

FAC-200 Recirculating Chiller

U00052



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FAC-200 Recirculating Chiller Instruction and Operation Manual

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Preface

Compliance

Products tested and found to be in compliance with the requirements defined in the EMC standards defined by 89/336/EEC can be identified by the CE label on the rear of the unit. The testing has demonstrated compliance with the following standards:

EMC:

EN 55011, Class A Verification Industrial, Scientific and Medical Emissions

IEC 801-2:1991 Electro-Static Discharge

IEC 801-3:1988 Radiated Electromagnetic Field

IEC 801-4:1988 Conducted Electrical Fast Transient/Burst

For any additional information refer to the Letter of Compliance that shipped with the unit.

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.

If this product has been modified to operate at 0°C or lower, it has been tested with a non-freezing fluid. Although the system has been drained, some residual fluid may remain. This will not hinder your unit's performance.

Warranty

Units have a warranty against defective parts and workmanship for one full year from date of shipment. See back page for more details.

After-sale Support

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

Before calling, please refer to the labels on the rear of the unit to obtain the following information:

- *unit BOM number* _____

- *unit serial number* _____

- *pump type* _____

Section I Safety

Warnings



Warnings are posted throughout the manual. These warnings are designated by an exclamation mark inside an equilateral triangle and text highlighted in bold. Read and follow these important instructions. Failure to observe these instructions can result in permanent damage to the unit, significant property damage, or personal injury or death.

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).

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

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

Never connect the SUPPLY or RETURN fitting to your building water supply or any water pressure source.

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.

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

Do not replace reservoir plug with a non-vented type or damage to the tank may occur.

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

Additional Warnings

In addition to the specific warnings listed on the previous page the following general warnings apply to you unit:

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.

Never operate the unit without cooling fluid in the reservoir.

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

Always empty the reservoir before moving the unit.

Never operate equipment with damaged power cords.

Refer service and repairs to a qualified technician.

Section II General Information

Description

The FAC-200 Recirculating Chiller is designed to provide a continuous supply of cooling fluid at a constant temperature and volume.

The unit consists of an air-cooled refrigeration system, a sealable reservoir, recirculating pump, an MRS-232 interface and a temperature controller.

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

Specifications

Cooling Capacity¹	3000 Watts @ 10°C
Pumping Capacity	3.4 GPM @ 60 PSI
Temperature Stability	±1.0°C
Reservoir Volume <i>Gallons</i> <i>Liters</i>	3.0 11.4
Unit Dimensions² (H x W x D) <i>Inches</i> <i>Centimeters</i>	37 ³ / ₄ x 21 ³ / ₈ x 34 95.9 x 54.3 x 85.3
Shipping Weight <i>Pounds</i> <i>Kilograms</i>	472 214
Power Requirements³	208/230V, 60Hz, 1 Phase 200/220V, 50Hz, 1 Phase

1. Cooling capacity will vary with fluid temperature, ambient temperature, and cooling fluid.
2. Unit height is measured from the floor to the top of the unit case. Add ½ inch (1.3 centimeters) to include the height of the thumbscrews on the reservoir access panel.
3. Must configure terminal strip (3TB) located in rear power box, see Electrical Requirements on page 8.

Section III Installation

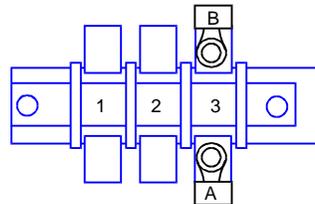
Electrical Requirements



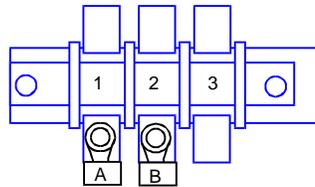
The unit construction provides extra protection against the risk of electrical shock by grounding appropriate metal parts. The extra protection may not function unless the power cord is connected to a properly grounded outlet. It is your responsibility to assure a proper ground connection is provided.

Refer to Section II, Specifications, and to the serial number label on the rear of the unit for the specific electrical requirements of your unit.

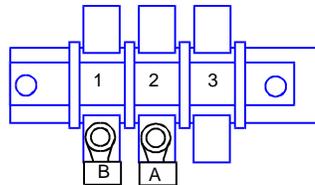
Terminal strip (3TB) located in the rear electrical box must be configured as shown below.



208/230V 60Hz
200V 50Hz



220V 50Hz



200V 60Hz

Plumbing Requirements

Before installing the unit to an instrument that previously used tap water as a cooling fluid, flush the instrument several times to remove any rust or scale that has built up. The manufacturer of the instrument should be able to recommend a cleaning fluid for their equipment.

The plumbing connections are located on the rear of the unit and are labelled SUPPLY and RETURN. These connections are ½ inch FPT.

Remove the plastic protective plugs from both plumbing connections.

Connect the SUPPLY fitting to the inlet of the instrument being cooled. Connect the RETURN fitting to the outlet of the instrument being cooled.



Never connect the SUPPLY or RETURN fitting to your building water supply or any water pressure source.

Flexible tubing, if used, should be of heavy wall or reinforced construction. All tubing should be rated to withstand 80 psig at +30°C. Make sure all tubing connections are securely clamped. Avoid running tubing near radiators, hot water pipes, etc. If substantial lengths of tubing are necessary, insulation may be required to prevent loss of cooling capacity.

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

It is important to keep the distance between the unit and the instrument being cooled as short as possible, and to use the largest diameter tubing practical. Tubing should be straight and without bends. If diameter reductions must be made, they should be made at the inlet and outlet of the instrument being cooled, not at the FAC-200.

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

Fluids

The unit is designed to run on 3M PF5080.

Filling Requirements

Remove the reservoir access panel by unscrewing the thumbscrews. Locate the reservoir plug (square nut). Remove the plug and fill the reservoir with clean cooling fluid, following the special considerations outlined in the following paragraphs.

Circulating to a closed system (closed to the atmosphere)

Fill the reservoir to the bottom of the fill hole threads. Since the reservoir capacity is small compared to many instruments being cooled, have extra cooling fluid on hand to keep the system topped off when external circulation is started.

Circulating to an open system (open to the atmosphere)

Fill the reservoir so $\frac{3}{4}$ of the fill hole threads are covered. Wrap the tank plug with Teflon® sealing tape. Replace the tank plug and tighten securely to prevent air entry.

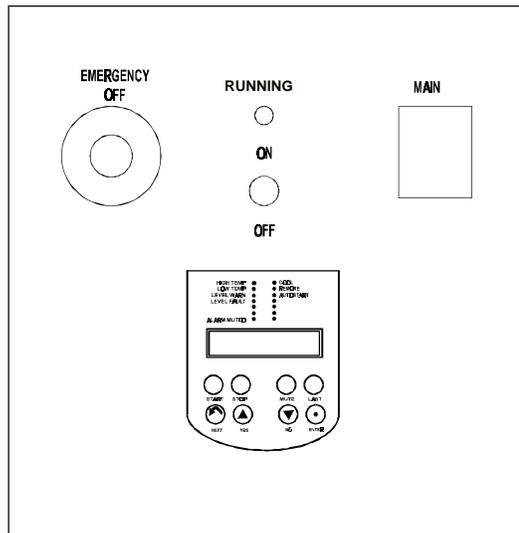
When circulating cooling fluid to an open vessel or tank, connect the SUPPLY and RETURN lines to the open tank. Secure the RETURN (suction) line below the fluid surface. The RETURN line should be submerged deep enough to avoid sucking air. Make sure the RETURN line is free of particles and debris that can block the flow of fluid. A baffle or screen may be required.

Section IV Operation

Start Up

Before starting the unit, check all electrical (3TB) and plumbing connections and make sure the circulating system (the FAC-200, the instrument being cooled, and the tubing that connects them) has been properly filled with cooling fluid. The unit may need additional fluid as the plumbing starts to fill.

Place the MAIN circuit breaker to the on position. The controller will go through a self test routine and then display the temperature of the fluid in the reservoir.



To start the unit locally, ensure the LOCAL REMOTE switch on the rear of the unit is in LOCAL and that the EMO button is out. Place the ON OFF switch to ON and then depress the START key. The refrigeration system and the recirculation pump will start. The RUNNING LED will illuminate.

The unit can be started remotely if REMOTE is selected on the LOCAL REMOTE switch on the rear of the unit, the ON OFF switch is in ON, the EMO is out and the appropriate signal is sent to the interface connection also located on the rear of the unit.

NOTE: The unit will not start in LOCAL or REMOTE with a LEVEL FAULT displayed on the controller.

With the unit running use the operator's menu, explained in the next section, to view the fluid temperature and change the setpoint (LOCAL mode only). Scroll through the operator's menu using the NEXT key.

To turn the unit off, depress the STOP key (LOCAL or REMOTE) or use the interface (REMOTE only). The RUNNING LED will go out.

For emergencies, press the EMO button. To preclude accidentally restarting, before resetting the EMO place the ON OFF toggle switch to OFF.

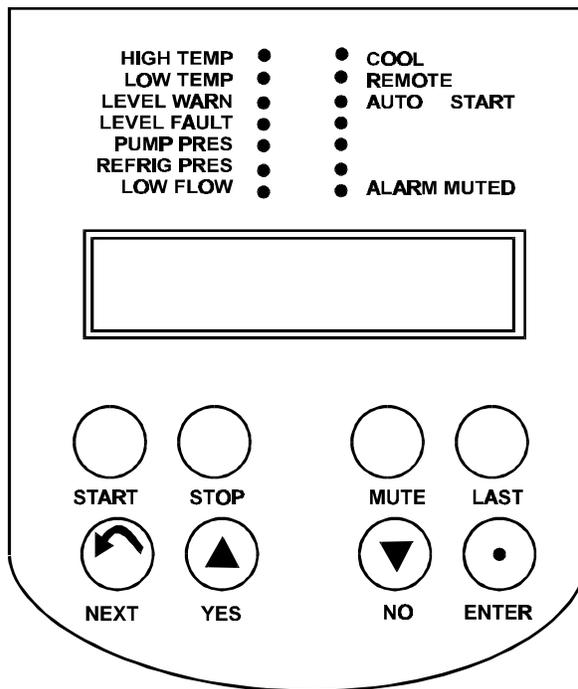
When the unit is shut off, wait approximately five minutes before restarting. This allows time for the refrigeration pressures to equalize. If the pressures are not allowed to equalize, the compressor will short-cycle (clicking sound) and no cooling will occur.

Temperature Controller

Temperature Adjustment

To display the temperature setpoint, press and hold the NEXT key. To adjust the temperature setpoint, simultaneously depress and hold the ENTER and NEXT keys. The display will indicate SETUP? Press the YES key and the display will indicate SET XXC. Use the arrow keys to change the value. Once the desired value is flashing press ENTER. Press the NEXT key until the display indicates SAVE? Press YES to save the change, press NO to return to the original values.

The display will now indicate the temperature of the fluid in the reservoir.



Status Indicators

HIGH TEMP

This lamp flashes whenever the reservoir fluid temperature exceeds the setpoint. An alarm will also sound.

LOW TEMP

This lamp flashes whenever the reservoir fluid temperature falls below the setpoint. An alarm will also sound.

LEVEL WARN

This lamp flashes whenever the reservoir fluid in the reservoir falls below the top float switch. An alarm will also sound.

LEVEL FAULT

This lamp flashes whenever the reservoir fluid falls below the bottom float switch. An alarm will also sound.

PUMP PRESS

This lamp flashes whenever the pump pressure is above or below the limits set on the controller. An alarm will also sound.

REFRIG PRESS

This lamp flashes whenever the refrigeration pressure is above or below the limits set on the controller. An alarm will also sound.

LOW FLOW

This lamp flashes whenever the flow is below the limit set on the controller. An alarm will also sound.

COOL

This lamp flashes when the controller is in the Proportional band. The lamp illuminates when the controller is in the 100% ON band. The lamp is extinguished when the controller is in the 100% OFF band.

REMOTE

The lamp illuminates when the rear panel remote switch is in the remote position. In this mode the unit can be remotely started or stopped via the 9-pin connector on the rear of the unit.

NOTE: The unit can always be stopped using the STOP key on the controller or by depressing the EMO button.

AUTOSTART

The lamp illuminates when the operator selects Autostart Enable from the display menu. When enabled the controller will start the unit upon power returning after a power loss.

ALARM MUTED

The lamp illuminates when the MUTE key on the controller has been depressed.

START

The **START** key is used to start the unit.

STOP

The **STOP** key is used to stop the unit.

MUTE

The MUTE key is used to silence the audible alarm if a warning or failure condition is present. The MUTE key will not prevent a new warning or failure condition.

LAST

The **LAST** key is used to step through the displays in reverse order.

NEXT

The **NEXT** key is used to sequence through the displays.

YES

The **YES** key is used to increment through conditions or to accept questions on the display.

NO

The **NO** key is used to decrement through conditions or to reject questions on the display.

ENTER

The **ENTER** key is used to accept new values.

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.

RTD FAIL

This message is displayed whenever the internal temperature probe has failed, i.e. shorted or opened, and the probe is controlling (displaying) temperature at the time of failure. This condition stops temperature control but the pump continues to operate. This condition automatically resets.

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 depress again.

For large values then 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** or **LAST** 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 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.

Controller Loops

Various controller loops allow the operator to display and/or alter different parameters of the controller. The various controller loops 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 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**.

Changing loops

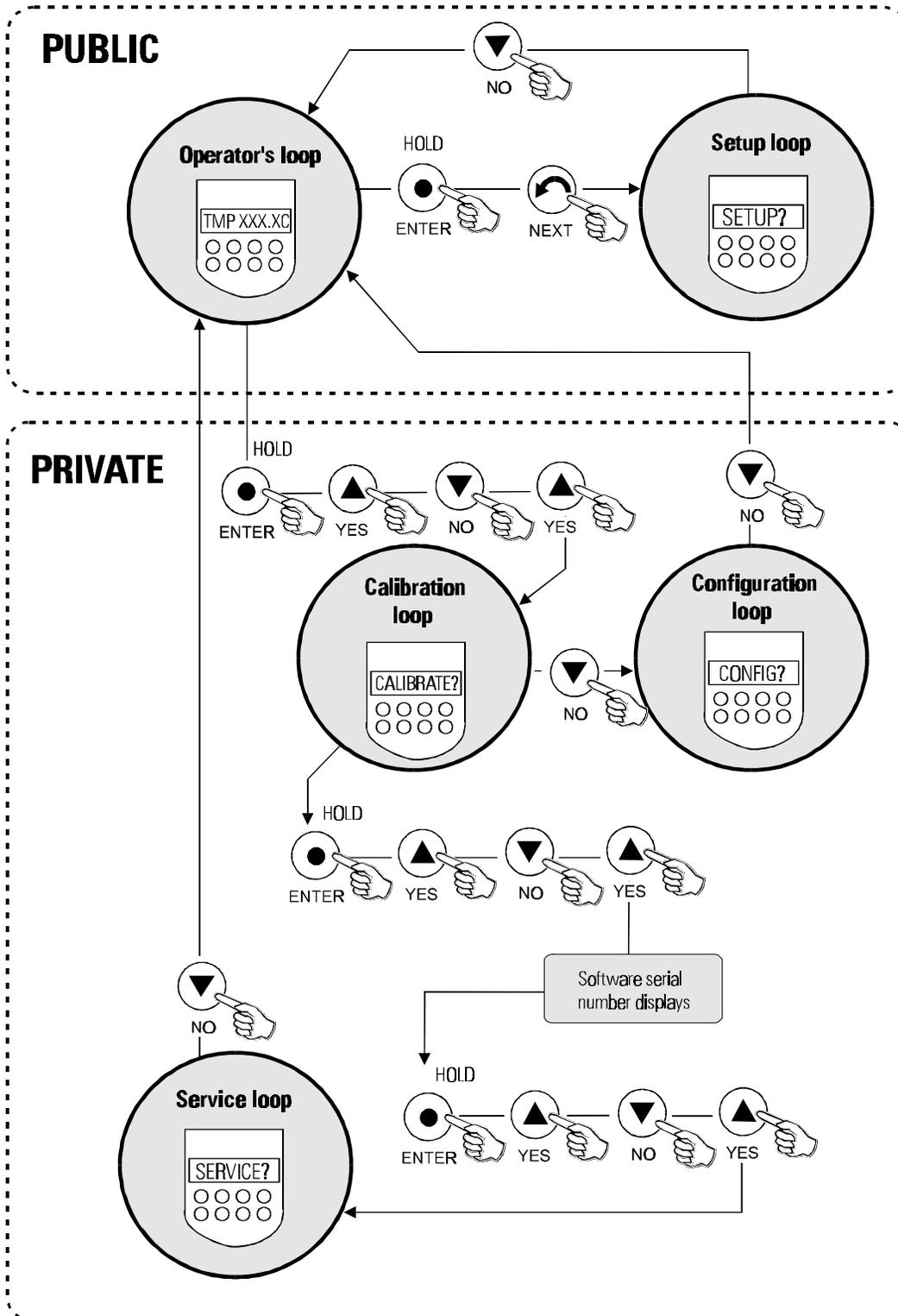


Figure 1 Changing Loops

Operators Loop

When the controller is first powered it goes through a short self test and then enters the operator loop, displaying the reservoir temperatures.

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

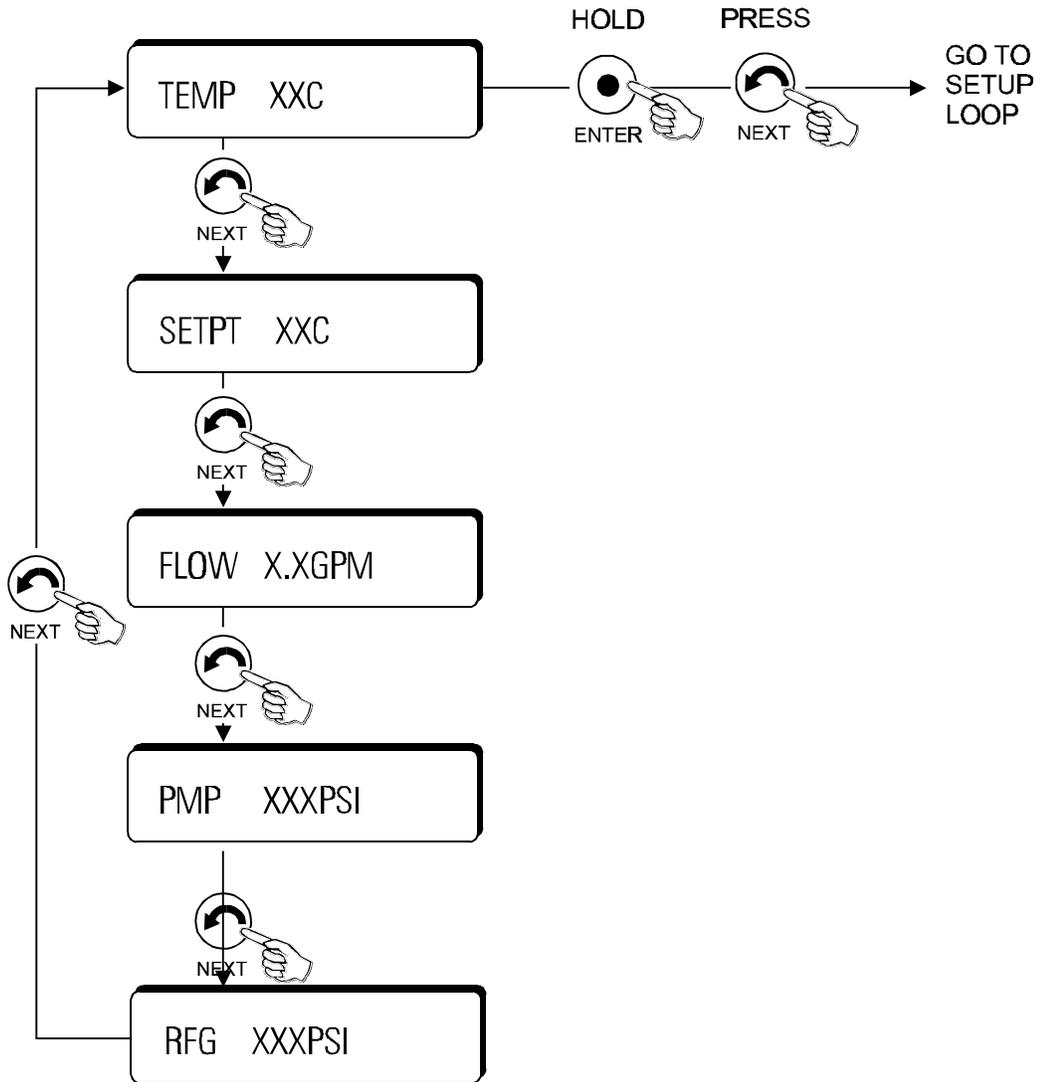


Figure 2 Operators Loop

Setup Loop

The setup loop allows the operator to change the temperature setpoint, and temperature, flow and pressure limits. It also enables/disables autorestart and RS-232 operation.

To enter this loop you must be in the operators loop and displaying the temperature. Depress and hold the ENTER key while pressing the NEXT key.

Adjust values with the UP and DOWN arrows. Press enter for the controller to accept each new entry.

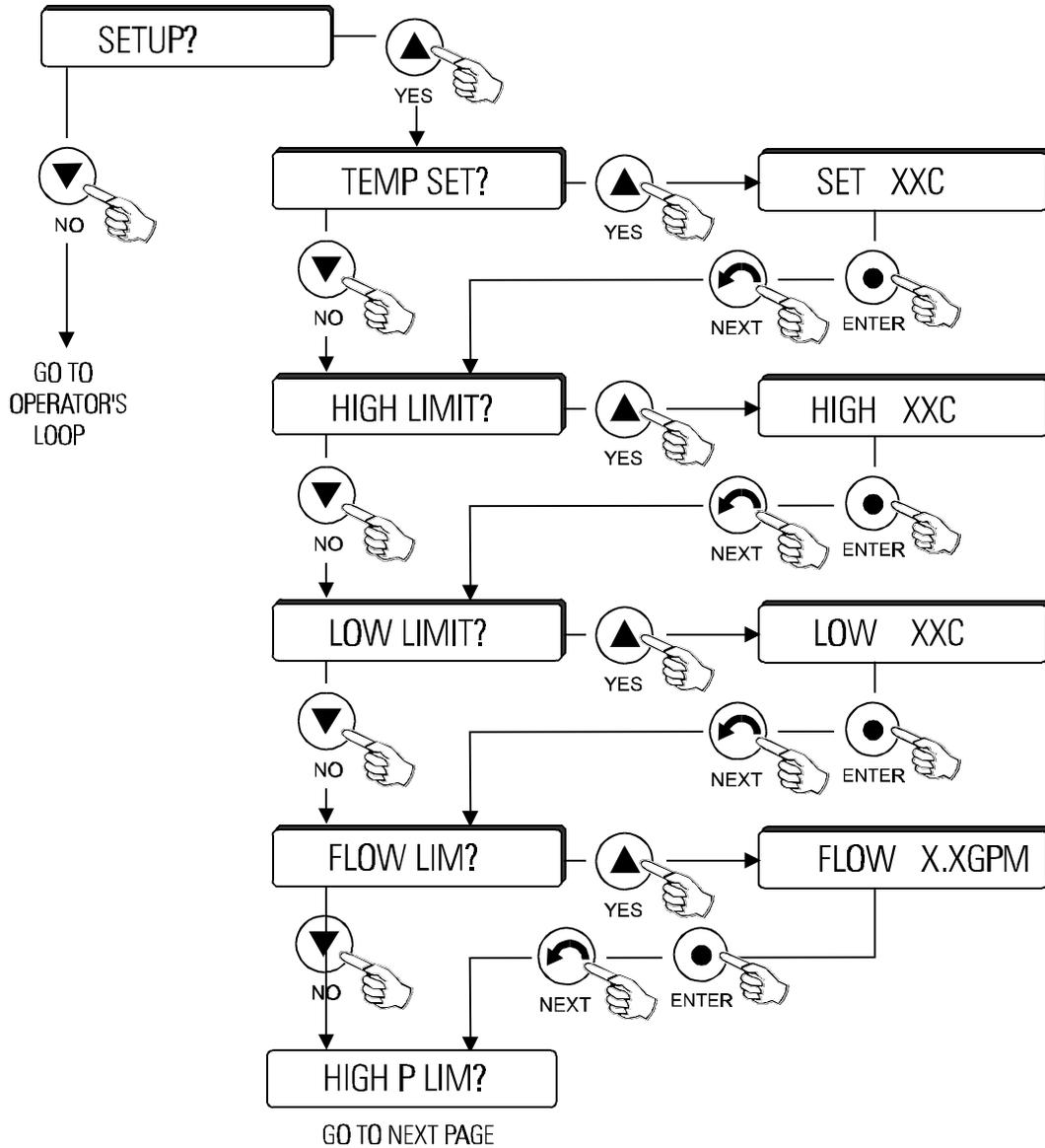


Figure 3 Setup Loop (1 of 2)

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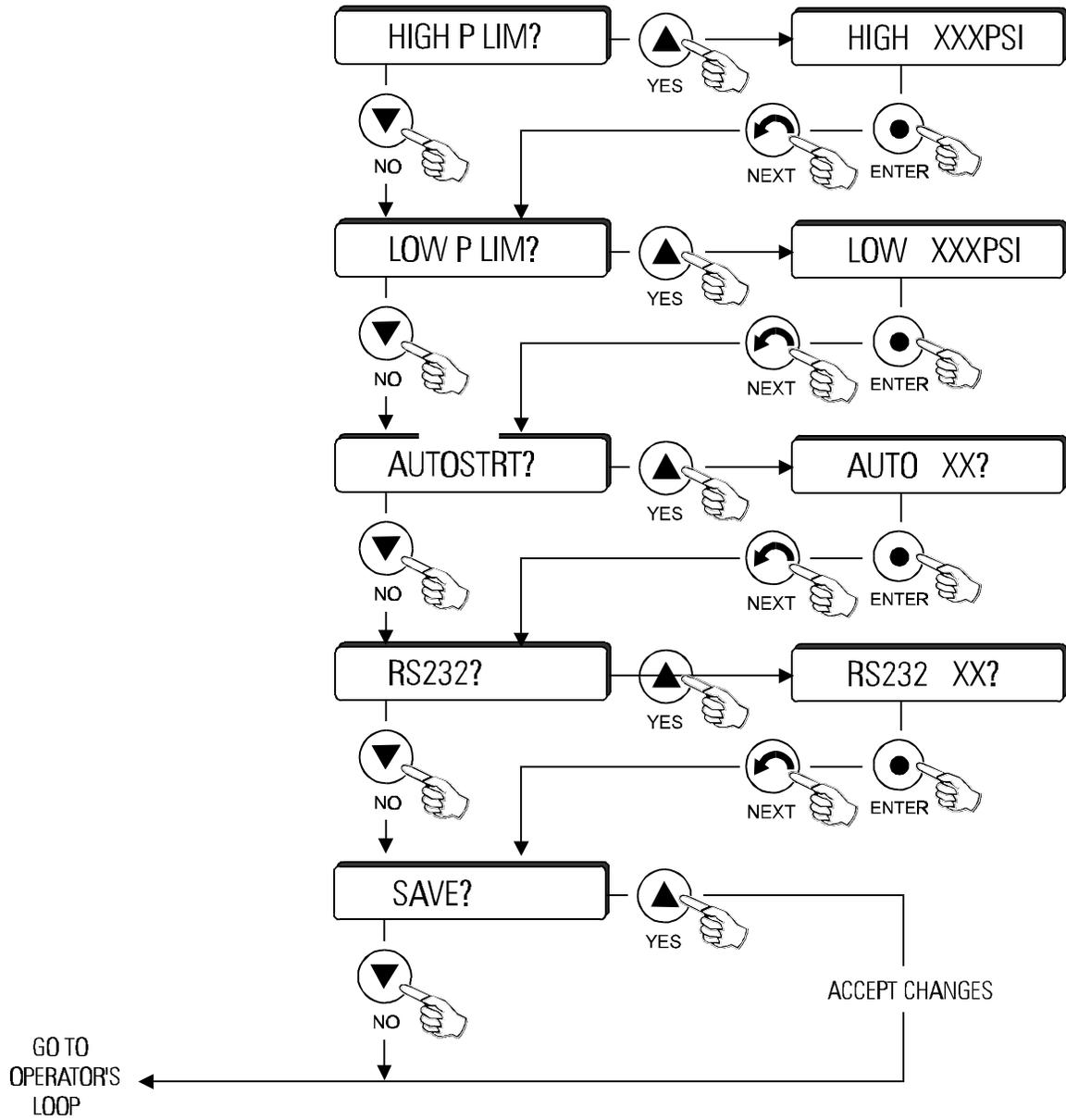


Figure 3 Setup Loop (2 of 2)

Calibration Loop

Calibration of the temperature and resistivity sections of the controller are accomplished in the CALIBRATE loop.

To enter this loop you must be in the operators 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 the CALIBRATE question.

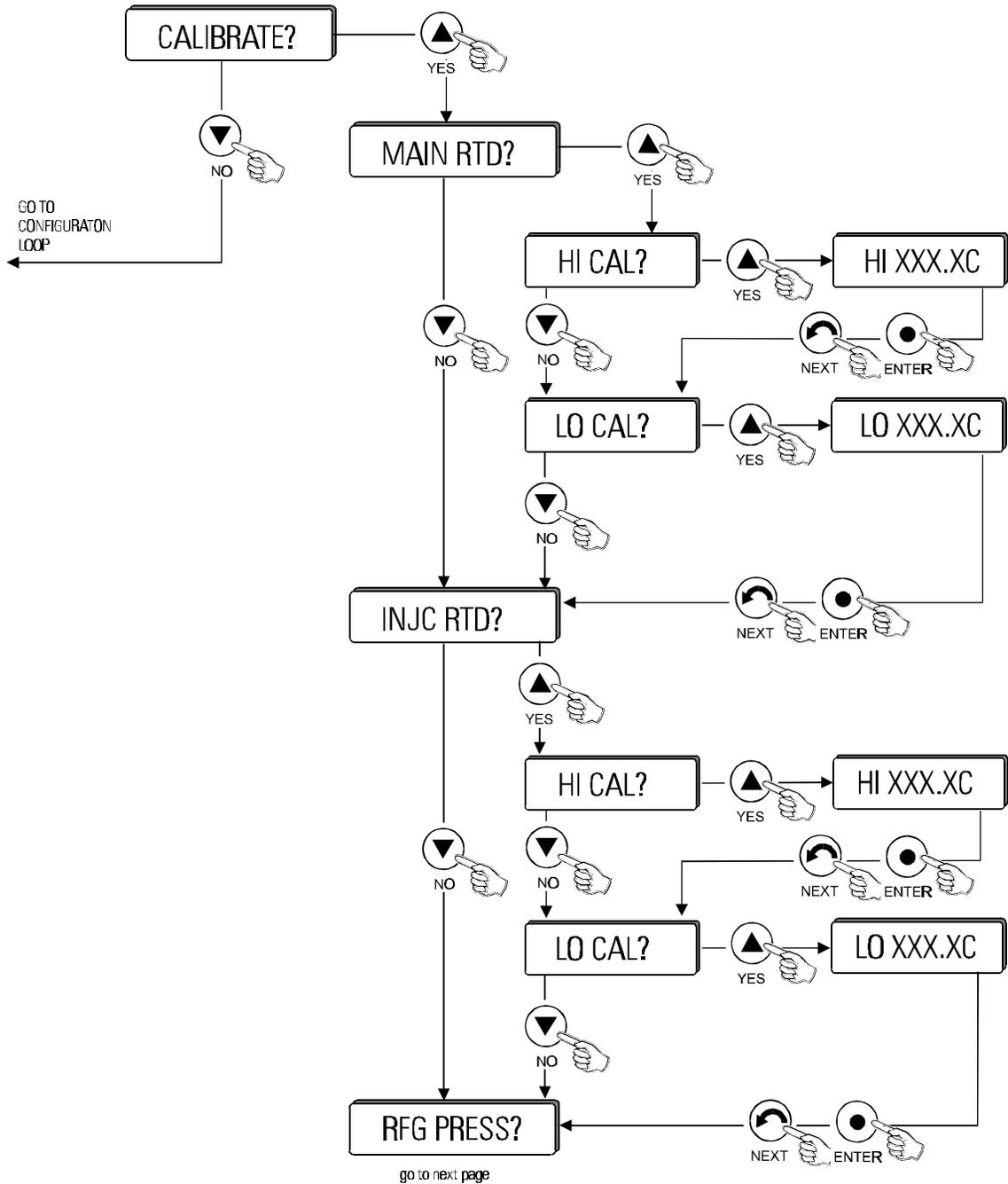


Figure 4 Calibration Loop (1 of 2)

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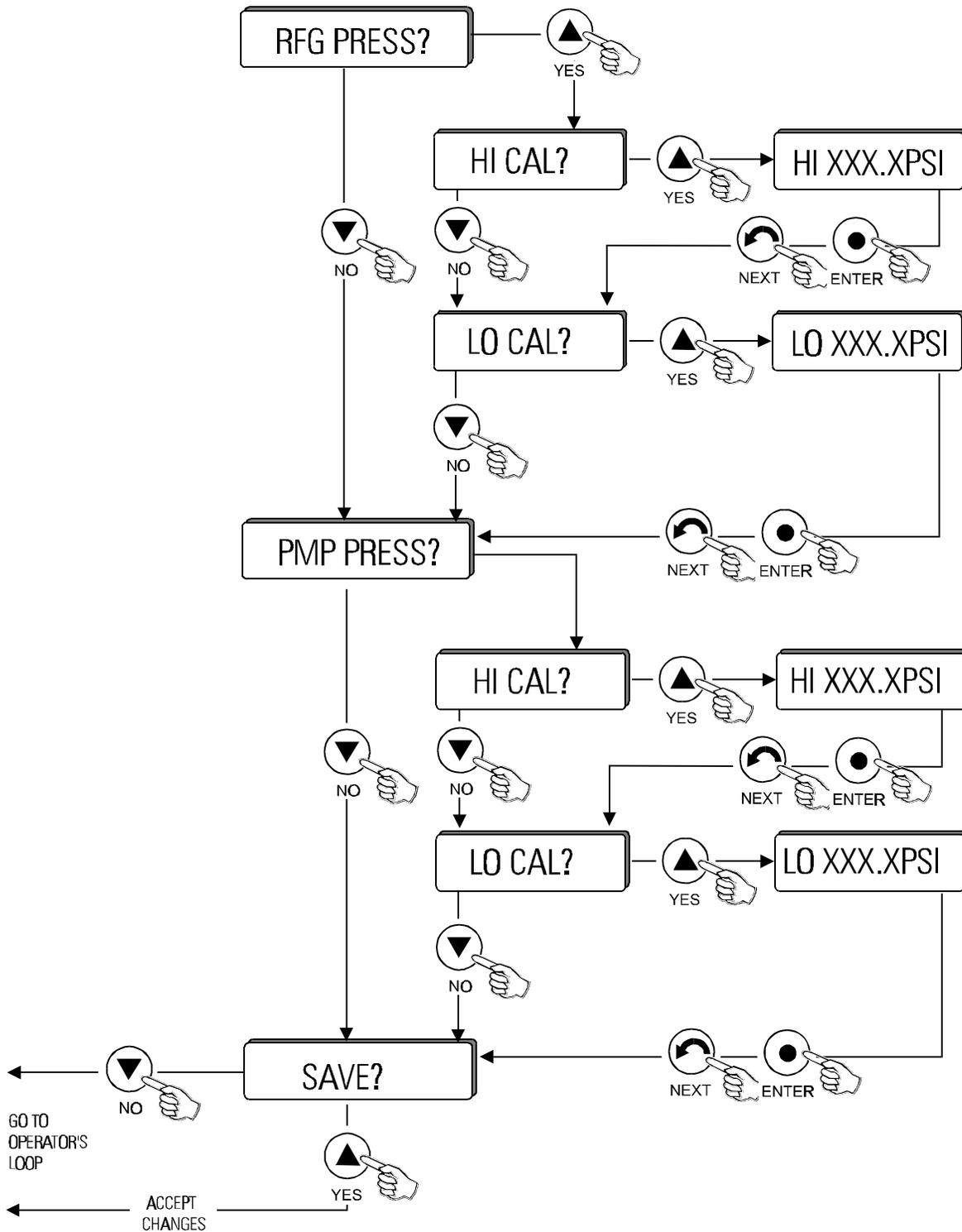


Figure 4 Calibration Loop (2 of 2)

Configuration Loop

The configuration loop allows you to adjust frequency, cooling valve cycle time, set the injector setpoint and adjust controller cooling constants.



The unit is calibrated at the factory. Changing any values will nullify temperature indications. The calibration loop should only be used by qualified factory or service personnel. Improper calibration can affect product temperature measurements.

NOTE: Cool P is factory preset at 30.0% of setpoint span. Cool I is preset at 0.20 repeats per minute. Cool D is preset at 0 minutes.

To enter this loop you must be in the operators loop and displaying the temperature. Depress and hold the ENTER key. While holding the ENTER key enter the key sequence YES-NO-YES. Press NO to the CALIBRATE question and then YES to the CONFIGURE question.

Configuration Loop

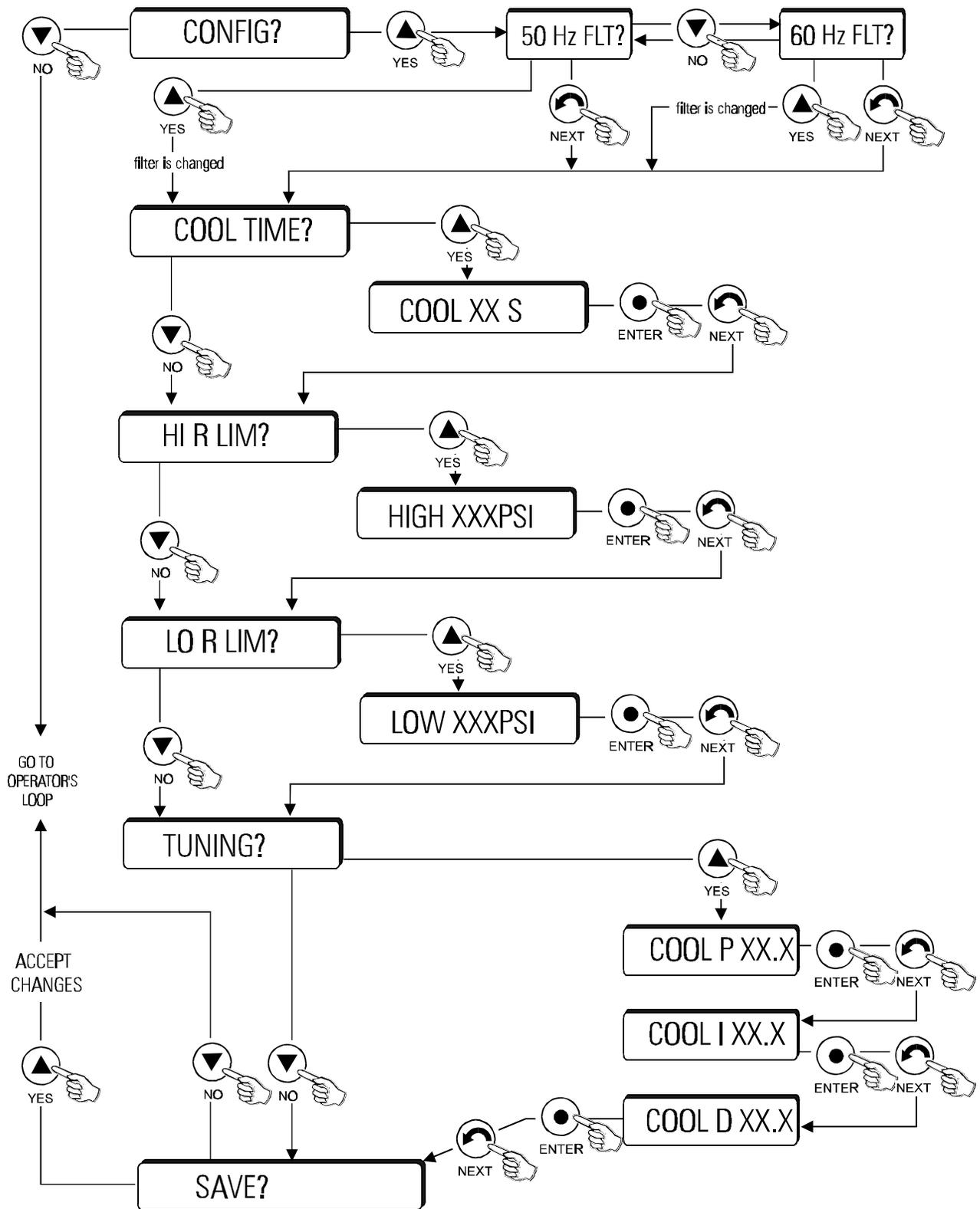


Figure 5 Configuration Loop

Service Loop

The service loop allows you to test the input and output features, test the key pad, test the watchdog timer and access the unit timers.

To enter this loop you must be in the operators loop and displaying the temperature. Depress and hold the ENTER key. While holding the ENTER key enter the key sequence YES-NO-YES. Continue to depress the ENTER key and when the display shows "CALIBRATE ?" Enter the key sequence YES-NO-YES. The controller will display the program version in the format "005881.1" or similar.

Continue to depress the ENTER key and again enter the key sequence YES-NO-YES. The controller will now display SERVICE. Press the YES key.

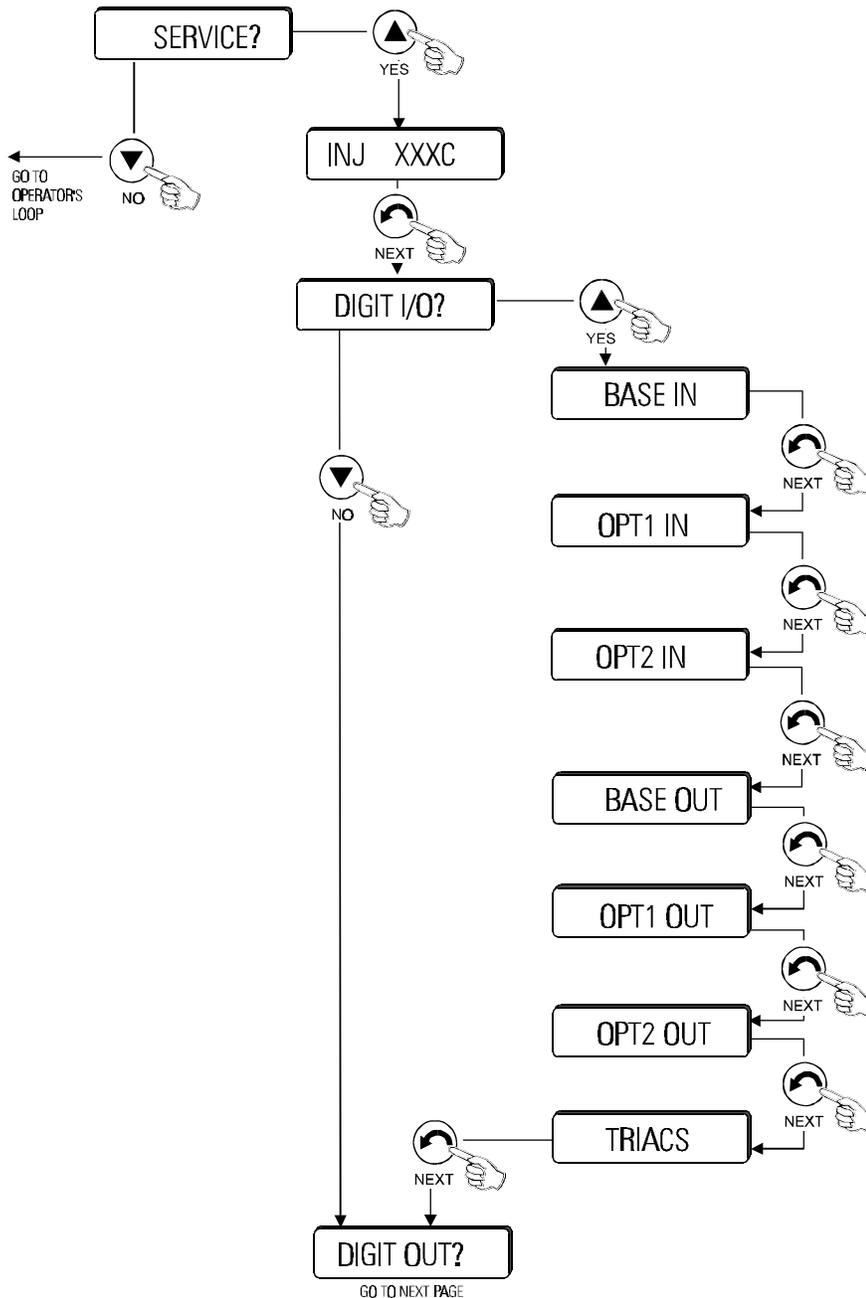


Figure 6 Service Loop (1 of 2)

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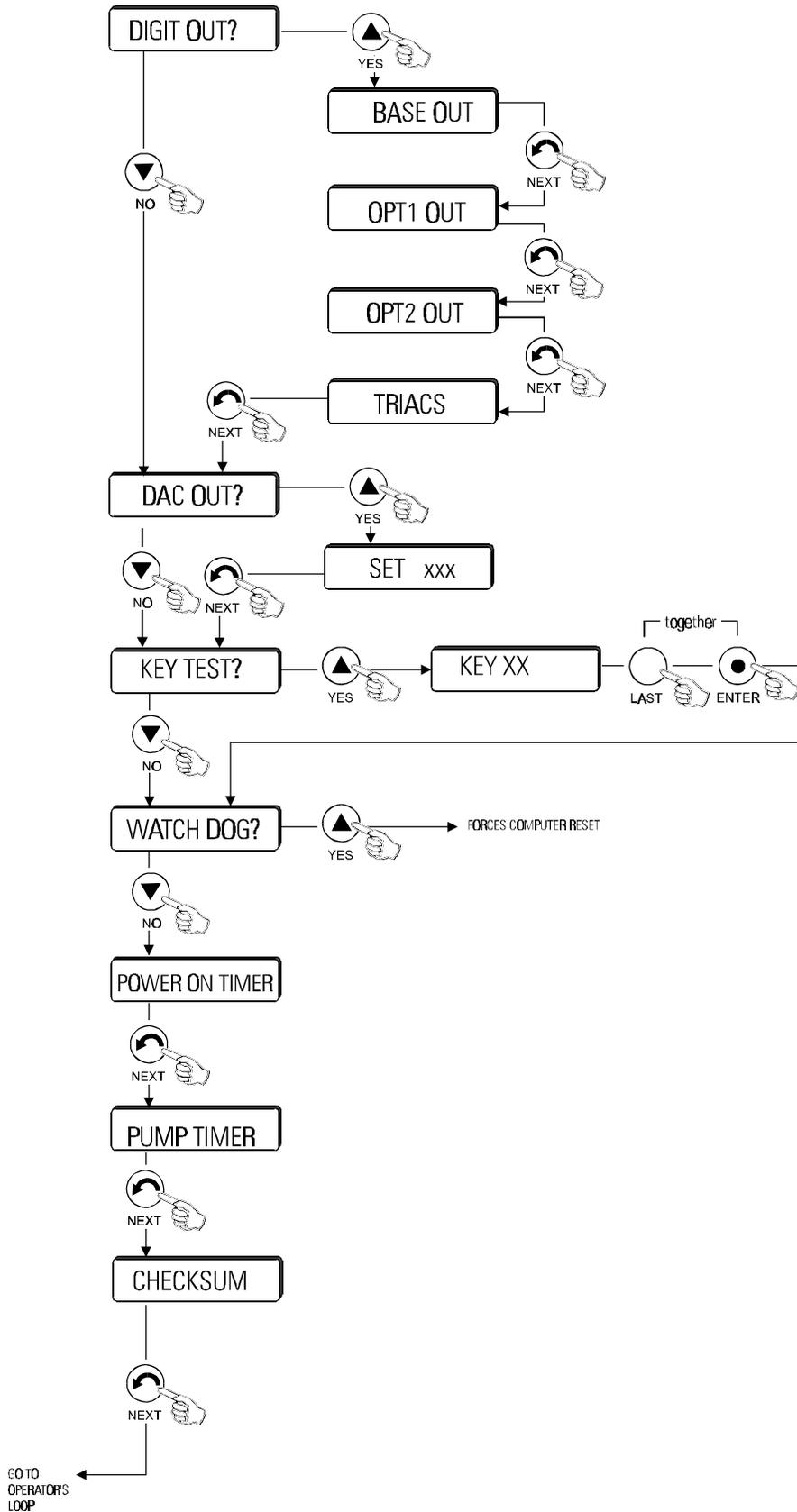


Figure 6 Service Loop (2 of 2)

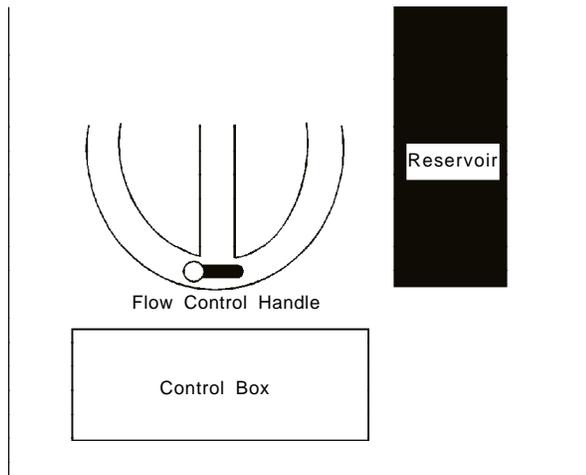
Pressure Relief Valve

The pressure relief valve establishes the maximum operating pressure of the unit. If the pressure of the fluid leaving the pump exceeds the valve setting, the relief valve will bypass the fluid within the unit to relieve the pressure. The valve does not determine the actual operating pressure; the operating pressure of the system is determined by the back pressure of the system.

The valve is factory preset at 90psi. If adjustment seems necessary, consult our Service Department for assistance.

Flow Control

The flow control handle is located under the unit's wrapper. It is factory preset for full flow at 50 Hertz operation. To reduce the flow rate for 60 Hertz operation, turn the handle clockwise.



Top View (Wrapper Removed)

9-Pin Connector

The 9-pin connector located on the rear of the unit is designed for remote operation. When used, the LOCAL/REMOTE switch must be in the REMOTE position.

Pin out information is:

Pins 1-2	EMO Loop
Pins 3-4	Stop Switch
Pins 4-5	Start Switch
Pins 7-8	RUN Light
Pin 9	+24VAC.

RS-232 Information

The RS-232 9-pin female D connector is located on the rear of the unit. Pin out information is:

Pin-1	Not Used
Pin-2	TX (Data Out)
Pin-3	RX (Data In)
Pin-4	Not Used
Pin-5	Signal Ground
Pin-6 to 9	Not Used

Serial communication protocol:

Baud Rate	9600
Parity	None
Data Bits	8
Stop Bits	1
Flow Control	None

Queries and commands must be uppercase followed by a carriage return.

The following queries are available. The RS-232 does not need to be set ON in the setup loop.

?	Help
T?	Report fluid temperature (°C)
S?	Report temperature setpoint (°C)
F?	Report fluid flow (gpm)
P?	Report pump pressure (psi)
R?	Report refrigerant pressure (psi)
H?	Report high temperature limit (°C)
L?	Report low temperature limit (°C)
A?	Report autostart enable status (T/F)
US?	Report unit status: "ddddd"
	each "d" is either a T or F meaning TRUE or FALSE
	1 Level fault
	2 Level warn
	3 High temperature warn
	4 Low temperature warn
	5 Motors on status
	6 Remote start enable status

The following commands are available only when the RS-232 is set ON in the setup loop:

Sn	Change temperature setpoint to n(°C)
Hn	Change high temperature limit to n (°C)
Ln	Change low temperature limit to n (°C)
A	Toggle autostart enable status
START	Start unit
STOP	Stop unit

NOTE: When power to the controller is lost, the RS-232 will reset to OFF when power is returned.

Section V Maintenance

Service Contracts

NESLAB offers on-site Service Contracts that are designed to provide extended life and minimal down-time for your unit. For more information, contact our Service Department (see Preface, After-sale Support).

Cleaning

Reservoir

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 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.

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

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 with debris and scale. Therefore, 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.

The strainer is located in the pump suction line.

Remove the wrapper from the unit. Unscrew the 1¼ nut on the line and remove the screen.

Clean the screen by rinsing it with water.

When the screen is clean, replace it in the strainer, tighten the nut and replace the wrapper. Refer to Section III, Filling Requirements for instructions on replacing the cooling fluid.

Algae

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

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

Section VI Troubleshooting

Checklist

Unit will not start

Check the position of the LOCAL/REMOTE switch on the side of the electrical enclosure.

Check the line cord, make sure it is plugged in.

Check the voltage of the power source. Make sure it is within the rated voltage of the unit, $\pm 10\%$ (see Section III, Electrical Requirements).

Check for low fluid level (LOW LEVEL SHUTDOWN light).

Check the fuses.

Unit will not circulate fluid

Check the reservoir level. Fill, if necessary.

Check the pressure gauge. If the reading is 60 psig, check the instrument being cooled for restrictions in the cooling line.

Inadequate temperature control

If the temperature continues to rise, make sure the heat load of the instrument being cooled does not exceed the rated specification (see Section II, Cooling Capacity).

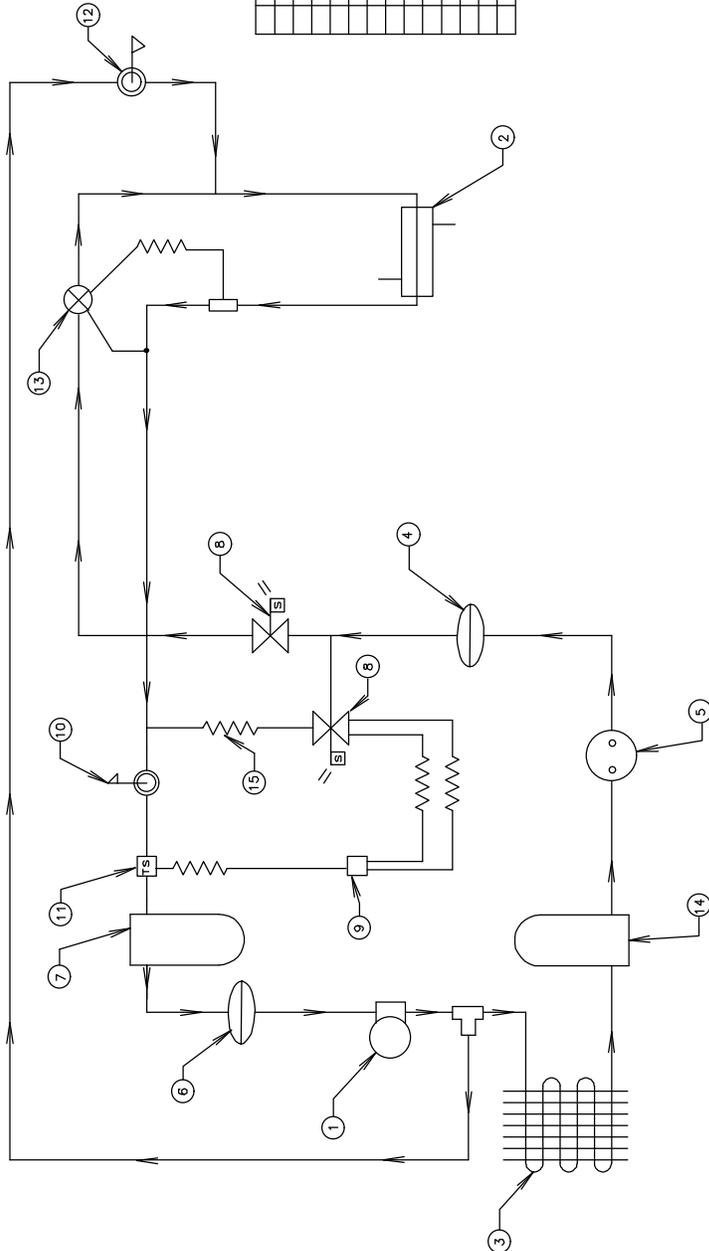
If the compressor short-cycles (a clicking sound), check the line voltage. It should be within the 10% of the specified voltage. Wait 5 minutes before restarting the unit.

Service Assistance

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

- *unit BOM number*
- *unit serial number*
- *voltage of unit*
- *voltage of power source*

Flow Diagram



15	1	INJECTOR CAP TUBE	.075 x 20" LG
14	1	RECEIVER	
13	1	TXV	SPFC
12	1	VALVE	HOT GAS BY-PASS
11	1	SENSOR	
10	1	VALVE	CRANK-CASE REGULATOR
9	1	INJECTOR CONTROLLER	NORMALLY CLOSED
8	2	SOLENOID VALVE	
7	1	ACCUMULATOR	
6	1	SUCTION FILTER	
5	1	SIGHT GLASS	
4	1	DRYER	
3	1	CONDENSER	
2	1	PLATE EXCHANGER	
1	1	COMPRESSOR	

McDONOUGH 10-26-95

AS SHOWN HIGH TEMPERATURE REFRIGERATION SYSTEM

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Wiring Diagram

