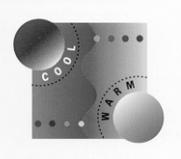


HEMOTHERM[®]

DUAL RESERVOIR COOLER/HEATER



MODEL 400MR

OPERATION & TECHNICAL MANUAL



Cincinnati Sub-Zero Products, Inc. • 12011 Mosteller Road • Cincinnati, Ohio 45241, U.S.A.
In Europe: CEpartner4U • Esdoornlaan 13, 3951 DB Maarn
The Netherlands

SYMBOLS



Caution: Read operation instructions and manual before operating



Pump



Cool



Heat



Compressor



Water Temp - Heat



Water Temp - Cool



Temperature Set



Low Water



Test Indicators



Silence Alarm



High Limit



Low Limit



High Heater



Low Heater



Temperature Limit



Operating instructions or "Important / Caution Information"



Decreasing Temperature



Increasing Temperature



Fill to Screen



Separate collection for electrical and electronic equipment



Water Temperature



AC Voltage



Outlet



Return



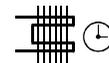
Drain



Power Cord Holder



Change Water Monthly



Clean Condenser Monthly



Clean Water Filter Quarterly



Equipotentiality



Remote Port



Protective Earth (Ground)



Danger; Risk of Electric Shock



Disconnect Power before Servicing



Earth (Ground)



Risk of Explosion: Do not use in the Presence of Flammable Anesthetics



CAUTION



Type B Equipment

HEMOTHERM[®] MODEL 400MR

OPERATION & TECHNICAL MANUAL

The operator must read and understand the **Operation & Technical Manual** in its entirety prior to operating the equipment.

Cincinnati Sub-Zero Products, Inc., reserves the right to make equipment changes and improvements which may not be reflected in this manual.

This document may not be reproduced in whole or in part without written permission from Cincinnati Sub-Zero Products, Inc.

CAUTION

Federal law restricts this device to use only on the order of a physician.

CAUTION

- **Use** distilled water only. **Failure to use distilled water may result in poor performance and damage to the Hemotherm unit.**
- **Do not** use De-ionized Water. The majority of de-ionizers do not maintain a neutral pH of 7. If the de-ionized water is acidic, it will cause a battery effect and the copper refrigeration line will begin to deteriorate and cause a leak in the refrigeration system.
- **Do not** use Reverse Osmosis (R.O.) water in a Hemotherm.
- **Do not** use alcohol. Alcohol may cause blanket deterioration.
- **Do not** operate without water to avoid damage to internal components.
- **Do not** overfill. Overfilling may result in overflow when the water in the blanket drains back into the system when the system is turned off.

Manual 56234 Rev. Q
DCN # M006-3983 2010-07

DANGER

- Do not use the Hemotherm system in the presence of flammable anesthetics. **Risk of explosion can result.**
- Power interruption will cause the Hemotherm unit to revert to **FILL MODE**. Follow instructions for desired mode to resume operation. **Failure to resume therapy could result in serious injury or death.**

DANGER

The repair, calibration, and servicing of the Hemotherm unit should be performed by qualified Medical Equipment Service Technicians, Certified Biomedical Electronics Technicians, or Certified Clinical Engineers familiar with good repair practices for servicing medical devices, and in accordance with instructions contained in this manual. **Improper repair can result in patient injury and damage to the Hemotherm unit.**

DANGER

Before returning the Hemotherm unit to patient use **after** repairs, the INITIAL SET-UP in Section 2 must **always** be performed.



WARNING



When warming blankets are used in conjunction with the Hemotherm unit, the following applies:

- A physician's order is required for setting blanket water temperature and use of equipment. At least every 20 minutes, or as directed by a physician, check patient's temperature and skin condition of areas in contact with blanket; also, check blanket water temperature. Pediatric, temperature-sensitive, patients with vascular disease and operating room patients should be checked more frequently. **Notify the physician promptly of any change in order to avoid serious injury or death.**
- The method of temperature control provided by all hyper-hypothermia units presents the danger of heating or cooling body tissues, particularly the skin, to a point where they are injured, i.e., burns or frostbite, respectively. Depending on the extent and severity of a burn, very serious and even fatal complications may arise.
- Prevent excessive and/or prolonged tissue pressure and shearing forces, especially over bony prominences, to prevent skin damage that may result.
- Do not place additional heat sources between the patient and blanket. **Skin damage may result.**
- The area between the patient and the blanket should be kept dry to avoid injury to patient.

TABLE OF CONTENTS

	Page No.
TECHNICAL HELP	1
AUTHORIZED EUROPEAN REPRESENTATIVE:	1
BEFORE YOU CALL FOR SERVICE... ..	1
IN-WARRANTY REPAIR AND PARTS.....	1
RECEIVING INSPECTION.....	1
IMPORTANT SAFETY INFORMATION.....	1
SECTION 1. GENERAL INFORMATION.....	2
1.0 GENERAL SAFETY PRECAUTIONS.....	2
1.1 FUNCTION OF HEMOTHERM MODEL 400MR COOLER/HEATER EQUIPMENT	2
1.2 COOLING SYSTEM.....	2
1.3 HEATING SYSTEM.....	3
1.4 CIRCULATION SYSTEM	4
1.5 GENERAL OPERATION	5
1.6 GENERAL SAFETY PRECAUTIONS.....	9
1.7 EQUIPMENT DESCRIPTION AND SPECIFICATIONS.....	9
1.8 REMOTE CONTROL OPTION	9
1.9 CLINICAL APPLICATIONS.....	10
1.10 HEMOTHERM SYSTEM EQUIPMENT & ACCESORIES.....	10
1.11. HEMOTHERM SYSTEM EQUIPMENT SPECIFICATIONS	12
1.11. HEMOTHERM SYSTEM EQUIPMENT SPECIFICATIONS	13
1.12. HEMOTHERM CERTIFICATIONS	13
SECTION 2. OPERATING INSTRUCTIONS	14
2.1 INITIAL SET-UP	14
2.2 CONNECTION PROCEDURE	15
2.3 SUGGESTIONS FOR PROTECTING THE RESERVOIR FROM BACTERIA	18
2.4 BUILT-IN SAFETY PRECAUTIONS.....	19
SECTION 3. GENERAL MAINTENANCE AND REPAIR	20
3.1 GENERAL INSTRUCTIONS-MAINTENANCE, REPAIR OR REPLACEMENT OF COMPONENTS	20
3.2 MAINTENANCE OF THE WATER RESERVOIRS	20
3.3 MAINTENANCE OF THE WATER CIRCULATING SYSTEM.....	21
3.4 MAINTENANCE OF THE WATER FILTER	22
3.5 MAINTENANCE OF THE CONDENSER GRILLE	23
3.6 MAINTENANCE OF BLANKETS.....	23
3.7 INSTRUCTIONS FOR REPLACING HEATERS.....	24
3.8 INSTRUCTIONS FOR REPLACING PUMP HOUSING OR PUMP.....	25
3.9 REPLACING THE SENSOR	25
3.10 REPLACING THE MICROPROCESSOR BOARD	26
3.11 REPLACING THE MEMBRANE CONTROL PANEL	27
3.12 REPLACING THE MANIFOLD	28
3.13 TROUBLESHOOTING THE COMPRESSOR (115, 230 AND 240 VAC UNITS)	29

3.14	TROUBLESHOOTING THE COMPRESSOR (100 VAC UNITS ONLY)	30
3.15	INSTRUCTIONS FOR LEAKAGE CURRENT	31
3.16	HI LIMIT TEST PROCEDURE	31
3.17	LOW LIMIT TEST PROCEDURE	32
3.18	SUGGESTED PREVENTIVE MAINTENANCE CHECKLIST (AT LEAST QUARTERLY).....	33
3.19	TROUBLESHOOTING GUIDE	34
3.19	TROUBLESHOOTING GUIDE	35
3.19	TROUBLESHOOTING GUIDE	36
3.19	TROUBLESHOOTING GUIDE	37
3.19	TROUBLESHOOTING GUIDE	38
3.19	TROUBLESHOOTING GUIDE	39
3.19	TROUBLESHOOTING GUIDE	40
3.20	MICROPROCESSOR BOARD ERROR CODE TROUBLESHOOTING	41
SECTION 4 PARTS INFORMATION		42
4.1	ORDERING INFORMATION FOR REPLACEMENT PARTS	42
4.2	RECOMMENDED REPLACEMENT PARTS INVENTORY	42
4-4.	SHIPPING PARTS	43
4-5.	EQUIPMENT AND ACCESSORIES ORDER INFORMATION	43
FIGURE 4.4 PARTS LIST FOR THE HEMOTHERM MEMBRANE CONTROL PANEL 100/115V		47
FIGURE 4. 6 PARTS LIST FOR THE HEMOTHERM ELECTRICAL SUB-PANEL		49
WORLDWIDE ORDER PLACEMENT		58

LIST OF ILLUSTRATIONS

	Page No.
Figure 4.1 HEMOTHERM Front & Side View.....	44
Figure 4.2 Parts List for the HEMOTHERM - Front & Side View.....	46
Figure 4.3 HEMOTHERM – Membrane Control.....	46
Figure 4.4 Parts List for the HEMOTHERM Membrane Control Panel 100/115V.....	47
Figure 4.5 HEMOTHERM - Electrical Sub-Panel.....	48
Figure 4. 6 Parts List for the HEMOTHERM Electrical Sub-Panel.....	49
Figure 4. 7 HEMOTHERM - Rear View.....	50
Figure 4. 8 Parts List for HEMOTHERM - Rear View.....	51
Figure 4.9 HEMOTHERM - Electrical Schematic 115 Volt.....	53
Figure 4.10 HEMOTHERM Electrical Schematic 230 Volt.....	54
Figure 4.11 HEMOTHERM - Electrical Schematic 240 Volt.....	55
Figure 4.12 HEMOTHERM - Electrical Schematic 100 Volt.....	56
Figure 4.13 HEMOTHERM - Water Circulation Diagram.....	56
Figure 4.14 HEMOTHERM - Refrigeration Flow Diagram.....	57

TECHNICAL HELP

United States and Canada
Cincinnati Sub-Zero Products, Inc.
12011 Mosteller Road
Cincinnati, OH 45241

Telephone 1-513-772-8810
Toll Free 1-800-989-7373
Fax 1-513-772-9119

Authorized European Representative:

CEpartner4U
Esdoornlaan 13, 3951 DB Maarn
The Netherlands

Telephone + 31 (0) 6-516.536.26

BEFORE YOU CALL FOR SERVICE...

To help us better serve you, please have the serial number of your Hemotherm unit ready when you call for parts or service.

IN-WARRANTY REPAIR AND PARTS

All parts on your Hemotherm unit are covered by a one-year warranty. To return defective parts or units, first obtain a Returned Materials Authorization (RMA) number from our Medical Technical Service department. A Hemotherm shipping carton will be sent to you, if needed.

RECEIVING INSPECTION

After unpacking the Hemotherm System, be sure to inspect the system for concealed damage. Retain all packing material and carefully describe or photograph any damage. Notify the carrier at once and ask for an inspection (in writing). Failure to do this within 15 days may result in loss of claim. Do not return the equipment to Cincinnati Sub-Zero. Call our Medical Technical Service department for further instructions.

IMPORTANT SAFETY INFORMATION

Refer to this manual for instructions and caregiver information. Read and understand all precautionary information before using, prescribing, or servicing the Hemotherm unit.

SECTION 1. GENERAL INFORMATION

1.0 GENERAL SAFETY PRECAUTIONS

To provide the patient maximum safety during the use of the HEMOTHERM Cooler/Heater system, a thorough knowledge and understanding, and the correct application and operating use of the system is required. Each person who is responsible for the use or the direction of use of the system, such as physicians, nurses, technicians and operators, must read and understand this operating manual, and all precautions and warnings prior to use. It is recommended that this manual be reviewed at least semi-annually as a refresher to safe operation and application.

1.1 FUNCTION OF HEMOTHERM MODEL 400MR COOLER/HEATER EQUIPMENT

The CSZ HEMOTHERM Model 400MR Cooler/Heater system is used to lower/raise the blood temperature and/or maintain blood temperature, as required, through conductive heat transfer. The conductive heat transfer is accomplished through any type of Blood Oxygenator/Heat Exchanger unit, along with the use of a blanket under the patient for the re-warming phase, if desired. The complete system usually comprises of the HEMOTHERM Cooler/Heater unit and reusable or disposable blanket on the O. R. Table-Adult, Pediatric, or Infant size. Available blankets are : the reusable PLASTIPAD[®] blankets (polyurethane) and the disposable MAXI-THERM[®], MAXI-THERM[®] LITE, and TEMP PAD[®] blankets.

The operator of the unit regulates the desired fluid temperature. Frequent observation of the actual blood temperature is required.

1.2 COOLING SYSTEM

The HEMOTHERM 400MR cooling system consists of:

1. A mechanically refrigerated water-to-refrigerant heat exchanger.
2. Chilled water reservoir.
3. Water re-circulation pump.
4. Microprocessor control system.
5. Low temperature safety.
6. Low water cut off safety.

With a capacity to lower the water temperature at a 2°C/minute rate, a reduction of blood temperature is produced. It is important to remember that there is no direct relationship between this and the rate of change in the blood temperature. The re-circulation pump and water flow circuitry have been designed for high flow rate to maximize the blood-to-water heat transfer efficiency.

The cooling system's temperature controller allows the operator to set the temperature range from +3°C to +32°C. An independent Low Limit Safety in the microprocessor board provides the low limit safety function and is factory preset at 2°C.

1.3 HEATING SYSTEM

The CSZ HEMOTHERM heating system consists of:

1. 300 Watt Heater.*
2. 1200 Watt Heater.*
3. Microprocessor control system.
4. Hot water reservoir.
5. Water re-circulation pump.
6. High temperature safety.
7. Low water cut off switch.

When in the cool mode, the 300 Watt heater will pre-warm the heat bath to the desired temperature set for that reservoir. While in the heat mode, the bath is heated with both heaters or 1500 watts of heat. The water temperature will increase at a rate of approximately 2.5°C/minute. It is important to remember that there is no direct relationship between this and the rate of change in the blood temperature.

The high temperature safety is designed to shut off the heaters at 44°C. If the controller should happen to fail at the 42°C set point, a high temperature LED warning light on the control panel will illuminate and alarm at 44°C. If this should occur, the system should be inspected by the hospital's maintenance or engineering department. The heating system will come back on after approximately a 1°C temperature drop.

* 230/240 VAC units have one 800 watt heater and one 1200 watt heater.

1.4 CIRCULATION SYSTEM

The HEMOTHERM 400MR circulation system consists of:

1. Two water reservoirs.
Cool Reservoir - (8 qts. - 7.6 liters)
Heat Reservoir - (6 qts. - 5.7 liters)
2. One magnetic-drive recirculation pump.
3. Four water flow control valves - solenoid operated.
4. One water filter.
5. Six external interfacing quick-disconnect couplings.
6. Interconnecting piping, internal.

Selection of the operation mode (heat or cool) determines which water flow circuit is used.

HEATING MODE: Pump draws water from the warm water reservoir and circulates it through the water filter to the external outlet couplings connected to the device in use (Blood Oxygenator/Heat Exchanger and/or blanket). Returning water flows back into the same (warm) water reservoir.

COOLING MODE: Pump draws water from the cooled water reservoir and circulates it through the water filter to the connected external device(s). Returning water flows back into the cooled water reservoir. The circulation system operates with distilled/sterile water.

DO NOT USE DEIONIZED WATER. No alcohol or ethylene glycol (antifreeze) required.

Flow rate capacity is as follows:

Through 1/2" self-sealing Hansen fittings: approximately 3.5 GPM (13 liters/minute).*

Through adult blanket: approximately 32 GPH (100 liters/hour).

* Flow rate will vary depending upon brand and model number of heat exchanger used and also upon length of tubing leading to and from heat exchanger.

1.5 GENERAL OPERATION

1. Collect all Supplies and Equipment:
 - A. HEMOTHERM Cooler/Heater unit: include connecting hoses to the heat exchanger making sure that all connections are tight.
 - B. Hyper-Hypothermia blanket: make sure that there are no leaks. Instructions for repairing the blanket can be found under Maintenance of Blankets, Section 3.4.
2. Place HEMOTHERM unit in O.R. suite as close to the heat exchanger as possible.
3. Read the operating instructions on the membrane control panel. Familiarize yourself with the name and location of all features and controls shown in Figure 4.4.
4. Check the level of the distilled/sterile water in both fluid reservoirs to make certain they are filled to where water can be seen in bottom of the strainer. (Heat reservoir holds 6 qts. (5.7 liters) and the Cool reservoir holds 8 qts (7.6 liters). It is necessary to add a little water after each use to replace water thrown away in disposable heat exchanger and Hyper-Hypothermia blanket if a disposable blanket was used.
5. Make sure the power switch is in the "OFF" position.
6. Inspect the hospital grade plug for bent or missing prongs. Insert the plug into a properly grounded, securely mounted receptacle. Grounding reliability can only be achieved when connected to an equivalent hospital grade receptacle. Do not bypass the third or grounding prong. An electrical hazard may result if it is bypassed, removed, or otherwise rendered useless.
7. Lay the Hyper-Hypothermia blanket flat on the O.R. table with hose attachment coming off the table as close as possible to where the HEMOTHERM unit will be placed. Cover the blanket with a sheet, or bath blanket.
8. Test-Indicators: Energize and De-energize all display segments and all red LED's. Press the power switch to the "ON" position.

NOTE: The HEMOTHERM unit will go through a two second self calibration procedure with both displays blank and then through a fill mode for approximately forty seconds. The displays will show FI on the Heat side and LL on the Cool side spelling out FILL. This allows the unit to calibrate itself and prime the pump automatically.

- A. Press "HEAT" or "COOL" for desired mode of operation. (Flashing Temperature is set point; Non-Flashing is actual reservoir temperature). Preset temperatures are 3°C -cooling; 42°C -heating .
- B. Select Cool - cool display will flash when below 10°C until pump switch is activated. Then it will display actual water temperature and the compressor will start up.
- C. If you wish to change the setting, depress the "Temp Set" switch. The display will flash the previous set point temperature or 3°C if the unit has just been turned on.

NOTE: You have five seconds to depress one of the arrows or the temperature readout will return to the actual reservoir temperature. Depress either the "up" or "down" arrow to raise or lower the set point temperature to the desired setting.

- D. Depress the "Cool" switch. When ready to circulate the water, depress the pump switch.

**WARNING**

The temperature cannot be set below 10°C without activating the "Pump" switch. If the operator attempts to do so, the set point temperature will flash until the "Pump" switch is activated. Then it will display the actual temperature and the compressor will activate.

- E. To prewarm the heat reservoir while cooling to the desired water temperature, press the "Temp Set" switch. The display will flash the previous set point temperature or 42°C if the unit has just been turned on.

NOTE: You have five seconds to depress one of the arrows or the temperature readout will return to the actual reservoir temperature. Depress either the "up" or "down" arrow to raise or lower the set point temperature to the desired setting.

NOTE: When the compressor cycles off, both heaters come on until the temperature of the heat reservoir is within 1°C of the set point. If the compressor cycles back on, only the 300 watt heater remains on for 100 and 115 VAC units. (See * for 230/240 VAC units.)

- F. The unit will not cool below 10°C unless the pump is activated.
- G. Select the "HEAT" switch. Depress the "Temp Set" switch. The display will flash the previous set point temperature or 42°C if the unit has just been turned on.

NOTE: You have five seconds to depress one of the arrows or the temperature readout will return to the actual reservoir temperature. Depress either the "up" or "down" arrow to raise or lower the desired setting. Depress the heat switch.

- H. When ready to circulate the water, depress the "pump" switch.

9. After the cool bath is preconditioned, proceed to connect your heat exchanger to the 1/2" self-sealing Hansen fittings.

NOTE: You may want to turn off the pump or the flow indicator shut-off valve first if you choose not to circulate cool water through the heat exchanger at this time.

10. Check physician's instructions to determine the desired cooling and heating temperatures.
11. At this point, you may choose to maintain normal body temperature (Step 12) or you may choose to cool the blood (Step 13).
12. Maintain normothermia by setting the desired temperature, depressing the heat switch, and making sure the pump is on. The "HEAT" temperature displayed is the fluid temperature circulating through the heat exchanger and the Hyper-Hypothermia blanket (if you choose to use a blanket).

NOTE: Both the 300 watt low heater and the 1200 watt high heater will cycle on and off to maintain the set point temperature for 115 VAC units. (See * for 230/240 VAC units.)

- * 230/240 VAC units have an 800 watt and a 1200 watt heater.

13. Cool the blood by setting the desired fluid temperature. Using the cool mode "temp set", you may choose 3°C for better efficiency. The "COOL" temperature displayed is the fluid temperature circulating through the heat exchanger.

NOTE: The compressor will cycle on and off to maintain the set point temperature.

14. Maintain final hypothermia temperature by resetting the Cool set point temperature to 10°C and turning off the pump when you reach the hypothermia temperature desired. If the temperature should tend to rise, reactivate the pump allowing the cool water to circulate through the heat exchanger and as a result bring the blood temperature down again.

NOTE: Preset your hot bath temperature to the desired initial rewarming temperature.

15. For 115 VAC units, rewarm by activating the "HEAT" switch and resetting the set point temperature to the desired water temperature. Both the 300 watt and the 1200 watt heaters will activate giving you a maximum of 1500 watts of heat to raise the hot bath fluid temperature to the set point temperature. At this point, if desired, connect your Hyper-Hypothermia blanket to the 1/8" Hansen fittings of the HEMOTHERM unit to maximize rewarming efficiency. (See * for 100 VAC and 230/240 VAC units.)

16. If you happen to overshoot your desired "COOL" bath temperature, you may push the "HEAT" switch for five to ten seconds allowing the water in the water lines and heat exchanger to empty into the "HEAT" bath and fill up with warm water. Switching back to the "COOL" mode will allow warm water in the water lines and heat exchanger to be dumped into the "COOL" bath, in turn warming the temperature of that bath a few degrees (1°-6°C) depending on the difference in temperature between the two reservoirs. The same can be done if you overshoot your desired hot bath temperature.

17. To discontinue operation, simply turn off the power switch and disconnect all lines leading to the heat exchanger and blanket from the HEMOTHERM unit.

* 100/115 VAC units have a 300 watt and a 1200 watt heater. 230/240 VAC units have one 800 watt and one 1200 watt heater.

1.6 GENERAL SAFETY PRECAUTIONS

If water is found leaking into or around the HEMOTHERM unit prior to or during the operating procedure discussed here, immediately disconnect power to the unit and correct the malfunction before proceeding.

Before performing any disassembly procedure, unplug power cord from receptacle.

High and low temperature limiting thermostats are preset at the factory and should perform satisfactorily for the life of the HEMOTHERM unit. Except for refrigeration component repairs, the repair and servicing of the HEMOTHERM unit requires no special tools. However, no attempt should be made to perform any of the repairs or service procedures outlined in this manual unless the proper skills and knowledge are possessed.

Exercise extreme caution if this equipment is used on electrically susceptible patients (probe, catheter or electrodes directly connected to the heart). Always test for current leakage before use. Additional warnings are expressed at appropriate points in the manual.

1.7 EQUIPMENT DESCRIPTION AND SPECIFICATIONS

Equipment descriptions and specifications for the HEMOTHERM Cooler/Heater System are included in Sections 1.10 and 1.11. They are subject to change without notice.

1.8 REMOTE CONTROL OPTION

All HEMOTHERM units manufactured after serial # 891-9327M are equipped with a remote control port. The 25 pin sub-d port connection is located on the right side of the unit, above the circuit breaker. If the remote control option is purchased, the "assembly" will include a mating 25 foot cable, the remote control unit, and a mounting clamp.

To install the remote control option, first turn the HEMOTHERM unit power switch off. Mount the remote control in a convenient place utilizing the universal mounting clamp provided. Connect the cable between the two devices and lock in place by tightening the thumb screws attached to the cable. The remote control will operate the same as the main membrane control panel located on the HEMOTHERM.

NOTE: The display on the remote control will be "blank" during the initial forty second fill mode.

1.9 CLINICAL APPLICATIONS

The HEMOTHERM Dual Reservoir Cooler/Heater was designed specifically for use in the extracorporeal circuit. The unit is a self contained temperature control device designed to deliver chilled or heated water to the blood heat exchanger in the cardiopulmonary bypass circuit.

The HEMOTHERM Cooler/Heater will develop and maintain temperatures in adults by utilizing the full range of controllability between 3°C - 42°C.

There are many variables that affect the heating or cooling of the patient in the extracorporeal circuit. Some of these include the patient's weight, blood flow, gas flow and oxygenator/heat exchangers. The HEMOTHERM Cooler/Heater has been designed to provide high water flow rates at low pressure for safe and highly efficient operation with all currently available heat exchangers.

The HEMOTHERM Cooler/Heater can help maintain normal body temperature (normothermia) particularly during lengthy surgical procedures or where the ambient (room) temperature is set low. This can be done with the use of a Hyper-Hypothermia blanket underneath the patient.

1.10 HEMOTHERM SYSTEM EQUIPMENT & ACCESORIES

<u>Cat. No.</u>	<u>HEMOTHERM Equipment</u>
400MR	HEMOTHERM Dual Reservoir Cooler/Heater
414	Remote Control
410	Protective Dust Cover
420	Flow Indicator with Shutoff Valve Assembly
UMC-1	Universal Mounting Clamp

MAXI-THERM® Single-Patient Use Blankets (Vinyl)

Contents: 20 Blankets per case (4 Cartons of 5 Each)

276	Adult/O. R. Table Size (24" x 60")
274	Pediatric Size (22" x 30")
273	Infant Size (12" x 18")
286	9' Connecting Hose (Extra Length Hoses Available)

MAXI-THERM® LITE Single Patient Use Blankets

876	Adult/O.R. Table Size (25" x 64")
874	Pediatric Size (25" x 33")
873	Infant Size (12.5" x 18")

PLASTIPAD® Reusable Plastic Blankets (Polyurethane)

- 196 Adult/O. R. Table Size (24" x 60")
- 194 Pediatric Size (22" x 30")
- 193 Infant Size (12" x 18")
- 186 9' Blanket Extension Hose With Couplings
(Extra Length Hoses Available)
- 168 PLASTIPAD Patch Kit

1.11. HEMOTHERM SYSTEM EQUIPMENT SPECIFICATIONS

<u>PHYSICAL</u>	<u>ELECTRICAL</u>
<ul style="list-style-type: none"> • Dimensions: 22"W x 22"D x 32"H (55.9cm Wide x 55.9cm Deep x 81.3cm High) • Floor space consumed: 484 sq. in. (3,123 sq. cm.) • Weight: 198 lbs. (89.8kg.) • Cabinet construction: 16 gauge steel • Warm air flow: bottom (downward) <p style="text-align: center;"><u>CIRCULATING SYSTEM</u></p> <p><u>Reservoir Capacity:</u> Cool - 8 qts. (7.6 liters) Heat - 6 qts (5.7 liters)</p> <p>Reservoir Fluid: Distilled Water Only Reservoir Opening: Easy-to-Fill Reservoir Construction: Plastic</p> <p><u>Flow Rate:</u></p> <ul style="list-style-type: none"> • 13 Liters/Minute through self-sealing Hansen Fittings • 15 Liters/Minute with flow through Hansen Fittings <p>Maximum Pressure: 12.5 PSI - Heat Exchanger</p> <p><u>Connections:</u></p> <ul style="list-style-type: none"> • 12.5 PSI - Blanket Connection Quick Disconnect Fittings • 1 Set ½" Hansen Fittings for Heat Exchanger • 1 Set 1/8" Hansen Fittings for Blanket • 1 Set ¼" Hansen Fittings for draining (on unit) • 1 Additional set ½" Hansen Fittings included for tubing 	<p>Electrical Characteristics:</p> <ul style="list-style-type: none"> • (std) 115V, 60Hz, 16.9 amps • (opt) 100V, 50/60Hz, 20 amps • (opt) 230V, 50/60HZ, 10.9 amps • (opt) 240V, 50/60HZ, 10.5 amps <p>Outlets Required:</p> <p><u>115VAC units</u> - 20 amps, AC grounded hospital grade plug</p> <p><u>100VAC units</u> - 20 amps, AC grounded with no plug</p> <p><u>230VAC units</u> - 15 amps, AC grounded with European plug</p> <p><u>240VAC units</u> - 15 amps, AC grounded with European plug</p> <p>Current Leakage: Under 300 micro amps (100/115) Under 500 micro amps (230/240)</p> <p>Circuit Breaker: In power switch</p> <p style="text-align: center;"><u>SAFETY</u></p> <p>Hi Limit Thermostat: 44°C ± .5°C Low Limit Thermostat: 2°C ± .5°C Operating Instructions On Unit: Yes</p>

1.11. HEMOTHERM SYSTEM EQUIPMENT SPECIFICATIONS

<p style="text-align: center;">COOLING SYSTEM</p> <p>Compressor: ½ HP oversize</p> <p>Fluid Cooling Range: 32°C to 3°C</p>	<p style="text-align: center;">CONTROL SYSTEM</p> <p>Fluid Temp Control Range: 3°C to 42°C</p> <p>Fluid Temp Control Accuracy: ± .5°C</p> <p>Fluid Temp Setting: 1°C</p>
<p style="text-align: center;">HEATING SYSTEM</p> <p>Power Rating:</p> <p><u>100/115 VAC units:</u> 300 Watt-Low Heater 1200 Watt-High Heater</p> <p><u>230/240 VAC units:</u> 800 Watt-Low Heater 1200 Watt-High Heater</p> <p>Fluid Heating Range: 25°C to 42°C</p>	<p style="text-align: center;">SERVICEABILITY</p> <p>Easy to Maintain - Yes</p> <p>Easy to Field Service - Yes</p> <p>Special Tools Required - No (Except for refrigeration repairs)</p> <p style="text-align: center;">WARRANTY PERIOD</p> <p>1 year parts and labor if returned to CSZ</p>

1.12. HEMOTHERM CERTIFICATIONS



SECTION 2. OPERATING INSTRUCTIONS

2.1 INITIAL SET-UP

Steps 1-11 should be followed the first time the HEMOTHERM unit is set-up. For subsequent operation, refer to General Operation Instructions, Section 1.5.

1. Collect proper equipment and supplies.
 - A. HEMOTHERM unit.
 - B. Hyper-Hypothermia blanket.
 - C. 17 qts. (16 liters) of distilled water. [The cool reservoir holds 8 qts. (7.6 liters), the heat reservoir holds 6 qts. (5.7 liters), the blanket (adult) holds 2 qts. (1.9 liters) and approximately 1.5 qts. (1.4 liters) will be required to fill the connecting lines and the heat exchanger]. No alcohol is required.
 - D. Bacteriostatic or bactericidal agent, if desired. See Section 2.3.
2. Make sure power switch is in the "OFF" position.
3. Lift the reservoir lid and remove individual reservoir covers. Fill cool reservoir with 8 qts. (7.6 liters) of distilled water and the heat reservoir with 6 qts. (5.7 liters) of distilled water. The level should be approximately 1" from the top of each reservoir or just covering the bottom of the strainer.
4. Add bactericidal agent, if desired. See Section 2.3.
5. Insert plug into properly grounded, securely mounted receptacle. Grounding reliability can only be achieved when connected to an equivalent hospital grade receptacle. Do not bypass the third or grounding leg. An electrical hazard may result if it is bypassed, removed or otherwise rendered useless.
6. Place HEMOTHERM unit next to or near heat exchanger, or in another convenient location.
7. Lay the Hyper-Hypothermia blanket on the O. R. table with hose attachments close to where the HEMOTHERM unit will be placed during operation. Cover the blanket with a sheet or bath blanket.
8. Attach the heat exchanger and the blanket connecting lines (if desired) to the HEMOTHERM unit. See Section 2.2.
9. Read operating instructions on the control panel before starting the 100/115V unit. Familiarize yourself with the name and location of all features and controls shown.

10. Fill the heat exchanger and blanket by activating the power switch. The HEMOTHERM will go through a two second self calibration procedure with both displays blank and then through a fill mode for approximately forty seconds. The displays will show FI on the Heat side and LL on the Cool side spelling out FILL. This allows the unit to calibrate itself and prime the pump automatically. Then activate the heat/cool mode switch and then the pump switch. Add more distilled or sterile water to the reservoir of the mode selected when filling.
 11. Reference Section 1.5 General Operations for Instructions on Heating or Cooling.
-

2.2 CONNECTION PROCEDURE

1. Take the set of 1/2" Hansen self-sealing fittings and attach them to (2), 1/2" I.D. plastic tubes long enough to reach from the HEMOTHERM unit to the Heat Exchanger. The shorter the length of tubing, the greater the flow rate. The female fitting should be attached to the tube leading to the Heat Exchanger's water inlet and the male fitting should be attached to the Heat Exchanger's water outlet.
2. After attaching the tubes to the heat exchanger, attach the 1/2" Hansen self-sealing fittings to the matched fittings on the lower right side of the HEMOTHERM unit (see Figure 4.1).
3. Attach the 1/8" Hansen self-sealing fittings leading from the Hyper-Hypothermia blanket to the matching set of 1/8" Hansen self-sealing fittings on the lower right hand side of the HEMOTHERM unit.
4. The air in the lines will be bled out after the pump switch is activated. Check the water level of the reservoirs after filling connecting water lines.

**FLUID CIRCUIT DISINFECTION/DRY STORAGE PROCEDURE
for Circulating Water Units Utilizing Airkem® A-33®**

The following procedure disinfects the fluid circuit in these products. If the product is to be placed back into service, stop after step #8. For protracted storage in a dry state, complete the procedure. The required tools/supplies are appropriate drain hose(s) and/or hose connector(s), a source of compressed air/nitrogen, Airkem® A-33® Disinfectant Packets, distilled water, and the appropriate AC electrical power.

1. Prepare distilled water/ A-33 solution in the volume needed to fill the unit's reservoir(s). Solution must be in the ratio of one packet of A-33 per gallon of distilled water. Set aside for later use.
2. Turn unit **OFF**.
3. Drain the water from the reservoir as described in the Technical Manual for the unit.
4. Flush unit:
 - a). Fill the reservoir with solution prepared in step #1.
 - b). Turn unit **ON**, set to heat to 100°F (38°C), and circulate for 5 minutes; for cooling units, set to cool to 50°F (10°C) and circulate for 5 minutes.
 - c). Drain unit as instructed in the Technical Manual for the unit.
 - d). Repeat steps 4.a - c. 3 times.
5. **If unit is to be returned to service**, replenish reservoir(s) with the appropriate volume of distilled water.
6. **If unit is being placed in dry storage**, continue with procedure.
7. When all fluid has been removed from the unit, disconnect the drain hose(s) and wipe unit clean.
8. Unit is now ready for storage.

When you are ready to return unit to service, replenish the reservoir(s) with distilled water. Perform all the checks as described in the respective Operation and Technical Manual.

Airkem and A-33 are registered trademarks of Ecolab Inc.

(OPTIONAL METHOD)
FLUID CIRCUIT DISINFECTION/DRY STORAGE PROCEDURE
for Circulating Water Units Utilizing Household Bleach (Sodium Hypochlorite)

The following procedure disinfects the fluid circuit in these products. If the product is to be placed back into service, stop after step #9. For protracted storage in a dry state, complete the procedure. The required tools/supplies are appropriate drain hose(s) and/or connector(s), a source of compressed air/nitrogen, a supply of household bleach (sodium hypochlorite), Fac-Chek pH strips, distilled water, and the appropriate AC electrical power.

1. Turn unit OFF.
2. Drain the water from the reservoir as described in the Technical Manual for the unit.
3. Flush unit:
 - a). Prepare a 9:1 solution of water and sodium hypochlorite (9 parts water and 1 part sodium hypochlorite). Fill reservoir with solution.
 - b). Turn unit **ON**, set to heat to 100°F (38°C), and circulate for 5 minutes; for cooling units, set to cool to 50°F (10°C) and circulate for 5 minutes.
 - c). Drain unit as instructed in the Technical Manual for the unit.
 - d). Repeat steps 3.a - c. 3 times.
4. Rinse unit three (3) times as described in Steps 3 a-c above, using **distilled water only**.
5. Fill reservoir(s) with distilled water and circulate.
6. Check the water with Fac-Chek pH strips or other appropriate method for detecting bleach. If bleach is detected, repeat steps 5 and 6.
7. When you no longer detect any bleach, drain reservoir.
8. **If unit is to be returned to service**, replenish reservoir(s) with the appropriate volume of distilled water.

If unit is being placed in dry storage, continue with procedure.
9. Re-connect the drain hose and drain all the fluid from the unit as in step #3 above, leaving drain hose attached.
10. When all fluid has been removed from the unit, disconnect the drain hose(s) and wipe unit clean.
11. Unit is now ready for storage.

When you are ready to return unit to service, replenish the reservoir(s) with distilled water. Perform all the checks as described in the respective **Operation and Technical Manual**.

2.3 SUGGESTIONS FOR PROTECTING THE RESERVOIR FROM BACTERIA

If sterile water is used and changed monthly, there should be no problem with bacteria forming in the reservoir or blanket(s). If hospital procedures require the use of a bacteriostatic or bactericidal agent, we suggest Hospital-Approved Bactericidal Agents which are non-acidic and non-foaming.

NOTE: Do not use De-ionized or Reverse Osmosis Processed Water. The majority of de-ionizers do not maintain a neutral pH of 7. If the de-ionized water is acidic, it will cause a battery effect and the copper refrigeration line will begin to deteriorate and cause a leak in the refrigeration system.

**SUGGESTED DECONTAMINATION GUIDELINES FOR
CINCINNATI SUB-ZERO EQUIPMENT**

(Developed in conjunction with the risk management department at the Shriners Burn Institute in Cincinnati, Ohio)

Quarterly, at a minimum, the FLUID CIRCUIT DISINFECTION/DRY STORAGE PROCEDURE, listed below, should be conducted.

The Procedure:

1. Drain the water reservoir of your CSZ unit as described in Section 3.2.
2. Flush the unit three (3) times per the following procedure.
 - A. Add one (1) ounce (30 cc) of household bleach (sodium hypochlorite) to the empty water reservoir.

CAUTION

It is strongly suggested that appropriate eye protection and gloves be worn when handling and using bleach. Wearing an apron is also suggested to protect clothing.

- B. Fill the reservoir with warm tap water.
- C. Turn the unit on and circulate per the chart below.

UNIT	MODE	TEMPERATURE	DURATION
Hemotherm 400MR	Heating	100°F	5 Min.

- D. Drain the unit after each flush.

3. Rinse the unit three (3) times as described in (2) except to omit the household bleach (sodium hypochlorite).
4. After the third rinse, drain the unit and add 32 ounces (1 liter) of distilled water to the water reservoir and circulate.
5. Check the water with "Fac-Chek" pH strips or other appropriate test method for detecting bleach. If bleach is detected, repeat steps 2 B, C, and D.
6. Once no bleach is detected, add the appropriate amount of U.S.P. Grade Propylene Glycol to the water reservoir per the following chart:

<u>UNIT</u>	<u>U.S.P. GRADE PROPYLENE GLYCOL PER UNIT</u>
Hemotherm 400MR	16 ounces (500 cc)

7. Continue to fill the water reservoir with distilled water.
8. Document the maintenance of the unit.
9. The unit is now ready to be placed back in service.

2.4 BUILT-IN SAFETY PRECAUTIONS

1. A Low Limit Thermostat will automatically shut off the compressor and the compressor indicator light at 2°C ±.5°C. The low t emp light will come on and the alarm will sound. However, the circulating pump continues to operate. In the unlikely event that the thermostat should malfunction, the water will freeze, provided no antifreeze solution has been added to prevent it. This will also stop the circulation of water.
2. A High Limit Thermostat will automatically shut off the heaters should the water temperature reach 44°C. Again, the circulati ng pump will continue to operate. If this happens, a high temperature warning light on the front panel will also illuminate and the alarm will sound. Then, the unit should be returned to the maintenance or engineering department to inspect the high temperature safety system.
3. Circuit Breaker - The HEMOTHERM unit (right side) is equipped with an over-current protection circuit breaker built into the power switch to protect the unit and the hospital wiring system against possible overload.

SECTION 3. GENERAL MAINTENANCE AND REPAIR

3.1 GENERAL INSTRUCTIONS-MAINTENANCE, REPAIR OR REPLACEMENT OF COMPONENTS

The HEMOTHERM Cooler/Heater unit is designed and built to be field serviceable. The repair, calibration and servicing of this unit requires no special tools, except for refrigeration repairs. However, no attempt should be made to perform any of these procedures unless the proper skills and knowledge are possessed. Repair or service of the HEMOTHERM by qualified hospital personnel will not void the warranty of the unit.



WARNING



Before performing any disassembly procedure, be sure the power cord is unplugged from the receptacle.

All internal operating components are readily exposed by removing the rear panel. This is accomplished by removing the five retaining screws around the perimeter of the panel. Pull rear panel away from the unit.

Access to the condenser grille is attained by removing the air intake vent at the front of the HEMOTHERM unit. To do this, loosen the four screws securing the vent to the unit.

3.2 MAINTENANCE OF THE WATER RESERVOIRS

It is very important that the water level in the HEMOTHERM unit be maintained for proper operation and effectiveness. The water level should be maintained to where the water is visible at the bottom of the strainer. No alcohol is required. Check the water level each time before the machine is started. If the blanket is empty, add distilled water to the reservoirs as the HEMOTHERM unit fills the blanket. Each adult blanket holds approximately 2 qts. (1.9 liters) of water. To ensure optimum circulation and prevent bacterial growth, the water in the reservoir should be changed at least once every month, more often if possible.

To empty the reservoirs, first make sure the power switch is in the "OFF" position. Then, attach the 1/4" female coupling of the drain tube over either of the 1/4" male fittings marked "DRAIN" on the side of the unit. Allow water to gravity drain from the one reservoir and then repeat for the other one. Be sure the other end of the drain tube drains into a container with a capacity of at least two gallons (7.6 liters). The pump will not run if the water level in the operation mode is not at the proper level. The low water light will come on and the alarm will sound.

NOTE: Unit is inoperable when reservoirs are completely dry.

Remove the reservoir covers by lifting the cover at the strainer handle. Clean any residue from the bottom and sides of the empty reservoir. Refill the reservoir with distilled water. The capacity of the reservoirs is - 6 qts (5.7 liters) for the heat reservoir and 8 qts. (7.6 liters) for the cool reservoir. Under all circumstances, the reservoirs should be filled before starting the HEMOTHERM unit. Replace the reservoir covers by pushing cover down on proper reservoir. It is not necessary to drain the reservoirs after each use.

If you desire to add an antibacterial agent to the reservoirs, please see Section 2.3 for complete information.

3.3 MAINTENANCE OF THE WATER CIRCULATING SYSTEM

The HEMOTHERM water circulating system includes the pump, heat reservoir, cool reservoir, fittings, and all interconnecting tubing. To clean the circulating system:

1. Drain the reservoir as described in Section 3.2.
2. Replenish with 14 qts. (13.2 liters) of clean water [8 qts (7.6 liters) - cool reservoir and 6 qts. (5.7 liters) - heat reservoir].
3. Turn unit on in heat mode and set at 42°C and circulate water for 2 - 4 hours. Switch the unit to the cool mode and set at 32°C. Circulate the water for 2 - 4 hours.
4. Drain the reservoir again and replenish with distilled water as described in Section 3.2.

NOTE: For the Suggested Decontamination Procedure, see Section 2.3.

3.4 MAINTENANCE OF THE WATER FILTER

The HEMOTHERM circulating system includes a water filter designed to clear the line of any particulate matter as the water is pumped through the system. As shown in Figure 4.8 (item #17), the water filter assembly is a plastic T-shaped fitting that intersects the hose from the pump to the outlet manifold. A stainless steel wire-mesh screen is located inside the clear plastic cap of the water filter assembly.

Once every six months, or more often if deemed necessary, the water filter should be disassembled and cleaned. To do so, the rear enclosure panel must be removed. The cap of the water filter assembly should then be unscrewed. The wire mesh and the plastic cap should then be cleaned. The parts are then to be reassembled.

1. Press the power switch to the OFF position.
2. Disconnect the unit from its power source.
3. Using a Phillips head screw driver, remove the five screws of the rear enclosure panel. Guide the panel outward towards the floor.
4. Locate the water filter assembly as shown in Figure 4.8.
5. Firmly grasp the notched rim of the cap of the assembly and turn it counterclockwise. The cap and hose may contain a small amount of water. The wire mesh may be lodged in the top of the fitting or it may be resting in the plastic cap.
6. Remove the wire mesh.
7. Clean the wire mesh and the plastic cap. Be careful not to lose the black O-ring in the rim of the plastic cap.
8. Replace the wire mesh in the plastic cap and position the wire mesh, O-ring and plastic cap under the fitting.
9. Screw the cap clockwise on to the fitting until it is secure.
10. Replace the rear enclosure. Replace the five screws.

3.5 MAINTENANCE OF THE CONDENSER GRILLE

Cool air is taken in through the grille at the front of the HEMOTHERM unit. Warm air is evenly expelled through the bottom of the unit. Both the air intake and outlet must be kept clear when the machine is in operation.

If the condenser grille becomes covered with dust and lint, the cooling capacity of the unit will be reduced. AT LEAST EVERY MONTH THE GRILLE SHOULD BE CLEANED. To do this, first loosen the four screws securing the cover over the condenser intake. Then, remove accumulated dust or lint with a brush or vacuum. Finally, replace grille cover and tighten all four screws.

3.6 MAINTENANCE OF BLANKETS

CSZ reusable plastic blankets (PLASTIPAD[®]) are constructed from rugged polyurethane. This extra-strength material helps resist punctures and provides triple the seam strength of most other plastic blankets. Because of our random flow design and because the blanket is lightweight, it allows even temperature distribution and faster water circulation which results in better cooling and heating rates. Because it is nonporous, stains and debris can be easily wiped away with soap and water. As necessary, cold sterilizable solution can be used for the O.R.

The additional advantage of our PLATIPADS[®] being a nonporous blanket is that it can be easily patched. Drain all the water from the blanket and, if possible, use air pressure to remove the remaining water. Using the patch kit, sold separately from PLASTIPAD[®], apply adhesive supplied in the kit to the patch. Using pressure, affix the patch to the pinhole in your blanket and allow a weight to remain on the patch for at least 24 hours. **NOTE:** Check instructions in patch kit.

Draining the blanket - the blanket should not be drained after each use. Water remaining after use will not damage the blanket. If it becomes necessary to drain the blanket, remove both the male and female fittings on the hose leading from the blanket. Force the water out with compressed air (10 p.s.i. maximum).

The MAXI-THERM[®], MAXI-THERM[®] LITE, and TEMP PAD[®] single-patient blankets offer the highest flow rate with a random flow pattern of any disposable blanket system. This results in less temperature differential between the blanket surface and the reservoir fluid in the unit while providing maximum thermal transfer from blanket to patient. Easy-to-use color-coded quick connectors and shut-off clamps make set-up and disposal a "snap". Maximum patient comfort is assured by either MAXI-THERM or MAXI-THERM LITE surfaces which produce a cushioning effect. The MAXI-THERM's vinyl surface can be wiped clean if soiled in use enabling it to last for the duration of the average patient stay.

3.7 INSTRUCTIONS FOR REPLACING HEATERS

1. Drain water from reservoir. See Section 3.2.
2. Press the power switch to the "OFF" position.
3. Disconnect the unit from its power source.
4. Remove rear enclosure panel by removing the five screws securing the panel to the unit.
5. Locate heaters at lower portion of the right reservoir as seen when viewing the unit from the back. The 300 watt heater is on the left and the 1200 watt heater on the right.*
6. Cut wires as close to the heater as possible.
7. Unscrew heater from reservoir by using a wrench.
8. Install new heater and seal using Teflon tape or equivalent.
9. Attach wires by splicing the old wires to the new heater.
10. Refill reservoir with distilled water only (see Section 2.1) and check for leaks.
11. Replace the rear enclosure panel. Tighten the screws.

* 100 VAC units have one 300 watt heater and one 1200 watt heater.
230/240 VAC units have one 800 watt heater and one 1200 watt heater.

3.8 INSTRUCTIONS FOR REPLACING PUMP HOUSING OR PUMP

1. Press the power switch to the OFF position.
2. Disconnect the unit from its power source.
3. Locate the pump housing towards the lower back side of the inside of the HEMOTHERM unit.
4. Disconnect rubber hoses from inlet and outlet housings.
5. Remove the three bolts holding the pump to the base.
6. Remove the seven screws securing pump housing to pump motor.
7. Remove the fitting from the housing.
8. Insert the fitting from the defective pump housing in step 7 above into the identical orifice of the new pump housing. Seal the fitting with Teflon tape or equivalent.
9. Secure new pump housing by replacing the seven screws removed in step 6 above. Do not tighten screws sequentially in either clockwise or counterclockwise direction. Tighten one screw, then a screw opposite it, etc...
10. Remount pump with the three bolts attached to the base.
11. Reattach hoses to inlet and outlet.
12. Plug unit into properly grounded receptacle.

NOTE: If just the pump is to be replaced, skip steps 5 - 8.

3.9 REPLACING THE SENSOR

1. Press the power switch to the "OFF" position.
2. Disconnect the unit from its power source.
3. Drain proper reservoir, see Section 3.2, depending on which sensor is being replaced. There is one dual thermistor temperature sensing probe located in each water reservoir.

4. Remove rear enclosure panel by removing the five screws securing the panel to the unit.
 5. Disconnect wire plug located approximately 6" from the sensor fitting. Remove the sensor from the proper reservoir. For location, see Figure 4.7.
 6. Place the new sensor into the reservoir and tighten.
 7. Connect wire plug.
 8. Replace rear enclosure panel and tighten all screws.
 9. Refill water reservoir (see Section 2.1) and check for leaks.
-

3.10 REPLACING THE MICROPROCESSOR BOARD

1. Press the power switch to the OFF position.
2. Disconnect the unit from its power source.
3. Unseat the membrane control panel by removing the four screws securing it to the HEMOTHERM unit.
4. Disconnect the 12 pin, 9 pin, 10 pin, 25 pin sub D and ground connectors leading from the control panel and the electrical compartment.
5. Unseat the microprocessor board by removing the six nuts and washers securing it to the membrane control panel. Remove the ground wire.
6. Take the new microprocessor board and reconnect the 12 pin, 9 pin, 10 pin, 25 pin sub D and ground wire.
7. Install the new microprocessor board in its original position by connecting the ground wire and replacing and tightening the six nuts and washers.
8. Secure the face panel in its original position by replacing and tightening the four screws.
9. Plug the HEMOTHERM unit into a properly grounded receptacle.

3.11 REPLACING THE MEMBRANE CONTROL PANEL

1. Press the power switch to the "OFF" position.
2. Disconnect the unit from its power source.
3. Unseat the membrane control panel by removing the four screws securing it to the unit.
4. Unseat the microprocessor board by removing the six nuts and washers securing it to the membrane control panel. Remove the ground wire.
5. Install the new membrane control panel by attaching the microprocessor board and the ground wire. Replace and tighten the six nuts and washers.
6. Secure the membrane control panel in its original position by replacing and tightening the four screws.
7. Plug the unit into a properly grounded receptacle.

3.12 REPLACING THE MANIFOLD

1. Press the power switch to the "OFF" position.
2. Disconnect the unit from its power source.
3. Drain the water from each reservoir. See Section 3.2.
4. Remove rear enclosure panel by removing the five screws securing it to the unit.
5. Locate manifolds in the lower left side when viewing the unit from the back.
6. Disconnect rubber hoses at the ends of the manifold.
7. Unscrew both outlet/male fittings and both inlet/female fittings (see Figure 4.1) from outside of unit.
8. Remove the whole manifold. Replace with new manifold. Replace all fittings with the male fittings on the top and the female fittings on the bottom and seal using Teflon tape or equivalent.
9. Reconnect the rubber hoses to the new manifold.
10. Refill reservoirs with distilled or sterile water. See Section 2.1.
11. Check manifold for leaks.

3.13 TROUBLESHOOTING THE COMPRESSOR (115, 230 and 240 VAC units)

1. Press the power switch to the OFF position.
2. Disconnect the unit from its power source.
3. Remove rear enclosure panel by removing the five screws securing it.
4. Locate compressor (see Figure 4.7) directly under the reservoir. Remove screws from around the cover protecting the overload protector and the compressor relay directly under the starting capacitor.
5. Replacement of the starting capacitor
 - A. Using a screw driver, unclip the starting capacitor from its mounting bracket.
 - B. Remove the two (2) screws from the compressor electric box cover and set the cover aside.
 - C. Remove one (1) capacitor lead wire from terminal S of the starting relay and the other lead wire from terminal S of the electrical junction board.
 - D. Install the new capacitor.
 - E. Attach new capacitor wires to both S terminals.
 - F. Snap the new capacitor into place.
 - G. Reinstall the electric box cover.
6. Replacement of the starting relay.
 - A. Remove the two (2) screws from the compressor's electric box cover and set the cover aside.
 - B. Remove the three (3) wires from the "slide-on" terminals of the starting relay.
 - C. Remove the two (2) screws that mount the starting relay to the compressor's electric box.
 - D. Install the new starting relay using the screws you removed in step c.
 - E. Reconnect the three (3) wires to the "slide-on" terminals of the new starting relay.
 - F. Reinstall the electric box cover.
7. Replacement of the overload protector
 - A. Remove the two (2) screws from the compressor's electric box cover and set the cover aside.

- B. Remove one overload protector lead wire from terminal C of the electrical junction board and the other lead wire from "slide-on" terminal C of the compressor motor leads.
 - C. Using a screwdriver, disengage the overload protector's mounting clip and remove the overload protector.
 - D. Install the new overload protector and fasten it with the mounting clip.
 - E. Reconnect the two lead wires to the C terminals from which you removed them in step B.
 - F. Reinstall the electric box cover.
-

3.14 TROUBLESHOOTING THE COMPRESSOR (100 VAC units only)

- 1. Press the power switch to the "OFF" position.
- 2. Disconnect the unit from its power source.
- 3. Remove rear enclosure panel by removing the five screws securing it.
- 4. Locate compressor (see Figure 4.7) directly under the reservoir . Remove screws from around cover protecting the overload protector and compressor relay, directly under the starting capacitor.
- 5. Replacement of starting capacitor
 - A. Unclip (with screwdriver) from either end.
 - B. Remove cap from end of capacitor.
 - C. Locate terminals #2 and #3 on compressor relay. Unscrew and detach wires leading from starting capacitor.
 - D. Install new capacitor.
 - E. Attach new capacitor wires to terminals #2 and #3.
 - F. Snap new capacitor into place.
- 6. Replacement of the starting relay
 - A. Using a screwdriver, remove the clip from each end of the compressor's electric box cover and set the cover aside.
 - B. Remove the two capacitor lead wires from the terminals on the left side of the starting relay.
 - C. Remove the starting relay by pulling toward you with a side to side motion.
 - D. Install the new starting relay.
 - E. Reconnect both the capacitor lead wires and the compressor wires to their proper terminals.
 - F. Reinstall the electric box cover and spring clip.

7. Replacement of overload protector
 - A. Remove red wire.
 - B. Unseat compressor relay by pulling it straight out.
 - C. Pull connector from terminal "C".
 - D. Remove spring clip.
 - E. Replace with new overload protector.
 - F. Snap spring clip back into place.
-

3.15 INSTRUCTIONS FOR LEAKAGE CURRENT

Using an electrical safety analyzer, measure electrical leakage current of the HEMOTHERM unit under the following conditions: Power ON and OFF, polarity normal and reverse, unit grounded and ungrounded. The leakage current should be less than 300 micro amps for 100/115V units and 500 micro amps for 230/240V units under all conditions. If a HEMOTHERM unit has leakage current that exceeds micro amps or has a significant increase in leakage current, the cause should be investigated.

Excessive leakage current is most commonly caused by a defective heater, but other components can also fail in such a way as to increase leakage current. To find the source of excessive leakage current, suspect components should be sequentially disconnected until the source of the high leakage is isolated.

3.16 HI LIMIT TEST PROCEDURE

1. Press the power switch to the "OFF" position.
2. Disconnect the unit from its power source.
3. Remove the four self-tapping screws from the membrane control panel.
4. Arrange the control panel in such a manner that the electric compartment is easily accessible.
5. Locate the two (2) solid state relays for the 1200 watt heater, number 11 and 12 on page 49, Figure 4.5.
6. Electrically jump (short) the primary side of relay number 11 and relay number 12 using test leads with alligator clips or a comparable item. On relay number 11, jump between terminals #1 and #9. On relay #12, jump between terminals #10 and #2.
7. Return the membrane control panel to its original position.
8. Plug the unit in and turn the power on.

9. After the unit goes through the FILL mode, press the heat and pump keys. The unit will now heat past its set point until it reaches $44^{\circ}\text{C} \pm .5^{\circ}\text{C}$. At this point, the unit will indicate HI TEMP (both visual and audible).
-

3.17 LOW LIMIT TEST PROCEDURE

1. Press the power switch to the OFF position.
2. Disconnect the unit from its power source.
3. Remove the four self-tapping screws from the membrane control panel.
4. Arrange the control paneling in such a manner that the electric compartment is easily accessible.
5. Locate the two (2) solid state relays for the compressor, number 4 and 5 in Figure 4.6.
6. Electrically jump (short) the primary side of relay number 4 and relay number 5 using test leads with alligator or a comparable item. On relay number 4, jump between terminals #4 and #2. On relay number 5, jump between terminals #1 and #3
7. Return the membrane control panel to its original position.
8. Plug the unit in and turn the power on.
9. After the unit goes through the FILL mode, press the COOL and PUMP keys. The unit will now cool down past its set point until it reaches $2^{\circ}\text{C} \pm .5^{\circ}\text{C}$. At this point, the unit will indicate LOW TEMP (both visual and audible).

3.18 SUGGESTED PREVENTIVE MAINTENANCE CHECKLIST (AT LEAST QUARTERLY)

HEMOTHERM Model 400MR Serial No. _____

Check when

Hospital I.D. No. _____

completed

- | | | |
|-----|--|--------------------------|
| 1. | External cabinet and controls in good condition (no unusual dents or missing parts). | <input type="checkbox"/> |
| 2. | All warning labels properly affixed. | <input type="checkbox"/> |
| 3. | Quick disconnect couplings (tight, straight, and not leaking). | <input type="checkbox"/> |
| 4. | Power cord (no cuts or exposed wire) and plug (no bent or missing pins). | <input type="checkbox"/> |
| 5. | Indicator lights (Heat & Cool mode, compressor, heaters, pump, power) operative. | <input type="checkbox"/> |
| 6. | Drain and clean reservoir. See Section 3.2. | <input type="checkbox"/> |
| 7. | Clean water filter. See Section 3.4. | <input type="checkbox"/> |
| 8. | Refill reservoir with distilled water. See Section 2.1. | <input type="checkbox"/> |
| 9. | Leakage current check (all readings should be under 300 micro amps for 100/115 Volt units and under 500 micro amps for 230/240 Volt units). | <input type="checkbox"/> |
| | OFF normal polarity <input type="checkbox"/> | |
| | OFF reverse polarity <input type="checkbox"/> | |
| | ON normal polarity (heat) <input type="checkbox"/> | |
| | ON reverse polarity (heat) <input type="checkbox"/> | |
| | ON normal polarity (cool) <input type="checkbox"/> | |
| | ON reverse polarity (cool) <input type="checkbox"/> | |
| 10. | Condition of blankets, hoses, couplings (check for leaks). | <input type="checkbox"/> |
| 11. | Refrigerant test | |
| | a. Clean condenser and fan <input type="checkbox"/> | |
| | b. Check sight glass (100 volt units only) <input type="checkbox"/> | |
| 12. | Check voltage across the power contacts of <u>all</u> the solid state relays. The voltage should be ½ the line voltage on each of the two 2SSR, 3SSR and 4SSR relays. Relays 1SSR, 5SSR and 6SSR should have total line voltage. | <input type="checkbox"/> |

Signature of Inspector

Date of Inspection

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
1. HEMOTHERM unit will not turn on.	Unplugged	Plug into properly grounded receptacle.
	No electric power at receptacle.	Check O.R. electric power source circuit breakers.
	Power switch circuit breaker is tripped.	Reset unit's power switch circuit breaker (upper right side panel) by turning OFF and ON. If circuit breaker trips immediately, check for a direct short. If unit operates for 5 minutes or more and again trips, investigate for low line voltage at receptacle.
	Faulty master power switch on right side of unit.	Replace switch.
	Internal wiring continuity.	Troubleshoot for open circuit wiring.
2. No water circulation through blood oxygenator/ heat exchanger.	Pump switch off.	Activate pushbutton switch on control panel. NOTE: LED can be inoperative and switch will still operate.
	Disengaged quick-disconnect couplings.	Check all couplings to assure <u>full</u> engagement. Partial engagement does not cause couplings to open internally. Collars return to their at-rest position upon full engagement.
	Clogged quick-disconnect couplings.	Remove couplings and force out any foreign matter with compressed air.

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
2. (Cont'd)	Clogged water filter.	Clean water filter.
	Vapor lock in unit's liquid piping.	Turn off pump and wait fifteen seconds. Turn the pump back on.
	Low reservoir water levels.	Turn the pump off. Fill both reservoirs to bottom of plastic strainer level. Turn the pump back on.
	Cool water reservoir partially or fully iced up	Switch to HEAT mode for ten seconds.
	Tripped circuit breaker.	See Symptom #1.
	Inoperative pump.	Troubleshoot for loss of electrical power to motor, defective motor, or defective pump assembly.
	Inoperative water flow-control solenoid valves.	Troubleshoot for loss of electrical power to affected valve, burned out solenoid coil, or mechanically stuck valve.
3. No circulation through connected patient blanket.	See Symptom #2 possible problems.	See Symptom #2 - solutions.
4. Blood oxygenator/heat exchanger will not cool.	Incorrect operational mode.	Actuate mode selector switch to COOL mode as indicated by LED.
	No water flow to oxygenator.	See Symptom #2.
	Inadequate flow.	See Symptom #2. Remove partial obstruction in external liquid circuitry. Solenoid valve stuck partially closed. Rap valve body sharply. Clean or replace <u>before</u> next use.

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
4. Cont'd		Worn pump: check output. (13 liters/min at 9 PSI).
	COOL set point set at too high a temperature.	Check set point by depressing COOL TEMPSET switch.
	COOL mode intermittent	Check the COOL reservoir's water temperature sensor for proper resistance values. Troubleshoot or replace the microprocessor board.
	Refrigeration system inoperative - water in COOL water reservoir not being chilled.	If electrical power is not reaching the compressor, troubleshoot circuitry (See wiring diagrams Figs. 4.9. and 4.12.) If electrical power is reaching compressor, troubleshoot compressor per Sec. 3.13. Refrigerant charge lost from system. Leak test. Replace filter drier. Then evacuate and recharge. NEW CHARGE - 27 ozs. of R-134A. <u>NOTE: DO NOT OVERCHARGE.</u>

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
5. Blood oxygenator/heat exchanger cools intermittently	Intermittent or erratic refrigeration system	<p>Check cooling airflow through condenser. Restricted airflow or defective fan motor can cause compressor to thermally overload and periodically shut down.</p> <p>Defective compressor control relays (2SSR).</p>
6. Blood oxygenator/heat exchanger cool-capacity low	Water flow partially obstructed	Check for partial obstruction in external liquid circuit or partially engaged quick disconnect fittings.
	Cool water reservoir partially or fully iced up	Switch to HEAT mode for ten seconds.
	Water flow control solenoid valve is stuck	Rap sharply. Clean or replace as soon as possible.
	Partially blocked cooling airflow	<p>Move external equipment from front of cabinet air grille.</p> <p>Check for dust and lint accumulation on condenser; remove grille and clean with vacuum. If exceptionally heavy, remove rear panel and blow dust outward with compressed air.</p> <p>Check condenser cooling fan motor.</p>

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
6. (Cont'd)	Low refrigerant charge	Refrigerant charge lost from system. Leak test. Replace filter drier. Then evacuate and recharge. NEW CHARGE - 27oz. (25 oz. for 100V) of R-134A. <u>NOTE: DO NOT OVERCHARGE.</u> <u>NOTE: In COOL mode, with compressor running,</u> sight glass (100 volt units only) should be full with only occasional bubbles visible.
	Improperly operating thermostatic expansion valve	Prior knowledge of refrigeration principles is required for proper evaluation of this component. Replace and evacuate - recharge if all other refrigeration components have been evaluated.
7. Blood oxygenator/ heat exchanger heats very slowly	Heater is inoperative	<p>Check high wattage: 115 VAC units - one 1200 watt heater</p> <p>100 VAC units - one 1200 watt heater 230/240 VAC units - one 1200 watt heater</p> <p>Check for electrical power to heaters and control voltage to 3SSR and 4SSR coils.</p>

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
7. (Cont'd)	Heat set point set below desired temperature	Check set point and reset if necessary.
8. Blood oxygenator/heat exchanger-heats slowly	High wattage heater	Check heater (1 heater) and control relay 3SSR.
	Microprocessor set point too low	Check set point and reset if necessary.
	Low water circulation rate	Check for obstruction in circulation loop.
9. Blanket will not cool	Refer to Symptom #4	Work through POSSIBLE PROBLEMS & SOLUTIONS for Symptom #4 in sequence given.
10. Blanket will not cool - Blood oxygenator does cool	Water flow through blanket is restricted	Check <ol style="list-style-type: none"> 1. Quick disconnect fittings for full engagement. 2. Obstruction in interconnecting tubing. 3. Obstruction in blanket-repair per section 3.4.
11. Blanket will not heat	Refer to Symptom #7	Check through POSSIBLE PROBLEMS & solutions Symptom #7 in sequence given.
12. Blanket will not heat - Blood oxygenator does heat	Water flow through blanket is restricted	Refer to SOLUTIONS for Symptom #10.
13. Unit will not operate when power switch is "ON"	Control-circuit voltage	Troubleshoot wiring or control voltage transformer (115VAC primary, 12VAC, 13VAC, 16VAC secondaries)

3.19 TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE PROBLEM	SOLUTION
13. (Cont'd)	Circuit breaker	Check to see if circuit breaker needs to be reset.
14. LED lights inoperative	LED burned out	Return Microprocessor board for exchange.
15. Water transferring from one reservoir to the other	Foreign matter in solenoid valve(s) - 4 total	Remove housing of solenoid valve. Clean, reassemble and replace.

3.20 MICROPROCESSOR BOARD ERROR CODE TROUBLESHOOTING

1. If the microprocessor board's seven segment display indicates **EE01**, the board's failsafe system is in error. If this condition occurs, you must remove the unit from service and replace the microprocessor board.
2. If **EE02** is indicated, the board's Nov Ram is defective. If this condition occurs, replace the microprocessor board.
3. If **EE04** is indicated, the board's analog to digital converter is defective. If this condition occurs, replace the microprocessor board.
4. If **EE05** is indicted, you may have: 1) a bad heat channel in the microprocessor board; 2) the heat side thermistor may be defective or unplugged; 3) or the thermistor wiring harness could have a loose connection.

To determine if the wiring harness has a bad connection or if the thermistor is bad, simply do a continuity (resistance) test on the harness and thermistor. If they appear to be correct, replace the microprocessor board.

5. If **EE06** is indicated, you may have: 1) a bad COOL-channel circuit in the microprocessor board; 2) the COOL side thermistor may be defective or unplugged; 3) or the thermistor wiring harness could have a loose connection.

To determine if the wiring harness has a bad connection or if the thermistor is bad, simply do a continuity (resistance) test on the harness and thermistor. If they appear to be correct, replace the microprocessor board.

NOTE: Helpful suggestions to determine which solenoid valve(s) is defective:

MODE OF OPERATION	COOL RESERVOIR	HEAT RESERVOIR	PROBLEM
Heat	Emptying	Filling	A
Heat	Filling	Emptying	B
Cool	Filling	Emptying	C
Cool	Emptying	Filling	D

- A) Cool outlet solenoid
- B) Cool return solenoid

- C) Heat outlet solenoid
- D) Heat return solenoid

SECTION 4 PARTS INFORMATION

4.1 ORDERING INFORMATION FOR REPLACEMENT PARTS

Replacement parts are available directly from CSZ,

CSZ International GmbH
Zehntfeldstrasse 240A
81825, Munich
Germany

Tel: 49-89-43-77-7814

in Europe, or through your local authorized Hemotherm dealer. To help us serve you better, please have the serial number of your Hemotherm unit available when you call for parts or service. The serial number is located on the rear panel of the unit along with the part number. There is no minimum order requirement for replacement parts.

It is strongly recommended that all Hemotherm parts be replaced with original manufacturers parts. Use of other parts could void the warranty on the unit and possibly damage the unit.

Replacement parts from the factory are shipped F.O.B., Cincinnati, Ohio. Generally, parts orders are shipped within 24 hours after we receive them. Therefore, it is not necessary for you to keep large quantities of parts on hand. However, it may be desirable that your maintenance department keeps a minimum number of recommended parts in stock for emergency use if you have three or more Hemotherm units. A suggested list of these parts is found in Section 4.2.

4.2 RECOMMENDED REPLACEMENT PARTS INVENTORY

<u>PART NO.</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
07000	1	Hansen Socket (female) 1/8"
06002	1	Hansen Plug (male) 1/8"
07015	1	Hansen Socket (female) 1/2"
06016	1	Hansen Plug (male) 1/2"
93500	1	Heater 300W, 115V
93501	1	Heater 1200W, 115V
40005	1	Relay, Solid State 25Amp: 115/100VAC & 230/240VAC
40006	1	Relay, Solid State 40Amp: 115/100VAC & 230/240VAC
93502	1	Heater 300W, 100VAC
93509	1	Heater 1200W, 100VAC
93505	1	Heater 800W, 230/240VAC
93506	1	Heater 1200W, 230/240VAC
05009	1	Solenoid Valve, 115/100VAC
05016	1	Solenoid Valve, 230/240VAC
91066	1	5C Pump Housing Assembly
93001	1	5C Pump Kit, 230/240VAC

4.3 RETURNING PARTS UNDER WARRANTY

All parts are covered by a one year warranty. To replace parts during the warranty period*, send the part prepaid to:

CINCINNATI SUB-ZERO PRODUCTS, INC.

12011 Mosteller Road
Cincinnati, Ohio 45241
Phone: (513) 772-8810
Fax: (513) 772-9119

To qualify for credit, warranty parts should be tagged with the following information:

1. The invoice number under which the unit/part was purchased.
2. Cause of failure.
3. Serial Number of Unit.
4. Date of installation or purchase.
5. RMA number*

* You must first obtain a RMA number by calling the factory prior to returning an item.

.

4-4. SHIPPING PARTS

Parts to be returned to the factory should be carefully packaged, especially the microprocessor board, and the control panel. Each of these boards should be cushioned in static safe packaging material to prevent damage from Electrostatic Discharge (ESD).

NOTE: Shipping damage will be the responsibility of the shipper. Insure if necessary.

4-5. EQUIPMENT AND ACCESSORIES ORDER INFORMATION

Equipment and accessories can be ordered directly from our authorized dealer for you area. For information on your dealer, you can call the Customer Service Department at the factory, at (513) 772-8810 or 800-989-7373.

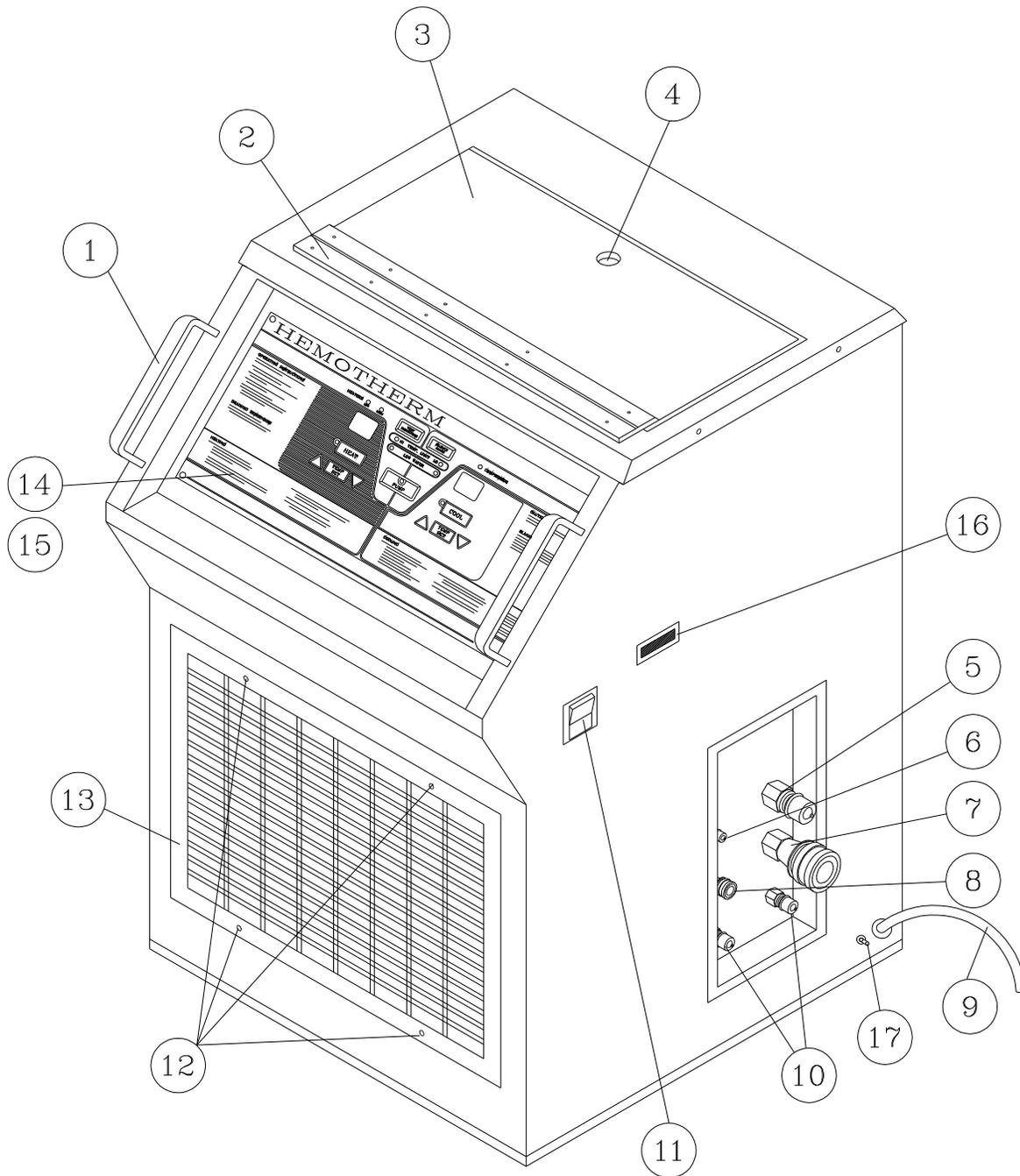


Figure 4.1 HEMOTHERM Front & Side View

Figure 4.2 Parts List for the HEMOTHERM - Front & Side View

<u>INDEX NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
0	400M	HEMOTHERM Cooler/Heater
1	55076	Half Round Handle
2	56151	Continuous Black hinge
3	52229	Plastic Top (Specify S/N)
4	--	Handle for Lid (Hole)
5	06016	Plug Hansen Fitting 1/2" (male) Outlet Fitting for Heat Exchanger
6	06002	Plug Hansen Fitting 1/8" (male) Outlet Fitting for Blanket
7	07015	Socket Hansen Fitting 1/2" (female) Inlet Fitting for Heat Exchanger
8	07000	Socket Hansen Fitting 1/8" (female) Inlet Fitting for Blanket
9	30318	Lead-in Cord - 100 V
	30309	Lead-in Cord - 115 V
	30320	Lead-in Cord - 230/240 V
10	06005	Plug Hansen Fitting 1/4" (male) Cool & Heat Reservoir Drain Fittings
11	35031	Power Switch - Green
12	06429	#8 Self Tapping Screws
13	47014	Condenser Grille
14	56818	Membrane Control Panel
15	09959	Microprocessor Control Board
16	93812	Remote Control Cable Port
17	32018	Grounding Lug (230/240V only)

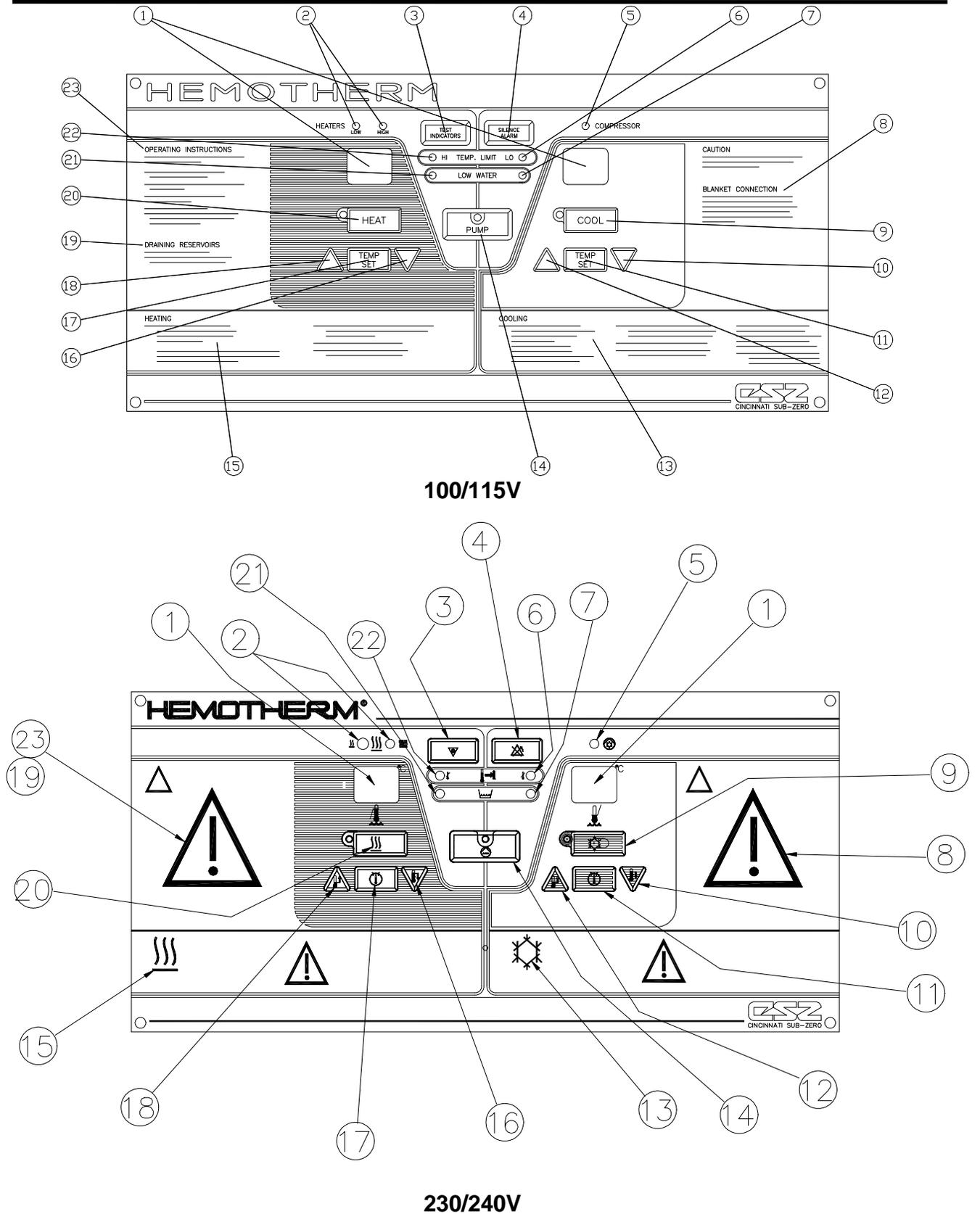


Figure 4.3 HEMOTHERM – Membrane Control

Figure 4.4 Parts List for the HEMOTHERM Membrane Control Panel 100/115V

<u>INDEX NO.</u>	<u>DESCRIPTION</u>
1	Cool & Heat LED Temperature Displays
2	Low & High Heater Indicator Lights
3	Test Indicator Switch
4	Silence Alarm Switch
5	Compressor Indicator Lights
6	Low Temp Indicator Light
7	Low Water Indicator Light
8	Blanket Connection
9	Cool Mode Switch
10	Down Set point Switch (Cool Mode)
11	Temp Set Switch (Cool Mode)
12	Up Set point Switch (Cool Mode)
13	Cooling Instructions
14	Pump Switch
15	Heating Instructions
16	Down Set point Switch (Heat Mode)
17	Temp Set Switch (Heat Mode)
18	Up Set point Switch (Heat Mode)
19	Draining Instructions
20	Heat Mode Switch
21	Low Water Indicator Light
22	High Limit Indicator Light
23	Operating Instructions

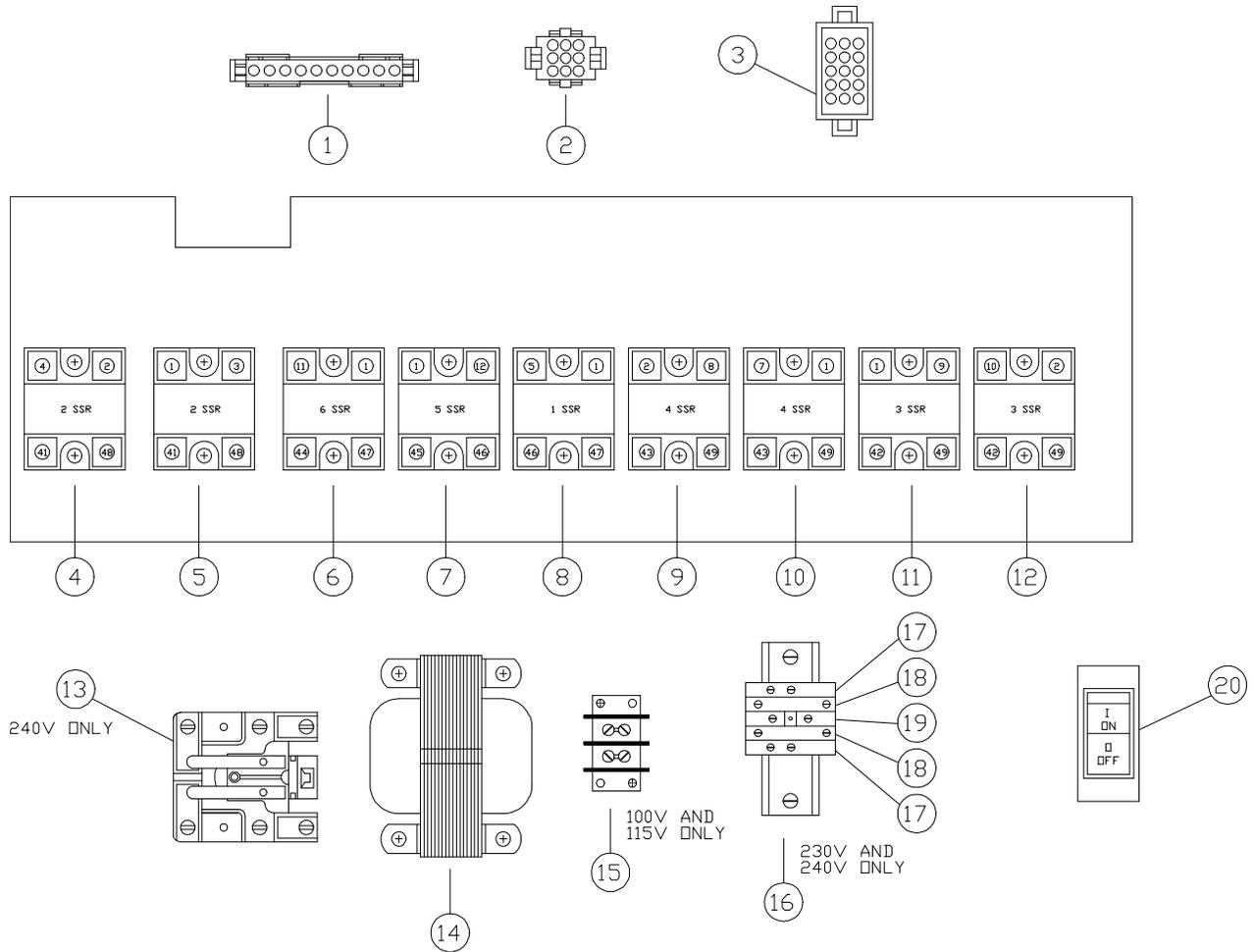


Figure 4.5 HEMOTHERM - Electrical Sub-Panel

Figure 4. 6 Parts List for the HEMOTHERM Electrical Sub-Panel

<u>INDEX NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>
1	29730	Connector Receptacle 10 pos
2	29905	Connector 9 pos
3	29720	Connector Mate/Lok Pin 15 pos
4	40006	Relay Solid State (Compressor) 40 amps
5	40006	Relay Solid State (Compressor) 40 amps
6	40005	Relay Solid State (Cool Solenoid)25 amps
7	40005	Relay Solid State (Heat Solenoid)25 amps
8	40005	Relay Solid State (Pump) 25 amps
9	40005	Relay Solid State (Low Heat) 25 amps
10	40005	Relay Solid State (Low Heat) 25 amps
11	40005	Relay Solid State (High Heat) 25 amps
12	40005	Relay Solid State (High Heat) 25 amps
13	40235	240VAC Relay
14	93620	Transformer Assembly - 12 V
15	28100	Terminal Block - 100/115VAC
16	33206	Din Rail - 230/240VAC
17	28420	Terminal Block Stop
18	28324	Terminal Block Fused
	37480	1/2 amp Fuse (to be used in terminal block fused)
19	28322	Terminal Block 600V
20	35031	Circuit Breaker - power switch, 20A - 100/115VAC
	35030	Circuit Breaker - power switch, 15A -230/240VAC

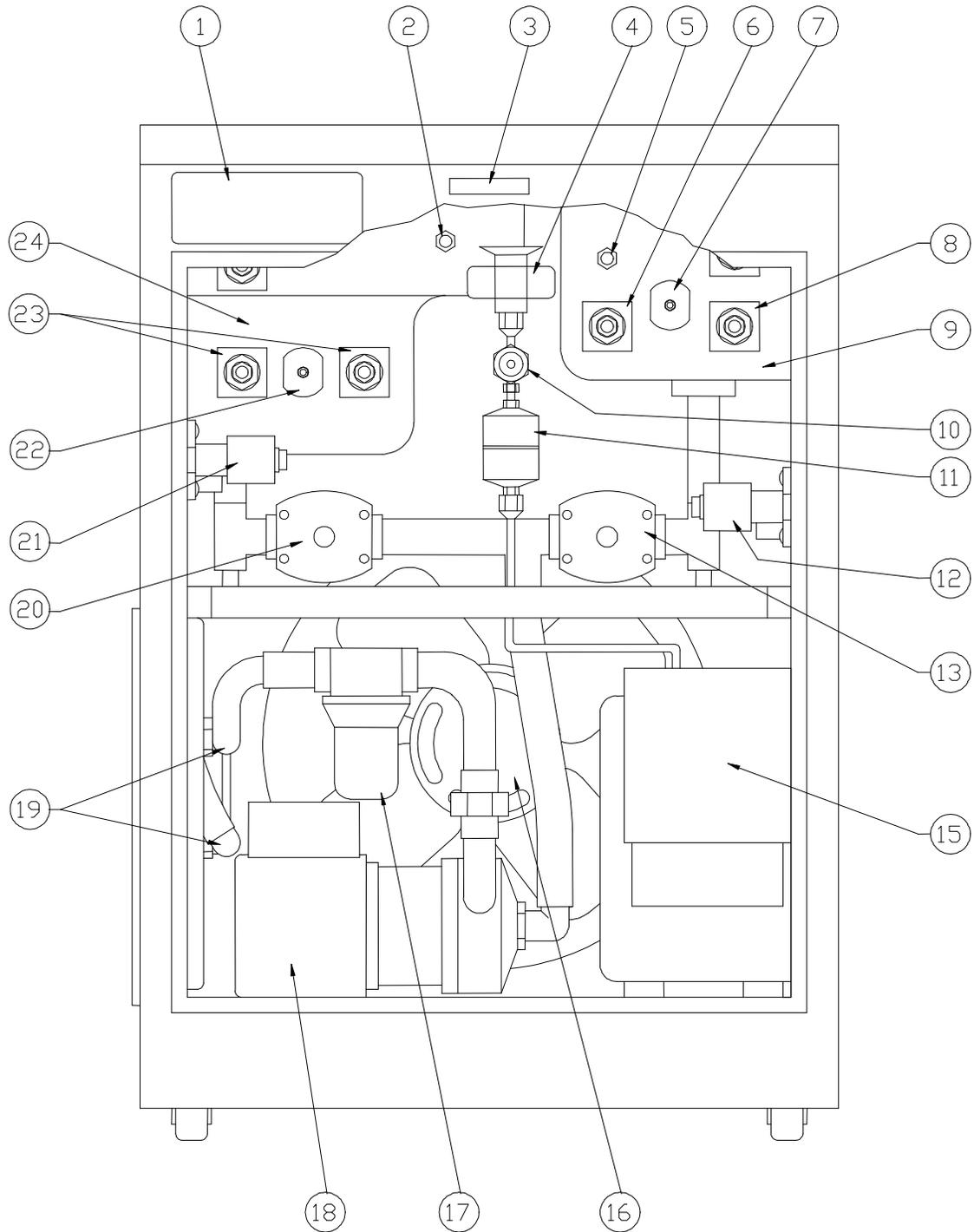


Figure 4. 7 HEMOTHERM - Rear View

Figure 4. 8 Parts List for HEMOTHERM - Rear View

<u>INDEX NO.</u>	<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
1	56532	Specification Label, 115 Volt	1
	56619	Specification Label, 230 Volt	1
	56647	Specification Label, 240 Volt	1
	56531	Specification Label, 100 Volt	1
2	93510	Float Switch, Cool Reservoir	1
3	06102	Serial Number Plate	1
4	04602	Thermo Expansion Valve	1
5	93510	Float Switch, Heat Reservoir	1
6	93500	Heater, 300 Watt - 115 Volt (8" Long)	1
	93505	Heater, 800 Watt - 230/240 Volt (8" Long)	1
	93502	Heater, 300 Watt - 100 Volt (8" Long)	1
7	41002	Sensor, Heat Reservoir	1
8	93501	Heater, 1200 Watt - 115 Volt (8" Long)	1
	93506	Heater, 1200 Watt - 230/240 Volt (8" Long)	1
	93509	Heater, 1200 Watt, 100 Volt (8" Long)	1
9	93800	Heat Reservoir	1
10	03021	Liquid Sight Glass Indicator	1
11	02001	Filter Drier	1
12	05009*	Solenoid Valve	1
13	05009*	Solenoid Valve	1
15	93518	Compressor, 1/2 HP - 115 Volt	1
	93517	Compressor, 1/2 HP - 230/240 Volt	1
	93513	Compressor, 1/2 HP - 100 Volt	1
16	47615	Condenser Fan Motor, 115/100VAC	1
	47616	Condenser Fan Motor, 230/240VAC	1
17	46505	3/4" Water Filter	1
18	93520	Pump, 5C - 115/100 Volt	1
	93519	Pump, 5C - 230/240 Volt	1
19	93512	Inlet/Outlet Manifold	1
20	05009*	Solenoid Valve	1
21	05009*	Solenoid Valve	1
22	41002	Sensor, Cool Reservoir	1
23	51014	3/8 Tank Fitting	2
24	93801	Cool Reservoir	1

* 05016 Solenoid Valve for 230/240 VAC Units

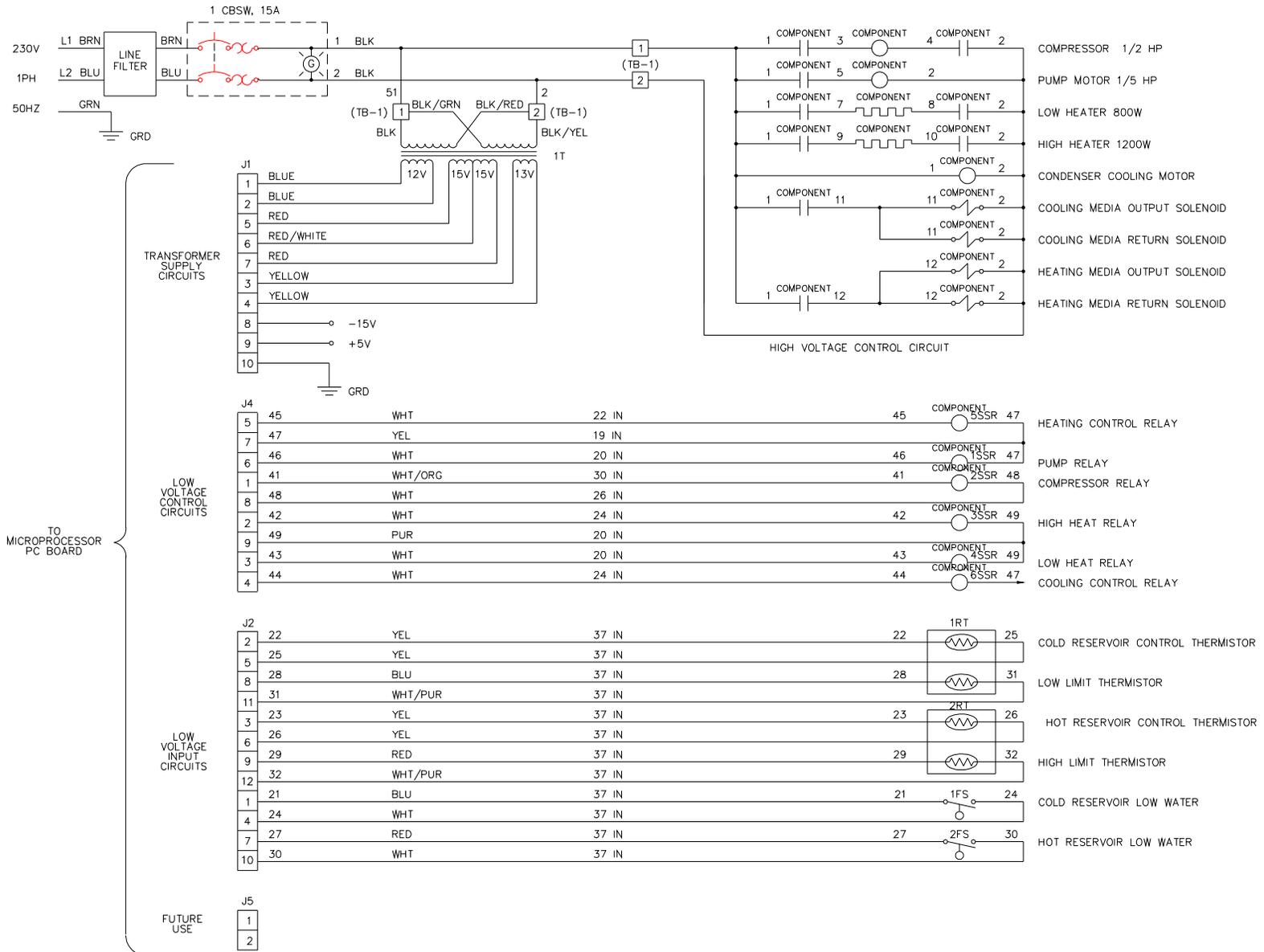


Figure 4.10 HEMOTHERM Electrical Schematic 230 Volt

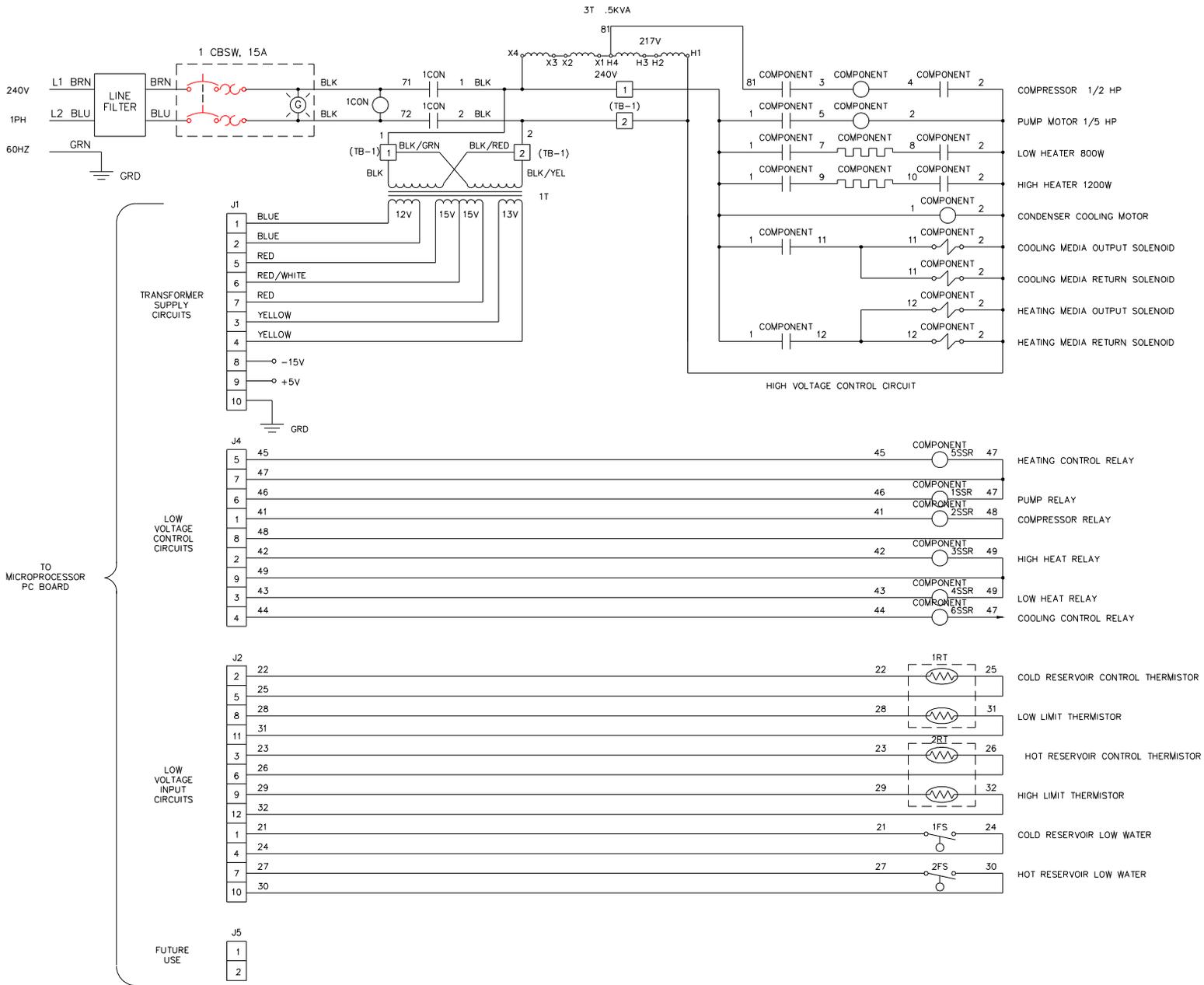


Figure 4.11 HEMOTHERM - Electrical Schematic 240 Volt

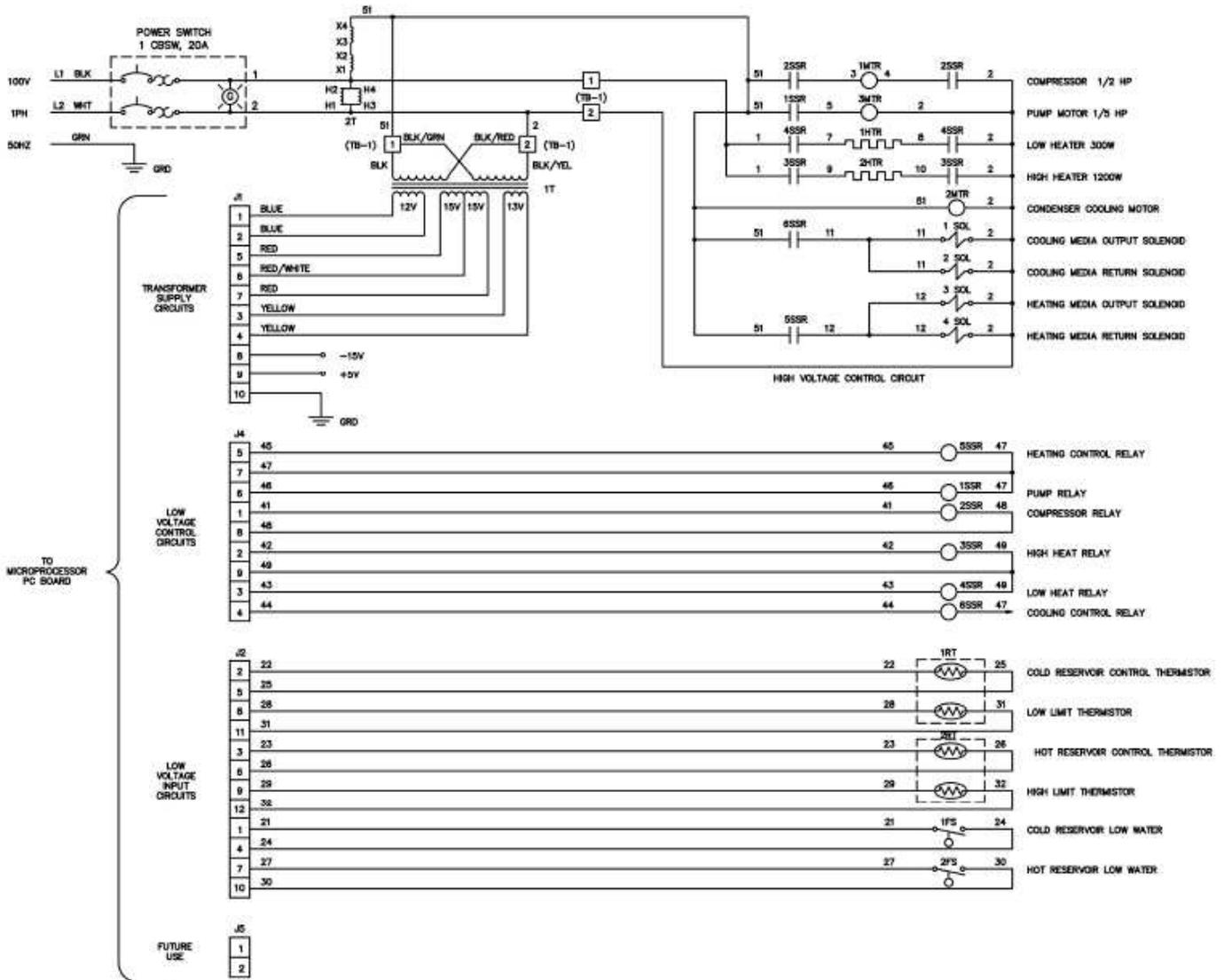


Figure 4.12 HEMOTHERM - Electrical Schematic 100 Volt

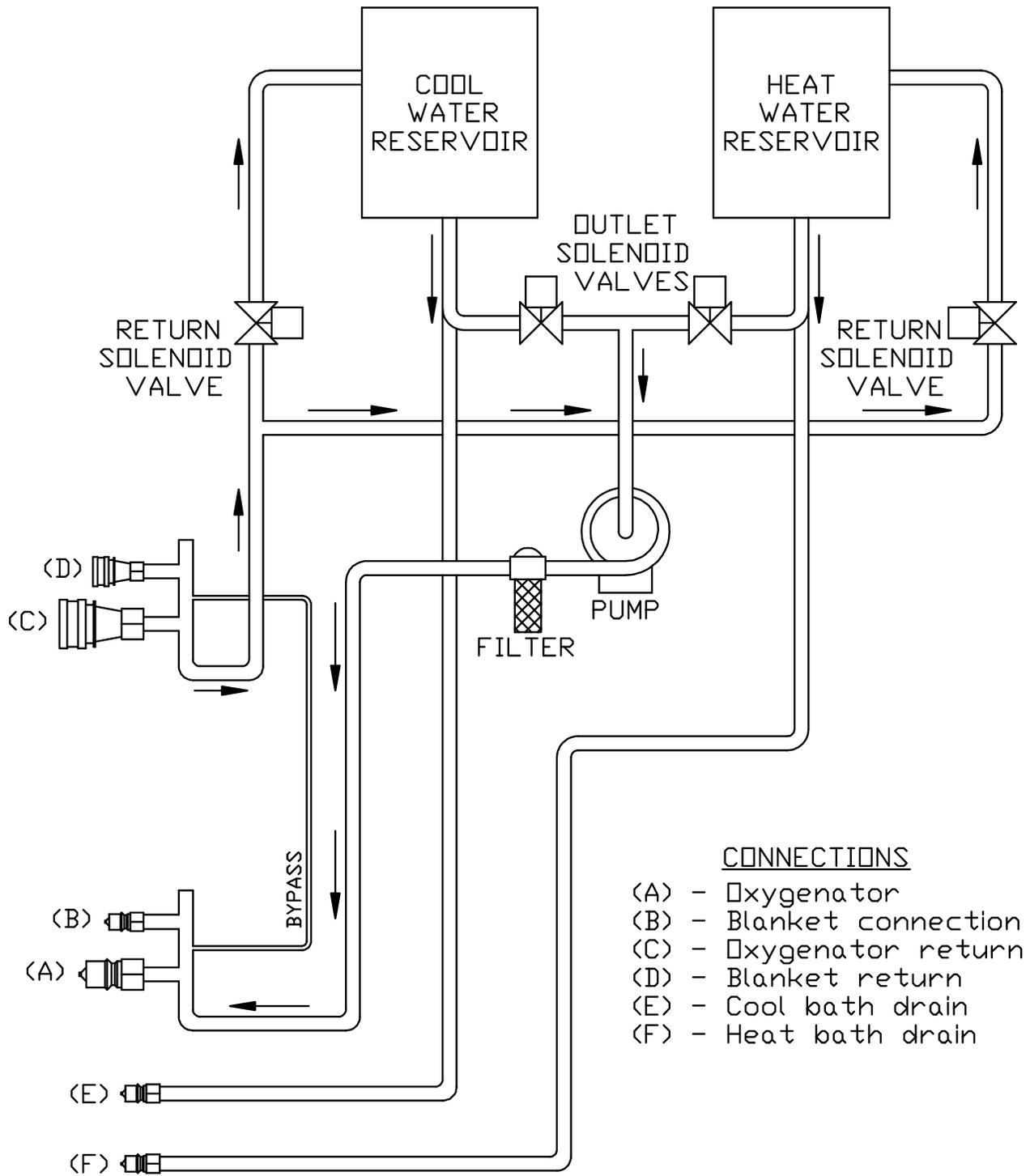


Figure 4.13 HEMOTHERM - Water Circulation Diagram

REFRIGERATION FLOW DIAGRAM

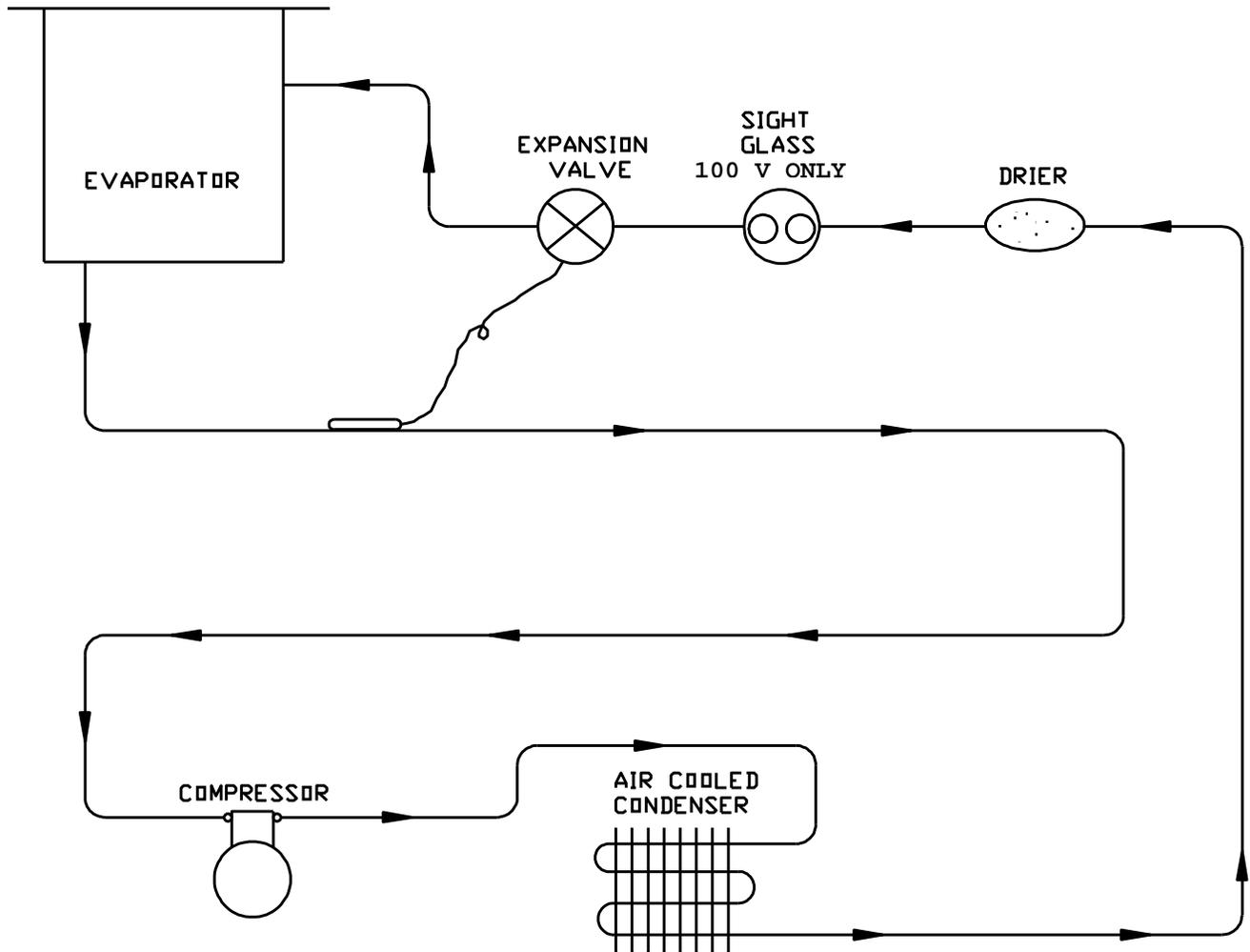


Figure 4.14 HEMOTHERM - Refrigeration Flow Diagram

Worldwide Order Placement

United States and Canada

Telephone..... 1-513-772-8810
(U.S.) Toll Free..... 1-800-989-7373
Fax..... 1-513-772-9119

International

CSZ International GmbH
Zehntfeldstrasse 240A
81825, Munich
Germany

Tel: 49-89-43-77-7814

HEMOTHERM, 400MR OPERATION & TECHNICAL MANUAL.

ORIGINALS. TO BE IMMEDIATELY RETURNED TO CINCINNATI SUB-ZERO PRODUCTS, INC., 12011 MOSTELLER ROAD, CINCINNATI, OH 45241. ATTN: Mike McGeorge, Purchasing Dept.
ORIGINAL ARTWORK FOR THE COVER IS AT MULTICRAFT.
PRINT 2-SIDED. GBC BINDING.

SPECIFICATIONS:

8 1/2" X 11"

PRINT 2-SIDED, GBC BINDING.

COVER/BACK TO BE OFF WHITE CARDSTOCK