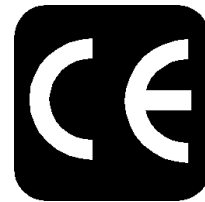


HX-540 Recirculating Chiller

NESLAB P/N 013499
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Instruction and Operation Manual



HX-540 Recirculating Chiller

Instruction and Operation Manual

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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 manual or unit performance will be derated. Inadequate water supply could cause the compressor to overheat and turn the unit off.

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 FACILITY WATER INLET and OUTLET, and RECIRCULATING FLUID INLET and OUTLET. Remove the plastic protective plugs from all the plumbing connections. Connect the FACILITY WATER INLET fitting to the facility cooling water and the FACILITY WATER OUTLET fitting to a drain. Connect the RECIRCULATING FLUID INLET fitting to the outlet of your application and the RECIRCULATING FLUID OUTLET fitting to the inlet of your application.

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

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 two inches of the top when the unit is at the desired operating temperature. If the fluid capacity of your application and recirculation lines are significant, have extra fluid on hand.

Operation

Before starting the unit, ensure the compressor mounting nuts have been loosened and that the facility water is on. Double check all electrical and plumbing connections. Make sure the circulating system has been filled with cooling fluid.

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.

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

The unit may be equipped with one of several optional controllers. In this case please refer to the instruction manual for details on their operation.

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.

The unit has a pump strainer. If debris is in the system, the strainer will prevent the material from being drawn into the pump and damaging the pump vanes.

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

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

Preface

Compliance

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

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

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

Unpacking

Retain all cartons and packing material until the unit is operated and found to be in good condition. 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 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 the 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 (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.

Observe all warning labels.

Never remove warning labels.

Never operate damaged or leaking equipment.

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

Never operate equipment with damaged line 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 print. Read and follow these important instruction. Failure to observe these instruction can result in permanent damage to the unit, significant property damage, or personal injury or death.

Section II General Information

Description

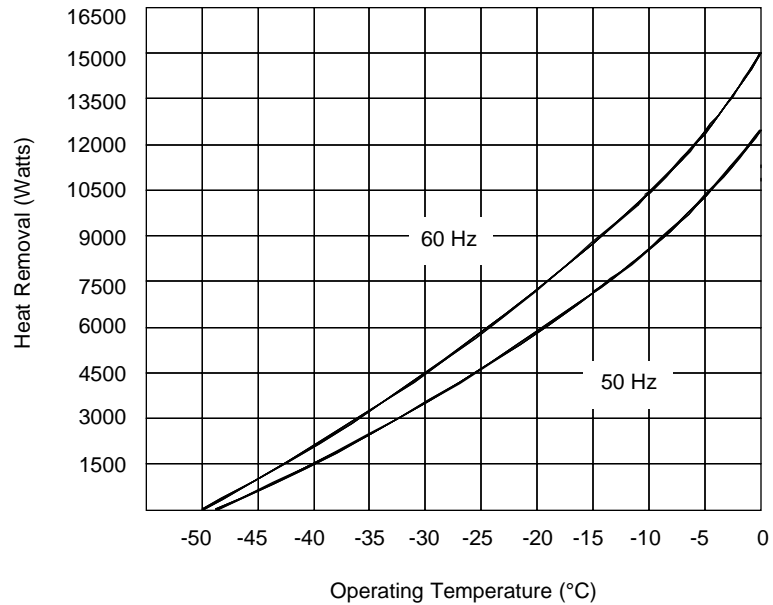
The HX-540 Recirculating Chiller is designed to provide a continuous flow of cooling fluid at a constant temperature and pressure.

The unit consists of a water-cooled refrigeration system, stainless steel reservoir, recirculating pump, and a digital controller.

An important characteristic of the unit is its ability to track a set temperature virtually independent of changing heat loads. Once the desired operating temperature is set, the operating temperature will not shift more than a few tenths of a degree.

Specifications

Cooling Capacity¹



Temperature Range

-40°C to 0°C

Temperature Stability

±0.5°C

Fluid Capacity²

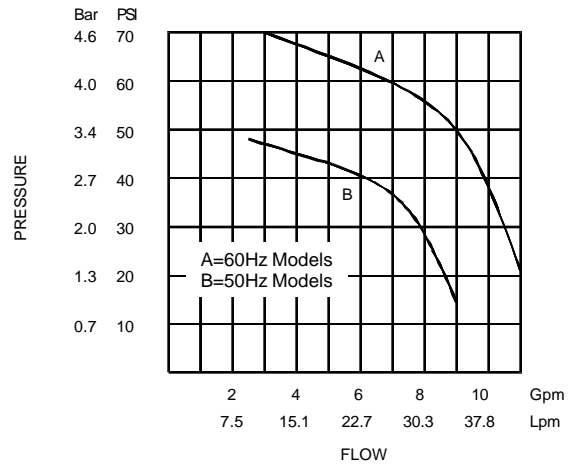
Gallons
Liters

5
19

1. Specific heat of cooling fluid is 0.6 BTU/lb°F.

2. Total fluid volume of the reservoir, exchanger, and all internal plumbing lines.

Pump Capacity³



Dimension⁴

(H x W x D)

Inches

Centimeters

44 x 34 x 25.5
111.8 x 86.3 x 64.7

Weight

Pounds

Kilograms

915

415

3. Specific gravity is 0.5.
4. Add 9 inches (22.9 cm) to depth for electrical enclosure.

Section III Installation

Site

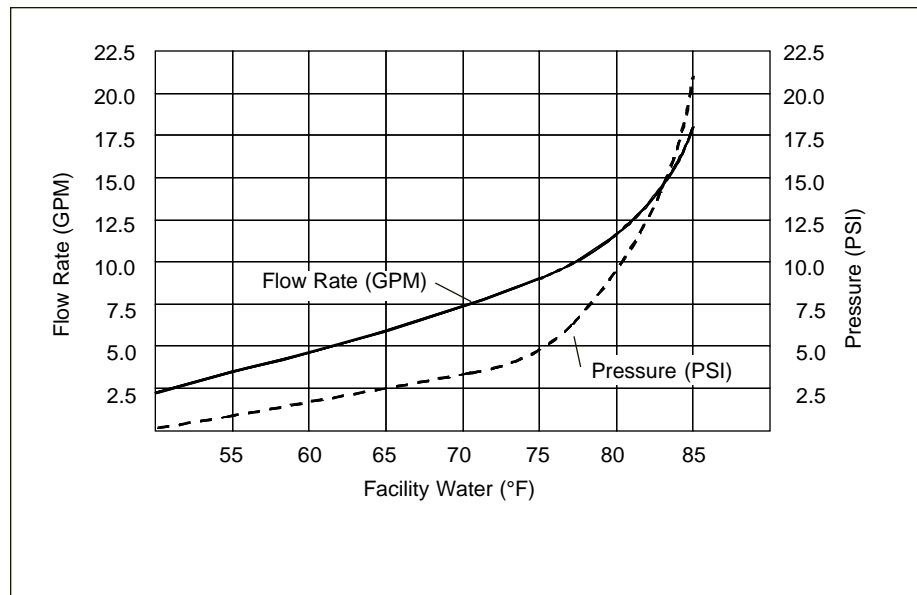
The unit is designed for indoor operation in a laboratory or clean industrial environment. Ambient temperatures should be in the range of +50°F to +100°F (+10 to +38°C). **Never install the unit in a location where excessive heat, moisture, or corrosive materials are present.**

The unit has a water-cooled refrigeration system. It should be placed in a location with easy access to a facility water source and a drain.

The unit will retain its full rated capacity with facility water temperatures to approximately +85°F (+30°C). Above 85°F, derate the cooling capacity 1% for every 1°F above +85°F, to a maximum facility water temperature of +95°F. In degrees Celsius, derate the cooling capacity 1% for every 0.5°C above +30°C, to a maximum facility water temperature of +35°C.

Facility Water Requirements

The facility water must meet or exceed the following requirements for the unit to retain its full rated capacity. If the facility water does not meet these standards, the cooling capacity will be derated.



The unit has a water regulating valve located in the FACILITY WATER INLET line. The valve regulates the flow rate of the facility water that passes through the heat exchanger based on the heat load. Flow through the heat exchanger is stopped when the unit turned off. If the facility water temperature or pressure do not meet the specified requirements, contact our Service Department for assistance.

Electrical Requirements

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

Ensure the voltage of the power source meets the specified voltage, $\pm 10\%$.

All power connections should be made by a qualified electrician. The power connection is three wire terminal block plus a ground connection and will operate on a delta or wye system. Make sure an adequate ground connection is provided.

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

The HX-540 Recirculating Chiller is a three phase unit. The unit is equipped with a phase rotation interlock. This interlock prevents the unit from starting if the phase rotation is wrong. If the unit will not start, see Section VI, Troubleshooting. If the options in the checklist are not applicable, the problem may be phase rotation.



For personal safety and equipment reliability, the following procedure should only be performed by a qualified technician.

Disconnect the power source from the power source. Remove the rear panel and the junction box cover. Reverse any two line cord leads on the line cord side of the relay.



Never remove the green ground wire.

Replace the rear panel and connect the power source. If the unit will not start, contact our Customer Service Department for assistance.

Plumbing Requirements

The plumbing connections are located at the rear of the unit.

The facility water connections are labelled FACILITY WATER INLET and OUTLET. These connections are 1 inch FPT.

The cooling fluid connections are labelled RECIRCULATING FLUID INLET and OUTLET. These connections are ¾ inch FPT.

Connect the FACILITY WATER INLET to the facility water source.

Connect the FACILITY WATER OUTLET to the drain.

Connect the RECIRCULATING FLUID INLET to the outlet of the instrument being cooled.

Connect the RECIRCULATING FLUID OUTLET to the inlet of the instrument being cooled.

All tubing should be rated to withstand 100 psi. Make sure all tubing connections are securely clamped. Avoid running lines 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 information.

Before installing the unit to a 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 to clean their equipment.

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, without bends or kinks. If reductions must be made, they should be made at the inlet and outlet of the instrument being cooled, not at the HX.

An externally mounted flow meter and temperature readout are required with this unit. These monitors will indicate whether the facility water requirements are being met (see Section III, Facility Water Requirements). It is the users responsibility to provide adequate facility water to the unit.

Both devices should be installed in the FACILITY WATER INLET line.

Fluids

A non-freezing fluid is required for operation at any recirculating or ambient temperature. Use a fluid capable of operating at -60°C without freezing.

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



Do not use automobile anti-freeze. Commercial anti-freeze contains silicates that can damage pump seals.

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.

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

Filling Requirements

The fluid capacity of the connecting tubes and the instrument being cooled may be appreciable. Have extra cooling fluid on hand until the entire system is filled.

Thermal expansion and contraction of the cooling fluid must be taken into account when filling the unit.

Lift the hinged access panel on the unit's cover. Loosen the two thumbscrews and remove the reservoir cover.

Fill the reservoir with cooling fluid so that the fluid level will be within 2 inches of the top when the unit is at the desired operating temperature.

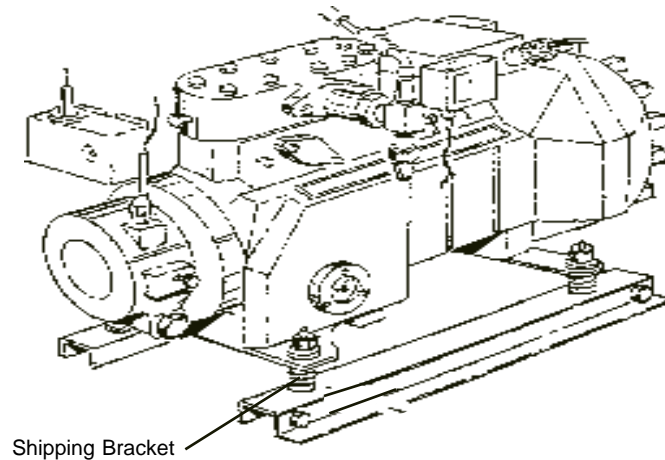
Replace the reservoir cover. Tighten the thumbscrews. Close the panel.

Section IV Operation

Pre-Start Up

Remove the two side access panels and the rear access panel (opposite end from the electrical enclosure) to access the compressor area.

Loosen the four compressor mounting nuts. There should be approximately 1/8" clearance between each compression mounting foot and shipping bracket to allow the compressor to "float" on the mounting springs.



Pump Down Cycle

The pump down cycle is designed to extend the life of the compressor in the refrigeration system. After the unit has been manually shut down, the refrigeration system will continue to run for about 30 seconds and will shut down when a low pressure fault occurs (see High and Low Pressure Cutout). This additional running time allows the refrigerant in the compressor to be removed and stored in the receiver.

In the event that a fault occurs, the unit will not start the pump down cycle, but will shut down immediately.

Shutting the unit off using a circuit breaker or other device on the line side of the relay defeats the purpose of the pump down cycle and is not recommended. If remote operation is desired, contact our Sales Department.

Electrical Enclosure (Optional)

Panel Controls

MAIN POWER

Indicates power is supplied to the unit.

SYSTEM ON

Indicates main contactor is closed. The contactor must be closed for the unit to start.

MACHINE ON

Indicates machine is running.

PUMP FAULT

Indicates a pump overload fault has occurred.

COMPRESSOR FAULT

Indicates a high or low refrigeration pressure fault has occurred.

PUSH/SYSTEM ON Button (Unlabelled)

Closes main contactor. Main contactor must be closed for the unit to start.

STOP/RUN/START Switch

To start the unit locally, turn the switch to the momentary START position. The RUN position is the normal operating position for the switch. To shut the unit off locally, turn the switch to the STOP position. The unit will start the pump down cycle.

EMERGENCY OFF Button (Optional)

When pressed, the unit will shut off immediately, bypassing the unit's pump down cycle. This button is intended for emergencies only. Do not use it as a normal shut down procedure. The button must be pulled out following an emergency shut down in order to perform the normal start up procedure.

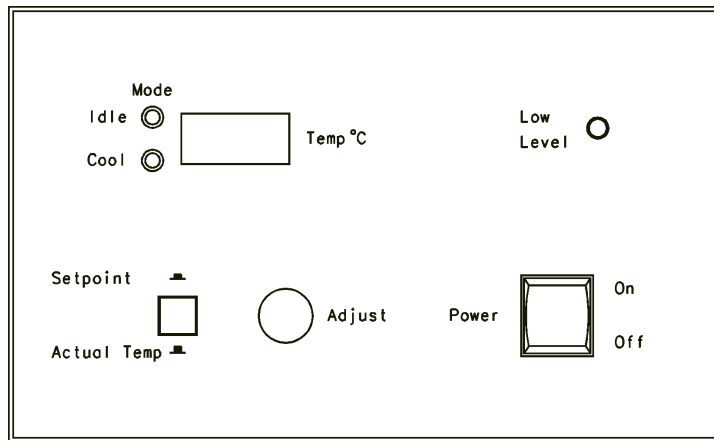
AUTO RESTART Switch

The AUTO RESTART switch is located inside the electrical enclosure. If the switch is in the ON position, the unit will automatically restart when power is restored following an outage (see Interface Access. panel).

Interface Receptacles

The REMOTE and ACCESSORY receptacles and the ENABLE/DISABLE switch are located on a panel on the right side of the electrical enclosure (facing the enclosure). Both receptacles and the switch are connected to the Interface Access. Panel located inside the electrical enclosure. Refer to the Interface Access. Panel description for more details, and to the Digital Temperature Controller (Remote) for installation instructions.

Panel Mounted Digital Temperature Controller



Digital Temperature Controller

Temperature Control

The Cool and Idle LEDs 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 LEDs cycle on and off to indicate the duty cycle of the system. The unit can be in the Cool or the Idle mode, but never both at the same time. A balance between Cool and Idle controls the temperature.

Start Up

Before starting the unit, check all electrical and plumbing connections and make sure the recirculating system (the HX, the instrument being cooled, and the recirculation lines) has been properly filled with cooling fluid. Also make sure the facility water is turned on and the flow control valve is fully closed (see Section V, Flow Control).

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 temperature of the fluid in the reservoir. 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 5 minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.

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.

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

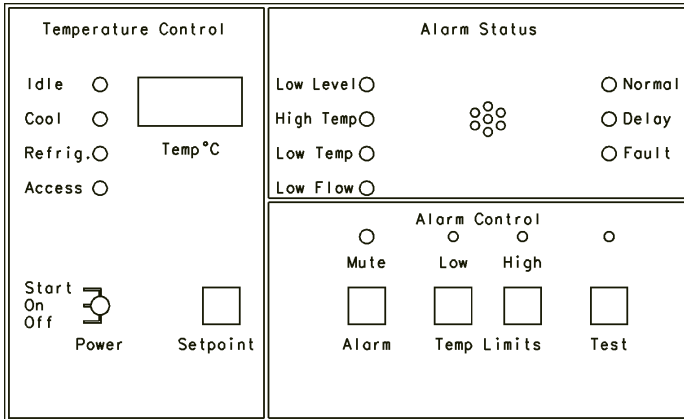
The Low Level indicator is connected to a float switch in the reservoir. The indicator warns the user of a low cooling fluid level in the reservoir. A low fluid level condition occurs when the cooling fluid in the reservoir drops below the operating level. The indicator serves only as a warning. The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

Series II Controller (Optional)

Description

The Series II temperature controller features are divided into four sections. Three are mounted on the controller front panel: Temperature Control, Alarm Control, and Alarm Status. The fourth section, the Interface Access panel is located inside the electrical enclosure.

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



Series II Temperature Controller

Temperature Control

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

Before starting the unit, double check all electrical and plumbing connections and make sure the circulating system (the HX, the instrument being cooled, and the tubing that connects them) has been properly filled with cooling fluid. Ensure the facility water is turned on.

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

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

The Temperature Control section is equipped with four indicators: Idle, Cool, Refrig. (refrigeration), and Access (accessory).

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

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

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

Alarm Control

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

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

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

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

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

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

Alarm Status

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

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

The Low Flow indicator is connected to a flow switch in the RETURN line. A low flow fault occurs when the flow rate of the returning cooling fluid drops below 0.5 gallons per minute (1.8 liters per minute). If a low flow condition is detected, the Low Flow indicator will light and the Delay indicator will flash. If the condition is not corrected within 5 seconds, the Delay and Normal .. indicators turn off, the Fault indicator turns on, and the audible alarm will sound. After 30 seconds (total elapsed time), the unit will shut down and the relay contacts will open.

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

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

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

The Delay indicator will flash:

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

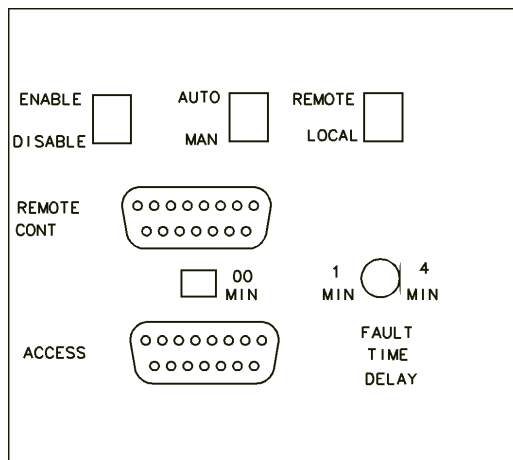
The Delay indicator turns off after these conditions are met.

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

Interface Access. Panel

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

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



Interface Access Panel

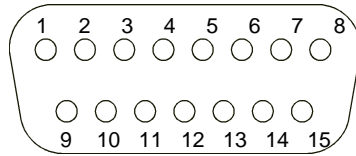
The RESTART AUTO/MAN switch controls the operation of the controller's START switch. If the switch is in the MAN position, the START switch is "open" and the unit must be manually restarted when power is restored following an outage. In the AUTO position, the START switch is "closed" and the unit will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

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

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

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

REMOTE CONT. Receptacle



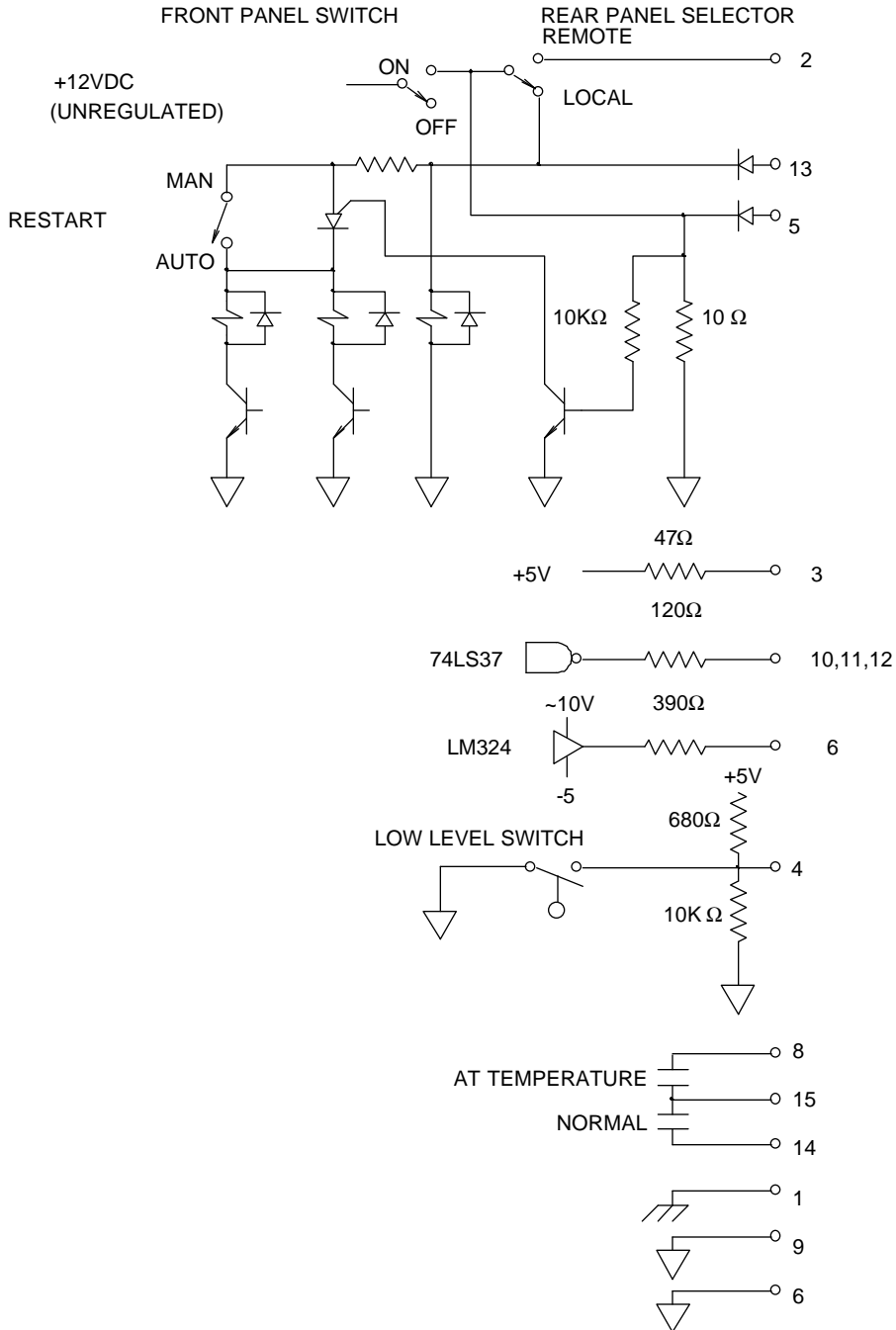
15 pin D-subminiature male

Pin #	Alarm circuitry	Control circuitry
1		Chassis ground.
2		ON/OFF control circuit power (+12VDC, unregulated). See ON/OFF/START Logic.
3	DC for LEDs (+5VDC, current limited through 47 Ω resistor).	
4	Low level switch (+5VDC, current limited through 680 Ω resistor).	
5		START button connection. See ON/OFF/START Logic.
6		Heater ON command, solid state relay drive (+8 to +13 VDC, current limited through 390 Ω resistor). Contact our Sales Department for more information.
7	Reserved.	
8	AT TEMPERATURE contact (24V, 1A maximum. AC and DC). When the fluid temperature is between the high and low temperature limits, this pin is connected to pin 15. See Relay Contact Logic.	
9	Common for DC power supplies, grounded.	

Pin #	Alarm circuitry	Control circuitry
10	FAULT indicator drive (-). Connect LED cathode here, anode to pin 3, for display of FAULT status. See External Status Indicator Logic.	
11	NOT AT TEMPERATURE indicator drive (-). Connect LED cathode here, anode to pin 3, for display indicating when the fluid temperature is not between the high and low temperature limits. See External Status Indicator Logic.	
12	NORMAL indicator drive (-). Connect LED cathode here, anode to pin 3, for display indicating when all status monitors (High Temperature, Low Temperature, Low Level, Low Flow) are normal. See External Status Indicator Logic.	
13		RUN switch connection. See ON/OFF/START Logic.
14	NORMAL contact (+24V, 1A maximum. AC and DC). When all status monitors are normal (see pin 12) this pin is connected to pin 15. See Relay Contact Logic.	
15	Relay contact common connection.	

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

Remote Connector Circuitry Details



ON/OFF/START Logic

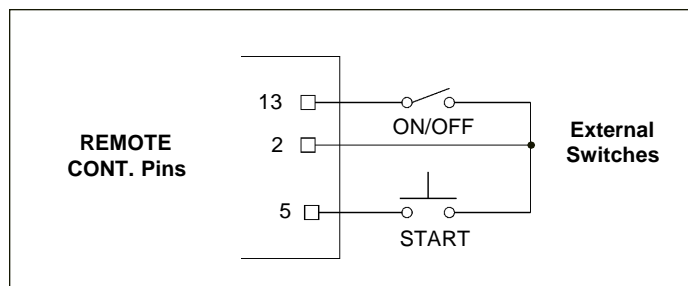
When the START/STOP LOCAL/REMOTE switch is set to LOCAL, the front panel ON/OFF/START switch controls the unit.

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

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

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

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



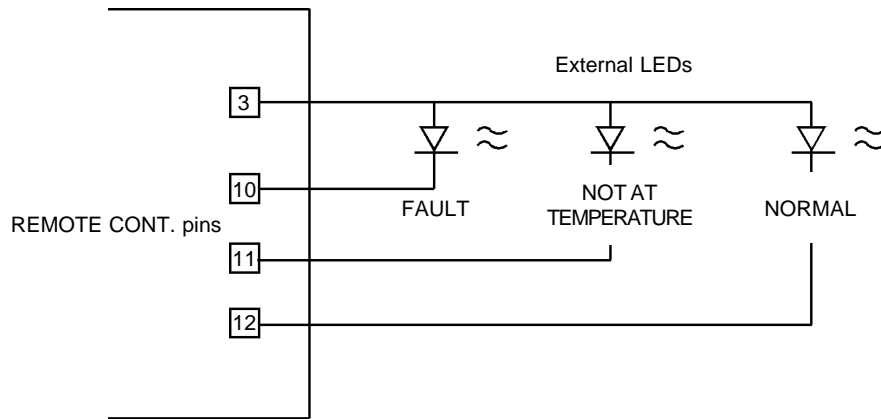
External Status Indicator Logic

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

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

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

Relay Contact Logic

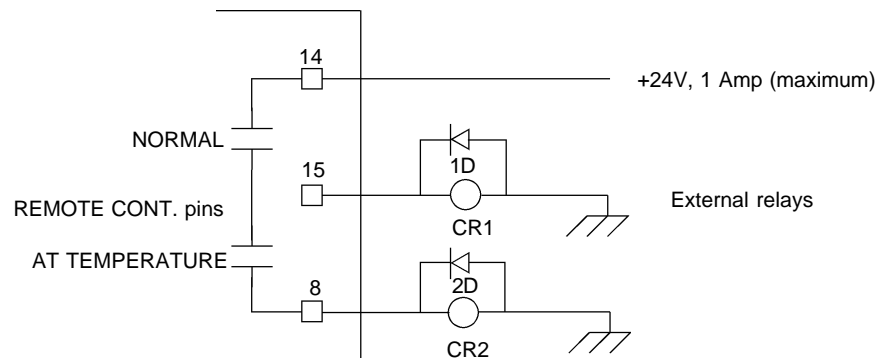


The NORMAL relay contacts are closed if all four status monitors are normal (no faults).

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

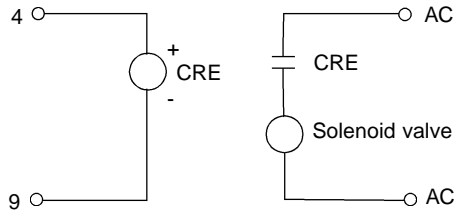
The AT TEMPERATURE contacts are closed if the fluid temperature is between the high and low temperature limits.

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

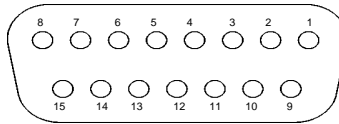


Low Level Switch/Auto Refill

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



ACCESS Receptacle



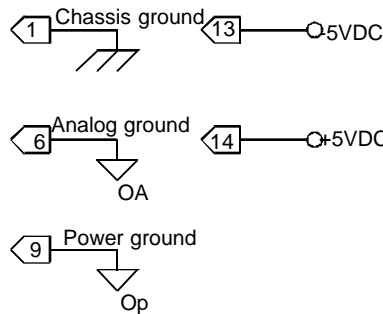
15 pin D-subminiature female receptacle

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

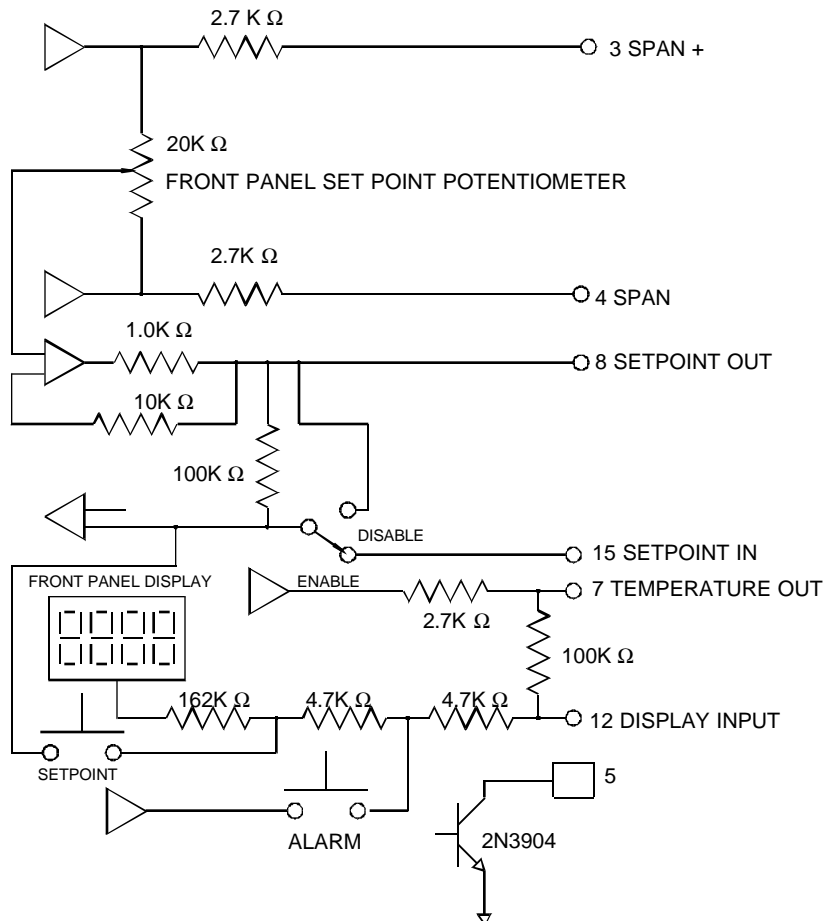
Continued on Next Page

Pin#	Function
12	Digital display (input only). An external voltage can be displayed on the operator panel digital display by applying the voltage to this pin. The display has a low input resistance and a full scale rating of $\pm 1.99\text{VDC}$. Input is referenced to analog ground, pin 6. The maximum voltage applied to the display should be limited to $\pm 2\text{VDC}$.
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 $10\text{mV}/^\circ\text{C}$, referenced to analog ground, pin 6 (example: $+230\text{mV} = +23.0^\circ\text{C}$). The DISABLE/ENABLE switch must be in the ENABLE position to control the setpoint from this pin.

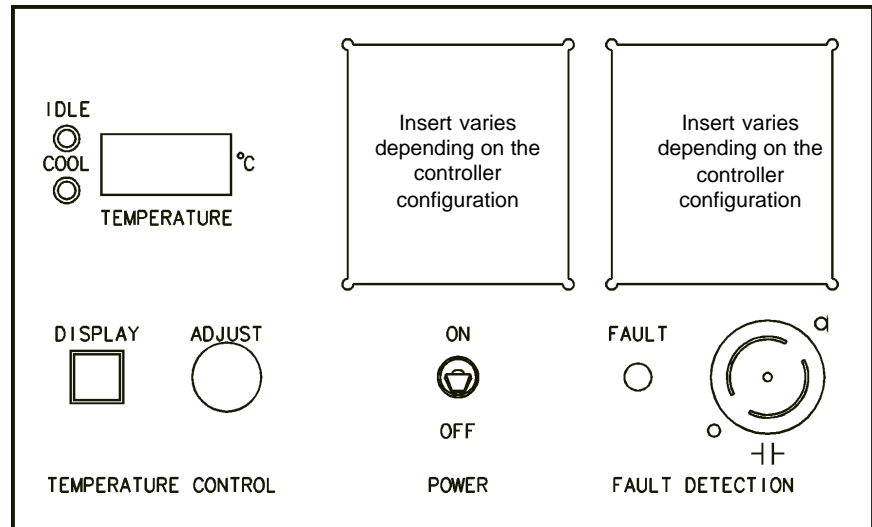
Access Receptacle Equivalent circuits



Access Receptacle Circuitry Details



Digital with Interlock Temperature Controller (Optional)



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 Control

The Cool and Idle LEDs 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 LEDs cycle on and off to indicate the duty cycle of the system. The unit can be in the Cool or the Idle mode, but never both at the same time. A balance between Cool and Idle controls the temperature.

Start Up

Before starting the unit, check all electrical and plumbing connections and make sure the recirculating system (the HX, the instrument being cooled, and the recirculation lines) has been properly filled with cooling fluid. Also make sure the facility water is turned on and the flow control valve is fully closed (see Section V, Flow Control).

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.

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

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

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

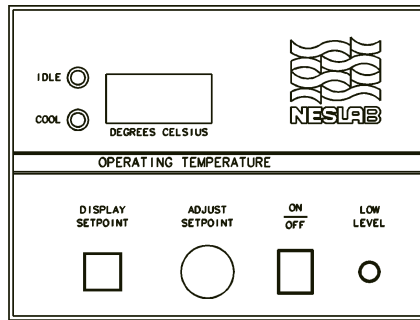
The optional low flow monitor is connected to a flow switch in the RETURN line. A low flow fault occurs when the flow rate of the returning cooling fluid drops below 0.3 gallons per minute (1.0 liters per minute).

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.

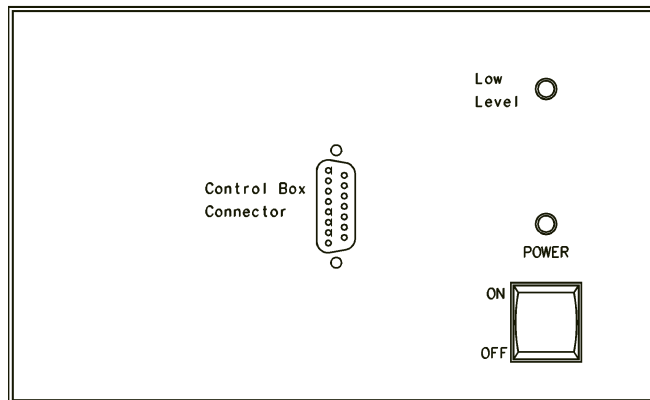
Interlock Relay Contacts

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.

Remote Digital Temperature Controller (Optional)



Remote Digital Temperature Controller - Front Panel



Remote 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.

Temperature Control

The Cool and Idle LEDs 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 LEDs cycle on and off to indicate the duty cycle of the system. The unit can be in the Cool or the Idle mode, but never both at the same time. A balance between Cool and Idle controls the temperature.

Start Up

Before starting the unit, check all electrical and plumbing connections and make sure the recirculating system (the HX, the instrument being cooled, and the recirculation lines) has been properly filled with cooling fluid. Also make sure the facility water is turned on and the flow control valve is fully closed (see Section V, Flow Control).

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.

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

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

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.

Flow Control

The flow control handle is located on the right side of the unit. The handle is connected to a valve that controls the flow of fluid to your application.

When the handle is in the vertical “+” position, the valve is open and all fluid is supplied to your application. When the handle is in the horizontal “0” position, the valve is closed and no fluid is supplied to your application. When the handle is between these two positions, the flow rate of the fluid is between full flow and no flow. Use a flow meter on the RECIRCULATING FLUID OUTLET to adjust the desired flow rate.

Ensure the flow control handle is in a slightly open position before starting the unit. Once the unit is running, slowly adjust the handle to the desired flow rate. Never start the unit with the handle in the full closed “0” position and never “crank” the valve wide open from the closed or slightly open position.

The pressure gauge next to the flow control valve (labelled RECIRCULATING PRESSURE) indicates the operating pressure of the system.

High and Low Pressure Cutout

High and low pressure cutouts prevent excessively high and low refrigeration pressures that can damage the unit. The cutouts are connected to a pressure gauge that monitors pressure at the suction side of the compressor.

In the event of a low refrigeration pressure fault, the unit will shut down and must be manually restarted.

In the event of a high refrigeration pressure fault, the unit will shut down. However, the unit will automatically restart once the refrigeration pressure drops below the cutout level.

Pressure Switch

An adjustable pressure switch, located next to the flow switch on the RECIRCULATING FLUID RETURN line, prevents the unit from operating under excessively high recirculating pressure. If the operating pressure exceeds the pre-set limit, the unit will shut down. The fault must be identified and corrected before the unit can be restarted.

If adjustment is required, contact our Service Department for assistance.

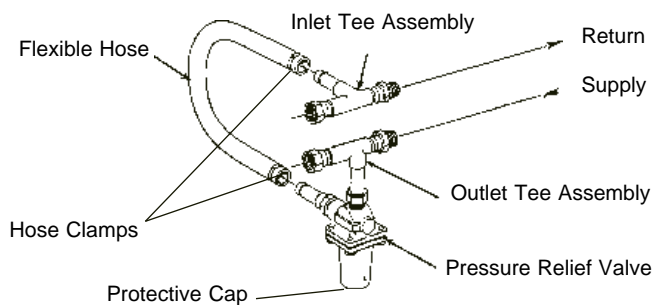
Pump Motor Overload Protector

An overload protector prevents the pump motor from exposure to excessively high current. If an overload condition occurs, due, for example, to a heavy work load, the overload protector shuts the unit down. The overload protector automatically resets after approximately two minutes. The source of the overload must be identified and corrected before the unit will restart.

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.

Section V Maintenance

Service Contracts

NESLAB offers on-site Service Contracts that are designed to provide extended life and minimal downtime for your unit. For more information, contact our Service Department. Phone numbers and addresses for all our Sales and Service Centers are located in the front of this manual (see Preface, After-sale Support) and on the back cover of this manual.

Cleaning

Periodically inspect the reservoir. 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 reduction in the cooling capacity.

Before changing the cooling fluid, raise the operating temperature of the unit to de-ice the reservoir. Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.

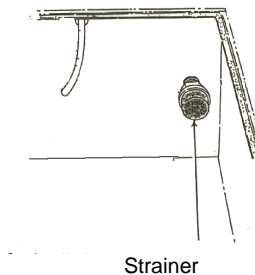
Pump Strainer

A wire mesh pump strainer is located in the reservoir on the pump suction line. If debris is drawn into the reservoir, the strainer will prevent the material from being drawn into the pump and damaging the pump vanes.

Inspect the strainer whenever the reservoir is checked for cleanliness (see Section V, Cleaning). If the strainer is visibly clogged, cleaning is required.

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

Cover the strainer with a baggie to catch any debris which may become free. Unscrew the strainer and rinse it with water. Replace the strainer. Refer to III, Filling Requirements for instructions on replacing cooling fluid.



Strainer

Section VI Troubleshooting

Checklist

Unit will not start.

Check house circuit breaker.

Ensure power source meets specified voltage, $\pm 10\%$. Refer to the serial number label on the rear of the unit to identify specific electrical requirements.

Make sure the facility water is connected to the FACILITY WATER INLET.

Unit will not circulate.

Check pump strainer (see Section V, Pump Strainer).

Check for obstructions or kinks in the tubing between the unit and the instrument being cooled.

Check pressure gauge reading. If reading is "0" with flow, the gauge may be faulty. Verify by placing a second gauge in the RECIRCULATING WATER OUTLET line.

Inadequate temperature control.

Check installation of unit for compliance with conditions in Section III.

Make sure instrument being cooled has not overcome the cooling capacity of the unit (see Section II, Specifications).

Service Assistance

If, after these troubleshooting steps, your unit fails to operate properly, contact our Service Department. Phone numbers and addresses for all our Sales and Service Centers are located in the front of this manual (see Preface, After-sale Support) and on the back cover of this manual. Before calling, please obtain the following information:

BOM number

Serial number

Voltage of unit

Voltage of power source

Temperature of facility water

Parts List

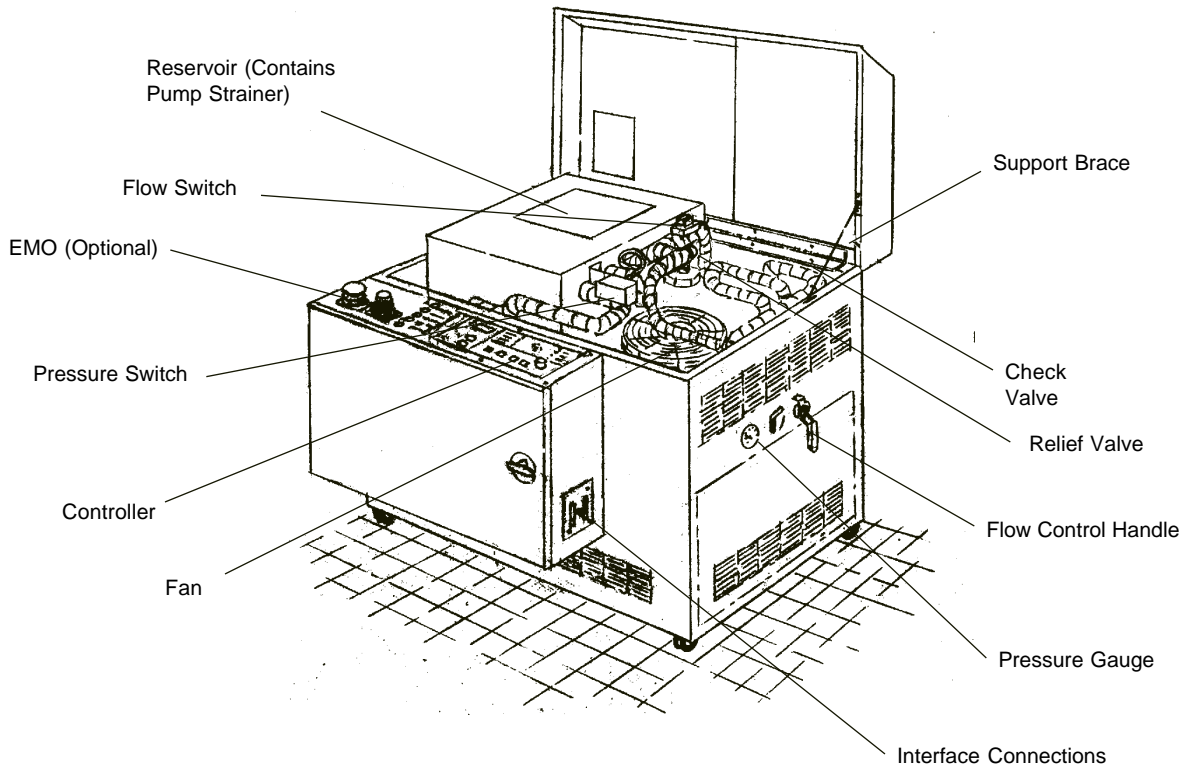
Our Service Department can provide you with a complete list of spare parts for your HX-540 Recirculating Chiller. Phone numbers and addresses for all our Sales and Service Centers are printed on the back cover of this manual. Before calling, please obtain the following information:

BOM number

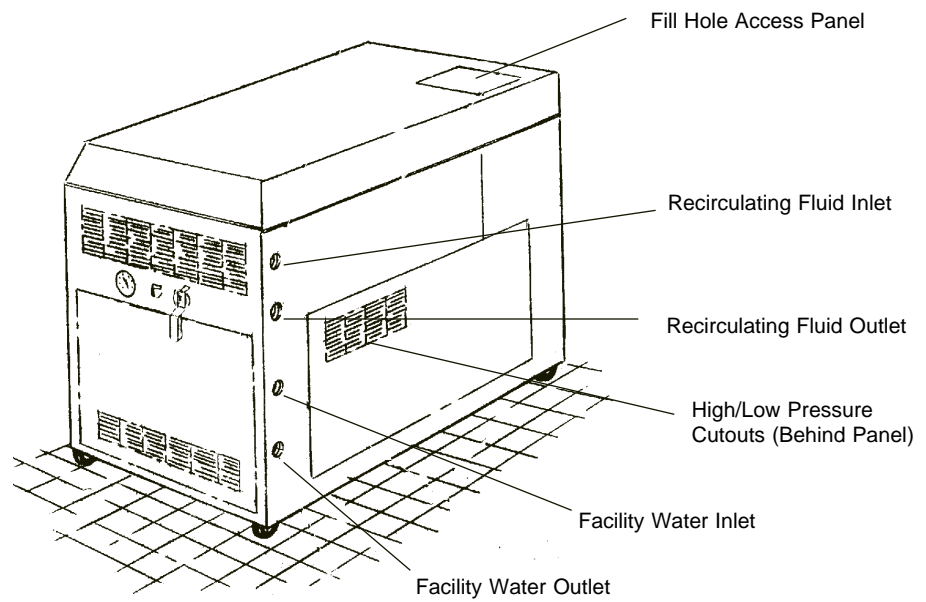
Serial number

Front View

Section VII Diagrams

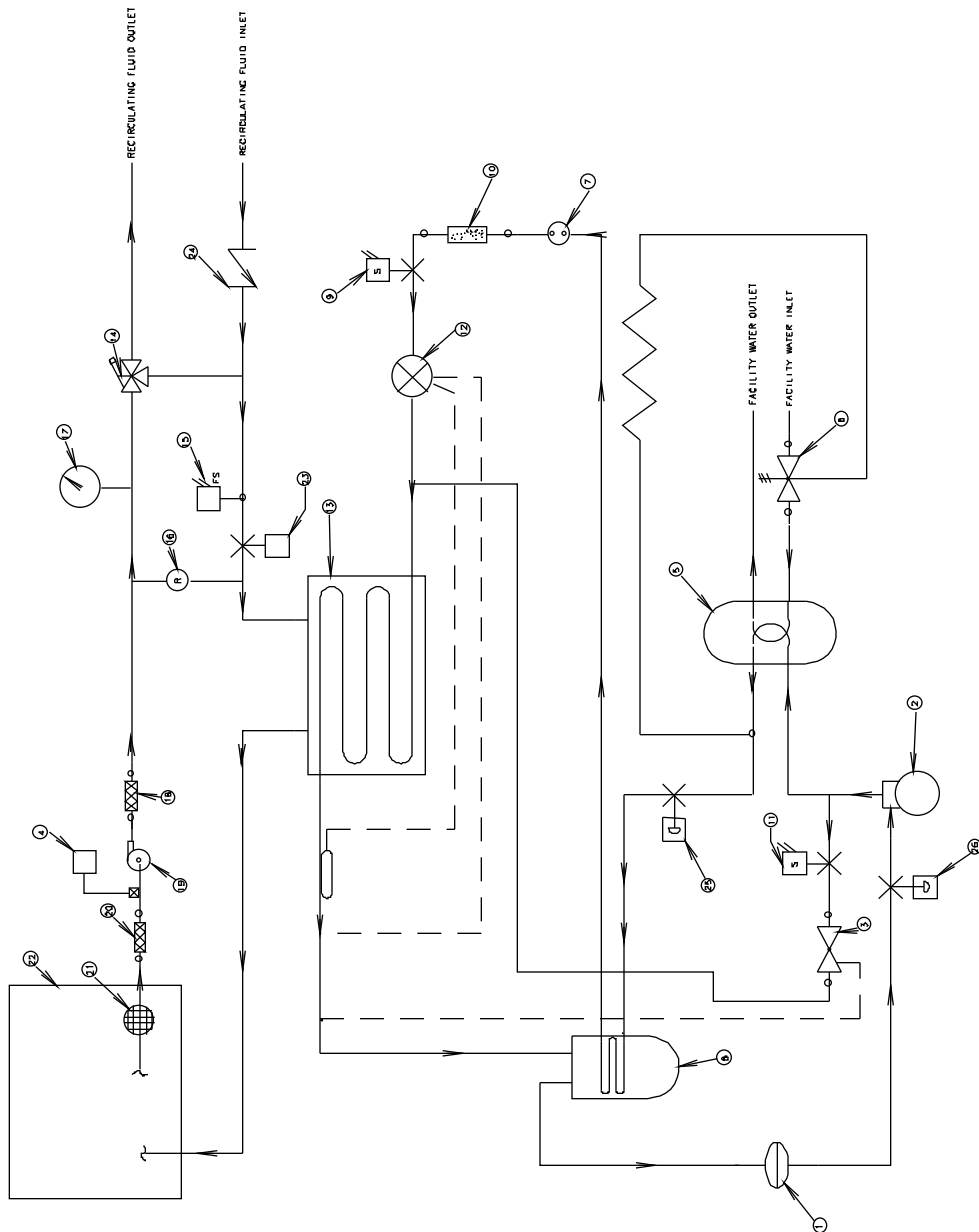


Rear View



Flow Diagram

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QTY	DESCRIPTION	REF ID	REF ID
28	1	LPC	REFRIGERATION-OUTLET
25	1	IPC	REFRIGERATION-OUTLET
24	1	CHECK VALVE	REFRIGERATION-OUTLET
23	1	PRESSURE SWITCH	40 PSIG OPEN 20 DIFF
22	1	RESERVOIR	
21	1	SUCTION SCREEN	
20	1	VIBRATION ELIMINATOR	0092108
19	1	PUMP	
18	1	VIBRATION ELIMINATOR	0092108
17	1	PRESSURE GAUGE	
16	1	RELIEF VALVE	1" 10-100 PSI
15	1	FLOW SWITCH	
14	1	BALL VALVE	
13	1	PLATE HEAT EXCHANGER	
12	1	TXV	
11	1	SOLENOID VALVE HOT GAS	009708
10	1	DRYER	
9	1	SOLENOID VALVE LIQUID LINE	009824
8	1	ACCUMULATOR	
7	1	SIGHT GLASS	
6	1	REGULATING VALVE	
5	1	RECEIVER/CONDENSER	
4	1	CUTOUT BUZZER HIGH TEMP.	
3	1	THYRISTOR VALVE	
2	1	COMPRESSOR	
1	1	SUBCOOLER	

HYDRAID 7-27-04
 SHELVEZ 7-27-04
 WELBY 7-28-04
 AS SHOWN
 STD HX340 R/A PUMP ASSEMBLY
 LOW TEMPERATURE
 F00352
 1 OF 1

Appendix A DeltaTemp Programming Software

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

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

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

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

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

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

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

NESLAB ONLINE

Mac: Conferences/Software/Macintosh

Windows: Conferences/Software/Windows

AMERICA ONLINE

Mac: Computing/software center/mac communications forum/industry connection/softarc

Windows: Computing/software center/communications programs

COMPUSERVE:

Mac: TWEUROPA/Teletools/FCMAC.ZIP

Windows: PCBBS/BBS programs/FC300.EXE

WORLD WIDE WEB

<http://www.softarc.com/try.htm>

Appendix B International Quick Reference Guides

HX-540 Kurzbedienungsanleitung

Installation

Stellen Sie das Gerät in einer sauberen Umgebung mit einfachem Zugang zu einem Gebäudewasseranschluß und einem Abfluß auf. Das Gebäudewasser muß den in der Anleitung festgelegten Anforderungen genügen, sonst wird die Leistung des Gerätes herabgesetzt. Unzureichende Wasserzufuhr kann zu einer Überhitzung des Kompressors und so zu einem Ausfall des Gerätes führen.

Vergewissern Sie sich, daß die Spannung Ihrer Stromanschlüsse mit der für das Gerät vorgesehenen Spannung übereinstimmt ($\pm 10\%$).

Die Schlauchanschlüsse des Gerätes befinden sich an der Rückseite und sind mit FACILITY WATER INLET und OUTLET und RECIRCULATING FLUID INLET und OUTLET bezeichnet. Bitte entfernen Sie die Gummiabdichtung von allen Anschlüssen. Schließen Sie den FACILITY WATER INLET-Anschluß an das Gebäudewasser und den FACILITY WATER OUTLET-Anschluß an den Abfluß an. Schließen Sie den RECIRCULATING FLUID INLET-Anschluß an den Ausgang Ihres Instruments und den RECIRCULATING FLUID OUTLET-Anschluß an den Eingang Ihres Instruments an.

Für den Betrieb bei allen Zirkulations- oder Umgebungstemperaturen muß eine nicht gefrierende Flüssigkeit verwendet werden. Die gewählte Flüssigkeit muß eine Viskosität von maximal 50 Centistokes bei der niedrigsten möglichen Betriebstemperatur haben.

Um das Reservoir zu füllen, öffnen Sie die Abdeckplatte in der linken hinteren Ecke der Gehäuseoberseite und entfernen Sie die Reservoirabdeckung, indem Sie die Flügelschrauben lösen. Füllen Sie das Reservoir bis 2 Zoll unterhalb des Randes (dieser Stand sollte erreicht werden, wenn das Gerät die gewünschte Betriebstemperatur erreicht hat). Wenn das zu kühlende Instrument und die Zirkulationsleitungen sehr viel Kühlfüssigkeit

aufnehmen können, sollten Sie zusätzliche Kühlfüssigkeit zur Hand haben, um gegebenenfalls nachfüllen zu können.

Inbetriebnahme

Vor Inbetriebnahme des Gerätes vergewissern Sie sich bitte, daß die Montagemuntern des Kompressors gelöst wurden und das Gebäudewasser angestellt ist. Überprüfen Sie, ob die elektrischen Anschlüsse und die Rohr- u. Schlauchanschlüsse sachgemäß installiert sind und daß das gesamte System mit Kühlfüssigkeit gefüllt ist.

Das Gerät muß vor dem Starten mindestens 12 Stunden an die Stromversorgung angeschlossen werden, damit das Öl im Kompressor erwärmt werden kann und sich von der Kühlfüssigkeit abscheiden kann.

Um das Gerät einzuschalten, müssen Sie den Hauptschalter auf „ON“ stellen. Die „COOL“- und „IDLE“-Anzeigen auf der Steuertafel geben den Status des Kühlsystems an. Die COOL-Anzeige leuchtet, wenn das Kühlsystem der Kühlfüssigkeit Wärme entzieht. Die HEAT-Anzeige leuchtet, wenn sich das Gerät im Hot Gas Bypass Modus befindet. Wenn die Temperatur der Kühlfüssigkeit sich der gewünschten Temperatur nähert, blinken die Anzeigen, um den Arbeitszyklus des Systems anzuzeigen.

Nach dem Ausschalten des Gerätes sollten Sie vor dem Wiedereinschalten ca. 5 Minuten warten, damit das Kühlsystem einen Druckausgleich durchführen kann. Beachtet man diese Wartezeit nicht, kommt es zu kurzen Schaltfrequenzen des Kompressors und eine Kühlung ist nicht möglich.

Um sich den Temperatur-Setpoint anzeigen zu lassen, drücken Sie den SETPOINT/ACTUAL

TEMP-Schalter und halten Sie ihn gedrückt. Um den Temperatur-Setpoint einzustellen, drücken Sie den Setpoint/Actual-Schalter, halten diesen, und drehen gleichzeitig den ADJUST-Schalter so lange, bis die gewünschte Temperatur in der Digitalanzeige angezeigt wird. Wenn die Temperatur eingestellt ist, lassen Sie den Setpoint/Actual-Schalter los. Die Digitalanzeige zeigt dann die Temperatur der Kühlflüssigkeit im Reservoir an.

Flußsteuerung

Der RECIRCULATION FLOW CONTROL Hebel kontrolliert die Durchflußmenge der Kühlflüssigkeit zu Ihrer Anwendung. In der „+“-Stellung wird die gesamte verfügbare Kühlflüssigkeit an die Anwendung abgegeben, in der „-“-Stellung wird keine Kühlflüssigkeit an die Anwendung abgegeben.

Wartung

Überprüfen Sie regelmäßig die Kühlflüssigkeit im Reservoir. Sollte eine Säuberung notwendig sein, spülen Sie das Reservoir mit einer speziellen Reinigungsflüssigkeit, die mit dem Umlaufsystem und der Kühlflüssigkeit kompatibel ist.

Das Kühlmittel sollten Sie regelmäßig erneuern. Wenn Sie das Gerät bei niedrigen Temperaturen betreiben, erhöht sich mit der Zeit der Wasseranteil in der Kühlflüssigkeit. Dies führt zum Verlust von Kühlkapazität.

Regelmäßiges Absaugen des Kondensator-Heizkörpers ist erforderlich. Die Reinigungshäufigkeit hängt von der Betriebsumgebung ab. Eine monatliche Überprüfung des Kondensators ist empfehlenswert. So werden Sie nach einigen Monaten einen Reinigungsrythmus gefunden haben.

Das Gerät ist mit einem Pumpenfilter ausgestattet. Der Filter sorgt dafür, daß kleine Teilchen und

Schmutzablagerungen nicht in die Pumpe gelangen und so die Pumpflügel beschädigen können.

Nach der Erstinstallation kann es zu einer Blockierung des Filters kommen. Die erste Reinigung sollte daher nach einer Woche erfolgen. Danach empfehlen wir eine monatliche Überprüfung des Filters. So können Sie nach einiger Zeit abschätzen, wie oft der Filter gereinigt werden muß.

Bevor Sie den Filter reinigen, ziehen Sie den Netzstecker aus der Steckdose und leeren Sie das Reservoir.

HX-540 Kvik reference.

Installation:

Opstilles i rene omgivelser.
Steder med meget støv skal undgås, og periodisk rensning skal udføres, hvis utilsigtet nedbrud skal undgås. Opbygning af støv vil medføre fald i kølekapaciteten og i værste fald overophedning af systemet.

Check at netspændingen er den nominelle 240V ± max. 10%.

Slangetilgang er på bagsiden mærket „FACILITY WATER INLET“ (ind) og „OUTLET“ (ud), samt Recirkulering „INLET“ og „OUTLET“. Inden tilslutning af fittings fjernes plaststøvkappen fra rørstudsene. „RECIRCULATING FLUID INLET“ tilsluttes den UDGANGEN på det emne, som skal TERMOSTATERES og „RECIRCULATING FLUID OUTLET“ til ind på emnet.

Fyldning af reservoiret foregår ved at fjerne panelet, som er forsynet med fingerskruer, og påfyld egnet rent kølevæske, max 5 cm fra toppen.

Betjening:

Før opstart checkes elektriske forbindelser, slangeforbindelser, væske stand, kompresseor og brugsvand er tilsluttet.

Systemet skal være tændt mindst 12 timer før det sættes igang.

Check hovedkontakten på badet. „Cool“ og „Idle“ LED viser status på badet.

Ønskes den instillede temperatur vist, hold da „Setpoint/Actual Temp“ kontakterne inde. Skal indstillingen ændres, skal der samtidig drejes på justeringsknappen.

Displayet vil skifte tilbage til aktuel temperatur.

Flow kontrol:

Drej på „RECIRCULATING FLOW CONTROL“ + for at åbne og - for at lukke.

Periodisk vedligeholdelse:

Check standen af væske periodisk. Check med mellemrum vakuumpumpen på pumpesiden, rens systemet og check for aflejringer, vækst, utætheder, check vakuumpumpen med kondenser og evt. filtre. Husk åben aldrig instrumentet uden strømmen er afbrudt, og strømkablet er taget ud!

Kortfattad Bruksanvisning för HX-540

Installation

Ställ maskinen i en ren miljö med lätt tillgång till kylningsvatten och ett vattenavlopp.

Kylningsvattnet måste möta de krav som är specificerade i instruktionerna annars minskas maskinens prestations förmåga.

Försäkra att spänningen är den samma som den som är given i instruktionerna $\pm 10\%$.

Röranslutningarna finns på baksidan av maskinen och är märkta "FACILITY WATER INLET/OUTLET" och "RECIRCULATING FLUID INLET/OUTLET". Ta bort de skyddande plast bitarna. Anslut "FACILITY WATER INLET" inpassningen till byggnadens kylvatten och "FACILITY WATER OUTLET" inpassningen till avloppet. Anslut "RECIRCULATING FLUID INLET" inpassningen till utsläppet av din anordning och "RECIRCULATING FLUID OUTLET" inpassningen till insläppet av din anordning.

För att fylla tanken, öppna luckan på den bakre vänstra delen av toppen på maskinen och lösgör skruvarna som håller den undre luckan på plats. Fyll tanken tills 2,5 cm återstår. Var beredd att fylla på om din anordning kräver extra vätska.

Vanligt kran vatten är den rekommenderade vätskan vid en temperatur mellan $+8^{\circ}\text{C}$ och $+80^{\circ}\text{C}$. Under $+8^{\circ}\text{C}$ måste en vätska som inte fryser användas. En blandning av vanligt vatten och etylenglykol (laboratorie kvalitet) föreslås.

Användning

Innan maskinen startas, kontrollera alla elektriska och alla rör anslutningar. Se till att cirkulations systemen har fyllts med vätska.

Var säker på att byggnads vattnet är påsatt.

På alla modeller från HX-200 till HX-750 måste maskinen vara kopplad till energikällan minst 12 timmar innan användning så att oljan tillåts att värmas upp och separera från köldmedlet.

Sätt start knappen på ON för att starta maskinen. COOL och IDLE på framsidan visar statusen på kylningssystemet. Cool lyser när värme tas bort från köldmedlet. Heat är på när "the hot gas bypass mode" används. När temperaturen närmar

sig den förbestämda önskade temperaturen kommer de två att växla.

Vänta 5 minuter innan maskinen sätts på igen efter att ha varit avstängd för att låta kylningstrycken att utjämnas. Ingen kylning kommer att utföras om inte trycken tillåts att utjämnas.

Temperatur Ändring

Håll Display knappen intryckt för att visa den önskade temperaturen. Håll Display knappen intryckt och vrid Adjust knappen för att ändra den önskade temperaturen. Släpp Display knappen efter att den önskade temperaturen visas på kontroll panelen. Temperaturen på vätskan i tanken visas nu på kontroll panelen.

Flödeskontroll

"RECIRCULATING FLOW CONTROL" handtaget kontrollerar flödet till din anordning. i "+" positionen får man fullt flöde, "-" positionen innebär inget flöde.

Periodiskt Underhåll

Inspektera vätskan i tanken periodiskt. Om rengöring är nödvändigt, spola tanken med en rengörings vätska som är förenlig med cirkulationssystemet och kylvätskan.

Kylvätskan bör bytas periodvis. När enheten används vid låga temperaturer kommer vätskans koncentration av vatten att öka vilket leder till en minskad kylningskapacitet.

Periodisk rengöring av kondensorn är nödvändig. Hur ofta rengöring är nödvändig beror på miljön. Vi rekommenderar en visuell inspektion av kondensorn varje månad efter installation. Efter flera månader kan det avgöras hur ofta kondensorn måste rengöras i framtiden.

Maskiner med PD och TU pumpar har ett filter. Filtret måste rengöras efter en veckas användning. Efter första rengöringen bör filtret inspekteras varje månad. Efter flera månader kan det avgöras hur ofta filtret måste rengöras.

Drag ur kontakten och töm tanken innan filtret rengörs.

HX-540, Handleiding voor snelle installatieprocedures

Installatie

Plaats het apparaat in een omgeving waar gebouwenwater en afvoer binnen handbereik zijn. De eisen van de waterfaciliteiten moeten overeenkomen met die gespecificeerd in de handleiding, anders zal het apparaat onvoldoende prestaties leveren.

Onvoldoende watertoevoer kan ertoe leiden dat de compressor oververhit raakt en het apparaat uitgeschakeld wordt.

Let erop dat de netspanning gelijk is aan het aangegeven voltage, $\pm 10\%$.

De slangaansluitingen zijn bevestigd aan de achterkant van het apparaat en zijn voorzien van de labels FACILITY WATER INLET en OUTLET, en RECIRCULATING FLUID INLET en OUTLET. Verwijder de plastic beschermingspluggen van alle slangaansluitingen. De FACILITY WATER INLET dient bevestigd te worden aan een watertoevoer en de FACILITY WATER OUTLET dient bevestigd te worden aan een afvoer. Bevestig de RECIRCULATING FLUID INLET aan de uitgang van uw applicatie en de RECIRCULATING FLUID OUTLET aan de ingang van uw applicatie.

Een non-freezing vloeistof wordt in het algemeen aanbevolen, indien u werkt bij omgevingstemperatuur. De gekozen vloeistof moet een viscositeit hebben van 50 Centistokes of minder wanneer circulatie gewenst is bij lage temperaturen..

Om het reservoir te vullen dient men het toegangspaneel aan de linkerachterkant te verwijderen door middel van het losdraaien van de duimschroeven. Vul nu het reservoir tot 2 inches van het maximum wanneer het apparaat de gewenste temperatuur heeft bereikt. Indien de vloeistoflevel van uw toepassingen en de toevoer leidingen voldoende zijn.

Operationeel gebruik

Alvorens het apparaat te starten, dient u ervan verzekerd te zijn dat de schroeven in de compressor losgedraaid zijn en dat er gebouwenwater is. Controleer alle elektrischen slangaansluitingen. Controleer ook of het systeem gevuld is met koelvloeistof.

Het apparaat dient 12 uur aangesloten te zijn aan de netspanning, zodat de olie verhit kan worden en gescheiden kan worden van de koelvloeistof.

Om het apparaat te starten moet men de schakelaar op "ON" zetten. De "Cool" en "Idle LEDs" aan de voorkant van het apparaat duiden de status van het koelsysteem aan. "COOL" is in werking wanneer het apparaat warmte van de koelvloeistof onttrekt, "HEAT" is in werking gesteld wanneer het apparaat in de Hot Gass Bypass stand is gesteld. Als de ingegeven temperatuur bereikt is zal de LED switchen.

Wanneer het apparaat uitgeschakeld is, gelieve 5 minuten te wachten alvorens u het apparaat weer in werking stelt. Deze tijd is nodig om drukken in het koelsysteem gelijk te stellen.

Indien dit niet gebeurt, zal er short-cycle optreden binnen de compressor en er vindt geen koeling plaats.

Om de temperatuur set-point af te kunnen lezen van de display, houdt u de Setpoint/Actual Temp knop ingedrukt. Om de temperatuur set-point aan te passen, houdt u de Setpoint/Actual Temp knop ingedrukt en draait u de Adjust knop net zolang, totdat de gewenste temperatuur set-point op de display af te lezen is.

Als de set-point bereikt is kunt u de Setpoint/Actual knop loslaten. De display zal nu de temperatuur weergeven van het koelvloeistof in het reservoir.

Het apparaat kan uitgerust zijn met een van de meerdere optionele regelaars. Mocht dit het geval zijn, kunt u het beste de gedetailleerde handleiding raadplegen betreffende het gebruik daarvan.

Flow Control

Met de RECIRCULATING FLOW CONTROL kunt u het debiet van uw applicatie regelen. In de "+" positie geeft u een volledig debiet, de "-" positie geeft u geen debiet.

Periodiek Onderhoud

De vloeistof dient regelmatig gecontroleerd te worden. Indien reiniging noodzakelijk is, zal het reservoir gespoeld moeten worden met een vloeistof, welke vergelijkbaar is met het circulatiesysteem en de koelvloeistof.

De koelvloeistof dient regelmatig vervangen te worden. Wanneer u werkt met lage temperaturen zal de concentratie van het water in de koelvloeistof gedurende die tijd toenemen, wat verlies van koelcapaciteit tot gevolg kan hebben.

Periodiek lucht vrijmaken van de condensor is noodzakelijk. Het aantal malen dat dit moet gebeuren hangt af van de omgeving waar het apparaat staat opgesteld en gebruikt wordt. Wij raden een algemene maandelijkse inspectie van de condensor aan na de installatie. Na enkele maanden zal duidelijk zijn hoe vaak men het apparaat moet reinigen.

Het apparaat heeft een pompafvoer. Indien vuil in het systeem aanwezig is, zal de afvoer ervoor zorgen dat het materiaal niet in de pomp terecht komt en daardoor de pomp niet beschadigd.

Nadat het apparaat geïnstalleerd is zou de afvoer verstopt kunnen raken. De afvoer zal in de eerste week na de installatie schoongemaakt moeten worden. Nadat dit gebeurt is, is een maandelijkse inspectie aan te raden. Na enkele maanden zal duidelijk zijn hoe vaak men de afvoer moet reinigen.

Alvorens de afvoer te reinigen, gelieve het apparaat uit te schakelen en het reservoir te ledigen.

Kortfattad Bruksanvisning för HX-540

Installation

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Drag ur kontakten och töm tanken innan filtret rengörs.

NOTICE D'UTILISATION

HX 540

INSTALLATION

Installer l'appareil dans un environnement propre avec un accès facile à une arrivée d'eau. Cette source d'eau doit correspondre à ce qui est spécifié dans la notice pour ne pas altérer les performances de l'équipement. Une source non conforme pourrait causer une surchauffe du compresseur et un arrêt de l'appareil.

S'assurer que la tension électrique soit celle requise à $\pm 10\%$.

Les connexions sont situées à l'arrière et référencées :

- " Facility water inlet "
- " Facility water outlet "
- " Recirculating fluid inlet "
- " Recirculating fluid outlet "

Retirer les embouts plastique. Connecter le " Facility water inlet " vers l'arrivée d'eau ; le " Facility water outlet " au robinet; le connecteur " Recirculating fluid inlet " à la sortie de votre application et le " Recirculating fluid outlet " à l'entrée.

Utiliser un fluide antigel dont la viscosité doit être inférieure à 50 centistokes à la température la plus basse.

Pour remplir le réservoir, ouvrir la tôle en haut à gauche et retirer le couvercle en dévissant. Remplir jusqu'à 2 " pouces " du sommet (niveau). Si le volume total à refroidir est important, il convient d'avoir une réserve de fluide immédiatement disponible sous la main pour ne pas désamorcer la pompe.

MISE EN ROUTE

S'assurer au préalable que les écrous de montage sont desserrés et que l'alimentation en eau est connectée. Vérifier les connexions électriques, ainsi que le remplissage des tuyaux de circulation. Connecter l'appareil à la source électrique 12 heures avant utilisation pour chauffer et séparer l'huile du réfrigérant.

Mettre en route en appuyant sur ON. Les diodes " Cool " et " Idle " renseignent sur le mode de fonctionnement. " Cool " est allumé quand le refroidisseur extrait de la chaleur au fluide; " Heat " est allumé quand il est en mode " BY-PASS " gaz chaud. Lorsque la température souhaitée est atteinte, la diode s'éteint et s'allume.

Après avoir éteint l'appareil, attendre environ 5 minutes avant de le rallumer, pour un bon équilibrage des pressions, autrement, le cycle serait trop bref et le refroidissement n'aurait pas lieu.

Pour afficher la température souhaitée, maintenir appuyé l'interrupteur et tourner le bouton de réglage jusqu'à ce que la température souhaitée soit affichée. Relâcher ensuite l'interrupteur. L'affichage indique alors la température du fluide dans le réservoir.

Votre refroidisseur est peut-être équipé avec d'autres types de contrôleurs de température. Veuillez, dans ce cas, vous référer au manuel d'instructions.

CONTROLEUR DE DEBIT

La poignée " Recirculating flow control " règle le débit de recirculation. En position " + ", votre application reçoit un débit maximum; en position " - ", il n'y a plus de débit.

MAINTENANCE PREVENTIVE

- Vérifier régulièrement le niveau du réservoir,
- Changer de temps à autre le liquide utilisé,
- En cas de nettoyage, rincer avec un produit de lavage compatible,
- Aux basses températures, la concentration en eau a tendance à augmenter ce qui peut générer une perte de puissance de refroidissement,
- Avant de changer de liquide, recirculer à une température plus élevée pour réchauffer le serpentin,
- Nettoyer régulièrement selon les conditions de travail la grille d'aspiration. Nous recommandons d'effectuer la première inspection du condenseur un mois après l'installation,
- Les modèles fonctionnent avec une pompe équipée d'un filtre qui retient les impuretés. Il est recommandé de nettoyer ce filtre après la première semaine et, ensuite, une fois par mois. Ce nettoyage s'effectue après avoir débranché l'appareil et vidangé le réservoir

PROCEDIMIENTOS DE OPERACION DE REFERENCIA RAPIDA PARA EL HX-540

INSTALACION

Sitúe la unidad en un entorno limpio con fácil acceso a la instalación de agua de enfriamiento y un desagüe. Los requerimientos de la instalación de agua deben adaptarse a las especificadas en el manual de instrucciones o el funcionamiento de la unidad se verá mermado. Un suministro de agua inadecuado podría causar que el compresor se sobrecalentara y se apagara la unidad.

Asegúrese de que el voltaje de la fuente de energía sea igual que el voltaje especificado, $\pm 10\%$.

Las conexiones de tuberías están situadas en la parte trasera de la unidad y están marcadas como FACILITY WATER INLET y OUTLET. Saque los protectores de plástico de todas las conexiones de tuberías. Conecte el adaptador FACILITY WATER INLET a la instalación de agua de enfriamiento y el adaptador FACILITY WATER OUTLET a un desagüe.

Conecte el adaptador RECIRCULATING FLUID INLET a la salida de su aplicación y el adaptador RECIRCULATING FLUID OULET a la entrada de su aplicación.

Se necesita un fluido no congelante para operación a cualquier temperatura de ambiente o de recirculación. El fluido seleccionado debe tener una viscosidad de 50 centistokes o menos a la temperatura de funcionamiento más baja.

Para llenar el reservorio, abra el panel de acceso al reservorio por la esquina trasera izquierda y saque la tapa del reservorio desatornillando los tornillos. Llene el reservorio hasta dos pulgadas del tope cuando la unidad esté a la temperatura de funcionamiento deseada. Si la capacidad de fluido de sus líneas de aplicación y recirculación son significativas, tenga fluido extra a mano.

OPERACION

Antes de poner en marcha la unidad, asegúrese de que las tuercas de montaje del compresor se han aflojado y que la instalación del agua está conectada. Compruebe todas las conexiones eléctricas y de tuberías. Asegúrese de que el sistema circulador se ha llenado con fluido de enfriamiento.

La unidad debe conectarse a la red de energía durante al menos 12 horas para permitir que el aceite se caliente y se separe del refrigerante.

Para poner en marcha la unidad, ponga el interruptor de encendido en posición ON. Los LED Cool y Idle del panel frontal indican la situación del sistema de refrigeración. Cool está en marcha cuando la unidad está eliminando calor del fluido de enfriamiento. Heat está en marcha cuando la unidad está en el modo by-pass gas caliente. A medida que la temperatura de funcionamiento se aproxima al punto fijado, el LED ciclará.

Cuando se apaga la unidad, espere aproximadamente cinco minutos antes de volver a ponerla en marcha para dar tiempo para que las presiones de refrigeración se equalicen. Si no se permite equalizarse las presiones, el compresor se cortocircuitará y no enfriará.

Para que el punto de ajuste de temperatura aparezca en pantalla, mantenga presionado el interruptor Setpoint/Actual Temp. Para fijar el punto de ajuste de temperatura, mantenga presionado el interruptor Setpoint/Actual Temp y gire el botón ADJUST hasta que la pantalla digital indique el punto de ajuste de temperatura deseado. Una vez fijado el punto de ajuste, suelte el interruptor Setpoint/Actual Temp. La pantalla indicará la temperatura del fluido en el reservorio.

La unidad puede equiparse con uno de los varios controladores opcionales. En este caso, refiérase al manual de instrucciones para ver más detalles de su operación.

CONTROL DE FLUJO

El mango RECIRCULATING FLOW CONTROL controla la escala de flujo a su aplicación. En la posición + recibirá flujo completo, en la posición - no hay flujo.

MANTENIMIENTO PERIODICO

Inspeccione periódicamente el fluido del reservorio. Si es necesaria una limpieza, rocíe el reservorio con un fluido de limpieza compatible con el sistema de circulación y el fluido refrigerante.

El fluido refrigerante debe sustituirse periódicamente. Cuando se funciona a baja temperatura, la concentración de agua en el fluido refrigerante aumentará con el tiempo, ocasionando una pérdida de capacidad refrigerante.

Es necesario un vaciado periódico de las aletas del condensador. La frecuencia de limpieza depende del entorno en que funciona el aparato. Recomendamos una inspección visual mensual del condensador después de la instalación inicial. Después de varios meses, quedará establecida la frecuencia de limpieza.

La unidad tiene un filtro. Si hay residuos en el sistema, el filtro prevendrá que el material entre en la bomba y dañe las paletas de la bomba.

Después de la instalación inicial, el filtro puede bloquearse. El filtro debe limpiarse después de la primera semana de la instalación. Después de esta primera limpieza, se recomienda una inspección visual mensual. Después de varios meses, se establecerá la frecuencia de limpieza.

Antes de limpiar el filtro, desenchufe el aparato y vacíe el reservorio.

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 rescission 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.