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NAVSHIPS 92182

(Non-Registered)

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TECHNICAL MANUAL

for

NAVY MODEL AT-317/BRR,
AT-317A/BRR, AT-317B/BRR VLF
AND AT-317C/BRR VLF
LOOP ANTENNA SYSTEM
FOR USE WITH
MODELS RAK, RBA, AND AN/SRR-11
RADIO RECEIVING EQUIPMENTS

THE AMPHENOL-BORG ELECTRONICS CORPORATION
CHICAGO, ILLINOIS

BUREAU OF SHIPS

NAVY DEPARTMENT

★

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Approved by BuShips: 12 JUNE 1954

Change 4: 24 August 1962

LIST OF EFFECTIVE PAGES

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| A | 4 | 6-11 to 6-12 | 3 |
| B to C | Original | 6-13 to 6-14 | 2 |
| i to iii | 2 | 6-15 to 6-16 | Original |
| 1-0 to 1-4 | 2 | 6-16A to 6-16B | 1 |
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| 3-0 to 3-6 | 2 | 7-0 to 7-0B | 2 |
| 4-1 to 4-2B | 2 | 7-0C to 7-0D | Original |
| 5-1 to 5-2 | Original | 7-1 to 7-12 | Original |
| 5-3 | 2 | i-1 to i-3 | Original |
| 6-0 | Original | | |

CHANGE 4 to Technical Manual for Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System for use with Models RAK, RBA, and AN/SRR-11 Radio Receiving Equipments NAVSHIPS 92182

This permanent change revises the book to correct errors in the original technical manual, and to introduce Navy Model AT-317C/BRR VLF Loop Antenna System. The following serial numbers apply:

SERIAL NUMBERS FOR AT-317C/BRR ANTENNA SYSTEM

| ANTENNA AT-317C/BRR | COUPLER CU-352A/BRR |
|---------------------|---------------------|
| A1 | 111 |
| A2 | 112 |
| A3 | 113 |
| A4 to A103 | 124 to 223 |

Maintenance activities shall insert Change 4 entries in the technical manual immediately upon receipt because only specific equipments are changed. The manual will continue to cover the original equipment. When inserted, Change 4 supersedes T-4.

1. Remove superseded pages and insert revised or added pages as indicated below:

| <u>Page</u> | <u>Remove</u> | <u>Insert</u> |
|-------------|---------------|---------------|
| Title A | Ch. 2 Ch. 2 | Ch. 4 Ch. 4 |
| 1-0A 1-0B | -- | Ch. 4 Ch. 4 |
| 6-16E 6-16F | -- | Ch. 4 Ch. 4 |

2. Make the following pen-and-ink corrections and mark the notation "Ch. 4" adjacent to the pen-and-ink entry:

| <u>First Issued In</u> | <u>Page No.</u> | <u>Ch. In Effect</u> | <u>Col'm or Fig.</u> | <u>Line or Location</u> | <u>Action</u> |
|------------------------|-----------------|----------------------|----------------------|-------------------------|--|
| Ch. 4 | All pages | Orig. and Ch. 1-3 | -- | -- | Make the following changes everywhere they appear in the technical manual, except where otherwise noted: Change "AT-317B/BRR" to read "AT-317B/BRR and/or AT-317C/BRR" except in the following figure titles: 1-1A, pp ii, 1-0; 1-2A, pp ii, 1-1; 3-5A, pp ii, 3-6; 6-9B, pp iii, 6-16C. |

Change "RG-264/U" to read "RG-264/U or RG-264A/U."

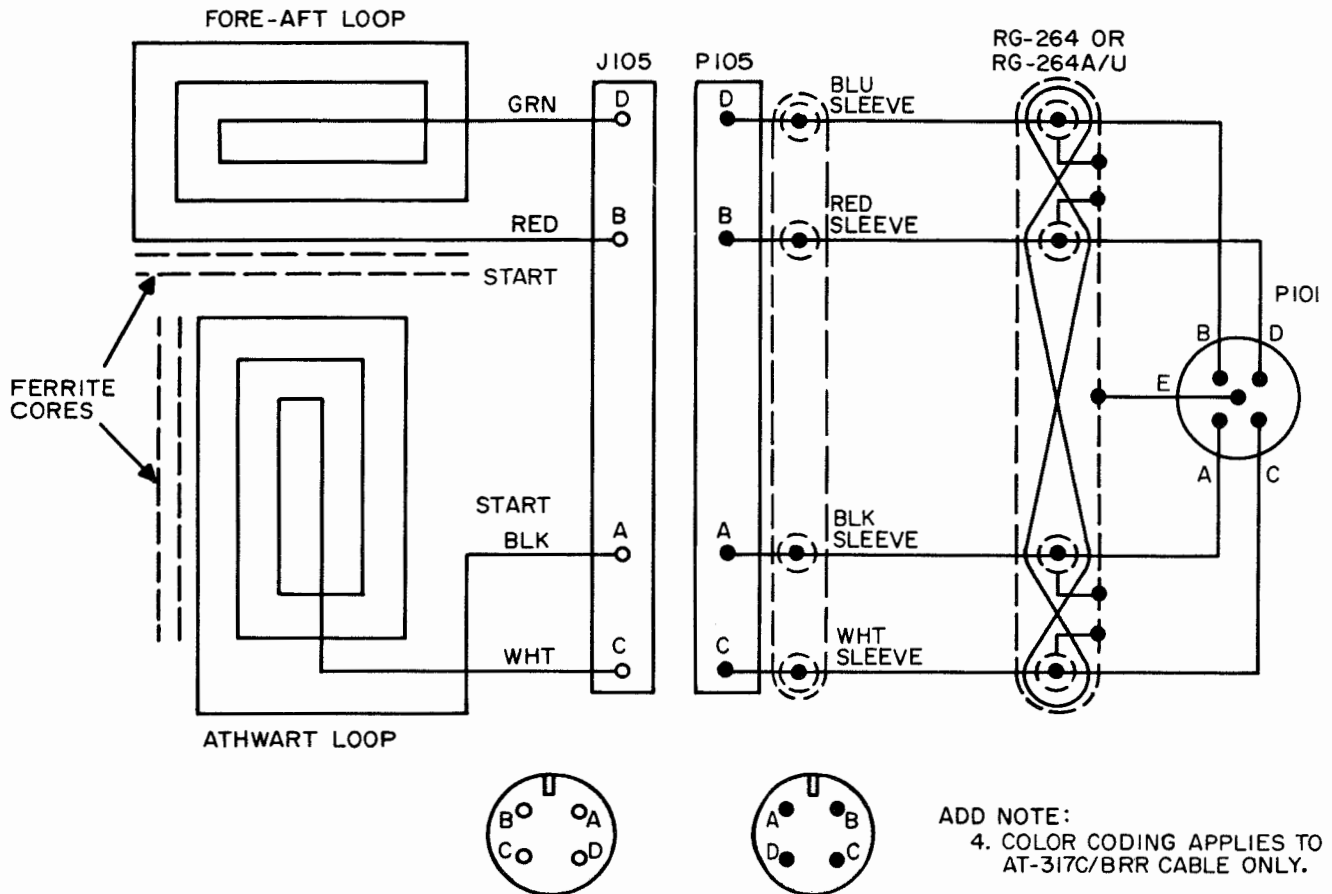
NOTE

For inboard use, RG-264/U or RG-264A/U. For outboard use, RG-264A/U only, manufactured by Times Wire with AT-317B/BRR or by Amphenol-Borg when received with AT-317C/BRR.

| | | | | |
|-------|-----|-------|---------------------------|--|
| Ch. 4 | ii | Ch. 2 | Col. 1 after figure 1-1A. | Add "1-1B. Navy Model AT-317C/BRR VLF Loop Antenna System Relationship of Units. Page 1-0A 1-0B." |
| | | | Col. 1 after figure 1-2A. | Add "1-2B. Navy Type AT-317C/BRR VLF Loop Antenna. Page 1-0A 1-0B." |
| Ch. 4 | iii | Ch. 2 | Col. 2 after figure 6-9B | Add: "6-9C Assembly Instructions for Water-tight Connector Assembly P105 for Antenna AT-317C/BRR. Page 6-16E 6-16F." |

| First Issued In | Page No. | Ch. In Effect | Col'm or Fig. | Line or Location | Action |
|-----------------|--------------|---------------|----------------------------------|------------------|---|
| Ch. 4 | 1-2B | Ch. 2 | Paragraph 5b. | | Add: "and NObsr 81071 dated December 17, 1959." |
| Ch. 4 | 3-1 | Ch. 2 | Col. 2, Para. 2d., last sentence | | Delete and substitute the following: "See figure 6-8 for RG-160/U or RG-160A/U Cable; see figure 6-8A for RG-264/U or RG-264A/U Cable." |
| Ch. 4 | 3-6 | Ch. 2 | Fig. 3-5A title | | Add: "See figures 6-7A and 6-9C for Model AT-317C/BRR." |
| Ch. 4 | 6-11, 6-12 | Ch. 3 | Fig. 6-7 | | Change receiver input "J103" to read "J104." |
| Ch. 4 | 6-12A, 6-12B | Ch. 2 | Fig. 6-7A | | Change antenna selector switch symbol "S101" to read "S102." |

Change figure to appear as shown below:



| | | | | |
|-------|------|-------|-----------------------------|---|
| Ch. 4 | 6-14 | Ch. 2 | Fig. 6-8A opposite step 10. | Reverse letters "A" and "B." |
| | | | Below step 10. | Add: "Note. See figures 6-7A and 6-9C to check for correct wiring and continuity between connectors." |

| <u>First Issued In</u> | <u>Page No.</u> | <u>Ch. In Effect</u> | <u>Col'm or Fig.</u> | <u>Line or Location</u> | <u>Action</u> |
|------------------------|-----------------|----------------------|---|-------------------------|---|
| Ch.4 | 7-0B | Ch.2 | "Symbol Desig" col. after "P105**" | | Add symbol "P105****" |
| | | | "Name of Part and Description" col. op- posite "P105****" | | Add: "See Change 4." CONNECTOR, PLUG: 4 round male contacts; polarized straight type; overall 4-3/4 in. lg by 3-5/8 in. dia; cylindrical body, brass body, nickel plated, molded phenolic insert; 3/4 in. dia max cable opening; Mfr and Mfrs Designation CPH 142-894; Contractor Dwg and Part No. 142-894. |
| Ch.4 | 7-0B | Ch.2 | "Symbol Desig" col. after "W102**" | | Add symbol "W102****" |
| | | | "Name of Part and Description" col. op- posite "W102****" | | Add: "See Change 4." CABLE ASSEMBLY: Consists of P101, P105, W102A; 1 male connector ea end; Mfr and Mfrs Designation CPH 142-895; Contractors Dwg and Part No. 142-895. |
| Ch.4 | 7-0B | Ch.2 | "Symbol Desig" col. after "W102A**" | | Add symbol "W102A****" |

NOTE

For inboard use, RG-264/U or RG-264A/U. For outboard use, RG-264A/U only, manufactured by Times Wire with AT-317B/BRR or by Amphenol-Borg when received with AT-317C/BRR.

"Name of Part and Description" col. opposite
"W102A****"
Add: "See Change 4." CABLE, RF: type RG-264A/U special purpose; estane jacket, polyethylene dielectric; copper shielded; 180 ft. lg; Mfr and Mfrs Designation CPH 153-390; Contractors Dwg and Part No. 153-390.

Ch.4 7-0B Ch.2 Bottom of page Add below "†": "**** Used on Antenna AT-317C/BRR."

3. Destroy superseded pages but not until complete manual has been checked against list of effective pages.

4. Remove and destroy superseded Temporary Corrections and then insert this permanent change in the technical manual immediately after the front cover and preceding Change 3.

5. Make appropriate entry on Correction Page.

CHANGE 3 to TECHNICAL MANUAL
FOR AT-3171 BRR VLF LOOP ANTENNA SYSTEM

Change 3 revises the manual to reflect the equipment changes made by Field Change 1-CU-352/BRR. The purpose of this field change is to provide for connection of a ship antenna. This field change applies to all CU-352/BRR.

When this change is included in the manual, the manual shall cover the equipment as though Field Change 1-CU-352/BRR had been accomplished on the equipment. This change does not supersede any other correction or changes.

Maintenance Support Activities shall make this correction in the technical manual immediately but shall keep the superseded data intact for support of equipments that have not been modified.

Holders of equipment accompanied by technical manuals shall not make this change in the manual until accomplishment of the field change.

Make the following pen-and-ink corrections. Insert this temporary correction in the technical manual immediately after the front cover and preceding change 2.

1. Remove Figure 6-7, Overall Schematic Diagram and insert the new Overall Schematic Diagram Figure 6-7.
2. In table 7-2 Table of Replaceable Parts, delete all information relating to the old switch S-101.
3. In table 7-2 insert the following data regarding the new switch (S-101) and the new jack (J-105)

| Ref. Desig. | Notes | Name and Description | Fig. No. |
|-------------|--|--|----------|
| S-101 | Switch Rotary; 2 section; 6 max. number of switch position; 4 pole spring brass, cadmium plated contacts; steatite insulation; 1 1/8" long by 1 5/16" wide by 1 1/2" high bushing mounted; solder lug type shaft mfd. 2 1/4" long; shaft cut to 3/8" long. | Switch, Rotary CBN type PA-2011M N-5930-733-9254 | 6-7 |
| J-105 | Same as J-104 | | |

CHANGE 2 TO TECHNICAL MANUAL FOR NAVY MODEL AT-317/BRR AND AT-317A/BRR VLF LOOP ANTENNA SYSTEM FOR USE WITH MODEL RAK, RBA, AND AN/SRR-11 RADIO RECEIVING EQUIPMENTS (NAVSHIPS 92182).

This permanent change revises the book to reflect errors described in Temporary Correction T-3 plus the equipment changes in Navy Model AT-317B/BRR VLF Loop Antenna System.

Change 2 shall be inserted in the manual immediately upon receipt because this change is made to specific equipment. The manual will continue to cover the original equipment.

This Change, when inserted into the technical manual, supersedes Temporary Correction T-3.

1. Remove superseded pages and insert revised pages as indicated below:

| <u>Page</u> | <u>Remove</u> | <u>Insert</u> | <u>Page</u> | <u>Remove</u> | <u>Insert</u> |
|-------------|---------------|---------------|-------------|---------------|---------------|
| T.P./A | Ch.1/Ch.1 | Ch.2/Ch.2 | 6-1/6-2 | Orig/Orig | Ch.2/Ch.2 |
| 1/11 | Orig/Orig | Ch.2/Ch.2 | 6-3/6-4 | Orig/Orig | Ch.2/Ch.2 |
| 111/1-0 | Orig/Orig | Ch.2/Ch.2 | 6-4A/6-4B | -/- | Ch.2/Blank |
| 1-1/1-2 | Orig/Orig | Ch.2/Ch.2 | 6-5/6-6 | Orig/Orig | Ch.2/Ch.2 |
| 1-2A/1-2B | -/- | Ch.2/Ch.2 | 6-6A/6-6B | -/- | Ch.2/Blank |
| 1-3/1-4 | Orig/Orig | Ch.2/Ch.2 | 6-7/6-8 | Orig/Orig | Ch.2/Ch.2 |
| 2-1/2-2 | Orig/Orig | Ch.2/Ch.2 | 6-9/6-10 | Orig/Orig | Ch.2/Ch.2 |
| 2-4A/2-4B | -/- | Orig/Blank | 6-12A/6-12B | -/- | Ch.2/Blank |
| 2-5/3-0 | Orig/Orig | Ch.2/Ch.2 | 6-13/6-14 | Orig/Blank | Ch.2/Ch.2 |
| 3-1/3-2 | Orig/Orig | Ch.2/Ch.2 | 6-16C/6-16D | -/- | Ch.2/Blank |
| 3-5/3-6 | Orig/Orig | Ch.2/Ch.2 | 6-19/7-0 | Orig/Ch.1 | Ch.2/Ch.2 |
| 4-1/4-2 | Orig/Orig | Ch.2/Ch.2 | 7-0A/7-0B | Orig/Blank | Ch.2/Ch.2 |
| 4-2A/4-2B | -/- | Ch.2/Blank | 7-0C/7-0D | -/- | Orig/Blank |
| 5-3/6-0 | Orig/Orig | Ch.2/Orig | | | |

2. Make the following pen-and-ink corrections and mark "Ch.2" adjacent to the pen-and-ink correction:

| <u>FIRST</u> <u>ISSUED</u> <u>IN</u> | <u>PAGE</u> <u>NO.</u> | <u>CH.</u> <u>IN</u> <u>EFFECT</u> | <u>COL'M</u> <u>OR</u> <u>FIG.</u> | <u>LINE</u> <u>OR</u> <u>LOCATION</u> | <u>ACTION</u> |
|--|---------------------------|--|--|---|---------------|
|--|---------------------------|--|--|---|---------------|

Make the following changes everywhere that they appear in the instruction book, except where otherwise stated. Where corrections or additions are required on single spaced print, place an asterisk at the point where an addition is to be made and include addition or change as a footnote.

| | | | | | |
|------|-------------|-------|---------|----------------|---|
| T-3 | All | Orig. | | | Change existing references to "AT-317/BRR and AT-317A/BRR" to "AT-317/BRR, AT-317A/BRR and AT-317B/BRR." |
| T-3 | All | Orig. | | | Change "CU-352/BRR" to "CU-352/BRR and CU-352A/BRR." |
| T-3 | All | Orig. | | | Change "RG-160/U and RG-160A/U" to "RG-160/U, RG-160A/U and RG-264/U." |
| Ch.2 | 3-3, 3-4 | Orig. | Fig.3-2 | Upper right | Add "NOTE: Overall dimensions of Loop Antenna AT-317B/BRR and Antenna Coupler CU-352A/BRR are the same as shown. For front panel details of Antenna Coupler CU-352A/BRR see Figure 4-1A." |

16 MAY 1960

INSTRUCTION SHEET

CHANGE 2

| <u>FIRST ISSUED IN</u> | <u>PAGE NO.</u> | <u>CH. IN EFFECT</u> | <u>COL'M OR FIG.</u> | <u>LINE OR LOCATION</u> | <u>ACTION</u> |
|--------------------------------|---------------------|------------------------------|------------------------------|---|--|
| Ch.2 | 4-5, 4-6 | Orig. | Fig.4-3 | Title Line 1 | Change "SELECTOR" to "SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR." |
| | | | | Title Line 2 | Change "TUNING" to "TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR." |
| Ch.2 | 5-1, 5-2 | Orig. | Table 5-1 | Item 3 "What to Check" Column | Add after "J104)" "on CU-352/BRR and J102, J103 and J104 on CU-352A/BRR." |
| Ch.1 | 6-15, 6-16 | Orig. | Fig.6-9 | Title | Add "on AT-317/BRR." |

3. Destroy superseded pages but not until the complete manual has been checked against the "LIST OF EFFECTIVE PAGES."

4. Remove and destroy the superseded Temporary Corrections, and then insert this Instruction Sheet just behind the front cover immediately in front of the Title Page.

5. Make appropriate entry on the Correction Page.

CHANGE 1 TO TECHNICAL MANUAL FOR NAVY MODEL AT-317/BRR VLF LOOP ANTENNA SYSTEM FOR USE WITH MODEL RAK, RBA, AND AN/SRR-11 RADIO RECEIVING EQUIPMENTS (NAVSHIPS 92182).

This permanent change revises the book to reflect errors described in Temporary Corrections T-1 and T-2, plus: (1) the equipment changes in Navy Model AT-317/BRR VLF Loop Antenna System, serial numbers 144 through 156, and (2) Navy Model AT-317A/BRR VLF Loop Antenna System.

Change 1 shall be inserted in the manual immediately upon receipt because this change is made to specific equipment. The manual will continue to cover the original equipment.

This Change, when inserted into the technical manual, supersedes Temporary Corrections T-1 and T-2.

1. Remove superseded pages and insert revised pages as indicated below:

| <u>Page</u> | <u>Remove</u> | <u>Insert</u> |
|-------------|---------------|---------------|
| T.P./A | Orig/Orig | Ch.1/Ch.1 |
| 6-11/6-12 | Orig/Orig | Ch.1/Ch.1 |
| 6-16A/6-16B | -/- | Ch.1/Ch.1 |
| 6-19/7-0 | Orig/Orig | Orig/Ch.1 |
| 7-0A/7-0B | -/- | Orig/Blank |

2. Make the following pen-and-ink corrections and mark "Ch.1" adjacent to the pen-and-ink correction:

| <u>FIRST</u> <u>ISSUED</u> <u>IN</u> | <u>PAGE</u> <u>NO.</u> | <u>CH.</u> <u>IN</u> <u>EFFECT</u> | <u>COL'M</u> <u>OR</u> <u>FIG.</u> | <u>LINE</u> <u>OR</u> <u>LOCATION</u> | <u>ACTION</u> |
|--|---------------------------|--|--|---|---------------|
|--|---------------------------|--|--|---|---------------|

Make the following changes everywhere that they appear in the instruction book, except where otherwise stated. Where corrections or additions are required on single spaced print, place an asterisk at the point where an addition is to be made and include addition or change as a footnote.

| | | | | | |
|------|-----|-------|--|--|--|
| T-2 | All | Orig. | | | Change existing references to "AT-317/BRR" to "AT-317/BRR and AT-317A/BRR", except in Figure 3-5 and where otherwise stated. |
| T-2 | All | Orig. | | | Change existing cable nomenclature references to "RG-160/U or RG-160A/U." |
| Ch.1 | All | Orig. | | | Change all existing references to "The American Phenolic Corporation" to "The Amphenol-Borg Electronics Corporation." |
| Ch.1 | i | Orig. | | Ahead of "SECTION 7 - PARTS LIST" | Add "SECTION 7A - SUPPLEMENTARY PARTS LIST 7-0A". |

| <u>FIRST ISSUED IN</u> | <u>PAGE NO.</u> | <u>CH. IN EFFECT</u> | <u>COL'M OR FIG.</u> | <u>LINE OR LOCATION</u> | <u>ACTION</u> |
|---|---------------------|------------------------------|------------------------------|---|---|
| Ch.1 | ii | Orig. | 2 | - | Place as asterisk at Figure 6-9 and add the following: "6-9A...Assembly Instructions for Watertight Connector Assembly P103 for Antenna AT-317A/BRR ...6-15A". |
| Ch.1 | iii | Orig. | 2 | As first item of "SECTION 7 - PARTS LIST" | Add "7-1A SUPPLEMENTARY PARTS LIST 7-0A". |
| T-2 | 1-1 | Orig. | 1 | 3 | Just ahead of paragraph 1 add the following: |
| NOTE | | | | | |
| "References and illustrations have been changed throughout the text only to the extent needed for clarity. All reference to AT-317/BRR applies equally well to AT-317A/BRR except as specifically indicated." | | | | | |
| Ch.1 | 1-2 | Orig. | 2 | Para. 5b | Insert after "May 5, 1952," "and NObsr-75189 dated 1 April 1959." |
| T-2 | 1-3 | Orig. | Table 1-1 | Line 1 | Add "or AT-317A/BRR" after "AT-317/BRR" in the "Navy Type Designation" column. |
| T-2 | 1-4 | Orig. | Table 1-3 | Line 1 | Add "or AT-317A/BRR" after "AT-317/BRR" in the "Designation" column. |
| Ch.1 | 2-1 | Orig. | 2 | Para. 2b Line 11 | Place an asterisk before the following sentences; "The braided shields of the coaxial lines are tied together and connected to the cable assembly outer shield. This provides a ground return between the loop antenna and the coupler." and add the following: "*these sentences do not apply to Antenna AT-317/BRR serial no's 144 through 156 or Antenna AT-317A/BRR." |
| T-2 | 3-1 | Orig. | 3-1 | Fig. caption and upper right | Add "or AT-317A/BRR" after "AT-317/BRR" in the figure caption and after the callout in the upper right-hand corner of the illustration. |
| T-2 | 3-1 | Orig. | 2 | Para. 2f, Line 1 | Add "or AT-317A/BRR" after "AT-317/BRR." |

| <u>FIRST ISSUED IN</u> | <u>PAGE NO.</u> | <u>CH. IN EFFECT</u> | <u>COL'M OR FIG.</u> | <u>LINE OR LOCATION</u> | <u>ACTION</u> |
|--------------------------------|---------------------|------------------------------|------------------------------|---------------------------------|--|
| T-2 | 3-5 | Orig. | 3-3 | Caption | Add "or AT-317A/BRR" after "AT-317/BRR" in the figure caption. |
| T-1 | 6-2 | Orig. | 1 | Step 7 | Add after "STEP 7", "Set the ANTENNA LOOP SELECTOR switch to 'OMNI'". |
| T-1 | 6-2 | Orig. | 2 | Step 7 | Add after "STEP 7", "Set the ANTENNA LOOP SELECTOR switch to 'OMNI'". |
| T-2 | 6-15, 6-16 | Orig. | 6-9 | Step four | Place an asterisk at "STEP 4" and add the following note: "*On Antenna AT-317/BRR serial no's 144 through 156 the outer braid is not connected to the connector shell. The outer braid is floating at the loop end." |

3. Destroy superseded pages but not until the complete manual has been checked against the "LIST OF EFFECTIVE PAGES."

4. Remove and destroy the superseded Temporary Corrections, and then insert this Instruction Sheet just behind the front cover immediately in front of the Title Page.

5. Make appropriate entry on the Correction Page.



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

IN REPLY REFER TO
Code 993-100
17 March 1954

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

Subj: Instruction Book for Antenna
AT-317/BRR NAVSHIPS 92182

1. This is the instruction book 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. 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 Bureau of Ships Journal and in the Index of Bureau of Ships General and Electronics Publications, NAVSHIPS 250-020.

W. D. Leggett, Jr.
Chief of Bureau

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Figure 1-1B. Navy Model AT-317C/BRR VLF Loop Antenna System Relationship of Units.

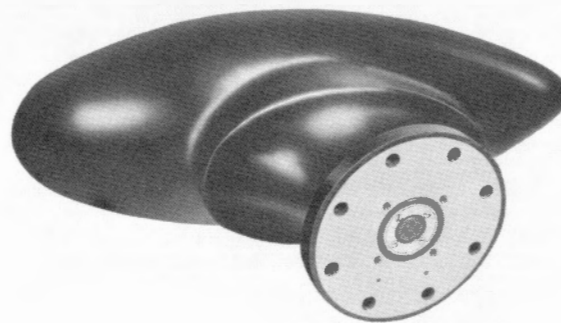


Figure 1-2B. Navy Type AT-317C/BRR VLF Loop Antenna.

SECTION 1

GENERAL DESCRIPTION

Note

REFERENCES AND ILLUSTRATIONS HAVE BEEN CHANGED THROUGHOUT THE TEXT ONLY TO THE EXTENT NEEDED FOR CLARITY. ALL REFERENCES TO AT-317/BRR APPLIES EQUALLY WELL TO AT-317A/BRR AND AT-317B/BRR. ALSO ALL REFERENCES TO CU-352/BRR APPLIES EQUALLY WELL TO CU-352A/BRR EXCEPT AS SPECIFICALLY INDICATED.

1. INSTRUCTION BOOK COVERAGE.

This instruction book covers the installation, operation and maintenance of Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System, (figs. 1-1 and 1-1A).

2. PURPOSE OF EQUIPMENT.

Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR Loop Antenna is a very low frequency streamlined loop designed for submarine service. The antenna system has been designed to cover the frequency range of 14.6 to 38 kilocycles and is primarily used to operate with models RAK, RBA and AN/SRR-11 radio receiving equipments. The CU-352/BRR and CU-352A/BRR Antenna Coupler is an integral part of the system and was developed to fill the immediate needs for an adapter which could provide various modes of radio reception including omni-directional coverage of radio signals with the submarine surfaced or submerged.

3. BASIC PRINCIPLES OF OPERATION.

Two loop windings are connected to the antenna coupler by means of either a 75-foot length of RG-160/U cable on the AT-317/BRR, a 75-foot length of RG-160A/U cable on the AT-317A/BRR or a 180-foot length of RG-264/U cable on the AT-317B/BRR. Each loop winding receives maximum energy at right angles to its axis. The antenna is mounted on the submarine so that the axis of the athwart loop winding is in a fore-aft direction (fig. 3-3). A switching arrangement in the antenna coupler permits either winding to be used individually or combined for omni-directional reception. The signal voltages from the antenna are combined

in the antenna coupler. The resulting signal energy is conveyed to the receiving equipment by a 3 foot interconnecting cable. By proper switching

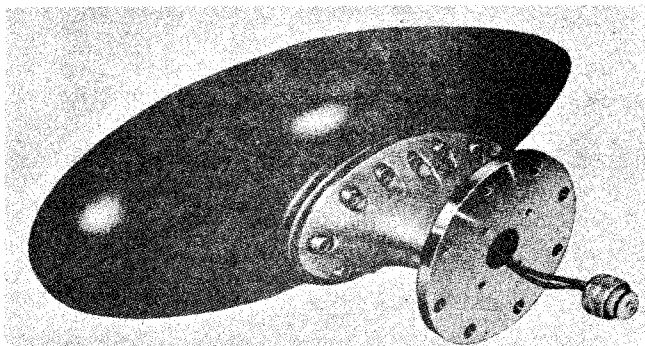


Figure 1-2. Navy Type AT-317/BRR and AT-317A/BRR VLF Loop Antenna.

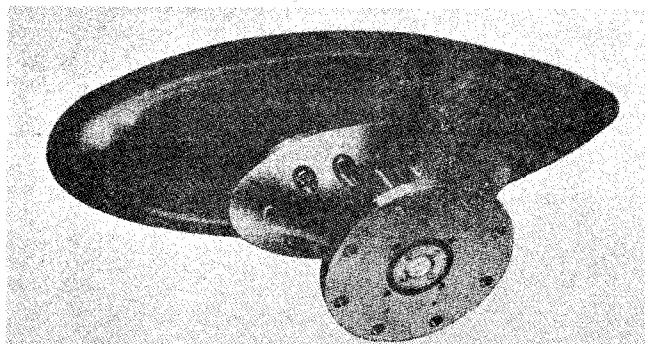


Figure 1-2A. Navy Type AT-317B/BRR VLF Loop Antenna

and tuning, reception is possible in a plane fore-aft, athwart ship, or from all directions (omni-directional).

4. DESCRIPTION OF UNITS.

a. ANTENNA.— The AT-317/BRR, AT-317A/BRR (fig. 1-2) and AT-317B/BRR (fig. 1-2A) consists of two loop windings orientated at right angles to each other on a common cylindrical ferrite core. The loop inductor windings and core assembly are imbedded in a solid "teardrop-shaped" polyethylene shell which is covered with a 1/4 inch jacket of neoprene rubber. Such a shape tends to reduce

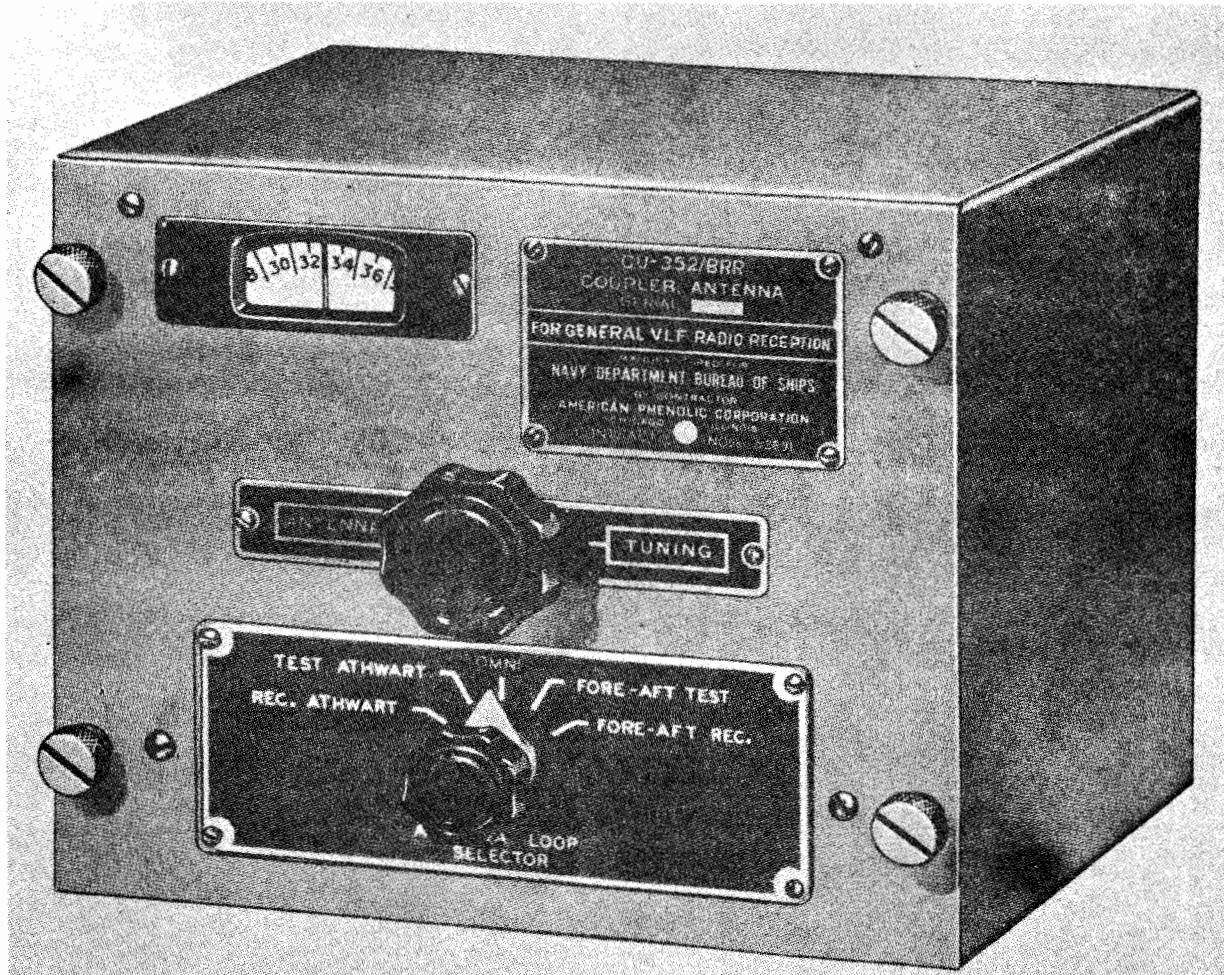


Figure 1-3. Navy Type CU-352/BRR VLF Antenna Coupler (Part of Antenna System).

underwater drag.—The loop inductor windings are connected through 75 feet of RG-160/U on AT-317/BRR, 75 feet of RG-160A/U on AT-317A/BRR and 180 feet of RG-264/U on the AT-317B/BRR via a pressure-proof connector. The antenna and cable assembly for AT-317/BRR and AT-317A/BRR will withstand an external water pressure of 600 pounds per square inch. Model AT-317B/BRR antenna and cable assembly will withstand 1000 pounds per square inch.

b. ANTENNA CABLE.—The antenna cable (RG-160/U and RG-160A/U) consists of two individual coaxial cables. RG-160/U cable also contains six insulated control wires. The coaxial cables are twisted along their lengths to achieve flexibility and provide an overall circular cross-section to insure watertight integrity. In the system described in this manual the six control wires (RG-160/U) are not used. The two coaxial cable braids and the outer braid are joined together at the pressure-proof connector on model AT-317/BRR. The two coaxial cable braids serve as returns for the loop

windings and with the outer cable braid are joined together at the coupler connector on model AT-317A/BRR. The antenna cable RG-264/U consists of 4 individual coaxial cables. Flexibility and watertight integrity is achieved in the same manner as the RG-160/U and RG-160A/U cable. The RG-264/U construction provides a “balanced” connection between the antenna and coupler (CU-352A/U). Each pair of coaxial cables are connected to a loop winding. All four coaxial braids and the cable outer braid are collected and terminated at the CU-352A/U coupler connector to provide a FARADAY SHIELD. If necessary the pressure-proof connector can be disconnected from the base of the loop antenna. The coupler (inboard) side of the cable is terminated with a water-proof plug. (See figs. 1-1 and 1-1A.)

c. ANTENNA COUPLER.—Antenna Coupler CU-352/BRR (fig. 1-3) and CU-352A/BRR (fig. 1-3A), are housed in a gray metal case. CU-352/BRR has three connectors in the rear and two controls on the front panel, CU-352A/BRR has 4 con-

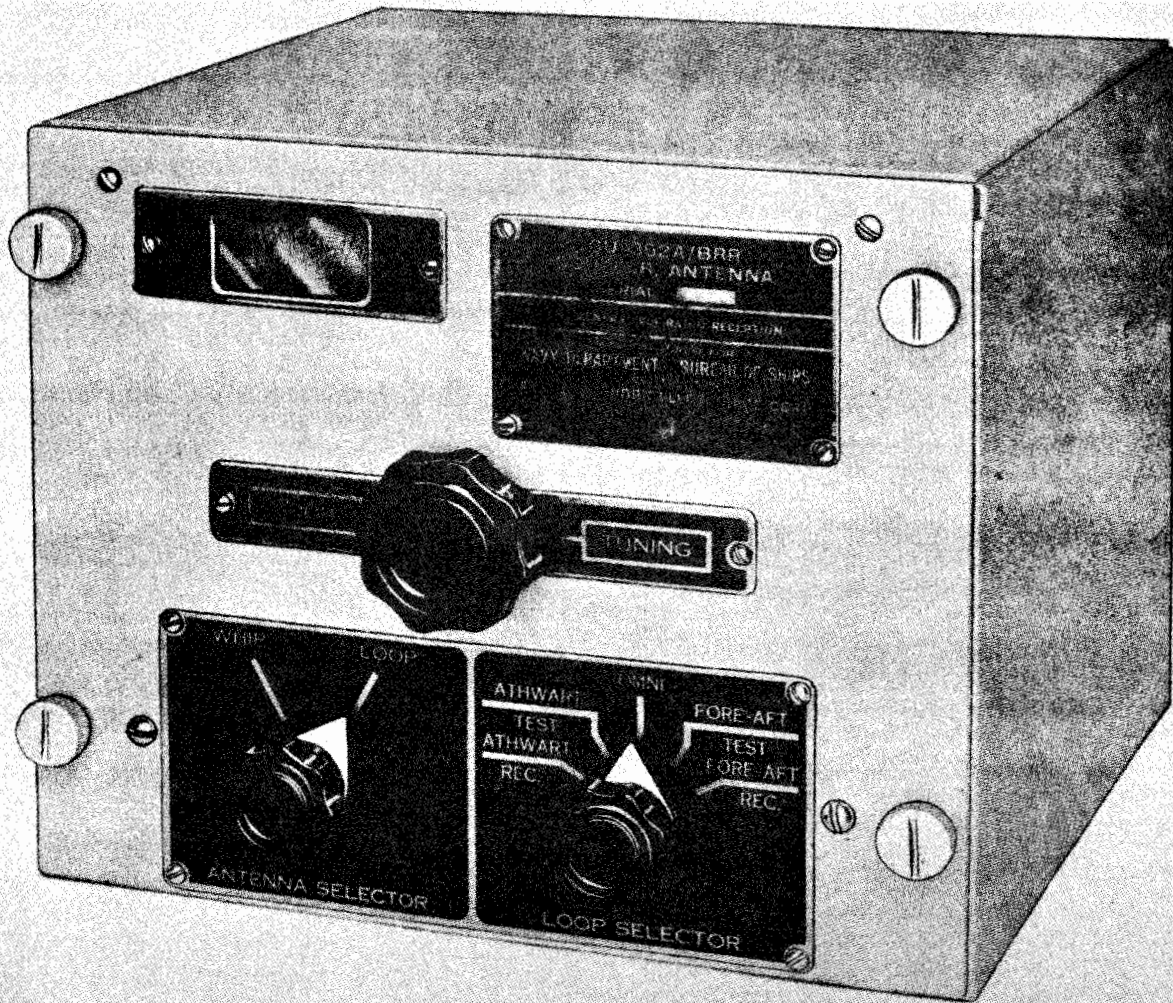


Figure 1-3A. Navy Type CU-352A/BRR VLF Antenna Coupler (Part of Antenna System).

nectors in the rear and three controls on the front panel. The controls are the ANTENNA TUNING and ANTENNA LOOP SELECTOR on CU-352/BRR and LOOP TUNING, ANTENNA SELECTOR and LOOP SELECTOR on the CU-352A/BRR. ANTENNA TUNING on CU-352/BRR and LOOP TUNING on the CU-352A/BRR controls tunes the coupler to any desired frequency between 14.6 and 38 kilocycles. The ANTENNA LOOP SELECTOR or LOOP SELECTOR is a five position switch for determining the mode of reception. The five positions listed from left to right on the front panel are as follows.

(1) REC. ATHWART— single plane loop operation providing maximum antenna sensitivity for signals received exactly athwart ship.

(2) TEST ATHWART—for testing signals while tuning for omni-operation.

(3) OMNI— for reception of signals from all directions.

(4) FORE-AFT TEST—for testing signals while tuning for omni-operation.

(5) FORE-AFT REC.— single plane loop operation, providing maximum antenna sensitivity for signals received exactly in fore and aft directions.

The ANTENNA SELECTOR on the CU-352A/BRR provides switching between AT-317B/BRR and any high impedance straight wire antenna.

d. ANTENNA COUPLER ACCESSORIES.

(1) INTERCONNECTING CABLE.—The antenna coupler unit is supplied with a 3-foot interconnecting cable, type RG-11/U. This cable assembly is terminated with two connectors, types UG-21B/U and CN-49121A. It is used to connect the coupler to the radio receiving equipment.

(2) RESISTOR TEST DECADE UNIT.—The resistor test decade unit is a small plug-in assembly containing a one-tenth ohm, and a ten ohm precision resistor. (See fig. 1-4.) The assembly is

used for maintenance test measurements. When not in use the unit is disconnected and stored inside the antenna coupler by plugging it in a mounting receptacle. The test decade unit for CU-352A/BRR has one finger for switch interrupting (see fig. 1-4A).

NObsr-75189 dated April 1, 1959 and NObsr-75555 dated September 18, 1958.

c. Contractor: Amphenol-Borg Electronics Corporation, Chicago 50, Illinois.

d. The Cognizant Naval Inspector; Inspector Naval Material, Chicago, Illinois.

e. Number of packages per equipment; 1 package.

f. Total cubic contents; approximately 23.15 cu. ft.

g. Frequency range; 14.6 to 38 kilocycles.

5. REFERENCE DATA.

a. This manual describes Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System.

b. The equipment is manufactured under Navy Contract Number NObsr-52691 dated May 5, 1952,

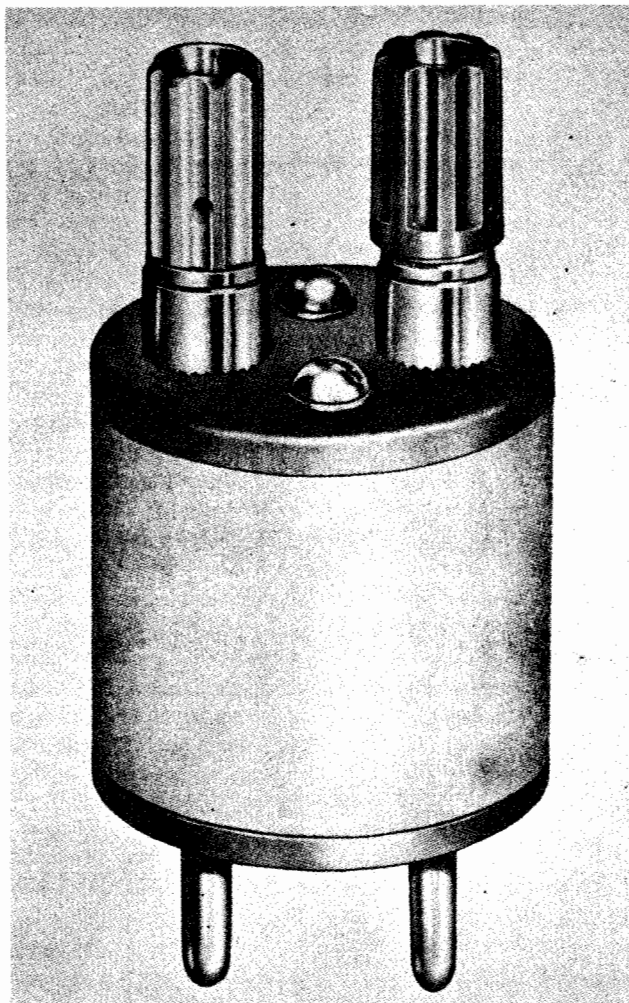


Figure 1-4. Resistor Test Decade Unit (Part of Antenna Coupler CU-352/BRR).

Figure 1-4A. Resistor Test Decade Unit (Part of Antenna Coupler CU-352A/BRR).

TABLE 1-1. EQUIPMENT SUPPLIED

| Quantity per Equipment | Name of Unit | Navy Type Designation | Over-all Dimensions | | | Volume | Weight |
|------------------------|-----------------------|--|--------------------------------|------------------------------------|------------|---------------|--------|
| | | | Height | Width | Depth | | |
| 1 | Loop Antenna | AT-317/BRR, AT-317A/BRR or AT-317B/BRR | 13-1/4 in. | 8-1/2 in. | 24-1/2 in. | 663.9 cu. in. | 126 |
| 1 | Antenna Coupler | CU-352/BRR or CU-352A/BRR | 7-3/16 in. | 8-3/4 in. | 10-5/8 in. | | |
| | | | Length | Diameter | | | |
| 1 | Interconnecting Cable | RG-11/U | 3 feet | .405 in. | | | |
| 1 | Antenna Cable | RG-160/U, RG-160A/U or RG-264/U | 75 feet 75 feet 180 feet | 1.125 in. 1.125 in. .750 in. | | | |

TABLE 1-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

| Quantity per Equipment | Name of Unit | Navy Type Designation | Required Use | Required Characteristics |
|------------------------|--------------------|-----------------------|---|--|
| 8 | Bolt, 1/2 in. dia. | | Used for mounting antenna base to submarine. | Corrosion resistant. |
| 1 | Hull fitting | | Permits access of antenna cable RG-160/U, RG-160A/U or RG-264/U through hull. | RG-160/U must stand 600 P.S.I. RG-264/U must stand 1000 P.S.I. |
| 1 | Capacitor, fixed | | Dummy load capacitor C111. | Mica dielectric 5% tolerance 3/4 x 3/4 x 1/4; Cornell-Dubilier type CM-30C---J |

TABLE 1-3. SHIPPING DATA

| Shipping Box No. | Contents | | Over-all Dimensions | | | Volume | Weight |
|------------------|-----------------------|--|---------------------|--------|------------|-----------------------|----------|
| | Name | Designation | Height | Width | Depth | | |
| 1 | Loop Antenna | AT-317/BRR, AT-317A/BRR or AT-317B/BRR | 16-1/2 in. | 63 in. | 38-1/2 in. | 40020.75 cubic inches | 310 lbs. |
| | Coupler, Antenna | CU-352/BRR or CU-352A/BRR | | | | | |
| | Antenna cable | RG-160/U, RG-160A/U or RG-264/U | | | | | |
| | Interconnecting cable | RG-11/U | | | | | |

SECTION 2

THEORY OF OPERATION

1. GENERAL.

Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System is designed for the reception of vlf (very low frequency) radio signals by submarine radio receiving equipment while surfaced or submerged. Signal energy can be picked up from all directions or in a plane fore-aft or athwart ship. A switching arrangement and balanced circuits in the coupler give the desired modes of reception. In the block diagram (fig. 2-1) the loop antenna is shown with three operational modes. These are fore-aft, athwart ship, and omni-directional modes of reception. The various modes of reception are selected by a switch on the antenna coupler. The radio receiving equipments required for use with this system are not supplied.

2. CIRCUIT ANALYSIS.

a. LOOP ANTENNA.—Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna is a solid, teardrop-shaped structure of polyethylene, 24 inches long and 8 inches in diameter. This structure is covered by a one-quarter inch thick rubber neoprene jacket. Imbedded within this structure are two high-Q, crossed-loop antennas wound on a common ferrite core. Either of the two loops may be used separately to produce bi-directional patterns in a plane fore-aft or athwart ship. By introducing a phasing network to shift the phase 90 degrees, the individual loop windings may be combined vectorially to produce an omni-directional pattern so that equal signal strength can be received from all directions (fig. 2-2). This allows the operator to leave the equipment unattended even though the ship may change course.

b. ANTENNA TRANSMISSION LINE.—The radio frequency energy picked up by the loop antenna windings is conveyed to the antenna coupler via the RG-160/U cable in the AT-317/BRR, RG-160A/U cable in the AT-317A/BRR and RG-264/U cable in the AT-317B/BRR. The cable has a special pressure-proof type fitting at the base of the loop antenna that will withstand water pressure up to 600 pounds per square inch in the AT-317/BRR and AT-317A/BRR models. The AT-317B/BRR model will withstand water pressures up to 1000 pounds per square inch. The cable should not be disconnected from the antenna unless absolutely necessary. The RG-160/U is composed of a number of conductors but only the two coaxial cables are used. The braided shields of the coaxial lines are tied together and connected to the cable assembly outer shield. This provides a ground return between the loop antenna and the coupler. In the RG-160A/U the braided shields of the coaxial lines serve as returns for the loop windings. These shields and the outer cable shield are tied together at the coupler connector end. The RG-264/U contains four coaxial cables. These cables provide a balanced line between the antenna and the coupler. The braided shields of the coaxial cables are collected along with the outer shield of the cable and terminated at the coupler connector end. This provides a FARADAY SHIELD in addition to a balanced quad transmission line. The coupler end of the RG-160/U, RG-160A/U or RG-264/U cable is terminated by a water proof connector but not designed to withstand water pressure.

c. ANTENNA COUPLER.—The various modes of reception are chosen by the ANTENNA LOOP SELECTOR switch (fig. 2-3) on the CU-352/BRR and by the LOOP SELECTOR switch on the CU-352A/BRR. When the switch is in the FORE-AFT REC.

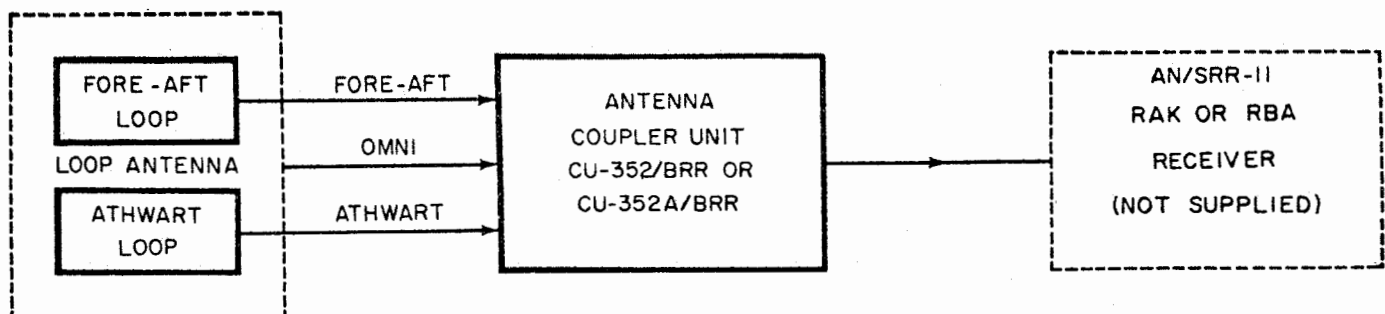


Figure 2-1. Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System Block Diagram.

position the signal from the fore-aft loop is fed directly into the primary of loop input transformer T101. The secondary is made resonant to the signal frequency by means of a tuning capacitor (C101). The signal voltage from this resonant circuit is then transferred to the receiver input receptacle through the "T" isolation network (C107, C108, C109). This isolation network is necessary to keep the receiver tracking properly, and prevents the coupler unit from loading down the receiver input circuits. With the coupler unit and the receiver peaked to the incoming signal frequency, the resultant mode of reception is single plane or a figure-eight pattern with maximum sensitivity in the fore-aft directions. When the ANTENNA LOOP SELECTOR on the CU-352/BRR or LOOP SELECTOR on the CU-352A/BRR is set to the REC. ATHWART position, the signal from the athwart loop is fed to the primary of loop input transformer T101 resulting in a single plane mode of reception or a figure-eight pattern with maximum sensitivity athwart-ship. In order to tune the coupler unit for an omni-directional mode of reception either of two test positions of the ANTENNA LOOP SELECTOR on the CU-352/BRR or LOOP SELECTOR on the CU-352A/BRR switch is used. The position which gives greater signal output is the proper one to select. In this condition the signal is fed to the primary of the input transformer in use. The unused primary is loaded with a capacitive-inductive network (C111, L101). This network forms a dummy load and its purpose is to maintain alignment and tracking of the coupler unit. When the selector switch is set to the OMNI position the signals from both antenna loops are fed to both input transformers (T101, T102). The secondaries of these transformers with their associated capacitors form two tuned circuits resonant to the same frequency. When the coupling between these two circuits approaches critical coupling (or 90-degree phase shift) the signals add vectorially and produce an omni-directional response pattern. This coupling is controlled by the combination of two capacitors (C105, C106). The proper value of the trimmer (C105) is obtained during the calibration procedure of the coupler unit. The shorting links (E101, E102) complete the circuits of the input transformer primaries to ground. During normal operation of the coupler

unit these links are in the "short" position. During testing and alignment these links may be opened for the insertion of the resistor test decade unit (see figs. 1-4 and 6-2).

In CU-352A/BRR, S104 and S105 provide center taps on primary of T101 and T102. During testing and alignment, the insertion of the resistor test decade unit (see figs. 1-4A and 6-2) automatically opens switches S104 and S105.

The CU-352A/BRR is also provided with an ANTENNA SELECTOR switch which provides use of either the AT-317B/BRR Loop Antenna or a high impedance whip antenna.

d. INTERCONNECTING CABLE.—The interconnecting cable is supplied to connect the coupler unit to the vlf radio receiving equipment. The cable assembly is 38 inches long, and in order to maintain calibration of the coupler unit the length of this assembly should vary not more than two inches. The cable assembly also has a different connector at each end. This allows reversing the cable which may be connected to either of the two different receptacles wired in parallel and located on the back of the coupler unit. When the coupler unit is used with RAK or RBA radio receiving equipment, the cable assembly is mated with the UG-58A/U receptacle (J104 on CU-352/BRR and J102 on CU-352A/BRR) on the coupler unit and the free end is connected to the CN-49120 receptacle on either receiver. When the coupler unit is used with AN/SRR-11 radio receiving equipment the cable assembly is reversed and mated with the CN-49120 receptacle (J102 on CU-352/BRR and J103 on CU-352A/BRR) on the coupler unit, and the free end is connected to the UG-58A/U receptacle on the AN/SRR-11 receiver.

3. TEST PROCEDURES.

The AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System requires a minimum amount of testing. Resistance tests and signal output measurements are the primary tests and will reveal almost any fault. See tables 5-1, 6-3 and 6-3A.

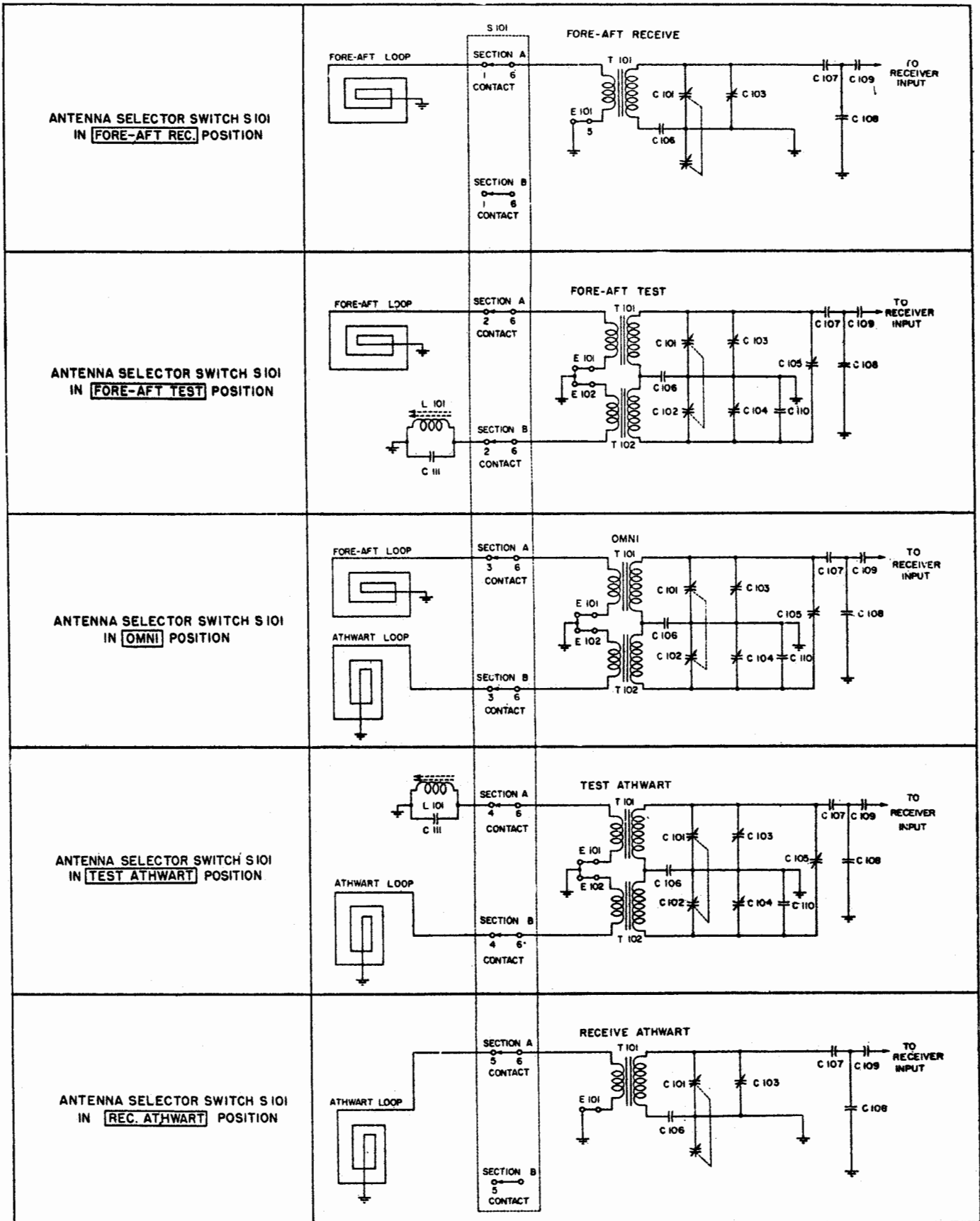


Figure 2-3. Functions of the ANTENNA LOOP SELECTOR Switch on CU-352/BRR.

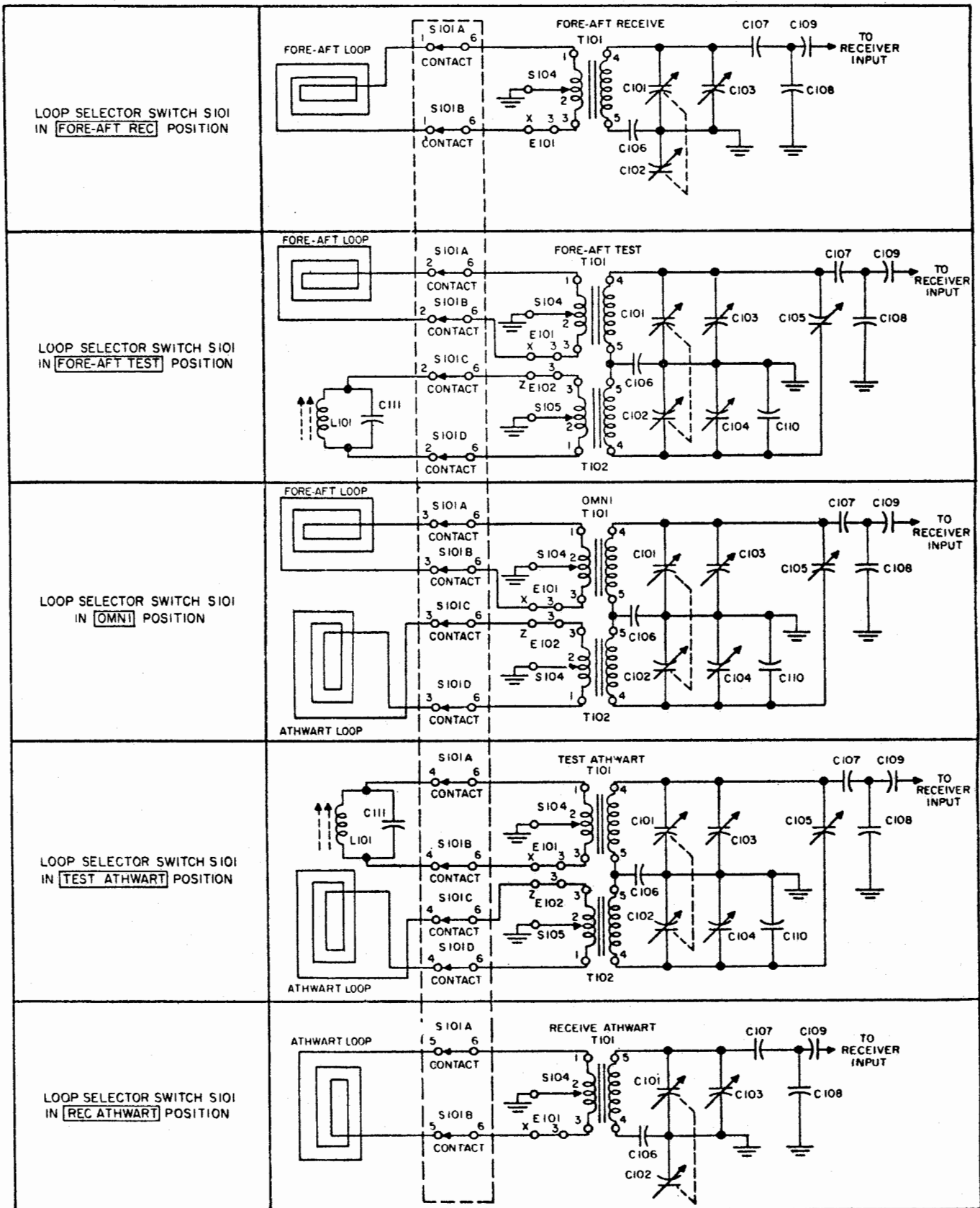


Figure 2-3A. Functions of the LOOP SELECTOR Switch on CU-352A/BRR.

SECTION 3

INSTALLATION

1. UNPACKING.

CAUTION

THE AT-317/BRR, AT-317A/BRR AND AT-317B/BRR VLF LOOP ANTENNA OR ITS ASSOCIATED COMPONENTS MAY BE EASILY DAMAGED DURING THE UNPACKING PROCESS. BE EXTREMELY CAREFUL NOT TO DROP OR DAMAGE THE UNITS. AVOID THRUSTING PINCH-BARS OR ANY OTHER UNPACKING TOOLS INTO THE INTERIOR OF THE FIBERBOARD SHIPPING CONTAINER. DO NOT UNPACK IN A LOCATION WHERE DUST, DIRT, OR EXCESSIVE MOISTURE MAY AFFECT THE EQUIPMENT. FIGURE 3-1 ILLUSTRATES THE UNPACKING PROCEDURE.

a. Using nail puller, remove the nails in the top of the shipping container and remove the top cover.

b. Remove the excelsior from the shipping container.

c. Lift out the waterproof bags containing the antenna coupler unit.

d. Slit the waterproof bags and remove outer carton containing the coupler.

e. Remove the coupler and antenna from the shipping container.

f. The unit is now unpacked and ready for installation.

2. INSTALLATION.

The AT-317/BRR, AT-317A/BRR or AT-317B/BRR VLF Loop Antenna is mounted in line with the axis of the submarine as shown in figure 3-3. The following points should be followed when making the installation.

a. The antenna is mounted with eight one-half inch bolts (see table 1-2) equally spaced around a six-inch diameter circle. The bolts are not supplied. (See fig. 3-2).

b. The antenna coupler unit should be installed next to the radio receiving equipment. Three .265

inch diameter holes spaced as shown in figure 3-2 are required for mounting. To install the antenna coupler unit proceed as follows.

(1) Loosen the four knurled fasteners on the antenna coupler front panel and remove the chassis from the cabinet.

(2) Set the cabinet over the mounting holes next to the radio receiving equipment.

(3) Place three bolts of a suitable size and length through the anchor studs in the bottom of the cabinet and through the three .265 inch diameter holes provided for mounting.

(4) Place a flat washer, a lock washer, and the proper size nut on the threaded end of each of the three mounting bolts.

(5) Tighten the nuts securely but do not over-tighten.

(6) Place the chassis back in place and re-tighten the four knurled fasteners.

(7) The mounting bolts are not supplied and must be furnished by the installing activity.

c. Seventy-five feet of RG-160/U on AT-317/BRR, RG-160A/U on AT-317A/BRR or 180 feet of RG-264/U on AT-317B/BRR antenna cable has been assembled and connected to the loop antenna by the contractor. This cable can be increased or decreased to suit installation needs in accordance with directions given in paragraph 3-2f. Any bends in the antenna cable assembly must have a radius greater than 7 inches. The cable should not be disconnected from the loop antenna unless absolutely necessary.

Note

ANTENNA CABLING MUST BE INSTALLED WITHIN SUITABLE CONDUIT REMOVED FROM HIGH CURRENT CARRYING AC AND DC CABLING IN ORDER TO PROVIDE MAGNETIC AS WELL AS ELECTROSTATIC SHIELDING.

Note

THE MATING ENDS OF THE CONNECTOR

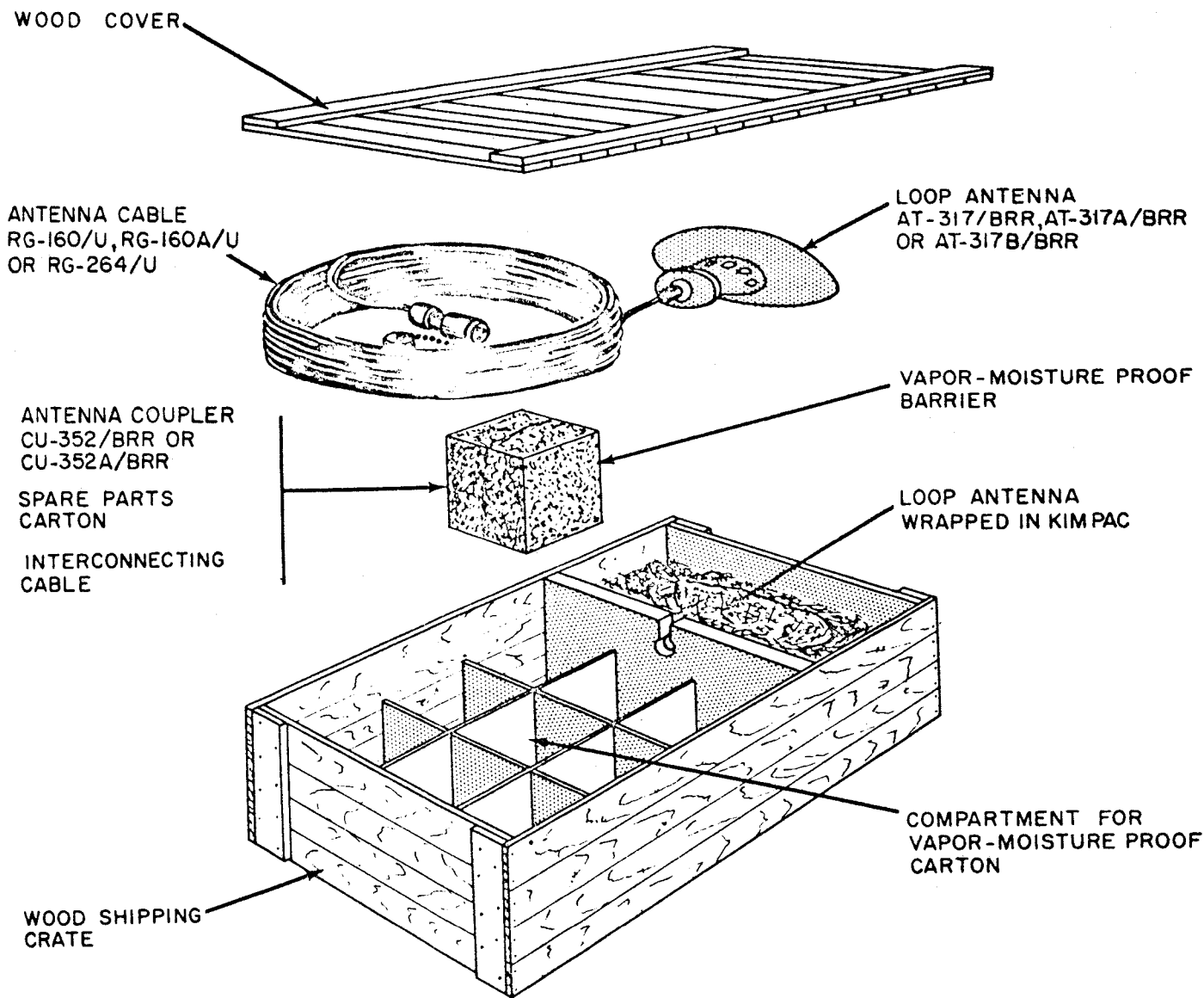


Figure 3-1. Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System Unpacking Procedure.

(J103 ON AT-317/BRR AND AT-317A/BRR, AND J105 ON AT-317B/BRR) ON THE ANTENNA BASE AND THE CONNECTOR (P103 ON AT-317/BRR AND AT-317A/BRR, AND P105 ON AT-317B/BRR) ON THE ANTENNA FORM A PRESSURE-PROOF CONNECTION. THESE SURFACES ARE CAREFULLY MACHINED AND IT IS IMPERATIVE THAT THEY BE HANDLED WITH SPECIAL CARE TO PREVENT SCRATCHES, NICKS, OR OTHER DAMAGES DURING INSTALLATION. THESE PARTS MUST FIT TOGETHER TIGHTLY BEFORE, DURING, AND AFTER THE CABLE CLAMP NUT IS ASSEMBLED AND TIGHTENED. SEE FIGURES 6-9, 9A OR 9B. INSTALLATION OF THE CABLE REQUIRES A SPECIAL HULL FITTING WHICH

WILL BE PROVIDED BY THE INSTALLING ACTIVITY. WHEN INSTALLING THE HULL FITTING BE SURE TO OBSERVE PROPER WIRE POLARITY. SEE FIGURE 3-5 OR 3-5A.

d. The other end of the RG-160/U, RG-160A/U or RG-264/U antenna cable is connected to the antenna coupler by means of a standard connector (P101). This connector will not withstand water pressure as in the case of the hull fitting but is moisture proof. If it becomes necessary to remove this connector during installation, extreme care should be used upon reassembly to insure close fitting and maintaining good contact. See figure 6-8 or figure 6-8A for RG-264/U.

e. The interconnecting cable is used to connect

the coupler unit to the vlf radio receiving equipment. The cable assembly mates with either J102 or J104 on the CU-352/BRR and J102 and J103 on CU-352A/BRR coupler unit. The other end of the cable mates with the antenna input receptacle on the radio receiving equipment. J104 on CU-352A/BRR provides connection for ships whip or any other high impedance antenna.

f. When the AT-317/BRR, AT-317A/BRR or AT-317B/BRR Loop Antenna System has been installed the total length of RG-160/U, RG-160A/U or RG-264/U that has been used should be estimated. This estimated length is necessary to determine the value of load capacitor C111. The CU-352/BRR equipment is supplied with a 2200 uuf load capacitor. The CU-352A/BRR equipment is supplied with a 3600 uuf load capacitor. The graph (fig. 6-12) shows that the 2200 uuf value of load capacity can be used with 65 to 85 of RG-160/U or RG-160A/U cable. The 3600 uuf value of load capacity can be used with 170 to 190 feet of RG-264/U cable. If installation is more or less than the values indicated above, load capacitor C111 should be replaced by another capacitor of the

proper value as determined by the graph. If the load capacitor is replaced with a capacitor of another value, the load inductor (L101) must be realigned in accordance with paragraph 6-4c steps one through ten.

Note

WHEN THE ANTENNA COUPLER IS USED WITH THE RAK RADIO RECEIVER, THE LINK ACROSS C101 OF THE RAK RADIO RECEIVER SHOULD BE CLOSED. REFER TO THE RAK INSTRUCTION BOOK. WHEN THE ANTENNA COUPLER IS USED WITH THE RBA RADIO RECEIVER THE INPUT COUPLING SWITCH ON THE FRONT PANEL OF THE RECEIVER MUST BE SET TO POSITION 3. THE ANTENNA COUPLER WILL NOT WORK PROPERLY IN ANY OTHER POSITION. REFER TO THE RBA INSTRUCTION BOOK. WHEN THE ANTENNA COUPLER IS USED WITH THE AN/SRR-11 RADIO RECEIVER, LINKS 0101 AND 0102 ARE PLACED IN THE HIGH IMPEDANCE ANTENNA POSITION. REFER TO THE AN/SRR-11 INSTRUCTION BOOK.

INSTALLATION

NAVSHIP 92182
AT-317/BRR

Section 3
Figure 3-2

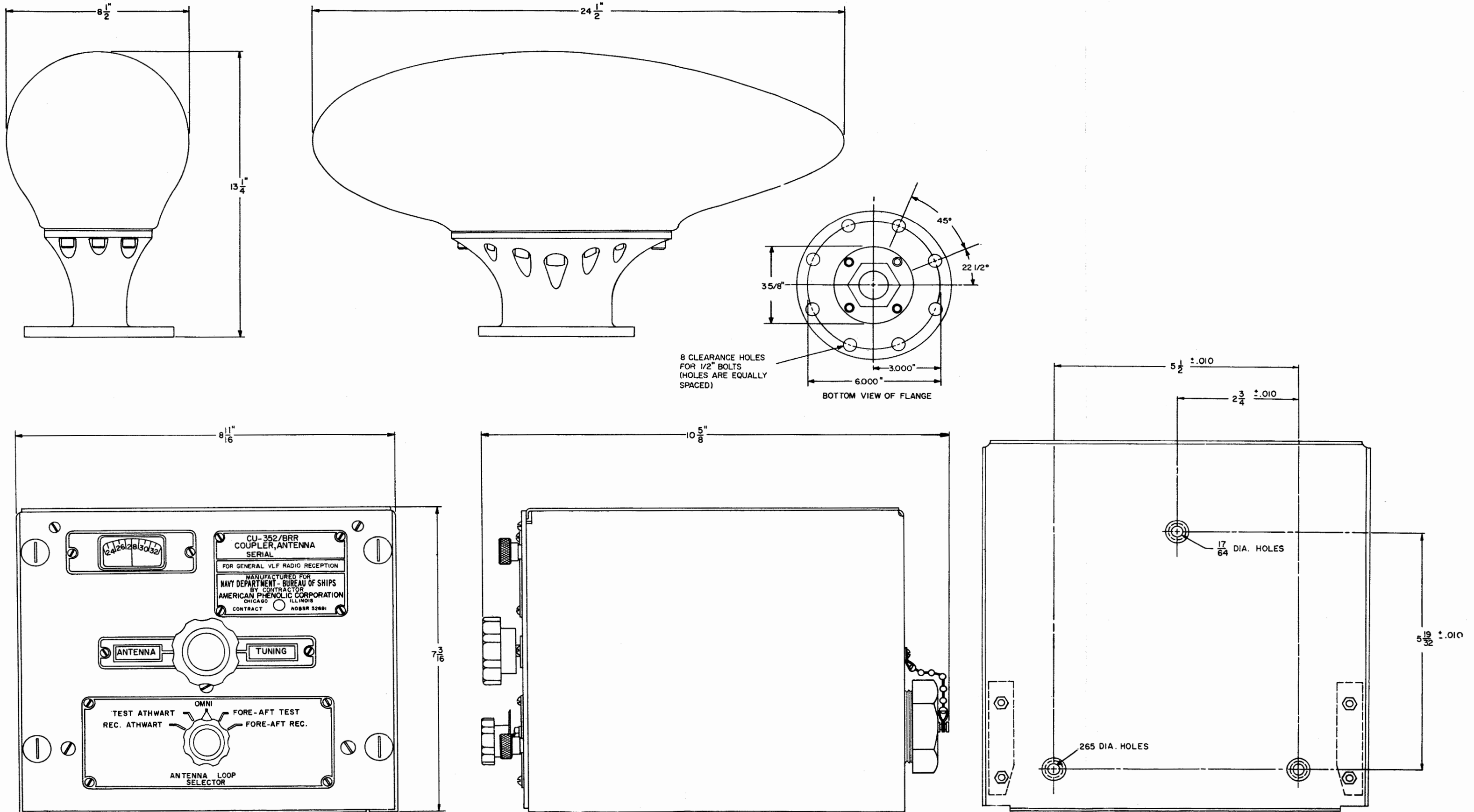


Figure 3-2. Dimensional Drawings of Loop Antenna AT-317/BRR and Antenna Coupler CU-352/BRR.

ORIGINAL

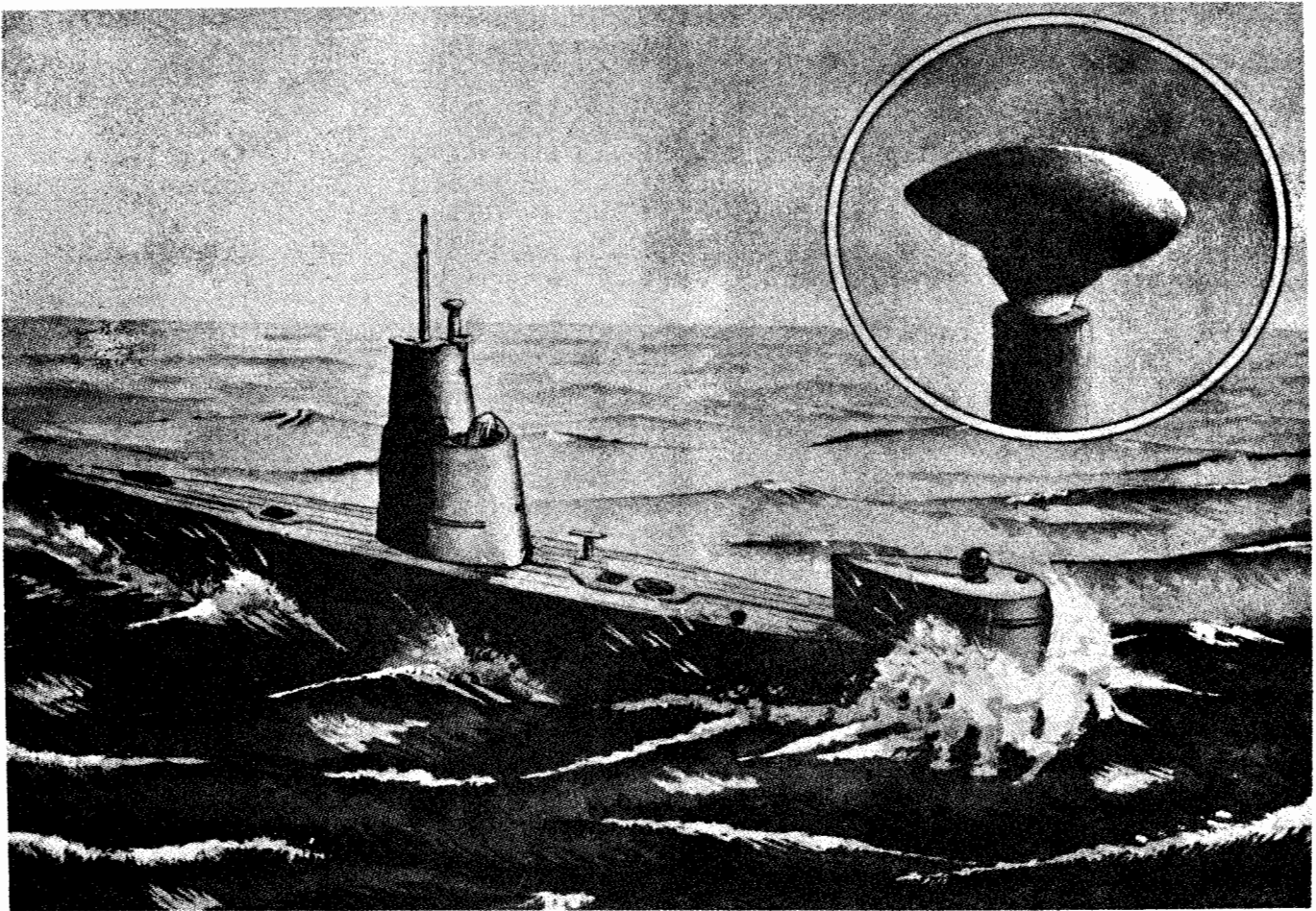


Figure 3-3. Loop Antenna AT-317/BRR, AT-317A/BRR and AT-317B/BRR Shown in Its Relative Position to a Submarine.

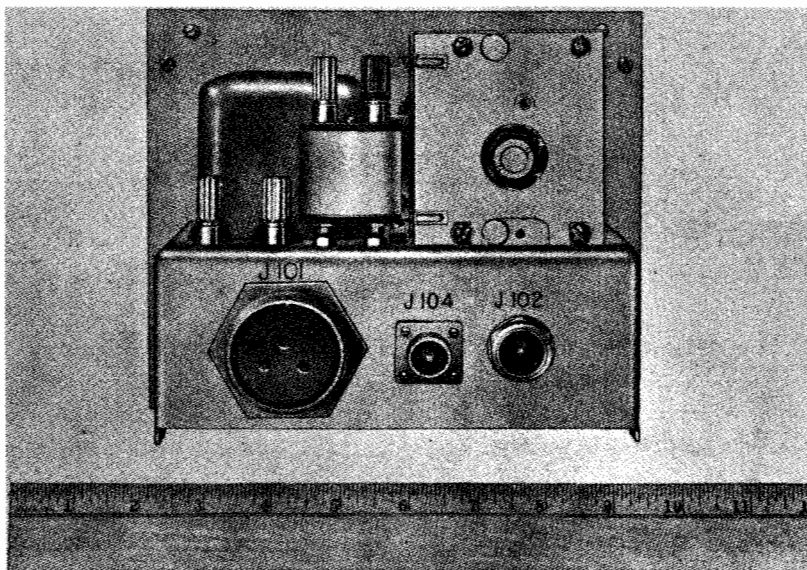


Figure 3-4. Rear of Antenna Coupler CU-352/BRR Showing Cable Connections and the Resistor Test Decade.

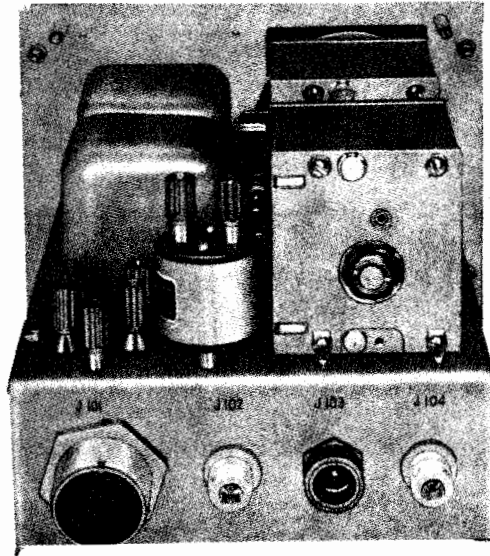


Figure 3-4A. Rear of Antenna Coupler CU-352A/BRR Showing Cable Connections and the Resistor Test Decade.

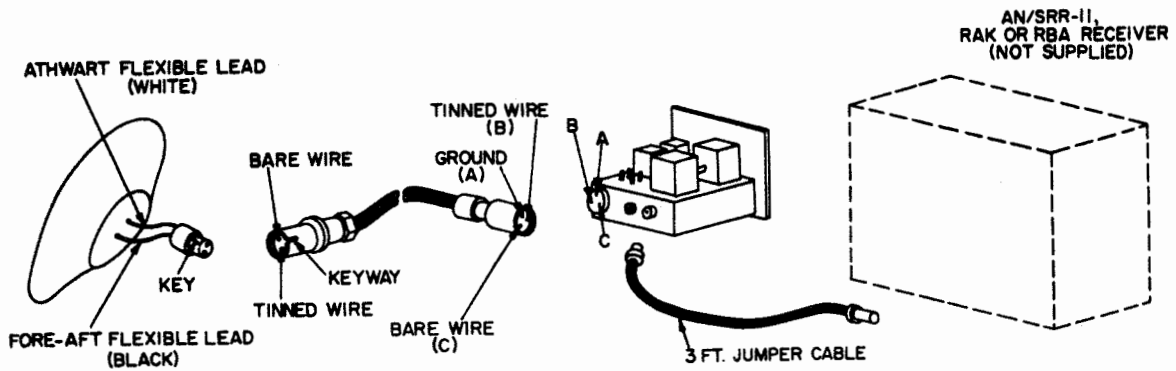


Figure 3-5. Cabling Diagram of the AT-317/BRR and AT-317A/BRR VLF Loop Antenna System Showing Polarization of the Antenna Cable.

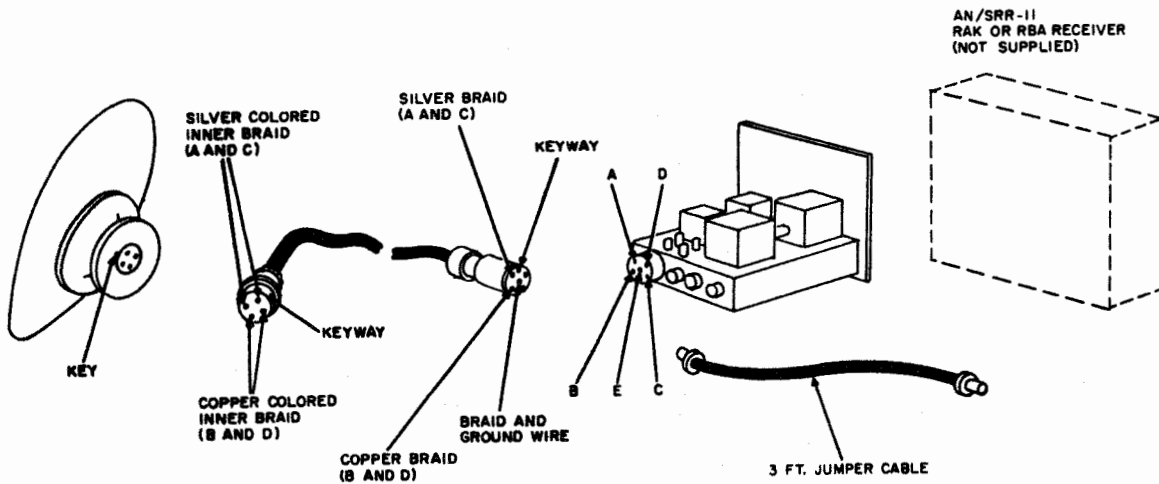


Figure 3-5A. Cabling Diagram of the AT-317B/BRR VLF Loop Antenna System Showing Polarization of the Antenna Cable.

SECTION 4
OPERATION**1. CAPABILITIES AND LIMITATIONS.**

Navy Model AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna will receive signals between 14.6 and 38 kilocycles while the loop antenna is surfaced or submerged. The actual limit of operational depth is dependent on the transmitting station's power and distance. The CU-352/BRR or CU-352A/BRR Antenna Coupler is capable of selecting the proper loop or loops for fore-aft, athwart ship, or omni-directional reception. The AT-317/BRR, AT-317A/BRR or AT-317B/BRR Loop Antenna will also provide limited homing operation. The general direction from which the received signal will come must be known in order to home accurately.

2. OPERATION OF EACH FUNCTION.

a. The ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch (S101) connects the loop circuits in combinations to receive athwart ship, to test athwart ship, to

receive from all directions (OMNI), to test fore and aft, and to receive fore and aft.

b. The ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control rotates tuning capacitors C101 and C102 to the frequency of the incoming signal.

3. TUNING PROCEDURE.**a. SIGNAL SEARCH.**

(1) Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch on the antenna coupler to OMNI position.

(2) Rotate the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control on the coupler and the radio receiver tuning control at the same time and to approximately the same frequency.

(3) When a signal is heard in the headphones or

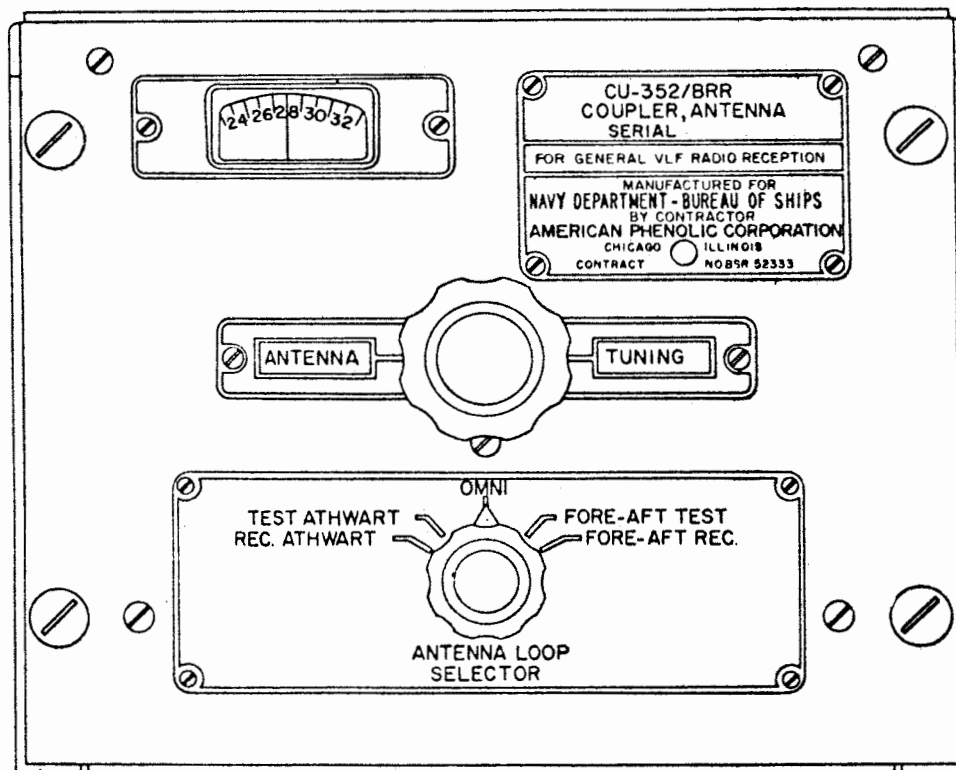


Figure 4-1. Front Panel of Antenna Coupler CU-352/BRR Showing Tuning and Switching Controls.

indicated on the output meter of the radio receiver adjust the radio receiver tuning dial for maximum output.

b. FINAL ADJUSTMENTS.—The Signal is now tuned in. The following adjustments are necessary to insure omni-directional reception.

(1) Turn the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to either the FORE-AFT TEST position or the TEST ATHWART position; whichever gives the strongest signal.

(2) Turn the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control slowly to resonance and observe the output meter on the radio receiver. The FORE-AFT TEST position will give a double-peak response. Set the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control to the valley between the peaks. The ATHWART TEST position will give a single-peak response. Set the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control to the peak (see fig. 4-3).

(3) After the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control has been set to the proper frequency, rotate the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to the OMNI position. The antenna coupler will then be adjusted for omni-directional reception.

Note

UNDER CERTAIN CONDITIONS IT MAY BE DESIRABLE AND ADVANTAGEOUS TO USE SINGLE PLANE RECEPTION. BY SELECTING EITHER THE FORE-AFT

LOOP OR THE ATHWART LOOP THE SIGNAL STRENGTH IN EITHER OF THESE DIRECTIONS MAY BE INCREASED. THE ONE GIVING THE GREATEST SIGNAL IS THE ONE TO USE. WHEN USING THE RECEIVE ATHWART OR THE FORE-AFT RECEIVE POSITION, IT SHOULD BE REMEMBERED THAT A CHANGE IN COURSE OR DEPTH OF THE SUBMARINE WILL RESULT IN A CHANGE IN SIGNAL STRENGTH.

c. HOMING PROCEDURE.—When Antenna Coupler CU-352/BRR or CU-352A/BRR is used with any of the radio receiving equipments mentioned the AT-317/BRR, AT-317A/BRR or AT-317B/BRR VLF Loop Antenna has the ability to home on a received radio signal. The direction from which the signal is transmitted must be determined because each loop has two minimum and maximum directions of reception. After the direction of the transmitting station has been found, the actual homing is done on the fore null of the athwart ship loop.

(1) Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to the REC. ATHWART position.

(2) Change ship's course slowly toward the transmitting station until a null or minimum signal is obtained; then hold this course.

(3) The ship is now traveling in the direction of the transmitting station. Check periodically to see that the ship proceeds on course (on the null).

(4) If the ship drifts or changes course, an increase in signal strength will be observed. This condition is corrected by changing course (as in step 2 above) back to where the null or minimum signal is obtained.

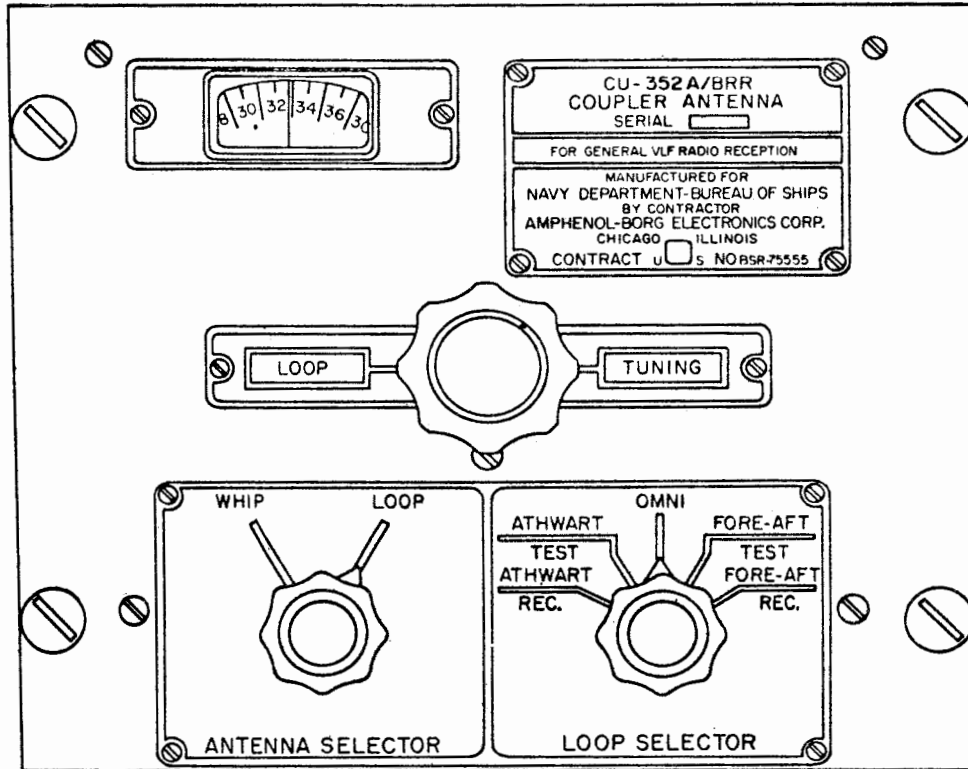
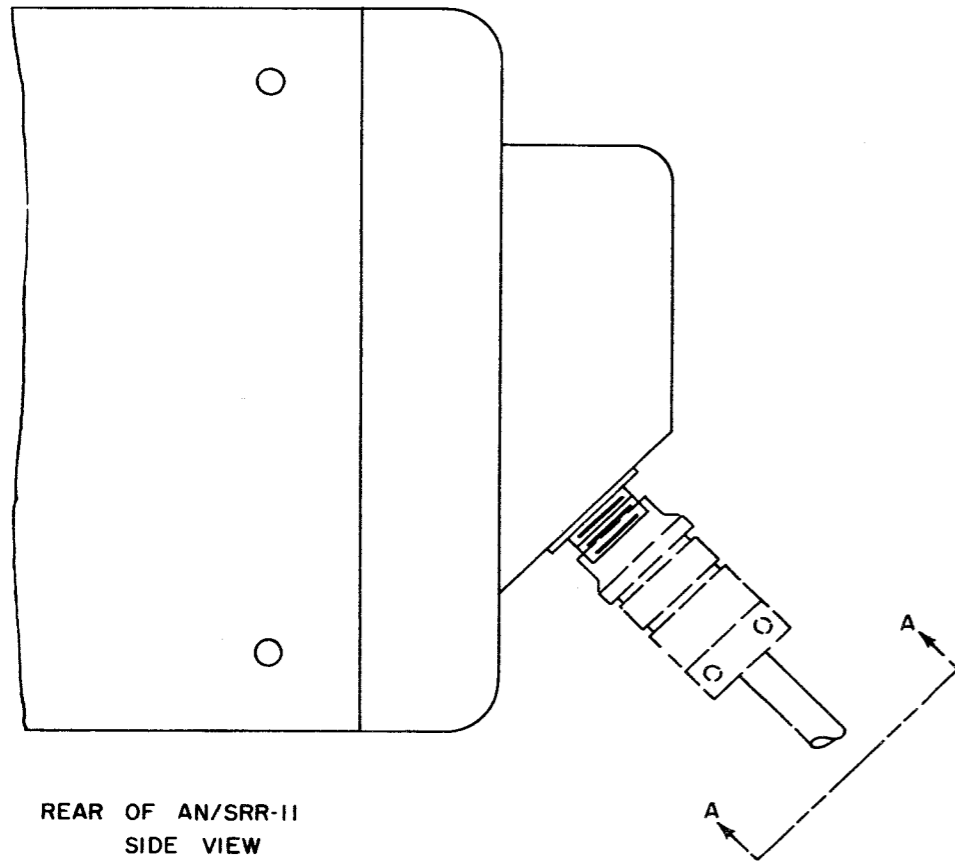
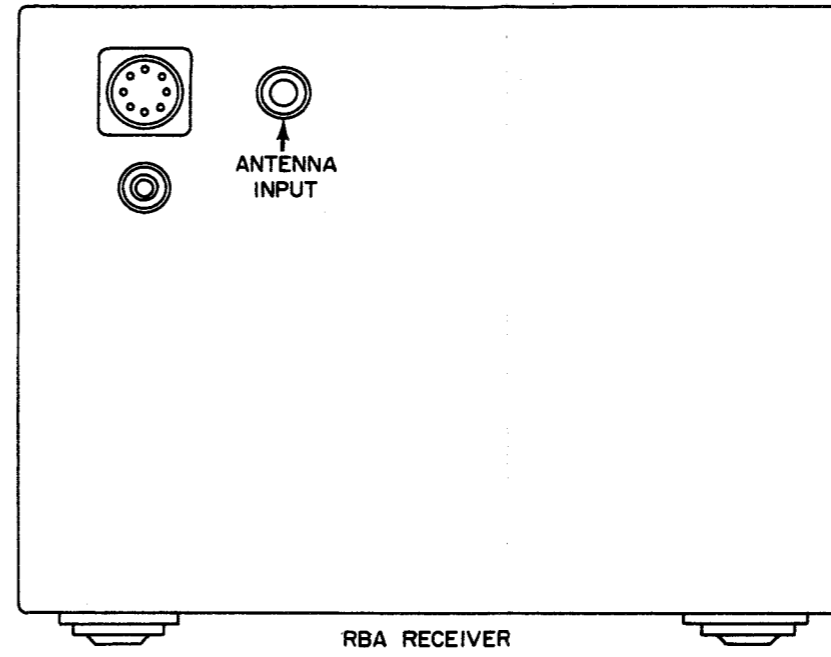
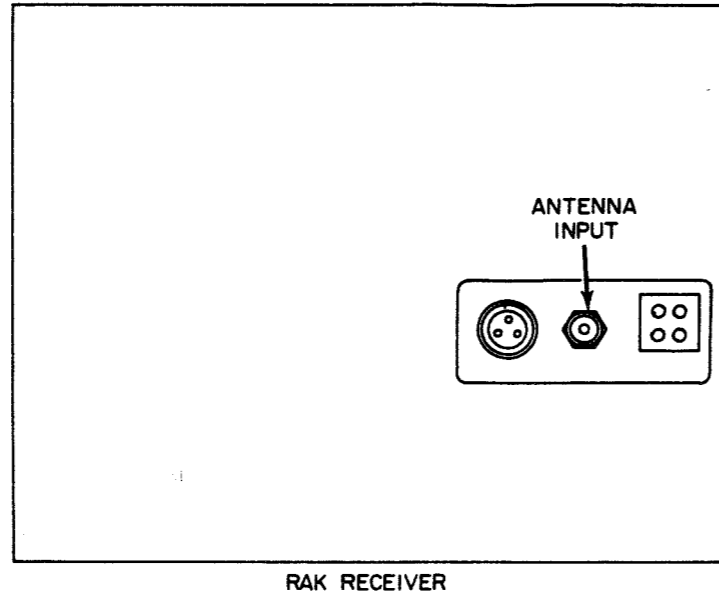


Figure 4-1A. Front Panel of Antenna Coupler CU-352A/BRR Showing Tuning and Switching Controls.



REAR OF AN/SRR-11
SIDE VIEW

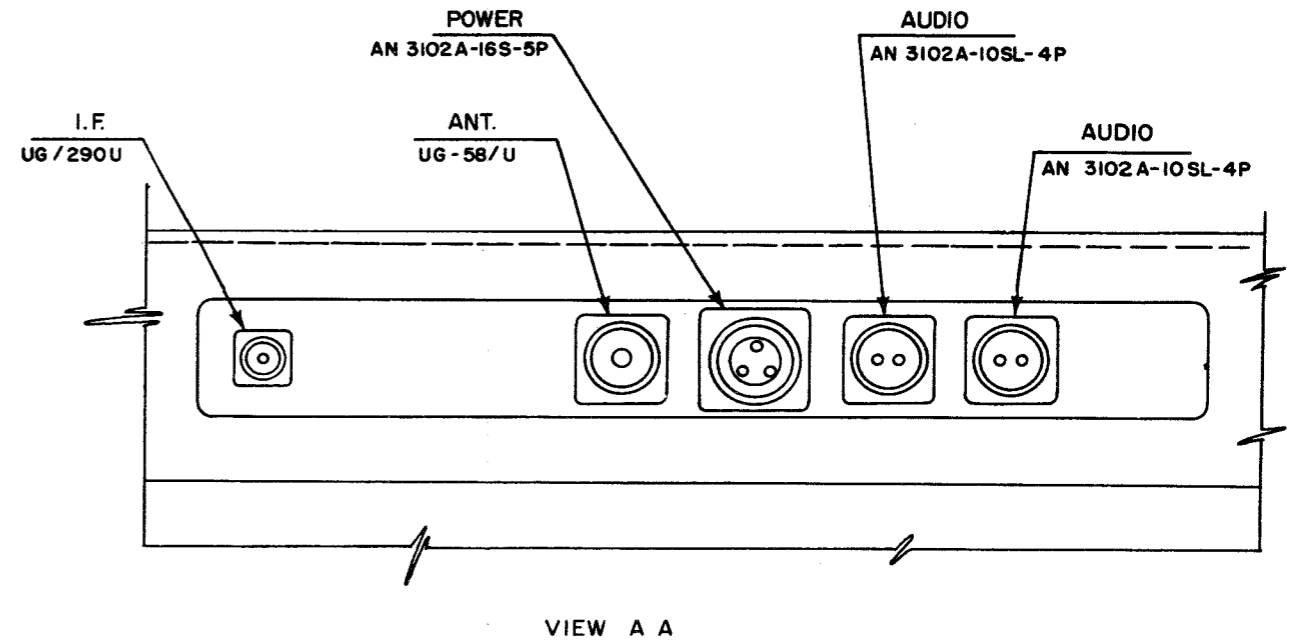
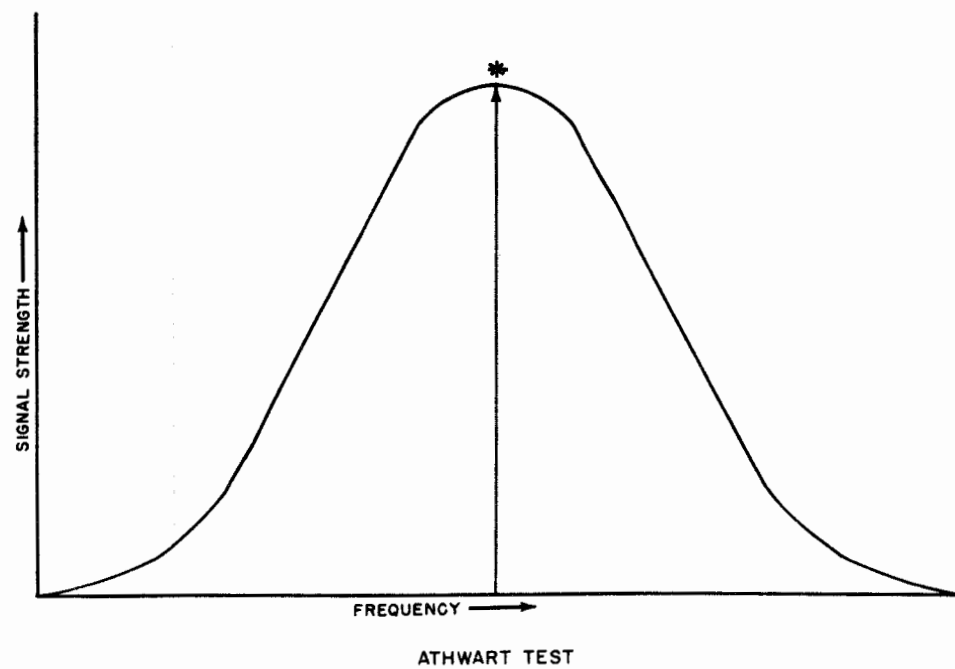
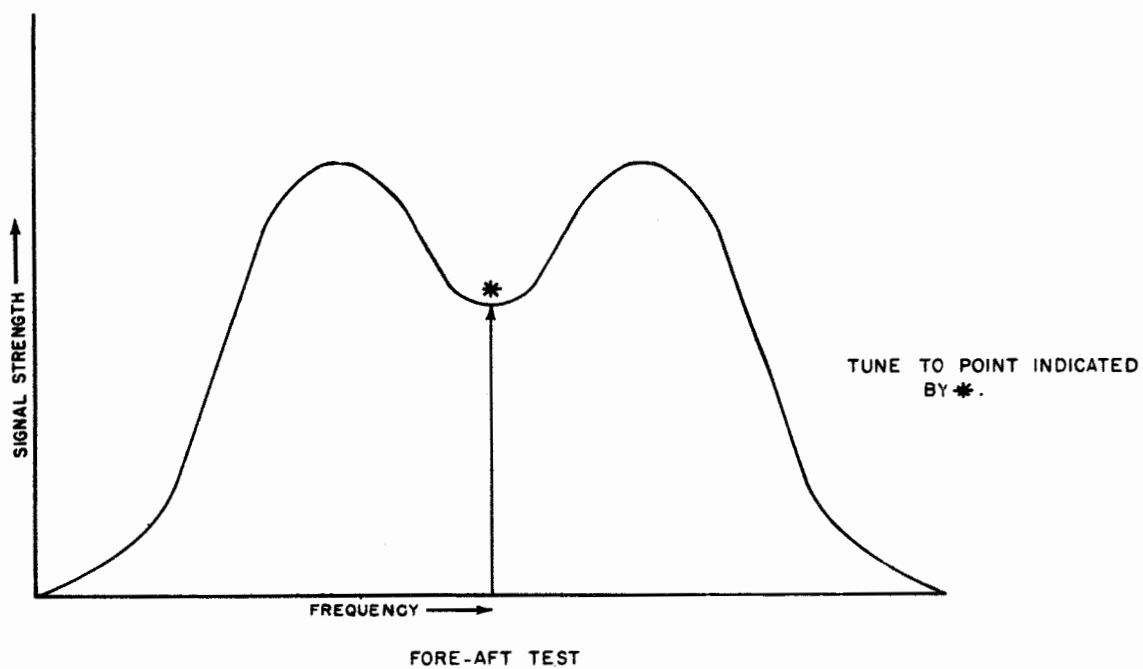


Figure 4-2. Rear View Showing Antenna Connections to the Receiving Equipment Used with Navy Model AT-317/BRR VLF Loop Antenna System.



NOTE:
THE PEAKS ON THE FORE-AFT TEST SENSITIVITY DIAGRAM ARE NOT NECESSARILY THE SAME AMPLITUDE.

Figure 4-3. Sensitivity Diagram of FORE-AFT TEST and TEST ATHWART Positions of the ANTENNA LOOP SELECTOR Switch When the ANTENNA TUNING Control is Rotated Through Resonance.

SECTION 5

OPERATOR'S AND PREVENTIVE MAINTENANCE

1. ROUTINE CHECKS.

The following periodical inspections will determine whether or not the equipment is functioning properly.

- a. Check the twelve Allen-head cap screws holding the antenna on the base with a torque wrench for 30 foot-pounds of torque.
- b. Check the eight 1/2 inch bolts around the antenna base for tightness.
- c. Check the hull fitting for tightness and corrosion.
- d. Keep the tuning gears free from all foreign matter.

2. INTERNAL ADJUSTMENTS.

NOTICE TO OPERATORS: Operators will not attempt to make any internal adjustments on the antenna coupler without proper authorization.

3. DEFINITION OF PREVENTIVE MAINTENANCE.

PM (preventive maintenance) is work performed on equipment, usually when the equipment is not

in use, to keep it in such good working order that breakdowns and needless interruptions in service will be kept to a minimum. PM differs from trouble shooting and repair since its object is to eliminate certain troubles before they occur. The necessity of PM cannot be over-emphasized. Therefore, it is important that the equipment be maintained properly.

4. ROUTINE MAINTENANCE CHECK CHARTS.

The maintenance check chart that follows this paragraph shows how to maintain the equipment so that trouble shooting and repair will be reduced to a minimum. This chart indicates what to check, when to check, and how to check, and the precautions which should be taken before, during, and after checking the equipment.

Note

GASOLINE WILL NOT BE USED AS A CLEANING FLUID FOR ANY PURPOSE. THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL, OF THE LATEST ISSUE.

TABLE 5-1. MAINTENANCE CHECK-CHART

| What to Check | When to Check | How to Check | Precautions |
|---|---------------|---|--|
| 1. Input plug to coupler unit (P101). | daily | Inspect visually for corrosion, dirt, and moisture. | Make certain that no lint or other foreign materials are left in the connector after cleaning. |
| 2. Antenna coupler input receptacle (J101). | daily | Same as above. | Same as above. |
| 3. Antenna coupler output receptacle (J102 and J104). | daily | Same as item 1 above. | Same as item 1 above. |
| | | | |

TABLE 5-1. MAINTENANCE CHECK-CHART (cont'd)

| What to Check | When to Check | How to Check | Precautions |
|---|---------------|---|---|
| 4. Antenna coupler controls. | daily | Check all knobs for tightness and rotate the tuning knob throughout its range to make sure there is no binding or sticking. | |
| 5. Output connectors P102 and P104 on CU-352/BRR or P102 and P103 on CU-352A/BRR. | daily | Retighten the connectors to make sure they are tight on both the radio receiver and the coupler unit. | Do not overtighten. |
| 6. The 12 Allen-head cap screws holding the antenna on the base. | monthly | Apply a torque wrench and rotate it for 30 foot-pounds of torque. | Do not overtighten. |
| 7. The eight antenna base mounting bolts. | monthly | Apply a wrench and retighten. | Do not overtighten. |
| 8. The loop antenna assembly. | monthly | Visually inspect for any dirt or foreign materials around the antenna assembly. | Be careful when removing any foreign matter from the antenna. The neoprene rubber covering should not be damaged in any manner. |
| 9. The antenna cable where accessible. | monthly | Visually check for loose mounting, chafing, punctures, or the collection of any foreign materials. | Avoid all bends having a radius less than seven inches. Do not use cleaning solvent on external cable covering. |
| 10. Fixed capacitors. | monthly | Visually inspect for discoloration, corroded leads, loose mountings and connections, and for sufficient clearance between capacitor leads and other circuits. | Take care not to change the trimmer capacitor settings. |
| 11. Variable capacitors. | monthly | Visually inspect for corrosion, bent plates, and foreign matter. | Take care not to change the trimmer capacitor settings. |
| 12. The flexible mechanical coupling between C101 and C102. | monthly | Retighten the coupling set screws. | Be sure the capacitors are still balanced. |
| 13. Antenna coupler internal wiring. | monthly | Visually inspect all wiring for corrosion, and defective connections. | Do not change the settings of the trimmer capacitors. |
| 14. Hull fitting. | monthly | Inspect for good tight fitting and moisture accumulation. | |

FAILURE REPORTS

A Failure Report must be filled out for the failure of any part of the equipment whether caused by defective or worn parts, improper operation, or external influences. It should be made on Failure Report, form NAVGEN 1025, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T-803, in the case of a transformer, or R-207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest District Printing and Publication Office.

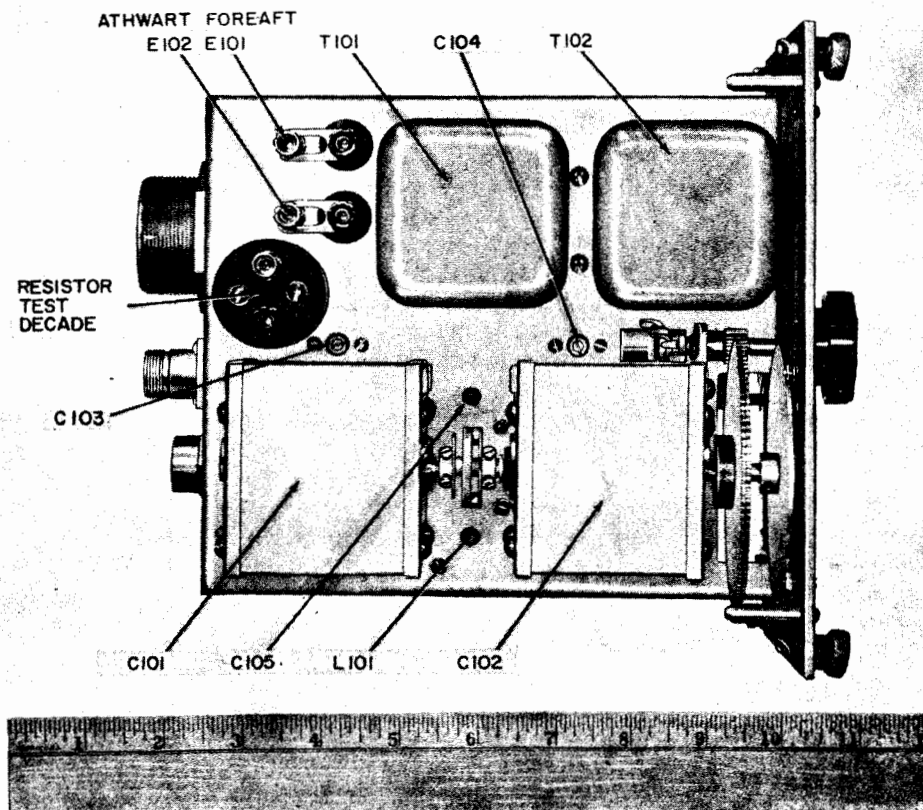


Figure 6-1. Top View of Antenna Coupler CU-352/BRR with Cover Removed.

SECTION 6

CORRECTIVE MAINTENANCE

1. THEORY OF LOCALIZATION.

Causes for breakdown in electronic equipment are many and of various natures. Since breakdowns will occur, their rapid location and remedy will depend on the ability of the technician. Preventive maintenance will assist in keeping continuous operation most of the time.

Note

THE INFORMATION CONTAINED IN SECTION 5 AND THIS SECTION IS INTENDED AS AN ASSISTANCE IN TROUBLE SHOOTING, PINPOINTING, AND RECOGNIZING WHERE TROUBLE HAS DEVELOPED IN THE EVENT OF A BREAKDOWN. USE IT AS A GUIDE BUT DO NOT MISINTERPRET IT AS A FULL AND COMPLETE INDEX TO ALL POSSIBLE TROUBLES WHICH MAY DEVELOP.

2. RELATIVE SENSITIVITY TEST.

If the equipment becomes inoperative, and all of the preliminary checks have been made without locating the cause of the trouble, the relative sensitivity test should be performed. Use of the resistor test decade unit is required in order to make the relative sensitivity test. The resistor test decade unit is stored inside the coupler unit (Figure 6-1 and 6-1A) and is used on conjunction with the two pairs of binding posts (E101, E102) located next to transformer T101. The relative sensitivity test is divided into the two parts which are given in the following paragraphs.

a. FORE-AFT SENSITIVITY TEST.— The procedure listed below should be followed for testing the fore-aft circuit.

STEP 1. Set the radio receiver AUDIO switch to SHARP.

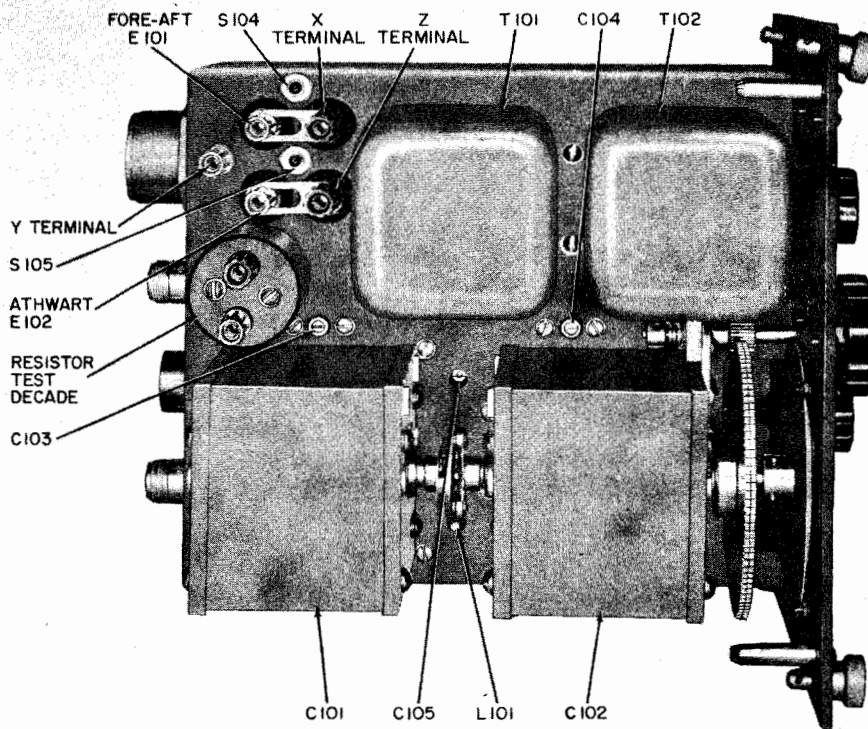


Figure 6-1A. Top View of Antenna Coupler CU-352A/BRR with Cover Removed.

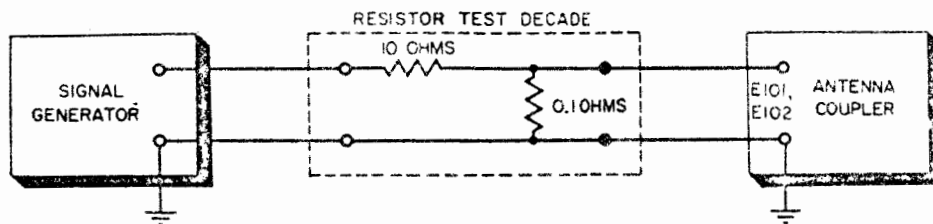
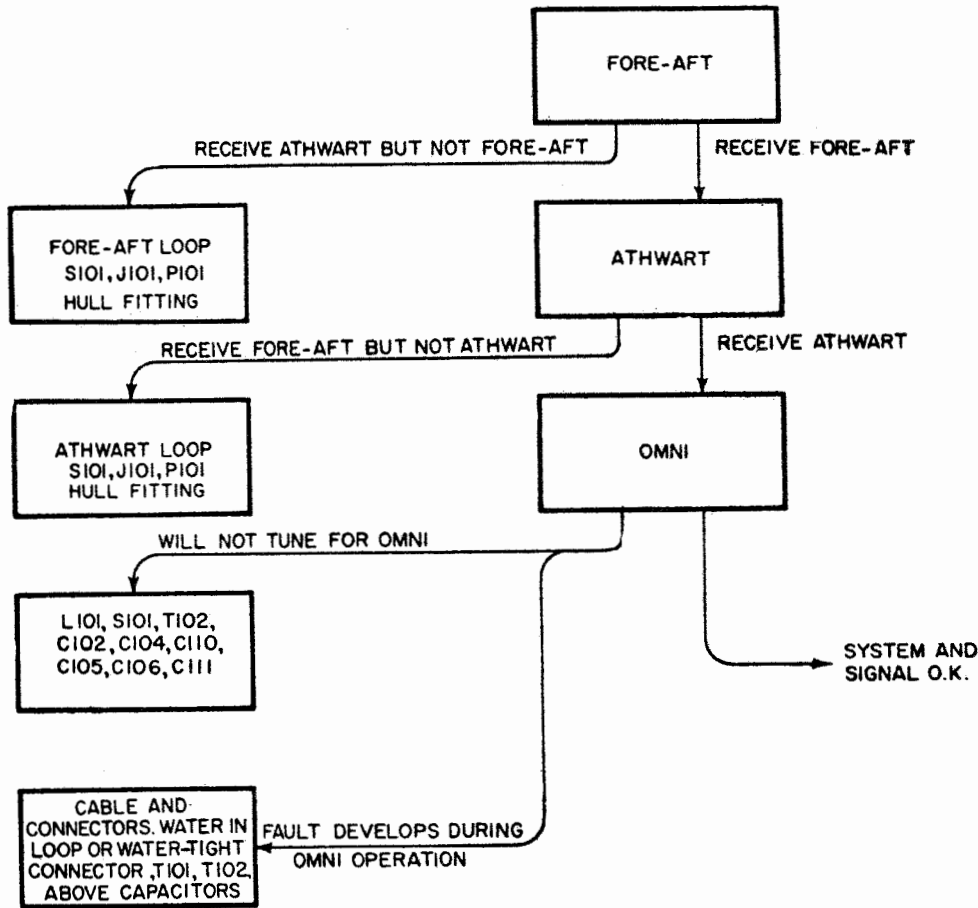


Figure 6-2. Functional Diagram of the Resistor Test Decade.

- STEP 2.** Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to FORE-AFT TEST.
- STEP 3.** Remove the shorting link from the fore-aft binding posts (E101) and plug in the resistor test decade on CU-352/BRR. On CU-352A/BRR attach shorting link to terminal Y.
- STEP 4.** Connect the output leads of a signal generator such as AN/URM-25 to the resistor test decade. The signal lead connects to the red binding post and the ground lead connects to the ground binding post on the resistor test decade. (See figure 6-2).
- STEP 5.** Turn on and tune the signal generator and the radio receiver to 20 kc and adjust the radio receiver tuning for maximum on the receiver OUTPUT meter.
- STEP 6.** Tune the antenna coupler ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control to the valley between the peaks. (See figure 4-3).
- STEP 7.** Turn off the signal generator. Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to "OMNI".
- STEP 8.** Switch the radio receiver ADD DECIBELS control to DIRECT for RAK and RBA receivers or to -10 for the AN/SRR-11 receiver, and adjust the receiver GAIN control until the OUTPUT meter reads 0 db (noise level).
- STEP 9.** Switch the receiver ADD DECIBELS control to 20 for RAK and RBA receivers or to +10 on the AN/SRR-11 receiver.
- STEP 10.** Turn on the signal generator.
- STEP 11.** Adjust the signal generator output until the radio receiver OUTPUT meter reads 0 db.
- STEP 12.** Read the signal generator output and divide it by 100 to obtain sensitivity. Readings should be less than .85 microvolts. Use the graph (figure 6-3) for comparison.
- STEP 13.** Change frequency to 25 kc then 30 kc, and repeat the above steps each time.
- STEP 14.** Remove the resistor test decade unit and replace the shorting link across E101.
- b. ATHWART SHIP SENSITIVITY TEST.**
- STEP 1.** Set the radio receiver AUDIO switch to SHARP.
- STEP 2.** Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to TEST ATHWART.
- STEP 3.** Remove the shorting link from the athwart binding posts (E102) and plug in the resistor test decade on CU-352/BRR. On CU-352A/BRR attach shorting link to terminal Z.
- STEP 4.** Connect the signal generator output lead to the red binding post and the ground lead of the signal generator to the ground binding post on the resistor test decade (see figure 6-2).
- STEP 5.** Turn on and tune the signal generator and the radio receiver to 20 kc and adjust the radio receiver tuning for maximum on the receiver OUTPUT meter.
- STEP 6.** Tune the antenna coupler ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control to peak output (see figure 4-3).
- STEP 7.** Turn off the signal generator. Set

TABLE 6-1. TROUBLE SHOOTING CHART



the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to "OMNI".

- STEP 8. Switch the radio receiver ADD DECIBELS control to DIRECT for RAK and RBA receivers or to -10 for the AN/SRR-11 receiver and adjust the receiver GAIN control until the OUTPUT meter reads 0 db (noise level).
- STEP 9. Switch the receiver ADD DECIBELS control to 20 for RAK and RBA receivers or to +10 on the AN/SRR-11 receiver.
- STEP 10. Turn on the signal generator.
- STEP 11. Adjust the signal generator output until the radio receiver OUTPUT meter reads 0 db.
- STEP 12. Read the signal generator output and divide it by 100 to obtain sensitivity. Readings should be less than .85 microvolts. Use the graph (figure 6-3) for comparison.

STEP 13. Change frequency to 25 kc, then 30 kc, and repeat the above steps each time.

STEP 14. Remove the resistor test decade unit and replace the shorting link across E102.

3. FIELD OVER-ALL Q TEST.

The field over-all Q test requires the use of a high input impedance vacuum tube voltmeter such as ME-25/U. The Q test procedures are as follows.

a. FORE-AFT OVER-ALL Q TEST.

- STEP 1. Remove the shorting link from the fore-aft binding posts (E101) and plug in the resistor test decade on CU-352/BRR. On CU-352A/BRR attach shorting link to terminal Y.
- STEP 2. Connect the output leads of a signal generator such as AN/URM-25 to the resistor test decade. The signal lead connects to the red binding post and the ground lead connects to the

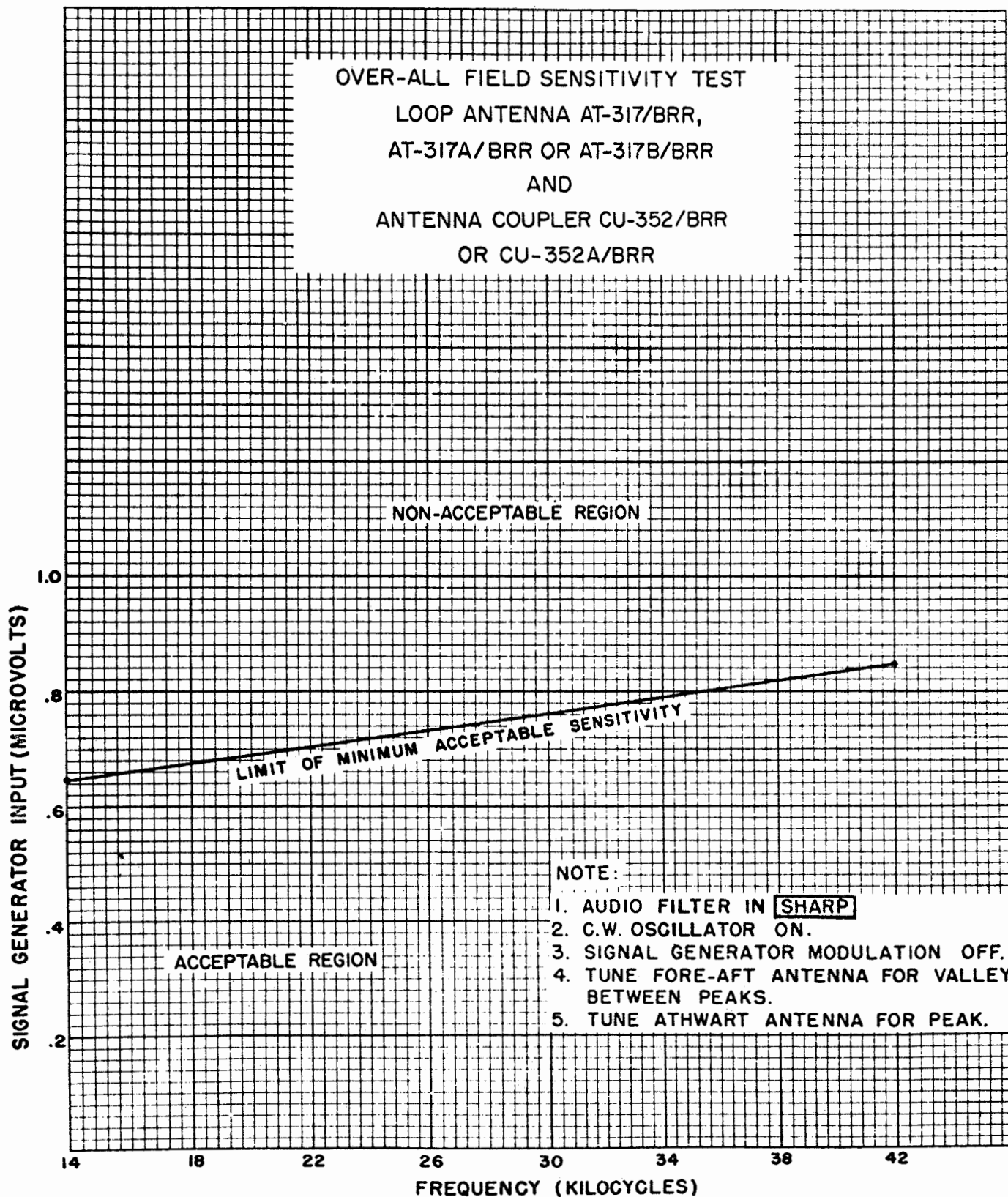


Figure 6-3. Sensitivity Graph AT-317/BRR, AT-317A/BRR and AT-317B/BRR VLF Loop Antenna System.

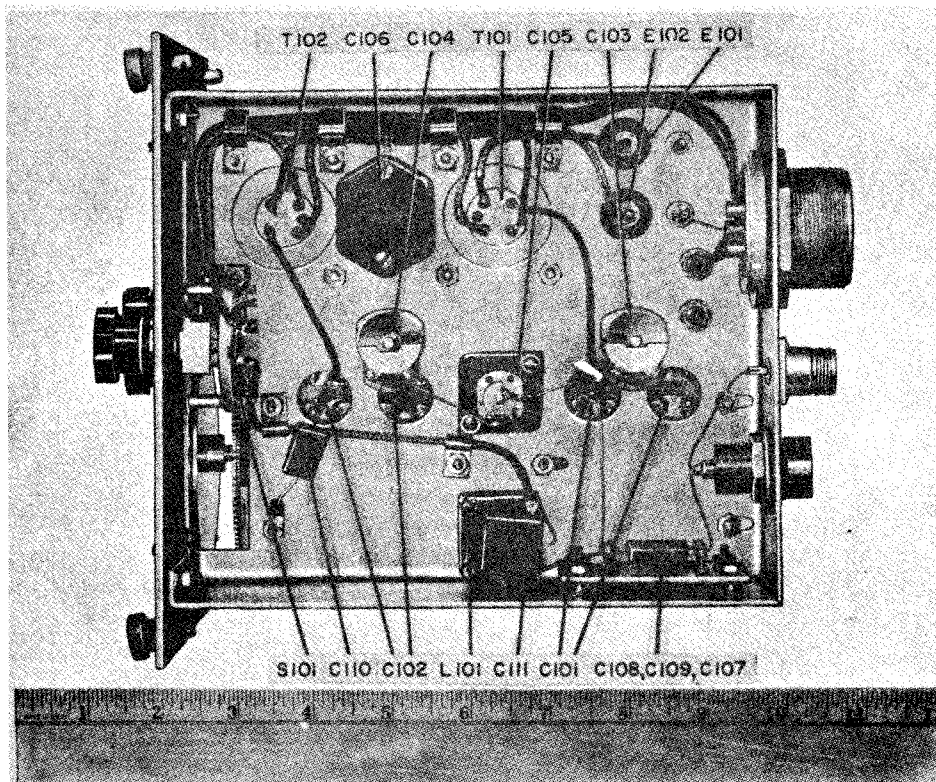


Figure 6-4. Bottom View of Antenna Coupler CU-352/BRR Showing Components Layout.

ground binding post on the resistor test decade. (See figure 6-2).

- STEP 3. Connect a vacuum tube voltmeter such as ME-25/U, across pins 4 and 5 of transformer T101.
- STEP 4. Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to the FORE-AFT RECEIVE position.

STEP 5. Adjust the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control on the antenna coupler for maximum output on the vacuum tube voltmeter.

STEP 6. The frequency indicated on the signal generator is recorded as f_R :

STEP 7. Keep the signal generator output constant and the antenna coupler

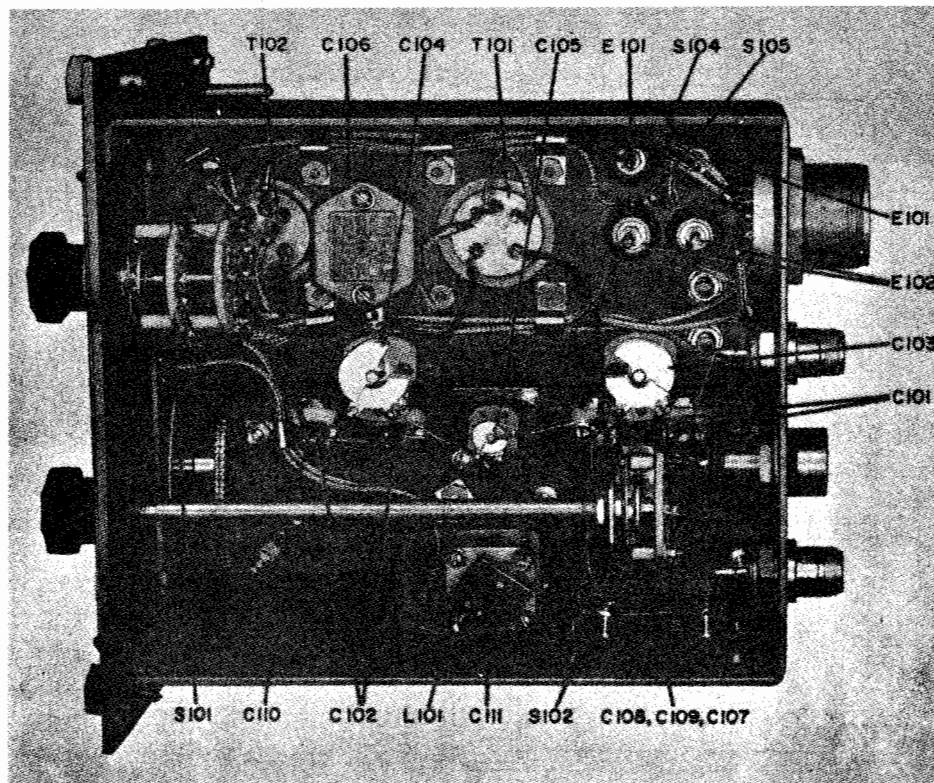


Figure 6-4A. Bottom View of Antenna Coupler CU-352A/BRR Showing Components Layout.

controls set, then vary the signal generator frequency until the reading on the vacuum tube voltmeter drops 3 db or .707 of maximum voltage deflection.

STEP 8. The frequency now indicated by the signal generator is recorded as f_1 .

STEP 9. Change the signal generator frequency back through the center frequency f_R (maximum voltage deflection) until the vacuum tube voltmeter reading falls 3 db or .707 of maximum deflection on the other side of f_R .

STEP 10. Record this frequency as f_2 .

STEP 11. The over-all Q of the fore-aft circuit is equal to f_R divided by $f_1 - f_2$ or:

$$Q = \frac{f_R}{f_1 - f_2}$$

The chosen center frequency is f_R and f_1 must be greater than f_2 .

STEP 12. The fore-aft circuit is considered

normal when the calculated Q values are 50 ± 10 percent.

STEP 13. Remove the resistor test decade and replace the shorting link.

b. ATHWART SHIP OVER-ALL Q TEST.

STEP 1. Remove the shorting link from the athwart binding posts (E102) and plug in the resistor test decade on CU-352/BRR. On CU-352A/BRR attach shorting link to terminal Y.

STEP 2. Connect the output leads of a signal generator such as AN/URM-25 to the resistor test decade. The signal lead connects to the red binding post and the ground lead connects to the ground binding post on the resistor test decade. (See figure 6-2).

STEP 3. Connect a vacuum tube voltmeter such as ME-25/U across pins 4 and 5 of transformer T101.

STEP 4. Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to the TEST ATHWART position.

STEP 5. Adjust the ANTENNA TUNING on

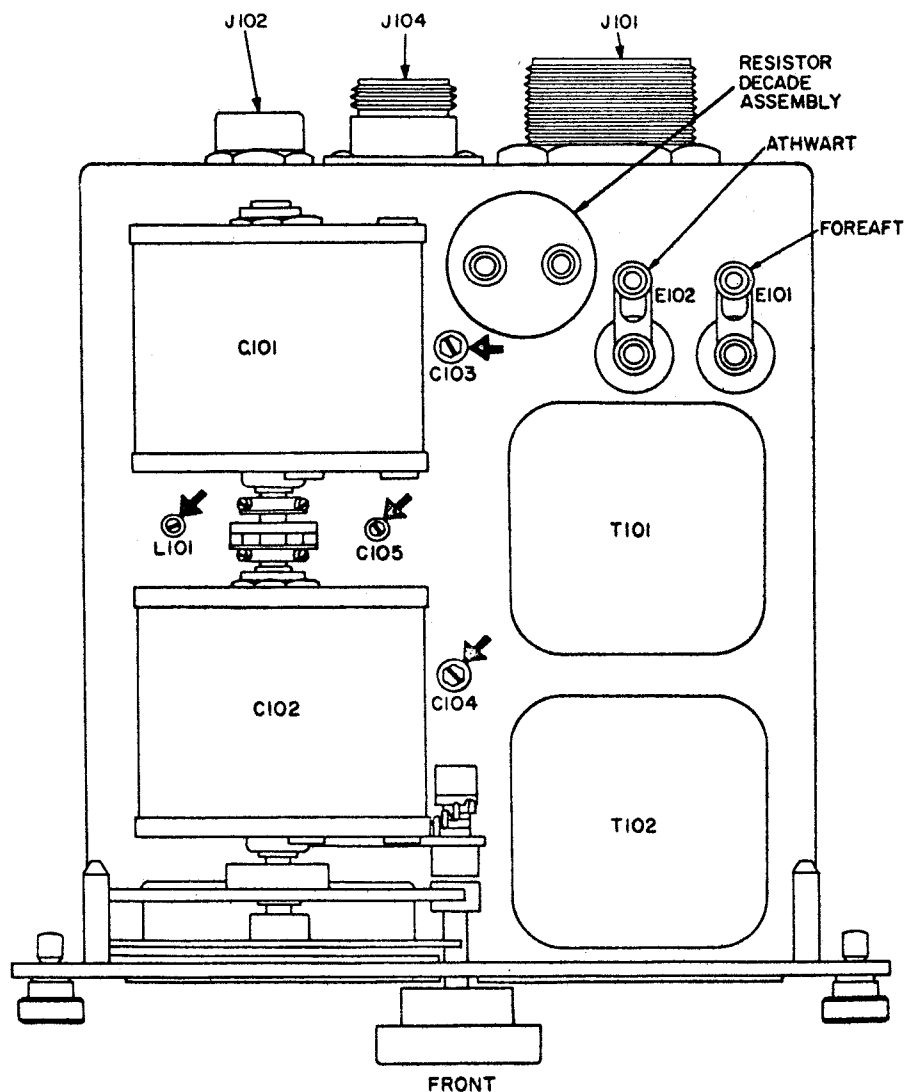


Figure 6-5. Alignment Points on Antenna Coupler CU-352/BRR.

CU-352/BRR or LOOP TUNING on CU-352A/BRR control on the antenna coupler for maximum output on the vacuum tube voltmeter.

- STEP 6. The frequency indicated on the signal generator is recorded as f_R .
- STEP 7. Keep the signal generator output constant and the antenna coupler controls set, then vary the signal generator frequency until the reading on the vacuum tube voltmeter drops 3 db or .707 of maximum voltage deflection.
- STEP 8. The frequency now indicated by the signal generator is recorded as f_1 .
- STEP 9. Change the signal generator frequency back through the center

frequency f_R (maximum voltage deflection) until the vacuum tube voltmeter reading falls 3 db or .707 of maximum deflection on the other side of f_R .

- STEP 10. Record this frequency as f_2 .
- STEP 11. The over-all Q of the athwart circuit is equal to f_R divided by $f_1 - f_2$ or:

$$Q = \frac{f_R}{f_1 - f_2}$$

The chosen center frequency is f_R and f_1 must be greater than f_2 .

- STEP 12. The athwart ship circuit is considered normal when the calculated Q values are 50 ± 10 percent.

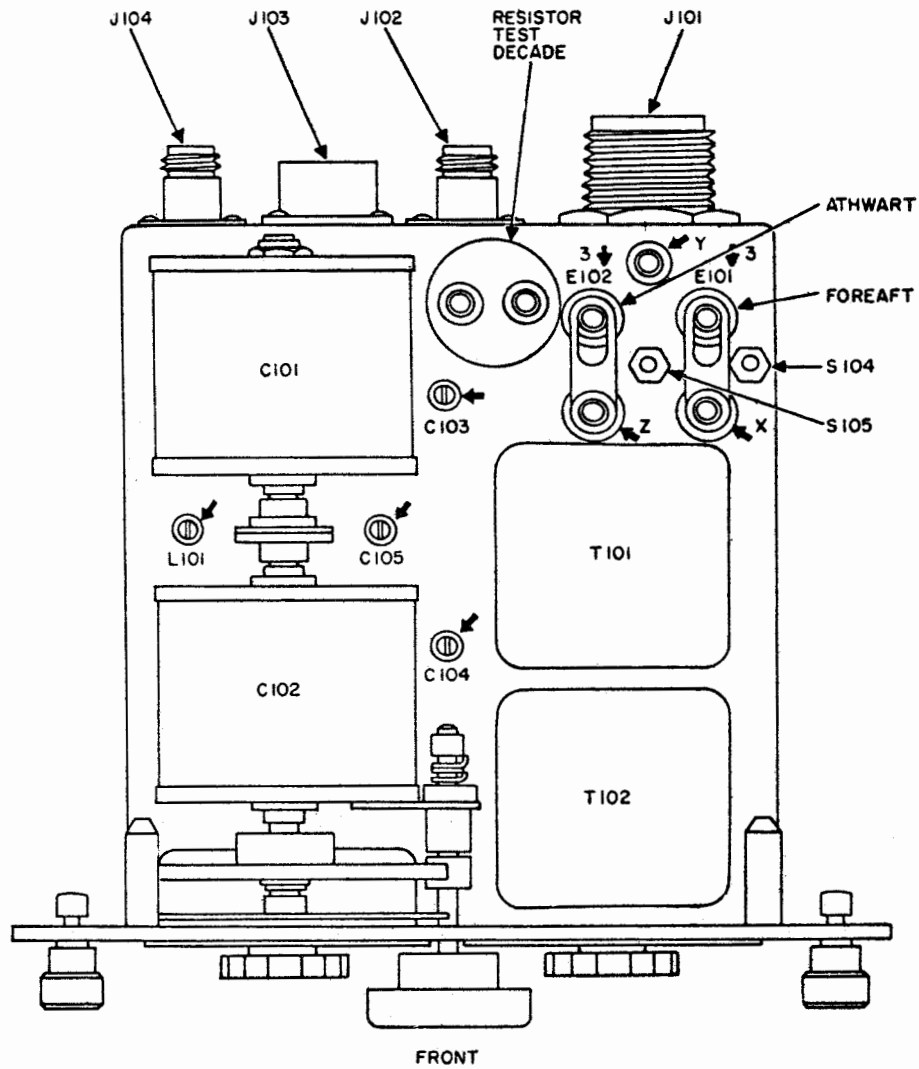


Figure 6-5A. Alignment Points on Antenna Coupler CU-352A/BRR.

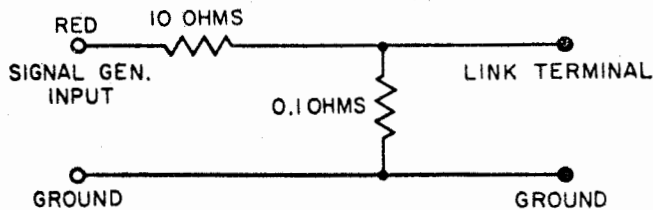


Figure 6-6. Schematic Diagram of the Resistor Test Decade.

STEP 13. Remove the resistor test decade unit and replace the shorting link.

4. CALIBRATION.

a. The CU-352/BRR and CU-352A/BRR ANTENNA COUPLER is calibrated by the contractor before shipment. No attempt should be made to recalibrate the antenna coupler unless all of the following conditions exist.

(1) All preliminary tests have been made to indicate the equipment is in proper working order.

(2) Sensitivity and over-all Q tests show the antenna coupler is in operating condition.

(3) The coupling which holds the shafts of the main tuning capacitors is not loose.

(4) Omni-directional reception is not obtained.

b. CALIBRATION PROCEDURE.— The following steps, if followed correctly, will align the antenna coupler so that reception will be equal within $\pm 1\frac{1}{2}$ db (decibel) from all directions simultaneously. See figures 6-5 and 6-5A.

STEP 1. Remove the shorting link from the fore-aft binding posts (E101) and plug in the resistor test decade unit on CU-352/BRR. On CU-352A/BRR attach shorting link to terminal Y.

STEP 2. Turn on the signal generator and set it to 35 kc.

STEP 3. Connect the signal generator output lead to the red binding post and the ground lead of the signal generator to the ground binding post of the resistor test decade.

STEP 4. Set the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR switch to OMNI.

STEP 5. Open trimmer capacitors C103 and C104 to minimum capacity.

STEP 6. Adjust the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on

CU-352A/BRR control for maximum output as indicated by the radio receiver OUTPUT meter.

STEP 7. Rotate the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control past the resonant peak until a 1 db drop is indicated on the receiver OUTPUT meter.

STEP 8. Loosen the set screw holding the dial, set the dial for 35 kc, and re-tighten the set screw.

STEP 9. Peak the output meter with trimmer capacitor C103.

STEP 10. Tune the trimmer capacitor C104 for a dip.

STEP 11. Peak the output again with trimmer C103.

STEP 12. Adjust trimmer C104 for a dip.

STEP 13. Adjust trimmer capacitor C105 for approximately a 2 db dip. This dip can be observed by rocking the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control through resonance. See figure 4-3.

c. CABLE INSTALLATION.— If the cable has been increased or decreased from the 75-foot length of RG-160/U, RG-160A/U or 180 feet of RG-264/U supplied, load capacitor C111 must be changed. The approximate value of C111 can be obtained from the graph in figure 6-12.

STEP 1. Refer to steps 1 and 3 in paragraph 6-4b.

STEP 2. Set the signal generator to 15 kilocycles.

STEP 3. Set the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR to the valley between the peaks as indicated on the radio receiver while the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR is in OMNI position.

STEP 4. Rotate the ANTENNA LOOP SELECTOR on CU-352/BRR or LOOP SELECTOR on CU-352A/BRR on the FORE-AFT TEST position.

STEP 5. Adjust dummy coil L101 for a dip as indicated by the radio receiver.

STEP 6. Rotate the ANTENNA LOOP SELEC-TOR on CU-352/BRR or LOOP SE-LECTOR on CU-352A/BRR to OMNI position. No change should be noted in the position of the dip on the dial. If a change does occur, proceed to the following steps.

STEP 7. Set the signal generator to 35 kilo-cycles.

STEP 8. Set the ANTENNA TUNING on CU-352/BRR or LOOP TUNING on CU-352A/BRR control to the valley between the peaks as indicated by the radio receiver.

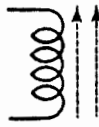
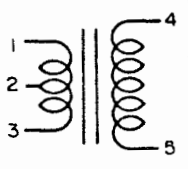
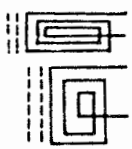
STEP 9. Turn the ANTENNA LOOP SELEC-

TOR on CU-352/BRR or LOOP SE-LECTOR on CU-352A/BRR to the FORE-AFT TEST position.

STEP 10. Modify the value of load capacitor C111 according to the graph (fig. 6-12) so that the position of the dip on the dial will not change when the ANTENNA LOOP SELEC-TOR on CU-352/BRR or LOOP SELEC-TOR on CU-352A/BRR is switched from FORE-AFT TEST to OMNI and vice versa.

STEP 11. Remove the resistor test decade unit and replace the shorting link across E101.

TABLE 6-2. WINDING DATA

| DESIGNATION SYMBOL | DIAGRAM | WINDING | WIRE SIZE | TURNS | DC. RESISTANCE (OHMS) | REMARKS |
|--------------------|---|--|------------------------------------|---------------|---|---|
| L-101 |  | STATIONARY UNIVERSAL | 20-38 LITZ | 65 | 33 | INDUCTANCE: 475- 525 MICROHENRIES VARIABLE |
| T-101, 102 |  | PRIMARY SECONDARY | NO. 20 NO. 29 | 40 265 | 1-3 .12 1-2 .6 2-3 .6 22.5 | 350 MICROHENRIES AT 1000 CPS 228.12 MILLIHENRIES AT 1000 CPS |
| AT-317 |  | SOLENOIDAL (ATHWART) RECTANGULAR (FORE-AFT) | 60-30 LITZ 60-30 LITZ | 28 28 | .33 .33 | INDUCTANCE: 476.3 MICROHENRIES AT 1000 C.P.S. 476.3 MICROHENRIES AT 1000 C.P.S. |

NOTE: RG-160/U OR RG-264/U DISCONNECTED FROM COUPLER UNIT.

TABLE 6-3. RESISTANCE MEASUREMENTS

T101 IN CU-352/BRR

| Pins | To Ground | To C106 | To B J101 | To C J101 |
|------|-----------|---------|-----------|-----------|
| 1 | <1 | ∞ | 0 | <1 |
| 2 | <1 | ∞ | <1 | <1 |
| 3 | 0 | ∞ | <1 | <1 |
| 4 | ∞ | 22.2 | ∞ | ∞ |
| 5 | ∞ | 0 | ∞ | ∞ |

T102 IN CU-352/BRR

| Pins | To Ground | To C106 | To B J101 | To C J101 |
|------|-----------|---------|-----------|-----------|
| 1 | <1 | ∞ | <1 | 0 |
| 2 | <1 | ∞ | <1 | <1 |
| 3 | 0 | ∞ | <1 | <1 |
| 4 | ∞ | 22.2 | ∞ | ∞ |
| 5 | ∞ | 0 | ∞ | ∞ |

S101-A IN CU-352/BRR

| Contact | To Ground | To B J101 | To C J101 | To 6 S101-B |
|---------|-----------|-----------|-----------|-------------|
| 1 | <1 | 0 | <1 | <1 |
| 2 | <1 | 0 | <1 | <1 |
| 3 | <1 | 0 | <1 | <1 |
| 4 | <1 | <1 | <1 | <1 |
| 5 | <1 | <1 | 0 | 0 |
| 6 | <1 | 0 | <1 | <1 |

S101-B IN CU-352/BRR

| Contact | To Ground | To B J101 | To C J101 | To 6 S101-A |
|---------|-----------|-----------|-----------|-------------|
| 1 | ∞ | ∞ | ∞ | ∞ |
| 2 | <1 | <1 | <1 | <1 |
| 3 | <1 | <1 | 0 | <1 |
| 4 | <1 | <1 | 0 | <1 |
| 5 | ∞ | ∞ | ∞ | ∞ |
| 6 | <1 | <1 | 0 | <1 |

J101 IN CU-352/BRR

| Pin | To Pin A | To Pin B | To Pin C | To Chassis | To L101 |
|-----|----------|----------|----------|------------|---------|
| A | 0 | <1 | <1 | 0 | <1 |
| B | <1 | 0 | <1 | <1 | <1 |
| C | <1 | <1 | 0 | <1 | <1 |

T101 IN CU-352A/BRR

| Pins | To Ground | To C106 | To B J101 | To D J101 |
|------|-----------|---------|-----------|-----------|
| 1 | <1 | ∞ | <1 | <1 |
| 2 | 0 | ∞ | <1 | <1 |
| 3 | <1 | ∞ | <1 | <1 |
| 4 | ∞ | 22.2 | ∞ | ∞ |
| 5 | ∞ | 0 | ∞ | ∞ |

T102 IN CU-352A/BRR

| Pins | To Ground | To C106 | To A J101 | To C J101 |
|------|-----------|---------|-----------|-----------|
| 1 | <1 | ∞ | <1 | <1 |
| 2 | 0 | ∞ | <1 | <1 |
| 3 | <1 | ∞ | <1 | <1 |
| 4 | ∞ | 22.2 | ∞ | ∞ |
| 5 | ∞ | 0 | ∞ | ∞ |

S101-A IN CU-352A/BRR

| Contact | To Ground | To B J101 | To D J101 | To 6 S101-B |
|---------|-----------|-----------|-----------|-------------|
| 1 | <1 | <1 | 0 | <1 |
| 2 | <1 | <1 | 0 | <1 |
| 3 | <1 | <1 | 0 | <1 |
| 4 | ∞ | 0 | ∞ | ∞ |
| 5 | <1 | 0 | ∞ | ∞ |
| 6 | <1 | <1 | 0 | <1 |

S101-B IN CU-352A/BRR

| Contact | To Ground | To B J101 | To D J101 | To 6 S101-A |
|---------|-----------|-----------|-----------|-------------|
| 1 | <1 | 0 | 0 | <1 |
| 2 | <1 | 0 | 0 | <1 |
| 3 | <1 | 0 | 0 | <1 |
| 4 | ∞ | ∞ | ∞ | ∞ |
| 5 | <1 | ∞ | ∞ | ∞ |
| 6 | <1 | 0 | 0 | <1 |

S101-C IN CU-352A/BRR

| Contact | To Ground | To A J101 | To C J101 | To 6 S101-D |
|---------|-----------|-----------|-----------|-------------|
| 1 | ∞ | ∞ | ∞ | ∞ |
| 2 | ∞ | ∞ | ∞ | ∞ |
| 3 | <1 | 0 | <1 | <1 |
| 4 | <1 | 0 | <1 | <1 |
| 5 | ∞ | ∞ | ∞ | ∞ |
| 6 | <1 | 0 | <1 | <1 |

All resistances are in ohms. All measurements taken with an Electronic Voltmeter such as ME-25/U. All cables disconnected, S101 in OMNI position. Shorting links in place on E101, E102. <1 means less than 1.

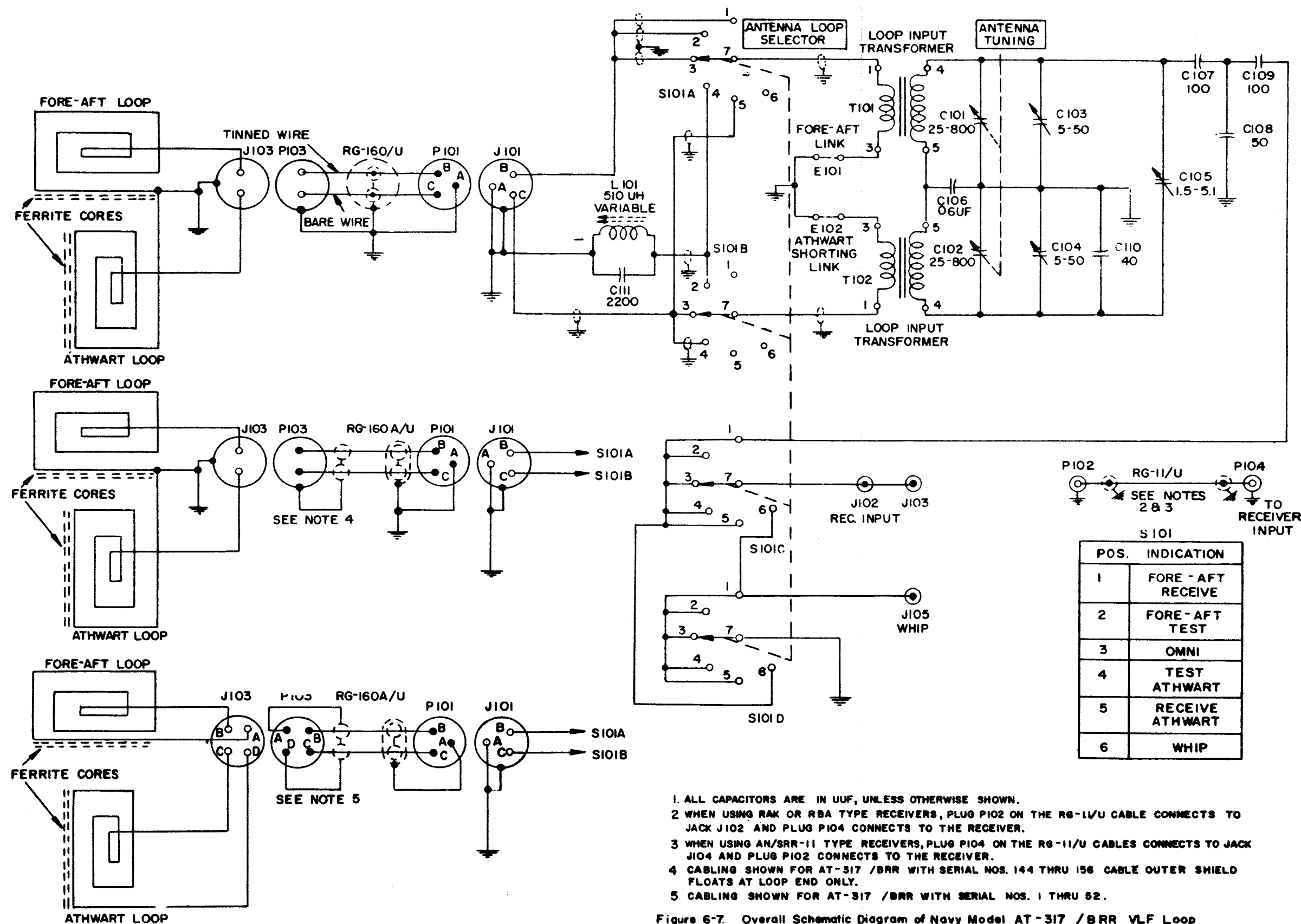
∞ indicates infinity.

S101-D IN CU-352A/BRR

| Contact | To Ground | To A J101 | To C J101 | To 6 S101-C |
|---------|-----------|-----------|-----------|-------------|
| 1 | ⊖ | ⊖ | ⊖ | ⊖ |
| 2 | ⊖ | ⊖ | ⊖ | ⊖ |
| 3 | <1 | <1 | 0 | <1 |
| 4 | <1 | <1 | 0 | <1 |
| 5 | ⊖ | ⊖ | ⊖ | ⊖ |
| 6 | <1 | <1 | <1 | <1 |

J101 IN CU-352A/BRR

| Pin | To Pin A | To Pin B | To Pin C | To Pin D | To Pin E | To Chassis |
|-----|----------|----------|----------|----------|----------|------------|
| A | 0 | <1 | <1 | <1 | <1 | 0 |
| B | <1 | 0 | <1 | <1 | <1 | <1 |
| C | <1 | <1 | 0 | <1 | <1 | <1 |
| D | <1 | <1 | <1 | 0 | <1 | <1 |
| E | <1 | <1 | <1 | <1 | 0 | 0 |



1. ALL CAPACITORS ARE IN UUF, UNLESS OTHERWISE SHOWN.
2. WHEN USING RAK OR RBA TYPE RECEIVERS, PLUG P102 ON THE RG-11/U CABLE CONNECTS TO JACK J102 AND PLUG P104 CONNECTS TO THE RECEIVER.
3. WHEN USING AN/SRR-11 TYPE RECEIVERS, PLUG P104 ON THE RG-11/U CABLES CONNECTS TO JACK J104 AND PLUG P102 CONNECTS TO THE RECEIVER.
4. CABLING SHOWN FOR AT-317 / BRR WITH SERIAL NOS. 144 THRU 156 CABLE OUTER SHIELD FLOATS AT LOOP END ONLY.
5. CABLING SHOWN FOR AT-317 / BRR WITH SERIAL NOS. 1 THRU 52.

Figure 6-7. Overall Schematic Diagram of Navy Model AT-317 / BRR VLF Loop Antenna Systems.

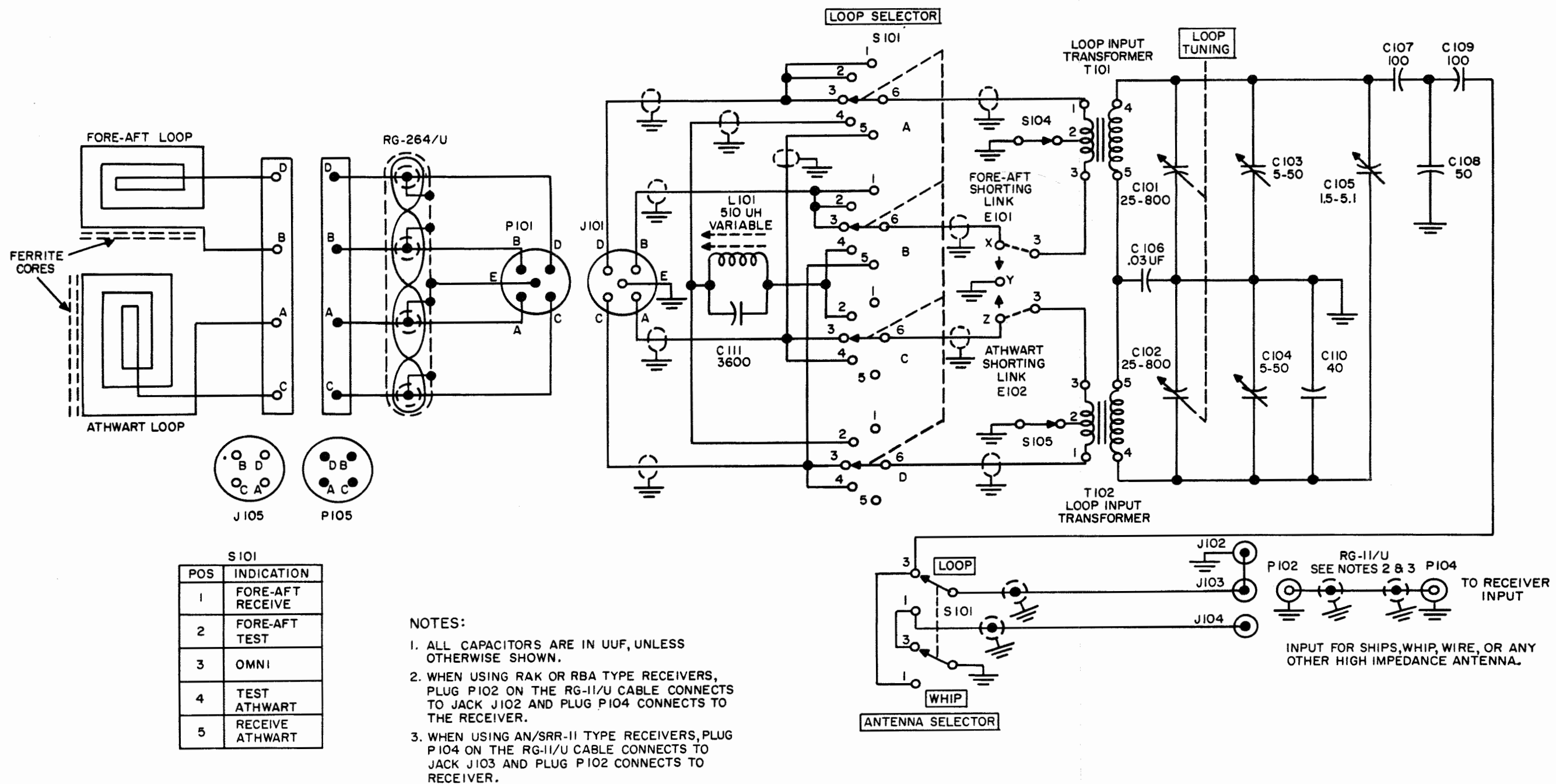


Figure 6-7A. Overall Schematic Diagram of Navy Model AT-317B/BRR VLF Loop Antenna System.

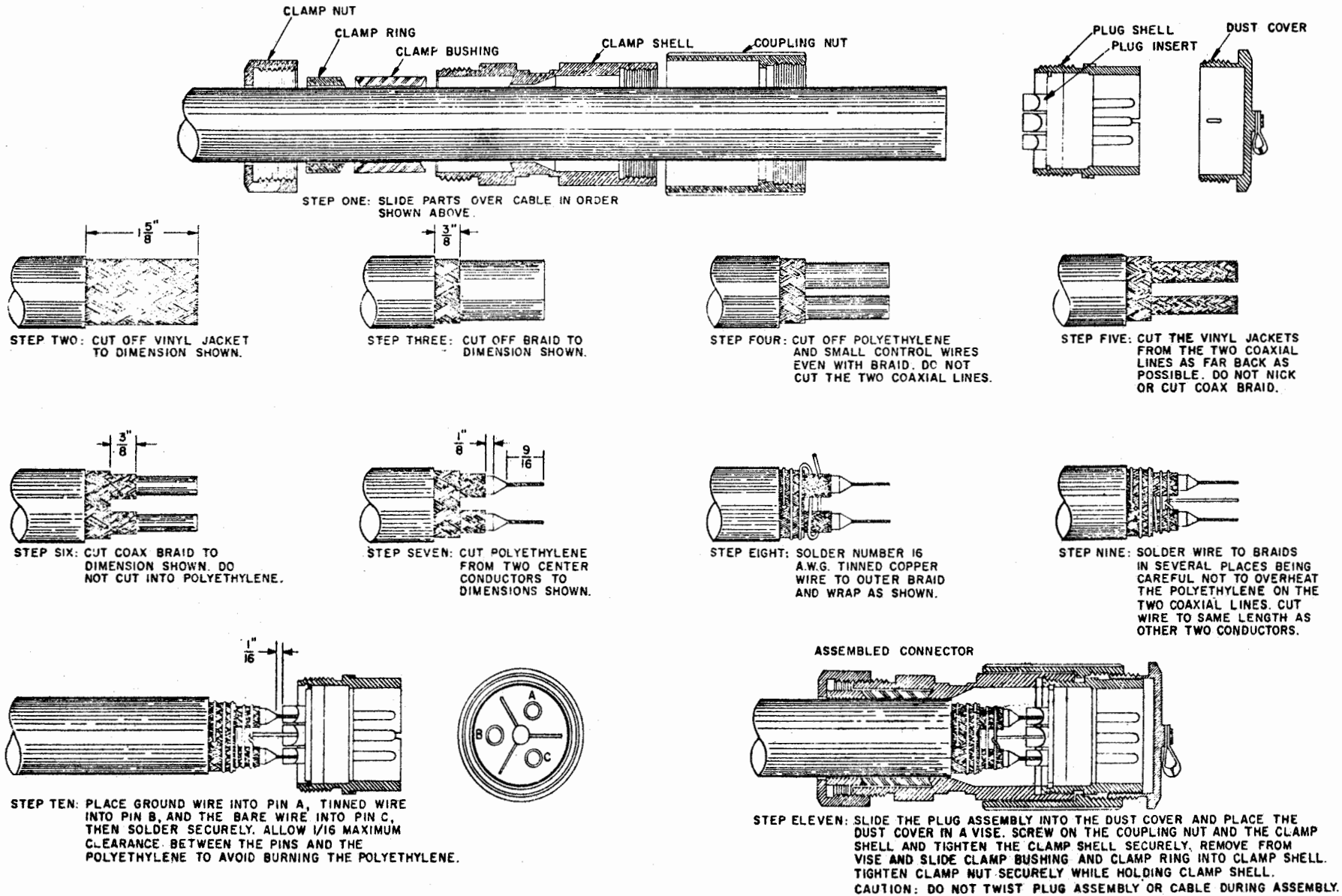


Figure 6-8. Assembly Instructions for Input Connector P101 Used on AT-317/BRR and AT-317A/BRR.

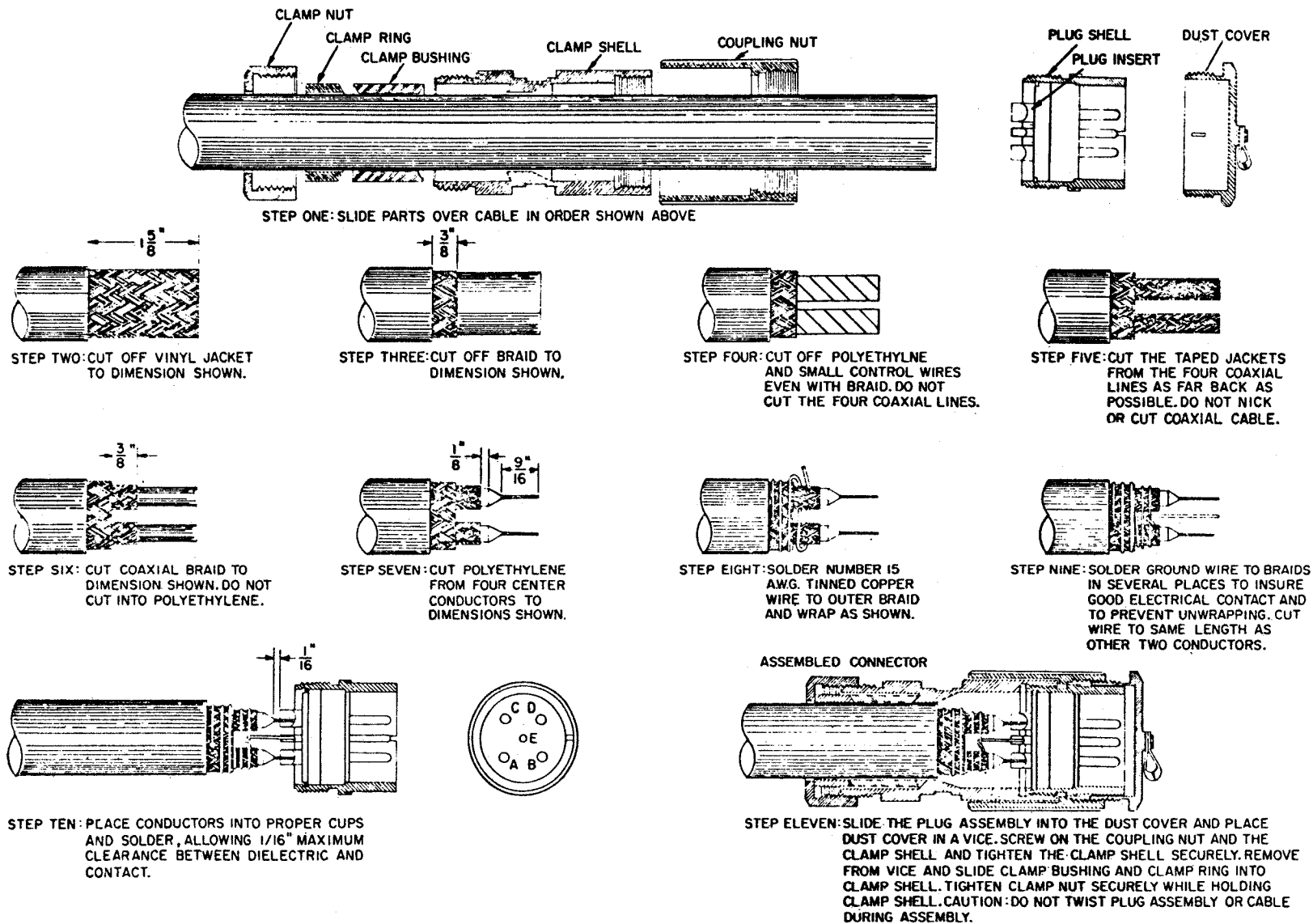
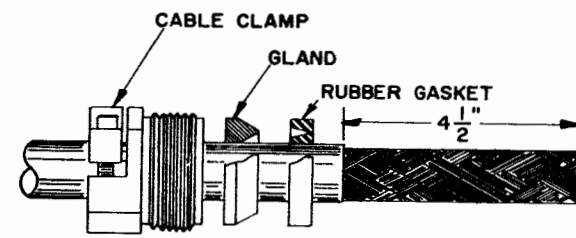


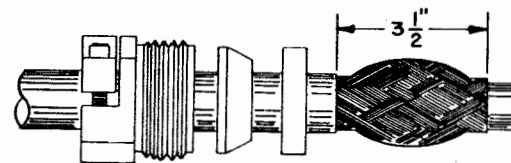
Figure 6-8A. Assembly Instructions for Input Connector P101 Used on AT-317B/BRR.

NAVSHIP 92182
AT-317/BRR, AT-317A/BRR and AT-317B/BRR

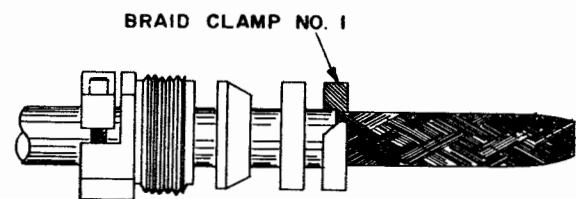
CORRECTIVE
MAINTENANCE



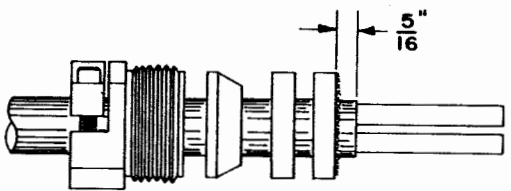
STEP ONE:
SLIDE THE CABLE CLAMP, THE GLAND AND THE RUBBER GASKET OVER THE VINYL JACKET. REMOVE VINYL JACKET TO THE DIMENSIONS SHOWN. DO NOT NICK OR CUT THE BRAID.



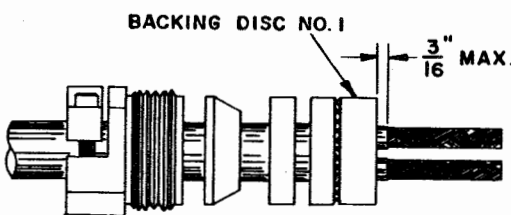
STEP TWO:
PUSH BACK THE BRAID AND CUT OFF THE POLYETHYLENE AND ALL THE INNER CONDUCTORS TO THE DIMENSION SHOWN.



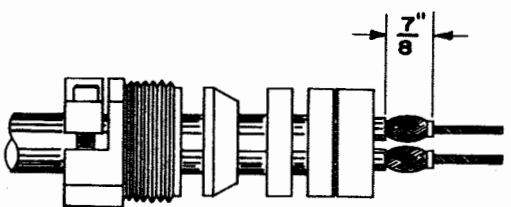
STEP THREE:
TAPER THE BRAID AND SLIDE BRAID CLAMP NO. 1 OVER BRAID. PRESS THE REAR SIDE OF THE BRAID CLAMP TIGHTLY AGAINST THE VINYL JACKET.



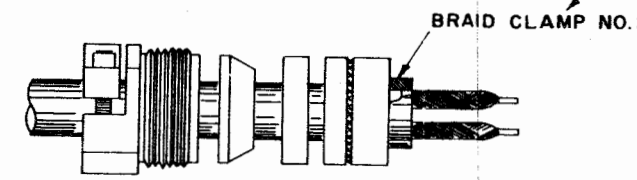
STEP FOUR:
COMB OUT THE BRAID AND FOLD IT SMOOTHLY BACK OVER BRAID CLAMP NO. 1. TRIM OFF EXCESS EVEN WITH THE EDGE OF THE BRAID CLAMP. REMOVE THE POLYETHYLENE AND SMALL CONTROL WIRES FROM AROUND THE TWO COAXIAL LINES AS SHOWN IN THE DRAWING.



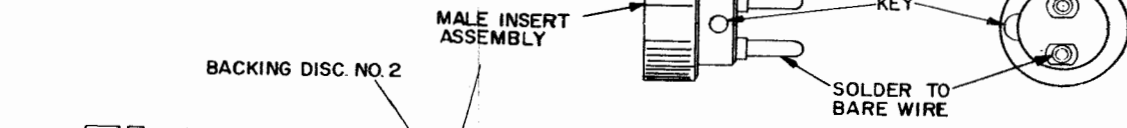
STEP FIVE:
SLIDE BACKING DISC NO. 1 OVER THE CABLES AND PRESS TIGHTLY AGAINST THE COMBED OUT BRAID. REMOVE THE VINYL JACKET FROM THE TWO COAXIAL LINES TO THE DIMENSIONS SHOWN. DO NOT CUT INTO THE BRAID WHEN REMOVING THE VINYL.



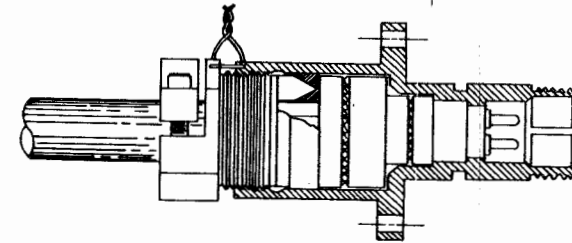
STEP SIX:
PUSH BACK THE BRAID AND REMOVE THE POLYETHYLENE FROM THE TWO COAXIAL LINES TO THE DIMENSIONS SHOWN. DO NOT NICK THE TWO CENTER CONDUCTORS.



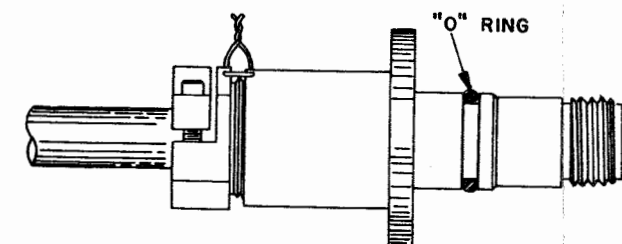
STEP SEVEN:
TAPER THE BRAIDS AND SLIDE BRAID CLAMP NO. 2 SQUARELY AGAINST THE ENDS OF THE VINYL JACKETS.



STEP EIGHT:
FOLD THE BRAIDS BACK SMOOTHLY OVER THE BRAID CLAMP AND TRIM OFF EXCESS. SLIDE BACKING DISC NO. 2 OVER THE CABLES AND REST AGAINST COMBED OUT BRAID. SLIDE THE MALE INSERT ASSEMBLY OVER THE CONDUCTORS AND RUN THE CENTER CONDUCTOR WIRES THROUGH THE INSERT PIN. CHECK THE POLARITY TO MAKE CERTAIN THAT THE WIRES ARE IN THE PROPER PINS, THEN SOLDER AND TRIM OFF ANY EXCESS THAT EXTENDS BEYOND THE INSERT PINS.

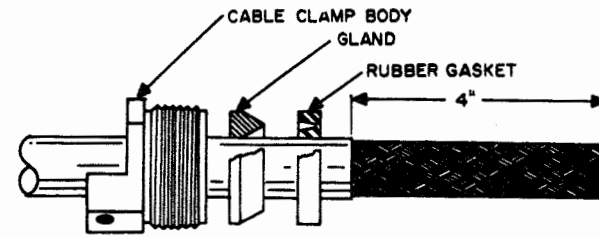


STEP NINE:
PUSH THE ASSEMBLY INTO THE CONNECTOR BODY BEING SURE THAT THE KEY ON THE MALE INSERT LINES UP WITH THE KEYWAY ON THE CONNECTOR BODY. PUSH THE RUBBER GASKET AND THE GLAND INTO PLACE AND COMPRESS THEM BY SCREWING THE CABLE CLAMP INTO THE CONNECTOR BODY. ATTACH THE SAFETY WIRE AND TIGHTEN THE CLAMP AGAINST THE CABLE BY SCREWING IN THE CAP SCREWS ON THE CLAMP.

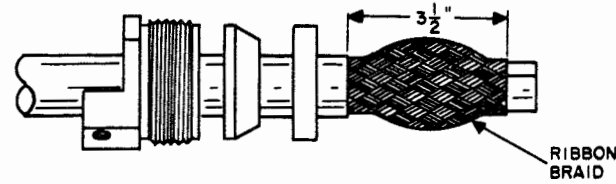


STEP TEN:
SLIP THE "O" RING OVER THE CONNECTOR AND DROP INTO PLACE IN THE GROOVE. BE CAREFUL NOT TO SCORE THE "O" RING.

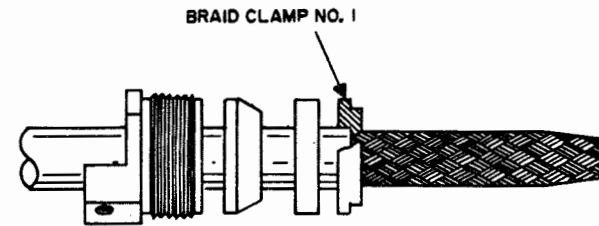
Figure 6-9. Assembly Instructions for Water-tight Connector Assembly P103.



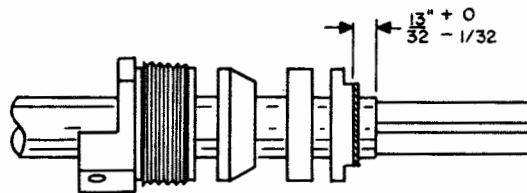
STEP ONE:
SLIDE CABLE CLAMP BODY, GLAND AND RUBBER GASKET OVER THE JACKET AS SHOWN, REMOVE JACKET AND MYLAR TAPE TO DIMENSION SHOWN. CUT MUST BE SQUARE. (DO NOT NICK THE BRAID)



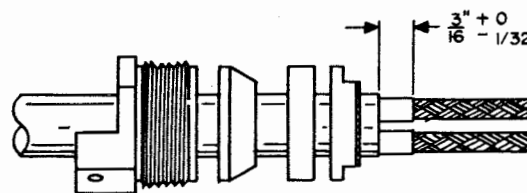
STEP TWO:
FOLD OR PUSH BACK BRAID AND CUT OFF POLYETHYLENE JACKET AND INNER CABLES FLUSH AS SHOWN.



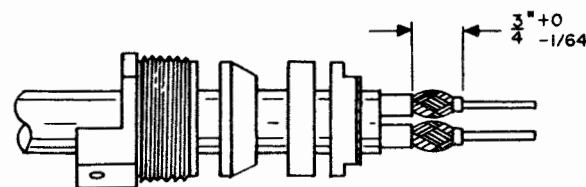
STEP THREE:
TAPER BRAID AND SLIDE BRAID CLAMP OVER BRAID. FIT INNER SHOULDER OF BRAID CLAMP SQUARELY AGAINST END JACKET.



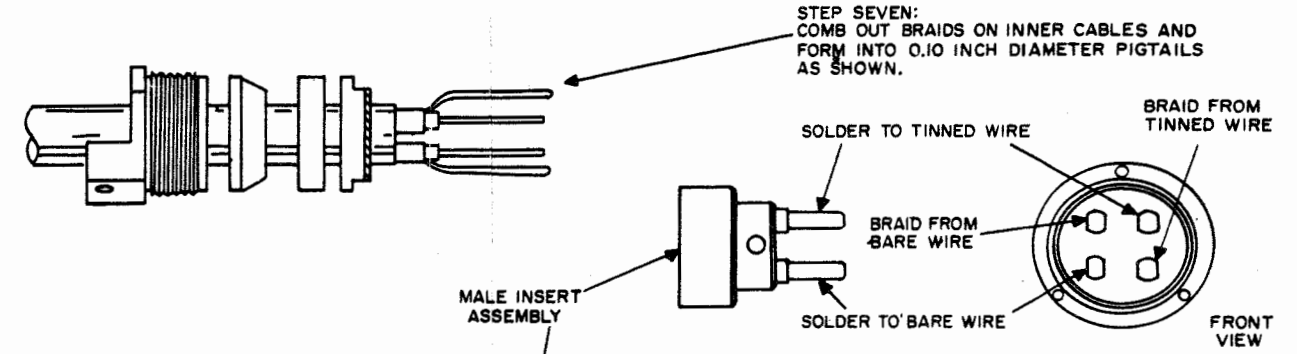
STEP FOUR:
WITH BRAID CLAMP IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AND TRIM EXCESS. REMOVE VINYL JACKET FROM AROUND THE TWO INNER CABLES SO THAT A 13/32" SHOULDER PROTRUDES PAST THE BRAID CLAMP. CUT OFF THE TWO CONTROL WIRES AND THE FOUR FILLER WIRES FLUSH AT THIS POINT. (THESE WIRES ARE NOT USED).



STEP FIVE:
REMOVE VINYL JACKET FROM THE TWO CABLES SO THAT A 3/16" SHOULDER PROTRUDES PAST THE OUTER CABLE JACKET. (DO NOT NICK BRAID).

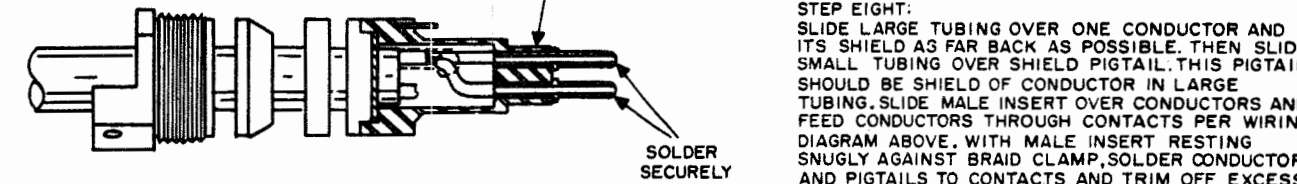


STEP SIX:
PUSH BACK BRAIDS AND REMOVE INSULATION FROM THE TWO CABLES AS SHOWN. (DO NOT NICK CENTER CONDUCTORS).

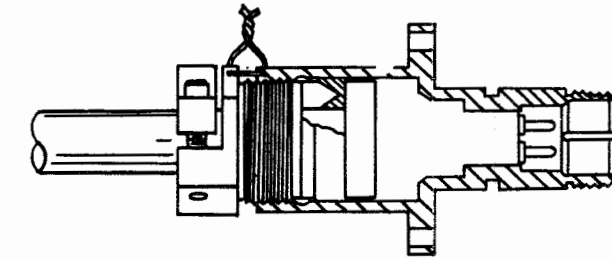


STEP SEVEN:
COMB OUT BRAIDS ON INNER CABLES AND FORM INTO 0.10 INCH DIAMETER PIGTAILS AS SHOWN.

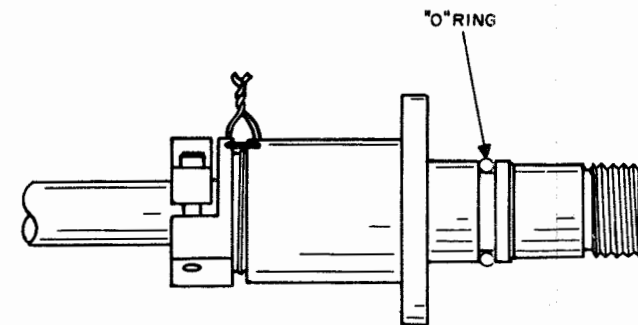
Labels: SOLDER TO TINNED WIRE, BRAID FROM TINNED WIRE, BRAID FROM BARE WIRE, SOLDER TO BARE WIRE, FRONT VIEW.



STEP EIGHT:
SLIDE LARGE TUBING OVER ONE CONDUCTOR AND ITS SHIELD AS FAR BACK AS POSSIBLE. THEN SLIDE SMALL TUBING OVER SHIELD PIGTAIL. THIS PIGTAIL SHOULD BE SHIELD OF CONDUCTOR IN LARGE TUBING. SLIDE MALE INSERT OVER CONDUCTORS AND FEED CONDUCTORS THROUGH CONTACTS PER WIRING DIAGRAM ABOVE. WITH MALE INSERT RESTING SNUGLY AGAINST BRAID CLAMP, SOLDER CONDUCTORS AND PIGTAILS TO CONTACTS AND TRIM OFF EXCESS WIRE AND BRAIDS.

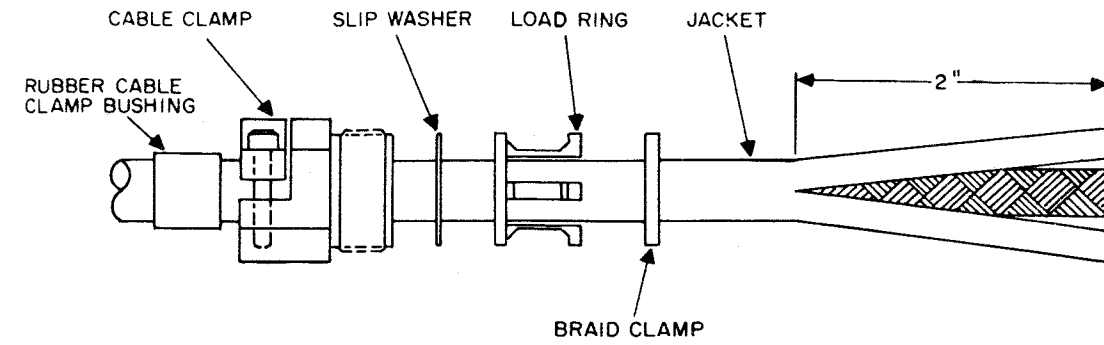


STEP NINE:
PUSH ASSEMBLY INTO CONNECTOR BODY, BEING CERTAIN THAT THE PINS IN THE MALE INSERT LINE UP WITH THE HOLES IN THE CONNECTOR BODY. PUSH THE RUBBER GASKET AND GLAND IN PLACE AND COMPRESS BY SCREWING CABLE CLAMP BODY INTO CONNECTOR BODY. ATTACH SAFETY WIRE. ASSEMBLE AND TIGHTEN CLAMP CAP AGAINST CABLE BY TIGHTENING CAP SCREWS.

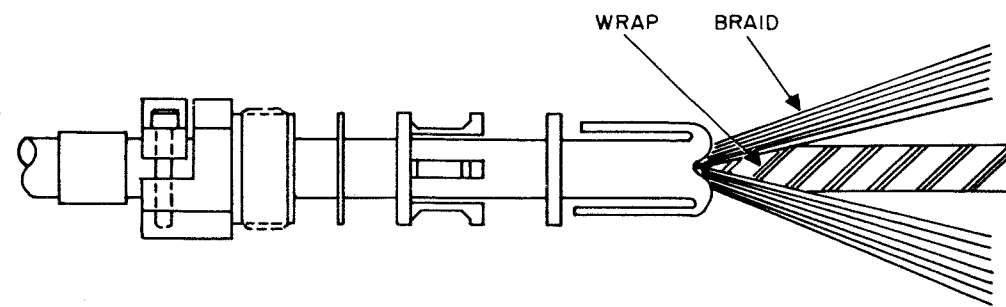


STEP TEN:
SLIP NO. 22 "O" RING OVER CONNECTOR BODY AND DROP INTO GROOVE. (BE CAREFUL NOT TO SCORE OR TEAR "O" RING).

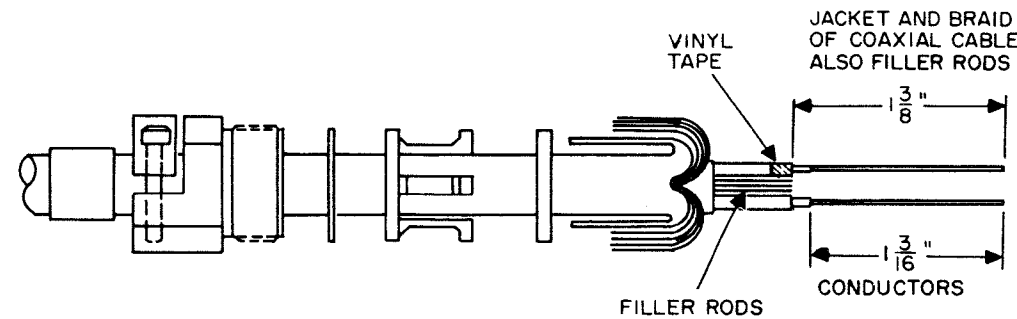
Figure 6-9A. Assembly Instructions for Water-tight Connector Assembly P103 for Antenna AT-317A/BRR.



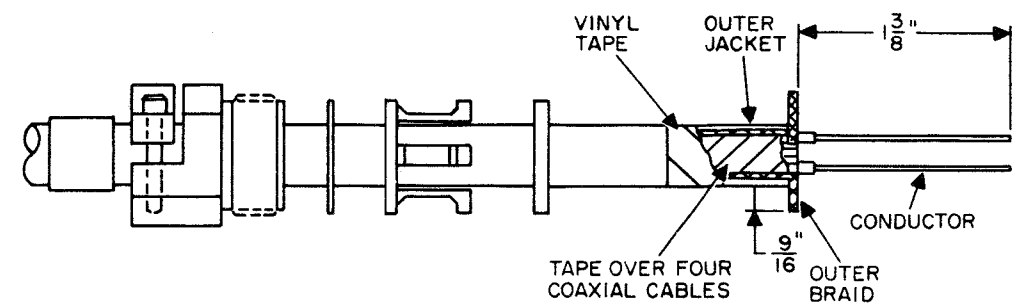
STEP ONE
SLIDE CABLE CLAMP BUSHING, CABLE CLAMP, SLIP WASHER, LOAD RING AND BRAID CLAMP OVER OUTER JACKET AS SHOWN. MAKE TWO SLITS THRU CABLE OUTER JACKET 180° APART AND 2" LONG AS INDICATED. DO NOT CUT THRU OR NICK BRAID.



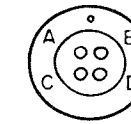
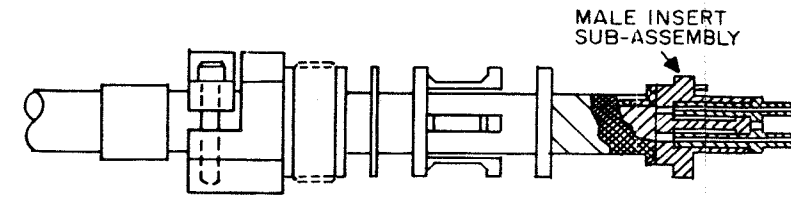
STEP TWO
FOLD JACKET BACK, REMOVE WRAP AND COMB BRAID TO THE END OF SLIT AND FOLD BACK OVER OUTER JACKET.



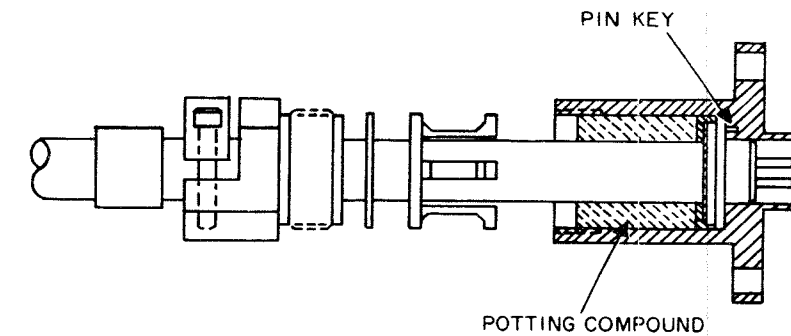
STEP THREE
CUT JACKET AND BRAID OF COAXIAL CABLE SHARP AND SQUARE TO DIMENSIONS SHOWN. IMPORTANT: BRAIDS OF EACH COAXIAL CABLE SHOULD NOT SHORT TO EACH OTHER OR TO OUTER BRAID. INSULATE WITH VINYL TAPE. CUT FILLER RODS FLUSH WITH JACKET AND BRAID OF COAXIAL CABLES. CUT OFF DIELECTRIC TO DIMENSION SHOWN AND TIN. DO NOT NICK OR CUT CONDUCTORS.



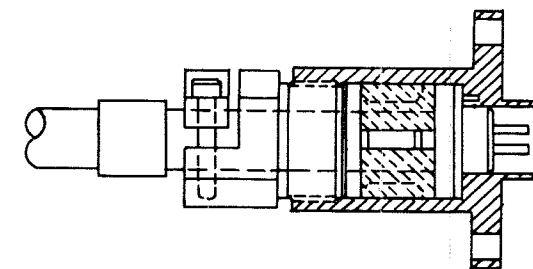
STEP FOUR
WRAP TAPE AROUND THE FOUR COAXIAL CABLES AS SHOWN. BRING OUTER BRAID OVER THE TAPED CABLES, FOLD OVER AND TRIM AS INDICATED. CUT OUTER JACKET TO FIT FLUSH AGAINST THE BRAID. WRAP TAPE OVER OUTER JACKET STARTING FROM END OF JACKET FLUSH AGAINST OUTER BRAID WORKING SLIGHTLY PAST SLIT PORTION OF JACKET. CAUTION: DO NOT BUILD UP THICKNESS OF CABLE WITH THE TAPE MORE THAN NECESSARY.



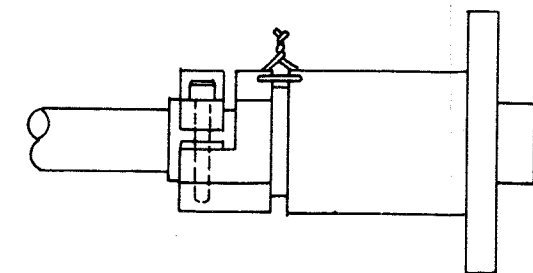
STEP FIVE
CLEAN AND PRIME CABLE JACKET PRIOR TO POTTING. PLACE MALE INSERT SUB-ASSEMBLY OVER CONDUCTORS AND SEAT AGAINST DIELECTRIC OF CONDUCTORS. CAUTION: THE TWO CENTER CONDUCTORS WITH COPPER COLORED INNER BRAID MUST BE INSERTED THRU CONTACTS MARKED "B" AND "D". THE TWO CENTER CONDUCTORS WITH SILVER COLORED INNER BRAID MUST BE INSERTED THRU CONTACTS MARKED "A" AND "C". WIRES MUST NOT CROSS EACH OTHER. SOLDER CONDUCTORS TO CONTACTS AND TRIM EXCESS WIRE. REMOVE EXCESS SOLDER FROM MALE CONTACTS. ABRASE CABLE UNDERNEATH RUBBER CABLE CLAMP BUSHING.



STEP SIX
PLACE MALE BODY OVER INSERT AND POSITION UNTIL PIN KEY SEATS ITSELF IN HOLE PROVIDED IN BODY. INVERT ENTIRE ASSEMBLY (CONTACT PINS DOWN), BEING CAREFUL NOT TO DISENGAGE PIN KEY. SLIDE BRAID CLAMP INTO BODY AND SEAT FIRMLY AGAINST BRAID. INJECT THIKOL POTTING COMPOUND INTO BODY CAVITY AND FILL TO LEVEL OF 1/2 THREAD AREA (APPROXIMATELY).

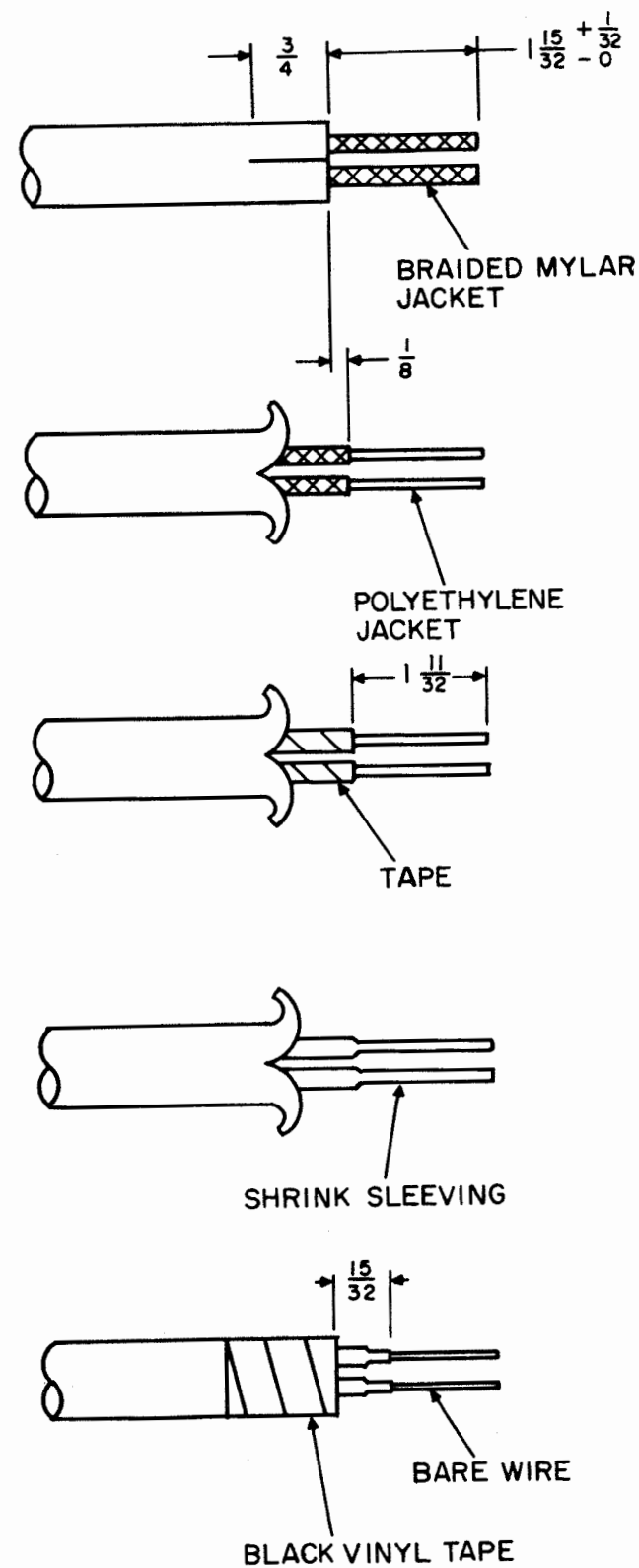


STEP SEVEN
SLIDE LOADING RING DOWN INTO POTTING AND SEAT FIRMLY AGAINST BRAID CLAMP. SEAT SLIP WASHER AGAINST LOAD RING. SCREW CABLE CLAMP TIGHTLY AGAINST SLIP WASHER. WIPE OFF ALL EXCESS POTTING FROM ENTIRE ASSEMBLY.



STEP EIGHT
SLIDE BUSHING IN PLACE AND TIGHTEN CABLE CLAMP SCREWS UNTIL CABLE CLAMP CAP IS FLUSH AGAINST SPACER WASHER. WITH ASSEMBLY IN VERTICAL POSITION (CONTACTS POINTING DOWN) ALLOW TO CURE FOR APPROXIMATELY 24 HOURS. ATTACH SAFETY WIRE AS SHOWN.

Figure 6-9B. Assembly Instructions for Water-tight Connector Assembly P105 for Antenna AT-317B/BRR.



1. TRIM OUTER JACKET TO $1\frac{15}{32}$ INCH DIMENSION SHOWN. CUT TWO SLOTS IN OUTER JACKET $\frac{3}{4}$ INCH LONG.

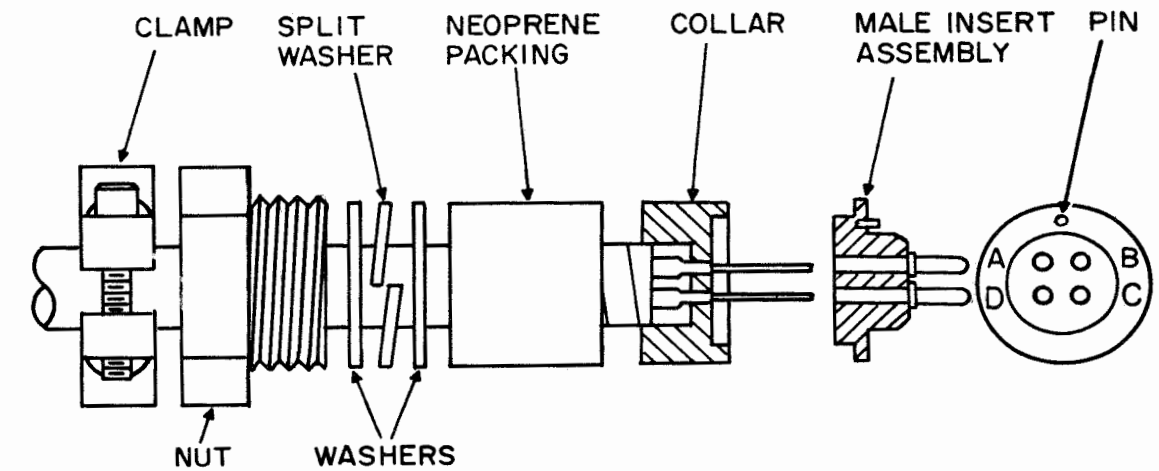
2. PULL BACK OUTER JACKET AND TRIM OUTER SHIELD, CORD, MYLAR WRAP AND FILLER AS CLOSE TO $\frac{3}{4}$ INCH DIMENSION AS POSSIBLE.

3. WRAP FOUR BRAIDED MYLAR JACKETS INDIVIDUALLY WITH $1\frac{11}{32}$ TURNS OF CLEAR PRESSURE SENSITIVE TAPE. TRIM BRAIDED MYLAR JACKETS TO DIMENSION SHOWN.

4. PLACE SHRINK SLEEVING OVER CONDUCTORS AS FOLLOWS:
BLACK SLEEVE OVER COPPER COLORED BRAID.
WHITE SLEEVE OVER COPPER COLORED BRAID WITH BLUE MARKER TAPE.
RED SLEEVE OVER SILVER COLORED BRAID WITH BLUE MARKER TAPE.
D. BLUE SLEEVE OVER SILVER COLORED BRAID.
BRING SLEEVING AS FAR BACK ON CABLE AS POSSIBLE. APPLY MINIMUM OF 275 DEGREE F HEAT TO SLEEVES UNTIL SLEEVING SHRINKS TO FORM A TIGHT MECHANICAL BOND.

CAUTION: CHECK STEP 6 BEFORE INSTALLING SLEEVING, TO DETERMINE CORRECT END OF CABLE TO MATCH CONNECTOR CONTACT.

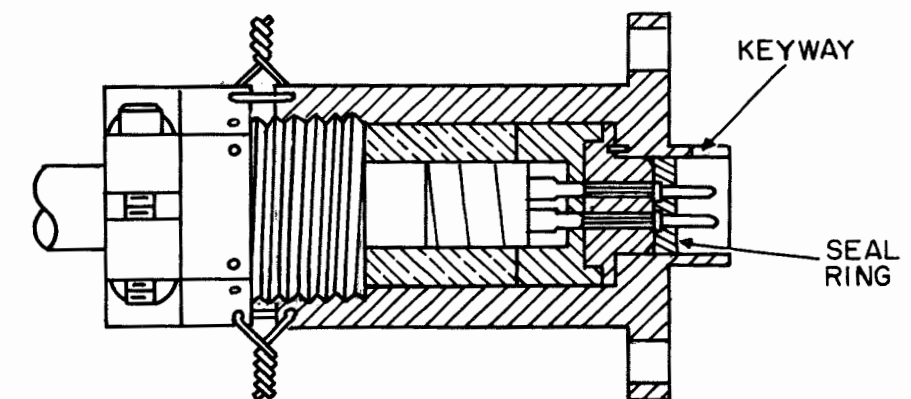
5. TRIM SLEEVE AND POLYETHYLENE JACKET TO BARE WIRE TO DIMENSION SHOWN. PULL BACK OUTER JACKET TO ORIGINAL POSITION. WRAP OUTER JACKET AS TIGHTLY AS POSSIBLE WITH TWO THICKNESSES (NOT TO EXCEED $2\frac{1}{2}$ TURNS) OF BLACK VINYL TAPE. TWIST STRANDS OF CONDUCTORS AND TIN USING ROSIN CORE SOLDER.



6. ASSEMBLE CLAMP, NUT, FLAT WASHER, SPLIT WASHER, FLAT WASHER AND NEOPRENE PACKING OVER STRIPPED END OF CABLE. ASSEMBLE COLLAR OVER STRIPPED END OF CABLE, FORCING CABLE OUTER JACKET INTO C'BORE AS FAR AS POSSIBLE. ASSEMBLE CONDUCTORS INTO MALE INSERT ASSEMBLY IN THE FOLLOWING MANNER:

CONDUCTOR WITH BLACK VINYL SLEEVING IN CONTACT HOLE A.
CONDUCTOR WITH RED VINYL SLEEVING IN CONTACT HOLE B.
CONDUCTOR WITH WHITE VINYL SLEEVING IN CONTACT HOLE C.
CONDUCTOR WITH BLUE VINYL SLEEVING IN CONTACT HOLE D.

ASSEMBLE FOUR MALE CONTACTS OVER INDIVIDUAL CONDUCTORS AND SOLDER. CHECK ASSEMBLY FOR CONTINUITY.



7. ASSEMBLE FEMALE BODY ONTO MALE INSERT, NEOPRENE PACKING, WASHER, SPLIT WASHER, WASHER AND NUT. TIGHTEN NUT. TIGHTEN CABLE CLAMP SCREWS. ATTACH LOCKWIRE AS SHOWN. INSERT SEAL RING AS SHOWN.

Figure 6-9C. Assembly Instructions for Water-tight Connector Assembly P105 for Antenna AT-317C/BRR.

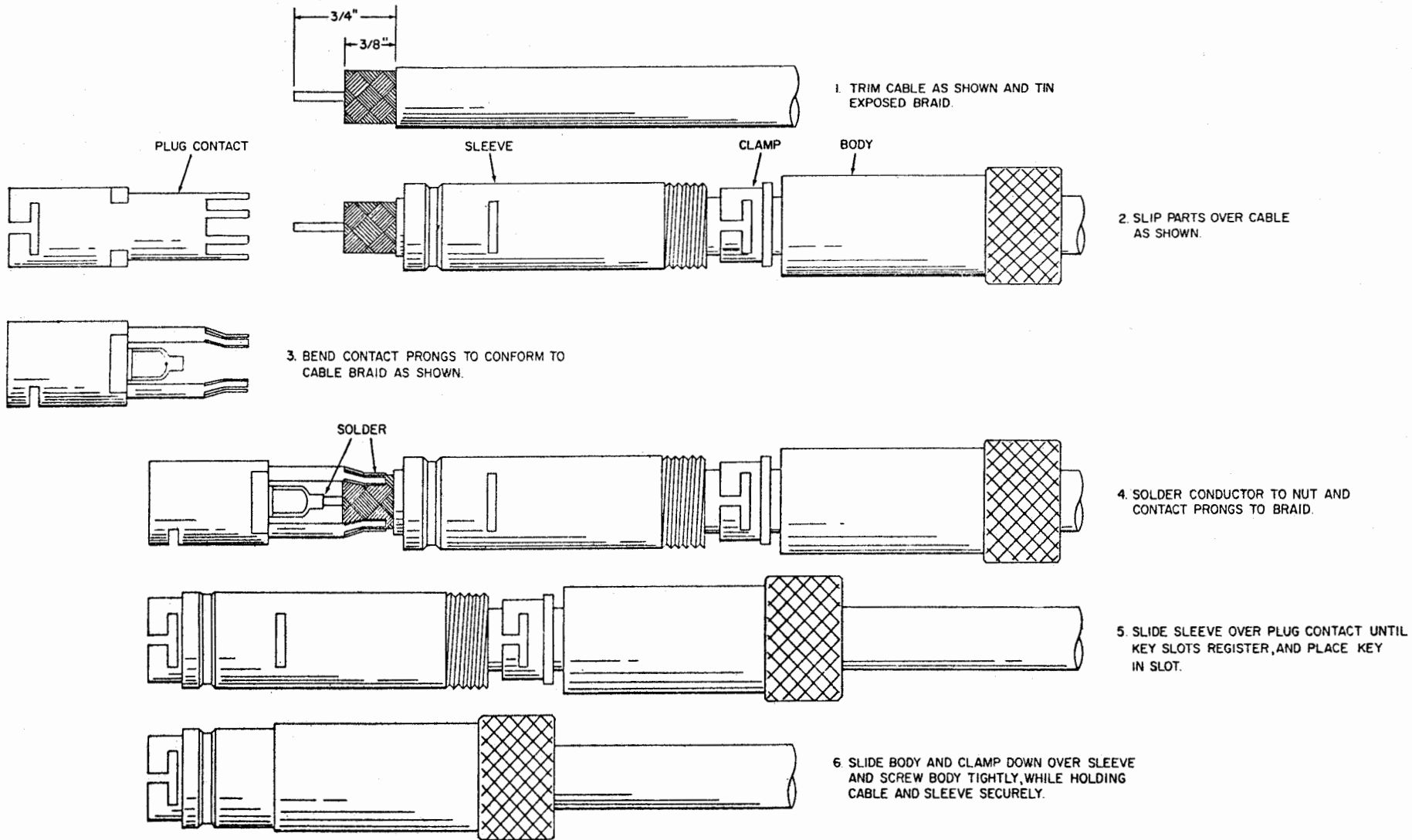
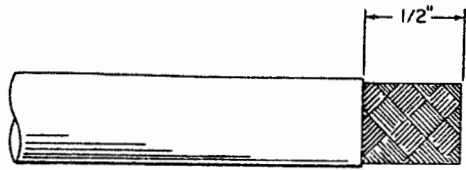
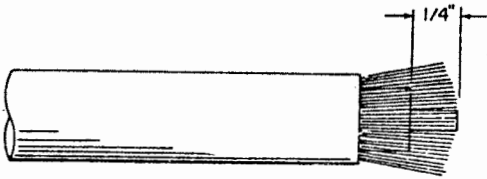


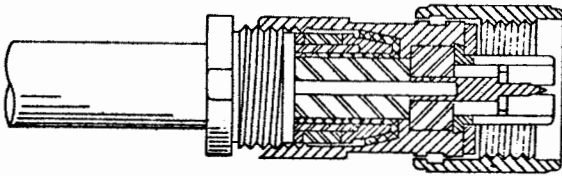
Figure 6-10. Assembly Instructions for Plug P102.



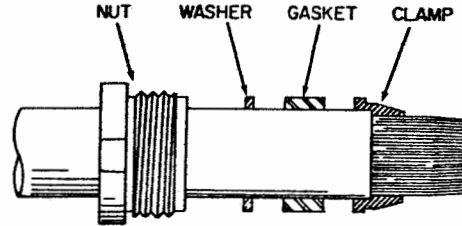
1. CUT END OF CABLE SHARP AND EVEN. CUT VINYL JACKET 1/2" FROM END. DO NOT NICK BRAID.



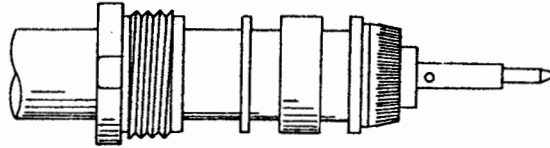
2. COMB OUT COPPER BRAID AS SHOWN. CUT OFF DIELECTRIC 1/4" FROM END DO NOT NICK CENTER CONDUCTOR. TIN CENTER CONDUCTOR.



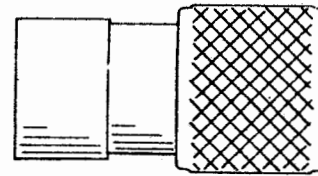
5. SLIDE BODY INTO PLACE CAREFULLY SO THAT CONTACT ENTERS HOLE IN INSULATOR. FACE OF DIELECTRIC MUST BE FLUSH AGAINST INSULATOR. SLIDE COMPLETED ASSEMBLY INTO BODY BY PUSHING NUT. WHEN NUT IS IN PLACE, TIGHTEN WITH WRENCHES UNTIL SUFFICIENTLY TIGHT.



3. TAPER BRAID AS SHOWN. SLIDE NUT, WASHER, AND GASKET OVER VINYL JACKET. SLIDE CLAMP OVER BRAID WITH INTERNAL SHOULDER OF CLAMP FLUSH AGAINST END OF VINYL JACKET.

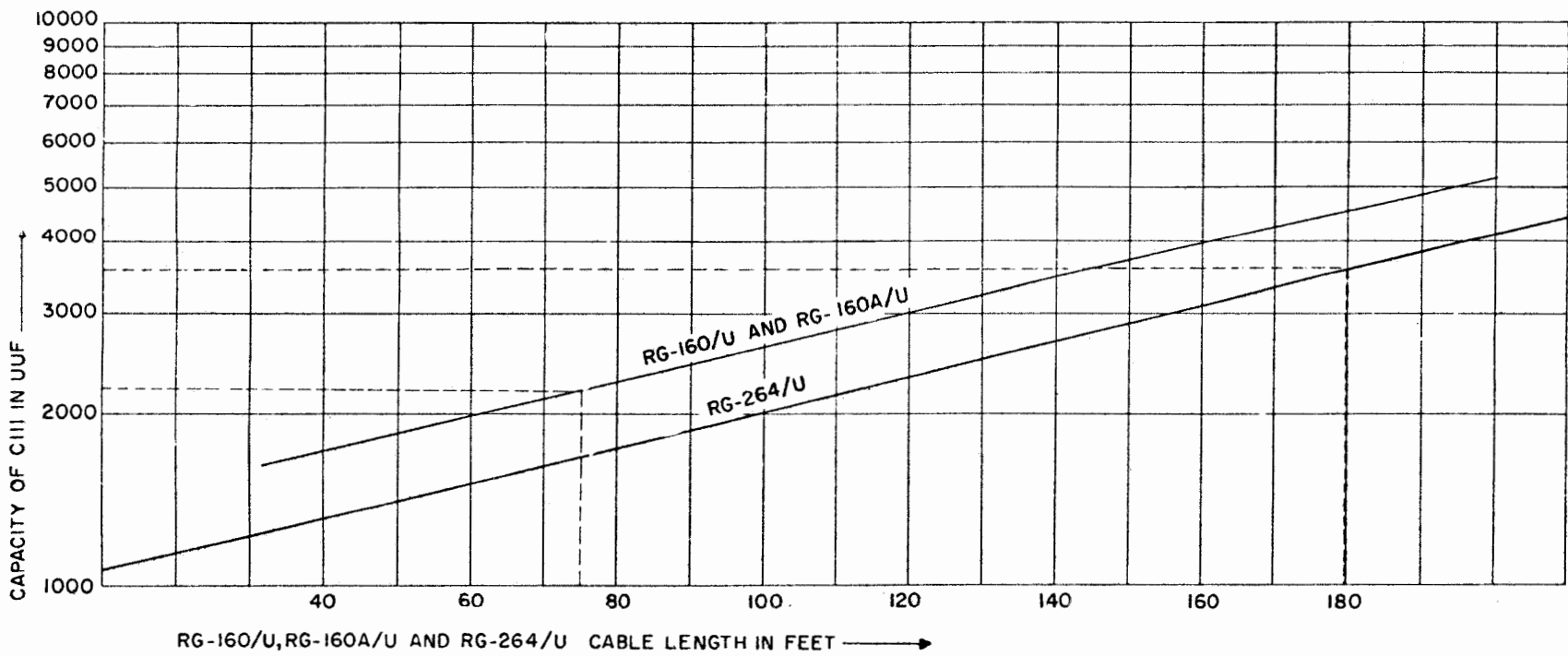


4. SMOOTH BRAID BACK OVER CLAMP AND TRIM. SOFT SOLDER CONTACT TO CENTER CONDUCTOR. AVOID USE OF EXCESSIVE HEAT AND SOLDER. SEE THAT END OF DIELECTRIC IS CLEAN AND FREE OF SOLDER, RESIN, AND FOREIGN MATERIAL. CONTACT MUST BE FLUSH AGAINST DIELECTRIC. OUTSIDE OF CONTACT MUST BE FREE OF SOLDER.



PLUG BODY
UG-21B/U

Figure 6-11. Assembly Instructions for Plug P104.



NOTE:
DOTTED LINE SHOWS THE SUPPLIED LENGTH OF CABLE
AND THE VALUE OF C111 FOR THE SUPPLIED LENGTH.

Figure 6-12. Recommended Values of Capacitor C111 for Different Lengths of RG-160/U, RG-160A/U and RG-264/U Antenna Cable.

SECTION 7A

SUPPLEMENTARY PARTS LIST

Note

Stock Number Identification Tables (SNIT) or Allowance Parts List (APL) issued by the Electronics Supply Office include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference shall be made to the appropriate SNIT or APL for this information.

Note

The parts list section has been corrected by means of the following supplementary table. Always refer to the appropriate supplementary table for a given item first as it completely supersedes any corresponding listing in the basic table. If no information is shown for a given item then refer to the basic table for the required information.

SUPPLEMENTARY TABLE 7-1A. LIST OF MAJOR UNITS.

| Nomenclature | Name of Part and Description |
|--------------|---|
| AT-317A/BRR | LOOP ANTENNA: crossed-loop type; 14.6 to 38 kc frequency range; 472.6 inductance each section; terminated for four conductor coaxial transmission line; streamlined molded polyethylene; neoprene coated; fixed; special features; has ability to withstand 600 P/SI hydrostatic pressure; twelve mounting holes 7/16 in. dia; Mfr and Mfrs Designation CPH 142-007; Contractor Dwg and Part No. 142-007. |
| AT-317B/BRR | LOOP ANTENNA: crossed-loop type; 14.6 to 38 kc frequency range; 472.6 inductance each section; terminated for four conductor coaxial transmission line; streamlined molded polyethylene; neoprene coated; fixed; special features; has ability to withstand 1000 P/SI hydrostatic pressure; twelve mounting holes 7/16 in. dia; Mfr and Mfrs Designation CPH 142-010; Contractor Dwg and Part No. 142-010. |
| CU-352A/BRR | COUPLER, ANTENNA: transformer coupling; 14.6 to 38 kc frequency range; capacitance tuned; four connectors located on back; aluminum body; gray enamel finish; overall dimensions; 10-5/8 in. lg by 8-11/16 in. wide by 7-3/16 in. high; special features; has ability to select three modes of reception, ie. single-plane fore-aft, single-plane athwartships, and omni-directional. Part of AT-317B/BRR Loop Antenna System; Mfr and Mfrs Designation CPH 142-011; Contractor Dwg and Part No. 142-011. |

SUPPLEMENTARY TABLE 7-2A. PARTS LIST FOR NAVY MODEL AT-317A/BRR AND AT-317B/BRR VLF LOOP ANTENNA SYSTEMS

| Symbol Desig. | Name of Part and Description | Locating Function |
|---------------|--|---|
| A101** | BASE, ANTENNA: manganese bronze, nickel plate; twelve mounting holes; 7/16 in. dia; equally spaced on bottom; Mfr and Mfrs Designation CPH 142-820; Contractor Dwg and Part No. 142-820. | Antenna base |
| C106*** | CAPACITOR, FIXED, MICA DIELECTRIC: 30,000 mmf $\pm 10\%$, 600V dcw; -200 to +200 ppm per $^{\circ}\text{C}$; molded low loss bakelite case, 1-3/4 in. lg by 1-5/16 in. wide by 3/4 in. high 2 hole type terminal, mounted .144 in. dia; located on each end; Mfr and Mfrs Designation CD 9A-11030; Contractor Dwg and Part No. 142-878. | Phase shift capacitor |
| C111*** | CAPACITOR, FIXED, MICA DIELECTRIC: 3600 mmf $\pm 5\%$, 500V dcw; -200 to +200 ppm per $^{\circ}\text{C}$; molded low loss bakelite case 51/64 in. lg. by 51/64 in. wide by 5/16 in. high; 2 wire lead type terminals, located one on each end; terminal mounting; Mfr and Mfrs Designation CM 35D-362J; Contractor Dwg and Part No. 142-879. | Dummy load capacitor |
| E113*** | POST BINDING: brass; cadmium plated; overall above surface 1-1/8 in. lg by 5/32 in. dia; .110 max cable opening; Mfr and Mfrs Designation CAG 938-R; Contractor Part and Dwg No. 142-875. | Provides connection for E101A |
| J101*** | CONNECTOR, RECEPTACLE: 5 round female contacts; polarized straight type; overall 1-13/32 in. lg by 1-7/8 in. dia; cylindrical body; aluminum alloy, anodized finish, molded phenolic insert; Mfr and Mfrs Designation CPH-89-222-135; Contractor Dwg and Part No. 89-222-XX. | Input receptacle |
| J102*** | CONNECTOR, RECEPTACLE: 1 round female contact; straight type; 1-37/64 in. lg by 13/16 in. dia; radio frequency connector; cylindrical body w/circular mounting flange; brass; silver plated; glass insert; 5/8 in. double D mounting hole; .527 in. across flats; Mfr and Mfrs Designation UG-680/U; Contractor Dwg and Part No. 82-811. | Output connector |
| J103*** | CONNECTOR, RECEPTACLE: 1 round banana type male contact; straight type; overall 1-9/16 in. lg by 7/8 in. wide across flats or hex nut; radio frequency connector; cylindrical body; brass; silver plate lock type; phenolic insert; Contractor Dwg and Part No. 142-622; Mfr and Mfrs Designation CN-49120. | Output connector |
| J104*** | Same as J102. | Whip and high impedance antenna connector |
| J105** | CONNECTOR, RECEPTACLE: 4 round female contacts; polarized straight type; overall 1.500 in. lg by 1.843 in. dia; cylindrical body; brass alloy; nickel plated; molded phenolic insert; Mfr and Mfrs Designation CPH 142-823; Contractor Drawing and Part No. 142-823. | Antenna output connector |
| P101*** | CONNECTOR, PLUG: 5 round male contacts; polarized straight type; overall 4-1/2 in. lg by 1-21/32 in. dia. cylindrical body; aluminum alloy, anodized finish; molded phenolic insert; 3/4 in. dia. max cable opening; Mfr and Mfrs Designation CPH-89-122-13P (12) Contractor Dwg and Part No. 89-122-XX. | Input Connector |
| P103* | CONNECTOR, PLUG: 4 round male contacts; polarized straight type; overall 6-1/2 in. lg by 3-5/8 in. dia; cylindrical body; aluminum, anodized finish; lock type; molded phenolic insert; 1-1/16 in. dia | Input connector |

SUPPLEMENTARY TABLE 7-2A. PARTS LIST FOR NAVY MODEL AT-317A/BRR AND AT-317B/BRR VLF LOOP ANTENNA SYSTEMS

| Symbol Desig. | Name of Part and Description | Locating Function |
|---------------|--|------------------------------|
| P105** | max cable opening; Mfr and Mfrs Designation CPH 142-807; Contractor Dwg and Part No. 142-807. CONNECTOR, PLUG: 4 round male contacts; polarized straight type; overall 4-3/4 in. lg by 3-5/8 in. dia; cylindrical body; brass body; nickel plated; lock type; molded phenolic insert; 3/4 in. dia. max cable opening; Mfr and Mfrs Designation CPH 142-836; Contractor Dwg and Part No. 142-836. | Input connector |
| R103*** | RESISTOR, TEST DECADE: consists of 2 binding posts, 1 10 ohm, 0.1 ohm resistor, 2 banana plugs, 2 insulators, 1 interrupter stud 31/32 in. lg; 5/32 in. dia at base; Mfr and Mfrs Designation CPH 142-877; Contractors Dwg and Part No. 142-877. | Used for test purposes |
| S101*** | SWITCH, ROTARY: 2 section; 5 max number of switch position; non pile up type, 2 pole; spring brass, coined silver contacts, stealite insulation; 2-1/2 in. lg by 1-1/4 in. wide by 1-1/2 in. high; bushing mounted; solder lug type; shaft 9/16 in. lg; Mfr and Mfrs Designation PA 2011; Contractor Dwg and Part No. 142-876. | Loop selector switch |
| S102*** | SWITCH, ROTARY: 1 section; 2 max number of switch position; non pile up type, 2 pole, spring brass, coined silver contacts; stealite insulation; 7-5/8 in. lg by 1-1/4 in. wide by 1-1/2 in. high; bushing mounted; solder lug type; shaft 6-3/4 in. lg; Mfr and Mfrs Designation PA 2011; Contractor Dwg and Part No. 142-851. | Antenna selector switch |
| S104*** | SWITCH, PUSH: single pole, single throw, normally closed; button travel approx. 0.065; 10 ounce force required to bottom button, black button; rated at 100 MA. 110 AC resistance circuit; contact resistance approx. .003 ohms; 17/64 in. dia mtg hole. Overall dim., 0.98 m.h. x 0.37 in. dia; 1/4-32 NEF 2 thread. 2 solder type terminals. Mfr and Mfrs Designation 142-872, Contractor Dwg and Part No. 142-872 | Grounds terminal #2 of T101 |
| S105*** | Same as S104. | Grounds terminal #2 of T102. |
| W102* | CABLE ASSEMBLY: consists of P101, P103, W102A; 1 male connector ea end; Mfr and Mfrs Designation CPH 142-813; Contractors Dwg and Part No. 142-813. | Couples antenna to coupler |
| W102** | CABLE ASSEMBLY: consists of P101, P105, W102A; 1 male connector ea end; Mfr and Mfrs Designation CPH 142-818; Contractors Dwg and Part No. 142-818. | Couples antenna to coupler |
| W102A† | CABLE: RF; type RG-160A/U special purpose; polyethylene dielectric; copper shielded; 74 ft lg; Mfr and Mfrs Designation CPH 21-763; Contractor Dwg and Part No. 21-763. | Part of W102 |
| W102A** | CABLE: RF; type RG-264/U special purpose; Black Vinyl jacket; polyethylene dielectric; copper shielded; 180 ft lg; Mfr and Mfrs Designation CPH 21-773; Contractors Dwg and Part No. 21-773. | Part of W102 |

* Used on Antenna AT-317A/BRR.

** Used on Antenna AT-317B/BRR.

*** Used on Coupler CU-352A/BRR.

† Used on Antenna AT-317/BRR Serial Numbers 144 through 156 and AT-317A/BRR.

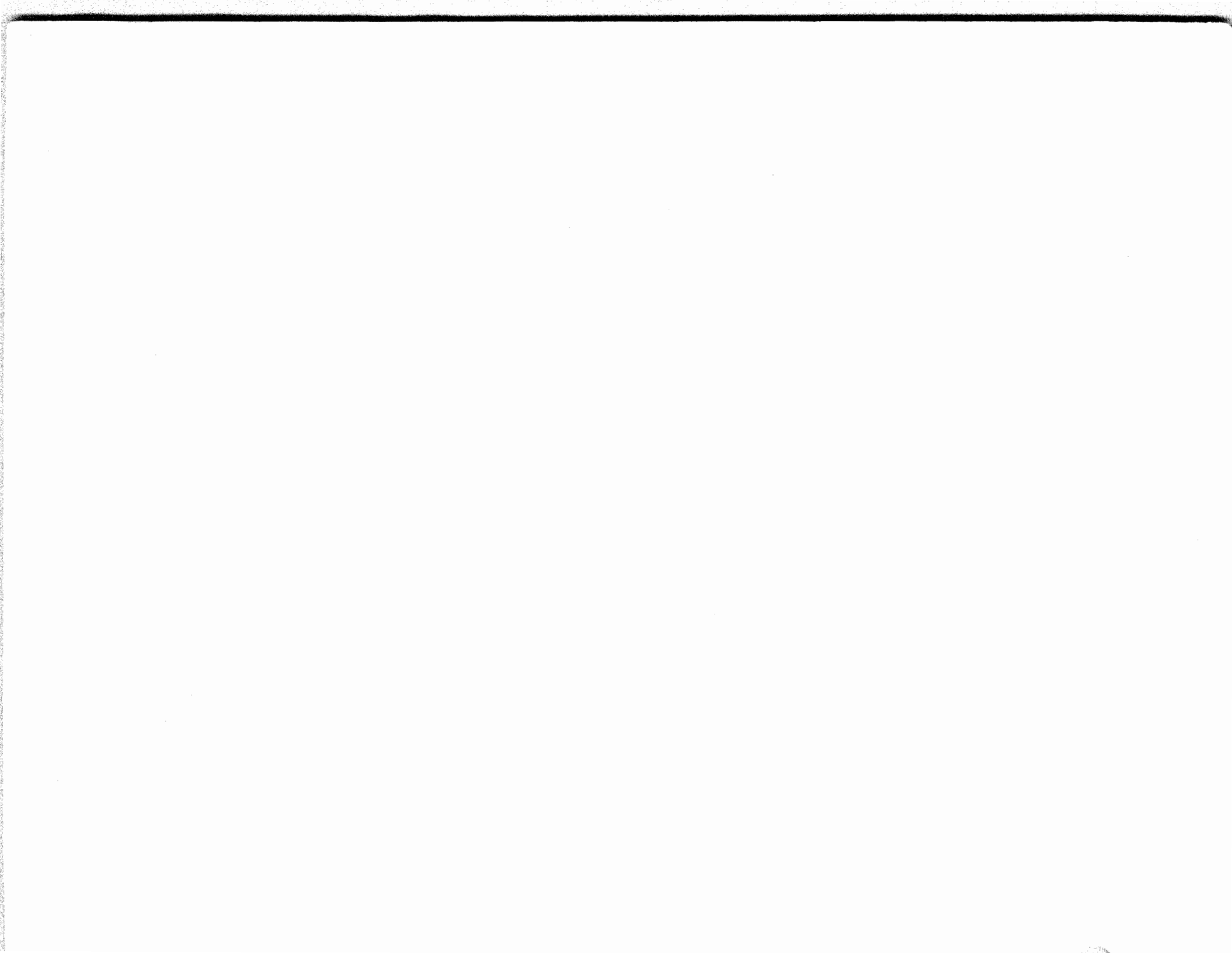
SECTION 7
PARTS LIST

TABLE 7-1. LIST OF MAJOR UNITS.

| NOMEN- CLATURE | NAME OF PART AND DESCRIPTION | STANDARD NAVY STOCK NUMBER |
|-------------------|---|-------------------------------------|
| AT-317/BRR | LOOP ANTENNA: crossed-loop type; 14.6 to 38 kc frequency range; 472.6 inductance each section; terminated for twin-coaxial transmission line; streamlined molded polyethylene; neoprene coated; fixed; special features; has ability to withstand 600 P/SI hydrostatic pressure; twelve mounting holes 7/16 in. dia; Mfr and Mfrs Designation CPH 142-002; Contractor Dwg and Part No. 142-002. | |
| CU-352/BRR | COUPLER, ANTENNA: transformer coupling; 14.6 to 38 kc frequency range; capacitance tuned; three connectors located on back; aluminum body; gray enamel finish; overall dimensions; 10-5/8 in. lg by 8-11/16 in. wide by 7-3/16 in. high; special features; has ability to select three modes of reception, ie. single-plane fore-aft, single-plane athwartships, and omni-directional. Part of AT-317/BRR Loop Antenna System; Mfr and Mfrs Designation CPH 142-005; Contractor Dwg and Part No. 142-005. | |

TABLE 7-2. TABLE OF REPLACEABLE PARTS

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|---|----------------------|
| A101 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | BASE, ANTENNA: manganese bronze, nickel plate; twelve mounting holes; 7/16 in. dia; equally spaced on bottom; Mfr and Mfrs Designation CPH 142-404; Contractor Dwg and Part No. 142-404. | Antenna base. |
| A102 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | DIAL ESCUTCHEON: stainless steel, black enamel; rectangular; 3 in. lg by 1 in. wide by 3/32 in. thick; 2 mounting holes, 1/4 in. dia, spaced 2-3/4 in. C to C; excludes dial glass; Mfr and Mfrs Designation 142-601; Contractors Part and Dwg No. 142-601. | Dial scale cover. |



| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|---|--|
| A103 | Shop Manufacture | GASKET: sheet type; black neoprene; overall, 10 in. lg by 5 in. wide by .062 in. thick; twelve 15/32 in. mounting holes; Mfr and Mfrs Designation CPH 142-455; Contractor Dwg and Part No. 142-455. | Waterproofing. |
| A104 | Shop Manufacture | GLASS: rectangular; 1-7/8 in. lg by 15/16 in. wide by .095 in. thk; bracket mounted; Mfr and Mfrs Designation CPH 142-603; Contractors Dwg and Part No. 142-603. | Dial window. |
| A105 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | ESCUTCHEON BACK PLATE: brass; black enamel; rectangular; 3 in. lg by .036 in. thk by 1 in. high; 2 mounting holes, .125 in. dia, spaced 2-3/4 in. C to C; Mfr and Mfrs Designation CPH-142-602; Contractor Dwg and Part No. 142-602. | P/O dial glass mounting. |
| A106 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | BRACKET AND BUSHING ASSEMBLY: p/o gear assy, pinion consists of 1 bushing and 1 bracket cadmium plate; rectangular; 1-3/4 in. lg by 1-19/32 wide by 7/16 in. high; 4 mounting holes 5/32 in. dia spaced 1/2 in. C to C; Mfr and Mfrs Designation CPH A-142-641; Contractors Dwg and Part No. A-142-641. | Mounts pinion gear shaft. |
| A107 | Shop Manufacture | GUIDE: brass; 3-5/8 in. lg by 1/2 in. wide by 1/8 in. thk; 2 mounting holes .144 in. dia. spaced 2-3/4 in. C to C; Mfr and Mfrs Designation CPH 142-658; Contractors Dwg and Part No. 142-658. | Guides chassis into case. |
| A108 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | SHIELD, CAPACITOR: brass rectangular; 2.781 in. lg by 1/4 in. thk by 3.413 in. high; screw mounted; Mfr and Mfrs Designation CPH 142-646; Contractors Dwg and Part No. 142-646. | Front shield for C101 and C102. |
| A109 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | SHIELD, CAPACITOR: brass; rectangular; 2.781 in. lg by 1/4 in. thk by 3.413 in. high; screw mounted; Mfr and Mfrs Designation CPH 142-647; Contractors Dwg and Part No. 142-647. | Rear shield for C101 and C102. |
| A110 | Low Failure item- if required, req- uisition from ESO referencing Nav Ships 900,180A | SHIELD, CAPACITOR: brass; rectangular; 2.718 in. lg by 2.437 in. wide by 3-5/32 in. high; bracket mounted; Mfr and Mfrs Designation CPH 142-645; Contractors Dwg and Part No. 142-645. | Top and side shield for C101 and C102. |
| C101 | ----- | CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type, double section; 25 to 800 mmf; straight line capacity tuning characteristic; overall dim. excluding shaft, 3-7/16 in. lg by 3-3/16 in. wide by 2-23/32 in. high; shaft dim. beyond bushing 1/4 in. lg by 1/4 in. dia; shaft adjustment 180° cw; bakelite insulated base; 4 solder lug type terminals; 4 tapped | Tunes secondary of T101. |

TABLE 7-2. TABLE OF REPLACEABLE PARTS. (cont.)

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|--|-----------------------------|
| C102 | ----- | <p>#8-32 holes on end plates; 24 aluminum plates first section; 28 aluminum plates second section; Mfr and Mfrs Designation CRK 887543; Contractor Dwg and Part No. 142-609.</p> <p>CAPACITOR, VARIABLE, AIR DIELECTRIC: plate meshing type, double section; 25 to 800 mmf; straight line capacity tuning characteristic; overall dim. excluding shaft. 4-1/4 in. lg by 3-3/16 in. wide by 2-23/32 in. high; shaft adjustment 180° cw; bakelite insulated base; 4 solder lug type terminals; 4 tapped #8-32 holes on end plate; 24 aluminum plates first section, 28 aluminum plates second section; Mfr and Mfrs Designation CRK 887544; Contractor Dwg and Part No. 142-608.</p> | Tunes secondary of T102. |
| C103 | For replacement use N16-C-59823-8441 | CAPACITOR, VARIABLE, AIR DIELECTRIC: plate mesh type, single section; 5 to 50 mmf; straight line capacity tuning characteristic; overall dim. excluding shaft. 1-17/32 in. lg by 1-5/16 in. wide by 1-7/32 in. high; shaft dim. beyond bushing, 1/2 in. lg by 13/64 in. dia; shaft adjustment 360°; stealite insulated base; 2 solder lug type terminals; 2 tapped #4-40 THD holes on plate; 20 brass nickel plated plates; Mfr and Mfrs Designation CHC APC-50; Contractor Dwg and Part No. 142-614. | Trimmer capacitor for C101. |
| C104 | ----- | Same as C103. | Trimmer capacitor for T102 |
| C105 | N16-C-58031-8824 | CAPACITOR, VARIABLE MIDGET, AIR DIELECTRIC: plate mesh type, single section; 1.5 to 5.1 mmf; straight line capacity tuned characteristic; overall dim. excluding shaft. 1-7/64 in. lg by 5/8 in. wide by 3/4 in. high. Shaft dim. beyond bushing 1/2 in. lg by .187 in. dia shaft adjustment 360° stealite insulated base; 2 solder lug type terminals; 1 mounting hole 1/4 in. dia; 180° locking bearing; 5 brass nickel plated plates; Mfr and Mfrs Designation CEJ-5M11; Contractor Dwg and Part No. 142-613. | Phase shift capacitor. |
| C106 | For replacement use N16-C-35390-2251 | CAPACITOR, FIXED, MICA DIELECTRIC: 60,000 mmf ±10%, 600v dcw; -200 to +200 ppm per °C; molded low loss bakelite case, 1-3/4 in. lg by 1-5/16 in. wide by 3/4 in. high 2 hole type terminal, mounted .144 in. dia; located on each end; Mfr and Mfrs Designation CD 9A-11060; Contractor Dwg and Part No. 142-632. | Phase shift capacitor. |
| C107 | N16-C-28553-1201 | CAPACITOR, FIXED, MICA DIELECTRIC: 100 mmf ±5% 500v dcw; -200 to +200 ppm per °C; molded | Isolation capacitor. |

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|--|--------------------------------------|
| C108 | N16-C-27656-2601 | low loss bakelite case, 3/4 in. lg by 7/16 in. wide by 3/16 in. high; 2 wire leads type terminal; located one on each end; terminal mounted; Spec JAN-C-5; Mfr and Mfrs Designation CM20C101J; Contractor Dwg and Part No. 142-627. CAPACITOR, FIXED, MICA DIELECTRIC: 51 mmf $\pm 5\%$, 500 v dcw; -100 to +100 ppm per $^{\circ}\text{C}$; molded low loss bakelite case, 11/16 in. lg by 7/16 in. wide by 3/16 in. high; 2 wire lead type terminals; located one on each end; terminal mounted; Mfr and Mfrs Designation CM20C510J; Contractor Dwg and Part No. 142-626. | Isolation capacitor. |
| C109 | ----- | Same as C107. | Isolation capacitor. |
| C110 | N16-C-27366-1201 | CAPACITOR, FIXED, MICA DIELECTRIC: 39 mmf $\pm 5\%$, 500v dcw +200 to -200 ppm per $^{\circ}\text{C}$; molded low loss bakelite case, 3/4 in. lg by 7/16 in. wide by 3/16 in. high; 2 wire lead type terminals; located one on each end; terminal mounted; Mfr and Mfrs Designation CM20C390J; Contractor Dwg and Part No. 142-684. | Isolation capacitor. |
| C111 | N16-C-31903-1089 | CAPACITOR, FIXED, MICA DIELECTRIC: 2200 mmf $\pm 5\%$, 500v dcw; -200 to +200 ppm per $^{\circ}\text{C}$; molded low loss bakelite case 3/4 in. lg by 3/4 in. wide by 1/4 in. high; 2 wire lead type terminals, located one on each end; terminal mounting; Mfr and Mfrs Designation CM30C-222J; Contractor Dwg and Part No. 142-685. | Dummy load capacitor. |
| E101 | Assemble from component parts | RECEPTACLE: consists of 2 binding posts; 2 bar shorting link. | Connection for Test Decade. |
| E101A | Shop Manufacture | BAR, SHORTING: link type; brass, bright alloy plated finish; overall dim., 1-1/32 in. lg by 7/16 in. wide by 1/32 in. thick; slotted ends to accommodate binding posts; Mfr and Mfrs Designation CAG-938-L; Contractor Dwg and Part No. 142-617. | Grounds transformer primary winding. |
| E101B | For replacement use N17-P-69135-8551 | POST BINDING: insulated; cap, brass, cadmium plate; base, phenolic; overall above surface 1-1/8 in. lg by 3/4 in. dia; mounting steel, 13/16 in. lg by 5/32 in. dia; 0.110 max. wire opening; connection in cap for Test Decade; Mfr and Mfrs Designation CAG 938-WB; Contractor Part and Dwg No. 142-628. | Part of E101. |
| E101C | N17-P-69136-7406 | POST BINDING: brass; cadmium plate; overall above surface; 1-1/8 in. lg by 5/32 in. dia; 0.110 max. cable opening; connection in cap for Test Decade; Mfr and Mfrs Designation CAG 938-P; Contractor Part and Dwg No. 142-630. | Part of E101. |

TABLE 7-2. TABLE OF REPLACEABLE PARTS. (cont.)

| SYM- -COL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|---------------------------------------|--|---|----------------------------------|
| E102 | ----- | Same as E101. | Connection for Test Decade. |
| E103 | N16-K-700362-208 | KNOB: round; black; accommodates a 1/4 in. dia, round shaft; has a 1/2 in. deep shaft hole, 2 #8-32 set screws; brass insert; w/o markings; 1-1/8 in. dia by 5/8 in. high; pointer located at base; 1-3/16 in. lg by .041 in. thick; Contractor Dwg and Part No. 142-621. | Antenna loop se- lector. |
| E104 | N16-K-700362-301 | KNOB: round; material; black; accommodates a 1/4 in. dia, round shaft; has a 5/8 in. deep shaft hole, 2 #10-32 set screws, brass insert w/o markings; 1-5/8 in. dia by 3/4 in. high; Contractor and Part No. 142-620. | Antenna tuning control. |
| E105 | Fabricate from N17-I-42455-9541 | PLATE, SPACER: linen base bakelite; rectangular; 15/16 in. lg by 1/8 in. wide by .040 in. thk; Mfr and Mfrs Designation CPH 142-629; Contractors Dwg and Part No. 142-629. | Dial window spacer. |
| E106 | Shop Manufacture | CLIP, ELECTRICAL: phosphor bronze; silver plate; 1/2 in. lg by 17/32 in. wide by 1 in. high; 2 mounting holes .144 in. dia. spaced 1/2 in. C to C; Mfr and Mfrs Designation CPH 142-659; Contractors Dwg and Part No. 142-659. | Grounds case to chassis. |
| E107 | For replacement use SNSN N17-I- 70226-1101 | INSULATOR, STANDOFF: linen base bakelite; wax impregnate; rectangular; 3/4 in. lg by 5/16 in. sq.; 1 tapped mounting hole ea end, 4-40 NC-2 by 5/16 in. deep; Mfr and Mfrs Designation CPH 142-666; Contractors Dwg and Part No. 142-666. | Mounts C105. |
| E108 | Shop Manufacture | INSULATOR SHEET, ELECTRICAL: linen base bakelite; wax impregnate; 1-1/8 in. sq by .062 in. thk; 2 mounting holes, .125 in. dia. spaced 1-3/16 C to C; Mfr and Mfrs Designation CPH 142-667; Contractors Dwg and Part No. 142-667. | Trimmer Insula- tor (C105). |
| E109 | For replacement use SNSN N17-I- 69158-6211 | INSULATOR STANDOFF: linen base bakelite; wax impregnated; rectangular; 3/4 in. lg by 3/8 in. sq.; 1 tapped mounting hole, 6-32 NC-2; Mfr and Mfrs Designation CPH 142-615; Contractors Dwg and Part No. 142-615. | Mounts C106. |
| E110 | Procured on de- mand by nearest Naval Shore Sup- ply Activity | POST, BINDING: polystyrene cap; brass base; 2-3/16 in. lg by 7/16 in. dia.; mounting stud 1-1/16 in. lg by 1/8 in. dia. 6-32 NC-2 thd; .110 max. wire hole; Mfr and Mfrs Designation CPH 142-678; Contractors Dwg and Part No. 142-678. | Part of Resistor Test Decade. |

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|---|---|---|
| E111 | For replacement use SNSN N17- C-73108-3595 | CONTACT, ELECTRICAL: brass; nickel plate; 5/8 in. lg by 3/8 in. dia.; 1-1/4-32 NC-2 mounting nut; Mfr and Mfrs Designation DCE 7740; Contractors Dwg and Part No. 142-669. | p/o dummy re- ceptacle for Re- sistor Test De- cade. |
| E112 | For replacement use SNSN N17- C-71408-3700 | CONTACT, ELECTRICAL: p/o resistor test decade assembly; brass; nickel plate; 1-1/8 in. lg by 5/16 in. dia.; 1 mounting nut, 6-32 thd; Mfr and Mfrs Designation CPH 142-633; Contractors Dwg and Part No. 142-633. | P/o resistor Test decade. |
| H101 | N16-R6566-2199 | RING, RETAINER: p/o gear pinion assy; carbon spring steel; parkerize; round; .225 ID by .025 in. thk; Mfr and Mfrs Designation Waldes Kohinoor, Inc. 5100-25; Contractors Dwg and Part No. 2-134. | Holds pinion shaft to its mounting. |
| H102 | Low Failure item- if required, req- uisition from ESO referencing Nav- Ships 900,180A | DRIVER: p/o of gear assembly; gear; brass; round; .437 in. dia. by 9/32 in. high; 1 mounting hole .159 in. dia; Mfr and Mfrs Designation CPH 142-691; Contractors Dwg and Part No. 142-691. | Rotates dogs on pinion shaft. |
| H103 | Procured on de- mand by nearest Naval Shore Sup- ply Activity | POST, SPACING: Brass; cadmium plate; cylindrical; 1/4 in. OD. by .144 ID. by 3/16 in. high; Mfr and Mfrs Designation CPH 142-678; Contractors Dwg and Part No. 142-648. | Terminal Board spacer. |
| H104 | Shop Manufacture | STUD: brass; cadmium plate; 1 in. lg by 1/4 in. dia; 1 tapped hole one end, 5-40 NC-2 by 3/8 in. deep; Mfr and Mfrs Designation CPH 142-657; Contractors Dwg and Part No. 142-657. | Guides chassis into cabinet. |
| H105 | Shop Manufacture | STANDOFF: brass; silver plate; rectangular; 3/4 in. lg by 3/8 in. sq; 1 tapped mounting hole 6-32 NC-2; Mfr and Mfrs Designation CPH 142-616; Contractors Dwg and Part No. 142-616. | Mounts C106. |
| H106 | Procured on de- mand by nearest Naval Shore Sup- ply Activity | CLAMP, ELECTRICAL: brass; nickel plate; 1 mounting hole, .144 ID; 15/16 in. lg by 3/8 in. wide by 5/16 in. high; designed to hold 5/16 in. dia. cable; Mfr and Mfrs Designation DCE H506-F; Contractors Dwg and Part No. 142-683. | Cable Clamp. |
| H107 | Procured on de- mand by nearest Naval Shore Sup- ply Activity | CLAMP, ELECTRICAL: brass; nickel plate; 1 mounting hole, .144 ID; 5/8 in. lg by 3/8 in. wide by 1/8 in. high; designed to hold 1/8 in. cable; Mfr and Mfrs Designation No. H502-F; Contractors Dwg and Part No. 142-682. | Cable Clamp. |
| H108 | N42-F-3615-400 | FASTENER, DZUS: knob type; steel, cadmium plate; 5/8 in. dia. by 15/16 in. high; Mfr and Mfrs Designation Dzus Fastener Co. No. KJ4-40X-247; Contractors Dwg and Part No. 142-636. | Retains chassis in case. |

TABLE 7-2. TABLE OF REPLACEABLE PARTS. (cont.)

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|---|---|----------------------------|
| J101 | ----- | CONNECTOR, RECEPTACLE: 3 round female contacts; polarized straight type; overall 1-13/32 in. lg by 2-1/4 in. dia; cylindrical body; aluminum alloy, anodized finish; molded phenolic insert; Mfr and Mfrs Designation CPH-89-228-3S; Contractor Dwg and Part No. 89-228-XX. | Input receptacle. |
| J102 | N17-C-73411-2793 | CONNECTOR, RECEPTACLE: 1 round banana type male contact; straight type; overall 1-9/16 in. lg by 7/8 in. wide across flats or hex nut; radio frequency connector; cylindrical body; brass; silver plate lock type; phenolic insert; Contractor Dwg and Part No. 142-622; Mfr and Mfrs Designation CN-49120. | Output connector. |
| J103 | ----- | CONNECTOR, RECEPTACLE: 2 round female contacts; polarized straight type; overall 1-1/2 in. lg by 1-7/16 in. dia; cylindrical body; aluminum alloy, anodized finish; molded phenolic insert; Mfr and Mfrs Designation CPH A-142-456; Contractor Dwg and Part No. A-142-456. | Antenna output connector. |
| J104 | N17-C-73108-5906 | CONNECTOR, RECEPTACLE: 1 round female contact; straight type; overall 7/8 in. lg by 1 in. sq; radio frequency connector; cylindrical body w/ square mounting flange; brass; silver plated; teflon insert; 4 mounting holes, 7/8 in. C to C, .125 in. dia; Mfr and Mfrs Designation UG-58A/U; Contractor Dwg and Part No. 82-97. | Output connector. |
| L101 | ----- | COIL, RF: loading coil, 65 turns, stationary universal windings; 20-38 Litz wire; unshielded. 475 to 525 uh; 1-1/2 in. lg by 1-1/2 in. wide by 1-13/16 in. high; 2 tapped mounting holes 1.187 in. C to C; adjustable powdered iron core tuning; Mfr and Mfrs Designation CAD HLQ-85, Contractor Dwg and Part No. 142-610. | Loading coil. |
| N101 | Low Failure item- if required, req- uisition from ESO referencing Nav- Ships 900,180A | DIAL SCALE: application not indicated on dial; 14 to 38 kc counterclockwise; graduated in 25 scale divisions; approximately 169.5 deg arc; circular shape, 3-1/2 in. dia. by 1/2 in. thick; secured to shaft by two #6-32 set screws; anodized aluminum; black enamel characters and markings; Mfr and Mfrs Designation CPH-142-605; Contractor Dwg and Part No. A-142-605. | Frequency indi- cating. |
| O101 | ----- | GEAR ASSEMBLY; speed reducing, anti-backlash; consists of 2 brass spur gears and 1 brass hub; gear dia. 3-9/16 in; 1/16 in. thk; 112 teeth; 32 D.P.; 14-1/2 degree pressure angle; 3 spring slots lo- | Dial drive. |

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|---|--|
| O102 | Low Failure item- if required, req- uisition from ESO referencing Nav- Ships 900, 180A | cated 120 degrees apart: hub dia. 1 inch; 1/4 inch clearance hole to accommodate capacitor shaft; 2 No. 6-32 Allen-head set screws 90 degrees apart to secure capacitor shaft; American Phenolic Part No. 142-604. GEAR ASSEMBLY, PINION: consists of 1 pinion; 4 dogs, 1 dog stop, 1 spring washer, 1 retaining ring, 1 bracket and bushing assembly, 1 driver; Mfr and Mfrs Designation CPH A-142-692; Contractors Dwg and Part No. A-142-692. | Dial drive pinion gear. |
| O103 | For Reference Only | "O" RING: synthetic rubber; round; .114 ID. by .073 in. wide by .070 in. thk; Mfr and Mfrs Designation CPH 169-014-01; Contractor Dwg and Part No. 169-014-01. | Part of J103. |
| O104 | ----- | GEAR: p/o gear assembly pinion; brass, cadmium plate; 2-27/32 in. lg by 1/2 in. dia; Mfr and Mfrs Designation CPH 142-642; Contractors Dwg and Part No. 142-642. | Drives the dial gear. |
| O105 | ----- | GASKET: synthetic rubber; single hole; round; 1 in. ID. by 1-3/4 in. OD. by 3/8 in. thk; 1.390 dia. groove 5/16 in. deep; Mfr and Mfrs Designation CPH 142-451; Contractors Dwg and Part No. 142-451. | Part of P103. |
| O106 | For Reference only | "O" RING: synthetic rubber; round; 1.171 in. ID. by .142 in. wide by .139 in. thk; Mfr and Mfrs Designation CPH 169-017; Contractors Dwg and Part No. 169-017. | Part of P103. |
| O107 | Shop Manufacture | COUPLING ASSEMBLY: brass; nickel plate; round; 1-1/4 in. dia. by 11/16 in. high; shaft mounted; Mfr and Mfrs Designation CHC, FNC-46-S; Contractors Dwg and Part No. 142-643. | Flexible connection between C101 and C102. |
| P101 | ----- | CONNECTOR, PLUG: 3 round male contacts; polarized straight type; overall 4-1/2 in. lg by 2.031 in. dia. cylindrical body; aluminum alloy, anodized finish; molded phenolic insert; 1-1/8 in. dia. max. cable opening; Mfr and Mfrs Designation CPH-89-128-3P(17) Contractor Dwg and Part No. 89-128-XX. | Input connector. |
| P102 | N17-C-71120- 4869 | CONNECTOR, PLUG: 1 round female contact; straight type; overall 2-7/8 in. lg by 1-1/16 in. dia; radio frequency connector; cylindrical body; brass silver plate phenolic; Mfr and Mfrs Designation CN-49121; Contractor Dwg and Part No. 142-625. | Output connector. |
| P103 | ----- | CONNECTOR, PLUG: 2 round male contacts; polarized straight type; overall 6-1/2 in. lg by 3-5/8 in. dia; cylindrical body; aluminum, anodized finish; | Input connector. |

TABLE 7-2. TABLE OF REPLACEABLE PARTS. (cont.)

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|--|--|
| P104 | N17-C-71416- 2550 | lock type; molded phenolic insert; 1-1/16 in. dia max. cable opening; Mfr and Mfrs Designation CPH A-142-461; Contractor Dwg and Part No. A-142-461. CONNECTOR, PLUG: 1 round male contact; straight type; overall 1-7/8 in. lg by 13/16 in. dia. radio frequency connector; cylindrical body, brass silver plate; Mfr and Mfrs Designation UG-21B/U; Contractor Dwg and Part No. 82-61. | Output connector. |
| R101 | ----- | RESISTOR, FIXED, WIRE-WOUND: non-inductive winding; 0.1 ohm 1%, 1/2 watt, ±0.0022 temp coef. operating temperature; body dim. excluding terminals 1 in. lg by 9/16 in. dia; cement coating, resistant to humidity and salt water immersion; 2 lug type terminals 3/8 in. lg by 1/4 in. wide by .016 in. thick; requires two brackets, mounted by bolt through center; Mfr and Mfrs Designation CIR WWJ4; Contractor Dwg and Part No. 142-624. | Part of resistor test decade assembly. |
| R102 | For replacement use N16-R-78701-2229 | RESISTOR; FIXED, WIRE-WOUND: non-inductive winding; 10 ohm, 1%, 1/2 watt. ±0.0022 temp coef. operating temperature; body dim. excluding terminals, 1 in. lg by 9/16 in. dia; cement coating, resistant to humidity and salt water immersion; 2 lug type terminals 3/8 in. lg by 1/4 in. wide by .016 in. thick; requires two brackets, mounted by bolt through center; Mfr and Mfrs Designation CIR WWJ4; Contractor Dwg and Part No. 142-623. | Part of resistor test decade. |
| R103 | Assemble from component parts | RESISTOR, TEST DECADE: consists of 2 binding posts, 1 10 ohm, 0.1 ohm resistor, 2 banana plugs, 2 insulators; Mfr and Mfrs Designation CPH A-142-665; Contractors Dwg and Part No. A-142-665. | Used for test purposes. |
| S101 | N16-S-15806-40 | SWITCH, ROTARY: 1 section; 12 max. number of switch position; non pile up type, 2 pole; spring brass, silver plated contacts; steatite insulation; 2-1/16 in. lg by 1-5/8 in. wide by 1-7/8 in. high; bushing mounted; solder lug type; shaft mfrd 2-1/8 in. lg, shaft cut to 9/16 in. lg; break before make; Mfr and Mfrs Designation CBN-25-5; Contractor Dwg and Part No. 142-612. | Antenna loop selector switch. |
| T101 | ----- | TRANSFORMER, RADIO FREQUENCY: 2 windings, single layer wound; primary inductance 350 microhenries at 1000 cycles per sec., secondary inductance 228.12 millihenries at 1000 cycles per sec; primary 40 turns, No. 20 formvar wire, secondary 265 turns No. 29 formvar; 2-9/16 in. wide, 2-9/16 in. high; air core; no. 5 pierced terminals, | Loop input transformer. |

| SYM- BOL DES- IGNA- TION | STOCK NUMBER SIGNAL CORPS STANDARD NAVY AIR FORCE | NAME OF PART AND DESCRIPTION | LOCATING FUNCTION |
|--------------------------------------|--|--|--|
| T102 | ----- | located on bottom; hermetically sealed Mfr and Mfrs Designation CAD Q85A; Contractor Dwg and Part No. 142-611. Same as T101. | Loop input trans- former. |
| TB101 | Shop Manufacture | TERMINAL BOARD: bakelite, 6 turret type terminals; w/o barriers; overall dim. 2-1/2 in. lg by 1-7/8 in. wide by 3/32 in. thick; four mounting 1/8 in. dia; Mfr and Mfrs Designation CPH A-142-618; Contractor Dwg and Part No. A-142-618. | Component mounting. |
| W101 | Assemble from Component parts | CABLE ASSEMBLY: consists of P102, P104, W101A; 1 male connector ea end; Mfr and Mfrs Designation CPH A-142-679; Contractors Dwg and Part No. A-142-679. | Couples the out- put of antenna coupler to input of the receiver. |
| W101A | N15-C-12200-775 | CABLE: RF; type RG-11/U cable; coaxial; 75 ohm impedance; 4000v RMS; 7/26 tinned copper wire; black vinyl jacket; polyethylene dielectric; copper shielded; 36 in. lg by .405 in. dia. Mfr and Mfrs Designation CPH 21-007; Contractors Dwg and Part No. 21-007. | Part of W101. |
| W102 | Assemble from Component parts | CABLE ASSEMBLY: consists of P101, P103, W102A; 1 male connector ea end; Mfr and Mfrs Designation CPH A-142-458; Contractors Dwg and Part No. A-142-458. | Couples antenna to coupler. |
| W102A | ----- | CABLE: RF; type RG-160/U special purpose; polyethylene dielectric; copper shielded; 75 ft lg; Mfr and Mfrs Designation CPH 21-493; Contractors Dwg and Part No. 21-493. | Part of W102. |

TABLE 7-3. MAINTENANCE PARTS LIST.

| SYMBOL DESIGNATION | ITEM NAME | PART NUMBER | QUANTITY | |
|--------------------|---------------|-------------|-----------------------------|-------------------------|
| | | | EQUIPMENT MAINTENANCE PARTS | STOCK MAINTENANCE PARTS |
| A103 | Gasket | 142-451 | 0 | 30 |
| C101 | Capacitor | 142-609 | 0 | 10 |
| C102 | Capacitor | 142-608 | 0 | 10 |
| J101 | Connector | 89-228-3S | 1 | 34 |
| J103 | Connector | 142-456 | 0 | 30 |
| L101 | Coil | 142-610 | 0 | 22 |
| O101 | Gear assembly | 142-604 | 0 | 30 |
| O102 | Gear assembly | 142-642 | 0 | 30 |
| P101 | Connector | 89-128-3P | 1 | 34 |
| P103 | Connector | A-142-461 | 0 | 20 |
| R101 | Resistor | 142-624 | 1 | 34 |
| T101 | Transformer | 142-611 | 1 | 22 |

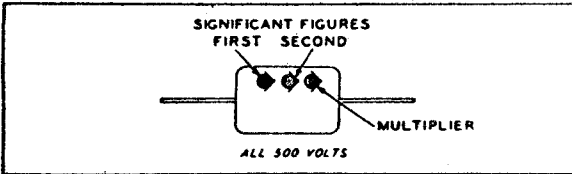
TABLE 7-4. CROSS REFERENCE PARTS LIST.

| JAN (or AWS) DESIGNATION | KEY SYMBOL | NAVY TYPE | KEY SYMBOL |
|--------------------------|------------|-----------|------------|
| CM20C101J | C107 | 49120 | J102 |
| CM20C510J | C108 | | |
| CM20C390J | C110 | 49121 | P102 |
| CM30C222J | C111 | | |
| RG-11/U | W101A | | |
| RG-160/U | W102A | | |
| UG-58A/U | J104 | | |
| UG-21B/U | P104 | | |

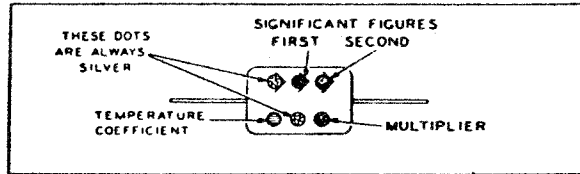
TABLE 7-5. COLOR CODES.

CAPACITOR COLOR CODES

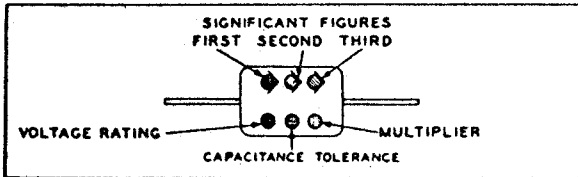
RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



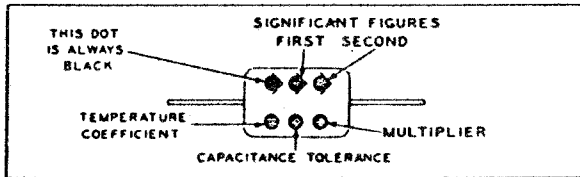
JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



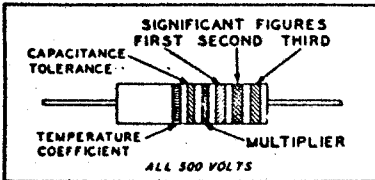
RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



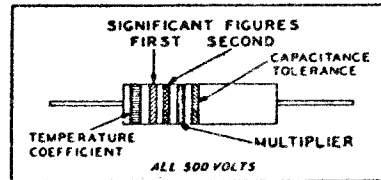
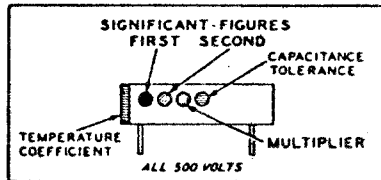
JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS



JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

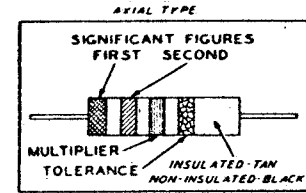


RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

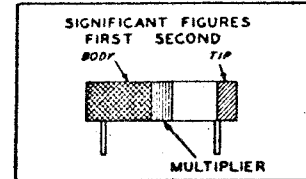
| RESISTORS | | | | CAPACITORS | | | | |
|-----------|------------|--------------------|----------|---------------------------------|-------------------------------|------------------------|----------------|-------------------------|
| TOLERANCE | MULTIPLIER | SIGNIFICANT FIGURE | COLOR | MULTIPLIER | | | VOLTAGE RATING | TEMPERATURE COEFFICIENT |
| | | | | RMA MICA AND CERAMIC-DIELECTRIC | JAN MICA AND PAPER-DIELECTRIC | JAN CERAMIC DIELECTRIC | | |
| | 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 | 1000 | 1000 | 1000 | 300 | D |
| | 10000 | 4 | YELLOW | 10000 | | | 400 | E |
| | 100000 | 5 | GREEN | 100000 | | | 500 | F |
| | 1000000 | 6 | BLUE | 1000000 | | | 600 | G |
| | 10000000 | 7 | VIOLET | 10000000 | | | 700 | |
| | 100000000 | 8 | GRAY | 100000000 | | 0.01 | 800 | |
| | 1000000000 | 9 | WHITE | 1000000000 | | 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

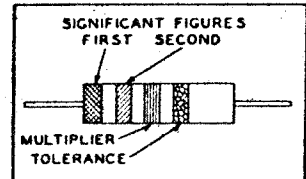


RADIAL TYPE



JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS

AXIAL TYPE INSULATED



RADIAL TYPE NON-INSULATED

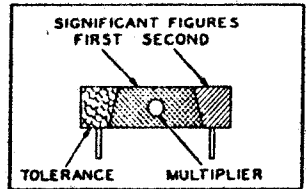


TABLE 7-6. LIST OF MANUFACTURERS.

| MANUFACTURER | BUREAU OF SHIPS CODE | NAVY CODE |
|---|-------------------------|--------------|
| American Phenolic Corporation (Amphenol) Chicago, Illinois | CPH | AMP |
| Central Radio Laboratory (Centralab) Milwaukee, Wisconsin | CBN | CN |
| Cornell-Dubilier South Plainfield, New Jersey | CD | CLD |
| Davies, Harry Moulding Company Chicago, Illinois | | DHM |
| Dzus Fastener Company Babylon, New York | | |
| General Cement Rockford, Illinois | | DCE |
| General Radio Company Cambridge, Massachusetts | CAG | GER |
| Hammerlund Manufacturing Company New York, New York | CHC | HMM |
| International Resistance Company (IRC) Philadelphia, Pennsylvania | CIR | IRC |
| E. F. Johnson Company Waseca, Minnesota | CEJ | JON |
| National Electrical Machine Works Silver Springs, Maryland | CN | NEMS |
| Radio Condenser Company Camden, New Jersey | CRK | RAD |
| Standard Coil Products Company Chicago, Illinois | CADH | SXA |
| Waldes Kohinoor Inc. Long Island City, New York | | |

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