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RADIAC

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NAVAL SHIP ENGINEERING CENTER

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NOTES

(1) The number listed in this column indicates that this handbook issue incorporates information from EIB issues up to and including the one shown. In addition to this column entry, effective with this change and in all succeeding changes, a source reference code will be inserted immediately following the last line of copy of pertinent articles picked up in EIMB handbooks. The following examples show the coding method used to identify origin of material used:

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*Only articles which have been revised to omit classified data but retain information of value and lasting interest.

(2) The entry in this column indicates that all field changes assigned up to and including the date shown have been picked up in the FCIG of this issue.

** This issue of the Radiac Handbook has been superseded by later changes.

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PREFACE

POLICY AND PURPOSE

The Electronics Installation and Maintenance Book (EIMB) has been established as the medium for collecting, publishing, and distributing, in one convenient documentation source, those subordinate maintenance and repair policies, installation practices, and overall electronics equipment and material-handling procedures required to implement the major policies set forth in Chapter 9670 of the Bureau of Ships Technical Manual. All data contained within the EIMB are authoritative, and derive their authority from Chapter 9670 of the Bureau of Ships Technical Manual, as established in accordance with Article 1201, U. S. Navy Regularions.

Since its inception, however, the EIMB has been expanded to include selected information of general interest to electronic installation and maintenance personnel. These items are such as would generally be contained in textbooks, periodicals, or technical papers, and form (along with the information cited above) a comprehensive, single-source reference document. In application, the EIMB is to be used for information and guidance by all military and civilian personnel involved in the insrallation, maintenance, and repair of electronic equipment under cognizance, or technical control, of the Naval Ship Systems Command (NAVSHIPS). All information, instructions, and procedures in the EIMB supplement such instructions and data supplied in equipmenr technical manuals and other approved maintenance publications.

ORGANIZATION

The EIMB is organized into a series of handbooks to afford maximum flexibility and ease in handling. The handbooks are stocked and issued as separate irems so that activities requiring extra copies of any handbook may obtain them with relative ease.

The handbooks fall within two categories general information handbooks and equipment-oriented handbooks. The general information handbooks contain data which are of interest to all personnel involved in installation and maintenance, regardless of their equipment specialty. The titles of the various general information handbooks give only an overall idea of their data content; a more complete description of each handbook is provided in the General Handbook.

The equipment handbooks are devoted to information on a particular equipment class; they provide general test procedures, adjustments, general servicing information, and field change identification data.

The following table lists all handbooks of the series, together with their old and new NAVSHIPS numbers. (The old NAVSHIPS numbers are shown in parentheses.) The new NAVSHIPS numbers, although not presently imprinted on all handbooks of the EIMB series, serve also as the srock numbers which are to be used on any requisitions submirted.

HANDBOOK TITLE	NAVSHIPS NUMBER
(General Information Handbooks)	
General	0967-000-0100 (900,000.100)
Installation Standards	0967-000-0010 (900,000.101)
Electronic Circuits	0967-000-0120 (900,000.102)
Test Methods and Practices	0967-000-0130 (900,000.103)
Reference Data	0967-000-0140 (900,000.104)
RFI Reduction	0967-000-0150 (900,000.105)
General Maintenance	0967-000-0160
(Equipment-Oriented Handbooks)	
Communications	0967-000-0010 (900,000.1)
Radar	0967-000-0020 (900,000.2)
Sonar	0967-000-0030 (900,000.3)
Test Equipmenr	0967-000-0040 (900,000.4)
Radiac	0967-000-0050 (900,000.5)
Countermeasures	0967-000-0070 (900,000.7)

PREFACE

INFORMATION SOURCES

Periodic revision's are made to provide the best current data in the EIMB and keep abreast of new developments. In doing this, many source documents are researched to obtain pertinent information. Some of these sources include the Electronics Information Bulletin (EIB), the Naval Ship Systems Command Technical News, electronics and other textbooks, industry magazines and periodicals, and various military installation and maintenance-related publications. In certain cases, NAVSHIPS publications have been incorporated into the EIMB in their entirety and, as a result, have been cancelled. A list of the documents which have been superseded by the EIMB and are no longer available is given in Section 1 of the General Handbook.

SUGGESTIONS

NAVSHIPS recognizes that users of the EIMB will have occasion to offer comments or suggestions. To encourage more active participation, a self-addressed comment sheet is frequently provided in the back of each handbook change. Complete information should be given when preparing suggestions. It is most desirable that the suggestor include his name and mailing address on the form to facilitate direct correspondence in the event clarification is required and an immediate reply can be supplied regarding the suggestion. Any communication will be made through a personal letter to the individual concerned.

If a comment sheet is not available or correspondence is lengthy, suggestions should be directed to the following:

Commander, Naval Ship Engineering Center
Department of the Navy
Washington, D. C. 20360
Attn: Technical Data and Publications Section
(SEC 6181C)

CORRECTIONS

Report all inaccuracies and deficiencies noted in all NAVSHIPS technical publications (including this manual, ship information books, equipment manuals, drawings, and such) by a "Planned Maintenance System (PMS) Feedback Report, OPNAV 4700.7 (REV. 5-65)" or superseding form. If PMS is not yet installed in this ship, report technical publication deficiencies by any convenient means.

DISTRIBUTION

The Electronics Installation and Maintenance Book is transmitted to using activities through automatic distribution procedures. activities not already on the EIMB distribution list and those requiring changes to the list should submit correspondence to the following:

Commander, Naval Ship Engineering Center
Department of the Navy
Washington, D. C. 20360
Attn: Technical Data and Publications Section
(SEC 6181C)

Activities desiring extra copies of EIMB handbooks or binders should submit requisitions directly to Naval Supply Depot, Philadelphia, Pennsylvania. Complete instructions for ordering publications are given in the Navy Stock List of Forms and Publications, NAVSANDA Publication 2002.

RECORD OF CORRECTIONS MADE

CHANGE NO	DATE	CHANGES MADE	SIGNATURE

NOTES

1-1. INTRODUCTION

Purpose. –The purpose of this section is to provide the technician in the fleet with general maintenance instructions for maintaining radiac equipments.

Scope. –This section contains general maintenance instructions which cover all portable and nonportable Navy-type radiac equipments. These instructions are not inclusive, nor are they intended to take precedence over specific maintenance and technical publications covering individual radiac equipment. Unless otherwise stated, maintenance instructions are applicable to all radiac equipments.

General. –Radiac equipments vary from small, portable, battery-operated sets to large, integrated, monitoring systems requiring associated electronic equipment. The purpose of radiac equipments is to detect and indicate the amount of radioactivity present in a given area. The type of radioactivity detected (alpha and beta particles, gamma radiation, fast and slow neutrons) is determined by the type of radiac equipment used. Basically, radiac equipments contain one or more, or a combination of, the following:

a. Radiac Detector – A device that is sensitive to radioactivity or free nuclear particles and reacts in a manner that can be interpreted or measured by various means.

b. Radiacmeter – A device that detects the presence of radioactivity and indicates the dose rate or total dose.

c. Computer-Indicator – A device that computes and indicates radiac data received from the radiac detector or detectors.

1-2. HANDLING RADIOACTIVE MATERIAL

WARNING

All personnel working with radioactivity must exercise caution to prevent bodily damage. While the radiation from radioactive substances cannot be seen or felt, prolonged or extensive exposure may result in serious damage. One-tenth of a roentgen per week (0.1 r/week or 100 mr/week) is the maximum permissible exposure.

General. –Many types and quantities of radioactive material are required to calibrate or check the performance of radiac equipments. The use of the larger sources is restricted to authorized radiac repair facilities only. These sources are adequately marked and are handled only by personnel authorized by the A.E.C.

Smaller sources of radioactive material are supplied with some radiac sets for the purpose of field testing the operation of the equipments. Proper use and handling of these sources are covered in the technical manuals for the equipments. If the instructions do not outline the proposed use of the source, refer to local health and/or safety personnel. Safety precautions and instructions on the handling of radioactive material are contained in NAVMED P-5055, Radiological Safety Regulations, and various Bureau of Standards Handbooks, particularly Nos. 23, 42, 48, and 52.

Some radiac equipments contain built-in radioactive sources to facilitate field testing. These sources must not be handled except by authorized personnel at radiac repair facilities.

NOTE

Equipments containing built-in radioactive sources must be serviced by a radiac repair facility at least every six months.

Hazards of Radioactive Luminescent Material. – Damaged or deteriorated luminescent markers or equipment can contaminate local areas with radioactive particles which then can circulate in the air, or be picked up on the hands and clothing of personnel. Also, when airborne radioactive particles are present, ventilation filters and electrostatic precipitators will collect and concentrate these particles and may themselves become radiological hazards. These conditions may lead to inhalation or ingestion of radioactive particles.

The physiological effects of unsafe exposure to small amounts of radioactivity are not immediately apparent; they may take months or years to appear and may never be traced to the initial cause. It is imperative, therefore, that visual inspection and monitoring be performed to detect the presense of radioactive luminescent materials. Monitoring should include periodic checks of spaces, such as watch repair shops, where work involves the handling of components bearing this material. Any material exhibiting a radiation level of more than 0.1 milliroentgen per hour (mr/hr) above background at a distance of approximately 1 inch from the material should be treated as radioactive. Also, adjacent areas should be checked for possible contamination. Radiac Set AN/PDR-27( ), with the detector end window open, is a suitable instrument for detecting this radioactivity.

All radioactive luminescent items, including spare parts, which are not operationally essential shall be removed.

Components bearing radioactive material should not be handled any more than is necessary. When such handling of radioactive material is necessary, personnel should wear gloves and refrain from smoking or eating. Keep radioactive material away from personnel property and foodstuffs. Special care should be taken in handling any equipment on which the radioactive material is flaking or dusting. All areas suspected of being contaminated must be cleaned thoroughly to prevent inhalation or ingestion of the material or spread of the contamination. All radioactive material removed, including rags used in cleaning, should be collected and promptly sealed in leakproof containers, marked as radioactive, and transferred to the nearest Naval supply activity for disposal. Liquid wastes incidental to the cleaning operation may be disposed of through the sanitary waste system or directly overboard. Further information is contained in BUSHIPS INSTRUCTION 5100.16; also

BUSHIPS INSTRUCTION 5100.15 reiterates safety precautions pertinent to handling radioactive materials.

Storage. –Radiac equipment containing radioactive material should be kept in a clean segregated storage area with controlled access to prevent handling or removal by unauthorized personnel. Battery life of portable radiac equipment is extended when stored in a relatively cool, dry area. On the other hand, if temperatures are expected to drop below freezing, provision for heating should be made. Radiation intensities at supply points where large quantities of equipments containing radioactive material are to be stored must be controlled to the extent that no person would be likely to receive a whole body does in excess of 300 milliroentgens per calendar quarter or 500 milliroentgens per year. Such areas should be monitored at least every six months or whenever stock is increased or rearranged.

NOTE

Immediate guidance from the Industrial Hygienist, Radiological Safety Officer or the Safety Superintendent should be obtained to cope with such problems as:

a. Broken or damaged radiac equipment, parts or sub-assemblies containing radioactive material.

b. Radiation intensity exceeding the above criterion.

c. Inability to reduce radiation intensity by dispersal of stock.

Wipe Testing. –Wipe testing of Radiac equipments must be performed on all parts and sub-assemblies upon issue. This service is provided on a no cost basis by nuclear tenders and radiac repair facilities. Radiac equipment received from contract in original unopened packages need not be wipe tested as long as they remain in stock status. However, radiac equipment received from any other source should be forwarded to one of the shore radiac repair facilities for wipe testing. If radiologically safe, or if made safe after decontamination, the radiacmeter or other component containing the radioactive material should be placed in a leak-proof plastic bag, sealed, and marked in accordance with the latest issue of Military Specification MIL-M-19590. Radiac equipment received from repair facilities after processing need not be wipe tested while they remain in storage, but upon re-issue, they should be shipped to a radiac repair facility for maintenance and leak testing. If a radiac set is returned to the supply activity, the carrying case will suffice as a suitable storage container for items previously sealed in plastic bags.

Authority to Possess Byproduct Material. –Bureau of Ships Instruction 9673.19A, Ser. 36B3-499 lists all AEC licenses issued to the Naval Ship Systems Command for byproduct material sources used in radiac equipment. License 8-38-12 shall be cited when information as to the authority for possession of the source listed is requested from any activity in the Naval Establishment. These instructions also list the conditions and requirements imposed by each AEC license. Procedures for obtaining a U.S. AEC license and for handling by-product material are specified by the Naval Ship Systems Command.

Marking of Commodities and Containers to Indicate Radioactive Material. –Stocking and trans-shipment activities shall insure that all radiac equipment, parts, or subassemblies which incorporate radioactive material in the Naval Supply System are marked in accordance with the requirements of the current issue of Military Specification MIL-M-19590. The markings shall be placed on the enclosed radioactive material and on each surrounding container so that the presence of the radioactive material within can be readily recognized and located. In addition to being marked in accordance with the quoted manual, shipping containers and documents must also be labeled so the presence of radioactive material is clearly understood. If the marking of a particular Radiac Set is in question, consult your local maintenance authority. BUSHIPS Notice 9673 Serial 682-254 of 16 January 1964 contains amplifying information for radiac equipment.

Radium-Treated Components in Certain Navigation Instruments. –BUSHIPS INSTRUCTIONS 9240.21 and 5100.9 warn of potential hazards associated with radium-treated components used in certain navigation instruments.

Accountability of Radioactive Byproduct Material and Radium. –Bureau of Ships Instruction 5100.19 (Ser. 682-172), dated 26 November 1963 prescribes methods to be used to assure adequate accountability of licensed radioactive byproduct material under the cognizance of the Naval Ship Systems Command. Equipments for which accountability is required are listed as follows:

EQUIPMENT OR COMPONENTS CONTAINING ACCOUNTABLE RADIOACTIVE MATERIAL

Equipment/ Components	Isotope	Quantities
AN/BDQ-1 & 1A	Strontium 90	100 microcuries
AN/BDQ-3	Strontium 90	3 microcuries
AN/PDR-18 & 18B	Strontium 90	300 microcuries
AN/PDR-18A	Strontium 90	100 microcuries
AN/PDR-27B & D	Radium 226	6 microcuries
AN/PDR-27C, E, F, G, H, & J	Radium 226	7 microcuries
AN/PDR-43 & 43B	Krypton 85	100 microcuries
AN/PDR-43C & 43D	Krypton 85	80 microcuries
AN/PDR-44	Strontium 90	160 microcuries
AN/PDR-45	Strontium 90	40 microcuries
AN/PDR-45A	Strontium 90	20 microcuries
AN/SDR-1	Strontium 90 (2 sources)	150 microcuries each
AN/SDR-2	Krypton 85 (2 sources)	15 microcuries each
	Krypton 85 (2 sources)	500 microcuries each
AN/UDM-1	Cobalt 60	9 curies
AN/UDM-1A	Cesium 137	120 curies

Equipment/ Components	Isotope	Quantities
AN/USM-113	Cesium 137	1.6 millicuries
IM-118(XN-1)	Strontium 90	700 microcuries
IM-144/WDQ	Strontium 90	15 microcuries
IM-144A/WDQ	Strontium 90	50 microcuries
IM-148/WDQ	Strontium 90	14 microcuries
IM-151 & 151A/WDQ	Strontium 90	20 microcuries
IM-192/WDQ	Strontium 90	77 microcuries
TS-1189/PD	Cesium 137	700 microcuries
TS-1216()/PD	Cesium 137	30 curies
Tube Type 1P41	Radium 226	6.6 microcuries
Tube Type 1B45	Radium 226	6.6 microcuries
Tube Type 1B49	Radium 226	6.6 microcuries
Tube Type 642	Radium 226	3.3 microcuries
Tube Type 759	Radium 226	6.6 microcuries
Tube Type 759.1	Radium 226	3.3 microcuries
Tube Type 5939	Radium 226	3.3 microcuries
Tube Type 6260	Radium 226	3.3 microcuries

Removal of Certain Radioactive Luminous Markers. – BUSHIPS INSTRUCTION 5100.7 and BUSHIPS INSTRUCTION 9650.31A direct the removal of certain radioactive luminous markers.

Disposal of Radioactive Wastes. –Since radioactive wastes present a potential health hazard, all radiac equipments, parts or sub-assemblies containing radioactive material which are broken or unfit for use must be disposed of through the proper channels. Requirements for the disposal of radioactive wastes for all naval activities are established in SECNAV INSTRUCTION 4555.1, OP-752, Ser. 322P75 of 17 October 1961. The appropriate instruction should be consulted when questions arise regarding the proper procedures to be followed in handling radioactive material. Copies of the records of all such transfers shall be forwarded to the cognizant Management Authority and to the Chief of Naval Operations, Atomic Energy Division, annually as of 31 December.

The U.S. Atomic Energy Commission has estabilised specific regulations that must be adhered to by all persons engaged in radioactive waste disposal. A number of commercial firms have met AEC requirements and are licensed to conduct radioactive wastes disposal operations. Naval activities should dispose of such wastes through these organizations or ship them to an AEC land disposal site. A current list of authorized commercial activities and information regarding land disposal sites should be obtainable from the District Commandant.

The following is a partial list of commercial firms licensed by the AEC to receive and dispose of radioactive wastes.

Allied Crossroads Nuclear Corporation
201 Victory Road
Dorchester, Massachusetts

New England Tank Cleaning Co.
135 First Street
Cambridge 41, Massachusetts

California Salvage Company
700–745 N. Pacific Avenue
San Pedro, California

Nuclear Engineering Co., Inc.
Box 594
Walnut Creek, California

California Nuclear, Inc.
2323 South Ninth Street
Lafayette, Indiana

Laboratory for Electronic, Inc.
Tracerlab Division
1601 Trapelo Road
Waltham, Massachusetts

The Walker Trucking Company
1283–1285 East Street
New Britian, Connecticut

Long Island Nuclear Service Corporation
35 New Mill Road
Smithtown, New York

Radiological Service Co., Inc.
811 West Merrick Road
Valley Stream
Long Island, New York

These firms should be contacted directly for information regarding services which they can provide.

NOTE

This list does **not** include commerical firms licensed entirely by "Agreement States." An "Agreement State" is defined as any State with which the Commission has entered into an effective agreement under subsection 274b of the Atomic Energy Act of 1954.

1-3. CALIBRATION

Because of the dangerous radioactive materials used as standard calibration sources, maintenance and calibration of radiac equipments are restricted to adequately equipped facilities. These radiac repair and calibration

facilities are located at each of the major industrial repair activities and are assigned the responsibility of maintaining radiac equipments in a state of operational readiness for activities under their maintenance and for naval vessels. No charge is made for these services.

For reasons stated above and during normal conditions, if any equipment fails during its monthly check-out, it should be returned to the nearest Radiac Repair Facility. However, during emergency situations, activities afloat may repair their equipment. The procedures contained in the applicable equipment technical manual and the procedures described in paragraph 1-4 will apply.

1-4. PORTABLE-TYPE EQUIPMENTS

General Tests.—When a radiac set is initially placed in operation or has not been used for a short period of time, general tests should be performed to insure the overall performance of the equipment is satisfactory. These tests normally are performed by the operator and include routine checks on batteries, detector elements, meter circuits, and general overall operation.

Battery Condition Test.— The majority of portable radiac equipment failures are caused by dead batteries, corroded battery compartments, electronic circuit failures, and physical damage. Of these four major causes, corrosion has appeared most frequently and has proved to be most serious.

Radiac equipment should be checked when brought aboard ship and each time the equipment is to be used to determine battery and battery compartment conditions. Most equipments contain built-in provisions for checking battery conditions. The circuit of the radiacmeter functions as a voltmeter with the battery voltage displayed on the indicating meter. If the meter readings are below those specified, replace the batteries immediately. Dead batteries, if permitted to remain in the equipment, will swell and cause corrosion.

In some equipments, the meter will indicate the condition of one battery only. Therefore, it is possible that other batteries may be defective. When the equipment functions improperly, replace all batteries and retest the equipment.

When stowing radiac equipment for a prolonged period, check battery conditions at least every 30 days. Replace the batteries if any sign of corrosion or leakage is evident Partially used batteries will go dead during inactivity; new batteries will fail during stowage after normal shelf life is exceeded.

Overall Test.— Some portable radiac sets are equipped with a radioactive test sample for the purpose of checking the equipment and determining the condition of the detector elements and meter circuit. Test procedures for using the radioactive test sample vary for each radiac set and must be followed exactly as instructed in the applicable technical manual for the specific type of equipment. (See Para. 1-2. Handling Radioactive Material.)

WARNING

Use the radioactive test sample prudently. Direct contact or, in some cases, holding the radioactive test sample close to the skin may cause excessive exposure to the radiation and may result in serious skin and internal burns. Handle only as instructed in the applicable instruction manual.

Overall performance of the equipment can be checked using the radioactive test sample and setting the range switch of the equipment to the specified positions. The indicating meter will display a reading for each setting of the range switch and, from these readings, operability of the equipment can be determined.

NOTE

Readings obtained with the radioactive test sample are approximate and are intended primarily to indicate that the detector elements and the equipment are operating normally.

Meter readings and headphone signals, when properly interpreted, provide considerable self-testing for the radiacmeter and detector. When used in conjunction with the radioactive test sample, the meter readings are extremely valuable in isolating causes of faulty operation.

The following procedures should save time and labor in locating defective components.

a. Set the function switch in the battery-test position. If the meter does not indicate the required voltage, measure the terminal battery voltage of each battery, under load, with a voltmeter. If the batteries are not defective, check for loose connections or a defective function switch.

b. Rotate the function (range) switch through the sensitivity ranges while expcsing the detector to the radioactive test sample. Observe the meter deflection and listen for the clicks in the headphones. If the clicks are heard but an incorrect deflection is observed on the meter, the integrating circuit or meter circuit probably is open. Test these circuits with a 20,000 ohms/volt voltmeter. If the headphones are dead also, a thorough check of the equipment must be mode. Remove the detector tube and test it as instructed in paragraph 1-6, Special Test Equipment. If the detector tube is functioning properly, check the amplifier and multivibrator circuits. If continuous readings are observed, either the high voltage to the detector tube is too high, the detector tube is defective, or the equipment is contaminated.

Visual Checks.—The importance of maintaining radiac equipments in operable condition cannot be overemphasized. Visual checks, though seemingly unimportant and laborious, must be performed frequently and thoroughly to insure equipment operability and to prevent passible equipment failure.

Exercise care when inspecting the chassis interiar so electrical and mechanical parts will not be damaged. Visually inspect battery and battery compartment condi-

tions. Replace batteries immediately if they are swelled or corroded. Check for loose tubes, broken tube and/or transistor pins, defective tube and/or transistor sockets, damaged components, loose mechanical parts and connections, burned or chafed insulation, solder drops, and short circuits due to bent wires or contacts.

CAUTION

Do not touch subminiature tubes and resistors used in electrometer circuits. These tubes are extremely sensitive. Surface leakage and decreased amplifying properties will result if touched with bare hands. Resistor elements are vacuum-sealed in thin glass envelopes.

External checks are equally as important as inspecting the chassis interior. The overall outside condition of the equipment should be inspected to insure that all screws are tight, the front pannel assembly and main housing are clean, and dust and grease have not accumulated on external surfaces. All scratches should be retouched with a brush. If dust and grease are evident, wipe them off with a clean, dry cloth.

Extension cords of headsets and radiac detectors should be checked for frayed insulation and broken wires. Harnesses should be inspected for wear of the straps and seams.

Inspect the radiac carrying case. Dust and grease permitted to accumulate in the case will damage the equipment if not removed.

Dosimeters.– Dosimeters measure and, in some cases, indicate the accumulated dose of radiation to which an individual has been exposed. These units are of various sizes and forms, the most common being comparable in appearance and size to a fountain pen. This type dosimeter contains an optical eyepiece at one end and a charging contact, consisting of a diaphragm and charger pin, at the other end. A small electrometer, calibrated in roentgens or milliroentgens, is contained in an ionization chamber within the dosimeter housing. The electrometer is a phosphor bronze wire frame and a quartz fiber. The calibrated scale is mounted in such a manner that the amount of radiation to which the wearer has been exposed since the dosimeter was charged can be read directly by holding the dosimeter to a light source and looking through the eyepiece.

Dosimeters of the type mentioned previously are charged in the following manner:

a. Insert the dosimeter into the charging well of a radiac detector charger.

b. Slowly rotate the charging knob on the detector charger. If no fiber is observed in the dosimeter, remove the dosimeter from the well and reinsert it to short the charger.

Occasionally, dosimeters will not charge or will leak after charging. If this occurs, visually inspect the diaphragm. **Wash the diaphragm with petroleum ether if dirt is** evident. Let the dosimeter dry before recharging. If the diaphragm is not dirty, a particle of dust or line in the ion chamber may be forming a leakage path for the charge. Hard tapping on the dosimeter should correct this condition.

Dosimeters should be kept clean at all times. When cleaning dosimeters, a white lacquer stick can be used to fill in serials and numbers on the dosimeter tubular housing.

1-5. NONPORTABLE-TYPE EQUIPMENTS

General.– Nonportable-type radiac equipments are large integrated systems used to detect and monitor the levels of radioactivity at critical locations aboard ship. Detection is accomplished by radiation-sensitive detector units located in these critical areas. Radioactivity levels are indicated by meters on the detector units and/or on computer-indicator units which are contained in a centrally located console.

A detector unit, associated amplifier (if required), and a corresponding computer-indicator unit combine to form a detector channel. One or more detector channels, performing similar or dissimilar functions, combine to form a monitoring system.

Air Particle Channels.– Air particle channels are used to continuously sample the air and to check the samples for the presence of radioactive dust particles. Air is drawn through an intake port and forced through a moving strip of paper tape or filter paper by a blower. The filter paper or paper tape moves from a feed reel to a take up reel, passing the detector elements enroute. The amount of radiation collected on the paper or tape is then indicated either on the detector meter or computer-indicator meter, or both.

Gamma Channels.– Gamma channels are used to detect and measure gamma rays and are provided with an internal calibration source. Alarm circuits can be set to operate at any desired level of radioactivity, within the range of the equipment, to give a visual indication and audible alarm, and also to provide remote alarm signals.

1-6. SPECIAL TEST EQUIPMENT

General.– Some components, such as electrometer subminiature tubes, Geiger-Mueller (G-M) tubes, and high-valued resistors cannot be tested thoroughly with ordinary test equipment. In these instances, specialized test equipments are required.

Electrometer Subminiature Tubes.– Electron Tube Test Set TV-6/U is designed to test electrometer subminiature tubes such as those used in radiac equipments. The tester measures grid current, grid voltage, plate current, plate voltage, mutual conductance, and leakage. The following procedure is used:

a. Withdraw the compartment at the upper left section of the tester.

b. Place the electrometer tube to be tested in the compartment and make the proper connections to the tube pins. (Connections are made with a series of clips and leads. Each clip is colored differently to facilitate connection to the proper tube element.)

c. Set the selector switch in the TEST position and apply the correct operating voltage to each tube element by

adjusting the front-panel controls. (The correct operating voltage for each specific tube is outlined in the instruction manual for that particular radiac equipment in which the tube is used.)

d. Read the meter deflection to determine the condition of the electrometer tube.

G-M and High Voltage Regulator Tubes.—Electron Tube Test Set AN/USM-113 is required to test G-M radiation counter tubes, type 5979/BS-1 and 5980/BS-2, and corona discharge voltage-regulator tubes, type 5962/BS-101. Counter tubes can be tested for counting rate (response), plateau slope, and gamma sensitivity; corona discharge voltage-regulator tubes can be tested for operating voltage and voltage regulation. Detailed test procedure instructions are furnished with the tester.

High-Valued Resistors.— As some radiac equipments use resistors of extremely high resistances, special test equipment is necessary to measure these values. Electron Tube Test Set TV-6/U is designed for this purpose and is used in the following manner:

a. Withdraw the compartment at the upper left section of the tester and drop the hinged front panel.

b. Insert the resistor in the tube-resistor holder and place one lead under the thumbnut terminal marked HIGH Z.

c. Connect the white clip to the other lead of the resistor and return the compartment to its original position.

CAUTION

Do not handle the body of the resistor. This type resistor should only be handled by its leads.

d. Check the condition of the batteries of the tester by setting the OFF-BATT-TEST switch to BATT. If the batteries are operating properly, set the switch to TEST.

e. Place the multiplier switch to the approximate range scale required.

f. Set the READ-SET switch to SET. Rotate the SET knob until the meter needle is exactly on the meter scale SET mark.

g. Place the READ-SET switch to READ and adjust the PRECISION INDICATOR dial until the meter needle again falls on the SET mark.

h. Read the PRECISION INDICATOR dial setting and multiply this reading by the multiplier setting to obtain the resistance value.

Batteries.— Battery Test Set TV-3/U is required for testing batteries under load. Detailed test procedures are furnished with the tester.

Viewer and Dryer for Radiac Dosimeters.—The testing of quartz-fibre dosimeters can be tedious and time consuming, depending on the quantity and the condition of dosimeters involved. One difficulty is that dosimeter's must be held up to a light to be checked for drift or accuracy. If the dosimeter fails this initial test, the process must be repeated. Also, when dosimeters require cleaning, petroleum ether must be used and dosimeters have to be dried thoroughly before they are charged. To facilitate the reading and drying of dosimeters, the following viewer and dryer may vary depending on the workload at a particular radiac repair facility. (See Figure 1-1).

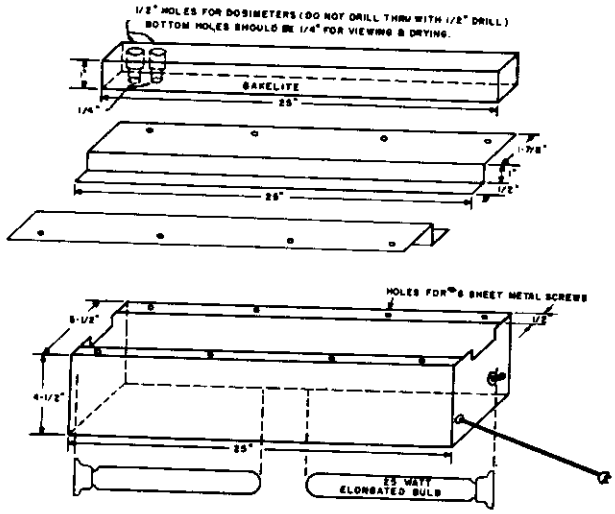

Figure 1-1. Viewer and Drier for Dosimeters

1-7 MAINTENANCE OF RADIAC EQUIPMENT ON BOARD SHIP

The arrival reports from various shipyards indicate that a majority of shipboard radiac equipments are inoperative for many reasons. Failure reports have revealed that most of the difficulty is caused by dead batteries, electronic circuit failure, corroded battery compartments and physical damage. Corrosion appeared most frequent and proved most serious.

The study of radiac equipments aboard the ships indicated that negligence in routine maintenance was responsible for the critical conditions of the equipment. To alleviate the possibility of inoperative radiac equipment, certain information and regulations should be emphasized.

1. Radiac equipments are extremely sensitive and should be checked when brought aboard ship. If not immediately stowed, they should be rechecked before stowage.
2. Location of stowage should be readily accessible for inspections and frequent (at least on a monthly basis) inspections performed accordingly.
3. Strict adherence to the regulation of BUSHIPS Manual, Article 67-120 is mandatory.

AN/BDQ-1 AND AN/BDQ-1A RADIATION MONITORING SYSTEM

Air Particle Detectors CP-306/BDQ-1 and CP-337/BDQ-1A, components of the Radiation Monitoring System, have experienced air pump (B1604) failures prior to and shortly after ships commissioning. The major cause for these failures is due to the accumulation of dirt and oil from the ship's atmosphere on internal parts of these pumps which causes the vanes to bind.

The binding failures can be reduced or eliminated by performing the preventive maintenance procedures specified in NAVSHIPS 92912(A), Section 6 Paragraph 10, at two week intervals until the ship's atmosphere reaches a normal level of cleanliness. When cleaning the air pumps, care should be taken to use as little of the solvent (Trichloroethylene) as is necessary.

REPLACEMENT OF TRANSISTOR TYPE TI 970 (N5960-583-1978) BY TYPE 2N122 (N5960-563-9617)

The TI970 (N5960-583-1978) power transistor manufactured by Texas Instruments Inc., used in the AN/BDQ-3 and IM-134/WDQ specifically, and other equipments as applicable, is obsolete and will be replaced by transistor type 2N122 (N5960-563-9617).

Both transistor types are electrically and physically interchangeable except that type 2N122 has a welded case and 3, not 2, leads. The third lead is the emitter which is electrically connected to the case. Temporarily, ESO will procure 2N122's with the emitter lead cut off. In the future, ESO will purchase transistor type 2N122 with 3 leads and the cutting of the emitter lead will be done in the fleet.

USE OF PROPER VOLTAGE REGULATOR TUBE FOR RADIAC EQUIPMENTS

The equipments listed below utilize voltage regulator tube type BS101/5962, FSN5960-188-6592 (manufactured by Electronic Products) in the high voltage power supply circuit:

AN/BDQ-3
IM-134/WDQ
IM-144A/WDQ
IM-151/WDQ
IM-151A/WDQ

This tube type is not suitable for use in these equipments. The Electronic Products designation, as it appears on the tube, is JAN-CY-5692. These tube types are to be turned in at nearest supply depot in exchange for CBON-BS101/5962, which is produced by Lionel Electronics, or CCZJ BS-101/5962, produced by EON Corporation. This action will ensure proper operation in the high voltage power supply circuites in the above mentioned equipments.

AN/PDR-10D, REPAIR OF RADIAC PROBES

The following maintenance procedures for repairing the probes of Radiac Set AN/PDR-10D have been prepared for use by authorized radiac repair facilities only.

1. **Removal of Counting Chamber.**—Remove counting chamber as described in 3c(2) on page 7-9 of NAVSHIPS 92162, Instruction Book for Radiac Set AN/PDR-10D.

CAUTION

Care should be exercised when removing counting chamber to prevent damage to the grid wires.

2. **Replacement of Aluminum Foil**—Make a form out of 3/8 inch plywood to the same dimensions as the aluminum foil and sand lightly to eliminate any burrs. Remove all traces of damaged aluminum foil from the counting chamber by scraping or light sanding and insure a clean surface, free of oil or grease. Place a sheet of Mylar over the wooden form and stretch with the aid of masking tape to remove wrinkles. The formed Mylar is then attached to the counting chamber, using a rubber base cement of the following proportions:

3 parts of Minnesota Mining & Mfg. Co. 3M type 1357 or equivalent

1 part of Toluene, FSN 6810-281-2005

Use a flat weight to hold the form in place and allow approximately one hour for the cement to dry. After drying, trim all excess Mylar with a razor blade and coat the edges with Aquadag. Any excess cement or other foreign matter should be removed from the chamber and the chamber cleaned with streams of dry air from a syringe.

3. **Replacement of Counting Chamber.**—Replace counting chamber in reverse order of removal, exercising care to avert damage to the grid wires. (2S)

AN/PDR-43( ) INFORMATION FOR RADIAC REPAIR FACILITIES

Boston Naval Shipyard has suggested that, for complete calibration of the AN/PDR-43( ), a dummy housing be used, with access holes to permit rapid screw adjustment of Inductors L1 and L2. The dummy housing may be made of sheet aluminum, but should be of the same size and shape as the original.

This dummy housing will eliminate the need to remove and replace the housing at each partial adjustment and reading, as called for in NAVSHIPS 93225A and NAVSHIPS 93562.

After having been calibrated with the dummy housing, the radiac set should be given a final check with its own housing in place.

NOTE: The other two calibration controls, R13 and L3, are not affected. There is already an access hole for R13 in the top panel; L3, however, can be adjusted only by moving the taps.

AN/PDR-43( ) SERIES-RADIAC SET, POWER SUPPLY CHECK

Leakage between the positive battery terminal and ground has been discovered in several of these sets. This malfunction causes a continuous current drain on the batteries, leading to shortened battery life, corrosion, leaky batteries, and damaged contacts.

Authorized Radiac repair facilities are requested to perform the preventive maintenance check outlined below and, if necessary, to take the specified corrective action.

1. Remove batteries.
2. Using the AN/USM-34 Multimeter, measure the resistance between the positive battery terminal and the chassis ground. In taking this reading, the ohms multiplier switch should be in the X1 meg position.
3. If the resistance between the two points is less than 30 megohms, the following action should be taken:
   a. Remove the screw holding the positive contact and the positive battery terminal assembly.
   b. Remove the small washer on the opposite side of the battery box and replace it with a fiber washer (extruded type G.C. No. 6525M, 5/6 inch O.D. or equivalent).
   c. Double check the resistance to insure that it is 30 megohms or higher, (652)

TOOL TO TURN TEST SAMPLE MX-2608/PDR-43 IN RADIAC SET AN/PDR-43

A tool that will allow Test Sample MX-2608/PDR-43 to be turned more readily from one position to another has been designed by the Charleston Naval Shipyard. Provisions for storing the tool in the carrying case by means of a spring clip is also included. Installation of the tool will be left to the discretion of the Radiac Repair Facility when Radiac Sets AN/PDR-43 are received for normal routine maintenance.

The manufacture of the tool and spring clip is relatively simple and inexpensive and requires no change in the equipment other than the installation of the spring clip in the carrying case.

The tool and clip, with necessary detail instructions for manufacture and installation, are shown in Figure 1.

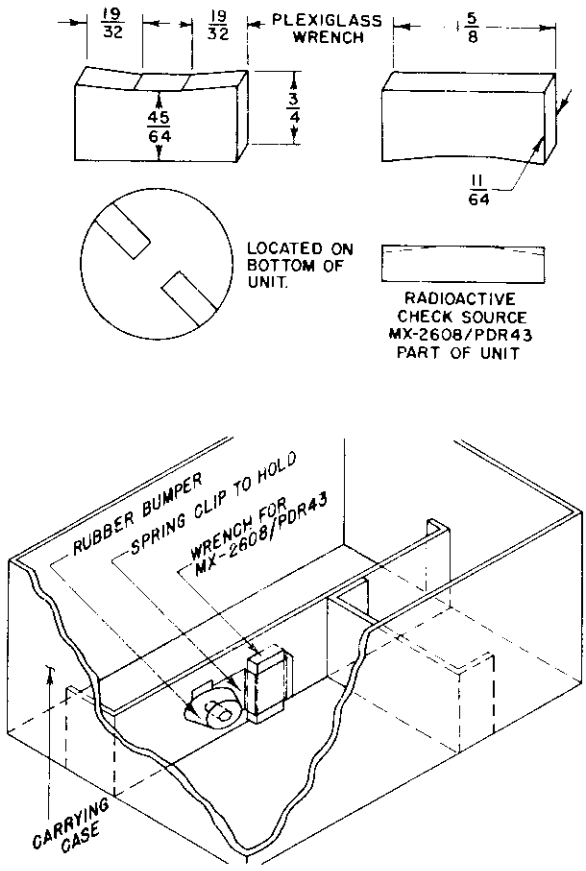

Figure 1. Test Sample Wrench Assembly

AN/PDR-54, REPAIR OF RADIAC PROBES

The following maintenance procedures for repairing the probe of Radiac Set AN/PDR-54 has been prepared for use by authorized Radiac repair facilities only.

1. **Removal of Probe Face.** –Because of the strong binding cement used in attaching the probe face to the probe chamber, care should be exercised in their separation in order to avoid damaging the probe face. Remove the eight screws holding the probe face to the probe and soak the probe in Toluene for five minutes before removing the face from the chamber.

2. **Replacement of Probe Face Window.** –Remove all traces of damaged window by scraping or light sanding, ensuring a clean surface, free of oil or grease. Place a section of Mylar over a single layer of felt which has been fastened to a flat surface and, using masking tape, stretch the Mylar until smooth and free of wrinkles. Spray the cleaned probe face with a light coat of clear Krylon and immediately place the probe face on the prepared Mylar. Press firmly and allow to dry for approximately 20 minutes. When dry, trim excess Mylar with a razor blade. If the window is wrinkled, passing over a heat lamp will tighten it. However, care should be exercised so as not to melt the Mylar.

3. **Replacement of Probe Face.** –Clean the groove around the probe chamber edge by scraping with a wooden or plastic scraper. Make sure the groove is smooth and free of burrs. Clean the chamber with streams of dry air from a syringe.

CAUTION

Use extreme care not to break the anode wire inside the probe chamber. If anode wire is broken or damaged, it should be replaced with General Electric Company Tungsten wire member 32, 0.001 inch in diameter.

Before replacing the face, fill the groove with a rubber base cement of the following proportions:

3 parts of Minnesota Mining and Mfg. Co. 3M type 1357 or equivalent

1 part of Toluene, FSN 6810-281-2005

Be careful that the cement does not flow into the probe chamber. Replace the face on the probe chamber and lock in place with the eight retaining screws.

NOTES

Allow at least 24 hours after replacement of face before running a plateau. Undried cement inside the chamber will give off fumes which will affect the plateau. (2S)

REPLACEMENT OF TRANSISTOR TYPE TI 970 (N5960-583-1978) BY TYPE 2N122 (N5960-563-9617)

See article in AN/BDQ-3 section under the same title.

USE OF PROPER VOLTAGE REGULATOR TUBE FOR RADIAC EQUIPMENTS

See article in section AN/BDQ-3 under the same titel.

USE OF PROPER VOLTAGE REGULATOR TUBE FOR RADIAC EQUIPMENTS

See article in section AN/BDQ-3 under the same title.

REPLACEMENT OF TRANSFORMER T401

When ordering replacements for transformer T401, specify that transformer manufactured by Milwaukee Transformer Company are not acceptable.

USE OF PROPER VOLTAGE REGULATOR TUBE FOR RADIAC EQUIPMENTS

See article in section AN/BDQ-3 under the same title.

CORRECT STOCK NUMBER FOR METER M-101

There has been confusion concerning the correct stock number for meter M-101 in Radiacmeters IM-151/WDQ and IM-151A/WDQ. The correct stock number is N6625-991-7143.

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