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## ASSOCIATED DETAIL SPECIFICATION

### MANUAL, TECHNICAL REPAIR STANDARDS (TRS) REQUIREMENTS FOR ELECTRONIC EQUIPMENT

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification sets forth the content requirements and instructions for the development of technical repair standards (TRSs) for use in performing class B overhauls to electronics and interior communications equipment and components.

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, SEA 03R42, Naval Sea Systems Command, 2531 Jefferson Davis Hwy, Arlington, VA 22242-5160 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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AREA TMSS

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## SPECIFICATIONS

## MILITARY

- MIL-M-24784 - Manual, Technical: General Acquisition and Development Requirements.
- MIL-M-24784/1 - Manual, Technical Change Package Requirements.
- MIL-M-24784/2 - Manual, Technical Revision Requirements.

## STANDARDS

## MILITARY

- MIL-STD-454 - Standard General Requirements for Electronic Equipment.
- MIL-STD-973 - Configuration Management.
- MIL-STD-1345 - Test Requirements Document, Preparation of.
- MIL-STD-1364 - General Purpose Electronic Test Equipment.
- MIL-STD-1367 - Packaging, Handling, Storage and Transportability Program Requirements (for Systems and Equipment).
- MIL-STD-45662 - Calibration Systems Requirements.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Document Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

## PUBLICATIONS

## DEPARTMENT OF DEFENSE

- DoD 5200.1-R - Information Security Program Regulation.
- DoD 5220.22-M - Industrial Security Manual for Safeguarding Classified Information.

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

2.2 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for associated detail specifications), the text of this specification shall take precedence. When a generic requirement is in conflict with a unique requirement from the governing associated detail specification, the unique requirement shall take precedence. Nothing in this specification, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Security classifications. The overall classification assigned to a technical manual shall agree with the highest classification assigned to any portion within and shall be placed conspicuously at the top and bottom of the Cover and Title page or abbreviated title. Security classification markings shall

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be in accordance with DoD 5220.22-M and 5200.1-R and shall be placed in accordance with DoD 5220.22-M and 5200.1-R. The security markings shall be the same as for other title pages.

3.2 Deliverable products and data items. The deliverable products and data items shall be specified in the Contract Data Requirements List (CDRL) and shall conform to the requirements specified in MIL-M-24784 and herein. Data items shall include the following, as applicable:

- (a) Outline or book plan.
- (b) Review draft copy (RDC).
- (c) Preliminary technical manual (PTM).
- (d) Final reproducible copy (FRC).
- (e) Supplements.
- (f) Changes (see 3.2.1).
- (g) Revisions (see 3.2.2).
- (h) Management data (see 3.2.3).
- (i) Cost and pricing data (see MIL-M-24784).

3.2.1 Change packages. When specified (see 6.2), change packages shall be in accordance with MIL-M-24784/1.

3.2.2 Revisions. When specified (see 6.2), revisions shall be in accordance with MIL-M-24784/2.

3.2.3 Management data. Unless otherwise specified (see 6.2), the following quality assurance data items shall be provided in accordance with MIL-M-24784:

- (a) Technical Manual Quality Assurance Program Plan.
- (b) Validation Plan.
- (c) Validation Certification.
- (d) Technical Manual Evaluation Records.
- (e) Verification Plan.
- (f) Technical Manual Verification Incorporation Certification.

3.3 Arrangement. Unless otherwise specified, the manual shall be arranged in a standardized format (that is, front matter, technical content, appendices, glossaries, indexes and back matter) and appropriately divided by volume, part, chapter and section in accordance with the requirements of MIL-M-24784, Appendix C and the following.

3.3.1 TRS subject matter. The TRS shall provide detailed instructions for performing a class B overhaul. The TRS shall discuss critical procedures (see 6.5.1), testing and maintenance examinations, supporting illustrations, lists of items to be replaced and any special tools needed for the overhaul. The TRS shall also describe critical operations and checks that shall be done during item reassembly, minimum quality control requirements, and specific post-overhaul inspections. The technical content for systems and equipment shall be formatted to meet electronics (see 3.5) requirements. The TRS sequence and breakdown of divisions shall be as follows:

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- (a) The technical content shall follow the front matter and shall be arranged in chapters. Each chapter shall consist of one or more sections that are divided into main paragraphs, and then subdivided into subparagraphs. Each section and major (numbered) paragraph shall have a brief title describing the content or action required. The level of detail shall be geared to the journeyman-level mechanic.
- (b) Technical content for a compound (composite) item, with major subassemblies (see 6.5.4), shall be divided so that each major item will be addressed in a separate chapter to promote the work-unit, work-package concept (see 6.5.5).
- (c) Minor assemblies shall be divided into separate sections and included with their major subassemblies, to promote work group breakdown structure of authorized overhaul facilities.

3.3.2 Multipart volumes. The TRS shall be divided into two parts. Part 1 shall contain all overhaul procedures, requirements, and drawings necessary to perform the overhaul. Part 2 shall record all readings specified in part 1.

#### 3.4 Format and development instructions.

3.4.1 Writing style. Unless otherwise specified, the style of writing, level of writing, readability, and referencing shall be in accordance with the requirements of MIL-M-24784, Appendix B.

3.4.2 Safety precautions. Unless otherwise specified, safety and health warnings, cautions and notes shall be in accordance with the requirements of MIL-M-24784, Appendix D.

3.4.3 Tabular material. Unless otherwise specified, the preparation of tables shall be in accordance with the requirements of MIL-M-24784, Appendix E.

3.4.4 Graphics. Unless otherwise specified, the preparation of illustrations, drawings, diagrams and sketches shall be in accordance with the requirements of MIL-M-24784, Appendix F.

3.4.5 Numbering. Unless otherwise specified, the numbering of paragraphs, procedures, divisions, issues, changes, illustrations, tables, and publications shall be in accordance with the requirements of MIL-M-24784, Appendix G.

3.5 Electronic equipment TRS technical content. The sequence of electronic equipment TRSs technical data shall conform to the following:

- (a) Title page (see MIL-M-24784).
- (b) Front matter (see MIL-M-24784).
- (c) Chapter 1 - General information (see 3.5.1).
- (d) Chapter 2 - Facilities, test equipment, personnel, and test conditions (see 3.5.2).
- (e) Chapter 3 - Inspection methods (see 3.5.3).
- (f) Chapter 4 - Performance test procedure (see 3.5.4).
- (g) Chapter 5 - Overhaul procedure and final acceptance test (see 3.5.5).

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- (h) Chapter 6 - Packaging and handling (see 3.5.6).
- (i) Appendix A - Repairable item data (see 3.5.7.1).
- (j) Appendix B - Test support equipment data (see 3.5.7.2).
- (k) Appendix C - Test data record sheets (see 3.5.7.3).
- (l) Additional appendices (D - G) - Other appendices or enclosures (as required) (see 3.5.7.4).
- (m) TMDERs/UATMCSs (see MIL-M-24784).

3.5.1 Chapter 1 - General information. This chapter shall state the purpose, organization, and intended use of the TRS. This section shall include the following information.

3.5.1.1 Frontispiece illustration. A pictorial representation of the repairable items (see 6.5.4) covered in the TRS shall be placed on the left-hand page preceding Chapter 1 (see MIL-M-24784).

3.5.1.2 Production process. This chapter shall include production process flow charts or work flow block diagrams (MIL-M-24784) graphically depicting the required sequence of repair/overhaul events during the maintenance process described in the TRS. These displays may consist of block diagrams depicting the entire process with more detailed flow charts showing specific phases of the repair/overhaul process. Sufficient detail shall be provided to clearly illustrate the described process.

3.5.1.3 Scope. The scope shall:

- (a) Include a brief summary of the technical content of the TRS including all appendices. It shall include statements that:
  - (1) Conformance with the TRS is required of designated commercial and Government activities authorized to conduct the class B overhaul of the items covered in the TRS.
  - (2) Ensure that component configuration changes are not authorized unless previously approved by the life cycle manager.
  - (3) The TRS reflects the latest (state the date) approved configuration and technical documentation (see MIL-STD-973).
- (b) Identify the repairable items (see 6.5.3) covered by the TRS using approved nomenclature, national stock number (NSN), allowance parts list (APLs), and all applicable commercial and Government entity code (CAGEC) and part numbers. It shall also identify the next higher assembly, equipment, and system in which the repairable item is used. These data shall be listed in tabular form.
- (c) In cases where the TRS specifically pertains to a repairable end item containing a repairable subassembly, it shall contain statements that:
  - (1) Identify the subassembly in the same fashion as item (b) above and the applicable subassembly TRS document number.
  - (2) Briefly state the relationship of the subassembly to the repairable end item.
  - (3) Provide the data in tabular form.

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- (d) Provide a tabular list of ship alteration records (SHIPALTs), field changes, or engineering changes that have been incorporated into the TRS.
- (e) Provide a point of contact for answering questions which may arise during overhaul/repair concerning configuration or SHIPALTs in accordance with the requirements of the acquisition activity (see MIL-STD-973).

3.5.1.4 Item description. A tabular listing of the overall dimensions, approximate weight, and approximate volume of the repairable items covered by the TRS shall be determined. Overall dimensions shall be the height, width, and depth in inches; approximate weight shall be the total weight in pounds and ounces; and approximate volume shall be the total volume in cubic feet and inches for the uncrated repairable items, with appropriate metric conversions, if required.

3.5.1.5 Documentation. A tabular listing of all publications, product engineering drawings and schematics, specifications and standards, engineering and field changes data, and other reference data used in the development of the TRS shall be presented. Applicable documents shall be listed in the order they are referenced in the text.

3.5.1.6 Deviations and waivers. A statement shall be provided that waivers and deviations for minor material or performance characteristics may be approved at the local level only with Government approval. Major design or logistic deviation and waiver request will be approved in writing by the Government. Parts, clearances, or conditions for which specified requirements cannot be met require compliance with MIL-STD-973, execution of Form 1694 for deviations and waivers, and approval for a departure from specification.

3.5.1.7 User's comments procedure. A brief instruction to the manual user shall specify that comments or recommendations concerning the manual are to be forwarded for consideration (see MIL-M-24784).

3.5.2 Chapter 2 - Facilities, test equipment, personnel, and test conditions. This chapter shall state the requirements for the facilities, equipments, and overhaul personnel required to accomplish effective, efficient refurbishment of the items covered by the TRS. This section shall consist of the following information.

3.5.2.1 Facilities. The facilities required (specify quantities) for the repair process shall be identified and described. The following information shall be normally listed in a tabular form:

- (a) Work area, space, and storage requirements.
- (b) Shop machine, handling, and support equipment requirements (common and special).
- (c) Electrical power and ground requirements.
- (d) Hazard or safety and security requirements.
- (e) Electromagnetic interference and compatibility requirements.
- (f) Forced ventilation or air changes required from the facility.
- (g) Service requirements; for example, water, gas, hydraulic oil, and so forth (specify required pressures and flow rates).
- (h) Other facility requirements as determined.

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3.5.2.2 Test equipment. A tabular listing shall be developed and shall describe all test equipment and repair aids required (specify quantities) in the examination, repair (including alignment, adjustment, and troubleshooting), and performance or acceptance testing of the repairable items covered by the TRS. These data shall be provided in the form shown on figure 8-1.

- (a) General purpose electronic test equipment (GPETE) shall be selected from standard or substitute standard GPETE as listed in MIL-STD-1364. (When it is determined that there is no standard or substitute standard GPETE suitable for performing the required tests, the situation shall be described, justified, and referred to the Government. Written authorization must be obtained prior to the selection of nonstandard test equipment).
- (b) Equipment that is no longer manufactured nor available to the Government shall not be listed.
- (c) The accuracy of the recommended test equipment shall be less than 25 percent of the tolerance allowed for the measured parameter.
- (d) Common hand tools normally used at depot maintenance facilities for example, screwdrivers, wrenches, and pliers, shall not be listed in the tabular format.
- (e) Unique or special maintenance and calibration requirements of the equipment listed in this section of the TRS shall be specified. If no unique or special maintenance and calibration is required of any listed equipment, the TRS shall so specify (see MIL-STD-45662).

3.5.2.2.1 Test equipment list. The following types of equipment shall be listed:

- (a) GPETE.
- (b) Special purpose electronic test equipment (SPETE).
- (c) Automatic test equipment (ATE), and its peripheral equipment and software.
- (d) Dynamic test equipment; for example, rate tables, tilt tables, centrifuges, vacuums, and atmospheric pressure equipment.
- (e) Weapon system or equipment product hardware (when prescribed as a test bed for repairable items testing).
- (f) Special test equipment or test set-up accessories; for example, adapters, extender cards, and connecting cables required to interface with the repairable items.
- (g) Special test holding fixtures, jigs, gauges, and special handtools.
- (h) Standard measuring instruments (SMI) required for inspection or examination that are not normally available at depot maintenance facilities.

3.5.2.3 Personnel. The number of personnel required in the overhaul process to perform the examination, test, and repairs specified in the TRS shall be estimated. Each skill, work category, or function shall be defined and an estimate of the number of man-hours per category needed shall be provided in a brief, narrative form or in a tabular listing.

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3.5.2.4 Test conditions. All special depot work station environmental conditions required in the overhaul process shall be so specified; for example, atmospheric pressure, temperature, relative humidity, and clean rooms, including class (see FED-STD-209). This information may be presented in table format.

3.5.3 Chapter 3 - Inspection methods. This chapter shall define the conventional and any special inspection methods, procedures, and responsibilities involved in the overhaul of the items covered by the TRS. Normally, the inspection requirements specified in the TRS shall include the following.

3.5.3.1 Responsibility for inspection. A short paragraph shall specify that the quality assurance element of the overhaul activity is responsible for the performance of all inspection requirements.

3.5.3.2 Document inspection. A paragraph shall specify the requirement to review all applicable publications such as standard documents, references, drawings, and schematics to determine whether they are relevant to the items under inspection.

3.5.3.3 Initial inspection. This paragraph shall specify all initial inspection requirements (for example, visual inspection for loose, broken, or damaged parts, conductors, contacts, and terminals). It shall verify the repairable items configuration, and ensure that all applicable engineering, production, and field changes have been properly incorporated. This paragraph shall also specify that all discrepancies and defects are to be noted and corrected before proceeding with further examinations and tests.

3.5.3.4 In-process and final inspection. This paragraph shall specify (by category or type) all critical repair processing operations covered in the TRS requiring informal inspection and verification. This information shall be presented as a tabular listing that cites the appropriate portion of the TRS (by section or paragraph number) that delineates the required inspection procedure.

3.5.4 Chapter 4 - Performance test procedure. This chapter shall provide detailed mechanical and electrical performance test procedures necessary to verify that the repairable item is operating within standards in all modes of operation. The test procedures shall serve two primary purposes:

- (a) To be used as an initial performance test of the item prior to the accomplishment of the overhaul, and
- (b) To be used as a final acceptance test after all required repairs have been accomplished and the repairable item is considered to be ready-for-issue (RFI).

The object of the initial functional examination is to determine the status of the repairable item as received by the depot; to compare test results with data contained in incoming repairable items discrepancy or failure reports; to identify repair item malfunctions and discrepancies; and to determine the extent of repairs required. This section shall be developed in accordance with the test procedures paragraph of MIL-STD-1345 and shall contain, as a minimum, the following requirements.



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3.5.4.1 Performance test procedure requirements. Performance test procedure requirements shall be similar to that presented in the example of test procedures paragraph of Appendix A of MIL-STD-1345. The test procedure shall specify:

- (a) Safety precautions and instructions.
- (b) The titles of tests or examinations to be performed.
- (c) Preliminary set-up data required to perform the tests or examinations (see figure 8-2).
- (d) Detailed step-by-step procedures for accomplishing the tests or examinations.
- (e) Test equipment and tools (see the test equipment and tooling listing paragraph of MIL-STD-1345). Only equipment in chapter 2 that applies to performance testing shall be specified.
- (f) Other data as may be determined for the repairable items type may be shown.

3.5.4.2 Test data record. The TRS shall require that the results of the test procedure be recorded on the test data record. The satisfactory operation of the RFI repairable items shall be verified by the depot quality assurance element personnel.

- (a) The data required are the procedural steps, performance requirements, TRS title, TRS number, item nomenclature, and item part number (see figure 8-3).
- (b) The TRS shall also indicate that the designated depot maintenance activity responsible for the repairable items repair, shall establish and maintain a file of the completed TRS test data records.
- (c) Other instructions as may be determined for the repairable items type shall be specified.

3.5.5 Chapter 5 - Overhaul procedure and final acceptance test. This chapter shall contain all procedures, processes, and methods for the satisfactory accomplishment of all overhaul and repair work. It shall also contain the instructions required for the accomplishment of the final acceptance test of the repairable items covered by the TRS. Acceptance or rejection criteria for wear, deterioration, dimensions, electrical parameters, alignments, adjustments, and other standards of acceptance shall be specified. Additional information may be required to properly accomplish particularly difficult repair actions.

3.5.5.1 Removal, disassembly, and inspection. Illustrations and step-by-step procedures (see MIL-M-24784) for the removal, disassembly, and inspection of the repairable items shall be developed. Disassembly instructions shall be limited to areas where the sequence of disassembly is not obvious or where special techniques are required for access to a part requiring repair. Where examinations, inspections, and tests must be performed during disassembly, the TRS shall so specify.

3.5.5.1.1 Disassembly illustrations. Illustrations shall show the sequence of disassembly and shall contain part identification data by item number, noun name, quantity, and reference designation.

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3.5.5.1.2 Criteria for suitability of worn-in-parts versus new parts.

Criteria to determine the suitability of worn or degraded critical parts for continued use shall be presented. The criteria shall explicitly state those measurable wear or deterioration limits which, if exceeded, require replacement by new parts. These data shall be briefly presented, preferably in table format, and shall identify the parts involved, provide the measurable limits, and specify the required actions. Mandatory replacement items shall be clearly identified and reference made to the appropriate listing in the TRS Appendix A.

3.5.5.2 Cleaning and inspection. When applicable to the repairable items covered in the TRS, the process and methods of cleaning and examination to be performed on each disassembled item shall be described. Cleaning and inspection instructions shall contain the following:

- (a) The pre-cleaning examination requirements and the cleaning process to be used for each item requiring cleaning.
- (b) Step-by-step procedures for accomplishing the process (see 3.5.5.1).
- (c) Specific identification of cleaning material to be used in the process by their commonly known name and specification number. These data may be provided in tabular format.
- (d) Quantitative instructions for the variables associated with the cleaning process; for example, air pressure, moisture content, solvent temperature, soak time, ultrasonic frequency, drying time, and temperature.
- (e) Procedures for use of any special tools, jigs, or fixtures required during cleaning.
- (f) Post-cleaning examination, preservation, and handling instructions.
- (g) Cautions or warnings to be observed to protect personnel and equipment.
- (h) Other data as may be determined appropriate for the repairable items.

3.5.5.3 Reassembly and inspection. Illustrations and all reassembly instructions and examination requirements for the reassembly of the repairable items shall be developed. The use of any special tools, jigs, fixtures, or test equipment shall be specified. If reassembly is the reverse of disassembly, a statement to that effect will satisfy this requirement. The instructions or procedures shall indicate the following:

- (a) Use of corrosion-preventive compounds, paints, or other materials. Gaskets or sealing compound materials shall be specified by nomenclature, trade name, specification number, and NSN.
- (b) Identification of all points requiring lubrication, the kind of lubricants required, and the method of application. Lubricants to be used shall be those in accordance with the lubricants requirements of MIL-STD-454 or as approved in writing by the Government.
- (c) The correct manner of installing all fasteners, safety wiring, cotter pins, and other locking devices.
- (d) The method of aligning, adjusting, and measuring tolerances (both electronic and mechanical), clearances, end-play back-lash and tolerances between any two gears.

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- (e) Gearing and linkage alignment data.
- (f) Identification of critical examinations and tests required during reassembly.
- (g) References to tables and illustrations as applicable.
- (h) Other data as may be determined appropriate for the repairable items type.

3.5.5.4 Fault location and repair. Step-by-step procedures, special instructions, examination, and technical information (including supplementary illustrations and tabular lists) shall be determined to perform effective and efficient troubleshooting and repair of the repairable items covered in the TRS. The actions to be performed shall ensure that the items shall meet or exceed the specified performance requirements of the final acceptance test (see 6.5.2) and shall satisfy all quality assurance inspection requirements.

3.5.5.4.1 Fault location. Detailed step-by-step procedures for troubleshooting and fault location to the faulty part, misalignment, or other trouble cause, shall be identified or developed in accordance with the fault location procedures paragraph of MIL-STD-1345.

3.5.5.4.2 Repair and replacement. Detailed step-by-step procedures for corrective actions, including the repair and replacement of defective, damaged, or deteriorated parts shall be identified or developed.

3.5.5.4.3 Alignments and adjustments. Detailed step-by-step procedures shall be identified or developed for all mechanical and electrical alignments and adjustments. Procedures shall include detail of methods used, and special tools and equipment required to achieve the setting and positioning of all (a) electronic tuning adjustments and controls, and (b) mechanical, gearing, and linkage alignments within the repairable item which, if maladjusted, would cause faulty operation. This information shall be developed in accordance with the alignment procedures of MIL-STD-1345.

3.5.5.4.4 Supplementary technical data requirements. This section shall contain all supplementary technical information, illustrations, and tabular lists to aid the overhaul personnel in performing the specified actions. Such data shall include:

- (a) Hazard or safety instructions.
- (b) Test equipment and repair aids requirements. Only that equipment listed in Chapter 2 (see 3.5.2), that applies to the procedure being developed (fault location, repair and replacement, alignment) may be specified.
- (c) Test set-up diagrams.
- (d) Detailed step-by-step procedures for accomplishing the tests.
- (e) Waveforms, truth tables, fault logic, and timing circuit diagrams.
- (f) Exploded views and gearing and linkage diagrams (see MIL-M-24784).
- (g) Troubleshooting diagrams (see figure 8-4).
- (h) Parts list and location instructions and illustrations.
- (i) Printed-circuit board (PCB) foil layouts, as appropriate.

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- (1) Printed-circuit boards shall be illustrated foil side up. When printed wiring appears on both sides of the board, both sides shall be illustrated. All parts mounted on the board shall be outlined in black solid (front) or dashed line (rear) (even though mounted on the reverse side of the board) and their connections to the printed wiring clearly illustrated.
  - (2) If insufficient room exists, separate illustrations of front and rear views shall be provided. Internal elements of such items as electron tubes, coils, transformers, and transistors shall be illustrated schematically within the part outline and each part shall be labeled with the applicable reference designation.
  - (3) To facilitate parts location, a locating grid and corresponding guide chart shall be provided when more than 30 items are mounted on a board.
  - (4) Test point graphic symbols shall be located outside the board area, when not printed on the board by manufacturer, with call-out leaders drawn from these symbols to the test point locations. In like manner (when equivalent information is not printed on the board) the input and output terminals shall be labeled with the functions (signals and voltages) carried, and their point of origin or destination.
- (j) Other special information, instructions, methods, processes, and materials peculiar to the repair operation that are not contained elsewhere in the TRS.

NOTE: Obvious repair actions, such as soldering and use of hand tools, shall not be included except where these actions involve hazards to personnel or equipment.

3.5.5.5 Final acceptance test (FAT). This section shall specify that:

- (a) After accomplishment of all overhaul actions, and the repairable item is considered ready for final examination, the item shall be inspected for proper identification, workmanship quality, and subjected to the final acceptance test (FAT) (see 6.5.2) to verify satisfactory performance.
- (b) The FAT shall be accomplished in accordance with the established performance parameter requirements and test procedures (see 3.5.4) and make reference to the other pertinent data contained elsewhere in the TRS.
- (c) The FAT shall be witnessed by designated quality assurance personnel responsible for final inspection and acceptance of the repairable item.
- (d) The test results and all required data shall be recorded on the TRS test data record (see 3.5.4.2).
- (e) Upon satisfactory completion of all FAT provisions, the TRS test data record shall be verified for completeness and accuracy, and duly dated, signed, and approved by the applicable responsible depot personnel thereby certifying the satisfactory operation of the repairable electronic item and its condition as RFI to the fleet.

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- (f) The overhaul activity shall ensure the disposition of the completed TRS test data record as follows:
- (1) One copy of the record shall be packaged with the repaired item for information purposes.
  - (2) One copy shall be mailed to the field maintenance agent (FMA) if a FMA has been designated for the repaired items.
  - (3) One copy shall be mailed to the technical repair agency (TRA) or its designated representative.
  - (4) The original shall be retained by the overhaul activity in a central file as a permanent record of the items repair. The file shall be maintained current.

3.5.6 Packaging, handling, storage, and transportability (PHST). This chapter shall identify the PHST requirements including any special stowage (shipboard), storage (shore based), handling equipment, and transportability (delivery concepts and needs) for systems, equipment, and support items (spares and repair parts). PHST requirements shall be in accordance with MIL-STD-1367.

3.5.6.1 Packaging and handling requirements. This section shall describe the packaging and handling requirements (conventional, special, or both) applicable to the repairable items covered in the TRS. This section shall specify that the maintenance activity designated for overhaul of the item shall determine and maintain the latest instructions, documentation, work details, and requirements for packaging and handling the repairable item.

3.5.6.1.1 Special handling procedures. This section shall describe the procedures required for using the special crates, boxes, containers, transportation vehicles, and other facilities for repairable items handling. If there are no requirements for special handling procedures or equipment, the TRS shall so specify.

3.5.6.1.2 Special packaging procedures. This section shall describe the procedures required for special packaging of the repairable items. If there are no requirements for special packaging procedures, the TRS shall so specify.

3.5.6.1.3 Classified repairable items. When the repairable items covered in the TRS are classified items, this section shall specify security requirements and controls necessary for proper handling, packaging, marking, storage, and shipping of the repairable items.

3.5.6.2 Special preservation, storage, and transportation requirements. This section shall identify the requirements for special preservation, storage, and transportation of the repairable items. For example, preservation for storage when the repair item is not to be installed (fleet use) for an extended period of time and the methods used for preservation and storage of the repairable items are critical. If there are no requirements for special preservation, storage, and transportation, the TRS shall so specify.

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3.5.7 Appendices. The TRS shall provide pertinent supplementary and reference data required in the inspection, repair, troubleshooting, testing, final acceptance, packaging, and handling of the repairable items covered in the TRS. Each appendix shall contain a lead-in statement delineating its purpose and application.

3.5.7.1 Appendix A - Repairable item data. This appendix shall consist of repairable items, servicing and troubleshooting block diagrams, schematic diagrams, component location illustrations, and parts list tables.

3.5.7.1.1 Service and troubleshooting block diagrams. Servicing and troubleshooting block diagrams shall be in accordance with the block diagram paragraph of MIL-STD-1345 for the repairable items type covered by the TRS.

3.5.7.1.2 Repairable items schematic diagrams. Repairable items schematic diagrams shall be in accordance with the requirements of the schematic diagrams paragraph of MIL-STD-1345 or the repairable items type covered by the TRS.

3.5.7.1.3 Repairable items component location illustrations. Repairable items component location illustrations shall provide positive and rapid location of parts. Types of component location illustrations shall show exploded views, engineering drawings, and sectional views.

3.5.7.1.4 Repairable items parts list tables. Repairable items parts list tables shall be in accordance with figure 8-5.

3.5.7.1.5 Mandatory overhaul replacement parts list (MORPL). This section shall contain a comprehensive list of items that shall be replaced regardless of observed conditions. There shall be a separate sheet listing the mandatory replacement parts (see figure 8-6) for each subassembly or breakout item listed in Chapter 5. The parts to be recommended for the mandatory overhaul replacement parts list shall be dependent on the repair experience of the TRS developer and shall be specified by the Government acquisition activity by considering those parts which:

- (a) Are damaged or destroyed during disassembly.
- (b) Are subject to wear.
- (c) Are judged to be more economical to replace than to inspect and repair.
- (d) Have a history of high usage.
- (e) Parts that have a high documented failure rate and are costly to replace between overhauls. No direct or indirect citation of the actual failure rate of any part is allowed. Technical manuals shall not list or cite any figures of merit for the reliability or maintainability of the equipment (or parts) at any level of indenture.

3.5.7.1.6 Contingency material list. A contingency material list shall be developed in accordance with MIL-M-24784. It shall be a tabular listing of parts similar to figure 8-7. When developed, there shall be a separate sheet for each subassembly or breakout item listed in Chapter 5. The contingency material list is a guide for material that may be needed when the unit is overhauled. It shall

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list the parts which may require replacement during the overhaul of the unit. Any part listed in the contingency material list shall be addressed in the appropriate inspection and repair subsection of the TRS. Those parts whose costs approach or exceed the total cost of the unit shall not be listed. Parts which rarely require replacement and are not normally replacement parts for unit overhaul shall not be listed.

3.5.7.2 Appendix B - Test support equipment data. This section shall contain augmenting instructions, data, and illustrations required to fabricate, maintain, and calibrate (unique requirements) the test and repair support equipment utilized in the TRS:

- (a) Examples of support equipment are: test fixtures and special electronic test equipment; mounting, holding, and support jigs; special tools and gauges; special mechanical and electrical interface or interconnection (mating) adapters, cables, and connectors, and so forth.
- (b) If there are no requirements for special test support equipment data, the TRS shall so specify.

3.5.7.2.1 Test support equipment data requirements. Data shall be developed in accordance with SPETE information, nonstandard general purpose electronic test equipment information, maintenance tools summary, and the test fixture information paragraphs of MIL-STD-1345.

3.5.7.3 Appendix C - Test data record sheets. This section shall contain the TRS test data record sheets for the repairable items covered by the TRS.

3.5.7.4 Additional appendices (D and on). Other appendices shall be developed for the specific repairable items type covered by the TRS as required.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

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4.2 Quality control. Unless otherwise specified (see 6.2), the quality conformance inspection, Government inspection, validation, verification, technical manual quality assurance (TMQA) program reviews, technical manual evaluation records and rejection requirements shall be in accordance with MIL-M-24784.

## 5. PACKAGING

5.1 Packaging requirements. Unless otherwise specified (see 6.2), the packaging and preservation requirements for delivery of book plans, review draft copies, preliminary technical manuals, final reproducible copy, technical manuals, replenishment materials, changes and revisions shall be in accordance with MIL-M-24784.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The TRS supplements the technical maintenance section of the technical manual for the electronic item and provides all necessary technical information required to rebuild or restore the electronics item. Normal maintenance and test procedures covered in the technical manual for the item should not be repeated in the TRS except when deemed necessary for clarity or continuity. Instead, reference to the manual will be made.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- (a) Title, number, and date of this specification (or any TMCR referencing this specification).
- (b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1).
- (c) Applicable publication number, classification, and distribution statement (see 3.1).
- (d) An outline or book plan manual must be specified whenever a technical manual is required for a new equipment or system (see 3.2a).
- (e) Double column text must normally be specified. When increased effectiveness of presentation results, a single column format is also acceptable.
- (f) A review draft copy (RDC) must always be specified for every new technical manual (see 3.2b). An RDC also must be specified for manual change or revision procurements (see 3.2f and 3.2g), unless changes to the technical manual have been pre-approved (TMDER, ECP, and so forth) by the Government.
- (g) Specify the number of weeks required for Government review of technical manual deliverables.
- (h) Specify a preliminary technical manual when an extended period of use is required prior to Government verification (normally applies to complex equipment and systems only), see 3.2c.
- (i) Final reproducible copy (see 3.2d).
- (j) Supplements to manuals (see 3.2e) must be specified when:



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- (1) Classified information can be confined to the supplement manual such that its basic technical manual will be routed as "unclassified".
  - (2) It augments a technical manual to provide for a different model and can be justified as a cost effective method of promulgation.
  - (3) It can be justified as a practical method of promulgation.
- (k) Changes must be specified only when they pertain to technical manual corrections resulting from a hardware change or modification. They may also be specified if it has been determined that significant omissions of technical data or information has been identified. Do not specify a change to correct minor or editorial corrections. When changes are justified on the above basis, the change package must include the correction of all outstanding temporary or interim changes and may include minor changes (see 3.2f). The change package must be developed in accordance with MIL-M-24784/1.
- (l) Whenever the number of change pages is estimated to exceed approximately 25 percent of the total number of pages in the manual, an update revision must be specified (see 3.2g) and developed in accordance with MIL-M-24784/2.
  - (m) When the total number of pages requiring change exceed approximately 50 percent of the total number of pages in the manual, a complete revision must be specified (see 3.2g) and developed in accordance with MIL-M-24784/2.
  - (n) Cost and pricing data (see 3.2i).
  - (o) What quality assurance and management data items are to be delivered (see 3.2.3, 4.2, 6.4 and MIL-M-24784).
    - (1) TMQA program.
    - (2) Validation plan.
    - (3) Validation certification.
    - (4) Evaluation records.
    - (5) Verification plan.
    - (6) Verification incorporation certification.
  - (p) Identification of inspection and repair of items covered in the TRS (see 3.5.5).
  - (q) Requirements for parts lists (see 3.5.5.4.4, 3.5.7.1.5 and 3.5.7.1.6).
  - (r) When preservation, packing, and marking are other than as specified (see Section 5. PACKAGING).
  - (s) For classified equipment, attach a DD Form 254 specifying the following:
    - (1) Security classification.
    - (2) Downgrading and declassification notification.
    - (3) Areas requiring security protection.

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6.3 Technical manual acquisition. This specification (or a TMCR based on this specification) must be listed on the Contract Data Requirements List (DD Form 1423) in order to acquire the technical manuals described by this specification, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

6.4 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>
3.2.3	DI-M-2194	Manual, Technical; Quality Assurance Program Plan
3.2.3	DI-M-2195	Manual, Technical; Validation Plan
3.2.3	DI-M-2196	Manual, Technical; Validation Certification
3.2.3	DI-M-2197	Manual, Technical, Evaluation Record
3.2.3	DI-M-2198	Manual, Technical; Verification Plan
3.2.3	DI-M-2201	Technical Manual Verification Incorporation certification

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.5 Definitions. The words or phrases used throughout this specification shall be as defined in MIL-M-24784 and the following.

6.5.1 Critical procedures. Those procedures which:

- (a) Are necessary to restore the equipment to performance specifications.
- (b) If not accomplished, would prevent the equipment from operating between overhauls.
- (c) Contain safety related or precautionary measures designed to minimize personal injury or equipment damage.

6.5.2 Final acceptance tests (FAT). The examination and testing of repairable items after completion of overhaul or repair to ensure that the items satisfy performance requirements.

6.5.3 Repairable item. An item of durable nature which, when unserviceable, normally can be economically restored to a serviceable condition through repair procedures performed by a Government or commercial overhaul facility.

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6.5.4 Subassembly. A portion of an assembly or unit which is replaceable as a whole, but also has a part or parts which are individually replaceable. (The distinction between an assembly and a subassembly is determined by the individual application. An assembly in one instance may be a subassembly in another, where it forms a portion of an assembly.)

6.5.5 Work-unit/work-package concept. An individual unit of information containing all data necessary for a technician to perform a specific task with minimal referencing.

6.6 Subject term (key word listing).

Examination test and repair action record.  
Material condition/overhaul report.  
Material deficiency evaluation report.  
Technical manual identification number.

Review activity:  
Navy - EC

Preparing activity:  
Navy - SH  
(Project TMSS-N242-08)

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2.2.1 Minimum use specifications are the principal parameters required for performance of the required tests, and are included to assist in the selection of alternate equipment, which may be used at the discretion of the using activity. Satisfactory performance of alternate items shall be verified prior to use. All applicable equipment must bear evidence of current calibration in accordance with MIL-C-45662.

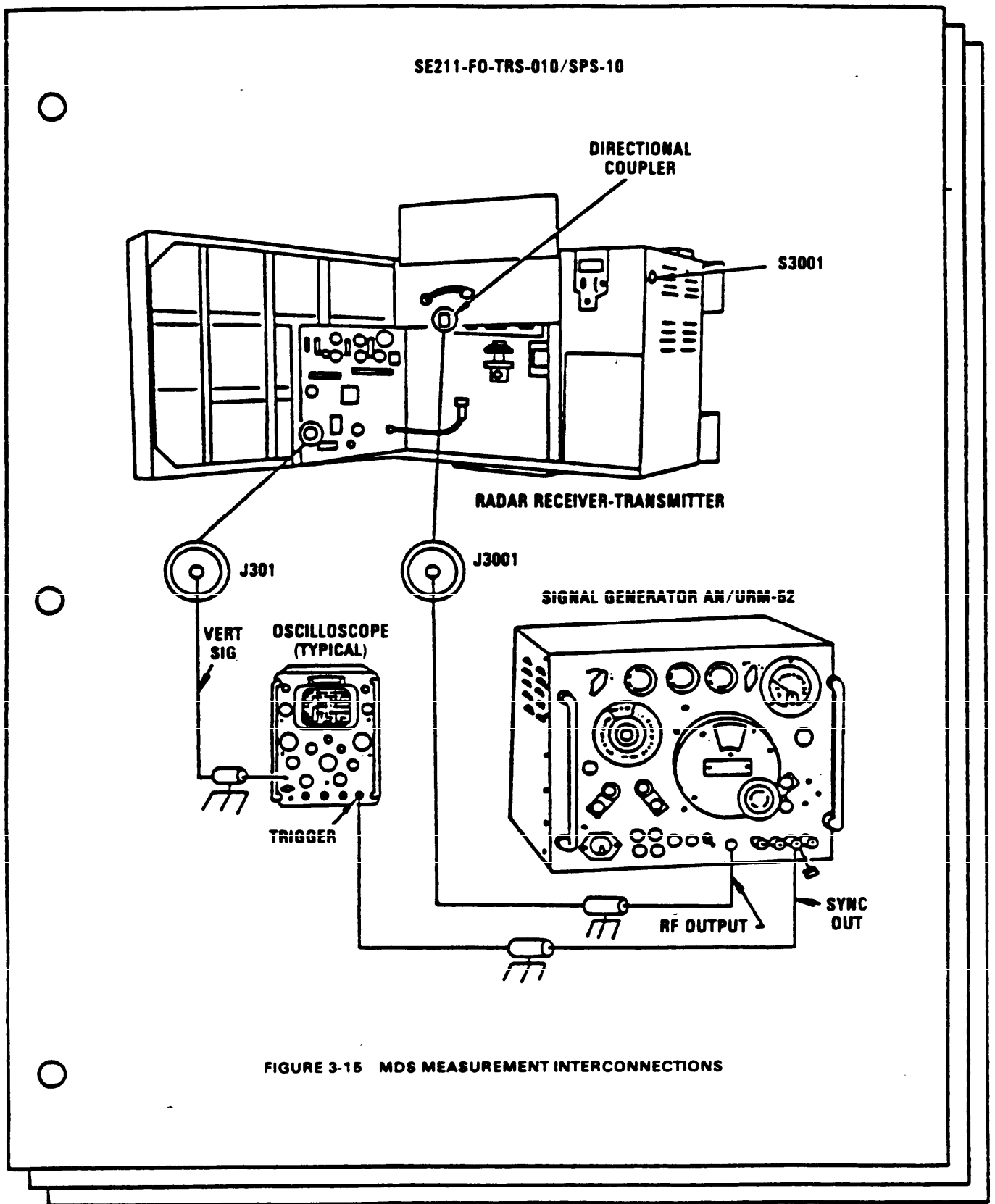
2.2.2 The instruments utilized in these procedures were selected from those known to be available at Department of Defense facilities, and the listing by make or model number carries no implication of preference, recommendation, or approval by the Department of Defense for use by other agencies. It is recognized that equivalent equipment produced by other manufacturers may be capable of equally satisfactory performance in the procedure. Alternate equipment, where necessary, shall be selected in accordance with MIL-STD-1364. Refer to Table 2-2 for recommended test equipment.

Table 2-2. Test Equivalent

MFR AND MODEL NUMBER	DESCRIPTION	MINIMUM USE SPECIFICATIONS
TS-2133/WRC-1	Test Fixture	Test A2A6
HP 606B or Equivalent	Signal Generator	2-29 MHz at 10 mV out
HP 5245L or Equivalent	Frequency Counter	1 KHz to 35 MHz
AN/USM-281 or Equivalent	Oscilloscope	Scope trace between 2.3-3.6 Vdc with min. ripple
Simpson 260 or Equivalent	Multimeter	As Required
Fluks 8120 or Equivalent	Digital Voltmeter	+28 Vdc
HP 141T or Equivalent	Display and Main Frame	CRT display of information processed by HP 8443A, 8552B and 8553B
HP 8443A or Equivalent	Tracking Generator	100 KHz to 110 MHz -120 dBm to +10 dBm
HP 8552B or Equivalent	1-F Section	10 dB/div log, 2 db/div log and linear displays
HP 8553B or Equivalent	Spectrum Analyzer/ RF Section	1 kHz to 23.5 MHz 3 to 90 mV
HP 1121A or Equivalent	500 MHz Probe	100k ohm, 3 pF input AC, Impedance
NAVSECNORDIV TS-2133/ WRC/A1 or Equivalent	MHz Repair Aid	Interface with A2A6A1
NAVSECNORDIV TS-2133/ WRC/A2 or Equivalent	100 kHz SYN Repair Aid	Interface with A2A6A2
NAVSECNORDIV TS-2133/ WRC/A3 or Equivalent	1 & 10 KHz Repair Aid	Interface with A2A6A3
NAVSECNORDIV TS-2133/ WRC/A5 or Equivalent	500 Hz SYN Repair Aid	Interface with A2A6A5

FIGURE 8-1. Test equipment requirements table. (Sample)

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**FIGURE 3-15 MDS MEASUREMENT INTERCONNECTIONS**

**FIGURE 8-2. Performance test set-up. (Sample)**

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SXXXX-XX-TRS-XXX					
TRS TEST DATA RECORD					
DOP ACTIVITY		NAME _____			
		LOCATION _____			
TRS TITLE		RF AMPLIFIER ELECTRONIC ASSEMBLY			
NOMENCLATURE		PART NO.	SER NO.		
RF AMPLIFIER ELECTRONIC ASSEMBLY		866230-019			
TEST VERIFICATION CHECK LIST					
EQUIPMENT			TEST		
PROC STEP	PERFORMANCE REQUIREMENT	ACTUAL PERFORMANCE (RECORD TEST RESULTS)	TEST INSPEC- TION DATE	CONDUCTOR (INITIAL)	INSPECTOR (INITIAL)
4.3.1f	-1 TO -11 dB				
4.3.1g	± 3 dB, MAX. VARIATION				
4.3.1h	± 1 dB, MAX. VARIATION				
4.3.1i	± 3 dB, MAX. VARIATION				
4.3.1j	-1 TO -11 dB (2-20 MHz)				
	-3 TO -15 dB (21-29 MHz)				
4.3.2e	-1 TO -11 dB				
4.3.2f	-50 dB BELOW REFERENCE				
4.3.2g	-14 TO -25 VDC				
4.3.2h	NLT + 18 dB				
4.3.2k	(1)NLT + 18 dB				
DOP:		TEST RESULTS ACCEPTED BY:			
TEST SUPERVISOR:	DOP:	CUSTOMER: (OPTIONAL)			
	QUALITY ASSURANCE OFFICE:	AGENCY:			
APPROVED:	APPROVED:	CONCURRED BY:			
DATE: _____	DATE: _____	DATE: _____			

FIGURE C-2 RF AMPLIFIER ELECTRONIC ASSEMBLY

C-7

FIGURE 8-3. Test data record. (Sample)

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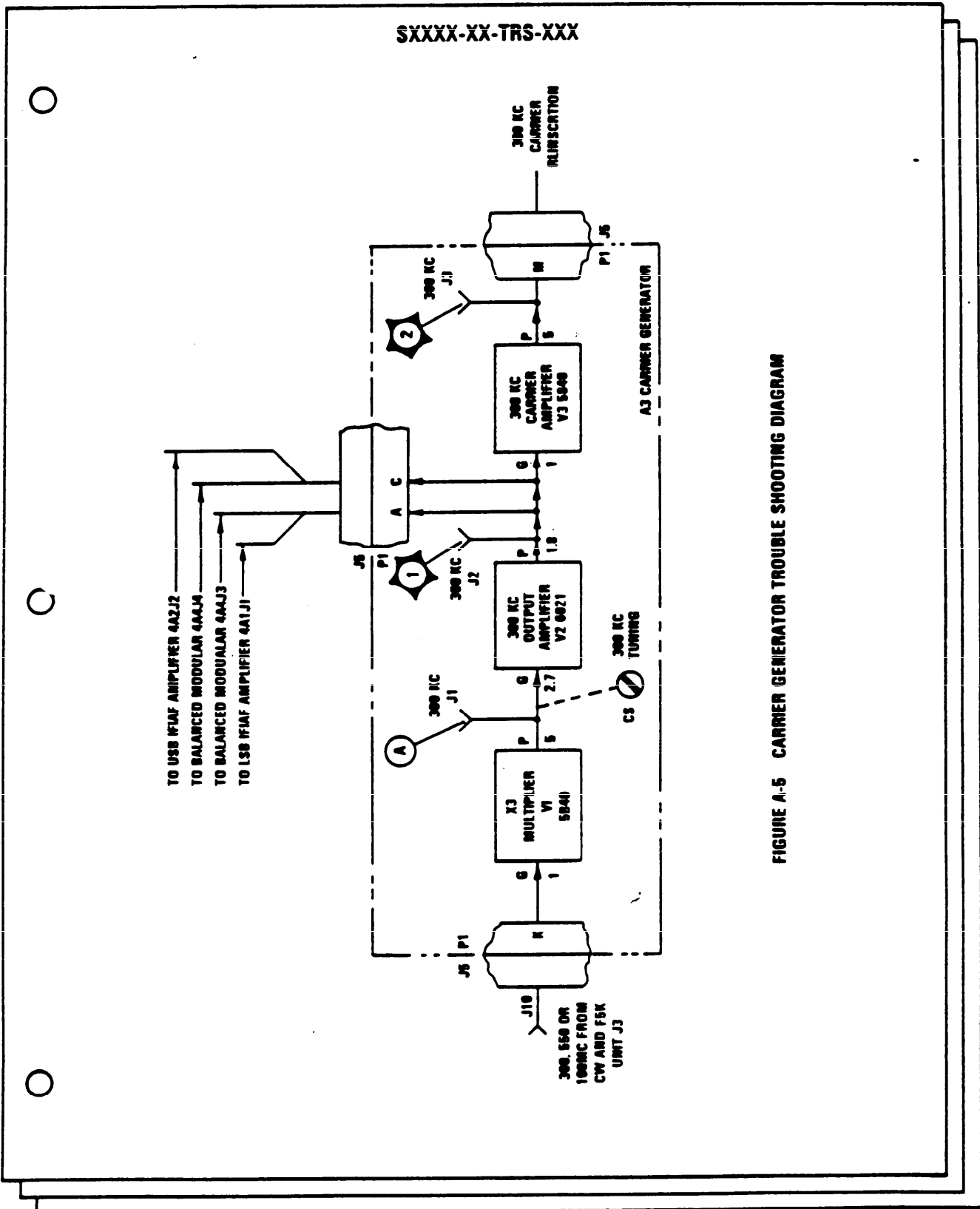


FIGURE A-5 CARRIER GENERATOR TROUBLE SHOOTING DIAGRAM

FIGURE 8-4. Repairable item troubleshooting block diagram. (Sample)

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## SXXXX-XX-TRS-XXX

TABLE A-1 REPAIRABLE ITEMS PARTS LIST

REF DESIG	NAME AND DESCRIPTION	FIG. NO.
A2A6	TRANSLATOR-SYNTHESIZER SUBASSEMBLY, Mfr 06845 PN 2058940-0501	5-1
A2A6C1	CAPACITOR, MIL Type CS13F470K	5-1
A2A6C2	SAME AS A2A6C1	5-1
A2A6J4	CONNECTOR, Receptacle, Electrical, 2.08 x 0.42 x 0.62 in., 17 Contacts, Mfr 71468, PN DBMF17W2S2C31	5-1
A2A6J5	CONNECTOR, Receptacle, Electrical, 2.08 x 0.42 x 0.62 in., 13 Contacts, Mfr 71468, PN DBMF13W3S2C31	5-1
A2A6J6	CONNECTOR, Receptacle, Electrical, 2.08 x 0.42 x 0.62 in., 9 Contacts, Mfr 71468, PN DBMF9W4S2C31	5-1
A2A6P1	CONNECTOR, Plug, Electrical, 2.72 x 0.42 x 0.62 in., 25 Contacts, Mfr 71468, PN DCM25W3P	5-1
A2A6P2	CONNECTOR, Plug, Electrical, 1.54 x 0.42 x 0.62 in., 3 Contacts, Mfr 71468, PN DAM3W3P	5-1
A2A6P3	SAME AS A2A6P2	
A2A6P7	CONNECTOR, Plug, Electrical, Red, 0.14 Dia x 0.34 in., Mfr 98291, PN SKT-14	5-1
A2A6P8	CONNECTOR, Plug, Electrical, Green, 0.14 dia x 0.34 in., Mfr 98291, PN SKT-14	5-1
A2A6P9	CONNECTOR, Plug, Electrical, Orange, 0.14 dia x 0.34 in., Mfr 98291, PN SKT-14	5-1
A2A6P10	CONNECTOR, Plug, Electrical, Gray, 0.14 dia x 0.34 in., Mfr 98291, PN SKT-14	5-1
A2A6P11	CONNECTOR, Plug, Electrical, Rt Angle, 0.63 x 0.53 in., Mfr 06845, PN 559998-273	5-1
A2A6P12	SAME AS A2A6P11	
A2A6P13	CONNECTOR, Plug, Electrical, Mfr 06845, PN 559998-299	5-1
A2A6P14	SAME AS A2A6P11	
A2A6P15	SAME AS A2A6P7	

A-XX

FIGURE 8-5. Repairable item parts list table. (Sample)







## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the comment number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of this form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

 1. DOCUMENT NUMBER  
MIL-M-24784/8(SH)

 2. DOCUMENT DATE (YYMMDD)  
940906

## 3. DOCUMENT TITLE

MANUAL, TECHNICAL REPAIR STANDARDS (TRS) REQUIREMENTS FOR ELECTRONIC EQUIPMENT

4. NATURE OF CHANGE (identity paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

## 5. REASON FOR RECOMMENDATION

## 6. SUBMITTER

A. NAME (Last, First, Middle Initial)

b. ORGANIZATION

c. ADDRESS (include Zip Code)

 d. TELEPHONE (Include Area Code)  
(1) Commercial  
(2) DSN  
(if applicable)

7. DATE SUBMITTED (YYMMDD)

## 8. PREPARING ACTIVITY

 A. NAME Technical Point of Contact (TPOC)  
MR. MICKEY ANDER, SEA 04TD3  
ADDRESS ALL CORRESPONDENCE AS FOLLOWS:

 b. TELEPHONE (Include Area Code)  
(1) Commercial:

DSN:

TPOC: 703-602-8701

8-332-8701

 c. ADDRESS (Include Zip Code)  
COMMANDER, NAVAL SEA SYSTEMS COMMAND  
ATTN: SEA 03R42  
2531 JEFFERSON DAVIS HIGHWAY  
ARLINGTON, VA 22242-5160

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:

 Defense Quality and Standardization Office  
5203 Leesburg Pike, Suite 1403  
Falls Church, VA 22041-3466  
Telephone 703-756-2340 DSN 289-2340