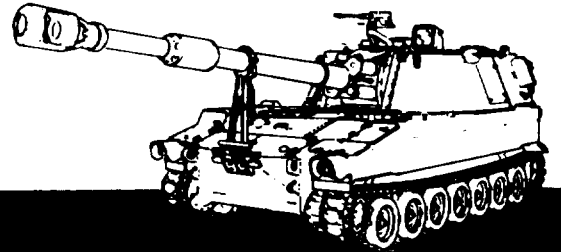


TECHNICAL MANUAL

OPERATORS, ORGANIZATIONAL
DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE



BATTLEFIELD DAMAGE ASSESSMENT AND REPAIR

M109/M110/M578
VEHICLES
HOWITZER, MEDIUM,
SELF-PROPELLED
FULL-TRACKED

M109A2 Howitzer
NSN 2350-01-031-4586 (EIC: 3EZ)
M109A3 Howitzer
NSN 2350-01-031-8851 (EIC: 3E2)
M109A4 Howitzer
NSN 2350-01-277-5770 (EIC: 3E8)
M109A5 Howitzer
NSN 2350-01-281-1719 (EIC: 3E7)
M110A2 Howitzer
NSN 2350-01-041-4590 (EIC: 2E3)
M578 Recovery Vehicle
NSN 2350-00-439-6242 (EIC: 3LA)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

31 JANUARY 1984

**BDAR FIXES SHALL BE USED ONLY IN COMBAT
AT THE DISCRETION OF THE COMMANDER
AND SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES
AS SOON AS PRACTICABLE AFTER THE MISSION IS COMPLETED.**

OPERATOR'S, ORGANIZATIONAL
DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE

GENERAL BATTLEFIELD DAMAGE
ASSESSMENT AND REPAIR
for
M 109 AND MI 10 SERIES
SELF-PROPELLED HOWITZER
AND M578 RECOVERY VEHICLE

REPORTING OF ERRORS

You can help to improve this manual by calling attention to errors and by recommending improvements. Your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) and/or DA Form 2028-2 (Recommended Changes to Equipment Technical Manuals), may be used. Copies of DA Form 2028-2 are attached in the back of the manual for your use. Please mail your recommended changes directly to Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN; AMSMC-MAS, Rock Island, IL 61299-6000. A reply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

**BDAR FIXES SHALL BE USED ONLY IN COMBAT
AT THE DISCRETION OF THE COMMANDER
AND SHALL BE REPAIRED BY STANDARD MAINTENANCE PROCEDURES
AS SOON AS PRACTICABLE AFTER THE MISSION IS COMPLETED.**

SECTION I. General

1-1. Purpose.

- a. This technical manual (TM) is for use by operators, organizational, and direct support/general maintenance personnel. It provides procedures and guidelines for battlefield repairs on the M 109 Self-Propelled Howitzer/M 110 series Self-Propelled Howitzer/M578 Recovery Vehicle, Full-Track, 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 operational commander by expeditiously fining, by-passing, or jury-rigging components to restore the minimum essential systems required for the support of the specific combat mission or to enable the vehicle 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 the M 109 vehicles/M110 series vehicles/M578 Recovery Vehicles. Expedient repairs of a general nature applicable to systems or subsystems common to more than one combat vehicle are covered in TM 9-2350-276-BD. ■
- b. Many expedient repair techniques helpful in preparing a vehicle for recovery are included in FM 20-22 Vehicle Recovery Operations. Details of such procedures are not duplicated in this TM, although certain quick fix battlefield operations which would, in some cases, prepare the vehicle for recovery or self-recovery will be described. Users of this manual should refer to FM 20-22 for further recovery-associated expedient repairs.
- c. All possible types of combat damage and failure modes can not be predicted nor are all effective field expedient repairs known. This TM provides guidelines for assessing and repairing battlefield failures of the M 109 vehicles/M110 series vehicles/M578 Recovery Vehicles and is not intended to be a complete catalog of all possible emergency repairs. The repairs described here will serve as guidelines and will stimulate the experienced operator or mechanic to devise expedients as needed to rapidly repair equipment in a combat crisis. ■

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1-3. Application.

a. The procedures in this manual are designed for battlefield environments and should be used in situations where standard maintenance procedures are impractical. These procedures are not meant to replace standard maintenance practices, but rather to supplement them strictly in a battlefield environment. Standard maintenance procedures will provide the most effective means of returning a damaged vehicle to ready status provided that adequate time, replacement parts, and necessary tools are available. BDAR procedures are only authorized for use in an emergency situation in a battlefield environment, and only at the direction of the commander.

b. BDAR techniques are not limited to simple restoration of minimum functional combat capability. If full functional capability can be restored expediently with a limited expenditure of time and assets, this should be done.

c. Some of the special techniques in this manual, if applied, may result in shortened life or damage to components of the M 109 vehicle/M 110 series vehicle/M 578 Recovery Vehicle. The commander must decide whether the risk of having one less vehicle available for combat outweighs the risk of applying the potentially destructive expedient repair technique. Each technique gives appropriate warnings and cautions, and lists systems limitations caused by this action.

1-4. Definitions.

a. The term "battlefield damage" includes all incidents which occur on the battlefield and which prevent the vehicle from accomplishing its mission, such as combat damage, random failures, operator errors, accidents, and wear-out failures,

b. The term "repair" or "fix" in this manual includes any expedient action that returns a damaged part or assembly to a full or an acceptably degraded operating condition, including:

- (1) Short cuts in parts removal or installation.
- (2) Installation of components from other vehicles that can be modified to fit or interchange with components on the vehicle.
- (3) Repair using M109/M110/M578 parts that serve a non-critical function elsewhere on the same vehicle for the purpose of restoring a critical function.
- (4) Bypassing of non-critical components in order to restore basic functional capability.
- (5) Expeditious cannibalization procedures.

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- (6) Fabrication of parts from kits or readily available materials.
- (7) Jury-rigging.
- (8) Use of substitute fuels, fluids or lubricants.

c. **“Damage Assessment”** is 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 (i.e., crew, maintenance team (MT), or maintenance support team (MST), and where the repair should be made. The assessment procedure includes the following steps:

- (1) Determine if the repair can be deferred, or if it must be done.
- (2) Isolate the damaged areas and components.
- (3) Determine which components must be fixed.
- (4) Prescribed fixes.
- (5) Determine if parts or components, materials, and tools are available.
- (6) Estimate the manpower and skill required.
- (7) Estimate the total time (clock-hours) required to make the repair.
- (8) Establish the priority of the fixes.
- (9) Decide where the fix shall be performed.
- (10) Decide if recovery is necessary and to what location.

d. **A Maintenance Team** (MT) consists of organizational mechanics, who may be trained in assessing battle damage and field repair procedures. MT are called to out-of-action vehicles to supplement (or confirm) the crew's original damage assessment. MT assessment determines if field repairs will be conducted or if recovery is required. Depending on available time, the MT will assist the crew in restoring the vehicle to mission capability.

e. **Maintenance Support Team** (MST) consists of direct support/general support mechanics and technical specialists, who are trained in assessing battle damage in addition to their specialty. The MST is called by the MT when vehicle damage exceeds MT assessment capability or organizational repair capability.

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f. The **MT/MST assessor** is a senior member of the forward MT/MST. He is a systems mechanic/technician trained in BDAR techniques. He must know:

- (1) The unit's mission and the commander's requirements.
- (2) The maintenance capability of the unit, including the available skills, tools, repair parts, and materials.
- (3) How to detect contamination and effect decontamination of equipment.
- (4) The unit's maintenance workload.
- (5) The maintenance capability of all accessible rally and maintenance collection points,

g. The term **fully mission capable** (FMC) means that the vehicle can perform all its combat missions without endangering the life of the crew. To be FMC the vehicle must be complete and fully operable with no faults listed in ■ the "Not Fully Mission Capable If:" column of the operator's Preventive Maintenance Checks and Services (PMCS).

h. The term **combat capable** means that the vehicle meets the minimum functional combat capability requirements. (See paragraph 1-10.)

i. The term **combat emergency capable** means that the vehicle meets the needs for specific tactical ■ maneuver or firing missions; however, some systems are not functional. Also, additional damage due to the nature of an expedient repair may occur to the vehicle if it is used. The commander must decide if these limitations are acceptable for that specific emergency situation.

j. The term **self-recovery capable** means that the vehicle meets the needs for recovery under self-power. It could include hazardous equipment conditions such as partial brakes or limited steering

k. The term **cannibalization** as used in this TM means any use of repair parts or components obtained from another combat vehicle either damaged or of lower priority to the immediate mission. In this TM, the term is used to include controlled exchange.

1-5. BDAR Recommendations and QDR/EIR.

a. Personnel originating new BDAR procedures should forward them directly to Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-MAS, Rock Island, IL 61299-6000. Personnel are encouraged to develop and report new BDAR ideas, techniques and procedures.

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b. Equipment Improvement Recommendations (EIR) may be submitted by anyone who knows of an unsatisfactory condition with equipment design or use. You do not have to show a new design or list a better way to do a procedure, just tell why the design is unfavorable or why a procedure is hard. EIR may be submitted on SF 368, Quality Deficiency Report. Mail these directly to Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-QAD, Rock Island, IL 61299-6000. A reply will be sent directly to you.

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SECTION II. Battlefield Damage Assessment and Repair - Standards and Practices

1-6. BDAR Characteristics.

BDAR capability requires simplicity, speed, and effectiveness. Some BDAR procedures include repair techniques that violate standard peacetime maintenance practices. In a combat emergency situation, greater risks are necessary and acceptable.

1-7. Training.

The unit commander should ensure that an adequate number of members of his organization, including supervisors, are trained in BDAR procedures applicable to his equipment. Each vehicle crewman should be trained to perform initial battle damage assessment for his crew position.

1-8. Waiver of Precautions.

Under combat conditions, BDAR may be performed on M 109 vehicles vehicles/M 110 series vehicles/M578 Recovery Vehicles, which are fueled and/or armed. Other similar precautions may be waived at the discretion of the commander. See paragraph 1-13e.

1-9. Environment.

BDAR may be required in a chemically toxic environment or under other adverse conditions with severe limitations in personnel, facilities, equipment, and materials. Performance of repair tasks may be necessary while wearing protective gear. Expedient decontamination procedures are described in FM 3-5.

1-10. Serviceability and Operability (Operating characteristics).

The Minimum Functional Combat Capability (MFCC) criteria for the M 109 vehicles/M 110 Series Vehicles/M578 Recovery Vehicles are as follows:

NOTE

These criteria may be waived for recovery or if the tactical situation demands otherwise.

a. Armament and Fire Control.

(1) M 109 Vehicle: Turret must traverse 360 degrees and elevate with no oscillations either manually or by power.

(2) M1 10 Series Vehicle: Turret must traverse either manually or by power 30 degrees right or left of center.

(3) M109/M110: Main gun must have Recoil Mechanism, Turret, Equilibrators, and Cannon Assembly.

(4) M109/M110: Must have an operational fire control mount and an indirect sighting device.

b. Mobility.

(1) Must have operational track on both sides of the vehicle.

(2) May be missing roadwheels with the following stipulations:

(a) May not be missing more than a total of two individual roadwheels on each side.

(b) The first, second, and last roadwheel stations must each have complete sets of roadwheels.

(c) May not be missing two adjacent roadwheel positions.

(3) Drive train must be functional and must be capable of reverse and at least one forward gear.

(4) Power train performance degradation cannot exceed that level which would cause the vehicle to be incapable of traveling 10 miles per hour on a level, unimproved road.

c. Communications. No requirements. ■

1-11. Permanent Repair.

Upon completion of the mission, or at the next practicable opportunity, the vehicle will be recovered or evacuated to the appropriate maintenance facility for permanent standard repair as required.