NOT MEASUREMENT SENSITIVE

MIL-PRF-63003B(TM)
20 April 1998

SUPERSEDING

MIL-M-63003A(TM)
12 APRIL 1988

PERFORMANCE SPECIFICATION MANUALS, TECHNICAL: BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR, PREPARATION OF

This specification is approved for use by the Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

l. SCOPE

1.1 General. This specification covers the format, style, and content requirements for preparation of technical manuals (TMs) used for battlefield damage assessment and repair (BDAR) of weapon systems/ equipment damaged or failed on the battlefield. It covers content requirements which are mandatory, and some which are optional but become mandatory when applicable, as determined and specified by the contracting activity. Examples at the rear of this specification are typical and may be adapted to fit the specific equipment or situation being covered.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be used in improving this document should be addressed to: Executive Director, USAMC Logistics Support Activity, Acquisition Logistics Center, ATTN: AMXLS-AP, Redstone Arsenal, AL 35898-7466 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC A7304 **AREA TMSS**

1.2 Limitation. This specification covers only assessment and repair of equipment failures occurring on the battlefield. This repair is sometimes limited to such means of fixing as bypassing, patching, or jury-rigging components, or the use of alternative procedures to restore the equipment/system performance to a minimum operating condition.

1.2.1 BDAR procedures. Fix procedures in BDAR TMs are for use in combat only. Standard maintenance procedures are used as soon as practicable.

1.2.2 Maintenance level. Unless otherwise specified, repair functions covered in BDAR TMs are accomplished by the following maintenance levels:

a. Unit and aviation unit maintenance - performed by operator/crew or by forward organizational maintenance team (MT).

b. Intermediate and aviation intermediate maintenance - performed by intermediate direct support and intermediate general support maintenance support teams (MSTs), when damage exceeds unit repair capability. When required repair time or tactical conditions dictate, the damaged/failed item will be recovered or evacuated as appropriate.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in section 3 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in section 3 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issue 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).

STANDARDS

DEPARTMENT OF DEFENSE

MIL-STD-12	—	Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents
MIL-STD-100	—	Engineering Drawing Practices
MIL-STD-38784	—	Standard Practices For Manuals, Technical: General Style and Format Requirements.

(Unless otherwise indicated, copies of the above standard are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable law and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 General requirements. BDAR TMs shall follow the format and content requirements specified herein. All requirements herein are mandatory except for "optional" requirements which are listed on the Content/Format Selection Summary List (Appendix). The appendix must be completed by the contracting activity before this specification can be invoked contractually. In general, unless otherwise specified herein, style and format shall be in accordance with MIL-STD-38784.

3.2 Format

3.2.1 Divisions. BDAR TMs shall be divided into volumes, chapters, sections, paragraphs, appendixes, glossary, and indexes as appropriate. Specific format and content of these divisions shall be as specified and as indicated by a completed Content/Format Selection Summary List (Appendix A of this specification).

3.2.1.1 Volumes. When a technical manual exceeds a thickness of two inches (1500 pages or 750 sheets), the manual shall be divided into volumes which shall be numbered consecutively.

3.2.1.2 Chapters/sections/paragraphs. Numbering and formatting of chapters, sections, paragraphs, and subparagraphs shall be in accordance with MIL-STD-38784. The following boxed-in statement shall be centered immediately below each chapter title. See Figure 1. Chapters that contain two or more procedures for repair shall have an index preceding the repair procedures as specified in 3.11.4.1c.

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN ANY CASE, DAMAGE SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES AS SOON AS PRACTICABLE.

3.2.1.3 Appendixes/glossary/index. Location, identification, and page numbering of appendixes, glossary, and index shall be in accordance with MIL-STD-38784.

3.3 Illustrations. Illustrations shall support procedural steps and other text to provide clarity of understanding so that rapid repairs can be made. Illustrations shall be located as near as possible to the text that they support.

3.3.1 Line drawing. Illustrations shall consist of line drawings only. Exploded views shall be used to show detail of pertinent areas. See Figure 2.

3.3.2 Symbols. Symbols used on illustrations shall be in accordance with MIL-STD-100. New symbols not covered by MIL-STD-100 shall be defined in the introduction portion of the chapter/section where new symbols are used, and they shall be used only when approval is granted by the contracting activity.

3.3.3 Items/callouts. Items/callouts on figures shall be identified by item name where space permits. Where space does not permit, legends shall be used.

3.3.4 Foldouts. Unless otherwise specified by the contracting activity (see 6.2), foldouts shall not be used.

3.4 Tables. Tables shall be arranged, numbered, and titled in accordance with MIL-STD-38784.

3.5 Warnings, cautions, and notes. Warnings, cautions, and notes shall comply to the requirements of MIL-STD-38784.

3.6 Procedural steps. Detailed step-by-step procedures shall be used to instruct the user how to test/check/inspect, assess, operate, maintain/repair/fix, or perform other BDAR functions. The second person imperative mood shall be used. Each step shall begin with an action word, shall be concise, and shall contain only one action. Each set of step-by-step procedures shall be given an overall title and shall be preceded by information that the user needs (e.g., location, equipment, peculiar tools, material, time, and personnel required).

3.7 Operating procedures. Operating procedures in BDAR manuals shall be restricted to testing a system, subsystem, or component for the purpose of damage assessment, or testing after a field expedient

repair has been performed. If any change to normal operating procedures is made, the new procedures to be followed must be given.

3.8 Terminology/nomenclature. Terms used shall be familiar to the intended user and shall be used consistently throughout the BDAR manual. Items shall be referred to by their Federal item name or nomenclature when applicable.

3.9 Abbreviations and acronyms. Abbreviations and acronyms shall be held to a minimum. Abbreviations shall be in accordance with MIL-STD-12. Terms identified by acronyms shall be spelled out and identified at their first occurrence within each major division of the manual (i.e., chapters and sections).

3.10 References. Unless otherwise specified by the contracting activity (see 6.2), information published in a current technical manual that exceeds one page in length shall not be repeated in manuals being developed. The manual containing this information shall be referenced in that portion of the BDAR manual where the information is needed. In addition, each referenced document shall be listed in the BDAR TM reference appendix.

3.11 Content. Unless otherwise specified by the contracting activity (see 6.2), TMs prepared to provide instruction for making battlefield damage assessment and repair shall consist of data specified herein. Content shall be directed to fix-forward battlefield conditions, that is, repairs must be made as quickly as possible and to the extent necessary to restore or maintain the applicable equipment/system. Unless otherwise specified by the contracting activity (see 6.2), content and order of presentation shall be as follows:

a. Front Matter.
b. Chapter 1, General Information.
c. Chapter 2, Assessing Battlefield Damage.
d. Chapter 3, General Repair.

e. Chapter 4 thru ( ), (major functional group) -Total number of chapters determined by the number of major functional groups applicable.
f. Last Chapter, Auxiliary Equipment (if applicable).
g. Appendixes.
h. Glossary.
i. Index.

3.11.1 Front matter. Front matter shall consist of a cover/title page, warning page(s), table of contents, and how to use this manual instructions and shall be prepared in accordance with MIL-STD-38784.

3.11.1.1 Cover/title page. The cover/title page shall be configured as shown in Figure 3 and include the following (see Figure 3):

a. Technical manual designator/publication number.
b. The words "Technical Manual."
c. The manual type "Battlefield Damage Assessment and Repair" on black background.
d. Nomenclature (i.e., item name and model number or collective equipment description)/national stock number (if applicable). When space on the cover is not adequate, this information shall continue on the back of the cover page.
e. National stock number (end item), if applicable.
f. End Item Code (EIC).
g. Front cover index.
h. Name of authorizing agent (e.g., Headquarters, Department of the Army).
i. The publication date.

j. Representative line drawing of end item/system.
k. Appropriate distribution statement, destruction notice, and export control warning notice (if applicable) placed on the cover in accordance with DOD Directive 5230.24 as provided by the contracting activity (see 6.2).

3.11.1.2 Warning page. A warning page(s), located on back of cover or immediately following the cover page, shall include each general type of warning and warning symbol used within the technical manual. This page(s) shall not list specific warnings that pertain to specific steps, but shall include general subject data (e.g., radiation, chemicals, voltages, gas pressure, laser light, etc.) as shown in Figure 4.

3.11.1.3 Title block page. A title block page shall be a right-hand page and follow the warning page. It shall contain the information and be formatted as shown in Figure 5.
3.11.1.4 Table of contents. All manuals shall contain a table of contents. When appendixes are included in the manual, a list of appendices shall follow the table of contents. See Figure 6.
3.11.1.5 How to use this manual. Instructions on how to use this manual shall begin on the page following the table of contents. The title "HOW TO USE THIS MANUAL" shall be centered at the top of the page. These instructions shall not repeat explanations that are given within the chapters or sections; such as, instructions on "how to use fault assessment tables." Illustrations, charts, and tables shall be used here when text alone cannot convey the thought adequately.

3.11.2 Chapter 1, General information. This chapter and each subsequent chapter shall begin on a right-hand page. This chapter shall contain information that is general in nature. It shall inform the user/reader of the purpose and scope of the manual and its relationship to user personnel, other publications, and the end item/system it supports. In addition, the chapter shall include definitions, standards, practices, identification of responsibilities, and tasks to be performed.

3.11.2.1 BDAR fixes statement. Chapter 1 and each subsequent chapter shall contain the boxed-in statement as shown in Figure 1. This statement shall be centered below the chapter title on the first page of each chapter.
3.11.2.2 Section 1, Introduction. This section shall state the purpose and scope of the TM and how it is applied to the task of BDAR. Terms used in the TM that are new or peculiar to BDAR shall be defined. As a minimum, this section shall contain paragraphs as follows:

a. Purpose.
b. Scope.
c. Application.
d. Definitions.
e. Quality deficiency report/equipment improvement recommendations (QDR/EIR). This paragraph shall contain the following statement: "If your (insert short item name) needs improvement, let us know. Send an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Product Quality Deficiency Report). Mail it to us at (enter address of proponent activity). We will send you a reply."

3.11.2.3 Section II, Standards and practices. This section shall contain information pertaining to standards and practices peculiar to combat conditions. It shall include, as a minimum, the paragraph headings and data (expanded as applicable) as follows:

a. BDAR Characteristics - explanation of the expediency of repair, reason for deviation from standard maintenance practices, need to take greater risks, and other characteristics peculiar to repair under combat conditions.

b. Waiver of precautions - reference to deviations from normal peacetime precautions, and if such deviations are summarized in another portion of the TM, reference shall be made to that portion.

c. Operating characteristics - minimum functional combat capability criteria for the applicable end item/system.
d. Training - explanation/rationale concerning use of BDAR fixes for training.

3.11.2.4 Section III, Tasks and responsibilities. This section shall consist of tasks that may be required as a result of battlefield damage. The person/group responsible for each task shall be identified. The tasks shall appear in the order in which they should be performed. This information shall be presented in narrative form. This section shall include the following paragraphs:

a. Tagging/identifying BDAR repairs - instructions for identifying components affected by BDAR fixes.
b. Reports - instructions for completing reports resulting from BDAR fixes.

3.11.2.5 Section IV, Combat Threats (Aviation Only). This section shall consist of the description of damage from threats confronting aircraft while on combat missions from armor-piercing, armor piercing incendiary projectiles, and high-explosive incendiary projectiles and from exposure to bombs, mortars, and artillery fragments and blasts when on the ground. The resulting effects on the metal airframe structure and follow-on effects should the mission be continued, of secondary damage such as cracks, crippling, or buckling and loss or damage to mechanical fasteners shall be given. Structure damage modes shall be defined for the type of materials and structure affected.

3.11.3 Chapter 2, Assessing battlefield damage. Chapter 2 shall provide information for assessing battlefield damage to the end item/component covered in the BDAR TM. The chapter shall contain Section I, Introduction, and Section II, General Fault Assessment Tables.

3.11.3.1 Section I, Introduction. The primary purpose of this section shall be to introduce the assessment table(s) in Section II. It shall contain paragraphs that will cover the scope of the chapter and application of assessment tables.
3.11.3.2 Section II, General fault assessment tables. This section shall contain assessment tables that pertain to the overall system or major subsystems and its capability to perform its mission essential functions. These tables shall be so developed that they will lead the user to a decision or another chart/table in the associated chapter that will further aid in analyzing/assessing damage. As specified by the contracting activity (see 6.2), the format of assessment tables shall be either a flow chart diagram, Figure 7, or table, Figure 8.

3.11.4 Chapter 3, General repair. Unless otherwise specified by the contracting activity (see 6.2), Chapter 3 shall provide information for battlefield repair of items that are not necessarily associated with a specific component or subsystem of the end item.

3.11.4.1 Section I, Introduction. This section shall contain paragraphs as follows:

a. Scope - brief statement that describes the purpose and application of the overall coverage of the chapter.
b. Assessment procedure - a general statement(s) concerning the assessment of damage and repair required pertaining to type of repairs covered.

c. Repair procedure index - list of all procedures contained in the chapter, listed in the order in which they appear and formatted in accordance with Figure 9. Procedures authorized for training and listed in Appendix E of the TM shall be boxed in.

3.11.4.2 Section II, ( ). This section and each subsequent section in the chapter shall be titled to represent the repair item covered therein. The format and content of this section shall be as follows:

a. General - remarks concerning general nature and causes related to the damage and repair of the item. These remarks shall be brief.

b. (Item name, trouble) - item name and the trouble shall be used as the paragraph side head. The side head shall be followed with a general statement(s) concerning the particular type of trouble and repair to be made. Statement(s) shall be brief and as concise as possible. Subparagraphs shall be as follows:

(1) Limitations - this statement(s) shall identify the limits that would be imposed on the equipment/end item, in relation to operational capability, if the fix that follows is performed.

(2) Personnel/time required - the number of personnel and time required to accomplish the fix shall be listed as follows:

1 soldier - 1.0 hrs (express time in decimal point hours to the nearest one-tenth hour).

(3) Materials/tools - list of materials and tools (peculiar) needed to make the BDAR fix. Following each item listed shall be a reference (in parenthesis) to that item number and appendix (e.g., "hose, (item 4, appx c))." Reference to tools shall reference instructions for tool fabrication when applicable. Any other necessary information (such as quantities and sizes) shall be provided.

(4) Procedural steps - each step shall be listed numerically and placed in the sequential order in which it will be performed. Steps shall be as prescribed in 3.6. The last procedural step for every BDAR fix shall be: "Record BDAR action taken. When mission is complete, as soon as practical, repair the equipment/system using standard maintenance procedures."

c. Options - more than one method of making the same repair/fix. Options shall be listed in order of effectiveness and listed consecutively as option 1, option 2, etc. Each option provided under the item name/trouble paragraph side head (b. above) shall contain subparagraphs: Limitations, Personnel/time required, Materials/tools, and Procedural steps. Alternatives that do not include fixes shall also be listed as options.

d. (Item name, category) - when the basic item, identified in the section title, is divided into categories or types, each specific item shall be titled and covered within a separate paragraph. Each of these paragraphs shall contain only the information that applies to that specific item. For example: Information or procedures under a heading "high pressure" shall pertain to high pressure; low pressure information/procedures (if applicable) shall appear under the heading, "low pressure."

3.11.4.3 Section III, IV, V, etc. ( ). The total number of sections required for chapter 3 shall be determined by the nature and complexity of the end item. The format and content for these sections shall be as specified in 3.11.4.2.

3.11.5 Chapter 4 thru ( ), (Major functional group). Unless otherwise specified by the contracting activity (see 6.2), these chapters shall be titled, arranged, and correspond to the functional groups as they appear in the maintenance allocation chart (MAC) and the repair parts and special tools list (RPSTL). The total number of chapters in the BDAR TM shall be determined by the number of major functional groups applicable to the equipment/system covered by the manual.

3.11.5.1 Section I, Introduction. This section shall contain paragraphs as follows:

a. Scope - brief statement that describes the purpose and application of the overall coverage of the chapter.

b. Assessment procedure - flow chart or table formatted in accordance with Figure 7 or 8. This assessment procedure shall apply to the subsystem or major component identified by the chapter title. The procedure shall direct or reference the user to the instructions for making fixes/repairs. References shall indicate chapter, section, paragraph, or another document, as appropriate. The assessment procedure shall be developed and arranged so that logical and expedient methods are used to locate trouble.

c. Repair procedure index - list of all procedures contained in the chapter, listed in the order in which they appear and formatted in accordance with Figure 9. Procedures authorized for training and listed in appendix E of the TM shall be boxed in.

3.11.5.2 Section II, ( ). This section and each subsequent section in the chapter (the total number of sections shall be determined by the nature and complexity of the subsystem or major component) shall follow the format specified in 3.11.4.2.

3.11.6 Last chapter, chapter ( ) auxiliary equipment. Auxiliary equipment shall be covered in the last chapter of the BDAR TM. The format and content, in general, shall conform to the same requirements established for the chapters covering major functional groups. (See 3.11.5.)

3.11.7 Appendixes. Appendixes shall be used with BDAR TMs to provide lists of supplies specifically provided, or available to aid in performing BDAR fixes. When applicable, appendixes shall immediately follow the last chapter and shall appear in the order as presented in 3.11.7.1 through 3.11.7.5. Each appendix shall have a brief introduction stating its purpose. All tables and charts shall be simple and self explanatory. The BDAR fix statement is required at the beginning of each appendix. See Figure 1.

3.11.7.1 Appendix A, references. Publications referenced in the TM text shall appear in alphanumeric order by publication number. The title of publications shall be on the same horizontal line as the publication number. See Figure 10.

3.11.7.2 Appendix B, special or fabricated tools. All tools and test equipment called out in the TM that are not common or require fabrication to perform BDAR fixes shall be listed by an appropriate tool name or function. When fabrication is required, instructions (and material list) shall be included. See Figure 11.

3.11.7.3 Appendix C, expendable/durable supplies and materials. This appendix shall contain a list of expendable/durable supplies and materials that are available for BDAR fixes. Material shall be listed alphabetically by item name. A brief description shall follow the item name. An item number shall be assigned to the item for reference/identification only. For example, see Figures 12 and 13.

3.11.7.4 Appendix D, substitute materials/parts. This appendix shall list materials and parts that may be used for BDAR fixes. Lists or tables shall include the primary material/part, the substitute/alternate material/part, and remarks (when applicable) that identify the limitations or degradation effected by use of the substitutes. The appendix shall be divided into sections by material type. When sections are required, Section I shall be titled introduction and shall provide a general explanation of the purpose and content of the other sections. When applicable, a section shall be dedicated to petroleum, oil, and lubricant (POL) substitutes. For example of alternate/substitute material listing, see Figure 14. For examples of POL substitutes, see Figures 15 and 16.

3.11.7.5 Appendix E, BDAR training procedures. This appendix shall list all BDAR fixes that have been approved for training. The fix (training) procedures shall be grouped by major system(s) or

components(s) as they appear in the TM. Each procedure shall be cross-referenced to the paragraph where it appears. For example see Figure 17.

3.11.7.6 Appendixes - other. When applicable, other appendixes shall be included.

3.12 Glossary. Unless otherwise specified by the contracting activity (see 6.2), the BDAR TM shall contain a glossary containing terms and acronyms that are peculiar to the TM. See MIL-STD-38784.

3.13 Index. The BDAR TM shall contain an alphabetical index listing every topic for which users are likely to look. See MIL-STD-38784.

3.14 Changes to BDAR Manuals. Changes to BDAR manuals shall be prepared in accordance with MIL-STD-38784 and shall have change instruction sheets and/or lists of effective pages.

4. VERIFICATION.

4.1 Verification. The verification requirements shall be as specified in the contract or order (see 6.2).

5. PACKAGING.

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. BDAR TMs prepared in accordance with this specification are for use on the battlefield where repair is limited to such means as bypassing, patching, or jury-rigging components to restore the equipment/system performance to a minimum operating condition.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. The issue of the DODISS cited or, if required, the specific issue of the referenced documents (see 2.2.1).
c. Use of foldouts (see 3.3.4)
d. Reference information that exceeds one page in length, unless otherwise specified (see 3.10).
e. Content and order of presentation, unless otherwise specified (see 3.11).
f. Distribution statement, destruction notice, export control warning (if applicable) (see 3.11.1.1j).
g. Format of assessment tables (see 3.11.3.2).
h. General repair information, unless otherwise specified (see 3.11.4).
i. Chapters in accordance with functional groups in MAC and RPSTL, unless otherwise specified (see 3.11.5).
j. Glossary, unless otherwise specified (see 3.12).
k. Verification requirements (see 4.1).

l. Packaging requirements (see 5.1).
m. Specification tailoring by selection of optional requirements on the content/format selection summary (see Appendix A at the back of this document).

6.3 Technical manuals. The requirement for technical manuals should be considered when this specification is applied on a contract. If technical manuals are required, specifications and standards that have been cleared and listed in DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL) must be listed on a separate Contract Data Requirements List (DD Form 1423), which is included as an exhibit to the contract. The technical manuals must be acquired under separate contract line item in the contract.

6.4 Definitions.

6.4.1 Battlefield damage. This term includes all incidents such as combat damage, random failures, operator errors, accidents, and wear-out failures that occur on the battlefield and which prevent the equipment/end item from accomplishing its mission.

6.4.2 Damage assessment. A procedure to rapidly determine what is damaged, whether it is repairable, what assets are required to make the repair, who can do the repair, (e.g., crew, maintenance team (MT), or maintenance support team (MST)), and where the repair should be made. The assessment procedure includes the following steps:

a. Determine if the repair can be deferred, or if it must be done.

b. Isolate the damaged areas and components.
c. Determine which components must be fixed.
d. Prescribe fixes.
e. Determine if parts or components, materials, and tools are available.
f. Estimate the manpower and skill required.
g. Estimate the total time (clock-hours) required to make the repair.
h. Establish the priority of the fixes.
i. Decide if recovery is necessary and to what location.

6.4.3 Evacuation. A combat service support function which involves the movement of recovered materiel from a main supply route, maintenance collection point, or maintenance activity to higher categories of maintenance. The materiel may be returned to the user, to the supply system for reissue, or to property disposal activities.

6.4.4 Maintenance collection point. A point operated by intermediate support maintenance units for the collection of equipment for repair.

6.4.5 Maintenance support team (MST). A team consisting of direct support/general support and aviation intermediate support mechanics and technical specialists who are trained in assessing battle damage in addition to their specialty.

6.4.6 Maintenance team (MT). A team consisting of organizational and aviation unit mechanics who may be trained in assessing battle damage and field repair procedures.

6.4.7 Recovery. Retrieval of immobile, inoperative, or abandoned materiel from the battlefield or immediate vicinity and its movement to a maintenance collection point, the main supply route, or a maintenance activity for disposition, repair, or evacuation.

6.4.8 Repair or fix. Any expedient action that returns a damaged part or assembly to acceptable operating condition.

6.5 Subject term (key word) listing.

Battlefield damage

Damage assessment
Evacuation
Recovery
Repair or fix

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

TM X-XXXX-XXX-BD-1

CHAPTER 1

GENERAL INFORMATION

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN ANY CASE, DAMAGE SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES AS SOON AS PRACTICABLE.

SECTION I. INTRODUCTION

1-1. PURPOSE

a. This Technical Manual (TM) is for use by operators, unit and Direct Support (DS) maintenance personnel. It provides procedures and guidelines for battlefield repairs on the M1, IPM1, and M1A1 Abrams Tanks under the forward support maintenance concept during combat.

b. The purpose of Battlefield Damage Assessment and Repair (BDAR) is to rapidly return disabled combat vehicles to the operation commander by expediently fixing, bypassing, or jury-rigging components to restore the minimum essential systems required for the support of the specific combat mission or to enable the tank to self-recover. These repairs may be temporary and may not restore full performance capability.

1-2. SCOPE

a. This TM describes BDAR procedures applicable specifically to M1, IPM1, and M1A1 Abrams Tanks. For further information on expedient repairs of a general nature applicable to systems common to more than one combat vehicle, see TM 9-2350-276-BD.

b. Many repair techniques helpful in preparing a tank for recovery are included in FM 20-22, Vehicle Recovery Operations. Details of such procedures are not duplicated in the TM, although certain quick-fix battlefield operations which would, in some cases, prepare the vehicle for recovery or self-recovery will be described. For further information on recovery-associated expedient repairs, see FM 20-22.

c. All possible types of combat damage and failure modes cannot be predicted, nor are all effective field repairs known. This TM provides guidelines for assessing and repairing battlefield failures of the M1, IPM1, or M1A1 tank and is not intended to be a complete catalog of all possible emergency repairs. The repairs described here serve as a guideline and are intended to stimulate the experienced mechanic to devise methods, as needed, to rapidly repair equipment in a combat crisis.

1-1

FIGURE 1. Example - BDAR fixes statement.

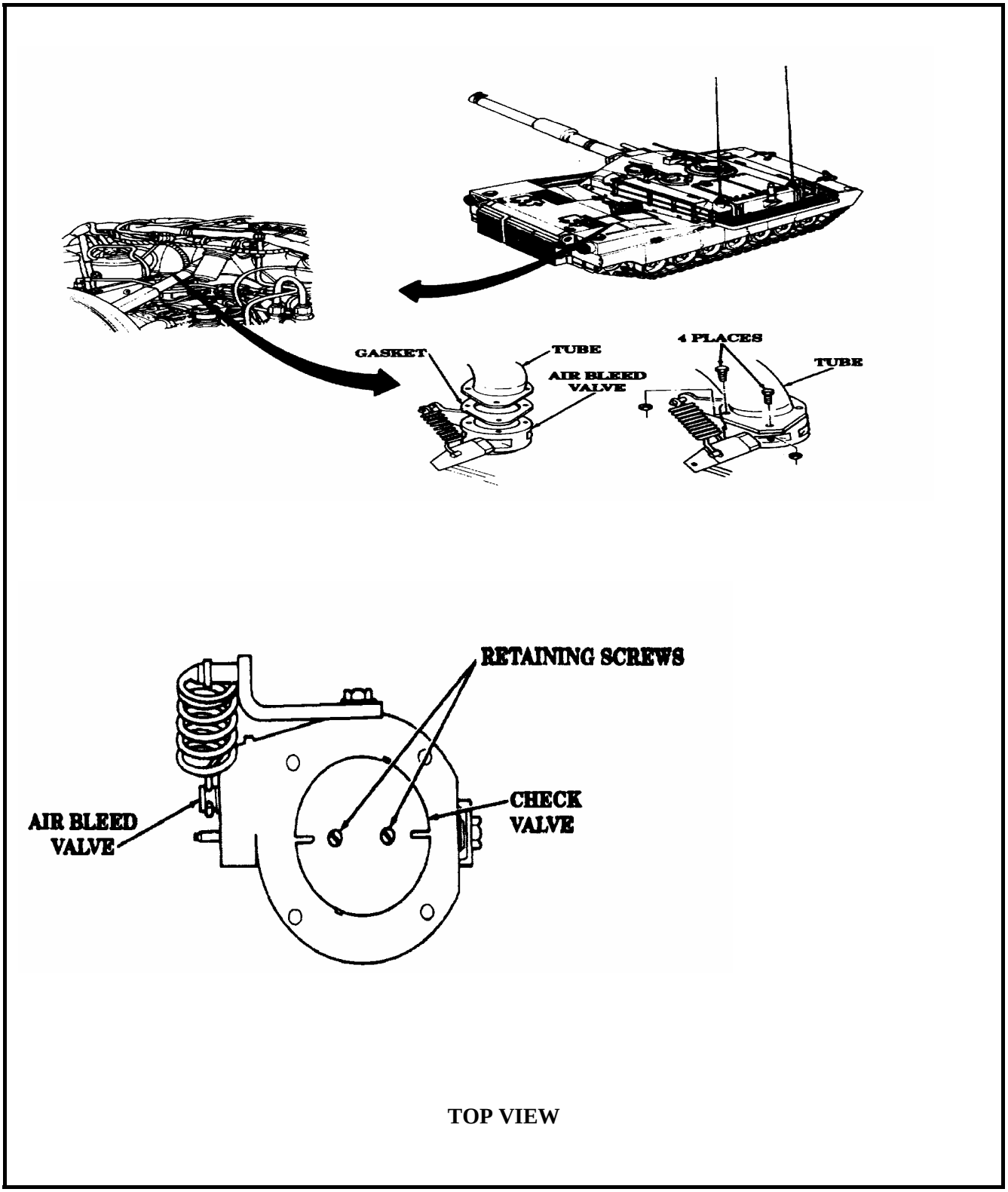
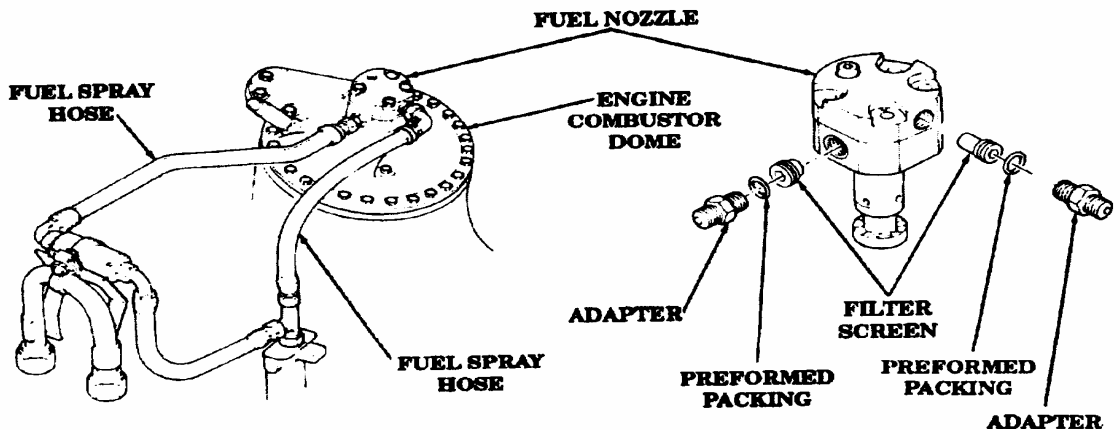
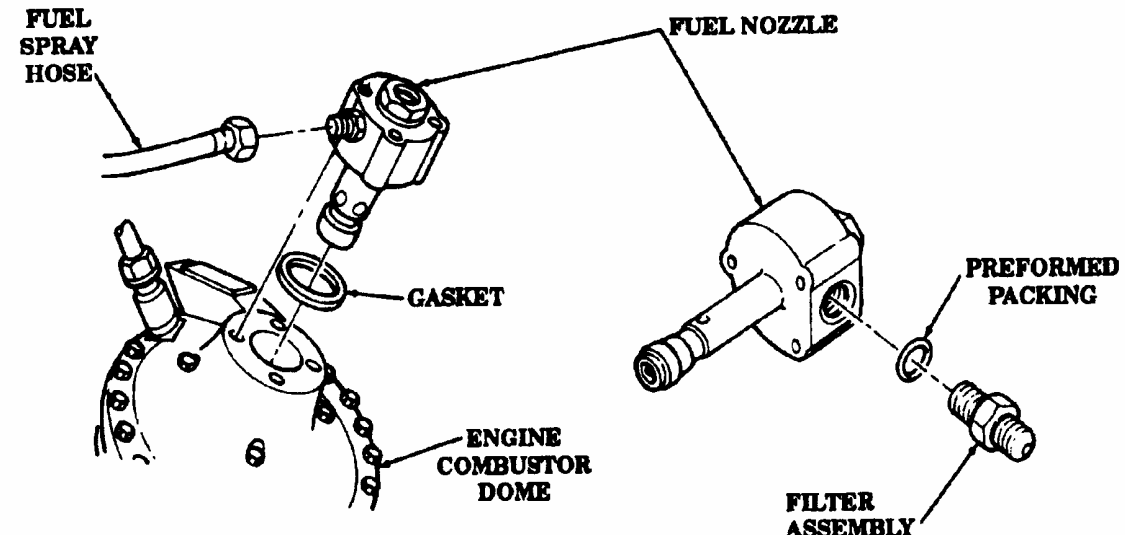


FIGURE 2. Example - line drawings.



TWO PIECE FUEL NOZZLE



ONCE PIECE FUEL NOZZLE

FIGURE 2. Example - line drawings - Continued.

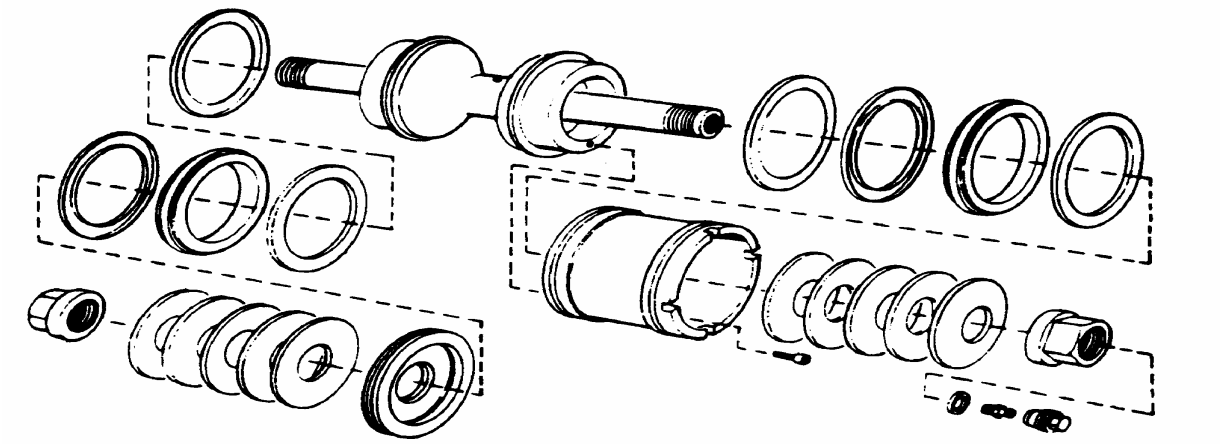


FIGURE 2. Example - line drawings - Continued.

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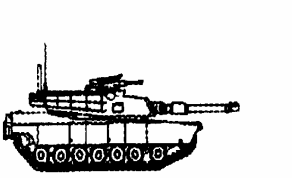
Supersedes TM X-XXXX-XXX-BD (Date)

TECHNICAL MANUAL

OPERATOR'S UNIT,
AND DIRECT
SUPPORT MAINTENANCE



BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

FOR

Nomenclature
Model Number
(NSN)
EIC

HEADQUARTERS, DEPARTMENT OF THE ARMY

FIGURE 3. Example - cover/title page.

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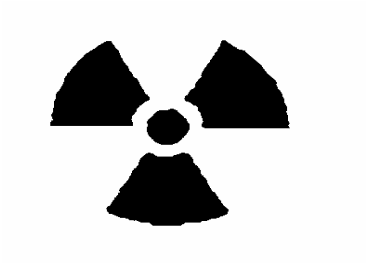
WARNING

RADIOACTIVE MATERIAL



HANDLE CAREFULLY

RADIOACTIVE

The M1, IPM1, and M1A1 Series Collimators (Muzzle Reference Sensors) used to compensate for gun tube bend contain the radioactive isotope “tritium” (H-3).

The radioactive material is completely encased within the unit and poses no external radiation treat to the user.

The anti-reflective coating on all infrared optics contains thorium fluoride which is slightly radioactive. The only potential hazard involves ingestion (swallowing or inhaling) of this material. For further information on disposing of broken lens, etc., see AR 385-11.

RADIATION HAZARD

RULES AND REGULATIONS

Copies of the following rules and regulations are maintained at HQ, AMCCOM, Rock Island, IL 61299-6000. Copies may be requested, or information pertinent to these rules and regulations obtained, by contacting the AMCCOM Radiological Protection Officer (RPO), DSN 793-2965, Commercial (309) 782-2964.
10CFR Part 19 - Notices, Instructions, and Reports to Workers; Inspections.
10CFR Part 20 - Standards for Protection Against Radiation.
10CFR Part 21 - Reporting of Defects and Noncompliance.
NRC license, license conditions, and license application.

a

FIGURE 4. Example - warning page.

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Technical Manual)
TM X-XXXX-XXX-BD-2)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 11 September 1999

OPERATOR'S, UNIT, AND DIRECT SUPPORT MAINTENANCE

BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

NOMENCLATURE:
MODEL NUMBER
(NSN)
EIC

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) located in the back of this manual directly to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MBP, Warren, MI 48397-5000. You may also send your recommended changes via electronic mail or by fax. Our fax number is DSN *(DSN telephone number)* or commercial *(commercial telephone number)*. Our e-mail address is *(e-mail routing address)*. A reply will be furnished to you.

DISTRIBUTION STATEMENT C. Distribution authorized to U.S. Government agencies and their contractors. This publication is required for administration and operational purposes, as determined 15 November 89. Other requests for this document shall be referred to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MBP, Warren, MI 48397-5000.

DESTRUCTION NOTICE. For unclassified, limited documents, destroy by any method that will prevent disclosure of contents or reconstruction of the document.

*This manual supersedes hull portion of TM X-XXXX-XXX-BD dated (*Insert date*), including all changes.

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FIGURE 5. Example - title block page.

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TABLE OF CONTENTS

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TABLE OF CONTENTS - CONT

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FIGURE 6. Example - table of contents.

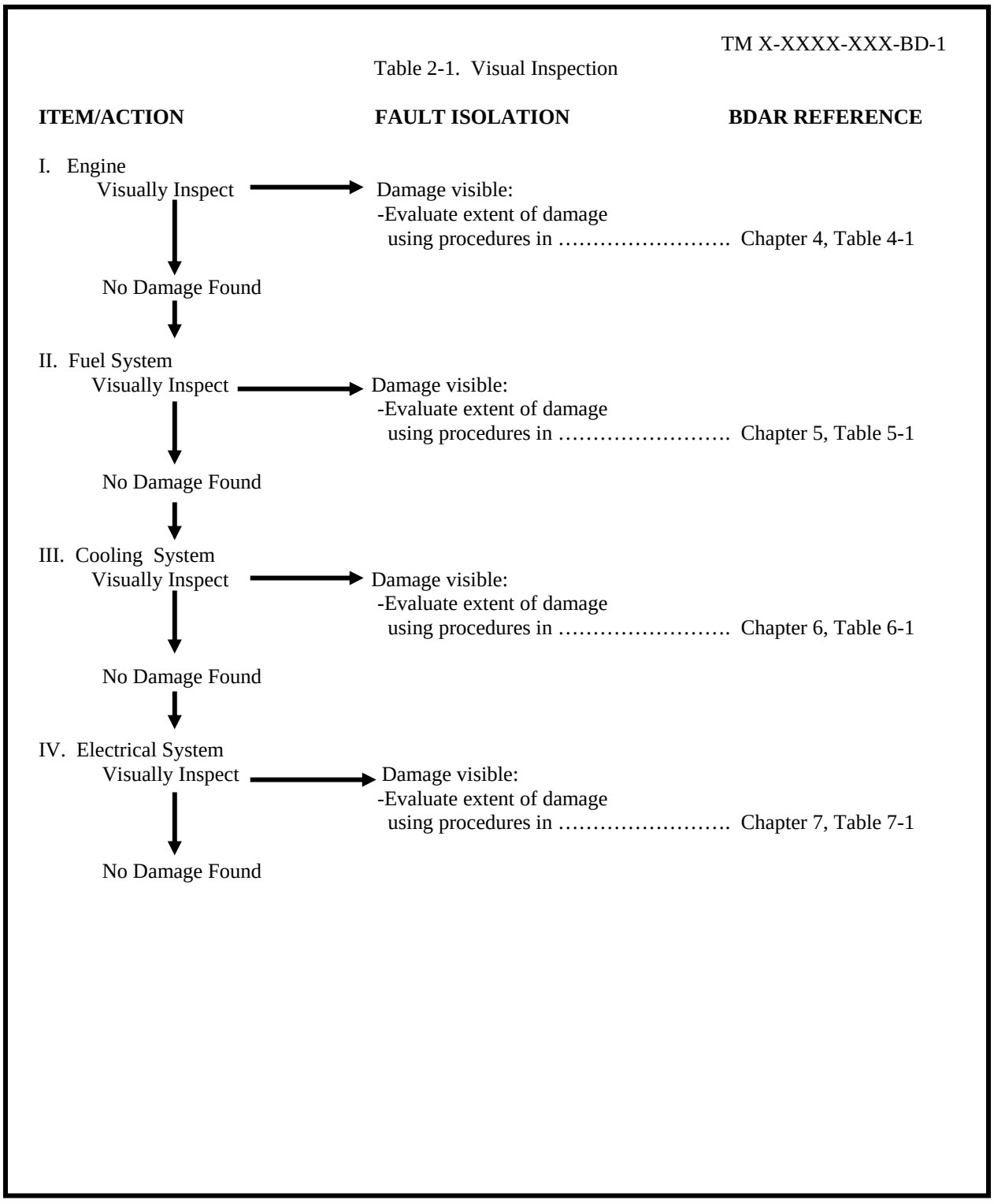

FIGURE 7. Example-assessment flowchart diagram.

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2.10 How to use the fault assessment tables.

a. A fault assessment table is organized so the user can quickly assess a particular system or capability by asking a series of questions.

b. First, ask a question. Your only reply will be either a “yes” or “no”. If it is “yes”, then you have no problem so go to the next question.

c. If it is “no”, then proceed to the page listed.

Table 2-1. Mobility

Does engine start/run?	If no, go to table 3-1, page 3-14.
Does tank move in “D” and “R”?	If no, go to table 4-1, page 4-6.
Are the track and suspension intact?	If no, go to Chapter 7.
Does tank steer/pivot?	If no, go to table 4-1, page 4-6.
Does tank brake?	If no, go to table 4-1, page 4-6.
Does tank have full power?	If no, go to table 3-1, page 3-14.

FIGURE 8. Example - assessment table.

CHAPTER 3

GENERAL REPAIR

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN ANY CASE, DAMAGE SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES AS SOON AS PRACTICABLE.

SECTION I. INTRODUCTION

3.1 SCOPE

This chapter describes quik fix procedures for components of a combat vehicle.

3.2 ASSESSMENT PROCEDURE

Visually inspect damaged components to determine the extent of damage and repair required.

3.3 REPAIR PROCEDURE INDEX PARA

FIGURE 9. Example - repair procedure index.

APPENDIX A
REFERENCES

Publication Number	Title
AR 385-11	Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, and Radiation Safety)
AR 385-40	Accident Reporting and Records
AR 385-63	Policies and Procedures for Firing Ammunition for Training, Target Practice, and Combat
CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-970	Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)
DA Form 2028	Recommended Changes to Publications and Blank Forms
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA PAM 738-750	The Army Maintenance Management System (TAMMS)
DD Form 1577	Unserviceable (Condemned) Tag - Material
FM 3-3	NBC Contamination Avoidance
FM 20-22	Vehicle Recovery Operations
FM 21-11	First Aid for Soldiers
FM 3-5	NBC Decontamination
SF 368	Product Quality Deficiency Report
TB 9-1300-278	Guidelines for Safe Response to Handling, Storage, and Transportation Accidents Involving Army Tank Munitions or Armor Which Contain Depleted Uranium
TM 9-2350-276-BD	Operator's, Organizational, Direct Support, and General Support Maintenance, Battlefield Damage Assessment and Repair for Combat Vehicles

FIGURE 10. Example - appendix A, references.

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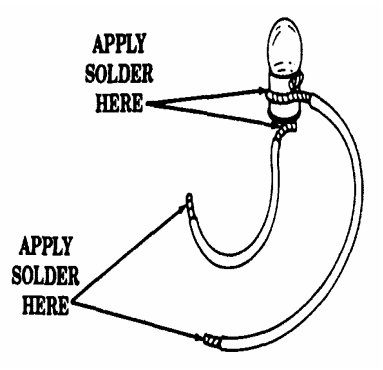
SECTION III. FABRICATED TOOLS

Description

Test lamp, 18-30 vdc

NOTE
The voltage rating of the bulb should be close to the value of the expected voltage being measured.



Material List

1. One bulb
2. Wire, electrical, length as required, two pieces
3. Solder

Figure 1. Test lamp.

Fabrication/Test procedure:

1. Solder a wire to center terminal an another wire to case of bulb.

NOTE
An 18- to 30-volt bulb from the driver's instrument panel can be used. A 5-volt bulb from a 2-battery flashlight also can be used. See Figure 1.

2. Touch soldered wire ends to voltage source test voltage.

NOTE
Polarity need not be observed - even AC voltage can be tested.

B-3

FIGURE 11. Example - appendix B, special fabricated tools.

APPENDIX C
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists expendable supplies and materials you will need to make BDAR fixes on the M1, IPM1, and M1A1 tanks. Items are listed alphabetically by the item name shown in the Description column. These items are authorized by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

C-2. EXPLANATION OF COLUMNS IN SECTION II

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is

b. Column (2) - National Stock Number (NSN). This is the NSN assigned to the item; use it to

c. Column (3) - Description. Indicates the federal item name, and if required, a description to

d. Column (4) - Unit of Issue (U/I). The abbreviation “U/I” identifies the unit(s) under which

FIGURE 12 Example - appendix C, expendable/durable supplies and materials, section I.

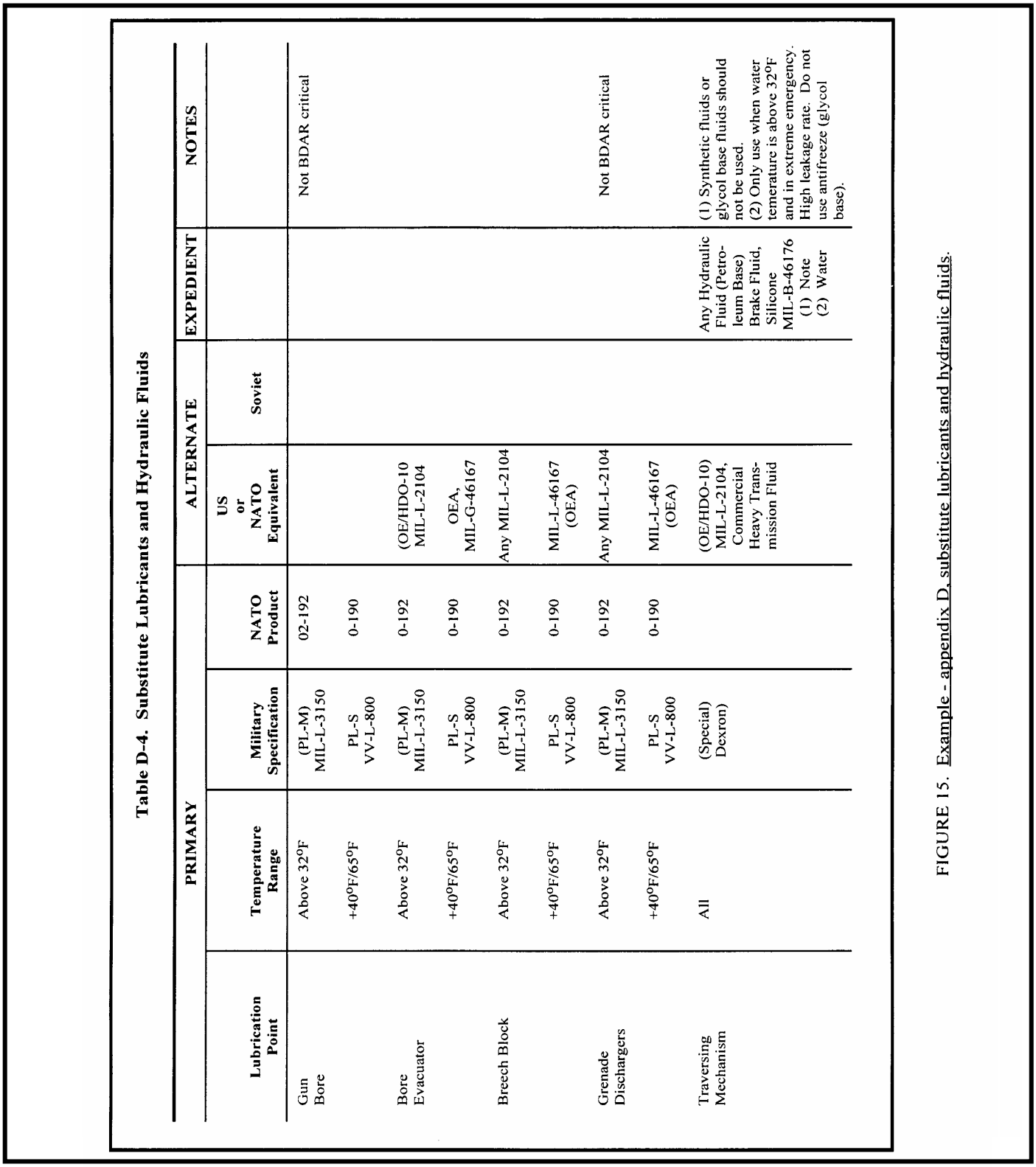


Table D-4. Substitute Lubricants and Hydraulic Fluids

Lubrication Point	PRIMARY			ALTERNATE		EXPEDIENT	NOTES
	Temperature Range	Military Specification	NATO Product	US or NATO Equivalent	Soviet		
Gun Bore	Above 32°F	(PL-M) MIL-L-3150	02-192				Not BDAR critical
	+40°F/65°F	PL-S VV-L-800	0-190				
Bore Evacuator	Above 32°F	(PL-M) MIL-L-3150	0-192	(OE/HDO-10 MIL-L-2104			
	+40°F/65°F	PL-S VV-L-800	0-190	OEA, MIL-G-46167			
Breech Block	Above 32°F	(PL-M) MIL-L-3150	0-192	Any MIL-L-2104			
	+40°F/65°F	PL-S VV-L-800	0-190	MIL-L-46167 (OEA)			
Grenade Dischargers	Above 32°F	(PL-M) MIL-L-3150	0-192	Any MIL-L-2104			Not BDAR critical
	+40°F/65°F	PL-S VV-L-800	0-190	MIL-L-46167 (OEA)			
Traversing Mechanism	All	(Special) Dexron)		(OE/HDO-10) MIL-L-2104, Commercial Heavy Transmission Fluid		Any Hydraulic Fluid (Petroleum Base) Brake Fluid, Silicone MIL-B-46176 (1) Note (2) Water	(1) Synthetic fluids or glycol base fluids should not be used. (2) Only use when water temerature is above 32°F and in extreme emergency. High leakage rate. Do not use antifreeze (glycol base).

FIGURE 15. Example - appendix D, substitute lubricants and hydraulic fluids.

FIGURE 13. Example - appendix C, expendable/durable supplies and materials, section II.

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SECTION II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) NSN	(3) Description	(4) U/I
1	8040-00-865-8991	Adhesive (01139) RTV 103	kt
2	4730-00-007-2194	Adapter, straight, pipe to hose (01276) 190418-4-64	ea
3	3960-00-505-7816	Cable, copper 2 AWG (45206) 15238	ft
4	2590-00-148-7961	Cable, kit, special purpose (slave cable) (19207) 11682379-1	ea
5	4730-00-289-5909	Clamp, hose, 3/8-in. to 1-in. (81349) MIL-C-11569	ea
6	8305-01-152-3587	Cloth, batiste (81349) MIL-C-40129	yd
7	1220-01-254-5939	Connector splice (10001) 2316832P1	ea
8	4730-01-160-2682	Coupling assembly, metal (00624) 155S4-4	ea
9	5330-00-399-7960	Gasket material (82094) 315	ft
10	9150-00-944-8953	Grease, aircraft (81349) MIL-G-81322	lb
11	9150-01-197-7689	Grease (1), automotive and artillery (81349) MIL-G-10924	lb
12	4720-00-288-9873	Hose, nonmetallic, 3/4-in. I.D. (81349) MIL-H-24135	ft
13	9150-00-111-6256	Hydraulic fluid, fire-resistant (FRH) Type 1 (81349) MIL-H-46170	qt

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FIGURE 13. Example - appendix C, expendable/durable supplies and materials. section II.

Table D-1. Hull Spares and Repair Parts

Parts		Applies To		From Weapons System											
NSN	Description	M1 IPM1	M1A1	M2 M3 Tank	M34 A2 Truck	M48 A5 Family	M60 Family	M88 Family	M109 Vehicle	M110 Vehicle	M113 Family	M578 Recv Vehicle	M728 Engr Vehicle	M813 Series
5935-00-001-7325	Connector Plug	X	X	X									X	
5315-00-014-1283	Pin, Straight, Headless	X	X			X	X						X	
2530-00-015-2774	Spacer, Hub Track	X	X	X		X	X	X	X	X		X	X	X
4730-00-018-9566	Plug, Pipe	X	X	X		X	X	X	X	X		X	X	X
2920-00-034-4216	Shaft, Shouldered	X	X										X	
4730-00-050-4203	Fitting, Lubrication	X	X			X	X							
4730-00-050-4208	Fitting, Lubrication	X	X			X	X							
5340-00-057-3537	Clevis, Road End	X	X			X	X							
2530-01-201-4816	Roadwheel Assembly	X	X				X	X						
4730-00-080-9847	Adaptor, Straight	X	X					X	X	X		X		
5340-00-088-1254	Clamp, Loop	X	X			X	X					X		
5340-00-088-6655	Clamp, Loop	X	X			X	X							
2920-00-088-8613	Motor, Field Winding	X	X									X		
4820-00-093-3756	Valve, Check	X	X	X								X		
3110-00-100-0337	Cup	X	X				X							
3110-00-100-0593	Cup	X	X				X							
3110-00-100-0684	Cone	X	X				X							
2920-00-100-3403	Kit, Parts, Electrical	X	X					X						

FIGURE 14. Example - appendix D, substitute materials/parts .

Table D-4. Substitute Lubricants and Hydraulic Fluids

PRIMARY				ALTERNATE		EXPEDIENT	NOTES
Lubrication Point	Temperature Range	Military Specification	NATO Product	US or NATO Equivalent	Soviet		
Gun Bore	Above 32°F	(PL-M) MIL-L-3150	02-192				Not BDAR critical
	+40°F/65°F	PL-S VV-L-800	0-190				
Bore Evacuator	Above 32°F	(PL-M) MIL-L-3150	0-192	(OE/HDO-10 MIL-L-2104			
	+40°F/65°F	PL-S VV-L-800	0-190	OEA, MIL-G-46167			
Breech Block	Above 32°F	(PL-M) MIL-L-3150	0-192	Any MIL-L-2104			
	+40°F/65°F	PL-S VV-L-800	0-190	MIL-L-46167 (OEA)			
Grenade Dischargers	Above 32°F	(PL-M) MIL-L-3150	0-192	Any MIL-L-2104			Not BDAR critical
	+40°F/65°F	PL-S VV-L-800	0-190	MIL-L-46167 (OEA)			
Traversing Mechanism	All	(Special) Dexron)		(OE/HDO-10) MIL-L-2104, Commercial Heavy Trans-mission Fluid		Any Hydraulic Fluid (Petro-leum Base) Brake Fluid, Silicone MIL-B-46176 (1) Note (2) Water	(1) Synthetic fluids or glycol base fluids should not be used. (2) Only use when water temerature is above 32°F and in extreme emergency. High leakage rate. Do not use antifreeze (glycol base).

FIGURE 15. Example - appendix D, substitute lubricants and hydraulic fluids.

Table D-5. Part I: Substitute Fuels for Diesel Fuel W-F-800, DF-1, and NATO-F-54

Primary Fuel	Alternate Fuel	Expedient Fuel	Military Specification	Commercial Specification
)iesel Fuel VV-F-800 DF-1, NATO- F-54	See Below	See Below	X	
	*Automotive Diesel: ASTM-D-975 (1-D and 2-D)			X
	Kerosene: ASTM-D-3699			X
	Fuel Oil: ASTM-D-396 (Numbers 1 and 2)			X
	Distillate: NATO-F-75 (Low pour point)		X	
	Kerosene: NATO-F-5B		X	
	Aviation Turbine: MIL-T-5624 (JP4 and JP5) NATO-F-40 NATO-F-44		X	
	Aviation Turbine: ASTM-D-1655 (Jet B)			X
	Aviation Turbine: MIL-T-83133 (JP-8) NATO-F-34		X	
	Aviation Turbine: ASTM-D-1655 (Jet A-1)			X
	Turbine Fuel: ASTM-D-2880 0-GT, 1-GT, 2-GT, 3-GT, 4-GT)			

FIGURE 16. Example - appendix D, substitute fuels for diesel fuel.

APPENDIX E

BDAR FIXES AUTHORIZED FOR TRAINING

BDAR FIXES SHALL BE USED ONLY IN COMBAT OR FOR TRAINING AT THE DISCRETION OF THE COMMANDER. (AUTHORIZED TRAINING FIXES ARE LISTED IN APPENDIX E.) IN ANY CASE, DAMAGE SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES AS SOON AS PRACTICABLE.

REPAIR PROCEDURES PAGE

ENGINE

FUEL SYSTEM

ELECTRICAL SYSTEM

FIGURE 17. Example - appendix E, BDAR fixes authorized for training.

APPENDIX A

CONTENT/FORMAT SELECTION SUMMARY FOR BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR (BDAR) TECHNICAL MANUALS

A.1 GENERAL.

A.1.1 Scope. This appendix facilitates the tailoring of requirements for BDAR technical manuals acquisition/preparation contained in the body of this specification. This appendix is a mandatory part of this specification. The information contained herein is intended for compliance when the Content/Format Selection Summary is completed by the Government.

A.1.2 Application. This appendix is intended to be copied/reproduced, completed, used for contract solicitation, and incorporated into the contract.

A.1.3 Tailoring. The contracting activity should evaluate the individual requirements of this specification to determine the extent to which they are most suitable for the acquisition and modify the requirements to ensure that each achieves the optimal balance between operational needs and cost. Exclusions of sections, paragraphs, or sentences shall be indicated on the Content/Format Selection Summary. When necessary, remarks should be expanded and included on a separate sheet of paper attached to the Summary List. In all cases, tailoring shall be compatible with this specification.

A.1.4 Explanation of columns - content/format selection summary. Column (1), Item no., self explanatory. Column (2) is the type of requirement and column (3) identifies the applicable paragraph in the specification. Column (4), Options Selected, subcolumn (a) “yes”, should be marked with an “X” for each item/requirement applicable to the solicitation/acquisition as written. Column (4), subcolumn (b), “no” should be marked with an “X” for each item that is not applicable as written, but is applicable as specified in subcolumn (c). Subcolumn (c), Explanation/Remarks is provided for clarity.

A.2 APPLICABLE DOCUMENTS.

This section is not applicable to this appendix.

APPENDIX A

CONTENT/FORMAT SELECTION SUMMARY FOR
BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR (BDAR) TECHNICAL MANUALS

EQUIPMENT NAME/NOMENCLATURE_____

CONTRACT NO._____

NOTE: Applicable requirements are indicated by an "X" in column 4a or explained in column 4b.

(1) Item No.	(2) Requirements	(3) Applicable Paragraph No.	(4)		
			(a)	(b)	(c)
			Options Selected		Explanation/ Remarks
			(yes)	(no)	
1	Foldouts	3.3.4			
2	Reference information exceeding one page	3.10			
3	Table format for assessment tables	3.11.3.2			
	Flowchart diagram format for assessment tables	3.11.3.2			
4	Chapter 3, General Repair	3.11.4			
5	Chapter 4 through ( ) arranged in functonal groups per MAC/RPSTL	3.11.5			
6	Glossary	3.12			

NOTE: The above selected requirements tailoring options identified by an "X" in the Options Selected column 4, subcolumn 4(a) or 4(b), or the explanation provided in the Remarks subcolumn 4(c) are a mandatory part of this contract.

COMPLETED BY:_____
(authorized signature)

PUBLICATIONS ACTIVITY: _____ DATE: _____

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CONCLUDING MATERIAL

Custodian
Army - TM

Preparing Activity:
Army - TM

Review activities:
Army - AL, AR, AT, CR, MI, TE

(Project. TMSS A346)

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2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing agency must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE	1. DOCUMENT NUMBER **MIL-PRF-63003B (TM)**	2. DOCUMENT DATE (YYMMDD) **980420**

3. DOCUMENT TITLE
MANUALS TECHNICAL: BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR, PERPERATION OF

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (*Last, First, Middle Initial*)	b. Organization	
c. ADDRESS (*Include ZIP Code*)	d. TELEPHONE (*Includes Area Code)* (1) Commercial (2) AUTOVON (If applicable)	7. DATE Submitted (*YYMMDD*)

8. PREPARING ACTIVITY

a. NAME **USAMC Logistics Support Activity**	b. TELEPHONE (*Include Area Code*) (1) Commercial **(205) 955-9843** (2) AUTOVON **DSN 645-9843**
c. ADDRESS (*Include ZIP Code)* **ATTN: AMXLS-AP** Redstone Arsenal, AL 35898-7466	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Standardization Program Division 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 681-9340/9343 DSN 761-9340/9343

Commander
USAMC Logistics Support Activity
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Redstone Arsenal, AL 35898-7466