

# Thermo Scientific System III Heat Exchanger

Thermo Scientific Manual P/N U00678  
Rev. 09/28/2015

## Installation Operation Basic Maintenance



Visit our Web site at:

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

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# System III Liquid to Liquid Heat Exchanger Instruction and Operation Manual

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## Preface

### Compliance

Refer to the Declaration of Conformity that shipped with the exchanger.

### WEEE/RoHS

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:



Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive are available at:

**[www.thermofisher.com/WEEERoHS](http://www.thermofisher.com/WEEERoHS)**

### After-sale Support

Thermo Fisher Scientific is committed to customer service during and after the sale. If you have questions concerning the operation of your exchanger, contact our Sales Department. If your exchanger fails to operate properly, or if you have questions concerning spare parts, contact our Customer Service Department. Before calling, please obtain the following information:

- *BOM number*
- *Serial number*
- *Software version*

The BOM and serial number are on a label on the rear of the exchanger. To display the software version see page 20.

## **Unpacking**

Retain all cartons and packing material until the exchanger has been operated and found to be in good condition. If the exchanger shows external or internal damage, contact the transportation company and file a damage claim. Under ICC regulations, this is your responsibility.

### **Out of Box Failure**

An out of box failure is defined as any product that fails to operate in conformance with the seller's published specifications at initial power up. The exchanger must be installed in accordance with manufacturer's recommended operating conditions within 30 days of shipment from the seller.

Any product meeting the definition of an out of box failure must be packed and shipped back in the original packaging to Thermo Fisher Scientific for replacement with a new exchanger. The seller pays all shipping costs. The customer must obtain a Return Material Authorization (RMA) from Thermo Fisher prior to shipping.

## **Warranty**

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

## **Feedback**

We appreciate any feedback you can give us on this manual. Please e-mail us at [tmanuals@thermofisher.com](mailto:tmanuals@thermofisher.com).

Be sure to include the manual part number and the revision date listed on the front cover.

## Section I Safety

### Warnings

Make sure you read and understand all instructions and safety precautions listed in this manual before installing or operating your exchanger. If you have any questions concerning the operation of your exchanger or the information in this manual, contact our Sales Department.

**Performance of installation, operation, or maintenance procedures other than those described in this manual may result in a hazardous situation and may void the manufacturer's warranty.**

**Observe all warning labels.**

**Never remove warning labels.**

**Never operate damaged or leaking equipment.**

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

**Always empty the reservoir before moving the exchanger.**

**Never operate equipment with damaged line cords.**

**Never operate without fluid.**

**Refer service and repairs to a qualified technician.**



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



## Section II General Information

### Description

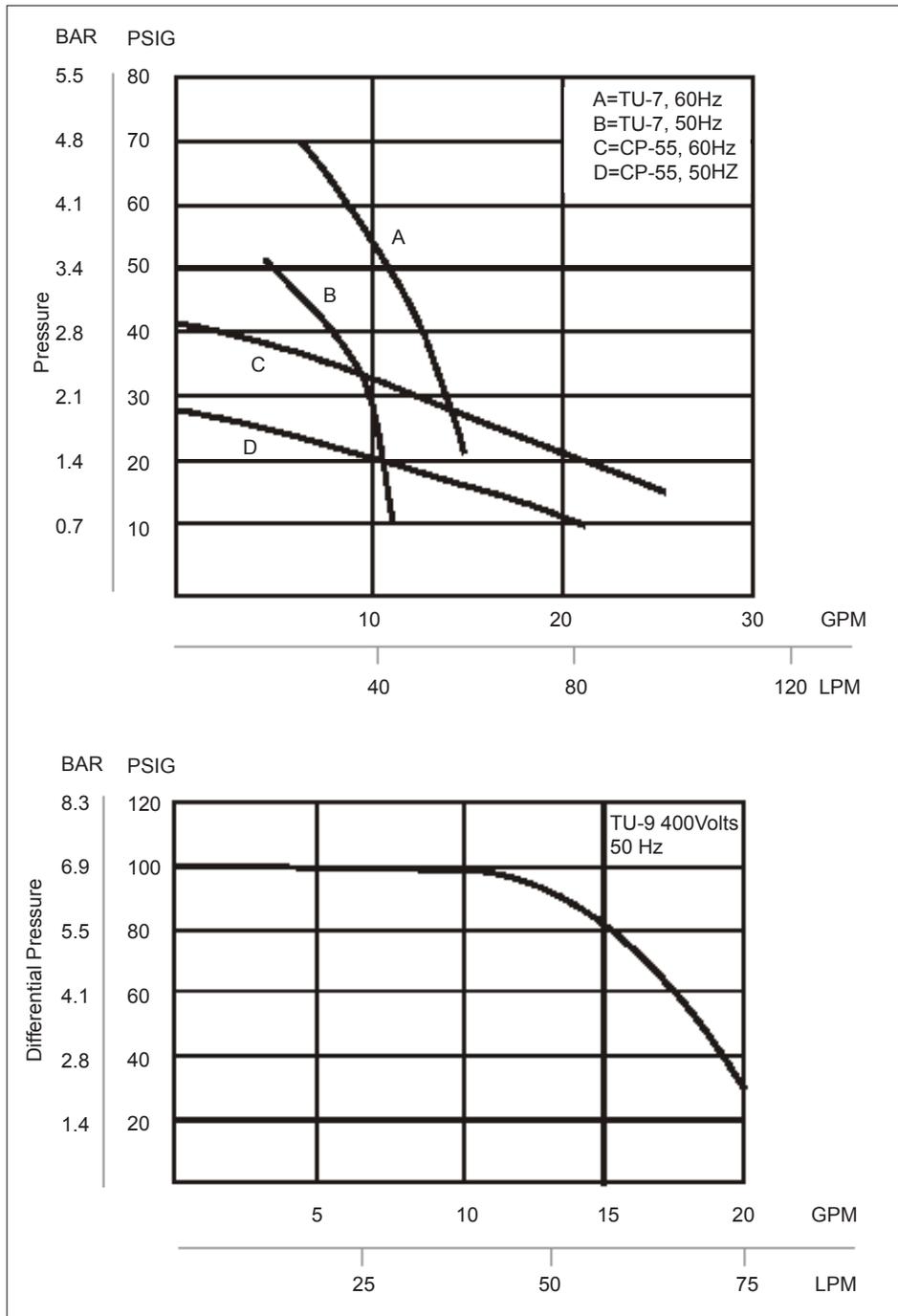
The Thermo Scientific System III Liquid to Liquid Heat Exchanger is designed to remove heat from water-cooled instruments. The heat exchanger consists of a recirculation pump, PVC reservoir, and a microprocessor controller.

### Specifications

<b>Temperature Range</b>	+5°C to +45°C
<b>Temperature Stability</b>	±1.0°C
<b>Heat Removal<sup>1</sup></b>	<p>The graph plots Cooling Capacity (KW) on the y-axis (0 to 80) against Facility Water Flow GPM on the bottom x-axis (5 to 25) and Pressure Drop (PSI)² on the top x-axis (1.0 to 10). Two lines, A and B, represent different pump flow rates. Line A is for 10 gpm pump flow and Line B is for 12 gpm pump flow. Both lines show a positive linear relationship between flow and cooling capacity. A constant temperature difference of +10°C ΔT is maintained. The legend indicates: A= 10 gpm pump flow, B= 12 gpm pump flow.</p>
<b>Cooling Capacity</b>	70kW / 238840BTU
<b>Reservoir Volume<sup>3</sup></b> Gallons/Liters	1.25 / 4.7
<b>Dimensions (H x W x D)<sup>4</sup></b> Inches Centimeters	20 <sup>3</sup> / <sub>4</sub> x 17 <sup>3</sup> / <sub>8</sub> x 27 52.7 x 44.1 x 68.6
<b>Shipping Weight<sup>5</sup></b> Pounds / Kilograms	206 / 93.4

- Specifications obtained using water as the recirculating fluid and as a coolant on the secondary loop, +25°C ambient condition, at nominal operating voltage. Other fluids, process temperatures, ambient temperatures, altitude, or operating voltages will affect performance. Specifications subject to change. Heat load removal is based on a 10°C Δ between the temperature of the cooling water supply (house water) and the cooling fluid as it leaves the System.
- Pressure drop obtained with the modulating valve fully open. Pressure drop indicates the minimum pressure differential pressure between the facility water inlet and outlet to achieve the corresponding facility water flow rate ( $Pressure_{inlet} - Pressure_{outlet} = Pressure_{drop}$ ).
- Larger volume reservoir exchangers are available.
- Exchangers with CP 55 pumps. Exchangers with TU 7 and TU 9 pumps measure 33<sup>3</sup>/<sub>4</sub> x 23 x 27 (85.7 x 58.4 x 68.6). For complete dimensions see pages 25-26.
- Larger volume exchangers weigh approximately 289 pounds (131 kilograms).

### Pump Capacity<sup>6</sup>



6. TU pumps require 3Ø power. TU 7 and TU 9 requires large case.

## Section III Installation

### Site

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

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

### Facility Water Requirements



**Limit the facility water inlet pressure to less than 150 psi (10,2 Bar) and limit the facility water inlet pressure to outlet pressure differential across the System III to less than 35 psid (2,4 Bar).**

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

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

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

## Electrical Requirements



The exchanger construction provides protection against the risk of electric shock by grounding appropriate metal parts. The protection will 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.

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

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

Pump	Voltage	Frequency	Phase	Amperage	Line Cord Plug
CP55	230	60	1	9	L6-15
TU7	230	60	3	8.2	L15-20
TU9	230	60	3	13.8	L15-20
TU7	380	50	3 (5W)	4	None

## Voltage Selection (60 Hertz Exchangers)

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

NOTE Exchangers rated 380-415 volt do not have a voltage selection switch.

## Plumbing Requirements

Before installing the exchanger 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 exchanger and are labelled FACILITY WATER and RECIRCULATING CLEAN FLUID.

The connections for exchangers with CP pumps are all are all 1 inch FPT. The facility water connections for exchangers with TU pumps are 1 inch, the process fluid connections are 1 1/2 inch.

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

Connect the FACILITY WATER connections to the cooling water supply and the drain. Connect the RECIRCULATING CLEAN FLUID connections to the instrument being cooled.

Flexible tubing, if used, should be of heavy wall or reinforced construction. All tubing should be rated to withstand 80 psi at +40°C. Make sure all tubing connections are securely clamped. Avoid running tubing near radiators, hot water pipes, etc. If substantial lengths of tubing are necessary, insulation may be required to prevent the loss of cooling capacity.

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

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

## External Pressure Regulator (Optional)

An optional External Pressure Reducer (EPR) limits the maximum pressure to your application. We recommend an EPR when circulating to applications that are sensitive to higher pressures.

### Fluids



**Never use flammable or corrosive fluids. Do not use automotive anti-freeze. Commercial anti-freeze contains silicates that can damage the pump seals. Use of automotive anti-freeze will void the manufacturer's warranty.**

We recommend distilled/deionized water with a 0.05 – 0.1 MOhmcm reading.



**Highly distilled/deionized water, above the 3 MOhmcm region, may become aggressive and is not recommended for use with exchangers with wetted parts other than stainless steel. Distilled/deionized water in the 15 MOhmcm region is definitely aggressive and should not be used. Exchangers operating in these regions should be closely monitored. See Water Quality Standards and Recommendations in the Appendix.**

If you do not have access to distilled/deionized water we recommend using filtered tap water. Thermo Fisher cannot recommend any custom fluids, these fluids are too dependent on your particular application.

Below +8°C a non-freezing solution is required. The selected cooling fluid must have a viscosity of 50 centistokes or less. A 50/50 mixture, by volume, of distilled/deionized water and laboratory grade ethylene glycol is suggested.

## Filling Requirements

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

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

## Automatic Refill Device (Optional)

The automatic refill device maintains the correct level of cooling fluid in the reservoir. The device consists of a float switch in the reservoir and a solenoid valve at the rear of the exchanger. If the cooling fluid level falls, the float switch will drop, opening the solenoid valve and allowing make-up fluid to fill the reservoir. Once the cooling fluid reaches the proper level, the float switch will rise and the solenoid valve will close.

**NOTE:** For the solenoid valve to close properly, the minimum supply flow rate should be 2.2 gallons per minute.

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

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

## Flow Control

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

When the handle is in the “+” position, the valve is open and all available cooling fluid is supplied to the instrument being cooled. When the handle is in the “0” position, the valve is closed and no cooling fluid is supplied to the instrument being cooled. When the handle is between these two positions, the flow rate of the cooling fluid is between full flow and no flow. Use the flow meter to adjust the desired flow rate.

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

## Auto Restart

Exchangers are equipped with an auto restart feature. If power is lost, the exchanger will automatically restart when power is restored. This feature is enabled/disabled using the controller's Setup Loop, see page 15.

## Section IV Operation

### Start Up

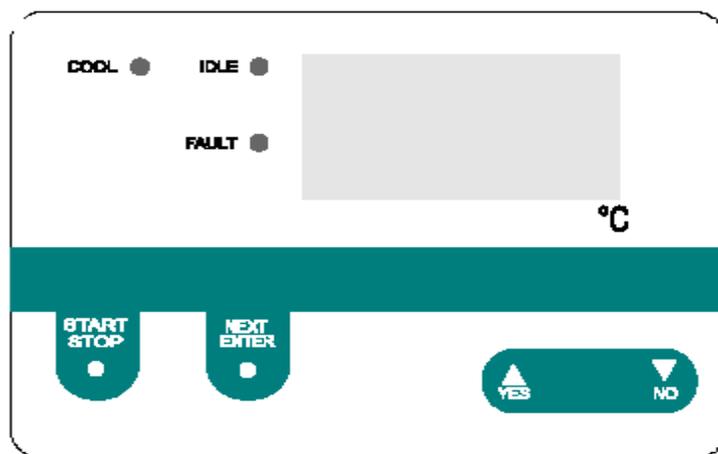
Before starting, double check all electrical and plumbing connections and make sure the circulating system (the System III, your application, and the tubing that connects them) has been properly filled with cooling fluid.

Turn the RECIRCULATING FLOW CONTROL to “0”. Press START/STOP. The pump starts and the controller displays the reservoir fluid temperature.

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

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

A control valve, located in the FACILITY WATER inlet line, regulates the flow rate of the cooling water supply as it enters the exchanger. The valve regulates the flow rate based on the heat load. Flow through the exchanger stops automatically when the exchanger is shut off.



Temperature Controller

To turn the exchanger off, press START/STOP. The pump will stop.

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

## Temperature Controller

The microprocessor controller controls temperature using a PID (Proportional-Integral-Derivative) algorithm. It is designed with self-diagnostic features and easy to use operator interface.

### **NEXT ENTER**

Use this key to accept and save changes.

### **YES, ▲**

This key is used to increase numerical values.

### **NO, ▼**

This key is used to decrease numerical values.

When the controller is powered it displays the reservoir fluid temperature. Press the **NEXT ENTER** key to view the setpoint. The display flashes between **SP** and the actual setpoint number. If desired, use the **YES** and **NO** keys to change the setpoint. The display flashes as soon as either key is depressed. Once the desired setpoint is displayed, press **NEXT ENTER**.

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

The temperature control system actuates a control valve in the FACILITY WATER line. The control valve adjusts the flow of the cooling water supply to produce the desired operating temperature.

**NOTE:** The controller does not use the new value until the **NEXT ENTER** key is depressed and the display stops flashing. 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 was entered.

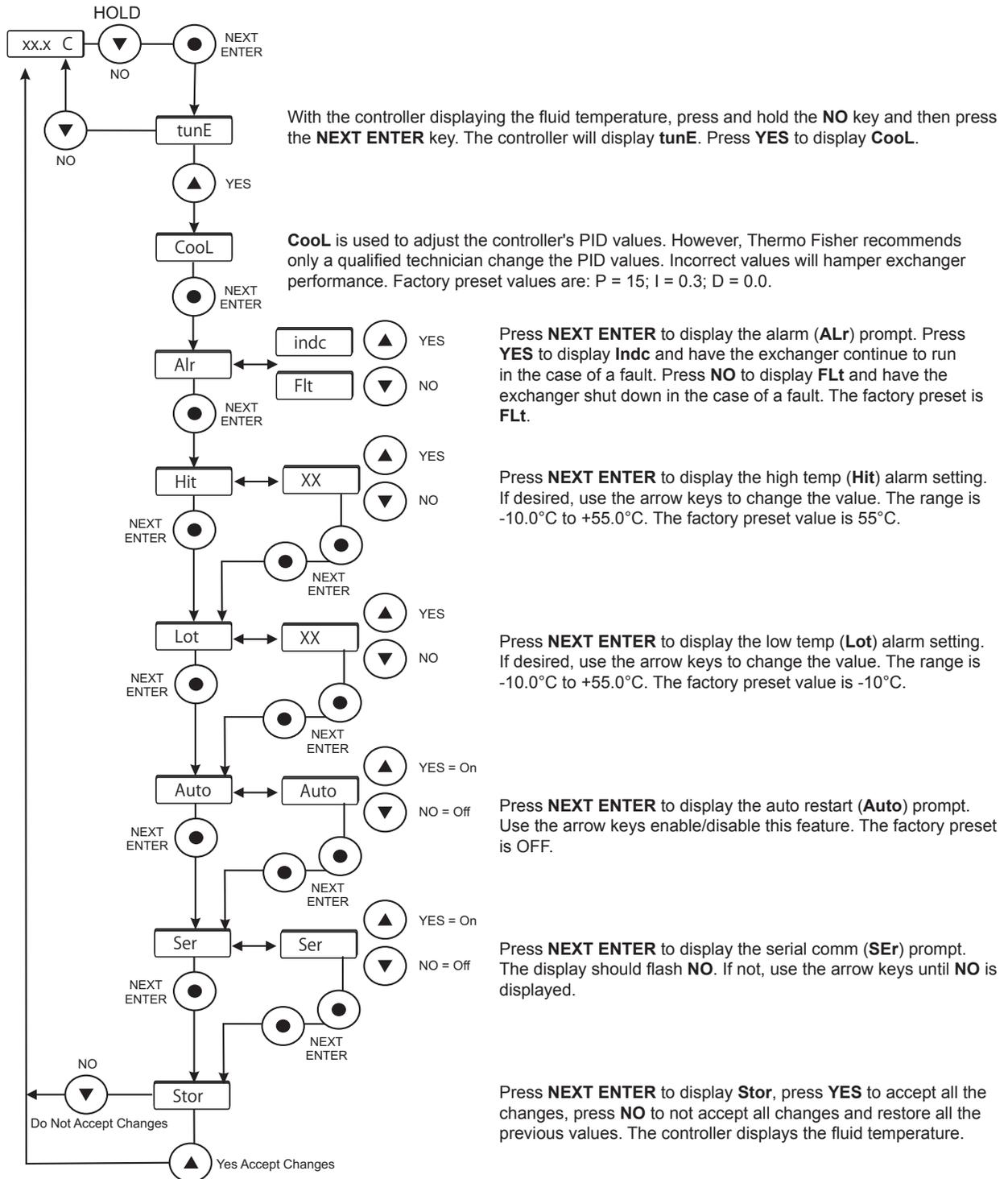
If the **NEXT ENTER** key is not depressed within one minute, the controller will time out and the new value will not be accepted. The controller will revert to the previous value.

**NOTE:** Error codes are addressed in Section V, Maintenance and Service.

## Setup Loop

The controller is used to tune the COOL PID values; configure the exchanger to continue to run (Indc) or shut down (FLt) in the event of a fault; set the high (Hit) and low (Lot) temperature limits; and enable/disable auto restart (Auto). If a temperature limit is exceeded the controller will display an error code, see Section VI.

**NOTE:** Serial Communication (SEr) is not operational. Ensure the display indicates OFF.



Setup Loop



## Section V Maintenance & Service



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

### Service Contracts

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

### Pump Strainer

Exchangers with TU pumps have a wire mesh pump strainer located at the bottom of the reservoir. If debris is drawn into the reservoir, the strainer will prevent the material from being sucked into the pump and damaging the pump vanes.

After initial installation, the strainer may become clogged with debris and scale within the first week. Therefore, the strainer must be cleaned after the first week of installation. After this first cleaning, the frequency of cleaning depends on the purity of the cooling water. We recommend a visual inspection of the reservoir be made monthly after the initial cleaning. After several months, the frequency of cleaning will be established.

If the strainer is visibly clogged, cleaning is required.

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

Cover the strainer with a plastic bag to help trap any particles which may become dislodged, and then remove the strainer by unscrewing it.

Clean the strainer by rinsing it with water.

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

## Facility Water Strainer

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

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

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

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

## Algae

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

## Configuration

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

In some cases, the side access panels needs to be removed. The access panels are secured using screws installed through the bottom of the cabinet.

**NOTE:** Some models have a one piece cover rather than separate top and side panels. One piece covers are secured by five screws on each side of the case.

## Voltage Selection (60 Hertz Exchangers)

**NOTE:** Exchangers rated 380-415 volt do not have a voltage selection switch.

Remove the top cover from the cabinet, see Configuration.

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

Replace the top cover.

## Pressure Relief Valve

Exchangers with TU pumps have a pressure relief valve is located on the pump discharge line. The relief valve establishes the exchanger's maximum operating pressure. If the pressure of the fluid leaving the pump exceeds the valve setting, the relief valve will bypass the fluid within the exchanger to relieve to the pressure. The relief valve does not determine the actual operating pressure; the actual operating pressure is determined by the flow control valve setting and pressure drop through the instrument being cooled.

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

## Fault Interlock Contact

A set of contacts is connected to a receptacle on the control panel. The contacts are rated 10A/240V. This is not a power inlet or outlet. The receptacle is isolated from the circuitry. Its ground pin is connected to the chassis. The contacts are closed during normal operation and open when the exchanger is turned off or when a fault is detected.

## Fuses

Three-phase exchangers have fuses. Refer to the serial number label on the rear of the exchanger for the specific electrical requirements.

Remove the top cover, the right access panel and the control box cover. The fuses are located inside the control box.

## Phase Rotation

Three phase exchangers with three phase pump motors are equipped with a phase rotation interlock. If the phasing is wrong, the controller will display **PHEr** and the exchanger will not start.

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



**Never remove the green ground wire.**

Plug in the exchanger. The **PHEr** display should be off and the exchanger should start.

## Pump Motor Overload Protector

Three phase exchangers with three phase pump motors have a pump motor overload protector.

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

## Displaying Software Version

This procedure will display the software version number on the exchanger's display. In the event the exchanger is not operational, the software version (and the checksum) can also be read from the label which is on the micro-processor chip itself.

The following chart uses an example of software version 000507.84A

begin at the reservoir temperature display	<b>20.3°C</b>
Press and hold NO for at least 10 seconds.	<b>0507</b>
displays software version digits to <b>left</b> of decimal. Note the two leading zeros do not display.	
Press NEXT	<b>84</b>
displays software version digits to <b>right</b> of decimal.	
Press NEXT	<b>1</b>
displays software version revision letter (as its equivalent number - display cannot show letters. A=1, B=2, etc.)	
Press NEXT	<b>0000</b>
displays checksum - this can be disregarded	
Press NEXT	<b>20.3°C</b>
returns to reservoir temperature display	

## Section VI Troubleshooting

### Error Codes

The controller also has the capability to display error codes.

#### Power up Errors

Power up errors are displays until any controller key is pressed. If the error message persists the problem is likely a keypad or controller board failure.

Display	Indication
Er 00	ROM checksum
Er 01	RAM check
Er 02	Keypad failure
Er 03	NOVRAM checksum error

#### Operating Errors

Operating errors are displays once and then clear after three seconds or when any controller key is pressed. If error messages Er 04 - Er 14 persist, the problem is likely controller board failure. If Er 15 is displayed, ensure serial communications is turned off in the Setup Loop. If Er 16 is displayed the exchanger needs calibration, contact Thermo Scientific for assistance.

Display	Indication
Er 04 - 13	Interrupt error
Er 14	Synchronous error
Er 15	Asynchronous error
Er 16	Bad calibration

#### Latching Errors

In order to restart the exchanger when a latching error is displayed, the controller's START/STOP button must be pressed after the condition is cleared.

Display	Indication
Lo t	Fluid temperature lower than low temp alarm setting.
Hi t	Fluid temperature higher than high temp alarm setting.
Er 22	Fluid temperature higher than the high overrange point. This is a fixed value, factory set at 55°C.
Er 25	RDT1 input shorted.
Er 26	RTD1 input open.
LLF	Low level fault switch open for at least three seconds.
PHEr	Improper phasing.
OL	Pump motor overload.

If any other code appears contact Thermo Fisher customer service, see Preface.

## Poor Temperature Stability

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

High temperature setpoint

Low facility water temperature

Small heat load

High facility water pressure

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

## Service Assistance

If, after following these troubleshooting steps, your exchanger fails to operate properly, contact our Service Department for assistance (see Preface, After-sale Support). Before calling please obtain the following information:

*BOM number*

*Serial number*

*Voltage of exchanger*

*Voltage of power source*

*Temperature at which the problem occurs*

*Temperature, pressure and flow rate of cooling water supply*

*Software Version*

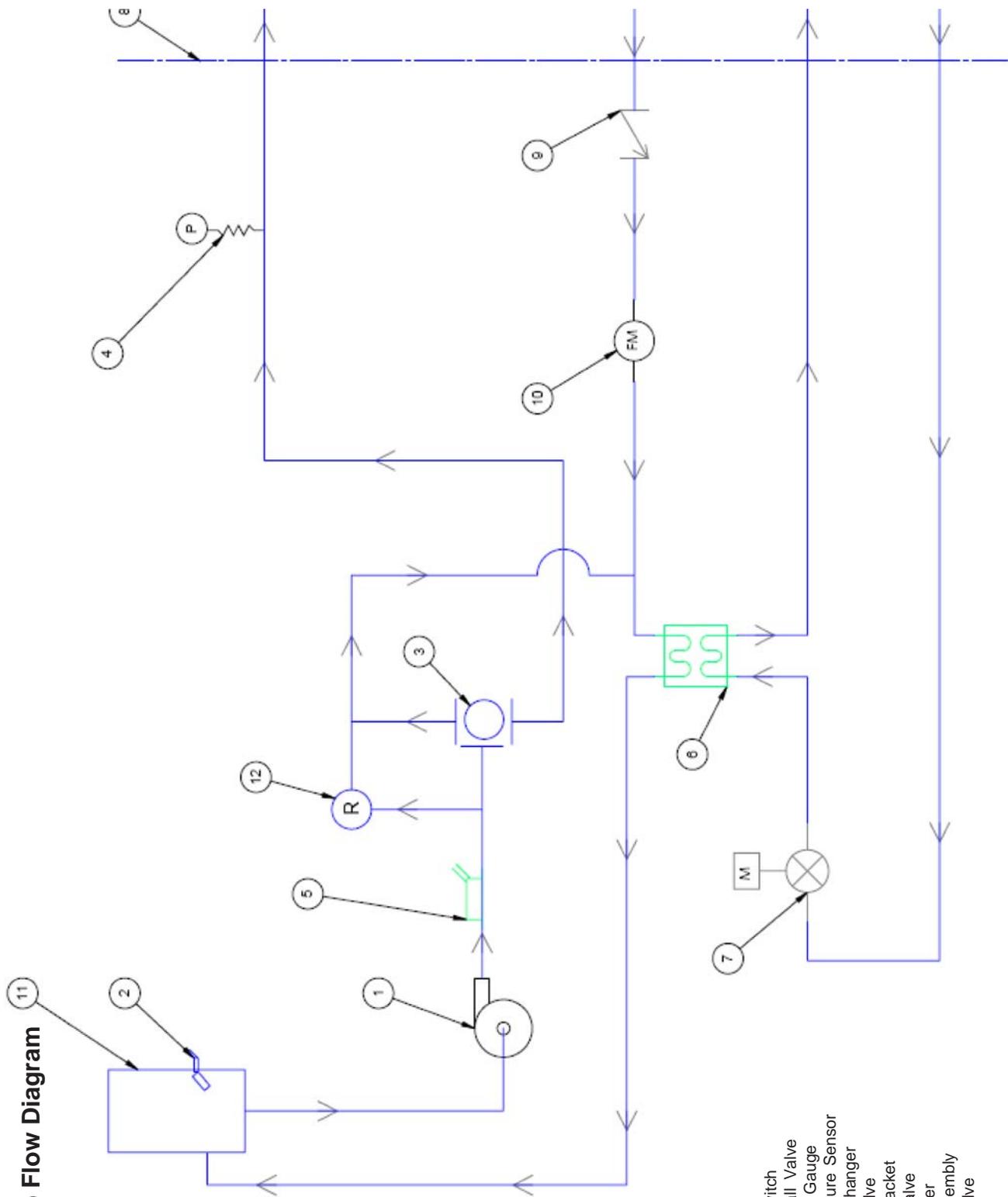
## Parts List

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

*BOM number*

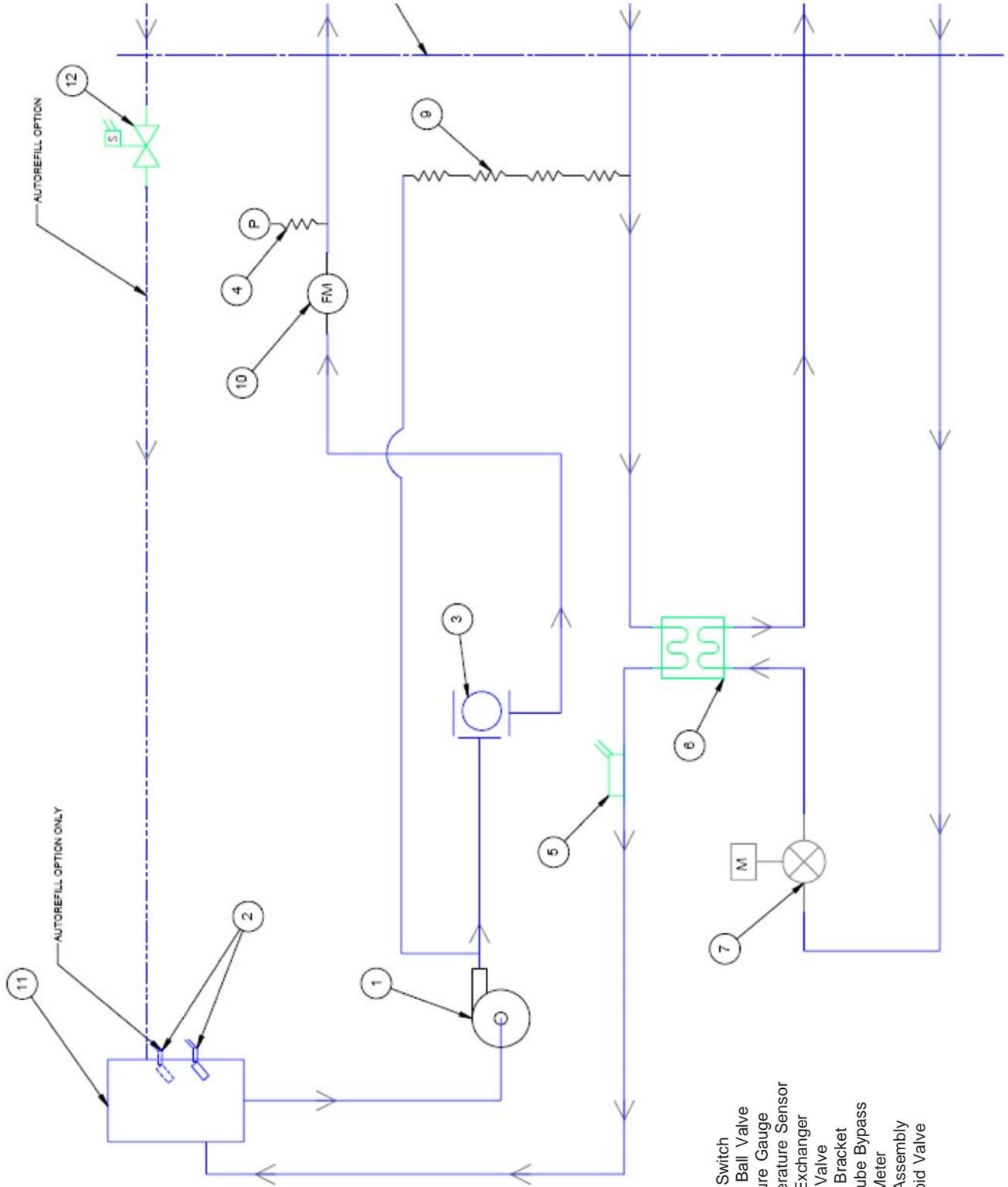
*Serial number*

# TU Pump Flow Diagram



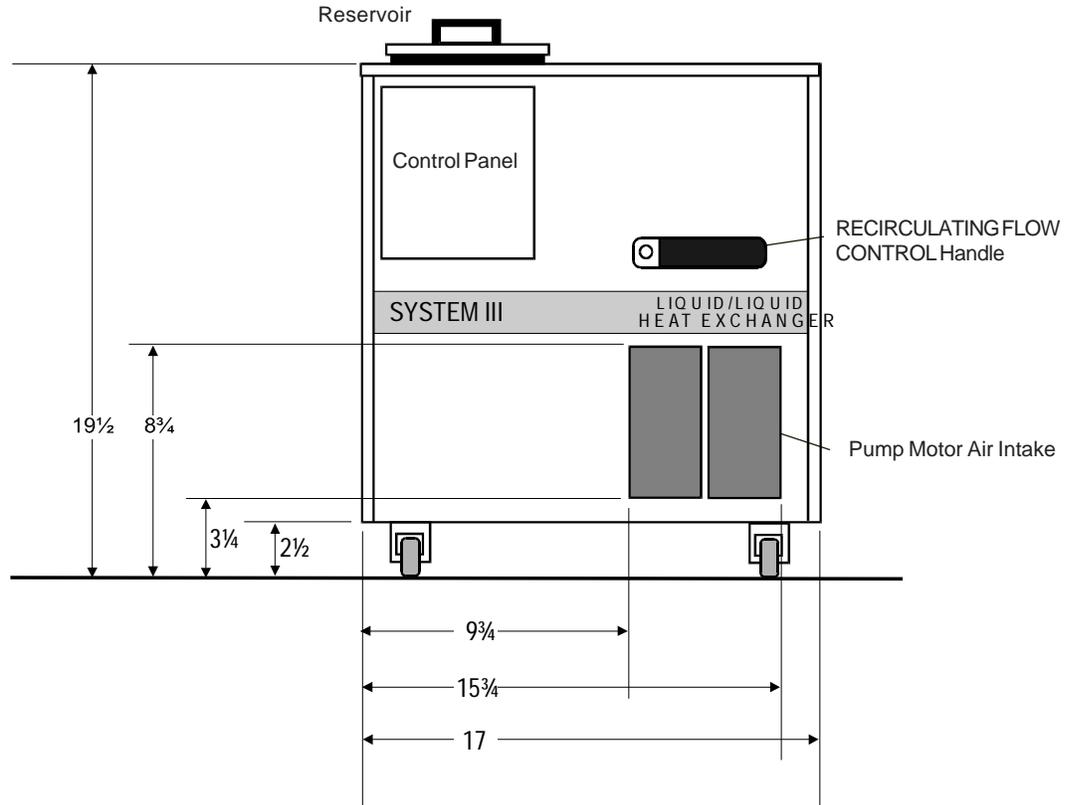
- 1 Pump
- 2 Level Switch
- 3 3-way Ball Valve
- 4 Pressure Gauge
- 5 Temperature Sensor
- 6 Plate Exchanger
- 7 Motor Valve
- 8 Water Bracket
- 9 Check Valve
- 10 Flow Meter
- 11 Tank Assembly
- 12 Relief Valve

# CP Pump Flow Diagram

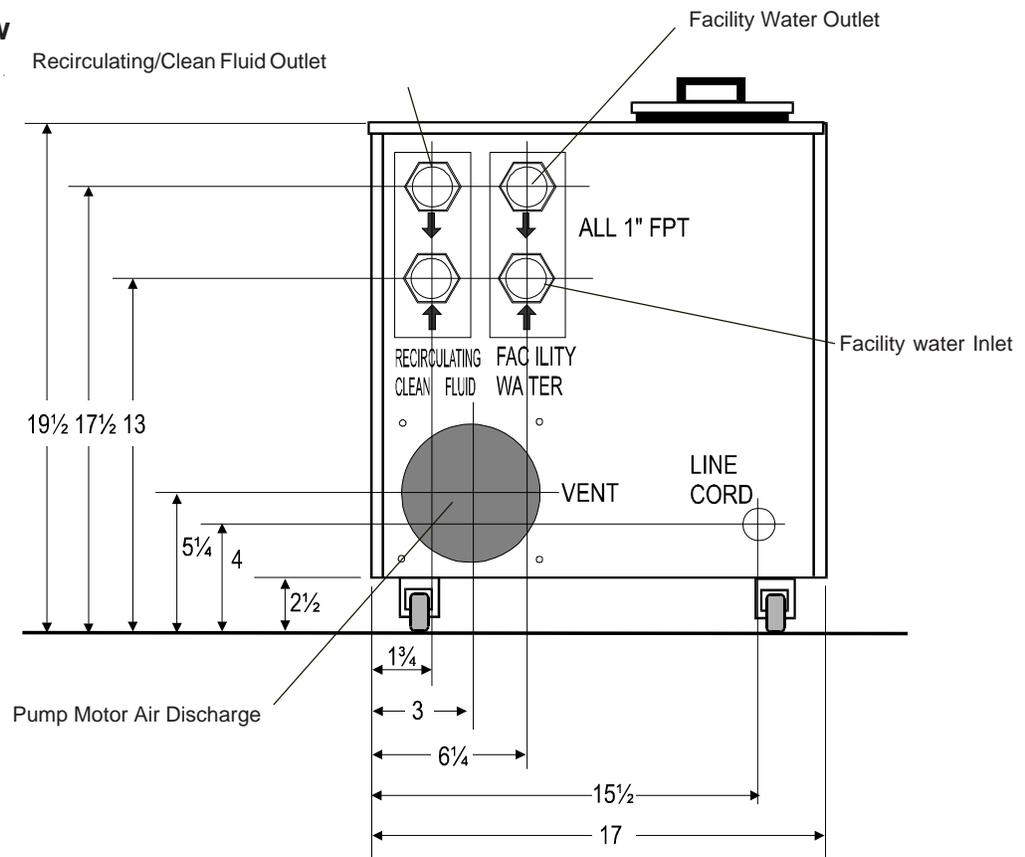


- 1 Pump
- 2 Level Switch
- 3 3-way Ball Valve
- 4 Pressure Gauge
- 5 Temperature Sensor
- 6 Plate Exchanger
- 7 Motor Valve
- 8 Water Bracket
- 9 Cap Tube Bypass
- 10 Flow Meter
- 11 Tank Assembly
- 12 Solenoid Valve

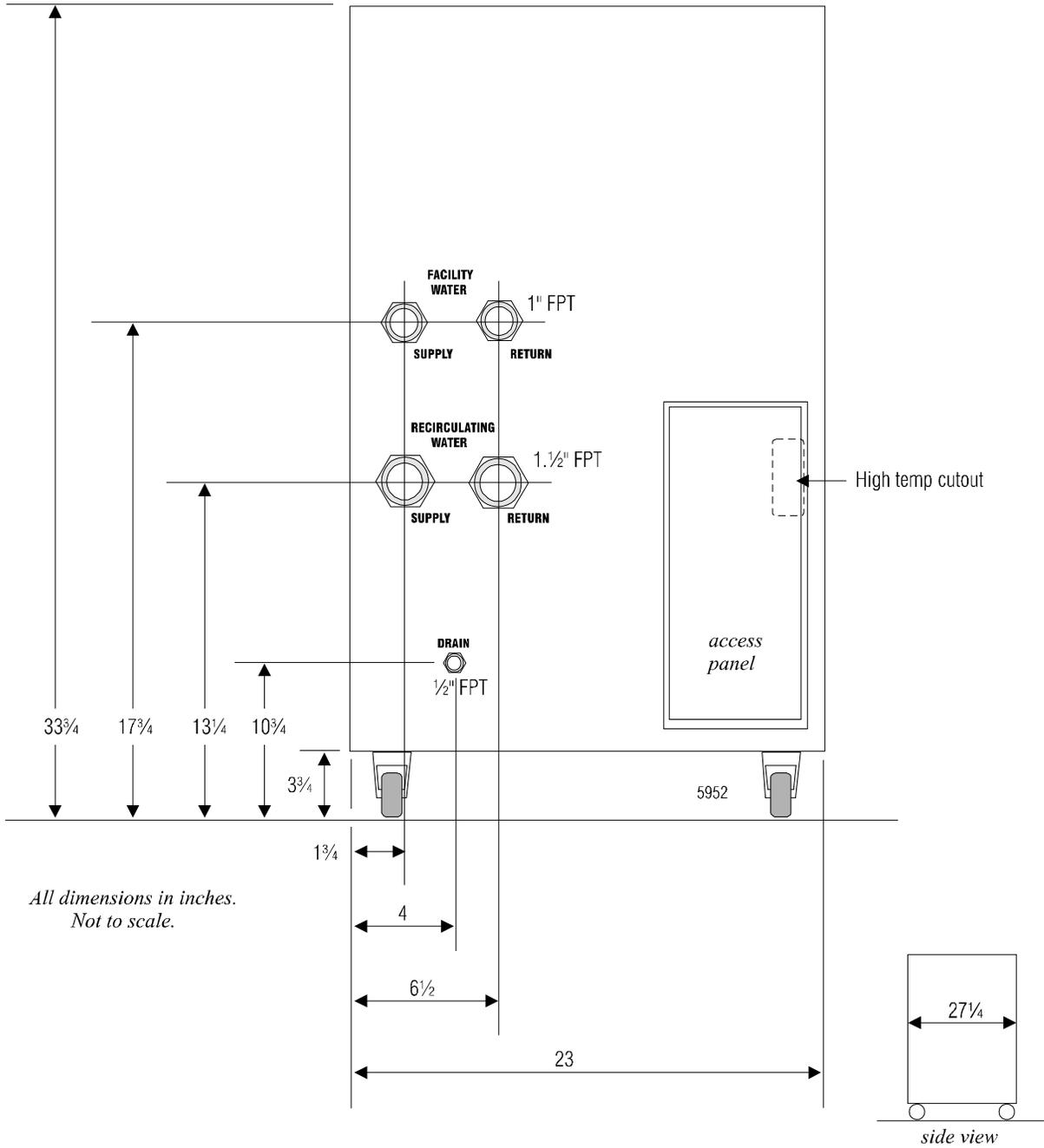
# Front View



# Rear View



# Large Volume Units



All dimensions in inches.  
Not to scale.

## Appendix

### Water Quality Standards and Recommendations

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

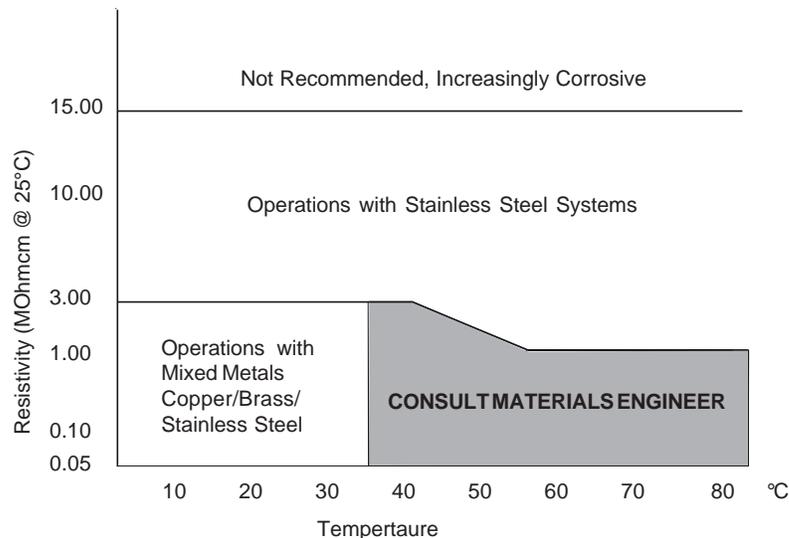
Unfavorably high total ionized solids (TIS) can accelerate the rate of galvanic corrosion. These contaminants can function as electrolytes which increase the potential for galvanic cell corrosion and lead to localized corrosion such as pitting. Eventually, the pitting could become so extensive that leaking will occur between the process water and facility water diminishing the System's heat transfer capability.

High water hardness (Calcium and Manganese) can also produce scaling. Scaling will inhibit heat transfer between the process and facility side by building up a deposit layer on metal surfaces. As an example, raw water in the United States averages 171 ppm (of NaCl). The recommended level for use in a water system is between 0.5 to 5.0 ppm (of NaCl).

Recommendation: Initially fill the tank with distilled/deionized water. Do not use untreated tap water as the total ionized solids level may be too high.

The desired level for long time usage is 1 to 3 MOhmcm (compensated to 25°C).

The above recommendation will reduce the electrolytic potential of the water and prevent or reduce the galvanic corrosion observed.



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