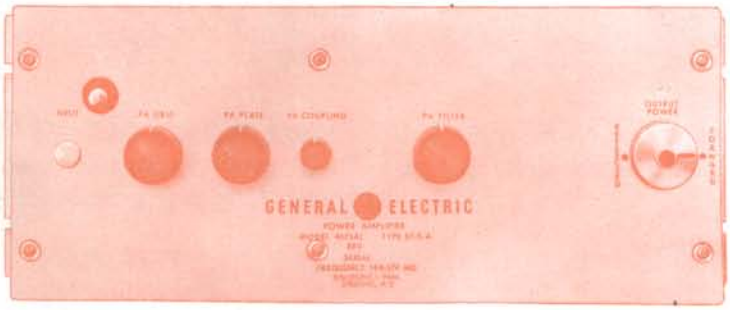
communications

MASTR Progress Line

POWER AMPLIFIER MODEL 4EF5A1



POWER AMPLIFIER

SPECIFICATIONS *

Model Number	4EF5A1
FCC Type Number	EF-5-A: Power Amplifier
Frequency Range	132-174 MC
Used With	Exciter Type ET-57-A and Power Supply Type EP-6-A, B to provide a 330-watt transmitter
Power Input	117 VAC, 50/60 cps Standby: 2 amps Transmit: 9 amps
Power Output	330 Watts
Tube Complement	(1) 4CX250B or 7032/4CX250B
AM Hum and Noise Level	Down 34 db
Rated Duty Cycle	Continuous -- Blower recommended for cabinet ventilation under conditions of high ambient temperatures or continuous duty operation.
Ambient Temperature Range	-30°C to +60°C (-22°F to +144°F)
Dimensions (H x W x D)	7" x 19" x 11"
Weight	30 pounds

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Certified and Guaranteed Specification Sheet for the complete specifications.

EF-5-A

GENERAL ELECTRIC

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WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Power Amplifier Model 4EF5A1 is a 330-watt amplifier designed for use in fixed stations operating in the 132-174 megacycle band, using an external exciter and power supply. The amplifier employs a 4CX250B as a Power Amplifier tube, with forced-air cooling provided by a blower mounted on the power supply. Standard RETMA rack-mounting dimensions are used. The tuning controls most frequently used are located on the front of the unit.

All the power connections, except the high voltage connection, are made with a 6-pin plug from the front of the unit. High voltage is brought to the plate at the rear of the plate compartment.

Antenna relay keying voltage connections are made behind the Output Power Indicator, using screw connections. The RF drive connection is made by an RG-58/U cable plugged into the exciter from the front of the unit.

CIRCUIT ANALYSIS

Excitation to the Power Amplifier at P482 is fed to coupling loop L482 and coupled to coil L484, which, with C481, forms the grid tank of the amplifier. By adjusting the PA GRID control (C481), the grid tank may be tuned to the operating frequency. Coil L481 isolates RF from the power cable.

Heater voltage on the Power Amplifier tube V481 may be varied on the power supply chassis. C482, C483 and C484 are RF by-pass capacitors and R481 is used as a screen RF de-coupling resistor. Built into the tube socket, XV481, is a ring-type capacitor which is used as a screen grid by-pass.

All input voltage connections to the Power Amplifier, except the B-plus voltage connection, are made at P481 on the front side of the panel. The 2000-volt B-plus lead is connected at terminal PO-2 located in the rear on the plate cavity cover. C485 provides by-passing for the B-plus and L485 is an RF choke. The plate tank is composed of C488 and L494. The plate tank is tuned to the operating frequency by adjusting the PA PLATE control C488.

Adjusting the PA COUPLING control varies the coupling from the plate to the output by controlling the amount of magnetic flux linking the plate coupling loop to the output loop. The filter consists of L490, L491, L492, L493, C492, C493, L494 and C495. Antenna coupling is adjusted by the PA ANTENNA control C489. The signal is fed from the filter to

J481. The signal from J481 is connected to the antenna through P1 and P2 on the Reflectometer and through the contacts on the antenna relay K482. C496 and C497 are neutralizing divider capacitors in series with the Neutralizer.

All input voltage connections to the Power Amplifier, except the B-plus voltage connection, are made at P481 on the front side of the panel. The 2000-volt B-plus lead is connected at terminal PO-2 located in the rear on the plate cavity cover. C485 provides by-passing for the B-plus and L485 is an RF choke. The plate tank is composed of C488 and the transmission line section formed by the inner and outer boxes of the plate cavity. The plate tank is tuned to the operating frequency by adjusting the PA PLATE control C488.

Adjusting the PA COUPLING control varies the coupling from the plate to the output by controlling the amount of magnetic flux linking the plate line to the filter line. L483 couples energy from the PA FILTER cavity to J481. The signal from J481 is connected to the antenna through P1 and P2 on the Reflectometer and through the contacts on the antenna relay K482.

Output Power Meter

The Output Power Meter (Reflectometer) indicates forward and reflected power output when used with a 0-3 VDC meter (use external probe from meter switching unit).

The probe samples the magnetic field caused by current in the transmission line and the electrical field from the voltage on the line. On a properly matched line, these two voltages are equal and cancel each other when reading REFLECTED power ("0" reflected power). When the probe is rotated 180°, these two voltages add to indicate FORWARD power.

When the load is not matched, these two voltages become unequal and provide a ratio of incident (forward) to reflected power. Any significant change in this ratio (if other than 1:1) after initial installation and check out, should be cause for examination of the antenna and feed line. Actual V.S.W.R. as measured on a calibrated bridge, should remain below 1.5:1 at all times.

Antenna Relay

K482, the antenna relay switches the antenna from the receiver to the transmitter when the transmitter is keyed.

MAINTENANCE

Preventive Maintenance

To obtain optimum performance from the equipment, a program of regular preventive maintenance should be followed. This preventive maintenance should include the following:

1. A check of the operating frequency as required by the Federal Communications Commission.

2. A check of the PA PLATE current, Power Amplifier GRID current and PA PLATE voltage meter readings.

3. A check of the PA plate tuning and reflected power (if any) and realignment if improper operation is indicated.

4. A check for loose nuts, screws, cables and parts.

5. An inspection of the high- and low-voltage connections.

Power Amplifier Tube Replacement

To remove the Power Amplifier tube, proceed as follows:

1. Remove the high-voltage lead from PO-2, located on the rear of the Power Amplifier.

2. Loosen the winged screws holding the rear cover plate to the assembly.

3. Slide off the rear cover plate.

4. Insert the prongs of the tube extractor (included with the station equipment) between the cooling fins of the PA tube plate.

5. Pull the tube straight out from the socket.

To reinsert the Power Amplifier tube, proceed as follows:

1. Insert the prongs of the tube extractor between the cooling fins of the PA tube plate.

2. Push the PA tube all the way into the socket while observing the key on the tube and socket. The tube extractor may be left on the tube cooling fins.

3. Replace the rear cover plate of the Power Amplifier.

4. Tighten the winged screws on the rear cover plate.

5. Replace the high-voltage lead to PO-2 on the rear of the Power Amplifier.

Blower

The blower motor bearings are to be lubricated every 2000 hours of operation. A small oil can for this purpose is mounted on the power supply chassis, at the right of the blower motor. Use the oil recommended in the Parts List. (See Parts List on back of Schematic Diagram.)

ALIGNMENT PROCEDURE

This Bench Alignment Procedure is provided for completely re-aligning and loading Power Amplifier Model 4EF5A1, using the ET-57-A as an Exciter unit.

Before tuning the Power Amplifier, the Exciter must be aligned according to the ALIGNMENT PROCEDURE.

1. Connect the antenna or some other suitable 50-ohm load to the top jack on the Power Amplifier antenna relay.

2. Turn the PLATE switch OFF on the PA Power Supply.

3. Turn the SCREEN adjust on the PA Power Supply fully counterclockwise.

   Note - If it has not already been done, remove fuse F502 from the EP-38-A power supply. This will limit plate voltage on the ET-57-A to 300 volts, which is proper for exciter service.

4. Place the power switches located on the Control Panel and Exciter Power Supply EP-38-A to the ON position. Turn the PA Power Supply CONTROL switch to the ON position. Allow 15-minutes for warmup.

5. Connect a microphone to the MIKE jack on the Exciter Power Supply.

6. Pull the PA COUPLING control out to its limit. Turn control clockwise until it engages with the coupling window. Push control in all the way to its back limit. Withdraw control approximately 1/4-inch from the back limit. Connect the red lead from meter switch panel to grid jack (J452-green on PA power supply) and rotate switch to external probe.

7. While keying the Exciter, tune the PA GRID for maximum PA GRID current at the GRID jack. A reading of 2.5-volts (25-ma of grid drive) should be obtained on the TUNING METER. If the reading is low, refer to the TRANSMITTER ALIGNMENT PROCEDURE for the Exciter.

8. Turn the PLATE switch on the PA Power Supply to the ON position.

9. While keying the Exciter, adjust the PA PLATE control for a minimum reading at the PA PLATE current meter.

10. Connect the red lead from the Meter Switching Panel to the jack on the front of the PA OUTPUT METER. Rotate OUTPUT METER to the FORWARD position.

11. While keying the Exciter, adjust the PA FILTER for maximum meter reading at the OUTPUT METER jack.

12. While keying the Exciter, increase the SCREEN control clockwise to a maximum of 200 ma.

13. While the Exciter is being keyed, pull the PA COUPLING a small amount, to a maximum of 250-ma at the PA PLATE current meter.

14. While keying the Exciter, readjust the PA PLATE control for minimum reading at the PA PLATE current meter.

15. Repeat steps 11 through 14 above until the licensed power output or power input is reached. Do not exceed 250-ma of PA PLATE current.

16. Neutralizing:

    a. Turn the PLATE switch OFF on the PA Power Supply.

    b. Turn the Power switch OFF on the Exciter Power Supply.

    c. Block the contacts closed on the PA antenna relay (use a piece of tape to hold the contacts).

    d. Disconnect the antenna cable from the ANT jack on the PA antenna relay.

    e. Disconnect the PA input cable from the output of the Exciter.

    f. Connect a short coaxial cable from the ANT jack on the Exciter to the ANT jack on the PA antenna relay.

> **CAUTION**
>
> Failure to have the PLATE switch in the OFF position when performing step 16g through 16k below, can result in damage to the equipment.

    g. The Exciter output will now be feeding into the Power Amplifier output for neutralizing the PA.

    h. Turn the Exciter Power switch ON. Do not turn on the PLATE switch on the PA Power Supply.

    i. Connect a lead from the TUNING METER to the GRID jack J452-green, located on the PA Power Supply.

    j. Adjust the PA Grid, PA Filter and the Exciter output for maximum PA Grid current.

    k. Using an insulated tuning tool, adjust the NEUTralizer adjustment (located under the plug button on the front of the Power Amplifier unit), for minimum PA Grid current.

    l. Turn the Power switch OFF on the Exciter Power Supply.

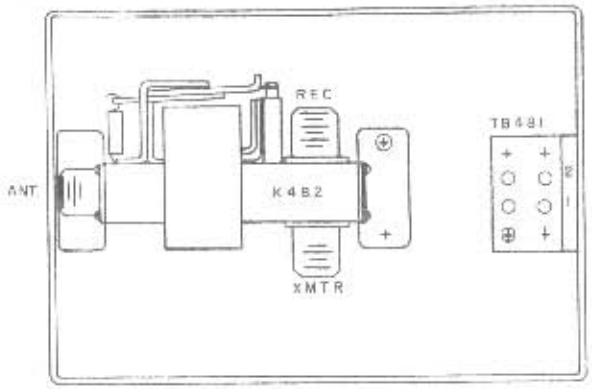
    m. Open the rear door on the Station cabinet, remove the block from the relay contacts, disconnect the coaxial cable, replace the PA antenna cable and replace the Exciter output cable.

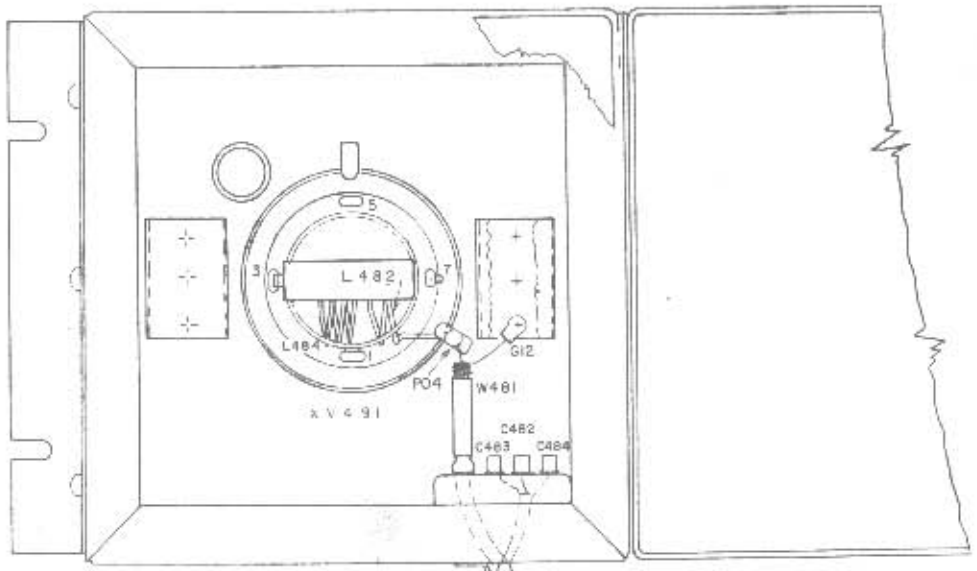
    n. Close the rear door.

17. Turn the Exciter Power Supply Switch ON.

18. Repeat steps 3 through 15 above until no further gain can be obtained. Do not exceed 250-ma of PA PLATE current.

19. Carefully turn the PA COUPLING control counterclockwise to disengage it from the internal coupling window. Push the PA COUPLING control in to its back limit.





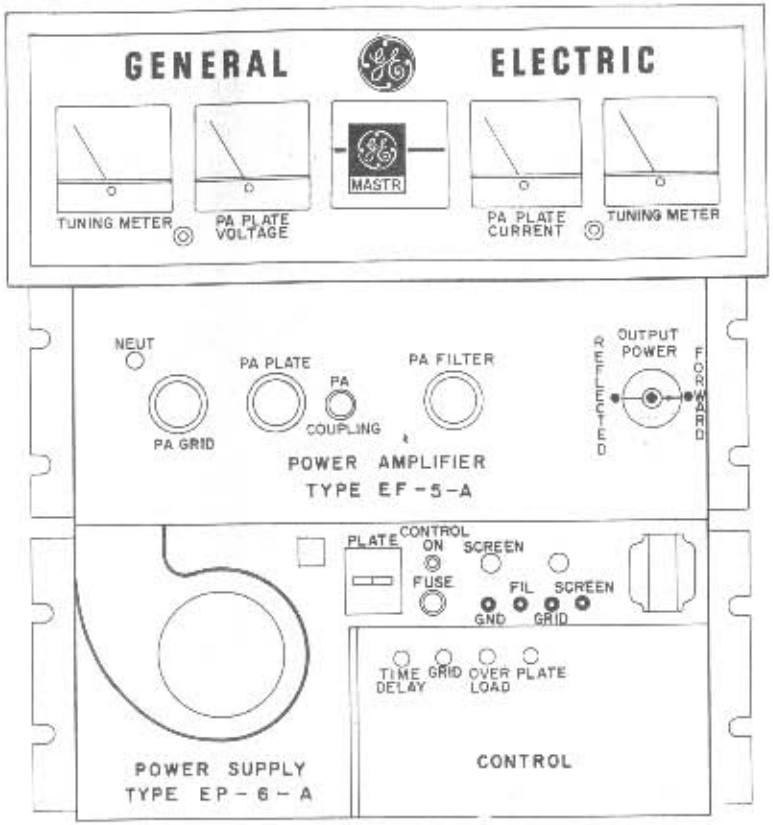
PARTIAL VIEW AT "A"

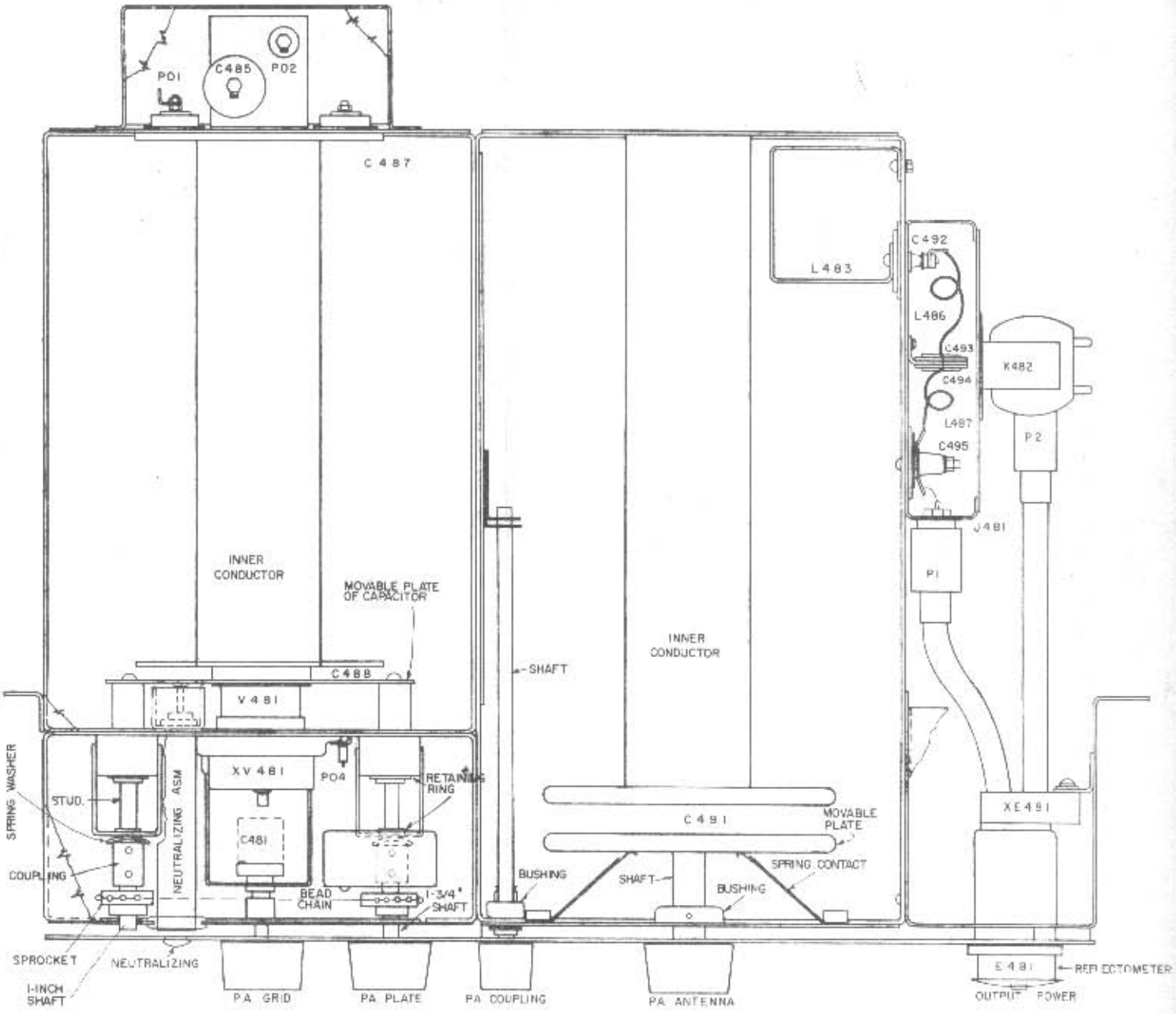
FLECTOMETER

W481

P482

P481





ALIGNMENT PROCEDURE & OUTLINE DIAGRAM

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MASTR POWER AMPLIFIER
MODEL 4EF5A1

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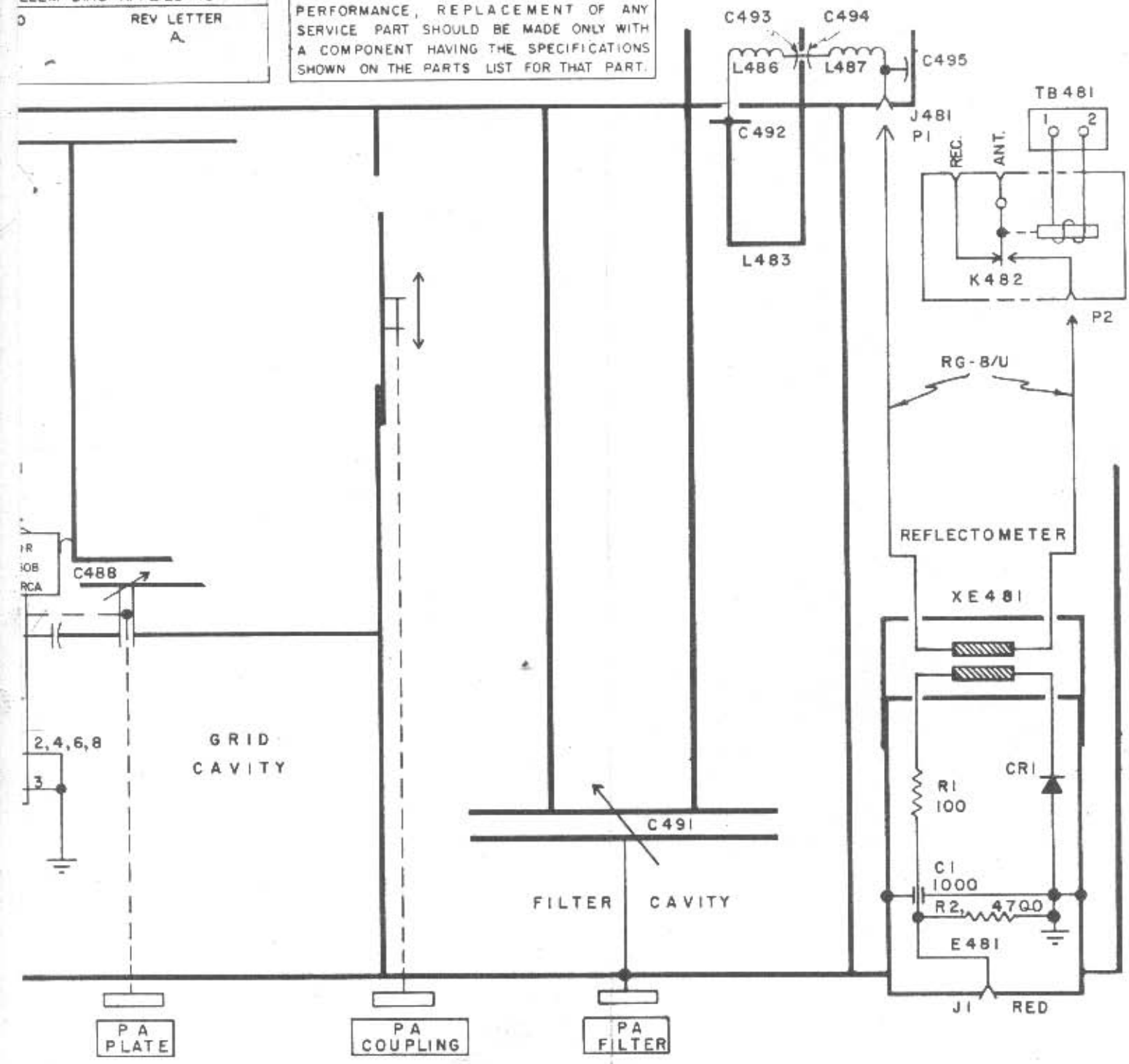
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



SCHEMATIC DIAGRAM

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MODEL 4EF5A1

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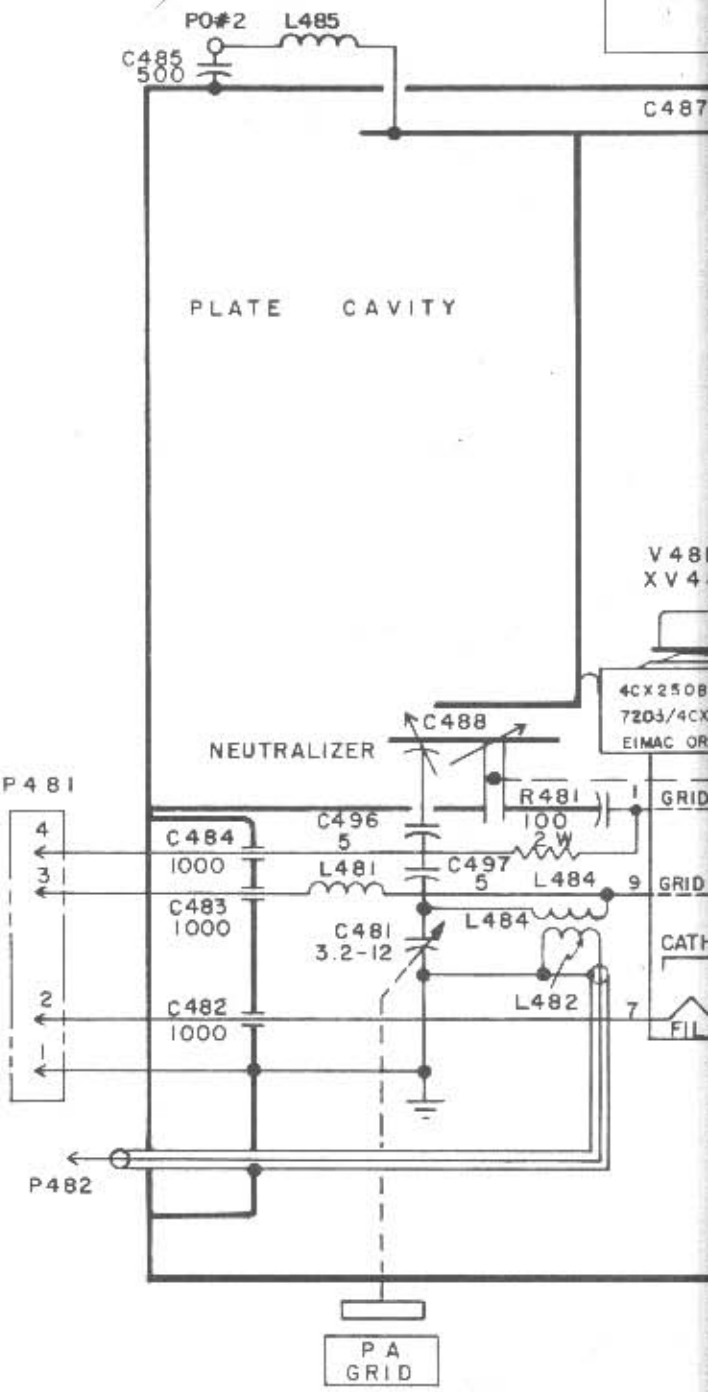

BENCH ALIGNMENT PROCEDURE FOR POWER AMPLIFIER MODEL 4EP5A1

This Bench Alignment Procedure is provided for completely re-aligning and loading Power Amplifier Model 4EP5A1, using an exciter unit. To tune and load full power to the antenna, the grid, plate and antenna circuits of the Power Amplifier must be adjusted as follows.

ALIGNMENT PROCEDURE

Before tuning the Power Amplifier, the Exciter multiplier stages must be aligned according to the procedure in the SERVICE OUTLINE or the BENCH ALIGNMENT PROCEDURE for the Exciter. If the exciter is to be used in conjunction with the 4EP4A3 exciter power supply, jumper must be connected from TB2-2 to TB10-1.

1. Connect the antenna or some other suitable 50-ohm load to the top jack on the Power Amplifier antenna relay.

2. Turn the PLATE switch OFF on the PA Power Supply.

3. Turn the SCREEN adjust on the PA Power Supply fully counterclockwise.

4. Place the power switches located on the Control Panel Exciter Power Supply and Receiver Power Supply to the ON position. Turn the PA Power Supply CONTROL switch to the ON position. Allow 15-minutes for warmup.

5. Connect a microphone to the MIKE jack on the Exciter Power Supply.

6. Pull the PA COUPLING control out to its limit. Turn control clockwise until it engages with the coupling winoow. Push control in all the way to its back limit. Withdraw control approximately 1/4-inch from the back limit.

7. While keying the Exciter, tune the PA GRID for maximum PA GRID current at the GRID jack (J452-green located on the PA Power Supply). A reading of 2.5-volts (25-ma of grid drive) should be obtained on the TUNING METER. If the reading is low, refer to the TRANSMITTER BENCH ALIGNMENT PROCEDURE.

8. Turn the PLATE switch on the PA Power Supply to the ON position.

9. While keying the Exciter, adjust the PA PLATE control for a minimum reading at the PA PLATE current meter.

10. Connect a lead from the TUNING METER to the jack on the front of the PA OUTPUT METER. Rotate OUTPUT METER to the FORWARD position.

11. While keying the Exciter, adjust the PA FILTER for maximum meter reading at the OUTPUT METER jack.

12. While keying the Exciter, increase the SCREEN control fully clockwise.

13. While the Exciter is being keyed, pull the PA COUPLING a small amount, to a maximum of 250-ma at the PA PLATE current meter.

14. While keying the Exciter, readjust the PA PLATE control for minimum reading at the PA PLATE current meter.

15. Repeat steps 11 through 14 above until the licensed power output or power input is reached. Do not exceed 250-ma of PA PLATE current.

16. Neutralizing:

a. Turn the PLATE switch OFF on the PA Power Supply.

b. Turn the Power switch OFF on the Exciter Power Supply.

c. Block the contacts closed on the PA antenna relay (use a piece of tape to hold the contacts).

d. Disconnect the antenna cable from the ANT jack on the PA antenna relay.

e. Disconnect the PA input cable from the output of the Exciter.

f. Connect a short coaxial cable from the ANT jack on the Exciter to the ANT jack on the PA antenna relay.

CAUTION

Failure to have the PLATE switch in the OFF position when performing step 16g through 16k below, can result in damage to the equipment.

g. The Exciter output will now be feeding into the Power Amplifier output for neutralizing the PA.

h. Turn the Exciter Power switch ON. Do not turn on the PLATE switch on the PA Power Supply.

i. Connect a lead from the TUNING METER to the GRID jack J452-green, located on the PA Power Supply.

j. Adjust the PA Grid, PA Filter and the Exciter output for maximum PA Grid current.

k. Using an insulated tuning tool, adjust the NEUTralizer adjustment (located under the plug button on the front of the Power Amplifier unit), for minimum PA Grid current.

l. Turn the Power switch OFF on the Exciter Power Supply.

m. Open the rear door on the Station cabinet, remove the block from the relay contacts, disconnect the coaxial cable, replace the PA antenna cable and replace the Exciter output cable.

n. Close the rear door.

17. Turn the Exciter Power Switch ON.

18. Repeat steps 3 through 15 above until no further gain can be obtained. Do not exceed 250-ma of PA PLATE current.

19. Carefully turn the PA COUPLING control counterclockwise to disengage it from the internal coupling window. Push the PA COUPLING control in to its back limit.

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GENERAL ELECTRIC COMPANY
LYNCHBURG, VIRGINIA

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BENCH ALIGNMENT PROCEDURE FOR POWER AMPLIFIER MODEL 4EF5A1

This Bench Alignment Procedure is provided for completely re-aligning and loading PowerAmplifier Model 4EF5A1, using an Exciter unit. To tune and load full power to the antenna, the grid, plate and antenna circuits of the Power Amplifier must be adjusted as follows.

ALIGNMENT PROCEDURE

Before tuning the Power Amplifier, the Exciter multiplier stages must be aligned according to the procedure in the SERVICE OUTLINE or the BENCH ALIGNMENT PROCEDURE for the Exciter. If the exciter is to be used in conjunction with the 4EP4A3 exciter power supply, jumper must be connected from TB2-2 to TB10-1.

1. Connect the antenna or some other suitable 50-ohm load to the top jack on the Power Amplifier antenna relay.

2. Turn the PLATE switch OFF on the PA Power Supply.

3. Turn the SCREEN adjust on the PA Power Supply fully counterclockwise.

4. Place the power switches located on the Control Panel, Exciter Power Supply and Receiver-Power Supply to the ON position. Turn the PA Power Supply CONTROL switch to the ON position. Allow 15-minutes for warmup.

5. Connect a microphone to the MIKE jack on the Exciter Power Supply.

6. Pull the PA COUPLING control out to its limit. Turn control clockwise until it engages with the coupling window. Push control in all the way to its back limit. Withdraw control approximately 1/4-inch from the back limit.

7. While keying the Exciter, tune the PA GRID for maximum PA GRID current at the GRID jack (J452-green located on the PA Power Supply). A reading of 2.5-volts (25-ma of grid drive) should be obtained on the TUNING METER. If the reading is low, refer to the TRANSMITTER BENCH ALIGNMENT PROCEDURE.

8. Turn the PLATE switch on the PA Power Supply to the ON position

9. While keying the Exciter, adjust the PA PLATE control for a minimum reading at the PA PLATE current meter.

10. Connect a lead from the TUNING METER to the jack on the front of the PA OUTPUT METER. Rotate OUTPUT METER to the FORWARD position.

11. While keying the Exciter, adjust the PA FILTER for maximum meter reading at the OUTPUT METER jack.

12. While keying the Exciter, increase the SCREEN control clockwise to a maximum of 200 ma.

13. While the Exciter is being keyed, pull the PA COUPLING a small amount, to a maximum of 250-ma at the PA PLATE current meter.

14. While keying the Exciter, readjust the PA PLATE control for minimum reading at the PA PLATE current meter.

15. Repeat steps 11 through 14 above until the licensed power output or power input is reached. Do not exceed 250-ma of PA PLATE current.

16. Neutralizing:

a. Turn the PLATE switch OFF on the PA Power Supply.

b. Turn the Power switch OFF on the Exciter Power Supply.

c. Block the contacts closed on the PA antenna relay (use a piece of tape to hold the contacts).

d. Disconnect the antenna cable from the ANT jack on the PA antenna relay.

e. Disconnect the PA input cable from the output of the Exciter.

f. Connect a short coaxial cable from the ANT jack on the Exciter to the ANT jack on the PA antenna relay.

CAUTION

Failure to have the PLATE switch in the OFF position when performing step 16g through 16k below, can result in damage to the equipment.

g. The Exciter output will now be feeding into the Power Power Amplifier output for neutralizing the PA.

h. Turn the Exciter Power switch ON. Do not turn on the PLATE switch on the PA Power Supply.

i. Connect a lead from the TUNING METER to the GRID jack J452-green, located on the PA Power Supply.

j. Adjust the PA Grid, PA Filter and the Exciter output for maximum PA Grid current.

k. Using an insulated tuning tool, adjust the NEUTralizer adjustment (located under the plug button on the front of the Power Amplifier unit), for minimum PA Grid current.

l. Turn the Power switch OFF on the Exciter Power Supply.

m. Open the rear door on the Station cabinet, remove the block from the relay contacts, disconnect the coaxial cable, replace the PA antenna cable and replace the Exciter output cable.

n. Close the rear door.

17. Turn the Exciter Power Switch ON.

18. Repeat steps 3 through 15 above until no further gain can be obtained. Do not exceed 250-ma of PA PLATE current.

19. Carefully turn the PA COUPLING control counterclockwise to disengage it from the internal coupling window. Push the PA COUPLING control in to its back limit.

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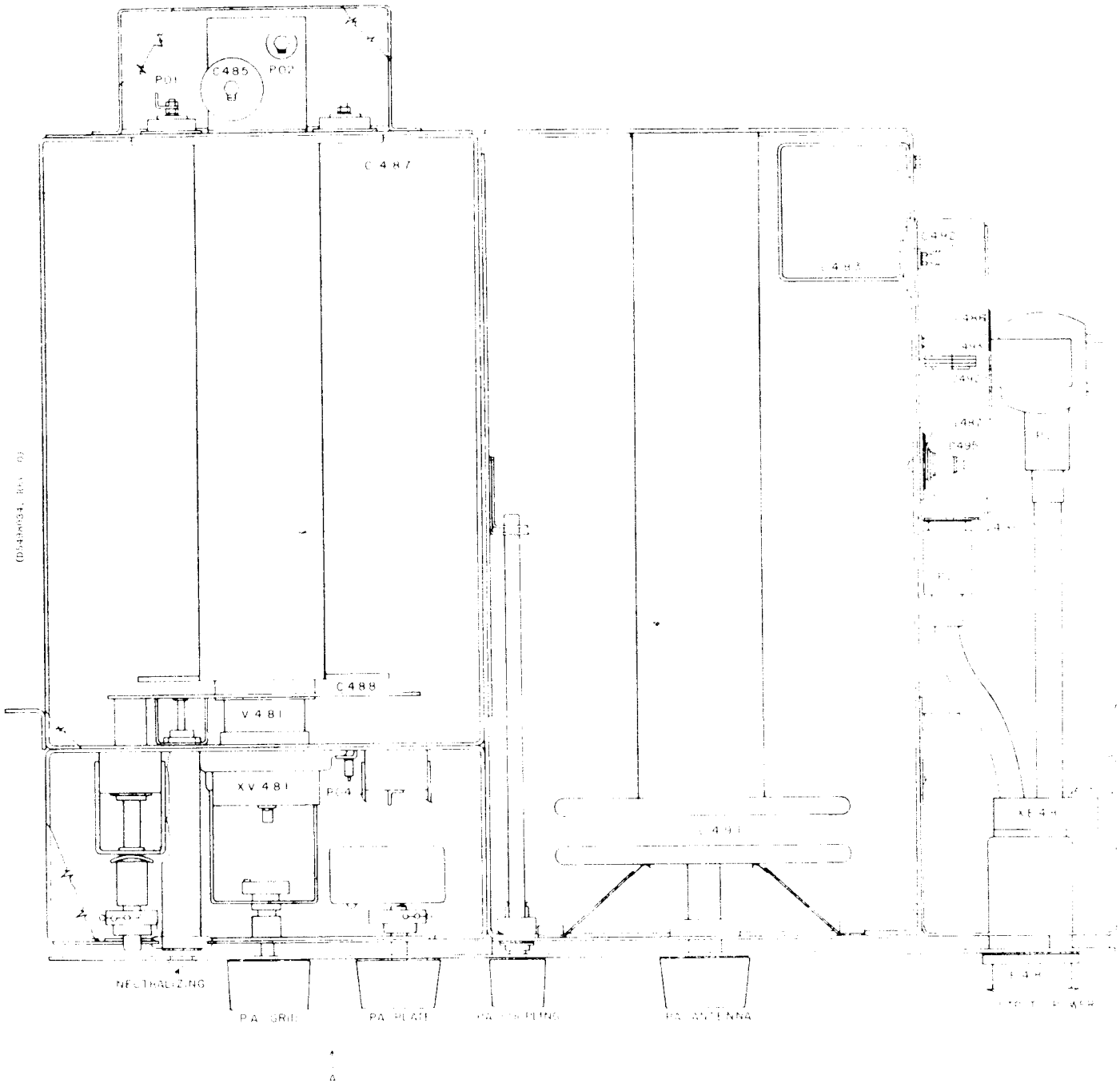
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C491
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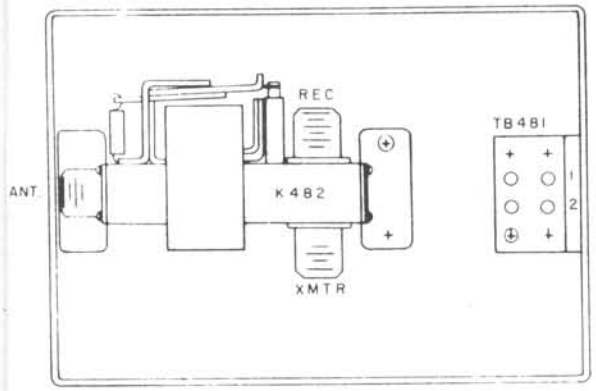
PA GRID
PA PLATE
PA SCREEN
PA ANTENNA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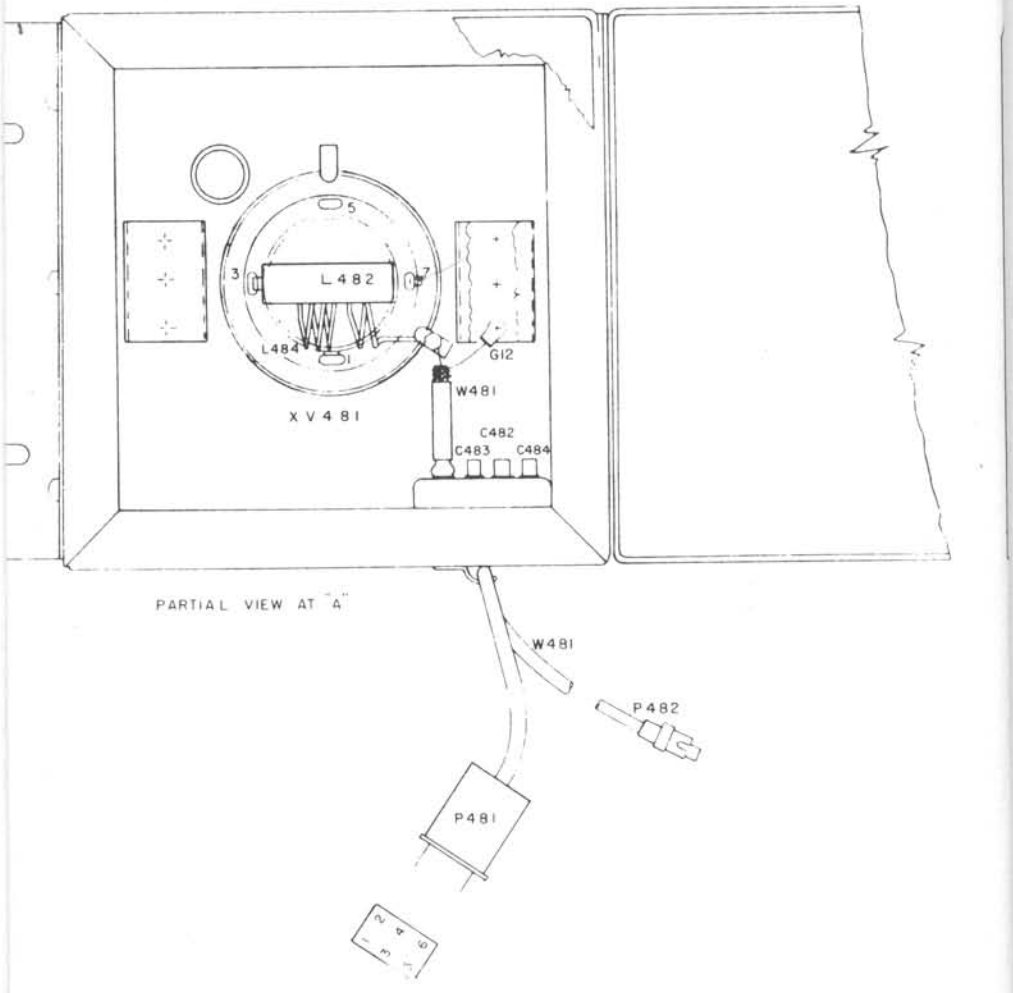
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PARTIAL VIEW AT "A"
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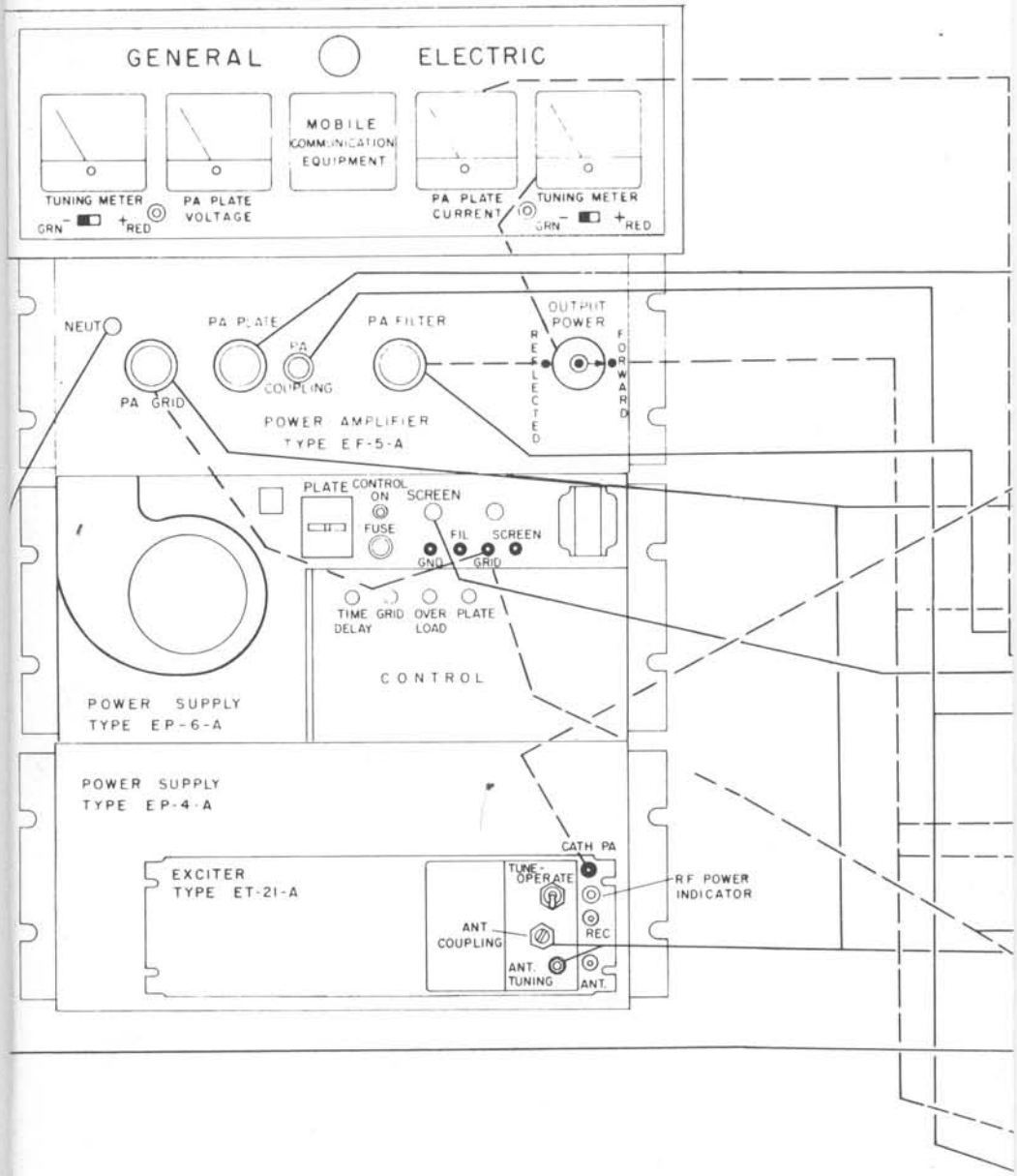

GENERAL ELECTRIC
MOBILE COMMUNICATION EQUIPMENT
TUNING METER
GRN - + RED
PA PLATE VOLTAGE
PA PLATE CURRENT
TUNING METER
GRN - + RED
NEUT
PA GRID
PA PLATE
PA COUPLING
PA FILTER
OUTPUT POWER
REFLECTED
FORWARD
POWER AMPLIFIER TYPE EF-5-A
PLATE
CONTROL ON
FUSE
SCREEN
FIL
SCREEN
GND
GRID
TIME DELAY
GRID OVER LOAD
PLATE
CONTROL
POWER SUPPLY TYPE EP-6-A
POWER SUPPLY TYPE EP-4-A
CATH PA
EXCITER TYPE ET-21-A
TUNE - OPERATE
RF POWER INDICATOR
ANT COUPLING
REC
ANT. TUNING
ANT.

SIMPLIFIED ALIGNMENT PROCEDURE

These instructions are intended for tuning the 250 Watt Power Amplifier. If the Power Amplifier is badly misaligned or the frequency of the Exciter is to be changed, refer to the complete POWER AMPLIFIER BENCH ALIGNMENT PROCEDURE. Before the alignment procedure outlined below is followed, the multiplier stages of the Exciter must be aligned. Instructions for aligning the Exciter are included on the Service Outline for the unit (see Table of Contents).

PRELIMINARY INSTRUCTIONS.

1. Connect the antenna or other suitable 50-ohm load to the ANT jack on the Power Amplifier.

2. RF cable for crystal is connected between pins 4 and 5 of crystal socket XY101 (Channel P crystal between pins 2 and 4 for two frequency operation), in the Exciter.

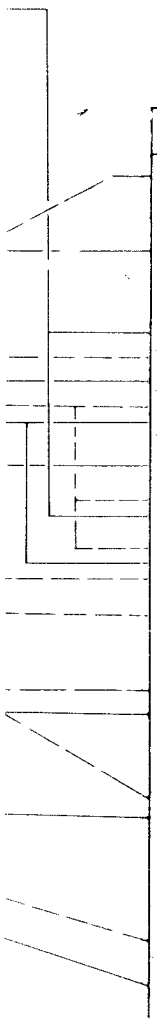
3. Turn the Plate switch OFF.

4. Turn the SCREEN control on the PA Power Supply fully counterclockwise.

5. Turn Power ON and allow 3 or 4 minutes for warmup.

6. Connect a microphone to the MIKE jack on the Exciter Power Supply.

7. Pull the PA COUPLING control OUT to its limit. Turn control clockwise until it engages with the coupling window. Push control IN to its back limit. Withdraw control approximately 1 1/4 in.*.



TUNING CONTROL	METERING	METER READING	PROCEDURE
	GRID (on Exciter) J106 red	1.6 volts	1. Check for drive of 1.2 volts at the GRID PA jack on the Exciter. If reading is low, refer to Exciter Bench Alignment Procedure.
PA GRID	GRID (on PA Power Supply) J402-green	Maximum	2. While keying the Exciter, tune the PA GRID for a maximum (7 to 25 ma) reading of 0.7 to 2.5 volts.
			3. Turn the PLATE switch on the PA Power Supply to the ON position.
PA PLATE	PA PLATE CURRENT	Minimum	4. While keying the Exciter, tune the PA PLATE control for minimum.
PA FILTER	OUTPUT POWER	Maximum	5. While keying the Exciter, tune the PA FILTER for maximum.
SCREEN	PA PLATE CURRENT	200 ma maximum	6. While keying the Exciter, adjust the SCREEN control for a maximum of 200 ma.
PA COUPLING	"	250 ma maximum	7. Pull the PA COUPLING control a small amount (250 ma maximum), while keying the Exciter.
PA PLATE	"	Minimum	8. While keying the Exciter, tune the PA PLATE for minimum.
SCREEN	OUTPUT POWER & PA PLATE CURRENT	250 ma maximum	9. While keying the Exciter, adjust the SCREEN control for maximum Output Power and minimum Plate current.
	OUTPUT POWER	Maximum	10. Repeat steps 7 through 9 above until no further gain can be obtained.
PA GRID, PA FILTER, EXCITER ANT COUPLING & ANT TUNING	GRID (on PA Power Supply) J402-green	Maximum	11. Turn Plate switch OFF.* Disconnect Output cable from Exciter. Disconnect Antenna cable from the ANT jack on the PA antenna relay. Connect a coaxial cable between the Exciter Output and the ANT jack on the PA antenna relay. Tape contacts closed on the PA antenna relay. Tune PA GRID, PA FILTER and Exciter OUTPUT adjustments (use insulated tuning tool) for maximum meter reading.
NEUT	"	Minimum	12. Tune NEUT adjustment (use insulated tuning tool) for minimum meter reading.
			13. Remove tape holding relay contacts, disconnect coaxial cable. Replace PA antenna cable and the Exciter output cable.
	OUTPUT POWER	Maximum	14. Turn Plate switch ON. Repeat steps 7 through 9 above until no further gain can be obtained.
PA COUPLING			15. Carefully turn the PA COUPLING control counterclockwise to disengage the coupling window. Push the PA COUPLING control IN to its limit.

SOLID LINES INDICATE TUNING CONTROLS.

BROKEN LINE INDICATES METERING.

* FAILURE TO HAVE THE PLATE SWITCH IN THE "OFF" POSITION WHILE PERFORMING STEPS 11, 12 & 13 ABOVE, CAN RESULT IN DAMAGE TO THE EQUIPMENT.

Service Outline

144-174 MC POWER AMPLIFIER MODEL 4EF5A1

(RC-478)

PRODUCTION CHANGE SHEET
FOR
POWER AMPLIFIER MODEL 4EF5A1

Changes listed below are identified by the letter appearing in the REV pad on the unit chassis.

- -

REV A - Purpose - To increase the ability of the output filter to withstand nearby lightning discharges.

Change - The dimensions of the capacitor plates and the teflon insulators in the output filter were changed to permit the use of higher voltage insulators between pass-through bolt and ground.

20121

COMMUNICATION PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY
LYNCHBURG, VIRGINIA

Printed in U.S.A.

communications

DATAFILE BULLETIN

FILE UNDER: TRANSMITTER POWER AMP

BULLETIN NO: EF-5-A 3061-1

DATE: April 1961

C492 THRU C495 REDESIGNED TO RESIST LIGHTNING DAMAGE

WHAT? Revision A of Power Amplifier EF-5-A increased the voltage rating of the capacitors in the output filter (C492, C493, C494 and C495), by changing the dimensions of the capacitor plates and Teflon® insulators to permit the use of higher voltage insulation between the pass-through bolts and ground.

Whenever one of these capacitors is replaced, it is recommended that the new type capacitor be used as a replacement. Replacing any of the capacitors in amplifiers earlier than Rev. A requires enlarging the mounting hole to 1/2 inch diameter.

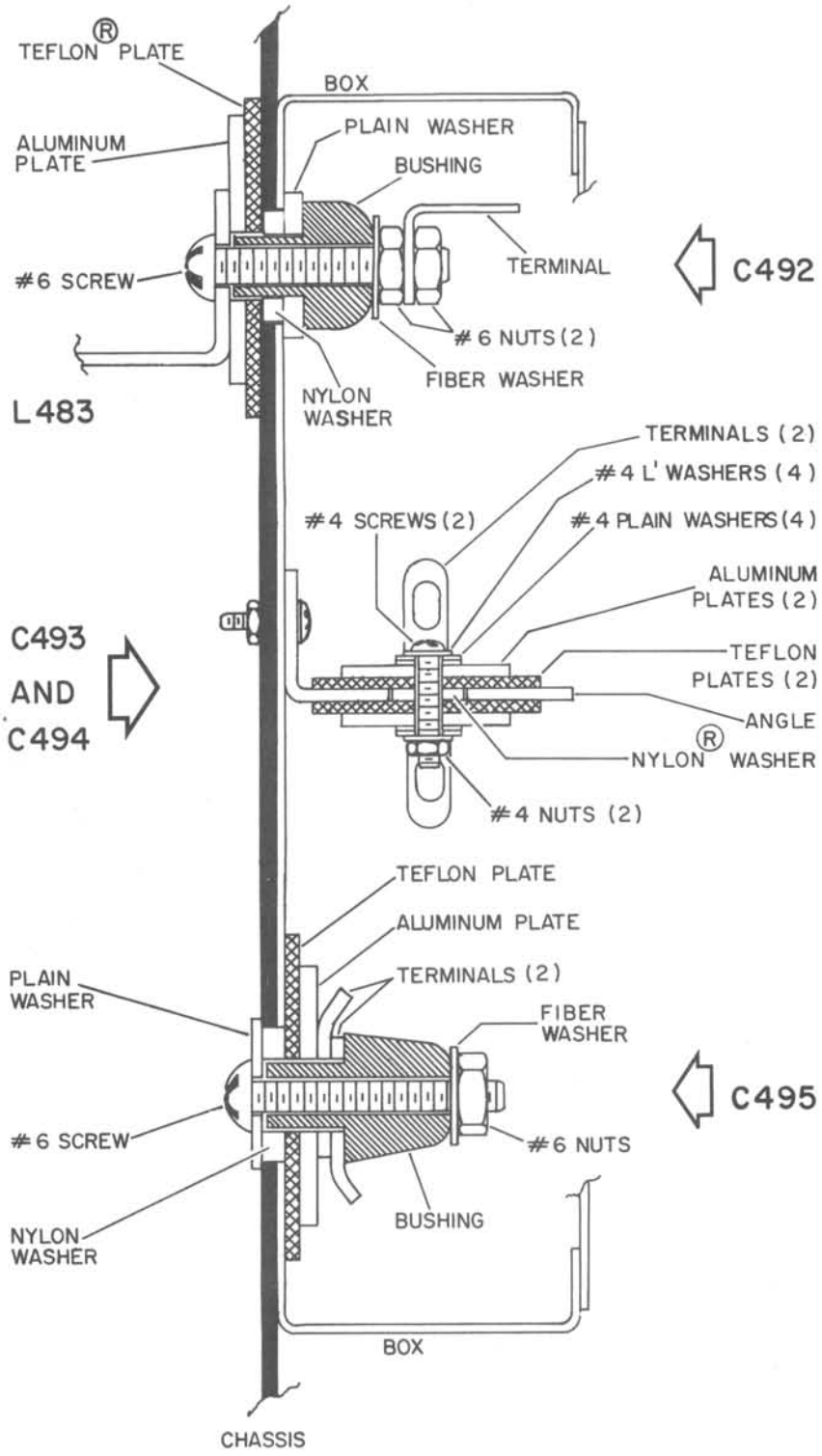
WHY? The voltage rating of capacitors C492, C493, C494 and C495 was increased to withstand the voltage surges resulting from nearby lightning discharges.

HOW? To replace any of these capacitors in amplifiers earlier than Rev. A, order all of the parts for that capacitor marked with an asterisk (*) on page 2 and any additional parts which have been damaged. It will be necessary to drill and ream the mounting holes for C492 or C495, if replaced, to 1/2 inch diameter. Be sure to remove any metal chips which fall into the amplifier. It is also recommended that any bare metal exposed by the drill be coated with lacquer or Glyptal® to prevent corrosion.

For amplifiers of Rev. A or later, only the damaged parts need be ordered.

Symbol Number	Description	Quantity	G-E Part Number
C492	Capacitor, Feed-Through:		
	• Machine Screw: #6	1*	N81-P13016
	• Aluminum Plate	1*	A-4029692-P1
	• Teflon® Plate	1*	A-4029691-P1
	• Nylon® Washer	1*	A-4035237-P1
	• Plain Washer	1*	N401-P41
	• Bushing	1*	M-7479752-P11
	• Fiber Washer: #6	1*	A-7872492-P1
	• Nuts: #6	2	N207-P13
	• Terminal	1	A-7135118-P2
C493 and C494	Capacitor, Stand-Off:		
	• Angle	1*	A-4029887-P1
	• Machine Screws: #4	2	N81-P9010
	• Lockwashers: #4	4	N414-P11
	• Plain Washers: #4	4	N401-P5
	• Terminals	2	A-7135118-P1
	• Aluminum Plates	2*	A-4029886-P1
	• Teflon Plates	2*	A-4029889-P1
	• Nylon Washers	2*	A-4035237-P2
	• Nuts: #4	2	N207-P9
C495	Capacitor, Stand-Off:		
	• Machine Screw: #6	1	N81-P13016
	• Plain Washer: #6	1*	N401-P67
	• Nylon Washer	1*	A-4035237-P1
	• Teflon Plate	1*	A-4029691-P1
	• Aluminum Plate	1*	A-4029692-P1
	• Terminals	2	K-7875267-P1
	• Bushing	1	M-7479752-P11
	• Fiber Washer: #6	1	A-7872492-P1
	• Nut: #6	1	N207-P13

FIG.1 - PARTS BREAKDOWN: C492 THRU C495



INSTRUCTIONS FOR POWER AMPLIFIER MODEL 4EF5B2

The General Electric 250 watt Power Amplifier Model 4EF5B2 has been designed for use in stations operating in the 144 to 174 MC band. An external exciter is required for driving the amplifier. A power supply is provided for external mounting. The amplifier employs a 4CX250-B tube as the final amplifier stage, with forced air cooling provided by a blower mounted on the power supply. Standard 19-inch relay rack mounting is employed for the amplifier and its power supply. Tuning controls are located on the front panel of the amplifier.

This power amplifier is exciter keyed. Only when RF is present at the grid of the PA tube will the power amplifier be keyed on to the full 250 watts.

RF AND POWER CONNECTIONS

All power connections (except the high voltage) are made through a six-conductor cable connected between the power supply and a plug (P481) on the front panel of the amplifier.

High voltage for the amplifier plate is supplied to a feed-through coupling (PO-2) at the rear of the plate compartment.

RF drive is connected between the exciter and a plug (P482) on the front of the unit by an RG-58/U coaxial cable.

PREVENTIVE MAINTENANCE

To obtain rated equipment performance, a program of regular preventive maintenance should be followed. Frequent checks of the operating frequency should be made as required by the FCC. Check the PA PLATE current, GRID current and PA PLATE voltage. Check for loose nuts, screws and damaged components. Inspect all power and RF cables and connectors for damage.

4CX250 POWER AMPLIFIER TUBE REPLACEMENT

A. To remove the power amplifier tube from its mounting, proceed as follows:

5154

1. Remove the high voltage lead from PO-2 located on the rear of the plate compartment.

2. Loosen the winged screws holding the rear cover plate assembly.

3. Slide off the rear cover plate assembly.

4. Insert the prongs of the tube extractor supplied with the equipment between the cooling fins of the tube.

5. Gently pull the tube straight out from the socket.

B. To insert the tube in its mounting, proceed as follows:

1. Insert the prongs of the tube extractor between the cooling fins of the tube.

2. Push the tube all the way into the socket.

3. Replace the rear cover plate assembly and tighten the winged screws.

4. Connect the high voltage lead to PO-2 on the rear of the PA.

BLOWER MAINTENANCE

The blower motor bearings are to be lubricated every 2000 hours of operation. Use Gulfcrest A (WCR) electric motor and generator low viscosity oil. Do not allow oil to get on the impeller blades. If the blades become coated with oil, they should be removed, washed in a grease solvent and hot water, thoroughly dried and replaced.

CIRCUIT DESCRIPTION

Excitation is fed to the power amplifier through P482 to the coupling loop L482 and coupled to Coil L484 which, with C481, forms the grid tank circuit of the amplifier. By adjusting the PA GRID control (C481), the grid tank is tuned to the operating frequency. L481 isolates RF from the power cable.

Heater voltage for V481 may be varied inside the control box or the power supply chassis. C482, C483 and C484 are RF by-pass capacitors. R481 is used as a screen decoupling resistor. Built into the tube socket is a ring type capacitor which serves as the screen by-pass.

C496 and C497 are neutralizing capacitors in series with the neutralizing adjustment. C485 provides RF by-passing for the B-PLUS and L485 is the RF choke in the plate supply. The plate tank is composed of C488 and the transmission line section formed by the inner and outer cages of the plate cavity. The plate tank is tuned to resonance by adjusting the PA PLATE control C488.

Adjusting the PA COUPLING control varies the coupling between the plate tank and the output of the amplifier by controlling the amount of magnetic flux linking the plate line and the filter line. L483 couples the energy from the PA FILTER cavity to the output connector J481. The signal at J481 is connected to the station antenna through the variable attenuator.

RF PROBE CIRCUIT

The RF probe circuit consists of L489, L488, R482, R483, CR481, CR482 and C489. L489 is the RF pick-up loop which feeds part of the RF energy present in the output circuit to the input of the RF probe detector. This RF energy is then rectified and a positive DC output is applied to an external RF Level Indicator. The RF Level Indicator is actuated when the power output exceeds 125 watts.

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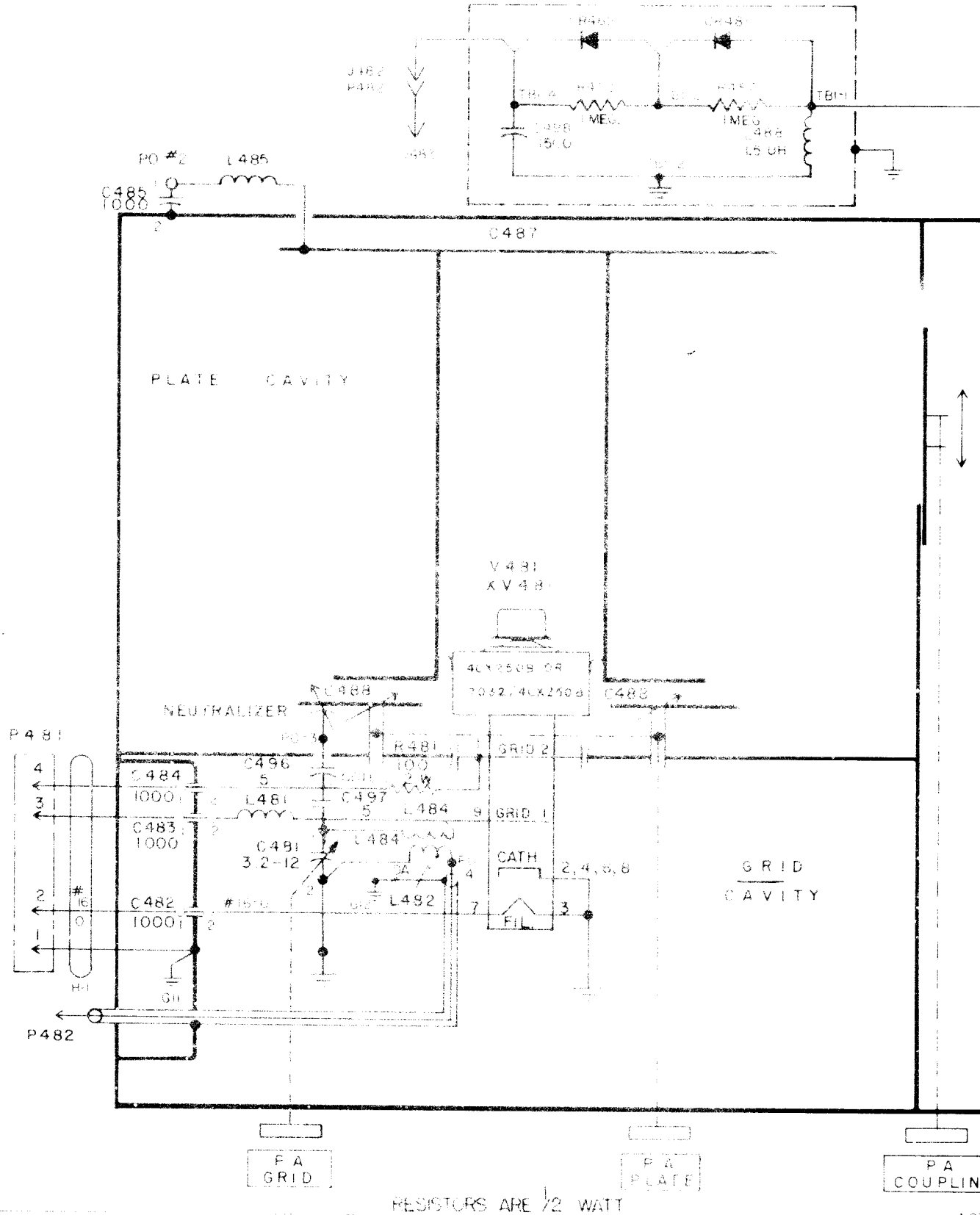
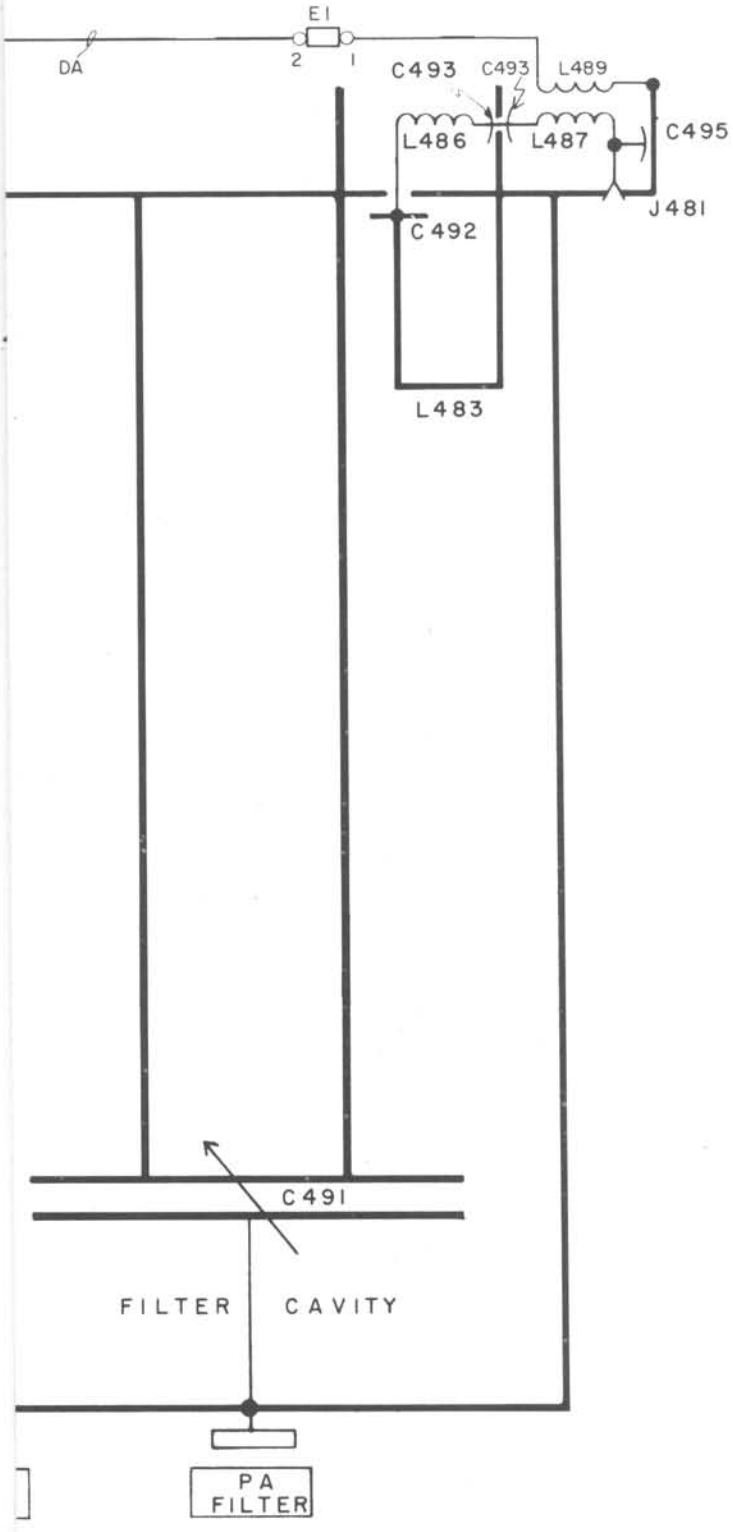


IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

RESISTORS ARE 1/2 WATT
RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS, OR MEG=1,000,000 OHMS
CAPACITOR VALUES IN MICROMICROFARADS UNLESS FOLLOWED BY UF=MICROFARADS
INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH=MILLIHENRYS OR H=HENRYS



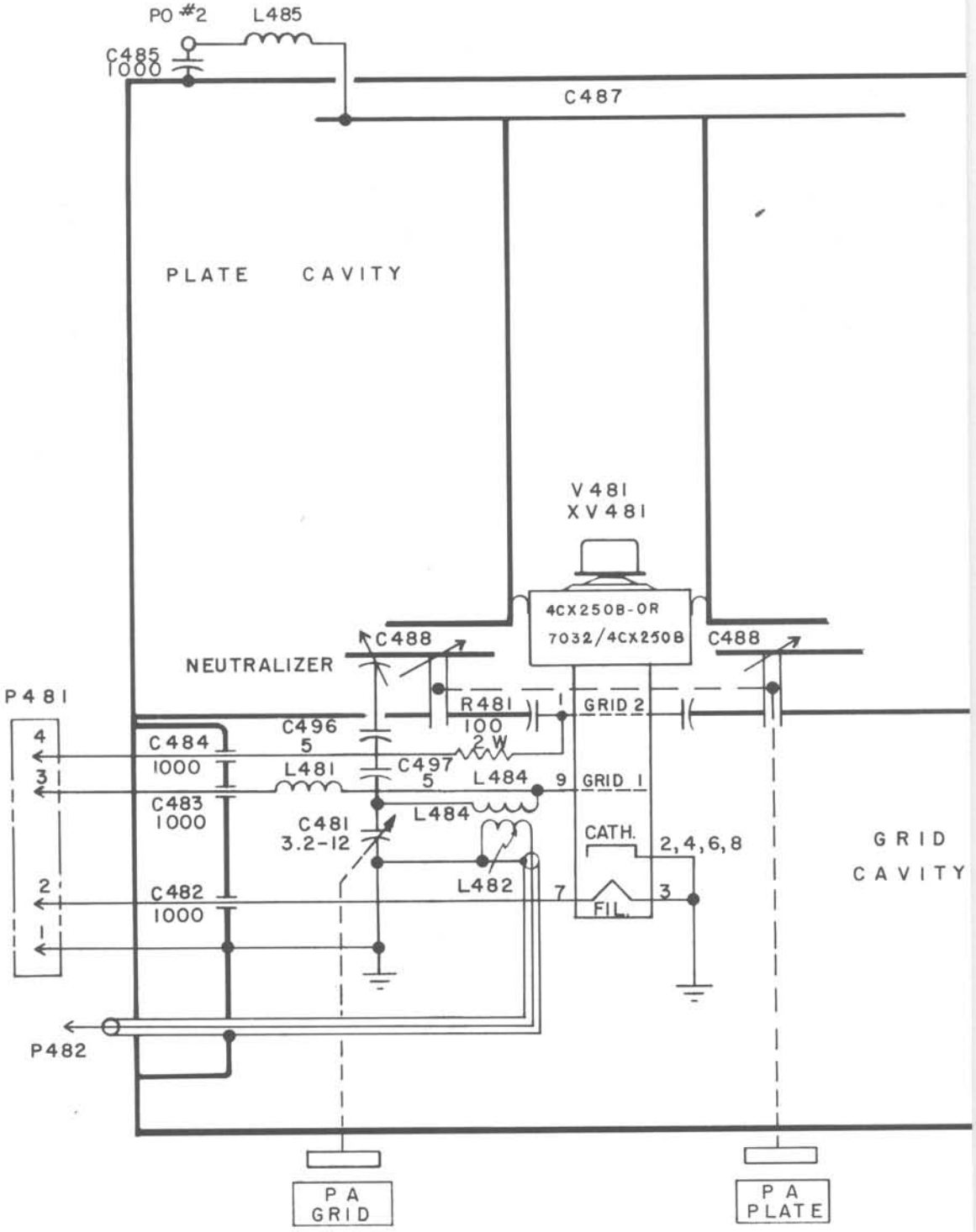
TWIST ENDS TOGETHER AND SOLDER

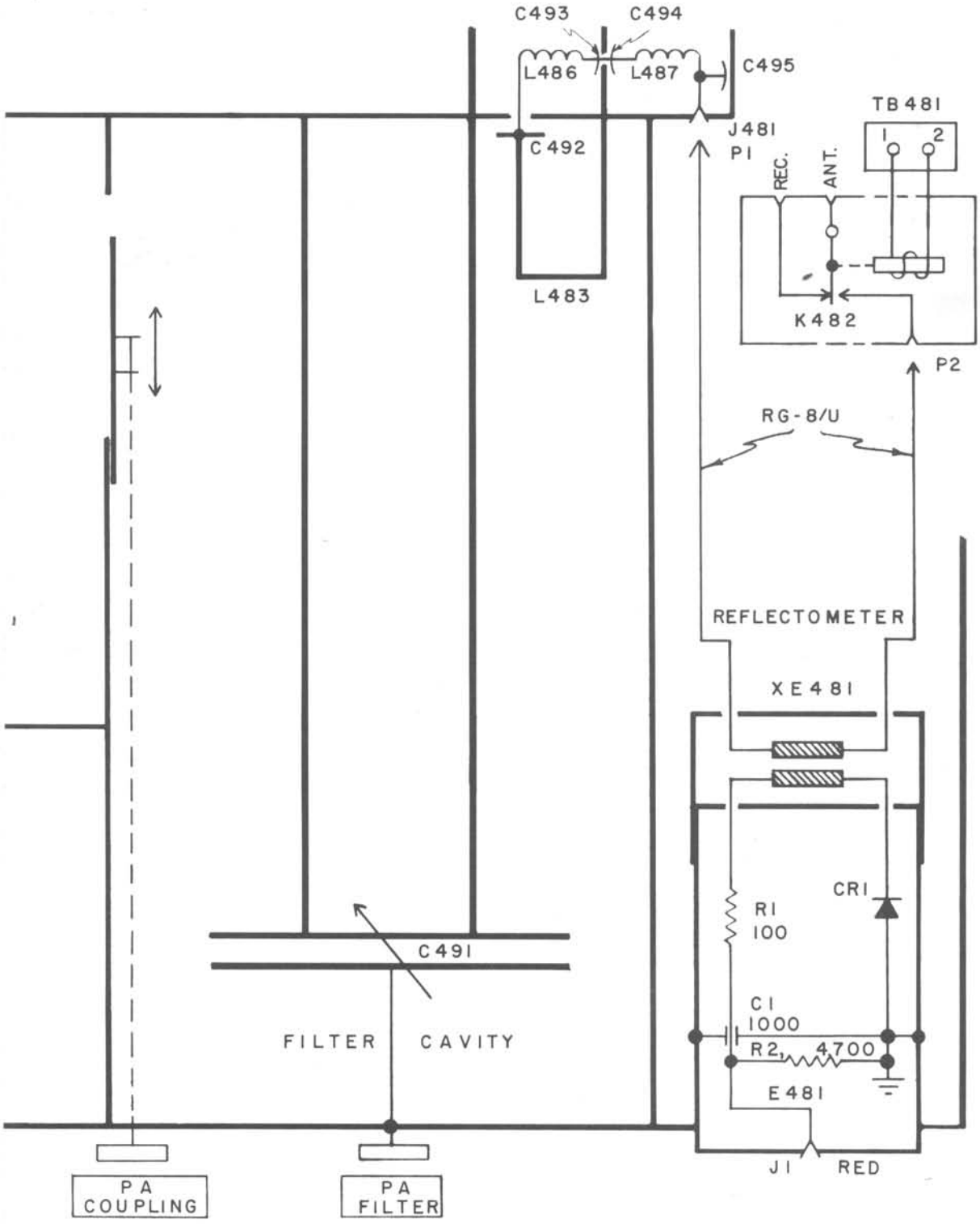
Wiring Diagram

POWER AMPLIFIER
144-174 MC, 250 W
MODEL 4EF5B2

(19C303086, Rev. 0)

IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.





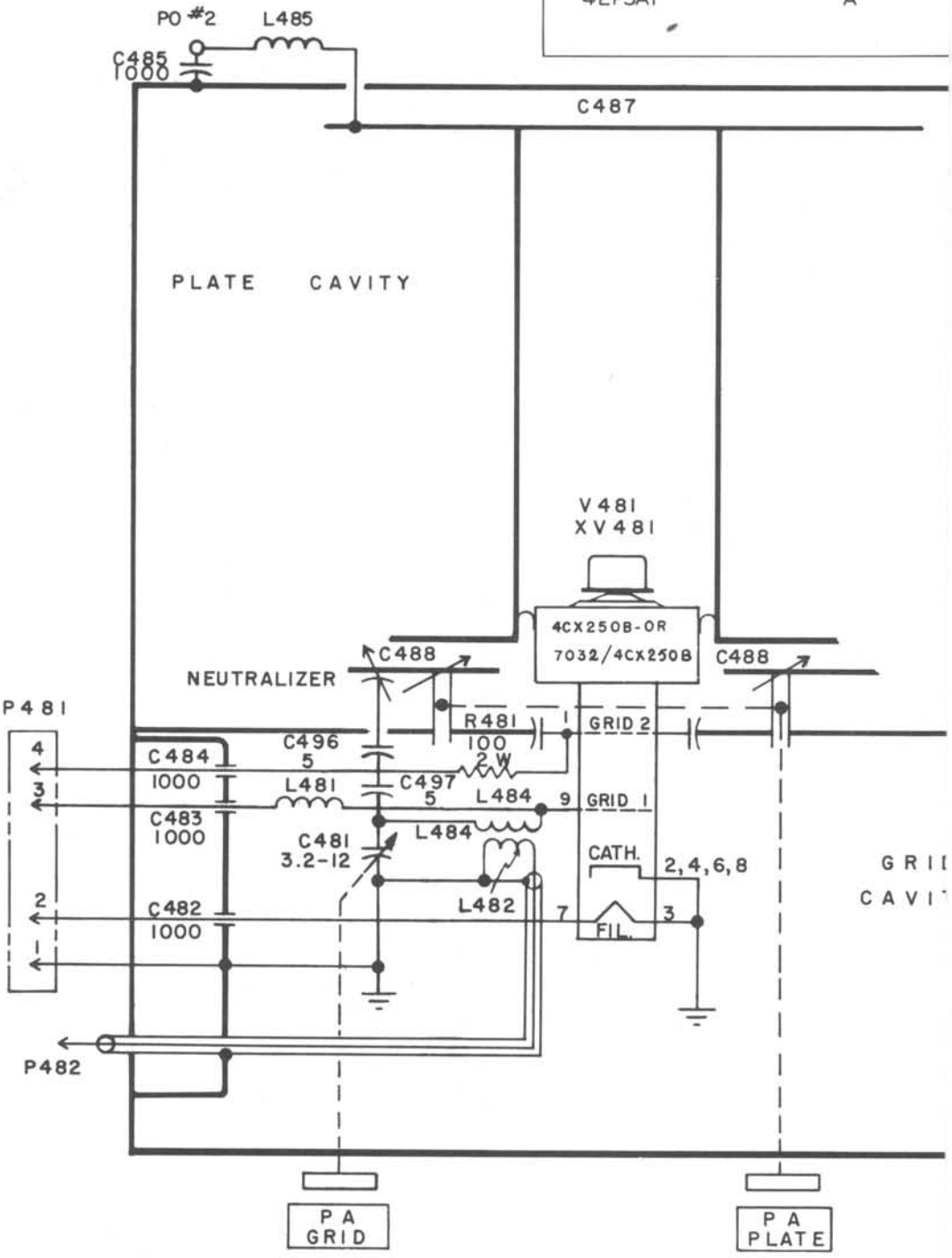
Elementary Diagram

250-WATT POWER AMPLIFIER
MODEL 4EF5A1, 144-174 MC

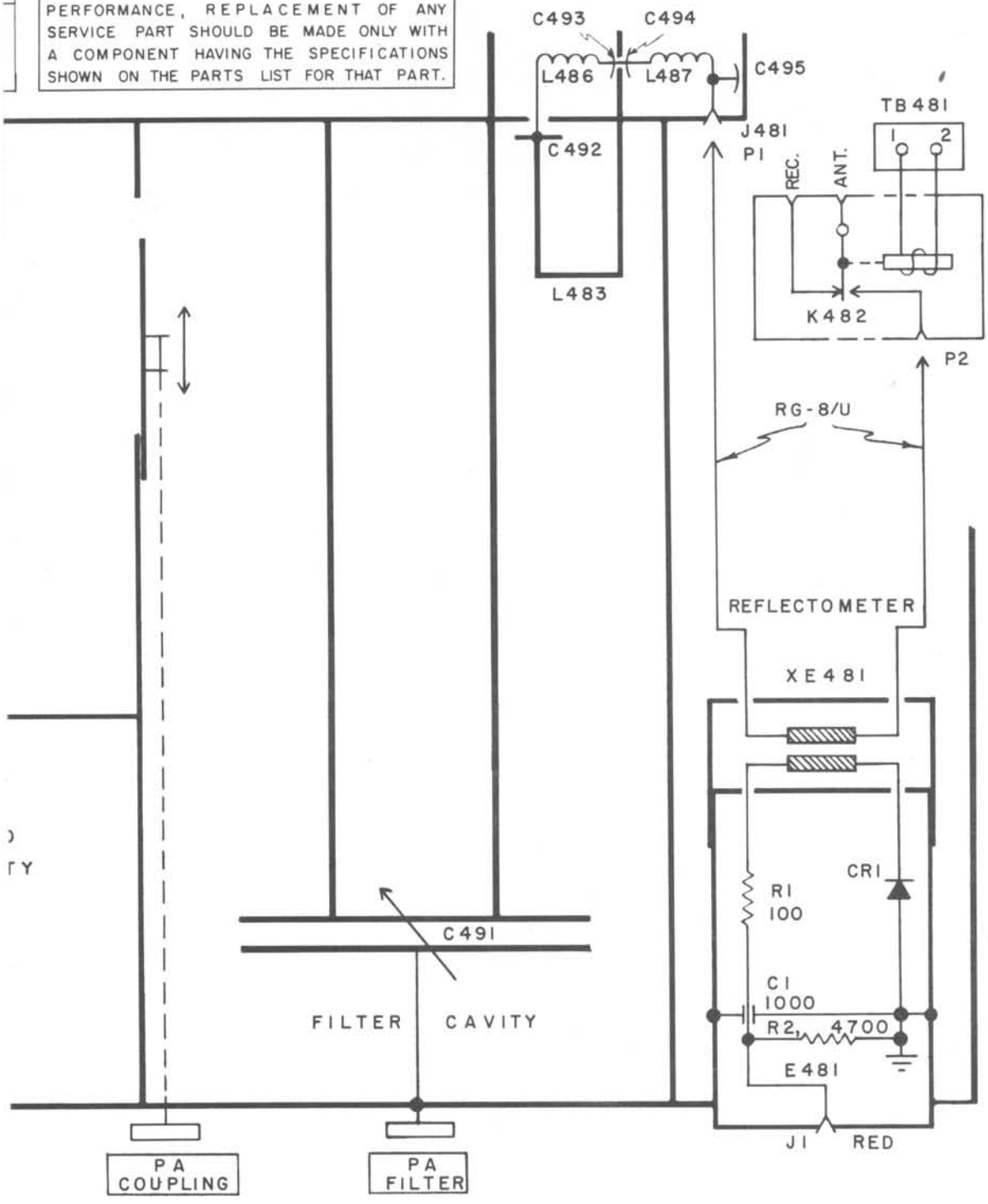
(C-5494558, Rev. 6)

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
4EF5A1	A



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.



Elementary Diagram

144-174 MC, 330-WATT
POWER AMPLIFIER
MODEL 4EF5A1, REV. A

(C-5494558, Rev. 7)

PARTS LIST

POWER AMPLIFIER 144-174 MC
MODEL 4EF5A1
REV A

SYMBOL	DESCRIPTION		G-E DRAWING & PART NO.
	CAPACITORS		
C481	Variable, air, 12 or 13 plates, 3.6 to 12 mmfd, air gap 0.039 to 0.045. Teleradio Cat. #T-9476		B-7491398-P1
C482 thru C484	Capacitor, fixed ceramic dielectric (feed through). Thermo-setting insulation 1,000 pf +20%, 500 VDCW, maximum power factor 2.5% at 1 Kc sec, variable temperature coefficient Erie Resistor Corp Type 327. (Hardware supplied)		[illegible]
C485	Ceramic, high voltage, 500 mmfd +50% -20%, 20,000 v d-c w. Similar to Centralab Cat. #DA209.		M-7186632-P23
C487	Capacitor, Feed-thru:	Quantity	
	Inner Conductor Assembly (Plate Cavity Inner Conductor)	1	PL-4029768-G1
	Printed Wiring Board	1	B-5490180-P1
	Fibre Washer: 0.875-inches od, 0.755-inches id	1	A-4035306-P50
	Ceramic Bushing	1	A-4029012-P1
	Fibre Washer: 0.500-inches od, 0.188-inches id	1	
	Plain Washer: #8	5	N401-P8
	Terminal	1	A-7135118-P2
	Lock Washer: #8	4	N111-P16
	Nut: #8	5	N207-P15
	Screw: #8	1	N83-P15012
C488	Capacitor, PA Plate, Tuning:	Quantity	
	Inner Conductor Assembly (Plate Cavity Inner Conductor)	1	PL-4029768-G1
	Movable Capacitor Plate	1	PL-4029712-G2
	Bracket	2	A-4029361-P1
	Block	2	PL-4029603-G1
	Retaining Ring: 0.770-in. od, 0.16[illegible]-in. id	2	[illegible]
	Stud	2	[illegible]
	Retaining Ring: 0.339-in. od, 0.260-in. id	[illegible]	[illegible]
	Spring Washer	[illegible]	[illegible]
	Coupling Sleeves	2	A-4029810-P2
	Bead Chain	[illegible]	A-4029870-P1
	Sprocket (Bead Chain Pulley)	2	A-4029856-P1
	Set Screw, #8 (Set Screw for Pulley)	2	A-4031097-P1
	Plate	1	A-4029950-P1
	Shaft: 1.060-inches long	1	A-4029954-P1
	Shaft: 1.760-inches long	1	A-4029954-P2
	Set Screw: #8	1	AN70-P1503C12
	Control Knob	1	B-7187773-P6
C490	Capacitor, PA Filter, Tuning:	Quantity	
	Inner Conductor Assembly (Plate Cavity Inner Conductor)	1	PL-4029768-G1
	Movable Capacitor Plate	1	A-4029670-P1
	Screw: #8, 0.[illegible]-inches long	1	N83-P150008
	Spring, Contact (Fastened to Capacitor Plate)	2	PL-4029772-G1
	Shaft (NOTE: Attached to Capacitor Plate by Screw #8)	1	A-4029121-P1
	Nut Plate	1	A-4029939-P1
	Lock Washer: #6	1	N111-P13
	Screw: #6	1	N81-P13005
	Screw: #6, 0.500-inches long	1	N83-P13004C13
	Bushing for Shaft	1	A-4029422-P1
	Spring Plunger	1	A-4031101-P1
	Screw: #4	1	N83-P9004
	Plain Washer: 0.2[illegible]-inches in diameter	1	N401-P41
	Set Screw: #8 and	1	AN70-P1503C13
	Control Knob	1	B-7187773-P6
C492	Capacitor, Feed-Through:	Quantity	
	Machine Screw: #6	1	N81-P13016
	Aluminum Plate	1	A-4029692-P1
	Teflon Plate	1	A-4029691-P1
	Outer Conductor	1	C-5495649-P1
	Nylon Washer	1	A-4035237-P1
	Box Assembly	1	PL-5490426-G1
	Plain Washer: #6	1	N401-P41
	Ceramic Bushing	1	M-7479752-P11
	Fibre Washer: #6	1	A-7872492-P1
	Terminal	1	A-7135118-P2
	Nut: #6	2	N207-P13
C493 and C494	Capacitor, Stand-Off:	Quantity	
	Angle	1	A-4029887-P1
	Machine Screw: #4	2	N81-P9010
	Lock Washer: #4	1	N111-P11
	Plain Washer: #4	1	N401-P5
	Terminal	2	A-7135118-P1
	Aluminum Plate	2	A-4029886-P1
	Teflon® Plate	2	A-4029889-P1
	Nylon® Washer	2	A-4035237-P2
	Nut: #4	2	N207-P9
C495	Capacitor, Stand-Off:	Quantity	
	Machine Screw: #6	1	N81-P13016
	Plain Washer: #6	1	N401-P67
	Outer Conductor	1	PL-5490317-G1
	Box	1	PL-5490426-G1
	Teflon® Plate	1	A-4029691-P1
	Aluminum Plate	1	A-4029692-P1
	Nylon® Washer	1	A-4035237-P1
	Terminal	2	K-7875267-P1
	Ceramic Bushing	1	M-7479752-P11
	Fibre Washer: #6	1	A-7872492-P1
	Nut: #6	1	N207-P13
C496 and C497	Silver mica, CM15 case; 5.0 mmfd ± 10%, 500 v d-c w. Electro Motive Mfg. Type CM-15.		P-3R122-P27

SYMBOL	DESCRIPTION		G-E DRAWING & PART NO.
	MISCELLANEOUS ELECTRICAL PART		
E481	Reflectometer Probe, consists of the following components with E481 prefix		PL-4129629-G1
E481-C1	Capacitor, feed thru 1000 mmfd +100% -0%, 500 v d-c w. Maida Development Co. Style 277A		[illegible]
E481-CR1	Diode, Germanium. Hughes Type 1N126.		[illegible]
E481-J1	Test point jack, stake in molded nylon. Alden Products Co. Type 110BC1 red.		[illegible]
E481-R1	Composition, 100 ohms ± 5%, 1/2 w.		[illegible]
E481-R2	Composition, 4700 ohms ± 5%, 1/2 w		[illegible]
	RECEPTACLE		
J481	Chassis receptacle. Amphenol Cat. #83-1R.		M-2822-P5
	RELAY		
K481	Coaxial relay: resistance 2000 ohms ± 10%, 115 v d-c +10% -20%, pick up 90 v or less, max 126 v d-c, 25 gms min contact pressure. Similar to Price Electric Type 6ABC.		[illegible]
	INDUCTORS		
L481	RF choke coil: inductance 1.8 uh, current 1000 ma, frequency range 75 to 100 Mc, green. Ohmite Cat. #Z-144.		P-7772864-P5
L482	Coil, [illegible] band wound.		[illegible]
L483	Loop, output.		[illegible]
L484	Coil assembly		[illegible]
L485	RF choke coil: inductance 1.8 uh current 1000 ma, frequency range 75 to 100 Mc, green. Ohmite Cat. #Z-144.		P-7772864-P5
L486 and L487	Coil.		[illegible]
	PLUGS		
P481	Plug: 8 pin male [illegible] Jones Cat. #P-308-FFT.		[illegible]
P482	Plug: [illegible] to W48.		
	POST		
P02	Post, Insulated	Quantity	
	Stud: #6	1	[illegible]
	Nut: #6	3	[illegible]
	Terminal	1	[illegible]
	Fibre Washer: [illegible]-in. od, [illegible]-in. id	1	[illegible]
	Fibre Washer: 0.50-in. od, 0.266-in. id	2	[illegible]
	Ceramic Bushing: 0.50-in. od, 0.24-in. id	1	[illegible]
	Ceramic Bushing: 0.375-in. od, 0.25-in. id	1	[illegible]
	Wing Nut	1	[illegible]
	RESISTOR		
R481	Composition, 100 ohms ± 10%, 2 w.		[illegible]
	TERMINAL BOARD		
TB481	Terminal board, molded black phenolic, 2-terminals. HB Jones Type #2 164-2 1W-EP		A-4[illegible]
	TUBE		
V481	Tube: EIMAC or RCA Type 4CX250B or 7032 4CX250B.		
	CABLE		
W481	Cable assembly: includes 32.75" of RG58A/U cable, with short pin silver plated phono plug molded on one end. G-E Dwg and Part No. K-7104941-P6.		B-[illegible]
	SOCKETS		
XE481	Reflectometer Housing. Includes the following with XE481 prefix:		PL-54[illegible]
XE481-P1 and XE481-P2	Connector, Coaxial: 2-piece straight plug. Amphenol Cat. No. 83-1SP. Signal Corps Cat. No. PL-259.		M-2821-P1
	2-sections of RG-8/U Cable.		
XV481	Socket, 8-pin connections, cathode connector 2, 4, 6 and 8 grounded to shell, includes a by-pass capacitor 2700 ± 500 mmfd, 400 v d-c w. Similar to Eitel McCullough Type #SK-610.		B-5490773-P2
	MISCELLANEOUS		
	Tube Extractor: Steel, 4-inches long, clamps sprung 8°. Eitel-McCullough Type SK661.		A-[illegible]

FIG. 1 - PARTS BREAKDOWN: C492 THRU C495

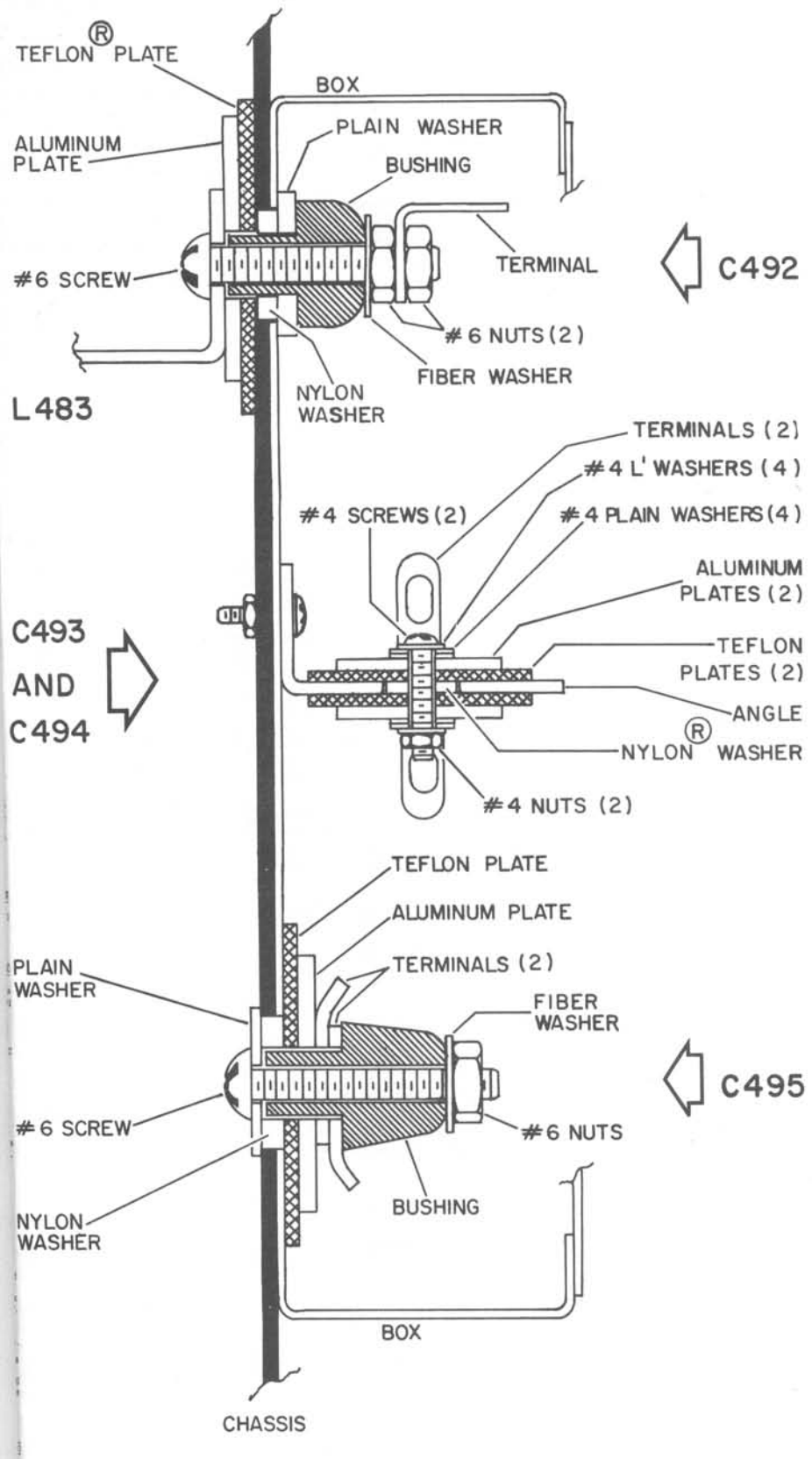
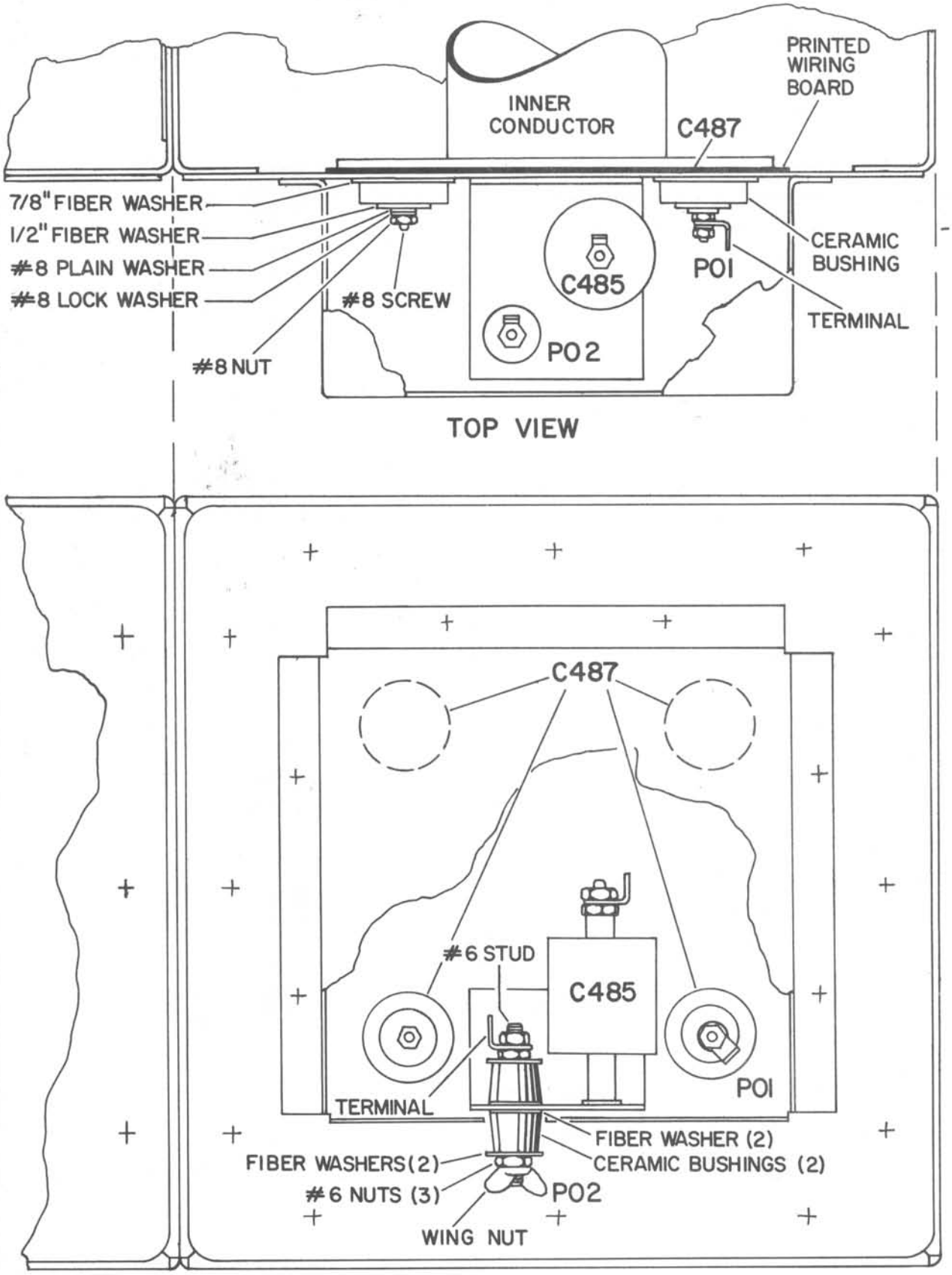
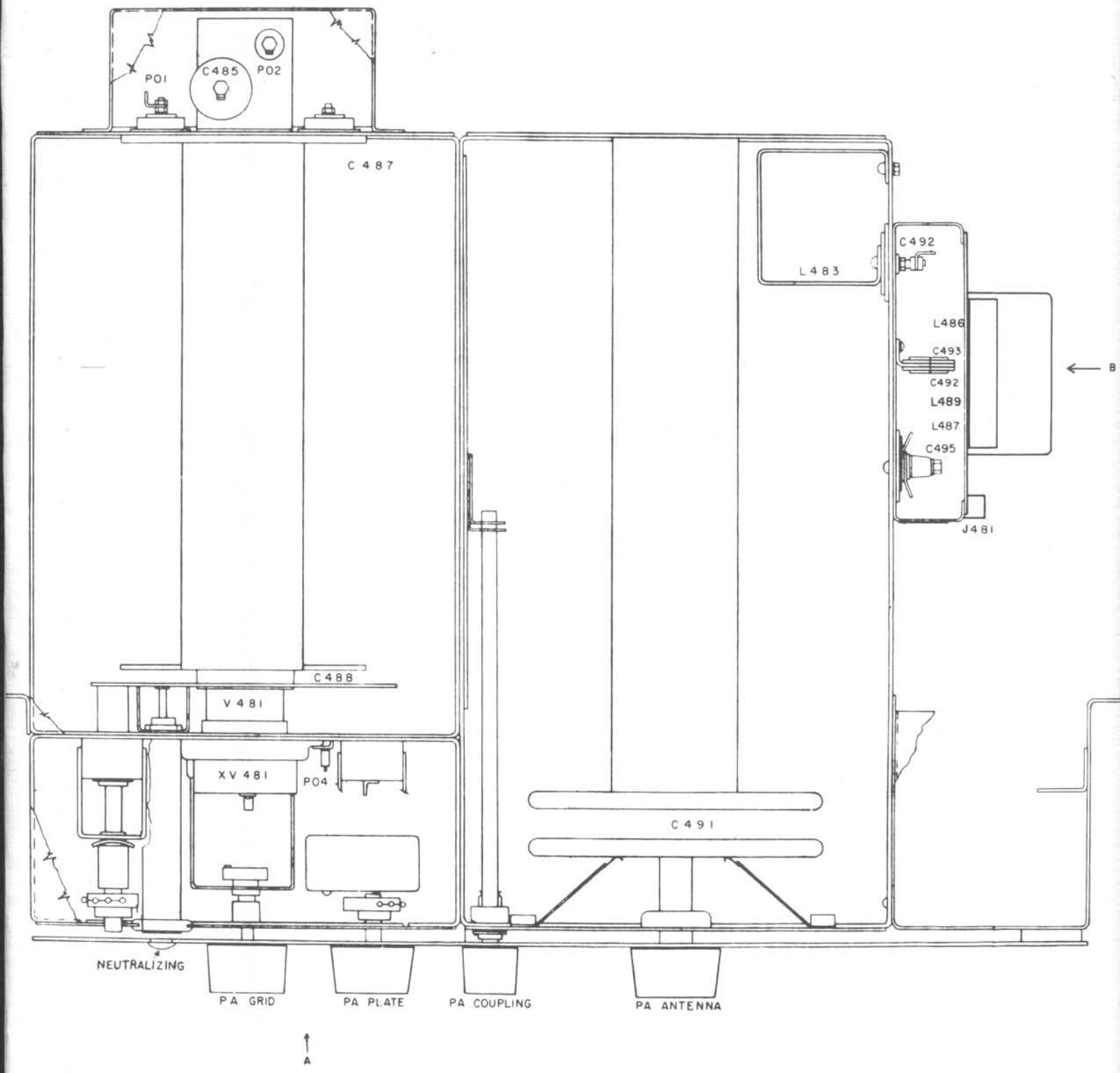
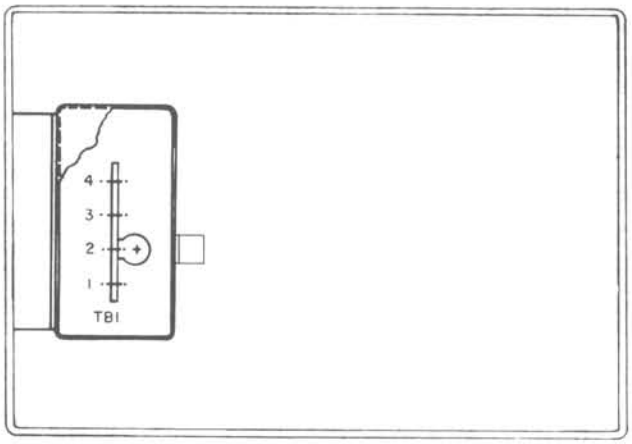


FIG. 2 - PARTS BREAKDOWN: C487, P01 & P02

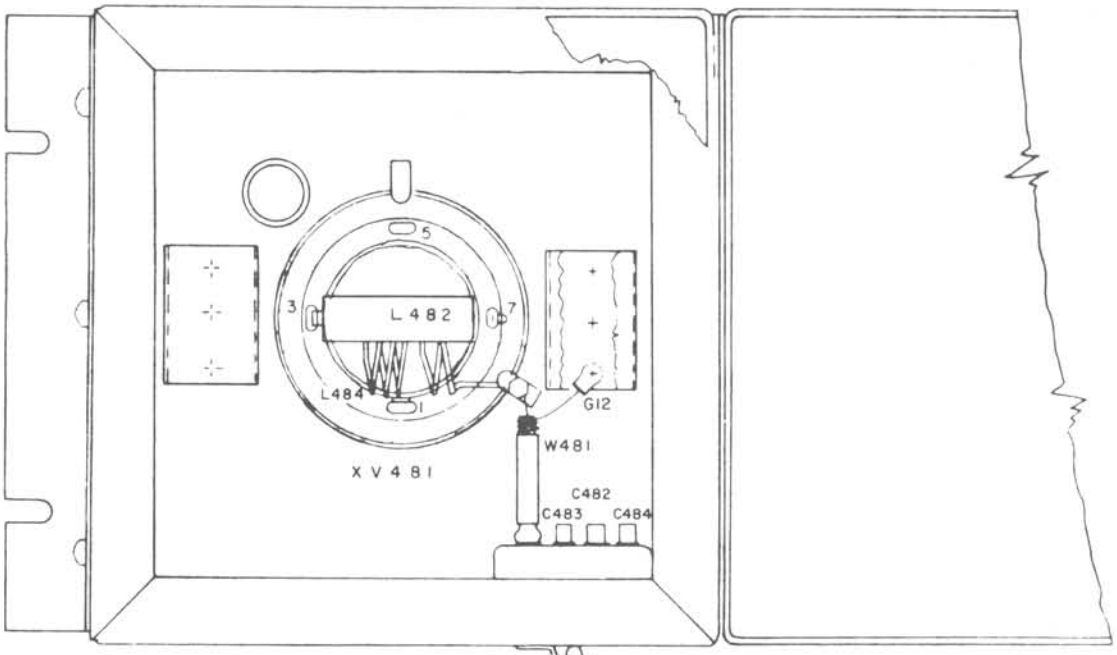


RC-701

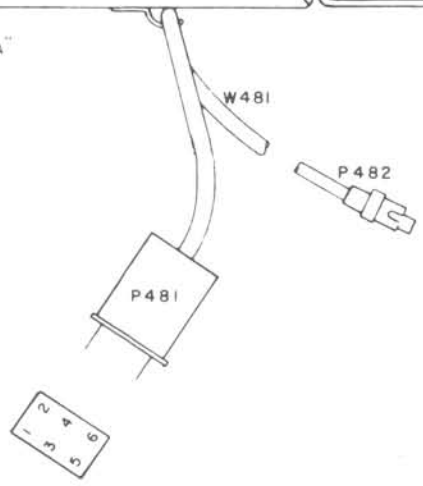

P01
C485
P02
C487
C492
L483
L486
C493
C492
L489
L487
C495
J481
B
C488
V481
XV481
P04
C491
NEUTRALIZING
PA GRID
PA PLATE
PA COUPLING
PA ANTENNA
A



VIEW AT "B"



PARTIAL VIEW AT "A"



Outline Diagram

POWER AMPLIFIER
144-174 MC, 250 W
MODEL 4EF5B2

(19D402031, Rev. 0)

ORDERING SERVICE PARTS

Each component appearing on the schematic diagram is identified by a symbol number, to simplify locating it in the parts list. Each component is listed by symbol number, followed by its description and G-E Part Number.

Service parts may be obtained from Authorized G-E Communication Equipment Service Stations or through any G-E Radio Communication Equipment Sales Office. When ordering a part, be sure to give:

1. G-E Part Number for component
2. Description of part
3. Model number of equipment
4. Revision letter stamped on unit

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.

Should further information be desired, or should particular problems arise which are not covered sufficiently for the purchaser's purposes, contact the nearest Radio Communication Equipment Sales Office of the General Electric Company.

MAINTENANCE MANUAL

LBI-3615

DF-3061

Progress Is Our Most Important Product

GENERAL ELECTRIC

COMMUNICATION PRODUCTS DEPARTMENT LYNCHBURG, VIRGINIA

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