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THE

RADAR INSTALLATION PLAN

Part E

SHIP BOARD
IFF MARK 3 EQUIPMENT
AND
RADAR BEACONS

NAVY DEPARTMENT

BUREAU OF SHIPS

39318

PAGE	TITLE		R.I.P. CHANGE
E-Submarines-2.1	The Installation of Model BN and Model BK Equipments And Associated Antenna System Aboard Submarines (Cont'd)		#41
E-Submarines-2.2	" " " " (Cont'd)		#41
E-Submarines-3	The Interconnection of Model BN and BK Equipments For Single Operation With SD Series Radars		#41
E-Submarines-3.1	" " " " " (Cont'd)		#41
E-Submarines-4	Dual IFF Mark 3 Operation With Two Search Radars		#41
E-Submarines-4.1	" " " " "		#41
E-Submarines-5	IFF MK 3 Type Installation For Submarines	RE 66F 450B	#41
E-Submarines-6	Shear Valve Assembly For Submarine Antenna Cable Use	RE 66F 451A	#41
E-Submarines-7	Navy Type CAGQ-66AFU Submarine Antenna Assembly (And Navy Type CAGQ 24AAE Antenna Change-Over Switch)	RE 66F 452A	#41
E-Submarines-8	IFF Equipment MK 3 Navy Type CAGQ-66AFU-1 Submarine Antenna Assembly	RE 66F 526A	#41
E-Submarines-9	IFF Equipment MK 3 Antenna Change-Over Switch CAGQ-24AAL Outline & Mtg. Dim's	RE 24AA 164A	#41
E-Submarines-10	IFF Mark 3 Interconnections For SD Series BN-BK	RE 43AA 324B	#41
E-Submarines-11	IFF MK 3 Equipment Models BN, BK & SD-5 Interconnections For Submarine Installation	RE 43F 428A	#41
E-Submarines-11.1	IFF MK 3 Equipment Models BN, BK & SV Interconnections For Submarine Installation	RE 43F 427A	#41
E-Submarines-12	IFF Equipment MK 3 Radar Selector Relay System Junct.-Box Navy Type CN-23AGK Outline & Mtg. Dimensions	RE 43AA 439B	#41
E-Submarines-13	IFF Equipment MK 3 Relay System For Dual Operation of Model BN With Two Radars	RE 43F 436C	#41
E-Submarines-14	IFF Equipment MK 3 Models BN & BK Interconnections For Dual Radar Submarine Operation	RE 43F 460B	#41
E-Submarines-15	IFF Equipment MK 3 Model BK Modification For Dual Radar Submarine Operation	RE 43F 488A	#41
E-Beacons-1	Radar Beacons		#41
E-AN/CPN6-1	AN/CPN-6		#41
E-AN/CPN6-1.1	" " " (Cont'd)		#41
E-AN/CPN6-1.2	" " " (Cont'd)		#41
E-AN/CPN6-2	CPN-6 Radar Beacon Installation Data	RE 43F 346-B	#41
E-AN/CPN6-3	CPN-6 Radar Beacon Outline and Mounting Dimensions	RE 10F 720B	#41
E-AN/CPN6-4	CPN-6 Radar Beacon Antenna Assembly Type AS-118/CPN-6	RE 66F 508A	#41

PAGE	TITLE		R.I.P. CHANGE
E-BM-3	MK 3 IFF Equipment Models BM & BM-1 External Cabling With SC-SK-SA (Series) Radars	RE 43F 347B	#40
E-BM-4	IFF MK 3 Equipment Models BM & BM-1 External Cabling With SC-4, SC-5 & SK-3 Radars	RE 43F 356B	#40
E-BM-5	Models BM-1, BM & BL Mark 3 IFF Equipment External Cabling to Model SR Radar	RE 8F 718C	#41
E-BM-6	IFF Equipment Mk 3 Model BM-1 Interconnection With Model SR-2 Radar	RE 43AA 493A	#41
E-BN-1	The Installation of Model BN Series Equipments		#41
E-BN-1.1	" " " " " " " "(Cont'd)		#41
E-BN-2	The Interconnection of Model BN Series Equipments to Various Search Radars		#41
E-BN-2.1	" " " " " " (Cont'd)		#41
E-BN-2.2	" " " " " " (Cont'd)		#41
E-BN-3	IFF Equipment Mk 3 Model BN Series Outline and Mounting Dimensions	RE 8F 532B	#40
E-BN-3.1	CTZ-50 ACW Duplexer	RE 8F 569-A	#41
E-BN-4	IFF Equipment MK 3 Model BN Series External Cabling	RE 8F 546C	#40
E-BN-4.1	IFF Equipment MK 3 External Cabling Model BN Series With SA-1, SD-3, SE, SF, and SG (Series) Radars	RE 43F 441B	#41
E-BN-4.2	IFF Equipment MK 3 External Cabling Model BN Series and SH, SJ, SL, SO & SU Radars	RE 43F 440B	#41
E-BN-4.3	IFF MK 3 Equipment Model BN Interconnection With SG-3/4 Radars	RE 43AA 434B	#41
E-BN-5	IFF MK 3 Equipment Model BN Interconnection With SU & SU-1 Radar	RE 43AA 405B	#40
E-BO-1	Model BO Equipments General Information		#41
E-BM/BO/SM-1	The Installation of IFF Mark 3 Components With Model SM Radars		#41
E-BM/BO/SM-2	IFF Equipment Interconnections For BM & BO Equipments With Radar Model SM	RE 43F 312C	#40
E-BM/BO/SM-3	IFF Equipment Interconnections For Models BM-1 & BO-1 With Radar Model SM	RE 43F 402A	#40
E-BM-1/BO-1/SP-1	The Installation of IFF Mark 3 Components With Model SP Radars		#40
E-BM-1/BO-1/SP-2	IFF Equipment Models BM-1 & BO-1 Interconnection Diagram With Model SP Radar	RE 43F 369B	#40
E-Submarines-1	General Information Concerning The Installation of IFF Mark 3 Equipments aboard Submarines		#41
E-Submarines-2	The Installation of Model BN and Model BK Equipments And Associated Antenna System Aboard Submarines		#41

PAGE	TITLE		R.I.P. CHANGE
E-BK-1	General Information Concerning The Assignment and Installation of Model BK Transpondors		#41
E-BK-1.1	" " " " " " (Cont'd)		#41
E-BK-2	Technical Factors Governing The Installation of Model BK Equipments		#41
E-BK-2.1	" " " " " " (Cont'd)		#41
E-BK-3	Installation and Stowage of AN-M3 Destructors for BK Equipments		#40
E-BK-3.1	" " " " " (Cont'd)		#40
E-BK-3.3	IFF Mark 3 Model BK Equipment Stowage Locker For AN-M3 Destructor	RE 10F 326A	#40
E-BK-4	Pre-Installation Tests and Modifications For BK Equipments		#41
E-BK-5	IFF Equipment Model BK Series Dimensions & Weights	RE 10F 315B	#40
E-BK-6	IFF Equipment Model BK Series Wiring Connections	RE 8F 511E	#41
E-BK-7	The Use of Suppression Circuits For Model BK Series Equipments		#41
E-BK-7.1	" " " " " " (Cont'd)		#41
E-BL-1	The Installation of Model BL Series Equipments		#41
E-BL-1.1	" " " " " " (Cont'd)		#41
E-BL-1.2	" " " " " " (Cont'd)		#41
E-BL-2	The Interconnection And Adjustment of BL Series Equipments With Various Search Radars		#41
E-BL-2.1	" " " " " "(Cont'd)		#41
E-BL-5	Model BL Series IFF Installation Dimensions	RE 8AA 278C	#40
E-BL-6	IFF Equipment MK 3 Model BL Series External Cabling	RE 62F 132D	#40
E-BL-7	IFF Equipment MK 3 Model BL Interconnection With SA, SC & SK Series	RE 43F 438A	#40
E-BL-9	Model BL Series IFF Equipments Cable Support Duplex Unit, Impedance Matching Section	RE 43A 279B	#40
E-BL-9.1	Type CTZ-50ABS-1 Duplexing Unit For Use With IFF Mk 3 Interrogator-Responsor Equipment	RE 8F 542A	#41
E-BL-10	Model BL-1, BL-2, & BL-3 IFF Equipment Installation of Power Cable For Ventilating Fan Motor	RE 8A 510B	#40
E-BL-11	Modification of BL Video Output Circuits For Operation With Various Search Radars		#41
E-BM-1	The Installation of Model BM Series Equipments		#41
E-BM-1.1	" " " " " " " (Cont'd)		#41
E-BM-1.2	" " " " " " " (Cont'd)		#41
E-BM-2	Outline and Mounting Dimensions Model BM & BM-1 Equipment	RE 8F 575C	#40
E-BM-2.1	IFF MK 3 Equipment Models BM & BM-1 Basic Connections	RE 43AA 403A	#40

THE RADAR INSTALLATION PLAN

Table of Contents

Part E

SHIPBOARD IFF MARK 3 EQUIPMENTS AND RADAR BEACONS

PAGE	TITLE		R.I.P. CHANGE
E-I, II, III, IV, V	Table of Contents		#41
E-General-1	IFF Mark 3 General Policy		#41
E-ANT-1	IFF Mark 3 Antennas Directional Arrays		#41
E-ANT-1.1	IFF Mark 3 Antennas With SA Series Radars		#41
E-ANT-1.2	IFF Mark 3 Antennas With SC Series Radars		#41
E-ANT-1.3	IFF Mark 3 Antennas With SK Series Radars		#41
E-ANT-1.4	IFF Mark 3 Antennas SC/SK Replacement Antenna		#41
E-ANT-1.5	IFF Mark 3 Antennas With SR Series Radars		#41
E-ANT-1.6	" " " " " (Cont'd)		#41
E-ANT-2	IFF Mark 3 Antennas Omnidirectional Types		#41
E-ANT-2.1	" " " " " (Cont'd)		#41
E-ANT-2.2	Antenna Type CTZ-66AFJ		#41
E-ANT-3	IFF Mark 3 Transmission Lines and Connectors		#41
E-ANT-3.1	" " " " " (Cont'd)		#41
E-ANT-3.2	" " " " " (Cont'd)		#41
E-ANT-4	IFF Equipment Large Vertical Antenna Type CTZ-66-ACF	RE 66F 385D	#41
E-ANT-5	IFF Equipment Mark 3 Small Vertical Antenna Type CTZ 66 ACG	RE 66F 410B	#41
E-ANT-6	IFF Equipment Mark 3 Small Vertical Antenna Type CTZ 66 AFJ	RE 66F 429A	#41
E-ANT-8	Installation Instructions For UG-32/U and UG-33/U End Seals for 7/8" Rigid Line	RE 49F 269A	#40
E-ANT-8.1	Instructions For Assembling Navy Type 49268 or 49269 Jack with Army & Navy Type RG-8/U or RG-10/U	RE 49AA 196B	#40
E-ANT-8.2	Instructions For Assembling A/N Type UG-23/U Jack with RG/8U or RG 10/U Cable	RE 49Z 270A	#40
E-ANT-8.4	Instructions For Assembling Connector Plug Navy Type 49483A on RG 17/U & RG 18/U Cables for use with A/M Type UG-22/U Jack & UG-23/U Connector	RE 49Z 232C	#40

PAGE	TITLE		R.I.P. CHANGE
E-AN/CPN6-5	CPN-6 Radar Beacon Top Shock Mount Installation Details	RE 43AA 479A	#41
E-AN/CPN6-6	TS-120/UP Test Set Outline & Mtg. Dimensions	RE 60AA 115A	#41
E-AN/CPN6-7	TS-28/UPN Synchroscope Test Equipment Outline & Mounting Dimensions	RE 60F 114B	#41
E-AN/CPN6-8	Type AN/UPA-1 Detector-Amplifier Test Equipment Outline Dimensions	RE 60AA 116A	#41
E-YJ-1	Model YJ Series		#41
E-YJ-1.1	" " " (Cont'd)		#41
E-YJ-2	Model YJ-1 Radar Beacon Outline & Mounting Dimensions and External Cabling	RE 10F 346A	#40
E-YJ-3	Mounting Bracket For YJ-1 Antenna	RE 66AA 496A	#40
E-YJ-4	Model YJ-2(B) Radar Beacon Outline & Mounting Dimensions and External Cabling	RE 66F 512B	#40
E-YJ-5	Model YJ-2(B) Radar Beacon Antenna Assembly Type CMD-66AJL	RE 66F 510B	#40
E-YJ-6	AN/UPM-1B Test Equipment Outline & Mounting Dimensions	RE 60F 113A	#41

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IFF MARK 3
GENERAL POLICY

1. IFF Mark 3 is a system of identification requiring installations in practically all types of vessels in the Fleet and involving many thousands of equipments. Its value in any given area requires a high percentage of completed and operating installations.

2. A small number of different equipments universal in application have been developed in order to expedite large scale installations and to minimize special requirements for individual installation. All radar models provide interconnection facilities and sufficient power for their associated IFF equipments; interconnecting cables are few and all of standard Navy type; equipments are small, relatively light weight, and electrically less complicated than detection radars, and antenna and duplexing systems are interchangeable.

3. Installations are considered to be within the capacity of Forces Afloat, and Tenders and Repair vessels should draw on Radio Pools for material. Antennas and cables are separate components of the system and are not included as items on the various equipment contracts. Duplexers are separate items for BL Series equipments, but are packed with BN and built into Models BM and BO equipments.

IFF MARK 3
TRANSMISSION LINES AND CONNECTORS

General

1. All IFF Mark 3 equipments, both Interrogator-Responsors and Transpondors, have been designed to operate with 50 ohm transmission lines. In addition, all equipments and all omnidirectional antennas provide connection facilities for the 50 ohm solid dielectric cable type RG-10/U.

2. Where connections are made to the gas-filled coaxial lines on various radar pedestals, special waterproof and gasproof connectors are required. These are described in the following pages.

Characteristics of RG-10/U

3. This cable has a nominal impedance of 52 ohms. At IFF Mark 3 frequencies losses are of the order of 3.2 db per hundred feet. Temperatures above 100 centigrade are injurious. The outside diameter is 0.460 inch.

4. Although originally the dielectric for this cable was polyisobutylene, all present production calls for polyethylene. The former is a white or grayish soft substance readily indented with a finger nail. If it has aged or been exposed to varying temperatures it invariably is characterized by a cracked surface effect often extending to the inner conductor. Polyethylene is characterized by an opaque, waxlike coloration not readily indented by the fingernail. Both types of cable are in use by the Navy.

5. Excessive lengths of transmission lines directly reduce the usable range of the IFF system. For this reason it is essential to keep such cable runs as short as practicable consistent with reasonably clear antenna locations.

6. In general longer runs are permissable for Interrogator-Responsors where directional antennas are used than for any omnidirectional antenna installations. In the former case, whereas the Interrogator-Responsor equipment will usually be located in the same spaces with the associated radar transmitter, the radar and IFF lines will be of the same length. This is satisfactory for all installations using built-in directional IFF arrays.

7. Transmission lines for BK, BL, BM and BN equipments (using omnidirectional antennas) should be kept to 100 feet in length.

Installations of Transmission Lines

8. The RG-10/U cable, although armored, is small and easily damaged. Excessive pressure caused by stuffing tubes or cable clamps will usually distort the cable changing its impedance considerably or short circuit the inner conductor. Activities concerned should carefully check all installations.

9. Where transmission line installations are so located that they are subject to accidental damage from other shipboard equipment or from personnel, protective measures should be taken.

10. Every effort should be taken to install this type of cable away from excessive temperature caused by stack gasses. Where such installations are necessary, the cable should be protected as much as possible. Various cooling and ventilating methods have been developed by installing activities to overcome

this difficulty. Each case will, in general, require particular investigation and solution. In all cases where damage is gradual it will be desirable to replace the entire cable at regular intervals.

11. There have been a few installations involving builtin IFF antennas where, because of severe damage to the RG-10/U cable from stack gasses, a solution was found involving the use of a gas-filled 7/8" coaxial line. The latter, connected at the radar pedestal, was of a sufficient length to pass through the high temperature zone at which point the normal RG-10/U cable was attached using the same type of connector originally installed at the pedestal. This type of installation is satisfactory where necessary, but is not desirable otherwise because of increased line losses and reflection.

Testing of Transmission Lines and Antennas.

12. After installation of the transmission line with connectors attached but before any connection is made to either the antenna or the equipment, a continuity check should be made to discover any accidental short circuits. Meggers may be used wherever available. It is essential that this test be completed prior to connection to the antenna (either directional or omnidirectional) because certain antenna systems will normally show a DC short circuit while others will be open circuited. Specific information is available in the discussions of each type of antenna.

13. It is sometimes difficult to determine accurately whether an antenna system is defective. Where the antenna would normally show a DC short it is impossible to determine whether another short is present by using the ordinary continuity meter; similarly, where an antenna is normally open circuit, it is impossible to determine whether the antenna has other open circuits. Where all indications are that an antenna is defective the following procedure is recommended where practicable:

(a) Remove the existing antenna connection at the equipment (at duplexer for BL Series and BN Series).

(b) Using a supplementary cable connect the equipment to the antenna of another IFF equipment and check results.

(c) If apparently normal on second antenna, reconnect original system, remove the connection at the antenna and check the transmission line. If normal operation is still not obtained, the antenna itself is probably at fault.

14. Where transmission lines have been damaged it is desirable for other than temporary installations to provide new lines rather than to insert new sections and additional connectors. There is no objection, however, to the use of cable splicing kits where available. At the present time only the polyethylene cables may be spliced effectively. A method for identifying polyethylene cables is outlined in a preceding paragraph.

Connectors

15. Two general types of connectors are used for IFF Mark 3 transmission lines.

(a) Those connectors which have been designed to provide normal connections for the RG-10/U cable.

(b) Those connectors which make it possible to connect RG-10/U to solid and gas-filled coaxial lines of different diameters and impedances.

16. The former types are used for connections to IFF Mark 3 equipments, duplexers and all omnidirectional antennas; the latter are used for connections to radar pedestals or to connect the RG-10/U cable to the 50 ohm 7/8" solid dielectric cable RG-18/U.

17. Instructions for making up the various types of connectors are outlined in the following pages; information as to the proper connector for each antenna may be found in the type antenna pages. Following are some of the particular combinations:

(a) To connect RG-10/U to antennas type CTZ-66ACF, CTZ-66ACG or CTZ-66AFJ Navy type 49195 or 49190 plug is used. This plug fits type 49194 jack. This is not a weatherproof connector.

(b) A low loss weatherproof connector for RG-10/U cable consists of plug type UG-21/U and jack UG-23/U. This connector is superior to that listed in (a) above and should be used wherever possible for splicing, et cetera.

(c) To connect RG-10/U cable to 7/8" gas-filled coaxial lines plug UG-21/U and connector UG-32/U should be used for 50 ohm 7/8" line and plug UG-21/U and connector UG-33/U for 70 ohm 7/8" line.

Note: Previous connectors used for this application were Navy types 49197 (50 ohms) and 49227 (70 ohms). These connectors required the use of DeKhotinsky cement, were difficult to install and were used initially for connection to SC Series, SA Series and SK antenna pedestals.

(d) To connect RG-10/U cable to RG-18/U (7/8" solid 50 ohm cable) Plug type UG-167/U is connected to the RG-18/U and Jack type UG-23/U to the RG-10/U. (The former designation for the UG-167/U was Navy type 49483A.)

GENERAL INFORMATION CONCERNING THE ASSIGNMENT AND INSTALLATION OF MODEL BK TRANSPONDORS

Assignments

1. In accordance with the assignments in Section B of the Radar Installation Plan, IFF Mark 3 equipments Model BK are assigned to all types of vessels scheduled therein. This includes practically all sea-going vessels.

2. Model BK equipments are small and light weight and easily installable by Forces Afloat. No interconnections are required between BK's and other shipboard electronic equipments except for one suppression cable. Installation details concerning the latter are contained in the E-BK-7 pages. Information concerning submarine installations is located in the E-Submarines pages.

3. Various vessels are assigned one to three BK equipments. The interpretation of these assignments is as follows:

(a) One BK Assigned: One complete installation.
(b) Two BK's Assigned: One complete installation and one spare ABK Receiver Transmitter. Both ABK's should, where practicable, be located side by side. One antenna installation, one power supply source and one destructor firing circuit are required. The second ABK is a standby unit for use in case the first one fails.
(c) Three BK's Assigned: Where three BK equipments are assigned, two ABK's are installed as in (b) above. This is the normal operating location. The third BK is installed as a completely separate installation in another location aboard ship. This third equipment is an operable emergency installation utilizing separate supporting structures where practicable for its antenna and an entirely separate power supply.

Material Requirements

4. Model BK equipments consist of a number of components procured on different contracts. The following basic material is required for each complete installation:

(a) Model ABK Series 24 Volt Transpondor: These equipments include the receiver transmitter, the Control Assembly and the necessary plugs and connectors.
(b) One Antenna: Omni-directional type CTZ-66ACG or CTZ-66AFJ.
(c) Motor Generator: Although not required for certain installations where a suitable power source is available, motor generators for these equipments have been procured primarily from Century Electric Company. Type Number CCL-211018 is fitted with a 115/230 volt AC motor; type CCL-211014 provides a 115 volt DC motor.

(d) Destructor Switch: Standard Navy type M-17-S or N-17-S.
(e) Destructor: Type AN-M3 available from ammunition depots. All destructors are procured and distributed by the Bureau of Ordnance.
(f) Batteries. Four trays of Class 6V-SBM-15AH Stock No. 17B-9490. These are required where no emergency source is available and where the BK is not normally operated from batteries.
(g) Miscellaneous: All cables, terminal boxes and switches are Standard Navy items. Basic requirements are shown on page E-BK-6.

Types of ABK Series Equipments

5. Large quantities of ABK Series equipments were manufactured for the Navy IFF Mark 3 programs. Models ABK, ABK-2, ABK-4 and ABK-6 were designed for 12V DC operation; Models ABK-1, ABK-3, ABK-5, and ABK-7 for 24V DC input. These various equipments are identical in size, weight, shape and mounting facilities, although there are minor circuit differences as outlined in the Confidential Instruction Book CSP-1375.

6. All shipboard installations are standardized for 24 volt operation. Although the initial shipboard program included ABK-7 equipments only, many of the other 24 volt models are now available in radio pools. In addition, some of the 12 volt models have been modified for 24 volt operation. Such modified equipments are clearly marked.

TECHNICAL FACTORS GOVERNING THE INSTALLATION OF MODEL BK EQUIPMENTS

Space and Power Requirements

1. Space requirements for BK's are outlined on page E-BK-5 together with the mounting dimensions and weights of the Century motor-generator set.

2. All shipboard BK installations require approximately 130 watts at 24 Volts DC input. Suitable motor-generators are available for vessels having 115 volts DC or 115/230 volts AC. Where none of these voltages is available, batteries should be utilized. Where batteries are installed as the main source of supply, it is expected that existing charging facilities or additional panels will be used. Standard 100 ampere hour batteries are recommended.

3. The use of dropping resistors in series with the BK and connected to DC mains is not a satisfactory power source and is injurious to the equipment. In cases of temporary operational necessity only is this method authorized and in each instance it is essential that a battery be floated across the input line to the BK equipment.

4. Where motor-generator sets are used, provision should be made for an emergency power supply. This should consist of a 24 volt bank of standard 6V-SBM-15AH batteries or a connection, as may be practicable, to any existing battery supply. These small, lightweight batteries have been provided because of the importance of emergency operation and the difficulties encountered in installing larger battery supplies in most vessels. Whereas they furnish a minimum of emergency operation, maintenance personnel should check the condition of these batteries regularly. For particular vessels there is no objection to the use of larger emergency batteries where such installations are practicable and approved by the authorities concerned.

5. A nameplate of some material such as lamacord, containing the following information, should be supplied by the installing activity and mounted in a conspicuous location near the BK unit. When operating BK equipments from motor-generator sets, it is important that the BK be turned on after the MG set when starting, and turned off before the MG when stopping. Otherwise the polarity of the generator output may reverse.

6. The Transmitter-Receiver, designed for shelf or table mounting, should be located in spaces adequately protected from bomb splinters, shell fragments and weather. The Control Assembly should be mounted in the same compartment.

7. The limiting factor governing the location of the BK is the necessity for keeping the antenna transmission line as short as practicable and not over 100 feet.

8. Because of the probability of shock excitation, it is undesirable to install the BK Transmitter-Receiver unit in the same compartment with radar transmitters or spark-gap modulators. Where such locations must be utilized, the BK equipment should be housed in a metal shielding locker suitably ventilated and provided with a hinged door to provide access to the equipment. Satisfactory shielding lockers have been developed by the Navy Yard New York (BuShips Plan 356452) and New York Shipbuilding Corporation, Camden, New Jersey, (BuShips Plan CL106-S6706-535600). Copies of these plans, if desired, may be obtained from these activities.

9. The location of the normal power supply is not critical, although, in general, 23 volts should be maintained at the equipment proper. The motor-generators are rated at 27 volts output and no trouble should be experienced with low supply voltages. Emergency battery supplies should be located as near the equipment as practicable.

10. Where two separate and complete installations are made, the antennas should, where practicable, be located on separate supporting structures. Separate power supplies and destructor circuits should be installed.

11. All BK installations utilize an omnidirectional antenna type CTZ-66AFJ (or CTZ-66ACG). Dimensions and mounting arrangements are outlined in the E-ANT section. Particular attention should be given to the location of the antenna aboard ship and every effort should be made to install it as much in the clear as possible such that the BK can reply to interrogations from all directions and effect maximum ship-to-ship identification ranges.

Cabling and Interconnections

12. It is highly essential that plugs and connectors be carefully attached to their respective cables to insure proper polarity and proper coding sequences. Attention is invited to page E-BK-6 for cabling requirements.

13. The 24 Volt BK power supply should not be grounded under any circumstances, although the equipment cabinet should be grounded by means of a flexible strap.

14. Information concerning the use of the BK Suppressor Cable is contained on page E-BK-7.

15. Installation of Destructor Circuits

Extreme care must be taken, by all installation and maintenance activities and all personnel aboard ship who are concerned, to provide safe BK destructor circuits and to take all precautions to avoid accidental injuries. Specific Information concerning the handling and stowage of destructors and the installation of firing circuits is detailed in the E-BK-3 pages.

16. A recent ruling by the Chief of Naval Operations directs that the installation of BK destructor circuits in submarines be continued, but states that detonators are not required and are not to be provided for present IFF Mark 3 equipments.

PRE-INSTALLATION TESTS AND MODIFICATIONS FOR BK EQUIPMENTS

General

1. A few simple modifications should be made to various BK equipments prior to installation. Further detailed descriptions are available in the Radar Maintenance Bulletin.

Screens Over Vent Holes

2. Certain of the ABK Series equipments were delivered with screens mounted inside the top covers and covering the vent holes. In many cases, the bar which holds this screen in place interferes with the normal operation of the Connecting Arm (Part 0-121) which drives the Tuning Rotor Shaft. This bar should be removed and replaced with washers. (This is BK Field Change #2).

Removal of Ballast Resistor R-182.

3. It has been determined that the removal of the ballast resistor R-182 will increase the life of the carbon pile regulator and tends to reduce the tendency of the equipment to squitter. These large resistors are mounted on the same chassis with the dynamotor and are held in place by ordinary clamps. Removal is simple.

Modification of BK Suppressor Circuit

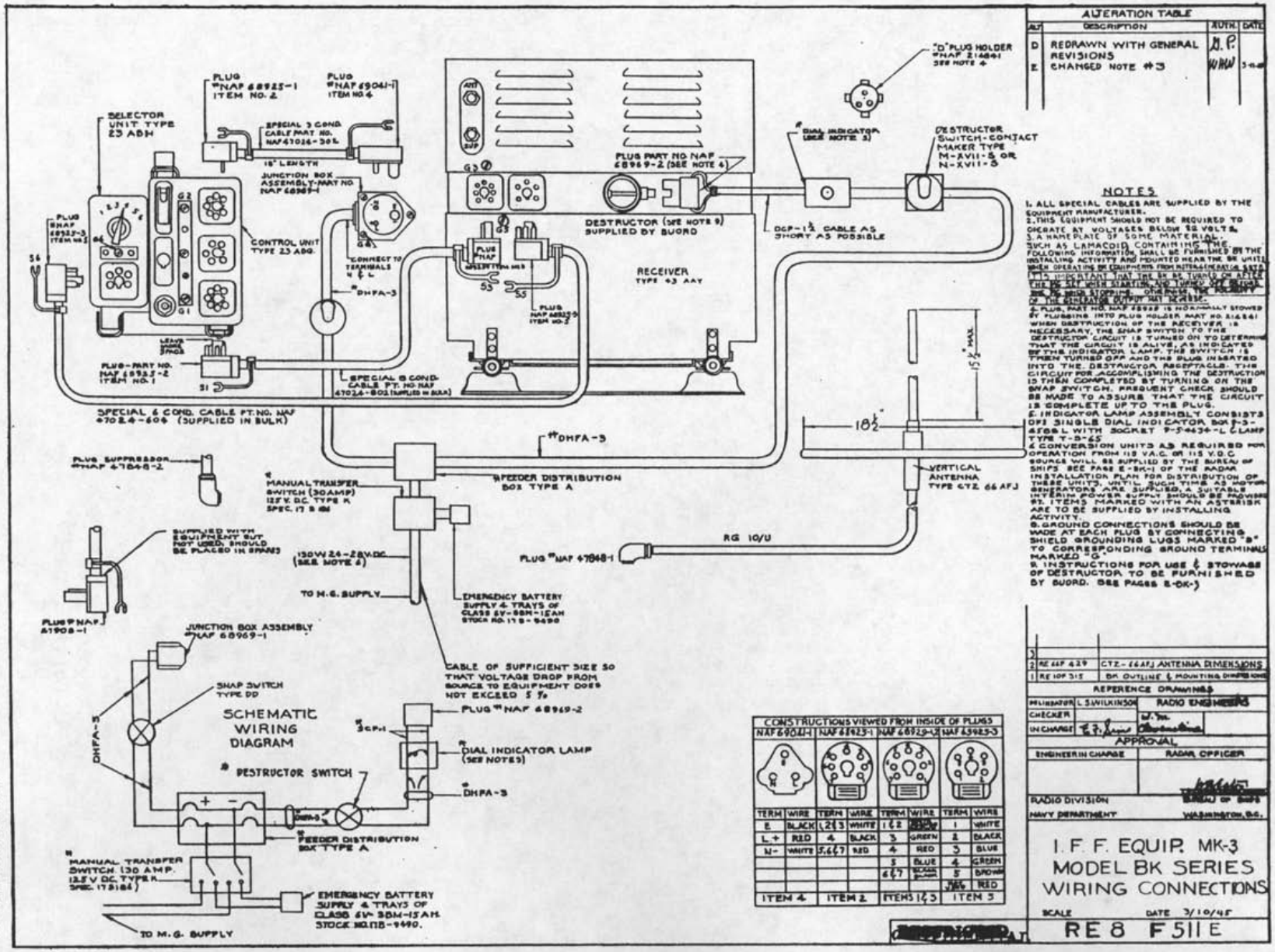
4. The original ABK Series suppressor circuit does not provide adequate suppression duration. All equipments should be modified as outlined in the RMB, BK Field Change #3.

Pre-Installation Testing of Equipments

5. Prior to installation aboard ship, each BK should be tested for proper electrical operation, coding, and frequency sweep. In addition, all parts requiring lubrication should be examined and serviced as required. Worn parts, particularly the Connecting Arm Assemblies and Switches, should be replaced.

Tests After Installation

6. Each completed installation should be carefully checked for proper operation. Particular care should be taken to insure proper cabling connections and power supply polarity. Antennas and transmission lines should be checked for normal operation.



ALTERATION TABLE

ALT	DESCRIPTION	AUTH.	DATE
D	REDRAWN WITH GENERAL REVISIONS	A.P.	
E	CHANGED NOTE #3	W.H.W.	3-10-45

NOTES

1. ALL SPECIAL CABLES ARE SUPPLIED BY THE EQUIPMENT MANUFACTURER.
2. THIS EQUIPMENT SHOULD NOT BE REQUIRED TO OPERATE AT VOLTAGES BELOW 22 VOLTS.
3. A NAMEPLATE OF SOME MATERIAL, SUCH AS LAMACOID, CONTAINING THE FOLLOWING INFORMATION, SHALL BE FURNISHED BY THE INSTALLING ACTIVITY AND MOUNTED NEAR THE DR UNIT WHEN OPERATING DR EQUIPMENTS FROM INTERMEDIATE SIZE GENERATORS. IT IS IMPORTANT THAT THE DR BE TURNED ON AFTER THE DC SET HAS STARTED AND TURNED UP TO RATED SPEED AND BEFORE STOPPING. OTHERWISE THE POLARITY OF THE GENERATOR OUTPUT MAY REVERSE.
4. PLUG, PART NO. NAF 68969 IS NORMALLY STOWED BY PLUGGING INTO PLUG HOLDER NAF NO. 21484-1 WHEN DESTRUCTION OF THE RECEIVER IS NECESSARY, THE SNAP SWITCH TO THE DESTRUCTOR CIRCUIT IS TURNED ON TO DETERMINE THAT THE CIRCUIT IS ALIVE, AS INDICATED BY THE INDICATOR LAMP. THE SWITCH IS THEN TURNED OFF AND THE PLUG INSERTED INTO THE DESTRUCTOR RECEPTACLE. THIS CIRCUIT FOR ACCOMPLISHING THE DESTRUCTION IS THEN COMPLETED BY TURNING ON THE SNAP SWITCH. FREQUENT CHECK SHOULD BE MADE TO ASSURE THAT THE CIRCUIT IS COMPLETE UP TO THE PLUG.
5. INDICATOR LAMP ASSEMBLY CONSISTS OF: 1 SINGLE DIAL INDICATOR BOX 3-4768 L WITH SOCKET 9-5-4434-L CLAMP TYPE T-3-45
6. CONVERSION UNITS AS REQUIRED FOR OPERATION FROM 110 V.A.C. OR 115 V.D.C. SOURCE WILL BE SUPPLIED BY THE BUREAU OF SHIPS. SEE PAGE E-BK-1 OF THE RADAR INSTALLATION PLAN FOR DISTRIBUTION OF THESE UNITS, UNTIL SUCH TIME AS MOTOR GENERATORS ARE SUPPLIED, A SUITABLE INTERIM POWER SUPPLY SHOULD BE PROVIDED BY ITEMS MARKED WITH AN ASTERISK ARE TO BE SUPPLIED BY INSTALLING ACTIVITY.
8. GROUND CONNECTIONS SHOULD BE MADE AT EACH PLUG BY CONNECTING SHIELD GROUNDING LUGS MARKED "S" TO CORRESPONDING GROUND TERMINALS MARKED "S".
9. INSTRUCTIONS FOR USE & STOWAGE OF DESTRUCTOR TO BE FURNISHED BY BUORD. SEE PAGES E-BK-3

CONSTRUCTIONS VIEWED FROM INSIDE OF PLUGS

NAF 68927-3		NAF 68925-1		NAF 68929-2		NAF 68925-3	
TERM	WIRE	TERM	WIRE	TERM	WIRE	TERM	WIRE
E	BLACK	1 & 3	WHITE	1 & 2		1	WHITE
L+	RED	4	BLACK	3	GREEN	2	BLACK
M-	WHITE	5 & 7	RED	4	RED	3	BLUE
				5	BLUE	4	GREEN
				6 & 7		5	BROWN
						6 & 7	RED
ITEM 4		ITEM 2		ITEMS 1 & 3		ITEM 3	

3		
2	RE 66F 429	CTZ-66AFJ ANTENNA DIMENSIONS
1	RE 10F 315	DR OUTLINE & MOUNTING DIMENSIONS

REFERENCE DRAWINGS

DELINEATOR	L. SWILKINSON	RADIO ENGINEERING
CHECKER		
IN CHARGE	E.T. Jones	

APPROVAL

ENGINEER IN CHARGE	RADAR OFFICER
RADIO DIVISION	BUREAU OF SHIPS
NAVY DEPARTMENT	WASHINGTON, D.C.

I.F.F. EQUIP. MK-3 MODEL BK SERIES WIRING CONNECTIONS

SCALE

DATE 3/10/45

RE 8 F 511 E

E-BK-6

R.I.P. CHANGE NO. 41

681156

THE USE OF SUPPRESSION CIRCUITS FOR MODEL BK SERIES EQUIPMENTS

General

1. The problem of interference between BK equipments and search radars installed aboard the same vessel is outlined as follows:

(a) Type of Interference: The interference may be a result of BK quench radiation or BK reply pulses. The former appears as heavy "grass"; the latter as an extension of the radar or interrogator initial pulse.

(b) Reception of Interference: In the case of search radars whose normal operating frequencies are located within the IFF Mark 3 band, the BK pulses and quench radiation are received directly by the radar receiver; search radars operating outside the IFF Mark 3 frequencies display BK interference via the interrogator-responsor receiver.

(c) Requirements for Eliminating Interference: The complete elimination of BK interference would require that the equipment be rendered inoperable (and therefore incapable of replying to external challenging) for selected periods of time depending upon the maximum range scales of the associated radar equipments and the repetition rates involved. Such an arrangement would include the installation of suppression circuits from all radars having interrogator-responsors.

(d) Limitations of Interference Elimination: BK interference can be alleviated but not completely eliminated because of the electrical as well as the practical limitations inherent in the system. The major limitation is that the suppression of the BK must not interfere with the ability of the equipment to reply to external interrogation.

Provisions for Suppressor Cables

2. The BK equipments provide a suppressor cable input jack located directly beneath the antenna jack. In addition, all IFF Mark 3 interrogator-responsors include connection facilities as shown below.

(a) BL Series: The suppression cable should be connected to the "SYNC" jack of the BL Series equipments and not the "LOCK OUT" jack. The "SYNC" jack and the "LOCK IN" jack of the BL equipments are in parallel. Under no conditions should the suppression cable be connected to "LOCK OUT" jack because of the inherent delays in the BL transmitter circuits and the fact that BL equipments are operated almost always from low repetition rate radars.

(b) BN Series: The suppression cable should be connected to the "PULSE OUT" jack (J201). Model BN equipments are in most cases operated with relatively high repetition rate radars. Divider circuits are provided such that the interrogation rate of the BN is lower than the radar repetition rate. Whereas the BN receiver is gated, it is desirable that the BK be suppressed only at the divided rate. For this reason the suppression cable should always be installed from the BN and not from associated radar circuits.

(c) BM Series: The suppression cable should be connected to the "PULSE OUT" jack located on the left side of the duplexer chassis. As with BN Series equipments, the BM suppression pulse has a repetition rate equal to that of the BM and not necessarily that of the associated radar.

Where Suppressor Cables Should be Installed

3. Because it is impracticable in most cases to suppress the BK equipments from more than one interrogator-responsor aboard the same vessel, the following general installation program has been determined, based upon the recommendation from various activities ashore and afloat.

(a) Vessels Normally Assigned One Radar: The BK equipment aboard vessels having one radar installation should be suppressed from the interrogator-responsor associated with the radar.

(b) Vessels Assigned More than One Radar: The BK equipment aboard vessels having more than one radar installation should be suppressed from the air search radar only.

(c) Vessels Having More Than One Air Search Radar: In all cases where two air search radars are installed, there are also two installed BK equipments. It is desired that the forward BK equipment be suppressed from one air search radar and the after BK be suppressed from the other. In this connection, the primary air search radar should suppress the primary BK equipment.

(d) Where two separate and complete BK installations are provided aboard ship the suppressor cable should be installed to the primary BK location.

Modifications Required for BK Equipments

4. Before satisfactory operation of the BK suppression circuits can be realized, one of two modifications is required:

(a) Change of existing BK Suppression circuits. This is Field Change #3 and is described in detail in the RMB.

(b) Installation of Suppressor Kit, Type CAGQ-10AEJ. This is Field Change No. 4, also described in detail in the RMB.

Where Suppressor Kit is Installed

5. The CAGQ-10AEJ Kit should be installed only in BK equipments aboard vessels having radars normally operating within the IFF Mark 3 frequency band. (Red and Green SC Series, SA-1). No other installations are authorized.

Where Circuit Modification Should Be Made

6. All ABK Series equipments should be modified in accordance with Paragraph 4(a) above except as noted in Paragraph 5.

THE INSTALLATION OF MODEL BN SERIES EQUIPMENTS

General

1. Model BN Series equipments are small Interrogator-Responsors of the IFF Mark 3 system, and are used in conjunction with all surface detection radars and certain other equipments in accordance with the B pages of this plan. Installations are well within the capacity of Forces Afloat; the equipments are small, and the interconnections few.

Space and Power Requirements

2. Space requirements are shown on page E-BN-3. At least 4 inches clearance should be maintained on the sides, back and top of the equipment to allow for ventilation and vibration. At least 20 inches clearance should be maintained in front of the equipment for removing or servicing the transmitter-receiver chassis. A minimum of 18 inches above the BN is required to permit maintanance when the BN is partially withdrawn from its case.

3. The BN equipments require approximately 275 watts of power at 115 volts AC, 50 to 425 cycles. This amount of power is available from practically all shipboard radar power supplies.

Blower Motor Replacements

4. All BN equipments are shipped with a 60 cycle blower motor installed and a 400 cycle motor in the equipment spares. Where 60 cycle operation is concerned, the 400 cycle motor in the spares should be exchanged for a 60 cycle motor, where 400 cycle operation is concerned, the 60 cycle motor must be removed from the equipment and exchanged for a 400 cycle motor. All stock spares contain both types.

Material Requirements

5. Model BN shipments include duplexers type CTZ-50ACW (manufactured under separate contracts) but do not include antennas. Each installation requires one omni-directional antenna type CTZ-66AFJ (or CTZ-66ACG if the former is not available).

6. No cables are furnished on BN contracts. Those required are all standard Navy types available in all Radio Pools.

Location of Equipment

7. The BN equipments should be located where practicable in the same spaces as the associated radar transmitters. Antennas should be in the clear where practicable with transmission lines generally limited to 100 feet. Details concerning antenna locations and mounting arrangements are contained in the E-ANT pages.

8. The duplexer type CTZ-50ACW is outlined on page E-BN-3.1. It should be located in the same compartment as the BN equipment and its cables to the BN should be as short as practicable.

Cabling

9. The video cable between the BN and the radar indicator may be up to 300 feet in length. Trigger lines, however, should be as short as practicable, to reduce triggering delays between the radar transmitter and the BN.

10. The length of the remote control cable is not critical and will usually parallel that of the video cable. Where radar indicators provide separate connectors for IFF gain and remote interrogation control it will be necessary to terminate the BN single cable in a suitable junction box and install separate cables as required.

11. All cable terminations at the BN equipment are located on the front panel. Sufficient slack cable must be provided such that the BN chassis may be pulled forward for maintenance purposes. It is recommended that, where practicable, all cables be clamped in position such that no strain is placed on the connectors themselves.

Grounding the Equipment

12. The BN cabinet should be securely grounded by means of a short flexible copper strap.

THE INTERCONNECTION OF MODEL BN SERIES EQUIPMENTS TO VARIOUS SEARCH RADARS

General

1. Model BN Series equipments are normally used with surface search radars and a few small air search radars. Detailed information concerning submarine installations is contained entirely in the E-Submarine pages.

2. All radars with which BN's are associated provide interconnection facilities. The following information is general in nature and applies to all installations; specific details for particular interconnections are outlined in subsequent pages. Basic cabling requirements for BN's are shown on page E-BN-4.

Remote Control Facilities

3. For BN equipments the remote control features are two-fold; control of receiver gain, and control of interrogation. No local controls are provided as is the case with the BM Series.

4. Both remote control circuits terminate in one jack as shown on page E-BN-4. In this three wire circuit the ground connection is common.

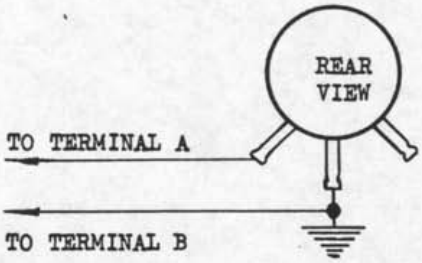
Remote Control of Interrogation

5. The remote switch for the control of interrogation is provided in the associated radar either as an integral part of the indicator or mounted in a separate IFF adapter unit.

6. Care must be taken to wire the switch between terminals "C" and "B" at the BN connector; otherwise, since the challenge circuit is associated with the low voltage power supply, the remote gain control will be burned out.

Remote Control of Gain

7. A 3.5K potentiometer is furnished with each BN equipment and should be installed at the radar control position in the position provided. Certain recent radars (SG-3/4, SU, SU-1) have the proper 3.5K potentiometer for BN operation furnished installed by the radar manufacturer. The arm of the potentiometer is grounded and connected to terminal "B" at the BN connector. Extreme care must be taken to check all connections to avoid burning out this potentiometer as noted above. When these terminals A and C are reversed, operation appears at first to be normal; however, it will be noticed that by varying the gain control the height of the transmitted pulse on the radar indicator will become smaller as the gain is reduced. Where such a condition is noticed, the equipment should be shut down immediately because the current through the control is sufficient to burn it out in a short time.

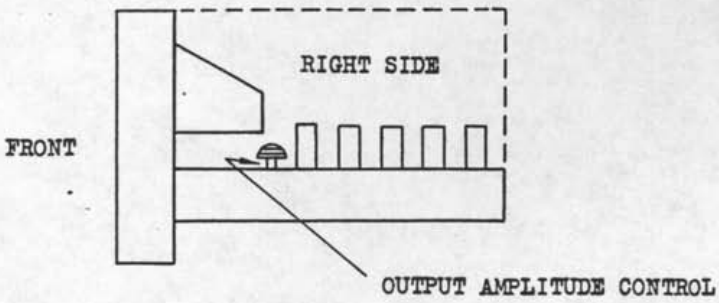


BN GAIN CONTROL
(Furnished with
equipment)

Adjustments for Proper IFF Display

8. All BN equipments are provided with a video output control (potentiometer) which must be adjusted for each installation such that the display on the associated radar oscilloscope is of the proper height. The setting of this potentiometer will be different for different equipments because of the variance in radar facilities for IFF video.

9. The output control potentiometer (R-144) is located vertically on the main chassis just below the receiver RF section and marked "OUTPUT AMPLITUDE".



Divider Circuits

10. BN equipments are designed for operation at a maximum repetition rate of 500. Should the input sync pulse rate exceed this figure the BN modulator (multi-vibrator) will automatically "count down" or divide. The control used to limit the multivibrator to 500 is potentiometer R172, adjustable from the top of equipment and located in the modulator compartment at the left rear part of the main chassis. It should not be necessary to adjust this control as it is pre-set at the factory.

Use of Gating Controls

11. Model BN equipments are provided with a receiver gating arrangement whereby the length of time the receiver is allowed to operate immediately following each transmitter pulse is controlled.

12. Two controls are provided as follows: (1) ON-OFF switch (S211) located at the top center of the BN panel, and (2) RECEIVER GATING WIDTH potentiometer (R-214) located on the front panel directly above the input power switch.

13. The RECEIVER GATING WIDTH controls the length of time the BN receiver operates after each pulse and is variable from approximately 250-1500 microseconds. This gating circuit operates at the "counted-down" rate for all high repetition rate radars. For this reason its use is particularly advantageous in that all noise is removed from the radar oscilloscope during the "in-between" traces.

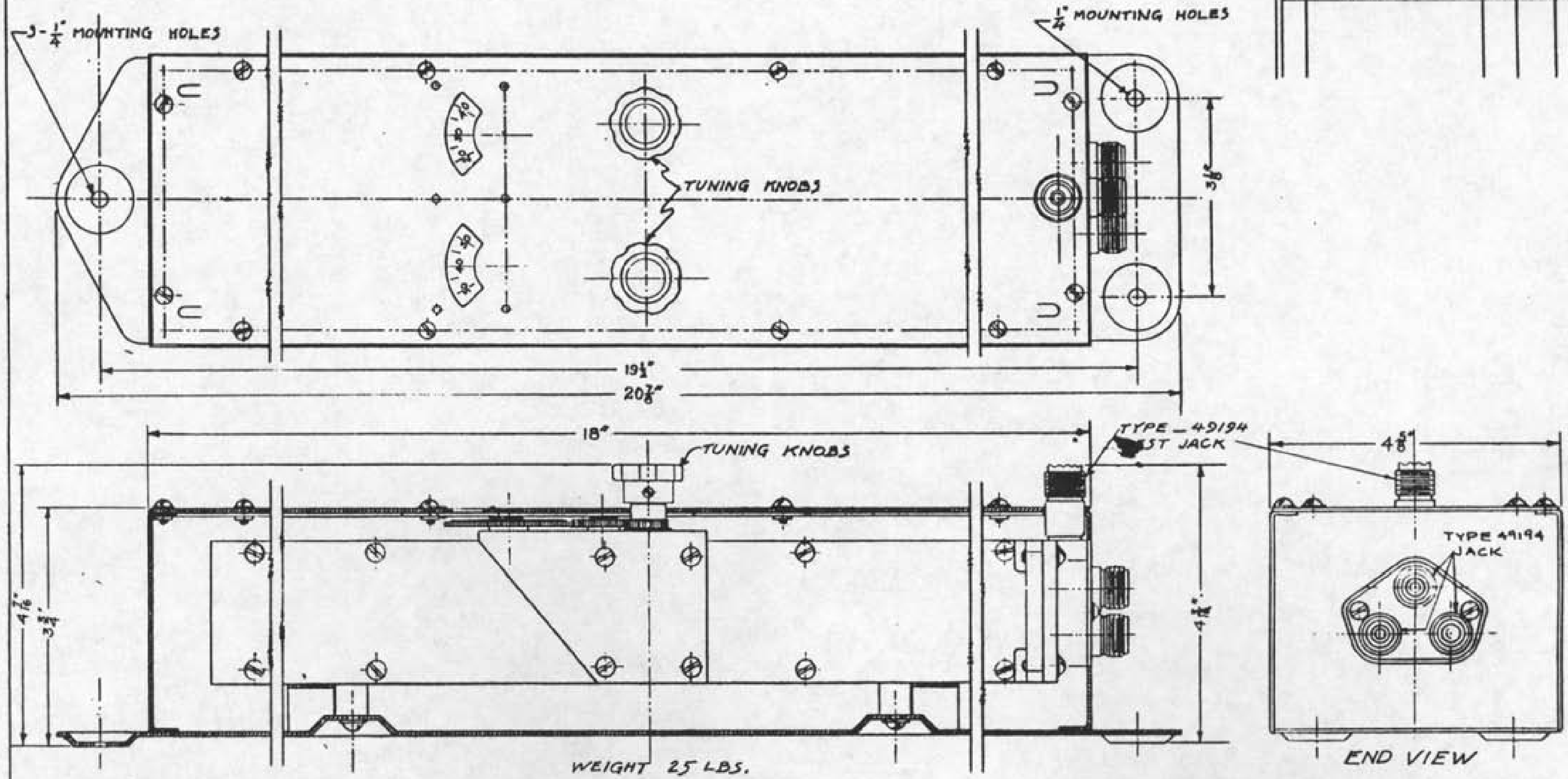
14. For initial adjustments, the WIDTH CONTROL should be turned fully counterclockwise and then rotated until the IFF "grass" on the radar oscilloscope goes out in range to the end of the trace. The BN gain control should be set for maximum gain and the radar sweep range should be maximum. No difficulty is experienced in determining where the IFF "grass" terminates because it abruptly ceases at the end of the gating duration.

15. After the gating control has been set, care must be taken to securely lock it in place. No IFF signals will be received beyond the duration of gating time. At the minimum setting this is only 20 miles. Care must be taken to utilize the maximum range sweep of the associated radar.

Suppression Cabling

16. Some installations require the use of a suppression cable from the BN PULSE OUTPUT jack to the BK SUPPRESSION jack. The policy governing such installations is contained in the E-BK-7 pages.

ALTERATION TABLE				
ALT	REMARKS	BY	APP'D	DATE



E-BN-3-1

NOTES: 1. CTZ 50 ACW DUPLEXER IS USED WITH BN EQUIPMENT. ONE PACKED WITH EACH BN. MAY ALSO BE USED WITH BL.
2. INSTALL NEAR TO, AND IN SAME COMPARTMENT WITH INTERROGATOR RESPONSOR WITH WHICH IT IS USED.
3. UPPER 49194 JACK IN 3 JACK CLUSTER (SHOWN IN END VIEW) TO ANTENNA. EITHER OF OTHER TWO TO RECEIVER OR TRANSMITTER.

NO	REFERENCE DRAWINGS	
1.	BU. SHIPS RE8F542	(CTZ-50ABS-1 DUPLEXING UNIT)
2.	BU. SHIPS RE8F546	(MODEL BN EXTERNAL CABLING

DELINEATOR	J.B.B.	CHIEF DRAFTSMAN
TRACER	J.B.B.	W.O. Lovell
CHECKER		

APPROVAL	
RADIO ENGINEERS	ENGINEER IN CHARGE
W.T.W. Clevenstine	Bergstein
W.H. Eaton	RADAR OFFICER LT. COMDR. U.S.N.R.
RADIO DIVISION NAVY DEPARTMENT	BUREAU OF SHIPS WASHINGTON, D.C.

IFF EQUIP. MK-3
CTZ-50ACW
DUPLEXER

RE 8 F569-A

~~RESTRICTED~~

RIPCHANGE #41

THE INSTALLATION OF MODEL BN AND MODEL BK EQUIPMENTS AND ASSOCIATED ANTENNA SYSTEM ABOARD SUBMARINES

General

1. Attention is invited to the E-BK and E-BN pages for information concerning space and weight requirements of these equipments.

2. Specific interconnection information for single and dual radar operation is contained in the following pages.

Material Requirements

3. The following items, outside of structural and mounting material, are required for complete installations:

(a) Model BN Series equipment and equipment spares.
(b) Two Model BK Series equipments and one set of equipment spares.
(c) Antenna Type CAGQ-66AFU-1 and Equipment Spares.
(d) Antenna Change-over Switch Type CAGQ-24AAL (or interim type CAGQ-24AAE).
*(e) Relay Box NT-V-S 125 W.T. with built-in relay.
**(f) Radar Selector Relay System Kit Type CN-23AGK.
(g) Shear Valve - Bureau of Ships drawing SS-S6700-468701.
(h) Standard Navy pressure-tight seamless galvanized steel pipe having an outside diameter of 1.050 inches and inside diameter of 0.75 inch.
(i) Standard Navy RG-8/U coaxial cable, and other standard interconnection cables.
(j) Standard motor generator, 27V DC output.

Note: *Required for single radar operation only.
**Required for dual radar operation only.

4. Items (a), (b), (c), (d), (e), (f), (i), and (j) are available in Radio Pools. (Items (c), (d) and (e) are packed together); item (g), manufactured by Navy Yard Portsmouth, is distributed via Submarine Supply Centers; item (h) is standard material not specially distributed for these installations.

Location of the Equipments

5. The arrangement of the IFF Mark 3 components in the Control Room, as outlined on page E-Submarine-5, represents a standard desirable location for the main equipments. The BN and BK equipments are near the antenna switch, the BN interconnections are short, and the BK's are shielded from the radar transmitters. The locations of the antenna switch, and the Radar Selector Switch (or Relay Box) in the Control Room are not critical. The BN duplexer (see page E-BN-3.1) should be mounted near the BN such that the face of the BN is visible when the duplexer is being tuned.

The Antenna System

6. The submarine Antenna system includes the antenna assembly, the antenna switch, the shear valve and a watertight steel pipe connecting the antenna and shear valve through which the RF transmission line is run. The installation of the antenna, pipe, and shear valve must be completed prior to the installation of the coaxial cable. Two types of antenna and two switches have been developed as detailed below:

(a) Antenna CAGQ-66AFU: This antenna, the first production type, is outlined on page E-Submarines-7. Under service conditions, these antennas developed excessive vibration resulting usually in broken radiator assemblies. All type 66AFU spring and dipole assemblies (not the mounting bases) installed aboard submarines or retained in equipment spares should be removed and replaced with Type CAGQ-66AFU-1.

(b) Antenna Type CAGQ-66AFU-1: The differences between this antenna and type 66AFU are few; a heavier spring and a partly hollow dipole are the main changes. The 66AFU-1 spring and dipole assemblies have been distributed to all radio pools. They are directly mountable on the existing base plates without modification. Outline dimensions are shown on page E-Submarines-8.

(c) Antenna Switch CAGQ-24AAE: Outline dimensions are shown on page E-Submarines-7. Some difficulty has been experienced with these switches, and all are to be replaced with Type CAGQ-24AAL as soon as the latter are available.

(d) Antenna Switch CAGQ-24AAL: Outline and mounting dimensions are shown on page E-Submarines-9. Sufficient quantities have been procured to replace all existing installations. All further procurements of submarine antenna assemblies will include these switches as standard items.

Antenna Location

7. The antenna assembly should be mounted on the port side, and bolted to the horizontal stiffener as indicated on page E-Submarines-5. Although differences in superstructure arrangements will affect particular installations, this location is considered desirable. It is necessary for installing activities to fabricate the supporting brackets and back plates as required for each installation.

Installation of Steel Pipe

8. The pressure-tight, seamless, galvanized steel pipe, through which is fed the RG-8/U transmission line, is welded to the base of the antenna mounting plate at one end and terminates at the shear valve at the other end.

9. Attention is invited to the necessity for securely fastening this pipe in position at proper intervals. All welding and fitting must be accomplished before the cable is run through. Where it is necessary to join two pieces of pipe, care should be taken to ream both ends such that the RF cable will not be damaged by sharp burrs. The sleeves must be welded properly in order to make the joints watertight. No sharp bends in the pipe are desirable because of the difficulties of pulling through the RF cable and the resulting damage thereto.

10. Upon the completion of the pipe installation, it should be tested to be sure it is watertight. One successful method of making this test is to place a cap on the antenna end of the pipe and check the installation from below with air pressures up to 300 pounds.

Shear Valve Installation

11. Details of the shear valve installation are shown on page E-Submarines-6. This valve can easily shear the coaxial RF cable with little applied force. Care should be taken to utilize the locking pin provided with each valve assembly to avoid accidental cable damage.

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Coaxial Cable

12. Standard RG-8/U 50 ohm solid dielectric coaxial cable is used for the RF transmission line. Extreme care is required when attaching this cable to the connector furnished with the antenna in order to avoid mismatches in the line. This connector should be attached prior to the installation of the cable. Before attempting to pull this cable through the pipe, it should always be covered with the Dow-Corning #4 Ignition Sealing Compound which is shipped with the antenna assembly and included in all equipment and stock spares. The white covered Restricted Installation Manuals shipped with each antenna (NAVSHIPS - 918.9) contained dimensional errors in the instructions for making up the antenna connector. These have been corrected in NAVSHIPS - 918.9-A which supersedes the former and which has been widely distributed. The following corrections apply:

(1) Page 12 - Figure 4E: Dimension 1 and 1/4 should be 1 and 11/16 inches.

(2) Page 12 - Figure 4F: Dimension 5/16 should read 1/4 inch; dimension 15/16 should read 1 and 3/8 inches.

13. After this cable has been pulled through the shear valve, sufficient slack should be allowed such that there is no sharp bend from the shear valve to the point of attachment inside the hull.

Power Supplies

14. The Model BK equipment requires approximately 130 watts at 24 volts DC from the motor-generator. The input to the latter is approximately 200 watts. Type numbers and dimensions are shown on page E-BK-5.

15. No emergency battery supply is required for the BK for submarine installations.

16. The power required for the BN equipment is approximately 275 watts at 60 cycles 115 volts AC. This power should be obtained as follows:

(a) For Single Radar Operation: The BN may be supplied from the associated radar power line, or any other suitable source.

(b) For Dual Radar Operation: The BN input power is connected via the Radar Selector System. The combined requirements of both are approximately 300 watts at 115 volts 60 cycles. This power should be obtained from the IC switchboard or other source which is constantly available when either of the two radars is switched off.

Interconnections:

17. Specific details concerning interconnections for the two systems with various radars are shown on the following pages.

Installation of BK Suppressor Cable

18. For all installations, an RG-8/U cable should be connected between the BN "PULSE OUT" jack and the BK "SUPPRESSOR" jack.

THE INTERCONNECTION OF MODEL BN AND BK EQUIPMENTS FOR SINGLE OPERATION WITH SD SERIES RADARS

General

1. The following paragraphs apply when the BN is operated with the SD Series radar only. This is the interim system for Submarines SS198 and above; and the normal arrangement for submarines SS197 and below.

A Relay System Is Required

2. When the IFF Challenge Switch in the SD Series Indicator is turned ON two circuits must be controlled:

(a) The BN transmitter must be turned on.
(b) The antenna must be switched from the BK to the BN.

3. Since the BN remote control circuit is DC and the Antenna Switch requires 115 volts AC, it is necessary to utilize a relay system such that both functions operate from 115 volts AC.

4. The interconnections required are detailed on pages E-Submarines-10 and E-Submarines-11. The relay boxes consist of Navy Type V-S 125 W.T. connection boxes with built-in Struthers-Dun relays and are shipped as an item of the Antenna Assemblies from the same manufacturer.

5. THE USE OF THIS RELAY SYSTEM REQUIRES THE FOLLOWING MODIFICATIONS TO THE SD SERIES RECEIVER-INDICATORS.

Wiring Changes to SD Series Equipments

6. This modification applies to all SD equipments up to and including Model SD-4. IT DOES NOT APPLY TO SD-5 EQUIPMENTS.

7. The IFF Challenge Switch (part of S-204) in the SD Series Receiver-Indicators is a simple make and break type. It is required that this switch be wired in SERIES with a 115 volt AC source. An examination of the pertinent Confidential Instruction Books shows that for all equipments SD-4 and below except SDa, there are two wires connected respectively from terminals C and D of J-205A to the switch contacts. For SDa equipments, these two wires are connected to terminals P and M in J-207B. The modification for all equipments is as follows:

(a) Unsolder one wire from the switch and reconnect it to terminal #1 of transformer T-202.

(b) Connect a wire from terminal #2 of T-202 to the switch using the same contact left available from (a) above.

8. Model SD-5 equipments have this modification already accomplished at the factory.

Systems Interconnections

9. All SD series radars provide interconnection facilities for IFF. With the exception of Model SDa all remote control cables terminate in receptacles located in the rear of the Receiver-Indicator Chassis. The SDa equipments are

provided with a separate IFF video amplifier Type CRV-50AAW. For detailed information as to connections between this video amplifier and the SDa, attention is invited to the CONFIDENTIAL INSTRUCTION BOOK ENG. 126, Part II.

10. Detailed interconnections for SD Series equipments through SD-4 are shown on page E-Submarines-10; for SD-5 equipments, page E-Submarines-11. (It should be noted that for SDa equipments the remote control and video cables terminate in the video amplifier assembly -- the same jack numbers apply.)

11. The gain control potentiometer furnished as part of the BN Series equipment must be installed in the SD Series (except SDa) Receiver-Indicator behind the front panel knob marked IFF Gain. The high end should be connected to terminal B of J-205A; the arm to terminal A of J-205A. Wires are provided for making this connection. For SDa equipments, install the potentiometer in the video amplifier and make the same internal connections.

BN Adjustments For Proper Display

12. Attention is invited to the E-BN pages for additional technical information. The BN video output control must be adjusted to provide a satisfactory deflection on the SD Series oscilloscope.

13. When operating at the SD repetition rate of 60, the BN divider operation is not required. Similarly the gating control may be turned off.

The SD Pulser Unit

14. The "SD Pulser", manufactured by the Navy Yard Mare Island, provides a trigger pulse to the SD Series indicators such that the BN equipment and the SD type display may be used for IFF operation without the necessity for energizing the SD transmitter. This pulser unit is considered a part of the radar and not the IFF system. No changes in IFF interconnections are required.

BN Power Supply

15. The BN power requirements of 275 watts at 115 volts AC may be obtained from the SD Series power input at the radar transmitter or any other convenient source.

DUAL IFF MARK 3 OPERATION WITH TWO SEARCH RADARS

General

1. The operation of the IFF Mark 3 system in conjunction with two search radars requires the use of the Type CN-23AGK Radar Selector System.

2. Outline dimensions are shown on page E-Submarines-12; internal connections on page E-Submarines-13, and interconnections with various radars on page E-Submarines-14.

Material

3. The Type CN-23AGK Relay System Kit includes relays and housing, 60 feet of special 12 conductor cable, two BN remote gain control potentiometers, six vinylite grommets and equipment spares.

Installation

4. The installation of this Relay System requires the following action:

(a) Removal (where installed) of the Relay Box used for SD operation only.
(b) A modification to the BK equipments.
(c) A modification to SD Series radars.
(d) New cabling.
(e) New BN video level adjustments.

Removal of Relay Box Used For Single Radar Operation

5. The CN-23AGK System provides facilities for Antenna Switching and remote BN control. Where already installed, the relay box used for single radar operation should be removed.

Modification To BK Equipments

6. The operation of one BN equipment with two radars whose repetition rates may vary appreciably introduces the problem of BK quench radiation which is very difficult to control. Inasmuch as the BK is not connected to the antenna system while the BN is in operation, no operational facility is removed if the BK is completely turned off during such periods. This switching is accomplished by breaking the B-minus circuit of the BK equipment.

7. Circuit changes are shown on page E-Submarines-15. This modification is authorized for submarine installations only.

8. Particular attention is invited to the requirement for a shorting plug attached to the BK chassis. When this plug is inserted into the receptacle provided on the front of the chassis the BK is restored to normal operation. This plug will be required only if trouble within the Relay Selector System develops such that the relays become inoperative.

Modifications to SD Series Radars

9. The use of the Radar Selector System requires that the IFF Challenge Switches in the Radar Indicators be UNGROUNDED AND NOT CONNECTED TO ANY INTERNAL POWER SOURCE NOR OTHER CIRCUIT.

10. The operation of all SD equipments used in the single radar system outlined in the E-Submarines-3 pages required that the IFF Challenge Switch be internally connected in series to a 115 volt AC power source. All SD equipments up to and including Model SD-4, if modified for single operation must be returned to the original circuit. In the case of SD-5 equipments, different contacts on the switch should be used. Attention is invited to page E-Submarines-14 for these specific connections.

Cabling

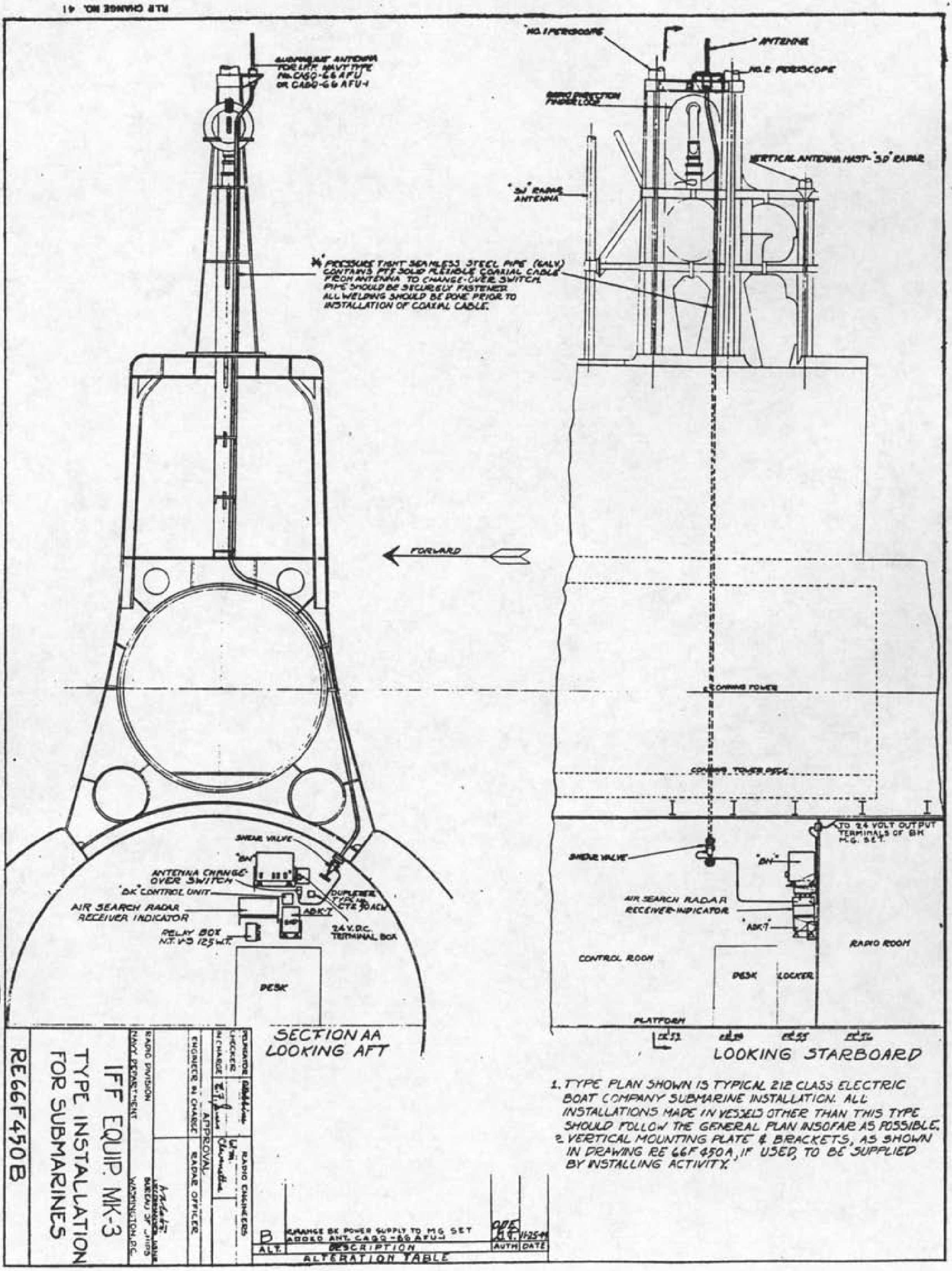
10. Interconnections and cabling are shown on page E-Submarines-14. It will be noticed that all connections from the Relay Selector System to the surface search radar indicator are contained in a special cable thus requiring the installation of only one cable through the pressure hull.

11. The standard Navy Stuffing Tube Type 46-2 (XLV1-11) Size "C" should be utilized. The vinylite grommets supplied with the CN-23AGK Kit are used for the packing. Two vinylite grommets should be used for each stuffing tube installation.

Adjustment of BN Video Level

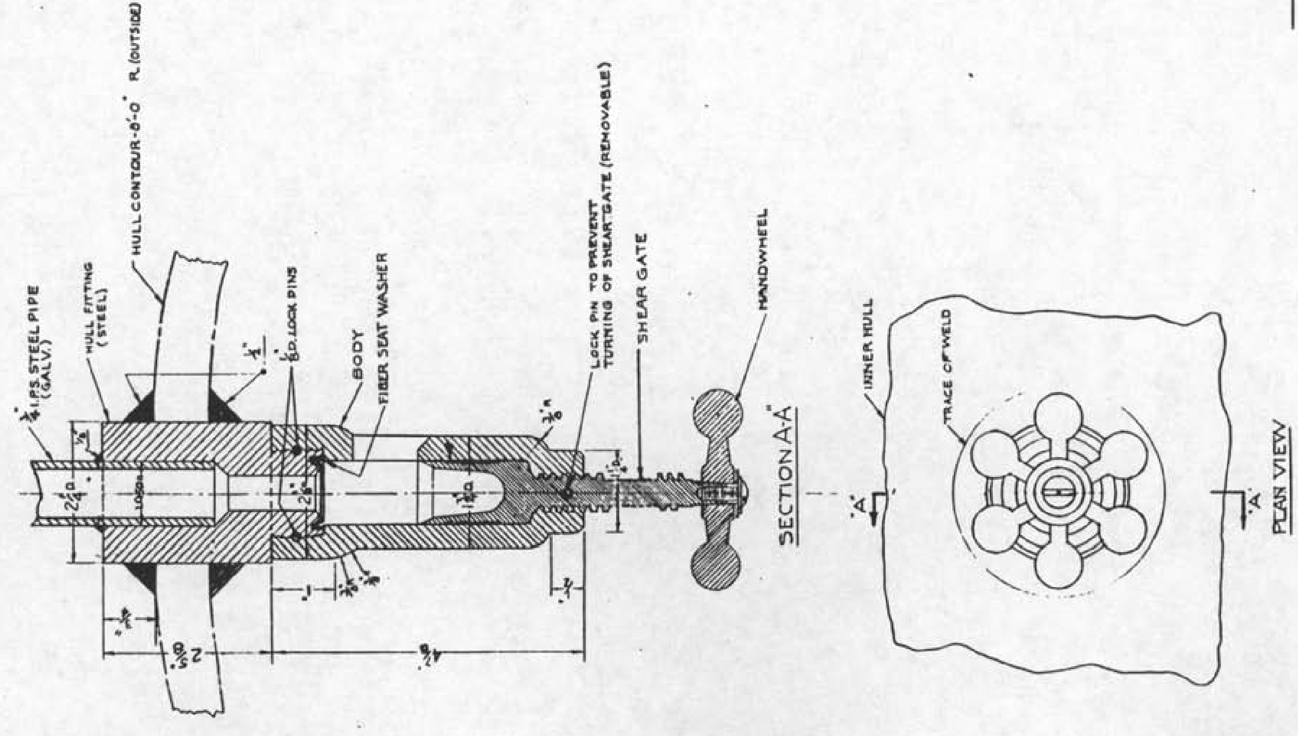
12. Whereas different radar indicators require different video levels for proper display, separate potentiometers (R-101 and R-103 in the Selector Relay Unit) are provided for individual adjustments.

13. The BN video output control (R-144) is first adjusted and then each of the series controls (R-101 and R-103) is varied to provide a 1/2 to 1 inch deflection on the radar display. Once set, these potentiometers should require no further adjustments.


NO. 1 PERISCOPE
ANTENNA
NO. 2 PERISCOPE
VERTICAL ANTENNA MAST- "SD" RADAR
"SJ" RADAR ANTENNA
¾" PRESSURE TIGHT SEAMLESS STEEL PIPE (GALV.) CONTAINS FTS SOLID FLEXIBLE COAXIAL CABLE FROM ANTENNA TO CHANGE-OVER SWITCH. PIPE SHOULD BE SECURELY FASTENED. ALL WELDING SHOULD BE DONE PRIOR TO INSTALLATION OF COAXIAL CABLE.
FORWARD
CONNING TOWER
CONNING TOWER DECK
TO 24 VOLT OUTPUT TERMINALS OF BK M.G. SET
SHEAR VALVE
"BN"
ANTENNA CHANGE-OVER SWITCH
"BK" CONTROL UNIT
DUPLEXER
AIR SEARCH RADAR RECEIVER INDICATOR
ABK-7
RELAY BOX
24 V.D.C. TERMINAL BOX
DESK
SECTION AA LOOKING AFT
AIR SEARCH RADAR RECEIVER-INDICATOR
"ABK-7"
RADIO ROOM
CONTROL ROOM
DESK
LOCKER
PLATFORM
LOOKING STARBOARD
1. TYPE PLAN SHOWN IS TYPICAL 212 CLASS ELECTRIC BOAT COMPANY SUBMARINE INSTALLATION. ALL INSTALLATIONS MADE IN VESSELS OTHER THAN THIS TYPE SHOULD FOLLOW THE GENERAL PLAN INSOFAR AS POSSIBLE.
2. VERTICAL MOUNTING PLATE & BRACKETS, AS SHOWN IN DRAWING RE 66F 450A, IF USED, TO BE SUPPLIED BY INSTALLING ACTIVITY.
IFF EQUIP. MK-3
TYPE INSTALLATION
FOR SUBMARINES
RE66F450B
RADIO ENGINEERS
APPROVAL
ENGINEER IN CHARGE
RADAR OFFICER
RADIO DIVISION
NAVY DEPARTMENT
BUREAU OF SHIPS
WASHINGTON, D.C.
B
CHANGE BK POWER SUPPLY TO MG SET
ADDED ANT. CAGO-66 AFU-4
ALT.
DESCRIPTION
AUTH
DATE
ALTERATION TABLE
RESTRICTED

Sec. 3.3
268156

ALT.	ALTERATION TABLE DESCRIPTION	AUTH.	DATE



0" 1" 2" 3"
SCALE

REFERENCE DRAWINGS	
DELINEATOR L. S. WILKINSON	RADIO ENGINEERS
CHECKER	
IN CHARGE	
APPROVAL	
ENGINEER IN CHARGE	RADAR OFFICER
RADIO DIVISION	BUREAU OF SHIPS
NAVY DEPARTMENT	WASHINGTON, D.C.

SHEAR VALVE ASSEMBLY FOR SUBMARINE ANTENNA CABLE USE

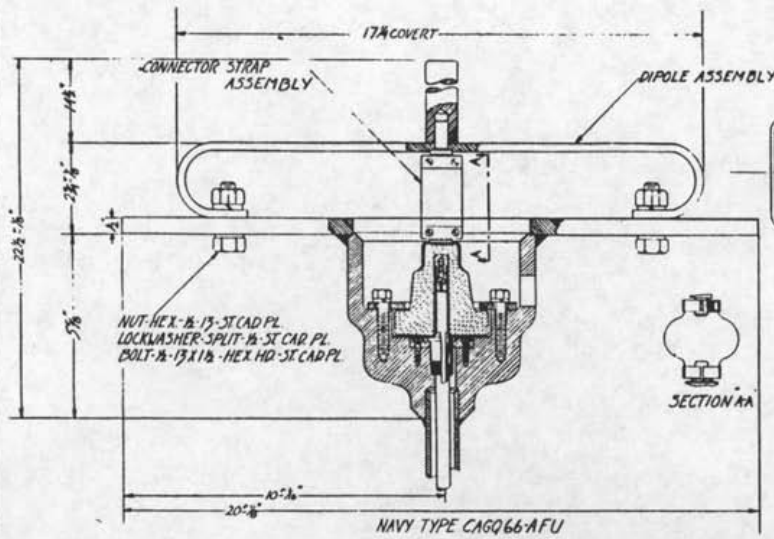
DATE 11 8 43

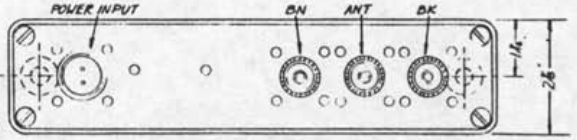
~~RESTRICTED~~ RE 66 F451-A

E-SUBMARINES-6

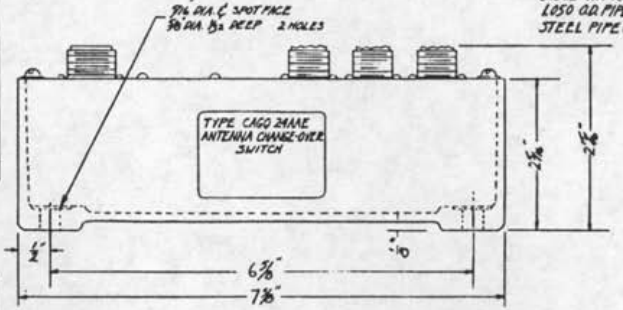
R.I.P. CHANGE NO. 41

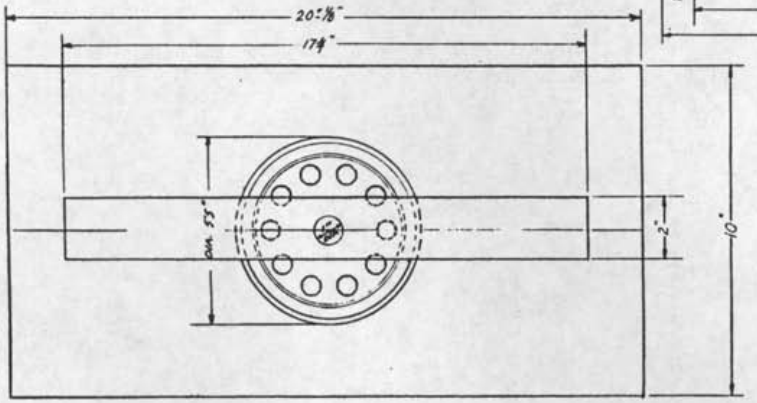
ALTERATION TABLE			
ALT.	DESCRIPTION	AUTH.	DATE





NOTE:
ALL MATERIAL SHOWN IN PRINT SUPPLIED AS PART OF CAGQ 66-AFU ANTENNA ASSEMBLY BY MANUFACTURER WITH EXCEPTION OF COAXIAL CABLE AN RG 8/U (NAVY TYPE CASSF-50-1) AND 1050 GQ PIPE (¾" PRESSURE TYPE SEAMLESS STEEL PIPE (GALV)).





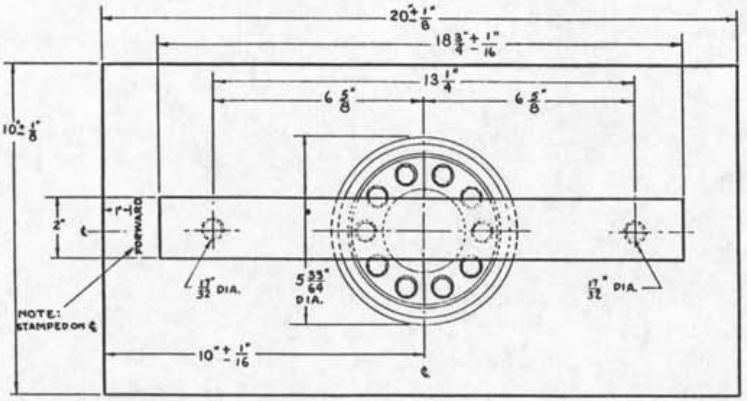
PLAN VIEW

3			
2			
1	RE66F526	NT CAGQ-66 AFU-1 SUB. ANT.	
REFERENCE DRAWINGS			
DELINEATOR	[illegible]	RADIO ENGINEERS	
CHECKER			
IN CHARGE	[illegible]		
APPROVAL			
ENGINEER IN CHARGE		RADAR OFFICER	
RADIO DIVISION		BUREAU OF SHIPS	
NAVY DEPARTMENT		WASHINGTON, D.C.	

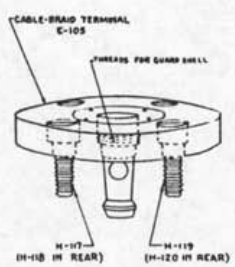
I.F.F. EQUIPMENT MARK-3
N.T. CAGQ-66 AFU SUBMARINE ANTENNA ASSEMBLY AND N.T. CAGQ-24 AAE ANT. CHANGE-OVER SWITCH

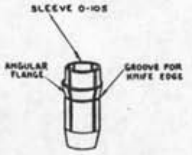
SCALE — DATE 11-10-43

RE66 F 452A

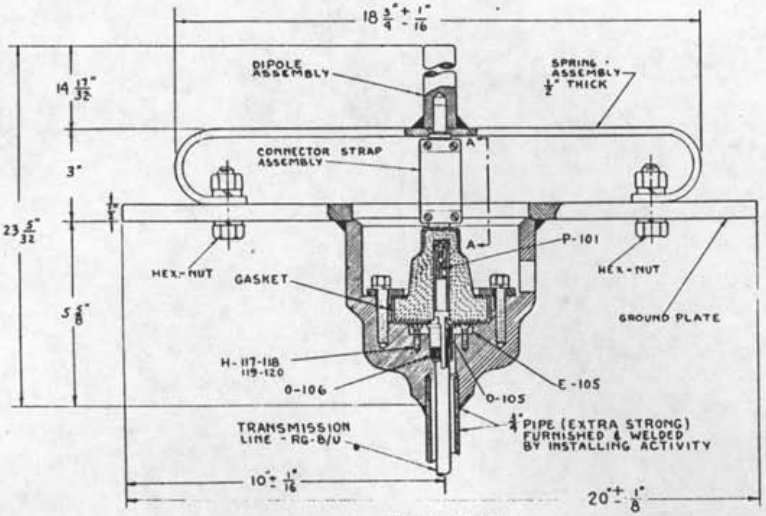


TOP VIEW





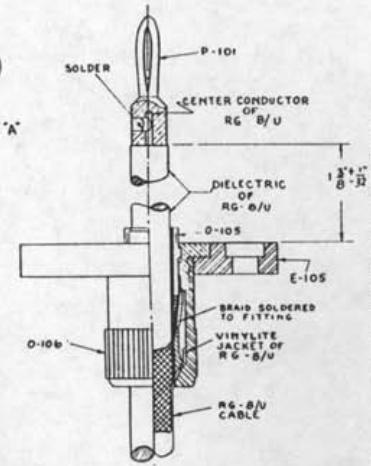
PARTS OF CABLE & PLUG TERMINAL ASSEMBLY



SIDE VIEW

SUBMARINE ANTENNA ASSEMBLY
NAVY TYPE CAGQ-66 AFU-1

SECTION "A"-"A"



DETAIL OF CABLE & PLUG ASSEMBLY

ALTERATION TABLE		
ALT	DESCRIPTION	AUTH. DATE

NOTES:
1. THE 3/4" PRESSURE TYPE SEAMLESS STEEL PIPE & THE RG-8/U CABLE IS TO BE FURNISHED BY THE INSTALLING ACTIVITY.

3	
2	RE24AA164 CAGQ-24AAL ANT SW DWG
1	RE66F452 MT CAGQ-66AFU ANT

REFERENCE DRAWINGS

DESIGNED	Glenn Stang	IN CHARGE OF DWG. UNIT
TRACED		A. Robbins
CHECKED		

APPROVAL

ENGINEER	ENGINEER IN CHARGE
Geo. Wright	Walter M. Clevenstine

OFFICER IN CHARGE

RADIO DIVISION — BUREAU OF SHIPS
NAVY DEPARTMENT — WASHINGTON, D. C.
INSTALLATION AND MAINTENANCE DRAWING

IFF EQUIP MK-3
NAVY TYPE CAGQ-66 AFU-1
SUBMARINE ANTENNA ASSEMBLY

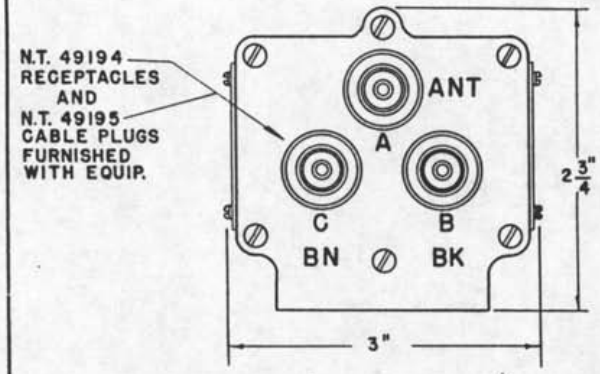
SCALE NONE — DATE NOV 23, 1944

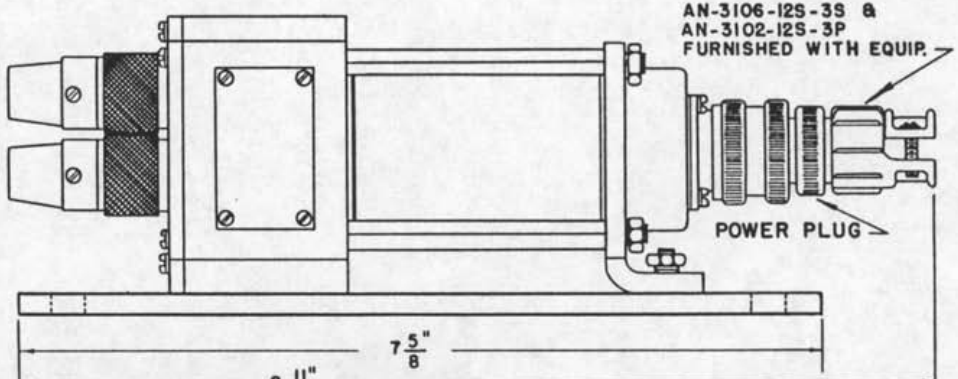
RE66F526A

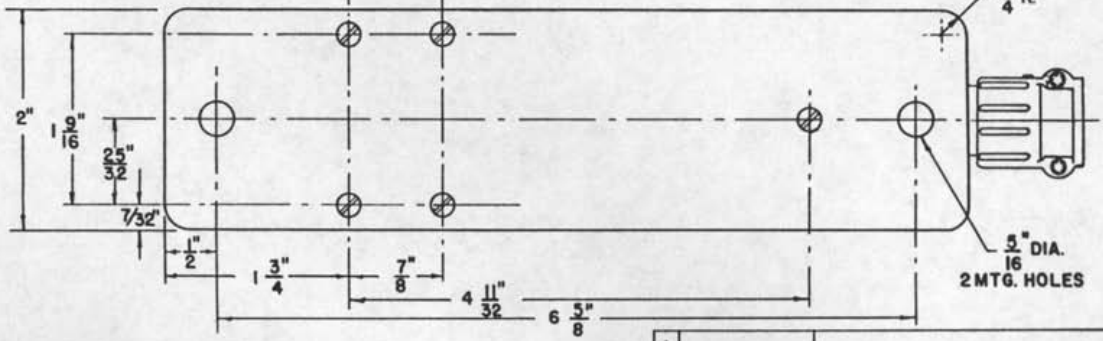
E-SUBMARINES-8

R.I.P. CHANGE NO. 41

~~RESTRICTED~~







NOTES

1. THE TYPE CAGQ-24AAL ANTENNA CHANGE-OVER SWITCH IS AN IMPROVED VERSION OF THE CAGQ-24AAE ANTENNA CHANGE-OVER SWITCH AND IS USED FOR SUBMARINE IFF INSTALLATIONS.
2. THE CAGQ-24AAL ANTENNA CHANGE-OVER SWITCH IS SUPPLIED WITH EACH CAGQ-66AFU-1 SUBMARINE ANTENNA ON CONTRACT NXss-53309.

APPROX. WEIGHT—2 1/2 LBS.

4		
3		
2	RE 66F 452	CAGQ-24AAE CHG.-OVER SW.
1	RE 66F 526	CAGQ-66AFU-1 ANT. ASSEMBLY

REFERENCE DRAWINGS

DELINEATOR	[illegible]	ELECTRONICS DIV. NAVY DEPARTMENT	BUREAU OF SHIPS WASHINGTON, D. C.
CHECKER	[illegible]	INSTALLATION & MAINTENANCE BRANCH	
IN CHARGE	[illegible]		
ENGINEER APPROVAL	Geo. Poyet	IFF EQUIP. MK-3	
ENGINEER IN CHARGE	W. M. Sherman	ANTENNA CHANGE-OVER SWITCH CAGQ-24AAL OUTLINE & MTG. DIM'S	
OFFICER IN CHARGE	[illegible]	SCALE NONE	DATE 3-8-45

ALT LET	REMARKS	DATE	APPV'L

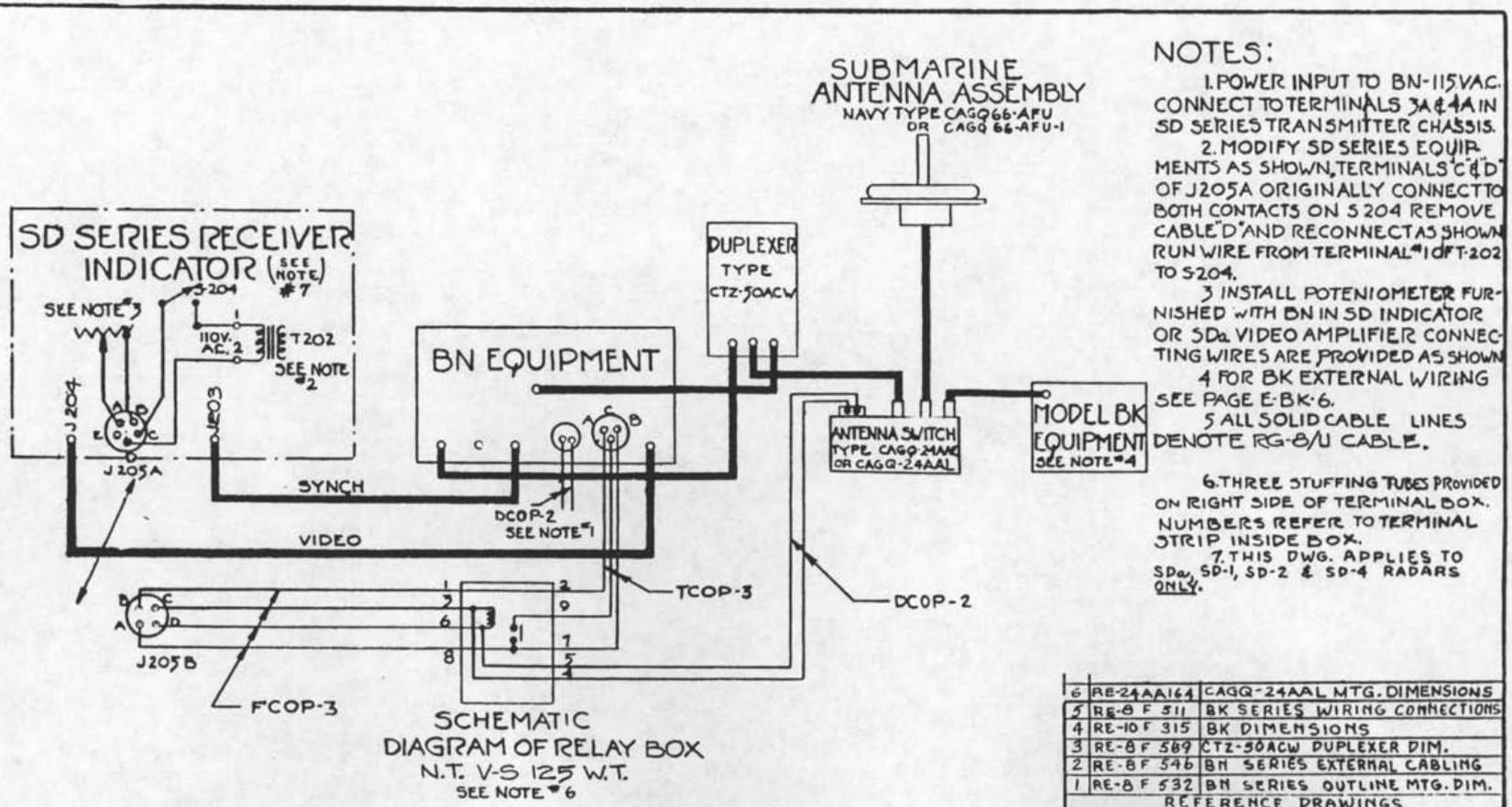
ALTERATION TABLE

RESTRICTED

RE 24AA 164A

E-SUBMARINES-9

R.I.P. CHANGE NO. 41



NOTES:

1. POWER INPUT TO BN-115 VAC. CONNECT TO TERMINALS 3A & 4A IN SD SERIES TRANSMITTER CHASSIS.
2. MODIFY SD SERIES EQUIPMENTS AS SHOWN, TERMINALS "C & D" OF J205A ORIGINALLY CONNECT TO BOTH CONTACTS ON S204 REMOVE CABLE "D" AND RECONNECT AS SHOWN RUN WIRE FROM TERMINAL #1 OF T-202 TO S204.
3. INSTALL POTENIOMETER FURNISHED WITH BN IN SD INDICATOR OR SDa VIDEO AMPLIFIER CONNECTING WIRES ARE PROVIDED AS SHOWN
4. FOR BK EXTERNAL WIRING SEE PAGE E-BK-6.
5. ALL SOLID CABLE LINES DENOTE RG-8/U CABLE.
6. THREE STUFFING TUBES PROVIDED ON RIGHT SIDE OF TERMINAL BOX. NUMBERS REFER TO TERMINAL STRIP INSIDE BOX.
7. THIS DWG. APPLIES TO SDa, SD-1, SD-2 & SD-4 RADARS ONLY.

6	RE-24AA164	CAGQ-24AAL MTG. DIMENSIONS
5	RE-8 F 511	BK SERIES WIRING CONNECTIONS
4	RE-10 F 315	BK DIMENSIONS
3	RE-8 F 589	CTZ-50ACW DUPLEXER DIM.
2	RE-8 F 546	BN SERIES EXTERNAL CABLING
1	RE-8 F 532	BN SERIES OUTLINE MTG. DIM.

REFERENCE DRAWINGS

DELINEATOR	RADIO DIVISION	BUREAU OF SHIPS
CHECKER	NAVY DEPARTMENT	WASHINGTON, D.C.
IN CHARGE F. [illegible]		
RADIO ENGINEER		
Wm Stevenstine		
APPROVAL		
ENGINEER IN CHARGE		
[illegible]		
RADAR OFFICER		

IFF MARK 3
INTERCONNECTIONS FOR SD SERIES BN-BK

SCALE — DATE 11/2744

B	REVERSED: SD VIDEO & SYNC. JACKS & ADDED NOTE 7	[illegible]	11-2744
ALT	REMARKS	APR'VL	DATE

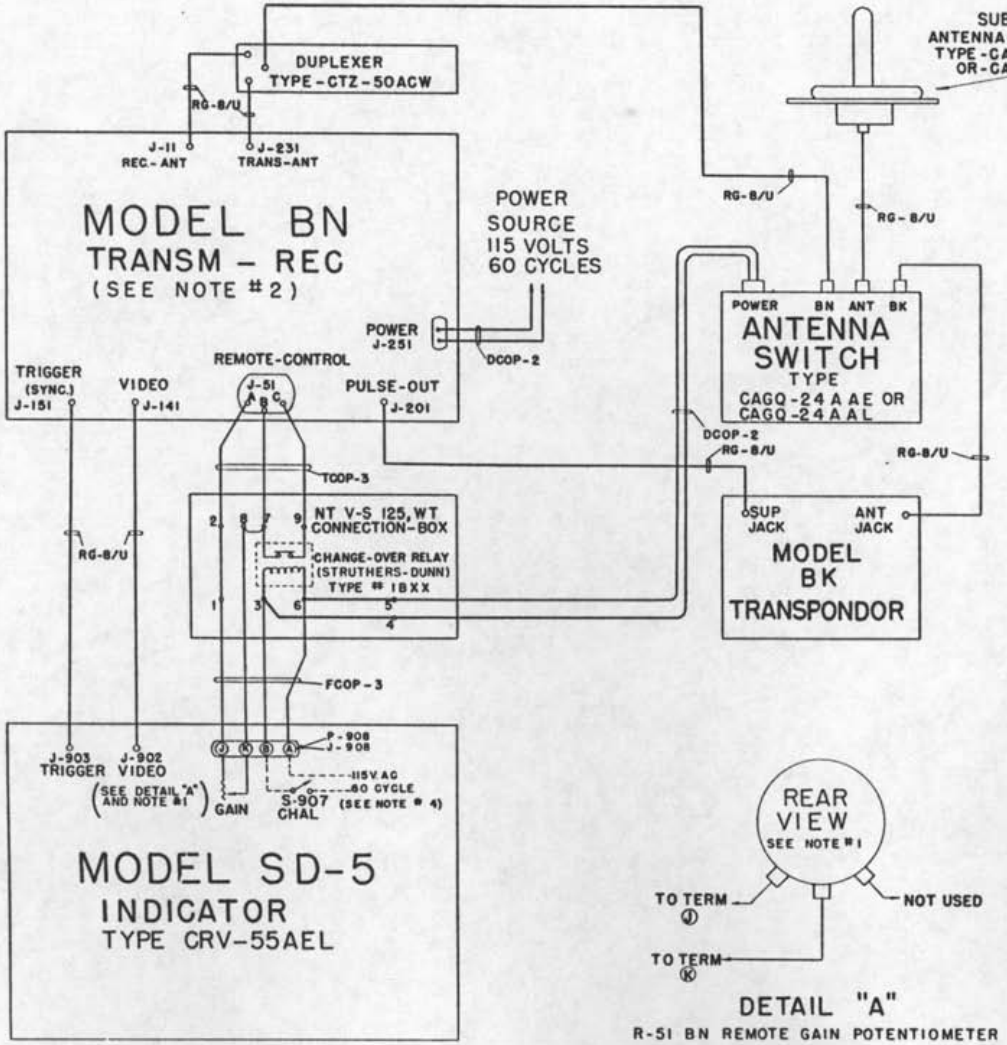
ALTERATION TABLE

~~RESTRICTED~~

RE43AA324B
RIP CHANGE NO. 41

E-SUBMARINES - 10

RIP CHANGE No 41



ALTERATION TABLE			
ALT.	DESCRIPTION	AUTH	DAT

NOTES:

1. A 3500 OHM POTENTIOMETER (R-51) IS SUPPLIED WITH EACH BN EQUIPMENT SPARE. THIS POTENTIOMETER SHOULD BE MOUNTED IN THE SD-5 INDICATOR UNIT AND CONNECTED AS SHOWN IN DETAIL SKETCH ("A").
2. SUFFICIENT LENGTH OF CABLES MUST BE PROVIDED TO ALLOW WITHDRAWAL OF BN CHASSIS APPROXIMATELY 10" FOR SERVICING.
3. ALL CABLES ARE TO BE FURNISHED BY INSTALLING ACTIVITY.
4. THE 115 V.A.C. 60 CYCLE POWER FOR THE "BN" CHALLENGE RELAY & ANTENNA SWITCH IS SUPPLIED TO TERMINALS A & B OF J-908 THRU SWITCH S-907 IN THE SD-5 INDICATOR BY THE MFG.

4	RE 24 AA 164	CAGQ-24AAL MTG. DIMENSIONS
3	RE 66 F 526	N.T. CAGQ-66AFU-1 SUB. ANT.
2	RE 8 F 532	BN OUTLINE & MTG-DIM.
1	RE 66 F 452	SUB-ANT. & CHG-OVER SWITCH

REFERENCE DRAWINGS

DELINEATOR	Elaine Haug	IN CHARGE OF DRAFTING
TRACER		A. Robbins
CHECKER		

APPROVAL

ENGINEER	ENGINEER IN CHARGE
Geo. Lovell	William M. Chronstine

OFFICER IN CHARGE

W. H. Wilson
LIEUTENANT U.S.N.R.

RADIO DIVISION — BUREAU OF SHIPS
NAVY DEPARTMENT — WASHINGTON D.C.
INSTALLATION AND MAINTENANCE BRANCH

IFF MK-3 EQUIP.

MODELS BN, BK & SD-5

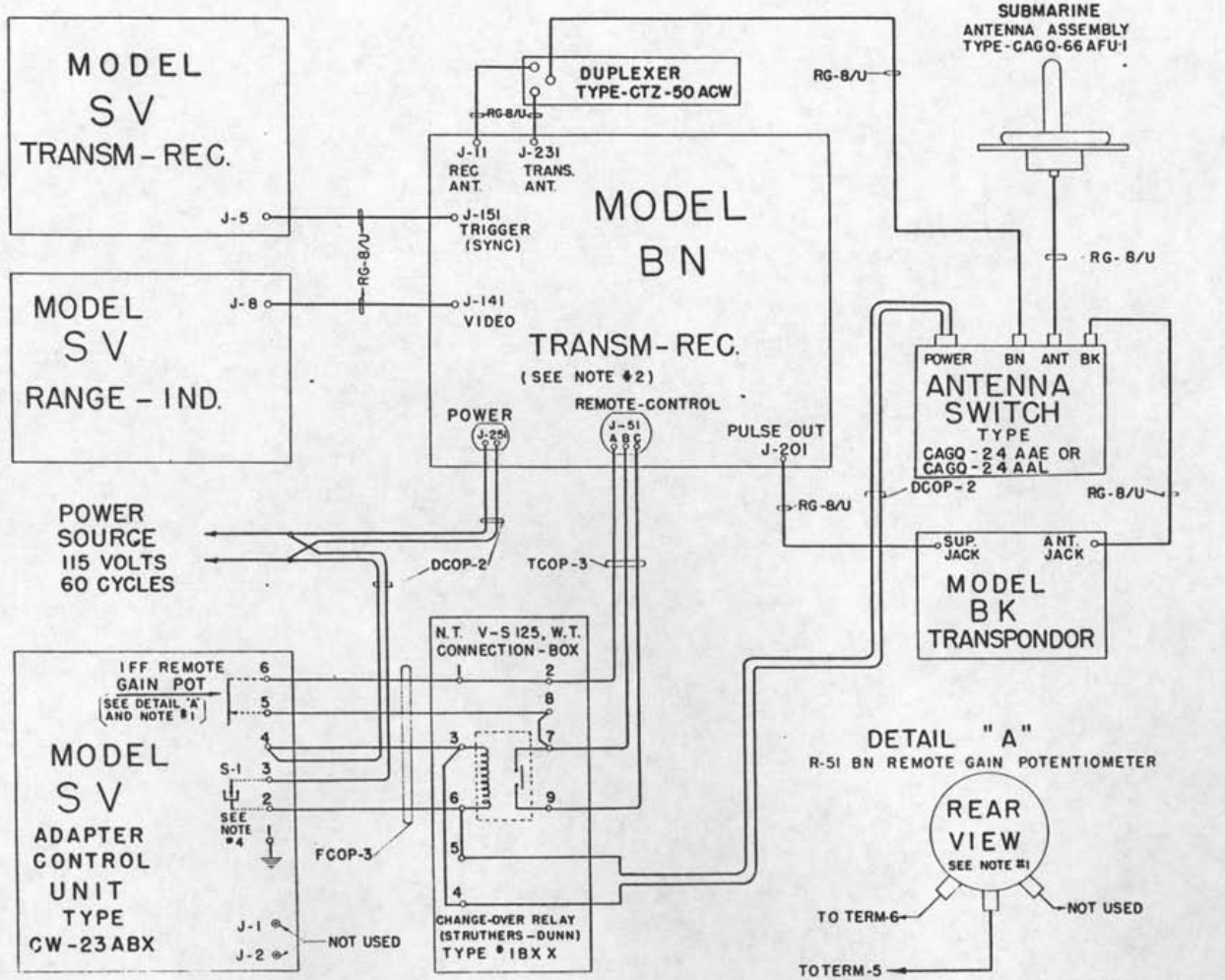
INTERCONNECTIONS FOR SUBMARINE INSTALLATION

SCALE NONE — DATE 10-31-44

RESTRICTED — RE 43 F 428 A

E - SUBMARINES - 11

RLP CHANGE NO. 41



ALTERATION TABLE			
ALT.	DESCRIPTION	AUTH.	DATE

NOTES:

1. A 3500 OHM POTENTIOMETER (R-51) IS SUPPLIED WITH EACH BN EQUIPMENT SPARE. THIS POTENTIOMETER SHOULD BE MOUNTED IN THE SV ADAPTER CONTROL UNIT AND CONNECTED AS SHOWN IN DETAIL SKETCH ("A"). (SEE NOTE #5)
2. SUFFICIENT LENGTH OF CABLES MUST BE PROVIDED TO ALLOW WITHDRAWAL OF BN CHASSIS APPROXIMATELY 10" FOR SERVICING.
3. ALL CABLES ARE TO BE FURNISHED BY INSTALLING ACTIVITY.
4. USE SWITCH SUPPLIED IN THE SV ADAPTER CONTROL UNIT FOR IFF REMOTE CONTROL SWITCH.
5. WHERE THE SV-RADAR REPLACES THE SD-RADAR, THE R-51 POTENTIOMETER (MENTIONED IN NOTE #1) MUST BE REMOVED FROM THE SD-IND. OR OBTAINED FROM STOCK.

4	RE 24 AA 164	CAGQ-24AAL MTG DIMENSIONS
3	RE 66 F 526	N.T. CAGQ-66 AFU-1 SUB. ANTENNA
2	RE 8 F 532	BN OUTLINE & MTG DIM.
1	RE 66 F 452	SUB-ANT & CHG-OVER SWITCH

REFERENCE DRAWINGS

DELINEATOR	Clevenstine	RADIO ENGINEERS
CHECKER		
IN CHARGE	H.L. Richtmyer	Leo Voigt

APPROVAL

ENGINEER IN CHARGE	RADAR OFFICER
Walter M. Clevenstine	O.D. Evans W.H. Wilson LIEUTENANT, USNR

RADIO DIVISION — BUREAU OF SHIPS
NAVY DEPARTMENT — WASHINGTON, D.C.

IFF MK-3 EQUIP.

MODELS BN, BK & SV

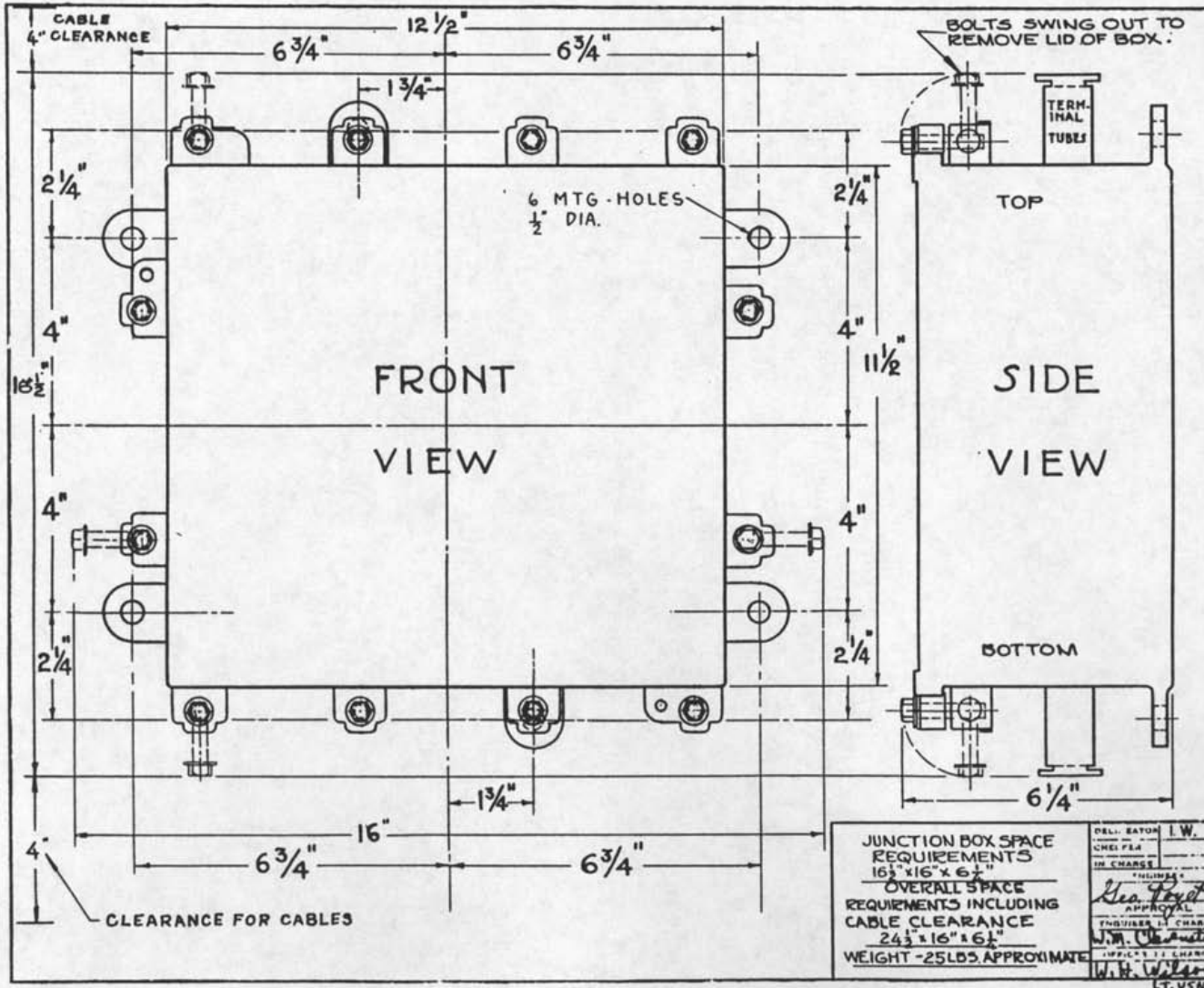
INTERCONNECTIONS FOR SUBMARINE INSTALLATION

SCALE NONE — DATE OCT 25, 1944

RE 43 F 427A

E-SUBMARINES-11-1

R.I.P. CHANGE No. 41



ALTERATION TABLE			
ALT	DESCRIPTION	AUTH	DATE
B	ADDED NOTE #2	[illegible]	9/6/49

NOTES

1. ALL CABLES WILL ENTER THROUGH TERMINAL TUBES LOCATED ON THE TOP AND BOTTOM.
2. THE CN-23 AGK JUNCTION BOX SHOULD BE LOCATED IN THE SAME COMPARTMENT AS THE AIR SEARCH RADAR INDICATOR.

JUNCTION BOX SPACE REQUIREMENTS
16 1/2" x 16" x 6 1/4"
OVERALL SPACE REQUIREMENTS INCLUDING CABLE CLEARANCE
24 1/2" x 16" x 6 1/4"
WEIGHT - 25 LBS. APPROXIMATE

DELINEATION I.W.
CHECKED
IN CHARGE
ENGINEER
Geo. Floyd
APPROVAL
ENGINEER IN CHARGE
J.M. Clements
OFFICER IN CHARGE
W.H. Wilson
LT. USNR

1 REVISION RELAY SYSTEM FOR DUAL OPERATION OF MODEL CN

REFERENCE DRAWINGS
RADIO DIVISION BUREAU OF SHIPS
NAVY DEPARTMENT WASHINGTON, D. C.
INSTALLATION METHOD AND CONNECTION NONE

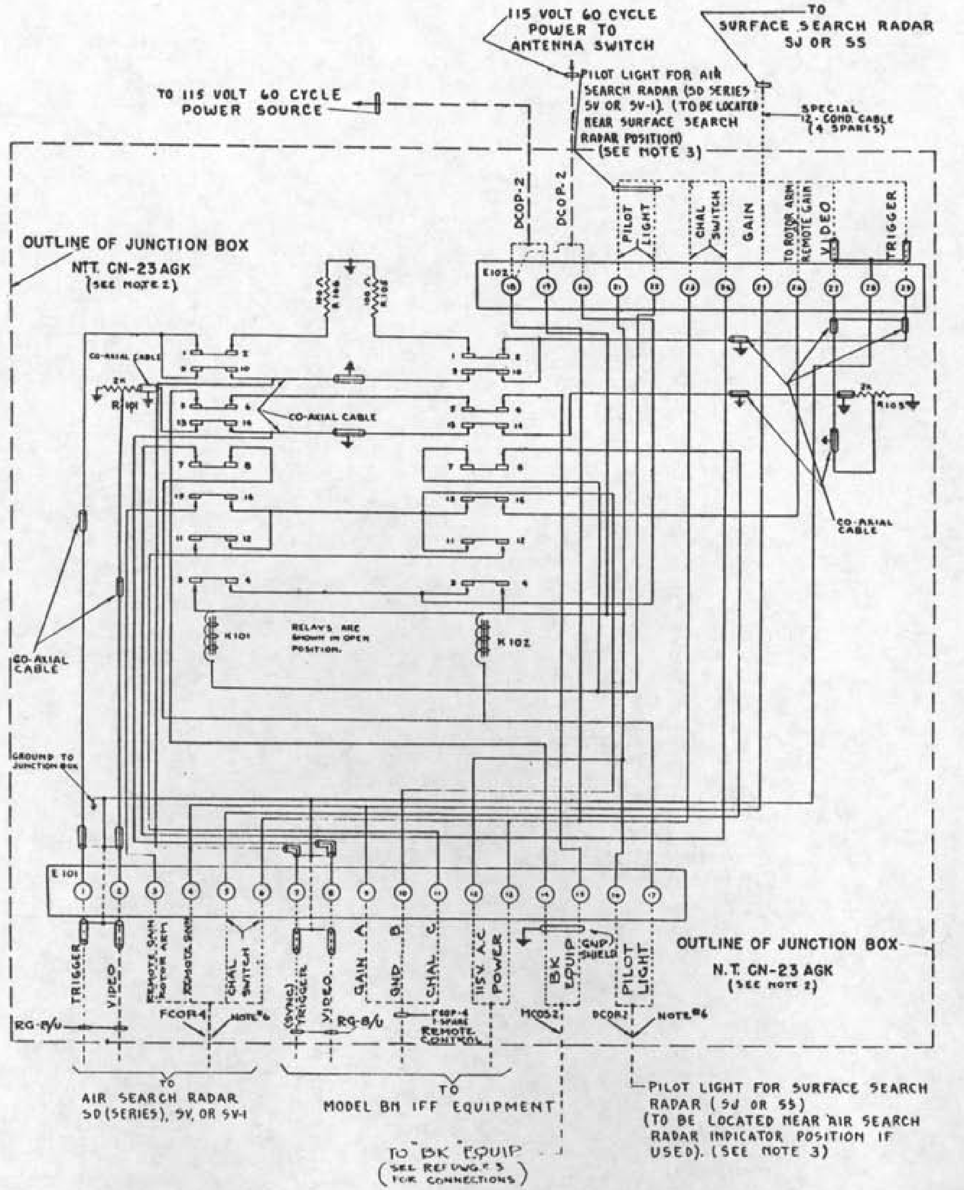
IFF EQUIP. MK-3
RADAR SELECTOR RELAY SYSTEM JUNCT.-BOX NAVY TYPE CN-23AGK
OUTLINE & MTG. DIMENSIONS
SCALE NONE 12-8-44

~~RESTRICTED~~

RE 43AA 4398

E - SUBMARINES - 12

RIP CHANGE NO. 41



	ALTERATION TABLE		
LTR	DESCRIPTION		
B	CHANGED LOCATION OF R2 & R4 & NUMERICAL DESIGNATION OF RESISTORS & RELAYS. ADDED NOTE 5.		-2-45
C	CHANGED WIRING E-101 TO APP RELAY CONTACTS TO "BK" EQUIP. REMOVED R102 & R104 APPEND.		3-3-45

NOTES:-

1. THIS JUNCTION BOX WITH EQUIPMENT SPARES, SPECIAL 12-CONDUCTOR CABLE AND TWO REMOTE GAIN POTENTIOMETERS FOR THE BN EQUIPMENTS WILL BE SUPPLIED IN A KIT. THIS KIT IS UNDER PROCUREMENT AND SHOULD BE AVAILABLE TO INSTALLING ACTIVITIES BEFORE 1 MARCH 1945.
2. THIS JUNCTION BOX SHOULD BE LOCATED IN THE SAME COMPARTMENT AS THE AIR SEARCH RADAR INDICATOR.
3. PILOT LIGHTS AND FACILITIES FOR MOUNTING SHALL BE PROVIDED BY INSTALLING ACTIVITY.
4. ALL CABLES, EXCEPT THE SPECIAL 12-CONDUCTOR CABLE, ARE TO BE FURNISHED BY THE INSTALLING ACTIVITY.
5. VINYLITE GROMMETS FOR SIZE "C" STUFFING TUBES ARE PROVIDED WITH THIS KIT. TWO GROMMETS ARE REQUIRED FOR EACH STUFFING TUBE INSTALLATION.
6. CABLES FCOP-4 & DCOP-2 CONNECTING TO TERMINALS 3,4,5,6,16 & 17 MAY BE COMBINED INTO ONE MCOP-7 CABLE FOR MODELS SV & SV-1 INSTALLATIONS

RE 43F 488 BK MOP SUB DUAL RADAR OPR
RE 43F 460 INTERCONNECTION FOR SUB RADARS
RE 43AA 439 OUTLINE & MTG DIM OF JCT BOX
REFERENCE DRAWINGS

DELINEATOR: Elmer Shaly — IN CHARGE OF DRAFTING: A. Robbins

APPROVAL

ENGINEER: Geo. Poyet — ENGINEER IN CHARGE: W.M. Clevestine

OFFICER IN CHARGE

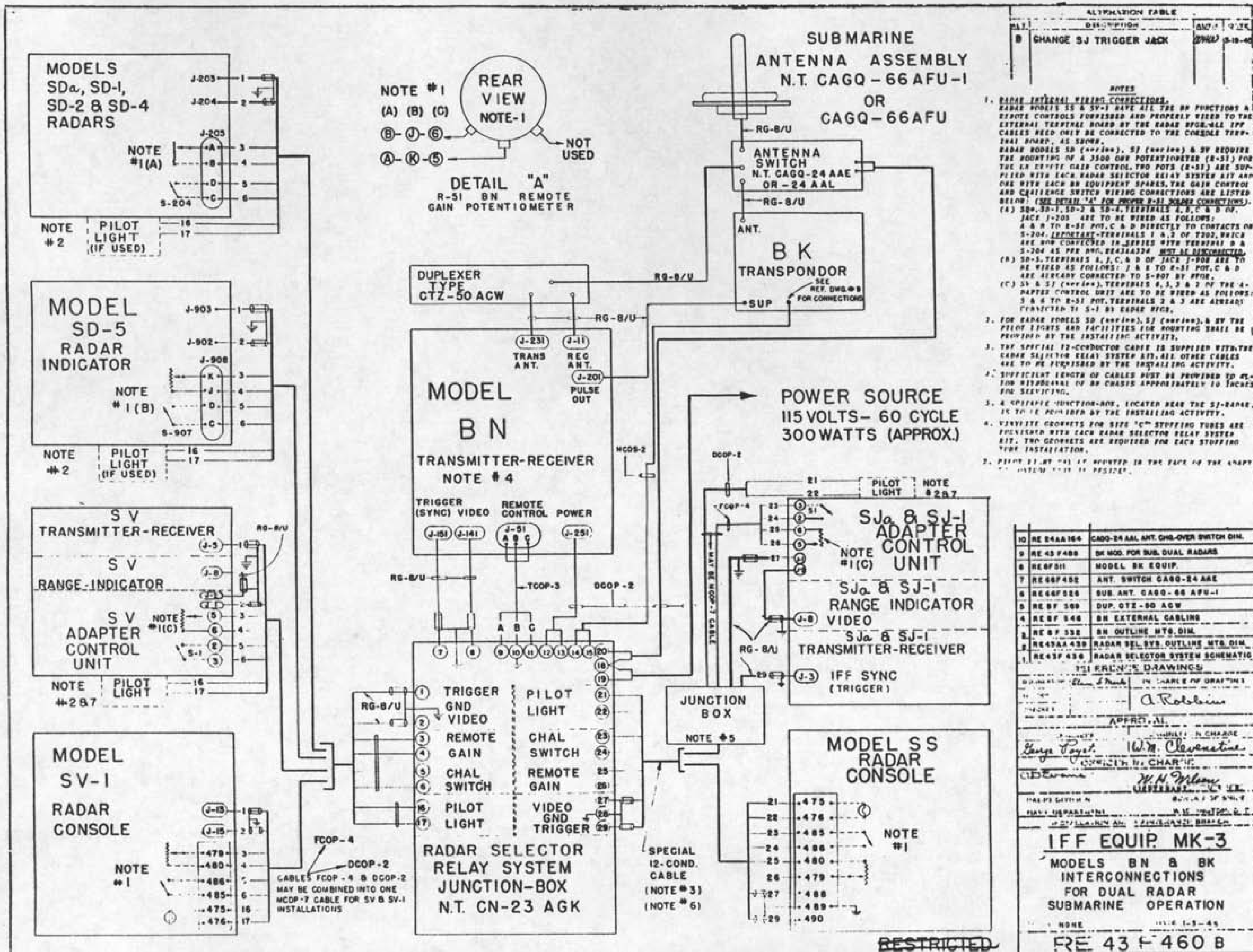
NAVAL DEPARTMENT — BUREAU OF SHIPS — WASHINGTON, D.C.

INSTALLATION AND MAINTENANCE CHANGE

IFF EQUIPMENT—MARK 3
RELAY SYSTEM FOR DUAL OPERATION OF MODEL BN WITH TWO RADARS

SCALE NONE — NOV. 7, 1944

RE43 F 436 C


MODELS SDa, SD-1, SD-2 & SD-4 RADARS
NOTE #1(A)
NOTE #2
PILOT LIGHT (IF USED)
MODEL SD-5 RADAR INDICATOR
NOTE #1(B)
S V TRANSMITTER-RECEIVER
S V RANGE-INDICATOR
S V ADAPTER CONTROL UNIT
NOTE #2&7
MODEL SV-1 RADAR CONSOLE
NOTE #1
CABLES FCOP-4 & DCOP-2 MAY BE COMBINED INTO ONE MCOP-7 CABLE FOR SV & SV-1 INSTALLATIONS
NOTE #1 (A) (B) (C)
REAR VIEW NOTE-1
NOT USED
DETAIL "A"
R-51 BN REMOTE GAIN POTENTIOMETER
DUPLEXER TYPE CTZ-50 ACW
MODEL BN TRANSMITTER-RECEIVER NOTE #4
TRIGGER (SYNC) VIDEO
REMOTE CONTROL
POWER
TRANS ANT.
REC ANT.
PULSE OUT
RADAR SELECTOR RELAY SYSTEM JUNCTION-BOX N.T. CN-23 AGK
TRIGGER GND VIDEO
REMOTE GAIN
CHAL SWITCH
PILOT LIGHT
SPECIAL 12-COND. CABLE (NOTE #3) (NOTE #6)
SUBMARINE ANTENNA ASSEMBLY N.T. CAGQ-66AFU-1 OR CAGQ-66AFU
ANTENNA SWITCH N.T. CAGQ-24 AAE OR -24 AAL
BK TRANSPONDOR
SEE REF. DWG. #9 FOR CONNECTIONS
POWER SOURCE 115 VOLTS- 60 CYCLE 300 WATTS (APPROX.)
JUNCTION BOX NOTE #5
SJa & SJ-1 ADAPTER CONTROL UNIT
SJa & SJ-1 RANGE INDICATOR
VIDEO
SJa & SJ-1 TRANSMITTER-RECEIVER
IFF SYNC (TRIGGER)
MODEL SS RADAR CONSOLE
ALTERATION TABLE
B CHANGE SJ TRIGGER JACK
NOTES
10 RE 24AA 164 CAGQ-24 AAL ANT. CHG-OVER SWITCH DIM.
9 RE 43 F 488 BK MOD. FOR SUB. DUAL RADARS
8 RE 6F 511 MODEL BK EQUIP.
7 RE 66F 452 ANT. SWITCH CAGQ-24 AAE
6 RE 66F 526 SUB. ANT. CAGQ-66 AFU-1
5 RE 8F 369 DUP. CTZ-50 ACW
4 RE 8F 546 BK EXTERNAL CABLING
3 RE 8F 532 BK OUTLINE MTG. DIM.
2 RE 43AA 439 RADAR SEL. SYS. OUTLINE MTG. DIM.
1 RE 43F 436 RADAR SELECTOR SYSTEM SCHEMATIC
REFERENCE DRAWINGS
APPROVAL
IFF EQUIP. MK-3
MODELS BN & BK INTERCONNECTIONS FOR DUAL RADAR SUBMARINE OPERATION
NONE
RE 43 F 460 B
RESTRICTED

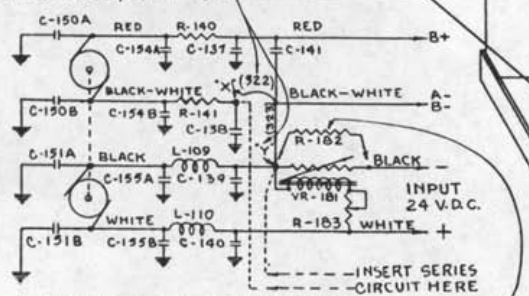
Sec. 3.3
968 156

E-SUBMARINES-15

R.I.P. CHANGE NO 41

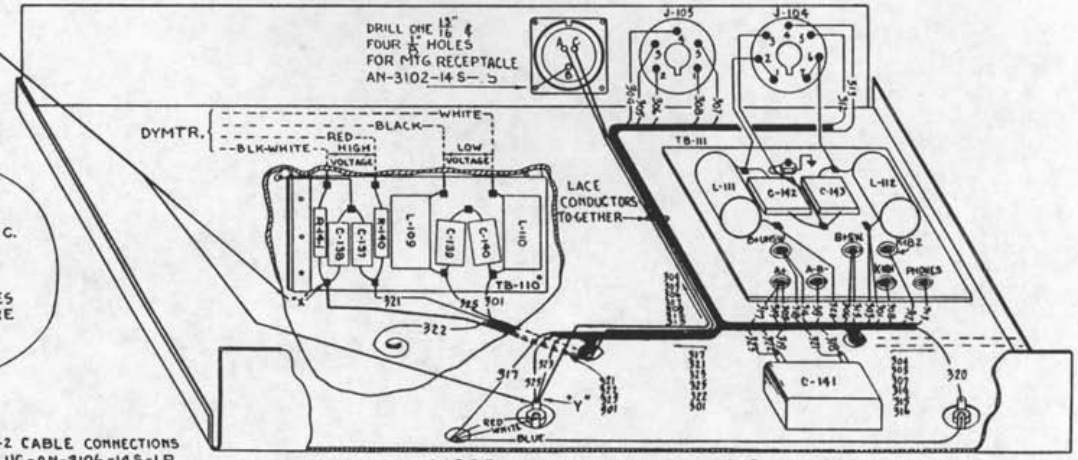
ALTERATION TABLE			
ALT.	DESCRIPTION	AUTH.	DATE

UNSOLDER & REMOVE JUMPER (322) FROM SOLDER-LUG JUNCTION OF R-141 & C-138 ON TB-110 (POINT "X"). TAPE & TURN BACK THE END OF THE JUMPER WIRE (322). INSERT THE EXTERNAL SERIES CIRCUIT BY SOLDERING ONE CONDUCTOR TO SOLDER LUG (POINT "X") & SOLDER THE OTHER CONDUCTOR TO SOLDER-LUG OF R-182 (POINT "Y").

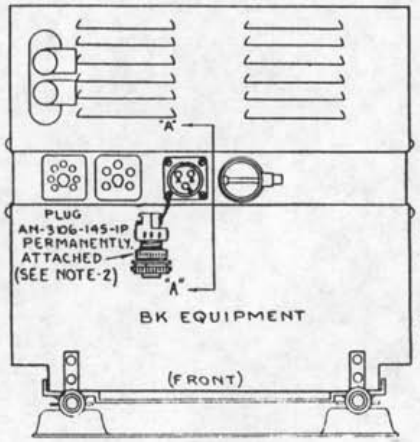


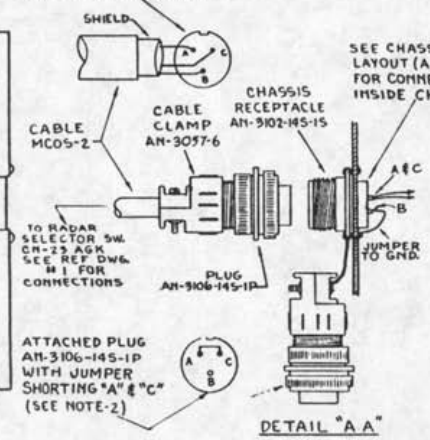
BK POWER CIRCUIT PARTIAL SCHEMATIC

REMOVE R-182 IN ACCORDANCE WITH R.I.P. PART "E" PAGE E-BK-4.



MODEL BK POWER CHASSIS LAYOUT





DETAIL "A A"

NOTES:

1. THIS MODIFICATION PROVIDES FOR SWITCHING THE B-MINUS CIRCUIT OF THE BK THROUGH RELAY CONTACTS IN THE TYPE CN-23AGK RADAR SELECTOR UNIT & IS AUTHORIZED ONLY FOR SUBMARINES. IT IS INTENDED TO OPEN THE B-MINUS CIRCUIT ONLY & NOT THE FILAMENT CIRCUIT.
2. THE PERMANENTLY ATTACHED PLUG WITH CONTACTS A & C WIRED TOGETHER, WHEN INSERTED IN THE AN-3102-14S-1S RECEPTACLE, RESTORES THE B-MINUS CIRCUIT OF THE BK TO NORMAL OPERATION & IS TO BE USED ONLY IF THE CN-23AGK SYSTEM BECOMES INOPERATIVE.

3		
2	RE43F460	IFF MK-3 SUBMARINE EXT. CABLING
1	RE43F436	CN-23AGK RADAR SEL. SW. WK. DIAGR.

REFERENCE DRAWINGS

DELINEATOR	Chas. Reed	IN CHARGE OF DRAFTING
TRACER		
CHECKER	Fitz	A. Robbins

APPROVAL

ENGINEER	ENGINEER IN CHARGE
Hue Foyt	Walter A. Clementine

OFFICER IN CHARGE

W. H. Wilson

ELECTRONICS DIVISION — BUREAU OF SHIPS
NAVY DEPARTMENT — WASHINGTON, D. C.
INSTALLATION AND MAINTENANCE BRANCH

IFF EQUIPMENT-MARK-3

MODEL BK MODIFICATION FOR DUAL RADAR SUBMARINE OPERATION

SCALE: NONE — DATE 5-5-45

RE 43F 488A

~~RESTRICTED~~