

T/PUMP®

TP400 Series

Heat Therapy System



LISTED 304L



STANDARD (NORME)
C22.2 NO. 125 RISK
CLASS (CATEGORIE
DE RISQUES) NO. 2G

SERVICE MANUAL

BEFORE YOU BEGIN . . .

READ AND UNDERSTAND THIS TIPUMP SERVICE MANUAL AND ALL PRECAUTIONS (SEE PAGE 2) PRIOR TO SERVICING THE TIPUMP.

The purpose of this manual is to provide operation, service, and repair information for GAYMAR heat therapy pumps.

RECEIVING INSPECTION

Check the shipping carton for damage immediately upon receipt. If package damage is discovered, the device should be unpacked with the carrier's agent present. Any claims for shortage or damage must be filed with the delivering carrier by the purchaser. Do not return pumps damaged in shipment to GAYMAR without contacting our Technical Service Department for advice (see phone numbers below). If damaged goods are returned to GAYMAR without notifying the carrier, GAYMAR will assume the repairs will be made at the customer's expense.

**TO RETURN PUMPS
TO FACTORY FOR
REPAIR OR EXCHANGE**

Merchandise returned to GAYMAR must be accompanied by a Return Goods Number (RG#), issued by GAYMAR, authorizing goods to be returned. Call Customer Service or Technical Service at

(716) 662-2551
1 800 828-7341

Advise model, serial number, and nature of problem. You will be given a Return Goods Number (RG#).

The serial number can be found on the back of the T/Pump (see figure 2, page 4).

CONTENTS

SAFETY PRECAUTIONS 2

INTRODUCTION 3

FEATURES 4

SPECIFICATIONS 5

OPERATING INSTRUCTIONS 6

STORAGE AND CLEANING 7

THEORY OF OPERATION 8

FUNCTIONAL CHECK AND SAFETY INSPECTION 10

INSPECTION FORM 15

DISASSEMBLY / REASSEMBLY 16

CALIBRATION 19

TROUBLESHOOTING 21

REPLACEMENT PARTS LISTS 28

WARRANTIES 31

ILLUSTRATIONS

1 T/PUMP® HEAT THERAPY SYSTEM 3

2 T/PUMP FEATURES/SPECIFICATIONS 4

3 CLIK-TITE® CONNECTORS 6

4 T/PUMP COMPONENTS 9

5 MOTOR 11

6 TPCI TEST COVERS 22

7 FUNCTIONAL CHECK TEST DIAGRAM 23

8 CIRCUIT DIAGRAM FOR T/PUMP 24

9 CIRCUIT DIAGRAM FOR TPCI TEST COVERS 25

10 EXPLODED VIEW OF T/PUMP 26

11 PC BOARD ASSEMBLY 27

⚠ DANGER

- **Risk of explosion.** Do not use in the presence of flammable anesthetics.
- **Risk of electric shock.** Disconnect power before servicing the T/Pump.

⚠ WARNING

- This device pumps warmed water through a pad. Set pad temperature only as prescribed by and under the guidance of a physician, and monitor the patient's temperature and skin condition every 20 minutes or as directed by a physician. **Failure to adhere to these warnings could result in patient injury.**

The following Groups/Conditions require additional surveillance:

Group/Condition at risk	Potential injury
Pediatric patients	Hyperthermia/hypothermia
Patients with impaired circulation	Ischemia
Areas of application are under pressure	Ischemia
In combination with topical solutions whose toxicity may be affected by the application of heat	Chemical injury
In combination with other heat sources	Thermal injury

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 10-14) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 15). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

- Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

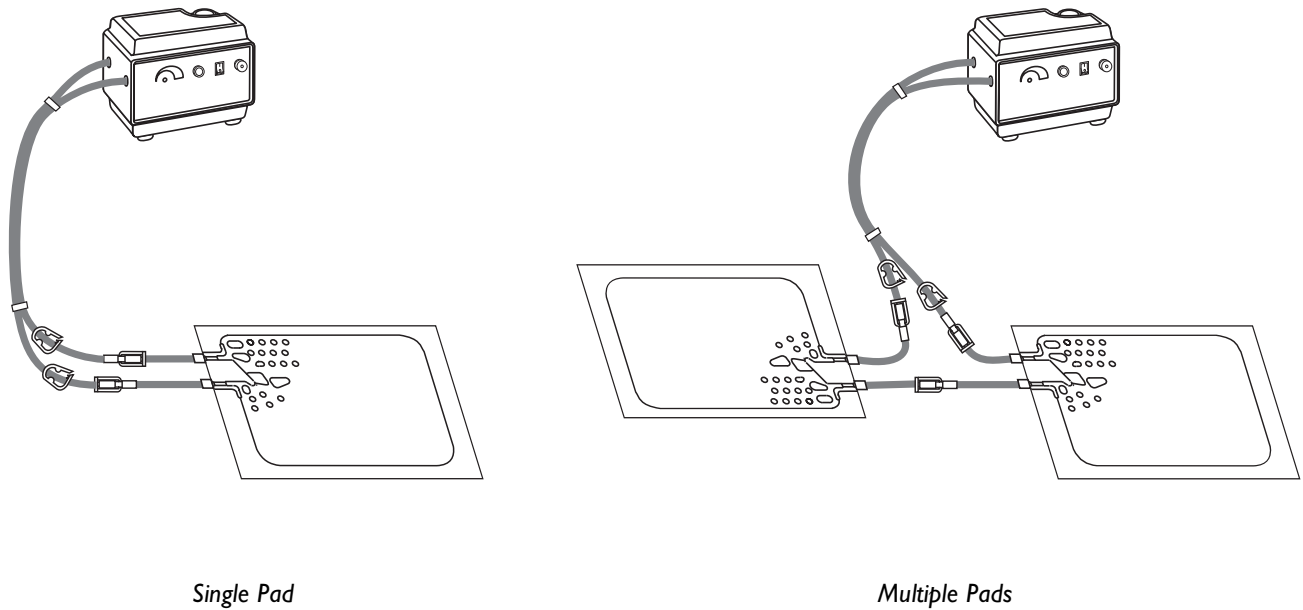


Figure 1 - T/Pump Heat Therapy System

Heat therapy is effective in the dilation of blood vessels, thereby increasing the blood flow to the heated area. Heat therapy has a variety of uses, the most common being treatment of aches and pains in joints and muscles.

The GAYMAR T/Pump® Heat Therapy System provides a means of applying heat therapy by supplying temperature controlled water through a connector hose to a Gaymar T/Pad®. The hose is terminated in easy-to-use Clik-Tite® connectors.

The T/Pad provides the interface for delivering the heat therapy. The unique button design allows water to flow and provides trouble-free operation when the pad is folded. This reduces the number of pads your facility must keep in inventory. The pads are applied to the part of the body requiring heat therapy, and the circulating water maintains the pad at the set point temperature. The temperature setpoint is key-operated to prevent tampering.

The T/Pads can be interconnected to provide therapy to more than one body site at a time.

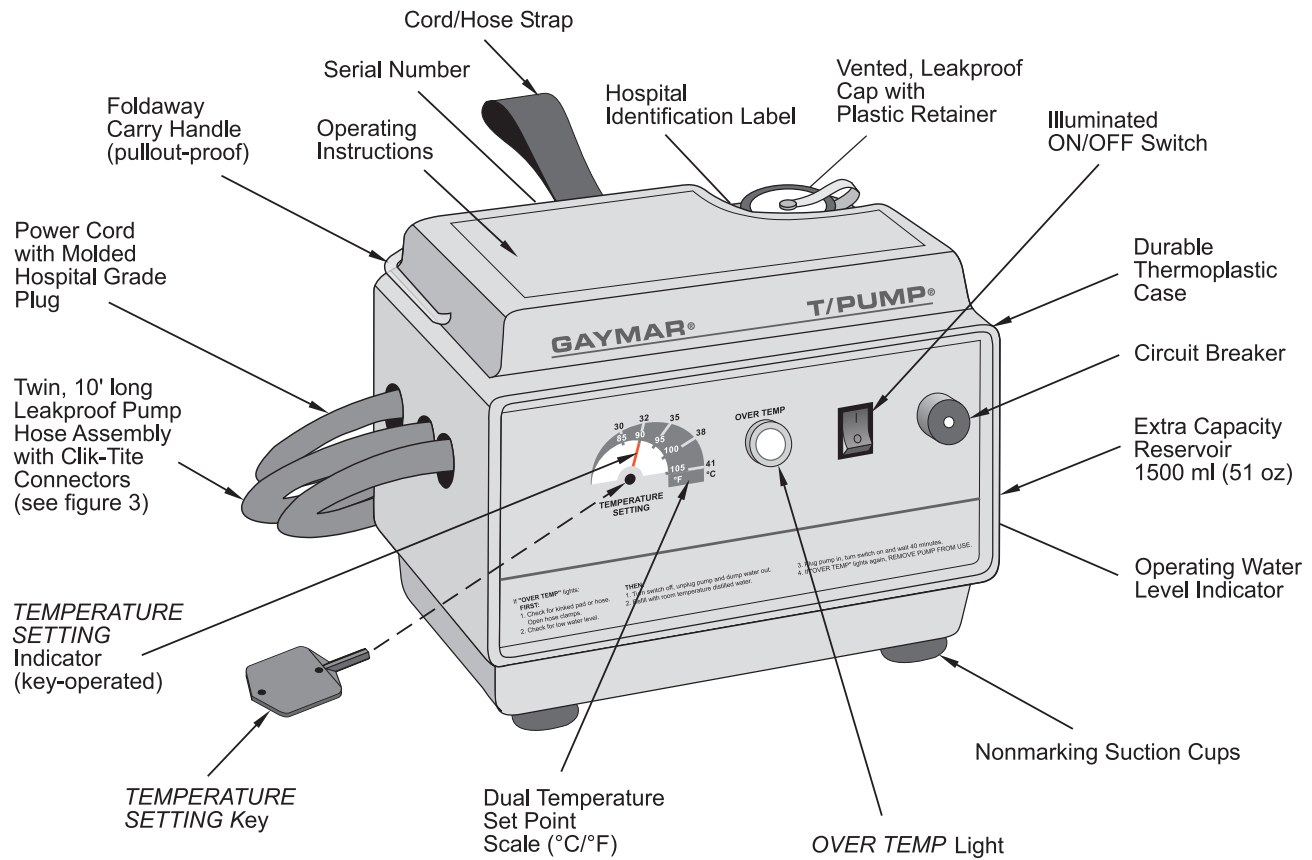


Figure 2 - T/Pump Features/Specifications

FEATURES

Attached Hose with Klik-Tite Connectors	10 ft (305 cm) dual channel. Connectors have male/female fittings (see fig. 3, p. 6) allowing pads to be interconnected, providing therapy to more than one body site at a time (fig. 1, p. 3).
Tip-over Switch	Turns heater off if pump is tipped. NOTE: This does not activate the <i>OVER TEMP</i> light.
Hospital ID Label	A label is provided on the back of the T/Pump for your convenience. Use a felt tip or ball point pen to add any required hospital identification.
<i>OVER TEMP</i> Light	Indicates the pump and heater have been turned off. This light is activated by the two <i>OVER TEMP</i> safety thermostats. Refer to the <i>TROUBLESHOOTING</i> section.
Circuit Breaker	When the circuit breaker trips, the small button in the center will extend 1/4", exposing a white band. Refer to the <i>TROUBLESHOOTING</i> section.
<i>OVER TEMP</i> Safety Thermostats	Either of two limit thermostats will shut off pump and heater if the high temperature limit is exceeded. The <i>OVER TEMP</i> light will glow. Refer to the <i>TROUBLESHOOTING</i> section.

SPECIFICATIONS

Size (approx.)	8- ¹ / ₈ " x 5- ⁵ / ₈ " x 6- ¹ / ₄ " (20.6 cm x 14.3 cm x 15.9 cm)		
Weight (empty)	5 lbs, 2 oz (2.3 kg)		
Reservoir capacity	51 oz (1500 ml) maximum		
Flow rate	9 gph (34 lph) minimum with pad attached		
Ambient operating temperatures	60°F to 90°F (15.6°C to 32.2°C)		
Storage temperatures (empty)	-30°F to 160°F (-34.4°C to 71.1°C)		
Temperature setpoint range	85°F to 105°F (29.4°C to 40.6°C)		
Average operating temperature accuracy	±2°F at 105°F setting		
Power cord	18 AWG, 3 conductor, 9 ft (274 cm), Type SJT with molded, hospital grade plug		
Circuit breaker	3 amperes		
1st backup limit thermostat (manifold mounted)	Bimetallic (trip point fixed) 108°F to 115°F (42.2°C to 46.1°C)		
2nd backup limit thermostat (well mounted)	Bimetallic (trip point fixed) 108°F to 122°F (42.2°C to 50°C)		
Current leakage	100 microamperes* maximum		
	* applies to all models except TP420, which is 200 microamperes maximum		
Ground resistance	0.5 ohm maximum		

Electrical requirements	<u>TP400*</u>	<u>TP401</u>	<u>TP420</u>
Voltage (VAC)	120	100	220
Frequency (Hz)	60	50/60	50/60
Current (amps)	1.8	2.0	1.0
Power req'd (watts)	200	200	200

* Tested to UL 544 and
 CSA C22.2, No. 125

CLIK-TITE® CONNECTORS:

To attach Clik-Tite connectors from hose to pad:

1. Insert male fittings into female fittings with a twisting motion (figs. 3A and 3B).
2. When fittings are fully inserted, snap locking ring into place (figs. 3C and 3D).
3. To disconnect, simply reverse the procedure.
4. To open or close the hose pinch clamps:
 - Open the clamp by pushing the serrated end (fig. 3E).
 - Close the clamp by pressing the clamp together (fig. 3F).

NOTE: Refer to figure 1 (p. 3) and item 9 (p. 7) when connecting multiple pads.

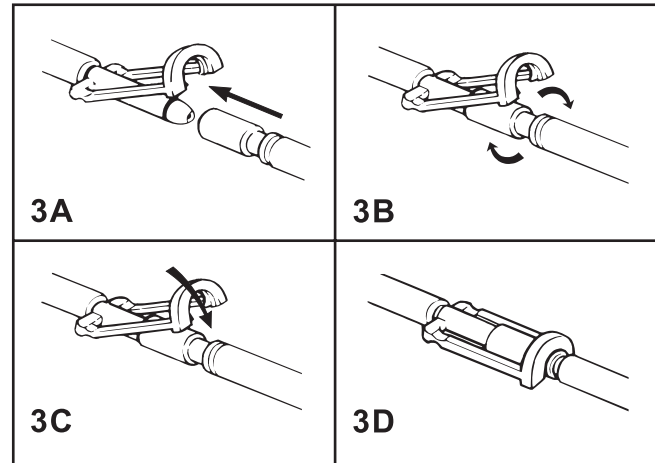


Figure 3A–3D—Clik-Tite® Connectors

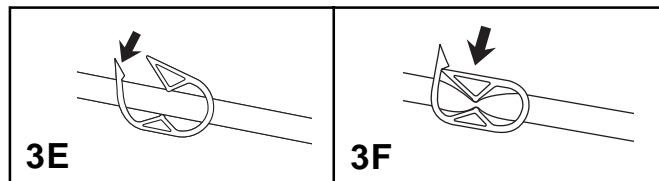


Figure 3E–3F—Hose Pinch Clamps

START-UP PROCEDURE

1. Before filling, always attach a T/Pad to the T/Pump connector hose. Unkink pad and hose. Open hose clamps.
2. Open the fill cap on top of the pump. Fill the pump with room temperature (i.e., not hot) **distilled water** to the operating level indicated on the side of the pump. **NOTE: Using tap water will decrease the life of the pump.**
3. Insert temperature setting key. Set temperature as prescribed by the physician. Remove key to prevent tampering.
4. Plug T/Pump into a properly grounded outlet.
5. Turn on the power switch. The selected water temperature will be reached in approximately 20 minutes.
6. If the water level drops below the operating level, add water. **Do not overfill. Overfilling can result in reduced pump motor life.**
7. Apply T/Pad to the patient. Follow T/Pad instructions.
8. For specified performance, keep the pump at or above the level of the pad.
9. If the pump is placed below the pad(s), water will drain into the pump when it is shut off. If the pump has been overfilled or if multiple pads are connected, excess water can leak out onto the floor or cause reduced motor life.

SHUTDOWN PROCEDURE

1. Turn off pump before disconnecting pad. Close hose clamps. To prevent water spillage, always disconnect pad from pump with connectors raised above the level of the pad and pump.
2. Connect the T/Pad Klik-Tite connectors together.
3. Connect the ends of the T/Pump connector hose together.

STORAGE AND CLEANING

Storage (Short term)

Disconnect pad. Connect ends of the connector hoses together. Open hose clamps. Leave water in the reservoir. To prevent hose kinks, coil the hose rather than folding it. Fasten the hose and cord with strap.

Storage (Long term)

Disconnect pad. Connect ends of the connector hose together. Open hose clamps. Add 1/4 ounce AirKem A-33, GAYMAR MTA33 germicidal or equivalent to water already in reservoir. Run for two (2) minutes. Drain pump. To prevent hose kinks, coil the hose rather than folding it. Fasten the hose and cord with strap and store pump.

Draining

Unplug the power cord. Disconnect the pad or hoses from one another, keeping hoses at or above the level of the T/Pump. Remove the fill cap and invert the T/Pump over a sink. When all fluid has drained from the hoses and reservoir, replace the fill cap and connect the hoses together.

Cleaning

Unplug the power cord.

To clean the external surfaces, use a non-abrasive cleaning solution (such as warm, soapy water) and a damp cloth.

To clean the fluid system, drain the pump. Fill the reservoir to the operating level indicated on the side of the pump. Add 1/4 ounce GAYMAR catalog MTA33 germicidal or equivalent. Set the temperature indicator to its lowest setting (fully counterclockwise). Start the T/Pump and circulate the solution for one hour. Drain the solution and refill the pump with distilled water. Using distilled water retards algae growth and mineral buildup.

Change the distilled water monthly or more often depending upon use.

Pads / Accessories

For best results use only GAYMAR T/Pads® or Mul•T•Pads®. The unique button design allows water to flow and provides trouble free operation when the pad is folded. This reduces the number of different sizes of pads your facility must keep in inventory. The T/Pads can be interconnected to provide therapy to more than one body site at a time (see fig. 1, p. 3). For a brochure listing the various T/Pads, contact the GAYMAR Customer Service Department (see inside cover for telephone numbers).

An optional bed bracket (model TP20A) is available to mount the T/Pump on the footboard of a bed.

WATER TEMPERATURE CONTROL

There are four devices that control the operation of the heater in the GAYMAR T/Pump:

- The temperature controller is thermistor actuated (fig. 4, item 1, p. 9). This controller is adjustable over a temperature range of 85°F to 105°F (29.4°C to 40.6°C). The desired water temperature is set with a special removable key (fig. 4, item 7). To prevent unauthorized temperature setting changes, remove the key after the temperature has been set.
- The manifold backup limit thermostat (fig. 4, item 9) is mounted on the brass manifold block (fig. 4, item 8). This thermostat senses water temperature flowing to the pad and will shut off the pump and heater and activate the *OVER TEMP* light if the water temperature exceeds specific limits. The purpose of the manifold backup limit thermostat is to prevent the pump from providing water at too high a temperature to the pad.
- The well backup limit thermostat (fig. 4, item 5) is mounted on the brass plate (fig. 4, item 11) that extends along and under the heater (fig. 4, item 4) near the bottom of the reservoir. This thermostat senses water temperature in the reservoir and will shut off the pump and heater and activate the *OVER TEMP* light if the reservoir temperature exceeds specific limits. The purpose of the well backup limit thermostat is to both prevent the pump from providing water at too high a temperature to the pad and to protect the pump from high temperature damage due to a low water level.
- The tip-over switch (fig. 4, item 2; see also fig. 11, item 64, p. 27) is mounted on the PC board. This mercury-type switch will shut off the heater if the pump is tipped more than 45° from the vertical position.

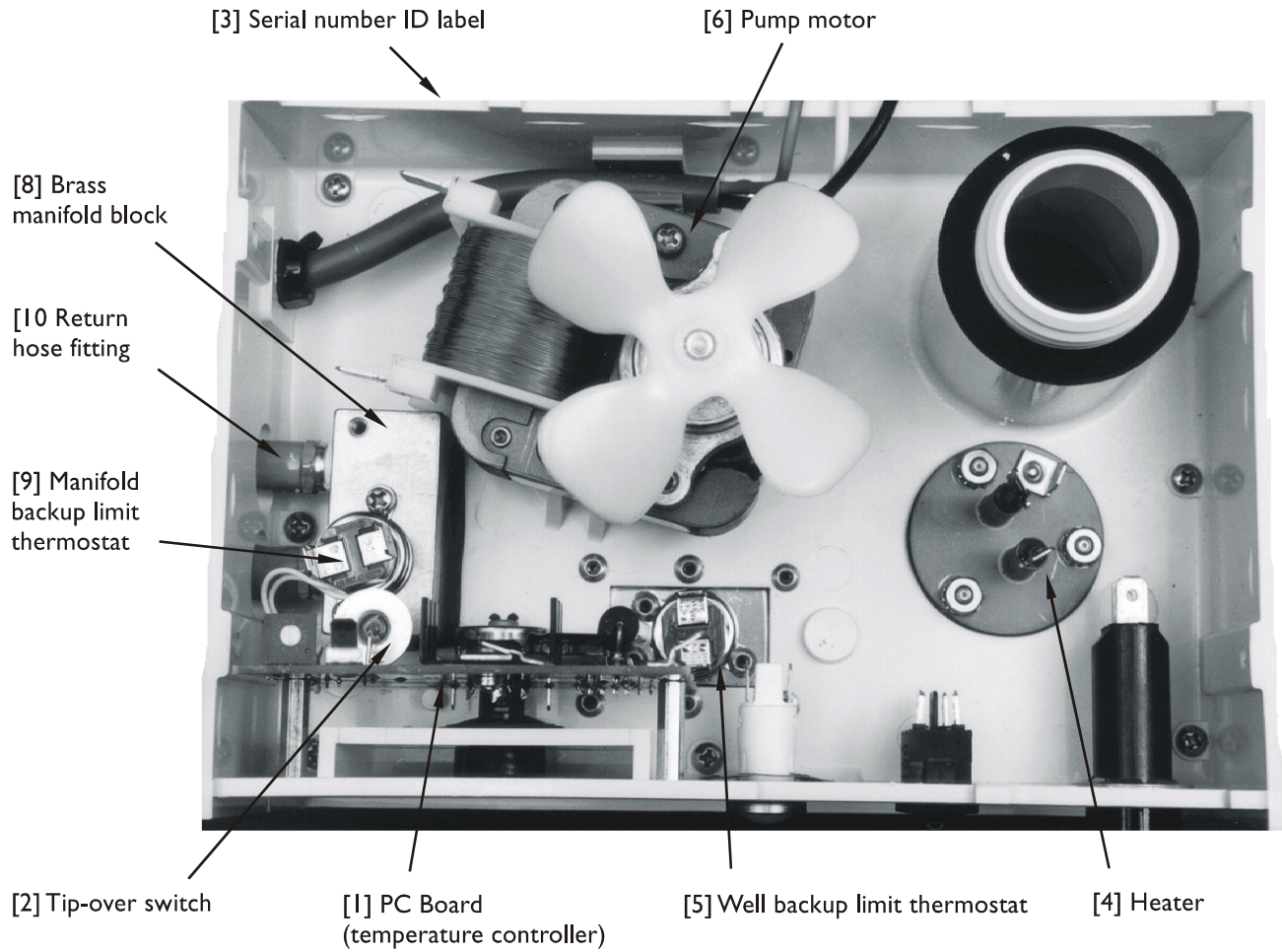
NOTE: The tip-over switch does not shut off the pump motor or activate the *OVER TEMP* light.

FLUID SYSTEM

The pump (fig. 4, item 12) is a sump configuration driven by an impedance protected, shaded pole AC motor (fig. 4, item 6).

The return hose fitting (fig. 4, item 10) is machined internally to act as an orifice. This maintains a back pressure in the pad to make it resistant to flow restrictions.

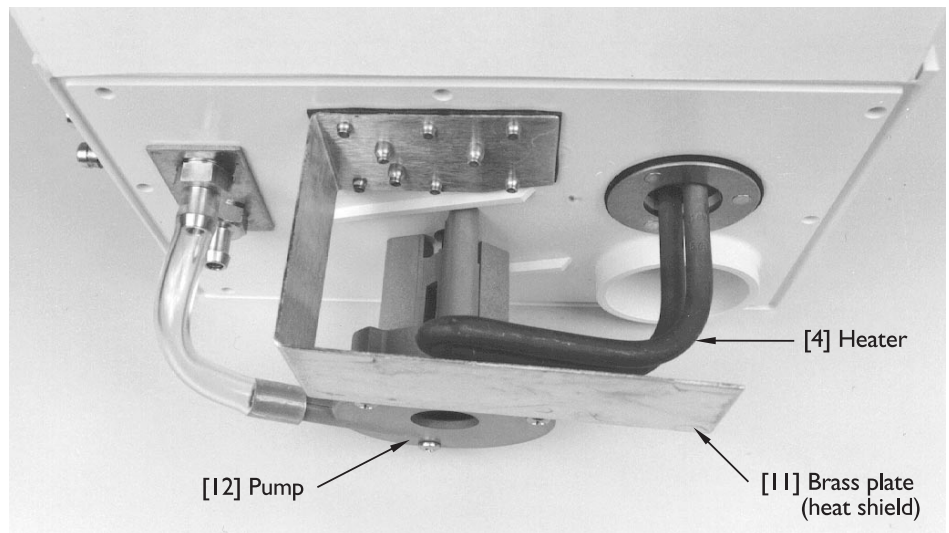
FIGURE 4 - TIPUMP COMPONENTS



TOP
(wire harness removed for clarity)



[7] Temperature setting key



BOTTOM

FUNCTIONAL CHECK & SAFETY INSPECTION

This section is designed to provide a complete check of all pump parameters. The order of tests should be followed so that the functional testing can be completed in the least possible time.

Follow the *FUNCTIONAL CHECK AND SAFETY INSPECTION* 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.

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 15). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

INTERVAL

To assure the optimum performance, dependability and safety, the following should be performed once per year (or as specified in the facility's preventive maintenance program) and after making repairs.

REQUIRED TOOLS

TPT9	-----	GAYMAR Flow and Temperature Tester
TFCI	-----	Thermometer, 30°F to 125°F (-2°C to 52°C), 1°C accuracy, 12" long, 3" immersion (e.g., Brooklyn Thermometer #73544 or equivalent, Brooklyn Thermometer Co., Farmingdale, NY 11735)
T/Pad	-----	Any GAYMAR "12" or "22" series T/Pad
TPCI	-----	GAYMAR T/Pump Test Cover
Ground Resistance Tester		
Current Leakage Meter		
Distilled Water	-----	2 liters (approximate)
Synthetic Oil	-----	Anderol #465 (GAYMAR P/N 77137-000)
<i>INSPECTION FORM</i>	-----	(p. 15)

**PHYSICAL CONDITION
CHECK**

1. 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.
2. Examine the plug on the line cord to be sure it is in good condition. If unit has non-molded type plug, open plug and check for wire breakage and loose terminal screw(s). If defective, replace with a hospital grade plug. Torque terminal screw(s) and outside housing screws to 12 in.-lbs.
3. Operate switches and control settings at all positions. Replace if defective.
4. Visually inspect pump. Check for cracked or damaged plastic parts. **Be sure unit is unplugged.** Remove retainer cap. Remove four (4) screws holding cover and remove cover. (Be sure not to lose fill neck gasket.) Perform visual inspection of all internal parts. Remove any accumulated dirt with a vacuum cleaner or compressed air hose. Leave cover off for balance of inspection.
5. Check Klik-Tite connectors for cracks or missing O rings. Replace connectors if necessary.

MOTOR LUBRICATION

1. Locate the motor manufacturer's ID on the top bearing housing. If the pump motor is by Jakel, no oiling is required. If the pump motor is by Uppco, proceed with the following oiling instructions.
2. Oil the pump motor every 6 months with Anderol #465 (GAYMAR P/N 77137-000) or equivalent to extend the life of the T/Pump motor. Anderol #465 is a synthetic oil. Do not use a petroleum-based oil since it will leave a residue as it breaks down, causing the motor to seize. Add four (4) drops of oil to the vent hole in the bearing housing of the motor located below the fan. Using a micro oiler, apply a similar amount to the lower bearing at the location indicated in figure 5.

NOTE: Early versions of the pump motor have an oiler tube which does not effectively distribute oil to the lower bearing. Do not use the oiler tube to apply oil to the lower bearing. Use a micro oiler to apply oil directly to the locations shown in figure 5.

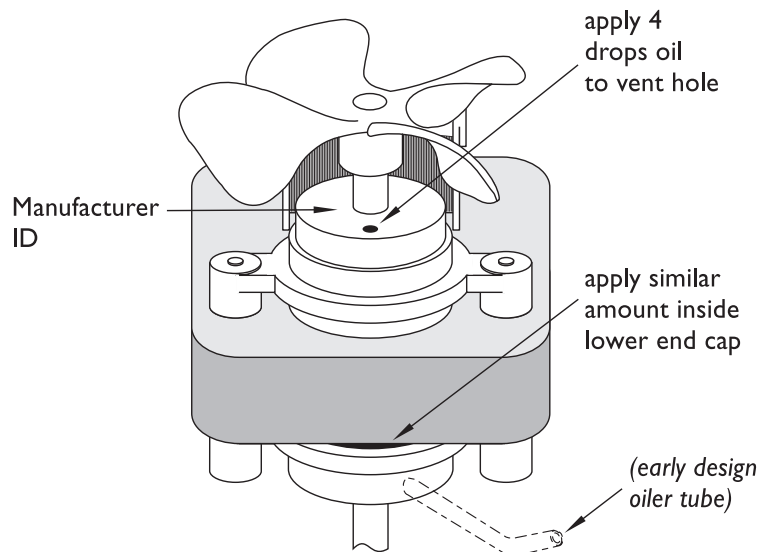


Figure 5 - PUMP MOTOR

TPCI TEST COVER INSTALLATION

1. When connecting the test cover, do not remove any wiring connections in the T/Pump. Simply clip the test cover alligator clips onto terminals with the same color wire.
2. Connect TPCI test cover (see fig. 6A/6B, p. 22 and 9A/9B, p. 25). Always match the color of TPCI wiring connections to the color of T/Pump wiring. Be sure to keep wires away from fan. Install test cover. Be sure to push cover on tightly. It is not necessary to install screws.
3. Connect pump with test cover, pad and TPT9 flow/temp tester (see fig. 7, p. 23). Be sure the TPT9 is connected to the supply side of the T/Pump, before the pad.
4. Fill unit with room temperature distilled water and replace fill cap. Connect any "12" or "22" series T/Pad. Place pad on an insulating material (e.g., cloth or towel).
5. Set both test cover switches to the *OPEN* position.

GROUND RESISTANCE CHECK

▲ DANGER

Risk of electric shock. Be sure unit is unplugged when performing ground resistance test.

1. Use a ground resistance meter to measure the resistance between the ground pin on the plug and the brass manifold block (fig. 10, item 47). Contact is available through the hole where the hoses connect to the pump. This value should not be more than 0.5 ohm.

CURRENT LEAKAGE CHECK

It will be convenient to check current leakage at this point since the unit is full and connected to a pad.

1. Measure the maximum current leakage in all combinations of heater "ON" or "OFF" and power switch "ON" or "OFF." Access to chassis ground for current leakage testing is available through the hole where the hose connects to the pump. The highest reading is typically less than 30 microamperes (60 μ A for the TP420). The maximum allowable reading is 100 microamperes (200 μ A for TP420). Record the highest reading.
2. Disconnect leakage meter setup.

TIP-OVER SWITCH CHECK

1. Check the tip-over switch at this point, since the test cover is on and the unit is full. Set temperature to maximum (105°F) on dial. The heater indicator (fig. 6, p. 22) will be on. Tip the unit approximately 45°. If the heater indicator goes out, the tip-over switch is operating. If not, repair or replace the PC board (p. 17). Record results.

FLOW RATE TEST

1. Be sure the pad is flat and warm (approximately 105°F) and at the same level as the pump. Top of TPT9 float (see fig. 7, p. 23) should read at least 9 gph. Record reading.

NOTE: If flow is below 9 gph, refer to *TROUBLESHOOTING* section (p. 21).

**OPERATING
TEMPERATURE TEST**

1. Make sure temperature is set to maximum (105°F) on dial. Allow unit to come to a steady temperature, approximately thirty (30) minutes.
2. To ensure accurate temperature readings, add a small amount of water to TPT9 well. Insert thermometer in TPT9 well.
3. Take readings every thirty (30) seconds for five (5) minutes for a total of ten (10) readings. The average of these readings should be 105°F ±2°F. Record the average value. If the unit is out of calibration, refer to *CALIBRATION* section (p. 19).
4. **Do not let the pump cool down.** Proceed directly to *Backup Limit Thermostat Test*.

**BACKUP LIMIT
THERMOSTAT TEST**

1. With the pump operating properly at 105°F ±2°F, move the primary shorting switch to the *SHORT* position (see fig. 6A/6B, p. 22). This will short out the temperature controller and allow the pump to continue heating to the trip point of the backup limit thermostat(s).
2. Carefully observe the rising temperature and record the highest reading. When a thermostat opens, the pump will turn off, the *OVER TEMP* light will be lit, and the *HEATER INDICATOR* light on the test cover will turn off. (If the *OVER TEMP* light does not light and a thermostat has tripped, replace the light.) Either the *MANIFOLD* or *WELL* light on the test cover will be lit or both lights will be off, depending on which thermostats have tripped.
 - If the manifold thermostat light is on, then the manifold thermostat has opened. The temperature recorded must be between 108°F to 115°F (42.2°C to 46.1°C). **If the thermostat operates outside its intended range, it must be replaced (see page 18).** Proceed to step 3.
 - If the well thermostat light is on, then the well thermostat has opened. The temperature recorded must be between 108°F to 122°F (42.2°C to 50°C). **If the thermostat operates outside its intended range, it must be replaced (see page 18).** Proceed to step 3.
 - If neither light is on, then both thermostats have opened at the same temperature. To confirm this, toggle the thermostat shorting switch to the *MANIFOLD* position. (The *MANIFOLD* light should be on.) Next, toggle switch to the *WELL* position. (The *WELL* light should be on.) **If either thermostat opens outside its intended range as defined above, it must be replaced (see page 18).** Proceed to step 4.

3. To test the remaining thermostat, toggle the limit thermostat shorting switch to the position corresponding to the non-tripped thermostat. (This will short out the previously opened thermostat and allow the unit to continue heating.) Both thermostat indicator lights should be off and the *HEATER INDICATOR* light should be on. Carefully observe the rising temperature and record the highest reading. When the water temperature rises to the trip point of the remaining thermostat, the *OVER TEMP* light will be on, the pump will turn off, the heater indicator light will turn off, and the appropriate thermostat light will be on.
 - If the manifold thermostat light is on, then the manifold thermostat has opened. The temperature recorded must be between 108°F to 115°F (42.2°C to 46.1°C). **If the thermostat operates outside its intended range, it must be replaced (see page 18).**
 - If the well thermostat light is on, then the well thermostat has opened. The temperature recorded must be between 108°F to 122°F (42.2°C to 50°C). **If the thermostat operates outside its intended range, it must be replaced (see page 18).**
4. Unplug the unit, remove the test cover and proceed to *LEAK TEST*.

LEAK TEST

1. Immediately upon completion of Backup Limit Thermostat Test, reinstall fill cap tightly. Put your finger over the hole in the cap and tilt unit toward you so the front is down. Hold for three (3) minutes.
2. Return the unit to upright position and carefully check inside of tray and reservoir tray joint for leaks. Repeat process turning pump on back face. If leakage is found, refer to the *DISASSEMBLY/REASSEMBLY* section (pp. 16-18), and correct problem.

COVER AND FILL NECK GASKET REINSTALLATION

When reinstalling cover, be sure the fill neck gasket (fig. 10, item 6, p. 26) is in place. Push cover down as tightly as possible. Hold in place when tightening cover screws.

This completes the *FUNCTIONAL CHECK* procedure. Return pump to service if it is operating properly, or proceed to the *DISASSEMBLY/REASSEMBLY* section pertaining to the problem(s).

Inspection forms vary from hospital to hospital. The following sample form is intended as a guide so that the important parameters are recorded.

T/Pump Functional Check and Safety Inspection Form				
			Date _____	
Model Number _____		Serial Number _____		
Item	Value	OK?	Action Needed?	Action Taken
		(check one)		
1.	Inspect physical condition (line cord, plug, housing)			
	Inspect electrical compartment (switches, fuse/circuit breaker)			
	Inspect hose connections, Klik-Tite connectors			
2. Lubricate motor				
3. Connect TPCI test cover; match wire colors of connections				
4. Measure ground resistance; <0.5 ohm . . . indicate value				
5. Measure current leakage; <100 μ A* . . . indicate value (* for model TP420, <200 μ A)				
6. Check tip-over switch				
7. Measure flow; > 9 gph (34 lph) . . . indicate value				
8. Measure operating temperature @ 105°F \pm 2°F . . . indicate average				
9.	Record manifold backup limit thermostat trip point; 108°F to 115°F (42.2°C to 46.1°C) . . . indicate value			
	Record well backup limit thermostat trip point; 108°F to 122°F (42.2°C to 50°C) . . . indicate value			
	OVER TEMP light operates			
10. Check for leakage				
11. Reinstall cover and the fill neck gasket				
Signature _____				

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 10-14) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 15). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

NOTE:

All wires are terminated with slip-on connectors. When text says “remove wire,” the slip-on connector is to be removed from the mating lug on the specific item.

COVER

1. Unscrew fill cap/valve assembly (fig. 10, item 1, p. 26) and remove. Unscrew plastic retainer.
2. Remove the four screws which retain the cover, two on each end of the pump.

NOTE: When reinstalling the cover, do not forget to replace the fill neck gasket (fig. 10, item 6).

MOTOR

1. Place a screwdriver under fan hub (fig. 10, item 7, p. 26) and twist to remove fan.
NOTE: When replacing the fan, make sure the hub is flush with top of motor shaft.
2. Remove green ground wire and orange and blue power wires.
NOTE: To prevent breaking the motor lugs, support them when removing the slip-on lugs.
3. Remove the four retaining screws and washers on the top face of the motor.

4. It is necessary to remove the reservoir to remove the motor. Remove the eight (8) screws located around the inside wall of the tray.
NOTE: It is not necessary to remove the front label (fig. 10, item 37). The front label is attached only to the tray and will slip off the reservoir.
5. Gently separate the reservoir from the tray. Do not damage the large O ring that seals the tray and reservoir.
6. Turn the tray on its backside (front label up). Place a screwdriver against the white impeller in the bottom of the pump housing to prevent the impeller from turning and remove the screw retaining the impeller. It is not necessary to remove the bottom housing (fig. 10, item 24) of the pump.
7. The impeller may now be slipped off the shaft. Return the tray assembly to an upright position. The motor may be removed by lifting straight up.
8. Center the new motor seal gasket over opening and insert new motor through seal. Replace impeller onto shaft and secure motor.
9. Do not overtorque the four (4) motor mounting screws. Torque value is 6 to 8 in.-lbs.
10. If tray inserts are loose or motor mounts are worn, a new tray with sensor bracket should be installed.

HEATER

1. Remove the ground wire (green) and the two (2) heater wires (red and blue). NOTE: On reassembly, the red wire goes on to the front post of the heater.
2. Remove the three (3) nuts retaining the heater. The screws are retained in the tray. The heater can then be removed by raising and tilting the top of the heater toward the left side of the T/Pump.
3. Reassembly is the reverse of the above.
4. Do not forget to install heater gasket (fig. 10, item 11, p. 26).

PC BOARD

1. Using the plastic key (fig. 4, item 7, p. 9), turn the temperature indicator to the eleven o'clock position. The slotted coupling should then be positioned with the slot opening up.
2. Cut the plastic tie holding the wire bundle to the PC board. Remove the red, orange, and blue wires from the PC board.
3. Remove the two screws (fig. 10, items 56 & 57, p. 26) retaining the PC board. The board can then be raised from the tray, exposing the thermistor probe assembly in the brass manifold block (fig. 10, item 47). Use caution to be sure no strain is put on thermistor leads (fine white wires).
4. Carefully remove the thermistor capsule from the manifold. To avoid damaging the thermistor, do not pull on the wires. A dental pick or scribe can be used to pry the capsule out of the hole.

**MANIFOLD BACKUP
LIMIT THERMOSTAT**

5. On reassembly, put a small quantity of silicone heat sink compound (Dow Corning #340 or equivalent) around the thermistor capsule. Carefully insert the thermistor capsule into the hole on the brass manifold block. To avoid damaging the thermistor, do not push on the wires. The capsule may be seated by placing needle nose pliers or tweezers on the edge of the capsule.
6. The remainder of the reassembly is the reverse of the above. Upon inserting the P. C. Board, the potentiometer shaft (fig. 10, item 52, p. 26) must be in the vertical position to mate with the slot in the temperature indicator (fig. 10, item 40). Refer to *CALIBRATION* procedures (pp. 19-20).

1. Remove the two (2) wire lugs. Note the position of the color coded wires. Facing the front of the T/Pump, the purple wire goes on the left hand lug, and the orange wire goes on the right hand lug.
2. Remove the two (2) screws retaining the thermostat to the brass manifold block.
3. Reassembly is the reverse of the above.
4. Always be sure to check the backup limit thermostats according to the *FUNCTIONAL CHECK* (pp. 13-14).

**WELL BACKUP
LIMIT THERMOSTAT****NOTE:**

Do not attempt to replace the well thermostat. To insure proper operation of this thermostat, it is riveted and sealed to the tray assembly. Experience has proven that it cannot be successfully replaced. **If this item is defective, replace the entire tray assembly (fig. 10, item 17, p. 26).**

TRAY

1. Remove the eight (8) screws (fig. 10, item 15, p. 26) around the inside wall of the tray. Gently pry the reservoir from the tray.
2. Remove all components including seal, bushing, and clips from the old tray and reinstall into the new tray assembly.
3. Attach the reservoir to the tray. Check that the reservoir ring seal (fig. 10, item 19) is properly located in the groove in the tray. Install the eight (8) screws torqued to approximately 6 in.-lbs.
4. Always be sure to check the backup limit thermostats according to the *FUNCTIONAL CHECK* (pp. 13-14).

CALIBRATION
EQUIPMENT

CALIBRATION

⚠ DANGER

Risk of electric shock. Disconnect power before servicing the T/Pump.

⚠ WARNING

- Only qualified medical service personnel should repair the T/Pump. **Improper repair may result in death or serious injury, equipment damage, or malfunction.**
- Always perform the *FUNCTIONAL CHECK AND SAFETY INSPECTION* (pp. 10-14) after making repairs and before returning the T/Pump to patient use. Document your findings on the *INSPECTION FORM* (p. 15). **Improper repair may result in death or serious injury, equipment damage, or malfunction.**

⚠ CAUTION

Do not perform any powered tests with the reservoir empty. **Damage to the T/Pump may result.**

- TPT9 ----- GAYMAR Flow and Temperature Tester
TPCI ----- GAYMAR T/Pump Test Cover
TFCI ----- Thermometer, 30°F to 125°F (-2°C to 52°C),
1°C accuracy, 12" long, 3" immersion (e.g.,
Brooklyn Thermometer #73544 or
equivalent)
T/Pad ----- Any GAYMAR "12" or "22" series
Insulated alignment tool

The calibration should be performed in a temperature controlled room, between 70°F and 75°F.

1. Remove the pump cover by removing the two (2) screws at each end of the pump. The fill cap/valve assembly can be removed by unscrewing the cap and plastic retainer. The cover is now free to be removed.
2. Carefully remove the blue torque seal from the R3 trim pot (fig. 11, item 63, p. 27), located at the top right corner of the printed circuit board.
3. Install test cover. See *FUNCTIONAL CHECK* (p. 11) and figures 6A/6B.
4. Connect pump, pad, and TPT9 Flow and Temperature Tester according to figure 7, page 23.
5. Fill pump with room temperature distilled water.

6. Set Temp Dial to 105°F (maximum).

NOTE:

Be sure the temperature dial is always set to the maximum clockwise position when making calibration measurements and adjustments.

7. The primary shorting switch (fig. 6A/6B, p. 22) on the test cover must be in the *OPEN* position. The backup limit thermostat shorting switch (fig. 6A/6B) must be in the *OPEN* position.
8. Turn unit on and allow to come to a steady temperature, approximately thirty (30) minutes.

The *HEATER INDICATOR* on the cover should be on whenever the heater is on.

NOTE:

Flow must be 9 gph, minimum.
If not, refer to *TROUBLESHOOTING* (p. 21).

9. Start recording the temperature readings every thirty (30) seconds for five (5) minutes for a total of ten (10) readings. The average of these readings should be 105°F ±2°F. If not, it will be necessary to adjust the R3 trim pot (fig. 6A/6B, p. 22). This is accomplished by inserting an insulated alignment tool through the small hole in the left side of the TPCI test cover. Turn the potentiometer screw clockwise to increase the water temperature. Turn the screw counterclockwise to decrease the water temperature.

Do not force the adjusting screw past its stops.

10. After the final adjustment is made, let the unit run for one-half hour and recheck the calibration as described in step 9. The bandwidth should not exceed 2°F. Bandwidth is the difference between the maximum and minimum temperature excursions. If the *OVER TEMP* light is activated during the calibration adjustment, the water must be replaced with water 75°F or less and the calibration procedure repeated.
11. Without letting the pump cool, proceed directly to the Backup Limit Thermostat Test as outlined in the *FUNCTIONAL CHECK* (p. 13). Record all results when recalibrating.

Apply blue torque seal after the trim pot has been adjusted properly.

PROBLEM	POSSIBLE CAUSE	REMEDY
"OVER TEMP" light is on.	1. Pad or hose is kinked. Hose clamps are closed.	Turn switch off, unplug pump, and dump water out. Unkink pad and/or hose. Open hose clamps. Refill with room temperature distilled water to proper level. Plug pump in, turn switch on, and wait 40 minutes.
	2. Water level is low, or reservoir is empty.	
	3. Pump is filled with water that is too hot (it must be below 75°F).	
	4. One of the backup limit thermostats has failed.	Unplug pump and install a test cover. Determine which thermostat has failed. Refer to Backup Limit Thermostat Tests (p. 13). Replace thermostat (p. 18).
	5. PC board (temperature controller) has failed.	Unplug pump, install test cover, and perform Calibration (pp. 19-20). Replace PC board as required (pp. 17-18).
T/Pump will not pump. ON/OFF switch pilot light is lit.	1. Water level is low, or reservoir is empty.	Refill with room temperature distilled water to proper level.
	2. "OVER TEMP" light is on.	Refer to "OVER TEMP" section above.
T/Pump will not pump. ON/OFF switch pilot light does not light.	1. The "ON" switch may not be fully engaged.	The light on the switch should be lit. Verify that the switch is fully engaged in the "ON" position.
	2. The electrical cord is not plugged into a grounded electrical receptacle.	Insert the plug fully into the receptacle.
	3. Check circuit breaker. If center button has moved forward exposing white band, breaker has tripped.	Unplug T/Pump. Determine cause. Reset breaker.
	4. Damaged cord or plug, or break in continuity between cord and breaker.	Check plug terminals. Check power cord continuity to breaker. NOTE: Flex cord while checking continuity. Replace power cord assembly as required.
T/Pump pumps OK, but will not heat.	1. Unit is tipped.	Place unit on level surface.
	2. Heater is not receiving power, or is defective.	Check if setpoint has been set too low. Remove cover and check power to heater. If power is present, heater is probably defective. Cold heater resistance is approximately 80 ohms. Replace if required. If there is no power at heater terminals, replace PC board.
	3. "OVER TEMP" light is on.	Refer to "OVER TEMP" section above.
T/Pump pumps OK, but ON/OFF switch pilot light does not light.	1. ON/OFF switch defective.	Replace ON/OFF switch. NOTE: Neon pilot light is not replaceable.
Flow rate is less than 9 gph.	1. Flow path is restricted or obstructed.	Be sure pump is at same level as pad, pad is flat, and water temperature is 105°F. (Flow is specified under these conditions.) Look for obstructions in the flow path. Open hose clamps. The orifice in the return hose fitting (fig. 4, item 10, p. 9) is the smallest hole.
	2. Motor is malfunctioning.	See #1 above. If flow path is clear, replace motor.
Current leakage is too high.	1. Heater will be the most probable cause.	Disconnect heater and check again. Replace heater if necessary. If current leakage remains high, continue disconnecting components until fault is located.
Resistance to ground failure (greater than 0.5 ohm)	1. Cord or plug connection(s) will be most probable cause.	Check that connections are tight (applies to older style [non-molded type] plugs). Disconnect power lead at circuit breaker and switch. Measure resistance of power cord alone. Replace if necessary. If problem persists, check grounding wire to each component for continuity.
Water leaks from Klik-Tite connector.	The T/Pump must always be connected to a T/Pad or the hose ends must be joined together to prevent water flow leakage. If the connector leaks, check for:	
	1. Damaged O ring.	If defective, replace Klik-Tite connector.
	2. Locking ring on Klik-Tite connector is not snapped into place (see fig. 3, p. 6).	Snap Klik-Tite locking ring shut.

Figure 6A - 'NEW' STYLE TPC1 TEST COVER

⚠ CAUTION

Route TPCI wires as shown to avoid interference with T/Pump fan motor.

NOTE:

Always match color of TPCI wiring connections to color of T/Pump wiring.

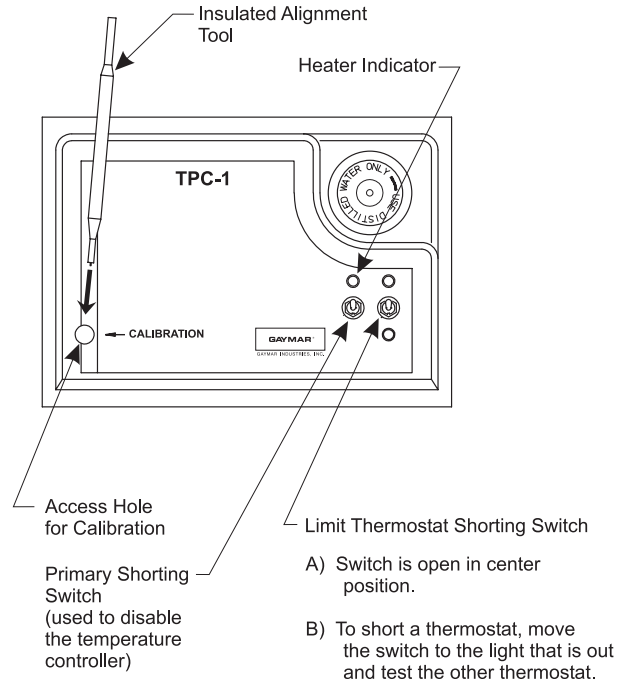
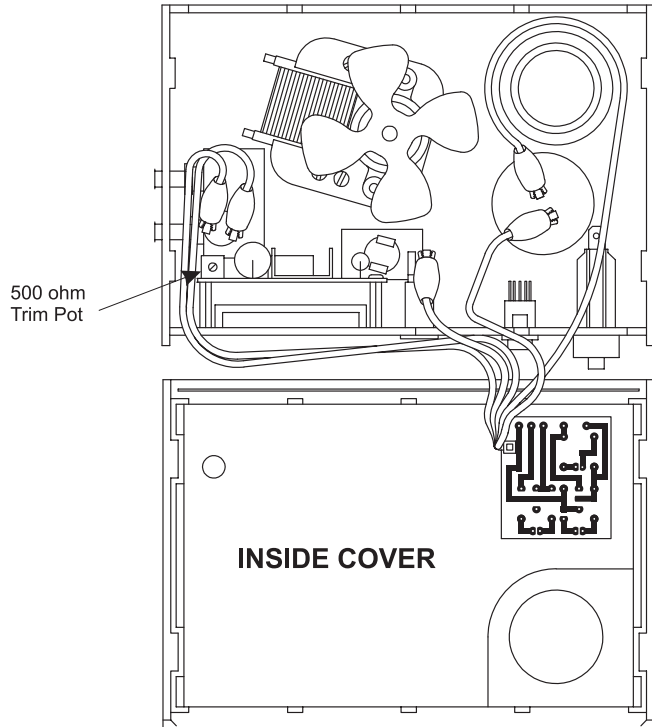


Figure 6B - 'OLD' STYLE TPC1 TEST COVER

NOTE:

Always match color of TPCI wiring connections to color of T/Pump wiring.

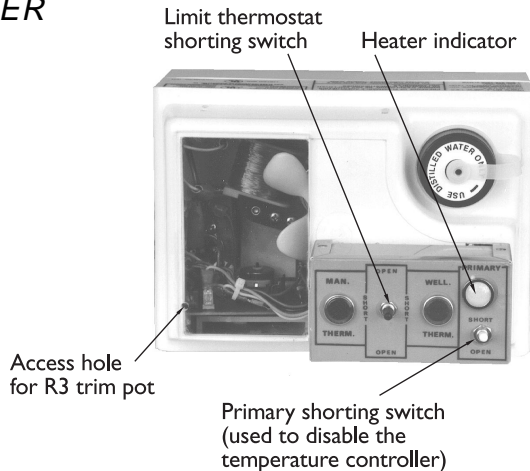
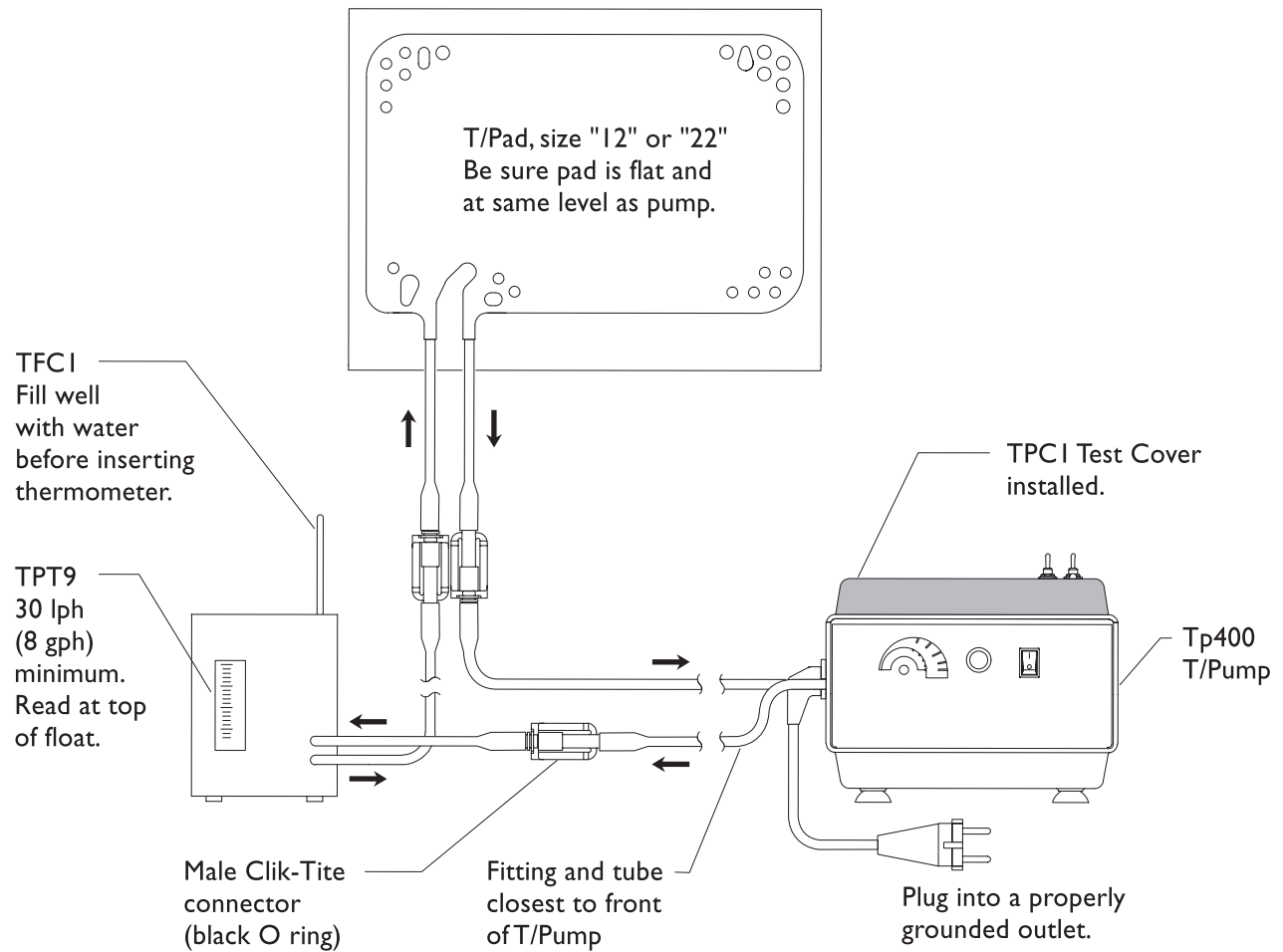


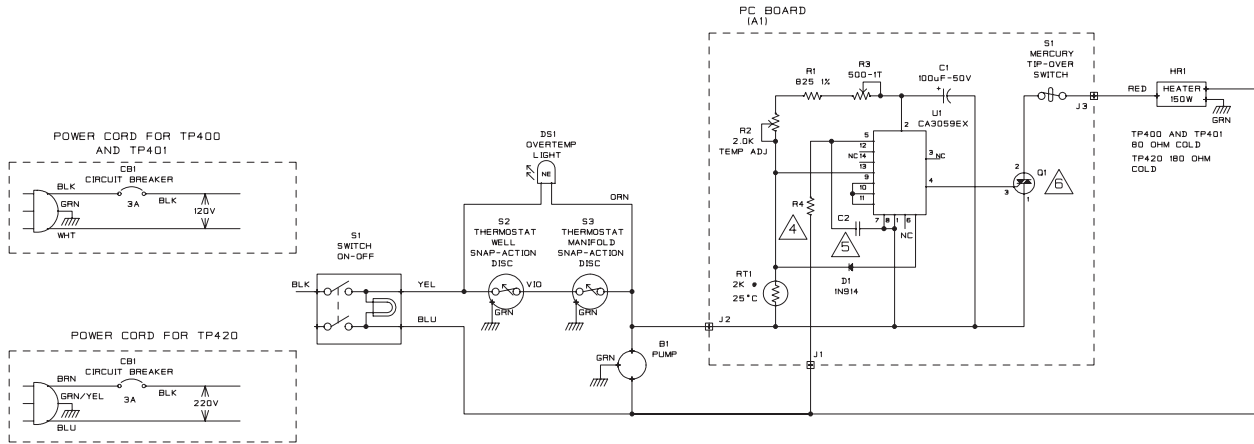
Figure 7 - FUNCTIONAL CHECK TEST DIAGRAM



NOTE:
If the flow meter is connected in
reverse, no flow will be noted
on the flow meter. Change the
pump connections so that the
male fitting (with black O ring)
is on the supply side.

Figure 8 - CIRCUIT DIAGRAM FOR TP400, TP401, & TP420

NOTE: Diagram is the same for TP400 and TP401; differences for TP420 are noted.



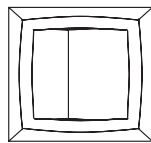
NOTES:

1. ALL RESISTANCES ARE IN OHMS.
2. ALL RESISTORS ARE 5% CARBON UNLESS NOTED.
3. ALL CAPACITORS ARE IN MICROFARADS UNLESS NOTED.
4. TP400 AND TP401 USES 8.2K-5W. TP420 USES 18K-5W.
5. NOT USED ON TP400 AND TP401. TP420 USES .1uF-250V.
6. TP400 AND TP401 USES 2N6347A OR EQUIVALENT. TP420 USES CR6CM-12.
7. REFERENCE: THIS DRAWING CORRELATES TO GAYMAR DRAWING (C)108102 REVISION: C.
8. CAUTION: THE ACTUAL ASSEMBLIES ARE SUSCEPTIBLE TO DAMAGE FROM ELECTROSTATIC DISCHARGE. HANDLING OF THIS PRODUCT SHALL BE ACCOMPLISHED ONLY WITH ADEQUATE PROVISION TO PREVENT ELECTROSTATIC DISCHARGE DAMAGE.

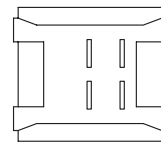


Switch wiring:

Larger switch



FRONT VIEW

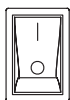


REAR VIEW

(220V—BRN FROM POWER CORD/POWER ENTRY MODULE)

(220V—BLU FROM POWER CORD/POWER ENTRY MODULE)

Smaller switch



FRONT VIEW

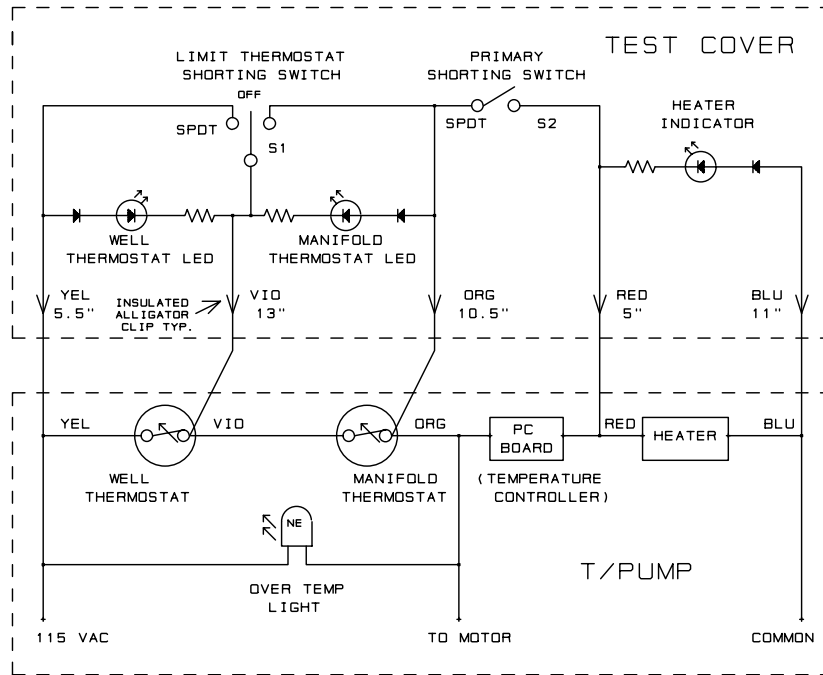


REAR VIEW

(220V—BRN FROM POWER CORD/POWER ENTRY MODULE)

(220V—BLU FROM POWER CORD/POWER ENTRY MODULE)

*Figure 9A - CIRCUIT DIAGRAM FOR 'NEW' TPC1 TEST COVER
(P/N 06520-000; to connect, refer to figure 6A)*



*Figure 9B - CIRCUIT DIAGRAM FOR 'OLD' TPC1 TEST COVER
(P/N 77083-000; to connect, refer to figure 6B)*

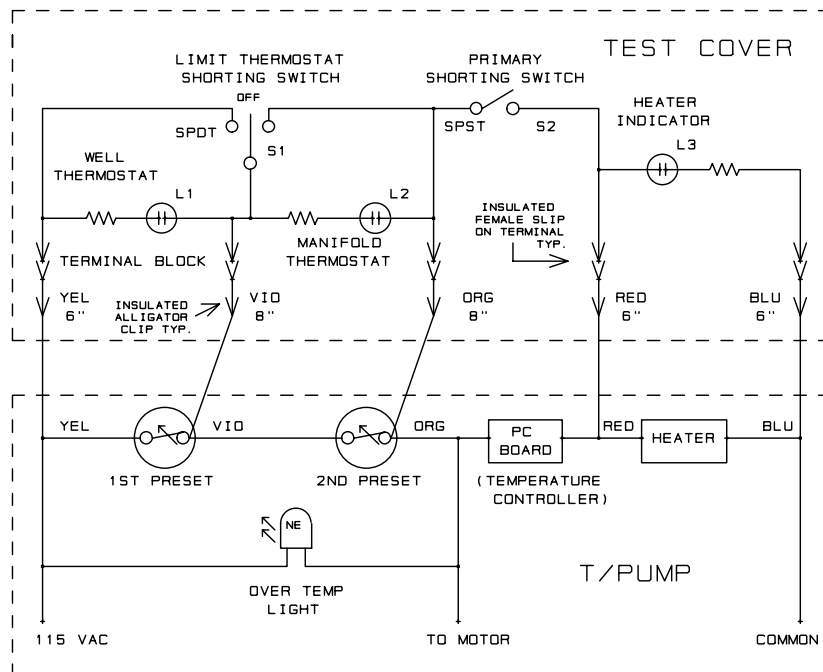


Figure 10 - EXPLODED VIEW

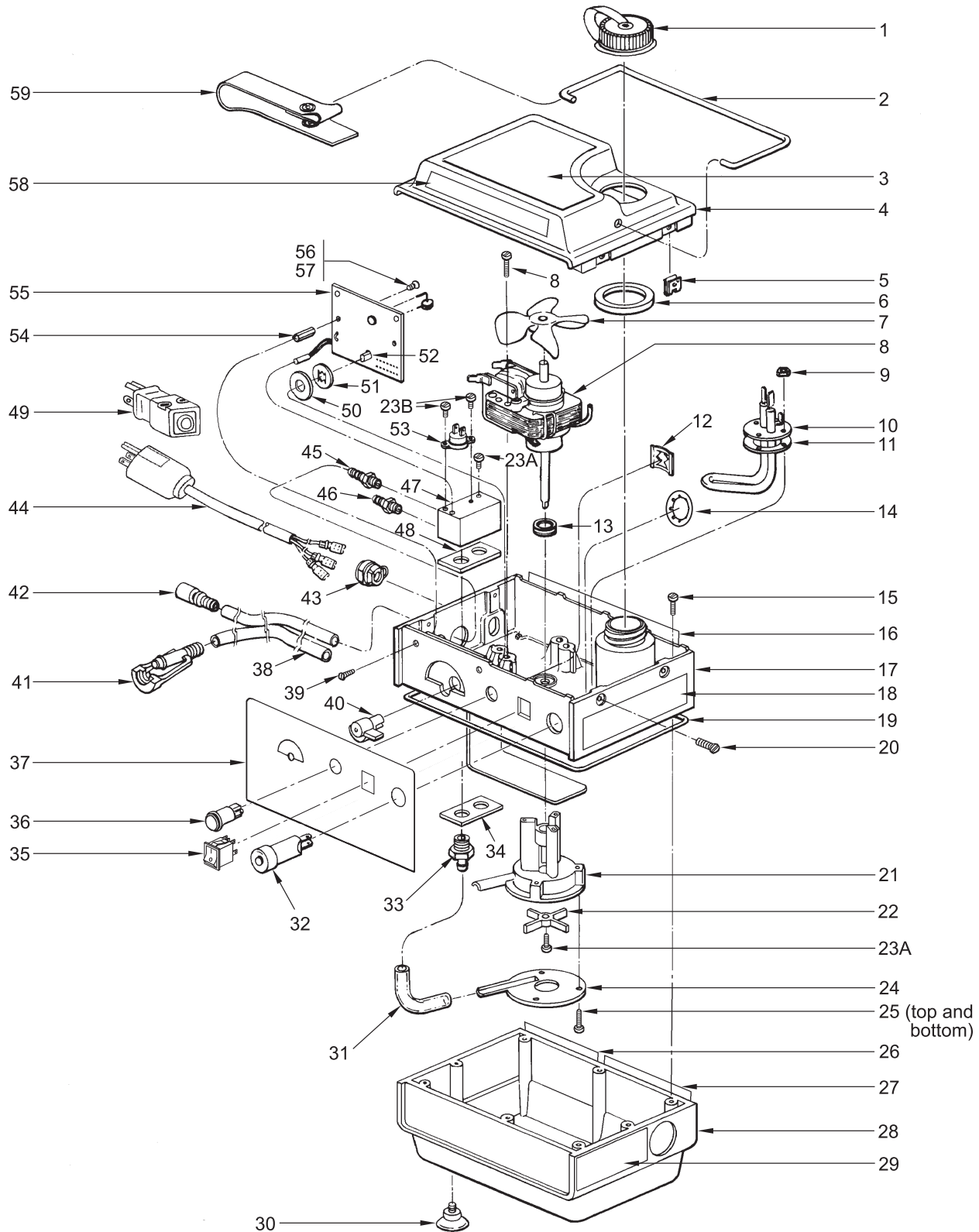
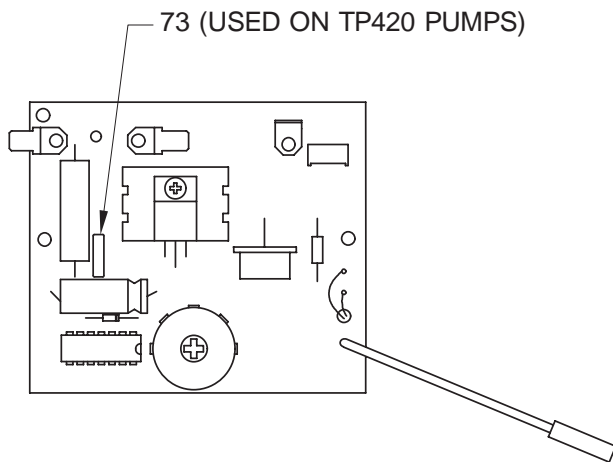
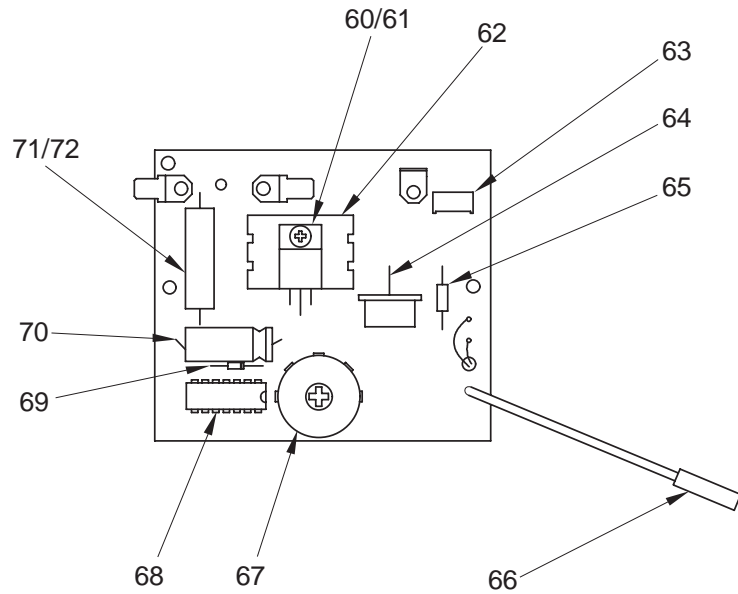


Figure 11 - PC BOARD



REPLACEMENT PARTS

SERVICE MANUAL TIPUMP (TP400 Series)

Item	P/N	Qty	Description	TP400	TP401	TP420
1	04553-001	1	Cap/Valve Assembly	X		X
	04553-002	1	Cap/Valve Assembly		X	
2	77875-000	1	Handle (Replacement Kit) [Included with item 4]	X	X	X
3	08632-000	1	Instruction Label [Included with item 4]	X		X
	08291-000	1	Instruction Label [Included with item 4]		X	
4	08087-001	1	Cover Assembly [includes items 2, 3, 58, and 59]	X		X
	08087-000	1	Cover Assembly [includes items 2, 3, 58, and 59]		X	
5	90085-033	4	Fastener Clip [Included with item 4]	X	X	X
6	03650-000	1	Fill Gasket	X	X	X
7	04152-000	1	Fan	X	X	X
8	77121-000	1	Motor Kit [includes item 13]	X	X	
	77123-000	1	Motor Kit [includes item 13]			X
9	91190-002	3	Nut, 6-32 SST	X	X	X
10	04013-000	1	Heater (120V)	X	X	
	04599-000	1	Heater (220V)			X
11	05069-000	2	Heater Gasket	X	X	X
12	90085-003	1	OVER TEMP Light Clip	X	X	X
13	04877-000	1	Motor Seal Gasket [included with item 8]	X	X	X
14	90085-041	1	Circuit Breaker Clip	X	X	X
15	91272-011	8	Screw, 6-20 x 5/8", type B, SST	X	X	X
16	07998-000	1	UL Label [included with item 17]	X		
	08295-000	1	ID and Ratings Label [included with item 17]		X	
	08089-000	1	ID and Ratings Label [included with item 17]			X
17	77864-000	1	Tray w/ Sensor Brkt, Thrmstat* [includes items 16, 18, 37]	X		
	77865-000	1	Tray w/ Sensor Brkt, Thrmstat* [includes items 16, 18, 37]		X	
	77866-000	1	Tray w/ Sensor Brkt, Thrmstat* [includes items 16, 18, 35, 37]			X
18	08242-000	1	Warning/Caution Label [included with item 17]	X		X
	08296-000	1	Warning/Caution Label [included with item 17]		X	
19	07968-000	1	Reservoir Seal	X	X	X
20	90018-061	4	Screw, 6-32 x 1/2", SST	X	X	X
21	03567-000	1	Pump Housing	X	X	X
22	03611-000	1	Impeller	X	X	X

* The well backup limit thermostat is part of the tray assembly.

Do not attempt to drill out the old thermostat. A leakproof installation is not possible.
Install tray assembly (see p. 18).

Item	P/N	Qty	Description	TP400	TP401	TP420
23A	90018-057	2	Screw, 6-32 x 1/4", SST, pan head	X	X	X
23B	91454-052	2	Screw, 6-32 x 1/4", SST, fillister head	X	X	X
24	03568-000	1	Bottom Housing	X	X	X
25	90514-011	6	Screw, 6-20 x 5/8", type BT, SST	X	X	X
26		1	Serial Number Label [included with item 28. NOT AVAILABLE SEPARATELY.]			
27	08090-000	1	Hospital Identification Label [included with item 28]	X		X
	08297-000	1	Hospital Identification Label [included with item 28]		X	
28	77867-000	1	Reservoir (Replacement Kit) [includes items 26, 27, 29]	X	X	X
29	04257-001	1	Water Level Label [included with item 28]	X		X
	08293-000	1	Water Level Label [included with item 28]		X	
30	90385-000	4	Suction Cup	X	X	X
31	81002-000	1	Tubing, 1/4" ID x 3-1/2" long	X	X	X
32	90500-000	1	Circuit Breaker w/ Clip	X	X	X
33	03394-000	2	Manifold Fitting	X	X	X
34	03881-000	1	Brass Bearing Washer	X	X	X
35	78301-000	1	Switch (120V)	X	X	
	90342-004	1	Switch (220V) * [see note below]			X
36	91282-007	1	OVER TEMP Lamp with clip	X	X	
	91282-011	1	OVER TEMP Lamp with clip			X
37	11198-000	1	Front Label [included with item 17]	X		X
	11199-000	1	Front Label [included with item 17]		X	
38	08086-000	1	Hose Assembly [includes items 41 and 42]	X	X	X
39	91275-027	2	Screw, 4-40 x 3/8", SST	X	X	X
40	03975-000	1	Indicator	X	X	X
41	03887-000	1	Male Klik-Tite [included with item 38]	X	X	X
42	03884-000	1	Female Klik-Tite [included with item 38]	X	X	X
43	90076-018	1	Strain Relief Bushing	X	X	X
44	78315-000	1	Power Cord Kit with molded plug	X	X	
	78316-000	1	Power Cord Kit with molded plug			X
45	03989-000	1	Hose Fitting (orificed)	X	X	X
46	03988-000	1	Hose Fitting (no orifice)	X	X	X

* The large 220V switch used on the TP420 T/Pump is no longer available. When replacing this switch, replace the tray assembly (item 17) which includes the smaller switch.

REPLACEMENT PARTS

SERVICE MANUAL T/PUMP (TP400 Series)

Item	P/N	Qty	Description	TP400	TP40I	TP420
47	03983-000	1	Brass Manifold Block	X	X	X
48	03381-000	1	Manifold Gasket	X	X	X
49	90255-000	1	Plug (replacement)	X	X	
50	90436-000	1	Fibre Washer	X	X	X
51	90085-015	1	Fastener Clip	X	X	X
52	03969-000	1	Potentiometer Shaft	X	X	X
53	78053-000	1	Backup Limit Thermostat (manifold)	X	X	X
54	90462-000	2	Spacer	X	X	X
55	77869-000	1	PC Board Assembly, includes thermistor	X	X	
	77870-000	1	PC Board Assembly, includes thermistor			X
56	90139-004	2	Lockwasher, Internal	X	X	X
57	90018-025	2	Screw, 4-40 x 1/4", SST	X	X	X
58	07999-000	1	LOGO Label [Included with item 4]	X	X	X
59			Hose Strap [Included with item 4. NOT AVAILABLE SEPARATELY]			
60	90586-000	1	SCR CR6CM8			X
61	90709-000	1	Triac, 2N6346A (RCA)	X	X	
62			Heat Sink [Included with item 55. NOT AVAILABLE SEPARATELY]			
63	90728-018	1	Potentiometer	X	X	X
64	03971-000	1	Mercury Switch	X	X	X
65	90092-391	1	Resistor, 825 ohm, 1/8W, 1%	X	X	X
66	06732-001	1	Thermistor	X	X	X
67	90728-127	1	Potentiometer	X	X	X
68	90886-031	1	IC CA3059E	X	X	X
69	90717-002	1	Diode, 1N914	X	X	X
70	90701-060	1	Capacitor, 100 µf, 50V	X	X	X
71	90092-440	1	Resistor, 8.2K ohm, 5W, 5%	X	X	
72	90092-441	1	Resistor, 18K ohm, 5W, 5%			X
73	90701-124	1	Capacitor, 0.1 µf, 220V			X
74	03661-000	2	Temperature Adjusting Key [NOT SHOWN]	X	X	X
75	TFC1	1	Thermometer [NOT SHOWN]	X	X	X
76	TPC1	1	Test Cover [NOT SHOWN]	X	X	X
77	TPT9	1	Flow and Temperature Test Tool [NOT SHOWN]	X	X	X

WARRANTIES

GAYMAR equipment and products are warranted against defects in material and workmanship under normal use and operation from the date of purchase for the time periods listed below for the respective equipment and products. **Except for such warranty, GAYMAR disclaims all other express and/or implied warranties including, but not limited to, the implied warranties of merchantability and of fitness for a particular purpose.**

PUMP

All labor performed and parts provided free of charge for a period of one (1) full year from the date of purchase, provided the equipment is returned with prior authorization* prepaid to an authorized GAYMAR service center or the factory.

**PAD, SINGLE
PATIENT USE**

Free replacement of product where defects in materials and/or workmanship are evident at time of delivery provided the product is returned with prior authorization* prepaid to GAYMAR Industries.

PAD, REUSABLE

Free replacement of product where defects in materials and/or workmanship occur within 90 days from date of delivery provided the product is returned with prior authorization* prepaid to GAYMAR Industries.

PARTS

Defective parts will be exchanged free of charge where defects in materials and/or workmanship occur within 90 days from date of delivery provided the parts are returned with prior authorization* prepaid to GAYMAR Industries.

* For prior authorization on all items being returned to the factory and for a Return Goods Number (RG#), call Customer Service at

(716) 662-2551
1 800 828-7341

GAYMAR®

GAYMAR INDUSTRIES, INC.

10 Centre Drive
Orchard Park, NY
14127-2295

Phone:
1 800 828-7341
(716) 662-2551

FAX:
1 800 993-7890
(716) 662-0748

T/PUMPS® AND T/PADS®
ARE MADE IN THE USA