NAVSHIPS 92832

TECHNICAL MANUAL

*for*

# RADIO TRANSMITTING SET AN/URT-7C

RAULAND-BORG CORPORATION
CHICAGO, ILLINOIS

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

*Contract: NObsr-71142*

*Approved by BuShips: 26 July 1956*

# LIST OF EFFECTIVE PAGES

| PAGE NUMBERS | CHANGE IN EFFECT | PAGE NUMBERS | CHANGE IN EFFECT |
|---|---|---|---|
| Title Page | Original | 4-0 to 4-5 | Original |
| A to C | Original | 5-0 to 5-5 | Original |
| i to vii | Original | 6-0 to 6-3 | Original |
| 1-0 to 1-5 | Original | 7-0 to 7-42 | Original |
| 2-0 to 2-20 | Original | 8-1 to 8-25 | Original |
| 3-1 to 3-13 | Original | i-0 to i-10 | Original |

CHANGE 1 TO TECHNICAL MANUAL FOR RADIO TRANSMITTER AN/URT-7C
NAVSHIPS 92832

The purpose of this change is to incorporate Federal Stock Numbers and Source Maintenance an Recoverability Code in Section 8, Table 8-2.

Insert "Change 1" pages 8-0A thru 8-0E after page 7-42, and before 8-1.

Make the following pen-and-ink corrections and mark "ch 1" adjacent to the pen-and-ink correction. Then insert this page in the instruction book, just after the front cover, and just ahead of the title page.

| Page | Change In Effect | Para. & Line or Fig. & Location | Action |
|---|---|---|---|
| Title | Orig | Bottom of page | Add "NOBSR 71907" and "CHANGE 1: (11 December 1957)" |
| A | Orig | After 7-0 to 7-42 | Add "8-0A to 8-0E" and "CHANGE 1" |
| vii | Orig | Section 8 Table, Title and Page | Add "8-2A Supplementary Parts List 8-0A" |
| | | | Delete "8-3 Maintenance Parts Kit 8-20<br>8-4 Shop Manufactured Parts 8-20<br>8-5 Low Failure Items 8-20" |
| 8-2 thru 8-19 | Orig | Standard Navy Stock Number Column | Delete all stock numbers |
| | | Bottom of each page | Add "See Table 8-2A for Federal Stock Number and Code" |
| 8-20 | Orig | | Delete Tables 8-3, 8-4, and 8-5 in there entirety. |
| 8-21 | Orig | Standard Navy Stock Number Column | Delete all stock numbers |
| | | Bottom of Table | Add "See Table 8-2A for Federal Stock Numbers" |

# SECTION 8A

# SUPPLEMENTARY PARTS LIST SOURCE MAINTENANCE AND RECOVERABILITY CODES SOURCE CODE AND FEDERAL STOCK NUMBERS

I. Source Codes

P Series Part Procured - Supply System Stock

P - Applied to parts which are procured in view of relatively high usage and which are relatively simple to manufacture within the Naval Establishment, if necessary. Code "P" indicates that the part is available in the supply system.

P1 - Applied to parts which are procured in view of relatively high usage but which are very difficult, impractical, or uneconomical to manufacture. Code "P1" indicates that the part is available in the supply system.

P2 - Applied to parts for which little usage is anticipated but which are procured in limited quantity for insurance purposes. Parts coded "P2" are difficult to manufacture, require special tooling not normally available within the Naval Establishment, or require long production lead time.

P3 - Applied to parts which are procured in quantity in accordance with the life expectancy of the part. Parts coded "P3" are deteriorative in nature and may require special storage conditions.

M Series Manufacture, Parts not Procured:

M - Applied to parts which are capable of being manufactured within the Naval Establishment. Parts coded "M" have no anticipated or relatively low usage, or possess restrictive installation or storage factors. Code "M" will not be applied to an item when the item is coded "P" for other applications and system support is maintained; the item appears in the Navy Stock List of General Stores or The Navy Stock List of the Electronics Supply Office; or supply support responsibility for the item has been vested in another inventory manager.

A Series Assemble, Assembly not Procured:

A - Applied to assemblies which are not procured but which are to be assembled within the Naval Establishment prior to installation. At least one of the parts in the assembly must be a "P" series part which carries an individual part number and description.

N Series Not Procured or Stocked, will be Procured on Demand:

N - Applied to parts which do not meet established criteria for stocking and which are normally readily available from commercial sources. Parts coded "N" will be procured on demand in accordance with applicable procedures.

X Series Not Procured, Normally Impracticable for Stocking, Maintenance, or Manufacture

X - Applied to main structural members or similar parts which, if required, would suggest extensive repair. The need for a part, or parts, coded "X" will normally result in a recommendation for complete overhaul or retirement of the equipment from service.

X1 - Applied to parts for which procurement of the next larger assembly source coded "P" is justified; e.g., an internal detail part, such as welded segments inseparable from its assembly, a part which must be machined and installed with other parts in a matched set, or a part of an assembly, which, if required, would suggest extensive reconditioning of each assembly.

X2 - Applied to parts which are not procured for stock but may be acquired for use through salvage. Activities requiring such parts will attempt to obtain from salvage; if not obtainable from salvage, such parts will be requisitioned through normal supply channels with supporting justification. Repeated requests may justify a change to a "P" source code.

U Series Not Procured, Not of Supply or Maintenance Significance

U - Applied to parts which are not of supply or maintenance significance, such as installation drawings, diagrams, instruction sheets, field service drawing numbers, and parts which should not or cannot be procured or manufactured (optional).

II. Maintenance Codes

| Code | | Maintenance Echelon |
|---|---|---|
| O | - | Overhaul activities. |
| T | - | Tender or repair ship. |
| F | - | Activity to which equipment is assigned (e.g. vessel, FASRON or self-supported squadron). |
| E | - | Specialized repair facilities. |
| B | - | Specific maintenance requirements not applicable (optional). |

III. Recoverability Codes

| Code | | Definition and Application of Code |
|---|---|---|
| R | - | Repairable - Parts which are uneconomical and practical to repair. Replacements will be obtained and expended parts returned in accordance with instructions issued by the inventory manager. |
| S | - | Salvageable - Parts which are economical and practical to salvage and which may be placed in "Ready for Issue" condition by cleaning, replating, anodizing, adjusting, replacement of bearings or bushings. "S" coded parts may contain parts or materials which are usable, valuable, or critical, and which may be placed in the supply system for issue. |
| C | - | Consumable (Expendable) - Parts that are neither repairable nor salvageable (optional). |
| 4 | - | Code Format. In assigning the above listed codes, the following sequence will be followed: |

| Source | | Maintenance | | Recoverability |
|---|---|---|---|---|
| (1) | | (2) | (3) | (4) |
| Consumer Source Information | | Lowest Maintenance echelon capable of installing part | Lowest Maintenance echelon capable of manufacturing, assembling or testing a part prior to installation | Recoverability status |

The parts list section has been corrected by means of the following supplementary tables. Always refer to the appropriate supplementary table for a given item first as it completely supersedes any corresponding listing in the basic table.

## SUPPLEMENTARY TABLE 8-2A - TABLE OF REPLACEABLE PARTS

| REF. DESIG. | FEDERAL CODE | STOCK NUMBER |
|---|---|---|
| A401 | P1FFC | N5820-643-7790 |
| A402 | P1FFC | N5820-325-8296 |
| A403-1 thru A403-4 | P1FFC | N5820-312-7131 |
| A501 | MFOC | |
| A502-1 thru A502-4 | P1FFC | N5820-311-8058 |
| A503 | MFOC | |
| A601-1 thru A601-4 | P1FFC | N5820-196-0351 |
| A602 | P1FFC | N5820-312-0169 |
| A603 | P1FFC | N5820-312-0170 |
| A604 | P1FFC | N5820-196-0329 |
| A605 | P1FFC | N5820-643-7100 |
| A606 | MFOC | |
| A607 | MFOC | |
| A608 | P1FFC | N4130-274-7894 |
| A609 | MFOC | |
| B601 | P1FFS | N4450-203-3895 |
| C101 C127 C411 | P1FFC | N5910-112-7399 |
| C102 | P1FFC | For replacement use N5910-644-3564 |
| C103 C105 C107 C125 | P1FFC | For replacement use N5910-665-0294 |
| C104 | P1FFC | N5910-126-9212 |
| C106 | P1FFC | For replacement use N5910-101-3852 |
| C108 C117 | P1FFC | For replacement use N5910-112-7486 |
| C109 C112 | P1FFC | N5910-578-1637 |
| C111 C113 C128 | P1FFC | N5910-112-8465 |
| C114 C115 C130 C131 C132 C133 | P1FFC | For replacement use N5910-101-4014 |
| C116 | P1FFC | For replacement use N5910-184-2697 |
| C118 | P1FFC | For replacement use N5910-161-6297 |
| C120 | P1FFC | For replacement use N5910-112-7483 |
| C121 C122 C123 | P1FFC | For replacement use N5910-248-2233 |
| C124 | P1FFC | N5910-126-1621 |
| C126 | P1FFC | N5910-129-6257 |
| C129 | P1FFC | For replacement use N5910-112-8227 |
| C195 | P1FFC | N5910-578-1371 |
| C401 C402 C403 | P1FFC | N5910-520-6631 |
| C404 C405 | P1FFC | N5910-171-3221 |
| C406 C407 | P1FFC | N5910-195-8415 |
| C408 C409 | P1FFC | N5910-171-2952 |
| C410 | P1FFC | N5910-126-9170 |
| C412 | P1FFC | For replacement use N5910-552-8510 |
| C601 C607 C608 C612 C613 C617 | P1FFC | N5910-666-5964 |
| C602 C609 C614 C620 | P1FFC | N5910-194-0161 |
| C603 | P1FFC | For replacement use N5910-666-7113 |
| C604 | P1FFC | N5910-666-5029 |
| C605 | P1FFC | N5910-699-2993 |
| C606 C615 | P1FFC | N5910-195-6934 |
| C610 | P1FFC | N5910-195-7071 |
| C611 C616 C621 | P1FFC | N5910-644-6435 |
| C618 C625 C631 C636 C641 | P1FFC | For replacement use N5910-284-5289 |
| C619.1 | AFFS | |
| C619.1-A C619.1-B | P1FFC | N5970-249-2476 |
| C619.1-C | P1FFC | N5820-315-3191 |
| C619.1-D | MFOC | |
| C622 C623 C624 C626 C627 C628 C629 C630 C632 C633 C634 C635 C639 C640 C643 C644 | P1FFC | For replacement use N5910-114-2356 |
| C637 | P1FFC | N5910-698-8365 |
| C638 | P1FFC | N5910-568-1417 |
| C642.1 | AFFS | |
| C642.1-A | P1FFC | N5970-343-3699 |
| C642.1-B | P1FFC | N5970-334-7960 |
| C642.1-C | P1FFC | N5940-643-7001 |
| C642.1-D | P1FFC | N5975-296-4633 |
| C642.1-E | P1FFC | N5910-284-5486 |
| C642.1-F | MFFC | |
| C645 | UBBC | |
| C645A | NFFC | |
| C646 | MFOC | |
| C647 | MFOC | |
| CR401 | P1FFC | N6130-237-0147 |
| CR402 | P1FFC | N6130-233-7364 |
| CR601 | | For replacement use N5960-262-0315 |
| E101-1 E101-2 | P1FFC | N5960-642-9570 |
| E102-1 E102-2 | P1FFC | N5960-642-9569 |
| E103-1 thru E103-4 E603-1 thru E603-3 | P1FFC | N5960-296-3834 |
| E105 | UFFC | |
| E107 | P1FFC | N5820-308-5207 |
| E108 | MFOC | |
| E109 | MFOC | |
| E110 | MFOC | |
| E111 | MFOC | |
| E401 | P1FFC | For replacement use N5935-666-1649 |
| E402 | P1FFC | N5355-644-1439 |
| E403 | MFOC | |
| E404-1 E404-2 | P1FFC | N5970-117-5119 |
| E405-1 E405-2 | P1FFC | For replacement use N5970-159-1406 |
| E406-1 thru E406-4 E602-1 thru E602-4 | P1FFC | For replacement use N5970-151-7970 |
| E407 | P1FFC | N5355-235-0596 |
| E408 | P1FFC | N5355-644-1440 |
| E409-1 E409-2 | P1FFC | N5920-258-8836 |
| E501 E502 | P1FFC | N5940-117-1073 |
| E503 | P1FFC | N5915-512-5642 |
| E601 | P1FFC | N5915-513-3405 |
| E604-1 thru E604-4 | P1FFC | N5970-310-7048 |
| E605 | P1FFC | N5355-235-0595 |
| E606 | P1FFC | N5355-235-0569 |
| E607 | P1FFC | N5355-235-0568 |
| E608 | NFFC | |

## SUPPLEMENTARY TABLE 8-2A - TABLE OF REPLACEABLE PARTS (cont)

| REF. DESIG. | FEDERAL CODE | STOCK NUMBER |
|---|---|---|
| E609-1 thru E609-3 | P1FFC | N5355-644-1860 |
| E610-1 thru E610-3 | P1FFC | N5355-372-3771 |
| E611-1 thru E611-5 | P1FFC | N5940-271-5286 |
| E613-1 thru E613-4 | P1FFC | For replacement use N5970-151-8012 |
| E614-1 E614-2 S601B-1 S601B-2 | P1FFC | For replacement use N5970-117-5197 |
| E615-1 E615-2 | P1FFC | N5977-033-3642 |
| E616-1 E616-2 | X1BBC | |
| E617-1 E617-2 | X1BBC | |
| E618-1 thru E618-3 | X1BBC | |
| E619 | X1BBC | |
| E620-1 E620-2 | P1FFC | N5970-281-0992 |
| E621 | P1FFC | N5970-280-9935 |
| E622 | P1FFC | N5970-281-0985 |
| F401* F402* F403* | P1FFC | N5920-642-7400 |
| F401** F402** F403** | P1FFC | N5920-184-0836 |
| F406 F407 | P1FFC | N5920-280-5000 |
| H101 | P1FFC | N5120-293-0654 |
| H102 | P1FFC | G5120-242-7410 |
| H103 | MFOC | |
| H105 | MFOC | |
| H108 | P1FFC | N5940-259-8596 |
| H109 H607-1 thru H607-4 | NFFC | |
| H401 | P1FFC | N5340-303-3919 |
| H402 | P1FFC | N5340-303-3918 |
| H403 | NFFC | |
| H404-1 thru H404-6 H110 | NFFC | |
| H405-1 H405-2 | NFFC | |
| H406-1 thru H406-16 | P1FFC | N5940-159-0223 |
| H407-1 H407-2 | NFFC | |
| H601 | P1FFC | N5960-296-1180 |
| H602-1 thru H602-12 | NFFC | |
| H603-1 thru H603-16 | NFFC | |
| H604-1 thru H604-28 | NFFC | |
| H605-1 thru H605-28 | NFFC | |
| H606 | P1FFC | N5935-248-2375 |
| I401 I402 | P1FFC | G6240-155-7859 |
| J101 P307 | P1FFC | N5935-259-3965 |
| J401 | P1FFC | For replacement use N5935-192-4729 |
| J401A | P1FFC | N5935-387-6546 |
| J402 | P1FFC | For replacement use N5935-283-1260 |
| J402A | P1FFC | N5935-387-6547 |
| J403 | P1FFC | For replacement use N5935-230-1561 |
| J403A | P1FFC | N5935-173-8395 |
| J501 | P1FFC | N5935-235-3927 |
| J502 J503 | P1FFC | N5935-258-1734 |
| J601 P306 | P1FFC | N5935-241-7189 |
| J602 J603 J604 | P1FFC | For replacement use N5935-518-8172 |
| K101 | P1FFC | N5945-257-6918 |
| K401 | P1FFC | N5945-259-6678 |
| K402 | P1FFC | N5945-257-8773 |
| K403 | P1FFC | N5945-259-5165 |
| K404 | P1FFC | N5945-644-7113 |
| L401 | P1FFC | N5950-647-6452 |
| L402 | P1FFC | N5950-647-6433 |
| L403 | P1FFC | N5950-647-6431 |
| L601 | P1FFC | N5950-228-7485 |
| L602 | MFOC | |
| L603 L605 L606 | P1FFC | N5950-246-4380 |
| L604 | MFOC | |
| L607 | MFOC | |
| L608 L617 | P1FFC | N5999-255-2948 |
| L609 | MFOC | |
| L610 | MFOC | |
| L611 | MFOC | |
| L612 | MFOC | |
| L613 | MFOC | |
| L614 | MFOC | |
| L615 | MFOC | |
| L616 | MFOC | |
| L618 | MFOC | |
| L619 L620 L621 | P1FFC | N5950-387-1491 |
| M401 | P1FFC | N6625-643-2230 |
| O601.1-1 O601.1-2 | P1FFC | N4820-314-0957 |
| O602 | P1FFC | N3010-254-1144 |
| O603 | P1FFC | N5820-254-1145 |
| O604 | P1FFC | N3040-303-3678 |
| O605 | P1FFC | N5820-665-3086 |
| O606 | P1FFC | N5820-665-3085 |
| O607 | X2FFC | |
| O608-1 O608-2 | P1FFC | G3110-156-8341 |
| P301 | P1FFC | N5935-642-3974 |
| P302 | P1FFC | N5935-235-9632 |
| P304 P401 | P1FFC | N5935-242-1158 |
| P305 P402 | P1FFC | N5935-295-5002 |
| P403 | P1FFC | N5935-259-6945 |
| P501 P502 P601 P602 W601A-1 W601A-2 | P1FFC | For replacement use N5935-258-4422 |
| P503 P504 | P1FFC | N5935-258-4598 |
| P603 | P1FFC | N5935-498-0772 |
| P604 | P1FFC | N5935-283-3729 |
| R101 | P1FFC | N5905-279-4218 |
| R102 R116 R130 R132 | P1FFC | For replacement use N5905-192-0390 |
| R103 R142 R144 | P1FFC | For replacement use N5905-279-1754 |
| R104 | P1FFC | For replacement use N5905-171-1998 |
| R105 | P1FFC | N5905-254-7101 |
| R106 R604 | P1FFC | N5905-279-2616 |
| R107 R129 R133 | P1FFC | For replacement use N5905-279-2515 |
| R108 R111 R140 | P1FFC | For replacement use N5905-192-0667 |
| R109 R125 R126 | P1FFC | For replacement use N5905-171-1976 |
| R110 R124 | P1FFC | For replacement use N5905-299-2022 |

## SUPPLEMENTARY TABLE 8-2A - TABLE OF REPLACEABLE PARTS (cont)

| REF. DESIG. | FEDERAL CODE | STOCK NUMBER |
|---|---|---|
| R112 | P1FFC | For replacement use N5905-192-0379 |
| R113<br>R115 | P1FFC | For replacement use N5905-665-4992 |
| R114<br>R139 | P1FFC | For replacement use N5905-195-6761 |
| R117<br>R118 | P1FFC | N5905-190-8880 |
| R119<br>R120 | P1FFC | For replacement use N5905-190-8889 |
| R121<br>R141 | P1FFC | N5905-279-4227 |
| R122<br>R190 | P1FFC | For replacement use N5905-249-3661 |
| R123<br>R608 | P1FFC | N5905-171-1999 |
| R127 | P1FFC | For replacement use N5905-254-7101 |
| R128 | P1FFC | For replacement use N5905-279-2675 |
| R131 | P1FFC | N5905-284-3544 |
| R134 | P1FFC | For replacement use N5905-195-6453 |
| R135<br>R136<br>R137<br>R138 | P1FFC | N5905-171-2000 |
| R143 | P1FFC | For replacement use N5905-279-3506 |
| R147<br>R148<br>R149<br>R150 | P1FFC | For replacement use N5905-279-1724 |
| R151<br>R606 | P1FFC | N5905-192-3973 |
| R195 | P1FFC | N5905-257-0935 |
| R401 | P1FFC | N5905-192-4490 |
| R402 | P1FFC | N5905-279-3515 |
| R403 | P1FFC | N5905-195-6800 |
| R404<br>R405 | P1FFC | N5905-279-3521 |
| R406 | P1FFC | For replacement use N5905-270-6287 |
| R407 | P1FFC | For replacement use N5905-157-5612 |
| R408 | P1FFC | For replacement use N5905-191-6371 |
| R409 | P1FFC | For replacement use N5905-157-0820 |
| R410 | P1FFC | For replacement use N5905-187-4341 |
| R411 | P1FFC | For replacement use N5905-253-5999 |
| R412 | P1FFC | For replacement use N5905-185-8395 |
| R413 | P1FFC | For replacement use N5905-192-3971 |
| R414 | P1FFC | For replacement use N5905-299-2036 |
| R415<br>R416 | P1FFC | N5905-279-2528 |
| R417 | P1FFC | N5905-249-3663 |
| R418 | P1FFC | For replacement use N5905-264-7081 |
| R601 | P1FFC | N5905-195-5571 |
| R602 | P1FFC | N5905-279-3513 |
| R603<br>R607<br>R609 | P1FFC | N5905-192-0445 |
| R605 | P1FFC | N5905-171-2006 |
| R610 | P1FFC | N5905-171-1998 |
| R611 | P1FFC | N5905-171-1976 |
| R612 | P1FFC | N5905-239-0568 |
| R613 | P1FFC | N5905-192-0450 |
| R614<br>R615 | P1FFC | N5905-185-8516 |
| R616 | P1FFC | N5905-185-8510 |
| R617 | P1FFC | N5905-279-1385 |
| R618 | P1FFC | N5905-299-2062 |
| S101<br>S404 | P1FFC | N5930-260-3144 |
| S102<br>S104 | P1FFC | N5930-229-3390 |
| S103 | P1FFC | N5930-050-2707 |
| S401 | P1FFC | N5930-249-2939 |
| S402 | P1FFC | For replacement use N5930-050-2686 |
| S403 | P1FFC | N5930-050-2704 |
| S405 | P1FFC | N5930-108-7019 |
| S601 | P1FFC | N5820-303-4595 |
| S601A-1<br>S601A-2 | P1FFC | N5930-039-6473 |
| T101 | P1FFC | N5950-647-6006 |
| T102 | P1FFC | N5950-235-6811 |
| T103 | P1FFC | N5950-647-7974 |
| T401 | P1FFC | N5950-284-5694 |
| T402 | P1FFC | N5950-647-6237 |
| V101 | | N5960-193-5139 |
| V102<br>V104<br>V107<br>V110 | | N5960-262-0210 |
| V103<br>V108 | | N5960-262-0185 |
| V105<br>V106 | | N5960-114-4868 |
| V109 | | N5960-166-7675 |
| V401<br>V402 | | N5960-108-0252 |
| V601<br>V602<br>V603 | | N5960-262-0167 |
| V604<br>V605<br>V606 | | N5960-230-5272 |
| W301 | P1FFC | N5995-250-5527 |
| W302 | P1FFC | N5995-244-6683 |
| W303.1 | AFFC | |
| W601 | P1FFC | N5995-198-6909 |
| XF401<br>XF402 | P1FFC | N5920-156-9233 |
| XF406 | X2FFC | |
| XI401 | P1FFC | N6210-295-1779 |
| XI401A<br>XI402A | X1FFC | |
| XI401B | P1FFC | N6210-250-5470 |
| XI402 | P1FFC | N6210-231-3877 |
| XI402B | P1FFC | N6210-247-1764 |
| XV101<br>XV103<br>XV108<br>XV109 | P1FFC | N5935-222-9741 |
| XV102<br>XV104<br>XV107<br>XV110<br>XV601<br>XV602<br>XV603 | P1FFC | For replacement use N5935-644-5377 |
| XV105<br>XV106 | P1FFC | N5935-162-3071 |
| XV401<br>XV402 | P1FFC | N5935-129-3078 |
| XV604.1<br>XV605.1<br>XV606.1 | P1FFC | N5935-508-1876 |
| Z101 | P1FFC | N5915-665-1941 |
| Z601.1 | AFOC | |

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
26 July 1956

From: Chief, Bureau of Ships
To: All Activities Concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Technical Manual for Radio Transmitting Set AN/URT-7C NAVSHIPS 92832

1. This is the technical manual for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

4. Errors found in this manual (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes, should be reported. Such report should include the complete title of the publication and the publication number (short title); identify the page and line or figure and location of the error; describe the error or indicate what change should be made; and be forwarded to the Electronics Publications Section of the Bureau of Ships.

5. All Navy requests for NAVSHIPS electronics publications should be directed to the nearest District Publications and Printing Office. When changes or revised books are distributed, notice will be included in the Electronics Information Bulletin, NAVSHIPS 900,022, and in the Index of Bureau of Ships General and Electronics Publications, NAVSHIPS 250-020.

A. G. MUMMA
Chief of Bureau

# RECORD OF CORRECTIONS MADE

| CHANGE NO. | DATE | SIGNATURE OF OFFICER MAKING CORRECTION |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# TABLE OF CONTENTS

# TABLE OF CONTENTS (Cont)

# TABLE OF CONTENTS (Cont)

# LIST OF ILLUSTRATIONS

# LIST OF ILLUSTRATIONS (Cont)

# LIST OF TABLES

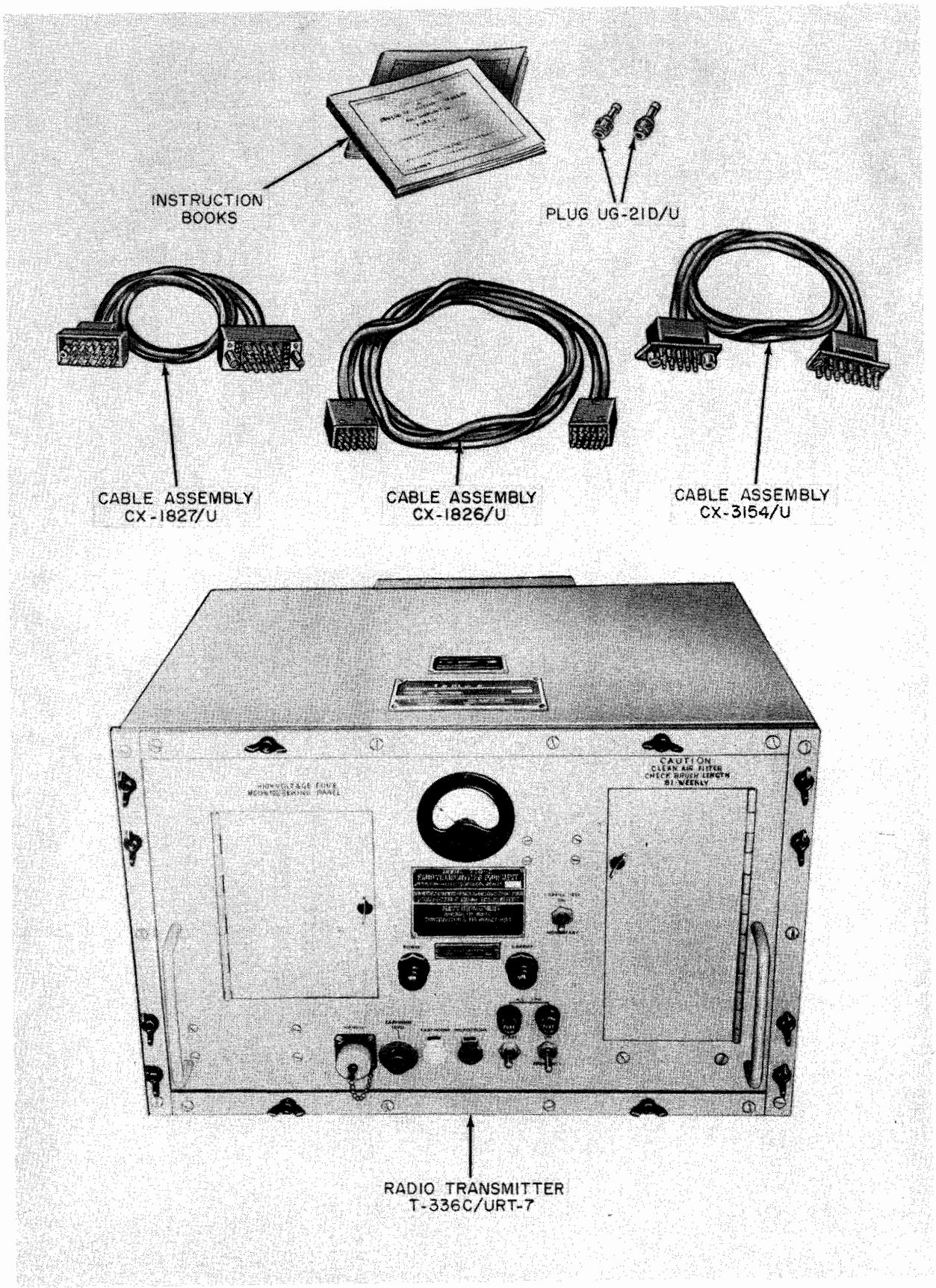



*Figure 1-1. Radio Transmitting Set AN/URT-7C*

# SECTION 1

# GENERAL DESCRIPTION

## 1. INTRODUCTION.

This technical manual contains information concerning the theory, operation, installation, maintenance, and repair of the Radio Transmitting Set AN/URT-7C.

## 2. PURPOSE OF EQUIPMENT.

The major components of Radio Transmitting Set AN/URT-7C consist of Radio Transmitter T-336C/URT-7 and Cable Assemblies CX-1827/U, CX-1826/U, and CX-3154/U; see figure 1-1. The equipment is employed for radiotelephone and modulated-continuous-wave (MCW) communications at frequencies from 115 to 156 megacycles per second. These frequencies limit the reliable range of the equipment to approximately "line-of-sight" transmission. The equipment can be installed on ships, submarines, and at shore stations.

The Radio Transmitter operates from a 115-volt or 230-volt, 50/60-cps power source and delivers 30 watts output. The equipment may be mounted on a table or may be removed from its cabinet and mounted in a standard 19-inch relay rack. If desired, remote control operation may be accomplished from a standard Remote Radiophone Unit Navy Type-23500, or equivalent. Alternatively, limited control of the Radio Transmitter from a remote location may be obtained with Transmitter Control Navy Type-23555.

## 3. DESCRIPTION OF UNITS.

*a.* RADIO TRANSMITTER T-336C/URT-7.—The Radio Transmitter, shown in figure 1-2, contains all the equipment required for radio transmission by voice or telegraph, except for such accessories as handset, key, and antenna. The units comprising the transmitter are Power Supply PP-733C/URT, Radio Modulator MD-163C/URT, Amplifier-Oscillator AM-638C/URT, Electrical Equipment Cabinet CY-1126A/URT, and a terminal box. The Power Supply occupies the center of a drawer-type chassis attached to the front panel. The Radio Modulator and Amplifier-Oscillator units are removable assemblies mounted, respectively, to the left and right of the power supply components. Small doors, one on either side of the front panel, provide access to the Radio Modulator and Amplifier-Oscillator operating controls.

Connections between the Power Supply and the other two units are made through plugs mounted on the rear of the Power Supply front panel. These plugs engage receptacles mounted on the lower front of the Radio Modulator and Amplifier-Oscillator chassis. The terminal box, which is attached to the cabinet (or directly to the back of the Power Supply chassis when the cabinet is not used), contains all terminals necessary for external connections.

(1) POWER SUPPLY PP-773C/URT.—The Power Supply chassis contains the power transformers, high-voltage rectifier tubes, low-voltage selenium rectifiers, filters, and bleeder resistors needed to produce all voltages required for operation. Control relays are also located on this chassis. The meter mounted on the front panel is used to monitor various currents and voltages in the entire Radio Transmitter; the switching circuit is located on the Power Supply chassis. Also mounted on the front panel are the power and control switches, indicators, and line fuses, as well as microphone and handset jacks.

(2) RADIO MODULATOR MD-163C/URT.—The Radio Modulator unit contains the audio transformers, tubes, and circuits required to effect voice or MCW modulation of the r-f carrier. The conventional speech amplifying and modulating circuits are supplemented by special circuits to provide expander, AVC, and clipper-filter action, all of which considerably increase the average carrier sideband power under voice-modulated operating conditions. A 1,000-cycle oscillator is included for MCW operation.

The modulator tubes are located toward the rear of the unit, while the speech amplifiers and the other smaller tubes are mounted on a shelf near the top and extending to the front panel. The nonoperating controls and switches associated with the modulator circuits are also grouped on this shelf. Most of the larger and heavier components (transformers, filter, etc.) are grouped at the bottom of the chassis, with the space between them and the small tubes at the top occupied by terminal boards upon which are mounted the smaller circuit components (capaci-

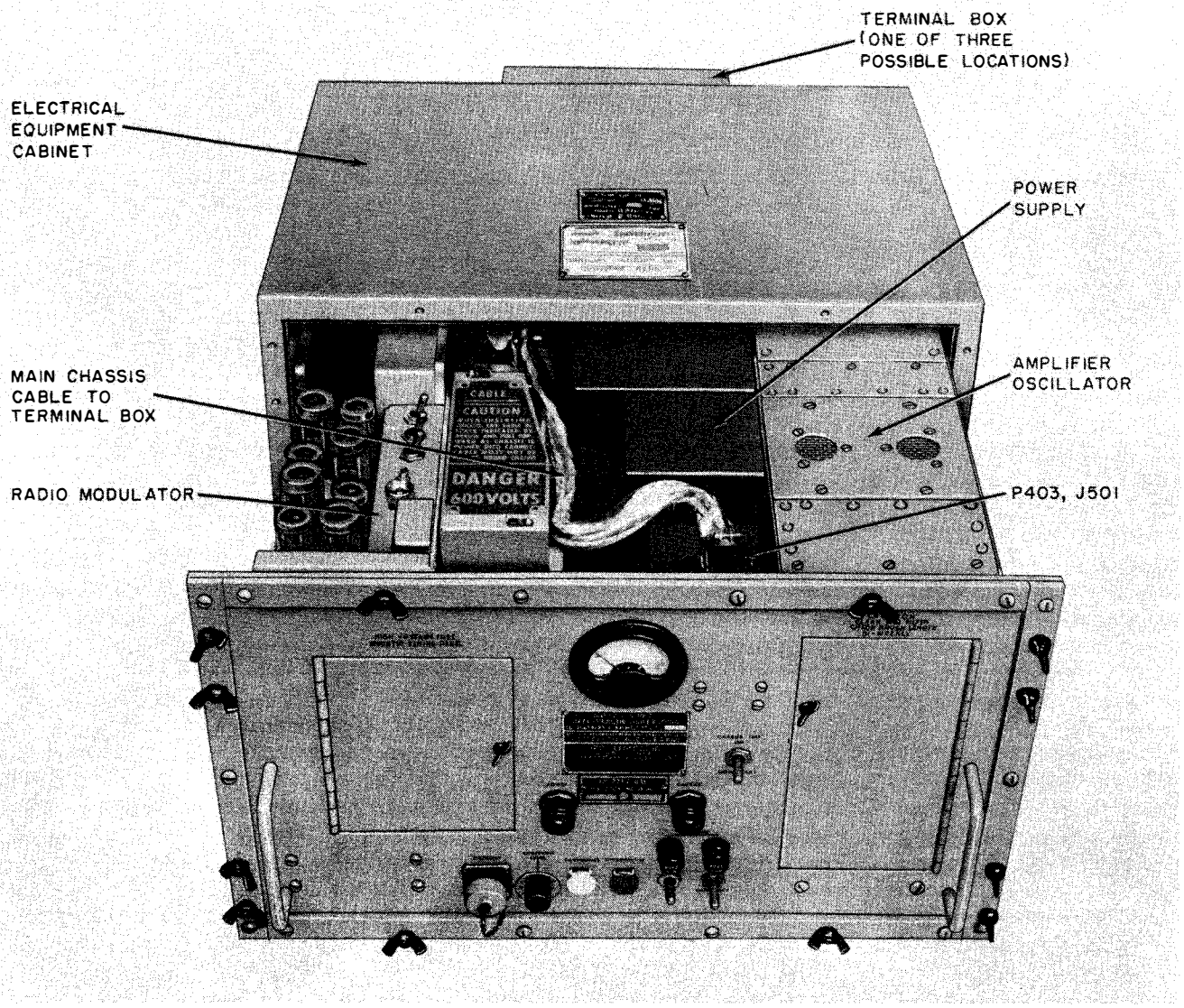



*Figure 1-2. Radio Transmitter T-336C/URT-7, Partly Removed from Cabinet*

tors, resistors, etc.). Mounted on the front panel, in addition to the operating controls, are an r-f alignment tool and an Allen wrench for the control-knob setscrews; these items are not visible through the panel door when the Radio Modulator is mounted on the Power Supply chassis. A tube puller for the type 4X150A r-f tubes is clip-mounted immediately behind the small receiving-type tubes.

(3) AMPLIFIER - OSCILLATOR AM-638C/URT.—The Amplifier-Oscillator unit includes all the electrical components required for generation of the r-f carrier. The master oscillator is crystal-controlled and multiplied six times to produce output frequencies of 115 to 156 megacycles per second. Mountings for four crystals are provided by a crystal-selector switch, permitting rapid selection of any one of four frequencies. Under emergency conditions, the oscillator circuit may be operated without using a crystal, with some loss in frequency stability.

The rear portion of the Amplifier-Oscillator is occupied by a blower, which provides forced-air ventilation. The remainder of the unit is divided into three sections by two horizontal shelves spaced above the chassis base. The oscillator and frequency-multiplier stages are mounted on the base, or lower shelf, along with the ganged tuning capacitor associated with those stages. The power-amplifier grid-circuit components and grid-tuning capacitor are located in the center compartment between the intermediate

and top shelves, while the power-amplifier tubes and plate-circuit components and tuning capacitor are mounted on the top shelf. The front panel mounts the tuning controls and indicators, as well as the crystal switch. A small access panel permits installation of crystals from the front of the unit. The top, sides, and bottom of the Amplifier-Oscillator are completely enclosed by removable cover plates, which provide r-f shielding.

(4) ELECTRICAL EQUIPMENT CABINET CY-1126A/URT.—The cabinet, shown in figure 1-2, houses the drawer-type chassis and provides facilities for mounting the equipment and for accommodating external connections. Two slotted guides are mounted in the bottom of the cabinet to permit easy removal and insertion of the chassis. When the transmitter installation utilizes the cabinet, the terminal box is mounted on the outside. For flexibility in mounting, the cabinet is designed to permit attachment of the terminal box in any one of three positions: on the back or on either of the two sides. Two removable louvered plates are used to cover the unused cabinet openings.

(5) TERMINAL BOX.—The terminal box, shown mounted on the rear of the cabinet in figure 1-2, provides facilities for making all external connections to the Radio Transmitter, except for accessories (handset, microphone, etc.) connected to front-panel receptacles. It contains two terminal boards, a noise-suppression filter, and two coaxial receptacles for the antenna and receiver cables. As previously stated, the terminal box is mounted on the cabinet when the Radio Transmitter installation utilizes that enclosure, or at the rear of the Power Supply when relay-rack mounting is employed.

*b.* TEST CABLES.—The three cable assemblies shown in figure 1-1 are supplied so that the Radio Transmitter may be operated with its component units physically disassembled. Operation of this type is often necessary when testing or repairing the equipment in order to gain access to circuits or components not readily available when the transmitter is completely assembled. Cable Assembly CX-1826/U is used to connect the Power Supply to the terminal box (when mounted on the cabinet). Cable Assembly CX-1827/U is employed between the Power Supply and the Radio Modulator, and Cable Assembly CX-3154/U connects the Power Supply to the Amplifier-Oscillator unit.

**4. REFERENCE DATA.**

*a.* NOMENCLATURE.—Transmitting Set, Radio AN/URT-7C.

*b.* CONTRACT NUMBER AND DATE.—NObsr-71142, 22 December 1955.

*c.* COGNIZANT NAVAL INSPECTOR.—Inspector of Naval Material, 608 S. Dearborn St., Chicago 5, Ill.

*d.* CONTRACTOR.—Rauland-Borg Corp., Chicago, Ill.

*e.* NUMBER OF BOXES.—Two.

*f.* CUBICAL CONTENTS.—See tables 1-1 and 1-3.

*g.* WEIGHT.—See tables 1-1 and 1-3.

*h.* FREQUENCY RANGE.—115 to 156 mc.

*i.* TYPE OF FREQUENCY CONTROL.—Crystal.

*j.* TYPES OF EMISSION AND MODULATION CAPABILITY.—A-2 (MCW) 100 percent, A-3 (Phone) 100 percent.

*k.* NOMINAL CARRIER OUTPUT.—30 watts.

*l.* CRYSTALS.—Type CR-24/U.

*m.* FREQUENCY STABILITY.—±0.007 percent under any conditions or combination of conditions.

*n.* IMPEDANCE.

(1) Microphone input: 600 ohms.
(2) Antenna output: 50 ohms.

*o.* AUDIO INPUT VOLTAGE.— -25 db to +5 db from a 0.006-watt reference level (0.1 to 3.4 volts).

*p.* AUDIO-FREQUENCY RESPONSE CHARACTERISTIC.—Flat within ±3 db, from a 1,000-cps reference level, from 300 to 3,500 cps.

*q.* AUDIO-FREQUENCY FILTER CHARACTERISTIC.—Flat within ±2 db from a 1,000-cps reference level and -50 db at 5,000 cps and over.

*r.* INPUT TO CLIPPING STAGE.—Normally held 20 ±5 db above the clipping level by action of the AVC circuit for variations in the input of -25 to +5 db from 0.006-watt reference level.

*s.* POWER SUPPLY.
115/230 volts, 50 to 60 cps, ac, single phase.
Power factor: 0.85.

Input power: 750 watts.

Maximum permissible line-voltage variation: ±10 percent.

Maximum permissible line-frequency variation: ±5 percent.

*t.* HEAT DISSIPATION.—700 watts.

*u.* Table 1-5 lists the basic similarities of AN/URT-7 equipment. The installation, operation, and maintenance procedures in this technical manual are similar to those provided for any AN/URT-7 model.

**TABLE 1-1. EQUIPMENT SUPPLIED**

| QUANTITY PER EQUIPMENT | NAME OF UNIT | NAVY TYPE DESIGNATION | OVER-ALL DIMENSIONS* | | | VOLUME* | WEIGHT* |
|---|---|---|---|---|---|---|---|
| | | | HEIGHT | WIDTH | DEPTH | | |
| 1 | Radio Transmitter, includes | T-336C/URT-7 | 13-23/32 | 19† | 16-1/2† | 2.75 | 146 |
| | 1 Amplifier-Oscillator | AM-638C/URT | 10 | 5 | 13-3/4 | 0.42 | |
| | 1 Electrical Equipment Cabinet | CY-1126A/URT | 13-23/32 | 19† | 15† | 2.5 | |
| | 1 Power Supply | PP-773C/URT | 12-7/32 | 19 | 14-1/2 | 2.0 | |
| | 1 Radio Modulator | MD-163C/URT | 10 | 4 | 13-3/8 | 0.33 | |
| 1 | Cable Assembly | CX-1826/U | | | | | 1-3/4 |
| 1 | Cable Assembly | CX-1827/U | | | | | 1-1/2 |
| 1 | Cable Assembly | CX-3154/U | | | | | 1 |
| 2 | Connector, Plug | UG-21D/U | 1-3/4 | 13/16 | 13/16 | | 0.03 |
| 1 | Maintenance Parts Kit | | 7-1/2 | 21-1/4 | 11-1/4 | 0.9 | 40 |
| 2 | Technical Manual | NAVSHIPS 92832 | 11-1/4 | 8-11/16 | 1/2 | 0.03 | 1-1/4 |

*Dimensions are in inches, volume in cubic feet, and weight in pounds.
†Add 2 inches to width or depth, dependent upon location of terminal box.

**TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED**

| NAME OF UNIT | NAVY TYPE DESIGNATION | REQUIRED USE | REQUIRED CHARACTERISTICS |
|---|---|---|---|
| Remote Radiophone Unit | -23500 | Remote operation | Per 16R28 (RE) |
| Hand Telephone Assembly or | -51081 or equivalent | Speaking and listening | Per RE8944A |
| Chestset | -51090 or equivalent | Speaking and listening | — |
| Antenna Assembly | -66095 | Transmitting and receiving | — |
| Interconnecting Cables | — | — | — |
| Crystal Unit | CR-24/U | Frequency control of transmitter | — |

## TABLE 1-3. SHIPPING DATA

| SHIPPING BOX NO. | CONTENTS | | OVER-ALL DIMENSIONS* | | | VOLUME* | WEIGHT* |
|---|---|---|---|---|---|---|---|
| | NAME | DESIGNATION | HEIGHT | WIDTH | DEPTH | | |
| 1 | Radio Transmitting Set | AN/URT-7C | 19-1/4 | 23-1/4 | 25 | 6.4 | 221 |
| 2 | Equipment Spares | | 7-1/2 | 21-1/4 | 11-1/4 | 0.9 | 40 |

*Dimensions are in inches, volume in cubic feet, and weight in pounds.

## TABLE 1-4. ELECTRON TUBE COMPLEMENT

| UNIT | NUMBER OF TUBES OF TYPE INDICATED | | | | | | | | TOTAL NO. OF TUBES |
|---|---|---|---|---|---|---|---|---|---|
| | 3B28 | 4X150A | 5726/ 6AL5W | 6AT6 | 5749/ 6BA6W | 12AT7WA | 5814 | 807 | |
| Radio Transmitter T-336C/URT-7: | | | | | | | | | |
| Amplifier-Oscillator AM-638C/URT | | 3 | | | | 3 | | | 6 |
| Radio Modulator MD-163C/URT | | | 2 | 1 | 1 | | 4 | 2 | 10 |
| Power Supply PP-773C/URT | 2 | | | | | | | | 2 |
| Total Number of Each Type | 2 | 3 | 2 | 1 | 1 | 3 | 4 | 2 | 18 |

## TABLE 1-5. BASIC SIMILARITIES IN MODEL AN/URT-7 EQUIPMENT

| MODEL | RADIO TRANSMITTER UNIT TYPE | ELECTRICAL DESIGN | REMARKS |
|---|---|---|---|
| AN/URT-7 | | Basic equipment. | |
| AN/URT-7A | | Same as AN/URT-7, except for addition and change of several minor parts. | Different manufacturer |
| AN/URT-7B | | Overheating protection, blower "break-away" connectors added; improved antenna relay used; modulator transient suppression added. | |
| AN/URT-7C | | Removal of modulator fuse, and addition of high voltage fuse; new parts to replace previous type; new tube shields, shield bases and tube sockets. | |

# SECTION 2

# THEORY OF OPERATION

## 1. GENERAL CIRCUIT DESCRIPTION.

Radio Transmitter T-336C/URT-7 comprises a radio frequency unit (Amplifier-Oscillator AM-638C/URT), a modulator unit (Radio Modulator MD-163C/URT), and a power supply unit (Power Supply PP-773C/URT). A functional block diagram of the entire transmitter, showing the various stages in each unit, appears in figure 2-1; the complete schematic diagram is shown in figure 7-24. The function of the Amplifier-Oscillator is to generate the r-f carrier output at any chosen frequency in the range of 115 to 156 megacycles, while the Radio Modulator impresses voice or tone modulation upon the carrier so generated. In addition, special circuits are incorporated in the Radio Modulator to improve the overall modulation efficiency. The Power Supply operates from a 115- or 230-volt, 50-to-60 cycle source and provides all required operating voltages.

*a.* AMPLIFIER-OSCILLATOR AM-638C/URT.—Crystal oscillator V601 generates an output between 19.17 and 26 megacycles. This signal is doubled in frequency (38.33 to 52 megacycles) by doubler V602, and then amplified by amplifier V603. The first three stages utilize type 12AT7WA twin triodes. Tripler V604 (4X150A tetrode) multiplies the signal to a frequency between 115 to 156 megacycles, which is then amplified by the push-pull 4X150A power amplifier stage (V605 and V606). A tuned output filter minimizes the radiation of harmonics. The r-f output reaches the antenna via an antenna relay mounted on the Power Supply chassis; the relay is provided to switch the antenna between the Radio Transmitter and the receiver being used, during periods of transmission and reception, respectively.

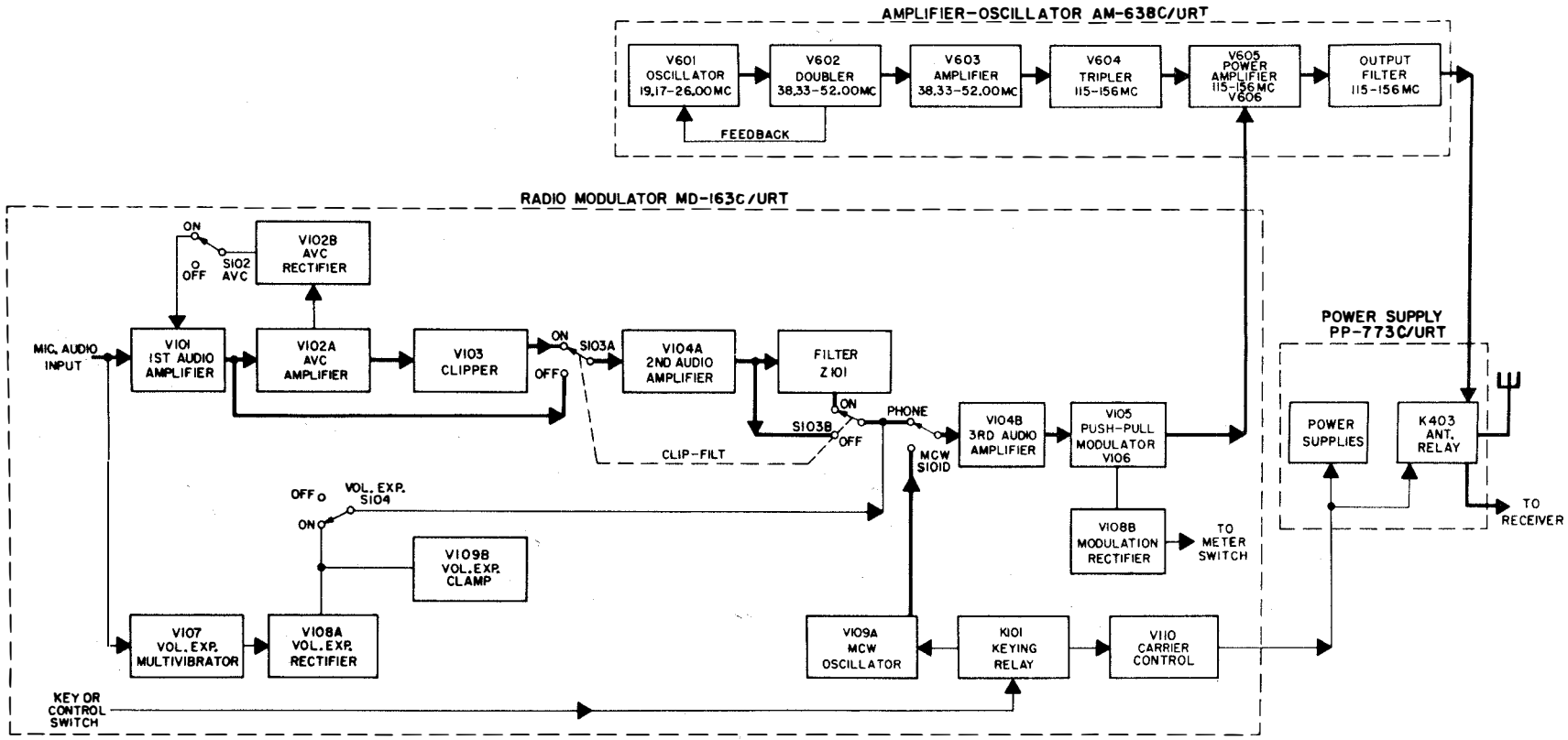
*b.* RADIO MODULATOR MD-163C/URT.—The Radio Modulator includes a basic audio channel which amplifies speech or MCW tone to a level sufficient for 100-percent modulation of the r-f carrier output. Also incorporated are AVC, clipper, and filter circuits for increasing the average modulation percentage, as well as an expander circuit to minimize background noise during voice modulation. An audio oscillator provides a 1,000-cycle modulation tone for MCW operation.

(1) BASIC AUDIO CHANNEL.—Figure 2-1 can be used to visualize the basic audio circuits if switches S102, S103, and S104 are assumed to be in their OFF positions. The speech input is amplified by the 5749/6BA6W first audio amplifier, V101. It is further amplified by V104, a 5814 twin triode functioning as the second and third audio amplifiers. Output from V104B drives the push-pull 807 modulator stage (V105 and V106), which modulates the d-c input to the power amplifier. When switch S101 is in the MCW position, for operation in that mode, the audio output from MCW oscillator V109 (triode section of a 6AT6 duo-diode-triode) is applied directly to the input of the third audio amplifier, since the oscillator output is considerably higher than the microphone output level.

(2) CLIPPER-FILTER AND AVC CIRCUITS.—When switches S102 and S103 are placed ON, the clipper, filter, and AVC circuits are connected into the audio channel. Instead of being applied directly to the second audio amplifier, the output from first audio amplifier V101 is increased in amplitude by AVC amplifier V102A (one half of a 5814) and then fed to the 5726/6AL5W clipper, V103. That stage clips the audio at a preset level. The low-pass filter (Z101) then attenuates all the high-frequency components above 3,500 cps which are present in the clipped audio signal to prevent modulation of the carrier by those frequencies. The average modulation level is thereby increased and the effect of voice-level fluctuations is minimized.

The clipper circuit is aided by AVC action provided by the AVC rectifier, V102B (a diode-connected section of a 5814 twin triode). V102B rectifies a portion of the output from AVC amplifier V102A; the rectified signal is applied as an AVC bias to the first audio stage. The AVC action helps maintain an audio level which is suitable for continuously efficient clipping by V103.

(3) VOLUME EXPANSION.—A volume-expander circuit is provided to eliminate transmission of extraneous background noise when pauses in speech occur during transmission. The expander utilizes an electronic control cir-


AMPLIFIER-OSCILLATOR AM-638C/URT
V601 OSCILLATOR 19.17-26.00MC
V602 DOUBLER 38.33-52.00MC
V603 AMPLIFIER 38.33-52.00MC
V604 TRIPLER 115-156MC
V605 POWER AMPLIFIER 115-156MC V606
OUTPUT FILTER 115-156MC
FEEDBACK
RADIO MODULATOR MD-163C/URT
ON
OFF
S102 AVC
V102B AVC RECTIFIER
MIC. AUDIO INPUT
V101 1ST AUDIO AMPLIFIER
V102A AVC AMPLIFIER
V103 CLIPPER
ON
OFF
S103A
V104A 2ND AUDIO AMPLIFIER
FILTER Z101
ON
S103B
OFF
PHONE
CLIP-FILT
V104B 3RD AUDIO AMPLIFIER
V105 PUSH-PULL MODULATOR V106
MCW S101D
OFF
VOL. EXP. S104
ON
V109B VOL. EXP. CLAMP
V108B MODULATION RECTIFIER
TO METER SWITCH
V107 VOL. EXP. MULTIVIBRATOR
V108A VOL. EXP. RECTIFIER
V109A MCW OSCILLATOR
K101 KEYING RELAY
V110 CARRIER CONTROL
KEY OR CONTROL SWITCH
POWER SUPPLY PP-773C/URT
POWER SUPPLIES
K403 ANT. RELAY
TO RECEIVER

cuit which disables the third audio amplifier when the microphone input drops below a preset level; switch S104 must be ON. The circuit consists of a 5814 monostable multivibrator (V107), rectifier V108A (one diode section of a 5726/6AL5W), and a clamping circuit which utilizes the diode sections of V109. In the absence of microphone audio input, a bias voltage keeps V104B cut off. When the audio input triggers the multivibrator, the output from that stage is rectified by V108A and overcomes the bias on V104B, allowing the amplified audio to reach the modulator tubes.

(4) MODULATION INDICATOR.—A portion of the output from the modulator tubes is rectified for application to the Radio Transmitter meter circuit. One half of a 5726/6AL5W dual diode (V108B) is utilized as the rectifier, so that the relative modulating audio voltage can be monitored.

(5) CARRIER CONTROL AND ANTENNA CHANGE-OVER.—The local or remote carrier-control switch, the microphone or handset press-to-talk switch, or the key (when MCW operation is employed) energizes keying relay K101. In turn, K101 is connected to V110, the 5814 carrier control tube. This stage controls relay circuits which energize portions of the Power Supply to allow generation of the modulated carrier and transfer the antenna from the receiver to the output of the transmitter r-f circuits.

(6) AUDIO MONITORING CIRCUIT.—Audio signal from a receiver associated with the Radio Transmitter is brought in to a winding on the Radio Modulator input transformer. From the primary winding it is fed into the earpiece of the operator's telephone handset. Besides receiver monitoring, this arrangement also provides operating side-tone. Relay operation disconnects the receiver audio when the carrier is on.

*c.* POWER SUPPLY PP-773C/URT.

(1) POWER SUPPLIES.—The Power Supply includes conventional transformer, tube rectifier, and filter circuits to develop high-voltage plate and screen supplies. In addition, there is a bias circuit using a transformer, selenium rectifier, and filter circuit to produce a negative 42-volt supply. Also included is a selenium-rectified 12-volt d-c supply which is used to operate pilot lamps and may be used as a source of microphone voltage for remote-control operation.

(2) METERING CIRCUIT.—A single front-panel meter, used in conjunction with a selector switch (both located on the Power Supply chassis), provides a means of measuring various grid and plate currents, as well as relative power output,

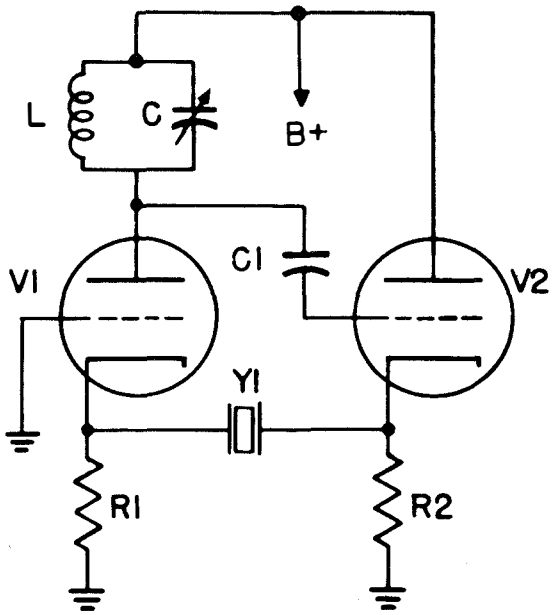



***Figure 2-2. R-F Oscillator, Simplified Equivalent Circuit***

AVC current, modulation level, volume expansion, etc.

**2. CIRCUIT ANALYSIS.**

*a.* AMPLIFIER-OSCILLATOR AM-638C/URT.

(1) OSCILLATOR.—The r-f oscillator utilizes V601, a 12AT7WA twin triode, in a crystal-controlled circuit which obtains feedback voltage from doubler V602; see figure 2-3. To explain the operation of the oscillator, an equivalent but simplified circuit has been illustrated in figure 2-2. L and C form a tank circuit in the plate circuit of V1; it is tuned to the resonant frequency of the crystal, Y1. Oscillations appearing at the plate of V1 are coupled to the grid of V2 through C1. V2 acts as a cathode follower, its output cathode voltage being in phase with the V1 plate voltage oscillations. Crystal Y1, oscillating in a series-resonant mode, transmits the voltage at the cathode of V2 to the cathode of V1. In turn, V1 now acts as a grounded-grid amplifier, and reinforces the oscillations at its plate. Thus the positive feedback necessary to sustain oscillation is obtained.

The actual circuit is shown in figure 2-3. The stage corresponding to V1 of the simplified circuit is a 12AT7WA dual triode, V601, both sections of which are connected in parallel. Since V601 effectively functions as a single triode, it is so shown in figure 2-3. Keyed plate voltage is supplied through decoupling network C601-

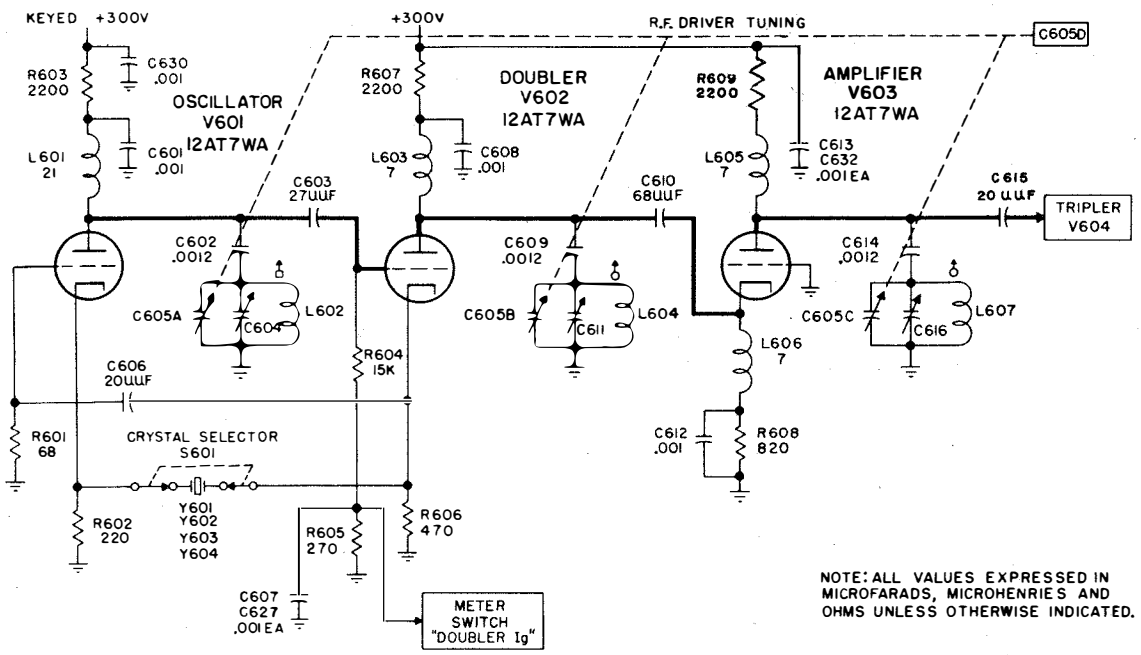



***Figure 2-3. Oscillator, Doubler, and Amplifier Stages, Simplified Schematic Diagram***

R603-C630 and r-f choke L601. The tank circuit is shunt-fed through C602 and is comprised of C605A, C604, and L602. It is tunable through the frequency range of 19.17 to 26 megacycles by C605A.

The necessary cathode impedance corresponding to R1 of figure 2-2 is R602.

The second stage, corresponding to V2 of figure 2-2, is doubler V602, another 12AT7WA twin triode with both sections connected in parallel; V602 is also shown as one triode, since it functions as a single stage. The doubler plate-tank circuit tunes a frequency range twice that of the oscillator stage, i.e. 38.33 to 52 megacycles. The tank-circuit impedance at the crystal oscillator frequency is therefore very low, resulting effectively in grounded-plate operation of V602 for the oscillator frequency, as indicated in figure 2-2. The cathode-follower action is obtained by the connection of R606 which corresponds to R2 of figure 2-2, and the output voltage is fed back through the selected crystal to the cathodes of V601. Thus V601 and V602 oscillate at the crystal frequency when C605A tunes the oscillator plate-tank circuit to the crystal frequency. C605A is gang-tuned with the other sections of C605. C604 is the plate padder and, with L602, is varied to make the final tuning-range adjustments for proper tracking of the ganged control. Coupling capacitor C603, corresponding to C1 of figure 2-2, couples the output of the oscillator into the doubler. To prevent oscillations at spurious frequencies, R601 is inserted in the grounded-grid circuit of V601 and a small amount of degenerative feedback is coupled from the cathode of V602 to the grid of V601 through C606.

(2) DOUBLER. —The doubler, V602, serves as part of the oscillating circuit and also as a frequency multiplier; see figure 2-3 and subparagraph (1), above. The signal voltage developed in the oscillator circuit is applied to the grid of V602 through coupling capacitor C603.

Operating bias for the stage is developed across grid resistor R604 by the discharge of C603 on the negative swing of the input signal, while protective bias is developed across the cathode resistor, R606. The grid is returned to ground through R604 and R605, the latter serving as the shunt for switch position 1 (DOUBLER $I_g$) of the meter. Capacitors C607 and C627 bypass the meter circuit for rf.

Plate voltage is supplied through decoupling network R607-C608 and the r-f choke, L603. The plate-tank circuit, consisting of C605B, C611, and L604, is shunt-fed through C609. The tank circuit is tuned to the second harmonic of the input frequency. The output, coupled to the succeeding amplifier stage through C610, has a frequency range of 38.33 to 52 megacycles.

(3) AMPLIFIER.-- A paralleled 12AT7WA twin triode (V603) is used as a Class C grounded-grid amplifier to provide sufficient drive for the tripler stage. V603 is shown in figure 2-3 as a single triode, reflecting the manner in which it actually functions. The input signal is coupled into the cathode from the plate of the doubler. L606 presents the necessary impedance for developing the signal voltage. The plate-tank circuit, which tunes the same frequency range as the doubler, 38.33 to 52 megacycles, is shunt-fed through C614. C605C, the third section of the four-section capacitor, is the main tuning control. Alignment adjustments are made with L607 and C616, both of which are variable, to insure proper tracking of the ganged control. The output of the amplifier is coupled into the grid of the tripler through C615. Cathode bias for the amplifier is provided by R608 and C612. Plate voltage is supplied through r-f choke L605 and resistor R609; capacitors C613 and C632 (connected in parallel) bypass the 300-volt supply for rf.

(4) TRIPLER.—A 4X150A tetrode amplifier tube is used as a frequency tripler and appears in the simplified schematic of figure 2-4. Protective bias of -42 volts is applied to the grid via the meter-switching circuit in the Power Supply; the meter measures grid current when its associated switch is in the TRIPLER $I_g$ position. Additional bias for Class C operation is developed across R610 by grid-current flow resulting from the input signal voltage. The meter circuit is bypassed by capacitors C617 and C624.

Plate voltage is supplied through r-f filter L608-C618-C625 from the meter circuit in the Power Supply. A meter shunt used in measuring the tripler plate current is incorporated in the meter circuit; the meter indicates the relative value of plate current when its switch is set to TRIPLER $I_p$.

The plate-tank circuit, consisting of L609, L610, C621, and C605D (the fourth section of ganged capacitor C605), is shunt-fed through C620. This tank tunes a range of 115 to 156 megacycles, which is three times the input frequency. Alignment adjustments are made with L609 and C621 to insure proper tracking of C605D with the other sections of that ganged-capacitor assembly. The output of the tripler stage is link-coupled to the power amplifier grid circuit by L611 and L612; those two link coils are connected by coaxial cable W601 and connectors J602 and J603.

Resistors R611 and R612, in series, and R613 form a voltage divider connected across the keyed 300-volt line. Screen-grid voltage for V604 is tapped from the junction of R612 and R613 and the screen is bypassed to ground by C619.

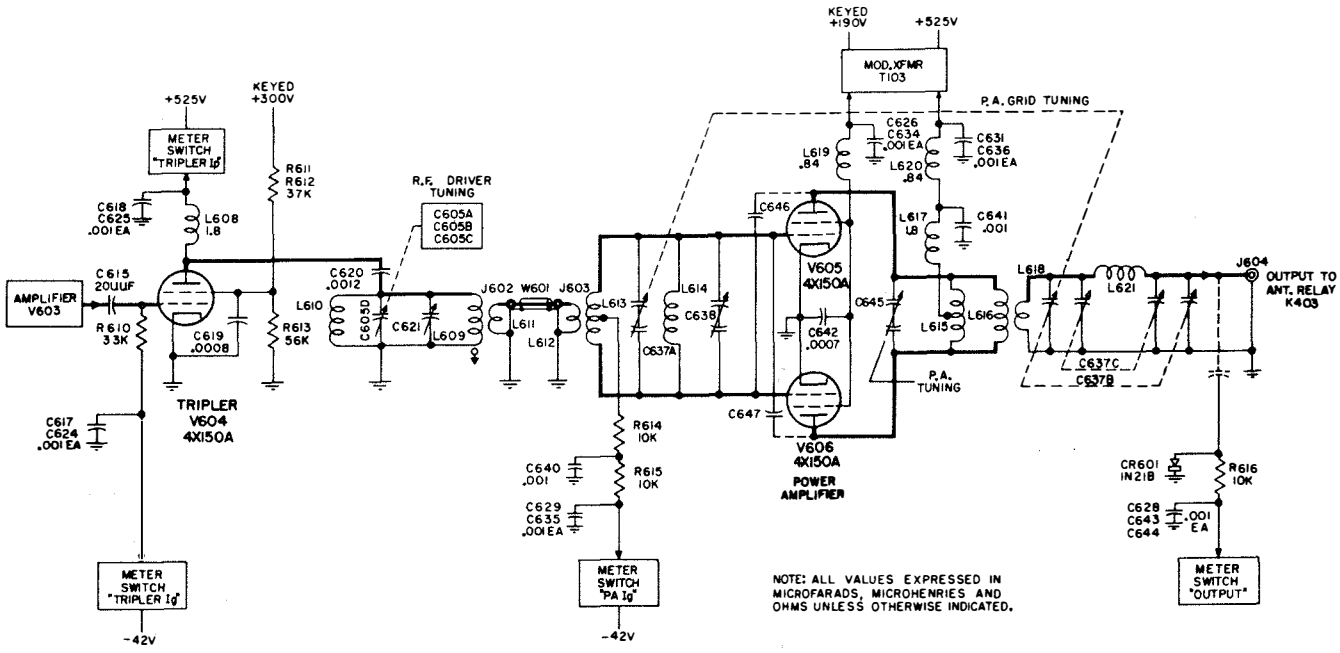



*Figure 2-4. Tripler and Power Amplifier Stages, Simplified Schematic Diagram*

C619, shown in figure 7-17, is a parallel-plate capacitor. One side is a spring-fingered contact plate which contacts the screen ring of the 4X150A tube. The other side is the chassis itself and a brass cover plate, which is grounded to the chassis by means of mounting screws. Two thin mica sheets between these conductors act as the dielectric, one being above and one below the spring-fingered contact plate.

(5) POWER AMPLIFIER.—The power amplifier employs two 4X150A tetrodes in a push-pull plate-and-screen modulated circuit; see figure 2-4. Excitation from tripler V604 is coupled into the grid circuit by L611, L612, and W601. The grid tank comprises L613, L614, C637A, and C638. C637A, a split-stator section of ganged capacitor C637, functions as the P.A. GRID TUNING control. C638, also a split-stator capacitor, is used to make alignment adjustments, as is L614. Grid-leak bias is developed across resistors R614 and R615, while protective bias of -42 volts is fed to the grid via the meter circuit in the Power Supply. When the meter switch is in the PA $I_g$ position, PA grid current is monitored by the meter. The grid-return circuit is filtered by r-f bypass capacitors C640, C629, and C635.

The plate tank circuit consists of P.A. TUNING capacitor C645 and inductors L615 and L616. Plate voltage (525 volts) is applied through the plate-modulation winding of modulation transformer T103 and through r-f chokes L620 and L617 to the center-tap of L615. The plate supply is bypassed by capacitors C631, C636, and C641. The output from the PA stage is coupled from L616 to the output filter circuit.

The PA tubes are neutralized by capacitors C646 and C647. One plate of each capacitor consists of a short length of heavy wire connected to the stator of C637A. This wire lead is brought near the envelope of the tube opposite the end of C637A to which the wire is connected. The plate of that tube forms the other plate of the capacitor. The capacitance which then exists between the wire and the plate of the adjacent tube is sufficient to neutralize the grid-to-plate capacitance of the tube.

Screen-grid voltage (190 volts) is supplied to the PA tubes via the screen-modulation winding of T103 and r-f choke L619. The screen supply is bypassed for rf by capacitors C626 and C634, while the screen grids of both tubes are bypassed by C642. The latter component is a special bypass capacitor, used to reduce screen-grid impedance to ground, and is connected to the screen-grid rings of the PA tubes; see figure 7-16. The screen bypass capacitor uses the chassis as one plate. In the power-amplifier stage, a sheet of Teflon is placed on the chassis; the screen-grid connection is made through a metal plate above the Teflon sheet. The inner circumference of this plate is ringed with spring contacts, which fit against the screen-grid ring. Above the screen-connecting plate is an additional Teflon sheet topped by another metal plate, which is the other side of the capacitor. This top plate is grounded to the chassis by spring contacts and the mounting screws which hold the assembly together. By grounding the screens in this manner, the additional lead inductance of a normal capacitor is eliminated.

(6) OUTPUT FILTER. —An output filter network is included in the equipment to help prevent undesired frequencies, developed in the frequency-multiplier stages, from reaching the antenna and being radiated. As shown in figure 2-4, the output of the power amplifier is coupled into the filter circuit by L618. The configuration of the filter is that of a pi-network in which L621 forms the series inductive element and capacitive shunt elements. Both capacitors are split-stator types, having their rotors grounded; C637B is ganged with P. A. GRID TUNING capacitor C637A and tunes the filter over the range 115 to 156 megacycles. Tracking between C637B and C637A is accomplished by trimmer capacitor C637C. Output from the Amplifier-Oscillator unit is directly coupled to J604 from L621.

(7) OUTPUT MONITOR. —The output monitor circuit provides a relative indication of output power on the front-panel meter when the meter switch is set to OUTPUT. The reading obtained is not an absolute indication, since it will vary with frequency, increasing as the frequency increases; it will also vary with changes in loading and with the standing-wave ratio on the line to the antenna.

The monitor circuit uses a 1N21B crystal-diode rectifier and depends upon wiring capacitance to pick up the energizing signal. This signal produces a voltage across CR601. The signal voltage is then rectified by the crystal diode and filtered by R616, C628, C643, and C644. The d-c voltage thus produced is used to give the output power indications on the meter.

The following facts should be noted insofar as the meter readings obtained are concerned:

(a) The meter indicates voltage into a transmission line which may have a relatively high standing-wave ratio. The meter reading therefore will depend in part on the location of the maximum and minimum of the standing wave

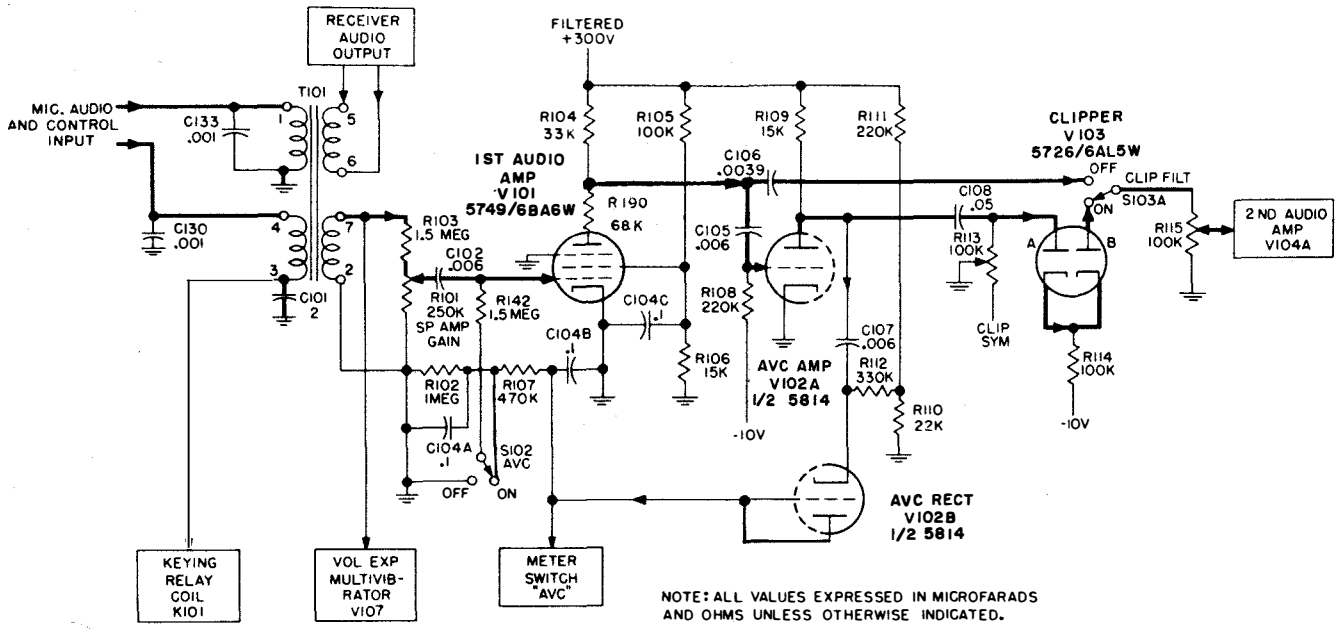



***Figure 2-5. First Audio Amplifier, AVC, and Clipper Circuits, Simplified Schematic Diagram***

of voltage, which is independent of the power through the transmission line.

(b) The meter reading will change with different crystal diodes.

(c) The d-c output of the crystal is not necessarily linear with the r-f input.

To measure the true output power, R-F Wattmeter ME-11/U must be used. If the wattmeter is substituted for the antenna and the P.A. TUNING control adjusted for maximum wattmeter reading, the wattmeter will indicate the true carrier power.

Neither the wattmeter nor the built-in voltage indicator will measure the side-band power under modulation, however, as they are average-voltage-reading devices. The average voltage with a given carrier level is independent of the modulation from zero to 100 percent. Any change in the meter readings under modulation indicates a shift in carrier level.

*b.* RADIO MODULATOR MD-163C/URT.

(1) FIRST AUDIO AMPLIFIER.—The first audio stage employs V101, a 5749/6BA6W pentode, as a resistance-coupled, high-gain voltage amplifier; see figure 2-5. The audio input signals from the microphone or handset are coupled across input transformer T101 and developed across R103 and R101. The latter serves as the SP AMP (speech amplifier) gain control. The signal then reaches the grid of V101 via capacitor C102. When AVC switch S102 is OFF, the grid is returned to ground through R142; the circuits involved when S102 is set to ON are discussed in subparagraph (2), below. The amplifier output is applied to AVC amplifier V102A by C105. When CLIP-FILT (clipper-filter) switch S103 is in the OFF position, the output is also coupled to the second audio amplifier (V104A) by C106. Plate voltage is obtained from the filtered 300-volt supply while screen-grid voltage is obtained from the voltage divider, R105 and R106. R104 serves as the plate-load resistor, and C104C is the screen-grid bypass capacitor.

(2) AVC AMPLIFIER AND RECTIFIER.—As shown in figure 2-5, the AVC amplifier is V102A, one half of a 5814 twin triode. A conventional resistance-coupled circuit is employed, in which fixed bias of -10 volts is applied to the grid through R108. The output signal, developed across plate load R109, is coupled to clipper V103 by C108 and to the cathode of the AVC rectifier by C107.

The AVC rectifier utilizes V102B, the other section of the 5814 twin triode. The plate of V102B is grounded and the cathode is held at a positive potential by voltage divider R110 and R111, so that neither plate nor grid current can flow. When the signal from V102A, developed across R112 and R110, is applied to the rectifier cathode, the negative peaks drive the cathode negative with respect to the grid, resulting in a flow of grid current. Consequently, a rectified negative voltage appears across R107 and R102;

these two resistors, in conjunction with C104A and C104B, form a filter network having a time-constant which eliminates audio-frequency variations from the AVC voltage.

AVC is provided primarily to maintain a signal of relatively constant amplitude at the input to the clipper stage for efficient clipping, regardless of the variation in speech amplitude. Therefore, it is likely that AVC will be utilized only when the clipper-filter circuit is also in use. When AVC switch S102 is in the ON position, the grid of V101 is returned to ground through R142 and R102, so that the negative AVC voltage across R102 controls the gain of that stage. The grid of V101 is returned to ground through resistor R142 when switch S102 is in the OFF position.

The AVC position of the METER selector switch (S401) indicates whether or not AVC voltage is being developed. However, this metering circuit presents a low-impedance load to the diode rectifier, and impairs the operation of the AVC circuit. For proper AVC circuit performance, therefore, the METER switch must not be left in the AVC position.

(3) CLIPPER.—The output of AVC amplifier V102A is applied to clipper V103, a 5726/6AL5W dual diode. The cathodes of both diodes are connected to a negative 10-volt bias source through a common cathode resistor, R114; therefore, both diodes draw plate current through R114. The plate of V103A is returned to ground through rheostat R113, and the plate of V103B through R115.

On the negative swing of the input signal, voltage is developed across R113 which decreases the voltage at the plate of V103A with respect to the cathode. The resultant drop in diode current lowers the voltage at the cathodes of V103A and V103B. Therefore, the conduction of the latter diode increases, causing an increased (negative-going) output signal voltage to be developed across R115. When the input to V103A reaches approximately -3.3 volts, the plate is sufficiently negative with respect to the cathode to cut off that diode. Any further decrease in signal input has no effect on V103A, since it remains cut off. Hence, the voltage at the cathodes of the diodes, the current through V103B, and the voltage across R115 remain constant beyond the point of cut-off, clipping any portion of the input signal which is below the negative 3.3-volt level.

On the positive swing of the input signal, the increased conduction through V103A increases the voltage at the cathodes of the two diodes. This causes the current flow through V103B to drop, resulting in a decreased (negative-going) output signal across R115. When the input to V103A becomes sufficiently positive, the current flowing through R114 (due to diode V103A) causes the voltage at the cathode of V103B to exceed that at the plate, cutting off that section of the clipper. Any further increase in signal amplitude cannot be transmitted to the succeeding second audio amplifier; thus, the positive peaks of the input voltage are clipped.

Clipper-symmetry control R113 is part of the load across V103A. The setting of R113 determines, in part, the voltage which appears across R114 due to conduction of V103A. In turn, this voltage acts to cut off the diodes and provide the clipping action described above. The optimum setting of R113 is that which results in symmetrical clipping of the positive and negative signal peaks.

The action of the clipper stage and of the preceding AVC circuit assures high average sideband power and constant modulation levels over a wide range of voice signal strengths, and increases the intelligibility of speech when receiving signals of low signal-to-noise ratios.

(4) SECOND AUDIO AMPLIFIER.—As shown in figure 2-5, the input to the second audio amplifier, V104A, may be obtained from either of two sources. With CLIP-FILT switch S103 in the ON position, the input is obtained from the clipper stage, V103. With S103 in the OFF position, the input is obtained from the first audio amplifier (V101) through C106. In both cases, the input voltage to this stage is varied by potentiometer R115, which functions as the MOD (speech modulation) level control.

The circuit of this stage appears in figure 2-6. V104A, one triode section of a 5814, functions as a conventional Class A voltage amplifier. Cathode bias is provided by R117, which is unbypassed to introduce a small amount of degenerative feedback. The plate load consists of filter Z101. When CLIP-FILT switch S103 is OFF, output from V104A is obtained directly from the plate of the tube, with Z101 having no effect upon the signal other than functioning as the plate load. When S103 is in the ON position, the audio voltage is taken from the output terminals of Z101.

Filter Z101 is a band-pass network whose cut-off frequencies are 300 and 3,500 cps. Consequently, it will pass frequencies within that range, but will attenuate all others. When the audio peaks are clipped by V103, the resulting square-topped waveforms contain harmonics of

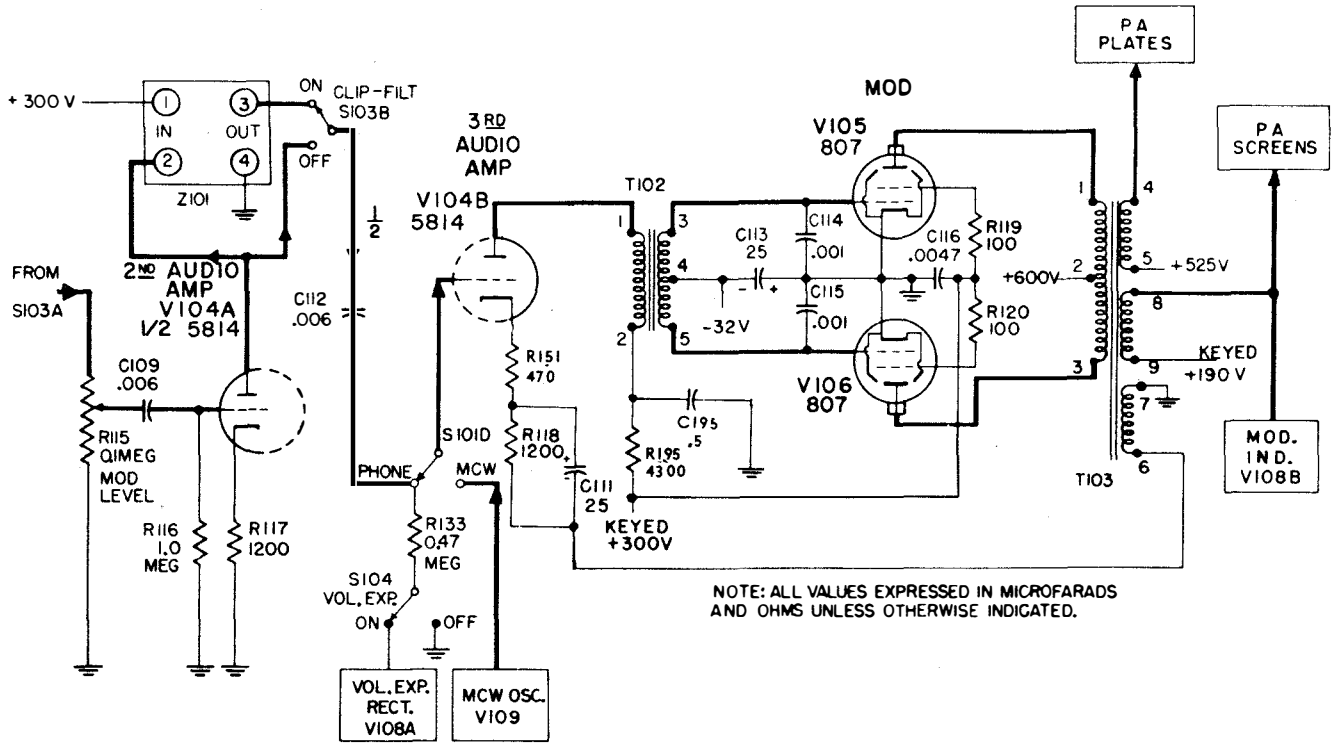



***Figure 2-6. Second and Third Amplifiers and Modulator Stage, Simplified Schematic Diagram***

the fundamental audio frequency. Z101 eliminates the component frequencies above 3,500 cps, minimizing high-frequency distortion and preventing modulation of the r-f carrier by those frequencies.

(5) THIRD AUDIO AMPLIFIER.—The input to the third audio amplifier, V104B, is provided by one of two sources, as indicated in figure 2-6. When switch S101 is in the PHONE position, speech input is coupled to the grid via C112. With S101 set to MCW, the 1,000-cps tone from the MCW oscillator is applied to the stage.

When PHONE operation is employed, VOL EXP (volume expander) switch S104 may be either ON or OFF. With S104 at the OFF position, the grid of V104B is returned to ground through R133 and the tube operates as a conventional Class A amplifier with cathode bias provided by R118 and C111. With S104 at the ON position, the grid is returned to a negative 42-volt biasing potential, which cuts the tube off and permits operation only when the volume-expander circuit acts to remove the bias. Refer to paragraph 2b(7).

Degenerative feedback is introduced into the cathode circuit of V104B by means of an additional secondary winding on the transformer in the modulator circuit which succeeds this stage. This winding, terminals 6 and 7 of T103, is directly between the cathode and ground, and introduces a negative-feedback voltage in order to reduce distortion generated in the modulator.

The output of the third audio amplifier is coupled to the modulator tubes via T102, the primary winding of which is in the plate circuit of V104B, and the secondary of which is in the grid circuit of the succeeding modulator stage. The combination of resistor R195 and capacitor C195 reduces transient voltages in transformer T102 and prevents overloading the power amplifier plate supply bypass capacitors C631, C636, and C641 when plate power is removed from tube V104B.

(6) MODULATOR STAGE.—Two 807 beam-power tubes (V105 and V106) are operated in push-pull as a Class $AB_1$ modulator stage; see figure 2-6. Bias is provided from the negative 32-volt tap of the bias bleeder network, and is fed to the center-tap on the secondary of T102. Since the stage is operating Class $AB_1$, no grid current flows and very little loading of the third audio amplifier occurs. C113 serves to hold a constant bias on the tubes by keeping the center-tap of T102 secondary at a-c ground potential. Capacitors C114 and C115, connected from the grids to ground, attenuate the higher voice fre-

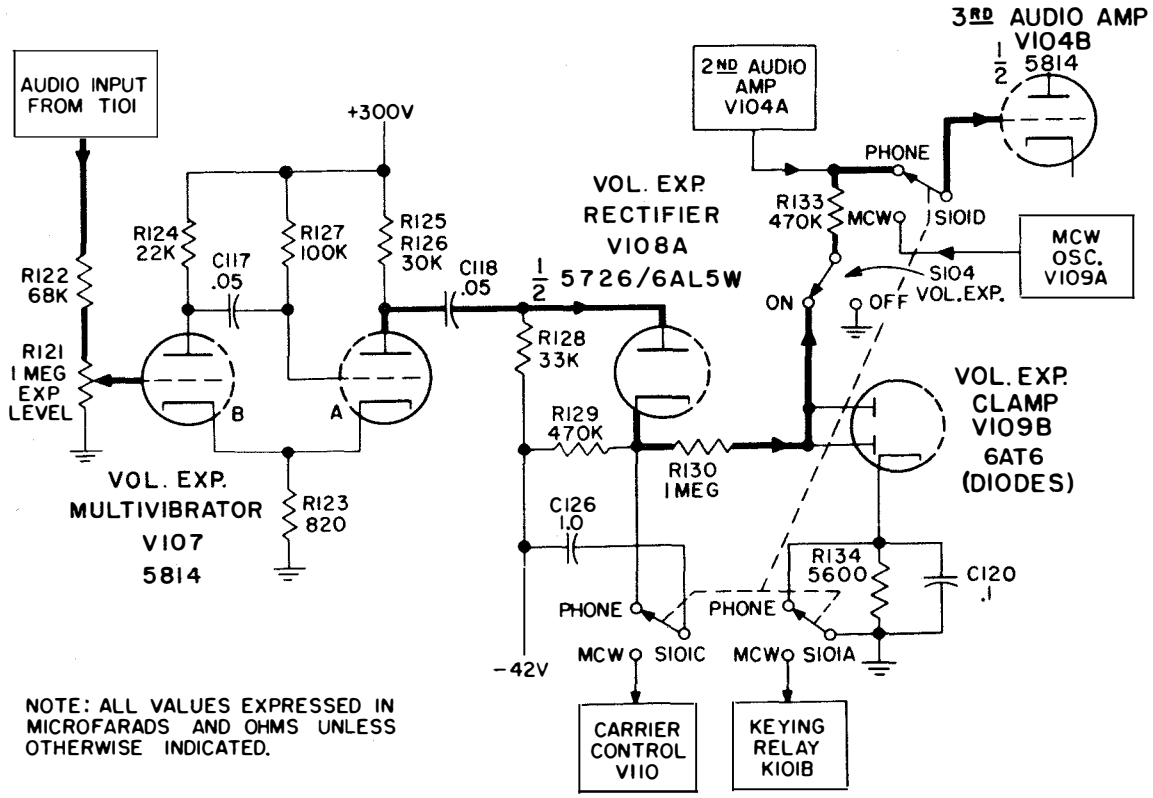



*Figure 2-7. Volume-Expander Circuit, Simplified Schematic Diagram*

quencies, which may be present when audio filter Z101 is not used, without materially affecting the lower frequencies.

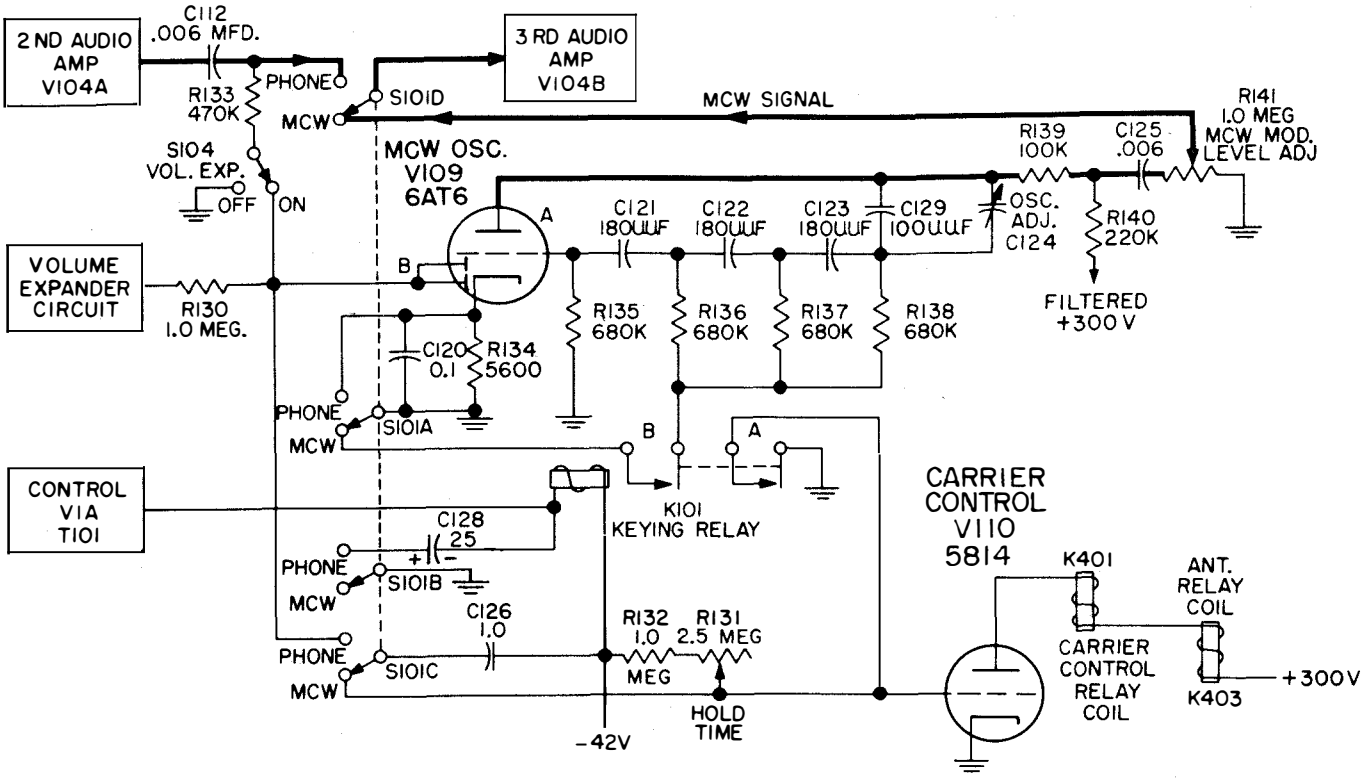
Plate voltage for V105 and V106 is supplied through the center-tap of the primary winding of the modulation transformer, T103. Screen-grid voltage is obtained from the keyed 300-volt supply. Because of the possibility that parasitic oscillations may occur in the screen-grid circuit, suppressor resistors R119 and R120 are inserted, while capacitor C116 serves as a common a-f bypass to ground.

Modulation of the plates and screen grids of the radio-frequency power amplifier is accomplished by two separate secondary windings of T103. The audio voltage produced in these secondary windings varies the d-c voltage applied to the r-f power amplifier plates and screen grids. A third winding (terminals 6 and 7) develops feedback voltage for the third audio amplifier, as described in paragraph 2b(5).

(7) VOLUME EXPANDER.—The volume-expander circuit shown in figure 2-7 is used to prevent modulation of the r-f carrier by background noise during voice transmission. This is accomplished by cutting off the third audio amplifier whenever speech input to the microphone ceases.

(a) VOLUME-EXPANDER MULTIVIBRATOR.—Multivibrator V107, a 5814 twin triode, functions as a monostable ("one-shot") circuit. The grid of triode B is returned to ground through potentiometer R121, the EXP (volume expander) control, while the grid of triode A is connected to a positive source. Signal is applied from the microphone input transformer, T101 (shown in figure 2-5), and applied to potentiometer R121 via resistor R122. The insertion of R122 provides isolation and prevents overloading of the T101 secondary if the grid of V107B conducts on positive audio peaks. R121 provides an adjustment of the signal level fed to the volume-expander circuit.

With no input signal, V107A conducts under a zero-bias condition because its grid is connected to the 300-volt supply through R127. The conduction develops a high bias voltage across the common cathode resistor, R123, and keeps triode B cut off. However, V107B will start to conduct when a positive voltage of sufficient magnitude to overcome the cut-off bias is applied to the grid. The resulting negative voltage appearing across the V107B plate-load re-




NOTE: ALL VALUES EXPRESSED IN MICROFARADS AND OHMS, UNLESS OTHERWISE INDICATED.

***Figure 2-8. MCW Oscillator, Carrier-Control Circuit, and MCW-PHONE Switch Circuits, Simplified Schematic Diagram***

sistor (R124) is coupled through C117 to the grid of triode A and cuts off that section, leaving V107B conducting. Then C117 starts to discharge through R127 and the voltage at the grid of section A starts to rise. When it exceeds the cut-off voltage, section A starts to conduct again; this causes the common cathode voltage to rise and effectively lowers the bias on the grid of section B and causes the current in that tube to decrease. When the plate current of section B is decreased, its plate voltage increases and this, in turn, is transmitted to the grid of section A, which increases the grid voltage of that tube. Thus the circuit rapidly returns to its initial condition.

The resultant output from the multivibrator, developed across plate-load resistors R125 and R126, is a positive square wave which is applied to the succeeding diode rectifier. This output occurs whenever audio voltage of sufficient amplitude is present at the grid of V107B. EXP level control R121 is adjusted to a satisfactory voice level so that square-wave output is obtained from V107 whenever the operator talks.

(b) VOLUME-EXPANDER RECTIFIER AND CLAMP.—The output of V107A is coupled by C118 to diode rectifier V108A, which is used to rectify the positive square wave. Both the plate and cathode of this tube are returned to a negative 42-volt potential. When switch S101 is in the PHONE position and VOL EXP switch S104 is ON, the 42-volt bias is applied to the grid of V104B via resistors R129, R130, and R133, holding that tube in a cut-off condition. The positive square-wave output from multivibrator V107 causes diode V108A to conduct through R128 and R129. The portion of voltage which appears across R129, positive at the cathode end of the resistor, overcomes the cut-off bias on V104B and permits that stage to amplify the speech input. During speech pauses, or between syllables, V104B would again return to cut-off, distorting the speech, except for the long time-constant of C126 and R129, through which the bias must be applied. The time-constant is sufficient to hold the stage in operation during such pauses.

To prevent the positive voltage developed by V108A from maintaining the grid of V104B at too

high a positive potential, a clamping circuit is included in the volume expander. This circuit employs both diode plates (V109B) of a 6AT6 dual-diode-triode. The positive voltage applied to the diode plates causes conduction to occur, producing a voltage across R130 which counteracts that due to V108A. Thus, the grid of V104B is kept practically at ground potential. R134 and C120, in the cathode circuit of V109, are shorted out by S101A; they function as part of the MCW-oscillator circuit when S101 is set to MCW, as discussed in subparagraph (8), below. Similarly, C126, connected to S101C, serves as part of the carrier-control circuit during MCW operation; refer to subparagraph (9).

(8) MCW OSCILLATOR.—For MCW operation, 1,000-cycle audio voltage is provided by the triode section (A) of V109, operating as a phase-shift oscillator; see figure 2-8. In this oscillator, a network of resistors (R135 through R138) and capacitors (C121 through C124, C129) are inserted between grid and plate so that a 180-degree phase shift is obtained at the desired output frequency. Since tube gain is sufficient to overcome network losses, regeneration is established and stable oscillation results. C124 is a screwdriver-adjusted variable element to provide a limited amount of frequency adjustment. Cathode bias is used, as developed across R134 and C120.

The oscillator is keyed by operation of keying relay K101, which has two sets of contacts that operate simultaneously. One set (B) grounds the common connection of R136, R137, and R138 (through S101A in the MCW position) to make the MCW oscillator operative. The other provides a necessary ground in the carrier-control circuit, as explained in subparagraph (9) following. Output from the MCW oscillator is taken via isolation resistor R139, C125, and MCW modulation level control R141. With S101 in the MCW position, this output is fed to the grid of the third audio amplifier, V104B.

(9) CARRIER CONTROL.—The carrier-control circuit utilizes V110, a 5814 twin triode having its two sections connected in parallel; it is shown functionally as a single triode in figure 2-8. The tube is used to activate carrier-control relay K401 and antenna change-over relay K403, both located on the Power Supply chassis. These relays are in series with each other and with V110, and are energized when the tube conducts. Plate power for V110 is obtained via dropping resistors in the Power Supply and coils of relays K401 and K403. The grids of V110 are subject to a negative 42-volt bias applied via R131 and R132; this maintains V110 in a non-conducting condition, and K401 and K403 are therefore de-energized.

When the microphone or handset press-to-talk switch is operated, keying relay K101 is energized. Contact set A grounds the grid of V110, and the tube conducts to energize K401 and K403. The carrier-control relay (K401) contacts apply B+ voltage to make the Radio Transmitter operative, while the antenna relay (K403) transfers the antenna to the Radio Transmitter. The 42-volt negative bias is not shorted by grounding the grid of V110, since R132 and part of R131 are always in series with the voltage source.

When switch S101 is in the MCW position, provision is made for holding the carrier on during the short keying intervals. Note that S101C transfers C126 to the grid of V110, in parallel with the series combination of R131 and R132. When the grid of V110 is grounded by contact A of keying relay K101, C126 charges rapidly to the 42-volt bias potential. When the key is opened and the ground is removed from the grid, the charge of C126 opposes the negative 42-volt bias and maintains V110 in a conducting condition until the capacitor has partially discharged through R131 and R132. The time-constant of those resistors with C126 is sufficiently long to hold the carrier on the air approximately one second after the key is opened. At the end of this time, V110 is again cut off by the bias, and K401 and K403 are de-energized to return the equipment to the stand-by position. R131 is variable for setting the time delay of this circuit. This "constant carrier" delay bias is not provided in the PHONE position of S101, since the microphone press-to-talk switch is normally kept closed until the transmission is ended, at which time the carrier is not desired.

(10) MODULATION RECTIFIER.—V108B, half of a 5726/6AL5W twin diode, is used as a rectifier to provide a means of indicating the modulation level on M401; the circuit is shown in figure 2-13, switch position 6. The meter is in series with R144 and R414; the three components are connected across the diode and the screen-grid secondary winding of modulation transformer T103. The rectifier serves to shunt the meter on positive half-cycles of the audio signal but permits meter conduction on negative half-cycles. Therefore, the meter reading will indicate the relative modulation signal amplitude.

(11) AUDIO MONITORING CIRCUIT.—The audio monitoring circuit enables the operator to listen to the output of the receiver when the transmitted carrier is off, and to speech side-tone when the carrier is on. A simplified diagram of

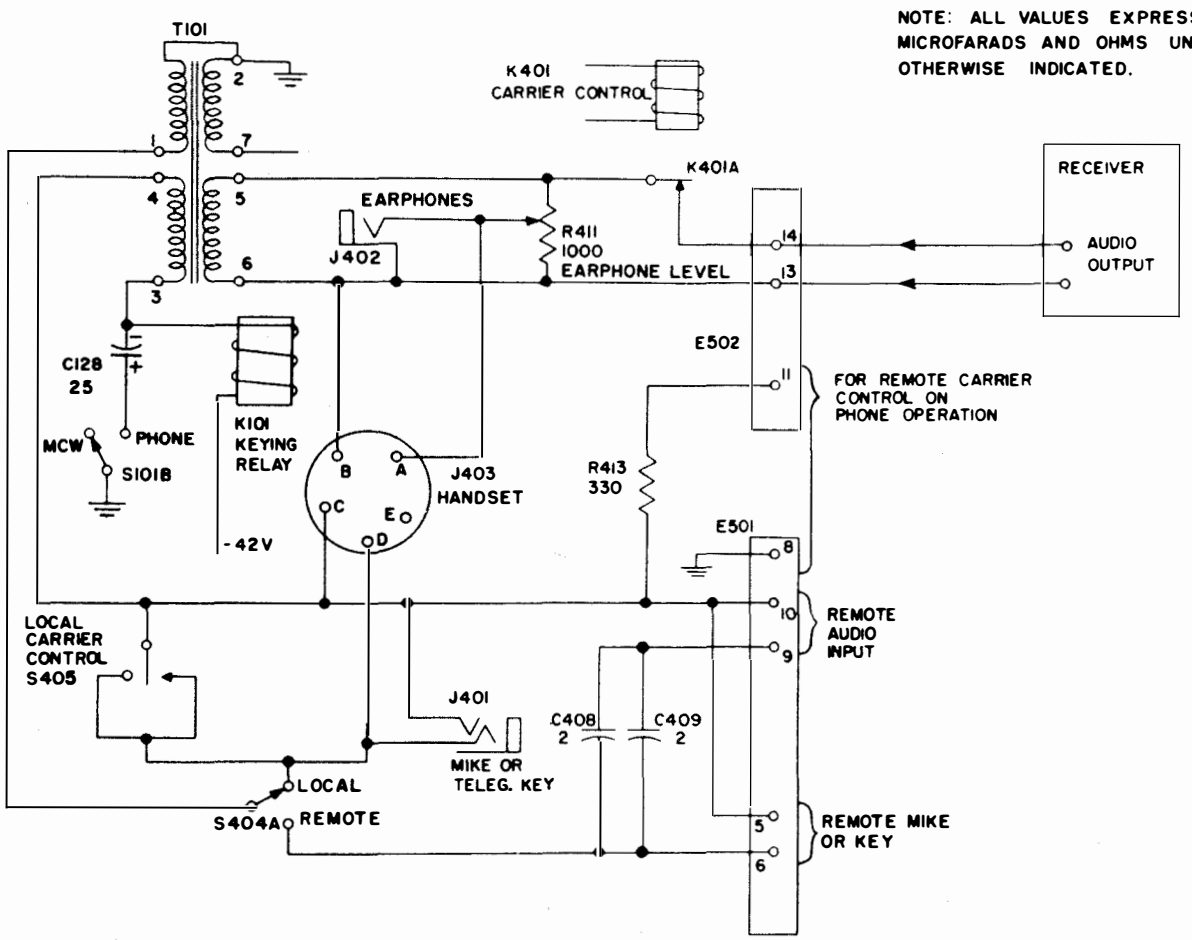



*Figure 2-9. Audio Monitoring Circuit, Simplified Schematic Diagram*

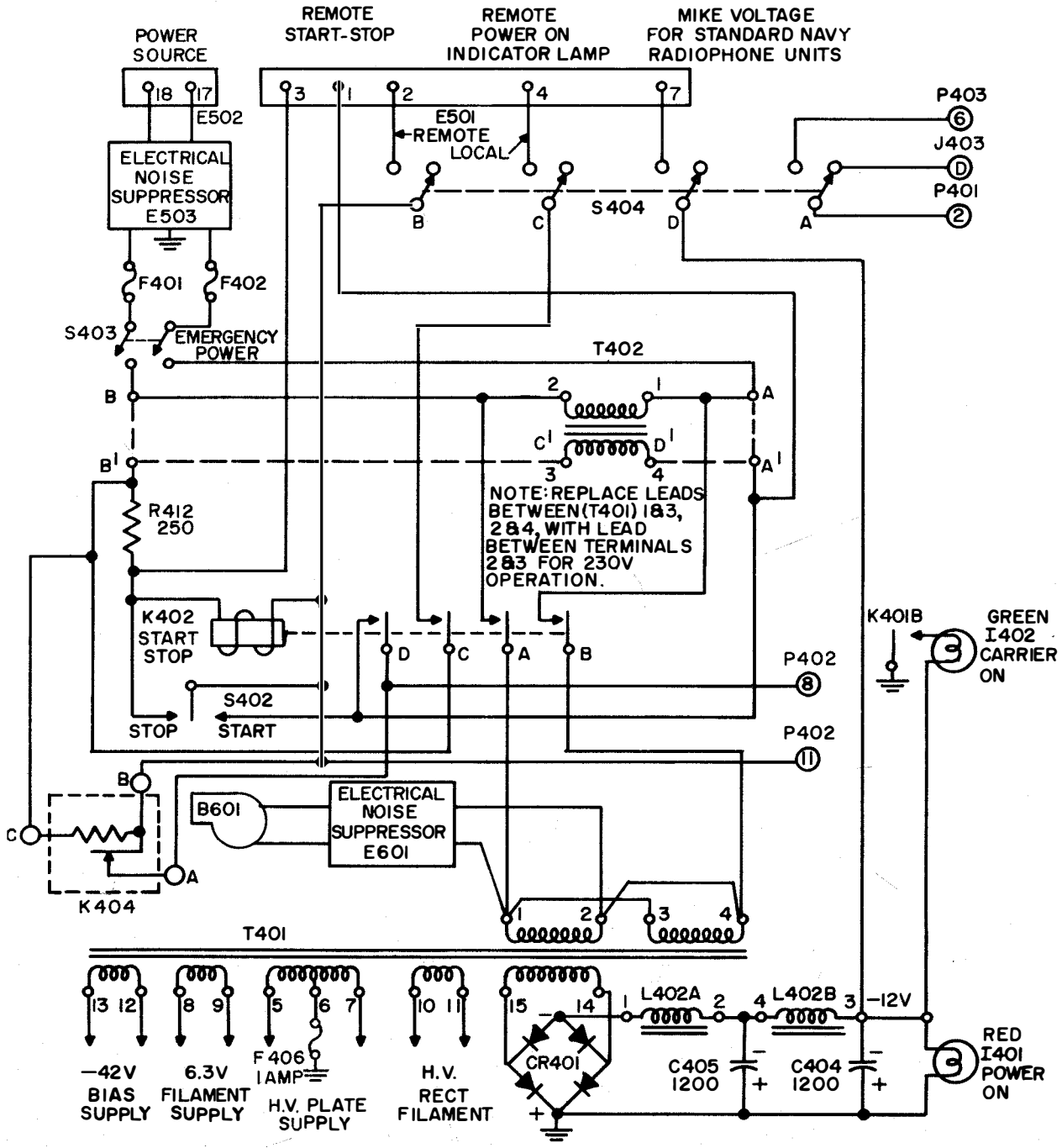
the monitoring circuit appears in figure 2-9. Monitoring may be accomplished either locally or remotely.

Receiver audio is brought in via terminal board E502, terminals 13 and 14, and contacts A of relay K401. It is fed to EARPHONE LEVEL potentiometer R411 as well as to the tertiary winding (terminals 5 and 6) of the input transformer, T101. When the carrier is off, that is, when carrier-control relay K401 is de-energized, the receiver audio may be monitored locally by plugging phones into the front-panel EARPHONES jack, J402. For remote operation from Transmitter Control Navy Type -23555 (not supplied with this equipment), the receiver audio is induced into the split primary winding of T101, which is connected to the remote-control lines (terminals 5 and 6 of E501). The receiver signal reaches the remote station via the control circuit. When Remote Radiophone Unit Navy Type -23500 (not supplied with this equipment) is used for remote operation, connections are made directly between that unit and terminals 13 and 14 of E502, in addition to those from the receiver. Thus, the receiver audio output is applied directly to the remote unit.

When the r-f carrier is on, relay K401 disconnects the receiver audio. In this case, microphone side-tone is obtained from the tertiary winding of T101 and is impressed across potentiometer R411 for local monitoring via J402. If operation of the equipment is accomplished remotely from Transmitter Control Navy Type -23555, the microphone side-tone is obtained directly from the remote-control unit. When employing Remote Radiophone Unit Navy Type -23500, or equivalent, side-tone is obtained from the receiver.

*c.* POWER SUPPLY PP-773C/URT.

(1) PRIMARY POWER CIRCUIT. (See figure 2-10.)—Satisfactory operation of the equipment requires that the 115/230-volt, 50/60-cps, single-phase power source vary not more than ±10 percent in voltage or ±5 percent in fre-




NOTES:
1. CONNECT A-A' & B-B' (T402) STRAPPING ONLY FOR 115V OPERATION.
2. CONNECT B'-C' & A'-D' STRAPPING ONLY FOR 230V OPERATION.
3. ALL VALUES EXPRESSED IN MICROFARADS, HENRIES AND OHMS UNLESS OTHERWISE INDICATED.

*Figure 2-10. Primary Power Distribution, Simplified Schematic Diagram*

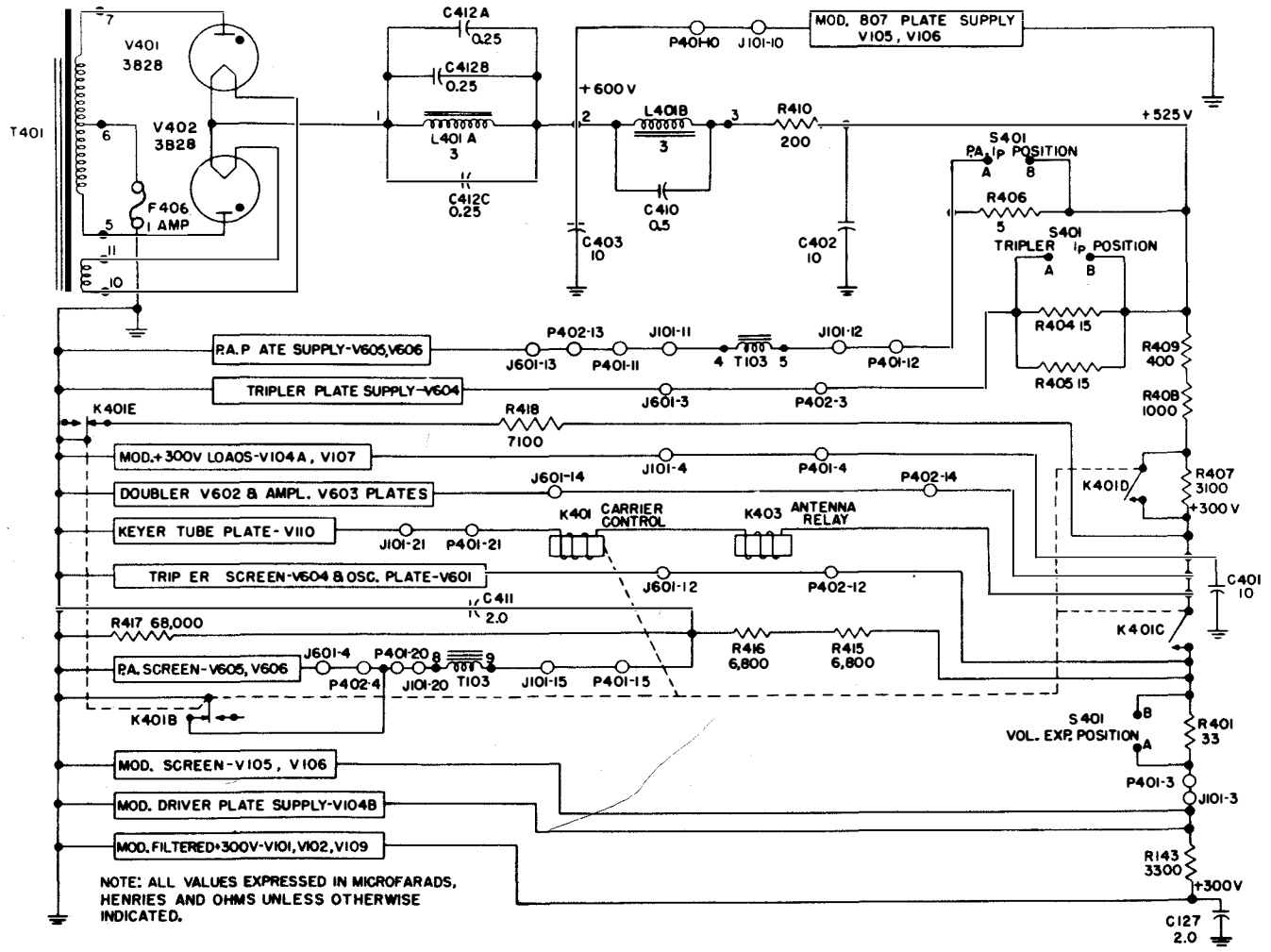



*Figure 2-11. High-Voltage Rectifier and D-C Distribution, Simplified Schematic Diagram*

quency. The input power is applied to terminals 17 and 18 of terminal board E502, thence through an electrical noise suppressor, E503. Fuses F401 and F402 provide line protection, and S403 is the POWER ON-EMERGENCY OFF switch. A 2:1 ratio step-down transformer (T402) is used only when the input power is supplied from a 230-volt source. The START-STOP momentary-contact switch, S402, energizes primary power relay K402 whose contacts control the power to T401, the power indicator lamps on the Remote Radiophone Unit Navy Type -23500 or equivalent (when used), and provide a holding voltage for the coil of K402. Relay K404 is normally closed, but opens and turns the transmitter off when the blower motor fails. Optional connections on T401 and T402 provide for operation either on 115 or 230 volts. Electrical noise suppressor E601 prevents the introduction in the equipment of any electrical noise generated by blower B601.

(2) HIGH-VOLTAGE RECTIFIER.—The high-voltage rectifier uses two 3B28 gas-filled half-wave rectifier tubes, V401 and V402, arranged for full-wave rectification, to supply all stages of the Radio Transmitter with plate and screen power; see figure 2-11. A five-volt filament winding (terminals 10 and 11) for these tubes is included in T401. Terminals 5, 6, and 7 of T401 connect to the high-voltage winding; terminal 6 is the grounded center-tap. In each half of the transformer windings, 720 volts ac are induced and, with a two-section choke-input filter, 525 volts dc at 370 ma and 600 volts dc at 130 ma are obtained at the output points. The modulator plate supply is tapped from the first section of the filter L401A and C403 at +600 volts and fed through pin 10 of P401 and J101 to the center-tap on the primary of the modulation transformer, T103. The output of L401B, R410, and C402, the second section of the filter, sup-

plies d-c plate power at +525 volts to the tripler and PA plates. The output of this second filter section is also applied through dropping resistors R407, R408, and R409 to R418, and the 300-volt loads in the Radio Modulator and Amplifier-Oscillator chassis, to contact C of K401. C401 is an additional filter for this supply. Those stages requiring a keyed 300-volt supply do not have power applied until the carrier is turned on, thereby energizing K401. When K401 is energized, contact C applies the positive 300 volts. An R-C filter network, R143 and C127 (located in the Radio Modulator unit), supplies additional filtering for V101, V102, and V109. The additional load of these stages is prevented from increasing the voltage drop across R407, R408, R409, and R410, and decreasing the voltage below the 300-volt level because R407 is shorted out by contact D of K401 and the R418 load is removed from the supply by contact E of K401. The drop across R408, R409, and R410 at a higher current maintains the voltage supply at 300 volts.

Capacitors C412A, B, and C are connected across filter choke L401A. The inductive reactance of the choke and the capacitive reactance are selected so that the combination is resonant at the ripple frequency. Increasing the series impedance for the ripple frequency in this manner provides better filtering. Similarly C410 is connected across L401B to improve the filtering of the second filter section. Fuse F406 protects the high-voltage supply from overload.

(3) LOW-VOLTAGE RECTIFIER. (See figure 2-10.)—The negative 12-volt output of the full-wave, bridge-type rectifier, CR401, is used to supply the remote microphone power when Remote Radiophone Unit Navy Type -23500, or equivalent, is used. It also supplies the power for the local indicator lamps I401 and I402, POWER on and CARRIER on respectively. When the Remote Radiophone Unit is not used, only the latter function is served. The output of the rectifier is taken through a two-section choke input filter network consisting of L402A, L402B, C404, and C405.

The bridge-type rectifier supplies unidirectional current in the following manner: when the phase of the a-c voltage across the secondary of T401 is such that terminal 15 is positive and terminal 14 is negative, current will flow from terminal 15 through one section of the selenium rectifier to ground, through the indicator lamps, through L402B, L402A, and through one section of the rectifier to terminal 14.

On the subsequent half-cycle, terminal 14 is positive and terminal 15 is negative. Then current will flow from terminal 14 to ground through one section of the rectifier, through the indicator lamps, through L402B, L402A, and through one section of the rectifier to terminal 15. In this manner current is always flowing in the same direction through the lamp load. In each case, the arrowhead part of the selenium-rectifier symbol gives the direction of conventional current flow.

(4) BIAS RECTIFIER.—Bias rectifier CR402 is a full-wave, bridge-type selenium rectifier which operates in the same manner as CR401; see figure 2-12. It supplies a negative 42-volt output to the divider network R147, R148, R149, and R150, located in the Radio Modulator unit. All current and voltages required by the biased stages, keying relay K101, and microphone (for local operation or remote operation employing Transmitter Control Navy Type -23555) are supplied by this rectifier. Bias for the r-f tripler and PA stages is also obtained from the rectifier. The filter network for the rectifier is comprised of L403A, L403B, C407, and C406.

*d.* METERING CIRCUIT.—The metering circuit is provided to enable personnel to tune and maintain the transmitter. All currents and voltages necessary for tuning and aligning the equipment are measured by meter M401; a simplified schematic diagram of each circuit associated with METER switch S401 appears in figure 2-13. The following conditions of operation can be measured:

(1) "DOUBLER $I_g$" POSITION.—With S401 set to this position, meter M401 measures the grid current in the doubler stage of the Amplifier-Oscillator unit. The oscillator tank is tuned using this position.

(2) "TRIPLER $I_g$" POSITION.—With S401 in this position, meter M401 measures the grid current of the tripler stage. The doubler and grounded-grid amplifier tanks are tuned using this position.

(3) "PA $I_g$" POSITION.—With S401 in this position, meter M401 measures grid-current flow in the r-f power amplifier. The PA grid and tripler plate tanks are tuned using this position.

(4) "OUTPUT" POSITION.—This position of S401 connects M401 in series with the power-output monitor rectifier. The monitor circuit absorbs and rectifies a portion of the output at the antenna coil, providing a small d-c current for the meter; refer to paragraph 2a(7), this section. The PA plate tank is tuned in this position.

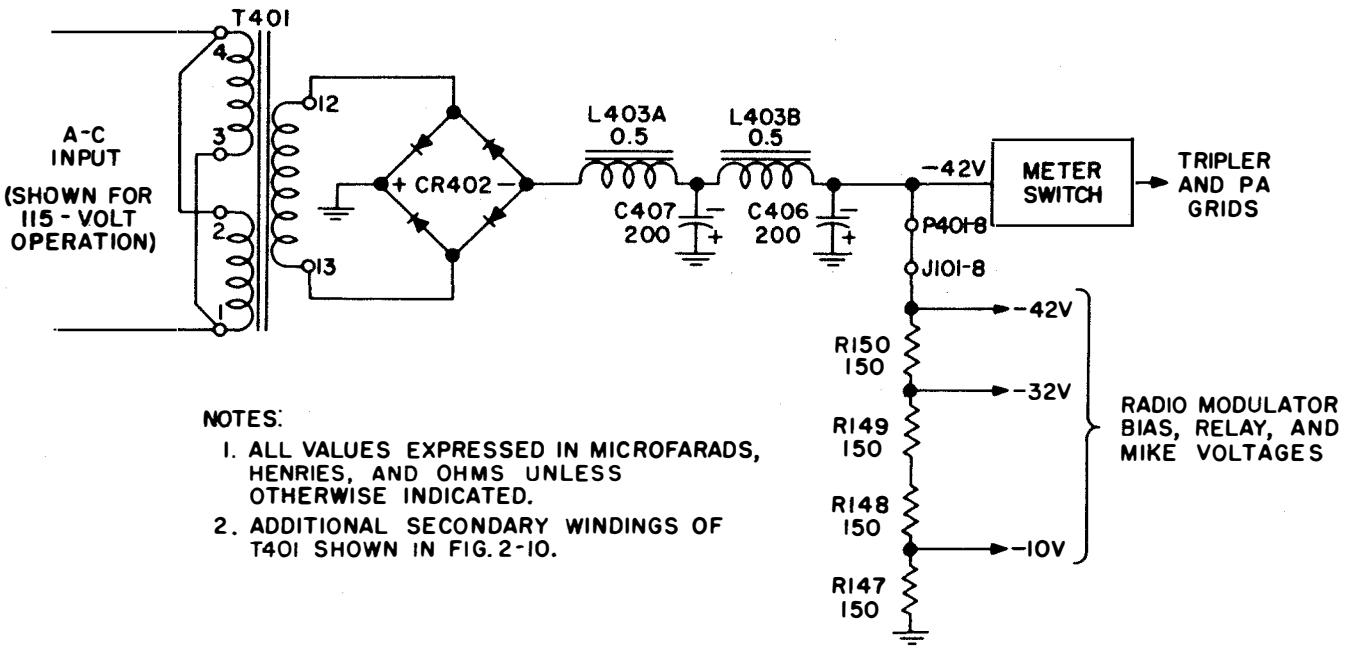



*Figure 2-12. Bias Rectifier, Simplified Schematic Diagram*

(5) "AVC" POSITION.—This position of S401 connects the meter across the output of the AVC rectifier to provide an indication of AVC voltage.

**Note**

The AVC position of METER switch S401 is intended only to provide a means of checking AVC voltage during tests or adjustments. The metering circuit impairs the operation of the AVC circuit; therefore S401 must not remain in the AVC position during actual operation.

(6) "MOD" POSITION.—This switch position places the meter circuit in shunt with modulation rectifier V108B, providing an indication of modulation amplitude. The operation of this circuit is explained in paragraph 2b(10) of this section.

(7) "VOL EXP" POSITION.—The meter, in this switch position, is placed in series with the keyed 300-volt line to the audio circuits. Plate voltage for V104B, as well as screen voltage for the modulator tubes (V105 and V106), is obtained from this source. After being filtered by R143 and C127, the 300-volt source also supplies plate voltage for V101, V102, and V109. Of the total current through the meter, that drawn by V104B forms a substantial portion. When V104B is cut off, the reading of M401 is relatively low (approximately 40). However, when the output from the volume-expander circuit permits V104B to conduct, the meter reading rises to a higher value (approximately 80). Thus, the meter current provides an indication of volume-expander action.

(8) "TRIPLER $I_p$" POSITION.—With S401 in this position, meter M401 measures the plate-current flow in the tripler stage. Plate tank-circuit resonance is indicated in this position.

(9) "PA $I_p$" POSITION.—Meter M401 indicates power-amplifier plate current when switch S401 is set to this position.

*e.* CONTROLS AND CONTROL CIRCUITS.—The various switches, relays and control circuits included in the Radio Transmitter are discussed in the following subparagraphs. Where the control circuits have been described in other paragraphs of this section, appropriate references are made thereto.

(1) "POWER ON-EMERGENCY OFF" SWITCH, S403.—S403 is the line power switch and is a toggle-type switch on the front panel of the Power Supply. It controls both sides of the input power line and must be closed in order to start the equipment with the START-STOP switch S402; see figure 2-10. Likewise, if an emergency requires, power can be quickly removed from the entire equipment by throwing S403 to the EMERGENCY OFF position.

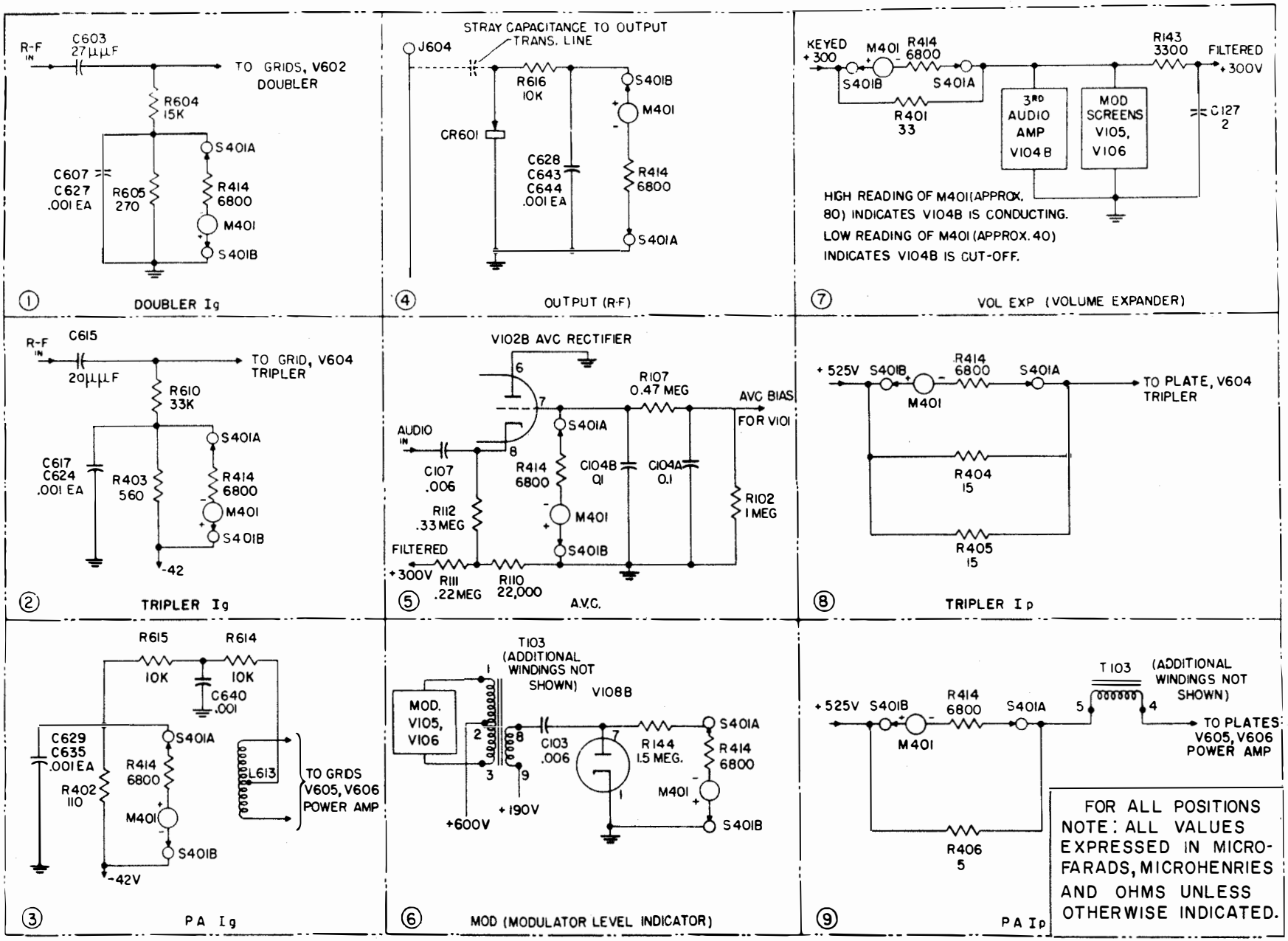



***Figure 2-13. Meter Circuits for all Positions of METER Switch, Simplified Schematic Diagram***

(2) "START-STOP" SWITCH, S402.—This control is a toggle-type momentary-contact (nonlocking) front-panel switch used to start or stop the equipment, after S403 has been closed; see figure 2-10. Momentary closure of S402 on the START side energizes start-stop relay K402, which locks itself in with its own contact pair D. K402 then remains energized until its coil is shorted by momentarily pressing S402 down to the STOP position.

(3) "LOCAL-REMOTE" SWITCH, S404.—S404 is a rotary switch located on the Power Supply panel, accessible through the access door leading to the Radio Modulator panel. When set to LOCAL S404A connects the local handset, microphone jack, and local carrier control switch S405 across the input winding of input transformer T101, to provide local control of the carrier; see figure 2-9. Switch S404 disconnects indicating and control functions from all remote units by operation of its other sections, as shown in figure 2-10. Turning the switch to the REMOTE position causes the following to take place (see figures 2-9 and 2-10):

(a) S404A connects the input winding of T101 to terminal 6 of E501 (via P403 and J501). This connects the handset, microphone, or key in the remote unit to the Radio Transmitter, and disables local carrier-control circuits.

(b) S404B applies the common lead of the start-stop circuit to the REMOTE-OFF switch of a Remote Radiophone Unit (if used).

(c) S404C connects one side of the 115-volt a-c line to pin 4 of E501 (via P403 and J501), which applies power to the indicator in a Remote Radiophone Unit; the other side of the line is always connected through pin 1 of E501, J501, and P403.

(d) S404D applies a negative 12 volts, the output of selenium rectifier CR401, to pin 7 of E501 (via P403 and J501) to supply microphone current to a Remote Radiophone Unit, when used.

(4) "MCW-PHONE" SWITCH, S101.—S101 is a rotary switch mounted on the Radio Modulator front panel; the switch circuits are shown in figure 2-8.

(a) S101A.—In the MCW position, this section grounds the stationary contact of K101B. When K101 is energized by the key, contact set B grounds R136, R137 and R138 of the phase-shift oscillator, allowing the oscillator to function. In the PHONE position, section S101A grounds the cathode of V109 to clamp the volume-expander output at ground potential via the diode portions of V109; refer to paragraph 2b(7)(b), this section.

(b) S101B.—In the MCW position, this section disconnects C128 from K101 to allow rapid keying of K101. In the PHONE position, this section connects C128 across K101 to bypass the audio input voltage that would otherwise appear across K101.

(c) S101C.—In the MCW position, this section connects C126 across R131 and R132 to provide the time-constant required to keep the carrier on between keying intervals and for approximately one second after the key is open. This circuit function is explained in paragraph 2b(9) of this section. In the PHONE position, C126 is connected to the output of the volume-expansion rectifier to introduce a time-constant sufficiently long to prevent cutting off modulation between syllables or words. Refer to paragraph 2b(7)(b) for an explanation of this circuit.

(d) S101D.—In the MCW position, this section connects the input of the third audio amplifier (V104B) to the MCW modulation level control R141, across which the MCW-oscillator output appears. In this operating mode, the low-level audio, clipper-filter, AVC, and volume-expander circuits are disconnected from the Radio Modulator output stages. In the PHONE position, S101D connects the output of V104A to the input of V104B, and provides for connecting the V104B grid-return either to ground or to the volume-expander circuit.

(5) "CARRIER TEST" SWITCH, S405.—S405 is a toggle switch which turns on the r-f carrier for test purposes when pressed either up or down. It locks in its upper position so that the carrier may be kept on without holding the switch, while the lower position is nonlocking for tests of short duration. S405 is connected across the microphone line (figure 2-9) and operates keying relay K101 in the same manner as the handset press-to-talk button, except that during use of S405 the microphone audio output is shorted.

(6) "METER" SWITCH, S401.—The circuits associated with S401, the front-panel control which permits meter M401 to monitor various voltages and currents in the Radio Transmitter, are described fully in paragraph 2d, this section.

(7) "CRYSTAL SELECTOR" SWITCH, S601.—S601 is a turret-type switch with provision for mounting four crystals on its revolving section. It is used to connect the desired crystal into the r-f oscillator circuit. The crystals in the turret unit may be replaced readily where it is required that new channels be used, or when a crystal must be replaced because of defective operation. The switch is mounted on the front panel of the Amplifier-Oscillator unit.

(8) "R.F. DRIVER TUNING" CONTROL.—This dial, mounted on the Amplifier-Oscillator front panel (behind the access door), is the control for the four ganged sections of C605. These capacitor sections tune the plate tanks of V601,

V602, V603, and V604; see figures 2-3 and 2-4.

(9) "P.A. GRID TUNING" CONTROL.—This front-panel dial (behind the Amplifier-Oscillator access door) drives the ganged sections A and B of capacitor C637. These capacitors tune the PA grid tank and the pi-section output filter, as shown in figure 2-4.

(10) "P.A. TUNING" CONTROL.—This is also a dial on the Amplifier-Oscillator front panel (behind the access door); it controls the tuning of capacitor C645, in the PA plate circuit.

(11) "SP AMP" CONTROL R101.—Potentiometer R101 is the speech-amplifier gain control located on the Radio Modulator front panel. It is used to set the signal level into the first audio amplifier (V101), as described in paragraph 2b(1) of this section.

(12) "MOD" CONTROL, R115.—This potentiometer, located on the front panel of the Radio Modulator unit, is the speech modulation-level control; it is used to adjust the level of signal input to the second audio amplifier, V104A. This sets the modulation level after clipper action has created a uniformity in the amplitude of signal peaks; see figure 2-5.

(13) "EXP" CONTROL, R121.—This Radio Modulator front-panel potentiometer control determines the signal level at which the volume-expander circuit will make the speech circuits operative. It is actually a signal-gain control at the grid of volume-expander multivibrator V107, as shown in figure 2-7.

(14) "EARPHONE LEVEL" CONTROL, R411.—Potentiometer R411 is a front-panel control used to adjust the level of the receiver audio and the speech side-tone monitored at EARPHONES jack J401. The gain-control circuit is described in paragraph 2b(11), this section.

(15) "AVC" SWITCH, S102.—The operation and use of S102 is explained in paragraph 2b(2) of this section, in connection with the AVC circuit. This toggle switch is not a front-panel control, but is located atop the Radio Modulator chassis.

(16) "CLIP-FILT" SWITCH, S103.—The operation and use of S103 is explained in paragraphs 2b(1) and 2b(3) of this section, in connection with the clipper-filter circuits. This toggle switch is also located internally atop the Radio Modulator chassis.

(17) "VOL EXP" SWITCH, S104.—The operation and use of this switch is explained in paragraph 2b(5), this section. It is located within the Radio Modulator unit.

(18) CLIPPING SYMMETRY ADJUSTMENT, R113.—The clipping symmetry control, R113, is a rheostat in the clipper circuit of V103. The function of this adjustment is described in paragraph 2b(3), this section.

(19) MCW MODULATION LEVEL ADJUSTMENT, R141.—Potentiometer R141 is a gain control in the output circuit of the MCW oscillator and adjusts the level of the MCW audio voltage applied to the grid of the third audio amplifier, V104B; see figure 2-8. It is an interior screwdriver control adjustment on the top of the Radio Modulator chassis.

(20) MCW OSCILLATOR FREQUENCY ADJUSTMENT, C124.—C124 is a screwdriver-adjusted trimmer capacitor in the MCW-oscillator circuit (figure 2-8) and provides adjustment of the oscillator frequency over a limited range. It is located at the top of the Radio Modulator unit.

(21) MCW HOLD-TIME ADJUSTMENT, R131.—R131 is a variable resistor used to adjust the time-constant at the grid of carrier-control tube V110, as explained in paragraph 2b(9), this section. It is a screwdriver potentiometer located toward the rear of the Radio Modulator unit, near the modulator tubes.

(22) RELAY CIRCUITS.—Four relays are incorporated in the circuits of the Radio Transmitter: K101, the keying relay; K401, the carrier-control relay; K402, the equipment start-stop relay; and K403, the antenna change-over relay. Relay K404 is a thermal cutout relay.

The keying relay (K101) has two contact pairs; see figures 2-8 and 7-24. One keys the MCW oscillator to provide MCW characters; the other simultaneously grounds the grid of the carrier-control tube V110 as required to keep the carrier on for such transmission (with the aid of a time-constant circuit). During phone transmission, only the second function is used.

Both K401, the carrier-control relay, and K403, the antenna change-over relay, are in the plate circuit of V110 and energize when V110 is made to conduct by operation of K101. The carrier-control relay applies B+ voltages in certain circuits, as required, to turn on the r-f carrier. The antenna relay merely transfers the antenna circuit from a receiver coaxial connection to the Radio Transmitter connection.

The start-stop relay, K402, energizes in response to operation of the front-panel START-STOP switch (S402), as described in paragraph 2e(2) of this section. K402 contacts, besides locking in K402, close the line input to power transformer T401, and to the ventilating blower, B601, in the Amplifier-Oscillator unit. The contacts of thermal relay K404 are closed under normal operation conditions, but if the temperature of the relay exceeds normal, due to the loss of air flow, the relay contacts open and re-

move the power to relay K402 which stops the transmitter.

(23) MICROPHONE AND KEYING CIRCUITS, LOCAL OPERATION. (See figure 2-9.)—The voltage necessary to operate microphone and keying relay K101 is obtained from the negative 42-volt supply. This voltage is applied to one side of K101 in series with terminals 3 and 4 of T101, and to the microphone press-to-talk switch (when LOCAL-REMOTE switch S404 is in the LOCAL position). Terminals 1, 2, 3, and 4 of T101 identify the complete primary input winding. Each time the microphone press-to-talk switch is closed, current flows through this circuit energizing keying relay K101, which operates the carrier-control tube, V110. If a telegraph key is used instead of the microphone, the same series circuit is involved, except that the microphone press-to-talk switch is replaced by the key.

### 3. BLOWER.

Blower B601, consisting of an electric motor and a centrifugal-type fan, is mounted in a compartment at the rear of the Amplifier-Oscillator unit. This blower must operate whenever the equipment is in use, in order to protect the 4X150A tubes and maintain safe internal operating temperatures. A removable filter, located at the rear wall of the unit, cleans the air supply and minimizes fouling of the transmitter by dirt and other impurities in the air.

# SECTION 3

# INSTALLATION

## 1. UNPACKING.

*a.* GENERAL.—Each complete Radio Transmitting Set AN/URT-7C is shipped in two containers. Container No. 1 includes the Radio Transmitter and accessories. Equipment spare parts are included in the second container. Cable Assemblies CX-1826/U, CX-1827/U, and CX-3154/U are also included in container No. 1. The method of packing is as shown in figure 3-1. In some cases the wooden packing case will not be included.

*b.* UNPACKING RADIO TRANSMITTER T-336C/URT-7.

(1) Set up the packing crate as designated by the markings on the outside.
(2) If a wooden packing case is included, remove the nails with a nail puller.

**CAUTION**

Do not use a pinch bar or claw hammer to remove nails.

(3) Slit the top of the outer carton and remove contents in the order shown in figure 3-1.
(4) Carefully lift out the Radio Transmitter and place it on a sturdy work bench or table.

**WARNING**

Two men should be employed when lifting the transmitter. Be sure the work bench or table is sturdy enough to hold the transmitter.

*c.* UNPACKING EQUIPMENT SPARE PARTS.—Open the spare parts container and check the contents against the packing list. After checking the parts, replace them in the container and store them in a suitable place, as designated by the officer in charge.

## 2. INSPECTION.

*a.* Radio Transmitter T-336C/URT-7 is shipped completely assembled with all tubes and other components installed. Also, when the unit is shipped the terminal box is bolted to the rear of the cabinet.

*b.* Examine the equipment (including the spare parts box) for evidence of damage which may have been incurred in shipment. Report any abnormality, as well as any which may be discovered in the procedures which follow, to the Officer-in-Charge.

*c.* Loosen the twelve captive wingnuts on the front panel. Pull the main chassis out of the cabinet as far as the travel-limiting retainer locks permit.

**CAUTION**

The cable between the terminal box and the Power Supply chassis must be handled with care to avoid unnecessary strain on the wires. When the chassis is pulled part way out, the cable is accessible for disconnection.

*d.* Remove connector J501 from receptacle P403 at the rear of the front panel; see figure 1-2.

*e.* Reach under the main chassis and release the spring locks by exerting an upward pressure on the spring catch release bars; see figure 3-2. Carefully pull the chassis out as far as it will come.

**CAUTION**

When the chassis is withdrawn beyond the stops, the front end must be supported.

*f.* Disconnect the two coaxial cables from the front of the antenna change-over relay (K403); the cables are terminated by P501 (painted green) and P502 (painted red), respectively.

*g.* In order to remove the equipment from the cabinet, it is necessary to lift the rear end of the chassis so that the guide buttons come out of the slots. To accomplish this, tilt the chassis (see figure 3-2) so that the top rear portions of the assembly clear the cabinet. Then raise the chassis sufficiently to clear the guide buttons,

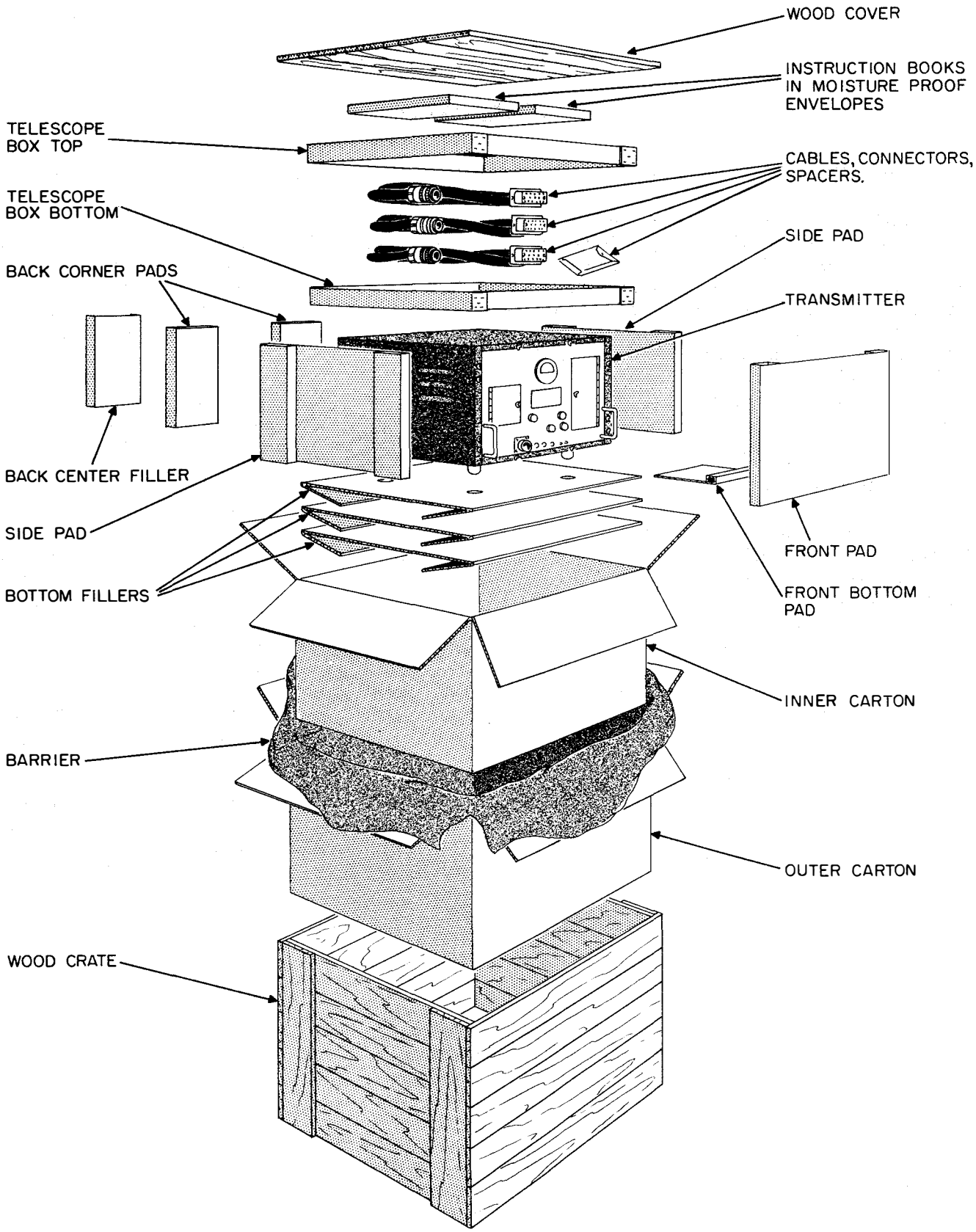



*Figure 3-1. Radio Transmitting Set AN/URT-7C, Method of Packing*

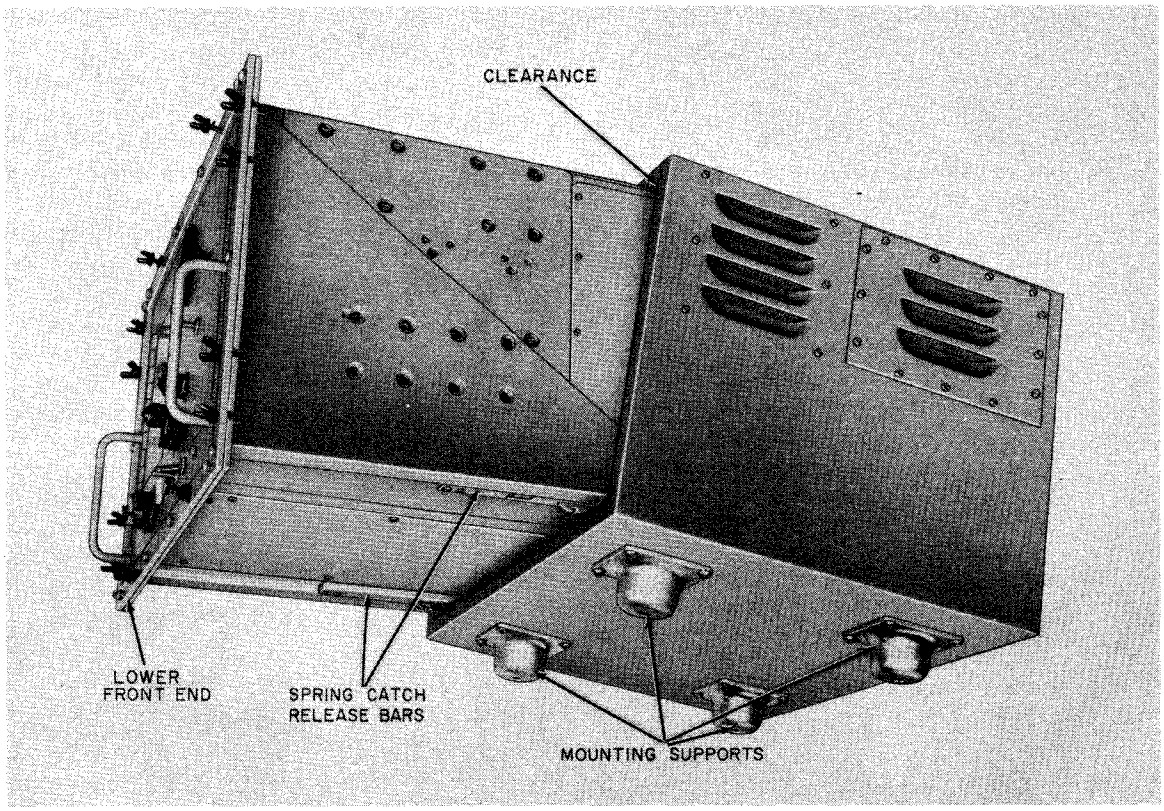



***Figure 3-2. Method of Removing Main Chassis from Cabinet***

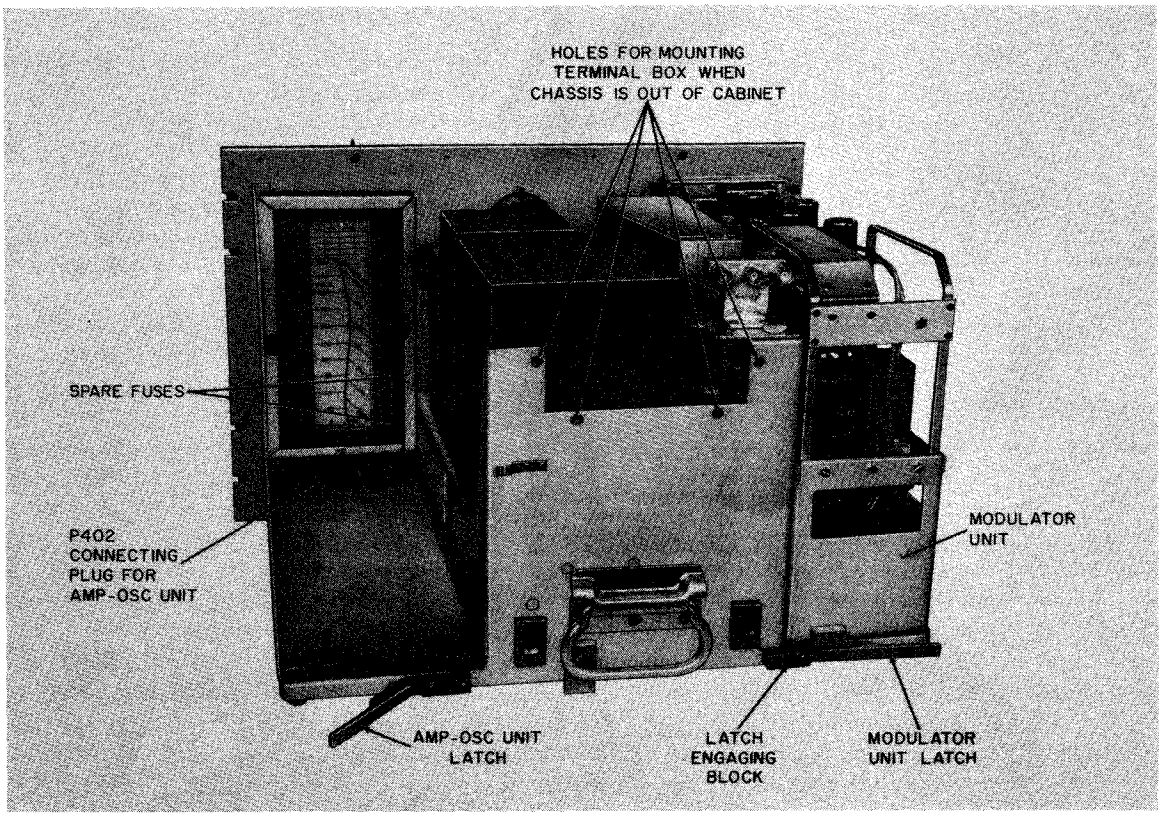



***Figure 3-3. Method of Removing Amplifier-Oscillator and Radio Modulator Units from Main Chassis***

without striking the cabinet top, and withdraw the chassis. Disconnect the coaxial cable, terminated by P602 (painted yellow), from the rear of the antenna relay.

*b.* Pull open the latches at the rear of the Amplifier-Oscillator and Radio Modulator units and remove those units from the main chassis; see figure 3-3. Remove the cover plates on the sides and top of the Amplifier-Oscillator and the plate on the right side of the blower compartment. Also remove the bottom plate of the Power Supply chassis.

*i.* Inspect each unit carefully. Check each component for damage, particularly the tubes, relays, and selenium rectifiers. All moving parts, including relays, tuning controls, switches, and potentiometers, should be checked for free movement. Check the operation of the locking knobs on the r-f tuning controls (B, C, and D), as well as those on the SP AMP and MOD controls. Inspect each tube individually to ascertain that it is properly seated in its socket.

*j.* Replace the cover plates previously removed from the Amplifier-Oscillator. If the equipment has not been used before and is to be operated from a 115-volt power source, replace the bottom plate on the Power Supply chassis. However, if a 230-volt source is to be utilized, or if the equipment has been used, check the transformer wiring specified in paragraph 3 of this section before replacing the bottom plate.

*k.* Place the AVC, VOL EXP, and CLIP-FILT switches, located at the top of the Radio Modulator chassis, in their ON positions.

*l.* Replace the Amplifier-Oscillator and Radio Modulator units on the main chassis. Do not replace the chassis in the cabinet until after the equipment has been installed in accordance with the instructions of paragraph 5, this section. (If relay-rack mounting is employed, the cabinet may be stored.)

### 3. TRANSFORMER CONNECTIONS FOR 115-VOLT OR 230-VOLT POWER SOURCE.

The Radio Transmitter, as shipped from the factory, is wired for operation from a 115-volt, 50/60-cycle power source. If operation from that primary voltage is to be employed, and the equipment has not been used, proceed to the instructions of paragraph 4.

However, if the equipment has been previously used or if 230-volt operation is contemplated, it is necessary to check and possibly change the primary connections of transformers T401 and T402. The terminal connections of these transformers, accessible when the bottom plate is removed from the Power Supply chassis, are shown in figure 3-4. Carefully inspect the terminal wiring, making changes as required to insure that the connections are proper for the line voltage to be used.

### 4. LOCATION OF EQUIPMENT.

*a.* Under conditions of normal installation and operation, the Radio Transmitter will not interact with other communications equipment. To assure satisfactory operation in areas of extreme electrical interference, particular care should be exercised to assure the adequate bonding to ground of all units.

*b.* To assure optimum performance, the equipment should be located so as to permit connection to auxiliary equipment with the shortest possible lead lengths. Refer to figure 3-5 for all special wiring instructions.

c. The Radio Transmitter should be so located that the ambient temperature will remain within the limits of -20° C. to +50° C. (-4° F. to +122° F.).

d. It is also desirable that the equipment be so located as to permit tuning adjustments to be made and minor repairs accomplished, without removal of the chassis from the cabinet.

e. If a remote-control unit is used, it may be located at any convenient place subject only to the wiring restrictions detailed in figure 3-5.

### 5. MOUNTING THE EQUIPMENT.

*a.* RADIO TRANSMITTER T-336C/URT-7. — The Radio Transmitter may be mounted, in the cabinet supplied, on any rigid table, desk, shelf, or suitable flat surface. Alternatively, it may be mounted in a standard 19-inch relay rack without the cabinet.

**CAUTION**

The Radio Transmitter must be mounted with a minimum clearance of three inches on each side to allow for free circulation of cooling air.

(1) CABINET MOUNTING. — Mounting clearances and drilling templates for mounting the cabinet on a flat supporting surface are shown in

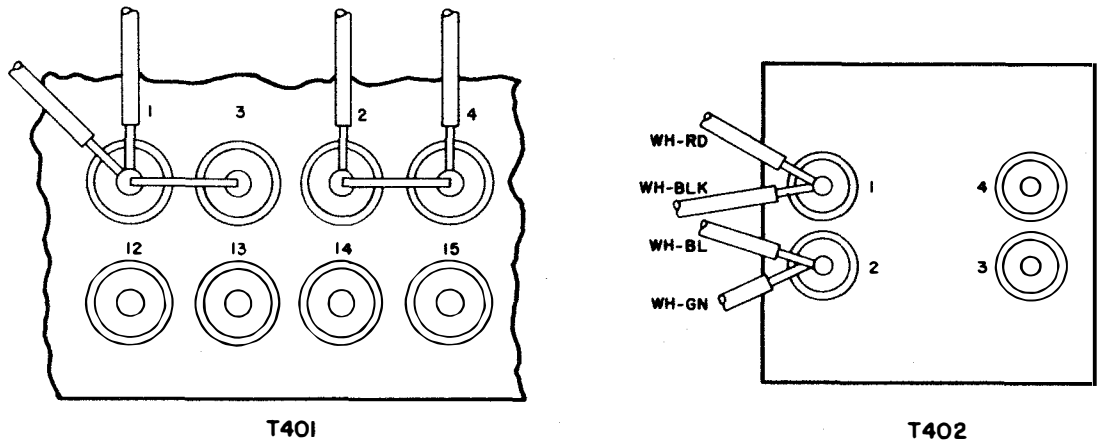



***Figure 3-4. Transformer Connections for 115-Volt and 230-Volt Operation***

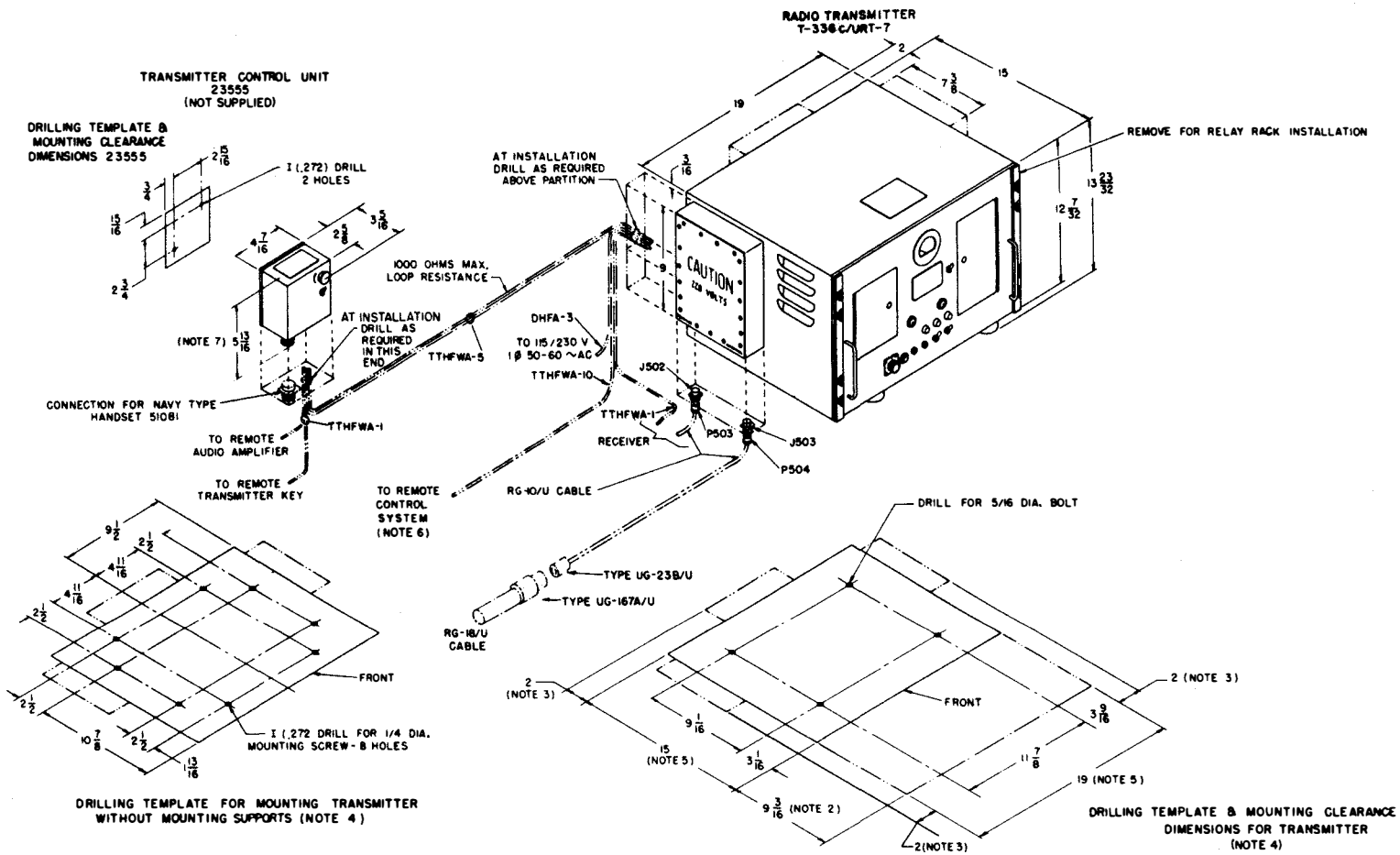
figure 3-5. When mounted within three inches of the mounting-surface front edge, as in most installations, the four supports should be removed and the cabinet mounted directly on the mounting surface. The mounting bolts are not supplied as part of the equipment and must be procured locally. The four mounting supports must be used whenever the equipment is being mounted back from the front edge of the mounting surface. Their use is required to obtain the clearance necessary for removal of the chassis.

The terminal box may be mounted in any one of the three positions indicated in figure 3-5, depending on available clearances and wiring facilities. Figure 3-6 shows the box mounted on the rear wall of the cabinet and also indicates the two alternative side positions.

After securing the cabinet to the mounting surface, reinstall the main chassis, being careful to engage the guide buttons. Before sliding the chassis completely into the cabinet, connect the multiconductor cable to the Power Supply connector on the rear of the front panel and the coaxial cables to the antenna relay. Be certain to match the connector colors to those on the relay. After the cables are connected, slide the chassis in and tighten the wingnuts on the front panel.

**CAUTION**

When inserting the chassis in the cabinet, lay the power cable in the space immediately to the right of the caution plate atop the Power Supply (see figure 1-2) and pull the cable forward as the chassis is pushed




NOTES: 1. EQUIPMENT SHOWN IN PHANTOM NOT SUPPLIED WITH RADIO TRANSMITTING SET

2. FRONT CLEARANCE REQUIRED TO SERVICE CHASSIS IN CABINET. 20" FRONT CLEARANCE IS REQUIRED TO PERMIT REMOVING THE CHASSIS FROM THE CABINET.

3. TERMINAL HOUSING ASSEMBLY FRL-22852-1 MAY BE MOUNTED IN ANY ONE OF 3 POSITIONS SHOWN.

4. EQUIPMENT SHOULD BE MOUNTED WITHOUT SUPPORTS IF FRONT EDGE OF SHELF IS NOT MORE THAN 3" FROM FRONT PANEL. OTHERWISE USE TEMPLATE FOR MOUNTING WITH SUPPORTS.

5. MINIMUM OF 3" CLEARANCE, MEASURED FROM CABINET LOUVERS TO ADJACENT WALL, IS REQUIRED ON BACK AND EACH SIDE FOR SUFFICIENT AIR CIRCULATION.

6. NAVY STANDARD RADIOPHONE UNITS 23500 OR EQUIVALENT. CONNECT TERMINALS 1 TO 14 IN TRANSMITTER TO CORRESPONDING TERMINALS IN RADIOPHONE UNITS.

7. MAINTAIN SUFFICIENT CLEARANCE FOR 51081 HANDSET PLUG.

8. AMBIENT OPERATING TEMPERATURES -20°C TO +50°C. HEAT DISSIPATION 700 W.

*Figure 3-5. Radio Transmitting Set AN/URT-7C, Installation Drawing*

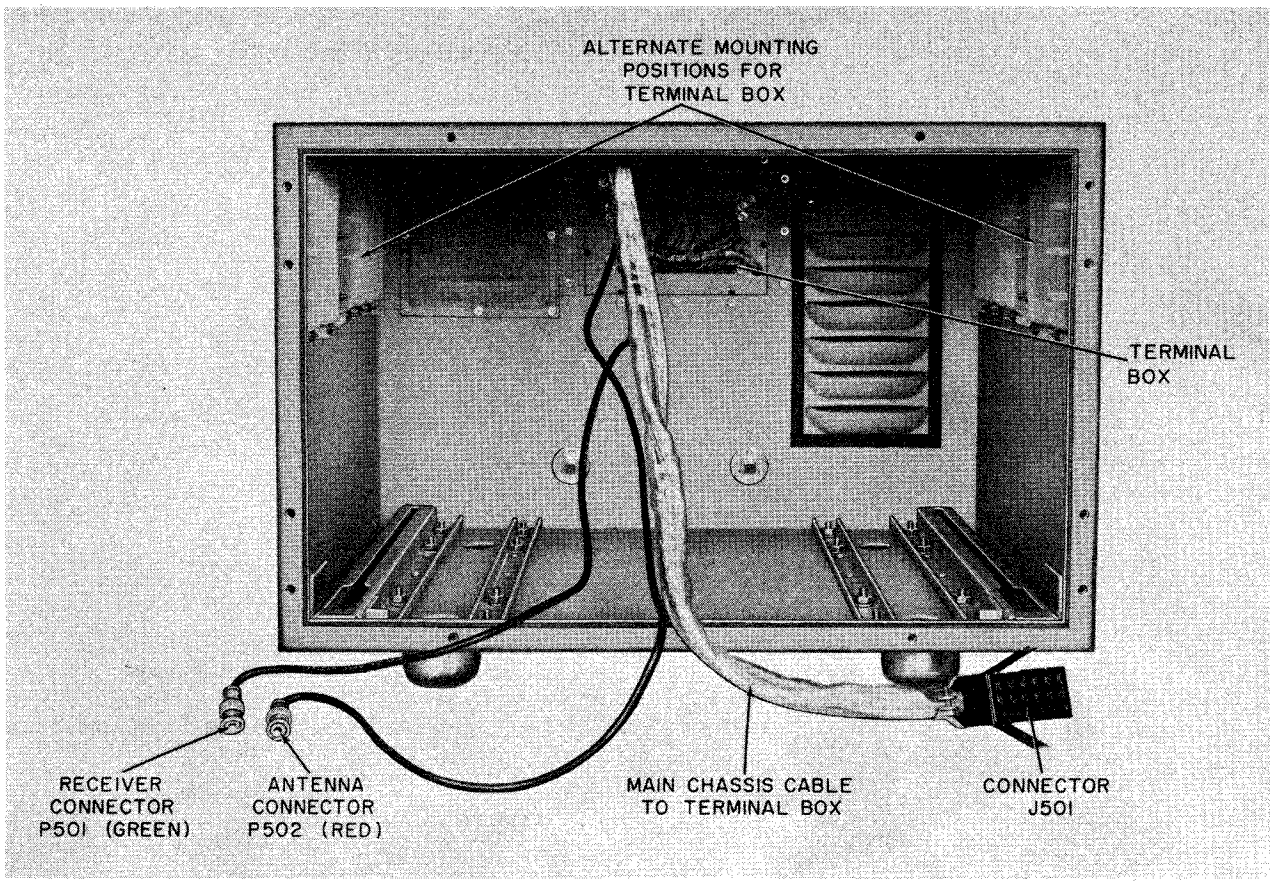



*Figure 3-6. Electrical Equipment Cabinet CY-1126A/URT, Main Chassis Removed*

into the cabinet. The cable must not be pinched behind the chassis.

(2) RACK MOUNTING.—For mounting the equipment in a 19-inch relay rack, refer to figure 3-7; the complete procedure is outlined in the notes thereon. Note that it is necessary to remove the six screws securing the two vertical strips to the side edges of the face of the front panel. This will make available the eight slots required to rack-mount the unit. When mounted in a relay rack, the terminal box must be attached to the back of the main chassis, using the four tapped studs (A403), which are packed in the cable carton.

*b.* REMOTE-CONTROL UNITS.—If a Transmitter Control Navy Type -23555 is used for remote operation, it is to be installed as indicated in figure 3-5. After drilling the mounting surface as shown, remove the back plate and bolt to the drilled surface. Make all the necessary connections to the terminal board before securing the remainder of the control unit to the back plate.

If a Remote Radiophone Unit Navy Type -23500 is used, it should be installed in accordance with the technical manual and/or installation drawings accompanying it, following the latest standard Navy procedure.

## 6. GROUNDING THE EQUIPMENT.

To assure satisfactory operation in areas of extreme electrical interference, particular care should be taken to assure adequate bonding of the equipment to ground. Ground the equipment in accordance with standard Navy procedures for electronic equipment. Since the Radio Transmitter operates from an alternating-current source, it may be bonded to ground without regard to the ground characteristics of the power source used.

## 7. ANTENNA.

An antenna designated for ship and shore use with Radio Transmitting Set AN/URT-7C is Antenna Assembly Navy Type -66095; see figure 3-8. This antenna is a fixed, vertically polarized, half-wave dipole and consists of the vertical dipole elements attached to a horizontal supporting transmission-line section. It is connected

NOTES

TO CHANGE OVER THE TRANSMITTER FROM CABINET MOUNTING TO STANDARD 19" RELAY RACK MOUNTING, FOLLOW THE PROCEDURE AS OUTLINED BELOW -

a. WITHDRAW TRANSMITTER FROM CABINET, DISCONNECT POWER PLUG ON REAR OF FRONT PANEL AND TWO BNC CONNECTORS ON ANTENNA CHANGE-OVER RELAY.

b. TAKE TRANSMITTER OUT OF CABINET.

c. REMOVE THE TWO CAPTIVE SCREW STRIPS FROM EITHER SIDE, TOP AND BOTTOM OF THE FRONT PANEL EXPOSING SLOTS.

d. REMOVE COVER FROM TERMINAL HOUSING ON THE CABINET. THIS EXPOSES THE SCREWS THAT HOLD THE TERMINAL HOUSING TO THE CABINET. REMOVE THESE SCREWS AND TWO CABLE CLAMPS ON INNER TOP OF CABINET WHICH HOLDS THE POWER CORD IN PLACE. TAKE THE TERMINAL HOUSING OFF THE CABINET.

e. OBTAIN 4 TAPPED SPACERS, A403, FROM THE CABLE BOX AND SCREW THEM INTO THE 4 TAPPED INSERTS ON THE UPPER REAR CENTER OF THE TRANSMITTER.

f. USING FOUR OF THE SAME SCREWS & LOCKWASHERS THAT HELD THE TERMINAL HOUSING TO THE CABINET, ATTACH THE TERMINAL HOUSING TO THE TAPPED SPACERS.

g. PLUG IN THE POWER CORD & BNC CONNECTORS.

h. ATTACH TRANSMITTER TO RELAY RACK WITH 8 #12-24 SCREWS.

i. DRILL HOLE IN ANY SIDE OF TERMINAL HOUSING BEST SUITED FOR EXTERNAL SUPPLY & BRING IN LEADS TO TERMINAL BLOCK.

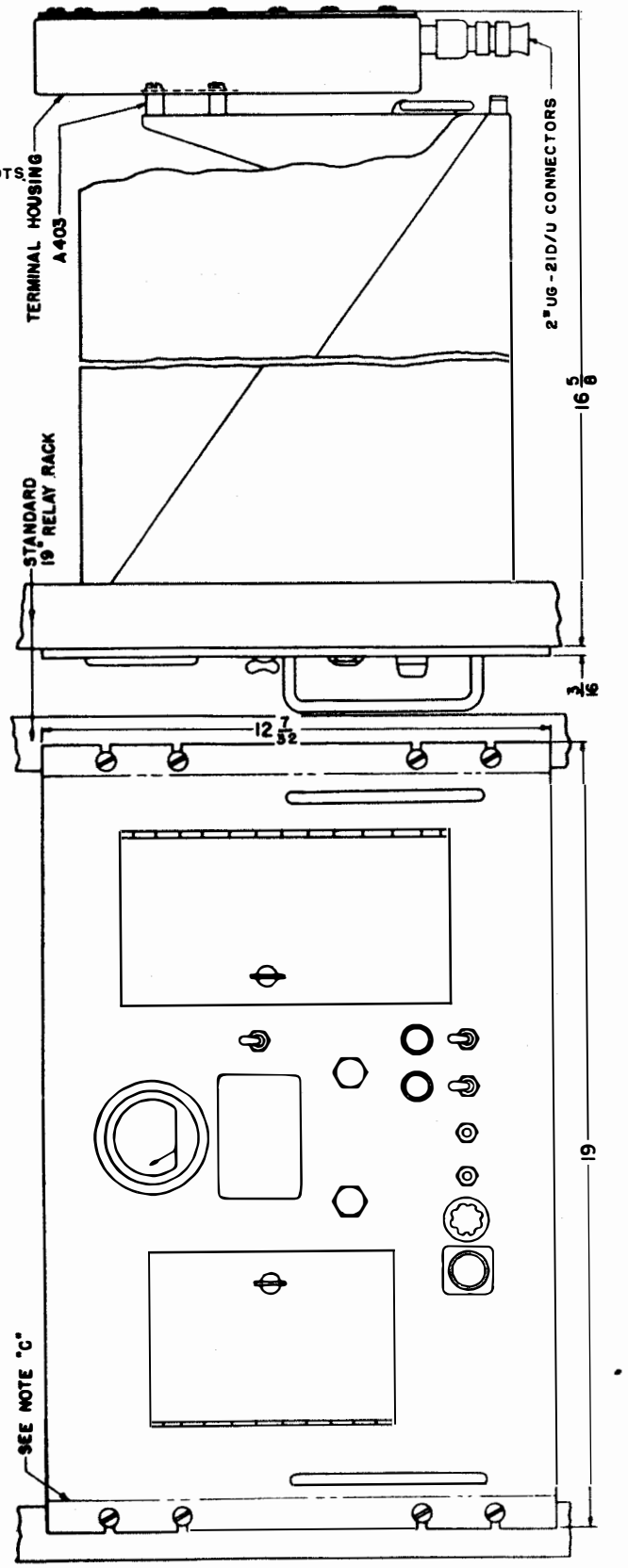



*Figure 3-7. Radio Transmittor T-336C/URT-7, Installation for Relay-Rack Mounting*

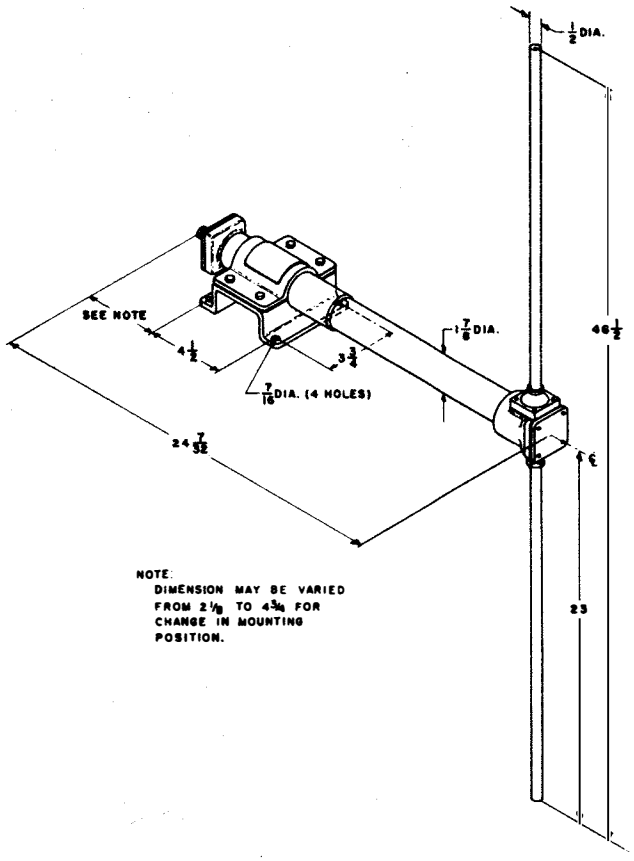



*Figure 3-8. Antenna Assembly Navy Type -66095*

to the Radio Transmitter by means of 50-ohm coaxial cable.

A mounting clamp is provided to attach the antenna support securely to the mounting surface. When mounted in position, the dipoles are approximately two feet from the mounting structure and extend about two feet above and below the antenna support. Electrical connection to the antenna conductor is made at the mounting end of the antenna-support tube by means of a standard Navy-type transmission-line connector. No adjustments of the Antenna Assembly are required.

Bolt the mounting base plate to the selected location in such manner that the antenna-supporting tube lies in a horizontal position.

Place the base end of the antenna-support tube in the concave section of the mounting plate, with the antenna-support tube in a horizontal position and the dipoles in a vertical position; the insulated radiator should be uppermost. Place the mounting clamp over the base end of the antenna-support tube, then insert and tighten the four retaining cap-screws. The position of the antenna-support tube may be changed through a maximum of 2-1/8 inches by slipping it through the mounting clamp before the cap-screws are made secure.

For submarine installations, Antenna AS-535B is used. For details of this antenna refer to Instruction Book NAVSHIPS 91852.

## 8. INTERCONNECTIONS AND INSTALLATION OF CABLES.

*a.* CABLING AND CONNECTORS SUPPLIED. —No external cables are furnished with the equipment, other than the three special-purpose cable assemblies (W301, W302, and W303.1) provided for testing the Radio Transmitter units when disassembled from each other or from the cabinet. However, all connectors needed for the fabrication of cables to units of the equipment and for connections to auxiliary equipment are supplied; these connectors are shipped in a cloth bag tied to the front panel.

**Note**

The latest Bureau of Ships installation plans should be consulted before proceeding.

*b.* INTERCONNECTING WIRING. —All interconnections between the Radio Transmitter and auxiliary units are terminated at the terminal box (figure 3-9) mounted on the cabinet, or at the rear of the main chassis, if the equipment is rack-mounted. Except for the antenna trans-

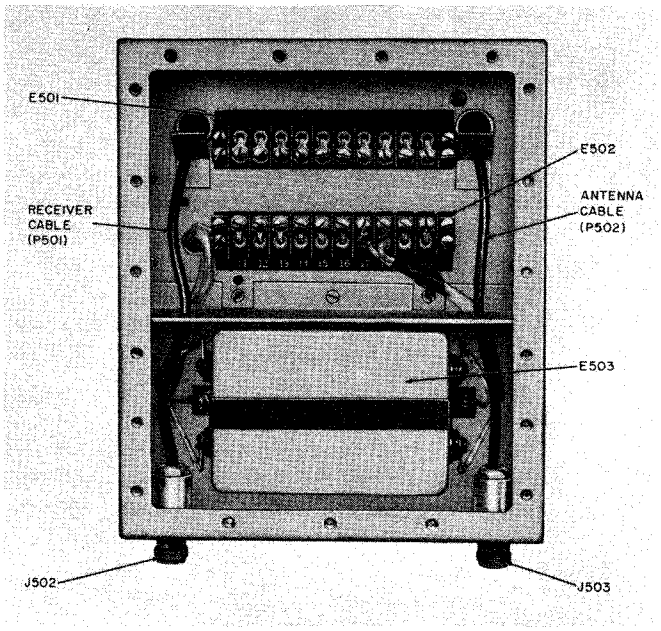



*Figure 3-9. Terminal Box, Cover Removed*

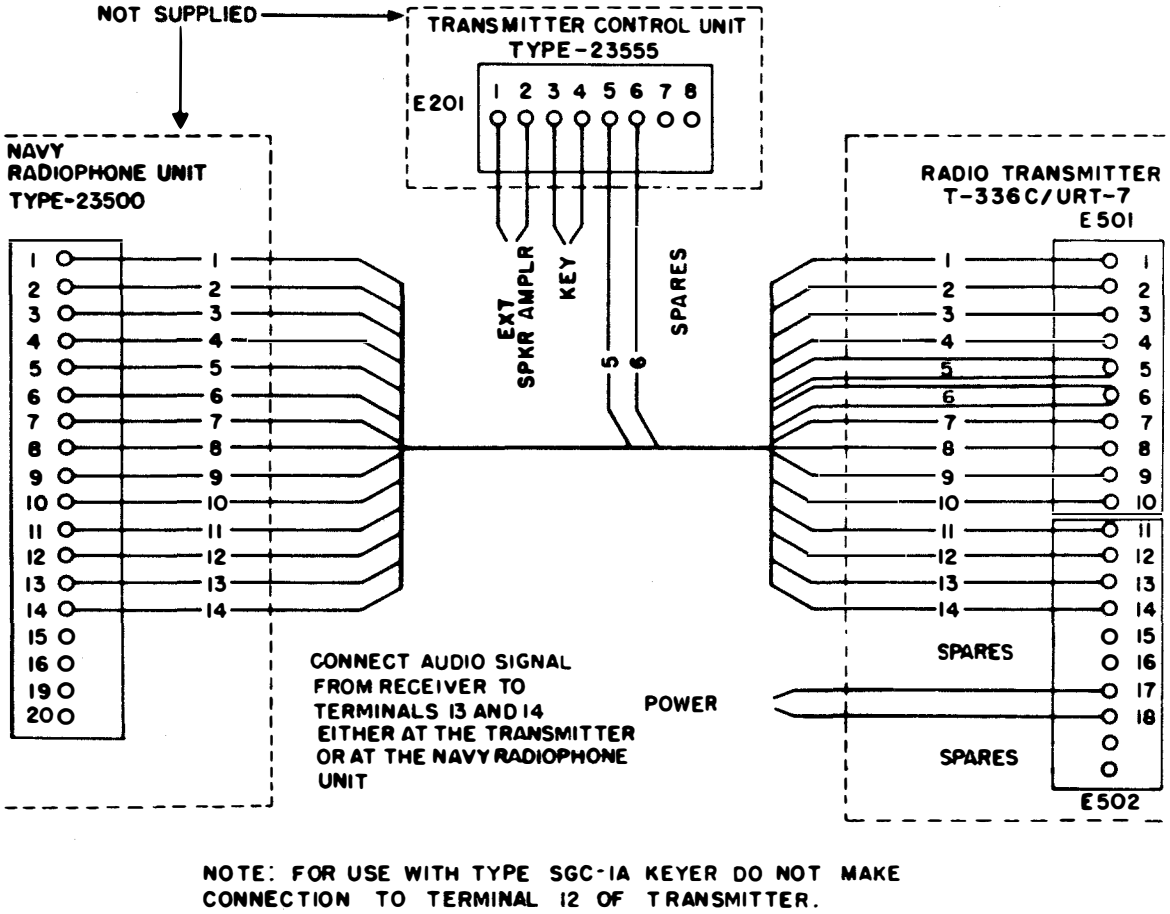



*Figure 3-10. Radio Transmitting Set AN/URT-7C, Interconnection Wiring Diagram*

mission line and the coaxial cable leading to the receiver antenna terminal, all interconnection wiring is shown in figure 3-10. If the Type-23500 Radiophone Unit is not used, the audio-output terminals of the receiver should be connected directly to terminals 13 and 14 of E502, in the Radio Transmitter terminal box.

The coaxial cables between the terminal box and the antenna, and between the terminal box and the receiver antenna input, are indicated in figure 3-5. Instructions for assembling the connectors to the cables appear in subparagraphs c and d, which follow.

**Note**

Although type UG-21D/U connectors are furnished for installing the equipment using RG-8/U or RG-9/U cable, the installation may be made with RG-18/U cable and UG-167A/U or UG-167B/U connectors.

The assembly of type BNC connectors to coaxial cable is described in subparagraph e, below. Connectors of this type are used on the coaxial cables within the equipment; no assembly need be performed during installation of the equipment. However, the assembly instructions are included at this point in order to group such information at one place in this technical manual.

*c.* ASSEMBLY OF TYPE UG-21D/U PLUG CONNECTOR TO CABLE. (See figure 3-11).

(1) Cut cable off sharply. Cut off vinyl jacket 1/2 inch from end, being careful not to nick braid.

(2) Fan out copper braid. Cut inner dielectric 1/4 inch from end to bare center conductor; be careful not to nick conductor.

(3) Taper braid over end of cable. Slide nut, washer, and gasket onto vinyl jacket. Slide clamp onto braid.

(4) With clamp in place, trim braid 1/16 inch back from end of center conductor so that length of exposed braid is 3/16 inch.

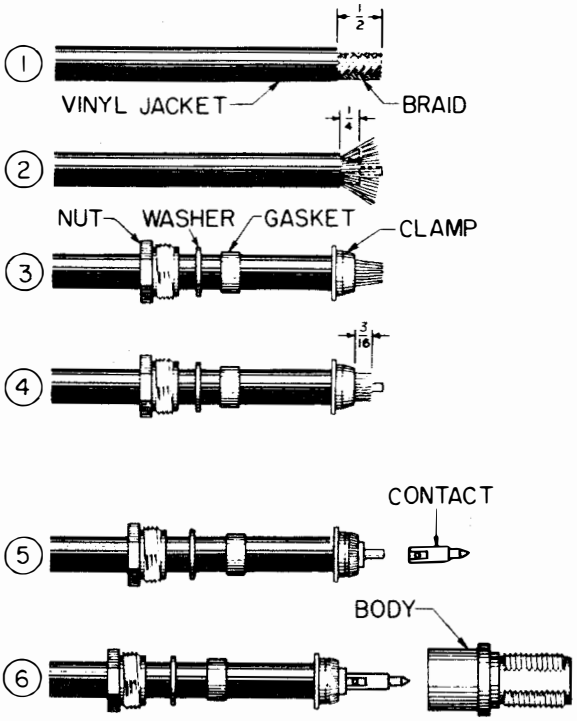



*Figure 3-11. Assembly of Type UG-21D/U Plug Connector to Cable*

(5) Fold braid back on clamp. Tin center conductor of cable, using minimum amount of heat to prevent damage to dielectric.

(6) Holding contact with pliers, solder contact to center conductor of cable. Back end of contact must be flush with polyethylene dielectric. Do not use excess of solder and wipe cable and contact clean after soldering.

(7) Slide body into place so that center conductor contact enters hole in insulator. Face of cable dielectric must fit flush against insulator. Tighten body and nut with wrenches, exercising care not to damage connector.

**Note**

The UG-21D/U plugs furnished with the equipment are used with RG-10/U cable between the terminal box output connectors, J110 and J111, and any approved local connecting device. See figure 3-11 for instructions on assembly of the UG-21D/U connectors on the cable. UG-21D/U is a later version of the UG-21B/U connector. UG-941A/U and UG-21D/U are identical except that UG-941A/U has an armor clamp for RG-10/U cable. Armor clamp MX-564A/U is required for UG-21D/U when used with RG-10/U cable.

*d.* ASSEMBLY OF TYPE UG-167A/U PLUG CONNECTOR TO CABLE. (See figure 3-12).

(1) Cut RG-18/U cable sharply and squarely to correct length and slide nut over end of cable. Starting at a point 7/8 inch from end of cable, carefully cut through armor braid and down to vinyl jacket. Do not cut jacket.

(2) Turn out radially 1/8 inch of armor braid against end of nut. Slide washer and gasket over end of cable against turned-out armor. At a point exactly 5/8 inch from end of cable, carefully cut sharply and squarely through vinyl jacket and down to outer connector braid. Do not nick this braid. Slide clamp over end of cable and against face of gasket.

**Note**

The end of the vinyl jacket will not fit snugly against the internal shoulder of

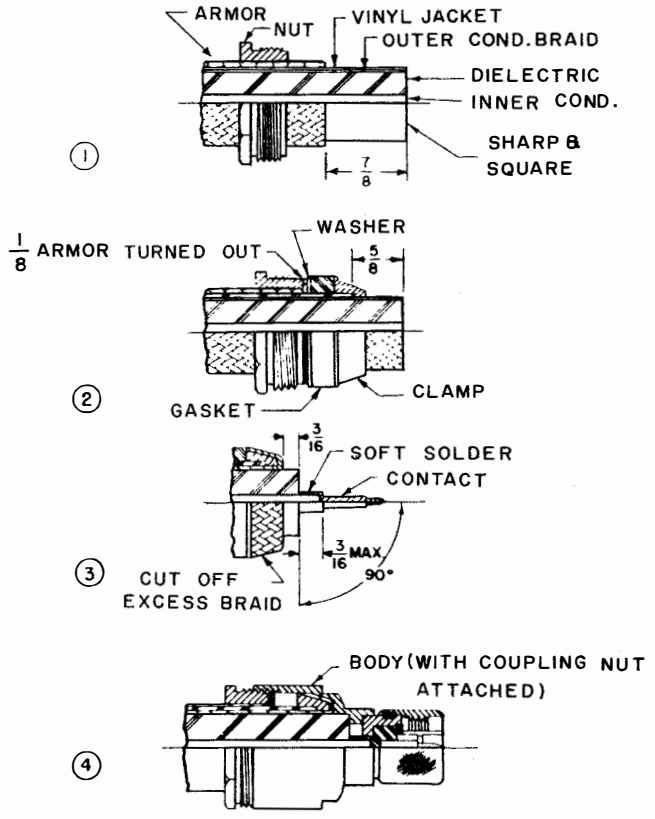



*Figure 3-12. Assembly of Type UG-167A/U Plug Connector to Cable*

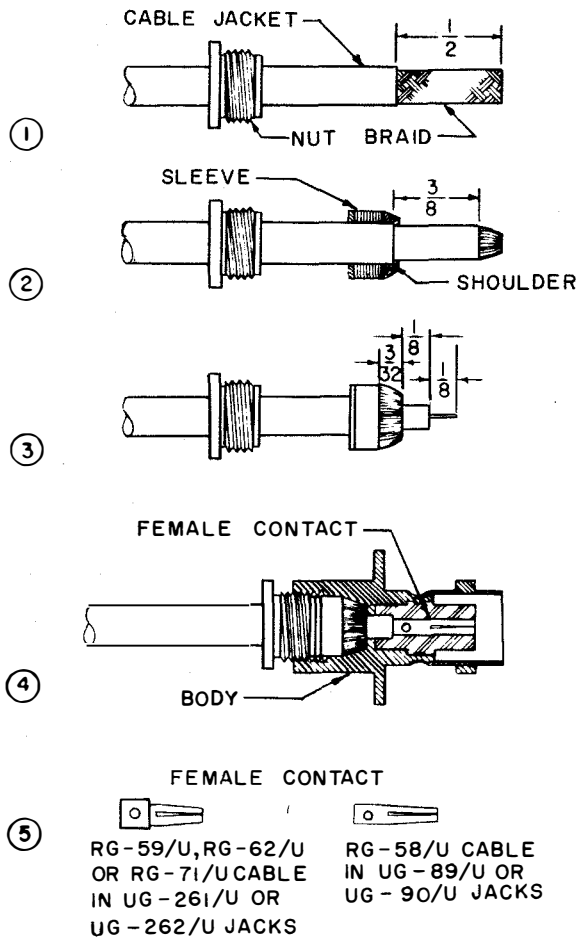



***Figure 3-13. Assembly of Type BNC Connector to Cable***

the clamp when the gasket is in a released position. Allowance has been made for the vinyl jacket to fit snugly against this shoulder of the clamp when the nut is tightened into the body.

(3) Fan braid back over tapered shoulder of clamp, cutting off excess strands at flange. At a point 3/16 inch from point where braid fans back over clamp, cut sharply and squarely through polyethylene dielectric and down to inner conductor, being careful not to nick, bend, or otherwise damage inner conductor. Cut off end of inner conductor sharply and squarely 3/16 inch (maximum) from end of dielectric and taper slightly to mate easily with male contact. Tin end of conductor and hole in end of contact. Solder contact to inner conductor, making sure that contact is flush with and perpendicular to end of dielectric.

(4) Push body (with coupling nut attached) onto end of cable as far as possible. From other side, tighten nut into body.

*e.* ASSEMBLY OF TYPE BNC CONNECTOR TO CABLE. (See figure 3-13).

(1) Cut cable off sharply. Slide nut over cable. Cut off jacket 1/2 inch from end, being careful not to nick braid.

(2) Cut off inner insulation and wire under braid 3/8 inch from end of jacket; taper braid and slide sleeve onto cable. Inner shoulder of sleeve must fit squarely against end of cable jacket.

(3) With sleeve in place, comb out braid; fold back smooth and trim to 3/32 inch from end. Cut inner dielectric 1/8 inch from braid, being careful not to nick inner conductor, and cut off inner conductor 1/8 inch from end of dielectric.

(4) Tin inside hole of contact and center conductor of cable. Then slip female contact in place and solder; remove excess solder. Be sure cable dielectric is not heated excessively and swollen, so as to prevent dielectric entering body. Push dielectric into body as far possible; then slide nut into body and screw into place with a wrench until moderately tight. Hold cable and shell rigidly and rotate nut.

**Note**

This assembly procedure applies to BNC jacks. The assembly for plugs is the same except for the use of male contacts and a plug body. Two types of female contacts may be used with the BNC jack.

*f.* CARE OF CABLES.—Cables should be run so that they will be protected from damage. Care should be taken that the cables at no time are pressed against sharp edges or subjected to excessive pressure or bends. Each cable should be mechanically supported at frequent intervals throughout its length.

## 9. CHECKING INSTALLATION AND OPERATION OF EQUIPMENT.

After the installation has been completed, check all connections and wiring between units to ascertain that no errors have been made. When it is certain that the installation has been properly accomplished, check the operation of the equipment, as follows:

*a.* Check that the three internal Radio Modulator switches (AVC, VOL EXP, and CLIP-FILT) are all ON; refer to paragraph 2k, this section.

*b.* Place the equipment in operation, as outlined in Section 4, paragraph 2. Functions of the operating controls are discussed in paragraphs 1b and 3 of that section. Check the operation by comparing the values obtained on the panel meter with the typical readings included on the OPERATING INSTRUCTIONS chart located on the inside of the left front-panel access door. If any reading is appreciably different from the normal value, refer to Section 7 for corrective measures.

**Note**

Do not leave the METER switch set to the AVC position after checking the AVC meter reading, since the meter circuit impairs operation of the AVC circuit. The switch should remain in one of the other positions.

*c.* If remote operation is to be used, check such operation by following the applicable instructions of Section 4, paragraph 4.

# SECTION 4

# OPERATION

## 1. INTRODUCTION.

*a.* DESCRIPTION OF USE.—Radio Transmitting Set AN/URT-7C is employed for short-range communication by either radiotelephone or MCW operation. The equipment may be operated locally or remotely; remote-control units to be used for remote operation are not supplied with the equipment, but may be furnished separately by the cognizant supply office. In general, operation from a remote location consists of turning the equipment on and off (as permitted by the type of control unit in use), and using either a microphone or handset for voice transmission or a telegraph key for MCW transmission. Operation at the actual site of the Radio Transmitter includes additional procedures, such as changing frequency of operation, tuning, monitoring meter readings, etc., as required in tactical use of the equipment.

*b.* OPERATING CONTROLS, JACKS, AND INDICATORS.—All controls normally used by operating personnel are located externally on the front of the equipment, or within front access doors. No internal adjustments or settings should be attempted by the operator, other than those that may be indicated in paragraph 3 of this section, or in Section 5. The various front-panel controls, jacks, and indicators are shown in figure 4-1, and are as follows:

(1) "POWER ON - EMERGENCY OFF" SWITCH.—This toggle switch is the main power switch which opens both sides of the input power line feeding primary power to the equipment. This function cannot be controlled from a remote point, regardless of the setting of the LOCAL-REMOTE switch.

(2) "START-STOP" SWITCH.—This control is a nonlocking toggle switch which is used to turn the Radio Transmitter on (locally) with a momentary operation. This does not turn on the carrier, but merely readies the equipment for transmission.

(3) "POWER" INDICATOR LAMP.—This red-lensed lamp indicates that power is on and the transmitter is ready for use, when both the POWER ON-EMERGENCY OFF and START-STOP switches have been operated to turn the equipment on.

(4) "CARRIER TEST" SWITCH.—This toggle switch may be used to turn the carrier on locally for test or adjustment purposes. It may be actuated momentarily by depressing it downward, in which direction it is nonlocking, or it may be snapped upward to a locking position, if the operator desires to leave the carrier on and have both hands free for other adjustments.

(5) "CARRIER" INDICATOR LAMP.—This green-lensed lamp indicates that the transmitter carrier is on, either through manipulation of the CARRIER TEST switch or with voice or MCW transmission in normal use.

(6) "LOCAL-REMOTE" SWITCH.—Manipulation of this rotary switch transfers some operating control functions from the Radio Transmitter to a remote-control unit, or vice versa. The particular functions transferred depend upon the limitations of the remote-control unit used.

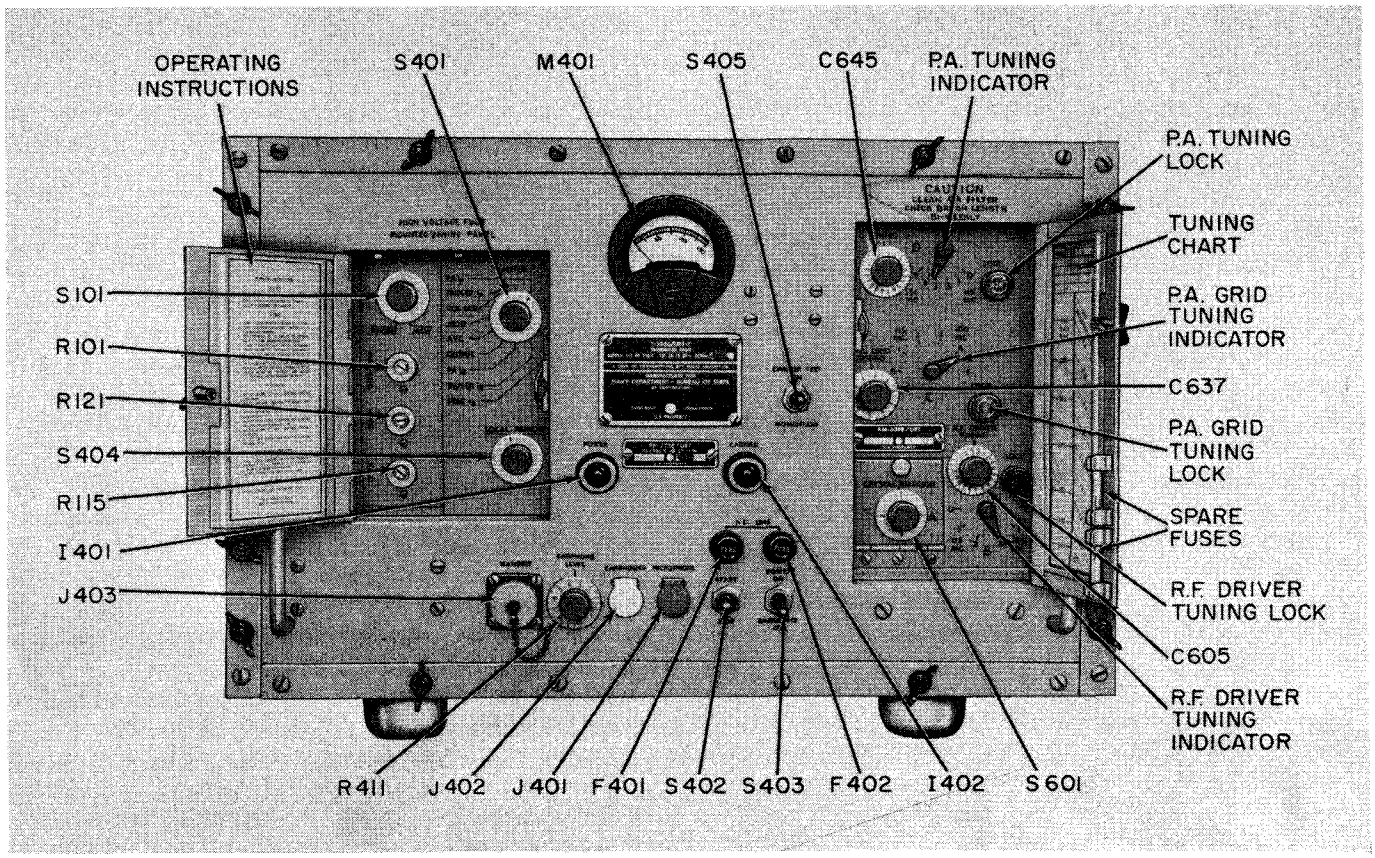
(7) "MCW-PHONE" SWITCH.—This rotary switch is used to switch the equipment from radiotelephone operation to MCW telegraph operation, or vice versa. When MCW is used, a telegraph key is substituted for the microphone at the MICROPHONE jack.

(8) "METER" SWITCH AND METER.—The rotary METER switch is used to connect the single front-panel meter into various circuits for measuring pertinent operating voltages and currents. The various circuits involved and the values measured are designated on the panel in the corresponding switch position.

**Note**

Do not leave the METER switch set to the AVC position except to check AVC operation, since the meter circuit impairs AVC action. The switch should be set to the OUTPUT position during normal operation.

(9) "CRYSTAL SELECTOR" SWITCH (A).—This rotary, turret-type switch provides a selection of any one of four crystals which correspond to four frequency channels that are available. By replacing the crystals with other frequency crystals, other channels may be substituted, as required. However, no more than four crystals can be set up in the switch holder at any one time, and only one crystal (for one




**Legend**

C605 R.F. DRIVER TUNING Control (B)
C637 P.A. GRID TUNING Control (C)
C645 P.A. TUNING Control (D)
F401 Line FUSE
F402 Line FUSE
I401 POWER Indicator Lamp
I402 CARRIER Indicator Lamp
J401 MICROPHONE Jack
J402 EARPHONES Jack
J403 HANDSET Jack
M401 Meter
R101 SP AMP Gain Control
R115 MOD Level Control
R121 EXP Level Control
R411 EARPHONE LEVEL Control
S101 MCW-PHONE Switch
S401 METER Switch
S402 START-STOP Switch
S403 POWER ON-EMERGENCY OFF Switch
S404 LOCAL-REMOTE Switch
S405 CARRIER TEST Switch
S601 CRYSTAL SELECTOR Switch (A)

***Figure 4-1. Radio Transmitter T-336C/URT-7, Operating Controls***

transmitting frequency) can be used at any one time.

(10) "R.F. DRIVER TUNING" CONTROL (B). — This dial is used to tune the driver stages of the Amplifier-Oscillator unit. The complete control comprises a main indicator pointer with a scale (marked on the front panel) from 0 to 9 over a 180-degree arc, and a control knob with a dial for interpolating between main scale graduations. A tuning setting consists of a three-digit figure, with the first digit obtained from the main indicator and the last two from the tuning dial. The dial on the control knob travels through 360 degrees (one complete turn) for a movement of the indicator over two main graduated intervals. Therefore, the dial is graduated between 0 and 9 twice, each occupying 180 degrees, so that each full graduation from 0 to 9 corresponds to one interval on the main panel graduation. Thus, if the indicator were between 3 and 4, and the dial were at 65, the control setting would be 365. Similarly, with the indicator between 0 and 1, and the dial at 65, the reading would be 065. A knob-type rotary tuning lock is provided to lock the control after it has been set.

(11) "P.A. GRID TUNING" CONTROL (C). — The control, as its name indicates, is used to

tune the power-amplifier grid tank; it also tunes the output-filter network. It consists of a main indicator, a graduated dial, and a locking knob, and is similar to the R.F. DRIVER TUNING control described in subparagraph (10), above. The important difference is in the graduation of the tuning dial, whose scale of 0 to 9 covers the entire 360 degrees; rotating the dial completely corresponds to an indicator movement over one main scale interval. The dial and indicator are read in exactly the same manner as the R.F. DRIVER TUNING control.

(12) "P.A. TUNING" CONTROL (D).—The P.A. TUNING control drives the tuning capacitor in the power-amplifier plate circuit, tuning that tank. Except for the fact that the main indicator scale, graduated between 0 and 5, covers only 90 degrees of rotation, the control is identical to that of the R.F. DRIVER TUNING.

(13) "MOD" CONTROL.—The MOD control is a gain control used to adjust the level of speech modulation in the Radio Transmitter. Note the dial lock.

(14) "SP AMP" CONTROL.—The SP AMP control varies the input level to the speech-amplifier (first audio) stage. Note the dial lock.

(15) "EXP" CONTROL.—This control is used to adjust the level at which the volume-expander circuit operates; that is, the level of speech signal which must be fed into the microphone before the audio circuits respond. The volume-expander circuit eliminates unwanted background noise that would otherwise be transmitted between pauses in speech. Note that this is a locking screwdriver adjustment not subject to frequent change.

(16) "EARPHONE LEVEL" CONTROL.—This gain control, as indicated by its designation, controls the level of the audio signal available at the EARPHONES jack.

(17) "EARPHONES" JACK.—This jack provides the facility for monitoring speech sidetone or the audio from the receiver used in association with the Radio Transmitter.

(18) "HANDSET" JACK.—This five-pin connector is utilized for the connection of the local telephone handset.

(19) "MICROPHONE" JACK.—When local operation is utilized, the microphone (for 'phone transmission) or the key (for MCW transmission) is plugged into this jack.

*c.* CONDITIONS OF OPERATION.—The Radio Transmitter is relatively simple to operate, although slight variations from the exact procedure may occur, depending on whether local or remote operation is employed. The operating instructions in paragraph 2 presume that the equipment has been installed properly, checked by qualified technical personnel, and is ready for operation. It is also assumed that the internally located AVC, CLIP-FILT, and VOL EXP switches are all in the ON position. Refer to Section 5 if proper operation is not obtained; typical meter readings appear in table 5-1.

## 2. STARTING AND TUNING PROCEDURE.

*a.* Open the right access door and open the hinged door containing the CRYSTAL SELECTOR switch and turret assembly; insert the proper crystals for the desired operating frequencies. The numbers on the turret indicate the crystal position corresponding to the switch position indicated on the front panel of the unit.

**Note**

The frequency marked on the crystal is the oscillator frequency. The output frequency is six times the oscillator frequency.

*b.* Place the LOCAL-REMOTE switch in the LOCAL position.

*c.* Turn the CRYSTAL SELECTOR (A) to the crystal position corresponding to the desired frequency.

*d.* Set the R.F. DRIVER TUNING (B), P.A. GRID TUNING (C), and P.A. TUNING (D) controls to the settings indicated on the tuning chart inside the righthand door. (See figures 4-1 and 4-2.)

*e.* Place the METER switch in the TRIPLER $I_g$ position.

*f.* Set the POWER ON-EMERGENCY OFF switch to the POWER ON position.

*g.* Place and hold the START-STOP switch in the START position until the red POWER indicator lights. Allow 30 seconds for warm up. If the blower motor does not operate, thermal relay K404 will open the ac power circuit in the equipment.

**Note**

All indicator lamps have dimmers which, if completely closed, will keep light from being emitted.

*h.* Ascertain, by listening, that the blower motor is operating.

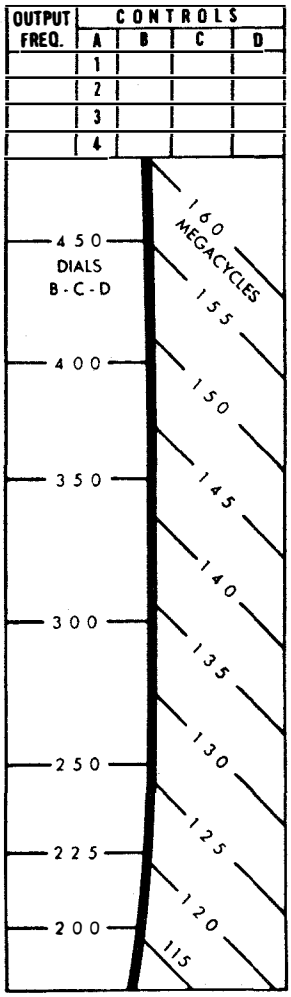



*Figure 4-2. Tuning Chart*

**CAUTION**

If the blower motor is not operating, immediately throw the POWER ON-EMERGENCY OFF switch to the EMERGENCY OFF position. Have a technician locate and make necessary repairs.

*i.* Operate the CARRIER TEST switch and tune the R.F. DRIVER TUNING control for maximum reading on the meter. This reading will be approximately 105.

*j.* Place the METER switch in the PA $I_g$ position.

*k.* Operate the CARRIER TEST switch and tune the P.A. GRID TUNING control and R.F. DRIVER TUNING control for maximum meter reading (approximately 30 to 45, depending upon the frequency).

*l.* Place the METER switch in the OUTPUT position.

*m.* Operate the CARRIER TEST switch and tune the P.A. TUNING control for maximum. This reading should be approximately 35.

*n.* Lock all tuning controls and log the dial and meter readings. Close the right access door.

*o.* The Radio Modulator controls located behind the left access door do not normally require resetting when the output frequency is changed. However, the setting of these controls should be checked in the following manner:

(1) Place the MCW-PHONE switch in the PHONE position.
(2) Connect the handset or microphone at the appropriate jack on the front panel.
(3) Place the METER switch in the AVC position.
(4) Close the press-to-talk switch and speak into the microphone. A maximum meter indication of approximately 50 should occur on the loudest syllables. If this is not the case, speak into the microphone and adjust the SP AMP control until the meter indicates this value.
(5) Place the METER switch in the MOD position.
(6) Close the press-to-talk switch and hum loudly into the microphone. The meter should read approximately 55. If this reading is too high or too low it should be correctly set, using the MOD control. This control should then be locked.
(7) Place the METER switch in the VOL EXP position.
(8) Close the press-to-talk switch. The meter reading should be about 41. Hum into the microphone; the reading should jump to 80 or more. If both these conditions are not met, readjust and then lock the EXP control.

*p.* The equipment is now ready for operation. If remote control is desired, place the LOCAL-REMOTE switch in the REMOTE position.

**Note**

Automatic shutdown of the equipment is provided when the blower motor does not operate.

*q.* To place the equipment in its stand-by state, set the START-STOP switch to the STOP position.

*r.* Placing the POWER ON-EMERGENCY OFF switch in the EMERGENCY OFF position re-

moves all power from the equipment and disables the control from a remote location.

### 3. INTERNAL RADIO MODULATOR SWITCHES.

*a.* GENERAL.—The three toggle switches mounted at the top of the chassis, inside the Radio Modulator unit, are normally left in the ON positions; see figure 5-1. Because of that, the switches are not considered operating controls in the same sense as those controls which have been described in the preceding portions of this section. However, if any of these switches require resetting, it will usually be accomplished by the operator acting under instructions from authorized maintenance or communications personnel. Consequently, operating personnel should become familiar with the location and function of these internal controls.

In order to gain access to the top of the Radio Modulator unit, the main chassis must be partially withdrawn from the cabinet; this is accomplished by loosening the captive wingnuts on the front panel and pulling the chassis out by means of the handles on either side of the panel until the switches are accessible.

*b.* SWITCH SETTINGS.

(1) "CLIP-FILT" SWITCH.—This control switches the speech clipper-filter circuit in or out of the audio circuit. When the switch is ON, the clipper and filter circuits increase the average effective modulation percentage. The resultant side-band intelligence is high, although some speech distortion is caused by the clipping action. If the CLIP-FILT switch is OFF, audio frequencies higher than 3,500 cps will be transmitted and the distortion resulting from the clipper circuit will be eliminated. However, the average modulation will decrease if the audio gain controls are set so that modulation on audio peaks does not exceed 100 percent.

(2) "AVC" SWITCH.—When this switch is ON, the AVC circuit maintains a nearly constant audio level, regardless of variations in loudness of speech. This switch should be thrown OFF when improperly functioning AVC circuits prevent use of the equipment. If switching the AVC circuit out permits operation, the Radio Transmitter may be operated in this manner until repairs can be made by a qualified technician. The AVC switch should also be set to OFF whenever the VOL EXP switch is OFF. As explained in subparagraph (3) below, background noise will modulate the carrier when the volume expander is off. Since the AVC circuit tends to equalize the amplitude of all sounds reaching the speech-amplifier stages, switching that circuit off will improve the audio signal-to-noise ratio, when the VOL EXP switch is OFF.

(3) "VOL EXP" SWITCH.—In the ON position, this switch permits the volume-expander circuit to control the Radio Modulator output. The volume expander prevents background noise from modulating the carrier during pauses in speech by cutting off the speech circuits during such pauses. If the audio stages are held inoperative because the volume expander fails to function properly, the VOL EXP switch should be thrown OFF until repairs can be made by a technician.

**Note**

When any of these switch positions are changed, the settings of the Radio Modulator front-panel controls should be checked and readjusted, as outlined in paragraph 2o.

### 4. REMOTE OPERATION.

*a.* OPERATION FROM TRANSMITTER CONTROL NAVY TYPE-23555.

(1) At the Radio Transmitter, perform the procedure described in paragraph 2, this section.

(2) Turn the LOCAL-REMOTE switch on the front panel of the Radio Transmitter to the REMOTE position. Place the MCW-PHONE switch, also on the front panel, in the desired position.

(3) Throw the REMOTE-OFF switch on the front panel of the control unit to the REMOTE position.

**Note**

This switch should always be set to the OFF position when the remote unit is not in use.

(4) The remote unit is now ready to operate, using the microphone press-to-talk switch or telegraph key to control the Radio Transmitter. Start-stop operation is not provided from this unit. The volume control on the front of the control unit is provided to set the audio level in the earphones.

*b.* OPERATION FROM REMOTE RADIOPHONE UNIT NAVY TYPE-23500.

(1) At the Radio Transmitter, perform the procedure described in paragraph 2, this section.

(2) Turn the LOCAL-REMOTE switch on the front panel of the Radio Transmitter to the RE-

MOTE position. Place the MCW-PHONE switch, also on the front panel, in the desired position.

(3) Normal operation may now be controlled from the remote unit. The Radio Transmitter may be switched on and off (equivalent of START-STOP switch), provided the POWER ON-EMERGENCY OFF switch remains in the POWER ON position.

## 5. EMERGENCY OPERATION WITHOUT A CRYSTAL.

Radio Transmitter T-336C/URT-7 is designed for operation with a type CR-24/U crystal in the radio-frequency oscillator circuit. However, it is possible to connect a small capacitor or composition resistor across the crystal-contact springs and maintain satisfactory power output from the equipment.

**Note**

This type of operation should not be used except in an emergency, since the frequency stability and tracking are not as good as in crystal-controlled operation.

If it becomes necessary to operate the equipment at a frequency for which a crystal is not available, proceed as follows:

*a.* Connect a capacitor (either mica or ceramic) of any value from 470 mmf to 1,000 mmf, or a composition resistor (one-half or one watt) of any value between 100 and 470 ohms, across the CRYSTAL SELECTOR fixed contact springs. If none of these components are available, the equipment may be operated temporarily by shorting the contact springs with a wire jumper.

*b.* Set the R.F. DRIVER TUNING, P.A. GRID TUNING, and P.A. TUNING controls to the dial readings indicated on the tuning chart for the frequency desired; see figure 4-2.

*c.* Start the equipment and switch on the carrier, following the applicable instructions of paragraph 2, this section.

*d.* Adjust the P.A. GRID TUNING control for maximum meter reading in the PA $I_g$ position of the METER switch. Tune the P.A. TUNING control for maximum meter reading in the OUTPUT position of the METER switch.

*e.* Check the output frequency with a frequency meter, receiver, or other suitable frequency-measuring equipment.

*f.* Readjust the R.F. DRIVER TUNING control to correct any error between the actual and desired frequency. Retune the P.A. GRID TUNING and P.A. TUNING controls and again measure frequency. Repeat as often as necessary until the correct frequency is obtained.

# SECTION 5

# OPERATOR'S MAINTENANCE

## 1. GENERAL INSTRUCTIONS.

Ordinarily, operating personnel should make only those checks and adjustments which can be accomplished by means of front-panel controls and indications. In cases of emergency and with proper authorization, the maintenance listed under paragraph 2, this section, may be undertaken by the operator. Otherwise, further tests, checks, adjustments, etc., must be done by maintenance personnel, as outlined in Section 7 of this manual. Complete starting and tuning instructions are described in Section 4, paragraph 2.

A list of operating checks appears in the routine check chart, table 5-1. In general, these checks should be made at the beginning of each watch. However, if the equipment is in normal use at such time, items 1 and 2 may be omitted since it will be evident that operation is normal in these respects.

**CAUTION**

Do not continue operation of the equipment if meter readings are abnormal, particularly in the case of excessively high plate currents.

If the results noted in the Remarks and Precautions column are not obtained, refer to the instructions in paragraph 2 of this section or notify a maintenance technician, as required.

## 2. EMERGENCY MAINTENANCE.

**Notice to Operators**

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

*a.* REPLACEMENT OF FUSES.—Detailed information covering fuse locations, ratings, and protected circuits appears in table 5-2. It should be noted that the line fuses (F401 and F402) must be 4-ampere fuses if the equipment is operated from a 230-volt a-c line, or 8-ampere fuses if the power source is 115 volts.

Spare fuses are held in the fuse clips marked F403 and F407, located on the back of the access door to the Amplifier-Oscillator unit; see figure 3-3. When a fuse is removed, it should be replaced so that a spare fuse will always be immediately available.

**WARNING**

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time unless the cause of failure has been corrected.

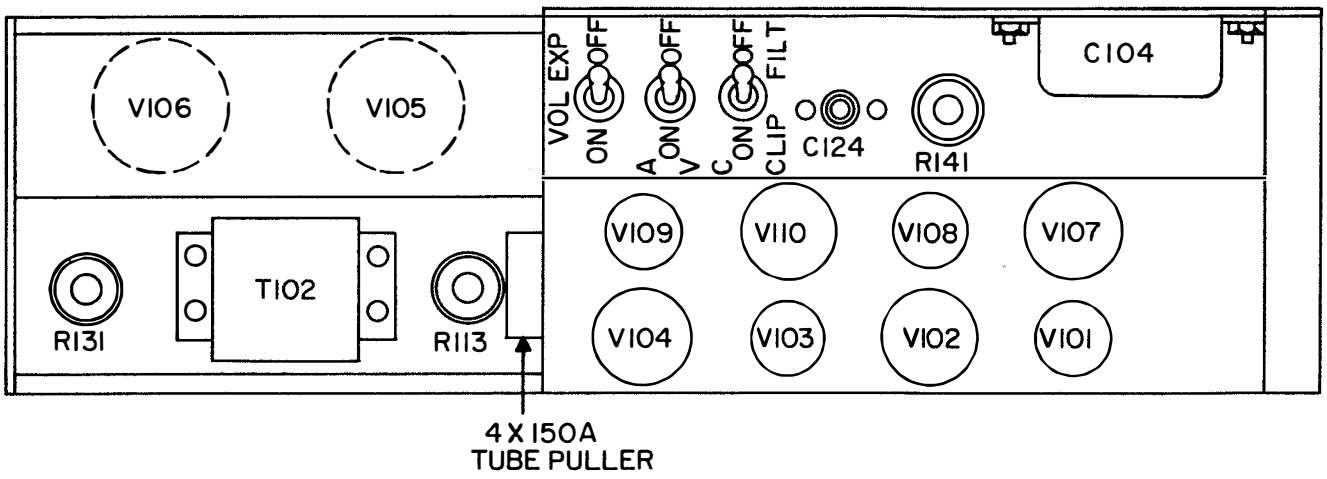
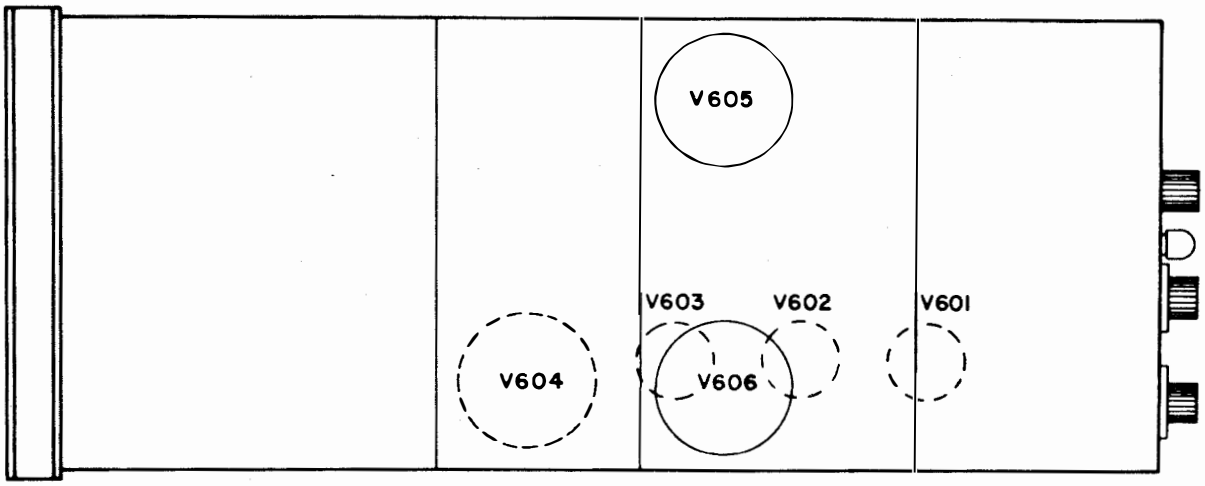
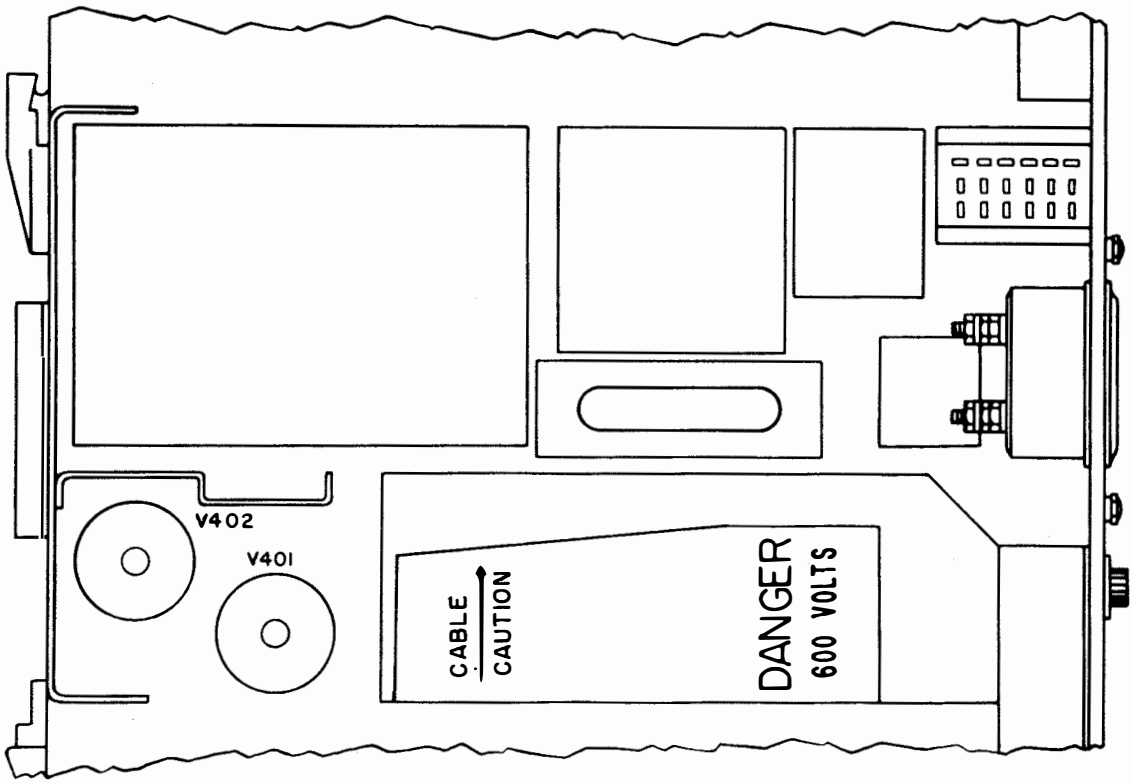



*Figure 5-1. Radio Modulator MD-163C/URT, Location of Tubes and Internal Controls*




NOTE: V605 & V606 SHOWN EXPOSED BY REMOVAL OF PERFORATED TUBE ACCESS COVER.

*Figure 5-2. Amplifier-Oscillator AM-638C/URT, Location of Tubes*




NOTE: COAXIAL RELAY K403 REMOVED TO EXPOSE V401 & V402.
CLIPS FOR V401 & V402 PLATE CAPS ATTACHED TO UNDERSIDE AT K403 HINGED SHELF

*Figure 5-3. Power Supply PP-773C/URT, Location of Tubes*

b. REPLACEMENT OF TUBES.—Figures 5-1, 5-2, and 5-3 illustrate the location of all tubes. Also, reference symbols are marked adjacent to the tubes in the equipment.

**TABLE 5-1. ROUTINE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | REMARKS AND PRECAUTIONS |
|---|---|---|
| 1. Proper starting of equipment. | Turn POWER ON-EMERGENCY OFF switch to POWER ON and START-STOP switch to START. | Note that the red POWER lamp lights and the blower starts. If blower does not operate, turn off POWER ON-EMERGENCY OFF switch immediately. If lamp does not light, check panel dimmer. |
| 2. Carrier-control circuit. | Operate local CARRIER TEST switch to its MOMENTARY side; monitor audio with earphones plugged into EARPHONES jack. | Note that green CARRIER lamp lights and receiver noise stops in headphones. If lamp does not light, check panel dimmer. |
| 3. Doubler grid current. | Set METER switch to DBLR $I_g$; operate CARRIER TEST switch; read meter. | Meter should read approximately 75-120. If no reading is obtained, check crystal seating by rotating and returning CRYSTAL SELECTOR switch to desired crystal position. |
| 4. Tripler grid current. | Set METER switch to TRIPLER $I_g$; operate CARRIER TEST switch; read meter. | Meter should read approximately 105. |
| 5. Power-amplifier grid current. | Set METER switch to PA $I_g$; operate CARRIER TEST switch; read meter. | Meter should read at least 55. |
| 6. R-F output. | Set METER switch to OUTPUT; operate CARRIER TEST switch; read meter. | Meter should read approximately 35. |
| 7. AVC circuit. | Set METER switch to AVC position; operate microphone press-to-talk switch and hum into microphone; read meter. | Meter should read between 15 and 55 during humming. |
| 8. Modulation level. | Set METER switch to MOD; operate microphone press-to-talk switch and speak in normal voice; read meter. | Meter should read approximately 65 on speech peaks. |
| 9. Volume-expander operation. | Set METER switch to VOL EXP; operate microphone press-to-talk switch and hum into microphone; read meter. | Meter should read approximately 80 during humming. |

**TABLE 5-1. ROUTINE CHECK CHART (Cont)**

| WHAT TO CHECK | HOW TO CHECK | REMARKS AND PRECAUTIONS |
|---|---|---|
| 10. Tripler plate current. | Set METER switch to TRIPLER $I_g$; operate CARRIER TEST switch; read meter. | Meter should read approximately 35. |
| 11. Power-amplifier plate current. | Set METER switch to PA $I_g$; operate CARRIER TEST switch; read meter. | Meter should read approximately 75-87. |

**TABLE 5-2. FUSE LOCATIONS AND SYMPTOMS OF FAILURE**

| SYMBOL | LOCATION | PROTECTS | AMPS | VOLTS | NUMBER | SYMPTOMS OF FAILURE |
|---|---|---|---|---|---|---|
| F401 | Front panel | Input power line | 4<br>8 | 230<br>115 | MDL-4<br>MDL-8 | Equipment completely inoperative when F401 and/or F402 fails. |
| F402 | Front panel | Input power line | 4<br>8 | 230<br>115 | MDL-4<br>MDL-8 | Blower stops, indicator lamps go out, meter reads zero in all switch positions. |
| F403 | Back of right access door | Spare for F401, F402 | 4<br>8 | 230<br>115 | MDL-4<br>MDL-8 | |
| F406 | Behind front panel | High voltage rectifier circuit | 1 | 600 | F02G1R00B | If F406 blows, all B+ voltage is disabled; the green CARRIER indicator will not light for voice or MCW operation. The red POWER indicator will light and the blower will operate. |
| F407 | Back of right access door | Spare for F406 | 1 | 600 | F02G1R00B | |

## WARNING

DANGEROUS VOLTAGES EXIST IN THE CHASSIS WHEN POWER IS ON. BE SURE THAT POWER IS OFF BEFORE STARTING TO REPLACE ANY TUBE.

The tubes in this equipment, with the exception of V601 through V604 in the Amplifier-Oscillator unit, are readily accessible for replacement by the operator when the main chassis is removed from the cabinet. All the tubes in the Radio Modulator unit are available from the top of the chassis. The rectifier tubes are located below the hinged shelf on which the antenna relay is mounted. The catch which secures this shelf may be released by the use of a thin coin or a screwdriver.

The r-f power-amplifier tubes are located under the cover plate on top of the Amplifier-Oscillator. This cover plate may also be released by use of a thin coin or screwdriver. To remove these tubes, use the tube puller (H103) provided, which is mounted in a clip on the Radio Modulator chassis, near the two modulator tubes at the rear; see figure 5-4. Insert the two ends of the U-shaped tool through opposite holes in the cooling vanes of the 4X150A tube. After making sure the hooked ends are properly engaged, apply a steady pull sufficient to remove the tube from its socket; see figure 5-4. Be ready to

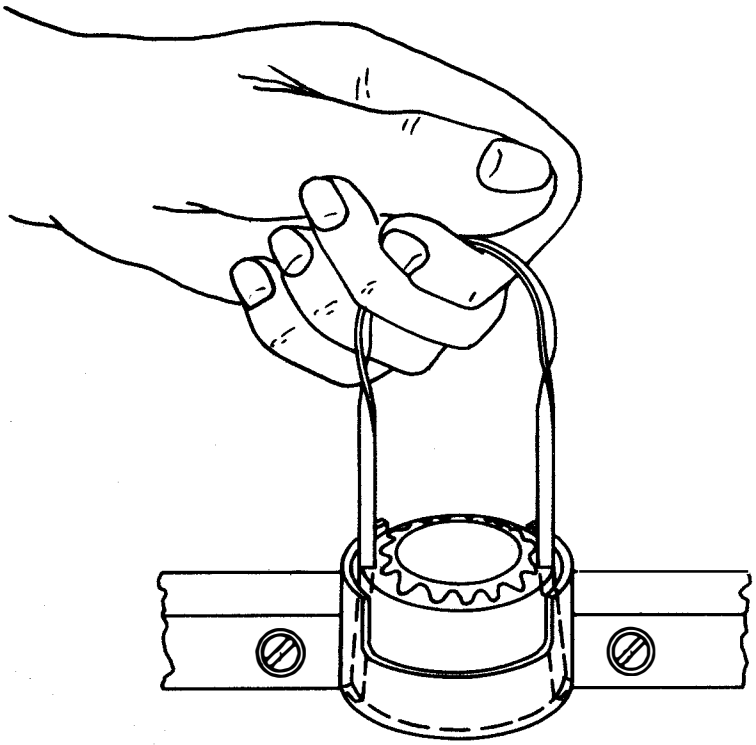


*Figure 5-4. Use of Tube Puller*

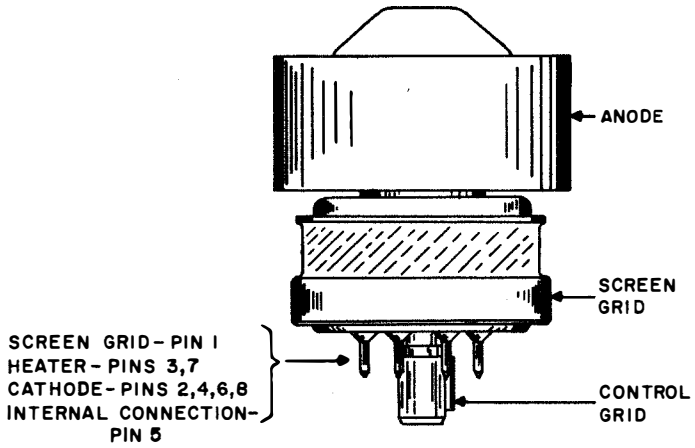



*Figure 5-5. Tube Type 4X150A, Electrode Connections*

catch and hold the tube if it releases suddenly. Figure 5-5 shows the electrical connections of a type 4X150A tube.

**CAUTION**

When replacing one of these tubes, be sure to engage the tube key with the socket keyway properly before pressing it home.

When replacing the cover plate over the r-f amplifier tubes, be certain that the fasteners are securely seated. If this is not done and one of the fasteners becomes released when in the cabinet, removal of the main chassis from the cabinet will be very difficult.

To remove any of the tubes located in the radio-frequency driver section (V601 through V604), it is necessary to remove the Amplifier-Oscillator unit from the main chassis. To do this, remove the main chassis from its cabinet or relay rack. After removing the Amplifier-Oscillator chassis from the main chassis, remove the left side shield from the Amplifier-Oscillator. V601, V602, and V603 are then readily available for replacement. V604 is the same type (4X150A) as the power-amplifier tubes, but does not require the use of the tube puller, because of its location and method of mounting. In order to remove V604, it is necessary to loosen the screw fastening on the clamp which contacts the anode of the tube.

*c.* SYMPTOMS OF DEFECTIVE TUBE OPERATION. —The symptoms which may indicate defective tube operation will be failure of one or more operating functions and/or abnormal meter readings in one or more of the METER switch positions. In practically all cases, defective operation will be accompanied by abnormal meter readings. Therefore, the meter readings are a good general guide. Table 5-3 indicates possible defective tubes for an incorrect reading in a given METER switch position; all switch positions are covered. This information should be utilized in conjunction with that provided in table 5-1, Routine Check Chart. If the recommended tube changes do not correct faulty operation of the equipment, qualified maintenance personnel should be notified to perform the necessary repairs or adjustments.

**TABLE 5-3. SYMPTOMS OF DEFECTIVE TUBES**

| SYMPTOM | POSSIBLE DEFECTIVE TUBES |
|---|---|
| 1. Abnormal DOUBLER $I_g$ meter reading. | V601, V602 |
| 2. Abnormal TRIPLER $I_g$ meter reading; DOUBLER $I_g$ reading normal. | V603, V604 |
| 3. Abnormal PA $I_g$ meter reading; TRIPLER $I_g$ and TRIPLER $I_p$ readings normal. | V605, V606 |
| 4. Abnormal OUTPUT meter reading; PA $I_g$ reading normal. | V605, V606 |
| 5. Abnormal AVC meter reading. | V101, V102 |
| 6. Abnormal MOD meter reading; AVC and VOL EXP readings normal. | V105, V106 |
| 7. Abnormal VOL EXP meter reading; AVC reading normal. | V104, V107, V108, V109 |
| 8. Abnormal VOL EXP and MOD meter readings; AVC reading normal. | V105, V106 |
| 9. Abnormal TRIPLER $I_p$ meter reading; TRIPLER $I_g$ reading normal. | V604 |
| 10. Abnormal PA $I_p$ meter reading; PA $I_g$ reading normal. | V605, V606 |

# SECTION 6

# PREVENTIVE MAINTENANCE

## 1. GENERAL.

While it is anticipated that Radio Transmitting Set AN/URT-7C will provide as continuous and as trouble-free operation as is possible, a certain amount of wear and component break-down must be expected in any equipment of this type. However, if detected and corrected at an early stage, trouble from these causes can be minimized; if nothing is done until a breakdown actually occurs (assuming that early symptoms of the defect manifest themselves), a serious shutdown may become necessary at a time when the equipment is most needed.

## 2. ROUTINE MAINTENANCE CHECK CHARTS.

Since wear and deterioration are not always evident in themselves during normal operation, it is essential to continued trouble-free operation that certain vital points of the equipment be inspected periodically. This inspection includes both an electrical inspection, made by means of the front-panel meter readings, and mechanical inspections of various portions and components of the equipment. Tables 6-1 through 6-4 list the minimum requirements of such inspection checks. It is not unlikely that this schedule will be modified during actual operational use of the equipment, since operating schedules and other tactical requirements will become determining factors in establishing inspection routines. Nevertheless, all checks outlined in the charts should be performed at intervals close to those indicated, with additional checks as may be specified by authorized maintenance personnel.

**Note**

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL OF THE LATEST ISSUE.

**TABLE 6-1. DAILY MAINTENANCE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| 1. Meter readings. | Compare readings with previously logged values or with typical readings in table 5-1. | Investigate extreme differences in readings and correct. |
| 2. Temperature and ventilation. | a. Feel cabinet for excessive operating temperature.<br>b. Observe operation of blower and condition of the filter. | Be certain blower operates to properly ventilate cabinet and that air filter is not clogged. |

**TABLE 6-2. WEEKLY MAINTENANCE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| 1. Blower motor brushes. | Remove side panels from blower compartment and remove brushes. | Replace brushes if shorter than 1/2 in. or if otherwise damaged; see Section 7, par. 6b. If replacement is not required, be certain to return each brush to holder from which it was |

**TABLE 6-2. WEEKLY MAINTENANCE CHECK CHART (Cont)**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| | | removed; maintain previous orientation with respect to motor rotation. |
| 2. Front-panel and chassis controls, knobs, switches, etc. | Check for looseness of switch and control mounting nuts. Check for missing or loose knobs. | Tighten loose mounting nuts and knobs; replace missing knobs. |

**TABLE 6-3. MONTHLY MAINTENANCE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| 1. Terminal boards and connectors. | Check connections. | a. Clean and tighten all contacts.<br>b. Remove any frayed wire ends. |
| 2. Relays. | Check movement and contacts. | Clean and burnish all contacts; see par. 5, this section. Be sure movement is not impeded and is sufficient to make and break all necessary contacts. |
| 3. Air filter. | Remove and examine air filter. | a. Clean with solution of hot water and grease solvent, such as dishwashing compound (SNSN G51-E-1576-100). Let dry thoroughly.<br>b. Dip in Military Symbol -2190T or -3100 lubricating oil or a similar grade oil (SAE 30 to 50) according to operating temperature. Let excess drain off (1/2 hr). |
| 4. Tuning capacitors. | Check gear trains for free movement and backlash. | Clean thoroughly, and adjust backlash; see Section 7, par. 3d. |

**TABLE 6-4. SEMI-ANNUAL MAINTENANCE CHECK CHART**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| 1. Blower motor. | Remove assembly per instructions in Section 7, Par. 6a. | Clean unit and replace defective parts, See section 7, Par. 6a. |
| 2. Thermal relay K404. | Press START switch. Equipment should start. If it does not, check relay contacts. | Relay contacts are normally closed. |

**TABLE 6-4. SEMI-ANNUAL MAINTENANCE CHECK CHART (Cont)**

| WHAT TO CHECK | HOW TO CHECK | CORRECTIVE MEASURES |
|---|---|---|
| | Cover ventilation slots between r-f and power supply sections with tape. Start equipment. K404 contacts should open in about 20 seconds and stop equipment; see paragraph 7b, this section. | Be sure to remove ventilating slot cover from slots at end of test. |

### 3. LUBRICATION.

No part of this equipment requires lubrication. The ball bearings used in the blower motor (B601) are of the doubly sealed type. Deterioration, therefore, is mainly dependent upon the chemical life of the grease. This, in turn, depends upon running temperature. It is expected that the chemical life of the grease is well over 1,000 hours. It is recommended that after 1,000 hours of operation, when replacement of brushes is due, the motor be blown out and new bearings fitted; refer to Section 7, paragraph 6.

### 4. RE-TROPICALIZATION.

Re-tropicalization is not required, since in manufacture the Radio Transmitter is not tropicalized as a complete assembly, or by subassemblies. Instead, use is made of components and materials which are either inherently resistive to moisture and fungus growth, or which have been tropicalized prior to assembly in the equipment. The maintenance parts supplied are identical in all respects (including tropicalization) to those used in the equipment; therefore, it will not be necessary to tropicalize items from the spare parts kit when making repairs.

### 5. CARE OF RELAYS.

Relays K101 (figure 7-14), K401 and K402 (figure 7-6) require periodic inspection and cleaning in order to rid the contacts of accumulated dirt and grime. For monthly maintenance purposes, a visual check of the relays' condition will suffice. If corrosion or dirt is encountered on any of the contacts, as evidenced by inspection or by defective operation, clean the contacts.

This can be done by moistening a clean strip of paper with a volatile cleaning solution (Dry Cleaning Solvent 140F, F.S.N. WM6850-274-5421) and drawing the paper between the contacts while holding them closed. If any dirt or corrosion persists after this treatment, clean the contacts with a suitable burnishing tool.

**Note**

Do not use carbon tetrachloride to clean relay contacts.

Check to see that all relay armatures are free and do not bind during movement. Springs should be straight and free from damage or distortion; contact gaps should be uniform. The operation of the armature, springs, and contacts can be observed by operating the armature manually. In making such checks, be careful not to disturb spring settings, contact gaps, etc. of normally functioning relays.

# FAILURE REPORTS

"Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD 787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment nameplate), the type number of the major unit (from the major unit nameplate), and the type number and reference designation of the particular defective part (from the instruction book). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember — there are two sides to the failure report ---

"YOUR SIDE"

Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office."

*Figure 7-1. Failure Report, Sample Form*

# SECTION 7

# CORRECTIVE MAINTENANCE

## 1. THEORY OF TROUBLE LOCALIZATION.

An important part of remedying defective equipment operation is the procedure of localizing the source of trouble to a small portion, section, or stage of the equipment, before making detailed checks or individual components. Proper isolation of the trouble to a definite section avoids time-wasting detailed checks in sections or circuits that may be completely free of defective operation in themselves.

In most electronic equipment, such a localizing procedure consists mainly of a "signal-tracing" method. In the case of r-f circuits, such as in the Amplifier-Oscillator unit of the Radio Transmitter, this will be a stage-to-stage check; the starting point can be either at the output where signal is missing or defective, and checking backward until normal signal is encountered, or alternatively, at the oscillator and checking each stage until signal defect is encountered. In either case, the faulty stage would generally be indicated as the first stage (in normal signal progression) where the signal was found to be defective or missing. In the Radio Modulator unit, a similar procedure should be used, except for some of the special circuits incorporated therein. Methods of isolating trouble in these circuits are described in later paragraphs. In the Power Supply circuits, where the "signal" to be traced is a supply voltage rather than an audio- or radio-frequency signal, the procedure is still basically the same, except that the voltages will be traced from output terminals back to filters, rectifiers, transformers, etc., rather than in a stage-by-stage check.

When trouble is encountered, make it a habit to consider the existing indications carefully and properly isolate the trouble, rather than making hasty and haphazard stop checks at various points in the equipment. Many troubles can be traced to a section or stage by using the front-panel meter readings as indications of defective circuit operation.

## 2. TROUBLE SHOOTING.

*a.* GENERAL.—Radio Transmitter T-336C/URT-7 is composed of three major units: Amplifier-Oscillator AM-638C/URT, Radio Modulator MD-163C/URT, and Power Supply PP-773C/URT. Therefore, the first step in trouble shooting is to localize the particular defect to one of the three units. In general, this can be accomplished by correct interpretation of the readings obtained on the front-panel meter, prior to removing the equipment from its cabinet or rack.

The second step in servicing is to localize the fault to the defective component responsible for the abnormal condition. Some faults, such as burned-out resistors, r-f arcing, and shorted transformers, may be located by sight, smell, and sound. The majority of faults, however, must be located by electrical tests, usually the checking of voltages and resistances.

### WARNING

VOLTAGES ARE PRESENT IN THIS EQUIPMENT WHICH ARE DANGEROUS AND WHICH MAY BE FATAL IF CONTRACTED. OBSERVE ALL SAFETY PRECAUTIONS; REFER TO THE SAFETY NOTICE AT THE FRONT OF THIS TECHNICAL MANUAL.

*b.* INTERPRETATION OF METER READINGS.--The meter on the front panel of the equipment provides indications of circuit operation for many of the stages in both the Amplifier-Oscillator and Radio Modulator units. The interpretation of these meter readings, however, and the correlation of abnormal readings to the defective stage, are functions of the skill and knowledge of the trouble-shooting technician. Complete familiarity with the theory of operation of the equipment is extremely important if servicing is to be accomplished in a minimum of time. Section 2 of this technical manual explains the operation of all circuits in the equipment, including those used for metering. It is strongly recommended that this material be reviewed before any trouble shooting or repair is attempted.

Various stages in the Amplifier-Oscillator are monitored in the following positions of the METER switch (S401): DOUBLER $I_g$, TRIPLER $I_g$, TRIPLER $I_p$, PA $I_g$, PA $I_p$, and OUTPUT.

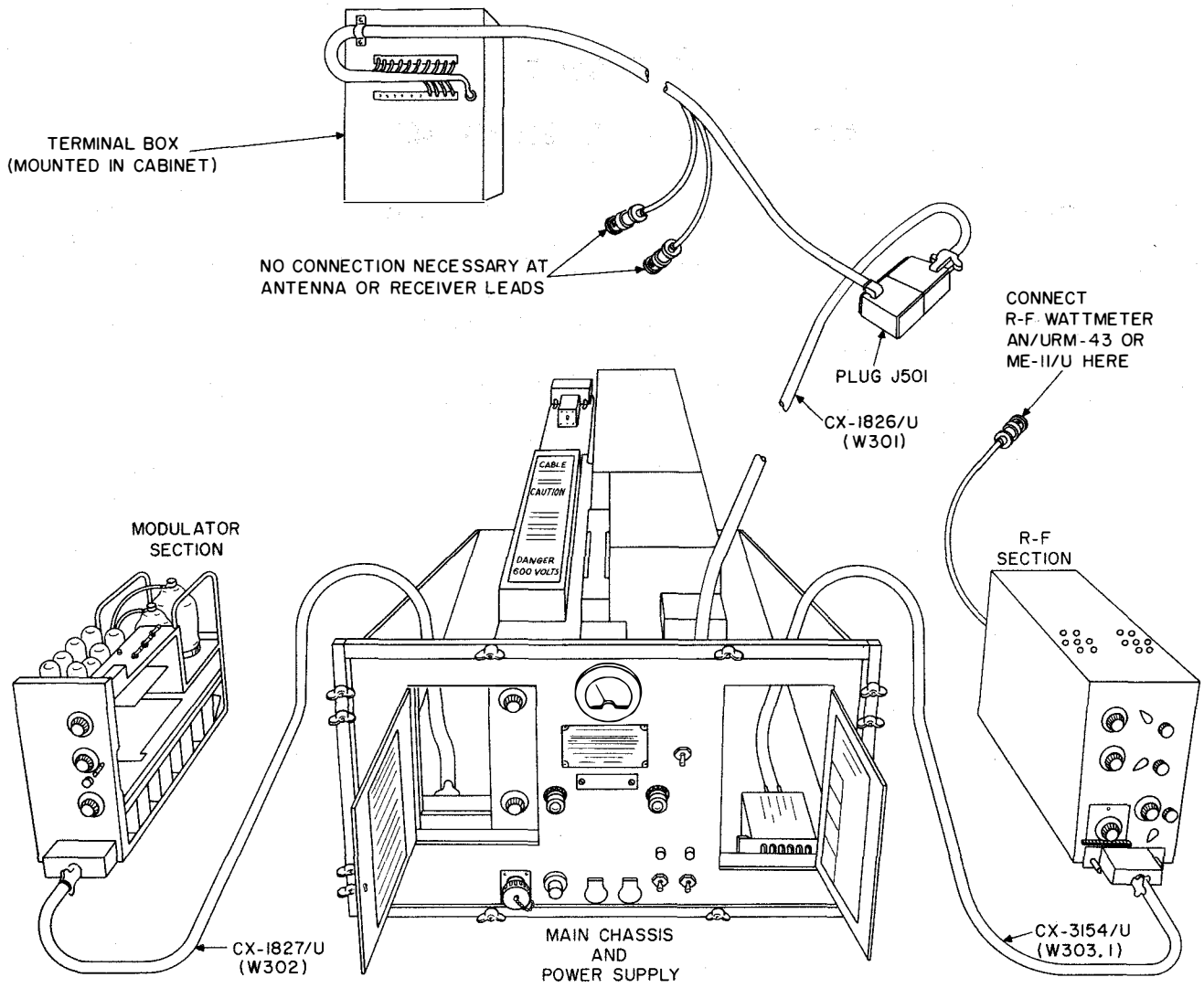



***Figure 7-2. Bench Test Interconnections with Special Purpose Cable Assemblies***

Switch positions AVC, MOD, and VOL EXP permit the meter to check certain circuits in the Radio Modulator, but not in so straightforward a manner as for the r-f circuits. However, all the meter circuits are explained in Section 2, paragraph 2d, with the audio positions of S401 sufficiently described to allow proper interpretation of readings by the average radio technician. Normal meter readings are incorporated in table 5-1.

*c.* TEST EQUIPMENT AND BENCH SET-UP. —Maintenance, testing and trouble shooting can be performed on the Radio Transmitter without the use of special test equipment. However, the following general-purpose test equipment is required in order to service the Radio Transmitter.

(1) Multimeter TS-352/U, or equal (1,000 ohms per volt).

(2) R-F Wattmeter ME-11/U, or equal.

(3) Oscilloscope OS-8/U, Navy Model OBL, Navy Model OBT, or equal.

(4) Audio Oscillator Navy Model LAJ, or equal.

When trouble shooting the equipment, it is impossible to accomplish all the necessary measurements with the units assembled, as is evident from the physical construction of those units. Therefore, a bench test set-up is required which permits the units to be mechanically disassembled from one another, but to remain electrically interconnected so that the equipment can function. The three special-purpose cable assemblies supplied with the equipment are used

to interconnect the units, as shown in figure 7-2; the cables function as follows:

(1) Cable Assembly CX-1826/U (W301) connects J501 from the terminal box to P403 on the Power Supply chassis. The cable is used only when the equipment is normally contained in the cabinet, to allow freedom of movement of the main chassis; if the equipment is rack-mounted, the terminal box will have been secured to the rear of the main chassis.

(2) Cable Assembly CX-1827/U (W302) connects the Radio Modulator unit to the Power Supply chassis.

(3) Cable Assembly CX-3154/U (W303.1) connects the Amplifier-Oscillator unit to the Power Supply chassis.

*d.* REFERENCE MATERIAL SUPPLIED. — Take advantage of the reference material supplied in this technical manual to help in the rapid location of faults. Consult the following material when applicable:

(1) Schematic diagram, figure 7-24.

(2) Trouble-shooting charts, tables 7-1 to 7-3.

(3) Transformer and coil information, table 7-5.

(4) Capacitor and resistor color codes, table 8-7.

(5) Illustrations of equipment sections for use in locating and identifying parts and tracing circuits, figures 3-9, 7-6 to 7-8, 7-10 to 7-12, 7-14 and 7-15, and 7-18 to 7-20.

(6) Equipment interconnection diagram, figure 3-10.

(7) Primary power distribution diagram, figure 2-10.

(8) Practical wiring diagrams, figures 7-25 to 7-28.

(9) Tube characteristics, table 7-4.

*e.* VOLTAGE MEASUREMENT PROCEDURE.

**WARNING**

VOLTAGES OVER 300 VOLTS SHALL BE MEASURED AS DESCRIBED BELOW.

(1) De-energize the equipment. Ground the terminals to be measured to discharge any capacitors connected to those terminals; see step (10).

(2) Connect the test meter to the terminals to be measured using a range higher than the expected voltage.

(3) Without touching meter or test leads, energize the equipment and read the meter.

(4) De-energize the equipment. Ground the terminals connected to the meter before disconnecting the meter.

(5) Make sure you are not grounded whenever you are adjusting equipment or using measuring equipment.

(6) In general, use one hand only when servicing live equipment.

(7) If the test meter must be held or adjusted while voltage is applied, ground the case of the meter before starting measurement and do not touch the live equipment or personnel working on live equipment while you are holding the meter. Some moving-vane type meters should not be grounded; these should not be held during measurements.

(8) Do not forget that, because of equipment breakdown, high voltages may be present across terminals that are normally at low potentials. Be careful even when measuring low voltages.

(9) Do not use test equipment known to be in poor condition.

(10) High-voltage, high-capacity capacitors should be discharged with a grounding stick with approximately 10 ohms in series with the grounded line. Where neither terminal of a capacitor is grounded, short the capacitor terminals to each other.

*f.* USE OF TROUBLE-SHOOTING CHARTS. — The trouble-shooting charts (tables 7-1, 7-2, and 7-3) have been compiled for the purpose of facilitating rapid localization of trouble in the equipment. The three tables divide the possible sources of trouble into control and power circuits, r-f circuits, and a-f circuits, in that sequence, and are based primarily on symptoms which are perceptible either visually or audibly.

When the trouble-shooting charts are used, it is recommended that the symptoms described in table 7-1 be investigated before proceeding to table 7-2 or table 7-3. Checking the equipment in that manner will usually permit the maintenance technician to isolate the cause of defective operation to one of the major groups of circuits, mentioned above. For example, if either the control or power circuits are defective, the fault usually manifests itself as one of the symptoms between 1 and 4 in table 7-1. Similarly, trouble in the radio- or audio-frequency stages usually results in symptom 5 or 6, respectively. The corrective measures for the latter two symptoms then refer the technician to either table 7-2 or 7-3.

Regardless of which chart is being used, the symptoms listed therein should be investigated in numerical sequence. They have been prepared in such manner that defective circuits which

could normally have two or more indicative symptoms are listed as being possibly defective only under the symptom which first appears in the chart. An example of this is the -42-volt rectifier circuit. Failure of that power source would affect both the tripler and power-amplifier stages in the Amplifier-Oscillator. Since the symptoms associated with a faulty tripler stage call for trouble shooting that rectifier circuit, the information is not repeated under power-amplifier corrective measures; presumably, the defective circuit would be found from the indication of improper tripler operation.

**Note**

Before attempting to trouble shoot the equipment, be sure that an attempt has been made to tune and adjust it in accordance with the procedure outlined in Section 4, paragraph 2.

**TABLE 7-1. EQUIPMENT, CONTROL, AND POWER CIRCUIT TROUBLE-SHOOTING CHART**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 1. Red POWER lamp (I401) does not light when S403 is set to POWER ON and S402 is pressed to START. | 1. a. No primary power. | 1. a. Check power source and connections to equipment. |
| | b. Line fuse(s) blown. | b. Replace F401, F402. |
| | c. Lamp burned out. | c. Replace I401. |
| | d. 115/230-volt transformer circuit defective or improperly connected. | d. Check T402 and terminal connections. |
| | e. Start-stop circuit defective. | e. Check S402, K402, R412. |
| | f. -12-volt rectifier defective. | f. Check T401, CR401, L402, C404, C405. |
| 2. Blower (B601) does not start. | 2. a. Amplifier-Oscillator unit not properly seated on main chassis. | 2. a. Push unit in and set snap lock at rear. |
| | b. Open power circuit. | b. Check wiring, contacts of J601, P402, check filter E601. |
| | c. Motor defective. | c. Repair or replace motor. (See par. 6, this section.) |
| | d. Thermal relay K404 defective. | d. Replace or adjust relay. |
| 3. Green CARRIER lamp (I402) does not light when CARRIER TEST switch (S405) is ON or when either key or microphone press-to-talk switch is closed. | 3. a. Lamp burned out. | 3. a. Replace I402. |
| | b. Carrier-control circuit defective. | b. Check V110, K401, K403, 300-volt power source. |
| | c. Keying circuit defective. | c. Check K101, S405, T101, -42-volt rectifier (T401, CR402, L403, C406, C407). |

**TABLE 7-1. EQUIPMENT, CONTROL, AND POWER CIRCUIT TROUBLE-SHOOTING CHART (Cont)**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 4. No meter indications in both OUTPUT and MOD positions of METER switch. | 4. a. High-voltage rectifier defective.<br>b. Meter circuit defective. | 4. a. Check V401, V402; trouble shoot power supply.<br>b. Check M401, S401, R414. |
| 5. Zero or low meter reading in OUTPUT position; MOD indication normal. | 5. Amplifier-Oscillator r-f circuits defective. | 5. Trouble shoot Amplifier-Oscillator. (See table 7-2.) |
| 6. Zero or low meter reading in MOD position; OUTPUT indication normal. | 6. Radio Modulator audio circuits defective. | 6. Trouble shoot Radio Modulator. (See table 7-3.) |
| 7. Equipment operates at excessive temperature for a while, then stops. | 7. Blower air filter clogged. | 7. Clean air filter. (See table 6-3.) |
| 8. Equipment shuts off. | 8. Blower motor inoperative. | 8. a. Check blower motor.<br>b. Check thermal relay. (See par. 7, Sec. 7.) |

**TABLE 7-2. R-F CIRCUITS TROUBLE-SHOOTING CHART**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 1. Zero or low doubler grid current; METER switch set to DOUBLER $I_g$. | 1. a. Oscillator defective.<br>b. Doubler defective.<br>c. Crystal switch S601 or crystal (Y601-Y604) defective.<br>d. Oscillator tank circuit misaligned. | 1. a. Check V601; trouble shoot oscillator circuit.<br>b. Check V602; trouble shoot doubler circuit.<br>c. Replace defective component.<br>d. Realign r-f circuits. (See par. 4, this section.) |
| 2. Zero or low tripler grid current; METER switch set to TRIPLER $I_g$. | 2. a. Doubler defective.<br>b. Amplifier defective.<br>c. Tripler defective.<br>d. Doubler or amplifier tank circuit misaligned. | 2. a. Check V602; trouble shoot doubler circuit.<br>b. Check V603; trouble shoot amplifier circuit.<br>c. Check V604; trouble shoot tripler circuit.<br>d. Realign r-f circuits. (See par. 4, this section.) |

**TABLE 7-2. R-F CIRCUITS TROUBLE-SHOOTING CHART (Cont)**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 3. Abnormally high tripler grid current; METER switch set to TRIPLER $I_g$. | 3. a. Low grid bias.<br>b. Meter circuit defective. | 3. a. Check and trouble shoot -42-volt rectifier.<br>b. Check shunt resistor R403. |
| 4. Zero or low tripler plate current; METER switch set to TRIPLER $I_p$. | 4. a. Tripler defective.<br>b. Screen-bypass capacitor shorted.<br>c. Low plate or screen voltage.<br>d. High grid bias. | 4. a. Check V604; trouble shoot tripler circuit.<br>b. Check C619 for foreign metallic matter between plates.<br>c. Check and trouble shoot high-voltage rectifier.<br>d. Check and trouble shoot -42-volt rectifier. |
| 5. Abnormally high tripler plate current, or no variation in current when R.F. DRIVER TUNING is adjusted; METER switch set to TRIPLER $I_p$. | 5. a. Tripler tank circuit misaligned.<br>b. Mechanical slippage in tuning drive.<br>c. Meter circuit defective. | 5. a. Realign r-f circuits. (See par. 4, this section.)<br>b. Check tuning drive and shaft coupling. (See par. 3d, this section.)<br>c. Check shunt resistors R404, R405. |
| 6. Zero or low PA grid current, or no variation in current when P.A. GRID TUNING is adjusted; METER switch set to PA $I_g$. | 6. a. PA defective.<br>b. Coupling circuit defective.<br>c. Tripler defective.<br>d. Mechanical slippage in tuning drive. | 6. a. Check V605, V606; trouble shoot PA circuit.<br>b. Check W601, L611, L612.<br>c. Check V604.<br>d. Check tuning drive and shaft coupling. (See par. 3d, this section.) |
| 7. Abnormally high PA grid current; METER switch set to PA $I_g$. | 7. Meter circuit defective. | 7. Check shunt resistor R402. |
| 8. Zero or low PA plate current; METER switch set to PA $I_p$. | 8. a. PA defective.<br>b. Screen-bypass capacitor shorted to ground. | 8. a. Check V605, V606; trouble shoot PA circuit.<br>b. Check C642.1 or foreign metallic matter between plates. |

**TABLE 7-2. R-F CIRCUITS TROUBLE-SHOOTING CHART (Cont)**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 9. Abnormally high PA plate current, or no variation in current when P.A. TUNING is adjusted; METER switch set to PA $I_p$. | 9. a. Meter circuit defective.<br>b. Mechanical slippage in tuning drive. | 9. a. Check shunt resistor R406.<br>b. Check tuning drive and shaft coupling. (See par. 3d, this section.) |
| 10. Zero or low r-f output; METER switch set to OUTPUT. | 10. a. Crystal rectifier defective.<br>b. PA tubes defective.<br>c. Output filter misaligned.<br>d. Monitor circuit defective. | 10. a. Replace CR601.<br>b. Check V605, V606.<br>c. Realign r-f circuits. (See par. 4, this section.)<br>d. Trouble shoot rectifier and filter circuit. |

**TABLE 7-3. AUDIO CIRCUITS TROUBLE-SHOOTING CHART**

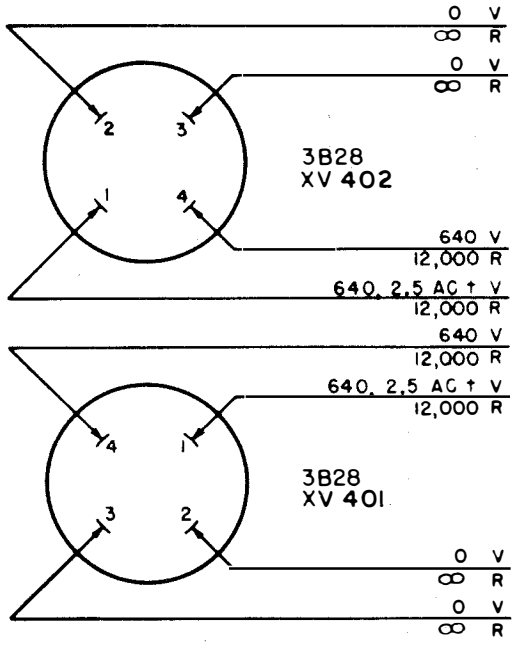
| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MEASURE |
|---|---|---|
| 1. No AVC voltage when speaking into microphone; METER switch set to AVC. (AVC switch S102 in ON position.) | 1. a. SP AMP gain control misadjusted.<br>b. Defective tube.<br>c. 1st audio amplifier defective.<br>d. AVC amplifier-rectifier circuits defective.<br>e. Microphone or speech input circuit defective.<br>f. High grid bias at V102A. | 1. a. Readjust control. (See Section 4, par. 2.)<br>b. Check V101, V102.<br>c. Trouble shoot stage.<br>d. Trouble shoot circuits.<br>e. Check microphone, cable, T101.<br>f. Check and trouble shoot -42-volt supply and divider (R147-R150). |
| 2. Low or zero modulator output, PHONE operation; METER switch set to MOD, VOL EXP switch (S102) and CLIP-FILT switch (S103) both OFF. | 2. a. MOD gain control misadjusted.<br>b. Defective tube.<br>c. High modulator grid bias. | 2. a. Readjust control. (See Section 4, par. 2.)<br>b. Check V105, V106, V104, V108.<br>c. Check and trouble shoot -42-volt supply and divider (R147-R150). |

**TABLE 7-3. AUDIO CIRCUITS TROUBLE-SHOOTING CHART (Cont)**

| SYMPTOM | PROBABLE TROUBLE | CORRECTIVE MAINTENANCE |
|---|---|---|
| | d. Defective modulator stage.<br>e. Defective audio stage. | d. Trouble shoot circuits.<br>e. Trouble shoot 2nd and 3rd audio amplifier stages. |
| 3. Same as Symptom 2, except CLIP-FILT switch (S103) ON. | 3. a. Defective clipper.<br>b. Defective audio filter. | 3. a. Check V103; trouble shoot circuit.<br>b. Replace Z101. |
| 4. Zero or low volume-expansion indication; VOL EXP switch (S104) ON, METER switch set to VOL EXP. | 4. a. EXP control misadjusted.<br>b. Defective tube.<br>c. Defective volume-expander circuit. | 4. a. Readjust control. (See Section 4, par. 2.)<br>b. Check V107, V108, V109, V104.<br>c. Check volume-expander multivibrator, rectifier, clamp. |
| 5. Abnormally high volume-expansion indication; VOL EXP switch (S104) ON, METER switch set to VOL EXP. | 5. a. Defective tube.<br>b. Defective component at keyed or filtered 300-volt lines.<br>c. Defective meter circuit. | 5. a. Check V104, V105, V106, V101, V102.<br>b. Trouble shoot circuits, especially C127, C116.<br>c. Check shunt resistor R401. |
| 6. Low or zero modulator output, MCW operation; METER switch set to MOD. | 6. a. MCW modulation-level control (R141) misadjusted.<br>b. Defective MCW oscillator. | 6. a. Readjust R141. (See par. 5c, this section.)<br>b. Check V109; trouble shoot oscillator circuit. |
| 7. No side-tone audio output at EARPHONES jack. | 7. a. EARPHONE LEVEL control misadjusted.<br>b. Monitoring circuit defective. | 7. a. Readjust control for normal volume.<br>b. Check J402, R411, T101, K401A. |

*g.* TROUBLE SHOOTING CONTROL AND POWER CIRCUITS.--If the symptoms of table 7-1 (or tables 7-2 and 7-3) indicate that the control or power circuits are at fault, those circuits can be checked directly from the schematic diagram, figure 7-24. The voltage and resistance measurements indicated in figures 7-3, 7-4, and 7-5 will also be of value in isolating the defective circuit or components. As explained previously, the power and control circuits are checked by tracing voltages, checking circuit continuity, etc., starting at the output of the control circuit or rectifier presumed to be faulty. No individual trouble-shooting chart is supplied for these circuits, since there are no visible symptoms of faulty operation, other than those which are incorporated in tables 7-1 through 7-3.

Many of the supply voltages may be checked conveniently at the terminals of the front-panel meter rather than at the less accessible connectors and terminal points. The approximate




NOTES:
VOLTAGE MEASUREMENTS TAKEN WITH AMP-OSC AND RADIO MOD UNITS CONNECTED AND OPERATING.
CARRIER FREQ.- 115 MC. RESISTANCE MEASUREMENTS TAKEN WITH AMP-OSC AND RADIO MOD UNITS DISCONNECTED.
R INDICATES DC RESISTANCE TO GROUND.
V INDICATES VOLTAGE READINGS TAKEN TO GROUND, USING A 1000 OHM-PER-VOLT VOLTMETER WHOSE MAX. SCALE READING IS NOT MORE THAN APPROXIMATELY THREE TIMES THE VALUE GIVEN.

† AC MEASURED TO PIN 4.

VOLTAGES NOT OTHERWISE INDICATED ARE DC.

*Figure 7-3. Power Supply PP-773C/URT, Tube Socket Voltages and Resistances*

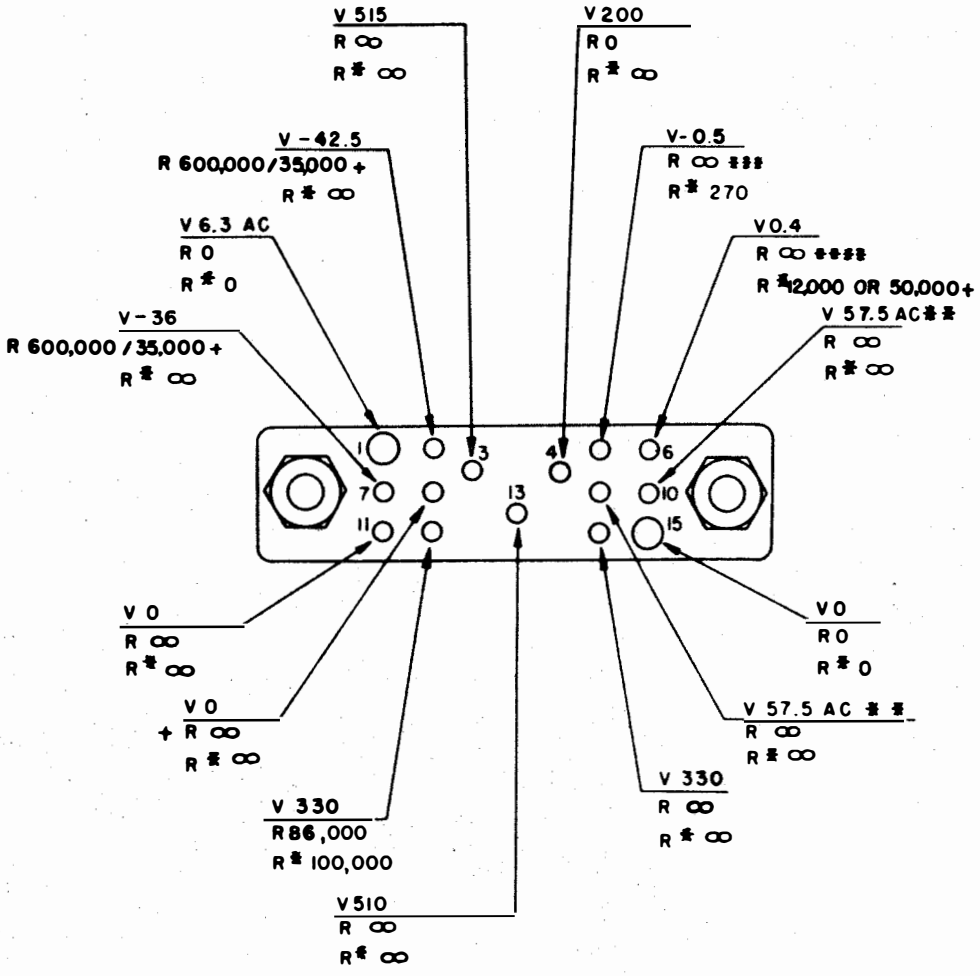
voltages which should be obtained for the pertinent METER switch (S401) positions are as follows:

| | |
|---|---|
| TRIPLER $I_g$ | -42.5 volts |
| PA $I_g$ | -42.5 volts |
| TRIPLER $I_p$ | +515 volts |
| PA $I_p$ | +515 volts |
| VOL EXP | +310 volts (keyed) |

In the event of zero or low output voltages, check first the rectifier tubes (V401, V402) or the selenium rectifiers (CR401, CR402), depending on the voltage which is not of proper value. Then check filter capacitors for opens, shorts, and leakage, and resistors for opens or changes in value. Other possibilities are defective transformers and filter chokes. The locations of the various components on the Power Supply chassis are shown in figures 7-6, 7-7, and 7-8. However, maintenance personnel are cautioned not to restrict trouble shooting to those components on the main chassis; it is entirely possible that the defective components may be located within the other units of the equipment. The resistance measurement procedures described in figures 7-4 and 7-5 are intended to aid in the isolation of the defective circuit to one of the major units.

*b.* TROUBLE SHOOTING R-F CIRCUITS. —If faulty operation of the r-f circuits in the Amplifier-Oscillator unit is indicated, the trouble-shooting chart of table 7-2 should be used. Isolation of the source of faulty operation to a particular stage is made relatively simple by the six positions of the METER switch (S401) which allow the meter to monitor the r-f stages. Once the trouble has been isolated to an individual stage, by means of the meter readings and table 7-2, the defective component can usually be determined by checking tubes and taking voltage and/or resistance measurements. Figure 7-9 indicates the readings which should be obtained at the tube sockets, while those which should be present at connector J601 appear in figure 7-4. It should be noted, however, that the most likely causes of trouble are defective tubes and misalignment of the r-f circuits; both of these items should be checked prior to any other trouble-shooting procedure. The alignment adjustments are described in paragraph 4 of this section.

If any of the ceramic feed-through capacitors used throughout the r-f circuits break down, it will usually be evidenced by discoloration of the capacitor. A defective component of this type can be located visually; it may also give rise to the appearance of parasitic oscillations. Such spurious frequencies may result in unstable operation, poor power output, high transmitted noise level or hum, or other symptoms of improper operation not immediately traceable by meter readings or measurements. Refer to




AMP-OSC JACK (J601)

POWER SUPPLY PLUG (P402)

NOTES: ALL VOLTAGES APPLY TO ACTUAL READINGS OBTAINED WHEN USING A 1,000 OHM-PER-VOLT VOLTMETER WHOSE MAXIMUM SCALE READING IS NOT MORE THAN APPROXIMATELY THREE TIMES THE VALUE GIVEN.

R INDICATES DC RESISTANCE FROM CONTACTS OF P402 TO CHASSIS GROUND WITH AMP-OSC AND RADIO MOO UNITS DISCONNECTED FROM POWER SUPPLY.

R* INDICATES DC RESISTANCE FROM CONTACTS OF J601 TO CHASSIS GROUND WITH AMP-OSC DISCONNECTED FROM POWER SUPPLY.

V INDICATES VOLTAGE READINGS TAKEN TO GROUND UNLESS OTHERWISE NOTED, WITH AMP-OSC CONNECTED THROUGH PATCH CORD TO POWER SUPPLY. NORMAL "CARRIER ON" OPERATION AT 115 M C. MODULATOR SWITCHES AND FRONT PANEL CONTROLS IN POSITIONS GIVEN IN FIG. 7-13.

VOLTAGES NOT OTHERWISE INDICATED ARE DC.

† DEPENDS ON POLARITY.

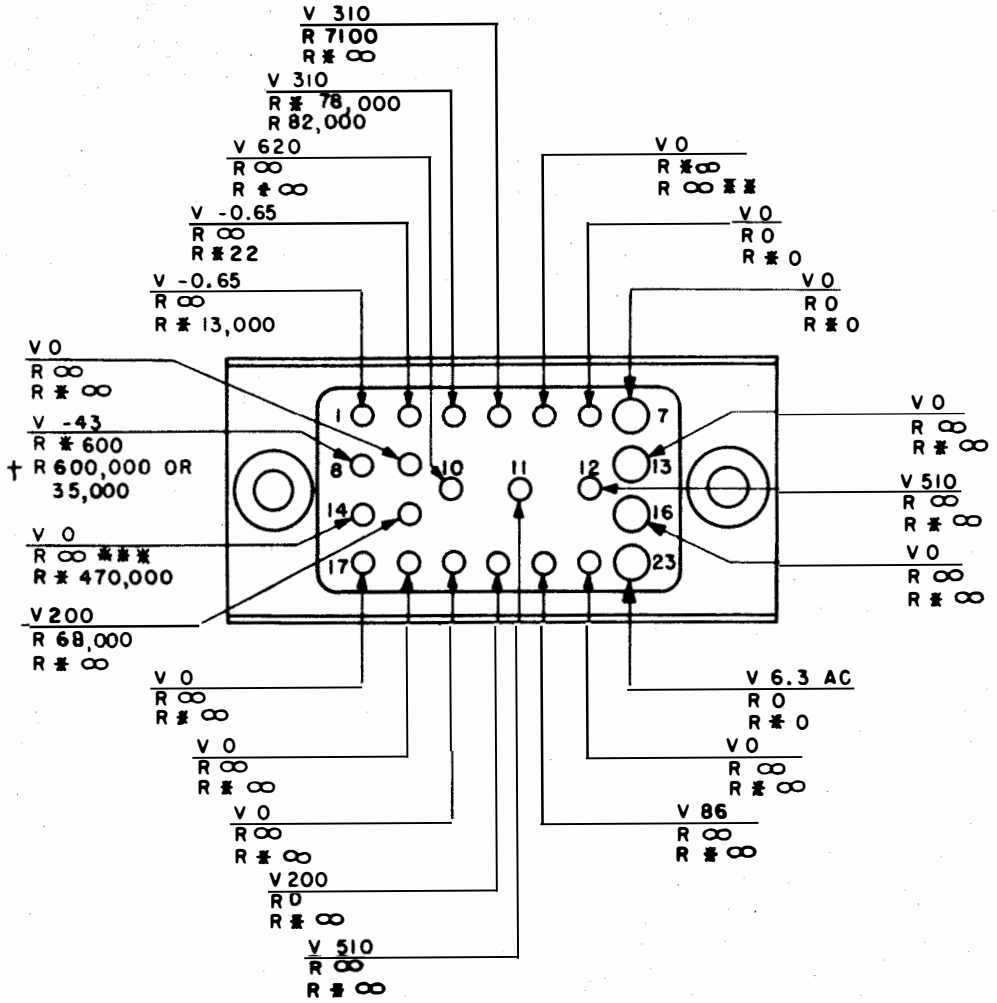
** 115 AC BETWEEN PINS 9 AND 10.

*** 8,000 WITH METER SWITCH IN DOUBLER Ig POSITION.

**** 8,000 WITH METER SWITCH IN OUTPUT POSITION.

115 VAC BETWEEN PINS 8 AND 9, AND 11 AND 9.

*Figure 7-4. Amplifier-Oscillator Power Connectors (P402 and J601), Terminal Voltages and Resistances*




RADIO MODULATOR JACK (J101)

POWER SUPPLY PLUG (P401)

NOTES: R INDICATES DC RESISTANCE FROM CONTACTS OF P401 TO CHASSIS GROUND WITH AMP-OSC AND RADIO MOD UNITS DISCONNECTED FROM POWER SUPPLY.

R * INDICATES DC RESISTANCE FROM CONTACTS OF J101 TO CHASSIS GROUND WITH RADIO MOD UNIT DISCONNECTED FROM POWER SUPPLY.

V INDICATES VOLTAGE READINGS TAKEN TO GROUND WITH MODULATOR UNIT CONNECTED THROUGH PATCH CORD TO POWER SUPPLY. NORMAL "CARRIER ON" OPERATION AT 115 MC. MODULATOR SWITCHES AND FRONT PANEL CONTROLS IN POSITIONS GIVEN IN FIG. 7-13.

ALL VOLTAGES APPLY TO ACTUAL READINGS OBTAINED WHEN USING A 1,000 OHM-PER-VOLT VOLTMETER WHOSE MAXIMUM SCALE READING IS NOT MORE THAN APPROXIMATELY THREE TIMES THE VALUE GIVEN.

VOLTAGES NOT OTHERWISE INDICATED ARE DC.

† DEPENDS ON POLARITY.

*** 8000 WITH METER SWITCH IN AVC POSITION

** 8000 WITH METER SWITCH IN MOD POSITION.

*Figure 7-5. Radio Modulator Power Connectors (P401 and J101), Terminal Voltages and Resistances*

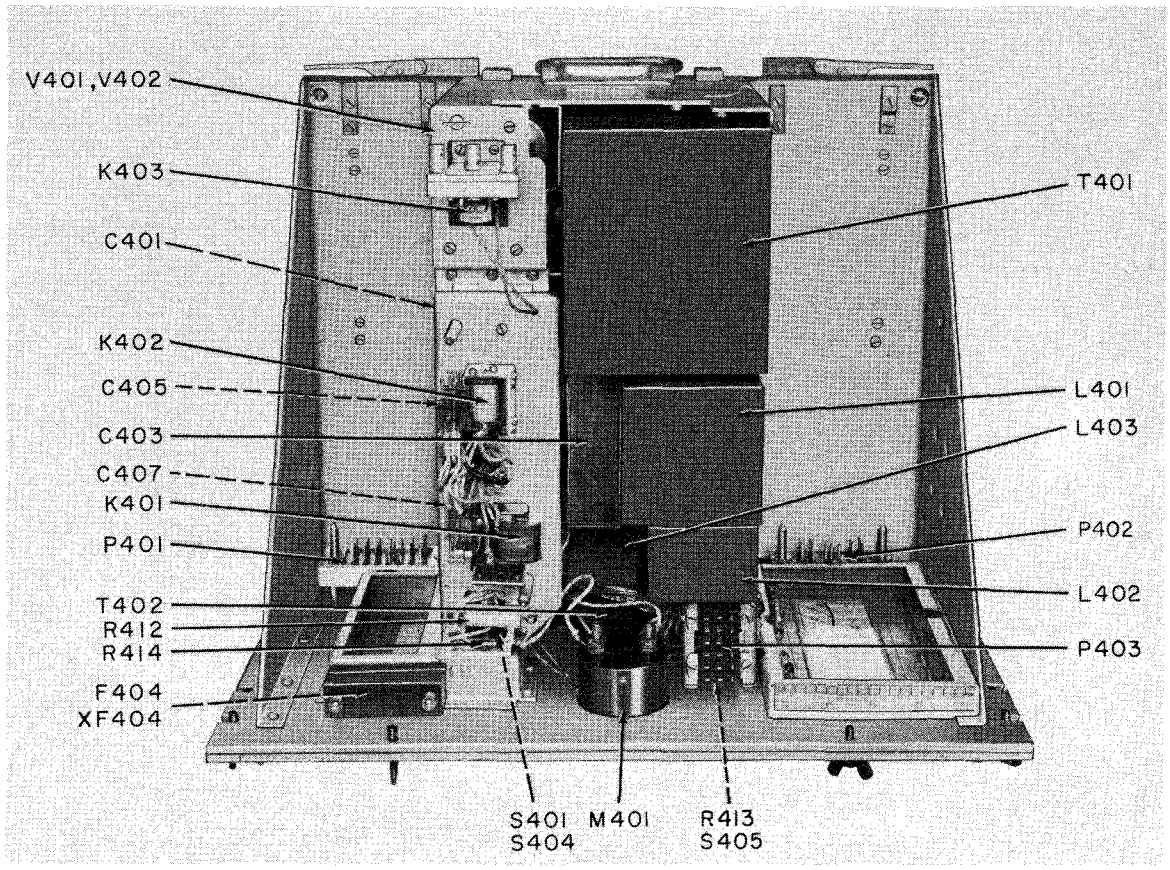



*Figure 7-6. Power Supply PP-773C/URT, Top View*

paragraph 3 of this section for additional information regarding repair and replacement of r-f components.

The locations of the various components in the Amplifier-Oscillator unit are shown in figures 7-10, 7-11, and 7-12. The illustrations of the subassemblies, figures 7-18, 7-19, and 7-20, may also be of value in this respect.

*i.* TROUBLE SHOOTING AUDIO CIRCUITS.— Table 7-3 provides trouble-shooting information for the audio circuits, most of the components of which are in the Radio Modulator unit. Although the MOD, AVC, and VOL EXP positions of the METER switch (S401) permit the meter to partially check these circuits, the indications so obtained are not as complete or conclusive as those for the r-f circuits. For that reason, it is extremely important that the sequential procedure of table 7-3 be followed in order to quickly isolate the trouble to a particular stage or group of stages. The most likely sources of faulty operation are defective tubes and improper adjustment of the various operating and non-operating controls and switches. Check and replace all tubes which are weak or bad, or substitute tubes which are known to be good. Be certain that the screwdriver-adjusted controls within the unit are set correctly; refer to paragraph 5, this section.

If it becomes necessary to check voltages and resistances in order to locate a defective component, follow the measurement procedure described in the tube-socket diagram, figure 7-13. The readings which should be obtained are indicated in that illustration, while those which should appear at connector J101 are shown in figure 7-5. The components of the Radio Modulator may be identified from figures 7-14 and 7-15.

### 3. REPAIR AND REPLACEMENT OF R-F COMPONENTS.

*a.* GENERAL INSTRUCTIONS.—The repair and replacement of certain of the r-f components used in the Amplifier-Oscillator unit require careful and accurate workmanship. This is especially true of those components and assemblies which are mechanically complex or which are specially designed for high-frequency application. The material which follows is intended

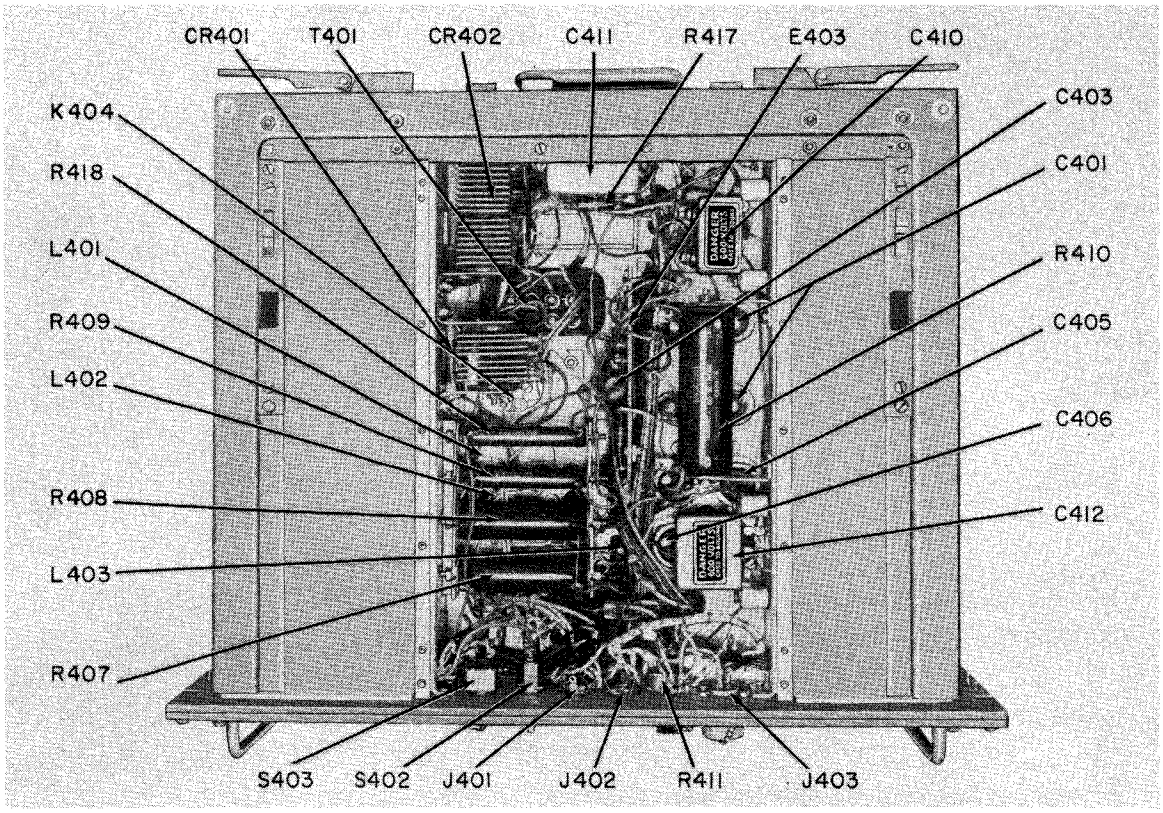



*Figure 7-7. Power Supply PP-773C/URT, Bottom Cover Plate Removed*

to allow repairs or replacements to be made with a minimum of effort and to preclude the possibility of damage to other components.

*b.* PA SCREEN BYPASS CAPACITOR, C642.1. —The construction of the power amplifier bypass capacitor is very similar to that of the tripler capacitor, except that Teflon rather than mica is used as the dielectric and the elements are cut to almost cover the width of the upper shelf so that one piece will serve for both tubes (see figure 7-16). The ground for the brass cover plate is made through spring assemblies which are riveted to the plate. The springs press against the chassis for ground connection. The mounting hardware provides an additional ground path for the cover plate. Four of the mounting screws are put in from the top of the chassis and secured with lockwashers and nuts applied from the top. The screen contact ring has oversize holes drilled through it to prevent the screws from shorting the screen grid to ground.

When replacing elements of this capacitor, line up the lower Teflon, the screen contact ring, the upper Teflon, and the cover plate properly with the tube sockets. The two screws which are soldered in place under the shelf plate should be lined up in the center of their mounting and clearance holes. The four remaining screws should line up accordingly.

**Note**

Before tightening the mounting screws, place the 4X150A tubes in their sockets. Tighten the mounting screws while the screen contact ring is thus properly aligned.

*c.* TRIPLER SCREEN BYPASS CAPACITOR, C619.1.—Careful work is required when repairing screen bypass capacitors C619.1 in the tripler stage and C642.1 in the power amplifier.

(1) If it becomes necessary to remove or repair the tripler bypass capacitor C619.1 (see

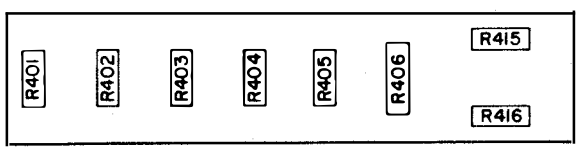
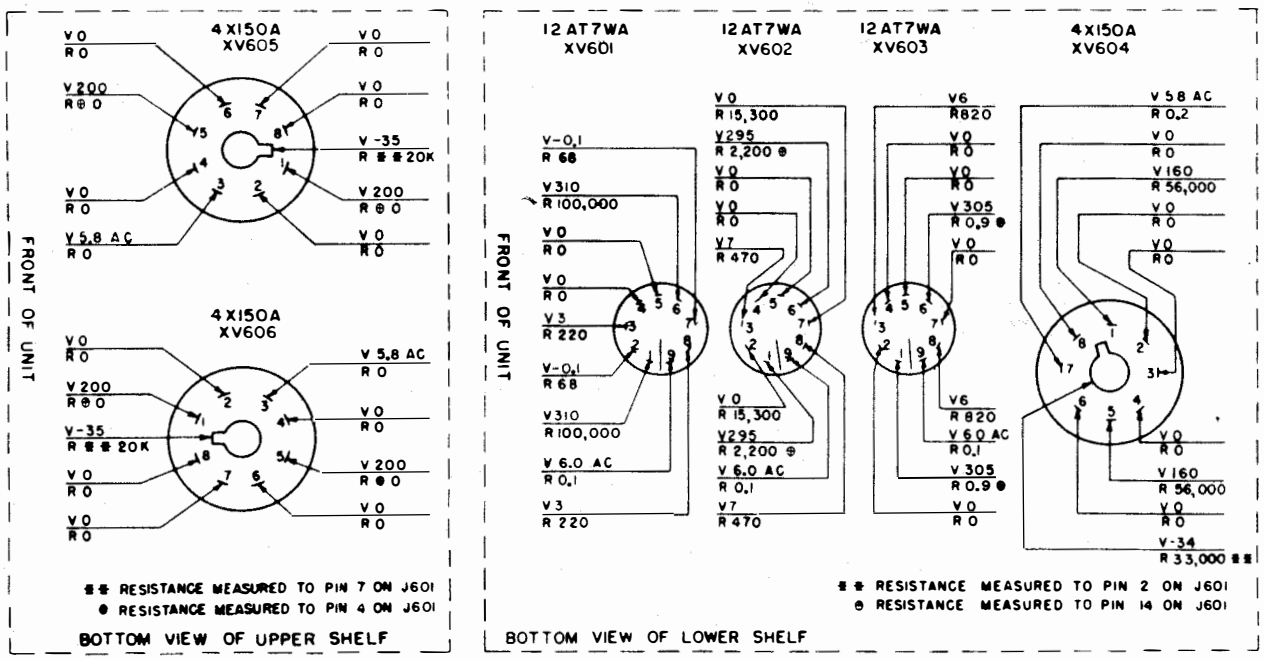



*Figure 7-8. Terminal Board E403*




NOTES:

R INDICATES DC RESISTANCE TO GROUND, UNLESS OTHERWISE NOTED

V INDICATES VOLTAGE READINGS TO GROUND. AMP-OSC CONNECTED THROUGH PATCH CORD TO POWER SUPPLY. EQUIP'T IN NORMAL "CARRIER-ON" OPERATION AT 115 MC. ALL VOLTAGES APPLY TO ACTUAL READINGS OBTAINED WHEN USING A 1000 OHM-PER-VOLT VOLTMETER WHOSE MAXIMUM SCALE READING IS NOT MORE THAN APPROXIMATELY THREE TIMES THE VALUE GIVEN.

MOODULATOR CONTROLS AND SWITCHES IN POSITIONS GIVEN IN FIG. 7-13.

VOLTAGE READINGS NOT OTHERWISE INDICATED ARE DC.

***Figure 7-9. Amplifier-Oscillator AM-638C/URT, Tube Socket Voltages and Resistances***

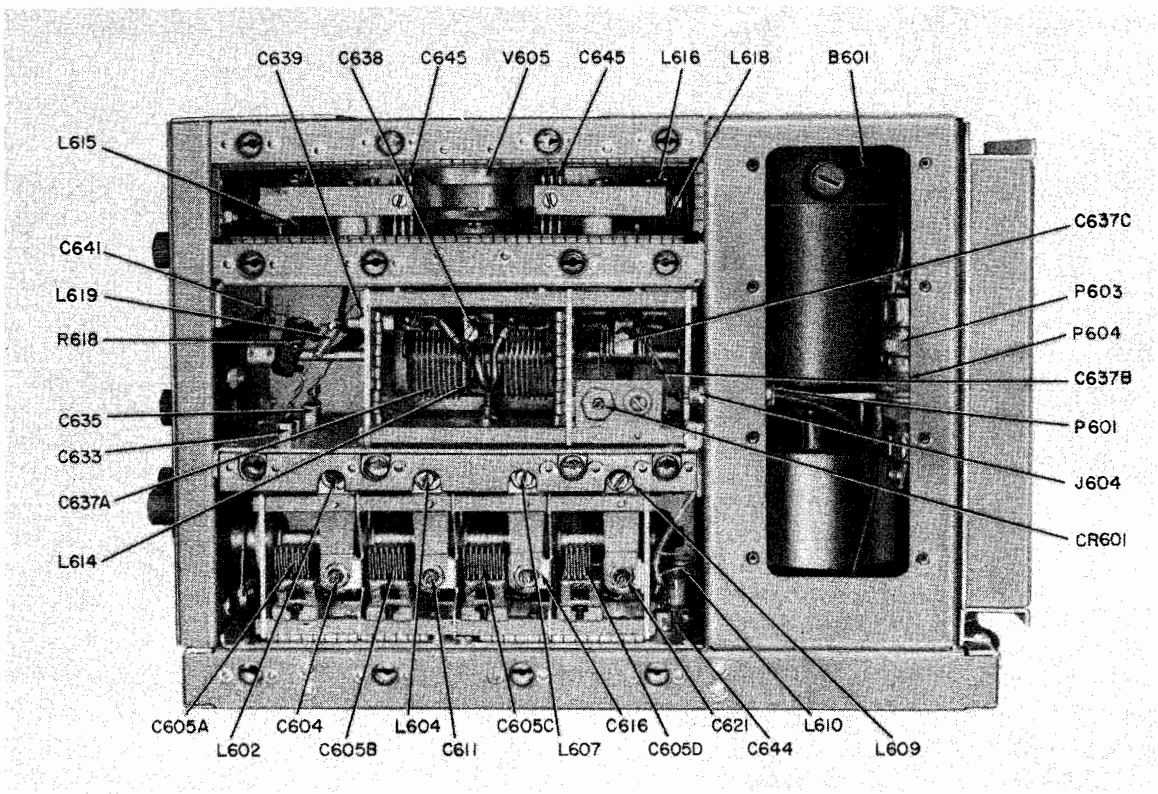



***Figure 7-10. Amplifier-Oscillator AM-638C/URT, Right Side Panels Removed***

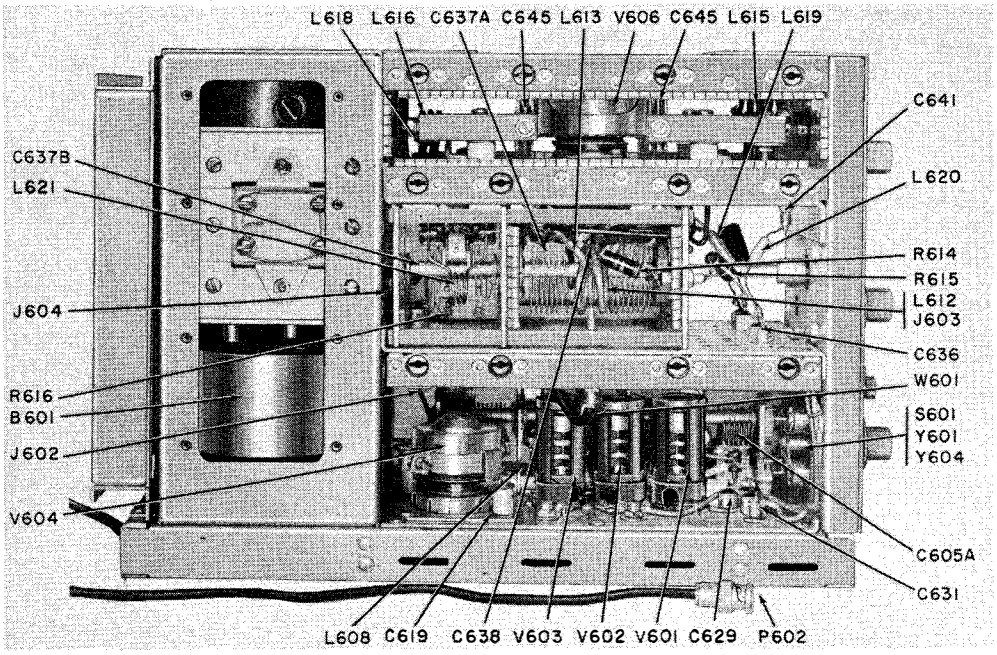



***Figure 7-11. Amplifier-Oscillator AM-638C/URT, Left Side Panels Removed***

figures 7-11 and 7-17), it can be removed as follows:

(a) Remove the left side plate and bottom cover plate of the r-f section by loosening the eight camloc fasteners on the side and by removing the fifteen screws from the bottom.

(b) Remove V604 as described in section 5, paragraph 2b.

(c) Disconnect capacitor C618 from the driver plate clamp.

(d) Remove the two stand-off insulators (with clamp attached) by unscrewing the two holding screws from underneath the chassis. It is not necessary to disassemble the driver clamp and attached spacer insulators to service capacitor C619.1, but for purpose of clarity the complete disassembly is shown in exploded view in figure 7-17.

Mica is used as the dielectric material in this capacitor. The elements of the capacitor are cut wide enough so that the 4X150A tube fits inside the capacitor. The chassis and brass cover plate form one side of the capacitor, with the mica dielectric material between them and the screen contact ring acting as the other plate of the capacitor. The screen contact ring is cut somewhat smaller than the dielectric and is mounted

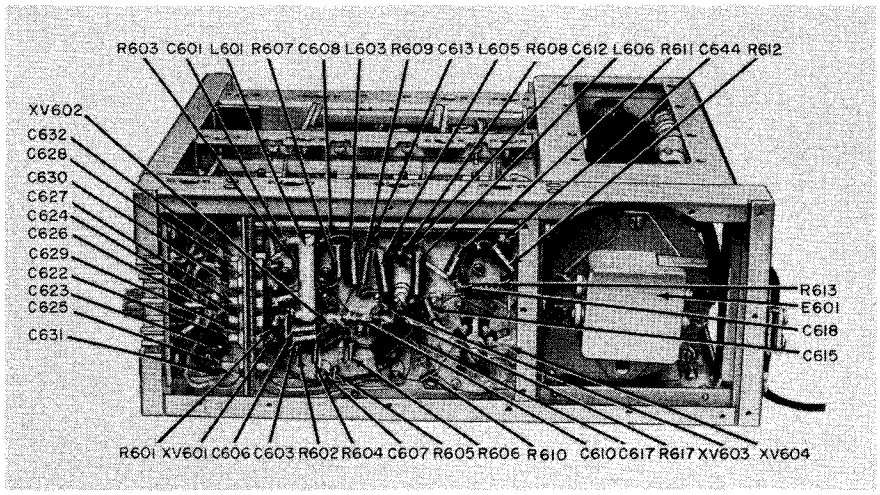



***Figure 7-12. Amplifier-Oscillator AM-638C/URT, Bottom Cover Plate Removed***

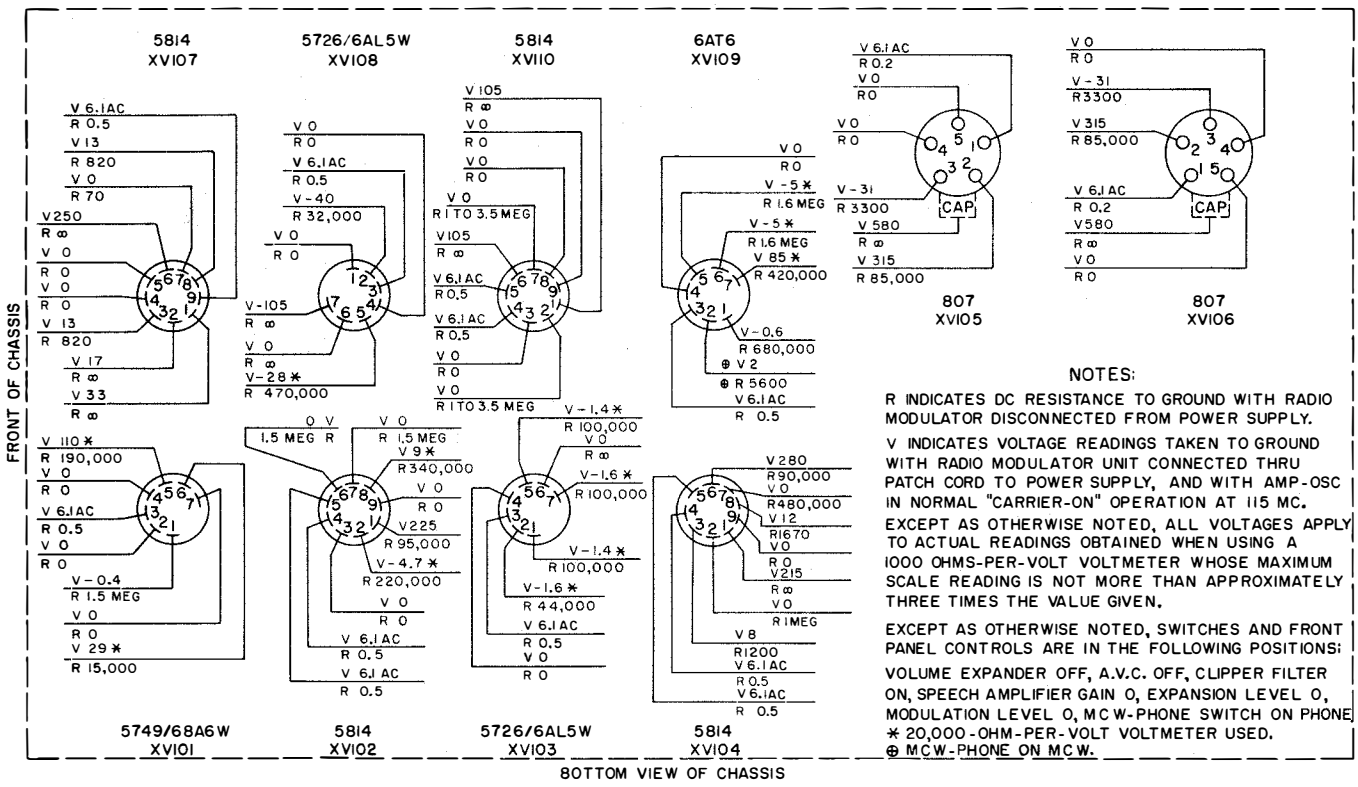



***Figure 7-13. Radio Modulator MD-163C/URT Tube Socket Voltages and Resistances***

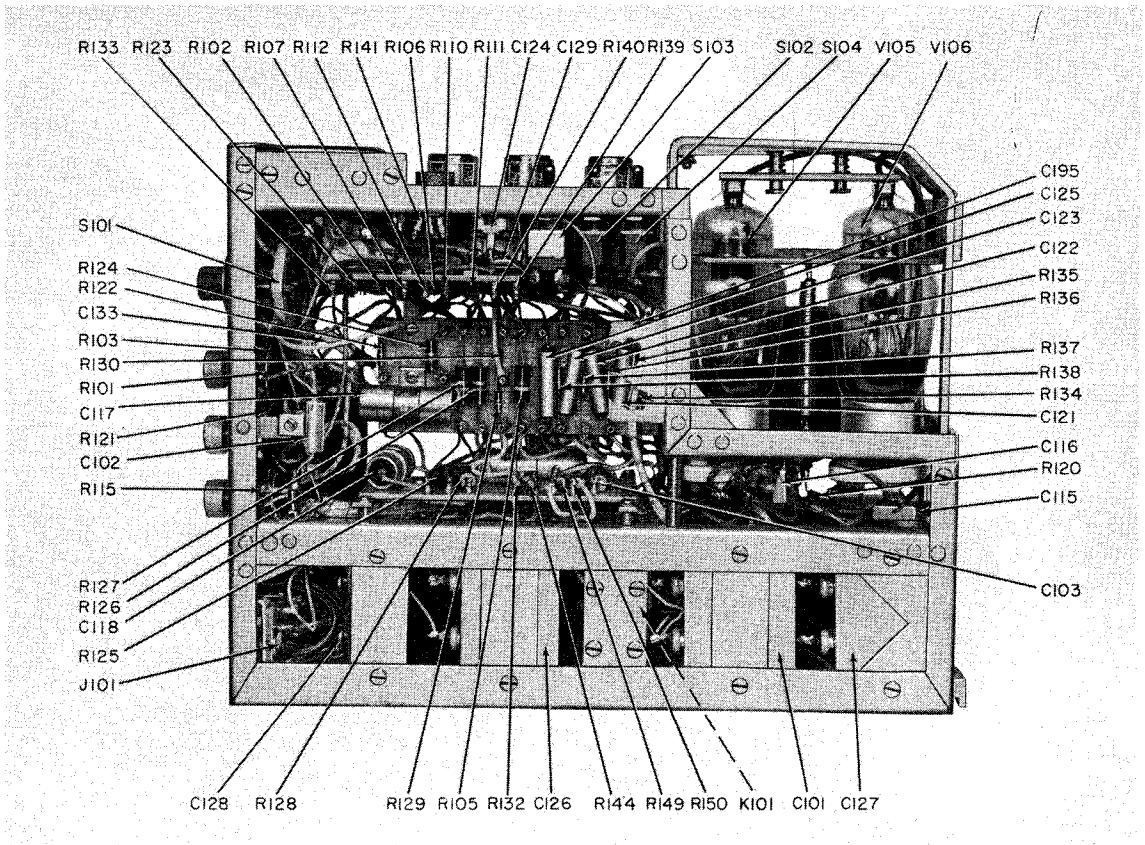



***Figure 7-14. Radio Modulator MD-163C/URT, Right Side View***

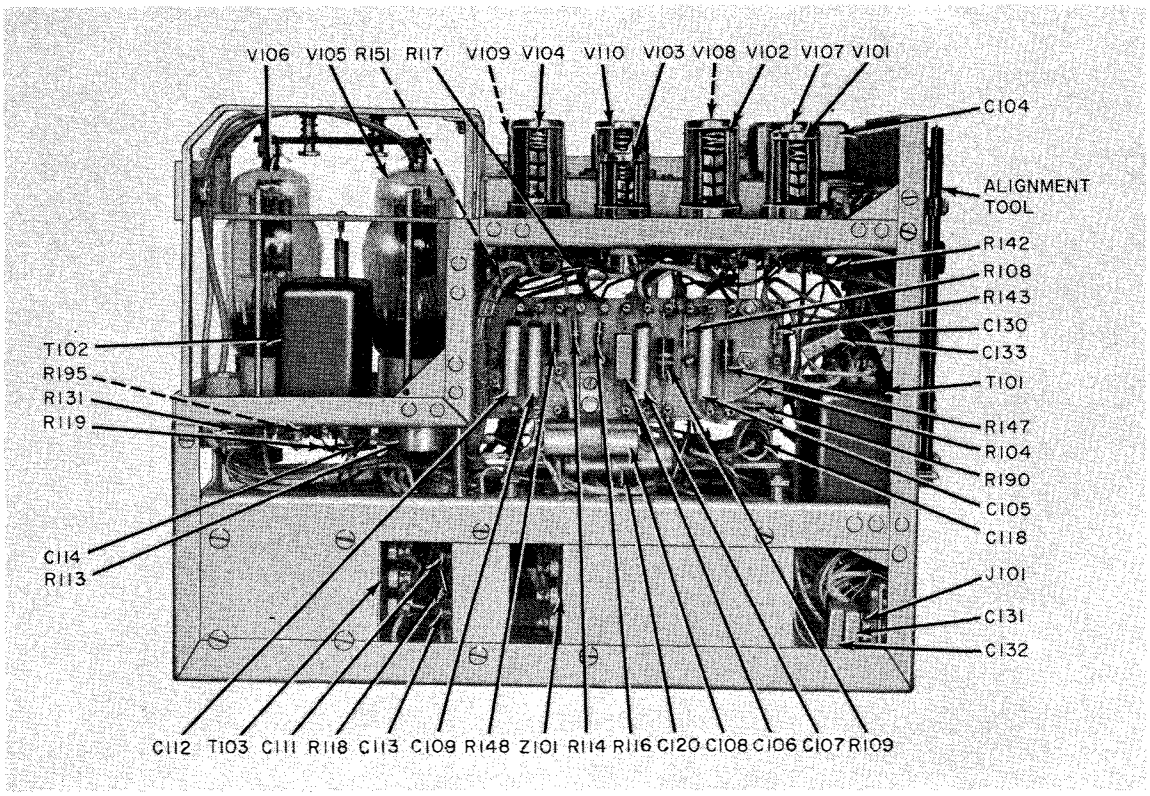



*Figure 7-15. Radio Modulator MD-163C/URT, Left Side View*

above the mica. The circumference of the hole in the screen contact ring, through which the tube passes, is ringed with contact springs. These springs press against the screen connecting ring of the tube (when the tube is inserted) and assure good electrical contact. Above this screen contact ring is the second piece of mica, topped by a brass cover plate. Four mounting screws are used to secure the assembly and to provide ground contact for the cover plate. Two of these mounting screws enter from underneath the shelf plate and are screwed into standoff insulators. The remaining two enter from the top of the chassis plate and are secured underneath with lockwashers and nuts.

When reassembling capacitor C619.1, align the insulator contact ring, and the cover plate concentric with the tube socket in their original order. The four corner holes in each item should then line up. The screen contact ring must always be aligned so that the mounting screws are in the center of their clearance holes and do not touch the ring. The clearance holes in the contact ring are oversize and should be concentric with the screws when the screws are tightened.

*d.* TUNING DRIVES.—If trouble, such as slippage or excessive backlash, is encountered in any of the tuning drives, it may be necessary to remove and replace the defective assembly. Instructions for replacement are as follows:

(1) Loosen the Camloc fasteners and remove the side plates. Remove all crystals from the CRYSTAL SELECTOR switch (S601).

(2) Using the No. 6 Allen-head setscrew wrench (H102), mounted on the front panel of the Radio Modulator unit, remove and tag all front-panel dials, indicators, and knobs, except the CRYSTAL SELECTOR control, which is an integral part of the front-panel assembly.

**Notes**

Use a 1/16-inch diameter drive-pin punch to remove the tapered pins in the tuning-lock knobs.

(3) Remove all screws around the sides and top of the front panel.

(4) Take off the front panel.

(5) At this point, excessive backlash or mechanical damage can be detected visually.

(6) To remove any tuning drive, loosen the setscrews in the mechanical coupling between the gear shaft and capacitor-bank shaft. Use the No. 6 Allen-head setscrew wrench, H102.

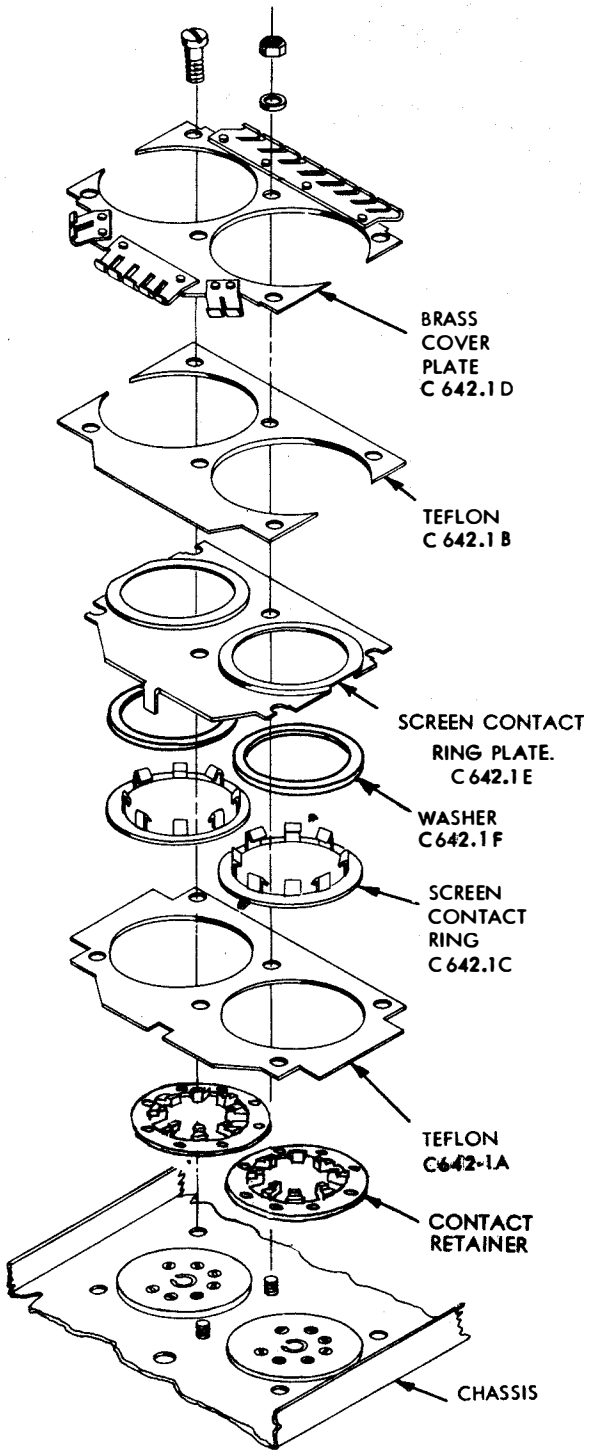



*Figure 7-16. Power Amplifier Screen Bypass Capacitor*

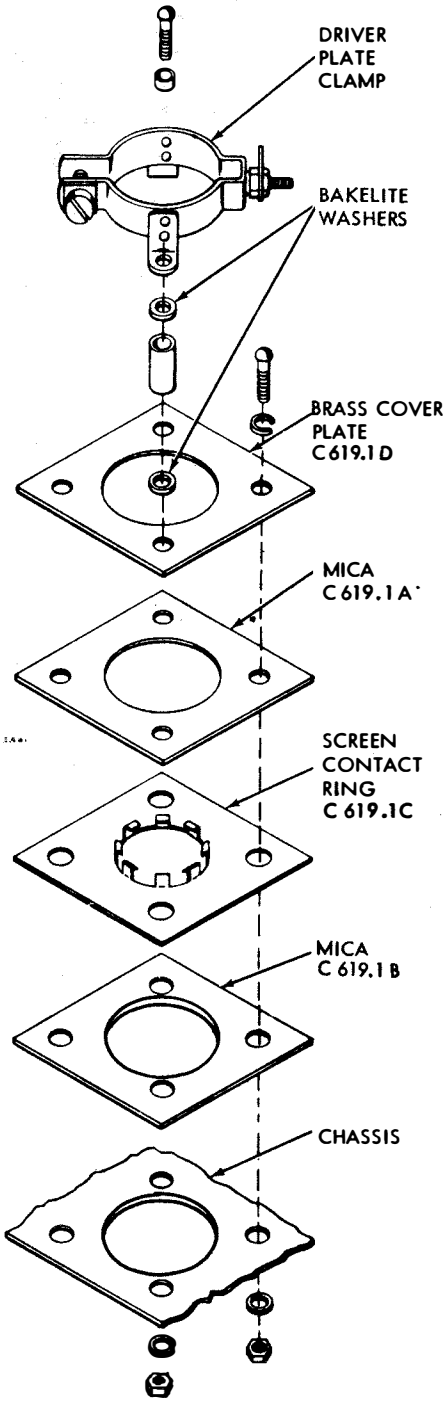



*Figure 7-17. Tripler Screen Bypass Capacitor*

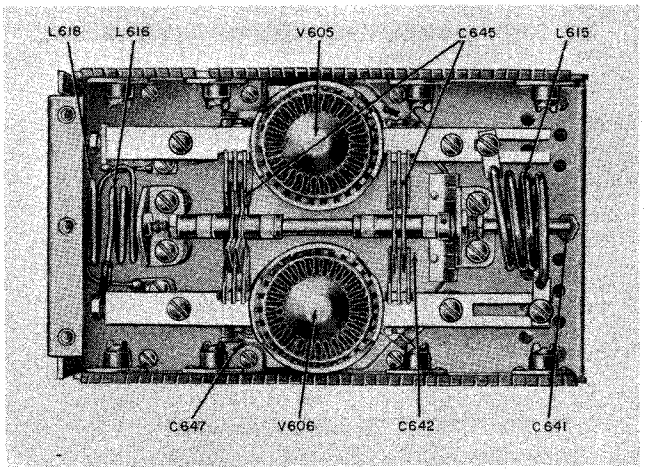



*Figure 7-18. Power Amplifier Shelf Assembly, Top View*

(7) The tuning drive may now be removed by removing the retaining screws on the rear plate.

(8) Reassembly procedure is similar to the preceding steps, but in reverse order. The tuning drive should first be mounted firmly, but not tightly, on its three mounting screws. The drive shaft should then be lined up with the capacitor shaft so that the coupling slides freely over the ends of both shafts. Tighten the coupling setscrew and then tighten the tuning-drive mounting screws. This assures perfect shaft alignment.

(9) Adjust and tighten coupling so that the gang capacitor is at maximum capacity when the tuning drive is against its stop.

(10) Align r-f circuits, as necessary. (See paragraph 4, this section.)

*e.* PA GRID AND OUTPUT FILTER TUNING CAPACITOR, C637. —If it should become necessary to replace or repair any part of capacitor C637, or to tighten or straighten any of the stator plate assemblies, removal of C637 from the Amplifier-Oscillator can be accomplished by the following steps (see figures 7-18 and 7-19):

(1) Loosen the Camloc fasteners and remove the side plates. Remove all crystals from the CRYSTAL SELECTOR switch (S601).

(2) Remove the six screws holding the top plate in place and remove the top plate assembly.

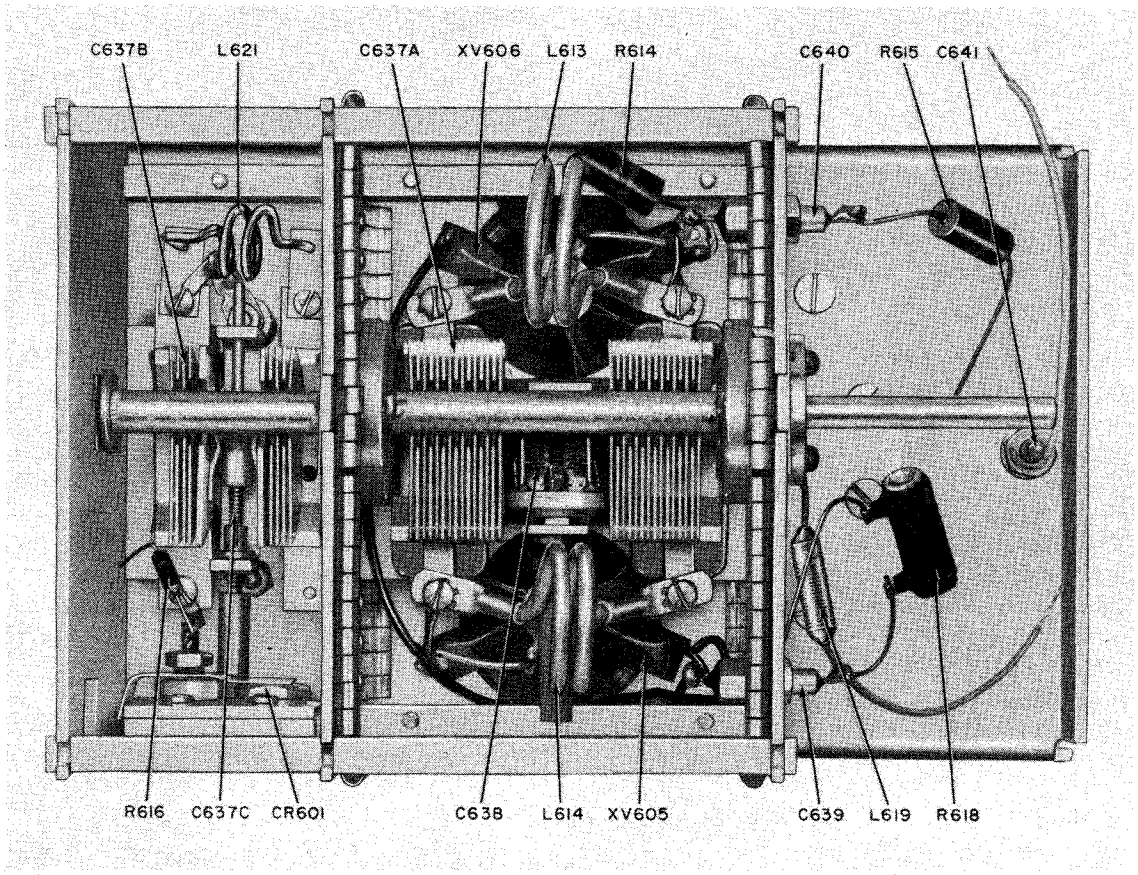



*Figure 7-19. Power Amplifier Shelf Assembly, Bottom View*

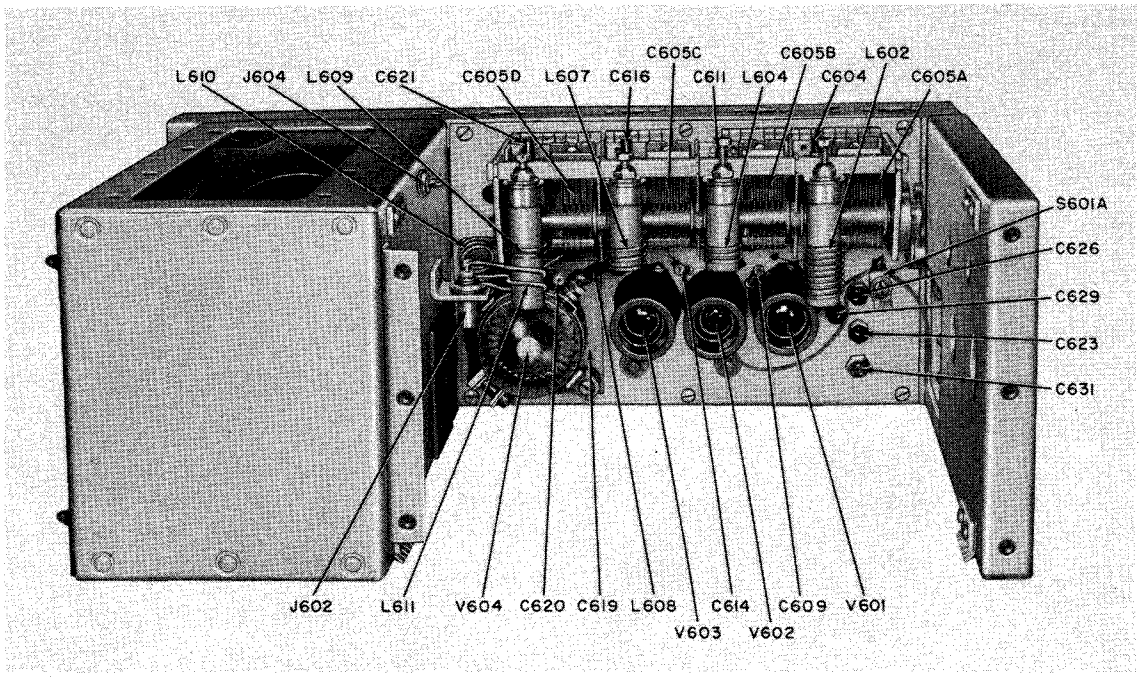



*Figure 7-20. Driver Shelf Assembly, Top View*

(3) Using the No. 6 Allen-head setscrew wrench (H102), mounted on the front of the Radio Modulator unit, remove and tag all front-panel dials, indicators, and knobs, except the CRYSTAL SELECTOR control, which is an integral part of the front-panel assembly.

**Note**

Use a 1/16-inch diameter drive-pin punch to remove the tapered pins in the tuning-lock knobs.

(4) Remove all screws around the sides and top of the front panel and take off the front panel.

(5) Loosen the setscrews in the rigid mechanical couplings between the P.A. TUNING and P.A. GRID TUNING drive shafts and the capacitor-bank shafts; slide the couplings back on their respective shafts. Use the No. 6 Allen-head setscrew wrench.

(6) Disconnect W601 from J603 to facilitate removal of electron tube V604.

(7) Remove all tubes and tube shields. Mark each tube and shield, so it may be replaced in the same socket.

(8) Set all capacitor gangs at maximum capacity.

(9) Unsolder the following connections:

(a) L620 at its junction to C636.
(b) R615 at its junction to C635.
(c) R618 at its junction to C633.
(d) L619 at its junction to C634.
(e) Lead to J604.
(f) R616 at its junction to C643.

(10) Remove the two vertical contact fingers on the left side of the PA-plate compartment.

(11) Remove the vertical contact finger from the right side, rear, of the PA-plate compartment.

(12) Remove the screws, front and rear, holding the PA shelf.

(13) Slide the PA shelf assembly, including the PA-grid capacitor, the PA shelf, and the PA-plate tank, to the left. Be careful to lift the assembly clear of C643 in the center-rear compartment and to clear L612, the PA-grid input coupling coil.

(14) Detach the terminal-lug assembly, consisting of two joined solder lugs, from capacitor C637B by removing the screw and lockwasher from the front stator of the capacitor.

(15) Detach the lug which grounds the frame of C637C by removing the hardware at the left-hand end of L618. Do not unsolder the lug from the capacitor frame.

(16) Unsolder the following connections:
(a) Grid leads to XV605 and XV606.
(b) L618 at its junction to C637B.
(c) Filament connection to C639.
(d) Filament lead to pin 3 of XV606.

(17) Pull clear the filament lead from XV605 to XV606. (Note the position of this lead, as it must be replaced in the same position.)

(18) Remove the six screws holding the capacitor C637 to the PA shelf, being careful not to lose the spacers.

(19) Capacitor C637 can now be completely removed for service or replacement.

(20) The stators can be adjusted to position at this time, if desired, by loosening the screw holding the individual stators.

(21) To reassemble, perform the preceding steps in reverse order. Be certain to ground the lug soldered to the frame of C637C by securing it with the hardware which grounds the left end of L618. When tightening the couplings between the tuning drives and the capacitor shafts, each capacitor must be at maximum capacity when the tuning drive is against its stop.

(22) Align r-f circuits as necessary. (See paragraph 4, this section.)

*f.* R-F DRIVER TUNING CAPACITOR, C605. —If it should become necessary to replace or repair any part of C605, or to tighten or straighten any of the stator plate assemblies, removal of C605 from the Amplifier-Oscillator can be accomplished by the following steps (see figure 7-20):

(1) Follow steps (1) through (13) of paragraph 3e, this section, performing step (5) for all three tuning drives; refer to figures 7-18 and 7-19.

(2) Unsolder the leads to C633, C634, C635, C641, and C644.

(3) Remove the screws which secure the intermediate shelf to the blower compartment at the rear and to the front frame. Remove the shelf by lifting the front end and sliding out.

(4) Remove W601 from J602.

(5) At this point, any of the driver tank coils (L602, L604, L607, L609, or L610) may be removed and replaced if such is required.

(6) Unsolder C602, C609, C614, and C620 from the stators of C605.

(7) Take out the 15 retaining screws which secure the bottom cover plate to the frame and remove the plate.

(8) Remove C605 by removing the three screws which hold it in position; the screws are accessible from the bottom of the driver shelf. Do not lose the spacers.

(9) To reassemble, perform the preceding steps in reverse order. When tightening the couplings between the tuning drives and the capacitor shafts, each capacitor must be at maximum capacity when the tuning drive is against its stop.

(10) Align r-f circuits, as necessary. (See paragraph 4, this section.)

*g.* MISCELLANEOUS REPAIR. —Because of the frequencies at which the r-f stages operate, care must be taken when replacing any components or leads. This is especially true insofar as the tripler-plate and power-amplifier circuits are concerned. The length and position of the leads in these stages are very critical. If any of the leads are to be replaced, they must be cut to the exact length of the original lead and placed as nearly as possible in the same position. Shortening or lengthening of any of these leads may make it impossible to track the r-f circuits. The indications that may be expected are these: Lengthening a lead will result in reduction of tuning range and adjustment of the trimmer capacitor will not bring in the high end of the band. A shorter lead will allow the trimmer a greater range, but will cause trouble in trying to track both ends of the band. The middle range frequencies will also be difficult to track.

If it is necessary to replace any of the ceramic feed-through capacitors used in the r-f circuits, extreme care must be taken. These capacitors are extremely fragile; mechanical stress or overheating while soldering will result in damage to components of that type.

When making any repairs in the Amplifier-Oscillator, exercise care not to bend or otherwise damage the grounding contact fingers used in that unit. Should any of the fingers be out of line and not contacting the cover plates, the effective r-f shielding will be considerably reduced.

**4. R-F ALIGNMENT.**

*a.* CHECKING ALIGNMENT.

**Note**

The Radio Transmitter must be completely assembled during alignment or a check thereof. Do not use the test cables for interconnections.

(1) After being certain that the CRYSTAL SELECTOR is resting in one of its four positions, open the access door to the crystal compartment. If the switch is between two normal positions, the access door will not open without being forced. Forcing the door may damage the crystal holders.

(2) Insert the crystal for the low-frequency end of the band, 115 mc (oscillator frequency 19.167 mc), in CRYSTAL SELECTOR switch position 1. Insert the crystal for the high-frequency output, 156 mc (oscillator frequency 26.00 mc), in position 4 of the CRYSTAL SELECTOR. Two middle-frequency crystals may

be used in positions 2 and 3 for spot-checking the alignment.

(3) Set the CRYSTAL SELECTOR to position 4, the high-frequency crystal. Tune the equipment, following the instructions in Section 4, paragraph 2.

(4) Check the tracking at the high end by switching the METER switch to DOUBLER $I_g$, to read doubler grid current. Vary the R.F. DRIVER TUNING control to note the position of the maximum reading. Then set the METER switch to TRIPLER $I_g$ and vary the tuning control. The maximum reading should occur at the same tuning-dial position for both the doubler and tripler grid readings. If it is found that the stages do not track, proceed with the alignment procedure outlined below.

(5) Switch the CRYSTAL SELECTOR to position 1 and tune the low end of the band. Check tracking on the low end in the same manner as in step (4) above.

*b.* HIGH-FREQUENCY TRACKING.—If it has been established that the r-f stages are not tracking, they should be aligned by using the following procedure:

(1) Switch the CRYSTAL SELECTOR to position 4, the high-frequency crystal.

(2) Push the sliding cover plate for the trimmer capacitors and slug adjustments toward the rear of the Amplifier-Oscillator unit, using the tabs projecting from the hole nearest the front of the chassis. (See figure 7-10).

(3) Set the R.F. DRIVER TUNING, the P.A. GRID TUNING, and the P.A. TUNING controls all to 458. Turn the METER switch to OUTPUT to read the relative r-f output.

(4) Operate the CARRIER TEST switch and adjust the P.A. TUNING control for maximum output.

(5) Set the METER switch to DOUBLER $I_g$ to read doubler grid current, and operate the CARRIER TEST switch. Tune the oscillator plate trimmer, C604, for maximum doubler grid current.

(6) Set the METER switch to TRIPLER $I_g$ to read the tripler grid current, and operate the CARRIER TEST switch. Tune the doubler plate trimmer, C611, for maximum tripler grid current. Then adjust the amplifier plate trimmer, for a similar indication. Repeat both adjustments as often as necessary to obtain maximum grid current.

(7) Turn the METER switch to PA $I_g$, measuring C616, the grid current in the power amplifier, and operate the CARRIER TEST switch. Adjust the tripler plate trimmer, C621, for maximum meter indication. Follow this with a similar adjustment of the PA grid trimmer, C638. Repeat these adjustments until the highest possible reading is obtained.

(8) Set the METER switch to OUTPUT and operate the CARRIER TEST switch. Readjust the P.A. TUNING control (D) for maximum r-f output. Then tune the output filter trimmer, C637C, for maximum output. Retune control D and trimmer C637C as often as necessary to obtain the maximum output.

**Note**

If any tubes in the r-f driver stages are changed, only the adjustments described in the preceding steps need be performed. It is not necessary to track the low-frequency end of the tuning range.

*c.* LOW-FREQUENCY TRACKING.

(1) Place the CRYSTAL SELECTOR in position 1, the low-frequency crystal. Set the three r-f tuning controls (B, C, and D) each to 195.

(2) Turn the METER switch to OUTPUT and operate the CARRIER TEST switch. Adjust the P.A. TUNING control (D) for maximum r-f output.

(3) Turn the METER switch to DOUBLER $I_g$ and operate the CARRIER TEST switch. Adjust the slug of L602, in the oscillator plate tank, for maximum grid current.

(4) Turn the METER switch to TRIPLER $I_g$ and operate the CARRIER TEST switch. Adjust the slug of L604, in the doubler plate tank, for maximum grid current. Then adjust the slug of L607, in the amplifier plate tank, for a similar indication. Repeat these two adjustments as often as necessary to obtain maximum current in the tripler grid circuit.

(5) Turn the METER switch to PA $I_g$ and operate the CARRIER TEST switch. Adjust the slug of L609, in the tripler plate tank, for maximum PA grid current. If difficulty is encountered in obtaining a maximum, coil L610 should be physically compressed or expanded so that L609 tracks at approximately the middle of its tuning range; see figure 7-20.

(6) Check the alignment of the power-amplifier grid circuit by varying the grid trimmer capacitor, C638. If the grid tank is properly tracking, the reading on the meter should decrease as it is varied each side of its original position. No further adjustment is necessary in the grid for the low end of the band, if this is the case. If a rise in grid current occurs when the

trimmer capacity is decreased, the inductance of L614 should be decreased, and vice versa.

If it is found necessary to adjust the grid coil, the right side plate of the unit must be removed. Sixteen Camloc fasteners hold this cover plate in position. Adjustment of the grid coil of the power amplifier must be made by compressing or expanding the turns of the coil as necessary. Each time an adjustment is made, the side plate must be replaced and the tracking checked. Never try to check the alignment of the grid circuit without the side cover plate in place. The absence of the plate will change the entire alignment of the r-f circuits. To increase the inductance of L614, compress the turns. To decrease the inductance of L614, spread the turns farther apart. Very little movement of the coil turns is required to change the settings, so any adjustment made should be very slight. When making any adjustment, care must be taken that the coil is not pushed in or pulled out toward the side plate. The proper position of the coil is approximately three quarters of an inch in from the mounting surface of the side plate. If the coil is pushed in further than this limit, difficulty in tracking the lower frequencies will result. Moving the coil out toward the side plate will cause an increase in the capacitance of the circuit and it will not tune the high end of the range.

(7) Turn the METER switch to OUTPUT, and operate the CARRIER TEST switch. Check the tracking of the plate tank at the low end by tuning it with control D. If a peak cannot be obtained, or the peak occurs too high above the minimum calibration, it will be necessary to adjust the inductance of the plate coil by spreading or compressing the turns.

Turn the equipment off to remove all voltages. Remove the top cover plate to gain access to the plate-tank coil. If a peak meter reading cannot be obtained, increase the inductance of coil L615 by compressing the turns. If the peak occurs too far above the nominal calibration point on the dial, reduce the inductance by spreading the turns apart. Very little movement of the coil turns is required to change the dial setting, so that any adjustment made should be slight. When making adjustments, do not pull the coil out of position; see the precautions in subparagraph (6) above. After adjusting L615, replace the cover and check the calibration; readjust if necessary. Do not check the calibration without the cover in place, since the entire calibration of the unit will be affected.

(8) Turn the METER switch to PA $I_p$ and operate the CARRIER TEST switch. Check the PA plate current. Repeat this procedure at the high-frequency end of the tuning range. If the output coupling is correctly set, readings between 75 and 87 should result. If readings greater than 87 are obtained, decrease the coupling by increasing the separation between coils L616 and L618 (see figure 7-18). Conversely, if the plate-current readings are low, decrease the spacing between the coils.

(9) After completing the alignment on the low end of the range, it will be necessary to repeat the entire alignment at the high end. Some changes will occur at the high end because of adjustments made at the low end. The readjustments at the high end, if necessary, will necessitate rechecking the low end once again. Repeat this procedure until no change is noted in the meter readings at either end.

*d.* MID-RANGE TRACKING. —When the alignment of the high and low ends of the band is complete, the tracking at some mid-range frequency should be checked. This may be done by switching the CRYSTAL SELECTOR to position 2 and setting the METER switch to DOUBLER $I_g$ to read the doubler grid current. Adjust the R.F. DRIVER TUNING control to check the position of maximum current indication. Turn the METER switch to TRIPLER $I_g$ and again adjust the R.F. DRIVER TUNING control. The reading should fall off on either side of the original setting of the tuning control. If it does not, the maximum is occuring at a different point from that of the doubler and the unit is not tracking. It can be made to track by adjusting the serrated plates of the tuning capacitors in the driver section.

The right side cover plate of the Amplifier-Oscillator unit must be removed to give access to the capacitor plates. Before adjusting any of the serrated plates of any of the tuning capacitors in the driver section, vary the trimmer capacitor of the stage in question to see where the peak reading occurs. Should the trimmer capacitor have to be increased to obtain a peak, the serrated plates (the two outside plates of the capacitor) must be bent inward. If the trimmer capacitance has to be decreased to obtain a peak, the capacitance of the tuning capacitor must be decreased by pushing the serrated plates out. Should it be necessary, compensation in one stage may be accomplished by compensation in the opposite direction in other stages. Adjustments made in the first stages of the driver can be checked without replacing the side plate. The additional capacitance when the plate is replaced can be compensated for by adjusting the trimmers. The spacing of the plates of the tuning capacitors is not too critical in regard to arcing in these first stages. Very little rf is present and there is no

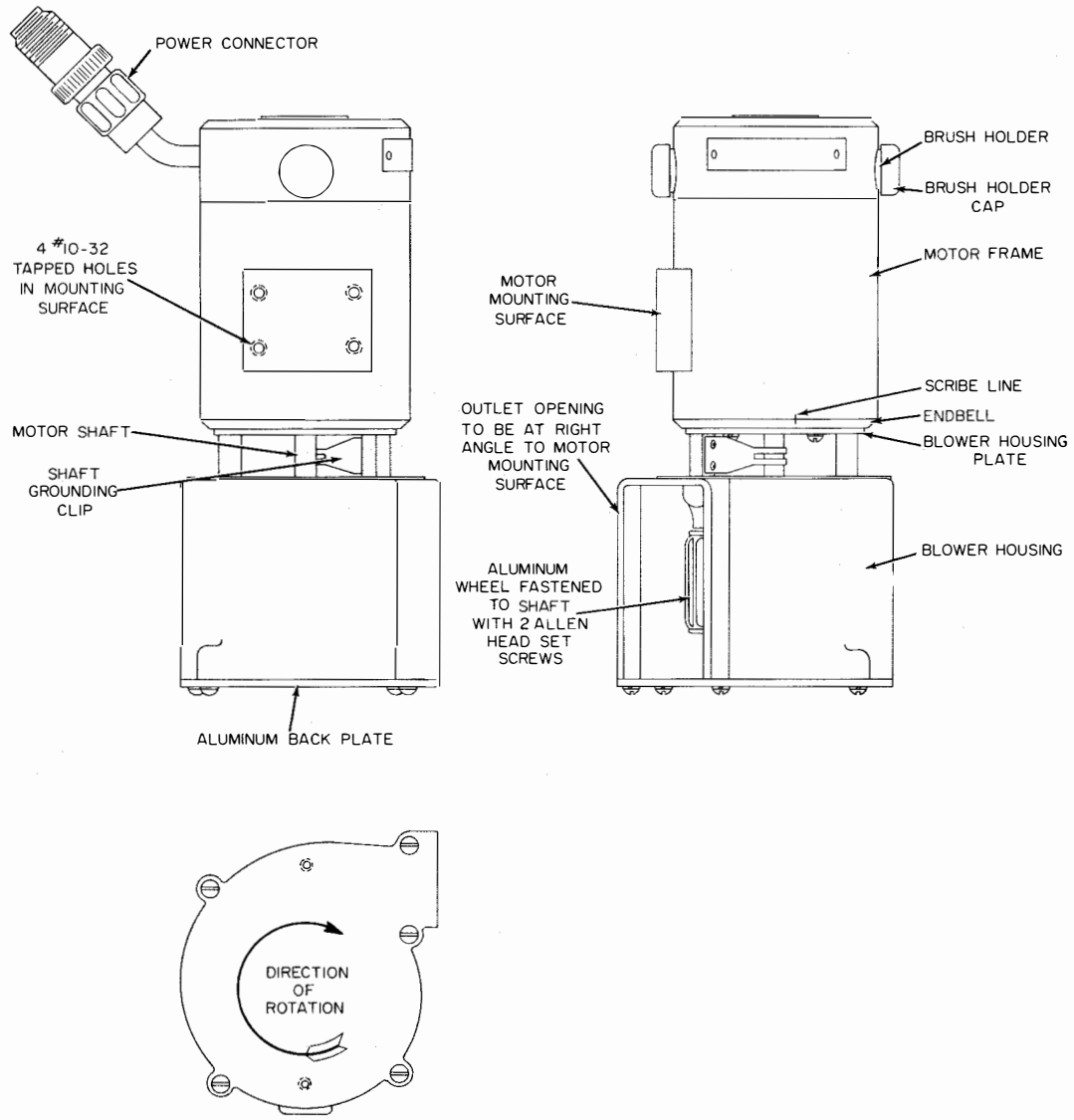



*Figure 7-21. Blower, Outline Drawing*

dc on the capacitor since the stages are shunt fed. Adjustments of the serrated plates of the tripler tuning capacitor, however, must be made with care. There will be a considerable amount of r-f energy present in this tank circuit and it may cause arcing between the plates of the capacitor.

## 5. ADJUSTMENT OF NONOPERATIONAL RADIO MODULATOR CONTROLS.

*a.* GENERAL.—Although the operating instructions in Section 4 cover the adjustment of the switches (AVC, VOL EXP, and CLIP-FILT) located internally in the Radio Modulator unit, as well as those controls mounted on the front panel, there are several screwdriver-adjusted controls in that unit which are not normally used by operating personnel. These controls, illustrated in figure 5-1, are preset at the factory prior to shipment and should not be varied unless there is evidence of improper operation of the circuits with which each is associated. It is imperative that the recommended test equipment be available before any changes are made in the control settings; refer to paragraph 2c, this section.

*b.* CLIPPING SYMMETRY CONTROL, R113.—Potentiometer R113 should be readjusted only if major repairs are made in the clipper circuit. If it is necessary to readjust the control, an oscilloscope (AN Type OS-8/U, Navy Model OBL or OBT, or equal) and an audio oscillator with a calibrated output (Navy Model LAJ, or equal) are required to perform the following steps.

(1) Set the MCW-PHONE switch (S101) to PHONE, turn the SP AMP gain control (R101) to zero, and the MOD level control (R115) to approximately 2. Atop the Radio Modulator chassis, the CLIP-FILT switch (S103) must be ON and the AVC switch (S102) OFF.

(2) Connect the output of the audio oscillator directly across the input winding of input transformer T101. This connection can be made at pins C and D of the HANDSET connector (J403).

(3) Connect the vertical input of the oscilloscope between the wiper arm (center terminal) of R115 and ground.

(4) Advance the SP AMP gain control unit a slight amount of clipping, evidenced by flattening of the sine-wave peaks, becomes visible on the oscilloscope.

(5) Loosen the locknut and adjust clipping symmetry potentiometer R113 until the degree of clipping on the positive half-cycles is equal to the degree of clipping on the negative half-cycles. Tighten the locknut on R113.

*c.* MCW MODULATION LEVEL CONTROL, R141. —The setting of potentiometer R141 can be checked by MCW operation of the Radio Transmitter, as follows:

(1) Turn the MCW-PHONE switch (S101) to MCW and set the METER switch (S401) to MOD; operate the CARRIER TEST switch (S405). The front-panel meter should indicate approximately 58.

(2) If the meter reading is other than 58, loosen the locknut on potentiometer R141 and adjust the control until the proper reading is obtained. Tighten the locknut.

*d.* MCW OSCILLATOR FREQUENCY CONTROL, C124. —If any of the components in the MCW-oscillator circuit are replaced, especially those which comprise the R-C phase-shifting network, it may be necessary to reset the oscillator frequency to 1,000 cps. To accomplish this adjustment, an oscilloscope (AN Type OS-8/U, Navy Model OBL or OBT, or equal) and an audio oscillator (Navy Model LAJ, or equal) are needed.

(1) Set the oscilloscope sweep control for an external sweep source. Connect the output of the audio oscillator to the horizontal input terminals of the oscilloscope to provide a 1,000-cps sinusoidal sweep.

(2) Connect the vertical input terminals of the oscilloscope between terminal 5 of interstage transformer T102 and ground; see figure 7-15. Exercise care not to short out the bias voltage on the modulator tubes.

(3) Set the MCW-PHONE switch (S101) to MCW and operate the CARRIER TEST switch (S405).

(4) Adjust frequency-control capacitor C124 until an elliptical or straight-line pattern is observed on the oscilloscope, indicating that the MCW-oscillator frequency is equal to the 1,000-cps frequency of the audio oscillator.

*e.* MCW TIME-DELAY CONTROL, R131. —In MCW operation, the carrier should remain on for 1.0 ±0.2 seconds after the key is opened. This time delay is introduced so that there is no break in transmission between the keyed characters and words. The hold time can be checked by using a watch with a sweep second hand (or a stop watch, if available) in conjunction with the front-panel meter, as follows:

(1) Set the MCW-PHONE switch (S101) to MCW and the METER switch (S401) to OUTPUT.

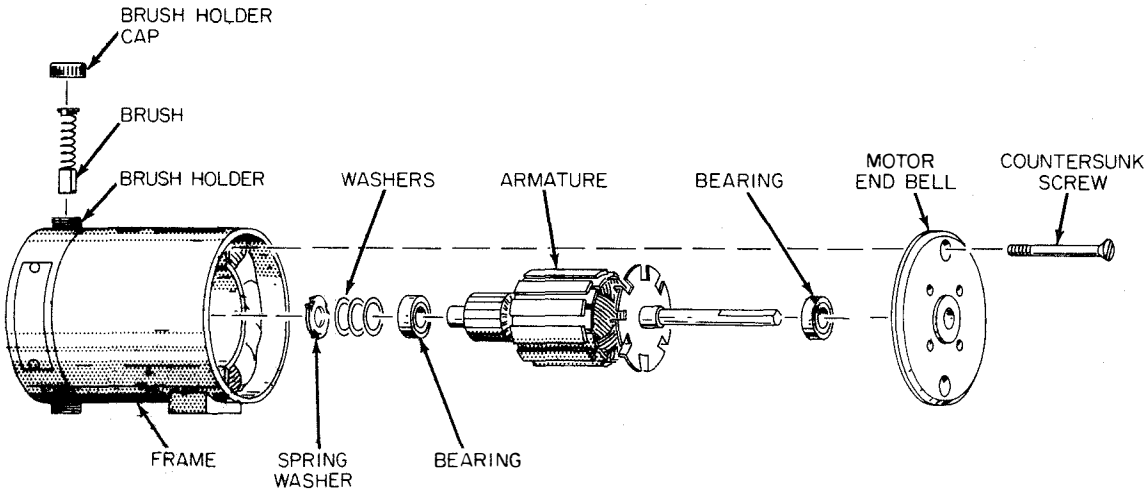
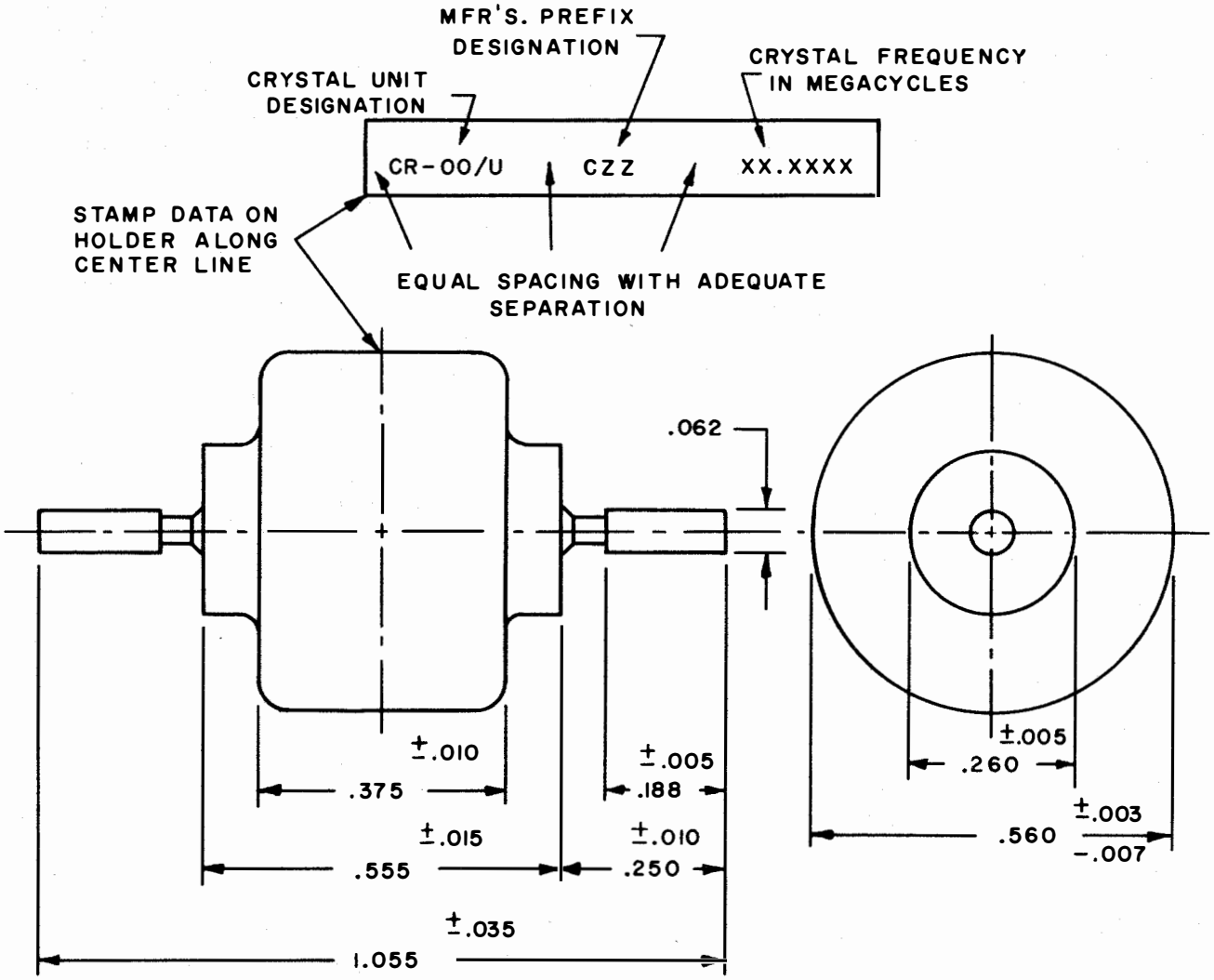



*Figure 7-22. Blower Motor, Exploded View*




1. FREQUENCY RANGE OF CRYSTALS USED = 19.1667 TO 26.0000 MC.
2. METHOD OF MULTIPLICATION = CRYSTAL FREQUENCY X2 X3.
3. TEMP. CHARACTERISTIC = ±0.005% DEVIATION BETWEEN -55°C(-67°F) AND +90°C(+194°F).
4. TEMPERATURE OF OPERATION AND CALIBRATION = -55°C(-67°F) TO +90°C(+194°F).
5. MODE OF OPERATION = 5TH MODE FOR 25-50 MC., 3RD MODE FOR 15-25 MC.

*Figure 7-23. Crystal Unit CR-24/U, Outline and Data*

(2) Hold the watch next to the front-panel meter so that both are in the field of vision. Operate the CARRIER TEST switch (S405).

(3) Check the reading of the second hand of the watch and simultaneously release the CARRIER TEST switch. Note the interval between the time the CARRIER TEST switch was released and the time that the meter pointer starts to drop.

**Note**

An alternate indication for the drop in meter reading is to check, either by watching or listening, the time of release of relay K401 or K403 (see figure 7-6).

(4) If the timed interval is less than 0.8 second, loosen the locknut and adjust potentiometer R131 counterclockwise until the proper delay is obtained, repeating steps (2) and (3) as necessary. If the interval is greater than 1.2 seconds, adjust R131 in a clockwise direction. Then tighten the locknut.

**6. BLOWER MOTOR.**

(See figures 7-21 and 7-22)

*a.* REMOVAL FOR SERVICING. —The motor and blower used in this transmitter are located at the rear of the amplifier-oscillator unit. To remove the motor and blower for servicing, proceed as follows:

(1) Remove the bottom cover plate of the amplifier-oscillator unit. This plate is held in place by 16 screws.

(2) Loosen the four fasteners holding the air filter and remove the filter.

(3) Disconnect the mating connectors P-603 and P-604 which are exposed after removing the end plate.

(4) Remove the left-side cover plate of the motor housing.

(5) Remove the right-side cover plate.

(6) Disconnect the antenna coaxial lead. This connector is located in the motor housing and will otherwise interfere with the removal of the motor.

(7) Take out the four screws from the mounting plate on the left side; remove the two screws and lockwashers that hold E601.

(8) Move E601 out of the way and lift the blower out through the bottom of the chassis.

*b.* INSPECTION OR REPLACEMENT OF BLOWER MOTOR BRUSHES. —To inspect or replace the blower motor brushes, proceed as follows:

(1) Remove the right and left side cover plates over the blower motor in the amplifier-oscillator unit.

(2) Remove the brush holder caps.

(3) Remove the brush assembly consisting of cap, spring, shunt, and carbon.

(4) If the brushes are less than one-half inch long, clean the motor, as described in subparagraph d, and replace the brushes.

(5) Insert the brush assembly. Care should be taken that the beryllium copper coil spring is loaded into the brush holder evenly and not distorted in the operation.

*c.* REPLACEMENT OF BLOWER HOUSING.

(1) Remove the blower motor assembly from the amplifier-oscillator unit as described in subparagraph a.

(2) Remove the aluminum backplate (secured by five screws) from the molded blower housing.

(3) Remove the aluminum wheel from the motor shaft by inserting an Allen wrench through the opening of the blower outlet port and loosening the two setscrews.

(4) Remove the blower housing by inserting a long screwdriver through the blower housing and removing the four screws and lockwashers which secure the blower housing plate to the endbell.

(5) Replace the old blower housing with a new one. Reassemble by reversing the procedures given above. Note that the blower outlet opening is at a right angle to the motor mounting surface (see figure 7-21).

*d.* REPLACEMENT OF BLOWER MOTOR BEARINGS.

(1) Remove blower motor and housing assembly from the amplifier-oscillator unit as described in subparagraph a.

(2) Remove the blower housing from the motor frame as described in subparagraph c.

(3) Remove the brush-holder caps, and the brush assemblies (consisting of cap, spring, shunt, and carbon).

(4) Scribe a line on the endbell and motor frame to show proper alignment. Remove endbell by removing the two countersunk screws (figure 7-22).

(5) Withdraw the motor armature from the frame, being careful not to lose the washers used at the end of the armature shaft. Blow out carbon dust from motor parts.

(6) Remove the two ball bearings with a bearing puller. Do not misalign the armature shaft by exerting excessive pressure during this operation.

(7) Fit two new ball bearings (0-608) on the shaft, using an arbor press or suitable bearing installer tool. Locate them in the same positions as those just removed.

(8) Replace the armature in the motor frame; be certain to replace the flat washers between the closed end of the frame and the bearing.

(9) Replace the spring-loading washer on the shaft so that the flat surface of the washer will fit flush against the inner surface of the endbell. Replace the endbell.

(10) Replace all other parts in reverse sequence from the preceding disassembly procedure.

*e.* REPLACEMENT OF BLOWER MOTOR ASSEMBLY.—When replacing the blower motor assembly in the amplifier-oscillator unit, reverse the procedure given in subparagraph a. Be sure to line up the blower nozzle with the air vent in the housing before fastening the motor in place.

## 7. ADJUSTING THERMAL RELAY K404.

Thermal relay K404 (see figure 7-7) should normally open, thereby disabling the transmitter, when the temperature within the transmitter becomes excessive. A test and adjustment procedure for this relay can be performed as follows:

*a.* Remove the transmitter from the cabinet and operate it out of the cabinet.

*b.* Slide a thin metal or fiber sheet between the left side of the Amplifier-Oscillator and down past transformer T401 and reactor L401 on the power supply (see figure 7-6). This covers an opening on the power supply, and thereby prevents thermal relay K404 from receiving the cooling air stream from the Amplifier-Oscillator.

*c.* Thermal relay K404 should open and disable the transmitter in 20 to 30 seconds after the air stream is cut off.

*d.* If the relay does not function as specified, adjust the relay by first loosening the locknut and turning the thermal relay adjusting screw. This adjustment is located above CR101 (see figure 7-7).

*e.* If the first adjustment does not bring the time of disabling between 20 and 30 seconds, readjust the relay again, taking note if the disabling time is more or less out of limits.

*f.* After the relay is adjusted, tighten the locknut on the adjusting screw, remove the thin sheet, and slide the transmitter back into the cabinet.

## 8. COMPONENT DATA.

*a.* ELECTRON TUBES.—The rated characteristics of all electron tubes used in the equipment appear in table 7-4. Indications of faulty operation which may be rectified by replacement of one or more tubes are listed in table 5-3 and are treated in the trouble-shooting portions of paragraph 2, this section.

**Note**

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO EMPLOYMENT OF TUBES FROM GENERAL STOCK.

*b.* CRYSTALS.—All pertinent data for Crystal Unit CR-24/U, used as the frequency-controlling component in this equipment, appear in figure 7-23.

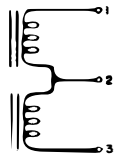
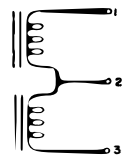
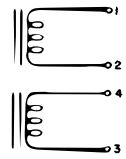
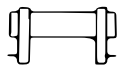
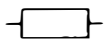
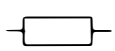
*c.* TRANSFORMERS AND INDUCTORS.—The inductance, d-c resistance, turns ratio, wire size and number of turns, and other miscellaneous information (as applicable) for all transformers, chokes, and coils used in this equipment are listed in table 7-5.

**TABLE 7-4. TUBE CHARACTERISTICS**

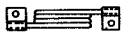
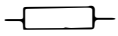
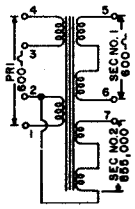
| TUBE TYPE | FILAMENT VOLTAGE (V) | FILAMENT CURRENT (A) | PLATE VOLTAGE (V) | GRID BIAS (V) | SCREEN VOLTAGE (V) | PLATE CURRENT (MA) | SCREEN CURRENT (MA) | A-C RESISTANCE OHMS | VOLTAGE AMPLIFICATION FACTOR (MU) | NORMAL TRANSCONCUCT. MICROMHOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 3B28 | 2.5 | 5.0 | 10,000* | — | — | — | — | 8V drop | — | — |
| 4X150A | 6.0 | 2.6 | 600 | -75 | 250 | 200 | 37 | — | — | 12,000 approx. |
| 5726/ 6AL5W | 6.3 | 0.3 | 460* | — | — | — | — | — | — | — |
| 6AT6 | 6.3 | 0.3 | 250 | -3 | — | 1.0 | — | 58,000 | 70 | 1200 |
| 5749/ 6BA6W | 6.3 | 0.3 | 250 | -20 | 100 | 11 | 4.2 | 1 meg. | — | 4400 |
| 12AT7WA | 6.3 | 0.3 | 250 | -2 | — | 10.0 | — | 10,000 | 55 | 5500 |
| 5814 | 6.3 | 0.35 | 250 | -8.5 | — | 10.5 | — | 7700 | 17 | 2200 |
| 807 | 6.3 | 0.9 | 600 | -30 | 300 | 100 | 6.5 | — | — | 6000 approx. |

*Peak inverse voltage.

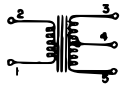
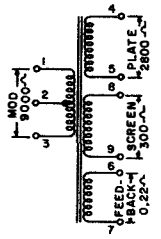
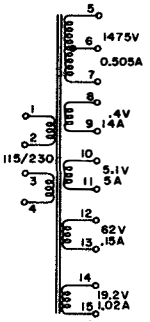
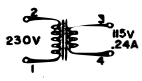
## TABLE 7-5. WINDING DATA

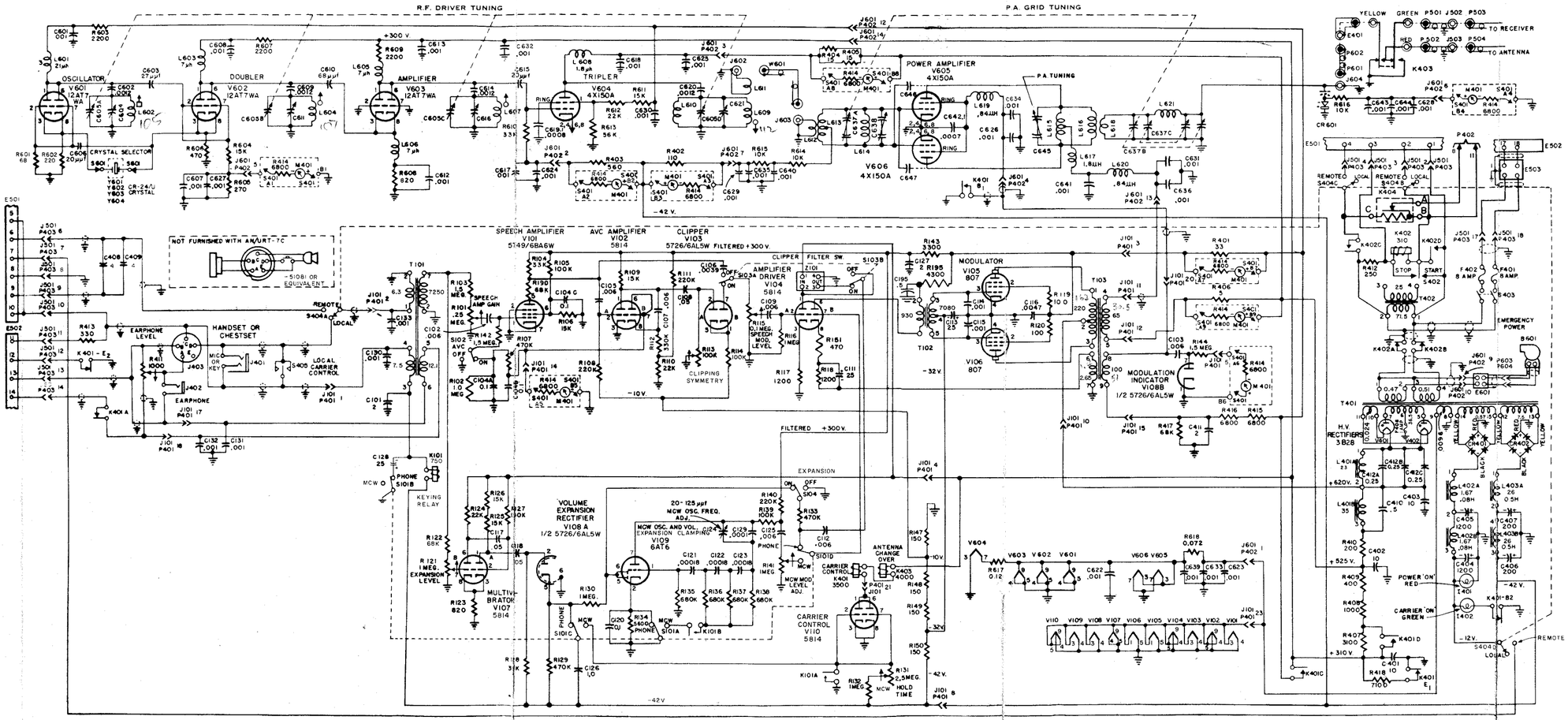
| DESIGNATION SYMBOL | PART NO. | DIAGRAM | WINDING | WIRE SIZE | TURNS | MAXIMUM D.C. RESISTANCE IN OHMS | IMPEDANCE RATIO | HIPOT AC VOLTS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| L401 | LC-0213 |  | 1-2 | #24E | 1121 | 23 | — | 3100 | Inductance: 2.6 hys min at 0.5 A DC and 240 v RMS 120 cps across winding. |
| | | | 2-3 | #26E | 1300 | 35 | — | 3100 | Inductance: 2.6 hy s min at 0.4 A DC and 25 v 120 cps across winding. |
| L402 | LC-0214 |  | 1-2 | #21E | 216 | 1.67 | — | 5000 | Inductance measured across (1-2) or (2-3): 0.080 hy min at 600 ma dc with 0.3 v RMS (2-3) and 7 v RMS (1-2), 120 cps, across winding. |
| | | | 2-3 | #21E | 216 | 1.67 | — | 5000 | |
| L403 | LC-0215 |  | 1-2 | #30E | 650 | 26.0 | — | 500 | 1. Across winding 4-3: Min inductance = 0.5 hy at 0.13 A DC and 0.3 v RMS 120 cps. |
| | | | 2-3 | #30E | 650 | 26.0 | | 500 | 2. Across winding 1-2: Same as above except 35 v RMS. |
| L601 | LC-0210 |  | Single-layer solenoid | #34 | 115 | 2.4 | — | — | Inductance: 21 microhenries; resonance frequency: above 40 mc; current rating: 600 ma. |
| L602 | VG-2892 |  | Single-layer solenoid | 0.064" D. Silver plated | 12 | — | — | — | |
| L603 L605 L606 | LC-0209 |  | Single-layer solenoid | #33 | 57 | 0.894 | — | — | Inductance: 7.0 microhenries; resonance frequency: above 80 mc; current rating: 1000 ma. |
| L604 L607 | VG-2895 VG-2894 |  | Single-layer solenoid | 0.064" D. Silver plated | 5 | — | — | — | L607 similar to L604 except for Part No. |
| L608 L617 | LC-0208 |  | Single-layer solenoid | #32 | 35 | 0.294 | — | — | Inductance: 1.8 microhenries; resonance frequency: 180 mc; current rating: 1000 ma. |
| L609 | VG-2893 |  | Single-layer solenoid | 0.064" D. Silver plated | 2 | — | — | — | |

## TABLE 7-5. WINDING DATA (Cont)

| DESIGNATION SYMBOL | PART NO. | DIAGRAM | WINDING | WIRE SIZE | TURNS | MAXIMUM D.C. RESISTANCE IN OHMS | IMPEDANCE RATIO | HIPOT AC VOLTS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| L610 | LW-0087 |  | Single-layer solenoid | 0.064" D. Silver plated | 2-1/2 | — | — | — | |
| L611 | LW-0060 |  | Single-layer solenoid | 0.064" D. Silver plated | 2 | — | — | — | |
| L612 | LW-0061 |  | Single-turn loop | 0.064" D. Silver plated | 1 | — | — | — | |
| L613 | LW-0085 |  | Single-layer solenoid | #8 Silver plated | 2 | — | — | — | |
| L614 | LW-0079 |  | Single-layer solenoid | #8 Silver plated | 2 | — | — | — | |
| L615 | LW-0091 |  | Single-layer solenoid | #8 Silver plated | 3 | — | — | — | |
| L616 | LW-0093 |  | Single-layer solenoid | #8 Silver plated | 2-1/2 | — | — | — | |
| L618 | LW-0089 |  | Single-turn loop | #11 Silver plated | 1-1/4 | — | — | — | |
| L619<br>L620 | LC-0207 |  | Single-layer solenoid | — | — | 0.049 | — | — | Inductance: 0.84 microhenries; resonance frequency: above 260 mc; current rating: 1000 ma. |
| L621 | LW-0095 |  | Single-layer solenoid | 0.064" D. Silver plated | 2 | — | — | — | |
| T101 | LA-0053 |  | Primary #1<br>Primary #2<br>Sec. #1<br>Sec. #2 | #30E<br>#30E<br>#31E<br>#44E | 191<br>191<br>270<br>10,380 | 6.3<br>7.5<br>12.1<br>7250 | | 1250<br>1250<br>1250<br>1250 | |

## TABLE 7-5. WINDING DATA (Cont)

| DESIG-NATION SYMBOL | PART NO. | DIAGRAM | WINDING | WIRE SIZE | TURNS | MAXIMUM D.C. RESIST-ANCE IN OHMS | IMPEDANCE RATIO | HIPOT AC VOLTS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| T102 | LM-0058 |  | Primary (1-2) | #42E | 2450 | 930 | 7700 ohms | 1500 | |
| | | | Secondary (3-4-5) | #43E | 11,200 C.T. | 7080 | 136,000 ohms C.T., 17.7:1 | 1500 | |
| T103 | LH-0001 |  | Modulator | #33E | 1930 C.T. | 220 | | 3000 | |
| | | | Plate | #29E | 773 | 65 | | 3000 | |
| | | | Screen | #35E | 283 | 100 | | 2500 | |
| | | | Feedback | #35E | 7 | 2.65 | | 500 | |
| T401 | LP-0234 |  | Primary (1-2) | #17E | 86 | 0.47 | — | 1000 | |
| | | | Primary (3-4) | #17E | 86 | 0.51 | — | 1000 | |
| | | | Plate (5-6-7) | #24E | 1148 | 36.5 | — | 3500 | |
| | | | Fila. #1 (8-9) | #9E | 5 | 0.0095 | — | 500 | |
| | | | Fila. #2 (10-11) | #15E | 4 | 0.024 | — | 500 | |
| | | | Sel. Rect.#1 (12-13) | #30E | 49 | 7.5 | — | 500 | |
| | | | Sel. Rect.#2 (14-15) | #24E | 15 | 0.57 | — | 500 | |
| T402 | LP-0235 |  | Primary (1-2) | #31E | 1570 | 71.5 | — | 100 | |
| | | | Secondary (3-4) | #28E | 850 | 25 | — | 500 | |




NOTES:

1. CAPACITOR VALUES IN MICROFARADS EXCEPT WHERE OTHERWISE NOTED. RESISTOR VALUES IN OHMS EXCEPT WHERE OTHERWISE NOTED. K=1000 OHMS.
2. ALL WAFER SWITCHES SHOWN IN NORMAL OPERATING POSITION.
3. ALL RELAYS SHOWN UNENERGIZED.
4. ARROW ACROSS ARM OF POTENTIOMETER SHOWS DIRECTION OF CLOCKWISE ROTATION FACING SHAFT END
5. THIS DIAGRAM IS DRAWN FOR 115 V. AC OPERATION.
6. DC RESISTANCE OF COILS AND TRANSFORMER WINDINGS IS LESS THAN ONE OHM UNLESS OTHERWISE NOTED. NUMBER WITH ARROW REFERS TO TOTAL DC RESISTANCE OF THE WHOLE WINDING IN OHMS.
7.

| SPARE TERMINALS | | GROUNDED TERMINALS | |
|---|---|---|---|
| P401, J101 | 9, 13, 16, 19, 22 | P401, J101 | 6, 7 |
| | | P402, J601 | 15 |
| | P403, J501 | 5, 15, 16 | |
| E502 | 15, 16, 19, 20 | | |

8. THE INDICATOR CIRCUIT (M401, R414, S401A, B) ENCLOSED IN DOTTED LINES IS SHOWN FUNCTIONALLY. SELECTOR SWITCH S401 TRANSFERS INDICATION TO THE FOLLOWING CIRCUITS:

| POSITION | INDICATION | POSITION | INDICATION |
|---|---|---|---|
| 1 | DOUBLER $I_g$ | 6 | MOD. |
| 2 | TRIPLER $I_g$ | 7 | VOL. EXP. |
| 3 | PA $I_g$ | 8 | TRIPLER $I_p$ |
| 4 | OUTPUT | 9 | PA $I_p$ |
| 5 | AVC | | |

9. RELAY INFORMATION

K101 KEYING RELAY
- A — BIAS CONTROL OF CARRIER CONTROL TUBE (V110)
- B — MCW OSCILLATOR KEYING

K401 CARRIER CONTROL RELAY
- A — ASSOCIATED RECEIVER AUDIO CONTROL
- B — CARRIER INDICATOR (I402) CONTROL
- C — PA SCR GRID GROUND CONTROL
- D — KEYS 300 V. SUPPLY VOLTAGE (SEE FIG. 2-11)
- E — 300V. SUPPLY REGULATION (SEE FIG. 2-11)
- STANDARD REMOTE UNIT CARRIER INDICATOR CONTROL
- 300V. SUPPLY REGULATION (SEE FIG. 2-11)

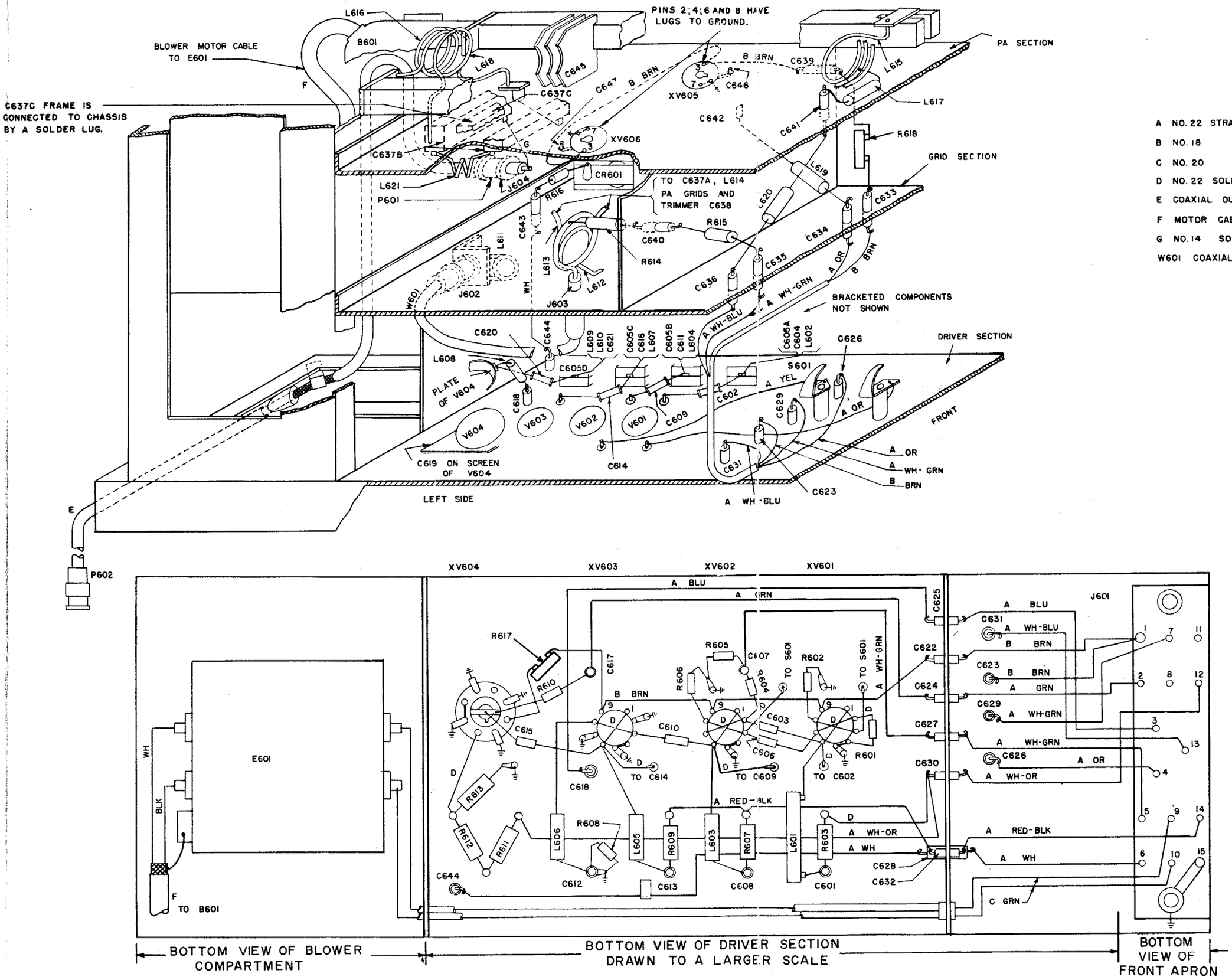
K402 START-STOP RELAY
- A — PRIMARY POWER CONTROL OF TRANSFORMER T401
- B
- C — STANDARD REMOTE UNIT POWER INDICATOR CONTROL
- D — HOLDING VOLTAGE FOR COIL K402

K403 ANTENNA TRANSFER RELAY

THERMAL CUT-OUT RELAY K404

10. FOR EMERGENCY OPERATION, THE START SWITCH S106, CAN BE HELD CLOSED IF THE THERMOSTAT DOES NOT STAY CLOSED.

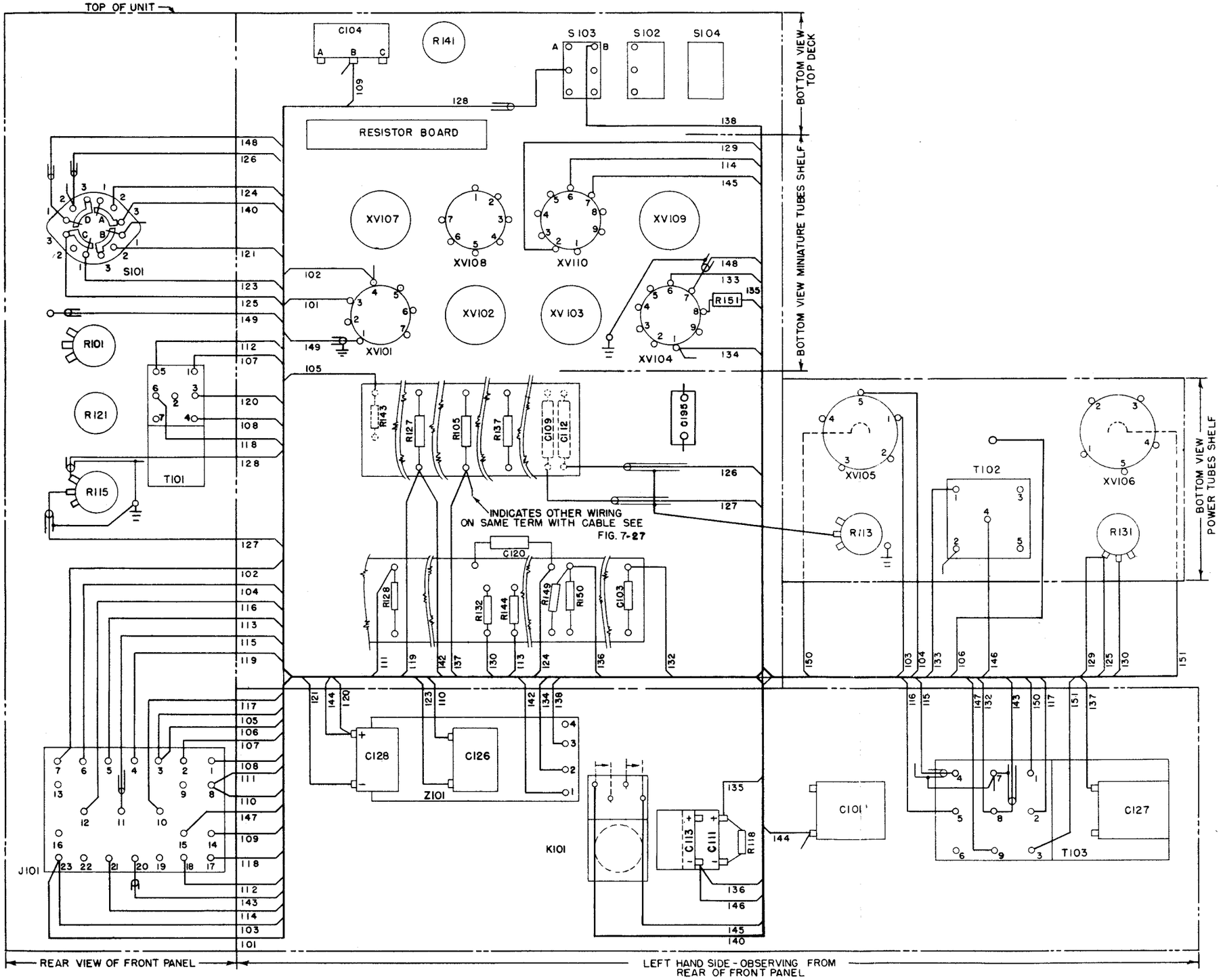
*Figure 7-24. Radio Transmitter T-336C/URT-7 Schematic Diagram*




WIRE LEGEND

A NO. 22 STRANDED WIRE TYPE SRIR (COVERED)
B NO. 18 " " " " "
C NO. 20 " " " " (UNCOVERED)
D NO. 22 SOLID BUS WIRE WITH SLEEVING
E COAXIAL OUTPUT CABLE RG-58/U
F MOTOR CABLE PART OF MOTOR
G NO. 14 SOLID BARE BUS WIRE WITH SILVER JACKET
W601 COAXIAL INTERCONNECTING CABLE RG-58/U

*Figure 7-25. Amplifier-Oscillator AM-638C/URT, Wiring Diagram*

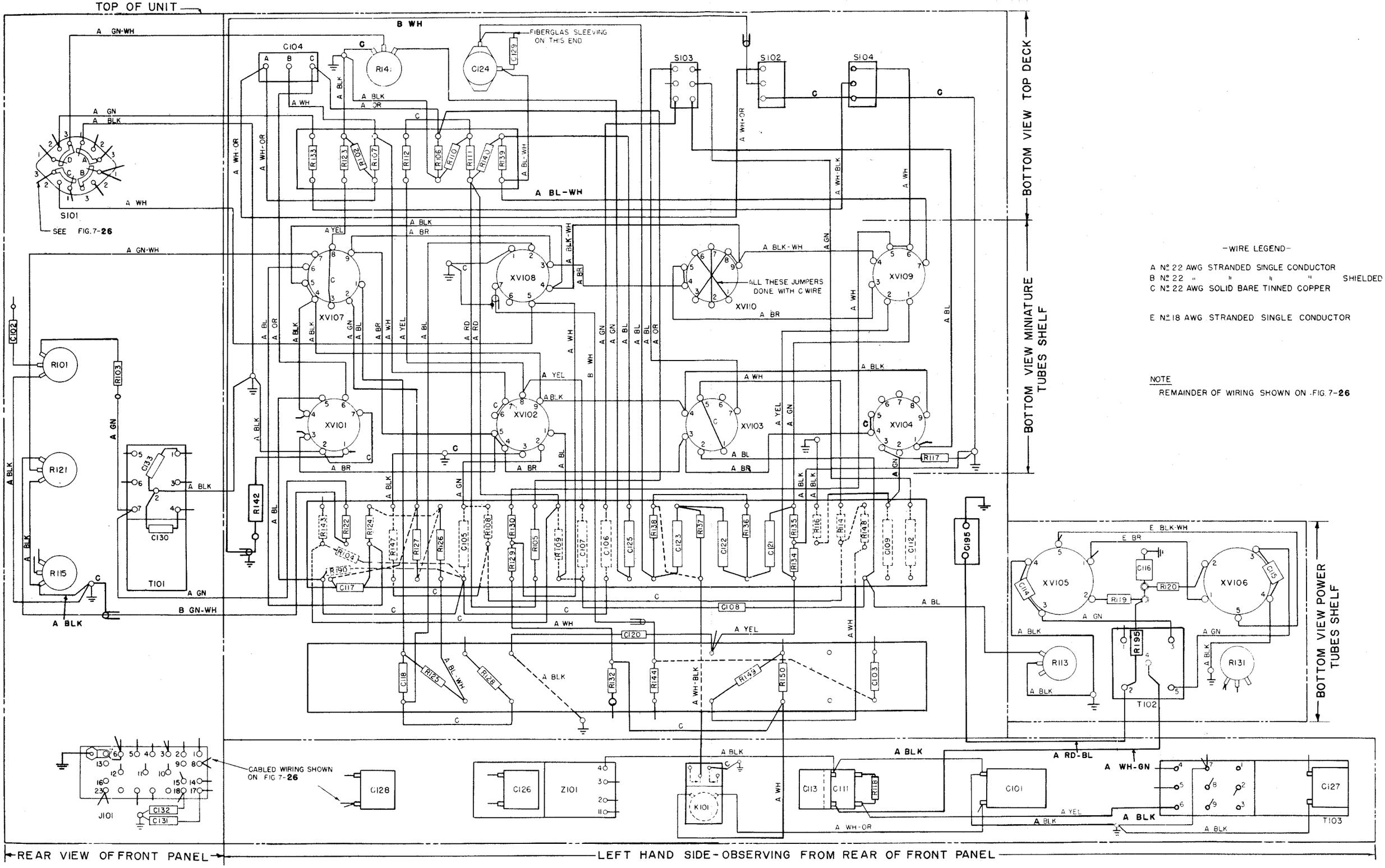



WIRE LEGEND

| WIRE N° | FROM | TO | DESCRIPTION |
|---|---|---|---|
| 101 | J101-23 | XV101-3 | N° 18 AWG BR |
| 102 | " -6 | " -4 | " " BLK-WH |
| 103 | " -23 | XV105-1 | " " BR |
| 104 | " -6 | " -5 | " " BLK-WH |
| 105 | " -3 | R143 | N° 22 " OR |
| 106 | " -3 | TERM. POINT | " " OR |
| 107 | " -2 | T101-1 | " " WH-BR |
| 108 | " -1 | T101-4 | " " WH-GN |
| 109 | " -14 | C104-B | " " WH-RD |
| 110 | " -8 | C126 | " " WH |
| 111 | " -8 | R128 | " " WH |
| 112 | " -18 | T101-5 | " " WH-BL |
| 113 | " -5 | R144 | " " BL-WH |
| 114 | " 21 | XV110-6 | " " BL |
| 115 | " -11 | T103-4 | N° 22 SHIELDED WH-OR |
| 116 | " -12 | T103-5 | N° 22 AWG RD-WH |
| 117 | " -10 | T103-2 | " " RD |
| 118 | " -17 | T101-6 | " " WH-BLK |
| 119 | " -4 | R127 | " " RD-BLK |
| 120 | T101-3 | C128+ | " " WH-OR |
| 121 | C128- | S101-B2 | " " WH-BR |
| 122 | | | |
| 123 | S101-C1 | C126 | " " WH-OR |
| 124 | S101-A2 | C120 | " " YEL |
| 125 | S101-C3 | R131 | " " WH-BLK |
| 126 | S101-D2 | C112 | N° 22 SHIELDED WH-OR |
| 127 | C109 | R115 | " " WH-YEL |
| 128 | S103-A | R115 | " " WH-OR |
| 129 | R131 | XV110-2 | N° 22 AWG GN |
| 130 | R132 | R131 | " " WH-RD |
| 131 | | | |
| 132 | C103 | T103-8 | N° 22 AWG OR |
| 133 | XV104-6 | T102-1 | " " BL-WH |
| 134 | XV104-1 | Z101-2 | " " BL-RD |
| 135 | R151 | C111+ | " " YEL |
| 136 | R149 | C113- | " " WH-GN |
| 137 | R105 | C127 | " " RD |
| 138 | Z101-3 | S103-B | " " WH-BLK |
| 139 | | | |
| 140 | K101 | S101-A3 | N° 22 AWG WH-RD |
| 141 | | | |
| 142 | R127 | Z101-1 | N° 22 AWG RD-BLK |
| 143 | J101-20 | T103-8 | N° 22 SHIELDED WH-YEL |
| 144 | C128+ | C101 | N° 22 AWG WH-OR |
| 145 | K101 | XV110-7 | " " GN |
| 146 | | | |
| 147 | J101-15 | T103-9 | WH-OR |
| 148 | S101-D1 | XV104-7 | N° 22 SHIELDED WH-YEL |
| 149 | TERM. POINT | XV101-1 | " " " " |
| 150 | T103-1 | V105 CAP | N° 18 AWG BL-RD 2,500V |
| 151 | T103-3 | V106 CAP | " " BL 2,500V |

NOTE
REMAINDER OF WIRING (POINT TO POINT) SHOWN ON FIG. 7-27

*Figure 7-26. Radio Modulator MD-163C/URT Wiring Diagram, Cabled Wiring Only*




-WIRE LEGEND-

A Nº 22 AWG STRANDED SINGLE CONDUCTOR
B Nº 22 " " " " SHIELDED
C Nº 22 AWG SOLID BARE TINNED COPPER

E Nº 18 AWG STRANDED SINGLE CONDUCTOR

NOTE

REMAINDER OF WIRING SHOWN ON FIG. 7-**26**

***Figure 7-27. Radio Modulator MD-163C/URT, Wiring Diagram, Point-to-Point Wiring Only***

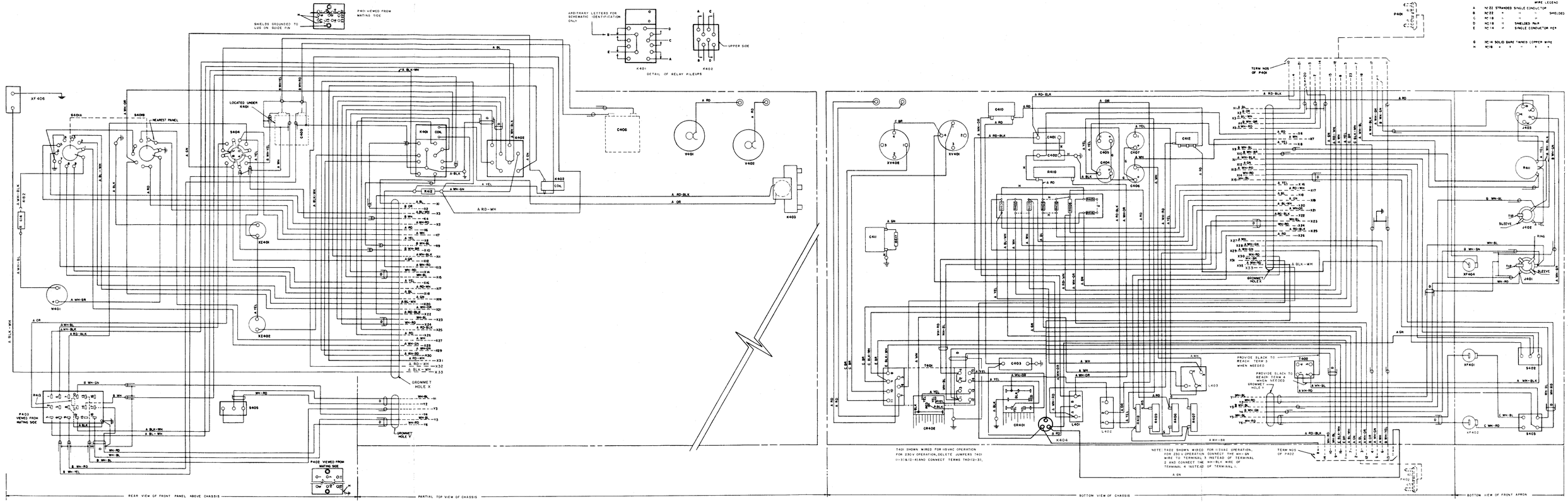



*Figure 7-28. Power Supply PP-773C/URT, Wiring Diagram*

# SECTION 8

# PARTS AND SPARE PARTS LISTS (AND MISCELLANEOUS TABLES)

## TABLE 8-1. LIST OF MAJOR UNITS

| SYMBOL GROUP | QUANTITY | NAME OF MAJOR UNIT | DESIGNATION | STANDARD NAVY STOCK NUMBER FOR AN/URT-7C |
|---|---|---|---|---|
| | 1 | Transmitter, Radio | T-336C/URT-7 | |
| 101-199 | 1 | Modulator, Radio | MD-163C/URT | |
| 301-399 | 1 | Cable Assembly Set | | |
| 401-499 | 1 | Power Supply | PP-773C/URT | |
| 501-599 | 1 | Cabinet, Electrical Equipment | CY-1126A/URT | |
| 601-699 | 1 | Amplifier-Oscillator | AM-638C/URT | |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| | | TRANSMITTING SET, RADIO AN/URT-7C | |
| A401 | N17-C077417-3587 | CONTACT, case: #32 (B&S) heat treated beryllium copper, silver pl; 4-3/4" lg x 11/16" wd x 11/32" h o/a; mtd by five 0.096" diam holes spaced 1-1/16" apart starting 1/4" from one end; eighteen 1/32" wd sawcuts spaced 1/4" c to c along one side; same side bent to angle of 30° and outer edge rolled to semi-cylinder, on 1/8" radius; RAQA Dwg No. AG-4393. | Grounds Top of RF Unit to Power Supply Chassis. |
| A402 | N17-C077413-2201 | CONTACT, case: #32 (B&S) thk heat treated beryllium copper, silver pl; 2" lg x 1-1/16" wd x 9/16" h o/a; mtd by two 0.169" diam holes spaced 0.687" c to c; 3 equally spaced 1/64" wd slits each end; bent to form irregular profile; RAQA Dwg No. AG-4394. | Grounds Side of RF Unit to Power Supply Chassis. |
| A403-1 thru A403-4 | N17-P070009-4001 | POST, supporting: non-shock; cad pl brass; 3/4" lg hex rod with #8-32 x 7/32 lg thd one end, #8-32 thd x 3/8" d axial hole other end, and 0.015" wd x root diam thd-relief undercut at base of thd section; mtd by male end; RAQA Dwg No. BG-1507. | Fastening for Terminal Housing. |
| A501 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | GASKET: 1/32" thk molded neoprene; rectangular aperture 7-7/8" lg x 6-1/4" w; 1/2" w bearing surface, 19 mtg holes, 3/16" dia; RAQA Dwg No. QR-0285. | Terminal Housing Cover Gasket. |
| A502-1 thru A502-4 | N16-S854061-0102 | LEG, radio set: steel; zinc pl; 3" lg x 3" w x 1-1/2" h overall; four 17/64" holes on 2-1/2" x 2-1/2" mtg centers; one 11/32" dia center hole; RAQA Dwg No. AG-4416. | Cabinet Support. |
| A503 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | GASKET: 1/32" thk; 50-60 duro-meter moulded neoprene; rectangular aperature 6-1/4" lg by 3-15/16" w; 1/2" w bearing surface; 13 mtg holes, 3/16" dia; RAQA Dwg No. QR-0293. | Separates Cabinet and Terminal Housing. |
| A601-1 thru A601-4 | N17-C077409-5001 | CONTACT, case: #32 (B&S) beryllium copper, silver pl; 1-1/8" lg x 17/32" w x 5/32" h o/a; mtd by two 0.128" dia holes on 0.625" mtg ctrs; one side bent at 45° angle, to 3/16" from edge, with five equally spaced cuts 1/64" w x 3/16" w x 3/16" d from same edge; RAQA Dwg No. AG-4395. | Grounds Plate Tank Compartment to Chassis (Vertical; 2 Sides, Front and Rear). |
| A602 | N17-C077417-8006 | CONTACT, case: #32 (B&S) ga beryllium copper, silver pl; 7-13/16" lg x 7/8" w x 1/8" h o/a; mtd by four 7/16" dia and ten 0.096" dia holes, unequally spaced; one side bent at 45° angle to 1/8" from edge, with 39 cuts 1/64" w x 1/8" d from edge x 3/16" c to c; RAQA Dwg No. AG-4396. | Grounds Side-Shield to Plate Tank Compartment (Horizontal; Lower Right Side). |
| A603 | N17-CO77417-8008 | Same as A602, except edge bent 45° in opposite direction; RAQA Dwg No. AG-4397. | Grounds Side-Shield to Plate Tank Compartment (Horizontal; Lower Left Side). |
| A604 | N17-C077417-8001 | CONTACT, case: #32 (B&S) ga beryllium copper, silver pl; 7-23/32" lg x 3/4" w x 3/32" h; mtd by four 7/16" and twelve 0.096" dia holes unequally spaced; outer side bent at 45° to 9/32" from edge, with 35 slots 1/32" w x 9/32" d from same edge x 7/32" c to c starting 13/64" from one end; RAQA Dwg No. AG-4398. | Grounds Side-Shield to Plate Tank Compartment (Horizontal; Upper Right Side). |
| A605 | N17-C077417-8003 | CONTACT, case: #32 (B&S) ga beryllium copper, silver pl; 7-23/32" lg x 3/4" w x 3/32" h; mtd by four 7/16" and twelve 0.096" dia holes unequally spaced; same as A604, except 45° bend is in opposite direction; RAQA Dwg No. AG-4399. | Grounds Side-Shield to Plate Tank Compartment (Horizontal; Upper Left Side). |
| A606 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | CUSHION, 7/32 shock pad: rectangular; 3-3/16" lg x 2-7/8" w x 1/4" thk; black neoprene rubber plates; twelve 3/16" dia holes drilled thru major surfaces; RAQA Dwg No. QR-0291. | Mtg for Blower B601. |
| A607 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | GASKET: 1/32" thk; 50-60 duro-meter moulded neoprene; 8-11/16" lg by 4-3/4" w overall; 6-9/16" lg by 4" w aperture; four 7/32" dia mtg holes on 8-1/16" by 3-3/8" centers; RAQA Dwg No. QR-0290. | Air Filter Holder. |
| A608 | N17-C0794001-0228 | CLEANER, air: 7-3/16" lg by 4-7/16" w by 3/4" thk overall; anodized aluminum; wire screen type; RAQA Dwg No. AG-4380. | Air Filter for Blower B601. |
| A609 | Shop Manufacture | CONTACT, Electrical: 1-7/32" lg by 3/8" w by 5/16" h overall; RAQA Dwg No. AG-4415. | Contact for CR601. |
| B601 | N17-B021188-4040 | BLOWER: Centrifugal vane fan; single unit operating on a common shaft. Prime mover supplied with unit, electric motor, 115 VAC, 50 to 60 cycles, single phase, 1.45 amp, 7500 rpm p/m 200 rpm; American Blower part No. K17200; RAQA Dwg No. PG-0009. | Cools Transmitter. |
| C101 | N16-C049197-3878 | CAPACITOR, fixed: paper; MIL type CP53B1EF205K; 2 uf ±10%; 600 vdcw; spec MIL-C-25A. | Relay K101 Bypass. |
| C102 | N16-C041627-5675 | CAPACITOR, fixed: paper; MIL type CP29A1EF602M; 6000 uuf ±20%; 600 vdcw; spec MIL-C-25A. | Speech Amplr Coupling. |
| C103 | FOR REPLACEMENT USE N16-C041596-9252 | CAPACITOR, fixed: paper; 6000 uuf ±20%; MIL type CP25A3EF602M; 600 vdcw; spec MIL-C-25A. | Modulation Indicator Coupling. |
| C104 | N16-C054460-4481 | CAPACITOR, fixed: paper; MIL type CP53B5EF104V; 3 sect; 100,000 uuf ±10% each sect; 600 vdcw; 1 term ea sect gnd; spec MIL-C-25A. | (See C104A, C104B and C104C). |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C104A | | Part of C104. | AVC Filter. |
| C104B | | Part of C104. | AVC Filter. |
| C104C | | Part of C104. | Speech Amplr Screen Bypass. |
| C105 | | Same as C103. | AVC Amplr Coupling. |
| C106 | FOR REPLACEMENT USE N16-C032430-6138 | CAPACITOR, fixed: mica; MIL type CM35B392K; 3900 uuf ±10%; 500 vdcw; spec MIL-C-5. | Filter Amplr Coupling. |
| C107 | | Same as C103. | AVC Rect Coupling. |
| C108 | FOR REPLACEMENT USE N16-C044257-2597 | CAPACITOR, fixed: paper; MIL type CP28A1EF503M; 50,000 uuf ±20% 600 vdcw; spec MIL-C-25A. | Clipper Coupling. |
| C109 | FOR REPLACEMENT USE N16-C041921-2406 | CAPACITOR, fixed: paper; MIL type CP29A3EF602M; 6000 uuf ±20% 600 vdcw; spec MIL-C-25A. | Filter Amplr Coupling. |
| C110 | | Not used. | |
| C111 | N16-C019786-3791 | CAPACITOR, fixed: electrolytic; JAN type CE63C250H; 25 uuf, 100 vdcw; spec JAN-C-62. | Driver Amplr Cathode Bypass. |
| C112 | | Same as C109. | Driver Amplr Coupling. |
| C113 | | Same as C111. | Modulator Bias Filter. |
| C114 | FOR REPLACEMENT USE N16-C031085-3694 | CAPACITOR, fixed: mica; MIL type CM30B102M; 1000 uuf ±20%; 500 vdcw; spec MIL-C-5. | Modulator Grid Bypass. |
| C115 | | Same as C114. | Modulator Grid Bypass. |
| C116 | FOR REPLACEMENT USE N16-C032641-6338 | CAPACITOR, fixed: mica; MIL type CM35B472M; 4700 uuf ±20%; 500 vdcw; spec MIL-C-5. | Modulator Screen Bypass. |
| C117 | | Same as C108. | Multivibrator Coupling. |
| C118 | FOR REPLACEMENT USE N16-C044257-1819 | CAPACITOR, fixed: paper; MIL type CP29A1EF503M; 50,000 uuf ±20%; 600 vdcw; spec MIL-C-25A. | Vol Expander Diode Coupling. |
| C119 | | Not used. | |
| C120 | FOR REPLACEMENT USE N16-C045780-7662 | CAPACITOR, fixed: paper; MIL type CP28A1EF104M; 100,000 uuf ±20%; 600 vdcw; no int gnd; spec MIL-C-25A. | MCW Oscillator Cathode Bypass. |
| C121 | N16-C017587-5601 | CAPACITOR, fixed: ceramic; JAN type CC36RH181J; 180 uuf ±5%; 500 vdcw; spec JAN-C-20A. | MCW Oscillator Feedback. |
| C122 | | Same as C121. | MCW Oscillator Feedback. |
| C123 | | Same as C121. | MCW Oscillator Feedback. |
| C124 | N16-C064232-8500 | CAPACITOR, variable: ceramic; JAN type CV12D121; rotary type, 1 sect; 20 to 125 uuf; 500 vdcw; spec JAN-C-81. | MCW Oscillator Freq Adjustment. |
| C125 | | Same as C103. | MCW Driver Coupling. |
| C126 | N16-C048810-4190 | CAPACITOR, fixed: paper; MIL type CP53B1EC105K; 1.0 uf ±10%; 200 vdcw; no int gnd; spec MIL-C-25A. | MCW Carrier Hold. |
| C127 | | Same as C101. | High Voltage Supply Filter. |
| C128 | | Same as C111. | Relay K101 Bypass. |
| C129 | FOR REPLACEMENT USE N16-C017077-1294 | CAPACITOR, fixed: ceramic; JAN type CC26UJ101K; 100 uuf ±10%; 500 vdcw; spec JAN-C-20A. | MCW Oscillator Feedback. |
| C130 | | Same as C114. | Audio Input Line Bypass. |
| C131 | | Same as C114. | Receiver Line Bypass. |
| C132 | | Same as C114. | Receiver Line Bypass. |
| C133 | | Same as C114. | Audio Input Line Bypass. |
| C195 | N16-C047293-9460 | CAPACITOR, fixed: paper; MIL type CP54B2EF504K; 500,000 uuf ±10%; 600 vdcw; spec MIL-C-25A. | Plate transient suppressor. |
| C401* | | CAPACITOR, fixed; paper; Navy type; 10 uf ±10%; 1000 vdcw; no int gnd; CD type T10100-J-3; RAQA Dwg No. C0-106A. Char. "F" MIL-C-25A; 1-1/4" w x 3-3/4" d x 5-1/4" h excl terms 2 solder lug term 3/8" h. | 300-volt Supply Filter. |
| C402 | | Same as C401. | 525-volt Supply Filter. |

*Physical size of this item is critical, use exact size for replacement.

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C403 | | Same as C401. | 525-volt Supply Filter. |
| C404 | N16-C020931-7851 | CAPACITOR, fixed: electrolytic; JAN type CE41C122F; 1200 uf, -10%, +150%; 25 vdcw; no int gnd; spec JAN-C-62. | -12-volt Supply Filter. |
| C405 | | Same as C404. | -12-volt Supply Filter. |
| C406 | N16-C020461-8100 | CAPACITOR, fixed: electrolytic; JAN type CE41C201H; 200 uf, -10%, +150%; 100 vdcw; no int gnd; spec JAN-C-62. | -42-volt Supply Filter. |
| C407 | | Same as C406. | -42-volt Supply Filter. |
| C408 | N16-C049948-9347 | CAPACITOR, fixed: paper; MIL type CP53B1EB405K; 4 uf ±10%; 100 vdcw; no int gnd; spec MIL-C-25A. | Audio Line DC Blocking. |
| C409 | | Same as C408. | Audio Line DC Blocking. |
| C410 | N16-C047297-3180 | CAPACITOR, fixed: paper; MIL type CP54B1EF504K; 500,000 uuf ±10%; 600 vdcw; no int gnd; spec MIL-C-25A. | 525-volt Supply Filter. |
| C411 | | Same as C101. | 190-volt Supply Filter. |
| C412 | FOR REPLACEMENT USE N16-C054496-4050 | CAPACITOR, fixed: paper; 3 sect, each 250,000 uuf +20% -10%, 400 vdcw; HS metal can; 1-13/16" lg x 1-1/2" h x 29/32" w o/a excl term and mtg ears; impr and filled w/"hyvol D" (castor oil); three 11/16" lg solder lug term 1/2" c to c on bottom; 1 term ea sect gnd to case; mtd by two 3/16" dia holes, 2-1/8" c to c, in ears flush w/bottom at ends of case; CAW No. 430-MAB; RAQA Dwg No. CP-754. | 525-volt Filter. |
| C601 | N16-C018659-7792 | CAPACITOR, fixed: ceramic dielectric; 1000 uuf ±20%; temp coef variable; 500 vdcw; CER type No. 326; RAQA Dwg No. CC-102G. | RF Oscillator Plate Bypass. |
| C602 | N16-C018692-1100 | CAPACITOR, fixed: ceramic dielectric; 1200 uuf ±10% ; temp coef variable; 500 vdcw; CER type No. 302; RAQA Dwg No. CC-122. | RF Oscillator Plate Coupling. |
| C603 | FOR REPLACEMENT USE N16-C016237-2583 | CAPACITOR, fixed: ceramic; JAN type CC21UJ270K; 27 uuf ±10%; 500 vdcw; spec JAN-C-20A. | RF Oscillator Output Coupling. |
| C604 | N16-C058139-1980 | CAPACITOR, variable: air dielectric; plate meshing type, 1 sect; 1.75 to 8.69 uuf; SLC characteristic; 750 v RMS test; ceramic insulation; CEJ Part No. 160-104; RAQA Dwg No. CV-090C. | RF Oscillator Plate Padding. |
| C605 | N16-C063465-8921 | CAPACITOR, variable, air dielectric: plate meshing type; 4 sections; section 1, 8.6 to 88.1 uuf, section No. 2, 8.6 to 95 uuf, section No. 3, 9 to 103 uuf, section No. 4, 7.5 to 65 uuf; mid-line frequency characteristic; 750 v rms test; 6-15/16" lg x 2-17/32" w x 2" deep overall; extension shaft; 48 brass plates plus nickel plate plus silver plate; cw to increase capacity; ceramic insulation; solder lugs on stator, rotor grounded; tapped holes in frame of assy for mounting on chassis; has provision for mounting capacitors C604, C611, C616, C621, and inductors L602, L604, L607, L609, L610; circuit symbols for same stamped adjacent; lubricated w/molykote dry lubricant; RAQA Dwg No. CV-111. | Driver tuning. |
| C606 | FOR REPLACEMENT USE N16-C016076-8561 | CAPACITOR, fixed: ceramic; JAN type CC21SH200J; 20 uuf ±5%; 500 vdcw; spec JAN-C-20A. | RF Oscillator Neutralizing. |
| C607 | | Same as C601. | Doubler Grid Bypass. |
| C608 | | Same as C601. | Doubler Plate Bypass. |
| C609 | | Same as C602. | Doubler Plate Coupling. |
| C610 | N16-C016799-4750 | CAPACITOR, fixed: ceramic dielectric; 68 uuf ±10%; temp coef variable; 500 vdcw; CER type No. 315; RAQA Dwg No. CC-680C. | Doubler Output Coupling. |
| C611 | N16-C058445-6331 | CAPACITOR, variable: air dielectric; plate meshing type, 1 sect, 2.15 to 14.58 uuf; SLC characteristic; 750 v RMS test; ceramic insulation; CEJ Part No. 160-107; RAQA Dwg No. CV-150E. | Doubler Plate Padding. |
| C612 | | Same as C601. | RF Amplr Cathode Bypass. |
| C613 | | Same as C601. | RF Amplr Plate Bypass. |
| C614 | | Same as C602. | RF Amplr Plate Coupling. |
| C615 | | Same as C606. | RF Amplr Output Coupling. |
| C616 | | Same as C611. | RF Amplr Plate Padding. |
| C617 | | Same as C601. | Tripler Grid Bypass. |
| C618 | FOR REPLACEMENT USE N16-C018660-1582 | CAPACITOR, fixed: ceramic dielectric; 1000 uuf ±20%; temp coef variable; 1500 vdcw, CBN DA-720; RAQA Dwg No. CC-102E. | Tripler Plate Bypass. |
| C619.1 | FOR REFERENCE ONLY | CAPACITOR, fixed: mica dielectric; 800 uuf ±20%; temp coef not specified; 300 vdcw; RAQA Dwg No. VG-2879. | Tripler Screen Bypass. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C619.1-A | N17-I064046-1245 | INSULATOR, plate: dielectric plate for screen bypass capacitor u/w electron tube type 4X150A (V604); ruby mica sheet; 2-1/2" x 2-1/2" x 0.002" thk; mounted by four 0.169" dia holes on 1.750" mtg centers; single 1.625" dia holes; RAQA Dwg No. AC-1302. | P/O C619.1. |
| C619.1-B | | Same as C619.1-A. | P/O C619.1. |
| C619.1-C | N17-C079659-5001 | CONTACT, electron tube: contact for electron tube type 4X150A (V604); heat treated beryllium copper silver pl; 2-1/4" lg x 2-1/4" w x 5/16" overall; four 5/16" dia holes on 1.75" x 1.75" mtg centers; 1-3/16" dia hole in center w/8 spring contact fingers, 45° apart; RAQA Dwg No. AG-4400. | P/O C619.1. |
| C619.1-D | Shop Manufacture | PLATE, electrical connector: brass, silver pl; square shape; 2-1/4" lg x 2-1/4" w x 0.064" thk overall; 1-5/8" dia center hole; 4 holes 5/32 dia on 1-3/4 x 1-3/4 centers; RAQA Dwg No. AG-4624. | P/O C619.1. |
| C620 | | Same as C602. | Tripler Plate Coupling. |
| C621 | | Same as C611. | Tripler Plate Padding. |
| C622 | N16-C018657-8801 | CAPACITOR, fixed: ceramic dielectric; 1000 uuf ±20%; temp coef variable; 500 vdcw; feed thru "Ceramicon", incl mtg nut, CER-327; RAQA Dwg No. CC-102F. | RF Driver Filament Bypass. |
| C623 | | Same as C622. | PA Filament Bypass. |
| C624 | | Same as C622. | Tripler Grid Return Bypass. |
| C625 | | Same as C618. | Tripler Plate Supply Bypass. |
| C626 | | Same as C622. | PA Screen Supply Bypass. |
| C627 | | Same as C622. | Doubler Grid Meter Bypass. |
| C628 | | Same as C622. | Pwr Output Ind Bypass. |
| C629 | | Same as C622. | PA Grid Return Bypass. |
| C630 | | Same as C622. | Keyed 300-volt Supply Bypass. |
| C631 | | Same as C618. | PA Plate Supply Bypass. |
| C632 | | Same as C622. | 300-volt Supply Bypass. |
| C633 | | Same as C622. | PA Filament Bypass. |
| C634 | | Same as C622. | PA Screen Supply Bypass. |
| C635 | | Same as C622. | PA Grid Return. |
| C636 | | Same as C618. | PA Plate Supply Bypass. |
| C637 | N16-C063457-9641 | CAPACITOR, variable, air dielectric: plate meshing type; 4 sections; sections 1 and 2 connected for split-stator operation, 12 to 62 uuf; sections 3 and 4 connected for split stator operation, 8.6 to 29 uuf; straight line frequency characteristic; 5-15/32" lg, 4-27/32" w, 2-45/64" h; bushing 1-1/8" OD, 1/4" ID, 3/16" thk; extended shaft 2-3/32" lg, 1/4" dia; shaft adjustment, 180° ccw rotation; sections 1 and 2, 13 plates per section, sections 3 and 4, 4 plates per section; silver plate brass; RAD No. 800262, RAQA Dwg No. CV-580. | PA Grid and Output Filter Tuning. |
| C638 | N16-C062067-7300 | CAPACITOR, variable, air dielectric: plate meshing type, 2 sections connected for split stator operations; ea section 2.72 to 8.50 uuf; straight line capacity characteristic; 750 v rms test; ceramic insulated; CEJ No. 9MB11 (w/locking bearing); RAQA Dwg No. CV-080A. | PA Grid Padding. |
| C639 | | Same as C622. | PA Filament Bypass. |
| C640 | | Same as C622. | PA Grid Return Bypass. |
| C641 | | Same as C618. | PA Plate Supply Bypass. |
| C642.1 | FOR REFERENCE ONLY | CAPACITOR, fixed: teflon dielectric; 700 uuf ±20%; 500 vdcw; no specified temp coef; RAQA Dwg No. VG-2880. | PA Screen Bypass. |
| C642.1-A | N17-I064144-3044 | INSULATOR, plate: teflon dielectric; 5-3/8" lg x 3-3/8" w x 0.010" thk; non-std shape; two 2-1/8" dia holes; RAQA Dwg No. AC-1357; 2 holes 2-1/8" dia, 1-5/8" c to c on minor ctr line; 4 holes 3/32" dia on 4-7/32" x 2-5/16" centers symmetrical to C lines. | P/O C642.1. |
| C642.1-B | N17-I064144-4546 | INSULATOR, plate: teflon dielectric; 4-7/32" lg x 3-3/8" w x 0.010" thk; non-std shape; two 2-1/4" dia holes on major CL, other holes same as C642.1-A; RAQA Dwg No. AC-1358. | P/O C642.1. |
| C642.1-C | N17-C814951-0136 | CLIP, electrical: silver pl beryllium copper; 2-1/8" OD x 1-5/16" ID x 5/16" overall; 8 contact fingers equally spaced; RAQA Dwg No. AG-4608. | P/O C642.1. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| C642.1-D | N16-P403081-0156 | PLATE, capacitor: silver pl copper alloy; 4-9/16" lg x 3-7/8" w x 1/8" overall; irregular shape; 2 holes 2-1/8" dia on major CL; 5 grounding strips along edges; RAQA Dwg No. VG-2874. | P/O C642.1. |
| C642.1-E | N17-P404181-0271 | PLATE, capacitor: silver pl brass; 4-9/16" lg x 3-1/4" w x 45/64" overall; irregular shape; 2 holes 1-21/32" dia on major CL and each 1-1/4" from minor CL; 6 holes 1/4" dia for mtg; RAQA Dwg No. AG-4612. | P/O C642.1. |
| C642.1-F | Shop Manufacture | WASHER: silver pl brass; 2-1/8" OD x 0.032" thk overall; 1-5/8" ID; RAQA Dwg No. WJ-0256. | P/O C642.1. |
| C643 | | Same as C622. | Output Indicator Bypass. |
| C644 | | Same as C622. | Output Indicator Bypass. |
| C645 | FOR REFERENCE ONLY | CAPACITOR, variable: air dielectric: plate meshing type; 4 sections, 5 plates per section. | P/O Z601. |
| C645A | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | ROTOR, capacitor: 4 sections, 2 plates per section; brass, copper flash, silver over nickel pl; 5-23/32" lg x 1-5/16" w x 2-7/32"; 1/4" dia shaft; RAQA Dwg No. VG-2801. | P/O C645. |
| C646 | Shop Manufacture | PLATE, capacitor: air neutralizing; c/o 2-3/8" lg #14 ga (B&S) copper wire, silver pl and 2-1/8" lg #18 sleeving; 0.5 to 5 uuf; one solder lug term, mtd, adj by varying position; 2-5/8" lg x 7/64" w x 21/32" overall; RAQA Dwg No. CV-050A. | PA Neutralizing. |
| C647 | Shop Manufacture | PLATE, capacitor: air neutralizing; c/o 4-3/4" lg #14 ga (B&S) copper wire, silver pl and 4-1/2" lg #18 sleeving; 1.0 to 10 uuf; one solder lug terminal, mtd, adj by varying position; 5" lg x 7/64" x 21/32" h overall; RAQA Dwg No. CV-050B. | PA Neutralizing. |
| CR401 | N17-R051053-8320 | RECTIFIER, metallic: single stack, selenium; full wave bridge; AC input 26 v max; DC output; new 18 aged 19 v, 1.4 amp max resistive or inductive load; cont duty, 1 phase; 60°C ambient oper temp with normal convection cooling; RAQA Dwg No. JR-0020. | 12-volt Rectifier for Indicator Lamps and Microphone current for Remote Control. |
| CR402 | N17-R051277-2831 | RECTIFIER, metallic; single stack, selenium; full wave bridge; AC input 104 v max; DC output, new 84 v, aged 78 v, 0.2 amp max resistive or inductive load; cont duty, 1 phase; 35°C ambient oper temp with normal convection cooling; RAQA Dwg No. JR-0021. | 42-volt Rectifier for Bias, Microphone and Relay Voltages. |
| CR601 | N16-T051721-0010 | CRYSTAL UNIT, rectifying: MIL type 1N21B; spec MIL-E-1B. | Output Indicator Rectifier. |
| E101-1, E101-2 | N16-S034607-8379 | SHIELD, tube: Spring phosphor bronze, black cad pl; tube contact liner beryllium copper per MIL-C-6942A; black cad pl; shell and cap alum alloy per QQ-A-359B, black anodized per QQ-A-696A-2305; 1-11/32" lg x 29/32" dia; International Electronics Research Corp; part No. T5-1015; RAQA Dwg No. JS-0214. | Shielding for Type 5726/6AL5W tubes (V103 and V108) tubes. |
| E102-1, E102-2 | N16-S034607-8384 | SHIELD, tube: Spring phosphor bronze, black cad pl; tube contact liner beryllium copper per tube contact liner beryllium copper per MIL-C-6942A; black cad pl; shell and cap, alum alloy per QQ-A-359B, black anodized per QQ-A-696-A-2305; 1-13/16" lg x 29/32" dia; International Electronic Research Corp; part No. T5-1020; RAQA Dwg No. JS-0215. | Shielding for Type 5749/6BA6W (V101) and 6AT6 (V109) tubes. |
| E103-1 thru E103-4 | N16-S034561-2060 | SHIELD, tube: Spring phosphor bronze, black cad pl; tube contact liner beryllium copper per MIL-C-6942A; black cad pl; shell and cap, alum alloy per QQ-A-359B, black anodized per QQ-A-359B, black anodized per QQ-A-696A-2305; 1-13/16" lg x 1-1/32" dia; International Electronics Research Corp; part No. T6-1020; RAQA Dwg No. JS-0216. | Shielding for Type 5814 tubes (V102, V104, V107, V110). |
| E104 | | Not used. | |
| E105 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | DIAL: same as E407, except (1) dial has a single radial index line 1/8" lg from edge and (2) RH setscrew is 90° to left of index line; RAQA Dwg No. VG-2771. | Control for Switch S101. |
| E106 | | Not used. | |
| E107 | N17-C0815501-0118 | CLIP, electrical: beryllium copper, nickle pl; 3-1/2" lg x 1" w x 9/16" h overall; melamine glass insulation; 2 clips riveted on insulation, spaced 2-3/4" c to c; RAQA Dwg No. VG-2760. | Plate Cap for Type 807 Tubes (V105, V106). |
| E108 | Shop Manufacture | BOARD, terminal: 2-1/8" w x 5" lg sheet 3/32" thk plastic, type PBE-P per spec MIL-P-3115; 8 pairs brass stud type terminals located on vertical lines spaced 3/8" apart starting 25/32" from right end of board w/ one terminal of ea pair on line 5/32" above bottom long edge and other terminal spaced 1-13/16" above these on vertical lines, except pairs No. 5 and 6 spaced 29/32" apart; overall dim; 2-1/8" w x 5" lg x 19/32" deep including terminals: mounted by four 0.136" dia (No. 29 drill) holes located on 5/32" from top and right edge; two 0.221" (No. 2 drill) holes, one located 3-15/16" from right end on center line, and one 9/32" below top edge and 2-3/32" from right end; stamped with circuit symbol of capacitors and resistors, in 3/32" characters and lacquered; less capacitors, resistors and wire; bracket; mtg on 2 brackets 3-11/16" lg x 5/16" w x 3/32" thk; RAQA Dwg No. VT-0306. | Support for C103, C118, C120, R125, R128, R132, R144, R149, and R150. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| E109 | Shop Manufacture | BOARD, terminal: plastic type PBE-P per spec MIL-P-3115; 13 pairs brass stud type terminals; overall dim 2-1/8" w x 5-3/8" lg x 1/2" deep overall including terminals; mounted by four 0.136" dia holes located on 1-13/16" x 4-11/16" centers w/one of the holes 5/32" from top and right edges; two 0.221" holes, one located 3-15/16" from right end on center line, and one 9/32" below top edge and 2-3/32" from right end; RAQA Dwg No. VT-0307-A. | Support for C105 thru C109, C112, R104, R108, R109, R114, R116, R143, R147, R148 and R190. |
| E110 | Shop Manufacture | BOARD, terminal: plastic type PBE-P, per spec MIL-P-3115; 13 pairs of brass stud type terminals; 2-1/8" w x 5-3/8" lg x 1/2" deep, including terminals overall; mounted by four 0.1695" holes located on 29/32" x 4-9/16" centers w/one of the holes located 5/32" from top and right edges; RAQA Dwg No. VT-0308. | Support for C117, C121, C122, C123, C125, R105, R122, R124, R126, R127, R129, R130, R134 thru R138. |
| E111 | Shop Manufacture | BOARD, terminal: plastic type PBE-P, per spec MIL-P-3115; 7 pairs brass stud type terminals; 1-3/8" w x 3-9/16" lg x 1" deep, including terminals and brackets; mounted by two 90° metal brackets ea w/single 0.154" dia hole, hole spaced 1-5/8" c to c; RAQA Dwg No. VT-0309. | Support for R102, R106, R107, R110, R111, R112, R123, R133, R139 and R140. |
| E401 | N17-C067443-5401 | CONNECTOR, adapter: AN type UG-306/U; male one end, female other end; 1 round male cont, 1 round female cont; 90° angle; 500 volts: 52 ohms RF impedance; freq-impedance characteristic constant; Navy spec RE49F429; RAQA Dwg No. SM-0200. | RF Adapter. |
| E402 | N16-D046337-9483 | DIAL: same as E105 except index line is 180° apart; for mtg on 4-1/8" by 1-5/8" centers 3/16" from one end and side; RAQA Dwg No. VG-2739. | Control for Switch S401. |
| E403 | Shop Manufacture | BOARD, terminal: 8 pairs of terminals stud; 2" w x 5" lg x 3/32" thk; 4 holes 3/16" dia excluding terminals; RAQA Dwg No. VT-0320. | Support for R401 thru R406, R415 and R416. |
| E404-1, E404-2 | FOR REPLACEMENT USE N17-I048679-2409 | INSULATOR, feed-thru: male section: c/o neck portion plus conical collar: JAN type NS3W4101; grade III white glazed ceramic; 5/8" lg x 1/2" OD x 0.143" ID o/a; neck 15/64" OD x 1/4" lg; collar tapers 1/2" to 3/8" toward end; spec JAN-I-8; RAQA Dwg No. QC-0113. | HV Rectifier Plate Lead. |
| E405-1, E405-2 | FOR REPLACEMENT USE N17-I047363-4201 | INSULATOR, feed-thru: JAN type NS3W4201; female section: conical shape; grade III white glazed ceramic; 3/8" lg x 1/2" max OD x 3/8" min OD x 0.143" ID with 1/4" dia axial recess 1/4" deep in large end; spec JAN-I-8; RAQA Dwg No. QC-0114. | HV Rectifier Plate Lead. |
| E406-1 thru E406-4 | FOR REPLACEMENT USE N17-I069173-7115 | INSULATOR, stand-off: cylindrical; JAN type NS3W0205 grade III white glazed ceramic; 5/8" lg x 1/2" dia with #8-32 thd x 3/16" d axial hole each end; spec JAN-I-8; RAQA Dwg No. QC-0117. | Supports for C410 and C412. |
| E407 | N16-D046337-9487 | DIAL, disc type; c/o 5/8" dia bronze knob and 1-1/8" dia nickel silver (#20 B&S ga) dial; dial calibrated over 300° of arc with short radial lines spaced 15° apart at circumference, with alternate lines (30° spacing) numbered "0" thru "10" counterclockwise; 9/16" lg x 1-1/8" OD; for 0.251" dia shaft; mtd on shaft by two #6-32 thd x 3/16" lg, Allen type headless steel cup point setscrews, 120° apart in knob, with RH screw aligned with numeral "7"; knob copper plated, 40 turns per inch straight knurl; dial dull satin finish, lacquer dipped; dial characters etched and filled w/black enamel; RAQA Dwg No. VG-2736. | Controls for Potentiometers R101 and R115. |
| E408 | N16-D046337-9485 | DIAL: same as E105 except RH setscrew is in line with index line; RAQA Dwg No. VG-2740. | Control for LOCAL-REMOTE Switch S404. |
| E409-1, E409-2 | N17-C814365-0451 | CLIP, electrical: beryllium copper nickel pl; 2-3/32" lg x 31/32" w x 11/16" h overall; melamine glass insulations; RAQA Dwg No. VG-2742. | Plate Cap for Type 3B28 tube. |
| E501 | N17-B077936-5240 | BOARD, terminal: general purpose; 10 solder term and brass nickel pl binder head screws; term 3/8" c to c with barriers; molded bakelite 4-3/8" lg x 7/8" thk o/a; four 0.160" dia mtg holes on 4-1/8" and 5/16" ctr; CJC type 10-140-Y; RAQA Dwg No. TS-0199. | External Connections. |
| E502 | | Same as E501. | External Connections. |
| E503 | | SUPPRESSOR, electrical noise: 550V dc, 250V ac, 5 amps; 5.051" lg x 3" w x 1.343" h overall, including terminals; 4 solder lug terminals, 2 ea end; bracket required for mtg; Sprague Electric Co. S37412; RAQA Dwg No. LC-0231. | Power Line Noise Filter. |
| E601 | N5915-513-3405 | SUPPRESSOR, electrical noise: 125V ac/dc 3 amps; 3.625" lg x 2.50" w x 1.046" h overall, includes terminals; 4 solder lug terminals, 2 ea side; 2 mtg holes 1 ea end 3.187" c to c; third mtg hole in bracket on one end of case, centered on line parallel to and 1.312" from long center line and 5/8" from baseline; Sprague Electric Co. part No. S66457; RAQA Dwg No. LC-0230. | Blower Motor Noise Filter. |
| E602 | | Same as E406. | Supports for C647. |
| E603-1 thru E603-3 | | Same as E103-1 thru E103-4. | Shielding for Type 12AT7WA Tubes (V601, V602, V603). |
| E604-1 thru E604-4 | N17-I049498-4210 | INSULATOR, bushing: shoulder; Teflon plastic; 0.250" lg x 0.375" OD x 0.187" ID; stepped to 0.291" OD 1/16" from one end; RAQA Dwg No. QP-0326. | PA Capacitor (C645) Rotor Shaft Insulation. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| E605 | N16-D046337-9481 | DIAL: same as E407, except (1) for 0.187" dia shaft, (2) dial has two 180° divisions, each division calibrated with short radial lines spaced 9° apart at circumference, with alternate lines (18° spacing) numbered "0" thru "9" clockwise and (3) RH setscrew is aligned with one "0" mark; RAQA Dwg No. VG-2737. | Control for PA Tuning (C645). |
| E606 | N16-D046337-9491 | DIAL, same as E407, except (1) dial is calibrated with four short radial lines spaced 90° apart at circumference and numbered "1" thru "4" counterclockwise and (2) LH setscrew is at numeral "3"; RAQA Dwg No. VG-2738. | Control for Crystal Transfer Switch S601. |
| E607 | N16-D046337-9489 | DIAL: same as E407, except (1) for 0.187" dia shaft, (2) 360° of dial is calibrated with short radial lines spaced 18° apart at circumference, with alternate lines (36° spacing) numbered "0" thru "9" clockwise and (3) RH setscrew is aligned with "0" mark; RAQA Dwg No. VG-2741. | Control for PA Grid Tuning (C637). |
| E608 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | DIAL: same as E605, except (1) calibrated counterclockwise, (2) for 0.251 shaft; RAQA Dwg No. VG-2910. | Control for Driver Tuning (C605). |
| E609-1 thru E609-3 | N16-K700266-0881 | KNOB: round type; black; nickel pl brass, lacquer dipped; for 0.250" dia shaft; mtd by #6-32 thd x 3/16" lg Allen headless hollow cup-point steel setscrew and #6/0 x 5/8" lg SS taper pin in 0.062" (#52 drill) radial hole 90° clockwise from screw; 2 curved engraved arrows on top, 3/16" radius x 1/32" w x 180° lg, clockwise from pin; 1/2" lg x 5/8" dia o/a; 0.251" dia x 5/16" d shaft hole; 40 turns per inch straight knurl; (plus nonmagnetic setscrew and pin); "Lock" engraved between arrows, aligned with pin; word and arrows filled with white enamel; RAQA Dwg No. BG-1508. | Control for Lock for PA Tuning, PA Grid Tuning and RF driver tuning. |
| E610-1 thru E610-3 | N16-P500001-0143 | POINTER, indicator: brass, black nickel pl; for 3/16" dia shaft, 7/8" lg x 3/8" w x 1/4" h; mtd by 0.188" dia x 0.187" d shaft hole and single #6-32 thd x 1/8" lg Allen headless hollow cup-point steel setscrew located 90° counterclockwise from index line; line 0.015" w, filled with white enamel; RAQA Dwg No. QD-0238. | Tuning Indicator for RF Driver and for Power Amplr and for PA Grid tuning. |
| E611-1 thru E611-5 | N17-I059404-5595 | INSULATOR, feed-thru: cylindrical with axial wire leads: 11/16" lg o/a x 0.130" dia of body x 0.200" OD of flange; term 0.040" wire, glass ins, tin dipped with 0.045" hole in flattened ends; 750V ac peak at 90% humidity; 5 amp for 40°C cont temp rise; CBEF AA-40W-PP; RAQA Dwg No. QC-0112. | Crystal Lead Feed-thru and Driver Tank Feed-thru. |
| E613-1 thru E613-4 | FOR REPLACEMENT USE N17-I069178-7156 | INSULATOR, stand-off: JAN type NS3W0208; cylindrical; grade III white glazed ceramic; 1" lg x 1/2" dia with #8-32 thd x 3/8" d tapped axial hole each end; spec JAN-I-8; RAQA Dwg No. QC-0115. | Support for Stators of C645. |
| E614-1, E614-2 | FOR REPLACEMENT USE N17-I069154-6200 | INSULATOR, stand-off: JAN type NS3W0104; cylindrical; grade III white glazed ceramic; 1/2" lg x 3/8" dia with #6-32 thd x 5/32" dia axial hole each end; spec JAN-I-8; RAQA Dwg No. QC-0116. | Supports for Tripler for Plate Clamp. |
| E615-1, E615-2 | N17-B099999-0236 | BRUSH, electrical cont: square shape with 1/32" bevel on corners; 5/8" lg, 9/32" w, grade 235; shunt and pressure spring 1-1/4" lg; RAQA Dwg No. AG-4604. | Brush for Blower B601. |
| E616-1, E616-2 | FOR REFERENCE ONLY | FORM, coil: steatite; 1-3/4" lg x 1/2" OD x 3/8" ID; plain; RAQA Dwg No. QC-0108. | Use with (L602 and L609). |
| E617-1, E617-2 | FOR REFERENCE ONLY | FORM, coil: steatite; 1-3/16" lg x 1/2" OD x 3/8" ID; plain; RAQA Dwg No. QC-0110. | Use with (L604 and L607). |
| E618-1 thru E618-3 | FOR REFERENCE ONLY | CORE, adjustable tuning: brass, silver pl; 0.365" OD x 1-1/2" lg overall; on threaded rod; RAQA Dwg No. VG-2752. | |
| E619 | FOR REFERENCE ONLY | CORE, adjustable tuning: G-2 iron, mounted on threaded brass, silver pl rod; 0.365" OD x 1-1/2" lg overall; RAQA Dwg No. QM-0003. | Use with L602. |
| E620-1, E620-2 | N17-I049498-5595 | INSULATOR, feed-thru: steatite, shoulder bushing shape; 7/16" OD x 3/16" high x 0.150" ID overall; RAQA Dwg No. QC-0111. | P/O Mtg for CR601 output rectifier. |
| E621 | N17-I047363-4222 | INSULATOR, feed-thru: rd bowl counterbore shape; 0.150" ID x 3/8" OD x 1/4" high overall; mates w/E622; RAQA Dwg No. QC-0118. | P/O Mtg for L618. |
| E622 | N17-I049485-1151 | INSULATOR, feed-thru: steatite; shoulder bushing shape; 0.150" ID x 3/8" OD x 3/8" high overall; mates w/E621; RAQA Dwg No. QC-0119. | P/O Mtg for L618. |
| F401* | N17-F014306-0510 | FUSE, cartridge: time delay; 8 amp; blow time 60 min at 135% rated load 25 sec at 200%, 8 sec at 300%; one time; glass body; nonindicating; ferrule term; 1/4" dia x 1-1/4" lg; CFA #MDL-8; RAQA Dwg No. F-0046. | Main Line Protection. |
| F401** | N17-F014305-0060 | FUSE, cartridge: Navy type -28060-4; time delay; 4 amp; blow time 60 min at 135%, rated load; 25 sec at 200%, 8 sec at 300%, 3 sec at 500%; one time; glass body; ferrule term; nonindicating; 1/4" dia x 1-1/4" lg; CFA #MDL-4, RAQA Dwg No. F-0045. | Main Line Protection. |
| F402* | | Same as F401*. | Main Line Protection. |
| F402** | | Same as F401**. | Main Line Protection. |

* For 115 v Line.
** For 230 v Line.

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| F403* | | Same as F401*. | Spare. |
| F403** | | Same as F401**. | Spare. |
| F406 | N17-F099999-0138 | FUSE, cartridge: high time-lag, 1 amp; 250 v; blow time, carry 110%, open at 135% in 1 hr; ferrule terminals; glass body; one time; non-indicating; 1-1/4" lg x 1/4" dia; in accordance with MIL-F-15160; Type F02G1R00B; RAQA Dwg No. F-0057. | High Voltage Rectifier Protection. |
| F407 | | Same as F406. | Spare. |
| H101 | N16-T751512-0134 | TOOL, alignment: plastic body; 6-1/8" lg x 1/4" dia o/a; recessed screw nib on one end, metal scdr on other end; ICA part #6166; RAQA Dwg No. AG-4405. | Tuning Adjustment Tool. |
| H102 | G5120-242-7410 | WRENCH: for #6 hex socket head screw; 2-3/16" lg x 3/4" w x 3/32" between flats; alloy steel; 90° bend 21/32" from one end (L-shape): CAYT #6, RAQA Dwg No. AG-4406. | Tool for Knobs and Couplings. |
| H103 | Shop Manufacture | PULLER, tube: U- shaped steel strip with hook formed at end of each leg; #22 ga USS CRS strip 55; 1-3/4" w x 3-5/8" h x 7/16" d o/a; RAQA Dwg No. AG-4407. | Tool for Extracting Type 4X150A Tubes. |
| H104 | | Not Used. | |
| H105 | Shop Manufacture | RETAINER, tube: c/o octangonal plate 4-7/8" lg x 2-1/2" w x 1/8" thk w/two 1-5/8" dia holes 2-3/4" c to c and expansion spring riveted to center of plate 2" lg x 1/4" dia; plate from 1/8" thk laminated thermosetting plastic, spring from .026" dia music wire, zinc pl; 4-7/8" lg x 2-1/2" w x 2" h w/spring contracted, 3-9/16" h w/spring extended; two #12 (.189) drill mtg holes for studs, 2-3/4" c to c; RAQA Dwg No. VG-2751. | Retainer for Type 807 Tubes (V105-V106). |
| H106 | | Not Used. | |
| H107 | | Not Used. | |
| H108 | N17-T028255-1031 | TERMINAL, stud: 27/32" lg x 1/4" dia overall; #4-40 thd by 5/32" deep tapped hole for mts; molded plastic insulation; RAQA Dwg No. BG-1512. | Support for R103 and C102. |
| H109 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | LATCH, fastener: Slotted pin and slotted head type; cadmium pl steel; 5/16" dia head, 3/16" dia body; 3/8" lg overall; Dzus part No. F3-30; RAQA Dwg No. BG-1534. | Locks Retaining Shelf for Modulator Tubes. |
| H110 | | Same as H404. | U/w H109. |
| H401 | N16-L150001-0131 | LATCH, fastener: brass, nickel plated and SS; lever type: 4-5/8" lg x 5/8" w x 19/32" h o/a; mtd by two 5/32" holes spaced 13/16" c to c; for RH operation; RAQA Dwg No. VG-2743. | Modulator Unit Latch. |
| H402 | N16-L150001-0130 | Same as H401, except for LH operation; RAQA Dwg No. VG-2744. | RF Unit Latch. |
| H403 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | LATCH, fastener: slotted pin and wing head type; steel, cad pl; 5/8" lg x 5/8" w overall; 3/16" dia pin; Dzus part No. FW3-30; RAQA Dwg No. BG-1617. | Lock K403 Relay Shelf. |
| H404-1 thru H404-6 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | CATCH, fastener: steel, cad pl; spring type; 1" lg x 1/4" w x 0.200" thk overall; two 3/32" dia holes on 5/8" mtg centers; Dzus Part No. S3-200; RAQA Dwg No. AG-4470. | Used with H109, H403, and H607, cover for PA tubes relay shelf and retainer shelf for modulator tubes. |
| H405-1, H405-2 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | LATCH, fastener: slotted pin and wing head type; 7/8" lg x 7/8" w overall; 1/4" dia pin; steel cad pl and black iridite; Dzus part No. AW4-40; RAQA Dwg No. BG-1571. | Fastens Front Door. |
| H406-1 thru H406-16 | N17-T028218-4116 | TERMINAL, stud: general use; stud material; brass, zinc chromate pl, paper lam phenolic ins; 13/16" lg x 5/16" across flats; #6-32 thd on mtg stud 1/4" lg; breakdown voltage 1500 v RMS at 60 cps; RAQA Dwg No. BG-1349. | Support for Resistors and Capacitors. |
| H407-1, H407-2 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | CATCH, fastener: spring type; steel cad pl; 1-1/8" lg x 3/8" w x 1/4" high overall; RAQA Dwg No. WR-0065. | Used with H405. |
| H601 | N16-C300605-0901 | CLAMP, electrical: phosphor bronze; silver pl; screw type fastener; 3" lg x 2-1/8" w x 5/8" overall; designed to hold 4X150A tubes; RAQA Dwg No. VG-2763. | Retainer for V604. |
| H602-1 thru H602-12 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | LATCH, fastener: steel, cad pl; slotted head type; 0.471" lg x 0.437" dia; mounted in 0.468" dia hole; Camloc type No. 2700-4; RAQA Dwg No. VG-2757. | RF Unit Side Panels. |

* For 115 v Line.
** For 230 v Line.

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| H603-1 thru H603-16 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | LATCH, fastener: steel cad pl; 0.501" lg x 0.437" od mounts in 0.468" min dia hole; Camloc type No. 2700-5; RAQA Dwg No. VG-2758. | RF Unit Side Panels. |
| H604-1 thru H604-28 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | CATCH, fastener: bronze, cad pl; 1/2" lg by 1/2" w by 1/2" h; two 3/32" dia mtg holes on 3/4" ctrs; Camloc part No. 212-12; RAQA Dwg No. AG-4419. | Used with H602 and H603. |
| H605-1 thru H605-28 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | WASHER, Lock: stainless steel; rd 0.019" thk x 5/16" od x 3/32" id; split type; Camloc type No. 2700-SW; RAQA Dwg No. WK-0044. | Use on H602 and H603. |
| H606 | N17-C781255-0925 | CLAMP, electrical: type AN3057-4. | Holds Cable to P603 and P604. |
| H607-1 thru H607-4 | | Same as H109. | U/w H607. |
| I401 | N17-L006543-0200 | LAMP, incandescent: 12-16 v; type T-3-1/4 bulb; miniature bayonet base; CG type #1815, RAQA Dwg No. JL-0023. | Power ON Indication. |
| I402 | | Same as I401. | Carrier ON Indication. |
| J101 | N17-C073330-5001 | CONNECTOR, receptacle: 23 round female cont, asymmetrical arrangement straight type; 300 v, 8 amp rating; all cont except #7, #13, #16 and #23 are 15 amp, #10 and #12 are 500 v, and 11 is 1000 v; CARO #F23A, RAQA Dwg No. SF-0240. | Audio Section Input and Output Connections (u/w P401). |
| J401 | FOR REPLACEMENT USE N17-J039435-6234 | JACK, telephone: Navy type -49039A, JAN type JJ-033 (less locating pin): for 0.2065" dia 3 conductor plug; 1.245" lg x 0.937" w x 3/4" h o/a; J2 cont arrangement; incl 3/8" -32 thd x 7/32" lg mtg bushing with hex nut, 2 phenolic washers; no locating pin; same as Sig C jack JK-33-A (less loc pin); spec JAN-J-641; RAQA Dwg No. AG-4410. | Microphone Connection. |
| J401A | N17-C201579-0715 | COVER, telephone jack: aluminum, red semi-gloss enamel finish; spring hinge, normally closed, opens at 90°; 27/32" lg x 23/32" OD; 0.380" dia hole in fixed part mts around bushing and under nut of associated jack; 1/16" thk pad inside cover; RAQA Dwg No. AG-4411. | Moisture and Dust Cover for Jack J401. |
| J402 | FOR REPLACEMENT USE N17-J039248-3341 | JACK, telephone: navy type -49025B; for 2-conductor 1/4" dia plug; 1.271" lg x 1" w x 3/4" h o/a, approx; J1 cont arrangement; 3/8" -32 thd x 3/8" lg mtg bushing, incl hex nut, 2 phenolic washers; no locating pin; BuShips Dwg RE49AA195; RAQA Dwg No. AG-4412. | Earphone Connections. |
| J402A | N17-C201579-0717 | Same as J401A, except white finish; RAQA Dwg No. AG-4413. | Moisture and Dust Cover for Jack J402. |
| J403 | FOR REPLACEMENT USE N17-C072252-1135 | CONNECTOR, receptacle: 5 round female cont, pol; straight type; AN Aero Std type AN3102A-14S-5S; RAQA Dwg No. SF-0244. | Handset Connections. |
| J403A | FOR REPLACEMENT USE N17-C200987-0501 | COVER, electrical connector: anodized and painted gray; 9/16" h by 1-1/16" dia body dim; with captivating chain 2-9/16" lg; Amphenol No. 9760-373; RAQA Dwg No. AG-4409. | Moisture and Dust Cover for J403. |
| J501 | N17-C071317-6092 | CONNECTOR, plug: 18 silver pl rectangular cont (arr 6 vert in one row and 6 horiz in 2 rows) in rectangular molded Bakelite insert; rectangular metal shell; straight type: 700 v RMS, 10 amp rating; CJC #S-318-CCE, cad pl plus silver pl; RAQA Dwg No. SF-0235. | External Connections to Power Supply. |
| J502 | N17-C073114-7071 | CONNECTOR, receptacle: 1 round female cont, coaxial; straight type; 500 v peak; 52 ohms characteristic impedance; for RG-55/U or RG-58/U cable; CARO #36000, RAQA Dwg No. SF-0238. | Receiver Output Connections. |
| J503 | | Same as J502. | Antenna Connections. |
| J601 | N17-C073309-7501 | CONNECTOR, receptacle: 15 round female cont; symmetrical arrangement; straight type; 300 V, 8 amp cont rating, all cont except #3 and #4 are 525 V, #1 and #15 are 15 amp and #13 is 525 V plus modulating voltage; CARO #F15B, RAQA Dwg No. SF-0239. | RF Section Input and Output Connections. |
| J602 | N17-C073108-7477 | CONNECTOR, receptacle: 1 round female cont, coaxial, straight type; 500 v peak; 52 ohms characteristic impedance; CARO #5575, RAQA Dwg No. SF-0237; UG-625/U. | RF Drive Output Connections. |
| J603 | | Same as J602. | PA Input Connection. |
| J604 | | Same as J602. | RF Output Connection. |
| K101 | N17-R064872-9211 | RELAY, armature: pile up type, 2A; dpst normally open; single break, 32 v DC or 115 v AC, 3 amp; 1 winding inductive, 750 ohms ±10%, dc 0.0135 amp, 10 v; 1-3/8" lg x 1-1/2" w x 1" h overall; RAQA Dwg No. D-0076. | Transmitter Keying. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| K401 | N17-R065377-4006 | RELAY, armature: pile up type, 2C1B2A; five poles, 2 double throw w/normally closed contact, 1 single throw normally closed, 2 single throw normally open; single break; 32 vdc or 115 vac, 3 amp; 1 winding inductive, 3800 ohms ±10% dc, 0.0135 amp, 51 v; 1-11/16" lg x 1-1/2" w x 1" h overall; RAQA Dwg No. D-0077. | Carrier Control Relay. |
| K402 | N17-R064029-1101 | RELAY, armature: pile up type 4A; four poles, single throw, normally open, single break, ac, 115 vac, 15 amp; 1 winding inductive, 125 v, 0.050 amp, 50 cycles; 2-3/8" lg x 1-7/16" w x 1-11/16" h overall; RAQA Dwg No. D-0078. | Equipment Start-Stop. |
| K403 | N17-R065161-7238 | RELAY, armature: 2C contact arrangement; 4000 ohms p/m 10% DC coil resistance; 15 ma DC max; antenna changeover; RAQA Dwg No. D-0089. | Antenna Changeover. |
| K404 | N17-R099999-0900 | RELAY, thermal: spst; VAC; 2000 ±20% ohm heater element; 1-3/8" dia by 9/16" h overall; Reynolds Electric No. M4199; RAQA Dwg No. D-0088. | Equipment overheating protection. |
| L401 | N16-R029783-2450 | REACTOR: fixed inductance type; coil data; 2 coils; (terminals 1 and 2) 3 hy at 240V rms 120 cycles; 500 ma dc, 23 ohms dc resistance (terminals 2 and 3), 3 hy at 25V rms, 120 cycles; 500 ma dc, 35 ohms dc resistance; 1.5 kv rms test voltage; hermetically sealed fully enclosed metal case; 3-1/4" lg x 3-1/4" w x 7-5/8" h overall dim; per MIL-T-27; RAQA Dwg No. LC-0213. | Plate Rectifier Filter. |
| L402 | N16-R029757-6501 | REACTOR: fixed inductance type; coil data; 2 coils; (terminals 1 and 2), 0.08 hy at 7V rms, 120 cycles; 600 ma dc, 1.67 ohms dc resistance; (terminals 2 and 3), 0.08 hy, 0.3V rms, 120 cycles; 600 ma dc, 1.67 ohms dc resistance; 1.5 kv rms test voltage; hermetically sealed fully enclosed metal case; 2-5/16" lg x 2-11/16" w x 5-7/8" h overall dim; per MIL-T-27; RAQA Dwg No. LC-0214. | -12V Rectifier Filter. |
| L403 | N16-R029765-7301 | REACTOR: fixed inductance type; coil data; 2 coils; (terminals 1 and 2), 0.5 hy at 35V rms, 120 cycles, 130 ma dc, 26 ohms dc resistance; (terminals 3 and 4), 0.5 hy 0.3V rms, 120 cycles, 130 ma dc, 26 ohms dc resistance; 500V rms test voltage; hermetically sealed fully enclosed case; 1-1/2" lg x 1-1/2" w x 4-1/2" h overall dim; per MIL-T-27; RAQA Dwg No. LC-0215. | -42V Rectifier Filter. |
| L601 | N16-C073313-1069 | COIL, RF: choke; single wnd, single layer wnd; unshielded; 21 uh at 20-60 mc, 0.6 amp; 2.4 ohms dc resistance; 0.6 uuf distrib capacity; 115 turns #34 AWG wire; 1-3/4" lg x 5/16" OD; steatite form, aircore; term mtg; 1-1/2" radial wire leads welded to lug term, one ea encl, wnd mp and ins; COM #Z-28; RAQA Dwg No. LC-0210. | Oscillator Plate Choke. |
| L602 | Shop Manufacture | COIL, RF: single layer, solenoid spaced wound, 1/2" ID, 12 turns, #14 silver pl copper wire; mtg bracket, core, coil and coil form included; RAQA Dwg No. VG-2892. | Oscillator Plate Tuning. |
| L603 | N16-C073043-1051 | COIL, RF: choke; single wnd, single layer wnd; unshielded; 7 uh at 35-110 mc, 1 amp; 0.894 ohm dc resistance; 0.5 uuf distrib capacity; 57 turns #33 AWG wire; 7/8" lg x 9/32" OD; low PF plastic core (and form); term mtg; one 1" lg axial wire lead ea end; wnd mp coating; COM #Z-50; RAQA Dwg No. LC-0209. | Doubler Plate Choke. |
| L604 | Shop Manufacture | COIL, RF: 5 turns, #14 silver pl copper wire; single layer, space wnd; 1/2" ID; mtg bracket, core, coil and coil form included; RAQA Dwg No. VG-2895. | Doubler Plate Tuning. |
| L605 | | Same as L603. | RF Amplifier Plate Choke. |
| L606 | | Same as L603. | RF Amplifier Cathode Choke. |
| L607 | Shop Manufacture | COIL, RF: 5 turns #14 silver pl copper wire; single layer, space wound; 1/2" OD; mtg bracket, core, coil and coil form included; RAQA Dwg No. VG-2894. | RF Amplifier Plate Tuning. |
| L608 | N16-C072841-7430 | COIL, RF: choke; single wnd, single layer wnd; unshielded; 1.8 uh at 80-200 mc; 1 amp; 0.294 ohm dc resistance; 0.5 uuf distrib capacity; 35 turns #32 AWG wire; 3/4" lg x 3/16" OD; low PF plastic rod core and form; 1-1/2" axial wire lead ea end; term mtg; wnd mp coated; COM #Z-144; RAQA Dwg No. LC-0208. | Tripler and PA Plate Choke. |
| L609 | Shop Manufacture | COIL, RF: 2 turns #14 silver pl copper wire; single layer, space wnd; 1/2" ID; mtg bracket, core, coil and coil form included; RAQA Dwg No. VG-2893. | Tripler Plate Tuning. |
| L610 | Shop Manufacture | COIL, RF: 2-1/2 turns #14 silver pl copper wire; 1/2" ID, single layer, space wnd; air core; RAQA Dwg No. LW-0087. | Tripler Plate Tuning. |
| L611 | Shop Manufacture | COIL, RF: 2 turns #14 silver pl copper wire; single layer, space wnd; 1/2" ID; air core; RAQA Dwg No. LW-0060. | Tripler Output Coupling. |
| L612 | Shop Manufacture | COIL, RF: single turn #14 AWG 1/2 hard copper wire silver plated; single turn loop; unshielded; air core space wound 3/4" ID; 1-15/32" lg x 1-1/8" w x 1/4" thk overall; one crimp-on 1/8" dia copper rod terminal and one spade lug terminal soldered at each end of coil; terminal mounted; coupling; RAQA Dwg No. LW-0061. | PA Grid Input Coupling. |
| L613 | Shop Manufacture | COIL, RF: 2 turns #8 AWG silver pl copper wire; 1/2" ID; single layer, space wnd; air core; RAQA Dwg No. LW-0085. | PA Grid Tuning. |
| L614 | Shop Manufacture | COIL, RF: 2 turns #8 AWG silver pl copper wire; 27/32" ID; single layer, space wnd; air core, terminal mtd, solder lug terminals spaced 1-7/8" c to c; RAQA Dwg No. LW-0079. | PA Grid Tuning. |
| L615 | Shop Manufacture | COIL, RF: 3 turns #8 silver pl copper wire; single wnd; 9/16" lg x 3" w x 1-5/16" ID overall excluding terminals; RAQA Dwg No. LW-0091. | Power Amplifier Plate Tuning. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| L616 | Shop Manufacture | COIL, RF: 2-1/2 turns #8 silver pl copper wire: single wnd: 9/16" lg x 1-13/16" w x 11/16" ID overall, excluding terminals: RAQA Dwg No. LW-0093. | Power Amplifier Plate Tuning. |
| L617 | | Same as L608. | PA Plate Choke. |
| L618 | Shop Manufacture | COIL, RF: 1-1/4 turns #11 nickel plus silver pl copper wire: air core: 1-1/4" ID x 5/8" lg x 2-1/8" w x 1-1/16" h; RAQA Dwg No. LW-0089. | PA Output Coupling. |
| L619 | N16-C072768-8717 | COIL, RF: choke; single wnd, single layer wnd; unshielded: 0.84 uh at 160-350 mc, 1 amp: 0.049 ohm dc resistance: 0.34 uuf distrib capacity: 3/4" lg x 3/16" OD; low PF plastic rod core and form: term mtg: one 1-1/2 axial wire lead ea end; wnd mp coated COM #Z-235; RAQA Dwg No. LC-0207. | PA Screen Choke. |
| L620 | | Same as L619. | PA Plate Choke. |
| L621 | Shop Manufacture | COIL, RF: 2 turns 0.064" dia silver pl copper wire; single wnd; 1" lg x 1-1/4" w x 1/2" ID; overall excluding term: RAQA Dwg No. LW-0095. | Output Filter Tuning. |
| M401 | N17-M021878-2323 | METER, arbitrary scale: type MR26W163SPECR per spec MIL-M-6A. | Monitoring. |
| O601.1-1, O601.1-2 | N16-V010551-1027 | VENT, air: material, Revolite No. 1422 as mfr by Rey Corp: cylindrical with varying ID: 1-3/16" lg by 1-3/4" OD: mounted by three tapped No. 6-32 thd holes parallel to axis and spaced 120 degrees apart on 1-1/2" dia bolt circle: RAQA Dwg No. AC-1356. | Guides Air through Cooling Fins on PA Tubes. |
| O602 | N17-C098431-6201 | COUPLING, shaft, rigid: sleeve type: 1/2" OD x 0.253" ID x 1/2" lg: brass, silver pl: 2 pairs, tapped #6-32 thd, radial holes, spaced 90° apart: pair aligned axially and located 3/32" from ends of coupling: Allen #6 setscrews included: RAQA Dwg No. BG-1511. | Couples C637 to Drive. |
| O603 | N17-C098431-6221 | COUPLING, shaft, rigid: insulated: sleeve type: c/o brass collars pressed onto ends of Revolite #1422 hub: hub formed to provide flange between collars: 1/2" lg x 3/4" OD x 0.252" ID overall: 2 pairs, tapped #6-32 thd, holes spaced 120° apart, alined axially and located 3/32" from ends of coupling: Allen #6 setscrews provided; RAQA Dwg No. BG-1510. | Couples C645 to Drive. |
| O604 | N16-C099999-2025 | COUPLING, shaft flexible: spring and fulcrum type: brass; silver pl: 1-1/2" lg x x 1/2" w; 4 #6-32 x 1/8" setscrew for mtg: RAQA Dwg No. VG-2869. | Couples C605 to Drive. |
| O605 | N16-D901161-0136 | DRIVE, tuning: c/o two gears, 1 pinion and front and back plates: 2 gears ea 1/16" thk brass, 2-1/2" PD, 48 DP, 120 std involute teeth with 14-1/2° pressure angle: pinion is 1/4" PD, SS, 12 teeth: front and back plates each 1-7/8" wd x 3-1/4" h x 1/16" thk aluminum with corners cut from bottom and notch cut in top center: gears assembled with springs to form non-lash pair: 3-1/4" h x 2-1/2" w x 1-1/4" d o/a: mtd by three 0.196" dia holes in plates, two centered 1-1/2" apart on line 3/16" below top and one 3/16" below top and 1/4" to left of vert ctr line: RAQA Dwg No. VG-2746. | Drive for PA Plate Tuning C645. |
| O606 | N16-D901161-0135 | DRIVE, tuning: c/o two gears, 1 pinion, 1 double grooved sheave and front and back assembly plates: 2 gears each 1/16" thk brass, 2-1/2" PD, 48 DP: 120 std involute teeth with 14-1/2° pressure angle: pinion is 1/4" PD, SS, 12 teeth, sheave is 1-3/4" od x 0.156" thk brass wheel with two 0.037" w grooves: front and back plates each 1-7/8" w x 3-1/4" h x 1/16" thk aluminum with corners cut from bottom and notch cut in top center to clear mtg holes: gears assembled with spring to make non-lash pair: mtd by three 0.196" dia holes at apexes of isoceles triangle having 1-1/2" base and 2-7/8" alt: RAQA Dwg No. VG-2747. | Drive for PA Grid Tuning C637. |
| O607 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | DRIVE, tuning: 2 gears, pinions, front and back plate 2 gears back: 0.045" thk brass, 1.56" PD, 48 DP. 75 std involute teeth w/14-1/2° PA: 2-5/16" x 1-3/16" x 1-3/4" thk overall: 3 holes 3/16" dia on apexes, 1" base x 2-3/16" altitude in back plate: RAQA Dwg No. VG-2888. | Drive for RF Driver Tuning, C605. |
| O608-1, O608-2 | G3110-156-8341 | BEARING: ball type: New Departure No. 99038; RAQA Dwg No. BG-1509. | Bearing for Blower B601. |
| P301 | N17-C071606-1085 | CONNECTOR, plug: 18 male contacts: flat, polarized, straight, 2" lg by 1-1/8" w x 2-31/32" h: rectangular body, steel, enameled: molded black bakelite insert 9/16" dia cable opening: 700 v rms, 10 amp constant rating: CJC part No. P-318-CCT; RAQA Dwg No. SM-0197. | P/O W301. |
| P302 | N17-C071317-6091 | CONNECTOR, plug: 18 female contacts: flat, polarized, straight: 2" lg x 1-1/8" w x 2-9/16" h: rectangular body, steel, enameled: molded bakelite insert: 9/16" dia cable opening: 700 v rms 10 amp constant rating: CJC part No. S-318-CCT: RAQA Dwg No. SF-0234. | P/O W301. |
| P304 | | Same as P401. | P/O W302. |
| P305 | | Same as P402. | P/O W303.1. |
| P306 | | Same as J601. | P/O W303.1. |
| P307 | | Same as J101. | P/O W302. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| P401 | N17-C073627-1001 | CONNECTOR, receptacle: 23 round parallel male cont in asymmetrical arrangement: straight type; cont rated at 300 V, 8 amp, except #7, #13, #16 and #23 are 15 amp, #10 and #12 are 500 V and #11 is 1000 V; CARO #M23A: RAQA Dwg No. SM-0202. | Audio Unit Input and Output Connections (Mates with J101). |
| P402 | N17-C073597-1001 | CONNECTOR, receptacle: 15 round male cont in asymmetrical arrangement straight type; cont rated at 300 V, 8 amp, except #3 and #4 are 525 V, #1 and #15 are 15 amp and #13 is 525 V plus mod voltage: CARO #M15B, RAQA Dwg No. SM-0201. | Input and Output Connections to RF Section. |
| P403 | N17-C073605-9185 | CONNECTOR, receptacle: 18 rectangular male cont; straight type; polarized: overall dim 1-15/16" lg x 1-11/16" w x 1-5/32" h: 700 V rms 10 amp constant rating: CJC No. P-318-AB: RAQA Dwg No. SM-0204. | External Connections to Power Supply. |
| P501 | FOR REPLACEMENT USE N17-C071408-9255 | CONNECTOR, plug: AN type UG-88/U: 1 round coaxial male cont; straight type; 52 ohms characteristic impedance: Navy spec RE49F246: RAQA Dwg No. SM-0199. | Receiver Connection to Relay K403. |
| P502 | | Same as P501. | Antenna Connections to Relay K403. |
| P503 | FOR REPLACEMENT USE N17-C071417-9699 | CONNECTOR, plug: AN type UG-21D/U: 1 round coaxial male contact: straight type; 52 ohms characteristic impedance: RAQA Dwg No. SM-0188. | Connections from External Recr to Xmtr. |
| P504 | | Same as P503. | External Antenna Connection to Xmtr. |
| P601 | | Same as P501. | Output of RF Section. |
| P602 | | Same as P501. | Transmitter Connection to Relay K403. |
| P603 | N17-C070579-6120 | CONNECTOR: type AN3106A-12S-3P: RAQA Dwg No. SM-0212. | Blower Motor Line Connector. |
| P604 | N17-C070276-8061 | CONNECTOR: type AN3101A-12S-3S: RAQA Dwg No. SF-0257. | Blower Motor Line Connector. |
| R101 | N16-R088079-4689 | RESISTOR, variable: comp: one section: 250,000 ohms ±10%, 2 watts: 3 radial solder lug terminals: encl plastic can w metal cover: 1-5/32" dia x 5/8" lg FMS with scdr slot: C taper: ins cont arm: no off pos: normal torque: similar to RV4ATSA254C; w/slotted type 3/8-32 bushing: CBZ type JLA2541: RAQA Dwg No. RP-254M. | Speech Amplr Gain Control. |
| R102 | FOR REPLACEMENT USE N16-R050974-0438 | RESISTOR, fixed: comp: MIL type RC20GF105K: 1 megohm ±10%: 1/2 watt: spec MIL-R-11A. | AVC Feedback Divider. |
| R103 | FOR REPLACEMENT USE N16-R051019-0440 | RESISTOR, fixed: comp: MIL type RC20GF155K: 1.5 megohms ±10%: 1/2 watt: spec MIL-R-11A. | Speech Amplr Input Divider. |
| R104 | FOR REPLACEMENT USE N16-R050416-0435 | RESISTOR, fixed: comp: MIL type RC20GF333K: 33,000 ohms ±10%: 1/2 watt: spec MIL-R-11A. | Speech Amplr Plate Load |
| R105 | N16-R050633-0136 | RESISTOR, fixed: comp: MIL type RC42GF104J: 100,000 ohms ±5%: 2 watts: spec MIL-R-11A. | Speech Amplr Screen Dropping. |
| R106 | N16-R050335-0438 | RESISTOR, fixed: comp: MIL type RC20GF153J: 15,000 ohms ±5%: 1/2 watt: spec MIL-R-11A. | Speech Amplr Screen Bleeder. |
| R107 | FOR REPLACEMENT USE N16-R050821-0276 | RESISTOR, fixed: comp: MIL type RC20GF474K: 470,000 ohms ±10%: 1/2 watt: spec MIL-R-11A. | AVC Feedback Divider. |
| R108 | FOR REPLACEMENT USE N16-R050713-0380 | RESISTOR, fixed: comp: MIL type RC20GF224K: 220,000 ohms ±10%: 1/2 watt: spec MIL-R-11A. | AVC Amplr Grid Leak. |
| R109 | FOR REPLACEMENT USE N16-R050335-0940 | RESISTOR, fixed: comp: MIL type RC42GF153K: 15,000 ohms ±10%: 2 watts: spec MIL-R-11A. | AVC Amplr Plate Load |
| R110 | FOR REPLACEMENT USE N16-R050371-0711 | RESISTOR, fixed: comp: MIL type RC30GF223K: 22,000 ohms ±10%: 1 watt: spec MIL-R-11A. | AVC Delay Voltage. |
| R111 | | Same as R108. | AVC Delay Voltage Divider. |
| R112 | FOR REPLACEMENT USE N16-R050758-0377 | RESISTOR, fixed: comp: MIL type RC20GF334K: 330,000 ohms ±10%: 1/2 watt: spec MIL-R-11A. | AVC Rectifier Load. |
| R113 | N16-R088009-4721 | RESISTOR, variable: comp: 100,000 ohms ±10%: 2 watts at 70° C: 3 radial solder lug terms: encl plastic can with metal cover: 1-5/32" dia x 9/16" d: round metal shaft 1/4" dia x 5/8" lg FMS with scdr slot: linear taper: ins cont arm: no off pos: normal torque: 3/8" -32NEF-2 thd x 1/2" lg locking type mtg bushing with non-turn device at 9 o'clock pos on 17/32" radius: CBZ type JLU1041: RAQA Dwg No. RP-104V. | Clipping Symmetry Adjustment. |
| R114 | FOR REPLACEMENT USE N16-R050632-0416 | RESISTOR, fixed: comp: MIL type RC20GF104K: 100,000 ohms ±10%: 1/2 watt: spec MIL-R-11A. | Clipper Cathode. |
| R115 | | Same as R113. | Modulation Level Adjustment. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| R116 | | Same as R102. | Filter Amplr Grid Leak. |
| R117 | N16-R049939-0271 | RESISTOR, fixed: comp; MIL type RC20GF122J; 1200 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Filter Amplr Cathode Bias. |
| R118 | | Same as R117. | Driver Cathode Bias. |
| R119 | FOR REPLACEMENT USE N16-R049579-0131 | RESISTOR, fixed: comp; MIL type RC20GF101K; 100 ohms ±10%; 1/2 watt; spec MIL-R-11A. | Parasitic Suppressor. |
| R120 | | Same as R119. | Parasitic Suppressor. |
| R121 | N16-R088339-5012 | RESISTOR, variable: comp; one section 1.0 megohm ±10%; 2 watts; 3 radial solder lug terminals; encl plastic can with metal cover; 1-5/32" dia; round metal shaft 1/4" dia by 5/8" lg FMS with scdr slot; A taper; ins cont arm; no off pos; normal torque; similar to RV4ATSA105A; w/slotted type 3/8-32 bushing; CBZ type JLU1052; RAQA Dwg No. RP-105Z. | Expansion Level Adjustment. |
| R122 | FOR REPLACEMENT USE N16-R050551-0401 | RESISTOR, fixed: comp; MIL type RC20GF683K; 68,000 ohms ±10%; 1/2 watt; spec MIL-R-11A. | Multivibrator Input Divider. |
| R123 | FOR REPLACEMENT USE N16-R049876-0438 | RESISTOR, fixed: comp; MIL type RC20GF821J; 820 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Multivibrator Cathode Bias. |
| R124 | | Same as R110. | Multivibrator Plate Load. |
| R125 | | Same as R109. | Multivibrator Plate Load. |
| R126 | | Same as R109. | Multivibrator Plate Load. |
| R127 | FOR REPLACEMENT USE N16-R050633-0136 | RESISTOR, fixed: comp; MIL type RC42GF104K; 100,000 ohms ±10%; 2 watts; spec MIL-R-11A. | Multivibrator Grid Leak. |
| R128 | N16-R050416-0944 | RESISTOR, fixed: comp; MIL type RC42GF333K; 33,000 ohms ±10%; 2 watts; spec MIL-R-11A. | Volume Expander Diode Load. |
| R129 | | Same as R107. | Volume Expander Diode Load. |
| R130 | | Same as R102. | Volume Expander Clamping. |
| R131 | N16-R088409-5111 | RESISTOR, variable: comp; 2.5 megohms ±20%; 2 watts; 3 radial tap term; encl plastic case w/metal cover; 1-5/32" dia x 9/16" d; metal shaft slotted 1/4" dia x 5/8" lg; linear taper; ins cont arm; no off pos; normal torque; 3/8" -32 thd x 1/2" lg locking mtg bushing w/non-turn device at 3 and 9 o'clock on 17/32" rad; CBZ type JLU2552; RAQA Dwg No. RP-255D. | MCW Carrier Holding Time Constant Adjustment. |
| R132 | | Same as R102. | MCW Carrier Holding Time Constant. |
| R133 | | Same as R107. | Phone Driver Grid Leak. |
| R134 | FOR REPLACEMENT USE N16-R050164-0435 | RESISTOR, fixed: comp; MIL type RC20GF562K; 5600 ohms ±10%; 1/2 watt; spec MIL-R-11A. | MCW Oscillator Cathode Bias. |
| R135 | N16-R050893-0435 | RESISTOR, fixed: comp; MIL type RC20GF684J; 680,000 ohms ±5%; 1/2 watt; spec MIL-R-11A. | MCW Oscillator Grid Leak. |
| R136 | | Same as R135. | MCW Oscillator Feedback. |
| R137 | | Same as R135. | MCW Oscillator Feedback. |
| R138 | | Same as R135. | MCW Oscillator Feedback. |
| R139 | | Same as R114. | MCW Oscillator Plate Load. |
| R140 | | Same as R108. | MCW Oscillator Plate Load. |
| R141 | | Same as R121. | MCW Mod Level Control. |
| R142 | | Same as R103. | Speech Amplr Grid Leak. |
| R143 | FOR REPLACEMENT USE N16-R050065-0438 | RESISTOR, fixed: comp; MIL type RC20GF332K; 3300 ohms ±10%; 1/2 watt; spec MIL-R-11A. | "B" Supply Filter. |
| R144 | | Same as R103. | Modulation Indicator. |
| R145 | | Not used. | |
| R146 | | Not used. | |
| R147 | FOR REPLACEMENT USE N16-R049624-0715 | RESISTOR, fixed: comp; MIL type RC30GF151J; 150 ohms ±5%; 1 watt, spec MIL-R-11A. | Mod Bias Divider. |
| R148 | | Same as R147. | Mod Bias Divider. |
| R149 | | Same as R147. | Mod Bias Divider. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| R150 | | Same as R147. | Mod Bias Divider. |
| R151 | N16-R049768-0438 | RESISTOR, fixed: comp; MIL type RC20GF471J; 470 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Driver Cathode Bias. |
| R190 | | Same as R122. | P/O Speech Amplr Plate Load. |
| R195 | N16-R050110-0438 | RESISTOR, fixed: comp; MIL type RC20GF432J; 4300 ohms, ±5%; 1/2 watt; spec MIL-R-11A. | Plate Transient Suppressor. |
| R401 | N16-R049363-0438 | RESISTOR, fixed: comp; MIL type RC20GF330J; 33 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Volume Expander Meter Shunt. |
| R402 | N16-R049588-0438 | RESISTOR, fixed: comp; MIL type RC20GF111J; 110 ohms ±5%; 1/2 watt; spec MIL-R-11A. | PA Grid Meter Shunt. |
| R403 | N16-R049804-0438 | RESISTOR, fixed: comp; MIL type RC20GF561J; 560 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Tripler Grid Meter Shunt. |
| R404 | N16-R049282-0438 | RESISTOR, fixed: comp; MIL type RC20GF150J; 15 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Tripler Meter Shunt. |
| R405 | | Same as R404. | Tripler Plate Meter Shunt. |
| R406 | FOR REPLACEMENT USE N16-R068297-7255 | RESISTOR, fixed: WW; MIL type RW55J5RO; 5 ohms ±5%; 5 watts; spec MIL-R-26B. | PA Plate Meter Shunt. |
| R407 | FOR REPLACEMENT USE N16-R066168-2370 | RESISTOR, fixed: WW; MIL type RW34G312; 3100 ohms ±5%; 30 watts; spec MIL-R-26B. | HV Supply Voltage Dropping. |
| R408 | FOR REPLACEMENT USE N16-R066030-9511 | RESISTOR, fixed: WW; MIL type RW34G102; 1000 ohms ±5%; 30 watts; spec MIL-R-26B. | HV Supply Voltage Dropping. |
| R409 | FOR REPLACEMENT USE N16-R065846-2006 | RESISTOR, fixed: WW; MIL type RW33G401; 400 ohms ±5% 18 watts; spec MIL-R-26B. | HV Supply Voltage Dropping. |
| R410 | FOR REPLACEMENT USE N16-R065755-7351 | RESISTOR, fixed: WW; MIL type RW36G201; 200 ohms ±5%; 60 watts; spec MIL-R-26B. | HV Supply Voltage Dropping. |
| R411 | N16-R087349-4788 | RESISTOR, variable comp: JAN type RV4ATRD102A; 1000 ohms ±10%; 2 watts; spec JAN-R-94. | Earphone Volume Control. |
| R412 | FOR REPLACEMENT USE N16-R068369-8366 | RESISTOR, fixed: WW; MIL type RW55J251; 250 ohms ±5%; 5 watts; spec MIL-R-26B. | Relay K402 Current Limiting. |
| R413 | FOR REPLACEMENT USE N16-R049705-0321 | RESISTOR, fixed: comp; MIL type RC20GF331K; 330 ohms ±10%; 1/2 watt; spec MIL-R-11A. | Audio Line Balancing. |
| R414 | FOR REPLACEMENT USE N16-R050200-0701 | RESISTOR, fixed: comp; MIL type RC30GF682J; 6800 ohms ±5%; 1 watt; spec MIL-R-11A. | Meter (M401) Series Resistor. |
| R415 | N16-R050201-0137 | RESISTOR, fixed: comp; MIL type RC42GF682J; 6800 ohms ±5%; 2 watts; spec MIL-R-11A. | PA Screen Voltage Dropping. |
| R416 | | Same as R415. | PA Screen Voltage Dropping. |
| R417 | N16-R050552-0142 | RESISTOR, fixed: comp; MIL type RC42GF683J; 68,000 ohms ±5%; 2 watts; spec MIL-R-11A. | PA Screen Bleeder. |
| R418 | FOR REPLACEMENT USE N16-R066329-6746 | RESISTOR, fixed: WW; MIL type RW33G712; 7100 ohms ±5%; 18 watts; spec MIL-R-26B. | 300V Bleeder. |
| R601 | N16-R049498-0438 | RESISTOR, fixed: comp; MIL type RC20GF680J; 68 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Parasitic Suppressor. |
| R602 | N16-R049660-0438 | RESISTOR, fixed: comp; MIL type RC20GF221J; 220 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Oscillator Cathode. |
| R603 | N16-R050012-0146 | RESISTOR, fixed: comp; MIL type RC42GF222J; 2200 ohms ±5%; 2 watts; spec MIL-R-11A. | Oscillator Plate Dropping. |
| R604 | | Same as R106. | Doubler Grid Leak. |
| R605 | N16-R049687-0321 | RESISTOR, fixed: comp; MIL type RC20GF271J; 270 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Doubler Grid Meter Shunt. |
| R606 | | Same as R151. | Doubler Cathode. |
| R607 | | Same as R603. | Doubler Plate Dropping. |
| R608 | | Same as R123. | RF Amplr Cathode. |
| R609 | | Same as R603. | Amplr Plate Dropping. |
| R610 | N16-R050416-0435 | RESISTOR, fixed: comp; MIL type RC20GF333J; 33,000 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Tripler Grid Leak. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| R611 | N16-R050335-0940 | RESISTOR, fixed: comp; MIL type RC42GF153J; 15,000 ohms ±5%; 2 watts; spec MIL-R-11A. | Tripler Screen Dropping. |
| R612 | N16-R050372-0131 | RESISTOR, fixed: comp; MIL type RC42GF223J; 22,000 ohms ±5%; 2 watts; spec MIL-R-11A. | Tripler Screen Dropping. |
| R613 | N16-R050515-0955 | RESISTOR, fixed: comp; MIL type RC42GF563J; 56,000 ohms ±5%; 2 watts; spec MIL-R-11A. | Tripler Screen Bleeder. |
| R614 | N16-R050282-0131 | RESISTOR, fixed: comp; MIL type RC42GF103J; 10,000 ohms ±5%; 2 watts; spec MIL-R-11A. | PA Grid Leak. |
| R615 | | Same as R614. | PA Grid Leak. |
| R616 | N16-R050281-0438 | RESISTOR, fixed: comp; MIL type RC20GF103J; 10,000 ohms ±5%; 1/2 watt; spec MIL-R-11A. | Output Indicator Filter. |
| R617 | N16-R070198-9907 | RESISTOR, fixed: WW; inductive wound; 0.12 ohm ±10%; 5 watts; 1" lg x 5/16" dia body dim; RAQA Dwg No. RW-3012. | Tube V604 Filament Dropping. |
| R618 | N16-R070151-2001 | RESISTOR, fixed: WW; inductive wound; 0.072 ohm ±10%; 5 watts; 1" lg x 5/16" dia body dim; RAQA Dwg No. RW-4072. | Tubes V605 and V606 Filament Dropping. |
| S101 | N17-S062523-1361 | SWITCH, rotary: 4 pole, 2 pos. 2 throws, 12 cont; 1 sect; cont: silver pl brass, non-shorting; 1 amp rating; wax impr ceramic wafers; 1" lg x 1-5/8" w x 1-7/8" h; 30° detent action; radial solder lug term; 3/8" -32 thd x 1/4" lg mtg bushing; shaft 1/4" dia x 11/16" lg FMS with 3/8" lg flat; RAQA Dwg No. X-0289. | MCW-PHONE Switch. |
| S102 | N17-S071894-1544 | SWITCH, toggle: SPDT; JAN type ST42D; spec JAN-S-23; RAQA Dwg No. X-0281. | AVC On-Off. |
| S103 | N17-S073959-1025 | SWITCH, toggle: DPDT; JAN type ST52N; spec JAN-S-23; RAQA Dwg No. X-0279. | Clipper Filter On-Off. |
| S104 | | Same as S102. | Volume Expander On-Off. |
| S401 | N17-S063671-8620 | SWITCH, rotary: 2 pole, 10 pos, 10 throws; 2 sect, 1 pole each sect; cont: silver pl brass, non-shorting, 1 amp rating; wax impr ceramic wafers; 1-7/32" lg x 1-5/8" w x 1-7/8" h; 30° detent action; radial solder lug term; 3/8" -32 thd x 1/4" lg mtg bushing; shaft, 1/4" dia x 23/32" lg FMS with 13/32" lg flat; RAQA Dwg No. X-0290. | Meter (M401) Selector Switch. |
| S402 | FOR REPLACEMENT USE N17-S072396-1725 | SWITCH, toggle: SPDT; JAN type ST40G; spec JAN-S-23; RAQA Dwg No. X-0282. | Equipment Start-Stop. |
| S403 | N17-S072828-2605 | SWITCH, toggle: DPST; JAN type ST52K; spec JAN-S-23; RAQA Dwg No. X-0280. | Emergency Power Switch. |
| S404 | | Same as S101. | LOCAL-REMOTE Selection. |
| S405 | N17-S072396-1685 | SWITCH, toggle: SPDT; JAN type ST42H; spec JAN-S-23; RAQA Dwg No. X-0285. | Local Carrier Control. |
| S601 | N16-T043276-1083 | TRANSMITTER SUBASSEMBLY: c/o bracket, bearing and shaft for mounting and shifting into contact position CR-24 crystals; 1-13/16" lg x 1-13/16" w x 1-13/16" h overall; RAQA Dwg No. VG-2749. | Crystal Mechanical Transfer. |
| S601A-1, S601A-2 | N17-C081967-5001 | CONTACT, switch: spring leaf type; brush action; 0.008" thk beryllium copper, silver pl; 5/16" lg x 3/16" w cont area; "J" shaped; 23/32" lg x 3/4" w x 5/16" h o/a; mtd by one 0.154" OD and one 0.062" OD hole, in different planes; RAQA Dwg No. AG-4414. | Contact for Xtal Switch. |
| S601B-1, S601B-2 | | Same as E614-1 | Support for Contacts of Xtal Switch S601. |
| T101 | N17-T061047-1200 | TRANSFORMER, af: input type; impedance data; two primaries 150 ohms ±5% ea, two secondaries 855000 ohms ±5% and 600 ohms ±5%; dc rating 0.050 amp ea primary, 0 amp ea secondary; test voltage 1250 v; overall dim 4-1/8" lg, 1-3/4" w, 1-7/8" h; turns ratio 1 to 75.5 primary to secondary (7-2) and 1 to 2 primary to secondary (5-6); ±.75 db 300 to 3500 cycles: per MIL-T-27; RAQA Dwg No. LA-0053. | Audio Input. |
| T102 | N17-T065004-7500 | TRANSFORMER, af: plate coupling type; impedance data; primary 7700 ohms ±10%, secondary 136,000 ohms ±10% overall center tapped; direct current rating primary 0.011 amp; test voltage 1500 v; overall dim 2-7/16" lg, 1-9/16" w, 2-13/16" h; 0.050 w max audio operating level; turns ratio 1 to 4.2 primary to secondary; 300 to 3500 cycles frequency range, ±1.0 db over frequency range; per MIL-T-27; RAQA Dwg No. LM-0058. | Driver to Modulator Interstage Coupling. |
| T103 | N17-T063251-8741 | TRANSFORMER, af: modulation type; impedance data; primary 9,000 ohms center tapped; secondary (terminals 4 and 5) 2800 ohms, (terminals 8 and 9) 300 ohms, (terminals 6 and 7) 0.22 ohm; feedback winding provided; direct dc, primary 0.075 amp ea half, secondary (terminals 4 and 5) 0.190 amp, (terminals 8 and 9) 0.007 amp, (terminals 6 and 7) 0.011 amp; test voltages, primary 3000 v, (terminals 4 and 5) 3000 v, (terminals 8 and 9) 2500 v, (terminals 6 and 7) 500 v; overall dim 3-7/16" lg; 2-1/2" w, 2-5/8" h; operating level, 20 w max; turns ratios primary to secondary (terminals 4 and 5) 1:0.57, (terminals 8 and 9) 1:0.196, (terminals 6 and 7) 1:0.0052; ±0.75 db 300 to 3500 cycles, not tuned; per MIL-T-27; RAQA Dwg No. LH-0001. | Modulation. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| T401 | N17-T077398-1025 | TRANSFORMER, power step down and step-up: hermetically sealed fully enclosed in metal case; 2 primary windings, 115V, 50 to 60 cps, single phase; secondary windings: 1475V ac, 0.505 amp dc, center tapped; 6.4V ac, 14 amp ac; 5.1V ac, 5 amp ac; 62V ac, 0.15 amp ac; 19.2V ac, 1.02 amp ac; test voltages: primary 1000V, secondary (terminals 5, 6 and 7) 3500V, all other windings, 500V; air cooled; impregnated; overall dim 5-1/2" lg x 4-21/32" w x 7-3/8" h; per MIL-T-27; RAQA Dwg No. LP-0234. | Equipment Power. |
| T402 | N17-T068817-5501 | TRANSFORMER, power step down: hermetically sealed fully enclosed metal case; primary winding 230V ac, 50 to 60 cps, single phase; secondary winding 115V ac, 0.240 amp; test voltages: primary 1000V, secondary 500V; air cooled; overall dim 2-1/8" lg x 2-1/4" w x 3-7/16: h; per MIL-T-27; RAQA Dwg No. LP-0235. | Control Voltage Supply. |
| V101 | N16-T075749 | TUBE, electron: MIL type 5749/6BA6W; pentode; spec MIL-E-1B; RAQA Dwg No. EG-5749. | Speech Amplifier. |
| V102 | N16-T075814 | TUBE, electron: MIL type 5814; dual triode; spec MIL-E-1B; RAQA Dwg No. EG-5814A. | AVC Amplr (V102A) and AVC Rectifier (V102B) |
| V103 | N16-T075726 | TUBE, electron: MIL type 5726/6AL5W; dual diode; spec MIL-E-1B; RAQA Dwg No. EG-5726. | Clipper. |
| V104 | | Same as V102. | Filter Amplr (V104A) and Driver Amplr (V104B). |
| V105 | N16-T068070 | TUBE, electron: MIL type 807; beam power tetrode; spec MIL-E-1B; RAQA Dwg No. EG-807. | Modulator. |
| V106 | | Same as V105. | Modulator. |
| V107 | | Same as V102. | Multivibrator. |
| V108 | | Same as V103. | Vol Expander Rect (V108A) and Modulation Indicator (V108B). |
| V109 | N16-T056203 | TUBE, electron: MIL type 6AT6; dual diode and triode; spec MIL-E-1B; RAQA Dwg No. EG-6AT6. | MCW Osc (Triode) Vol Expander and Clamping (Diodes). |
| V110 | | Same as V102. | Carrier Control. |
| V401 | N16-T053228 | TUBE, electron: MIL type 3B28; gas-filled diode; spec MIL-E-1B; RAQA Dwg. No. EG-3B28. | Rectifier. |
| V402 | | Same as V401. | Rectifier. |
| V601 | N16-T058240-14 | TUBE, electron: MIL type 12AT7WA; dual triode spec MIL-E-1B; RAQA Dwg No. EG-12AT7WA. | RF Oscillator. |
| V602 | | Same as V601. | Doubler. |
| V603 | | Same as V601. | RF Amplr. |
| V604 | N16-T054950 | TUBE, electron: MIL type 4X150A; power tetrode; spec MIL-E-1B; RAQA Dwg No. EG-4X150A. | Tripler. |
| V605 | | Same as V604. | Power Amplr. |
| V606 | | Same as V604. | Power Amplr. |
| W301 | N17-C048887-2951 | CABLE ASSEMBLY, special purpose; CX-1826/U c/o 15 wires (incl shielded pair) in plastic sleeve; 8' lg between connectors; one CJC #P-318-CCT male connector one end and one #S-318-CCT female connector other end; RAQA Dwg No. VW-0796. | Chassis to Cabinet Servicing Interconnection. |
| W302 | N17-C048890-3151 | CABLE ASSEMBLY, special purpose: CX-1827/U c/o 18 wires in plastic sleeve; 36" lg between connectors; one CARO #M-23A male connector one end and one F-23A female connector other end; RAQA Dwg No. VW-0797. | Modulator to Chassis to Servicing Interconnections. |
| W303.1 | Assemble from Component parts. | CABLE ASSEMBLY, special purpose; CX-3154/U; c/o 13 wires in plastic sleeve; 36" lg between connectors; one CARO #M15B male connector one end and one F15B female connector other end; RAQA Dwg No. VW-0885. | RF Unit to Chassis Servicing Interconnection. |
| W601 | N16-C011943-2350 | CABLE ASSEMBLY, RF: AN type CG-409/U (0', 6-1/2"); JAN type RG-58/U coax cable with one JAN type UG-88/U connector each end; 6-1/2" (±1/8) lg o/a; RAQA Dwg No. VM-0429. | Tripler to PA Grid Coupling. |
| W601A-1 | | Same as P501. | P/O Cable W601. |
| W601A-2 | | Same as P501. | P/O Cable W601. |
| XF401 | N17-F074267-5075 | HOLDER, fuse: extractor post type; for type 3AG glass fuse; molded Bakelite body; 15 amps, 250 v rating 2-9/32" g x 11/16" dia o/a; 1/2" -24 thd x 1/2" lg bushing and 1/8" thk x 11/16" (between flats) hex nut; 2 solder lug term at rear; bayonet type removable retainer cap; resistant to salt water; CFA type HKP; RAQA Dwg No. SF-0236. | Holder for Fuse F401. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIG-NATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| XF402 | | Same as XF401. | Holder for Fuse F402. |
| XF406 | Low Failure item -if required requisition from ESO referencing Nav-Ships 900,180A | HOLDER, fuse: c/o spacer board, fuse clip board and fuse cover; for single 3AG cartridge fuse; plastic material type PBE-P per spec MIL-F-3115, w/ nickel pl phosphor bronze clips; spacer board is 2-5/8" lg x 13/16" w x 1/16" h, two 11/64" dia mtg holes on 2-3/16" centers; fuse clip board is 2-3/4" lg x 13/16" w x 3/8" h overall, machine slotted 1/4" deep x 9/16" w x 1-57/64" lg plus 9/32" radius on one end, 2 fuse clips riveted on 1-1/32" centers, two 11/64" dia mtg holes on 2-3/16" centers; fuse cover is 2-3/4" lg x 13/16" w x 3/4" h overall, machine slotted 9/16" deep x 1-1/32" dia mtg holes on 2-3/16" centers with 7/16" dia x 1/4" deep counterbore; RAQA Dwg Nos. VG-3072 (fuse clip board assy), AC-1454 (spacer) NG-1017 (fuse cover) and misc hardware. | Holder for F406. |
| XI401 | N17-L076854-4200 | LIGHT, indicator: with 1/2" dia smooth red rear-frosted lens; for miniature bayonet base type T-3-1/4 bulb; encl shell, black nickel finish; Bakelite insert; 2-5/16" lg x 13/16" across flats; 11/16" dia mtg hole; lamp replaceable from front; threaded jewel; 2 solder lug term at rear; dims to blackout by 3 triangular holes; CAYZ #98B-2210-11-1; RAQA Dwg No. SL-0057. | Socket for Lamp I401. |
| XI401A | FOR REFERENCE ONLY | LIGHT, indicator: w/out lens; w/outCPA;CAYZ Part No. 98B-2210-11; RAQA Dwg No. SL-0066. | P/O XI401. |
| XI401B | N17-L250627-0560 | LENS, light: red CAYZ Part No. 98B-111; RAQA Dwg No. SL-0064. | P/O XI401. |
| XI402 | N17-L076770-4445 | Same as XI401 except green lens; CAYZ series DV707, #98B-2210-11-2; RAQA Dwg No. SL-0058. | Socket for Lamp I402. |
| XI402A | | Same as XI401A. | P/O XI402. |
| XI402B | N17-L250305-0452 | LENS, light: green; CAYZ Part No. 98B-112; RAQA Dwg No. SL-0065. | P/O XI402. |
| XV101 | N16-S062603-6919 | SOCKET, tube: JAN type TS102C03; spec JAN-S-28A Ref MS 91514-1. | Socket for Tube V101. |
| XV102 | N16-S062603-6927 | SOCKET, tube: JAN type TS103P03; spec JAN-S-28A Ref MS 91515-2. | Socket for Tube V102. |
| XV103 | | Same as XV101. | Socket for Tube V103. |
| XV104 | | Same as XV102. | Socket for Tube V104. |
| XV105 | N16-S061706-1481 | SOCKET, tube: Navy type 49363; 5 cont medium; below chassis wafer mtg; two 0.170" dia mtg holes 1-3/4" c to c; oval ceramic body 2-5/16" lg x 1-11/16" w x 1/4" h o/a excl term; phosphor-bronze silver pl cont; cont separated from ceramic base by cloth base lam ins, CEJ type No. 122-225-201; RAQA Dwg No. ST-500P. | Socket for Tube V105. |
| XV106 | | Same as XV105. | Socket for Tube V106. |
| XV107 | | Same as XV102. | Socket for Tube V107. |
| XV108 | | Same as XV101. | Socket for Tube V108. |
| XV109 | | Same as XV101. | Socket for Tube V109. |
| XV110 | | Same as XV102. | Socket for Tube V110. |
| XV401 | N16-S060842-7501 | SOCKET, tube: Navy type 49362; 4 cont medium; below chassis wafer mtg; two 0.17" dia mtg holes 1-3/4" c to c; oval ceramic body 2-5/16" lg x 1-11/16" w x 17/64" h o/a excl term; phosphor-bronze silver pl cont; cont separated from ceramic base by cloth base lam ins, CEJ type No. 122-224-6; RAQA Dwg No. ST-400Z. | Socket for Tube V401. |
| XV402 | | Same as XV401. | Socket for Tube V402. |
| XV601 | | Same as XV102. | Socket for Tube V601. |
| XV602 | | Same as XV102. | Socket for Tube V602. |
| XV603 | | Same as XV102. | Socket for Tube V603. |
| XV604.1 | N16-S099999-0635 | SOCKET, tube: 9 contact lock-in type; medium; 2-1/8" dia x 15/16" h overall; eight .132" dia holes for mtg on 1.906" dia circle; copper alloy silver plated contacts; modified EIMAC #990-4S; RAQA Dwg No. VG-2877. | Socket for Tube V604. |
| XV605.1 | | Same as XV604.1 | Socket for Tube V605. |
| XV606.1 | | Same as XV604.1 | Socket for Tube V606. |
| Y601 | GFM | CRYSTAL, quartz: harmonic mode; unit CR-24/U; frequency as specified; Government furnished. | Frequency Control Position 1. |
| Y602 | | Same as Y601. | Frequency Control Position 2. |
| Y603 | | Same as Y601. | Frequency Control Position 3. |
| Y604 | | Same as Y601. | Frequency Control Position 4. |

## TABLE 8-2. TABLE OF REPLACEABLE PARTS (Cont)

| REFERENCE DESIGNATION | STOCK NUMBER Standard Navy | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---|---|---|---|
| Z101 | N16-F044056-2306 | FILTER, low pass: 3500 cps cut-off freq; 4-7/16" h x 2-11/16" w x 2-3/4" dia o/a, incl 7/16" h term; 7700 ±20% ohms input; rectangular metal case; mtd by two #8-32 thd x 5/16" dia tapped holes (in inserts) spaced 3" x 2-1/8" c to c on side of case; four 7/16" h pillar type ins solder term, located 11/16" from rt edge, 5/8" from front edge and 1/2" c to c on top of case; RAQA Dwg. No. LC-0216. | Audio Filter. |
| Z601.1 | Assemble from Component parts | TUNER, radio frequency; c/o four sections of variable air capacitor (C645) and two transmission lines terminated by inductances (L615 and L616); 115 to 156 mc operating frequency range; one solder lug terminal; two pressure band anode connectors for type 4X150A tubes; 6-5/8" lg x 4-1/2" w x 2" h; seven no. 8-32 thd tapped mtg holes irregularly spaced; for maintenance part complete with C645, L615, L616, E613-1 thru E613-4 and E602-1 thru E602-4, use RAQA Dwg No. VG-2922. | Power Amplifier Plate Tuning. |

## TABLE 8-3 MAINTENANCE PARTS KIT

| KEY DISIGNATION | QUANTITY | KEY DESIGNATION | QUANTITY |
|---|---|---|---|
| A608 | 1 | K101 | 1 |
| B601 | 1 | K401 | 1 |
| C401 | 1 | K402 | 1 |
| C619.1-A | 1 | K403 | 1 |
| C642.1-A | 1 | K404 | 1 |
| C642.1-B | 1 | L401 | 1 |
| C642.1-D | 1 | L402 | 1 |
| C642.1-E | 1 | L403 | 1 |
| E615-1 | 4 sets | O601.1-1 | 1 |
| F401* | 5 | R617 | 1 |
| F402** | 5 | R618 | 1 |

* MDL-8, 8-ampere, 115-volt operation.
** MDL-4, 4-ampere, 230-volt operation.

The following items have been given the classification of Shop Manufactured.

## TABLE 8-4. SHOP MANUFACTURED PARTS

| | |
|---|---|
| A609 | L604 |
| C619.1-D | L607 |
| C642.1-F | L609 |
| C646 | L610 |
| C647 | L611 |
| E108 | L612 |
| E109 | L613 |
| E110 | L614 |
| E111 | L615 |
| E403 | L616 |
| H103 | L618 |
| H105 | L621 |
| L602 | |

The following parts have been classified as LOW FAILURE Items. If required, requisition from ESO referencing NAVSHIPS 900,180A.

## TABLE 8-5. LOW FAILURE ITEMS

| | |
|---|---|
| A501 | H407-1 |
| A503 | H407-2 |
| A606 | H602-1 thru |
| A607 | H602-12 |
| A645A | H603-1 thru |
| E105 | H603-16 |
| E608 | H604-1 thru |
| H109 | H604-28 |
| H403 | H605-1 thru |
| H404-1 thru | H605-28 |
| H404-6 | O607 |
| H405-1 | XF406 |
| H405-2 | |

## TABLE 8-6. CROSS REFERENCE PARTS LIST

| STANDARD NAVY STOCK NUMBER | KEY SYMBOL |
|---|---|
| G3110-156-8341 | 0608-1, 0608-2 |
| G5120-242-7410 | H102 |
| N17-B021188-4040 | B601 |
| N16-C011943-2350 | W601 |
| N16-C016076-8561 | C606 |
| N16-C016237-2583 | C603 |
| N16-C016799-4750 | C610 |
| N16-C017077-1294 | C129 |
| N16-C017587-5601 | C121 |
| N16-C018657-8801 | C622 |
| N16-C018659-7792 | C601 |
| N16-C018660-1582 | C618 |
| N16-C018692-1100 | C602 |
| N16-C019786-3791 | C111 |
| N16-C020461-8100 | C406 |
| N16-C020931-7851 | C404 |
| N16-C300605-0901 | H601 |
| N16-C031085-3694 | C114 |
| N16-C032430-6138 | C106 |
| N16-C032641-6338 | C116 |
| N16-C041596-9252 | C103 |
| N16-C041627-5675 | C102 |
| N16-C041921-2406 | C109 |
| N16-C044257-2597 | C108 |
| N16-C044257-1819 | C118 |
| N16-C045780-7662 | C120 |
| N16-C047293-9460 | C195 |
| N16-C047297-3180 | C410 |
| N16-C048810-4190 | C126 |
| N16-C049197-3878 | C101 |
| N16-C049948-9347 | C408 |
| N16-C054460-4481 | C104 |
| N16-C054496-4050 | C412 |
| N16-C058139-1980 | C604 |
| N16-C058445-6331 | C611 |
| N16-C062067-7300 | C638 |
| N16-C063457-9641 | C637 |
| N16-C063465-8921 | C605 |
| N16-C064232-8500 | C124 |
| N16-C072768-8717 | L619 |
| N16-C072841-7430 | L608 |
| N16-C073313-1069 | L601 |
| N16-C073043-1051 | L603 |
| N16-C099999-2025 | 0604 |
| N16-D046337-9481 | E605 |
| N16-D046337-9483 | E402 |
| N16-D046337-9485 | E408 |
| N16-D046337-9487 | E407 |
| N16-D046337-9489 | E607 |
| N16-D046337-9491 | E606 |
| N16-D901161-0135 | 0606 |
| N16-D901161-0136 | 0605 |
| N16-F044056-2306 | Z101 |
| N16-K700266-0881 | E609-1 thru E609-3 |
| N16-L150001-0130 | H402 |
| N16-L150001-0131 | H401 |
| N16-P040641-0250 | C619.1-D |
| N16-P403081-0156 | C642.1-D |
| N16-P500001-0143 | E610-1 thru E610-3 |
| N16-R029757-6501 | L402 |
| N16-R029765-7301 | L403 |
| N16-R029783-2450 | L401 |
| N16-R049282-0438 | R404 |
| N16-R049363-0438 | R401 |
| N16-R049579-0131 | R119 |
| N16-R049588-0438 | R402 |
| N16-R049624-0715 | R147 |
| N16-R049660-0438 | R602 |
| N16-R049687-0321 | R605 |
| N16-R049705-0321 | R413 |
| N16-R049768-0438 | R151 |
| N16-R049804-0438 | R403 |
| N16-R049876-0438 | R123 |
| N16-R049939-0271 | R117 |
| N16-R050012-0146 | R603 |
| N16-R050065-0438 | R143 |
| N16-R050110-0438 | R195 |
| N16-R050164-0435 | R134 |
| N16-R050200-0701 | R414 |
| N16-R050201-0137 | R415 |
| N16-R050281-0438 | R616 |
| N16-R050282-0131 | R614 |
| N16-R050335-0438 | R106 |
| N16-R050335-0940 | R109 |
| N16-R050371-0711 | R110 |
| N16-R050372-0131 | R612 |
| N16-R050416-0435 | R104 |
| N16-R050416-0944 | R128 |
| N16-R050515-0955 | R613 |
| N16-R050551-0401 | R122 |
| N16-R050552-0142 | R417 |
| N16-R050632-0416 | R114 |
| N16-R050633-0136 | R105 |
| N16-R050713-0380 | R108 |
| N16-R050758-0377 | R112 |
| N16-R050821-0276 | R107 |
| N16-R050974-0438 | R102 |
| N16-R051019-0440 | R103 |
| N16-R065755-7351 | R410 |
| N16-R065846-2006 | R409 |
| N16-R066030-9511 | R408 |
| N16-R066168-2370 | R407 |
| N16-R066329-6746 | R418 |
| N16-R068297-7255 | R406 |
| N16-R068369-8366 | R412 |
| N16-R070151-2001 | R618 |
| N16-R070198-9907 | R617 |
| N16-R087349-4788 | R411 |
| N16-R088009-4721 | R113 |
| N16-R088079-4689 | R101 |
| N16-R088339-5012 | R121 |
| N16-R088409-5111 | R131 |
| N16-S034561-2060 | E103-1, E103-4 |
| N16-S034607-8379 | E101-1, E102-2 |
| N16-S034607-8384 | E102-1, E101-2 |
| N16-S060842-7501 | XV401 |
| N16-S061706-1481 | XV105 |
| N16-S062603-6919 | XV101 |
| N16-S062603-6927 | XV102 |
| N16-S099999-0635 | XV604.1 |
| N16-S854061-0102 | A502-1 thru A502-4 |
| N16-T043276-1083 | S601 |
| N16-T051721-0010 | CR601 |
| N16-T053228 | V401 |
| N16-T054950 | V604 |
| N16-T056203 | V109 |
| N16-T058240-14 | V601 |
| N16-T068070 | V105 |
| N16-T075726 | V103 |
| N16-T075749 | V101 |
| N16-T075814 | V102 |
| N16-T751512-0134 | H101 |
| N16-V010551-1027 | 0601.1-1, 0601.1-2 |
| N17-B077936-5240 | E501 |
| N17-B099999-0236 | E615-1, E615-2 |
| N17-C048887-2951 | W301 |
| N17-C048890-3151 | W302 |
| N17-C067443-5401 | E401 |
| N17-C070276-8061 | P604 |
| N17-C070579-6120 | P603 |
| N17-C071317-6091 | P302 |
| N17-C071317-6092 | J501 |
| N17-C071408-9255 | P501 |
| N17-C071417-9699 | P503 |
| N17-C071606-1085 | P301 |
| N17-C072252-1135 | J403 |
| N17-C073108-7477 | J602 |
| N17-C073114-7071 | J502 |
| N17-C073309-7501 | J601 |
| N17-C073330-5001 | J101 |
| N17-C073597-1001 | P402 |
| N17-C073605-9185 | P403 |
| N17-C073627-1001 | P401 |
| N17-C077409-5001 | A601-1 thru A601-4 |
| N17-C077413-2201 | A402 |
| N17-C077417-3587 | A401 |
| N17-C077417-8001 | A604 |
| N17-C077417-8003 | A605 |
| N17-C077417-8006 | A602 |
| N17-C077417-8008 | A603 |
| N17-C794001-0228 | A608 |
| N17-C079659-5001 | C619.1-C |
| N17-C814365-0451 | E409-1, E409-2 |
| N17-C815501-0118 | E107 |
| N17-C081967-5001 | S601A-1, S601A-2 |
| N17-C098431-6201 | 0602 |
| N17-C098431-6221 | 0603 |
| N17-C200987-0501 | J403A |
| N17-C201579-0715 | J401A |
| N17-C201579-0717 | J402A |
| N17-C781255-0925 | H606 |
| N17-C814951-0136 | C642.1-C |
| N16-D901161-0136 | 0605 |
| N17-F014305-0060 | F401 |
| N17-F014306-0510 | F401 |
| N17-F074267-5075 | XF401 |
| N17-F099999-0138 | F404 |
| N17-I047363-4201 | E405-1, E405-2 |
| N17-I047363-4222 | E621 |
| N17-I048679-2409 | E404-1, E404-2 |
| N17-I049485-1151 | E622 |
| N17-I049498-4210 | E604-1 thru E604-4 |
| N17-I049498-5595 | E620-1, E620-2 |
| N17-I059404-5595 | E611-1 thru E611-5 |
| N17-I064046-1245 | C619.1-A |
| N17-I064144-3044 | C642.1-A |
| N17-I064144-4546 | C642.1-B |
| N17-I069154-6200 | E614-1, E614-2 |
| N17-I069173-7111 | E406-1 thru E406-4 |
| N17-I069178-7156 | E613-1 thru E613-4 |
| N17-J039248-3341 | J402 |
| N17-J039435-6234 | J401 |
| N17-L006543-0200 | I401 |
| N17-L076770-4445 | XI402 |
| N17-L076854-4200 | XI401 |
| N17-L250305-0452 | XI402B |
| N17-L250627-0560 | XI401B |
| N17-M021878-2323 | M401 |
| N17-P070009-4001 | A403-1 thru A403-4 |
| N17-P404181-0271 | C642.1-E |
| N17-R050893-0435 | R135 |
| N17-R051053-8320 | CR401 |
| N17-R051277-2831 | CR402 |
| N17-R064029-1101 | K402 |
| N17-R064872-9211 | K101 |
| N17-R065161-7238 | K403 |
| N17-R065377-4006 | K401 |
| N17-R099999-0900 | K404 |
| N17-S062523-1361 | S101 |
| N17-S063671-8620 | S401 |
| N17-S071894-1544 | S102 |
| N17-S072396-1685 | S405 |
| N17-S072396-1725 | S402 |
| N17-S072828-2705 | S403 |
| N17-S073959-1025 | S103 |
| N17-T028218-4116 | H406-1 thru H406-6 |
| N17-T028255-1031 | H108 |
| N17-T061047-1200 | T101 |
| N17-T063251-8741 | T103 |
| N17-T065004-7500 | T102 |
| N17-T068817-5501 | T402 |
| N17-T077398-1025 | T401 |

| MIL or JAN DESIGNATION | KEY SYMBOL |
|---|---|
| AN3057-4 | H606 |
| AN3101A-12S-3S | P604 |
| AN3102A-14S-5S | J403 |
| AN3106A-12S-3P | P603 |
| CC21SH200J | C606 |
| CC21UJ270K | C603 |
| CC26UJ101K | C129 |
| CC36RH181J | C121 |
| CE41C122F | C404 |
| CE41C201H | C406 |
| CE63C250H | C111 |
| CM30B102M | C114 |
| CM35B392K | C106 |
| CM35B472M | C116 |
| CP25A3EF602M | C103 |
| CP28A1EF104M | C120 |
| CP28A1EF503M | C108 |
| CP29A1EF503M | C118 |
| CP29A1EF602M | C102 |
| CP29A3EF602M | C109 |
| CP53B1EB405K | C408 |
| CP53B1EC105K | C126 |
| CP53B1EF205V | C101 |
| CP53B2EF504K | C195 |
| CP53B5EF104V | C104 |
| CP54B1EF504K | C410 |
| CR-24/U | Y601 |
| CV120121 | C124 |
| JJ-033 | J401 |
| MR26W163SPECR | M401 |
| NS3W0104 | E614 |
| NS3W0205 | E406-1 thru E406-4 |
| NS3W0208 | E613-1 thru E613-4 |
| NS3W4101 | E404-1, E404-2 |
| NS3W4201 | E405-1, E405-2 |
| RC20GF101K | R119 |
| RC20GF103J | R616 |
| RC20GF104K | R114 |
| RC20GF105K | R102 |
| RC20GF111J | R402 |
| RC20GF122J | R117 |
| RC20GF150J | R404 |
| RC20GF153J | R106 |
| RC20GF155K | R103 |
| RC20GF221J | R602 |
| RC20GF224K | R108 |
| RC20GF271J | R605 |
| RC20GF330J | R401 |
| RC20GF331K | R413 |
| RC20GF332K | R143 |
| RC20GF333J | R610 |
| RC20GF333K | R104 |
| RC20GF334K | R112 |
| RC20GF432J | R195 |
| RC20GF471J | R151 |
| RC20GF474K | R107 |
| RC20GF561J | R403 |
| RC20GF562K | R134 |
| RC20GF680J | R601 |
| RC20GF683K | R122 |
| RC20GF684J | R135 |
| RC20GF821J | R123 |
| RC30GF151J | R147 |
| RC30GF223K | R110 |
| RC30GF682J | R414 |
| RC42GF103J | R614 |
| RC42GF104J | R105 |
| RC42GF104K | R127 |
| RC42GF153J | R611 |
| RC42GF153K | R109 |
| RC42GF222J | R603 |
| RC42GF223J | R612 |
| RC42GF333K | R128 |
| RC42GF563J | R613 |
| RC42GF682J | R415 |
| RC42GF683J | R417 |
| RV4ATRD102A | R411 |
| RW33G401 | R409 |
| RW34G102 | R408 |
| RW33G712 | R418 |
| RW34G312 | R407 |
| RW36G201 | R410 |
| RW55J251 | R412 |
| RW55J5R0 | R406 |
| ST40G | S402 |
| ST42D | S102 |
| ST42H | S405 |
| ST52K | S403 |
| ST52N | S103 |
| TS102C03 | XV101 |
| TS103P03 | XV102 |
| UG-21D/U | P503 |
| UG-88/U | P501 |
| UG-306/U | E401 |
| UG-625/U | J602 |
| 1N21B | CR601 |
| 12AT7WA | V601 |
| 3B28 | V401 |
| 4X150A | V604 |
| 5726-6AL5W | V103 |
| 5749-6BA6W | V101 |
| 5814 | V102 |
| 6AT6 | V109 |
| 807 | V105 |

| ARMY-NAVY TYPE NO. | KEY SYMBOL |
|---|---|
| AM-638C/URT | |
| CG-409/U | W601 |
| CX-1826/U | W301 |
| CX-1827/U | W302 |
| CX-3154/U | W303.1 |
| CY-1126A/URT | |
| MD-163C/URT | |
| PP-773C/URT | |
| T-336C/URT-7 | |
| -28060-4 | F401 |
| -49362 | XV401 |
| -49363 | XV105 |
| -49025B | J402 |
| -49039A | J401 |

| NAVY/BUSHIPS DWG. NO. | KEY SYMBOL |
|---|---|
| RE49AA195 | J402 |
| RE49F246 | P501 |
| RE49F249 | E401 |

## TABLE 8-6. CROSS REFERENCE PARTS LIST (Cont)

| REFERENCE DESIGNATION | RAULAND-BORG DWG. NO. | STOCK NO. AIR FORCE |
|---|---|---|
| A401 | AG-4393 | 1760-048386923 |
| A402 | AG-4394 | 1760-048386924 |
| A403-1 thru A403-4 | BG-1507 | |
| A501 | QR-0285 | 1760-046950605 |
| A502-1 thru A502-4 | AG-4416 | |
| A503 | QR-0293 | 1760-046950610 |
| A601-1 thru A601-4 | AG-4395 | 1760-048386925 |
| A602 | AG-4396 | 1760-048386926 |
| A603 | AG-4397 | 1760-048386927 |
| A604 | AG-4398 | 1760-048386928 |
| A605 | AG-4399 | 1760-048386929 |
| A606 | QR-0291 | 4BR5-QR0291 |
| A607 | QR-0290 | 4BR5-QR0290 |
| A608 | AG-4380 | 4BAA-221180-44 |
| A609 | AG-4415 | 3370-192000-2675 |
| B601 | PG-0009 | |
| C101 | CP53B1EF205V | 3330-317094982 |
| C102 | CP29A1EF602M | |
| C103 | CP25A3EF602M | |
| C104 | CP53B5EF104V | 3330-316777673 |
| C106 | CM35B392K | |
| C108 | CP28A1EF503M | 3330-057750463 |
| C109 | CP29A3EF602M | 3330-056750111 |
| C111 | CE63C250H | 3330-317536628 |
| C114 | CM30B102M | 3330-376120000 |
| C116 | CM35B472M | 3330-055950336 |
| C118 | CP29A1EF503M | 3330-317704006 |
| C120 | CP28A1EF104M | |
| C121 | CC36RH1815J | 3330-055350320 |
| C124 | CV120121 | 3330-313938030 |
| C126 | CP53B1EC105K | 3330-316958803 |
| C129 | CC26UJ101K | 3330-313889909 |
| C195 | CP54B2EF504K | |
| C401 | C0-106A | 3330-057252400 |
| C404 | CE41C122F | 3330-317630207 |
| C406 | CE41C201H | 3330-055600044 |
| C408 | CP53B1EB405K | 3330-317643023 |
| C410 | CP54B1EF504K | 3330-319001133 |
| C412 | CP-754 | 3330-057252402 |
| C601 | CC-120G | 3330-055475610 |
| C602 | CC-122 | 3330-055475615 |
| C603 | CC21UJ270K | 3330-055350163 |
| C604 | CV-090C | 3330-312944200 |
| C605 | CV-111 | 3330-058100161 |
| C606 | CC21SH200J | 3330-055350270 |
| C610 | CC-680C | 3330-055475617 |
| C611 | CV-150E | 3330-313050500 |
| C618 | CC-120E | |
| C619.1 | VG-2879 | |
| C619.1-A | AC-1302 | 3320-082354765 |
| C619.1-C | AG-4400 | 1760-048832110 |
| C619.1-D | AG-4624 | 1760-048386960 |
| C622 | CC-102F | 3330 |
| C637 | CV-580 | 3330-058100166 |
| C638 | CV-080A | 3330-312944011 |
| C642.1 | VG-2880 | |
| C642.1-A | AC-1357 | |
| C642.1-B | AC-1358 | |
| C642.1-C | AG-4608 | |
| C642.1-D | VG-2874 | |
| C642.1-E | AG-4612 | |
| C642.1-F | WJ-0256 | |
| C645A | VG-2801 | |
| C646 | CV-050A | |
| C647 | CV-050B | |
| CR401 | JR-0020 | 3370-679750-2164 |
| CR402 | JR-0021 | 3370-679750-1128 |
| CR601 | IN21B | 3370-211000-2145 |
| E101-1, E101-2 | JS-0214 | |
| E102-1, E102-2 | JS-0215 | |
| E103-1, E103-4 | JS-0216 | |
| E105 | VG-2771 | |
| E107 | VG-2760 | 1760-049664500 |
| E108 | VT-0306 | 8880-501674-6285 |
| E109 | VT-0307A | |
| E110 | VT-0308 | 8880-502574-4855 |
| E111 | VT-0309 | 8880-501474-7055 |
| E401 | SM-0200 | 8850-108900 |
| E402 | VG-2739 | 3320-0801511909 |
| E403 | VT-0320 | 8880-501677-6995 |
| E404-1, E404-2 | NS3W4101 | 3320-081550040 |
| E405-1, E405-2 | QC-0114 | 3320-333767001 |
| E406-1 thru E406-4 | QC-0117 | 3320-082740030 |
| E407 | VG-2736 | 3320-080151165 |
| E408 | VG-2740 | |
| E409-1, E409-2 | VG-2742 | 8850-433000-3155 |
| E501 | TS-0199 | 8880-501054-2855 |
| E503 | LC-0231 | |
| E601 | LC-0230 | |
| E604-1 thru E604-4 | QP-0326 | 3320-081553205 |
| E605 | VG-2737 | 3320-080151170 |
| E606 | VG-2738 | 3320-280151160 |
| E607 | VG-2741 | |
| E608 | VG-2910 | 3320-080151254 |
| E609-1 thru E609-3 | BG-1508 | 3320-083351718 |
| E610-1 thru E610-3 | QD-0238 | 3320-084409215 |
| E611-1 thru E611-5 | QC-0112 | 8880-700775-3445 |
| E613-1 thru E613-4 | QC-0115 | 3320-082741820 |
| E614-1, E614-2 | QC-0116 | 3320-33373606 |
| E615-1, E615-2 | | 7700-050076 |
| E616-1, E616-2 | QC-0108 | 3340-061875050 |
| E617-1, E617-2 | QC-0110 | 3340-061875060 |
| E618-1 thru E618-3 | VG-2752 | 3340-061750280 |
| E619 | QM-0003 | |
| E620-1, E620-2 | QC-0111 | 3320-081553225 |
| E621 | QC-0118 | 3320-081553210 |
| E622 | QC-0119 | 3320-081553200 |
| F401 | F-0046 | 8870-212000-445 |
| F401 | F-0045 | 8870-212000-355 |
| F406 | F-0057 | |
| H101 | AG-4405 | 8870-112000-722 |
| H102 | AG-4406 | 7900 |
| H103 | AG-4407 | 7900-278501 |
| H105 | VG-2751 | 1760-048387360 |
| H108 | BG-1512 | 8880-821500-1457 |
| H109 | BG-1534 | |
| H401 | VG-2743 | 1760-047802503 |
| H402 | VG-2744 | 1760-047802504 |
| H403 | BG-1617 | |
| H404-1 thru H404-6 | AG-4470 | 6500-914701-4 |
| H405-1, H405-2 | BG-1571 | 6500-916648-495 |
| H406-1 thru H406-16 | BG-1349 | |
| H407-1, H407-2 | WR-0065 | |
| H601 | VG-2763 | |
| H602-1 thru H602-12 | VG-2757 | 6500-916055 |
| H603-1 thru H603-16 | VG-2758 | |
| H604-1 thru H604-33 | AG-4419 | 6500-631331 |
| H605-1 thru H605-28 | WK-0044 | |
| H606 | AN-3057-4 | |
| I401 | JL-0023 | 8870-938000-465 |
| J101 | SF-0240 | 8850-601960 |
| J401 | AG-4410 | 8850-767589 |
| J401A | AG-4411 | 8850-697861 |
| J402 | AG-4412 | |
| J402A | AG-4413 | 8850-697862 |
| J403 | SF-0244 | 8850-541632 |
| J403A | AG-4409 | 8850-076630 |
| J501 | SF-0235 | |
| J502 | SF-0238 | 8850-482975 |
| J601 | SF-0239 | |
| J602 | SF-0237 | 8850-490135 |
| K101 | D-0076 | |
| K401 | D-0077 | 3380-552180-55165 |
| K402 | K-0078 | 3380-552180-5498 |
| K403 | D-0089 | |
| K404 | D-0088 | |
| L401 | LC-0213 | |
| L402 | LC-0214 | |
| L403 | LC-0215 | 3340-062457310 |
| L601 | LC-0210 | 3340-307655416 |
| L602 | VG-2892 | 3340-060719320 |
| L603 | LS-0209 | 3340-307655418 |
| L604 | VG-2895 | |
| L607 | VG-2894 | 3340-060719340 |
| L608 | LC-0208 | 3340-307655417 |
| L609 | VG-2893 | 3340-060719330 |
| L610 | LW-0087 | 3340-060719240 |
| L611 | LW-0060 | 3340-060717350 |
| L612 | LW-0061 | 3340-060717380 |
| L613 | LW-0085 | 3340-060719230 |
| L614 | LW-0079 | |
| L615 | LW-0091 | 3340-060719260 |
| L616 | LW-0093 | 3340-060719270 |
| L618 | LW-0089 | 3340-060719250 |
| L619 | LC-0207 | 3340-310190455 |
| L621 | LW-0095 | 3340-060719280 |
| M401 | MR26W163 SPECR | 0809-MR26W163 SPECR |
| 0601.1-1, 0601.1-2 | AC-1356 | |
| 0602 | BG-1511 | 3330-058620006 |
| 0603 | BG-1510 | 3330-058620001 |
| 0604 | VG-2869 | |
| 0605 | VG-2746 | 1760-046711030 |
| 0606 | VG-2747 | 1760-046711032 |
| 0607 | VG-2888 | 1760-046711050 |
| 0608-1, 0608-2 | BG-1509 | |
| P301 | SM-0197 | 8850-364465 |
| P302 | SF-0234 | 8850-346000 |
| P401 | SM-0202 | 8850-603024 |
| P402 | SM-0201 | 8850-587450 |
| P403 | SM-0204 | 8850-592712 |
| P501 | SM-0199 | |
| P503 | SM-0188 | |
| P603 | SM-0212 | |
| P604 | SF-0257 | |
| R101 | RP-254M | 3350-793000-4368 |
| R102 | RC20GF105K | 3350-098000-6511 |
| R103 | RC20GF155K | 3350-098000-6671 |
| R104 | RC20GF333K | |
| R105 | RC42GF104J | 3350-146000-5459 |
| R106 | RC20GF153J | 3350-098000-4551 |
| R107 | RC20GF474K | 3350-098000-6191 |
| R108 | RC20GF224K | 3350-098000-5771 |
| R109 | RC42GF153K | 3350-146000-4557 |
| R110 | RC30GF223K | 3350-128000-5315 |
| R112 | RC20GF334K | 3350-098000-5931 |
| R113 | RP-104V | |
| R114 | RC20GF104K | |
| R117 | RC20GF122J | |
| R119 | RC20GF101K | |
| R121 | RP-105Z | |
| R122 | RC20GF683K | |
| R123 | RC20GF821J | |
| R127 | RC42GF104K | |
| R128 | RC42GF333K | |
| R131 | RP-255D | |
| R134 | RC20GF562K | 3350-098000-4151 |
| R135 | RC20GF684J | 3350-098000-6351 |
| R143 | RC20GF332K | 3350-098000-3811 |
| R147 | RC30GF151J | 3350-128000-2935 |
| R151 | RC20GF471J | |
| R195 | RC20GF432J | |
| R401 | RC20GF333J | 3350-098000-1691 |
| R402 | RC20GF111J | 3350-098000-2311 |

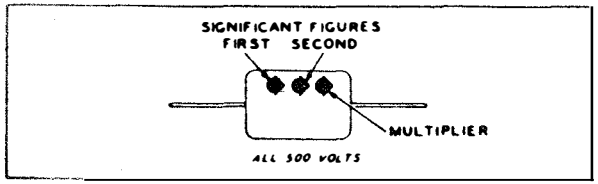
## TABLE 8-6. CROSS REFERENCE PARTS LIST (Cont)

| REFERENCE DESIGNATION | RAULAND-BORG DWG. NO. | STOCK NO. AIR FORCE | REFERENCE DESIGNATION | RAULAND-BORG DWG. NO. | STOCK NO. AIR FORCE | REFERENCE DESIGNATION | RAULAND-BORG DWG. NO. | STOCK NO. AIR FORCE |
|---|---|---|---|---|---|---|---|---|
| R403 | RC20GF561J | 3350-098000-2991 | R617 | RW-3012 | 3350-492000-1113 | V604 | EG-4X150A | 3370-445000-4235 |
| R404 | RC20GF150J | 3350-098000-1371 | R618 | RW-4072 | 3350-492100-1112 | W301 | VW-0796 | 1760-045645010 |
| R406 | RW55J5R0 | 3350-492000-1485 | S101 | X-0289 | 3360-073114236 | W302 | VW-0797 | 1760-045645012 |
| R407 | RW34G312 | 3350-551000-2315 | S102 | X-0281 | 3360-395853398 | V303.1 | VW-0885 | |
| R408 | RW34G102 | 3350-551000-1819 | S103 | X-0279 | 3360-395853615 | W601 | VM-0429 | 1760-045640020 |
| R409 | RW33G401 | 3350-533000-23545 | S401 | X-0290 | 3360-073114237 | XF401 | SF-0236 | 8870-556000-555 |
| R410 | RW36G201 | 3350-577000-1473 | S402 | X-0282 | 3360-39585389 | XF406 | VG-3072 | |
| R411 | RV4ATRD102A | 3350-793000-1682 | S403 | X-0280 | 3360-395853600 | | AC-1454 | |
| R412 | RW55J251 | 3350-492000-3239 | S405 | X-0285 | 3360-395853402 | | NG-1017 | |
| R413 | RC20GF331K | 3350-098000-2751 | S601 | VG-2749 | 1760-049586700 | XI401 | SL-0057 | 7700-535065-5232 |
| R414 | RC30GF682J | 3350-128000-4735 | S601A-1, S601A-2 | AG-4414 | 1760-046240520 | XI401A | SL-0066 | |
| R415 | RC42GF682J | | | | | XI401B | SL-0064 | |
| R417 | RC42GF683J | | T101 | LA-0053 | 3340-062754520 | XI402 | SL-0058 | 7700-547943-522 |
| R418 | RW33G712 | | T102 | LM-0058 | 3340-062754540 | XI402B | SL-0065 | 7700-52724726653 |
| R601 | RC20GF680J | | T103 | LH-0001 | 3340-062754530 | XV101 | | |
| R602 | RC20GF221J | | T401 | LP-0234 | | XV102 | | |
| R603 | RC42GF222J | | T402 | LP-0235 | 3340-063857660 | XV105 | ST-500P | 8850-880200 |
| R605 | RC20GF271J | | V101 | EG-5749 | | XV401 | ST-400Z | 8850-874627 |
| R610 | RC20GF333J | 3350-098000-4871 | V102 | EG-5814A | 3370-265000-5815 | XV604.1 | VG-2877 | |
| R611 | RC42GF153J | 3350-146000-4557 | V103 | EG-5726 | 3370-259000-5795 | Y601 | G.F. | |
| R612 | RC42GF223J | 3350-146000-4717 | V105 | EG-807 | 3370-427000-8185 | Z101 | LC-0216 | 1760-046868100 |
| R613 | RC42GF563J | 3350-146000-5217 | V109 | EG-6AT6 | 3370-265000-6135 | Z601.1 | VG-2922 | |
| R614 | RC42GF103J | 3350-146000-4397 | V401 | EG-3B28 | 3370-433000-3155 | | | |
| R616 | RC20GF103J | 3350-098000-4391 | V601 | EG-12AT7WA | 3370-316000-1367 | | | |

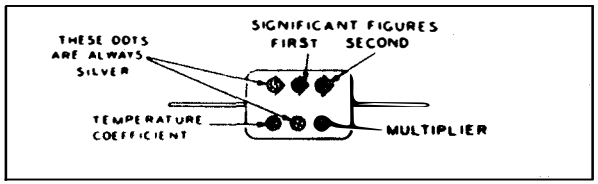
# TABLE 8-7. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

## CAPACITOR COLOR CODES

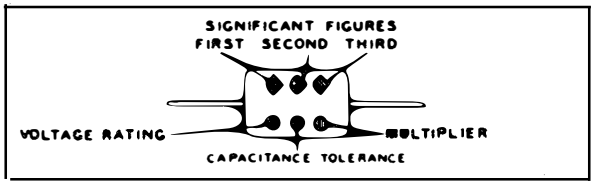
RMA 5-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



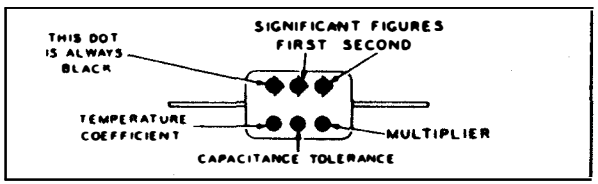

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



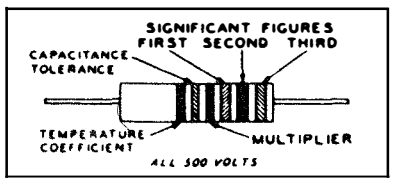

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS




JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

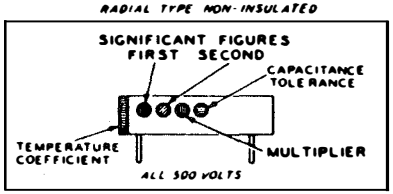



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

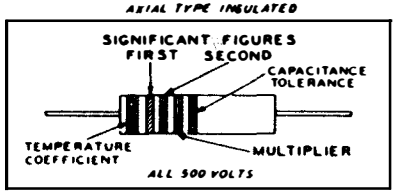



JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

RADIAL TYPE NON-INSULATED




AXIAL TYPE INSULATED



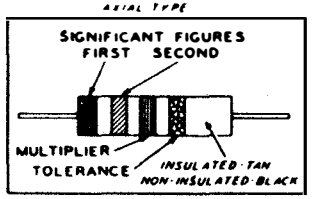

RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

| RESISTORS | | CAPACITORS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | MULTIPLIER | | | | |
| TOLERANCE | MULTIPLIER | SIGNIFICANT FIGURE | COLOR | RMA MICA AND CERAMIC-DIELECTRIC | JAN MICA AND PAPER-DIELECTRIC | JAN CERAMIC DIELECTRIC | VOLTAGE RATING | TEMPERATURE COEFFICIENT |
| | 1 | 0 | BLACK | 1 | 1 | 1 | | A |
| | 10 | 1 | BROWN | 10 | 10 | 10 | 100 | B |
| | 100 | 2 | RED | 100 | 100 | 100 | 200 | C |
| | 1000 | 3 | ORANGE | 1,000 | 1000 | 1000 | 300 | D |
| | 10000 | 4 | YELLOW | 10,000 | | | 400 | E |
| | 100,000 | 5 | GREEN | 100,000 | | | 500 | F |
| | 1,000,000 | 6 | BLUE | 1,000,000 | | | 600 | G |
| | 10,000,000 | 7 | VIOLET | 10,000,000 | | | 700 | |
| | 100,000,000 | 8 | GRAY | 100,000,000 | | 001 | 800 | |
| | 1,000,000,000 | 9 | WHITE | 1,000,000,000 | | 0.1 | 900 | |
| 5 | 0.1 | | GOLD | 0.1 | 0.1 | | 1000 | |
| 10 | 0.01 | | SILVER | 0.01 | 0.01 | | 2000 | |
| 20 | | | NO COLOR | | | | 500 | |

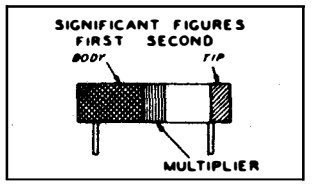
## RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE

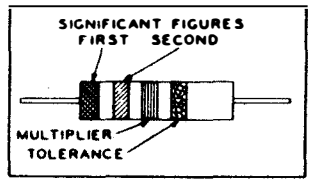



RADIAL TYPE

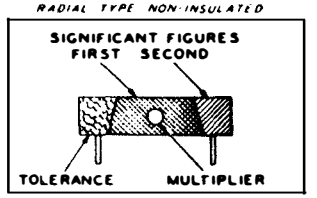



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED




RADIAL TYPE NON-INSULATED



## TABLE 8-8. LIST OF MANUFACTURERS

| PREFIX | NAME | ADDRESS |
|---|---|---|
| CARO | Industrial Products Co. | Brookfield St., Danbury, Conn. |
| CAW | Aerovox Corp. | 740 Belleville Ave., New Bedford, Mass. |
| CAYT | Allen Mfg. Co., The | 100 Sheldon St., Hartford 2, Conn. |
| CAYZ | Dialight Corp. | 60 Stewart Ave., Brooklyn, N.Y. |
| CBEF | Electrical Industries Corp. | Newark, N.J. |
| CBN | Centralab Division Globe-Union, Inc. | 900 E. Keefe Ave., Milwaukee, Wis. |
| CBZ | Allen-Bradley Co. | 136 W. Greenfield Ave., Milwaukee 4, Wis. |
| CEJ | Johnson, E.F. Co. | Waseca, Minn. |
| CER | Erie Resistor Corp. | 644 W. 12th St., Erie, Pa. |
| CFA | Bussmann Mfg. Co. | 2538 W. University St., St. Louis 7, Mo. |
| CD | Cornell-Dubilier Corp. | 333 Hamilton Blvd., South Plainfield, N.J. |
| CG | General Electric Co. Lamp Division | Nela Park, Cleveland, Ohio |
| CJC | Jones, Howard B. Div. Cinch Mfg. Co. | 1026 S. Homan Ave., Chicago 24, Ill. |
| COM | Ohmite Mfg. Co. | 4835-55 W. Flournoy St., Chicago, Ill. |
| EIMAC | Eitel-McCullough, Inc. | San Bruno, Calif. |
| ICA | Insuline Corp. of America | 30-30 Northern Blvd., Long Island City, N.Y. |
| RAD | Radio Condenser Co. | Camden, N.J. |
| RAQA | Rauland-Borg Corp. | 3515 W. Addison St., Chicago 18, Ill. |
| | American Blower Corp. | Detroit, Mich. |
| | Camloc Fastener Corp. | 22 Spring Valley Rd., Paramus, N.J. |
| | Dzus Fastener Co., Inc. | Box 185, Babylon, N.Y. |
| | International Electronics Research Corp. | 175 W. Magnolia Blvd., Burbank, Calif. |
| | New Departure Div. General Motors Corp. | Bristol, Conn. |
| | Sprague Electric Co. | 125 Marshall St., North Adams, Mass. |
| | Reynolds Electric Co. | 3000 River Rd., River Grove, Ill. |

# INDEX

# C

# C