

HTD-I Water-Cooled Galden[®] Chiller

NESLAB Manual P/N 000806
Rev. 09/09/97

Instruction and Operation Manual

HTD-I Water-Cooled Galden® Chiller

PREFACE	
	Compliance 4
	Unpacking 4
	Shipping List 4
	After-sale Support 4
SECTION I	
Safety	
	Warnings 5
	Material Data Safety Sheets 5
SECTION II	
General Information	
	Description 6
	Specifications 6
SECTION III	
Installation	
	Site 8
	Electrical Requirements 8
	Plumbing Requirements 9
	Fluids 10
	Filling Requirements 10
SECTION IV	
Operation	
	Start Up 11
	Front Panel Controls 12
	Front Panel Gauges 13
	Rear Panel Controls 13
	Control Display 14
	Indicator Lamps 15
	Failure and Warning Condition Table 18
	Changing a Value 20
	Controller Displays 20
	Error Messages 27
SECTION V	
Special Features	
	Heater Package 30
	Pump Motor Overload Protector 30
	Compressor Motor Overload Protector 30
	Pressure Relief Valve 31
	High Pressure Cutout 31
	Low Pressure Cutout 32
	High Temperature Cutouts 32
	Cabinet High Temperature Cutout 32
	Electrical Interlocks 32
	Tank Relief Valves 32

	High Injector Temperature	33
	Phase Voltage Monitor	33
	Temperature Control	33
	Flow Monitors	33
	Low Level Monitors	33
	Temperature Sensor	33
	Accessory Connections	34
SECTION VI		
Maintenance		
	Service Contracts	35
	Draining	35
	Reservoir Cleaning	36
	Filter Cartridge Cleaning	36
	Preventive Maintenance	37
SECTION VII		
Troubleshooting		
	Troubleshooting	38
SECTION VIII		
Spare Parts List		
	Critical Spare Parts List	39
	Common Spare Parts List	40
SECTION IX		
Diagrams		
	Flow Diagram	41
	Wiring Diagrams	42

HDT-I Quick Reference Guide

Description

The HTD-I Water-Cooled Chiller is designed to provide a continuous flow of Galden® heat transfer fluid at a constant temperature and flow rate. The unit consists of 2 water-cooled refrigeration systems each with a fluid reservoir, fluid recirculation pump and a microprocessor temperature controller. A 5 kilowatt heater is located in each fluid reservoir.

Specifications

Refer to page 6 for each channel's specifications.

Site

Locate the unit in a laboratory or clean industrial environment where ambient temperatures are inside the range of +68°F to +86°F (+20°C to +30°C). The unit will retain its full rated capacity with cooling water temperatures to approximately 86°F (30°C). Above 86°F, derate the cooling capacity 1% for every 1°F above 86°F.

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

Electrical Requirements

Control

Rated Voltage: 208VAC ±10%, 50/60Hz, 1Ø

Rated Current: 5Amps

Electrical Requirements

Power

Rated Voltage: 208VAC ±10%, 50/60Hz, 3Ø

Rated Current: 63Amps

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

The unit construction provides extra protection against the risk of electrical shock by grounding appropriate metal parts. It is the user's responsibility to assure that a proper ground connection is provided to the unit.

Each channel is provided with a 4-conductor line cord for power and a 3-conductor line cord for control.

The wiring code is:

Phase ¹ A	U	BLK
Phase ² B	V	WHT
Phase ³ C	W	RED

The green wire is safety ground and must be attached to the ground bar.

NFPA-79, Section 7.8.1, Exception No2, allows this machine to have the main disconnect remotely mounted "through a flexible cord, cable or conduit providing the disconnect means is in sight from, readily accessible to, and no more than 20 feet (6m) from the machine operator."

Plumbing Requirements

The coolant plumbing connections are located on the rear of the unit. The connections are ½" Swagelock fittings. Connect the SUPPLY fittings to the application's inlet. Connect the RETURN fittings to your application's outlet.

Keep the distance between the chiller and your application as short as possible, and use the largest diameter tubing practical. The tubing should be straight and without bends. If diameter reductions are needed make them at the inlet and outlet of your application, not at the chiller.

The reservoir DRAIN connections are on the back of the unit. They are Nupro brass plug valves with a ¾" O.D. Swagelock connection.

Start Up

Before starting check all electrical connections and ensure the plumbing connections are correctly made to the fittings on the rear of the unit.

To place the chiller in "off" mode (power available but each channel is off)

-connect power cord to 208V 3Ø supply

-connect control cord to 208V 1Ø supply

-place main and control power breakers in closed position

-unit is now in "off" mode (white POWER lamp will illuminate)

-ensure the EMO (Red Emergency Stop Button) is out

-the cover must be on the power box or the power box interlock placed in the maintenance position

-the cover must be on the heater box or the heater box interlock placed in the maintenance position

To start the channel

-depress the ON/OFF or, if channel is in remote, the remote START button

-the chiller will start as long as no failure conditions are present (channel UNIT OK and RUNNING LEDs illuminated)

To stop the channel

-depress the ON/OFF or, if channel is in remote, the remote STOP button

NOTE: Any failure will place the chiller into the "off" mode.

NOTE: Opening the power, depressing the chiller STOP switch or activating the Emergency Stop Button (EMO) switch places the chiller in "off" mode.

Changing a Value

The **YES** key increments the value. The **NO** key decrements the value. The display will flash as soon as either key is depressed, and will continue to flash until the **ENTER** key is pressed to accept the new value.

The new value will not be used by the controller until the **ENTER** key is depressed and the display stops flashing. If the **NEXT** or **LAST** key is pressed while the value is flashing, the new value will not be accepted. The display will stop flashing and the original value will be displayed. In this case the **NEXT** or **LAST** key can be used to abort data entry. The display will not sequence unless the **NEXT** or **LAST** key is depressed again.

The controller will not allow you to enter a value above the maximum or below the minimum value, or any illegal value. If you try to enter an illegal value the display will revert to its original value when the last digit is entered.

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. This label indicates 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

NOTE: A copy of these instructions is attached to the crate's exterior surface.

Remove the front panel. The panel will serve as a ramp.

Remove the remaining side panels as one piece by unscrewing the lag bolts which hold the sides to the base.

Mount the ramp to the base and install lag bolts to secure the ramp to the base.

Remove the support and strapping.

Extend the four leveling feet on the chiller and then slowly raise the chiller evenly off the support rails.

Remove the support rails by loosening the lag screws.

Lower the chiller onto the castors and then slowly push the chiller towards the ramp.

Reverse these directions to repackage the chiller.

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.

Shipping List

TEL HTD-I Chiller	Test data
Exhaust ring with 4 mounting screws	System verification checklist
Control system power cord	Flow Diagram
Main power cord	Wiring diagrams (3 pages)
Declaration of Conformity for CE Mark	Operator's manual
QA checklist	

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. Before calling, please refer to the serial number label on the rear of the unit to obtain the following information (see Section II, Description for

serial number label location).

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, please contact our Sales Department (see 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 cause damage.

Observe all warning labels.

Never remove warning labels.

Never operate damaged or leaking equipment.

Never operate the unit without fluid in the reservoir.

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

Always empty the reservoir before moving the unit.

Never operate equipment with damaged power cords.

Refer service and repairs to a qualified technician.

In addition to the safety warnings listed above, warnings are posted throughout the manual. 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.

Material Data Safety Sheets

Galden® HT-200	Ausimont USA, Inc. PO Box 26 Thorofare, NJ 08086-0026 609-853-8119
LOCTITE®	LOCTITE Corporation 705 North Mountain Road Newington, CN 06111 203-278-1280
De-Ox Anti-Oxidant	IlSCO 4730 Madison Road

Section II General Information

Description

The HTD-I Water-Cooled Chiller is designed to provide a continuous flow of Galden® heat transfer fluid at a constant temperature and flow rate.

The unit consists of 2 water-cooled refrigeration systems, 2 fluid reservoirs, 2 fluid recirculation pumps and 2 microprocessor temperature controllers. A 5 kilowatt heater is located in each fluid reservoir.

Specifications

Temperature Range

-20°C to 150°C

Reservoir Volume

5 Gallons
19 Liters

Unit Dimensions¹ (Outer Envelope) (H x W x D)

59 x 31 x 34 Inches
149.9 x 81.3 x 86.4 Centimeters

Frame Dimensions (H x W x D)

55 x 31 x 34 Inches
139.7 x 78.7 x 86.4 Centimeters

Cooling Capacity²

1050 watts @ -10°C
962 Kcal @ -10°C
3580 BTU/Hr @ -10°C

Heating Capacity

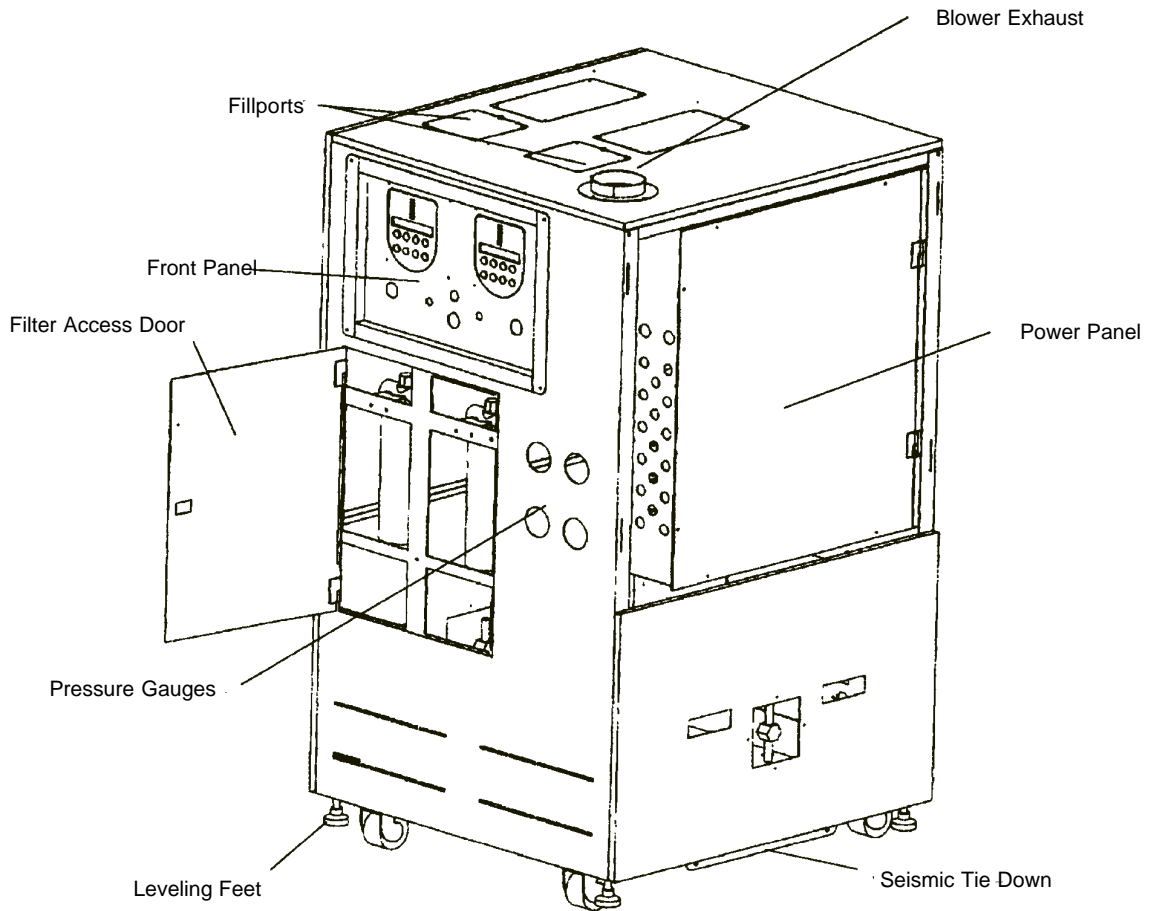
5000 watts @ 208V
4300 Kcal @ 208V
17050 BTU/Hr @ 208V

15 LPM @ 5 Kg/Cm²
4 GPM @ 71PSIG

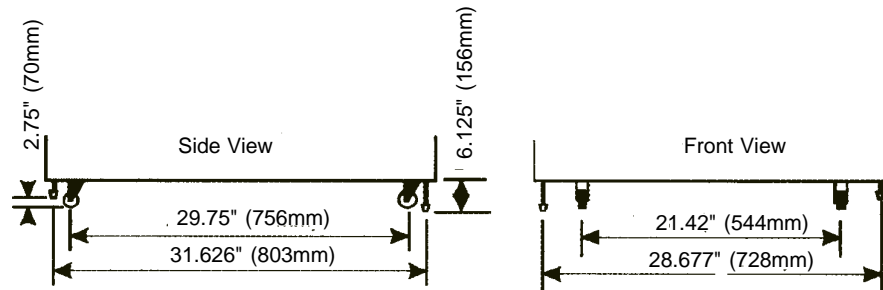
1. Includes casters.

2. Cooling capacities were obtained at 30°C ambient using HT-200 Galden® heat transfer fluid with 208VAC, 50Hz power. Cooling capacities vary depending on the fluid temperature, ambient temperature and cooling fluid .

2.208VAC, 50 Hz power.



The unit is equipped with four lockable casters and leveling feet. The leveling feet can be retracted $2\frac{3}{4}$ " (70mm) from the floor and extended $6\frac{1}{8}$ " (156mm) from the unit's case bottom.



Section III Installation

Pumping Capacity³

Site

Locate the unit in a laboratory or clean industrial environment where ambient temperatures are inside the range of +20°C to +30°C (+68°F to +86°F).



The unit will retain its full rated capacity with cooling water temperatures to approximately 30°C (86°F). Above 30°C, derate the cooling capacity 1% for every 0.5°C above 30°C.

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

Electrical Requirements



The unit construction provides extra protection against the risk of electrical shock by grounding appropriate metal parts. It is the user's responsibility to assure that a proper ground connection is provided to the unit.

Control

Rated Voltage: 208VAC ±10%, 50/60Hz, 1Ø

Rated Current: 5Amps

Power

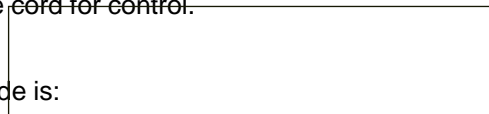
Rated Voltage: 208VAC ±10%, 50/60Hz, 3Ø

Rated Current: 63Amps

Make sure the voltage of the power source meets the specified voltage ±10%.

The prototype is provided with a 4-conductor line cord for power and a 3-conductor line cord for control.

The wiring code is:



Phase A	208VAC
Phase B	208VAC
Phase C	208VAC

The green wire is safety ground and must be attached to the ground bar.

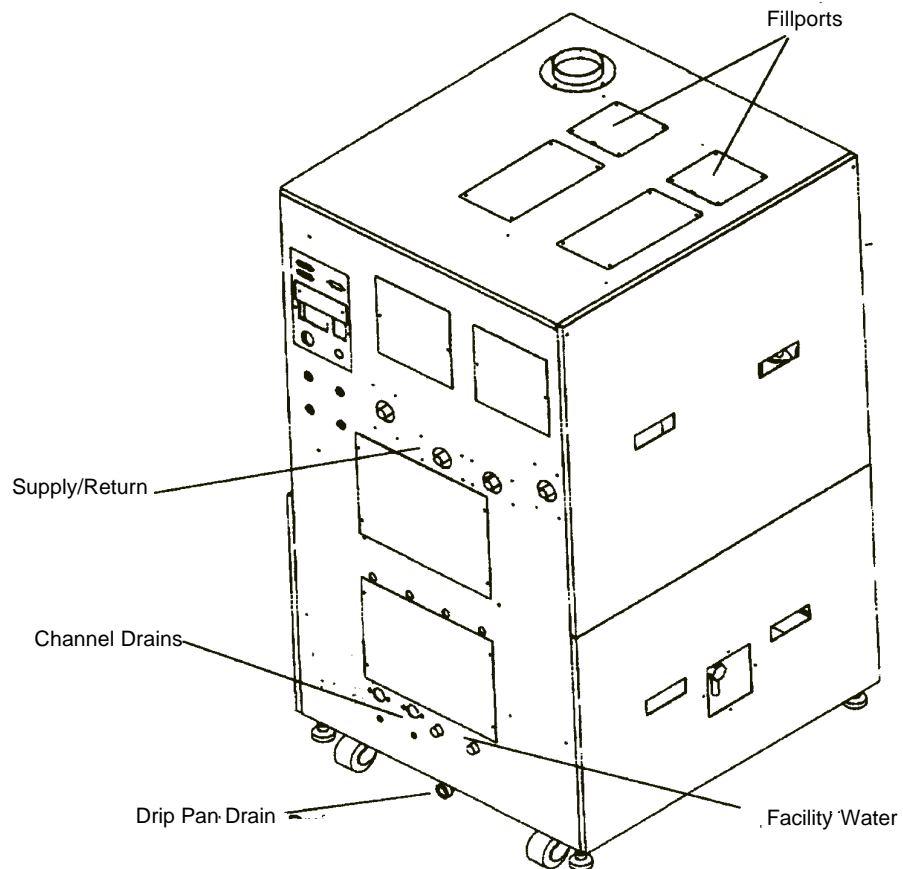
NFPA-79, Section 7.8.1, Exception No 2, allows this machine to have the main disconnect remotely mounted "through a flexible cord, cable or conduit providing the disconnect means is in sight from, readily accessible to, and no more than 20 feet (6m) from the machine operator."

Plumbing Requirements

The plumbing connections are located on the bottom rear of the unit. The connections are ½" Swagelock fittings. Connect the SUPPLY fitting to the inlet of the application. Connect the RETURN fittings to the application outlet.

Keep the distance between the chiller and your application as short as possible, and use the largest diameter tubing practical. The tubing should be straight and without bends. If diameter reductions are needed make them at the inlet and outlet of your application, not at the chiller.

The reservoir DRAIN connections are also on the rear of the unit. They are Nupro brass plug valves with a ¾" O.D. Swagelock connection. The drain outlet is located directly below the drain valve handle.





The unit is designed to use Galden® HT200 or Fluorinert 4236 as a heat transfer fluid..



Do not use water as a substitute fluid.

Never use flammable or corrosive fluids with the unit. Do not use automobile antifreeze. Commercial antifreeze contains silicants that can damage the pump seals and cause leaks. Use of automobile antifreeze will void the manufacturer's warranty.

Filling Requirements

Remove the reservoir access cover and then the filler cap from the top of the reservoir. Using a funnel, carefully fill the reservoir with fluid.

Fill the reservoir until the ADD FLUID LED on the microprocessor extinguishes.

The amount of recirculating fluid required depends on the total requirements of the application system. If substantial lengths of recirculating lines are used, add enough fluid to compensate for their volume. The maximum reservoir volume is 5 gallons (19 liters).

Replace the filler cap and access panel.

Section IV Operation

Start Up

Before starting the unit check all electrical connections and ensure the plumbing connections are correctly made to the fittings on the rear of the unit.

To place the chiller in "off" mode (power available but each channel is off)

-connect power cord to 208V 3Ø supply

-connect control cord to 208V 1Ø supply

-place main and control power breakers in closed position

-unit is now in "off" mode (white POWER lamp will illuminate)

-pull out the EMO (Red Emergency Stop Button)

-the cover must be on the power box or the power box interlock placed in the maintenance position

-the cover must be on the heater box or the heater box interlock placed in the maintenance position

To start either channel

-depress the ON/OFF or, if channel is in remote, the remote START button

-the chiller will start as long as no failure conditions are present (channel UNIT OK and RUNNING LEDs illuminated)

To stop either channel

-depress the ON/OFF or, if channel is in remote, the remote STOP button

NOTE: Any failure will place the chiller in the "off" mode.

NOTE: Removing the power or heater box cover, depressing the chiller STOP switch or activating the Emergency Stop Button (EMO) switch places the chiller in "off" mode.

Front Panel Controls

1 POWER light (white)

The POWER light indicated that the main disconnect circuit breaker is on, the phase voltage monitor is operational, and all electrical enclosure doors and interlocks are set.

28 status indicators LEDs (14/channel)

2 vacuum florescent displays, alphanumeric, 10 character (1/channel)

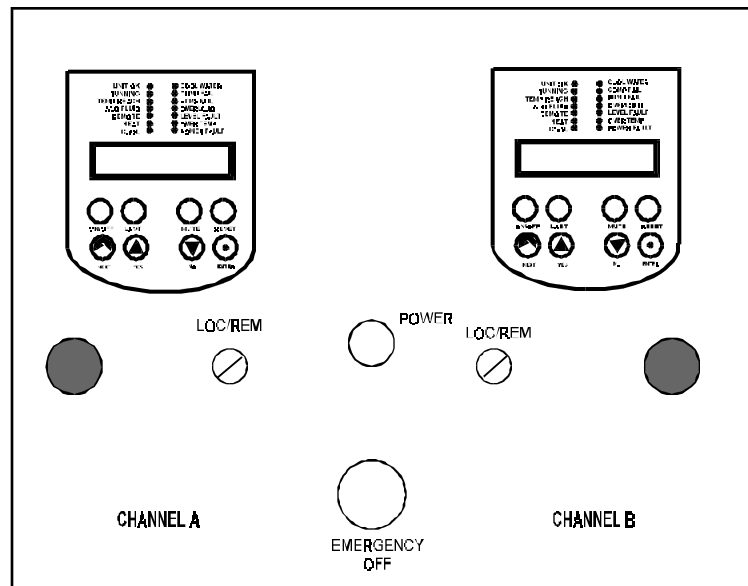
16 control switches, low profile pressure sensitive (8/channel)

1 EMO emergency stop button, push-pull

2 warning/failure buzzers (1/channel)

2 LOCAL/REMOTE selector switches (1/channel)

Temperature control is done through PID algorithms. Heat and cool have separate PID parameters. PID values can be changed, see Display section.



Front Panel Gauges

2 fluid supply pressure gauges. Reads the fluid pressure at each channel outlet.

2 fluid filter inlet pressure gauges. Reads the fluid pressure at each channel filter inlet.

Rear Panel Controls

Main Disconnect Circuit Breakers

The unit is provided with:

1 63 AMP GFI circuit breaker for the power system

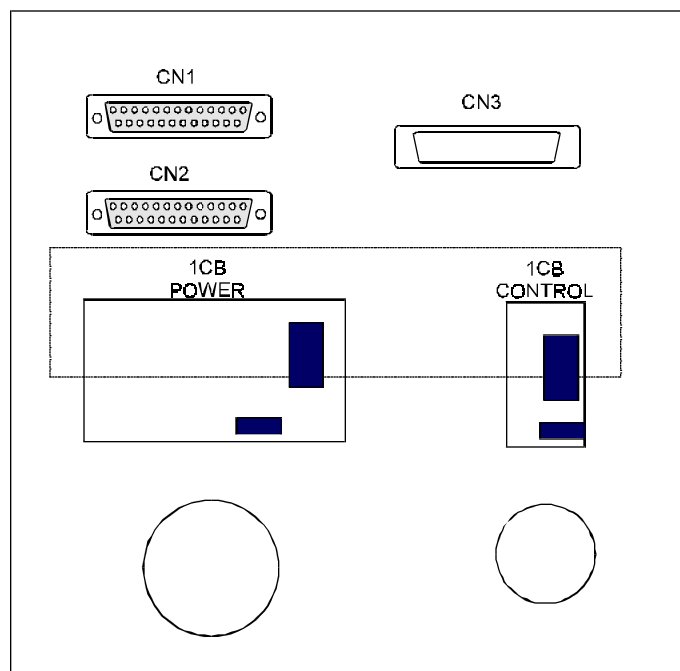
1 16 AMP GFI circuit breaker for the control system

2 25-pin D-subminiature connectors (CN1, CN2) for RS-232 communications (1/channel)

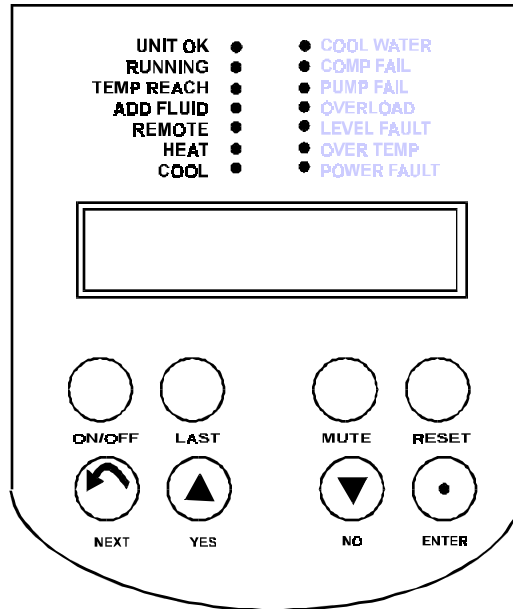
1 24-pin Type 57F connector (CN3) for control signal I/O

1 power cable, #4 AWG with 4 conductors. "SO" line cord, 10 meters in length

1 control cable, #12 AWG with 3 conductors. "SO" line cord, 10 meters in length.



Controller Keypad



ON/OFF Toggles the controller between on and off. The controller will not switch to the on mode unless proper condition exist inside the unit. See Error Messages in this section.

LAST Scrolls backward through the displays.

MUTE Toggles audible alarm silence function for the current alarm. The MUTE key will not prevent a new warning or failure condition.

RESET Clears the warning or failure condition status.

NEXT Scrolls forward through the menus.

YES Answers Yes to Y/N questions, increments numerical values upward for setting numeric values.

NO Answers NO to Y/N questions, increments numerical values downward for setting numeric values.

ENTER Used to accept new values.

Indicator Lamps

UNIT OK (Yellow Light)

When lit, the unit is in either stand by or running. No chiller failures or warnings are present.

RUNNING (Yellow Light)

When lit, the unit is running and cooling/heating is taking place. No chiller failures or warnings present.

TEMP REACH (Yellow Light)

When lit, the unit is running and cooling/heating is taking place. The fluid temperature matches the setpoint (\pm the ready width).

ADD FLUID (Yellow Light)

When lit, the unit is in run or off and the coolant level is below the low level value set on the controller. The unit continues to operate and the audible alarm will sound. The LEVEL OK lamp is extinguished and the WARNING SIGNAL is given.

REMOTE (Yellow Light)

When lit, the unit will respond to the remote setpoint, ready width and remote start/stop.

HEAT (Yellow Light)

When lit, the unit is in run. The lamp is on steady when the controller is supplying 100% heat. The lamp is off when the controller is not supplying any heat. The lamp is flashing when the controller is controlling the temperature inside the heat PID proportional band.

COOL (Yellow Light)

When lit, the unit is in run. The lamp is on steady when the controller is in full cool mode. The lamp is off when the controller is not supplying any cooling. The lamp is flashing when the controller is controlling the temperature inside the cool PID proportional band.

COOL WATER (Red Light)

When lit, a cooling water failure exists. The lamp is on when no cooling water is available to the chiller channel. There will be no flow indication on the flow meter, the high pressure cutout will activate and the UNIT OK lamp will extinguish.

NOTE: To restart the channel, the limit switch or failure must be cleared or repaired the alarm reset button must be pressed.

COMP FAIL (Red Light)

When lit, the unit was running and cooling/heating was taking place. This condition is reached by the following:

- 1) high pressure limit switch opening,
- 2) low pressure switch opening,
- 3) high injector temperature exceeded.

The channel stops and the audible alarm sounds. A FAIL SIGNAL is given, and the COMP FAIL lamp illuminates.

NOTE: To restart the unit, the limit switch or failure must be cleared or repaired, the alarm reset button is pressed and the unit placed in run.

PUMP FAIL (Red Light)

When lit, the unit was running and cooling/heating was taking place. This condition is reached by the following:

- 1) low or no Galden® fluid flow,
- 2) pump overload relay shorted,
- 3) pump breaker tripped.

A FAIL SIGNAL is given, the PUMP FAIL lamp illuminates, and the UNIT OK lamp extinguishes.

NOTE: To restart the channel, the limit switch or failure must be cleared or repaired and the alarm reset button is pressed.

OVERLOAD (Red Light)

When lit, the unit was running and cooling/heating was taking place. This condition is reached by the following:

- 1) main GFI breaker tripped,
- 2) compressor breaker tripped,
- 3) pump breaker tripped,
- 4) heater breaker tripped
- 5) pump overload relay tripped,
- 6) compressor overload tripped.

A FAIL SIGNAL is given, the OVERLOAD lamp illuminates and the UNIT OK lamp extinguishes.

NOTE: To restart the channel, the limit switch or failure must be cleared or repaired and the alarm reset button is pressed.

LEVEL FAULT (Red Light)

When lit, the unit was running or in the off mode and the coolant level was below the low level value or above the high level value set on the controller. The channel turns off and the audible alarm sounds. A FAIL SIGNAL is given, the LEVEL FAULT lamp illuminates, and the UNIT OK lamp extinguishes.

NOTE: To restart the unit, the limit switch must be cleared and the unit placed in run.

OVERTEMP (Red Light)

When lit, the unit was running and cooling/heating was taking place. This condition is reached by the following:

- 1) high Galden® fluid temperature in the tank,
- 2) high cabinet temperature,
- 3) high fluid outlet temperature.

A FAIL SIGNAL is given, the OVERTEMP lamp illuminates, and the UNIT OK lamp extinguishes

NOTE: To restart the channel, the limit switch or failure must be cleared or repaired and the alarm reset button pressed.

POWER FAULT (Red Light)

When lit, the unit was running or in the off mode and:

- 1) the phase and voltage monitor relay detected a problem,
- 2) the door interlock is tripped,
- 3) loss of 12VDC.

NOTE: To restart the unit, the limit switch must be cleared, the alarm reset button pressed and the unit placed in run.

Failure and warning Condition Table

Error Message	Indications	Type	Corrective action
FLUID RTD	UNIT OK off, RUNNING off	Failure	Check connection, replace RTD.
INJ RTD	UNIT OK off, RUNNING off	Failure	Check connection, replace RTD.
PHASE VOLT	UNIT OK off, RUNNING off, POWER FAULT on	Failure	Check input voltage for $208 \pm 10\%$, check for three phase power, and check for phase voltage imbalance.
EMG STOP	UNIT OK off, RUNNING off	Failure	Reset emergency stop button by pulling out.
DOOR INTLK	UNIT OK off, RUNNING off, POWER FAULT on	Failure	Check that power box and heater door are in place. Check that door interlocks are working properly.
PUMP OVLD	UNIT OK off, RUNNING off, PUMP FAIL on, OVERLOAD on	Failure	Overload must be reset before unit will run. If overload has tripped more than twice investigation of pump is required.
COMP OVLD	UNIT OK off, RUNNING off, COMP FAIL on, OVERLOAD on,	Failure	Overload must be reset before unit will run. If overload has tripped more than twice investigation of compressor is required.
LOW PRESS	UNIT OK off, RUNNING off, COMP FAIL on	Failure	Reset low pressure cutout and if LPC trips again check charge in compressor.
HIGH PTESS	UNIT OK off, RUNNING off, COMP FAIL on	Failure	Reset high pressure cutout and if HPC trips again check charge in compressor.
COOL WATER	UNIT OK off, RUNNING off, COOL WATER on	Failure	Reset high pressure cutout and research loss of facility cooling water.
TEMP FAIL	UNIT OK off, RUNNING off, OVERTEMP on	Failure	Check cooling fan for proper airflow.
HI INJ TEMP	UNIT OK off, RUNNING off, COMP FAIL on	Failure	Check for proper injector solenoid operation.
HI HTR TEMP	UNIT OK off, RUNNING off, OVERTEMP on	Failure	Check for proper heater operation.
HI LIQ TEMP	UNIT OK off, RUNNING off, OVERTEMP on	Failure	Check for proper heater operation.
HI TNK TEMP	UNIT OK off, RUNNING off, OVERTEMP on	Failure	Check for proper heater operation.

Error Message	Indications	Type	Corrective action
NO FLOW	UNIT OK off, RUNNING off, PUMP FAIL on	Failure	Check blockage in supply line, check flow out of pump.
LOW FLOW	UNIT OK off, RUNNING on, PUMP FAIL on	Warning	Check blockage in supply line, check flow out of pump.
LOW LEVEL	UNIT OK off, RUNNING off, LEVEL FAULT on	Failure	Add fluid until level resets, check for leaks. Drain fluid until level resets.
HIGH LEVEL	UNIT OK off, RUNNING off, LEVEL FAULT on	Failure	Add fluid until level resets, check for leaks.
ADD FLUID	UNIT OK off, RUNNING on, ADD FLUID on	Warning	Breaker must be reset before unit will run. If breaker has tripped more than twice investigation of channel is required.
CHAN BKR	UNIT OK off, RUNNING off, OVERLOAD on	Failure	Breaker must be reset before unit will run. If breaker has tripped more than twice investigation of pump is required.
PUMP BKR	UNIT OK off, RUNNING off, OVER LOAD on	Failure	Breaker must be reset before unit will run. If breaker has tripped more than twice investigation of heater is required.
HEATER BKR	UNIT OK off, RUNNING off, OVER LOAD on	Failure	Breaker must be reset before unit will run. If breaker has tripped more than twice investigation of compressor is required.
COMP BKR	UNIT OK off, RUNNING off, COMP FAIL on, OVERLOAD on	Failure	Check FU12 and FU13, replace if blown. Also check 1PWS and replace if necessary.
LOSS 12VDC	UNIT OK off, RUNNING off	Failure	This is not a fault condition. To restart the unit locally place the LOCAL/REMOTE selector switch to the LOCAL position. Check cooling fan for proper airflow.
REM STOP	UNIT OK off, RUNNING off		
TEMP WARN	UNIT OK off, RUNNING on, OVERTEMP on	Warning	

Changing a Value

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

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

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

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

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

The controller will not allow you to enter a value above the maximum (+150°C) or below the minimum (-20°C). If you try to enter an value outside the range, the display will revert to its original value.

Controller Displays

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

Various controller loops allow you to display and/or alter different parameters of the controller. They can be accessed from the temperature display by pressing and holding the key combinations shown on Figure 1 on the next page. Public loops are designed for day-to-day operation, private loops should be run by only qualified technicians.

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

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

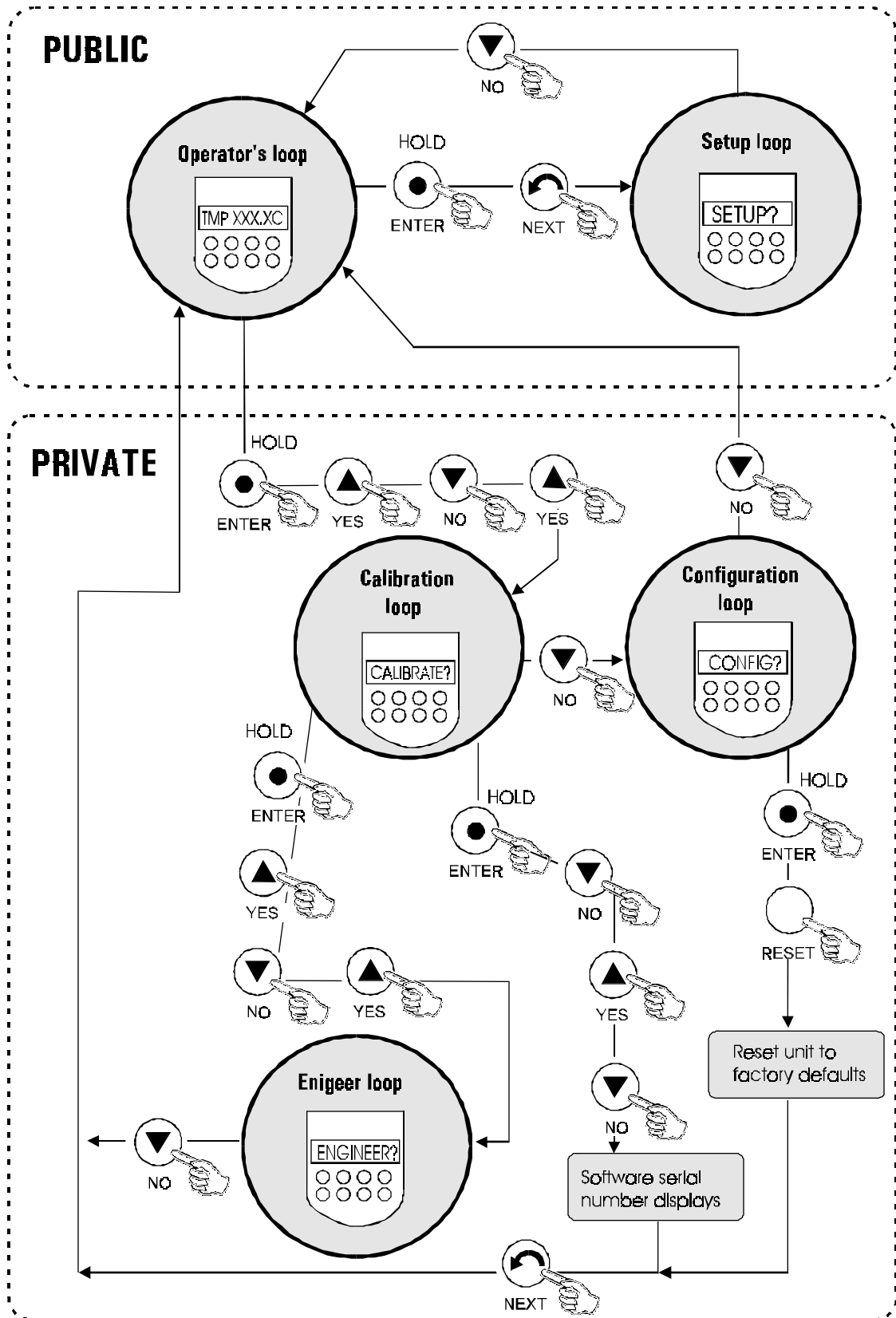
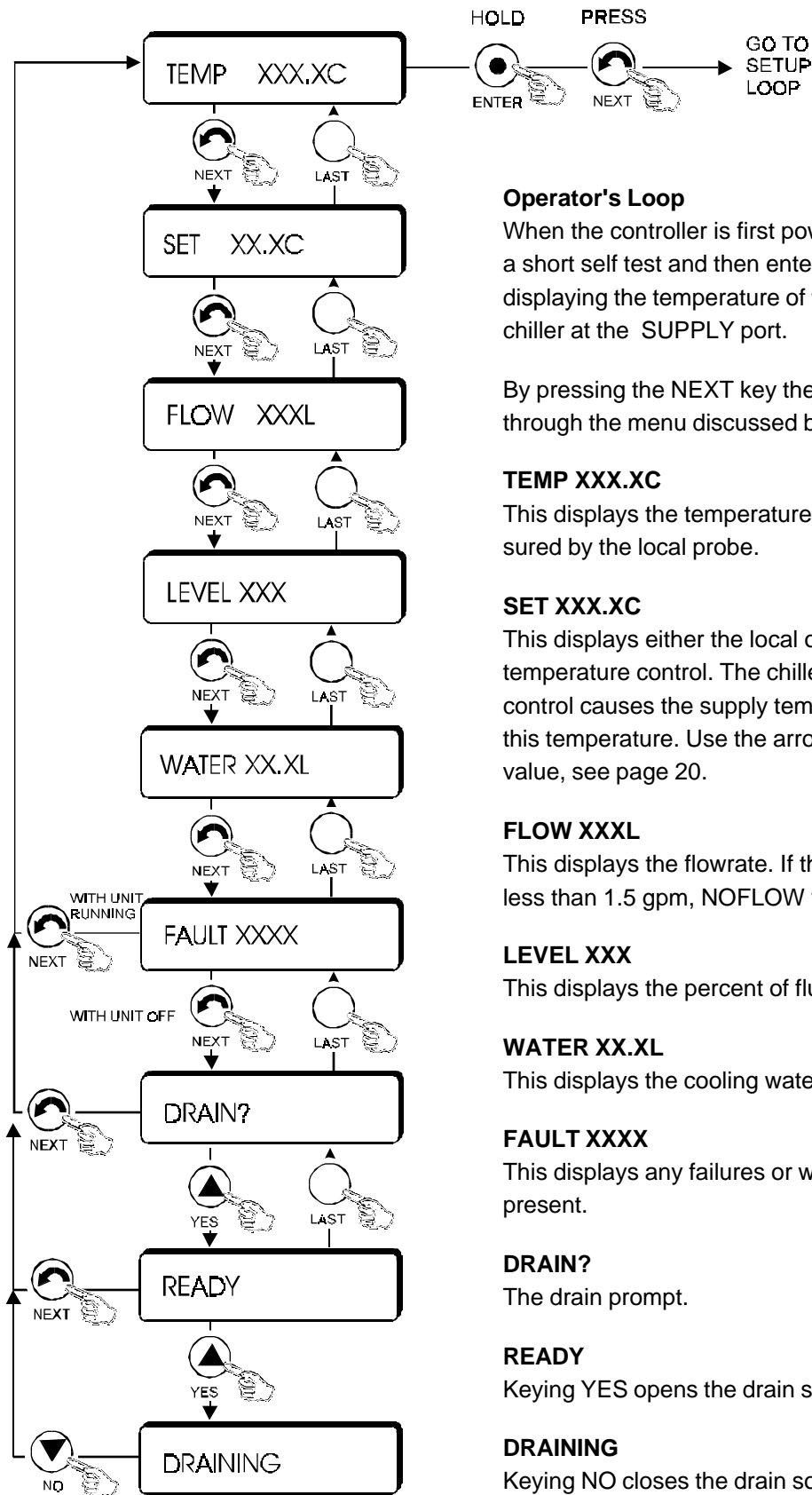


Figure 1 Changing Loops



Operator's Loop

When the controller is first power up it goes through a short self test and then enters the Operator's Loop, displaying the temperature of the coolant leaving the chiller at the SUPPLY port.

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

TEMP XXX.XC

This displays the temperature of the coolant measured by the local probe.

SET XXX.XC

This displays either the local or remote setpoint for temperature control. The chiller's temperature control causes the supply temperature to be equal to this temperature. Use the arrow keys to change the value, see page 20.

FLOW XXXL

This displays the flowrate. If the flow alarm is set for less than 1.5 gpm, NOFLOW will be displayed.

LEVEL XXX

This displays the percent of fluid in the tank.

WATER XX.XL

This displays the cooling water flow rate.

FAULT XXXX

This displays any failures or warnings that are present.

DRAIN?

The drain prompt.

READY

Keying YES opens the drain solenoid valve.

DRAINING

Keying NO closes the drain solenoid valve.

Figure 2 Operator's Loops

Calibration Loop



The unit is factory calibrated. Changing any values will nullify temperature indications. Only qualified technicians should use this loop. Improper calibration can affect product temperature measurements.

To enter this loop you must be in the Operator's Loop and displaying the temperature. Depress and hold the ENTER key. While holding the ENTER key enter the key sequence YES-NO-YES. Answer YES to CALIBRATE? Adjust values with the up and down arrow keys. Press ENTER for the controller to accept each new entry.

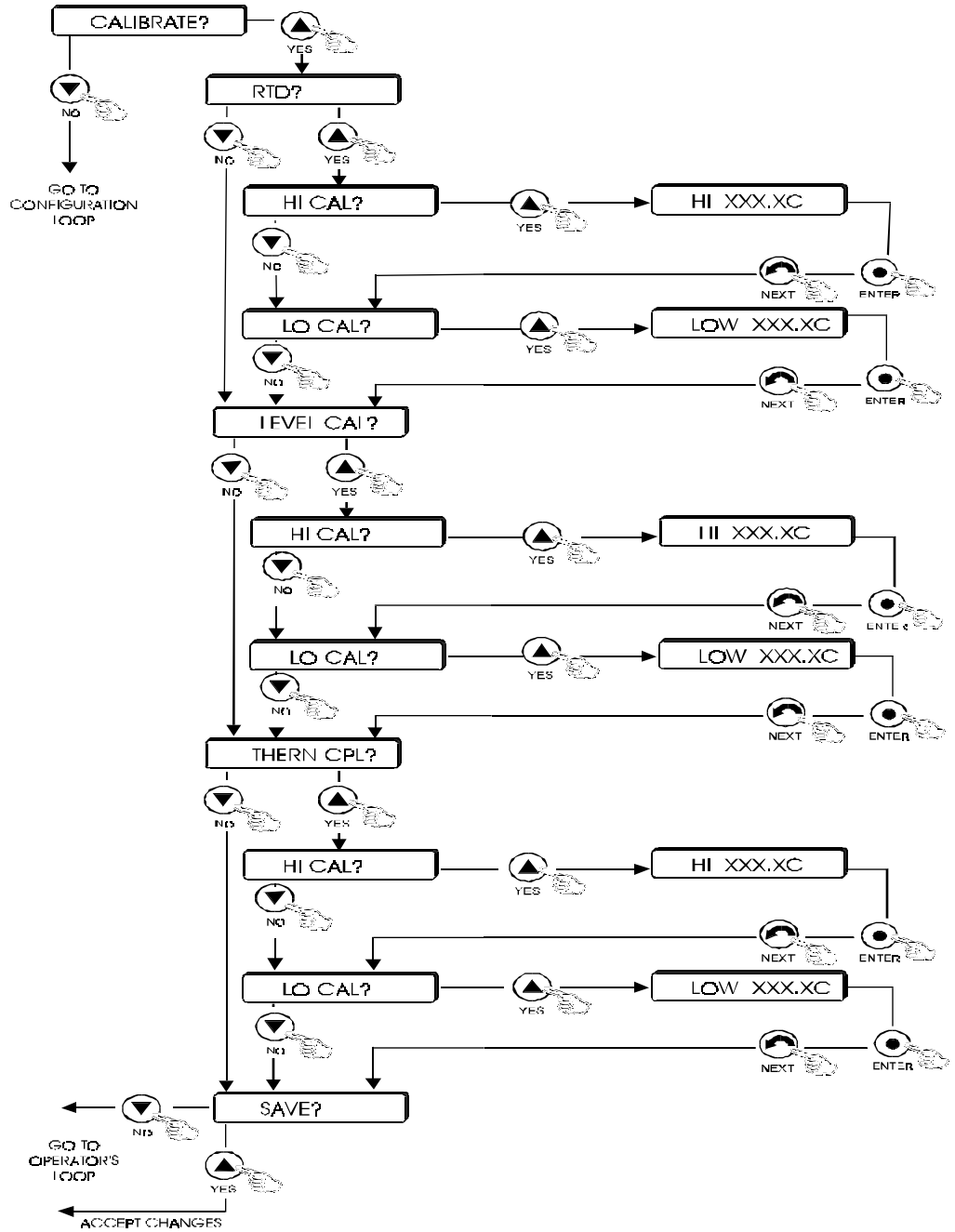


Figure 4 Calibration Loop

Configuration Loop



The unit is factory configured. Changing any values will nullify temperature indications. Only qualified technicians should use this loop. Improper calibration can affect product temperature measurements.

The Configuration Loop allows you to adjust frequency; cooling valve cycle time; and adjust the blower for high, low, or low only operation.

To enter this loop you must be in the Operator's Loop and displaying the temperature. Depress and hold the ENTER key. While holding the ENTER key enter the sequence YES-NO-YES. Answer NO to CALIBRATE? and then YES to CONFIGURE? Adjust values with the up and down arrow keys. Press ENTER for the controller to accept each new entry.

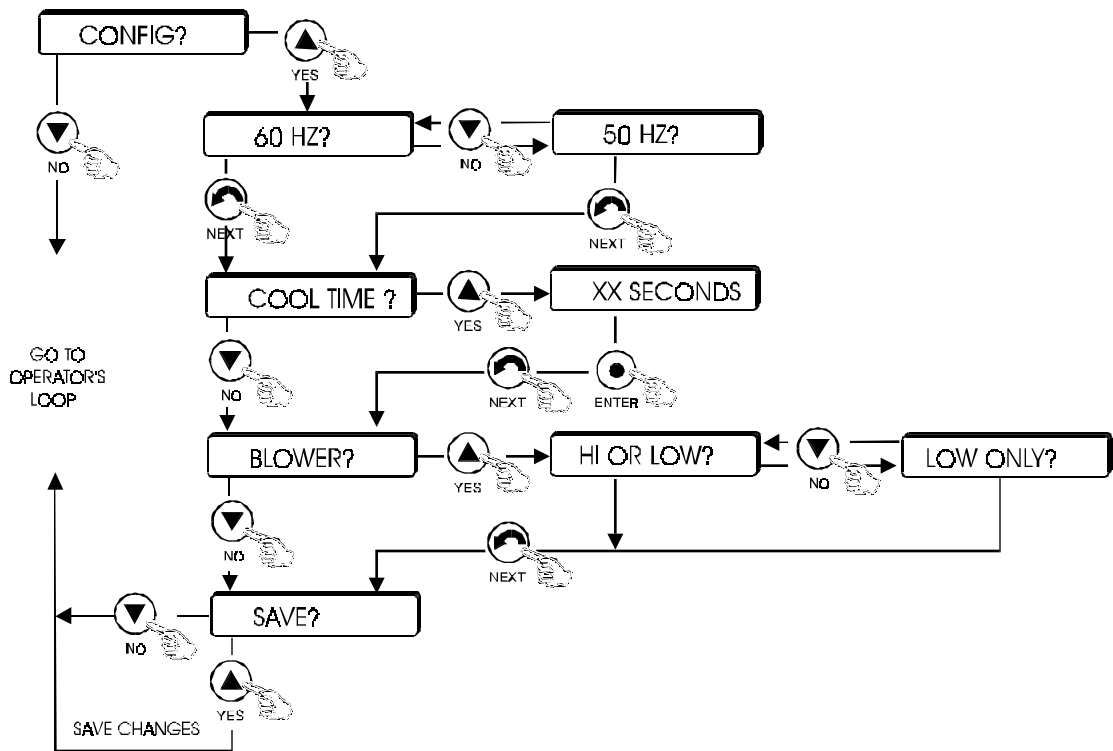


Figure 5 Configuration Loop

Engineer Loop

The Engineer Loop allows you to set the unit alarms and adjust the blower.

To enter this loop you must be at the CALIBRATE? prompt. While holding the ENTER key enter the key sequence NO-YES-NO.

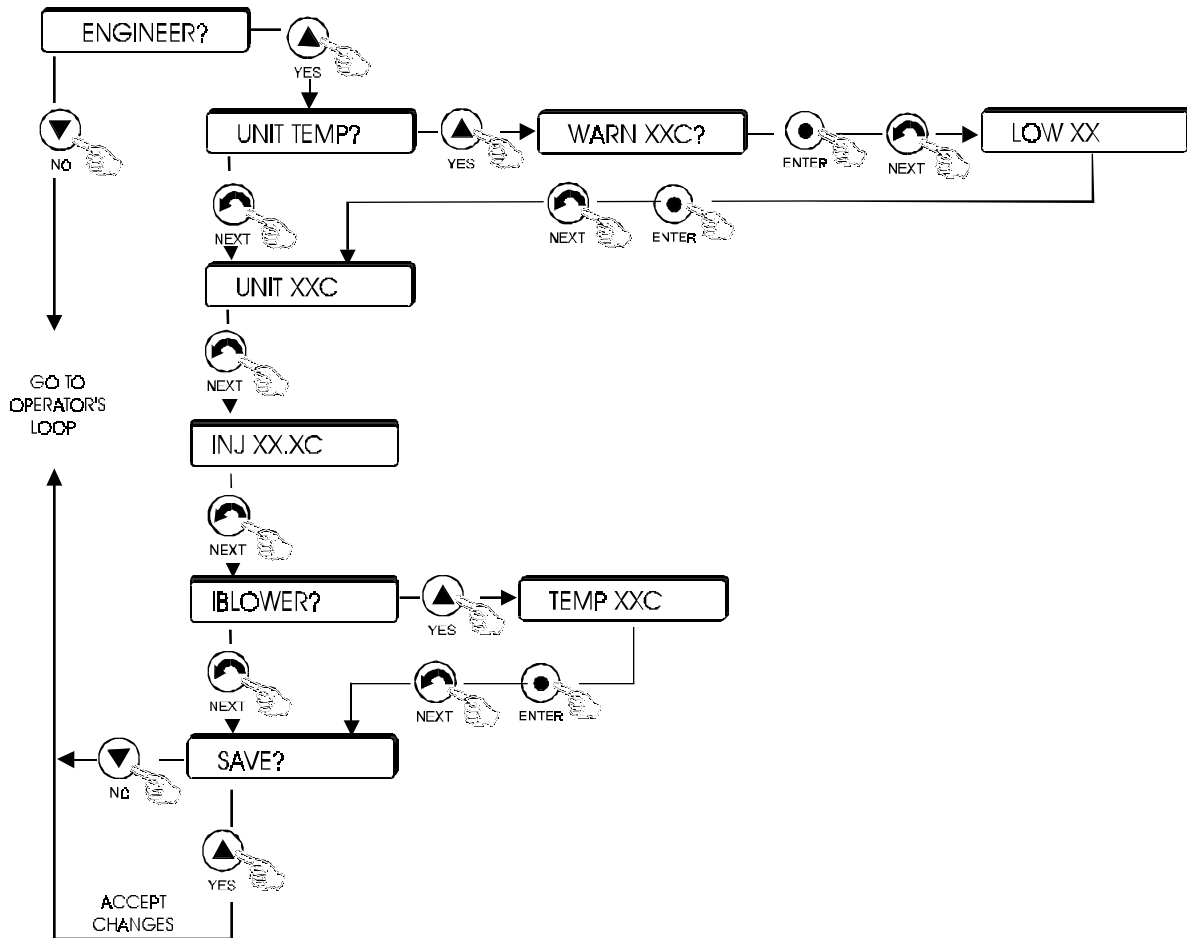


Figure 6 Engineer Loop

Error Messages

Error messages are displayed whenever certain conditions are detected. When this occurs the error message will be displayed by alternating the error message and the normal display. The keys and menus will perform normally.

All error messages will disappear when the error condition is corrected.

FLUID RTD

Indicates the internal temperature probe has failed, i.e. shorted or opened. Upon failure the channel enters the off mode.

PHASE VOLT

Indicates the phase voltage monitor relay has detected an incoming power problem, i.e., loss of phase, phase voltage imbalance, phase reversal, and low voltage. Upon failure the channel enters the off mode.

PUMP OVLD

Indicates the pump motor overload has tripped. Upon failure the channel enters the off mode.

COMP OVLD

Indicates the compressor motor overload has tripped. Upon failure the channel enters the off mode.

LOW PRESS

Indicates the refrigeration system low pressure switch has detected low pressure. Upon failure the channel enters the off mode. The switch must be manually reset.

HIGH PRESS

Indicates the refrigeration system high pressure switch has detected high pressure. Upon failure the channel enters the off mode. The switch must be manually reset.

HI HTR TEM

Indicates the heater high temperature cutout has detected over temperature. Upon failure the channel enters the off mode.

HI INJ TEM

Indicates the refrigeration system high temperature cutout has detected over temperature. Upon failure the channel enters the off mode.

HI LIQ TEM

Indicates the controller sensed a liquid temperature over normal operating range. Upon failure the channel enters the off mode.

NO FLOW

Indicates the controller sensed a liquid line flow loss, i.e., less than 5.75 LPM. Upon failure the channel enters the off mode.

LOW LEVEL

Indicates the controller sensed a liquid level in the tank that is below the heater level. Upon failure the channel enters the off mode.

HIGH LEVEL

Indicates the controller sensed a liquid level in the tank that is above the proper operating level range. Upon failure the channel enters the off mode.

REM STOP

With the channel in the remote mode, indicates the remote stop button is open.

MAIN BKR

Indicates the main breaker has tripped. Upon failure the channel enters the off mode. The breaker must be manually reset.

CHAN BKR

Indicates the channel breaker has tripped. Upon failure each channel enters the off mode. The breaker must be manually reset.

PUMP BKR

Indicates the pump breaker has tripped. Upon failure the channel enters the off mode. The breaker must be manually reset.

COMP BKR

Indicates the compressor breaker has tripped. Upon failure the channel enters the off mode. The breaker must be manually reset.

HEATER BKR

Indicates the heater breaker has tripped. Upon failure the channel enters the off mode. The breaker must be manually reset.

TEMP FAIL

Indicates the internal thermal couple has detected an over temperature condition. Upon failure the channel enters the off mode.

HI TNK TEM

Indicates the tank High Temperature Cutout (HTC) has detected an over temperature condition. Upon failure the channel enters the off mode. The HTC must be manually reset.

EMO

Indicates the EMO button is depressed. Each channel enters the off mode.

DOOR INTLK

Indicates a door interlock (heater boxes or power box) is open. Each channel enters the off mode.

LOSS 12VDC

Indicates the internal 12 volt power supply has failed. Each channel enters the off mode.

COOL WATER

Indicates no cooling water detected so the high pressure cutout opened. The channel enters the off mode.

INJ RTD

Indicates the refrigeration system liquid injector temperature sensor has failed, i.e., shorted or opened.

LOW FLOW

Indicates the controller senses a liquid line flow that is less than a proper operating flow.

ADD FLUID

Indicates the controller senses a tank liquid level that is less than a proper operating level.

TEMP WARM

Indicates the internal thermal couple has detected an over temperature condition. The fan enters the high mode, if possible.

Section IV Special Features

Heater Package

Each heater package consists of a 5000 watt (@208V, 3Ø) immersion heater in the unit's fluid reservoir, and a high temperature limit device. The high temperature limit device disconnects power to the heater if the heater surface temperature exceeds a preset limit.

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

The heater surface temperature may operate several degrees higher than the reservoir fluid. The limit device is factory set to 200°C.



For personal safety and equipment reliability, do not adjust the high temperature limit device.

To reset a tripped temperature limit device depress the reset switch on the back of the unit.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Pump Motor Overload Protector

The unit is equipped with a pump motor overload protector. The overload protector prevents the pump motor from damage due to excessive current. If an overload occurs, due, for example, to excessive pressure or flow, or excessive ambient temperatures, the overload protector will shut off the pump motor.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Compressor Motor Overload Protector

The unit is equipped with a compressor motor overload protector. The overload protector prevents the compressor motor from damage due to excessive current. If an overload occurs, due, for example, to excessive pressure, excessive ambient temperatures, or high suction temperatures, the overload protector will shut off the compressor.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Pressure Relief Valves

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

High Pressure Cutout

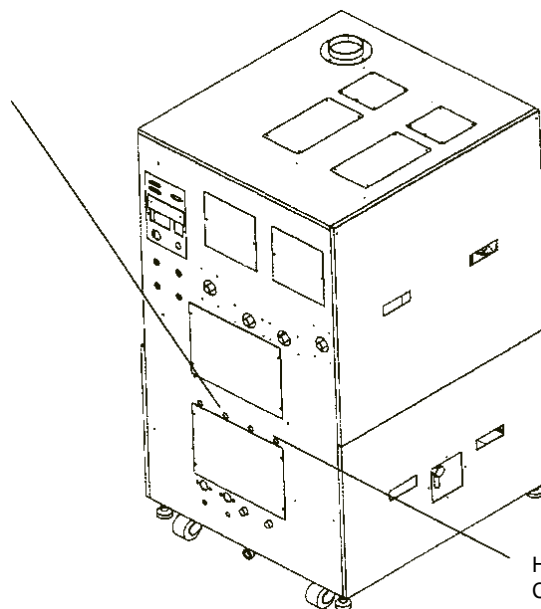
If the unit's refrigeration discharge pressure become too high, the high pressure cutout activates and shuts down the unit. High pressure can be caused by a lack of cooling water flow to the condenser or debris in the refrigeration lines. The cutout is located on the back of the unit.

Once the cause of the problem has been identified and corrected you must manually reset the cutout. Locate the white reset switch on the high pressure cutout. Press in on the switch until a "click" is heard. If the reset does not "click" the cutout was not activated and the unit shut down occurred for another reason.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

NOTE: A main cause of high discharge pressure is insufficient facility cooling water flow or pressure change. Refer to Section VII, Troubleshooting on page 42.

High/Low Pressure
Cutouts Channel B



High/Low Pressure
Cutouts Channel A

Low Pressure Cutout

If the unit's refrigeration discharge pressure become too low, the low pressure cutout activates and shuts down the unit. The cutout is located on the back of the unit.

Once the cause of the problem has been identified and corrected you must manually reset the cutout. Locate the white reset switch on the low pressure cutout. Press in on the switch until a "click" is heard. If the reset does not "click" the cutout was not activated and the unit shut down occurred for another reason.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

High Temperature Cutout

Each channel's tank is equipped with a High Temperature Cutout (HTC). Each HTC is installed on the channel's tank outlet. Should the tank's fluid temperature become too high, the HTC trips and that channel enters the off mode. The HTC is located on the back of the unit.

Once the cause of the problem has been identified and corrected, you must manually reset the HTC.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Cabinet High Temperature

The chiller is equipped with a thermal couple that monitors the power box temperature. Should the unit's internal temperature become too high (>55°C), Channel A enters the off mode.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Electrical Interlocks

Each heater electrical box and the unit's power box is equipped with mechanical interlocks. If any is removed while the chiller is operating, the main chiller power will be disconnected and each channel will enter the off mode.

NOTE: Each interlock can be pulled out to override normal operation and allow the chiller to operate during servicing.

Tank Relief Valve

For safety reasons each reservoir is equipped with pressure and vacuum relief valves. Each valve is a Nupro® check valve. The pressure and vacuum valves are designed to operate at 0.7 kg/cm² (10PSI) and 0.02 kg/cm² (0.33PSI) respectively.

High Injector Temperature

If the unit's refrigeration suction temperature become too high, the high injector temperature sensor will indicate an over temperature to the controller and the channel will enter the off mode. High temperature can be caused by a defective liquid injection system.

Once the cause of the problem is identified and corrected the cutout automatically resets.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Phase Voltage Monitor

Power input problems activates the phase voltage monitor and places the chiller in the standby mode. Input problems can be caused by low voltage, loss of phase, phase imbalance, and phase reversal.

Once the cause of the problem is identified and corrected the cutout automatically resets.

NOTE: The microprocessor controller will indicate a fault and must be manually reset before the unit can be placed in the run mode.

Temperature Control

Fluid temperature control is achieved by activating a refrigeration system, pump, and a tank heater. PID microprocessor algorithms control both the refrigeration system and the heater.

Flow Monitors

Each recirculating channel is equipped with a flow sensor. The flow sensor confirms proper flow returning from your application.

Each channel is also equipped with a water flow transducer to help diagnose facility water flow problems.

Low Level Monitors

There is an analog level switch in each reservoir. When the fluid level drops to 50%, the ADD FLUID lamp illuminates and a warning signal is sent to the tool. If the fluid level should drop to 25%, the LEVEL FAULT lamp illuminates.

Temperature Sensor

A temperature sensor is located in each recirculating process fluid outlet line. Sensor temperature readings are communicated to the tool via the RS-232 communication port.

Accessory Connector

CN1 RS232

Channel A current temperature, output signal target temperature (setpoint), input signal temperature and deviation value input signal.

CN2 RS232

Channel B current temperature, output signal target temperature (setpoint), input signal temperature and deviation value input signal.

CN3

Pin 1	Ch A Start/Stop
Pin 2	Ch A Remote/Local
Pin 3	Ch A Run (LED)
Pin 4	Ch A ALM1 (LED)
Pin 5	Ch A ALM2 (LED)
Pin 6	Ch B Remote/Local
Pin 7	Ch B Run (LED)
Pin 8	Ch B ALM1 (LED)
Pin 9	Ch B ALM2 (LED)
Pin 10	Ch B Start/Stop
Pin 11	Ch A Stop
Pin 12	EMG SW
Pin 13	12VDC RET
Pin 14	Ch A Common
Pin 15	Ch A Ready (LED)
Pin 16	+12VDC
Pin 17	Ch A Remote/Local (LED)
Pin 18	Ch B Common
Pin 19	Ch B Ready (LED)
Pin 20	+12VDC
Pin 21	Ch B Remote/Local (LED)
Pin 22	12VDC RET
Pin 23	Ch B Stop
Pin 24	EMG SW
Pin 25	Not Used

Section VI Maintenance

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

Draining

NOTE: The procedure for draining either channel is identical.

Open Channel A or B drain valve located on the rear of the unit.

When the fluid finishes draining close the drain valve. Open the lower rear access panel. Locate and open the secondary drain. (The secondary drain is located just below the opening on the right side for Channel A, left side for Channel B.) The secondary drain removes the last few ounces in the lower part of the heat exchanger into the drip pan.

Close the secondary valve when the draining is complete.

Remove the insulation off the bottom of the filter cannister and then remove the cannister's bottom drain plug.

When draining is complete replace the cannister's O-ring, reinstall the plug and insulation.

Use the following procedure to drain the exchanger's lines and completely drain either channel.

Open Channel A or B drain valve located on the rear of the unit.

After 2 - 3 gallons (8 - 12 liters) have drained, use the channel control system to manually open the solenoid valve.

The drain option is the seventh display on the main menu. (**NOTE:** The **DRAIN?** display appears only if the channel is off, see Section IV.)

With **DRAIN?** displayed press **YES**.

READY will be displayed, press **YES** to open the valves.

DRAINING will be displayed. When draining is complete press **YES** to close the valves. The fluid temperature will be displayed.

Close the drain valve on the rear of the chiller.

When the fluid finishes draining close the drain valve. Open the lower rear access panel and locate and open the secondary drain. (The secondary drain is located just below the opening on the right side for Channel A, left side for Channel B.) The secondary drain removes the last few ounces in the lower part of the heat exchanger into the drip pan.

Close the secondary valve when the draining is complete.

Remove the insulation off the bottom of the filter cannister and then remove the cannister's bottom drain plug.

When draining is complete replace the cannister's O-ring, reinstall the plug and insulation.

Reservoir Cleaning

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

Filter Cartridge Cleaning

If debris is drawn into the system, the filter prevents the material from being drawn into the fluid loop.

Check the pressure drop across the filter assembly. If the drop is greater than 15 PSI, change or clean the filter cartridge.

Drain the reservoir. The drain for each channel is located on the unit's back.

Drain the fluid from the filter by removing the plug on the sump housing.

Reinstall the plug onto the housing. Unscrew the ring nut from the filter head and slide the sump housing down off the head. Empty the remaining fluid from the sump housing and remove the stainless steel filter cartridge.

The stainless steel cartridge can be cleaned by using either ultrasound or rinsing with Galden® or alcohol.

NOTE: If rinsed, ensure the stainless steel filter cartridge is dry before reinstalling.

Replace the O-ring when the housing is reinstalled.

Reinstall the cannister.

Hand tighten the ring nut and check for leaks.

Preventive Maintenance

NOTE: Every installation can be different, therefore a preventive maintenance can be established after a series of monthly checks.

Requirement	Monthly	Semiannual	Annual
Filter			
Check and record differential pressure	x		
Clean Filter*		x	
Check fluid level	x		
Fluid sampling		x	
Grease pump motor housing			x
Replace pump gears			x
Clean case vents			x
Clean blower inlet and outlet			x
Check calibration of RTDS			x
Check calibration of cabinet thermocouple			x
Check operation of HTC's			x
Check operation of LPC's and HPC's			x
Check operation of circuit breakers			x
Check operation of door interlocks			x
Check operation of motor overloads			x
Verify LEDs**			x
Check low level fault indication			x

* or of differential pressure exceeds 15 PSI.

**can be done with the controller self test during power up.

Section VII Troubleshooting

Main power is not available to unit

- Check main breaker on rear of chiller
- Check incoming power supply
- Check cable connection in the power box and at your application
- Check door interlock on power box
- Check door interlock on heater box
- Check EMO

Unit fails to enter run mode

- Check microprocessor for fault conditions
- See Failure and Warning Condition Table on page 18

Unit will not circulate fluid

- Check tubing between chiller and application
- Check pump circuit breaker
- Check pump overloads
- Check pressure drop across the filter assembly
- Check for proper fluid level

Inadequate temperature control

- Check compressor circuit breaker
- Check heater circuit breaker
- Check temperature probe
- Check for fluctuating input power
- Check microprocessor for proper calibration
- Check for refrigeration system failure

Control system fails to power up

- Check control breaker on the rear of the unit
- Check incoming power supply
- Check cable connection in the power box and at your application

Section VIII Spare Parts

Critical Spare Parts

NESLAB P/N	Description	Quantity	Replace
008916	Pump	2	C
016618	Filter Housing Gasket	2	A
014704	Fluid Flow Transducer	2	C
008882	Pressure Gauge	4	C
004948	Pressure Relief Valve	2	C
007770	Compressor	2	C
009479	Condenser (Water-Cooled)	2	C
001298	High Pressure Switch	2	C
001299	Low Pressure Switch	2	C
009138	Hot Gas Bypass Valve, ADRP-3	2	C
009324	Suction Filter	2	C
009320	Dryer, Liquid Line	2	C
006694	Hot Gas Solenoid Coil, OMKC2	4	C
009478	Hot Gas Solenoid Valve	4	C
009625	Liquid Line Valve	2	C
009182	Liquid Line Solenoid Coil, MKC1	4	C
009626	Liquid Injector Solenoid Valve	2	C
009865	Valve, Crankcase Press. Reg.	2	C
009858	Plate Exchanger	2	C
009857	TXV, R-404A, EMC 12 SZ	2	C
000767	Heater 208V, 5KW	2	C
000598	Level Sensor	2	C
059349	Controller Assembly	2	C
001821	RTD, 6"	2	C
001822	RTD, 1.5"	2	C
001996	Motor Overload Relay, 5 - 8 Amp	2	C
000766	HTC 160, Manual Reset	2	C
000765	HTC 200, Manual Reset	2	C
010413	SSR, 10A, 3-32VDC	2	C
000424	SSR 2.5A, 3-32DC	4	C
006987	SSR 40A, 3-32DC	4	C
024570	Transformer 208/24V, 350VA	1	C
000353	Fuse 2A 600V KTK-2	3	C
010882	Fuse 2A 250V FLM	5	C
010855	Fuse 1A 250V FLMS		C
006069*	Fuse 15A 250V FNM	1	C
004524	Water Flow Transducer	2	C
009144	Valve, Water Press. Reg.	2	C
008894	Gear Kit	2	B

Replacement Codes:

A - Less than 1 (one) year

B - 1 (one) year or more

C - Parts may be replaced due to trouble or loss

*Unit comes with two spare fuses located in the bottom of the power box

Common Spare Parts

NESLAB P/N	Description	Quantity	Replace
011914	Tank Assembly	2	C
008362	Filter Housing	2	C
008371	Stainless Steel 20 Micron Filter	2	C
004940	Check Valve, Tank Vacuum Relief, 1/3 PSI	2	C
004939	Check Valve, Tank Pressure Relief, 10 PSI	2	C
003711	Secondary Drain Valve	2	C
009304	Accumulator	2	C
009604	Sightglass	2	C
004936	Check Valve, 3/4 FNPT	2	C
004938	Fluid Solenoid Valve/Coil	2	C
000410	Lamp, Power Indicator	1	C
001946	Buzzer	2	C
005755	Switch, 2 Position, Selector	2	C
000427	12VDC Power Supply (85-264VAC)	1	C
005792	24V Isolation Transformer, 10VA	2	C
006129	Safety Interlock Switch	3	C
006587	DPDT 7A, 250V Relay	2	C
000656	Blower	1	C
001322	Relay PM SPDT 5A 200-280V	1	C
000641	Relay 12VDC SPDT	10	C
000605	Circuit Breaker, 16AMP GFI	1	C
005807	Circuit Breaker, 30AMP	2	C
005808	Circuit Breaker, 20AMP	2	C
005810	Circuit Breaker, 10AMP	2	C
005919	Circuit Breaker, 3P, 15AMP	2	C
024963	Circuit Breaker, 63AMP GFI	1	C
005815	Connector, 30A, 3 Phase	6	C
000845	Drain Valve	2	C

Replacement Codes:

A - Less than 1 (one) year

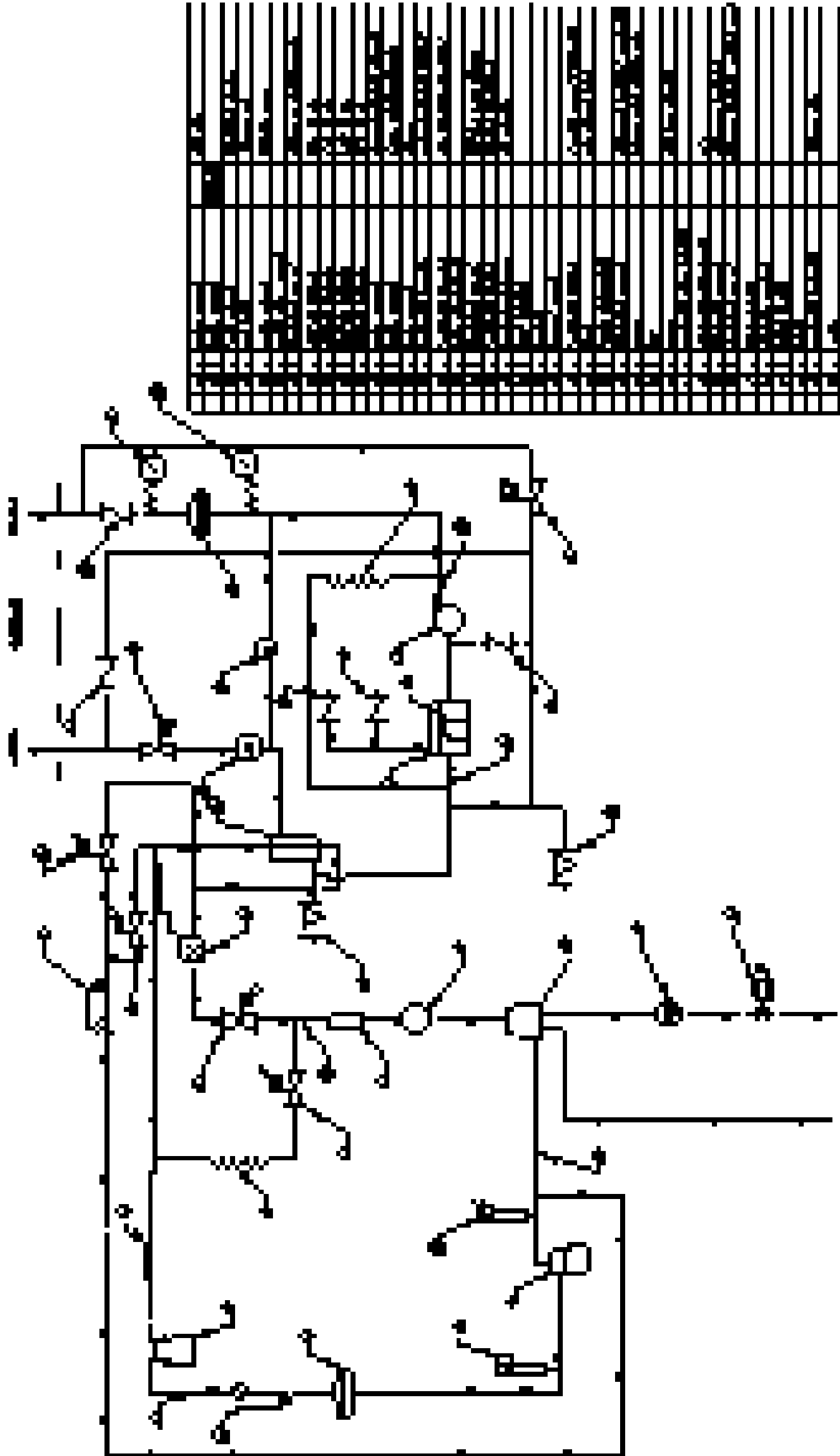
B - 1 (one) year or more

C - Parts may be replaced due to trouble or loss

*Unit comes with two spare fuses located in the bottom of the power box

Flow Diagram

Section IX Diagrams



Flow Diagram
Section IX Diagrams