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## CHAPTER 2

# PUBLICATIONS AND DIRECTIVES

Electronics and electronic maintenance are subjects in which there is no shortage of readily available general reference material. Such material includes texts, handbooks, bulletins, instruction books, and technical maintenance publications. The purpose of this chapter is to identify some of the more pertinent reference materials and to provide a brief description of the contents of each. For up-to-date course numbers, check the current edition of *List of Training Manuals and Correspondence Courses* (NAVEDTRA 10061).

Electronics technical publications include manufacturer's technical manuals and various handbooks, bulletins, and manuals published by the Naval Sea Systems Command (NAVSEA), formerly NAVSHIPS, and the Naval Electronics System Command (NAVELECSYSCOM/NAVELEX). Navy Stock List of Forms and Publications Cognizant Symbol I (NAVSUP 2002), furnishes a complete list of NAVSEA/NAVSHIPS technical publications along with the instructions for ordering these publications through the Navy Supply system.

### THE ELECTRONICS INSTALLATION AND MAINTENANCE BOOK (EIMB)

In this chapter, frequent reference is made to the EIMB (*Electronics Installation and Maintenance Book*). The EIMB has been established as the medium for collecting, publishing and distributing, in one convenient documentation source, those subordinate maintenance and repair policies, installation

practices, and overall electronics equipment and material-handling procedures required to implement the major policies set forth in chapter 9670 of the NAVSEA/NAVSHIPS Technical Manual. In addition, selected information of general interest to electronic installation and maintenance personnel contained in textbooks, periodicals, or technical papers is included to form a single source reference document. The EIMB is used by all military and civilian personnel involved in the installation, maintenance, and repair of electronic equipment under the cognizance, or technical control, of the Naval Sea Systems Command and the Naval Electronics Systems Command. Maintenance technicians should be thoroughly familiar with all information, instructions, and procedures in the EIMB. This publication supplements the instructions, and procedures in the EIMB. This publication supplements the instructions and data supplied in equipment technical manuals and other approved maintenance publications.

The EIMB, (NAVSEA/NAVSHIPS 0967-LP-000-0000), consists of 13 handbooks. The complete set of books or separate handbooks and changes thereto, may be ordered using the proper stock number for each.

The first six handbooks of the EIMB cover a particular kind or class of equipment and are known as equipment oriented handbooks: *Communications* (NAVSEA/NAVSHIPS 0967-LP-000-0010); *Radar* (NAVSEA/NAVSHIPS 0967-LP-000-0020); *Sonar* (NAVSEA/NAVSHIPS 0967-LP-000-0030); *Test Equipment* (NAVSEA/NAVSHIPS 0967-LP-000-0040); *Radiac* (NAVSEA/NAVSHIPS 0967-LP-000-0050); and *Countermeasures*

(NAVSEA/NAVSHIPS 0967-LP-000-0070). Each handbook is divided into the following sections: General; Circuit Applications; Field Change Identification Guide; Service Notes; and Reference Data. The Reference Data section is oriented toward the equipment category covered in the handbook.

The last seven handbooks are known as general information handbooks. The titles give only a clue as to their content. A brief description of each handbook and stock number, therefore, will be helpful.

General (NAVSEA/NAVSHIPS 0967-LP-000-0100), is an introduction for the entire series. It describes the contents of the other general handbooks, provides a general outline of administrative information of special interest to maintenance personnel. It also contains three indexes identifying the location of data contained in the *Electronics Information Bulletin* (EIB) and in the thirteen handbooks of the EIMB series.

Installation Standards (NAVSEA/NAVSHIPS 0967-LP-000-0110), provides data which is considered to be of primary interest to installation personnel. It describes procedures, parts, and special considerations involved in equipment installation. Subjects covered include equipment handling, equipment location and mounting, interconnection cabling and wiring, RF transmission lines, antennas and detection devices, and general information on soldering, welding, and brazing.

Electronic Circuits (NAVSEA/NAVSHIPS 0967-LP-000-0120), contains descriptions of electronic circuits commonly encountered in all types of equipment. The handbook covers both electron tube and semiconductor circuits; each circuit description includes the application of the particular circuit, its characteristics, an analysis of operation, and a discussion of failures based on input/output signals. Some of the categories are: power supplies, amplifiers, oscillators, multivibrators, mixers, and logic circuits.

Test Methods and Practices (NAVSEA/NAVSHIPS 0967-LP-000-0130), describes the use and application of test equipment in the installation and maintenance of all manner of electronic gear. ((*The Test Methods* Handbook, however, should not be

confused with *The Test Equipment Handbook* (NAVSEA/NAVSHIPS 0967-LP-000-0040), which is concerned with maintenance of test equipment; not its use)). The *Test Methods and Practices Handbook* contains descriptions of all types of measuring devices, and explains the use of test equipment in performing certain basic measurements.

Reference Data (NAVSEA/NAVSHIPS 0967-LP-000-0140), contains all types of pertinent information required by maintenance personnel, but which cannot logically be placed in any of the other general-series handbooks. Such information includes various color and identification codes, formulas and mathematical data, and other handy lists and tables; i.e., prefixes for the powers of ten, logs, decimal/metric/inch equivalents, etc.

Electromagnetic Interference Reduction (NAVSEA/NAVSHIPS 0967-LP-000-0150), presents material relative to the causes, effects, detection, measurement, and methods for elimination of radio-frequency interference.

General Maintenance (NAVSEA/NAVSHIPS 0967-LP-000-0160), discusses procedures that should be followed in trouble shooting and maintaining all types of electronic equipment, and is to be used as a guide in forming and maintaining good shop practices. Some of the information included covers equipment level maintenance, maintenance of subassemblies and modular components, and testing and replacing individual parts.

## SECURITY AND ORGANIZATION PUBLICATIONS

Security guidelines are discussed in the *Department of the Navy Information Security Program Regulation* (OPNAVINST 5510.1); which also incorporates regulations from the *Department of Defense Information Security Program Regulation* (DOD 5200.1-R). The DOD regulations that are incorporated into OPNAVINST 5510.1 appear in boldface type. OPNAVINST 5510.1 contains definitions of terms and information relative to the following: security education and training; classification of official information; the individual's responsibilities regarding stowage,

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accountability, disposition, destruction, and transmission of classified material; security violations and compromises; control of discussion, disclosure, photography, reproduction, visitors, and personal censorship; communication security; and personnel security investigations and clearances.

*NAVSECGRU Security and Emergency Destruction* (NSGTP 69305), is a classified publication which was prepared under the modular concept (the modular concept is discussed below), in an effort to bring security material of a relevant nature into a training publication.

This publication is composed of nine chapters which contains information that you as a CTM will require in fulfilling your duties and responsibilities in relation to security methods and practices within the Naval Security Group, as well as within the Navy.

*Naval Cryptology In National Security* (NSGTP 69304), is a classified publication available at all Naval Security Group activities. It was designed to provide Naval Security Group personnel with a general orientation of the national cryptologic community with particular emphasis on its mission, functions, and organization.

Information concerning mandatory and recommended courses as well as other sources of CTM study material is contained in NAVSECGRUINST 1552.1.

### SAFETY

Nothing in the CTM training program can be more important to the individual than his own safety and the safety of his fellow workers. Because this is such a personal matter, its importance should be obvious. In few other fields of work is the expression "carelessness kills" more appropriate.

Electronic equipment and circuits are potentially dangerous. As you, the apprentice technician, become more familiar with your job, you may tend to become less cautious when operating or maintaining electronic equipment. The dangers of electrical shock, exposure to toxic solvents or radioactive substances in

electron tubes, or breakage of cathode ray tubes do not decrease with familiarity of maintenance procedures. The possibility of danger, in fact, increases as job familiarity increases. It is, therefore, incumbent upon you to remain up-to-date through continuous application and review of basic electronic safety precautions. The following paragraphs provide a brief description of the sources of information related to safety as it applies to electronics maintenance.

*Safety Precautions for Shore Activities* (NAVMAT P-5100), promulgates the safety policies established by the Chief of Naval Material for all naval activities. It is applicable to all naval personnel, both military and civilian, and to all naval commands and activities ashore. It covers all aspects of safety and is basic and general in nature.

*NAVSEA/NAVSHIPS Technical Manual* (Chapter 9670), Electronics, sets forth Naval Sea Systems Command policies and instructions for the handling of electronic material under its cognizance or technical control. Section V (Safety), discusses the safety precautions that must be observed by electronics maintenance personnel.

*EIMB, General*. Section 3 of the EIMB, General handbook, provides recommended practices for prevention and elimination of hazards to personnel ashore and afloat. The EIMB, in its role as a central source of electronics information, expands upon the safety precautions discussed in the previously mentioned publications. Section 3 covers the responsibilities for safety, general safety precautions, operating hazards, electrical fires, lightning, electrical shock, use of warning signs and tags, and information concerning resuscitation and artificial respiration.

### ELECTRICITY AND ELECTRONICS

It is normally a prerequisite for the CTM to be a graduate of the Communications Technician "M" Class A School. This text will not, therefore, repeat basic electronics theory. It is suggested, however, that the latest editions of *Basic Electricity* (NAVEDTRA 10086), *Basic Electronics* (NAVEDTRA 10087), and their

associated correspondence courses be taken and studied as an aid in preparation for advancement, as well as for the usefulness of the knowledge in the performance of your daily tasks. It is impractical to list here all the subjects covered by these two courses, but you can be assured that upon completion of these courses you will be one of the better informed technicians in the Naval Security Group.

*Principles of Radio Wave Transmission* (NAVEDTRA 10250), (formerly NSGTP 68310), was the first in a series of common modules which will ultimately include all subject areas which are common to two or more CT ratings. The purpose of the "common" approach is to eliminate the excessive duplication of information in the current training publications. That is, the information included in NAVEDTRA 10250 will not be included in future editions of the various rate training manuals and Naval Security Group training publications which now contain such information. Additionally, the common modules will be smaller in size, thus facilitating more frequent and timely revisions. *Principles of Radio Wave Transmission* (NAVEDTRA 10250), and its assignment booklet NAVEDTRA 13001 (formerly NSGTC 2441), are intended to provide personnel with the basic concepts of sinewaves and radio wave propagation. Although basic in content, it is suggested that this training course be studied as an aid in making you a more knowledgeable technician.

*Radio Wave Modulation and Signal Multiplexing* (NSGTP 68311), contains information on sinewave characteristics; frequency, phase, amplitude, and pulse modulation; single sideband; frequency and time division multiplexing. The purpose of this publication is to provide the technician with the most basic knowledge of several extremely complex subjects. In keeping with the modular concept, the information contained in NSGTP 68311 and its associated training course NSGTP 2442 will not be included in this RTM. It is therefore recommended that this training course be taken and studied.

*Digital Computer Basics* (NAVEDTRA 10088), is intended for use as a basic reference for all personnel whose duties require a

knowledge of the fundamentals of electronic data processing. It presents a coverage of the basic concepts of computers and automatic data processing. Emphasis is placed on logic functions and the theory of operation for representative data processing circuits and components.

This manual presents background information and introduces the concepts of data processing systems. It provides an introduction to number systems and Boolean Algebra so that computer logic and symbology can be understood prior to any discussions of the actual operation of computer circuits. Basic operations of representative computer sections such as the control unit, arithmetic unit, memory and storage unit, input/output units, and their interrelationships are discussed. Some of the circuits commonly used in each section are then presented. The principles of programming are presented in three parts.

Part I covers basic programming concepts; Part II establishes characteristics and assumes a repertoire of instructions for a hypothetical computer, explaining how the computer interprets these instructions and operates using machine language; and Part III explains the purpose and uses of compilers. Following Part III, the basic principles of analog to digital and digital to analog conversion are presented. There are many applications in which these conversions are necessary in problem solving. For example, data received from a radar set, as airspeed probe, or a shaft position (all are analog in nature) must be converted to digital computer applications.

Conversely, digital output control data must be converted to analog for control of shaft positioning, cathode ray tube beam positioning, oscilloscopic sweeps, or to drive other types of analog circuits. The text also shows how diagnostic maintenance routines (maintenance programs) are used to isolate malfunctions in a data processing system.

## EQUIPMENT TECHNICAL PUBLICATIONS

The satisfactory performance of modern electronic equipments and the accomplishment of a station's mission depend to a great extent upon the maintenance procedures employed by

the maintenance technician. The publications listed in the following paragraphs provide general maintenance procedures and information, and are guidelines for all electronics maintenance personnel.

### EQUIPMENT TECHNICAL MANUALS

Equipment technical manuals are prepared in accordance with military specifications. Since these specifications change periodically, the technical manuals you will be using may differ in title and arrangement of chapters to meet specifications applicable at the time of printing. The following information from military specification, MIL-M-15071G, 01 Aug 1969, reflects current equipment technical manual style.

The major divisions of a technical manual are: front matter, technical content, appendixes, index and user activity comment sheets. Front matter consists of a cover and title pages, a list of effective pages, a record of changes page, a table of contents, a list of illustrations, and a list of tables.

In a multi-volume manual, Volume I contains a complete table of contents and list of illustrations covering all volumes, while the remaining volumes contain their own individual listings. Volume I provides a central source for locating subjects in the manual.

#### Technical Content

Technical content is divided into eight chapters which contain the substance of the manual. The following is a brief outline of chapter contents.

Chapter 1—General Information. This chapter contains information which can be easily reviewed to determine the purpose, physical and functional characteristics, and the operational capabilities of the equipment covered. It contains illustrations of the major units showing relative size of the units, basic interconnections, etc. The latest field changes and factory modifications are included.

Chapter 2—Operation. This chapter includes all procedures necessary to enable operating personnel to efficiently and effectively use the equipment. This comprises routine and

emergency operating instructions, safety precautions, operating limits, operator equipment checks, and operator maintenance action.

Chapter 3—Functional Description. This chapter contains a detailed analysis of the principles of operation and major functions of the over-all equipment. This information is provided in three levels; over-all analysis, major functional analysis, and circuit-level analysis.

Chapter 4—Scheduled Maintenance. This chapter contains preventive maintenance procedures and performance test instructions to be accomplished on a scheduled basis. The preventive maintenance interval, action required, procedures to follow, and required performance tests are found here.

Chapter 5—Troubleshooting. This chapter contains information required to enable the technician to locate malfunctions. This includes troubleshooting procedures and diagrams, signal-flow diagrams, control diagrams, power-distribution diagrams, maintenance schematics, logic diagrams, and flow charts.

Chapter 6—Corrective Maintenance. This chapter contains all instructions required to adjust, align, remove, repair, reinstall and realign all repairable parts and assemblies. This includes the action required, any necessary safety precautions, the tools required, test equipment, parts and materials, and control settings and set-up instructions needed to complete the repair.

Chapter 7—Parts List. This chapter identifies all shipboard, tender and shore-based repair parts including attaching hardware. The part name, description, part number, and manufacturer are listed. Illustrations are included which show parts location.

Chapter 8—Installation. This chapter includes drawings and information of all phases of installation work from site selection to installation verification tests. Some examples of the information provided are unpacking and handling instructions; special tool and material requirements; site selection and preparation; environmental, electrical, and space requirements; and test procedures for check-out.

## SYMBOLIC INTEGRATED MAINTENANCE MANUAL

The Symbolic Integrated Maintenance Manual (SIMM), provides information on a particular equipment and contains functional description, installation procedures and directions, theory of operation, troubleshooting, maintenance and repair, and spare parts. The SIMM is normally associated with test equipment and does not normally meet MILSPEC's.

This manual is similar in content to the equipment technical manuals previously discussed, but is written in a more concise form designed to aid both the experienced and the inexperienced technician in the maintenance, alignment, and repair of the equipment as expeditiously as possible. Its main superiority is that it contains a detailed troubleshooting chart. The data content and its method of presentation is discussed below.

### Section 1.—General Information.

The general information section consists of reference data on the equipment. This information is for the use of command level personnel and others requiring a general summary of the equipment, its performance, advantages and limitations, and the relationships of the units.

### Section 2.—Theory of Operation.

The theory of operation is presented by blocked schematic, precise-access block diagrams and blocked test. These presentations are described in the following paragraphs.

(a) **Blocked Schematic.**—The blocked schematic diagrams are schematics of hardware items arranged in block form. Blue and gray shaded areas are used to denote the functional and physical location of the circuit elements. Specifically, they denote the following:

Each area of blue denotes a functional entity, which comprises all circuit elements included in accomplishing a circuit function. Each functional entity is identified by a circuit-identifier code that indicates the active element, the circuit function, and the numeric occurrence of the same type of functional entity on the schematic. The functional entity is enclosed in the lightest blue shade. Subfunctional entities are one shade darker than

the shade of the grouping of subfunctional entities to which they belong.

The gray-shaded areas denote the physical location of the circuit elements. The level of physical location is shown by the lightest shade of gray. Subordinate locations are shown by increasing densities of gray shading.

(b) **Precise-Access Block Diagram.**—The precise access block diagram shows all the functional entities within a unit, signal flow within the unit, and all cabling and wiring within the unit. Each functional entity shown by symbols, is identified by the circuit-identifier code and blue shading used on the block schematic diagram. Gray shading, showing physical location of the functional entities, is also used on the precise-access block diagram.

(c) **Blocked Text.**—Blocked text is presented on a page facing the blocked schematic diagrams and the precise-access block diagrams. The arrangement of the blocked text is identical to that of the associated diagram. Concise text of high information content, pertaining only to the functional entity being described, is substituted for the circuit elements or symbols in the respective blue-shaded area. The circuit-identifier code is included with the text to aid in identification.

### Section 3.—Maintenance Information.

Maintenance information is divided into two categories: checkout and trouble isolation; and alignment, adjustment, and repair data. Checkout and trouble isolation is presented on maintenance dependency charts, and alignment adjustment and repair data is presented on the assembly maintenance data pages. The data presented by both methods is as follows:

(a) **Maintenance Dependency Chart.**—The maintenance dependency chart displays the sequence of power or signal flow in the equipment. Each horizontal line displays an event such as a lamp lighting, a relay energizing, or an availability of a signal or voltage. Symbols on the event line indicate the functional entities, circuit elements, or previous events that the event is dependent on. The symbols are located within the vertical columns, which identify the functional entities and circuit elements. When an event or signal availability is not present, the previous events, signal

**ELECTRONIC INFORMATION BULLETIN**

The EIB (Electronic Information Bulletin), NAVSEA 0967-LP-001-3XXX, published every two weeks by the Naval Ship Engineering Center, is forwarded to all naval ships and to naval electronics installations and maintenance activities. It contains advance information on field changes, installation techniques, beneficial suggestions adopted by various yards and bases, and new publications. The information is both authoritative and directive in nature, and reference may be made to a particular issue as the authority for adoption of ideas contained therein. In general, it is devoted to information which is of primary benefit to the activities to which it is distributed. Confidential issues (CEIBs) are published when sufficient classified data warrants. The EIB is not intended to be a permanent-type publication. For this reason, articles of lasting interest are picked up and incorporated in the EIMB for future reference. EIB-published field changes are listed in the EIMB along with pertinent data, but the EIMB does not include the procedural steps for their accomplishment as does the EIB. This information is contained in official NAVSEA field change bulletins listed in the EIMB which are stocked by U. S. Naval Publications and Forms Center, Philadelphia, Pa. 19120. In order to maintain an up-to-date EIMB, a box score is published periodically in the EIB which lists, by handbook, the latest changes in effect, ordering information, the latest EIB covered, and the cutoff date for the latest field changes incorporated in the FCIG (Field Change Identification Guide) sections of the handbooks.

The NAVSEA numbers for EIBs are the same as the NSNs (National Stock Numbers) for ordering them. This relationship between NAVSEA numbers and NSNs also exists for EIMBs as well as various other NAVSEA publications.

**ENGINEERING AND MATERIAL BULLETIN**

The EMB (Engineering and Material Bulletin), published by Naval Security Group Command, is an unclassified informal vehicle for sharing technical knowledge or material information especially pertinent to

availabilities functional entities, and circuit elements on which the event is dependent can be readily ascertained. Three different types of symbols are used to indicate the accessibility of the point where the event or signal may be measured or observed. The three symbols, and what each symbol indicates, are as follows:

A black box with white letters— the event can be recognized from outside the equipment.

A gray box with black letters— the event can be recognized or measured at a readily accessible point within the equipment.

A white box with black letters— a circuit point at which an event or signal availability may be measured. This circuit point is not necessarily readily available.

The circuit identifier codes and all symbols used on the diagrams and maintenance dependency charts are shown in tabular form with an explanation of their meanings in each manual. In order to use diagrams and maintenance dependency charts effectively, the technician must familiarize himself with symbols used and their meanings.

(b) Assembly Maintenance Data.—The assembly maintenance data pages contain data necessary to align, adjust, remove, replace, disassemble, reassemble, and test the unit and components of the unit.

Section 4. Parts listing data is only provided for parts that may be replaced during maintenance of the equipment. The parts listing data arrangement is explained in the following paragraphs.

(a) Assembly Location and Description.—The assembly location and description page provides photographs that identify the equipment and the locations of the subassemblies. A tabular listing provides the name, manufacturer, and part number of the equipment and subassemblies.

(b) Electronic Parts List.—The electronic parts list comprises a photograph or line drawing with a superimposed blue grid and a tabular listing. The tabular listing provides the reference designation of the part, grid coordinates of the parts location, description of the part, name of manufacturer, and part number.

(c) Mechanical Parts List.—Except that there is no reference designator, the mechanical parts list is identical to the electronic parts list.

NAVSECGRU maintenance personnel. The EMB is normally published on a quarterly basis and it is distributed to all NAVSECGRU elements with a maintenance shop. The EMB is not authoritative and cannot be cited as authority to perform equipment modifications. However, reference may be made to particular issues for discussion purposes. The back page of the EMB is a User's Comment Sheet which may be used to submit informal comments and recommendations relative to electronics maintenance techniques, facilities, and supply matters which are of sufficient interest or importance to warrant wide dissemination.

### ADMINISTRATION AND SUPPLY

As a CTM, you will be responsible for preparing various maintenance records and reports. You may also be responsible for ordering/requisitioning spare or replacement parts and equipment.

The procedure, following repair of an equipment, usually includes completion of a trouble chit or worksheet, a log entry, completion of a 4790.4 Maintenance Action Form, and possibly a parts requisition. You will also be required to make entries on Cross-Connect Record Sheets, and Resistance Test Record Cards.

The *EIMB General* handbook, chapter 2, contains the basic information on electronic administration, supply, reports, and publications of value to the technician. It is the basis for all procedural guidance related to electronics administration.

The *NAVSEA/NAVSHIPS Technical Manual* is one of the most complete authoritative references available on shipboard-installed equipment.

It is issued in three volumes: Vol. I, NAVSEA/NAVSHIPS 0250-LP-000-0010; Vol. II, NAVSEA/NAVSHIPS 0901-LP-000-0020; Vol. III, NAVSEA/NAVSHIPS 0901-LP-000-0030.

Chapter 9670 of the manual is titled "Electronics", and is required reading for all electronics personnel. This chapter is available as a separate pamphlet (NAVSEA/NAVSHIPS 0901-LP-670-0002), and two copies per ship or

station are usually required, one for the shop and one for the electronics officer. Chapter 9670 lists other chapters containing information of value to electronics personnel.

Chapter 9670 provides the major policies and instructions pertaining to electronics repair and material aboard ship or ashore.

The information contained in the latest revisions to manuals, instructions, and notices referred to in chapter 9670 apply in all cases. The index includes a list of applicable instructions, notices, and publications in effect at the date of preparation of the chapter.

The *NAVSEA Journal* is produced monthly by Naval Sea Systems Command and contains useful information on all aspects of shipboard equipment. It contains information which supplements and clarifies information contained in NAVSEA/NAVSHIPS publications and presents information on new equipment, policies, and procedures.

*Procurement and Inventory of Equipment System (PIES)* Manual, NSGINST 2300.1, prescribes the procedures to be followed for control, inventory, and utilization of electronic/communications equipment under the management control of COMNAVSECGRU.

PIES provides the basic source of information for NAVSECGRU planning and programming decisions to meet operational requirements. The PIES information aids all levels of management by allowing positive control of equipment from the time programming action is initiated through budgeting, procurement, delivery, and individual station accounting, until final disposition when the equipment is removed from COMNAVSECGRU accountability.

Maintenance technicians should become familiar with chapters 3 and 4 of this instruction. *Maintenance and Material Management System within the Naval Security Group* (NSGINST 4790.4), prescribes the necessary policy guidance, organization, and procedures for implementation of the 3-M (Maintenance and Material Management) system. Chapter 1 is an introduction which explains the 3-M concept, and provides an overall picture of the 3-M system organization and responsibilities. Chapter 2 is a description of the PMS (Planned Maintenance Subsystem). Chapter 3 is a



description of MDCS (Maintenance Data Collection Subsystem). A thorough knowledge of this publication is a necessary requirement for all CTMs.

### NAVY DIRECTIVES ISSUANCE SYSTEM

*Navy Directives Issuance System* (SECNAVINST 5215.1C), establishes a uniform method of issuing directives by all activities in the Navy. A directive is an instruction, notice, or change transmittal that prescribes or establishes policy, organization, conduct, or procedures requiring action or setting forth information essential to the effective administration or operation of activities concerned; or it may contain authority or information that must be promulgated formally.

**Instruction.**—A directive which contains information of a continuing nature or requires continuing action which must be taken but cannot be completed in less than six months. An Instruction has continuing reference value and is effective until the originator cancels or supersedes it.

**Notice.**—A directive of a one-time or brief nature, which has a self-cancelling provision, and which has the same force and effect as an instruction. Usually it will remain in effect for less than six months, but is not permitted to remain in effect for longer than one year. Any requirement for continuing action is contained in a notice, such as the submission of a report, use of a form, or following a specified procedure. The required action is considered cancelled when the notice is cancelled, unless the requirement is incorporated into another suitable document.

**Change Transmittal.**—A change transmittal is the medium used to transmit changes to an instruction or, under extenuating circumstances, a notice. Each transmittal describes the nature of the changes it transmits, and gives directions for making them. Change transmittals are cancelled after appropriate action has been taken.

**Identifying and Numbering Directives.**—Each origination office identifies its directives by (1)

the originator's abbreviation, (2) the type of directive, (3) the subject classification number and (4) a consecutive number, preceded by a decimal point (for instructions only), and (5) an alphabetic suffix (for revisions to an instruction). For example:

(1)	(2)	(3)	(4)	(5)
SECNAV	INSTRUCTION	5215	.1	A

Each directive is assigned a subject number from the *Department of the Navy Standard Subject Identification Codes Manual* (SECNAVINST 5210.11).

**Security Identification.**—The security classification of confidential or secret instructions and notices is indicated by prefixing the subject numbers by "C" for confidential, and by "S" for secret.

### CORRECTIONS TO TECHNICAL PUBLICATIONS

In addition to his daily maintenance duties, the cryptologic technician utilizes a large number of technical publications and manuals. Of particular importance are those publications issued by the Naval Sea Systems Command.

Corrections to publications may take the form of pen-and-ink corrections, page changes, or paste-in corrections. All corrections must be recorded for future reference. Pen-and-ink corrections published in the EIB are recorded by entering the EIB number adjacent to each pen-and-ink correction as the authority for the correction and by making the appropriate entries of the Record of Corrections page if such a page is included in the publication.

The EIB publishes ordering information for changes to technical manuals which involve more than a simple pen-and-ink correction. These changes are ordered through the supply system. All corrections are recorded on the Record of Corrections page, and the authority for making the manual correction is recorded adjacent to each pen-and-ink or paste-in correction.

Publication corrections may also be included in any field changes promulgated within the Electronics Field Change Program. The

Electronics Field Change Program provides operational reliability, and maintainability improvements to existing electronic equipment by means of field changes (alterations or modifications) to equipment. It is as important to make the indicated corrections to the applicable publications as it is to accomplish the alteration or modification to equipment.

Official field changes initially appear in the EIB and then are incorporated into the FCIG (Field Change Identification Guide) section of the EIMB. In addition to providing a current compilation of field changes listed by equipments, FCIGs contain information enabling technical personnel to determine by inspection if the field change has been accomplished and to order the necessary material.

No matter what publication is involved, it is extremely important that publication corrections are entered promptly and exactly as directed. Failure to do this may result in the loss of valuable time spent troubleshooting by using inaccurate or outdated publications or schematics. Even more important is the possibility that using inaccurate or outdated publications may present a safety hazard to personnel or cause damage to equipment. For these same reasons, any errors found in technical manuals must be reported to the cognizant authority as soon as they are detected.

**OTHER SOURCES OF INFORMATION**

*Tools and Their Uses* (NAVEDTRA 10085), is a training manual which provides the technician with descriptive information about tools and their proper utilization and care.

The objectives of this manual are to aid in the maintenance effort by

(a) providing descriptions, general uses, correct operation, and approved maintenance procedures for those handtools and power tools commonly used in the Navy.

(b) indoctrinating all personnel engaged in maintenance work with the importance of good workmanship.

(c) preventing and minimizing personal injury and equipment damage by emphasizing good safety practices.

Upon completion of this manual, you should be able to identify tools and fastening devices by their correct names; cite the specific purposes and uses of each tool; describe the correct operation, care and maintenance required to keep the tools in proper operating condition; and finally, perform accurate measurements.

*Electronics Test Methods and Practices* (NAVPERS 91229) is a training course which is used in conjunction with the EIMB; *Test Methods and Practices Handbook* (NAVSEA/NAVSHIPS 0967-LP-000-0130).

The intricacies of modern electronic equipment demands that the technician have a knowledge of many complex test equipments. This training course is designed to aid technicians in acquiring that knowledge; and to impress upon them the proper methods of maintenance.

**Shipboard Antenna Systems.**—This publication serves as a source of information for those concerned with the installation and maintenance of shipboard antennas. Information contained in this manual supplements, but does not supersede, existing specifications. There are five volumes to this publication, as follows:

NAVSEA / NAVSHIPS 0967-LP-177-3010  
Volume 1 Antenna Shipboard Details

NAVSEA/NAVSHIPS 0967-LP-177-3020  
Volume 2 Antenna Systems Shipboard

NAVSEA/NAVSHIPS 0967-LP-177-3030  
Volume 3 Antenna Systems Shipboard,  
Multicouplers

NAVSEA/NAVSHIPS 0967-LP-177-3040  
Volume 4 Antenna Shipboard Details

NAVSEA/NAVSHIPS 0967-LP-177-3050  
Volume 5 Antenna Systems Shipboard, Data  
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**BLUEPRINT AND DRAWINGS**

Drawing is the universal language used by engineers, technicians, and skilled craftsmen. Whether this drawing is made freehand or with drawing instruments, it is needed to convey all the necessary information to the individual who will fabricate, assemble, or repair the object; whether it be an electrical, electronic, or a mechanical device.

Blueprints are reproduced copies of technical drawings. This section contains general information concerning blueprints. After studying this section you should be able to tell what information is contained on a blueprint, and where this information is located.

Military drawings and blueprints are prepared in accordance with the definitely prescribed standards and procedures set forth in Military Standards (MIL-STDS). These MIL-STDS are listed in the *Department of Defense Index of Specifications and Standards*, which is issued as of 31 July of each year. Common MIL-STDS concerning engineering drawings and blueprints are listed by number and title below.

<u>NUMBER</u>	<u>TITLE</u>
MIL-STD-100A	Engineering drawing practices
MIL-STD-8C	Dimensioning and tolerancing
MIL-STD-9A	Screw thread conventions and methods of specifying
MIL-STD-10A	Surface roughness, waviness, and lay
MIL-STD-12C	Abbreviations for use on drawings
MIL-STD-14A	Architectural symbols
MIL-STD-15 Part No. 1	Graphic symbols for electrical and electronics diagrams part 1A
MIL-STD-15 Part No. 2	Electrical wiring equipment symbols for ships plans part 2

MIL-STD-15 Part No. 3	Electrical wiring symbols for architectural and electrical layout drawings, part 3
MIL-STD-16C	Electrical and electronic reference designations
MIL-STD-17B Part 1	Mechanical Symbols
MIL-STD-17B Part No. 2	Mechanical symbols for aeronautical, aerospacecraft, and spacecraft use
MIL-STD-18A	Structural symbols
MIL-STD-20	Welding terms and definitions
MIL-STD-21	Welded-joint designs, armored-tank type
MIL-STD-22A	Welded joint design
MIL-STD-25	Nomenclature and symbols for ship structure

Military blueprints are prepared as to size, format, location of, and information included, in the various blocks, etc., according to MIL-STD-100A of 1 October 1967. The various parts of a blueprint are described briefly in the following paragraphs.

**TITLE BLOCK**

The title block (figure 2-1) is located in the lower right-hand corner of all blueprints and drawings prepared in accordance with Military Standards. The block contains the drawing number, the name of the part or assembly that the blueprint represents, and all information required to identify the part or assembly.

The title block also includes the name and address of the Government agency or organization preparing the drawing, the scale, drafting record, authentication, and the date.

A space within the title block with a diagonal or slant line drawn across it (not shown in figure 2-1) indicates that the information usually placed in it is not required or is given elsewhere on the drawing.

NNDWG NO. <b>0101 46</b>		NEWPORT NEWS SHIPBUILDING & DRY DOCK CO. NEWPORT NEWS, VIRGINIA FSCM NO. 43689 HULL DESIGN DIV STRUCTURAL DEPT					
DRAWN <i>H.E. Baker</i> CHECKED <i>R.F. Casper</i> SUPVR <i>L. Hanley</i> DATE <i>5/11/68</i>		TITLE <b>AIRCRAFT CARRIER CVAN 68                  DOUBLE BOTTOM                  AFT OF FRAME 180                  COMPARTMENT &amp; ACCESS.</b>					
EXAMINED <i>E.W. Taylor</i> DATE COMPLETED <i>5/17/68</i>		APPROVED <i>D.E. Clark</i> DATE <b>JUL 17 1968</b> FOR SUPERVISOR OF SHIPBUILDING USN					
AUTHORIZED		TYPE OF DWG <b>WORKING DRAWING</b>		SIZE <b>H</b>	CODE IDENT NO. <b>80064</b>	NAVSHIP SYSTEM COMMAND NO. <b>800 2647537</b>	REV. <b>A</b>
		SCALE $\frac{1}{8}'' = 1'$		SHEET <b>1</b> OF <b>1</b>			

A

DES. <i>R. HATHAWAY</i>		DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND <b>U.S. NAVAL STATION, WASHINGTON, D.C.</b>			
DRWN. <i>R. HATHAWAY</i>		<b>INSTALLATION OF NEW LIGHTING                  BLDG. 220-3E4                  WASHINGTON NAVY YARD</b>			
CHK. <i>B.W. Duck</i>					
SUPV. <i>T.A. Barrett</i>					
IN CHARGE <i>E. GRANT</i>					
SATISFACTORY TO <i>W.G. Johnson</i>		CODE IDENT NO. <b>80091</b>	SIZE <b>F</b>	FEC DRAWING NO. <b>1167420</b>	
APPROVED <i>J.R. Jones</i> DATE <i>5/17/68</i> OFFICER IN CHARGE		SCALE $\frac{1}{8}'' = 1'$		SPEC. 82805/68 NBY 82805 SHEET <b>1</b> OF <b>1</b>	
APPROVED <i>John G. Hayes</i> DATE <i>5/12/68</i> PUBLIC WORKS OFFICER					

B

45,159(65)

Figure 2-1.—Blueprint Title Blocks. (A) Naval Ship Systems Command; (B) Naval Facilities Engineering Command.

REVISION BLOCK

The revision block (not shown) is usually located in the upper right-hand corner of the blueprint and is used for the recording of changes (revisions) to the print. All revisions are

noted in this block and are dated and identified by a letter and a brief description of the revision. A revised drawing is shown by the addition of a letter to the original number as shown in figure 2-1A. If the print shown in figure 2-1A was again revised, the letter A in the revision block would be replaced by the letter B.

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**DRAWING NUMBER**

All blueprints are identified by a drawing number, NAVSHIPS or NAVSEA Systems Command (figure 2-1A), or NAVFACENGCOM, NAVELECSYSCOM or NAVELEX drawing (figure 2-1B), which appears in a block in the lower right corner of the title block. It may be shown in other places also; for example, near the top border line in the upper corner, or on the reverse side at both ends so that it will be visible when a drawing is rolled up. If a blueprint has more than one sheet, this information is included in the number block indicating the sheet number and the number of sheets in the series. For example, note that in the title blocks shown in figure 2-1, the sheet is sheet 1 of 1.

**REFERENCE NUMBERS**

Reference numbers that appear in the title block refer to numbers of other blueprints. When more than one detail is shown on a drawing, a dash and a number are frequently used. For example, if two parts are shown in one detail drawing, both prints would have the same drawing number, plus a dash and an individual number, such as, 8117041-1 and 8117041-2.

In addition to appearing in the title block, the dash and number may appear on the face of the drawings near the parts they identify. Some commercial prints show the drawing and dash number, and a line with an arrow to the part; others use a circle, 3/8 inch in diameter around the dash number, and carry a line to the part.

A dash and number are used to identify modified or improved parts, and also to identify right-hand and left-hand parts. Many parts on the left-hand side of an object are exactly like the corresponding parts on the right-hand side—in reverse. The left-hand part is usually shown in the drawing.

Above the title block on some prints you may see a notation such as "159674 LH shown; 159674-1 RH opposite." Both parts carry the same number. But the part called for is distinguished by a dash and number. (LH means left-hand, and RH means right-hand.) Some companies use odd numbers for right-hand parts and even numbers for left-hand parts.

**ZONE NUMBERS**

Zone numbers on blueprints serve the same purpose as the numbers and letters printed on borders of maps to help you locate a particular point. To find a particular point, you mentally draw horizontal and vertical lines from these letters and numerals, and vertical lines from these letters and numerals, and the point where these lines intersect is the particular point sought.

You will use practically the same system to help you locate parts, sections, and views on large blueprinted objects. Parts numbered in the title block can be located on the drawing by looking up the numbers in squares along the lower border. Zone numbers read from right to left.

**SCALE**

The scale of the blueprint is indicated in one of the spaces within the title block. It indicates the size of the drawing as compared with the actual size of the part. The scale may be shown as  $1'' = 2''$ ,  $1'' = 12''$ ,  $1/2'' = 1'$ , and so on. It may also be indicated as full size, one-half size, one-fourth size, and so on.

If a blueprint indicates that the scale is  $1'' = 2''$ , each line on the print is shown one-half its actual length. In a scale showing  $3'' = 1'$ , each line on the print is three times its actual length.

Very small parts are enlarged to show the views clearly, and large objects are normally reduced in size to fit on a standard size drawing paper. In short, the scale is selected to fit the object being drawn and space available on a sheet of drawing paper.

Remember: NEVER MEASURE A DRAWING. USE DIMENSIONS. Why? Because the print may have been reduced in size from the original drawing; Or, you might not take the scale of the drawing into consideration. Then too, paper stretches and shrinks as the humidity changes, thus introducing perhaps, the greatest source of error in actually taking a measurement by laying a rule on the print itself. Play it safe and READ the dimensions on the drawing; they always remain the same.

Graphical scales are often placed on maps and plot plans. These scales indicate the number

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of feet or miles represented by an inch. A fraction is often used, as  $1/500$ , meaning that one unit on the map is equal to 500 like units on the ground. A **LARGE-SCALE MAP** has a scale of  $1'' = 10'$ ; a map with a scale of  $1'' = 1000'$  is considered to be a **SMALL-SCALE MAP**.

Various types and shapes of scales are used in preparing blueprints. Three common types are shown in figure 2-2.

Architects' scales (figure 2-2A), are divided into proportional feet and inches and are generally used in scaling drawings for machine and structural work. The triangular architects' scale usually contains 11 scales, each subdivided differently. Six scales read from the left end, while five scales read from the right end. Figure 2-2A shows how the  $3/16$ -inch subdivision of the architects' scale is further subdivided into 12 equal parts representing 1 inch each, and the  $3/32$ -inch subdivision into 6 equal parts representing 2 inches each.

Engineers' scales (figure 2-2B), are divided into decimal graduations (10, 20, 30, 40, 50, and 60 divisions to the inch). These scales are used for plotting and map drawing and in the graphic solution of problems.

Metric scales (figure 2-2C), are used in conjunction with drawings, maps, and so forth, made in countries using the metric system. This system is also being used with increasing frequency in the United States. The scale is divided into centimeters and millimeters. In conversion, 2.54 cm (centimeters) are equal to 1 inch.

Graphic scales (figure 2-2D), are lines subdivided into distances corresponding to convenient units of length on the ground or of the object represented by the blueprint. They are placed in or near the title block of the drawing and their relative lengths to the scales of the drawing are not affected if the print is reduced or enlarged.

## BILL OF MATERIAL

The bill of material block on a blueprint contains a list of the parts and/or material used on or required by the print concerned. The block identifies parts and materials by stock number or other appropriate number, and also lists the quantity used or required.

The bill of material often contains a list of standard parts, known as a parts list or schedule. Many commonly used items, such as machine bolts, screws, turnbuckles, rivets, pipefittings and valves have been standardized by the military. A bill of material for an electrical plan is shown in figure 2-3.

## APPLICATION BLOCK

The application block (figure 2-4) is usually located near the title block and identifies directly or by reference the larger units of which the detail part of assembly on the drawing forms a component. The **NEXT ASS'Y** column (figure 2-4), shows the drawing number or model number of the next larger assembly to which the drawing applies. The **USED ON** column shows the model number or equivalent designation of the assembled units(s) of which the part is a component.

## NOTES AND SPECIFICATIONS

Blueprints contain all the information about an object or part which can be presented graphically (that is, in drawing). A considerable amount of information can be presented this way, but there is more information required by supervisors, contractors, manufacturers, and craftsmen, which is not adaptable to the graphic form of presentation. Information of this type is generally given on the drawings as notes or as a set of specifications attached to the drawings.

**NOTES** are generally placed on drawings to give additional information to clarify the object on the blueprint. Leader lines are used to indicate the precise part being notated.

A **SPECIFICATION** is a statement or document containing a description or enumeration of particulars, as the terms of a contract, or details of an object or objects not shown on a blueprint or drawing.

Specifications (specs) describe items so that they may be procured, assembled, and maintained to function in accordance with the performance requirements; furnish sufficient information to permit determination of conformance to the description; and furnish the above in sufficient completeness for accomplishment without the need of research,

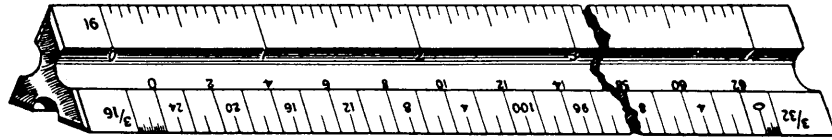
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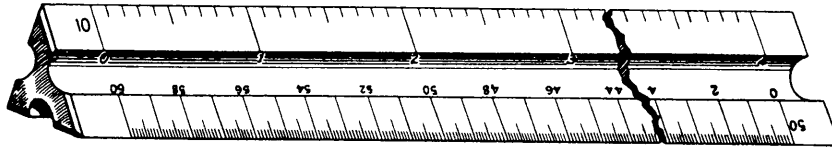
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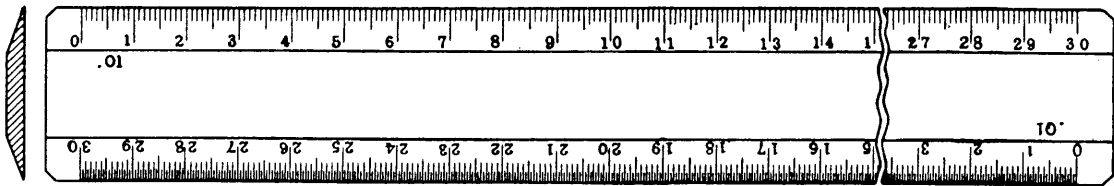
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ARCHITECTS' SCALE



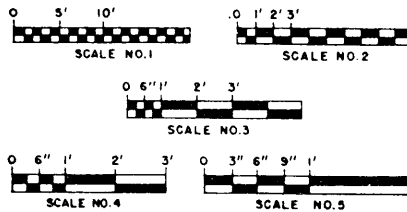
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ENGINEERS' SCALE



(C)

METRIC SCALE



(D)

GRAPHIC SCALES

Figure 2-2.—Types of scales.

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BILL OF MATERIAL					
ITEM NO.	DESCRIPTION	UNIT	ASSEMBLY OR FSN NO.	QUANTITIES	
				TROP	NORTH
3-1	LIGHTING CIRCUIT - NAVFAC DWG NO. 283414	EA.	3016	3	3
3-2	POWER BUS, 100A - NAVFAC DWG NO. 504131	EA.	3047	1	1
3-3	RECEPTACLE CKT - NAVFAC DWG. NO. 303668	EA	3019	2	2
3-4	BOX, RECEPTACLE W/CLAMP FOR NONMETALLIC SHEATH WIRE	EA	5325-102-604	5	5
3-5	LAMP ELECTRIC, MED. BASE, INSIDE FROSTED, 200 W, 120 V	EA	6240-180-314	60	60
3-6	PLUG: ATTACHMENT, 3 WIRE, 15 AMP, 125 V.	EA	5935-102-309	10	10
3-7	PLATE: BRASS, DUPLEX RECEPTACLE	EA	5325-600-101	5	5
3-8	RECEPTACLE, DUPLEX, 3 WIRE, 15 AMP, 125V.	EA	5325-100-102	5	5
3-9	ROD, GROUND, 3/4" x 10'-0"	EA	5306-200-180	12	12
3-10	WIRE, NO. 2 1/C STRANDED, HARD DRAWN, BARE	LB	6143-134-200	52	52
3-11	SWITCH, SAFETY, 2P, ST 30 AMP, 250 V, PLUG FUSE	EA	5930-142-401	2	2
3-12	CLAMP, GROUND ROD	EA	5209-100-101	13	13
3-13	SWITCH, SAFETY, 200 AMP, 250V, 3P	EA	5930-201-903	1	1
3-14	FUSE, RENEWABLE, 200 AMP, 250 V	EA	5920-100-000	6	6
3-15	LINK, FUSE, 200 AMP, 250 V	EA	5920-100-001	6	6
	FUSE PLUG, 30 AMP, 125 V	EA	5920-100-102	12	12

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Figure 2-3.—Bill of material.

NEXT ASS'Y	USED ON
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Figure 2-4.—Application block.

development, design engineering, or help from the preparing organization.

Federal specifications cover the characteristics of material and supplies used jointly by the Navy and other Government departments.























All Federal specifications used by the Navy Department as purchase specifications are listed in the Department of Defense Index of Specifications and Standards.

**LEGEND OR SYMBOLS**

The legend, if used, is generally placed in the upper right-hand corner of a blueprint below the revision block. The legend is used to explain or define a symbol or special mark placed on a



LEGEND:

-  FLUORESCENT FIXTURE, 8 DENOTES CIRCUIT NUMBER, # 50 DENOTES TYPE
-  HOMERUN, 3 -#12 WIRE IN 1/2" CONDUIT
-  UNLESS OTHERWISE NOTED, 3/4" CONDUIT IN FLOOR
-  DUPLEX RECEPTACLE
-  SWITCH
-  3 WAY SWITCH
-  CONDUIT IN FLOOR
-  CONDUIT IN CEILING
-  OUTLET BOX, FIXTURE No. 11 TO BE INSTALLED
-  EXIT LIGHT
-  FLOOD LIGHT
-  FIRE ALARM SIREN
-  BELL-4 INCH, 110 V. VIBRATING TYPE
-  CLOCK OUTLET
-  THERMOSTAT
-  JUNCTION BOX
-  FAN, TOILET ROOMS
-  MOTOR CONNECTION
-  TELEPHONE OUTLET
-  PLUG IN MOUNDING
-  FIREALARM SWITCH 110V.
-  110V. PUSH BUTTON FOR BELLS

FIXTURE#	PLATE #(9Y9)	WATTAGE
5	2	100W
7	2	2-25W
11	2 (WITH WALL SWITCH)	60W
23	5	60W
25	5	100W
28	5	100W
50	(SPEC.)	2-40W
51	(SPEC.)	150W

NOTE: SEE SPECIFICATIONS FOR DETAILED INFORMATION ON LIGHTING FIXTURES

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SYMBOL	DESCRIPTION	DATE	APPROVAL
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DPW DRAWING NO.	DEPARTMENT OF THE NAVY DISTRICT PUBLIC WORKS OFFICE	BUREAU OF YARDS & DOCKS 3TH RD. NORFOLK, VA.	
54409	LAWRENCE D. CANNACK ARCHITECT		LEXINGTON, KY.
DES	NAVAL RESERVE ELECTRONICS FACILITY		
DRWN	DANVILLE, KENTUCKY		
CHK	ELECTRICAL PLAN RISER DIAGRAM		
PROJ. NO.			
D P W O			
CHE. FL.			
BR. MGR. C.A.S.			
SP. ASST.	APPROVED _____ DATE _____		
BR. DES. _____	APPROVED FOR BUREAU OF YARDS & DOCKS _____		
DATE 10/23/58		SHEET 2 OF 8 NO. 20326	
SUBMITTED BY L. D. CANNACK ARCHITECT		Y&D DRAWING NO. 811709	
DATE 10/23/58		DATE JAN 20 1959	

Figure 2-5.—An electrical plan.

blueprint. Figure 2-5 shows a legend for an electrical plan.

**HANDLING BLUEPRINTS**

Blueprints or prints are valuable permanent records that can be used over and over again if necessary. However, if you are to keep these prints as permanent records, you must handle them with care. Here are a few simple rules to follow to preserve these prints:

1. Keep them out of strong sunlight—they will fade.
2. Don't allow them to become wet or smudged with oil or grease; these ingredients seldom dry out completely, thereby making the prints practically useless.
3. Don't make pencil or crayon notations on a print without proper authority. If you receive instructions to mark a print, use an

appropriate colored pencil and make the markings a permanent part of the print. Yellow is a good color to use on a print with a blue background (blueprint).

4. Keep prints stowed in their proper place so they can be readily located the next time you want to refer to them.

Most of the prints that you will handle will be received properly folded. Your main concern will be to refold them correctly. You may, however, have occasion to receive prints that have not been folded at all, or have been folded improperly.

The method of folding prints depends upon the type and size of the identifying marks on the prints. It is preferable to place identifying marks at the top of prints when filing them vertically (upright), and at the bottom right-hand corner, when filing them flat. In some cases, construction prints are stored in rolls.

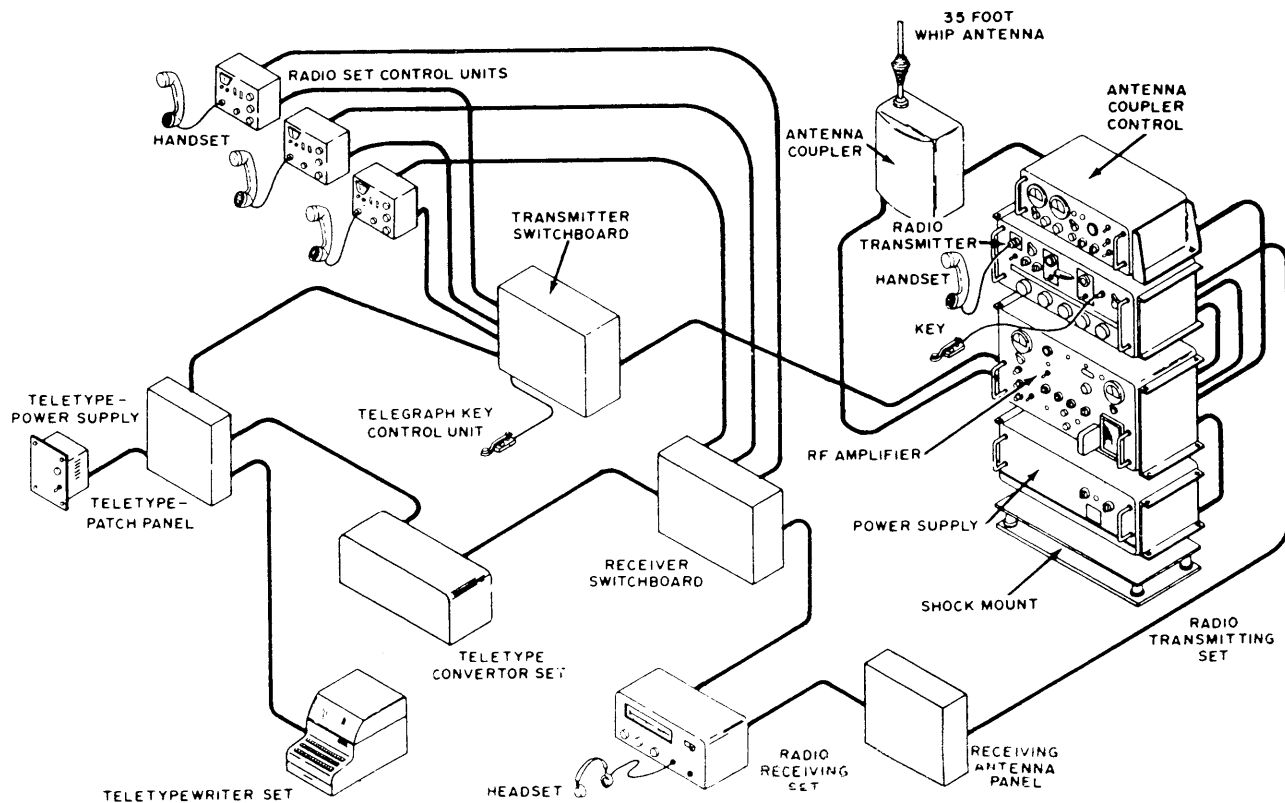
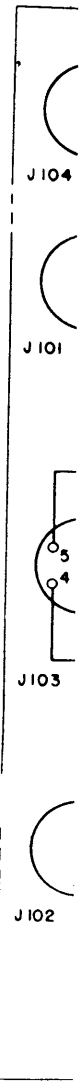


Figure 2-6.—Communication system pictorial view.

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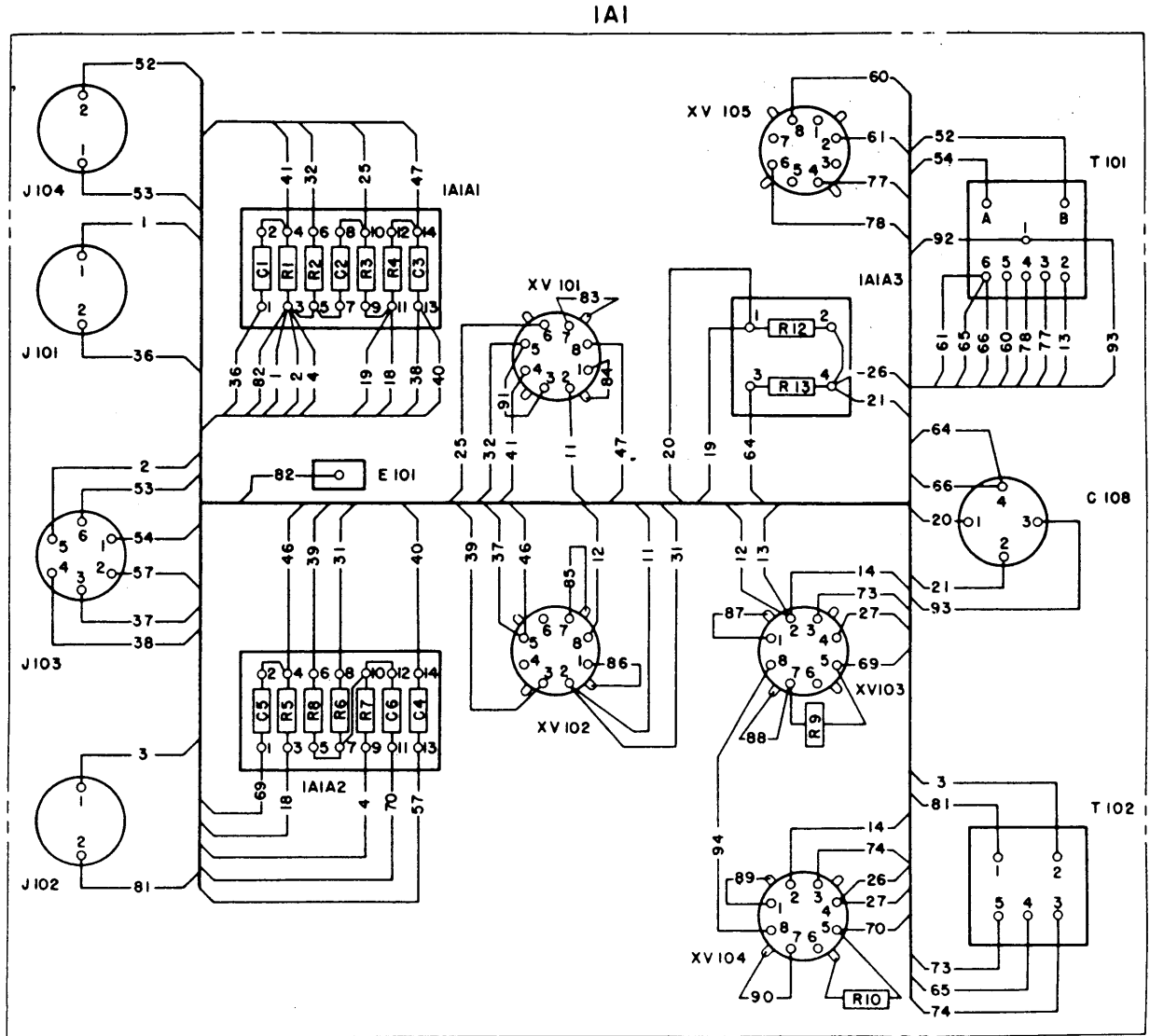


Figure 2-7.—Sample wiring diagram.

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**ELECTRICAL AND ELECTRONIC PRINTS**

Navy electrical and electronic prints are used by the technician in the installation, maintenance, and repair of electrical and electronic equipment and systems. These prints include various types of diagrams as defined in the following paragraphs.

**PICTORIAL WIRING DIAGRAM.**—A diagram showing actual pictorial sketches of the various parts of an equipment and the connections between the parts. Figure 2-6 shows

a pictorial wiring diagram of a communication system.

**WIRING (CONNECTION) DIAGRAM.**—A diagram showing the individual connection within a unit and the physical arrangement of the components. Figure 2-7 shows a sample wiring diagram.

**SCHEMATIC DIAGRAM.**—A schematic diagram uses graphic symbols to show how a circuit functions electrically. Figure 2-8 is a simplified schematic.



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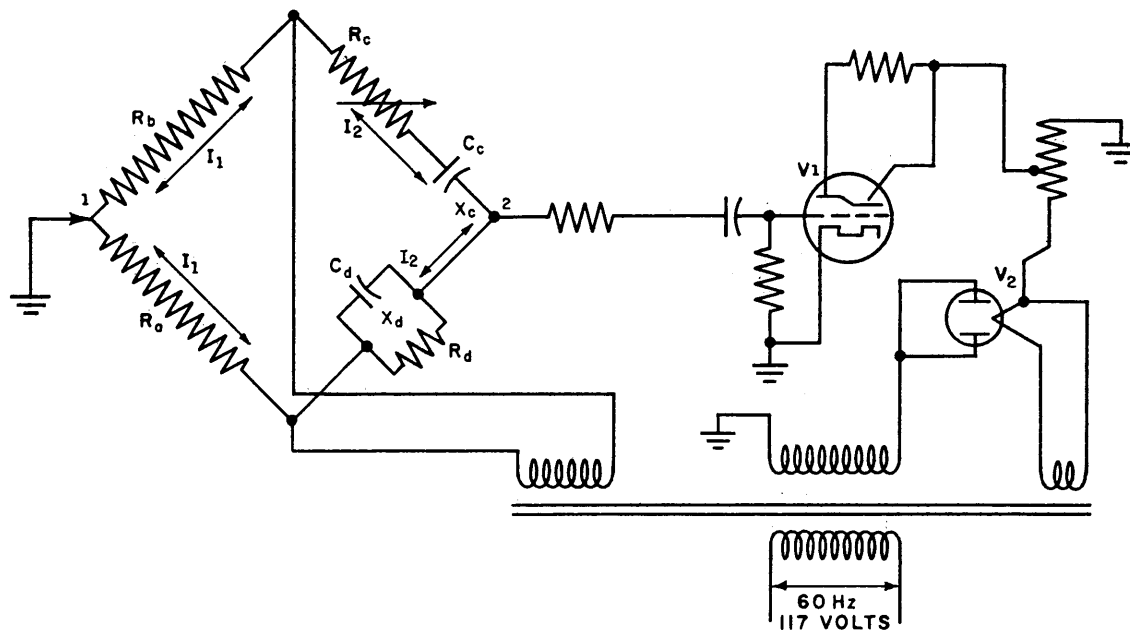


Figure 2-8.—Simplified schematic of capacitance checker.

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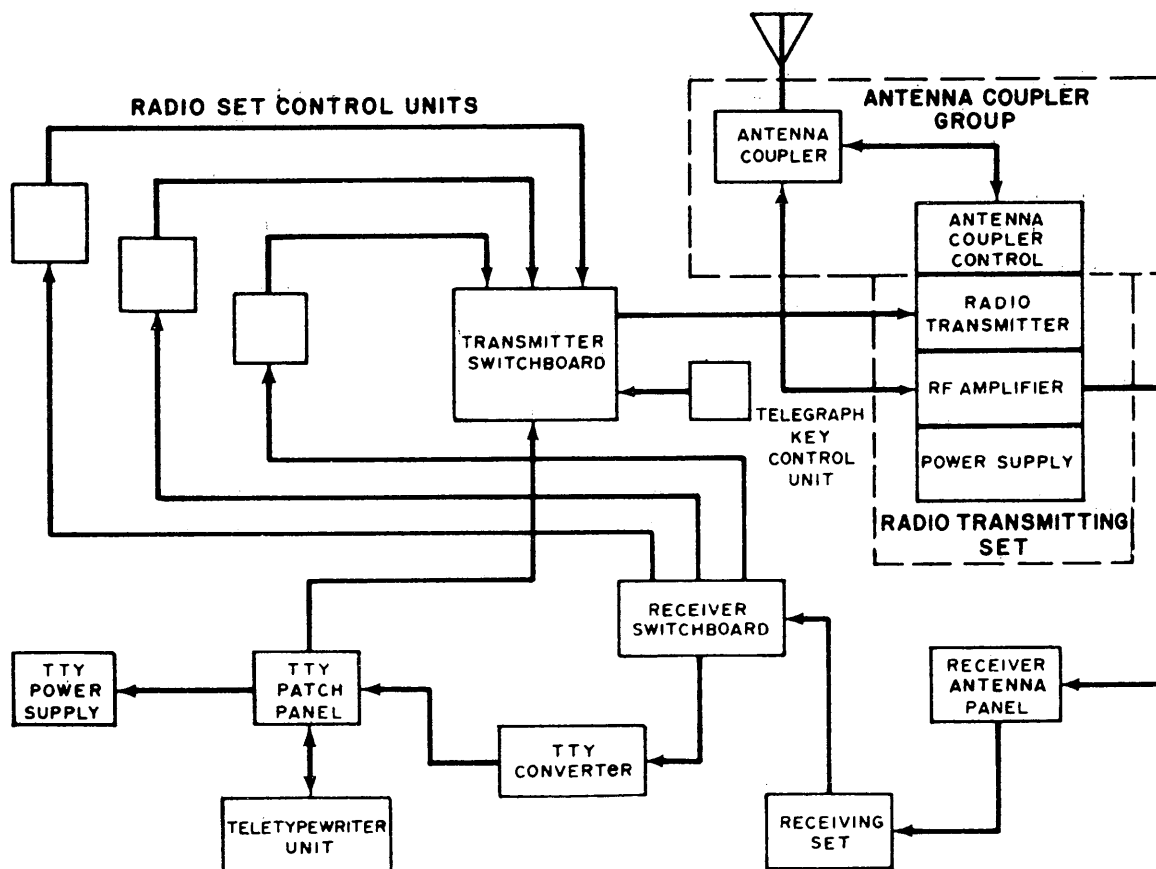


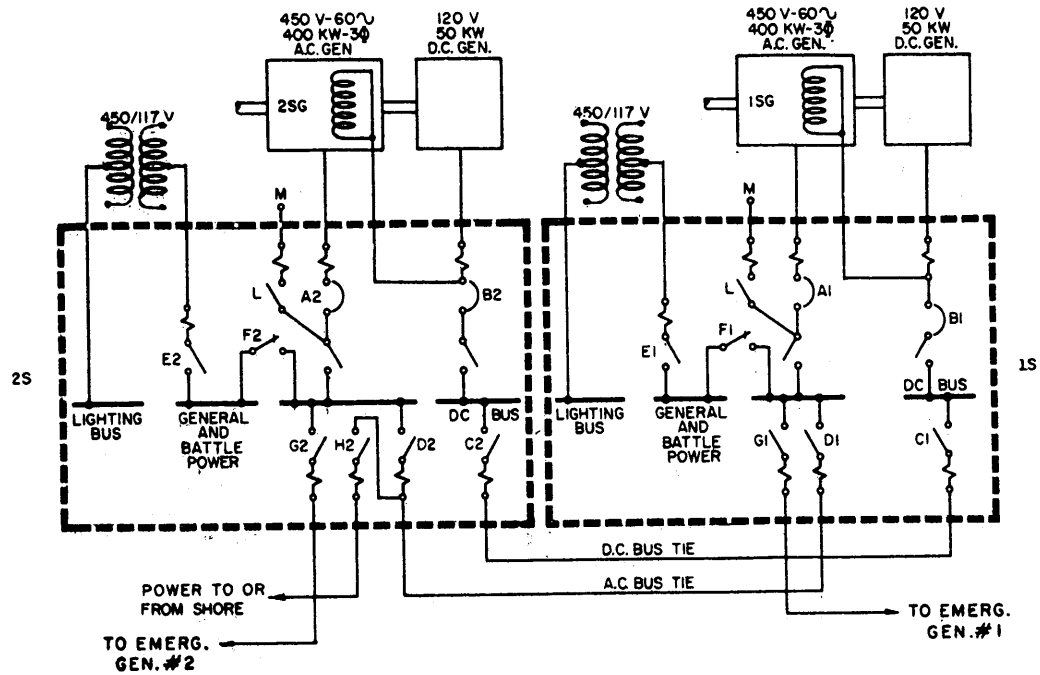
Figure 2-9.—Communication system block diagram.

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- A. A.C. GENERATOR CIRCUIT BREAKER
- B. D.C. GENERATOR CIRCUIT BREAKER
- C. D.C. BUS TIE CIRCUIT BREAKER
- D. A.C. BUS TIE CIRCUIT BREAKER
- E. A.C. LIGHTING CIRCUIT BREAKER
- F. A.C. BATTLE & GENERAL POWER CIRCUIT BREAKER
- G. EMERGENCY GENERATOR BUS CIRCUIT BREAKER
- H. SHORE POWER CIRCUIT BREAKER
- J. EMERGENCY GENERATOR CIRCUIT BREAKER
- L. AQB CASUALTY POWER BREAKER
- M. CASUALTY POWER TERMINAL

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Figure 2-10.—Single line diagram.

**BLOCK DIAGRAM.**—A diagram in which the major components of an equipment or system are represented by squares, rectangles, or other geometric figures, and the normal order of progression of a signal or current flow is represented by lines as illustrated in figure 2-9.

**SINGLE LINE DIAGRAM.**—A diagram using single lines and graphic symbols to simplify a complex circuit or system (see figure 2-10).

**REFERENCE DESIGNATORS.**—A reference designation is a combination of letters and numbers used to identify the various parts and components on electrical or electronic drawings, diagrams, parts lists, etc. The

application of reference designations is shown in figure 2-11.

### As-built Installation Drawings

These drawings are available at every station and consist of overall plot plans, which provide information on site location and topography; outline drawings giving building and room dimensions, nomenclature, and general usage; detailed drawings showing equipment location, type and function; functional block diagrams of RF/AF distribution systems, distribution frame cross-connect records, primary and emergency power systems, major operational systems and positions, and single line drawings of communications circuits. Some of these

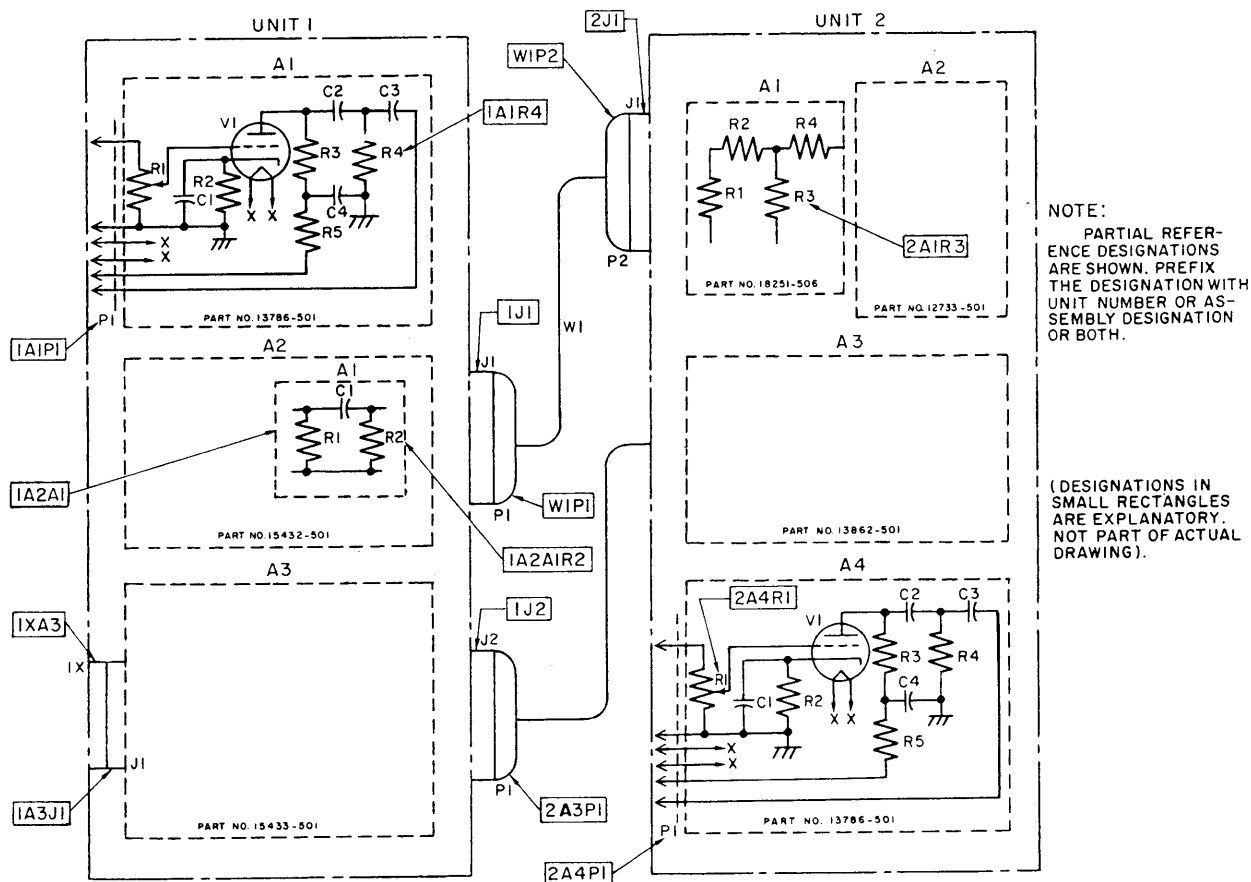


Figure 2-11.—Application of reference designations.

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drawings are major troubleshooting tools when analyzing system malfunctions in which various equipments may be at fault. Equipment will be identified on the as-built installation drawings by its AN nomenclature and/or noun name. The drawings are provided by the station EFA (Electronic Field Activity), which is the local field support organization representing the Naval Electronics Systems Command (NAVELECSYSCOM).

**Shore Station Facilities Book (FACS Book)**

The FACS Book provides, in a single document of one or more volumes, complete factual and current information on existing station facilities and equipment. FACS Books are prepared by all NAVSECGRU activities, departments, and detachments. Each station will

submit one copy of the original FACS Book and each semiannual change report by speedletter to the following commands: COMNAVSECGRU (G40), DIRNSA (L33), DIRNSA(R412), and CO NAVELEXSYSSECENGCEN (Code 03). This provides these management personnel with information normally available only at the activity level for utilization in efficient facility planning. Change reports are required semi-annually in order to maintain up-to-date information. Due to its wide scope, the FACS Book is also a good single document source for general information at the station. The FACS Book contains information on equipment resources, antennas, power, air conditioning, storage, and communications facilities, photographs, as-built installation drawings, and other pertinent information.

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