System III
Liquid to Liquid
Heat Exchanger

NESLAB Manual P/N 013736
Rev. 06/05/97

Instruction and Operation Manual

System III Liquid to Liquid Heat Exchanger Instruction and Operation Manual

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Compliance

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

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

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

Unpacking

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

Warranty

Units have a warranty against defective parts and workmanship for one full year from date of shipment. See back page for more 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, 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 obtain the following information from the unit's serial number label:

- *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.

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.

Observe all warning labels.

Never remove warning labels.

Never operate damaged or leaking equipment.

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

Always empty the reservoir before moving the unit.

Never operate equipment with damaged line cords.

Never operate without fluid.

Refer service and repairs to a qualified 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 print. 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.

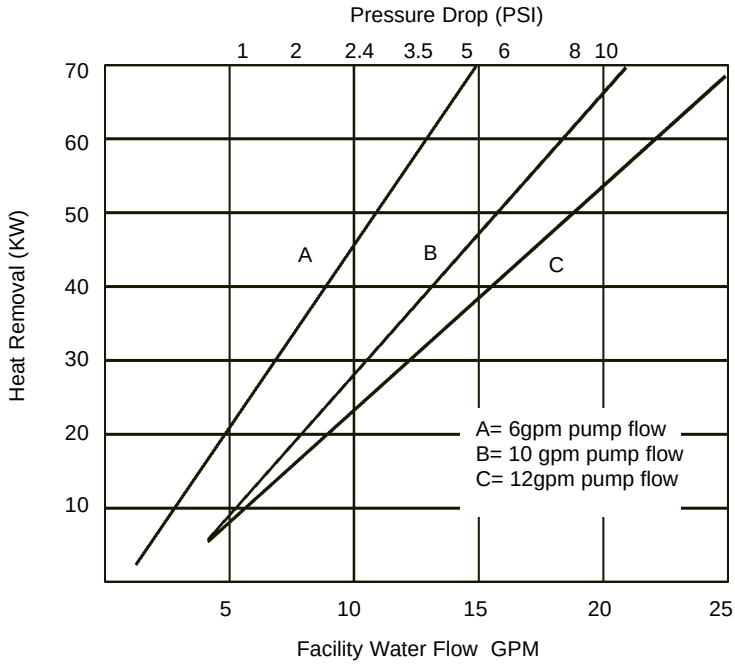
Section II General Information

Description

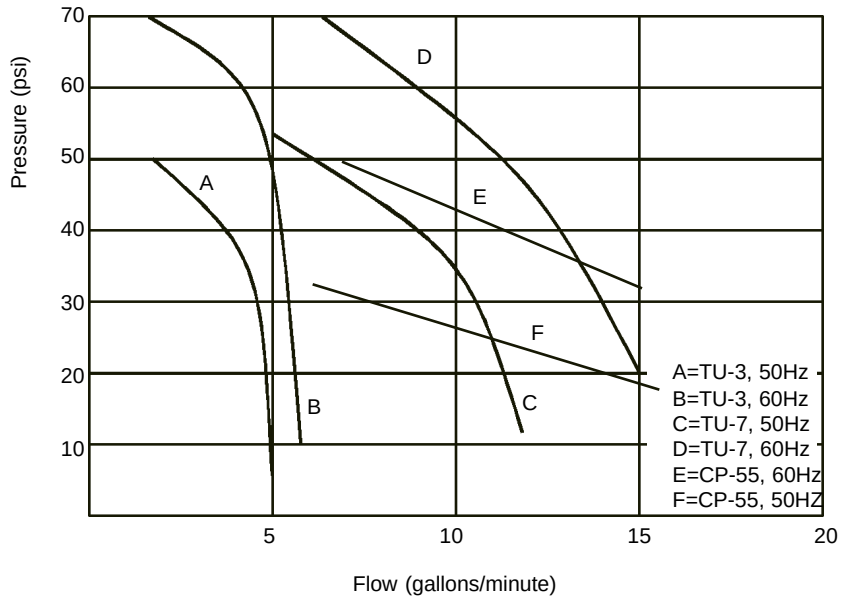
The System III Liquid to Liquid Heat Exchanger is designed to remove heat from water-cooled instruments.

The unit consists of a heat exchanger, recirculation pump, PVC reservoir, and an analog controller.

Specifications

Temperature Range	+5°C to +40°C
Temperature Stability	±1.0°C
Cooling Capacity[1]	

1. Cooling capacity is based in a 10°C difference between the temperature of the cooling water supply and the cooling fluid flowing from the System III to the instrument being cooled (see Section III, Facility Water Requirements). Pressure drop obtained with the System III modulating valve fully open.

Pump Capacity	
Reservoir Volume[2]	
Gallons	1.25
Liters	4.7
Dimensions[3]	
(H x W x D)	
Inches	20¾ x 17⅜ x 27
Centimeters	52.7 x 44.1 x 68.6
Shipping Weight[4]	
Pounds	206
Kilograms	93.4

2. Larger volume reservoirs are available.
3. Large volume units measure 32½ x 23 x 27 (82.5 x 58.4 x 68.6).
4. Large volume units weigh approximately 355 pounds (161 kilograms).

Section III Installation

Site

The unit should be located in a laboratory or clean industrial environment with easy access to a facility cooling water supply and a drain. Never place the unit in a location where excessive heat, moisture, or corrosive materials are present.

Refer to the pump label on the rear of the unit to identify the specific type of pump in your unit. Units with a TU-7, TU-8 or TU-9 pump are equipped with a pump motor fan. The fan is used to cool the pump motor and prevent the motor from overheating. Air is drawn through the front of the unit and is discharged through the rear of the unit. A minimum clearance of 6 inches (0.15 meters) at the front and rear of the unit is necessary for ventilation.

Facility Water Requirements

Refer to the Cooling Capacity chart in Section II, Specifications. The flow rate of the cooling water supply must meet or exceed these requirements for the unit to operate at its full rated capacity. If the cooling water does not meet these standards, the cooling capacity will be derated. The chart is based on a difference between the temperature of the cooling water supply (House Water) and the cooling fluid flowing from the System III to the instrument being cooled.

As the heat load increases, the required flow rate of the cooling water supply increases. For example, on a System III with a 6 gpm pump flow, if the heat load is 12 kilowatts, approximately 3 gpm of cooling water flow is required to remove the heat. However, if the heat load is increased to 36 kilowatts, about 8 gpm of cooling water flow is required.

The flow meter on the front of the unit does not measure the flow rate of the cooling water supply. The flow meter measures the flow rate of the cooling fluid returning to the instrument being cooled.

Electrical Requirements

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

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

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.

Voltage Selection

If the unit is to be operated from a 220 to 240V source, a voltage range selector switch inside the unit must be reset. See Service section for instructions on changing the voltage selector.

Plumbing Requirements

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. The manufacturer of the instrument should be able to recommend a cleaning fluid for their equipment.

The plumbing connections are located on the rear of the unit and are labelled FACILITY WATER and RECIRCULATING CLEAN FLUID. The top fittings are outlets and the bottom fittings are inlets.

These connections are 1 inch FPT.

A basket strainer is supplied with the unit to protect the heat exchanger from becoming clogged by dirty cooling water. Install this strainer on the FACILITY WATER inlet. A clogged strainer can adversely affect cooling capacity. See Section V, Facility Water Strainer for cleaning instructions.

Connect the FACILITY WATER connections to the cooling water supply and the drain.

Connect the RECIRCULATING CLEAN FLUID connections to the instrument being cooled.

Flexible tubing, if used, should be of heavy wall or reinforced construction. All tubing should be rated to withstand 80 psi at +40°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 the 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 reductions must be made, they should be made at the inlet and outlet of the instrument being cooled, not at the unit.

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

Fluids

Refer to the Water Quality and Recommendations section.

Tap water is the recommended cooling fluid.

Water Quality Standards and Recommendations

	Permissible(PPM)	Desirable(PPM)
Microbiologicals		
(algae,bacteria,fungi)	0	0
Inorganic Chemicals		
Calcium	<40	0.6
Chloride	250	<25
Copper	1.3	1.0
Iron	0.3	<0.1
Lead	0.015	0
Magnesium	<12	0.1
Manganese	0.05	<0.03
Nitrates\Nitrites	10 as N	0
Potassium	<20	0.3
Silicate	25	<1.0
Sodium	<20	0.3
Sulfate	250	<50
Hardness	17	<0.05
Total Dissolved Solids	50	10
Other Parameters		
pH	6.5-8.5	7-8
Resistivity	0.01*	0.05-0.1*

* Megohm-Cm (Compensated at 25C)

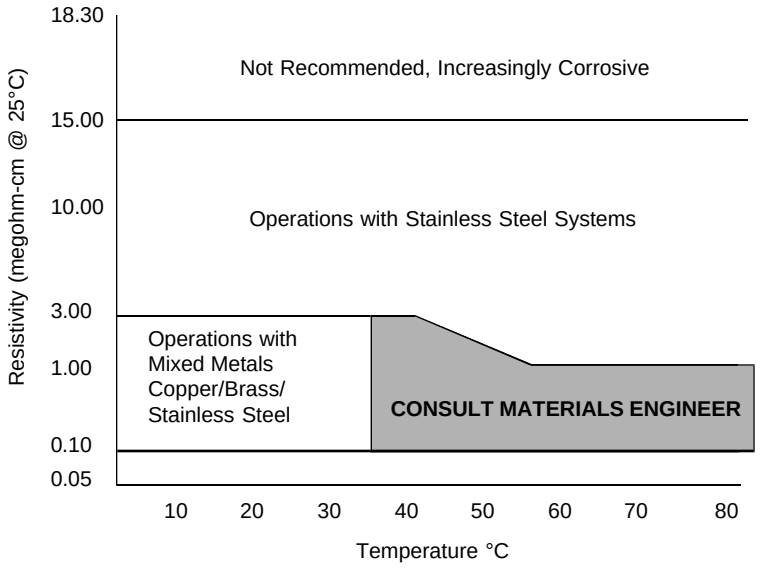
Unfavorably high total ionized solids (TIS) can accelerate the rate of galvanic corrosion. These contaminants can function as electrolytes which increase the potential for galvanic cell corrosion and lead to localized corrosion such as pitting which can be observed at the studs and on the outside surface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

Remove the reservoir cover. Fill the reservoir with clean cooling fluid to within 1 inch of the top of the reservoir. Have extra cooling fluid on hand and follow the steps described in Section IV, Start Up.

Automatic Refill Device (Optional)

The automatic refill device maintains the correct level of cooling fluid in the reservoir. The device consists of a float switch in the reservoir and a solenoid valve at the rear of the unit. 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 reaches the proper level, the float switch will rise and the solenoid valve will close.

Connect the $^{3}/_{8}$ inch OD stainless steel barbed fitting on the solenoid valve to the make-up fluid source using $^{5}/_{16}$ or $^{3}/_{8}$ inch ID flexible tubing.

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

Section IV Operation

Start Up

Before starting the unit, double check all electrical and plumbing connections and make sure the circulating system (the System III, the instrument being cooled, and the tubing that connects them) has been properly filled with cooling fluid.

Turn the RECIRCULATING FLOW CONTROL to “0”. Press the START button. The pump will start.

The low fluid level monitor in the reservoir prevents the unit from operating if the fluid level in the reservoir is below the safe operating level. By slightly, and/or intermittently opening the RECIRCULATING FLOW CONTROL (toward “+”) and using extra cooling fluid to keep the reservoir topped off, the system can be filled without repeated tripping of the low fluid level monitor.

If the unit shuts down, top off the reservoir and restart it. When the system is full, the reservoir level will no longer drop when the RECIRCULATING FLOW CONTROL valve is opened (toward “+”).

Temperature Adjustment

A control valve, located in the FACILITY WATER inlet 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.

Turn the TEMPERATURE CONTROL knob on the control panel to desired operating temperature. The temperature control system actuates a control valve in the FACILITY WATER line. The control valve adjusts the flow of the cooling water supply to produce the desired operating temperature.

When selecting an operating temperature, remember that the lowest achievable temperature is a function of the available flow rate, the temperature of the cooling water supply and the heat load.

The amber IDLE and green COOL lights indicate the control valve’s status. When the temperature control valve is wide open (for maximum cooling), the COOL light is on steady. When the control valve is closed, the IDLE light is on. As the control valve moves between these extremes, the two lights flash with varying on-time to indicate the approximate position of the control valve.

Flow Control

The RECIRCULATING FLOW CONTROL handle is connected to a three-way valve that controls the flow of the cooling fluid to the instrument being cooled. The handle is located on the front of the unit.

When the handle is in the “+” position, the valve is open and all available cooling fluid is supplied to the instrument being cooled. When the handle is in the “0” 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 the flow meter to adjust the desired flow rate.

The gauge next to the flow control handle indicates the operating pressure.

Monitors

The unit is equipped with the following monitors:

Low Fluid Level

High Temperature

A fault condition will cause the unit to be shut down immediately. The fault must be identified and corrected before the unit can be restarted.

Low Fluid Level Monitor
The low fluid level monitor is connected to a float switch in the reservoir. A low fluid level fault occurs when the cooling fluid in the reservoir drops below the operating level.

High Temperature Monitor
The high temperature monitor is connected to a sensor that monitors the cooling fluid temperature as it exits the heat exchanger. The monitors protect the heat exchanger from exposure to excessively hot cooling fluid. A temperature fault occurs when the cooling fluid temperature exceeds the set temperature limit.

Set the temperature limit using the HIGH TEMPERATURE LIMIT knob on the control panel.

Fault Interlock Contact

A set of contacts is connected to a receptacle on the control panel. The contacts are rated 15A/240V. 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 closed during normal operation and open when the unit is turned off or when a fault is detected.

Fault Response Modes

In the event of a low fluid level or high temperature fault, two modes of response to a fault are possible: SHUTOFF and SIGNAL ONLY.

In the SHUTOFF mode, if either fault occurs, the fault interlock contacts will open, the FAULT light will light and the unit will shut down.

In the SIGNAL ONLY mode, the fault interlock contacts will open, the FAULT light will light, but the unit will continue to operate. This mode is available for customers who prefer to accept the risk of damage to the System III in order to continue to provide all available cooling fluid to the instrument being cooled in the event of a failure.

The unit is shipped from the factory with the SHUTOFF mode selected. The mode selector switch is inside the unit to prevent tampering or inadvertent operation. Refer to Section V, Fault Selection for instructions on changing the fault response mode.

Pump Motor Overload Protector (optional)

Three phase units with three phase pump motors have a pump motor overload protector. These units can be identified as having a MOL light next to the FAULT light on the control panel.

The overload protector prevents the pump motor from exposure to excessively high current. If an overload fault occurs, due, for example, to a heavy work load, the MOL light will light and the unit will shut down. The overload protector will automatically reset after about two minutes. The unit must be manually restarted.

Section V Maintenance & Service

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

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).

Pump Strainer

A wire mesh pump strainer is located at the bottom of the reservoir. If debris is drawn into the reservoir, 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 within the first week. Therefore, the strainer must be cleaned after the first week of installation. After this first cleaning, the frequency of cleaning depends on the purity of the cooling water. We recommend a visual inspection of the reservoir be made monthly after the initial cleaning. After several months, the frequency of cleaning will be established.

If the strainer is visibly clogged, cleaning is required.

Disconnect the power cord from the power source and drain the reservoir before cleaning the strainer.

Remove the strainer by unscrewing it.

Clean the strainer by rinsing it with water.

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

Facility Water Strainer

The facility water strainer is the user-installed basket strainer on the FACILITY WATER inlet. **NOTE:** The strainer is designed to be used only with water. Clean the strainer when it becomes visibly clogged or dirty.

Disconnect the power cord from the power source and turn off the facility cooling water.

Place a container under the strainer to collect any water that spills out of the basket when it is removed.

Unscrew the clear plastic basket. Remove the screen and rinse it with water. Replace the screen and the basket.

Algae

To restrict the growth of algae in the reservoir, it is recommended that the reservoir cover be kept in place and that all circulation 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.

Configuration

The unit top is secured to the cabinet by four ball stud retainers; one at each corner. Remove cabinet top by prying upward gently (cover pops off) in order to perform the following adjustments.

In some cases, the side access panels may need to be removed. The access panels are secured using screws installed through the bottom of the cabinet. **NOTE**: Some models have a one piece cover rather than separate top and side panels. This type of cover is secured by five screws on each side of the case.

Voltage Selection

Remove the top cover from the cabinet.

The VOLTAGE SELECT toggle switch is located on the right side of the control box. Two ranges are available: 200-208V and 220-240V. Set the switch for the appropriate range.

Replace the top cover.

Fault Selection

Remove the top cover from the cabinet.

See Section IV, Fault Response Modes for a discussion of these options. Locate the SHUTOFF/SIGNAL ONLY toggle switch on the right side of the control box. Set the switch for the desired mode.

Replace the top cover.

Pressure Relief Valve

A pressure relief valve is located on the pump discharge line. The 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 to the pressure. The relief valve does not determine the actual operating pressure; the actual operating pressure is determined by the flow control valve setting and pressure drop through the instrument being cooled.

If adjustment is necessary, consult our Service Department for assistance (see Preface, After-sale Support).

Fuses

Refer to the serial number label on the rear of the unit for the specific electrical requirements of your unit. Replacement fuses are 3/4 amp, time delay fuses. **Do not replace with an alternate amperage.**

Single Phase Units
Remove the top cover from the cabinet.

The fuses are located on the right side of the control box.

Three Phase Units
Remove the top cover, the right access panel and the control box cover.

The fuses are located inside the control box.

Phase Rotation

Three phase units with three phase pump motors are equipped with a phase rotation interlock. These units can be identified as having a PHASE light next to the FAULT light on the control panel.

This interlock prevents the unit from starting if the phase rotation is wrong. If the phasing is wrong, the PHASE light will light and the unit will not start.

Unplug the unit. Reverse any two power cord wires in the power cord plug.

Never remove the green ground wire.

Plug in the unit. The PHASE light should be off and the unit should start.

Section VI Troubleshooting

Checklist

Unit does not start, FAULT light does not come on when START button is pushed.

- Check the voltage of the power source. Refer to the serial number on the rear of the unit for the specific electrical requirements of your unit. Make sure the voltage of the power source meets the specified voltage, ±10%.
- Check the fuses (see Section V, Fuses).

When START switch is pushed, unit does not run, FAULT light comes on (SHUTOFF mode)

- Check fluid level in the reservoir. The low fluid level monitor prevents the unit from starting if the fluid level is below the safe operating level.
- Make sure the TEMPERATURE CONTROL setting is less than the HIGH TEMPERATURE LIMIT setting.

Unit runs, but FAULT light is on (SIGNAL ONLY mode)

- Check fluid level in the reservoir. The low fluid level monitor indicates a fault if the fluid level is below the safe operating level.
- Make sure the TEMPERATURE CONTROL setting is less than the HIGH TEMPERATURE LIMIT setting.

Unit continues to run for a short periods and then stops

- Check fluid level in the reservoir. If low, check the system for leaks.
- Make sure the heat load is not greater than the cooling capacity (see . Section II, Cooling Capacity).
- Make sure the cooling water supply meets the requirements outlined in Section III, Facility Water Requirements.
- Possible power interruption has occurred causing “latch” relay to unlatch. Attempt to restart.
- Ensure proper voltage (see Section III, Voltage Selection).

Green light always on, temperature is not dropping

- Make sure the heat load is not greater than the cooling capacity (see . Section II, Specifications).
- Make sure the cooling water supply meets the requirements outlined in Section III, Facility Water Requirements.
- Clean the pump and facility water strainers

Amber light always on, temperature is not rising

- Little, to no, heat load exists in instrument being cooled.

Poor Temperature Stability

The System III is designed to maximize heat removal with minimal facility cooling water requirements. Under conditions of excessive cooling capacity, instability may result. The condition may be aggravated by :

High temperature setpoint

Low facility water temperature

Small heat load

High facility water pressure

The situation can be remedied by limiting the available facility cooling water. Facility water pressure can be reduced with a pressure regulator before the System III. However, excessive restriction of facility water will reduce the System III's capacity.

Service Assistance

If, after following these troubleshooting steps, your units 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

Voltage of unit

Voltage of power source

Temperature at which the problem occurs

Temperature, pressure and flow rate of cooling water supply

Parts List

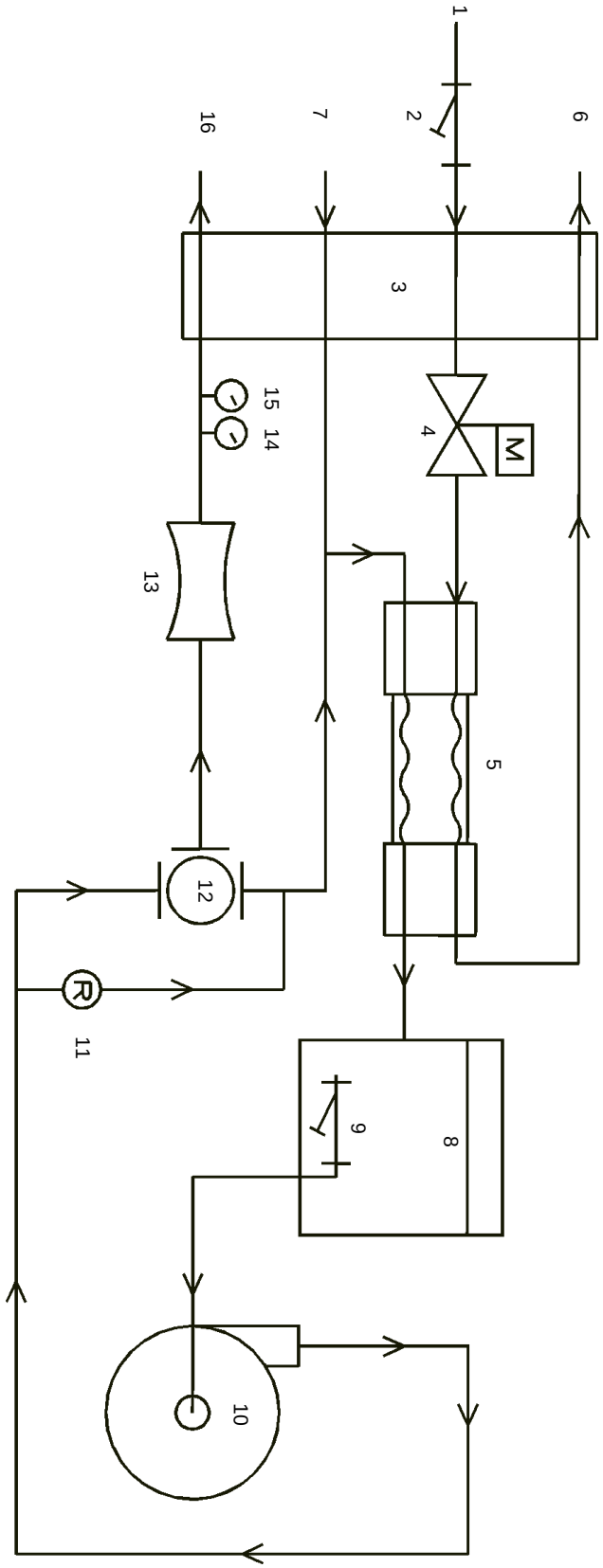
Our Service Department can provide you with a complete list of spare parts for your unit (see Preface, After-sale Support). Before calling, please obtain the following information:

BOM number

Serial number

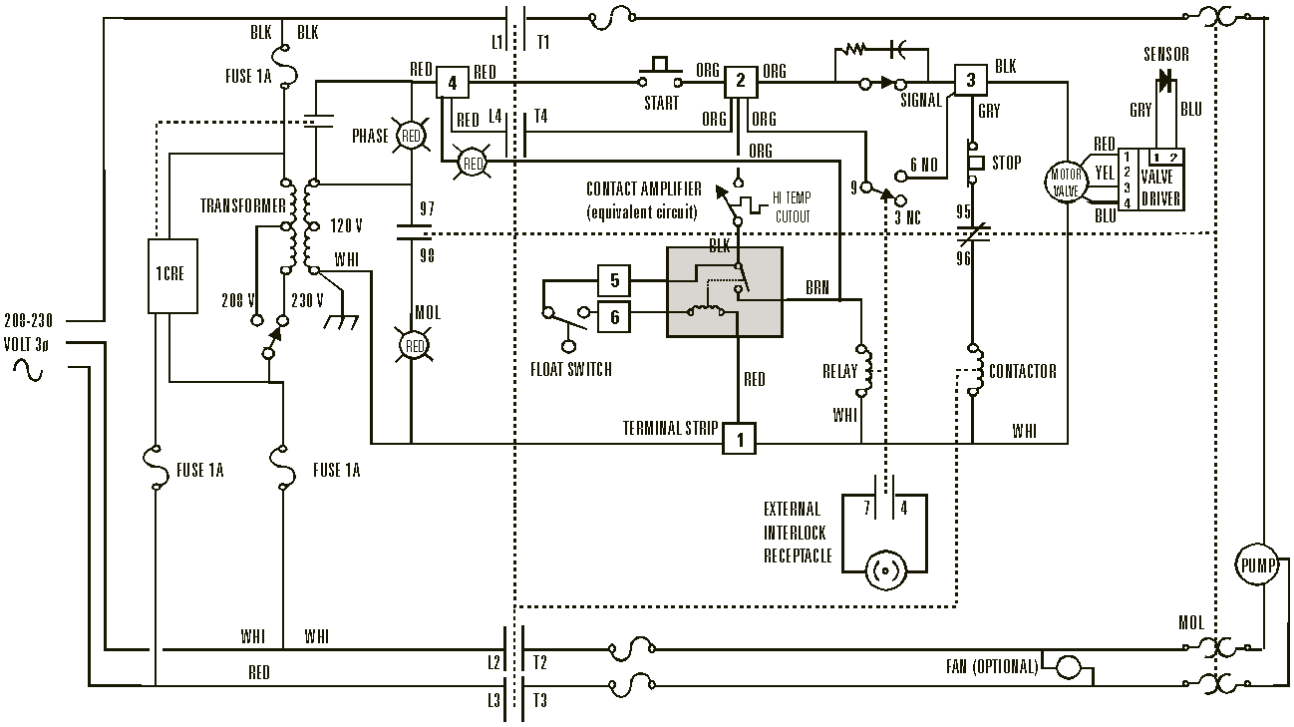
Section VII Diagrams

Flow Diagram

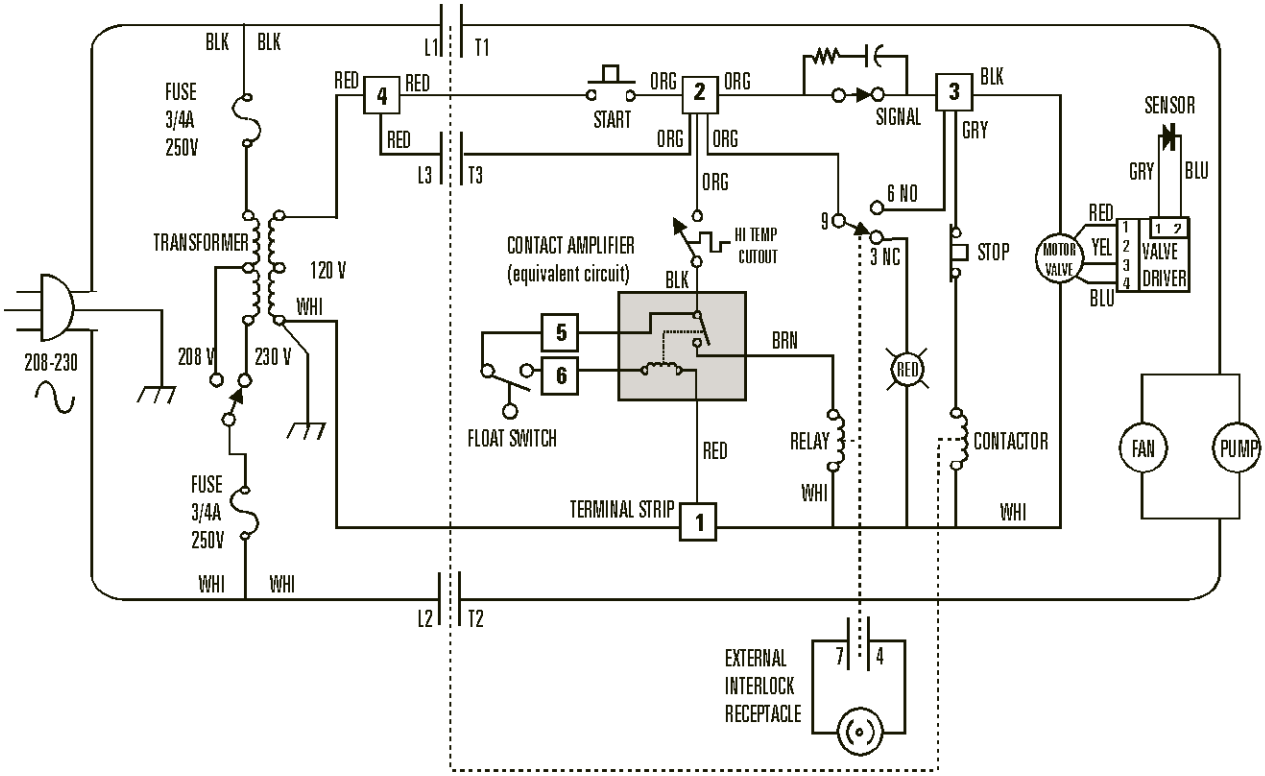


1. Facility Water Inlet
2. Facility Water Strainer
3. Water Bracket Assembly
4. Control Valve
5. Heat Exchanger
6. Facility Water Outlet
7. Recirculating Clean Fluid Inlet
8. Reservoir
9. Pump Strainer
10. Pump
11. Pressure Relief Valve
12. Ball Valve
13. Flow Meter
14. Temperature Gauge
15. Pressure Gauge
16. Recirculating Clean Fluid Outlet

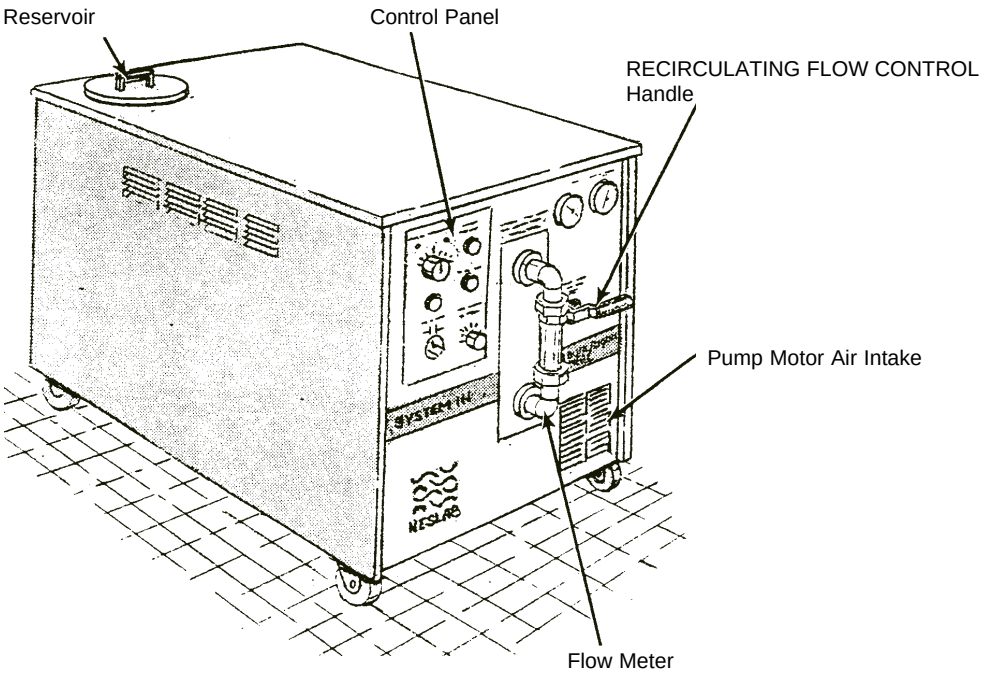
Wiring Diagram 3Ø Units



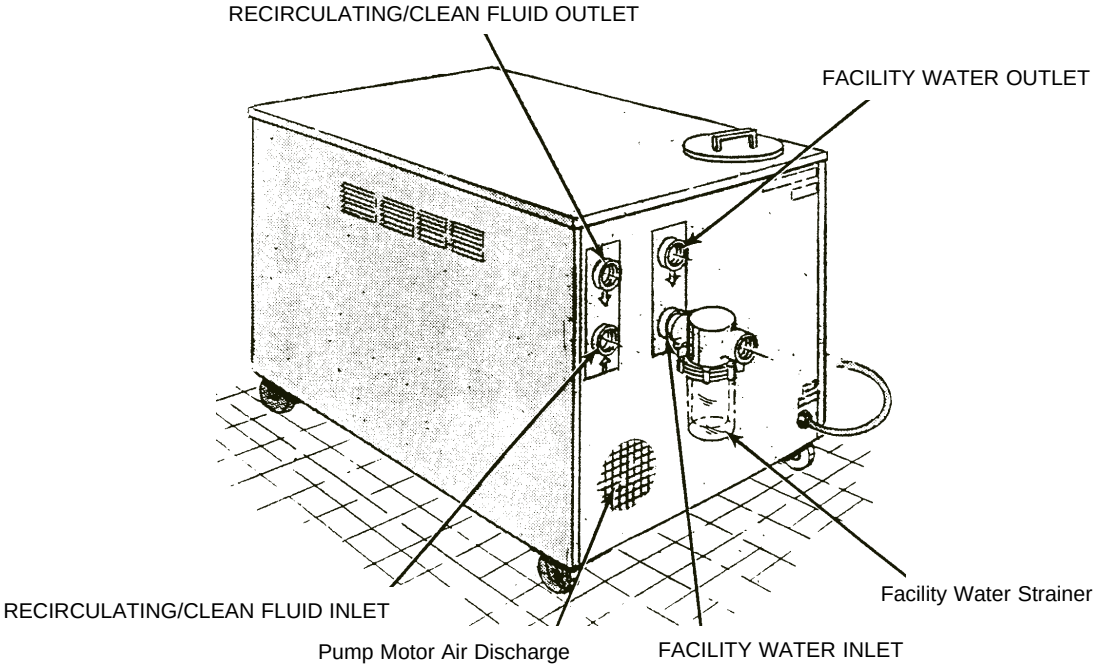
Wiring Diagram 1Ø Units



Front View



Rear View



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.