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Serial No. 25542

FINAL INSTRUCTION BOOK

for *AN/ARR-1 and Navy Model ZB-3 Aircraft Radio Homing Adapter Equipment and Portable Test Oscillator

Manufactured for U. S. Navy Department

Bureau of Ships

Contract NOs. 84433, Dated March 29, 1941

by

WESTERN ELECTRIC COMPANY
Kearny, N. J.
U. S. A.

General

During manufacture, AN nomenclature was applied to this equipment and to the major units. The *AN/ARR-1 Aircraft Radio Receiving Equipments bearing serial numbers 17857 and succeeding numbers, except for spare parts, are identical to the ZB-3 Homing Adapter Equipments bearing serial numbers 7857 to 17856, inclusive. The designation changes are shown in tabular form below.

Table B (page 2) shows the interchangeability of units of this equipment series.

Substitution of Components

Procurement difficulties during the time of manufacture occasionally made it necessary to use components of alternate suppliers in various units of the equipment. These alternates do not impair or alter the operation or performance of the equipment in any way. If they are supplied in the spare parts box, these alternates may be used interchangeably with the original items on all equipments manufactured on contract NOs-84433.

Cables

In lieu of rubber-covered cable for the three-conductor and eight-conductor power cables, Vinylite-covered cables are supplied with equipments bearing serial numbers 17857 and succeeding numbers. (Vinylite-covered cables and the corresponding plugs also were supplied with some of the latter units of the ZB-3 equipments.) The four-conductor cable replacing the three-conductor cable is of slightly larger diameter than that supplied with equipments bearing serial numbers 1 to 4692 and 7857 to 17856, inclusive, and require the use of plugs having a larger opening to accommodate the cable. However, the outside diameter of the plug, pin spacing, and location of pins are identical with those supplied with equipments bearing serial numbers 1 to 4692 and 7857 to 17856, inclusive, and the cordage consisting of plug(s) and cable is interchangeable as an assembly. (See note 3, Table B.) The Vinylite-covered cable will be supplied in the future for both the ZB-3 and the *AN/ARR-1 equipments in the interest of conserving rubber.

Relay

The relay used in the CW-29173 Switching Relay in serial numbers 17856 and succeeding numbers may be per ESO-684312–1 or BO-31815–1 (rotary-type relay) or BO-31814–5 (rotary-type relay). If the rotary-type units are used, the wiring diagram shown in Fig. A1 should be used.

Should it be necessary to replace the latching-type relay K301 in the -29173 Switching Relay, it is recommended that the unit be converted to the equivalent of the *RE-1A/ARR-1 unit. The differences between the -29173 and the *RE-1A/ARR-1 relays are the substitution of the rotary-type relay for the latching-type relay, the addition of a resistance to limit the current through the relay in 24-volt systems, and the addition of a second communication antenna binding post. Information for converting the -29173 relay to the *RE-1A/ARR-1 is shown in Fig. A4.

Relay Adjustment

In some installations, the contacts of the latching-type relay K301 (ESO-684312–1) may produce interference with the reception of the communication receiver. To alleviate this condition, the relay adjustment has been modified as follows: The working contact pressure of each armature should be adjusted to 100 grams minimum as measured at the point of contact, and the contact gap should be set to 0 015 inch by bending the

Table A. Designation Changes

Unit	*Serial Numbers 7857 to 17856, Inclusive*	*Serial Numbers 17857 and Succeeding Numbers*
Equipment	Model ZB-3	*AN/ARR-1
Adapter	CW-69076	*R-1/ARR-1
Switching Relay	CW-29173	*RE-1/ARR-1 or *RE-1A/ARR-1 (See notes 7 and 8, page 3)
Pilot's Control Box	CW-23214	*C-1/ARR-1
Portable Test Oscillator	CW-60013	*TS-1/ARR-1
Adapter Mounting Plate		*MT-2/ARR-1
Relay Mounting Plate		*MT-3/ARR-1
Control Box Mounting Plate		*MT-1/ARR-1

Table B. Table of Interchangeability

Interchangeability Data for Navy Model ZB Series Equipment and United Nations Model *AN/ARR-1

Item	*Identification*	*ZB*	*ZB-1*	*ZB-2*	*ZB-3*	**AN/ARR-1*
Radio Receiver	-69060	†	†			
Radio Receiver	-69076			†	†	‡
Radio Receiver	*R-1/ARR-1			‡	‡	†
Antenna Switching Relay	-29093	†	†			
Antenna Switching Relay	-29173			†	†	‖
Switching Relay	*RE-1/ARR-1 or *RE-1A/ARR-1			‖	‖	†
Pilot's Control Box	-23214	†	†	†	†	‡
Control Box	*C-1/ARR-1	‡	‡	‡	‡	†
Portable Test Oscillator	-60013	†	†	†	†	‡
Test Oscillator	*TS-1/ARR-1	‡	‡	‡	‡	†
Three-conductor Power Cable	(Rubber)	†	†	†	†	§
Four-conductor Power Cable	(Vinylite)	§	§	§	§	†
Eight-conductor Power Cable	(Rubber)	†	†	†	†	‡
Eight-conductor Power Cable	(Vinylite)	‡	‡	‡	‡	†
Flexible Concentric Transmission Line	(Beaded)	†	†			
Flexible Concentric Transmission Line	CASSF-50-1 or WC-549 (solid)			†	†	†
Rigid Concentric Transmission Line	ES-677960-3	†	†			
Transmission Line Plug	-49137	†	†			
Transmission Line Plug	-49195 or PL-259 or PL-259A			†	†	†
Transmission Line Connector	ES-677956-2	†	†			
Three-contact Power Plug	-49132	†	†	†	†	§
Three-contact Power Plug	-49232	§	§	§	§	†
Four-contact Power Plug	-49133	†	†	†	†	§
Four-contact Power Plug	-49233	§	§	§	§	†

upper stationary contacts with a pair of pliers. In making this adjustment, care should be taken to see that the contact arms are not twisted.

Fabrication of Power Cables

The fabrication of the Vinylite-covered power cables is similar to that of the rubber-covered cables for which detailed instructions are given in the main text of this book. Colors and connections for the new cables are shown in Fig. A2.

Outline Dimensions

The mounting plates for the CW-69076 Adapter Unit, the CW-29173 Switching Relay Unit, and the CW-23213 Pilot's Control Box were not specified as major units in the ZB-3 Homing Adapter Equipment and hence the over-all dimensions of these items were included with those of the major item with which they were associated. In the *AN/ARR-1 Equipment, the mounting plates have been specifically designated; outline dimensions for these units are shown in Fig. A3.

Alternate Components

Table C shows alternate components which have been approved for use on contract NOs-84433; these alternate components may be used interchangeably with those shown in Section V of the main text of this book. As an aid in identifying the alternate part, the first item of each part is that supplied initially (as shown in Section V of the main text), and all succeeding items may be used interchangeably with the first. Table C begins on page 4 of this section (Addenda).

Manufacturers and Addresses

The following manufacturers and addresses should be added to the list given in Table VI of the main text:

Navy Prefix	*Code Letter in Table C*	*Manufacturer*
	Q	Allen-Bradley Co., Milwaukee, Wis.
	R	Oak Manufacturing Co., Chicago, Ill.
	S	Whitney Blake Co., New Haven, Conn.

Table B. Table of Interchangeability (Continued)

Item	*Identification*	*ZB*	*ZB-1*	*ZB-2*	*ZB-3*	**AN/ARR-1*
Five-contact Power Plug	-49134	†	†	†	†	§
Five-contact Power Plug	-49234	§	§	§	§	†
Eight-contact Power Plug	-49062	†	†	†	†	†
Slip Cover for Homing Adapter	ES-678397-1	†	†	†	†	†
Slip Cover for Portable Test Oscillator	ES-678398-1	†	†	†	†	†
Mounting Plate for Homing Adapter	ES-677740-2	†	†	†	†	‡
Mounting Plate for Radio Receiver	*MT-2/ARR-1	‡	‡	‡	‡	†
Mounting Plate for Switching Relay	ES-677309-2	†	†	†	†	‡
Mounting Plate for Switching Relay	*MT-3/ARR-1	‡	‡	‡	‡	†
Mounting Plate for Pilot's Control Box	ES-677304-3	†	†	†	†	‡
Mounting Plate for Control Unit	*MT-1/ARR-1	‡	‡	‡	‡	†
Vacuum Tubes for Homing Adapter	-954	†	†	†	†	†
Vacuum Tubes for Portable Test Oscillator	-955	†	†	†	†	†

NOTES:

1. † Indicates item was supplied with the equipment shown at the head of the column.
2. ‡ Indicates item is interchangeable with the item furnished with the equipment shown at the head of the column.
3. § Indicates interchangeability, but Vinylite-covered cables require a 1/10-inch larger hole in rear of plug than rubber cables.
4. ‖ Indicates item is directly interchangeable only on 24-volt aircraft employing a communications antenna other than the whip (stub or mast) type. When interchanging -29173 and *RE-1/ARR-1 on 12-volt aircraft, it will be necessary to ascertain that the cable conductor carrying the actuating current to the K301 relay coil connects to terminal 71 of plug P505 for -29173 and to terminal 70 of P505 for *RE-1/ARR-1. If -29173 is substituted for *RE-1/ARR-1 on aircraft employing a whip- or mast-type communications antenna, it may be necessary to short-circuit the 150-micromicrofarad fixed capacitor, C301, in the -29173 switching relay.
5. In some installations the following parts are not used, and one eight-contact plug -49062 is changed by shorting terminals 41 to 42, 48 to 49, and 40 to 52: Switching Relay and Mounting Plate; Control Box and Mounting Plate; Four-Contact Power Plugs: one Eight-Contact Power Plug.
6. Where the receiver unit is mounted on top of an RU or ARB receiver, no mounting plate is required.
7. The *RE-1/ARR-1 Switching Relays bearing serial numbers 17857 to 18143, inclusive, have been supplied with the latching-type relay K301 per ESO-684312-1.
8. The *RE-1/ARR-1 Switching Relays bearing serial numbers 18144 to 18593, inclusive, and *RE-1A/ARR-1 Antenna Switching Relay units, are interchangeable as a unit.

   The *RE-1/ARR-1 unit uses a rotary-type relay with a 115-ohm holding winding. The *RE-1A/ARR-1 unit uses a rotary-type relay with a 65-ohm holding winding.

IDENTIFICATION:

Three-digit numbers are type numbers of vacuum tubes.

Five-digit numbers are Navy type numbers.

Es- numbers are Western Electric Company drawing numbers.

Table C. Alternate Components

Designation	*Description*	*Navy Type Number*	*Mfr.*	*American War Standards or Mfr's. Type No.*	*Drawing or Part Number*
C101.2	Capacitor, ceramic, 5 ± ¼ μμf, 500 v d-c working	-481173–5	B	P120K	ESO-677726–2 (See note 1, page 6.)
	or				
	Capacitor, ceramic, 5 ± ½ μμf, 500 v d-c working	-481173–10	B	P120K	ESO-677726–5 (See note 1, page 6.)
C103	Capacitor, ceramic, 30 ± 1 μμf, 500 v d-c working	-481175–3	B	N680K	ESO-677726–4
	or				
	Capacitor, ceramic, 30 ± 3 μμf, 500 v d-c working	-481175–10	B	N680K	ESO-677726–6
C104	Same as C103				
C105	Same as C103				
C106	Same as C101.2				
C107	Same as C101.2				
C109	Same as C101.2				
C110	Same as C103				
C111	Same as C103				
C112	Same as C101.2				
C113	Same as C101.2				
C116	Capacitor, ceramic, 30 ± 1 μμf, 500 v d-c working	-481175–3	B	N680K	ESO-677726–4
	or				
	Capacitor, ceramic, 30 ± 3 μμf, 500 v d-c working	-481175–10	B	N680K	ESO-677726–6
C117	Same as C103				
C119	Same as C101.2				
C120	Same as C116				
C121	Same as C103				
C122	Capacitor, mica, 0.006 μf ± 10%, 300 v d-c working				
	or				
	Capacitor, mica, 0.006 μf ± 20%, 300 v d-c working				
	or				
	Capacitor, paper, 0.006 μf ± 20%, 600 v d-c working		A	404A	ESO-696599–1
	or				
	Capacitor, mica, 0.0068 ± 20%, 300 v d-c working			CM35B682M	ESO-696[illegible]
C123	Same as C116				
C124	Same as C116				
C125	Same as C122				
C126	Same as C103				
C127	Same as C103				
C128	Same as C103				
C129	Same as C103				
C130	Same as C116				
C131	Same as C116				

Table C. Alternate Components (Continued)

Designation	*Description*	*Navy Type Number*	*Mfr.*	*American War Standards or Mfr's. Type No.*	*Drawing or Part Number*
C132	Same as C116				
C133	Same as C101.2				
C301	Capacitor, mica, 150 μμf ± 10%, 500 v d-c working	-48689-B10	C	5WLS CM20B151K	ESO-677316-1 ESO-696599-7
C401	Same as C116				
C402	Same as C116				
C403	Same as C116				
C404	Same as C122				
C405	Capacitor, mica, 50 μμf ± 10%, 500 v d-c working	-48895-B10	C	5WLS	ESO-677316-2
	or				
	Capacitor, ceramic, 50 μμf ± 10%, 500 v d-c working		B	NO30M50	ESO-696600-1
	or				
	Capacitor, mica, 50 μμf ± 10%, 500 v d-c working			CM20B500K	ESO-696599-9
C407	Same as C122				
C408	Same as C116				
C409	Same as C116				
R101	Resistor, composition, 200,000 ohms ± 10%, ½ watt	-63360-10	E Q	BT-½ EB	ESO-677726-14 ESO-696600-15
R102	Resistor, composition, 30,000 ohms ± 10%, ½ watt	-63360-10	E Q	BT-½ EB	ESO-677726-12 ESO-696600-12
R103	Resistor, composition, 50,000 ohms ± 10%, ½ watt	-63360-10	E	BT-½	ESO-677726-13
	or				
	Resistor, composition, 50,000 ohms ± 20%, ½ watt		E Q	BT-½ EB	ESO-677726-30 ESO-696600-13
R104	Resistor, composition, 1000 ohms ± 10%, ½ watt	-63360-10	E Q	BT-½ EB	ESO-677726-11 ESO-696600-9
R105	Same as R102				
R106	Same as R101				
R107	Same as R103				
R108	Same as R104				
R109	Same as R101				
R110	Same as R102				
R111	Resistor, composition, 20,000 ohms ± 10%, ½ watt	-63360-10	E	BT-½	ESO-677726-16
	or				
	Resistor, composition, 20,000 ohms ± 20%, ½ watt		E Q	BT-½ EB	ESO-677726-19 ESO-696600-11
R112	Resistor, wire wound, 10 ohms ± 10%, ½ watt	-63678-10	E	BW-½	ESO-677726-22
	or				
	Resistor, wire wound, 10 ohms ± 20%, ½ watt	-63678-20	E	BW-½	ESO-677726-23
	or				
	Resistor, composition, 10 ohms ± 20%, ½ watt		Q	EB	ESO-696600-7
R113	Same as R102				
R114	Same as R101				

Table C. Alternate Components (Continued)

Desig-nation	*Description*	*Navy Type Number*	*Mfr.*	*American War Standards or Mfr's Type No.*	*Drawing or Part Number*
R115	Resistor, wire wound, 50 ohms ± 10%, ½ watt	-63678–10	E	BW-½	ESO-677726–21
	or				
	Resistor, wire wound, 50 ohms ± 20%, ½ watt	-63678–20	E	BW-½	ESO-677726–24
	or				
	Resistor, composition, 50 ohms ± 20%, ½ watt		Q	EB	ESO-696600–8
R116	Resistor, composition, 100,000 ohms ± 10%, ½ watt	-63360–10	E	BT-½	ESO-677726–17
	or				
	Resistor, composition, 100,000 ohms ± 20%, ½ watt		E	BT-½	ESO-677726–31
			Q	EB	ESO-696600–14
R117	Same as R104				
R401	Same as R103				
R402	Same as R104				
R403	Same as R103				
R404	Same as R104				
R405	Resistor, composition, 10,000 ohms ± 10%, ½ watt	-63360–10	E	BT-½	ESO-677726–15
	or				
	Resistor, composition, 10,000 ohms ± 20%, ½ watt		E	BT-½	ESO-677726–18
			Q	EB	ESO-696600–10
R406	Same as R104				
K301	Relay, latching, SPDT auxiliary contacts for operation from 12 v or 24 v		I	CX-3190B	ESO-684312–1
	or				
	Relay, rotary, 115-ohm holding winding		R		BO-31815–1 (See note 4.)
	or				
	Relay, rotary, 65-ohm holding winding		R		BO-31815–5
	Power cable, four-conductor (used with P505, P506, P507, and P508)		S	AR-4	ESA-696118
R301	Resistor, wire wound, 100 ohms ± 10%, 7.4 watts	-631575–10	E	MW-2	ESO-695589–8 (See note 2.)
	or				
	Resistor, wire wound, 60 ohms ± 10%, 7.4 watts	-631574–10	E	MW-2	ESO-695589–7 (See note 3.)
	Power cable, eight-conductor (used with P509 and P510)		S	AR-8	ESA-696117
The power plugs used with the Vinylite-insulated power cable are as follows:					
P505	Plug 2, four-contact straight type	-49233	K	LU-400S4	ESO-696429-2
P506	Same as P505				
P507	Plug 3, three-contact straight type	-49232	K	LU-400S3	ESO-696429–3
P508	Plug 74, five-contact straight type	-49234	K	LU-400M5	ESO-696429–1

NOTES:

1. Capacitor C101.2 is not used on *R-1/ARR-1 Receiver (Adapter).
2. Used only in *RE-1/ARR-1 Antenna Switching Relay units bearing serial numbers 18144 to 18593, inclusive. For replacement purposes, use a 60-ohm resistor per ESO-695589–7 in this group of units.
3. Used in *RE-1A/ARR-1 Antenna Switching Relay units and for replacement purposes in *RE-1/ARR-1 units.
4. The rotary relay per BO-31815–1 having a holding-winding resistance of 115 ohms, is used in *RE-1/ARR-1 Switching Relay units bearing serial numbers 18144 to 18593, inclusive. A 100-ohm dropping resistor is also used in these units. For replacement purposes, the 65-ohm relay per BO-31815–5 and the 60-ohm dropping resistor R301 per ESO-695589–7 should be used.

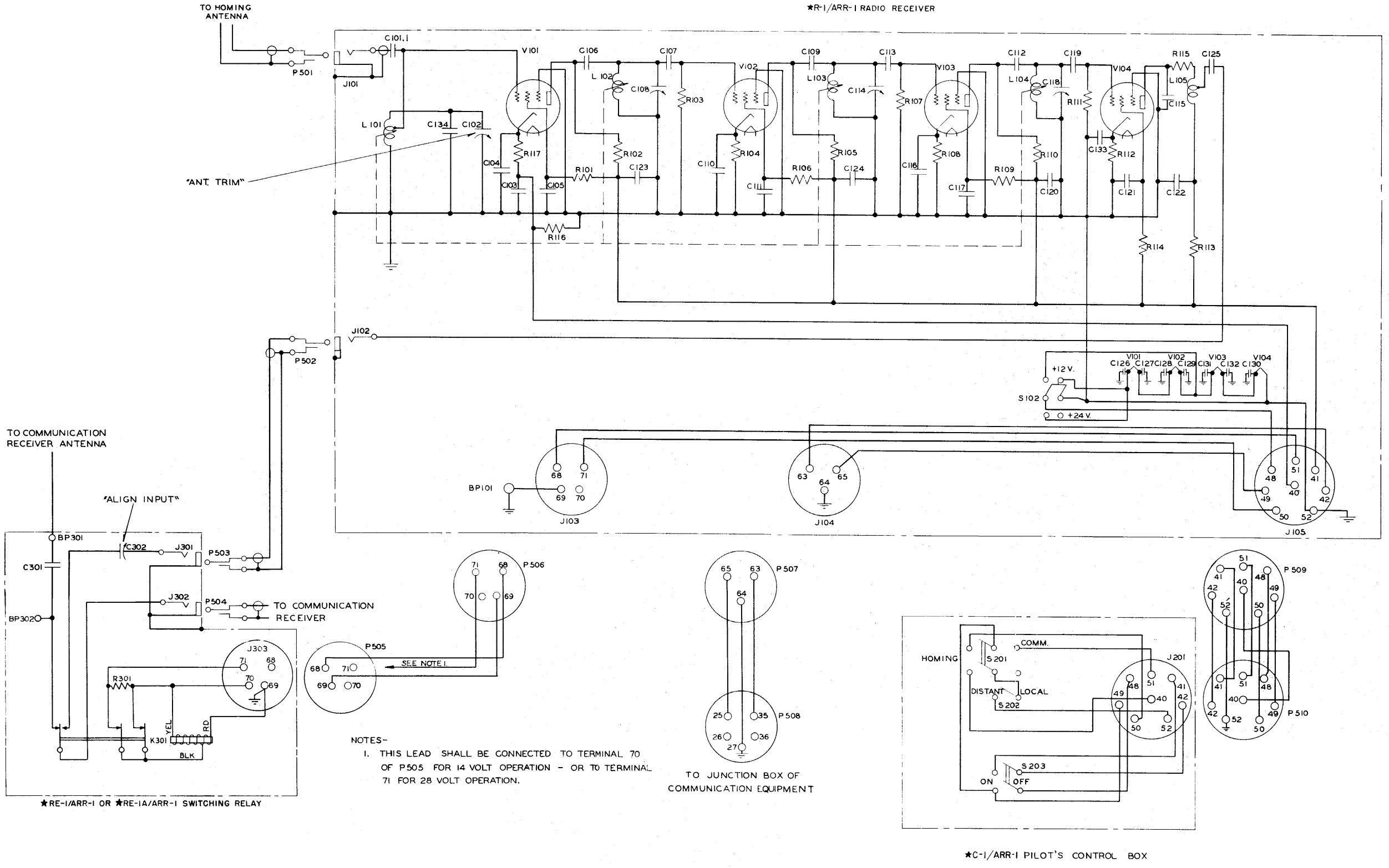

Fig. A5—*AN/ARR-1 Aircraft Radio Receiving Equipment: Schematic Diagram

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GUARANTEE

This equipment, including all parts and spare parts, except vacuum tubes, is guaranteed for a period of TWO YEARS with the understanding that, as a condition of this contract, all items found to be defective as to design, material, workmanship or manufacture will be replaced without delay and at no expense to the Government; provided that such guarantee and agreement will not obligate the contractor to make replacement of defective material unless the failure, exclusive of normal expected shelf-life deterioration, occurs within a period of TWO YEARS from the date of delivery of the equipment to and acceptance by the Government, and provided further, that if any part or parts fail or are found defective to the extent of ten per cent (10%) or more of the total number of similar units furnished under the contract (exclusive of spares), such part or parts, whether supplied in the equipment or as spares, will be conclusively presumed to be of defective design, and as a condition of contract subject to one hundred per cent (100%) replacement by suitable redesigned units.

Failure due to poor workmanship, while not necessarily indicating poor design, will be considered in the same category as failure due to poor design. Redesigned replacements which will assure proper operation of the equipment shall be supplied promptly, transportation paid, to the Naval activity using such equipment, upon receipt of proper notice and without cost to the Government.

All such defective parts will be subject to ultimate return to the contractor. In view of the fact that normal activities of the Naval service may result in the use of equipment in such remote portions of the world or under such conditions as to preclude the return of the defective item or unit prior to replacement without jeopardizing the integrity of Naval operations or communications, the exigencies of the service therefore may necessitate expeditious repair of such item or unit in order to prevent extended interruption of operations or communications. In such cases the return of the defective item or unit for examination by the contractor prior to replacement will not be required. The report of a responsible authority, including details of the conditions surrounding the failure, will be acceptable for effective adjustment under the provisions of this contractual guarantee.

The above period of TWO YEARS will not include any portion of the time that the equipment fails to give satisfactory performance due to defective items and the necessity for replacement thereof. All replacement parts will be guaranteed to give TWO YEARS of satisfactory service.

REPORT OF FAILURE

Report of failure of any part of this equipment during its life shall be made on Form N Aer. 4112 "Report of Unsatisfactory or Defective Material" in accordance with the latest instructions issued by the Bureau of Aeronautics. Copies of this report shall be forwarded to the Bureau of Ships (3 copies) and to the Inspector of Naval Material, New York (1 copy). Copies required for other activities shall be forwarded in accordance with existing instructions. Such reports of failure shall include:

(a) Contract NOs 84433, dated March 29, 1941

(b) Model Letter of Equipment.....

Navy Type.....

(c) Serial Number of Equipment.....

(d) Date of Acceptance by the Navy.....

(e) Date Placed in Service.....

(f) Part which Failed.....

(g) Nature and Cause of Failure.....

(h) Covered by Contract Guarantee.....

(i) Replacement Needed (Yes or No).....

(j) Remedy Used or Proposed.....

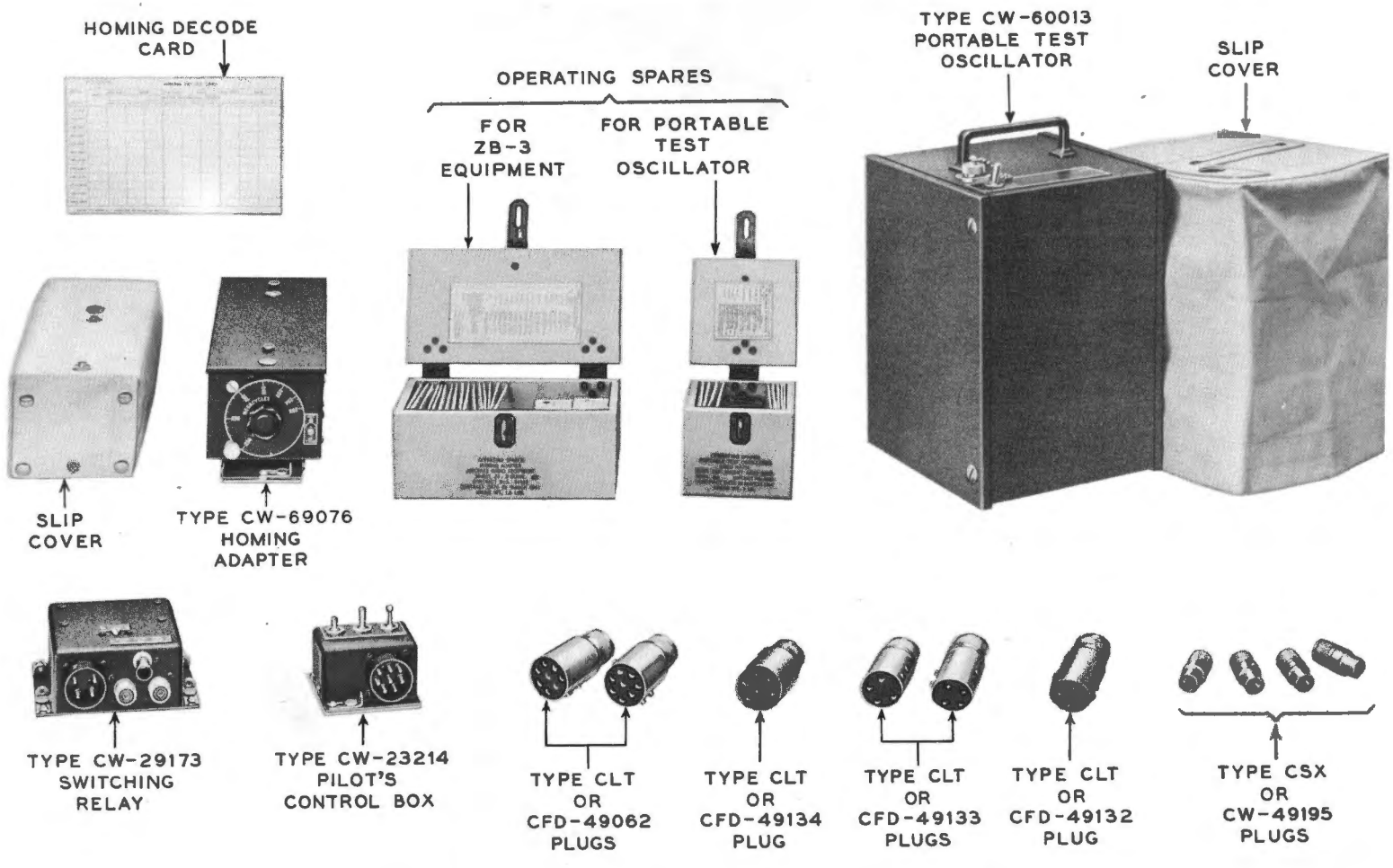


FIG. 1—PRINCIPAL UNITS OF MODEL ZB-3 HOMING ADAPTER EQUIPMENT AND PORTABLE TEST OSCILLATOR

I. DESCRIPTION

GENERAL

Model ZB-3 Aircraft Radio Homing Adapter Equipment is designed for use on aircraft. It does not constitute a complete self-contained radio receiving equipment but is designed solely for operation in conjunction with standard Navy aircraft radio receiving equipment. The ZB-3 equipment may be used to receive radio frequency signals in the frequency range of 234 to 258 megacycles which are amplitude modulated by a telegraphically keyed radio frequency in the range of 540 to 830 KC. The adapter unit delivers the keyed modulation component of the signal to the input circuit of the communication receiver where it is further amplified and converted to an audio frequency signal. The resulting audio frequency signal is keyed in conformity with the keying present on the modulation frequency of the received signal.

EQUIPMENT SUPPLIED FOR MODEL ZB-3 HOMING ADAPTER EQUIPMENT AND PORTABLE TEST OSCILLATOR ON CONTRACT NOs 84433

The following units, accessories and spare parts are supplied as a complete model ZB-3 equipment on contract NOs 84433.

Unit	*Overall Dimensions*	*Weight*
(1) Type CW-69076 Homing Adapter	12¼" Long x 3¾" Wide x 3⅞" High	4.0 lbs.
(2) Type CW-29173 Switching Relay	4 15/16" Long x 4" Wide x 2 5/16" High	1.4 lbs.
(3) Type CW-23214 Pilot's Control Box	3" Long x 3" Wide x 2 5/16" High	0.56 lb.
(4) 4—Navy Type—954 Vacuum Tubes	Installed in homing adapter	Weight included in homing adapter unit.
(5) 1 each of the following concentric transmission lines: (Transmission lines and plugs supplied in bulk)		
(a) Homing Antenna to Adapter		
1 plug type CW-49195 or CSX-49195	13/16" Diameter	.06 lb.
Flexible transmission line Type-PT5	*15' Long 13/32" Diameter	.11 lb. per ft.
(b) Homing Adapter to Switching Relay		
2 plugs type CW-49195 or CSX-49195	13/16" Diameter	.06 lb. per plug
Flexible transmission line Type-PT5	*3' Long 13/32" Diameter	.11 lb. per ft.
(c) Switching Relay to Communication Receiver		
1 plug type CW-49195 or CSX-49195	13/16" Diameter	.06 lb.
Flexible transmission line Type-PT5	*2' Long 13/32" Diameter	.11 lb. per ft.
(6) 1 each of the following power cables: (Cables and plugs supplied in bulk)		
(a) Homing Adapter to Pilot's Control Box		
2 plug type CLT-49062 or CFD-49062	1⅜" Diameter	.15 lb. per plug
8 Conductor Cable per ESO-677960-1	*10' Long ½" Diameter	.12 lb. per ft.
(b) Homing Adapter to Switching Relay		
2 plugs type CLT-49133 or CFD-49133	1¼" Diameter	.10 lb. per plug
3 Conductor Cable per ESO-677960-2	*5' Long 25/64" Diameter	.07 lb. per ft.
(c) Homing Adapter to Communications Receiver Junction Box		
1 plug type CLT-49132 or CFD-49132	1¼" Diameter	.10 lb.
1 plug type CLT-49134 or CFD-49134	1⅜" Diameter	.12 lb.
3 Conductor Cable per ESO-677960-2	*5' Long ⅜" Diameter	.07 lb. per ft.

* These cables and transmission lines are supplied in bulk. The indicated lengths are for a typical installation.

The weight of a complete model ZB-3 equipment consisting of the above items 1 to 6 inclusive and using typical cable lengths is approximately 11.0 pounds.

One slip cover and three homing decode cards are supplied with each complete model ZB-3 equipment. The combined weight of these miscellaneous items is 0.2 pound.

An insulated wrench for use in aligning the ZB-3 Adapter is included with each equipment. This wrench is packed in the operating spare parts box.

Portable test oscillators as supplied on contract NOs 84433 have the following overall dimensions: 6¾ inches long x 7⅛ inches wide x 11⅛ inches high; and weigh 14.5 pounds.

A slip cover is supplied with each portable test oscillator. The weight of this slip cover is 0.25 pound.

One set of operating spare parts is supplied with each model ZB-3 equipment and with each portable test oscillator. These are packed in individual boxes having the following overall dimensions and weights shown at the bottom of this page.

An itemized list of operating spare parts supplied on Contract NOs 84433 is given on pages 38 and 39 of this book.

An itemized list of bulk spare parts supplied on Contract NOs 84433 is given on pages 40 and 41 of this book.

ADDITIONAL EQUIPMENT REQUIRED FOR OPERATION OF COMPLETE HOMING EQUIPMENT

The following units which are not a part of the model ZB-3 equipment must be supplied in order to provide a complete and operative homing equipment:

1. An operative radio receiving equipment of the RU, ARA, or similar Navy type capable of receiving keyed CW signals in the frequency range 540 to 830 kc, and capable of supplying .28 ampere at 12 volts or .14 ampere at 24 volts and 10 milliamperes at 220 volts. This receiving equipment must be complete with all accessories, including head set and primary power supply. It must also be equipped with a receptacle to fit plug 74 to supply operating power for the ZB-3 equipment. The power drain of the ZB-3 equipment for various input voltages is shown in the table on page 28.

2. A homing antenna suitably matched to a 50 ohm transmission line. (See page 20.)

3. A connector for connecting the homing antenna to the adapter input transmission line.

Information for the installation, operation and maintenance of the communication receiver should be obtained from the instruction book for that equipment.

SIMILARITY TO CORRESPONDING UNITS OF MODELS ZB AND ZB-1 EQUIPMENTS

All Units of the model ZB-3 Equipment are similar to and perform identical functions as the corresponding units of models ZB and ZB-1 equipments. The pilot's control box and power cables are identical with that used in previous models of ZB equipment. The other components of the equipment, however, are not interchangeable due to the use of a new type of concentric transmission line and new transmission line plugs and jacks.

DIFFERENCES IN SERIAL GROUPS OF ZB-3 EQUIPMENT

The CW-69076 Homing Adapters bearing serial numbers from 1 to 4692 inclusive, differ from those bearing the serial numbers from 7857 and above in the type of tuning mechanism used. The first group uses a round shaft with a box type gear housing while the group from 7857 and above uses a square shaft with an open gear assembly. A second difference is in the location of the antenna trimming capacitance. Those adapters with serial numbers from 7857 and above have this capacitance located slightly higher than the adapters with serial numbers from 1 to 4692 inclusive, and due to the elimination of the box gear-housing in the group from 7857 and above, the distributed capacity of the antenna circuit is lower. To equalize this effect, a 2 mmf capacitance, C134, is added to adapters bearing serial numbers 7857 and above.

In adapters having serial numbers 1 to 4692 inclusive, the antenna coupling capacitor may be composed of two units designated as C101.1 and C101.2 or it may be only the single unit C101.1 depending on the circuit requirements as determined in manufacture.

In CW-29173 switching relay units bearing serial numbers above approximately 2500 the

Unit	*Overall Dimensions*	*Weight Including Spare Parts*
Spare parts Box for Model ZB-3 Homing Adapter Equipment	7¾" Long x 4¼" Wide x 3½" High	1.8 lb.
Spare parts box for Portable Test Oscilator	3⅞" Long x 3⅞" Wide x 3½" High	1.0 lb.

white strap between terminals of K301 has been omitted. This removes the shunt capacitor (C301) which formerly was across the communication antenna when relay K301 was in the homing position.

The reference numbers used in the following discussion refer to parts shown and similarly numbered in the photographs and drawings of this book. The same numbers are also shown in the Parts List by Symbol Designation.

VACUUM TUBES

Four Navy Type–954 Vacuum Tubes are used in the CW-69076 Homing Adapter. Three of these tubes are used as RF amplifiers and the fourth is used as a grid leak detector. The Navy Type–954 Tube is an acorn type pentode tube comprising an indirectly heated cathode, a control grid, a suppressor grid, a screen grid and a plate. The tube is designed primarily for operation at high frequencies, the upper limit being above the band 234–258 megacycles.

Two Navy Type–955 Vacuum Tubes are used in the CW-60013 portable test oscillator. One of these tubes operates as an oscillator at 246 megacycles while the second is used as an oscillator at 710 kilocycles to plate modulate the 246 megacycle frequency. The Navy Type–955 Tube like Navy Type–954 is designed particularly for operation at high frequencies. It is a triode consisting of an indirectly heated cathode, a control grid and a plate.

The following table shows the recommended operating conditions and average characteristics of these tubes:

	Navy Type–954	*Navy Type–955*
Heater Voltage	6.3 Volts	6.3 Volts
Heater Current	.15 Ampere	.15 Ampere
Control Grid Voltage	—3 Volts	—5.0 Volts
Screen Grid Voltage	100 Volts	—
Screen Grid Current	0.7 Milliampere	—
Plate Voltage	250 Volts	180 Volts
Plate Current	2.0 Milliamperes	4.5 Milliamperes
Amplification Factor	More than 2,000	25
Mutual Conductance	1400 Micromhos	2,000 Micromhos

TYPE CW-69076 HOMING ADAPTER (INCLUDING ADAPTER MOUNTING PLATE)

The Type CW-69076 Homing Adapter is housed in a grounded metal cabinet which contains all the equipment required to tune, amplify and demodulate the received signal and to deliver the modulation component to the input circuit of a standard Navy communication receiver. The Homing Adapter is shown in Figures 1, 2, 3, 4, 5,

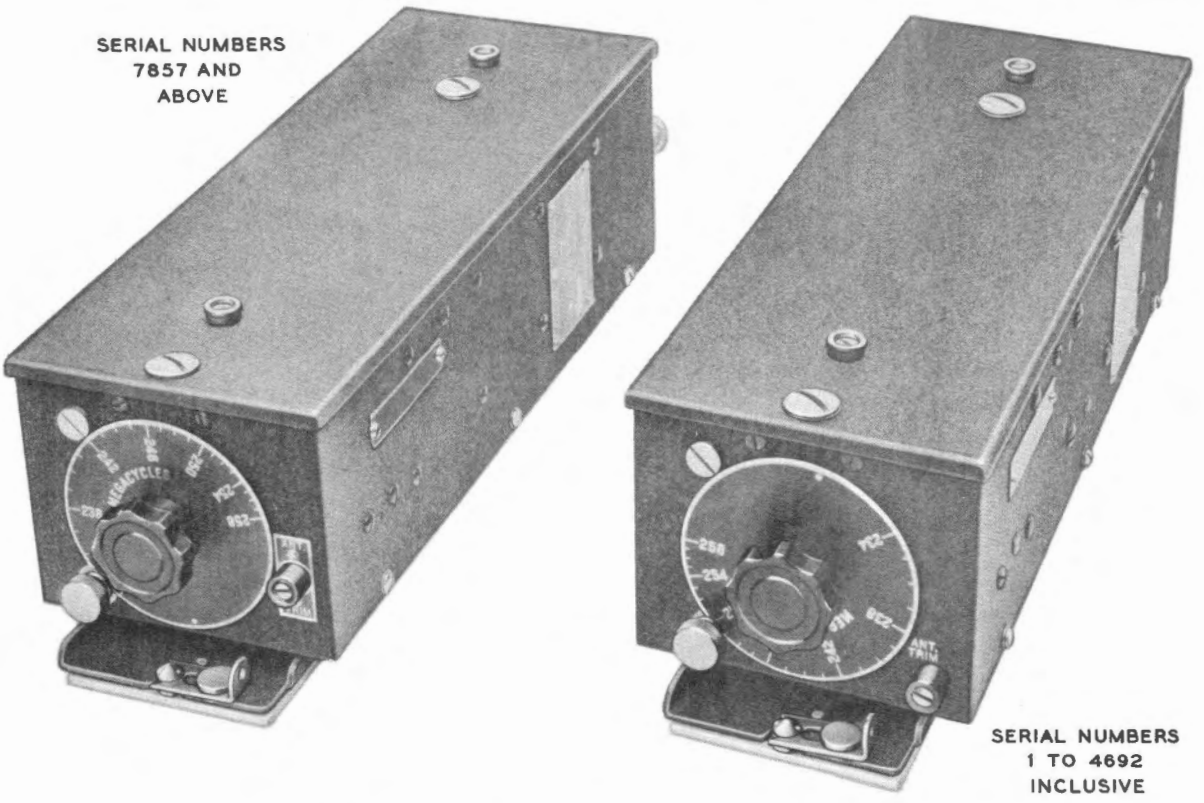


FIG. 2—TYPE CW-69076 HOMING ADAPTER UNIT—EXTERNAL FRONT VIEW

6, 7, 13, 15, 17 and 18. In the following descriptive material, frequent reference will be made to the schematic circuit diagram shown in Figure 13.

The adapter case is constructed in the form of a rectangular box, open on the top and bottom. The bottom of this box is closed by means of a baseplate to which are attached four shockproof mounting details which are in turn fastened to a flat plate. This flat plate carries two snap-slides by means of which the adapter unit may be fastened to the adapter mounting plate. The adapter may also be mounted on top of the communication receiver if this receiver is equipped with the necessary snap-slide studs.

The baseplate and mounting assembly are fastened to the adapter case by means of screws. The top of the adapter case is closed by means of a cover which is held in place by means of two Dzus fasteners. This arrangement provides convenient access to the adapter unit for changing tubes and making such other adjustments as may be required.

The front face of the adapter unit carriers a tuning dial, a dial lock and the homing antenna trimming adjustment, C102. The rear face of the adapter carries power plug receptacles J103, J104 and J105, as well as BP101 and receptacles J101 and J102 for connecting to the homing antenna and to the switching relay.

Electrically, the adapter consists of three stages of inductively tuned radio frequency amplification and a grid leak detector. The four tubes used in each unit are Navy Type–954. The three radio frequency amplifier stages are coupled by means of four tuned circuits, each consisting of a tuning coil and a trimmer condenser. The four circuits are tuned over the range of 234 to 258 megacycles by means of four silver plated copper cores which are moved, simultaneously, in and out of the respective tuning coils by means of a rack and worm gear arrangement driven from the main tuning dial.

The antenna is connected through a coaxial line and plug to jack J101 and then through condenser C101 to the tuned circuit L101-C102. In some adapters, a single condenser C101.1 is used while in other adapters, C101.1 and C101.2 are connected in series to form a single capacitor

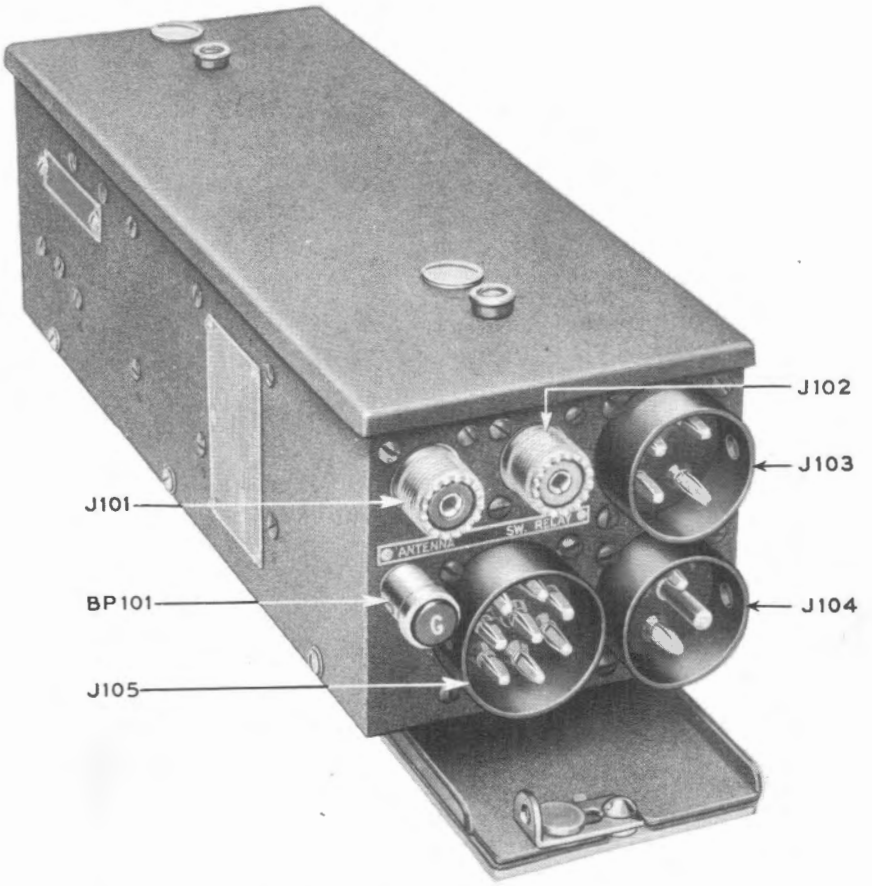


FIG. 3—TYPE CW-69076 HOMING ADAPTER UNIT—EXTERNAL REAR VIEW

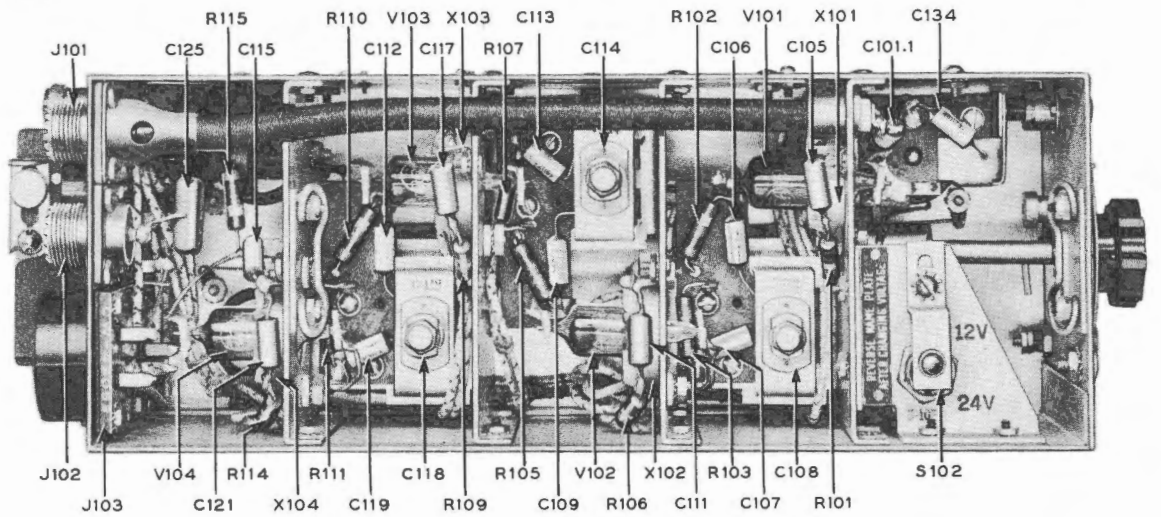


FIG. 4—TYPE CW-69076 HOMING ADAPTER UNIT—INTERNAL TOP VIEW FOR SERIAL NOS. 7857 AND ABOVE

designated here as C101 (see page 12). Condenser C102 is adjustable from the front panel and may be used to align the input circuit. This adjustment is labeled "ANT. TRIM." The grid of the first radio frequency amplifier tube V101 (Navy Type −954) is connected to a tap on coil L101. Bias for this tube in the "Distant" position of the local-distance switch S202 is provided by the drop in the cathode resistance R117. In the "Local" position of switch S202, this bias is greatly increased by the addition of the drop in R116. Plate voltage is supplied through R102 and screen voltage through R101. The plate of V101 is connected through coupling condenser C106 to the tuned circuit L102-C108 which is coupled by means of condenser C107 to the grid of the second radio frequency amplifier tube V102. The circuits for the second and third radio frequency amplifier stages V102 and V103 are identical with the circuits of V101 except that no provision is made for varying their bias. Condensers C102, C108, C114 and C118 are not operating tuning adjustments but are used to trim the interstage capacities. *These condensers will generally require readjusting when the associated vacuum tubes have been replaced.*

The detector circuit with V104 (Navy Type−954) is designed to demodulate the high frequency signals which are modulated by frequencies in the range 540 to 830 kilocycles. The detector is of the grid leak type and is provided with a very small

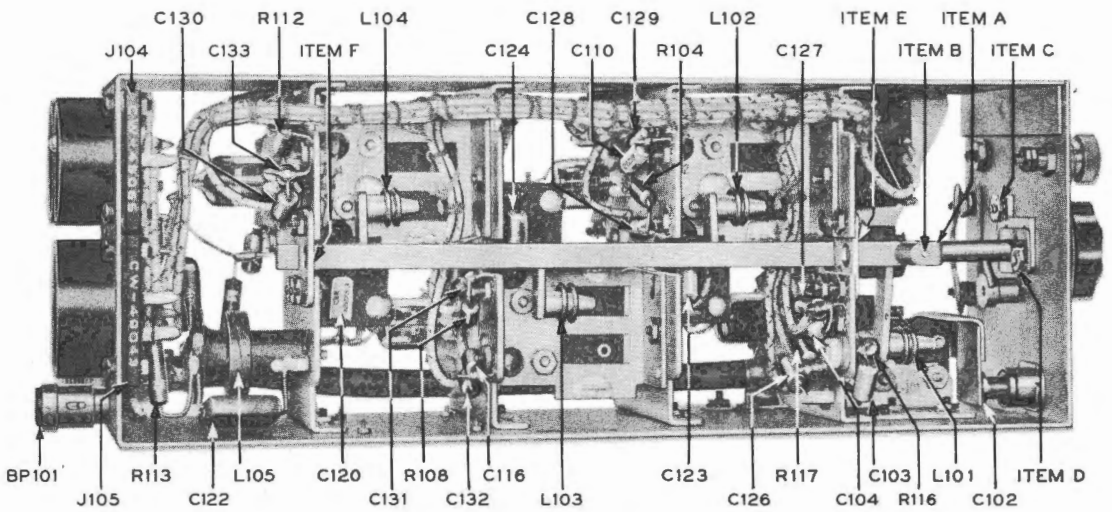


FIG. 5—TYPE CW-69076 HOMING ADAPTER UNIT—INTERNAL BOTTOM VIEW FOR SERIAL NOS. 7857 AND ABOVE

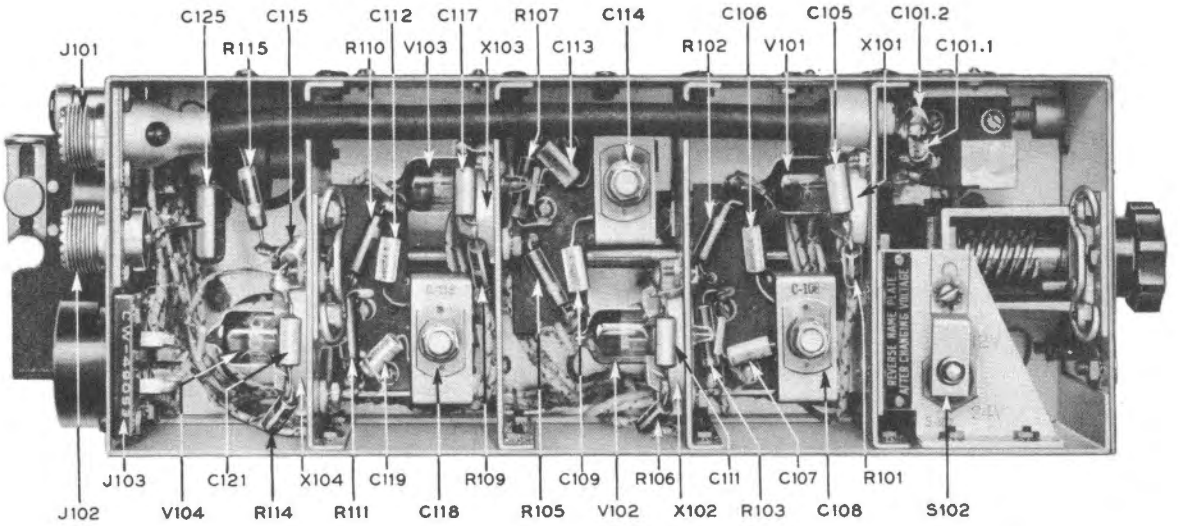


FIG. 6—TYPE CW-69076 HOMING ADAPTER UNIT—INTERNAL TOP VIEW FOR SERIAL NOS. 1-4692 INCLUSIVE

bias by the drop in resistor R112. The plate of V104 is connected through R115, L105 and C125 into a low capacity concentric transmission line which is connected to the communication receiver through the switching relay. A condenser C115 is provided from the plate of V104 to ground which, in combination with R115 and the distributed capacitance of L105, serves to remove the carrier component from the output of the detector. Coil L105 is designed to match the output impedance of V104 into the input circuit of the communication receiver when the two are interconnected by means of the flexible concentric transmission line supplied with the equipment.

Resistance-capacity filters are used in the plate and screen supply circuits of the various tubes and condensers are connected between the heaters of these tubes and ground in order to prevent undesirable regenerative effects.

When switch S102 is in the "24 volt" position, it connects the heaters of the four vacuum tubes in series for operation from a 24 volt supply. When this switch is thrown to the "12 volt" position the heaters are reconnected for series parallel operation from a 12 volt supply. A locking mechanism, which may be released by means of a screwdriver, is provided so that this switch cannot be operated accidentally.

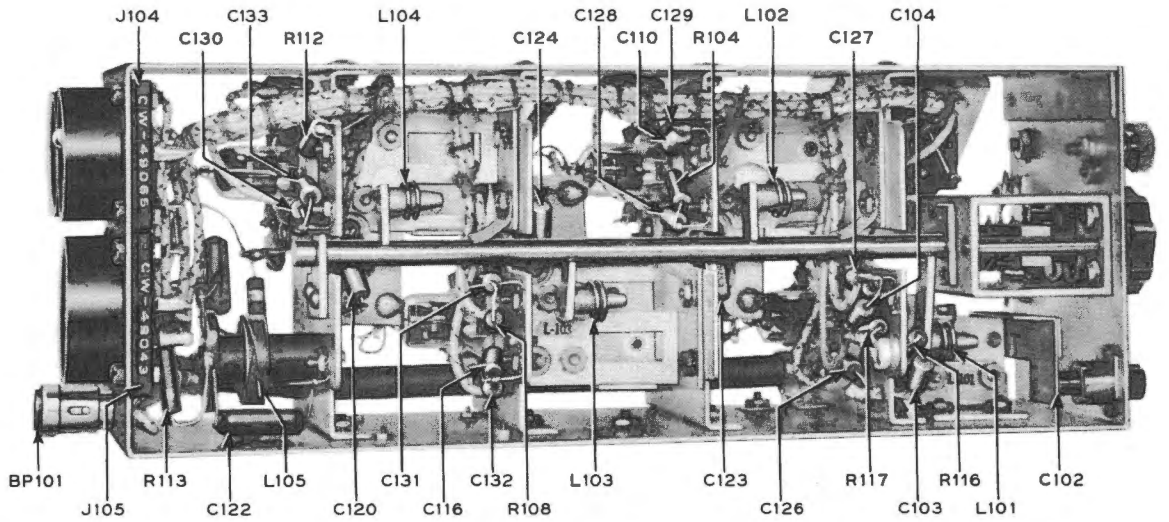


FIG. 7—TYPE CW-69076 HOMING ADAPTER UNIT—INTERNAL BOTTOM VIEW FOR SERIAL NOS. 1-4692 INCLUSIVE

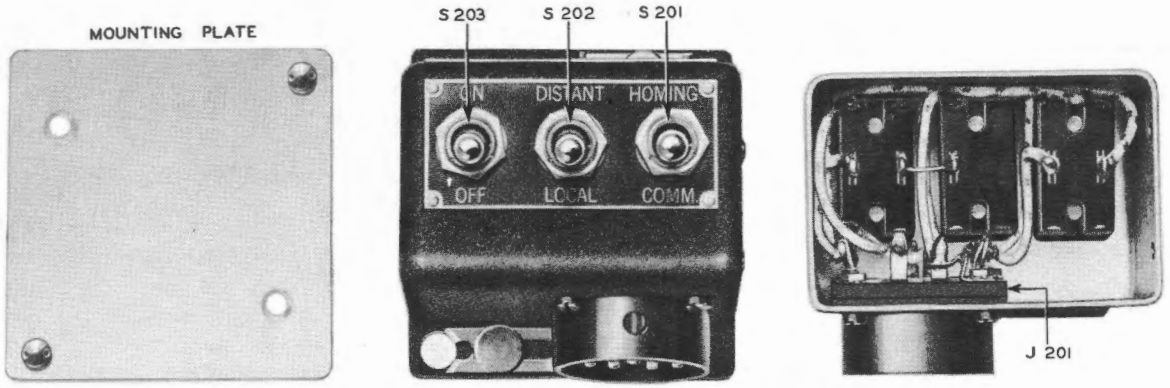


FIG. 8—TYPE CW-23214 PILOT'S CONTROL BOX

TYPE CW-23214 PILOT'S CONTROL BOX (INCLUDING MOUNTING PLATE)

Type CW-23214 Pilot's Control Box is shown in Figures 1, 8, 13, 15, 17 and 19. It is a small unit containing an "On-Off" switch, a "Communication-Homing" switch, a "Local-Distant" switch and a receptacle, J201. When "On-Off" switch S203 is in the "On" position both the 12/24 volt and the 220 volt supply from the junction box of the communication receiver are supplied to the homing adapter unit. With this switch in the "Off" position both voltages are removed from the adapter unit. "Local-Distant" switch S202 controls the sensitivity of the adapter. When this switch is in the "Distant" position the sensitivity of the receiver is at maximum and when the switch is in the "Local" position the sensitivity is reduced. "Homing-Communication" switch S201 controls the operation of switching relay K301 and thereby determines whether the communication receiver is connected to its antenna or to the output of the adapter unit.

TYPE CW-29173 SWITCHING RELAY (INCLUDING MOUNTING PLATE)

Type CW-29173 Switching Relay is shown in Figures 1, 9, 13, 15, 17 and 19. It is housed in a grounded metal box and contains a mechanically latching two-position relay, an antenna trimmer, a fixed condenser and the necessary coaxial jacks and power plugs for interconnecting this unit with the homing adapter unit and the pilot's control box.

Antenna relay K301 is controlled by the Communication-Homing switch located in the pilot's control box. The relay is of the mechanical latching type with energizing contacts so arranged that as soon as the relay has thrown to the position selected by the Communication-Homing switch, the 12/24 volt supply is disconnected from the energizing coils. This feature permits the use of this relay on either 12 or 24 volts without change.

When in the "Communication" position the relay connects the communication antenna to the input of the communication receiver. When the

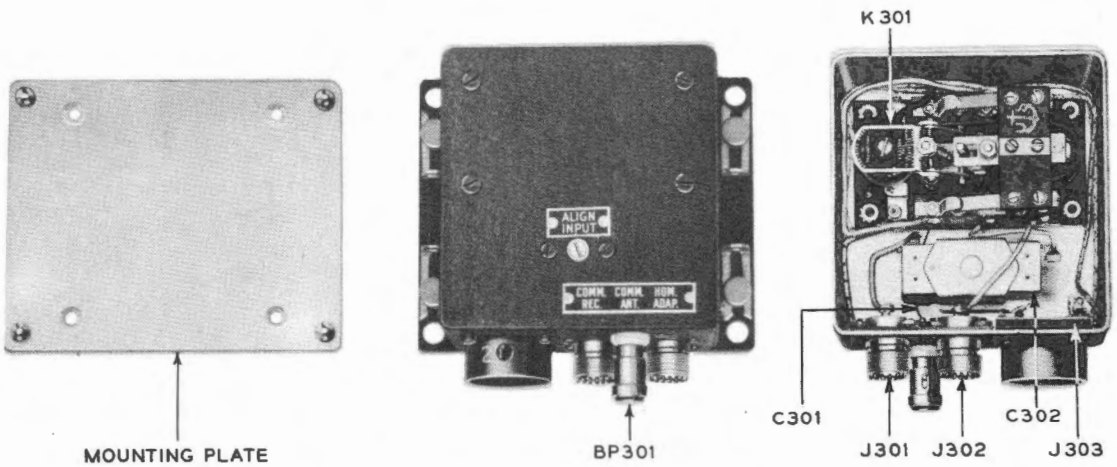


FIG. 9—TYPE CW-29173 SWITCHING RELAY

relay is in the "Homing" position it transfers the input circuit of the communication receiver from its antenna to the output of the adapter.

The antenna tuning adjustment C302 "Align Input" provides a means of adjusting the output circuit of the adapter to provide the same capacitance as the communication antenna so that the input circuit of the communication receiver need not be readjusted when switching from "Communication" to "Homing." Condenser C301 is connected in series with the communication antenna in order to keep its effective capacity within relatively narrow limits.

CONCENTRIC TRANSMISSION LINES

Concentric transmission lines are required for operation of the Model ZB-3 Adapter Equipment as follows: Homing antenna to homing adapter, homing adapter to switching relay and switching relay to communication receiver. The line from the homing antenna to the homing adapter is equipped with one coaxial plug Type CW-49195 or CSX-49195 for connecting the line to the adapter. The plug for connecting this line to the homing antenna is furnished by the Navy. The line connecting the homing adapter to the switching relay is terminated at each end in a plug type CW-49195 or CSX-49195. A similar line is used between the switching relay and the communications receiver except that only a single plug Type CW-49195 or CSX-49195 is supplied. These lines are not interchangeable with the lines of Model ZB or ZB-1 Equipments.

The concentric transmission lines are shown in Figures 1 and 17 and instructions for assembling these lines are given in Figure 22. The minimum bending radius of the flexible line is 3 inches. Cables should be installed to be as nearly straight as possible.

POWER CABLES

The power cables required for the operation of the model ZB-3 homing adapter equipment are shown below.

Each power cable is shielded with tinned copper braid which is protected by an exterior covering of thermoil lacquer. The cables and their arrangement are shown in Figure 17. Instructions for assembling these cables are given in Figure 21.

TYPE CW-60013 PORTABLE TEST OSCILLATOR

Type CW-60013 Portable Test Oscillator, shown in Figures 1, 10, 11, 12, 14, 16 and 20, is contained in a sturdy weatherproof metal case provided with a handle for ease of carrying. The unit includes all the necessary coils, vacuum tubes and batteries for its operation. The portable test oscillator contains a 246 megacycle oscillator modulated at 710 kilocycles. Its purpose is to provide a test signal for tuning models ZB, ZB1 and ZB-3 homing adapter equipment.

A resonant concentric tuning unit, E402, is used in the grid circuit of this oscillator in order to secure a high degree of frequency stability against changes of temperature, operating voltages and change of vacuum tubes. This circuit provides a high degree of mechanical stability as well as a very low power factor.

The grid of V401 (Navy Type—955) is connected through C401 to a tap on the inner conductor of the concentric line E402. Bias for V401 is supplied by grid current through resistors R401 and R402. The plate circuit of V401 is tuned by the primary winding of T401 in combination with the plate capacity of tube V401. The secondary winding of T401 is connected to a short rod antenna E401, external to the case of the unit.

The low frequency or modulation oscillator operates at a frequency of 710 kilocycles and provides the necessary energy to modulate the 246 megacycle carrier approximately 70%. This oscillator is of the tuned plate grid feedback type. The plate circuit of V402 (Navy Type—955) is tuned by circuit L402-C406 and the plate voltage, including the 710 KC energy, is applied to the plate circuit of V401 through R405 and L401. L401 prevents high frequency energy generated by V401 from flowing into the plate circuit of V402 while R405 adjusts the DC and modulating voltages applied to V401 to the correct amount to produce approximately 70% modulation. Grid bias for V402 is obtained by the drop due to grid current flowing in resistors R403 and R404.

The power supply for both oscillators is obtained from two 6-volt dry batteries B401.1 and B401.2 and two 45-volt batteries B402.1 and B402.2.

Brackets inside the front cover of the portable test oscillator are for storing the antenna.

Use	*No. of Conductors*	*Marking on Plug and Receptacle (See Figure 17)*
Homing Adapter to Pilot's Control Box	8	1
Homing Adapter to Switching Relay	3	2
Homing Adapter to Communication Receiver Junction Box	3	3–74

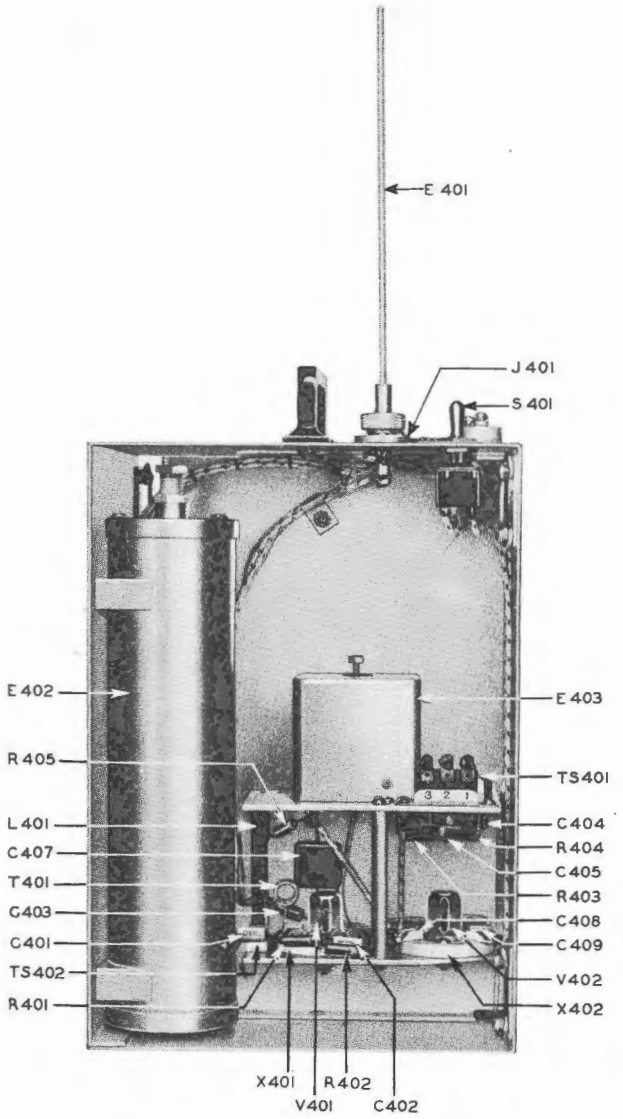


FIG. 10—TYPE CW-60013 PORTABLE TEST OSCILLATOR—VACUUM TUBE SIDE

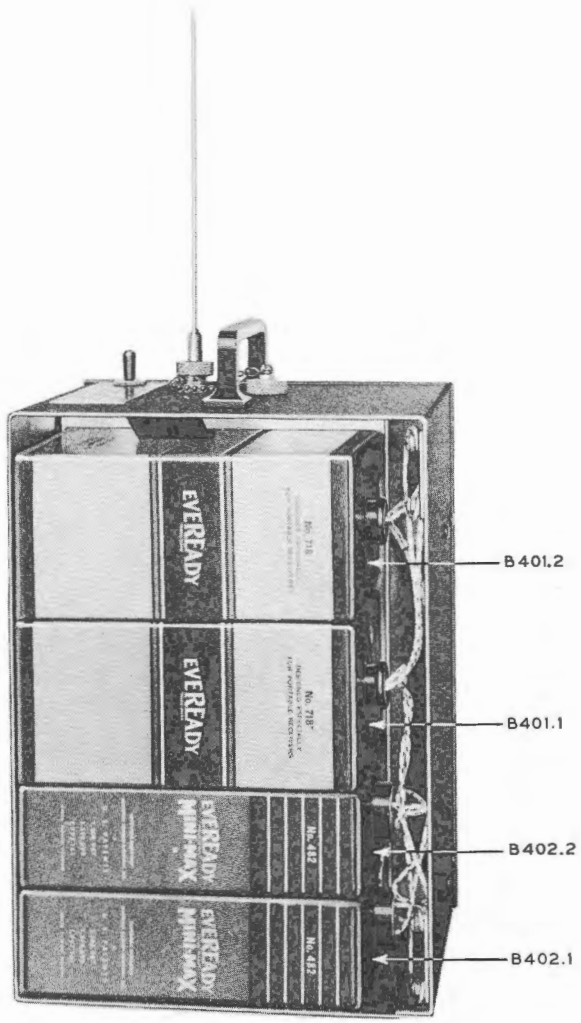


FIG. 11—TYPE CW-60013 PORTABLE TEST OSCILLATOR—BATTERY SIDE

II. INSTALLATION

GENERAL

The same precautions must be observed in installing the Model ZB-3 Homing Adapter Equipment as are required in installing the radio receiving equipment with which it is used. The aircraft engine, generator and accessories must be completely shielded to prevent electrical interference with radio reception. All metal parts of the airplane must be bonded together in order to prevent electrical interference due to variable or rubbing contact of metal parts. Since noise originating in the ignition system of the airplane or due to rubbing or variable ground contacts enters the adapter through the antenna, the useful sensitivity of the homing equipment will be reduced unless the bonding and shielding are done in a very careful and complete manner.

HOMING ANTENNA

The antenna to be used with the ZB-3 Homing Adapter Equipment and the connector that connects it to the adapter input transmission line are not supplied as a part of this equipment but are furnished by the Navy. A ¼ or ¾ wavelength antenna, carefully adjusted to the correct length so that it may be connected directly to a concentric transmission line, will generally be satisfactory. The location for the antenna must be selected with care to provide a good antenna pattern and also to prevent undesirable modulation by the rotating propellers of the aircraft. In general, the antenna should be removed as far as practicable from the propeller and from other projecting members whose length is an appreciable part of a quarter wavelength. The optimum position for an antenna operating in this frequency range varies considerably with the type of aircraft and no specific instructions can be given which would apply to all types of installations. It is suggested that antenna radiation patterns be plotted to determine the best antenna location for each specific type of aircraft.

It is recommended that the slotted line test equipment, which is available at Navy Overhaul Bases, be used for checking the matching of the antenna and transmission lines.

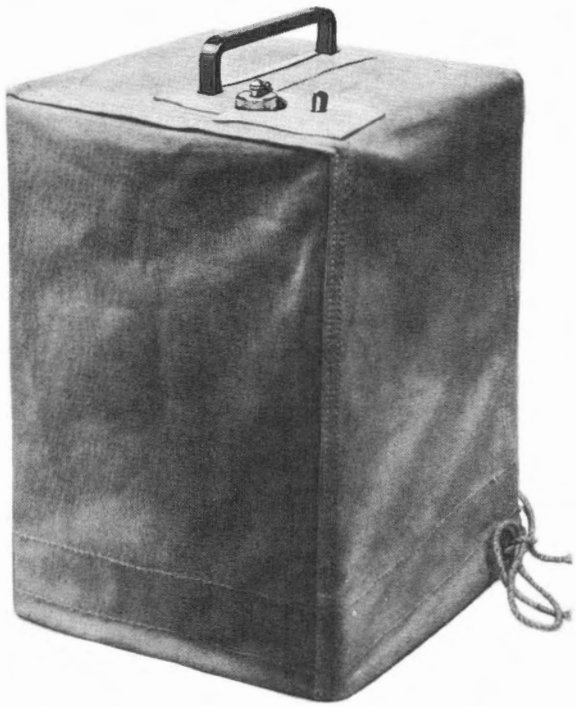


FIG. 12—TYPE CW-60013 PORTABLE TEST OSCILLATOR—WITH SLIP COVER

HOMING ADAPTER

The homing adapter unit is equipped with two snap-slides by means of which it may be mounted on the communication receiver or it may be mounted on a separate mounting plate. If the separate mounting plate is used it should be bolted permanently to the structure of the airplane.

In selecting a location for the adapter unit the following points must be considered:

1. Proximity to the communication receiver.
2. Proximity to the homing antenna.
3. Avoidance of sharp bends in the concentric transmission lines and interconnecting cords.
4. Weight distribution.
5. Accessibility for tuning.

In considering item 1 it should be remembered that the total length of lead from the output of the adapter to the communication receiver, including the switching relay, must not exceed 5 feet. A total length of 20 feet of transmission line may be used between the adapter and its antenna, but it is desirable to keep this distance as short as possible in order to prevent undesirable losses in long interconnecting lines.

The adapter unit must be accessible for tuning although this is not an operating adjustment unless it is considered necessary to change frequency in flight.

Installation information for the complete Model ZB-3 Homing Adapter Equipment is shown in Figures 15 and 17.

PILOT'S CONTROL BOX

The pilot's control box must be mounted so that it is convenient to the person who will be operating the radio receiving equipment. It is supplied with a separate mounting plate which should be permanently bolted in place in the airplane. The control box is attached to its mounting plate by means of snap-slides.

SWITCHING RELAY

The switching relay is connected to the communication receiver, to the communication antenna and to the RF output of the adapter unit. Since all of these leads are critical as to length, the location for this unit should be chosen with a view to minimizing these cable lengths.

The switching relay is attached by means of snap-slides to a separate mounting plate which must be permanently bolted to the airplane framework.

POWER CABLES AND CONCENTRIC TRANSMISSION LINES

The power cables and concentric transmission lines which interconnect the various units should be lashed or clamped to structural members of the airplane along their length. The transmission line connecting to the antenna should be carefully bonded to the airplane structure wherever it is likely to come in contact with a grounded surface in order to prevent the possibility of noise being generated due to an intermittent contact.

The minimum bending radius of the power cables and flexible concentric transmission lines is 3 inches. All cables and transmission lines should be installed to be as nearly straight as possible.

ADJUSTMENT OF ANTENNA ALIGNMENT CONDENSERS

The final installation operation of the ZB-3 Homing Adapter Equipment is the alignment of the antenna circuit of the adapter by means of trimming condenser C102 "ANT. TRIM" located on the front of the adapter unit and the adjustment of the adapter output circuit by means of condenser C302 "ALIGN INPUT" located on top of the switching relay. Both of these installation adjustments are made with a screwdriver.

Operate the communication receiver on CW and manual gain control and set switches S201, S202 and S203 in the pilot's control box to "Communication," "Distant" and "On," respectively. Now tune in a signal in the 540 to 830 KC range of the communication receiver and adjust the antenna alignment condenser of this receiver in the normal manner. After this adjustment has been completed set switch S201 in the pilot's control box to the "Homing" position. Tune in a signal on the adapter unit (if no other signal is available, use the portable test oscillator as described on page 15) and tune the communication receiver to the modulation frequency of the received signal. Adjust the gain of the communication receiver as required. Now adjust condenser C302 "ALIGN INPUT" on the switching relay to give maximum output signal. The adjustment of the condenser C302 in the switching relay unit will not affect the alignment of the communication receiver when it is used in the "Communication" position. Now adjust the antenna trimming condenser C102 "ANT. TRIM" on the front of the adapter unit for maximum output. If the homing antenna is properly matched into the concentric transmission line it will be found that one trimming adjustment will provide satisfactory operation over the entire tuning range.

After the alignment procedure has been completed, carefully tune the adapter to the frequency at which the equipment is to be operated. If the frequency is 246 megacycles, the portable test oscillator may be used to supply this signal. Tune the dial of the adapter a small amount on either side of resonance to aid in determining the exact center of the tuning adjustment. Set the dial to this exact tuning point and clamp it by means of the dial lock located on the lower left edge of the tuning dial.

USE OF PORTABLE TEST OSCILLATOR

The portable test oscillator furnishes a test signal which may be used to tune and align the Model ZB-3 Homing Adapter Equipment. It produces a stable signal at 246 megacycles which is modulated at approximately 710 KC. To use the portable test oscillator, remove the rod antenna from its mounting within the front cover and install it in jack J401 on the top of the oscillator unit. Turn the "OFF-ON" switch S401 to the "ON" position. The oscillator should be placed approximately 10 feet from the receiving antenna.

CAUTION: TYPE CW-60013 PORTABLE TEST OSCILLATOR IS BATTERY OPERATED AND SWITCH S401 SHOULD BE IN THE "OFF" POSITION WHENEVER THE UNIT IS NOT ACTUALLY IN USE.

SLIP COVERS

Waterproof slip covers are supplied for the adapter and the portable test oscillator. It is important that these units be protected at all times from water and oil spray by means of these covers.

III. OPERATION

OPERATION OF THIS EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY PRECAUTIONS. SEE SAFETY INSTRUCTIONS IN THE FRONT OF THIS BOOK.

GENERAL

The ZB-3 Homing Adapter Equipment derives its operating voltages from the communication receiver with which it is used. Furthermore, the communication receiver is used to amplify and detect the signals delivered to it by the adapter. It is essential that the communication receiver be operated on CW and manual gain control and tuned to the correct frequency in the 540 to 830 KC band. The communication receiver should be operated as directed by its instruction book for the reception of keyed CW signals in the frequency range of 540 to 830 KC.

The operation of the adapter is controlled by the switches located on the pilot's control box. The on-off switch controls all power, both filament and plate, for the adapter unit. When this switch is in the "Off" position power is removed from all units of the adapter except switching relay K301 which is still under the control of the homing-communication switch. With switch S203 in the "On" position and the communication receiver turned on as described in the above paragraph and with the communication homing switch S201 in the "Communication" position, the communication receiver is connected to its antenna and the homing adapter is inoperative. When switch S201 is in the "Homing" position the input circuit of communication receiver is connected to the output circuit of the adapter unit and the system may be used for the reception of signals in the 234 to 258 megacycle band. Local-Distant switch S202 is an auxiliary sensitivity control for the adapter unit and is used in conjunction with the gain control of the communication receiver. This switch should be placed in the "Distant" position under all conditions except when in the immediate vicinity of a transmitter where the gain control of the communication receiver is insufficient to reduce the signal to the desired value.

CHECK WITH PORTABLE TEST OSCILLATOR

After installation and before flying with the homing adapter equipment, operating tests should be made in accordance with the following instructions:

1. Set up the portable test oscillator at some convenient location and at a distance of approximately 10 feet from the homing adapter antenna. Insert test antenna E401 in jack J401 of the test oscillator and turn the switch S401 to the "On" position.

2. With the switches of the pilot's control box on "Communication," "Distant" and "On," check the operation of the communication receiver in the band 540 to 830 KC in accordance with instructions furnished for that equipment. Be sure that the communication receiver is operated on manual control and that the CW-MCW switch is in the "CW" position.

3. Throw the homing switch to the "Homing" position. Tune the adapter to the frequency of the test oscillator and the communication receiver to the modulating frequency of the test oscillator in accordance with its calibration data. Adjust both tuning controls for optimum beat note and adjust the gain control of the communication receiver as required to maintain a comfortable level in the head set.

4. Carefully tune the homing adapter a small amount on either side of resonance to determine the exact center of the tuning adjustment. Set the dial to this exact tuning point and clamp the dial by means of the dial lock.

5. Throw the local-distant switch to the "Local" position. The received signal should be greatly reduced in volume.

OPERATING ROUTINE

To operate the ZB-3 Homing Adapter Equipment turn the "Off-On" switch in the pilot's control box to "On" and at the same time turn on the communication receiver. The position of the homing-communication switch determines whether the communication receiver is used as a conventional radio receiving equipment or whether the system is used to receive signals on the homing frequency.

It is essential that the communication receiver be operated on *manual gain control* in the "CW" position whenever the equipment is used in the "Homing" position. The use of AVC when receiving homing signals results in a broad or indefinite course indication. Keep the local-distant switch in the "Distant" position.

Tuning of the adapter unit is ordinarily accomplished on the ground and no tuning adjustments need be made in flight. The communication receiver must be carefully tuned to the modulation frequency of the homing signals. Adjust the gain control of the communication receiver to keep a comfortable signal in the head set. This level should be kept as low as possible as overloading or volume compression in the communication receiver will result in a broad or indefinite course indication.

When in the immediate vicinity of a transmitter the gain control of the communication receiver may not reduce the received signal to a sufficiently low value. Under these conditions the local-distant switch may be placed in the "Local" position.

IV. MAINTENANCE

INSPECTION

The Model ZB-3 Homing Adapter Equipment and associated operating apparatus should be given a flight inspection before each radio flight according to the following routine:

1. Inspect all snap-slides and see that each plug is locked in its receptable.
2. See that the proper coil set is in the communication receiver and check the operation of this receiver in accordance with maintenance instructions given in its instruction bulletin.
3. Check the operation of the adapter by means of the portable test oscillator or such other signal of the correct frequency as may be available.
4. Check the dial lock to see that it is tight. If the lock is loose carefully retune the adapter to the correct frequency as directed in Section III and lock the dial.
5. Check the operation of the switching relay by operating the "Communication-Homing" switch.

The following service inspection should be made after each 15 hours of operation:

1. Check all associated radio receiving equipment as directed in the bulletin for the particular communication receiver that is being used.
2. Inspect the tubes in the adapter unit to see that all grid and plate clips are properly attached.

WARNING: TURN OFF ALL POWER TO THE ADAPTER BEFORE REMOVING COVERS.

3. Check the bonding of all cables and inspect all antenna and ground connections.
4. Check the alignment of the input and output circuits of the adapter as directed in Section II.
5. Check the tuning of the adapter unit and see that the dial-lock is firmly clamped in place after the final tuning adjustment is made.

SLIP COVERS

Waterproof slip covers are supplied for the adapter unit and the portable test oscillator. It is important that these units be protected at all times from water and oil spray by means of these covers.

OPERATING DIFFICULTIES AND POSSIBLE CAUSES

The Model ZB-3 Homing Adapter Equipment is operated in conjunction with other radio receiving equipment. Whenever the equipment fails to work properly first determine if the fault definitely lies in the adapter equipment by operating the associated receiver independently of the adapter. If the trouble is definitely traced to the adapter equipment replace each unit one at a time by a similar unit known to be in good operating condition. This method of replacing units should include changing individual cables and transmission lines until the fault is definitely traced to a specific unit. The remedy suggested below should be applied only after a unit has actually been shown to be defective by the method outlined:

1. Adapter Operative But Noisy

There are a number of causes which might lead to the complaint of noisy operation of homing adapter equipment and it will be necessary to identify the particular type of noise which is causing the trouble. The following table may be used as a guide in locating such trouble:

a. *Atmospheric or External Man-made Interference*

Disconnecting the input transmission line at the adapter input jack J101 will generally give a satisfactory test for this type of interference. If the noise encountered is static or other external noise, it will greatly diminish or disappear when the input is disconnected.

b. *Dynamotor Noise*

Dynamotor noise is usually related to the speed of the machine and may be identified by switching on and off at the control box. Dynamotor noise will generally affect the communication receiver before it becomes objectionable to the homing adapter unit. If the dynamotor supplying power to the adapter is suspected of being noisy, it should be compared with another machine of the same type.

c. *Intermittent Contacts in Phone Cords, Plugs or Contacts to the Communication Receiver*

d. *Ignition Noise*

This may be identified by varying the speed of the engine and by switching from one magneto to the other.

e. *Generator and Voltage Regulator Noise*

This may be identified by varying the speed of the aircraft engine up to the point at which the generator cuts in. If the noise originates in the generator itself it will be a characteristic machine noise, while if it is due to the voltage regulator it will appear only above a certain critical speed and will be of an intermittent character. Noise originating in the generator or voltage regulator circuits may be distinguished

from ignition noise by the fact that it usually is suppressed by opening the generator circuit at the battery.

f. *Vacuum Tube Noise*

Vacuum tube noise usually produces a crackling or ringing sound which will sometimes appear under sustained vibration and not be heard if the adapter is jarred intermittently by hand.

g. *Intermittent Contacts in an Internal Circuit of the Adapter*

This type of noise may be identified by jarring the adapter unit. Disconnecting the antenna and vibrating the adapter are not necessarily a complete test because noises of this type are sometimes increased by a strong incoming signal. If the trouble is definitely traced to the adapter it should be dismounted and inspected internally for loose connections.

2. Adapter Inoperative

If the homing adapter unit is inoperative check all plugs and cord connections and check all operating voltages with reference to the table given on page 27. When measuring these voltages it is desirable to use a voltmeter having a resistance of at least 5,000 ohms per volt. If a meter having a resistance of only 1,000 ohms per volt is used, somewhat lower values will be measured for the screen voltages, since these are measured in series with a resistance of 200,000 ohms. If any voltage departs materially from normal, check the circuit back to the circuit supply line. If an ohm-meter is available check the value of the resistors in the adapter and check all condensers for short circuits. The resistance measurements must be made with all power to the adapter off. All tubes should be checked for mutual conductance or, if no method of measuring this is available, they should be replaced by new tubes of the proper type.

WARNING: ALL POWER TO THE ADAPTER SHOULD BE TURNED OFF BEFORE ATTEMPTING TO REMOVE TUBES.

3. Adapter Unit Oscillates

The presence of oscillation in the adapter unit will not necessarily produce the usual heterodyne beats with the incoming signal because of the high operating frequency. The usual effect will be to greatly increase the noise level and reduce the sensitivity of the adapter. If it is suspected that the adapter oscillates, check all by-pass condensers for open or broken connections.

4. Adapter Operative But Insensitive

First check all operating voltages in accordance with the table on page 27, and vacuum tubes as outlined on page 27. If this does not locate the trouble it is possible that some of the tuned circuits within the adapter may be out of alignment.

PROCEDURE FOR REALIGNING THE ZB-3 HOMING ADAPTER

To realign the ZB-3 Homing Adapter, set up a portable Test Oscillator as described on page 21, "Use of Portable Test Oscillator" and on page 22, "Check with Portable Test Oscillator." Connect an Antenna, equivalent to the Homing Antennas used on aircraft, to the Adapter Unit. Tune the Adapter and Communication Receiver for maximum output, adjusting the sensitivity control of the Communication Receiver to keep this output at a comfortable level. The adapter should tune at a dial setting between 244 and 248 megacycles. The use of an output meter equipped with a plug and cord for measuring output power will give a better indication of maximum output than can be obtained by ear. Adjust the Antenna Trimmer Condenser of the Adapter (C-102) for maximum output. Remove the tube access cover.

CAUTION: HIGH VOLTAGE. USE INSULATED ALIGNMENT TOOL FURNISHED IN OPERATING SPARE PARTS BOX OF EQUIPMENT OR ANY INSULATED HEXAGONAL WRENCH IN MAKING THESE ADJUSTMENTS.

Adjust Trimmer Capacitors C-108, C-114 and C-118 for maximum output.

If any of these circuits fail to tune to a definite point of maximum output, check the following:

1. See that coils L-101, L-102, L-103 and L-104 are concentric with respect to their respective tuning slugs.

2. See that all 4 coils have approximately the same physical dimensions.

3. See that these 4 coils are positioned approximately the same with respect to their tuning slugs, e.g. with the slugs withdrawn from the coils as far as possible, the front edge of all slugs should be approximately the same distance from the nearest edge of their respective coils.

If after noting the above points, one of the Trimmer Capacitors still fails to tune to a definite point of maximum output, it will be necessary to change the dimensions of its associated coil as follows:

1. If most output is obtained with the Trimmer Capacitor set at its minimum capacity position (with the screw as far out as possible) the inductance of the coils should be reduced by spreading the turns slightly.

2. If a Trimmer Capacitor gives most output when in the position of maximum capacity, the

inductance of its associated tuning coil should be increased by spacing the turns of the coil somewhat closer together.

INSTRUCTIONS FOR REMOVING TUNING MECHANISM IN ADAPTERS HAVING SERIAL NOS. 7857 AND ABOVE

If it becomes necessary or desirable to remove the tuning mechanism, this may be done in accordance with the following instructions and with the aid of Fig. 5.

If the tuning shaft only is to be removed, this may be done as described in operations 1, 2, 3, 4, and 5.

If the worm shaft assembly only is to be removed this may be done as described in operations 1, 2, 6, 7, 8, 9, and 10.

1. Remove the top cover and bottom base plate of the adapter.
2. Turn the tuning dial until the dot is at the fiducial marker.
3. Disengage spring (Item A) from the top of the follower pin (Item B). Remove the follower pin and spring.
4. Remove both front and rear tuning shaft bearings, Items E and F.
5. Push the tuning shaft back towards the plug end of the box. Hold the shaft at both ends and lift it out of the box horizontally. During this operation be careful not to disturb any of the tuning coils or other circuit components.
6. Remove the two nuts holding the dial lock screw and then remove the dial lock screw and the milled washer and spring washer which are assembled under the dial lock screw.
7. Loosen the two set screws on the dial and remove the dial.

CAUTION: Do not touch the screw, covered with red lacquer, which holds the dial stop cam.

8. Remove the two screws (Items C and D) holding the front worm shaft bearing.
9. Remove the fork spring and shim if any.
10. Slide the front bearing to the shaft stop pin and then remove the worm shaft assembly. To do this, move the shaft forward to disengage the rear bearing. Then lift the rear end of the shaft assembly and remove (the worm shaft and bearing must be removed from the bottom of the adapter). If the tuning shaft is still in place the worm shaft must be removed from the side nearest the DP-DT switch S102.

INSTRUCTIONS FOR REASSEMBLY OF TUNING MECHANISM IN ADAPTERS HAVING SERIAL NOS. 7857 AND ABOVE

If the tuning shaft alone is to be assembled, this may be done as described in operations 4, 5, 6, 7, 8, and 11.

If the worm shaft alone is to be assembled, this may be done as described in operations 1, 2, 3, 8, 9, 10, and 11.

1. Slide the front bearing onto the worm shaft to the shaft stop pin. Slip the worm shaft and bearing into the hole in the front panel and then insert the shaft into the rear bearing.
2. Assemble the front worm shaft bearing to the box with Item C.
3. Slide the shim, if any, into place as well as the fork spring. Assemble shims, spring, and bearing to box by means of the screw (Item D).
4. Hold the tuning shaft horizontally and as near the rear of the adapter as the tuning slugs and partitions will allow, being careful not to disturb any coils or other apparatus in inserting the shaft. Push back the center wiper spring with the shaft before engaging the other wiper springs.

CAUTION: Wiper springs must not be depressed with fingers or tools.

5. Assemble front and rear tuning shaft bearings, Items E and F, loosely with their screws.
6. Press the shaft and bearing firmly into the corner of the front fixed bearing and tighten the three screws holding the front adjustable bearing, Item E.
7. Repeat operation 6 for the rear tuning shaft bearing, Item F.
8. Drop the follower pin (Item B) pointed end first into its bushing. Press lightly on the follower pin and turn the worm shaft until it engages the follower pin. Lift up the follower pin ¼ inch. Place the arm of the spring (Item A) having the larger hole between the worm and shaft. Drop the follower pin into place and slip the spring over the top of the follower pin.
9. Turn the worm shaft clockwise to the stop. Place the dial on the worm shaft and tighten the dial set screws so that the dial place rests on the bottom plate of the dial lock and the dot lines up with the fiducial marker. Seal set screws with red lacquer.
10. Replace the dial lock screw which has on it the spring washer and milled washer and tighten. The milled out portion of the washer should engage the dial plate. Assemble the locking nuts on the dial lock screw so that there is .016 ± .005 inch clearance between the inner nut and the threaded end of the dial locking bushing. Tighten the outer nut against the inner nut.
11. Realign as described on page 25.

ADJUSTMENT OF RELAY K301

If it becomes necessary to readjust relay K301, it should be adjusted so that the contact gap is .025" and the contact pressure is 50 grams at the point of contact. This applies both to the main contacts and the auxiliary contacts. There should be a clearance of .006" between the armature and the core face of either coil after operating the relay.

TEST OF VACUUM TUBES

Since the Navy model OD vacuum tube analyzer is NOT suitable for measuring Navy Type −954 or −955 Vacuum Tubes, it is suggested that all tube tests be made on a comparison basis. Set up the test oscillator and tune the adapter and communication receiver to resonance. The use of an output meter as suggested in the preceding section is recommended. Replace all tubes, one at a time, with new tubes and note the relative output, keeping all operating conditions fixed. After changing each tube the alignment condensers must be readjusted for maximum output. (See page 25 for Realignment Instructions.)

WARNING. ALL POWER TO THE ADAPTER SHOULD BE REMOVED BEFORE REPLACING TUBES.

In general a tube should be discarded if the receiver output voltage increases by a ratio of 2.5 to 1 or greater after the tube is replaced. Due to the square law action of the detector a 2.5 to 1 increase in output voltage represents an increase in sensitivity, expressed in microvolts input for a fixed output, of 58 per cent.

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

USE OF NAVY MODEL OE RECEIVER ANALYZER

The selective analyzer of the model OE Receiver Analyzer may be used in locating troubles in the Model ZB-3 Adapter Equipment. This analyzer consists of a milliammeter-voltmeter-ohmmeter. Since model 666 socket selector unit does not have provisions for type −954 or −955 Tubes, this feature of the model OE Receiver Analyzer cannot be used. All power must be removed from the adapter unit before an ohmmeter is used for measurement of circuit continuity or resistance.

MAINTENANCE OF PORTABLE TEST OSCILLATOR

Since the portable test oscillator is used as a source of signal for tuning the adapter unit, it is essential that it be maintained in good operating condition. Battery voltages should be measured at regular intervals. The filament battery should be replaced if its voltage drops below 5.5 volts and the plate battery should be replaced when its voltage drops below 75 volts. These voltages may be measured at the terminals of S1 when the switch is in the "ON" position. Grid current of both the low and high frequency oscillators may be measured at a terminal strip accessible when the front cover of the oscillator is removed. Grid current of the low frequency oscillator, measured between terminals 1 and 2, will normally be about 85 microamperes. Grid current of the high frequency oscillator, measured between terminals 1 and 3, will normally be about 110 microamperes.

The frequency of the portable test oscillator should be checked by comparison with a crystal controlled frequency. If the frequency of the test oscillator is found to depart materially from the correct value, it may be adjusted by means of the trimming adjustment located at the top of the concentric tuning unit E402. If this unit is readjusted, the control should be firmly locked after the correct frequency has been established. An open end wrench, which fits this locking nut, is included in the operating spare parts box for the portable test oscillator.

NORMAL OPERATING VOLTAGES *

12 or 24 Volt Supply

Vacuum Tube	*Heater Voltage*	*Cathode Voltage*	*Screen Voltage*	*Plate Voltage*	*Plate Supply Voltage*
RF Amplifier Tubes	5.9	2.6	85	160	220
Detector Tube	5.9	.25	45	145	
		14 or 28 Volt Supply			
RF Amplifier Tubes	6.8	3.0	95	185	250
Detector Tube	6.8	0.3	50	170	

* Measured with a meter having a resistance of 5000 ohms per volt.

POWER DRAIN

Primary Voltage	*Primary Current*	*Plate Voltage*	*Plate Current*
12	.28 Ampere	220	10 Milliamperes
14	.33 "	250	11.8 "
24	.14 "	220	10 "
28	.16 "	250	11.8 "

RESISTOR COLOR CODE

Small composition resistors are color coded by one of two methods to represent the resistance in ohms. The first method is as follows: first digit by body color, second digit by tip color, the number of zeros after the second digit by a dot painted on the body. The second method is as follows: three narrow rings are painted around the body starting at one end. The color of the end ring represents the first digit, the second ring the second digit and the third ring the number of zeros after the second digit. A fourth ring represents the tolerance ± 5% by gold and ± 10% by silver.

0—Black	3—Orange	7—Violet
1—Brown	4—Yellow	8—Gray
2—Red	5—Green	9—White
	6—Blue	

Example: 350,000 ohms. First method: body orange, tip green, dot yellow. Second method: orange, green and yellow rings starting at one end.

If the second method were used and the fourth ring were silver, it would denote a tolerance of ± 10% from nominal.

CAPACITOR COLOR CODE

Fixed capacitance molded mica capacitors which are too small to be conveniently marked with capacitance values are color coded by the use of three dots. Colors represent the same numbers as listed above for resistors. Reading from left to right in the direction of the arrow the capacity expressed in micro-microfarads is indicated by the following: first color, first digit; second color, second digit; third color, the number of zeros after the second digit.

Example: 350 micro-microfarads (0.00035 mfd) would have an orange, green and brown dot reading from left to right.

ASSEMBLY OF POWER CABLES

All power cables for the Model ZB-3 Homing Adapter Equipment are supplied in stock lengths on contract NOs 84433. See pages 11 and 18 for a tabulation of these cables and associated power plugs. Figure 21 shows the method of assembling the cables to the plugs and Figure 17 shows their installation.

1. The cutting length for bulk cable is the nominal cable length plus 2" for each cable.

2. Remove the cable insulation from the shielding for a distance AD indicated in Figure 21. Remove the shielding and rubber insulation for a distance AC and remove the rubber insulation from the individual conductors for a distance AB.

3. Pass parts H1 and H2 over the cable. Remove the screw and lock washer H5 and remove part E1. Pass shell H3 over the cable.

4. Tin each individual insert H6 and also the exposed ends of the individual conductors. Solder the tinned ends AB of the conductors into the inserts H6 as indicated by the wiring information in Figure 21. Do not allow surplus lumps of solder to remain on these inserts or on any part of the Bakelite insulation.

5. Use a short length, approximately 4", of No. 18 gauge insulated Tinned Copper Wire for the ground wire W2. Remove the insulation from W2 for a distance of 1½" on one end and for a distance AB on the other. Wrap the long end of W2 around the shielding of the cable for approximately five turns and solder securely to the shielding. Solder the end AB in the ground insert of E1 as indicated in the respective cable assembly.

6. Bunch the insulated portions of all of the conductors together so that they will not rub on the shell H3 when the plug is reassembled. Draw the shell H3 up on the part E1. As this operation is performed, the hairpin spring H4 must be held in close contact with the inner surface of the shell and with the two studs protruding through the holes in the top of the shell. As the shell is drawn up on E1 spring H4 should pass into and be held in the square groove in the top of E1. Line up the screw hole in the shell with the threaded hole in the bottom of E1 and replace screw and lock washer H5.

7. Pull part H2 up against the rear of the plug and complete the assembly by tightening H1 on the threaded portion of the shell H3.

Do not use acid flux or paste in soldering; use only resin flux.

ASSEMBLY OF CONCENTRIC TRANSMISSION LINES

All flexible concentric transmission lines for the Model ZB-3 Homing Adapter Equipment are supplied in bulk lengths on contract NOs 84433. See page 11 for a tabulation of these lines and associated plugs. Figure 17 shows the installation of these lines.

The method of assembly of type CW-49195 or CSX-49195 plugs and flexible concentric transmission line is shown on Figure 22A and described below. The procedure is as follows:

1. Cut the cable to the length desired, allowing 1½" for length inside each plug.
2. Prepare the cable end as shown in Fig. 22A, removing the Vinyl covering for the length AD, the shielding for the length AC, and the dielectric for the length AB. The exposed shield over the length CD and the inner conductor should then be tinned, avoiding excessive solder, since the clearance inside the plug is only 1/16" over the bare shield.
3. Take the plug apart by backing out screw H3 and then removing parts H2 and H1 in sequence.
4. Slip the shell H2 and the clamping nut H1 onto the cable in that order.
5. Screw the plug body E1 onto the cable until the face B seats solidly against the insulated bushing of E1. This should expose the tip of the center conductor at point A.
6. Solder the shield to the plug body E1 through the four holes provided. Solder the center conductor to the plug sleeve at A. After cooling, dress down excess solder with a file to the sleeve diameter. In both these soldering operations *avoid excessive application of heat*, since the dielectric insulating bushing in the plug body can be damaged thereby.
7. Draw the clamping nut H1 up over the plug body E1, push the shell H2 up until it is well onto the body E1 but still allows free rotation of the clamping nut H1. This will require considerable force, which should be resisted by pushing against the rim of E1, rather than pulling on the cable. A convenient jig can be made for this operation by bench-mounting a dummy jack to which the body and clamping nut can be attached to give firm support for forcing H2 into place.
8. When the shell H2 is in proper position, tighten screw H3 to complete the assembly.

The flexible concentric transmission line is prepared for connection to the communications receiver as shown in Fig. 22B and as described below.

1. Remove the Vinyl covering for the length AD, the shield for the length AC, and the dielectric for the length AB.
2. Cut two lengths of No. 18 Gauge Insulated Wire approximately 10 inches long, one white and one black, for the end connections. Skin the ends, tin the shield and inner conductor and make connections to the shielding and inner conductor of the transmission line as indicated in the figure, making black the shield lead. Solder these connections securely.
3. Cover the entire assembly with one layer of rubber and one layer of friction tape.
4. The white lead is to be connected to the antenna post, and the black lead to the ground post of the communication receiver.

Do not use acid flux or paste in soldering; use only resin flux.

V. APPARATUS LISTS

Table I

LIST OF MAJOR UNITS AND ACCESSORIES OF MODEL ZB-3 EQUIPMENT AND PORTABLE TEST OSCILLATOR

Page No.	*Navy Type No.*	*Name of Major Unit or Accessory*	*Quantity per Equipment*	*Manufacturer's Designation*	*Unit Weight in Pounds*
32	CW-69076	Homing Adapter with mounting plate and tubes	1	ESR-691631-1	4.0
35	CW-23214	Pilot's Control Box with mounting plate	1	ESO-677303-3	.56
35	CW-29173	Switching Relay with mounting plate	1	ESO-691632-1	1.4
36	CW-60013	Portable Test Oscillator with tubes and batteries	1	ESR-677742-4	14.5
37	CW-49195 or CSX-49195	Coaxial Plug	4	ESL-638583 ESO-692851-1	.06
37	CLT-49062 or CFD-49062	8 Contact Power Plug	2	ESO-677955-1 ESO-677955-5	.15 ...
37	CLT-49133 or CFD-49133	4 Contact Power Plug	2	ESO-677955-3 ESO-677955-7	.10 ...
37	CLT-49132 or CFD-49132	3 Contact Power Plug	1	ESO-677955-4 ESO-677955-8	.10 ...
37	CLT-49134 or CFD-49134	5 Contact Power Plug	1	ESO-677955-2 ESO-677955-6	.12 ...
37		*8 Conductor Power Cable	10′	ESO-677960-1	.12/ft.
37		*3 Conductor Power Cable	10′	ESO-677960-2	.07/ft.
37		*Flexible Concentric Transmission Line	25′	ESO-677963-6	.11/ft.
37		Adapter Slip Cover	1	ESO-678397-1	.25

* These cables and transmission line are supplied in manufacturer's stock lengths.

Page No.	*Navy Type No.*	*Name of Major Unit or Accessory*	*Quantity per Equipment*	*Manufacturer's Designation*	*Unit Weight in Pounds*
37		Portable Test Oscillator Slip Cover	1	ESO-678398-1	.25
37		Homing Decode Card	3	ESO-678324-4	.01
38		Operating Spare Parts for Adapter	1	ESO-681296-3	1.8
40		Bulk Spare parts for Adapter	1 set per 10 equipments	ESA-692619 pages 7 & 8	. . .
39		Operating Spare Parts for Portable Test Oscillator	1	ESO-681294-3	1.0
41		Bulk Spare Parts for Portable Test Oscillator	1 set for 10 equipments	ESA-692619 page 9	
		Final Instruction Books	3		

Table II

PARTS LIST BY SYMBOL DESIGNATION

Type CW-69076 Homing Adapter

Desig-nation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
BP101	Ground Binding Post	Binding Post		A		ESO-677734-4
C101.1	Antenna Coupling Capacitor	Capacitor, Ceramic, 2 μμf ± ¼ μμf, 500 volts DC working	CER-481173-12	B	N680K	ESO-677726-1
C101.2	Antenna Coupling Capacitor	Capacitor, Ceramic, 5 μμf ± ¼ μμf, 500 volts DC working	CER-481174-5	B	P120K	ESO-677726-2
C102	Antenna Circuit Trimmer Capacitor	Capacitor, Variable Air, 2 plate		A		For number, see note page 35
C103	First R.F. Amplifier Cathode By-pass Capacitor	Capacitor, Ceramic, 30 μμf ± 1 μμf, 500 volts DC working	CER-481175-3	B	N680K	ESO-677726-4
C104	First R.F. Amplifier Cathode By-pass capacitor	Same as C103				
C105	First R.F. Amplifier Screen By-pass Capacitor	Same as C103				
C106	First R.F. Amplifier Plate Coupling Capacitor	Same as C101.2				
C107	Second R.F. Amplifier Grid Coupling Capacitor	Same as C101.2				
C108	Second R.F. Amplifier Grid Trimmer Capacitor	Capacitor, Variable Air, 2 plate		A		For number, see note page 35
C109	Second R.F. Amplifier Plate Coupling Capacitor	Same as C101.2				
C110	Second R.F. Amplifier Cathode By-pass Capacitor	Same as C103				
C111	Second R.F. Amplifier Screen By-pass Capacitor	Same as C103				
C112	Third R.F. Amplifier Plate Coupling Capacitor	Same as C101.2				
C113	Third R.F. Amplifier Grid Coupling Capacitor	Same as C101.2				
C114	Third R.F. Amplifier Grid Trimmer Capacitor	Capacitor, Variable Air, 2 plate		A		For number, see note page 35
C115	Detector Plate By-pass Capacitor	Capacitor, Ceramic, 20 μμf ± 1 μμf, 500 volts DC working	CER-481022-5	B	N680K	ESO-677726-3
C116	Third R.F. Amplifier Cathode By-pass Capacitor	Same as C103				
C117	Third R.F. Amplifier Screen By-pass Capacitor	Same as C103				
C118	Detector Grid Trimmer Capacitor	Capacitor, Variable Air, 2 plate		A		For number, see note page 35
C119	Detector Grid Coupling Capacitor	Same as C101.2				
C120	Plate Supply Decoupling Capacitor	Same as C103				
C121	Detector Screen By-pass Capacitor	Same as C103				

Designation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
C122	Detector Plate By-pass Capacitor	Capacitor, Mica 0.006 μf ± 10%, 300 volts DC working	CD-48847-B10	C	1WLS	ESO-677316–11
C123	Plate Supply Decoupling Capacitor	Same as C103				
C124	Plate Supply Decoupling Capacitor	Same as C103				
C125	Output Circuit Coupling Capacitor	Same as C122				
C126	First R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C127	First R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C128	Second R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C129	Second R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C130	Detector Heater By-pass Capacitor	Same as C103				
C131	Third R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C132	Third R.F. Amplifier Heater By-pass Capacitor	Same as C103				
C133	Detector Cathode By-pass Capacitor	Same as C101.2				
C134	Antenna Tuning Capacitor	Same as C101.1				
J101	Coaxial Input Jack	Concentric Coaxial Jack	CW-49194 or	A	D-162865	ESL-638614
J102	Coaxial Output Jack	Same as J101	CSX-49194	D	J-PT-5	ESO-692851–2
J103	Receptacle for Antenna Switching Relay Cable	Receptacle Plate Assembly, 4-Terminal	CW-49053	A	SO-54	ESO-677313–2
J104	Receptacle for Power Input Cable	Receptacle Plate Assembly, 3-Terminal	CW-49065	A	SO-57	ESO-677739–1
J105	Receptacle for Pilot's Control Box Cable	Receptacle Plate Assembly, 8-Terminal	CW-49043	A	SO-43	ESO-677312–4
L101	Antenna Tuning Coil	Radio Frequency Tuning Coil, Air Core		A		ESO-677735–5
L102	Second R.F. Grid Circuit Tuning Coil	Same as L101				
L103	Third R.F. Grid Circuit Tuning Coil	Same as L101				
L104	Detector Grid Circuit Tuning Coil	Same as L101				
L105	Detector Output Circuit Coupling Coil	Radio Frequency Coil, Air Core		A		ESO-677740–1
R101	First R.F. Amplifier Screen Resistor	Resistor, Composition, 200,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–14
R102	First R.F. Amplifier Plate Resistor	Resistor, Composition, 30,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–12
R103	Second R.F. Amplifier Grid Resistor	Resistor, Composition, 50,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–13

Desig-nation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
R104	Second R.F. Amplifier Cathode Bias Resistor	Resistor, Composition, 1,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–11
R105	Second R.F. Amplifier Plate Resistor	Same as R102				
R106	Second R.F. Amplifier Screen Resistor	Same as R101				
R107	Third R.F. Amplifier Grid Resistor	Same as R101				
R108	Third R.F. Amplifier Cathode Bias Resistor	Same as R104				
R109	Third R.F. Amplifier Screen Resistor	Same as R101				
R110	Third R.F. Amplifier Plate Resistor	Same as R102				
R111	Detector Grid Resistor	Resistor, Composition, 20,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–16
R112	Detector Cathode Resistor	Resistor, Composition, 10 ohms ± 10%, ½ watt	CIR-63678–10	E	BW-½	ESO-677726–22
R113	Detector Plate Resistor	Same as R102				
R114	Detector Screen Resistor	Same as R101				
R115	Detector Plate Decoupling Resistor	Resistor, Composition, 50 ohms ± 10%, ½ watt	CIR-63678–10	E	BW-½	ESO-677726–21
R116	Gain Control Resistor	Resistor, Composition, 100,000 ohms ± 10%, watt	CIR-63360–10	E	BT-½	ESO-677726–17
R117	First R.F. Amplifier Cathode Bias Resistor	Same as R104				
S102	12–24 Switch	Toggle Switch, DPDT; contacts rated 6 amps. at 125 volts, 3 amps. at 250 volts	CHH-24079-A	F	81012	ESO-677306–3
V101	First R.F. Amplifier Vacuum Tube	Vacuum Tube, Detector, Amplifier Pentode	–954		954	
V102	Second R.F. Amplifier Vacuum Tube	Same as V101				
V103	Third R.F. Amplifier Vacuum Tube	Same as V101				
V104	Detector Vacuum Tube	Same as V101				
X101	First R.F. Amplifier Vacuum Tube Socket	Vacuum Tube Socket, 5 Contact	CHC-49376 or CFK-49376	H N	UHS-900	ESO-677316–26 ESO-677316–27
X102	Second R.F. Amplifier Vacuum Tube Socket	Same as X101				
X103	Third R.F. Amplifier Vacuum Tube Socket	Same as X101				
X104	Detector Vacuum Tube Socket	Same as X101				

Note: The drawing numbers for the variable trimmer capacitors are as follows:

Capacitor	*Homing Adapter Serial Nos.*	*Rotor Plate Assembly*	*Stator Plate Assembly*
C102	1–4692, inclusive	ESO-678798–4	ESO-677736–5
	7857 and above	ESO-678798–4	ESO-691779–5
C108	1–4692, incl. and 7857 and above	ESO-691803–2*	
C114	1–4692, incl. and 7857 and above	ESO-691803–1*	
C118	1–4692, incl. and 7857 and above	ESO-691803–3*	

* These condensers consist of sub-assemblies which include other resistors and capacitors mounted on the stator insulator plate.

Type CW-23214 Pilot's Control Box

Designation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
J201	Homing Adapter Unit Cable Jack	Same as J105				
S201	Homing Communication Switch	Toggle Switch, DPDT; contacts rated 6 amps. at 125 volts, 3 amps. at 250 volts	CHH-24079	F	81012	ESO-677306–2
S202	Local Distant Switch	Toggle Switch, SPDT; contacts rated 6 amps. at 125 volts, 3 amps. at 250 volts	CHH-24078	F	81021	ESO-677306–1
S203	Main Power Switch	Same as S102				

Type CW-29173 Switching Relay

BP101	Binding Post for Communication Antenna	Binding Post		A		ESO-677734–5
C301	Antenna Series Capacitor	Capacitor, mica, 0.00015 μf ± 10%, 500 volts DC working	CD-48689-B10	C	5WLS	ESO-677316–1
C302	Antenna Trimmer Capacitor	Capacitor, mica, variable compression type, 20–150 μμf		A		ESO-677315–3
J301	Coaxial Jack for Homing Adapter Unit Output	Same as J101				
J302	Coaxial Jack for Communication Receiver	Same as J101				
J303	Homing Adapter Unit Cable Jack	Same as J103				
K301	Antenna Switching Relay	Relay, latching type, SPDT plus auxiliary contacts, for operation from 12 V. or 24 V.		I	CX-3190-B	ESO-684312–1

Type CW-60013 Portable Test Oscillator

Desig-nation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
B401.1	Filament Power Supply	Dry Battery, 6 V.	CNC-19020	J	718	ESO-678325-1
B401.2	Filament Power Supply	Same as B401.1				
B402.1	Plate Power Supply	Dry Battery, 45 V.	CNC-19021	J	482	ESO-678325-2
B402.2	Plate Power Supply	Same as B402.1				
C401	H.F. Oscillator Grid Coupling Capacitor	Same as C103				
C402	H.F. Oscillator Grid Filter Capacitor	Same as C103				
C403	H.F. Oscillator Plate By-pass Capacitor	Same as C103				
C404	L.F. Oscillator Grid Filter Capacitor	Same as C122				
C405	L.F. Oscillator Grid Capacitor	Capacitor, mica, 0.00005 μf ± 10%, 500 volts DC working	CD-48895-B10	C	5WLS	ESO-677316-2
C406	L.F. Oscillator Tuning Capacitor	Capacitor, mica, 0.0001 μf ± 5%, 500 volts DC working	CD-48674-D5	C	5R	ESO-677316-3
C407	L.F. Oscillator Plate By-pass Capacitor	Same as C122				
C408	H.F. Oscillator Heater By-pass Capacitor	Same as C103				
C409	L.F. Oscillator Heater By-pass Capacitor	Same as C103				
E401	High Frequency Antenna	Antenna for Test Oscillator		A		ESO-690284-1
E402	H.F. Oscillator Tuning Unit	Resonant Concentric Transmission Line		A		ESO-677748-5
E403	L.F. Oscillator Tuning Unit	Oscillator Tuning Unit Assembly		A		ESO-677728-1
J401	Output Jack	Concentric Coaxial Jack		A	KS-10130	ESL-690295
L401	R.F. Choke Coil	R.F. Choke Coil, air core		A		ESO-677743-4
L402	L.F. Oscillator Coil	Oscillator tuning coil, adjustable iron dust core		A		ESO-677728-2
R401	H.F. Oscillator Grid Resistor	Same as R103				
R402	H.F. Oscillator Grid Resistor	Same as R104				
R403	L.F. Oscillator Grid Resistor	Same as R103				
R404	L.F. Oscillator Grid Resistor	Same as R104				
R405	H.F. Oscillator Plate Resistor	Resistor, Composition; 10,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-15
R406	L.F. Oscillator Plate Resistor	Same as R104				
S401	Power Switch	Switch, DPST, contacts rated 6 amps. at 125 volts, 3 amps. at 250 volts	CHH-24080	F	81009	ESO-677306-4
T401	R.F. Output Transformer	R.F. Output Transformer, air core		A		ESO-677743-3 ESO-677748-3

Desig-nation	*Function*	*Description*	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*
TS401	Terminal Strip	Terminal Strip		A		ESO-677748-4
TS402	Terminal Strip	Terminal Strip		A		ESO-677729-3
V401	H.F. Oscillator Vacuum Tube	Vacuum Tube, Detector, Amplifier Triode	-955		955	
V402	L.F. Oscillator Vacuum Tube	Same as V401				
X401	H.F. Oscillator Vacuum Tube Socket	Same as X101				
X402	L.F. Oscillator Vacuum Tube Socket	Same as X101				
		Plugs				
P501	Coaxial Input Plug	Concentric Coaxial Plug, Straight Type	CW-49195 or CSX-49195	A D	D-162865 PL-PT-5	ESL-638583 ESO-692851-1
P502	Coaxial Output Plug	Same as P501				
P503	Coaxial Plug	Same as P501				
P504	Coaxial Plug	Same as P501				
P505	Power Cable Plug	Plug 2, 4-Contact, Straight Type	CLT-49133 or CFD-49133	K L	LU300S4	ESO-677955-3 ESO-677955-7
P506	Power Cable Plug	Same as P505				
P507	Power Cable Plug	Plug 3, 3-Contact, Straight Type	CLT-49132 or CFD-49132	K L	LU300S3	ESO-677955-4 ESO-677955-8
P508	Power Cable Plug	Plug 74, 5-Contact, Straight Type	CLT-49134 or CFD-49134	K L	LU300M5	ESO-677955-2 ESO-677955-6
P509	Power Cable Plug	Plug 1, 8 Contact, Straight Type	CLT-49062 or CFD-49062	K L	LU300M8	ESO-677955-1 ESO-677955-5
P510	Power Cable Plug	Same as P509				
		Transmission Lines and Cables				
		(Supplied in Stock Lengths)				
		Power Cable, 8 Conductor		O		ESO-677960-1
		Power Cable, 3 Conductor		O		ESO-677960-2
		Flexible Concentric Transmission Line Type PT-5	CASSF-50-1	M		ESO-677963-6
		Miscellaneous Items				
		Slip Cover for Adapter		A		ESO-678397-1
		Slip Cover for Portable Test Oscillator		A		ESO-678398-1
		Homing Decode Card		A		ESO-678324-4

Table III

LIST OF OPERATING SPARE PARTS

Type CW-69076 Homing Adapter

Parts Furnished	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*	*Quantity*
Capacitor, Ceramic, 2 μμf ± ¼ μμf (500 volts DC working)	CER-481173–12	B	N680K	ESO-677726–1	1
Capacitor, Ceramic, 30 μμf ± 1 μμf (500 volts DC working)	CER-481175–3	B	N680K	ESO-677726–4	1
Capacitor, Ceramic, 5 μμf ± ¼ μμf (500 volts DC working)	CER-481174–5	B	P120K	ESO-677726–2	1
Capacitor, Ceramic, 20 μμf ± 1 μμf (500 volts DC working)	CER-481022–5	B	N680K	ESO-677726–3	1
Capacitor, Mica, 0.006 μf ± 10%, 300 volts DC working	CD-48847-B10	C	1WLS	ESO-677316–11	1
Capacitor, Mica, 0.00015 μf ± 10%, 500 volts DC working	CD-48689-B10	C	5WLS	ESO-677316–1	1
Resistor, Composition, 200,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–14	1
Resistor, Composition, 100,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–17	1
Resistor, Composition, 30,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–12	1
Resistor, Composition, 50,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–13	1
Resistor, Composition, 1,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–11	1
Resistor, Composition, 20,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–16	1
Resistor, Composition, 10 ohms ± 10%, ½ watt	CIR-63678–10	E	BW-½	ESO-677726–22	1
Resistor, Composition, 50 ohms ± 10%, ½ watt	CIR-63678–10	E	BW-½	ESO-677726–21	1
Vacuum Tube	–954		954		4
Plate and Grid Clip		A		ESO-677727–2	8
Concentric Coaxial Plug	CW-49195	A	D-162865	ESL-638583	2
	or CSX-49195	D	PL-PT-5	ESO-692851–1	
Insulator		A		ESO-677314–1	1
Aligning Tool		A		ESO-678646–4	1
Parts for Struthers Dunn, Inc., Relay CX-3190-B consisting of:		I			1 set
Left Front Fixed Contact					
Right Front Fixed Contact					
Left Back Fixed Contact					
Right Back Fixed Contact					
Movable Contact Less Pigtails					
Auxiliary Fixed Right Contact					
Auxiliary Fixed Left Contact					
Auxiliary Movable Contact					
Tension Spring					
Relay Coil					

Type CW-60013 Portable Test Oscillator

Parts Furnished	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*	*Quantity*
Capacitor, Ceramic, 30 μμf ± 1 μμf	CER-481175-3	B	N680K	ESO-677726-4	1
Capacitor, Mica, 0.006 μf ± 10%, 300 volts DC working	CD-48847-B10	C	1WLS	ESO-677316-11	1
Capacitor, Mica, 0.00005 μf ± 10%, 500 volts DC working	CD-48895-B10	C	5WLS	ESO-677316-2	1
Capacitor, Mica, 0.0001 μf ± 5%, 500 volts DC working	CD-48674-D5	C	5R	ESO-677316-3	1
Resistor, Composition, 50,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-13	1
Resistor, Composition, 1,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-11	1
Resistor, Composition, 10,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-15	1
Vacuum Tube	—955		955		2
Choke Coil		A		ESO-677743-4	1
Open End Wrench		A		ESO-678646-3	1

Table IV

LIST OF BULK SPARE PARTS

Type CW-69076 Homing Adapter

Parts Furnished	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*	*Quantity*
Capacitor, Ceramic, 2 μμf ± ¼ μμf, 500 volts DC working	CER-481173-12	B	N680K	ESO-677726-1	1
Capacitor, Ceramic, 30 μμf ± 1 μμf, 500 volts DC working	CER-481175-3	B	N680K	ESO-677726-4	2
Capacitor, Ceramic, 5 μμf ± ¼ μμf, 500 volts DC working	CER-481174-5	B	P120K	ESO-677726-2	1
Capacitor, Ceramic, 20 μμf ± 1 μμf, 500 volts DC working	CER-481022-5	B	N680K	ESO-677726-3	1
Capacitor, Mica, 0.006 μf ± 10%, 300 volts DC working	CD-48847-B10	C	1WLS	ESO-677316-11	1
Capacitor, Mica, 0.00015 μf ± 10%, 500 volts DC working	CD-48680-B10	C	5WLS	ESO-677316-1	1
Resistor, Composition, 200,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-14	1
Resistor, Composition, 30,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-12	1
Resistor, Composition, 50,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-13	1
Resistor, Composition, 1,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-11	1
Resistor, Composition, 20,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-16	1
Resistor, Composition, 10 ohms ± 10%, ½ watt	CIR-63678-10	E	BW-½	ESO-677726-22	1
Resistor, Composition, 50 ohms ± 10%, ½ watt	CIR-63678-10	E	BW-½	ESO-677726-21	1
Resistor, Composition, 10,000 ohms ± 10%, ½ watt	CIR-63360-10	E	BT-½	ESO-677726-17	1
Plug 1, 8-contact	CLT-49062 or CFD-49062	K L	LU300M8	ESO-677955-1 ESO-677955-5	2 2
Plug 2, 4-contact	CLT-49133 or CFD-49133	K L	LU300S4	ESO-677955-3 ESO-677955-7	2 2
Plug 74, 5-contact	CLT-49134 or CFD-49134	K L	LU300M5	ESO-677955-2 ESO-677955-6	1 1
Plug 3, 3-contact	CLT-49132 or CFD-49132	K L	LU300S3	ESO-677955-4 ESO-677955-8	1 1
Concentric Coaxial Plug	CW-49195 or CSX-49195	A D		ESL-638583 ESO-692851-1	4 4
Insulator		A		ESO-677314-1	1
Mounting Plate for CW-69076 Homing Adapter		A		ESO-677740-2	2
Mounting Plate for CW-23214 Pilot's Control Box		A		ESO-677304-3	2
Mounting Plate for CW-29173 Switching Relay		A		ESO-677309-2	2
SPDT Switch	CHH-24078	F	81021	ESO-677306-1	2
DPDT Switch	CHH-24079	F	81012	ESO-677306-2	2
Binding Post		A		ESO-677734-5	2
Pilot's Control Box	CW-23214	A		ESO-677303-2	1
Dial Assembly		A		ESO-677740-6	1
Switching Relay	CW-29173	A		ESO-691632-1	1
*8 Conductor Power Cable		O		ESO-677960-1	10 ft.
*3 Conductor Power Cable		O		ESO-677960-2	10 ft.
*Flexible Concentric Transmission Line		M		ESO-677963-6	25 ft.
Bushing		A		ESO-677294-6	2

* These cables and transmission line are supplied in manufacturer's stock lengths.

Type CW-60013 Portable Test Oscillator

Parts Furnished	*Navy Type No.*	*Mfr.*	*Mfr. Type No.*	*Drawing and Part No.*	*Quantity*
Capacitor, Ceramic, 30 μμf ± 1 μμf, 500 volts DC working	CER-481175–3	B	N680K	ESO-677726–4	1
Capacitor, Mica, 0.006 μf ± 10%, 300 volts DC working	CD-48847-B10	C	1WLS	ESO-677316–11	1
Capacitor, Mica, 0.00005 μf ± 10%, 500 volts DC working	CD-48895-B10	C	5WLS	ESO-677316–2	1
Capacitor, Mica, 0.0001 μf ± 5%, 500 volts DC working	CD-48674-D5	C	5R	ESO-677316–3	1
Resistor, Composition, 50,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–13	1
Resistor, Composition, 1,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–11	1
Resistor, Composition, 10,000 ohms ± 10%, ½ watt	CIR-63360–10	E	BT-½	ESO-677726–15	1
Switch, DPST	CHH-24080	F	81009	ESO-677306–4	1
Jack		A	KS-10130	ESL-690295	1
Antenna Rod Assembly		A		ESO-690284–1	1

Table V

PARTS LIST BY NAVY TYPE NUMBER

Navy Type No.	ZB-3 Homing Adapter Equipment: Quantity per Equipment	ZB-3 Homing Adapter Equipment: Symbol Designations Involved	Portable Test Oscillator: Quantity per Equipment	Portable Test Oscillator: Symbol Designations Involved
Batteries (Class 19)				
19020			2	B401.1, 401.2
19021			2	B402.1, 402.2
Switches (Class 24)				
24078	1	S202		
24079	1	S201		
24079-A	2	S102, 203		
24080			1	S401
Vacuum Tubes (Class 38)				
—954	4	V101, 102, 103, 104		
—955			2	V401, 402
Capacitors (Class 48)				
481022–5	1	C115		
481173–12	2	C101.1, 134		
481174–5	8	C101.2, 106, 107, 109, 112, 113, 119, 133		
481175–3	18	C103, 104, 105, 110, 111, 116, 117, 120, 121, 123, 124, 126, 127, 128, 129, 130, 131, 132	5	C401, 402, 403, 408, 409
48674-D5			1	C406
48689-B10	1	C301		
48847-B10	2	C122, 125	2	C404, 407
48895-B10			1	C405
Plugs and Sockets (Class 49)				
49043	2	J105, 201		
49053	2	J103, 303		
49062	2	P509, 510		
49065	1	J104		
49132	1	P507		
49133	2	P505, 506		
49134	1	P508		
49194	4	J101, 102, 301, 302		
49195	4	P501, 502, 503, 504		
49376	4	X101, 102, 103, 104	2	X401, 402

Resistors (Class 63)

	ZB-3 Homing Adapter Equipment		*Portable Test Oscillator*	
Navy Type No.	*Quantity per Equipment*	*Symbol Designations Involved*	*Quantity per Equipment*	*Symbol Designations Involved*
63360–10 (1,000 ohms)	3	R104, 108, 117	3	R402, 404, 406
63360–10 (10,000 ohms)			1	R405
63360–10 (20,000 ohms)	1	R111		
63360–10 (30,000 ohms)	4	R102, 105, 110, 113		
63360–10 (50,000 ohms)	2	R103, 107	2	R401, 403
63360–10 (100,000 ohms)	1	R116		
63360–10 (200,000 ohms)	4	R101, 106, 109, 114		
63678–10 (10 ohms)	1	R112		
63678–10 (50 ohms)		R115		

Table VI

IDENTIFICATION OF MANUFACTURERS

Navy Prefix	*Code Letter In Table I*	*Manufacturer*
CW-	A	Western Electric Co., Kearny, N. J.
CER-	B	Erie Resistor Corp., Erie, Pa.
CD-	C	Cornell-Dubilier Condenser Corp., South Plainfield, N. J.
CSX-	D	Selectar Mfg. Co., Long Island City, N. Y.
CIR-	E	International Resistance Co., Philadelphia, Pa.
CHH-	F	Arrow-Hart & Hegeman Electric Co., Hartford, Conn.
CHC-	H	Hammarlund Mfg. Co., New York, N. Y.
CSD-	I	Struthers Dunn, Inc., Philadelphia, Pa.
CNC-	J	National Carbon Co., New York, N. Y.
CLT-	K	Lundquist Tool Co., Worcester, Mass.
CFD-	L	Federal Mfg. & Engineering Corp., Brooklyn, N. Y.
CPH-	M	American Phenolic Corporation, Chicago, Ill.
CFK-	N	A. W. Franklin Mfg. Co., New York, N. Y.
	O	General Cable Co., New York, N. Y.

Fig. 13—Model ZB-3 Homing Adapter Equipment—Schematic Circuit Diagram

TYPE CW-69076 HOMING ADAPTER

SEE NOTE 1

"ANT TRIM"

TO HOMING ANTENNA

TO COMMUNICATION RECEIVER ANTENNA

"ALIGN INPUT"

TO COMMUNICATION RECEIVER

TYPE CW-28173 SWITCHING RELAY

ON ALL RELAYS ABOVE APPROX. SERIAL NO. 2500 THIS CONNECTION IS OMMITTED.

TO JUNCTION BOX OF COMMUNICATION EQUIPMENT

TYPE CW-2321A PILOT'S CONTROL BOX

FIG. 13A

FIG. 13B

NOTES

1. FOR MODELS SERIAL NOS. 7857 AND ABOVE, CONNECTIONS ARE AS SHOWN ON SCHEMATIC. FOR MODELS SERIAL NOS. 1 TO 4692 C134 IS OMITTED AND CONNECTIONS MAY BE EITHER AS SHOWN ON FIG. 13A WHEN C101.1 AND C102 ARE USED OR AS SHOWN ON FIG. 13B WHEN C101.1 ONLY IS USED DEPENDING ON CIRCUIT REQUIREMENTS AS DETERMINED IN MANUFACTURE.

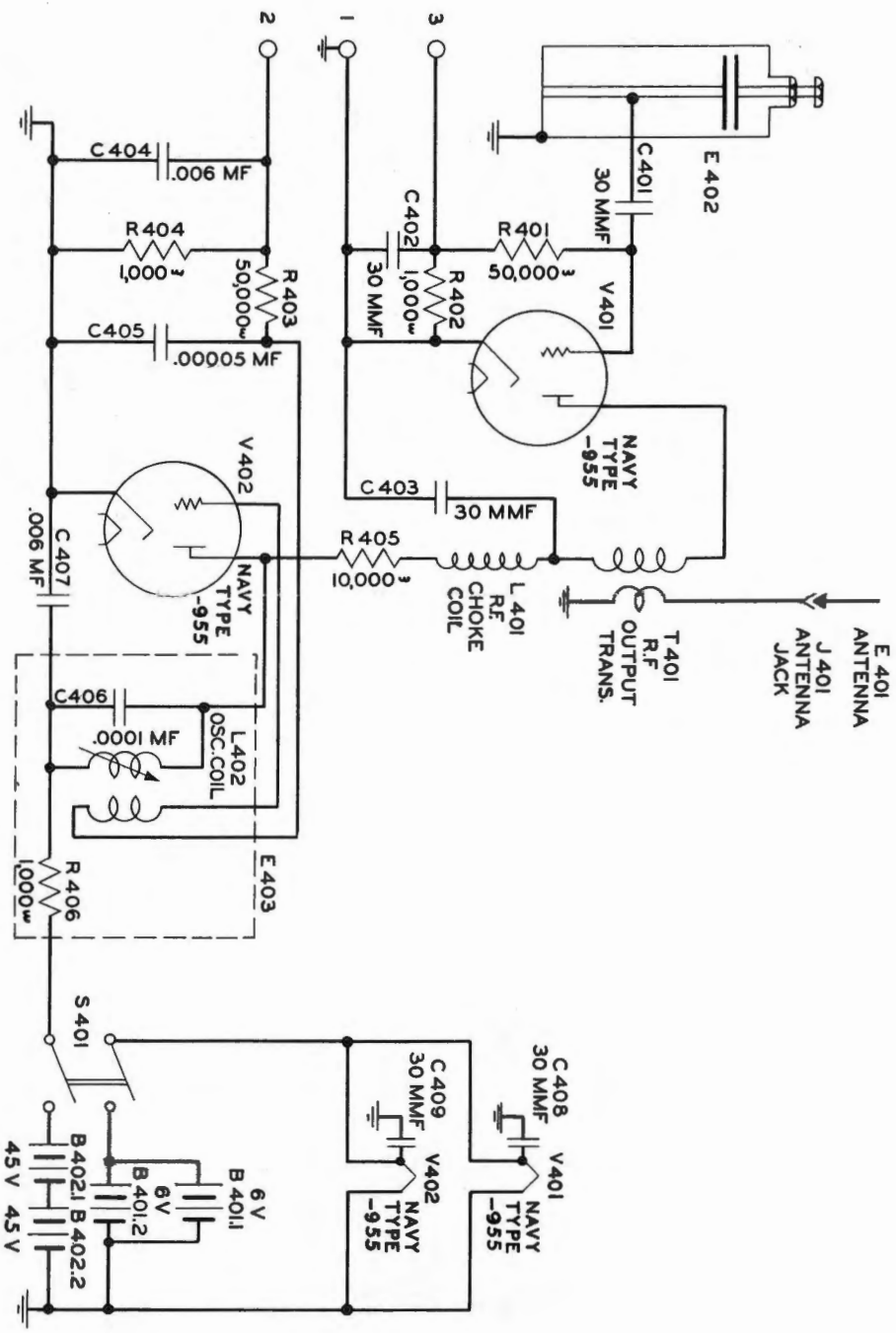
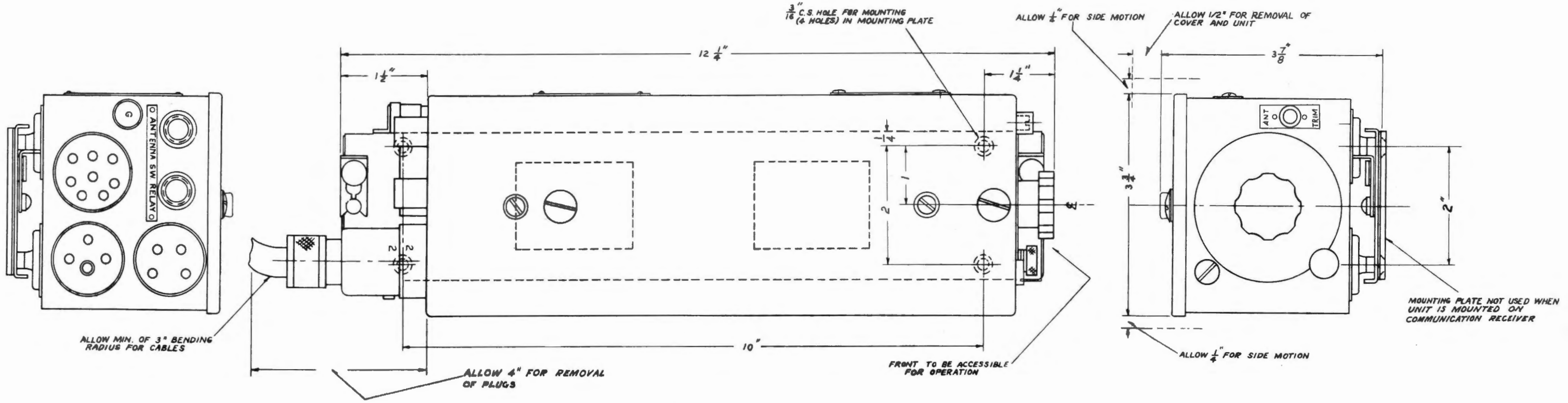
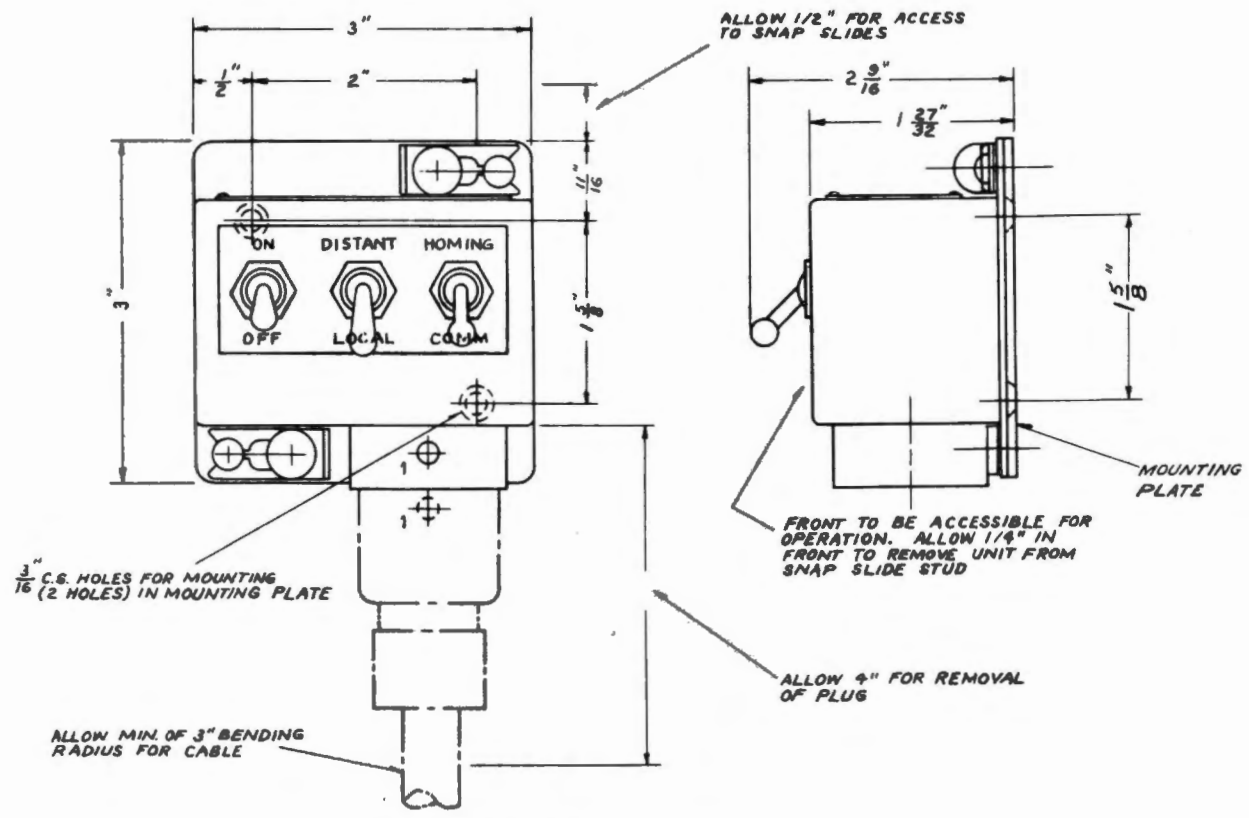


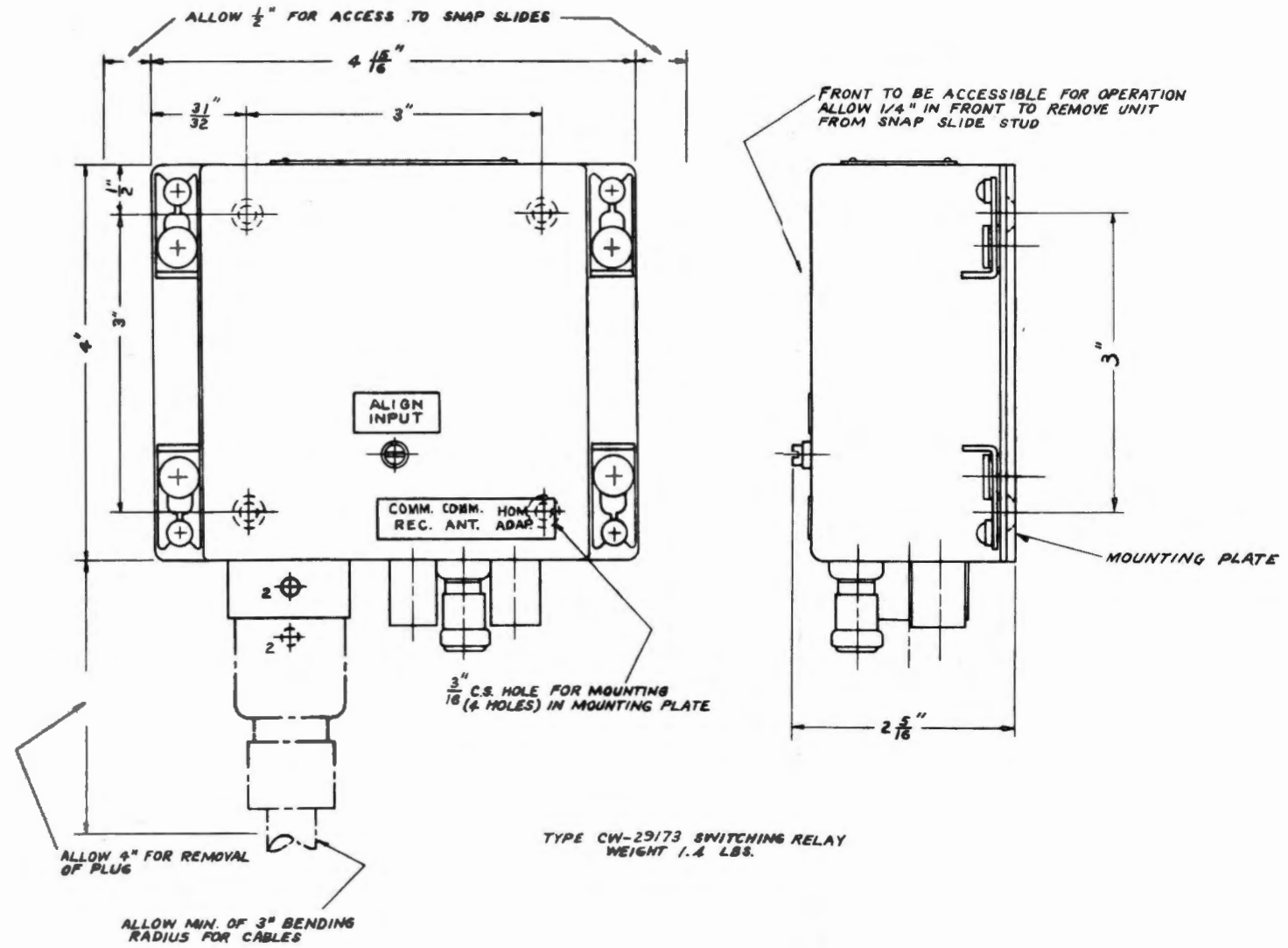
Fig. 14—Type CW-60013 Portable Test Oscillator—Schematic Circuit Diagram



TYPE CW-69076 HOMING ADAPTER
WEIGHT 4.0 LBS.
INCLUDING TUBES

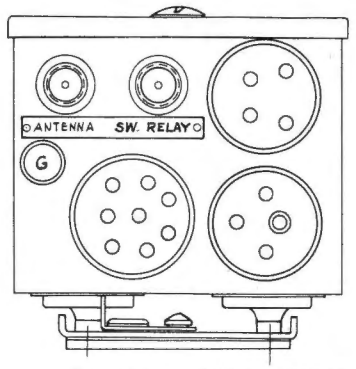


TYPE CW-23214 PILOT'S CONTROL BOX
WEIGHT 0.56 LB.



TYPE CW-29173 SWITCHING RELAY
WEIGHT 1.4 LBS.

Fig. 15—Model ZB-3 Homing Adapter Equipment—Outline Dimensions



CW-69076 HOMING ADAPTER
REAR VIEW

TYPE CW-69076 HOMING ADAPTER
WEIGHT 4.0 LBS. INCLUDING TUBES

TYPE CW-49195 OR
CSX-49195 PLUGS

TYPE CLT-49133 OR
CFD-49133 PLUG

CABLE ASSEMBLY #2
3 CONDUCTOR POWER CABLE & 4 CONTACT PLUGS
ALLOW 1 5/16 DIA. HOLE FOR CLEARANCE FOR PLUGS

ALLOW 1" DIA. HOLE FOR CLEARANCE FOR PLUG.

25/64" O.DIA.

FLEXIBLE CONCENTRIC TRANSMISSION LINE #2
ALLOW 1" DIA. HOLE FOR CLEARANCE FOR PLUGS.

ALLOW 1" DIA. HOLE FOR CLEARANCE FOR PLUG

TYPE CLT-49062 OR
CFD-49062 PLUG

13/32" O.DIA.

FLEXIBLE CONCENTRIC TRANSMISSION LINE #1
TO HIGH FREQUENCY ANTENNA

CABLE ASSEMBLY #3
3 CONDUCTOR POWER CABLE AND PLUGS

13/32" O.DIA.

ALLOW 1 5/16" DIA. HOLE FOR CLEARANCE FOR PLUG.

25/64" O.DIA.

TYPE CW-29173 SWITCHING RELAY
WEIGHT 1.4 LBS.

TYPE CW-49195 OR
CSX-49195 PLUGS

TO COMMUNICATION RECEIVER
ANTENNA (FURNISHED BY NAVY)

TYPE CLT-49134 OR
OR CFD-49134 PLUG

ALLOW 1 7/16" DIA. HOLE FOR
CLEARANCE FOR PLUG

FLEXIBLE CONCENTRIC TRANSMISSION LINE #3
TO COMMUNICATION RECEIVER

JUNCTION BOX
FURNISHED BY NAVY

TYPE CLT-49132 OR
CFD-49132 PLUG

1/2" O.DIA.

CABLE ASSEMBLY #1
8 CONDUCTOR POWER CABLE & PLUGS
ALLOW 1 7/16" DIA. HOLE FOR CLEARANCE FOR PLUGS.

NAMEPLATE

ON DISTANT HOMING
OFF LOCAL COMM

TYPE CW-23214 PILOT'S CONTROL BOX
WEIGHT 0.56 LB.

TYPE CLT-49062
OR CFD-49062 PLUG

NOTES

1. LENGTH OF CABLES TO BE AS REQUIRED IN INDIVIDUAL INSTALLATIONS WITH FOLLOWING QUALIFICATIONS:
   - A. ALL TRANSMISSION LINES AND CABLES TO BE AS SHORT AS POSSIBLE.
   - B. FLEXIBLE TRANSMISSION LINE #1 (HOMING ADAPTER TO ANTENNA) NOT TO EXCEED 20 FT.
   - C. TOTAL LENGTH OF FLEXIBLE TRANSMISSION LINE #2 (HOMING ADAPTER TO SWITCHING RELAY) PLUS FLEXIBLE TRANSMISSION LINE #3 (SWITCHING RELAY TO COMMUNICATION RECEIVER) NOT TO EXCEED 5 FT.
2. CABLES, TRANSMISSION LINE AND PLUGS TO BE FURNISHED IN BULK WITH ALLOWANCE FOR EACH EQUIPMENT AS FOLLOWS:
   - A. FLEXIBLE CONCENTRIC TRANSMISSION LINE - 25 FT. (.11 LB./FT.)
   - B. THREE CONDUCTOR POWER CABLE - 10 FT. (.069 LB./FT.)
   - C. EIGHT CONDUCTOR POWER CABLE - 10 FT. (.125 LB/FT.)
   - D. PLUGS - AS SHOWN.
3. ALLOW MINIMUM BENDING RADIUS OF 3 IN., FOR ALL CABLES.

TYPICAL WEIGHT SUMMARY
(BASED ON MAXIMUM LENGTHS OF CABLE SUPPLIED.)

	WEIGHT
CW-69076 HOMING ADAPTER INCLUDING TUBES & MOUNTING PLATE	4.0 LBS.
CW-23214 PILOT'S CONTROL BOX	0.56 LB.
CW-29173 SWITCHING RELAY	1.4 LBS.
* TOTAL OF ALL REQUIRED PLUGS	0.97 LBS.
* FLEXIBLE TRANSMISSION LINE SUPPLIED (25')	2.75 LBS.
* 8 CONDUCTOR POWER CABLE SUPPLIED (10')	1.25 LBS.
* 3 CONDUCTOR POWER CABLE SUPPLIED (10')	0.69 LB.
TOTAL WEIGHT	11.62 LBS.

*SEE NOTE 2

Fig. 17—Model ZB-3 Homing Adapter Equipment—Cabling Diagram