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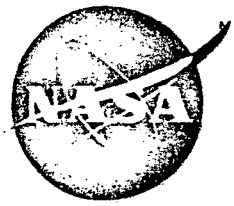

JOHN F. KENNEDY
SPACE CENTER

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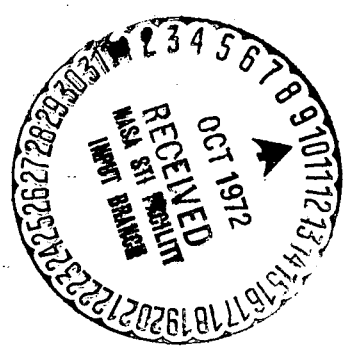
TECHNICAL MANUAL

OPERATION AND MAINTENANCE

FIRE RESCUE AIR PACK

VOLUME II
(COMMUNICATIONS)



TM-626

TECHNICAL MANUAL

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FIRE RESCUE AIR PACK

VOLUME II
(COMMUNICATIONS)

JUNE 1, 1972

CONFIGURATION CHART

TM ISSUE	ECP'S	PRODUCTION EFFECTIVITY	MAINTENANCE INSTRUCTION (MI)

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Insert latest changes; destroy superseded pages.

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v thru vii	Original
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1-6 Blank	Original
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INTRODUCTION

Volume II of this manual covers operation and maintenance procedures for the development model of the Fire Rescue Air Pack (FRAP) voice amplifier assembly, including the battery charger. Operational instructions include a general description of the assembly, specifications, and installation and operation. Maintenance instructions include theory of operation, preventive maintenance, repair, adjustment, and a parts list.

The FRAP is intended to permit fire rescue personnel to enter a smoke-filled, toxic, or oxygen-depleted environment carrying their own source of breathing air. The voice amplifier assembly permits the wearer to communicate by voice with other persons in the vicinity. The battery charger assembly provides a means of keeping the amplifier batteries fully charged.

Volume I of this manual covers operation and maintenance of the mechanical assemblies, consisting of harness, mask, air cylinders, cylinder manifold, and valves.

SECTION I

GENERAL INFORMATION

1.1 PURPOSE

This volume contains installation, operation, and maintenance instructions for the Fire Rescue Air Pack Voice Amplifier System. The Voice Amplifier System provides capability of voice communications between personnel wearing the Fire Rescue Air Pack (FRAP) and other personnel within normal hearing range.

1.2 EQUIPMENT DESCRIPTION

The Voice Amplifier Assembly (Figure 1-1) consists basically of a microphone assembly, an amplifier assembly, a speaker, a push-to-talk switch, a battery pack, and a battery charger. The components of the system are physically small, as light as practical, and are packaged to be attached to the FRAP harness. The system is designed to permit conversation while wearing the FRAP face mask assembly. The amplifier assembly output will vary according to the voice level into the microphone tube so that variations from a whisper to a shout are possible. The battery charger (Figure 1-2) is capable of simultaneously recharging four battery packs. The method of connecting and operating the system is described in section III.

The amplifier assembly consists of a printed circuit (pc) board, a volume control with on-off switch, a microphone connector, a battery connector, and a speaker connector mounted in a cast aluminum box. A push-to-talk switch extends from the amplifier box on a cable.

The battery pack consists of a cable and a battery holder fitted with 12 size AA nickel-cadmium rechargeable batteries. It fits into a fabric pouch that attaches to the harness waist strap. The cable with plug is used to connect the battery pack to the amplifier.

The microphone assembly is made up of a Pacific Plantronics Model MS-40-4 microphone assembly with a cable attached. A mask adapter is provided as a permanent part of the FRAP mask assembly to provide the voice path from inside the mask to the externally mounted microphone.

The speaker assembly is a 3-ohm, 15-watt speaker mounted in a small box.

The battery charger assembly consists of a standard chassis containing a power transformer, a rectifier, and distribution circuits. The distribution circuits feed four charging jacks with associated indicator lights. An ON-OFF switch and indicator light is provided for control.

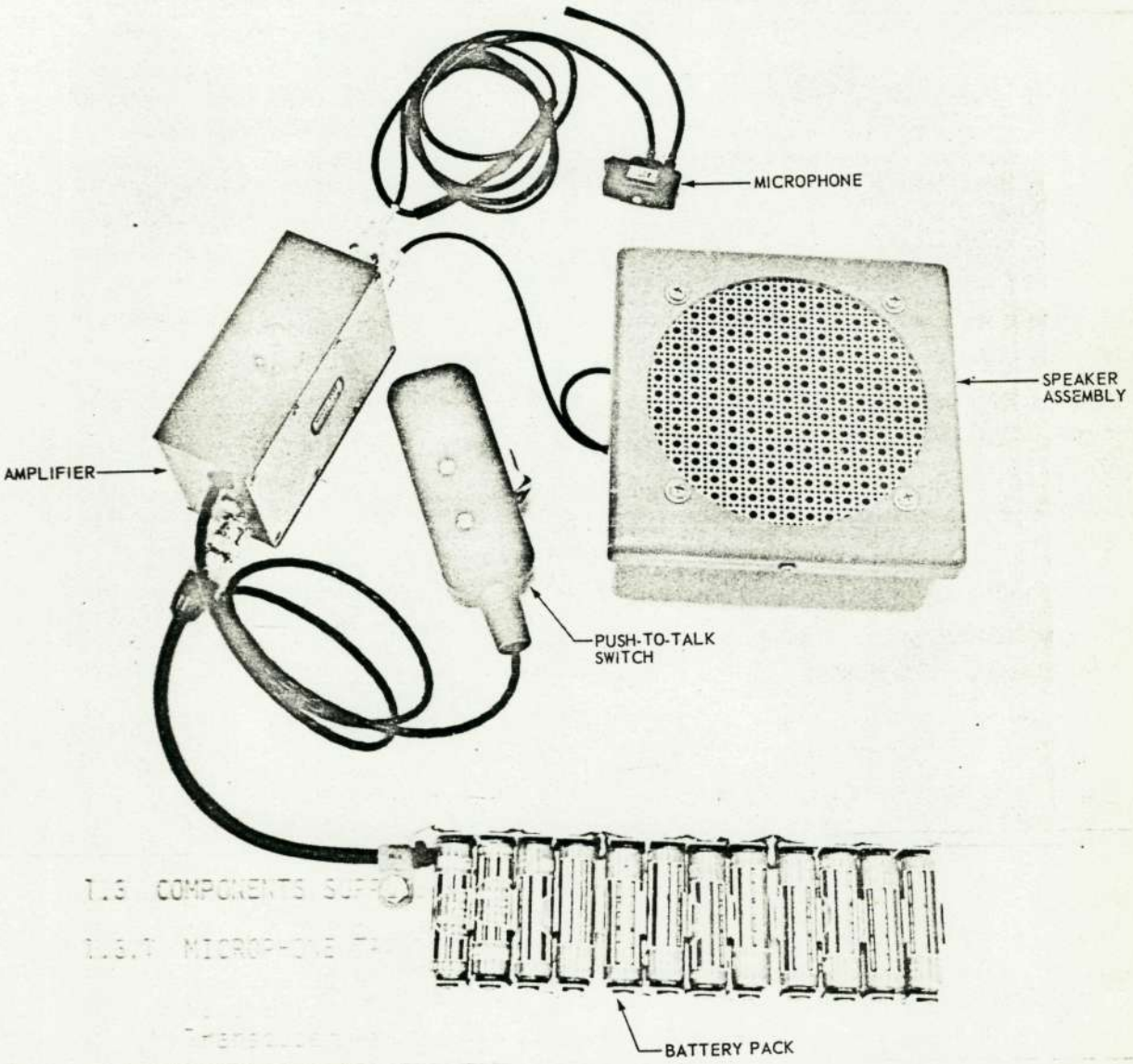


Figure 1-1. Voice Amplifier System

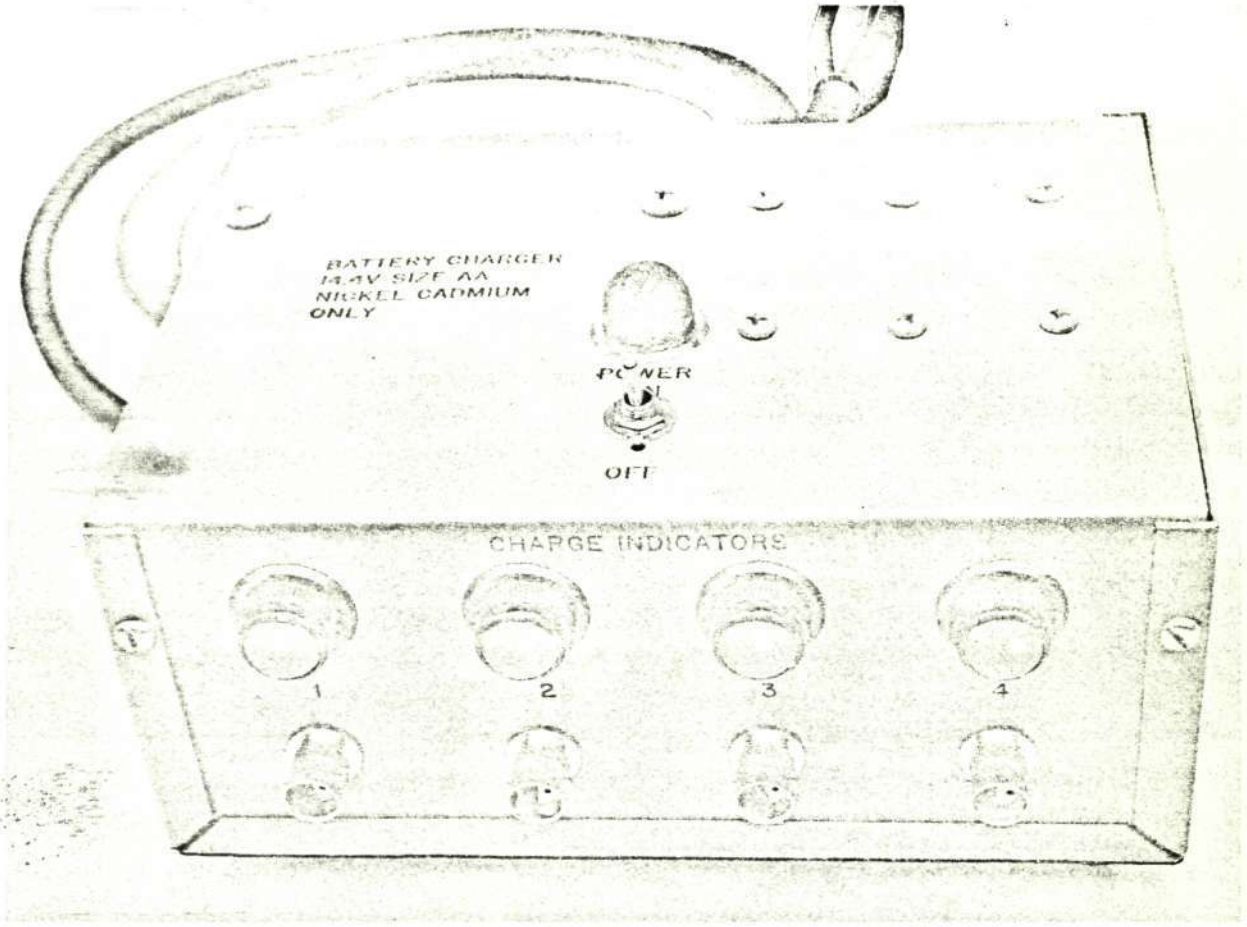


Figure 1-2. Battery Charger

1.3 COMPONENTS SUPPLIED

1.3.1 MICROPHONE TRANSDUCER AND ADAPTER

Manufacturer: Pacific Plantronics, Inc.
Transducer Part Number: MS-40-4
Adapter Part Number: PMM-18
Weight: 3 oz

1.3.2 SPEAKER ASSEMBLY

Manufacturer: Kennedy Space Center
Part Number: 79K02426-9
Length: 5.3 in
Width: 5.3 in
Depth: 2.5 in

Capacity: 15W
Weight: 1 lb, 12 oz

1.3.3 AMPLIFIER ASSEMBLY

Part Number: 79K02624-2
Height: 3-1/8 in
Width: 4-3/4 in
Depth: 2 in
Weight: 1 lb, 3 oz

1.3.4 BATTERY PACK

Part Number: 79K02624-5
Height: 2-1/4 in
Width: 8-3/8 in
Depth: 1 in
Weight: 1 lb, 12 oz

1.3.5 BATTERY CHARGER ASSEMBLY

Part Number: 79K02624-8
Height: 4 in
Width: 7 in
Depth: 5 in

1.4 EQUIPMENT SPECIFICATIONS

1.4.1 MICROPHONE

Impedance: 3000 ohms
Output Level: 1.55 mV at 98 dB sound pressure level (SPL)
(0 dB SPL equals 0.0002 dyn/cm^2)

1.4.2 SPEAKER UNIT

Manufacturer: Motorola
Part Number: 50C850633
Impedance: 3.2 ohms
Power Rating: 15W

1.4.3 AMPLIFIER ASSEMBLY

Input Impedance: 3000 ohms
Output Impedance: 3 ohms
Frequency Response: 300 Hz to 5000 Hz $\pm$ 3 dB
Power Output: 4W
Harmonic Distortion: 5 percent at 4W

1.4.4 BATTERY PACK

Power Output: 14.4 ± 1V at 0.45 Ah

1.5 LIST OF LETTER SYMBOLS

The letter symbols used in this manual are in accordance with the American National Standard, ANSI Y10.19 - 1969. Those used in this manual are as follows:

A	ampere
Ah	ampere-hour
cm	centimeter
dB	decibel
dyn	dyne
Hz	hertz
k	kilo (1000)
in	inch
uF	microfarad
mA	milliampere
Ω	ohm
oz	ounce
lb	pound
cm2	centimeter squared
mV	millivolt
V	volt
W	watt

1.6 LIST OF ABBREVIATIONS

The abbreviations used in this manual are as follows:

ac	alternating current
dc	direct current
FRAP	Fire Rescue Air Pack
KSC	Kennedy Space Center, NASA
pc	printed circuit
rms	root mean square
SPL	sound pressure level

SECTION II

INSTALLATION AND OPERATION

2.1 UNPACKING AND HANDLING

All components of the Voice Amplifier System (amplifier, switch, speaker, and battery pack) are attached to the FRAP harness. The battery charger is a shelf or bench item that remains on permanent location. Unpack the battery charger first and put it into operation, charging the battery packs for initial use. Unpack each item carefully to avoid damaging the equipment.

CAUTION

Do not pick up or hold any item by its cable. Do not drop any component.

2.2 INSTALLING VOICE AMPLIFIER SYSTEM (Figures 2-1 and 2-2)

This section describes how to install the Voice Amplifier System on the harness prior to its use in the field. Normally, the equipment will be received installed, and will remain installed until it is necessary to disassemble the system. These instructions are for reference when the FRAP has been disassembled for cleaning, overhaul, or other purposes. To install the system, perform the following steps:

a. Install battery pack in pouch on rear of waist strap.

b. Install speaker in pouch on front of waist strap.

c. Install amplifier on left side in pouch above air bottles with the end having two connectors toward front and the end having one connector and switch cable toward rear.

d. Route switch cable over right shoulder. Secure switch to strap with two screws through strap eyelets on front of right shoulder strap.

e. Secure switch cable under shoulder pad snaps and under Velcro fasteners on shoulder strap.

f. Connect speaker plug to amplifier receptacle marked SPKR. (See Figure 2-2.)

g. Connect battery pack plug to receptacle on rear end of amplifier marked BATT. (See Figure 2-2.)

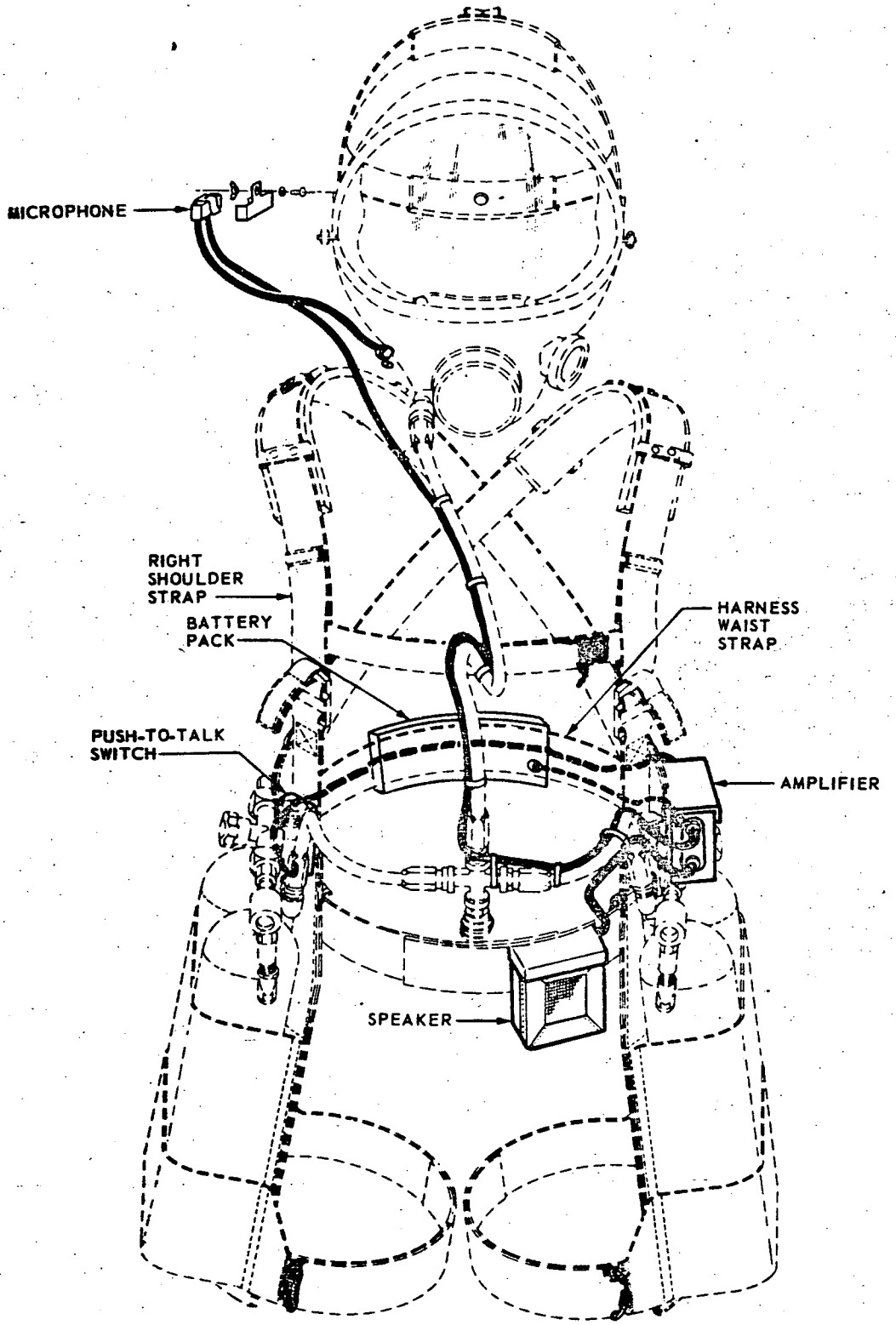


Figure 2-1. Voice Amplifier System Installation

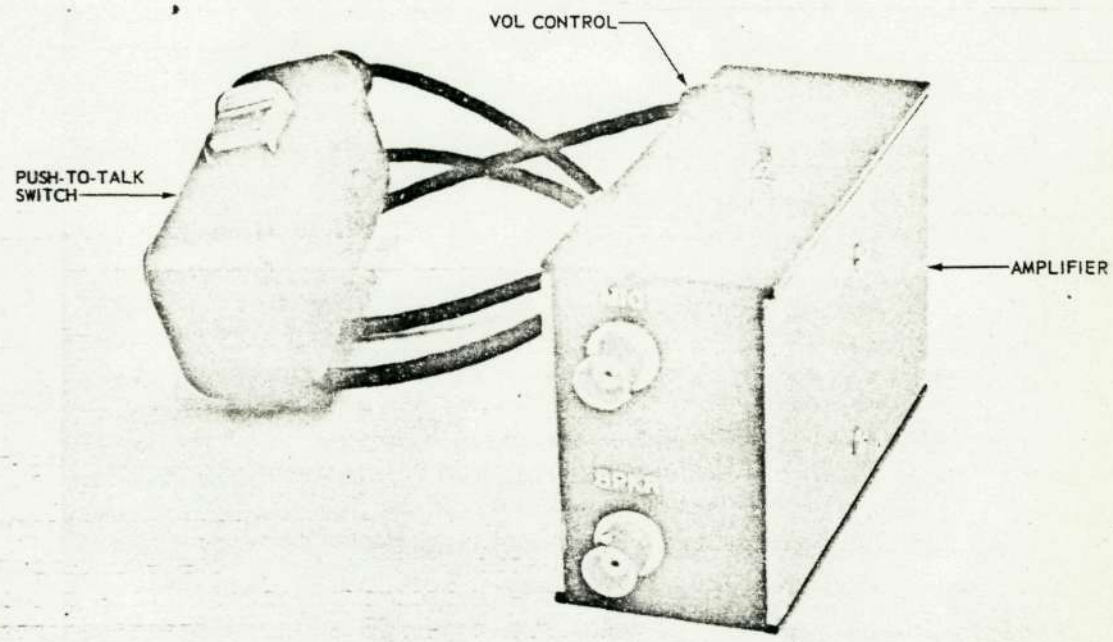


Figure 2-2. Amplifier Assembly

h. Install mask adapter for microphone transducer tube in side of mask.

i. Install microphone clip to side of mask, using the screw holding head harness to mask skirt.

j. Insert voice tube into mask adapter and insert transducer into clip.

k. Secure microphone transducer to clip, using plastic cable tie.

l. Secure microphone cable to air hose, using plastic cable tie.

m. Connect microphone plug to receptacle on amplifier marked MIC.

2.3 OPERATION

2.3.1 VOICE AMPLIFIER. Don the FRAP assembly and turn on the air supply as directed in volume I. Turn volume control knob fully clockwise. Press the push-to-talk switch and speak into the microphone tube. If feedback from the speaker to the microphone causes howling, reduce the volume until the howling stops.

The system is designed to follow the voice level. If more volume is needed after adjusting the volume control, speak louder into the microphone tube.

When removing the FRAP, turn the amplifier volume control fully counterclockwise. Clean the FRAP as directed in volume I, and recharge the battery pack. In working situations, install a recharged battery pack before putting the FRAP in the carrying case, to assure fully charged batteries for the next use. A suitable procedure is to keep one battery pack on charge and one fully charged battery pack installed in the FRAP. Unless used sooner, rotate the battery pack to the charger twice a week to assure fully charged batteries in the FRAP at all times. Continuous charging will not damage the batteries and is recommended when possible. Fully discharging the batteries is likely to damage them, requiring replacement of the batteries.

CAUTION

Make sure push-to-talk switch is not accidentally depressed when carrying case is closed.

2.3.2 BATTERY CHARGER (Figure 1-2). Plug the battery charger into a standard 115V ac outlet. Turn the ON-OFF switch to ON. The pilot light DS5 will light. Plug in the battery pack(s) to be charged into any of the four connectors on the charger. The indicator light above the connector will light to indicate charging. A discharged battery pack should be charged for a minimum of 10 hours. The battery packs may be left on charge continuously.

CAUTION

To prevent possible damage to the battery charger, do not allow battery packs to touch each other while on charge. A vinyl sleeve over the battery pack will aid in maintaining electrical separation.

SECTION III

TROUBLESHOOTING

3.1 GENERAL

This section contains troubleshooting information for the Voice Amplifier Assembly. The information is presented in two parts:

a. Theory of Operation - Describes operation of the equipment.

b. Fault Isolation - Localizes trouble to the affected component.

3.2 THEORY OF OPERATION

3.2.1 MICROPHONE ASSEMBLY. The microphone assembly is a general class dynamic microphone employing a voice tube instead of a standard diaphragm. This allows the bulk of the microphone element to be away from the mouth. The microphone assembly has a 3000-ohm output impedance and an output rating of 1.55 mV for an input of 98 dB SPL (0 dB SPL equals 0.0002 dyn/cm^2).

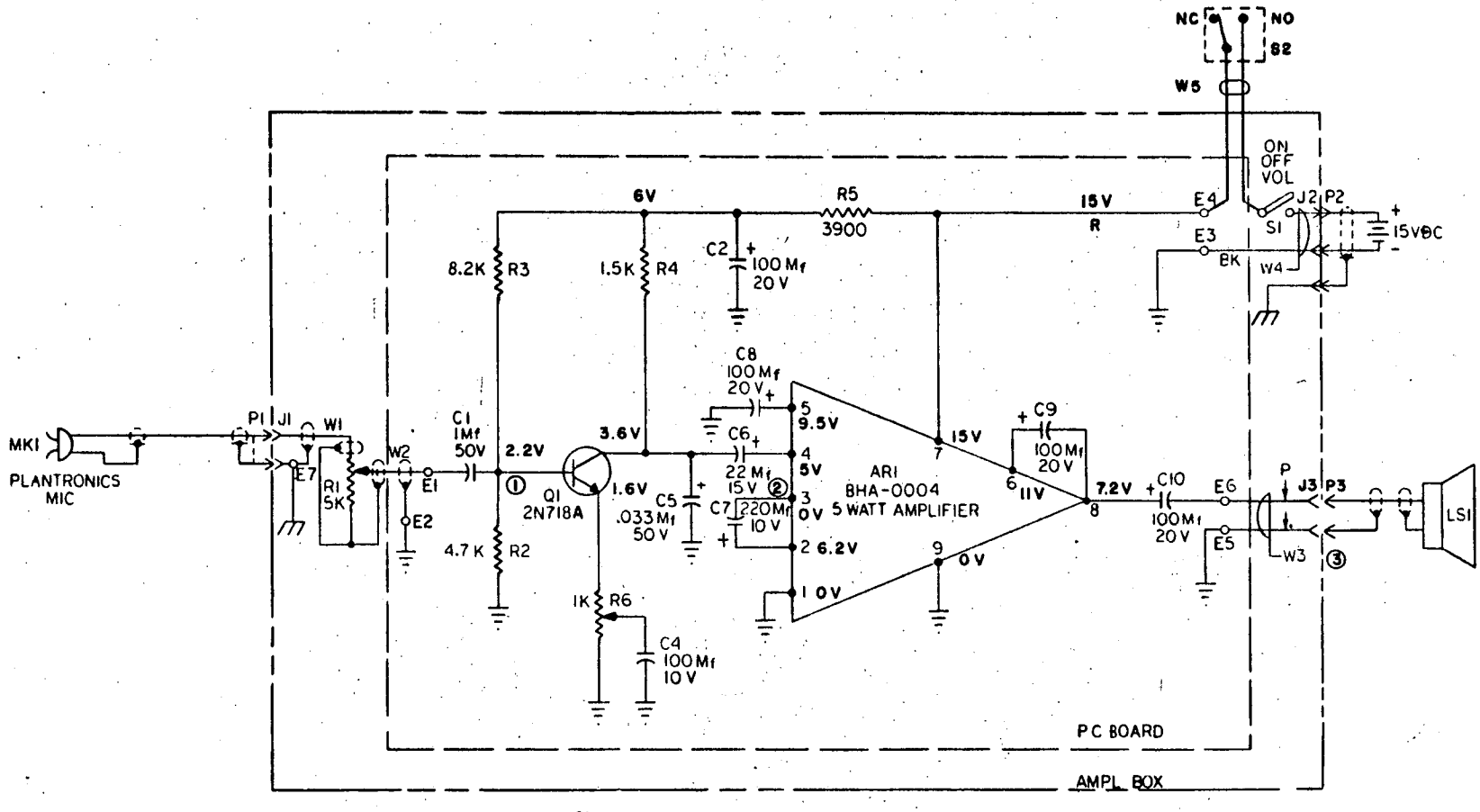
3.2.2 AMPLIFIER ASSEMBLY. The amplifier assembly consists of a shielded box containing a preamplifier, a power amplifier, and a volume control. Switch S2 is wired into the shielded box on a cable to provide the push-to-talk function. The amplifier is off until this switch is closed. A schematic diagram of the amplifier assembly is shown in Figure 3-1.

3.2.2.1 Connections to the Amplifier. Power from the battery pack is applied to the amplifier through connector J2, which is wired to the printed circuit board through the switch section of the volume control, S1. The input from the microphone connected to J1 is grounded to the box on one side and connected to the pc board through R1, the variable resistor portion of the volume control. The output from the power amplifier (terminals E5 and E6) is connected to the speaker through connector J3.

3.2.2.2 Printed Circuit Board. The pc board consists of a preamplifier and a power amplifier. The preamplifier is a single gain stage using a type 2N718A transistor, Q1. Gain of the stage is controlled by varying variable resistor R6 which is bypassed by capacitor C4. Capacitor C6 is chosen to determine the high frequency cutoff point.

The power amplifier is a single unit 5W amplifier employing discrete components and deposited film resistors bonded to a ceramic substrate. Four capacitors are connected to the unit for feedback, low frequency cutoff, and compensation.

A filter, consisting of capacitor C2 and resistor R5, is employed for decoupling between the preamplifer and power amplifier sections.



NOTE: VOLTAGES ARE DC WITH 10% TOLERANCE MAXIMUM, EXCEPT AS FOLLOWS:
AC VOLTAGES MEASURED WITH 4 mV, 1000 Hz INPUT AND 3-OHM LOAD

① 4 mV RMS
② 18 mV RMS
③ 3.8 V RMS

Figure 3-1. Amplifier Assembly Schematic Diagram

3.2.3 SPEAKER. The speaker is a 3-ohm permanent magnet type.

3.2.4 BATTERY PACK. The battery pack consists of 12 nickel cadmium size AA cells which provide a total of 15±1V at 0.45 Ah. The battery pack will last approximately 10 hours under use. However, depleting the battery pack entirely will cause some of the cells to fail. Therefore, the battery packs should be charged after each use and left on charge when not in use.

3.2.5 BATTERY CHARGER. (Figure 3-2) The battery charger is capable of charging four battery packs simultaneously. The charger is powered from a standard 115V ac outlet. Power enters the charger through a fuse, F1, and toggle switch, S1, to transformer T1. A power on indication is provided by neon indicator light DS5. Transformer T1 steps the power line voltage down to 34V. This is converted to direct current by the full wave rectifier CR1. This dc power is fed to resistors R1, R2, R3, and R4, which serve as voltage dropping resistors, to connectors J1, J2, J3, and J4. Indicator lights DS1, DS2, DS3, and DS4 show when batteries are charging. The indicator lights are connected in series with each charging circuit, and hence illuminate only when a battery pack is plugged into the associated output connector. The open circuit voltage at the connector is 34±2V dc. Under load, the output voltage is 16±2V dc with a current of 45±10 mA.

3.3 FAULT ISOLATION

3.3.1 GENERAL. The troubleshooting procedures given below provide a means of isolating a fault to a particular component which then can be repaired or replaced. Before employing the troubleshooting procedures, perform the following checks to be certain there is a fault in the equipment. Check to see that:

a. A fully charged battery pack is connected to the amplifier box.

b. The microphone is operating properly. (Check by connecting the microphone to a system known to be good.)

c. A properly operating speaker is attached to the output. (Check by connecting the speaker to a system known to be good.)

d. The VOL control R1 is on and turned fully clockwise.

e. The push-to-talk switch S2 is depressed.

Table 3-1 lists the equipment required to troubleshoot. Tables 3-2 through 3-7 present the faults by symptoms and list the logical fault isolation procedures.

3.3.2 TROUBLESHOOTING PROCEDURES. Tables 3-2 through 3-7 list suggested troubleshooting procedures.

Figure 3-2. Battery Charger Schematic Diagram

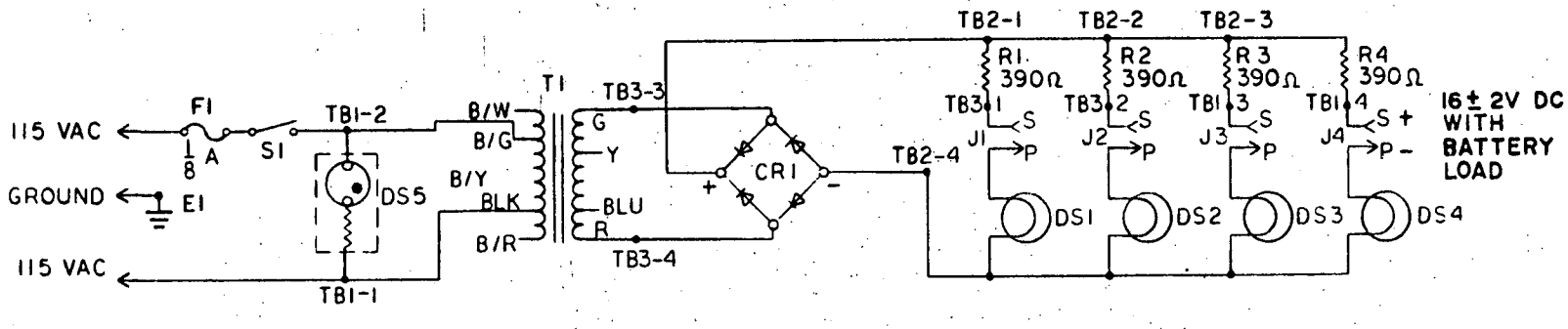


Figure 3-2. Battery Charger Schematic Diagram

Table 3-1. Troubleshooting Equipment List

Volt-Ohm Milliameter	Simpson model 360, or equal
Oscilloscope	Hewlett-Packard model 12013, or equal
Distortion Analyzer	Hewlett-Packard model 331A, or equal
Voltmeter	Hewlett-Packard model 400E, or equal
Audio Oscillator	Hewlett-Packard model 240D, or equal
Sound Pressure Oscillator	Hewlett-Packard model 15117A, or equal (Special adapter required)

Table 3-2. Troubleshooting Procedure for Low or No Battery Voltage

SYMPTOM	PROCEDURE
No voltage. Battery pack will not light charge indicator light on charger.	1. Connect dc voltmeter common to negative end of battery cells. Using other voltmeter lead, check each cell in turn until the defective cell is located. If each cell voltage is normal, check cable and connector.
Low voltage after battery pack has been charged 10 hours.	2. Place a 2-ohm, 2-watt resistor across each cell for 5 minutes. A good cell fully charged should be able to take this drain for at least 5 minutes without dropping below 1.2V. Check the voltage of each cell. Replace all cells which fail this test.
Low voltage. Battery pack will not hold charge properly.	3. Check each cell as in step 2 with battery cells in a partially discharged condition. Recharge all cells that seem to be weak and replace any that will not pass test in step 2.

Table 3-3. Troubleshooting Procedure for Inoperative Microphone or Low Output

SYMPTOM	PROCEDURE
Low Output Level.	1. Using a sound pressure generator, check the microphone at 98 dB SPL for an output of 1.4 mV. If microphone fails to meet this specification, check mask adapter and voice tube for blockage and replace if necessary. If this procedure fails, return microphone to manufacturer for repair or replacement. CAUTION Mask adapter contains a metal diaphragm. Do not damage diaphragm.
No Output.	2. Check voice tube and mask adapter for blockage. (See caution above.) If this fails, replace microphone connector. The cable below the microphone transducer housing may be replaced with RG-174 coaxial cable; however, the connection of cable inside microphone housing must be done at the factory.

Table 3-4. Troubleshooting Procedure for Low or No Speaker Output

SYMPTOM	PROCEDURE
Low output or no output.	1. Check speaker for open or short circuit using an ohmmeter. Typical dc resistance of the speaker is 3 ohms. Repair or replace speaker cable and connector if indicated. The speaker is generally not repairable and must be replaced if defective.

Table 3-5. Troubleshooting Procedure for Amplifier Low or No Output; Amplifier Oscillates

SYMPTOM	PROCEDURE
Test setup	1. Before troubleshooting, the following test conditions should be set up: a. Open the amplifier box top and fold back for access to the printed circ-circuit board. (See Figure 4-1.) b. Remove the speaker and replace with a 3-ohm, 10-watt load. c. Replace the microphone input with an audio oscillator. d. Attach an ac voltmeter/distortion analyzer across the output load resistor. CAUTION Check for proper grounding of the meter and oscilloscope to the amplifier. e. Monitor the output of the amplifier with an oscilloscope. f. Connect a freshly charged battery pack to the amplifier. g. Tape push-to-talk switch closed. h. Refer to Figure 3-3 for test setup block diagram and to Figure 3-1 for circuit diagram with test voltages.
Low output level or no output.	2. Check amplifier for proper alignment. Apply a 4-mV 1000-Hz test tone to the input of amplifier. Turn on amplifier and turn volume control to maximum. Check output voltage of preamplifier at pin 4 (Figure 3-1) for 18±2 mV, 1000-Hz signal. The waveform should be a clean sine wave. If these conditions are not met, disconnect capacitor

Table 3-5. Troubleshooting Procedure for Amplifier Low or No Output; Amplifier Oscillates (cont)

SYMPTOM	PROCEDURE
	C4 from pin 4 of the power amplifier AR1 and check again. A good signal indicates a fault in the power amplifier section. A weak or distorted signal indicates a fault in the preamplifier. 3. Isolate fault within preamplifier (power amplifier good). a. Check to see that 4 mV appears at terminal E1. If not, check resistor R1. b. Disconnect the signal source and check dc voltages at capacitor C2 and around transistor Q1. If the supply voltage at capacitor C2 is not normal, check for 15±1V at terminal E4. If voltages around transistor Q1 are not as specified in Figure 3-1, check transistor Q1 and associated capacitors C1, C4, C5, and C6. 4. Isolate fault within power amplifier (preamplifier good). With input signal disconnected, check all voltages around preamplifier. If all are normal, reconnect test tone and check output directly at pin 8 with the oscilloscope (Figure 3-3). If voltages differ from values specified in Figure 3-1, check associated capacitors C7 through C10. If this fails to correct the problem, replace power amplifier AR1.

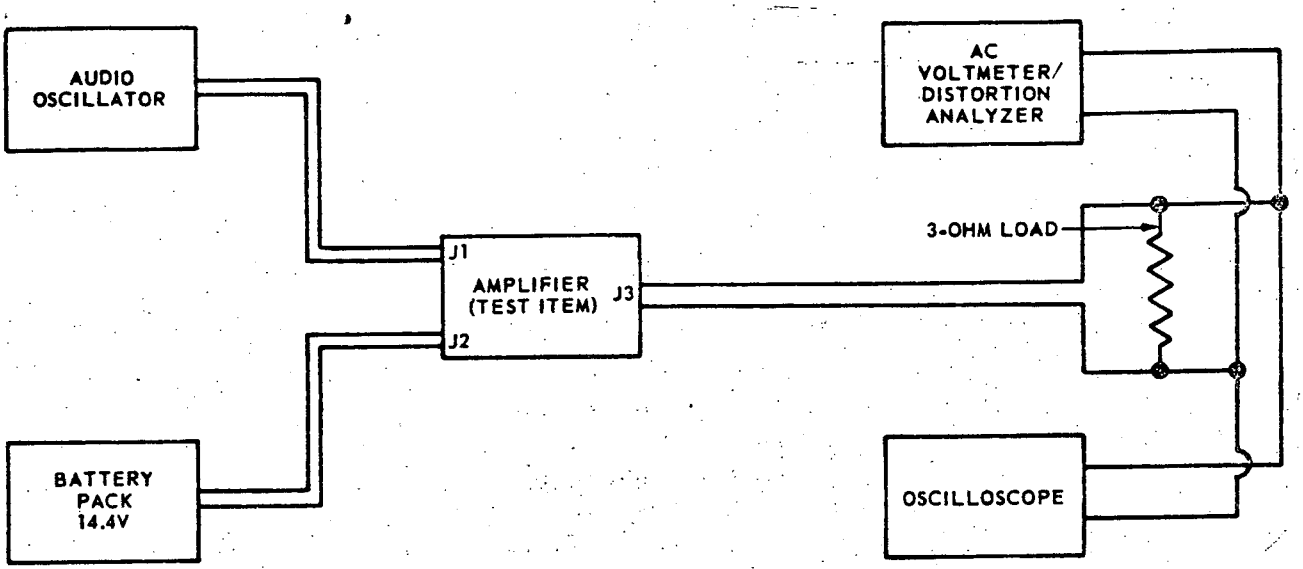


Figure 3-3. Amplifier Test Setup

Table 3-6. Troubleshooting Procedure for Amplifier Oscillation

SYMPTOM	PROCEDURE
Amplifier oscillates with low or no input. (Note: this does not refer to acoustic feedback with the microphone and speaker attached, unless the problem can be duplicated using the test setup shown in Figure 3-3.)	1. If the oscillation is a "motorboating," check capacitor C2. 2. If oscillation continues, check capacitors associated with the power amplifier. If this fails, replace power amplifier AR1.

Table 3-7. Troubleshooting High Current Drain by the Amplifier

SYMPTOM	PROCEDURE
Current to amplifier is 55A or greater.	1. Connect a fully charged battery pack and a 4-ohm output load to the amplifier. 2. Disconnect the lead from terminal E4 of the pc board and insert a dc ammeter with the positive lead to the loose wire and the common to terminal E4. 3. Turn the VOL control switch on and adjust for minimum volume. 4. Check capacitors C5, C6, C7, C8, C9, and C10 for short circuits. Replace any defective capacitors. If these capacitors are good, replace power amplifier AR1.

SECTION IV

MAINTENANCE

4.1 GENERAL

This section contains maintenance procedures for the Voice Amplifier System. The repair portion covers the removal and adjustment of the printed circuit board. This section also includes necessary preventive maintenance inspections.

4.2 PREVENTIVE MAINTENANCE

Perform the following inspection of the Voice Amplifier System:

a. Check wiring for loose connections, frayed insulation, and overheating.

b. Check printed circuit board for cracks and lifting of printed circuitry. Check components for evidence of overheating.

c. Check for dirt, dust, and moisture accumulation.

d. Check volume control and connectors for proper operation and tightness.

4.3 REPAIR

4.3.1 REMOVAL OF PRINTED CIRCUIT BOARD. To remove the pc board, proceed as follows:

a. Remove eight screws holding front cover on amplifier. (Front cover has two additional pan head screws near the center.)

b. Lift gently and turn board over in the direction of the VOL control.

c. Unsolder leads from terminals E1, E2, E3, E4, E5, and E6.

d. Remove the two remaining screws from the front cover holding the printed circuit board. A small amount of heat sink compound is between power amplifier and front cover. Do not remove compound unless it is necessary.

4.3.2 INSTALLATION OF PRINTED CIRCUIT BOARD. To install the pc board, reverse the procedure in paragraph 4.3.1. The heat sink compound used is Dow Corning number 340. Any commercial heat sink compound made for this purpose may be used.

4.4 ADJUSTMENT

4.4.1 GENERAL. The adjustment portion of the maintenance section consists of an overall alignment procedure for the Voice Amplifier System. Connect the equipment as shown in Figure 3-3.

4.4.2 ALIGNMENT PROCEDURE

a. Tape push-to-talk switch closed.

b. With the VOL control R1 set to minimum, apply a 4-mV, 1000-Hz signal to the input of the amplifier.

c. Turn the volume control R1 clockwise until the voltmeter indicates 3.8V and the signal is a clean or very slightly clipped sine wave. If the volume control goes to maximum before 3.8V output is reached, skip to step e.

d. Adjust variable resistor R6 (Figure 4-1) so as to decrease the output, and adjust volume control R1 to increase the output until volume control R1 is at maximum and the output is at 3.8V rms. Omit step e.

e. With volume control R1 at maximum, adjust variable resistor R6 so as to increase the output to 3.8V rms (Figure 4-1).

f. Disconnect the input signal and turn the VOL control R1 switch off. Disconnect the lead going to terminal E4 of the printed circuit board. Connect an ammeter into the circuit with the positive connected to the free lead and the common to terminal E4. Turn on volume control R1 to minimum volume (no input). The current drain should be 20 ± 5 mA. If the current drain exceeds 55 mA, refer to Table 3-7 for troubleshooting procedure.

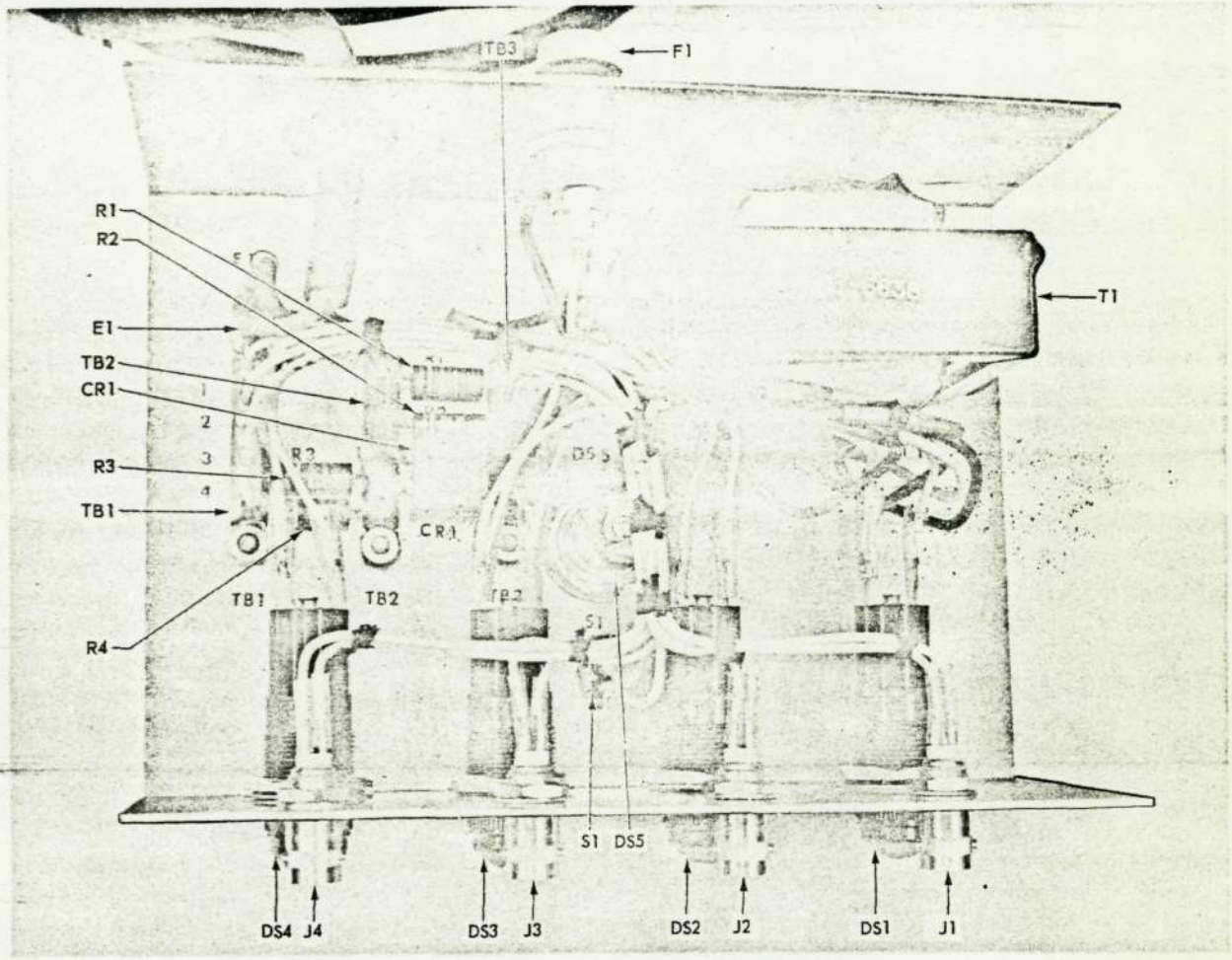


Figure 4-1. Variable Resistor R6 Adjustment Screw

SECTION V

PARTS LISTS

5.1 GENERAL

The following parts lists provide information on the more important replaceable parts of the development model of the FRAP Voice Amplifier Assembly. For a complete listing of all parts and supplies used in constructing the assembly, refer to drawing 79K02624.

5.2 MANUFACTURER CODES

The manufacturer codes listed in the following parts lists are taken from Cataloging Handbook H 4-1, Federal Supply Code for Manufacturers, Name to Code. The codes shown are the Federal Supply Code for Manufacturers in the U.S. and Canada. These codes were used for convenience in preparing the parts lists. Company names and addresses corresponding to the codes shown are as follows:

01121	Allen Bradley Co., 1201 S. Second Street Milwaukee, Wisconsin 53204
04713	Motorola Semiconductor Products, Inc. 5005 E. McDowell Road Phoenix, Arizona 85008
05276	Pomona Electronics Co., Inc. 1500 E. 9th Street Pomona, Calif. 91766
07999	Amphenol Corp., Borg Instruments Div. 902 Wisconsin Street Delavan, Wisconsin 53115
08806	General Electric Co., Miniature Lamp Dept. M9-1 Nela Park Cleveland, Ohio 44112
13327	Solitron Devices, Inc. 256 Oak Tree Road Tappan, N.Y. 10983
56289	Sprague Electric Co. North Adams, Mass. 01247

70903	Belden Corp. 415 S. Kilpatrick Chicago, Ill. 60644
71279	Cambridge Thermionic Corp. 445 Concord Ave. Cambridge, Mass. 02138
71400	Bussman Mfg. Div., McGraw Edison 2536 W. University Street St. Louis, Mo. 63107
71483	David Clark Co. 360 Franklin St. Worcester, Mass. 01604
71785	Cinch Mfg. Co. 1026 S. Homan Ave. Chicago, Ill. 60624
72619	Dialight Corp. 60 Stewart Ave. Brooklyn, N.Y. 11237
AMPLIFIER ASSEMBLY → 76055	Mallory Controls Div., P.R. Mallory & Co., Inc. Box 327 Frankford, Indiana 46041
80294	Bourns, Inc. 1200 Columbia Ave. Riverside, Calif. 92507
81095	Triad Transformer Corp. 4055 Redwood Ave. Venice, Calif. 90293
82389	Switchcraft, Inc. 5555 N. Elston Ave. Chicago, Ill. 60630
83330	Herman H. Smith, Inc. 812 Snediker Ave. Brooklyn, N.Y. 11027
95146	Alco Electronics Products, Inc. P.O. Box 1348 Lawrence, Mass. 01843
KSC	John F. Kennedy Space Center, NASA Kennedy Space Center, Florida 32899

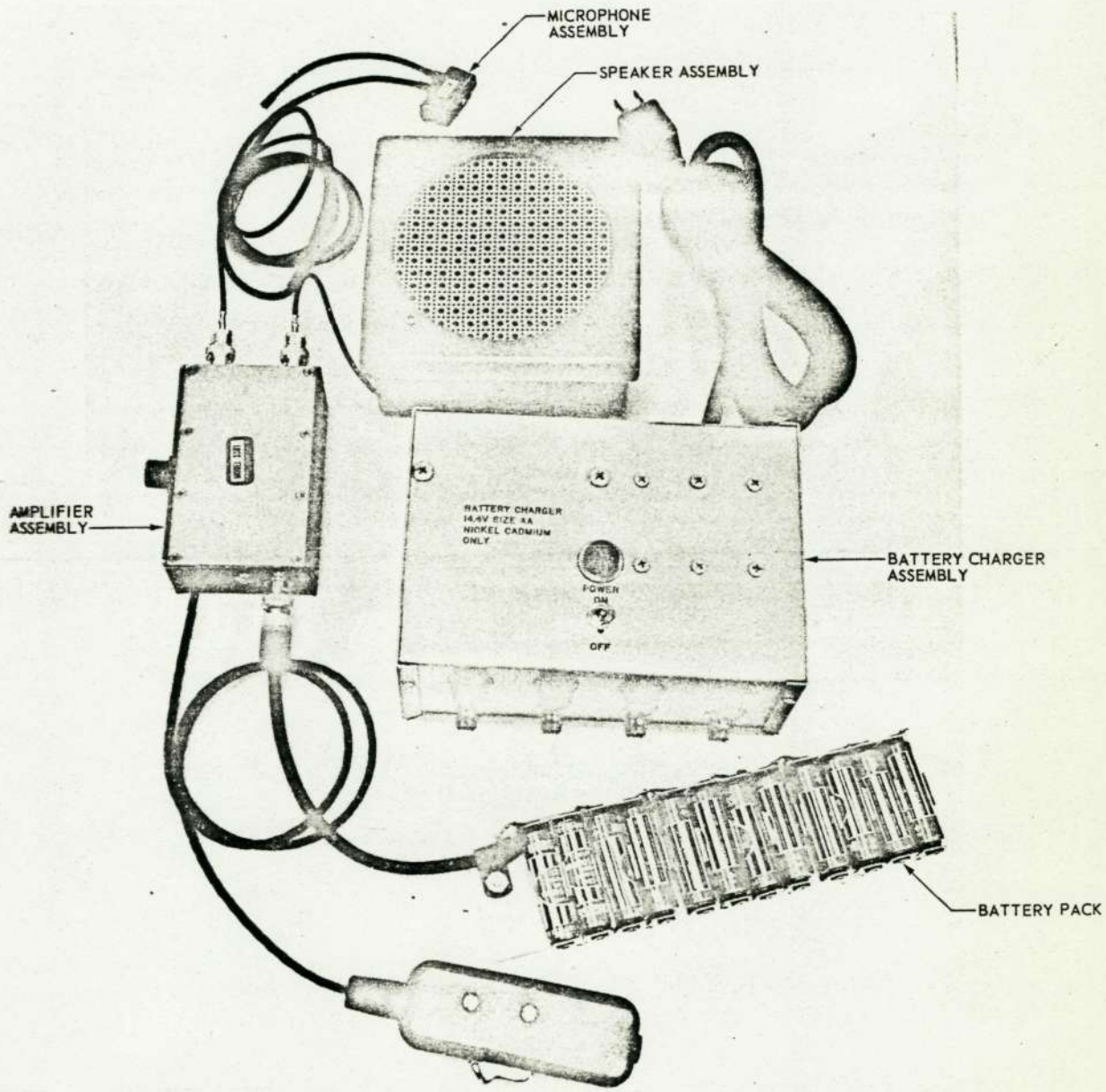


Figure 5-1. Voice Amplifier Assembly Components (Sheet 1 of 2)

REF DES	DESCRIPTION	MFGR	PART NO
	Voice Amplifier Assembly	KSC	79K02624-1
1	Amplifier Assembly	KSC	79K02624-2
2	Battery Pack	KSC	79K02624-5
3	Microphone Assembly	KSC	79K02624-7
4	Battery Charger Assembly	KSC	79K02624-8
5	Speaker Assembly	KSC	79K02624-9

Figure 5-1. Voice Amplifier Assembly Components (Sheet 2 of 2)

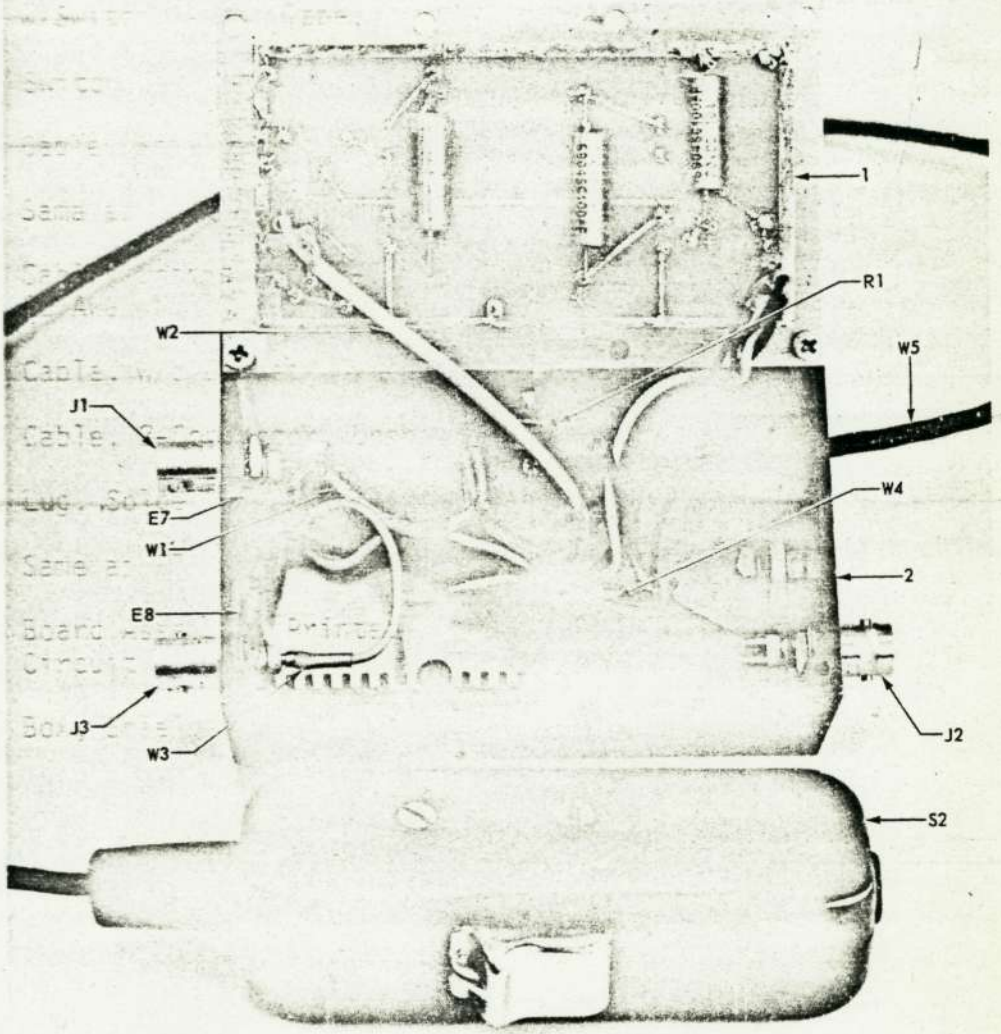


Figure 5-2. Amplifier Box Components (Sheet 1 of 2)

REF DES	DESCRIPTION	MFGR	PART NO
J1	Receptacle, Connector	07999	UG-625 B/U
J2	Receptacle, Connector	07999	31-2225
J3	Receptacle, Connector	07999	UG-625 B/U
R1	Resistor, Variable, 5%, 5k ohms, w/Switch, Audio Taper	76055	MLC-53AS
S2	Switch	71483	12151G-01
W1	Cable, Shielded	70903	8417
W2	Same as W1		
W3	Cable, Unshielded, 2-Conductor, 22 AWG	70903	8481
W4	Cable, w/o Jacket	70903	8470
W5	Cable, 2-Conductor, Unshielded	70903	8442
E7	Lug, Solder	83330	1497
E8	Same as E7		
1	Board Assembly, Printed Circuit	KSC	79K02624-3
2	Box, Shielded	05276	3301

Figure 5-2. Amplifier Box Components (Sheet 2 of 2)

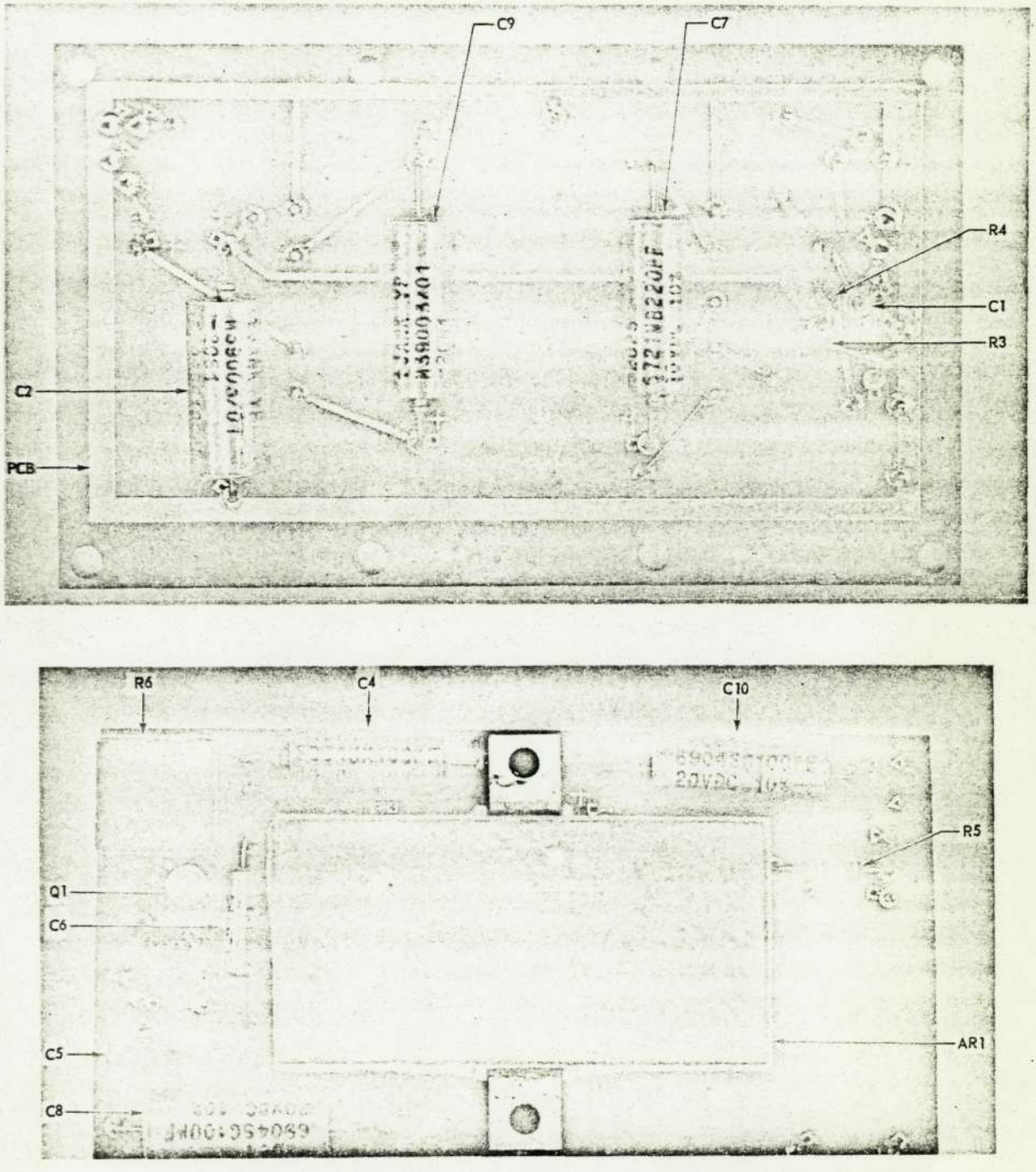


Figure 5-3. Printed Circuit Board Components (Sheet 1 of 3)

REF DES	DESCRIPTION	MFGR	PART NO
AR1	Amplifier, Hybrid, 5W	13327	BHA-0004
C1	Capacitor, Ceramic, 1uF, 50V	56289	M39003/ 01-2356
C2	Capacitor, Ceramic, 100uF, 20V	56289	M39003/ 01-2301
C4	Capacitor, Ceramic, 100uF, 10V	56289	M39003/ 01-2261
C5	Capacitor, Ceramic, 0.033uF, 50V	56289	M390014/ 1B-0424
C6	Capacitor, Ceramic, 22uF, 15V	56289	M39003/ 01-2271
C7	Capacitor, Ceramic, 220uF, 10V	56289	M39003/ 01-2265
C8	Same as C2		
C9	Same as C2		
C10	Same as C2		
E1	Terminal	71279	1785-2
E2	Same as E1		
E3	Same as E1		
E4	Same as E1		
E5	Same as E1		
E6	Same as E1		
Q1	Transistor, 2N718A	04713	2N718A

Figure 5-3. Printed Circuit Board Components (Sheet 2 of 3)

REF DES	DESCRIPTION	MFGR	PART NO
R2	Resistor, Fixed, 5%, 4.7 Ohms, 1/4W	01121	RCR07G472JS
R3	Resistor, Fixed, 5%, 8.2k Ohms, 1/4W	01121	RCR07G822JS
R4	Resistor, Fixed, 5%, 1.5k Ohms, 1/4W	01121	RCR07G152JS
R5	Resistor, Fixed, 5%, 3.9k Ohms, 1/4W	01121	RCR07G392JS
R6	Resistor, Variable, 5%, 1k Ohms, Linear Taper	80294	RT22C2P102
1	Board, Printed Circuit	KSC	79K02624-4

Figure 5-3. Printed Circuit Board Components (Sheet 3 of 3)

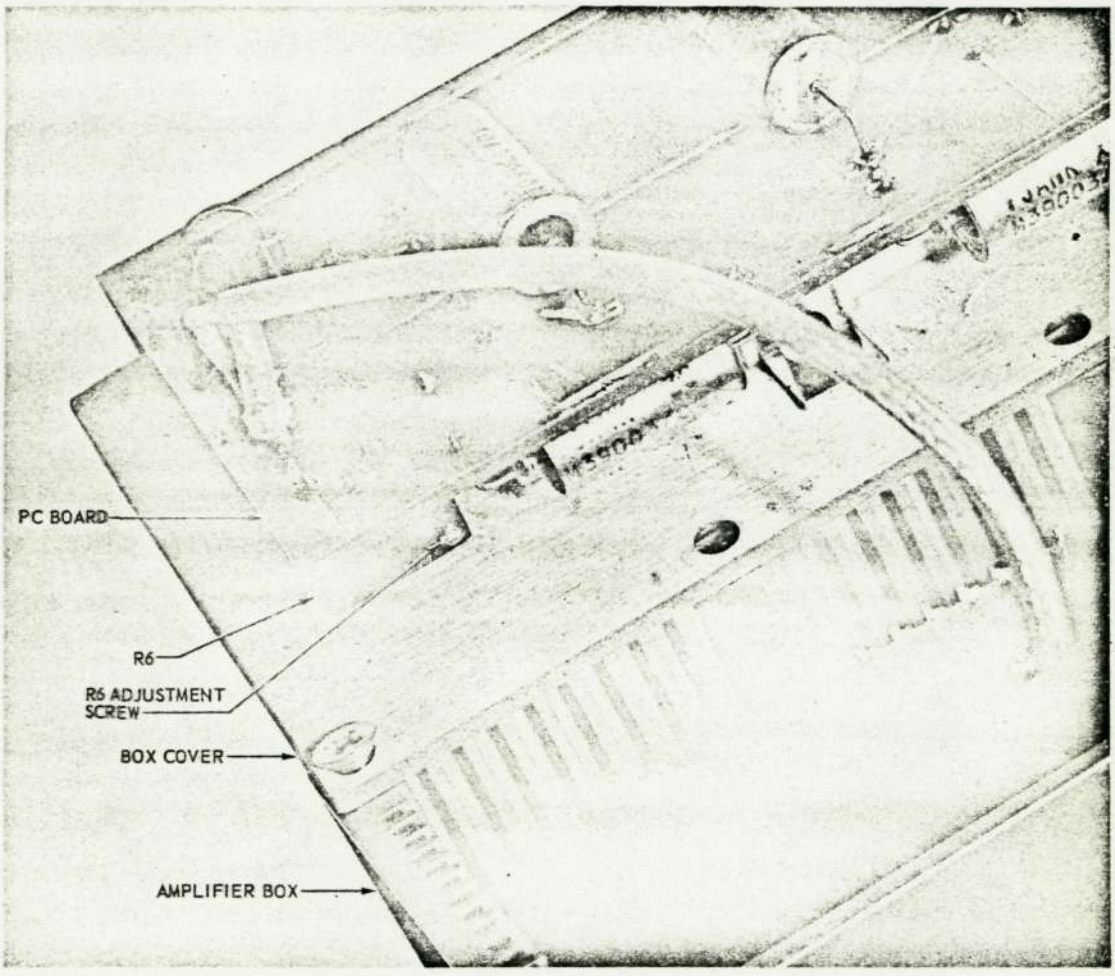


Figure 5-4. Battery Charger Components (Sheet 1 of 2)

REF DES	DESCRIPTION	MFGR	PART NO
CR1	Rectifier	04713	MDA942-2
DS1	Lamp Holder	72619	81-0410-0117-201
DS2	Same as DS1		
DS3	Same as DS1		
DS4	Same as DS1		
	Lamp	08806	49
DS5	Lamp Holder	72619	95-0463-0931-211
	Lamp, Neon	08806	NE-51H
E1	Lug, Solder	83330	1486-6
F1	Fuse Holder	71400	FHN31G1
	Fuse, 1/8A	71400	MKB
J1	Receptacle	07999	31-2225
J2	Same as J1		
J3	Same as J1		
J4	Same as J1		
R1	Resistor, Fixed, 5%, 390 Ohms, 1W	01121	RCR32GF391JS
R2	Same as R1		
R3	Same as R1'		
R4	Same as R1		
S1	Switch	95146	MST 105D
T1	Transformer, Power	81095	F91X
TB1	Terminal Strip	71785	2004
TB2	Same as TB1		
TB3	Same as TB1		

Figure 5-4. Battery Charger Components (Sheet 2 of 2)

SECTION VI

DIAGRAMS

6.1 DRAWINGS

The following drawings of the John F. Kennedy Space Center, NASA, Kennedy Space Center, Florida 32899, apply to the Fire Rescue Air Pack.

79K02567	Fire Rescue Air Pack
79K02624	Fire Rescue Air Pack, Voice Amplifier Assembly