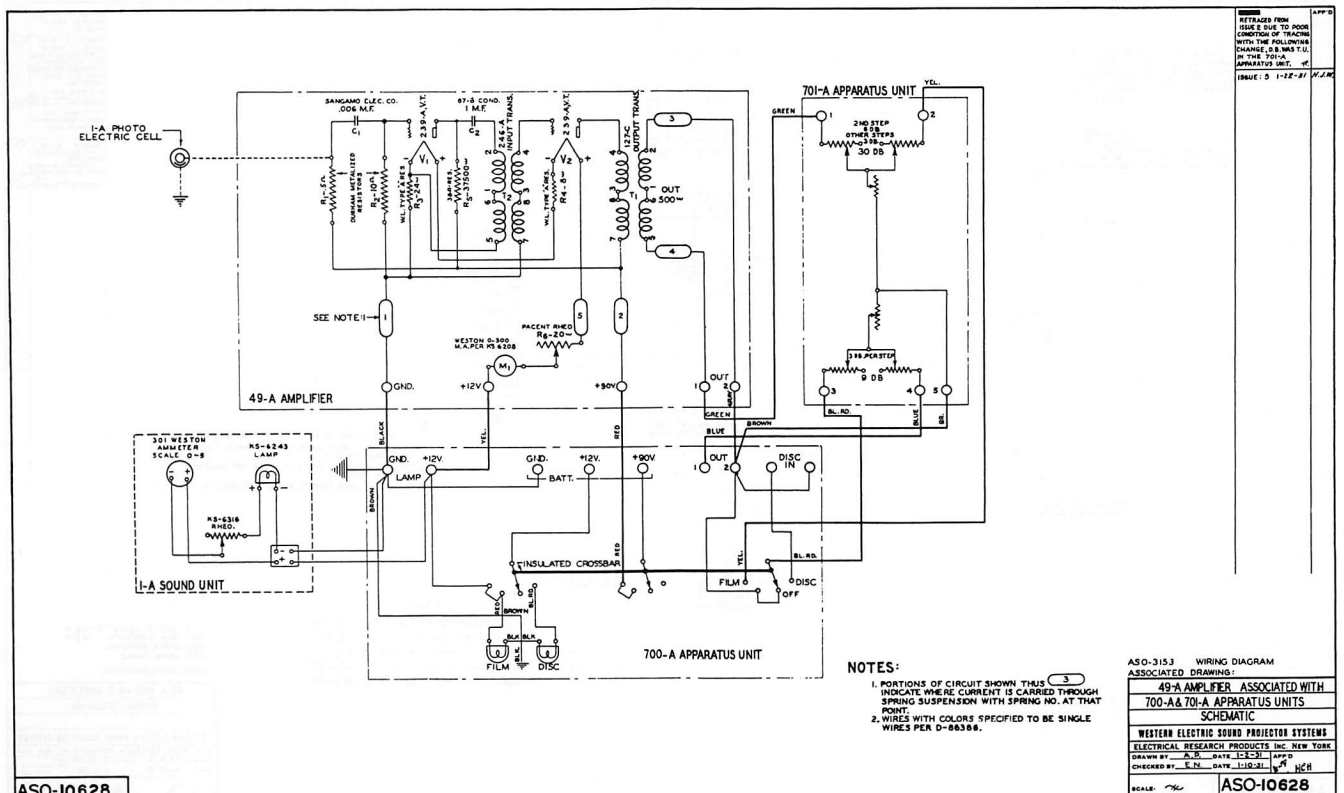


Electrical Research Products Inc.



RETRACED FROM ISSUE 8 DUE TO POOR CONDITION OF TRACING WITH THE FOLLOWING CHANGE: 2. 8 WAS T.U. IN THE TITLE APPARATUS UNIT.

EQUIPMENT BULLETIN

1. Purpose of this Bulletin

1.1 To describe the modifications to be made in the following amplifiers in use in systems supplied from 12 volt storage batteries where the size of the conductors is not sufficiently great to provide a satisfactory value of filament current for the 239-A Vacuum Tubes. The amplifiers affected are: 41-A, 46-A, 46-B, 46-C, 49-A, 49-B, D-85943 and D-86729.

2. Discussion of Conditions

2.1 When the first sound reproducing systems were installed in theatres, the operating filament current for the 239-A Vacuum Tubes in this type amplifiers was 250 milliamperes. Some time later, due to an improvement in manufacturing of tube, the operating filament current was increased to 270 milliamperes. In many installations it was found that the size of wire which had originally been installed was insufficient to provide the proper voltage at the amplifier terminals to produce this increased value of filament current. It is reported at the present time that there are many instances where the maximum filament current obtainable is of the order of 260 milliamperes. It has also come to our attention that there are a few cases where the maximum current obtainable is approximately 250 milliamperes or even less.

2.2 A recent survey of this situation indicates that the majority of 239-A Vacuum Tubes should give satisfactory operation on filament currents ranging from 250 to 270 milliamperes. It is also thought, due to an improvement in manufacturing operations, that it may be possible to return to the original operating filament current of 250 milliamperes. Accordingly, it is considered that the above condition justifies remedy only if a filament current of 250 milliamperes is not obtainable.

2.3 A satisfactory method is described below for remedying this condition in those installations where a filament current of 250 milliamperes cannot be obtained under present conditions, and where rewiring the circuits is precluded due to prohibitive cost.

3. Description of Modification

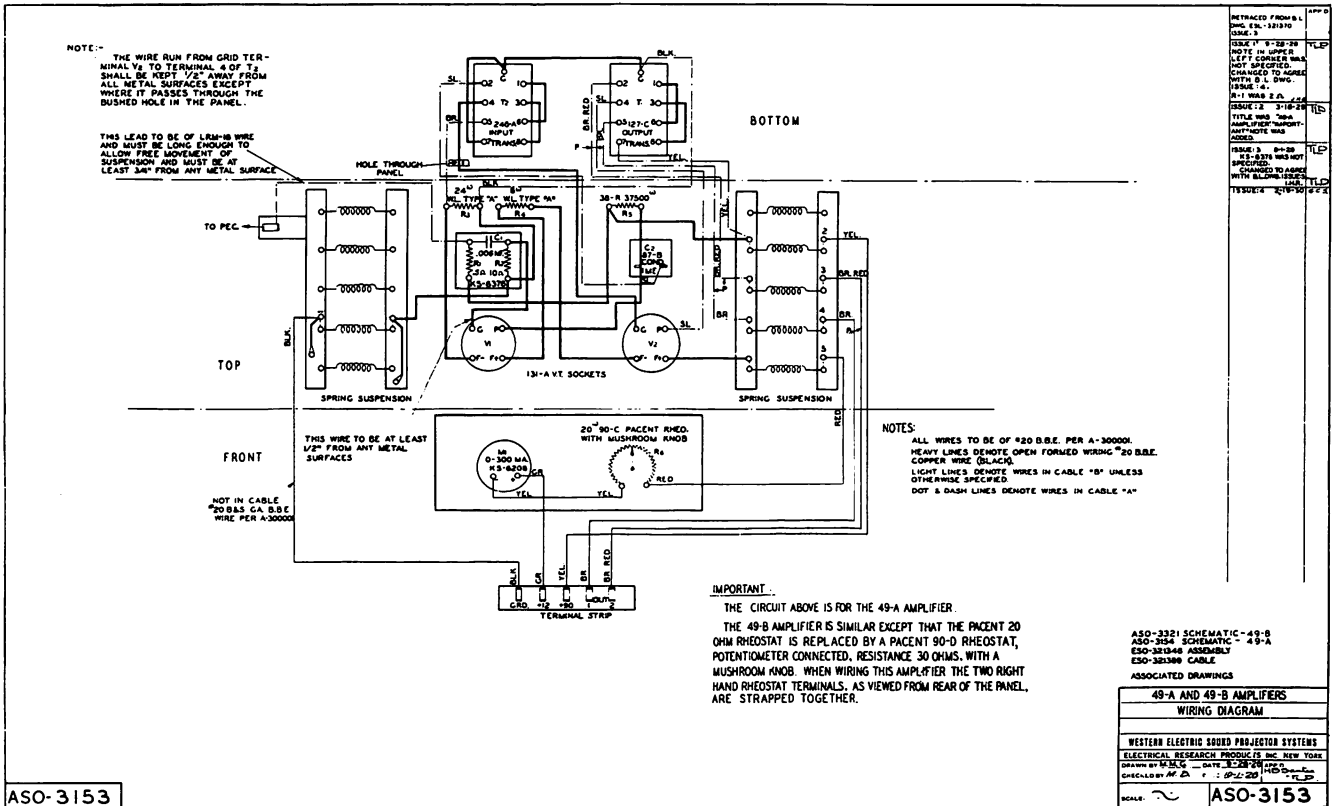
3.1 In each of the amplifiers to be modified, replace the resistance unit listed in the second column of the following table with the resistance unit listed in the fourth column.

Amplifier	Resistance Unit to be removed		Resistance Unit to be installed	
	Type	Ohms	Type	Ohms
41-A	18-FU	22	18-DY	17.1
46-A 46-B 46-C	19-GF	32	19-EF	28
			19-BA use 27 Ohm portion	
49-A 49-B	W.L. Size "A"	24	W.L. Size "A" tab terms.	19
D-85943 D-86729	W.L. Size "A"	24	W.L. Size "A" tab terms.	19

3.2 There may be in use some 41-B Amplifiers which have been converted in the field or in the Warehouse from 41-A Amplifiers and still have in circuit an 18-FU, 22 Ohm resistance unit. Where such amplifiers are encountered, it will be satisfactory to make the same modification as prescribed for the 41-A Amplifier in the above table.

3.3 Apparatus Required

3.31 The resistance unit required for the modification of any particular amplifier is given in the fourth column of the table under Section 3.1. They are not stocked in the Warehouse, but are obtainable on order. In ordering them, quote the information in the fourth and fifth columns of the table.



AMPLIFIERS - GENERAL MODIFICATION

EQUIPMENT BULLETIN

3.4 Apparatus Recovered

3.41 The resistance unit recovered from the modification of any particular amplifier is given in the second column of the table under Section 3.1, and should be retained at the theatre for possible restoration of the Amplifier to normal at a future time.

3.5 The modifications described above have the effect of reducing the grid bias on some of the tubes in these amplifiers as well as that of reducing the filament circuit resistance. Accordingly the Weston #561 Vac. Tube Test Set must not be used in conjunction with such amplifiers after modification since the test limits specified in the instructions for the use of this set would no longer apply.

3.6 Marking

3.61 A typewritten label, worded as follows, should be shellaced to the inside of the cover of all amplifiers modified in accordance with this Bulletin:-

"This amplifier has been modified in accordance with the Equipment Bulletin on 'Amplifiers, General, Modification,' to decrease the filament circuit resistance. It is accordingly not suitable for use in conjunction with the #561 Weston Vacuum Tube Test Set."

H. B. Santee T.L.D.
Director of Theatre Engineering

HAD:
JOC:90

AMPLIFIERS - GENERAL ADDENDUM #1

EQUIPMENT BULLETIN

1. Purpose

1.1 To provide information on the use of the #781 Eveready Battery as the standard replacement "G" battery for 8 type, 9 type and 10 type Amplifiers. 1.2 To specify that when the mechanism of the Door Switch Assembly of the 10, 42, 43 and 46 type Amplifiers requires replacement, the mechanism only shall be replaced. This also applies to the 706, 708 and B-88451 type Control Cabinets.

1.3 To direct attention to the reason for door or cover switches on certain amplifiers and other equipment, and to the necessity for keeping them in circuit at all times.

1.4 To specify that the soldered connections in the amplifier wiring be inspected at the time of installation.

2. Use of #781 Eveready Battery

2.1 The #781 Eveready Battery replaces the #703 Eveready Battery for replacement purposes in the 8, 9 and 10 type Amplifiers. It is a 44 cell unit similar to the #703 type except that it is provided with screw terminals which will permit more permanent connections and thereby reduce appreciably contact troubles from this source. It mounts in the #6 type Battery Box with its terminals outward. A slight change in the battery box is required as outlined in Section 3.

The present routine (see O.B. #19 - F.R. 4.01) of replacing "G" batteries every six months is unaffected by the adoption of the #781 Eveready Battery.

3. Amplifier Modification to Permit Use of #781 Eveready Batteries

3.1 On all 8 type, 9 type and 10 type Amplifiers make the following changes in the #6 type Battery Box and leads thereto when the next replacement of #703 Eveready Batteries becomes necessary. For materials required, see Section 3-3.

- (a) Disconnect all wires on the rear of the panel from the spring contact assembly terminals of the #6 type Battery Box and remove the box from the panel.
(b) Remove the spring contacts from the battery box by first cutting off the hooked ends of the spring contact assembly terminals and then sawing the hooked ends through with a small hand saw. Then remove the bottom side of the battery box through which the spring contact terminals pass. This will permit easy removal of the washers so that the spring contact assemblies may be pulled out from the inside of the box.
(c) Remove the 4 small solder contacts (designed to permit voltage measurements when batteries are in box) embedded in the top side of the battery box by the application of a hot soldering iron. This operation removes all wiring from the "G" battery box.
(d) Splice approximately 10" of #18 Belden varnished cambric motor lead wire (Engineer's kit) to the end of each of the wires disconnected from the battery box in operation (a) above, tape the soldered joints, and pass the wires through the small insulating bushings in the amplifier panel and connect them to the soldered terminals in the chassis in the battery box from which the soldered washers referred to in (c) were removed. In the several 6 type Amplifiers referred to, the wires should be threaded as illustrated in Figs. 1, 2 and 3, respectively.

- (e) Remount battery box on amplifier panel.
(f) Pull the Belden motor lead wire extensions tight, and cut off, leaving approximately 3" of slack for easy connection to the #781 Battery terminals. Solder to the end of each wire (see Figs. 1, 2 & 3) one of the special tinned locking terminal lugs supplied for this purpose.
(g) Insert the #781 Batteries into the box with their terminals outward and with the positive and negative posts of consecutive batteries adjacent to facilitate strapping.
(h) Connect the positive and negative posts of the first wire one complete turn around each battery post, and draw the wire tight by means of a pair of long nose pliers. Connect the new battery leads to their proper terminals. Finally screw the blinding post nuts down securely.

3.2 No change in amplifier coding is required by this modification.

3.3 Merchandising: The #781 Eveready Battery is now the standard replacement for 8 type, 9 type and 10 type Amplifiers. Order as: "One #781 Eveready Battery". The special locking terminals mentioned in change procedure, 3.1 (f), are available in the District Offices; they are known as: "#2108-8 Locking Terminals".

NOTE: A small stock of #703 Eveready Batteries will be maintained as the replacement battery for 521-A Subscriber Sets. However, if the customer desires to carry only one type of battery, the 521-A Subscriber Set may be modified to use the #781 Eveready Battery.

4. Replacement of Door Switches

4.1 Should the mechanism of the door switch assembly (P-221522, Det. 1-A, ESA-32233 or #7246 CH Door Switch) of the 10, 42, 43 and 46 type Amplifiers, (also 706-A, 708-A and D-86551 Control Cabinets) require replacement, the mechanism only, instead of the complete assembly should be replaced. This should be ordered as:

"One #7246 Switch, Less Plate"

The drawings associated with the equipment bulletins on these amplifiers and control cabinets will eventually include this information. Meanwhile mark the existing copies accordingly.

5. Door Switches

5.1 Door or cover switches are provided on the following equipment items:

- 10, 42, 43 and 46 Type Amplifiers
- 706, 708 and D-86551 Type Control Cabinets
- 519, 520 and D-94850 Type Panels

The purpose of these switches is to protect from injury unauthorized persons who might open the door or remove the cover of the equipment and might otherwise come in contact with high voltages. They also provide a safety protection to those who might incur liability in case of such injury. In all of the above equipment the door or cover switch disconnects the 110V supply, except on the 10 type Amplifier and 519 type Panel, where the 750V supply is disconnected.

5.2 In view of the above, it is essential that these switches be in circuit at all times. Specifically, they should never be cut out of circuit for convenience in testing, or for other reasons, and if not in proper operating condition, they should be replaced at once. These instructions do not affect in any way the paralleling of the door switches on 43 type Amplifiers, and 706 and 708 type Control Cabinets, as covered in the Equipment Bulletins on these items.

b. Amplifier Wiring Inspection

6.1 Although amplifiers are thoroughly inspected and tested prior to shipment by the W.E. Co., experience has shown that wiring troubles often result from shipment and subsequent handling. In order to reduce the number of such troubles to a minimum, each newly installed amplifier should be checked for poorly soldered connections, loose particles of solder or wire clippings, and broken wires.

In making this inspection, care must be exercised. Connections that appear satisfactory should not be disturbed; those that appear questionable should be checked more closely and resoldered if necessary. To test a soldered connection press against the wire about 1" from the terminal using the finger or a pointed stick (not pliers) and gently move it about 1/4" back and forth. Motion of the wire at the terminal will generally be observable, if the connection is loose. Inaccessible connections need not be inspected if considerable time would be consumed in gaining access to them.

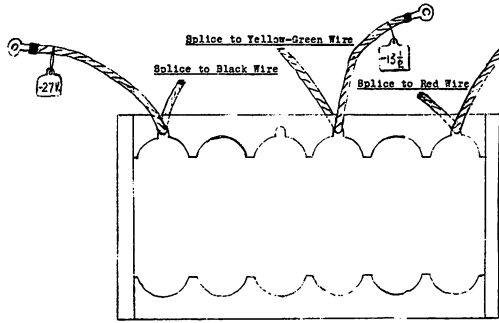


FIG. 1
6F BATTERY BOX OF 6B AMPLIFIER
MODIFIED FOR #781 EVEREADY BATTERIES

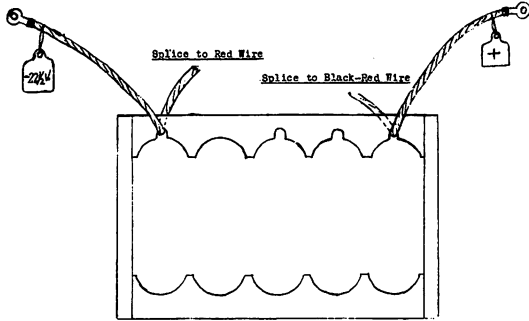


FIG. 2
6E BATTERY BOX OF 6A AMPLIFIER
MODIFIED FOR #781 EVEREADY BATTERIES

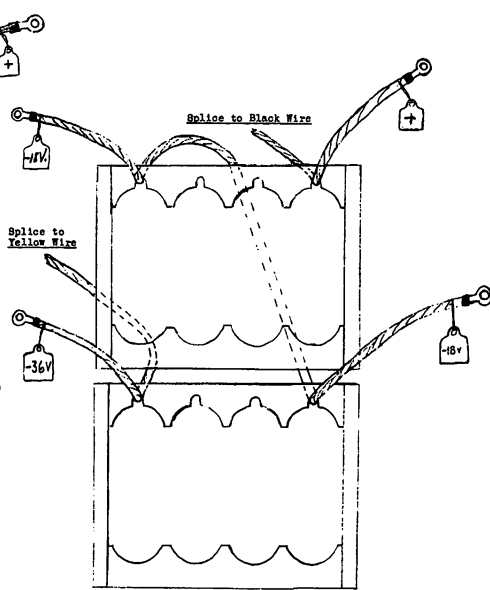


FIG. 3
6D BATTERY BOX OF 10-A AMPLIFIER
MODIFIED FOR #781 EVEREADY BATTERIES

EQUIPMENT BULLETIN

**AMPLIFIERS, GENERAL
ADDENDUM #1**

Replacing Addendum #2, 7/26/33

1. Reason for Release
 - 1.1 To omit information now covered in the separate Equipment Bulletins on the amplifiers affected.
 - 1.2 To include gain data on the D-49-C, D-55943-D, and D-56729-D Amplifiers.
 - 1.3 To supersede Addendum #2, dated 7/26/33.

2. Gain of PFC Amplifiers in EW Wide Range Systems

2.1 Except for the gain, the tabulated information in this Equipment Bulletin for "A-49-A, B-49-A, C-49-C, D-49-C, E-49-C" Amplifiers applies to the D-49-C also, and the information on the "D-55943-B, D-56729-B, D-55943-C, D-56729-D" Amplifiers applies to the D-55943-D and D-56729-D as well. The gain of the D-49-C, D-55943-D and D-56729-D Amplifiers varies with the values of the PFC mesh resistors used, and is given in the following table:-

D-49-C		D-55943-D		D-56729-D		Gain (DB)
R1 (Meg.)	R2 (Meg.)	R1 (Meg.)	R2 (Meg.)	R1 (Meg.)	R2 (Meg.)	
2.	10.	10.	10.	2.	2.	3.5
1.	10.	10.	1.	1.	1.	2.5
0.5	10.	10.	0.5	0.5	0.5	0.5
2.	0	0	0.2	2.	2.	2.5
2.	0	0	0	2.	2.	1.5

3. Door Switches

- 3.1 Door or cover switches are provided on the following equipment items:-
 - 10, 42, 43 and 46 type Amplifiers
 - 706, 708 and D-86551 type Control Cabinets
 - 519, 520 and D-94836 type Panels

The purpose of these switches is to protect from injury unauthorized persons who might open the door or remove the cover of the equipment and might otherwise come in contact with high voltages. They also give legal protection to those who might incur liability in case of such injury. In all of the above equipment the door or cover switch disconnects the 110V. supply, except on the 10 type Amplifier and 519 type Panel, where the 750V. supply is disconnected.

- 3.2 In view of the above, it is essential that these switches be in circuit at all times. Specifically, they should never be cut out of circuit for convenience in testing, or for other reasons, and if not in proper operating condition, they should be replaced at once. These instructions do not affect in any way the paralleling of the door switches on 45 type Amplifiers, and 706 and 708 type Control Cabinets, as covered in the Equipment Bulletins on these items.

4. Amplifier Wiring Inspection

- 4.1 Although amplifiers are thoroughly inspected and tested prior to shipment by the W.E.Co., experience has shown that wiring troubles often result from shipment and subsequent handling. In order to reduce the number of such troubles to a minimum each newly installed amplifier should be checked for poorly soldered connections, loose particles of solder or wire clippings, and broken wires. In making this inspection, care must be exercised. Connections that appear satisfactory should not be disturbed; those that appear questionable should be checked more closely and resoldered if necessary. To test a soldered connection press against the wire about 1" from the terminal using the finger or a pointed stick (not a liere) and gently move it about 1/4" back and forth. Motion of the wire at the terminal will generally be observable if the connection is loose. Inaccessible connections need not be inspected if considerable time would be consumed in gaining access to them.

EQUIPMENT BULLETIN

AMPLIFIERS, 49 TYPE

Replacing Addenda #1, November 29, 1932; #2, July 6, 1933 & #3, August 26, 1933

0. Reason for Reissue

- 0.1 To revise the instructions for modifying 49 type Amplifiers to B-49-A and B-49-C (Sect. 3.2); and to bring the Equipment Bulletin up to date.

1. Associated Drawings

- 1.1 ASL-2606, Schematic, D-49-C Amplifier
- ASO-3659, Wiring Diagram, D-49-C Amplifier
- ASO-3157, Wiring Diagram, 49-A and 49-B Amplifiers
- ASO-3576, Wiring Diagram, A-49-A and B-49-C Amplifiers
- ASO-3578, Circuit Label, A-49-A and B-49-C Amplifiers
- ASO-3609, Wiring Diagram, B-49-A and B-49-C Amplifiers
- ASO-3613, Schematic, B-49-A and B-49-C Amplifiers

NOTE: ASO-3154, Schematic, 49-A Amplifier; and ASO-3121, Schematic, 49-B Amplifier; are associated with E.B.'s Apparatus Units, 700-A Type, and "Apparatus Units, 700-B Type", respectively.

2. Description

- 2.1 For tabulated data on 49 type Amplifiers, see E.B. "Amplifiers, General", F.R. 4.03. The 49 type Amplifier is used in "U" and "A" type Systems as a preliminary PFC Amplifier. In "U" type Systems, it mounts in the 700 type Apparatus Unit and in "A" type Systems in the 4 type Pedestal.

- 2.2 This amplifier is constructed in skeleton form, and includes a cradle from which is suspended by ten spiral springs, a mounting plate containing the principal components of the amplifier. A panel attached to the cradle front, mounts a milliammeter and rheostat for filament control. A terminal strip for external connections is directly below the panel. A separate spring terminal for the PFC connection is attached to the left hand cradle upright.

- 2.3 The 49-A and 49-B type Amplifiers are alike electrically except for the filament control rheostats which are 20W and 30W respectively. The standard replacement rheostat is 30W for all 49 type Amplifiers. Accordingly, in re-coding 49 type Amplifiers after modifications they should be considered as 49-A or 49-B Type depending on whether the filament rheostat is 20W or 30W, and irrespective of the "49-A" or "49-B" marking on the nameplate.

3. Field Modifications

- 3.1 For use of 3-A PFC and 244 type Vacuum Tubes (49-A Amplifier to A-49-A, and 49-B to E-49-C; DEF. PA-4104)

3.1.1 Purposes:

- (a) The reduction of the filament circuit resistance to increase filament current to 300 mills required by the 264 type Vacuum Tubes.
- (b) The change from transformer coupling to impedance coupling to reduce the interstage gain and prevent overloading of V2 with the use of the 3A PFC.

3.1.2 Required Material (Available in Branch Offices)

- One - K-40285 W.L. Resistor (18W)
- One - Copy ASO-3536, Circuit Label

3.13 Procedure:

- (a) Unsolder the external leads from the amplifier terminals, and the PEG anode lead from the spring terminal and remove the Amplifier R5 (2W) by E-40285 Resistor. In reconnecting the leads, leave the brown wire disconnected and tape the end after cutting off the lead to the bottom of the cable form as shown in figure 1.
- (c) The plate lead to C2 and terminal #2 of T2 should be cut as near the taped portion of the cable form as possible (upper side of amplifier) and the frame and connected to G of V2.
- (d) Remove lead between P+ of V1 and R4, cut to length and reconnect to P+ of V1.
- (f) Replace amplifier, reconnect the external leads and the PEG lead.
- (g) Affix the upper half of circuit label ASO-3538 directly over the existing label in the 700 type Apparatus Unit, and recode to A-49-A or E-49-C respectively, in accordance with E.B. "Equipment Modifications, General", F.R. 4.01. If the amplifier modified was a 49-A with 30W rheostat (see Sect. 2.3), it should be recoded to E-49-C.

NOTE: In an A-49-A Amplifier, if the 20W filament rheostat is replaced by a 30W rheostat, the amplifier shall be recoded "E-49-C" and the change marked on the circuit label in ink.

- 3.14 As noted in 3.11 (b), after this modification has been made and the 3-A Photoelectric Cells installed, the output will be greater than with the 2-A Photoelectric Cells. In "W" type Systems, this should be attenuated approximately 16 db, at the 701 type Apparatus Unit. In "A" type Systems, reduce the setting of the gain control potentiometer in the main amplifier if required.

3.2 For Use of D-96101 or D-96101 Filter (A-49-A Amplifier to E-49-A, and E-49-C to E-49-G, Per 4.1.3)

- 3.21 General: This modification will usually be made in the field where, in systems having 42 or 46 type Amplifier, it is desired to obtain the 90V. DC supply for the PEG Amplifier. In the above mentioned main amplifiers through a D-96101 or D-96101 Filter, the above mentioned results in the addition of a "trap filter" in the 90V PEG polarizing circuit to prevent any remaining AG from reaching the PEG and the substitution of resistance for impedance in the invertege coupling to improve the overall characteristic.

49-A and 49-B Amplifiers may be similarly modified, if at the same time, they are modified (except for label & marking) to A-49-A and E-49-C Amplifiers, respectively.

3.22 Required Material (Available in Stores Division)

- 1 - Set of ASP-929 Conversion Parts, consisting of:
 - 1 - 38-W Resistance
 - 1 - #6 (.136") - 32 x 3/4" R.H.B.M. Screw
 - 1 - #6 - 32 Std. Br. Hex. Nut
 - 1 - Std. St. Lockwasher for #6 Screw
 - 2 - P-213936 Bushings
 - 1 - #5 (.125") - 40 x 3/4" R.H.B.M. Screw
 - 1 - #5 - 40 Std. Br. Hex. Nut
 - 1 - Std. Br. Washer for #5 Screw
 - 1 - Std. St. Lockwasher for #5 Screw
 - 1 - Mounting Plate Assembly per ASL-2690, Det. 1-A
 - 1 - Copy of Circuit Label per ASO-3613

3.23 Procedure (Refer to ASO-3609)

- (a) Mount the Det. 1-A, ASL-2690 Mounting Plate Assembly on the amplifier cradle using the #6 - 32x3/4" R.H.B.M. Screw, Hex. Nut and Lockwasher in place of one of the existing screws (right side, viewed from rear) which hold T1 to the under side of the cradle. The mounting plate should be perpendicular to the cradle and at right angles to its rear edge, and the upper lug of R5 should be bent up so it will be accessible. After the assembly has been mounted, tie the cable form to the bracket of the mounting plate assembly. Remove the W.L. type "A" resistor R4 and mount in its place the 38-W Resistor using the screw bushings and nut supplied.
- (c) At lower terminal of R5 disconnect wire leading from C2, cut to length and reconnect to rear terminal of R7.
- (d) At C2, disconnect wire leading from P of V1, cut to length and reconnect to lower terminal of R5 together with rear terminal wire of C3.
- (e) Remove wire connecting G of V2, and C2, and connect front terminal wire of C3 to G of V2.
- (f) At terminal 4 of T2, disconnect wire leading from G of V2, cut to length and connect to upper terminal of R4.
- (g) At lower terminal of R1, disconnect wire leading from R5, cut to length and reconnect to front terminal of R7. Connect a new wire between lower terminal of R1 and rear terminal of R7.
- (h) Connect a new wire from terminal of C2 (previously connected to G to V2) to lower terminal of R4, and strap lower terminals of R3 and R4.
- (j) Affix the upper half of the circuit label per ASO-3613 directly over the existing circuit label in the 700 type Apparatus Unit. In the 700-A or A-700-A Apparatus Unit, the adjoining lines will not match and should, therefore, be joined with pen and ink. Recode per E.B. "Equipment Modifications, General", F.R. 4.01.

4. D-49-C Amplifier (Stores Division Modification, per TA-186)

- 4.1 This is a 49 type Amplifier, modified for use in EW Wide Range Systems. This modification will be made before shipment in all cases, and detailed instructions are not included herein. The purposes of the modification are:-

- (a) To so change the characteristic of the amplifier, that it serves to equalize the film and loudspeaker characteristics in EW Wide Range Systems.
- (b) To include a filter in the 90V. PEG polarizing circuit, to permit 90V. supply from D-9614 or D-96101 Filter, if desired.
- (c) To change the filament circuit resistance for use of 264 type Vacuum Tubes.

The modification requires that the amplifier be used with a 3-A PEG and 264 type Vacuum Tubes.

5. Installation

- 5.1 Before installing the amplifier, remove the two wooden blocks which hold the suspended member in place for shipment. Tighten the four locking screws in their tapped holes taking care to see that they enter the guide holes in the suspended member.

- 5.2 Modify amplifier, if necessary, depending on its present coding, and the conditions under which it will operate (see E.B. "Equipment Modifications, General", F.R. 4.01).

5.3 Before the amplifier is placed in the 700 type Apparatus Unit, or 4-A Pedestal housing, securely solder the free end of the stranded printer wire extending from the photoelectric cell compartment to the spring terminal on the left hand cradle upright. Next push the amplifier into position as far as it will go. Take out the slack in the printer wire by pulling the wire into the photoelectric cell compartment after the Repro-ducer Set has been adjusted for the correct angle of projection. Pull this wire taut before it is soldered to the PEG anode terminal block. If any considerable length of stranded wire is left over, lay it aside for possible future use.

5.4 In "A" type Systems, connect the wires in the 700 type Apparatus Unit cable form, to the amplifier terminals (see systems drawings and E.B.'s, "Apparatus Unit, 700-A Type", and "Apparatus Units, 700-B Type", F.R. 4.06). In "A" type Systems make connections per systems drawings.

6. Operation

6.1 Insert 239 or 264 type Vacuum Tubes in their sockets, and adjust the filament current to 270 mills (239 type V.T.) or 300 mills (264 type V.T.) (see Sect. 6.2).

6.2 Either 239-A or 264-A Vacuum Tubes may be used in 49 type Amplifiers modified for use of 264-type Vacuum Tubes provided the filament current is adjusted to suit. 2-A PHOTOELECTRIC CELLS will operate reasonably satisfactorily in the modified amplifiers provided the gain of the main amplifier can be increased sufficiently to compensate for the reduced PEG output.

7. Maintenance

7.1 Field Replacement of 49 type Amplifiers

7.1.1 Should it be necessary to replace a 49 type Amplifier in the field, observe the following:-

- (a) Replace a D-49-C Amplifier by a D-49-C Amplifier only.
- (b) Replace a E-49-A or E-49-C Amplifier by a E-49-C Amplifier, obtained by converting an E-49-C to E-49-C.
- (c) Replace any other 49 type Amplifier by an E-49-C.

NOTE: In installations using 2-A Photoelectric Cells it may be necessary to reconnect transformer T2 (disconnected at time of modification to E-49-C) of the E-49-C Amplifier if it is found that main amplifier gain cannot be increased and that the output is not sufficient. In such cases the coding, E-49-C, should not be changed but the amplifier should be tagged with the change indicated.

7.1.2 In an emergency, a D-49-C Amplifier may be replaced by an E-49-C Amplifier. While the latter amplifier does not include the feature per 4.1 (b) above, the operation will be satisfactory until a regular replacement, D-49-C, is obtained. If the existing D-49-C plate supply is from a D-94814 or D-96101 Filter, the emergency replacement may be a E-49-C Amplifier, or an E-49-C with "B" Batteries.

7.2 Emergency Operation - One PEG Amplifier Defective

7.2.1 In case one PEG Amplifier should become inoperative, serious program interruption may be avoided by one of the following methods:-

- (a) When immediate operation is required remove the anode lead of the PEG associated with the defective amplifier from the connect-

ing block. Reconnect this lead to the like connecting block of the alternate machine by means of a jumper, preferably lead covered. Power for the amplifier and exciter lamp is controlled by the switch in the 700 type Apparatus Unit or the power switch in the 713 type Control Cabinet. To operate the good machine proceed as usual closing its power supply and opening that for the defective machine. To operate the machine with defective amplifier, leave the power switch to the good machine closed, but block off the light from its exciter lamp with a card, and close the power switch for the defective machine.

- (b) When a short time for preparation is available, mount a single pole double throw switch on the wall below the volume control cabinet.

Interpose the switch between the PEG anode leads of both machines and the PEG anode connecting block of the machine having the good amplifier. This permits selection of the desired PEG output. A smooth changeover may be effected by reducing the volume to 0. during reversing of the switch.

7.3 ASP-787 Mounting Blocks

Description: Two ASP-787 Mounting Blocks supersede the rubber pad formerly used as a support for the 49 type Amplifier. These blocks are unaffected by oil and will give indefinite service. They are supplied in sets, each consisting of two blocks, one left and one right, and four flat head machine screws for attaching the blocks to the under side of the amplifier.

Installation: Disconnect and remove the amplifier, and detach the rubber pad from the under side of the cradle, cleaning away all accumulation of oil. Attach the mounting blocks to the amplifier utilizing the existing screw holes and screws supplied. Reinstall the amplifier, but before making the connections, check for clearance between the amplifier and compartment door. Due to variations in 700 type Apparatus Unit castings, it may be necessary to remove some material from the rear edges of the blocks where they interfere with a fillet in the corner of the compartment. Should the amplifier still interfere with the complete closing of the door, remove the felt which is glued to the inner side of the door.

7.4 Suspension Spring Connections: Should a 49 type Amplifier go intermittently dead or noisy, examine the suspension spring connections. Such troubles are sometimes caused by defective soldering at these points.

8. Merchandising

8.1 Stores Division Stock: Only two type 49 amplifiers are available in the Stores Division, namely, D-49-C for Wide Range installations and E-49-C for other than wide range installations. Only this E-49-C Amplifier is carried in Branch Office Stocks. Order as: "One D-49-C (or E-49-C) Amplifier".

8.2 B-49-A and B-49-C Amplifiers are obtainable only through field modification of the A-49-A and E-49-C Amplifiers.

8.3 Order replacements for suspension springs and rubber pads as:-
 "One P-290097 Spring Assembly"
 "One Set of ASP-787 Mounting Blocks"

NOTE: The P-290097 Spring Assembly includes a flexible connector which, depending upon the position of the spring in the amplifier, may be discarded if not required.

AMPLIFIERS, 49 TYPE
ADDENDUM #1

EQUIPMENT BULLETIN

0. Reason for Release

0.1 To include the changes described in 1.2 and 1.3 below.

1. Purpose

1.1 To prevent damage to KS-6376 Resistors by heat from soldering during modification. (See Sect. 2.)

1.2 To supply a revised instruction for modifying the 49 type Amplifier for the use of the D-96101 Filter (Sect. 3).

1.3 To change the merchandising information (Sect. 4).

2. Removal of KS-6376 Resistors during Modification

2.1 Before beginning a wiring modification to a 49 type Amplifier, remove the KS-6376 Resistors R1 and R2. These resistors are subject to damage by heat transmitted through their mounting clips, during soldering operations. Several cases of trouble have been traced to this cause.

2.2 The above also applies to D-85943 and D-86729 type Amplifiers, and notation accordingly should be made in the E.B. Amplifiers, D-85943 & D-86729 Types*.

3. Modification of A-49-A Amplifier to E-49-A, and E-49-C to B-49-C (per TA-178) for use of D-96101 Filter

NOTE: This instruction replaces Section 3.2 in the main Equipment Bulletin.

3.1 General: This modification will ordinarily be made in the Stores Division for new installations and in the Field when the D-96101 Filter is added to an existing system. The modification results in the addition of a trap filter in the feedback circuit, to prevent any remaining AC from reaching the PEO, and 50V PEO polarizing of resistance for impedance in the interstage coupling. This proves the characteristic. If the amplifiers to be modified are 49-A or 49-B, they must first be converted (except for label and code marking) to A-49-A or E-49-C, respectively.

3.2 Required Material (Available in Stores Division)

- 1 - Set of ASP-929 Conversion Parts, consisting of:
- 1 - 38-W Resistance
 - 1 - #6 (.136") - 32 x 3/4" R.H.B.M. Screw
 - 1 - #6 - 32 St'd. Br. Hex. Nut
 - 1 - St'd. St. Lockwasher for #6 Screw
 - 2 - P-21398 Bushings
 - 1 - #5 (.123") - 40 x 3/4" R.H.B.M. Screw
 - 1 - #5 - 40 St'd. Br. Hex. Nut
 - 1 - St'd. Br. Washer for #5 Screw
 - 1 - St'd. St. Lockwasher for #5 Screw
 - 1 - Mounting Plate Assembly per ASL-2690, Det. 1-A
 - 1 - Copy of Circuit Label per ASO-3613

3.3 Procedure (Refer to ASO-3609)

(see "d")

(a) At lower terminal of R5, disconnect wire leading from O2, and fold back

(b) At O2, disconnect wire leading from P of V1, cut to length and reconnect to lower terminal of R5 together with rear terminal wire of O3.

(c) Mount the Det. 1-A, ASL-2690 Mounting Plate Assembly on the amplifier cradle using the #6-32x3/4" R.H.B.M. Screw, Hex. Nut and Lockwasher in place of one of the existing screws (right side, viewed from rear) which hold T1 to the under side of the cradle. The mounting plate should be perpendicular to the cradle

2 Pages - Page 1 Operating Engineering Dept. - Equipment Div. July 20, 1954 Issue #2

AMPLIFIERS, 49 TYPE
ADDENDUM #1

EQUIPMENT BULLETIN

and at right angles to its rear edge, and the upper lug of R5 should be bent up so it will be accessible. After the assembly has been mounted, tie the cable form to the bracket of the mounting plate assembly.

(c) Cut wire (see "a") to length and connect to rear terminal of R7.

(e) Remove wire connecting G of V2, and O2, and connect front terminal wire of O3 to G.

(f) Remove the W.L. type "a" resistor R4 and mount in its place the 38-W Resistor using the spacers, bushings and nut supplied.

NOTE: In 49-B type amplifiers of later design the mounting hole for the R4 resistor is 13/16" from the rear edge of the mounting plate and directly over a transformer mounted underneath which interferes with the mounting of the 38-W Resistor. In such cases a new hole should be drilled (5/32" drill) 3/8" from the edge of the plate so as to clear the transformer.

(g) At terminal 4 of T2, disconnect wire leading from G of V2, cut to length and connect to upper terminal of R4.

(h) At lower terminal of R4, disconnect wire leading from R5, cut to length and reconnect to front terminal of R7. Connect a new wire between lower terminal of R1 and rear terminal of R7.

(j) Connect a new wire from terminal of O2 (previously connected to G to V2) to lower terminal of R4, and strap lower terminals of R3 and R4.

(k) Affix the upper half of the circuit label per ASO-3613 directly over the existing circuit label in the 700 type Apparatus Unit. In the 700-A or A-700-A Apparatus Unit, the adjoining lines will not match and should, therefore, be joined with pen and ink. Recode per E.B. "Equipment Modifications, General", F.R. 4.01.

4. Merchandising

4.1 Field Replacement of 49 type Amplifiers

NOTE: The following replaces Section 7.11 in the main E.B.

4.1.1 Should it be necessary to replace a 49 type Amplifier in the field, observe the following:

(a) Replace a D-49-C by a D-49-C only.

(b) Replace a B-49-A or B-49-C by a B-49-C.

(c) Replace any other 49 type Amplifier by an E-49-C or a B-49-C.

NOTE: In installations using 2-A Photoelectric Cells it may be necessary to reconnect transformer T2 (disconnected at time of modification to E-49-C) of the E-49-C Amplifier if it is found that main amplifier gain cannot be increased and that the output is not sufficient. In such cases the coding, E-49-C, should not be changed but the amplifier should be tagged with the change indicated.

4.2 Stores Division Stock:

NOTE: The following replaces Section 8.1 and 8.2 of the main E.B.

4.2.1 Stores Division Stock: Only two 49 type Amplifiers are available in Stores Division and Emergency Stocks; namely, D-49-C for Wide Range and B-49-C for other than Wide Range installations.

Order as: "One D-49-C (or B-49-C) Amplifier."

2 Pages - Page 2

Operating Engineering Dept. - Equipment Div.

July 20, 1954 Issue #2



1. ABSTRACT

1.1 This addendum specifies:
 (a) The insulation of the lead sheaths of wire entering the housing of the 49 type Pedestal, to prevent noise and/or hum in the system.
 (b) A change in the value of condenser C-4 of the D-49-C Amplifier, under certain conditions, at the discretion of the engineer.
 (c) Suggested values for R1 and R2 in PEG Amplifiers, when used in a 2-Way Wide Range System, having TA-4151 (or TA-4153) and 597 (or 596) type Loudspeaking Telephones.
 1.2 It is reassued to include Section 4 below.

2. INSULATION OF CABLE SHEATHING FROM AMPLIFIER FRAMES

2.1 In "A" type Power Unit Systems, the 12V filament circuits are grounded through the -90V leads from the 49 type Amplifiers to terminals 10 and 18 in the 713 type Control Cabinet, which are connected to the ground strip therein, which in turn connects to the system ground. Accordingly, the "C" at each 49 type Amplifier, and consequently the amplifier cradle and frame which are insulated from the housing but connected to the "G", are above ground potential by the amount of drop in the -90V lead, from the amplifier to the control cabinet. The lead sheathing of the cables entering the pedestal housing is presumably at ground potential, and contact between it and the amplifier frame may result in system noise. To avoid this, insulate the lead cables from each amplifier frame, by the application of friction tape, or by the insertion of fish paper or fibre board insulation, on the first convenient occasion.

3. D-49-C AMPLIFIER - CHANGE IN VALUE OF C-4

3.1 In wide range systems where the usual methods for reducing "boominess" have not been successful (see E.B.'s on Wide Range, File 4.385), another method described below, may be resorted to, at the discretion of the field engineer. It should be understood, however, that this expedient is not a substitute for proper damping. Its effect is similar to that given by increasing the resistance in series with the low frequency units, except that the scheme described below also affects the response of the mid-frequency units, which are sometimes responsible for "boominess". The net result is to reduce the system response up to about 500 cycles, with maximum reduction in the 100-300 cycle range.

3.2 Modification - In such cases as described above, the field engineer may make the following change in each D-49-C Amplifier, at his discretion:-

- (a) Change the value of C-4 by shunting the existing .001 mf Condenser by another .001 mf Condenser of the same type ("Illini". .001 mf). The added condenser should be mounted beside the present one, with the adjacent terminals of the two condensers soldered together.
- (b) Change the circuit and wiring labels in ink, and change the code label, to D-49-CA, in accordance with E.B. "Equipment Modifications, General", File 4.01.

4. EW (2-WAY) WIDE RANGE SYSTEMS - PEG COUPLING MESH RESISTORS

4.1 In these systems, as formerly installed, using TA-4151 (or TA-4153) and 597 (or 596) Loudspeaking Telephones on the stage, the most satisfactory operation will generally be obtained with resistors in the D-49-C Amplifiers as follows:

R1 - 2. meg. R2 - 0.2 meg.

5. MEGAHANDISING

5.1 The Illini B-3 Condensers, .001 mf required per Section 3.2 above, are stocked at the Stores Division. Order as "Two Illini B-3 Condensers, .001 mf, equipped with insulated mounting ears".



0. PURPOSE

- 0.1 To provide information on modifying B-49-A, B-49-C, A-49-A and E-49-C Amplifiers for transformer coupling.
- 0.2 To indicate the necessity of changing the values of C₃ to 1 mf. in the B-49-A and B-49-C Amplifiers when making the transformer reconnection, so as to eliminate a 5 db resonance peak at 30 cycles.
- 0.3 To advise that the transformer reconnection does not change the transmission characteristic of the amplifiers so modified.

1. ASSOCIATED DRAWINGS

ASL-14174
ASL-14175

2. MATERIAL REQUIRED FOR MODIFICATION OF B-49-A AND B-49-C AMPLIFIERS TO B-49-AF AND B-49-CT, AND A-49-A AND E-49-C TO A-49-AF AND E-49-CT.

- 2.1 For each B-49-A and B-49-C Amplifier modified to B-49-AF and B-49-CT:
 - 1 - Aerovox Type 484, 1 Mf. Paper Condenser (400 V) and spaghetti tubing.
- 2.2 No extra material is required for modification of A-49-A and E-49-C Amplifiers modified to A-49-AF and E-49-CT.

3. PROCEDURE

3.1 Where B-49-A and B-49-C Amplifiers are now installed, proceed as follows:

- (a) At G terminal of V₂ remove wire connecting to C₃ (D-95309 - 1 Mf. Cond.) At lower terminal of R₂ remove wire connecting to C₂. Remove C₃ from panel.
- (b) Remove lead running from R₁ to G of V₂ and reconnect existing black wire from terminal 4 of T₂ to G of V₂. If this wire has been removed, a new wire should be run between these points. Remove R₁ from panel.
- (c) Reconnect existing wire from terminal 5 of T₂ to terminal of R₃ which connects to -F terminal of V₁. If this wire has been removed, a new wire should be run between these points.
- (d) Disconnect at both ends, the two wires connected to present C₂ (S7-B Condenser) and remove both wires from amplifiers.
- (e) Splice wire from one terminal of S7-B - 1 Mf. Condenser to existing slate lead from terminal 2 of T₂. If this wire has been removed, a new wire should be run between these points.
- (f) Connect wire from other terminal of this condenser to top lug of R₅. Re-mark this condenser "C₁".
- (g) Drill hole with #50 (1/16") drill in top of bakelite panel holding R₇ midway between edges and about 1/4" from top of panel and drill same size hole in panel supporting R₂ just below lower terminal of R₂.
- (h) Place 1 Mf. Aerovox paper condenser in vertical position between R₃ and R₇ panels, as close to R₇ panel as possible, putting leads through holes drilled with spaghetti on leads between ends of condenser and panels. The leads themselves will act as supports. Connect top lead of condenser to lug terminal of R₇ which goes to R₁ and the bottom lead to the bottom terminal of R₂. This condenser should be marked "C₂".

3.2 Where A-49-A and E-49-C Amplifiers are now installed, proceed as follows:

- (a) At G terminal of V₂ remove wire leading to C₂ and splice to existing slate wire from terminal 2 to T₂. If this wire has been removed, a new lead should be run between these two points.
- (b) Reconnect existing wire from terminal 5 of T₂ to terminal of R₃ which connects to -F terminal of V₁. If this wire has been removed, a new lead should be run between these points.
- 3.21 When the A-49-A and E-49-C Amplifiers are further modified for operation with the D-5041 Filter, it will be necessary merely to install R₇ .5 Meg. Resistor and C₂ 1 Mf. Aerovox Type 484 Paper Condenser in the filter trap as shown in Drawing ASL-14175.

3.3 All 49 Type Amplifiers which have been modified in accordance with instructions contained in Par. 3.1 and 3.2 shall be recorded with proper designation as shown in Sec. 2.

EQUIPMENT BULLETIN

1. ABSTRACT

1.1 This addendum specifies:

- (a) Information on modifying D-49-C Amplifiers for transformer coupling.
- (b) The necessity of changing the value of C3 to 1 mf. in the D-49-C Amplifier when making the transformer reconnection, so as to eliminate a 5 db resonance peak at 30 cycles.
- (c) That the transformer reconnection does not change the transmission characteristic of the D-49-C Amplifiers so modified.

2. ASSOCIATED DRAWING

ASL-14175

3. MATERIAL REQUIRED FOR MODIFICATION OF D-49-C AMPLIFIERS TO B-49-CT

3.1 For each D-49-C Amplifier modified to B-49-CT:

- 1 - Aerovox Type 484, 1 mf. Paper Condenser (400 V.) and spaghetti tubing

4. PROCEDURE

- 4.1 Where D-49-C Amplifiers are installed, proceed as follows: (Refer to Wiring Diagram ASO-3869, Issue 2.)
 - (a) Remove wires at terminals of C6 Condenser, tape and fold back.
 - (b) Remove R8 from circuit by cutting lead which runs to terminal 2 of T2. (This lead also connects to R7 and C3.)

2 Pages - Page 1 Electrical Research Products Inc. Issue 1
Foreign Department April 26, 1940
Technical Section

EQUIPMENT BULLETIN

- (c) Disconnect at both ends, leads connected to C2 (87-B) 1 mf. Condenser and remove these leads from amplifier.
- (d) Remove wire from end of R5, connecting to C5, fold back and tape. Connect lead from this end of R5 to one terminal of 87-B 1 mf. Condenser.
- (e) Connect wire from other terminal, 87-B 1 mf. Condenser to terminal 2 of T2 by splicing to lead which was removed from R8. Re-mark this condenser "C3."
- (f) Remove Condenser C4.
- (g) Remove Resistor R4 and panel terminal #1 to which it is connected. Connect to the lower terminal of R2 the lead from R3 which formerly connected to top of R4.
- (h) Resistor R9 of the D-49-C becomes R7 of the B-49-CT.
- (i) After putting spaghetti over leads locate 1 mf. paper tubular condenser in vertical position between R3 and R7 panels, putting leads through holes made available by removal of R4 and terminal #1. The leads themselves will act as supports. Connect top lead of condenser to lower lug terminal of R7 (which goes to R1). Connect bottom lead to bottom of R2. The new condenser should be marked "C2."

Issue 1 Elec. Research Products Inc. 2 Pages - Page 2
April 26, 1940 Foreign Department
Technical Section

1. DESCRIPTION - Skeleton form, 2 stage (DC) or 1 stage (AC), resistance or transformer coupled pre-amplifier, arranged for mounting in 700 Type Apparatus Unit or 4 Type Pedestal. Dimensions 6 1/2" x 8-3/4" x 9-7/8". Weight 16 lbs.

1.1 Upon receipt of this bulletin, amplifier coding is to be changed as follows:

Previous Code Number	Significant Circuit Characteristics	Recode
E-49-C, A-49-A, A-49-C	Resistance coupled. No PEC decoupling filter.	49 See Note 2
B-49-A, B-49-C	Resistance coupled. Has PEC decoupling filter.	49-F
D-49-C	Wide Range Special.	49-W
D-49-CA	Wide Range Special - modified.	49-W-1
B-49-A and B-49-C modified for Microphonic	ASP-8523 Equalization Parts.	49-FM
D-49-C modified for Microphonic	ASP-8328 Equalization Parts.	49-WM
49-AC	AC operation - single stage.	49-AC

Note 1 - When interstage transformer is reconnected, add the letter "M". (Example 49-FM)
2 - When PEC decoupling filter is installed, add the letter "W". (Example 49-FW)

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

3. MAINTENANCE

3.1 Insulate lead cables from amplifier frame, with friction tape or other suitable means, in "A" Type Power Unit Systems, to reduce system noise.

3.2 To reduce filament rheostat noise (DC only) connect a TA-4115 or BRH-255, 500 mf, 25V Condenser between GND terminal and #5 Suspension Spring.

4. MODIFICATIONS

4.1 49 Amplifier to 49-F (For use with D-96101 Filter).

4.1.1 Material Required - 1 set ASP-929 Conversion Parts, consisting of:

- 1 - 38-W Resistance
- 1 - #6 (.138") - 32 x 3/4" R.H.B.M. Screw
- 1 - #6 - 32 St.G. Br. Hex. Nut
- 1 - St.G. St. Lockwasher for #6 Screw
- 2 - P-213998 Bushings
- 1 - #5 (.123") - 40 x 3" R.H.B.M. Screw
- 1 - #5 - 40 St.G. Br. Hex. Nut
- 1 - St.G. Br. Washer for #5 Screw
- 1 - Mounting Plate Assembly per ASU-2690, Det. 1-A
- 1 - St.G. St. Lockwasher for #5 Screw

4.1.2 Modification Procedure

- a. At R-5, disconnect wire leading from C-2, and fold back (see "d").
- b. At C-2, transfer wire leading from F of V-1, to terminal of R-5 from which wire in (a) was disconnected. Also connect rear terminal wire of C-3 to this terminal of R-5.
- c. Mount the Det. 1-A, ASU-2690 Mounting Plate Assembly in place of one of the existing screws (#2 - 3/4" R.H.B.M. Screw, Hex. Nut and Lockwasher in place of one of the existing screws (right side) removed from rear) in the hole and #2 to the under side of the cradle. The mounting plate should be perpendicular to the hole and at right angles to its rear edge, and the lug of R-5 should be bent so that it will be accounted for in the assembly has been mounted. Tie the cable form to the bracket of the accounting plate assembly.
- d. Cut wire (see "a") to length and connect to rear terminal of R-7
- e. Remove wire connecting G of V-2, and C-2, and connect front terminal wire of C-3 to G of V-2.
- f. Remove the W.L. type "M" resistor R-4, and mount in its place the 38-W Resistor using the screw, bushings and nut supplied.

NOTE: In 49 Type Amplifiers of later design the mounting hole for the R-4 Resistor is 13/15" from the rear edge of the mounting plate and directly over a transformer mounted underneath which interferes with the mounting of the 38-W Resistance. In such cases a new hole should be drilled (5/32" drill) 3/8" from the edge of the plate so as to clear the transformer.

Issued by
Engineering Department

- g. At terminal 4 of T-2, disconnect wire leading from G of V-2, cut to length and connect to upper terminal of R-4.
- h. At lower terminal of R-1, disconnect wire leading from R-5, cut to length and reconnect to front terminal of R-7. Connect a new wire between lower terminal of R-1 and rear terminal of R-7.
- i. Connect a new wire from terminal of C-2 (previously connected to G of V-2) to lower terminal of R-4 and strap the lower terminal of R-4 to the terminal of R-3 having two wires, one of which comes from R-2.

4.2 49-W Amplifier to 49-FM (To reduce "boominess" in Wide Range Systems).

4.2.1 Material Required - 1 - .001 mf. Illini Condenser

4.2.2 Modification Procedure - Change the value of C-4 by shunting the existing .001 mf. condenser with another .001 mf. condenser. The added condenser may be mounted beside the present one or it may be bridged across R-2 resistor, without removing amplifier from its cabinet.

4.3 49-F Amplifier to 49-FM (For use in Microphonic Systems).

4.3.1 Material Required - 1 set ASP-8523 Equalization Parts consisting of:

- 2 - 31-B Terminal Bushings
- 1 - P-216227 Terminal Bushing
- 1 - #4-48 x 5/16" R.H.B. Machine Screw
- 1 - #4-48 Hex. Br. Nut
- 5 - "Shakeproof" Washers for #4 Screw
- 1 - KS-6376 - 2 meg. Resistor
- 2 - .005 mf. Aerovox Type 1467 Condensers
- 1 - BT-1, IRC Resistor 150,000 ohms
- 1 - BT-1, IRC " 0.5 meg "
- 1 - BT-1, IRC " 2.0 " "
- 1 - BT-1, IRC " 300,000 ohms

4.3.2 Modification Procedure - Refer to ASO-8545 Schematic and ASO-8546 Wiring Diagram.

4.4 49-W Amplifier to 49-WM (For use in Microphonic Systems).

4.4.1 Material Required - 1 set ASP-8328 Equalization Parts consisting of:

- 1 - .001 mf. B-3 "Illini" Condenser
- 1 - .002 mf. " "
- 1 - 150,000 ohm KS-6376 Resistor
- 1 - 0.5 megohm " "
- 1 - 2 megohm " "

4.4.2 Modification Procedure - Refer to Systems - M Type, Equalization Table ASO-8324

4.5 Increased Gain - Transformer Coupling

4.5.1 Material Required - 1 Aerovox Type 484, 1 mf. Condenser and spaghetti tubing. (Usually ordered with equalization parts for system amplifier.)

4.5.2 Modification Procedure

4.5.2.1 49-F to 49-FM

- a. At G terminal of V-2 remove wire connecting to C-3 (D-95309 .1 mf Cond.). At lower terminal of R-5, remove wire connecting to C-5. Remove C-5 from panel.
- b. Remove lead running from R-4 to G of V-2 and reconnect existing black wire from terminal 4 of R-2 to G of V-2. If this wire has been removed, a new wire should be run between these points. Remove R-4 from panel.
- c. Disconnect existing wire from terminal 5 of R-2 to terminal of R-3 which connects to -F terminal of V-1. If this wire has been removed, a new wire should be run between these points.
- d. Disconnect at both ends, the two wires connected to present C-2 (87-B Condenser) and remove both wires from amplifiers.
- e. Splice wire from one terminal of 87-B 1 mf. Condenser to existing slate lead from terminal 2 of R-2. If this wire has been removed, a new wire should be run between these points.
- f. Connect wire from other terminal of this condenser to that end of R-5 which connects to V-1 plate.
- g. Drill hole with #50 (1/16") drill in top of bakelite panel holding R-7 midway between edges and about 1/4" from top of panel and drill same size hole in panel supporting R-2 just below lower terminal of R-2.
- h. Place 1 mf. Aerovox paper condenser in vertical position between R-3 and R-7 panels, as close to R-7 panel as possible, putting leads through holes drilled. The spaghetti should be placed on the leads between ends of condenser and panels. The leads themselves will act as supports. Connect top lead of condenser to lug terminal of R-7 which goes to R-1 and the bottom lead to the bottom terminal of R-2. This condenser should be marked "C3".

Issued by
Engineering Department