A-M BROADCAST TRANSMITTING EQUIPMENT

INSTRUCTIONS

Type BTA-1R A-M Transmitter

ES-27238

RADIO CORPORATION OF AMERICA
INDUSTRIAL ELECTRONIC PRODUCTS, CAMDEN, N. J.

PRINTED IN U.S.A.
DU 690

IB-30248

INSTALLATION

A SIZE | 8959063

COMP. BY W. Yates FEB. 10, 1959 | ~~CHKD. BY~~ FEB. 23, 1959 | SHEET 0 CONT'D ON SHEET 1

						FIRST MADE FOR
					501	MI-34309-5

DRAWING TITLE

INSTALLATION

REVISIONS

AP. BY L. E. Penn | 0

AP. MFG.

APPROVED

L. S. Leppin Feb. 23, 1959

FEB. 23. 1959 | 1

GENERAL REVISIONS
SHEETS 1 TO 5 ADDED.
ECN J-1

W. B. Fletcher. June 1, 1960

MAY 24, 1960 | 2

RADIO CORPORATION OF AMERICA

XJ13
A1
20
TP
TC
FI
PF

8959063

REVISIONS	
AP. BY	Ø
AP. MFG.	
1 2	

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING; ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

8959063

INSTALLATION INFORMATION

CONELRAD KITS FOR BTA-500/1R (ES-34209 & ES-34210)

I. GENERAL

Before beginning the modification, check all items of MI-34309-5 against the items received. Check the frequency determining parts received against the ES Sheet for the stations particular carrier and conelrad frequency combination.

The Conelrad Control Unit (MI-34309-5 Item 1) will be mounted in the lower rear side panel of the transmitter as shown on drawing 648254. This drawing also shows the location of the rotary switch, the buffer relay, and the PA tank capacitor (if used). Special care should be used in mounting and wiring the buffer relay, the rotary switch, and the PA tank capacitor since they are located in the RF portion of the transmitter. All RF wiring should be short, direct, and as neat as possible to insure correct operation of the transmitter on the conelrad frequency. The load must be tuned to the Conelrad frequency when operating on Conelrad either by the station personnel, their consultant, or RCA Service Co. personnel. In case of a single tower it is usually necessary to have an RF contactor at the base of the tower to be used for Conelrad to switch in a network to match the tower to the transmission line at the conelrad frequency. If the tower is part of a directional array, make sure this does not disturb the pattern. An additional set of single pole double throw contacts are available on 1K704 to control the auxilliary relays for antenna switching.

II. MOUNTING

Installation drawing 648254 gives the necessary information for drilling and tapping of holes and for the mounting of all components. Hardware is supplied on MI-34309-5 - items 6A,B,C,D mount the control unit, 6E,F, G mount the buffer relay, 6H,I,J, mount the rotary switch, and 6K,L,M,N mount the PA tank capacitors. It is imperative that the holes to be added are properly located. If capacitors 1C704 & 1C705 are supplied, the paint on the mounting panel under the capacitor must be removed before the capacitors. Capacitors 1C704 & 1C705 mount in series. If 1C704, 1C705 are not used and 1C304 & 1C305 are switched in and out of circuit, move 1C304 & 1C305 to location indicated for 1C704 & 1C705 on 648254 Installation Drawing.

VARIATIONS ON FINISHED DIMENSIONS UNLESS OTHERWISE MARKED

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	±.02	±.005
ABOVE 6 TO 24	±.03	±.010
ABOVE 24	±.06	±.015

ANGULAR DIMENSIONS ±½°

SEE PURCH. SPEC. FOR STOCK TOLERANCE

INSTALLATION

FIRST MADE FOR MI-34309-5 USED ON

DRAWN BY W. KATES FEB 10, 1959

~~REDRAWN BY~~ ~~DESIGNED BY~~ P. Falgie May 24, 1960

CHECKED BY

COMMODITY CODE

A SIZE 8959063

SHEET 1 CONT'D. ON SHEET 2

XJ1-
A1
200
TP
TC
F1
PF

REVISIONS	
AP. BY	Ø
AP. MFG.	
X 2	

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING; ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

8959063

III. WIRING

The schematic diagram shows all switch and relay contacts in the main operating condition. "B" terminals are located in the lower rear side panel of the transmitter, "F" terminals are located in the exciter portion of the transmitter, "G" terminals are located on the conelrad control panel, and "H" terminals are located on the rotary switch assembly. The PA plate tank connections and preliminary Conelrad tap settings for various main and Conelrad frequency combinations are shown in the chart at the end of this section. One half inch wide strap (MI-34309-5 Item 7b) is provided for wiring to the rotary switch contact and to the associated PA tank circuit. This wiring should be made as short, direct and as neat as possible to insure correct operation. Do not run strap too close to components located in the transmitter. Cut strap to fit, mount to rotary switch section with #6 hardware supplied.

#16 black wire (MI-34309-7a) is provided for the RF wiring of the buffer relay and associated buffer circuit. #16 black wire is also provided for the contact wiring of the conelrad kit.

On some models of the transmitter the crystal switching circuits have been modified. On these modified units, terminal board "F", terminals 44 thru 51, is located to the left of the oscillator (rear view). Referring to installation drawing 648254, terminals 6G and 7G are to be wired either to transmitter terminals 21B and 20B or to 46F and 45F depending upon the transmitter being wired.

Remove the jumper wire between transmitter terminals 10B and 11B. Wire the control circuit according to the wire chart attached and schematic diagram 648254.

After all mounting and wiring has been completed, check the circuits completely before energizing any circuit.

When this check has been completed, switch the transmitter line switch (1S210) to the "ON" position. Do not energize the high voltage.

Operate the "Conelrad" switch located on the front panel of the transmitter. Check the conelrad circuit to see that all circuits operated properly.

Operate the "Main" switch located on the front panel of the transmitter. Check the conelrad circuit to see that all circuits operated properly.

VARIATIONS ON FINISHED DIMENSIONS UNLESS OTHERWISE MARKED

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	±.02	±.005
ABOVE 6 TO 24	±.03	±.010
ABOVE 24	±.06	±.015

ANGULAR DIMENSIONS ±½°

SEE PURCH. SPEC. FOR STOCK TOLERANCE

INSTALLATION

FIRST MADE FOR MI-34309-5 USED ON

DRAWN BY W. KATES FEB 16, 1959

~~DESIGNED BY~~ REDRAWN BY P. Falgie May 24, 1960

CHECKED BY

COMMODITY CODE

A SIZE 8959063

SHEET 2 CONT'D. ON SHEET 3

XJ1 A1 200 TP TC FI PP

REVISIONS	
AP. BY	Ø
AP. MFG.	
12	

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A BEFORE PLATING AND CLASS 2 AFTER PLATING; ALL INTERNAL THREADS TO BE CLASS 2B, UNLESS OTHERWISE SPECIFIED.

8959063

Operate the "Conelrad" switch on the front panel. The transmitter is now ready to tune to the conelrad frequency.

Refer to the instruction book supplied with the transmitter. Tune the buffer in accordance with the information given for station frequencies of 640 KC or 1240 KC depending upon the conelrad frequency desired.

Since the harmonic network is not used in the conelrad frequency do not make adjustments on this circuit.

Operate the "Crystal 1" or "Crystal 2" switch on the front panel. If the transmitter had been tuned up on the "Main" frequency before installation of the conelrad kit, some de-tuning of the PA on the "Main" static frequency may be noticed. Correct this by slight retuning before tuning up the PA on the Conelrad frequency. If an initial tune up, follow the complete instructions in the instruction book in tuning up on main frequency before starting on Conelrad tune up.

Operate the "Conelrad" switches on the front panel. If a cut-back kit has been installed, operate the Day-Night switch on the front panel to the night power. If not, remove the plate cap from one rectifier tube. Connect the Conelrad output tap near the top (ground end) of 1C301. Re-adjust the Conelrad shorting tap on 1C301 until minimum plate current is obtained. Move the loading tap on the coil down until about 50% of the output is obtained. Return the transmitter to high power. Continue to adjust Conelrad output tap until desired antenna current is obtained. Check the PA plate tank resonance by moving the tap.

VARIATIONS ON FINISHED DIMENSIONS UNLESS OTHERWISE MARKED

BASIC DIMENSIONS	2 PLACE DECIMALS	3 PLACE DECIMALS
UP TO 6	±.02	±.005
ABOVE 6 TO 24	±.03	±.010
ABOVE 24	±.06	±.015

ANGULAR DIMENSIONS ±½°

SEE PURCH. SPEC. FOR STOCK TOLERANCE

INSTALLATION

FIRST MADE FOR MI-34309-5 USED ON

DRAWN BY W. KATES FEB. 10, 1959

~~DESIGNED BY~~ REDRAWN BY P. Falgi May 24, 1960

CHECKED BY

COMMODITY CODE

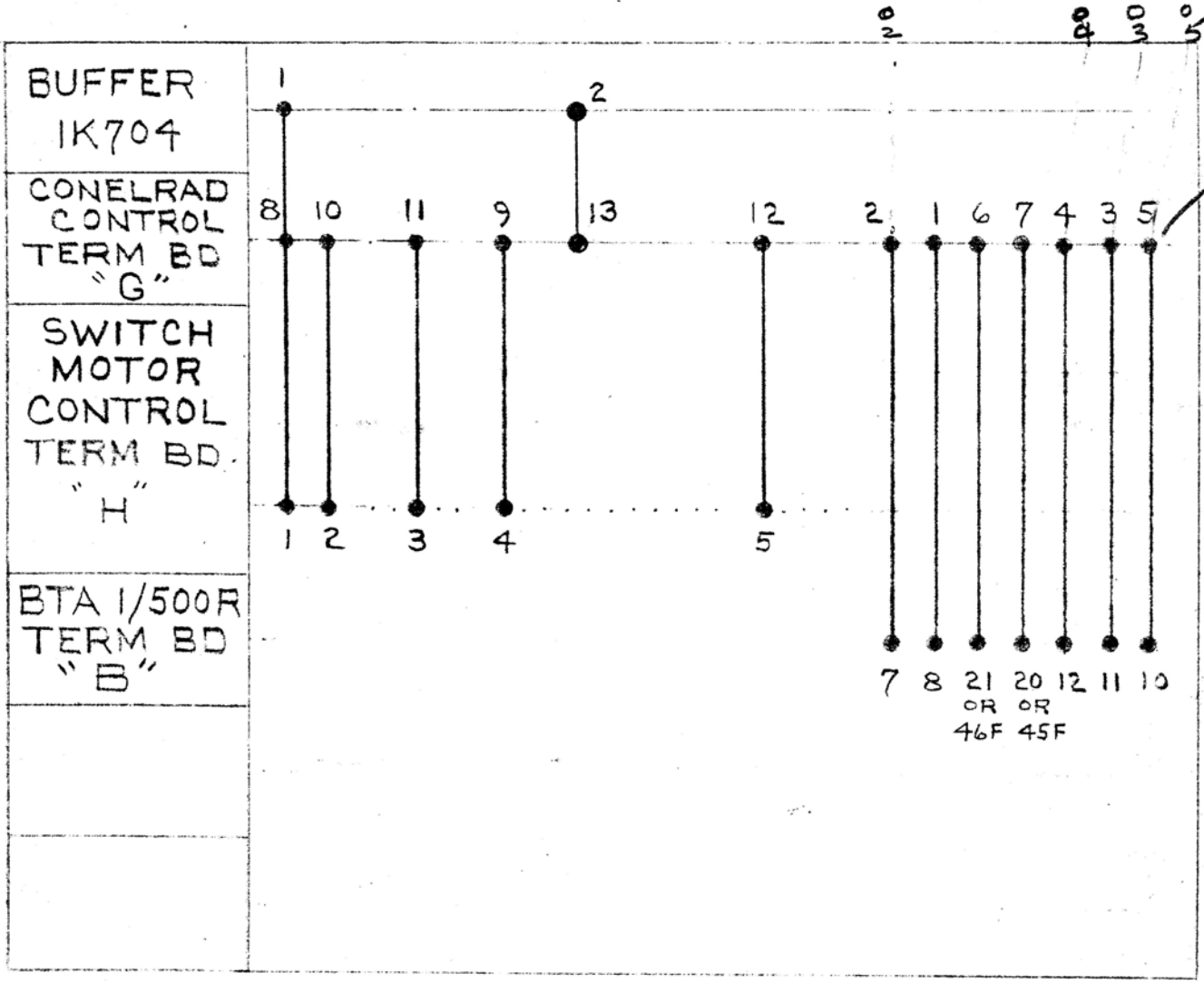
A SIZE 8959063

SHEET 3 CONT'D. ON SHEET 4

XJ
A
20
TR
TC
F
PR

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A (AM. STD.), ALL INTERNAL THREADS TO BE CLASS 2B (AM. STD.), UNLESS OTHERWISE SPECIFIED.

8959063 SHEET 4 CONT ON SHEET 5



WIRE CHART

FOR DETAILS SEE SCHEMATIC DWG Nº 648254

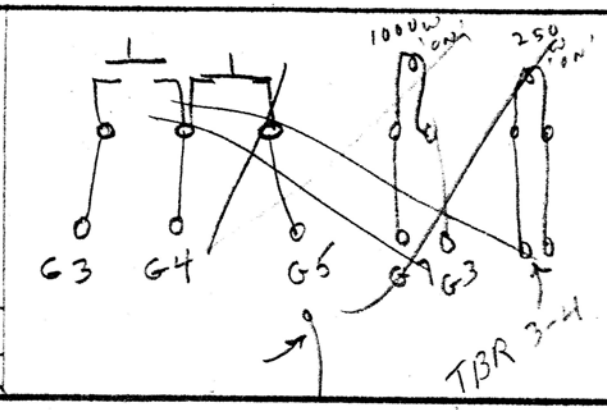
USE #16 BLACK WIRE AS SUPPLIED FOR ABOVE CONNECTIONS.

R.F. CONNECTIONS NOT SHOWN.

REVISIONS

AP. BY

AP. MFG.



INSTALLATION

MI-
FIRST MADE FOR 34309-5 USED ON

DRAWN BY W. Yates Dec. 5, 1958

TRACED BY

CHECKED BY

A 8959063

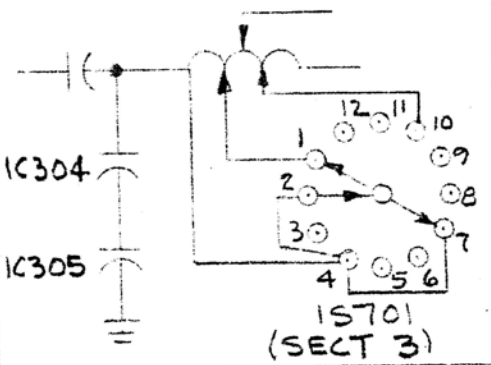
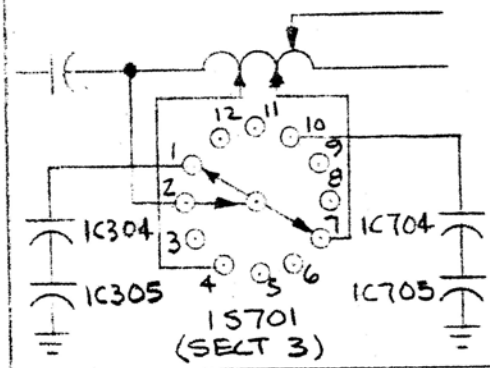
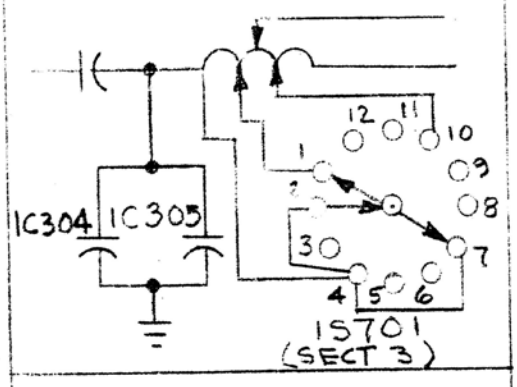
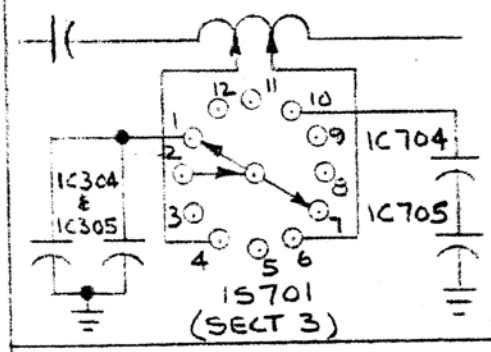
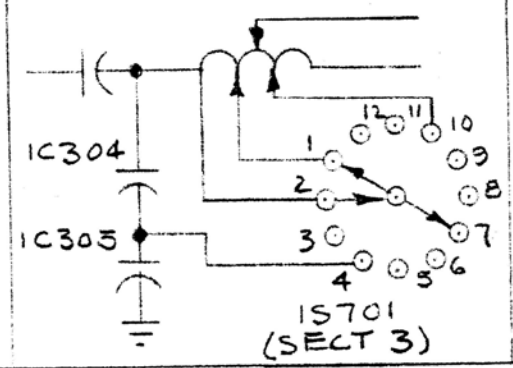
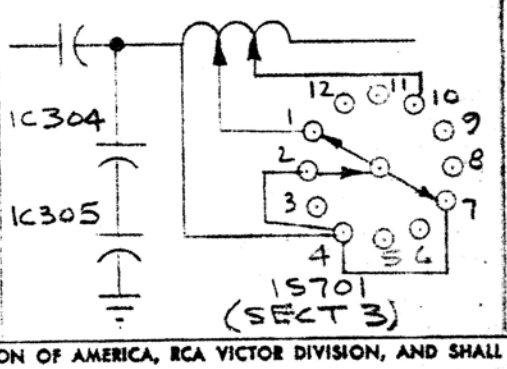
SHEET 4 CONT'D ON SHEET 5

RADIO CORPORATION OF AMERICA, RCA VICTOR DIVISION, CAMDEN, N. J.

DIMENSIONS ARE IN INCHES, AND INCLUDE THICKNESS OF PLATING. DO NOT SCALE DRAWING. ALL EXTERNAL THREADS TO BE CLASS 2A (A.M. STD.), ALL INTERNAL THREADS TO BE CLASS 2B (A.M. STD.), UNLESS OTHERWISE SPECIFIED.

8959063 SHEET 5 CONT'D ON SHEET FINAL

1S701 SECT 3 WIRING CONNECTIONS
(1C304 & 1C305 ARE F.D. PARTS SUPPLIED WITH TRANSMITTER)

CONELRAD FREQ	640 KC		1240 KC	
FREQ RANGE	CAPACITOR CONN	1L301 CONELRAD SHORTED TURNS	CAPACITOR CONN	1L301 SHORTED TURNS
535-640	 1S701 (SECT 3)	39	 1S701 (SECT 3)	
650-770		35		
780-930		27		
940-1110	 1S701 (SECT 3)	10	 1S701 (SECT 3)	48
1120-1620	 1S701 (SECT 3)	33	 1S701 (SECT 3)	

RADIO CORPORATION OF AMERICA, RCA VICTOR DIVISION, CAMDEN, N. J.

REVISIONS

AP. BY	AP. MFG.	
		2

INSTALLATION

FIRST MADE FOR MI-34309-5 USED ON

DRAWN BY P. Fulgin May 23, 1960

TRACED BY

CHECKED BY

A 8959063

SHEET 5 CONT'D ON SHEET FINAL

J. H. Wall & Co. "Makuff" 101

EQUIPMENT LOST OR DAMAGED IN TRANSIT

When delivering the equipment to you, the truck driver or carrier's agent will present a receipt for your signature. Do not sign it until you have (a) inspected the containers for visible signs of damage and (b) counted the containers and compared with the amount shown on the shipping papers. If a shortage or if evidence of damage is noted, insist that notation to that effect be made on the shipping papers before you sign them.

Further, after receiving the equipment, unpack it and inspect thoroughly for concealed damage. If concealed damage is discovered, immediately notify the carrier, confirming the notification in writing, and secure an inspection report. This item should be unpacked and inspected for damage WITHIN 15 DAYS after receipt.

Report all shortages and damages to RCA, Broadcast and Television Department, Camden 2, N. J.

Radio Corporation of America will file all claims for loss and damage on this equipment so long as the inspection report is obtained. Disposition of the damaged item will be furnished by RCA.

REPLACEMENT PARTS AND ENGINEERING SERVICE

RCA field engineering service is available at current rates. Requests for field engineering service may be addressed to your RCA Broadcast Field Representative or the RCA Service Company, Inc., Broadcast Service Division, Camden, N. J. Telephone: WOodlawn 3-8000.

When ordering replacement parts, please give symbol, description, and stock number of each item ordered.

The part which will be supplied against an order for a replacement item may not be an exact duplicate of the original part. However, it will be a satisfactory replacement differing only in minor mechanical or electrical characteristics. Such differences will in no way impair the operation of the equipment. Parts with no stock numbers are standard components. They are not stocked by RCA and should be obtained from your local electronic parts distributor.

The following tabulations list service parts and electron tube ordering instructions according to your geographical location.

SERVICE PARTS

LOCATION	ORDER SERVICE PARTS FROM:
Continental United States, including Alaska and Hawaii	RCA Electron Tube Division, Parts and Equipment, P.O. Box 654, Camden, New Jersey or through your nearest RCA Regional Office. Emergency orders may be telephoned, telegraphed, or teletyped to RCA Emergency Service, Bldg. 60, Camden, N. J. (Telephone: WO 3-8000).
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	RCA International Division, Clark, N. J., U.S.A. or through your local Sales Representative.

ELECTRON TUBES

LOCATION	ORDER ELECTRON TUBES FROM:
Continental United States, including Alaska and Hawaii	Local RCA Tube Distributor.
Dominion of Canada	RCA Victor Company Limited, 1001 Lenoir Street, Montreal, Quebec or through your local Sales Representative or his office.
Outside of Continental United States, Alaska, Hawaii and the Dominion of Canada	Local RCA Tube Distributor or from: Tube Department RCA International Division 30 Rockefeller Plaza New York 20, New York, U.S.A.

RETURN OF ELECTRON TUBES

If for any reason, it is desired to return tubes, please return them through your local RCA tube distributor, RCA Victor Co. Ltd., or RCA International Div., depending on your location.

PLEASE DO NOT RETURN TUBES DIRECTLY TO RCA WITHOUT AUTHORIZATION AND SHIPPING INSTRUCTIONS.

It is important that complete information regarding each tube (including type, serial number, hours of service and reason for its return) be given.

When tubes are returned, they should be shipped to the address specified on the Return Authorization form. A copy of the Return Authorization and also a Service Report for each tube should be packed with the tubes.

LIST OF RCA REGIONAL OFFICES

Atlanta 3, Georgia
1121 Rhodes-Haverty Bldg.
134 Peachtree St. N.W.
JAckson 4-7703

Boston 16, Mass.
Room 2301, John Hancock Bldg.
200 Berkley St.
HUbbard 2-1700

Chicago 54, Ill.
1186 Merchandise Mart Plaza
DElaware 7-0700

Cleveland 15, Ohio
1600 Keith Bldg.
CHerry 1-3450

Dallas 35, Texas
7901 Empire Freeway
FLeetwood 2-3911

Hollywood 28, Calif.
RCA Bldg., 1560 N. Vine St.
HOllywood 9-2154

Kansas City 6, Missouri
340 Home Savings Bldg.
HArrison 1-6480

New York 20, New York
36 W. 49th St.
JUdson 6-3800

Branch—San Francisco 2, Calif.
420 Taylor St.
ORdway 3-8027

Seattle, Washington
2250 First Ave., S.
MAin 2-8350

TABLE OF CONTENTS

	Page
TECHNICAL DATA	5
TUBE COMPLEMENT	5
RECOMMENDED TEST EQUIPMENT	5
EQUIPMENT LIST	7
OPTIONAL AND ACCESSORY EQUIPMENT	7
DESCRIPTION	7
General	7
Circuit	7
LAYOUT	8
Transmission Line	9
Atmospheric Static Accumulations	9
Electrical Storms	10
Antenna Current Readings	10
Unpacking	10
INSTALLATION	11
CONTROL CIRCUIT CHECK	13
TUNING	13
Preliminary Tuning Procedure	13
Output Network Tuning	16
Final Tuning Adjustments	17
Power Cutback Operational Check	20
CONELRAD	20
Impedance Matching Network	20
Conelrad Tuning	20
OPERATION	22
MAINTENANCE	22
General	22
Cleaning	22
Overload Relays	23
Fuses	23
Control Components	23
Tubes	23
Feedback Ladders	24
PRINTED CIRCUITS	24
Printed Board Repair	24
Component Replacement	25
RECOMMENDED STATION SPARE PARTS	28
LIST OF PARTS	29

LIST OF ILLUSTRATIONS

Figure		*Page*
1.	Type BTA-1R A-M Transmitter	6
2.	Typical Tower Lighting Circuit	10
3.	Power Cutback Circuit Connection Details	12
4.	Tuning Chart, PA Tank, Coil 1L301 Jumper Connections	15
5.	Tuning Chart, Second Harmonic Trap, Coil 1L304 Jumper Connections	15
6.	Schematic Diagram, RF Detector	17
7.	Repair of Surface Damage to Board and Printed Wiring	25
8.	Repair of Severe Crack through Board and Printed Wiring	26
9.	Replacing Double-Ended Component	26
10.	Removal of Multi-Element Component	26
11.	Insulator Details	27
12.	Outline Drawing, BTA-1R	37, 38
13.	Front View, BTA-1R, Door Removed	39, 40
14.	Rear View, BTA-1R, Rear Panels Removed	41, 42
15.	Rear View, BTA-1R Exciter Section	43, 44
16.	Power Cutback Kit, MI-28099-A, Installed	45, 46
17.	Schematic Diagram, Conelrad Kit	47, 48
18.	Schematic Diagram, BTA-1R	49, 50

LIST OF TABLES

Table		*Page*
1.	External Connections	11
2.	Transformer Primary Taps	13
3.	Buffer Coil 1L601 Settings	14
4.	Frequency Determining Parts	16
5.	Output Network Tuning	16
6.	Final Tuning Adjustment	17
7.	Typical Panel Meter Readings	18
8.	Typical Panel Meter Reading for BTA-1R Operated at a Rated Output of 500 Watts	19
9.	Conelrad Tank Connections and Settings	21
10.	Recommended Overall Maintenance Schedule	22
11.	Overload Relay Settings	23
12.	Tube Socket Voltages	24
13.	Insulator Data	27

TECHNICAL DATA

AF Input Impedance
150 or 600 ohms

AF Input Level, 100% Modulation
+10 ±2 dbm

AF Response
50 to 7,500 cps — ±1 db
30 to 10,000 cps — ±1.5 db
30 to 12,000 cps — ±2.5 db

AF Distortion, 95% Modulation
50 to 10,000 cps — 2%
50 to 12,000 cps — 3%

Noise, Below 100% Modulation
60 db

Frequency Range
535 to 1,620 kc

Frequency Stability
±5 cps

Type of Output
Single-ended

Carrier Shift, 0 to 100% Modulation
3%

Output Impedance
40 to 250 ohms

RF Voltage for Frequency Monitoring
10 v rms, 75 ohms

RF Voltage for Modulation Monitoring
10 v rms, 75 ohms

Power Output, Nominal
1,000 watts

Power Output Capability
1,100 watts

Power Supply
208 v to 240 v

Line Frequecy
60 cps

Phase
Single

Power Consumption
0% Modulation — 3,000 watts, approximately
100% Modulation — 4,300 watts, approximately
Average Program Modulation — 3,200 watts, approx.

Power Factor
90%

Permissible Combined Line Voltage Variation and Regulation
±5%

Crystal Heater Power Supply
117 v, 60 cps

Altitude Range
0 to 5,000 feet

Ambient Temperature Range
+10°C (50°F) Min.*
+45°C (113°F) Max.

Dimensions and Weight
Height — 84 inches
Width — 34 inches
Depth — 32½ inches (less door handle)
Weight — 1,500 pounds, approximately

TUBE COMPLEMENT

Symbol	*Type*	*Function*	*Symbol*	*Type*	*Function*
1V101	6AK5	Oscillator	1V401	8008*	HV Rectifier
1V102	5763	RF Amplifier	1V402	8008*	HV Rectifier
1V301	4-400A	Power Amplifier	1V601	6146	Buffer
1V302	4-400A	Power Amplifier	1V603	2E26	1st AF Amplifier
1V303	4-400A	Modulator	1V604	2E26	1st AF Amplifier
1V304	4-400A	Modulator			

RECOMMENDED TEST EQUIPMENT

RCA Type WV-97 VoltOhmyst
RCA Type WM-71A Distortion and Noise Meter
RCA Type WA-28A Audio Push Button Oscillator
RCA Type WO-88A Oscilloscope
RCA Type BW-11A A-M Frequency Monitor
RCA Type BW-66F Modulation Monitor
Dummy Load
R-F Detector or equivalent (see figure 6)

* For −20°C to +45°C operation, specify type CH-1120 Xenon Rectifier Tubes (MI-34615) instead of type 8008 tubes.

Figure 1. Type BTA-1R A-M Transmitter

EQUIPMENT LIST

TYPE BTA-1R A-M TRANSMITTER ES-27238

Quantity	*Description*	*Reference*
1	BTA-1R A-M Transmitter	MI-27649
1	Set of Operating Tubes	MI-27695
1	Set of Frequency Determining Parts	MI-27691
1	Crystal, Type TMV-130B	MI-27493
1	Cabinet Door	MI-27645-A
1	Nameplate	MI-28180-1
1	Touch-Up Finish Kit	MI-27660-A
2	Instruction Book	IB-30248

OPTIONAL AND ACCESSORY EQUIPMENT

Set of Spare Tubes MI-27696
Crystal, Type TMV-130B
(Conelrad and/or Spare) MI-27493
Power Cutback Kit MI-28099-A
Conelrad Kit MI-34309-5
Antenna Tuning Equipment ES-27250
Remote Control System, Type BTR-11B
Studio Control Unit MI-27537
Transmitter Control Unit MI-27538-A
Remote Control System, Type BTR-20A
Studio Control Unit MI-27539
Transmitter Control Unit MI-27526
Remote Control Metering Panel ES-27220

DESCRIPTION

General

The RCA Type BTA-1R Transmitter, shown in figure 1, is designed for high fidelity broadcasting within a frequency range of 535 kc to 1,620 kc. The BTA-1R has a nominal rated output of 1,000 watts and maximum rated output of 1,100 watts, which provides compensation for losses in the transmission line and antenna tuning equipment.

Air cooled tubes are used throughout the transmitter, and the output frequency is regulated by a crystal mounted in a thermostatically controlled heated enclosure. The crystal heaters require a nominal operating voltage of 117 v, 60 cps, single phase. An input voltage of 208–240 volts, 60 cps, single phase is required for transmitter operation.

The transmitter is completely self-contained in an attractively styled metal cabinet with wiring ducts, front and rear. Easy access to these ducts for interconnecting wiring is provided by removable panels. To provide maximum accessibility to all components for maintenance and service, the component chassis are mounted vertically in the cabinet.

All operating controls and meters are on the panels on each side of the front door panel. Figure 13 shows the BTA-1R with the front door panel removed; figure 14 is a rear view with the two rear panels removed, and figure 15 is a closeup rear view of the Exciter section. Figure 16 shows the installation of Power Cutback Kit MI-28099-A.

Safety interlock switches are connected to all door panels so that the high voltage supply line to the transmitter is opened and the high voltage buss is automatically grounded when any door panels are opened.

Power for the blower motor is supplied through a motor starter which not only protects the blower motor but also opens the filament circuit in case the blower fails.

The transmitter is wired to permit remote control operation of all essential transmitter functions. Convenient installation of the RCA BTR-11B or BTR-20A Remote Control System can be made using the connections already provided for this purpose on the transmitter's external connections terminal board. If other than RCA remote control equipment is to be used, installation instructions should be obtained from the manufacturer or supplier or such equipment.

An additional feature of the BTA-1R is that it also meets the needs of broadcasters authorized to operate at 500 watts. No circuit modifications or component changes are required to operate the BTA-1R at a nominal rated output of 500 watts.

The Power Cutback Kit, MI-28099-A, supplied as an optional item, is to be installed in the field. However, in some transmitters it was installed at the factory.

Circuit

The transmitter r-f circuit is a combination of four stages. The first two are constructed on a printed circuit board, consisting of a 6AK5 (1V101) crystal controlled oscillator driving a 5763 (1V102) r-f amplifier. The output from the printed circuit combination is applied to the grid of 1V601, a 6146 class "C" buffer amplifier, which, in turn, is the driver for the power amplifier stage. The PA consists of two 4-400A type tubes (1V301, 1V302) connected in parallel. The PA is screen modulated by self-modulation, induced by the high resistance screen dropping resistor and plate modulated by the modulator.

The printed circuit oscillator can be switched to any one of three separate crystals without re-tuning. This gives the advantage of putting a heated standby

crystal into operation instantly without the necessity of an additional oscillator. At the same time, a conelrad crystal can be ready for immediate operation. Any one of the three crystals can be selected from the front panel or from a remote location. This enables the operator to change crystals without loss of air time even when the transmitter is being operated remotely. The only adjustment necessary is to trim the separate crystals of the oscillator to the assigned frequencies.

The buffer amplifier, a 6146 type tube (1V601), is designed for broad-band tuning which eliminates the necessity of fine tuning adjustments. This stage is tuned by shorting a portion of the plate choke coil, 1L601. A series of taps covering the broadcast band are provided on coil 1L601 for this purpose. A sample of r-f for monitoring purposes is taken off the cathode resistor of 1V601. This sample is fed to connector 1J601 and from there applied to the station's frequency monitor.

The PA is made up of two plate modulated 4-400A's (1V301, 1V302) connected in parallel which function as class "C" amplifiers to feed the output network. The output network is a double-pi type consisting of the PA tank, 1L301, the second harmonic filter, 1L302, and a combination of six capacitors, 1C304 through 1C309. Different combinations of these capacitors are used to tune the output network to match the low impedance of the antenna or transmission line to the high impedance of the plate. The PA tank, 1L301, is tuned by a silver-plated copper slug, and is the only tuning control in the transmitter.

When the transmitter is equipped with a Conelrad Kit, the output circuit is switched to a simple parallel resonant tank circuit during Conelrad operation, with the r-f output tapped directly off the coil (see figure 17).

Harmonic radiation is reduced within the double pi network, and second harmonic radiation in particular is reduced still further by a trap. This trap is made up of a series tuned coil, 1L304, and capacitor 1C324, which are tuned by a shorting strap on 1L304. The power output of the PA stage is controlled by resistor 1R405, which varies the plate and screen voltage applied to the PA stage. The harmonic filter is switched out of the circuit during Conelrad operation.

For modulation monitoring, r-f voltage at 10 volts, 75 ohms, is supplied at the taps of the modulation monitoring coil, 1L305. These taps provide for voltage adjustment, as required, when different loads and different power levels are used.

The audio system consists of a two-stage, push-pull amplifier, which uses a pair of 2E26's (1V603, 1V604) in the first stage and two 4-400A's (IV303, 1V304) in the second stage. Input coupling to the first stage is provided by the audio input transformer, 1T601, the primaries of which can be connected in parallel for a 150-ohm input, or in series for a 600-ohm input. Feedback voltage from feedback ladders 1Z301 and 1Z302 is applied to the first audio stage through the secondary of input transformer 1T601. The two 2E26 tubes (1V603, 1V604) operate in push-pull to drive the second stage, the two 4-400A tubes (1V303, 1V304). The latter, in turn, are used to modulate the plates of the PA stage, 1V301 and 1V302, another pair of 4-400A's.

D-C voltage is obtained from three power supplies. Of these three supplies, only the high voltage supply uses tubes, these being a pair of type 8008 tubes, 1V401 and 1V402, which furnish the high voltage for the PA and modulator tubes. The other two supplies, low-voltage and bias, use selenium rectifiers. Filament voltages on all tubes may be adjusted by variable resistor 1R505, which is controlled from the front panel. Voltmeter 1M202 indicates the input voltage in the filament transformers, 1T301, 1T302, 1T401, 1T602, and 1T603.

The power control circuit utilizes a time-delay relay, 1K601, to prevent application of plate power until thirty seconds after the filament power has been applied. In addition, the plate voltage will be removed if an overload occurs. After the cause of the overload has been corrected, the transmitter may be returned to the air by operating the overload re-set switch, 1S204, on the front panel. A short occurring in any circuit will cause the transmitter to shut down. Before the transmitter can be returned to the air, corrective action must be taken to remove the cause of the short.

LAYOUT

The basic step in installation of the BTA-1R transmitter is to decide upon the equipment layout and make provisions for the necessary external connections. After the space requirements have been determined, the equipment can be unpacked, assembled, and connected as specified. Outline dimensions for the transmitter are shown in figure 12.

Inasmuch as some of the optional and associated items include their own instruction books, the installation procedure for such units will not be repeated.

Instead, reference should be made to the instruction books (IB's) accompanying such equipment. These books are:

BPA-11A/B Antenna Tuning Unit IB-30223
Remote Pick-Up Unit IB-30209-1
Transmission Lines,
Hangers and Accessories IB-36164-1

Factors to be considered in layout are incoming power lines, accessibility of a good station ground, and the route for the transmission line to the antenna. The room in which the transmitter is to be installed should be well-ventilated and have an abundant supply of clean, dry air. The maximum ambient temperature is listed under TECHNICAL DATA.

Separate disconnect switches and power leads must be supplied for the 208–240 volt and 110–125 volt incoming power lines. The transmitter is protected by a 25 amp line circuit breaker in the 208–240 volt incoming line. Note that the crystal ovens require a separate 110–125 volt line so that the ovens may be energized 24 hours a day without interruption.

Disconnect switches and wiring must be provided for such items as the transmitter room exhaust fan, if any, and monitoring racks. The tower lighting circuit should also be planned, although no material is provided for this item.

Wiring to and from the transmitter should be carried in conduit or a trench terminating below the unit. The base plan of the outline drawing, figure 12, indicates where this wiring should enter the unit. The ground connection must be connected to the station ground, with copper strap about 3 inches wide. Table 1 lists the external connections to be made.

It is not intended that these instructions shall supersede any applicable local codes. Where the instructions in this book conflict with any local electrical, construction, or building code, the provisions of the applicable local code should be followed.

Transmission Line

The r-f output from the transmitter terminates at the insulated fitting, as shown in figure 12. Beyond this point no lines or fittings are supplied with this transmitter, but must be ordered separately.

A coaxial or open-type wire transmission line with a resistive impedance of either 51.5 ohms, 72 ohms, or 230 ohms may be used. The coupling network capacitors supplied serve to match the transmitter output to a specific transmission line impedance at the operating frequency.

Where an underground transmission line is to be used, coaxial lines and fittings must be employed. Layout information, dimensions, and installation data for the coaxial transmission lines are supplied in the transmission line instruction book.

If coaxial transmission line is used, the installation of items such as dehydrating or gassing units, if required, should not be overlooked. Data for installation of these items is supplied in the transmission line instruction book, IB-36164-1.

The RCA Type BPA-21A/B/C/D Antenna Tuning Unit is recommended for matching the antenna to the BTA-1R transmitter. If desired, the unit can also be furnished to supply an a-f voltage for program monitoring, and a rectified carrier current for remote antenna current indication.

An antenna tuning house is also desirable, especially when multi-element arrays are used, since it offers weather protection and facilities for test and measuring units, tower lighting equipment and intercommunication components.

Before completing the layout from the transmitter to the transmission line and antenna, station engineering personnel should check the antenna system for protection against atmospheric static accumulations and electrical storms. If this is not done, the transmitter may be damaged. Refer to the next two headings for a discussion of the details involved.

Atmospheric Static Accumulations

In certain localities, atmospheric conditions build up high static potentials on the antenna towers, making it imperative to provide a drain path to ground for these accumulations. If no direct path is provided, the charge will build up potential until flashover occurs, either across the tower base arc-gap or across one of the capacitors in the antenna coupling system.

Where tower lighting chokes are used and one side of the a-c supply line is grounded, the lighting choke will act as a satisfactory discharge path. When neither side of the a-c line is grounded, or when a toroidal tower lighter transformer is utilized, a drain path must be provided. Such a path, however, may already exist in the transmitter output circuit or antenna coupling unit. Existence of such a path may be checked after installation and before any circuits are energized by connecting an ohmmeter between the tower and ground. Any resistance up to approximately 250,000 ohms will provide a satisfactory return circuit. When no discharge path is indicated, one may be supplied by the installation of an r-f

choke or a 100,000 to 200,000-ohm Globar resistor. Connect either the choke or the resistor from the antenna feed line to ground. The line terminating unit will generally serve to house the component used.

Electrical Storms

In areas subject to lightning storms, a direct electrical path from the tower to ground is required to avoid capacitor and antenna current meter burnout if lightning strikes the tower. This requirement can generally be met by installing arc-gaps across the base insulators. If these gaps are properly spaced, at the instant of discharge the gaps will present a low impedance path to ground and thus carry directly to ground any current caused by the lightning striking the tower. Although there is a second path to ground through the tuning equipment or transmitter output, the higher impedance of this second path usually prevents excessive discharge under normal conditions. In instances where the tuning house is located under the tower or directly adjacent to it, the ratio of these two impedances may not be sufficiently high to prevent appreciable discharge current through the tuning equipment to ground with consequent destruction of the coupling equipment. To increase this ratio, a one- or two-turn loop should be installed in the antenna lead from the tower to the tuning house. No such loop is required where the tuning house is more than several feet from the tower. In the latter instance, the longer lead provides the necessary higher impedance.

Antenna Current Readings

Under certain circumstances when the tower lights are on, the 60-cycle tower lighting current may cause fluctuations or inaccuracies in the antenna current meter reading. This condition is created when the tower itself serves as one side of the lighting circuit and, hence, provides a common path for the tower lighting current and the r-f current. Where this situation exists, it is possible to have two ground return paths for the 60-cycle lighting current: one through the antenna coupling equipment and transmitter output circuit; the other in the a-c lighting circuit through the tower lighting chokes to ground where one side of the a-c is grounded. A simplified schematic diagram of a typical circuit illustrating this possibility is shown in figure 2. To prevent the meter fluctuations, it is necessary for the 60-cycle tower lighting current to be returned by a path other than the r-f circuits feeding the tower.

If a toroidal tower lighting transformer is used, no antenna current meter fluctuations will occur. Where lighting chokes are used, the circuit should be checked for the existence of a second ground path as previously described.

Elimination of the 60-cycle return path through the coupling equipment or transmitter output circuit is achieved by inserting a blocking capacitor in the antenna feed line. The capacitor may be connected in either of two places: just ahead of the antenna current meter or between the transmitter output and the transmission line. The location depends upon the type of coupling circuit used in the line terminating unit. As a general rule, the reactance of the blocking capacitor, shown dotted in figure 2, should not be greater than approximately one-tenth the characteristic impedance of the transmission line.

To determine whether antenna current meter variations are caused by the condition just described, turn on the tower lights when the transmitter is off. The presence of any current reading on the antenna current meter at this time indicates the need for corrective measures.

Unpacking

An understanding of the overall shipping system will be of assistance in unpacking the equipment and locating items. Each RCA equipment is accompanied by a packing slip which lists the complete contents of the shipment by "master item" or "MI" numbers. This shipping voucher is usually packed in one of the smaller cardboard cartons, appropriately marked.

Where more than one item is listed on an MI, a sub-division or "item" number is listed after the MI number. Thus, a component might carry the designation, "MI-99999-2". This indicates that the part is "item 2" on the MI-99999 list. These MI sheets are essentially packing lists, and where there are two or more boxes to a major unit, the box containing the MI sheet is identified by stenciling. Thus

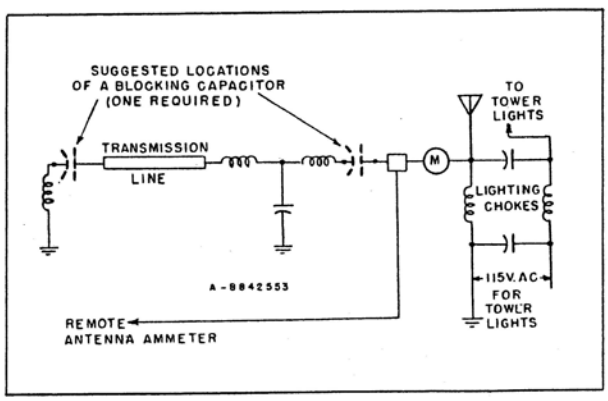


Figure 2. Typical Tower Lighting Circuit

it is possible to identify the contents of each box and systematically plan the overall uncrating. All items listed on the MI sheets should be located before crates or boxes are destroyed, to avoid loss of small items overlooked during unpacking.

The MI sheets, as previously noted, are of value only in locating items for assembly. The MI sheets should not be used for installation sequence nor for installation details. Refer to the appropriate drawings and the following notes for this information.

It is possible that the configuration or mechanical design of a component or part may be different in appearance or that its location may have been changed from that shown in a photograph or drawing. Changes such as these are the result of manufacturing considerations or design modifications that have been incorporated during production, after the photographs and drawings have been released for publication. However, the function of any different appearing component or part is the same as that of its illustrated counterpart, unless otherwise specified.

The equipment may now be unpacked. Tubes and crystals should not be unpacked until required. In addition, the frequency-determining parts, MI-27691, should be left in their carton until installation is specified.

INSTALLATION

Be sure to remove all red metal straps supporting the larger projecting components in the transmitter cabinet before installing the components shipped separately. These straps were installed at the factory to brace these large in-place components during shipment.

Various components have been removed from the transmitter cabinet and packed separately for shipment. All such parts are individually tagged with an MI and item number. Do not remove any identification tags until all the components have been installed.

Refer to the appropriate drawings and photographs for the location and placement of these components.

Hardware required for re-assembly is shipped in place or the hardware required will be specified as needed.

Before making any connections or installing any components, place all switches and circuit breakers in the OFF position. This will prevent possible damage to the equipment if the incoming power switch is closed accidentally.

The following items are shipped separately as part of MI-27649.

Modulation Transformer 1T501 (item 2)
Plate Transformer 1T502 (item 3)
Modulation Reactor 1L501 (item 4)
HV Filter Reactor 1L502 (item 5)
Modulator Blocking Capacitor 1C501 and Brackets (item 6)
Blower 1B501 (item 7)

With the exception of the blower, 1B501 (item 7) these components are to be mounted on the floor of the transmitter. However, it may be more convenient to set the arc-gap on the HV filter reactor (item 5) and the modulation transformer (item 2) before

TABLE 1. EXTERNAL CONNECTIONS, BTA-1R

Point of Connection	*External Circuit*	
1B	Ground	
2B 3B	208/240 volts, 60 cycles, power input	
4B 5B	117 volts, 50/60 cycles for crystal heater	
8B 9B	External plate voltage interlock connections	
10B 11B	Remote control plate off	
11B 12B	Remote control plate on	
13B 15B	Remote control transmitter on	
14B 15B	Remote control transmitter off	
16B 15B	Remote control power raise	
17B 15B	Remote control power lower	
22B 15B	#1 crystal common	Remote control crystal switching
19B 15B	#2 crystal common	
21B 15B	main crystal common	
20B 15B	conelrad crystal common	
23B 24B	Remote plate voltage metering	
25B 24B	Remote cathode current metering	
26B 27B	Spare	
28B 29B	Audio input	
1J601	R-f to frequency monitor	
1L305	R-f to modulation monitor	

installing them in the cabinet. Adjust the contacts on 1L502 for a gap of 1/16 of an inch; adjust the contacts on 1T501 for a gap of 3/16 of an inch. Although this is the nominal setting for 1T501, a readjustment may be required later as part of the final operational adjustments.

Refer to figure 14 for the placement of these components and then make the required connections according to the connection tags attached to the leads and the terminals.

Refer to figure 15 and install the blower, 1B501, in the upper rear section, using the hardware in place to fasten the blower to the cabinet. Make the connections according to the connection tags attached to [illegible] terminals.

When all components except the frequency-determining parts, tubes, and crystals have been installed, make the external connections required. Carefully check the wiring for accuracy. If a buzzer and battery are used for circuit checking, temporarily short-circuit all meters in the transmitter, or disconnect one side of each meter, to prevent meter damage.

Check the high-voltage grounding switches, 1S217 to 1S219 for proper operation, using a battery and buzzer or the lowest scale on an ohmmeter.

Install the nameplate, item 8 of ES-27238 on the rear panel.

Set aside the tubes, crystal, and frequency-determining parts for specific instructions given as part of the PRELIMINARY TUNING PROCEDURE.

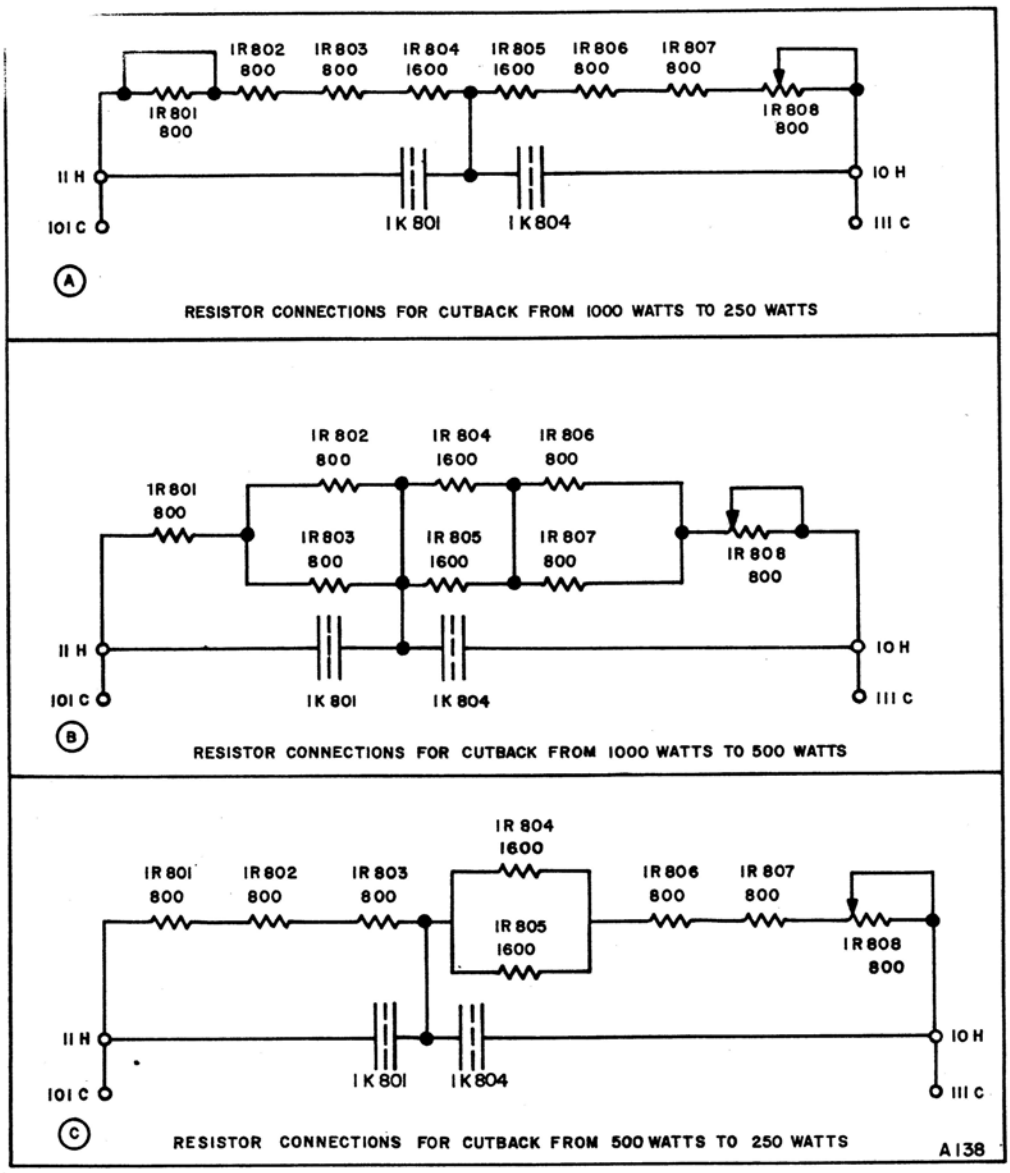


Figure 3. Power Cutback Circuit Connection Details

Power Cutback

The cutback resistors whether factory installed or furnished in the optional kit form are connected in series for 250-watt reduced power operation, as shown in figure 3(A). In those cases where nominal operation of the transmitter is at 1000 watts with reduced power rated at 500 watts, the series-parallel resistor combination shown in figure 3(B) must be followed. If normal operation of the transmitter is at 500 watts rated power, the cutback resistors must be reconnected according to the series-parallel combinations shown in figure 3(C).

The three different connection combinations have been arranged so that the voltage developed across a particular cutback network is divided equally between relay 1K801 and relay 1K804.

A functional check of the power cutback circuit is to be made later, after the Final Tuning Adjustments have been completed.

CONTROL CIRCUIT CHECK

To insure that all connections have been correctly made, the following Control Circuit Check should be made before applying plate and bias voltages to the transmitter.

1. Disconnect and tape the primary leads of 1T402 and 1T502 at terminals 36F and 37F and the primary of 1T403 at terminals 10D and 11D.

2. Switch the LINE CIRCUIT BREAKER, 1S210, to the ON position.

3. Switch the TRANS ON/OFF control, 1S203, to the ON position. This will energize the PLATE ON latching relay, 1K604.

4. Switch the BLOWER ON/OFF control, 1S301 (located on the tube shelf near 1V304), to the ON position. This will start the blower, 1B501.

5. Switch the FILAMENT CIRCUIT BREAKER, 1S211, to the ON position. This will cause FILAMENT LINE meter, 1M202, to indicate and, within 30 to 60 seconds later, the PLATE TIME DELAY contactor, 1K601, to energize.

6. Turn the FILAMENT CONTROL, 1R505, fully clockwise and read the incoming line voltage on the FILAMENT LINE meter, 1M202. Adjust the taps on the transformer primaries to same voltage as that of the line, or as close as possible to the line voltage if the range of transformer taps does not permit setting the exact voltage. Refer to Table 2 for a list of the transformers and their taps. Figures 14 and 15 show the location of these transformers in the cabinet. The schematic diagram, figure 18, shows the electrical connections.

TABLE 2. TRANSFORMER PRIMARY TAPS

Transformer	*208 V Line Taps*			*240 V Line Taps*		
	−11	*0*	*+11*	*−11*	*0*	*+11*
1T301	197	208	219	229	240	251
1T302	197	208	219	229	240	251
1T401	197	208	219	229	240	251
1T402	197	208	219	229	240	251
1T403	—	208	—	—	240	—
1T502	197	208	219	229	240	251
1T602	197	208	219	229	240	251
1T603	197	208	219	229	240	251

7. Place the OL RESET-PLATE ON/OFF switch, 1S204, to the ON position. This will energize the PLATE ON contactor, 1K602, and cause the PLATE ON lamp, 1I201, to glow.

8. To check the operation of the interlock circuit, open and close the door and then remove the rear panels one by one, replacing the first panel before removing the second. As each door and panel is opened, the interlock switches, 1S214, 1S215, or 1S216 will operate; the PLATE ON lamp, 1I201, will go off; and the PLATE ON contactor 1K602, will de-energize. Each time 1K602 is de-energized, it will be necessary to operate 1S204 to energize 1K602.

9. Switch the TRANS ON/OFF control, 1S203, to the OFF position and re-connect the primary leads of transformers 1T402, 1T403, and 1T502.

PRELIMINARY TUNING PROCEDURE

WARNING

USE EXTREME CAUTION WHEN TUNING OR CHECKING THE TRANSMITTER. THE VOLTAGES REQUIRED TO OPERATE THIS EQUIPMENT ARE SUFFICIENTLY HIGH TO CAUSE SERIOUS INJURY OR LOSS OF LIFE. TAKE CARE NOT TO TOUCH ANY CIRCUITS WHEN THE POWER IS ON. SWITCH THE PLATE OFF AND GROUND ALL CAPACITORS AND CIRCUITS BEFORE TOUCHING ANY COIL OR CAPACITOR WHEN MAKING TUNING ADJUSTMENTS OR REPAIRS.

1. Place all switches and circuit breakers in the OFF position.

2. Rotate 1R403 and 1R404 fully counterclockwise.

3. Install all tubes in the transmitter, except the 8008 HV rectifiers (1V401 and 1V402) and the 4-400A modulators (1V303, 1V304). Connect a dummy load of the proper impedance to the transmitter antenna connection.

4. Place the crystal in its socket, and apply power to the crystal heaters. Allow the crystal heaters to operate for at least 30 minutes before making any adjustments.

5. Place the following switches in the ON position.
   a. LINE CIRCUIT BREAKER, 1S210
   b. FILAMENT CIRCUIT BREAKER, 1S211
   c. BLOWER MOTOR BREAKER, 1S301
   d. TRANS ON/OFF, 1S203.

The blower motor will start and filament voltage will be applied to all tubes.

6. Measure the filament voltage at pins 1 and 5 of the 4-400A's (1V301, 1V302, 1V303, and 1V304) with an a-c voltmeter and adjust the filament control, 1R505, to obtain 5 volts across the filaments. Note that the voltage measured at the modulator sockets may be higher than normal since the tubes are not yet in their sockets.

7. Place the TRANS ON/OFF switch, 1S203, in the OFF position.

8. Connect the tap on the buffer plate coil, 1L601, to the desired frequency as shown in Table 3. Place the TRANS ON/OFF and the PLATE ON/OFF switches in the ON position. Place the 11-POSITION METER switch, 1S201, in the AMP Ig position. Note the meter reading. It may be necessary to select an adjacent tap on the buffer plate coil, 1L601, to obtain maximum amplifier grid current.

TABLE 3. BUFFER COIL, 1L601, SETTINGS

Frequency in KC	*Tap*
535 to 620	Full Coil
630 to 810	1
820 to 1040	2
1050 to 1350	3
1360 to 1620	4

9. Place the PLATE ON/OFF and the TRANS ON/OFF controls in the OFF position.

10. The frequency determining capacitors are supplied under MI-27691. These capacitors must be installed in various values and combinations as listed in Table 4 according to the transmitter's frequency and load impedance. Connect them according to the schematic diagram.

11. Adjust the shorting strap on the harmonic filter coil, 1L302, to leave 5 turns in the circuit.

12. Refer to the Tuning Charts, figures 4 and 5, and adjust the shorting straps on the PA tank coil, 1L301, and the second harmonic trap coil, 1L304, according to the assigned frequency.

CAUTION: Make certain that the coil clip on the shorting strap on 1L301 does not touch the adjacent turns on the coil.

13. Place the TRANS ON/OFF switch in the ON position and operate the POWER RAISE/LOWER control, 1S202, until the motor driven power output resistor, 1R405, is at the mid-point of its travel.

14. Place the TRANS ON/OFF switch in the OFF position. Place the 4-400A modulator tubes (1V303, 1V304) and the 8008 HV rectifier tubes (1V401, 1V402) in their sockets. Connect the plate cap on each modulator tube (4-440A) and the plate cap on 1V401 (8008) only.

15. Place the TRANS ON/OFF control in the ON position, and operate the transmitter in this manner for at least 30 minutes to expel the mercury globules from the filaments of the rectifier tubes.

16. Refer to Step 6 and check that the specified filament voltage is being maintained on all tubes.

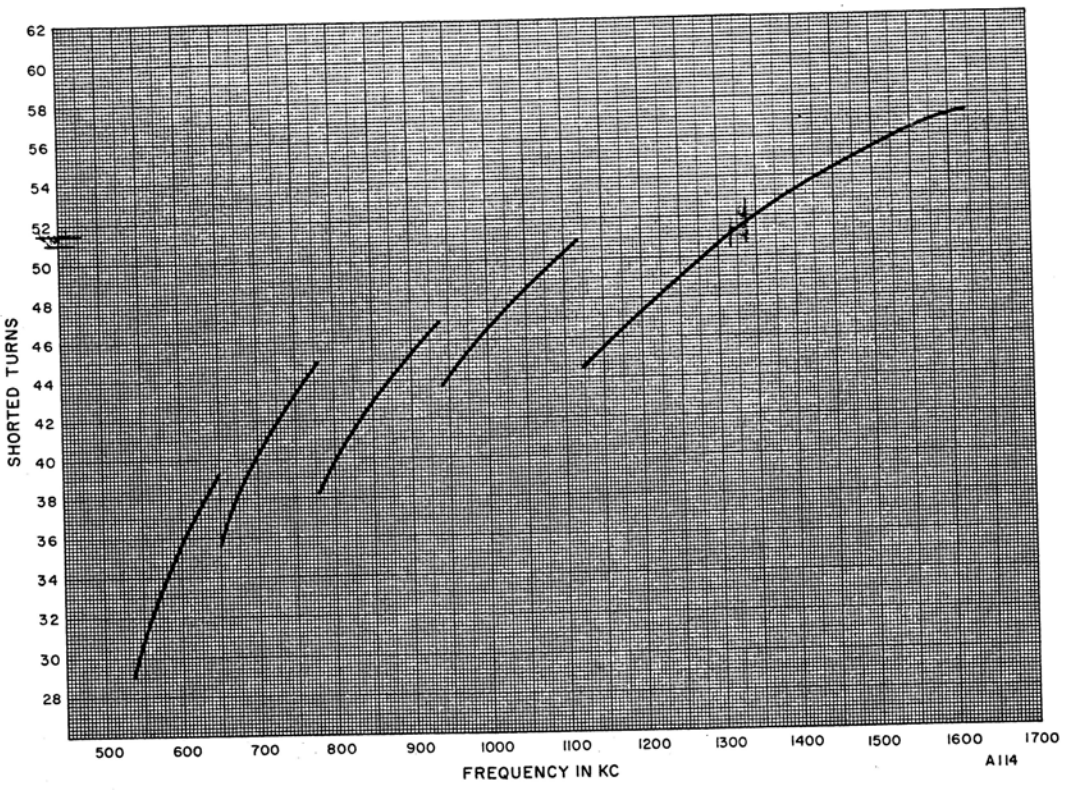


Figure 4. Tuning Chart, PA Tank, Coil 1L301 Jumper Connections

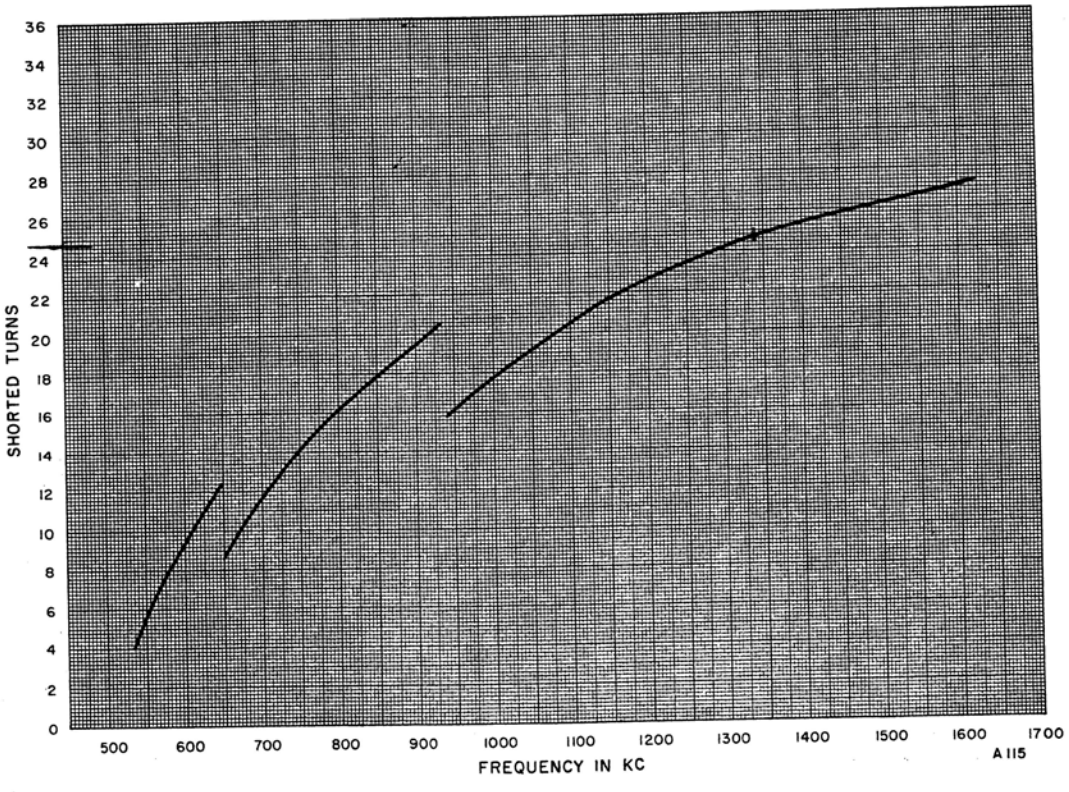


Figure 5. Tuning Chart, Second Harmonic Trap, Coil 1L304 Jumper Connections

TABLE 4. BTA-1R FREQUENCY-DETERMINING PARTS

Output Line (Ohms)	Frequency (KC)	1C304 (μμf)	1C305 (μμf)	Connect 1C304, 1C305	1C308 (μμf)	1C309 (μμf)	Connect 1C308, 1C309	1C306 (μμf)	1C307 (μμf)	Connect 1C306, 1C307	1C324 (μμf)
51.5	535–640	1500	1500	Series	10000	—	Parallel	10000	10000	Series	620
	650–770	1300	1300	Series	8200	—		8200	8200	Series	510
	780–930	1000	1000	Series	6200	—		6200	6200	Series	510
	940–1110	100	330	Parallel	3300	3300		6200	6200	Series	360
	1120–1330	620	620	Series	10000	10000	Series	1000	1300	Parallel	360
	1340–1620	620	620	Series	3900	—		1000	1000	Parallel	360
72	535–640	1500	1500	Series	10000	—	Parallel	10000	10000	Series	620
	650–770	1300	1300	Series	8200	—		8200	8200	Series	510
	780–930	1000	1000	Series	6200	—		6200	6200	Series	510
	940–1110	100	330	Parallel	3900	1300		6200	6200	Series	360
	1120–1330	620	620	Series	3900	—		1000	1300	Parallel	360
	1340–1620	620	620	Series	3900	—		1000	1000	Parallel	360
230	535–640	1500	1500	Series	3900	1300	Parallel	10000	10000	Series	620
	650–770	1300	1300	Series	3300	1300	Parallel	8200	8200	Series	510
	780–930	1000	1000	Series	3900	—		6200	6200	Series	510
	940-1110	100	330	Parallel	1300	1300	Parallel	6200	6200	Series	360
	1120–1330	620	620	Series	1300	1300	Parallel	1000	1300	Parallel	360
	1340–1620	620	620	Series	1000	1000	Parallel	1000	1000	Parallel	360

TABLE 5. OUTPUT NETWORK TUNING

Step	Switches or Breakers		Component	Operation	Procedure
	Control	Position			
1	TRANS PLATE	ON ON	1L301	Quickly rotate the AMP TUNING control until a minimum reading is obtained on the AMP PLATE CURRENT meter.	If a minimum dip cannot be obtained, place the PLATE ON/OFF control in the OFF position and move the shorting strap on the PA Tank Coil, 1L301, one turn in either direction. It may be necessary to repeat this procedure, moving the shorting strap on 1L301 up or down until a minimum reading is obtained on the AMP PLATE CURRENT meter. IMPORTANT—To insure optimum transmitter efficiency, the final tuning adjustment of 1L301 should be such that minimum plate current is obtained with the tuning slug just out of the coil. *Caution: Make certain that the coil clip on the shorting strap on 1L301 does not touch the adjacent turns on the coil.*
2	PLATE TRANS	OFF OFF	(8008) 1V402	Connect the plate cap.	Place the TRANS ON/OFF and PLATE ON/OFF controls in the ON position and repeat step 1.
3	TRANS	ON	1C324 1L304	Measure and note the RF voltage across this capacitor using an R-F Detector (such as shown in figure 6).	Place the PLATE ON/OFF control in the OFF position. Move the shorting strap on 1L304 up or down until maximum voltage is obtained. The 2nd Harmonic Trap, 1L304 and 1C324, will be tuned on the second harmonic of the carrier frequency when the shorting strap is connected to the coil turn giving maximum voltage output. (See Note.)

NOTE: Alternatively, the second harmonic trap may be adjusted by using a receiver tuned to the second harmonic and adjusting for a minimum signal.

TABLE 5. OUTPUT NETWORK TUNING (Continued)

4	PLATE	OFF	1L302	Adjust shorting strap on 1L302 to obtain 95% of rated RF power, then adjust AMP TUNING control for rated power output.	Move the shorting strap on the Harmonic Filter, 1L302, tap by tap, in the direction of increasing inductance. Note the power output. Continue to move the shorting strap and, with each change of tap, adjust the AMP TUNING control for a minimum reading on the AMP PLATE CURRENT meter. If a minimum dip in plate current cannot be obtained, repeat step 1. At the point of tuning where 95% of power is obtained simultaneously with minimum plate current, turn the AMP TUNING control counterclockwise until the rated power output is indicated on the output meter.

TABLE 6. FINAL TUNING ADJUSTMENTS

Step	*Switches or Breakers*		*Component*	*Operation*	*Procedure*
	Control	*Position*			
1	TRANS PLATE	ON ON	1R402 1R403	Adjust bias potentiometers for a 30% indication on PERCENT meter.	Place the PERCENT meter control to 2nd AF I_{K-L}, then to 2nd AF I_{K-R} and adjust 1R402 and 1R403 so that the meter reading is identical for each position.
2	TRANS PLATE	ON ON	C101, C102 or C103	Crystal unit trimmer adjustment for carrier frequency correction.	Check the operating frequency with a frequency monitor. If a slight correction in transmitter frequency is indicated, adjust trimmer C101, C102, or C103 with an insulated alignment tool. *Note: Whenever the station's Frequency Monitor is disconnected from the Frequency Monitor connector, 1J601, this connector should be grounded.*
3	PLATE TRANS	OFF ON	1L305	Adjusting modulation monitoring coil for required output.	Connect a modulation monitor to tap #1 of the Modulation Monitoring coil, 1L305. Place the PLATE ON/OFF control in the ON position. Check the carrier level on the monitor. It is necessary to move up one tap at a time until a point is reached giving just the required output.
4	PLATE TRANS	OFF OFF	1T501	Setting arc gap on modulation transformer.	Adjust the spacing on the Modulation Transformer, 1T501, until the gaps occasionally flashover on 100% modulation peaks. Then increase the spacing slightly beyond this point.
5	PLATE TRANS	OFF OFF		Disconnect the dummy RF load and connect the antenna transmission line.	Readjust coils 1L301 and 1L302 if necessary. Record all meter readings and tap settings. Typical Panel meter readings are given in Table 7 for 1000-watt operation and Table 8 for 500-watt operation.

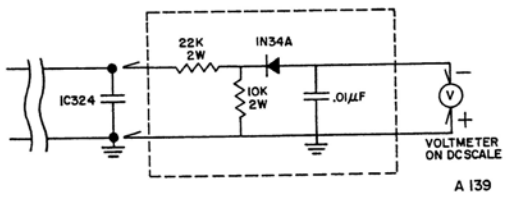


Figure 6. Schematic Diagram, RF Detector

TABLE 7. TYPICAL PANEL METER READINGS

Meter Symbol	*Panel Designation*	*Meter Reading*	*Remarks*		
			Modulation Percentage	*Meter 1M201 Currents*	
				At Reading Indicated	*At 100% Indication*
		1000 WATTS			
1M501	Plate Voltage	3100 v	0–100		
1M502	Amp Plate Current	460 ma	0–100		
1M201	Meter				
	Amp I k-r	105%	0–100	240 ma	233 ma
	Amp I k-l	105%	0–100	240 ma	233 ma
		500 WATTS			
1M501	Plate Voltage	2200 v	0–100		
1M502	Amp Plate Current	335 ma	0–100		
1M201	Meter				
	Amp I k-r	76%	0–100	177 ma	233 ma
	Amp I k-l	76%	0–100	177 ma	233 ma
		250 WATTS			
1M501	Plate Voltage	1550 v	0–100		
1M502	Amp Plate Current	250 ma	0–100		
1M201	Meter				
	Amp I k-r	58%	0–100	135 ma	233 ma
	Amp I k-l	58%	0–100	135 ma	233 ma
		1000 — 500 — 250 WATTS			
1M201	Meter				
	Osc I k-1	100%	0–100	4.5 ma	4.5 ma
	Osc I k-2 (RF Amp)	100%	0–100	50.0 ma	50.0 ma
	Buf Ig	65%	0–100	2.73 ma	4.2 ma
	Buf Ip	75%	0–100	57.0 ma	76.0 ma
	Amp Ig	110%	0–100	19.8 ma	18.0 ma
	1st AF I k-r	65%	0–100	4.7 ma	7.2 ma
	1st AF I k-l	65%	0–100	4.7 ma	7.2 ma
	2nd AF I k-r (Mod)	30%	0 . . .	82.5 ma	275.0 ma
	2nd AF I k-l (Mod)	30%	0 . . .	82.5 ma	275.0 ma
	2nd AF I k-r (Mod)	105%	. . . 100	289.0 ma	275.0 ma
	2nd AF I k-l (Mod)	105%	. . . 100	289.0 ma	275.0 ma

Note 1: Variation in the meter readings of ±20% may be considered normal.

Note 2: Subscripts L and R refer to the left and right tubes.

TABLE 8. TYPICAL PANEL METER READINGS FOR BTA-1R OPERATED AT A RATED OUTPUT OF 500 WATTS

Meter Symbol	*Panel Designation*	*Meter Reading*	*Remarks*		
			Modulation Percentage	*Meter 1M201 Currents*	
				At Reading Indicated	*At 100% Indication*
		500 WATTS			
1M501	Plate Voltage	3100 v			
1M502	Amp Plate Current	230 ma			
1M201	Meter				
	Amp I k-r	55%	0–100	125 ma	233 ma
	Amp I k-l	55%	0–100	125 ma	233 ma
		250 WATTS			
1M501	Plate Voltage	2300 v			
1M502	Amp Plate Current	165 ma			
1M201	Meter				
	Amp I k-r	40%	0–100	92 ma	233 ma
	Amp I k-l	40%	0–100	92 ma	233 ma
		500 — 250 WATTS			
1M201	Meter				
	Osc I k-1	100%	0–100	4.5 ma	4.5 ma
	Osc I k-2 (RF Amp)	100%	0–100	50.0 ma	50.0 ma
	Buf Ig	65%	0–100	2.73 ma	4.2 ma
	Buf Ip	75%	0–100	57.0 ma	76.0 ma
	Amp Ig	110%	0–100	19.8 ma	18.0 ma
	1st AF I k-r	65%	0–100	4.7 ma	7.2 ma
	1st AF I k-l	65%	0–100	4.7 ma	7.2 ma
	2nd AF I k-r (Mod)	30%	0 . . .	82.5 ma	275.0 ma
	2nd AF I k-l (Mod)	30%	0 . . .	82.5 ma	275.0 ma
	2nd AF I k-r (Mod)	105%	. . . 100	289.0 ma	275.0 ma
	2nd AF I k-l (Mod)	105%	. . . 100	289.0 ma	275.0 ma

Note 1: Variation in the meter readings of ±20% may be considered normal.

Note 2: Subscripts L and R refer to the left and right tubes.

Power Cutback Operational Check

Because of inherent differences in components, the efficiency and loading of each transmitter must be considered individually. The total resistance obtained by the connection arrangements shown in figure 3 applies to the typical values given in Table 7 or Table 8. It may be necessary when loading the antenna to change the resistance of a particular network from that shown in figure 3, e.g., to add resistance to the circuit by removing the shorting strap from 1R801 on decrease the resistance by shorting out additional resistors. However, the final connections should be such that the voltage developed across a network is still approximately evenly divided between relays 1K801 and 1K804.

Operate the transmitter at rated day power output, with the output control, 1R405, set at approximately mid-point. Press the DAY-NIGHT switch, 1S212, to the NIGHT position. Refer to the appropriate power level given in Table 7 or Table 8 and observe the readings on the panel meters.

Place the PLATE ON-OFF and TRANS ON-OFF switches in the OFF position. Readjust the total resistance of the cutback circuit by moving the tap on R808 and, if necessary, by shorting out one or more resistors. Repeat this procedure until the combination of resistors is obtained that gives the proper value of resistance for the licensed NIGHT antenna or common point current.

CONELRAD

Impedance Matching Network

The impedance match between the transmission line and the antenna will be disrupted when the transmitter is switched from the main frequency to a Conelrad frequency. Therefore, some switching arrangement must be provided to adjust the antenna tuning unit to match the impedance of the transmission line to the antenna, so that the transmitter when switched to Conelrad operates into a resistive load of the proper value.

The impedance of the antenna must be measured at the Conelrad frequency and the antenna matching network then tuned to match the antenna to the transmission line. An R-F bridge should be used.

It may be necessary to add another capacitor and to select a different tap on the coils of the existing antenna matching network in order to tune it to the Conelrad frequency.

An R-F contactor controlled by auxiliary relays can be used to switch the antenna matching network from main frequency to a Conelrad frequency. Also available is an unwired set of contacts on relay 1K704 that may be connected for this purpose.

Conelrad Tuning

The addition of the Conelrad Kit components to the output circuit may cause a slight de-tuning of the transmitter on the main frequency. Therefore, before tuning to a Conelrad frequency, check the operation of the transmitter on the main frequency and make any tuning readjustments required to compensate for this detuning effect.

If this is the initial installation of both the transmitter and the Conelrad Kit, complete the main frequency tuning procedure first, before tuning to a Conelrad frequency.

The following tuning procedure assumes that a circuit check of the Conelrad Kit installation has been made to determine all circuits function properly.

1. Make certain the PLATE ON-OFF and TRANS ON-OFF switches are in the OFF position.

2. Check that the Conelrad switching contractor, 1K704, is connected to the appropriate tap on coil 1L601 as indicated in Table 3.

3. Connect the Conelrad shorting tap to the appropriate turn of coil 1L301 as indicated in Table 9. Connect the Conelrad output tap near the top (ground side) of 1L301.

4. Operate the transmitter at reduced power. If the transmitter does not have power cutback switching facilities, remove the plate cap from one of the 8008 tubes.

WARNING

THE *PLATE* SWITCH MUST BE TURNED *OFF* BEFORE EACH TAP ADJUSTMENT IS MADE TO COIL 1L301.

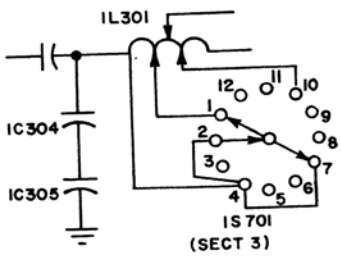
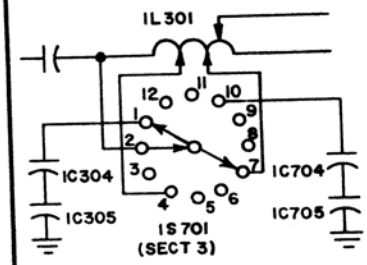
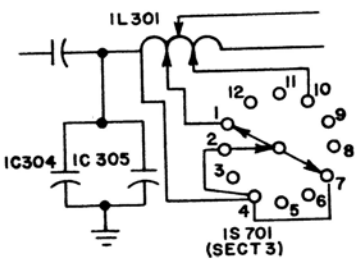
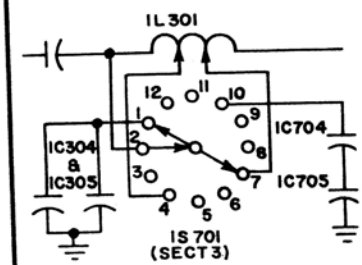
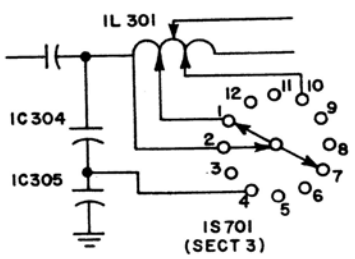
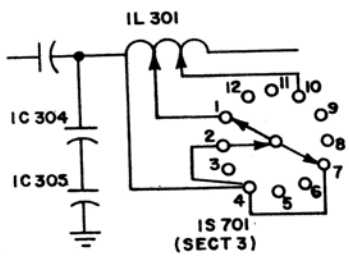
5. Place the PLATE ON-OFF and TRANS ON-OFF switches in the ON position. Observe the plate current indication. Adjust the Conelrad shorting tap on 1L301 until a dip in plate current is obtained.

6. Slide the Conelrad output tap away from the ground side of 1L301 until the transmitter is loaded approximately 30%.

7. Restore the transmitter to full power and check the plate current.

8. Repeat steps 4, 5, and 6 until proper loading is obtained at minimum plate current.

TABLE 9. CONELRAD TANK CONNECTIONS AND SETTINGS

STANDARD BROADCAST FREQUENCY RANGE	CONELRAD 640 KC		CONELRAD 1240 KC	
	IL 301 SHORTED TURNS	CAPACITOR CONNECTIONS	IL 301 SHORTED TURNS	CAPACITOR CONNECTIONS
535 - 640 KC 650 - 770 KC 780 - 930 KC	39 35 27		48	
940 - 1110 KC	10		48	
1120 - 1620 KC	33		48	

A140

OPERATION

In routine operation, it is necessary to operate the PLATE ON/OFF and TRANS ON/OFF switches for stopping the transmitter. All other circuit breakers and switches should be left in the ON position at end of each shut-down.

Where unusual conditions make it desirable to employ additional heating time for the rectifier tube filaments before applying plate voltage, operate only the TRANS switch to the ON position and after the required interval, operate the PLATE switch to the ON position. Normally, sufficient warm-up time is provided by the plate time-delay relay except for abnormally low ambient temperature.

To interrupt transmission for a short interval, operate only the PLATE switch to OFF. This will maintain filament power on the tubes, and the transmitter will be returned to immediate operation when the PLATE switch is closed.

For stability, the crystal heaters are intended to be operated at all times, except when the transmitter is to be shut down for extended periods. Therefore, the external switch controlling crystal heater power should not be opened at routine shut downs. The crystal units require a minimum of 30 minutes warm-up time before operating the transmitter.

If an overload occurs, plate power will be removed from the transmitter. After the cause of the overload has been corrected, operate the over-load re-set switch on the front panel to place the transmitter back on the air.

Day-Night Switching

To switch the transmitter to reduced power for night operation, press the DAY-NIGHT switch on the front panel to the NIGHT position. To return the transmitter to day power output, press the DAY-NIGHT switch to the DAY position.

MAINTENANCE

General

With ordinary care a minimum of service will be required to keep the BTA-1R transmitter in operation. To avoid interruptions during broadcasts, however, a regular schedule of inspection should be established. Table 10, a recommended schedule for the transmitter, should be correlated with other station equipment maintenance to insure overall peak efficiency.

Always open the LINE circuit breaker and discharge circuits with a grounding stick before touching any component.

TABLE 10. RECOMMENDED OVERALL MAINTENANCE SCHEDULE

— DAILY —
— Check and compare all meter readings at start-up. Adjust filament voltages if necessary. Take steps to correct any condition revealed by abnormal reading. — Check filament voltages every hour, for increased tube life. — Make general visual inspection after shut-down. — If overloads have occurred, examine components concerned at shut-down, and repair or replace as necessary.
— WEEKLY —
— Clean internal parts of transmitter. Use clean, soft cloth on insulators. Use a vacuum cleaner or hand blower for removing dust or dirt. — Test all door interlocks and grounding switches. — Check PA and output r-f circuits for evidence of heating at connector or junction points. — Make overall check of distortion and noise level.
— MONTHLY —
— Check spare crystal in operating crystal socket. — Check condition of relay contacts. Service if necessary. — Check and record tube socket voltages. Compare with previous readings to detect irregularities. — Inspect air filter. Clean, if necessary, using a vacuum cleaner or brush. — Inspect blower wheel blades and remove accumulation of dirt, if necessary.
— QUARTERLY —
— Operate all spare mercury-vapor rectifier tubes for 30 minutes, filament only. — Lubricate all tuning drive mechanism gears and bearings. Use petrolatum, Lubriplate No. 110, or equivalent. — Clean air filter.
— SEMI-ANNUALLY —
— Inspect relay contacts and replace where required. — Test spare tubes. — Tighten all connections in transmitter.

Cleaning

Ceramic insulators and bushings should be kept clean at all times. Insulators subject to stress in high-voltage d-c fields may rupture if sufficient dust accumulates to cause corona discharge. Clean insulators by using a soft clean cloth. Insulator details are shown in figure 11. Other pertinent insulator data such as dimensions, stock number, etc. is given in Table 13.

Keep tube envelopes clean to avoid possible puncture of the glass due to ion bombardment or corona. Tissue paper and alcohol are effective for this purpose.

Clean plate tank coils with a dry cloth. NEVER USE LIQUID POLISH OR STEEL WOOL ON THESE ITEMS. Avoid any scratches on the silver-plated surfaces.

Keep safety gaps clean. If gaps are pitted, polish them with crocus cloth.

Periodic inspection of circuit breakers and relays should be made, and at such time all contacts should be cleaned and adjusted if necessary.

Relay contacts should be cleaned with carbon tetrachloride applied with a soft brush, after which they should be burnished with a tool such as the RCA stock No. 22963 Contact Cleaning Tool. Finally, contacts should be wiped with a clean piece of bond paper.

Overload Relays

The sensitivity of the overload relays is controlled by spring tension. This is set at the factory and usually no further adjustment is required. However, if the transmitter shuts down without apparently overloading, the sensitivity of the overload relays should be checked. Table 11 shows the nominal energizing voltage required to trip each relay. Refer to figure 13 for the location of the relays and to the schematic diagram for their electrical connections.

TABLE 11. OVERLOAD RELAY SETTINGS

Symbol	*Function*	*Voltage*
1K401	HV Overload	1V
1K603	Modulation Overload	1V
1K605	LV Overload	½V
1K606	PA Overload	1V

To check the relays an external source of power is needed, along with a control network consisting of a VoltOhmyst (or similar instrument) and a variable resistor. A convenient source of power is a battery cell, capable of supplying the energizing voltage indicated in Table 11. The variable resistor, in conjunction with the voltmeter, is used to maintain the output of the battery at the levels shown in Table 11.

Before applying power to the relays, the panel meters in the relay circuits should be shorted. This will prevent the meters from possible damage should there be excessive meter deflection while the variable resistor is being adjusted.

Ground the negative side of the battery, and connect the positive side, through the variable resistor, to the appropriate tube filament or other point as indicated by the schematic.

The contacts on the overload relays should just close at the voltage values shown in Table 11. If a relay trips at a voltage other than shown, re-set the sensitivity of that relay by turning the spring tension screw (visible through the hex locking nut on the front of the relay). Turning the screw in a clockwise direction reduces the spring tension, thus increasing the sensitivity; conversely, counterclockwise rotation of the screw will reduce the sensitivity of the relay.

Fuses

In addition to the overload relays and circuit breakers, two 1 amp fuses, 1F601 and 1F602, are connected in the input line to the crystal heaters.

Control Components

The components for the operating controls on each front panel are located on a sub-chassis which is bolted on the back of each front panel. The sub-chassis can be removed from inside the front of the cabinet, thus making any component that might require replacement readily accessible.

To remove the sub-chassis from the rear of the right side control panel, take the AMP TUNING and FILAMENT control knobs off their shafts and remove the handles from OL RESET switch and the CRYSTAL switches. Disconnect the AMP TUNING cable from the cable drum; then remove the six nuts from the sub-chassis mounting bolts. Take care not to kink the control cable tubing when lifting the sub-chassis free and provide adequate support to the sub-chassis so that the wiring connected to the control components is not subjected to undue strain. When removing the left side sub-chassis follow the same procedure, first disconnecting resistor 1R202 from switch 1S201.

Tubes

Check all tubes periodically. Tube failure can be anticipated by keeping a log of tube life and replacing tubes when indicated by the log or when reduced output is apparent. Typical tube voltages are given in Table 12.

Before use, each spare mercury-vapor rectifier tube should be conditioned or "seasoned" by operating it for a minimum of 30 minutes with only filament voltage applied. Store the tubes in an upright position afterward. Take care not to tip the tube or to

TABLE 12. BTA-1R TUBE SOCKET VOLTAGES

Tube	Type	Function	Plate		Cathode		Grid		Screen		Filament	
			Pin No.	Volts DC	Pin No.	Volts DC	Pin No.	Volts DC	Pin No.	Volts DC	Pin No.	Volts AC
1V101	6AK5	Oscillator	5	165	7	1	1	—	6	75	3-4	6.3
1V102	5763	R-F Amp	1	220	7	1	8.9	—	6	192	4-5	6.0
1V601	6146	Buffer	Cap	550	1,4,6	—	5	−60	3	180	2-7	6.3
1V603	2E26	1st AF_R	Cap	400	1,4,6	40	5	21	3	165	2-7	6.3
1V604	2E26	1st AF_L	Cap	400	1,4,6	40	5	21	3	165	2-7	6.3
1V301	4-400A	Amp_R	Cap	3000	—	—	3	−400	2,4	500	1-5	5
1V302	4-400A	Amp_L	Cap	3000	—	—	3	−400	2,4	500	1-5	5
1V303	4-400A	Mod_R	Cap	3100	—	—	3	−145	2,4	750	1-5	5
1V304	4-400A	Mod_L	Cap	3100	—	—	3	−145	2,4	750	1-5	5

splash mercury on the tube elements after "seasoning." If mercury is splashed on the elements, it will be necessary to reseason the tube. Spare mercury-vapor rectifier tubes should also be seasoned every three months due to gradual absorption of mercury-vapor by the filament.

Feedback Ladders

Excessive distortion may result if there is unbalance in the feedback ladders, 1Z301 and 1Z302. Unbalance is usually caused by an open or a shorted capacitor in the feedback ladder network. If excessive distortion or excessive unbalance of the 2E26 cathode currents exists, a check of the feedback voltages can be made at terminals 8 and 9 on the secondary of the Audio Input Transformer, 1T601. The d-c voltage measured from each terminal to ground should be approximately 21 volts and the two voltages should be balanced within approximately 2%. If the d-c voltages are unbalanced by more than 2%, the resistors are unbalanced and the ladders should be checked for a defective resistor.

To check the feedback capacitors, apply a 1000-cycle signal to the transmitter input at approximately 50% modulation and measure the a-c voltages at terminals 8 and 9 of the input transformer, 1T601, to ground with a VoltOhmyst or other a-c voltmeter. Again, the voltages should be balanced within 2%. A balance exceeding 2% indicates a defective capacitor.

PRINTED CIRCUITS

In general, the same techniques used in servicing wired chassis work equally well in servicing printed circuit boards. Circuit analysis and trouble shooting procedures remain the same, as does the test equipment normally utilized for this purpose. However, the methods usually used in replacing components on a wired chassis must be amended slightly to suit the physical characteristics peculiar to printed circuit board construction. In addition, the board itself may, on occasion, require repairs due to surface blisters or cracks.

The following information and accompanying illustrations, figures 7, 8, 9, and 10, are intended to acquaint the reader with the accepted practices used in repairing printed circuit boards and in replacing components.

During the actual soldering process, it is of the utmost importance that only enough heat necessary to melt the solder be applied to the printed wiring or component connection. Excessive heat or heat applied for a long duration will cause the adhesive that holds the copper foil to the board to lose its adhesive qualities. This, in turn, will cause the printed circuitry to become separated from the board.

Equipment

Low wattage soldering iron, 35 to 50 watts
Diagonal cutters
Long nose pliers
Solder aid or scribe
Small knife
Single edge razor blade
Small stiff bristle brush
Camel hair brush
Solvent such as denatured alcohol or lacquer thinner.
Clear lacquer.

Board Repair

When the crack runs under the circuit path, drill a 1/16 inch hole at each end of the crack. This will prevent the crack from lengthening.

To repair a break in the printed wiring, place a piece of tinned bus wire across the broken printed wiring. Hold the bus wire in place with a soldering aid or scribe. Heat the bus wire with a soldering iron and flow on low-temperature solder along the length of bus wire. Use a solvent to clean the soldered area.

If there is a blister on an open area of the board, peel the blistered area with a razor blade. Smooth AT-N wax over this area until level with the board, and then apply a coating of lacquer over the waxed area with a camel hair brush.

If the blister is under the printed wiring, do not peel if off the board. Clean the blistered area thoroughly with a solvent and solder piece of bus wire over the conductor to extend beyond the limits of the blister. Then apply a coat of clear lacquer over the blistered area with a camel hair brush.

If there is a severe crack in the board running through the printed wiring, a support must be used to relieve the strain. This can be done by drilling a 1/16 inch hole in each side of the crack, first making certain that there are no components or adjacent printed wiring on the side opposite the holes. Form a piece of wire into a "U" and insert it through the holes so that the loop portion is on the under side of the board. Bend the protruding ends of wire flat against the printed wiring and then solder them to the surface of the printed wiring.

Component Replacement

Remove the defective component by clipping the component leads so as to leave approximately 1/4 inch of lead protruding through the board. Form each of these wire ends into a loop with long nose pliers. Run the replacement components leads through the loops, twisting them to make a solid mechanical connection and then solder. Keep tension on each lead through the board while soldering so that any overheating can be quickly detected.

Particular care should be exercised when replacing single-ended components, such as transformers, coils, and electrolytic capacitors. These components are mounted vertically on the board and they must be unsoldered from the printed side of the board.

To remove a multi-element component, e.g., a socket with six or eight terminals, hold the wired side down if possible and apply heat to each terminal in turn. When most of the excess solder has been removed, repeat the unsoldering process, this time

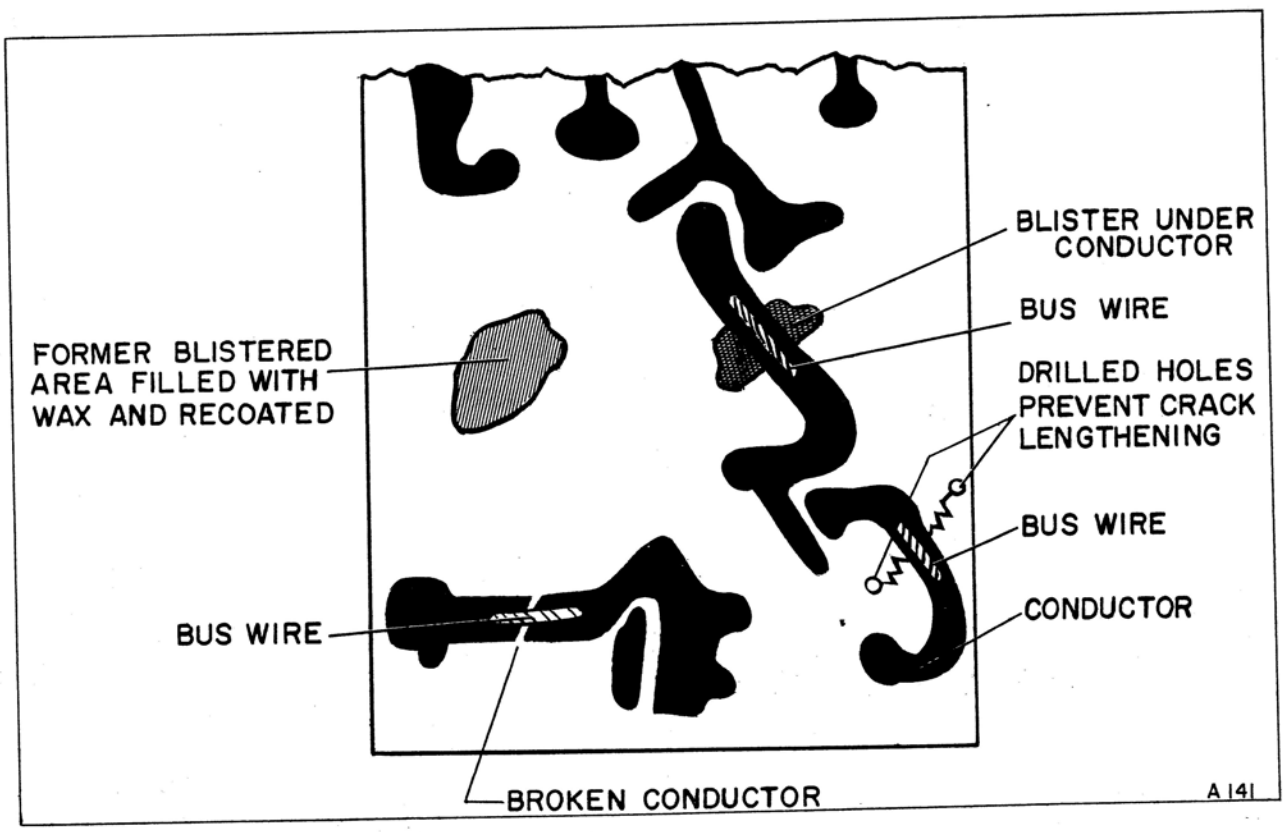


Figure 7. Repair of Surface Damage to Board and Printed Wiring

using a knife or soldering aid to pry up the socket terminals from the printed foil. Use a small stiff brush to clean off any remaining solder from the terminals. In some instances it may be more convenient to remove the tube socket from the top of the board. Use a pair of diagonal cutters to clip the socket terminals between the base of the socket and the top of the board. Then apply just enough heat to loosen the socket terminals so they can be removed freely from the printed wiring with a pair of long-nose pliers.

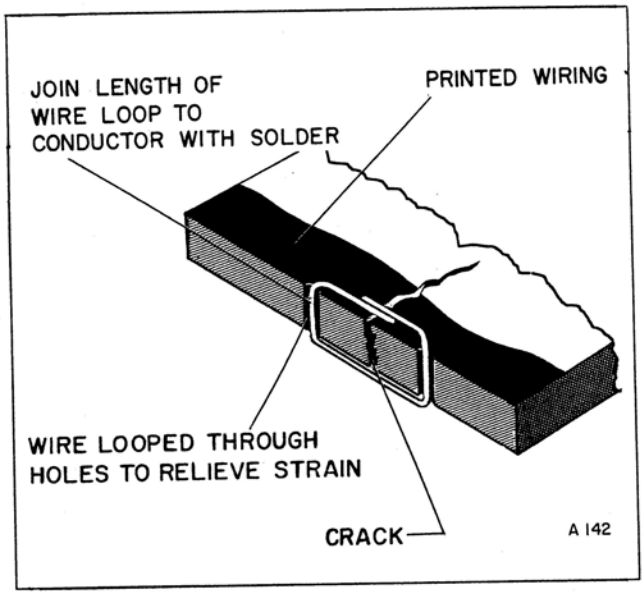


Figure 8. Repair of Severe Crack through Board and Printed Wiring

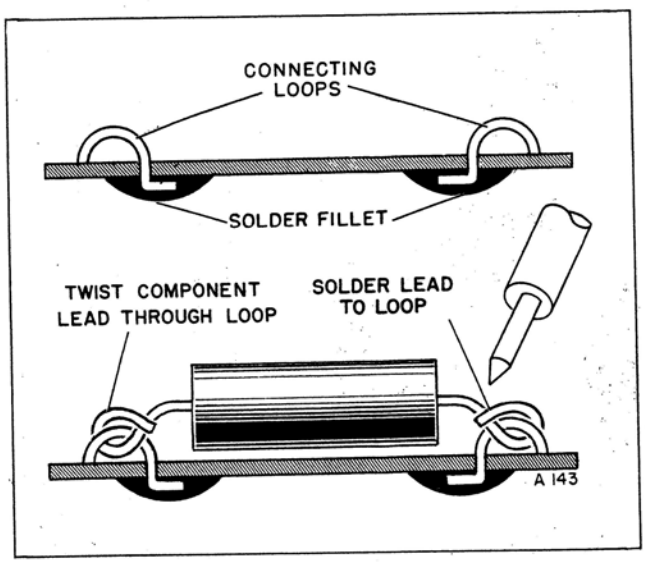


Figure 9. Replacing Double-Ended Component

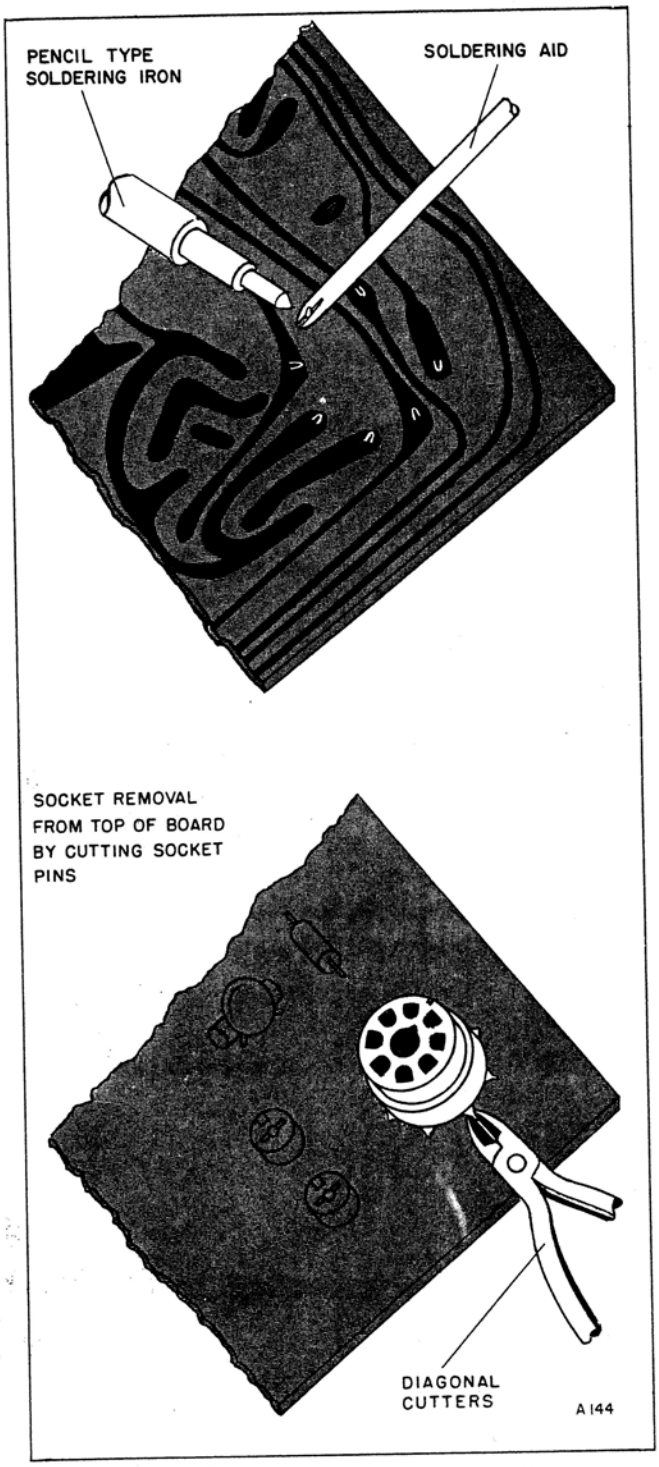


Figure 10. Removal of Multi-Element Component

TABLE 13. INSULATOR DATA

Type Designation	Stock No.	Drawing No.	Figure	Dimensions in Inches								Tap Size
				A	B	C	D	E	F	G	H	
NS5WP104	211423	426765-3	I	3/8	1/2	.16	—	—	—	—	—	.138-32
NS5W0108	208116	426765-12	I	3/8	1	.38	—	—	—	—	—	.138-32
NS5W0110	212086	426765-15	I	3/8	1 1/4	.38	—	--	--	—	—	.138-32
NS5W0116	217752	416765-21	I	3/8	2	.38	—	—	—	—	—	8-32
NS5W0208	210376	426766-9	I	1/2	1	3/8	—	—	—	—	—	1/4-20
NS5WP412	55800A	426768-6	I	1	1 1/2	1/2	—	—	—	—	—	10-32
NS5W1208	210084	426773-3	II	3/4	1	3/8	—	--	--	—	--	10-32
NS5W1210	209664	426773-6	II	3/4	1 1/4	3/8	—	—	—	—	—	10-32
NS5W1212	209711	426773-9	II	3/4	1 1/2	3/8	—	—	—	—	—	10-32
NS5W2012	51781A	426762-6	III	1/2	1 1/2	3/8	1	—	—	—	—	8-32
NS5W2501	48459A	99067-6	IV	25/32	1 3/8	—	2 1/8	—	—	—	—	—
NS5W4101	211247	426764-3	V	5/8	1/4	15/64	1/2	.143	3/8	—	—	—
NS5W4104	210340	426764-12	V	15/16	9/16	47/64	1 1/8	.200	1	—	—	—
NS5W4201	211246	426764-53	VI	3/8	1/4	1/4	1/2	.143	3/8	—	—	—
NS5W4502	51088A	426761-12	VII	1 1/8	7/16	7/8	1 3/4	1/16	1	1 1/4	17/64	—

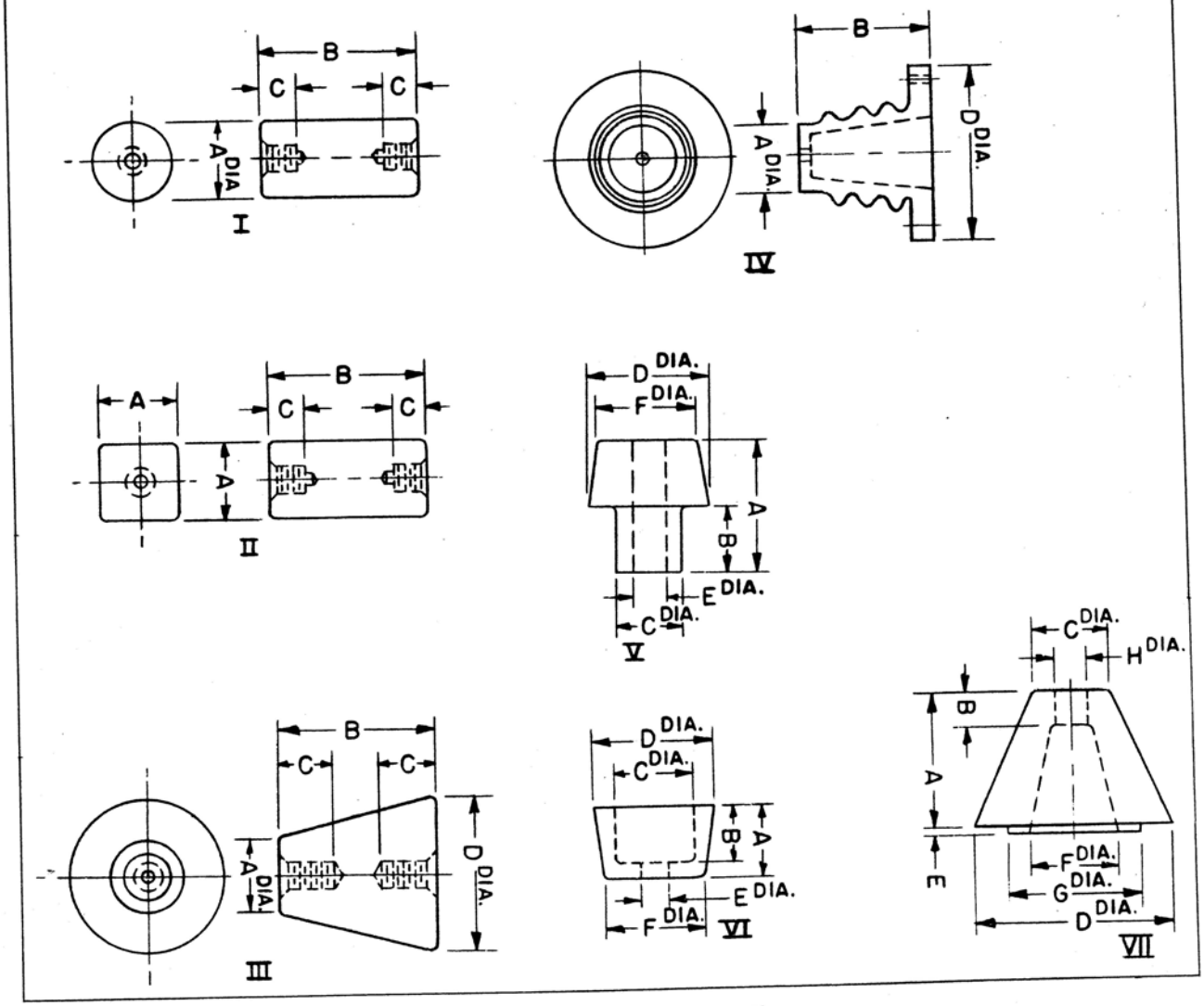


Figure 11. Insulator Details

RECOMMENDED STATION SPARES

Symbol No.	Stock No.	Drawing No.	Description	Qty.
1C201 to 1C204	610003	36655-503	Capacitor: meter by-pass, 0.01 μf, 1200 v	1
1C301, 1C302, 1C310, 1C311	217987	990701-83	Capacitor: filament by-pass, .033 μf, 1200 v	2
1C303	96173	990705-242	Capacitor: plate blocking, 620 μμf ±5%, 10,000 v	1
1C312	601002	728647-41	Capacitor: screen by-pass, 1000 μμf ±20%, 2500 v	1
1C313	215595	940173-102	Capacitor: plate by-pass, 500 μμf, 30 kv	1
1C314 to 1C317, 1C319 to 1C322	215600	8843560-17	Capacitor: feed-back, 300 μμf, 5000 v	2
1C318, 1C323	68466	728647-365	Capacitor: feed-back, 0.01 μf ±2%, 1200 v	2
1C601	39670	727866-165	Capacitor: fixed, mica, 5600 μμf ±10%, 500 v	1
1C602	39662	727866-147	Capacitor: fixed, mica, 1000 μμf ±10%, 500 v	1
1C603	610003	728647-65	Capacitor: fixed, mica, 0.01 μf ±20%, 2500 v	1
1C604	601002	728647-41	Capacitor: fixed, mica, 1000 μμf ±20%, 2500 v	1
1C608	18501	990193-8	Capacitor: fixed, paper, 10 μf ±10%, 600 v	1
1C609	56124	984678-8	Capacitor: fixed, paper, 1 μf ±10%, 600 v	1
1C613	218307	8976364-1	Capacitor: fixed, paper, 0.05 μf, 2500 v	1
1C401, 1C402	209618	990193-127	Capacitor: fixed, paper, 6 μf ±10%, 4000 v	1
1C403, 1C404	57017	450184-4	Capacitor: fixed, paper, 10 μf, 400 v	1
1C406	55018	863691-2	Capacitor: motor, 1.2 μf	1
1C501	97537	990193-184	Capacitor: fixed, paper, 1 μf ±10%, 7500 v	1
1C502	76578	984663-21	Capacitor: fixed, mica, 100 μμf ±10%, 1000 v	1
1C503, 1C504	204351	990421-193	Capacitor: fixed, paper, 0.1 μf ±10%, 1000 v	1
1C505	218308	8438547-1	Capacitor: high-voltage, 0.05 μf, 7500 v	1
1CR402, 1CR403, 1CR601, 1CR602	215501	459484-7	Rectifier: selenium	2
1CR401	215555	459484-8	Rectifier: selenium	1
1I201	16154	459610-36	"Plate On" lamp	2
1I202	16154	459610-36	"Crystal On" lamp	2
1F601, 1F602	14133	990157-8	Fuse: lamp, 1 amp	3
1K601	215614	8411073-5	Contactor: plate time delay	1
1K602	216988	8412197-3	Relay: plate on	1
1K603, 1K605, 1K606	215504	754291-3	Relay: overload	1
1K604	216181	480070-1	Relay: trans. on latching	1
1K401	215504	754291-3	Relay: H.V. overload	1
1R405	217842	433747-4	Resistor: variable, 400 ohm, 225 w	1
1R402, 1R403	215554	737809-5	Resistor: variable, W.W., 5000 ±20%, 3 w	1
1R505	216027	415724-14	Resistor: variable, 25 ohm, 150 w	1
1R310, 1R315	215588	891769-23	Resistor: fixed, carbon, 62,000 ohm ±1%	2
1R307 to 1R314	215599	8928565-1	Resistor: fixed, precision, 2.2 meg ±1%	2
1S214 to 1S216	54920	8881052-1	Switch: interlock	1
1S301	94357	8836936-1	Switch: blower motor	1
1S210	215947	482740-2	Circuit Breaker: line	1
1S211	215946	482740-1	Circuit Breaker: filament	1

LIST OF PARTS

Symbol No.	Stock No.	Drawing No.	Description
			BTA-IR A-M TRANSMITTER, ES-27238
		755773-501	Equalizer Assembly (1Z501)
C1	210803	990417-124	Capacitor: fixed, paper, 0.068 μf ±10%, 200 v
C2	99630	722031-513	Capacitor: fixed, mica, 10,000 μμf ±5%, 300 v
L1	210804	862943-12	Choke: 5 millihenry
L2	210805	8913168-1	Choke: 60 millihenry
R1,R2		722320-57	Resistor: fixed, composition, 390 ohm ±10%, ½ w
R3 to R6		722320-63	Resistor: fixed, composition, 1200 ohm ±10%, ½ w
R7		722320-65	Resistor: fixed, composition, 1800 ohm ±10%, ½ w
			Crystal Oscillator (1Z601)
C101 to C103	215924	8946100-1	Capacitor: variable, ceramic, 5-25 μμf
C104	59906	748252-211	Capacitor: fixed, mica, 12 μμf ±5%, 500 v
C105	98385	737837-243	Capacitor: fixed, mica, 330 μμf ±10%, 500 v
C106,C107	215921	737837-245	Capacitor: fixed, mica, 390 μμf ±10%, 500 v
C108 to C110	39670	727871-165	Capacitor: fixed, mica, 5600 μμf ±10%, 500 v
C111 to C118	73960	8811182-5	Capacitor: disc, ceramic, 10,000 μμf +100 -20%, 450 v
K101,K102	215601	8410963-1	Relay: crystal switching, 110 v, 60 cycle
L101	215920	8914343-505	Coil: plate choke, 400 uh
R101 to R103		90496-25	Resistor: fixed, composition, 100,000 ohm, ±20% 1 w
R104		90496-17	Resistor: fixed, composition, 4700 ohm, ±20%, 1 w
R105		99126-82	Resistor: fixed, composition, 47,000 ohm, ±10% 2 w
R106		99126-79	Resistor: fixed, composition, 27,000 ohm, ±10%, 2 w
R107	69297	458574-60	Resistor: fixed, wire wound, 4000 ohm, ±5%,10 w
R108	104181	867970-304	Resistor: fixed, wire wound, 0.39 ohm, ±10%, ½ w
R109		90496-117	Resistor: fixed, composition, 18 ohm, ±5%, 1 w
R110		90496-144	Resistor: fixed, composition, 240 ohm, ±5%, 1 w
XV101	209285	8817695-1	Socket: tube, 7 pin miniature
XV102	209284	8817696-1	Socket: tube, 9 pin noval
XV101 to XV103	207707	8817694-1	Socket: octal
1C201 to 1C204	610003	36655-503	Capacitor: mica, 0.01 μf ±20%, 1200 v
1I201		459610-8	Lamp: indicator, "plate on"
	99765	459610-31	Jewel - red
	16154	459610-36	Lamp
	16155	459610-41	Resistor
	99763	459610-46	Socket
1I202		459610-12	Lamp: indicator, "crystal on"
	99768	459610-35	Jewel - blue
	16154	459610-36	Lamp
	16155	459610-40	Resistor
	99763	459610-46	Socket
1M201	215707	486165-2	Meter: multimeter, 0-150%
1M202	216023	459672-129	Meter: filament bus, 0-300 v AC
1R201,1R202	217614	8871557-53	Resistor: fixed, wire wound, 1250 ohm ±1%, 1 w
1S201	215704	480092-2	Switch: meter, rotary, wafer type
1S202	211065	738998-5	Switch: raise lower
1S203	211065	738998-5	Switch: trans on-off
1S204	215702	738998-12	Switch: O.L. reset, plate on-off
1S205	216212	8430345-1	Switch: crystal
1S206 to 1S209			Not Used
1S210	215947	482740-2	Circuit Breaker: line

Symbol No.	*Stock No.*	*Drawing No.*	*Description*
1S211	215946	482740-1	Circuit Breaker: filament
1S212	211065	738998-5	Switch: day-night
1S213			Not Used
1S214 to 1S216	54920	8881052-1	Switch: interlock
1S217 to 1S219	216022	8953364-501	Switch: grounding
			Miscellaneous
	17269	737820-501	Knob (for 1S201)
			CAPACITORS:
1C301,1C302	217987	990701-83	mica, 0.033 μμf ±20%, 1200 v
1C303	96173	990705-242	mica, 620 μμf ±5%, 10,000 v
1C304 to 1C309			see Frequency Determining Kits, MI-27691
1C310,2C311	217987	990701-83	mica, 0.033 μμf ±20%, 1200 v
1C312	601002	728647-41	mica, 1000 μμf ±20%, 2500 v
1C313	215595	940173-102	ceramic, 500 μμf +50 −0%, 30,000 v (replaces old 1000 μμf cap. in early version transmitters)
1C314 to 1C317	215600	8843560-17	mica, 300 μμf ±2%, 5000 v
1C318	68466	728647-365	mica, 0.01 μf ±2%, 1200 v
1C319 to 1C322	215600	8843560-17	mica, 300 μμf ±2%, 5000 v
1C323	68466	728647-365	mica, 0.01 μf ±2%, 1200 v
1C324			see frequency determining kits, MI-27691
1K301	94117	458722-1	Relay: surge suppressor
	206338		Coil: 120 v DC
	206337		Contact: movable
	206336		Contact: stationary
1L301	215598	740486-503	Coil: tank, inductance 230 mh
	215597	740451-7	Coil only
1L302	216296	757431-2	Coil: filter, inductance 57 microhenry
1L303	215593	418486-502	Choke: PA plate
1L304	93612	740230-1	Coil: inductance 40 microhenry
1L305	216788	8434008-501	Coil: mod. monitoring
			RESISTORS:
			Fixed, comp. unless otherwise specified
1R301,1R302		99126-7	100 ohm, ±20%, 2 w
1R303			Not Used
1R304	216020	8702674-507	meter mult.
	52819	8702674-3	resistor only: 0.5 meg ±1%, ½ w
1R305			Not Used
1R306 to 1R309	215599	8928565-1	deposited carbon, 2.2 megohm, ±1%, 1 w
1R310	215588	891769-23	deposited carbon, 62,000 ohm, ±1%, 2 w
1R311 to 1R314	215599	8928565-1	deposited carbon, 2.2 megohm, ±1%, 1 w
1R315	215588	891769-23	deposited carbon, 62,000 ohm, ±1%, 2 w
1R316,1R317	219649	8986541-4	w.w. 3.75 ohm, ±1%, 2 w
1R318,1R319	219648	8986541-3	w.w. 3.16 ohm, ±1%, 2 w
1R320,1R321	219647	8986541-2	w.w. 1.5 ohm, ±1%, 2 w
1R322		99126-25	100,000 ohm, ±20%, 2 w
1R323,1R324		99126-7	100 ohm, ±20%, 2 w
1R325		99126-76	15,000 ohm, ±10%, 2 w
1R326,1R327		99126-7	100 ohm, ±20%, 2 w
1S301	94357	8836936-1	Switch: double pole, enclosed, 250 v AC, heater only
	211743		heater only
1T301,1T302	215591	992045-1	Transformer: filament
1XV301 to 1XV304			Socket: tube
	215589	8413482-1	Plate
		77850-149	Spacer
	215590	8920938-1	Contact
1Z301,1Z302	215596	482771-501	Ladder: feed-back, complete, includes the following: 1C314 to 1C323, 1R306 to 1R315

Symbol No.	Stock No.	Drawing No.	Description
			Miscellaneous:
	51089	7862770-4	Clip: for 1-1/16" dia. ferrule
	95590	8899056-4	Connector: tube
	216709	8833154-2	Clip: for coil 1L301
	96480	8833154-1	Clip: for coil 1L302
	211323	892090-2	Clip: for coil 1L304
1B402	215552	480051-1	Motor: 115 v 60 cy.
1C401, 1C402	209618	990193-127	Capacitor: paper, 6 μf ±10%, 4000 v
1C403, 1C404	57017	450184-4	Capacitor: paper, 10 μf ±10%, 400 v
1C405			Not Used
1C406	55018	863691-2	Capacitor: paper, 1.2 μf 220 v AC
1CR401	215555	459484-8	Rectifier: selenium
1CR402, 1CR403	215501	459484-7	Rectifier: selenium
1K401	215504	754291-3	Relay: H.V. overload
1R401	48568	458574-47	Resistor: fixed, w.w. 1000 ohm, ±5%, 10 w
1R402, 1R403	215554	737809-5	Resistor: variable, w.w. 5000 ohm, ±20%, 3 w
1R404	45515	458574-56	Resistor: fixed, w.w. 2500 ohm, ±5%, 10 w
1R405	217842	433747-4	Resistor: variable, 400 ohm, 225 w
1R406	219670	8986541-1	Resistor: fixed, w.w. 0.75 ohm, ±1%, 2 w
1R407	210643	99031-40	Resistor: fixed, w.w. 8000 ohm, ±5%, 55 w
1T401	215556	992050-1	Transformer: filament
1T402	215553	482736-1	Transformer: plate
1T403	215558	482737-1	Transformer: plate, bias
1T404	215557	8413415-1	Transformer: control
1XV401, 1XV402	219800	3843563-3	Socket: (RCA 8008)
			Miscellaneous:
	209421	8890121-502	Connector: tube cap
	206706	8879208-2	Pad: felt, 2-9/32" lg. x 5/8" w x 1/16" thk.
1B501	215696	8702683-1	Blower: 230 v, 50/60 cy.
1C501	97537	990193-184	Capacitor: fixed, paper, 1 μf ±10%, 7500 v
1C502	76578	984663-21	Capacitor: fixed, mica, 100 μμf ±10%, 1000 v
1C503, 1C504	204351	990421-193	Capacitor: paper, .1 μf ±10%, 1000 v
1C505	218308	8438547-1	Capacitor: paper, 0.05 μf 7500 v
1L501	208210	900289-1	Reactor: modulation
1L502	52038A	900304-2	Reactor: H.V. filter
1M501	216024	482744-23	Voltmeter: P.A. plate 0-4 KV D.C.
1M502	211715	482744-4	Meter: amp. P.A. plate 0-1 amp, D.C.
1R501	19688	99027-39	Resistor: fixed, w.w. 6300 ohm, ±10%, 25 w
1R502	54626	99031-36	Resistor: fixed, w.w. 3150 ohm, ±10%, 55 w
1R503	215698	99029-44	Resistor: fixed, w.w. 20,000 ohm, ±10%, 45 w
1R504	47267	99031-42	Resistor: fixed, w.w. 12,000 ohm, ±10%, 55 w
1R505	216027	415724-14	Resistor: variable, 25 ohm 150 w
1R506	216025	99037-48	Resistor: fixed, w.w. 50,000 ohm, ±10%, 200 w
1R507	215698	99029-44	Resistor: fixed, w.w. 20,000 ohm, ±10%, 45 w
1R508 to 1R511		99126-207	Resistor: fixed, comp. 100,000 ohm, ±5%, 2 w
1R512, 1R513		99126-86	Resistor: fixed, comp. 100,000 ohm, ±10%, 2 w
1T501	215700	486140-1	Transformer: modulation
1T502	215701	992051-1	Transformer: plate
			Miscellaneous:
	217144	8898735-3	Box: control teleflex
		8840193-12	Cable: control, teleflex
	95160	888488-3	Filter: air
	209711	426773-9	Insulator: steatite, 1.5" x 3/4" square
	17269	737820-501	Knob: for 1R505
	216154	8955437-1	Mount: shock
			CAPACITORS:
1C601	39670	727866-165	mica, 5600 μμf ±10%, 500 v
1C602	39662	727866-147	mica, 1000 μμf ±10%, 500 v
1C603	610003	728647-65	Mica, 0.01 μf ±20%, 2500 v
1C604	601002	728647-41	mica, 1000 μμf ±20%, 2500 v
1C605, 1C606			Not used

Symbol No.	Stock No.	Drawing No.	Description
1C607	211133	990193-31	paper, 15 μf ±10%, 1000 v
1C608	18501	990193-8	paper, 10 μf ±10%, 600 v
1C609	56124	984678-8	paper, 1 μf ±10%, 600 v
1C610, 1C611			Not Used
1C612	39664	727866-159	mica, 3300 μμf ±10%, 500 v
1C613	218307	8976364-1	paper, 0.05 μf 2500 v
1CR601, 1CR602	215501	459484-7	Rectifier: selenium
1F601, 1F602	14133	990157-8	Fuse: 1 amp 250 v
1J601	51800	255223-2	Connector: coaxial
1K601	215614	8411073-5	Contactor: plate time delay
1K602	216988	8412197-3	Relay: plate on
1K603	215504	754291-3	Relay: mod. overload
1K604	216181	480070-1	Relay: plate on latching
1K605	215504	754291-3	Relay: L.V., O.L.
1K606	215504	754291-3	Relay: P.A., O.L.
1L601	209621	429932-502	Coil Assembly: buf.plate
1L602	93659	949250-1	Reactor: L.V. filter 10 h., 0.2 A
1P601			Not Used
1P602	216156	8415018-1	Connector: female, 18 contacts
1P603		8949731-1	Connector: phone tip
			RESISTORS:
			Fixed, Composition - Unless Otherwise Specified
1R601		99126-58	470 ohm, ±10%, 2 w
1R602	93644	8871557-15	w.w. 11.5 ohm, ±1%, 1 w
1R603		99126-79	27,000 ohm, ±10%, 2 w
1R604	215507	8871557-45	w.w. 260 ohm, ±1%, 1 w
1R605		99126-20	15,000 ohm, ±20%, 2 w
1R606	97134	458574-82	w.w. 25,000 ohm, ±5%, 10 w
1R607	215509	8871557-47	w.w. 51 ohm, ±1%, 1 w
1R608	219648	8986541-3	w.w. 3.16 ohm, ±1%, 2 w
1R609, 1R610		90496-195	33,000 ohm, ±5%, 1 w
1R611, 1R612		90496-50	100 ohm, ±10%, 1 w
1R613	215511	8871557-48	w.w. 132 ohm, ±1%, 1 w
1R614		99126-175	4700 ohm, ±5%, 2 w
1R615	215511	8871557-48	w.w. 132 ohm, ±1%, 1 w
1R616	52075	458574-80	w.w. 20,000 ohm, ±5%, 10 w
1R617	53702	458574-90	w.w. 56,000 ohm, ±5%, 10 w
1R618 to 1R624			Not Used
1R625	96536	458574-67	w.w. 8000 ohm, ±5%, 10 w
1T601	93800	949347-1	Transformer: input
1T602, 1T603	215512	8412123-1	Transformer filament
1XF601, 1XF602	48894	99088-2	Holder: fuse
1XV601 to 1XV604	68590	99391-1	Socket: tube, octal
1Z601			Oscillator: crystal
			Miscellaneous:
	42736	99045-4	Clip, for 13/16" dia. ferrule
	53325	99045-5	Clip, for 9/16" dia. ferrule
	215612	8928515-1	Knob: brass, 1-1/4" lg. x 3/8" dia.
COLELRAD KIT, MI-34309-5			
1C701	93849	442901-23	Capacitor: electrolytic, 10 μf 250 v
1C702	56616	442901-21	Capacitor: electrolytic, 50 μf 150 v
1C703	219919	984610-77	Capacitor: paper, 0.47 μf ±20%, 600 v
1CR701	220181	459484-9	Rectifier: selenium
1K701, 1K702	220213	627511-63	Relay: switching aux., 110 v 60 cycle
1K703	220195	627511-51	Relay: switching aux., 96 v DC
1K704	220956	8836923-2	Relay: buffer, 96 v DC, DPDT
1R701	206914	993007-44	Resistor: fixed ww 4500 ohm ±5%, 5 w
1R702	54418	993007-83	Resistor: fixed ww 1200 ohm ±5%, 5 w
1S701		8430315-1	R.F.Switch: rotary, 4 section (following parts stocked)
	220188		Contact rotor assy. (1 req. per section)
	220187		Contacts: stationary, long, for section #1, #2, or #3 (1 req. per section)
	220186		Contacts: stationary, short, for sections #1, #2 or #3 (11 req. per section)
	220189		Shaft: ceramic rotor

Symbol No.	Stock No.	Drawing No.	Description
	220183		Solenoid: rotary, 96 v DC
	220184		Switch: wafer only, ceramic, with contacts sections #1, #2 or #3
	220185		Switch: wafer only, phenolic with contacts, section #4
			Miscellaneous:
	97821	486041-10	Terminal: stand off
NOTE: For stations operating on a frequency within the range of 535 KC to 1115 KC the two additional capacitors listed below under MI-28093-2 are required to shift to Conelrad frequency 1240 KC.			
MI-28092-2			
1C704	96173	990705-242	Capacitor: mica, 620 μμf ±5%, 10,000 v
1C705	96173	990705-242	Capacitor: mica, 620 μμf ±5%, 10,000 v
POWER CUT BACK UNIT, MI-28099-A			
1C801	217970	990703-254	Capacitor: mica, 2000 μμf ±5%, 5000 v
1K801	222157	458722-5	Relay: High voltage
1K802	215601	8410963-1	Relay: auxiliary power change
1K803	221179	8449729-1	Relay: modulation monitor
1K804	222157	458722-5	Relay: high voltage
1R801 to 1R803	97749	99037-30	Resistor: w.w. 800 ohm ±5%, 200 w
1R804, 1R805	45983	99037-33	Resistor: w.w. 1600 ohms±5%, 200 w
1R807, 1R807	97749	99037-30	Resistor: w.w. 800 ohm ±5%, 200 w
1R808	50675	890015-6	Resistor: tapped 800 ohm ±10%, 200 w
1R809	99803	427230-45	Resistor: w.w. 250 ohm 25 w
	52717	7862770-1	Clip: resistor
	212086	426765-15	Insulator: 3/8" dia. x 1.25"lg.
	51781A	426762-6	Insulator: 1" dia. x 1-1/2" lg.
	209664	426773-6	Insulator: 3/4" sq. x 1-1/4" lg.

Symbol No.	Stock No.	Drawing No.	Description
SERIES OF FREQUENCY DETERMINING KITS, MI-27691			
535-640 KC 51.5 Ohm Line, MI-27691-1			
1C304, 1C305	96176	990705-251	Capacitor: fixed, mica, 1500 μμf ±5%, 10,000 v
1C306 to 1C308	96181	990705-271	Capacitor: fixed, mica, 10,000 μμf ±5%, 5000 v
1C324	53389	990704-242	Capacitor: fixed, mica, 620 μμf ±5%, 6000 v
535-640 KC 72 Ohm Line, MI-27691-2			
1C304, 1C305	96176	990705-251	Capacitor: fixed, mica, 1500 μμf ±5%, 10,000 v
1C306 to 1C308	96181	990705-271	Capacitor: fixed, mica, 10,000 μμf ±5%, 5000 v
1C324	53389	990704-242	Capacitor: fixed, mica, 620 μμf ±5%, 6000 v
535-640 KC 230 Ohm Line, MI-27691-3			
1C304, 1C305	96176	990705-251	Capacitor: fixed, mica, 1500 μμf ±5%, 10,000 v
1C306, 1C307	96181	990705-271	Capacitor: fixed, mica, 10,000 μμf ±5%, 5000 v
1C308	217365	990704-261	Capacitor: fixed, mica, 3900 μμf ±5%, 6000 v
1C309	217367	990704-250	Capacitor: fixed, mica, 1300 μμf ±5%, 6000 v
1C324	53389	990704-242	Capacitor: fixed, mica, 620 μμf ±5%, 6000 v
650-770 KC 51.5 Ohm Line, MI-27691-4			
1C304, 1C305	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C306 to 1C308	96180	990705-269	Capacitor: fixed, mica, 8200 μμf ±5%, 5000 v
1C324	93928	990704-240	Capacitor: fixed, mica, 510 μμf ±5%, 6000 v
650-770 KC 72 Ohm Line, MI-27691-5			
1C304, 1C305	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C306 to 1C308	96180	990705-269	Capacitor: fixed, mica, 8200 μμf ±5%, 5000 v
1C324	93928	990704-240	Capacitor: fixed, mica, 510 μμf ±5%, 6000 v

Symbol No.	Stock No.	Drawing No.	Description
		650-770 KC 230 Ohm Line, MI-27691-6	
1C304, 1C305	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C306, 1C307	96180	990705-269	Capacitor: fixed, mica, 8200 μμf ±5%, 5000 v
1C308	217366	990704-259	Capacitor: fixed mica, 3300 μμf ±5%, 6000 v
1C309	217367	990704-250	Capacitor: fixed, mica, 1300 μμf ±5%, 6000 v
1C324	93928	990704-240	Capacitor: fixed, mica, 510 μμf ±5%, 6000 v
		780-930 KC 51.5 Ohm Line, MI-27691-7	
1C304, 1C305	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C306 to 1C308	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C324	93928	990704-240	Capacitor: fixed, mica 510 μμf ±5%, 6000 v
		780-930 KC 72 Ohm Line, MI-27691-8	
1C304, 1C305	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C306 to 1C308	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C324	93928	990704-240	Capacitor: fixed, mica, 510 μμf ±5%, 6000 v
		780-930 KC 230 Ohm Line, MI-27691-9	
1C304, 1C305	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C306, 1C307	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C308	96178	990705-261	Capacitor: fixed, mica, 3900 μμf ±5%, 8000 v
1C324	93928	990704-240	Capacitor: fixed, mica, 510 μμf ±5%, 6000 v
		940-1110 KC 51.5 Ohm Line, MI-27619-10	
1C304	211956	990705-223	Capacitor: fixed, mica, 100 μμf ±5%, 10,000 v
1C305	211957	990705-235	Capacitor: fixed, mica, 330 μμf ±5%, 10,000 v
1C306, 1C307	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C308, 1C309	217366	990704-259	Capacitor: fixed, mica, 3300 μμf ±5%, 6000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		940-1110 KC 72 Ohm Line, MI-27691-11	
1C304	211956	990705-223	Capacitor: fixed, mica, 100 μμf ±5%, 10,000 v
1C305	211957	990705-235	Capacitor: fixed, mica, 330 μμf ±5%, 10,000 v
1C306, 1C307	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C308	217365	990704-261	Capacitor: fixed, mica, 3900 μμf ±5%, 6000 v
1C309	217367	990704-250	Capacitor: fixed, mica, 1300 μμf ±5%, 6000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		940-1110 KC 230 Ohm Line, MI-27691-12	
1C304	211956	990705-223	Capacitor: fixed, mica, 100 μμf ±5%, 10,000 v
1C305	211957	990705-235	Capacitor: fixed, mica, 330 μμf ±5%, 10,000 v
1C306, 1C307	96179	990705-266	Capacitor: fixed, mica, 6200 μμf ±5%, 5000 v
1C308, 1C309	217367	990704-250	Capacitor: fixed, mica, 1300 μμf ±5%, 6000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		1120-1330 KC 51.5 Ohm Line, MI-27691-13	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C307	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C308, 1C309	217364	990704-271	Capacitor: fixed, mica, 10,000 μμf ±5%, 4000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		1120-1330 KC 72 Ohm Line, MI-27691-14	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C307	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C308	217365	990704-261	Capacitor: fixed, mica 3900 μμf, ±5%, 6000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v

Symbol No.	Stock No.	Drawing No.	Description
		1120-1330 KC 230 Ohm Line, MI-27691-15	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C307	96175	990705-250	Capacitor: fixed, mica, 1300 μμf ±5%, 10,000 v
1C308, 1C309	217367	990704-250	Capacitor: fixed, mica, 1300 μμf ±5%, 6000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		1340-1620 KC 51.5 Ohm Line, MI-27691-16	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306, 1C307	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C308	96178	990705-261	Capacitor: fixed, mica, 3900 μμf ±5%, 8000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		1340-1620 KC 72 Ohm Line, MI-27691-17	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306, 1C307	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C308	96178	990705-261	Capacitor: fixed, mica, 3900 μμf ±5%, 8000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v
		1340-1620 KC 230 Ohm Line, MI-27691-18	
1C304, 1C305	96173	990705-242	Capacitor: fixed, mica, 620 μμf ±5%, 10,000 v
1C306 to 1C309	96174	990705-247	Capacitor: fixed, mica, 1000 μμf ±5%, 10,000 v
1C324	217368	990704-236	Capacitor: fixed, mica, 360 μμf ±5%, 6000 v

FIRST AID

WARNING

OPERATION OF ELECTRONIC EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE THE EQUIPMENT WITH VOLTAGE SUPPLY ON. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS, ETC. TO AVOID CASUALTIES, ALWAYS DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

Personnel engaged in the installation, operation and maintenance of this equipment or similar equipment are urged to become familiar with the following rules both in theory and in the practical application thereof. It is the duty of every radioman to be prepared to give adequate First Aid and thereby prevent avoidable loss of life.

ARTIFICIAL RESPIRATION

(Courtesy of the American Red Cross)

If victim is not breathing, begin some form of artificial respiration at once. Wipe out quickly any foreign matter visible in the mouth, using your fingers or a cloth wrapped around your fingers.

MOUTH-TO-MOUTH (MOUTH-TO-NOSE) METHOD

Fig. 1

Tilt victim's head back. (Fig. 1). Pull or push the jaw into a jutting-out position. (Fig. 2).

Fig. 2

If victim is a small child, place your mouth tightly over his mouth and nose and blow gently into his lungs about 20 times a minute. If victim is an adult (see Fig. 3), cover the mouth with your mouth, pinch his nostrils shut, and blow vigorously about 12 times a minute.

Fig. 3

If unable to get air into lungs of victim, and if head and jaw positions are correct, suspect foreign matter in throat, To remove it, place victim in position shown in Fig. 4, and slap sharply between shoulder blades.

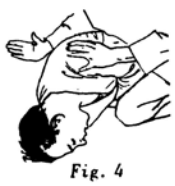


Fig. 4

Rescuers who cannot, or will not, use mouth-to-mouth or mouth-to-nose technique should use a manual method.

THE BACK PRESSURE-ARM LIFT (HOLGER-NIELSEN) METHOD

Place victim face-down, bend his elbows and place his hands one upon the other, turn his head slightly to one side and extend it as far as possible, making sure that the chin is jutting out. Kneel at the head of the victim. Place your hands on the flat of the victim's back so that the palms lie just below an imaginary line running between the armpits (Fig. 5).

Fig. 5

Rock forward until the arms are approximately vertical and allow the weight of the upper part of your body to exert steady, even pressure downward upon the hands (Fig. 6).

Fig. 6

Immediately draw his arms upward and toward you, applying enough lift to feel resistance and tension at his shoulders (Fig. 7). Then lower the arms to the ground. Repeat this cycle about 12 times per minute, checking the mouth frequently for obstruction.

Fig. 7

If a second rescuer is available, have him hold the victim's head so that the jaw continues to jut out (Fig. 8). The helper should be alert to detect any stomach contents in the mouth and keep the mouth as clean as possible at all times.

Fig. 8

RELATED INFORMATION FOR BOTH METHODS

If vomiting occurs, quickly turn the victim on his side, wipe out his mouth, and then reposition him.

When a victim is revived, keep him as quiet as possible until he is breathing regularly. Keep him from becoming chilled and otherwise treat him for shock. Continue artificial respiration until the victim begins to breathe for himself or a physician pronounces him dead or he appears to be dead beyond any doubt.

Because respiratory and other disturbances may develop as an aftermath, a doctor's care is necessary during the recovery period.

BURNS

FIRST DEGREE BURN

SKIN REDDENED. Temporary treatment—Apply baking soda or Unguentine.

SECOND DEGREE BURN

SKIN BLISTERED. Temporary treatment — Apply baking sode, wet compress, white petroleum jelly, foille jelly, olive oil, or tea.

THIRD DEGREE BURN

FLESH CHARRED. Temporary treatment — Apply baking soda, wet compress, white petroleum jelly, or foille spray. Treat for severe shock.

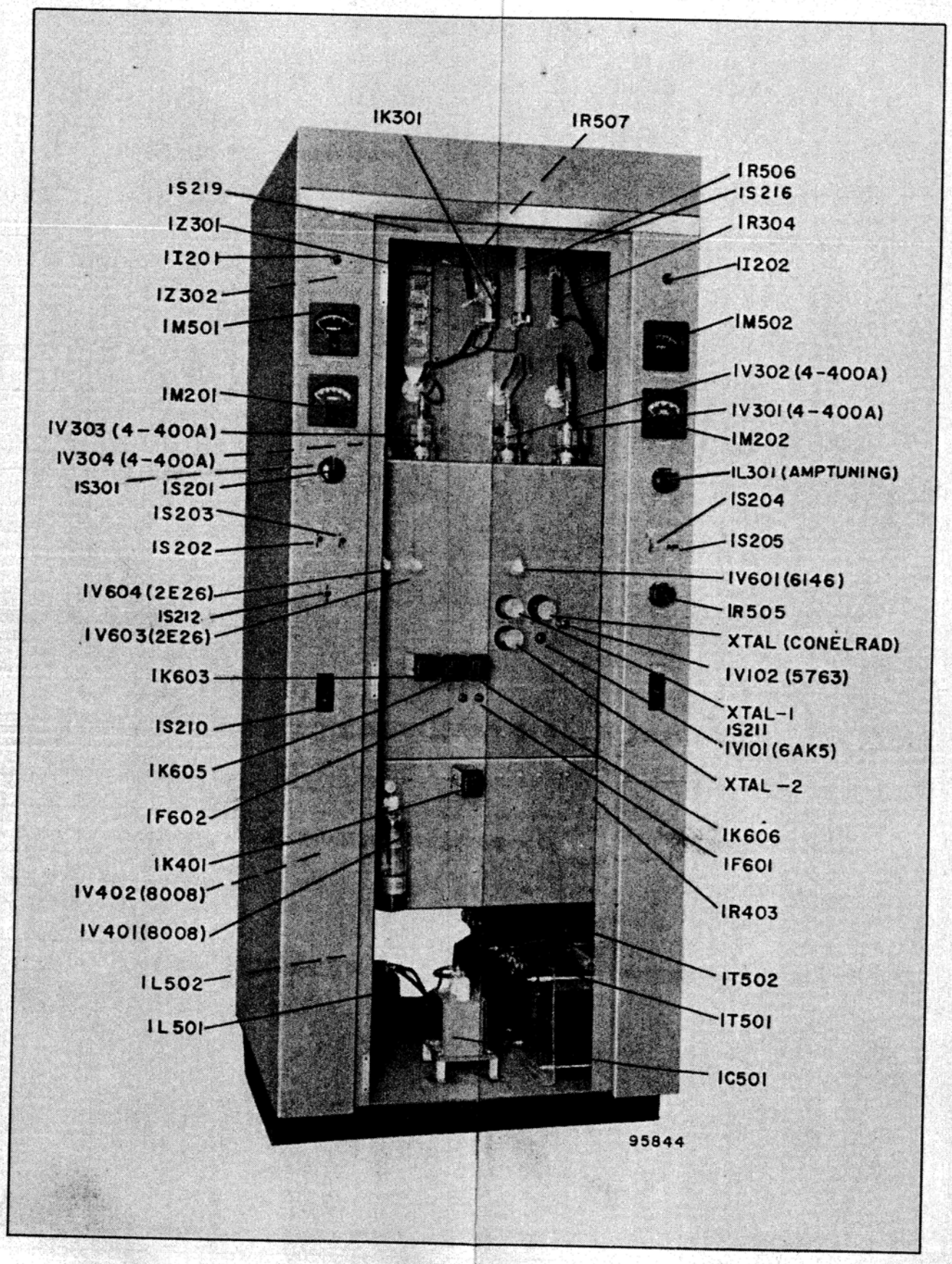


Figure 13. Front View, BTA-1R, Door Removed

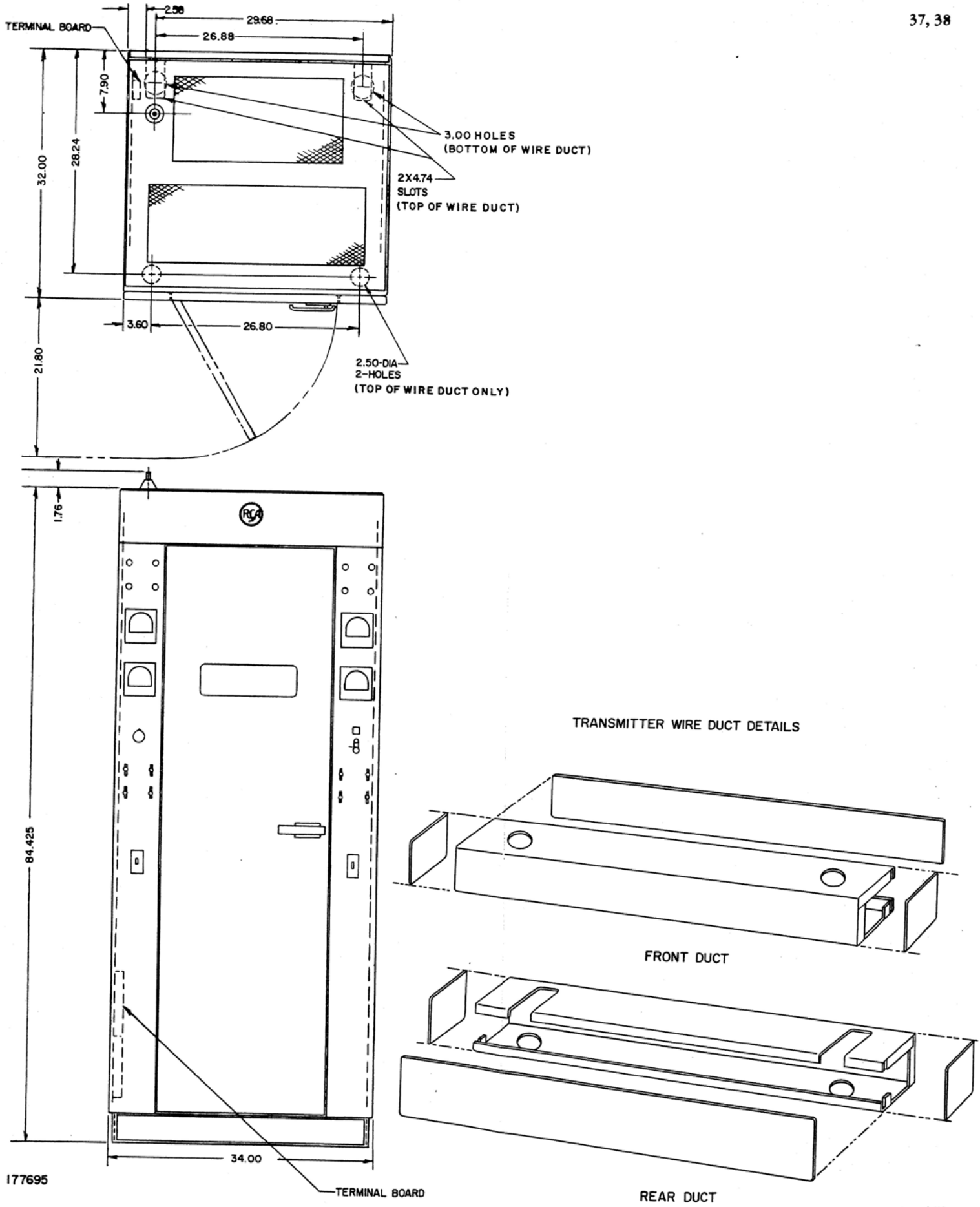


Figure 12. Outline Drawing, BTA-1R

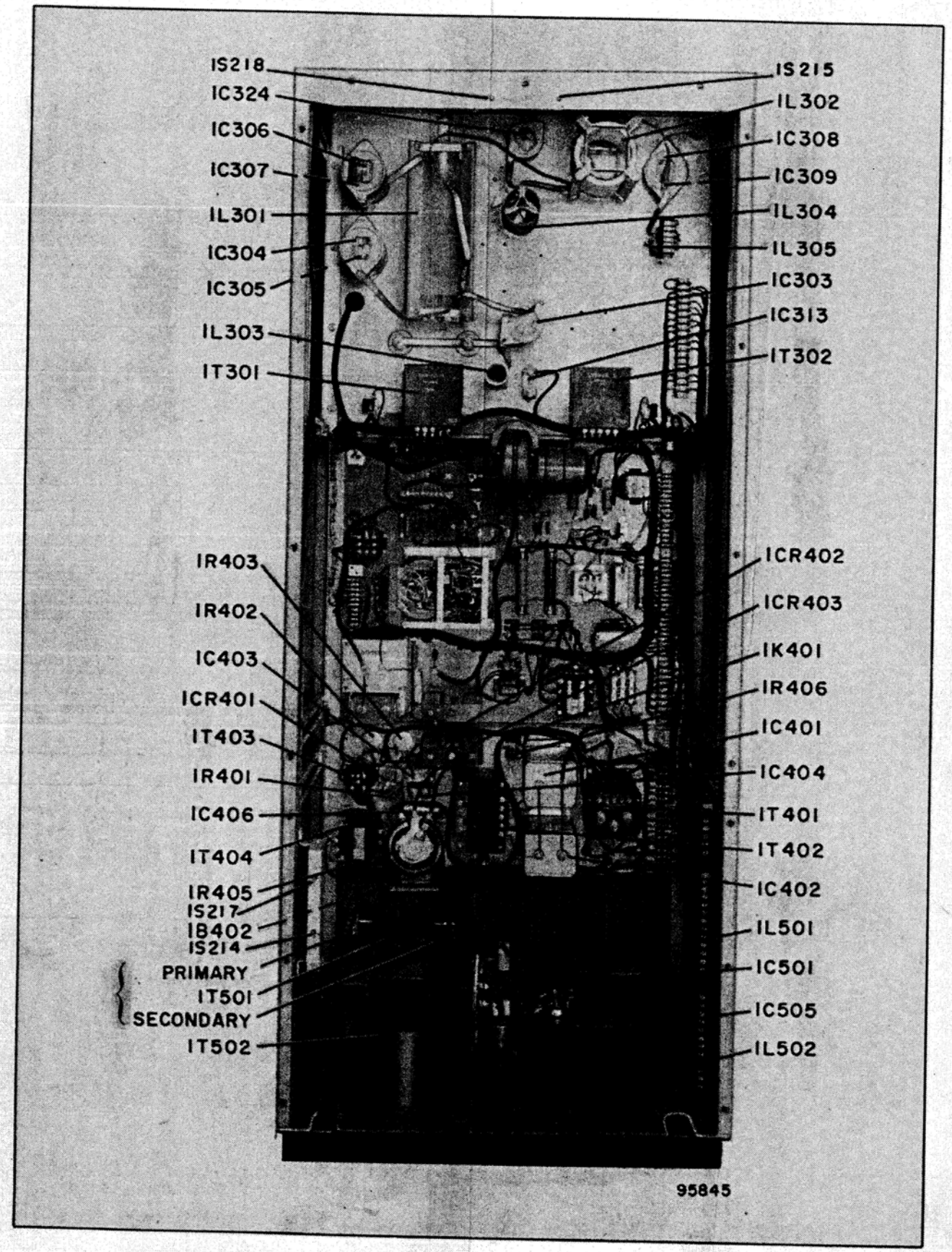


Figure 14. Rear View, BTA-1R, Rear Panels Removed

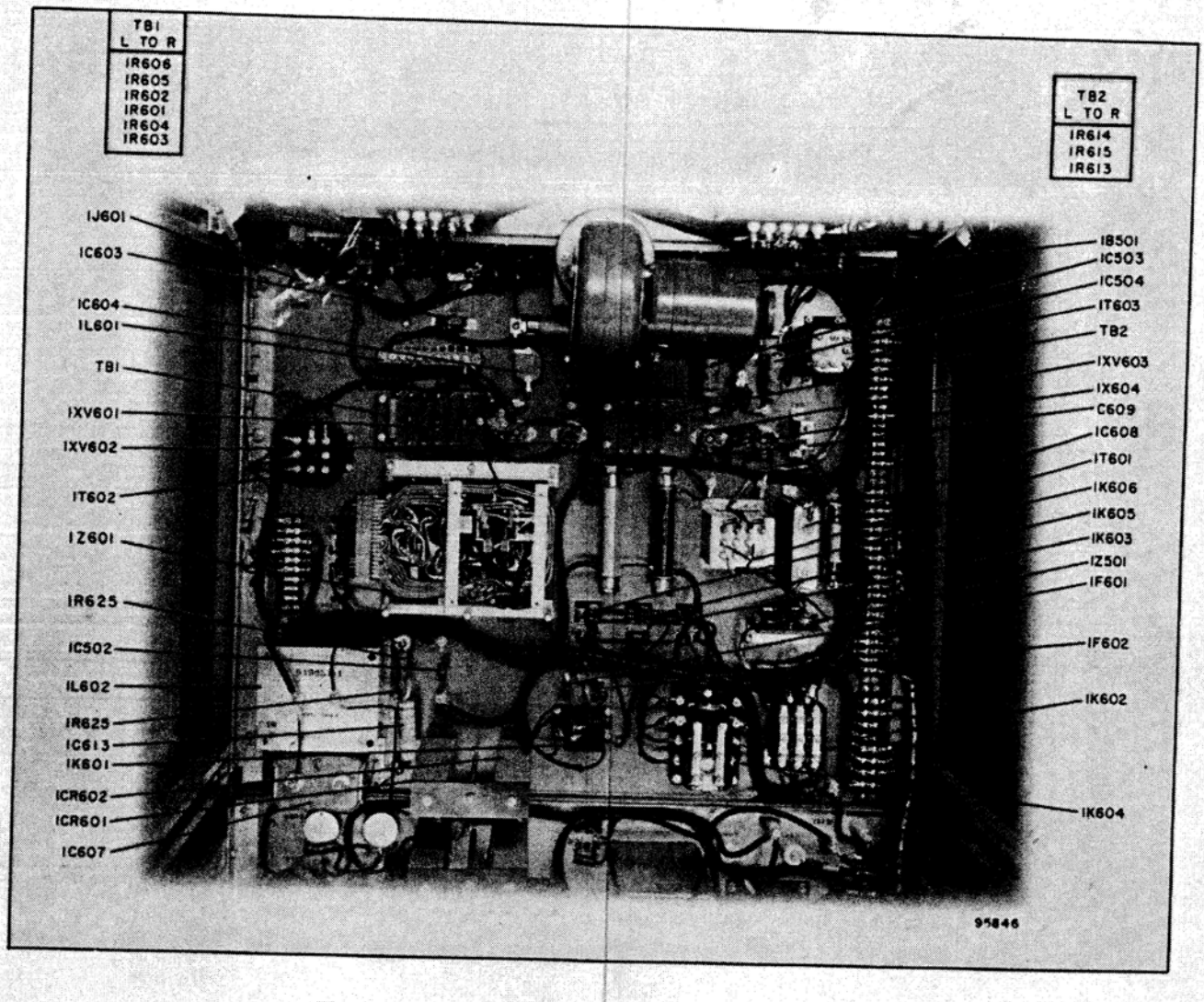


Figure 15. Rear View, BTA-1R Exciter Section

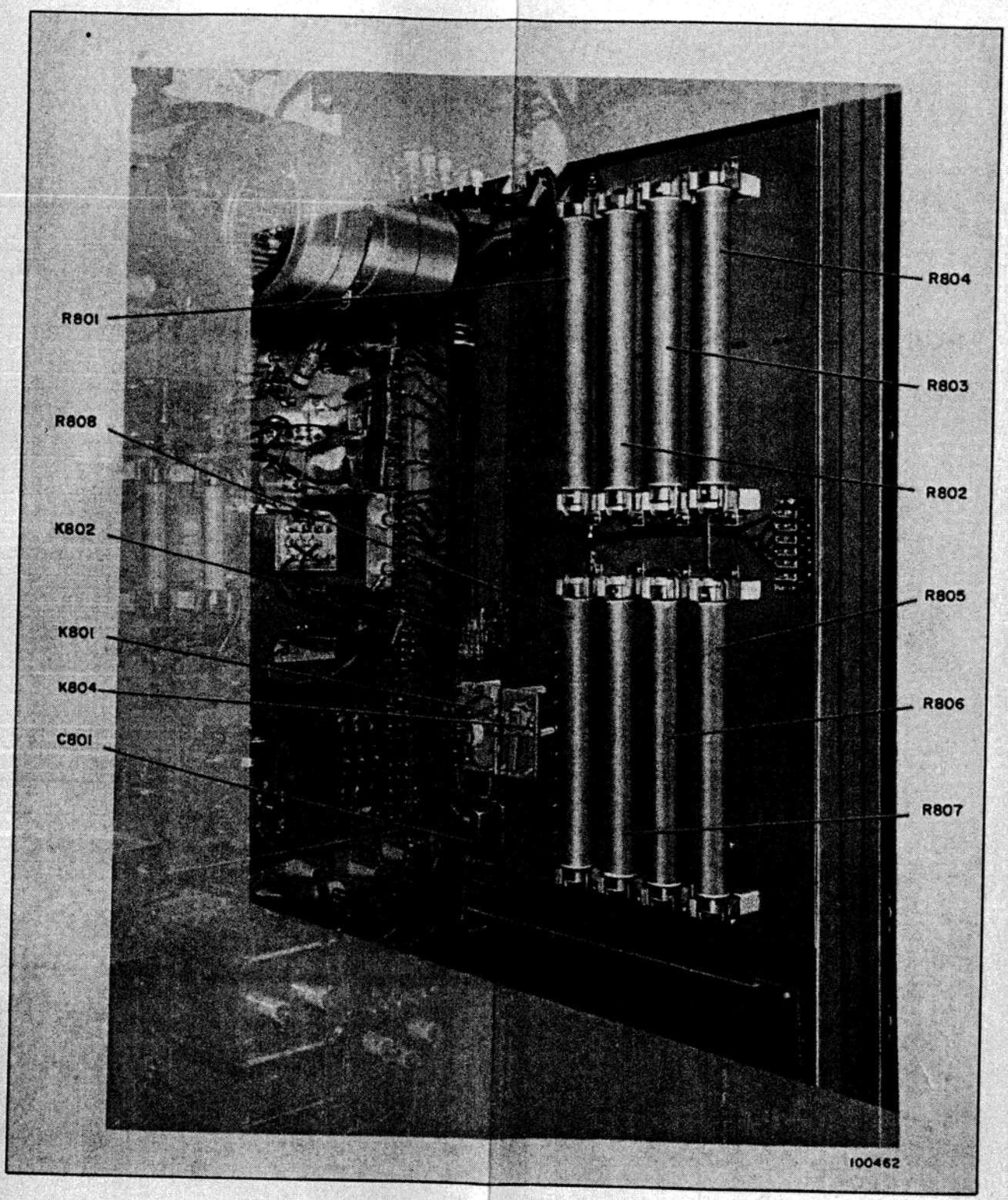
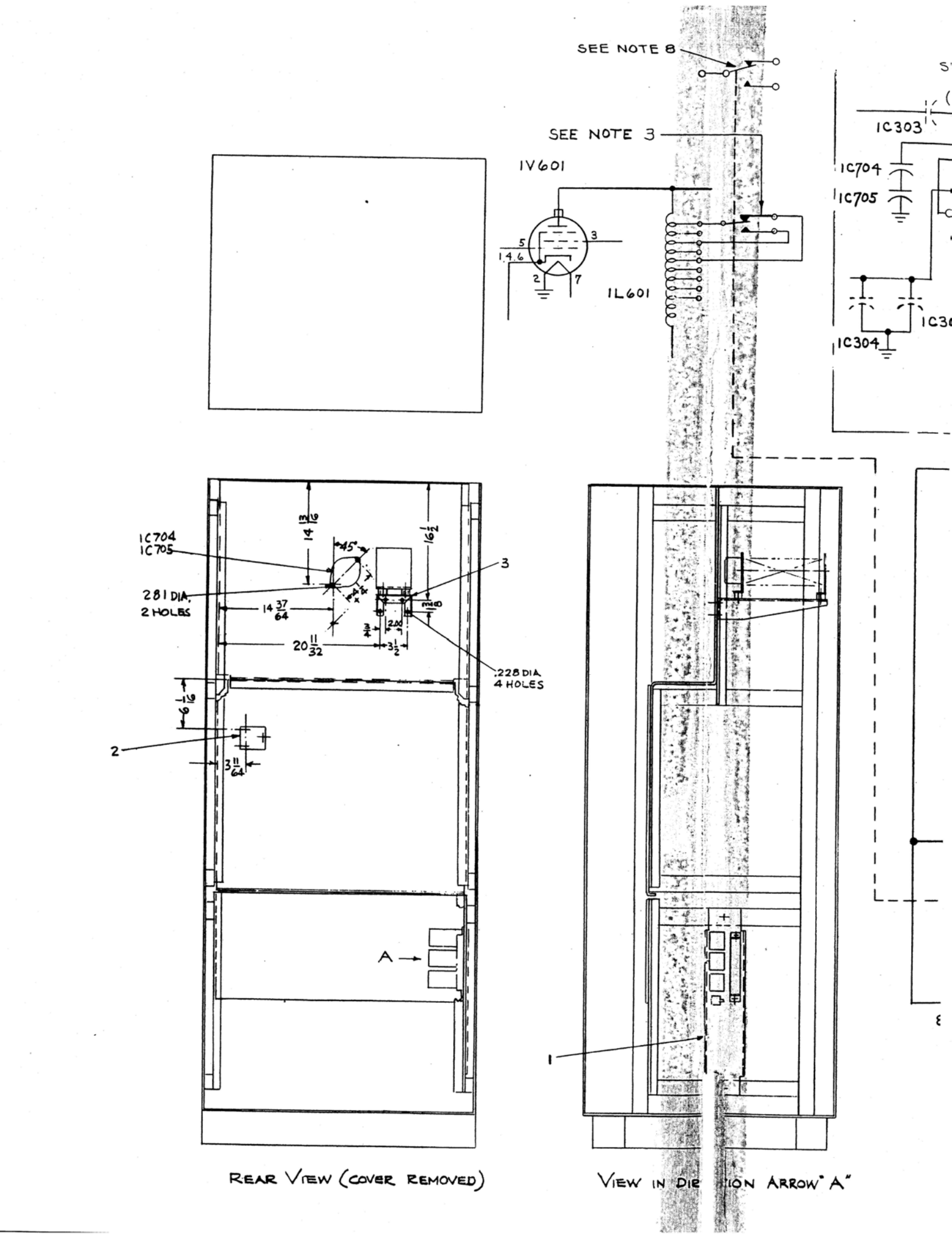
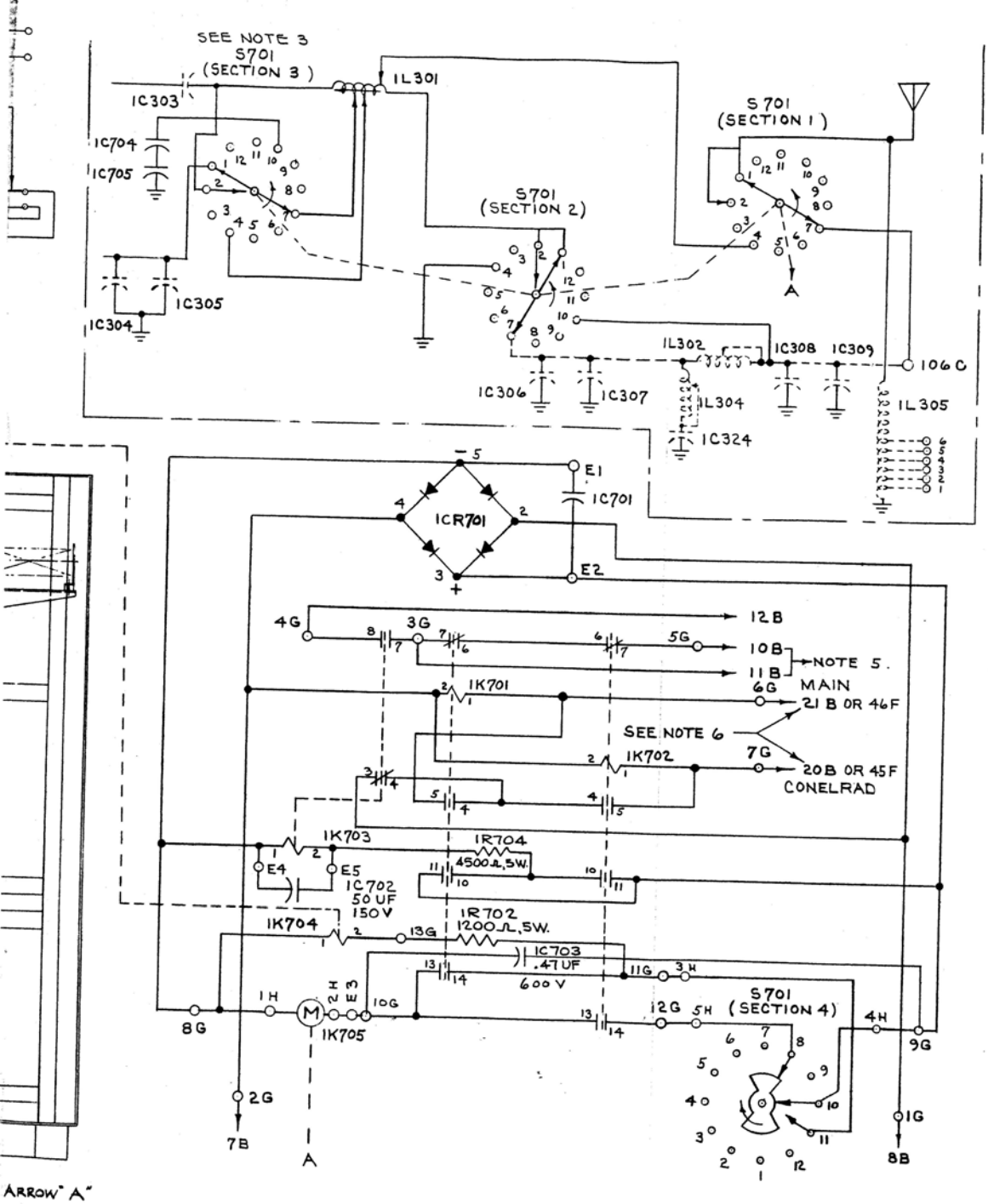


Figure 16. Power Cutback Kit, MI-28099-A, Installed


SEE NOTE 8
SEE NOTE 3
1V601
1L601
IC303
IC704
IC705
IC304
IC704
IC705
281 DIA.
2 HOLES
.228 DIA
4 HOLES
A
1
2
3
REAR VIEW (COVER REMOVED)
VIEW IN DIRECTION ARROW "A"



NOTES

1:- ALL 300 SERIES COMPONENTS ARE LOCATED IN TRANSMITTER; 700 SERIES ARE SUPPLIED WITH KIT.

2:- IF CAPACITORS C704 AND C705 ARE NOT SUPPLIED, NO CONNECTIONS ARE REQUIRED TO S701 - SEC. 4, TERMS 10 AND 1.

3:- FOR CONNECTIONS OF PA PLATE TANK AT VARIOUS FREQUENCY COMBINATIONS SEE CHART IN INSTALLATION INFORMATION 8959063.

4:- ALL SWITCH SECTIONS SHOWN IN MAIN FREQUENCY POSITION.

5:- REMOVE JUMPER WIRE BETWEEN TRANSMITTER TERMINALS 10B AND 11B BEFORE WIRING TO TERMINALS 5G AND 3G ON CONTROL UNIT.

6:- REFER TO INSTALLATION INFORMATION SUPPLIED AS DRAWING Nº 8959063.

7:- NUMBERS & SYMBOLS REFER TO MI-34309-5

8:- AVAILABLE AMPERE CONTACTS TO CONTROL.

648254-2

Figure 17. Schematic Diagram, Conelrad Kit

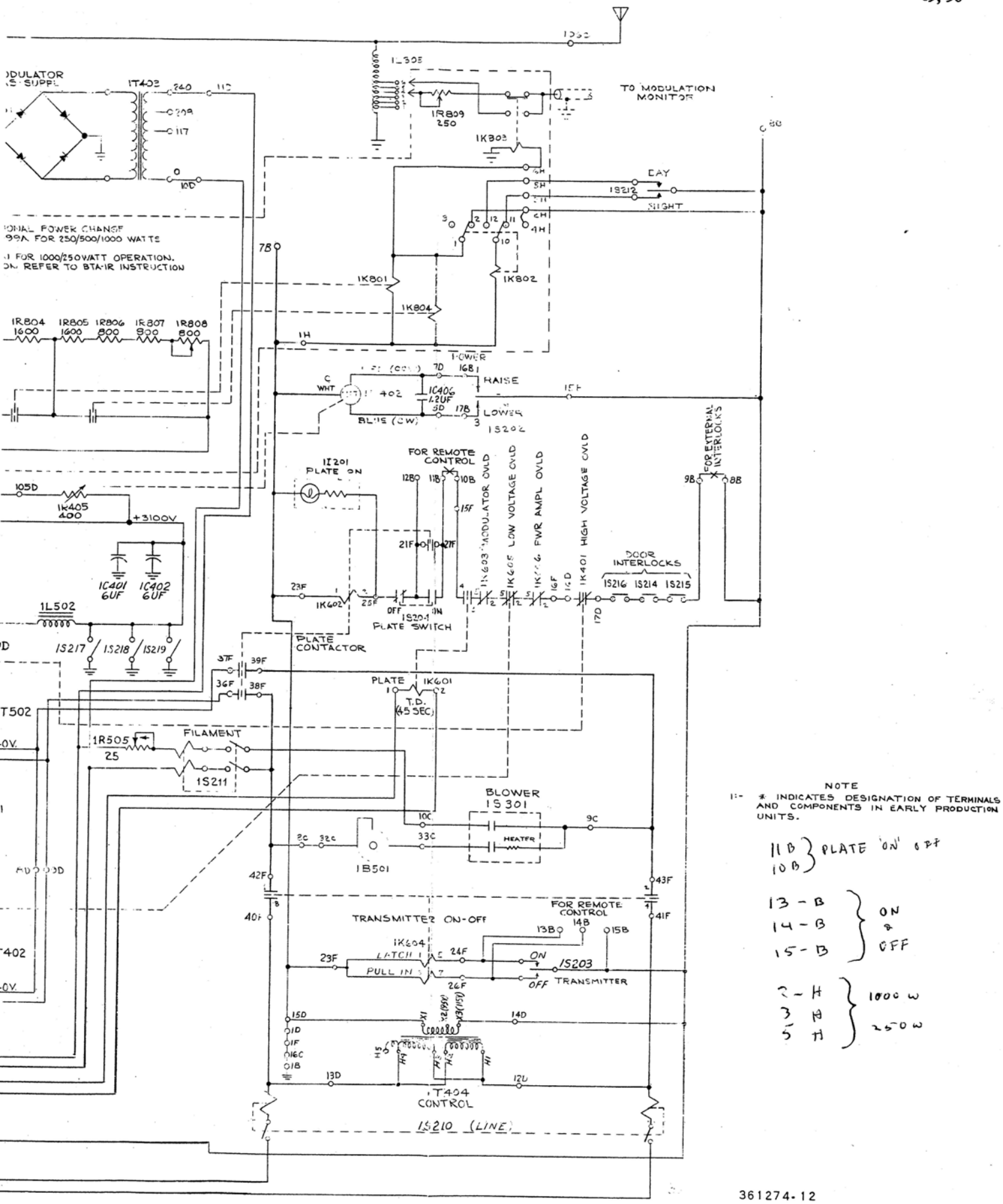
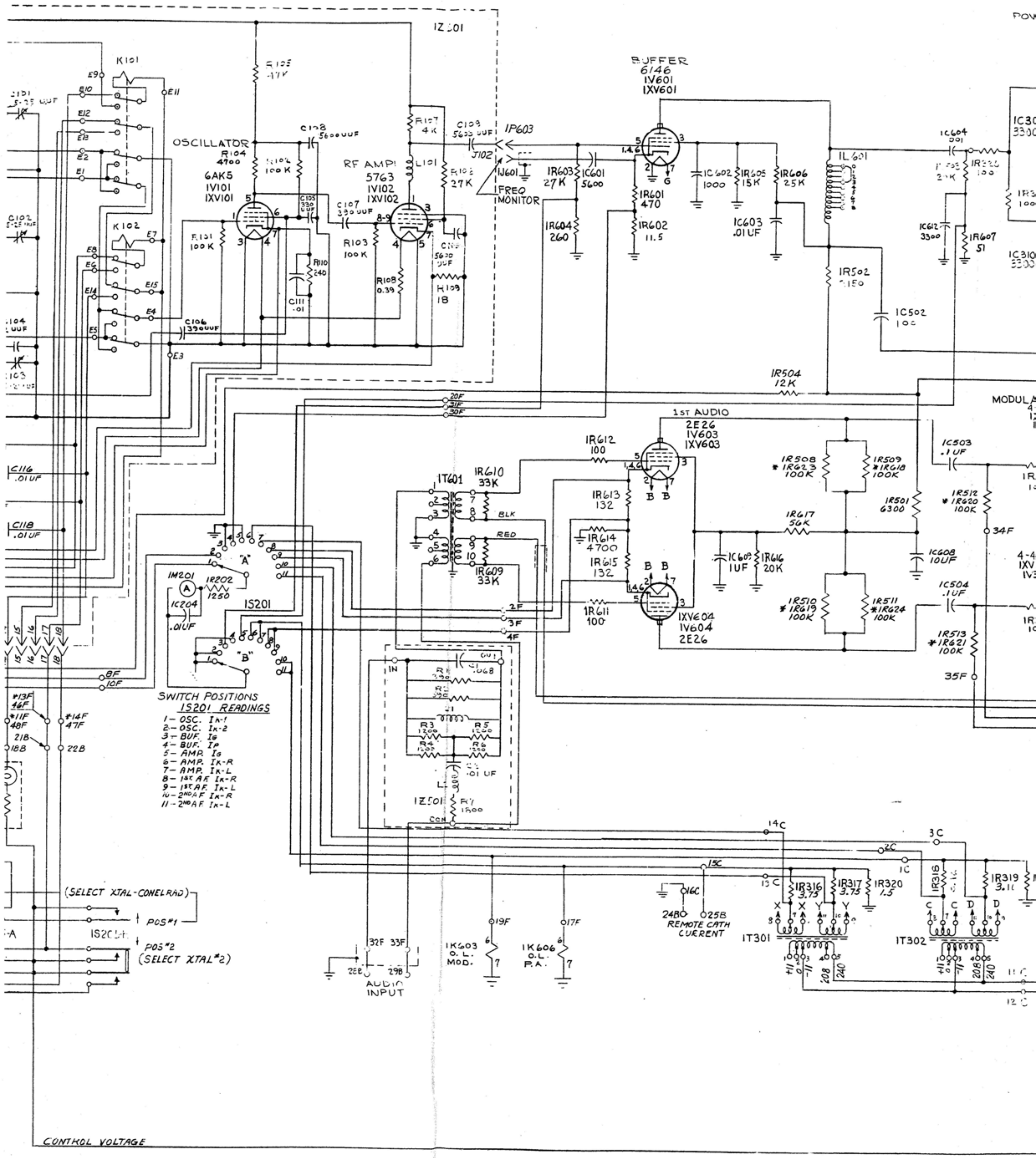
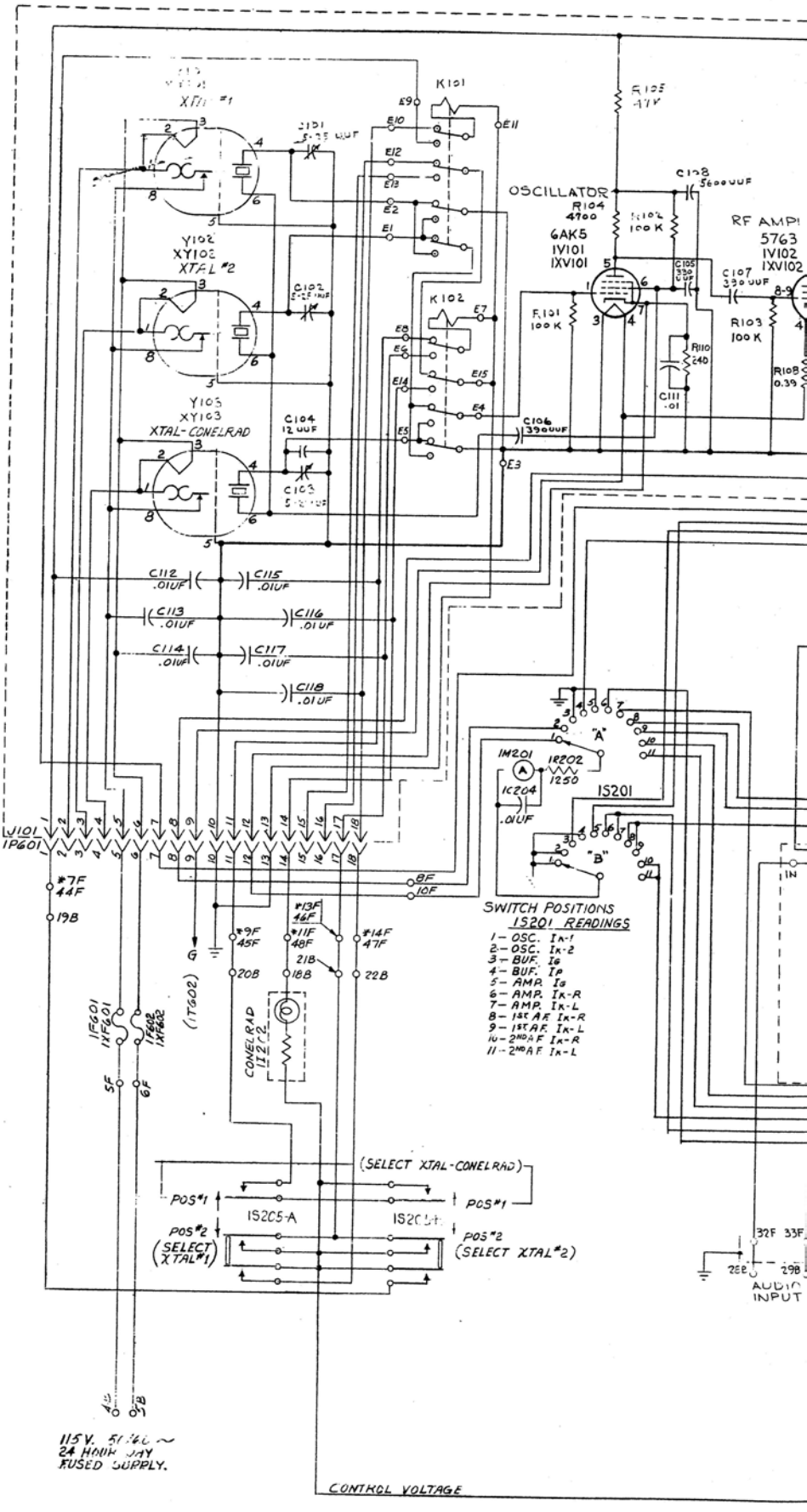


Figure 18. Schematic Diagram, BTA-1R

POWER AMPLIFIER
4-400A
IXV301
IV301
IC303
620
IL302
IL304
IC304
IC305
IC306
IC307
IC308
IC309
IC324
IC301
33000
IC302
33000
IC604
.001
IR326
100
IR325
100
4-400A
IXV302
IV302
IR327
100
IR324
100
IC312
1000
IL303
IR607
51
IC310
33000
IC311
33000
IR506
50K
IC313
1000
IR304
4 MEG
IR322
100K
7C
IC201
.01UF
IM501
23B REMOTE PLATE VOLTAGE
IR201
1250
24B
IR403
5000
IR402
5000
IR404
2500
107C
MODULATOR
4-400A
IXV303
IV303
IZ301
109C
IC314
300
IR306
2.2 MEG
IC315
300
IR307
2.2MEG
IC316
300
IR308
2.2MEG
IC317
300
IR309
2.2MEG
IC318
.01UF
IR310
62K
IC323
.01UF
IR315
62K
IC322
300
IR314
2.2MEG
IC321
300
IR313
2.2MEG
IC320
300
IR312
2.2MEG
IC319
300
IR311
2.2MEG
IZ302
110C
IC503
.1UF
IR361
100
IR512
* IR620
100K
34F
IC504
.1UF
IR362
100
IR513
* IR621
100K
35F
RED 104C
BLK
105C
1T501
HIGH
TAP
LOW
102C
IR507
20K
IR325
15K
1K301
REMOVE JUMPER
WHEN MI-28099-A
CUTBACK IS
USED.
101C
111C
3D
4D
IL501
IC202
.01UF
IM502
103D
1K301
105D
1K405
400
H.V. RECTIFIERS
102D
8008
IXV401
IV401
8008
IXV402
IV402
1L502
104D
101D
IR406
.75
100D
IR407
6000
IC505
.05UF
1K401
1T401
1T502
210V
208V
+11V.
0V.
10D
11D
+11V.
0
208V
240V.
1L602
4750
IC607
15UF
ICR601
ICR602
IC613
.05UF
LOW VOLTAGE
SUPPLY
ICR403
ICR402
1R608
3.1
1K605
930
LO
HI
1T402
+11V
0V.
-11V
208V
240V.
IC203
.01UF
1M202
FILAMENT
LINE
VOLTMETER
1T603
1T602
IR319
3.1
IR321
1.5
11C
12C
28F
29F
MODULATOR
BIAS SUPPL
IR401
1000
-175V
IC403
10UF
IC404
10UF
CONNECTIONS FOR OPTIONAL POWER CHANG
EQUIPMENT. MI-28099A FOR 250/500/100
OUTPUT.
CONNECTIONS SHOWN FOR 1000/250WATT O
FOR 500 WATT OPERATION REFER TO BTA-1R
BOOK (IB-30248).
IR801
800
IR802
800
IR803
800
IR804
1600
IR805
1600
IC801
2000
208/240 V. 50/60 ~
FUSED SUPPLY.
2B
3B



1Z101
K101
K102
OSCILLATOR
R104 4700
6AK5 1V101 1XV101
R101 100K
R102 100K
C108 5600UUF
C105 330UUF
C107 330UUF
RF AMPL
5763 1V102 1XV102
R103 100K
R107 4K
R106 27K
L101
C109 5600UUF
R110 240
C111 .01
R108 0.39
R109 18
C106 390UUF
1P603
J102
1J601
FREQ MONITOR
BUFFER
6146
1V601
1XV601
1R603 27K
1C601 5600
1R604 260
1R601 470
1R602 11.5
1C602 1000
1R605 15K
1R606 25K
1C603 .01UF
1L601
1C604 .001
1R607 51
1C612 3300
1R502
1C502
1R504 12K
MODULA
1ST AUDIO
2E26
1V603
1XV603
1R612 100
1T601
1R610 33K
BLK
RED
1R609 33K
1R613 132
1R614 4700
1R615 132
1C609 1UF
1R616 20K
1R617 56K
1R611 100
1XV604
1V604
2E26
1R508 *1R623 100K
1R509 *1R618 100K
1R501 6300
1C608 10UF
1R510 *1R619 100K
1R511 *1R624 100K
1C503 .1UF
1R512 *1R620 100K
34F
1C504 .1UF
1R513 *1R621 100K
35F
20F
31F
30F
2F
3F
4F
8F
10F
1M201
1R202 1250
1C204 .01UF
1S201
"A"
"B"
SWITCH POSITIONS
1S201 READINGS
1 – OSC. IK-1
2 – OSC. IK-2
3 – BUF. IG
4 – BUF. IP
5 – AMP. IG
6 – AMP. IK-R
7 – AMP. IK-L
8 – 1ST A.F. IK-R
9 – 1ST A.F. IK-L
10 – 2ND A.F. IK-R
11 – 2ND A.F. IK-L
1Z501
IN
OUT
.068
.01 UF
L1
R7 1500
COM
*13F 46F
*11F 48F
*14F 47F
21B
18B
22B
(SELECT XTAL-CONELRAD)
POS#1
1S205
POS#2
(SELECT XTAL#2)
32F
33F
28B
29B
AUDIO INPUT
19F
1K603 O.L. MOD.
17F
1K606 O.L. P.A.
16C
24B
25B
REMOTE CATH CURRENT
14C
15C
13C
3C
2C
1C
1R316 3.75
1R317 3.75
1R320 1.5
1R318
1R319
1T301
1T302
208
240
CONTROL VOLTAGE


OSCILLATOR
R104
4700
6AK5
1V101
1XV101
RF AMP
5763
1V102
1XV102
K101
K102
XTAL #1
XTAL #2
XTAL-CONELRAD
C112 .01UF
C113 .01UF
C114 .01UF
C115 .01UF
C116 .01UF
C117 .01UF
C118 .01UF
C104 12 UUF
C106 330UUF
C107 330 UUF
C108 5600UUF
R101 100 K
R102 100 K
R103 100 K
R105 47K
R108 0.39
R110 240
C111 .01
C105 330 UUF
J101
1P601
1S201
1M201
1R202 1250
1C204 .01UF
SWITCH POSITIONS
1S201 READINGS
1 - OSC. Ik-1
2 - OSC. Ik-2
3 - BUF. Ig
4 - BUF. Ip
5 - AMP. Ig
6 - AMP. Ik-R
7 - AMP. Ik-L
8 - 1ST A.F. Ik-R
9 - 1ST A.F. Ik-L
10 - 2ND A.F. Ik-R
11 - 2ND A.F. Ik-L
CONELRAD 1T2T2
(1T602)
1F601
1XF601
1F602
1XF602
(SELECT XTAL-CONELRAD)
POS #1
POS #2
(SELECT XTAL #1)
(SELECT XTAL #2)
1S205-A
1S205-B
115 V. 50/60 ~
24 HOUR DAY
FUSED SUPPLY.
CONTROL VOLTAGE
AUDIO INPUT