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SENSITIVE

MIL-T-24747(SH)  
27 February 1991

MILITARY SPECIFICATION  
TECHNICAL REPAIR STANDARDS (TRS) MANUAL;  
PREPARATION OF

This specification is approved 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 preparation of technical repair standards (TRSs) for use in performing class B overhauls (see 6.4.5 ) to hull, mechanical, and electrical (HM&E), electronics, and ordnance equipment and components (see 6.4.7). This specification contains specific integrated instruction for the preparation of:

- (a) Schedules and status reports.
- (b) Outline/book plan.
- (c) Manuscripts and preliminary draft manuals.
- (d) Final reproducible copy.
- (e) Changes and revisions.
- (f) Cost and pricing data.

1.2 Classification. This specification is applicable to TRSs for the following types of equipment (see 6.2):

- (a) Type I - HM&E.
- (b) Type II - Electronics and interior communications.
- (c) Type III - Ordnance.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 5523, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC TMSS

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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## 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).

## SPECIFICATIONS

## MILITARY

- MIL-M-15071 - Manuals, Technical: Equipments and Systems Content Requirements for.
- MIL-M-38784 - Manuals, Technical: General Style and Format Requirements.
- MIL-M-85337 - Manuals, Technical: Quality Assurance Program; Requirements for.

## STANDARDS

## FEDERAL

- FED-STD-209 - Clean Room and Work Station Requirements, Controlled Environment.

## MILITARY

- MIL-STD-278 - Welding and Casting Standard.
- MIL-STD-454 - Standard General Requirements for Electronic Equipment.
- MIL-STD-480 - Configuration Control - Engineering Changes, Deviations and Waivers.
- MIL-STD-481 - Configuration Control - Engineering Changes, (Short Form) Deviations and Waivers.
- 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-2073-1 - DoD Materiel Procedures for Development and Application of Packaging Requirements.
- MIL-STD-45662 - Calibration Systems Requirements.

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HANDBOOKS

MILITARY

MIL-HDBK-267 - Guide for Selection of Lubricants and Hydraulic Fluids for Use in Shipboard Equipment.

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

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

PUBLICATIONS

DOD-5220.22-M - Industrial Security Manual for Safeguarding Classified Information (USDP).

N0000-00-IDX-000/TMINS - Technical Manual Identification Numbering System (TMINS) Application Guide and Index.

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

DRAWINGS

NAVSEA 0900-LP-038-6010 - Electroplating Brush on Method, Deposition of Metals by Contact.  
NAVSEA 0948-LP-04507010 - Material Control Standard (Non Nuclear)

(Application for copies should be addressed to the Standardization Documents Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 3951 - Standard Practice for Commercial Packaging.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services).

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Security classifications. Unless otherwise specified, the TRS shall not contain classified information. Handling, production, and dissemination of unclassified material shall be in accordance with the limitations imposed in the applicable distribution statement provided by the contracting activity (see 6.2). When the TRS must contain classified data, the marking of all classified material will be assigned by the Government in accordance with MIL-M-38784 and DOD-5220.22-M. The assigned document identification number will reflect the classification level in accordance with N0000-00-IDX-000/TMINS.

3.2 Deliverable data items. The deliverable data items of the TRS shall be specified in the contract data requirements listing (CDRL) and shall conform to the requirements specified herein. Data items shall include the following, as applicable:

- (a) Schedules and status reports.
- (b) Outline/book plan.
- (c) Engineering judgment record.
- (d) Cost and pricing data.
- (e) Manuscript TRS.
- (f) Preliminary TRS.
- (g) Changes.
- (h) Revisions.
- (i) Final reproducible copy.

3.2.1 Schedules and status reports. Schedules and status reports for all products and data items shall be specified in accordance with the requirements of 3.2.1.1 through 3.2.1.2 (see 6.2). These reports may be combined with other management level reports.

3.2.1.1 Format and style. Schedules and status reports may be typewritten on 8-1/2 by 11-inch commercial bond paper in a format similar to figure 1.

3.2.1.2 Content. Schedules and status reports shall provide a comprehensive management level analysis of all preparation activities. They shall summarize what was completed during the past reporting period, current status of TRS development, and an explanation of any problem encountered or anticipated delays. Reports shall further indicate what action is being taken to correct or minimize the problems and shall highlight any action required on the part of the acquisition activity. Proposed changes to the outline/book plans

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shall be included with the report for acquisition activity review and acceptance. The report shall routinely include a listing of the actual percentage of completion of milestones for each data item.

**3.2.2 Outline/book plan.** A two-part plan for each recommended volume of each proposed TRS shall be approved prior to preparation of the TRS (see 6.2). The outline/book plan shall consist of a narrative outline and a book plan.

**3.2.2.1 Outline coverage.** A brief narrative in outline form shall summarize the main points of the outline/book plan. The outline shall address the following:

- (a) The approach to be used in presenting the overhaul (see 6.4.16) strategy shall be described. A repair (see 6.4.18) process flow chart similar to figure 2 shall be used to present the overhaul strategy.
- (b) The range and depth of outline coverage shall be based upon the logistic support analysis records (LSARs) and reliability centered maintenance program (RCM) of the equipment (see 6.4.10) and the complexity of the planned overhaul (see 6.4.17) and shall include:
  - (1) The minimum procedures and testing requirements to ensure that the class B overhaul can be performed in an efficient manner by a journeyman-level mechanic.
  - (2) The minimum mandatory replacement parts consistent with the required period between planned overhauls.
  - (3) Preparation of an engineering judgment record (EJR) package for HM&E and Ordnance TRSs.
- (c) For compound items, the preferred method of data presentation is to divide the major unit into functional volumes and parts. Each assembly (see 6.4.4) should be contained in a separate volume. It may be considered appropriate to present the test data record sheets for an item as a separately bound part of a TRS volume. For HM&E TRSs, examination, test, and repair action record data sheets shall be contained in a separately bound part of a TRS volume for each item.
- (d) The outline/book plan shall fully enforce all TRS content requirements.
- (e) Problems regarding requirements, interpretation, and application shall be identified.
- (f) Conflicts between guidance documents shall be highlighted.

**3.2.2.2 Book plan coverage.** A book plan shall be prepared based on the development of a table of contents for each planned volume (including separately bound parts of that volume):

- (a) A text guide shall list chapter, section, and informative paragraph titles. A brief statement (outlining the content and intended coverage) shall follow each chapter, section, and paragraph title.

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- (b) A list of illustrations and a list of tables shall be keyed to the text plan. Each illustration and table listed shall be described. The illustration plan shall contain figure numbers, title, information content, and approximate size and nature for all illustrations (such as schematic, line drawing, and exploded view). A sample of each drawing type referenced in the illustration plan shall be included.
- (c) The estimated total number of text and illustration pages per chapter shall be listed.
- (d) Data for the front matter, including a brief description of the material to be presented in the foreword, shall be prepared.
- (e) Data required for the technical content portion of the TRS shall outline the planned TRS coverage by proposed volumes, divisions, and so forth, in accordance with the content and format requirements of this specification. For general TRS subject matter presentation guidance see 3.4, for HM&E equipment see 3.5, for electronics equipment see 3.6, for ordnance equipment see 3.7.

3.2.2.3 Model manual. When approved by the contracting activity, an existing TRS may be used as an outline and that manual shall be marked up and submitted as a book plan. The text from the model manual may be used verbatim with changes to cover the equipment differences and to correct inconsistencies, unclear wording, or obvious editorial or typographical errors. However, the format requirements in this specification shall apply for all new TRSs. All inconsistencies, unclear wording, or errors noted by the preparing activity in the model manual shall be identified to the acquisition activity. All deviations from the model manual shall be approved by the contracting activity.

3.2.2.4 Outline, book plan, model manual acceptance. The outline/book plan, or model manual, shall be submitted prior to development of the TRS. All unacceptable portions shall be corrected and re-submitted. The accepted outline/book plan or model manual shall be available for review and comparison with draft TRS material at all scheduled in-process review (IPR) conferences.

3.2.2.5 Outline, book plan updating. The outline/book plan shall be kept current during TRS development, and until acceptance of the TRS. Significant changes to the book plan shall be submitted for acceptance. Improved data presentation shall be considered the prime justification for changing the outline/book plan.

3.2.3 Engineering judgment record (EJR). EJR records shall accompany HM&E and ordnance TRSs submitted, but shall not form a part of the TRS. The EJR shall contain the engineering analyses and reasoning in support of all deviations to tolerances, limits, and other parameters included in the TRS. Each deviation shall be identified with the associated paragraph numbers of the TRS. If deviations from specification requirements are necessary, requests for deviation shall be submitted together with a separate engineering analysis in accordance with established procedures in DOD-STD-480. The format of a typical EJR is shown

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on figure 3 (see 6.2). The Government will retain this record for reference and information.

- (a) First time acquisitions. Concurrent with the first acquisition of a new system (see 6.4.21), equipment, or component design; a concise, formal EJR shall be prepared for each data entry.
- (b) Reacquisitions. For TRSs or TRS change pages prepared for existing equipment or systems, a formal EJR is not required for each data entry. When changes or deviations from existing documents are proposed with regard to clearances, tolerances, materials, procedures, or the implementation of new procedures, worksheets justifying the change or deviation shall be submitted.
  - (1) Departure from design specifications shall only be authorized in accordance with DOD-STD-480.

3.2.4 Cost and pricing data. TRSs shall be acquired in a cost-effective manner (see 6.2). Detailed cost and pricing data shall be obtained for each new, revised, or changed TRS. A separate analysis shall be provided together with supporting documentation for each TRS developed. The cost of TRSs shall be limited to the effort and material needed to produce the TRS from source data. Figure 4 is an example of a cost and pricing data form.

3.2.5 Manuscript TRS. A TRS manuscript shall be prepared for review and approval in accordance with MIL-M-38784 and, when specified the final reproducible copy (FRC), prior to the preparation of the camera-ready copy (see 6.2). The review manuscript shall include all data required for the final TRS. The review manuscript shall contain all front matter, text, tables, and illustrations necessary to meet the content requirements of this specification. The manuscript shall be technically accurate (see 6.4.2), adequate (see 6.4.3), and shall represent the configurations of the repairable items (see 6.4.19) for which the TRS is prepared. The manuscript shall be validated (see 6.4.22) in accordance with the provisions of the approved validation plan.

3.2.5.1 Manuscript preparation. The TRS manuscript front matter and text shall be prepared in accordance with MIL-M-38784 and the following:

- (a) Unclassified manuscripts shall be duplicated and loose leaf bound in pressboard or equivalent binders.
- (b) Illustrations, drawings, and tables shall be final size, complete with titles, figures, and table numbers.
- (c) Official nomenclature, common names, and equipment abbreviations shall appear in their normal-reading sequence. The nomenclature shall be used consistently in the text, figures, and tables of the text plan. Transposed nomenclature shall be used in illustrated parts breakdowns (IPBs) or indexes.
- (d) The words "MANUSCRIPT COPY" shall be placed on the cover and title page above the technical manual identification number (TMIN). Letters shall be 18-point bold-face type and capitalized.



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- (e) The manuscript shall be complete in all respects with all in-process review comments incorporated. A completed and signed validation certificate shall accompany the manuscript submitted for technical review. Following review, the preparing activity shall incorporate all required changes.
- (f) Appropriate EJRs (HM&E and ordnance only) shall accompany the review manuscript.

3.2.5.2 Manuscript rejection criteria. Failure to meet the procurement requirements as specified herein shall be cause for rejection and subject to correction:

- (a) Technical inaccuracy and inconsistencies. Failure of all information to exactly represent the equipment or system being described and to be consistent with descriptive terms.
- (b) Omission of data. Omission of any applicable data elements or inspection and verification (I&V) (see 6.4.13) points.
- (c) Illustration and drawing clarity. Failure to provide legible illustration or drawing copies which are easy to read.
- (d) Evidence of validation. Failure to provide adequate evidence of validation.
- (e) Workmanship. Significant typographical and grammatical errors.
- (f) Change requirements. Failure to include changes or corrections required as conditions for approving the manuscript.

3.2.5.3 Manuscript approval. TRSs shall be approved by the government commodity manager. For HM&E equipment, the life cycle manager (LCM) is the technical approval authority unless previously delegated. Once a TRS has been approved, it shall not be modified without further approval.

3.2.6 Preliminary TRS. When specified (see 6.2) a preliminary TRS shall be prepared. The preliminary manual shall reflect the review manuscript with all Government review comments incorporated and shall be superseded by a final manual. The preliminary manual shall be prepared in accordance with MIL-M-38784 and the following:

- (a) The words "PRELIMINARY ISSUE" shall be placed on the cover and title page above the NAVSEA TMIN. Letters shall be 18-point bold-face type and capitalized.
- (b) Unclassified preliminary TRS copies may be duplicated, loose-leaf bound, and delivered in accordance with this specification.
- (c) The preliminary TRS shall be complete in all respects and shall reflect the manuscript with all comments incorporated. The preliminary TRS shall be submitted for final review and NAVSEA LCM signature. Should additional changes be required, the developing activity shall revise accordingly and resubmit to NAVSEA LCM for signature. At time of submittal of the preliminary TRS, the developing activity shall obtain a distribution list from the cognizant maintenance activity.



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- (d) The reproducible copy and integrally-related artwork (including schematics, wiring diagrams, and block diagrams) shall be of sufficient darkness to reproduce clearly at required reproduction size without additional treatment. Illustrations shall be final size, complete with figure numbers and titles.
- (e) Copies of the preliminary TRS may be used as an interim TRS and for verification (see 6.4.23).

3.2.7 Permanent changes. (See 6.2).

3.2.7.1 Change sheet. A change sheet shall be prepared for each TRS, as needed, in accordance with MIL-M-38784.

3.2.7.2 Change record. A permanent change record (see figure 5) shall be included in each TRS in accordance with MIL-M-38784.

3.2.8 Revisions. A revision of a TRS (see 6.2) is a reissue of a complete TRS and shall be prepared, issued, and identified in accordance with MIL-M-38784. Each revision shall incorporate all outstanding approved changes of the previous issue, as well as approved changes proposed by the change record that creates the need for revision. A complete revision supersedes a basic TRS when a major portion of the basic TRS is designated inadequate because of obsolescence, method of presentation, arrangement, or any other reason detrimental to the user.

3.2.9 Final reproducible copy. The final TRS shall be prepared in accordance with MIL-M-38784 and shall incorporate all comments resulting from the technical and format-compliance reviews, approved changes resulting from on-site verification, comments resulting from interim use of the preliminary TRS's (see 6.2). The TRS reproducible copy shall be the property of the Government. The reproducible copy and related artwork including schematics, wiring diagrams, and block diagrams, shall be prepared in accordance with MIL-M-38784. Text shall be single-column, single spaced, with unjustified right-hand margins. Justified right-hand margins may be provided if there is no additional cost to the Government. The following shall be addressed:

- (a) Running feet of text pages shall include "Original" at the inboard edge and the page number at the outboard edge.
- (b) There shall be no drawing data, other than horizontal lines, placed closer than 1/8-inch from the image area limit.
- (c) Minimum printed type size for text shall be 10-point elite type. Nomenclature, callouts, tabular material, and symbols on illustrations shall be upper-case with 7-point (0.10 inch) minimum printed size (see 6.2).

3.3 TRS arrangement. Each TRS shall be arranged into volumes according to a standardized format:

- (a) Title page.
- (b) Front matter.
- (c) Technical content subject matter.

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- (d) Appendices.
- (e) Glossaries.
- (f) Indices.
- (g) Technical Manual Deficiency Reports (TMDERs).

3.3.1 TRS title page. The TRS title page (see figure 6) shall be prepared in accordance with MIL-M-38784 and this specification. Type style shall be universal, medium condensed, or equivalent. Type size indicates the height of capital letters. Spacing and placement of necessary information may be varied slightly according to the number and length of information items to be presented. The end product should be a well-balanced title page.

3.3.2 Publication date. The publication date is the copy freeze date. It shall be the day of the month in which the latest material is included in the TRS. The day, month, and year shall be shown in that order on the title page only, below and to the right of the authority notice. The publication date shall not be shown on the cover. If more than one volume is printed, the date shall be the same on all volumes.

3.3.3 TRS front matter. The front matter shall be formatted in accordance with MIL-M-38784:

- (a) List of effective pages.
- (b) Change record.
- (c) Table of contents.
- (d) List of illustrations.
- (e) List of tables.
- (f) Safety summary.

3.3.3.1 List of effective pages. The list of effective pages shall be prepared in accordance with MIL-M-38784 (see figure 7).

3.3.3.2 Change record. A change record shall be prepared in accordance with MIL-M-38784 (see 6.2).

3.3.3.3 Table of contents. A table of contents shall be prepared in accordance with MIL-M-38784 (see figure 8).

3.3.3.4 List of illustrations. A list of illustrations shall be in accordance with MIL-M-38784 (see figure 9).

3.3.3.5 List of tables. A list of tables shall be prepared in accordance with MIL-M-38784 (see figure 10).

3.3.3.6 Safety summary. A safety summary shall be prepared in accordance with MIL-M-38784 (see figure 11).

3.3.4 TRS subject matter. The TRS shall provide detailed instructions for performing a class B overhaul. The TRS shall discuss critical procedures (see 6.4.9), testing and maintenance examinations, supporting illustrations,

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lists of items to be replaced (see 6.4.14), and any special tools needed for the overhaul. The TRS shall also describe critical operations and checks that must 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 type I HM&E (see 3.5), type II electronics (see 3.6), and type III ordnance (see 3.7) requirements. The TRS sequence and breakdown of divisions shall be as follows:

- (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 6.4.20), shall be divided so that each major item will be addressed in a separate chapter to promote the work-unit, work-package concept (see 6.4.24).
- (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.

3.3.4.1 TRS divisions. The presentation of the technical subject matter shall be in accordance with MIL-M-38784 and as described in 3.3.4.1.1 through 3.3.4.1.5.

3.3.4.1.1 Volumes. TRS volumes shall be formatted in accordance with MIL-M-38784 and this specification. Each volume of a TRS will be formatted into two or more separate parts according to required subject matter and be identified by a unique NAVSEA TMIN, stock number, title, and subtitles that describe the contents. TRS prime titles for HM&E equipment shall be consistent with the official expanded ship work breakdown structure (ESWBS) nomenclature.

3.3.4.1.2 Parts. When specified by the acquisition activity (or a volume exceeds 3 inches), 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.

3.3.4.1.3 Chapters. The TRS shall be divided into chapters to provide a logical work sequence arrangement. Chapters shall start on a right-hand page and shall be identified by use of an Arabic numeral on the heading page. Pages within a chapter are identified by use of a chapter number, hyphen, and successive page numbers.

3.3.4.1.4 Sections. TRS sections shall be formatted in accordance with MIL-M-38784 and this specification. When multiple-coverage in chapters of TRSs for compound items is approved by the contracting activity, a chapter sectioning technique may be employed. In this instance, a section that reflects a separate

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breakout item or separate allowance parts list (APL)-identified unit shall start on a new right-hand page.

3.3.4.1.5 Paragraphs. TRS paragraphs shall be formatted and numbered in accordance with MIL-M-38784.

3.3.4.1.6 Paragraph headings. TRS paragraph headings shall be developed in accordance with MIL-M-38784 and this specification. Informative paragraph headings shall be used to identify subject matter (see figure 12). Each paragraph heading (sidehead) shall describe that paragraph's contents and start with a significant word.

3.3.4.1.6.1 Informative headings. Headings shall be informative and not merely labels. Headings shall serve two purposes. First, they shall make access to information easier by permitting the reader to scan a page to find the information needed. Second, they shall alert the reader to the type of information contained in the text to follow. Examples are as follows:

<u>Label heading</u>	<u>Information heading</u>
Procedure	Procedure for recording temperature
Instrumentation	Heat measured by thermocouples
Discussion	Reasons for waveform variations
General description	Symbols created for radar PPI

3.3.4.1.6.2 Headings and relevance. A paragraph or procedure heading shall uniquely identify the content of the material that it heads. All material under a single heading shall be consistent with the heading.

3.3.4.1.6.3 Heading length. Headings shall be limited to 10 words or less. Only 10 percent of all headings shall be more than 7 words in length.

3.3.4.1.6.4 Headings per page. To facilitate the user's search for information in the technical contents sections of the manual:

- (a) If more than half of a page consists of text, there shall be at least two headings on the page.
- (b) If one-fourth to one-half of a page consists of text, there shall be at least one heading on the page.

3.3.4.1.7 Procedures. Step-by-step procedures for removal, disassembly, repair, and inspection of the repairable items shall be developed only as required. Procedural steps and checklist items shall be numbered in accordance with MIL-M-38784. Extensive use of uniform standards and methods is encouraged. Instructions shall be limited to areas where the sequence of operations is not standard shop practice or where special techniques are required for access to a part requiring repair. Instructions on the tagging, labeling, and match-marking of parts shall be included in the procedure. When examinations and inspections must be performed prior to or during disassembly, the procedure shall so specify.

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3.3.4.1.7.1 Procedural step content. A procedural step shall be limited to a single operation or to repetitions of a single operation with the following exceptions:

- (a) If simultaneous operations are required, they shall be listed together in the same step.
- (b) If the step is a major step in a dual-level presentation (see 3.3.4.1.8), the major step shall express the action with a single verb; for instance, "Turn equipment ON".
- (c) If the step represents a detailed procedure, as in (b), but the procedure is so basic that the details should rarely be needed by the intended users, or if the procedure is very frequently repeated, such as turn on, turn off, and calibration procedures, the step shall refer to the procedure with a single verb and cite a reference to the detailed steps. For instance, "Turn equipment ON (see 3-46 for details)."
- (d) Verification of the result of an operation may be included in the step. For example, "Press pushbutton A to be sure indicator A is lit."

3.3.4.1.7.2 Procedure length. Each separate procedure shall be limited to a maximum of 10 steps.

3.3.4.1.8 Dual-level presentation. If users of a procedure are expected to vary widely in experience and capability, the contracting activity may direct that certain procedures be presented in a dual-level format. In this format, detailed steps appropriate for inexperienced users shall be listed under major steps. The major steps, without reference to the detailed steps, shall be sufficient to support the performance of experienced users (see figure 13). Dual-level, step-by-step procedures shall be provided in any of the following cases:

- (a) When accomplishment of the required action would not be obvious to a journeyman mechanic unfamiliar with the peculiar equipment covered by the TRS.
- (b) When a peculiar or special action is required.
- (c) When safety-related or precautionary procedures are required to prevent personnel injury or equipment damage.
- (d) When the required action involves an area with a known history of failure due to improper procedures.
- (e) When because of complexity of a particular procedure, it is necessary to maintain the continuity of the TRS.
- (f) When verification of the TRS demonstrates the need for a step-by-step procedure to satisfactorily complete the required action.

3.3.4.1.9 Introduction to procedure. Prior to the listing of procedural steps, introductory information shall be provided to help the user carry out the procedure without interruption. Examples of relevant introductory information:

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- (a) References to relevant explanatory, descriptive, or theoretical material.
- (b) Number and qualifications of personnel required to carry out the procedure.
- (c) Test equipment required.
- (d) Special range of shop tools required.
- (e) Supplies and materials required.
- (f) Condition of the equipment at the beginning of the procedure, and references to procedures required to establish this condition.
- (g) List of any steps in the procedure that are discussed elsewhere in the manual, with references to those procedures.
- (h) Warning, if applicable, to note and obey safety notices in the text.

3.3.4.1.9.1 Lead-in. Procedural steps shall not be prefaced by a lead-in which duplicates the heading, e.g.:

"Disassembly of a sensing unit. The sensing unit is disassembled according to the following procedure: . . ."

3.3.4.1.9.2 Relevance of procedural text. A procedure shall present only that information necessary for completing a task or preventing error.

3.3.5 Appendices. Each appendix shall be developed in accordance with MIL-M-38784.

3.3.6 Glossaries. When required, a glossary shall be in accordance with MIL-M-38784.

3.3.7 Indices. When required, an index shall be in accordance with MIL-M-38784.

3.4 Format instructions. TRSs shall be prepared in accordance with MIL-M-38784.

3.4.1 Text footnote numbering. Footnotes, if required, shall be numbered consecutively within each chapter using superscript Arabic numerals. Footnotes to the text shall be placed at the bottom of the page on which they appear.

3.4.2 Warnings, cautions, and notes. Warning, caution, and note statements (see figure 14) shall be included for emphasis in all applicable installation, operating, maintenance and repair procedures, and data in accordance with MIL-M-38784.

3.4.3 Health hazards. Health hazards shall be identified in accordance with MIL-M-38784.

3.4.4 Energy efficiency requirements. TRSs covering products that directly consume energy in normal operations shall include their energy efficiency ratings in accordance with MIL-M-38784.



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3.4.5 Tables. Tables shall be prepared in accordance with MIL-M-38784, figure 15, and the following:

- (a) Center the word "Table", the applicable number, and the title above the head rule.
- (b) Capitalize the word "Table" and each principal word in the title.
- (c) Capitalize each principal word in column heads.
- (d) Single space entries within the table.
- (e) Align related entries in different columns.
- (f) Align entries within columns as follows:
  - (1) For decimal data, decimal points shall be aligned.
  - (2) For mathematical notation, multiplication signs shall be aligned.
  - (3) All other numeric data shall be aligned flush right.
  - (4) Alphabetic or alphanumeric data shall be aligned flush left.
- (g) Indent carryover lines two spaces.
- (h) Specify units of measurement in row or column headings.
- (i) Arrange row entries in tables in groups of up to five rows. Groups shall be separated with white space if no entries are blank, and with light horizontal lines if any entries are blank. At least 25 percent of the area within tables and between columns and groups of rows shall be white space.

3.4.5.1 Continued material for tables. When a table requires more than one page, the number and title shall be repeated on the column head of all following pages of the table, followed by "(Cont'd)". Column heads shall also be repeated. When information opposite an item is continued, the items shall be repeated, followed by "(Cont'd)".

3.4.6 Illustrations, drawings, and sketches. Illustrations shall be used to convey essential information and to support instructions in the TRS. The use of illustrations shall be required in instances where use will improve clarity and reduce the volume of written material. Illustrations shall be prepared in accordance with MIL-M-38784. Figure 16 provides a typical illustration. An illustration shall contain the following information.

- (a) Illustration use. Liberal use of illustrations is encouraged to ensure clarity of descriptive text and procedural steps. Exploded views shall be used to the greatest extent possible. Parts shall be numbered to show the sequence of assembly or disassembly and shall contain part identification by noun name, quantity, and other references. Redundant drawings shall not be included. When only a part of an existing drawing is required, only that section of the drawing shall be provided.
- (b) Illustration placement. Each illustration shall be included as part of a paragraph or follow as closely as possible to its first reference in the narrative text. Use of fold-out illustrations is discouraged. However, when an illustration does require a foldout sheet, such as for a large schematic diagram, it shall be located at the end of its relative



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discussion in the text and shall be printed with an apron. Foldup-foldout (map fold) illustrations are strictly prohibited.

- (c) Illustration titles. An illustration (not integral to the text of a single numbered paragraph) shall be assigned figure numbers and titles. The title shall identify the contents or purpose of the illustration in such a manner as to distinguish that illustration from others in the TRS. The title shall follow the number (separated by a period and two spaces) on the same line. The complete caption shall be centered below the illustration. If the figure title exceeds one line, the second line shall be flush left under the first word of the title. Single spacing shall be used. The word "Figure" and each principal word in the title shall be initial capitals. The complete title for sectionalized foldout illustrations shall be placed flush right on the last segment.
- (d) Material or parts list. A material or parts list shall be included with each drawing. Only those parts referenced in the text shall be identified on the drawing. When specifying disassembly in accordance with disassembly sequence numbers, all parts shall be listed. Text and illustrations shall complement each other to communicate the required information. Nomenclature shall be consistent throughout the TRS.
- (e) Acceptability of drawings and illustrations. Engineering drawings and illustrations that are not prepared primarily for TRS illustration purposes are acceptable if the copy print is legible, reproducible, and readable when reduced to TRS size. All irrelevant material shall be removed.
- (f) Callouts. Illustrations shall identify key part locations with callouts neatly placed around the drawing. Care shall be taken not to introduce clutter and distractions. The associated operator's manual identification numbers should be included as a cross-reference indicator to aid the user. Cite the method used to present data as a note in the drawing.
- (g) Drawing reduction. Drawings which are to scale but not dimensioned shall be reduced for inclusion in the manual. A line approximately three to six inches long, indicating the actual scale of the subject drawing, shall be added to the drawing before reduction. The scale shall then be reduced in the same proportion as the drawing.
- (h) Drawing identification. Drawings and sketches reproduced or modified from an existing approved blueprint or drawing shall contain information identifying the drawing.

3.4.6.1 Examples of illustration types. The following are TRS illustration types:

- (a) Isometric projection exploded views.
- (b) Illustrated parts breakdown.
- (c) Engineering drawings.
- (d) Sectional views.

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- (e) Assembly, disassembly, reassembly, installation, and fabrication drawings.
- (f) Schematic diagrams, block diagrams, and timing circuit diagrams.
- (g) Item location illustrations.
- (h) Test set-up diagrams.
- (i) Wiring diagrams.
- (j) Gearing and linkage diagrams.

3.4.6.2 Illustration selection criteria. Exploded view isometric drawings shall be used whenever possible to show the proportionate size of machinery parts, proper relation to other parts, and assembly or disassembly sequence. It is preferable that all parts be exploded in isometric projection of their line of assembly axis. Sectional views or item location drawings should be used to indicate where critical measurements shall be taken or when the information presented is easier to understand when depicted as a cross-sectional view. Parts should be numbered in disassembly order sequence, with a parts list including part name and number on each figure. As a rule, sectional drawings are not needed when isometric drawings are available.

3.4.7 Style of writing. Writing style shall be in accordance with MIL-M-38784 and the GPO style manual.

3.4.7.1 Support of user tasks. To the extent possible, information shall be presented that:

- (a) Directly supports the immediate task of the user.
- (b) Minimizes need for reading, studying, and conceptualizing skills.
- (c) Minimizes need to refer to other documents or text material.

3.4.7.2 Organization of the technical manual. To ensure comprehensibility (see 6.4.8), technical manuals shall be organized on the basis of the user's need for information. In complex equipment (see 6.1.6 and 6.4.15) or systems, where hierarchies of functional (see 6.4.12) and physical relationships exist, corresponding technical tasks shall be grouped together in order of importance. An overview of the hierarchical arrangement of tasks by which the manual is organized shall be provided. This overview may be illustrated as a family tree or top-down breakdown of the tasks. The hierarchical arrangement shall be described in the introductory chapter of the technical manual.

3.4.7.3 Consolidation of material. To the extent possible, all information required to complete a single task shall be put in one location in the manual. Information and artwork shall be repeated as necessary to fulfill this requirement. The need for the user to refer to other parts of the manual or to other information sources during performance of a task shall be minimized.

3.4.7.4 Text.

3.4.7.4.1 Vocabulary. The vocabulary shall conform to the requirements in MIL-M-38784.

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3.4.7.4.1.1 Concrete and specific language. Concrete and specific language shall be used to reduce vagueness. Examples are as follows:

- |     |                        |  |
|-----|------------------------|--|
| (a) | Abstract and general:  | Precautions should be taken against fire.  |
|     | Concrete and specific: | Periodically inspect fire doors and automatic sprinkler system.                                      |
| (b) | Abstract and general:  | It is wise to make the area comfortable and to make provisions for shutting out noise from the shop. |
|     | Concrete and specific: | Air-condition the area and soundproof the walls.   |

3.4.7.4.1.2 Simple versus complex phrases. Complicated phrases shall be avoided. Examples are as follows:

<u>Simple</u>	<u>Unnecessarily elaborate</u>
About	As to, with regard to
After	Subsequent to
Because	Inasmuch as, for the reason that
Require	Necessitate
Enough	Sufficient
Find out	Ascertain
For	For the purpose of
Get	Acquire, obtain, receive
If	In the event that
Now	At this time, presently
Since	Inasmuch as
To	In order to

3.4.7.4.1.3 Variety. Use of synonyms to provide variety in technical writing can lead to confusion. If there are several synonyms for a concept or object, only one shall be selected and used consistently throughout the technical manual. For example, do not use the terms unit, assembly, equipment, component, and hardware interchangeably to refer to the same item.

3.4.7.4.1.4 Nomenclature. Nomenclature associated with systems, equipment, and components shall be introduced by means of illustrations coordinated with descriptive text.

3.4.7.4.1.5 Shortened equipment names. In each section supporting a single user task, official terminology shall be used for the first reference to a hardware item. Official terminology shall be used wherever the use of a shortened name might be ambiguous.

3.4.7.4.1.6 Abbreviations and acronyms. Abbreviations and acronyms shall be used sparingly and in accordance with MIL-M-38784. The use of abbreviations and acronyms shall be such that there is no need for experienced users to consult

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a glossary of abbreviations and acronyms. Abbreviations and acronyms should be used for those systems, subsystems, equipment, components, organizations, or other items which are ordinarily referred to by their abbreviations or acronyms by experienced personnel. When abbreviations or acronyms are used as markings on the equipment, the same abbreviations and acronyms shall be used in the technical manual.

#### 3.4.7.4.2 Sentence structure and grammar.

3.4.7.4.2.1 Word order. Sentences and clauses shall be written using simple word order (subject, verb, object) to the extent possible. Modifiers, including prepositional phrases, shall be as close as possible to the word modified. These word order requirements shall be relaxed only to the extent necessary to avoid ambiguity or distortion of meaning. Procedural steps shall start with an active verb; lubricate, remove, tighten, and so forth.

3.4.7.4.2.2 Complex sentences. If a sentence has more than one clause and is more than 20 words in length, it shall whenever possible be rewritten as two or more simple sentences (see 6.2).

3.4.7.4.2.3 List form. If any series of three items or more appears in a sentence, the sentence shall be written so the items will appear in explicit list form as follows:

- (a) All dirty, greasy, or water-repellent surfaces are then rubbed or scrubbed with swabs or brushes.
- (b) Using swabs or brushes, rub or scrub all surfaces which are:  
     dirty  
     greasy  
     water-repellent.

3.4.7.4.2.4 First person pronouns. First person pronouns should be used, to avoid indefinite passive construction; for example, "We found that..." rather than "It has been found....".

3.4.7.4.2.5 Standard English grammar. Rules of grammar for standard American English shall be used. Colloquial, substandard, and slang expressions shall not be used. Infinitives may be split and sentences may be ended with prepositions in cases where not doing so sounds awkward or stilted and is likely to distract the user's attention from comprehending the content.

3.4.7.4.2.6 Sentences in procedures. Sentences directing the actions of the user shall be in the active voice and imperative mode. If more than one person is involved, the directions shall be in the active voice, indicative mode, third person.

3.4.7.4.2.7 Positive form. Procedural steps shall be in positive form ("Close the container" rather than "Do not leave the container open") unless the meaning demands the negative form.

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3.4.8. References. References shall be kept to a minimum and shall be limited to government approved documents such as military specifications and standards, technical manuals, drawings, engineering change data, and other approved material which will enhance the clarity and support the repair requirements and processes delineated in the TRS. When commercial documents are the only suitable reference material available, approval shall be requested of the Government upon request of the TRS preparing activity. Strong justification must be provided. Referencing shall conform to the following:

- (a) Where a small amount of information is needed (fewer than two pages), the applicable material shall be copied verbatim.
- (b) Where a large amount of material is required (more than two pages) the applicable material shall be referenced fully, including the publication number and title. An example is NAVSEA 0900-LP-038-6010 (Chrome Plating). Reference to alternative repair procedures and drawings required to refurbish parts is acceptable if that refurbishment information is not routinely required.
- (c) Where the reference is to an entire content of another document, the reference shall be only to the title of the publication and the publication identifying number. It is not considered necessary to repeat quality control standards or other approved routine procedures which have been addressed during specialty training. For example, the requirements of MIL-STD-278 (Welding) or NAVSEA 0948-LP-045-7010 (Level I Material) shall not be repeated but invoked through reference.

3.4.8.1 Text reference placement. References within the text shall conform to the following:

- (a) When a reference applies to one item within a sentence, place the reference in parentheses immediately after the item being referenced. For example: "The test set (figure 1-1) comprises a main panel (figure 1-2) and a power supply (figure 1-3)." When a reference applies to an entire sentence, place the reference at the end of the sentence: "This characteristic causes the first portion of control movement to be less effective (figure 3-3)," or show the reference in a complete sentence: "The procedure for making the adjustment is shown in figure 3-23."
- (b) When a reference applies to an entire paragraph or paragraphs, place the reference after the paragraph heading, for example, "3-2 Condenser Tube Nest Arrangement (figure 3-56)."

3.4.9 Enclosures. Enclosures may be used to include closely related material which is not an inherent part of the TRS. The enclosures, identified in full, shall be listed by numbers, for example, (1), (2), and (3), in the order they are mentioned in the text. Enclosures shall be inserted immediately after the last Appendix. The page designation shall be "Enclosure \_\_, page \_\_ of \_\_."

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3.4.10 Copyrights and proprietary information. Commercial copyright and proprietary material shall not be incorporated in the TRS unless essential to satisfying the TRS objectives (see 6.2). When it is necessary to include this material, it shall be clearly identified and the following warning statement included on the TRS title page:

"This document contains copyright or proprietary materials. Infringement of copyright or proprietary material may violate existing Federal laws and statutes and result in criminal penalties, imprisonment, or removal from office."

3.5 Type I - HM&E TRS technical content. The TRS shall be developed as a two-volume package. HM&E TRS technical data shall be formatted as follows.

(a) Part one of the volume shall contain:

- (1) Title page (see 3.3.1).
- (2) Front matter (see 3.3.3).
- (3) Chapter 1 - General information (see 3.5.1).
- (4) Chapter 2 - Shipboard removal (and replacement) (see 3.5.2).
- (5) Chapter 3 - Unit disassembly (see 3.5.3).
- (6) Chapters 4 through "n" - Item overhaul procedures for each major component and assembly with a separate chapter for each component (pump, turbine) and major assembly (governor, governor valve and servomotor, attached oil pump, motor driven oil pump) shall be provided. Each chapter shall discuss disassembly, inspection, repair, reassembly, testing, and so forth (see 3.5.4).
- (7) Chapter n + 1 - Unit assembly (see 3.5.5).
- (8) Chapter n + 2 - Unit shop test (see 3.5.6).
- (9) Chapter n + 3 - Shipboard installation, alignment, and testing (see 3.5.7).
- (10) Appendix A - Mandatory overhaul replacement parts list (see 3.5.8.1).
- (11) Appendix B - Contingency material list (see 3.5.8.2).
- (12) Technical manual deficiency evaluation report (TMDER) (see 3.5.9)/User activity technical manual comment sheet (UATMCS) (see 3.6.8).

(b) Part two of the volume shall contain:

- (1) Title page (see 3.3.1).
- (2) Front matter that describes content and instructions for collecting and disposing of the data package (see 3.3.3).
- (3) Material condition/overhaul report (see 3.5.8.3).
- (4) Appendix C - examination, test, and repair action record (ETRAR) (see 3.5.8.4).
- (5) Additional appendices (D and on) - special requirements (see 3.5.8.5).
- (6) TMDERs (see 3.5.9).

3.5.1 Chapter 1 - General information. This chapter shall provide a general overview of the data presented in the TRS. The chapter shall include



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the information specified in 3.5.1.1 through 3.5.1.8 and identified with numbered paragraph headings as applicable.

**3.5.1.1 Scope.** The scope shall include a brief summary of the purpose, content, and arrangement of the TRS, including appendices. It shall also state that all commercial and government activities involved in the overhaul process must meet all TRS class B overhaul requirements.

**3.5.1.2 Points of contact.** This paragraph shall state that the TRS takes precedence over all other technical documents for overhaul of the commodity. It shall further state that the shop supervisor or design division should be contacted regarding problems associated with use of the TRS.

**3.5.1.3 Overhaul conformance.** This paragraph shall state that compliance with the applicable chapters of the TRS is mandatory and that, upon completion of the overhaul, equipment must meet the stated performance specifications. This paragraph shall also contain the following information:

- (a) Specify that configuration changes are not authorized without Government approval.
- (b) Address visual inspection requirements of replacement parts and specify that the TRS does not require replacement part testing.
- (c) State that parts listed in the mandatory overhaul replacement parts list (appendix A) are included because of high past failure rates and/or cost to repair or replace and that these parts shall be replaced regardless of condition. Therefore, this material shall be on hand prior to performing a class B overhaul in accordance with the TRS.
- (d) Specify that the contingency material list (appendix B) contains a list of those parts that may need to be replaced during the overhaul. The decision to buy these contingency parts shall be made by the overhauling activity.
- (e) Direct the TRS user to record specified readings, test results, inspection and examination results, as well as corrective actions; and forward this data to the TRS maintenance activity.
- (f) Specify that data readings are recorded at certain inspection and verification (I&V) points during the overhaul. An individual shall be chosen to sign off on all mandatory I&V points. The local overhauling activity may designate additional I&V points if needed.

**3.5.1.4 Documentation and references.** A tabular listing shall be developed to present all documents, publications, product engineering drawings and schematics, specifications and standards, engineering change data, and other reference data used in the preparation of the TRS and referenced in the text. Applicable documents shall be listed in the order they are referenced in the text.

**3.5.1.5 Unit/assembly/subassembly.** This paragraph shall identify the repairable items covered by the TRS. Items shall be identified by nomenclature,



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model number, APL, commercial and government entity code (CAGEC), and manufacturer's part number. These data shall be listed in tabular form. This paragraph shall also provide a tabular list of the ship or machinery alterations which have been incorporated into the TRS and the hull numbers to which they apply. If no ship or machinery alterations have been incorporated into the TRS, a statement to that effect shall be included.

3.5.1.6 Parts replacement. Subparagraphs in this topic area shall be developed to specify that:

- (a) The local manufacture or fabrication of certain parts is strictly forbidden. Because of the critical nature and stringent manufacturing requirements, the Government has restricted the manufacture of these parts to qualified sources. A tabular listing of all such parts shall be provided. The list shall contain the restricted part by name and part number. In addition, these parts shall be highlighted by an appropriate note in Appendices A or B, as applicable. A printout of those parts which have been restricted may be obtained from the Government activity providing supply support for the commodity.
- (b) Parts examined which do not meet acceptance criteria may be repaired (if not on appendix A or a restricted part) or shall be turned in to the supply system or disposed of using current procedures and documentation. Local manufacture of non-restricted parts may be accomplished when acquisition is delayed; however, these parts shall conform to drawing specifications and source inspections.
- (c) Shop store items such as gaskets and packing material, locknuts and lockwashers, cotter pins, keys, etc., are not listed in the mandatory overhaul replacement parts list or contingency material list but shall be replaced. This material shall be on hand to accomplish the planned overhaul maintenance.

3.5.1.7 Special facilities, test equipment, skills, and test conditions. This paragraph shall note the special or unusual equipment, facilities, or personnel skills required to accomplish the TRS equipment overhaul. It shall include the following information as required:

- (a) The special facilities required to perform the overhaul shall be identified as prescribed and listed in tabular form.
- (b) Special test equipment (or acceptable alternative items) and repair aids required (specify quantities) in the examination, repair (including alignment, adjustment, and troubleshooting), and performance or acceptance testing (see 6.4.1) of the items covered by the TRS, shall be identified and described. A tabular listing is preferred.
- (c) Skills requiring special training shall be defined. This information shall be presented in a brief narrative form or a tabular listing.

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- (d) Special work station environmental conditions required in the overhaul process shall be specified; for example: atmospheric pressure, specific temperatures, relative humidity, or clean rooms. This information may be appropriately detailed in table format.

3.5.1.8 TRS user's comments procedure. A brief instruction to the TRS user shall be developed specifying that comments or recommendations concerning the TRS are to be forwarded for consideration. The following statements are examples of instructions to be included in the TRS.

- (a) For materials under NAVSEA's cognizance, errors, omissions, discrepancies, and routine suggestions for improving TRSs shall be reported to the Commanding Officer, Naval Ship Weapon Systems Engineering Station (Code SH00), Port Hueneme, CA 93043, on a Technical Manual Deficiency/Evaluation Report. To facilitate such reporting, three copies of Form 9086/10 are included at the end of this TRS. All comments will be thoroughly investigated and originators advised of actions taken. Extra copies of NAVSEA Form 9086/10 may be requisitioned from the Standardization Document Order Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.
- (b) Urgent priority TRS deficiencies shall be reported by Naval message with transmission to NAVSHIPWPNSYSENG-STA, Port Hueneme, CA; the designated ISEA (specify by short title from the U.S. Navy Plain Language Address Directory); the TRS maintenance activity; and the commodity life cycle manager as multiple addressees. Local message handling procedures shall be used. The TRS by title and TMIN/stock number shall identify each message processed.

3.5.2 Chapter 2 - Shipboard removal (and replacement). This chapter shall include procedural, inspection, repair, data recording, and testing information with supporting appendices, warning and caution statements, and sketches in accordance with applicable TRS requirements:

- (a) Unit boundary identification (addressing overhaul considerations for complete or partial unit overhaul/removal).
- (b) Draining unit.
- (c) Insulation removal (with appropriate asbestos hazard warnings).
- (d) Interference, interface, and piping removal (with appropriate asbestos hazard warnings).
- (e) Unit installation site (foundation, interface, and so forth.
  - (1) Preparation.
  - (2) Cleaning.
  - (3) Inspection.
  - (4) Repair.
  - (5) Blanking-off, tagging, etc. (including applicable tag out requirements).

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- (6) Removal (and replacement) routes (where specific routes have been developed, they shall be included or referenced as required).

3.5.3 Chapter 3 - Unit disassembly. This chapter of the TRS shall specify the requirements for disassembly of the major components (see MIL-M-15071) of the unit to facilitate the work breakdown structure of a compound unit, as broken down into repair sections in chapters 4 through "n", as required. Procedural and data recording requirements with supporting appendix pages, warning and caution statements, and sketches in accordance with the applicable requirements shall be provided for the following:

- (a) Major unit boundary identification.
- (b) Coupling separation/interface and piping removal, electrical disconnection.
- (c) Major unit removal.

3.5.4 Chapters 4 through "n" (and others as required) - Item overhaul procedures. These chapters shall contain procedures, minimum test and inspection requirements, processes, methods, and data deemed necessary for the satisfactory accomplishment of a class B overhaul. Acceptance or rejection criteria for wear, deterioration, dimensions, operating parameters, alignment, and other standards of acceptance shall be specified, with limits listed in the text and in appendix C. Each component or major assembly shall be defined in a separate chapter. The chapters and the sections within each chapter shall be arranged in a top-down logical sequence of disassembly, repair, and assembly. Each chapter shall contain the following sections:

- (a) Removal, disassembly, inspection, and repair procedures.
- (b) Examination and acceptance criteria, corrective action, mandatory replacement parts, cleaning methods, and data collection.
- (c) Reassembly procedures.
- (d) Acceptance testing (if applicable). Subsections will usually discuss subassemblies or individual parts (may be more than one related part per subsection).

3.5.4.1 Removal, disassembly, inspection, and repair procedures. Step-by-step procedures for the disassembly, repair, and inspection of the repairable items shall be developed. Detailed instructions shall be limited to areas where the sequence of operations is not obvious or where special techniques are required for access to a part requiring repair. When the sequence of disassembly is obvious, it is sufficient to state "Disassemble by removing parts in accordance with the disassembly sequence numbers." Additional instructions, cautions, and warnings should be specified in sequence with a disassembly instruction as required. Instructions on the tagging, labeling, and match-marking of parts shall be included in this paragraph. When examinations and inspections must be performed prior to or during disassembly, the TRS shall so specify. Step-by-step procedures shall be provided in any of the following cases (see figure 13):

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- (a) When accomplishment of the required action would not be obvious to a journeyman mechanic unfamiliar with the particular equipment covered by the TRS.
- (b) When a peculiar or special action is required.
- (c) When safety related or precautionary procedures are required to prevent personnel injury or equipment damage.
- (d) When the required action involves an area with a known history of failure due to improper procedures.
- (e) When because of the complexity of a particular procedure it is necessary to maintain the continuity of the TRS.

3.5.4.2 Mandatory replacement parts. When the requirement exists for the planned mandatory replacement of particular items, the TRS shall reference the mandatory overhaul replacement parts list (see figure 17). The list shall be in tabular format, in appendix A, and shall identify those parts that are required to be replaced, regardless of their condition. Replacement materials shall be available at the overhaul activity in accordance with the TRS instructions. Examples of mandatory replacement items may be parts such as seals, washers, vacuum tubes, air filters, and motor brushes (see 6.2).

3.5.4.3 Examination criteria. Criteria to determine the suitability of worn or degraded critical parts for continued use shall be developed and shall explicitly state the measurable wear and deterioration limits which, if exceeded, would require corrective action to maintain reliability and specified performance. These data shall appear in the text and be presented, in tabular form, in appendix C. Data shall identify the part and measurable limits. Departures from existing limits shall be highlighted with a text footnote. Corrective actions shall also be specified in the text.

3.5.4.4 Special cleaning methods. When applicable to the repairable items covered in the TRS, special processes and methods of cleaning and examination to be performed on each disassembled item shall be described. Special cleaning and inspection instructions shall include:

- (a) The pre-cleaning examination requirements and cleaning process to be used for each item requiring cleaning.
- (b) Step-by-step procedures for accomplishing the cleaning process.
- (c) Specific identification of cleaning materials to be used 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 special tools, jigs, or fixtures.
- (f) Post-cleaning examination, preservation, and handling instructions.

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- (g) Cautions or warnings to be observed to protect personnel and equipment.
- (h) Other data as may be determined appropriate for the repairable items.

3.5.4.5 Inspection, data collection, and corrective actions. Procedures, special instructions, examination, and technical information (including supplementary illustrations and tabular lists) required to perform effective inspection and repair of the repairable items covered in the TRS shall be identified (see 6.2). The actions to be performed shall ensure that the repairable items meets or exceeds the specified performance requirements of the final acceptance test (see 6.4.11) and satisfies all quality assurance inspection requirements.

3.5.4.5.1 Fault identification. Detailed step-by-step procedures for identifying problems shall be developed.

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

3.5.4.5.3 Inspection and verification (I&V). I&V points shall be noted in the TRS left-hand margin by "I" or "V", both in the text and appendix C. I&V points shall be determined by using the best engineering judgement. All data to be collected shall be specified in the text. The requirement to sign all I&V points shall be included in the front matter of parts 1 and 2 of the TRS. Signature blocks shall be provided as appropriate in the examination, test, and repair action record (ETRAR) (see 3.5.8.4).

3.5.4.5.4 Alignment and adjustment procedures. Detailed procedures shall be identified or developed for sophisticated mechanical and electrical alignments and adjustments. Procedures shall describe the methods used and special tools and equipment required to achieve the setting and positioning of adjustments and controls, and mechanical, gearing, and linkage alignments within the repairable item.

3.5.4.6 Reassembly. Illustrations, reassembly instructions, and examination requirements for the reassembly of the repairable items shall be developed as required. The use of any special tools, jigs, fixtures, or test equipment shall be specified. Where sequence of reassembly is obvious, it is sufficient to state "Reassemble by installing parts in accordance with the reassembly sequence numbers". Additional instructions, cautions, and warnings shall be specified in sequence within a reassembly instruction when required. Figures prepared to support disassembly instructions may be repeated; however, sequence numbers shall be changed to reflect proper numerical order for reassembly. The instructions or procedures shall indicate the following:

- (a) The use of corrosion-preventive compounds, paints, or other materials and the use of gaskets or sealing compound materials shall be specified by nomenclature, trade name, specification

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- number, and national stock number (NSN). Non-NSN consumables and materials shall be avoided whenever possible.
- (b) Identification of all points requiring lubrication, the kind of lubricants required, and the method of application. Lubricants to be used shall be those specified in the standard lubricants lists. A NSN shall be listed if available. Additional information regarding lubrication can be found in MIL-HDBK-267.
  - (c) Any special instructions for installing fasteners, safety wiring, cotter pins, and other locking devices.
  - (d) Special instructions for aligning, adjusting, and measuring tolerances, clearances, end play, backlash, and tolerances between gears and linkage alignment data.
  - (e) Identification of critical examinations and tests during reassembly and, if required, provisions for data collection.
  - (f) Reference to tables, appendices, or illustrations as applicable.
  - (g) Other data as may be determined appropriate for the repairable items type.

3.5.4.7 Acceptance test. Acceptance testing shall be specified for each individual component, if needed, and for the system as a whole. The section shall specify that:

- (a) After completing all repair or overhaul actions and when the repairable item is considered ready for final examination, the item shall be inspected for proper identification and tested to verify satisfactory performance.
- (b) The acceptance test shall be accomplished in accordance with the established performance requirements. Reference shall be made to pertinent data contained elsewhere in the TRS.
- (c) Specified data collection requirements for the item shall be included in the TRS ETRAR (see 3.5.8.4).

3.5.5 Chapter n + 1 (or as applicable) - Unit assembly. This chapter shall specify all criteria addressed in chapter 3 as applicable to unit reassembly. The following items shall be covered:

- (a) Major unit installation.
- (b) Piping/interface installation/alignment.
- (c) Coupling cold alignment.

3.5.6 Chapter n + 2 (or as applicable) - Shop unit test. This chapter shall be developed to facilitate work breakout for a complete unit that requires a unit shop test prior to shipboard installation. An approved outline for the generic unit shall be used in determining the following unit test requirements:

- (a) Test stand requirements.
- (b) Unit flush.
- (c) Unit shop test requirements.



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3.5.7 Chapter n + 3 (or as applicable) - Shipboard installation, alignment and testing. This chapter shall specify requirements for:

- (a) Unit installation.
- (b) Insulation installation.
- (c) Cold alignment recheck.
- (d) Pping/interface installation/alignment.
- (e) System check.
- (f) Coupling hot alignment.
- (g) Unit break-in.
- (h) Final acceptance test.
- (i) Interfacing system inspection.

3.5.8 Appendices. The TRS shall provide pertinent supplementary and reference data required in the inspection, parts replacement, testing, and final acceptance of the repairable items covered in the TRS. Each appendix shall contain a statement delineating its purpose and application. Appendices shall be in accordance with MIL-M-38784 (see 6.2).

3.5.8.1 Appendix A - Mandatory overhaul replacement parts list. This appendix shall contain a comprehensive list of items which must be replaced, regardless of observed condition (see 3.5.4.2). There shall be a separate sheet listing the mandatory replacement parts for each unit subassembly or major subassembly component. The parts designated for the mandatory overhaul replacement parts list shall be specified by the preparing activity and approved by the acquisition activity using the following considerations:

- (a) Parts which are usually damaged or destroyed during equipment disassembly.
- (b) Parts normally subject to accelerated wear.
- (c) Parts known to be more economical to replace than inspect.
- (d) Parts which have a history of high usage.
- (e) Parts that have a high documented failure rate and/or are costly to replace between overhauls.

NOTE: All TRS written requirements shall be met before a class B overhaul will be certified as complete. If a material ordering guide (MOG) exists for an item being covered in the TRS, the MOG may be used to develop appendix A.

3.5.8.2 Appendix B - Contingency material list. A contingency material list shall be developed. It shall be a tabular listing of parts, similar to figure 18. When developed, there shall be a separate sheet for each unit subassembly or major subassembly/component. The contingency material list is a guide for material that may be needed when the unit is overhauled. It shall 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



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overhaul shall not be listed. A MOG, if it exists, may be used to develop appendix B.

3.5.8.3 Material condition/overhaul report (MC/OR). A certification document shall be prepared for the TRS stating that the overhaul has been properly completed and meets all means specified acceptance criteria. It will also provide a means to collect additional information from the line mechanic concerning conditions observed prior to, and during, the overhaul. Directions for recording data and distribution of the report shall be specified in the TRS text. A typical MC/OR is shown in figure 19. At a minimum, MC/ORs shall conform to the following:

- (a) Check-the-box and short fill-in questions shall be used to the greatest degree possible.
- (b) A heading identifying the component shall be completed by the preparing activity.
- (c) Specific questions regarding the "as found" material condition of the item shall be prepared.
- (d) Provision shall be made for the mechanic to supply informal comments and short remarks.
- (e) Specific questions or statements regarding the "as overhauled" state of the item shall be prepared.
- (f) Provision shall be made for the mechanic to record or highlight any approved or unapproved deviations and out-of-spec data.
- (g) A separate MC/OR shall be prepared for each subassembly and major subassembly component and shall be included in the appropriate data section in part 2.
- (h) MC/ORs shall be identified in the table of contents, list of effective pages, and TRS text.

3.5.8.4 Appendix C (part 2) - ETRAR. Required ETRAR information (see figure 20) shall include the system test step number and the desired response and tolerance limits. Other information may vary according to the equipment type or user requirements. Separate summary sheets shall be developed for each subassembly and major subassembly/component as previously specified in the TRS and assigned an appropriate title. Each instruction to record data in the TRS text shall also be entered in the ETRAR. When possible, a line drawing identifying the measurement to be taken shall be provided on the same page. Reading specifications or parameters that depart from original design characteristics shall be highlighted and footnoted with rationale. A space for signatures at specified data entry and I & V points shall also be provided. The last section of appendix C for each major subassembly component and the last section of the total unit shop test and unit final acceptance test shall specify the minimum criteria for determining whether the class B overhaul requirements are in accordance with Government testing criteria. No space for recording data on these pages shall be provided. However, activities shall be directed to submit all local shipyard test forms with the completed overhaul record (part 2 of the TRS).

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3.5.8.5 Additional appendices (D and on). When specified (see 6.2), the text in the body of the TRS shall specify any other special requirements covered, with additional appendices.

3.5.9 Technical manual deficiency evaluation report (TMDER). The preparing activity shall include three copies of this form at the back of each TRS (see figure 21). The TMDER shall be used to provide feedback on corrections and suggested improvements to the methods and procedures specified by the TRS. The TMIN and title shall be preprinted on each form by the preparer.

3.6 Type II - Electronic Equipment TRS technical content. The sequence of electronic equipment TRSs technical data shall conform to the following:

- (a) Title page (see 3.3.1).
- (b) Front matter (see 3.3.3).
- (c) Chapter 1 - General information (see 3.6.1).
- (d) Chapter 2 - Facilities, test equipment, personnel, and test conditions (see 3.6.2).
- (e) Chapter 3 - Inspection methods (see 3.6.3).
- (f) Chapter 4 - Performance test procedure (see 3.6.4).
- (g) Chapter 5 - Overhaul procedure and final acceptance test (see 3.6.5).
- (h) Chapter 6 - Packaging and handling (see 3.6.6).
- (i) Appendix A - Repairable item data (see 3.6.7.1).
- (j) Appendix B - Test support equipment data (see 3.6.7.2).
- (k) Appendix C - Test data record sheets (see 3.6.7.3).
- (l) Additional appendices (D and on) - Other appendices or enclosures (as required) (see 3.6.7.4).
- (m) TMDERs/UATMCSs (see 3.6.8).

3.6.1 Chapter 1 - General information. This chapter shall state the purpose, organization, and intended use of the TRS. This section shall include the information specified in 3.6.1.1 through 3.6.1.7.

3.6.1.1 Frontispiece illustration. A pictorial presentation of the repairable items covered in the TRS shall be placed on the page preceding chapter 1 (see figure 22).

3.6.1.2 Production process. This chapter shall include production process flow charts or work flow block diagrams (figure 2) 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.

3.6.1.3 Scope. The scope shall:

- (a) Include a brief summary of the technical content of the TRS including all appendices. It shall include statements that:

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- (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.
- (b) Identify the repairable items covered by the TRS using approved nomenclature, NSN, APLs, and all applicable 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.
- (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.

3.6.1.4 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.

3.6.1.5 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 preparation of the TRS shall be presented. Applicable documents shall be listed in the order they are referenced in the text.

3.6.1.6 Deviations and waivers. A statement shall be provided that waivers/deviations for minor material or performance characteristics may be approved at the local level only with contracting activity approval. Major design or logistic deviation/waiver request will be approved in writing by the Government. Parts, clearances, or conditions for which specified requirements cannot be met require compliance with DOD-STD-480, execution of Form 1694 for deviations/waivers, and approval for a departure from specification.

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3.6.1.7 TRS users comments procedure. A brief instruction to the TRS user shall be developed in accordance with requirements (see 3.5.1.8).

3.6.2 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 information described in 3.6.2.1 through 3.6.2.4.

3.6.2.1 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.

3.6.2.2 Test equipment. A tabular listing shall be prepared 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 23.

- (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 contracting activity and written authorization must be obtained prior to non-standard 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

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is required of any listed equipment, the TRS shall so specify (see MIL-STD-45662).

3.6.2.2.1 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 hand tools.
- (h) Standard measuring instruments (SMI) required for inspection or examination that are not normally available at depot maintenance facilities.

3.6.2.3 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 manhours per category needed shall be provided in a brief, narrative form or in a tabular listing.

3.6.2.4 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.

3.6.3 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 those specified in 3.6.3.1 through 3.6.3.4.

3.6.3.1 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.

3.6.3.2 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.

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3.6.3.3 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.

3.6.3.4 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.

3.6.4 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 requirements specified in 3.6.4.1 and 3.6.4.2.

3.6.4.1 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 24).
- (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.

3.6.4.2 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.



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- (a) The data required are the procedural steps, performance requirements, TRS title, TRS number, item nomenclature, and item part number (see figure 25).
- (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.

3.6.5 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.

3.6.5.1 Removal, disassembly, and inspection. Illustrations and step-by-step procedures for the removal, disassembly, and inspection of the repairable items shall be developed (see figure 13). 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.

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

3.6.5.1.2 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.

3.6.5.2 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 3.6.5.1).



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- (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.

3.6.5.3 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 contracting activity.
- (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.
- (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.

3.6.5.4 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 and shall satisfy

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all quality assurance inspection requirements. This portion of the TRS shall, as a minimum, include the requirements of 3.6.5.4.1 through 3.6.5.4.4.

**3.6.5.4.1 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.

**3.6.5.4.2 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.

**3.6.5.4.3 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.

**3.6.5.4.4 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 3.6.2), 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 figure 26).
- (g) Troubleshooting diagrams (see figure 27).
- (h) Parts list and location instructions and illustrations.
- (i) Printed-circuit board (PCB) foil layouts, as appropriate.
  - (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

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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.

3.6.5.5 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 6.4.11) to verify satisfactory performance.
- (b) The FAT shall be accomplished in accordance with the established performance parameter requirements and test procedures (see 3.6.4) 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 3.6.4.2).
- (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.
- (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.

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- (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.

3.6.6 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.

3.6.6.1 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.

3.6.6.1.1 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.

3.6.6.1.2 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.

3.6.6.1.3 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.

3.6.6.2 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 items 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.

3.6.7 Appendices. The TRS shall contain appendices to 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.

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3.6.7.1 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.

3.6.7.1.1 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.

3.6.7.1.2 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.

3.6.7.1.3 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.

3.6.7.1.4 Repairable items parts list tables. Repairable items parts list tables shall be in accordance with figure 28.

3.6.7.1.5 Mandatory overhaul replacement parts list (MORPL) (figure 17). This section shall contain a comprehensive list of items which must be replaced regardless of observed conditions. There shall be a separate sheet listing the mandatory replacement parts for each subassembly or breakout item listed in chapter 5. The parts to be recommended for the mandatory overhaul replacement parts list will be dependent on the repair experience of the TRS preparer and shall be specified by the contracting agency 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/or are costly to replace between overhauls.

3.6.7.1.6 Contingency material list. A contingency material list shall be developed. It shall be a tabular listing of parts similar to figure 18. 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 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.

3.6.7.2 Appendix B - Test support equipment data. This section shall contain augmenting instructions, data, and illustrations required to fabricate,

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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, etc.
- (b) If there are no requirements for special test support equipment data, the TRS shall so specify.

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

3.6.7.3 Appendix C - Test data record sheets. This section shall contain the TRS test data record sheets. for the repairable items covered by the TRS (see 3.6.4).

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

3.6.8 TMDER/UATMCS (see figure 29).

- (a) For information concerning TMDERs, see 3.5.9.
- (b) For materials under the Space and Naval Warfare Systems Command (SPAWAR's) cognizance, all changes for improving TRSs shall be reported to the Commanding Officer, Naval Electronic Systems Engineering Center Portsmouth, P.O. Box 55, Portsmouth, VA 23705-0055, Attention: SPAWAR Technical Data Center, on a UATMCS. To facilitate such reporting, three copies of the UATMCS are included at the end of this TRS. All comments will be thoroughly investigated and originators advised of actions taken. Extra copies of the UATMCS may be requisitioned from the Standardization Document Desk, Bldg. 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

3.7 Type III - Ordnance TRS technical content. The sequence of ordnance TRSs shall conform to the following:

- (a) Title page (see 3.3.1).
- (b) Front matter (see 3.3.3).
- (c) Chapter 1 - General requirements information (see 3.7.1).
- (d) Chapter 2 - Examination, tests, and corrective actions (see 3.7.2).
- (e) Chapter 3 - Planned overhaul/repair maintenance (see 3.7.3).
- (f) Chapter 4 - Reassembly and grooming (see 3.7.4).
- (g) Chapter 5 - Final acceptance tests (see 3.7.5).



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- (h) Chapter 6 - Facilities, equipment and personnel requirements (see 3.7.6).
- (i) Chapter 7 - Preservation, packaging, handling, storage, and transportation requirements (see 3.7.7).
- (j) Chapter 8 - Overhaul/repair record requirements (see 3.7.8).
- (k) Appendix A - Contingency material list (see 3.7.9(a)).
- (l) Appendix B - Planned overhaul/repair material list (see 3.7.9).
- (m) Appendix C - Traveler and inspection/discrepancy/repair record (see 3.7.9(b)).
- (n) Enclosures (see 3.7.10).
- (o) TMDERs (see 3.7.11).

3.7.1 Chapter 1 - General requirements information. This chapter delineates repairable end-product requirements, procedures for obtaining changes or waivers, and work flow diagrams or charts. The chapter shall include, as a minimum, the information specified in 3.7.1.1 and 3.7.1.2.

3.7.1.1 Frontispiece illustration. A pictorial representation of the repairable items covered in the TRS shall be placed on the left-hand page preceding chapter 1 (see figure 22).

3.7.1.2 Content. Chapter 1 shall include statements that:

- (a) The overhauling/repairing activity is responsible for overhauling/repairing the system, equipment, or component so that it satisfies the post-overhaul/repair requirements specified in chapter 5 (final acceptance test).
- (b) When there is conflict between the TRS and original design, the requirements in the TRS and associated quality assurance test and inspection plans (QATIPs) shall take precedence. Prior to the inclusion of procedures in the TRS and QATIPs that are in conflict with original design criteria, approval shall be obtained from the LCM.
- (c) Component configuration changes shall not be made when such changes will prohibit use of approved parts for the item involved unless required engineering changes, waivers, or deviations have been obtained in accordance with provisions of DOD-STD-480 (or DOD-STD-481 as applicable). This action shall be detailed in order to maintain authorized configurations.
- (d) Production process flow charts or work flow block diagrams (figure 2) graphically depicting the sequence of repair/overhaul events required to occur throughout the maintenance process described in the TRS. These displays may consist of an overall block diagram depicting the entire process with more detailed flow charts for specific phases or repair/overhaul activity. Sufficient detail should be provided to clearly illustrate the described process.
- (e) TRS users' comments procedure is included. A brief instruction to the TRS user shall be developed in accordance with the requirements of 3.5.1.8.

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3.7.2 Chapter 2 - Examination, tests, and corrective actions. This chapter shall include maintenance requirements and associated actions, and shall include the information specified in 3.7.2.1 through 3.7.2.5.

3.7.2.1 Pre-overhaul/repair maintenance (see 6.4.17) inspection. Examinations and inspections required prior to and during repair and refurbishment to determine the need for work in addition to that prescribed by planned overhaul or repair maintenance, commensurate with prescribed levels of maintenance shall be specified. The method of examination or inspection shall be described and acceptance and rejection criteria specified. Examples of items and examination/inspection criteria are set forth in 3.7.2.5.

3.7.2.2 Pre-overhaul/repair performance or other evaluation tests. Performance or other evaluation tests necessary for item failure diagnosis and for the determination of requirements for corrective maintenance in addition to that prescribed by planned overhaul or repair maintenance shall be specified. Testing and evaluation requirements shall be scaled to the activity level of maintenance and shall specify the detailed steps for test accomplishment.

3.7.2.3 Corrective maintenance actions. Corrective maintenance actions appropriate to the level of maintenance which are acceptable to correct deficiencies found during pre-overhaul/repair performance tests and examinations/inspections shall be specified (see 6.2). Corrective actions include replacement, repair, or refurbishment. Where corrective actions must be accomplished and certified in accordance with a specific procedure, the TRS shall invoke the applicable procedure.

3.7.2.4 Recording results. Methods for recording inspection and examination results, and corrective actions taken shall be specified. Distribution requirements for reports shall be identified.

3.7.2.5 Inspection and acceptance criteria. Inspection and acceptance criteria shall include the following:

- (a) Items that are subject to wear, corrosion, erosion, and aging shall be examined and tested to see whether such wear or other deterioration would ultimately result in failure to meet performance specifications. Specific acceptance criteria shall be furnished in the TRS for each such item. The criteria shall be based on actual wear, corrosion, erosion, and aging data when such data are available. These criteria shall be based on assuring satisfactory performance for the planned period of service between refurbishments for the particular item. The criteria will in many instances be a matter of engineering judgment when wear or deterioration rates have not been established for shipboard operating conditions.
- (b) Where specific parts are mentioned, the part number (NSN, national item identification number (NIIN), manufacturers or Government part number as applicable), and applicable reference

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document shall be written in the TRS text to minimize the possibility of misunderstanding.

- (c) When the technical manual includes charts of clearances and tolerances, this information may be used as a starting point in specifying allowable wear. The following list illustrates typical examples of items and applicable criteria of acceptability:
- (1) Bushings or bearings and mating shafts. Clearances or dimensions.
  - (2) Pump wear rings or rotors. Clearances or dimensions.
  - (3) Thrust bearings. End play.
  - (4) Gear trains. Backlash, contact pattern, and alignment.
  - (5) Pressure containing parts. Wall thickness (thinnest area, erosion path, or both), and leakage rate.
  - (6) Couplings and shafts. Alignment and clearance.
  - (7) Piping, valves, fittings. Thickness and leakage rate.
  - (8) Operating mechanisms. Backlash or play.
  - (9) Cylinders and pistons. Clearances, diameters, and leakage rate.
  - (10) Valves, disks, and seats. Dimensions for important parts, seat angles, seat rings, ball diameters.
  - (11) Electrical wire. Insulation resistance.
  - (12) Switches, transformers, relays, and other electronic or electrical components. Electrical and mechanical characteristics.

3.7.3 Chapter 3 - Planned overhaul/repair maintenance (see 6.4.17). Paragraphs under this heading shall specify the requirements of 3.7.3.1 through 3.7.3.6.

3.7.3.1 Planned overhaul/repair requirements. Planned overhaul/repair requirements delineated in scope to appropriate level of maintenance shall be specified. These requirements shall include cleaning, refurbishing, and replacement of parts. By planned overhaul or repair work, it is intended to mean the minimum maintenance work for the system, equipment, or compound regardless of condition. These requirements shall be delineated to reflect the extent of maintenance to be performed by specific levels of maintenance such as designated overhaul activity/specialized overhaul activity (DOA/SOA), and designated repair activity/tender repair (DRA/TR). Examples of presentation styles are shown on figure 13. Such requirements are not dependent on data obtained from pre-overhaul/repair examination and tests. The requirements shall be determined by application of engineering judgement and consideration of the following:

- (a) Review of the design.
- (b) Service of the item.
- (c) Past experience.
- (d) Performance requirements.
- (e) Trade-off in cost and reliability between individual part replacement versus part refurbishment.

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3.7.3.2 Disassembly instructions. General disassembly instructions will normally suffice except in cases when certain detailed disassembly procedures are required to prevent damage to critical components or when personnel safety may be jeopardized. In these cases, disassembly procedures and limits shall be specified to the degree appropriate to the level of maintenance. When disassembly instructions are given correctly in technical manuals, the manuals may be referenced if instructions are lengthy and require the manual to ensure clarity and comprehension. When examinations, inspections, and tests must be performed prior to or during disassembly, the TRS shall so specify. QATIPs hold points shall be specified. Detailed disassembly instructions apply to actions required for both planned and corrective overhaul/repair maintenance.

3.7.3.3 Planned maintenance lists. Planned overhaul and repair material lists shall be included. These lists shall identify those parts which are specifically required to be replaced regardless of their condition. Selected materials shall be on hand at the appropriate maintenance level activities to accomplish the planned maintenance actions in accordance with the TRS. These material lists, depending upon extent, may either be contained in the body of the TRS or placed in an appendix and referred to in the body of the TRS.

3.7.3.4 Contingency material list. Contingency material lists shall be included (see figure 18). These lists shall identify those parts based on engineering analysis or experience, delineated with respect to levels of maintenance, which may be expected to require some replacement. It shall be stated that the contingency material lists are provided so that the maintenance activity will have the necessary material on hand if required. It is not intended to make the acquisition of such material mandatory. Contingency material lists may be either contained in the TRS body or placed in an appendix and referred to in the body of the TRS.

3.7.3.5 Criteria for suitability of worn-in parts versus new parts. Criteria shall be provided by which the overhauling activity determines whether worn or degraded parts are suitable for continued use until the next similar overhaul/repair period. The criteria shall explicitly state those measurable, wear/ deterioration limits which, if exceeded, require replacement by new parts.

3.7.3.6 Receipt inspection of new/refurbished parts. Procedures shall be included for the critical inspection and review of new parts and of overhauled/repairs parts received from DOA/SOA activities (including their comparison with parts being replaced to establish equivalency before installation).

3.7.4 Chapter 4 - Reassembly and grooming. Paragraphs in this chapter shall:

- (a) Provide all necessary reassembly instructions, including required hold points for quality inspection accomplishment as delineated by QATIPs. Where such instructions are given correctly in technical documentation they shall be referenced instead of repeating lengthy instructions in the TRS. Where critical

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- examinations and tests are required to be performed during reassembly, the TRS shall so specify.
- (b) Specify grooming which is required before or during post-overhaul tests. Grooming instructions given in technical manuals shall be referenced rather than repeated in the TRS. Typical examples of grooming are:
    - (1) Adjustment of relief bypass valves.
    - (2) Rotor balancing to reduce noise levels.
    - (3) Honing of valve seats to reduce leakage.
    - (4) Improving coupling alignment.
  - (c) Specify that, upon completion of grooming, the overhaul/repair activity will place suitable data on the body of the part which will provide in legible form the following information: part number, serial number (if applicable), overhaul/repair activity identification, and the date of overhaul/repair. These data may be engraved in prepared metal plates, printed on suitable decal material, or stenciled on the part depending upon the part dimensions, use environment, and material composition. Identification methods shall be included in the TRS for the applicable item.

3.7.5 Chapter 5 - Final acceptance tests. Paragraphs in this chapter shall:

- (a) Specify the system, equipment, or component performance requirements.
- (b) Specify the examinations and tests, including required test equipment and documentation, required to ensure that the item satisfies the above performance requirements.
- (c) Specify hold points for quality inspection accomplishment as delineated by QATIPs.
- (d) Specify the method of recording test data.

3.7.6 Chapter 6 - Facilities, equipment, and personnel requirements. This chapter shall note the special equipment, facilities, and personnel skills required to accomplish the equipment overhaul covered by the TRS. It shall include the requirements specified in 3.7.6.1 through 3.7.6.4.

3.7.6.1 Facility requirements. This paragraph shall contain a complete description of the minimum plant facilities and test beds required to accomplish the overhaul. Clean rooms and other unique requirements shall be designated when required. Care shall be taken not to over subscribe facility requirements. A summary of all utilities required such as air, water, power, steam, shall be provided.

3.7.6.2 Test equipment requirements. A tabular form shall be prepared that includes all the tools and test equipment required to accomplish the overhaul. Only tools and testing devices usually found at a well stocked repair facility may be designated unless specifically required. Equipment type,

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manufacturer, model number, and equivalency data and title of the test or procedural step to which it applies shall be identified (see figure 23).

3.7.6.3 Test conditions. All test procedures and special requirements to verify the proper overhaul of the equipment shall be included. References may be made to applicable tests, procedures, and data for clarity. If special requirements such as clean rooms, positive pressure air flow, etc. are imposed they shall be highlighted in this section.

3.7.6.4 Personnel requirements. The number and minimum experience level of the technician who can be expected to perform the task shall be included. If special training, skill, or experience is required to accomplish a particular step, phase of operations, or testing, it shall be noted. This section shall also identify QA personnel requirements.

3.7.7 Chapter 7 - Preservation, packaging, handling, storage, and transportation requirements. This chapter shall identify the requirements for special preservation, storage, and transportation of the repairable items. For example, preservation for storage when the item is not to be installed for an extended period of time and the methods used for preservation and storage are critical. If there are no requirements for special preservation, storage, and transportation, the TRS shall so specify.

3.7.8 Chapter 8 - Overhaul/repair record requirements. The TRS shall require the recording of information during the overhaul process to:

- (a) Provide a permanent record of the overhaul/repair test and inspection.
- (b) Define items and areas requiring additional work.
- (c) Provide data for future overhaul planning.
- (d) Serve as a basis for determining the adequacy of the TRS for use on subsequent overhauls or refurbishments.
- (e) Provide data for automated data processing (ADP) reporting systems as required.
- (f) Serve as an information library which may be used in analyzing post-overhaul malfunctions.

3.7.8.1 Data record. Fulfillment of overhaul/repair record requirements shall be accomplished through preparation and completion of the traveller and inspection/discrepancy/repair report (TIDRR) in accordance with the example format and preparation/completion instructions shown on figure 30. The TIDRR will serve as a dual purpose, permanent record by directing the movement of the item being overhauled/repared from receipt to issue status, and by providing for a record of inspections, discrepancies, and overhaul/repair actions accomplished during the overhaul process. The TIDRR shall be comprised of five sections traveller, inspection/discrepancy, planned overhaul/repair actions, examinations/tests, and remarks, which will require recording, as a minimum, data required of and derived from:



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- (a) Examinations.
- (b) Tests.
- (c) Corrective actions.
- (d) Disassembly/reassembly and grooming.
- (e) Overhaul and repair actions.
- (f) Final acceptance tests.

3.7.8.2 Traveller and inspection/discrepancy/repair report (TIDRR). The TRS originator shall provide the TIDRR data sheet form in the example format shown on figure 30, in quality suitable for reproduction. When completed, TIDRRs shall be retained by the overhaul/repair activity for review by the cognizant engineering agent and as a data source for repairables management program information requirements and ADP reporting systems input preparation.

3.7.9 Appendices. Appendices shall be used to separate relatively bulky information from the body of the TRS when such separation will increase the clarity of the overall TRS. When used, appendices shall be identified by capital letters (for example, (A), (B), and (C)). The following are examples of material which may be placed in appendices:

- (a) Contingency material list (see 3.7.3.4).
- (b) Planned overhaul/repair material list (see 3.7.3.5).
- (c) Format for the TIDR (see 3.7.8.2).

3.7.10 Enclosures. Enclosures may be used to include closely related material which is not an inherent part of the TRS. The enclosures, identified in full, shall be listed by numbers (for example, (1), (2), and (3)) in the order that they are mentioned in the text.

3.7.11 TMDR (see 3.5.9).

#### 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 the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibilities 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 inspection, as part of the manufacturing

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operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept effective material.

4.2. Quality assurance program requirements. The quality assurance program shall be in accordance with the requirements of MIL-M-85337 (see 6.2).

4.3. Inspection of packaging. The inspection of packaging (preservation, packing, and marking) for shipment, stowage and storage shall be in accordance with requirements of section 5 and the documents specified therein.

## 5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 General.

5.1.1 Classified information (see 3.1). Classified information shall be packaged or prepared for shipment in accordance with DOD-5220.22-M.

5.2 Preservation. Unless otherwise specified (see 6.2), preservation shall be Level C as follows:

5.2.1 Final reproducible copy (see 1.1 (d) and 3.2 (i)).

- (a) Accompany equipment. TRS manuals, which accompany shipments, shall be unit packed in a transparent, waterproof plastic bag, minimum 4 mil thick. Closure shall be by heat sealing. Manuals shall not be placed within any flexible, sealed barrier enclosing components. The copies of the manual shall be placed in the shipping container housing the main unit. Packing lists shall indicate which container contains the manuals and shall also state the approximate location therein. For ease of removability, the location of the manual shall be such that it is readily accessible when the container is opened and no damage is sustained by the flexible barrier enclosing the component.
- (b) Bulk. TRS manuals, when shipped in bulk quantities, shall not be individually wrapped. Manuals shall be packed as specified in 5.3.

5.2.2 All other data items (see 1.1 and 3.2). Each data item shall be unit protected within a transparent or opaque unit pack (wrap, bag, envelope, or mailing tube) and sealed. Flexible items in flat unit packs shall be provided with paperboard or fiberboard stiffeners to prevent item and unit pack damage. Items such as artwork, ink-lined or vellum illustrations may be rolled and unit packed in mailing tubes. Manuscript and preliminary TRS's are to be unit packed together with their supporting EJR's.

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5.3 Packing. Packing shall be Level A, B, C, or commercial as specified (see 6.2).

5.3.1 General requirements for levels A, B, and C. Containers selected (see 5.3.2), shall be of minimum weight and cube consistent with the protection required, of uniform size, and contain identical quantities of identical material.

5.3.2 Levels A, B, and C containers. Material shall be packed in exterior shipping containers for the level of packing specified (5.3), in accordance with table VII of MIL-STD-2073-1, Appendix C, and herein. Unless otherwise specified (see 6.2), container selection shall be at the contractor's option.

5.3.2.1 Caseliners, closure and gross weight.

5.3.2.1.1 Caseliners. Unless otherwise specified (see 6.2), level A shipping containers shall be provided with waterproof caseliners in accordance with MIL-STD-2073-1.

5.3.2.1.2 Closure. Container closure, reinforcing, or banding shall be in accordance with the applicable container specification or appendix thereto except that weather-resistant fiberboard boxes shall be closed in accordance with method V and reinforced with non-metallic or tape banding and domestic or fire retardant fiberboard boxes shall be closed in accordance with method I using pressure sensitive tape.

5.3.2.1.3 Weight. Wood, plywood, and cleated type containers exceeding 200 pounds gross weight shall be modified by the addition of skids in accordance with MIL-STD-2073-1 and the applicable container specification or appendix thereto.

5.3.3 Commercial. Material shall be packed for shipment in accordance with ASTM D 3951 and herein.

5.3.3.1 Container modification. Shipping containers exceeding 200 pounds gross weight shall have a minimum of two, 3-inch by 4-inch nominal woods skids laid flat, or a skid or sill type base which will support the material and facilitate handling by mechanical handling equipment during shipment, stowage and storage.

5.4 Marking, levels A, B, C and commercial. In addition to any special marking required (see 6.2), interior packs and shipping containers shall be marked including bar coding for shipment, stowage, and storage in accordance with MIL-STD-2073-1, Appendix F.

## 6. NOTES

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

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6.1 Intended use. The TRS supplements the technical maintenance section of the technical manual for the item and provides all necessary technical information required to rebuild or restore the 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.
- (b) Type and quantity of TRS required (see 1.2).
- (c) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1).
- (d) Applicable distribution statement (see 3.1)
- (e) Schedules and status reports (see 3.2.1).
- (f) Outline/book plan (3.2.2).
- (g) Engineering judgment records (see 3.2.3).
- (h) Cost and pricing data (see 3.2.4).
- (i) TRS manuscript (see 3.2.5).
- (j) Preliminary TRS (see 3.2.6).
- (k) Permanent change, interim change, revision (see 3.2.7 and 3.3.3.2).
- (l) Revision of a TRS (see 3.2.8).
- (m) Final TRS (see 3.2.9).
- (n) Typography, if other than specified (see 3.2.9(c)).
- (o) Reading grade level (see 3.4.7.4.2.4).
- (p) Rights-in-data (3.4.10).
- (q) Requirements for parts lists (see 3.5.4.2).
- (r) Identification of inspection and repair of items covered in the TRS (see 3.5.4.5).
- (s) Requirements for appendices (see 3.5.8 and 3.5.8.5).
- (t) Warranty/guarantee information (see 3.7.2.3).
- (u) Quality assurance requirements (MIL-M-85337) (see 4.2).
- (v) Preservation of other than specified (see 5.2).
- (w) Level of packing required (see 5.3).
- (x) Container selection if other than contractors option (see 5.3.2).
- (Y) Special marking required (see 5.4).

6.3 Technical manual acquisition. 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 Definitions.

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6.4.1 Acceptance tests. An examination and test of an item after completion of its overhaul or repair to ensure that the item satisfies minimum specified performance requirements.

6.4.2 Accuracy. The precision and technical correctness of the contents of a manual. Accuracy includes the requirements that the technical manual reflect the "as built" or "as is" configuration of the associated hardware.

6.4.3 Adequacy. A depth of scope or coverage sufficient to support all tasks and functions at the prescribed level of the user, consistent with the equipment to be used and the mission environment in which the manual is to be utilized (see MIL-M-85337).

6.4.4 Assembly. A number of parts or subassemblies or any combination thereof joined together to perform a specific function and capable of being disassembled.

6.4.5 Class B overhaul. Work which requires such overhaul or repair as will restore the operating and performance characteristics of a system, subsystem, or component to its original design and technical specifications.

6.4.6 Complex equipment and components. Those equipment and components that have a high maintenance history, are sophisticated or complicated in design, are mission or safety critical, or have significant material problems.

6.4.7 Component. A composite fabricated unit (generally complete within itself) that is designed to perform a stated service when installed in its proper position (for example, lube oil cooler, overspeed trip, strainer, and so forth) (see MIL-M-15071).

6.4.8 Comprehensibility. How well information can be located, understood, remembered, or acted upon by the user. High comprehensibility permits the user to have a minimum of searching, reading, studying, and conceptualizing skills.

6.4.9 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.

6.4.10 Equipment. A component or components and necessary assemblies, subassemblies, and parts connected or associated together to perform an operational function (boilers, feed pumps, motor generator sets, etc.).

6.4.11 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.

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6.4.12 Function. A group of circuits or other devices which operate together to accomplish a portion of an equipment or system objective (for example, transmit, receive, display, hoist, and control) (see MIL-M-15071).

6.4.13 Inspection and verification (I&V). Inspection requirements are developed for processes that require either specialized training and certification or independent observation. Verification requirements are developed for processes that do not require independent observation. I&V requirements are identified by the shipyard technical authority to ensure that all repair, overhaul, conversion, or refurbishment of Naval ship systems, subsystems, and components fully meet Navy requirements. TRSs also state when I&V functions are to be performed. Those time periods are called I&V designated points.

6.4.14 Item. A nonspecific term used to denote any product, including systems, materials, parts, subassemblies, sets, accessories, and so forth.

6.4.15 Non-complex equipment and components. Those equipment and components that are not mission or safety critical, lend themselves to relatively routine overhaul and repair procedures, and are of a simple or basic configuration.

6.4.16 Overhaul. The process of reconditioning a system or equipment to conform to the stated performance and technical specifications of the system or equipment with a life expectancy equivalent to similarly configured new systems or equipment. Overhaul is also performed to repair or replace parts and components that have failed or are of marginal quality because of wear, deterioration, or damage so as to preclude premature failure. Installation of authorized approved engineering or field changes may be included as part of the overhaul.

6.4.17 Planned overhaul/repair maintenance. The minimum overhaul or repair maintenance required for an item covered by a TRS. This work is determined by such means as experience and engineering judgment. The purpose of this requirement is to permit preplanning or repair to the maximum extent practicable to minimize potential failures before they develop into major defects or malfunctions.

6.4.18 Repair. Work necessary to restore an unserviceable system or component to operational status without change in design, materials, number, location, or relationships of the component parts that have failed or are of marginal quality due to wear, deterioration, or damage. The repair process includes all necessary adjustment, alignment, and calibration procedures.

6.4.19 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.

6.4.20 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.



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(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.)

6.4.21 System. Two or more equipments (sets) or components, each having its own identity and nomenclature, arranged and interconnected to perform a specific operation or function.

6.4.22 Validation. The process by which the TRS-preparing activity tests a TRS for technical accuracy, adequacy, comprehensibility, and usability. It is conducted at the preparing activity's facility or at an overhaul site and involves performance of procedures, including check-out, calibration, removal, installation and alignment instructions, and associated checklists. Disassembly and reassembly, removal and installation procedures are validated by performance or simulation as approved in writing by the acquisition activity. Other data, such as part numbers, schematic diagrams, illustrations, and wiring data are checked against current source data (see MIL-M-85337).

6.4.23 Verification. The process by which the acquisition activity tests a TRS to be accurate and adequate for the overhaul, repair, or restoration of the system, equipment, or component to which it applies. Verification may include preparing activity assistance and support. It is the final quality assurance iteration by the acquisition activity for acceptance of the TRS (see MIL-M-85337).

6.4.24 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.

6.5 Superseded documents. The following documents are superseded by this specification:

- (a) DOD-STD-2147
- (b) MIL-STD-1604
- (c) MIL-STD-2111
- (d) MIL-M-21742

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.  
 Traveller and inspection/discrepancy/repair report.

Preparing activity:  
 Navy - SH  
 (Project TMSS-N204)

NAVAL SHIPYARD

DATE

EQUIPMENT	APL	DATE ASSIGNED	MANUSCRIPT		PRELIMINARY ECD	COMMENTS
			ECD	PERCENT COMPLETE		
7. MAIN FEED PUMP	016180185	4/02/83	8/17/83	100	11/15/83	PRELIMINARY COPY IN PROGRESS.
8. L.P. AIR COMPRESSOR	061430246	4/15/83	8/31/83	100	11/25/83	MANUSCRIPT SUBMITTED FOR APPROVAL.
9. L.P. AIR COMPRESSOR	061900359	5/10/83	9/14/83	80	12/15/83	PROOFING AND EDITING IN PROGRESS.
10. AUX CIRC PUMP	01612387	6/05/83	10/12/83	75	1/11/84	TMIN REQUESTED FROM NSDSA.
11. WARNER LUBE OIL PUMP	016020541	7/09/83	11/22/83	50	2/22/84	DIFFICULTY IN PROCURING MANUFACTURER'S DRAWINGS.
12. MN FD BST PMP	78235003	8/11/83	12/20/83	40	3/21/84	AN INFORMAL IN-PROCESS REVIEW TO DISCUSS DATA PRESENTATION STYLES IS REQUESTED.
13. 2500 KW SSTG	057805285	9/12/83	1/18/84	30	4/26/84	AWAITING NAVSEA APPROVAL FOR 3 SEPARATE VOLUMES.  VOLUME I      2500 KW SSTG TURBINE AND REDUCTION GEAR  VOLUME II      2500 KW SSTG CONTROL SYSTEM  VOLUME III     2500 KW SSTG ELECTRICAL GEN- ERATOR

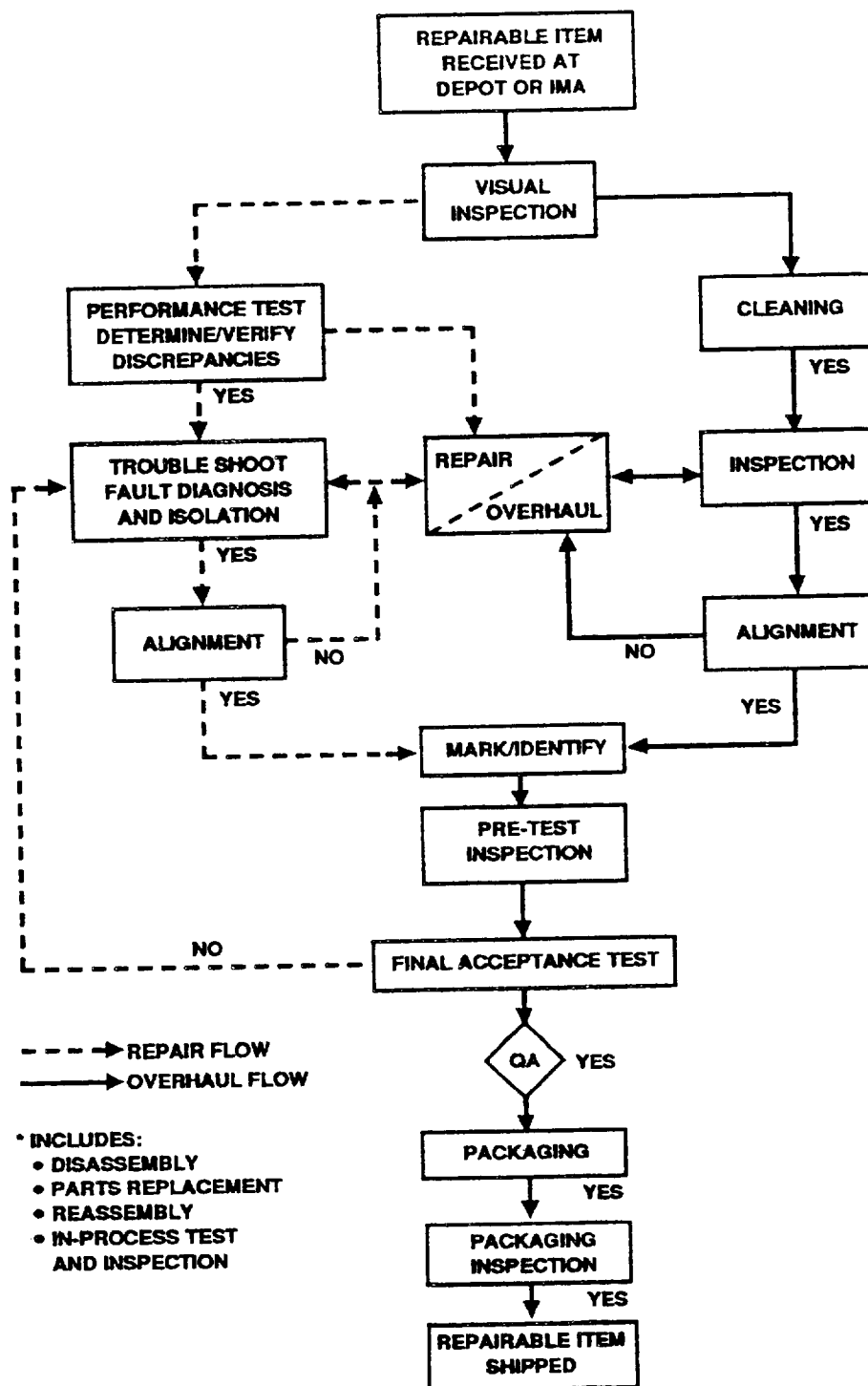
MIL-T-24747 (SH)

Sheet 2 of 4  
Enclosure 1

FIGURE 1. Example status report.

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SXXXX-XX-TRS-XXX/X-X-X



ORIGINAL

Figure X-X. Title of TRS

1-4

FIGURE 2. Example of a repair process flow chart.

TRIS TITLE: \_\_\_\_\_

TMIN \_\_\_\_\_ APL (S) \_\_\_\_\_

**TMCN/TMSR/BOA** \_\_\_\_\_

### PREPARING ACTIVITY \_\_\_\_\_

PARAGRAPH	JUSTIFICATION	REFERENCE SOURCE

### GENERAL REMARKS

**FIGURE 3. Engineering judgement record.**

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# **TECHNICAL MANUAL COST AND PRICING DATA FORM**

NAME OF OFFEROR		CONTRACT/SOLICITATION NO.		LINE ITEM NO.
OFFEROR'S ADDRESS (INCLUDE ZIP CODE)				
PROPOSED/ACTUAL TECHNICAL MANUAL TITLE OR SUBJECT				TMCN NO.
<b>SHIP/SYSTEM/EQUIPMENT APPLICABILITY</b>				
NOUN NAME		TYPE	MODEL/MARK	MODIFICATION
MANUFACTURER (FSCN)			PART NO.	
NATIONAL STOCK NO. (NSN)	SHIP TYPE	CLASS	HULL(S)	
NUMBER OF PARTS (EXCLUDING COMMON FASTENERS)		ALLOWANCE PARTS LIST (APL) NO.		
TOTAL	REPLACEABLE			
<b>ESTIMATED PAGE UNITS (8 1/2 X 11 INCHES)</b>				
TYPE	NEW	REVISED	UNCHANGED	TOTAL
<b>TEXT:</b>				
1. DESCRIPTION				
2. PROCEDURAL				
3. PARTS LIST				
<b>ILLUSTRATIONS:</b>				
1. SECTIONAL VIEWS				
2. CUTAWAY VIEWS				
3. EXPLODED VIEWS				
4. SCHEMATICS				
5. BLOCK DIAGRAMS				
6. TEST SET-UP DIAGRAMS				
7. OUTLINE/PLAN VIEW DIAGRAMS				
8. WIRING DIAGRAMS				
9. PICTORAL DIAGRAMS				
10. FAULT LOCATION/TROUBLE-SHOOTING "TREES"				
11. MAINTENANCE DEPENDENCY CHARTS				
12. OTHER				
a. TONE ART (REQUIRES WAIVER)				
b. WAVEFORMS				
c. PERFORMANCE CHARTS				
d.				
<b>TOTAL UNITS:</b>				

**FIGURE 4. Example of cost pricing data form.**

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# TECHNICAL MANUAL COST AND PRICING DATA FORM

COST ELEMENTS	PAGE UNITS	MANHOURS ↓	RATE	COST <input type="checkbox"/> ESTIMATED <input type="checkbox"/> ACTUAL
<b>1. DIRECT MATERIAL:</b>				
a. PURCHASES				
b. SUBCONTRACTS (EXCLUDING PRINTING)				
c. SUBCONTRACTS (PRINTING)				
<b>2. MATERIAL OVERHEAD:</b>				
<b>3. DIRECT LABOR:</b>				
a. ENGINEERING, RESEARCH, LIAISON				
b. WRITING				
c. EDITING				
d. PARTS LISTING				
e. QUALITY ASSURANCE				
f. ILLUSTRATING/DRAFTING				
g. PRODUCTION COORDINATION (INCLUDES TYPING, COPY PREPARATION, PHOTO, PROOFREADING, ETC.)				
h. OTHER DIRECT LABOR				
(1) BOOK PLAN				
(2) VALIDATION				
(3) VERIFICATION SUPPORT				
(4) OTHER (IDENTIFY)				
<b>4. LABOR OVERHEAD:</b>				
<b>5. OTHER COSTS:</b>				
a. DATA ITEMS PER DD FORMS 1423 (REPRODUCTION, PACKAGING, AND SHIPPING ONLY; INCLUDE LABOR IN 3., ABOVE.)				
(1) BOOK PLAN				
(2) MANUSCRIPT FOR REVIEW				
(3) APPROVED MANUSCRIPT - INTERIM USE				
(4) PRELIMINARY MANUALS				
(5) REPRODUCIBLE COPY/ARTWORK				
(6) PHOTOLITH, NEGATIVES/MASKES/SCREENS				
(7) PROOF COPIES				
b. OTHER (IDENTIFY)				
<b>6. SUBTOTALS:</b>				
<b>7. GENERAL AND ADMINISTRATIVE EXPENSE</b>				
<b>8. PROFIT OR FEE</b>				
<b>9. TOTAL EST. COST/PRICE</b>				
I CERTIFY THAT THE DATA PROVIDED HERE REFLECTS OUR BEST ESTIMATES AS OF THIS DATE AND ONLY INCLUDES THE COST TO PRODUCE THE TECHNICAL MANUAL AND RELATED DATA ITEMS.				
TYPE NAME AND TITLE	SIGNATURE		DATE	
1. LABOR HOURS SHALL ONLY REPRESENT THE OVER AND BEYOND COSTS REQUIRED TO CONVERT ENGINEERING DATA GENERATED IN THE DESIGN, DEVELOPMENT, AND PRODUCTION EFFORTS AND TECHNICAL DATA (EQUIPMENT ENGINEERING DRAWINGS, ILSPs, MAINTENANCE ANALYSIS, LSAs, PMSs, ETC.) TO MEET THE CONTRACT REQUIREMENTS OF SUBJECT TECHNICAL MANUALS.				

FIGURE 4. Example of cost and pricing data form. (Cont'd)



**CHANGE RECORD/(CHANGE RECORD-2 BLANK)**

FIGURE 5. Sample change record.

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(REDUCTION FOR ILLUSTRATIVE PURPOSES)


		TYPE IN PT. SIZE
(Notes)		
a.	<b>S6225-YL-TRS-011/5212-086-618</b>	24
b.	<b>FORMERLY 5212-086-616</b>	14
c.		
d.	<b>VOLUME 1, PART 1</b>	14
e.	<b>TECHNICAL REPAIR STANDARD</b>	18
f.	<b>PUMP, FIREMAIN AND FLUSHING, MOTOR DRIVEN</b>	24
	<b>MODEL 5LRN-11</b>	24
	<b>OVERHAUL PROCEDURES</b>	18
	<b>PUMP: APL/CID 016032249</b>	
	<b>MOTOR: APL/CID 174342345</b>	
	<b>CONTROLLER: APL/CID 151406765</b>	14
g.	<b>ABBREVIATED TITLE: F&amp;F PMP</b>	
h.	<b>APPLICABLE T.M. NO.: 0967-LP-214-8010</b>	
i.		1 1/2"
j.	<b>APPLICABLE TO: DD 963 CLASS ONLY</b>	14
k.	<b>THIS TRS SUPERSEDES TRS NO. 5212-086-616</b>	10
q.	<b>DISTRIBUTION STATEMENT C: DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES AND THEIR CONTRACTORS ONLY FOR ADMINISTRATIVE/OPERATIONAL USE (15 DEC 1983). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO NAVSEA 56Y2.</b>	10
	<b>DESTRUCTION NOTICE: DESTROY BY ANY METHOD THAT WILL PREVENT DISCLOSURE OF CONTENTS OR RECONSTRUCTION OF THE DOCUMENT.</b>	10
r.	<b>APPROVED BY</b> _____ (SEA 56Y21)	8
s.		
c.	<b>PUBLISHED BY DIRECTION OF COMMANDER NAVAL SEA SYSTEMS COMMAND</b>	10
t.	<b>15 DECEMBER 1983</b>	12
u.		
	<b>FOR OFFICIAL USE ONLY</b>	14

FIGURE 6. Sample TRS cover and title page.

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## INSTRUCTIONS FOR COVER AND TITLE PAGE PREPARATION

## (Notes)

a. A Technical Manual Identification, Number (TMIN) shall be furnished in accordance with the procedures of the procuring agency. If the TRS will be jointly used by more than one service, the number will appear at the top with the other using Service's number immediately below it and each Service's number shall be prefixed with the word, Army, Marine Corps, or Air Force, as appropriate. All numbers shall appear above the ruled line at the left margin: 3/4 inch below the top edge of page.

b. When a TRS is renumbered, the former publication number shall appear below the new publication number, preceded by the word "Formerly." Both numbers shall remain at this location until the first following revision, at which time only the new number shall appear.

c. Horizontal lines in 1-point type size shall appear: 1-inch from the top edge of page, and 1-1/2-inches from the bottom edge of the page. Both lines shall extend from the left to the right margins.

NOTE: Spacing between items (b), (c), (d), (e), (f), and (g) may be varied to compensate for nomenclature length and other data requirements. Spacing of necessary information shall be such as to result in an attractive well balanced cover and title page.

d. The volume and part number of a multi-volume, multi-part TRS shall be included at the left margin below the horizontal line.

e. Each manual is assigned a technical manual stock number (13 characters) by Naval Publications and Forms Center (NPFC). Number is requested by the procuring activity from NPFC. The number is to be in 14-point type, and placed 1/8 inch below the volume and part number at the left margin below the horizontal line. If there is no volume and part number, place the stock number 1/8 inch below the horizontal line and aligned with TMINS number at the left margin.

f. TECHNICAL REPAIR STANDARD shall appear centered below the horizontal line.

g. The nomenclature of the equipment, type, model, part number (blocks, serial number, registration numbers, if appropriate), shall be positioned below the words identifying the TRS. The Allowance Parts List (APL) number and TRS identification of any other equipment covered by the TRS shall be shown. The classification of the equipment nomenclature shall be indicated (U), (C), (S), as specified in DOD Manual 5220.22-M, when the TRS itself is classified.

h. An approved abbreviated TRS short title may be included in the location shown.

i. If appropriate, a TMIN of other applicable technical manuals may be displayed in the title block.

FIGURE 6. Sample TRS cover and title page. (Cont'd)

## MIL-T-24747 (SH)

- j. A 1-1/4-inch diameter procuring agency seal shall appear centered on the page. Spacing between the necessary information shall be such as to result in an attractive, well-balanced title block.
- k. Applicable hull numbers shall be listed under the seal when required by the procuring agency.
- l. When a TRS supersedes a previous issue or other TRSs, a supersedure notice shall be in the space indicated
- m. If the TRS contains proprietary information, the cover shall contain a suitable notice
- n. TRSs containing classified information which may be liable to inadequate disclosure to foreign governments or foreign nationals shall bear a special handling notice.
- o. The espionage law notice shall be placed on the cover and title page for all classified manuals, including those bearing a FORMERLY RESTRICTED DATA marking, but not on those bearing a RESTRICTED DATA marking.
- p. National Security information notice is included when appropriate.
- q. Manuals classified Secret (with or without RESTRICTED DATA or FORMERLY RESTRICTED DATA markings) shall show the total page count and copy number
- r. Distribution Statement, Warning, and Destruction notice, as shown, centered below seal.
- s. APPROVED BY: Centered 1/4 inch below the distribution statement. A horizontal hair line shall be extended to within 1/8 inch of the margin and the code of the Final Approval Authority shall be centered 1/8 inch below the extended line. The "Approved By" block shall not be shown on the cover.
- t. Authority Notice: PUBLISHED BY DIRECTION OF COMMANDER, NAVAL SEA SYSTEMS COMMAND, shall be centered, 1/8 inch above a horizontal line across the lower part of page.
- u. The publication date shall appear in the location shown below the horizontal line on the title page only.

FIGURE 6. Sample TRS cover and title page. (Cont'd)

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S6225-A7-TRS-010/MN FD PMP

## LIST OF EFFECTIVE PAGES

Dates of issue for the original and changed pages are:

ORIG . . . . .	S6225-A7-TRS-010/MN FD PMP . . . . .	25 OCTOBER 1978
Ch A . . . . .	S6225-A7-TRS-01A/MN FD PMP . . . . .	2 FEBRUARY 1980
Ch B . . . . .	S6225-A7-TRS-01B/MN FD PMP . . . . .	14 JANUARY 1982
Ch C . . . . .	S6225-A7-TRS-01C/MN FD PMP . . . . .	16 JULY 1982

Total number of pages in this publication is 158 consisting of the following:

Page No.	*Change No.	Page No.	*Change No.
Title and A . . . . .	C	3-1 through 3-47 . . . . .	A
Change Record . . . . .	O	3-48 blank . . . . .	O
Change Record-blank . . . . .	O	3-49 through 3-55. . . . .	B
Foreword-1. . . . .	B	3-56 blank . . . . .	B
Foreword-2 blank. . . . .	O	A1-A15 . . . . .	O
1 through xi. . . . .	C	B1-B4. . . . .	B
1-0 through 1-17. . . . .	A	C-1 through C-31 . . . . .	C
1-18 blank. . . . .	O	C-32 blank . . . . .	C
2-1 through 1-12. . . . .	B	Index-1 through Index-4. . . . .	O

\*Zero in this column indicates an original page.

The portion of the text affected by the latest change is indicated by a vertical line in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands.

A

Change C

FIGURE 7. List of effective pages.

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S6225-A7-TRS-010/XXXX-XXX-XXX

## TABLE OF CONTENTS

<u>Chapter/Para</u>		<u>Page</u>
	Change Record	
	List of Illustrations	iii
	List of Tables	iv
	Safety Summary	ix
1	GENERAL INFORMATION	1-1
1-1	Scope	1-1
1-2	Point-of-Contact	1-1
1-3	Overhaul Preparation	1-1
1-3.1	Mandatory Overhaul Replacement Parts	1-2
1-3.2	Contingency Material List	1-2
1-4	Reports	1-3
1-4.1	Examination, Test and Repair Action Records (ETRAR)	1-3
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1-5	Documentation	1-4
1-6	Item Description	1-5
1-7	Parts Replacement	1-6
1-8	Special Facilities, Test Equipment, Skills and Test Conditions	1-7
1-8.1	Special Handling Facilities	1-7
1-8.2	Balancing Equipment	1-8
1-8.3	Environmental Condition Requirements	1-10
1-9	User Comments	1-11
1-9.1	Routine	1-11
1-9.2	Priority	1-11
2	SHIPBOARD REMOVAL	2-1
2-1	System Tag-Out Procedures	2-1
2-2	System Drainage Procedures	2-4
2-3	System Inspection Procedures	2-7
2-4	Equipment Removal Procedures	2-10
2-5	Equipment Transfer Procedures	2-14
2-5.1	Preparation and Handling Requirements	2-14
2-5.2	Transfer Procedures	2-17
3	UNIT DISASSEMBLY	3-1
3-1	Boundary Identification	3-1
3-2	Coupling Separation	3-2
3-3	Governor Removal	3-3
Original		

1

NOTE: THE EXAMPLE ABOVE IS HYPOTHETICAL; THE ACTUAL TABLE OF CONTENTS FOR A TRS IS TO BE BASED UPON THE SPECIFIC TRS CONTENT REQUIREMENTS FOR THE REPAIRABLE ITEM(S) COVERED BY THE TRS.

FIGURE 8. Example of TRS table of contents.



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## LIST OF ILLUSTRATIONS (Continued)

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2-1	Intermediate Bearing Housing Support .....	2-2
2-2	Gearbox Horizontal Drive Shaft Housing .....	2-4
2-3	Rear Gearbox .....	2-5
2-3.1	Retaining Plate, Rear Gearbox Dowel Pins .....	2-7
2-4	Compressor Front Frame (Steel) .....	2-9
2-5	Compressor Front Frame (Aluminum) .....	2-10
2-5.1	Front Frame (Aluminum) Hub ID Nick, Dent, Scratch, and Gouge Reference Areas .....	2-11
2-6	Aluminum Front Frame Anti-Icing Air Ducts and Spring Retainers .....	2-13
2-7	Aluminum Front Frame Seal Support .....	2-15
3-1	Steel Inlet Guide Vane Support .....	3-6
3-2	Aluminum Inlet Guide Vane Support .....	3-7
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3-4	Inlet Guide Vane Bearings .....	3-14
3-5	Main Cranks, Bellcranks and Master Rods .....	3-15
3-6	Vane Lever Components .....	3-19
3-7	Vane Lever Components (Wide Flange Bushings) .....	3-22
3-8	Teflon Bushing Crinkling .....	3-23
3-9	Teflon Bushing Reference Areas (Wide Flange Bushing) ...	3-24
3-10	Variable Van Tange and Lever Arm Disengagement .....	3-27
3-11	Half-Ring Assembly and Bellcrank Support .....	3-30
3-12	Half-Ring Connector Matching Fixture .....	3-31
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3-13.1	Matching IGV Half-Ring and Connecting Clevis .....	3-42
3-13.2	IGV Half-Ring and Connecting Clevis Alignment Pin Drill Guide Bushing .....	3-44
3-14	Actuator Bracket Assembly .....	3-45
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3-16	Compressor Front Casing .....	3-48

Change A

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NOTE: (WHEN THE LIST OF ILLUSTRATIONS AND LIST OF TABLES ARE BRIEF, BOTH MAY BE SHOWN ON THE SAME PAGE.)

FIGURE 9. Sample list of illustrations.

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## LIST OF TABLES

Number	Title	Page
1-1	Shaft Ratings . . . . .	1-4
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1-3	Lubrication System Data. . . . .	1-9
3-1	Clearance Requirements . . . . .	3-4
A-1	Consumable Materials . . . . .	A-2
B-1	Torque Wrench Sizes. . . . .	B-3
C-1	Torque Values for Locknuts . . . . .	C-1
C-2	Torque Values for Studs. . . . .	C-3
C-3	Torque Values for Nuts and Bolts . . . . .	C-7
C-4	Torque Values for Fittings . . . . .	C-9
C-5	Balancing Weights. . . . .	C-12
C-6	Equivalent Point System . . . . .	C-15
C-7	Computation. . . . .	C-17
C-8	Seal Clearance . . . . .	C-22

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FIGURE 10. Sample list of tables.

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## SAFETY SUMMARY

○ The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

## KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe all safety regulations. Do not replace components or make adjustments inside the equipment with the high voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is the off position, due to charges retained by capacitors. To avoid casualties, always remove power and discharge and ground a circuit before touching it.

## DO NOT SERVICE OR ADJUST ALONE

Under no circumstances should any person reach into or enter the enclosure for the purpose of servicing or adjusting the equipment except in the presence of someone who is capable of rendering aid.

## RESUSCITATION

○ Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

The following warnings appear in the text in this volume, and are repeated here for emphasis.

WARNING

High voltages capable of causing death are used in this equipment. Use extreme caution when servicing either the power supplies or their load components.  
(Page 3-27).

The following cautions appear in the text in this volume, and are repeated here for emphasis.

CAUTION

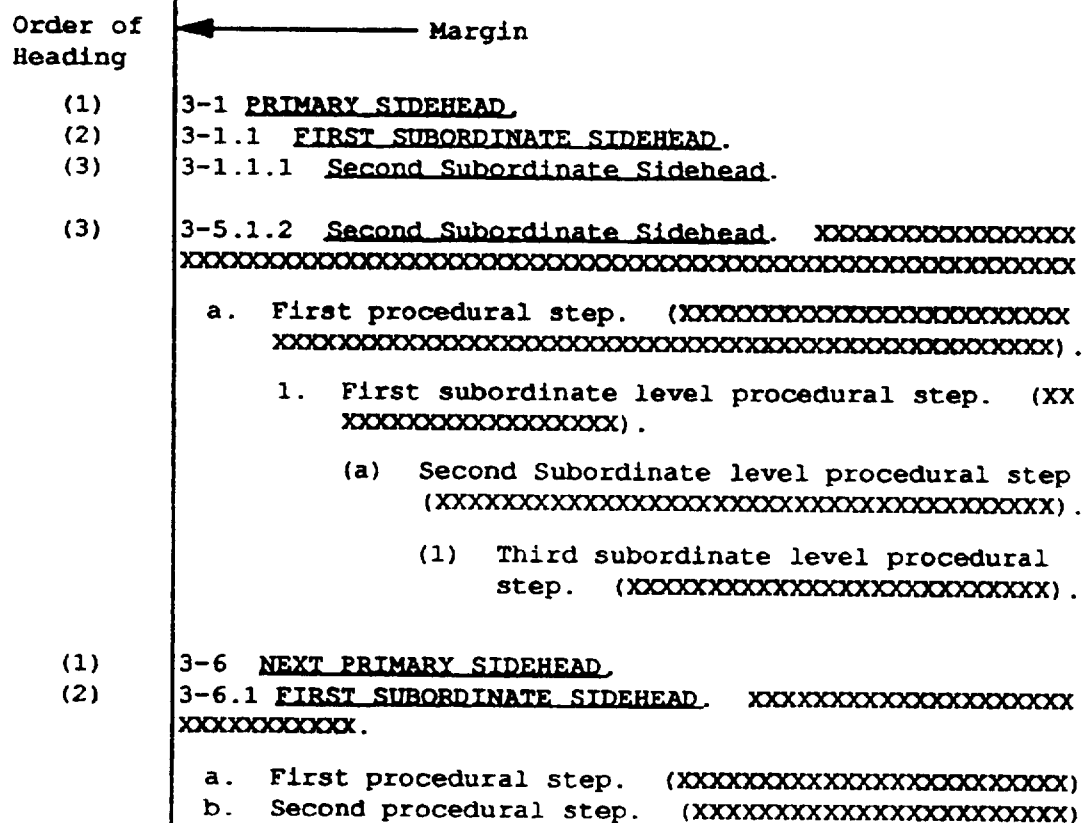
○ Improper equipment operation will result if these three jumpers are not in the correct position. Also remove the jumper between M1 and X1 on terminal board E101 when using the Voltage Regulator (Page 3-15).

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FIGURE 11. Example of safety summary.

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FIGURE 12. Paragraph heading.

S6225-22-TRS-031/MN FD PMP

## SECTION III

## 3-4 ATTACHED LUBE OIL PUMP

3-4.1 DISASSEMBLY OF ATTACHED L.O. PUMP. Item numbers below refer to figure 3-6.

- a. Remove nuts (1) from tapered pins (4).
- b. Remove nuts (2) and lock washers (3) from housing studs (23).
- c. Remove both tapered pins (4).
- d. Remove lower cover (5).
  - (1) Slowly.
  - (2) Ensure that both bearing bushings (20 and 21) are in place, within cover recesses.
- e. Remove gear housing (6). Slide off over the gears (7 and 9) and pump housing studs (23).
- f. Slide the idler gear (7) attached to the idler shaft (8) out of bearing (19) in upper bearing plate (12).
- g. Press idler gear (7) from idler shaft (8).
- h. Pull driver gear (9) from drive shaft (10) and remove key (11).
- i. Remove bearing plate (12) from shaft housing (24).
- j. Withdraw drive shaft (10) by lifting it through the bearing bushing (17) located in the retainer (16)/shaft housing (24) assembly.
- k. Remove oil pump coupling half (13) and key (14) from drive shaft (10).
- l. Remove screws (15) and lift the retainer (16) with bearing bushing (17) from shaft housing (24).
- m. Remove bearing bushings (17, 18, 19, 20, and 21) from lower cover (5), bearing plate (13), and retainer (16) by either pressing or machining, as applicable.

3-4.2 DETAILED L.O. PUMP INSPECTION AND REPAIR. Item numbers below refer to figures 3-6.

3-4.2.1 Parts Examination. The following shall be examined for: corrosion, pitting, scoring, wear, cracks, and damage to machine surfaces. Replace if cracked. Repair other defects by hand or replace.

Lower Cover (5)	Drive Shaft (10)
Gear Housing (6)	Bearing Plate (12)
Idler Gear (7)	Retainer (16)
Idler Shaft (8)	Shaft Housing (24)
Driver Gear (9)	

PRIME  
FUNCTION  
(SINGLE)  
LEVEL BULLET  
PRESENTATION

INFORMATIVE  
PARAGRAPH  
PRESENTATION

S6223-22-TRS-031/MN FD PMP

## NOTE

The inner face of the gear housing (6, Figure 3-6) was originally electrochemically coated with chromium. In this type plating, microcracking is intentionally introduced to assist in retention of lubricants.

3-4.2.2 Gear Housing Examination. Measure the inside diameter of the gear housing (6) at the driver and idler gear bores; required Diameter is 2.400 to 2.402 inches. Replace the housing if worn beyond limits. Record the final readings and/or corrective action taken (readings atb) in the attached L.O. pump examination, Test and Repair Action Record (ETRAR) Volume S6225-22-TRS-C32/MN FD PMP, Page C-14

3-4.2.3 Replacement Bushing Examination. Measure the inside diameter of bushings (17, 18, 19, 20 and 21). Record the final readings and/or corrective action taken in ETRAR, page C-15 as readings C, D, E, F, and G respectively. Allowable limits are:

Bushing 17	0.999 - 0.999
Bushing 18	0.810 - 0.811
Bushing 19	0.748 - 0.749
Bushing 20	0.748 - 0.749
Bushing 21	0.748 - 0.749

3-4.2.4 Gear Housing Bore and Gear Length Comparisons.

a. Measure depth of gear bores at point w (see page c-16). Record final reading for part 6; as item H, in the ETRAR matrix.

b. Measure the lengths of both the Idler gear (part 7) and the Driver Gear (part 9). Subtract the results of this measurement from the dimension recorded in step a to find the gear and clearance. End clearance should not exceed 0.005 inch. Replace gears if worn to point of allowing too much end clearance. Record final end clearance readings in Figure 3-8 as reading I and J respectively.

3-4.3 ATTACHED L.O. PUMP ASSEMBLY. Use figure 3-6 to reference part numbers. Reassemble in reverse order of disassembly (step 3-4.1).

3-4.3.1 Install New Bearing Bushings. Press bearing bushing (17) into retainer (16), bearing bushings (18 and 19) into bearing plate (12), and bearing bushings (20 and 21) into lower cover.

3-4.3.2 Fit Bushings. Assure diametrical clearance measurements are taken at points shown in figure 3-8. Diametrical clearance of bushings (17, 18, 19, 20, and 21) is 0.001 inch minimum to 0.002 inch maximum with shafts (8 and 10). Room bushings if necessary to meet minimum diametrical clearance requirements.

3-4.3.3 Record Diametrical Clearance Readings. Record final readings in figure 3-8 for letters K, L, M, N, and O respectively. Signify that bushings were replaced with a mark in the appropriate column.

3-4.3.4 Attach Idler Gear (7) to Idler Shaft (8).

- a. Press fit.
- b. Ensure idler gear (7) is centered on idler shaft (8).
- c. Ensure oil passage in idler shaft (8) is clear.

3-16

Change B

MIL-T-24747 (SH)

FIGURE 13. Samples of step by step procedural styles.

S6223-22-TRS-031/MN FD PMP

**3-4.3.3 UNIT REASSEMBLY STEPS.****a. Install retainer (16, Figure 3-6) with fitted bearing bushing (17).**

- (1) In shaft housing (24).
- (2) Ensure dowels (22) enter assigned holes.
- (3) Attach with screws (13).
- (4) Torque to 2 to 4 ft.-lbs.

**b. Insert key (14) in drive shaft (10).****c. Install oil pump coupling half (13).**

- (1) On drive shaft (10).
- (2) Ensure keyways match correctly.
- (3) Ensure oil passages in end of drive shaft (10) are clear.

**d. Replace drive shaft (10).**

- (1) Insert through bearing bushing (17) into shaft housing (24).
- (2) Ensure bearing surfaces are aligned.

**e. Install plate (12).**

- (1) Over pump housing studs (23).
- (2) Drive shaft (10) passes through bearing bushing (18).
- (3) Ensure tapered pin holes are aligned with matching holes in shaft housing (24).

**f. Insert key (11) in drive shaft (10).****g. Attach driver gear (9) to drive shaft (10).**

- (1) Ensure keyways match correctly.
- (2) Press driver gear (9) against shoulder on drive shaft (10).

**h. Install idler gear (7) and idler shaft (8).**

- (1) Engage gear teeth (7 and 9).
- (2) Twist-slide idler shaft (8) into bearing bushing (19).

**i. Replace gear housing (6).**

- (1) Slide it over gears (7 and 9), pump housing studs (23).
- (2) Ensure tapered pin holes are aligned with matching holes in bearing plate (12).

**j. Replace lower cover (5).**

- (1) Fit over studs and exposed shafting.
- (2) Shafts (8 and 10) fit into bearing bushings (20 and 21).

Original

3-17

S6223-22-TRS-031/MN FD PMP

**k. Install tapered pins (4, Figure 3-6).**

- (1) Insert tapered pins (4) through lower cover (5), gear housing (6), bearing plate (12) and shaft housing (24).

**CAUTION**

The following steps must be taken in the order presented without deviation. Improper alignment of the pump housing assembly may result if the steps of procedure are reversed.

- (2) Replace tapered pin nuts (1). Tighten to 2 to 4 ft.-lbs.

- (3) Install lock washers (3) over studs (23).

- (4) Replace nuts (2) on studs (23). Tighten nuts (2) to 14 to 30 ft.-lbs.

**3-4.4.6 L.O. Pump Reassembly Testing Requirement.****a. Hand rotate coupling (13).****b. Test to ensure free rotation of shafts (and gears) in the housing assembly.****c. Ensure that no binding can be detected.**

3-18

Change A

MIL-T-24747 (SH)

**FIGURE 13. Samples of step by step procedural styles. (Cont'd)**



MIL-T-24747 (SH)

\* **WARNING**

The following step applies dangerous potentials up to 7000 volts DC to exposed terminals and wiring in the oscilloscope chassis. Exercise extreme caution when working inside this chassis throughout the rest of this procedure.

\* **CAUTION**

All aluminum welding fluxes are highly corrosive. Exercise care to prevent the flux from entering the cooler core. Complete removal of the flux residues is essential for the same reason.

**NOTE**

Be sure to shut off the telephone system when the radar set is not operating. It usually obtains power from a separate source.

\* *Borders optional*\* **METHOD A**

(Above headings are normally for typeset copy but may be inserted with any copy.)

**WARNING** or **WARNING**

Extended flight is not possible after tail rotor drive system failure. Autorotation must be entered immediately.

**CAUTION** or **CAUTION**

The speed decelerator gear must be kept clean at all times to prevent contamination of the lube system. Do not separate the casing halves under any condition.

**NOTE**

Two flange bolts adjacent to each of the leakage air hose fittings are installed with heads aft.

\* **METHOD B**\* *Use one method consistently*

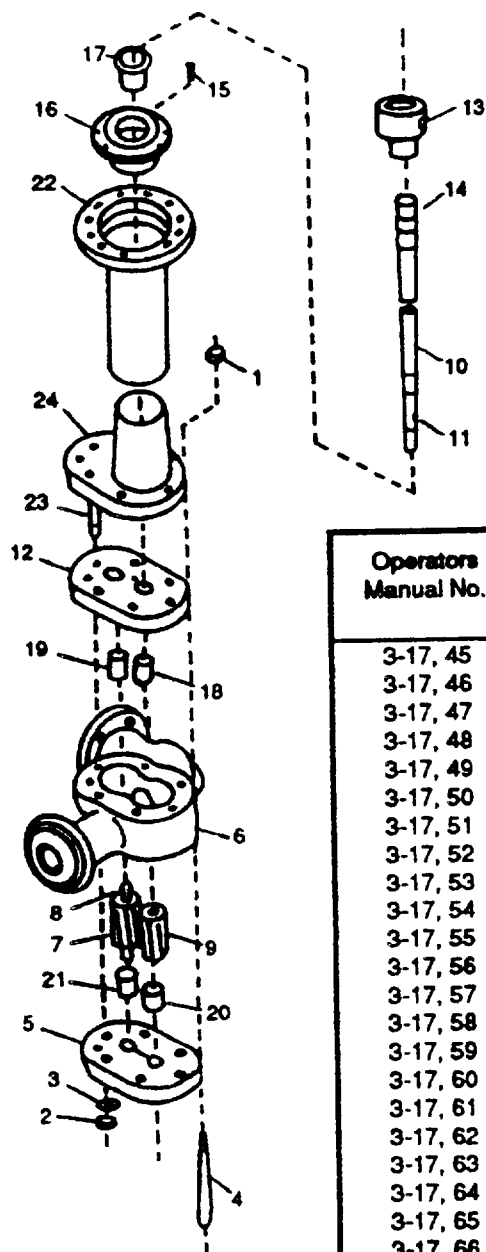
(Above is for copy prepared by office composing equipment or automated equipment. Underlining may be omitted for equipment without such a capability.)

FIGURE 14. Example of warnings, cautions and notes.



MIL-T-24747 (SH)

## S6225-A7-TRS-010/MN FD PMP



## PARTS LIST

Operators Manual No.	Disassembly/ Assembly Sequence No.	Title
3-17, 45	(1)	Tapered pin nuts (2)
3-17, 46	(2)	Nuts (6)
3-17, 47	(3)	Lock washers (6)
3-17, 48	(4)	Tapered pins (2)
3-17, 49	(5)	Lower cover (1)
3-17, 50	(6)	Gear housing (1)
3-17, 51	(7)	Idler gear (1)
3-17, 52	(8)	Idler shaft (1)
3-17, 53	(9)	Driver gear (1)
3-17, 54	(10)	Driver shaft (1)
3-17, 55	(11)	Key (1)
3-17, 56	(12)	Bearing plate (1)
3-17, 57	(13)	Oil pump coupling half (1)
3-17, 58	(14)	Key (1)
3-17, 59	(15)	Screws (8)
3-17, 60	(16)	Retainer (1)
3-17, 61	(17)	Bearing bushing (1)
3-17, 62	(18)	Bearing bushing (1)
3-17, 63	(19)	Bearing bushing (1)
3-17, 64	(20)	Bearing bushing (1)
3-17, 65	(21)	Bearing bushing (1)
3-17, 66	(22)	Dowels (2)
3-17, 67	(23)	Pump housing studs (6)
3-17, 68	(24)	Shaft housing (1)

FIGURE 3-46. ASSEMBLY/DISASSEMBLY ATTACHED LUBE OIL PUMP

CHANGE C

3-195/(3-196 BLANK)

ITEM \_\_\_\_\_

**S9233-XX-TRS-XXX/XXXX-XXX**

## MANDATORY OVERHAUL REPLACEMENT PARTS

APL NO.	DESCRIPTION	NAVSEA OR MFG. DWG. NO.	PC. NO.	MFG. PART NO.	QTY	FSN OR NSN

**ORIGINAL**

MIL-T-24747 (SH)

FIGURE 17. Sample of mandatory overhaul replacement parts list.

ITEM \_\_\_\_\_

S9233-XX-TRS-XXX/XXXX-XXX

**CONTINGENCY MATERIAL LIST**

APL NO.	DESCRIPTION	NAVSEA OR MFG. DWG. NO.	PC. NO.	MFG. PART NO.	QTY	% USAGE FACTOR	FSN OR NSN

ORIGINAL

B-XX

MIL-T-24747 (SH)

FIGURE 18. Example of contingency material list.

S9233-XX-TRS-XXX/XXXX/-XXX-XXX

**MATERIAL CONDITION OVERHAUL REPORT**

SHIP:

HULL NO.

AS FOUND MATERIAL CONDITION (CHECK ONE)

<input type="checkbox"/> UNUSUALLY GOOD MAINTENANCE COULD HAVE BEEN DELAYED	<input type="checkbox"/> AS EXPECTED MAINTENANCE WAS NECESSARY	<input type="checkbox"/> UNUSUALLY BAD MAINTENANCE SHOULD HAVE BEEN DONE SOONER
---	--	---

REMARKS:

## AS OVERHAULED CONDITION RECORD

WAS ALL MANDATORY OVERHAUL REPLACEMENT MATERIAL (APPENDIX A) REPLACED?	YES	NO
COULD MANDATORY OVERHAUL REPLACEMENT MATERIAL HAVE BEEN REUSED: (EXPLAIN IF YES)	YES	NO
DID OVERHAULED ITEM MEET ALL THE ACCEPTANCE CRITERIA IN THE TRS?	YES	NO

REMARKS: (EXPLAIN BLOCKS MARKED NO.)

WAS THERE AN APPROVED DEVIATION OF MATERIAL OR SPECIFIED  
PROCEDURES? (EXPLAIN IF YES)

YES	NO
<input type="checkbox"/>	<input type="checkbox"/>

I CERTIFY, BASED-ON PERSONAL KNOWLEDGE, THAT THE ABOVE ITEM HAS BEEN  
SATISFACTORILY OVERHAULED AND MEETS THE ACCEPTANCE CRITERIA PROVIDED  
HEREIN.

ORIGINAL

3-XX

FIGURE 19. Material condition/overhaul report.



# EXAMINATION, TEST AND REPAIR ACTION RECORD

SHIP NAME &amp; HULL NO. \_\_\_\_\_

TMIN \_\_\_\_\_

ITEM/SUBASSEMBLY \_\_\_\_\_

ITEM SERIAL NO. \_\_\_\_\_

TRS PARA NO.	DRAWING			DESCRIPTION	LIMITS	READINGS		CORRECTIVE ACTION TAKEN *	SIGNATURES
	REF NO.	PC NO.	REF LETTER		SPECIFICATION	INITIAL	FINAL		

ORIGINAL

(USE BACK OF SHEET FOR REMARKS)

C-XX

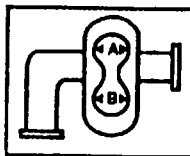
MIL-T-24747 (SH)

FIGURE 20. Examination, test and repair action record.

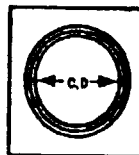
# EXAMINATION, TEST AND REPAIR ACTION RECORD

ITEM/SUBASSEMBLY: MN FD PMP ATTACHED LUBE OIL PUMP

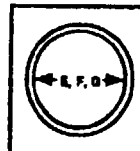
SHIP NAME & HULL NO. \_\_\_\_\_ PUMP NO. \_\_\_\_\_ S6225-AZ-TRS-012/2552-X86-993C



PART 6



PARTS 17 & 18



PARTS 19, 20, 21

TRS PARA NO.	DRAWING			DESCRIPTION	CLEARANCES			SIGNATURES	DATE	CORRECTIVE ACTION TAKEN
	REF NO.	PC NO.	REF LETTER		SPECIFIED LIMITS	READINGS				
						INITIAL	FINAL			
S-3.2.2	S-46	6	A	INSIDE DIAMETER DRIVER GEAR BORE	2.400"-2.402"			I		
			B	INSIDE DIAMETER DRIVER GEAR BORE	2.400"-2.402"			V		
S-3.2.3	S-46	17	C	INSIDE DIAMETER BEARING BUSHING	0.998"-0.999"			I		
		18	D	INSIDE DIAMETER BEARING BUSHING	0.910"-0.911"			V		
		19	E	INSIDE DIAMETER BEARING BUSHING	0.748"-0.749"					
		20	F	INSIDE DIAMETER BEARING BUSHING	0.748"-0.749"					
		21	G	INSIDE DIAMETER BEARING BUSHING	0.748"-0.749"					

EXAMPLE OF INFORMATION CONTENT

NOTE: \*As Per NAVSEA Ltr 56Y21/BJW: Jk Ser 907 of Dec 1983

CHANGE C

(USE BACK OF SHEET FOR REMARKS)

C-6

FIGURE 20. Examination, test and repair action record. (Cont'd)

MIL-T-24747 (SH)

(Insert Classif. of TMDER Here and At Bottom of Page) CLASSIFICATION:

# NAVSEA (USER) TECHNICAL MANUAL DEFICIENCY/EVALUATION REPORT (TMDER) NAVSEA S0005-AA-GYD-030/TMMP & NAVSEAINST 4160.3A

INSTRUCTION: Continue on 8-1/2" x 11" paper if additional space is needed.

1. USE THIS REPORT TO INDICATE DEFICIENCIES, PROBLEMS AND RECOMMENDATIONS RELATING TO PUBLICATION
2. BLOCKS MARKED WITH "\*" ARE TO BE FILLED IN BY THE CONTRACTOR BEFORE PRINTING.
3. FOR UNCLASSIFIED TMDERS, FILL IN YOUR RETURN ADDRESS IN SPACE PROVIDED ON THE BACK, FOLD AND TAPE WHERE INDICATED, AND MAIL (SEE OPNAVINST 5510.1H FOR MAILING CLASSIFIED TMDERS.)
4. FOR ADDITIONAL INFORMATION, CALL AUTOVON 551-2976/2968 OR COMMERCIAL 805-982-2976/2968.

1. NAVSEA TECHNICAL MANUAL NO.*	2. VOL PART*	3. TITLE*
4. REV. NO./DATE OR TM CH. NO./DATE	5. SYSTEM/EQUIPMENT NOMENCLATURE	6. SYSTEM/EQUIPMENT IDENTIFICATION/ (MK/MOD/AN/PART NO.)

## 7. USER'S EVALUATION OF MANUAL (Check Appropriate Blocks)

A. EXCELLENT	B. GOOD	C. FAIR	D. POOR	E. COMPLETE	F. INCOMPLETE
--------------	---------	---------	---------	-------------	---------------

8. GENERAL COMMENTS

## 9. RECOMMENDED CHANGES TO PUBLICATION

PAGE NO. A.	PARA- GRAPH B.	LINE NO. C.	FIG. NO. D.	TABLE E.	F. RECOMMENDED CHANGES AND REASONS TYPE OF PROBLEM (INDICATE SAFETY (S), MAJOR (M), OR MINOR (P))

10. ORIGINATOR'S NAME AND WORK CENTER (PLEASE PRINT)	11. SIGNATURE OF 3-M COORDINATOR	12. DATE SIGNED	13. AUTOVON/COMM. NO.
14. SHIP HULL NO. AND/OR STATION ADDRESS (DO NOT ABBREVIATE)			

## 15. THIS SPACE ONLY FOR NSDSA

A. CONTROL NO.	B. COG ISEA	C. DATE	D. PRIORITY	E. TRANSMITTED TO
		RECEIVED    FORWARDED    DUE		

NAVSEA 4160/1 (Rev. 10-89) (FRONT) (REPLACES NAVSEA 9086/10, DESTROY STOCK)

FIGURE 21. Technical manual deficiency evaluation report.

MIL-T-24747 (SH)

SE211-FO-TRS-010/SPS-10

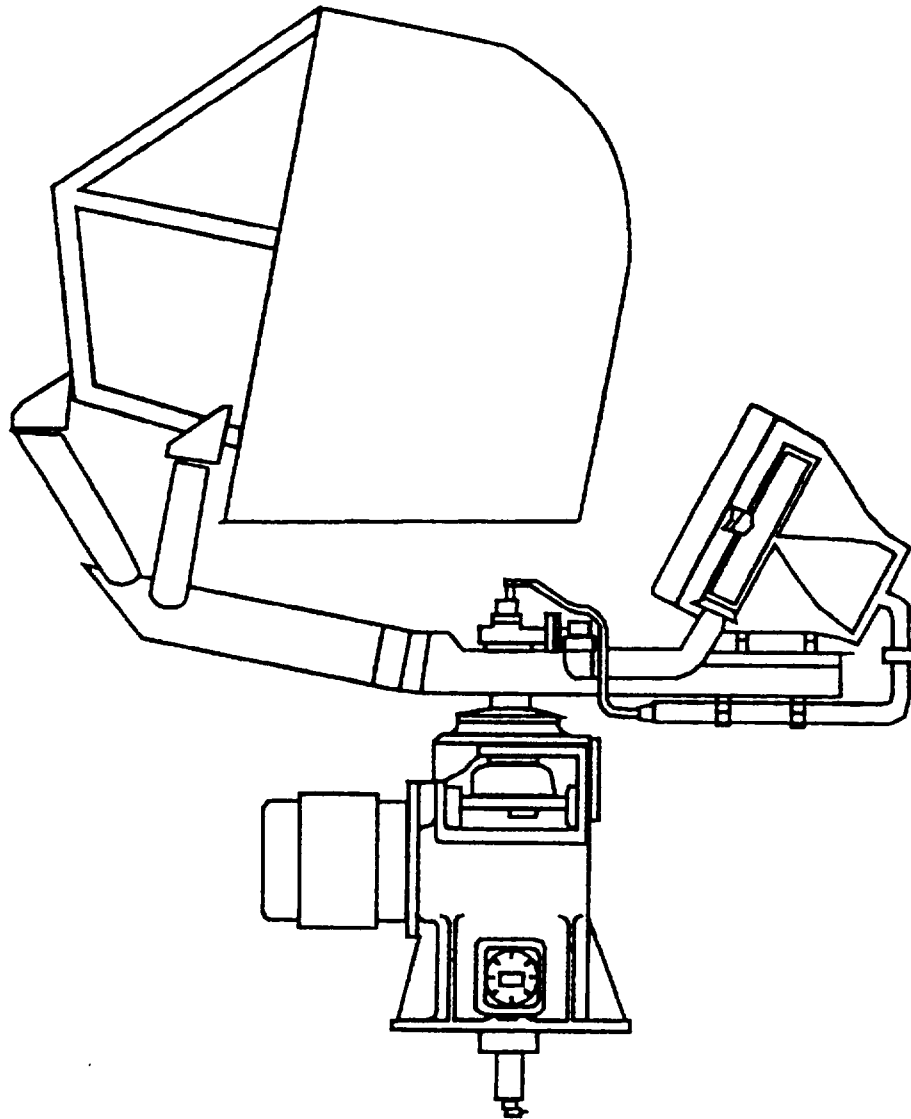


FIGURE 1-0 ANTENNA ASSEMBLY PS-036C/SPS-10

(BLANK/1-0)

ORIGINAL

FIGURE 22. Example of a frontispiece illustration.

MIL-T-24747 (SH)

## SXXXX-XX-TRS-XXX

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 Equipment

MFR AND MODEL NUMBER	DESCRIPTION	MINIMUM USE SPECIFICATIONS
TS-2133/WRC-1 HP 606B or Equivalent HP 5245L or Equivalent AN/USM-281 or Equivalent	Test Fixture Signal Generator Frequency Counter Oscilloscope	Test A2A6 2-29 MHz at 10 mV out 1 kHz to 35 MHz Scope trace between 2.3-3.6 Vdc with min. ripple
Simpson 260 or Equivalent Fluke 8120 or Equivalent HP 141T or Equivalent	Multimeter Digital Voltmeter Display and Main Frame	As Required +28 Vdc 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/ PF 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
NAVSECMORDIV TS-2133/ WRC/A1 or Equivalent	MHz Repair Aid	Interface with A2A6A1
NAVSECMORDIV TS-2133/ WRC/A2 or Equivalent	100 kHz SYN Repair Aid	Interface with A2A6A2
NAVSECMORDIV TS-2133/ WRC/A3 or Equivalent	1 & 10 kHz Repair Aid	Interface with A2A6A3
NAVSECMORDIV TS-2133/ WRC/A5 or Equivalent	500 Hz SYN Repair Aid	Interface with A2A6A5

ORIGINAL

2-3

FIGURE 23. Sample of a test equipment requirements table.

MIL-T-24747 (SH)

## SE211-F0-TRS-010/SPS-10

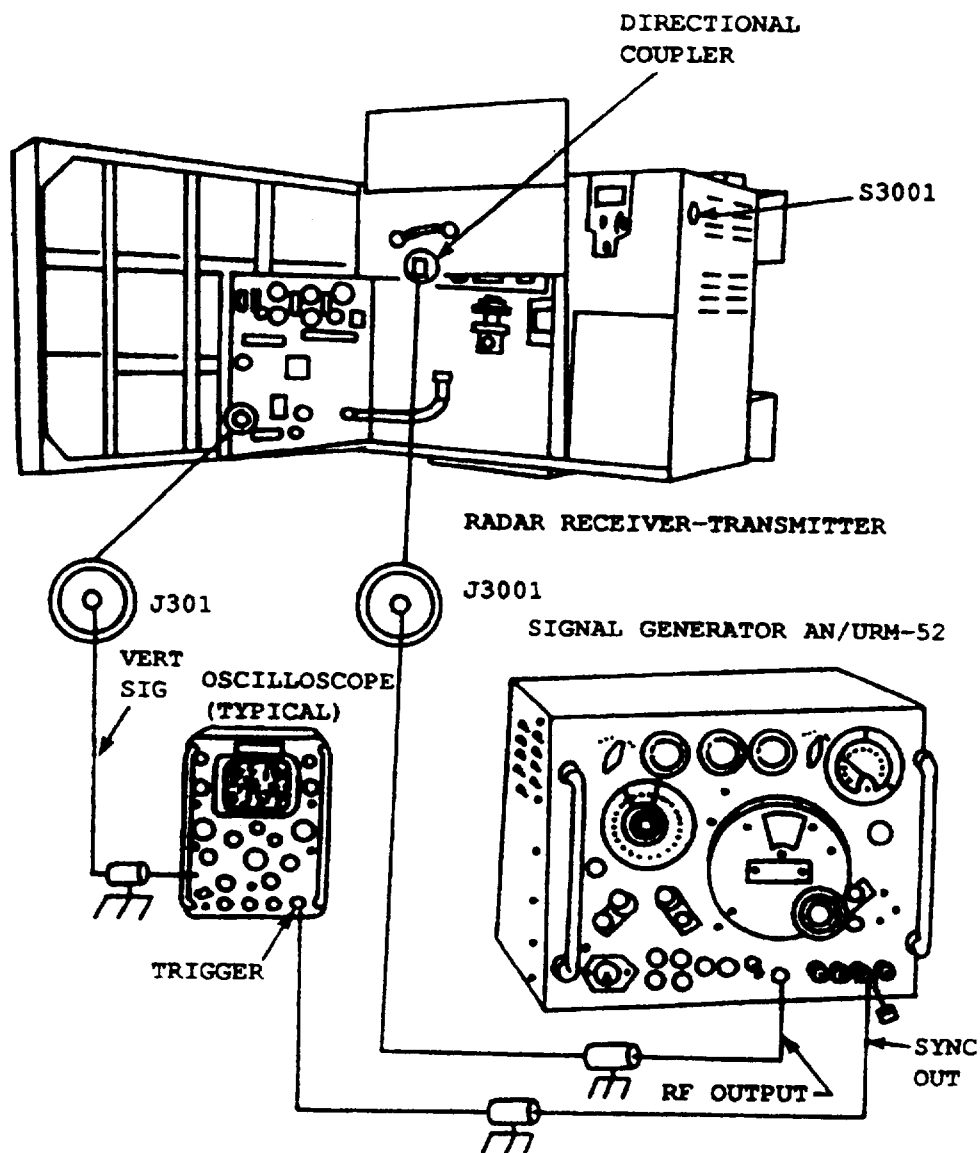


Figure 3-15. MDS Measurement Interconnections

ORIGINAL

3-27

MIL-T-24747 (SH)

**SXXXX-XX-TRS-XXX****TRS TEST DATA RECORD**

DOP ACTIVITY: NAME: \_\_\_\_\_

LOCATION: \_\_\_\_\_

TRS TITLE: RF Amplifier Electronic Assembly

<b>NOMENCLATURE</b>	<b>PART NO.</b>	<b>SER. NO.</b>
RF Amplifier Electronic Assembly	666230-019	

**TEST VERIFICATION CHECK LIST**

Proc'r Step	EQUIPMENT		Test - Insp'n. Date	TEST	
	Performance Requirement	Actual Performance (Record Test Results)		Conductor (Initial)	Insp'r (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				
4.3.3h	NLT +18 dB				
4.3.3k (1)	NLT +18 dB				

**DOP:****TEST RESULTS ACCEPTED BY:**

Test Supervisor: \_\_\_\_\_

**DOP:** \_\_\_\_\_

Customer: (optional) \_\_\_\_\_

Quality Assurance Office: \_\_\_\_\_

Agency: \_\_\_\_\_

Approved: \_\_\_\_\_

Approved: \_\_\_\_\_

Witnessed/Concurred by: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Figure C-2. RF Amplifier Electronic Assembly

ORIGINAL

C-7

NOTE: USE ADDITIONAL SHEETS AS REQUIRED. APPROVAL/ACCEPTANCE SIGNATURE BLOCK TO APPEAR AT BOTTOM OF LAST SHEET ONLY

FIGURE 25. Sample of a test data record.



MIL-T-24747 (SH)

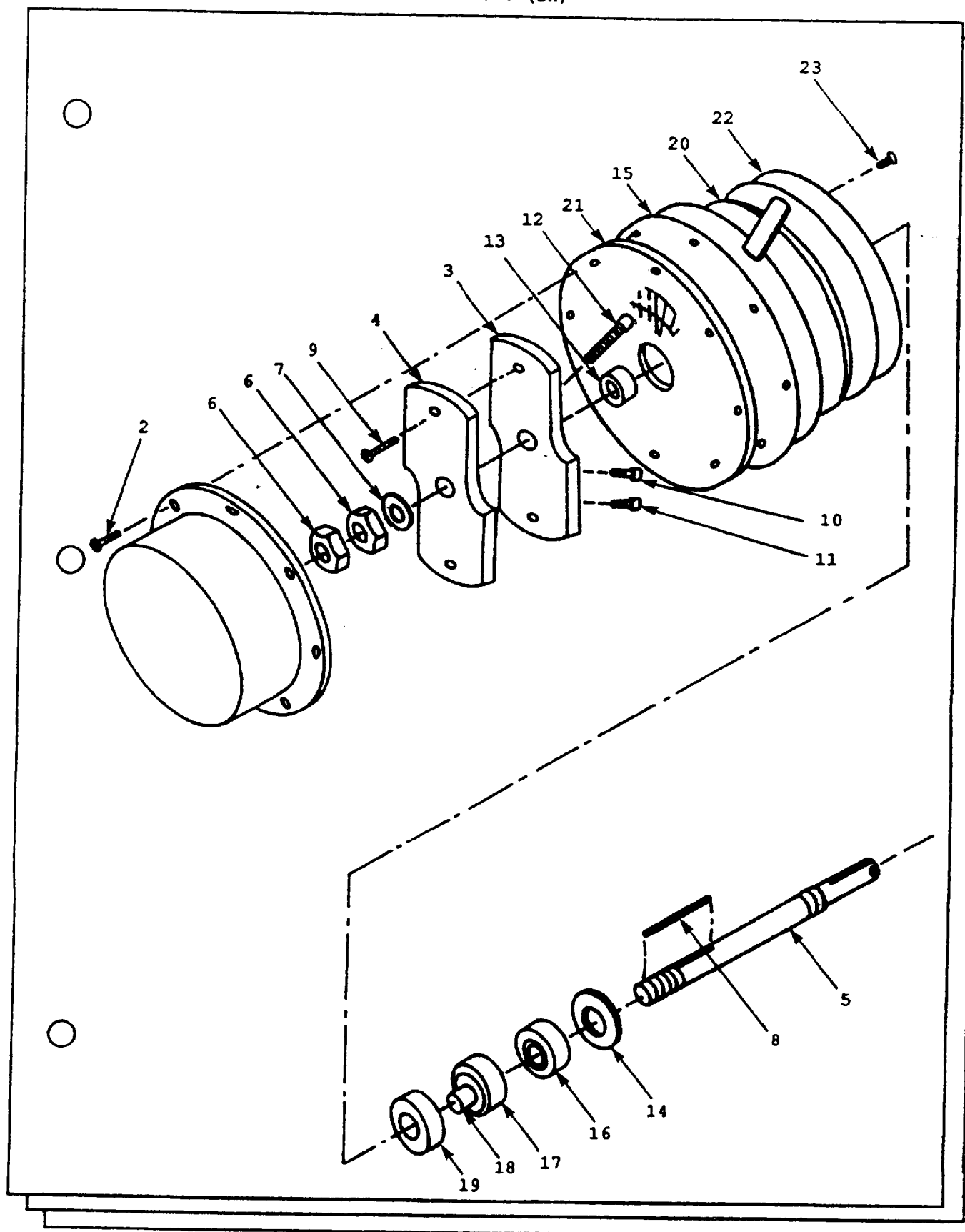


FIGURE 26. Sample of a repairable item, exploded view.

**SXXX-XX-TRS-XXX**



FIGURE 27. Sample of a repairable item troubleshooting block diagram

MIL-T-24747 (SH)

## SXXXX-XX-TRS-XXX

Table A-1. Repairable Item 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	5-1
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	5-1
A2A6P13	CONNECTOR, Plug, Electrical, Mfr 06845, PN 559998-299	5-1
A2A6P14	SAME AS A2A6P11	5-1
A2A6P15	SAME AS A2A6P7	5-1

ORIGINAL

A-XX

NOTE: USE ADDITIONAL PAGES AS REQUIRED

FIGURE 28. Sample of repairable item parts list table.

MIL-T-24747 (SH)

SPAWAR 4180/1A (10-85)

USER ACTIVITY TECHNICAL MANUAL COMMENT SHEET (UATMCS)					
1. UATMCS SEQUENCE NUMBER (SITE)				2. DATE	
3. PUBLICATION NUMBER		4. VOLUME NO.		5. TITLE NOMENCLATURE	
6. ORIGINAL PUBLICATION DATE		7. CHANGES			
8. CLASSIFICATION OF UATMCS <input type="checkbox"/> UNCLASSIFIED <input type="checkbox"/> CLASSIFIED _____					
9. THIS COMMENT IMPACTS: <input type="checkbox"/> SAFETY <input type="checkbox"/> EQUIPMENT <input type="checkbox"/> PREVENTIVE <input type="checkbox"/> CORRECT <input type="checkbox"/> TRAINING <input type="checkbox"/> PARTS <div style="display: flex; justify-content: space-around; font-size: small;"> <span>OPERATION</span> <span>MAINT.</span> <span>MAINT</span> <span>LIST</span> </div> <input type="checkbox"/> OTHER _____					
10. UATMCS TYPE <input type="checkbox"/> PROBLEM <input type="checkbox"/> QUESTION <input type="checkbox"/> SUGGESTION <input type="checkbox"/> COMMENT <div style="border-bottom: 1px solid black; height: 15px; margin-top: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-top: 5px;"></div> <div style="border-bottom: 1px solid black; height: 15px; margin-top: 5px;"></div>					
11. RECOMMENDED CHANGE TO PUBLICATION					
PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON
12. ORIGINATOR NAME			13. RANK/RATE/GRADE AND TITLE		
14. WORK CENTER			15. TELEPHONE (AUTOVON/COML)		
16. SHIP HULL NO. AND/OR DUTY STATION (DO NOT ABBREVIATE)					
17. FOR SPAWAR USE ONLY					
a. CONTROL NO.	b. COG NO.	c. DATES			d. PRIORITY
		REC	FWD	DUE	e. TRANSMITTED TO
INSTRUCTIONS.					
1. USE PLAIN WHITE PAPER FOR CONTINUATION SHEETS.					
2. FOR UNCLASSIFIED UATMCS FOLD ON DOTTED LINE ON REVERSE SIDE STAPLE/SEAL AND MAIL TO COMMANDING OFFICER, NAVELEXCEN PORTSMOUTH, P. O. BOX 55, PORTSMOUTH, VIRGINIA 23705-0055 ATTENTION SPAWAR TECH DATA CENTER. MARK AND MAIL CLASSIFIED UATMCS IN ACCORDANCE WITH OPNAVINST 5510.1 (CURRENT VERSION)					
3. FOR USE WITH NAVELEX/SPAWAR PUBLICATIONS ONLY.					
					PAGE 1 OF _____

FIGURE 29. Sample of user activity technical manual comment sheet.

MIL-T-24747 (SH)

TRS NO: SXXXX-XX-TRS-XXX / X-X-X

TRAVELER AND INSPECTION/DISCREPANCY/REPAIR REPORT (TIDRR)							
NOMENCLATURE		FSN		FINN/FSCM		PART NO.	
SYSTEM TITLE				EQUIPMENT TITLE			
JOB ORDER NUMBER:				TIDRR NO.			
TIDRR PREP BY		CODE	DATE	TIDRR APPR BY		CODE	DATE
TRAVELER SECTION (T)							
WORK SEQ	PROCESSING OPERATION	WORK CTR	SHOP CODE	SHOP SUPV	MAN- HOURS	QUAL ASSUR	DATE
	UNPACK						
	VISUAL INSPECTION						
	RECEIVING TEST/EXAM						
	DISASSEMBLY						
	PLANNED OVERHAUL/REPAIR						
	IN-PROCESS TESTS						
	CORRECTIVE ACTION						
	ASSEMBLY						
	PERFORMANCE TESTS						
	GROOM/PAINT						
	MARK/IDENTIFICATION						
	ACCEPTANCE TEST						
	CALIBRATE						
	TOUCH-UP						
	VISUAL CHECKS						
	FINAL ACCEPTANCE TEST						
	PACKING PACKAGING						
PROCESSING		TIDRR REVIEW					
START	COMPLETE	SUPERVISOR		CODE	QUALITY ASSURANCE		CODE

PART 1. TRAVELER SECTION (T)

APPENDIX A  
PAGE OFFIGURE 30. Traveler and inspection/discrepancy/repair report (TIDRR).

MIL-T-24747 (SH)

ITEM NOMENCLATURE				TIDRR NO.	
INSPECTION/DISCREPANCY RECORD					
NO	REPORTED DISCREPANCIES	RECOMMENDED ACTION			
<input type="checkbox"/> VERIFIED <input type="checkbox"/> NOT VERIFIED		INSPECTOR	SHOP	DATE	
NO	DISCR & REC ACTION	CORRECTIVE ACTION ITEM			QA
WORK COMPLETE & SATISFACTORY					
DATE	SUPERVISOR	CODE	DATE	QUALITY ASSURANCE	CODE

PART 2. Inspection and discrepancy record (VD)

APPENDIX A  
PAGE      OF

FIGURE 30. Traveler and inspection/discrepancy/repair report. (Cont'd).

MIL-T-24747 (SH)

TRS NO: SXXXX-XX-TRS-XXX/X-X-X

ITEM NOMENCLATURE			TIDRR NO.		
PLANNED OVERHAUL/REPAIR ACTION RECORD					
TRS PARA NO	ACTION ACCOMPLISHED	REPAIR PART NO USED	SHOP SUPVR	QA INSP	DATE
WORK COMPLETE & SATISFACTORY					
DATE	SUPERVISOR	CODE	DATE	QUALITY ASSURANCE	CODE

PART 3. Planned overhaul/repair action record (O/R)

APPENDIX A  
PAGE OF

**FIGURE 30. Traveler and inspection/discrepancy/repair report. (Cont'd).**



MIL-T-24747 (SH)

TRS NO: SXXXX-XX-TRS-XXX/X-X-X

ITEM NOMENCLATURE:  
ITEM PART NO.

TIDDR NO.  
ITEM SER NO.

[illegible]

**PART 4. Examination and test record (E/T).**

**APPENDIX A**  
**PAGE        OF**

FIGURE 30. Traveler and inspection/discrepancy/repair report. (Cont'd).

MIL-T-24747 (SH)

TRS NO: SXXXX-XX-TRS-XXX/X-X-X

ITEM NOMENCLATURE:

TIDDR NO.

ITEM SER NO.

REF NO	WRITTEN COMMENTS/SIGNATURE

PART 5. Remarks sheet (R).

APPENDIX A  
PAGE OFFIGURE 30. Traveler and inspection/discrepancy/repair report. (Cont'd).

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document 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 the 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.

<b>1. RECOMMEND A CHANGE:</b>		<b>1. DOCUMENT NUMBER</b> MIL-T-24747 (SH)	<b>2. DOCUMENT DATE (YYMMDD)</b> 12 October 1990
<b>3. DOCUMENT TITLE</b> Technical Repair Standards (TRS) Manual; Preparation of			
<b>4. NATURE OF CHANGE</b> (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)			
<b>5. REASON FOR RECOMMENDATION</b>			
<b>6. SUBMITTER INFORMATION</b>			
<b>7. PREPARING ACTIVITY</b>			
<b>a. NAME</b> Technical Point of Contact (TPOC) Mr. Mickey Ander		<b>b. TELEPHONE (Include Area Code)</b> (1) Commercial TPOC: (703) 602-1230 (2) AUTOVON 8 332-1230	
<b>PLEASE ADDRESS ALL CORRESPONDENCE AS FOLLOWS:</b>		<b>IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:</b>	
<b>c. ADDRESS (Include Zip Code)</b> Commander, Naval Sea Systems Command Department of the Navy (SEA 552332) Washington, DC 20362-5101		Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	