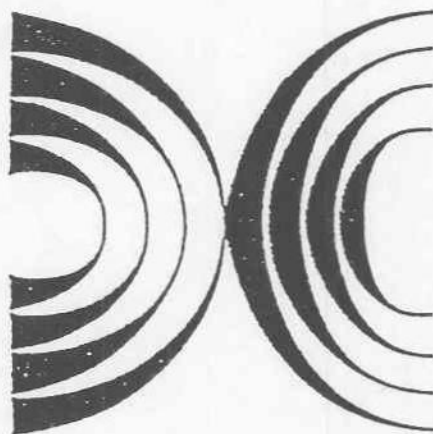


# FLOTEM IIe OPERATION INSTRUCTION MANUAL



DataChem Inc.  
7742 Moller Road  
Indianapolis, IN 46268-5105  
Phone: (317) 872-0760

Written 3/88  
Revised 8/93  
Rev. 5.1

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## INTRODUCTION

Thermal shock or patient discomfort can result from a rapid infusion of as little as 500-1500 ml of fluid at a temperature below a patient's body temperature. For this reason, cold I.V. fluids must be given slowly, wasting precious time. The FloTem IIe - Blood/Fluid Warmer alleviates this problem by bringing the external heat to the I.V. tubing and thus, to the actual fluid being administered. FloTem IIe accurately warms the fluid to proper temperature by the time it exits the FloTem IIe and keeps the temperature constant during infusion. FloTem IIe precludes any patient distress while it shortens the infusion time. FloTem IIe is ideal for the operating room, ICU floors and pediatric wings.

FloTem IIe is designed to relieve the complications associated with infusing cold blood or intravenous solutions. It also avoids problems associated with waterbath or fluid bags which require lengthy and complicated set-up. Instead, FloTem IIe uses standard I.V. and blood sets. FloTem IIe is an electronically controlled solid state unit. This provides accuracy in controlling the heating source and allows FloTem IIe to be ready for use easily and quickly.

## FEATURES

The heating plates are made of aluminium which is lightweight and a good conductor of heat.

FloTem IIe has four different exit channels for the I.V. tubing to adapt easily to most all standard tubing sets.

FloTem IIe is equipped with an LCD temperature readout to indicate when the desired temperature has been reached in the heating plates.

FloTem IIe has solid state Turbo Booster to keep plate temperature between 36.5 and 37.5 degrees C at flow rates above 25 ml/min.

FloTem IIe now has two grooved heating plates to improve heat transfer to the fluid being warmed.

FloTem IIe has a lightweight, high impact, flame retardant plastic case making the total unit weight only 6 lbs.

The FloTem IIe is equipped with "TRIPLE PROTECTION".

This unit has three independent temperature sensor circuits. The first provides power to the heaters via a solid state oscillator control. This temperature is directly indicated on the LCD display.

If the main control circuit should ever fail, a second solid state sensor will activate an audible alarm at  $40 \pm 1$  degree C and turn off power to the heaters by deactivating the main control circuit and the power control relay that supplies the 110 VAC source for the heaters.

The third sensor stage is a set of bi-metal thermostats that are independent of the solid state control circuitry. One thermostat control is mounted directly to each plate and wired in series with each heater so that if plate temperature ever reaches 42 degrees C., the thermostat will cut power to the heater.

#### UNIT CHECK LIST

Qty	DataChem Stock No.	Description	Use
1	7033	Operating Instruction Manual	User Ref.
1	7034	Maintenance Manual	Tech. Ref.
1	30032826	FloTem IIe Blood Warmer	

#### EQUIPMENT LIST NOT SUPPLIED (REPAIRS & MAINT.)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>MANF.</u>	<u>MODEL#</u>	<u>WHEN NEEDED</u>
1*	Soldering Iron 40W	Weller	WP 40	Rep. & Assy
1*	De-soldering tool			Rep. & Assy
1*	Digital Multimeter	Micronta	22-185A	Rep. & Assy
1	Electrical Analyzer	DynaTech	231C	Safety Lkg.
1*	Anti-Static Calib.Tool	GC	AS 8608	Rep./ReCal
1*	Digital Thermometer	B&D	403000	Rep./ReCal
1*	Wrist strap & grounding			
	cord.Antistatic protection #3m		-----	All
1	Hi pot tester 1100vac	DataChem	DCHP1	QC/Safety

NOTE: # = Different manufacturer is accepted with like unit specifications.

1\* = One unit needed per test or repair station.



## WARNINGS

**NOTICE:** The FloTem IIe should not be operated within (3) three feet of any type electrosurgical cutting equipment. **IMPORTANT:** The RF radiations from this type of cutting equipment has been known to cause mal-functions in the FloTem IIe warmer unit.

**DANGER !:** The FloTem IIe could be an explosion **HAZARD** when used in the presence of flammable anesthetics.

**WARNING !:** In cases alarm sounds, unplug or switch off the warmer unit. If the alarm sounds frequently, the unit is malfunctioning and may be in need of repair or recalibration.

For continued protection against risk of fire, replace only with same type and rating of fuses.

To reduce risk of electric shock, DO NOT remove cover (or back). Refer servicing to qualified service personnel only!

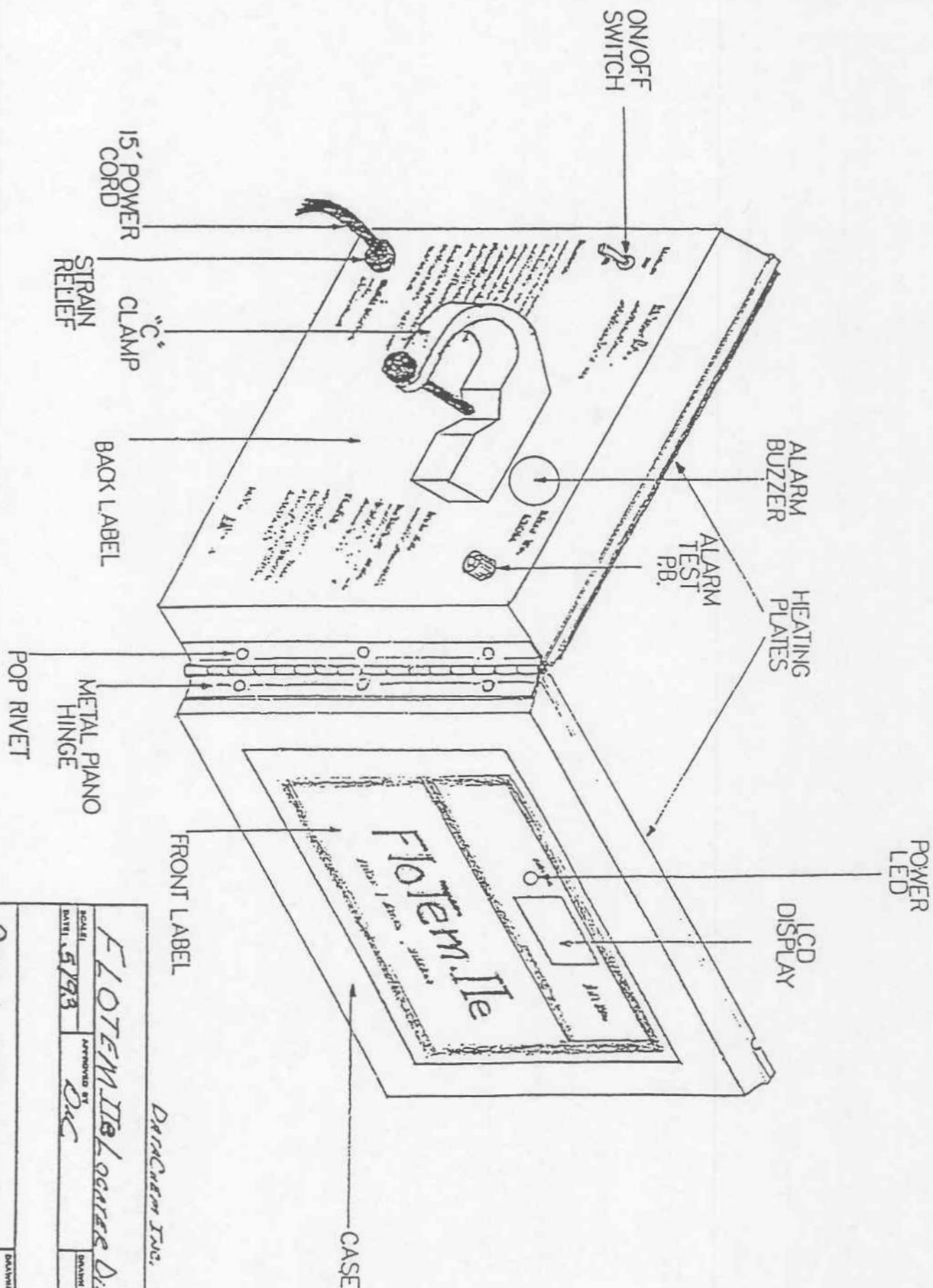
**IMPORTANT:**

The doors of the FloTem IIe must be closed at all times during warming of fluids. Leaving the doors un-latched can cause uneven heating and or system overheating and failure!

Units are supplied to operate from a standard 100-130 volts AC wall receptacle. If 220 volts AC operation is required, the unit will need to be:

1. Special ordered at 220 VAC operation.
2. Modified by qualified technician using the DataChem FT220V modification kit.

**NOTE:** If a 110 VAC unit is operated from a 220 VAC source, the unit may appear to operate correctly for a short period of time. If use is continued for more than appx. 30 seconds, the unit will be damaged and could explode.



PAGE 4  
LOCATOR DIAGRAM

FLOTHERM IIe Locates Diagram		DATE: 5/93		APPROVED BY: DUC		DRAWN BY: C.P.	
PAGE 4		SPEC. INSTR. M.U.I.		DRAWING NUMBER			

DATACHEM INC.

### LIMITED WARRANTY

Parts and labor of the FloTem IIE Blood/Fluid Warmer are guaranteed for (2) two years from the date of purchase by the original purchaser under normal operating conditions. The company will either repair the unit or replace the necessary parts to correct any defects in product or workmanship. Handling charges will be paid by the customer.

Warranty does not cover any equipment subjected to any misuse, abuse, modifications or alterations. This warranty covers FloTem IIE when used according to the procedures provided and under normal conditions. DataChem Inc. should be notified immediately upon discovery of any defects.

Warranty registration must be filled out and sent to DataChem Inc. within (10) ten days of the date of purchase. Otherwise, only a (90) ninety day warranty will be made applicable.

All rights are reserved by DataChem Inc. to change or revise any component of the FloTem IIE Blood/Fluid Warmer without being obligated to make corresponding changes or revisions in previously sold FloTem IIE Blood/Fluid Warmers.

FloTem is a registered trade mark for blood/fluid warmers. DataChem is a registered trade mark for DataChem Inc.  
U.S. Patent No. 4,532,414 Printed U.S.A. Copyright 1988  
DataChem Inc. 7742 Moller Road Indianapolis, In 46268 U.S.A.  
Telephone: (317) 872-0760

### SERVICE AND MAINTENANCE

Only qualified Electronic Technicians should attempt to repair or calibrate the FloTem IIE after the warranty period. If a qualified Electronic Technician is not available, the FloTem IIE should be returned to DataChem Inc. with the proper return authorization given by first calling DataChem Inc. at (317) 872-0760.

### SHIPPING AND HANDLING PRECAUTIONS

Always retain the original shipping carton in case a return is needed. Units damaged during shipping that have not been packed in their original shipping container and packing will terminate all applicable existing warranties given by DataChem Inc.

All DataChem equipment should be marked on the packaging with "FRAGILE". NOTE: Equipment will not be accepted at DataChem without a RETURN AUTHORIZATION NUMBER showing on the outer package and packing list

## EQUIPMENT STORAGE INFORMATION

The FloTem IIe must be stored in a CONTROLLED environment as shown below:

- 1.) Temperature from +15.0 degrees C to +40.0 degrees C.
- 2.) Relative humidity from 5% to 95%.

NOTE: Units placed in storage for more than 6 months should be recalibrated and tested before use.

## UNPACKING AND INITIAL TESTING INSTRUCTIONS

Cut or remove tape from top of corrugated shipping carton and open flaps. NOTE: Unit accessories may be packed at top and or side of carton. Remove top foam unit. The FloTem IIe should be setting on another foam unit face down. Remove FloTem by the attached "C" clamp on the back of the unit. The FloTem IIe when removed from the packing should be ready to use. The unit should be inspected for damage upon opening packaging. Inspect for cracks in plastic case and loose screws in plates. Remove the QC slip inside the unit by opening the latch at the right hand side of the unit. An operational check may now be performed in about three (3) minutes. NOTE: The FloTem when new is set for 110 VAC OPERATION, unless otherwise noted on the back label. DO NOT plug into a 220 VAC receptacle! Plug FloTem IIe into a 110 VAC receptacle and turn the power switch on the back of the unit on (see figure 2). The green LED, labeled power, should be on. Allow it about 2-3 minutes to warm up. The LCD display should read approximately 37.0. A normal overshoot temperature will occur when the unit is turned on from a cold start. If the audible alarm sounds and or the unit never warms to a reading of 37.0 then something may be wrong with the unit. If this should occur, the unit and its packing accessories should be returned to DataChem Inc. for repair or exchange. Send defective units to:

DataChem, Inc.  
7742 Moller Road  
Indianapolis, IN 46268-5105

ATTN: RA# \_\_\_\_\_ (Return Authorization Number must be given from a DataChem Representative before returning any items) Phone: (317) 872-0760 FAX: (317) 872-0796.



## OPERATION

FloTem IIe is ideal for use with commercially available I.V. blood sets. The I.V. tubing is simply and easily placed first through the right hand heating plate and then through the left hand heating plate via the serpentine channels (see fig. 1). Determination of what exit channel to use will be based on the maximum flow rate that will be needed during the infusion. Flow must always begin from the top right hand side of the unit and exit through one of the four channels at the lower left hand side of the unit.

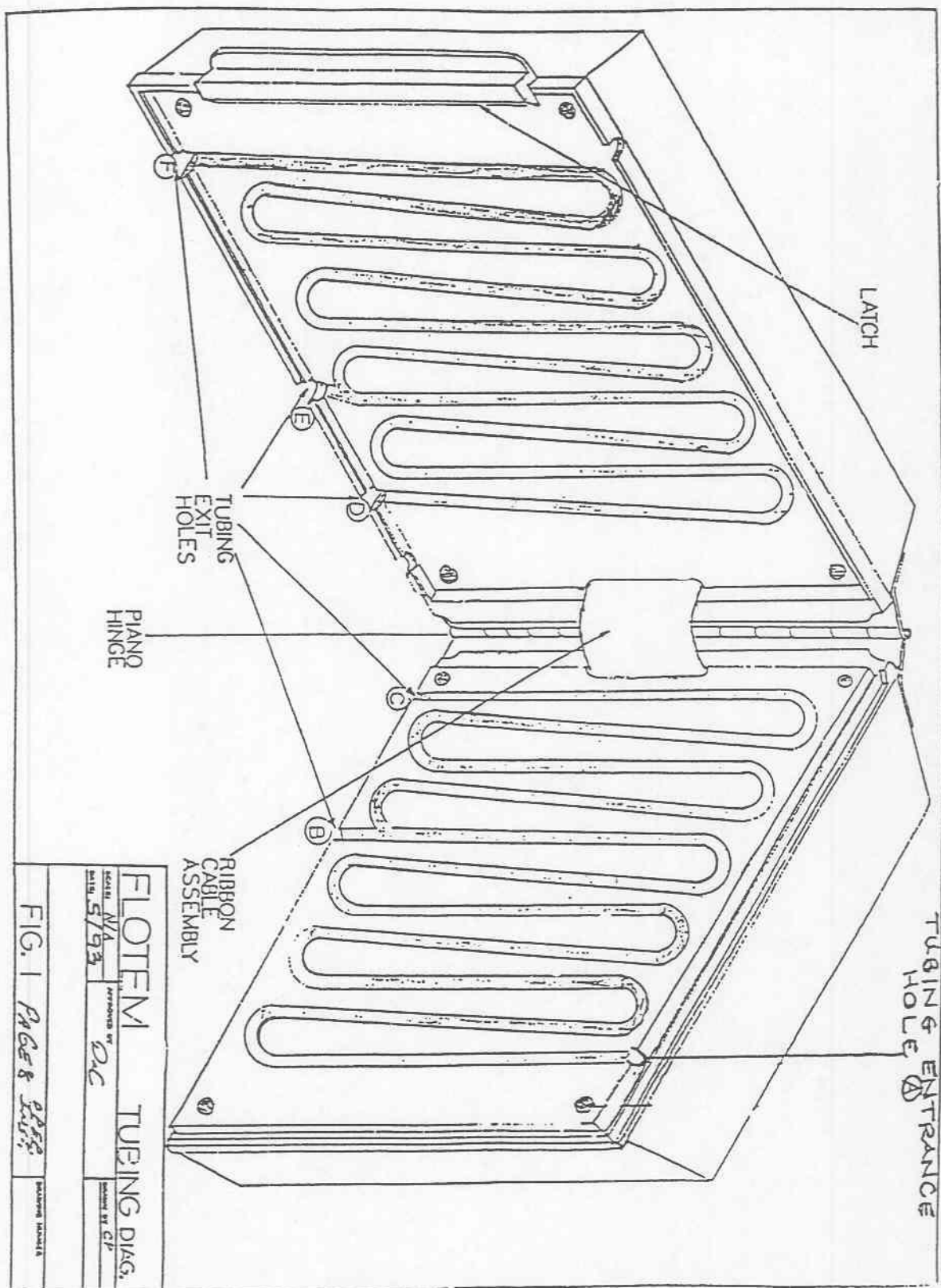
The temperature of the aluminum heating plates is displayed by the LCD digital readout at the front of the unit. The Green LED next to the display indicates that power is applied to the unit (see fig. 2).

### START UP PROCEDURE

- 1.) Mount the unit on an I.V. pole by use of the "C" clamp on the back of the FloTem IIe.
- 2.) Plug the AC power cord into a grounded (3) prong receptacle and turn the power switch on (UP). The switch is located on the back of the unit. **NOTE:** Allow the unit to **WARM UP** to 37 degrees C (shown by the display) **BEFORE** allowing liquid to flow through the tubing set.
- 3.) Facing the warmer, place hand on the back side of the latch. While pulling the latch toward you, curl fingers inward and open the door.
- 4.) (From figure #1), lay I.V. tubing into the Channel (Ent. A) so that when clamped onto the I.V. pole, fluid will enter from the top right and exit from the bottom left as shown in figure #1.
- 5.) Exit channel selection: (Reference Figure #1)
  - a) For flow rates of about 5ml-15ml/min, Exit Channel "B" should give adequate heat transfer.
  - b) For flow rates of about 15ml-40ml/min, Exit Channel "C" should give adequate heat transfer.
  - c) For flow rates of over 40ml/min, Exit Channel "C", then re-enter through channel "D" the Exit Channel "E". This should give adequate heat transfer.
  - d) For maximum heat transfer to the liquid, use the entire channel length by exiting channel "C", re-enter through channel "D", then exit through "F".

**NOTE:** These suggestions of channel selection are based on an incoming liquid temperature of 4 degrees C. The results listed above are taken from testing done at the DataChem Inc. laboratories and your actual results may vary.

6.) **IN EMERGENCY SITUATIONS:** Tubing may be inserted upon turning power on to the unit and used with a minimum amount of warming. (standard warming time is approximately 2-3 minutes., set-up time is approximately 1/2 - 1 minute).





## CALIBRATION TEST MAINTENANCE RECOMMENDATIONS

The FloTem IIe does not require mandatory replacement of parts after specific durations. However, it is advised that these units be tested once per month or 50 hours of operation, whichever comes first.

Calibration of the FloTem IIe can be tested by use of a thermometer such as the B&D model # 403000 digital. The unit should be on for at least 10-15 minutes without I.V. tubing in it.

1. Take any I.V. tubing that may be in the FloTem IIe out.
2. Close the door on the unit and plug into a 110VAC outlet.
3. Turn the power switch located on the back of the unit on and allow the FloTem IIe to warm up and stabilize (App. 10-15 minutes).
4. Insert a glass or digital thermometer into the upper right inlet (see fig. 1) and allow thermometer to rise to temperature.
5. With the LCD display on the FloTem IIe at 37.0 degrees C., the thermometer should read 37.0 degrees C  $\pm$  .5 degrees C.

## ALARM TESTING

Press the alarm test button located on the back of the FloTem IIe (see fig. A) and hold the button in while watching the temperature rise via the LCD display on the front of the FloTem IIe. When the LCD display shows 38.5 degrees C., release your finger from the test button. The temperature should continue to rise and at 40.0 degrees C  $\pm$  1.0 degrees C the audible alarm will sound.

**WARNING:** In case alarm sounds during normal operation, turn the power switch off and allow to cool. If alarm sounds frequently, the FloTem IIe is malfunctioning and needs repair. For continued protection against risk of fire, replace only with the same type and rating of fuses. To reduce the risk of electrical shock, do not remove the cover (or back).

## EQUIPMENT CARE

FloTem IIe should be cleaned and sterilized after each use by use of a soft cloth and proper cleaning solution. NOTE: that the heating plates are painted with a teflon coating manufactured by Dupont # 954-103.

## USER TROUBLESHOOTING

### SYMPTOM

### POSSIBLE CAUSE

---

Alarm sounds after warm-up sequence but shuts off after a few minutes.

Unit may be slightly out of calibration and or room (ambient) temperature may be too low. This is called overshoot and will not effect unit operation.

Power LED not on.

Unit is not plugged in to AC receptacle? Power switch is off?

LCD display jumps between 36.5 & 37.0 degrees.

This is normal in both high flow rate and 220 VAC unit applications.

Unit sluggish, not warming properly.

Is this a 220 VAC unit operating in a 110 VAC receptacle

I.V. fluid or blood not flowing properly.

I.V. tubing pinched within unit. Is liquid bag above warmer? It should be. Is warmer above the patient? It should be.

Door pops open.

Problem with tubing(see set-up procedure).

No heat, power LED on, shows approximate ambient temperature 20-26.0 on LCD.

Internal fuse blown, or driver circuit bad. SEND FOR REPAIR.

Alarms upon turning power switch on.

Ribbon cable or sensor board not properly connected.SEND FOR REPAIR.

## SPECIFICATIONS

Parameter	Description
Control circuit	Solid-state integrated circuit
Input Voltage	110-115 VAC or (220-230 VAC "Special Order").
Input Frequency	60 Hz @ 110 VAC or 50 Hz @ 220 VAC
Input power	330 watts max. / 3 amps.
Current leakage	Less than 50 microamps at 115 VAC. Less than 100 microamps at 230 VAC; using hospital grade cord provided.
Power cord resistance	Less than 150 m Ohms @ 115VAC test.
Exterior cabinet	High impact/ plastic/ metal hinge.
Plate material	Aluminum channeled with a black teflon coating by Dupont #954-103.
Dimensions	8"(L) x 6" (H) x 2"(D) or 23.3 cm(L) x 15.3cm (H) x 5cm (D).
Weight	6.0 LBS. or 2.75 KG.
Warm up time	Within 2 to 3 minutes.
Safety features	Independent audio alarm; automatic power cut-off to heating plates; separate in-line overtemperature thermostats cutting power to heating plates; LCD digital readout for actual plate temperature in degrees C.

## ORDERING INFORMATION

### ORDERS:

Orders for Flotem equipment, parts and supplies can be placed through a stocking distributor or directly through the main office. Service requests must be made directly to the main office at the following address:

DataChem, Inc.  
7742 Moller Road  
Indianapolis, IN 46268  
(317) 872-0760  
or  
(800) 527-7272

### TERMS:

All invoices payable in 15 days net f.o.b. Indianapolis, IN. Shipping and handling charges will be prepaid and added to the invoice. Late payments will be assessed a 2.0% interest charge per month. Credit will be refused to accounts 90 days delinquent.

### MINIMUM ORDERS:

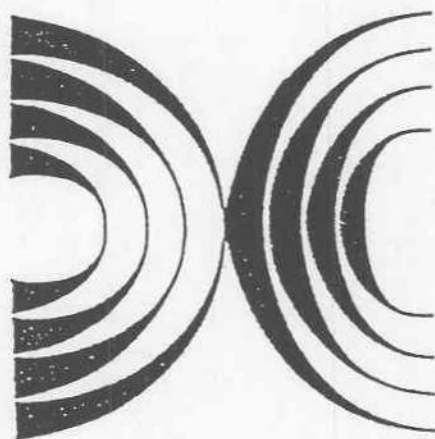
Orders placed must be for goods or services totaling no less than \$50.00., DataChem will accept pre-payment or agree to return ship C.O.D.. For orders above \$150.00, the NET 15 day terms shown above become applicable. Such terms must be specified at the time of purchase request.

### RETURNS:

No returns will be accepted without prior authorization from DataChem, Inc.. DataChem, must be notified of any shortages or items damaged in transit within 10 days of receipt of merchandise. Failure to report damaged or missing equipment within the specified time will make the purchaser liable for repairs or replacement. DataChem reserves the right to determine the cause of equipment failure or damage.

DataChem, Inc. reserves the right to change  
its price lists without notice.

# FLOTEM IIe TECHNICAL MAINTENANCE MANUAL



DataChem Inc.  
7742 Moller Road  
Indianapolis, IN 46268-5105  
Phone: (317) 872-0760

Written 3/88  
Revised 8/93  
Rev. 5.1 GOVT.

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## INTRODUCTION

Thermal shock or patient discomfort can result from a rapid infusion of as little as 500-1500 ml of fluid at a temperature below a patient's body temperature. For this reason, cold I.V. fluids must be given slowly, wasting precious time. The FloTem IIe - Blood/Fluid Warmer alleviates this problem by bringing the external heat to the I.V. tubing and thus, to the actual fluid being administered. FloTem IIe accurately warms the fluid to proper temperature by the time it exits the FloTem IIe and keeps the temperature constant during infusion. FloTem IIe precludes any patient distress while it shortens the infusion time. FloTem IIe is ideal for the operating room, ICU floors and pediatric wings.

FloTem IIe is designed to relieve the complications associated with infusing cold blood or intravenous solutions. It also avoids problems associated with waterbath or fluid bags which require lengthy and complicated set-up. Instead, FloTem IIe uses standard I.V. and blood sets. FloTem IIe is an electronically controlled solid state unit. This provides accuracy in controlling the heating source and allows FloTem IIe to be ready for use easily and quickly.

## FEATURES

The heating plates are made of aluminium which is lightweight and a good conductor of heat.

FloTem IIe has four different exit channels for the I.V. tubing to adapt easily to most all standard tubing sets.

FloTem IIe is equipped with an LCD temperature readout to indicate when the desired temperature has been reached in the heating plates.

FloTem IIe has solid state Turbo Booster to keep plate temperature between 36.5 and 37.5 degrees C at flow rates above 25 ml/min.

FloTem IIe now has two grooved heating plates to improve heat transfer to the fluid being warmed.

FloTem IIe has a lightweight, high impact, flame retardant plastic case making the total unit weight only 6 lbs.

The FloTem IIe is equipped with "TRIPLE PROTECTION".

This unit has three independent temperature sensor circuits. The first provides power to the heaters via a solid state oscillator control. This temperature is directly indicated on the LCD display.

If the main control circuit should ever fail, a second solid state sensor will activate an audible alarm at  $40 \pm 1$  degree C and turn off power to the heaters by deactivating the main control circuit and the power control relay that supplies the 110 VAC source for the heaters.

The third sensor stage is a set of bi-metal thermostats that are independent of the solid state control circuitry. One thermostat control is mounted directly to each plate and wired in series with each heater so that if plate temperature ever reaches 42 degrees C., the thermostat will cut power to the heater.

#### UNIT CHECK LIST

Qty	DataChem Stock No.	Description	Use
1	7033	Operating Instruction Manual	User Ref.
1	7034	Maintenance Manual	Tech. Ref.
1	30032826	FloTem IIe Blood Warmer	

#### EQUIPMENT LIST NOT SUPPLIED (REPAIRS & MAINT.)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>MANF.</u>	<u>MODEL#</u>	<u>WHEN NEEDED</u>
1*	Soldering Iron 40W	Weller	WP 40	Rep. & Assy
1*	De-soldering tool			Rep. & Assy
1*	Digital Multimeter	Micronta	22-185A	Rep. & Assy
1	Electrical Analyzer	DynaTech	231C	Safety Lkg.
1*	Anti-Static Calib.Tool	GC	AS 8608	Rep./ReCal
1*	Digital Thermometer	B&D	403000	Rep./ReCal
1*	Wrist strap & grounding			
	cord.Antistatic protection	#3m	-----	All
1	Hi pot tester 1100vac	DataChem	DCHP1	QC/Safety

NOTE: # = Different manufacturer is accepted with like unit specifications.

1\* = One unit needed per test or repair station.

## WARNINGS

**NOTICE:** The FloTem IIe should not be operated within (3) three feet of any type electrosurgical cutting equipment. **IMPORTANT:** The RF radiations from this type of cutting equipment has been known to cause mal-functions in the FloTem IIe warmer unit.

**DANGER !:** The FloTem IIe could be an explosion **HAZARD** when used in the presence of flammable anesthetics.

**WARNING !:** In cases alarm sounds, unplug or switch off the warmer unit. If the alarm sounds frequently, the unit is malfunctioning and may be in need of repair or recalibration.

For continued protection against risk of fire, replace only with same type and rating of fuses.

To reduce risk of electric shock, DO NOT remove cover (or back). Refer servicing to qualified service personnel only!

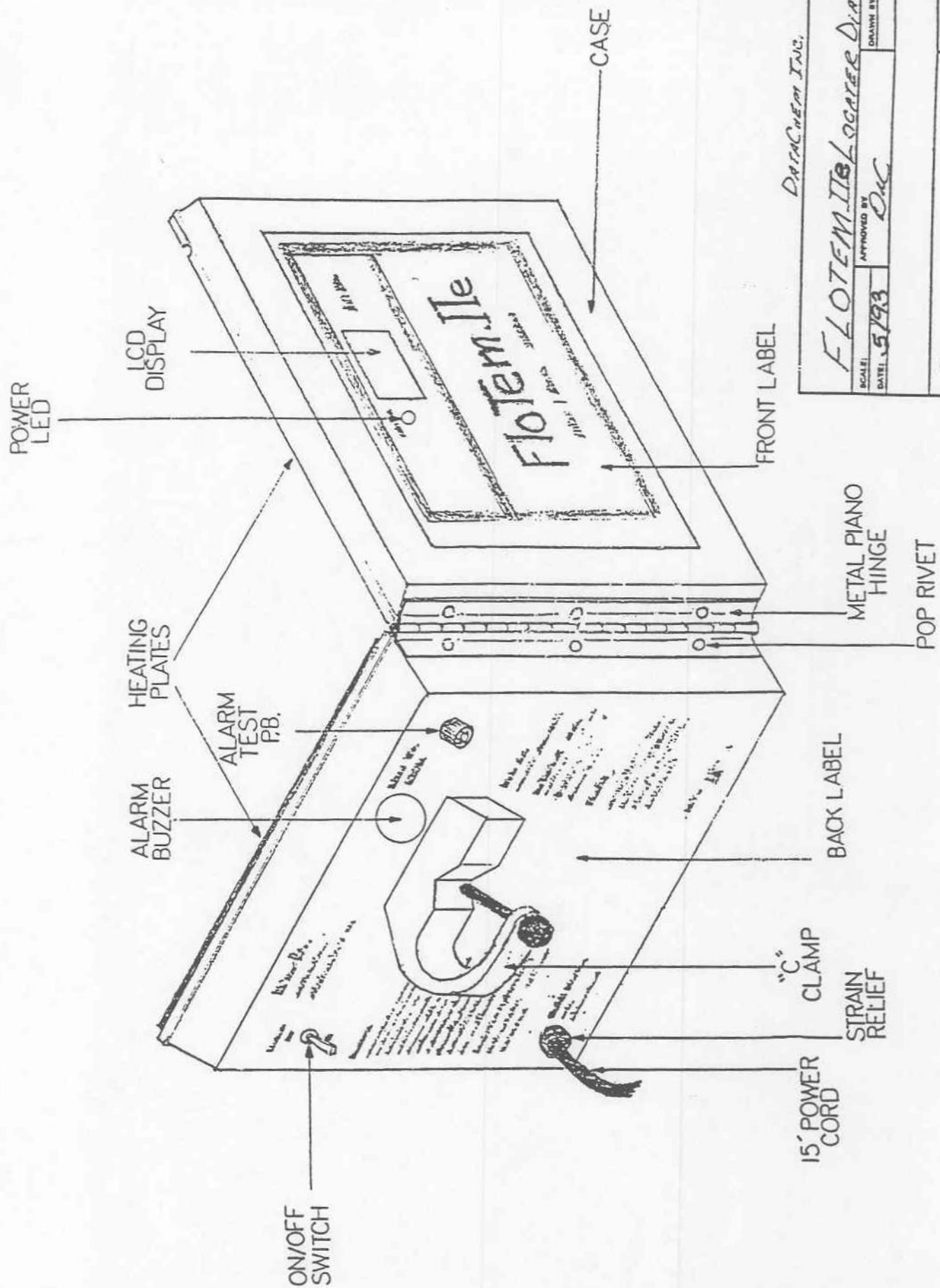
**IMPORTANT:**

The doors of the FloTem IIe must be closed at all times during warming of fluids. Leaving the doors un-latched can cause uneven heating and or system overheating and failure!

Units are supplied to operate from a standard 100-130 volts AC wall receptacle. If 220 volts AC operation is required, the unit will need to be:

1. Special ordered at 220 VAC operation.
2. Modified by qualified technician using the DataChem FT220V modification kit.

**NOTE:** If a 110 VAC unit is operated from a 220 VAC source, the unit may appear to operate correctly for a short period of time. If use is continued for more than appx. 30 seconds, the unit will be damaged and could explode.



DataCnem Inc.

*FloTem.IIe* LOCATOR DIAGRAM

DATE: 5/93

APPROVED BY: DUC

DRAWN BY: C.P.

PAGE 4 OPER. INST. MAN.

DRAWING NUMBER

## LIMITED WARRANTY

Parts and labor of the FloTem IIe Blood/Fluid Warmer are guaranteed for (2) two years from the date of purchase by the original purchaser under normal operating conditions. The company will either repair the unit or replace the necessary parts to correct any defects in product or workmanship. Handling charges will be paid by the customer.

Warranty does not cover any equipment subjected to any misuse, abuse, modifications or alterations. This warranty covers FloTem IIe when used according to the procedures provided and under normal conditions. DataChem Inc. should be notified immediately upon discovery of any defects.

Warranty registration must be filled out and sent to DataChem Inc. within (10) ten days of the date of purchase. Otherwise, only a (90) ninety day warranty will be made applicable.

All rights are reserved by DataChem Inc. to change or revise any component of the FloTem IIe Blood/Fluid Warmer without being obligated to make corresponding changes or revisions in previously sold FloTem IIe Blood/Fluid Warmers.

FloTem is a registered trade mark for blood/fluid warmers.  
DataChem is a registered trade mark for DataChem Inc.  
U.S. Patent No. 4,532,414 Printed U.S.A. Copyright 1988  
DataChem Inc. 7742 Moller Road Indianapolis, In 46268 U.S.A.  
Telephone: (317) 872-0760

## SERVICE AND MAINTENANCE

Only qualified Electronic Technicians should attempt to repair or calibrate the FloTem IIe after the warranty period. If a qualified Electronic Technician is not available, the FloTem IIe should be returned to DataChem Inc. with the proper return authorization given by first calling DataChem Inc. at (317) 872-0760.

## SHIPPING AND HANDLING PRECAUTIONS

Always retain the original shipping carton in case a return is needed. Units damaged during shipping that have not been packed in their original shipping container and packing will terminate all applicable existing warranties given by DataChem Inc.

All DataChem equipment should be marked on the packaging with "FRAGILE". NOTE: Equipment will not be accepted at DataChem without a RETURN AUTHORIZATION NUMBER showing on the outer package and packing list



## EQUIPMENT STORAGE INFORMATION

The FloTem IIe must be stored in a **CONTROLLED** environment as shown below:

- 1.) Temperature from +15.0 degrees C to +40.0 degrees C.
- 2.) Relative humidity from 5% to 95%.

**NOTE:** Units placed in storage for more than 6 months should be recalibrated and tested before use.

## UNPACKING AND INITIAL TESTING INSTRUCTIONS

Cut or remove tape from top of corrugated shipping carton and open flaps. **NOTE:** Unit accessories may be packed at top and or side of carton. Remove top foam unit. The FloTem IIe should be setting on another foam unit face down. Remove FloTem by the attached "C" clamp on the back of the unit. The FloTem IIe when removed from the packing should be ready to use. The unit should be inspected for damage upon opening packaging. Inspect for cracks in plastic case and loose screws in plates. Remove the QC slip inside the unit by opening the latch at the right hand side of the unit. An operational check may now be performed in about three (3) minutes. **NOTE:** The FloTem when new is set for **110 VAC OPERATION**, unless otherwise noted on the back label. **DO NOT** plug into a **220 VAC receptacle!** Plug FloTem IIe into a 110 VAC receptacle and turn the power switch on the back of the unit on (see figure 2). The green LED, labeled power, should be on. Allow it about 2-3 minutes to warm up. The LCD display should read approximately 37.0. A normal overshoot temperature will occur when the unit is turned on from a cold start. If the audible alarm sounds and or the unit never warms to a reading of 37.0 then something may be wrong with the unit. If this should occur, the unit and its packing accessories should be returned to DataChem Inc. for repair or exchange. Send defective units to:

DataChem, Inc.  
7742 Moller Road  
Indianapolis, IN 46268-5105

ATTN: RA# \_\_\_\_\_ (Return Authorization Number must be given from a DataChem Representative before returning any items) Phone: (317) 872-0760 FAX: (317) 872-0796.



## OPERATION

FloTem IIe is ideal for use with commercially available I.V. blood sets. The I.V. tubing is simply and easily placed first through the right hand heating plate and then through the left hand heating plate via the serpentine channels (see fig. 1). Determination of what exit channel to use will be based on the maximum flow rate that will be needed during the infusion. Flow must always begin from the top right hand side of the unit and exit through one of the four channels at the lower left hand side of the unit.

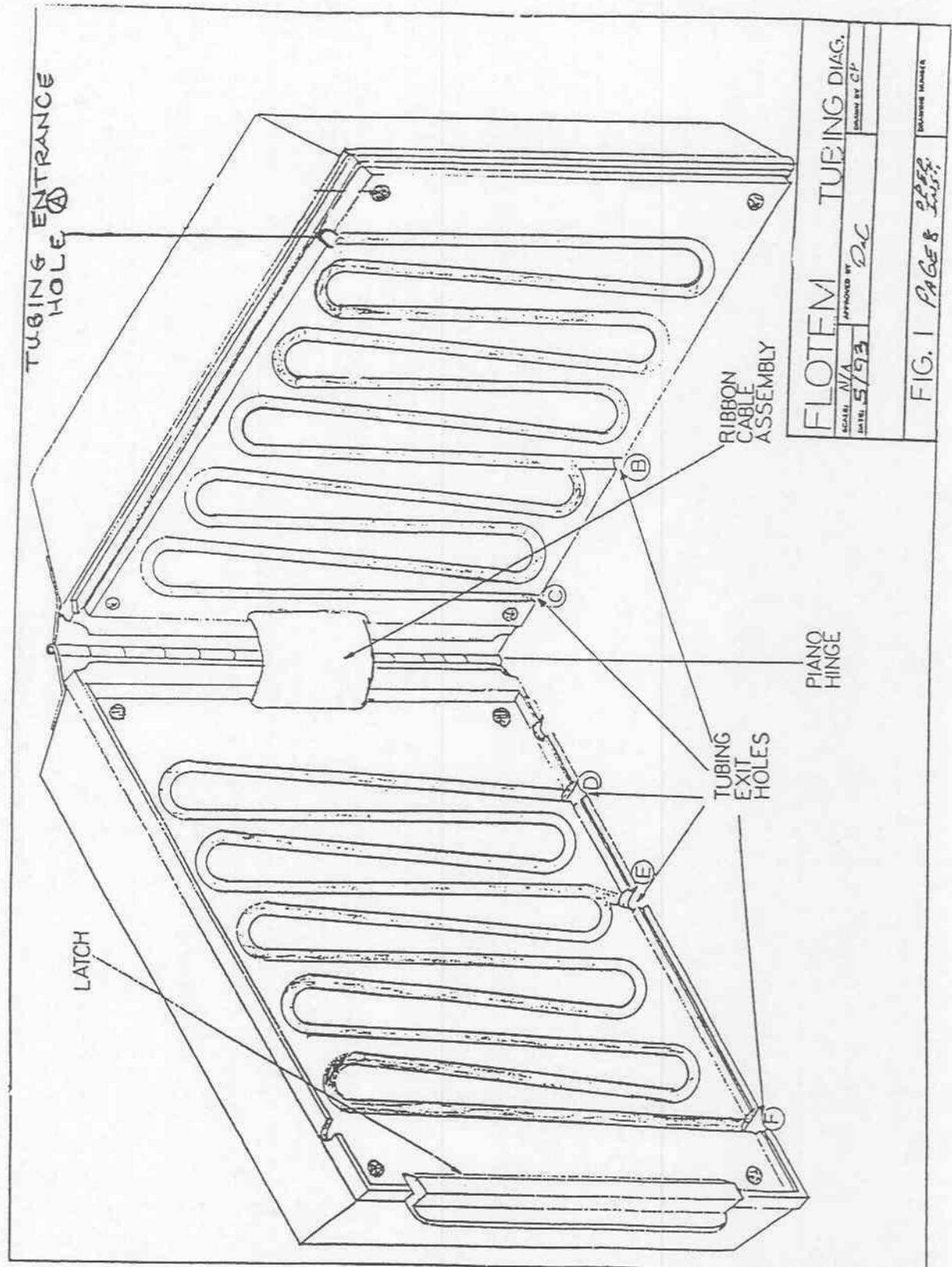
The temperature of the aluminum heating plates is displayed by the LCD digital readout at the front of the unit. The Green LED next to the display indicates that power is applied to the unit (see fig. 2).

### START UP PROCEDURE

- 1.) Mount the unit on an I.V. pole by use of the "C" clamp on the back of the FloTem IIe.
- 2.) Plug the AC power cord into a grounded (3) prong receptacle and turn the power switch on (UP). The switch is located on the back of the unit. **NOTE:** Allow the unit to **WARM UP** to 37 degrees C (shown by the display) **BEFORE** allowing liquid to flow through the tubing set.
- 3.) Facing the warmer, place hand on the back side of the latch. While pulling the latch toward you, curl fingers inward and open the door.
- 4.) (From figure #1), lay I.V. tubing into the Channel (Ent. A) so that when clamped onto the I.V. pole, fluid will enter from the top right and exit from the bottom left as shown in figure #1.
- 5.) Exit channel selection: (Reference Figure #1)
  - a) For flow rates of about 5ml-15ml/min, Exit Channel "B" should give adequate heat transfer.
  - b) For flow rates of about 15ml-40ml/min, Exit Channel "C" should give adequate heat transfer.
  - c) For flow rates of over 40ml/min, Exit Channel "C", then re-enter through channel "D" the Exit Channel "E". This should give adequate heat transfer.
  - d) For maximum heat transfer to the liquid, use the entire channel length by exiting channel "C", re-enter through channel "D", then exit through "F".

**NOTE:** These suggestions of channel selection are based on an incoming liquid temperature of 4 degrees C. The results listed above are taken from testing done at the DataChem Inc. laboratories and your actual results may vary.

6.) **IN EMERGENCY SITUATIONS:** Tubing may be inserted upon turning power on to the unit and used with a minimum amount of warming. (standard warming time is approximately 2-3 minutes., set-up time is approximately 1/2 - 1 minute).



TUBING DIAGRAM

PAGE 8

## CALIBRATION TEST MAINTENANCE RECOMMENDATIONS

The FloTem IIe does not require mandatory replacement of parts after specific durations. However, it is advised that these units be tested once per month or 50 hours of operation, whichever comes first.

Calibration of the FloTem IIe can be tested by use of a thermometer such as the B&D model # 403000 digital. The unit should be on for at least 10-15 minutes without I.V. tubing in it.

1. Take any I.V. tubing that may be in the FloTem IIe out.
2. Close the door on the unit and plug into a 110VAC outlet.
3. Turn the power switch located on the back of the unit on and allow the FloTem IIe to warm up and stabilize (App. 10-15 minutes).
4. Insert a glass or digital thermometer into the upper right inlet (see fig. 1) and allow thermometer to rise to temperature.
5. With the LCD display on the FloTem IIe at 37.0 degrees C., the thermometer should read 37.0 degrees C  $\pm$  .5 degrees C.

## ALARM TESTING

Press the alarm test button located on the back of the FloTem IIe (see fig. A) and hold the button in while watching the temperature rise via the LCD display on the front of the FloTem IIe. When the LCD display shows 38.5 degrees C., release your finger from the test button. The temperature should continue to rise and at 40.0 degrees C  $\pm$  1.0 degrees C the audible alarm will sound.

**WARNING:** In case alarm sounds during normal operation, turn the power switch off and allow to cool. If alarm sounds frequently, the FloTem IIe is malfunctioning and needs repair. For continued protection against risk of fire, replace only with the same type and rating of fuses. **To reduce the risk of electrical shock, do not remove the cover (or back).**

## EQUIPMENT CARE

FloTem IIe should be cleaned and sterilized after each use by use of a soft cloth and proper cleaning solution. **NOTE:** that the heating plates are painted with a teflon coating manufactured by Dupont # 954-103.

## USER TROUBLESHOOTING

### SYMPTOM

### POSSIBLE CAUSE

---

Alarm sounds after warm-up sequence but shuts off after a few minutes.

Unit may be slightly out of calibration and or room (ambient) temperature may be too low. This is called overshoot and will not effect unit operation.

Power LED not on.

Unit is not plugged in to AC receptacle? Power switch is off?

LCD display jumps between 36.5 & 37.0 degrees.

This is normal in both high flow rate and 220 VAC unit applications.

Unit sluggish, not warming properly.

Is this a 220 VAC unit operating in a 110 VAC receptacle

I.V. fluid or blood not flowing properly.

I.V. tubing pinched within unit. Is liquid bag above warmer? It should be. Is warmer above the patient? It should be.

Door pops open.

Problem with tubing(see set-up procedure).

No heat, power LED on, shows approximate ambient temperature 20-26.0 on LCD.

Internal fuse blown, or driver circuit bad. **SEND FOR REPAIR.**

Alarms upon turning power switch on.

Ribbon cable or sensor board not properly connected. **SEND FOR REPAIR.**

## SPECIFICATIONS

Parameter	Description
Control circuit	Solid-state integrated circuit
Input Voltage	110-115 VAC or (220-230 VAC "Special Order").
Input Frequency	60 Hz @ 110 VAC or 50 Hz @ 220 VAC
Input power	330 watts max. / 3 amps.
Current leakage	Less than 50 microamps at 115 VAC. Less than 100 microamps at 230 VAC; using hospital grade cord provided.
Power cord resistance	Less than 150 m Ohms @ 115VAC test.
Exterior cabinet	High impact/ plastic/ metal hinge.
Plate material	Aluminum channeled with a black teflon coating by Dupont #954-103.
Dimensions	8"(L) x 6" (H) x 2"(D) or 23.3 cm(L) x 15.3cm (H) x 5cm (D).
Weight	6.0 LBS. or 2.75 KG.
Warm up time	Within 2 to 3 minutes.
Safety features	Independent audio alarm; automatic power cut-off to heating plates; separate in-line overtemperature thermostats cutting power to heating plates; LCD digital readout for actual plate temperature in degrees C.



## ORDERING INFORMATION

### ORDERS:

Orders for Flotem equipment, parts and supplies can be placed through a stocking distributor or directly through the main office. Service requests must be made directly to the main office at the following address:

DataChem, Inc.  
7742 Moller Road  
Indianapolis, IN 46268  
(317) 872-0760  
or  
(800) 527-7272

### TERMS:

All invoices payable in 15 days net f.o.b. Indianapolis, IN. Shipping and handling charges will be prepaid and added to the invoice. Late payments will be assessed a 2.0% interest charge per month. Credit will be refused to accounts 90 days delinquent.

### MINIMUM ORDERS:

Orders placed must be for goods or services totaling no less than \$50.00., DataChem will accept pre-payment or agree to return ship C.O.D.. For orders above \$150.00, the NET 15 day terms shown above become applicable. Such terms must be specified at the time of purchase request.

### RETURNS:

No returns will be accepted without prior authorization from DataChem, Inc.. DataChem, must be notified of any shortages or items damaged in transit within 10 days of receipt of merchandise. Failure to report damaged or missing equipment within the specified time will make the purchaser liable for repairs or replacement. DataChem reserves the right to determine the cause of equipment failure or damage.

DataChem, Inc. reserves the right to change  
its price lists without notice.



## FLOTEM IIe TECHNICAL MANUAL

### INTRODUCTION:

DataChem, Inc. would like to thank you for your selection of the FloTem IIe blood/fluid warmer. This warmer has been designed to give the user years of trouble free service. While DataChem, Inc. does not regard the FloTem IIe as a user serviceable instrument, information will be given in this manual that will allow a qualified technician to test the operation of the warmer, check and reset the temperature calibration points, and do some troubleshooting to trace down a fault in the unit.

### OPERATION:

To test a FloTem IIe blood/fluid warmer, plug in the unit and turn it on. The LCD display on the front of the warmer will show the plate temperature in degrees centigrade (C). The display reading will increase fairly quickly until the set point temperature is reached. The display will overshoot slightly then the unit will cool down and maintain the set point temperature.

The FloTem IIe has been designed to maintain a constant heating place temperature of 37.0 degrees C. Actual fluid temperature can not be measured as this would cause contamination. The temperature is controlled through a solid state temperature sensor located in the grooved plate on the right hand side of the unit. A second temperature sensor in the same plate is used to sound an audible alarm and disable the AC power to the heating pads if the plate temperature ever reaches  $40.0 \text{ degrees C} \pm 1.0 \text{ degrees C}$ . Power to the heating pads will always be turned off when the alarm sounds, but a small temperature overshoot may be observed due to a heating time lag.

There is an alarm test switch located on the back panel of the warmer. When this switch is enabled the main control circuit will be overridden causing the plates to overheat. The alarm will sound when its set point temperature is reached and the power to the heating pads will be turned off. The test switch should now be disabled but the alarm will continue to sound until the plates cool down or the warmer is turned off.

**NOTE:** Units with a "P" suffix are not C.S.A. listed.

As a final safety, a passive bi-metal thermostat is mounted on each heating plate. If the temperature of either plate ever reaches 42.0 degrees c., it's thermostat will open, shutting down power to the heating pads. The user should not try to test this as it can be destructive to the warmer. If this should happen during use, please notify DataChem, Inc. and return the unit for repair.

In addition to the above safety features the FloTem IIe has been designed so that virtually any circuit fault (such as an opened or shorted supply voltage) will automatically turn off power to the heating pads. This will also be the case if the circuit boards are improperly connected.

#### **CALIBRATION:**

To check the temperature calibration of a FloTem IIe blood/fluid warmer turn on the unit and allow the temperature to stabilize. With the unit closed insert an accurate glass or digital thermometer into the tubing inlet on the top of the warmer. After the thermometer has stabilized compare the display reading to the reading on the thermometer. The warmer should hold its set point temperature to within  $\pm 0.5$  degrees C.

The alarm set point can similarly be checked by enabling the alarm test switch and comparing the display and thermometer reading when the alarm first sounds. This temperature should also be held to within  $\pm 0.5$  degrees C.

If these set point temperatures are not within their tolerances, the warmer needs to be recalibrated. Unplug the unit and allow it to completely cool down. Remove the finger guard on the alarm test switch and dress nut on the power switch. Now open the case and remove the eight plate mounting screws. Fold the plates down onto a smooth flat surface and remove the four springs under the grooved plate on the display side of the unit. Place a paper towel under the plates to protect them from scratches.

To keep the unit from heating during the initial calibrations disconnect one lead of each heating pad where it connects to the terminal block on the main board (positions 1H & 3H on TB1), or remove heat fuse. Turn on the warmer. The LCD should show a stable reading and the LED on the main board should be on (indicating power to the TB1 terminal block).

First check the calibration of the display board. A +2.490 VDC voltage should be observed on pin 11 of J1A. This voltage is set by trimpot DR19. Then compare the LCD reading to pin F on the main board (J2). The LCD should read 10 times the DC voltage on pin F.

**NOTE:** Units with a "P" suffix are not C.S.A. listed.

The LCD reading is adjusted by trimpot DR17. Next adjust the main board trimpot R3 for a +2.488 VDC reading on pin J of the J2 header.

The three trimpots on the sensor board control the temperature measurement calibrations. A bias voltage of -2.470 VDC should be present on pin A of header J2 on the main board (also on pin 3 of SU1 or SU2). This voltage can be adjusted through trimpot SR6. The DC voltage at pin F of P2 or J2 should now be equal to the actual plate temperature (at 0.1 VDC per degree C). This voltage can be adjusted through trimpot SR1. The alarm will sound when the voltage on pin F of header J2 reaches +2.488 VDC. This was set by trimpot R3. To make this correspond to a plate temperature of 40.0 degrees C., the SR10 trimpot should be adjusted to set pin G to approximately 1.5 VDC less than the present value of pin F. Trimpots SR1 and SR10 may have to be fine tuned during reassembly.

The trimpot R6 on the main board is used to set the plate temperature set point. To check this, turn the warmer off and reconnect the heating pad leads to TB1. Turn the unit on; the plates should now be warming. Watch the LED 1 on the main board. This should be on to start but as the temperature reaches the set point it will begin to blink. During the overshoot it will be off but will then blink at about once per second when the warmer is stabilized.

#### **TURBO CALIBRATION:**

If the LCD display temperature (not the actual temperature) is not 36.5 degrees C., then trimpot R6 and the main board should be adjusted. If the display is too low turn R6 until LED 1 blinks faster. If the LCD is too high turn R6 for a slower blink. (NOTE: The FloTem IIe Turbo booster is set to activate full power to the heat pads at 36.5 degrees. If LED 1 lights at full brightness at this point, skip to the TEMPERATURE CALIBRATION SECTION). Wait for the temperature to stabilize then recheck the LCD reading. Repeat as necessary until the LCD reads 36.5 when the plate temperature is stable. If the turbo turns on at a higher point than 36.5 you must turn trimpot R11 to reduce the trigger point until the unit is stable at 36.5 degrees via the FLASHING LED 1.

As LED 1 is blinking about once a second and maintaining a stable 36.5 degrees. adjust R11 slowly until the LED comes on at full brightness.

Now adjust R6 on the main board to read 36.8 degrees C on the LCD. If the display is too low, turn R6 up until LED 1 blinks faster. If the LCD is too high, turn R6 for a slower blink. Wait for the plate temperature to stabilize then recheck the LCD reading. Repeat as necessary until the LCD reads 36.8 when the plate temperature is stable. Note that by adjusting the LCD temperature to 36.8 while the unit is out of the case will cause the unit to read approximately 37.0 degrees when in the case.

The final temperature adjustment can now be made but first the warmer should be partially reassembled. Turn it off and replace the springs on their mounting studs, fold the plates back into the case, and tighten the four display plate mounting screws so that the heads are just below the surface of the plates and will allow the springs to compress. Replace the right hand grooved plate by first aligning the PC mounted switches with the holes in back of the unit and close the case, this will leave you with access to SR1 and SR10 when the case is opened. Turn the warmer on, and allow the plate temperature to stabilize, then insert a thermometer into the inlet channel.

If the LCD reading does not match the thermometer, SR 1 needs to be adjusted. Turn SR 1 until the LCD equals the ACTUAL plate temperature. Allow the plates to stabilize then recheck the LCD. Repeat as necessary until the LCD reading equals the temperature of the plates when stable. Temperature measurements should be taken when the case is closed.

The alarm set point should now be checked. Enabled the alarm test switch and note the reading of the LCD when the alarm first sounds. (It should be between 39.5 and 40.5). If the alarm set point is not correct, make a small adjustment to SR10, allow the warmer to cool down, and repeat the test. Re-adjust SR10 as necessary until the correct alarm set point is found. Be careful when making these adjustments as the thermostat and heating pad leads will be live with 110 VAC whenever the LED 1 is on. Also make a note of the direction that you turn the SR 10 trimpot to prevent unnecessary re-adjustments.

When these set point temperatures are correct the warmer should be turned off and allowed to cool down, unplug. Replace the four plate mounting screws on the right hand grooved plate. The left hand grooved plate screws should be set so that they are flush with the front of the plate when the plate and springs are compressed by hand. This will allow the two plates to touch when the case is closed.

After the warmer has been re-assembled it should be retested from a cold start to insure proper operation.



## TROUBLESHOOTING:

In order to assist a qualified technician in tracing down a fault in a FloTem IIe blood/fluid warmer, a definition of the board to board interfaces, a description of each board's operation, and a list of error condition and their possible causes will be given below.

J 2 Pin	Sensor Board	Dir	Main Board
A	Temp.Bias Voltage	-->	-2.47 VDC
B	-12VDC Input	---	-12 VDC Output
C	-12 VDC Output	---	-12 VDC Output
D	Ground Input	---	Ground Output
E	Ground Input	---	Ground Output
F	Temp. Sensor 1	-->	Control Temp.
G	Temp. Sensor	-->	Alarm Control 1
H	+12 VDC Input	---	+12 VDC Output
I	+12 VDC Input	---	+12 VDC Output
J	N.C.	<--	Alarm Set +2.488 VDC

The sensor board to main board interface is made through headers SH 1 and J 2, this is a 10 pin connection (lettered A through J). Only the middle eight pins need be connected for the warmer to work. The end pins are used to calibrate the individual boards. When the boards are connected properly their edges will line up.

Pin	Display Board	Dir	Main Board
1	Ground	-->	Alarm Control 2
2	N.C.	---	-12 VDC
3	N.C.	---	+12 VDC
4	Ground Input	---	Ground Output
5	Ground Input	---	Ground Output
6	Ground Input	---	Ground Output
7	Ground Input	---	Ground Output
8	Ground Input	---	Ground Output
9	Display Voltage	<--	Plate Temp.
10	Alarm On	<--	Alarm
11	Display Ref. Volt.	-->	N.C.
12	-12 VDC Input	---	-12 VDC Output
13	-5 VDC Output	---	N.C.
14	+5 VDC Output	---	N.C.
15	+12 VDC Input	---	+12 VDC Output
16	+12 VDC Input	---	+12 VDC Output



The display board to main board interface is made through a 16 pin ribbon cable between header DH 1 and J 1. This connection is made pin one to pin one. If this cable is disconnected while the unit is running, the alarm will sound continuously and the plates will not heat. To get around this during troubleshooting, pin 1 of J 1 should be grounded and the display temperature can be read off of pin 9 (at 0.1 VDC per degree C).

The insulated left hand grooved plate heating pad leads are run through the outer jacket of the ribbon cable but they are not in electrical contact with the cable.

The display board acts as a 3 1/2 digit A to D converter. The display value is equal to ten times the DC voltage present on pin 9 of DH 1. The  $\pm 12$  VDC inputs are regulated down to  $\pm 5$ VDC for the A to D converter.

The measurement and buzzer circuitry on this board are no longer used.

The sensor board consists of 2 independent temperature measurement circuits. These can be scaled independently. Also a reference voltage circuit is used to convert the sensor outputs to degrees C.

The main board performs three functions. First, a power supply circuit to produce the  $\pm 12$  VDC supplies from 110 or 220 VAC mains. The second function is the main temperature control circuit. This circuit controls a triac and its driver based on the present plate temperature and the temperature set point. This control is overridden when the alarm test switch is enabled. The third function is to turn on the buzzer if the alarm sensor ever reaches the alarm set point. This circuit will also turn off the heating circuit when the alarm set point is reached.

When trying to trace a circuitry fault, first make sure that the fuses are good and that the  $\pm 12$  VDC and  $\pm 5$  VDC supplies are correct on the main and display boards. If the supply voltages are not correct check for shorts or broken traces. Also check the ICs and transistors for excess heat. The heat sink on the Q2 triac is connected to the AC hot line.

The sensor board's operation can be checked by measuring the voltage level on the J2 header pins F and G. If these values are not correct, first make sure that the boards are mated together properly, so that their edges line up. If this isn't the problem look for shorted or broken temperature sensor leads or traces. The temperature sensors must sit all of the way into their mounting hole for proper heat sensing.

The display board's operation can easily be check by comparing the LCD reading to the voltage level on the DH 1 header pin 9. Extra or missing LCD segments would probably be due to shorts or broken traces between the LCD and DU 3.

The main board's heating control operation can be checked by watching LED 1.

There should be AC power present on header TB 1 whenever the LED is on. If the AC is present but no heating is occurring, disconnect the heating pad leads and do a continuity check of the heating pad and thermostat assemblies. The pads should read a nominal 90 ohms. If the AC is not present when the LED is on, check fuse F 1, the triac Q 2, and its driver U 1. If the LED does not turn on but the voltage on pin F is good, check ICs U 4 and U 2, also the resistor networks RP 1 and RP 2. The alarm circuitry can be checked by making sure that U 3 pins 1,2,9, and 14 all go low when the voltage level of pin 4 is greater than the reference voltage on pins 5, 7, and 8 as set by R 3.

## TROUBLESHOOTING GUIDE

### SYMPTOM

### POSSIBLE CAUSE

Unit doesn't turn on, Power LED doesn't come on

Check fuse F2 of main board. See if solder connections on ON/OFF switch are broken.

Unit alarms upon being turned on and LCD shows a -118

See if solder joints on the temp. sensor Q3 of sensor board are broken.

Unit heats up and doesn't cool down.

Check AC is applied across the heating pads after the pulse LED (LED 1) has gone off. If so the triac (Q 2) is probably bad, if not it could be a bad triac driver (U 1) on main board.

Unit doesn't heat up at all.

Check fuse F1 of main board. Check if heating pads are connected to TB 1 of main board properly. Check the resistance of the heating pads. They should be about 90 ohms each, if they are open they will not operate.

Unit upon being turned on has no power LED or LCD operation.

See if ribbon cable is connected properly to J 1 of main board.

Unit is measuring too high a temperature with external probe but R 1 of sensor board is turned all the way up.

Check if pin A of J 2, on the main board is exactly at -2.470 v, if not adjust R 6 of sensor board. Q 1 of sensor board could be bad.

## SYMPTOM

## POSSIBLE CAUSE

LCD comes on when unit is first turned on but then fades out.

Look for a solder, or other type of short on the display board.

Unit overshoots target temperature and alarms.

Make sure the temp. sensors go down into the holes in the heating plate all the way. Make sure there is plenty of thermal compound in the holes. Make sure the heating pads are sticking down good. Add R 4 to the main board and recalibrate. NOTE: Do this only as a last resort.

Unit has a high power cord resistance.

Make sure that the two bolts mounting the main board to the heating plate are tightened down good and that there is a lockwasher between the 1/2" spacer and the P.C.B.

Unit has high current leakage.

Probably a bad thermostat.

## OVERHAUL-ASSEMBLY/DISASSEMBLY INSTRUCTIONS

### DISASSEMBLY

1. Unplug power cord from electrical outlet.
2. Remove the dress nut and finger guard from the back of the unit.
3. Remove the 8 #6 self-tapping screws mounting from the 2 heating plates, be careful not to lose the 4 springs underneath the plate. Refer to drawing # 5046 for this step.
4. Carefully pull the plate assemblies out of the case.

### REPAIRS

Refer to the schematic diagrams for each board and check supply voltages and reference voltages to help determine the problem. Also the troubleshooting guide has several of the most common problems and their possible causes to aid repair.

### OVERHAUL

1. Follow the disassembly instructions.
2. Unscrew the two bolts holding the main and sensor boards on the heating plates and carefully remove the boards, being careful not to bend the sensors going in the plate. Refer to drawing #5042 for this step.
3. Clean the thermal compound out of the holes and apply 120vac across the heating pad and roll or press the pad back onto the previously pulled up off of plate you may need to remove the pad and clean the plate with alcohol first.
4. Refill the holes with thermal compound. Stir the compound with a piece wire to remove any air bubbles.
5. Clean any thermal compound off of the sensors and re-install the main and sensor boards. Be sure to put two lockwashers between the 1/2" spacer and the PCB to ensure a good ground and to space the boards properly. Be careful not to bend the sensors when reinstalling the boards. Refer to drawing #5042.
6. Remove the display board from the plate and heat and roll down the pads as described in step #3. Refer to drawings #5037 and 5038 for this step.
7. Recalibrate the unit following the calibration instructions in the manual.

### REASSEMBLY

1. Unplug the power cord from electrical outlet.
2. Connect the power cord wires to TB1 of the main board. Connect the hot (black) wire to the terminal closest to the outside of the unit.



3. Put the main plate assembly back into the case, being careful to get the switches through the holes in the case and to seat the buzzer into its hole (refer to drawing #5045). Screw in the 4 #6 self tapping screws to secure the plate to the case, don't over-tighten, refer to drawing #5046. Put on and tighten the finger guard and dress nut, refer to drawing #5045.

4. Turn the case so it is face down. Put the 4 springs on the posts in the case for the display plate assembly. Put the plate in the case and screw in the other 4 #6 self tapping screws. Tighten only to the point where the top of the plate is level with the bottom of the two shortest tubing exit holes, \*see drawing #5046.

## BLOCK DIAGRAM OPERATION (SEE DIAGRAM #1022)

### POWER SUPPLY

The power supply converts a 110 vac 60hz sine wave, or 220vac 50hz if modified (see conversion instructions), into a regulated positive and negative 12vdc supply voltages,. This circuit is protected by the 1/2A fuse.

### HEAT SENSING CIRCUIT

This circuit measures the temperature of the heating plates through the use of two temperature sensors which protrude into the holes provided for them in the right hand side heating plate. These holes are filled with a thermal compound to guarantee heat transference to the sensors. One of the sensors provides the temperature voltage for the heating control circuit and the display circuit. The other sensor provides the alarm voltage for the alarm circuit.

### HEATING CONTROL CIRCUIT

This circuit produces a variable duty cycle pulse at a frequency of 1.39Hz. This pulse is dependant upon the temperature voltage provided by the heat sensing circuit and is controlled by R6 on the main board. A normally open push button is included in this circuit to allow rapid heating to test the alarm circuit. This circuit contains a "turbo circuit" which, after the initial warmup period, allows the heating plates to warm rapidly if they are cooled below a set temperature, this allows for a higher flow rate to be run through the unit.

### ALARM CIRCUIT

This circuit monitors the alarm voltage generated by the heat sensing circuit and when the plate temperature surpasses a set point; the alarm is set off. Three things happen when the alarm is set-off, most noticeable among these is the sounding of the buzzer. More importantly, however, the heating control circuit is disabled and the relay, K1, opens shutting off all AC power to the heating circuit to prevent further heating of the plates. The alarm should activate when the display shows at 40.0 degrees C  $\pm$  1.0 degrees C.

### HEATING CIRCUIT

The heating circuit provides AC power to the heating pads in accordance to the pulse train generated by the heating control circuit. This circuit is protected by the 2 1/2A fuse.

## HEATING PADS

The heating element for the FloTem IIe consists of two heating pads which are affixed adhesively to the backs of the two heating plates. The heating pads have a normally closed thermostat which will open cutting off any current through the pads if the plates should exceed 40 degrees C. Each heating pad should have a resistance of approximately 90 ohms. In 110vac operation the pads are connected in a parallel configuration, in 220vac operation the pads are connected in series.

## DISPLAY CIRCUIT

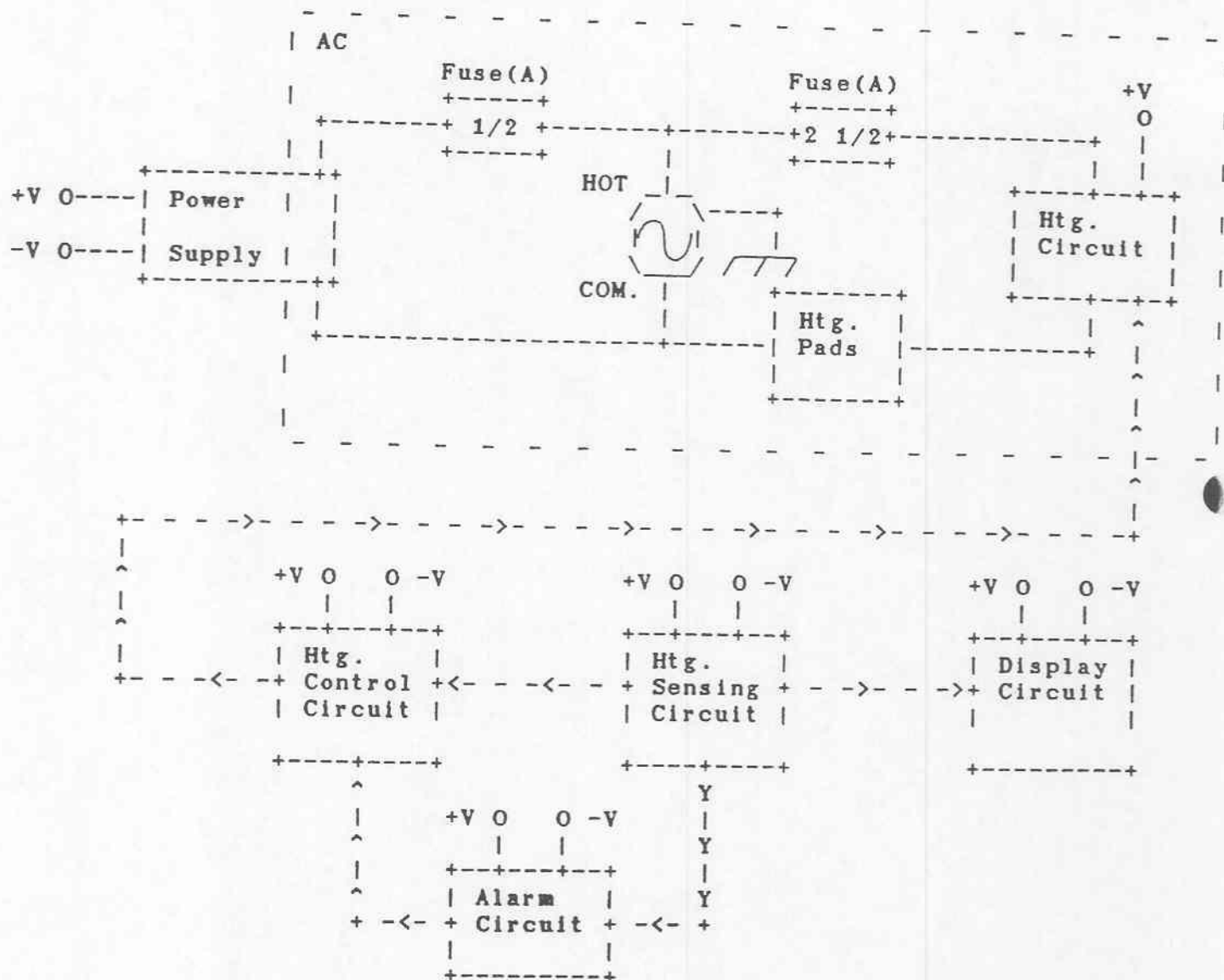
The display circuit shows the temperature of the heating plates in celsius on the LCD on the front of the unit. This is accomplished by multiplying the temperature voltage, generated by the heat sensing circuit, and converting it from an analog to a digital signal and displaying it on the LCD. For example a temperature voltage of 3.70 will be displayed as 37.0.

# APPENDIX

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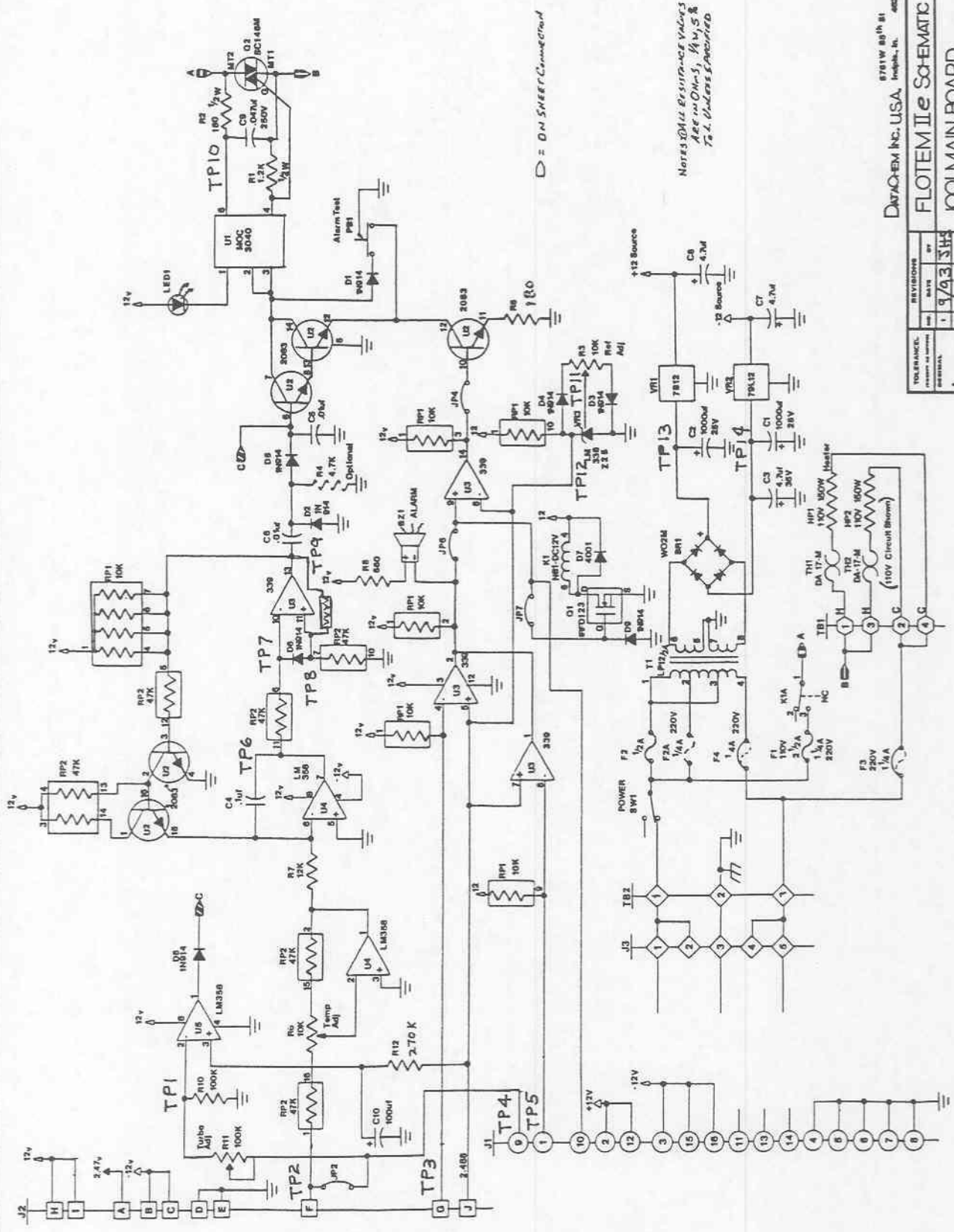
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# Flotem I<sub>2</sub> Block Diagram



Flotem I<sub>2</sub> Block Diagram  
 Drawn 1/11/90 by CG  
 Drawing # 1022





1001 MAIN BOARD SCHEMATIC

D = ON SHEET Connected

NOTES: ALL RESISTANCE VALUES ARE IN OHMS, 1/4W 5% TOL. UNLESS SPECIFIED

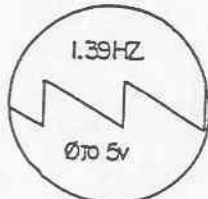
DATA-EM INC. USA 8781W 89th St. Inglewood, Ca. 90278

REVISIONS		TOLERANCES	
NO.	DATE	BY	REASON
1	9/23/85		INITIAL
2			REWORKED
3			REWORKED
4			REWORKED
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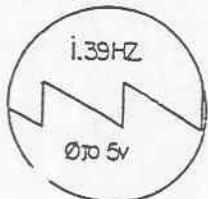
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100			REWORKED

# MAIN BOARD TEST POINTS

TP1: Approximately 2.516v  
 TP2: .3.7v (When at 37.0 deg.)  
 TP3: Approximately 2.18v  
 TP4: 3.7v (when at 37.0 deg.)  
 TP5: 0v  
 TP6:



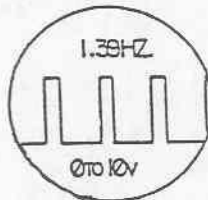
TP7:



TP8:



TP9:

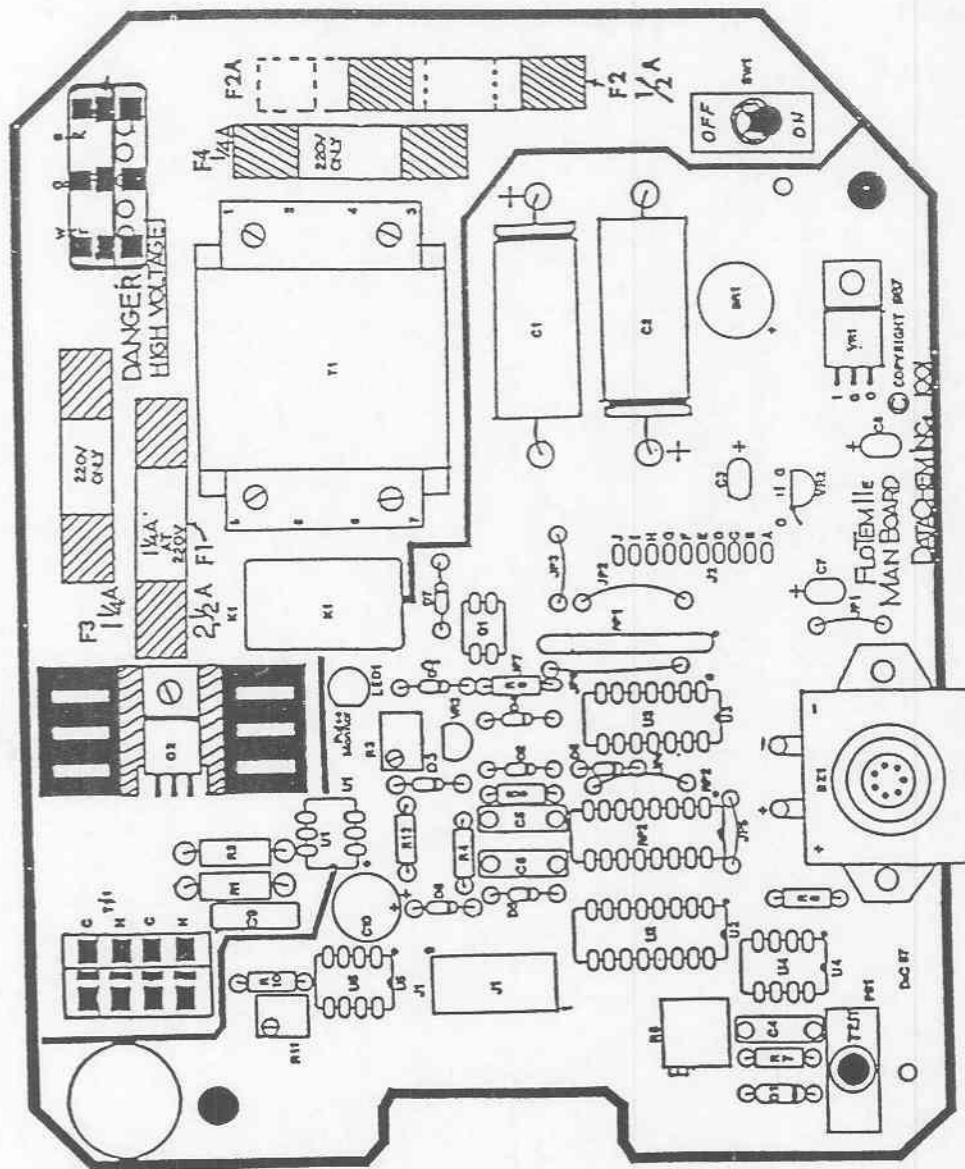


TP10: 120vac  
 TP11: Approximately 1.17v  
 TP12: 2.488  
 TP13: Approximately 17.7v  
 TP14: Approximately -19.7v

DATAHEM INC.  
 7742 MOLLER ROAD  
 INDIANAPOLIS, IN 46268-5105  
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## FLOTEM IIe TEST POINTS

SCALE: 5/93	APPROVED BY:	DRAWN BY: CP
DATE: 2/2		
		DRAWING NUMBER 7013



DATA CHEM INC.

Flotem Iie Main Board #1001

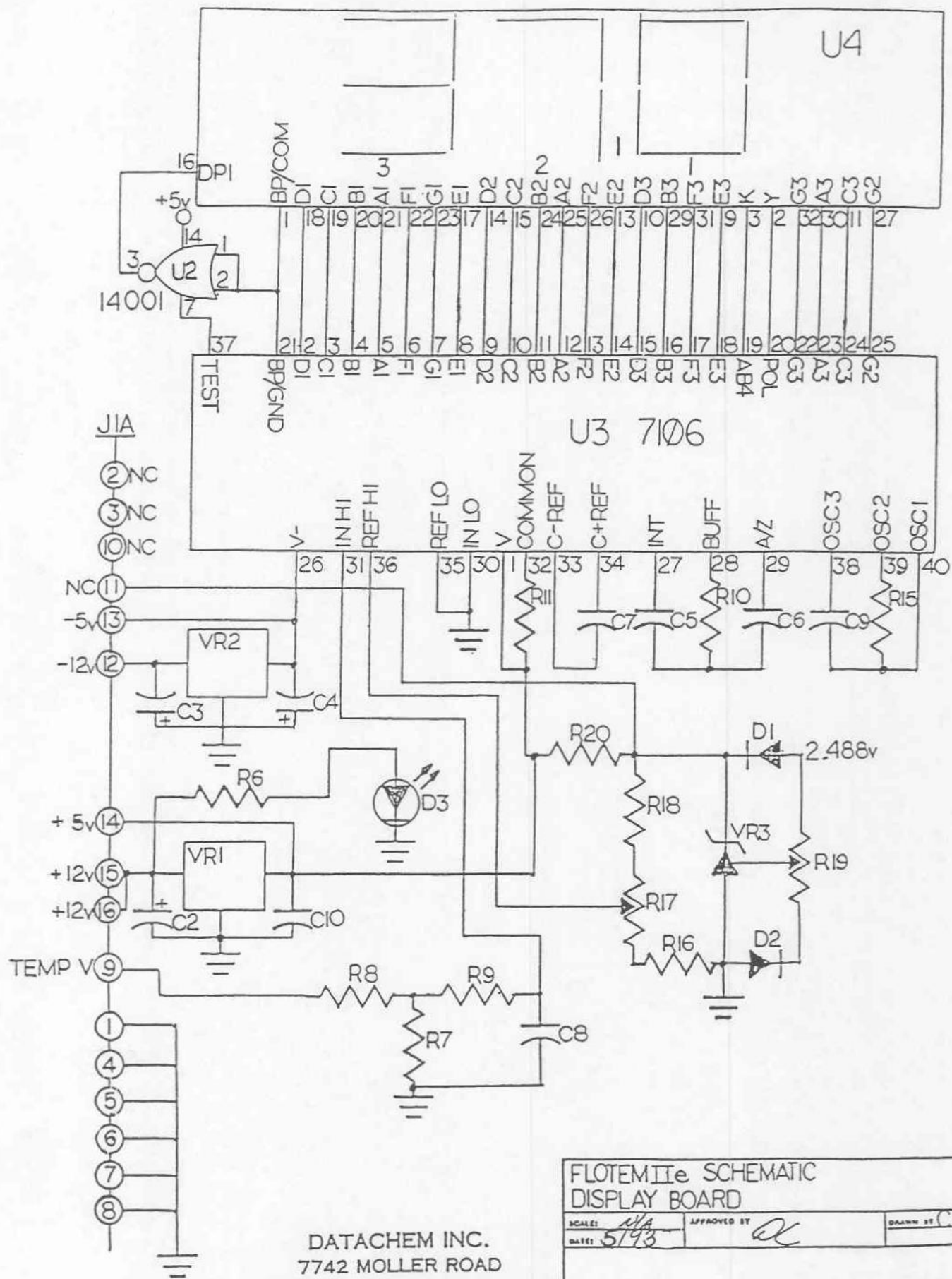
SCALE: 5/8" APPROVED BY: DATE: 5/93 DRAWN BY: DC

COMPONENT LAYOUT

DRAWING NUMBER: CL-1001

# FLOTEM IIe MAIN BOARD PARTS LIST

ITEM#	DESCRIPTION	DESIGNATOR	QTY
100300	LM339; VOLTAGE COMPARITOR	U3	1
100400	LM358; DUAL OP AMP	U4,U5	2
100600	ULN2083; TRANSISTOR ARRAY	U2	1
100700	MOC3040; TRIAC OPTO ISOLATOR	U1	1
110200	MC7812; 1 AMP +12 V REG.	VR1	1
110400	MC79L12;100mA -12 V REG.	VR2	1
110500	1N914; SIGNAL DIODE	D1-6,8,9	8
110600	W02; BRIDGE RECTIFIER	BR1	1
110700	1N4001; RECTIFIER DIODE	D7	1
111000	SC146; 10 A TRIAC TO 220	Q2	1
111005	LM336 Z 2.5; VOLTAGE REFERENCE	VR3	1
112000	IRFD123; HEX FET	Q1	1
120300	10K OHM; FLAT POT (20 T)	MR6	1
120400	10K OHM; UPRIGHT POT (20 T)	MR3	1
120500	100K OHM; UPRIGHT POT (20 T)	MR11	1
121100	10K OHM; 10 PIN SIP	RP1	1
121200	47K OHM; DIP	RP2	1
121400	180 OHM; 1/4W, 5% RESISTOR	MR5	1
121700	470K OHM; 1/4W, 5% RESISTOR	MR8	1
123100	12K OHM; 1/4W, 5% RESISTOR	MR7	1
123900	100K OHM; 1/4W, 5% RESISTOR	MR10	1
124150	270K OHM; 1/4W, 5% RESISTOR	MR12	1
124700	180 OHM; 1/2W, 5% RESISTOR	MR2	1
124800	1.2K OHM; 1/2W, 5% RESISTOR	MR1	1
130500	4.7uF; 35V TANT CAPACITOR	C3,7,8	3
130600	.01uF; MINI-BOX CAPACITOR	C5,6	2
130700	.047uF; MINI-BOX CAPACITOR	C9	1
130800	.1uF; MINI-BOX CAPACITOR	C4	1
131200	100uF; 16V RADIAL ELE CAP	C10	1
131300	1000uF; 25V AXIAL ELE CAP	C1,2	2
140100	1 X 10 RIGHT ANGLE HEADER	J2	1
140200	16 PIN DIP HEADER	J1	1
140300	3 POS TERMINAL BLOCK	TB2	1
140400	4 POS TERMINAL BLOCK	TB1	1
142008	#10 SOLDERLESS CONNECTOR	SW1,2	2
143300	6 PIN DIP SOCKET	MS1(U1)	1
150100	JUMBO RED LED	LED1	1
150400	12V BUZZER	BZ1	1
150500	1/2 AMP POWER FUSE	MF2	1
150600	2 1/2 AMP HEAT FUSE	MF1	1
151503	DUAL 17V TRANSFORMER	T1	1
151700	N.O. PUSH BUTTON SWITCH	SW2	1
152010	SPDT PCM TOGGLE SWITCH	SW1	1
155000	5 AMP, SPDT PCM RELAY	K1	1
164000	TO-220 HEAT SINK	HS	1
167000	PC MOUNT FUSE CLIP	FC1-4	4
171000	FLOTEM IIe MAIN PCB	MPC	1



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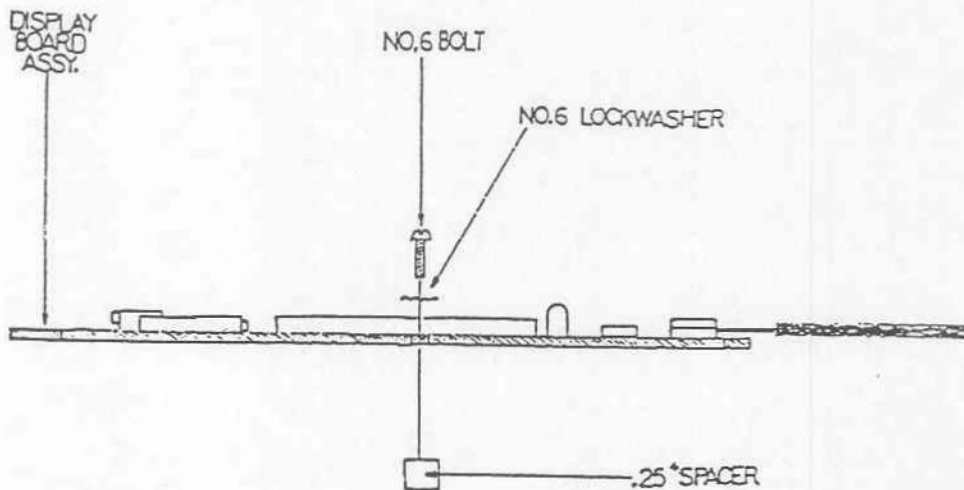
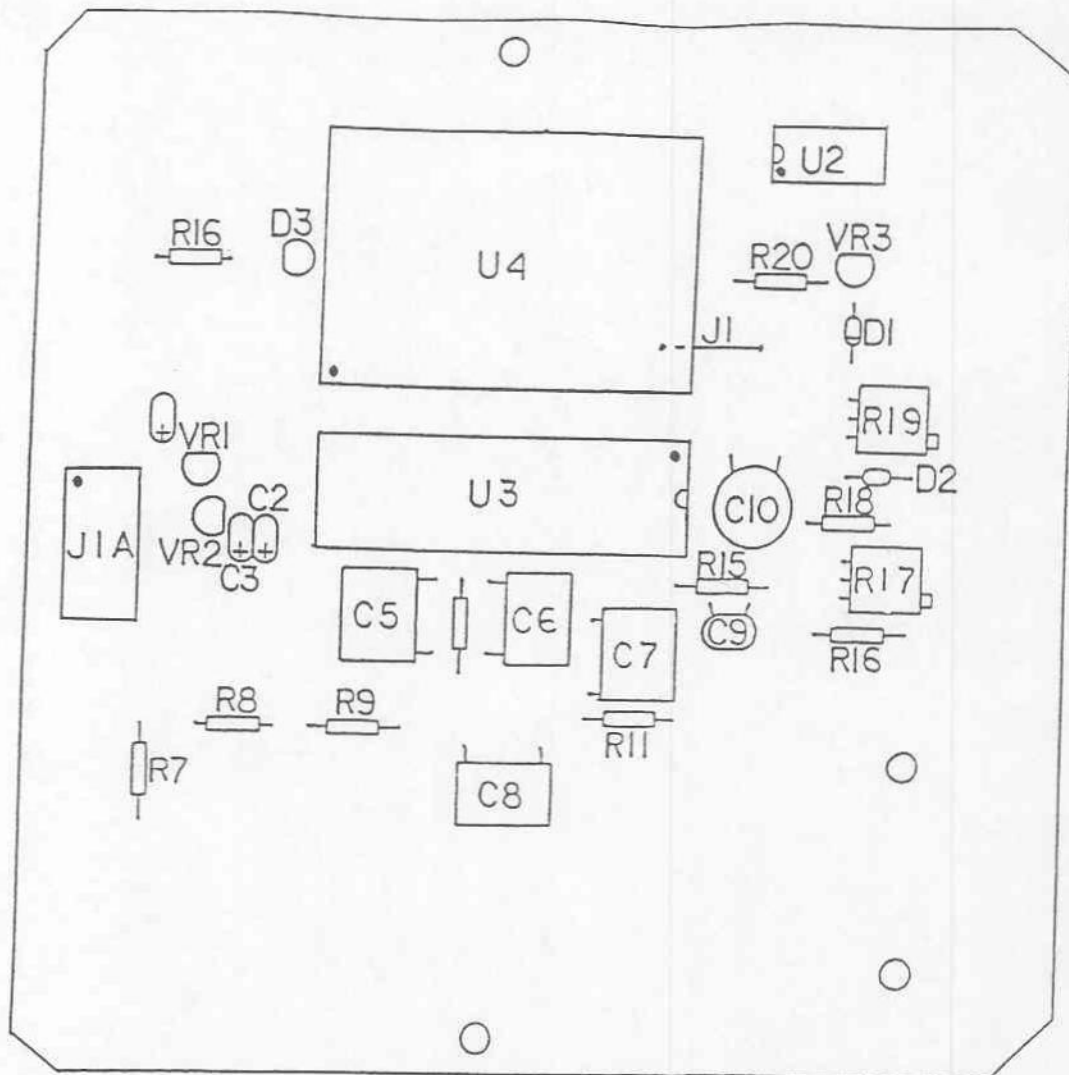
# FLOTEMITte SCHEMATIC DISPLAY BOARD

SCALE: *N/A* APPROVED BY: *AK* DRAWING BY: *CP*  
 DATE: *5/93*

REV. H.

DRAWING NUMBER  
1024



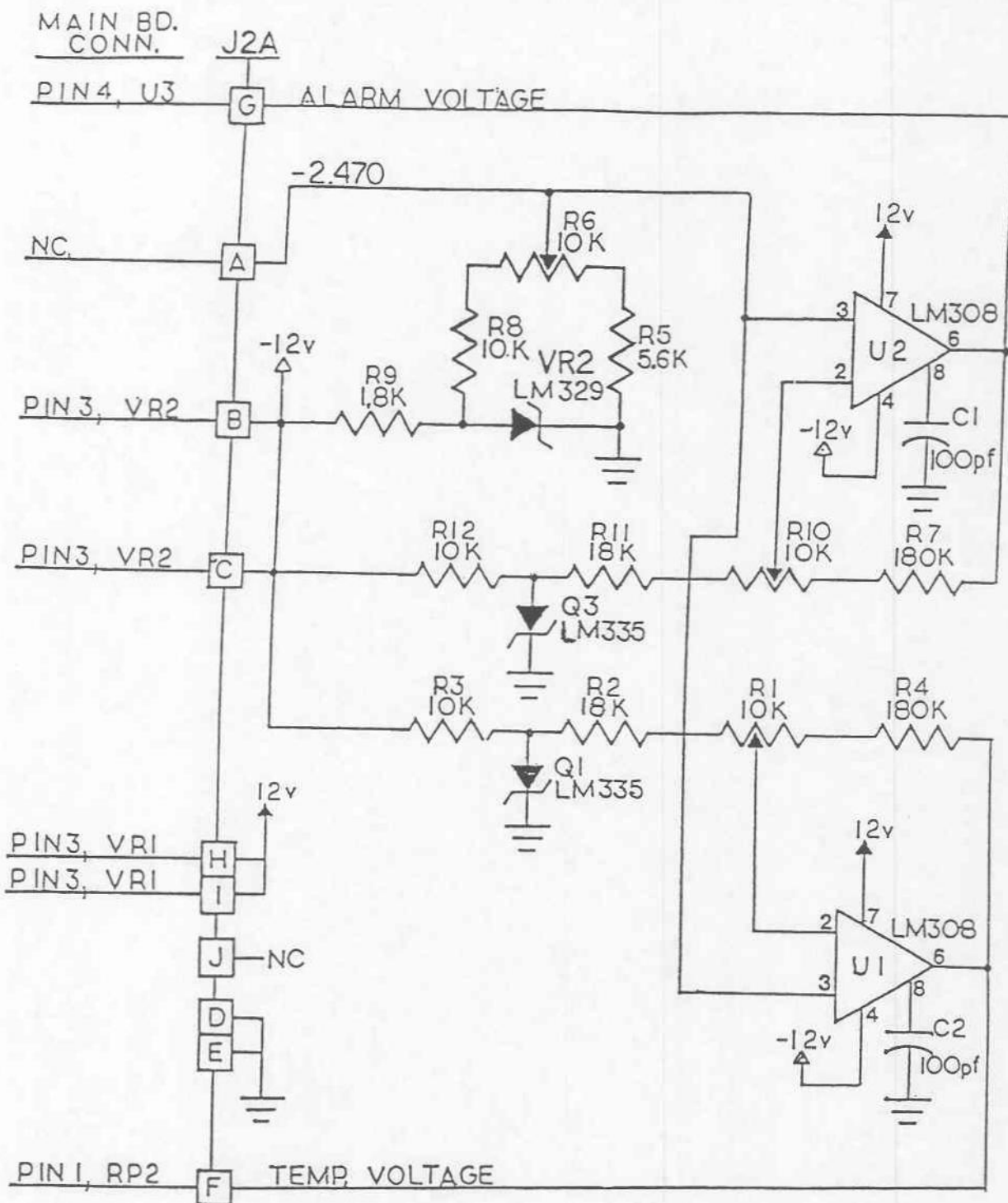


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FLOTEM II <sup>e</sup> DISPLAY BOARD LAYOUT		
SCALE: <i>N/A</i> DATE: <i>5/93</i>	APPROVED BY: <i>[Signature]</i>	DRAWN BY: <i>CG</i>
REV. H		
DRAWING NUMBER: 7012		

# FLOTEM IIe DISPLAY BOARD PARTS LIST

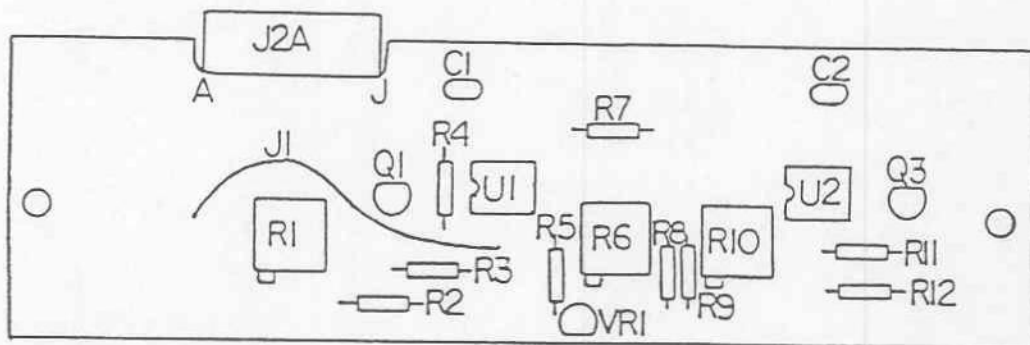
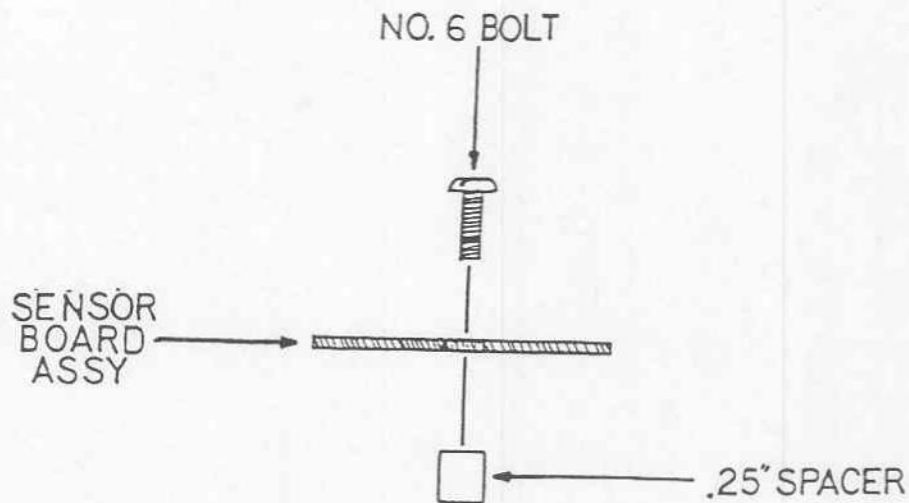
ITEM#	DESCRIPTION	DESIGNATOR	QTY
100800	MC14001; 2 INPUT NOR GATE	U2	1
100900	TSC7106; A/D DISPLAY DRIVER	U3	1
110100	MC78L05; 100mA +5 V REG.	Q1	1
110300	MC79L05; 100mA -5 V REG.	Q2	1
110500	1N914; SIGNAL DIODE	D1,2	2
111005	LM336 Z 2.5; VOLTAGE REFERENCE	Q3	1
120300	10K OHM; FLAT POT (20 T)	DR17,19	2
122000	1.2K OHM; 1/4W, 5% RESISTOR	DR6	1
122400	2.4K OHM; 1/4W, 5% RESISTOR	DR20	1
122500	2.7K OHM; 1/4W, 5% RESISTOR	DR16	1
122900	9.1K OHM; 1/4W, 5% RESISTOR	DR7	1
123100	12K OHM; 1/4W, 5% RESISTOR	DR18	1
123400	27K OHM; 1/4W, 5% RESISTOR	DR11	1
123800	91K OHM; 1/4W, 5% RESISTOR	DR8	1
123900	100K OHM; 1/4W, 5% RESISTOR	DR15	1
124200	470K OHM; 1/4W, 5% RESISTOR	DR10	1
124400	1M OHM; 1/4W, 5% RESISTOR	DR9	1
130200	100pF; SILVAMICA CAPACITOR	C9	1
130400	.1uF; CERAMIC CAPACITOR	C10	1
130500	4.7uF; 35V TANT CAPACITOR	C2,3,4	3
130600	.01uF; MINI-BOX CAPACITOR	C7	1
130700	.047uF; MINI-BOX CAPACITOR	C6	1
130800	.1uF; MINI-BOX CAPACITOR	C8	1
130900	.22uF; MINI-BOX CAPACITOR	C5	1



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# FLOTEM IIe SCHEMATIC SENSOR BOARD

SCALE: <i>N/A</i>	APPROVED BY: <i>[Signature]</i>	DRAWN BY: <i>CG</i>
DATE: <i>5/93</i>		
REV. F		DRAWING NUMBER 1023



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# FLOTEMIIE SENSOR BOARD LAYOUT

SCALE: <i>NA</i>	APPROVED BY: <i>[Signature]</i>	DRAWN BY: <i>CP</i>
DATE: <i>5/9/3</i>		
REV. F		DRAWING NUMBER 7011

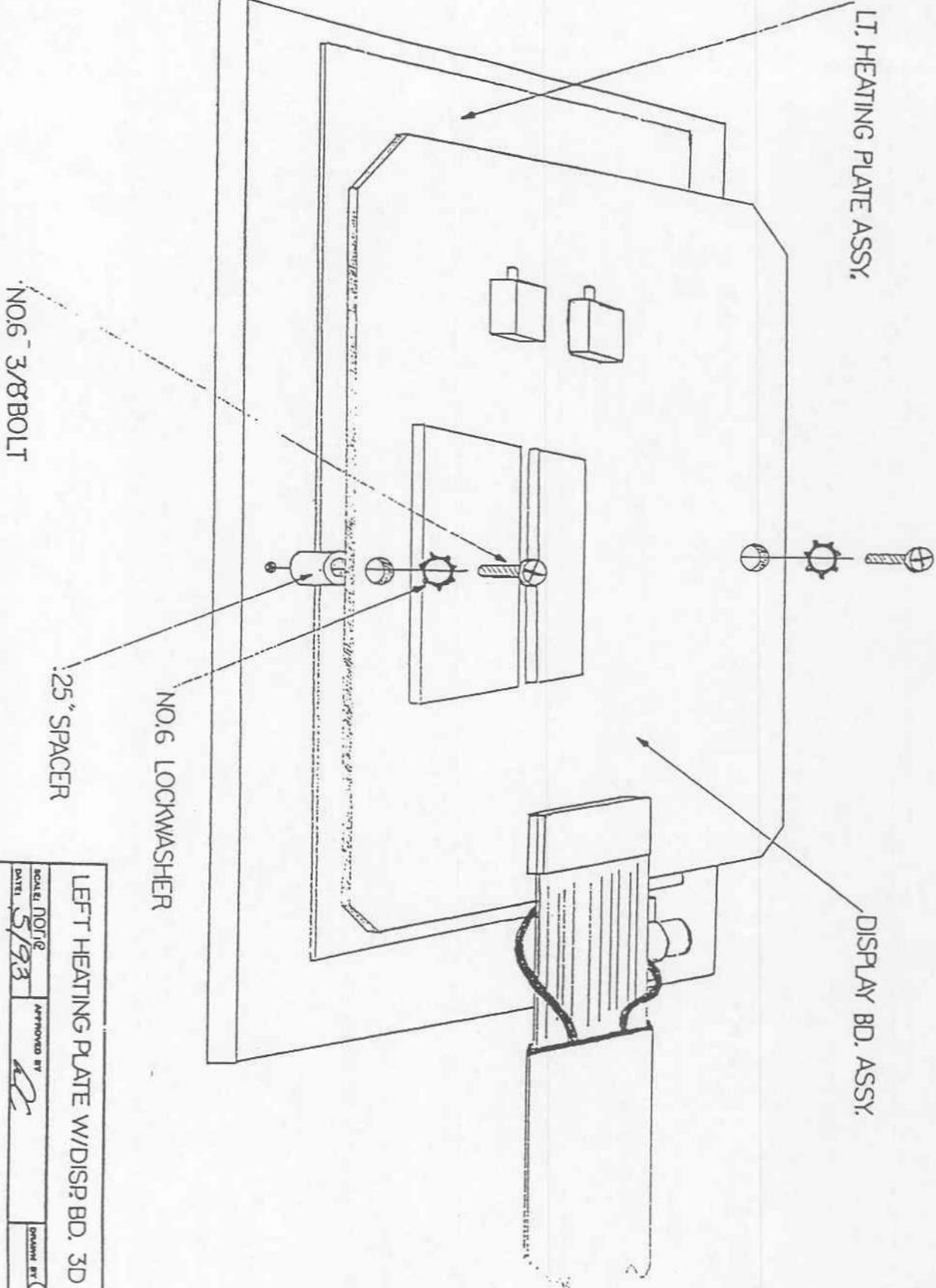
# FLOTEM Iie SENSOR BOARD PARTS LIST

ITEM#	DESCRIPTION	DESIGNATOR	QTY
100000	LM308; OP AMP	U1,2	2
111001	LM329; VOLTAGE REFERENCE	Q2	1
111002	LM335; TEMPERATURE SENSOR	Q1,3	2
120300	10K OHM; FLAT POT (20 T)	SR1,10,6	3
122200	1.8K OHM; 1/4W, 5% RESISTOR	SR9	1
122800	5.6K OHM; 1/4W, 5% RESISTOR	SR5	1
123000	10K OHM; 1/4W, 5% RESISTOR	SR3,8,12	3
123300	18K OHM; 1/4W, 5% RESISTOR	SR2,11	2
124000	180K OHM; 1/4W, 5% RESISTOR	SR4,7	2
130100	100pF; CERAMIC CAPACITOR	C1,2	2
140000	1 X 10 FEMALE CONNECTOR	H1	1
170200	FLOTEM Iie SENSOR PCB	SPC	1



# FLOTEM IIe HARDWARE PARTS LIST

ITEM#	DESCRIPTION	QTY
152004	40 DEGREE CELCIUS,NC THERMOSTAT	2
152054	DISPLAY HEAT PAD	1
152055	MAIN HEAT PAD	1
160000	1/4 X 20 HEX NUT	2
160200	4-40 HEX NUT	3
160400	6-32 HEX NUT	2
160600	DRESS NUT (PWR SW)	1
161000	4-40 X 1/2" MACHINE SCREW	7
161230	6-32 X 3/8" MACHINE SCREW	2
161245	6-32 X 5/8" MACHINE SCREW	2
161800	#6 X 1/2" BLK OX SELF TAPPING SCREW	8
162000	1/4" METAL SPACER	2
162010	1/2" METAL SPACER	2
162200	1/4" PLASTIC SPACER	3
162420	1/4" THREADED PLASTIC SPACER	2
166000	5/8" SPRING	4
167001	BLACK FINGER GUARD	1
167005	"C" CLAMP	1
167007	BLACK STRAIN RELIEF	1
167015	THERMOSTAT MOUNTING STRAP	2
182150	DISPLAY GRVD HEATING PLATE	1
182151	MAIN GRVD HEATING PLATE	1
182170	FLOTEM IIe CASE W/HINGE	1
192055	15' POWER CORD	1
212304	FLOTEM IIe PLASTIC FRONT LABEL	1
212307	FLOTEM IIe PLASTIC BACK LABEL	1



LEFT HEATING PLATE W/DISP. BD. 3D

SCALE: NORT

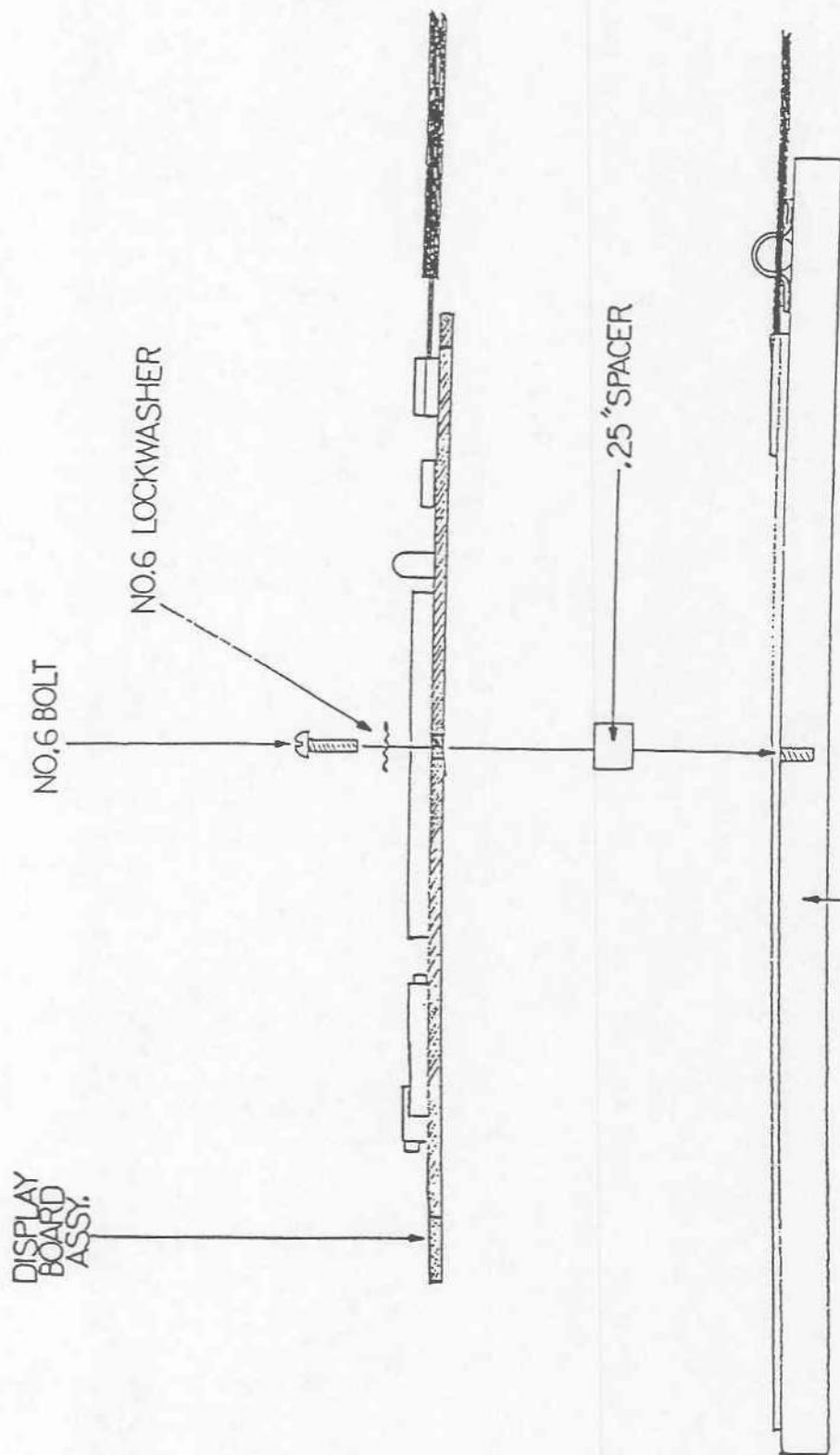
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APPROVED BY

*[Signature]*

DRAWN BY: CP

DRAWING NUMBER  
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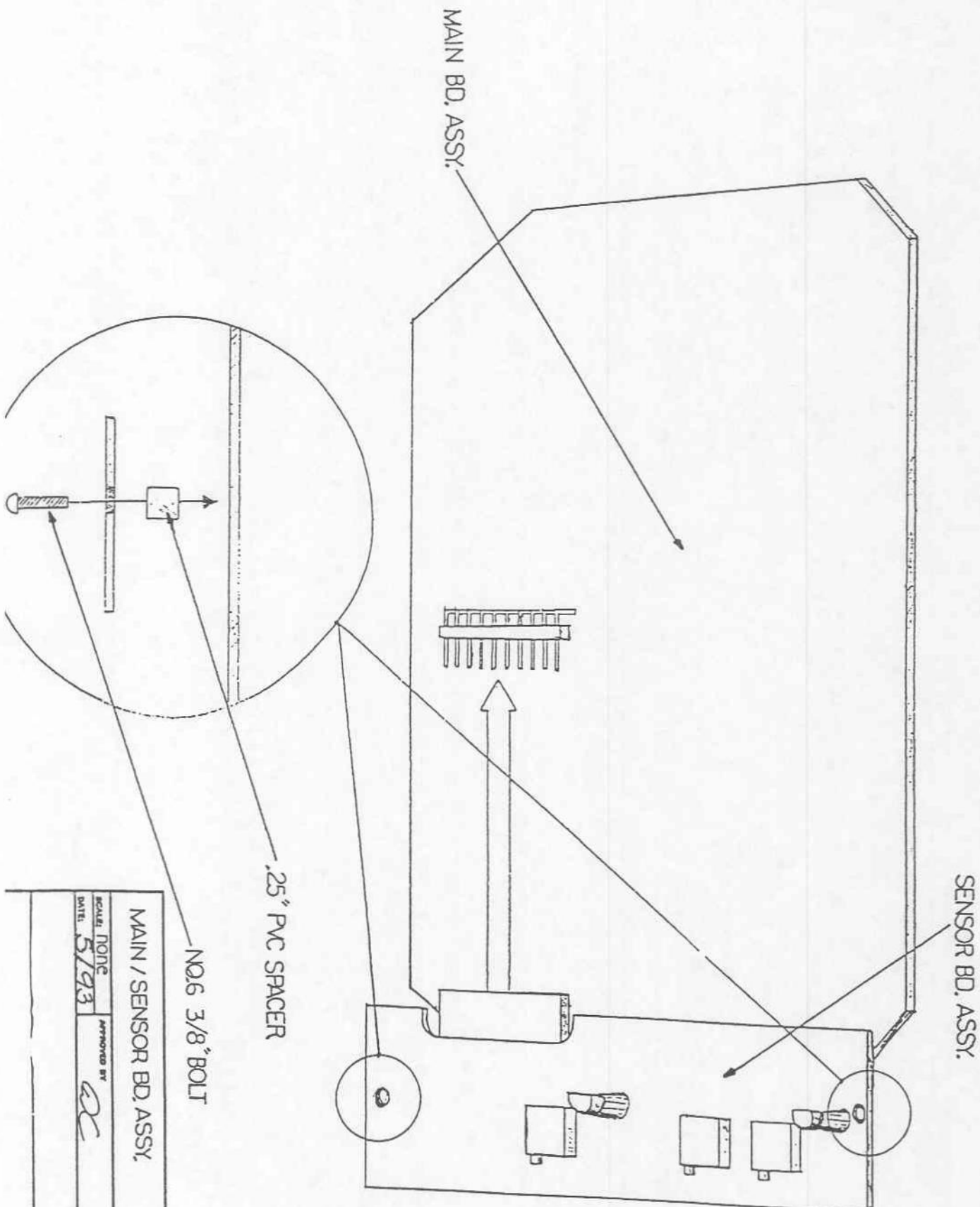


DISPLAY PLATE ASSEMBLY SIDE VIEW  
PAGE 40

LEFT HEATING PLATE W/DISP. BD.

SCALE: none	APPROVED BY	DESIGNED BY C.P.
DATE: 1/5/93	<i>AC</i>	
		DRAWING NUMBER
		5038

LT HEATING  
PLATE ASSY.



MAIN BOARD TO SENSOR BOARD CONNECTOR  
PAGE 41

MAIN / SENSOR BD. ASSY.

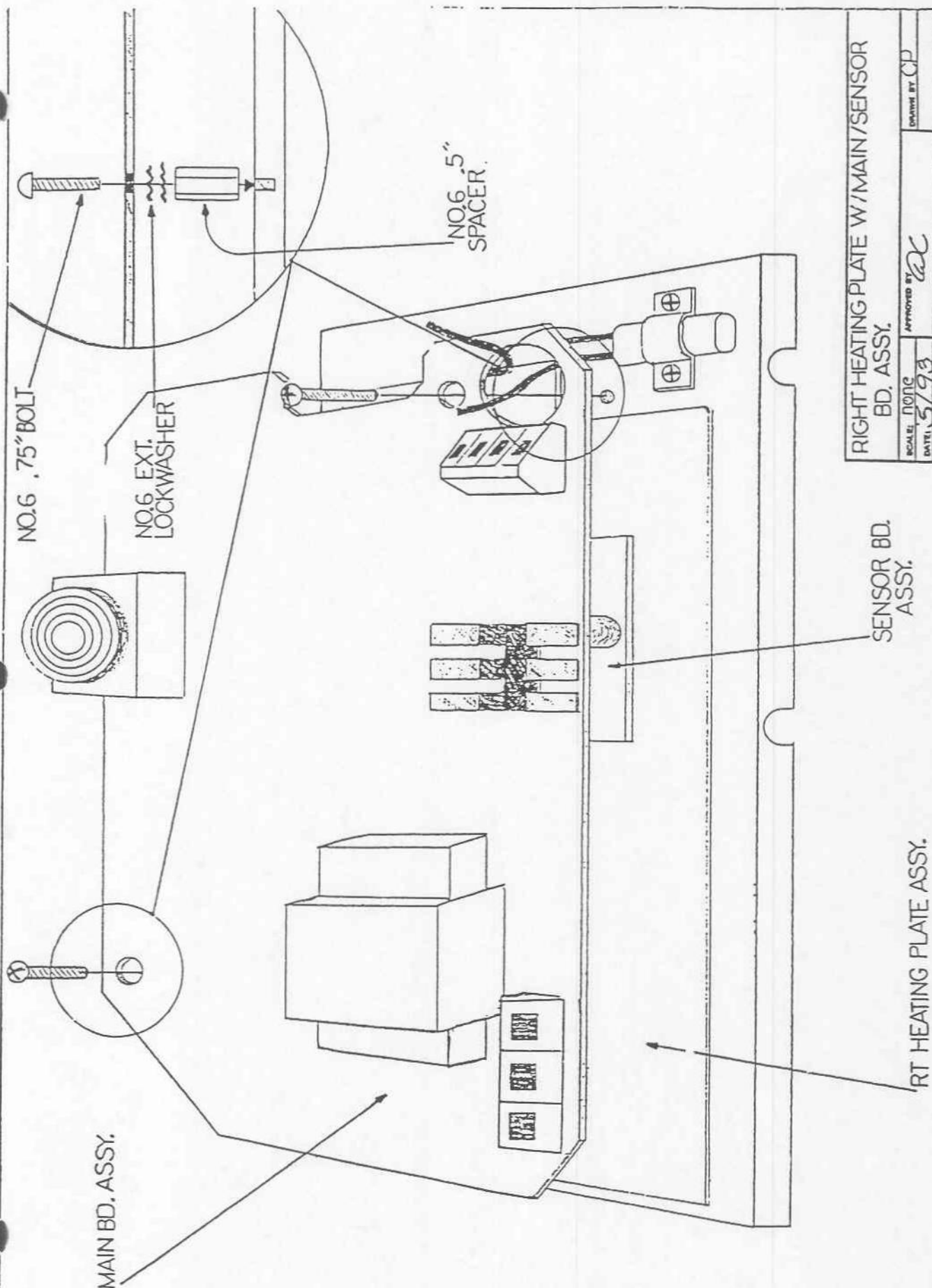
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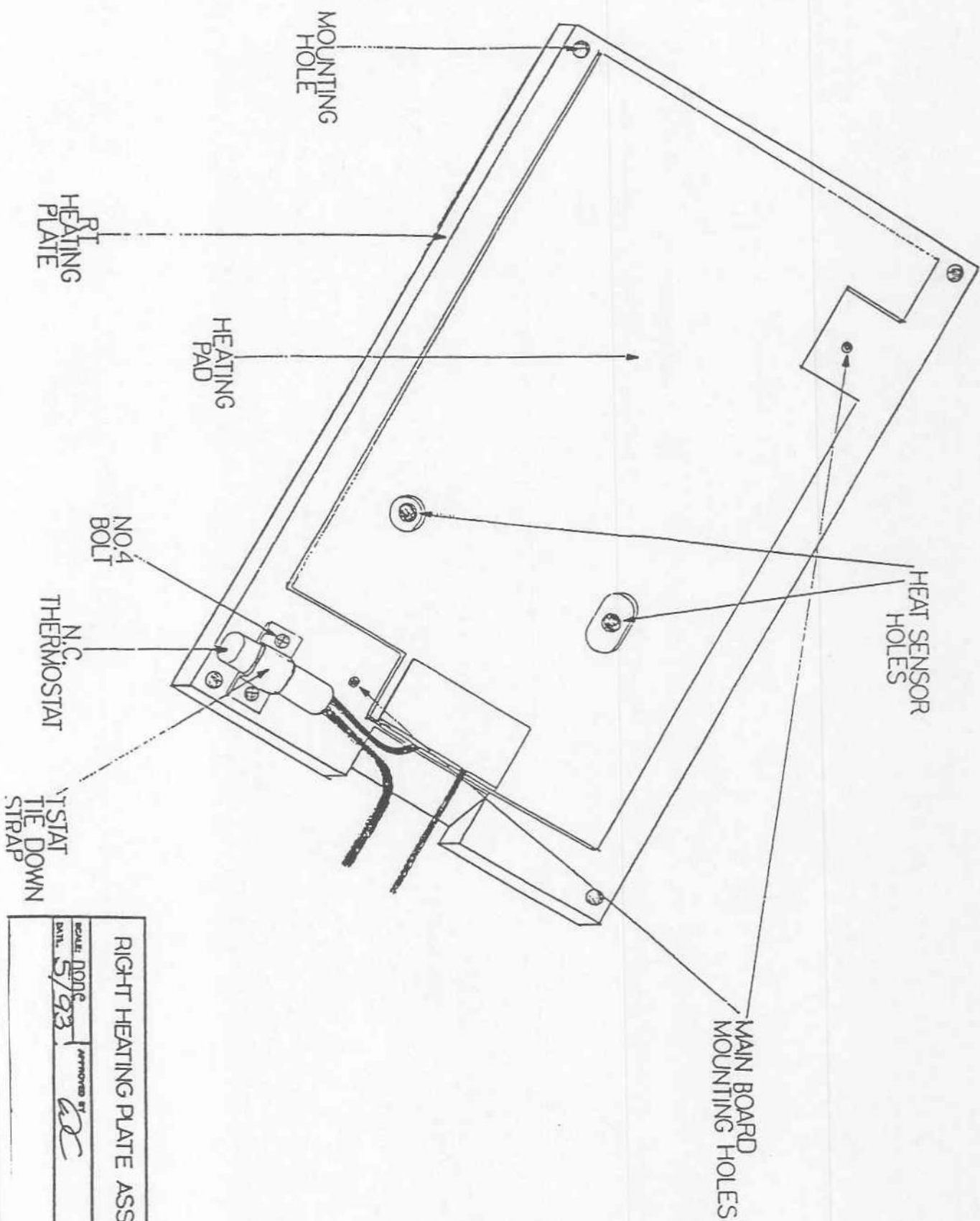
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DRAWING BY CP

5041

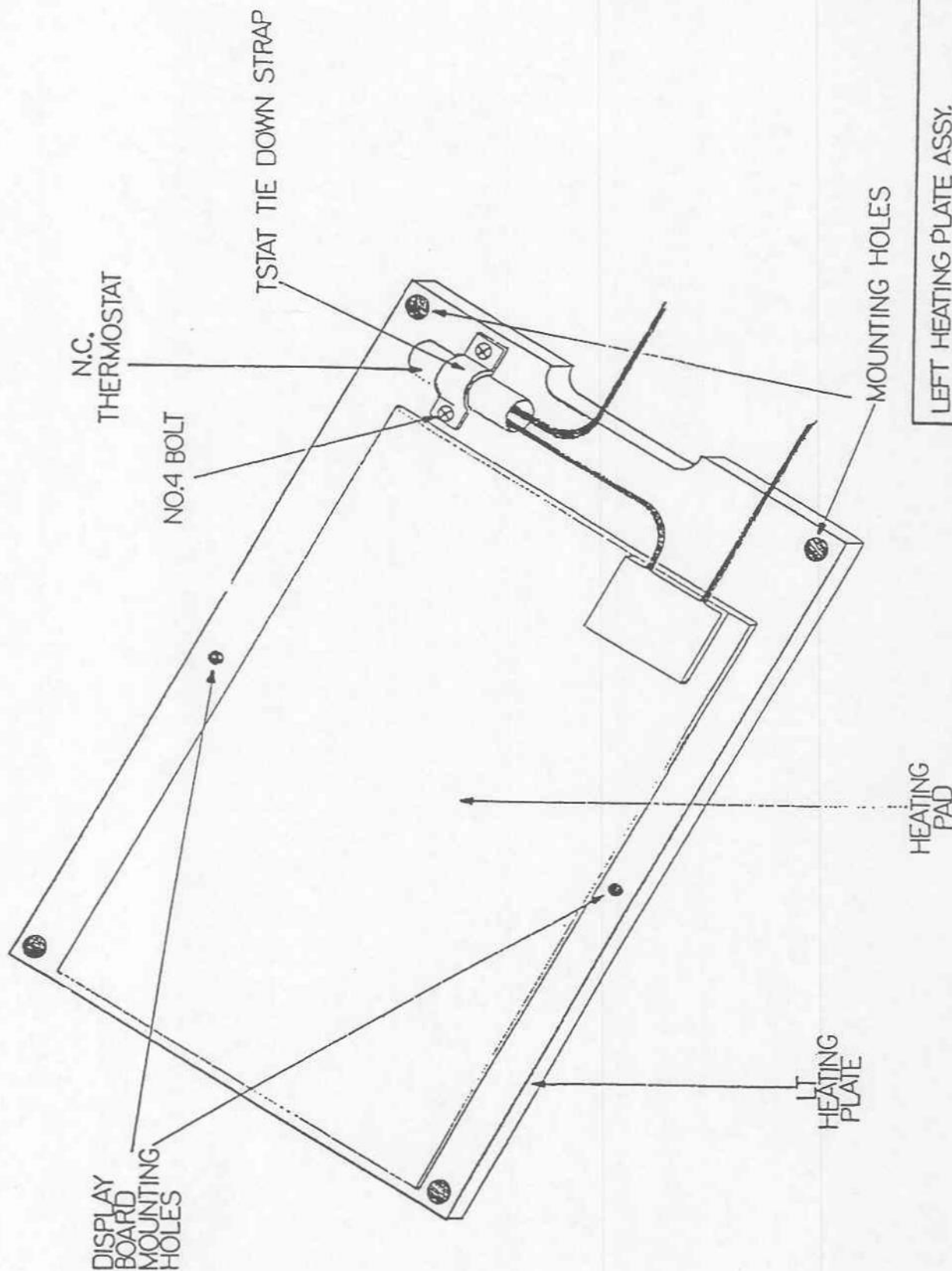






RIGHT HEATING PLATE ASSY.

SCALE: NONE	APPROVED BY:	DESIGNED BY: CP
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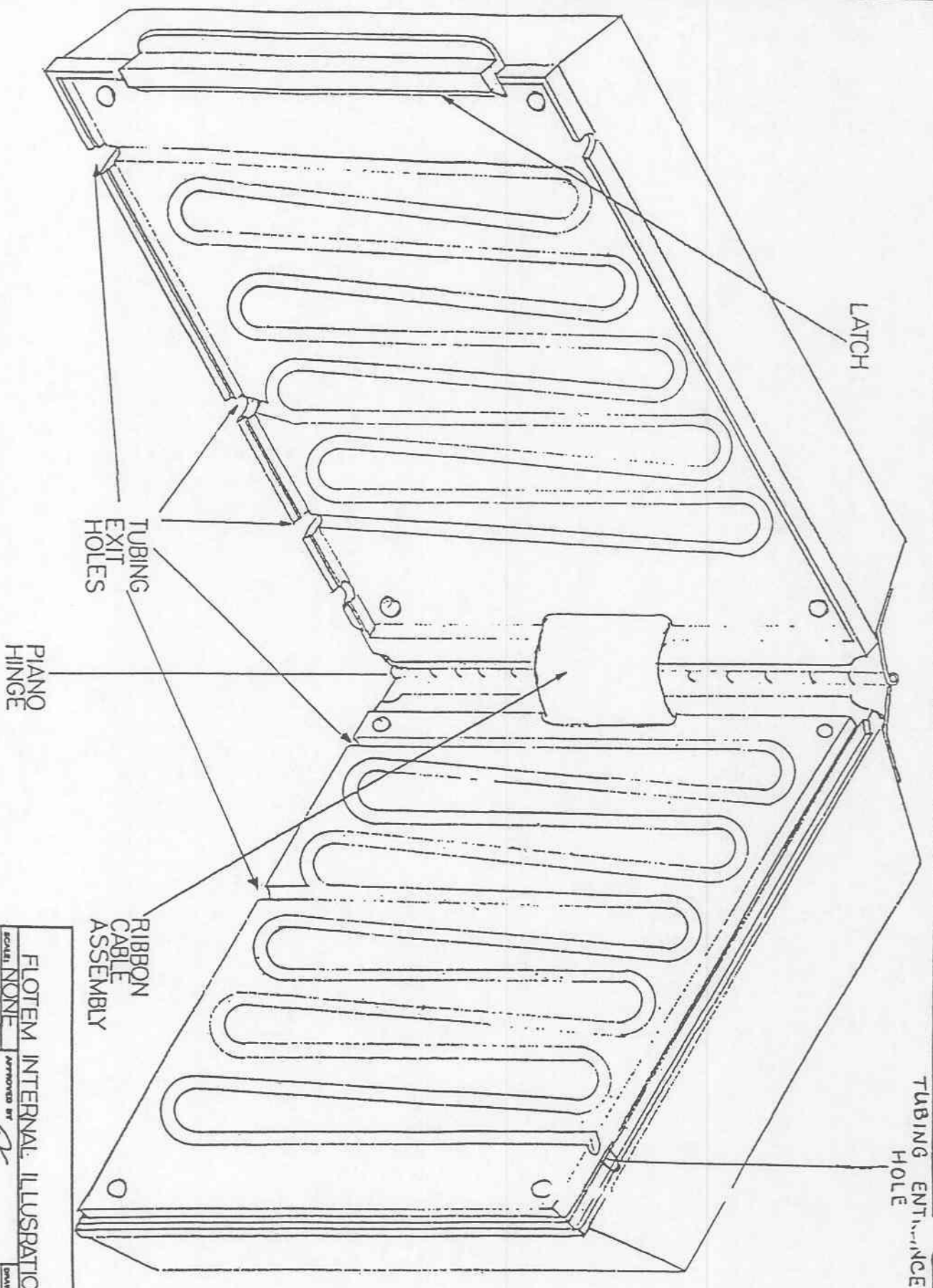


DISPLAY HEAT PLATE ASSEMBLY  
PAGE 44

LEFT HEATING PLATE ASSY.

SCALE: none	APPROVED BY: <i>[Signature]</i>	DRAWN BY: <i>CP</i>
DATE: 5/93		

DRAWING NUMBER
5044



FLOTEM INTERNAL ILLUSTRATION  
PAGE 45

FLOTEM INTERNAL ILLUSTRATION

SCALE: NONE

APPROVED BY

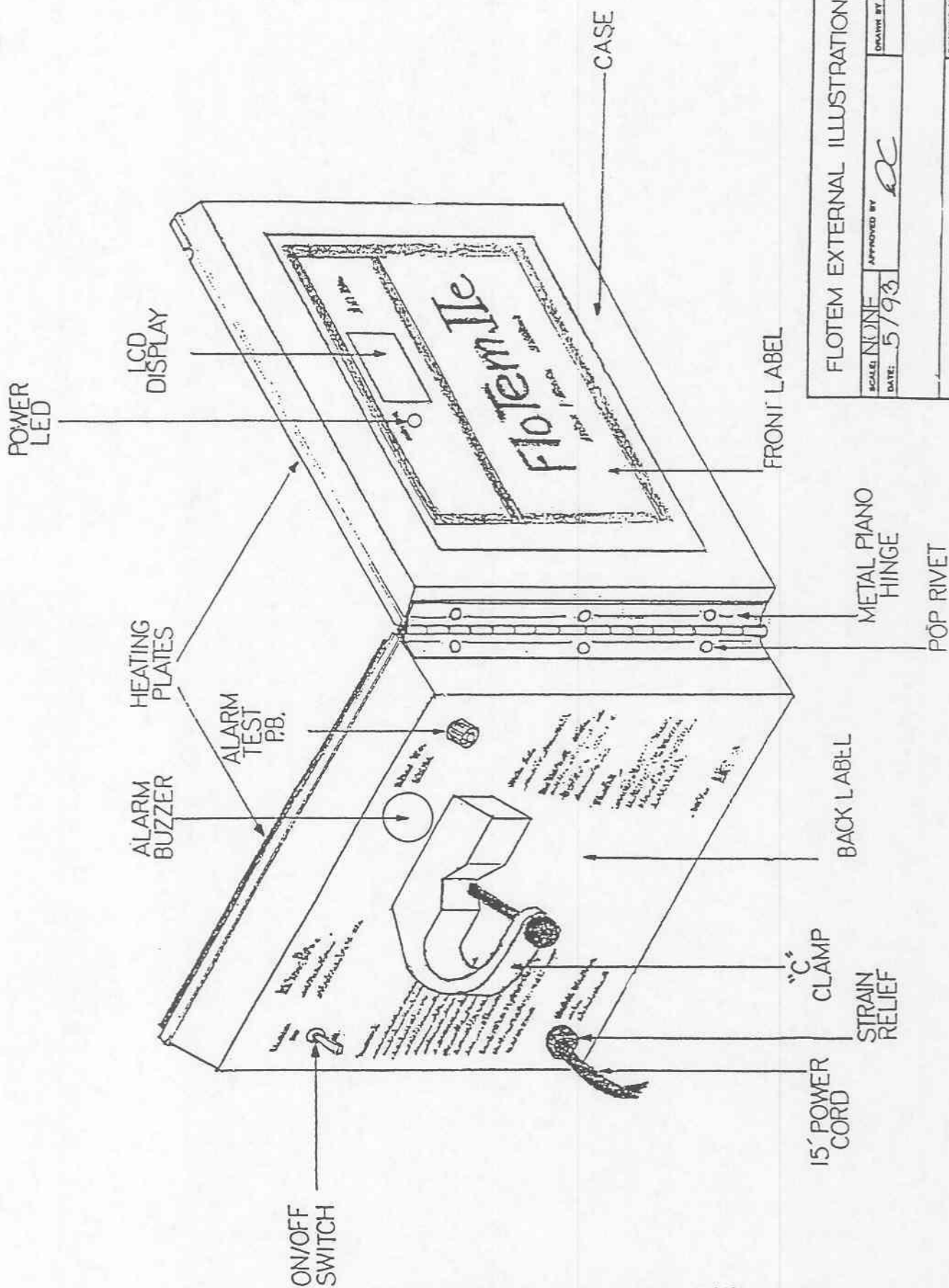
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*ac*

DRAWN BY: CP

5046

DRAWING NUMBER

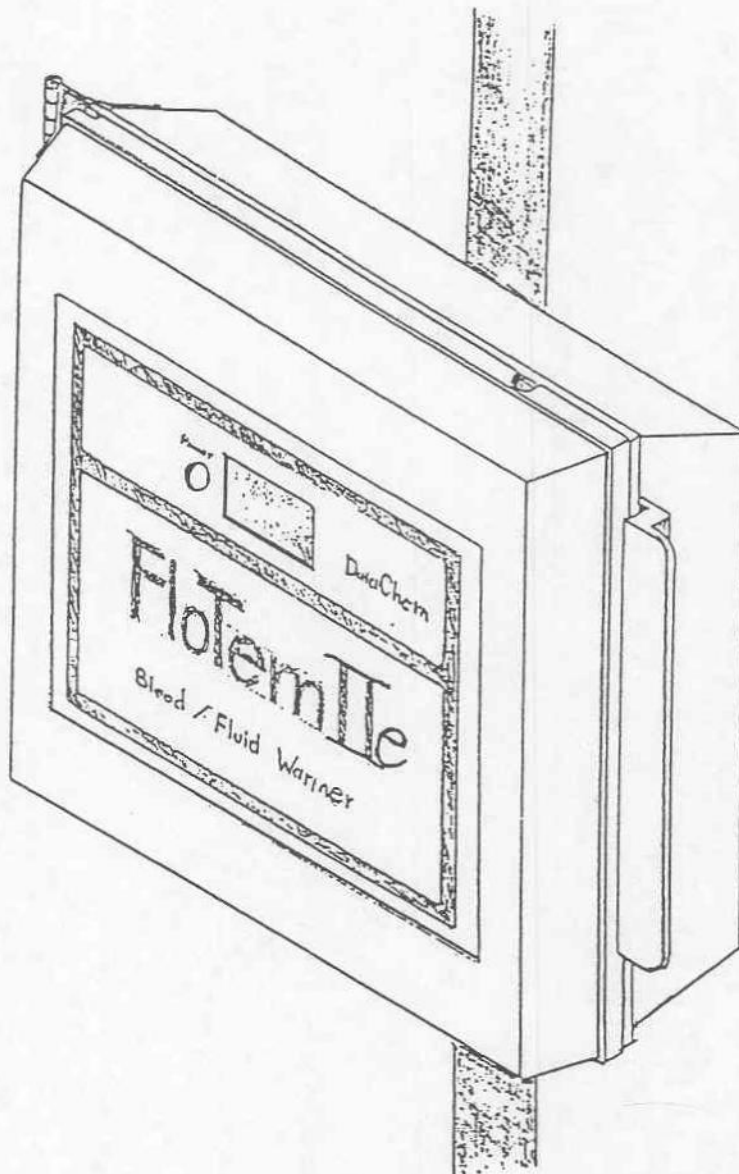


FLOTTEM EXTERNAL ILLUSTRATION

FLOTTEM EXTERNAL ILLUSTRATION

SCALE: NONE  
DATE: 5/93  
APPROVED BY: [Signature]  
DRAWN BY: CP

DRAWING NUMBER  
5045



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FLOTEM EXTERNAL ILLUSTRATION Closed

SCALE: none	APPROVED BY: <i>CP</i>	DRAWN BY: <i>CP</i>
DATE: 5/93		
		DRAWING NUMBER 50-17



## FLOTEM IIe 110VAC TO 220VAC CONVERSION

The following list of instructions is included to convert your FloTem IIe from 110VAC to 220VAC. The list of instructions should be followed in strict order to insure proper conversion and safety of your FloTem IIe.

**NOTE:** Refer to Figure 1. DWG #5039 IN APPENDIX.

1. Turn ON/OFF switch to the OFF position.
2. Disconnect the 15' POWER CORD from the wall receptacle.
3. Using a pair of pliers or a small wrench loosen and remove the DRESS NUT which is located on the ON/OFF switch.
4. Twist and remove the FINGER GUARD which is located on the ALARM TEST P.B.

**NOTE:** Refer to figure 2. DWG #5039 IN APPENDIX.

5. Open your FloTem IIe and place face down, revealing the heating plates.
6. Using a screw driver remove the 4 MOUNTING SCREWS located in the heating plate.

**NOTE:** There are two heating plates. Each heating plate has 4 MOUNTING SCREWS. Remove these 4 from the side of the unit that has the "C" clamp on the back. DO NOT REMOVE THE 4 MOUNTING SCREWS TO THE SIDE OF THE UNIT WHICH HAS THE LCD DISPLAY.

7. Place the unit on its bottom side as shown in Figure 2. Then pull the heating plate down so that it rests face down.

**NOTE:** At this point you should make sure that the 15' POWER CORD has been removed from the wall receptacle to insure safety.

**NOTE:** Refer to Figure 3. DWG #5039 IN APPENDIX

8. First locate the fuse which has been placed in the fuse clips at the location of F2 designated on the printed circuit board. This fuse is located right next to the ON/OFF switch.

9. Remove the fuse from the F2 location.

10. Bend fuse clip B back together so that it can hold the fuse in the F2A position.

11. Place the fuse ends into the fuse clips of B and D. The fuse will now be in the F2A position.

**NOTE:** Refer to figure 4. DWG #5040 IN APPENDIX.

12. Locate TB1, which is in the upper left hand corner of the board with four wires extending from it.

13. Disconnect J3 from P3 and J4 from P4.

14. Connect J4 to P3. Leave J3 and P4 disconnected.

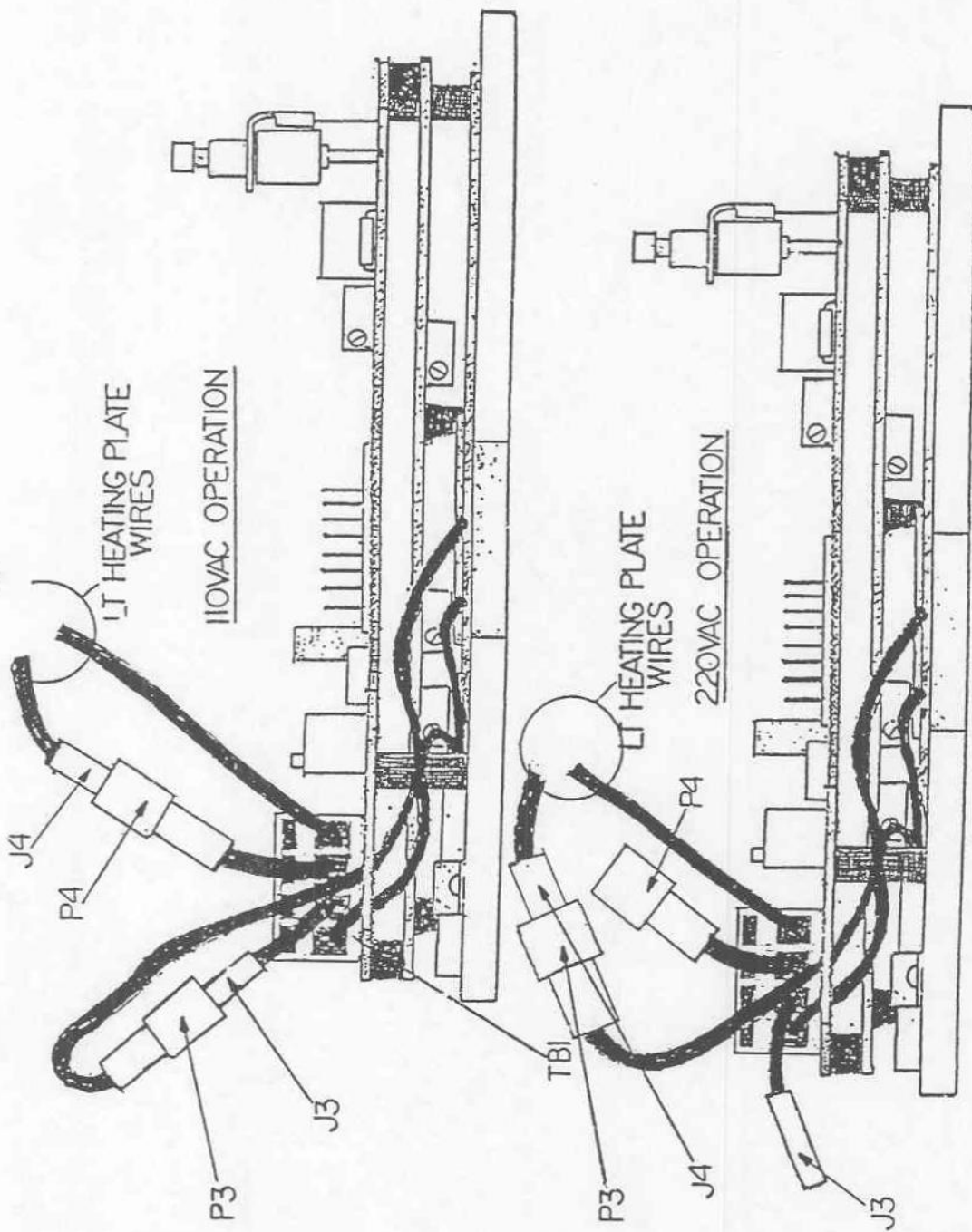
**NOTE:** Your HEATING PLATE wiring should now look like the 220VAC operation in Figure 4. DWG #5040.

15. Push the heating plate back up into the case. Make sure that both switches come through and extend out the back of the case.

16. Once the plate has been returned inside the case,, the 4 MOUNTING SCREWS need to be screwed back in.

17. The DRESS NUT should now be placed on the ON/OFF switch and tightened with a wrench.

18. The FINGER GUARD should be placed on the ALARM TEST P.B. and only hand tightened.



110 VOLT TO 220 VOLT CONVERSION

# HEATING PAD WIRE CONFIGURATION

110v vs 220v

SCALE NONE	APPROVED BY	DRAWN BY CP
DATE 5/93	<i>EC</i>	

REV. 1

5040

FIG.1

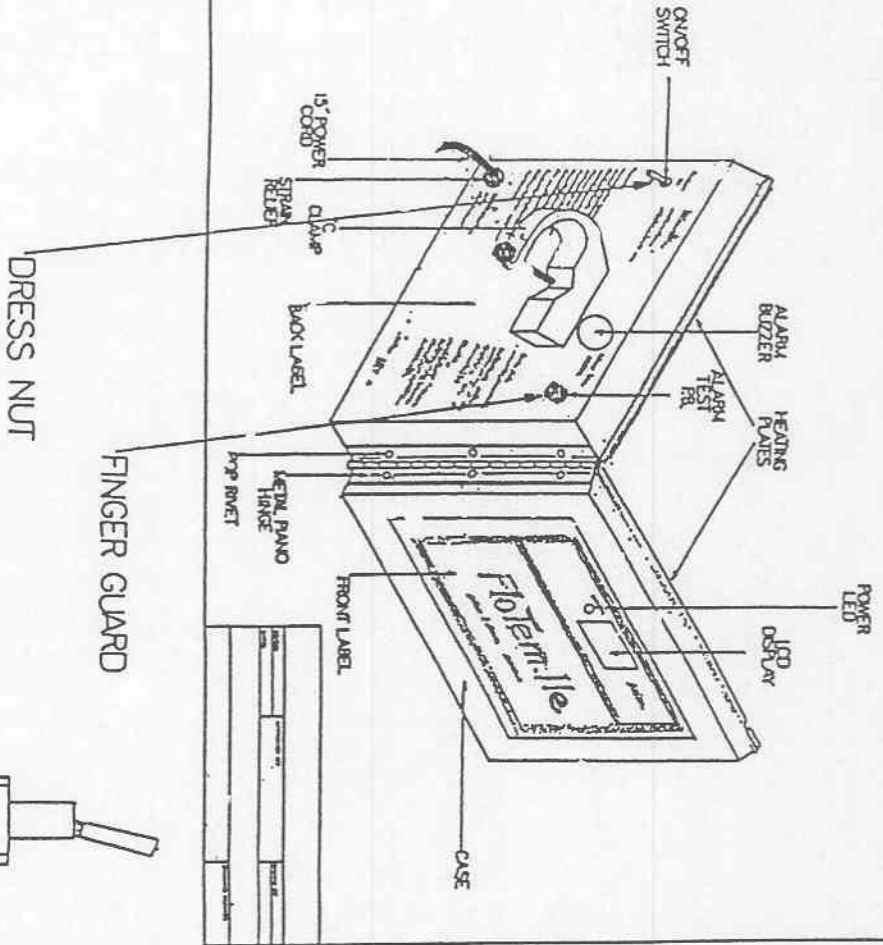


FIG.2

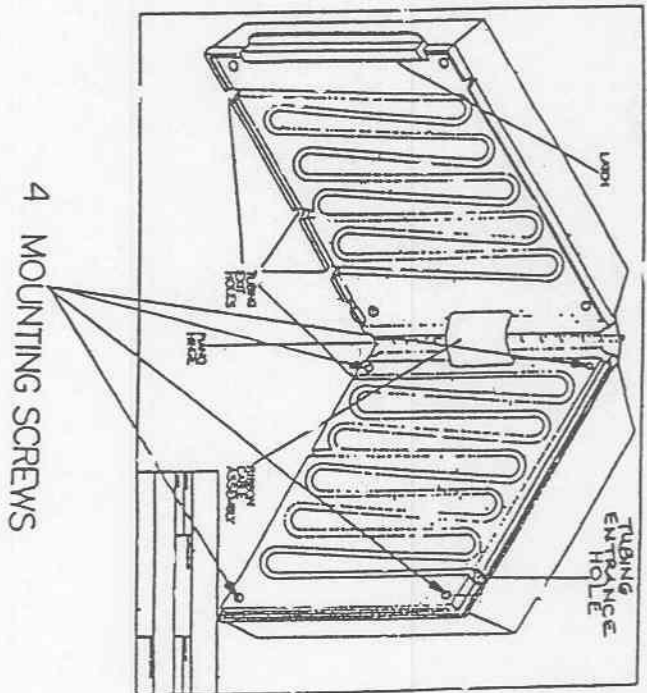
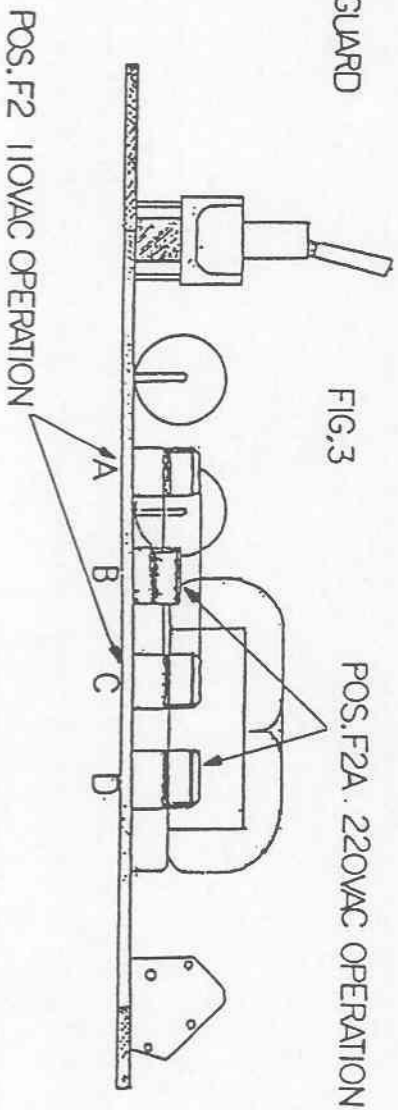


FIG.3



POWER REQUIREMENTS  
300 WATTS  
220-240VAC @ 50HZ 1.50 A

FIGS. 1, 2 and 3 of 110v to 220v CONVERSION

SCALE: NONE  
DATE: 5/93  
APPROVED BY: [Signature]  
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