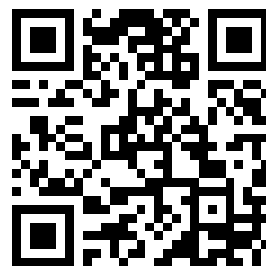

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BUREAU OF SHIPS MANUAL

CHAPTER 67 **ELECTRONICS**

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U. S. NAVY DEPARTMENT

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BUREAU OF SHIPS MANUAL

CHAPTER 67 **ELECTRONICS**

Navy Department,
Bureau of Ships,
1 September 1950.

This chapter supersedes chapter 67, "Radio Equipment," dated 29 May 1944. This chapter also supersedes chapter 68 on "Underwater Sound Apparatus." This issue of chapter 67 is effective upon receipt and shall be inserted in its proper place in the Manual binder.

D. H. CLARK,
Rear Admiral, U. S. N.,
Chief of Bureau.

Approved:
JOHN T. KOEHLER,
Assistant Secretary of the Navy.

NAVSHIPS 250-000-67

Chapter 67

ELECTRONICS

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SECTION I—GENERAL

Part 1—Administrative Policies

67-1. INTRODUCTION

(1) The purpose of this chapter of the Bureau of Ships Manual is to provide for the correlation of electronics material matters and such organizational, administrative, technical, and operational matters as may be necessary to facilitate the proper and expeditious handling of electronics work. This chapter includes material peculiar to electronics, material necessary to amplify or supplement instructions given elsewhere in this Manual or in other publications, and such key information and cross references as may be necessary to guide the user to the source of essential information. References are made in brief to pertinent publications, articles, etc., such as Navy Regulations, Standard Shipyard Regulations, Bureau of Supplies and Accounts Manual, etc., wherein the requirements for electronics material and the duties and responsibilities connected therewith may be found. Matters adequately covered in detail in other publications will not be covered in detail in this chapter.

(2) The wide variety of electronics equipment in use in the naval service precludes the inclusion in a publication of this type of detailed technical instructions. Comprehensive information covering the installation, maintenance, and operation of specific equipment will be found in the instruction books accompanying such equipment. Supplementary technical information is supplied by Bureau publications and correspondence.

(3) Section II, Procedures, has been subdivided into parts 1, 2, and 3 covering the requirements peculiar (unless otherwise noted) to ship, shore, and

Marine Corps electronics respectively and parts 4 to 12 inclusive covering general requirements. This section deals with the technical and operational aspects of electronic equipments and systems for shore, ship, and amphibious applications as distinct from the policy and cognizance articles contained in section I. It is the intent of this section to furnish certain basic information and requirements of a technical nature that are essential to proper operation and maintenance; and furnish certain bibliographic information for easy reference and greater detail.

67-2. BUREAU OF SHIPS' RESPONSIBILITIES (GENERAL)

The Bureau of Ships has certain responsibilities and technical control for all electronics equipment used by the Navy including Naval Reserves except those specifically assigned by the Chief of Naval Operations to the cognizance of other bureaus. (See ch. 5 of this Manual.) The Bureau's responsibilities include research, design, preparation of specifications, development, procurement, manufacture, testing, inspection, distribution, survey, alteration, repair, installation, maintenance, inactivation, preservation, and the preparation and distribution of technical instructions pertaining thereto. In addition, the Bureau of Ships is responsible for:

(1) Research, development, design, specifications, and tests of electron tubes, electronics components, parts and materials, except those peculiar to the needs of the Bureaus of Ordnance and Aeronautics.

(2) Standardization of electronics components and parts.

(3) Nomenclature, name plates, and identification plates for all electronics parts, power supplies, accessories, units, subassemblies, components, equipments, and systems.

(4) Management control at its assigned shore activities of installation, maintenance, repair, alteration, and appropriate tests of ordnance electronics equipment, subject to technical control by the Bureau of Ordnance.

67-3. BUREAU OF SHIPS' RESPONSIBILITIES FOR GROUND ELECTRONICS EQUIPMENT AT NAVAL AIR STATIONS AND FACILITIES

The Bureau of Ships exercises technical control of all ground electronic equipment at Naval Air Stations and Facilities through assigned maintenance yards as for other shore activities.

67-4. CRYPTOGRAPHIC EQUIPMENT

Cryptographic equipment (including special tools therefor), after procurement by the Bureau of Ships, is turned over to the cognizance of the Chief of Naval Operations (Director of Naval Communications) for distribution and property accounting. The Bureau of Ships is charged with the responsibility for alterations, authorized by the Chief of Naval Operations, and for maintenance and repair of such equipment. All work on such equipment must be given the security prescribed by current directives of the Chief of Naval Operations.

67-5. COMMANDING OFFICERS' RESPONSIBILITY

In the case of ordinary or routine maintenance, the commanding officer of a ship and the commanding officer or officer in charge of a shore station are responsible for maintaining equipment in a satisfactory condition for normal, continuous, efficient operation. When the work involved is beyond the capabilities of available personnel and facilities, the commanding officer or the officer in charge is responsible for reporting the conditions to the cognizant maintenance yard and requesting assistance therefrom.

67-6. MAINTENANCE YARDS

(1) Supplementing the routine electronics maintenance provided by the commanding officers of ships and shore stations, certain authority and duties of the Bureau of Ships are exercised through the commanders of various naval shipyards and the industrial managers of various naval districts. The Standard Naval Shipyard Regulations include the revised text of chapter VI, Electronics Office. (See also art. 67-21 (7).)

(2) Chapter VI, Standard Naval Shipyard Regulations, indicates:

(a) The organization of the electronics office.

(b) The responsibility of the electronics officer for technical control, inspection, and final testing of all electronics work and equipment including the technical aspects of methods and procedures.

(c) The responsibility of the electronics officer in his capacity as deputy planning officer for electronics exercising the full authority and responsibility of the planning officer with respect to electronics work performed in the planning department.

(d) The responsibility of the electronics officer in his capacity as deputy production officer for electronics exercising the full authority and responsibility of the production officer with respect to electronics work performed in the production department.

(e) The responsibility of the electronics officer as the shipyard commander's representative for the accomplishment of shore electronics work.

(f) The definition of electronics work.

67-7. WORK REQUIRING ACTION BY OTHER BUREAUS

Electronics matters pertaining to shore electronics activities and under technical control of the Bureau of Ships, requiring action by other bureaus, departments, or Government agencies, normally will be passed to such bureaus, departments, or agencies via the Bureau of Ships. In those locations where representatives are available, the recommendations of such representatives shall be obtained when practicable.

67-8. EXERCISE OF TECHNICAL CONTROL

In the exercise of technical control, the Bureau of Ships is guided by Naval Regulations, chapter 4, section 6, and by paragraph 4G of General Order No. 19 which is quoted below: "Each Bureau and Office of the Navy Department shall exercise Technical Control throughout the Naval Establishment over matters under its cognizance."

67-9. NAVAL AND MARINE CORPS RESERVES

Existing directives of the Secretary of the Navy require that the Naval Reserve be developed and maintained as an integral part of the Naval Establishment and that the various offices and bureaus of the Navy Department actively exercise their cognizant functions with respect to the Naval Reserve. Such items, services, and equipment as are required by the Naval Reserve and Marine Corps Reserve will be provided by that bureau which provides those items for the regular Navy. The Naval Reserve and Marine Corps Reserve shall be integrated into the Regular Establishment so completely that all agencies of the Navy will function for and provide for them, in all respects, as they do for the regular Navy.

67-10. TRAINING FACILITIES

The Bureau of Ships is responsible for the following items and costs involved in connection with all schools for the training of Naval and Naval Reserve operating and maintenance personnel:

(1) Providing and installing the necessary electronics equipment under Bureau of Ships cognizance, i. e., equipment normally procured by the Bureau of Ships.

(2) Making major repairs to such equipment.

(3) Replacing or reinstalling such equipment when necessary either within or remote from the activity or location at which previously installed. If the transfer, removal, or reinstallation of the

equipment concerned is accomplished at the request of or for the convenience of a bureau having neither cognizance of the equipment nor responsibility for the training involved, the financial responsibility for the costs so incurred will be that of the requesting Bureau or Office.

(4) Supplementing and modernizing the initially installed training equipment as necessary to insure modernity (including the incorporation of all field changes and modification kits).

(5) Providing adequate maintenance parts for the above equipment.

(6) Providing such technical advice and assistance as may be required in connection with the planning and operation of training facilities.

(7) Assisting in the preparation of curricula for electronics training. (See arts. 67-61 (5) and 67-70).

67-11. ELECTRONICS FIELD ENGINEERING SERVICE

In addition to the engineering assistance available from Naval service and civilian personnel attached to the various maintenance activities, the Bureau of Ships, when necessary to meet demands of the service and when funds available will permit, provides additional service by the employment of civilian electronics engineers under contracts with various manufacturers. These engineers are provided for instructional, installation, and maintenance purposes, as, for example, the training of yard, ship, or station personnel, that is, in connection with the installation and maintenance problems on the first five electronic equipments of an unusual type or design.

When required, such contract electronic engineers will be employed under contract with the Bureau of Ships and will normally be assigned to the particular maintenance yard involved. The engineers will perform the required service under the supervision of the electronics officer who will advise the Bureau of Ships monthly regarding the number of contract engineers under his supervision and the man-days of work accomplished under specific contracts.

Part 2—Definitions

67-21. DEFINITIONS OF TERMS

(1) *Electronics material and electronics equipment.* "Electronics equipment" includes, in general, those devices basically actuated by circuits utilizing electromagnetic wave motion, particularly those associated with vacuum or gas-filled tubes, the radio-frequency transmission systems in support thereof, and employing radio, radar, sound, and infrared propagation through space, water, or the atmosphere. This includes, but is not necessarily limited to, radio, radar, sonar, invisible light (infrared and ultraviolet) television, facsimile direction finding, or other electronic navigational aids, countermeasures, identification and recognition, remote control, indication and recording by means of

electronic links, cryptographic, teletype, radiac, also associated electronics training and test equipment, and associated special power-generating equipment. Related equipments employing electron tubes, and other devices for wire or radio communication purposes, harbor detection devices or systems, and special devices designed to work with or extend the use of electronics equipment are specifically included in this definition. It shall also include such terms as ocean cable and landwire telegraph, teletype, and telephone facilities directly connected with the operation of electronics equipment of Naval shore electronics activities. In vehicular equipment and other assemblies, the primary function of which is that of a radio or radar station, the term includes the vehicle and all other components necessary to the efficient operation of the assembled equipment.

(2) *Airborne electronics equipment.* Electronics equipment, as defined above, designed to be fitted or carried in aircraft.

(3) *Aircraft electronics equipment.* Airborne electronics equipment, as defined above, together with additional equipments or accessories specifically required for the installation or maintenance thereof.

(4) *Air-surface electronics systems* consist of airborne and surface (ships or ground) electronics equipments which must be complementary and interdependent for performance of an over-all function; viz., IFF, reconnaissance television, homing, loran, beaconry, cellometers, radio sonde, and certain communication applications.

(5) *Shore communications and/or electronic facilities.* This is a broad term embracing all of the following shore-based categories:

Navy communication system (stations, facilities, and units).

Communication department facilities (not in the communication system).

Electronics laboratories.

Electronics repair and project facilities.

Electronics training facilities.

Electronics, search, guidance, and instrumentation facilities.

(See art. 67-61 for definitions of the above categories.)

(6) *Ordnance electronics equipment.* Electronics equipment, as defined above, which forms an integral part of ordnance equipment, or the functioning of which is essential and peculiar to the operation of such equipment. This includes fire control radar; radars, the primary function of which is for missile control; certain target indication systems; identification and recognition devices integral with ordnance equipment; anti-jamming devices associated with ordnance equipment; influence fuzes; electronics equipment incorporated in missiles under cognizance of the Bureau of Ordnance; and sonar devices incorporated in ordnance equipments, such as mines and torpedoes.

(7) *Maintenance yards.* The term "maintenance

yards" as used herein shall be taken to mean naval shipyards, offices of industrial managers, United States Navy, and other shore commands which have been assigned technical and management control of shore electronics activities in an area or provide technical maintenance service for ships.

(8) *Command*. See definitions in General Order No. 19.

(9) *Management control*. See definitions in General Order No. 19.

(10) *Technical control*. See definitions in General Order No. 19 and articles 67-2, 67-5, 67-6, and 67-8 of this chapter, also Naval Regulations 1948, chapter 4, sections 1 and 6.

(11) *Experimental models*. Experimental models are constructed to demonstrate the workability and performance of a part, subassembly, component, set, system, or principle, in rough or breadboard form.

(12) *Developmental models*. Developmental models are constructed to meet or establish a performance specification for a new type of set or system, or for the purpose of operational testing and system evaluation. Developmental models shall be electrically equivalent and mechanically approximating the prototype or preliminary model, and shall be capable of being subjected to all the test requirements of the applicable individual equipment specification.

(13) *Prototype models*. Prototype models are constructed as a finished set, suitable for production line duplication but not necessarily made with production line jigs, fixtures, and methods. Prototype models shall incorporate all changes and modifications found necessary as a result of the evaluation test of the developmental model. Such models are intended for production duplication and may also be used for service or field evaluation.

(14) *Preliminary models*. Preliminary models are furnished under production contracts for the purpose of determining a contractor's ability to meet equipment specifications already established and accepted. They shall be electrically equivalent and mechanically representative of production sets, and shall not necessarily require production line jigs, fixtures, and methods. These models shall fulfill contract requirements. Such models may be used for laboratory and field evaluation of mechanical and electrical design and performance.

(15) *Preproduction models*. Preproduction models are made by production line jigs, fixtures, components, parts, and methods, incorporating all changes and modifications required for final approval, and fully interchangeable with initial production sets.

(16) *Part*. A part is any item not normally subject to further disassembly. (Examples: Resistor, gear, knob, insulator, electron tube.)

(17) *Subassembly*. A subassembly is a commonly mounted group of two or more parts which are physically or electrically combined to perform a specific

function within a component (major unit) but which will not perform that function until connected to related subassemblies or parts which comprise the complete component (major unit). (Example: IF strip, gear train.)

(18) *Component (major unit of a set)*. A component, also known in the Navy as a major unit, is a group of parts or subassemblies, electrically or mechanically connected to perform a specific function. (Examples: Radio receiver, radar transmitter, sonar transducer, modulator). (NOTE: This term shall be used to refer only to major units and shall not be used with reference to minor parts or subassemblies previously referred to as component parts but now designated as parts.) (See "Part," art. 67-21 (16), or "Subassembly," art. 67-21 (17).)

(19) *Accessory*. An accessory is usually an assembly of a group of parts or a component (major unit) which is not normally required for the operation of the set as originally designed. (Examples: Headphones for a component which is supplied with a loudspeaker, a vibrator power supply for use with a component having a built-in power supply.)

(20) *Group*. A group is a combination of two or more components (major units), subassemblies, or parts mounted in a common frame or cabinet and which does not normally perform the complete function of a set.

(21) *Set*. A set may consist of a component or a group of components (major units) which is capable of operation by itself and is not dependent upon other sets or accessories to perform its intended function and derives power from one or more sources. (Examples: AN/TPS-13 Radar Set, AN/URR-13-() Radar Set, AN/SQG-2() Sonar Set.)

(22) *System*. A system consists of a group of sets, or of sets and components, especially integrated to perform a specific function(s). The sets and components may be installed in one or more locations. (Examples: AEW Electronic System; GCA Electronic System.)

(23) *Maintenance part (formerly spare part)*. A maintenance part, also known as a repair part or as a replacement part, is a part which may be required for maintenance purposes during the life of the set(s). The term normally refers to tubes, resistors, capacitors, transformers, etc., that comprise a set but may refer to a subassembly of parts. (NOTE: The term maintenance part, i. e., maintenance repair part, adopted as more descriptive of the purpose for which such parts are provided, supersedes the term spare part previously used. The term maintenance part shall apply wherever the term repair part or spare part is used with reference to electronics items.)

(24) *Part common*. A part common is a part whose physical electrical and mechanical characteristics conform to standard military specifications and is suitable for use in two or more different sets, such as in models SR-1 and SR-2. It is distin-

guished in its basic identification by what it is and its high degree of interchangeability.

(25) *Part peculiar*. A part peculiar is a part designed specifically for a particular set. It is distinguished by its basic identification of where it fits and its uniqueness. Such parts are primarily designed for use in but one set and are generally obtained from the manufacturer of the basic set into which the part fits. A part peculiar may eventually become a part common through usage.

(26) *Maintenance part kit*. A maintenance part kit is an assemblage of those maintenance parts peculiar which will normally be furnished with a set for maintenance purposes.

(27) *Stock maintenance parts (formerly stock spares or bulk spares)*. Stock maintenance parts consist of those maintenance parts peculiar and common, assemblies, accessories, and complete sets which are furnished in bulk for replenishment purposes.

(28) *Interference*. Interference as used in connection with electronics systems and installations is a broad term used to cover the radiation and/or reception of spurious and unwanted signals as well as the adverse mutual effects produced by desired radiation within a group of electronics equipments.

(29) *Transmission system, radio frequency*. Transmission systems for radio frequency power cover all methods of transferring radiant energy from the generating component to the radiating elements. These systems appear in such forms as parallel lines, coaxial cables, waveguides, and their various appurtenances, for the accomplishment of maximum transmission of power with a minimum of loss.

(30) *Alterations*. An alteration is any change in hull, machinery, fittings, or equipment which involves changes in design, materials, number, location, or relationship of the component parts of an assembly or system regardless of whether undertaken separately or in conjunction with repairs. (See also art. 67-151.)

(31) *Repair*. Repair is the restoration of items, both hull and machinery, to a state of readiness generally equivalent to that existing at the time of outfitting or installation. For electronics equipments, components (major units), systems, and accessories, it is the correction of damage incurred through long use, accident, or other causes and is distinct and beyond the maintenance accomplished by the ship or station forces.

(32) *Alteration equivalent to repair*. An alteration equivalent to repair is the replacement of electronics equipment and items made necessary by the fact that economic and technical considerations do not justify a major repair. In most cases this is effected by the use of nonidentical equipment possessing similar or superior military and technical characteristics. (See art. 67-37.)

(33) *Maintenance*. Maintenance of electronic

equipment is the work done by ship or station forces to correct, reduce, and counteract wear and damage of the equipment while employed in operational and training service. This maintenance is accomplished in three main categories.

(a) *Operator maintenance* is the care and minor maintenance of the equipment, including careful and proper operation to confine corrective maintenance to a minimum, in those items not requiring detailed technical knowledge of the equipment functions and design.

(b) *Preventive maintenance* is the systematic accomplishment of items deemed necessary to reduce or eliminate failures and prolong the useful life of the equipment. These items are more specifically defined and outlined by the instruction books furnished with each equipment.

(c) *Corrective maintenance* is the elimination of electrical and mechanical derangements as they occur in order to restore the equipment to normal operating condition. This work, in general, requires skill and detailed technical knowledge of the equipment.

(34) *Field changes—Types—Kits—Bulletins and books*.

(a) *Field change*. A field change is a Bureau authorized mechanical, electronic, or electrical change, modification, or alteration made to any portion of an electronic equipment subsequent to delivery to the Navy. These changes are authorized to incorporate improvements in design or construction found necessary usually as the result of service operational maintenance experience or as the result of inspection and test of subsequent equipment on the production line.

(b) *Field change—Type classification*. Field changes are normally classified as follows: Type I—A field change kit, bulletins, instruction book and handbook changes which are required to accomplish an authorized field change to an electronic equipment. Type II—Bulletins, instruction book and handbook changes only which are required to accomplish an authorized field change using parts and material from stock.

(c) *Field change kit*. A field change kit is that portion of a field change consisting of the parts, material, and tools required in accomplishing a field change. The detail requirements for field change kits are covered by individual field change kit specifications.

(d) *Field change bulletin*. A field change bulletin is that portion of a field change giving detailed instructions for accomplishing a field change. These bulletins are identified by a NAVSHIPS number assigned by the Bureau for each specific field change.

(e) *Field change—Instruction book and handbook changes*. Field change instruction book and handbook changes are the changes which must be made in the instruction book or handbook as a result of a completed field change.

SECTION II—PROCEDURES

Part I—Ships Electronics

67-31. SHIPS ELECTRONICS

Ships electronics includes the following categories: Radio, radar, sonar, teletype, facsimile, radiac, invisible light (infrared and ultraviolet), television, I. F. F., telemeter systems, and electronic test equipment.

67-32. SHIP ELECTRONICS ALLOWANCES

(1) The allowances of electronic equipment for any type ship are properly determined by considering the tasks which are normally assigned to the type. Therefore, the equipment required to perform each task or combination of tasks plus a reasonable allowance for battle damage or other casualties will comprise the allowances of major equipment items.

In addition, the electronics allowance lists include certain fitting-out material such as test equipment, tools, tubes, components, and maintenance parts which are required to be on board a vessel in order to enable the vessel to perform effectively an assigned mission during hostilities and to maintain a continuous material readiness for war condition during periods of peacetime operation and training.

(2) *Electronic equipment type allowance book.* The "Electronic Equipment Type Allowance Book," NavShips 900,115 (known generally as the "TAB"), constitutes the official Bureau of Ships allowances of electronic equipment for all classes of vessels. A more detailed explanation of what its purposes and uses are and the rules relating to its application and distribution are contained in the "Introduction" to the above publication. This introduction and the applicable ship type allowance pages of "TAB" are supplied to all vessels of the fleet for insertion in their on-board copy of the Ship's Machinery Allowance and constitutes the particular ship's electronics allowance. Additional information is, therefore, not included in this Manual.

(3) *Ship electronics test equipment allowances.* Electronics and electrical test equipment allowances are being combined into the S69 allowance group. This allowance is being published in two parts; S69-1 for the electronic test equipment and S69-2 for the electrical test equipment allowance. Ships will be guided by the date of the latest allowance in determining which electronic test equipment allowance (S67 or S69-1) applies.

(4) *Ship electron tube allowances.* The allowance of electron tubes provides for an adequate number of spare tubes to insure satisfactory continuous operation of electronic equipment. Vessels which may be away from available sources of supply for relatively long periods of time as in extended special duty should carry sufficient tubes for the electronics service required. As spare tubes are utilized, immediate action should be taken toward effecting replacements. (See ch. 31.)

(5) *Ship electronics maintenance parts allowances.* (See art. 67-21 (23) for definition.) These parts consist of two general types—parts common and parts peculiar. (See arts. 67-21 (24) and 67-21 (25) respectively.) The allowances using standard navy stock numbers are provided by the Bureau. The vessel's supply officer should be advised of modifications to allowances in order that maintenance parts stock cards may be corrected to indicate the authorized carrying limit of maintenance parts. They are not mandatory but are prepared as a guide and may be modified by commanding officers or staff electronics officers to satisfy operating conditions. (See also art. 67-115.)

67-33. SHIP INSTALLATIONS — GENERAL CLASSIFICATIONS

Matters pertaining to installation of electronic equipment in ships are handled under the following general classifications:

(1) *New construction and conversion vessels.* Where construction of new types of vessels or conversion of existing vessels to new types is authorized by the Bureau of Ships, funds will be assigned under a suitable CSN (construction of ships—Navy) or IRNV (increase and replacement of naval vessels) appropriation and a project order will be assigned the vessel. Cost of construction or conversion including equipment, machinery, etc., will be charged against this project order. Where construction or conversion is accomplished in a private shipyard, the cognizant supervisor of shipbuilding and naval inspector of ordnance will be the Bureau's representative for all electronics matters dealing with the builder. Local or regional electronics officers assigned duty at all naval shipyards will supply technical information and engineering services upon request. Government furnished electronics material will in general be furnished by the cognizant naval supply officer.

(2) *Alterations and repairs to naval vessels.* Alterations to present installations or installation of additional electronic equipment in completed vessels will be accomplished by naval shipyards, naval stations, or forces afloat only upon receipt of specific authorization by the Bureau of Ships in each instance except for alterations to ordnance electronics in which case upon receipt of authorization from the Bureau of Ordnance. This authorization will generally be provided in the form of Shipalts, Navalts, Ordalts, Field Changes, letters, or dispatches. If alterations are accomplished under an emergency status and there is insufficient time to obtain authorization, the work shall be accomplished under authority of the commanding officer of the shipyard and the Bureau and type commander advised immediately of the circumstances. The installation, alteration, and repair of ordnance electronic equip-

ment performed at those activities under the management control of the Bureau of Ships shall be satisfactory to the Bureau of Ordnance.

(3) Changes in allowance lists involving installed equipment are alterations and will be so handled.

67-34. WORK BEYOND CAPACITY OF FORCES AFLOAT

(1) Electronics maintenance or repair work which is beyond the capacity of forces afloat will be accomplished by naval shipyards or naval stations upon receipt of approved work requests from the vessel concerned or in accordance with approved arrival conference reports.

(2) *Arrival inspection by naval shipyards.* Upon arrival of a vessel with assigned availability at a shipyard, the commander of the naval shipyard, or his authorized representative, will assist the ship's force in inspection of the electronic equipment with a view to assuring effective mechanical and electrical operation. This inspection is to be further guided by the details of inspection and report contained in chapter 6 of this Manual. This procedure does not relieve the ship of the responsibility of submitting work requests covering the correction of all known defects in electronic equipment at the time of availability. These requests shall give complete details relative to malfunctioning of equipment and specific information on known defects and repairs required. The early submission of requests is important for advance planning and estimating purposes. The commanding officer shall be advised of the results of the inspection as soon as practicable so that he may submit suitable "work requests" to the shipyard concerned via the chain of command.

(3) Installation record changes should be accomplished according to NAVSHIPS 900,135.

67-35. ALTERATION APPROVALS

Alterations other than those affecting military characteristics are approved by the Bureaus having cognizance with reference to the Chief of Naval Operations. Dockalts issued by the Bureau of Yards and Docks, Shipalts issued by the Bureau of Ships, and Ordalts issued by the Bureau of Ordnance are examples of this type of alteration. The Bureau concerned is responsible for determining whether or not military characteristics may be involved.

67-36. NAVALTS

Alterations which affect the military characteristics of a vessel may be approved only by the Chief of Naval Operations, who also establishes their relative priority of accomplishment. Changes of this nature are accomplished by the issuance of Shipalts which are further designated as Navalts by the promulgating Bureau. Navalts are identified by the word *Navalt* and number assigned to the applicable project, if any, in the Ship Improvement Guide (SIG) followed by the word *Shipalt* and the standard identifying *Shipalt* letters and numbers.

67-37. ALTERATIONS EQUIVALENT TO A REPAIR

Alterations equivalent to a repair are approved by the Bureau of Ships and authorized by type and reserve fleet commanders, provided that they do not involve increase in weight or vertical moment and that they otherwise meet the following requirements:

(1) The substitution, without other change of design, of different materials must involve only materials which have previously been approved by the Bureau for similar use and which are available from standard stock.

(2) The replacement of worn-out or damaged parts requiring renewal must involve only those of better and more suitable design which have been previously approved by the Bureau.

(3) The strengthening of parts to improve reliability must involve no other change in design.

(4) Minor modifications considered essential to prevent recurrence of unsatisfactory conditions must involve no significant changes in design or functioning of equipment.

(5) Alterations equivalent to repairs are financed and otherwise administered by type commanders in the same manner as repairs except that their approval must be reported to the Bureau.

(6) Electronics field changes for Bureau of Ships equipment are normally treated as alterations equivalent to repairs. Where the work required is extensive or requires concurrent weight and moment compensation, these changes will be designated as alterations. Proper *Navalts* or *Shipalts* will be issued.

(7) Requests for alterations equivalent to repair for electronics not previously authorized by the Bureau will be addressed to the Bureau of Ships via administrative chains of command as specified by the respective commanders in chief.

(8) Requests for alterations equivalent to repairs involving weight and moment changes will be addressed to the Bureaus as indicated for other alterations.

(9) Only in unusual circumstances will alterations be accomplished in reserve fleet vessels other than those which are equivalent to repairs and which are essential to restore the vessel concerned to an adequate operational readiness condition.

(10) Alterations accomplished in vessels assigned to *Naval Reserve Training* will be limited to the minimum necessary to provide satisfactory training units. Requests for such alterations will be forwarded to the Bureau of Ships by District Commandants with copy to the Bureau of Naval Personnel.

(11) Alterations recommended by the Board of Inspection and Survey normally will not be acted upon by the Bureau until after receipt of appropriate requests from commanding officers and the recommendations of type commanders.

(12) Alterations to recently completed vessels, which are approved within the statutory obligation period, will be chargeable to the appropriate project order.

67-38. INSTALLATION PLANNING

(1) The Bureau will issue a set of "Special Specifications for Machinery" and "Detail Specifications" for construction of new vessels. Similar publications called the "Contract Conversion Specifications" or "Circular of Requirements, Machinery" and "Circular of Requirements, Hull" will be furnished by the Bureau of Ships for conversion of vessels. These publications will state requirements and objectives desired in the completed vessel and will contain instructions for doing the work. In general, these publications will delineate the individual responsibilities of the shipbuilder and the Bureau of Ships.

(2) Unless exception is made in these Special Specifications, Contract Conversion Specifications, Circular of Requirements, or in subsequent correspondence, the following specifications apply:

(a) "General Specifications for Machinery for Vessels of the United States Navy." The following sections of this publication contain information pertinent to electronics installations:

- S1-1 Plans.
- S1-2 Materials, workmanship, and installation.
- S28-2 Designating and marking, electrical installations.
- S60-1 Electric plant—General requirements for electric machinery and equipment.
- S60-2 Electric plant—General requirements for power generation and distribution.
- S61-3 Motor generators and their shipboard applications.
- S62-1 Switchboards and panels.
- S62-2 Electric power distribution, cables.
- S62-3 Electrical wiring equipment, electric system distribution.
- S62-4 Storage batteries, electric power distribution.
- S62-5 Electric power distribution—protective devices.
- S63-6 Alternating current motors, control equipment, and brakes.
- S65-4 Electrical telegraph, signal, and indicating systems.
- S67 Electronics systems (use only revisions dated subsequent to 1 March 1939).

Appendix I, Part 1—Standard and Type Plans.

Part 2—Index of Electrical Standards.

General Specifications, Appendix 6—Instruction for painting.

(b) "General Specification for Building Vessels of the United States Navy."

(c) The following sections of these specifications contain information pertinent to the electronics installations:

- A-1 General.
- A-2 Summary of work pertaining to hull to be done by contractors.
- A-3 Work pertaining to other bureaus.
- A-11 Weighing material.
- A-12 Ratproofing.
- B-2 Changes.
- C-1 Workmanship.
- C-6 Materials.
- C-9 Painting, varnishing, and cementing.
- C-10 Welding and riveting.
- C-11 Threaded parts.
- D-1 Testing.
- N-1 Foundations and special framing.

- P-1 Masts.
- T-1 Turrets.
- U-18 Compressed-air systems, surface vessels.
- U-19 Compressed-air systems on submarines.
- U-22 Voice tubes and pneumatic tubes.
- V-4 Protection around operating rods, gearing, etc.
- W-4 Navigating damage control and ship control stations, including electronic and communication stations.
- W-10 Workshops and machinery spaces.
- W-11 Ordnance spaces.
- W-12 Storerooms and issue rooms.
- Y-10 Protectors, zinc and steel.
- Y-13 Rigging.
- Z-1 Stowage of portable articles.

General Specifications, Appendix 17—Standard and General Type Plans.

(3) (a) Electronics alterations in new construction or conversion vessels are done at builders' yards from detailed installation plans prepared by the design activity. In many cases the building yard is also the design activity.

(b) Electronics alterations in other vessels are done at a naval shipyard, naval station, or other installation activity from detailed installation plans prepared by the installing activity. These detailed plans are based upon the specifications listed above supplemented by additional information supplied by the Bureau. This information is supplied by letter. In some cases "Installation type plans" are forwarded. These type plans supply only basic types of information and cover a class or type of vessel.

(c) Space arrangement plans, antenna arrangement plans, and remote control interconnection wiring diagrams are supplied. In addition an interconnection wiring diagram for each major equipment or system and a plan showing outline and mounting dimensions of the major units will be supplied for each equipment.

(d) A complete index of these plans called the "Electronics Divisions Index of Drawings" is available from the Bureau of Ships.

67-39. TESTS OF SHIP INSTALLATIONS

(1) In new construction and conversion vessels, tests of the electronics installation in accordance with the approved test agenda prepared by the design agent shall be conducted by the contractor under the supervision of a representative of the Supervisor of Shipbuilding, USN, and Naval Inspector of Ordnance or, if performed in a naval shipyard, by qualified personnel of the shipyard.

(2) Additional tests necessary to demonstrate satisfactory installation and proper performance of the electronics installation shall be specified by the Supervisor of Shipbuilding or Commander Naval Shipyard.

(3) In carrying out the above procedure if the equipment involved has a confidential or secret classification, only those civilian or naval personnel who are cleared for that security classification will conduct tests.

(4) Upon completion of any electronics alteration, it shall be the responsibility of the installing

to correct all installation deficiencies noted, and to advise the commanding officer of the ship regarding the final status and the work accomplished.

(See arts. 67-181 to 67-186 regarding inspections and tests.)

67-40. NEED FOR PREVENTIVE MAINTENANCE

After completion of installation or alteration by shipyard or contract yard forces, an initial test of equipment is performed. As the equipment continues in use, some failures may be expected. Their prevalence will be governed, in general, by the complexity of the equipment, the demands placed on it, and the abuse to which it may be subjected. The degree of emphasis required on preventive maintenance due to complexity can be determined by reference to the instruction books provided with the equipment. Preventive maintenance procedures will be outlined by these instruction books and manuals. Most repairs can be accomplished by proper use of the information supplied therein and the judicious expenditure of maintenance parts carried aboard. Equipment abuse arises from lack of adequate preventive maintenance and from failure to follow proper operational procedures. The major factors involved in reducing these problems are set forth in the instruction books for specific equipment and various maintenance manuals and publications.

67-41. INSTRUCTION BOOKS AND MANUALS

Two copies of instruction books are normally supplied with each electronic equipment. File copies are supplied also to Naval and Marine Corps schools and to electronics activities concerned with installation and maintenance of electronic equipment. Instruction books and manuals may be obtained by activities having a clearly defined requirement for such publications by submitting a request to the nearest district publications and printing office. (See arts. 67-161 through 67-168.)

67-42. ELECTRONIC EQUIPMENT HISTORY CARDS

Each ship shall maintain electronic equipment history cards for recording the results of inspections, tests, and field changes. Forms furnished by the Bureau of Ships shall be used and shall be maintained in accordance with instructions set forth in chapter 6 of this Manual and the applicable maintenance manuals listed in article 67-166. They shall be kept up to date and be available for inspection at any time. These records are to be integrated into the current ships maintenance program.

67-43. INSPECTION OF RADIO-RADAR ANTENNAS

(1) At suitable appropriate intervals dependent upon local conditions, make visual inspections of antenna systems, including leads to trunks and coaxial transmission lines, strain, supporting, and entrance insulators to detect damage, fouling, excessive sagging, and other readily detectable conditions which affect antenna efficiency.

(2) Check mechanical condition and gas pressure

activity to test the system or equipment involved, in gas-filled lines.

(3) Check rotatable antennas for proper operation.

67-44. ANTENNA RIGGING PHOTOGRAPHS

(1) After any installation or alteration to a ship which changes or affects the antenna rigging or antenna system, photographs shall be taken by the installing or altering activity which shall contain the following views:

- (a) Broadside view.
- (b) Bow view about 45° relative.
- (c) Stern view about 225° relative.
- (d) Head on view.
- (e) View from directly astern.

(2) Before a photograph is taken, that space or portion of the vessel to be photographed shall be entirely completed as regards structure, and all staging, tools, extraneous wires, piping, hose, rubbish, dunnage, etc., shall be removed.

(3) The camera position should be so selected as to include as large a field as is practicable without the objects within the field becoming indistinct and without objectionable foreshortening effects. The camera used for these photographs shall have sufficient depth of focus so that objects in the background will not be out of focus. All antennas on each print shall be labeled as to equipment for which they are installed.

(4) The negative and three 8- by 10-inch prints of each of the above views shall be forwarded to the Bureau of Ships for record and study.

67-45. TRANSMISSION LINES (SHIP INSTALLATIONS)

Upon completion of an installation requiring the use of a transmission line, such as coaxial cable or wave guide, a quantitative determination of power loss in transmission shall be made by the installing or altering activities. Wattage measurements shall be made at both the input and output end of the transmission line, using the equipment for which the transmission line is installed as the power source. This is to be done on a minimum of two frequencies within the expected operating range of the equipment. The results are to be recorded in wattage or decibel loss for the entire transmission system and furnished to the Bureau of Ships with the prints of antenna photographs required by the preceding article.

67-46. INTERFERENCE ELIMINATION

(1) The effectiveness of electronic equipment can be largely nullified by interference created either aboard ship or in the vicinity of a naval shore activity. Moreover, it will take the continual efforts of all electronics personnel to keep interference down to an acceptable minimum.

(2) Radio interference rejection is an operational requirement for all military communication receiving equipment. Military characteristics for all such

equipment include the requirement for radio interference rejection and antijamming effectiveness.

(3) Installation of equipment in aircraft, vessels, vehicles, and on fixed installations shall be such as to reduce radio interference to a minimum in order that full advantage of all electronics equipment may be realized.

(4) Because of the important position occupied by the maintenance yard in any radio interference reduction program, it is essential that they be primarily responsible for both the ship and shore radio interference problems.

(5) The electronics officers of all maintenance yards shall report all radio interference complaints, work, and problems to the Bureau of Ships. Forces afloat shall report via their chain of command to the Bureau of Ships. Interference caused by aircraft electronics equipment and line maintenance equipment for aircraft shall be reported directly to the Chief of the Bureau of Aeronautics with a copy to the Bureau of Ships. This is essential to the overall coordination of interference reduction throughout the naval service and will be of benefit to each yard. The maintenance yard electronics officers shall provide engineering personnel for specialization in radio interference problems.

(6) It is the responsibility of the yard's electronics officer to see that proper installation techniques be employed and that particular emphasis be placed on the shielding, bonding, and grounding of all electronic equipment and cable.

(7) It is the responsibility of the ship's electronics repair officer to maintain close liaison with the communications officer in regard to efficient operation of all communications equipments, and he should be cognizant of any shipboard interference conditions affecting communication operations.

(8) It is the ship's electronics repair officer's responsibility to maintain all electronic equipment in an interference-free condition insofar as proper maintenance is concerned, and he should be particularly cognizant of all bonding, shielding, and grounding conditions of all current-carrying cables and equipment.

67-47. INSPECTION, PAINTING, AND SERVICING SONAR HOISTING EQUIPMENT AND TRANSDUCERS

Immediately after drydocking, the sonar equipment shall be inspected and serviced as applicable according to the following:

(1) Before fouling is dry, clean all exposed radiating and corrosion-resisting surfaces of retractable, nonretractable (fixed), and "torpedo" or "fish" type domes, and of projectors, using nonmetallic and nonabrasive brushes or wooden scrapers. Remove old paint with solvent and remove old potting compound from recesses. Clean growth and scale from other surfaces of the projector or dome.

(2) Extend and retract the transducer or retractable dome several times after complying with

article 67-304. (All fixed domes should be removed.) A qualified mechanic shall observe the operation to detect faults and lack of smoothness of operation.

(3) Remove both fixed and retractable domes where used and repeat the cleaning process on the then accessible corrosion-resisting surfaces including the inner walls of domes and sea chest as well as traveling bearing guides. In cleaning corrosive-resisting surfaces observe the precautions listed in (1) above.

(4) With the dome raft and hoisting screws completely removed from the directing gear, service the hoist-train equipment on the retracting gear. Grease as necessary and tighten all loose parts before reassembling.

(5) After the setting up of all plugs and bolts, all recesses should be filled with potting compound.

(6) Bearing surfaces of traveling bearings, shafts, slides, and guide rods shall be coated with a thin film of suitable water-resisting grade of rust-preventive compound, grade I, Navy Department Specification 52C18.

(7) The diaphragm of sonar sounding transducers shall, if corrosion has set in, be treated in the following manner:

(a) Spray on one thin coat of zinc-chromate primer, formula 84/47. Allow 4 hours' drying time.

(b) Brush or spray on one thin coat of cold plastic antifouling paint formula 105 (red) or No. 145 (black) or 15HP (hot plastic). This protection will be effective for about 8 months.

(8) Rubber hemispherical sections and rubber-covered flat diaphragms of transducers, the sound absorbing surfaces of baffles and rubber domes, shall be coated with rubber antifouling paint, BuShips Specification 52P89. One coat shall be used on interior surfaces and three coats on exterior surfaces.

(9) The corrosion-resisting surfaces of sound transparent windows of all type of sonar ranging domes (outside and inside); the corrosion-resisting diaphragms of all flat sonar ranging transducers and the corrosion-resisting hemispherical covers of spherical transducers are not to be painted, except in accordance with special instructions issued separately by the Bureau of Ships. If they have been painted, the paint should be removed with paint or varnish remover, Specification 52-R-12, and the surface cleaned with solvent. Polishing is to be done with bright work metal polish only. All scratches in the surface must be avoided, and all corrosion-resistant surface must be considered fragile.

(10) All remaining areas should be coated in the same manner as the ship's bottom.

67-48. SHIP ELECTRON TUBE SURVEYS

The Bureau of Ships does not require surveys for electron tubes used aboard ship. Surveys for specially designated tubes may be required by separate correspondence or by publication in the various maintenance bulletins. (See art. 67-223.)

Part 2—Shore Communication and/or Electronics Facilities

67-61. DEFINITIONS

The facilities covered by the broad term "shore communication" and/or "electronics facilities" are grouped in the following shore-based categories:

Navy communication system (stations, facilities and units).

Communication department facilities (not in the communication system).

Electronics laboratories.

Electronics repair and project facilities.

Electronics training facilities.

Electronics search, guidance, and instrumentation facilities.

(1) The Navy communication system is an integrated network, essentially interarea in nature, consisting primarily of the minimum number of functional communication activities required for basic communication coverage on a world-wide scale. The elements of the Navy communication system are:

(a) *Navy communication stations* (NavCommStas)*. A NavCommSta is an established organization which contains all communication facilities and ancillary equipment, regardless of physical location, which are required to provide for a specific area the essential interarea communication services. It will normally include a communication center, radio station(s) * as required, a registered publication issuing office (RPIO), and a fleet post office (FPO) if outside the continental United States.

(b) *Navy communication units (NavCommUnits)*. A NavComUnit is an organization which performs limited fleet support and/or special communication functions as required afloat or at places outside the continental United States. The units are numbered and are usually established at locations remote from any existing United States naval shore activity.

(c) RPIO's (not part of a NavCommSta).

(d) FPO's at New York and San Francisco.

(2) Communication department facilities are those whose functions are predominantly local (intra-activity and intra area) in nature and which are organic components of the shore station or activity for which they provide the requisite local communication services. Communication departments are *not* a part of the Navy communication system, but are a part of the naval communication service. Such departments will normally consist of a communication center, radio transmitting and receiving facilities, and a naval post office.

(3) Shore electronics laboratories are directly under the management and technical control of the Bureau of Ships. These laboratories are a separate parent command. Shore electronics laboratories include:

(a) Naval Electronics Laboratory, San Diego, Calif.

(b) Naval Underwater Sound Laboratory, New London, Conn.

(c) Naval Code and Signal Laboratory, Washington, D. C.

(d) Naval Computing Machine Laboratory, St. Paul, Minn.

(4) Shore electronics repair and project facilities may be separate activities or be a portion or component of other shore organizations, prosecuting projects requiring electronics devices. These include the following plus kindred facilities:

(a) Naval Observatory, Washington, D. C.

(b) Naval Research Laboratory, Washington, D. C.

(c) Naval Ordnance Laboratory, White Oak, Md.

(d) Naval Proving Ground, Dahlgren, Va.

(e) Atomic Energy Commission Test Center, White Sands, N. Mex.

(f) Arctic Test Station, Point Barrow, Alaska.

(g) Naval Air Missile Test Center, Point Mugu, Calif.

(h) Naval Ordnance Test Station, Inyokern, Calif.

(i) Contractual projects with various industrial firms and educational institutions.

(j) Naval Air Navigation Electronics Project, NATC, Patuxent River, Md.

(k) Naval Shipyards and Industrial Managers, USN.

(5) Shore electronics training facilities are those facilities or activities training electronics operating, installation, and maintenance personnel. These include the following plus kindred activities. (See art. 67-10 of this chapter.)

(a) Naval training schools and facilities.

(b) Naval Reserve Officers training corps units.

(c) Naval Reserve training centers, electronic warfare facilities and stations.

(d) Naval Reserve training facilities.

(e) Naval Air Reserve training centers.

(f) Naval Air Training commands and units.

NOTE 1: The United States Naval Academy and the United States Naval Postgraduate School at Annapolis are included within the scope of Bureau of Ships responsibilities in regard to procurement, installation, and maintenance of BuShips special material or training material under the exclusive cognizance of the Bureau of Ships.

NOTE 2: Fleet training schools and centers are directly under fleet command.

(6) Shore electronics search, guidance, and instrumentation facilities are defined as those utilizing electronic means to collect, evaluate, or distribute data relating to the presence and movement of friendly and enemy craft, air, surface, and subsurface; the presence of natural and special signals and radiations; the presence and movement of weather masses and other detectable phenomena; and the

*Will be designated "facilities" when located on foreign (not United States owned) territory.

control of industrial processes. These facilities may be a portion or component of any shore command or organization, or may have a separate command. The following plus kindred facilities are types of instrumentation facilities:

- (a) Air traffic control and defense centers.
- (b) Air warning centers and air surveillance radar installations.
- (c) Ground controlled approach units.
- (d) Harbor defense centers, harbor entrance control posts.
- (e) Weather stations and weather radar and photoelectronics installations.
- (f) Radiac stations.
- (g) Radar beacon stations.
- (h) Radio homing beacons.
- (i) Sonar beacons.
- (j) Radio locator stations.
- (k) SOFAR project (search and rescue stations).
- (l) Telemetry stations.
- (m) Industrial electronics installations.

67-62. MAINTENANCE YARD RESPONSIBILITY

Certain authority and duties in connection with technical control (and control of fiscal expenditures) over all items affecting shore electronics material matters which are the responsibility of the Bureau of Ships are delegated to Commanders of Naval Shipyards, Industrial Managers, USN, and other designated Commands, i. e., "Maintenance Yards." (See art. 67-21 (7).) This control will normally be exercised through the electronics officer as the shipyard commander's representative for the accomplishment of shore electronics work and includes the necessary authority to make appropriate inspections as required by article 1134, Communications Instructions DNC5. Such inspections shall be coordinated with the cognizant station officers. Yard responsibility covers all yard departments in their specialty as well as strictly electronics. In estimating personnel requirements, the needs of the various shore activities shall be considered by these departments in establishing their estimated workload.

67-63. MATERIAL CONDITION

All communications stations and electronics activities shall be maintained in material condition for satisfactory effective operation and capable of rendering required services. Maintenance yards have direct responsibility therefor in all material maintenance matters beyond the capacity of the station force.

67-64. COOPERATION BETWEEN COMMANDING OFFICERS OR OFFICERS IN CHARGE AND MAINTENANCE ACTIVITY (E. O.)

Close cooperation shall be maintained between electronics officers and commanding officers to insure that maintenance and operation of shore electronics activities are efficient and economical and that the standards of operation established by the

Chief of Naval Operations are fulfilled. Inspection, tests, maintenance, and new construction which might cause interruption to Naval Communications or otherwise adversely affect the functioning of the activity shall not be undertaken without the approval of the officer responsible for management control.

67-65. CHANGES TO EXISTING FACILITIES

(1) The officer responsible for management control of the station or activity concerned will be responsible for initiating action when changes in or additions to existing facilities are necessary to meet operational requirements. Such recommendations shall be forwarded for comment and approval, via the cognizant commands, the maintenance yard (electronics officer), and the Chief of Naval Operations to the Chief of the Bureau of Ships.

(2) Maintenance yards or commands, upon receipt of such advice or information, will make necessary investigations, prepare required plans and cost estimates, and submit them with appropriate recommendations to the Bureau of Ships. Upon receipt of approval by Chief of Naval Operations, the Bureau of Ships, and the allotment of funds, maintenance yards (electronics officers) will arrange for completion of the required alterations or work which is beyond the capacity of station personnel or facilities. Installation of equipment which is the responsibility of the Bureau of Ships will be performed by field personnel under the supervision of the maintenance yards. Ordinary installations, however, are normally considered to be within the capacity of station forces and shall be accomplished by them. Maintenance Yards will be accountable for proper expenditure and accounting of Bureau of Ships funds.

67-66. SHORE ELECTRONIC EQUIPMENT ALLOWANCES

Allowances of electronic equipment, other than test equipment, for shore communication stations and electronics facilities are determined and promulgated by the Chief of Naval Operations. If increases or decreases in such allowances are desired, appropriate requests with justification should be submitted for comments, recommendations, and approval via the cognizant commands, the maintenance yard (electronics officer), and the Bureau of Ships, to the Chief of Naval Operations. Such requests should indicate the type of equipment involved, the quantity on hand, the quantity already allowed, and the recommended new allowance.

67-67. SHORE ELECTRONIC TEST AND MEASURING EQUIPMENT ALLOWANCES

Allowances for electronics test and measuring equipments for shore communication stations and electronics facilities are established by the Bureau of Ships. Requests for changes in allowance which originate at shore communication stations or other electronics facilities should be submitted to the

Bureau of Ships via the maintenance yard for comments and recommendations.

67-68. SHORE ELECTRON TUBE ALLOWANCES

The quantities of electron tubes to be carried as spares at electronic stations ashore shall be in accordance with the Bureau of Ships electron tube allowance list or shall be determined by the cognizant maintenance yard in the event such a list is not available.

67-69. MAINTENANCE PARTS ALLOWANCES

See articles 67-21 (24) through 67-21 (27) for definitions and types also article 67-115 for allowances.

67-70. REQUISITIONS

Requests or requisitions for maintenance material, consumable supplies, and services properly chargeable to Bureau of Ships maintenance funds shall be submitted by commanding officers or officers in charge of shore communication or electronics activities to their maintenance activity. All training activities under the management and technical control of the Bureau of Naval Personnel shall submit their requests for electronic equipment and maintenance parts via their respective district director of training, their maintenance activity, and the Bureau of Naval Personnel. (See art. 67-10.)

67-71. INTERNAL SECURITY RADIO AND INDUSTRIAL CONTROL APPLICATIONS

Maintenance activities shall exercise the same supervision over all electronics material matters pertaining to electronic equipment used by police, fire, and industrial departments of the Naval Establishment for internal security, and other purposes as for other Navy electronic equipment.

67-72. UNAUTHORIZED MODIFICATIONS—REPORTING OF

As determined by quarterly or annual inspections and tests, all unauthorized modifications to electronic equipment shall be reported to the Bureau of Ships and appropriate action taken to correct such conditions or obtain specific approval from the Bureau of Ships. Alterations to electronic equipment require specific approval of the Bureau of Ships. (See art. 67-151.) If alterations are accomplished under emergency conditions, the Bureau should, at the earliest practicable date, be advised of such actions and proper acknowledgment obtained.

67-73. REPLACEMENT OF OBSOLETE OR UNSERVICEABLE EQUIPMENT

Refer to chapter 4, section III, of this Manual.

67-74. OUTAGE REPORTS OF UTILITY FAILURES

The maintenance yard should be notified immediately of all outages of communications facilities in-

volving failure of commercial power or control lines, the cause and time of the outage, remedial action taken, and time of restoration of service.

67-75. TEST—NEW SHORE INSTALLATIONS

(1) On new installations of transmitting equipment, tests shall be made at various frequencies over the range of the transmitter to ascertain that no critical points or frequencies exist which are accompanied by instability or erratic operation of the transmitter.

(2) New receiving installations should be examined, determining that receivers are properly aligned and operating prior to being turned over to operating personnel.

(3) Antenna transmission lines should be checked, upon installation, for standing waves. It is considered that a standing wave ratio of 1.5 or less should be obtained for most transmission lines. For all open wire radio-frequency power transmission lines, No. 6 copperweld wire with 12-inch spacing shall be considered standard. When practicable, all receiving transmission lines will utilize coaxial cable for all exterior runs, with an appropriate interior type being utilized within the buildings.

(4) In addition to the above and to tests specified in instruction books, the following types of installation shall be tested in the manner indicated and test reports submitted when required, in accordance with pertinent current instructions:

<i>Type of installation</i>	<i>Manner of test</i>
Direction finder-----	Calibration.
Radar beacon-----	Flight test.
Radio range and marker beacons-----	Flight test.
Search radar-----	Standing wave ratio test of transmission line and antenna system (allowable limit 1.25).

67-76. QUARTERLY INSPECTIONS AND TESTS

In addition to the regular inspection and tests performed by operating and maintenance personnel of the activity concerned and referenced in articles 67-181 to 67-186, a quarterly inspection shall be made by qualified technical personnel of the maintenance yard to insure efficient and reliable operation of electronic equipment and appropriate action to correct deficiencies.

67-77. ANNUAL INSPECTION AND TESTS

An annual inspection shall be made at all shore electronics activities by qualified technical personnel of the maintenance yard and a report submitted to the Bureau of Ships. These inspections and tests shall include the following:

(1) Noise and interference level measurements at radio receiving stations or facilities in order to de-

termine deterioration, if any, in potentialities of site for radio reception. Such measurements are to include the following frequencies with minimum plus or minus deviations as required to avoid operating frequencies:

VLF—25 kilocycles.

LF—60 and 140 kilocycles.

MF—200-350 and 550 kilocycles.

HF—4, 8, 12, 16, 20, 24, and 28 megacycles.

VHF—120 and 150 megacycles.

UHF—250, 300, 350, and 400 megacycles.

SHF—1000 megacycles.

Noise measurement equipments are now under procurement and will soon be available to cover all of the above mentioned frequencies not now covered by existing equipments. (See also art. 67-46.)

(2) Spot receiver sensitivity checks (not less than one in four of each installed type).

(3) Determine status of encroachment by industrial electronics activities, housing, or any form of construction capable of becoming a threat to the satisfactory operation of:

(a) Radio transmitting stations.

(b) Radio receiving stations.

(c) Communications centers.

(d) Message centers.

(e) Relay centers.

(f) Communications control link relay stations.

(g) Radio photo units.

(h) Communications security activities.

(i) Communications supplementary activity.

(j) Search and height finding radar installations.

(k) Navigational aids such as radio ranges, radio-direction finders, and radio and radar beacons.

(l) Fixed and mobile ground controlled approach systems.

(m) Any ground or cable-connected off-shore electronic, sonoelectronic, or photoelectronic instrument subject to interference of any kind.

(4) General review of antenna fields for conformance of construction to the best engineering practice.

(5) Shielding, bonding, and grounding.

(6) Condition and adequacy of maintenance parts.

(7) Condition and adequacy of maintenance facilities and maintenance parts for radiac equipment.

(8) Condition and adequacy of electronics test and measuring equipments and technical library.

(9) Reliability of CCL circuits and other data transmission systems.

(10) Condition and adequacy of normal, standby, and emergency power supply equipment.

(11) Degree of interference created at electronics facilities by devices, activities, and structures, specifying as to whether or not under naval control.

(12) Flexibility of control circuit arrangements, and display, test, monitor, and antenna switching facilities.

(13) Check for unauthorized modifications to electronics equipments.

(14) Frequency stability of transmitters and adherence to tolerances.

(15) Spot check of harmonic radiation of radio transmitters.

(16) Adequacy of station operation and maintenance personnel on board in terms of complement.

(17) Determine if due consideration has been given to safety features in all installations.

(18) Determine if electronics equipment history records are being adequately maintained. (See art. 67-152 and ch. 6.)

(19) Check major outages to determine cause and if remedial action has been taken to prevent recurrences.

(20) Ascertain that Bureau funds are expended only for duly authorized projects.

(21) Determine if electronic equipment instruction books have been corrected to show modifications to equipment and field changes, including changes to internal and external circuits.

(22) Determine adequacy of test and inspection procedures carried out by station personnel.

(23) Determine if electronic facilities on each station are being used for the purpose for which provided.

(24) Determine what electronic equipment including test equipment and maintenance parts in excess of allowances are on the station

67-78. REPORT OF ANNUAL INSPECTION

The report of such an annual inspection should be submitted in duplicate to the Bureau of Ships, with appropriate comments and recommendations, and with an indication as to what corrective measures have been taken to eliminate deficiencies. The above annual inspection report is not intended to include data normally included in the Annual Inspection of Public Works and Public Utilities initiated by the Bureau of Yards and Docks nor is it intended to include data that may be requested by the Chief of Naval Operations under a separate report. Reference shall be made to such reports where appropriate and essential to a more complete understanding of matters covered by the annual shore electronics inspection.

67-79. SHORE ELECTRON TUBE SURVEYS

Surveys shall be conducted before disposal by shore activities of all electron tubes having an original value over \$1,500. Surveys are not normally required for tubes having an original value of \$1,500 or less. Surveys for additional specially designated tubes may be required by separate correspondence or by publication in the various maintenance bulletins. (See also art. 7-223.)

67-80. PLANT ACCOUNT RECORDS OF ELECTRONIC EQUIPMENT

Refer to chapter 3, volume VI of the BUSANDA Manual for established procedures.

Part 3—United States Marine Corps

67-91. BUREAU RESPONSIBILITY

(1) The Bureau of Ships performs the following functions with respect to electronic equipment used by, or suitable for use by, the Marine Corps and Marine Corps Reserves, subject to the limitations of article 67-2:

(a) Studies systems and techniques involving electronic equipment for the purpose of improving the combat efficiency of Marine Corps organizations.

(b) Initiates and conducts such applied research as is necessary to substantiate developments directed toward producing electronic equipment required by the Marine Corps.

(c) Initiates and prosecutes supporting developments necessary for the design and production of electronic equipment required by the Marine Corps.

(d) Prepares contractual and engineering reports, receives and analyzes technical reports, exchanges information and effects liaison with other technical groups, and maintains a continuous survey of the electronic field for basic developments applicable to equipment used by the Marine Corps.

(e) Provides for the timely modernization of equipment developed by the Bureau; major changes subject to approval by Headquarters, Marine Corps.

(f) Maintains records of component and part failures, analyzes component and part failure records, and initiates corrective action as appropriate.

(2) The Bureau of Ships performs the following functions with respect to electronic equipment as requested by the Commandant of the Marine Corps and assigned by the Chief of Naval Operations:

(a) Acts as technical consultant for the study of specific systems, equipments, and techniques in their relation to tactical, logistic, or other factors involved in any particular plan, concept, or broad study program.

(b) Conducts the development of equipment in accordance with directives or approved military characteristics.

(c) Supervises the testing of equipment developed under (b) immediately above, or of such other equipment as may be referred to the Bureau, to determine good engineering practices and conformance with applicable technical characteristics and specifications.

(d) Furnishes such assistance to designated Marine Corps organizations as may be appropriate in the service testing of new types of electronics equipment.

(e) Acts as the coordinating and/or procuring agency in respect to Marine Corps requirements for items of electronic equipment, related tool equipments, instructional data, and associated articles and maintenance and supply parts for these items.

(f) Conducts such inspections as are required to insure that equipment obtained from other than

government sources is of such quality, quantity, and workmanship as to meet all contractual requirements.

(g) Assigns from the Marine Corps suballocation of the Maintenance Bureau of Ships budget to designated naval supply depots and naval shipyards funds as requested by the Quartermaster General of the Marine Corps for the procurement of maintenance material for use by Marine Corps supply and maintenance activities.

(h) Communication stations at Marine Corps air stations are subject to the provision of article 67-3. This, however, does not extend to Marine Corps tactical aircraft units.

(i) Electronics equipment for permanent Marine Corps Communication Stations is subject to the provisions of article 67-2.

67-92. INTERNAL SECURITY AND INDUSTRIAL CONTROL RADIO (UNITED STATES MARINE CORPS)

(1) Maintenance yards shall exercise the same supervision over electronics material matters pertaining to electronics equipment used by the Marine Corps for internal security and industrial control purposes as for other naval electronics equipment; care being taken to avoid interference with service operations thereof which are under the supervision of the district commandant.

(2) (a) This equipment will be accounted for as Navy property.

(b) Marine Corps supporting establishments (less air facilities) will maintain such equipment assigned to them to the extent of their capabilities using normally assigned personnel and facilities when such will not interfere with their primary mission.

(c) Maintenance beyond their capability is the responsibility of the designated naval activity.

(d) Marine Corps procured maintenance parts available locally and common to this equipment may be used in (b) above; otherwise, the designated naval activity will furnish the required maintenance parts.

67-93. PERSONNEL (UNITED STATES MARINE CORPS)

Marine Corps personnel in such numbers as the Chief of the Bureau may consider necessary and as authorized by the Commandant, United States Marine Corps, will be assigned to the Bureau of Ships to assist in carrying out those functions relating to Marine Corps electronic equipment as set forth in this chapter.

67-94. APPLICATION OF CHAPTER 67 TO UNITED STATES MARINE CORPS

In addition to the specific provisions of section II, part 3, the Marine Corps will be guided by all those instructions contained in this chapter which do not conflict either with this section or with Marine Corps regulations.

67-95. REPAIR AND MAINTENANCE OF TACTICAL ELECTRONIC EQUIPMENT

(1) The repair and maintenance of Marine Corps tactical electronic equipment will ordinarily be accomplished by Marine Corps activities.

(2) When equipments or components of new design are procured by the Bureau of Ships for the Marine Corps, the initial maintenance parts peculiar to the equipments will be procured by the Bureau of Ships, after determination by the Quartermaster General of the Marine Corps, on the same contract under which the parent equipment or component is procured. The parts peculiar will be shipped directly to Marine Corps supply depots. Stock of replenishment parts not peculiar to the equipment, however, will not be procured under these Bureau of Ships contracts but will appear in the Marine Corps supply system as increases in stock levels.

67-96. ACCOUNTING

Electronic equipment procured in accordance with requests from the Quartermaster General of the Marine Corps, including maintenance material under article 67-91 (g), are transferred to the custody of and thereafter accounted for by the Marine Corps only in the following manner:

(1) All such equipment and material will be expended to account 99106 and issued on memorandum invoice with notation thereon as to the book value of each separate item.

(2) The equipment and material so transferred to the Marine Corps are taken up on the property account of the Marine Corps accountable officer of the activity receiving same and are thereafter accounted for in the same manner as other Marine Corps property.

(3) Marine Corps electronic equipment and material subsequently returned to the custody of the Bureau will be invoiced by the Marine Corps accountable officer transferring same to the supply officer of the naval activity concerned, who will accomplish the invoice when the items are received and take same up at the invoiced price in the appropriation purchases accounts. He will thereafter account for the items as Navy property subject to disposal by the Bureau. The Marine Corps accountable officer will note on all copies of the invoice the authority for the transfer and that no transfer of funds is involved.

67-97. ELECTRON TUBE SURVEYS (MARINE CORPS)

The Bureau of Ships does not require surveys for electron tubes used by Marine Corps activities. Surveys for specially designated tubes may be required by separate correspondence or by publication in the various maintenance bulletins. (See art. 67-223.)

Part 4—General**67-111. INTRODUCTION TO PART 4 OF SECTION II**

The requirements of section II, part 4, are applicable in general, supplementing the specific require-

ments for the major branches of electronics as given in other parts of this chapter.

67-112. PROCUREMENT OF ELECTRONIC EQUIPMENT

Procurement of components, i. e., major units or sets (see definitions, arts. 67-21 (18), 67-21 (19), and 67-21 (21)) for electronic use is initiated by the Bureau of Ships to meet specific requirements afloat and ashore. These items are commonly referred to as Bureau controlled and their issue can be accomplished only upon approval by the Bureau of Ships. (See Bureau of Ships Index of Special Material, NAVSHIPS 250-1800, Bureau of Ships Material Requisition Guide, NAVSHIPS 4060, and Standard Stock Materials—Special Inventory Controls by Bureau of Ships, NAVSHIPS 4010.) (See arts. 67-113 and 67-114.)

67-113. BUREAU CONTROLLED ITEMS

The Bureau of Ships exercises direct control over the assignment and issue of major equipments, their components, power supplies, special accessories, test sets and stands, reproducers, and special tools. Requisitions to supply activities must cite the authority for issue in each instance wherein such equipment is desired. Requests for approval of issue are to be addressed to the Bureau of Ships via the chain of command. (See also arts. 67-32 and 67-33 for ship electronics; arts. 67-66, 67-67, and 67-68 for shore electronics; arts. 67-95 and 67-96 for Marine Corps electronics.)

67-114. TRANSFER AND REMOVAL OF BUREAU CONTROLLED ITEMS (AUTHORIZATION AND ACCOUNTING)

All sets and major units issued in accordance with articles 67-112 and 67-113 are part of the property investment and when charged to expenditure accounts in the 12000 series will be accounted for as ships' equipage. Such material when charged to expenditure accounts in the 41000, 42000, and 43000 series will be accounted for ashore in the plant account in accordance with the Bureau of Supplies and Accounts Manual. Authority for transfer, removal, or survey of these items must be obtained from the Bureau of Ships. When equipments are transferred or removed, they shall be surveyed in order to ascertain their depreciated value and a copy of the survey furnished the receiving activity to assist them in taking the equipment up on their property records at the survey established value. (See arts. 67-241 through 67-248.)

67-115. MAINTENANCE PARTS ALLOWANCES—GENERAL

(1) Maintenance parts are of two types—parts common and parts peculiar. (See arts. 67-21 (23) through 67-21 (27).) Allowances for each naval activity, utilizing Standard Navy Stock Numbers, are provided by the Bureau. These allowances are not of a mandatory nature. They are prepared to serve as a guide, and may be modified by commanding officers or staff electronics officers to sat-

isfy operating conditions. (See art. 67-32 (5) for Ship Maintenance Parts Allowances and 67-69 for Shore Maintenance Parts Allowances.) The supply officer of the naval activity shall be advised of modifications to allowances in order that stock records may be corrected to indicate the authorized carrying limit of maintenance parts. Stock can be replenished through the electronics supply system, and requisitioning procedures advanced by the Electronics Supply Office should be followed.

(2) A failure report (NAVSHIPS 383) as outlined in article 67-203 shall be prepared for every part or maintenance part which is replaced because of failure or because of preventive maintenance programs afloat or ashore, such as the current ships maintenance program (CSMP), or which has been damaged due to handling or prolonged storage.

67-116. ELECTRON TUBE ALLOWANCES—GENERAL

The allowances of electron tubes provide for an adequate number of spare tubes to insure satisfactory operation of electronic equipment. As spares are utilized, immediate action should be taken toward effecting replacements. (See art. 67-32 (4) for Ship Electron Tubes Allowances; art. 67-68 for Shore Electron Tube Allowances.)

Part 5—Crystals

67-131. CRYSTALS—PROCUREMENT AND DISTRIBUTION

The instructions included in articles 67-131 through 67-141 are applicable to crystals used in radio communication for control of transmitter and receiver frequency but do not apply to sonar transducer crystals, rectifier crystals, etc., nor to crystals for electronic equipment not under Bureau of Ships cognizance.

67-132. CLASSIFICATION OF CRYSTALS

The crystals covered herein are grouped in two general classifications as follows:

(1) *Stock crystals.* Individual hermetically sealed crystals of frequencies approved by Chief of Naval Operations which cannot be adjusted or repaired except through use of specialized manufacturing facilities and which when defective are expendable are hereafter defined as stock crystals. JAN types CR-7/U, CR-9/U, CR-18/U, and CR-24/U are examples. Lists of stock crystals will be promulgated from time to time.

(2) *Bureau-controlled crystals.* Crystals in holders which can be reground or relapped to another frequency and complete sets of hermetically sealed crystals which are packaged for specific equipments such as TDZ and RDZ are controlled by the Bureau of Ships.

67-133. DISTRIBUTION OF CRYSTALS

(1) Stock crystals will be distributed by the Electronics Supply Office, Great Lakes, in the same man-

ner as electron tubes, for all frequencies approved by the Chief of Naval Operations and the Bureau of Ships.

(2) Bureau-controlled crystals, holders, and raw quartz will be distributed in the following manner:

(a) Reserve stocks of complete sets, holders, and raw quartz will be maintained at the major supply depots for further Bureau of Ships distribution.

(b) Working stocks of holders and raw quartz will be maintained at activities assigned crystal grinding duties. These currently are Norfolk, Mare Island, Pearl Harbor Naval Shipyards, and Naval Operating Base, Guam. Additionally, crystals may be obtained from commercial crystal grinding activities in accordance with BuShips specifications.

(c) Stocks of complete sets of hermetically sealed crystals and individual crystals ground to standard frequencies for direct issue to vessels and shore stations will be maintained at Electronics Supply Branch, Ships Supply Depot, Naval Supply Center, Norfolk; Ships Supply Depot, Naval Supply Center, Oakland; Naval Supply Center, Pearl Harbor.

67-134. PROCUREMENT OF CRYSTALS

(1) Stock crystals are requisitioned via regular electronics supply system channels. The Electronic Supply Office, Great Lakes, will procure as indicated by supply demand review data.

(2) Individual Bureau-controlled crystals are obtained by submission of NAVSHIPS 370 accompanied by the defective crystal, to the nearest electronics supply activity for transmission to the nearest activity having crystal grinding facilities (art. 133 (2) (b)) if not in stock.

(3) All requests for complete sets of hermetically sealed crystals, holders, and raw quartz are to be forwarded directly to the Bureau of Ships.

67-135. CRYSTALS—GENERAL

To meet emergencies shipyard commanders, industrial managers, and service force commanders are authorized to make individual issues from complete sets provided immediate action is taken to replace that crystal by requisition upon the nearest supply center. The list of stock crystals will be revised as new frequencies are authorized by the Chief of Naval Operations.

67-136. INFORMATION REQUIRED ON CRYSTAL ORDERS

Crystal order form NAVSHIPS 370 shall be used for Bureau controlled crystals. This form provides for inclusion of essential information on crystals and holders. Where the form is not available, the following information must be supplied:

(1) Date needed.
 (2) Name of ship or station requiring crystal.
 (3) Shipment destination and suggested method of shipment.

(4) (a) Indicate use, i. e., transmitter, receiver, crystal frequency indicator, or frequency meter and Navy type number of unit in which used.

(b) Navy or Army-Navy model designation (or type number) and the serial number of the equipment in which used.

(c) If the equipment has not been assigned a Navy or Army-Navy model designation or type number through the Bureau of Ships, indicate manufacturer's name, address, and designation of equipment.

(5) (a) Navy or Army-Navy type number of crystal holder.

(b) If other than Navy or Army-Navy type holder, indicate commercial type, name, and address of manufacturer.

(6) Temperature of operation of crystal, i. e., room or oven temperature in degrees centigrade.

(7) Accuracy of frequency in percentage of crystal frequency.

(8) Type designation of crystal oscillator tube and plate voltage employed.

(9) Quantity of crystals required, the crystal frequency, and, in the case of transmitter and receiver frequency control crystals, the channel frequency for each. Where the crystal and channel frequencies differ, consideration will be given to proper circuit operation, i. e., whether doubling or tripling is employed, or to the intermediate frequency of receivers and crystals provided to give proper channel frequency. Where the crystal is used in a filter circuit, indicate the filter frequency.

(10) The intermediate frequency of the receiver and whether the oscillator frequency of receiver applied to detector or mixer tube is higher or lower than the incoming channel frequency.

(11) Remarks—special type of operation, such as operation of crystal at harmonic frequencies, multiplication of frequencies, etc.

67-137. DISPATCH REQUESTS FOR CRYSTALS

The minimum data for dispatch request for crystals shall include:

(1) Army-Navy or Navy model designation of equipment for which required including suffix numbers (e. g., TCB-3, TCS-1, etc., as in certain cases crystal holders and circuits have been changed in later equipment).

(2) Shipping information.

(3) Use of crystal.

(4) Channel frequency.

(5) Holder type designation.

These minimum data apply only to equipments assigned an Army-Navy or a Navy model designation. For other equipment, complete information, in conformity with article 67-136, will minimize delays due to lack of sufficient data.

67-138. CRYSTALS FOR CHANGES IN FREQUENCY ASSIGNMENTS

Crystal-controlled radio equipment furnished the naval service is normally provided with the initial set of piezoelectric crystals required for operation,

and, in certain cases, with spare crystals. Any additional crystals that may be required subsequent to receipt of the equipment, due to changes in frequency assignments, will not be furnished until specifically authorized by proper authority.

67-139. CRYSTALS NOT REQUIRED DUE TO REASSIGNMENT OF FREQUENCIES

When the use of crystals is discontinued because of a reassignment of frequencies and no further use of the crystals on the ship or station is foreseen, they shall be returned, if in suitable condition for use elsewhere, to the nearest or most accessible of the naval crystal supply activities, i. e., to Electronics Supply Branch, Ships Supply Depot, Naval Supply Center, Norfolk, Va.; Ships Supply Depot, Naval Supply Center, Oakland, Calif.; or Naval Supply Center, Pearl Harbor. Before such action can be taken, approval must be obtained from the responsible force or fleet commander, or by the Commandant for Marine Corps activities, or by the Chief of Naval Operations for other vessels and shore stations in naval districts. Any crystals which are not in condition for further use shall be considered within the scope of articles 67-140 and 67-141.

67-140. DEFECTIVE CRYSTALS—CHECKING

(1) Before a crystal is pronounced defective, care should be taken to insure that the trouble is in the crystal and not in the associated apparatus. Substitution of a spare crystal for a supposedly defective crystal will usually determine whether the fault lies in the crystal or in its associated apparatus or circuits.

(2) If the fault is in the crystal and the crystal is not damaged, there may be one of several causes. In some cases, skilled personnel can cause an apparently defective crystal mounted in a nonhermetically sealed holder to operate properly by opening and cleaning the holder and crystal. Crystals may be cleaned by using distilled water, or free running nonmineral water, a suitable brush equivalent to a nylon tooth brush, and detergent soap. Fresh fluid should be employed since fluid used for repeated cleaning becomes ineffective due to dirt or foreign matter.

(3) After the crystal has been thoroughly and carefully washed and dried, the surface of the crystal must not be permitted to come in contact with the fingers or anything which would render the crystal or electrode surfaces unclean. Clean, lintless cloth, optical tissue, and filter paper are suitable handling media for the crystals. Similarly, the faces of the electrodes which come in contact with the crystal must not be handled directly after cleaning. With strict adherence to scrupulous cleanliness throughout, this procedure should be effective if the trouble is due merely to dirt or moisture in the crystal holder.

67-141. DEFECTIVE CRYSTALS—DISPOSITION

All defective nonhermetically sealed piezoelectric quartz crystals whether guaranteed or not shall be returned to the nearest or most accessible of the naval activities engaged in production of crystals, i. e., to the Norfolk Naval Shipyard, Mare Island Naval Shipyard, or Pearl Harbor Naval Shipyard. Each crystal shall be accompanied by a duplicate copy of the failure report NAVSHIPS 383 (revised) in conformity with article 67-203. The original of NAVSHIPS 383 (revised) shall be transmitted to the Bureau of Ships with a notation that a copy was forwarded to the Norfolk Naval Shipyard, Mare Island Naval Shipyard, or Pearl Harbor Naval Shipyard as applicable. No attempt to recondition such crystals should be made except as prescribed in article 67-140.

Part 6—Alteration, Installation, and Transfer of Equipment

67-151. ALTERATIONS—AUTHORITY FOR

(1) No alterations to or modification of electronic equipment under Bureau of Ships cognizance shall be undertaken, except in actual emergencies, without approval of or direction by the Bureau. All requests for approval shall be forwarded via the chain of command accompanied by information as to the exact nature of the proposed alteration or modification, reason therefor (also if for permanent or for special temporary use), and appropriation to which chargeable. Unauthorized alterations to equipment which is still under a contractual guarantee may result in the nullification or cancellation of the guarantee and financial loss to the Government, and may result in failure of the equipment to provide the service for which the equipment was installed. If alterations are accomplished under emergency conditions, adequate consideration must be given to safety of personnel and equipment and to the basic performance requirements. The Bureau should be advised at the earliest practicable date of the actual changes made and approval requested.

(2) This requirement applies with equal force to alterations, modifications, and field changes to ship, shore, and portable electronic equipment and installations. An alteration or modification shall be interpreted as any mechanical or electrical change in the equipment. A method of operation other than that for which the equipment is designed shall also be considered in the same category.

(3) The completion of all field changes, alterations, and modifications to electronic equipment authorized by the Bureau shall be reported on proper forms, NavShips 537.

(4) A complete record of all field changes, alterations, and modifications shall be entered on the

applicable log and electronic equipment history card, NavShips 536.

67-152. ELECTRONIC EQUIPMENT HISTORY CARDS AND INSTALLATION RECORDS

Each activity engaged in the operation of electronic equipment shall maintain suitable installation record cards for recording the results of inspections, tests, and field changes. Forms furnished by the Bureau of Ships shall be used and shall be maintained in accordance with instructions given in chapter 6 of this Manual and the applicable maintenance manuals listed in article 67-166. They shall be kept up to date and available for inspection at any time. These records are to be integrated into preventive maintenance programs such as the current ships maintenance program (CSMP).

67-153. PREPARATION OF EQUIPMENT FOR TRANSFER

In the absence of any indications to the contrary, new or renovated equipment already boxed for shipment may normally be assumed to be in condition for transfer. In all other cases in order to obviate delay in placing equipment in operation when transferred from one activity to another, the ship or station making the transfer shall exercise all possible care in the removal, handling, storing, and shipment to avoid damage which would delay and increase costs of subsequent installation due to the need for repair. Appropriate action shall be taken to insure to the maximum extent practicable that:

(1) The specified equipment is complete, clean, and in operative condition.

(2) Each set is accompanied by all available accessories, tubes, and maintenance parts originally provided with the equipment.

(3) Each set is accompanied by the applicable equipment history cards and other available informative data showing field changes, alterations, and modifications made, defects known to exist, and any deficiencies in repair parts and accessories.

(4) Each set is carefully and suitably packed for domestic or ocean shipment, as applicable, in a manner to insure against damage in transit and is properly marked. (See Army-Navy Joint Packaging Instructions JPI-14 for packaging and packing of equipment; JAN-P 75 regarding electron tubes and the Navy Shipment Marking Handbook for both equipment and tubes.)

(5) All instruction books pertaining to the equipment are included in a sealed envelope in the shipment with the equipment.

(6) The activity designated to receive the equipment and the activity requesting shipment are advised promptly regarding any specific shortages, deficiencies, or noncompliance with the requirements of this article in order to expedite any further action necessary.

(7) The requirements of article 67-114 have been carried out.

67-154. REPORT OF CONDITION OF TRANSFERRED EQUIPMENT UPON RECEIPT

Reports shall be made to the Bureau of Ships by the receiving activity when any equipment is received in a condition which indicates noncompliance with instructions in article 67-153.

Part 7—Instruction Books and Maintenance Publications**67-161. INSTRUCTION BOOKS—INITIAL DISTRIBUTION**

Two copies of the instruction book are normally supplied with each electronic equipment. In addition, the Bureau supplies file copies to electronics activities concerned with the installation and maintenance of electronic equipment and with the training of personnel. Bulk books remaining after initial distribution are stored at the East Coast Publications Distribution Center and the West Coast Publications Distribution Center. These centers supply small stocks of most books to the various publications and printing offices for issue to the service. Where the supply of books is extremely limited, they are carried at the distribution centers only and issued upon requests received from the various publications and printing offices. The requirements for instruction books are included as a part of the contract for equipments. The number of books printed per equipment varies with the number of equipments included in the contract which means the quantity of books available is always limited and for that reason distribution must normally be limited to recipients of the equipment and activities required to service such equipment. A sufficient quantity of books, however, is obtained to take care of normal file requirements of Naval and Marine Corps electronics schools.

67-162. DISPOSITION OF SUPERSEDED BOOKS

Advance, preliminary, or temporary instruction books may be furnished where a delay in completing final instruction books is anticipated. Such books shall be destroyed upon receipt of final books as indicated in the promulgating letter concerning the revised books. If classified, disposal shall be in accordance with existing Navy regulations covering destruction of classified material. The promulgating letters for changes to instruction books will also indicate the desired disposition of superseded instruction book material.

67-163. MAINTENANCE OF CURRENT INSTRUCTION BOOK INFORMATION

Every effort shall be made by personnel concerned with the operation and maintenance of electronic equipment to maintain local files of instruction books, handbooks, and other maintenance manuals up to date and in agreement with the latest information on changes, revisions, etc. When final instruction books or changes are available for issue, notice to that effect will be published in the **ELECTRON**

and in various maintenance bulletins of the Bureau. These publications shall, therefore, be reviewed as issued to determine whether or not later instruction books, handbooks, maintenance parts catalogs, revisions, supplements, or changes pertaining to the equipment used by the particular ship or station have been distributed or made available for distribution and action shall be taken as necessary to provide the latest information for personnel engaged in the operation and maintenance of equipment. Instruction books are normally considered to be in final form unless the title is preceded by the words "advance," "temporary," or "preliminary." (See art. 67-164 for instructions on obtaining books.)

67-164. REQUESTS FOR INSTRUCTION BOOKS

All requests for instruction books for electronic equipment and other NAVSHIPS publications shall be made to the nearest or most accessible district publications and printing office. Requests from Marine Corps activities shall be submitted through the Marine Corps supply system. In view of the limited number of instruction books available and the excessive cost of reprinting when the stock is depleted, requests will not be approved for more than two books per equipment except in cases where the requesting activity is known to have such equipment in service, expects to install the equipment in the near future, or submits an adequate justification for the request. Requests for instruction books shall state the reason they are required. Books for instruction and study purposes can be issued only to naval and Marine Corps schools, and then in quantities consistent with the stock of books available.

67-165. SECURITY OF INSTRUCTION BOOKS

SECRET, CONFIDENTIAL, and RESTRICTED instruction books shall be handled, transported, and safeguarded as prescribed by United States Navy Regulations and the current edition of the Security Manual and Registered Publication Manual. Periodic accounting is required for registered publications. **SECRET, CONFIDENTIAL, and RESTRICTED** instruction books shall be made available to commissioned, warrant, and enlisted personnel whose duties require knowledge of their contents. Similarly, they shall be made available to civilian personnel of the Navy and to Navy contractors' civilian personnel whose duties involve the design, manufacture, installation, or maintenance of electronic equipment for the Navy and where the individuals concerned have been properly cleared to handle classified matter for the particular classification involved. The security classification of instruction books for Navy electronic equipment shall be as specified in the current edition of Security Classification of Electronic Equipment JANAP 140 (A) (including latest changes) except where it has been determined by the Chief of Naval Operations that a book may be classified lower than the equipment in order to permit a broader distribution. The security

classifications of electronic equipments are under constant review, and classifications are lowered or equipment declassified as soon as national safety, prestige, and the furtherance of public welfare and safety warrant. It is essential, therefore, that the security classification of all instruction books and handbooks be checked against the classification indicated in the current edition of JANAP 140 (A) including latest changes. Where the security classification given therein for a particular equipment is *lower* than that indicated on the applicable instruction books, the front cover and title page of the books shall be prominently marked with the revised classification. (See United States Navy Security Manual for classified matter.)

67-166. MAINTENANCE MANUALS

THE MAINTENANCE MANUALS AND PUBLICATIONS REFERENCED IN THIS AND THE FOLLOWING ARTICLE MAY BE OBTAINED BY ACTIVITIES HAVING A CLEARLY DEFINED REQUIREMENT FOR SUCH MATERIAL BY APPLICATION TO THE NEAREST DISTRICT PUBLICATIONS AND PRINTING OFFICE. Although some of the publications listed are primarily of interest to ship personnel, they are helpful also to shore activities engaged in installation and maintenance of ship equipment.

(1) The Sonar Bulletin NAVSHIPS 900,025A is a loose-leaf publication grouping together in one volume all the existing nonobsolete maintenance information for all types of shipboard and harbor detection sonar equipment. In addition, it carries a list of all field changes for these equipments, complete instructions for accomplishing all field changes that do not require kits, and a chapter on sonar publications and corrections. This bulletin is distributed to all sonar schools, ships with sonar equipment (other than echo sounding) on board, sonar repair ships, sonar installation or repair activities, sonar manufacturers, and any other activities with clearly defined uses for the bulletin. A vessel which has only echo sounding equipment is not entitled to the Sonar Bulletin. (See art. 67-166 (3) regarding information on Sonar Echo Sounding Equipment included in the CEMB in order to reach such vessels.)

(2) The Shipboard Radar Maintenance Bulletin (RMB) NAVSHIPS 900,096, is a confidential loose-leaf publication in two editions containing pertinent information necessary for the efficient maintenance of shipboard radar equipment. The two editions of the RMB are the "C" edition and the "S" edition. The "C" edition is for use by major ships and activities while the "S" edition contains information on equipments on the allowance of smaller ships. The RMB is distributed to all radar schools, ships on the radar allowance list, radar repair activities, radar equipment activities, and other miscellaneous activities having a clearly defined need for the information.

(3) The Communications Equipment Maintenance Bulletin (CEMB) NAVSHIPS 900,020A, is a loose-leaf publication containing information on the maintenance and repair of all electronic communications equipment, countermeasures, electronic navigational aids, direction finders, beacons, and sonar echo sounding equipment. Supplements are issued every three months to keep the bulletin up to date as in the case of the two bulletins mentioned above. The echo sounding section of the Sonar Bulletin is included as a regular section of the CEMB in order to reach vessels having this class of sonar equipment only. Much of the material is originated by the engineering staff of the Bureau through close liaison with personnel of the fleet and naval shipyards. Included are handy maintenance tricks which have been evolved by technicians in the field, endorsed by the Bureau, and passed on for the benefit of all maintenance personnel. CEMB is distributed to all ships (except landing craft), all type and force commanders, and all advanced bases and major shore activities.

(4) The Electronics Installation Bulletin (EIB) NAVSHIPS 900,022A, is published twice a month for naval electronics installation and maintenance activities such as naval shipyards, bases, tenders, and repair ships. It contains advance information on field changes, installation techniques, beneficial suggestions, and, in general, is devoted to information which is of primary benefit to the shore bases and tenders to which it is distributed. EIB is a loose-leaf publication but does not include a basic book. The loose pages received twice a month should be filed in a notebook or folder by consecutive issue numbers. This publication is not furnished to forces afloat other than tenders or operational or training commands. All literature of interest to activities not receiving this bulletin is also published in other mediums. This assures full coverage of all pertinent technical literature.

(5) The Electronic Type Allowance Book, NAVSHIPS 900,115, is a loose-leaf notebook kept up to date by the periodic issue of revisions, additions, or corrections. It contains the official Bureau of Ships Allowance of electronic equipment for all types and classes of naval vessels. Distribution of the complete TAB is limited to certain major commanders and to planning installation and supply activities directly concerned with the installation and supply of electronic equipment. Individual ships are not supplied with the complete book but receive only those pages from the book which apply to the individual ship type. Such pages are intended to be inserted in the ship's on-board copy of the machinery allowance, and as such, constitute the ship's allowance of group S67 materials.

(6) The magazine, "BuShips Electron," NAVSHIPS 900,100, is published for the purpose of keeping electronics personnel whether enlisted, officer, or civilian up to date in the Navy's broad field of

electronics and to help them gain an over-all understanding of the science. This publication is given wide distribution. All ships with electronics maintenance personnel, all shore activities engaged in electronics work, all radio stations, bases, air stations, G. C. A. units, shipyards, electronic schools, naval reserve training centers, and in general all activities connected in the least manner with installation, maintenance, or operation of Navy electronic equipment, or in the training of electronics personnel for such duties, receive copies.

87-167. LIST AND CATALOGS OF ELECTRONIC EQUIPMENT AND MATERIAL

The following list and catalogs of electronic items contain pertinent information of interest to personnel engaged in electronics work:

(1) The List of Naval Electronic Equipment, NAVSHIPS 900,123, and NAVSHIPS 900,123-1 are confidential publications containing descriptive data on all electronic equipments to which Navy model letters and "AN" model letters (Navy-developed only) have been assigned. Distribution is the same as the Type Allowance Book.

(2) The Catalog of Electronic Equipment, NAVSHIPS 900,116, is a loose-leaf confidential publication, the purpose of which is to supply a convenient and summarized reference of the principal Bureau of Ships electronic equipment (except airborne). Distribution is the same as the Type Allowance Book.

(3) The Catalog of Electronic Test Equipment, NAVSHIPS 900,105, serves the same purpose as the Catalog of Electronic Equipment, but is limited to testing devices developed for use in maintenance of the electronic equipment.

(4) The Catalog of Radiac Equipment, NAVSHIPS 900,141, is a separate pamphlet giving the same type of information as the Catalog of Electronic Equipment, but is limited to items of radioactivity detecting equipment. This separate pamphlet was prepared primarily to serve as a handy reference book for use by activities engaged in research and development of these equipments and associated subjects.

(5) The Catalog of Navy Type Electronic Material, NAVSHIPS 900,109 (A), is an eight-volume, loose-leaf, confidential publication which supersedes the Navy Type Number Book (NAVSHIPS 900,109). It includes complete descriptions of electronic material to which Navy type numbers or Army-Navy nomenclature have been assigned. It also contains equivalent JAN, Electronic Supply Office stock numbers, Aviation Supply Office stock numbers, standard Navy stock numbers, Signal Corps stock numbers, manufacturers' and contractors' numbers, equipments in which each item is used, and the quantity per set (for many models of equipment). The equivalent numbers have been arranged in numerical sequence to permit the user to enter the catalog with any number known to him. While the complete publi-

cation is classified confidential, the material has been arranged so that the first seven volumes are restricted and only volume 8 is confidential.

(6) The Cross Index of Electron Tube Types, NAVSHIPS 900,119, is compiled to provide as complete a list as possible of all electron tube types used in Army or Navy equipments or stocked in service depots, together with a cross-reference of any other type numbers or designations these same tubes may have. The information contained in this publication may be used as a guide to interchangeability, but the choice of a substitute tube always rests with those responsible for the operation of the particular equipment in which the tube is used.

(7) The List of Electronic Components Arranged by Navy Type Number, NAVSHIPS 900,113, was published with the view in mind of listing all common electronics parts used in naval electronic sets against a "Navy Type Number." The Navy Type Number, assigned by the Electronics Divisions of the Bureau of Ships, electrically and physically identifies the item to which it is assigned. This Navy Type Number, in many instances, is stamped or marked on the individual parts and is also found in the parts lists of instruction books which are issued with all naval electronic sets. The Navy Type Number facilitates the identification of electronics parts by any activity handling them in any manner, whether it be for actual use in sets, supplying them to various activities, or requisitioning. This list of electronics parts contains various sections, each section pertaining to a certain class of electronics parts used in the Navy. This publication is more in the nature of a catalog rather than a simple list and will be superseded by later developments of the cataloging program.

67-168. REFERENCE TO OTHER CHAPTERS THIS MANUAL

In addition to the information contained in chapter 67, the following chapters of this Manual should be of interest to electronics personnel:

- Chapter 1—Introduction.
- Chapter 3—Finances.
- Chapter 4—Allowances, Surveys, and Requests for Material.
- Chapter 5—Cognizance.
- Chapter 6—Inspections, Records, and Tests.
- Chapter 8—Trials.
- Chapter 9—Readiness and Care of Vessels in Inactive Status.
- Chapter 14—Deck Coverings.
- Chapter 15—Gasoline Stowage and Equipment.
- Chapter 18—Rigging (Rigging Insulators, Grounding Masts).
- Chapter 19—Painting Ships in Service.
- Chapter 21—(Section VI) Hydraulic Systems.
- Chapter 29—Weights, Stability, and Integrity (Seaworthiness).
- Chapter 31—Spare Parts (Maintenance Parts).
- Chapter 38—Ventilation and Heating.
- Chapter 40—Tables of Technical Data.

Chapter 45—Lubricants and Lubrication Systems.
 Chapter 60—Electrical Plant—General.
 Chapter 61—Electric Generators and Voltage Regulators.
 Chapter 62—Electric Power Distribution.
 Section I—Distribution Systems.
 Section II—Portable Storage Batteries and Dry Batteries.
 Chapter 63—Electric Motors and Controllers.
 Chapter 64—Lighting.
 Chapter 65—Interior Communication Installations.
 Chapter 69—Electrical Measuring and Test Instruments.
 Chapter 70—Sight Signaling Apparatus (Inter-ship).
 Chapter 88—Damage Control.
 Chapter 91—Workshop Equipment on Ships.
 Chapter 93—Fire Fighting, Ship.
 Chapter 97—Service Craft.

67-169. MAINTENANCE OF ELECTRICAL EQUIPMENT, FITTINGS, AND CABLES

The following items of chapter 60 of this Manual are of particular interest:

Section II—Electrical Safety Precautions.
 Section III—Electrical Insulation and Insulation Resistance.
 Section IV—Maintenance of Electrical Equipment.
 Section IV, Part 5—Maintenance of Cables and Cable Fittings.
 Section IV, Part 6—Maintenance of Electric Generators and Motors.
 Section V—Reconditioning Electrical Equipment which has been damaged by Sea Water.

Part 8—Inspections and Tests—Electronics Installations

67-181. ROUTINE INSPECTIONS AND TESTS

(1) Routine periodic inspections shall be conducted by ship or station personnel at appropriate intervals, depending upon the nature and extent of operations and services being performed, to insure efficient and reliable operation. Details of appropriate inspection, test, and maintenance procedures are normally contained in the publications listed below and such additional pertinent instructions as may be issued. (See also art. 67-168.)

- (a) Equipment Instruction Books.
- (b) Communication Equipment Maintenance Bulletin, NAVSHIPS 900,020A.
- (c) Radar Maintenance Bulletin, NAVSHIPS 900,096.
- (d) Sonar Bulletin, NAVSHIPS 900,025A.

(2) For additional information regarding test of ship installations see:

Article 67-34 (2)—Arrival Inspection by Naval Shipyards.
 Article 67-39—Tests of Ship Installations.

Article 67-43—Inspection of Radio Radar Antennas.

Article 67-45—Transmission Lines (Ship Installations).

Article 67-46—Radio Interference Elimination.

Article 67-47—Inspection, Painting, and Servicing Sonar Equipment.

(3) For additional information regarding test of shore installations see:

Article 67-75—Tests (New) Shore Installations.

Article 67-76—Quarterly Inspections and Tests.

Article 67-77—Annual Inspection and Tests.

67-182. PERSONNEL AND EQUIPMENT FOR INSPECTION AND TEST FORCE

Tests and inspections shall be made by operating and maintenance personnel of the activity concerned. Where qualified personnel or suitable testing equipment is not available at the activity, arrangements shall be made for the temporary services of qualified personnel and proper testing equipment through the unit commander or, in the case of a shore activity, through the responsible maintenance yard. Similar action should be taken in the event that the correction of defects or undesirable conditions noted includes work beyond the capabilities of operating forces or their equipment. Maintenance activities will assist as necessary and will advise the Bureau if additional assistance is required. (See also art. 67-11.)

67-183. MAINTENANCE OF SERVICE DURING INSPECTION AND TEST

Inspection and test shall not be permitted to interrupt unnecessarily the services provided by a ship or station. No equipment should be dismantled or otherwise made inoperative without proper authorization. "On the air" tests of transmitting equipment shall not be made during scheduled periods of silence or when such tests would interfere with normal service.

67-184. USE OF SUBSTITUTE EQUIPMENT TO FACILITATE INSPECTIONS

Personnel responsible for making these inspections and tests shall, where practicable, so arrange that substitute or standby equipment is available, where required, during the progress of inspection and those tests which may interfere with communications. If satisfactory substitute equipment is not available, proper authority must be obtained for temporarily placing equipment out of service.

67-185. DEFERRED TESTS

Where prescribed inspections and tests cannot be made, a complete statement of the circumstances shall be entered in the appropriate log and the responsible officer notified. In this event, the required inspection or test shall be made at the first opportunity. During long stays of a ship in port, schedules for daily tests may be modified. Additionally, while ships are in the yard, alongside dock,

or at anchor, certain of the suggested tests may be eliminated where local conditions warrant.

67-186. INSPECTIONS—DETERMINATION OF AVAILABILITY OF CALIBRATION DATA, INSTRUCTION BOOKS, ETC.

The scope of inspections required by articles 67-181 and 67-182 and by referenced articles shall be extended as applicable to establish the fact that essential operating data such as records for adjustment of transmitters and other equipment to assigned frequencies, calibration data, etc. are conveniently available to operating personnel and that current instruction books are available. Similarly the inspections should include observations and pertinent comment regarding the extent of compliance with requirements for maintenance of adequate electronic equipment history cards and other installation records, requirements for submission of failure reports, and with requirements of articles 67-281 through 67-312 for safety, etc. (See also art. 67-152.)

Part 9—Contractual Guarantees

67-201. CONTRACTUAL GUARANTEES ON ELECTRONICS EQUIPMENTS, ETC.

In most cases it is the practice of the Bureau of Ships, when purchasing electronic equipment, to include in the contract for complete sets of equipment a guarantee covering design, material, workmanship, and manufacture of each set of equipment and the components (major units), parts, and maintenance parts thereof (except batteries, rubber, and material normally consumed in operation), and electron tubes and piezoelectric quartz crystals which are covered by separate contract with the tube manufacturer (see arts. 67-211 to 67-224) and the crystal manufacturer (see arts. 67-131 to 67-135 and 67-141). Where an equipment guarantee exists, *the terms of the guarantee including the applicable dates are printed in the instruction books.* In recent contracts the practice is to require a 1-year guarantee which becomes effective from the date of acceptance by the inspector of naval material. The installation activity should record the date of acceptance and the date of installation in the appropriate logs and installation records and the equipment history card. The specified periods are automatically extended by whatever time the equipment fails to give the required performance due to any defect covered by the guarantee or lack of suitable replacement parts due to such defects. In addition, when failures (within the guarantee period) due to design defects have reached 10 percent of the number procured, most contracts require the manufacturer of the equipment to provide a suitably redesigned replacement for all sets, components, and parts under the common contract.

67-202. ENFORCEMENT OF GUARANTEE

To obtain the maximum protection and effectiveness under terms of the contractual guarantee, it is essential that all component or part failures be reported to the Bureau of Ships promptly. (See art. 67-203.) The Bureau of Ships will then contact the office of the inspector of naval material at the plant of the prime contractor. He is directly concerned with the enforcement of the guarantee protection and the obtaining of suitable adjustments. To permit the inspector to act promptly and effectively, it is not only essential that he be promptly informed of any failures that occur in sets of equipments, components, parts, or maintenance parts within the guarantee period, but that he also be in possession of complete information as to the conditions surrounding the failure and the cause of the failure. The inspector, upon receipt of information from the Bureau of Ships regarding failures or defects as reported on form NAVSHIPS 383 (revised), will take necessary action to obtain an appropriate adjustment under the terms of the guarantee.

67-203. REQUIREMENT FOR SUBMISSION OF FAILURE REPORTS

It is of major importance that the Bureau be informed promptly of ALL failures of and deficiencies in electronics equipment, systems, sets, components, parts, maintenance parts, and all electron tubes, whether subject to a contractual guarantee or not. To simplify the reporting of all failures of electronics items, the NAVSHIPS 383 (revised) failure report card was developed. This card supersedes the old long forms NAVSHIPS (NBS) 383 and 304. The form should be filled out promptly preferably by the engineer, technician, or mechanic who detects the failure or who is in charge of the repair work, whether aboard ship, at a shore station, in the electronics shop, or elsewhere in the field. New models or sets of equipment, or modifications to old models or sets, are usually in the process of design or manufacture, or specifications are being prepared for manufacture or modification of various sets of equipment. Prompt receipt of failure reports, therefore, enables the Bureau to initiate immediate corrective action to eliminate similar or other related deficiencies in subsequent production, prior to acceptance of equipment by the Navy, and to substantiate Bureau claims for replacements of characteristically weak or unsatisfactory items under the guarantee provisions of the applicable contract. The importance of reporting failures and the causes thereof cannot be too highly stressed, particularly the circumstances which exist when failures occur under actual operating conditions. Fill out the report completely and in conformity with the instructions accompanying the card. Many reports have been valueless as they did not contain the essential information required by the form or the information given was incomplete.

When indicating the model or type of equipment, include all significant nomenclature, letters, and digits. A separate NAVSHIPS 383 (revised) report should be made out for each failure. The accuracy of the entry describing the reason(s) for the failure should be verified. (See ch. 6 of this Manual.)

67-204. DISPOSITION OF DEFECTIVE PARTS

All defective parts should be disposed of as prescribed by existing salvage and security regulations. In cases of excessive failures, unusual conditions, etc., the Bureau of Ships, the inspector of naval material, or the contractor may desire to inspect the material. If such an inspection appears desirable to the reporting activity, indicate in the report that further inspection is recommended and hold the part for approximately 60 days. Generally, in the case of excessive failures of any particular items, special action will be initiated by the Bureau for collecting the items for inspection. For disposition of failed electron tubes, see article 67-221.

67-205. GUARANTEES ON REPLACEMENTS

It will be noted by referring to guarantee clauses appearing in instruction books that all replacements, parts, components, or sets of equipments, as well as original parts, components, or sets of equipments, are covered by a guarantee. Accordingly, these replacement items or parts should be given the same consideration as original sets of equipments as to the recording of dates of acceptance, periods of service, and procedure for reporting failures.

67-206. FAILURE CATEGORIES

Failures and reports thereon for all items or parts of electronics equipments, either electrical or mechanical, shall be classified in the following two categories:

- (1) All types of electron tubes and piezoelectric quartz crystals.
- (2) All other items or parts contained in or supplied as components, parts, or maintenance parts for use in or with electronic equipment.

67-207. METHODS OF REPORTING FAILURES

Failure of items or parts under category (1) of article 67-206 shall be reported on form NAVSHIPS 383 (revised) as prescribed by instructions contained in articles 67-141, 67-219, and 67-220. Failure of items or parts under category (2), 67-206, shall be reported on form NAVSHIPS 383 (revised) as prescribed by instructions in article 67-203. (See ch. 6, BuShips Manual.)

67-208. DISTRIBUTION OF REPORT COPIES

As soon as possible after a failure has occurred, an individual report for each item shall be completed and forwarded to the Bureau of Ships without forwarding letters. (See art. 67-141, 67-203, 67-219, and 67-220.) Normally copies of failure reports are not required except in the case of certain

electron tubes and certain crystals or in regard to failure reports from shore stations where the cognizant maintenance yard requires a copy to be furnished. (See ch. 6, BuShips Manual.)

67-209. REPLACEMENT OF DEFECTIVE PARTS

(1) In all cases of failure of items or parts, the reporting activity shall requisition the replacement part from stock from the nearest naval shipyard, tender, electronics supply activity, or the appropriate Marine Corps depot. This requisition shall bear the notation, "The items requested herein are not in excess of normal allowance for this activity. Failure report forms NAVSHIPS 383 (revised) covering defective parts have been submitted."

(2) In the event that an item not covered by a guarantee can be repaired by a naval shipyard or a tender, the usual work request should be submitted to the type (or appropriate) commander with copy to the activity which is to accomplish the repairs.

67-210. FAILURES OF ELECTRICAL AND ELECTRONICS MEASURING EQUIPMENT

(1) Failures of electrical measuring instruments such as voltmeters, ammeters, wattmeters, etc., shall be handled in accordance with chapter 69 of this Manual. Defective instruments covered by contractual guarantees shall not be opened or any attempt made to effect repairs. The Bureau of Ships and the cognizant Inspector of Naval Material shall be notified and the instruments retained until receipt of disposition instructions from either the Bureau of Ships or the Inspector of Naval Material concerned.

(2) Failures of electronics test equipments, which are supplied as separate items in accordance with allowances, shall be handled in accordance with the procedure indicated in articles 67-201 to 67-209 of this chapter.

67-211. ELECTRON TUBE—GUARANTEES

Electron tubes may be procured:

- (a) Subject to a service life guarantee based on the life of tubes in actual service operation.
- (b) Subject to a tube life rack guarantee based on life rack tests on random selected tubes by the manufacturer and the cognizant Inspector of Naval Material.
- (c) Without guarantee where life rack tests are not practicable and service life guarantee is not justifiable.

67-212. SERVICE LIFE GUARANTEED TUBES

(1) These tubes can be identified by the stamp on the base which gives the contract number, the numbers of hours' life for which guaranteed, and in some cases the manufacturer's serial number. When space is not available on the tube base, the tube envelope is used. Tubes obtained on a service life guarantee basis are usually tubes which are expensive, of high power, or of unconventional design, thereby justifying the closer observation and

records obtained on service life guaranteed tubes. Ordinary receiving tubes and low power transmitting tubes are rarely included in such guarantees.

(2) It is now the Bureau's general policy not to use service life guaranteed tubes aboard ship since the life and general suitability of most of the types of tubes involved can be adequately and more economically determined by suitable life rack tests at the point of production.

(3) To be eligible for adjustment under the guarantee, a defective tube must, within 2 years from the date of its acceptance by the Inspector of Naval Material, have failed due to a manufacturing defect or have rendered less service life than the life for which it is guaranteed; and it must be returned to the contractor within 30 months after its acceptance by the Inspector of Naval Material. This date of acceptance is indicated on the tube containers and should be recorded as the date accepted on the failure report form.

(4) A duplicate copy of the NAVSHIPS 383 (revised) failure report form required by article 67-203 should be forwarded to the cognizant Inspector of Naval Material whenever a service life guaranteed tube fails prior to the expiration of the guarantee except when the failure is due to accidental breakage. A statement should be added to the Bureau's copy of NAVSHIPS 383 (revised) that a duplicate has been forwarded to the inspector. These tubes should then be retained as prescribed in article 67-221.

67-213. ACTION BY THE COGNIZANT INSPECTOR OF NAVAL MATERIAL

(1) The cognizant Inspector of Naval Material shall, upon receipt of the failure report mentioned in article 67-212, determine from the manufacturer whether or not he desires the tube or tubes to be shipped back for examination before negotiating under the service life guarantee clause of the contract and shall inform the reporting activity and the Bureau of Ships as soon as practicable of his decision.

(2) The inspector, after negotiating a settlement with the tube contractor, shall forward a copy of the settlement to the Bureau. If no comment is received from the Bureau within 90 days from the date of the inspector's forwarding letter, the inspector may assume automatic Bureau approval of the settlement.

67-214. TUBE LIFE RECORDS

Ships and stations shall maintain a tube performance record card (NAVSHIPS 538) for determining the service life for each tube covered by a service life guarantee. Where life-hour meters are not provided, records should be maintained to enable a fair approximation of the service life. Records may be kept of large or expensive tubes for which detailed information is desired. Tube life records shall be maintained also for all tubes hav-

ing output ratings of 500 watts or more and used in shore equipment provided with tube life meters.

67-215. TRANSFER OF TUBE LIFE DATA WITH TUBES

When tubes covered by a service life guarantee are transferred or returned to stock for reissue, the tube performance record and any other pertinent tube life data shall be passed on with the tubes.

67-216. LIFE RACK GUARANTEE TUBES

The life of tubes purchased under life rack guarantee is determined by life rack tests of random-selected samples conducted by the tube manufacturer. Any deficiency in life indicated by these life tests is compensated for by the contractor. Consequently, tubes purchased under this guarantee have no adjustment value upon becoming unfit for further use, and, except in the case of abnormal recurrent failures, may be disposed of in accordance with article 67-221.

67-217. TESTING OF ELECTRON TUBES

(1) All electron tubes received by a ship, station, or other using activity shall be immediately examined for obvious breakage, defective packing, or signs of rough handling. Electrical tests shall also be conducted where feasible. All large or expensive tubes shall be checked for filament continuity, shorted elements, and loss of vacuum. Where a suitable gas detector is available, tubes other than mercury or gas-filled rectifier tubes shall be tested for gas. Where possible, tubes should be checked by operation in an equipment socket under rated operating conditions. (See art. 67-219.) All activities shall test at least quarterly all tubes covered by service life guarantees.

(2) Supply depots and other stocking activities shall NOT, as a routine procedure, check new tubes if repacking of the tube is necessitated thereby. In the event that the above activities are specifically directed to make such tests, they shall be performed by qualified technical personnel using extreme caution in unpacking and repacking the tube. Packers should be warned of the implosion or explosion hazard when handling large cathode ray tubes and should observe the precautions of article 67-312. All tubes which have been unpacked shall be repacked using the original carton and cushioning materials in a manner which duplicates the original tube packaging.

67-218. CIRCULATION OF ELECTRON TUBE STOCK

Tubes should not be allowed to remain indefinitely in storage or inactive. Little used tubes, including those in emergency equipment, should be advanced, if practicable, from such location into active equipment as replacements are required. The oldest tubes, as indicated by the dates of acceptance by the Inspector of Naval Material, should be placed in active service prior to tubes having subsequent dates of acceptance. At stocking activities, the oldest tubes shall be issued first.

67-219. REPORTS REQUIRED ON ALL ELECTRON TUBE FAILURES

(1) A failure report form NAVSHIPS 383 (revised) must be submitted by the using activity for all electron tubes which fail in storage, handling, installation, or operation. This form is suitably designed to facilitate its use for reporting electron tube failures in Bureau of Aeronautics Electronics Equipment and Bureau of Ordnance Electronics Equipment. The report forms should be filled out in detail with care being taken to insure that the information is complete. These report forms are used by the Bureau to determine the causes and rates of failures, both of which influence the design of tubes and equipment and the number of spare tubes allowed. NAVSHIPS 383 (revised) has no security classification. Therefore, classified military information, including in some cases the operating frequency, should not be included on the completed forms. Failures due to shock from own gunfire should be so stated. (Also, see art. 67-203.)

(2) An additional duplicate report shall be submitted when so required by article 67-208 or 67-212 (4).

(3) When tubes are received in defective condition, a failure report shall be made out, and, in addition, the supply activity from which the tubes were received should be notified promptly so that action in conformity with the Bureau of Supplies and Accounts Manual and the United States Navy Shipping Guide may be initiated. Information copies of correspondence concerning shipping claims shall be forwarded to the Bureau of Ships.

(4) Bureau of Ships Form NAVSHIPS 304 (Report of Vacuum Tube Failures) is obsolete and all copies should be destroyed.

67-220. SPECIAL ELECTRON TUBE FAILURE REPORTS

(1) Special letter reports should be made to the Bureau for any recurrent or abnormal failures of regular electron tubes. "Special" tubes on which reports are required will be listed in the various maintenance bulletins.

(2) Representative samples of failed tubes should be retained as specified in article 67-221.

67-221. DISPOSAL OF FAILED ELECTRON TUBES

(1) In general, all failed tubes except those listed below in (2), (3), and (4) may be disposed of without notification to the Bureau in conformity with existing security and salvage regulations, provided that any surveys prescribed by the Bureau of Ships Manual, Naval Regulations, or the Bureau of Supplies and Accounts Manual are completed. (See art. 67-114 and 67-241 through 67-248 for surveys required by the Bureau of Ships.)

(2) Service life guaranteed tubes which fail prior to the expiration of the guarantee (see art. 67-212) shall be held a minimum of six months pending disposition instructions from either the Bureau of

Ships or the cognizant inspector of naval material. If at the expiration of the six months period no disposition instructions have been received, the tubes may be disposed of as indicated in the preceding paragraph. The fact that the tubes are being held should be indicated on NAVSHIPS 383 (revised) Failure Report Form.

(3) Representative samples of recurrent or abnormal failures shall be retained pending Bureau disposition when special reports have been submitted in conformity with article 67-220. If no instructions are received within six months of the date of the report, the tubes may be disposed of as indicated above. The fact that the tubes are being retained should be indicated in the report.

(4) Failed tubes shall also be retained when so requested by official correspondence or by publication of such instructions in the regular maintenance bulletins.

(5) See article 67-48, 67-79, and 67-97 re Electron Tube Surveys.

67-222. DEMOLITION OF ELECTRON TUBES

When destroying electron tubes, completely demolish tubes by shattering the envelope and the tube elements. On board ship metal tubes shall have the vacuum destroyed by opening the envelope to assure that the tube will sink immediately after being thrown overboard.

67-223. ELECTRON TUBE SURVEYS—GENERAL

Normally the Bureau of Ships does not require surveys for electron tubes used aboard ship or by the United States Marine Corps, or for tubes valued at \$1,500 or less used at shore activities. Surveys for specially designated tubes may be required by the Bureau by special correspondence or by publication in the various maintenance bulletins. Tubes by nature are consumable but regardless of the \$1,500 limitation referenced above they shall not be considered as negligible in cost. Magnetrons, for example, cost as much as \$600 each. Because of the tremendous number of tubes in use in the naval establishment, it is essential that they be conserved.

67-224. DEPARTURES FROM INSTRUCTIONS

Since the exigencies of the service do not always allow complete compliance, those responsible for the carrying out of the instructions (art. 67-211 to 67-222 inclusive) shall use discretion in so doing. Where conditions make compliance impractical, departures from these instructions shall be reported to the Bureau of Ships in writing at the earliest practicable date.

Part 10—Surveys**67-241. GENERAL**

The following instructions supplement the general instructions on surveys issued in United States

Navy Regulations and Bureau of Supplies and Accounts Manual. (See also art. 67-114.)

67-242. SURVEY—AUTHORITY FOR

Except in emergency (and excepting items issued to temporary advanced bases), survey of the electronics items listed as Bureau of Ships controlled is not to be undertaken without first obtaining authority therefor from the Bureau. Requests for such authority should set forth in detail the necessity for the survey. (See art. 67-245 (5) of this Manual and art. 1948 of U. S. Navy Regulations, 1948 issue.)

67-243. SPECIAL INSTRUCTIONS FOR TUBES, CRYSTALS, AND INSTRUMENTS

Special instructions regarding the survey of electron tubes, piezoelectric crystals, and indicating instruments (ammeters, voltmeters, etc.) are contained in this chapter. (See art. 67-141, 67-210 and 67-223.)

67-244. DISPOSITION WITHOUT BUREAU APPROVAL

The United States Navy Regulations provide that except for the cases listed in article 67-245, the disposition of surveyed items may be accomplished as recommended in the survey report after approval by the reviewing officer, without formal approval by the Bureau. (See art. 1952, U. S. Navy Regulations, 1948.)

67-245. BUREAU ACTION NECESSARY

In the following cases the Bureau will indicate in writing its action on the survey reports, and no further action will be taken by the reviewing officer or others until after receipt of approval or further instructions:

(1) When the reviewing officer does not approve the recommendations of the surveying officer. (Art. 1951-1952, U. S. Navy Regulations, 1948.)

(2) When major items have been recommended for use in making repairs and such recommendation is approved by the reviewing officer. (Art. 1952, U. S. Navy Regulations, 1948.)

(3) When sale has been recommended, articles shall not be disposed of until after specific authority in the form of a copy of the survey request, report and expenditures, bearing approval of the Bureau has been returned to the reviewing officer via the Bureau of Supplies and Accounts. (Art. 1952, U. S. Navy Regulations, 1948.)

(4) When shore establishments plant equipments, reported to the Assistant Secretary of the Navy (Shore Establishment Division), in Booklet of Shop Equipment, or on lists indicating the shop equipment in the Appropriation Purchase Account available for transfer, are to be disposed of in any manner. (Art. 1949 and 1952, U. S. Navy Regulations. See also ch. 3, vol. VI of Bureau of Supplies and Accounts Manual.)

(5) When any of the articles listed as Bureau of Ships controlled have been surveyed in accordance

with Bureau authorization. (Art. 1948, U. S. Navy Regulations, 1948.)

67-246. SURVEY RECOMMENDATIONS NOT REQUESTS FOR REPLACEMENT

Recommendations made in surveys that the equipment or material be replaced will not be considered as requests for replacements and no action will be taken thereon by the Bureau regarding replacement.

67-247. DESCRIPTION OF ITEMS

Survey reports of special engineering material mentioned as Bureau of Ships controlled shall describe fully the items surveyed and shall specify the quantity, the Navy type number (or model letters), serial number (if available), date and source from which received, price at which carried, contract number if available, and all other pertinent data available.

67-248. DETERMINING CAUSE OF DAMAGE

If apparatus surveyed is inoperative due to missing or broken parts, or is unfit for use for other reasons, the surveying officer shall determine definitely the cause for this condition and place responsibility as indicated in accordance with articles 1949 and 1953, United States Navy Regulations, 1948.

67-249. EQUIPMENT FINISH AND PAINTING

Most major units of electronics equipment, including associated motors and generators, are coated with gray enamel smooth or wrinkle finish except Marine Corps equipment which is coated a forest green smooth or wrinkle finish. Earlier equipments were finished in a wear-resisting black. These finishes are applied and inspected at the point of manufacture. Specifications are rigid for the purpose of insuring a tough protective coat. The even thickness of the application promotes cleanliness and a neat appearance and, with reasonable care, unless subject to flame or abrasive damage, the finish should last throughout the life of the equipment.

67-250. RESTRICTIONS AGAINST PAINTING AND POLISHING EQUIPMENT

The original finish should not be painted over unless actual physical damage makes such procedure essential for preservation. (See also ch. 19, art. 19-101 of this Manual.) Metal polish shall not be used on name plates or on the base of transmitting tubes.

Part 11—Security

67-261. RESPONSIBILITY FOR MAINTAINING SECURITY OF ELECTRONIC EQUIPMENT AND ELECTRONICS INSTALLATION

Commandants of naval districts, commanders of naval shipyards, industrial managers, USN, commanding officers of independent activities, and com-

manding officers of ships are charged with safeguarding the security of electronic equipment installed or located in their commands. When equipment is being developed or built by civilian contractors, security shall be safeguarded by the cognizant Naval Inspectors. (See U. S. Navy Security Manual and JANAP 140A and Navy Regulations.)

67-262. AUTHORITY TO ENTER ELECTRONICS SPACES

No persons, unless specifically authorized by the Chief of Naval Operations or the cognizant Bureau, shall have access to any electronic equipment installed on board ship or at shore electronics activities, except the following:

(1) Officers and enlisted personnel of Army, Navy, Air Force, Coast Guard, and Marine Corps as required by their duties.

(2) Civilian personnel of the Navy or shipyard and employees of contractors as required by their duties when actually engaged in authorized work on or in the space housing electronic equipment. (See art. 67-263.)

67-263. IDENTIFICATION AND RESTRICTION OF VISITORS

Persons authorized to visit electronics spaces shall identify themselves satisfactorily. When persons are authorized to visit electronics spaces for a specific purpose, their authority carries no privilege to visit or to see equipment other than that specified.

67-264. PHOTOGRAPHING ELECTRONIC EQUIPMENT

Photographing electronic equipment is permitted only for official purposes, and must be specifically authorized by the Chief of Naval Operations, the Bureau having cognizance, or by the officer responsible for the security of the equipment. This paragraph is applicable regardless of the security classification of the electronic equipment.

67-265. CRYPTOGRAPHIC EQUIPMENT

Special instructions covering security of cryptographic equipment are issued by the Chief of Naval Operations.

Part 12—Safety Precautions

67-281. SAFETY—GENERAL

Safety from the viewpoint of electronics personnel requires full appreciation of various factors and hazards involved, i. e., the precautions necessary in the work of the average electrician (see ch. 60, sec. II of this Manual), the special precautions due to the employment of power supply circuits of 5,000, 20,000, 44,000 volts or special precautions due to the use of even higher radio frequency potentials often much in excess of the power circuit voltages indicated above, the effect of fields existing in the vicinity of antennas and antenna leads which introduce fire hazards, danger of shock to personnel, explosion hazards where ammunition or explosive vapors are present, and hazards (injuries due to

falls) incident to men working aloft complicated by possible presence of stack gases and by possible shock.

67-282. SCOPE OF THESE SAFETY PRECAUTIONS—ADDITIONAL INSTRUCTIONS

Safety precautions as listed herein and articles 67-281 to 67-312 do not supersede instructions concerning safety precautions in connection with the installation, maintenance, and operation of transmitting equipment incorporated in instruction books. These, together with the instructions incorporated in this chapter, comprise a nucleus for the promulgation of detailed instructions, as applicable to various installations, for the safe installation, maintenance, and operation of electronics facilities ashore and afloat. Responsible officers on shore and commanding officers afloat will issue such additional orders and instructions as are deemed necessary for the protection of personnel.

67-283. DANGEROUS VOLTAGES

The voltages encountered in electronic equipment are dangerous. The actual voltages involved are indicated in the equipment instruction books. The passage of even a very small current through a vital part of the human body will cause DEATH. The voltage necessary to produce the fatal current is dependent upon the resistance of the body, contact conditions, the path through the body, etc. Under unfavorable conditions, therefore, contact with such common potentials as 110 volts has been fatal. The voltages encountered in receiver installations may be dangerous. Plate voltages up to 180 volts are used with battery operated receivers, and with a-c line operated receivers higher voltages are used. The precautions in articles 67-281 to 67-312 inclusive shall be observed, therefore, insofar as may be applicable. Oscilloscope circuits employ voltages corresponding to those used in transmitting equipment. Similar safety precautions should be observed when working with oscilloscope circuits.

67-284. WARNING SIGNS

"DANGER" signs and suitable guards shall be provided to prevent personnel from coming in accidental contact with high voltages and for warning personnel to guard against the possible presence of explosive vapors in certain locations and against the poisonous effects of smoke pipe gases while servicing electronics material aloft. The following Bureau drawings have been prepared for suitable warning signs.

(1) Drawing RE 10AA608A—Warning regarding high voltage.

(2) Drawing RE 10AA529A—Warning regarding stack gases.

(3) Drawing RE 10A589A—Warning regarding explosive vapors.

See article 67-285 regarding availability of posters—Electric Shock—First Aid Treatment.

67-285. ELECTRIC SHOCK—FIRST AID TREATMENT; RESUSCITATION—PRONE PRESSURE METHOD

All personnel should familiarize themselves with the prone pressure method of artificial respiration as shown in the fire-fighting manual and the various instruction manuals for electronic equipment. More recent instruction manuals do not include the first aid instructions previously supplied. Copies of a poster, "Electric Shock—First Aid Treatment" (NAVMED 123), suitable for bulkhead or bulletin posting are obtainable from the Publications Section, Division of Preventive Medicine, Bureau of Medicine and Surgery. At suitable intervals, the electronics officer or other cognizant officer should require all personnel normally engaged in operation and maintenance of electronic equipment to demonstrate their practical knowledge of the application of artificial respiration and shall arrange for such additional training as may be necessary for all personnel to attain proficiency.

67-286. WORK TO BE DONE BY AUTHORIZED PERSONS ONLY

Because of the danger of fire, damage to material, and injury to personnel, all repair and maintenance work on electronics equipment shall be done only by duly authorized and competent persons. Where the work involves the use of voltages dangerous to life, personnel should not work alone.

67-287. INTENTIONAL SHOCKS FORBIDDEN

Intentionally taking a shock from any voltage is always dangerous and is strictly forbidden. Whenever it becomes necessary to check a circuit to see that it is alive, a test lamp, voltmeter, or other indicating device shall be used. The indicating device employed shall be suitable for obtaining the desired check without jeopardizing personnel. In the case of live circuits, never implicitly trust insulating material when considering personal safety. Insulating material has failed before and may fail again—be on the alert.

67-288. TAGGING OPEN SWITCHES

(1) When any electronic equipment is to be overhauled or worked on, the main supply switches or cutout switches in each circuit from which power could possibly be fed shall be secured in the open (or safety) position and tagged. The tag shall read "This circuit was ordered open for repairs and shall not be closed except by direct order of -----" (usually the person making, or directly in charge of, the repairs). After the work has been completed, the tag or tags shall be removed by the same person.

(2) When more than one repair party is engaged in the work, a tag for each party shall be placed on the supply switch. Each party shall remove only its own tag upon completion of the work.

(3) Where switch-locking facilities are available, the switch should be locked in the open (SAFETY)

position and the key retained by the person doing the work so that only he, or a person designated by him, can remove the lock and restore the circuit.

67-289. TAGGING OF TEMPORARY PROTECTIVE GROUNDS

When circuits are grounded for protection of personnel engaged in repair work, such grounds should be located in the vicinity of the working party and shall be properly secured to prevent accidental removal. If the location of the grounding point is not in the immediate vicinity of the working party, the tagging procedure indicated in article 67-288 shall be followed with the wording of the tags suitably revised to cover the applicable conditions.

67-290. OPERATING SWITCHES

(1) *Power and lighting circuits.* As a general rule, use only one hand for switching. Keep the other hand clear. One switch only should be touched at one time by one person. Before closing a switch, make sure that:

(a) The provisions of articles 67-288 and 67-289 have been met.

(b) The circuit is ready and all parts are free.

(c) Men near moving parts are notified that the circuit is to be energized. This is particularly important in cases where rotating antennas are energized.

(d) Proper fuses are installed for protection of the circuit.

(e) Circuit breaker is closed.

Ease the switch to a position of safe and quick action and then make the final motion positive and rapid. When opening switches carrying current, the break should be positive and rapid.

(2) *Radio frequency circuits.* Avoid breaking energized high voltage output circuits insofar as may be feasible. When other transmitting equipment is in use at the same installation or close by, be on the alert to prevent shock, burn, or other injury to personnel due to energy picked up from adjacent antennas or equipment.

67-291. FUSES

Fuses should be removed and replaced only after the circuit has been completely deenergized. When a fuse blows, it shall be replaced with a fuse of the proper capacity of the nonreplaceable link type and suitable for use at the circuit current and potentials involved. When practicable, a circuit should be checked before replacing a burned out fuse as such trouble is usually indicative of a circuit fault.

67-292. CIRCUIT BREAKERS

Except for operating handles, all parts of circuit breakers are normally conductors. In opening and closing circuit breakers:

(1) Use only one hand.

(2) Keep the hands clear of parts other than operating handles.

(3) Touch only one breaker handle at a time.

(4) Where positive and negative breakers have two handles, they shall *not* be closed at one time.

(5) Close the breaker first and then close the switches.

(6) Trip circuit breakers before opening switches.

(7) *Never* disable a circuit breaker.

(8) Keep the face turned away while closing circuit breakers.

(9) *Never* stand over a circuit breaker while power is on.

67-293. POWER LINE GROUNDS

Except in an installation where local power conditions require a grounded line as a normal operating condition, power shall be removed from equipment immediately when the power line shows a ground and shall not be replaced until it shall be determined that the ground is not in the equipment. Keep all electrical circuits which are not intentionally grounded free from grounds.

67-294. AVOID WORKING ON ENERGIZED CIRCUITS

(1) Insofar as practicable, repair work on energized circuits shall *not* be undertaken. When repair work of an emergency nature or repair work considered essential by the commanding officer is undertaken on an energized circuit, it shall be accomplished under the supervision of an electronic technician or other experienced electronics material or communication officer. In all such work every care shall be taken to insulate from ground the person performing the work and to use every known safety precaution. The following precautions shall be taken:

(a) Provide ample light for illumination.

(b) Remove loose clothing and personal accessories such as bracelets, rings, etc.

(c) Insulate worker from ground with dry wood, several layers of dry canvas, sheets of phenolic insulating material, or a suitable rubber mat depending upon conditions involved.

(d) Cover working metal tools with insulating rubber tape or cambric sleeving (not friction tape).

(e) Use only one hand, if practicable, in accomplishing the work.

(f) A rubber glove should be used on the hand not used for handling tools and, if the nature of the work permits, rubber gloves should be worn on both hands.

(g) Have men stationed by circuit breakers or switches so that the circuit or switchboard can be deenergized immediately in case of emergency.

(h) A man qualified in first aid for electric shock shall stand by during the entire period of repairs.

(2) *Circuits employing 1,000 volts or more.* Voltages in excess of 1,000 volts shall not be measured directly by means of flexible leads or probes. Whenever measurements are necessary on equipment employing potentials in excess of 1,000 volts, the precautions indicated above and the following addi-

tional precautions and procedures shall be observed:

(a) The equipment shall first be deenergized.

(b) High voltage capacitors shall be discharged with a suitably insulated shorting or grounding bar (See art. 67-300.)

(c) Technician shall ascertain that test equipment controls are set correctly for testing high voltage.

(d) Test leads capable of carrying high voltage shall be secured on the desired test points by the technician.

(e) Technician shall withdraw from the equipment under test making sure he is also free from leads and in good position for making correct meter readings.

(f) Equipment shall be energized by assistant standing by switch.

(g) After necessary reading is made, equipment shall be deenergized and high voltage capacitors shall be discharged before removing test leads.

(h) For each measurement, the above steps shall be repeated as applicable.

67-295. ADJUSTMENT OF ELECTRONIC TRANSMITTING EQUIPMENT

Transmitter adjustments shall not be made while motor generators are running or rectifiers are energized unless they can be accomplished by the use of the exterior controls normally provided for this purpose.

67-296. INTERLOCKS AND SAFETY DEVICES

Safety devices, such as interlocks, overload relays, and fuses shall not be altered or disconnected except for replacement, nor shall safeguard circuits be modified without specific authority of the Bureau of Ships in each case. Periodic tests and inspections shall be made to insure that they are functioning properly.

67-297. ALL PROTECTIVE ENCLOSURES TO BE KEPT CLOSED AND PERMANENT PROTECTIVE GROUNDS MAINTAINED

All fuse boxes, junction boxes, lever type boxes, and wiring accessories shall be habitually kept closed except when necessary to open. Care shall be exercised to ground effectively and to maintain such protective grounds on all metal enclosures for electrical and electronic equipment. (See ch. 60 of this Manual, arts. 60-24 through 60-26.)

67-298. AVOID TROUBLE DUE TO CARELESS HANDLING OF LOOSE METAL PARTS OR LIQUIDS

No person shall take loose metal parts or liquids near or above a starter box or above open electronic equipment. No person shall go above open electronics apparatus with loose metal objects attached to clothing. Stowage or insertion of foreign articles in or near switch-gear, control appliances, panels, etc., is forbidden.

67-299. DISCHARGE AND GROUND CIRCUITS

The electrical charge retained by electrical machinery when secured is in certain cases sufficient to cause a severe shock. This shall be considered when making connections to an apparently dead machine. Be safe—discharge and ground all machinery and power tools using an adequately insulated lead for this purpose.

67-300. DISCHARGE CAPACITORS

Prior to touching a capacitor which is connected to a deenergized circuit, or which is disconnected entirely, short circuit the terminals using a suitably insulated lead, shorting or grounding bar for this purpose.

67-301. USE OF PORTABLE CABLE OR LEADS

Portable cables shall be carefully selected for use with safety under the conditions involved. They shall be adequately insulated and of proper length and cross-sectional area. Spliced portable cables are extremely dangerous and shall not be used. (See also ch. 60 of this Manual, arts. 60-25 and 60-30.)

67-302. METAL FITTINGS OF WOOD MASTS AND SPARS TO BE GROUNDED

All metal fittings installed on wooden masts and wooden spars of ships shall be effectively grounded by suitable metallic strips, preferably copper not less than 1¼ inches wide by ¼₁₆ inch in thickness, in accordance with instructions issued by the Bureau of Ships.

67-303. WORK ON TRANSMITTING ANTENNAS

(1) Personnel shall not be permitted to go aloft while antennas are energized by electronic transmitting equipment except by means of ladders and landings rendered safe by grounded hand rails or similar structures unless it is definitely determined in advance by suitable tests that no danger exists. This will prevent casualty due to involuntary relaxation of the hands which might occur if a small spark is drawn from a charged piece of metal or section of rigging. The spark itself may be quite harmless. The voltages, or resonant circuits, set up in a ship's structure or section of rigging will cause shock to personnel or produce open sparks when contact is broken or when momentarily in contact with a metallic object. Personnel of the deck force or others working on rigging shall be warned regarding the hazards which may exist and the precautions to be observed. Safety belts shall be employed when working aloft to guard against falls. (See art. 67-309.)

(2) The above precautions should be observed also when other antennas in the immediate vicinity are energized by electronics transmitters unless it is definitely known that no danger exists. Other antennas may be interpreted to mean any antennas on board another ship moored alongside or across a pier or at a nearby shore station.

(3) There is serious danger to men aloft from falls caused by radar or other antennas which rotate or swing through horizontal or vertical arcs. Motor switches controlling the motion of radar antennas should be tagged and locked open before men are allowed aloft within dangerous proximity to such antennas.

67-304. PRECAUTIONS WHILE SHIP IS IN DRYDOCK

The electronic equipment of the ship may be energized only with the express permission of the docking officer. The hull must be adequately grounded. Excitation is not to be applied to sonar transducers unless properly immersed. Hoist mechanisms are to be operated only after it has been definitely ascertained that adequate clearance exists for the moving elements within their full limit of travel and that no mechanical damage will be incurred by such operation. This determination is to be made as soon as practicable after the dock is unwatered and if insufficient clearance does exist, positive steps are to be taken to prevent lowering of the transducer by gravity, manual, or power operation.

67-305. CLEANING OF ELECTRONIC EQUIPMENT

(1) All electronic equipment shall be cleaned to assure good performance and not for appearance only.

(2) Steel wool or emery in any form shall not be used on or near electronic equipment.

(3) Sandpaper and files shall be used only with competent advice or not at all.

(4) The use of a vacuum cleaner with nonmetallic hose and adequate dust receiver is to be resorted to wherever practicable.

(5) The use of solvents is to be resorted to only where absolutely necessary and in conformance with BuShips Manual, articles 15-8 and 67-306 and 67-307.

67-306. USE OF SOLVENTS

Alcohol or other inflammable solvents shall not be used on energized equipment or on equipment near other electronic equipment from which a spark is possible. They shall be exposed in the smallest possible quantity and shall be used only in well-ventilated compartments. Except in locations wholly in the open, alcohol shall be limited in quantity to one pint.

67-307. USE OF VOLATILE LIQUIDS

(1) When working with volatile liquids such as insulating varnish, paint, lacquer, turpentine, kerosene, and carbon tetrachloride, ample ventilation shall be provided to prevent accumulation of inflammable or noxious vapors. (See BuShips Manual, ch. 15-8.) Suitable warning signs shall be posted in locations where dangerous vapors may accumulate. (See art. 67-284, also ch. 60 of this Manual, arts. 60-38 through 60-41.)

(2) Careless use of carbon tetrachloride may

result in headache, dizziness, nausea, loss of consciousness, and even death. The widespread use of this solvent as a general cleaning fluid or degreasing solvent is not warranted because of numerous substitute materials developed for various purposes and which can be used in most cases. Whenever practicable, carbon tetrachloride if used should be used topside or in the open and never in a small inadequately ventilated compartment. Every effort should be made to prevent direct contact of the liquid with the skin or breathing any of the vapor. (See art. 67-308 (3) regarding creation of poisonous gas.)

67-308. ELECTRICAL FIRES

(1) In case of electrical fire:

(a) Deenergize the circuit for equipment involved.

(b) Sound alarm in accordance with station regulations or ship's fire bill.

(c) Report fire to officer of the day, or other designated duty officer by messenger or telephone in accordance with local instructions.

(d) Secure ventilation.

(e) Attack the fire with equipment available in the immediate vicinity such as portable 15-pound CO₂ extinguishers, requesting assistance as necessary.

(2) When extinguishing an electrical fire, it should be remembered that quick action is required only to deenergize the circuit. When this has been done—STOP! LOOK! THINK! *The use of CO₂ (carbon dioxide) fire extinguisher directed at the base of the flame is always best for all electrical fires.*

(3) Pyrene or carbon tetrachloride although effective for extinguishing an electrical fire, creates certain hazards when in contact with hot metal, because it changes to a poisonous gas, phosgene, which even in open air produces conditions endangering personnel. Pyrene or carbon tetrachloride, therefore, shall never be used for fires of electrical origin. A stream of salt water or foam directed against an energized circuit can conduct current to and shock fire fighters. The same danger is present, though to a lesser extent, when fresh water is used. Extreme care must, therefore, be used when employing these extinguishers around energized electrical circuits. Foam type fire extinguishers shall never be used in fighting electrical fires. In case of cable fires in which the inner layers of insulation, or insulation covered by armor, support combustion, the only positive method of preventing the fire from running the length of the cable is to cut the cable and separate the two ends. (See ch. 60 of this Manual, arts. 60-42 and 60-43.)

67-308. HIGH FREQUENCY OPERATING HAZARDS

(1) The use of electronic equipment in the frequency range of 30 megacycles and below will cause voltages to be induced in the standing rigging and other portions of a ship's structure that, under

certain conditions, must be considered hazardous. Operation in the higher frequencies (above 30 megacycles) is not considered hazardous in this respect due to the remote location of antennas from the normal working areas in a ship. The voltages, or resonant circuits, set up in a ship's structure or rigging will cause shock to personnel or produce open sparks when contact is made or broken, the circuit opened, or when momentarily in contact with other metallic objects. During the handling of ammunition, volatile liquids, or gases, particularly fueling operations involving delivery of gasoline from hoses, spouts, cans, or any place where gasoline vapors are present, adequate precautionary measures must be taken to nullify the hazards mentioned above. (See ch. 15 of this Manual.) The danger of firing electrically detonated guns, ammunition, VT fuses, destructors, and other electrically controlled circuits is not great under normal conditions, since construction of these units effectively shields their firing circuits. During the handling of ammunition, volatile liquids, or gases where booms, cranes, or burtoning wires are used, the following precautions must be observed:

(a) Call attention of the deck force or others to hazards involved.

(b) Use an insulated steering hook for guiding boom or crane cables.

(c) Insulate loading hook from burtoning wire, crane, or boom cables by use of manila rope or strain insulators.

(d) Observe all safety precautions with respect to ventilation, dangers from sparking, insulation of rigging, etc., as listed in chapters 15 and 18 of this Manual.

(2) The hazards referenced above exist mainly due to the operation of the ship's own electronic transmitting equipment. Caution must be exercised also when the antennas of a nearby ship or shore station are energized.

(3) Although the many variables encountered on service installations preclude approximation of the possible voltages encountered, the following examples are cited:

(a) Excessive radio frequency pickup from ship antennas has been noted on smokestack guys, davit head spans, and the like.

(b) A similar high radio frequency pickup has been observed on board ship particularly carriers when reeling in or paying out wire cable and wire hawsers when the length involved becomes resonant to the emitted frequency.

67-310. PRECAUTIONS REGARDING ELECTRICAL DETONATORS OR IGNITORS

Electrical detonators or ignitors, electrically fired rocket motors, or electric fuses (ordnance) shall not be located in the same compartment with, or be exposed within five feet of, any exposed electronic transmitting apparatus or exposed antenna

or antenna lead aboard ship or at a shore electronics activity. No danger due to radio frequency potentials exists with percussion detonators or detonators of any type while in a covered metal container.

67-311. OPERATING HAZARDS AT SHORE INSTALLATIONS

At shore installations, although the hazard conditions improve due to the fact that the space available permits greater separation of antennas and leads from other circuits and structures, the increased power of transmitting equipment increases certain hazards.

(1) The grounding of isolated metal parts wherever feasible and the bonding of parts together where grounding is not feasible is helpful in reducing fire hazards and interference. Metal used in building structures, and particularly in wood structures, shall be grounded.

(2) The fueling of motor vehicles in proximity to antennas and antenna down leads should be avoided or conducted with special precautions. An ungrounded automobile, an ungrounded filling nozzle, the attendant's body capacity—in close

proximity to transmitting antennas and down leads will produce sparks sufficient to ignite gasoline vapor when the nozzle contacts the tank opening. Pump nozzles must be grounded at all times, and motor vehicles must also be grounded when fueling and before opening the tank. (See ch. 15 of this Manual.)

67-312. PRECAUTIONS FOR HANDLING CATHODE RAY TUBES

Wear goggles to protect eyes from flying glass particles in event of envelope fracture which might cause implosion due to high vacuum within tube. Goggles which provide side and front protection and have clear lenses which will withstand a fairly rigid impact test are prescribed. Remove tube from packing box with caution, taking care not to strike or scratch the envelope. Insert into equipment socket cautiously, using only moderate pressure. Do not jiggle the tube. These precautions also apply when removing tube from equipment socket. Do not stand directly in front of the tube face. If the tube should implode, the tube base often is propelled directly forward with a velocity sufficient to cause severe injury. (See art. 67-217 (2).)

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