

MIL-M-81273/6A(WP)

## MILITARY SPECIFICATIONS FOR TECHNICAL MANUALS, ELECTRONICS EQUIPMENT, NONCOMPLEX (PART II)

### 1. SCOPE

1.1 This specification covers the requirements for noncomplex electronic and electromechanical equipment (as defined in MIL-M-81273/6A (WP) Part I). The format and layout requirements for text and artwork are given in MIL-M-81273A(WP).

1.2 Noncomplex equipment manuals for electronic equipment covered in this specification are primarily intended for use by maintenance personnel. The manuals shall include the following subjects as determined by the procuring activity:

Introduction

Description

Preparation for Use, Operational Checks, Stowage and Shipment

Operating Procedures

Principles of Operation

Maintenance

Troubleshooting

Alignment Procedures

Module Test and Repair Procedures

Repair Parts List

### 2. APPLICABLE DOCUMENTS

2.1 The applicable documents include issue of MIL-M-81273A(WP), General Specifications for Technical Manuals, and NAVSHIPS 0969-019-7000, Electronic Test Equipment Application Guide.

### 3. REQUIREMENTS

3.1 The manual shall be organized in accordance with the chapter headings given below. The chapters included and the depth of coverage required shall be only that needed to meet Fleet requirements as determined by the procuring activity. The general coverage required is given in conjunction with each chapter heading.

3.2 Introduction. The introduction shall provide general information regarding the intended use of the manual, the type of information given, and a brief description of the purpose of the equipment.

3.2.1 Purpose of the Manual. This shall include such information as the function of the manual and the type of information included: e.g., "The manual is intended for use by personnel responsible for maintenance of the equipment. The information includes a description of the pertinent physical data, and a detailed description of the principles of operation together with maintenance and troubleshooting guides."

3.2.2 Purpose of the Equipment. This information shall include only a brief description of the intended use of the equipment: e.g., "The equipment automatically indicates the leakage resistance and continuity of Cable CA-000. The indications are on a go, no-go basis."

3.2.3 Rating of Personnel. This

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information is not required in non-complex equipment manuals.

### 3.2.4 List of Related Publications.

Only those publications known to be available to user personnel, shall be cited here.

**3.3 Description.** The description shall include both a physical description and a brief description of the function of all external and internal controls, indicators, connectors, etc. Line drawings or photographs may be used. If photographs are used, they shall be large enough so that panel nomenclature will be clearly visible on the printed page. Line illustrations or BuWeps panel drawings may be used when equipment is not available for photographing at the time the formal manual is required. Index numbers shall be used only in cases where nomenclature is not marked on the panel. The information shall be presented in two tables: a table of physical data and a table of panel components.

**3.3.1 Table of Physical Data.** The table of physical data shall include the following information:

- a. Dimensions
- b. Weight
- c. Power input requirements
- d. Temperature range of operation
- e. Other pertinent physical data as required by individual equipment.

**3.3.2 Table of Panel Components.** The table of panel components (Fig. 1) shall include the following columnar headings arranged from left to right:

- a. Panel nomenclature or index number
- b. Schematic designation
- c. Function of each switch position

(or group of positions if several are related)

- d. Function of each color band, scale, etc., of all meters or other indicating devices
- e. Brief physical description

**3.3.3 Associated Equipment.** This information shall be tabularized and shall include schematic diagrams and line drawings or photographs of equipment where applicable. The information shall include a physical and functional description.

**3.3.4 Cable Assembly Description.** The cable assembly description shall indicate the use of each cable, its length, number of conductors, and the type of connector employed. Schematic drawings of the cables shall be included.

**3.4 Preparation for Use, Operational Checks, Shipment and Stowage.** This section shall include instructions for preparing the equipment for use, performance of operational checks, and for shipment and stowage. Illustrations and tables shall be used.

**3.4.1 Preparation for Use.** This section includes procedures for unpacking, inspection, and assembling. Visual and operational checks are also included together with shipping and stowage instructions.

**3.4.1.1 Facility Requirements.** This shall provide information concerning space requirements, electric power, air supply, etc.

**3.4.1.2 Unpacking.** Complete instructions shall be included for unpacking the equipment. If the components, modules or chassis are packaged separately, they shall be clearly identified by illustrations.

**3.4.1.3 Visual Inspection.** If the

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PANEL COMPONENTS

Panel Nomenclature	Schematic Designation	Function	Description
CA439 Receptacle	J2	Connects the test set to the depth control unit, using CA-439.	10-pin, female MS3 102E-18-1S
Humidity Indicator		Indicates the percent of relative humidity within the dust cover.	
CA440 Receptacle	J1	Connects the test set to the 95-to 130-volt, 60 CPS source, using CA-440.	3-pin, male, recessed.
POWER Light	DS1	Comes on when power is applied to the test set.	Neon bulb with clear lens, covered with silicone rubber boot.
POWER Switch	CB1, CB2	Connects 95 to 130 volts, 60 CPS to the test set and protects against excessive current.	Two 2.0-ampere circuit breakers mechanically coupled. Dwg. #1635970-4.
Meter	M1	Indicates whether the insulation resistance and contact resistance is satisfactory (indication in the 50 to 90 microampere green band) and whether the power supply potential is satisfactory (indication in the 85 to 90 microampere yellow band). The numerals 0, 50, and 100 are shown for calibration. A zero-adjust screw is provided in the meter face for mechanical adjustment.	0-100 microamperes DC; coil resistance: 2500 ohms $\pm 2\%$ ; accuracy: $\pm 2\%$ full scale. Dwg. #2032988
Counter	M2	In the pressure calibration test, checks the accuracy of the counter in the depth control unit.	Four-digit numerical, solenoid-operated. Dwg. #2033726

Figure 1 Sample of a Table of Panel Components

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equipment is packaged as a complete unit, the necessary external and internal inspection of all controls, meters, electronic components, etc., shall be provided. If the packaging is in the form of components, modules, or chassis, the preassembly inspection procedure for each shall be given.

#### 3.4.1.4 Assembly Instructions.

Detailed instructions for assembly of the components, modules, or chassis, to make up the complete equipment shall be given with accompanying photographs or line drawings. These illustrations shall clearly show all the details required in the procedure such as the proper assembly sequence, all screw holes, etc.

3.4.1.5 Operational Checks. Operational checks are intended for verification of correct functioning of all circuits in the equipment. The checks are not intended as a substitute for alignment procedures. Operational check procedures shall be included for equipments that contain self-check circuitry or verification units, and those that do not. Where self-check circuitry, or verification units are not included, procedures using general purpose test equipment shall be given in detail. Procedures for operation of the general purpose test equipment, however, shall not be given. General purpose test equipment shall be selected from NAVSHIPS 0969-019-7000. A simple system of cross keying operational checks to troubleshooting shall be given.

#### 3.4.1.5.1 Hook-Up Procedures.

Hook-up procedures shall be given for connecting the verification unit, or the general purpose equipment, to the equipment under test. Hook-up diagrams shall be used in preference to photographs. The diagrams

shall show only the connectors required for the hook-up.

#### 3.4.1.5.2 Turn-On Procedures.

These procedures shall cover all controls, adjustments, and indications required before the equipment is used. Where necessary, illustration coverage shall be given. A brief introductory statement shall be included for each group of procedures, summarizing the procedures in general terms.

#### 3.4.1.5.3 Verification Procedures.

These procedures shall be divided into groups of procedures each group covering verification of a single circuit. Each group shall include a title descriptive of the subject: e.g., "Power Supply Output Check," "Meter Circuit Check," etc. All necessary adjustments shall also be included. If the adjustment controls are difficult to locate, an illustration or photograph shall be used.

#### 3.4.1.5.4 Shutdown Procedures.

These procedures shall give the sequence of operation of all controls required for shutting down the equipment. A brief introductory statement will be included, summarizing the procedure in general terms.

3.4.2 Repacking for Shipment. These procedures will normally be the reverse of the procedures given in paragraph 3.4.1.2. Complete procedures, however, shall be written where differences exist. Precautions required for shipment shall be included.

3.4.3 Repacking for Stowage. These procedures shall be included only if they are different from those specified in paragraph 3.4.2.

3.4.4 Stowage Procedures. This section shall include the stowage

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conditions required such as temperature, humidity, etc. It shall also include any special precautions such as removal of batteries, disconnecting standard cells, periodic inspection, etc.

**3.5 Operating Procedures.** The operating procedures shall summarize the functional information given in the table of panel components. It shall also include detailed procedures for using the equipment.

**3.6 Principles of Operation.** This information shall consist of a functional description and a detailed qualitative circuit analysis. The description shall include the following information:

**3.6.1 Introduction.** This section shall include a general description of the functions of the equipment, and the type of circuits employed to perform those functions.

**3.6.2 Functional Description.** The description shall be based on a functional block diagram. Functional signal flow shall be from left to right. The text shall follow this sequence and shall employ the identical terminology used on the functional block diagram. On equipments with relatively simple circuitry (e.g., on the order of complexity of a multimeter, ohmmeter, etc.), the requirement for the functional description may be deleted.

**3.6.3 Detailed Circuit Description.** The detailed circuit description shall follow the identical pattern established by the functional description, i.e., schematic diagrams and detailed qualitative circuit analysis for each functional block. The intent is to organize the schematics so as to provide the fastest possible method for

troubleshooting. The layout shall include provision for an easy method of cross-referencing from the troubleshooting chapter. All information and terminology given on the schematic, shall be included in the text.

**3.7 Maintenance.** The maintenance information shall include a discussion of maintenance concepts, periodic checks, and removal and replacement procedures. The section shall also include information concerning the level of repair required together with sufficient data for rapid location of the suspected defective circuit elements. Graphical presentation with easy cross referencing to troubleshooting shall be used extensively. The maintenance section shall include the following items, tabularizing the information where possible.

**3.7.1 Maintenance Concepts:** This section is intended to provide maintenance personnel with general information concerning test and repair capability, periodic maintenance, and level of repair.

**3.7.1.1 Test and Repair Capability.** This section shall indicate the general type of measurements required and the kind of repairs that were planned for the equipment: e.g., manufacture gears, replace a diode, rewire a switch repair a module or a control transformer, etc. The repair capability shall depend on the Fleet spares specified for the equipment. The type of test equipment needed for post-repair testing shall depend upon the accuracy requirements of the device. A table of the required test instruments (Fig. 2) shall be included using NAVSHIPS 0969-019-7000. A statement shall be included that equipment made by the manufacturers listed are not mandatory and that equivalent equipment of other manufacturers may be used. Special

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**Table 1**  
**TEST INSTRUMENTS<sup>1</sup>**

**NOTE:** Minimum use specifications are the principle parameters required for the specific use and are included to assist in the selection of equivalent equipment. Satisfactory performance of equivalent items must be verified prior to use. All applicable equipment must bear evidence of current calibration.

Equipment Minimum Use Specifications	Connection Schematic Reference	Test
<b>Voltmeter</b> Accuracy: $\pm 5\%$ Input Impedance: 10,000 ohms/VDC, min. 1,000 ohms/VAC, min. Range: DC - 50V to 250V AC - 125V  AN/PSM - 4B or equivalent to above parameters.	V1	Voltage outputs
<b>Signal Generator</b> Accuracy - $\pm 5\%$ Output Impedance: 30 to 50 ohms Range: 10 to 1000 cps  SG-522/U or equivalent to above parameters.	SG1	Sensitivity
<b>Standard Cell</b> Accuracy: 0.01% Temp. Coefficient: at 28°C to 33°C <0.000010v per deg. C Eppley Model 110 or equivalent to above parameters	SC1	1.1VDC reference voltage

<sup>1</sup>The instruments used in this procedure were selected from those known to be available at Department of Defense facilities. The listing by make and/or model carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance for these applications.

**Figure 1 - Sample of a Table of Test Instruments**

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tools or special instrumentation required shall also be included in the table. An explanation of the use of special tools shall be provided.

**3.7.1.2 Periodic Maintenance.** This information shall include a general discussion of what is to be achieved by the periodic maintenance procedures. The procedures are preventive in nature, and include both static and dynamic checks.

**3.7.1.3 Level of Repair.** The level of repair shall be determined by the spares provided to the Fleet. It shall be covered here in general terms only.

**3.7.2 Maintenance Procedures.** These procedures consist of periodic maintenance, disassembly, assembly and repair procedures.

**3.7.2.1 Periodic Maintenance Procedures.** This shall include checks required daily, weekly, etc., as follows:

a. Visual inspection shall include external and internal inspection for damaged panel components, burned electronic components meter damage, etc.

b. Mechanical checks shall include such items as spring tension in stepper switches, relay adjustments, switch operation, etc.

c. Lubrication shall include the frequency, the quantity, and the type of lubricant required.

d. Detailed cleaning procedures shall be included, specifying the frequency, the equipment required, and its use.

e. Dynamic checks shall consist of the operational checks detailed in paragraph 3.4.1.5.

**3.7.2.2 Disassembly and Assembly Procedures.** These procedures shall

apply only to items which are replaceable (spared) and/or repairable. In some instances, replaceable or repairable items cannot be reached without removing other hardware. Removal and replacement procedures for these items shall be provided. Assembly procedures will normally be the reverse of the disassembly procedures. The assembly procedures, however, shall be written in full. A statement to the effect that the assembly procedures are the reverse of disassembly procedures, shall not be used.

**3.7.2.3 Repair Procedures.** This section shall cover only those procedures required because of the special nature of the items, i.e., where they depart from standard repair procedures for electronic or electro-mechanical circuitry or related hardware.

**3.8 Troubleshooting.** Troubleshooting is intended to assist in tracing troubles to the lowest spared or repairable item. When troubleshooting indicates a defective module that is spared or repairable, reference shall be made to the appropriate procedure in the section of the manual titled "Module Test and Repair Procedures."

**3.8.1 Format.** The format for covering troubleshooting shall depend on the complexity of the circuitry and shall be determined by the procuring activity. Tricolumnar tables are generally preferred in noncomplex equipment manuals.

**3.8.2 Keying.** Troubleshooting shall be keyed to appropriate sections of the operational checks and alignment procedures.

**3.8.3 Test Data.** Tables of voltage and resistance data shall be included



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in this section together with input and output wave shapes, as required.

**3.9 Alignment Procedures.** Alignment procedures shall consist of the following sections:

- a. General
- b. Equipment Required
- c. Preparation
- d. Detailed Procedures

If alignment procedures are not required, the chapter shall still be included, with a statement that such procedures are not required.

**3.9.1 General.** This section shall contain information on when and where to perform the alignment procedures. It shall also include a general description of the procedures, and what to do if the equipment cannot be aligned together with information regarding temperature, humidity requirements, etc., required for performance of the alignment.

**3.9.2 Equipment Required.** The equipment required for alignment shall be presented in tabular form where appropriate (Fig. 2). When general purpose (i.e., commercial) test equipment is required, it shall be selected from NAVSHIPS 0969-019-7000 unless otherwise specified by the design activity. It shall be clearly stated that equivalent equipment made by other manufacturers may be used. Sufficient specifications shall be provided so that equivalent equipment may be selected.

**3.9.3 Preparation.** This section shall include hook-up diagrams and appropriate text. It shall give those procedures that are preliminary to the alignment (e.g., starting positions for all controls, switches, warm-up times, etc.). Line drawings are preferred to photographs for hook-up

diagrams. Only the pertinent connections, nomenclature, and cables need be shown on the diagram.

**3.9.4 Detailed Procedures.** The detailed procedures shall be divided into definite and clearly labeled divisions. Each division shall cover only the specific circuit to be aligned. Each division shall include a title that is descriptive of the subject treated (e.g., Frequency Alignment, Alignment of the IFF Circuit, Alignment of the Z<sub>0</sub> Circuit, etc.). The procedures may be tabularized where feasible. The following headings may be used:

- a. Step No.
- b. Test Function
- c. Adjustment of Alignment Equipment
- d. Test Points
- e. Control Settings and Adjustments
- f. Performance Standard

**3.9.4.1 Summarized Instructions.** Summarized instructions shall be provided whenever complexity warrants. Summarization refers to the use of concise instructions that summarize the detailed steps to follow. Such instructions serve a dual purpose:

- a. To permit highly trained personnel to perform the alignment with minimal procedures.
- b. To assist the average technician to understand the technique more rapidly by providing him with summarized information.

Operating procedures for the general purpose equipment shall not be included; only the hook-up instructions and diagrams shall be included for this instrumentation.

**3.10 Module Test and Repair Procedures.** Information regarding test



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and repair of modules shall be in an appendix to the basic manual and shall include the following items:

- a. Functional description
- b. Detailed qualitative circuit analysis
- c. Tables for test and adjustment procedures where applicable
- d. A method for troubleshooting
- e. Schematic diagrams with waveforms and voltage levels at test points
- f. Special repair information where required
- g. Repair Parts List

3.11 Repair Parts List or Illustrated Parts Breakdown. A repair parts

list shall be generated in accordance with MIL-M-81273/6A(WP) Part I; the IPB in accordance with MIL-M-8910.

4. QUALITY ASSURANCE

4.1 Provisions for quality assurance are given in MIL-M-81273A(WP).

5. PREPARATION FOR DELIVERY

5.1 Instructions for preparing materials for delivery are given in MIL-M-81273A(WP).

6. NOTES

6.1 None.