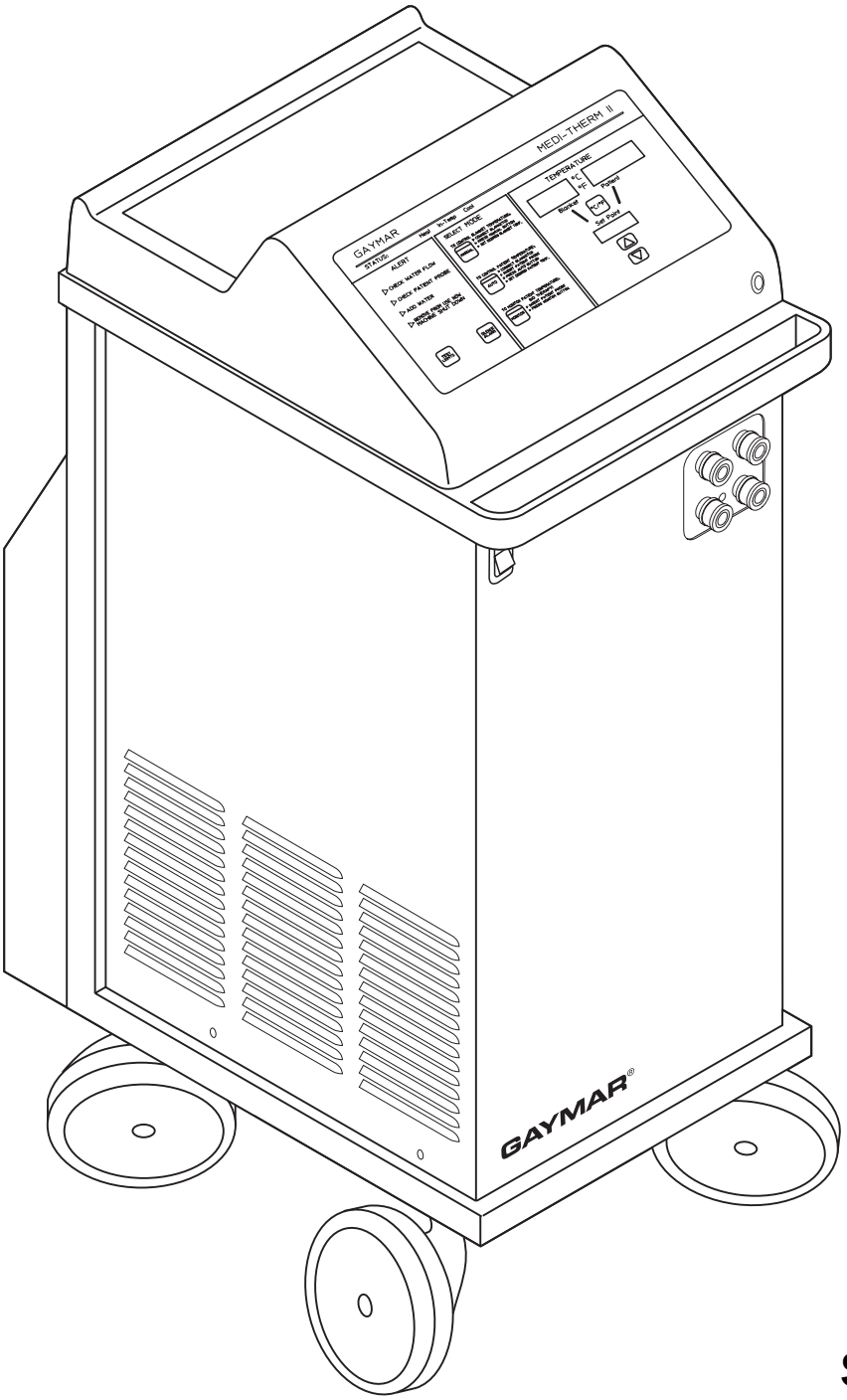
MEDI-THERM II

HYPER/HYPOTHERMIA MACHINE
MTA5900 SERIES



LISTED 303L

SERVICE MANUAL

www.gaymar.com P/N 10187-000 7/98

⚠ CAUTION

Federal law restricts this device to sale by or on the order of a physician.

SAFETY PRECAUTIONS

⚠ WARNING

- Repairs should be performed only by qualified personnel such as certified biomedical electronics technicians or certified clinical engineers familiar with repair practices for servicing medical devices, and in accordance with the *Medi-Therm II Service Manual.*
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3, p. 20) after making repairs and before returning the Medi-Therm II machine to patient use.

Improper repair may result in death or serious injury, equipment damage, or malfunction.

RECEIVING INSPECTION

Upon receipt, unpack the Medi-Therm II machine. Save all packing material. Perform a visual and mechanical inspection for concealed damage by removing the wraparound from the chassis (see page 73). If any damage is found, notify the carrier at once and ask for a written inspection. Photograph any damage and prepare a written record. Failure to do this within 15 days may result in loss of claim.

Refer to section 7.0 of this *Medi-Therm II Service Manual* for additional details.

Do not return the Medi-Therm II machine to Gaymar Industries without first contacting Gaymar's Technical Service Department for assistance.

Telephone:	**Direct**	**(716) 662-2551**
	Toll Free	**1 800 828-7341**

IMPORTANT

Before operating the Medi-Therm II machine, remove the compressor shipping brace. See p. 86, figure B.

OPERATING INSTRUCTIONS

For information on operating the Medi-Therm II machine, refer to the *Medi-Therm II Operating Instructions.*

CONTENTS

TABLES

ILLUSTRATIONS

1.0 PATIENT SAFETY

Use the Medi-Therm II Hyper/Hypothermia machine only under the direction of a physician.

Review the following precautions and procedures prior to each application:

⚠ DANGER

Do not use the Medi-Therm II machine in the presence of flammable anesthetics. **Risk of explosion can result.**

⚠ WARNING

- If the patient's temperature is not responding or does not reach the prescribed temperature in the prescribed time or deviates from the prescribed temperature range, notify the attending physician promptly. **Failure to notify the physician promptly may result in death or serious injury.**

- Power interruption will cause the Medi-Therm II machine to go into a standby mode, resulting in no therapy to the patient. Follow instructions for desired mode to resume operation. **Failure to resume therapy could result in death or serious injury.**

- The Medi-Therm II machine is provided with a means of checking rectal/esophageal temperature probes. When performing the probe check, use a disposable protective sheath (Becton-Dickinson catalog 3700 oral sheath or equivalent) on the probe. **Failure to use sheath could result in cross-contamination.**

- A physician's order is required for setting blanket temperature and for continued 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, and operating room patients should be checked more frequently. **Failure to monitor patient may result in skin damage or inappropriate patient temperature.**

  PEDIATRICS - The temperatures of infants and children are more responsive to surface heating and cooling than adults. The smaller the patient, the more pronounced the effect because of the patient's higher ratio of skin contact area to body mass.

  TEMPERATURE-SENSITIVE PATIENTS - Patients with impaired peripheral blood circulation caused by vascular diseases and patients who are incapacitated may be more sensitive to temperature changes than patients with more normal circulation.

  OPERATING ROOM PATIENTS - Patients with poor circulation associated with inadequate heart function, reduction in blood volume, and constriction of peripheral blood vessels may deviate from the normal response to the external application of heat and cold.

1.0 PATIENT SAFETY (continued)

⚠ WARNING

- Avoid placing additional heat sources between the patient and blanket. **Skin damage can result.**

  Heat applied by the blanket can result in a rise in skin temperature at the areas of contact. The additional heat rise due to electrosurgical currents flowing to the dispersive electrode could be sufficient to cause tissue injury. Each thermal effect by itself may be completely safe, but the additive effect may be injurious.[1] Keep additional heat sources from between the patient and the blanket.

- Prevent excessive and/or prolonged tissue pressure and shearing forces, especially over boney prominences. **Skin damage may result.**

  Localized skin injury due to tissue compressed between boney prominences and fluid-filled channels has occurred during prolonged cardiovascular procedures at blanket temperatures well below the scientifically established epidermal burn injury threshold.[2]

  Local ischemia can follow the application of pressures exceeding capillary pressure resulting in tissue necrosis. This local effect may be enhanced by generalized impairment of the circulation, local shearing forces and increased metabolic demand because of temperature elevation. Pathological changes may begin in two (2) hours.

- Keep the area between the patient and the blanket dry. **Excessive moisture may result in skin damage.**

  The application of heating or cooling may affect the toxicity of solutions. Prep solutions have been reported to injure the skin when allowed to remain between patients and water circulating heating blankets during prolonged procedures.[3]

⚠ CAUTION

- Place a dry absorbent sheet between the patient and the blanket when using all-vinyl blankets.

  A dry absorbent sheet placed between the patient and the Hyper/Hypothermia Blanket will absorb perspiration. Vinyl blankets with nonwoven fabric surfaces do not require an absorbent sheet when using the nonwoven side toward the patient.

- **Federal law restricts this device to sale by or on the order of a physician.**

REFERENCES

1 Gendron, F. G. *Unexplained Patient Burns.* chap. 5, p. 87, Quest Publishing Co., 1988.

2 Scott, Stewart M. *Thermal Blanket Injury in the Operating Room*. Arch. Surg., vol. 94, p. 181, Feb. 1967; Crino, Marjanne H. *Thermal Burns Caused by Warming Blankets in the Operating Room*. Clinical Workshop, vol. 29, pp. 149-150, Jan-Feb 1980; Gendron, Francis G. Journal of Clinical Engineering, vol. 5, no. 1, pp. 19-26, January-March 1980; Moritz, A. R. and Henriques, Jr., F.C. *Studies of Thermal Injury II. The Relative Importance of Time and Surface Temperature in the Causation of Cutaneous Burns.* Am. J. Path., 23:695, 1947; Stoll, Alice M. and Chianta, Maria A. *Method and Rating System for Evaluation of Thermal Protection.* Aerospace Medicine, vol. 40, no. 11, pp. 1232-1238, Nov. 1969; Stewart, T. P. and Magnano, S. *Burns or Pressure Ulcers in the Surgical Patient.* Decubitus, vol. 1, pp. 36-40, 1988.

3 Llorens, Alfred S. *Reaction to povidone-iodine surgical scrub, scrub associated with radical pelvic operation.* Am. J. Obstet. Gynecol., pp. 834-835, Nov. 14, 1974; Hodgkinson, Darryl J., Irons, George B. and Williams, Tiffany J., *Chemical Burns and Skin Preparation Solutions.* Surgery, Gynecology & Obstetrics, vol. 17 pp. 534-536, Oct. 1978.

2.0 MACHINE PRECAUTIONS

⚠ DANGER

Disconnect power before servicing unit.

Risk of electric shock.

⚠ WARNING

- Repairs should be performed only by qualified personnel such as certified biomedical electronics technicians or certified clinical engineers familiar with repair practices for servicing medical devices, and in accordance with the *Medi-Therm II Service Manual.* **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3, p. 20) after making repairs and before returning the Medi-Therm II machine to patient use. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Some manufacturer's patient probes may contain compensation resistors in series with YSI400 series thermistors. Do not use these probes with the Medi-Therm II machine. **Inaccurate patient temperature readouts will result and inappropriate therapy may be delivered.**

  NOTE: Use YSI400 series patient probes or equivalent. (Refer to the list of recommended probes in section 5.0, p. 7 *PROBE INFORMATION.*)

- Do not tip machine over without first draining the water out and unplugging the power cord. **Electrical shock or damage to the machine can result.**

⚠ CAUTION

Add distilled water only. **Failure to use distilled water may result in poor machine performance.**

- Do not use alcohol, since it is flammable. Alcohol may also accelerate blanket deterioration.
- Do not operate the machine without water, since damage to internal components may result.
- Do not overfill. Overfilling may result in overflow because the water in the blanket drains back into the machine when the machine is turned off.

3.0 REPAIR POLICY

The Medi-Therm II Hyper/Hypothermia machine is warranted free of defects in material and workmanship for a period of two (2) years, under the terms and conditions of the Gaymar warranty in place at the time of purchase. The compressor portion of the machine carries a five (5) year prorated warranty. The full warranty is available from Gaymar upon request. Medi-Therm II Hyper/Hypothermia machines can be repaired at the factory or in the field. Upon customer request, a shipping carton will be provided to safely return the machine to Gaymar or a qualified Service Center.

For customers who repair Gaymar Medi-Therm II machines at their location, this manual contains information to allow a qualified biomedical technician, familiar with practices for servicing medical devices, to make necessary repairs. Service training for the Hyper/Hypothermia machine is recommended and is available from Gaymar. For specific details, contact your Gaymar representative or the Technical Service Department at Gaymar. (See back cover of this manual for Gaymar telephone numbers.)

3.1 IN-WARRANTY REPAIRS

All in-warranty field repairs must be authorized by Gaymar's Technical Service Department before proceeding.

3.2 OUT-OF-WARRANTY REPAIRS

The following repair options are available when local machine servicing is elected:

1. **Defective Component**
   Replacement parts can be ordered. Specify the Gaymar part number; refer to Parts List in section 11, pp. 67 - 77 and 79 - 86 of this manual.

2. **Defective Printed Circuit (PC) Board**
   Defective PC boards can be exchanged for replacement boards at a fixed cost directly from the factory.

3. **Defective Top Module**
   The defective top module can be returned (without base) to the factory for repair.

4. **Machine Repairs**
   If the Medi-Therm II machine becomes defective and the cause of the problem cannot be determined, the complete machine can be returned to the factory for servicing at the purchaser's expense. This normally represents the most expensive repair option.

   Please contact Gaymar to obtain an RG (returned goods) number prior to returning the machine.

4.0 SPECIFICATIONS

4.1 PHYSICAL SPECIFICATIONS

PHYSICAL SPECIFICATIONS			
	MTA5942	MTA5900	MTA5901
Dimensions	37 in. high x 18-3/4 in. deep x 14 in. wide (94.0 cm high x 47.6 cm deep x 35.6 cm wide)		
Weight	149 lb (full); 130 lb (empty); shipping wt, 164 lb (72.1 kg (full); 62.6 kg (empty); shipping wt, 74.4 kg		
Normal Reservoir Operating Volume	Approximately 10 quarts (9-1/2 liters) distilled water		
Operating Ambient Temperature Range	60°F to 90°F (15.6°C to 32.2°C)	60°F to 90°F (15.6°C to 32.2°C)	60°F to 80°F (15.6°C to 26.7°C)
Dead Head Pressure	8.5 psi max (58.6 kPa max)		
Flow *	16 gph (gallons per hour) (60.6 liters/hour) *	16 gph (gallons per hour) (60.6 liters/hour) *	12 gph (gallons per hour) (45.4 liters/hour) *

* Minimum flow rates through a full size Gaymar Hyper/Hypothermia Blanket

4.2 THERMAL SPECIFICATIONS

THERMAL SPECIFICATIONS			
	MTA5942	MTA5900	MTA5901
High Temperature Limits Fixed (S2) & (S3)	111.2°F (44°C) to 120.2°F (49°C)	109.4°F (43°C) to 120.2°F (49°C)	109.4°F (43°C) to 120.2.°F (49°C)
	(Machine will go into REMOVE FROM USE NOW / MACHINE SHUTDOWN condition and audible alarm will be on.)		
Low Temperature Limits Fixed (S1)	26.6°F (-3.0°C) to 36.5°F (+2.5°C) (Machine will go into REMOVE FROM USE NOW / MACHINE SHUTDOWN condition and audible alarm will be on.)		
Add Water Alert Actuation	Less than 8 quarts (7.6 liters) of water in the cold reservoir		
Check Probe Activation Temperature (whenever probe is used)	Below 89.6°F (32°C) or above 113°F (45°C)		
Patient Temperature Control Range for Automatic Mode	89.6°F (32°C) to 105.8°F (41°C)		
Blanket Water Temperature Control Range for Manual Mode	39.2°F (4°C) to 107.6°F (42°C)	39.2°F (4°C) to 105.8°F (41°C)	39.2°F (4°C) to 105.8°F (41°C)

4.2 THERMAL SPECIFICATIONS (cont'd)

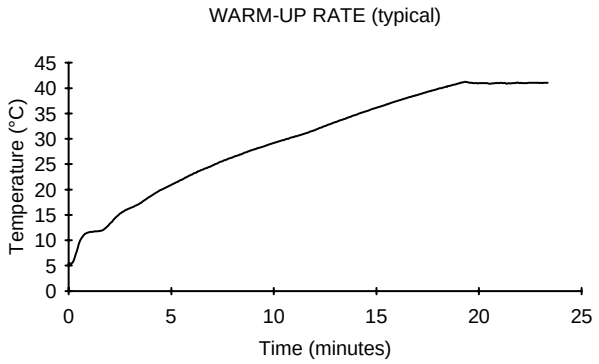


Figure 1—Typical warm-up rate (with full size blanket)

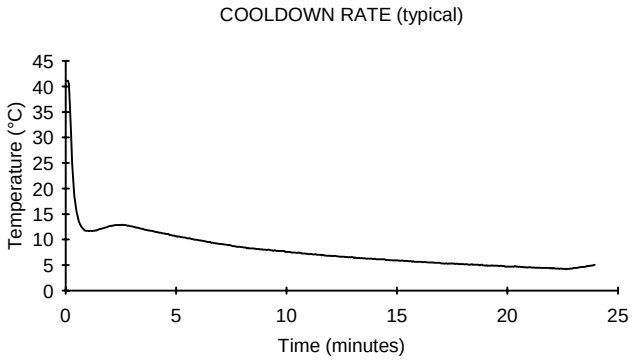


Figure 2—Typical cooldown rate (with full size blanket)

4.3 ELECTRICAL SPECIFICATIONS

ELECTRICAL SPECIFICATIONS				
		MTA5942	MTA5900	MTA5901
Patient Temperature Measurement Accuracy		±0.5°C, ±0.9°F (using Gaymar 400 series probe)		
Display Accuracy		±0.3°C, ±0.5°F		
Display Resolution	Blanket Water Temperature	1°C, 1°F		
	Patient Temperature	0.1°C, 0.1°F		
Controller Accuracy	Blanket Water Temperature	±0.8°C, ±1.4°F		
	Patient Temperature	±0.5°C, ±0.9°F		
Current Leakage	Chassis	100 microamps maximum		
	Patient Probe	50 microamps maximum		
Input Voltage		120 ± 10 volts	120 ± 10 volts	100, +10, -5 volts
Frequency		60 Hz	60 Hz	50/60 Hz
Power Consumption		1125 watts	1125 watts	1150 watts
Input Current	with compressor and heater ON	11.5 amps	11.5 amps	13.0 amps
	with compressor ON, heater OFF	8.5 amps	8.5 amps	8.8 amps
	with heater ON, compressor OFF	5.0 amps	5.0 amps	6.0 amps

5.0 PROBE INFORMATION

Disposable Probes

- DP400 Disposable Rectal/Esophageal - Adult/Small Child (3' [0.9 meters] long, requires adaptor); YSI400 series type

Reusable Probes

- PAT101 Patient probe—Rectal/Esophageal - Adult (10' [3.0 meters] long); YSI400 series type
- PAT102 Patient probe—Rectal/Esophageal - Pediatric (10' [3.0 meters] long); YSI400 series type
- PAT108 Patient probe—Skin surface (10' [3.0 meters] long); YSI400 series type

Probe Adaptor

- ADP10 Reusable adaptor cable for DP400: connects Gaymar disposable probe to Gaymar or Cincinnati Sub-Zero control unit for all applications that call for Baxter/Pharmaseal No. 66N2700.
- ADP10B Reusable adaptor cable for DP400: connects Gaymar disposable probe to American Medical Systems control unit or all applications that call for Baxter/Pharmaseal No. 66N27100.

⚠ WARNING

Some manufacturer's patient probes may contain compensation resistors in series with YSI400 series thermistors. Do not use these probes with the Medi-Therm II machine.

Inaccurate patient temperature readouts will result and inappropriate therapy may be delivered.

NOTE: Use YSI400 series patient probes or equivalent. (Refer to the list of recommended probes above.)

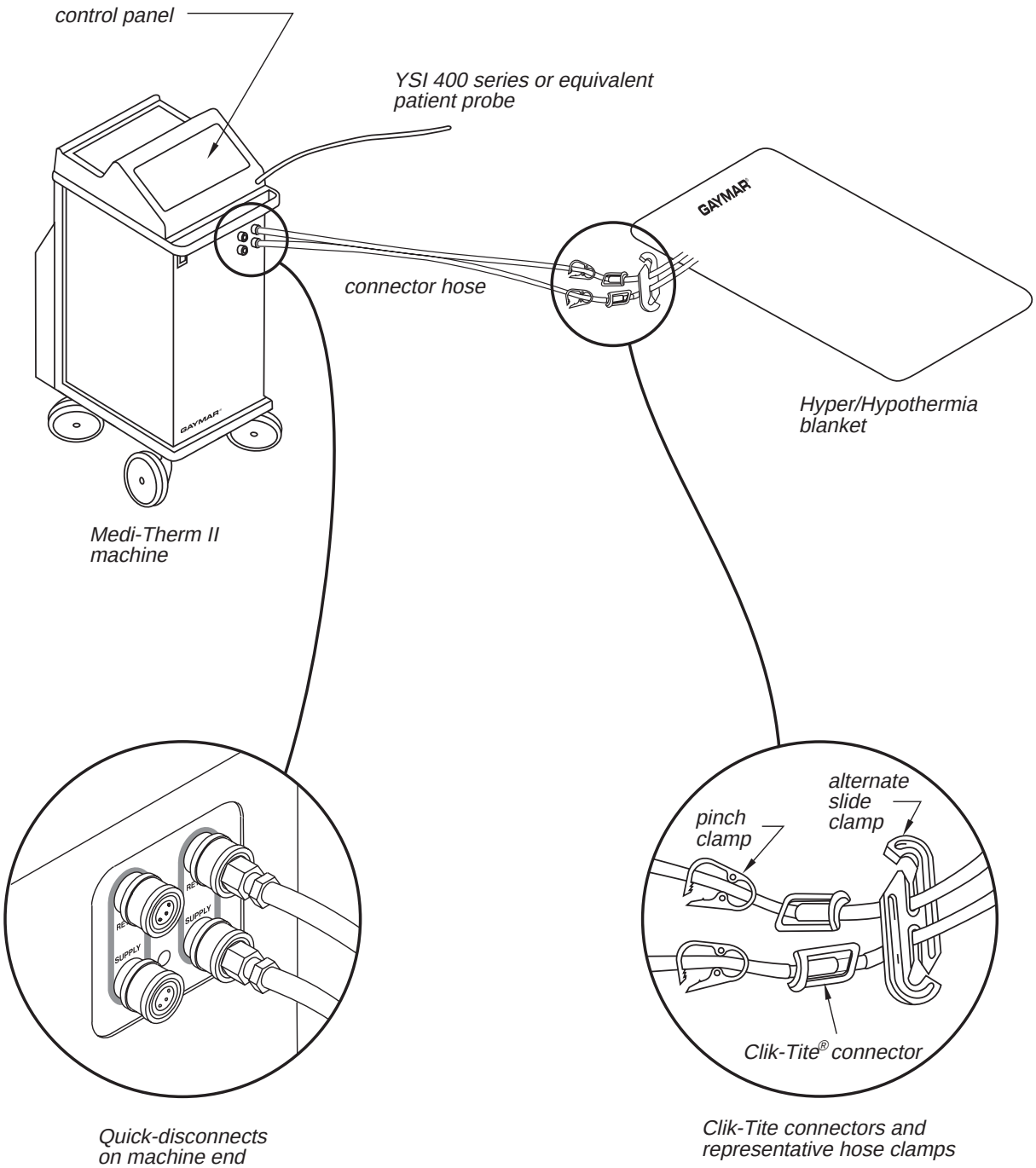


Figure 3—Medi-Therm II System

6.0 THEORY OF OPERATION, SYSTEM

The Gaymar Medi-Therm II machine provides a means of regulating patient temperature by supplying temperature-controlled water through a connector hose to a Gaymar Hyper/Hypothermia blanket. The blanket provides an interface for heating or cooling the patient. A patient probe senses patient temperature, which is displayed on the control panel. (See figure 3, p. 8.)

6.1 THEORY OF OPERATION, MEDI-THERM II MACHINE

The Medi-Therm II machine controls output water temperature by mixing hot and cold water from two reservoirs using hot and cold solenoid valves under microprocessor control. The feedback for control purposes is dependent on the machine's operating mode. A circulating pump, heater and refrigeration unit (all under microprocessor control) are also utilized.

Bimetallic thermostats and associated backup circuitry limit output water temperature independent of the microprocessor.

OPERATING MODES

The Medi-Therm II machine may be operated in one of three operating modes:

In ***MANUAL*** mode, the operator must observe patient temperature and manually adjust the blanket water set point temperature. An inline blanket water probe senses the temperature of the water pumped to the blanket and provides feedback for control purposes to the microprocessor. The patient temperature may be monitored by use of a patient probe.

In ***AUTO*** mode, the operator sets the desired patient temperature. The patient's temperature (as sensed by the patient probe) is automatically regulated to this set point. The patient probe input provides feedback to the microprocessor so it can adjust water temperature accordingly.

In ***MONITOR*** mode, the operator can monitor patient temperature through the patient probe. No patient therapy is provided. The pump, heater, and hot and cold solenoid valves are de-energized.

WATER RESERVOIRS

The hot water reservoir contains a small reserve of water. When the blanket water requires heating, a cartridge heater under microprocessor control quickly heats the water.

The cold water reservoir maintains approximately 10 quarts ($9^1/_2$ liters) of water at approximately 39.2°F (4°C). A cold water reservoir probe provides temperature feedback to the microprocessor which then cycles a refrigeration compressor to control the reservoir temperature.

6.1 THEORY OF OPERATION, MEDI-THERM II MACHINE (continued)

WATER TEMPERATURE CONTROL

Hot and cold solenoid valves regulate the flow path by directing water returning from the blanket to either the hot or cold water reservoir. Regulating the flow path controls the temperature of water pumped to the blanket. The microprocessor controls solenoid valve operation. Only one valve may open at a time:

When the *HEAT* status light is lit, the hot solenoid valve is open. Water returning from the blanket circulates through the hot water reservoir and is heated before being pumped back to the blanket. The heater, pump, and hot solenoid valve are energized. (See figure 10, p. 70.)

When the *COOL* status light is lit, the cold solenoid valve is open. Water returns from the blanket to the cold water reservoir and is replenished by chilled water from the cold water reservoir before being pumped back to the blanket. The pump and cold solenoid valve are energized. (See figure 11, p. 70.) The refrigeration compressor maintains the
cold water reservoir temperature and operates independently of the solenoid status.

When the *IN-TEMP* status light is lit, either the blanket water temperature is within 1.8°F (1°C) of the setpoint (in *MANUAL* mode) or the patient temperature is within 1.8°F (1°C) of the setpoint (in *AUTO* mode). Water temperature is controlled by alternating between heating and cooling (See figures 10 and 11).

REFRIGERATION UNIT

The refrigeration circuit (see figure 12, p. 71) consists of two heat exchangers operating at two pressures and two devices used to change these pressures. The first of these devices is the compressor which changes the gas pressure from low to high. The other device is the capillary tube which reduces the refrigerant pressure from high to low.

Beginning the cycle at the capillary tube, high pressure liquid refrigerant flows in the capillary tube and is discharged into the evaporator coil. The evaporator coil, which is a heat exchanger, receives the refrigerant as a mixture of liquid and vapor at a pressure low enough so that it boils and absorbs heat from the water surrounding it.

The heated refrigerant vapor then leaves the evaporator coils, enters the suction side of the compressor and is compressed, causing its pressure and temperature to increase. The vapor, much warmer than the ambient air, travels to the condenser.

The condenser is the other heat exchanger. The condenser fan draws the colder ambient air over the condenser coils and removes the heat being carried by the refrigerant and causes it to condense back into liquid refrigerant. This completes the cycle and the high pressure liquid refrigerant is returned to the capillary tube to be used over again. The temperature of the water surrounding the evaporator coil (in the cold water reservoir) is controlled by the microprocessor. The microprocessor senses the temperature with a cold water reservoir probe and cycles the compressor relay on and off.

6.1 THEORY OF OPERATION, MEDI-THERM II MACHINE (continued)

BACKUP SYSTEMS

Backup systems within the Medi-Therm II machine limit the temperature of water exiting the machine to specified ranges in the event of a failure of the control system including the microprocessor:

Maximum water temperature is limited by two bimetallic thermostats. If either of these two thermostats is actuated, a *REMOVE FROM USE NOW / MACHINE SHUTDOWN* circuit is triggered which:

- shuts down the pump and heater;
- lights the *ALERT* and the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* indicators; and,
- sounds the audible alarm.

In addition, if the microprocessor is operational, the compressor shuts down, the displays blank, and the *ALERT* indicator and audible alarm turn on and off.

Minimum water temperature is limited by a bimetallic thermostat. If this thermostat is actuated, a *REMOVE FROM USE NOW / MACHINE SHUTDOWN* circuit is triggered, which in turn:

- shuts down the pump and heater;
- lights the *ALERT* and the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* indicators; and,
- sounds the audible alarm. In addition, if the microprocessor is operational, the compressor shuts down, the displays blank, and the *ALERT* indicator and audible alarm turn on and off.

6.2 SYSTEM COMPONENT INTERCONNECTIONS

See figure 8, p. 67 for base-to-head and control/display board-to-power supply board connections; figure 18, p. 79 for system wiring diagram; figures 19, 20 and 21, pp. 80, 81, 82 for the electrical schematics; figures 22 and 23, pp. 83 and 84, for component layouts and part designations; and figure 24, p. 85 for the control/display board block diagram.

CONTROL/DISPLAY BOARD AND POWER SUPPLY BOARD

The Medi-Therm II machine uses two printed circuit boards (see figure 8, p. 67):

- The control/display board contains the microprocessor circuits, the display circuits, and all other low voltage control circuits.
- The power supply board contains the power supply, the low voltage to high voltage interface circuits, and the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* backup safety circuits.

The control/display board connects to the patient probe jack J1 via P2 at J2 and to the digital control assembly panel via P4 at J4. All other connections from the system's peripheral devices to the control/display board are made through the power supply board.

A 26-pin cable connects the control/display board via P1 at J1 to the power supply board via P3 at J4.

6.2 SYSTEM COMPONENT INTERCONNECTIONS (continued)

Four cables connect the components in the base of the machine to the PC boards in the head (see figure 8, p.67):

- A **9-pin connector** P6 ties the blanket water probe RT2, cold water reservoir probe RT1, flow switch S5, and level switch S4 to the power supply board at J2 and ultimately to the control/display board.
- A **12-pin connector** P7 ties the high voltage devices (pump, heater, hot solenoid valve SV2, cold solenoid valve SV1, and refrigeration compressor relay K1) to the interface circuits on the power supply board, as well as thermostats S1, S2, and S3 to the high voltage backup circuitry on the power supply board.
- A **6-pin connector** P5 connects transformer T1 housed in the base to the power supply circuitry at J3 on the power supply board.
- A **chassis ground harness** from the control/display board connects to the chassis.

6.3 POWER SUPPLY

See figure 18, p.79 for the system wiring diagram; figures 19, 20 and 21, pp. 80, 81, 82 for the electrical schematics; figures 22 and 23, pp. 83, 84 for component layouts and part designations; and figure 24, p. 85 for the control/display board block diagram.

Power enters the Medi-Therm II machine through circuit breaker CB1 to feed the refrigeration unit through relay K1. It also then enters the power supply board at J1 to feed the hot solenoid valve, cold solenoid valve, heater and pump triacs, the high voltage backup water temperature limiting circuits and transformer T1.

Power to drive the low voltage circuits on the control/display board is derived from the machine's power supplies which reside entirely on the power supply board. The transformer T1 output is rectified and filtered to generate unregulated positive and negative voltages. Q5, D1, L1 and associated components are configured as a DC to DC switching regulator in a buck configuration yielding a nominal output of +5.3 volts DC. Q6 is a linear regulator with a nominal output of plus twelve (+12) volts DC, while Q7, also a linear regulator, delivers a nominal output of minus twelve (-12) volts DC.

6.4 MACHINE FUNCTIONS

See figure 18, p. 79 for system wiring diagram; figures 19, 20 and 21, pp. 80, 81, 82 for the electrical schematics; figures 22 and 23, pp. 83, 84 for component layouts and part designations; and figure 24, p. 85 for the control/display board block diagram.

The U37 microprocessor is fully dependent on the code stored in the U31 EPROM. When the machine is on, the microprocessor continually cycles through its main program loop to perform the following:

- Thermistor output measurement (see section 6.4.1, p. 13)
- Digital control panel input (section 6.4.2, p. 13)
- Display update (section 6.4.3, p. 13)
- Peripheral input (section 6.4.4, p. 14)
- Blanket/Patient temperature control (section 6.4.5, p. 15)
- Cold water reservoir temperature control (section 6.4.6, p. 16)

Backup water temperature limiting is achieved independently of the microprocessor. (See section 6.4.7, p. 16.)

6.4.1 THERMISTOR OUTPUT MEASUREMENT

Temperature measurement is achieved using 400 series thermistor beads located in the blanket water path (blanket water probe RT2), the cold water reservoir (cold water reservoir probe RT1), and in the patient via the patient probe jack J1.

Under microprocessor U37 control, each of the three beads is connected to the current source circuitry (U38 and associated components) by a demultiplexor U49. At the same time, the resulting output voltage created by the current through the thermistor is presented to an amplifier circuit (U39 and associated components) via multiplexor U50. The amplified voltage is then applied to a voltage-to-frequency converter U24. A frequency up to 100kHz is presented to port pin P3.5 of the microprocessor. The microprocessor converts the incoming frequency to a temperature value.

At regular intervals two compensation resistors R13 and R12 are also processed in the same manner. These compensation resistors are precision resistors with values at each end of the probe temperature range of 32°F (0°C) to 122°F (50°C). The values from the precision resistors are used to compensate for circuit drift.

6.4.2 DIGITAL CONTROL PANEL INPUT

User input is entered via a digital control panel. The input from the buttons is decoded by U45. The "data available" line of U45 is tied to the microprocessor port pin P3.3. When a button press is decoded and debounced by U45, the "data available" line goes high and the microprocessor responds by inputting the decoded value.

6.4.3 DISPLAY UPDATE

For display of measured and set point temperatures, 7 segment LED displays are utilized:

- The set point display is driven by driver chip U48. The microprocessor interfaces to it via the data bus at addresses 0FFF8H, 0FFF9H, 0FFFAH, 0FFFBH.
- The patient display is driven by driver chip U6. The microprocessor interfaces to it via the data bus at addresses 0FFF4H, 0FFF5H, 0FFF6H, 0FFF7H.
- The blanket display is driven by driver chip U5. The microprocessor interfaces to it via the data bus at addresses 0FFECH, 0FFEDH, 0FFEEH, 0FFEFH.

6.4.3 DISPLAY UPDATE (continued)

All alarm and status indicators are lit by LED bars driven by inverter/driver IC's:

- The alarm latch U53 is the interface between the microprocessor and the *ALERT, ADD WATER, CHECK PROBE, CHECK FLOW, REMOVE FROM USE NOW / MACHINE SHUTDOWN, SELECT, °F** and *°C* drivers via the data bus at address 0FFBFH. A high signal written to the latch by the microprocessor activates the individual inverter/ drivers to light the corresponding indicator.
- The mode display latch U54 is the interface between microprocessor and the *IN-TEMP, COOL, HEAT, FLOW-OK, AUTO, MANUAL,* and *MONITOR* drivers via the data bus at address 0FFDFH. A high signal written to the latch by the microprocessor activates the individual inverter/drivers.
- The control latch U51 is the interface between the microprocessor and the two leader light drivers via the data bus at address 0FF7FH. When this latch is selected, a low signal on the data line from the microprocessor causes a high signal on the latch output Therefore, these two LED bar displays are "active low" in the eyes of the microprocessor in contrast to all the other LED bar displays of the machine.

The audible alarm is driven either by a high signal from the control latch U51 (from the microprocessor via the data bus at address 0FF7FH) or a high RFU IN signal from Q10 on the power supply board. A low data line signal from the microprocessor to U51 causes a high signal on the latch output Therefore, the alarm is "active low" in the eyes of the microprocessor. NOR gate U40, driver U26 and transistor Q1 work in conjunction to activate the alarm.

6.4.4 PERIPHERAL INPUT

The input buffer U55 is the interface between the microprocessor (via the data bus at a "read" address of 0FFFEH) and the input signals from the flow switch S5 and the level switch S4 (which travel from the base through the power supply board), the probe presence switch within the patient probe jack J1, and the service mode button S3 on the control/display board. The lines to the buffer from the peripheral devices are default high (via pull-up resistors).

The level switch S4 will pull its buffer input line low when it senses a sufficient water level.

The flow switch S5 will pull its buffer input line low when it senses sufficient flow.

The probe presence switch within J1 will pull its buffer input line low when it senses the presence of the patient probe.

Pressing the service mode switch S3 on the control/display board will pull its buffer input line low.

* Some models do not have the *°C/°F* feature.

6.4.5 BLANKET / PATIENT TEMPERATURE CONTROL

If the machine is in *MANUAL* mode, the blanket water temperature as sensed by the blanket water probe is used as the feedback signal for controlling the water temperature to the *MANUAL* mode set point temperature.

If the machine is in *AUTO* mode, the patient temperature as sensed by the patient probe connected to the patient probe jack is used as the feedback signal for controlling the patient temperature to the *AUTO* mode set point temperature. The machine accomplishes this by adjusting the water temperature.

For water temperature control, the microprocessor control system outputs a pulse train to each solenoid valve. The pulse train to the hot solenoid (and also heater) is the complement of the pulse train to the cold solenoid. The pulse train duty cycle depends on the magnitude and sense of the control signal calculated by the microprocessor. That is, while the solenoids are each either on or off, the ratio of on time to off time is proportional to the calculated control signal amplitude. For large differences between set point and probe temperatures, the output to each solenoid valve will be either on or off. For differences approaching zero, the outputs to the solenoid valves (and heater) will switch on and off, with the on and off times automatically adjusted to maintain a probe temperature equal to the set point.

The circulating pump is energized whenever the unit is in *AUTO* or *MANUAL* modes.

The control latch U51 on the control/display board is the interface between the microprocessor (via the data bus at address 0FF7FH) and the peripheral drivers on the power supply board.

Interface circuitry on the power supply board consists of U1, U2, U7, U8, Q3, Q4, Q8, Q9, and associated components. U1, U2, U7, and U8 are optically coupled triac drivers used to control their respective triacs (Q3, Q4, Q8, and Q9); these combinations provide electrical isolation between the low voltage microprocessor control circuits and the line voltage circuits.

The heater, pump, hot solenoid valve, and cold solenoid valve are individually controlled by the microprocessor through latch U51 on the control/display board. A high signal on the data line from the microprocessor causes a low signal on the appropriate output line of U51 which then sinks current from the power supply board to activate the peripheral devices.

Pin 11 of U51 on the control/display board and U8 and Q9 of the power supply board control the cold solenoid valve while pin 9 of U51 on the control/display board and U7 and Q8 of the power supply board control the hot solenoid valve. Pin 8 of U51 on the control/display board and U2 and Q4 of the power supply board control the circulating pump. Pin 7 of U51 on the control/display board and U1 and Q3 of the power supply board control power to the heater.

6.4.6 COLD WATER RESERVOIR TEMPERATURE CONTROL

The control latch U51 on the control/display board is the interface between the microprocessor (via the data bus at address 0FF7FH) and the refrigeration compressor relay driver on the power supply board. A high signal on the appropriate data line causes a low signal at pin 6 of U51 on the control/display board, which then activates Q12 on the power supply board. Q12 on the power supply board is the interface between the control/display board and the coil of the power relay K1 located in the machine base. The microprocessor switches power through the relay to the refrigeration compressor at cut-out and cut-in temperatures of 38°F (3.3°C) and 42.5°F (5.8°C). These temperatures are sensed by the cold water reservoir probe RTl located in the water reservoir. (See figure 12, p. 71.) Control of the cold water reservoir temperature takes place whenever the machine is on.

6.4.7 BACK-UP WATER TEMPERATURE LIMITING

The power supply board includes the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* circuitry, which includes U3, U4, U5, U6, U9, U10, D2, D3, Q1, Q2, their interconnected components, and fixed, nonadjustable thermostats S2, S3, and S1 located in the base. Under normal circumstances, Q1 and Q2 are kept turned on by the action of R7, C10, and D4 and R5, C15, and D5 to complete the conduction path for the heater and pump. If the blanket water falls into the low temperature limit range, S1 will open. If the blanket temperature rises into the high temperature limits ranges, S2 and/or S3 will open. (See section 4.2 Thermal Specification table, page 5, for the correct high or low temperature limits with corresponding model number of your machine.) When any one of these thermostats opens, it directly interrupts the circuit and shuts off the pump and heater; at the same time, full line voltage will appear between J1-2 and J1-3. In this case, U5 and U10 will be turned on by the action of R4, D3, and associated parts while U3 and U9 will be turned on by the action of R6, D2, and associated parts. U5 prevents Q2 from turning on and U3 prevents Q1 from turning on even if the open thermostat(s) closes again. The output of either U9 or U10, through buffer Q10, signals the microprocessor that a thermostat has tripped and that a *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition has resulted. Thus, should any thermostat (S1, S2, or S3) trip, the heater and pump are shut off and the microprocessor is notified.

On the control/display board, a high signal from Q10 of the power supply board feeds NOR gate U40 to drive the audible alarm, feeds driver U52 to light the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED, and feeds driver U11 to light the *ALERT* LED. All this is done independent of the microprocessor. This same signal is sent to port pin P3.2 of the microprocessor through C1, R1, and driver U11.

If the microprocessor is operational at the event of a high signal from Q10 of the power supply board, the signal at P3.2 causes the microprocessor to shut off the 7 segment displays, flash the *ALERT* LED and light the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED, toggle the audible alarm, store the appropriate RFU* code indicating the reason for the shutdown, turn off the heater and pump triacs Q3 and Q4, turn off the solenoid triacs Q8 and Q9, and turn off the compressor transistor Q12. Anytime the microprocessor

* RFU = *REMOVE FROM USE NOW / MACHINE SHUTDOWN*

6.4.7 BACK-UP WATER TEMPERATURE LIMITING (continued)

goes into a shutdown condition it also sends an output signal from port pin P3.4, through U40 of the control/display board, to command, via Q11, U4, and U6 on the power supply board, a *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition. The process of turning off the heater and pump triacs Q3 and Q4 by the microprocessor removes power from the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* circuitry on the power supply board which then allows the indicators on the control/display board to toggle under microprocessor control. This shutdown condition by the microprocessor program will remain until the machine is powered down. If, upon machine turn on, the fault condition still exists, attempting to resume therapy (which would turn on the pump and possibly heater) will replace power to the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* circuits on the power supply board and cause the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition to recur.

Also, if during normal operation, the microprocessor senses internal problems, it will attempt a shutdown as described above. (See table 2, section 8.1, p. 35.)

If the microprocessor is nonoperational at the event of a signal from Q10 of the power supply board, the user is notified of the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition by the fact that the above mentioned indicators are on continuously. In addition, there are separate, redundant circuits on the power supply board, each triggered by any of the thermostats, that insure that the pump and heater remain off even if the thermostat cools sufficiently to close again. The *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition remains latched and can be cleared only by an operator intervention in the form of turning the machine circuit breaker off. If, upon machine turn on, the fault condition still exists, attempting to resume therapy will cause the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* condition to recur.

7.0 FUNCTIONAL CHECK, SAFETY INSPECTION, AND PREVENTIVE MAINTENANCE

7.1 RECEIVING INSPECTION PROCEDURES

Concealed Damage

After unpacking the Medi-Therm II machine, inspect the machine for concealed damage. Save all packing material and carefully describe or photograph the 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 machine to GAYMAR — call Gaymar's Technical Service Department for advice.

Before placing the Medi-Therm II machine into service, perform a *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 20 to 33).

IMPORTANT

Before operating the Medi-Therm II machine, remove the compressor shipping brace. (See p. 86, figure B.)

7.2 CLEANING PROCEDURES

Fluid System

Use distilled water to retard algae growth and mineral buildup. Change the distilled water monthly or more often depending upon use.

The water circulation system, including blankets, should be cleaned every month to retard algae growth.

To clean the fluid system, drain the machine and prepare an algaecidal solution according to manufacturer's instructions. Use Gaymar product catalog MTA33, or AirKem A-33 or equivalent available from Enviro-San, Inc., 2361 Wehrle Drive, Williamsville, NY 14221 (telephone: (716) 634-9900). Add the solution to the machine, attach blankets, set the machine in *MANUAL* mode to a setpoint temperature of 27°C (80.6°F) and circulate the solution for 12 hours. Drain the solution and refill the machine with distilled water. Algaecide solution (MTA33 or equivalent) may be readded to the water and left in the machine in the recommended concentration to further retard algae growth.

⚠ CAUTION

- Do not exceed proper algaecidal solution concentration.

  Excessive algaecide may cause foaming, which can damage the circulating pump.

- Do not use bleach (sodium hypochlorite).

  Bleach will damage the heating element in the machine, which could result in excessive leakage current.

Compressor

Dirt that has accumulated on the condenser coils and cooling fins within the machine will reduce the efficiency of the compressor and should be removed with a vacuum cleaner or compressed air hose. This will require removal of the rear baffle assembly. This should be checked monthly or more frequently depending upon use. (See figure 14, p. 73.)

7.2 CLEANING PROCEDURES (continued)

Pump
Pump motor should be oiled once a year with 3-4 drops of general purpose motor oil in the locations identified on the pump label.

Panel Exterior
Clean the control panel and panel exterior with a cloth dampened with isopropyl alcohol.

Blankets
Outside surfaces of standard blankets may be cleaned with a damp cloth and mild detergent to prevent algae growth. To clean the insides, attach the blankets to the machine and follow instructions for section 7.2, p. 18, *CLEANING PROCEDURES,* Fluid System.

NOTE: Exposure to harsh chemicals will cause blankets to lose flexibility and resistance to cracking.

Probe Check Well
The Probe Check Well should be cleaned with a small tubular brush and detergent, and then wiped with a commercial disinfectant.

⚠ WARNING

When performing the PROBE CHECK, use a disposable protective sheath (Becton-Dickinson catalog 3700 oral sheath or equivalent) on the probe.

Failure to use sheath could result in cross-contamination.

Probes
Do not autoclave. Clean with a damp cloth and mild detergent. Wipe dry.

Probes are made of PVC. If probe must be sterilized, use any cold sterilization means except alcohol, which may accelerate probe deterioration. Always wipe dry.

If gas sterilization is necessary, probes should be handled like any other PVC product. Probes are made of PVC.

Reusable probes may be cleaned with a damp cloth and mild detergent. Always wipe dry. Exposure to harsh chemicals will cause probe to lose flexibility and resistance to cracking.

Disposable probes should be discarded after use.

NOTE: Exposure to harsh chemicals will cause probe to lose flexibility and resistance to cracking. Do not use damaged temperature probes. Discard probes having visible pinholes, cracks or abrasions.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION

To assure the optimum performance, dependability and safety, the following should be performed every three (3) months or as specified in the facility's preventive maintenance program.

An Inspection Form is provided at the end of this section to facilitate and document the inspection process. Lower case letters preceding the subheadings within section 7.3 correspond to the lines on the *INSPECTION FORM*.

⚠ WARNING

Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* after making repairs and before returning the Medi-Therm II machine to patient use.

Improper repair may result in death or serious injury, equipment damage, or malfunction.

Test Equipment Requirements

The following test equipment (or equivalent) is required to perform the preventive maintenance/functional check procedures:

- GAYMAR TPT9 Flowmeter/Temperature Tester
- GAYMAR TFC1 Mercury Thermometer (±1°C accuracy); -2°C to +52°C range
- GAYMAR DBK9 Blanket Connector Hose
- * GAYMAR MT590 Medi-Therm II Test Tool, or GAYMAR PRK2 Patient Temp Simulator Kit, or Precision Decade Box (0-10K ohms, 0.2% accuracy, 1 ohm increments)
- GAYMAR DHP901 or DHP813 Hyper/Hypothermia Blanket
- * GAYMAR MT590 Medi-Therm II Test Tool, or 6" (approximately 150 cm) Shorting Jumper
- Ground Resistance Checker
- Current Leakage Tester
- Static Control Wrist Strap

* The GAYMAR MT590 Medi-Therm II Test Tool is a dedicated test tool available from Gaymar Industries. This tool was designed to allow for more convenient and safer testing of the high temp backup thermostats by eliminating the need to remove the lower wraparound cover and avoiding the use of a shorting jumper that could be accidentally left inside the machine. In addition, the test tool can be used to monitor input/output signals between the head and base of the machine through the use of indicator lights. This feature can be of great value during any troubleshooting process. This test tool also provides a patient probe simulator which allows testing of the machine without a precision decade box.

For more information on the MT590 Test Tool, contact the Gaymar Technical Service Department.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

⚠ DANGER

Disconnect power before servicing unit. **Risk of electrical shock.**

Follow the following procedures carefully, paying particular attention to test setups. Any deviation from the setups, procedures, or test equipment may result in incorrect or misleading results.

Before making any repairs, be sure to recheck your test setup, procedure, and test equipment.

Test equipment should be calibrated in accordance with NIST (National Institute of Standards and Technology) guidelines to insure accurate readings.

a) Condition of Chassis

The following inspections should be performed:

1. The chassis should be clean and relatively free of rust and corrosion.
2. Exterior screws should be tight
3. Legends, markings, and operator instructions should be legible.
4. Dirt that has accumulated in vents and cooling fins within the machine should be removed with a vacuum cleaner or compressed air hose. This will require removal of the rear baffle assembly.
5. Check that the casters are tight and functioning properly.
6. The quick-disconnect fittings on the machine may become stiff and difficult to engage. If so, apply a silicone-base lubricant to the inside of the machine fittings and the outside of the blanket connector.
7. Clean the Probe Check Well according to the procedure described in section 7.2, p. 19.
8. Inspect the fluid system for debris and any sign of algae growth. Clean according to *Cleaning Procedures, Fluid System* (section 7.2).

b) Attachment Plug

Examine the attachment plug on the line cord to be sure that it is in good condition.

c) Line Cord and Strain Reliefs

Examine the line cord along its entire length for physical damage, such as cuts or cracked insulation. A damaged line cord should be replaced rather than repaired. Check the quality of the strain reliefs at both ends of the line cord.

d) Circuit Breaker

A worn out circuit breaker can be responsible for intermittent shutoffs, with no other apparent indications of failure.

Examine the physical condition of the circuit breaker, paying particular attention to the push-on terminals at the rear of the breaker. Terminals should be snug. Replace breaker and/or terminals if there is discoloration or any indications of heating.

Cycle the switch on and off several times. The switch should have a positive engagement ("click") for the *OFF* and *ON* positions.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

e) Condition of Lights and Alarm

Plug in the Medi-Therm II machine and turn it on. Press and hold the *TEST LIGHTS* button. The right and left halves of the display panel should light and blank alternately (along with the audible alarm). The four status legends (*FLOW OK, HEAT, IN-TEMP,* and *COOL),* the *ALERT* legend and its four (triangular) indicators, and the three mode legends and *SELECT* heading should be lit. The three temperature displays should indicate "888", "888.8", and "888.8". The two temperature scale indicators ("°C" and "°F") * and the two lines connecting *SET POINT* to both the *BLANKET* and *PATIENT DISPLAY* should be lit. The audible alarm should sound. Replace any LED's which do not light.

f) Flow

To measure the machine's flow rate and check the flow switch actuation, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. Connect the test setup shown in figure 13, p.72.
3. Turn machine on. Set machine in *MANUAL* mode.
4. Increase the temperature set point to light the *HEAT* status light. Note the flow rate. The *FLOW OK* indicator should be lit.
5. Decrease the temperature set point to light the *COOL* status light. Note the flow rate. The *FLOW OK* indicator should be lit.
6. The flow rate in both modes should exceed 16 GPH (60.6 liters/hr) for an MTA5942/MTA5900 and 12 GPH (45.4 liters/hr) for an MTA5901.

   NOTE: If the unit has been completely drained, air can be trapped in the pump causing the flow to be decreased. To clear the air, turn the unit off, wait approximately one minute, and start again from step 3.
7. Kink the hose to stop the flow. The *CHECK WATER FLOW* indicator should light, the *FLOW OK* indicator should go out, and the *ALERT* indicator should flash on and off.

g) Level Switch Actuation

To test the actuation of the level switch, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible. The *ADD WATER* indicator should be off.
2. Connect a DBK9 hose to a supply fitting on the machine and direct the other end to a drain or gallon (4 liter) container.
3. Turn machine on. Set machine in *MANUAL* mode. Adjust the temperature set point to 39.2°F (4°C) (*COOL* status light on).
4. Allow water to drain until bobber has bottomed out on the drain screen (about 3 quarts or 3 liters). The *ADD WATER* indicator should be lit.
5. Refill machine until the green band is fully visible and verify that the *ADD WATER* indicator goes out.

* Some models do not have the *°C/°F* feature.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

h) Cold Water Reservoir Controller

To check the cold water reservoir controller, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. Connect the test setup shown in figure 13, p. 72.

   NOTE: To minimize the test time for this test only, do not connect a blanket as shown in figure 13. Connect the return line of connector hose to the TPT9 tester.
3. Turn machine on and push the *MANUAL* mode button.
4. Set the Temperature Setpoint to 39.2°F (4°C).
5. Verify that the machine can supply water anywhere within the 37.4°F (3°C) to 42.8°F (6°C) range as measured by the thermometer and that the compressor turns off one time. (This will take 15-30 minutes, depending upon room temperature and other conditions. The use of a blanket for this test can extend this time up to 60 minutes.)

i) Blanket Water Temperature Controller and Display Test

To check the temperature controller, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. Connect the test setup shown in figure 13, p. 72.
3. Turn machine on. Set in *MANUAL* mode.
4. Set the Temperature Setpoint to the various settings specified on the *INSPECTION FORM* (section 7.4, p. 33), wait until the *IN-TEMP* LED comes on and the water temperature stabilizes, then record the temperature of the mercury thermometer and that shown on the display. Verify that the recorded values are within limits outlined on *INSPECTION FORM*, item i.

j) Automatic Mode, Blanket Water Limit Check

To check the blanket water limit in *AUTO* mode, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. Connect the test setup as shown in figure 13 (p. 72).
3. Connect a resistance of 1355 ohms to the patient probe jack to simulate a 37°C patient temperature.
4. Turn machine on and place in *AUTO* mode with setpoint of 40°C.
5. Verify that the mercury thermometer does not exceed 42°C.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

k) High Temperature Backup Thermostat Trip Temperatures

The following procedure describes two different approaches for measuring the trip points (actuation temperatures) of the machine's high temperature backup thermostats. Steps 1-15, pp. 25-26, should be followed when a Gaymar MT590 Test Tool is available. For those facilities not having access to an MT590, follow steps 1A-20A, pp. 27-28.

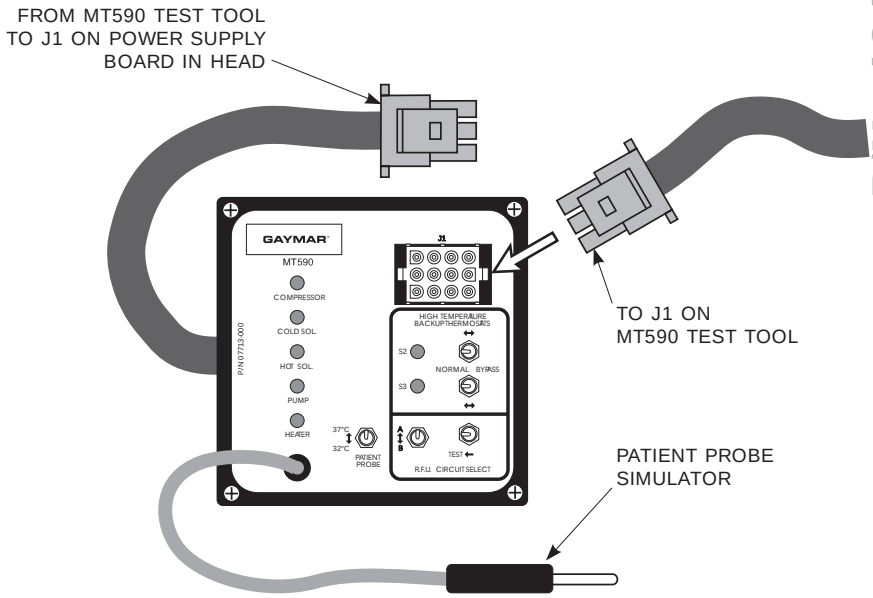


Figure 4—MT590 Test Tool

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

k) High Temperature Backup Thermostat Trip Temperatures [MT590 Test Tool Procedure]

⚠ WARNING

- Changes to the wiring of the high temperature backup thermostats can defeat their operation. To verify thermostat operation, perform the *Thermostat Verification Test* described in section 7.3, item *l,* p. 29 after performing the following test procedure.
- After performing the following test procedure, verify that the MT590 Test Tool or any installed shorting jumpers have been removed before returning the machine to patient use.

Failure to do the above may result in death or serious injury.

To measure trip points of the high temperature backup thermostats with an MT590 Test Tool, perform the following steps 1-15:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. **Unplug the power cord.**
3. Connect the test setup as shown in figure 13, p. 72.
4. Connect MT590 Test Tool as shown in figure 4. Connect P7 (base) to J1 (MT590). Connect 12 pin cable (MT590) to J1 (head, power supply board). Plug machine in. Insure the S2 and S3 toggle switches are in the *NORMAL* position.
5. Place the machine in service mode 3. Refer to section 8.1, *SERVICE MODES (*pp. 34-35) for instructions on how to access service modes.
6. To insure the correct measurement of thermostat trip points, run machine for 5 minutes in service mode 3 (see Table 3, service mode 3, p. 37) after the blanket water temperature has reached 105.8°F (41°C) for models MTA5900 or MTA5901, and 107.6°F (42°C) for model MTA5942. This allows the inside of the machine to achieve normal operating temperature. (Bottom wraparound cover must be on machine during this test.)
7. Enter service mode 4 (see section 8.1, p. 34) from service mode 3. Mode 4 will cause the machine to heat up until one of the safety thermostats trip.
8. Monitor the blanket water temperature. When the *ALERT* and *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED's light and the audible alarm sounds, the temperature on the mercury thermometer should be within the high temperature limits range. (See Table 1 below for high temperature limits with corresponding model number of your machine.) When the thermostat trips, record the thermometer temperature on the *INSPECTION FORM* (p. 33).

   (If this is the second thermostat tested, proceed to step 12. Otherwise, proceed with step 9.)

	MTA5942	MTA5900	MTA5901
High Temperature Limits Fixed (S2) & (S3)	111.2°F (44°C) to 120.2°F (49°C)	109.4°F (43°C) to 120.2°F (49°C)	109.4°F (43°C) to 120.2°F (49°C)

Table 1—High Temperature Limits

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

k) High Temperature Backup Thermostat Trip Temperatures [MT590 Test Tool Procedure, cont'd.]

9. An LED should be lit on the face of the MT590 Test Tool to indicate an open S2 or S3 thermostat. If both LED's are lit, proceed to step 12. (Both thermostats have tripped at the same temperature. This is allowable so long as the water at the TPT9 was within the high temperature limits range. (See Table 1, p. 25, for high temperature limits with corresponding model number of your machine.) Otherwise, toggle the corresponding switch S2 or S3 to the bypass position for whichever LED was lit.
10. Turn machine off.
11. Place machine in service mode 3. If machine still indicates *REMOVE FROM USE NOW / MACHINE SHUTDOWN,* then the other thermostat has tripped at the same temperature. This is allowable so long as the water temperature at the TPT9 was within the high temperature limits range. (See Table 1, p. 25 for high temperature limits with corresponding model number of your machine.) Verify the non-bypassed LED is lit. Record the temperature. Proceed to step 12.

    If the unit enters service mode 3 with no *REMOVE FROM USE NOW / MACHINE SHUTDOWN* alarm, then repeat steps 6 through 8 to check the other thermostat
12. Place both switches S2 and S3 in the bypass position. Turn the machine off, then turn the machine on and select *MANUAL* mode. Allow machine to run for approximately 1 minute. This will circulate cold water from the reservoir past the thermostats, causing them to reset.
13. Return switches S2 and S3 to the normal position. If unit continues to be in alarm condition, repeat step 12.
14. While the machine is running in *MANUAL* mode, place the RFU CIRCUIT SELECT A-B switch in the "A" position and toggle the *TEST* switch. The machine should shut down, blank the displays, light the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED, flash the *ALERT* LED and toggle the audible alarm. Turn the machine off, then restart the machine in the *MANUAL* mode.

    Repeat the above procedure with the RFU CIRCUIT SELECT switch in the "B" position.

    This step will verify that both (redundant) RFU circuits are functioning.
15. **Turn machine off and unplug the power cord.** Disconnect MT590 Test Tool from wire harness and reassemble machine.

⚠ WARNING

Verify that the MT590 Test Tool or any installed shorting jumpers have been removed before returning the machine to patient use.

Failure to do so may result in death or serious injury.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

k) High Temperature Backup Thermostat Trip Temperatures [Alternate Shorting Jumper Procedure]

To measure trip points of the high temperature backup thermostats if you do not have access to an MT590 Test Tool, perform the following steps 1A-20A. (If you have access to an MT590, follow steps 1-15 on the preceding pages.)

⚠ WARNING

- Changes to the wiring of the high temperature backup thermostats can defeat their operation. To verify thermostat operation, perform the *Thermostat Verification Test* described in section 7.3, item *l,* p. 29 after performing the following test procedure.
- After performing the following test procedure, verify that the MT590 Test Tool or any installed shorting jumpers have been removed before returning the machine to patient use.

Failure to do the above may result in death or serious injury.

1A. Fill machine with distilled water until green band on float stem is fully visible.

2A. **Unplug the power cord.**

3A. Remove wraparound (see figure 14, p. 73). Flex side panels of wraparound out slightly to clear foam.

4A. Remove plastic cover from wiring terminal block TB1. (See figure 14 for TB1 location.)

5A. Replace wraparound cover. Do not reinstall screws at this time.

6A. Connect test setup as shown in figure 13, p. 72.

7A. Plug the machine in.

8A. Place the machine in service mode 3. Refer to section 8.1, *SERVICE MODES* (pp. 34-35) for instructions on how to access service modes.

9A. To insure the correct measurement of thermostat trip point (because the wraparound was removed), run machine for 15 minutes after the blanket water temperature has reached 105.8°F (41°C) for models MTA5900 or MTA5901, and 107.6°F (42°C) for model MTA5942. This allows the inside of the machine to achieve normal operating temperature.

10A. Enter service mode 4 (see section 8.1, p. 34) from service mode 3. Mode 4 will cause the machine to heat up until one of the safety thermostats trip.

11A. Monitor the blanket water temperature. When the *ALERT* and *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED's light and the audible alarm sounds, the temperature on the mercury thermometer should be within the high temperature limits range. (See Table 1, p. 25, for high temperature limits with corresponding model number of your machine.) This indicates that one of the safety thermostats has tripped. Record the thermometer temperature at which the thermostat tripped on the *INSPECTION FORM*.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

k) High Temperature Backup Thermostat Trip Temperatures [Alternate Shorting Jumper Procedure, cont'd.]

NOTE: If this is the second time the thermostat has tripped (i.e., if you have previously completed steps 12A to 18A), proceed to step 19A. Otherwise, proceed to step 12A.

12A. **Turn the machine off and unplug the power cord.** Disconnect hoses.

13A. Remove wraparound cover from machine.

14A. Place a shorting jumper across terminals 7 and 9 of TB1. Reconnect the machine to the wall outlet, turn it on, and press the *MANUAL* mode button. If the unit indicates *REMOVE FROM USE NOW / MACHINE SHUTDOWN* proceed to step 15A. If the unit enters *MANUAL* mode with no *REMOVE FROM USE NOW / MACHINE SHUTDOWN* alarm, then proceed to step 17A.

15A. **Turn the machine off and unplug the power cord.** Remove shorting jumper from terminals 7 and 9 of TB1 and reconnect across terminals 7 and 10.

16A. Plug machine in and turn it on. Press the *MANUAL* mode button. If the machine still indicates a *REMOVE FROM USE NOW / MACHINE SHUTDOWN* alarm, then both thermostats have tripped at the same temperature. This is allowable so long as the water temperature at the TPT9 was within the high temperature limits range. (See Table 1, p. 25 for high temperature limits with corresponding model number of your machine.) If both thermostats have tripped, proceed to step 19A. If the unit enters *MANUAL* mode with no *REMOVE FROM USE NOW / MACHINE SHUTDOWN* alarm, then proceed to step 17A.

17A. **Turn the machine off and unplug the power cord.** Replace wraparound cover. Reconnect hoses from test setup to machine (see figure 13, p. 72).

18A. Repeat steps 7A through 11A.

19A. **Turn the machine off and unplug the power cord.** Disconnect supply hose from TPT9 and allow water to gravity drain into a container for approximately one minute. This will circulate cold water from the reservoir past the thermostats, causing them to reset. Do not install a second shorting jumper. Reconnect supply hose to TPT9 and return drained water to machine reservoir.

20A. Remove wraparound cover from machine. Remove shorting jumper. Replace plastic terminal block cover. Replace wraparound cover and reinstall screws.

⚠ WARNING

Verify that the MT590 Test Tool or any installed shorting jumpers have been removed before returning the machine to patient use.

Failure to do so may result in death or serious injury.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

I) Thermostat Verification Test

⚠ WARNING

Verify that the high temperature backup thermostats independently shut down the machine.

Incorrect operation of these thermostats may result in death or serious injury.

1. Fill machine with distilled water until green band on float stem is fully visible.
2. **Unplug the power cord.**
3. Remove wraparound (see figure 14, p. 73). Flex side panels of wraparound out slightly to clear foam.
4. Remove plastic cover from thermostats (see figs. 17 & 17A, p. 77 for thermostat location). (On some models only.)
5. Carefully disconnect the yellow wire from the top thermostat (S3) by pulling the connector off the terminal along the same angle as the terminal (see figures 17 & 17A, p. 77).
6. Plug in the machine and turn it on.
7. Select *MANUAL* mode.
8. Observe that the machine indicates *REMOVE FROM USE NOW / MACHINE SHUTDOWN.*
9. **Turn the machine off and unplug the power cord.**
10. Reconnect the yellow wire to S3.
11. Carefully disconnect the yellow wire from the lower thermostat (S2) by pulling the connector off the terminal along the same angle as the terminal.
12. Plug the machine in and turn it on.
13. Select *MANUAL* mode.
14. Observe that the machine indicates *REMOVE FROM USE NOW / MACHINE SHUTDOWN.*
15. **Turn the machine off and unplug the power cord.**
16. Reconnect the yellow wire to S2.
17. Replace the plastic cover over the thermostats.
18. Replace wraparound and reinstall screws.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

m) Patient Temperature Display Test

To check the patient temperature display, perform the following:

1. Fill machine with distilled water until green band on float stem is fully visible.
2. Connect a resistance of 1355 ohms to the patient probe jack, to simulate a 98.6°F (37°C) patient temperature.
3. Turn machine on and set it in the *MANUAL* mode.
4. *PATIENT* Temperature Display should indicate 98.6°F (37°C) ± 0.5°F (0.3°C). Record appropriate value on *INSPECTION FORM*.
5. Connect a resistance of 1667 ohms to the patient probe jack to simulate an 89.6°F (32°C) patient temperature.
6. *PATIENT* temperature display should indicate 89.6°F (32°C) ± 0.5°F (0.3°C). Record appropriate value on *INSPECTION FORM*.

   NOTE: The *CHECK PATIENT PROBE* alarm may flash on during step 6 if the display indicates less than 89.6°F (32.0°C). This condition is considered normal and allowable.

n) Low Temperature Backup Thermostat (S1) (Optional)

The low temperature backup thermostat is a fixed trip point thermostat to limit low temperatures between 26.6°F (-3.0°C) and 36.5°F (+2.5°C).
It is not necessary to test the trip point as part of this functional test. The function of the thermostat is to protect the machinery from freezing. It is not a patient safety-related device.

If there is reason to test this thermostat, perform the following:

1. Drain machine of water as follows:
   a. Connect a DBK9 connector hose to the *SUPPLY* fitting on machine.
   b. Turn machine on and select *MANUAL* mode. Allow machine to pump water out until *ADD WATER* light comes on. Turn machine off and allow unit to gravity drain until empty.
   c. Disconnect DBK9.
2. **Unplug the power cord.**
3. Add eight (8) quarts (7.6 liters) of water and two (2) quarts (1.9 liters) of alcohol to reservoir.
4. Connect the test setup shown in figure 13, p. 72.
5. Plug machine in and place it in service mode 2. Refer to section 8.1, *SERVICE MODES* (pp. 34-35) for instructions on how to access service modes.

   NOTE: In service mode 2, the compressor, pump, and cold solenoid are activated. No temperature measurement or other control is performed by the machine in this mode.

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

n) Low Temperature Backup Thermostat (S1) (cont'd.)

6. When the contacts of S1 open up, the audible alarm, the *REMOVE FROM USE NOW / MACHINE SHUTDOWN* LED, and the *ALERT* LED will come on. The mercury thermometer should read between 26.6°F (-3.0°C) and 36.5°F (+2.5°C) at this point.
7. Turn machine off. Allow it to warm up to reset thermostat.
8. Drain machine of water and alcohol mixture as in step 1 above.
9. Refill with distilled water until the green band on the float stem is fully visible.

o) Grounding Resistance

Use an ohmmeter to measure the resistance between the grounding pin on the line cord attachment plug and an exposed metal point on the chassis. The value should be less than 0.5 ohms.

p) Current Leakage, CHASSIS

Measure the maximum current leakage between the chassis and the ground in all operating configurations (heating, cooling, compressor *ON,* compressor *OFF,* normal and reverse polarity with the machine grounded and ungrounded). The current leakage should not exceed the following:

Condition	Current Leakage
Machine grounded	10 microamps
Machine ungrounded	100 microamps

Current Leakage, PATIENT PROBE

It is first necessary to prepare a patient probe by wrapping it tightly along its entire length with metal foil. Then measure current leakage at the foil for all combinations: grounded, ungrounded, normal polarity, and reversed polarity. The current leakage should not exceed 50 microamps.

NOTE: If additional information is required, refer to *AAMI American National Standard, Safe Current Limits for Electromedical Apparatus* or contact Gaymar's Technical Service Department.

q) Reset the RFU Code (not applicable to machines containing Version 1.0 software)

The Medi-Therm II machine will retain the previously stored code. Before returning a machine to service, reset the RFU code to zero so that a previous code is not held in memory.

To reset the RFU code to zero:

1. Place the machine in service mode 1 (see section 8.1, p. 34).
2. Press the *TEST LIGHTS* button on the control panel.

The RFU code is reset when the number on the blanket display shows "0".

7.3 FUNCTIONAL CHECK & SAFETY INSPECTION (continued)

This completes the recommended functional test and preventive maintenance procedures for the Gaymar Medi-Therm II.

If a machine passes all the requirements of paragraphs "a" through "q", the machine should be considered operational and suitable for return to service.

⚠ WARNING

Verify that the MT590 Test Tool or any installed shorting jumpers have been removed before returning the Medi-Therm II to service.

Failure to do so may result in death or serious injury.

7.4 INSPECTION FORM

Medi-Therm II Hyper/Hypothermia
Functional Check / Inspection Form *

Location _____ ***Serial number*** _____

Item	*OK? (Y/N)*	*Action needed*	*Action Taken (Date / Initials)*
a. Condition of chassis			
b. Condition of attachment plug			
c. Line cord and strain reliefs			
d. Circuit breaker			
e. Condition of lights and alarm			
f. Flow: MTA5942/MTA5900: 16 gph (60.6 l/hr); MTA5901: 12 gph (45.4 l/hr)			
1. Greater than . . . [HEATING]			
2. Greater than . . . [COOLING]			
3. Flow switch activation			
g. Level switch activation			
h. Cold water reservoir controller: 37.4°F (3°C) to 42.8°F (6°C)			
i. Blanket water temperature controller and display test:			
Temperature Control Setpoint / Display Reading / Mercury Thermometer Reading			
50°F (10°C)			
77°F (25°C)			
105.8°F (41°C)			
Display readings within 1.8°F (1°C) of temperature setpoint Mercury thermometer reading within 1.8°F (1°C) of temperature setpoint			
j. Automatic mode, Blanket water limit			
k1. MTA5900/MTA5901 S2: High temperature backup thermostat: 109.4°F (43°C) to 120.2°F (49°C) S3: High temperature backup thermostat: 109.4°F (43°C) to 120.2°F (49°C)			
k2. MTA5942 ONLY S2: High temperature backup thermostat: 111.2°F (44°C) to 120.2°F (49°C) S3: High temperature backup thermostat: 111.2°F (44°C) to 120.2°F (49°C)			
l. Thermostat verification test: S2/S3			
m. Patient temperature display test:			
Probe Resistance (ohms) / Patient Temperature Display			
1355 / 98.6°F ± 0.5°F (37°C ± 0.3°C)			
1667 / 89.6°F ± 0.5°F (32°C ± 0.3°C)			
n. Low temperature backup thermostat (S1): 26.6°F (-3.0°C) to 36.5°F (+2.5°C)			
o. Ground resistance less than 0.5 ohms			
p. Current leakage:			
Chassis (grounded) . . . . . 10 microamps max.			
Chassis (ungrounded) . . . . . 100 microamps max.			
Patient Probe . . . . . 50 microamps max.			
q. Reset of RFU code **			

* Complete entire Functional Check / Inspection Form prior to troubleshooting unit.

** Not applicable to machines containing Version 1.0 software (see section 4.1).

8.0 TROUBLESHOOTING & SERVICE MODES

Some troubleshooting and functional checks may be aided by using the Medi-Therm II machine's service modes of operation.

8.1 SERVICE MODES

All service modes are entered from service mode 1 by pressing the appropriate digital control panel button within 10 seconds of entry into service mode 1. If no button is pressed after service mode 1 is entered, the machine will reset itself to standby mode after 10 seconds. See table 3 for a description of each mode.

To initiate service mode 1:

1. Turn machine off.
2. Remove the 6 screws holding the head to the base.

⚠ CAUTION

Wear a static control device connected to the chassis ground to prevent electrostatic discharge. (See figure 5, p. 35.)

Electrostatic discharge can damage the control/display board.

3. Lift the head, press and hold service button S3 on the low voltage control/display board (figure 5), then turn the machine on.

   In service mode 1, the machine will display the last RFU* code (on the *BLANKET* display) and the software version (on the *PATIENT* display). An RFU code may help to debug a machine which has shut down due to a *REMOVE FROM USE* condition (table 2).

   Pressing the *TEST LIGHTS* button while in service mode 1 will reset the RFU code to zero. Whenever returning a machine to service, reset the RFU code to zero to avoid basing future troubleshooting decisions on an old code.

   NOTE: Early model machines containing version 1.0 software do not have the RFU reset feature. If this feature is desired, contact Gaymar's Technical Service Department. An updated EPROM with this feature can be purchased and installed in older model machines.

   * RFU = *REMOVE FROM USE NOW / MACHINE SHUTDOWN*

8.1 SERVICE MODES (continued)

Table 2 - RFU† Codes

RFU Code	Description	Troubleshooting Chart
*0	Reset code -- indicates no RFU condition recorded.	None
1	Measured blanket or reservoir probe value is out of the range 32°F to 122°F (0°C to 50°C).	Figure 6B
2, 3	Microprocessor system failure	Figure 6C
4	Compensation resistor 1 (R12) is out of spec -- too high or open-circuited.	Figure 6D
5	Compensation resistor 1 (R12) is out of spec -- too low or short-circuited.	Figure 6D
6	Compensation resistor 2 (R13) is out of spec -- too high or open-circuited.	Figure 6E
7	Compensation resistor 2 (R13) is out of spec -- too low or short-circuited.	Figure 6E
8	Blanket probe measurement is out of spec -- possibly open or short-circuited.	Figure 6F
9	Reservoir probe measurement is out of spec -- possibly open or short-circuited.	Figure 6G
--	Microprocessor system failure -- CHECKSUM.	Figure 6C
E	Microprocessor system failure -- RAMTEST.	Figure 6C
H	Microprocessor received REMOVE FROM USE NOW / MACHINE SHUTDOWN signal from the power supply board.	Figure 6H
*L	Microprocessor system failure	Figure 6C

† RFU = *REMOVE FROM USE NOW / MACHINE SHUTDOWN*

* Not applicable to machines containing software version 1.0.

SERVICE BUTTON S3 ON CONTROL/DISPLAY BOARD

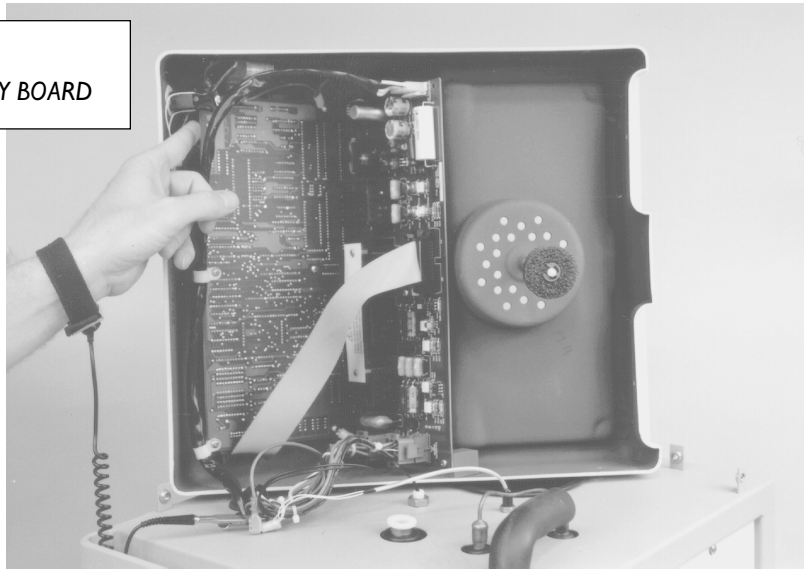


Figure 5—Initiating service mode 1

Table 3 - Service Modes

Service Mode 1:

To access	Press and hold S3 (see figure 5, p. 35) on the control/display board, then turn machine on.
Uses	• Verification of software version level. • Last RFU code indication and RFU code reset. • Verification of proper watchdog functioning (U34). • Entrance to other modes.
Description	• Required for entrance to other modes. • Patient display shows software version level. • Blanket display shows RFU code. • Pressing the *TEST LIGHTS* button will reset RFU code to zero. • *ALERT* LED flashes. • Leader lights flash. • Setpoint display flashes "1". • 10 second duration. Machine resets to standby mode after 10 seconds if no buttons are pressed.
To exit	Pressing the *MANUAL, AUTO,* or *MONITOR* buttons will cause entrance into other modes. If no further action is taken by the user, the machine will reset itself to standby mode after approximately 10 seconds.

Service Mode 2:

To access	Press *MANUAL* button while in service mode 1.
Uses	To assist in testing trip point of S1 thermostat.
Description	• Patient and blanket displays are blank. • *ALERT* LED flashes. • Leader lights flash. • Setpoint display flashes "2". • Pump and compressor are turned on, and cold solenoid valve is opened. • No temperature measurement is performed by the machine.
To exit	Pressing any button except the *MANUAL* button will reset the machine to standby mode. (Pressing the *MANUAL* button again will do nothing.)

(continued on next page)

RFU = *REMOVE FROM USE NOW / MACHINE SHUTDOWN*

Table 3 - Service Modes (continued)

Service Mode 3:

To access	Press *AUTO* button while in service mode 1.
Uses	To prewarm the machine for testing of high temperature thermostat S2 and S3 trip points.
Description	• Patient display is blank. • *ALERT* LED flashes. • Leader lights flash. • Setpoint display flashes "3". • The blanket display shows the blanket water temperature in degrees Celsius or Fahrenheit depending on choice made in last normal operating mode.* • For models MTA5900 and MTA5901, the output water temperature is controlled to 105.8°F (41°C). For model MTA5942, the output water temperature is controlled to 107.6°F (42°C).
To exit	Pressing any button except the *AUTO* button or the *°C/°F* button will reset machine to standby mode. (Pressing *AUTO* button again will do nothing.) Pressing the *°C/°F* button* will put the machine into mode 4 from mode 3.

Service Mode 4:

To access	Press *°C/°F* button* while in service mode 3.
Uses	To test the trip points of the high temperature thermostats S2 and S3.
Description	• Patient display is blank. • *ALERT* LED flashes. • Leader lights flash. • Setpoint display flashes "4". • The blanket display shows the blanket water temperature in degrees Celsius or Fahrenheit, depending on choice made in last normal operating mode.* • For models MTA5900 and MTA5901, the output water temperature is controlled to 118.4°F (48°C). For model MTA5942, the output water temperature is controlled to 120.2°F (49°C) .
To exit	Pressing any button except the *°C/°F* button will reset the machine to standby mode. (Pressing the *°C/°F* button again will do nothing.)*

Service Mode 5:

To access	Press *MONITOR* button while in service mode 1.
Uses	• To verify reservoir probe reading. • To assist troubleshooting cooling problems.
Description	• Patient display shows the cold water reservoir temperature in degrees Celsius or Fahrenheit, depending on what was selected during the last normal operating mode.* • *ALERT* LED flashes. • Leader lights flash. • Setpoint display flashes "5". • The blanket display is blank. • The pump is on and cold solenoid valve is opened. • The compressor is controlled using normal control algorithms.
To exit	Pressing any button except the *MONITOR* button will reset the machine to standby mode. (Pressing the *MONITOR* button again will do nothing.)

* Some models do not have the *°C/°F* feature. On the model MTA5901 machine, the *SILENCE ALARM* button replaces the service mode function of the *°C/°F* button. Temperatures will be displayed only in degrees Celsius.

8.2 TROUBLESHOOTING CHARTS

IMPORTANT

Whenever possible, perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (see section 7.3) prior to troubleshooting machine.

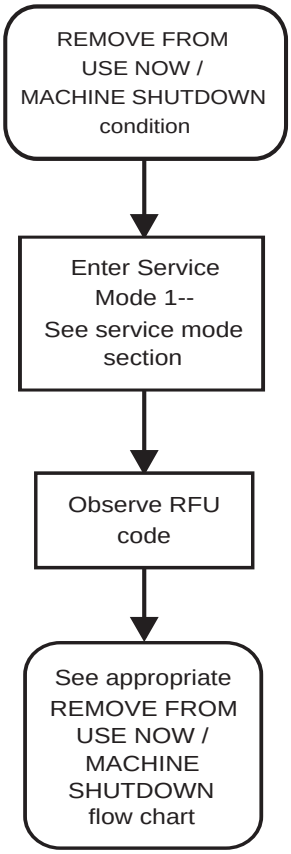


Figure 6A—Accessing RFU codes

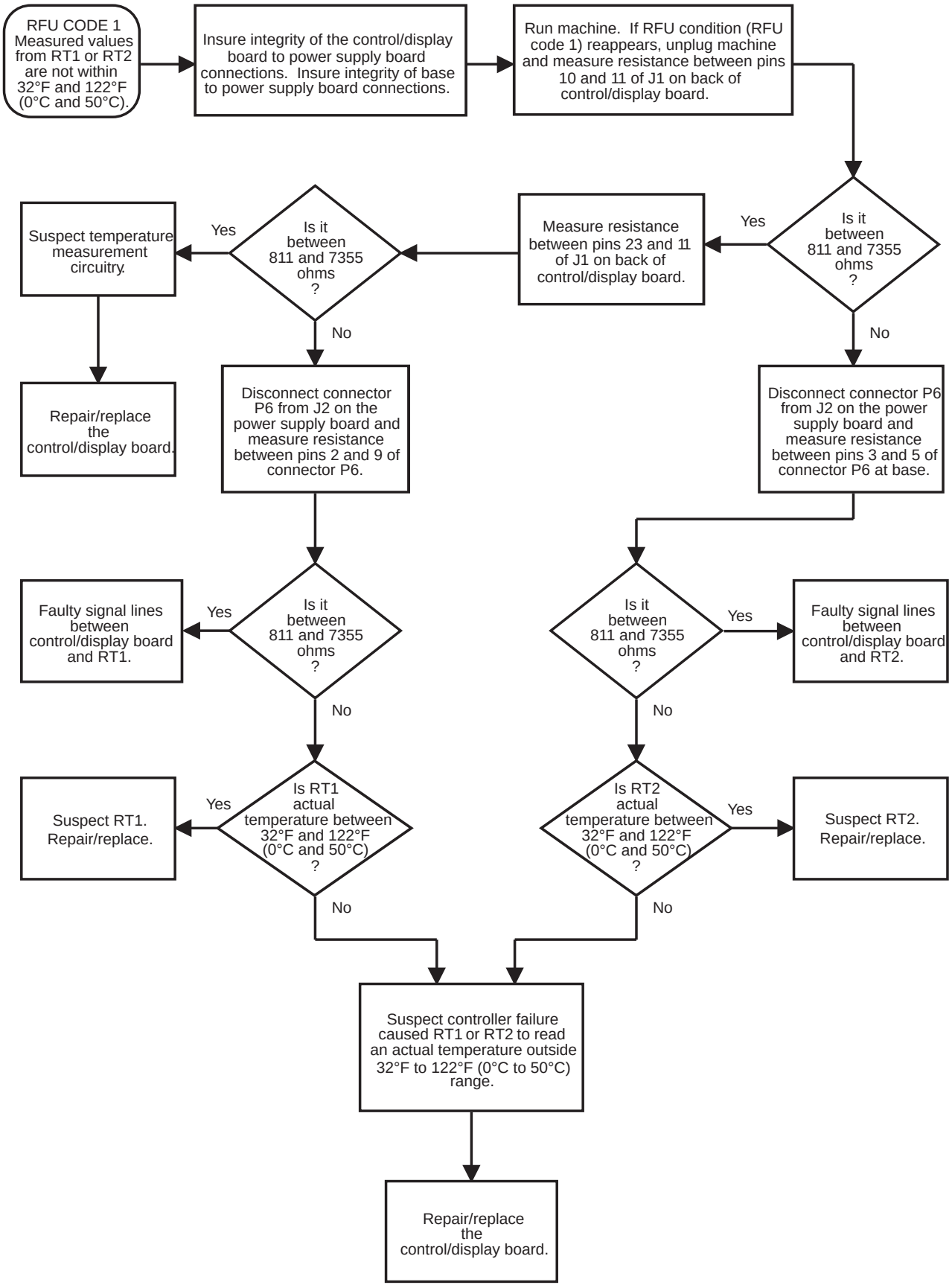


Figure 6B—RFU Code 1

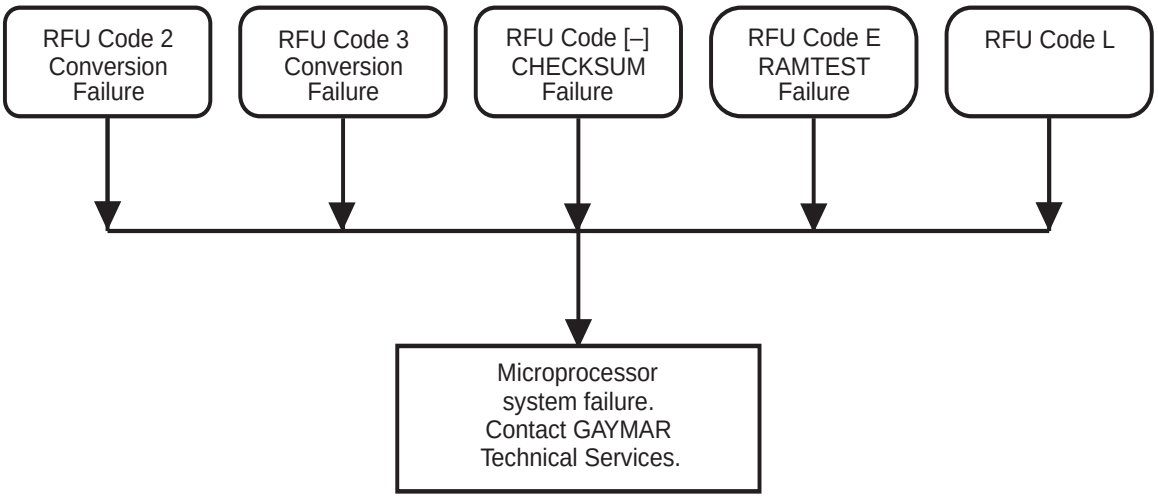


Figure 6C—RFU Codes 2, 3, – , E, and L

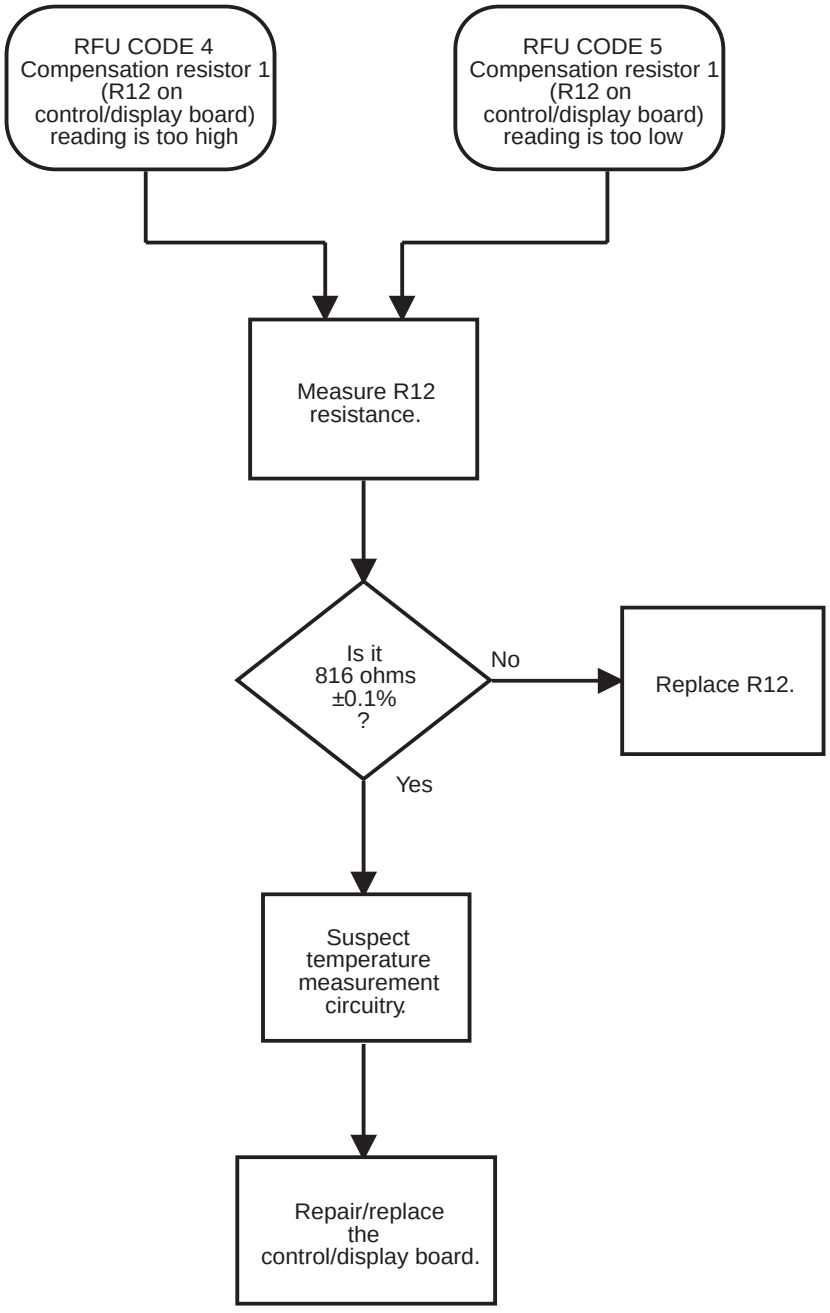


Figure 6D—RFU Codes 4, 5

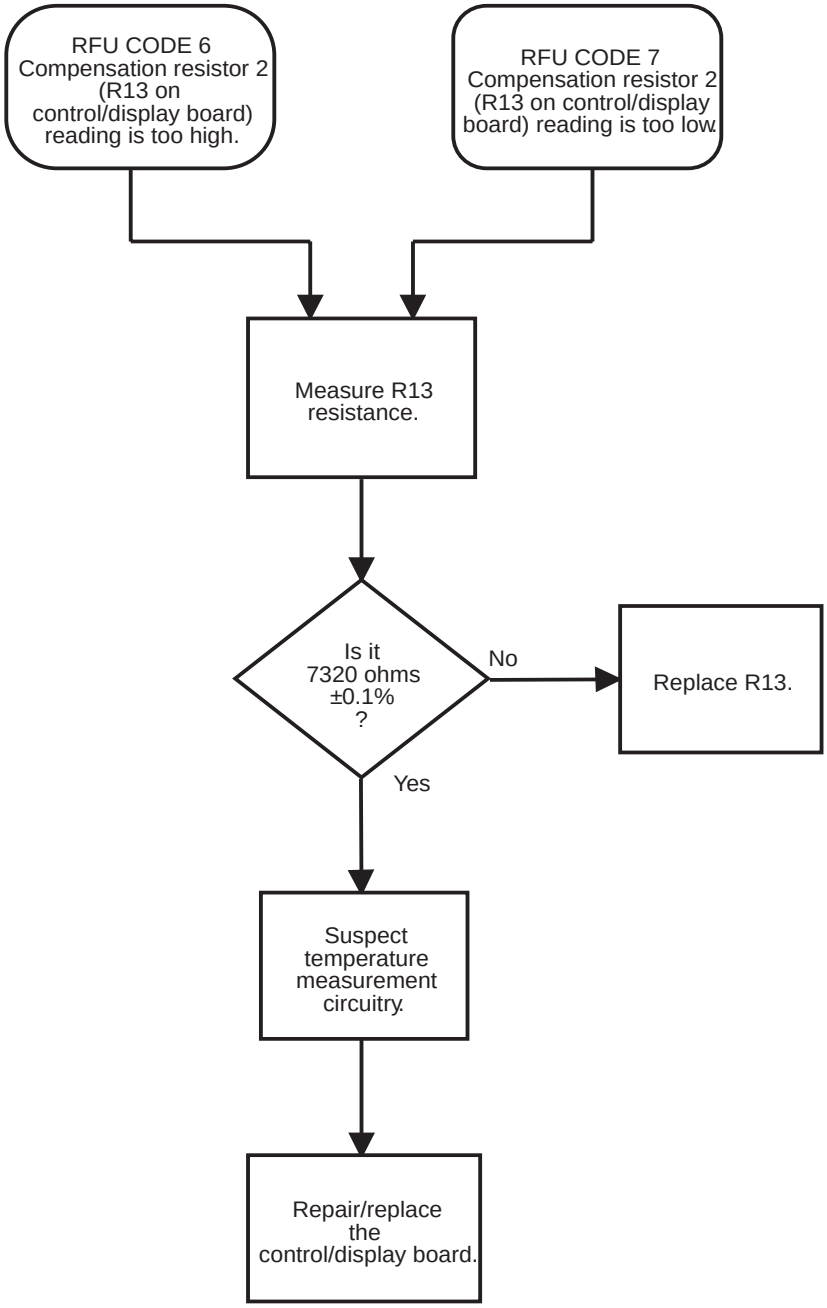


Figure 6E—RFU Codes 6, 7

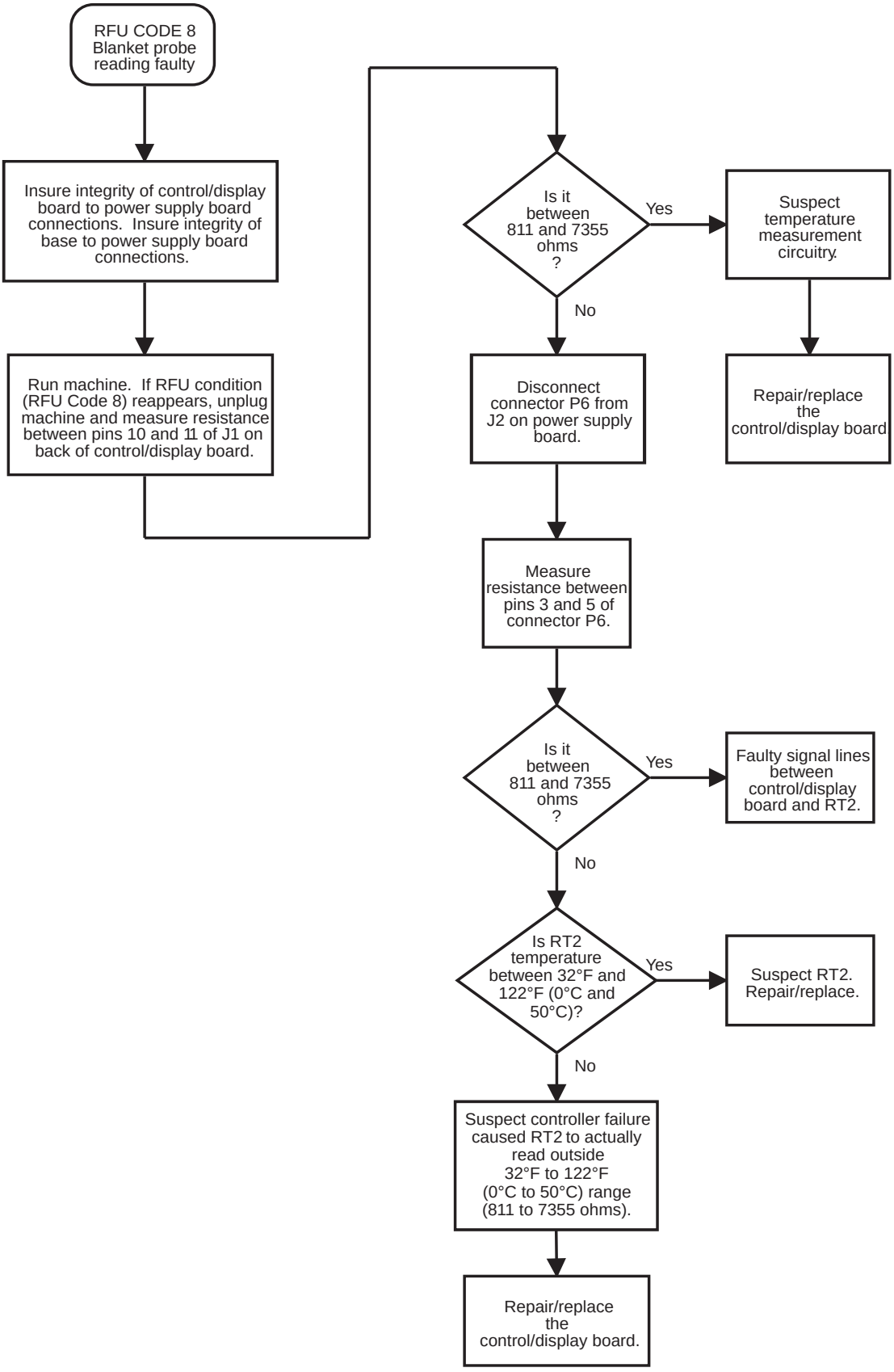


Figure 6F—RFU Code 8

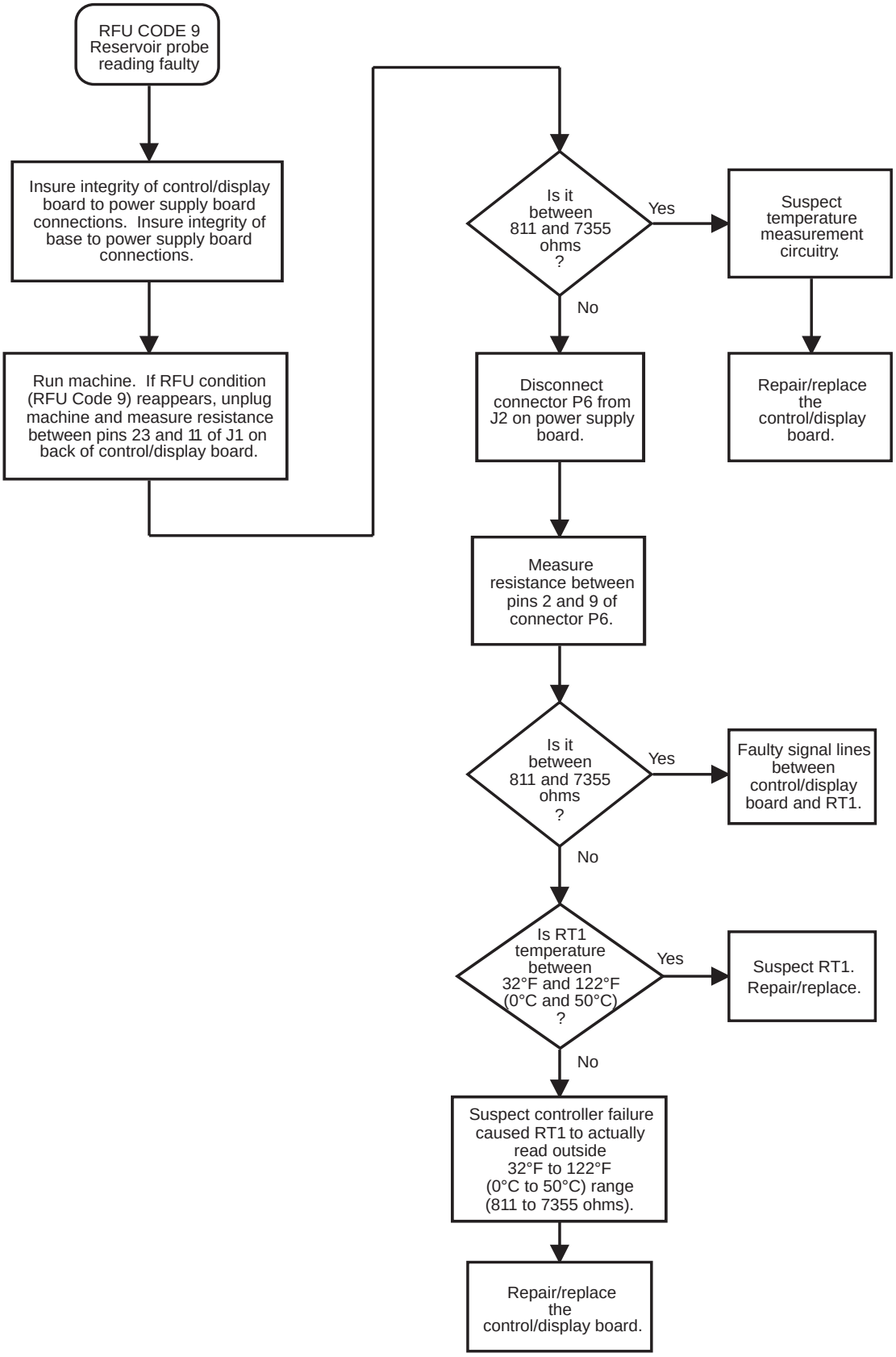


Figure 6G—RFU Code 9

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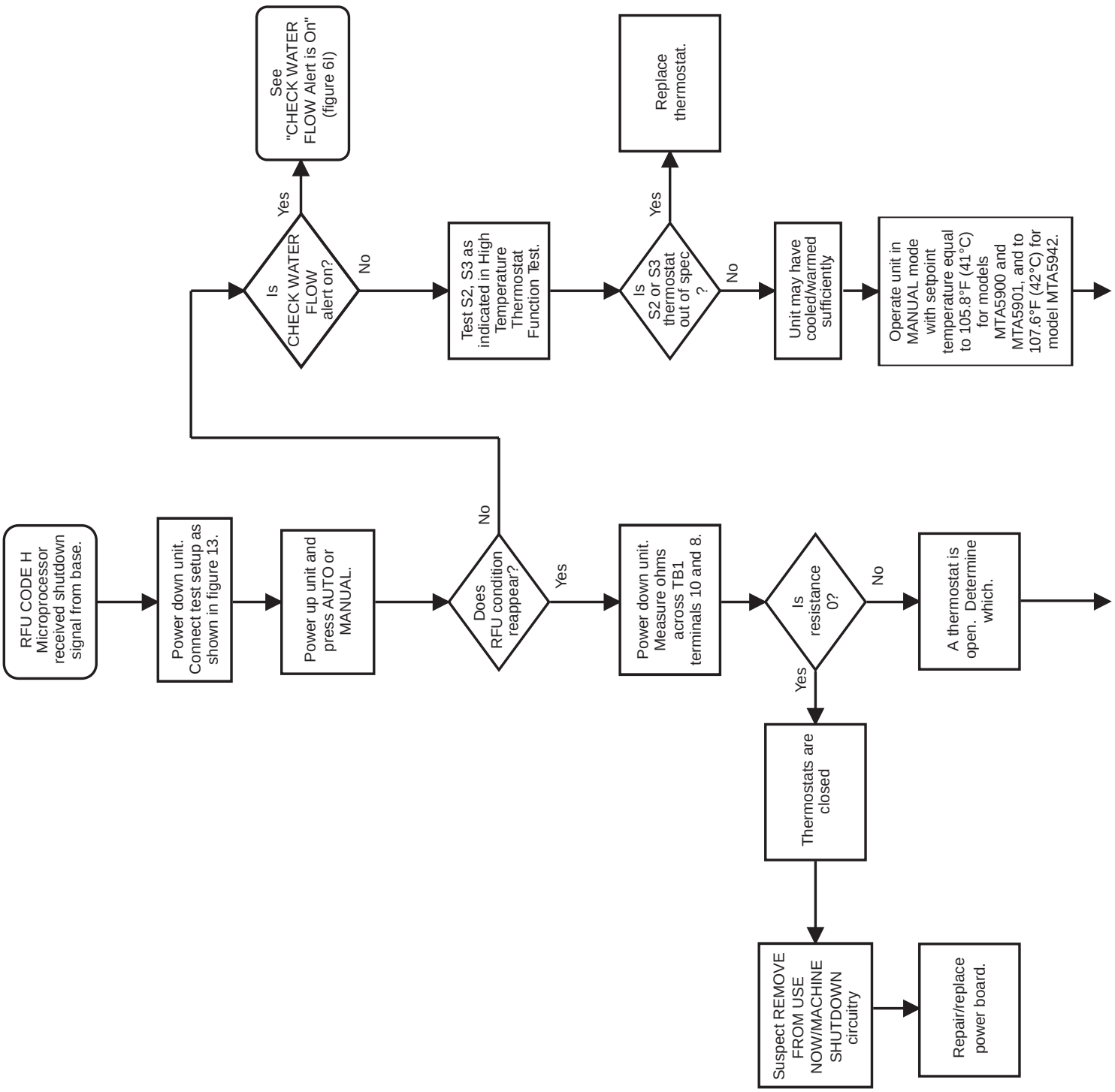


Figure 6H—RFU Code H, Page 1 of 2

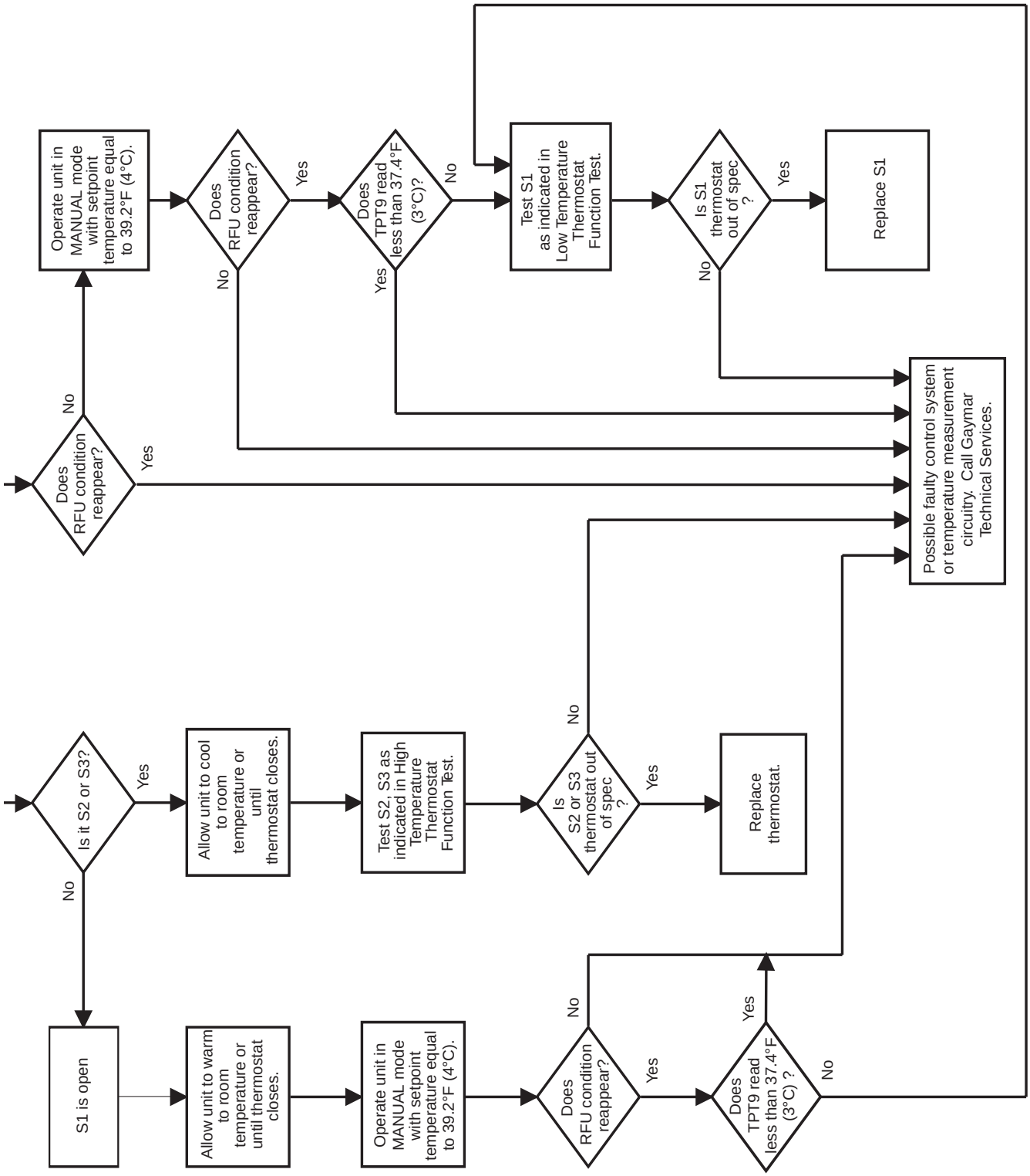


Figure 6H—RFU Code H, Page 2 of 2

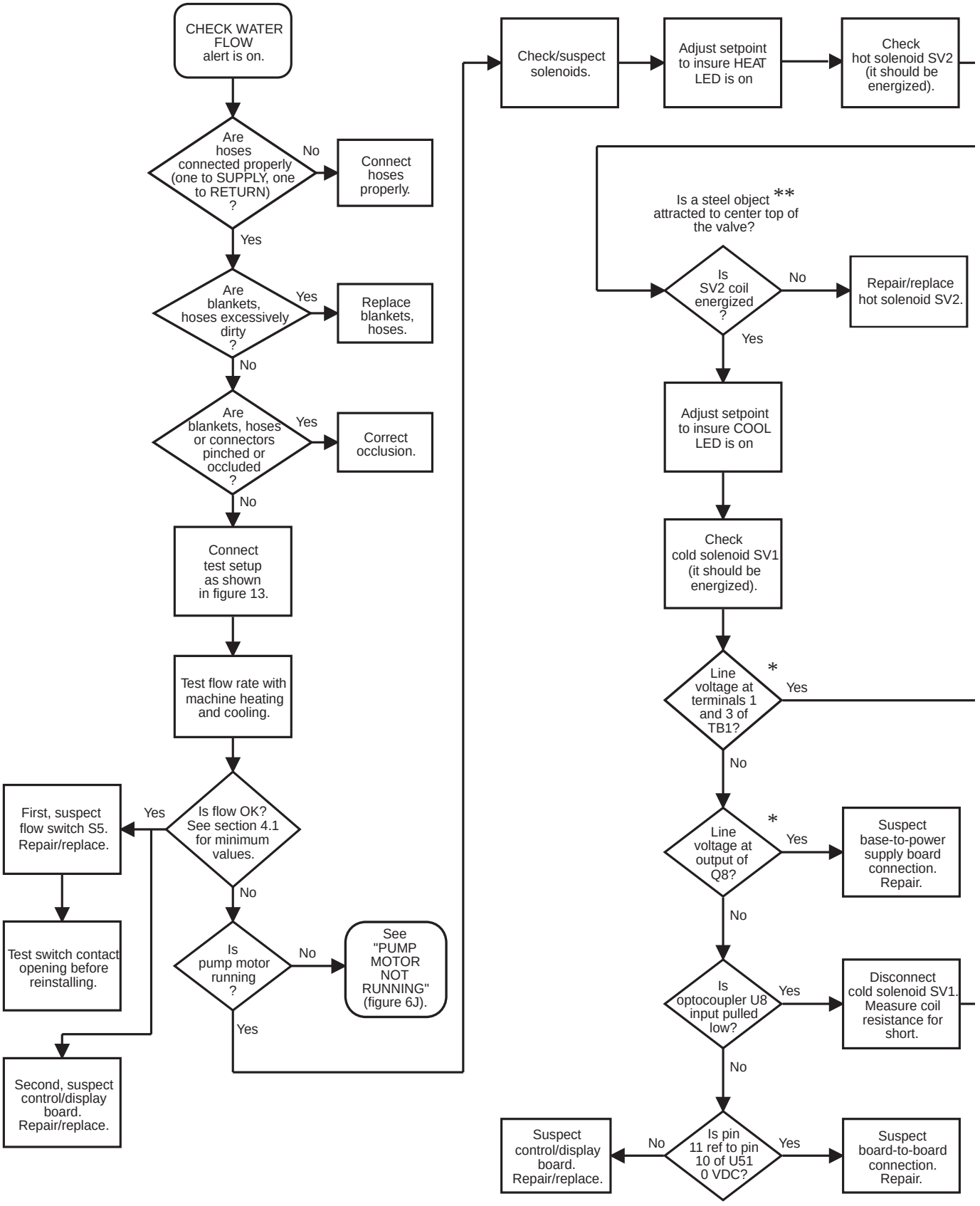
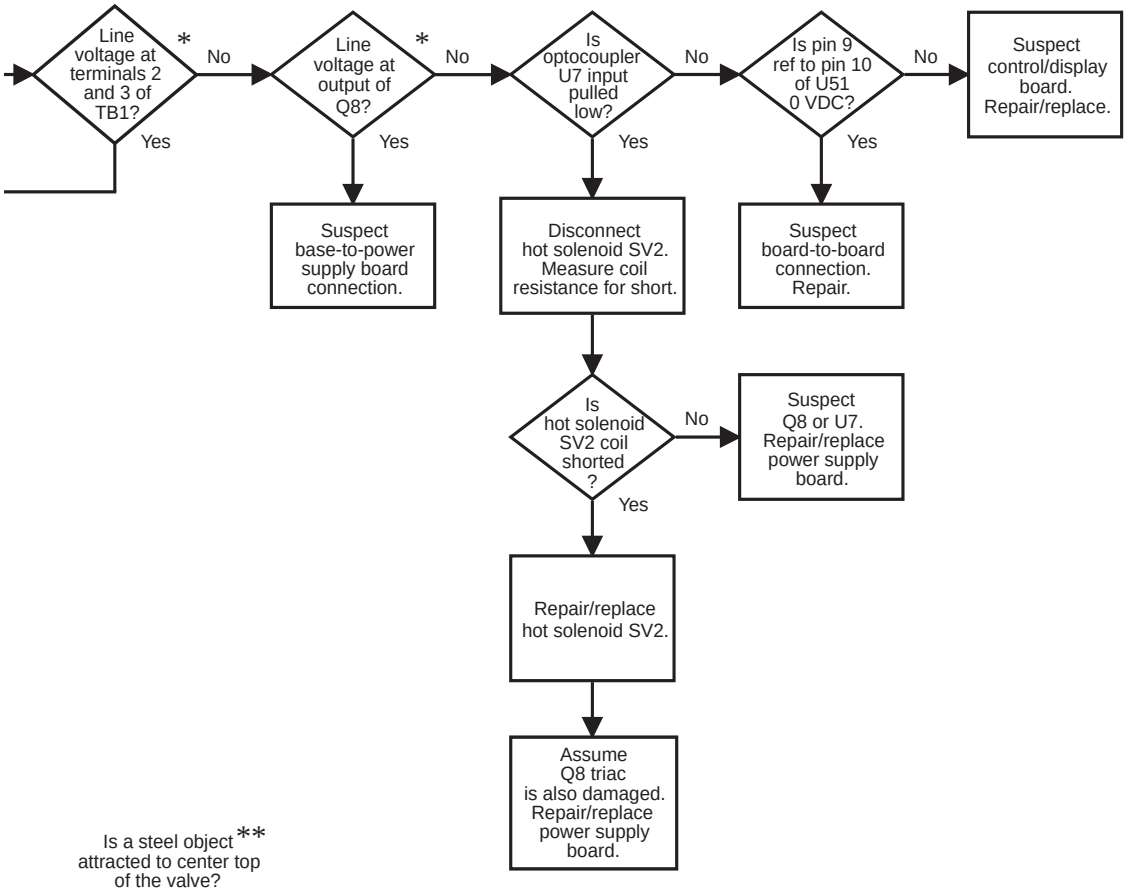
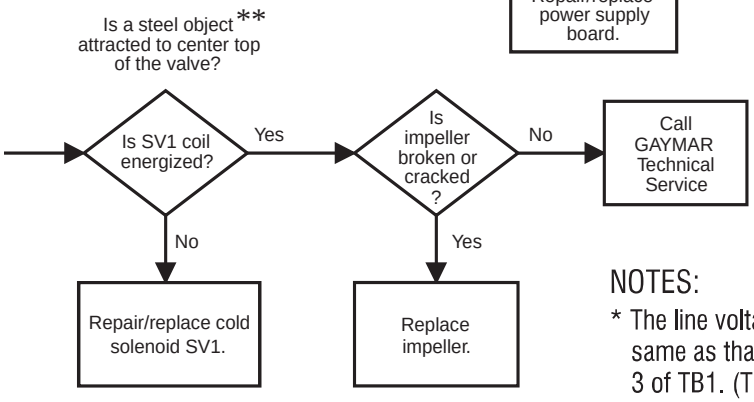
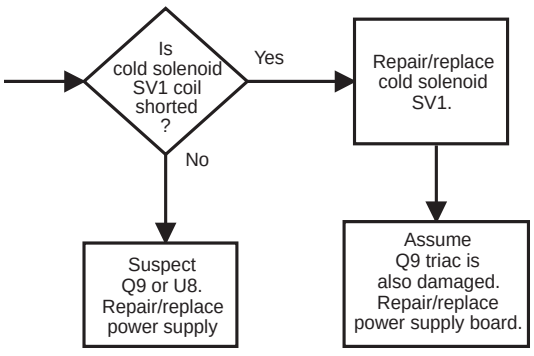


Figure 6I—Check Water Flow Alert is On, Page 1 of 2







NOTES:

* The line voltage measured should be the same as that measured across terminals 5 and 3 of TB1. (There may be residual voltage between terminals 2 & 3 or terminals 1 & 3 of TB1 when the circuitry is in the OFF state because of the solenoid valve construction and circuit configuration. These are not considered line voltage.)

** The solenoid coil can be tested with a multimeter set to the diode check function. With the power off, measure the diode drop across the terminals of the solenoid coil in both directions. There should be an open circuit in one direction and approximately 0.8V in the other. If not, the solenoid valve is bad and should be replaced.

Figure 61—Check Water Flow Alert is On, Page 2 of 2

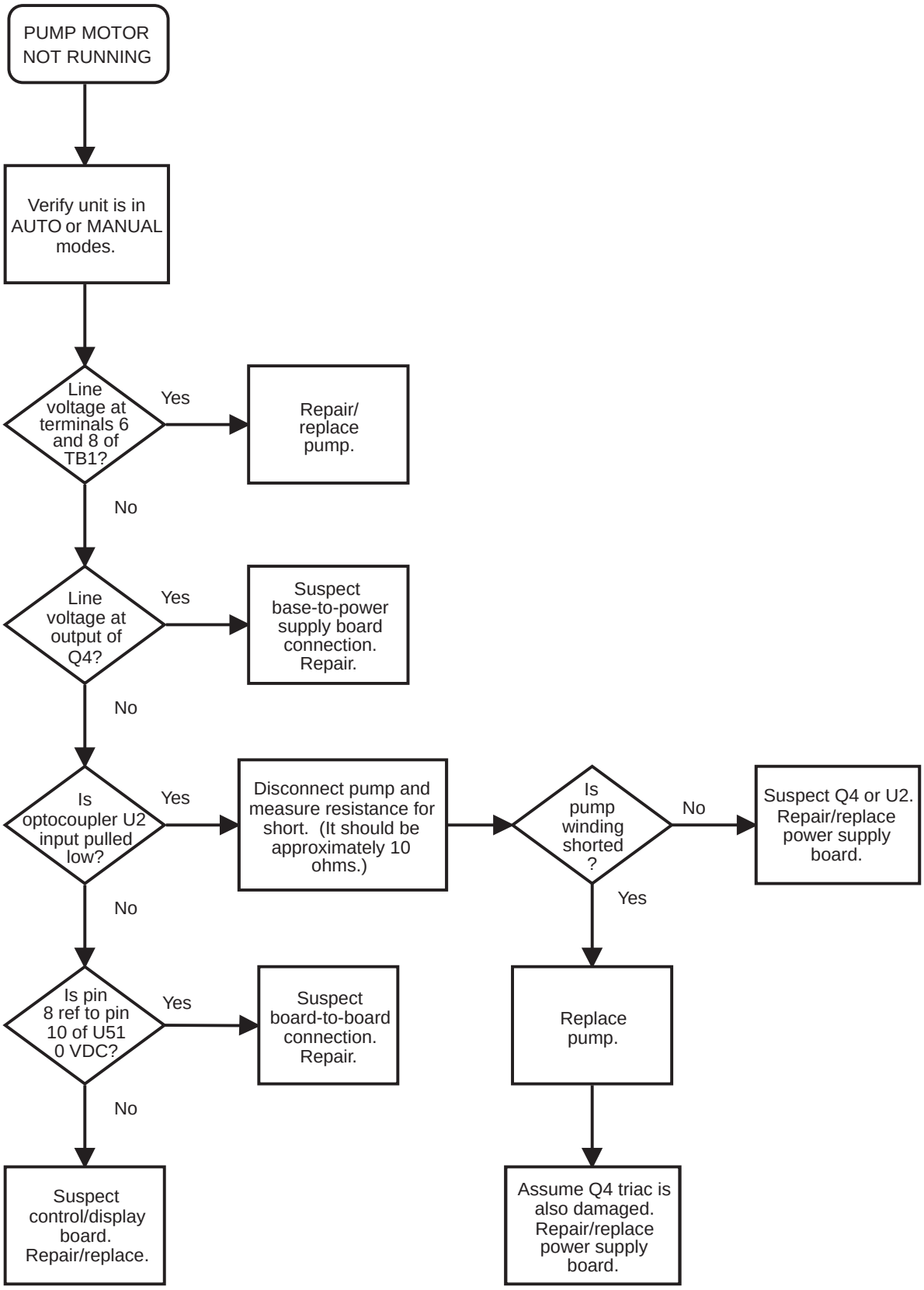


Figure 6J—Pump Motor Not Running

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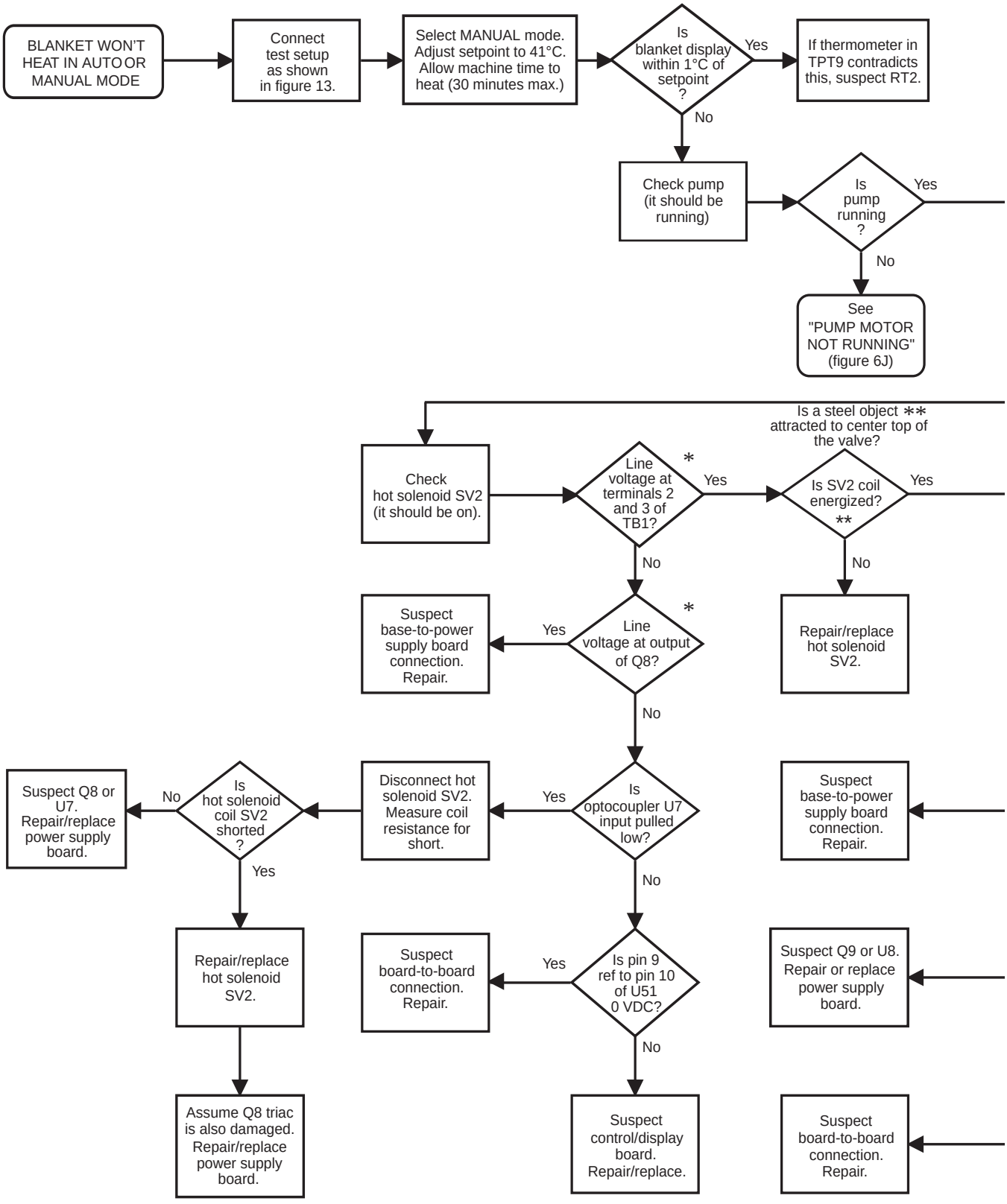


Figure 6K—Blanket Won't Heat in Auto or Manual Mode, Page 1 of 2

NOTES:

* The line voltage measured should be the same as that measured across terminals 5 and 3 of TB1. (There may be residual voltage between terminals 2 & 3 or terminals 1 & 3 of TB1 when the circuitry is in the OFF state because of the solenoid valve construction and circuit configuration. These are not considered line voltage.)

** The solenoid coil can be tested with a multimeter set to the diode check function. With the power off, measure the diode drop across the terminals of the solenoid coil in both directions. There should be an open circuit in one direction and approximately 0.8V in the other. If not, the solenoid valve is bad and should be replaced.

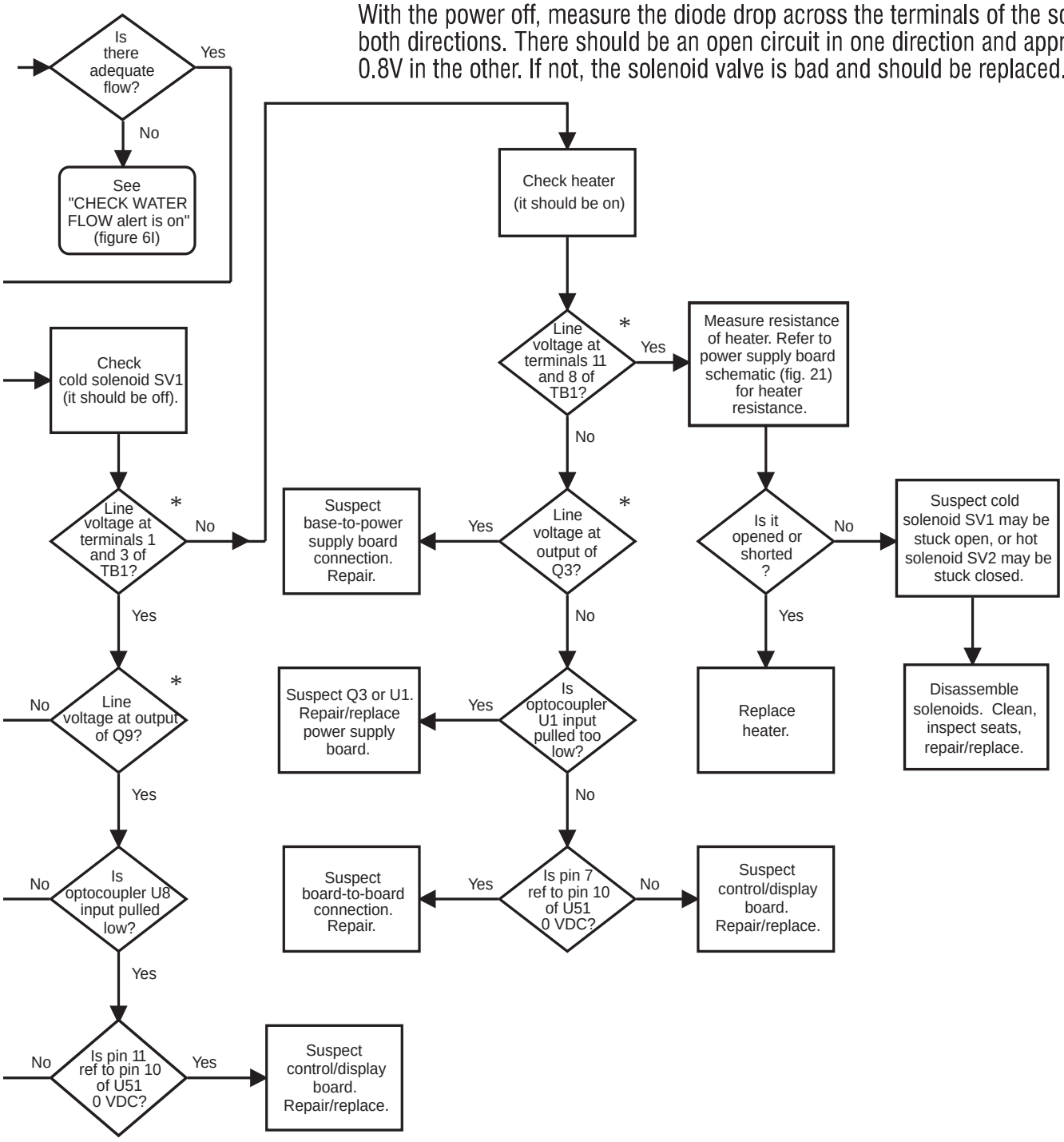


Figure 6K—Blanket Won't Heat in Auto or Manual Mode, Page 2 of 2

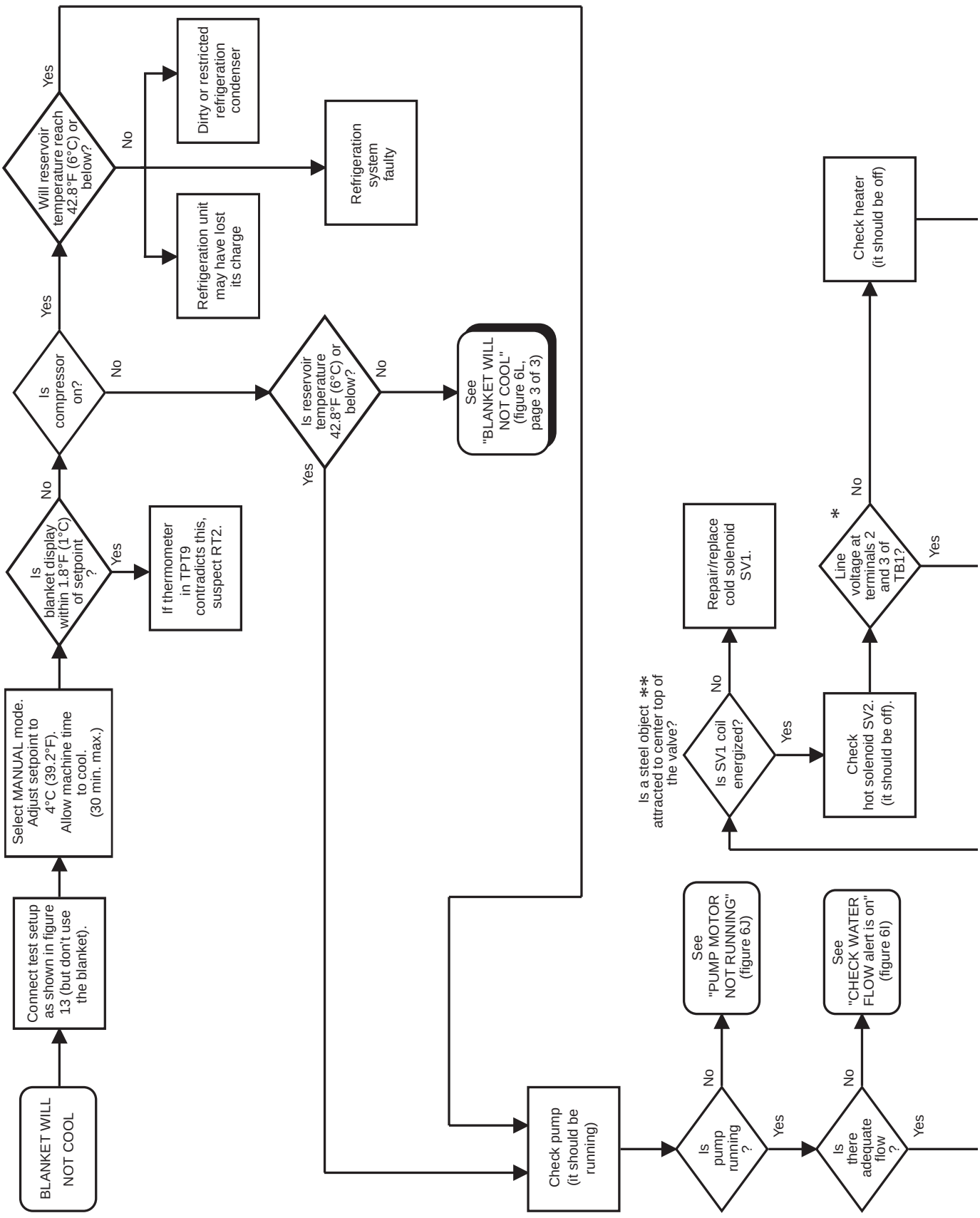
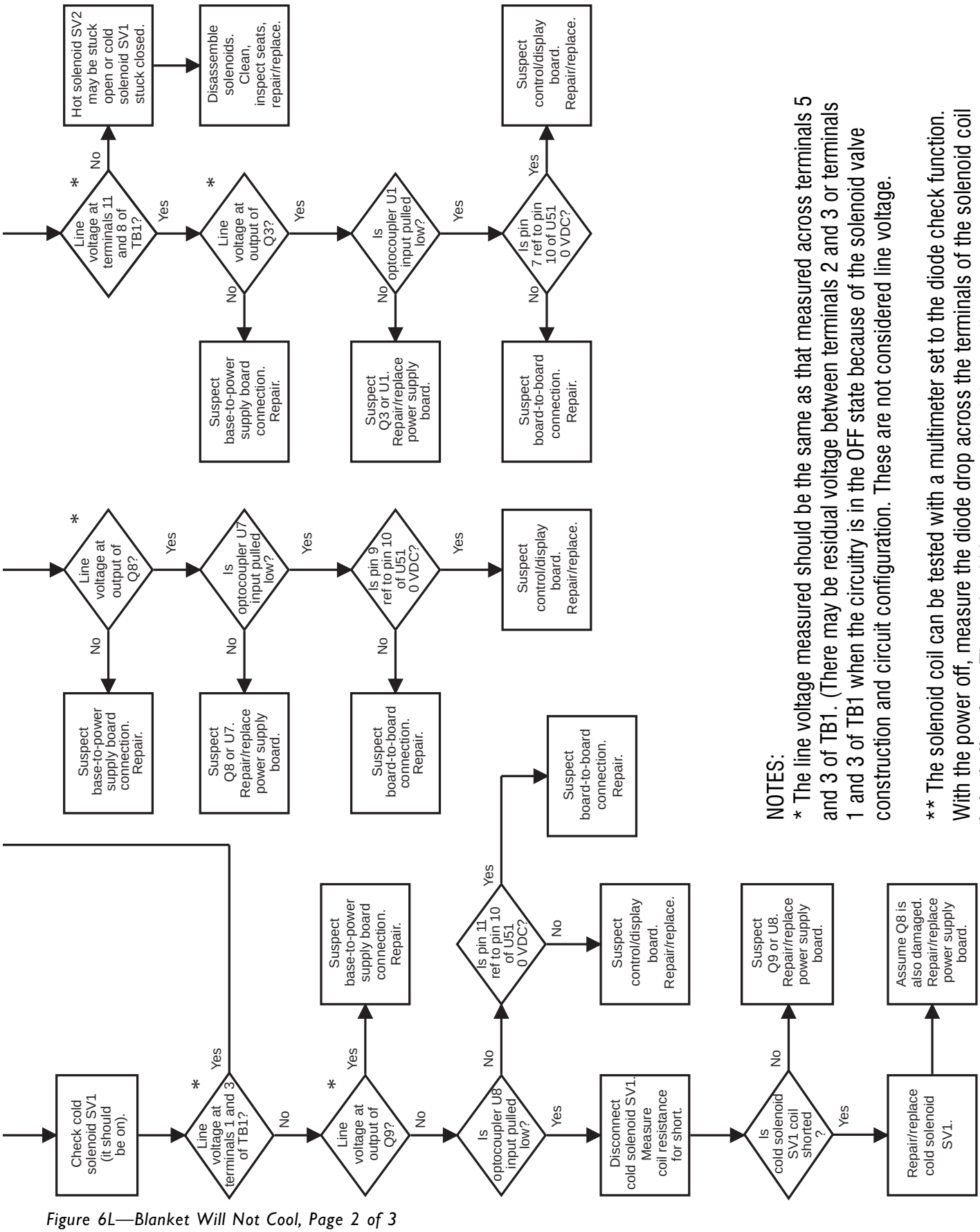


Figure 6L—Blanket Will Not Cool, Page 1 of 3



NOTES:

* The line voltage measured should be the same as that measured across terminals 5 and 3 of TB1. (There may be residual voltage between terminals 2 and 3 or terminals 1 and 3 of TB1 when the circuitry is in the OFF state because of the solenoid valve construction and circuit configuration. These are not considered line voltage.

** The solenoid coil can be tested with a multimeter set to the diode check function. With the power off, measure the diode drop across the terminals of the solenoid coil in both directions. There should be an open circuit in one direction and approximately 0.8V in the other. If not, the solenoid valve is bad and should be replaced.

Figure 6L—Blanket Will Not Cool, Page 2 of 3

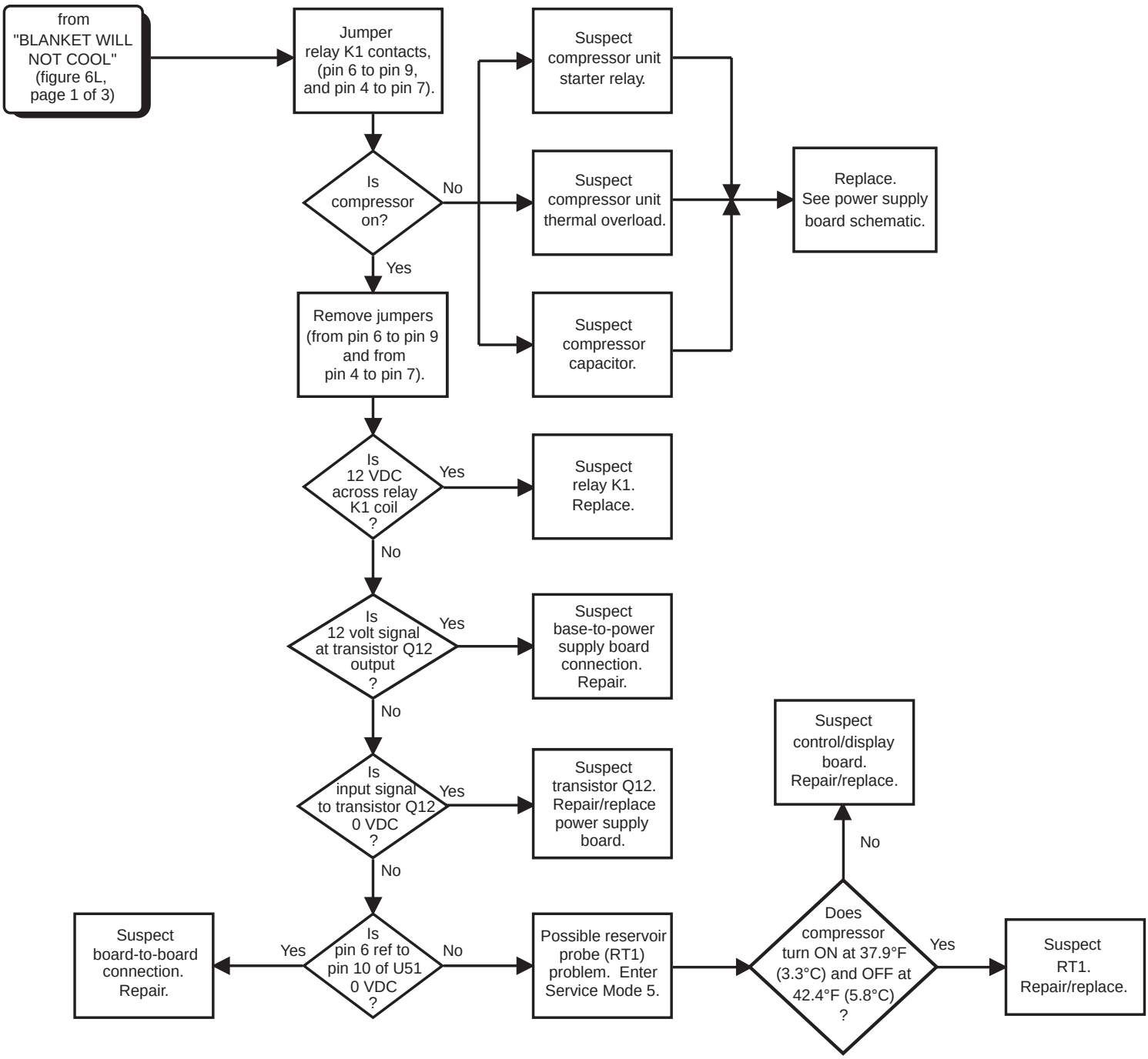


Figure 6L—Blanket Will Not Cool, Page 3 of 3

9.0 REPAIR PROCEDURES

⚠ WARNING

Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3) after making repairs and before returning the Medi-Therm II machine to patient use.

Improper repair may result in death or serious injury, equipment damage, or malfunction.

In addition to the following repair procedures, refer to the troubleshooting charts in section 8.0, page 34, *TROUBLESHOOTING AND SERVICE MODES.*

9.1 REFRIGERATION SYSTEM

⚠ WARNING

- Equipment contains refrigerant under high pressure. Refer servicing to a certified refrigeration service technician.

  Improper repair procedures can result in serious injury or damage the compressor unit.

- The refrigeration system contains rotating fan blades. Do not operate with fan shroud removed.

  Injury could result.

NOTE: Servicing and/or repair of the refrigeration system should be performed in compliance with applicable federal, state, and local regulations.

The Medi-Therm II refrigeration system uses either an R-12 (CFC-12) or an R-134a (HFC-134a) refrigerant, but not both. To determine which type of refrigerant is required by your system, refer to the nameplate located on the base of the compressor. If you are still unable to identify the refrigerant type, contact Gaymar's Technical Service Department for assistance.

Refer to the appropriate section (9.1.1 or 9.1.2, p. 58) for charging specifications.

9.1.1 R-12 SYSTEMS

Do not attempt servicing the R-12 refrigeration unit unless you are certified in R-12 refrigeration maintenance, repair, and reclaiming procedures.

Supply the following information to the refrigeration service technician:

- **⚠ CAUTION**

  Use only R-12 refrigerant and mineral oil when charging a Medi-Therm II R-12 system.

  Using other refrigerants or oils will damage the compressor.

- For refitting options approved for the Medi-Therm II, please contact Gaymar's Technical Service Department.
- The following values apply when the water temperature in the reservoir reaches 40°F (4.4°C), with the wraparound off, at a 72°F (22.2°C) ambient:

  R-12 charge ..... 1 pound (approx.)
  Low side pressure ..... 22 to 25 psi
  High side pressure ..... 125 to 150 psi

- If recharging is required, most likely there is a leak in the system. Locate and repair any leaks before recharging the unit.
- Replace the two service valve caps and two gage port caps after servicing the refrigeration system.

After servicing the refrigeration unit, be sure to perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (see section 7.3).

9.1.2 R-134a SYSTEMS

Do not attempt servicing the R-134a refrigeration system unless you are certified in R-134a refrigeration maintenance, repair, and reclaiming procedures. Supply the following information to the refrigeration service technician:

- **⚠ CAUTION**

  - Use only R-134a refrigerant and polyol ester oil when charging a Medi-Therm II R-134a system.

    Using other refrigerants or oils will damage the compressor.

  - The Medi-Therm II R-134a system uses a polyol ester oil for lubrication because conventional mineral oils do not provide sufficient lubricity and miscibility. R-134a refrigerant and polyol ester oil are highly susceptible to moisture absorption (more so than R-12 and mineral oil).

    It is important that proper system evacuation, charging, and leak detection procedures be employed. Do not leave the refrigeration system open to ambient air when servicing. Moisture absorption will result in reduced compressor life.

9.1.2 R-134a SYSTEMS (continued)

- The smaller molecular size of R-134a refrigerant allows it to leak from smaller openings than R-12.

- Prior to charging the system, Gaymar recommends evacuating the system to below 500 microns. Then, perform a vacuum decay test to assure there is not a large differential between the system and the vacuum pump. After 5 minutes, the system should still be at 500 microns or below.

- **For optimum performance, charge the R-134a system with 8.75 ounces of R-134a refrigerant.** Make sure that the entire 8.75 ounce charge is pulled from the gauge manifold and hoses into the system before disconnecting.

- If it is necessary to check a unit's charge, purge the refrigerant gauge manifold and hoses with R-134a refrigerant from an external source before opening the service valves to prevent affecting the unit's charge.

  In a properly charged unit, the low side refrigerant gauge pressure should be approximately 15 to 25 psi; the high side pressure should be approximately 115 to 135 psi, under the following conditions:

  1. the unit's wraparound is removed;
  2. the ambient temperature is 72°F (22.2°C);
  3. the unit is connected to a blanket, and the Medi-Therm II has been set to 39.2°F (4°C) in manual mode;
  4. the reservoir water temperature is 40°F (4.4°C); and,
  5. the pressure check is performed with a gauge manifold connected to the system with flexible hoses.

  Upon completion of the pressure check, turn the unit off and allow refrigerant in the manifold and hoses (especially the high side) to migrate back into the unit before closing the service valves and disconnecting the hoses. Warming the hose near the service valve with your hands for 2-3 minutes will ensure this.

- If recharging is required, most likely there is a leak in the system. Locate and repair any leaks before recharging the unit.

- Replace the two service valve caps and two gage port caps after servicing the refrigeration system.

After servicing the refrigeration unit, make sure to perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (see section 7.3).

9.2 REPLACING THE POWER SUPPLY BOARD

⚠ CAUTION

Wear a static control device connected to the chassis ground to prevent electrostatic discharge. (See figure 5, p. 35.)

Electrostatic discharge can damage circuitry on PC boards.

The following procedures describe replacement of the power supply board. A digital voltmeter is required.

Power Supply Board Removal (refer to figure 8, p. 67):

1. **Unplug the power cord.**
2. Disconnect the 26 conductor cable harness assembly from the power supply board at J4.
3. Disconnect the three cable harness connectors P5, P6, and P7.
4. Remove the seven (7) board mounting screws.
5. Lift board out of head.

Power Supply Board Installation (refer to figure 8, p. 67):

1. **Unplug the power cord.**
2. Place the new power supply board in head.
3. Install seven (7) board mounting screws.
4. Connect the three cable harness connectors P5, P6, and P7 to J3, J2, and J1 on the power supply board.
5. Perform a voltage check of the power supply board. Do not use the board or connect it to the control/display board if the voltages are incorrect.

   NOTE: To prevent an accidental short circuit, connect voltmeter leads while the machine is off.

   With the 26 conductor cable harness assembly disconnected from the power supply board and the machine on, measure for the following voltages at the following board locations (see figure 23, p. 84):

	DVM Common to Pin	DVM + Lead to Pin	Voltage Reading
Q7	1	3	-12 ± 0.5V
Q6	2	3	+12 ± 0.5V
C16	–	+	+5.3 ± 0.3V

6. Turn machine off.
7. Connect the 26 conductor cable assembly.
8. Perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3)

9.3 REPLACING THE CONTROL/DISPLAY BOARD

⚠ CAUTION

Wear a static control device connected to the chassis ground to prevent electrostatic discharge. (See figure 5, p. 35.)

Electrostatic discharge can damage circuitry on PC boards.

Control/Display Board Removal (refer to figure 8, p. 67):

1. **Unplug the power cord.**
2. Disconnect the 26 conductor cable harness assembly from the control/display board at J1.
3. Unfasten the patient probe assembly J1 from the head by removing the hex nut and pull the assembly from its mounting hole.
4. Remove the six (6) board mounting screws and one standoff.
5. Push aside the ground harness and transformer cable and lift board enough to gain access to the PC board.
6. Disconnect the digital control panel from the board at J4 and the patient probe assembly from the board at J2.

   NOTE: These connectors have locking tabs that must be pressed in order to disengage them from the board.

⚠ CAUTION

Use care when disconnecting the digital control panel ribbon from the control board.

Folding the ribbon cable may cause failure of the control panel.

7. Lift board out of cover.

Control/Display Board Installation (refer to figure 8, p. 67):

1. **Unplug the power cord.**
2. Place the new control/display board in head.
3. Install the six (6) board mounting screws and one standoff as follows:
   a. Install 3 board screws through the ground harness into the board.

      NOTE: Insure that the corner screw also connects the ground wire of the patient probe assembly to the board.

   b. Install the standoff through the middle mounting hole on the board's edge. Insert 2 board screws through the transformer cable retaining clips; mount one to the standoff, install the other directly through the board.
   c. Install the remaining board screw through the board.

9.3 REPLACING THE CONTROL/DISPLAY BOARD (continued)

4. Insert patient probe assembly into mounting hole and fasten with hex nut. Insure patient probe assembly is oriented so that the bevelled corner of the probe assembly is positioned as shown in figure 16, p. 76.
5. Connect the digital control panel plug P4 to the board at J4.
6. Connect the patient probe assembly plug P2 to the board at J2.
7. Perform a voltage check of the power supply board (see section 9.2, p. 60).
8. Connect the 26 conductor cable assembly from the power supply board.
9. Perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3).

9.4 REPLACING THE TOP COVER

To install a complete new cover:

1. **Unplug the power cord.**
2. Remove old top cover from machine by removing 6 screws underneath top cover and disconnecting cables. See figure 14, p. 73.
3. Install new top cover.
4. Perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3).

9.5 REPLACING THERMOSTATS

To replace thermostat (see figures 15, 17, 17A and 18, pp. 74-75, 77, 79):

1. **Unplug the power cord.**
2. Remove wraparound from chassis.
3. Remove thermostat cover. (On certain models only.)
4. Disconnect spade lugs from thermostat terminals.
5. Carefully peel back insulating material.
6. Remove the two screws holding the thermostat. Remove the thermostat.
7. Apply thermal grease * (P/N 50040-000) to the underside of the replacement thermostat to ensure proper operating temperature ranges.

   * Recommended thermal greases:

   - Silicone Heat Sink Compound
     (Dow Corning; Midland, Michigan)
   - Thermal Joint Compound Type 120-5
     (Wakefield Engineering; Wakefield, Massachusetts)

⚠ CAUTION

Always use thermal grease on thermostats for MTA5900 series Medi-Therm II units.

Failure to use thermal grease could raise trip points above the acceptable range.

8. Reconnect spade lugs to terminals. Refer to figures 17 & 17A, p. 77 to ensure thermostat is connected correctly.

> **⚠ CAUTION**
>
> Do not bend or alter terminals.
>
> **Terminals may break. Also, bending may alter the trip point range.**

9. Mount thermostat, using existing screws.
10. Reapply insulating material.
11. Perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (section 7.3).

9.6 CLEANING THE FLOW SWITCH

To clean the flow switch (see figure 7 below and figure 15, pp. 74-75):

1. Remove nuts (item A) and remove assembly.
2. Loosen hose clamps (items B and C) and remove hoses.
3. Remove barbed adapters (item D). Remove plunger.
4. Clean all parts with alcohol and remove any foreign matter.
5. To reassemble, reverse steps 1 through 3 above.

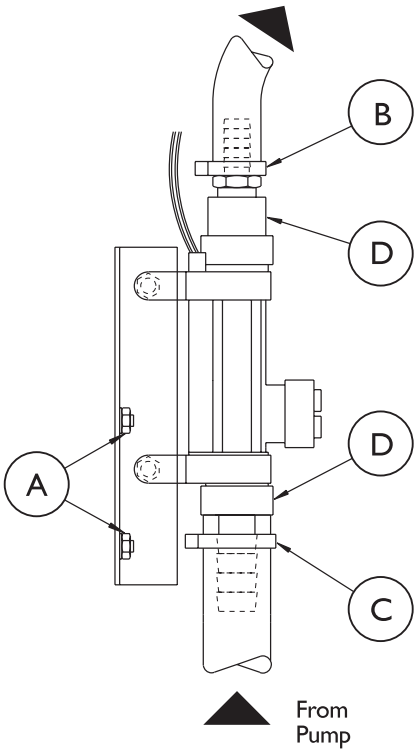


Figure 7—Flow Switch

9.7 REPLACEMENT PARTS

For base replacement parts information, refer to figure 15, table 7, pp. 74-75. For head replacement parts information, refer to figure 16, table 8, p. 76.

Repairs should only be performed by qualified personnel familiar with repair practices for servicing medical devices.

9.8 SHIPPING / REPACKAGING INSTRUCTIONS

⚠ CAUTION

Failure to install compressor shipping brace before shipment can result in extensive damage to the refrigeration section. (See p. 86, figure B.)

See figure 25, p. 86 for complete repackaging instructions to ship the Medi-Therm II machine back to Gaymar or to a qualified Service Center. If you do not have the original packing materials, please contact Gaymar's Technical Service Department and a complete Customer Return Kit will be sent to you.

Be sure to obtain return authorization from our Technical Service Department before shipping the machine.

10.0 REFERENCE TABLES

10.1 CELSIUS-FAHRENHEIT CONVERSION

°C	°F	°C	°F	°C	°F	°C	°F
0.0	32.0	11.5	52.7	23.0	73.4	34.5	94.1
0.5	32.9	12.0	53.6	23.5	74.3	35.0	95.0
1.0	33.8	12.5	54.5	24.0	75.2	35.5	95.9
1.5	34.7	13.0	55.4	24.5	76.1	36.0	96.8
2.0	35.6	13.5	56.3	25.0	77.0	36.5	97.7
2.5	36.5	14.0	57.2	25.5	77.9	37.0	98.6
3.0	37.4	14.5	58.1	26.0	78.8	37.5	99.5
3.5	38.3	15.0	59.0	26.5	79.7	38.0	100.4
4.0	39.2	15.5	59.9	27.0	80.6	38.5	101.3
4.5	40.1	16.0	60.8	27.5	81.5	39.0	102.2
5.0	41.0	16.5	61.7	28.0	82.4	39.5	103.1
5.5	41.9	17.0	62.6	28.5	83.3	40.0	104.0
6.0	42.8	17.5	63.5	29.0	84.2	40.5	104.9
6.5	43.7	18.0	64.4	29.5	85.1	41.0	105.8
7.0	44.6	18.5	65.3	30.0	86.0	41.5	106.7
7.5	45.5	19.0	66.2	30.5	86.9	42.0	107.6
8.0	46.4	19.5	67.1	31.0	87.8	42.5	108.5
8.5	47.3	20.0	68.0	31.5	88.7	43.0	109.4
9.0	48.2	20.5	68.9	32.0	89.6	43.5	110.3
9.5	49.1	21.0	69.8	32.5	90.5	44.0	111.2
10.0	50.0	21.5	70.7	33.0	91.4	44.5	112.1
10.5	50.9	22.0	71.6	33.5	92.3	45.0	113.0
11.0	51.8	22.5	72.5	34.0	93.2		

Table 4—Celsius-Fahrenheit Conversion

10.2 TEMPERATURE vs. RESISTANCE

PATIENT PROBE, BLANKET WATER PROBE (RT2), AND RESERVOIR PROBE (RT1) TEMPERATURE RESISTANCE

TEMPERATURE		RESISTANCE
°C	°F	(OHMS)
0	32.0	7355
1	33.8	6989
2	35.6	6644
3	37.4	6319
4	39.2	6011
5	41.0	5719
6	42.8	5444
7	44.6	5183
8	46.4	4937
9	48.2	4703
10	50.0	4482
11	51.8	4273
12	53.6	4074
13	55.4	3886
14	57.2	3708
15	59.0	3539
16	60.8	3378
17	62.6	3226
18	64.4	3081
19	66.2	2944
20	68.0	2814
21	69.8	2690
22	71.6	2572
23	73.4	2460
24	75.2	2354
25	77.0	2252

TEMPERATURE		RESISTANCE
°C	°F	(OHMS)
26	78.8	2156
27	80.6	2064
28	82.4	1977
29	84.2	1894
30	86.0	1815
31	87.8	1739
32	89.6	1667
33	91.4	1599
34	93.2	1533
35	95.0	1471
36	96.8	1412
37	98.6	1355
38	100.4	1301
39	102.2	1249
40	104.0	1200
41	105.8	1152
42	107.6	1107
43	109.4	1064
44	111.2	1023
45	113.0	983.8
46	114.8	946.2
47	116.6	910.2
48	118.4	875.8
49	120.2	842.8
50	122.0	811.3

Table 5—Temperature vs. Resistance

11.0 SERVICE INFORMATION

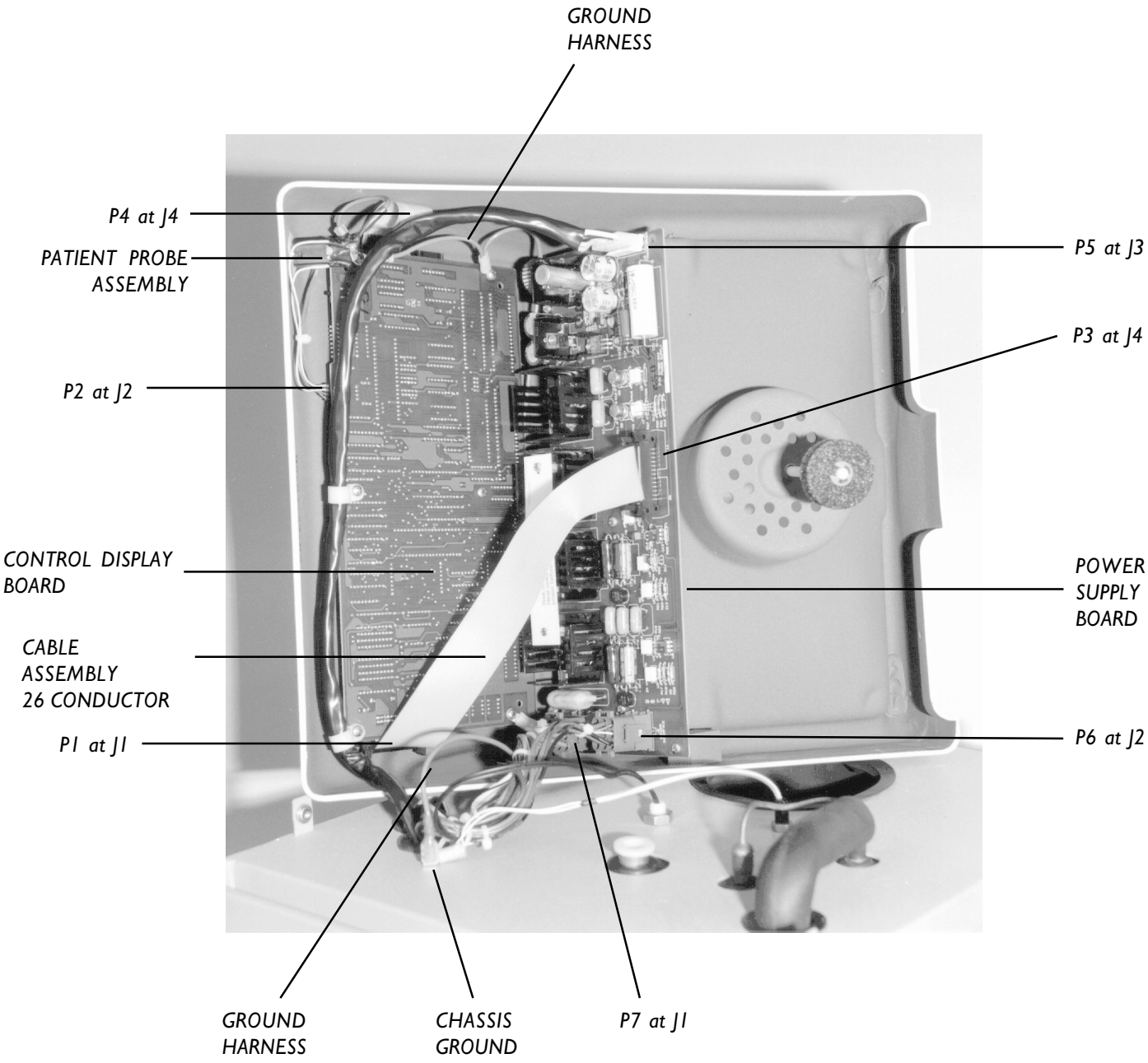
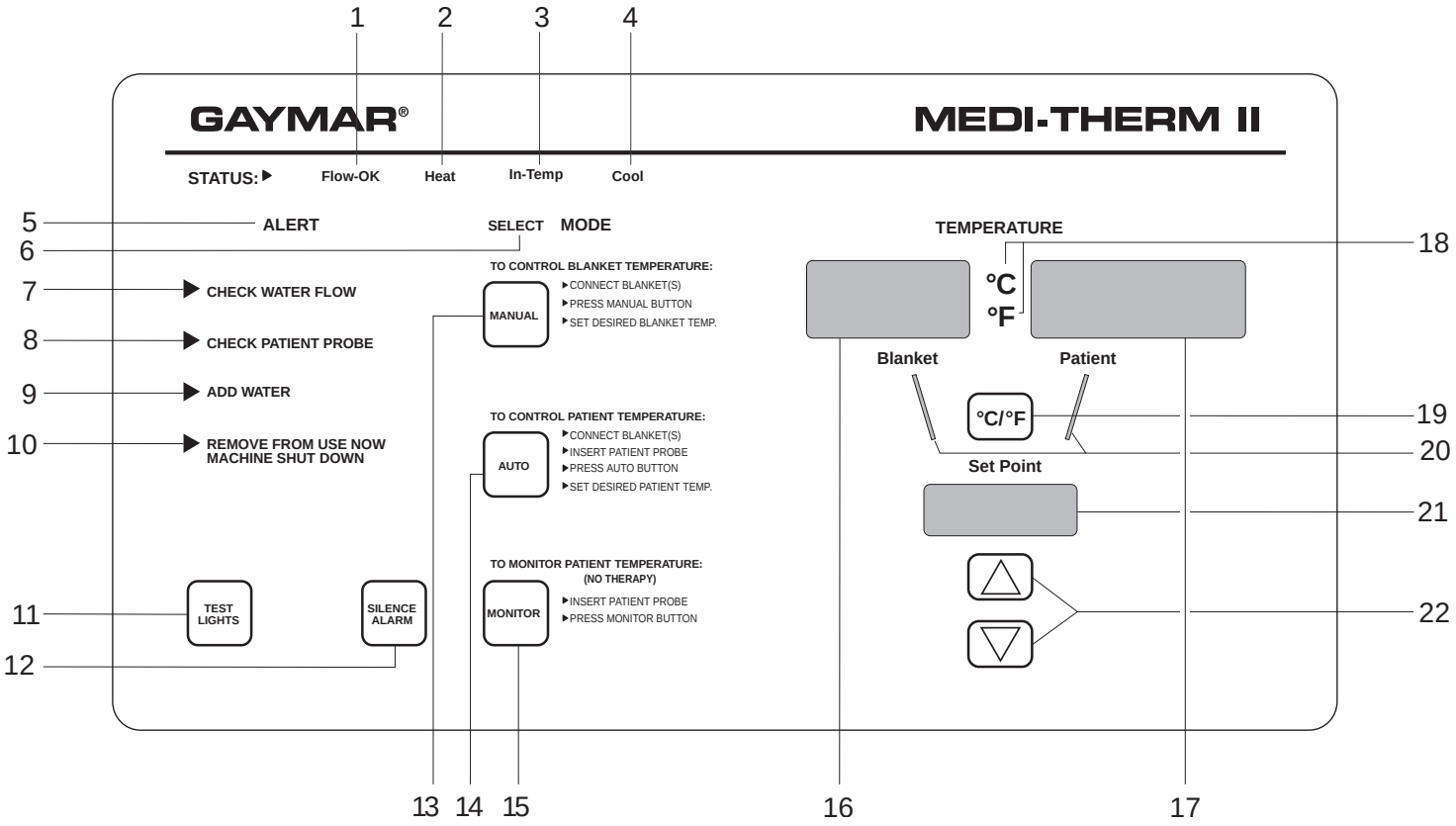


Figure 8—Circuit Boards and Connectors (Head)



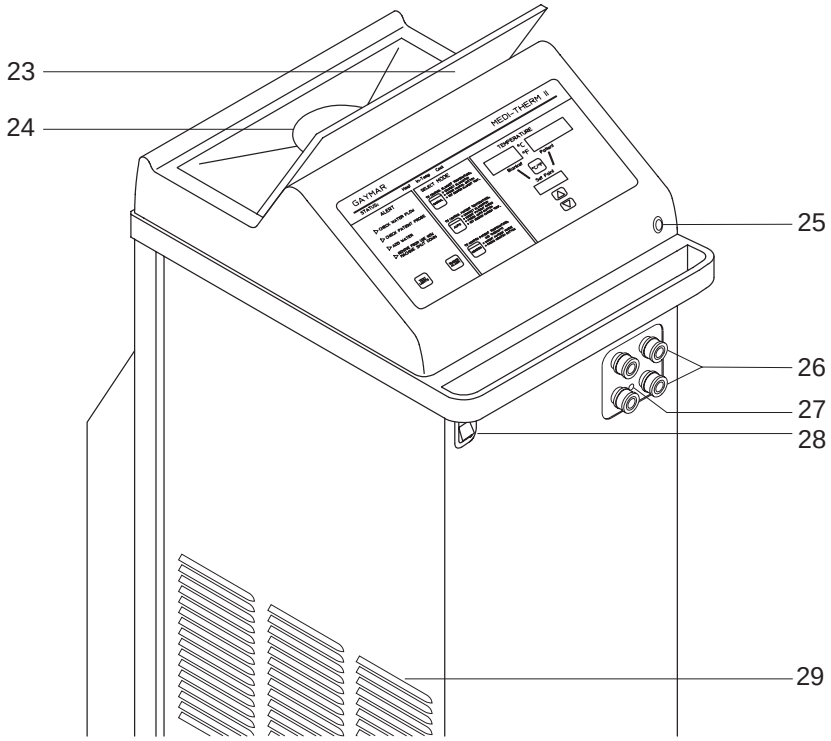


Figure 9—Operator Controls/Indicators

Item	Name	Function
1	FLOW-OK	Indicates blanket water is flowing adequately.
2	HEAT	Indicates blanket water is being heated. Refer to section 4.2 THERMAL SPECIFICATIONS, p..5
3	IN-TEMP	Indicates the Medi-Therm II is controlling temperature at the desired setting.
4	COOL	Indicates blanket water is being cooled. Minimum blanket temperature is 4°C (39.2°F).
5	ALERT	Indicates an alert condition exists.
6	SELECT	Indicates a mode must be selected. Flashes if set point buttons are pressed before selecting mode.
7	CHECK WATER FLOW	Indicates the flow of water to the blanket has been restricted.
8	CHECK PATIENT PROBE	Indicates the patient probe is sensing an abnormal patient temperature (below 32°C [89.6°F] or above 45°C [113°F]). An audible alarm accompanies this alert. **WARNING: It may indicate the patient probe has become dislodged, an incorrect probe is being used, or a probe has become defective.**
9	ADD WATER	Indicates the water reservoir is below the recommended level.
10	REMOVE FROM USE NOW / MACHINE SHUT DOWN	Indicates the Medi-Therm II has shut down due to blanket water temperature exceeding either the high or the low limit. It may also indicate the microprocessor has shut down the machine. Remove the Medi-Therm II machine from use immediately.
11	TEST LIGHTS	Enables the operator to confirm that all indicator lights and digital displays are working, and that the audible alarm is functioning. The displays flash and the audible alarm sounds as long as the TEST LIGHTS button is pressed.
12	SILENCE ALARM	Temporarily silences the audible alarm The alarm will reactivate in approximately 5 minutes if the condition persists. The SILENCE ALARM button will not function if the REMOVE FROM USE NOW / MACHINE SHUT DOWN indicator is lit.
13	MANUAL	Selects the manual mode of operation. In MANUAL mode, the operator must observe patient temperature and adjust the blanket water set point temperature to obtain the desired results.
14	AUTO	Selects the automatic mode of operation. In AUTO mode, the operator sets the desired temperature and the patient temperature is automatically regulated to the operator-specified set point.
15	MONITOR	Selects the monitor mode of operation. In MONITOR mode, the operator may monitor patient temperature without providing therapy.
16	BLANKET	Indicates the actual temperature of the water being delivered to the blanket. This display is illuminated when MODE is set to either MANUAL or AUTO.
17	PATIENT	Indicates actual patient temperature as sensed by the probe connected to the patient probe jack. This display is illuminated when MODE is set to MANUAL, AUTO, or MONITOR and a patient probe is plugged into the PATIENT PROBE jack.
18 *	°C/°F INDICATOR	Displays the temperature and setpoint in either degrees Celsius (°C) or Fahrenheit (°F). Pressing the °C/°F button will display the appropriate scale and light the corresponding indicator.
19 *	°C/°F BUTTON	
20	LEADER LIGHTS	Emphasizes whether blanket temperature or patient temperature is being set.
21 22	SET POINT SET POINT BUTTONS	Indicates the desired SET POINT temperature. When operating in MANUAL mode, pressing the SET POINT button (up or down) sets the desired BLANKET water temperature. When in AUTO mode, pressing the SET POINT button sets the desired patient temperature.
23	OPERATING INSTRUCTIONS	Condensed operating instructions are mounted on the machine head and on top of the water fill opening cover.
24	WATER FILL OPENING	Used to fill water reservoir to proper level. To fill, lift cover on the water fill opening and fill with distilled water until the green band on the float stem is fully visible. **CAUTION: Add distilled water only. Failure to use distilled water may result in poor machine performance. Do not use alcohol. Do not operate without water. Do not overfill.**
25	PATIENT PROBE JACK	Accepts patient probe plug connecting patient probe to machine. **Use only YSI 400 series probe or equivalent.**
26	BLANKET CONNECTIONS	Connects machine to quick-disconnects on the connector hose. Quick-disconnect fittings are marked BLANKET 1 and BLANKET 2.
27	PROBE CHECK WELL	Used to perform probe check (refer to Operating Manual for procedure). **WARNING: When performing the probe check, use a protective sheath (Becton-Dickinson catalog 3700 oral sheath or equivalent) on probe to prevent cross-contamination.**
28	ON / OFF SWITCH	(Circuit breaker) Controls power to the unit.
29	AIR VENTS	Permits adequate air circulation. Keep louvered openings clear on all three sides of the cabinet.

* Some models do not have the °C/°F feature

Table 6—Operator Controls/Indicators

*When the Medi-Therm II machine is **heating,** water flows in the path shown below.*

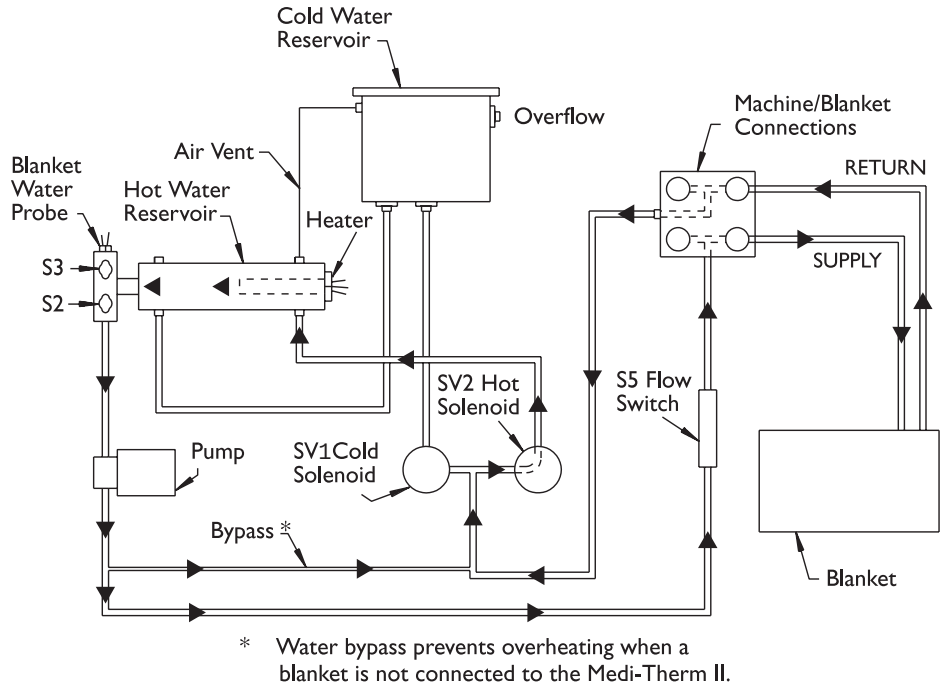


Figure 10—Heating flow diagram

*When the Medi-Therm II machine is **cooling,** water flows in the path shown below.*

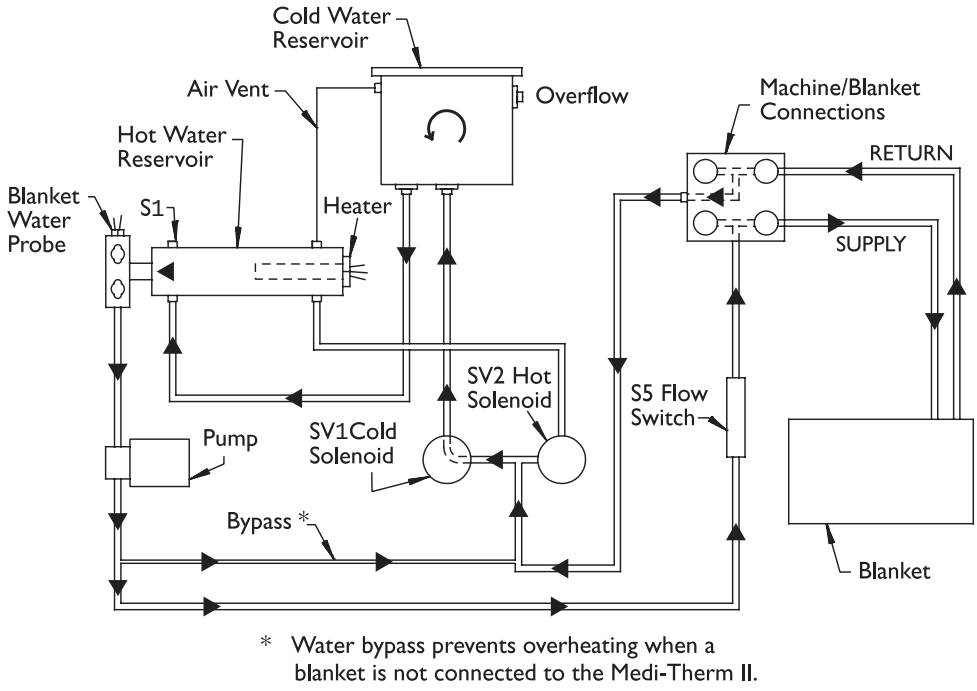


Figure 11—Cooling flow diagram

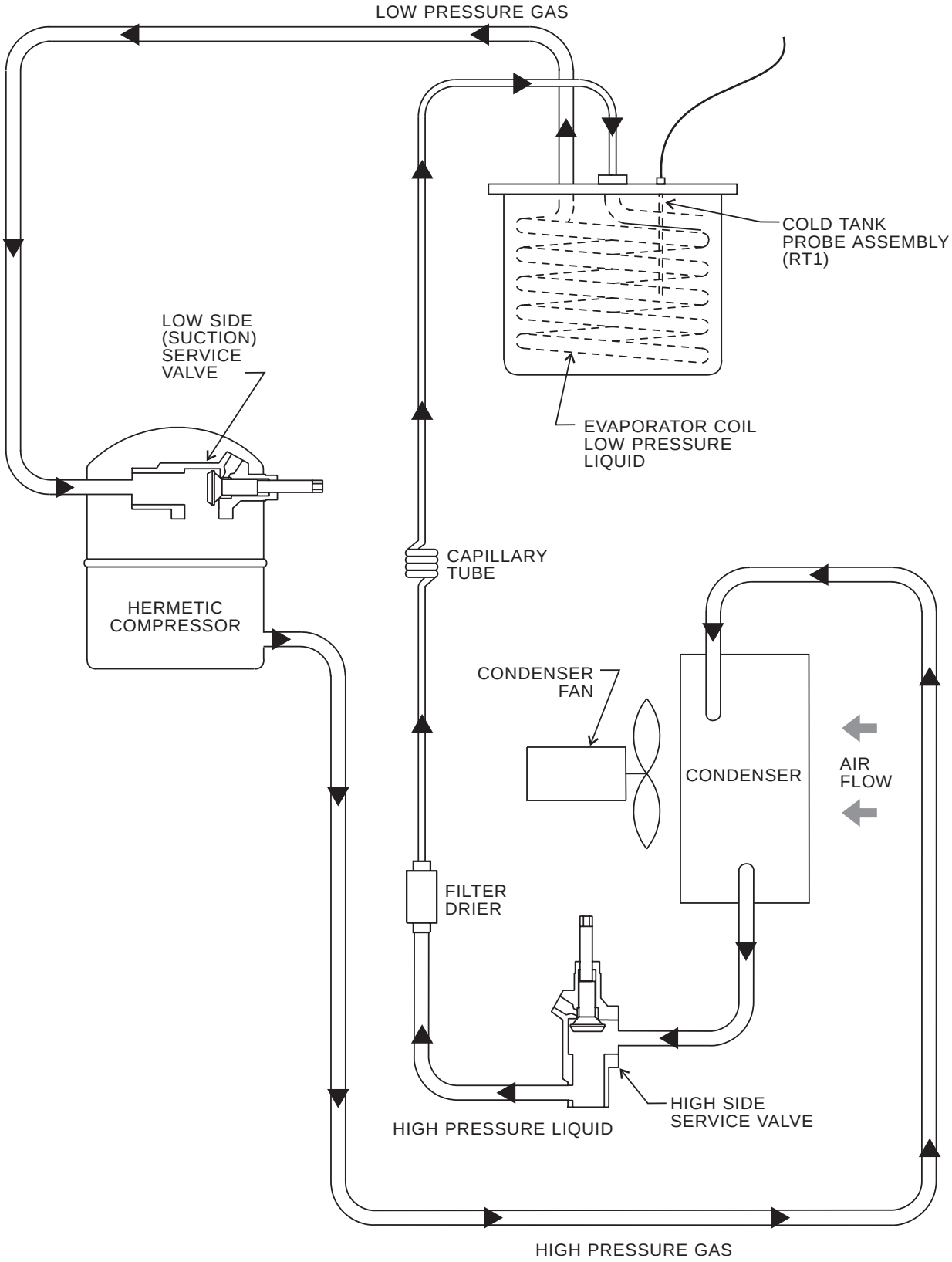


Figure 12—Refrigeration flow diagram

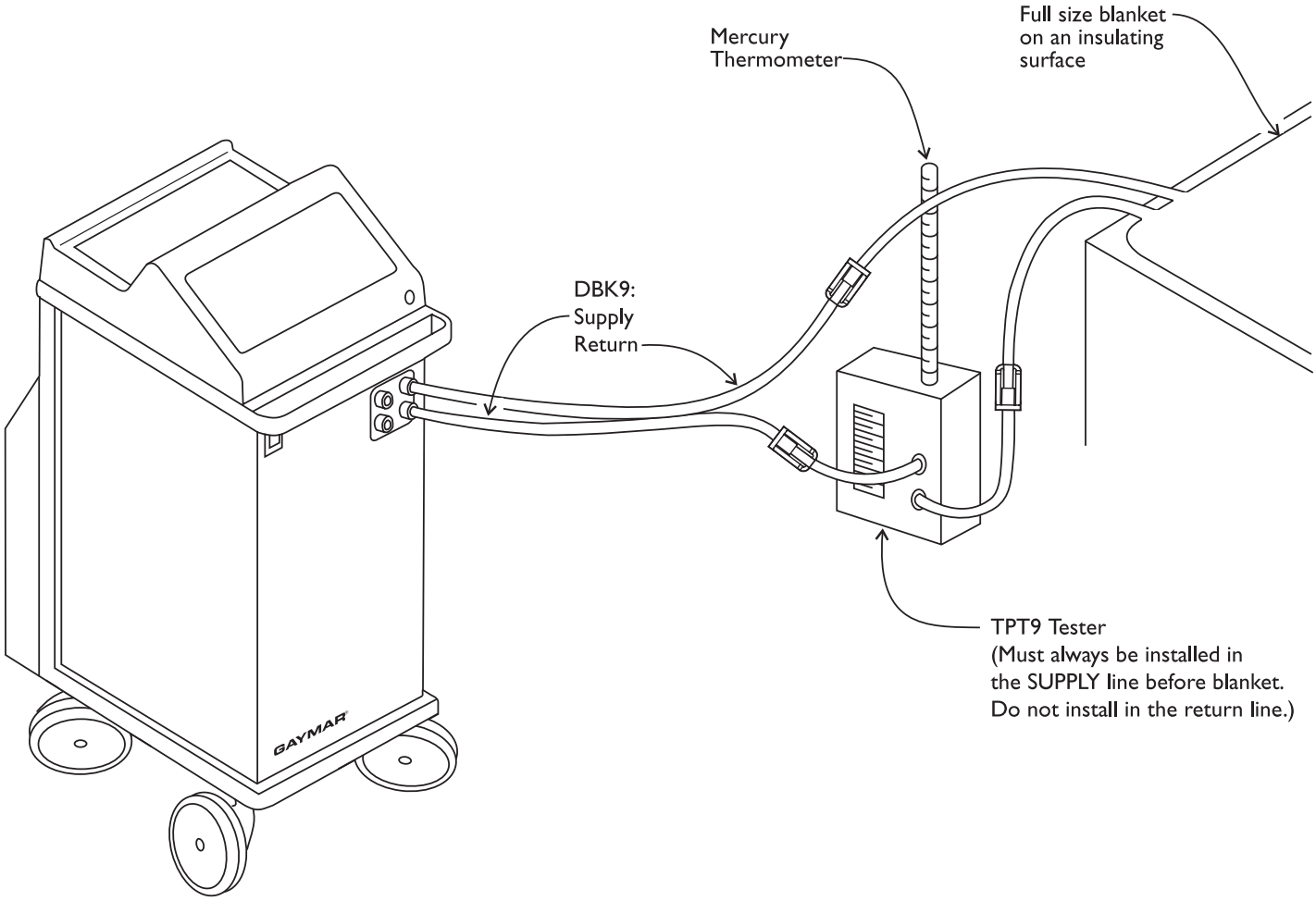
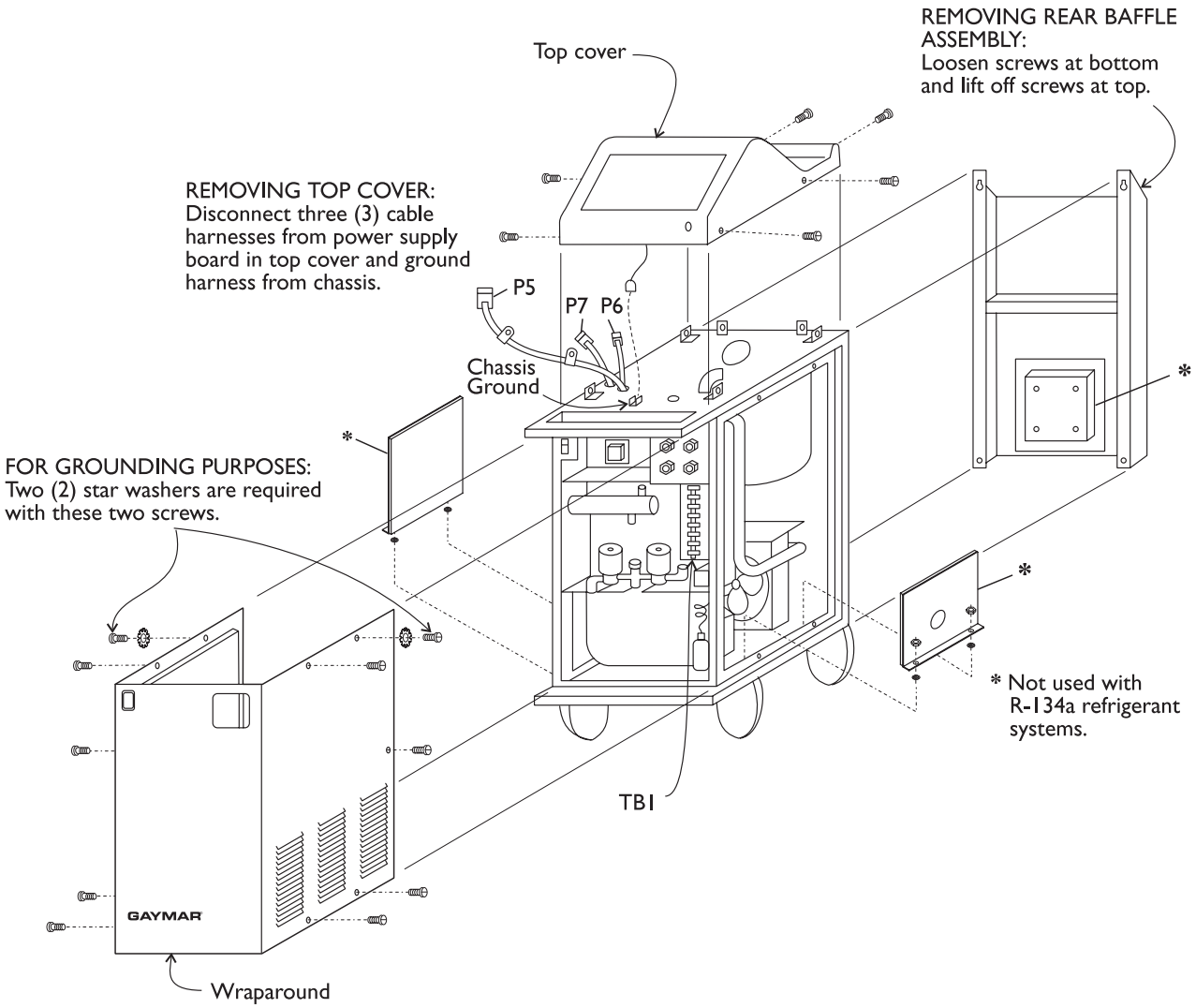
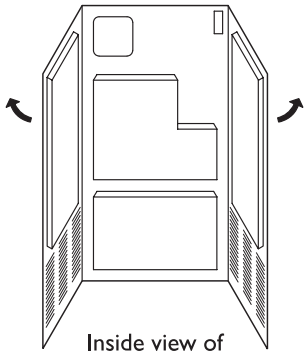


Figure 13—Test setup



REMOVING WRAPAROUND:
Flex side panels of wraparound out slightly to clear foam, as indicated by arrows.



Inside view of chassis wraparound showing foam

Figure 14—Machine disassembly

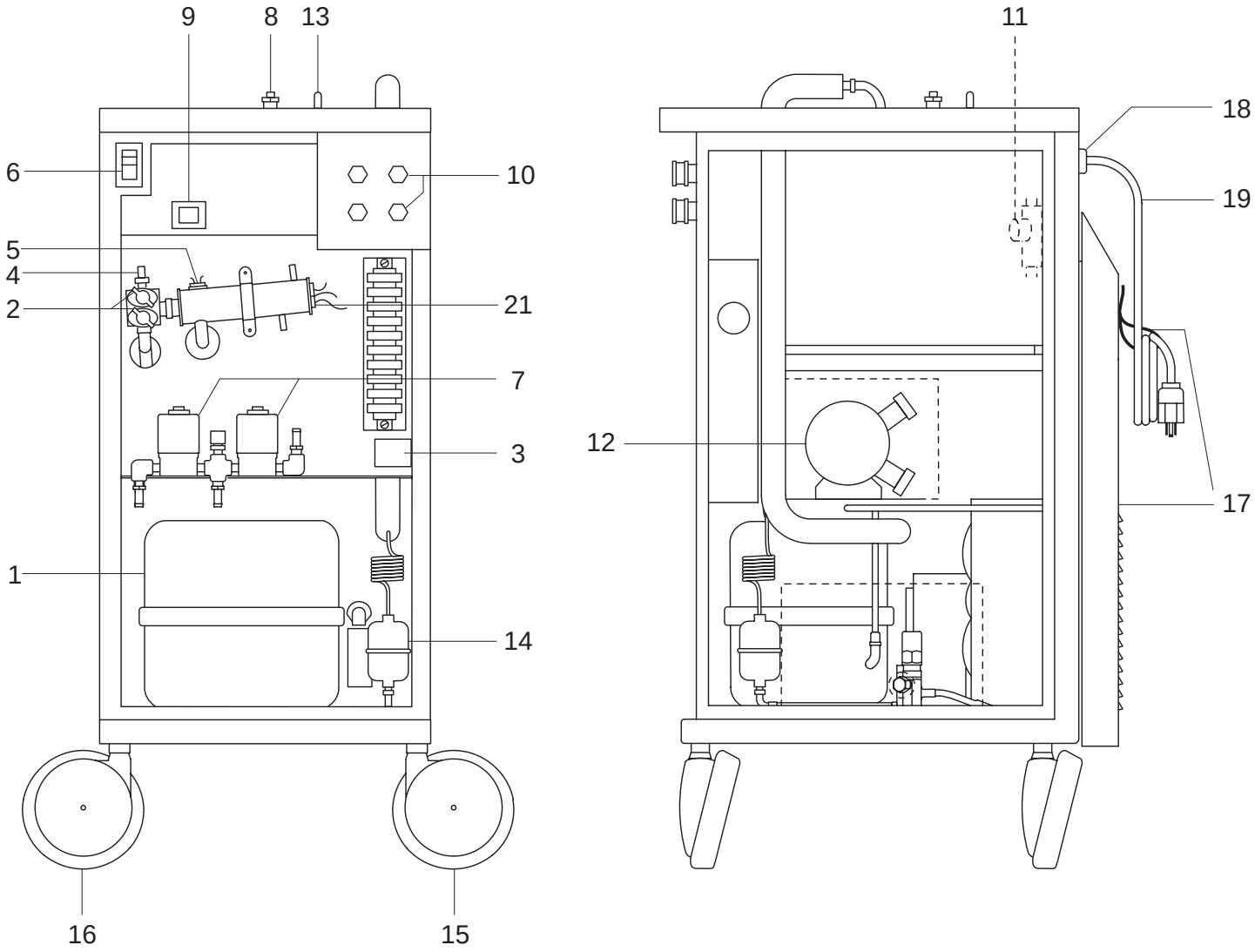


Figure 15—Parts Diagram (Base)

ITEM	DESCRIPTION		PART NUMBER		
			MTA5942	MTA5900	MTA5901
1	COMPRESSOR		07948-000	07948-000	07948-000
	A. CAPACITOR, START - FOR UNITS WITH RING TERMINALS		N/A	90701-138	90701-138
	CAPACITOR, START - FOR UNITS WITH PUSH ON TERMINALS		90701-140	90701-140	90701-140
	B. RELAY - FOR UNITS WITH RING TERMINALS		N/A	77237-000	77237-000
	RELAY - FOR UNITS WITH PUSH ON TERMINALS		77237-001	77237-001	77237-001
	C. THERMAL OVERLOAD	RING TERMINAL. . . R-134a UNITS	N/A	77851-000	77851-000
		PUSH ON TERMINAL . . . R-134a UNITS	77851-001	77851-001	77851-001
		PUSH ON TERMINAL . . . R-12 UNITS	N/A	77238-000	77238-000
2	THERMOSTAT, WHITE DOT (S2 & S3)		77749-000	77749-000	77749-000
3	COMPRESSOR RELAY		91234-000	91234-000	91234-000
4	TEMPERATURE PROBE ASSEMBLY (RT2) KIT		77737-000	77737-000	77737-000
5	THERMOSTAT, BLACK DOT (S1)		77372-000	77372-000	77372-000
6	CIRCUIT BREAKER (CB1)		77754-000	77754-000	77754-000
	CIRCUIT BREAKER COVER		77756-000	77756-000	77756-000
7	SOLENOID VALVE (SV1 & SV2)		77824-000	77824-000	77824-000
8	WATER LEVEL SENSOR		77757-000	77757-000	77757-000
9	TRANSFORMER ASSEMBLY (T1)		77826-000	77826-000	77826-001
10	QUICK DISCONNECT (FEMALE)		01080-000	01080-000	01080-000
11	FLOW SWITCH ASSEMBLY		77797-000	77797-000	77797-000
12	PUMP		07368-001	07368-001	07368-001
13	COLD TANK PROBE ASSEMBLY (RT1)		77759-000	77759-000	77759-000
14	FILTER DRIER ASSEMBLY	. . . R-134a UNITS	07954-000	07954-000	07954-000
		. . . R-12 UNITS	N/A	77414-000	77414-000
15	CASTER, R.H.		77101-001	77101-001	77101-001
16	CASTER, L.H.		77101-000	77101-000	77101-000
17	POWER CORD STRAP		03791-000	03791-000	03791-000
	REAR BAFFLE ASSEMBLY		07464-001	07464-001	07464-001
18	STRAIN RELIEF		90634-001	90634-001	90634-001
19	POWER CORD		77879-000	77879-000	77879-000
20	WRAPAROUND (Not Shown)		10288-000	10288-000	10288-000
21	HEATER ASSEMBLY		07370-000	07370-000	07772-000
22	RC NETWORK (Not Shown); connected between terminals 7 and 9 of COMPRESSOR RELAY (ITEM 3).		77787-000	77787-000	77787-000

Table 7—Parts List (Base)

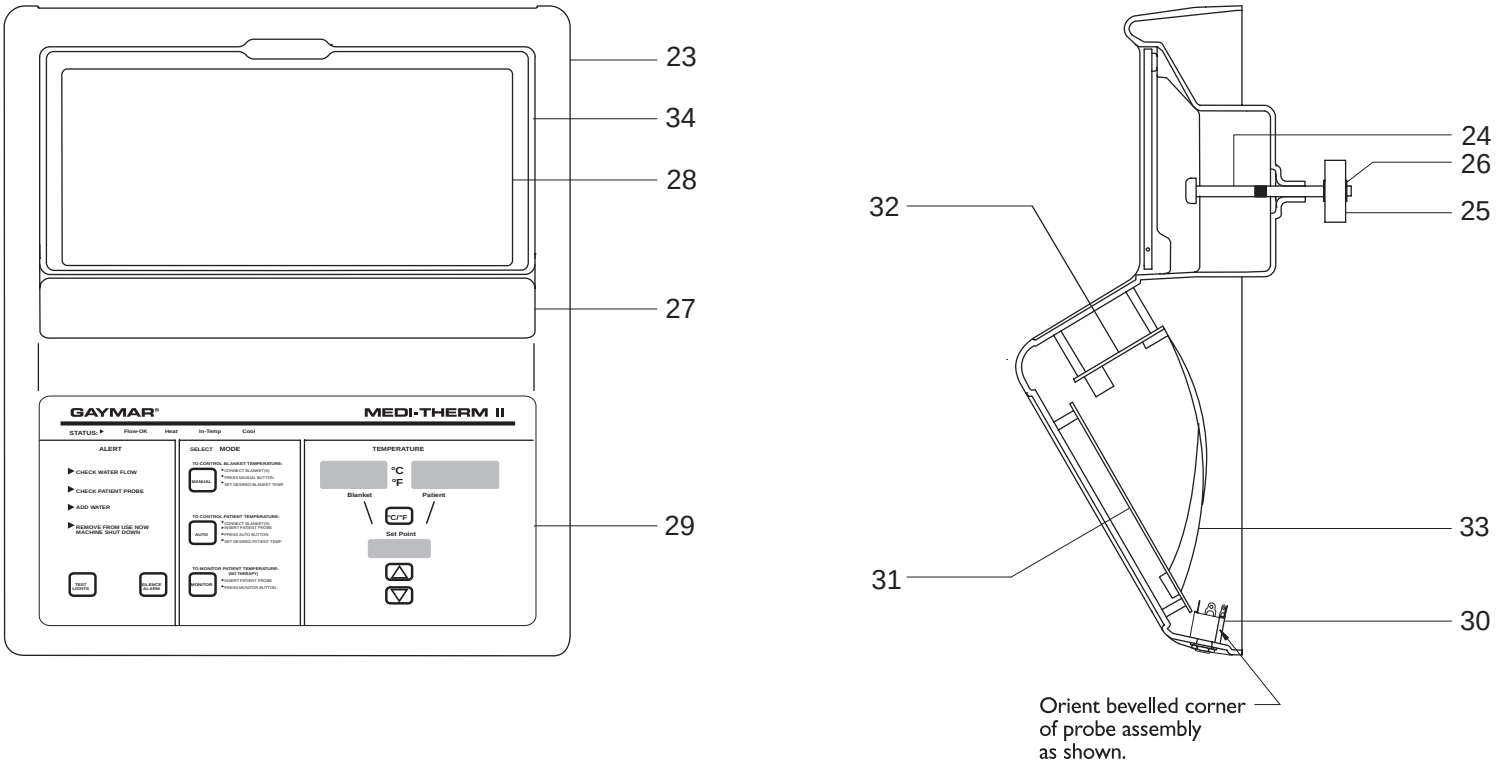


Figure 16—Parts Diagram (Head)

ITEM	DESCRIPTION	PART NUMBER		
		MTA5942	MTA5900	MTA5901
23	COVER, WITH LABELS, CONTROL PANEL, FLOAT ASSY	77764-000	77764-000	77800-000
24	STEM	77760-000 (ALL PARTS)	77760-000 (ALL PARTS)	77760-000 (ALL PARTS)
25	FOAM FLOAT			
26	RETAINING RING			
27	PRECAUTIONS AND ALERTS LABEL	09853-000	09853-000	07781-000
28	INSTRUCTIONS LABEL	09852-000	09852-000	07780-000
29	PANEL, DIGITAL CONTROL ASSEMBLY	77884-000	77884-000	07782-000
30	PATIENT PROBE JACK ASSEMBLY	07311-000	07311-000	07311-000
31	CONTROL/DISPLAY PCB ASSEMBLY	07757-001	07757-000	07788-000
32	POWER SUPPLY PCB ASSEMBLY	07433-000	07433-000	07433-000
33	CABLE ASSEMBLY 26 CONDUCTOR	07481-000	07481-000	07481-000
34	COVER DOOR WITH LABELS, HINGES	77761-000	77761-000	77801-000

Table 8—Parts List (Head)

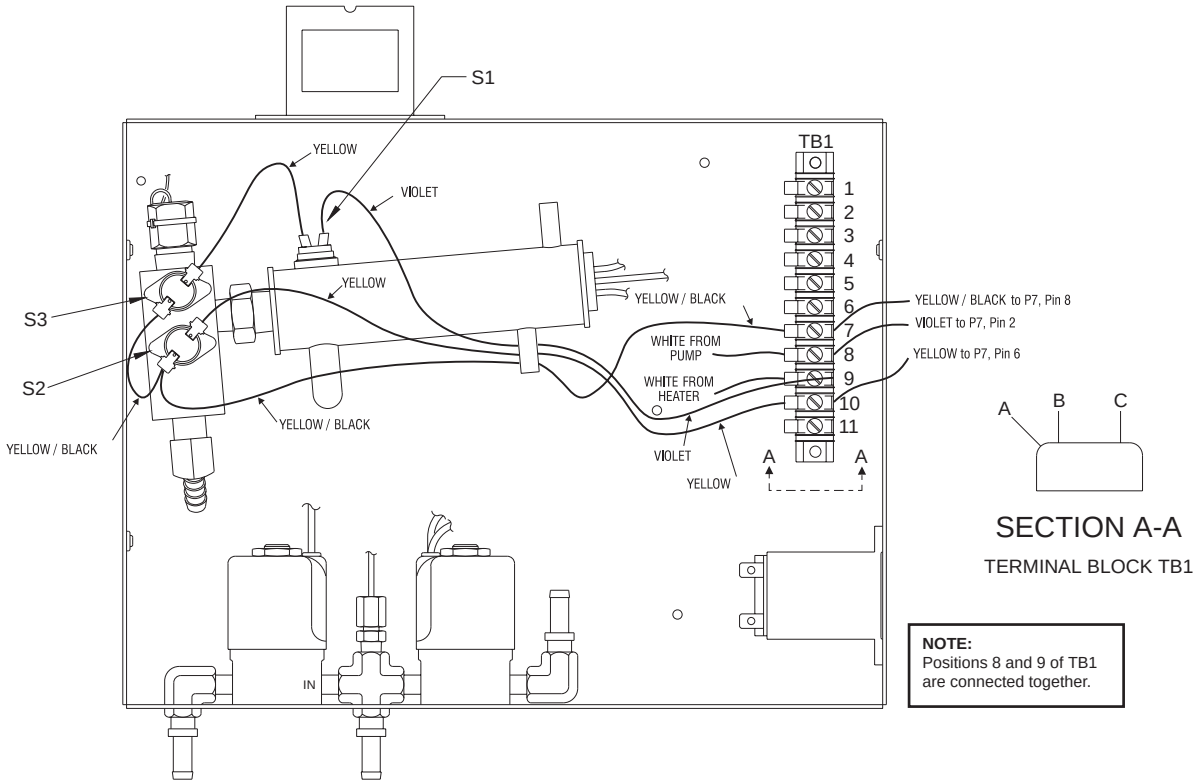


Figure 17—Original Thermostat Wiring Diagram for MTA5900/MTA5901

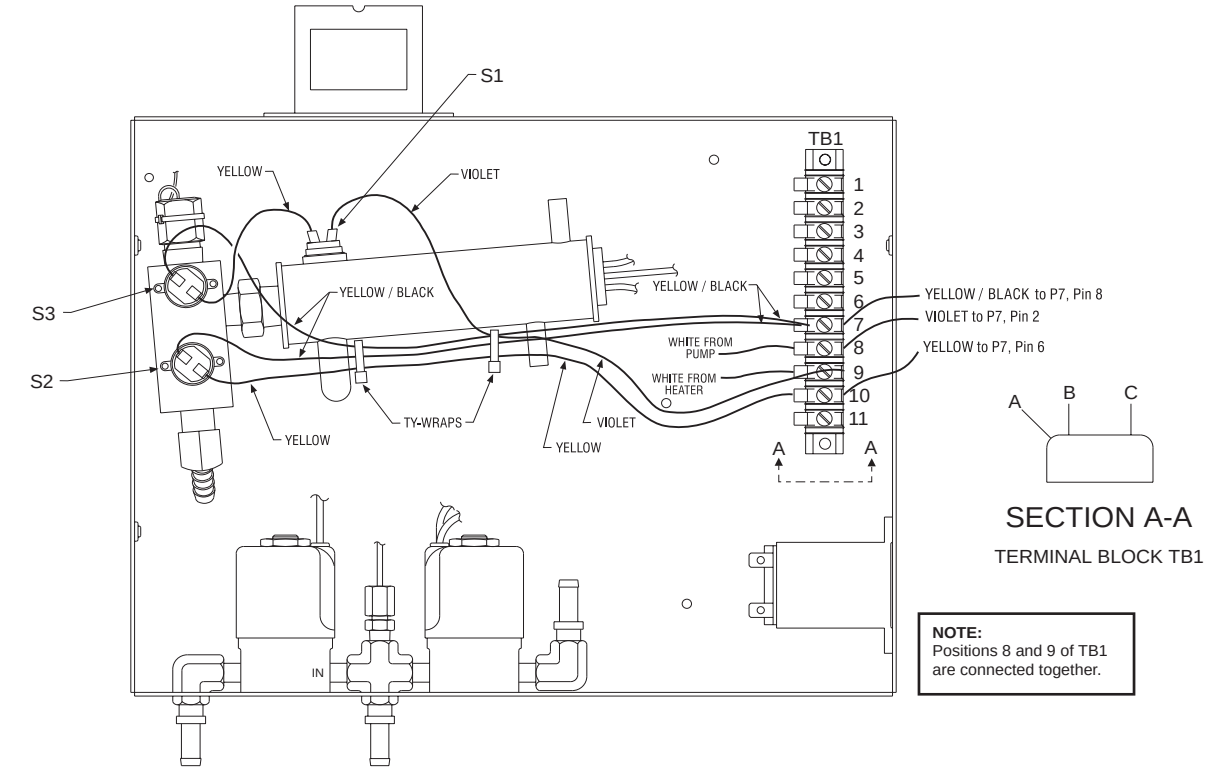


Figure 17A—New Thermostat Wiring Diagram for MTA5942 & MTA5900/MTA5901

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