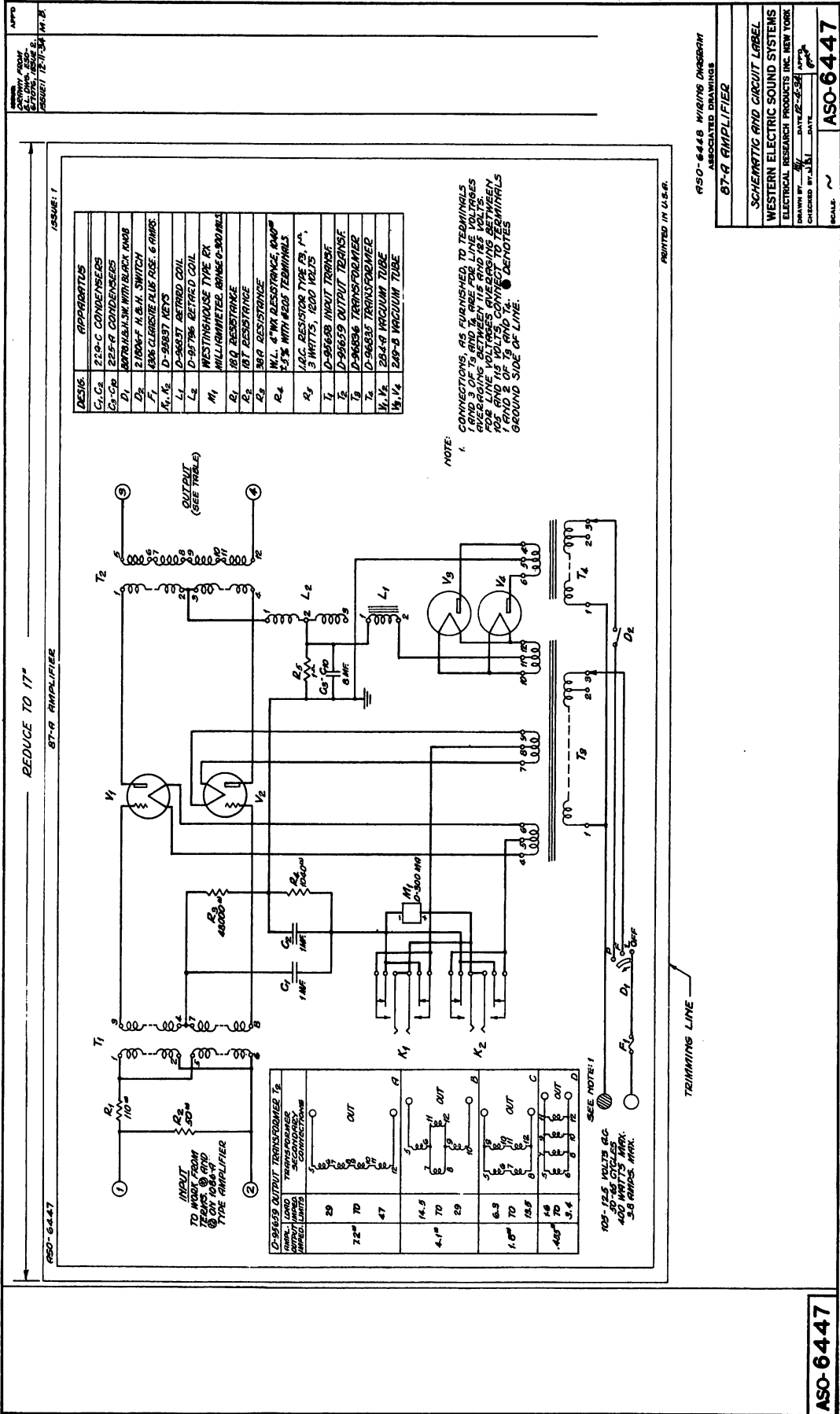






ASO-6447-1, Assoc. with AMPLIFIERS, 67 TYPE

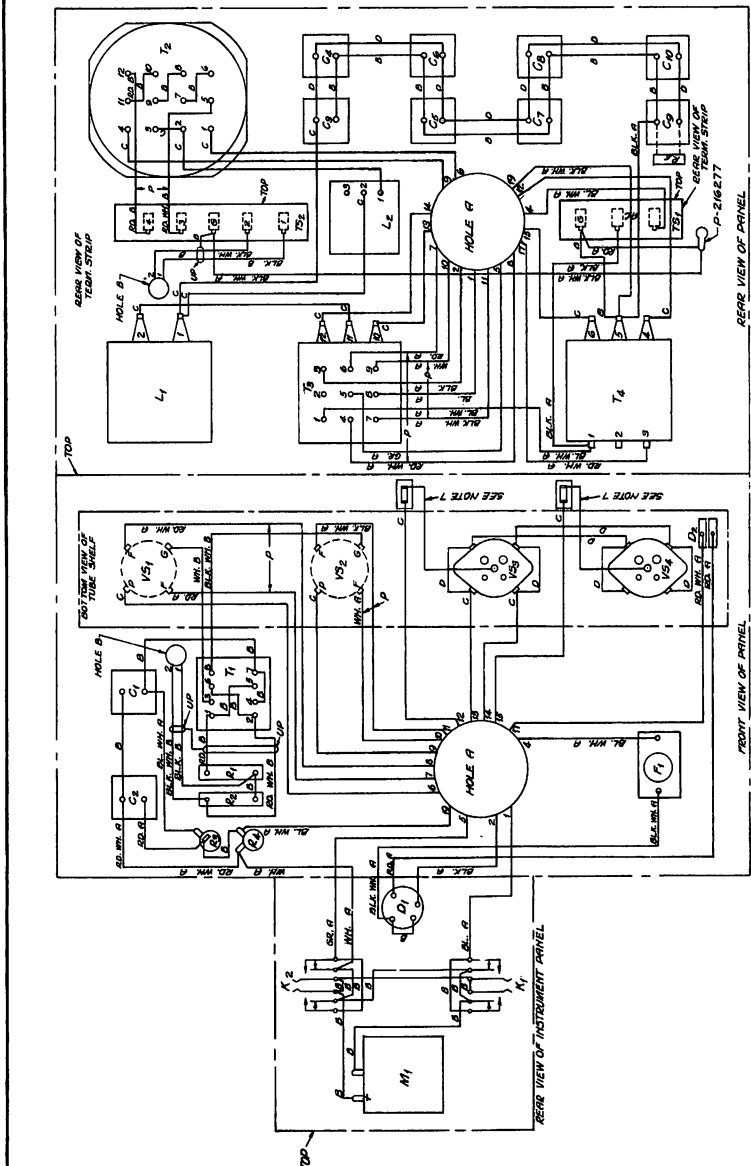


4.03

ASO-6448-1, Assoc. with AMPLIFIERS, 87 TYPE

APP'D	ISSUED 11-17-54
DESIGNED BY	W. J. B. (10)
CHECKED BY	W. J. B. (10)
DATE	11-17-54
PROJECT	ASO-6448-1
DESCRIPTION	ASSOCIATED DRAWINGS
REVISIONS	

SYMBOL	DESCRIPTION
APPARATUS	
C1	250-C CONDENSER
C2	225-A CONDENSER
D1	807B H.B.H. SWITCH WITH BLACK KNOB
D2	21006 P. H. B. H. SWITCH
F1	62389 BERRY ALUM FUSE CIRCUIT BASE
M1	D-96897 KEY
L1	D-96897 RETARD COIL
L2	D-96796 RETARD COIL
M1	WESTINGHOUSE TYPE RX MILLI-AMMETER. RANGE 0-300 MILLS.
R1	180 RESISTANCE
R2	187 RESISTANCE
R3	369 RESISTANCE
R4	1/2 WATT 400 OHM RESISTANCE RANGE WITH 250 OHM TERMINALS
R5	1/2 WATT 100 OHM RESISTANCE
T1	D-95669 INPUT TRANSFORMER
T2	D-95669 OUTPUT TRANSFORMER
T3	D-96836 TRANSFORMER
T3a	ESL-67715
T3b	ESL-67715
V3	6X45P VACUUM TUBE SOCKET
V3a	6X45P VACUUM TUBE SOCKET



NOTE:

1. WIRES MARKED "A" ARE #16 AWG. SILK BRAIDED STRIP WIRE PER M-23008, IN CABLE.
2. WIRES MARKED "B" ARE #16 AWG. SILK BRAIDED STRIP WIRE PER M-23008, OPEN FORM.
3. WIRES MARKED "C" ARE #14 AWG. COPPER WIRE, WEATHER-PROOFED COTTON Braid, IN CABLE. SEE NOTE 9.
4. WIRES MARKED "D" ARE #14 AWG. COPPER WIRE, 7 STRANDS, 1/32" WALL, VARNISHED CRAMBIC, WEATHER-PROOFED COTTON Braid, OPEN FORM. SEE NOTE 9.
5. "UP" DENOTES SHIELDED Pairs SHIELDED PER M-15066.
6. "P" DENOTES PAIRED WIRES.
7. P-236417 CONNECTOR LENGTH AS SPECIFIED IN ASSEMBLY.
8. WIRES SHOWN DOTTED ARE FURNISHED WITH APPARATUS.
9. IN NOTES 3 AND 4, THIS WIRE MAY BE OBTAINED FROM THE FOLLOWING SOURCES: BOSTON, MASS., 60 SIMPLEX CABLE #1042.

ASO-6447 SCHEMATIC & COT LABEL ASSOCIATED DRAWINGS

87-A AMPLIFIER

WIRING DIAGRAM

WESTERN ELECTRIC SOUND SYSTEMS  
ELECTRICAL RESEARCH PRODUCTS INC. NEW YORK

DRAWN BY: J. B. DATE: 11-17-54

CHECKED BY: W. J. B. DATE: 11-17-54

SCALE: ~

**ASO-6448**

ASO-6448



O. REASON FOR REISSUE

O.1 To include information regarding a field change to increase the factor of safety from 1.5 to 2.0 between the leads connecting to V85 and V84, and around (Section 3), to meet Underwriters requirements.

1. ASSOCIATED PHOTOGRAPHS & DRAWINGS

- ASO-6447 - 87-A Amplifier, Schematic & Circuit Label
- ASO-6448 - 87-A Amplifier, Wiring Diagram
- Photo #9486 - 87-A Amplifier, Front View, Cover Removed
- Photo #9487 - 87-A Amplifier, Rear View, Cover Removed
- Photo #9489 - 86 & 87 type Amplifiers, with associated equipment, on 101-0 Rack.

2. DESCRIPTION

2.1 The 87-A Amplifier is an A0 operated single stage amplifier. It is arranged for relay rack mounting and is similar in appearance to the 1086-A Amplifier. The overall dimensions are 19-1/4" high, 19" wide and 12-3/4" deep, and the weight is 141 lbs.

2.2 The amplifier has the following characteristics:-

- Gain - - - - - 9.7 db (when operated from 1086-A type Amplifier)
- Output Capacity - - - - - 50 Watts with maximum of 1/4 third harmonic
- Input Impedance - - - - - Designed to work from 12 ohm output terminals of 86-A type Amplifier, or an impedance of 3.7 ohms. Impedance into amplifier = 50 ohms.
- Output Impedance - - - - - For operation into nominal load impedances of 35, 20, 8.8 and 2.2 ohms (see ASO-6447 for Amplifier impedance and load impedance limits).
- Noise Level - - - - - 25 db, r.m.s. maximum.
- Vacuum Tubes - - - - - Two 289-A (or 284-D) Vacuum Tubes in a push-pull circuit.
- Power Consumption - - - - - Two 289-B Vacuum Tubes in a full wave rectifier circuit.
- Maximum Ambient Temperature - 110° F.

2.3 Two or three 87-A Amplifiers may be operated in parallel from the 1086-A Amplifier. In case of two or three 87-A Amplifiers so operated, connect the parallel terminals 10 and 12 of the 1086-A Amplifier to any of the 50 ohm resistances R2 to the terminals 10 and 12 of the 1086-A Amplifier. Refer to ASO-6450 (E.B. "Wide Range Systems Data - Index", File 4, 388) for information on output connections. The following tabulation covers the characteristics of the combined 1086-A and one, two or three 87-A Amplifiers:

	2, 87-A	3, 87-A
Gain (db, max.) see E.B. "Transmission Test Report, EPT-562", File 4, 604	108.7	111.1
Output Capacity (Watts at 100 cps, with max. of 1/4 third harmonic)	50	100
Noise Level (db, r.m.s. max.)	- 16	- 16
Power Consumption (Watts at 115V, 60 Cycles; P.F. of approximately 93.5%)	530	930

3. FIELD CHANGE AT RECTIFIER SOCKETS

3.1 In order to increase the factor of safety from breakdown, VT sockets V81 and V84 are to be lowered on all 87-A Amplifiers, including those already installed. The result will be an increase in the space between the socket terminals (and attached leads) and the metal shelf on which the sockets are mounted.

3.2 Required Material (for each 87-A Amplifier): 4 Spacers, Item 12, ESI-617639  
4 Screws, Item 23, ESI-617639

One set of these items will be supplied in the near future to District Offices. For each 87-A Amplifier installed, and one set will be supplied with each amplifier shipped in the future (for assembly during installation) until the corresponding manufacturing change becomes effective in the product as shipped. Each set will be enclosed in an envelope marked "Socket modification parts for 87-A Amplifier".

3.3 Procedure: Remove the four screws by which V81 and V84 are mounted. Remove the sockets using the new screws. Insert one of the spacers on each screw between the socket and shelf. The result will be 1/4" between the socket and shelf. Then inspect the leads connected to the socket terminals, and dress their skinned ends away from all grounds, if necessary.

4. MERCHANDISING

4.1 The 87-A Amplifier became available in the Stores Division about March 1, 1935. Order as: "One 87-A Amplifier".

O. REASON FOR REISSUE

O.1 To specify a gain of 9.7 db, instead of 12 db, in Section 2.2.

1. ASSOCIATED DRAWINGS & PHOTOGRAPHS

- ASO-6447 - 87-A Amplifier, Schematic & Circuit Label
- ASO-6448 - 87-A Amplifier, Wiring Diagram
- Photo #9486 - 87-A Amplifier, Front View, Cover Removed
- Photo #9487 - 87-A Amplifier, Rear View, Cover Removed

2. DESCRIPTION

2.1 The 87-A Amplifier is an A0 operated single stage amplifier. It is arranged for relay rack mounting and is similar in appearance to the 1086-A Amplifier. The overall dimensions are 19-1/4" high, 19" wide and 12-3/4" deep, and the weight is 141 lbs.

2.2 The amplifier has the following characteristics:-

- Gain - - - - - 9.7 db (when operated from the 1086-A type Amplifier)
- Output Capacity - - - - - 50 Watts with maximum of 1/4 third harmonic.
- Input Impedance - - - - - Designed to work from 12 ohm output terminals of 86-A type Amplifier, or an impedance of 3.7 ohms. Impedance into amplifier = 50 ohms.
- Output Impedance - - - - - For operation into nominal load impedances of 35, 20, 8.8 and 2.2 ohms (see ASO-6447 for Amplifier impedance and load impedance limits).
- Noise Level - - - - - 25 db, r.m.s. maximum.
- Vacuum Tubes - - - - - Two 289-A (or 284-D) Vacuum Tubes in a push-pull rectifier circuit.
- Power Consumption - - - - - 400 Watts, maximum at 105-125 volts, 50-55 cycles.
- Maximum Ambient Temperature - 110° F.

2.3 Two or three 87-A Amplifiers may be operated in parallel from the 1086-A Amplifier. In case of two or three 87-A Amplifiers so operated, connect the parallel terminals 10 and 12 of the 1086-A Amplifier to any of the 50 ohm resistances R2 to the terminals 10 and 12 of the 1086-A Amplifier. Refer to ASO-6450 (E.B. "Wide Range Systems Data - Index", File 4, 388) for information on output connections. The following tabulation covers the characteristics of the combined 1086-A and one, two or three 87-A Amplifiers:

	2, 87-A	3, 87-A
Gain (db, max.) see E.B. "Transmission Test Report, EPT-562", File 4, 604	108.7	111.1
Output Capacity (Watts at 100 cps, with max. of 1/4 third harmonic)	50	100
Noise Level (db, r.m.s. max.)	- 16	- 16
Power Consumption (Watts at 115V, 60 Cycles; P.F. of approx. 93.5%)	530	930

3. MERCHANDISING

3.1 The 87-A Amplifier became available in the Stores Division about March 1, 1935. Order as: "One 87-A Amplifier".



4-03

87 TYPE AMPLIFIER  
ADDENDUM #1

1. PURPOSE

1.1 To provide information on the modification of 87 type Amplifiers for adaptation to input from 42 and 46 type amplifiers with 500 ohm output impedance.

2. ASSOCIATED DRAWINGS AND BULLETINS

- ASO-6447 - Schematic 87-A and B-87-A Amplifiers
- ASO-6448 - Wiring Diagram 87-A and B-87-A Amplifiers
- ASO-6867 - Schematic 87-C Amplifier
- ASO-6868 - Wiring Diagram 87-C Amplifier
- AASO-9518 - Schematic 87-E Amplifier
- AASR-1549 - Circuit Label - 87-E Amplifier
- E.E. Systems - 42 & 46 Type Amplifiers with 87 Type Amplifier, File 4,395, Issue 1, dated November 20, 1940.

3. PROCEDURE

3.1 The following wiring changes should be made in the existing input circuit which will make it conform to that shown in Fig. 1.

3.2 For modification of 87-A or B-87-A Amplifiers, proceed as follows:

- (a) Disconnect strap between 1 and 5 and between 2 and 6 on T<sub>1</sub>.
- (b) Disconnect wire from 1 of T<sub>1</sub> to R<sub>1</sub> and from 2 of T<sub>1</sub> to R<sub>2</sub>.
- (c) Disconnect at R<sub>1</sub> and R<sub>2</sub> the two wires (1 and 2) going to terminal strip TS1 and reconnect the black-white wire (1) to terminal 1 of T<sub>1</sub> and the black wire (2) to terminal 6 of T<sub>1</sub>. (See Wiring Diagram ASO-6448)
- (d) Strap terminals 2 and 5 of T<sub>1</sub>.
- (e) Connect a 1000 ohm 10 watt resistor across terminals 1 and 2 of terminal strip in rear of amplifier.

3.3 For modification of 87-C or 87-E Amplifiers, proceed as follows:

- (a) Disconnect strap between 1 and 5 and between 2 and 6 on T<sub>1</sub>.
- (b) Disconnect wire from 1 of T<sub>1</sub> and the three wires (1-2-3) in black cable form connected to R<sub>2</sub> and R<sub>6</sub> (see Drawing ASO-6868 for 87-C and AASR-1549 for 87-E).
- (c) Disconnect wire running from 2 of T<sub>1</sub> to R<sub>2</sub> - fold back and tape.
- (d) Strap terminals 2 and 5 of T<sub>1</sub>.
- (e) Connect green wire (3) from cable form to 1 of T<sub>1</sub> and white wire (2) to 6 of T<sub>1</sub>.
- (f) Fold back and tape green wire (1) in 86-C Amplifier or yellow wire (1) in 87-E Amplifier.
- (g) Connect a 1000 ohm, 10 watt resistor across terminals 2 and 3 of terminal strip in rear of amplifier which will be the input terminals when 87-C or 87-E Amplifier is modified per preceding instructions.

4. ELECTRICAL CHARACTERISTICS

- 4.1 When driven by a 42 or 46 type Amplifier with 500 ohm output and unmodified for increased power, the gain of the 87 type Amplifier will be 20 db.
- 4.2 When driven by a 42 or 46 type Amplifier with 500 ohm output and modified for increased power, the gain of the 87 type Amplifier will be 18 db.
- 4.3 The voltage amplification of the 87 type Amplifier with the input arrangement as mentioned in Sec. 4.1 and 4.2, measured between the input terminals and a 9 ohm load is zero db; that is, the input terminal voltage is equal to the voltage across the 9 ohm load.

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Issued By  
Engineering & Merchandise Department

November 20, 1940

Issue #1  
November 20, 1940

Issued By  
Engineering & Merchandise Department

2 Pages - Page 2

5. MATERIAL REQUIRED

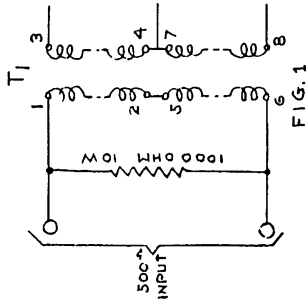
5.1 For each 87 type Amplifier to be modified, it will be necessary to order:

- 1 - Type AB, 1000 Ohm, 10 Watt Resistor.

5.2 This material is available in Warehouse Stock.

6. GENERAL

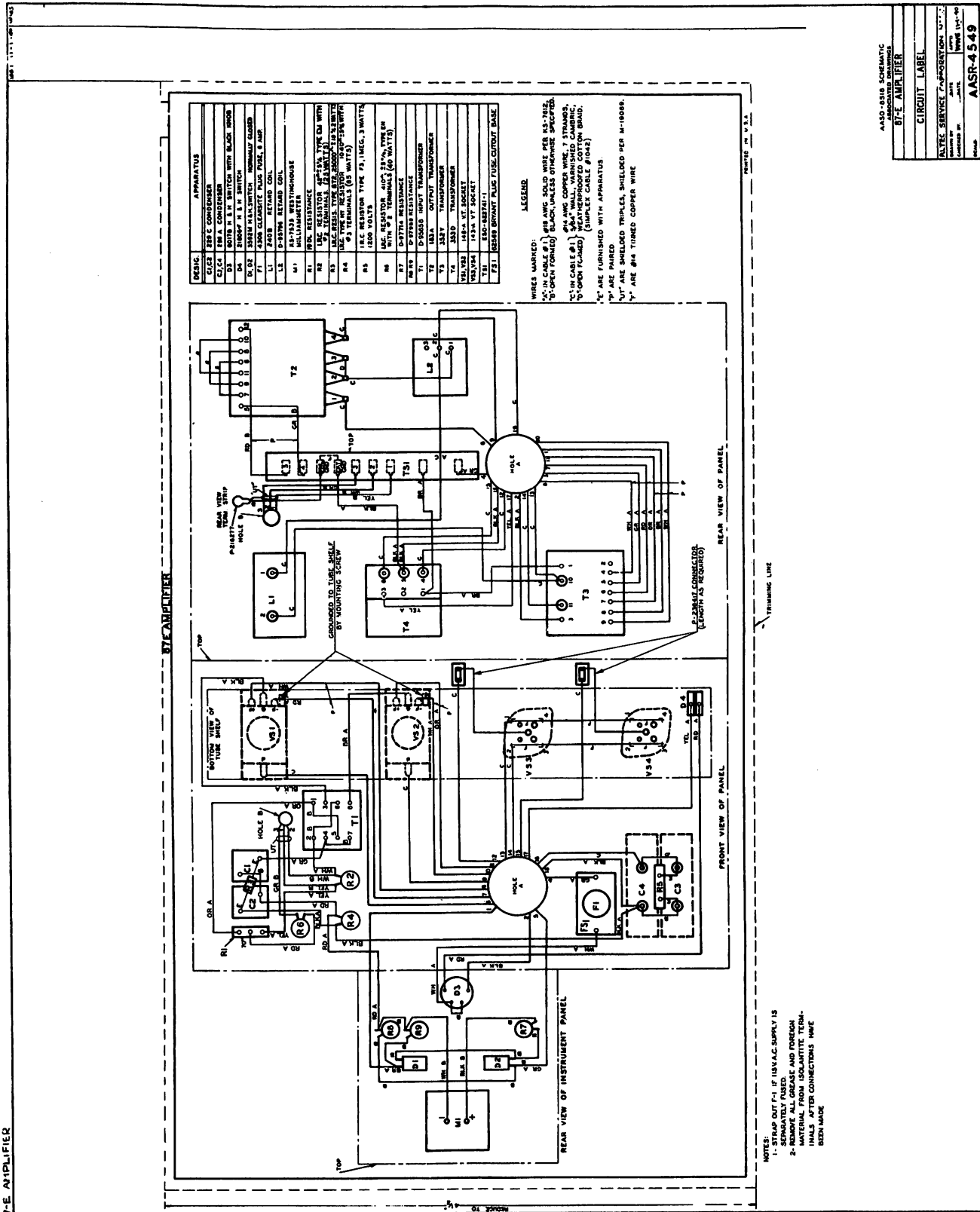
6.1 The 87-E Amplifier differs from the 87-C only in the type of output transformer and the terminal strip for external connections.





5030.12

87-E AMPLIFIER



DESIGNATION	APPARATUS
C1	250 V. CAPACITOR
D1	1/2" DIA. SWITCH WITH BLACK HOOD
D2	1/2" DIA. SWITCH WITH BLACK HOOD
D3	1/2" DIA. SWITCH WITH BLACK HOOD
D4	1/2" DIA. SWITCH WITH BLACK HOOD
D5	1/2" DIA. SWITCH WITH BLACK HOOD
D6	1/2" DIA. SWITCH WITH BLACK HOOD
D7	1/2" DIA. SWITCH WITH BLACK HOOD
D8	1/2" DIA. SWITCH WITH BLACK HOOD
D9	1/2" DIA. SWITCH WITH BLACK HOOD
D10	1/2" DIA. SWITCH WITH BLACK HOOD
D11	1/2" DIA. SWITCH WITH BLACK HOOD
D12	1/2" DIA. SWITCH WITH BLACK HOOD
D13	1/2" DIA. SWITCH WITH BLACK HOOD
D14	1/2" DIA. SWITCH WITH BLACK HOOD
D15	1/2" DIA. SWITCH WITH BLACK HOOD
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D17	1/2" DIA. SWITCH WITH BLACK HOOD
D18	1/2" DIA. SWITCH WITH BLACK HOOD
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D41	1/2" DIA. SWITCH WITH BLACK HOOD
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D85	1/2" DIA. SWITCH WITH BLACK HOOD
D86	1/2" DIA. SWITCH WITH BLACK HOOD
D87	1/2" DIA. SWITCH WITH BLACK HOOD
D88	1/2" DIA. SWITCH WITH BLACK HOOD
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D96	1/2" DIA. SWITCH WITH BLACK HOOD
D97	1/2" DIA. SWITCH WITH BLACK HOOD
D98	1/2" DIA. SWITCH WITH BLACK HOOD
D99	1/2" DIA. SWITCH WITH BLACK HOOD
D100	1/2" DIA. SWITCH WITH BLACK HOOD

LEGEND  
 WIRES MARKED:  
 "A" ARE FURNISHED WITH APPARATUS.  
 "B" ARE SHIELDED TRIPLEX, SHIELDED PER M-10089.  
 "C" ARE #14 TINNED COPPER WIRE.  
 "D" ARE #14 TINNED COPPER WIRE.  
 "E" ARE #14 TINNED COPPER WIRE.  
 "F" ARE #14 TINNED COPPER WIRE.  
 "G" ARE #14 TINNED COPPER WIRE.  
 "H" ARE #14 TINNED COPPER WIRE.  
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 "V" ARE #14 TINNED COPPER WIRE.  
 "W" ARE #14 TINNED COPPER WIRE.  
 "X" ARE #14 TINNED COPPER WIRE.  
 "Y" ARE #14 TINNED COPPER WIRE.  
 "Z" ARE #14 TINNED COPPER WIRE.

NOTES:  
 1- STRAP OUT F-1 IF 115 V.A.C. SUPPLY IS  
 2- TERMINAL BLOCKS AND FOREIGN  
 3- MATERIAL FROM ISOLANTITE TERMINALS  
 4- MATERIAL FROM ISOLANTITE TERMINALS  
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 95- MATERIAL FROM ISOLANTITE TERMINALS  
 96- MATERIAL FROM ISOLANTITE TERMINALS  
 97- MATERIAL FROM ISOLANTITE TERMINALS  
 98- MATERIAL FROM ISOLANTITE TERMINALS  
 99- MATERIAL FROM ISOLANTITE TERMINALS  
 100- MATERIAL FROM ISOLANTITE TERMINALS

ASR-4549 SCHEMATIC  
 87-E AMPLIFIER  
 CIRCUIT LABEL  
 DATE: SERVICE POSITION: 11-1-49  
 DRAWN BY: [Signature]  
 CHECKED BY: [Signature]  
 APPROVED BY: [Signature]

12-27-45

4033.11

WESTERN ELECTRIC  
SOUND EQUIPMENT BULLETIN  
AMPLIFIERS, 87 TYPE

1. DESCRIPTION - Single stage, push pull, all AC operated, power amplifier. Rack mounting. Dimensions 19" x 12-3/4" x 19-1/4". Weight 14 1/2 lbs. (For wall mounting use AF-1193 Bracket assembled per AF-1198).

NOTE: 87 type Amplifiers are also being supplied by Altec Lansing Corporation. For types refer to Altec Lansing Sound Equipment Bulletins.

1.1 Upon receipt of this bulletin recode amplifiers as follows:

Previous Code No.	Significant Circuit Characteristics	Recode
87-A	12 ohm input and D-9659 Output Transformer	87
B-87-A	12 ohm input and D-9659 Output Transformer	B-87
87-C	12/500 ohm input and D-9659 Output Transformer	C-87
87-E	12/500 ohm input and 183-A Output Transformer	E-87

NOTE:- When amplifier is modified for 250-500 ohm input with increased gain (refer to Section 4.1) add the letter "v" to the code number (i.e. C-87-v).

2. TYPES AND CHARACTERISTICS - Refer to Amplifiers, General - Chart - Page #4030.01

3. OPERATION - Preheat vacuum tube filaments 10 minutes (snap switch on "PL") before applying plate voltage (snap switch on "Plate").

4. MODIFICATIONS

4.1 250-500 ohm input with increased gain.

4.1.1 Material Required - 1 Type AB - 1000 ohm 10 watt Resistor.

4.1.2 Modification Procedure (Recode as shown).

87 or B-87 - To - 87-v or B-87-v	C-87 or E-87 - To - C-87-v or E-87-v
<p>a. Disconnect strap between 1 and 5 and between 2 and 6 on T-1.</p> <p>b. Disconnect wire from 1 of T-1 to R-1 and from 2 of T-1 to R-2.</p> <p>c. Disconnect at R-1 and R-2 the two wires (1 and 2) going to terminal 1 of T-1 and connect them to the black wire (2) to terminal 6 of T-1. (See Wiring Diagram MSO-6448).</p> <p>d. Strap terminals 2 and 5 of T-1.</p> <p>e. Connect a 1000 ohm 10 watt resistor across terminals 1 and 2 of terminal strip in rear of amplifier.</p>	<p>a. Disconnect strap between 1 and 5 and between 2 and 6 on T-1.</p> <p>b. Disconnect wire from 1 of T-1 to R-1 and the three wires (1-2-3) in black cable form MSO-6448 for C-87 and MSR-4549 for E-87.</p> <p>c. Disconnect wire running from 2 of T-1 to R-2.</p> <p>d. Fold back and tape.</p> <p>e. Strap terminals 2 and 5 of T-1.</p> <p>f. Connect green wire (3) from cable form to 1 of T-1 and white wire (2) to 6 of T-1.</p> <p>g. For C-87 amplifier green wire (1) in C-87 amplifier or yellow wire (1) in E-87 amplifier.</p> <p>8. Connect a 1000 ohm, 10 watt resistor across terminals 2 and 3 of terminal strip in rear of amplifier which will be the input terminals when C-87 or E-87 amplifier is modified per preceding instructions.</p>

ASSOCIATED DRAWINGS

- MSO-6447 87, B-87 Amplifier Schematic
- MSO-6448 87, B-87 Amplifier Wiring Diagram
- MSO-6867 C-87 Amplifier Schematic
- MSO-6868 C-87 Amplifier Wiring Diagram
- MSR-4548 E-87 Amplifier Schematic
- MSR-4549 E-87 Amplifier Wiring Diagram

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