure Regulator (Optional)

For applications requiring a maximum pressure less than 55 psi, an External Pressure Reducer (EPR) is available. An EPR allows an adjustable operating pressure of 10 to 50 psi. If the pressure of the fluid leaving the unit exceeds the valve setting the relief valve will bypass the fluid back into the unit to relieve the pressure. The pressure of the system is determined by the back pressure of the connected equipment and the flow rate of the recirculating fluid to your application.

Connect the EPR assembly as shown below. Tighten the hose clamps tight enough to prevent leakage. Do not over-tighten or the clamps will “bite” into the flexible tubbing and can cause excessive wear.



Connect the outlet tee assembly to the inlet of your application. Connect the inlet tee assembly to the outlet of your application.

Adjustment

When adjusting the relief valve some leaking may occur, place a container under the valve during adjustment.

Remove the protective cap and locate a threaded fitting with a slot for a large screwdriver. Hold the threaded fitting in place and loosen the lock nut on the valve body until it is almost flush with the threaded fitting. Unscrew the threaded fitting three to four turns. (If the threaded fitting unscrews completely from the valve housing, screw it back in two to three turns.)

To simulate blockage, close (or pinch off) the hose between the EPR outlet tee assembly and your application. Monitor the operating pressure of the HX unit. Turn the threaded fitting until the desired relief pressure is set (the EPR valve cannot be set lower than the total back pressure of your instrument, or flow will not be received).

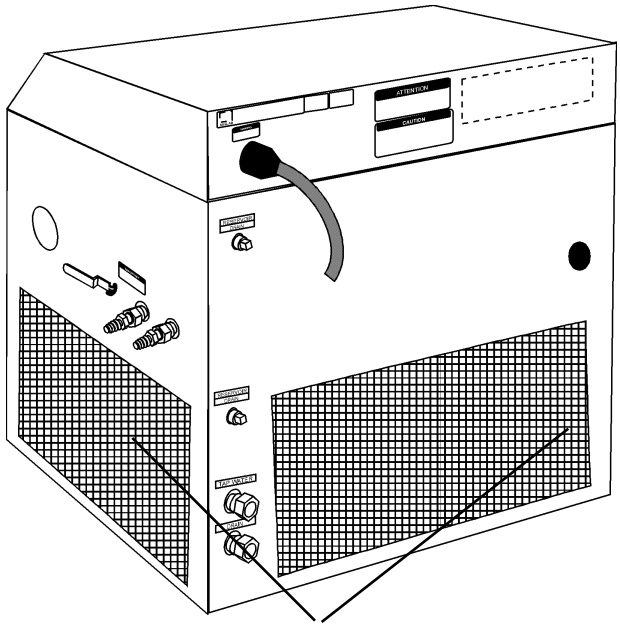
Tighten the locknut to secure the position of the threaded fitting. Open the hose between the EPR outlet tee assembly and your application.

Pump Motor Overload Protector

Refer to the serial number label on the rear of the case top for the unit's specific electrical requirements; specifically, identify the phase requirements.

The overload protector prevents the pump motor from exposure to excessive current. If an overload fault occurs, due, for example, to excessive pressure or flow, or excessive ambient temperature, the overload protector will shut off the pump motor. The overload protector will automatically reset after approximately one to two minutes.

If a fault occurs, a red lamp on the protector enclosure will light while the pump motor is off. The lamp goes out once the protector resets.



The pump motor overload protector is located directly under the fluid reservoir. It is in the left rear corner for HX200s and HX300s units. It is at the side access panel for HX500s and HX750s units.

The overload protector can be adjusted to require manual resetting after an overload fault. Contact our Service Department for adjustment instructions (see Preface, After-sale Support).

The unit will shut down in the event of a low flow fault. Manually restart the unit after the protector resets (if the RESTART switch on the Interface Access. panel is in the AUTO position, the unit will restart automatically).

If you are unsure of the phase of the pump motor in your unit, contact our Service Department (see Preface, After-sale Support).

Remote Condenser (Optional)

Units with the optional remote air-cooled condenser are equipped with high and low refrigeration pressure monitors. The monitors are connected internally to a pressure gauge that monitors refrigeration pressure at the suction side of the compressor. The monitors protect the refrigeration system from operating under excessively high and low refrigeration pressures. A pressure fault occurs when the refrigeration pressure exceeds the set pressure limit.

The status of the monitors is indicated by the COMPRESSOR LOW PRESSURE and COMPRESSOR HIGH PRESSURE indicators located on the operator panel.

In the event of either a low or high refrigeration pressure fault, the unit will shut down. The unit must be manually restarted after the cause of the fault has been identified and corrected. If both indicators are lit simultaneously, an interruption in the main power supply has occurred.

Nitrogen Purge (Optional)

Units equipped with nitrogen purge valves are designed to accept a constant flow of dry nitrogen into the reservoir. The nitrogen blankets the cooling fluid reducing fluid evaporation.

Remove the reservoir cover by removing the screws. Fill the reservoir with fluid. Replace the reservoir cover and screws. Connect the nitrogen line to the valve on the reservoir cover.

A pressure regulator, set to 0.5 psig (0.35 kg/cm^3) or lower, should be used to prevent fluid overflow.

Particulate Filters (Optional)

Some custom units are fitted with particulate filter assemblies attached to the supply side of the recirculation water. The frequency for cleaning/changing the filter depends on your usage. Should the unit's performance be degraded, check the filter.

Filters are available from NESLAB, contact our Customer Service Center. Before calling refer to the serial number label on the rear of the unit to obtain the following information:

-BOM number
-Serial number

Section VII Maintenance

Service Contracts

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 Service Department (see Preface, After-sale Support).

Condenser Cleaning (Air-cooled units only)

For proper operation, the unit needs to pull substantial amounts of air through a finned condenser. A build up of dust or debris on the fins of the condenser will lead to a loss of cooling capacity.

The frequency of cleaning depends on the operating environment. It is recommended that a visual inspection of the condenser be made monthly after initial installation. After several months, the frequency of cleaning will be established.

For "standard" air-cooled units, periodic vacuuming of the fins on the condenser is necessary.

For units with the optional remote air-cooled condenser, remove any debris from around the condenser site. If a visible accumulation of dust or dirt is found on the condenser fins, the condenser should be cleaned with a condenser cleaning solvent and rinsed with water.

Exercise caution not to damage the condenser fins or coil. Condenser fin or coil damage can result in a loss of performance and, in extreme cases, refrigeration system failure.

Algae

To restrict the growth of algae in the fluid reservoir, it is recommended that the reservoir cover be kept in place and that all recirculation lines be opaque. This will eliminate the entrance of light which is required for the growth of most common algae.

NESLAB recommends the use of Chloramine-T, one gram per gallon.

Section VIII Service

For personal safety and equipment reliability, the following procedure should only be performed by a qualified technician. Contact our Service Department for assistance (see Preface, After-sale Support).

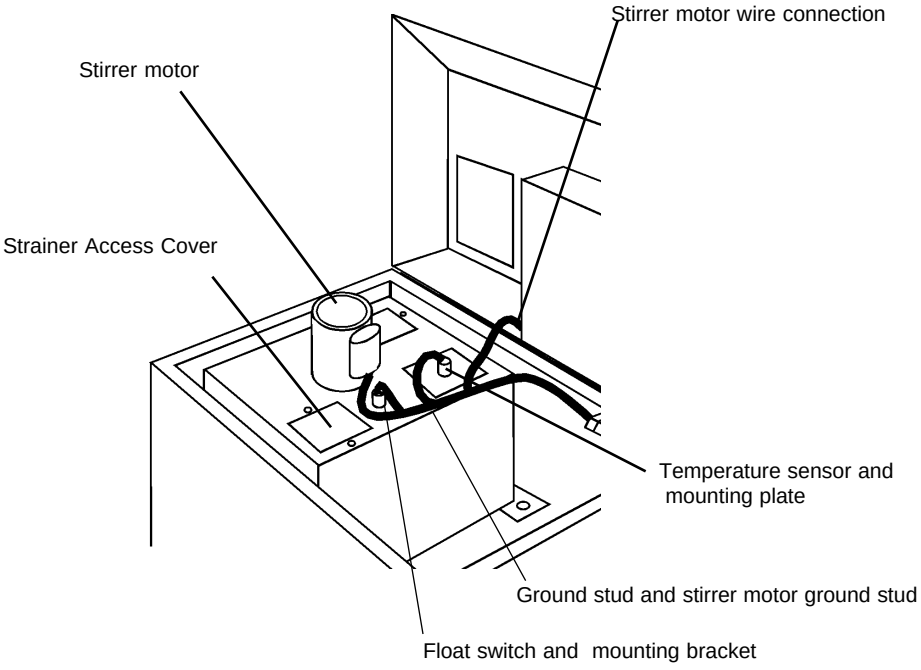
Configuration

Case Top

The unit has a hinged case top to allow service access. The case top is secured to the top of the unit base by a hinge between the case top and base (along the rear of the unit), and by two spring clips located at the front corners, see illustration on page 3. To gain access to the pump assembly or the reservoir area, disengage the spring clips with a flat bladed screw driver and lift the front of the top cover and tilt it back. A support brace, located on the right side of the inner base, will stop and support the case top. Ensure the spring clips engage when the top is lowered back into position.

Reservoir Cover

Access to the inside of the fluid reservoir is necessary to clean the reservoir. The figure below illustrates a typical layout of the components mounted on top of the reservoir cover. The component layout varies depending on the unit size. If you are unable to identify the components on your unit's reservoir cover, contact our Customer Service Department for assistance (see Preface, After-sale Support).



Disconnect the unit from its power source before removing the reservoir cover.

Locate the reservoir stirrer motor (units with plate heat exchangers and HX-75s do not have a stirrer motor; HX-500s and HX-750s have two stirrer motors). Disconnect the motor wires at the plug located on the side of the electrical box cover. Also disconnect the green ground wire that connects the ground stud on the reservoir cover to the unit's grounding bar.

Locate the float switch mounting bracket. Remove the two stainless steel screws that secure the bracket to the reservoir cover. Carefully remove the mounting bracket and place the assembly in an area adjacent to the reservoir. Make sure not to strain the connecting wires.

Locate the temperature sensor mounting plate. Remove the two stainless screws that secure the bracket to the reservoir. Carefully remove the sensor mounting plate with the sensor(s) attached and place the assembly in a protected area adjacent to the reservoir. Make sure not to damage the sensor(s) or strain the connecting wires.

Remove the stainless steel screws that secure the reservoir cover to the reservoir. Remove the cover and place it to one side in a manner that protects the stirrer motor blades from being bent.

Service Access Panels
Service access panels on your unit allow easy access to the pump and refrigeration assemblies. Panel location varies with the size and type of unit. The panels are designed to allow removal without disconnecting the HX from the instrument being cooled.

Disconnect the unit from its power source before removing any of the access panels.

Reservoir Cleaning

Periodic reservoir cleaning is necessary. We recommend that a visual inspection of the reservoir be made monthly after initial installation. After several months, the frequency of cleaning will be established.

Disconnect the unit from its power source and drain the reservoir before cleaning the reservoir.

Lift the top cover to access the reservoir. Remove the reservoir cover as described in Section VIII, Configuration. Clean the reservoir with a cleaning fluid compatible with the recirculating system and the cooling fluid.

Do not use steel wool or other abrasive materials. They can scratch the stainless steel surface and initiate rusting.

When the reservoir is clean, re-assemble the cover assembly and close the case top. Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.

Pump and Flow Switch Strainers

The pump and flow switch strainers require cleaning. If debris is drawn into the recirculating system, the pump strainer will prevent the material from being drawn into the pump and damaging the pump vanes and the filter strainer will prevent material from clogging the flow switch.

After initial installation, the strainers may become clogged with debris and scale. Clean the strainer after the first week of installation. After this first cleaning, a monthly visual inspection is recommended. After several months, the frequency of cleaning will be established.

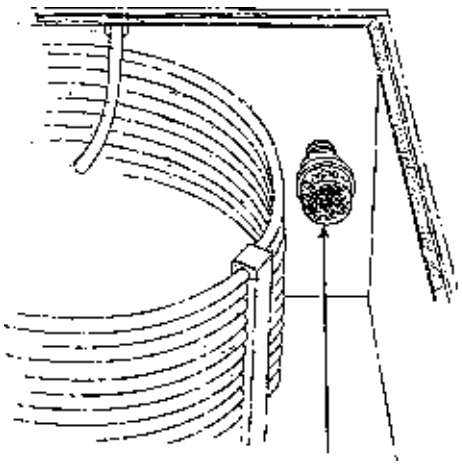
Disconnect the power cord from the power source and drain the fluid reservoir before cleaning the strainer. Do not operate the unit with any strainer removed.

PD-2 and TU Pumps

The wire mesh pump strainer is located in the reservoir on the pump suction line. Remove the strainer access panel located on top of the reservoir cover to access the strainer.

Cover the strainer with a plastic bag to help catch any debris which may become free.

Unscrew the strainer and rinse it with water. Replace the strainer. Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.



Pump Strainer

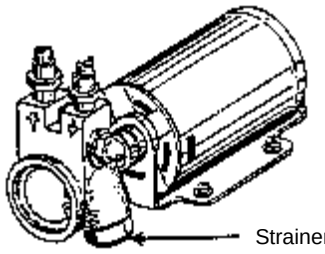
PD-1 Pumps

The wire mesh pump strainer is located on the inlet (suction) side in the pump head.

Lift the case top and remove the top right access panel to access the pump area. Unscrew the larger of the two acorn nuts on the pump head and remove the screen. Clean the screen by rinsing it with water.

When the screen is clean, replace it in the pump head and tighten the acorn nut. Replace the access panel and close the case top.

Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.

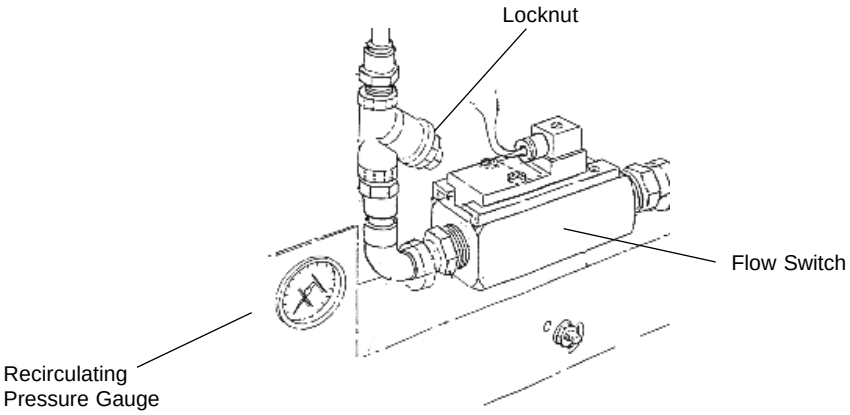


Flow Filter Strainer

The flow filter strainer is located behind the top right access panel on the inlet side of the flow switch.

Unscrew the locknut and remove the screen. Clean the screen by rinsing it with water.

Replace the strainer and locknut. Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.



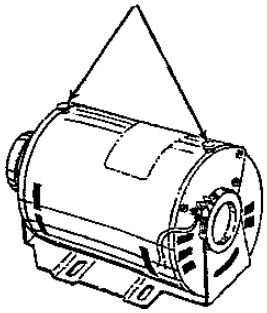
Pump Motor Lubrication

Units with PD-1 and PD-2 pumps require pump motor lubrication. Refer to the pump identification label on the rear of the case top to identify the specific pump in your unit.

Motors used to drive the pump are manufactured by several companies. These motors use sleeve type bearings with large oil reservoirs. Oiling instructions are generally posted on each motor. In the absence of instructions, add approximately 30 to 35 drops of SAE 20 non-detergent oil in each fill hole on the following schedule (SAE 20 = 142 CS viscosity):

Duty Cycle	Oiling Frequency
Continuous	Once every year
Intermittent	Once every 2 years
Occasional	Once every 5 years

Fill Holes (Typical)



Phase Rotation

Three phase units with three phase pump motors are equipped with a phase rotation interlock. Refer to the serial number label on the rear of the case top for the specific electrical requirements of your unit. The interlock prevents the unit from starting if the phase rotation is wrong. If the unit will not start, see Section IX, Checklist. If the options in the checklist are not applicable, the problem may be phase rotation.

Disconnect the unit from its power source, remove the rear panel and the junction box cover (if so equipped). Reverse any two line conductors on the line side of the relay.

Never remove the green ground wire.

Replace the junction box and the rear panel. Reconnect the unit to its power source. If the unit will not start, contact our Customer Service Department.

Suction Discharge Pressue Speed Check (R-22)

Air-Cooled Standard and High Temperature Units (All Pump Types)[1]

Unit	Suction(psi)	Discharge(psi)	Speed Check(°C/Minute)
HX-75	77 - 84	225 - 250	1.5 - 1.7
HX-100	75 - 83	245 - 265	1.3 - 1.6
HX-150	70 - 73	240 - 270	2.0 - 2.5
HX-200	85 - 105	230 - 255	1.6 - 1.9
HX-300	84 - 105	270 - 305	2.4 - 2.7
HX-500	80 - 90	215 - 235	2.0 - 2.4
HX-750	65 - 75	185 - 215	

Water-Cooled Standard and High Temperature Units (All Pump Types)[2]

Unit	Suction(psi)	Discharge(psi)
HX-75	72	170
HX-100	86 - 92	180
HX-150	65	175
HX-200	85 - 90	180
HX-300	73 - 78	180
HX-500	75 - 82	150
HX-750	50 - 60	180

1. 27°C unit temperature, water in reservoir, access panel removed.
2. 25°C unit temperature, water in reservoir.

NOTE: Refrigerant R-22. For low temperature units please call NESLAB.

Section IX Troubleshooting

Checklist

Unit will not start

For CE Mark units, ckeck the circuit breaker setting on the side of the bonnet.

Check power source for correct voltage output. Refer to the serial number label on the rear of the unit for the specific electrical requirements of your unit. Power source must be specified voltage, ±10%.

Check house circuit breaker.

On three phase units with three phase pump motors, the phase rotation may be reversed (see Section VIII, Phase Rotation).

On water-cooled units, ensure the facility water is on and make sure the cooling water supply is connected to the TAP WATER connection, not the DRAIN connection. Check the High Pressure Cutout, it may need to be reset (see Section V, Operation).

Unit will not circulate fluid

Check the tubing, flow switch strainer, and any optional filters/cartridges between the unit and your application for obstructions or for cleaning/ replacement.

Units with PD and TU type pumps may require pump strainer cleaning. Refer to the pump identification label on the rear of the case top to identify the specific pump in your unit. For instructions on cleaning the pump strainer, see Section VIII, Pump Strainer.

On units with CP type pumps, if the back pressure of the instrument being cooled is greater than the maximum pressure of the pump, adequate flow may not be obtained. Check for obstructions in the tubing.

Inadequate temperature control

Make sure the installation of the unit is in compliance with the conditions described in Section III.

Make sure the heat load of the instrument being cooled is not greater than the cooling capacity of the unit.

When the unit is shut off, wait approximately five minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.

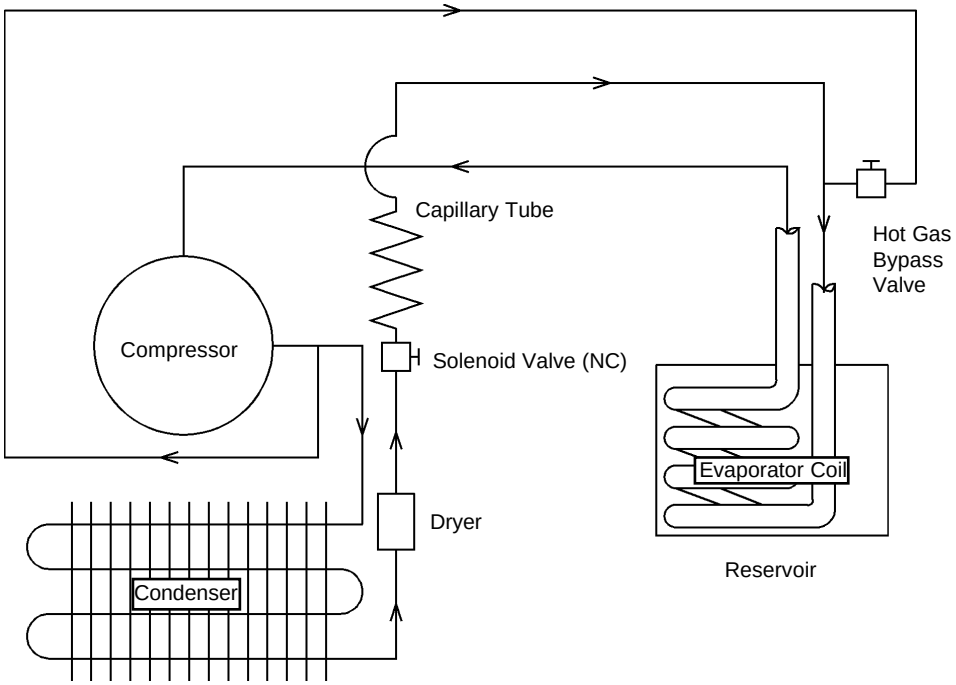
Service Assistance

If, after following these troubleshooting steps, your unit fails to operate properly, contact our Service Department for assistance (see Preface, After-sale Support). Before calling, please obtain the following information:

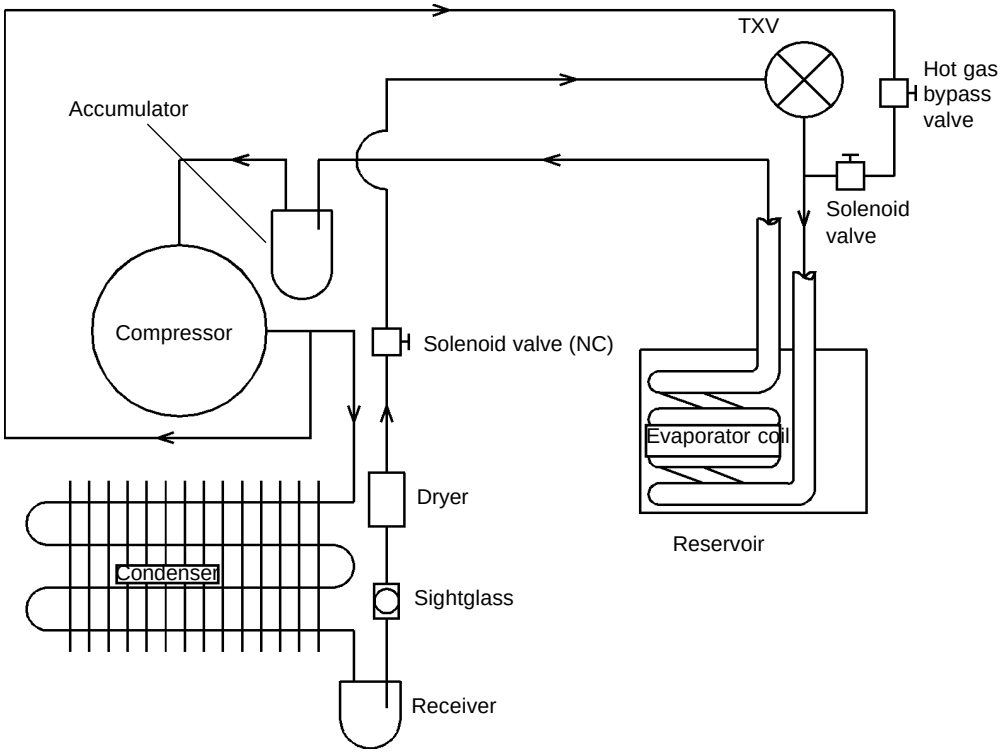
- BOM number
- Serial number

Section X Diagrams

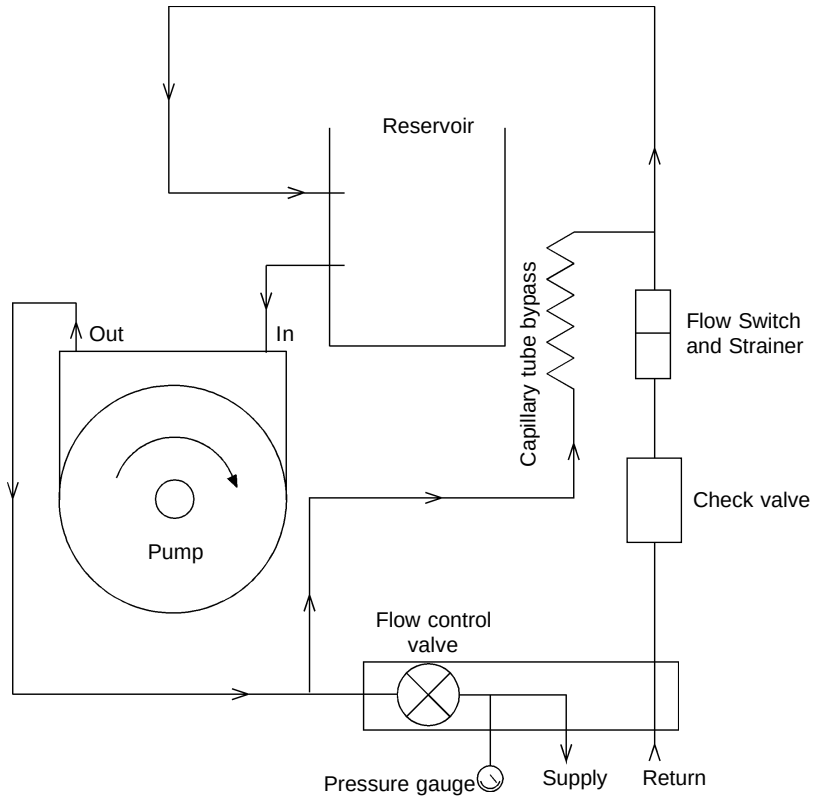
Refrigeration Flow Diagram
(HX-75 through HX-150)



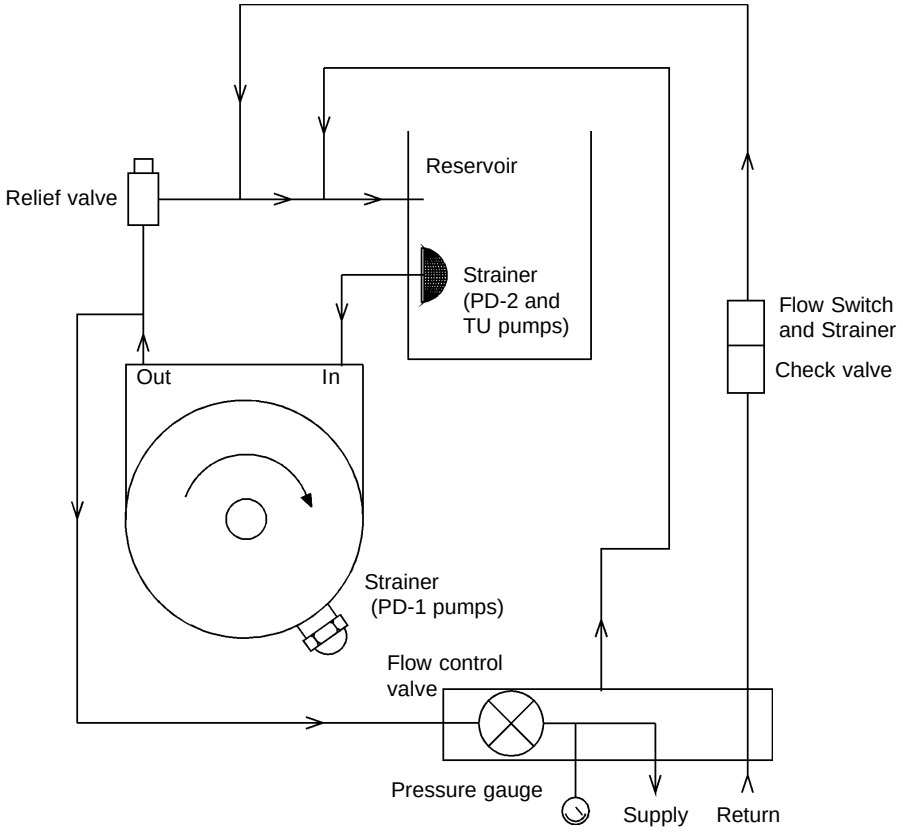
Refrigeration Flow Diagram
(HX-200 through HX-750)



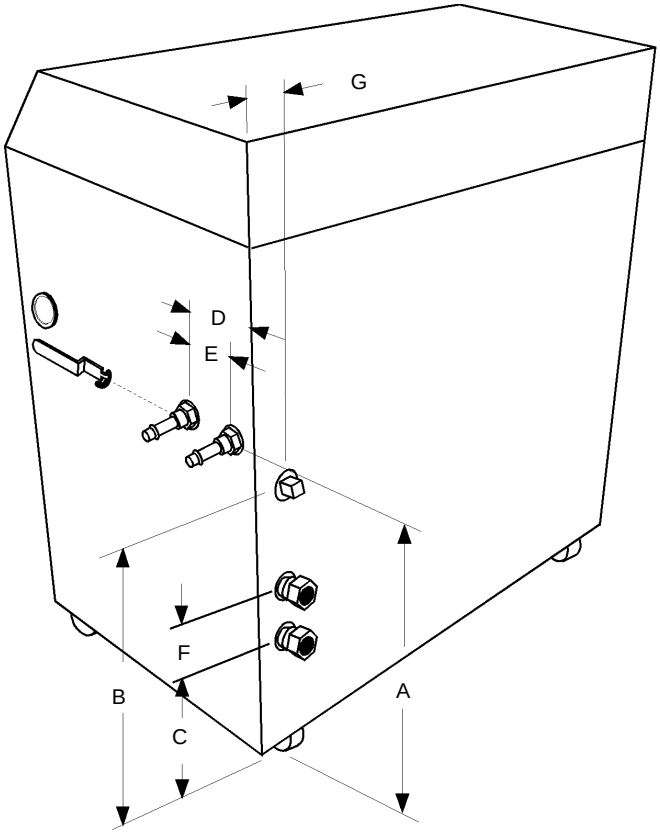
Pump Flow Diagram (CP Pumps)



Pump Flow Diagram (PD and TU Pumps)



Dimensions



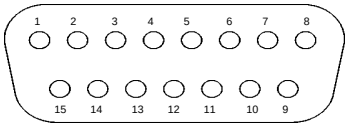
Unit Dimensions	HX75	HX100/HX150	HX200/HX300	HX500/HX900WC	HX750*/HX900AC
Dimension A	16	20	25 3/8	25¼	41
Dimension B	15¼	19¼	23½	21 1/8	33¾
Dimension C	8¼	9¼	8 3/8	5½	NA
Dimension D	7¼		7½	9½	
Dimension E	3				
Dimension F	3		3	5½	NA
Dimension G	1 3/8		1½	2¼	NA
Dimension H	2½		2 3/8	2¼	
Dimension I	24 7/8	27½	31½	35 1/8	35
Dimension J	48½	54	64 7/8	73½	86¼
Crate Dimensions (H x W x D)	46x30x27	49x33x29	55x40x33	61x54x36	74x54x36

* HX-750 air-cooled units. HX-750 water-cooled are the same size as the HX-500 units.

1. Dimensions are given in inches, ±1/8 inch.
2. Model HX-750 with a water-cooled condenser has the same dimensions as an HX-500.
4. Dimension A is the distance from the floor to the center of the SUPPLY and RETURN connections.
5. Dimension B is the distance from the floor to the center of the DRAIN connection.
6. Dimension C is the distance from the floor to the center of the tap water outlet connection.
7. Dimension D is the distance from the center of the SUPPLY connection to the rear of the unit case.
8. Dimension E is the distance between the SUPPLY and RETURN connections
9. Dimension F is the distance between the center of the TAP WATER connections (upper inlet and lower outlet).
10. Dimension G is the distance from the edge of the unit case to the center of the three plumbing connections.
11. Dimension H is the distance from the floor to the bottom of the case, height of the castors (not shown).
12. Dimension I is the depth of the unit with the case top open (not shown).
13. Dimension J is the height of the unit with the case top open (not shown).

AppendixA Additional Electrical Information

REMOTE CONT. Receptacle

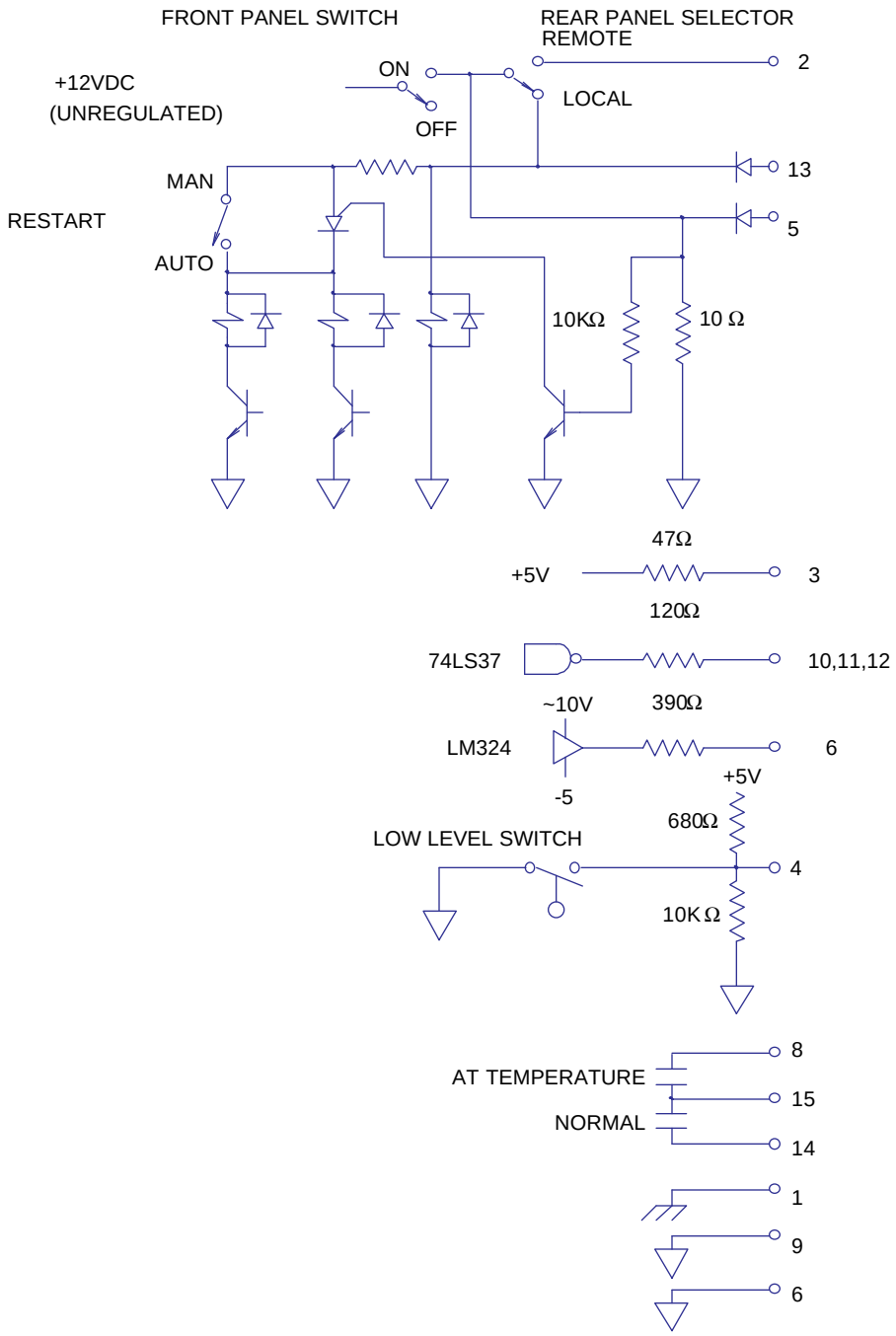


15 pin D-subminiature male receptacle

Pin #	Alarm circuitry	Control circuitry
1		Chassis ground.
2		ON/OFF control circuit power (+12VDC, unregulated). See ON/OFF/START Logic.
3	DC for LED indicators (+5VDC, current limited through 47Ω resistor).	
4	Low level switch (+5VDC, current limited through 680Ω resistor).	
5		START button connection. See ON/OFF/ START Logic.
6		Heater ON command, solid state relay drive (+8 to +13 VDC, current limited through 390Ω resistor). Contact our Sales Department for more information.
7	Reserved.	
8	AT TEMPERATURE contact (24V, 1A maximum. AC and DC). When the fluid temperature is between the high and low temperature limits, this pin is connected to pin 15. See Relay Contact Logic.	
9	Common for DC power supplies, grounded.	
10	FAULT indicator drive (-). Connect LED cathode here, anode to pin 3, for display of FAULT status. See External Status Indicator Logic.	
11	NOT AT TEMPERATURE indicator drive (-). Connect LED cathode here, anode to pin 3, for display indicating when the fluid temperature is not between the high and low temperature limits. See External Status Indicator Logic.	
12	NORMAL indicator drive (-). Connect LED cathode here, anode to pin 3, for display indicating when all status monitors (High Temperature, Low Temperature, Low Level, Low Flow) are normal. See External Status Indicator Logic.	
13		RUN switch connection. See ON/OFF/ START Logic.
14	NORMAL contact (+24V, 1A maximum. AC and DC). When all status monitors are normal (see pin 12) this pin is connected to pin 15. See Relay Contact Logic.	
15	Relay contact common connection.	

The exclusion of alarm circuitry is an available option for Series II temperature controllers. The alarm circuitry pin connections are not used on these controllers.

Remote Connector Circuitry



ON/OFF/START Logic

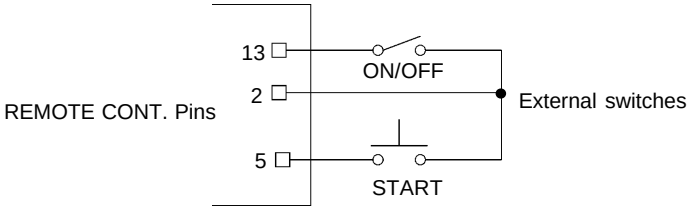
When the START/STOP LOCAL/REMOTE switch is set to LOCAL, the operator panel ON/OFF/START switch controls the unit.

When the LOCAL/REMOTE switch is set to REMOTE, the operator panel ON/OFF/START must be in the ON position for the unit to operate. An external switch is necessary to complete the circuit and start the unit.

If the operator panel ON/OFF/START switch is OFF, then external switches cannot start the unit. This allows an operator or service person at the unit to override the external controls and shut down the unit.

If the operator panel ON/OFF/START switch is ON, the external ON/OFF and START switches function just like the operator panel switch.

If the Interface Access. panel RESTART AUTO/MAN switch is set to AUTO, the START switch is not needed to start the unit. It will start when the external ON/OFF switch is switched to ON or when power is restored after an outage.



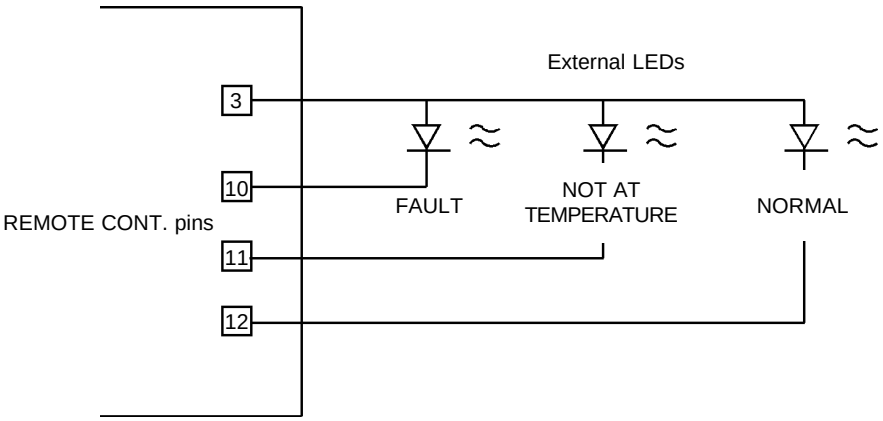
External Status Indicator Logic

The FAULT indicators light if one of the conditions monitored by the alarm circuit (High and Low Temperature, Low Level, and Low Flow) has occurred.

To prevent nuisance alarms, this signal does not indicate a FAULT condition when the unit is first turned on and the fluid temperature is outside the alarm limits. This situation will typically occur when the high temperature limit is set to a temperature below ambient. Once the fluid temperature is within the high and low temperature limits, subsequent excursions beyond those limits will produce a FAULT indication.

The NOT AT TEMPERATURE indicator lights when the operating temperature is not between the high and low temperature limits.

The NORMAL indicator lights when all four status monitors are normal (no faults). The NORMAL indicator logic is similar to the FAULT indictor logic; a temperature out of limits when the HX is first turned on is considered normal (not a fault).



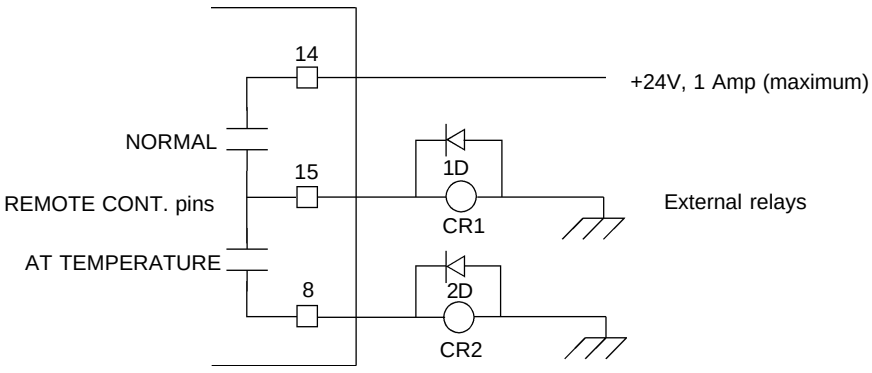
Relay Contact Logic

The NORMAL relay contacts are closed if all four status monitors are normal (no faults).

To prevent nuisance alarms, the contacts are closed when the unit is first turned on and the fluid temperature is outside the alarm limits. This situation will typically occur when the high temperature limit is set to a temperature below ambient. Once the fluid temperature is within the high and low temperature limits, subsequent excursions beyond those limits will cause the contacts to open.

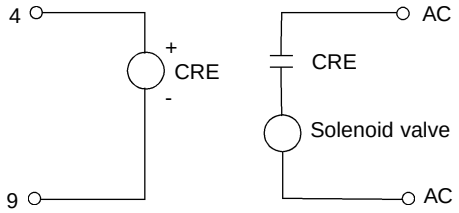
The AT TEMPERATURE contacts are closed if the fluid temperature is between the high and low temperature limits.

In the example circuit shown below, CR1 is energized when the unit is ON and there are on abnormal conditions. CR2 is energized when there are no abnormal conditions AND the fluid temperature is within limits. CR1 can serve as an alarm activator, while CR2 can indicate that the unit is ready to provide cooling fluid to the instrument being cooled.

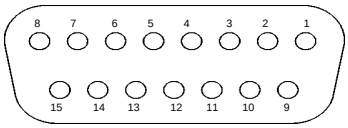


Low Level Switch/Auto Refill

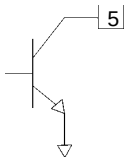
In the example circuit below, when the fluid level in the reservoir drops, DC is applied to the CRE control input to energize the solenoid valve. The valve opens to fill the reservoir. When the fluid level rises, CRE is turned off. If the level does not rise after about 30 seconds, a low level alarm occurs.



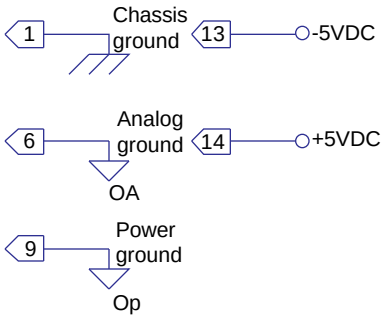
ACCESS Receptacle



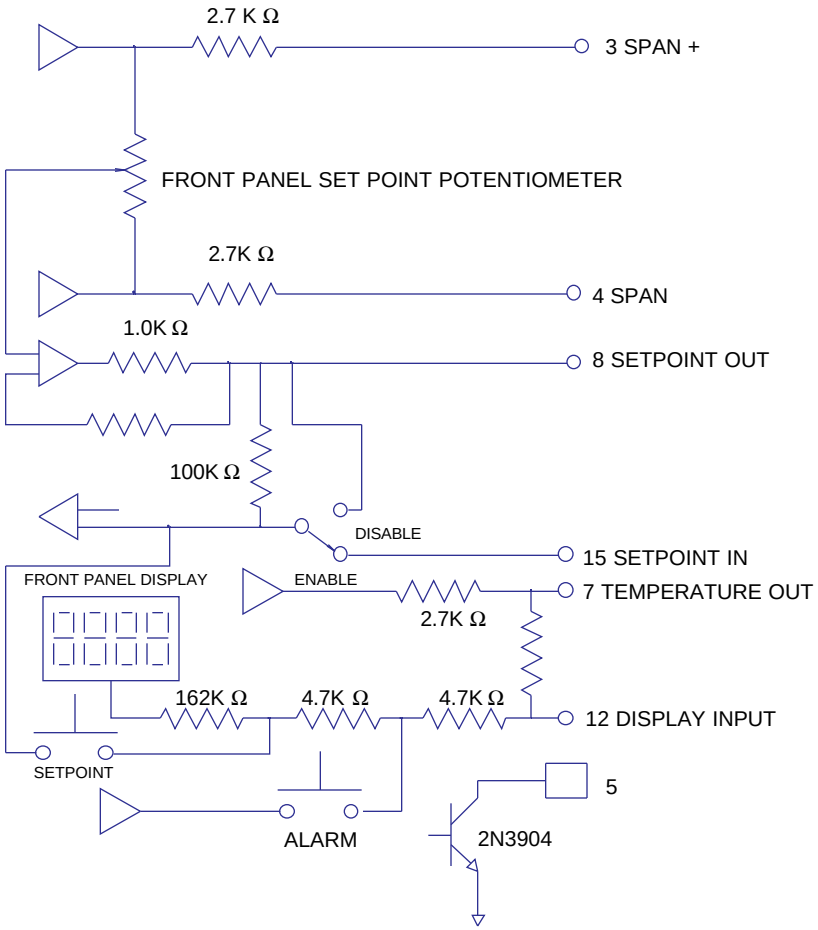
15 pin D-subminiature female receptacle

Pin #	Function
1	Chassis ground.
2	No connection.
3	Span +. Indicates the maximum setpoint value the unit can be set to operate. The temperature scale is 10mV/°C, referenced to analog ground, pin 6 (example: +350mV =+35.0°C).
4	Span -. Indicates the minimum setpoint value the unit can be set to operate. The temperature scale is 10mV/°C, referenced to analog ground, pin 6 (example: +50mV = +5.0°C).
5	AT TEMPERATURE indicator solid state relay drive (TTL output. Part of the alarm circuitry in the REMOTE CONT receptacle). Connect solid state relay drive (-) here, (+) to pin 3 on the REMOTE CONT receptacle to energize relay when the fluid temperature is between the high and low temperature limits. Pin reads 0V when fluid temperature is between limits, -5VDC when out of limits. 
6	Analog ground. The analog ground is physically separated from the power ground throughout the unit. To prevent offsets that result ground currents, the analog and power ground are only connected at the power supply. Analog ground should only be used as a reference pin when no current is flowing.
7	Sensor temperature (current limited through 2.7K OHM resistor). The fluid temperature, as measured by the controller's sensor located in the reservoir, can be read at this pin. The temperature scale is 10mV/°C, referenced to analog ground, pin 6 (example: +150mV = +15.0°C).
8	Setpoint out. The present temperature setpoint can be read at this pin. The temperature scale is 10mV/°C, referenced to analog ground, pin 6 (example: +150mV = +15.0°C).
9	Power ground. This pin should be used for functions that require the unit to draw input or output current. See pin 6.
10	No connection.
11	No connection.

Pin#	Function
12	Digital display (input only). An external voltage can be displayed on the operator panel digital display by applying the voltage to this pin. The display has a low input resistance and a full scale rating of ±1.99VDC. Input is referenced to analog ground, pin 6. The maximum voltage applied to the display should be limited to ±2VDC.
13	-5V. Power supply of -5VDC (15mA maximum).
14	+5V. Power supply of +5VDC (15mA maximum).
15	Setpoint in. The temperature setpoint can be controlled by applying a known voltage to this pin. The temperature scale is 10mV/°C, referenced to analog ground, pin 6 (example: +230mV = +23.0°C. The DISABLE/ENABLE switch must be in the ENABLE position to control the setpoint from this pin.



Access Receptacle Equivalent circuits



Access Receptacle Circuitry Details

Appendix B DeltaTemp Programming Software

DeltaTemp programming software is now available for free download from NESLAB ONLINE BBS (Bulletin Board System) at 603-427-2490.

DeltaTemp software allows you to write custom temperature programs for NESLAB digital units (any unit with a digital temperature readout AND a 10-15 pin INTERFACE port). The menu-driven program provides a table format for entering temperature parameters and a visual graph confirmation of the program you have designed. Program time can range from 0 to 999 minutes with unlimited looping. Choose upper and lower temperature limits and monitor system status with an audible alarm. DeltaTemp can also record your results on a printed graph or file. DeltaTemp is a DOS program, and requires an IBM or 100% compatible computer.

DeltaTemp may require use of a computer interface device, depending on which NESLAB unit is being used. Refer to the setup diagram in the DeltaTemp folder for full details.

To download the software, go to: CONFERENCES / SOFTWARE / DeltaTemp.

The folder also contains the operating manual, setup diagrams, application notes, and directions on making your own interface cable.

NESLAB ONLINE is a FirstClass® system accessible by general terminal software (Windows Terminal accessory, ClarisWorks Communications, Z-Term, Pro-Comm, or similar).

To use the full graphics and features of the BBS we recommend using FirstClass® Client software. FirstClass® Client is available for Macintosh or Windows platforms. It is available from many sources:

NESLAB ONLINE
Mac: Conferences/Software/Macintosh
Windows: Conferences/Software/Windows

AMERICA ONLINE
Mac: Computing/software center/mac communications forum/industry connection/softarc
Windows: Computing/software center/communications programs

COMPUSERVE:
Mac: TWEUROPA/Teletools/FCMAC.ZIP
Windows: PCBBS/BBS programs/FC300.EXE

WORLD WIDE WEB
http://www.softarc.com/try.htm

WARRANTY

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

Any part of the unit manufactured or supplied by NESLAB and found in the reasonable judgment of NESLAB to be defective in material or workmanship will be repaired at an authorized NESLAB Repair Depot without charge for parts or labor. The unit, including any defective part must be returned to an authorized NESLAB Repair Depot within the warranty period. The expense of returning the unit to the authorized NESLAB Repair Depot for warranty service will be paid for by the buyer. 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 recision of the contract of sales of any unit.

With respect to units that qualify for field service repairs, 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 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 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.

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.

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

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 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 NESLAB.

HX Series II
Recirculating Chiller

NESLAB Manual P/N 002143
Rev. 04/23/97

Installation, Operation, and Maintenance Manual