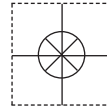


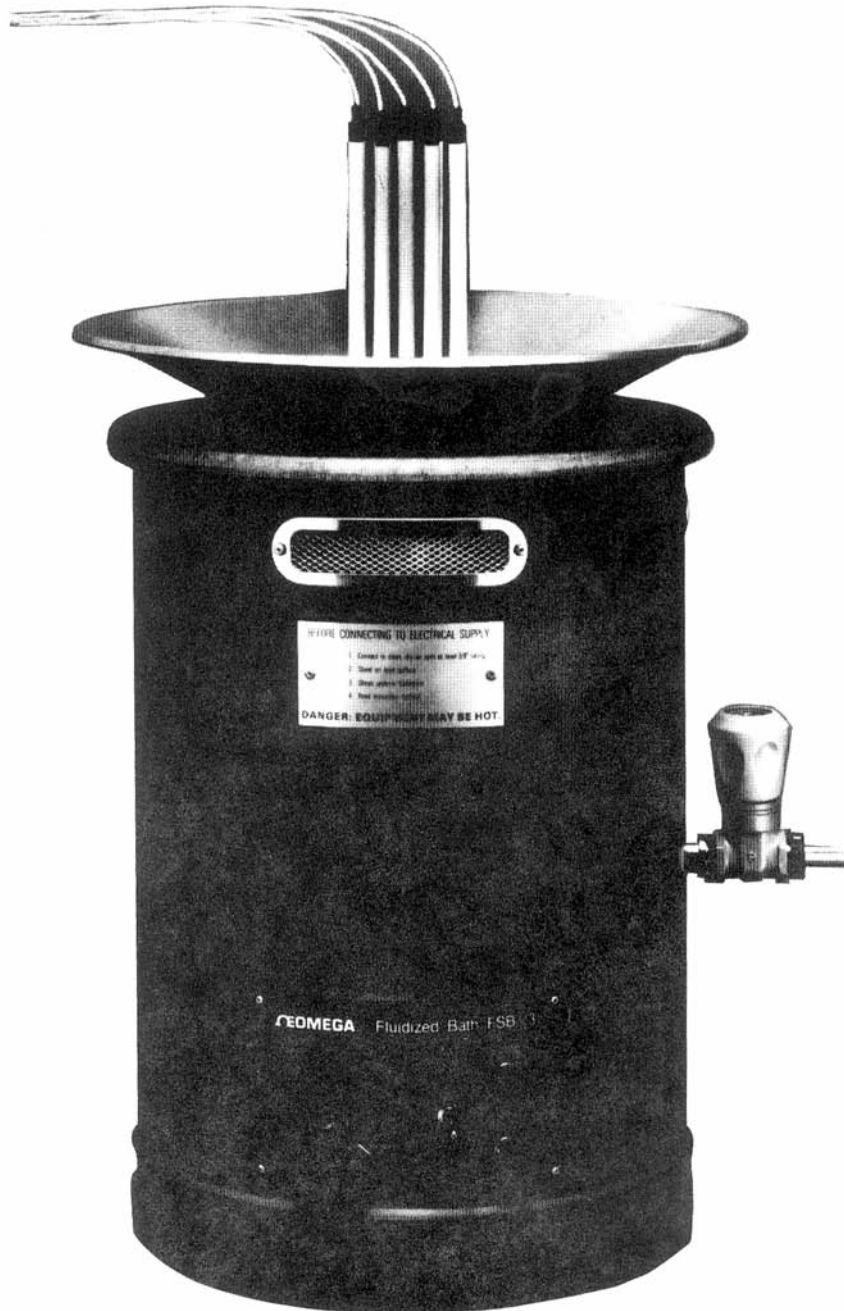
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# User's Guide



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MANCHESTER, UK

# FSB SERIES Fluidized Sand Baths For Temperature Probe Calibration

TABLE OF CONTENTS  
FSB LABORATORY CALIBRATION BATHS

SECTION	PAGE
SECTION 1 INTRODUCTION	1
1.1 General Description	1
1.2 Heating and Control	2
1.3 Features	2
SECTION 2 INSTALLATION	3
2.1 Unpacking	3
2.2 Location and Hookup	4
SECTION 3 OPERATION	4
SECTION 4 THEORY OF OPERATION	7
SECTION 5 SERVICE INFORMATION	8
5.1 Maintenance	8
5.1.1 Aluminum Oxide	8
5.1.2 Air Filter	8
5.1.3 Porous Plate	8
5.1.4 Heating Elements	8
5.2 Functional Checks	8
5.2.1 Energy Regulator	8
5.2.2 Fail-Safe Switch	9
5.3 Troubleshooting	10
5.3.1 Fail-Safe Switch	11
5.3.2 Energy Regulator	12
5.3.3 Heating Elements/Selector Switch	12
5.4 Disassembly	14
SECTION 6 SPECIFICATIONS	16
6.1 Accessories	17
6.2 Parts List	17

## SECTION 1 INTRODUCTION

### 1.1 GENERAL DESCRIPTION

The OMEGA® FSB Series Laboratory Calibration Baths are cylindrical, fluidized heating units which enable precision calibration of temperature measurement devices in a wide variety of shop or laboratory applications.

The OMEGA FSB Series is represented by four models that are essentially identical, except for differences in sizes and temperature ranges. These differences result in minor variations in parts, controls, and operating instructions, which are described in the appropriate sections of this manual.

The FSB Series baths are available in four models with a choice of four volumes and two temperature ranges:

Model FSB-1 - Working Volume: Depth: 4.5" (114 mm)  
Diameter: 6.5" (165 mm)  
Temperature Range: 122° to 662°F (50° to 350°C)

Model FSB-2 - Working Volume: Depth: 5.5" (140 mm)  
Diameter: 8.5" (216 mm)  
Temperature Range: 122° to 662°F (50° to 350°C)

Model FSB-3 - Working Volume: Depth: 7" (178 mm)  
Diameter: 6.5" (165 mm)  
Temperature Range: 122° to 1112°F (50° to 600°C)

Model FSB-4 - Working Volume: Depth: 14" (356 mm)  
Diameter: 8.5" (216 mm)  
Temperature Range: 122° to 1112°F (50° to 600°C)

The bath consists of a stainless steel inner container with a porous air-diffusion plate at the bottom. Inconel sheathed immersion heaters are located horizontally in the bath just above the porous plate. (Model FSB-1 has one 0.750 kW heater; Model FSB-2 has two 1 kW heaters; Model FSB-3 has two 0.750 kW heaters; Model FSB-4 has four 1 kW heaters). The steel outer case is painted with heat resistant paint and is insulated from the inner container with 1.0 in (25 mm) thick fiberglass insulation.

The bath stands on three rubber feet and includes a three wire cable and plug.

## 1.2 FEATURES

- o Accurate uniform temperature control over a wide range
- o Safe operation - clean, dry, inert, nontoxic
- o Rapid heating - high heat transfer rates
- o Safe for delicate instruments
- o Medium cannot evaporate or solidify
- o Low electrical conductivity

## 1.3 HEATING AND CONTROL

An energy regulator with graduations from 0 to 10 is used to set and control the temperature. The energy regulator controls the 0.750 kW heater in the Model FSB-1; and the initial heater in multi-heater models (FSB-2, -3, -4). A heater switch controls the other heater(s) on Models FSB-2, FSB-3, FSB-4. A neon light shows the status of the heater being controlled.

In units with more than one heater, additional neon lights are installed to show the status of these heaters. They are controlled by a switch located next to the energy regulator.

A thermocouple well protrudes horizontally into the bath. Access is from the outside of the bath through both the inner and outer containers.

An air flow control valve on the side of the unit accepts low-pressure (3 to 6 psi) clean, dry air either from an air line or a small compressor, if piped-in air is not available.

Table A below lists the FSB accessories and their part numbers as outlined in The OMEGA Temperature Handbook.

<b>MODEL NUMBER</b>	<b>DESCRIPTION</b>	<b>MANUAL NO.</b>
<b>FSB-F-784</b>	FILTER for use in compressed air system to remove most liquid and solid particles.	M1040
<b>FSB-P-783</b>	PRESSURE REGULAR AND GAGE (0-30 PSI) for reducing air line pressure.	M1039
<b>FSB-A-20</b>	Aluminum Oxide replacement "Sand"— 20 lbs	—
<b>FSB-A-34</b>	Aluminum Oxide replacement "Sand"— 34 lbs	—

These items can be found in Section "K" of the OMEGA® complete Temperature Measurement Handbook and Encyclopedia. In this 1000 plus page handbook you will find thousands of items for the measurement, recording, calibration, data transmission, and control of temperature and humidity.

Each unit includes a fail-safe pressure switch, operated by the fluidizing air that automatically turns off all the heaters if fluidization is lost, thus protecting the heaters against burnout.

## **SECTION 2 INSTALLATION**

### **2.1 UNPACKING**

Remove the packing list and verify that all equipment has been received. If there are questions about the shipment, please call OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

### **NOTE**

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

## **2.2 LOCATION AND HOOKUP**

- a. Place the bath on a firm level surface, allowing room at the top for the insertion and removal of objects. Turn the energy regulator and gate valve to the off positions.
- b. Connect the air inlet tube to a clean, dry, air supply (3 to 6 psi) using a 3/8 inch ID hose. Keep the length as near six feet as possible.

### **NOTE**

Gases other than air (i.e., argon or nitrogen) may be used if an inert atmosphere is required.

- c. Connect the power cord to a properly fused electrical outlet.

## **SECTION 3 OPERATION**

### **WARNINGS**

The inherent advantages of a fluidized bath, such as no fumes or smell, no vapors, and low temperature environment a few inches above the top of the bath, may give a false sense of security. It should be noted that the fluidizing media is at elevated temperatures and proper warning should be posted to prevent any injury to operating personnel.

Objects should be slowly immersed into the bath. They should not be dropped as this could damage the heaters. Also, an electrical shock hazard could result if the heaters are damaged.

**CAUTION**

Air to the fluidized bath should be clean and free from traces of oil. Neglecting this caution will result in clogged porous plates; also heaters will be damaged due to overheating.

1. Fill the bath with aluminum oxide to about two inches from the top rim.
2. Turn on the main air supply and adjust the pressure to 3 psi.
3. Make sure the energy regulator is set to OFF. Connect the unit to the correct electrical supply, ensuring correct polarity, and switch ON.
4. Slowly open the gate valve on the bath, allowing air to flow into it. Observe the oxide expand and begin to bubble. Adjust the gate valve until bubbles of approximately 3/4 inch are breaking the surface.
5. Set the thermometer in place and be sure it's reading normal room temperature.
6. Set the energy regulator to 5 and set the heater switch to MEDIUM (FSB-2 and FSB-3) or to LOW (FSB-4) (The Model FSB-1 is not equipped with a heater switch since it has only one heater). The neon light should begin to go on and off for approximately equal periods.
7. Set the energy regulator to 10; the neon light should be on continuously. The bath should be getting slightly warm.
8. If rapid heat up is required, set the energy regulator to 8 or 9, and set the heater switch to HIGH (on multi-heater models). As the desired temperature is reached, turn the energy regulator down. It may be necessary to switch off one of the heaters (multi-heater models) completely (e.g. switch back to MEDIUM) Experiment with settings to establish a relationship between them and the bath temperature.

9. In the Model FSB-1, the 0.750 kW heater is controlled by the energy regulator. The energy regulator knob is set to a certain value on the scale (0 to 10), depending upon the desired temperature.
10. In the Model FSB-2, only one (1kW) heater is required to maintain temperature in the bath up to a maximum of 662°F (350°C), the second heater being used as a "booster" or for rapid heat up.
11. In the Model FSB-3 the heat up time to 1112°F (600°C) with full power ON (1.5 kW) is approximately 2.5 hours. When the desired temperature is reached, it may be necessary to switch off one of the two 0.750 kW heaters.
12. In the Model FSB-4, it has been found that under most conditions, only two 1kW heaters are required to maintain temperatures in the bath up to the maximum of 662°F (350°C), the third heater to 1022°F (550°C) and the "boost" heater to 1112°F (600°C) or for rapid heat up. When the desired temperature has been reached, switch off the fourth (boost) heater.
13. With increase in temperature, or when objects are placed into or taken from the bath, adjustments of the air control valve may be necessary. The bath must be kept vigorously boiling.
14. Observe all cautions and warnings.

**CAUTION**

When the bath has been running at high temperatures (390°F or more) and the unit has to be turned off, only the power should be turned off. Fluidization should be maintained until the bath cools down considerably. This will prevent premature failure of the heaters.



## SECTION 4 THEORY OF OPERATION

Air diffused through a ceramic or stainless steel porous plate at low pressure and low velocity converts a particulate medium into a fluidized state. The medium actually looks and feels like a bubbling liquid and provides excellent heat transfer and temperature uniformity.

The principle of fluidization occurs when a gas--usually low pressure air or nitrogen--flows upward through a partially-filled chamber of dry, inert particles of aluminum oxide. The gas flows at a low velocity which sets the particles in motion, separates them, then suspends them at a stable level, giving the particles an appearance of turbulence similar to the state of boiling liquid.

Besides circulating and flowing like a liquid, fluidized solids exhibit excellent heat transfer characteristics; heat is distributed quickly and evenly throughout the bath and transferred rapidly to submerged objects. The bath temperature can be easily adjusted as required.

Fluidized solids have no melting or boiling point. They will not solidify when the temperature drops, or emit vapors or odors at high temperatures. Solidification, which takes place in cooling salt baths, and fumes from hot oil baths are also eliminated.

Fluidized solids are dry and relatively inert, making the medium safe and clean when compared to conventional liquid systems.

## **SECTION 5 SERVICE INFORMATION**

### **5.1 MAINTENANCE CHECKS**

#### **5.1.1 Aluminum Oxide**

Check that the medium level is maintained. Periodically remove and screen the medium; replace it entirely if it becomes thoroughly contaminated.

#### **5.1.2 Air Filter**

Examine the air filter at regular intervals for signs of air contamination. It is important that clean dry air be used. Replace the filter as necessary.

#### **5.1.3 Porous Plate**

When the medium is removed, examine the porous plate. Check for cracks and deterioration. Also check the peripheral seal; there should be no air leakage around the seal.

#### **5.1.4 Heating Elements**

Check for scaling, pin holes, or signs of deterioration. Check that the elements do not touch each other or the bath wall.

### **5.2 FUNCTIONAL CHECKS**

#### **5.2.1 Energy Regulator**

Connect power to the bath and turn on the energy regulator. The contacts should "click" on and off periodically, except when the energy regulator is set to 10.

### 5.2.2 Fail-Safe Switch

The fail-safe switch is an air pressure-actuated electrical circuit breaker. The switch is actuated by air pressure at the OUT port of the air gate valve on the side of the bath. The electrical contacts are series-connected in the power line so that if the air supply fails or drops too low, electrical power is disconnected from the heating elements, the energy regulator, and the neon indicators. There is a neon for each heating element.

The following procedure may be used to check the functioning of the fail-safe switch, the heater switches, and the heater neons:

- a. Set the energy regulator to 10. Turn on power, but do not bring up air pressure. There should be no neons lighted.
- b. Bring up air pressure until the bath just "fluidizes". The heating element neons should come on in accordance with heater switch positions (refer to Table 5-1). Check all positions.
- c. Check that elements begin to warm up.
- d. Reduce air pressure until "fluidizing" stops. The neons should all go off.
- e. Shut down by first turning off electrical power; then shut off air supply.

#### **CAUTION**

If bath temperature was allowed to rise to 390°F (200°C) or higher, fluidization should be continued until the bath cools down considerably. This will deter premature deterioration of the heating elements.

TABLE 5-1

HEATER SWITCH POSITIONS FOR FAIL-SAFE CHECK  
(Energy regulator set to 10. Fluidizing air is ON.)

MODEL	HEATER SWITCH POSITION	NEONS
FSB-1	(no switch)	1
FSB-2	MED	1
	HIGH	2
FSB-3	MED	1
	HIGH	2
FSB-4	LOW	1
	MED	2
	HIGH	3
	BOOSTER SW-ON	4

5.3 TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
1. Bed will not fluidize	Broken or leaking air lines	Repair air lines.
	air pressure too low	Adjust air supply to 3 to 6 psi and 4 cfm flow rate.
	Medium damp	Empty medium and dry it. Clean if necessary.
	Filters blocked or leaking	Check filters for leaks or restrictions. Replace if necessary

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
2. Bed fluidizes erratically in one spot	Porous plate cracked	Empty bath and check plate. Replace if cracked.
	Porous plate gasket leaking	Apply a bead of RTV106 to area of leak; allow 24 hours to cure. If plate still leaks, replace gasket.
	Porous plate clogged	Clean porous plate.
3. Bath does not heat	Blown fuse	Replace fuse.
	Fail-safe switch	Refer to paragraph 5.3.1.
	Energy regulator	Refer to paragraph 5.3.2.
	Heating elements/ selector switch	Refer to paragraph 5.3.3.
	No air or too low pressure	Bring up air and adjust to 3 to 6 psi and 4 cfm flow rate.

### 5.3.1 Fail-Safe Switch

- a. Turn off electrical power; leave air supply on
- b. Connect an ohmmeter between wiring terminals on the fail-safe switch
- c. With air pressure normal, the fail-safe switch should be closed
- d. Reduce air pressure; the fail-safe switch should open. If abnormal, replace the switch.

### 5.3.2 Energy Regulator

- a. Connect an ammeter, set for 25 A, minimum, full-scale range, in series with the ac power line. (See the appropriate wiring schematic to identify the LINE connection.)
- b. Fluidize the medium bed and set the energy regulator to 5. Adjust the heater selector switch to obtain the readings shown in Table 5-2. The diameter should alternate between zero and the readings shown. If not, replace the energy regulator.

### 5.3.3 Heating Elements/Selector Switch

- a. Connect an ammeter, set for 25 A, minimum, full-scale range, in series with the ac power line.
- b. Fluidize the medium bed and set the energy regulator to 10.
- c. Adjust the heater switch to obtain the readings shown in Table 5-2.
- d. If any reading is not appropriate, determine if the element or the switch is faulty. Make the continuity checks shown in Table 5-3; if continuities are correct, the heating element is faulty.

**WARNING**

Disconnect electrical power before any continuity checks.

**TABLE 5-2**  
**HEATER ELEMENT CURRENT READINGS**  
 (Energy regulator set to 10. Fluidizing air is ON.)

MODEL	HEATER SWITCH POSITION	CURRENT READING
FSB-1	(no switch)	6.5 A
FSB-2	MED	10 A
	HIGH	20 A
FSB-3	MED	6.5 A
	HIGH	13 A
FSB-4	LOW	4.2 A
	MED	8.4 A
	HIGH	12.6 A
	BOOSTER SW-ON	16.8 A

**TABLE 5-3**  
**SWITCH CONTINUITY CHECK**

MODEL	HEATER SWITCH POSITION	CONTACT SEQUENCE
FSB-1	(no switch)	
FSB-2 and FSB-3	MED	Contacts 1, 2 (Open)
	HIGH	Contacts 1, 2 (Closed)
FSB-4	OFF	Contacts 1, 2 (Open)
	LOW	Contacts 1, 2 (Closed)
	MED	Contacts 1, 2, 4 (Closed)
	HIGH	Contacts 1, 2, 4, 6, 9 (Closed)

## 5.4 DISASSEMBLY

Disassembly is described only to the extent required to expose electrical wiring and for removal of major components. Steps a through c expose the energy regulator, the fail-safe switch, and electrical wiring. The remaining steps are required for replacement of a heating element or the porous plate.

### NOTE

The assembly drawings are composites.  
Refer to the parts list for detailed parts identification.

### DISASSEMBLY PROCEDURE

- a. Disconnect electrical and air supplies, empty the medium, and turn the bath upside down.
- b. Unscrew the hex nut holding the base plate and carefully lift the base plate.
- c. Disconnect all flying leads between the baseplate and the main case at the terminal block on the baseplate.
- d. Remove the whole stud assembly by unscrewing the lock nut.
- e. Disconnect heater wires from the terminal block mounted on the base plate. Tag the leads so that they can be connected to the correct terminals.
- f. Unscrew the gate valve.
- g. If a thermocouple is installed in the thermocouple well, remove it.
- h. Slowly lift the outer case. The whole inner assembly will now be exposed. Tape the top rim to the inner bath.



- i. Remove the fiberglass insulation to expose the heater wire connections and lock nuts. To remove individual heaters, remove the appropriate link wires from the terminal ends and then unlock the nuts. From the outside of the container, squeeze the heater limbs together which will in turn withdraw the heater ends from the holes.
- j. To replace the center heater, it will be necessary to remove the top one first. To replace the bottom heater, it is advisable to remove the porous plate first and work from the bottom (FSB-3 and FSB-4 only).
- k. On models with a stainless steel porous plate (FSB-3 and FSB-4), remove the porous plate after removing the hexagon nut and lifting off the air chamber. On replacing a porous plate, the edge must be sealed with a water glass solution after tightening the screws.
- l. On models with ceramic porous plates (FSB-1 and FSB-2), remove the porous plate by using a sharp knife to separate the gasket either from the porous plate or the inner bath. Use a long screwdriver to lift the plate. Avoid damaging the inner bath. After the porous plate is removed, thoroughly clean the inner bath and remove the remaining gasket material adhering to the bath.
- m. If the porous plate support must be replaced (FSB-1 and FSB-2) put a bead of RTV106 around the inner periphery just above the air inlet tube, approximately 3/8 inches wide. Be sure not to block the air inlet tube. Lay the porous plate at the top of the inner tank and slowly push the plate downwards. Make sure the plate is always horizontal. Push down as far as possible. Let the RTV cure for 24 to 48 hours.
- n. In reassembly (reverse order to above), it is important that the fiberglass insulation is secured closely to the inner container by either wire bands or fiberglass rope, thus allowing an air gap between the insulation and the outer case.

## SECTION 6 SPECIFICATIONS

DIMENSIONS	<u>FSB-1</u>	<u>FSB-2</u>	<u>FSB-3</u>	<u>FSB-4</u>
HEIGHT:	12" (305 mm)	18.5" (470 mm)	18" (457 mm)	26" (660 mm)
DIAMETER:	9.5" (241 mm)	11.5" (292 mm)	13" (330 mm)	15" (367 mm)
<b>WORKING VOLUME</b>				
DEPTH:	4.5" (114 mm)	5.5" (140 mm)	7" (178 mm)	14" (356 mm)
DIAMETER:	6.5" (165 mm)	8.5" (216 mm)	6.5" (165 mm)	8.5" (216 mm)
<b>INSTRUMENT</b>				
WEIGHT:	36 lbs (16.3 kg)	65 lbs (29.4 kg)	51 lbs (23.1 kg)	130 lbs (58.9 kg)
RANGE:	122° to 662°F (50° to 350°C)	122° to 662°F (50° to 350°C)	122° to 1112°F (50° to 600°C)	122° to 1112°F (50° to 600°C)
STABILITY:	<u>+2°F</u> (1°C)	<u>+2°F</u> (1°C)	<u>+2°F</u> (1°C)	<u>+2°F</u> (1°C)
UNIFORMITY:	0.9°F(0.5°C)	0.9°F(0.5°C)	0.9°F(0.5°C)	0.9°F(0.5°C)
POWER:	750 W	1 kW or 2 kW	750 W or 1.5 kW	1,2,3, or 4 kW
VOLTAGE:	117 or 240 V ac	117 or 240 V ac	117 or 240 V ac	240 V ac
AIR SUPPLY:	3 psi(20 kPa)	3 psi (20 kPa)	3 psi (20 kPa)	3 psi (20 kPa)
AIR FLOW:	2.4cfm(66 l/m)	2.4cfm(66 l/m)	2.4cfm(66 l/m)	2.4cfm(66 l/m)
<b>ALUMINUM OXIDE</b>				
WEIGHT:	20 lbs (9.06 kg)	34 lbs (15.4 kg)	20 lbs (9.06 kg)	70 lbs (31.71 kg)

## 6.1 ACCESSORIES

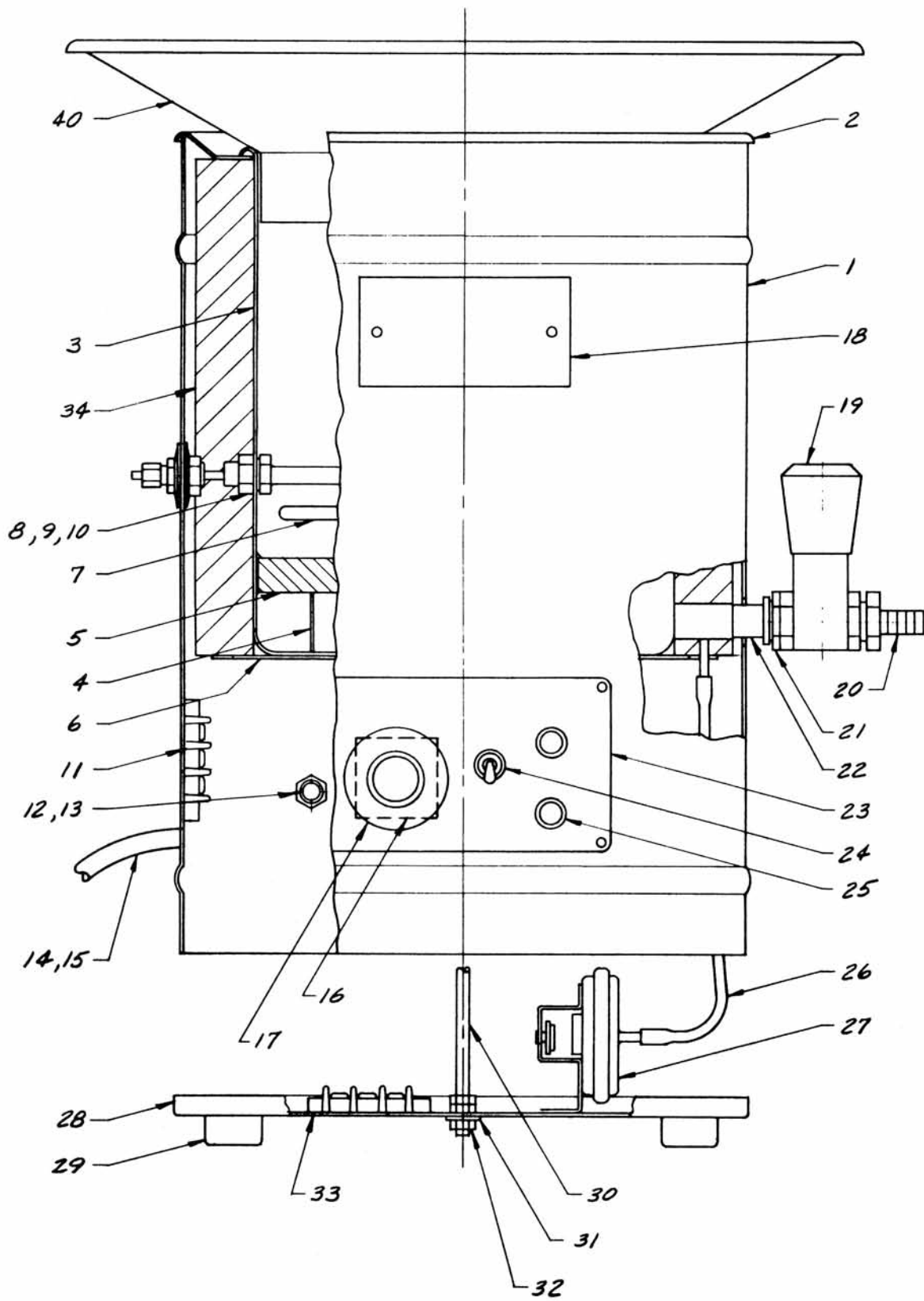
<b>OVERSPILL FLANGE:</b>	Supplied with all models. Fits into the top of the bath inner container; widens the top to prevent spillage when the medium bed nears the top.
<b>PRESSURE REGULATOR:</b>	For all models. Reduces air line pressure to suit the fluidized bath. The regulator is supplied with a pressure gage.
<b>AIR FILTER:</b>	For all models. Provides uncontaminated air to the fluidized bath. Recommended for use with pressure regulator.
<b>AIR COMPRESSOR:</b>	For all models. Oil-less unit with self-lubricating carbon vanes; provides clean dry air to fluidize FSB Series baths.
<b>ALUMINUM OXIDE:</b>	20 lb container, P/N 7030462 34 lb container, P/N 7030463 100 lb container, P/N 7030464

## 6.2 PARTS LIST

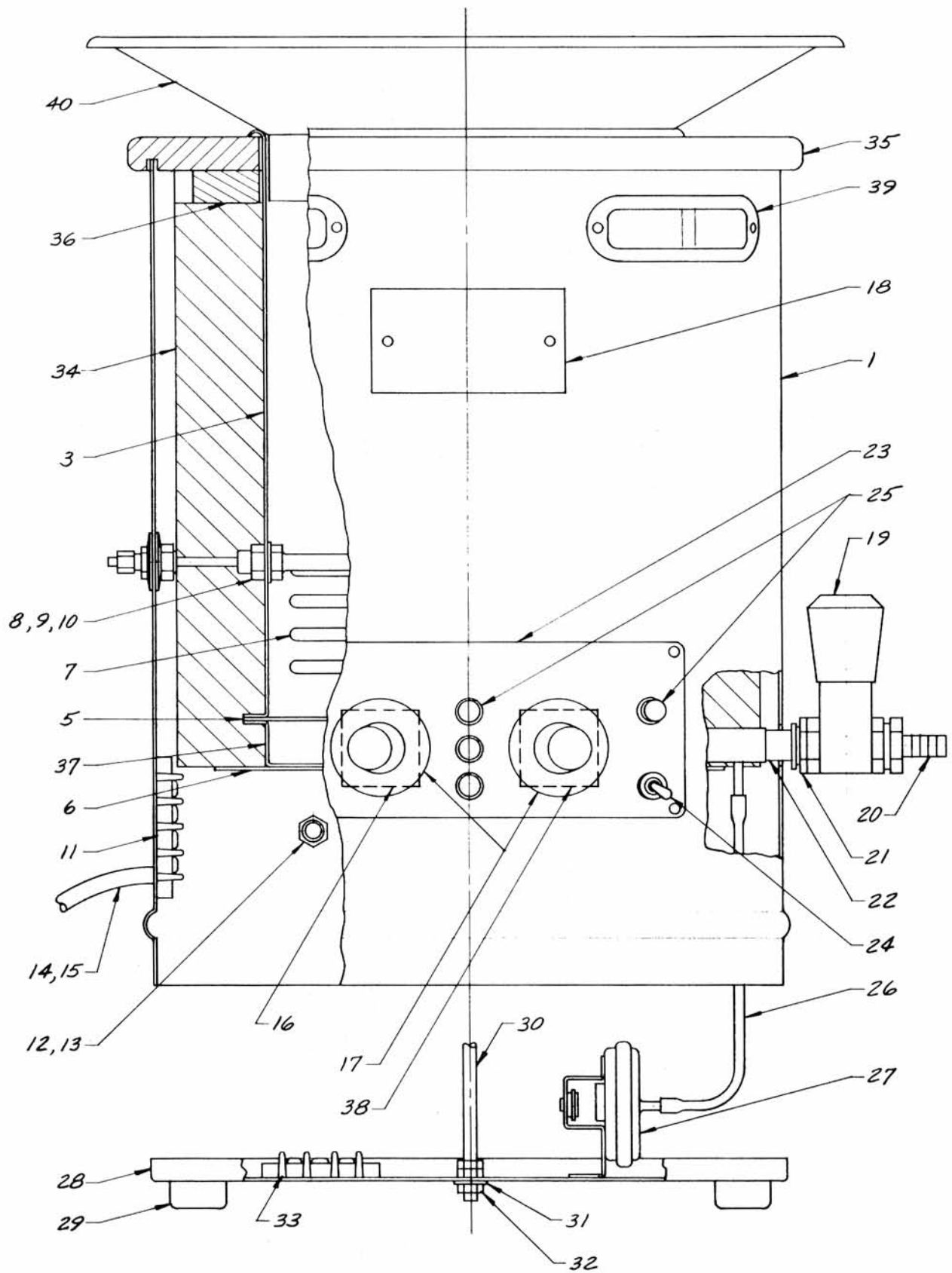
ITEM #	DESCRIPTION	FSB-1	FSB-2	FSB-3	FSB-4
1	Outer Case	7000633	6004443	7000513	6004909
2	Rim	7000635	6004446	-----	-----
3	Inner Container	7000634	6001138	7000689	6004908
4	Porous Plate Support	6001148	6001148	-----	-----
5	Porous Plate	6001147	6001147	7000493	6001557

6	Heat Shield	-----	7000626	7000504	6001558
7a	Heater Assy.				
	117 volt	7000459	6009963	7000459	-----
7b	Heater Assy.				
	208 volt	-----	-----	-----	6009965
7c	Heater Assy.				
	240 volt	6009955	7000293	6009958	7000293
8	Thermocouple Well	7001397	7001397	7001397	7001397
9	Washer, T/C	6001749	6001749	6001749	6001749
10	Nut, T/C	7001398	7001398	7001398	7001398
11	Terminal Block	7000510	7000510	7000510	7000510
12	Fuseholder	7001248	6008172	7001248	6008172
13	Fuse	7001250	7001249	7001249	7001395
14	Power Cord	7001269	7001269	7001269	7001355
15	Strain Relief	7001270	7001270	7001270	7001270
16a	Regulator 117 V	6001315	6001315	6001315	-----
16b	Regulator 208				
	240 volts	6001104	6001104	6001104	6001104
17	Knob	6001341	6001341	6001341	6001341
18	Caution Label	7001262	7001262	7001262	7001262
19	Gate Valve	6002437	6002437	6002437	6002437
20	Barbed Nipple	7001261	7001261	7001261	7001261
21	Locknut	6001113	6001113	6001113	6001113
22	Air Inlet				
	Connector	7001254	7001254	7001254	7001254
23	Front Label	7002108	7002109	7002110	7002379
24	Toggle Switch	-----	7000494	7000494	7000494
25a	Neon Indicator	7000505	7000505	7000505	-----
25b	Neon Indicator				
	208/240 volts	7001324	7001324	7001324	7001324
26	Tubing	7040049	7040049	7040049	7040049
27	Fail Safe Switch	7000379	7000379	7000379	7000379
28	Base	7000639	6004489	7000509	6004910
29	Rubber Foot	7000508	7000508	7000508	7000508
30	Threaded Rod	7000479	7000514	7000514	7001312
31	Washer	7040079	7040079	7040079	6001081

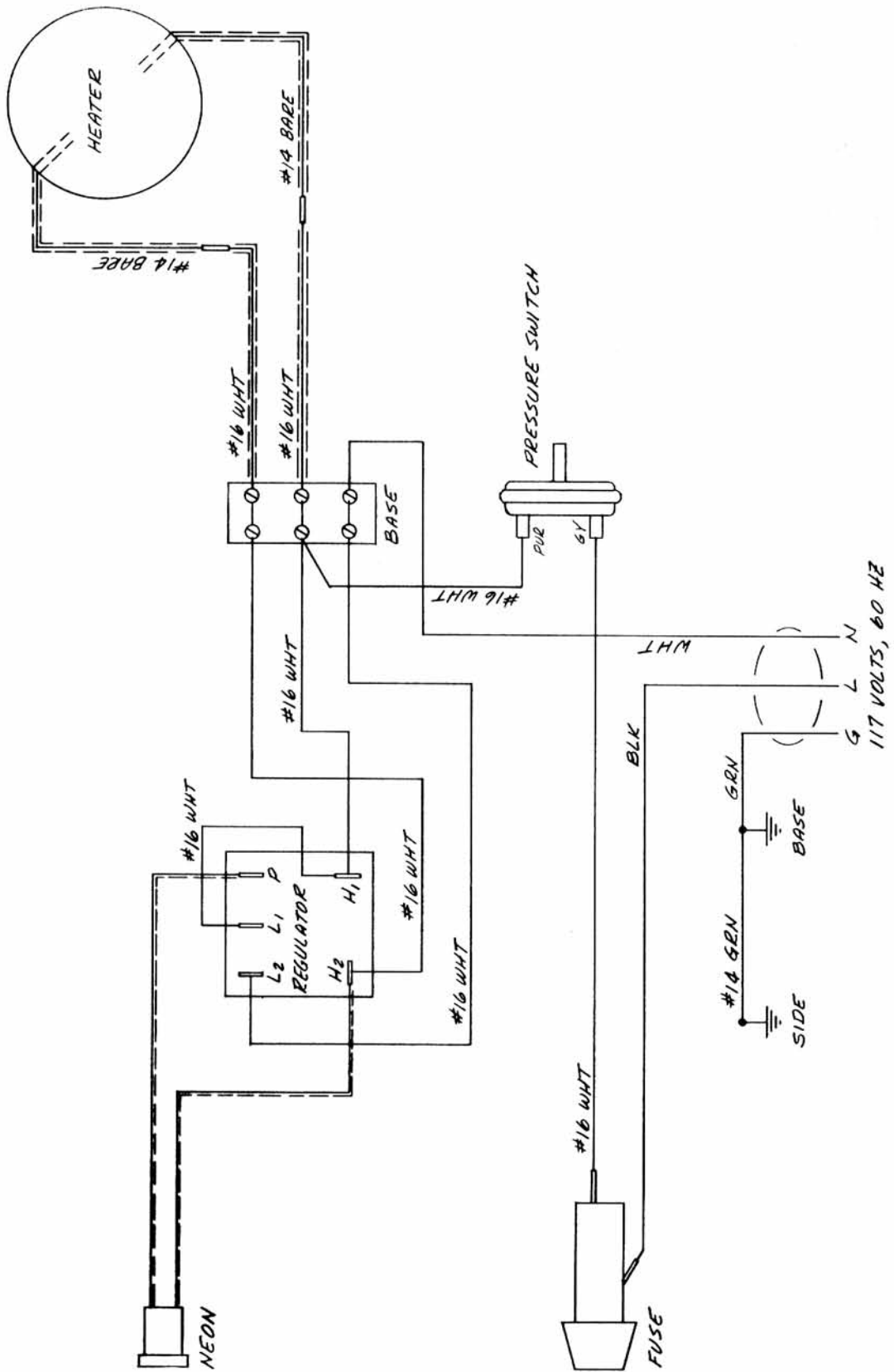
32	Nut	7040078	7040078	7040078	7040078
33	Terminal Block	7000510	7000510	7000510	7000510
34	Insulation	7040158	7040158	7040158	7040158
35	Top Plate	-----	-----	7000511	6004450
36	Top Plate Block	-----	-----	7000512	6001552
37	Air Chamber				
	Assembly	-----	-----	7000541	6001546
39	Vent Screen				
	Assembly	-----	-----	6001758	6001758
40	Overspill	6031116	6031133	6031116	6031133
	Flange				



Assembly, Models FSB-1 and FSB-2

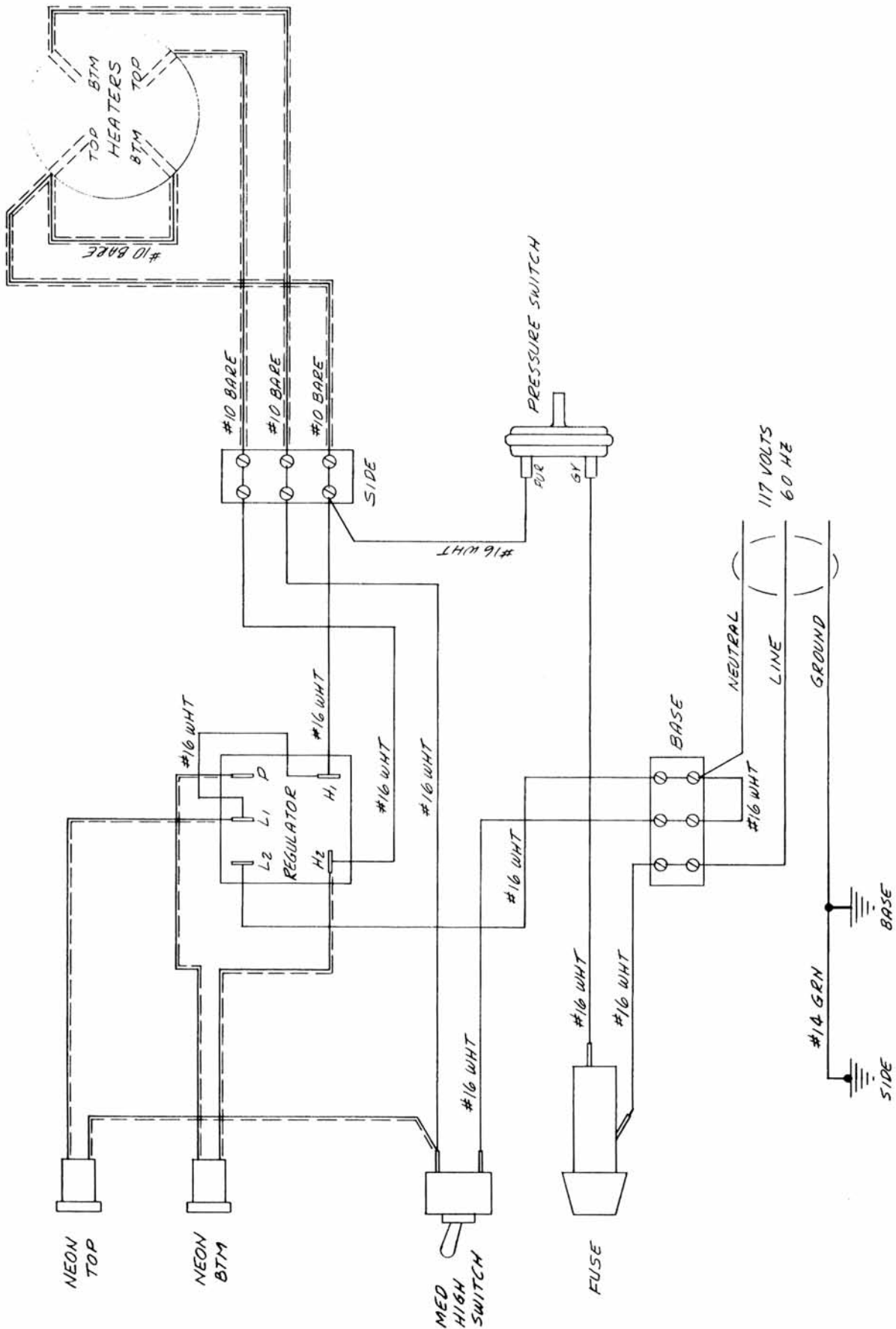


Assembly, Models FSB-3 and FSB-4

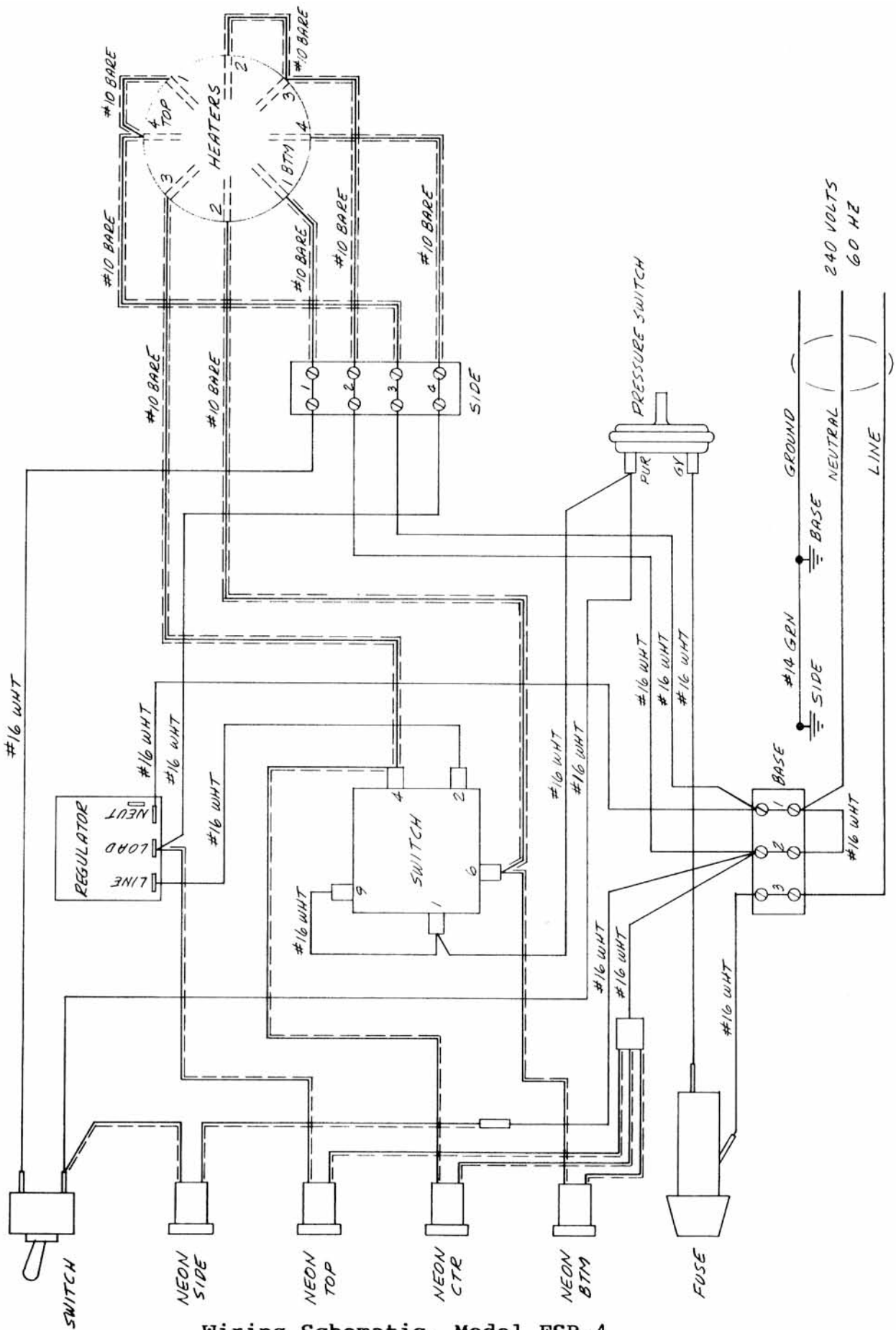


Wiring Schematic, Model FSB-1





Wiring Schematic, Models FSB-2 and FSB-3



Wiring Schematic, Model FSB-4



## WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

**OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

## RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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