

\* This publication supersedes TM 9-2320-260-34-1, TM 9-2320-260-34-2-1, TM 9-2320-260-34-2-2, TM 9-2320-260-34-2-3, TM 9-2320-260-34-2-4, and TM 9-2320-260-34-2-5, 31 December 1980, for M809 series vehicles.

**TECHNICAL MANUAL  
VOLUME 1 OF 2  
DIRECT SUPPORT AND  
GENERAL SUPPORT MAINTENANCE  
FOR  
5-TON, 6X6, M809 SERIES TRUCKS  
(DIESEL)**

TRUCK, CARGO: 5-TON, 6X6,  
M813 (2320-00-050-8902) (EIC:BSB);  
(2320-00-050-8890) (EIC:BSA)  
M813A1 (2320-00-050-891 3) (EIC: BSD);  
(2320-00-050-8905) (EIC:BSC)  
M814 (2320-00-050-8988) (EIC:BSK);  
(2320-00-050-8987) (EIC:BSJ)

TRUCK, BOLSTER, LOGGING: 5-TON, 6X6  
M815 (2320-00-050-8927) (EIC:BSE)

TRUCK, WRECKER, MEDIUM: 5-TON, 6X6  
M816 (2320-00-05 1-0489) (EIC:BSQ)

TRUCK, DUMP: 5-TON, 6X6  
M817 (2320-00-050-8970) (EIC:BSF);  
(2320-00-05 1-0589) (EIC:BSR)

TRUCK, TRACTOR: 5-TON, 6X6  
M818 (2320-00-050-8984) (EIC:BSH);  
(2320-00-050-8978) (EIC:BSG)

TRUCK, TRACTOR, WRECKER: 5-TON, 6X6  
M819 (2320-00-050-9004) (EIC:BSL)

TRUCK, VAN, EXPANSIBLE: 5-TON, 6X6  
M820 (2320-00-050-9006) (EIC:BSM)  
M820A1 (2320-00-050-9007)

M820A2 (2320-00-050-9010) (EIC:BSN)

TRUCK, STAKE, BRIDGE TRANSPORTING: 5-TON, 6X6  
M821 (2320-00-050-9015) (EIC:BSP)

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

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## **WARNING**

### **EXHAUST GASES CAN KILL**

1. DO NOT operate your vehicle engine in enclosed area.
  2. DO NOT idle vehicle engine with cab windows closed.
  3. DO NOT drive vehicle with inspection plates or cover plates removed.
  4. BE ALERT at all times for exhaust odors.
  5. BE ALERT for exhaust poisoning symptoms. They are:
    - Headache
    - Dizziness
    - Sleepiness
    - Loss of muscular control
  6. If YOU SEE another person with exhaust poisoning symptoms:
    - Remove person from area
    - Expose to open air
    - Keep person warm
    - Do not permit person to move
    - Administer artificial respiration, if necessary\*
- \* For artificial respiration, refer to FM 21-11

### **WARNING SUMMARY**

- Do not operate a deadlined vehicle without preliminary inspection. Failure to do so may cause further damage to a disabled component and possible injury to personnel.
- Hearing protection is required for driver, co-driver, and mechanic when engine is running. Noise levels produced by this vehicle exceed 85dB, which may cause injury to personnel.
- Ensure fuel shutoff valve is off and remove throttle cable before cranking engine. Failure to do so may result in injury to personnel.
- Diesel fuel is flammable. Do not perform troubleshooting checks near open flame, sparks, or electricity. Injury to personnel may result.
- Eye protection is required when performing fuel system troubleshooting checks. Failure to wear eye protection may result in injury to personnel.
- Ignition switch must remain off and battery ground cable disconnected during fuel system troubleshooting checks except when necessary to perform malfunction check. Failure to turn ignition system off and disconnect battery ground cable may result in injury to personnel.
- Hot coolant is under pressure. Care should be used when removing coolant filler cap or inspecting hot engine coolant leaks. Steam or hot coolant under pressure may cause severe injury to personnel.

**Warning a**

## WARNING SUMMARY (Contd)

- Wear hand protection at all times when working with heated parts. Failure to do so may result in injury to personnel.
- Overhead lifting device capacity must exceed dump body weight. A shifting, swinging, or falling load may cause injury to personnel. Overhead lifting device must remain attached to dump body until troubleshooting is completed. Released dump body may fall and may cause injury to personnel.
- Use properly rated hydraulic hose when performing hydraulic systems checks on vehicles not equipped with dump body lock. Failure to do this may result in injury to personnel.
- Bleed hydraulic pressure before cracking hydraulic lines. Failure to do so may result in damage to equipment and injury to personnel.
- All personnel must stand clear of dump body during lowering test. Falling dump body may cause injury to personnel.
- All personnel must stand clear during lifting operations. A swinging or shifting load may cause injury to personnel.
- Compressed air source will not exceed 30 psi (207 kPa). When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to personnel.
- Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment. Refer to TM 9-247 for correct information.
- Drycleaning solvent is flammable and will not be used near open flame. Use only in well-ventilated places. Failure to do so may result in injury to personnel.
- Do not use compressed air or a dry brush for cleaning when working in areas of vehicle where asbestos brake lining dust may accumulate. Remove asbestos dust and other residue from these areas using a soft bristle brush or cloth soaked with water. Breathing asbestos dust may cause injury to personnel.
- Do not disconnect air lines before draining air reservoirs. Small parts under pressure may shoot out with high velocity, causing injury to personnel.
- Lifting device and transmission lifting jack must have a weight capacity greater than the weight of the transmission to prevent damage to equipment and injury to personnel.
- Diesel fuel is flammable. Do not perform fuel system procedures near open flame. Injury to personnel may result.
- Test stand must be shut off before changing shims in spring pack. Small parts under pressure may shoot out causing injury to personnel or damage to equipment.
- Use prybar to free transfer from hang-ups or snags. Failure to do so may result in injury to personnel.
- Ensure transfer is securely mounted to jack with safety chain or strap. Failure to do so may result in injury to personnel.
- Transfer is heavy and bulky. Allow adequate clearance to remove transfer from vehicle. Failure to do so may result in injury or death to personnel.
- Weight of vehicle must be supported on jack stands at all times. Do not attempt to support weight of vehicle on hydraulic jack. Injury or death to personnel may result if jack fails.
- Eye protection is required when using wire brush for cleaning. Failure to do this may result in injury to personnel.
- Unloader valve assembly must be held down during removal. Small parts under pressure may shoot out, causing injury to personnel.

### Warning b

## WARNING SUMMARY (Contd)

- Do not detach chain from engine until all engine weight is evenly distributed and engine is stable on transport stand.
- Eye protection is required when removing hydraulic lines. Failure to do so may result in injury to personnel.
- Eyeshields must be worn during grinding operations. Failure to wear eyeshields may result in injury to personnel.
- If task is being performed in vehicle, ensure fuel shutoff valve is in OFF position and battery ground cable is disconnected to prevent engine from starting. Failure to do this may result in injury to personnel.
- Use care when removing fan blade. Failure to do so may cause injury to personnel.
- Do not touch hot exhaust system components with bare hands. Injury to personnel may result.
- Do not use hands to free engine of "hang-ups." Use tanker or prybars. Failure to do so may result in injury to personnel.
- Engine container is pressurized. Ensure pressure is released before opening container. Failure to do so may result in injury to personnel.
- Ensure engine compartment is free of all tools and working materials before starting engine. Failure to do so may result in injury to personnel.
- Flywheel is heavy. Use care when installing flywheel. Failure to do so may result in injury to personnel.
- Keep hands away from spray pattern when fuel is forced from injector spray holes. Failure to do so may result in injury to personnel.

Warning c (Warning d blank)

TECHNICAL MANUAL  
NO. 9-2320-260-34-1

TECHNICAL ORDER  
NO. 36A12-1C-1122-1

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington D. C., 25 July 1994

TECHNICAL MANUAL  
VOLUME 1 OF 2  
DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE  
FOR  
5-TON, 6X6, M809 SERIES TRUCKS  
(DIESEL)

Model	NSN Without Winch (EIC)		NSN With Winch (EIC)	
Truck, Cargo	M813	2320-00-050-8902 (BSB)	2320-00-050-8890 (BSA)	
	M813A1	2320-00-050-8913 (BSD)	2320-00-050-8905 (BSC)	
	M814	2320-00-050-8988 (BSK)	2320-00-050-8987 (BSJ)	
Truck, Bolster, Logging	M815		2320-00-050-8927 (BSE)	
Truck, Wrecker, Medium	M816		2320-00-051-0489 (BSQ)	
Truck, Dump	M817	2320-00-050-8970 (BSF)	2320-00-051-0589 (BSR)	
Truck, Tractor	M818	2320-00-050-8984 (BSH)	2320-00-050-8978 (BSG)	
Truck, Tractor, Wrecker	M819		2320-00-050-9004 (BSL)	
Truck, Van, Expansibile	M820	2320-00-050-9006 (BSM)		
	M820A1	2320-00-050-9007		
	M820A2	2320-00-050-9010 (BSN)		
Truck, Stake, Bridge Transporting	M821		2320-00-050-9015 (BSP)	

This manual is published in two parts. TM 9-2320-260-34-1 contains Chapters 1 through 11, and TM 9-2320-260-34-2 contains Chapters 12 through 17 and Appendices A, B, C, D, E, and F.

This manual contains a table of contents and an alphabetized index for Chapters 1 through 11.

\* This publication supersedes TM 9-2320-260-34-1, TM 9-2320-260-34-2-1, TM 9-2320-260-34-2-2, TM 9-2320-260-34-2-3, TM 9-2320-260-34-2-4, and TM 9-2320-260-34-2-5, dated 31 December 1980, for M809 series vehicles.

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

**REPORTING OF ERRORS**

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, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in back of this manual, direct to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MB, Warren, Michigan 48397-5000. A reply will be furnished to you.

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## HOW TO USE THIS MANUAL

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### ABOUT YOUR MANUAL

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Spend some time looking through this manual. You'll find that it has a new look, different than most of the TM's you've been using.

New features added to improve the convenience of this manual and increase your efficiency are:

- a. Accessing Information** - These include features such as the bleed-to-edge locators on the cover and edge of the manual. Extensive troubleshooting guides for specific systems lead directly to step-by-step directions for problem solving and maintenance tasks.
- b. Illustrations** - A variety of methods are used to make locating and fixing components much easier. Locator illustrations with keyed text, exploded views, and cut-away diagrams make the information in this manual easier to understand and follow.
- c. Keying Text With Illustrations** - Illustrations/text are located on facing pages that show the specific task you are working on. In some cases, the task steps and illustrations are located side by side. Continue reading for an example of modular text and illustrations.
- d. General Features** - Your TM is the best source available for providing information and data critical to vehicle operation and maintenance:
  - Safety warning summary (pages a through c)
  - General information, equipment descriptions, and data (Chapter 1)
  - Mechanical troubleshooting (Chapter 2, Section II)
  - Detailed maintenance procedures (Chapters 3 through 17)
  - References (Appendix A)
  - Common and special tools list (Appendix B)
  - Expendable/durable supplies and materials list (Appendix C)
  - Mandatory replacement parts (Appendix D)
  - Illustrated list of manufactured items (Appendix E)
  - Torque limits (Appendix F)

A typical example of how to use this manual is provided on the following pages.

**USING YOUR MANUAL: AN EXAMPLE**

**TASK:** The direct and general support maintenance mechanic of an M809 series vehicle reports that the engine will not crank. The vehicle has been assigned to you for repair.

**TROUBLESHOOTING STEPS:**

1. Look at the cover of this manual. You'll see chapter/section titles listed from top to bottom on the right-hand side.
2. Look at the right edge of the manual. On some of the pages you'll see edge indicators (black bars) that are aligned with the chapter/section bars on the cover. These are the locations of the chapters/sections in the text.
3. Look for "SERVICE AND TROUBLESHOOTING INSTRUCTIONS" in the chapter list on the cover. This is where the troubleshooting information is located.
4. Turn to those pages with the edge indicator matching the black bar for service and troubleshooting instructions. Page numbers are also listed next to chapter/section titles.
5. One of the first pages having service and troubleshooting instructions edge indicators is the "MECHANICAL TROUBLESHOOTING INDEX."
6. Look down the list until you find "ENGINE." Beneath that heading you will find the symptoms noted by the maintenance mechanic: "Engine will not crank."
7. Turn to the page indicated: 2-5.
8. On page 2-5, steps/tests relating to resolving the problem of "Engine will not crank" are found.

You perform the inspections and find that the fuel pump must be replaced. Paragraph 5-13 is referenced.

The rest of the inspection shows no other cause for the problem.

**\*ARMY TM 9-2320-260-34-1  
AIR FORCE TO**

\* This publication supersedes TM 9 2320 260 34 1, TM 9 2320 260 34 2 1, TM 9 2320 260 34 2 2, TM 9 2320 260 34 2 3, TM 9 2320 260 34 2 4, and TM 9 2320 260 34 2 5, 31 December 1960.

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

**DEPARTMENTS OF THE ARMY AND THE AIR FORCE**

**MECHANICAL SYSTEMS TROUBLESHOOTING  
SYMPTOM INDEX**

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
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c. Repeat coolant system pressure test. Cylinder liner or block is cracked if coolant leak is still present. Replace engine (para. 3-24).

Step 4. Check for fuel liquid lock.

a. Shut off fuel at fuel inlet to fuel pump (TM 9 2320 260 10).

b. Remove rocker lever housing covers (para. 3-14), turn engine, and observe for proper injector arm movement.

(1) Replace fuel injector(s) (para. 5-6) if injector arm movement is correct.

(2) Remove cam follower housing (para. 3-19), rotate engine, and check cams and mechanical linkage to injectors if injector arm movement is not correct. Install cam follower housing (para. 3-19).

Step 5. Check for mechanical lockup.

a. Remove fuel pump (para. 5-13).

(1) Replace fuel pump if engine rotates.

(2) Proceed to b. if engine does not rotate.

b. Remove air compressor (para. 11-3).

(1) Replace air compressor if engine rotates.

(2) Proceed to c. if engine does not rotate.

c. Remove accessory drive (para. 3-9).

(1) Replace accessory drive if engine rotates.

(2) Replace engine if engine still does not rotate (para. 3-24).

END OF TESTING

2-3



**DETAILED MAINTENANCE PROCEDURES:**

11. Detailed procedures: Include everything you must do to accomplish a basic maintenance task.
  - a. Before beginning the maintenance task, look through the procedure. You must familiarize yourself with the entire maintenance procedure before beginning the maintenance task. The entire procedure of paragraph 5-13: "Fuel Pump Replacement" includes: a. Removal and b. Installation.
  - b. The eight basic headings listed under "INITIAL SETUP" outline special tools, materials, personnel requirements, and special conditions. Headings will not be listed if there are no entries. The headings are:
    - **APPLICABLE MODELS** Any model(s) that require that particular maintenance task.
    - **TEST EQUIPMENT** Test equipment needed to complete the task.
    - **SPECIAL TOOLS** Special tools needed to complete the task.
    - **TOOLS** Common tools, not in the General Mechanic's Tool Kit, needed to complete the task.
    - **MATERIAIS/PARTS** All parts or materials needed to complete the task.
    - **PERSONNEL REQUIRED** The number of personnel needed to perform the task. If only one mechanic is needed, this heading will not be used. If you think that you need more help to correctly or safely complete a task (perhaps as the result of unusual conditions, etc.), alert your supervisor and ask for help.
    - **REFERENCES (TM)** Additional manuals needed to complete the task.
    - **EQUIPMENT CONDITION** Notes the conditions that must exist before starting the task.
    - **GENERAL SAFETY INSTRUCTIONS** Summarizes all safety warnings for the maintenance task.
  - c. A step-by-step maintenance procedure follows the "INITIAL SETUP" and gives detailed instructions for the procedure. These instructions give part name and action performed. The numbers in parentheses correspond to the part's callout number in the accompanying illustration. Warnings, cautions, and notes give additional information.
    - **WARNINGS** - Indicate conditions, practices, or procedures which must be observed to avoid personnel injury, loss of life, or long-term health hazard.
    - **CAUTIONS** - Indicate conditions, practices, Or procedures which must be observed to avoid damage to equipment or destruction of equipment.
    - **NOTES** - Include essential information of special importance, interest, or aid in job performance.
  - d. At the end of a procedure, "FOLLOW-ON TASK(S)" will list the additional task(s) that must be performed to complete the procedure.
12. You can also use the Table of Contents (page ii) to find more information about the vehicle.
13. Refer to TM 9-2320-260-34P, Direct Support and General Support Maintenance Repair Parts and Special Tools List for Truck, 5-Ton, 6x6, M809 series, when requisitioning parts, special tools, and equipment for direct support and general support maintenance.
14. Your manual is easier to use once you understand its design. We hope it will encourage you to use it more often as an aid to maintenance support for M809 series vehicles.

## CHAPTER 1

### INTRODUCTION

Section I. General Information (page 1-1)  
Section II. Equipment Description and Data (page 1-2)

#### Section I. GENERAL INFORMATION

---

##### **1-1. SCOPE**

---

a. This technical manual contains instructions for direct support and general support maintenance of 5-ton, 6x6, diesel, M809 series vehicles.

b. The vehicle model numbers and equipment names are:

- (1) M813 Cargo Truck, W/W and WO/W
- (2) M813A1 Cargo Truck, W/W and WO/W
- (3) M814 Cargo Truck, W/W and WO/W
- (4) M815 Bolster Logging Truck, W/W
- (5) M816 Medium Wrecker Truck, W/W
- (6) M817 Dump Truck, W/W and WO/W
- (7) M818 Tractor Truck, W/W and WO/W
- (8) M819 Tractor Wrecker Truck, W/W
- (9) M820 Expansable Van Truck, WO/W
- (10) M820A1 Expansable Van Truck, WO/W
- (11) M820A2 Expansable Van Truck, WO/W
- (12) M821 Bridge Transporting Stake Truck, W/W

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##### **1-2. MAINTENANCE FORMS, RECORDS, AND REPORTS**

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Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System (TAMMS).

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##### **1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE**

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Procedures for destruction of Army materiel to prevent enemy use can be found in TM 750-244-6.

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##### **1-4. PREPARATION FOR STORAGE OR SHIPMENT**

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Storage and shipment instructions are in TM 9-2320-260-20. Additional information can be found in TM 746-10, Marking, Packaging, and Shipment of Supplies and Equipment: General Packaging Instructions for Field Use.

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##### **1-5. OFFICIAL NOMENCLATURE, NAMES, AND DESIGNATIONS**

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The nomenclature, names, and designations used in this manual are in accordance with MIL-HDBK-63038-2.

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##### **1-6. EQUIPMENT REQUIRING CALIBRATION**

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Calibration requirements in this manual cover the fuel pump and fuel injectors and can be found in Chapter 5 of this manual.

**1-7. REPORTING QUALITY DEFICIENCIES, IDEAS, AND EQUIPMENT  
IMPROVEMENT RECOMMENDATIONS**

If your 5-ton, 6x6, M809 series vehicle needs improvement, let us know. Send us 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 (Quality Deficiency Report). Mail in accordance with DA PAM 738-750.

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**1-8. EQUIPMENT IMPROVEMENT REPORT AND MAINTENANCE DIGEST (EIR MD)**

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The quarterly Equipment Improvement Report and Maintenance Digest (EIR MD), TB 43-0001-39 series, contains valuable field information on the equipment covered in this manual. The information in the TB 43-0001-39 series is compiled from some of the Equipment Improvement Reports (EIR) that you prepared on the vehicles covered in this manual. Many of these articles resulted from comments, suggestions, and improvement recommendations that you submitted to the EIR program. The TB 43-0001-39 series contains information on equipment improvements, minor alterations, proposed Modification Work Orders (MWO's), warranties (if applicable), actions taken on some of your DA Form 2028's (Recommended Changes to Publications), and advance information on proposed changes that may affect this manual. The information will help you in doing your job better and will help in keeping you advised of the latest changes to this manual. Also, refer to DA PAM 25-30, Consolidated Index of Army Publications and Blank Forms, and Appendix A, References, in this manual.

**Section II. EQUIPMENT DESCRIPTION AND DATA**

**1-9. EQUIPMENT DESCRIPTION AND DATA**

Detailed descriptions covering the 5-ton, 6x6, M809 series vehicles are in TM 9-2320-260-10 and TM 9-2320-260-20.

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**1-10. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES**

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Detailed descriptions and data covering the 5-ton, 6x6, M809 series vehicles are described in TM 9-2320-260-20. Equipment configurations with dimensions and weights (tabulated data) follow.

## CHAPTER 2

### SERVICE AND TROUBLESHOOTING INSTRUCTIONS

Section I. Repair Parts, Special Tools, TMDE, and Support Equipment (page 2-1)  
 Section II. Troubleshooting (page 2-1)  
 Section III. General Maintenance Instructions (page 2-32)

#### Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

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##### 2-1. COMMON TOOLS AND EQUIPMENT

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Refer to Modified Table of Organization and Equipment (MTOE) for authorized common tools and equipment applicable to your unit.

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##### 2-2. SPECIAL TOOLS AND SUPPORT EQUIPMENT

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Special tools and support equipment are listed and illustrated in TM 9-2320-260-34P.

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##### 2-3. TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE)

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Calibrate all measuring and test equipment used to determine equipment conformance in accordance with MIL-STD-120, MIL-C-45662, MIL-L-45607, and TB 43-180.

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##### 2-4. FABRICATED TOOLS

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Fabricated tools needed to maintain the equipment mentioned in this manual can be found in Appendix E. These tools are not available for issue; therefore, each one must be fabricated locally and applied by direct and general support personnel.

##### 2-5. REPAIR PARTS

Repair parts are listed and illustrated in TM 9-2320-260-34P,

#### Section II. TROUBLESHOOTING

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##### 2-6. GENERAL TROUBLESHOOTING INSTRUCTIONS

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a. Troubleshooting procedures in this section cannot give all the answers or correct all vehicle malfunctions encountered. However, these procedures are an organized step-by-step approach to a problem that directs tests and inspections toward the source of a problem and successful solution.

Information in this section is for use by support maintenance personnel in conjunction with, and as a supplement to, the troubleshooting procedures in TM 9-2320-260-20.

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##### WARNING

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- Do not operate a deadlined vehicle without preliminary inspection. Failure to do so may cause further damage to a disabled component and possible injury to personnel.
- Do not operate vehicle in an enclosed area without adequate ventilation. Failure to do so may result in injury to personnel.
- Hearing protection is required for driver, co-driver, and mechanic when engine is running. Noise levels produced by this vehicle exceed 85dB, which may cause injury to personnel.

**2-6. GENERAL TROUBLESHOOTING INSTRUCTIONS (Contd)**

**b.** Perform the easiest and most obvious troubleshooting tasks and corrections first. Most malfunctions are easily corrected. For example:

- (1) Low power problems are generally caused by loose throttle linkage or dirty fuel or air filters.
- (2) Excessive oil consumption is generally caused by leaky gaskets or loose line connections.

**c.** Double check before disassembly. The source of most engine problems can be traced to more than one part in a system. For example:

(1) Excessive fuel consumption may not be caused by the fuel pump alone. Instead, the trouble could be a clogged air cleaner reducing air inflow or a restricted passage causing abnormally high back pressure.

(2) Engines very often are disassembled in search of a complaint and the real evidence of the problem is destroyed. Check again to be sure an easier solution to the problem has not been overlooked.

(3) Check all tags, service request forms, and vehicle logbook for repair history. This may help lead to the source of problems.

**d.** Before attempting to correct a problem, diagnose the cause of the problem. Do not allow the same malfunction to reoccur.

**MECHANICAL SYSTEMS TROUBLESHOOTING  
SYMPTOM INDEX**

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
<b>ENGINE</b>		
1.	Engine will not crank . . . . .	2-5
2.	Engine cranks slowly . . . . .	2-6
3.	Engine cranks but will not start . . . . .	2-6
4.	Engine starts, won't run . . . . .	2-6
5.	Engine stops when throttle is returned to idle position . . . . .	2-6
6.	Engine has poor acceleration and/or lack of power . . . . .	2-6
7.	Black exhaust smoke at idle . . . . .	2-7
8.	Engine surges . . . . .	2-7
9.	Engine misfires during normal operation . . . . .	2-7
10.	Engine stops during normal operation (engine restarts) . . . . .	2-7
11.	Engine stops during normal operation (engine does not restart). . . . .	2-7
12.	Exhaust color blue during normal operation . . . . .	2-8
13.	Exhaust color white during normal operation and idle . . . . .	2-9
14.	Engine oil pressure low at normal engine operating temperature. . . . .	2-9
15.	Engine oil pressure extremely high at normal operating temperature . . . . .	2-9
16.	Engine oil pressure zero . . . . .	2-10
17.	Engine oil loss during normal operation . . . . .	2-10
18.	Engine noise abnormal . . . . .	2-10
19.	Engine vibration abnormal . . . . .	2-11
<b>FUEL SYSTEM</b>		
20.	No fuel at fuel injectors . . . . .	2-12
21.	Lean fuel flow at injectors – low power – loss of power . . . . .	2-12
22.	Excessive exhaust smoke at idle and under load - excessive fuel consumption . . . . .	2-12
23.	Engine idle rough, erratic . . . . .	2-13
24.	Engine overspeeds . . . . .	2-13
25.	Engine lubricating oil diluted by fuel . . . . .	2-13
26.	Engine knocks . . . . .	2-13



## MECHANICAL SYSTEMS TROUBLESHOOTING SYMPTOM INDEX (Contd)

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
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30.	Burning odor evident with clutch engaged. . . . .	2-15
31.	Clutch noisy during engagement and disengagement . . . . .	2-15
32.	Vibration during clutch engagement. . . . .	2-16
<b>TRANSMISSION</b>		
33.	Engine stalls when clutch is engaged and transmission is in gear . . . . .	2-16
34.	Vehicle will not move when clutch is engaged and transmission is in gear . . . . .	2-16
35.	Excessive noise during shifting. . . . .	2-16
36.	Transmission oil leakage . . . . .	2-16
37.	Transmission grinds and/or pops out of gear during shifting . . . . .	2-17
<b>TRANSFER CASE</b>		
38.	Transfer case will not operate front differential . . . . .	2-17
39.	Transfer case will not operate rear differentials . . . . .	2-17
40.	Transfer case oil leakage..... . . . .	2-18
41.	Transfer case noisy . . . . .	2-18
42.	Transfer case grinds or pops out of gear during normal vehicle operation . . . . .	2-18
<b>DIFFERENTIAL</b>		
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44.	Differential clunks during turns or initial takeoff. . . . .	2-19
45.	Differential vibrates . . . . .	2-19
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<b>STEERING GEAR</b>		
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50.	Vehicle shimmy (front) . . . . .	2-20
51.	Steering gear leaking oil . . . . .	2-20
52.	Oil leaking from power steering pump . . . . .	2-20
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54.	Steering wheel hard to tum . . . . .	2-20
<b>AIR COMPRESSOR</b>		
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56.	Air compressor passes excessive oil (excessive oil bled from air reservoirs) . . . . .	2-21
57.	Air compressor does not unload (air governor adjusted and operative) . . . . .	2-21
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<b>POWER TAKEOFF</b>		
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61.	Power takeoff slips out of gear . . . . .	2-22
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**MECHANICAL SYSTEMS TROUBLESHOOTING  
SYMPTOM INDEX (Contd)**

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
<b>DUMP BODY</b>		
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65.	Dump body will not lower..... . . . .	2-25
66.	Dump body will not hold in raised position . . . . .	2-25
<b>MEDIUM WRECKER CRANE (M816)</b>		
67.	Crane boom fails to swing (other hydraulic systems operate satisfactorily) . . . . .	2-25
68.	Crane swings erratically . . . . .	2-26
69.	Boom fails to extend or retract (other hydraulic systems operate satisfactorily) . . . . .	2-26
70.	Boom extends or retracts sluggishly.. . . . .	2-26
71.	Hoist w-inch fails to rotate, operates too slowly, or operates erratically . . . . .	2-26
72.	Boom fails to raise or raises and lowers sluggishly . . . . .	2-27
<b>TRACTOR WRECKER (M819)</b>		
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<b>HYDRAULIC LIFTGATE (M820A2)</b>		
74.	Liftgate will not open or close . . . . .	2-27
75.	Platform does not stop at proper height. . . . .	2-28
76.	Liftgate at incorrect angle when closed. . . . .	2-28
77.	Liftgate fails cooperate on remote control . . . . .	2-28
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<b>WINTERIZATION KITS</b>		
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80.	Blower runs in START position; heater fails to ignite . . . . .	2-28
81.	Heater starts, but fails to run . . . . .	2-29
82.	Heater runs continuously in high or low heat . . . . .	2-29
83.	Heater overheats . . . . .	2-29
84.	Blower does not stop when heater is shutoff . . . . .	2-29
85.	Heater fails to start . . . . .	2-29
86.	Fuel burning heaters fail to turn on . . . . .	2-29
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90.	Heater smokes and bangs when starting. . . . .	2-30
91.	Blower will not stop after turn off. . . . .	2-30
92.	Odor of fuel in ventilating air (personnel heater only). . . . .	2-30
93.	Blower runs but heater fails to ignite. . . . .	2-31
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<b>WINCHES</b>		
95.	Clutch will not engage drum (front and midship winches). . . . .	2-31
96.	Winch noisy under load . . . . .	2-31
97.	Drum overruns cable or cable coils loosen when paying out cable (front and midship tithes) . . . . .	2-32
98.	Winch (all types) does not hold load when power released. . . . .	2-32
99.	Winch (all types) leaks oil . . . . .	2-32
100.	Rear winch operates atone speed only. . . . .	2-32

*Table 2-1. Mechanical Troubleshooting.*

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**ENGINE****1. ENGINE WILL NOT CRANK****WARNING**

Ensure fuel shutoff valve is off and remove throttle cable before cranking engine. Failure to do so may result in injury to personnel.

- Step 1. Hand rotate engine at crankshaft two complete turns.  
Proceed to step 2 if engine does not turn.
- Step 2. Remove rocker lever housings (para. 3-15) and remove decompression plugs. Rotate engine.
- If engine rotates and ejects liquid, determine if liquid is coolant or fuel. Install rocker lever housing (para. 3-15).
    - Proceed to step 3 if liquid is coolant.
    - Proceed to step 4 if liquid is fuel.
  - Proceed to step 5 if engine does not rotate.
- Step 3. Check for coolant liquid lock.
- Perform coolant system pressure test to confirm coolant leak into combustion space (malfunction 27).
  - Remove and inspect cylinder heads (para. 3-18). Replace cylinder head(s) if cracked or warped.
  - Repeat coolant system pressure test. Cylinder liner or block is cracked if coolant leak is still present. Replace engine (para. 3-24).
- Step 4. Check for fuel liquid lock.
- Shut off fuel at fuel inlet to fuel pump (TM 9-2320-260-10).
  - Remove rocker lever housing covers (para. 3-14), turn engine, and observe for proper injector arm movement.
    - Replace fuel injector(s) (para. 5-6) if injector arm movement is correct.
    - Remove cam follower housing (para. 3-19), rotate engine, and check cams and mechanical linkage to injectors if injector arm movement is not correct. Install cam follower housing (para. 3-19).
- Step 5. Check for mechanical lockup.
- Remove fuel pump (para. 5-13).
    - Replace fuel pump if engine rotates.
    - Proceed to b. if engine does not rotate.
  - Remove air compressor (para. 11-3).
    - Replace air compressor if engine rotates.
    - Proceed to c. if engine does not rotate.
  - Remove accessory drive (para. 3-9).
    - Replace accessory drive if engine rotates.
    - Replace engine if engine still does not rotate (para. 3-24).

END OF TESTING!

*Table 2-1. Mechanical Troubleshooting (Contd).*

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**2. ENGINE CRANKS SLOWLY**

- Step 1. Perform electrical troubleshooting (TM 9-2320-260-20).
  - Step 2. Perform malfunction 1, step 5, malfunction 14, step 2, and malfunction 15.
- END OF TESTING!

**3. ENGINE CRANKS BUT WILL NOT START**

- Step 1. Check for defective fuel pump shutoff valves.  
Replace fuel pump shutoff valves if defective (para. 5-15).
  - Step 2. Check for broken fuel pump driveshaft.
    - a. Disconnect tachometer cable from fuel pump, crank engine (TM 9-2320-260-10), and observe if driveshaft end in pump housing is rotating.
    - b. Replace fuel pump if driveshaft does not rotate (para. 5-13).
  - Step 3. Check for correct fuel injector and valve adjustment.  
Adjust fuel injectors and valves as necessary (para. 3-82, 3-83, or 3-84).
  - Step 4. Check for dirty or damaged fuel injectors.  
Replace fuel injectors if dirty or damaged (para. 5-6).
  - Step 5. Check fuel pump operation.  
Replace fuel pump if defective (para. 5-13).
- END OF TESTING!

**4. ENGINE STARTS, WON'T RUN**

- Step 1. Check for low fuel flow.  
Correct fuel line damage. Clean plugged or dirty fuel strainer (TM 9-2320-260-20).
  - Step 2. Proceed to malfunction 21.
- END OF TESTING!

**5. ENGINE STOPS WHEN THROTTLE IS RETURNED TO IDLE POSITION**

- Step 1. Check if engine governor idle speed is set too low.  
Adjust engine governor idle speed to specifications if incorrect (para. 5-25).
  - Step 2. Check fuel delivery system (malfunction 20).
- END OF TESTING!

**6. ENGINE HAS POOR ACCELERATION AND/OR LACK OF POWER**

- Step 1. Check if engine maximum governed speed is set too low.  
Adjust engine maximum governed speed to specifications if incorrect (para. 5-25).
  - Step 2. Check fuel injector operation (malfunction 21).
  - Step 3. Check engine valve train operation.  
Adjust valves to specifications if incorrect (para. 3-82, 3-83, or 3-84).
  - Step 4. Check engine cylinder compression (malfunction 12).
- END OF TESTING!

**Table 2-1. Mechanical Troubleshooting (Contd).**

<b>MALFUNCTION</b>	<b>TEST OR INSPECTION</b>	<b>CORRECTIVE ACTION</b>
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**7. BLACK EXHAUST SMOKE AT IDLE**

Check if engine maximum governed speed is set too high.

Adjust maximum engine governed speed to specification if incorrect (para. 5-25).

END OF TESTING!

**8. ENGINE SURGES**

Step 1. Check for low fuel supply at fuel pump and injectors.

Perform malfunction 20 if fuel supply is low.

Step 2. Check for excess fuel supply.

Perform malfunction 22 if fuel supply is excessive.

END OF TESTING!

**9. ENGINE MISFIRES DURING NORMAL OPERATION**

Step 1. Check fuel injector operation.

Replace fuel injectors if defective (para. 5-6).

Step 2. Check engine valve train operation and valve lash adjustment.

Correct valve train operation and adjust valves to specifications if incorrect (para. 3-82, 3-83, or 3-84).

Step 3. Check engine cylinder compression.

Perform engine cylinder compression test (malfunction 12).

END OF TESTING!

**10. ENGINE STOPS DURING NORMAL OPERATION (ENGINE RESTARTS)**

Perform malfunctions 4 and 5.

END OF TESTING!

**11. ENGINE STOPS DURING NORMAL OPERATION (ENGINE DOES NOT RESTART)**

Step 1. Crank engine (TM 9-2320-260-10).

a. Perform malfunction 1, step 5 if engine will not crank.

b. Proceed to step 2 if engine cranks.

Step 2. Check low oil pressure lockout switch (TM 9-2320-260-20).

a. Replace low oil pressure lockout switch if damaged (TM 9-2320-260-20).

b. Perform malfunction 21 if low oil pressure lockout switch is operative.

END OF TESTING!

**Table 2-1. Mechanical Troubleshooting (Contd).**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**12. EXHAUST COLOR BLUE DURING NORMAL OPERATION**

**NOTE**

- Blue exhaust indicates presence of excess engine oil in cylinder combustion space.
- Compression test supplements STE-ICE cylinder unbalance test by identifying defective components.

**Step 1. Engine cylinder compression test.**

- a. Preparation: Check valves and rocker arms for proper movement and ensure they are adjusted to specifications (para. 3-82 or 3-83), cutoff fuel supply at fuel pump (TM 9-2320-260-20), ensure batteries are fully charged and starter operates normally, and remove all decompression plugs in cylinder heads (para. 3-18).
- b. Connect compression gage and necessary adapter to decompression plug port of number 1 cylinder. Crank engine through at least five compression strokes or until gage stops rising. Record cylinder number and maximum gage reading. Remove gage from number 1 cylinder. This is the “dry” test.
- c. Repeat step lb. for remaining cylinders.
- d. Add 1 to 1-1/2 oz (28-43 ml) of clean engine oil through decompression plug port for each cylinder before connecting compression-gage. Repeat steps 1b. and 1c. This is the “wet” test. Record gage readings for “wet” test beside readings for “dry” test for each cylinder.

**Step 2. Analysis of compression test results.**

- a. Compute compression loss for “dry” test for each cylinder compared to cylinder with highest reading. Use the following formula:

$$\frac{\text{Highest Cylinder Reading} - \text{Each Remaining Cylinder Reading}}{\text{Highest Cylinder Reading}} \times 100 = \% \text{ Compression Loss}$$

- b. If one or more cylinders has an 8-10% or greater compression loss in “dry” test, but improved to acceptable (less than 8%) loss in “wet” test, piston, piston rings, or cylinder liner problem is indicated. Remove cylinder head(s) (para. 3-18) and inspect pistons, piston rings, and cylinder liner for breaks, wear, and scoring. Repair or replace defective parts (paras. 3-47 and 3-50).
- c. If one or more cylinders had an 8-10% or greater loss in both “wet” and “dry” tests, the compression loss is on top of engine. Remove cylinder head(s) (Para. 3-18) and inspect valves, valve seats and guides, and cylinder head gasket(s). Replace or repair defective parts (para. 3-53).
- d. If repairs performed in b. and/or c. do not sufficiently restore engine to normal operation, inspect camshaft, follower, and pushrod for defects. Repair or replace defective parts (paras. 3-44, 3-41, and 3-37).
- e. Replace valve seats and guides (para. 3-78) if compression test readings are within limits for all cylinders, engine develops normal power, but still shows blue exhaust.

**END OF TESTING!**

**Table 2-1. Mechanical Troubleshooting (Contd).**

<b>MALFUNCTION</b>
<b>TEST OR INSPECTION</b>
<b>CORRECTIVE ACTION</b>

**13. EXHAUST COLOR WHITE DURING NORMAL OPERATION AND IDLE****CAUTION**

Thick white smoke indicates coolant is present in engine combustion chambers during operation. When this condition is evident, shut engine down immediately and determine cause. Continued engine operation may result in permanent engine damage.

Step 1. Perform cooling system pressure test (malfunction 27).

Step 2. Check cylinder heads and gaskets for defects (para. 3-18).

**NOTE**

When engine exhaust color remains white during test run after cylinder heads or gaskets replacement, internal engine block cooling jacket failure is indicated.

Step 3. Replace engine (para. 3-24).

END OF TESTING!

**14. ENGINE OIL PRESSURE LOW AT NORMAL ENGINE OPERATING TEMPERATURE**

Step 1. Remove oil pan (para. 3-20) and check for excessive crankshaft bearing clearance.

Repair or replace engine if crankshaft bearing clearances are excessive (para. 3-24).

Step 2. Check oil pump operation.

Repair or replace oil pump if defective (para. 3-34 or 3-52).

**NOTE**

If engine oil pressure remains low after completing troubleshooting, internal engine block oil passage failure is indicated.

Step 3. Replace engine (para. 3-24).

END OF TESTING!

**15. ENGINE OIL PRESSURE EXTREMELY HIGH AT NORMAL OPERATING TEMPERATURE****NOTE**

Continued high oil pressure may indicate spun internal engine bearings or restricted engine block oil feed passages.

Disassemble engine (chapter 3, section IV) and check for spun bearings and restricted oil passages.

Replace engine (para. 3-24) if evidence of spun engine bearings or restricted oil passages is found.

END OF TESTING!

*Table 2-1. Mechanical Troubleshooting (Contd).*

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**16. ENGINE OIL PRESSURE ZERO**

**CAUTION**

Do not operate engine except during testing when condition of no oil pressure is evident. Continued operation may damage engine.

- Step 1. Check oil pressure gage for proper operation. Tee into oil pressure line and install test gage.
  - a. Replace faulty gage if test gage indicates proper oil pressure (TM 9-2320-260-20).
  - b. Perform step 2 if zero oil pressure is confirmed.

Step 2. Complete troubleshooting malfunction 14.

END OF TESTING!

**17. ENGINE OIL LOSS DURING NORMAL OPERATION**

Perform troubleshooting malfunctions 12 and 14.

END OF TESTING!

**18. ENGINE NOISE ABNORMAL**

**NOTE**

When abnormal engine noise is evident, engine should be checked and location of noise determined to ensure that engine will not be permanently damaged.

- Step 1. If knocking noise is located at front of engine, check camshaft gear and accessory drive gear for damage, excessive backlash, and loose fit. Check camshaft for excessive end play.
  - a. Remove front gear cover (para. 3-33).
  - b. Replace camshaft or accessory drive gears if gears are loose (para. 3-44 or 3-32).
  - c. Replace crankshaft gear and key if gear is loose (para. 3-48).
  - d. Replace worn gear(s) if backlash is excessive (paras. 3-42, 3-44, and 3-48).
  - e. Replace camshaft thrust plate if camshaft end play is excessive (para. 3-44).
- Step 2. If a knocking noise is located at top of engine, remove rocker lever housing covers (para. 3-14) and check valve train components mounted on cylinder heads for wear, defects, or incorrect adjustment.
  - a. Adjust valve train components as necessary (paras. 3-15 through 3-18).
  - b. Replace valve train components if worn or defective (paras. 3-15 through 3-18).
- Step 3. If knocking noise is located at side of engine, remove inspection cover, valve covers, valve train components, and cam followers. Check valve train components for defects or wear. Replace valve train components if worn or defective (paras. 3-15 through 3-18).



**Table 2-1. Mechanical Troubleshooting (Contd).**

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
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**NOTE**

When flywheel is loose on crankshaft., damage to flywheel/crankshaft mating surfaces can occur. Inspection of mating surfaces should be performed prior to tightening flywheel screws.

- Step 4. If a knocking noise is located at bottom or rear of engine, check flywheel for loose condition. Place transmission in neutral, start engine, and press and release clutch a number of times (TM 9-2320-260-10).
- If noise changes, remove transmission and clutch (paras. 8-4 or 8-5 and 4-2) and check flywheel screws and pilot bearing for damage and loose condition.
  - Tighten loose screws or replace flywheel parts if worn or defective (para. 3-21).
  - Replace pilot bearing if damaged (para. 4-2).
- Step 5. If a knocking noise is located at bottom of engine, remove oil pan (para. 3-20) and check condition of main bearings, crankshaft, and connecting rods for wear and defects.
- Replace main bearings and crankshaft if worn or defective (para. 3-48).
  - Replace connecting rods if worn or defective (para 3-47).
  - If no defects are found, remove pistons and connecting rods and check connecting rod wrist pins and pistons for wear and defects. Replace defective components (para. 3-47).

END OF TESTING!

**19. ENGINE VIBRATION ABNORMAL**

- Step 1. Check for loose or defective crankshaft vibration damper.
- If vibration damper is loose, check woodruff key and crankshaft and vibration damper mating surfaces for damage. Replace damaged components (paras. 3-5 and 3-48).
  - Replace vibration dampener if defective (para. 3-5).
- Step 2. Check engine cylinders compression readings (malfunction 12).
- Step 3. Complete troubleshooting malfunction 9.

END OF TESTING!

**FUEL SYSTEM****WARNING**

- Diesel fuel is flammable. Do not perform troubleshooting checks near open flame, sparks, or electricity. Injury to personnel may result.
- Eye protection is required when performing fuel system troubleshooting checks. Failure to wear eye protection may result in injury to personnel.
- Ignition switch must remain off during fuel system troubleshooting checks except when necessary to perform malfunction check. Failure to turn ignition system off may result in injury to personnel.