

HX Digital Recirculating Chiller

NESLAB Manual P/N 002002
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Installation, Operation, and Maintenance Manual



NESLAB online

Product Service Information, Electronic Catalog,
Applications Notes, MSDS Forms, e-mail.

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HX Analog/Digital Recirculating Chiller Installation, Operation, and Maintenance Manual

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WARRANTY

Water-Cooled HX Series Quick Reference Operating Procedures

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, $\pm 10\%$.

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 $+8^{\circ}\text{C}$ to $+80^{\circ}\text{C}$. Below $+8^{\circ}\text{C}$, 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.

Analog Controller Temperature Adjustment

To adjust the temperature setpoint, turn the $^{\circ}\text{C}$ dial on the front of the unit to the desired temperature.

Digital Controller Temperature Adjustment

To display the temperature setpoint, press and hold the DISPLAY switch. To adjust the temperature setpoint, press and hold the DISPLAY switch and turn the ADJUST knob until the desired temperature setpoint is indicated on the digital display. Once the setpoint is adjusted, release the DISPLAY 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.

For complete information, including troubleshooting procedures, please refer to the instruction manual.

Air-Cooled HX Series Quick Reference Operating Procedures

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, $\pm 10\%$.

The plumbing connections are located on the rear of the unit and are labelled SUPPLY and RETURN. These connections are $\frac{3}{4}$ 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 circulation 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.

Analog Controller Temperature Adjustment

To adjust the temperature setpoint, turn the °C dial on the front of the unit to the desired temperature.

Digital Controller Temperature Adjustment

To display the temperature setpoint, press and hold the DISPLAY switch. To adjust the temperature setpoint, press and hold the DISPLAY switch and turn the ADJUST knob until the desired temperature setpoint is indicated on the digital display. Once the setpoint is adjusted, release the DISPLAY 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.

For complete information, including troubleshooting procedures, please refer to the instruction manual.

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

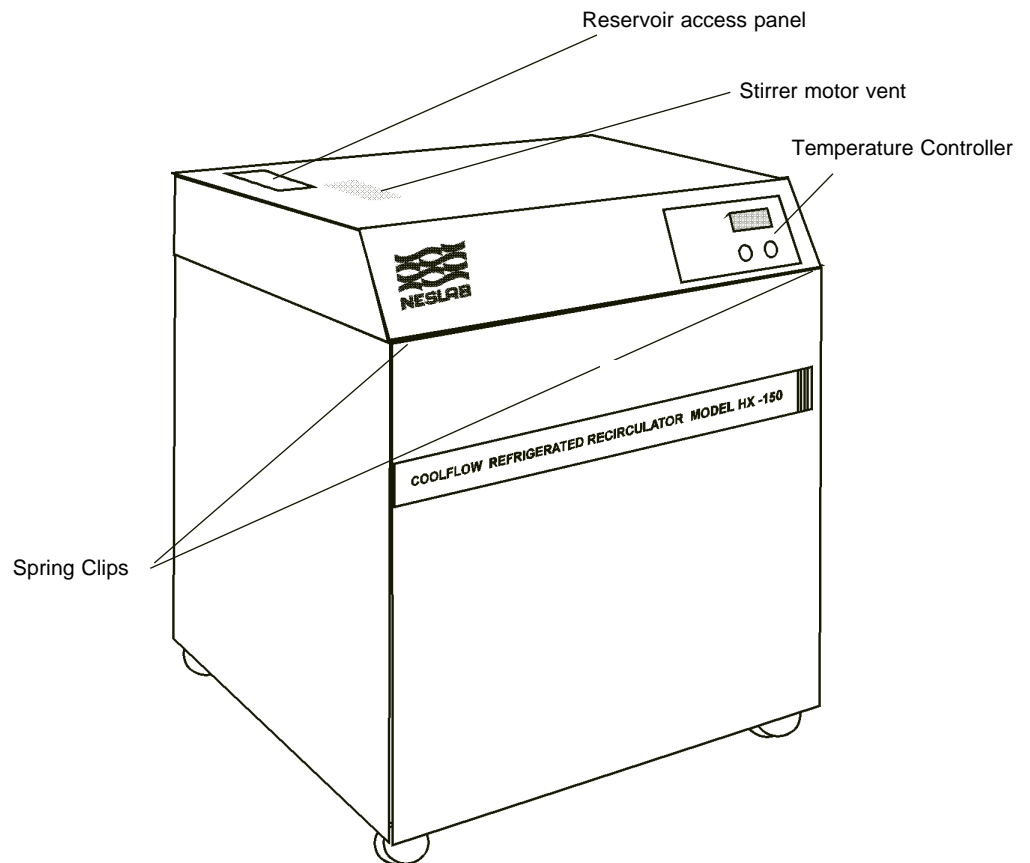
Description

The HX Series 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. The 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 Dimensions¹ (H x W x D) <i>Inches</i> <i>Centimeters</i>	35 ¾ x 23 ¼ x 18 ¾ 90.8 x 59.0 x 47.6	39 5/8 x 26 ¼ x 21 1/8 100.6 x 66.6 x 53.6		
Reservoir Volume <i>Gallons</i> <i>Liters</i>	5.0 19.0	8.0 30.3		
Shipping Weight <i>Pounds</i> <i>Kilograms</i>	261 118	300 136	320 145	
	HX-200	HX-300	HX-500	HX-750
Temperature Range	+5°C to +35°C			
Temperature Stability	±0.1°C			
Unit Dimensions^{1,2} (H x W x D) <i>Inches</i> <i>Centimeters</i>	45 7/8 x 33 ¾ x 25 ¼ 116.5 x 85.7 x 64.1		50 5/8 x 46 x 28 ¾ 128.3 x 116.8 x 73.0	63 ¾ x 46 x 29 162.0 x 116.8 x 73.6
Reservoir Volume <i>Gallons</i> <i>Liters</i>	15.0 56.8		28.0 106.0	40.0 151.0
Shipping Weight <i>Pounds</i> <i>Kilograms</i>	471 214	531 241	746 338	971 440

1. For additional dimensions see page 47.

2. HX-750 with a water-cooled refrigeration system has the same dimensions as the HX-500.

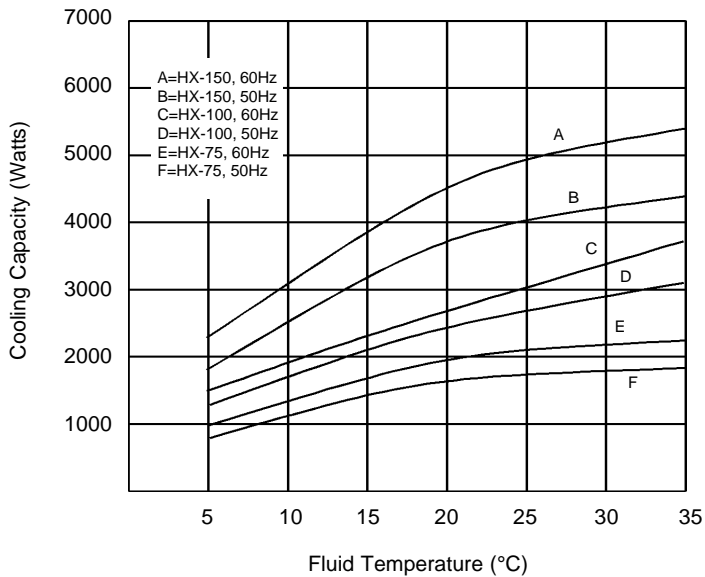
Cooling Capacity

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

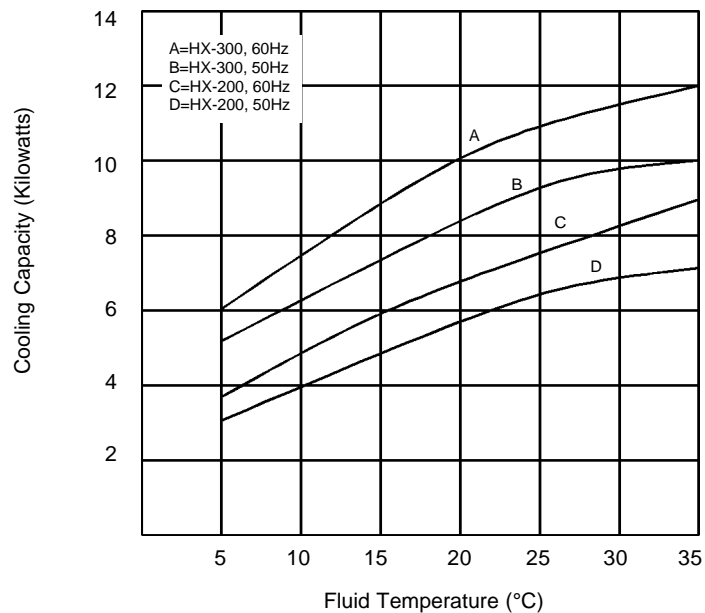
Cooling capacities for models HX-75 through HX-750 were obtained under the following conditions:

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.

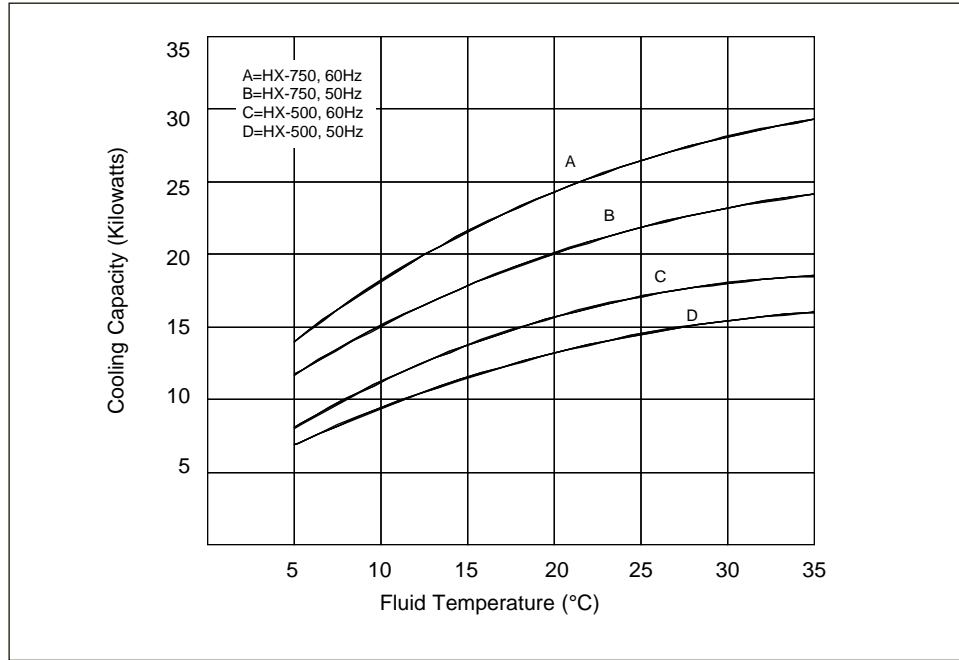
HX-75, 100, & 150



HX-200 & 300



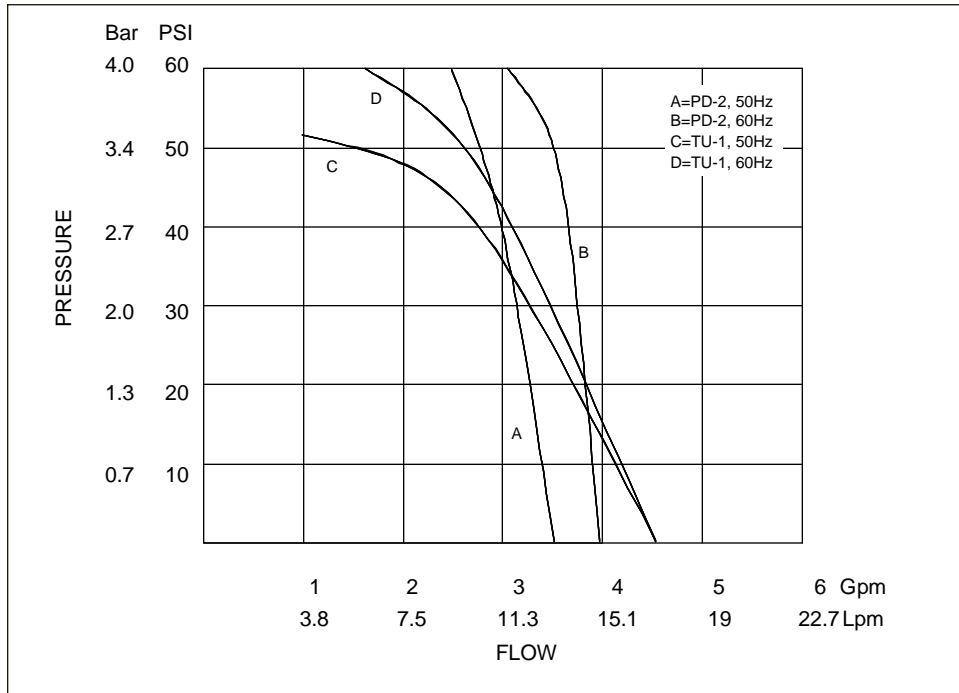
HX-500 & 750



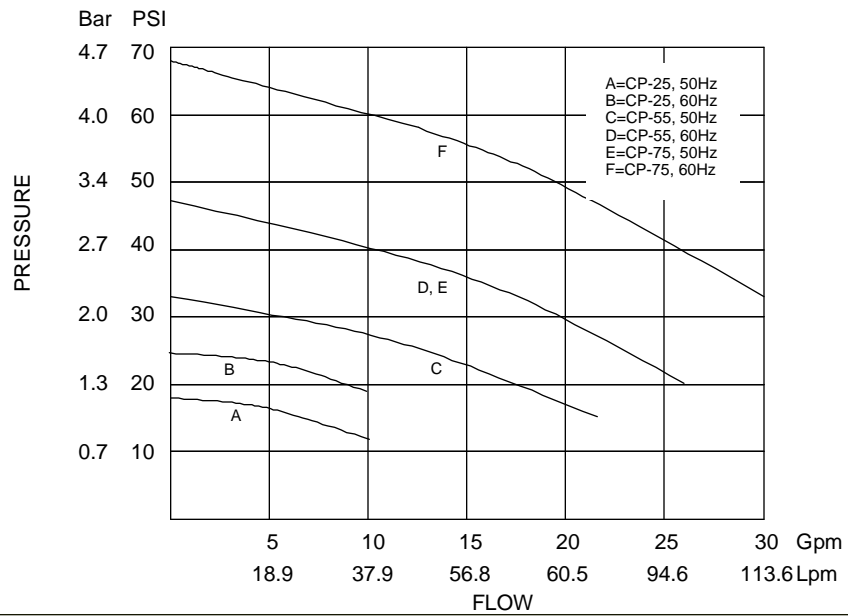
Pump Capacity

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.

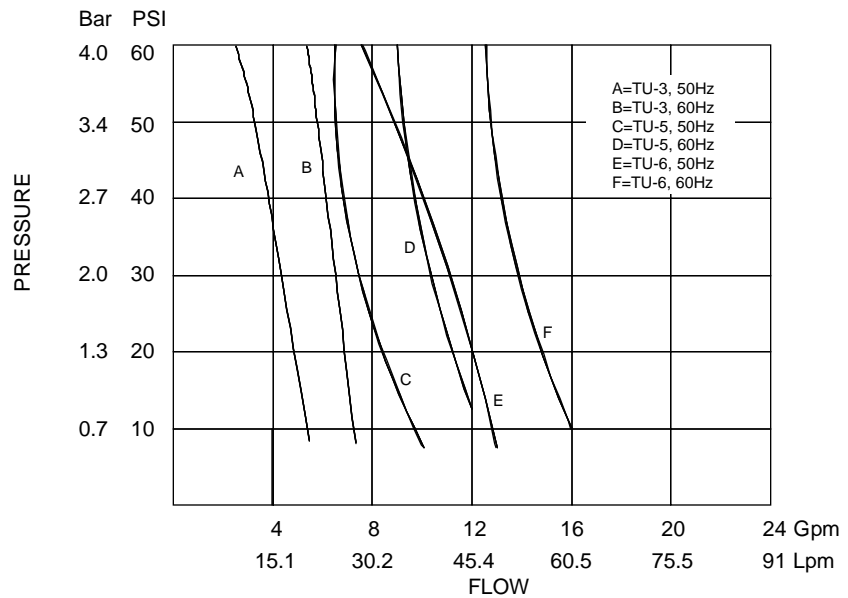
PD2 & TU1



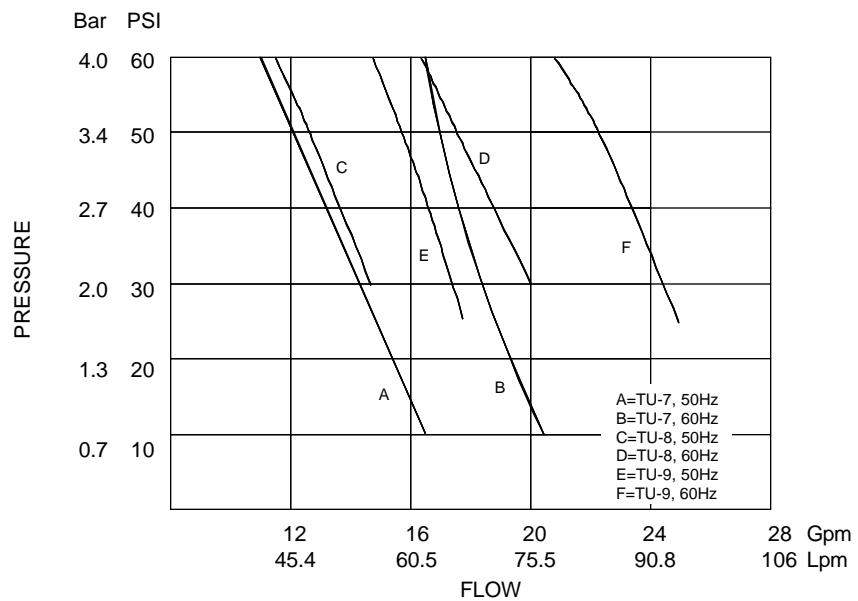
CP



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.

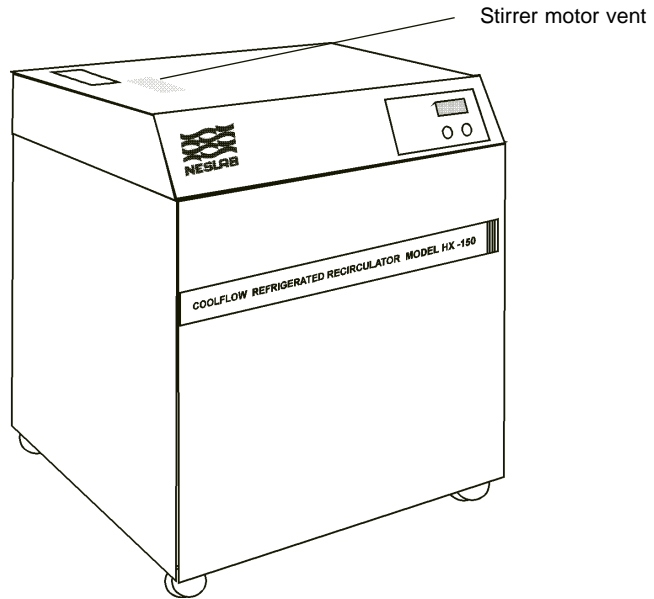
On models HX-200 — HX-750, air is drawn through the front of the unit and discharged through the side and rear. A minimum of 5 feet (1.5 meters) on all four sides of the unit is necessary for adequate ventilation.

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 digital 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.

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



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				
<i>Cubic feet per minute</i>	600	710	1050	2000
<i>Liters per minute</i>	17000	20100	29730	56640
	HX-300		HX-500	HX-750
Air Intake				
<i>Cubic feet per minute</i>	1900		5000	5600
<i>Liters per minute</i>	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 digital 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 previous page.

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				
<i>Gallons per minute</i>	0.7*	1.0	1.5	3.0
<i>Liters per minute</i>	2.8*	3.7	5.7	11.4
Pressure Drop				
<i>PSI</i>	1.5*	2.0	3.5	8.0
<i>Bar</i>	0.10*	0.13	0.24	0.55
HX-100				
Flow Rate				
<i>Gallons per minute</i>	1.0*	1.5	2.0	3.5
<i>Liters per minute</i>	3.7*	5.7	7.6	13.2
Pressure Drop				
<i>PSI</i>	2.0*	3.5	5.0	10.0
<i>Bar</i>	0.13*	0.24	0.34	0.69
HX-150				
Flow Rate				
<i>Gallons per minute</i>	1.0*	1.5	2.5	4.0
<i>Liters per minute</i>	3.7*	5.7	9.5	15.1
Pressure Drop				
<i>PSI</i>	2.0*	3.5	6.0	10.0
<i>Bar</i>	0.13*	0.24	0.41	0.69
HX-200				
Flow Rate				
<i>Gallons per minute</i>	1.8*	2.5	3.5	6.0
<i>Liters per minute</i>	6.8*	9.5	13.2	22.7
Pressure Drop				
<i>PSI</i>	5.0*	6.0	7.0	18.0
<i>Bar</i>	0.34*	0.41	0.48	1.24
HX-300				
Flow Rate				
<i>Gallons per minute</i>	2.5*	4.0	6.5	11.0
<i>Liters per minute</i>	9.5*	15.1	24.6	41.6
Pressure Drop				
<i>PSI</i>	6.0*	8.0	13.5	25.0
<i>Bar</i>	0.41*	0.55	0.93	1.72
HX-500				
Flow Rate				
<i>Gallons per minute</i>	3.5	5.0	8.0	16.0
<i>Liters per minute</i>	13.2	18.9	30.3	60.6
Pressure Drop				
<i>PSI</i>	13.0	17.0	23.0	57.0
<i>Bar</i>	0.89	1.17	1.58	3.93
HX-750				
Flow Rate				
<i>Gallons per minute</i>	6.0	8.0	12.5	16.6
<i>Liters per minute</i>	22.7	30.3	47.3	62.8
Pressure Drop				
<i>PSI</i>	14.0	20.0	28.5	40.0
<i>Bar</i>	0.96	1.38	1.96	2.76

*Estimated values

Electrical Requirements

Refer to the table below to determine electrical requirements of your unit. 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.

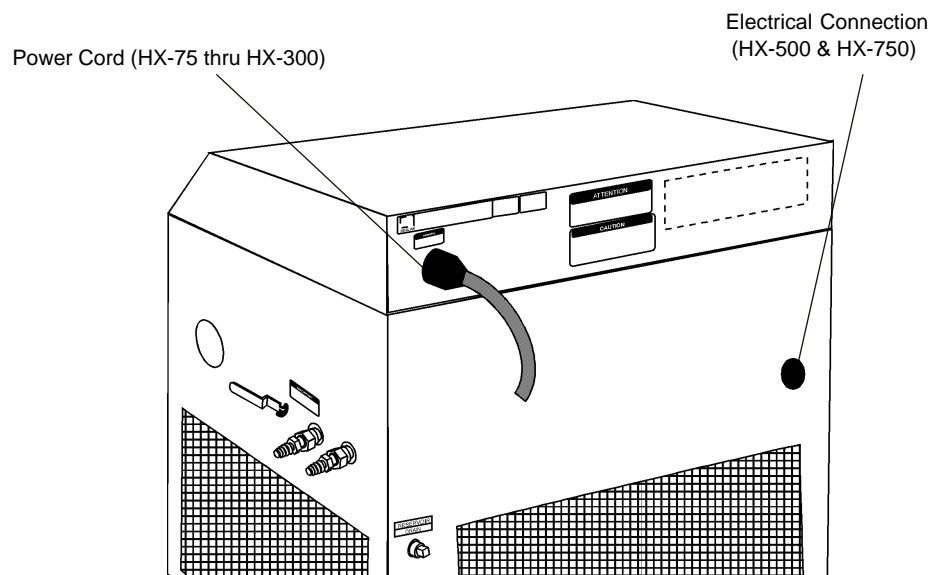
	HX-75		HX-100		HX-150	
Volts	208/230		220/240			
Hertz	60		50			
Phase	1		1			
Plug	NEMA L6-30P or L6-20P					
	HX-200		HX-300		Hx-500	HX-750
Volts	208/230	200/220	380/420		208/230	380/420
Hertz	60	50	50		60	50
Phase	3	3	3		3	3
Plug	NEMA L15-30P or L16-20P				N/A	

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 $\pm 10\%$ 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.

NOTE: 380V WYE connections are shown in Appendix B.





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

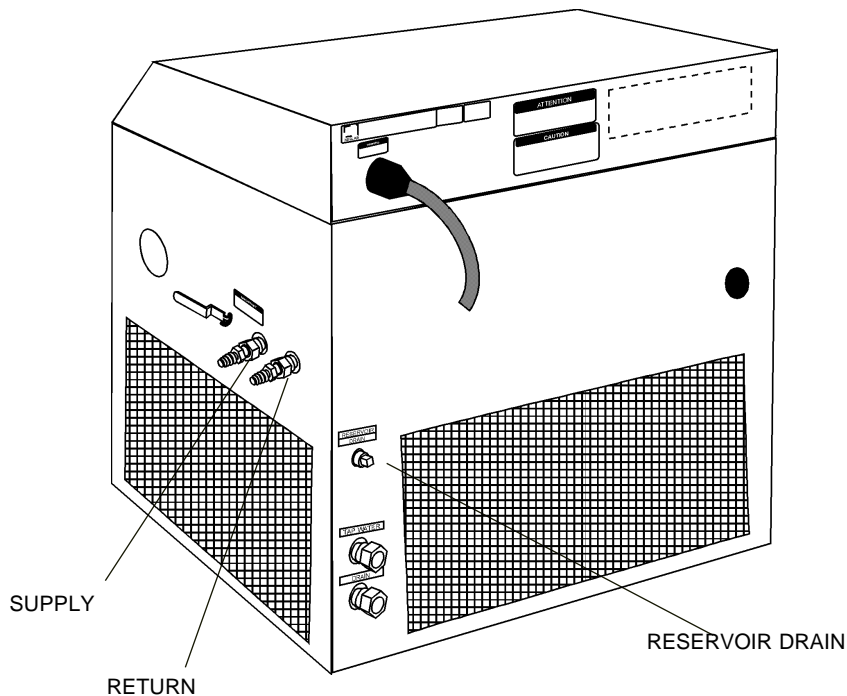
Air-cooled and water-cooled units

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 on the rear of the unit is a ½ inch FPT fitting connected internally to the unit's fluid reservoir. This fitting provides a means 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 ($\frac{3}{4}$ inch MPT x $\frac{5}{8}$ 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 $\frac{1}{2}$ or $\frac{5}{8}$ 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

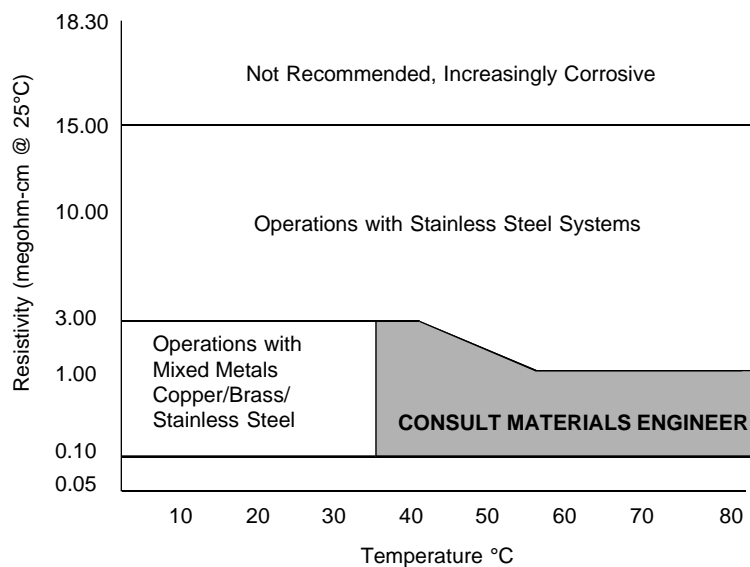
Unfavorably high total ionized solids (TIS) can accelerate the rate of galvanic corrosion. These contaminants can function as electrolytes which increase the potential for galvanic cell corrosion and lead to localized corrosion such as pitting which can be observed at the studs and on the outside surface 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

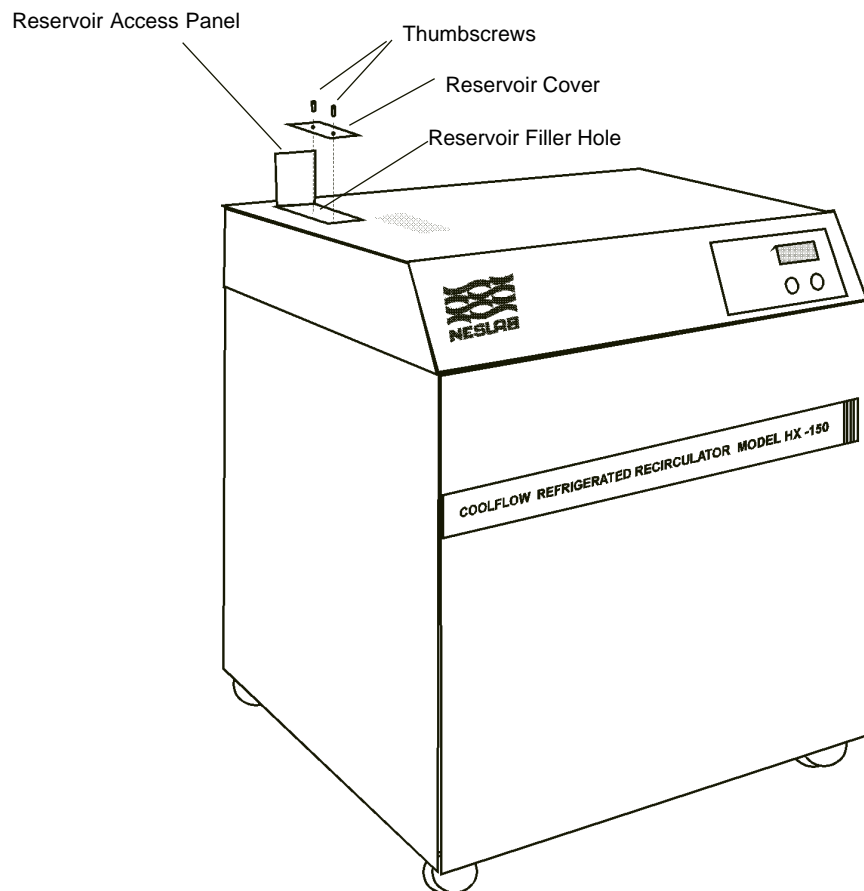
The reservoir access panel is located at the left rear corner of the case top, below an access panel. To open the access panel, slide the latch back (towards the rear of the unit) and lift.

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. Close the access panel.



Section IV Temperature Controllers

Temperature Controllers

The standard temperature controllers available with HX units are: Digital (Panel mounted or Remote) and Digital with Interlock. This section explains the installation (if applicable) and operation of the controllers.

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 is used to maintain constant temperature in all units.

The Idle and Cool 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 Cool or Idle, but never both at the same time. A balance between Cool and Idle controls the temperature.

Start Up

Before starting, check all electrical and plumbing connections and make sure the recirculating system (the HX, your application, and the recirculation lines) has been properly filled with cooling fluid. Also, make sure the flow control valve is fully closed (see Section V, Flow Control). For CE Mark units ensure the circuit breaker on the right hand side of the unit is on.

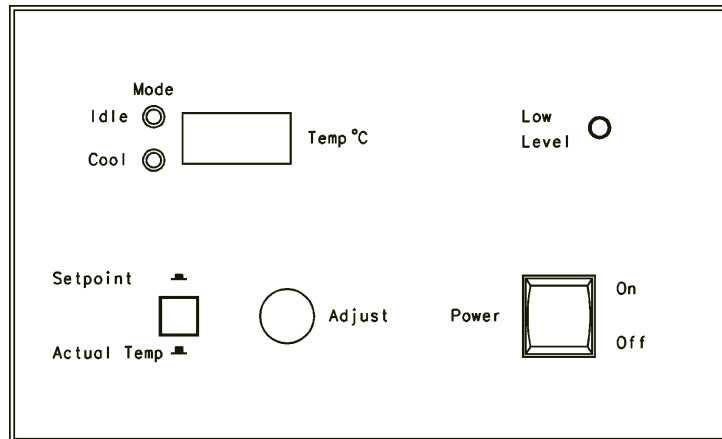
For water-cooled units — ensure that the facility water is turned on.

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.

To start the unit, place the Power On/Off switch in the On position. The pump and refrigeration system will start. The Temp°C display will indicate the reservoir fluid temperature. After starting recheck the fluid level, a "top off" may be needed. To shut the unit off, place the Power On/Off switch in the Off position.

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.

Digital (Panel mounted)



Digital Temperature Controller

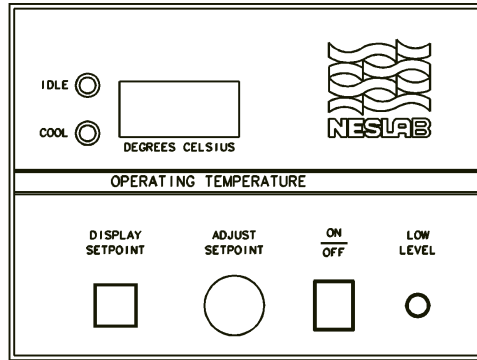
Temperature Adjustment

To display the temperature setpoint, press and hold the Setpoint/Actual Temp button. To adjust the setpoint, press and hold the Setpoint/Actual Temp button and turn the Adjust dial until the desired temperature setpoint is indicated on the Temp°C LED display. Once the setpoint is adjusted, release the Setpoint/Actual Temp button. The Temp°C LED display will indicate the temperature of the fluid in the reservoir.

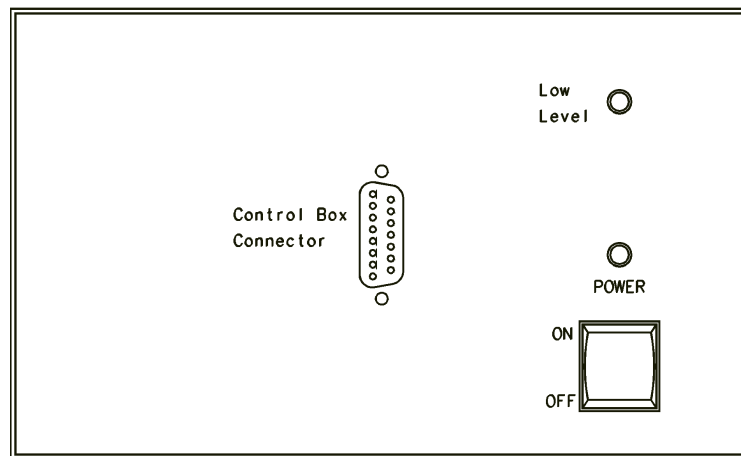
NOTE: Inadvertent movement of the Adjust dial will result in a change in the setpoint. The change will not be immediately reflected on the Temp°C display unless the Setpoint/Actual Temp button is pressed. The display will eventually change as the unit responds to the new setpoint

Low Level Warning

The Low Level indicator is connected to a float switch in the reservoir. The indicator warns the user of a low cooling fluid level in the reservoir. A low fluid level condition occurs when the cooling fluid in the reservoir drops below the operating level. The indicator serves only as a warning. The unit will not shut down as a result of a low fluid level condition.



Digital Temperature Controller
(remote)



Digital Temperature Controller

Installation

Controller dimensions are 4³/₄" x 7³/₄" x 3³/₄" (H x W x D).

Connect the Digital remote box to the unit by securing the connector on the remote box's cable to the Control Box Connector receptacle on the operator panel on the front of the case top.

Start Up

To start the unit, place the ON/OFF switch on the operator panel of the unit in the ON position and press the ON/OFF button on the remote box. The pump and refrigeration system will start, the POWER indicator on the operator panel will light and the DEGREES CELSIUS display on the remote box will indicate the fluid temperature. Either ON/OFF switch will shut the unit off.

Temperature Adjustment

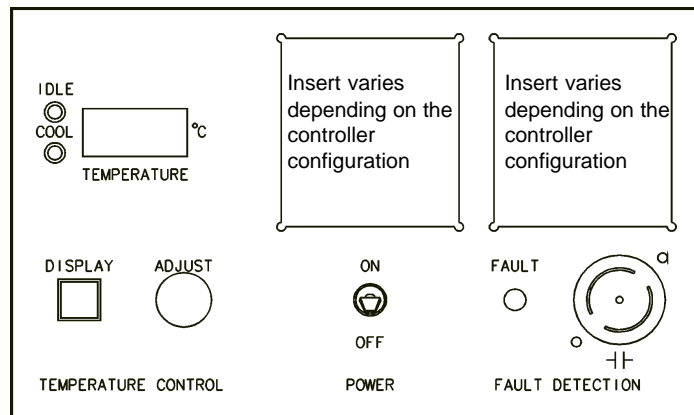
To display the temperature setpoint, press and hold the DISPLAY/SETPOINT button. To adjust the setpoint, press and hold the DISPLAY/SETPOINT button and turn the ADJUST SETPOINT dial until the desired temperature setpoint is indicated on the DEGREES CELSIUS LED display. Once the setpoint is adjusted, release the DISPLAY/SETPOINT button. The DEGREES CELSIUS LED display will indicate the temperature of the fluid in the reservoir.

NOTE: Inadvertent movement of the ADJUST SETPOINT dial will result in a change in the setpoint. The change will not be immediately reflected on the DEGREES CELSIUS display unless the DISPLAY/SETPOINT button is pressed. The display will eventually change as the unit responds to the new setpoint.

Low Level Warning

The LOW LEVEL indicator is connected to a float switch in the reservoir. The indicator warns the user of a low cooling fluid level in the reservoir. A low fluid level condition occurs when the cooling fluid in the reservoir drops below the operating level. The indicator serves only as a warning. The unit will not shut down as a result of a low fluid level condition.

Digital with Interlock



Digital with Interlock Temperature Controller

Description

The Digital with Interlock temperature controller is a Digital temperature controller with up to four monitoring options: low temperature, high temperature, low fluid level, and low flow. The controller can be built with any combination of these four monitors.

Temperature Adjustment

To display the temperature setpoint, press and hold the DISPLAY button. To adjust the temperature setpoint, press and hold the DISPLAY button and turn the ADJUST dial until the desired temperature setpoint is indicated on the TEMPERATURE °C LED display. Once the setpoint is adjusted, release the DISPLAY button. The TEMPERATURE °C display will indicate the temperature of the fluid in the reservoir.

NOTE: Inadvertent movement of the ADJUST dial will result in a change in the setpoint. The change will not be immediately reflected on the TEMPERATURE °C display unless the DISPLAY button is pressed. The display will eventually change as the unit responds to the new setpoint.

Fault Response

Controllers with a START switch are configured to shut off in the event that a fault occurs. Controllers NOT equipped with a START switch will allow the unit to continue to operate 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 cooling fluid to the instrument being cooled.

With either controller configuration, the relay contacts connected to the controller receptacle will open and the FAULT indicator will light if a fault occurs. The cause of the fault must be identified and corrected before the unit can be restarted.

START Switch

If the controller is equipped with a START switch, a fault will cause the unit to shut down. Press the START switch to restart the unit after the fault has been corrected. If the fault has not been corrected, the unit will not start and the FAULT indicator will light when the START switch is pressed.

Temperature Monitors

The optional high and low temperature monitors 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 fluid temperature exceeds the set temperature limit.

To adjust either temperature monitor, turn the appropriate calibrated dial to the desired temperature limit.

Low Fluid Level Monitor

The low fluid level monitor is connected to a float switch in the reservoir. If the controller is equipped with a LOW LEVEL indicator, the low level monitor is not connected to the fault circuit. The indicator will light if the reservoir cooling fluid drops below the operating level. The indicator serves only as a warning. A fault will not occur as a result of a low level condition.

If the controller is NOT equipped with a LOW LEVEL indicator, the low level monitor is connected to the fault current. A fault will occur if the reservoir cooling fluid level drops below the operating level.

Low Flow Monitor

The optional low flow monitor 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).

When starting a unit with a controller equipped with both a low flow monitor and a START switch, the START switch must be held in the ON position until the flow switch "closes" (2 or 3 seconds). If time is not allowed for the flow switch to close, the unit will stop when the START switch is released.

Interlock Relay Contacts

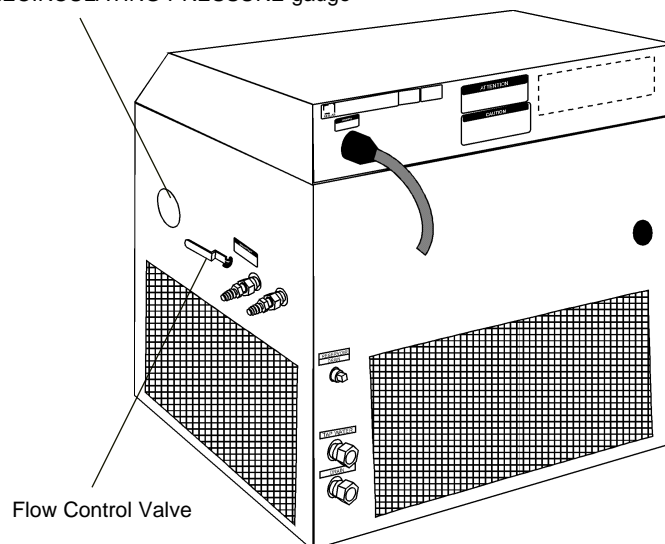
A set of contacts are connected to a receptacle on the operator panel. The contacts are rated 15A, 125V. This is not a power inlet or outlet. The receptacle is isolated from the circuitry. Its ground pin is connected to the chassis. The contacts are normally open: they are closed when the unit is running normally (no faults present), and they are open when the unit is off or when a fault occurs.

Section V Operation

Flow Control

The flow control handle is connected to a valve that controls the flow rate of the cooling fluid to the instrument being cooled. The handle is located on the right side of the unit and is labelled RECIRCULATING FLOW CONTROL.

RECIRCULATING PRESSURE gauge



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.

Make sure the flow control handle is closed before starting the unit. Once the unit is running, use the handle to slowly open the valve until the desired flow rate is adjusted.

On units equipped to detect a low flow condition (Digital with Interlock temperature controllers equipped with a low flow monitor), 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 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.

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-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:

- *unit part number*
- *unit 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

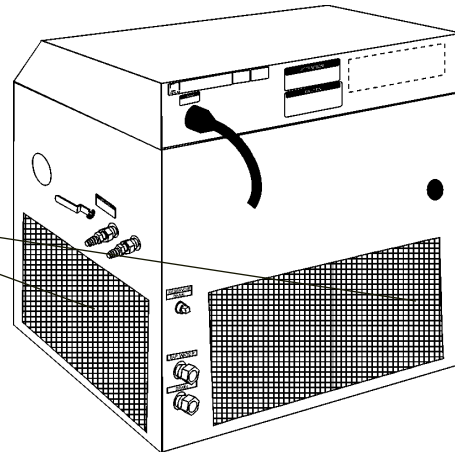
Pump Motor Overload Protector

Refer to the serial number label for the specific electrical requirements of your unit; specifically, identify the phase requirements of your unit.

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



The unit's fault response also varies depending on the unit's configuration.

If the unit has a Digital temperature controller and a single phase pump motor, the unit will continue to run if an overload fault occurs. The pump will restart as soon as the protector resets.

If the unit has a Digital controller and a three phase pump motor, the pump and refrigeration system will both shut down until the protector resets.

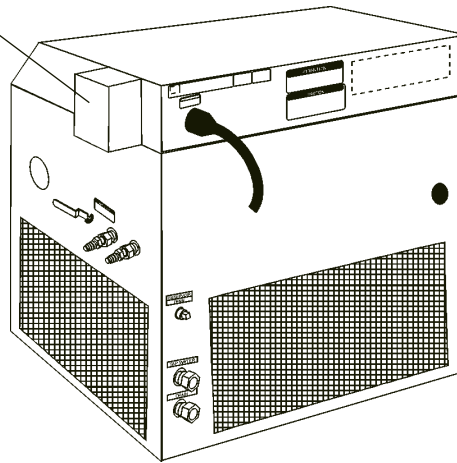
If the unit has a Digital with Interlock temperature controller with a low flow monitor, the unit will shut down due to a low flow fault. The unit must be manually restarted after the protector resets.

The overload protector can be adjusted to require manual resetting after an overload fault. If you are unsure of the phase of the pump motor in your unit, contact our Service Department (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.

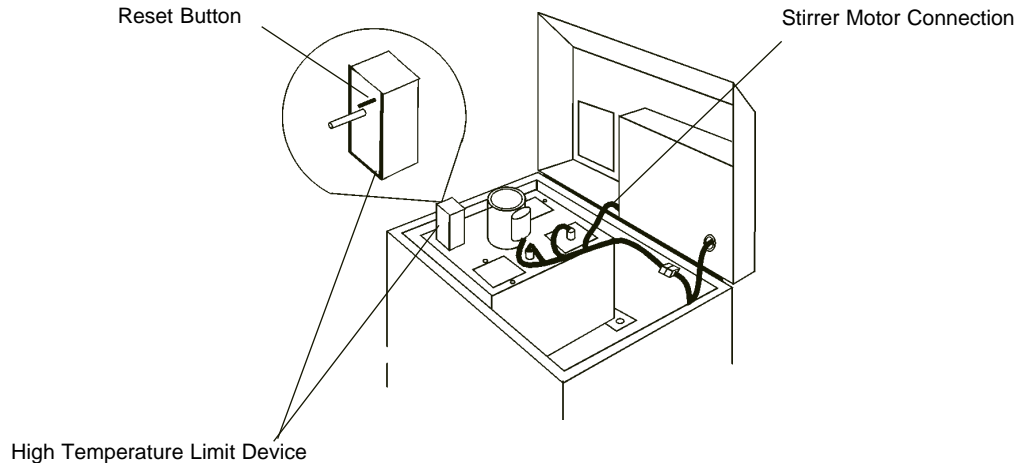
The heater high temperature limit device senses the surface temperature of the heater. If the heater temperature becomes too high, the limit device opens a mechanical relay to remove power from the heater.

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, see page 7. 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.

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/cm³) or lower, should be used to prevent fluid overflow.

Particulate Filters (Optional)

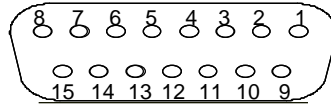
Some custom units are fitted with particulate filter assemblies attached to the supply side of the recirculation water. The frequency for cleaning/changing the filter depends on your usage. Should the unit's performance be degraded, check the filter.

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:

- unit serial number
- unit part number

15 pin Accessory Connector (Optional)

Units with digital controllers may be modified with a 15 pin accessory connector. To enable the connector slide the LOCAL/REMOTE switch on the temperature controller to the REMOTE position. The pin out information is listed below.



15 pin D-subminiature female receptacle

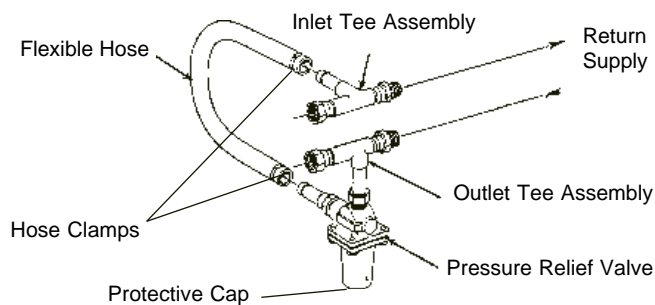
Pin # Function

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	No connection.
6	Analog ground. The analog ground is physically separated from the power ground throughout the unit. To prevent offsets that result from ground currents, the analog and power grounds are only connected at the unit's power supply. Analog ground should only be used as a reference pin .
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.
10	Heater output. Will source 3V at 6mA.
11	No connection.
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).

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 tubing 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.

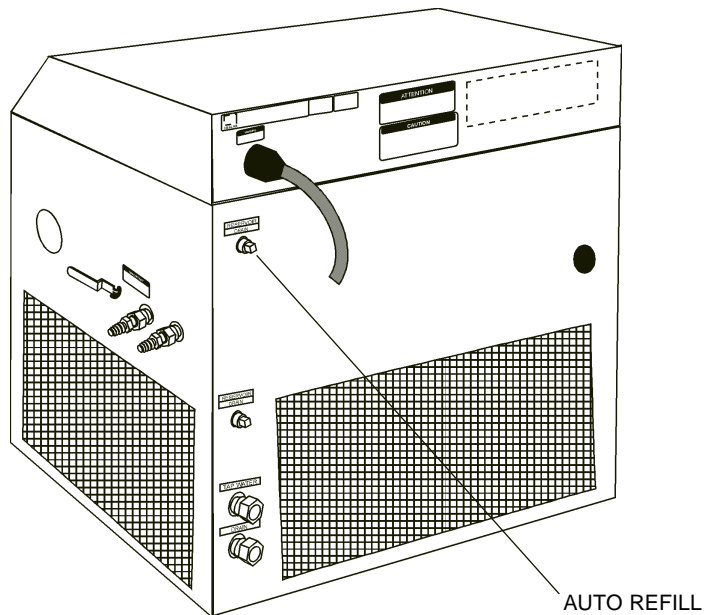
Automatic Refill Device (Optional)

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 $\frac{3}{8}$ inch OD stainless steel barbed fitting.

Connect this fitting to a make-up fluid source using $\frac{5}{16}$ or $\frac{3}{8}$ 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).



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.

Hoses

The unit's internal and external hoses and clamps should be inspected and tightened on at least a semiannual basis.

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 7. 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 on the next page 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 Service Department for assistance (see Preface, After-sale Support).

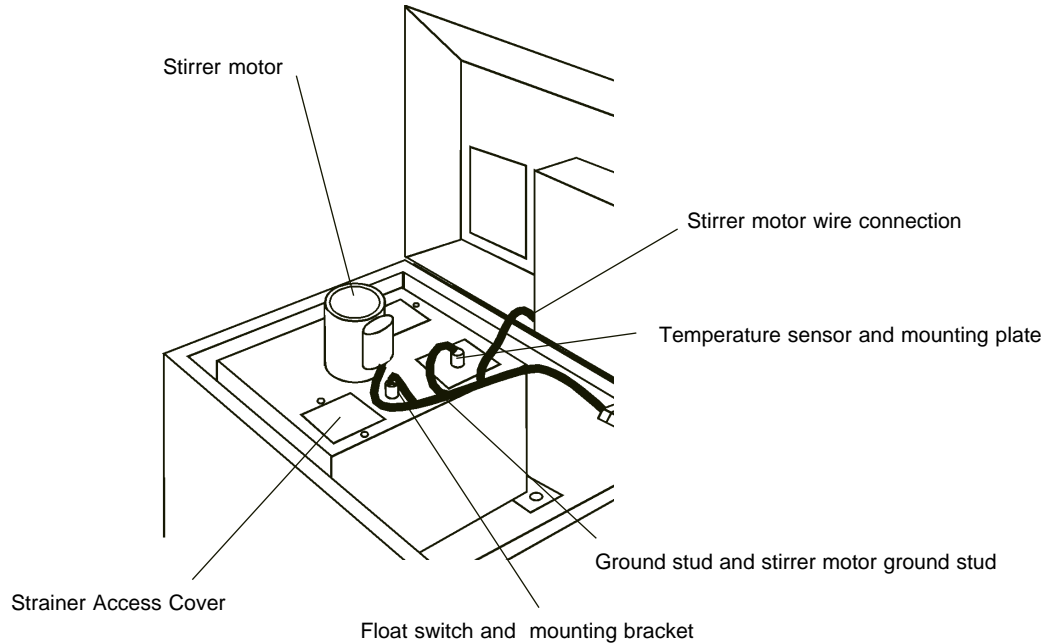


Disconnect the unit from its power source before removing the reservoir cover.

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 steel 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 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. It is recommended 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 Strainer (PD and TU Pumps Only)

If debris is drawn into the recirculating system, the strainer will prevent the material from being sucked into the pump and damaging the pump vanes.

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



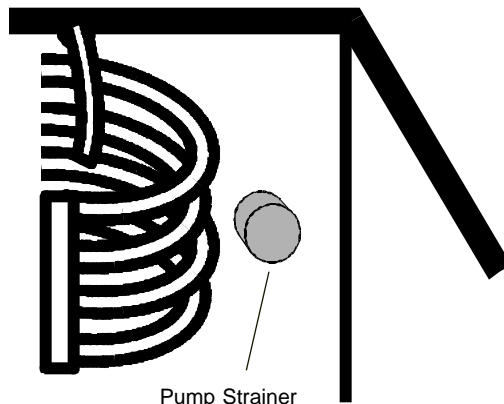
Disconnect the power cord from the power source and drain the fluid reservoir before cleaning the strainer. Do not operate the unit with the strainer removed.

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 fluid.



Pump Strainer

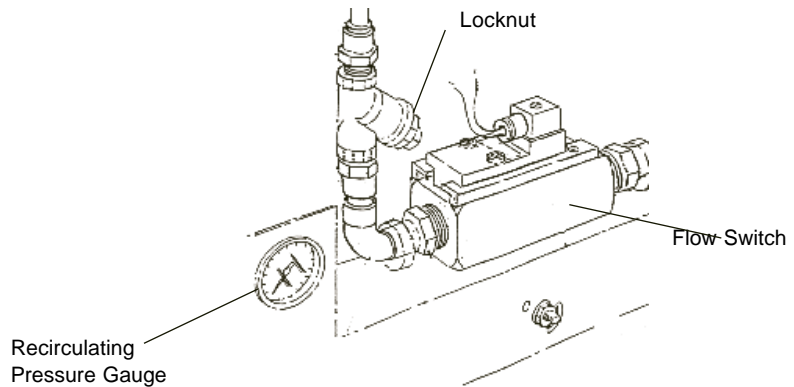
Reservoir cover deleted for clarity

Flow Filter Strainer (Optional)

Unit's equipped with flow switches have flow filter strainers 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.



Phase Rotation

Refer to the serial number label on the rear of the case top or rear of analog controller for the specific electrical requirements of your unit; specifically, identify the phase requirements of your unit.

Three phase units with three phase pump motors have a phase rotation interlock. 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 Service Department.

If you are unsure whether your three phase unit has a three phase pump motor, contact our Service Department (see Preface, After-sale Support).

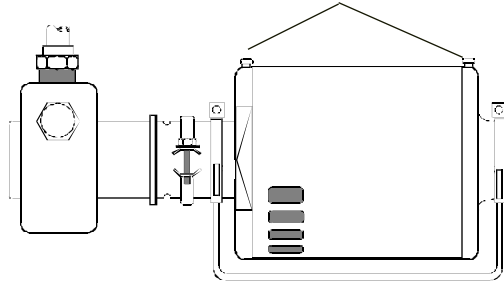
Pump Lubrication

Units with 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)



**Suction Discharge
Pressure
Speed Check**

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: For low temperature units please call NESLAB.

Section IX Troubleshooting

Checklist

Unit will not start

For CE Mark units, check the position of the circuit breaker on the right side of the unit.

Check power source for correct voltage output. Refer to the serial number label on the rear of the unit or rear of analog temperature controller for the specific electrical requirements of your unit. Power source must be specified voltage, $\pm 10\%$.

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, make sure the cooling water supply is connected to the TAP WATER connection, not the DRAIN connection. Ensure the facility water is turned on.

Check the High Pressure Cutout, it may need to be reset (see Section V, Operation).

Unit will not circulate fluid

Check the tubing between the unit and your application for obstructions.

The pump strainer may require cleaning (PD and TU pumps only). 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. 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.

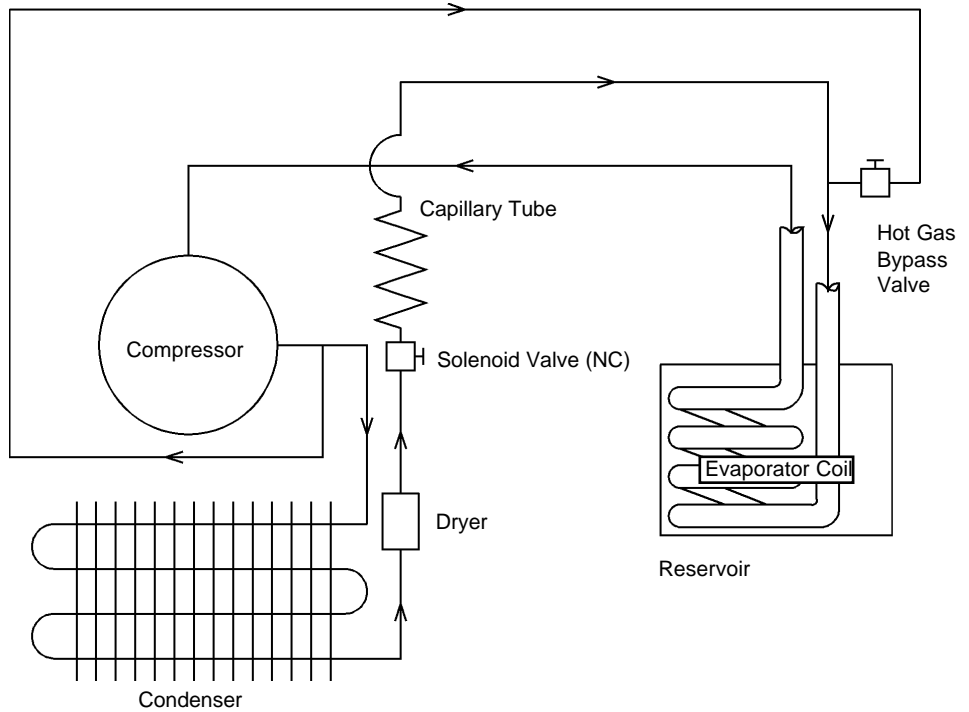
Service Assistance

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:

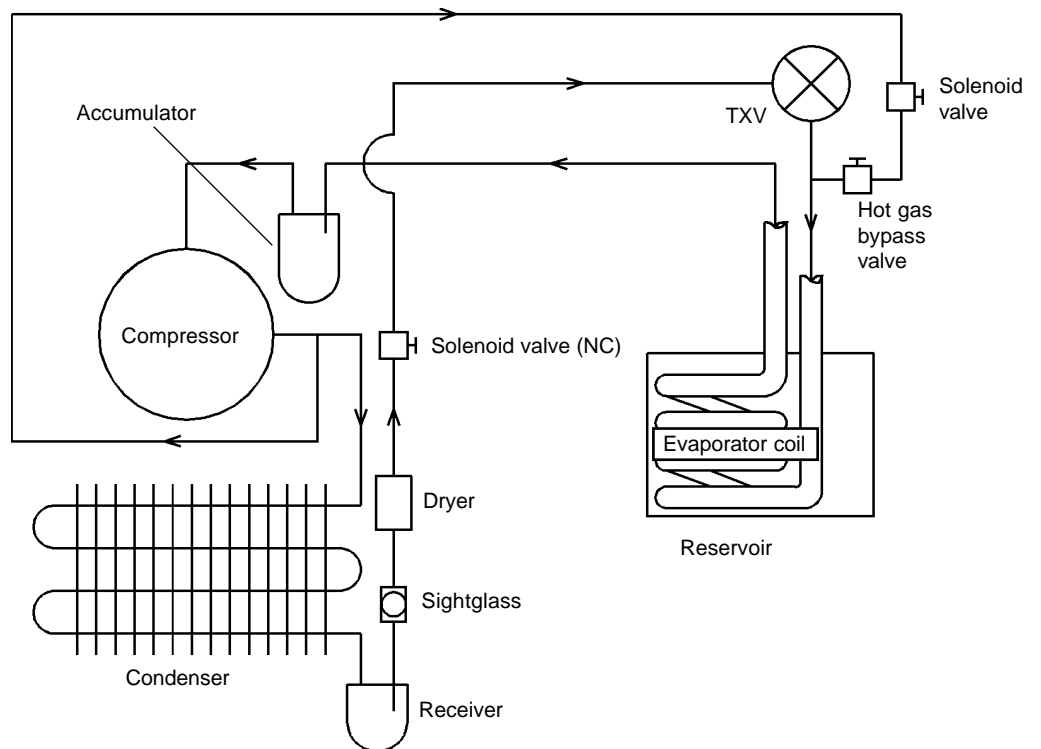
- *unit part number*
- *unit serial number*

Section X Diagrams

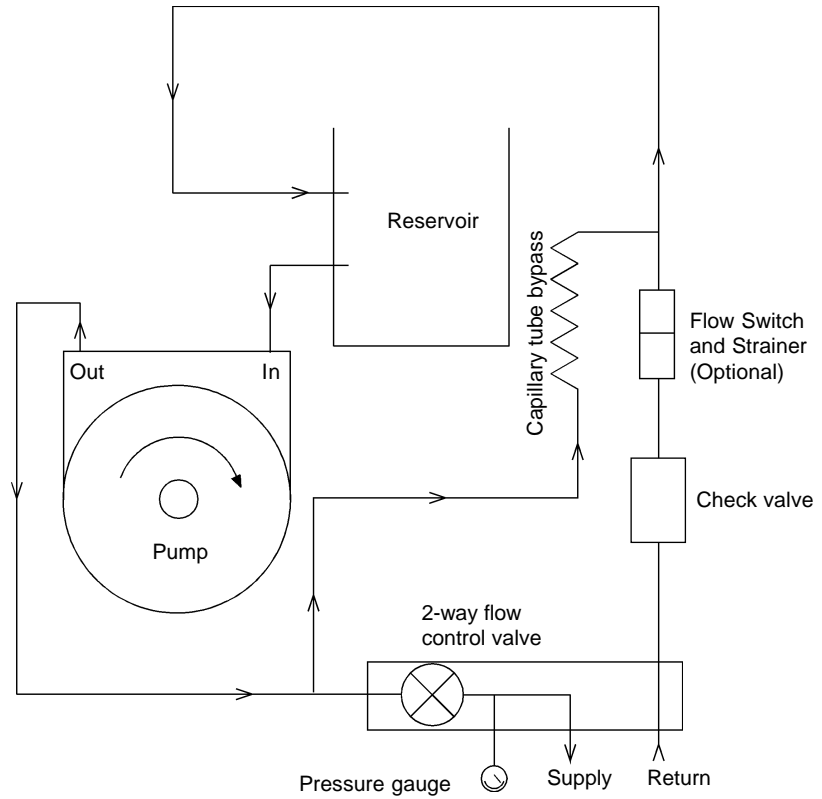
**Refrigeration
Flow Diagram
(HX-75 through HX-150)**



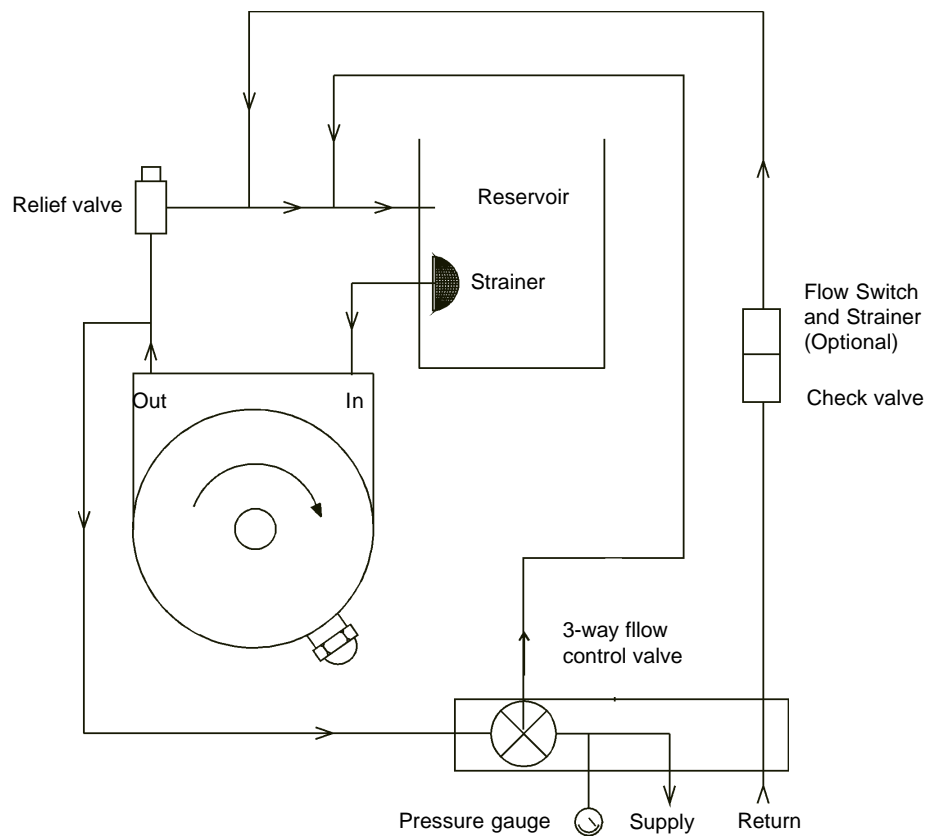
**Refrigeration
Flow Diagram
(HX-200 through HX-750)**



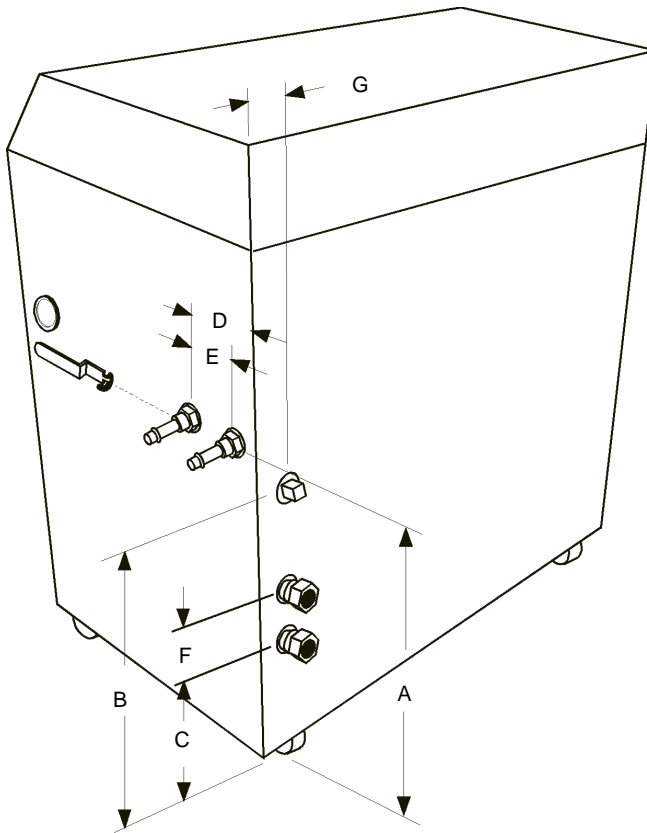
Pump Flow Diagram (CP Pumps)



Pump Flow Diagram (PD and TU Pumps)



Dimensions



	HX75	HX100/HX150	HX200/HX300	HX500	HX750*
Unit Dimensions					
<i>Dimension A</i>	16	20	25 3/8	25 1/4	41
<i>Dimension B</i>	15 1/4	19 1/4	23 1/2	21 1/8	33 3/4
<i>Dimension C</i>	8 1/4	9 1/4	8 3/8	5 1/2	NA
<i>Dimension D</i>	7 1/4		7 1/2		9 1/2
<i>Dimension E</i>			3		
<i>Dimension F</i>	3		3	5 1/2	NA
<i>Dimension G</i>	1 3/8		1 1/2	2 1/4	NA
<i>Dimension H</i>	2 1/2		2 3/8		2 1/4
<i>Dimension I</i>	24 7/8	27 1/2	31 1/2	35 1/8	35
<i>Dimension J</i>	48 1/2	54	64 7/8	73 1/2	86 1/4
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.

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

APPENDIX B 380V WYE MODIFICATION.

Refer to the serial number label on the rear of the unit for the specific electrical requirements of your unit.



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

Electrical connections are made in the electrical enclosure at the rear of the unit. Remove one of the “knock-outs” from the wall of the enclosure and install a conduit connector. Connect the line cord to the main contactor terminals labelled L1, L2, and L3. Connect the neutral wire (N) to the single pole terminal block labelled N. Connect the ground wire (G) to the grounding stud.

NOTE: Not all units require a neutral connector. Refer to the unit's serial number label on the rear of the unit and to your facility power source availability. Units not requiring a neutral connector use the same connection procedures except there will be no neutral wire or single pole terminal block.

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.

