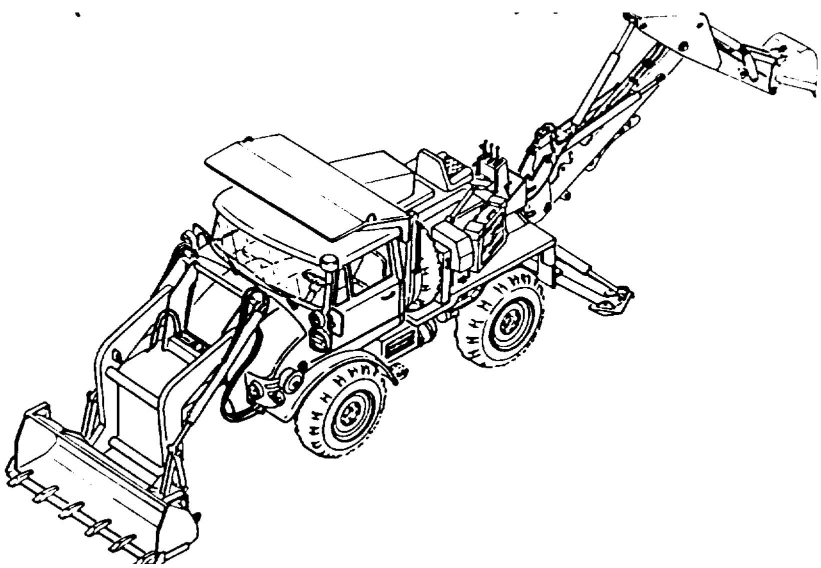
TM 5-2420-224-20-1
Volume No. 1

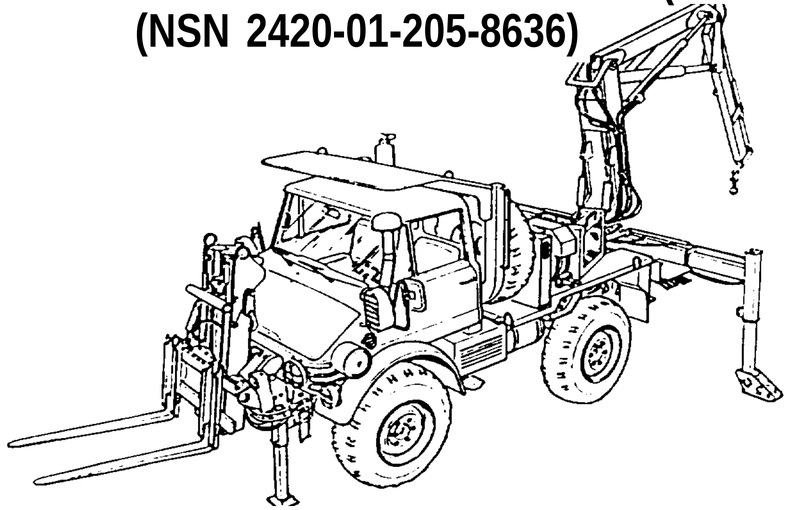
TECHNICAL MANUAL

UNIT MAINTENANCE MANUAL
FOR

TRACTOR, WHEELED, 4 X 4 DED
SMALL EMPLACEMENT EXCAVATOR (SEE)
(NSN 2420-01-160-2754) (EIC:EDL)



TRACTOR, WHEELED, 4 X 4 DED
HIGH MOBILITY MATERIAL HANDLER (HMMH)
(NSN 2420-01-205-8636)



HEADQUARTERS, DEPARTMENT OF THE ARMY **28 JULY 1993**

This manual along with TM5-2420-224-20-2 and TM5-2420-224-34 supersedes TM5–2420–224-24 dated December 1989

Approved for public release; distribution is unlimited.

WARNING

CARBON MONOXIDE POISONING CAN BE DEADLY

CARBON MONOXIDE IS A COLORLESS, ODORLESS, DEADLY POISONOUS GAS, WHICH, WHEN BREATHED, DEPRIVES THE BODY OF OXYGEN AND CAUSES SUFFOCATION. EXPOSURE TO AIR CONTAMINATED WITH CARBON MONOXIDE PRODUCES SYMPTOMS OF HEADACHE, DIZZINESS, LOSS OF MUSCULAR CONTROL, APPARENT DROWSINESS, OR COMA. PERMANENT BRAIN DAMAGE OR DEATH CAN RESULT FROM SEVERE EXPOSURE.

CARBON MONOXIDE OCCURS IN THE EXHAUST FUMES OF FUEL-BURNING HEATERS AND INTERNAL-COMBUSTION ENGINES AND BECOMES DANGEROUSLY CONCENTRATED UNDER CONDITIONS OF INADEQUATE VENTILATION. THE FOLLOWING PRECAUTIONS MUST BE OBSERVED TO ENSURE THE SAFETY OF PERSONNEL WHENEVER THE PERSONNEL HEATER, MAIN, OR AUXILIARY ENGINE OF ANY VEHICLE IS OPERATED FOR MAINTENANCE PURPOSES OR TACTICAL USE:

1. DO NOT operate engine of vehicle in an enclosed area unless it is ADEQUATELY VENTILATED.

2. DO NOT idle engine for long periods without maintaining ADEQUATE VENTILATION in the personnel compartments.

3. DO NOT drive any vehicle with inspection plates, cover plates, or engine compartment doors removed unless necessary for maintenance purposes.

4. BE ALERT. at all times during vehicle operation for exhaust odors and exposure symptoms. If either is present, IMMEDIATELY VENTILATE personnel compartments. If symptoms persist, remove affected personnel from vehicle and treat as follows: expose to fresh air; keep warm, DO NOT PERMIT EXERCISE; if necessary, administer artificial respiration (see FM 21-11).

THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS ADEQUATE VENTILATION.

WARNING

COMPRESSED AIR

To prevent injury, compressed air used for cleaning and drying purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

WARNING

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. Flash point is 100°-138° F (38°-50°C). If you become dizzy while using drycleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

WARNING

Remove rings, bracelets, wristwatches, and neck chains before working on vehicle. Jewelry can catch on equipment and cause injury, or may short across an electrical circuit and cause severe burns or electrical shock.

WARNING

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

WARNING

Do not connect or disconnect any electrical connector unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

WARNING

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.

WARNING

All vehicle electrical switches must be OFF before disconnecting battery cables. Failure to do so could result in injury to personnel.

WARNING

High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

WARNING

If NBC exposure is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

WARNING

Never use gasoline to clean parts. Gasoline is highly flammable. Serious personal injury could result if fuel ignites during cleaning.

WARNING

Prior to initial use, new, extensively repaired, or altered forklift or crane must be load tested to prevent injury to personnel.

WARNING

Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection are required.

WARNING

Solvents used with spray gun must be used in spray booth with filter. Face shield must be used by personnel operating spray gun. Failure to do so could result in serious injury to personnel.

WARNING

Drilling and grinding operations are hazardous to the eyes. Eye protection is required.

WARNING

On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. Avoid prolonged contact with skin.

WARNING

Before starting engine, make sure all personnel are clear of engine. Failure to do so could result in injury to personnel.

WARNING

When replacing fuses, make sure only fuses of correct amperage are installed. Failure to do so could result in injury to personnel or damage to equipment.

CHANGE NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 30 March 2004

UNIT MAINTENANCE MANUAL
FOR
TRACTOR, WHEELED, 4 X 4 DED
SMALL EMPLACEMENT EXCAVATOR (SEE)
(NSN 2420-01-160-2754) (EIC:EDL)

AND

TRACTOR, WHEELED, 4 X 4 DED
HIGH MOBILITY MATERIAL HANDLER (HMMH)
(NSN 2420-01-205-8636)

TM 5-2420-224-20-1, dated 28 July 1993, is updated as follows:

1. File this sheet in front of the manual for reference.

2. New or changed material is indicated by a vertical bar adjacent to the material and/or change designators at bottom of affected page.

3. New or changed illustrations are indicated by a miniature pointing hand adjacent to the updated area.

4. Remove old pages and insert new pages as indicated below.

Remove Pages	Insert Pages
A/(B Blank)	A and B
i and ii	i and ii
xi and xii	xi and xii
1-9 and 1-10	1-9 and 1-10
2-1 through 2-4	2-1 through 2-4
2-9 through 2-14	2-9 through 2-14
None	2-14.1 through 2-14.24
2-15 and 2-16	2-15 and 2-16
2-21 and 2-22	2-21 and 2-22
2-31 and 2-32	2-31 and 2-32
2-35 through 2-38	2-35 through 2-38
3-63 and 3-64	3-63 and 3-64
3-83 and 3-84	3-83 and 3-84
3-265 through 3-268	3-265 through 3-268
3-271 and 3-272	3-271 and 3-272
3-277 through 3-286	3-277 through 3-286
3-293 through 3-298	3-293 through 3-298
3-309 and 3-310	3-309 and 3-310
Index-9 through Index-12	Index-9 through Index-12

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
0406802

DISTRIBUTION:

To be distributed in accordance with the Initial Distribution Number (IDN) 380973 requirements for TM 5-2420-224-20-1.

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 7 October 2003

UNIT MAINTENANCE MANUAL
FOR
TRACTOR, WHEELED, 4 X 4 DED
SMALL EMPLACEMENT EXCAVATOR (SEE)
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4. Remove old pages and insert new pages as indicated below.

Remove Pages	Insert Pages
None	A/(B Blank)
iii and iv	iii and iv
vii and viii	vii and viii
1-1 and 1-2	1-1 and 1-2
None	1-16.1 through 1-16.22
2-5 through 2-12	2-5 through 2-12
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Index-1 and Index-2	Index-1 and Index-2
Index-5 and Index-6	Index-5 and Index-6
Index-11 through Index-14	Index-11 through Index-14
Index-17/(Index-18 Blank)	Index-17/(Index-18 Blank)
DA Form 2028-2	DA Form 2028

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
Secretary of the Army
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Change .... 1.................................. 7 October 2003
Change .... 2................................ 30 March 2004

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 1,390, CONSISTING OF THE FOLLOWING:

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*Zero in this column indicates an original page

Technical Manual
No. 5-2420-224-20-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 28 July 1993

UNIT MAINTENANCE MANUAL
FOR
TRACTOR, WHEELED, 4 X 4 DED
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(NSN 2420-01-160-2754) (EIC:EDL)

AND

TRACTOR, WHEELED, 4 X 4 DED
HIGH MOBILITY MATERIAL HANDLER (HMMH)
(NSN 2420-01-205-8636)

VOLUME 1 OF 2

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter or DA Form 2028 direct to: AMSTA-LC-CI / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

TABLE OF CONTENTS

This manual along with TM 5-2420-224-20-2 and TM 5-2420-224-34 supersedes
TM 5-2420-224-24 dated December 1989

TABLE OF CONTENTS (CONT)

LIST OF TASKS

VOLUME 2

A list of the maintenance procedures included in this manual is shown below, and on the following pages. If more information is needed, refer to the Table of Contents or the Alphabetical Index.

POWER PACKAGE MAINTENANCE (Section I)

CLUTCH MAINTENANCE (Section II)

FUEL SYSTEM MAINTENANCE (Section III)

LIST OF TASKS (CONT)

COOLING SYSTEM MAINTENANCE (Section V)

ELECTRICAL SYSTEM MAINTENANCE (Section VI)

LIST OF TASKS (CONT)

ELECTRICAL SYSTEM MAINTENANCE (Section VI)-CONT

TRANSMISSION MAINTENANCE (Section VII)

LIST OF TASKS (CONT)

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BRAKE MAINTENANCE (Section IX)

WHEEL MAINTENANCE (Section X)

LIST OF TASKS (CONT)

LIST OF TASKS (CONT)

BODY, CAB, AND HOOD MAINTENANCE (Section XIV)-CONT

BODY AND CHASSIS ACCESSORY ITEMS MAINTENANCE (Section XV)

HYDRAULIC SYSTEM MAINTENANCE (Section XVI)

LIST OF TASKS (CONT)

HYDRAULIC SYSTEM MAINTENANCE (Section XVI)-CONT

LIST OF TASKS (CONT)

HYDRAULIC SYSTEM MAINTENANCE (Section XVI)-CONT

GAGES (NON-ELECTRICAL) MAINTENANCE (Section XVII)

MACHINE TOOLS AND RELATED EQUIPMENT MAINTENANCE (Section XVIII)

CRANES, SHOVELS, AND EARTHMOVING EQUIPMENT COMPONENTS MAINTENANCE (Section XIX)

LIST OF TASKS (CONT)

CRANES, SHOVELS, AND EARTHMOVING EQUIPMENT COMPONENTS MAINTENANCE
(Section XIX)-CONT

HOW TO USE THIS MANUAL

This manual has an edge index that will help you find specific information in a hurry. Simply spread the pages in the right edge of the manual until the printed blocks can be seen. Open the manual where the block on the edge of the page lines up with your selected topic printed in the front cover block.

OVERVIEW

This manual is organized by chapters, sections, and appendices. A summary of the organization of this manual, by major divisions, follows:

Front cover index gives you a quick reference to chapters, sections, and appendices that you will use often.

WARNINGS—All warnings you should observe while working on or around the SEE/HMMH are shown in this part of the manual. These are repeated in the parts of the manual where they apply.

Table of Contents—The contents of the chapters and appendices are listed here.

Chapter 1—This chapter contains general information about the SEE/HMMH. It also shows and describes major components and lists specific data that you will find helpful while performing maintenance tasks.

Chapter 2—This chapter describes services and inspections that must be performed at the unit level, such as services you must perform upon receipt of the vehicle, preventive maintenance checks and services, and lubrication instructions. Other sections contain painting and restenciling of markings and general repair and cleaning methods.

Chapter 3—This chapter outlines troubleshooting of the SEE/HMMH and their systems. It includes a troubleshooting index, by symptom and system, and procedures on how to use the STE/ICE R components while troubleshooting.

Chapter 4—This chapter contains step-by-step instructions for doing the maintenance tasks. Each system of the SEE/HMMH has its own section within the chapter, and any special tools, equipment, or supplies you may need for a task are listed.

Appendix A—This appendix lists the technical manuals and other publications you may have to refer to while working on the SEE/HMMH.

Appendix B—This appendix contains the Maintenance Allocation Chart (MAC) for the SEE/HMMH.

Appendix C—This appendix lists the expendable supplies and materials you will need while performing maintenance on the SEE/HMMH.

Appendix D—This appendix lists and describes any manufactured items you will need for performing maintenance on the SEE/HMMH.

Appendix E—This appendix describes the proper method of tightening fasteners.

Index—The index is an alphabetical listing of the contents of this manual.

Back Cover—The inside back cover contains a metric conversion table.

USING THE MANUAL ON THE JOB

Find the task or component that needs repair by using the LIST OF TASKS (page iii) or the Index (page Index-1), then turn to the page listed for that task or component.

Read the INITIAL SETUP procedures, and gather the necessary items and personnel. Pay attention to the warnings. The INITIAL SETUP sheet is described on page xiv.

Although tasks are complete in detail, complete only the part of the task required. For example, if your task is to replace both air cleaner elements, you need not perform the remainder of the task to remove and replace the air cleaner canister.

TM 5-2420-224-20-2

1

FORKLIFT REPLACEMENT

2 This task covers: a. Removal b. Installation

INITIAL SETUP

3 **Applicable Configuration:**

HMMH

4 **Tools and Special Equipment:**

Shop Equipment, SC 4910-95-CL-A74
Tool Kit, SC 5180-90-CL-N26
Stand (2), P/N 419 580 70 18

5 **Materials/Parts:**

Washer, Lock (2)

Caps and Plugs	**Appendix C, Item 7**
Rags	**Appendix C, Item 32**

6 **Personnel Required: (2)**

7 **References:**

TM 5-2420-224-10

8 **Equipment Condition:**

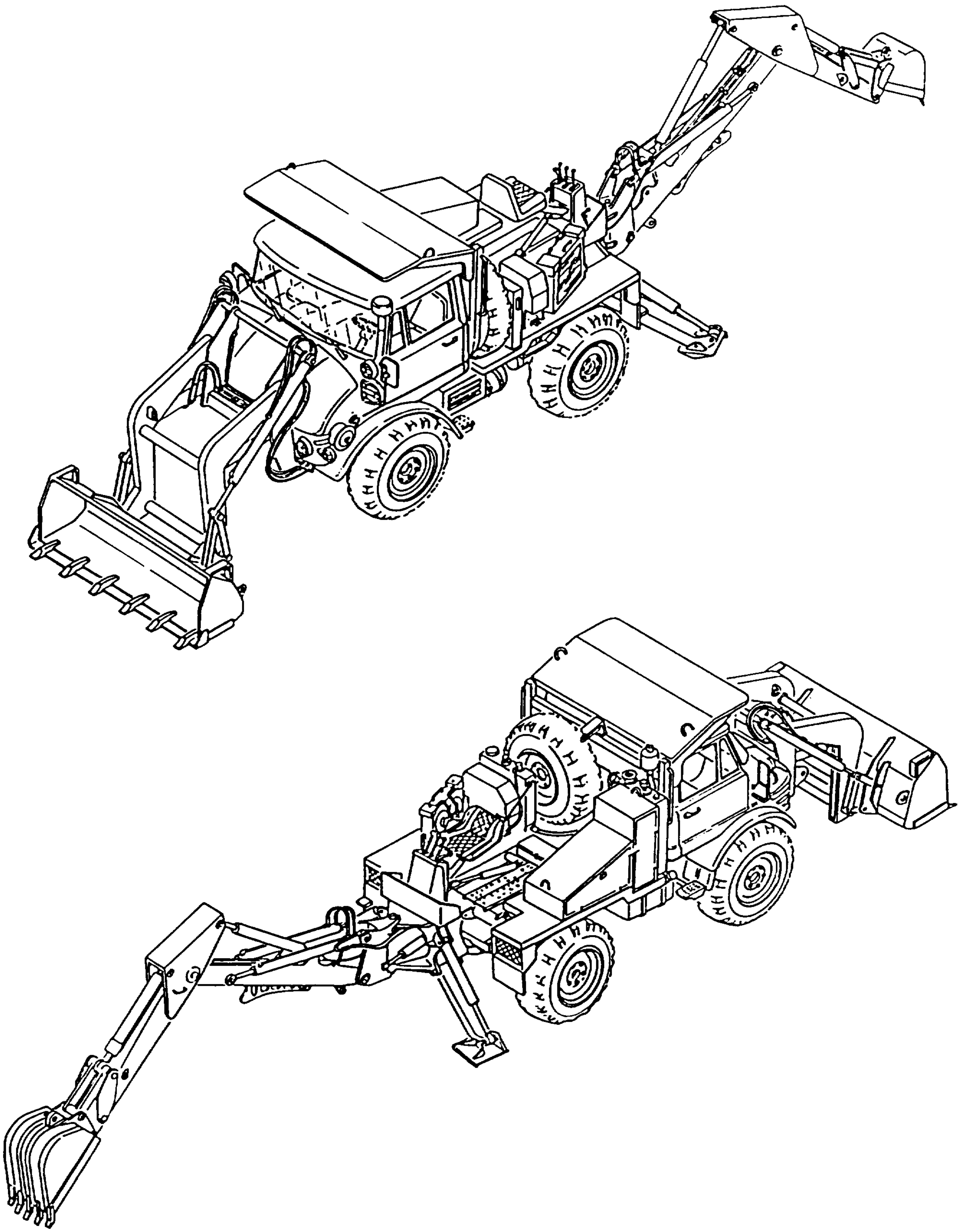
Reference	**Condition Description**
Page 2-23	**Hydraulic Pressure Relieved**

General Safety Instructions: 9

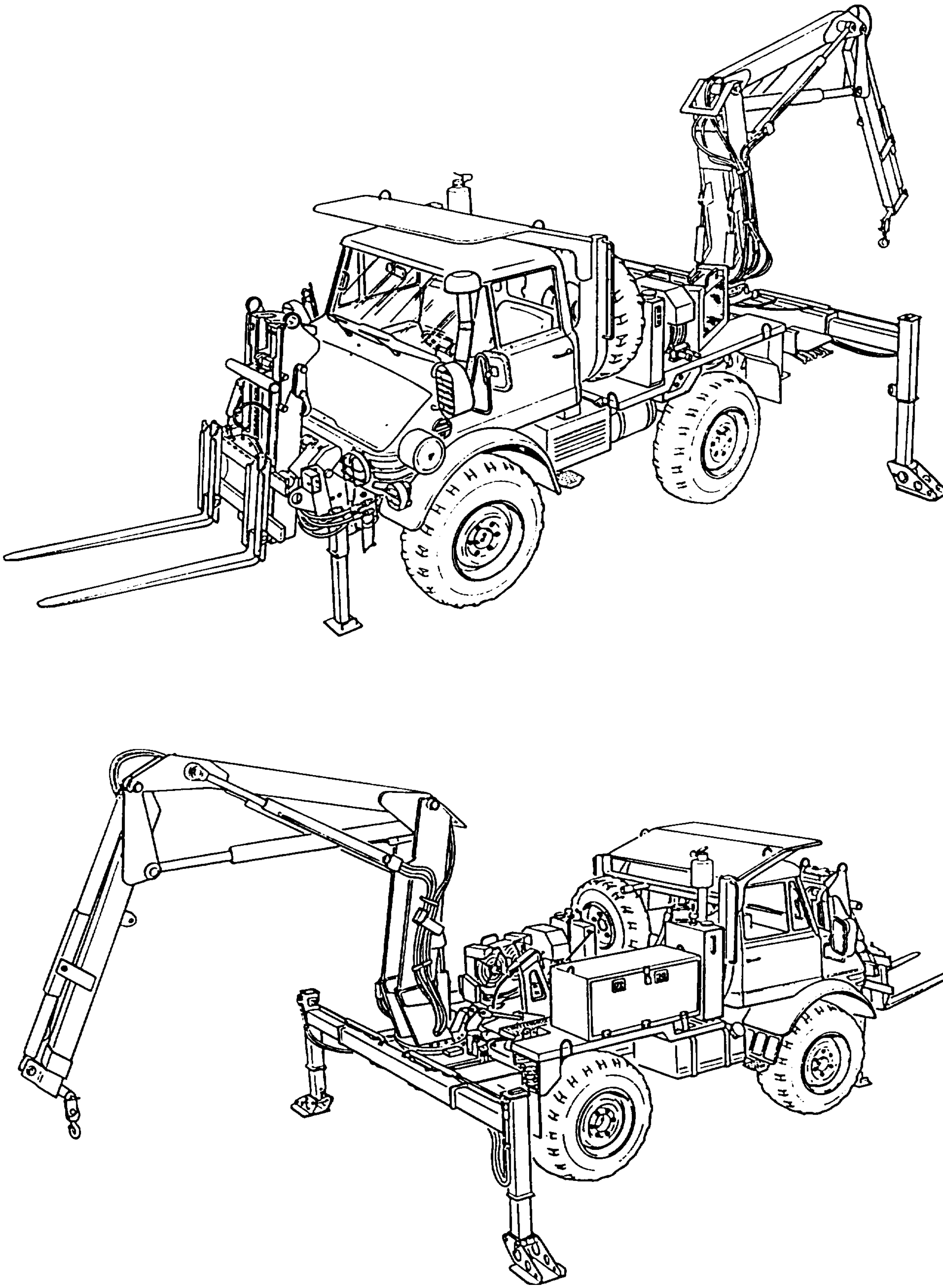
WARNING

- HMMH should not be operated with forklift removed, except in a maintenance facility. When maintenance is required and forklift is removed, never operate HMMH at speeds greater than 5 mph. Tractor stability and handling characteristics are greatly affected with forklift removed. This could cause loss of control and injury to personnel or damage to vehicle.
- High pressure hydraulics [oil under 2450 psi (26,893 kPa)] operate this equipment. Never disconnect any hydraulic fine or fitting without first dropping

1. TITLE—This is the name of the task.
2. TASK COVERS-This lists all the tasks included in the module.
3. APPLICABLE CONFIGURATION—If the task is applicable to only one of the vehicles. SEE or HMMH (as appropriate) will be listed here.
4. TOOLS AND SPECIAL EQUIPMENT—These are the tools and equipment you will need to do the task.
5. MATERIALS/PARTS—These are the supplies you will need to do the task. If parts or materials are required, they are listed here or referenced to Appendix C.
6. PERSONNEL REQUIRED-Personnel required to perform a task will be identified if the task requires more than one.
7. REFERENCES-These are the other technical publications you will need to do the task.
8. EQUIPMENT CONDITION—This is the condition(s) the vehicle must be in before you start the task. Other tasks that must be done first are listed by page number or by technical manual number if another manual is required.
9. GENERAL SAFETY INSTRUCTIONS—These are the safety precautions that must be observed while you are doing the task.
10. FOLLOW-ON MAINTENANCE—These are the tasks listed at the end of the procedure that must be completed to return the vehicle to an operational condition.



Small Emplacement Excavator (SEE)



High Mobility Material Handler (HMMH)

CHAPTER 1
INTRODUCTION

SCOPE

A list of sections contained in this chapter is shown below.

Section I. GENERAL INFORMATION

OVERVIEW

Type of Manual: Unit Maintenance.

Model Number and Equipment Name:

Model No. FLU419 Tractor, Wheeled, 4X4 DED Small Emplacement Excavator (SEE) with Attachments, NSN 2420-01-160-2754 (EIC:EDL).

Model No. FLU10344 Tractor, Wheeled, 4X4 DED High Mobility Material Handler (HMMH) with Attachments, NSN 2420-01-205-8636.

Purpose of Equipment:

The SEE is used for excavation, loading, lifting, and grading on various types of terrain. The vehicle is equipped with a front loader, backhoe, chain saw, pavement breaker, and hammer drill and is capable of rapid deployment for constructing protective positions.

The HMMH is used for material handling with forklift and crane attachments. The vehicle is equipped with an impact wrench to assist in maintenance of other equipment and is capable of rapid deployment.

MAINTENANCE FORMS, RECORDS, AND REPORTS

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).

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

When the tactical situation requires that Army materiel be abandoned, refer to TM 750-244-6, Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use, for procedures on destruction of the vehicle(s).

PREPARATION FOR STORAGE OR SHIPMENT

Instructions for storage and shipment, including administrative storage, are found in TM 740-90-1, MIL-V-62038D, and Chapter 2, Section VII.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

If your vehicle needs improvement, let us know. Send us a Quality Deficiency Report. 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 or performance. Put it on an SF Form 368 (QDR) and mail it to:

U.S. Tank-automotive and Armaments Command
Attn: AMSTA-TR-E/PQDR MS 267
6501 E. 11 Mile Road
Warren, MI 48397-5000

WARRANTY INFORMATION

The vehicles are warranted by Freightliner Corporation in accordance with TB 5-2420-224-15. Warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your unit maintenance shop.

METRIC SYSTEM

The equipment described herein contains metric components and requires metric common and special tools; therefore, metric units in addition to English units will be used throughout the manual. An English-to-metric conversion table is included as the last page of this manual inside the back cover.

Section II. EQUIPMENT DESCRIPTION AND DATA

OVERVIEW

This section contains information useful when performing unit level maintenance tasks on the SEE/HMMH. Refer to TM 5-2420-224-10 for additional equipment description and data.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

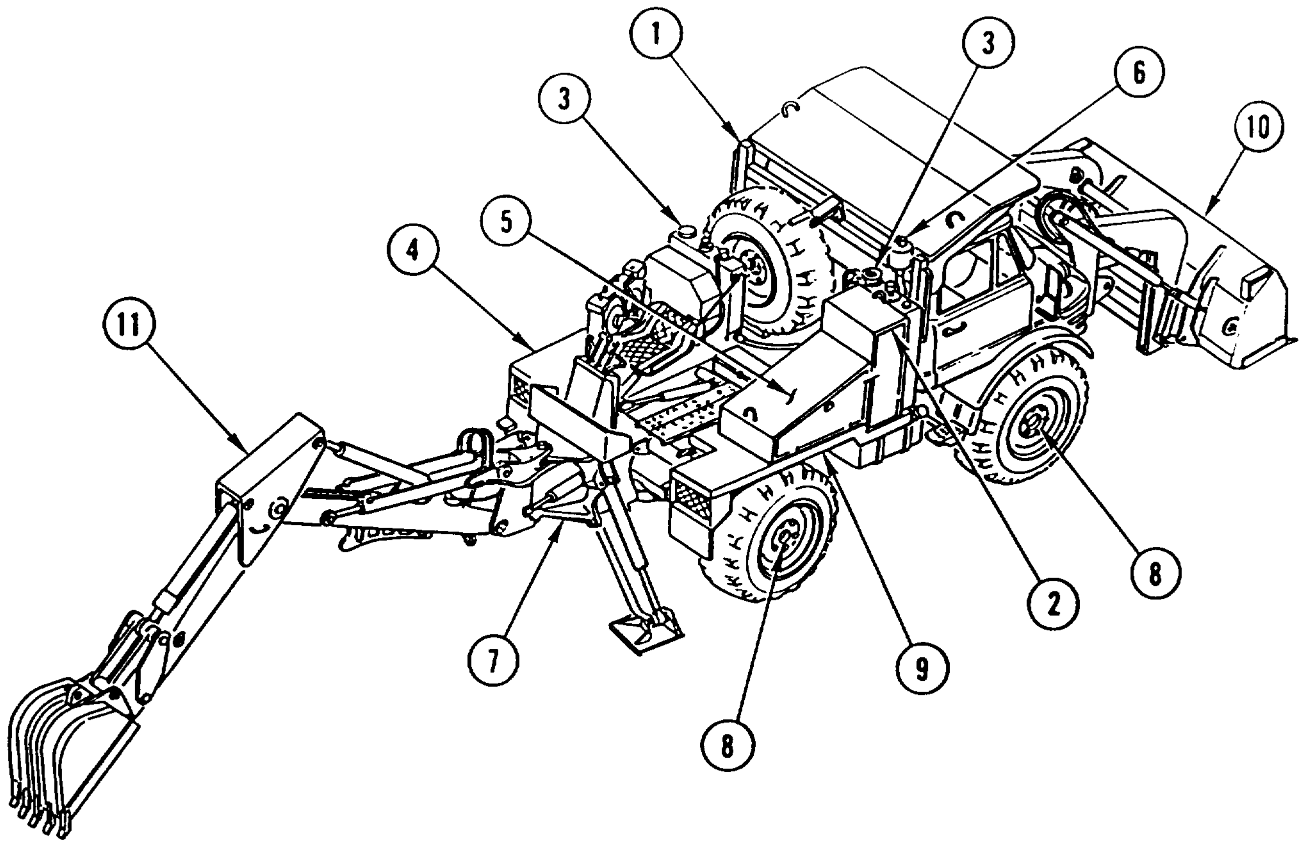
Characteristics

- Low center of gravity for stability
- Convoy speed
- Small turning radius
- 17-in. (43.2-cm) ground clearance under axles and frame
- Rapid deployment
- Multiple attachment versatility

Capabilities and Features

- Broad range of angles of approach and departure
- Four-wheel drive and differential locks on both axles can be engaged and disengaged while moving
- High-mounted air intake and vertical exhaust
- Traverse up and down 60% slopes and 30% side slopes
- 30-in. (76.2-cm) fording depth
- Power assisted disc brakes on all four wheels
- Power steering
- All steel cab
- Roll-Over Protective Structure (ROPS)
- Falling Objects Protective Structure (FOPS)
- Utility mounting platforms
- Trailer towing equipment
- Front loader/forklift or backhoe/crane and machine (hydraulic) tools can be operated simultaneously

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



ROLL-OVER PROTECTIVE STRUCTURE (ROPS) (1). Protects cab if vehicle roll-over occurs.

STOWAGE (2). Hydraulic tools and equipment.

HYDRAULIC SYSTEM (3). Belt driven front system and Power Take-Off (PTO) driven rear system, rated to power front loader/forklift, backhoe/crane, and machine tools.

UTILITY PLATFORM (4). Solid base, access backhoe operations.

BASIC ISSUE ITEMS (BII) TOOLS (5). Stored behind cab in hydraulic accessory box.

VERTICAL EXHAUST (6). Mounted behind cab.

TRAILER TOWING EQUIPMENT (7). Tow pintle with air brake and electrical connections.

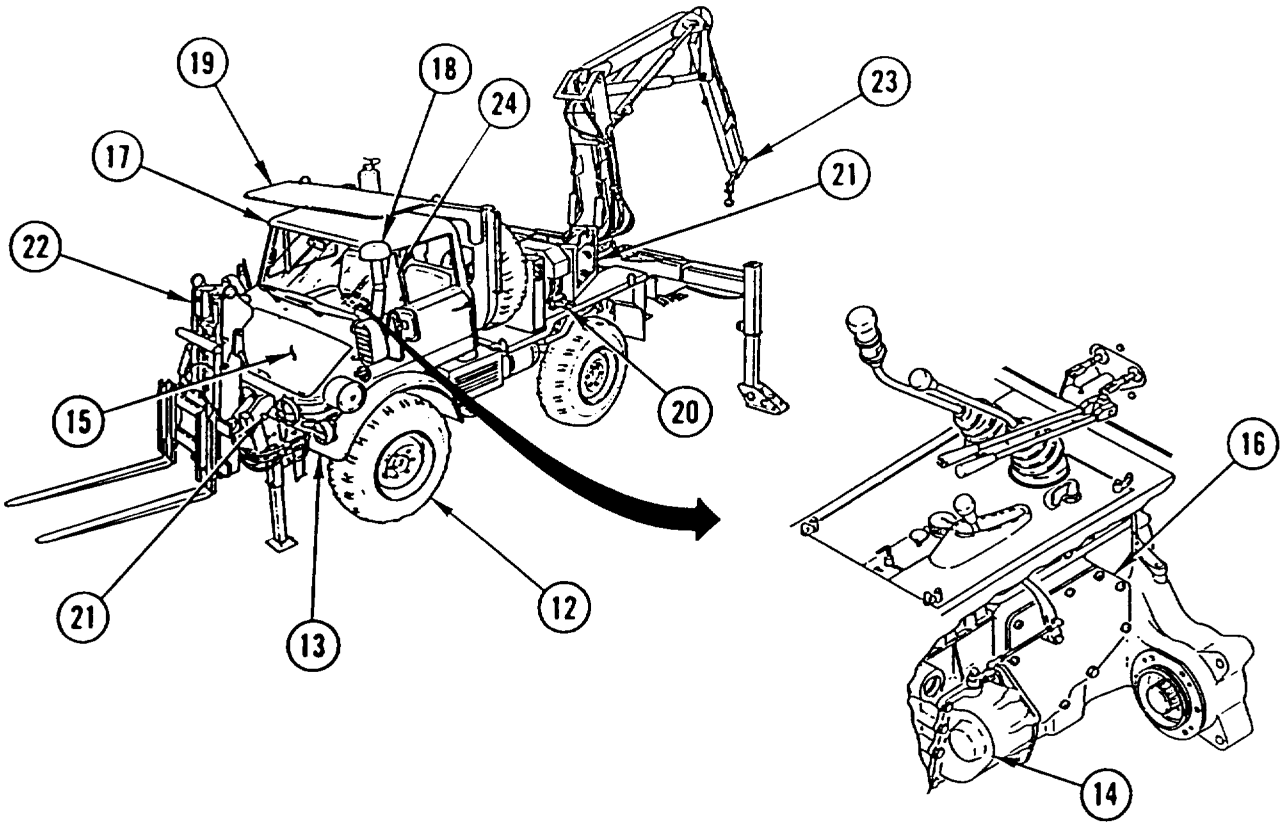
FOUR-WHEEL DRIVE (8). Four-wheel drive with differential lock, front and rear axles.

CHASSIS FRAME (9). Flexible, ladder-type, high-strength steel.

FRONT LOADER (SEE) (10). Used for excavating and filling excavations.

BACKHOE (SEE) (11). Digs excavations and trenches.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS (CONT)



MULTIPLE PURPOSE TIRES (MPT) (12). Low-pressure high-traction radial ply with mounted spare.

SUSPENSION (13). Coil springs, shock absorbers, and front suspension lockout cylinders on the HMMH.

POWER TAKE-OFF (PTO) (14). Supplies power to the rear hydraulic pump.

ENGINE (15). Four-stroke, six-cylinder diesel.

TRANSMISSION (16). Fully synchronized 16 forward, 8 reverse, and pneumatic preselect shift mechanism.

CAB (17). Two-person, all steel construction.

HIGH MOUNTED AIR INTAKE (18). Mounted on left front corner of cab.

FALLING OBJECTS PROTECTIVE STRUCTURE (FOPS) (19). Protects cab from falling objects.

HYDRAULIC TOOL COUPLINGS (20). Quick-disconnect type.

FRONT LOADER/FORKLIFT and BACKHOE/CRANE ATTACHMENT POINTS (21). One-person operation, easy installation and removal of front loader/forklift and backhoe/crane.

FORKLIFT (HMMH) (22). Loads and unloads palletized material.

CRANE (HMMH) (23). Lifts material for maintenance and supply operations.

FIRE EXTINGUISHER (24). Mounted between seats.

EQUIPMENT DIFFERENCES

SEE Tractor	HMMH Tractor
Front Loader	Suspension lockout system
Backhoe	Forklift
Chain saw	Crane
Pavement breaker	Impact wrench
Hammer drill	

EQUIPMENT DATA

Engine
- Manufacturer . . . . . Daimler-Benz
- Model 353.999
- Type . . . . . .4-stroke diesel, 6 cylinder
- Horsepower . . . . . .110(81kW

Clutch
- Type . . . . . Single dry plate

Engine Air Cleaner
- Manufacturer . . . . Donaldson
- Model FSGO9-0160
- Type . . . . . .Dry

Fuel System
- Fuel Pump
  - Manufacturer . . . . . .Bosch
  - Timing @ 700 rpm +50 . . . . Low idle
  - Injection Order 1-5-3-6-2-4
- Fuel Tank
  - Capacity . . . . . 30 gallons(114 l)

Cooling System
- Capacity . . . . . 6 gallons (23 l)

Electrical System
- Batteries
  - Number 2
  - Type . . . . Lead-acid
  - Voltage 12vdc
  - Connected . . . . . Series
  - Output . . . . . .24 vdc
  - Post to Ground . . . . . Negative
- Alternator
  - Manufacturer . . . . . .Bosch
  - Rating . . . .55 amps
  - Drive . . . . . Belt, by engine
- Starter
  - Manufacturer . . . . . .Bosch

Transmission
- Type . . . . . Fully synchronized
- Speeds . . . . . 16 forward, 8 reverse
- Power Take-Off . . . . . Engine driven

EQUIPMENT DATA (CONT)

Axles
- Type . . . . Portal with reduction thrust tubes
- Drive. 4-wheel

Suspension
- Springs . . . . Coil
- Shock Absorbers . . . . Telescopic
- Front Lockout . . . . Hydraulic actuated (HMMH)

Brakes
- Service
  - Type . . . . 4-wheel, dual-circuit disc/caliper
  - Power Actuated . . . . Hydraulic, air assist
  - Warning System . . . . Low-air pressure (audible and visual)
- Parking
  - Type . . . . Caliper, mechanical cable, rear wheels

Air Compressor
- Type . . . . Engine driven
- Cylinders 1
- Bore . . . . 3.03 inches (77 mm)
- Stroke . . . . 1.18 inches (30 mm)
- Capacity @ 2600 rpm . . . . 4.77 cfm (135 Ipm) @ 105 psi (724 kPa)

Wheels
- Type . . . . Interchangeable rim and wheel
- Tires . . . . 5 multipurpose
  - Size . . . . 12.5 R20 12 PR radial
  - Pressure . . . . Low
  - Track Width . . . . 64 inches (163 cm)

Steering
- Type . . . . Recirculating ball with power assist
- Power Steering Pump.... . . . . Belt, by engine

Hydraulic System
- Front (SEE)
  - Drive . . . . Engine
  - Capacity . . . . 8 gpm @ 2450 psi (30 lpm @ 167 bar) @ 2000 engine rpm
  - Use . . . . Front loader and machine tools
- Rear (SEE)
  - Drive . . . . PTO
  - Capacity . . . . 26 gpm @ 2450 psi (98 Ipm @ 167 bar) @ 2000 engine rpm
  - Use . . . . Backhoe

- Front (HMMH)
  - Drive . . . . Engine
  - Capacity . . . . 8 gpm @ 2450 psi (30 Ipm @ 167 bar) @ 2000 engine rpm
  - Use . . . . Forklift and impact wrench
- Rear (HMMH)
  - Drive . . . . PTO
  - Capacity . . . . 14 gpm @ 2450 psi (54 Ipm at 167 bar) @ 1100 engine rpm
  - Use . . . . Crane

SAFETY, CARE, AND HANDLING

Warnings and cautions are listed in the front of the manual, at the beginning of each task, and at points where they apply in the maintenance procedures. In addition to these warnings, always keep in mind the following when working on the SEE/HMMH:

- The hydraulic system operates at pressures up to 2450 psi (167 bar).
- Be aware of where personnel are at all times when operating front Ioader/forklift and backhoe/crane.
- Do not allow personnel to walk under a raised front loader/forklift or backhoe/crane either during operation or maintenance.
- Always remove all jewelry and wristwatch, and make sure the vehicle MASTER disconnect switch is OFF before working on the electrical system.

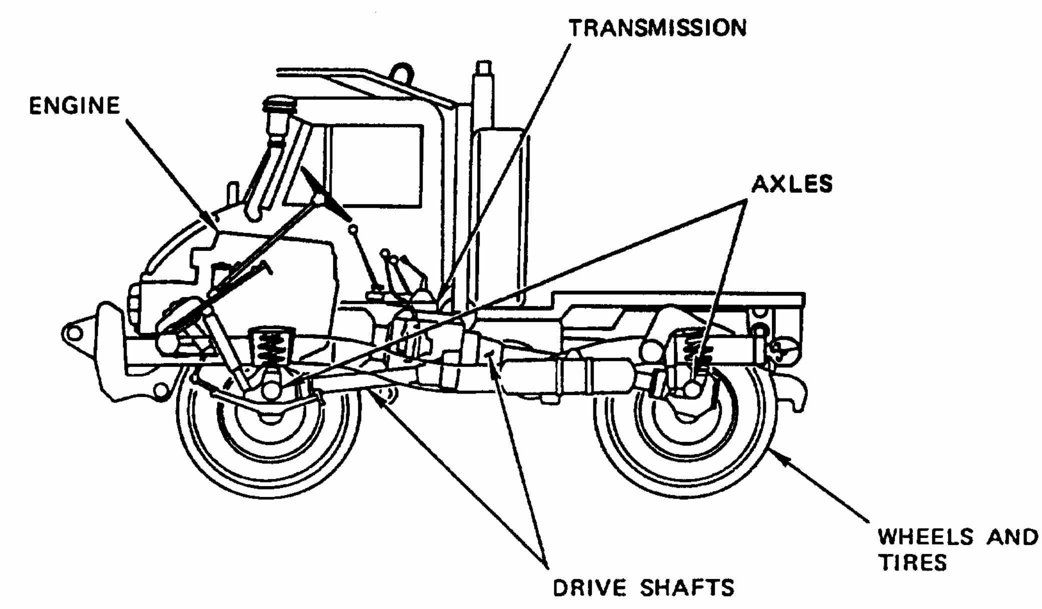
Section III. PRINCIPLES OF OPERATION

OVERVIEW

This section contains information on the principles of operation of the SEE/HMMH. The general functional description of the vehicle's separate systems is contained in this section. Unit maintenance personnel should be familiar with the principles of operation of these systems before working on or troubleshooting these systems. A more thorough understanding of the electrical system can be obtained by referring to the electrical system schematic diagrams In the troubleshooting section In Chapter 3. The systems and components are:

OVERVIEW (CONT)

POWER TRAIN



Engine. The engine is an in-line six cylinder, four stroke-cylinder direct injection starting, valve-in-head type diesel that develops 110 horsepower (81 kW). An ether injection system is connected to the air intake manifold to aid in cold weather starting. The engine is water-jacket cooled. An engine oil sampling valve is supplied to easily obtain a sample of the engine oil. (See page 2-14 for oil sampling procedures.)

Transmission. The transmission is manually operated with a single dry plate clutch. The main lever shifts all speeds no matter what gear range or intermediate speeds are preselected. Intermediate speed controls are main transmission reduction speeds and can be engaged and disengaged while driving in either forward or reverse. The group shift selector has three shifting functions: Range I, Range II, and Reverse. The Power Take-Off (PTO) lever engages and disengages the PTO when the clutch is fully depressed.

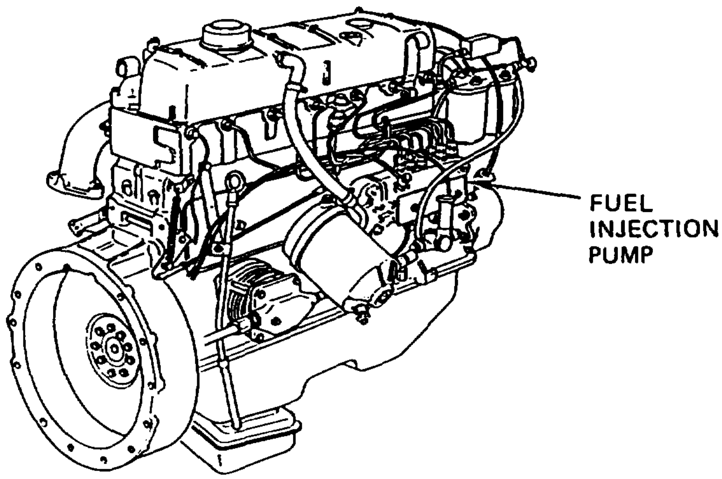
Drive Shafts. The purpose of the drive shafts is to transmit power to the axles from the transmission. The rear axle drive, four-wheel drive, and differential locks located on both axles can be engaged pneumatically while driving without interrupting the power flow.

POWER TRAIN (CONT)

Axles. There are two portal axles with hub reduction thrust tube mounted.

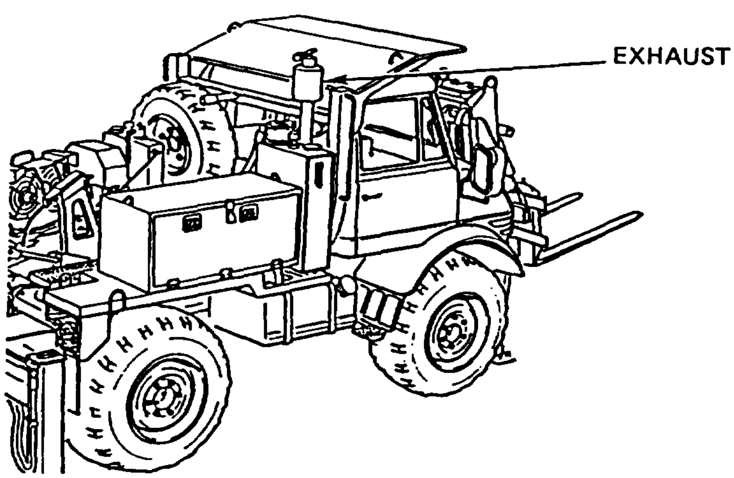
Wheels and Tires. Multipurpose tires are mounted on solid disc type wheels with the front and rear tires being equal in size. The rim size is 11.00-20, tire size is 12.5 R20 12 PR radial, and the track width is 64 in. (163 cm).

FUEL SYSTEM



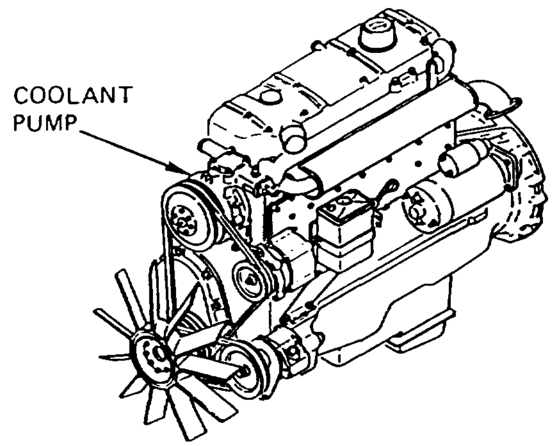
The fuel to power the engine is pumped out of the fuel tank by the fuel primer pump mounted on the fuel injection pump. The fuel pump is gear-driven directly from the engine camshaft. The fuel is filtered through a pre-sediment bowl and a primary and secondary fuel filter before it reaches the fuel injection pump, where it will be delivered to the fuel injectors. Fuel may be shut off near the tank with the shutoff valve.

EXHAUST SYSTEM



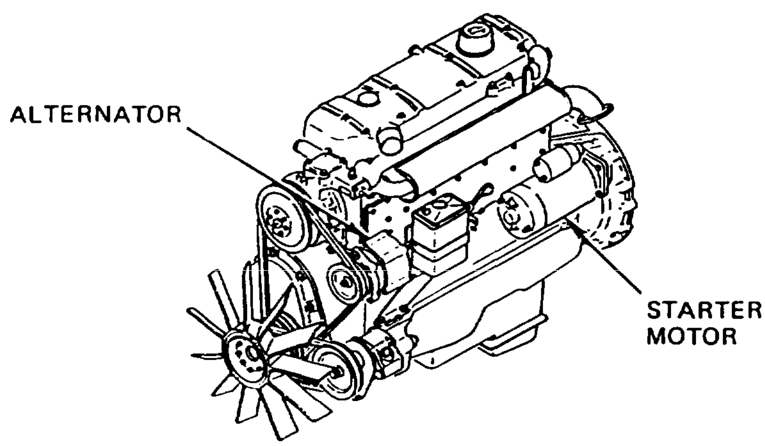
The exhaust system consists of an exhaust pipe from the manifold, a muffler, a vertical exhaust pipe, and a spark arrester.

COOLING SYSTEM



The coolant heated in the engine is circulated through the cooling system by an engine-driven coolant pump. The coolant is cooled in the coils of the radiator and any overflow is received in the expansion tank. The crankshaft-driven fan blows air through the radiator coils to aid cooling. The thermostat automatically regulates engine temperature by regulating the flow of heated coolant to the radiator.

ELECTRICAL SYSTEM



Alternator. The alternator is belt-driven at a speed sufficient to provide the electrical energy for the normal demands of the electrical system. Some of this energy is used to keep the batteries charged.

Starter Motor. The starter motor is located on the left rear side of the engine. It is activated by the start switch when the MASTER disconnect switch and power switch are on and the clutch is fully depressed.

Batteries. The two lead-acid batteries are mounted in a battery box located on the left side beneath the rear of the cab near the air reservoir tanks. The batteries provide electrical power to start the engine and supply power to the auxiliary circuit when the engine is stopped. A NATO-type slave receptacle is located next to the battery box to provide capability for a jump start from an auxiliary source if the batteries are too low to start the engine.

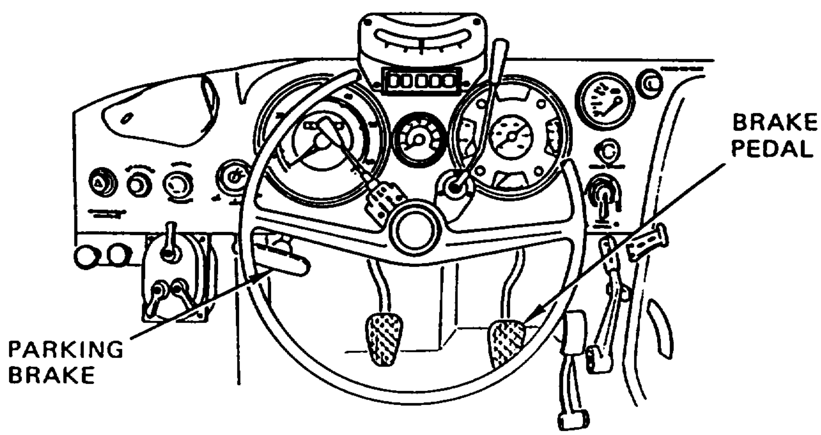
ELECTRICAL SYSTEM (CONT)

Switches and Gages. Refer to TM 5-2420-224-10 for the locations and detailed descriptions of the switches and gages.

Sending Units. The intermediate speed indicator is located on the right side of the transmission; the parking brake indicator is located on the cable lever at the center of the rear axle; the low air warning indicator is located on the air line to the trailer air brake valve; the Power Take-Off (PTO) indicator is located on the left side of the transmission housing at the PTO housing; the fuel level sending indicator is located on the right side top of the fuel tank; the neutral start switch indicator is located under the clutch pedal on the left side of the cab.

BRAKE SYSTEM

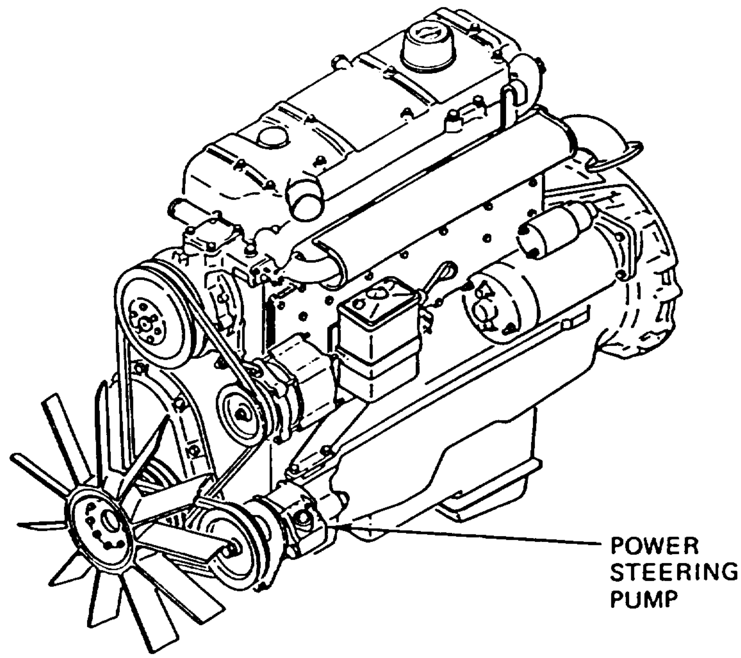
The vehicle is equipped with air-assisted hydraulic brakes. The dual circuit brake system utilizes four-wheel disc brakes with two calipers on each front wheel, one on each rear wheel, and a cable-operated parking brake at the rear.



Service Brakes. The service brakes consist of the brake booster, master cylinder, brake pedal, brake pads and discs, service brake warning light, and air pressure warning alarm.

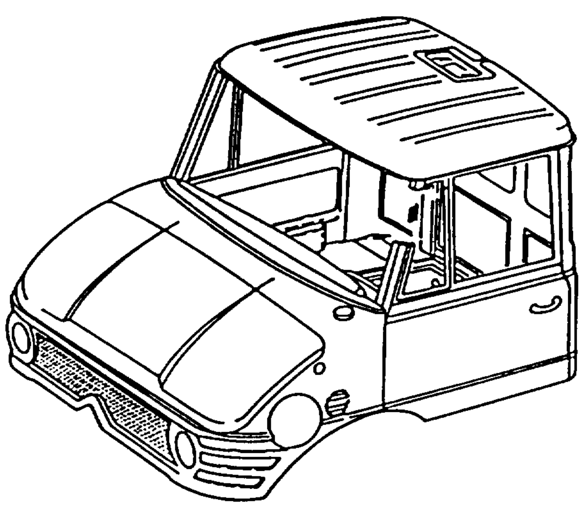
Parking Brake. A cable-actuated cam acts on the caliper brake on the rear wheel when the lever is pulled. There is also a parking brake warning light.

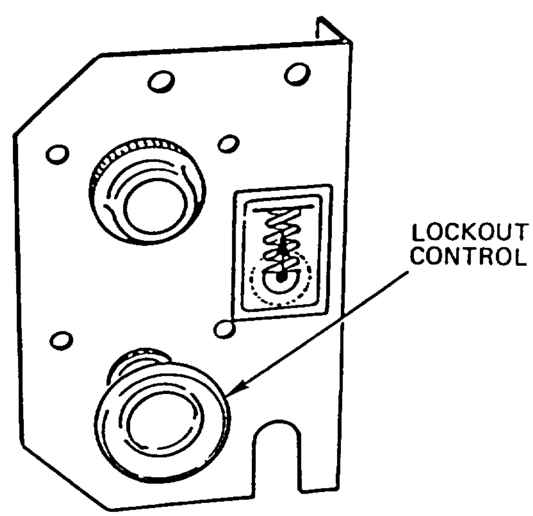
STEERING SYSTEM



Steering is hydraulically powered and consists of a V-belt driven power steering pump, tie rods, drag link, pitman arm, and hydraulic reservoir and filter.

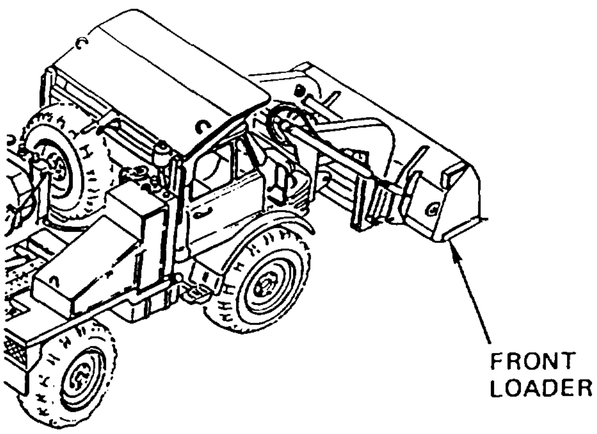
SUSPENSION

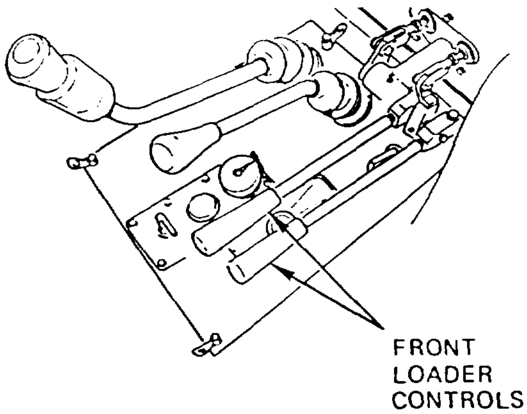




The suspension is mechanical and consists of coil springs, telescopic shock absorbers, and stabilizers. The HMMH uses a front suspension lockout system for use with forklift and crane operations.

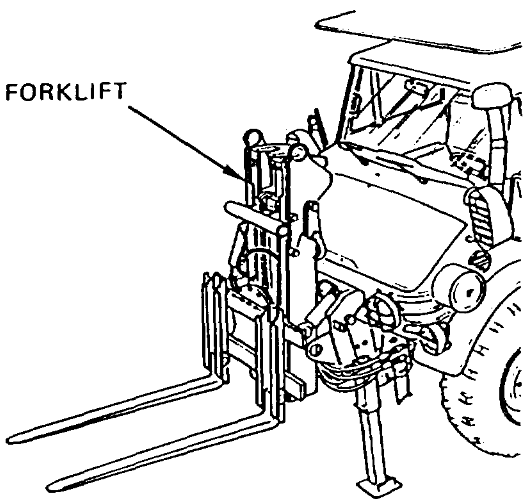
EARTHMOVING, MATERIAL HANDLING COMPONENTS AND CONTROLS

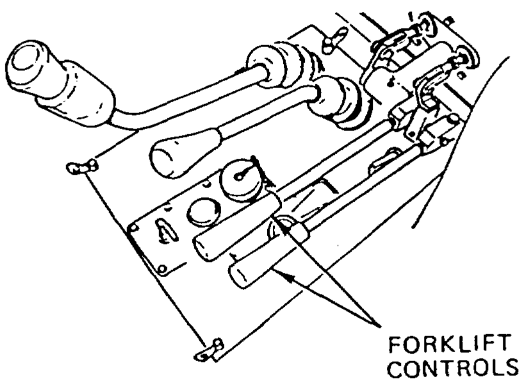




Front Loader (SEE). The front loader is used to scoop earth to construct fighting positions and artillery and missile emplacements, to grade surfaces, and to backfill excavations made with the backhoe.

Front Loader Controls (SEE). The front loader is equipped with two control levers located between the seats in the cab. Pull up on the left lever to raise the loader bucket, push down on the lever to lower the bucket, and push down past detent to activate the float feature. Pull up on the right lever to curl the loader bucket back, push down on the lever to curl the bucket down.

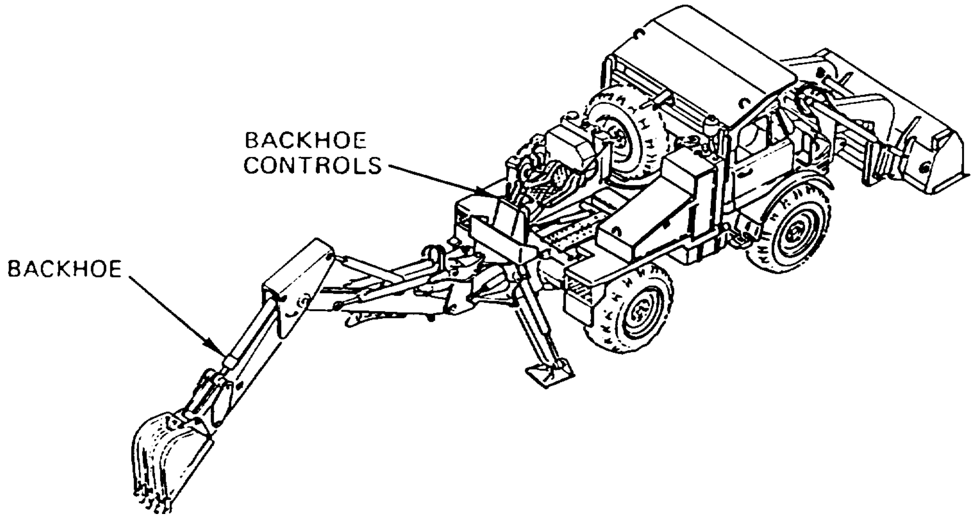




Forklift (HMMH). The forklift loads and unloads palletized cargo with the aid of the front suspension lockout system.

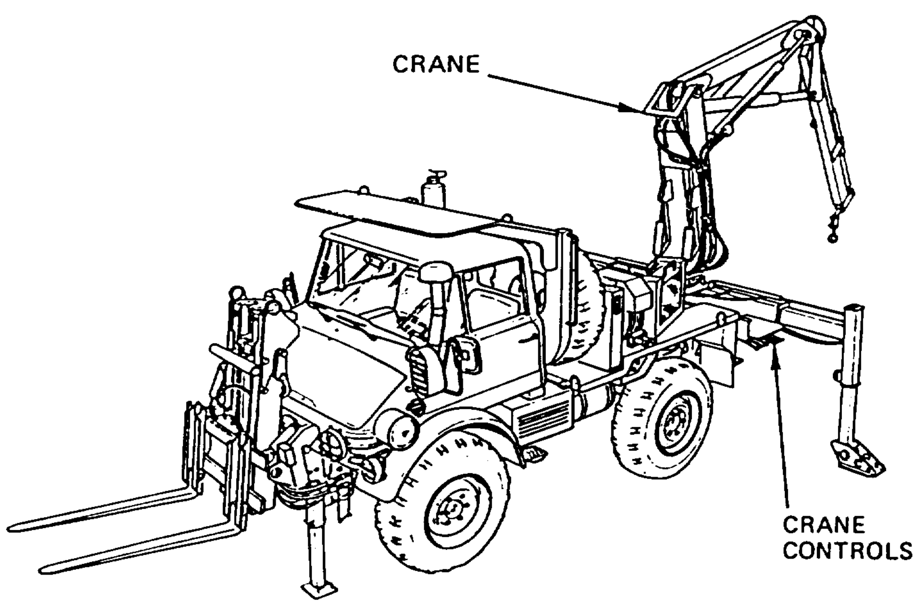
Forklift Controls (HMMH). The forklift is equipped with two control levers located between the seats in the cab. Pull up on the left lever to raise the mast, push down on the lever to lower the mast. Pull up on the right lever to tilt the mast back, push down on the lever to tilt the mast forward. Press the button on the right lever and pull up to rotate the carriage clockwise, press the button and push down to rotate the carriage counterclockwise.

EARTHMOVING, MATERIAL HANDLING COMPONENTS AND CONTROLS (CONT)



Backhoe (SEE). The backhoe is used to excavate trenches for fighting positions, communications, explosives, and power lines.

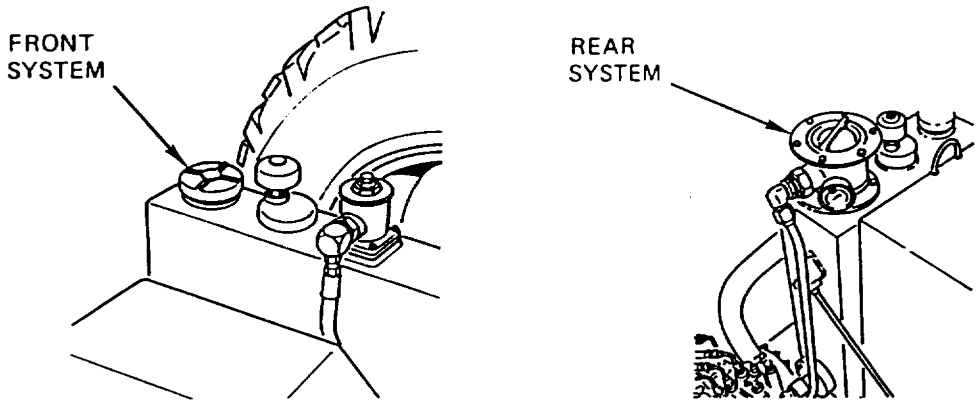
Backhoe Controls (SEE). The backhoe controls are located on the backhoe and operate the control cylinders. The backhoe controls consist of the stabilizer control levers, bucket control lever, dipper control lever, boom control lever, transport lock latch, and swing control pedals.



Crane (HMMH). The crane loads and unloads cargo and provides maintenance support in forward combat areas with the aid of the front suspension lockout system.

Crane Controls (HMMH). The crane controls are located on both sides of the vehicle when the crane is deployed. The crane controls consist of the mast folding lever, left outrigger vertical lever, right outrigger vertical lever, outrigger horizontal lever, boom extension lever, outer boom lever, inner boom lever, boom rotation lever, and latch levers.

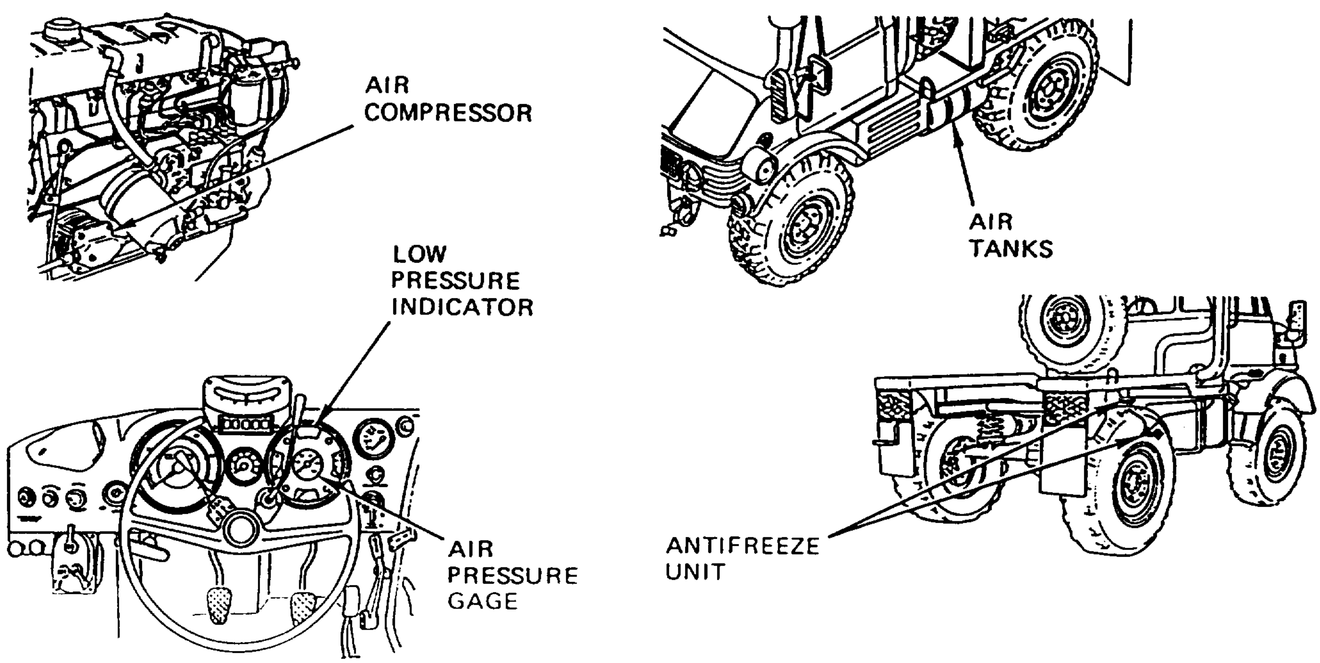
HYDRAULIC SYSTEM



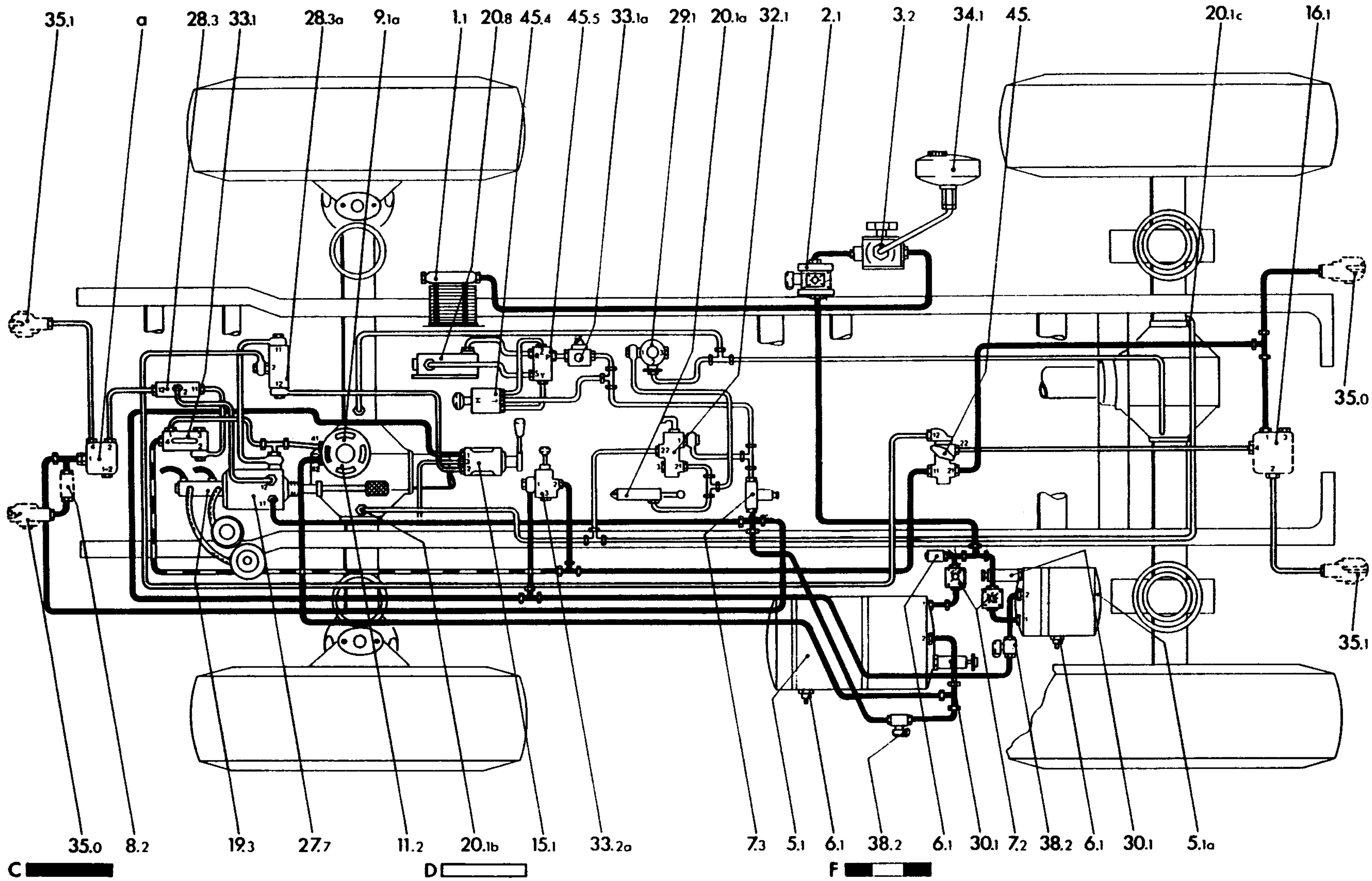
Front System. The front hydraulic system pump is belt-driven and supplies hydraulic fluid to the front loader/forklift and machine tools through an 11-gal (41.6-l) hydraulic tank located to the left rear of the cab.

Rear System. The rear hydraulic system pump is PTO-driven and supplies hydraulic fluid to the backhoe/crane through a 21-gal (79.4-l) hydraulic tank located to the right rear of the cab.

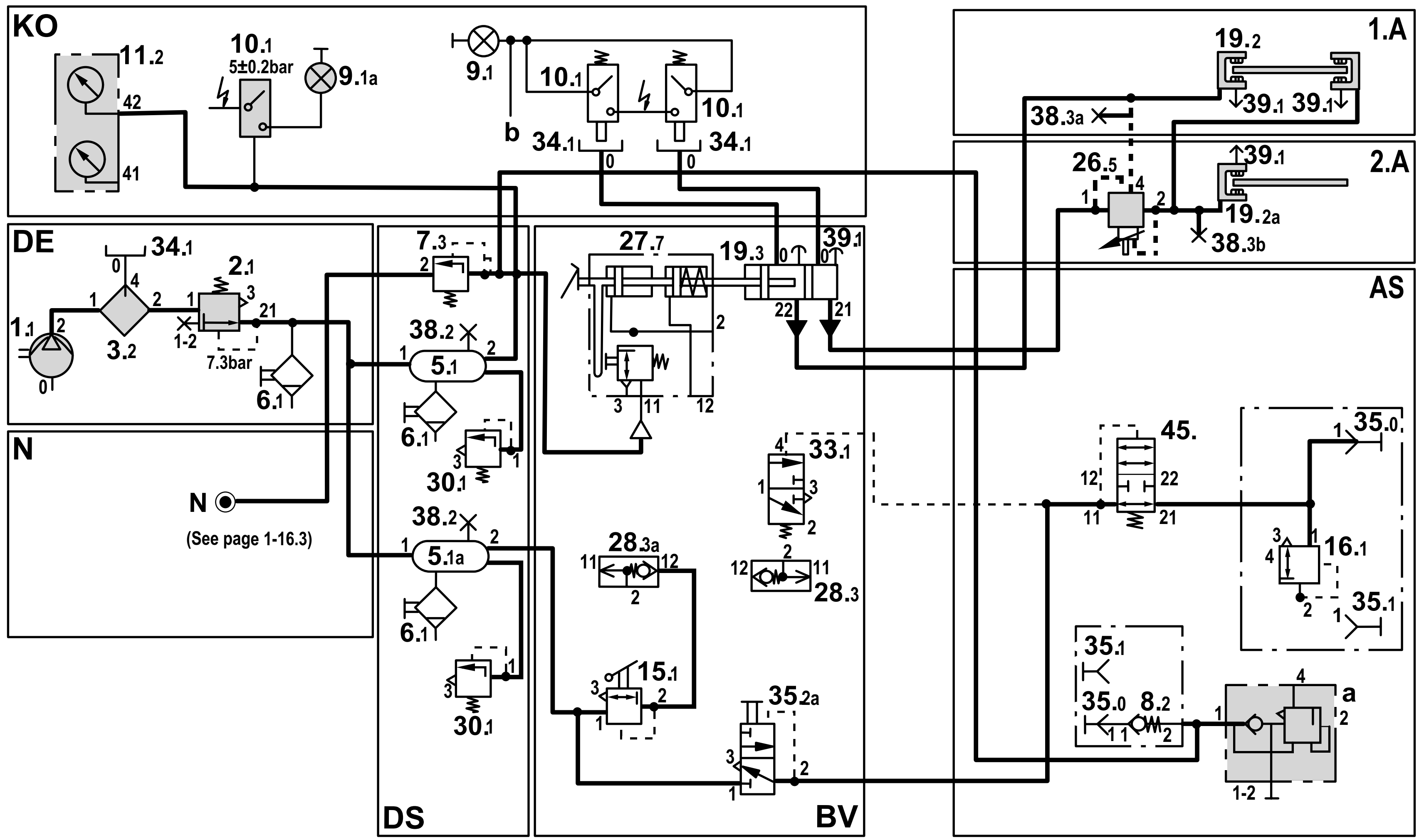
AIR SYSTEM



The air system consists of an air compressor, two air tanks, air pressure gage, low pressure indicator, low pressure buzzer, air pressure regulator, and compressed air anitfreeze unit.



Dual-circuit pneumatically air brake system and auxiliary loads, two-line trailer brake system.
For key, see 1-16.4.
For functional description, see 1-16.5 and 1-16.8.

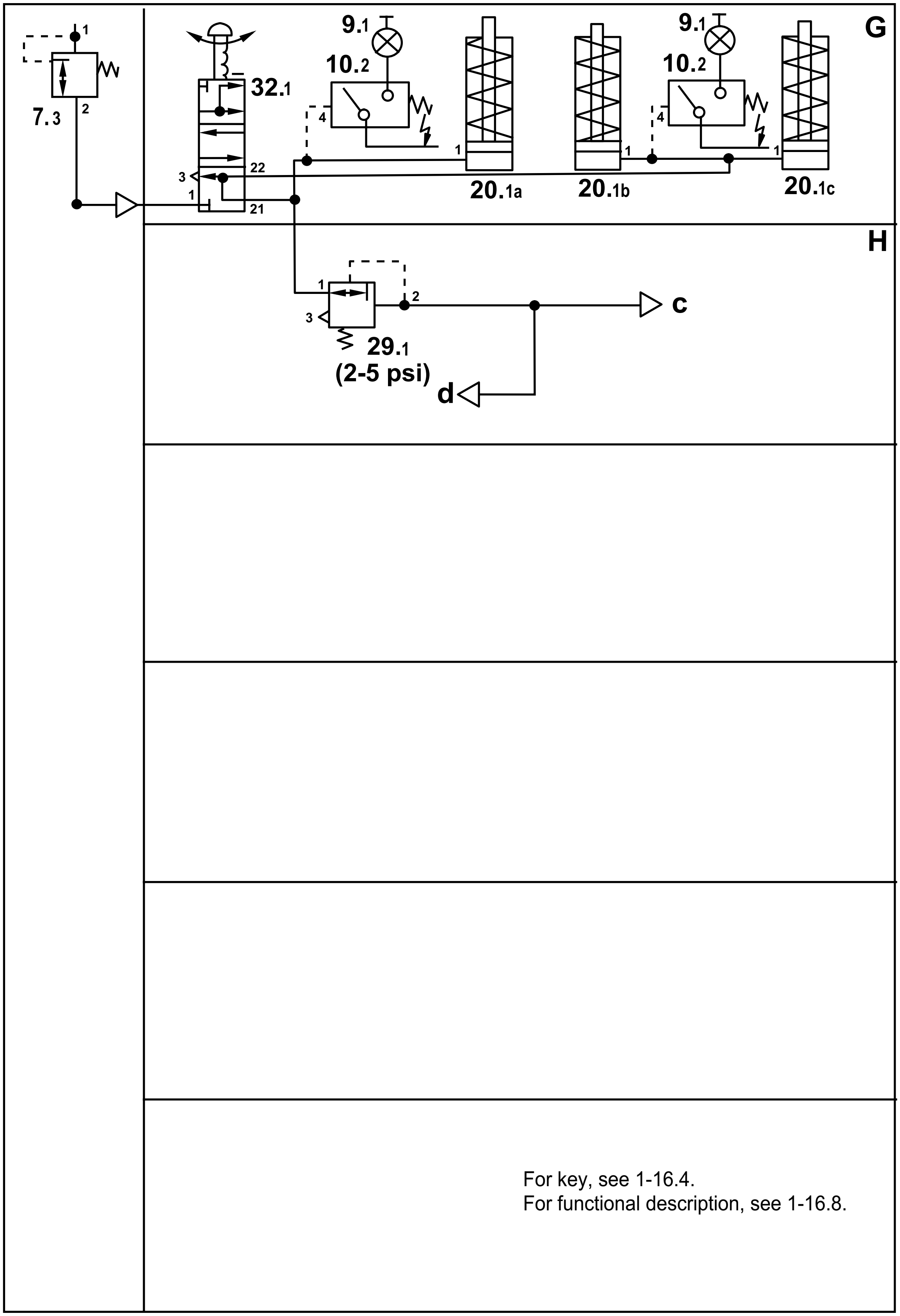


A B C F

Functional diagram of hydraulic and pneumatic air brake system.
For key, see 1-16.4.
For functional description, see 1-16.5.

AIR SYSTEM (CONT)

Functional Diagram of Auxiliary Loads



For key, see 1-16.4.
For functional description, see 1-16.8.

AIR SYSTEM (CONT)

Keys to Brake and Functional Diagrams

A	Hydraulic brake	**G**	Four-wheel drive and differential lock	**DS**	Pressure reservoir
B	Hydraulic control pressure	**H**	Axle vent	**BV**	Operating valves
C	Air supply pressure	**KO**	Indicator switch	**1.A**	1st axle
D	Brake dual-line assist and accessories	**DE**	Pressure generator	**2.A**	2nd axle
F	Control pressure - supply	**N**	Auxiliary load	**AS**	Trailer control

Number	Unit	Function/Description to 1-16.1 and 1-16.2
1.1	Compressor	Single-cylinder on engine
2.1	Pressure regulator	Cut-out pressure 7.35 bar (108 psi)
3.2	Antifreeze pump	Selectable
5.1	Pressure reservoir	27L supply pressure 7.35 bar (108 psi)
5.1a	Pressure reservoir	10L supply pressure 7.35 bar (108 psi)
6.1	Water separator	Standard
7.2	Overflow valve	With limited return flow
7.3	Overflow valve	Without return flow
8.2	Non-return valve	-
9.1a	Indicator, red in instrument cluster	Cut-in 5.0 bar (73.5 psi), cut-out 5.5 bar (81 psi)
9.1	Light indicator	Indicator lamp, brake fluid and parking brake
10.1	Off switch	Supply pressure tank 1
10.1a	Off switch	Supply pressure tank 2
10.2	On switch	For indicator lamps
11.2	Double pressure gauge	Supply pressure, both tanks 7.35 bar (108 psi)
15.1	Antijackknife brake valve	For trailer brake, graduated
16.1	Relay valve	For trailer brake
19.3	Tandem main brake cylinder	Dual-circuit
19.2	Fixed caliper	Disk brake, front
19.2a	Fixed caliper	Disk brake, rear
20.1a	Piston cylinder	Four-wheel shift on transmission
20.1b	Piston cylinder	Differential lock, front axle
20.1c	Piston cylinder	Differential lock, rear axle
26.5	ALB regulator	Brake force regulator (modulated via rear axle)
27.7	Brake booster	Selectable (twin chamber)
28.3	Check valve	Switchover for brake
28.3a	Check valve	Switchover, trailer operation
29.1	Pressure relief valve	For unit vent 0.35 bar (5 psi)
30.1	Safety valve	Four-wheel drive, differential lock
32.1	4/3-way valve	-
33.1	3/2-way valve	Switchover for brake booster
33.1a	3/2-way valve	Electrically actuated
33.2a	Safety valve	Vent and quick-release valve
34.1	Antifreeze reservoir	Approx. 0.5 l (1.05 pints) antifreeze
35.0	Coupling head, red	Supply (without shut-off valve)
35.1	Coupling head, yellow	Brake (without shut-off valve)
38.2	Test connection	For tire inflation connection
38.3a	Test connection, hydraulic brake	ALB-regulator, brake circuit unregulated
38.3b	Test connection, hydraulic brake	ALB-regulator, brake circuit regulated
39.1	Vent point	Hydraulic brake
45.	4/2-way valve	Trailer protection valve
45.4	Shift lever valve	Shift, intermediate speeds-main speeds
45.5	Control valve	Shift, intermediate speeds (L)-main speeds (H)
a	Protection/relay valve	For towing operation
b	Connection electrically	Indicator lamp, mechanically parking brake
c	Axle vent	Rear axle, approx. 0.4 bar (6 psi)
d	Axle vent	Front axle, approx. 0.4 bar (6 psi)

AIR SYSTEM (CONT)

Functional Description of the Dual-Circuit Air Brake System

The compressed air generated by the engine compressor (1.1) is directed to the antifreeze pump (3.2) from which it reaches the pressure regulator (2.1) automatically mixed with antifreeze during winter operation.

The pressure regulator filters the air and limits the system pressure to 107 PSI/7.35 bar (operating pressure). The pressure regulator is equipped with an inflation connection. For inflating tires, the operating pressure is reduced below 87 PSI/6.0 bar (cut-in pressure of the pressure of the pressure regulator 90 PSI/6.2 bar).

The two air tanks (5.1), 27 l capacity, and (5.1a), 10 l capacity, are filled simultaneously. The air tanks are equipped with safety valves (30.1) which open in the case of fault or at excess pressure (approx. 131 PSI/9.0 bar).

Two overflow valves (7.2) maintain the pressure in the air tanks. From a pressure of 75 PSI/5.2 bar, both tanks are connected by means of overflow.

A test connection is provided at each output of the pressure tanks.

Compressed air can be obtained at both the pressure regulator and at the pressure tanks.

The air tank (5.1) contains supply pressure for the trailer brake booster (27.2), the trailer protection valve (a) and the auxiliary consumers. Air tank pressure is indicated by means of a dual pressure gauge (11.2) and monitored via a warning light (9.1) and a warning buzzer.

The air tank (5.1a) provides compressed air to the trailer brake system, the antijackknife brake valve (15.1) and the safety valve (33.2).

For trailer operation, this valve (33.2a) is actuated-depressed by hand (push to supply trailer). The supply pressure flows to the trailer protection valve (45.) and from there further via the shut-off valve (8.3) and coupling head (35.0) to the trailer.

(See trailer operation)

AIR SYSTEM (CONT)

Single Operation

The pressure in the hydraulic dual-circuit brake system is assisted by the brake booster (27.7).

The brake booster (27.7) is designed as a twin chamber brake booster which transmits its full volume during single operation.

For trailer operation, the outer chamber is cut out, thereby reducing the effect of the brake booster to approx. 70%.

Pressure is applied to the double main brake cylinder (19.3) when the service brake is operated. At the same time, air is allowed to enter the brake booster (27.7).

From output (2) of the brake booster, the compressed air flows further to the shuttle valve (28.3a), leaves output (2) and then reaches the trailer protection valve (45.) input (12). This valve is ineffective when not in trailer operation.

This is also the case when the antijackknife brake valve (15.1) is actuated.

Without trailer operation, the air system only has an indirect function for the brake booster (27.7) and for the auxiliary consumers.

(Refer to auxiliary consumers.)

Trailer Operation

The trailer will be provided with compressed air after coupling the supply and brake lines.

However, supply air flows to the trailer only when the safety valve (33.2) is actuated.

The actuating knob is depressed (push to supply trailer) until it remains in this position on its own accord (After approx. 2.8 bar pressure increase).

As a result of this pressure increase, the passage for the control pressure into the relay valve (16.1) is opened in the trailer protection valve (45.).

AIR SYSTEM (CONT)

The valve (16.1) enables fast entry and escape of air in the trailer brake system and maintains the control pressure in the case of leakage in the trailer brake line.

When the safety valve (33.2a) is actuated, supply air also flows to the changeover valve (33.1) on the brake booster.

This valve has the task of disconnecting the outer chamber of the brake booster (27.7) as already described.

The reduction of the power assistance causes an improvement in braking characteristics during trailer operation.

The antijackknife brake valve (15.1) is an additional service brake valve which only acts on the trailer. Its function can be graduated and is used particularly for braking the trailer on slight inclines, with the service brake in the tractor unit not being used along side this brake.

The parking brake in the tractor vehicle acts mechanically on the rear wheels and has no effect on the trailer.

When a vehicle with trailer is parked, both the vehicle and the trailer must be braked by means of its own parking brake.

Towing

The vehicle is equipped with a brake system which permits compressed air supply from the towing vehicle, i.e., the system can be pressurized with supply air and braked from a towing vehicle, making it possible to maintain almost the same operating conditions as in the case of an intact vehicle.

In this case, supply air flows via the front connection (35.0) to the large air tank; in this way, the auxiliary loads are also supplied.

Control air flows to the brake valve (A) via the coupling head (35.1). The shuttle valve (28.3) is reversed by connection (2). In this way, the brake booster (27.7) is actuated via connection (4), i.e., only the outer booster chamber is effective.

AIR SYSTEM (CONT)

Functional Description Auxiliary Loads N

The auxiliary loads include:

- Four-wheel drive and differential locks (G)
- Axle vent (H)
- Intermediate speed shift (J)

The compressed air supply of the brake system has priority, i.e., a minimum pressure of approx. 80 PSI/5.5 bar is first made available to the brake system.

From a pressure of 80 PSI/5.5 bar, the auxiliary loads receive their supply via the overflow valve (7.3) up to an operating pressure of 107 PSI/7.35 bar.

Four-Wheel Drive – Differential Locks

The four-wheel drive is engaged in the transmission in position (1) of the changeover valve (32.1). In position (2) the differential locks of the axles are **additionally** activated.

Axle Vent

In both positions (1 and 2), the axles receive a compressed air supply at slight pressure for fording purposes.

This takes place by means of the pressure relief valve (29.1). The pressure is approx. 5 PSI/0.35 bar.

Intermediate Speed Shift

The intermediate speeds are pneumatically shifted with the aid of the shift lever valve (45.4).

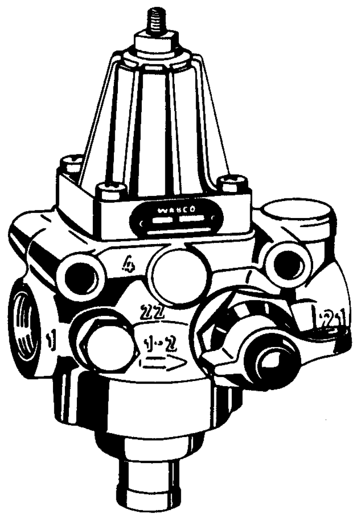
The control valve (45.5) provides the corresponding control pulses for air entry and escape in the shift cylinder (20.8) in the cascade box.

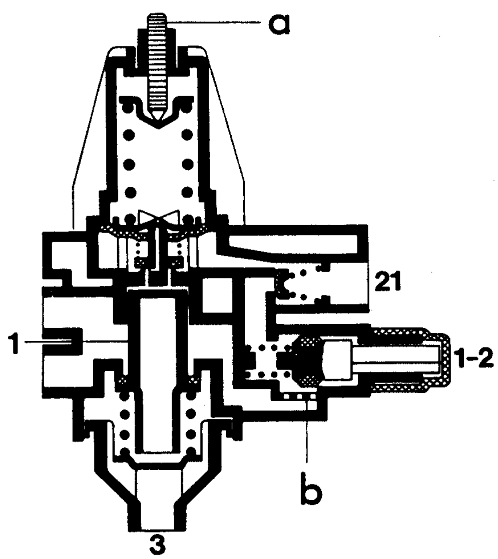
The solenoid valve (33.1a) releases the supply air to the control valve (45.5) only when the clutch is operated in order to shift speeds.

The valve (33.1a) is electronically actuated after the clutch pedal has been fully depressed down to the contact switch.

AIR SYSTEM (CONT)

Description of the Brake Units and Technical Data





1 Inlet
21 Outlet
3 Vent
1-2 Tire inflation connection
a Adjusting screw
b Filter

Pressure Regulator 2.1

With air filter and tire inflation connection.

Task

Automatic control of operating pressure within the brake system.

The regulator prevents dirt from entering the pipelines and valves. Automatically switched anti-freeze pump during winter operation

Technical Data

Operating pressure	PSI/bar
Cut-out pressure	107 PSI/bar 7.35
Cut-in pressure	90 PSI/bar 6.2
Switchover interval	17 PSI/bar 1.2

AIR SYSTEM (CONT)

Antifreeze Pump (3.2)

Technical Data

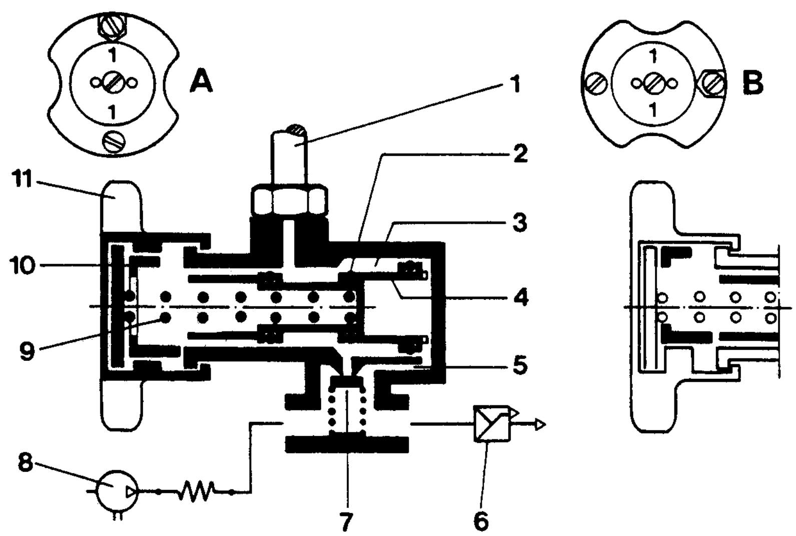
Temperature range	-40°		
Operating pressure max. bar 20 min. bar 6			
Delivered capacity		Position 0	1
Per stroke cm^3		Off	0.5
Reservoir capacity l	0.5		
Antifreeze: ethylalcohol			

Task

By means of automatic metering, the pump injects antifreeze into the flow of air from the compressor, thereby preventing icing in the entire system.

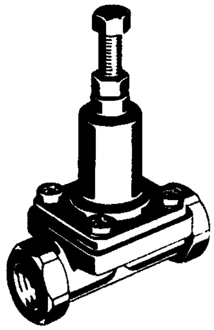
Function

During the cut-out phase of the pressure regulator, a corresponding amount of antifreeze is supplied. When the pressure regulator (2.1) switches over to the delivery position, antifreeze is injected into the brake system via the non-return valve (7).



1 = Supply
2 = Seal
3 = Ring chamber
4 = Piston
5 = Channel
6 = Pressure reg.
7 = Non-return valve
8 = Compressor
9 = Compression spring
10 = Stop
11 = Rotary knob
A = On
B = Off

AIR SYSTEM (CONT)

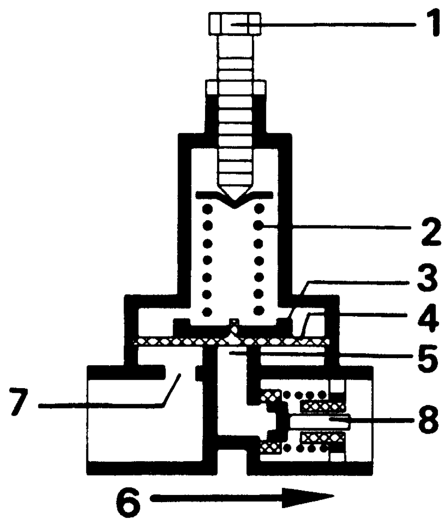


Overflow Valve
(With limited return flow) (7.2)
(Without return flow) (7.3)

Task

(7.3) Maintains brake priority in the brake system. Overflow from a pressure of 5.5 bar for all auxiliary loads.

(7.2) Overflow from 5.2 bar in the case of excessively high compressed air consumption to an air tank and pressure safeguard.



1 Adjusting screw
2 Adjusting spring
3 Piston
4 Diaphragm
5 Overflow channel
6 Direction of flow
7 Inlet hole
8 Check valve (only on accessory overflow valve)

Technical Data

Operating pressure	145 PSI/bar max. 10
Overflow pressure	80 PSI/bar 5.5
Connections	M 22 x 1.5

Overflow pressure for large and small tank valves is 75 PSI/5.2 bar.

Note: Observe direction of arrow for installation of accessory overflow valve.

The overflow pressure can be corrected by turning the adjusting screw (1). To increase overflow pressure, turn adjusting screw in clockwise direction.

AIR SYSTEM (CONT)

Non-Return Valve (8.2)

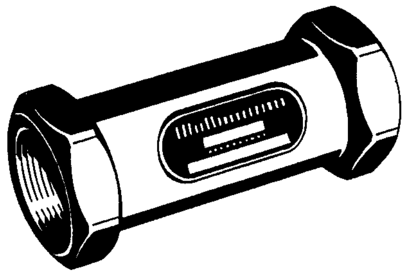
Task

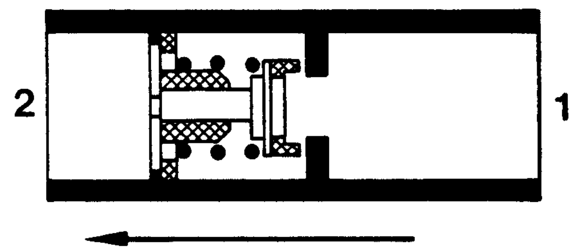
Safeguarding lines and reservoirs under pressure from depressurizing unintentionally.

Note: Observe direction of arrow for installation.

Technical Data

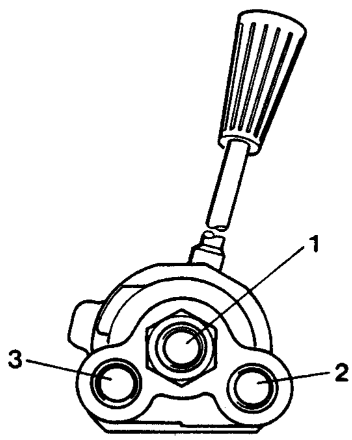
Operating pressure	290 PSI/max. bar 20
Connections	M 22 x 1.5





1 Inlet
2 Outlet

AIR SYSTEM (CONT)



1 Connection supply
2 Connection brake
3 Connection vent

Antijackknife Brake Valve (15.1)
With vent

Task

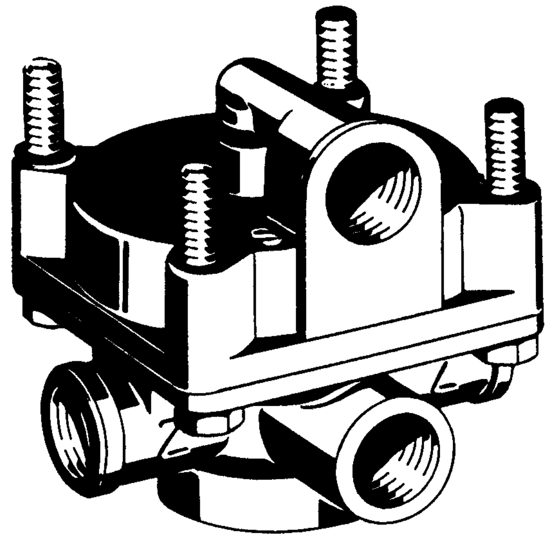
Graduated hand brake valve for the service brake of the trailer in the form of a separate trailer brake control (not for trailer parking brake).

Technical Data

Operating pressure	107 PSI/bar 7.35
Connections	1/4”

AIR SYSTEM (CONT)

Relay Valve (16.1)



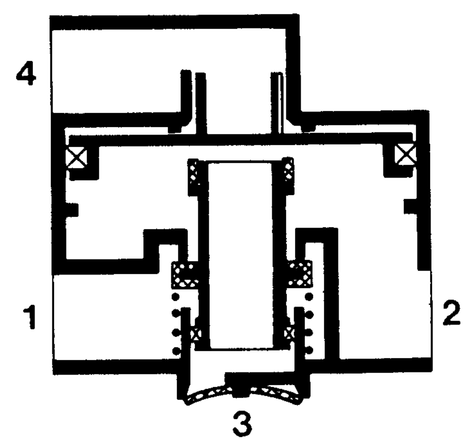
Task

Fast air entry and escape in the trailer brake, as well as shortened response and threshold time during braking.

Maintaining the control pressure in the case of leakage in the trailer brake line.

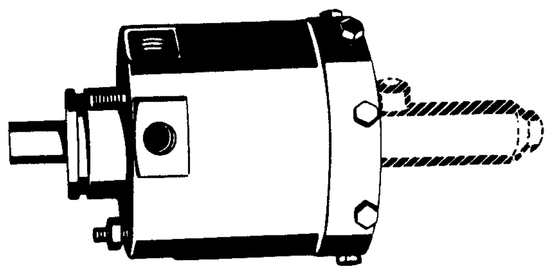
Technical Data

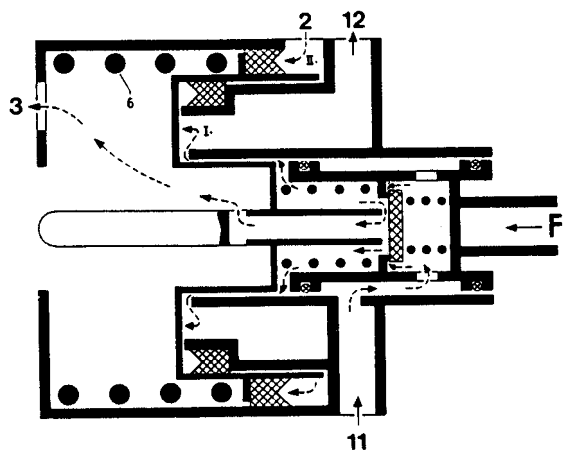
Operating pressure	116 PSI/bar 8.0
Connections	M 22 x 1.5



1 Inlet supply air
2 Outlet brake-trailer
3 Vent
4 Control pressure, brake

AIR SYSTEM (CONT)





Schematic Diagram of Brake Booster

F	Actuating brake pedal
2	Control line outside ring-housing
3	Vent
11	Connection, supply
12	Control line, inside ring-housing

Single-Circuit Brake Booster (27.7)

Full brake boosting effect stage I and II.

Reduced brake boosting effect stage I.

Task

Boosting the hydraulic brake pressure with automatic switchover to reduced boosting effect for trailer operation.

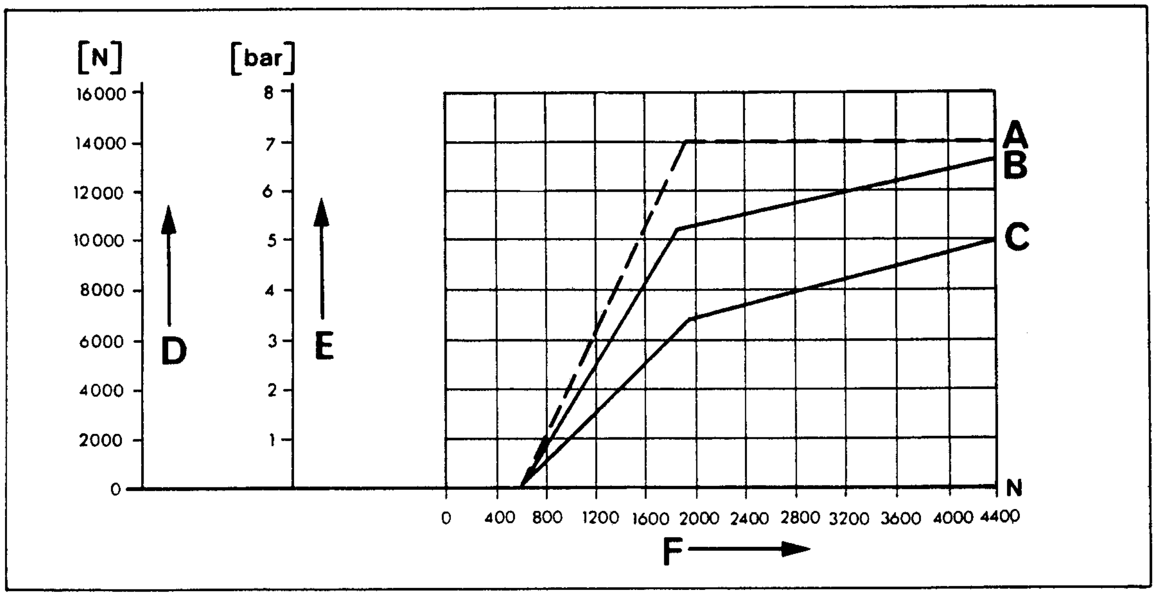
The switchover takes place by means of the supply pressure to the trailer which cuts out the outer ring chamber in the brake booster via the 3/2-way valve (33.1).

Technical Data

Operating pressure max.	116 PSI/bar 8.0
Response pressure approx.	6 PSI/bar 0.4
Piston stroke	mm 37
Piston diameter	mm 150
Connections mm	M 18 x 1.5

AIR SYSTEM (CONT)

Single-Circuit Brake Booster (27.7)
Function Diagram

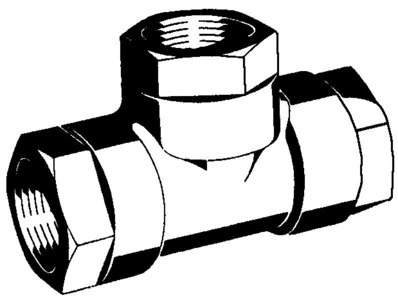


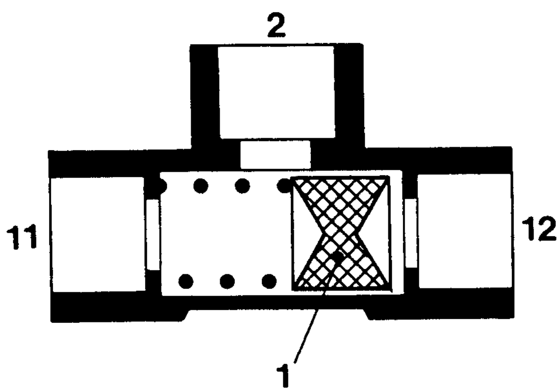
A Compressed air at port 2 or 12 of brake booster
B Piston force for single operation
C Piston force for trailer operation (reduce to 70%)
D Piston force actuated
E Pressure on connection 2 and 12
F Actuating force pedal

Important Information

The travel of the foot brake pedal must be set to ensure that the minimum push rod travel is always achieved, so that the trailer brake line can be fully actuated in the case of damage in the pneumatic brake system. Between the piston of the hydraulic master brake cylinder and the piston rod of the single-chamber brake booster, there must be **a minimum clearance of 1 mm** in the released position to ensure that the equalizing hole in the master cylinder is clear. Under no circumstances must the stroke of the master cylinder be shorter than that of the brake booster, otherwise the inner parts of the master brake cylinder would be damaged. When the brake is correctly adjusted, the piston stroke is approx. 1/3 of the total specified stroke.

AIR SYSTEM (CONT)





1 Piston valve
2 Outlet
11 Inlet 1
12 Inlet 2

Shuttle Valve (28.3 and 28.3a)

Two-way directional control valve, preloaded.

Task

This valve is used for changing over the pilot control flow during varying operating conditions, i.e., switchover of the brake booster for trailer operation, either via the antijackknife brake valve or the service brake.

Technical Data

Operating pressure max.	145 PSI/bar 10
Opening pressure from	1 PSI/bar 0.1
Connections mm	M 14/16 x 1.5

AIR SYSTEM (CONT)

Safety Valve (30.1)

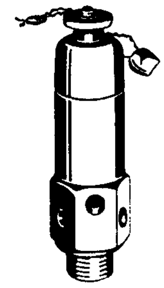
(Dustproof)

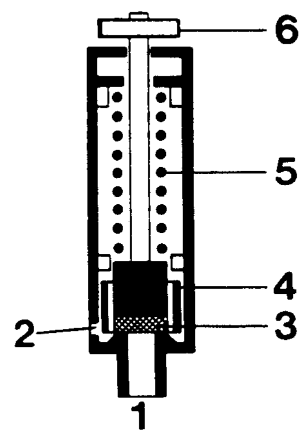
Task

Limiting the pressure within the compressed air system to a permissible maximum value. The opening pressure is punched on the lead seal.

Technical Data

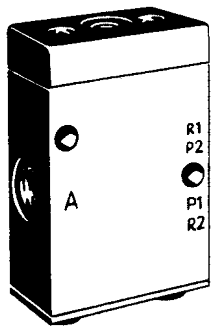
Opening pressure	131 PSI + 13/bar 9.0 + 0.9
Connection mm	M 18 x 1.5

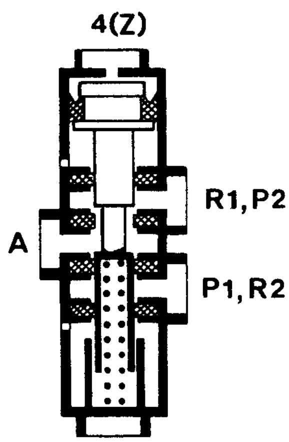




1 Connection
2 Vent
3 Plate valve
4 Piston
5 Spring
6 Adjusting screw

AIR SYSTEM (CONT)





P1, P2	delivery line
R1, R2	vent
A	working line
Z	control line

3/2-Way Valve (33.1)

Task

Changeover of the brake booster (27.7) to single or trailer operation by allowing air to enter and cutting out the outer ring chamber (stage II). The switching pulse is obtained by means of the supply pressure when coupling the trailer via connection 4 (Z).

Technical Data

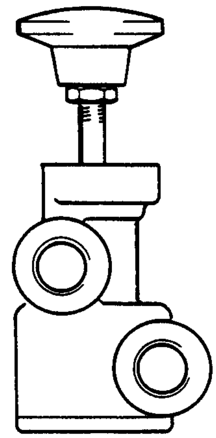
Operating pressure	max. 145 PSI/ bar 10.0
Control pressure	min. 44 PSI/ bar 3.0
Connections mm	M 10 x 1 (1/8 in.)

AIR SYSTEM (CONT)

Compressed Air Units

Safety Valve (33.2)

(With vent)



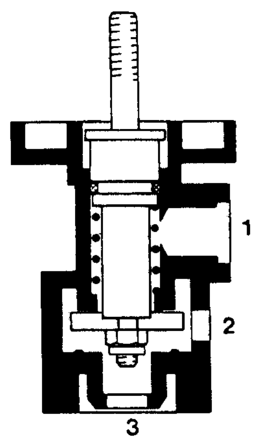
Task

For trailer operation, after coupling the trailer, supply air is applied via the valve by means of manual actuation.

Automatic release in the case of pressure drop in trailer below 41 PSI/2.8 bar via vent in valve.

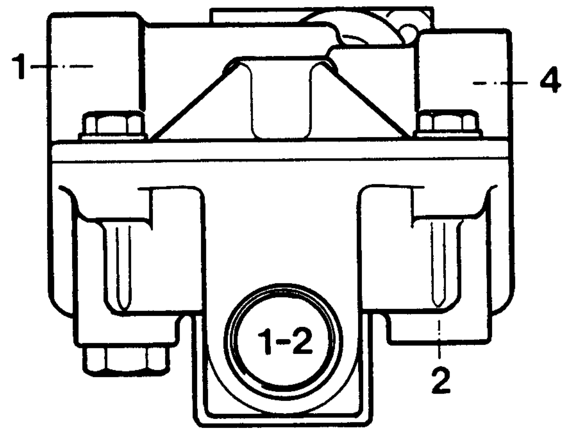
Technical Data

Operating pressure	107 PSI/bar 7.35
Opening pressure	28 PSI/bar 1.9
Connections	1/4 in.



1 Supply
2 Trailer
3 Vent

AIR SYSTEM (CONT)



1 Supply inlet
1-2 From supply tank
2 To shuttle valve
4 Control pressure brake

Trailer Relay Valve (a)

(Without Vent)

Task

Control of the vehicle brake system via the pulling vehicle during towing. Supplied with the necessary supply pressure from towing vehicle.

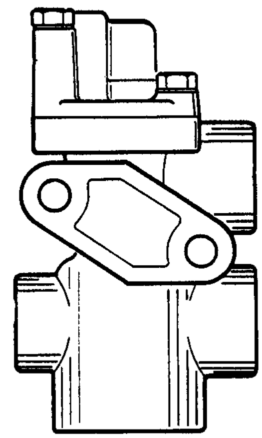
Technical Data

Operating pressure	107 PSI/bar 7.35
Connections	1/4, 3/8, 3/4 in.

AIR SYSTEM (CONT)

Trailer Protection Valve (45.)

(4/2-way valve)



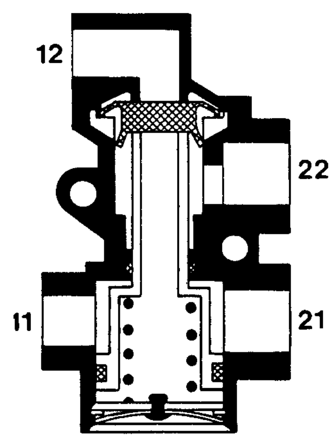
Task

Control of supply and brake pressure to trailer with integrated quick-release facility in the case of pressure drop in the supply. Used only in conjunction with safety valve (33.2a).

Also for interrupting the brake pressure at increasing residual pressure.

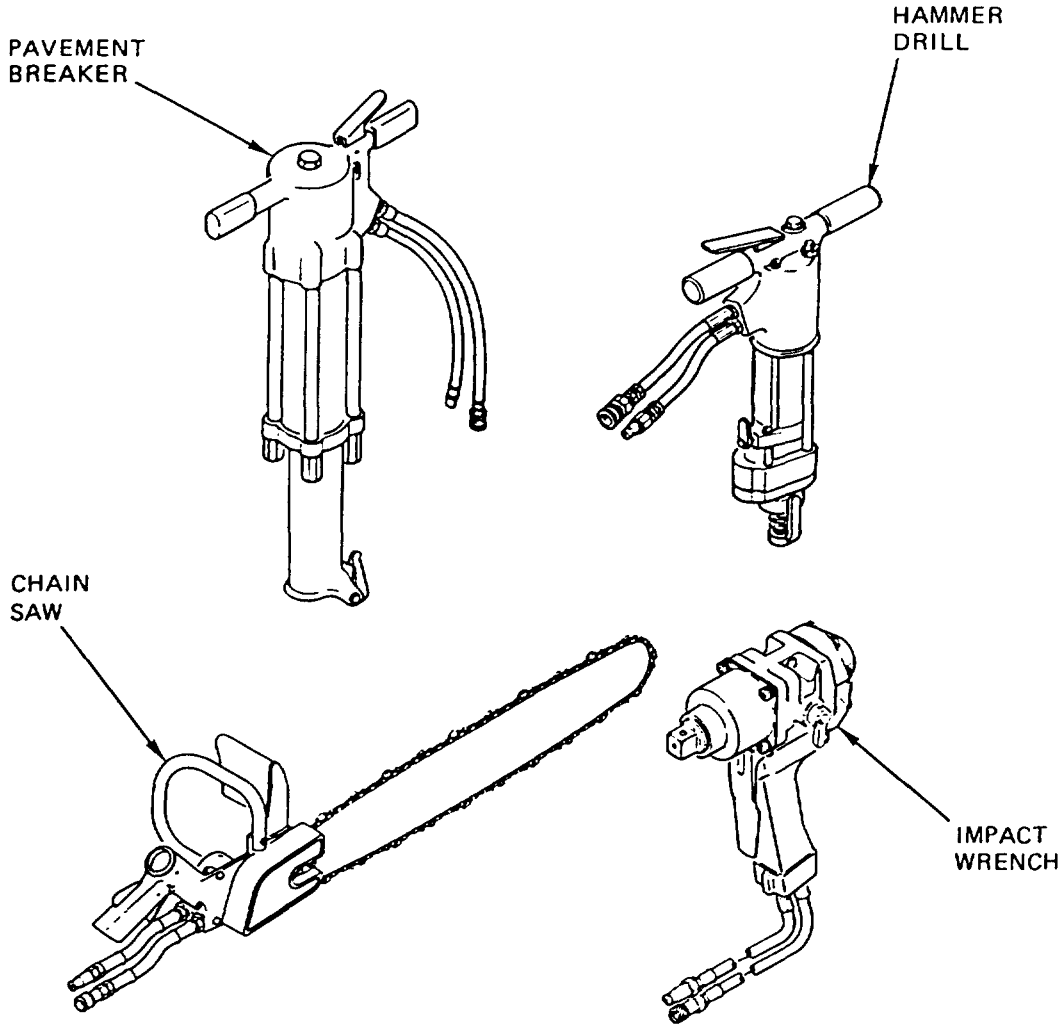
Technical Data

Operating pressure	107 PSI/bar 7.35
Release	41 PSI/bar 2.8
Connections	3/8, 1/4, 1/2 in.



11 Inlet supply
21 Outlet supply
12 Inlet brake
22 Outlet brake

MACHINE (HYDRAULIC) TOOLS



Chain Saw (SEE). The chain saw is used for debranching, pruning, and removal of trees and wood products. The 15-in. bar allows cutting of wood up to 30 in. in diameter. Squeezing the trigger controls the speed of the chain saw.

Pavement Breaker (SEE). The pavement breaker is used for breaking and chipping concrete, rock, pavement, and hard ground. The pavement breaker uses moil points, spade, and chisel attachments for breaking and chipping. Squeezing the trigger activates the pavement breaker.

Hammer Drill (SEE). The hammer drill is used for drilling holes in rock, concrete, or asphalt 3/4, 1, or 2 in. (12.7, 25.4, or 50.8 mm) in diameter. A switch controls the direction the tool operates. Squeezing the trigger activates and controls the speed of the hammer drill.

Impact Wrench (HMMH). The impact wrench is used for removing and installing hardware from containers and other equipment. A lever controls the direction and the trigger controls the speed of the impact wrench.

CHAPTER 2
SERVICES AND SCHEDULED VEHICLE MAINTENANCE

SCOPE

This chapter contains information you will need to prepare the SEE/HMMMH for daily use and to perform preventive and scheduled maintenance. The following sections are included in this chapter.

Section I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

OVERVIEW

This section includes information on tools and equipment you need to support the SEE and HMMH tractors.

COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit. Tool kits required for each task in this manual are listed in the Maintenance Allocation Chart (MAC) in Appendix B and on the INITIAL SETUP page of each task.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special tools and support equipment required to maintain the SEE/HMMH are listed in the Maintenance Allocation Chart (MAC) Appendix B and on the INITIAL SETUP page of each task. Special tools are also listed in the Repair Parts and Special Tools List (TM 5-2420-224-24P). Tools that are to be fabricated are described and listed in Appendix D of this manual.

REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (TM 5-2420-224-24P) covering the unit maintenance of this equipment.

Section II. SERVICE UPON RECEIPT

OVERVIEW

This section contains information on what to do when the vehicle is received.

CHECKING EQUIPMENT

1. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

2. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies with the instructions of DA PAM 738-750, The Army Maintenance Management System (TAMMS).

3. Check to see whether the equipment has been modified.

INITIAL SERVICES

1. Follow all precautions and instructions on tag DA Form 1397, Processing Record for Shipment, Storage, and Issue of Vehicle and Spare Engines.

2. Remove all packing and shipping materials, such as tape, tiedowns, protective covers, and shipping seals.

3. Remove all BII and COEI equipment and store in accordance with TM 5-2420-224-10.

4. If batteries have not been serviced, refer to TM 9-6140-200-14.

5. Service the vehicle in accordance with TM 5-2420-224-10 and Lubrication Instructions, page 2-14.

6. Refer to TM 5-2420-224-10 and perform functional checks of all major vehicle systems.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

OVERVIEW

This section details the Preventive Maintenance Checks and Services (PMCS) required for the SEE/HMMH. PMCS is a scheduled, step-by-step inspection and service of the vehicle and vehicle components. Its purpose is to keep the vehicle in good condition and to identify and correct problems before costly and time-consuming repairs are needed.

MAINTENANCE FORMS AND RECORDS

Use DA Form 2404, Equipment Inspection and Maintenance Worksheet, to record periodic maintenance services performed and faults corrected. The item number on the DA Form 2404 must be the same as the item number of the PMCS. For information on maintenance forms and records, see DA PAM 738-750.

OPERATOR PARTICIPATION

The operator will perform the Operator PMCS (TM 5-2420-224-10) and will also help unit maintenance do the unit PMCS, and perform lubrication in accordance with Lubrication Instructions, page 2-14.

INTERVALS

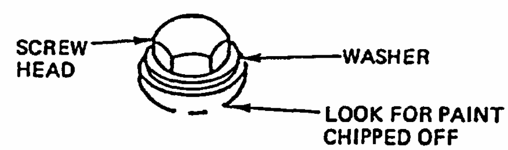
Unit PMCS should be performed at the intervals shown below:

- Do your (Q) PMCS quarterly (every 3 months).
- Do your (S) PMCS semiannually (every 6 months).
- Do your (A) PMCS annually (once every year).

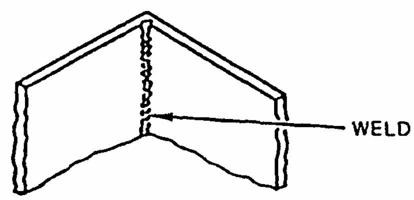
PROCEDURES

Refer to the following illustrations and descriptions for information on how to inspect common items on the vehicle.

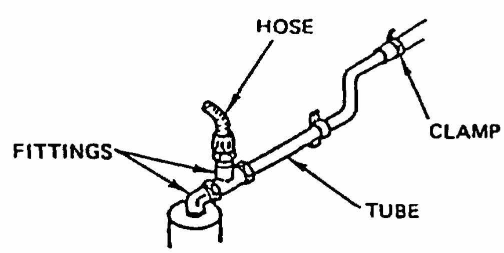
NUTS, BOLTS, AND SCREWS: Check for loose parts by looking for cracked or chipped paint around screw and bolt heads. Check for missing or broken cotter pins or lockwire.



WELDS: Check for damaged welds by cracks in paint or metal, and chipped paint in seams.



HOSES, TUBES, AND FITTINGS: Check all hoses, tubes, and fittings for damage, loose clamps, improper routing, leaks, looseness, and chafing. Do not overtighten hoses, tubes, or fittings.



ELECTRICAL LEADS AND HARNESSES: Check for loose or corroded leads and connectors, proper routing of harnesses, loose clamps, and chafing.

LEAKAGE DEFINITIONS

Class I — Leakage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II — Leakage of fluid great enough to form drops, but not enough to cause drops to drip from the item being checked/inspected.

Class III — Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

Table 2-1. Preventive Maintenance Checks and Services

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
				NOTE Perform all operator checks listed in Operator PMCS, as appropriate, as part of Road Test (TM 5-2420-224-10).
				ROAD TEST
				NOTE The following will be performed during Road Test. These inspections must be performed before any other unit level PMCS regardless of interval.
				During Road Test, vehicle will be driven at least 5 miles to give enough time to detect any malfunctions.
1				STARTER
		●		While starting vehicle, listen for unusual noises and difficult cranking of starter.
2				ENGINE AND ENGINE COMPARTMENT
		●		Listen for unusual noises, hesitation, and varying idle speed; observe response to accelerator feed.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
3				AXLE
		●		Check operation of differential lock/four-wheel drive.
4				BRAKES
	●			a. Test braking response to brake pedal. Vehicle should slow down immediately.
	●			b. At speed of approximately 20 mph, apply brake pedal with steady force. Vehicle should stop smoothly without noticeable side-pull or chatter.
	●			c. With vehicle on downgrade and transmission in neutral, engage parking brake. Vehicle should not move and indicator light should be on.
5				STEERING
		●		Check vehicle response to steering wheel action. Vehicle should respond instantly. With vehicle on straight level ground, lightly hold steering wheel to check for pull or wander. With vehicle in motion, free play should be no more than approximately 1-1/2 in. (39 mm) in either direction.
6				ENGINE
		●		a. Check engine operation at all speeds. Ensure engine does not exceed governed speed (2850 ±50 rpm).
		●		b. Observe engine instruments to detect malfunctions.
7				SUSPENSION
		●		Observe how vehicle responds to road shocks. Shifts, knocks, or constant bouncing indicate possible malfunction.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

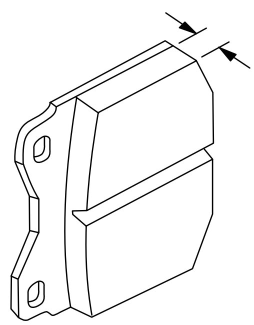
Item No.	Interval			Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
	Q	S	A	
				AFTER ROAD TEST
8				BRAKES, ROTORS, AND HUBS
				WARNING Brake rotor can get very hot during vehicle operation and could cause burns. Place hand near brake rotor to check for excessive heat, do not touch.
		●		a. Carefully check and compare each brake rotor for overheating, which can indicate dragging brake. Cool brake rotors could mean improper adjustment; defective, or inoperative brakes. 
			●	b. Check brake pads. Minimum thickness should be 0.078 in. (2 mm).
9				WHEELS AND TIRES
				CAUTION Do not use bias ply tires on vehicle. To do so could result in damage to equipment.
		●		a. Inspect tires for unusual wire, penetrating objects, and improper matching. If required, match tires according to tread design and degree of wear (TM 9-2610-200-24). Inflate or deflate to correct pressure (TM 5-2420-224-10).

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval			Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
	Q	S	A	
				WHEELS AND TIRES (CONT)
		●		b. Check lug nuts for proper torque of 260 lb-ft (350 N.m).
10				AIR BRAKE SYSTEM
		●		Check brake system components for leaks and damage. Check all brake hoses for wear, pinching, or interference. If any of these conditions are found, replace or reposition hose. Replacement is mandatory for any hose worn or chafed before vehicle use. Replacement is mandatory for any hose that is leaking or has bulges.
11				TRANSMISSION
		●		Check transmission for leaks, loose bolts, and obvious damage.
12				FRONT AXLE
		●		Check for loose screws and missing or damaged mounting hardware.
13				REAR AXLES
		●		Check for loose screws and missing or damaged mounting hardware.
14				SUSPENSION
		●		a. Check coil springs for cracks or breaks.
		●		b. Check torque of coil spring mounting bolts. Torque should be 103 lb-ft (140 N.m).
		●		c. Change oil and filter in front suspension lockout system (HMMH).
15				FRAME AND CROSSMEMBERS
		●		a. Inspect frame and side rails for cracks, breaks, bends, wear, deterioration, and loose bolts.

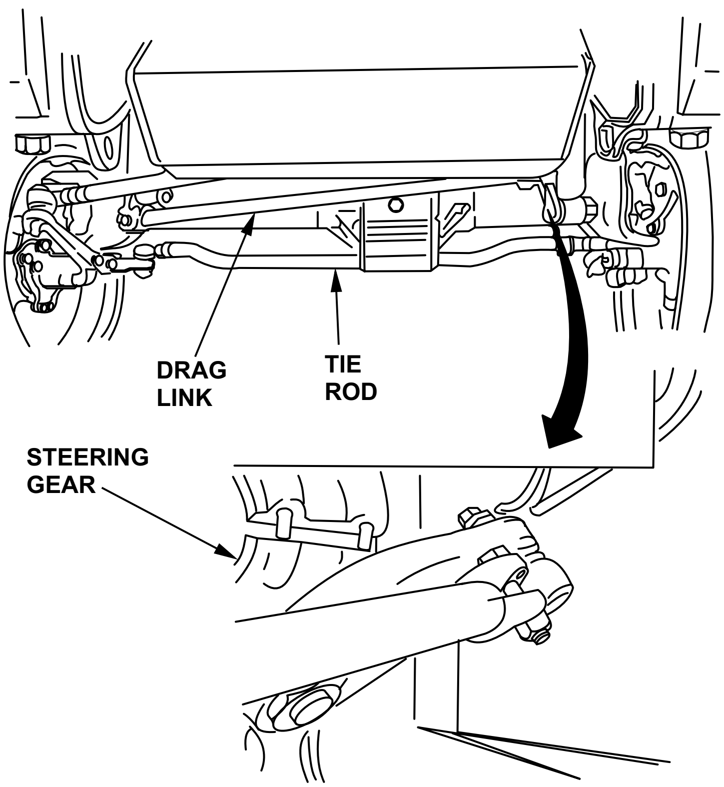
Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	S	A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
				FRAME AND CROSSMEMBERS (CONT)
		●		b. Inspect crossmembers for weld breaks.
16				STEERING
		●		a. Check steering gear for leaks and loose mounting bolts and components. Notify direct support maintenance for any repairs.



Item No.	Q	S	A	Item to be Inspected
		●		b. Check tie rod and drag link for movement by attempting to move by hand. Visually check ball joint ends for worn or damaged dust seals. If movement or damage is present, refer to direct support maintenance.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

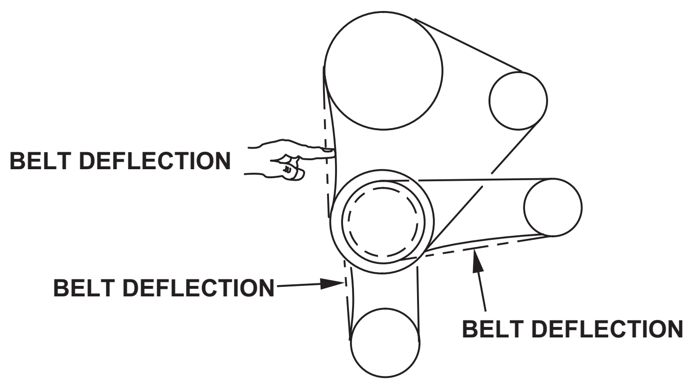
Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: / Procedure: Check for and have repaired, filled, or adjusted as needed.
				STEERING (CONT)
		•		c. Check all hydraulic steering lines, hoses, and tubes for loose fittings, rubbing, chafing, cracks, bends, breaks, and leaks. Tighten if loose and replace or repair hoses or lines that are damaged.
		•		d. Inspect power steering reservoir for leaks and loose hoses.
		•		e. Inspect power steering pump for leaks, cracks, or damage.
			•	f. Replace steering system filter (page 4-359).
17				DRIVEBELTS
				
	•			Check for proper tension/deflection of drivebelts. Fan belts should be 1/2-3/4 in. (13-19 mm).
18				EXHAUST SYTEM
				WARNING BURN HAZARD Allow engine to cool before performing maintenance on the muffler, exhaust pipe, or exhaust manifold. If necessary, use insulated pads and gloves.
		•		a. Check exhaust manifold, exhaust pipes, muffler, and tailpipe for leaks. Check for damaged pipes, loose clamps, and blown gaskets.
		•		b. Check raincap to make sure it operates freely.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	S	A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
19				FUEL SYSTEM
		•		a. Inspect fuel lines, fuel tank, and fuel system components for leaks and damage.
		•		b. Replace fuel filters (page 4-50).
20				COOLING SYSTEM **NOTE** Refer to TB 750-651 for cooling system service.
		•		a. Remove debris from cooling fins and check for bent fins.
		•		b. Inspect radiator core for leaks.
		•		c. Check hoses, cap, gaskets, rubber isolator mounts, and fan shroud mounting for cracks and leaks.
		•		d. Inspect water pump for leaks.
21				AIR INTAKE SYSTEM **WARNING** If NBC exposure is suspected, all filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.
		•		a. Check air cleaner, hoses, and air cleaner for proper installation, cracks, breaks, or loose connections that could let unfiltered air into air intake system.
		•		b. Check air intake screen for debris and damage.
		•		c. Check for dirty air filter elements.
		•		d. Clean/replace primary (outer) filter element (page 4-35). Never clean safety (inner) element.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
22				ENGINE
				NOTE • Oil filter(s) will be serviced/cleaned/changed when they are known to be contaminated or clogged; service is recommended by AOAP laboratory analysis; or at prescribed hard time intervals (page 2-14). • Engine oil must be sampled at 50 hours of operation or 90 days, whichever occurs first, for active Army units (Reserve and National Guard activities will use 50 hours or 180 days) as prescribed by DA PAM 738-750, Functional Users Guide for the Army Maintenance Management System (TAMMS).
		•		a. Check all oil lines, fittings, and hoses for leaks.
		•		b. Check oil filter housing, oil pan, and oil pan drain plug for leaks. Notify direct support maintenance if there are any leaks.
		•		c. Check valve cover for leaks.
			•	d. Check valve clearance (page 4-5).
		•		e. Check engine compartment wiring for frays, splits, missing insulation, or poor connections.
		•		f. Inspect mounting and attaching hardware for looseness. If mounting hardware is damaged, notify direct support maintenance.
23				ELECTRICAL SYSTEM
				NOTE Refer to TM 9-6140-200-14 for service and maintenance of batteries.
		•		a. Check alternator mounting for looseness. Inspect bracket and attaching hardware for cracks, bends, and loose mounting.
		•		b. Check alternator wiring for frays, splits, missing insulation, and loose terminal connections. Replace any broken terminal connections. Notify direct support maintenance for replacement of damaged wiring.
		•		c. Check battery cables for frays, splits, and looseness.
		•		d. Check battery box for corrosion and debris. Clean batteries and battery box.
23.1	•			Perform quarterly lubrication in accordance with page 2-14.
23.2		•		Perform semiannual lubrication in accordance with page 2-14.
23.3			•	Perform annual lubrication in accordance with page 2-14.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
24				HYDRAULIC SYSTEM
				NOTE • Oil filter(s) will be serviced/cleaned/changed when they are known to be contaminated or clogged; service is recommended by AOAP laboratory analysis; or at prescribed hard time intervals (page 2-14). • Hydraulic fluid systems must be sampled once a year as prescribed by DA PAM 738-750, Functional Users Guide for the Army Maintenance Management System (TAMMS).
			•	a. Sample oil for AOAP (DA PAM 738-750).
		•		b. Check hydraulic system components for leaks and damage. Check all hoses for wear, pinching, or interference. If any of these conditions are found, replace or reposition hose. Replacement is mandatory for any hose worn or chafed before vehicle use. Replacement is mandatory for any hose that is leaking or has bulges.
		•		b.1 Replace front (page 4-709) and rear (page 4-720) hydraulic filters.
	•			c. Check hydraulic filters for exposed indicator button.
25				FRONT LOADER OR FORKLIFT
		•		a. Start engine. Cycle each control and check for smooth operation of front loader or forklift.
		•		b. Inspect mounting and attaching hardware for looseness.
		•		c. Check hoses, cylinders, and valves for leaks.
		•		d. Inspect for weld breaks.
		•		e. Check adjustment of forklift carriage and mast chains (pages 4-559, 4-562).
26				BACKHOE OR CRANE
		•		a. Start engine. Cycle each control and check for smooth operation of backhoe or crane.
		•		b. Inspect mounting and attaching hardware for looseness.
		•		c. Check hoses, cylinders, and valves for leaks.
		•		d. Inspect for weld breaks.
		•		e. Inspect backhoe/crane travel lock for proper operation, cracks, corrosion, and damage.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q-Quarterly S-Semiannually A-Annually

Item No.	Interval Q	Interval S	Interval A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
27				FORKLIFT OR CRANE
				WARNING Prior to initial use, new, extensively repaired, or altered forklift or crane must be load tested to prevent injury to personnel.
				NOTE • Forklift or crane idle for 1 month or more, but less than 6 months, will be inspected under a Daily Inspection Criteria. Forklift or crane idle for 6 months or more will be inspected under a Periodic Inspection Criteria. • Inspections and testing of forklift or crane will be in accordance with TB 43-0142, dated 14 Jun 82 with Change 2, dated 4 Nov 86, Safety Inspection and Testing of Lifting Devices.
		•		Unit maintenance personnel, assisted by operator/crew personnel, will conduct periodic inspections in accordance with TB 43-0142 with Change 2.
28				VEHICLE EXTERIOR
		•		a. Thoroughly inspect for evidence of corrosion damage such as blistered paint, rust-through, or other evidence of damage in accordance with TB 43-0213.
			•	b. Check that following items are in place and in serviceable condition: • Fasteners • Hinges • Panels • Stowage Box Doors
			•	c. Check all data plates to ensure legibility.
		•		d. Inspect cab glass, doors, panels, fenders, and brackets for damage.

Table 2-1. Preventive Maintenance Checks and Services (Cont)

NOTE: Within designated interval, these checks are to be performed in the order listed.

INTERVAL DEFINITIONS

Q - Quarterly S - Semiannually A - Annually

Item No.	Interval Q	S	A	Item to be Inspected: Procedure: Check for and have repaired, filled, or adjusted as needed.
29				PINTLE
		●		Check pintle hook for proper operation and ensure mounting hardware is tight.
				FINAL ROAD TEST
				After all services and inspections have been completed, make sure all corrections have been made.

Section IV. LUBRICATION INSTRUCTIONS

INTERVALS AND MAN-HOURS

Intervals (on-condition or hard time) and the related man-hour times are based on normal operation. The man-hour time specified is the time you need to do the services prescribed for a particular interval. On-condition (OC) oil sample intervals shall be applied unless changed by the Army Oil Analysis Program (AOAP) laboratory. Change the hard time interval if your lubricants are contaminated or if you are operating the equipment under adverse operating conditions, including longer-than-usual operating hours. The hard time interval may be extended during periods of low activity. If extended, adequate preservation precautions must be taken. Hard time intervals will be applied in the event AOAP laboratory support is not available.

WARNING

Death or serious injury could result from repeated or prolonged breathing or skin contact of drycleaning solvent SD, type II, P-D-680. Use in well-ventilated area. Do not use near open flame or in excessive heat.

Clean fittings before lubricating. Clean parts with drycleaning solvent (SD) type II, or equivalent. Dry before lubricating.

NOTE

Dotted arrow points indicate lubrication on both sides of the equipment.

TOTAL MAN-HOURS

INTERVAL	MAN-HOURS
Quarterly (Q)	4.0
Semiannual (S)	3.5
Annual	5.0

LUBRICANTS

KEY

<table>
<tr><td colspan="2"></td><td></td><th colspan="3">EXPECTED TEMPERATURES</th><td rowspan="14">For Arctic operation refer to TM 9-207.</td><td></td></tr>
<tr><th colspan="2">LUBRICANTS</th><th>CAPACITIES</th><th>Above +32 °F
(Above 0 °C)</th><th>+40° to -10 °F
(+4° to -26 °C)</th><th>0° to -65 °F
(-17° to -53 °C)</th><th>INTERVALS</th></tr>
<tr><td>OE/HDO
(MIL-L-2104)</td><td>LUBRICATING OIL,
Internal Combustion Engine, Tactical Service</td><td>As Required</td><td rowspan="4">OE/HDO
15W40</td><td rowspan="4">OE/HDO-10</td><td rowspan="4">OEA</td><td rowspan="12">Q - Quarterly/
250 hours

S - Semiannually/
500 hours

A - Annually/
1000 hours

OC - On-condition</td></tr>
<tr><td>OEA
(MIL-L-46167)</td><td>LUBRICATING OIL,
Internal Combustion Engine, Arctic</td><td>As Required</td></tr>
<tr><td></td><td>Engine Crankcase</td><td>Max 11.6 qt (11.0 l)
Min 8.4 qt (8.0 l)</td></tr>
<tr><td></td><td>Engine Oil Filter</td><td>1.05 qt (1.0 l)</td></tr>
<tr><td></td><td>Hydraulic System</td><td>Front 44 qt (41.6 l)
Rear 84 qt (79.4 l)</td><td rowspan="3">OE/HDO-10</td><td rowspan="3">OE/HDO-10</td><td rowspan="3">OEA</td></tr>
<tr><td></td><td>Power Steering Reservoir</td><td>3 qt (2.8 l)</td></tr>
<tr><td></td><td>Front Suspension Lockout System (HMMH)</td><td>1 qt (0.94 l)</td></tr>
<tr><td rowspan="3">GO
(MIL-L-2105)</td><td>Transmission</td><td>7 qt (6.6 l)</td><td rowspan="3">GO-80/90</td><td rowspan="3">GO-80/90</td><td rowspan="3">GO-75</td></tr>
<tr><td>Front and Rear Axle Hub Drives</td><td>0.25 qt ea (0.23 l)</td></tr>
<tr><td>Front and Rear Differentials</td><td>2.4 qt (2.25 l)</td></tr>
<tr><td>PL
(Medium MIL-L-3150)
(Special VV-L-800)</td><td>LUBRICATING OIL,
General Purpose</td><td>As Required</td><td>PL-M
(Medium)</td><td>PL-S
(Special)</td><td>PL-S
(Special)</td></tr>
<tr><td>GAA
(MIL-G-10924)</td><td>GREASE, Automotive and Artillery</td><td>As Required</td><td colspan="3">ALL TEMPERATURES</td></tr>
</table>

OIL ANALYSIS PROGRAM SAMPLING PROCEDURES

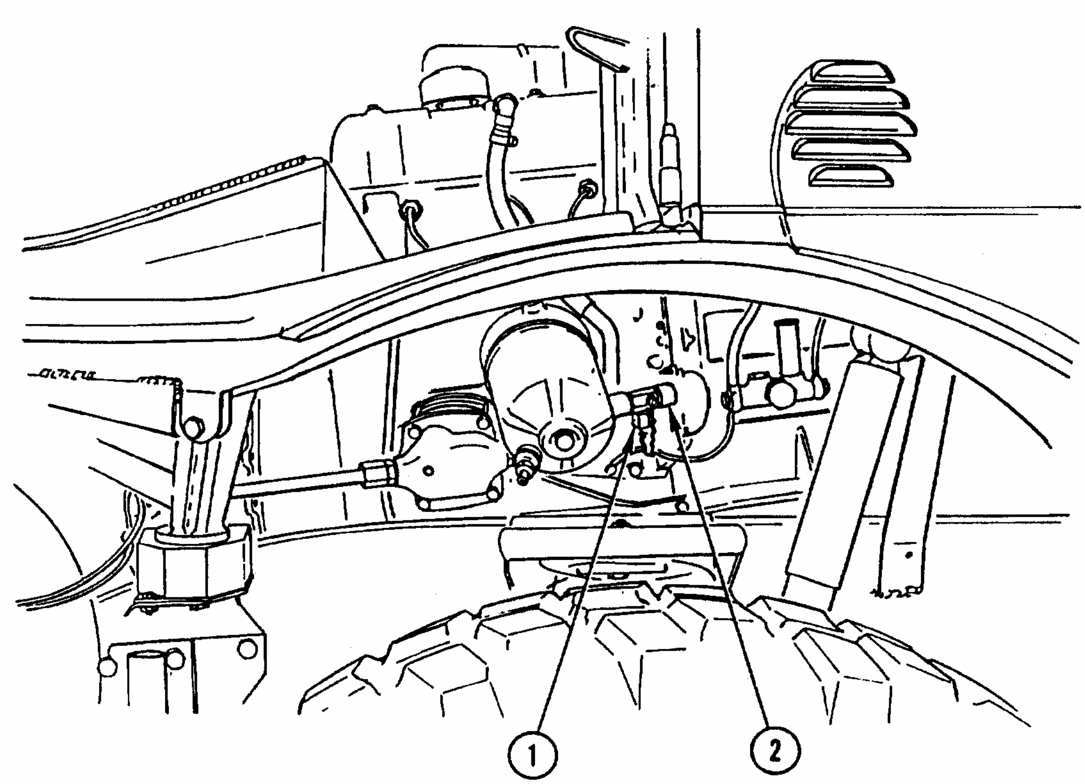
The engine oil sampling valve is located on the end of the oil filter located on the right side of the engine. When a lubrication note specifies that an oil sample must be taken, use the following procedures:

A Ensure that oil to be sampled is at its normal operating temperature (TM 5-2420-224-10).

B Open valve (1) and pump approximately two ounces of oil into suitable container, by pumping plunger (2). Discard this oil. This will remove waste impurities from oil filter.

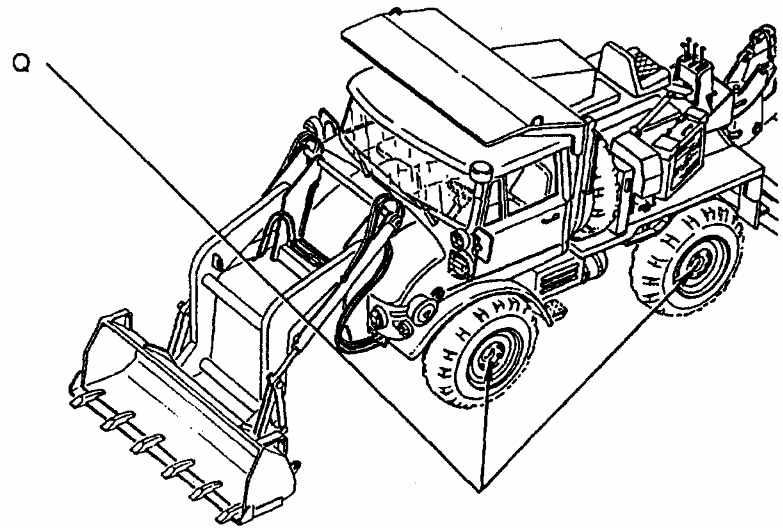
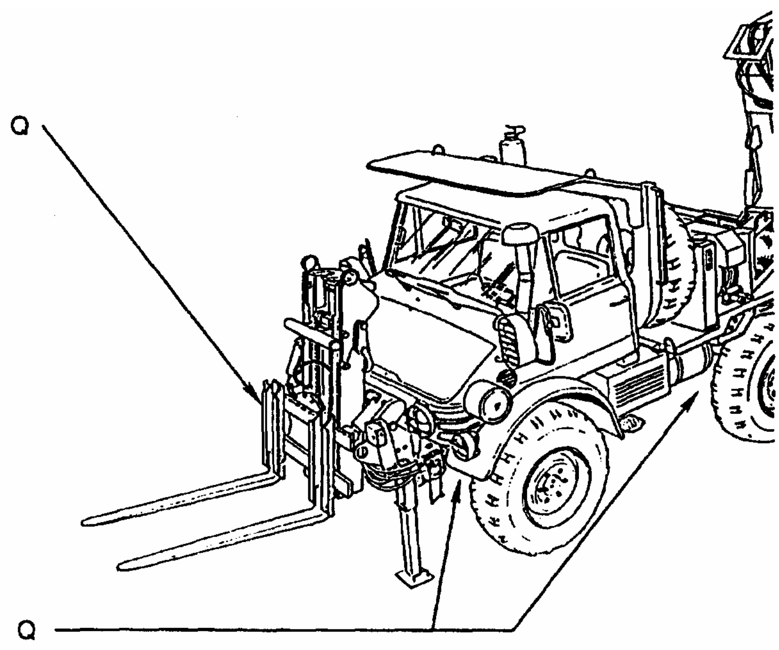
C Place sample bottle (TB 43-0210) under valve (1) and fill sample bottle to approximately 1/2 in. (1.3 cm) below neck of bottle. Close valve (1) and check for leaks.

D Send oil sample to AOAP laboratory.



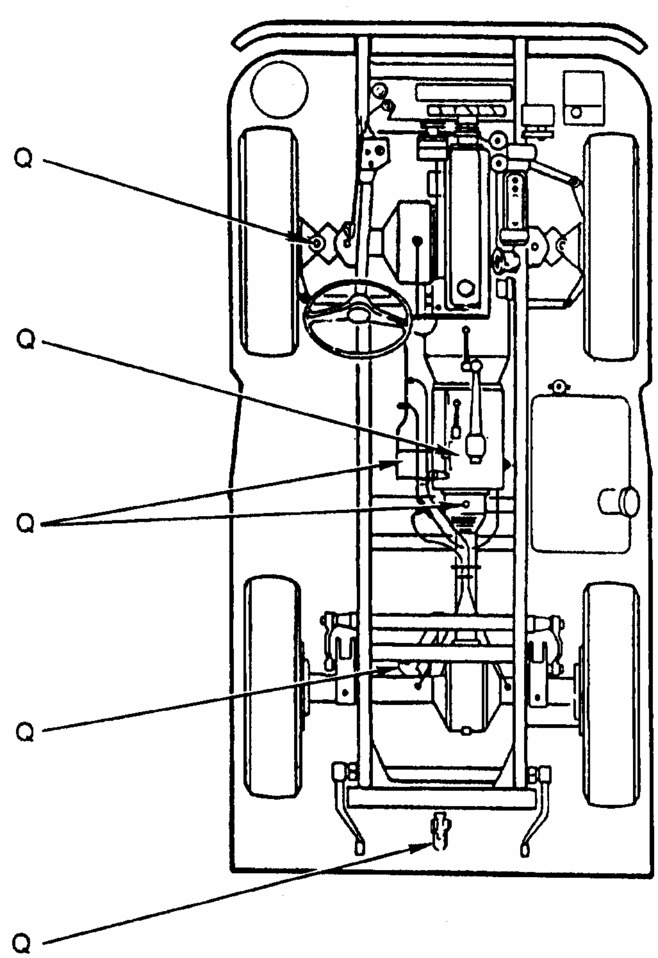
QUARTERLY NOTES:

LUBRICANT ● INTERVAL

Axle Drive and Wheel Hub Reduction of Front and Rear Axle (SEE/HMMH) (See Note 1)	GO	
Forklift (HMMH) (See Note 2)	GAA	
Front and Rear Differentials (SEE/HMMH) (See Note 3)	GO	

QUARTERLY NOTES (CONTINUED):

	LUBRICANT ● INTERVAL
King Pins (SEE/HMMH) (See Note 4)	GAA
Transmission (SEE/HMMH) (See Note 5)	GO
Front and Rear Thrust Ball Joint (SEE/HMMH) (See Note 6)	GAA
Hand Brake Lever (SEE/HMMH) (See Note 7)	GAA
Pintle Hook (SEE/HMMH) (See Note 8)	GAA



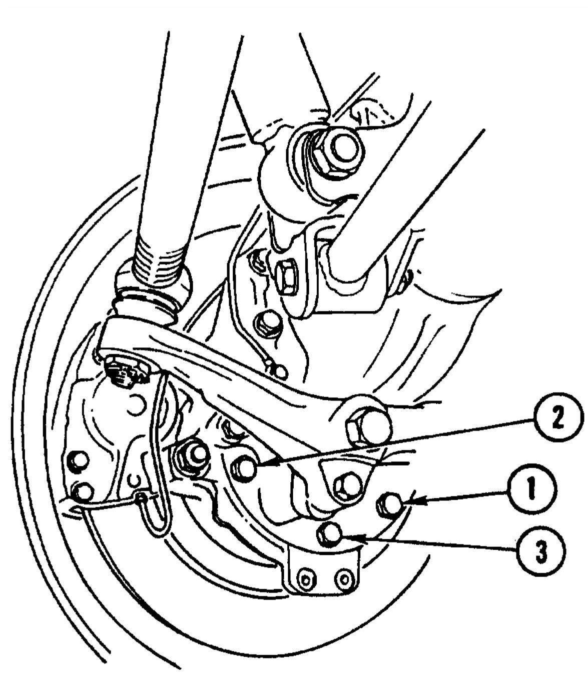
QUARTERLY NOTES (CONTINUED):

Note 1

AXLE DRIVE AND WHEEL HUB REDUCTION OF FRONT AND REAR AXLE (SEE/HMMH)

WARNING

Place vehicle in two-wheel drive before checking oil level. Oil is under pressure when in four-wheel drive position and could cause serious injury to eyes when removing inspection plug.



Remove inspection plug (1) in each axle and check oil level. Oil should be level with the bottom of the oil inspection hole. Add GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) as required.

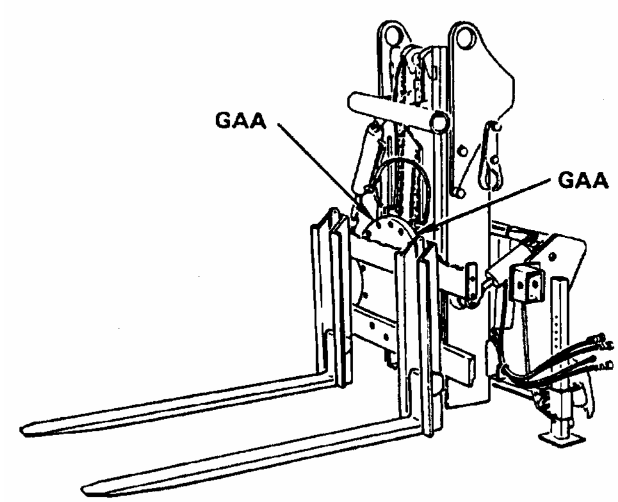
AXLE-WHEEL HUB DRIVE (DISC BRAKE)

1. CHECK PLUG (REAR)
2. FILL PLUG (FORWARD)
3. DRAIN PLUG (BOTTOM)

Note 2

FORKLIFT (HMMH)

Lubricate two fittings on rotator bearing every 300 hours with GAA (Appendix C, Item 19).



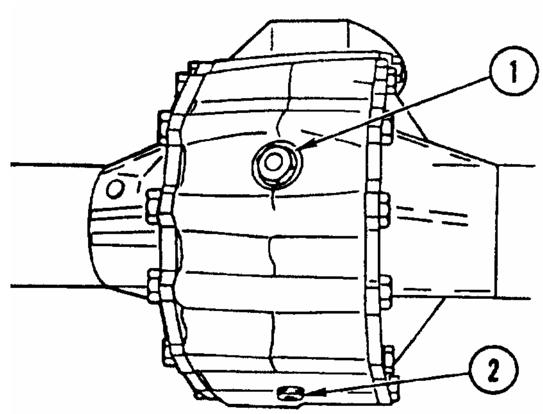
QUARTERLY NOTES (CONTINUED):

Note 3

FRONT AND REAR DIFFERENTIALS
(SEE/HMMH)

WARNING
Place vehicle in two-wheel drive before checking oil level. Oil is under pressure when in four-wheel drive position and could cause serious injury to eyes when removing inspection plug.

Remove inspection plug (1) in each differential and check oil level. Oil should be level with the bottom of the oil inspection hole. Add GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) as required.



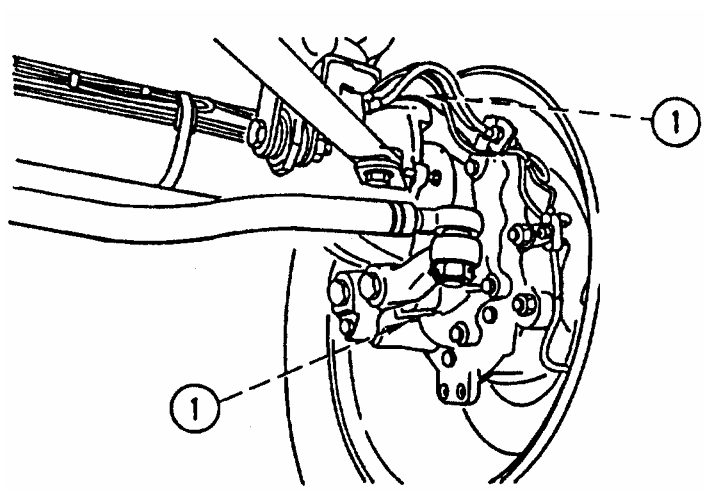
AXLE DRIVE

1. FILL AND CHECK PLUG
2. DRAIN PLUG

Note 4

KING PINS (SEE/HMMH)

Lubricate four king pins (1) with GAA (Appendix C, Item 19).

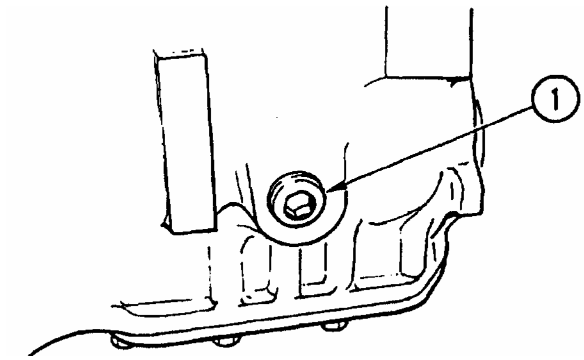


QUARTERLY NOTES (CONTINUED):

Note 5

TRANSMISSION (SEE/HMMH)

Check transmission oil level by removing fill plug (1). Oil should be level with the bottom of the oil inspection hole. Add GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) as required.

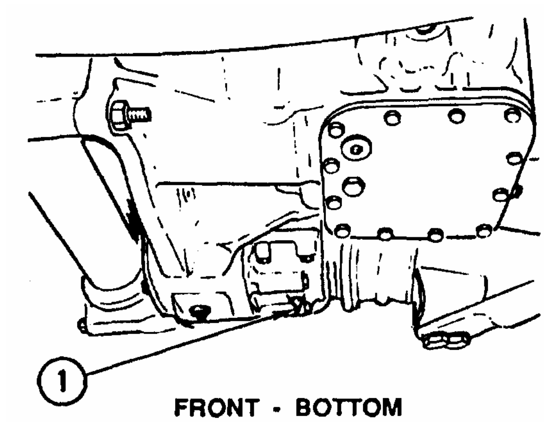


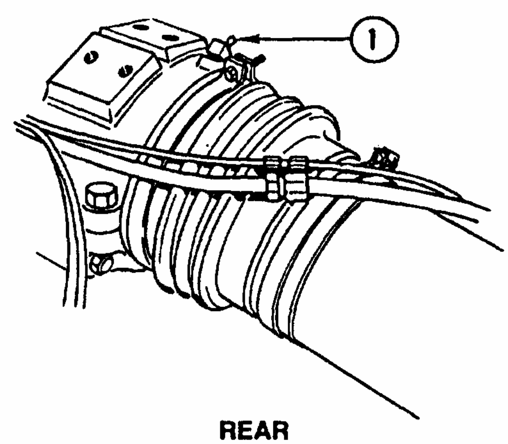
Note 6

FRONT AND REAR THRUST BALL JOINT (SEE/HMMH)

CAUTION
Damage to protective rubber bellows will occur if over-lubricated.

Lubricate ball joints (1) with five shots of GAA (Appendix C, Item 19) from a standard hand-held grease gun.



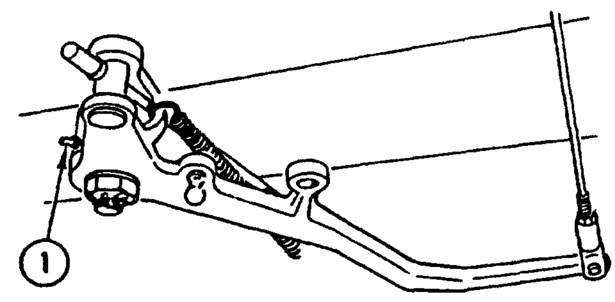


QUARTERLY NOTES (CONTINUED):

Note 7

HAND BRAKE LEVER (SEE/HMMH)

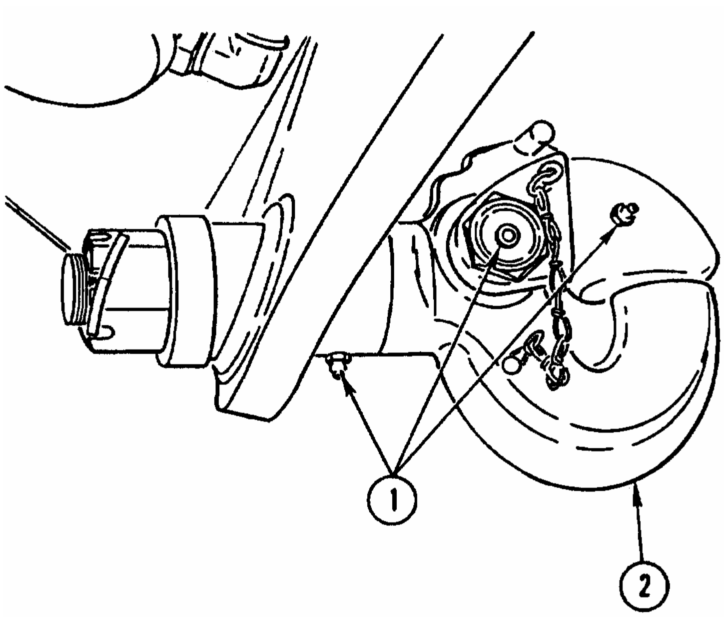
Lubricate hand brake lever fitting (1) above rear axle with GAA (Appendix C, Item 19).



Note 8

PINTLE HOOK (SEE/HMMH)

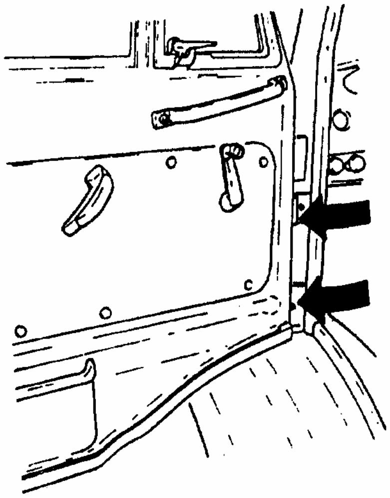
Lubricate three fittings (1) on pintle hook (2) with GAA (Appendix C, Item 19).



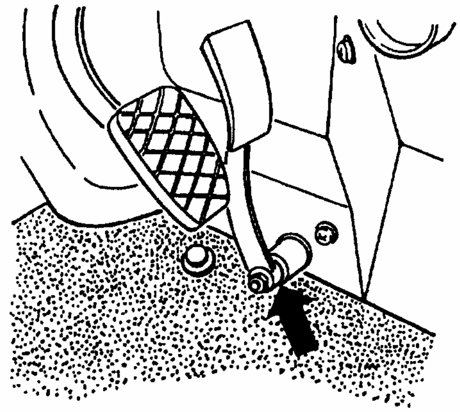
QUARTERLY NOTES (CONTINUED):

OIL CAN POINTS

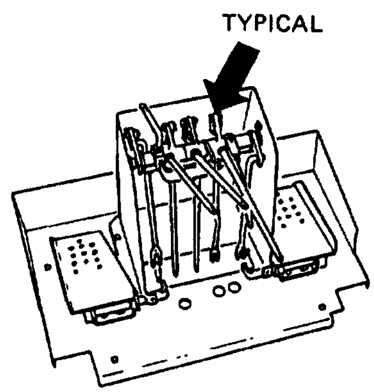
Lubricate with PL-M (Appendix C, Item 43) or PL-S (Appendix C, Item 44).



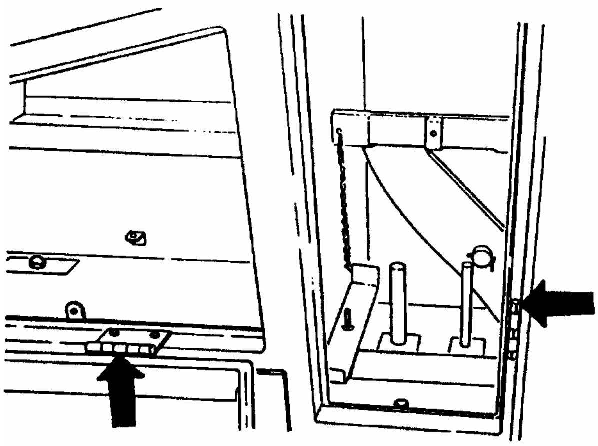
DOOR HINGES



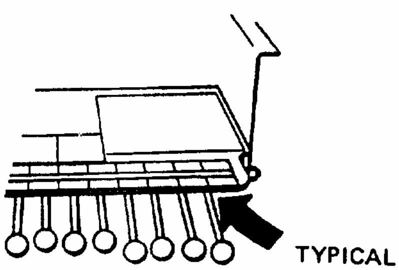
ACCELERATOR PEDAL



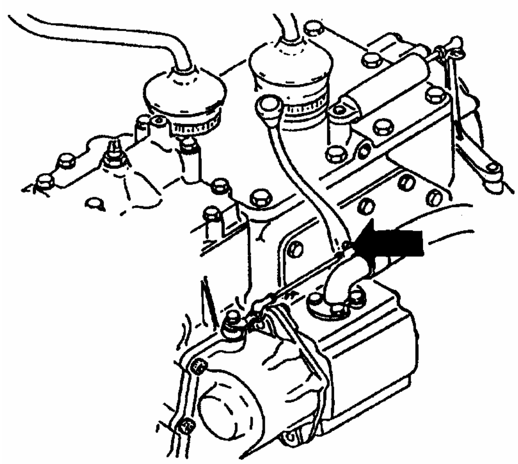
BACKHOE LINKAGES



TOOL BOX HINGES



CRANE LINKAGES

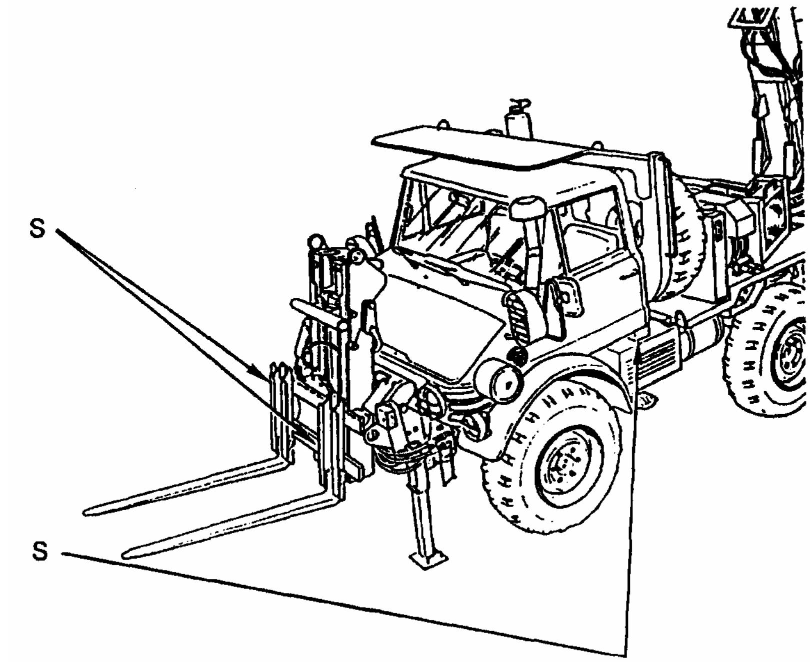


PTO LINKAGES

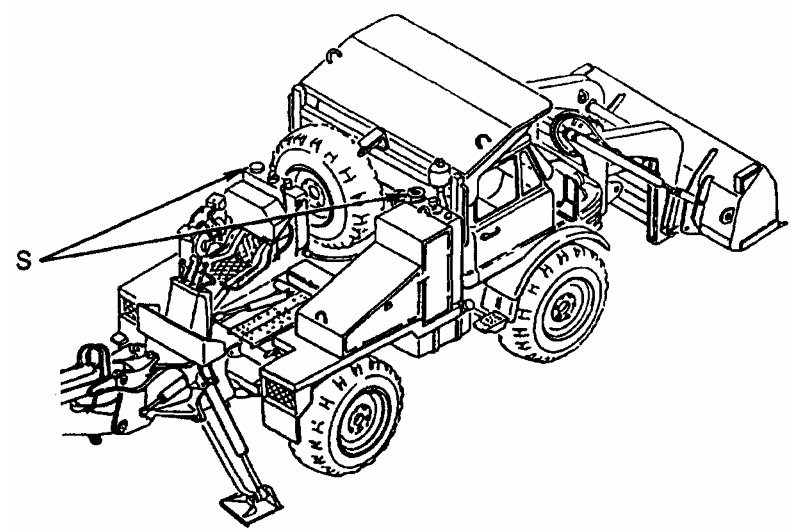
SEMIANNUAL NOTES:

LUBRICANT ● INTERVAL

Forklift Fork Hinges (HMMH) (See Note 9)	GAA	
Front Suspension Lockout System (HMMH) (See Note 10)	OE/HDO, OEA	



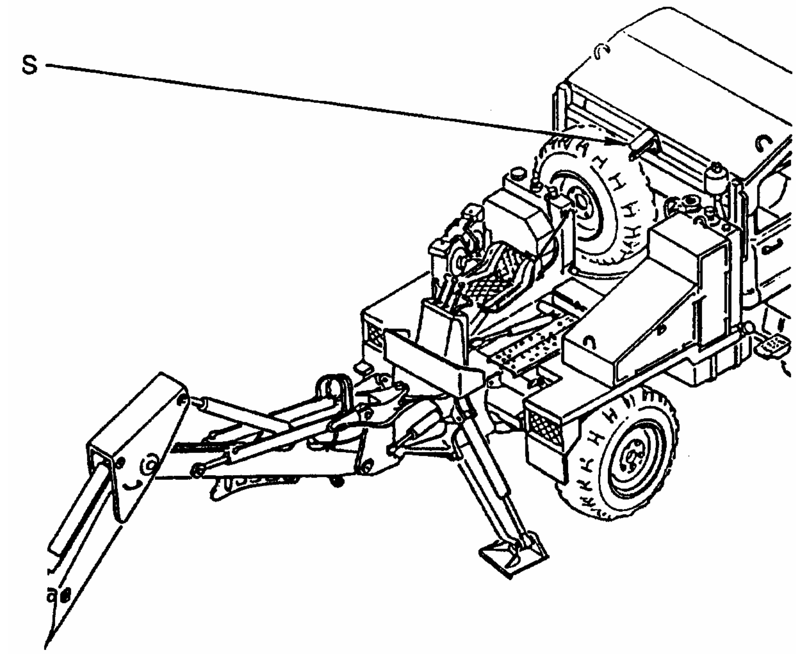
Hydraulic Tanks, Front and Rear (SEE/HMMH) (See Note 11)	OE/HDO, OEA	



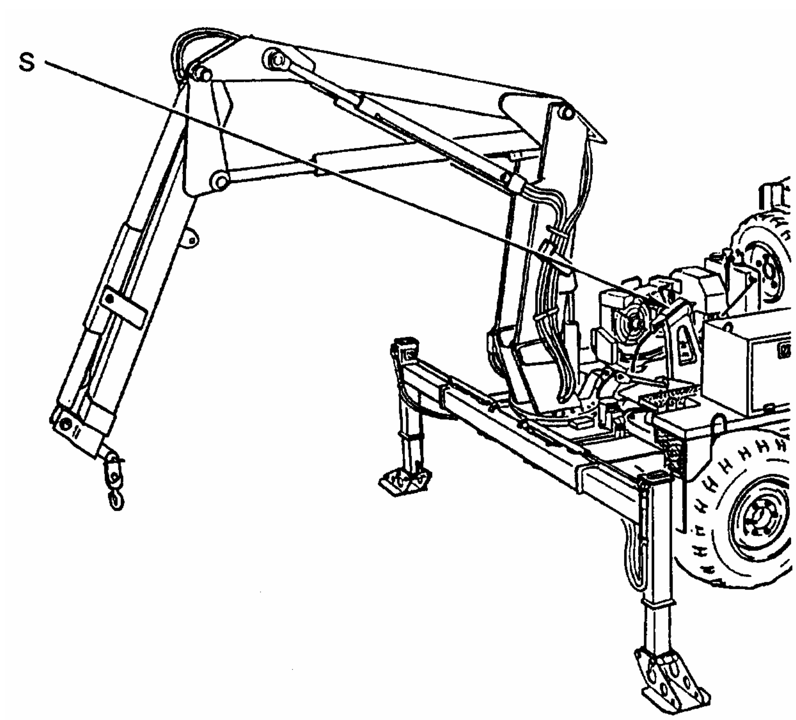
SEMIANNUAL NOTES (CONTINUED):

LUBRICANT ● INTERVAL

Implement Travel Lock Pin (SEE) (See Note 12) GAA



Implement Travel Lock Pin (HMMH) (See Note 13) GAA

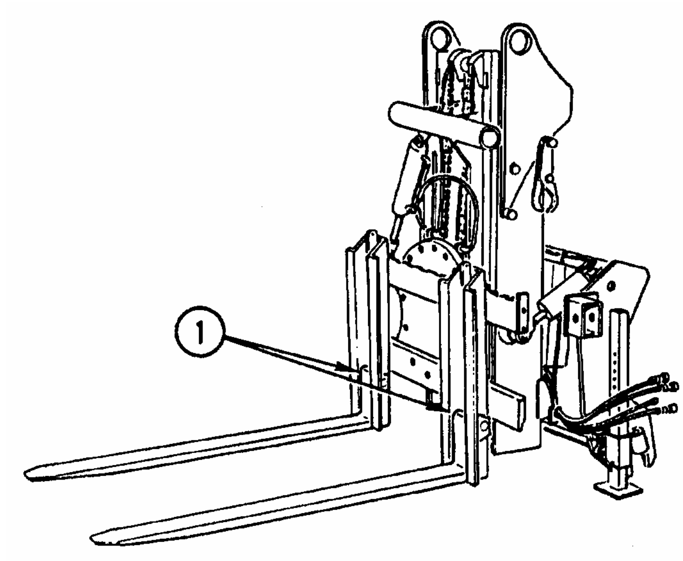


SEMIANNUAL NOTES (CONTINUED):

Note 9

FORKLIFT FORK HINGES (HMMH)

Lubricate forklift fork hinge points (1) with GAA (Appendix C, Item 19).



SEMIANNUAL NOTES (CONTINUED):

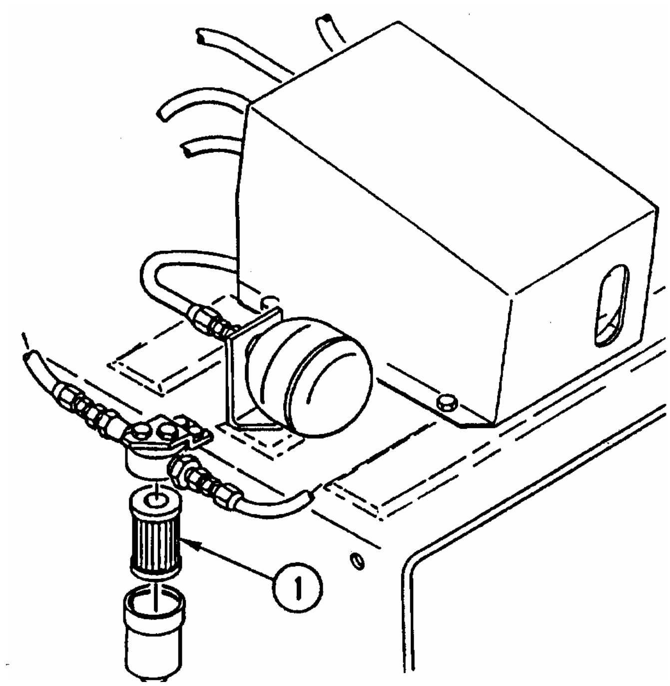
Note 10

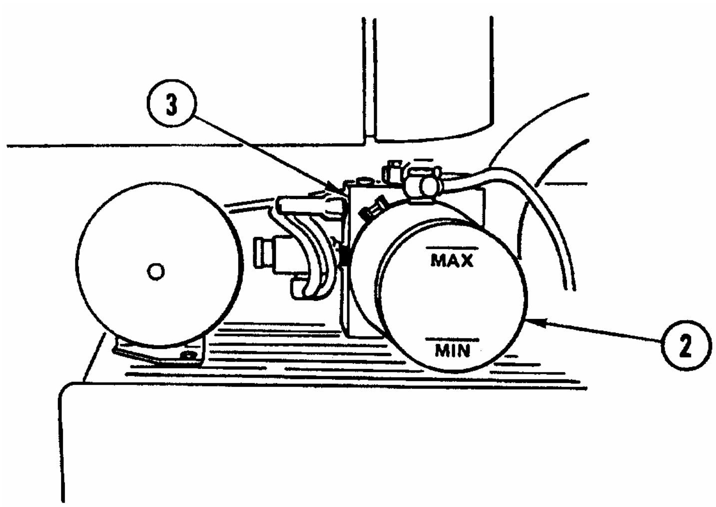
FRONT SUSPENSION LOCKOUT SYSTEM (HMMH)

A Remove and replace oil filter (1) (page 4-507).

B Remove reservoir (2) from manifold (3) and drain oil (page 4-511).

C Install reservoir (2) to manifold (3) and service with OE/HDO (Appendix C, Items 22, 23, 24, or 25) or OEA (Appendix C, Item 30). Oil should be at the MAX mark on reservoir (page 4-511).





SEMIANNUAL NOTES (CONTINUED):

Note 11

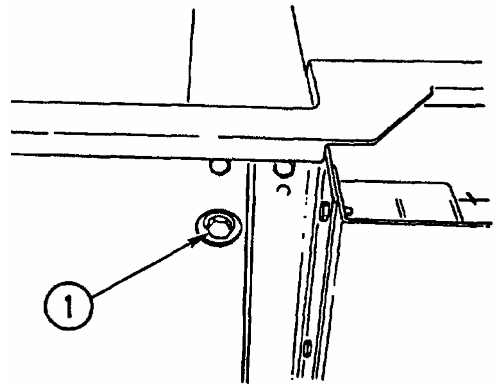
HYDRAULIC TANKS, FRONT AND REAR (SEE/HMMH)

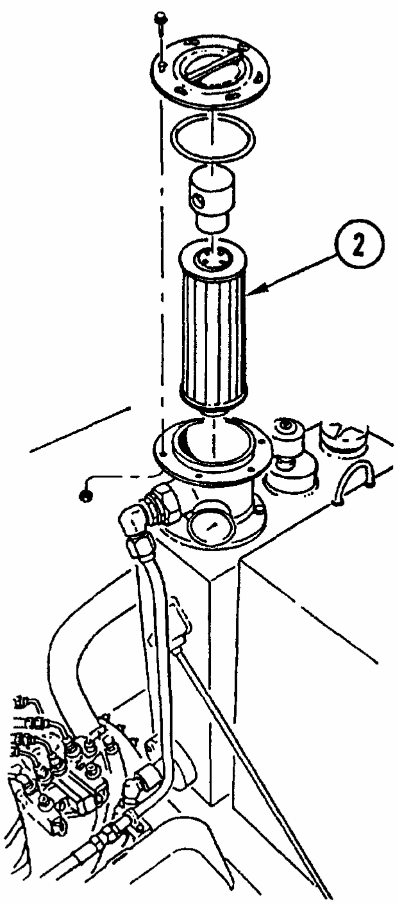
A Place suitable container under drain plug (1) and drain oil. Install drain plug.

B Replace hydraulic filter (2) at top of tank (front, page 4-709; rear, page 4-720).

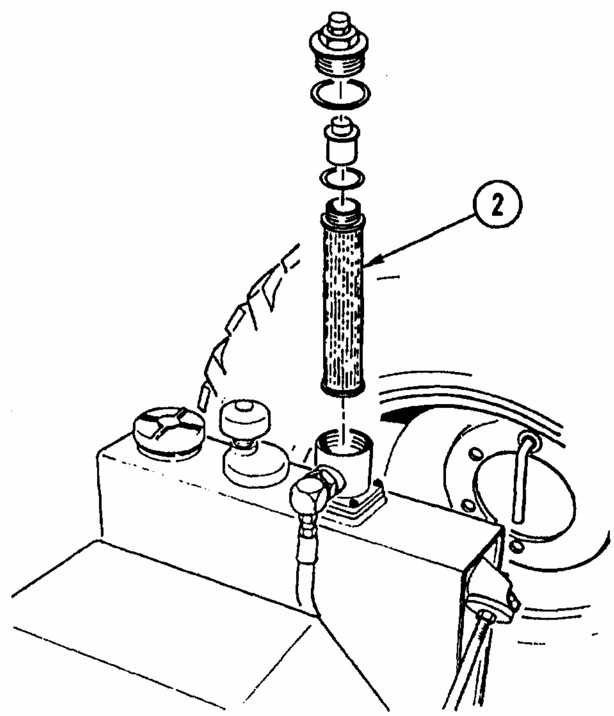
C Fill hydraulic tank with OE/HDO (Appendix C, Items 22, 23, 24, or 25) or OEA (Appendix C, Item 30) with implements in travel position.

D Check sight gage to ensure proper oil level is achieved (TM 5-2420-224-10).





REAR



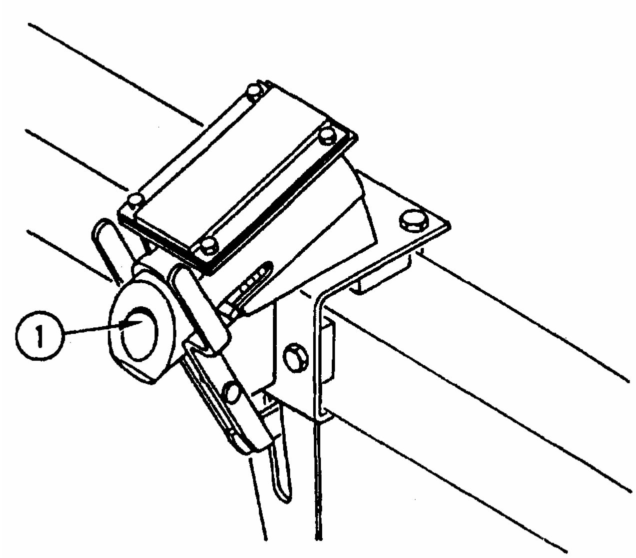
FRONT

SEMIANNUAL NOTES (CONTINUED):

Note 12

IMPLEMENT TRAVEL LOCK PIN (SEE)

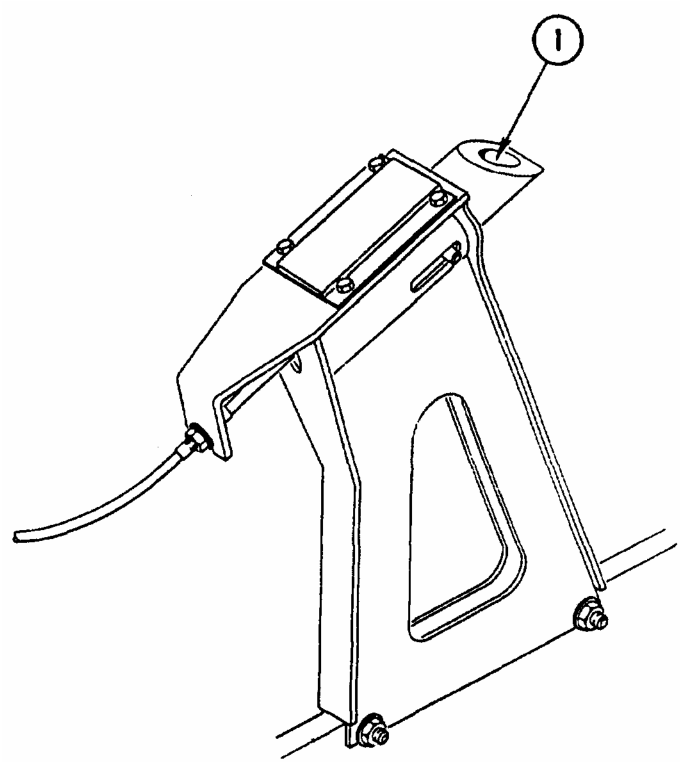
Lubricate one fitting on implement latch (1) with GAA (Appendix C, Item 19).



Note 13

IMPLEMENT TRAVEL LOCK PIN (HMMH)

Lubricate one fitting on implement latch (1) with GAA (Appendix C, Item 19).

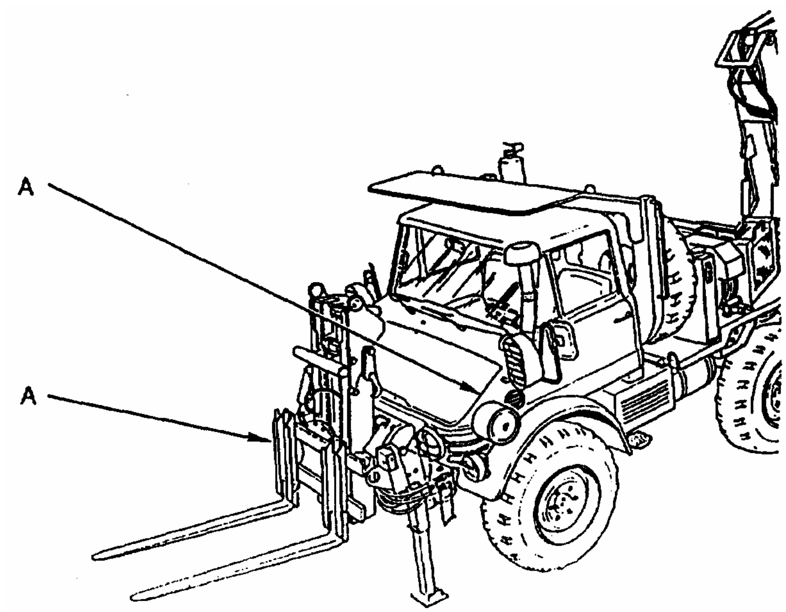


ANNUAL NOTES:

LUBRICANT • INTERVAL

Steering System Oil (SEE/HMMH) (See Note 14) — OE/HDO, OEA

Forklift (HMMH) (See Note 15) — GAA

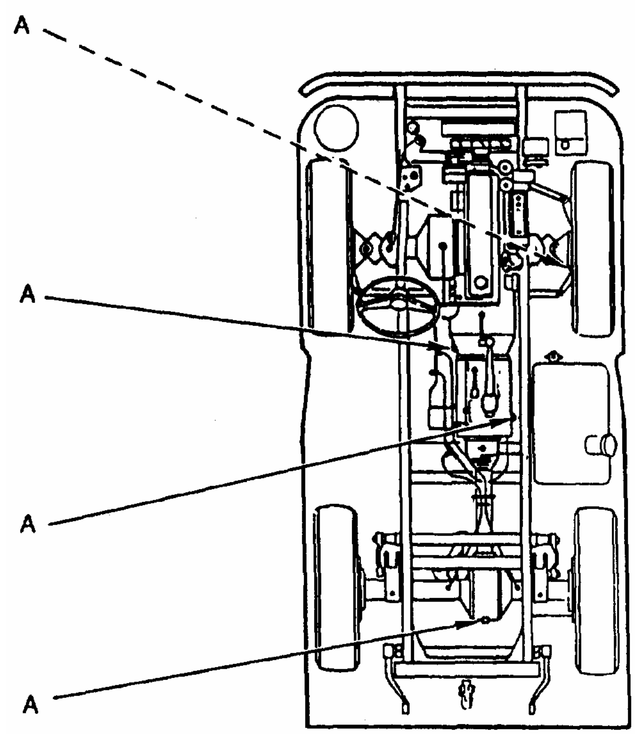


Front and Rear Axle Wheel Hub Drives (SEE/HMMH) (See Note 16) — GO

Clutch Release Shaft (SEE/HMMH) (See Note 17) — GAA

Transmission Oil (SEE/HMMH) (See Note 18) — GO

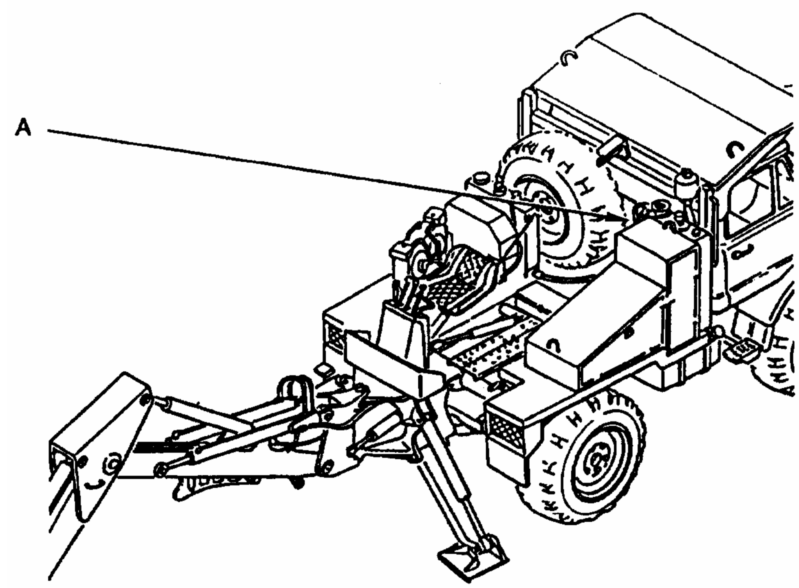
Differential Oil Filler Plug/Oil Drain Plug (SEE/HMMH) (See Note 19) — GO

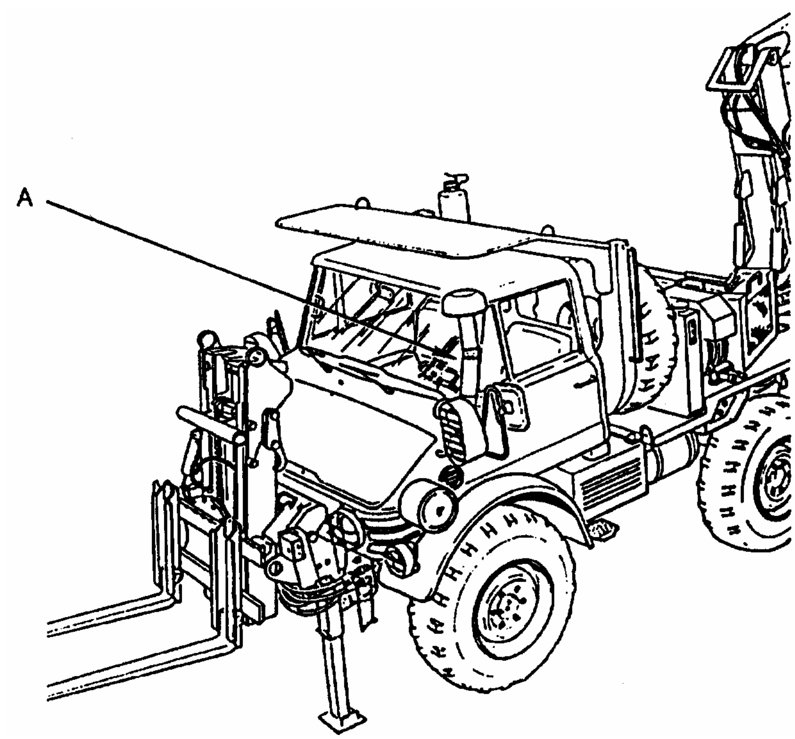


ANNUAL NOTES (CONTINUED):

LUBRICANT ● INTERVAL

Boom and Bucket Control Lever Linkage (SEE/HMMH) (See Note 20)	GAA





ANNUAL NOTES (CONTINUED):

Note 14

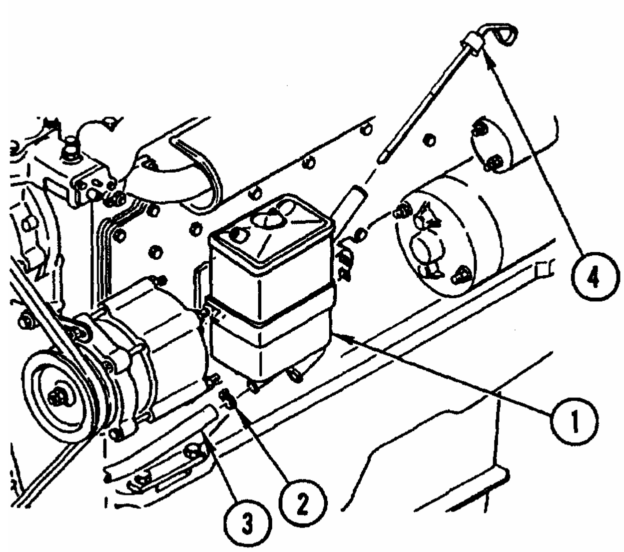
STEERING SYSTEM OIL (SEE/HMMH)

A Tilt cab (page 4-418).

B Place suitable container under steering system reservoir (1). Remove clamp (2) and hose (3) and drain oil.

C Replace steering system filter located in reservoir (1) (page 4-359).

D Fill reservoir (1) with OE/HDO (Appendix C, Items 22, 23, 24, or 25) or OEA (Appendix C, Item 30) to maximum (MAX) mark on dipstick (4) with engine running.

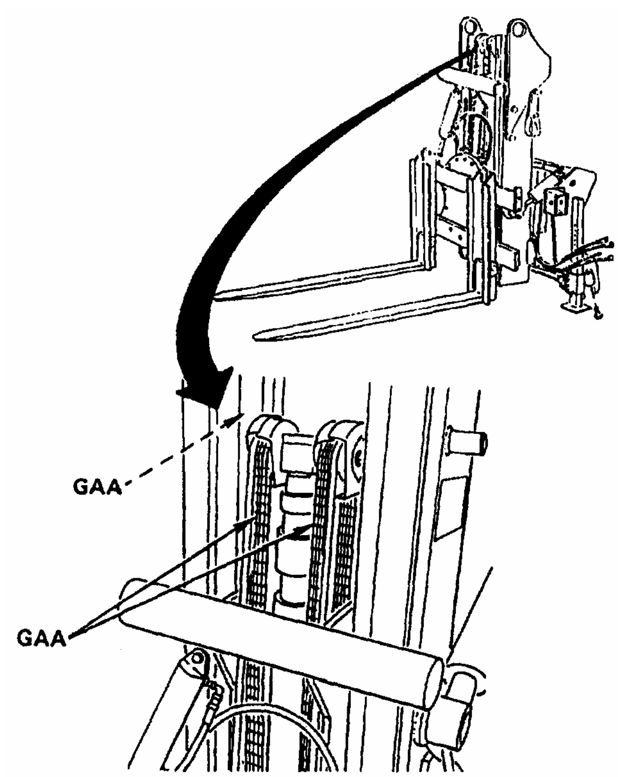


Note 15

FORKLIFT (HMMH)

WARNING
Death or serious injury could result from repeated or prolonged breathing or skin contact of drycleaning solvent SD, type II, P-D-680. Use in well-ventilated area. Do not use near open flame or in excessive heat.

Remove old grease from mast channel and mast chain with drycleaning solvent (SD, type II) (Appendix C, Item 34) and apply thin coating of GAA (Appendix C, Item 19).



ANNUAL NOTES (CONTINUED):

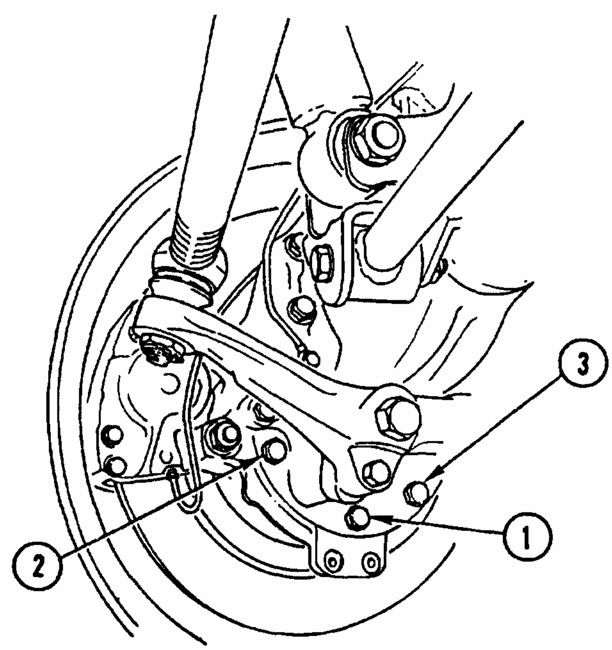
Note 16

FRONT AND REAR AXLE WHEEL HUB DRIVES (SEE/HMMH)

Place suitable container under drain plug (1) and drain oil. Install drain plug (1) and remove fill plug (2) and check plug (3). Fill axle with GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) through fill plug (2). Oil level should be level with bottom of the inspection hole (3). Install fill plug (2) and check plug (3).

AXLE-WHEEL HUB DRIVE (DISC BRAKE)

1. DRAIN PLUG (BOTTOM)
2. FILL PLUG (FORWARD)
3. CHECK PLUG (REAR)

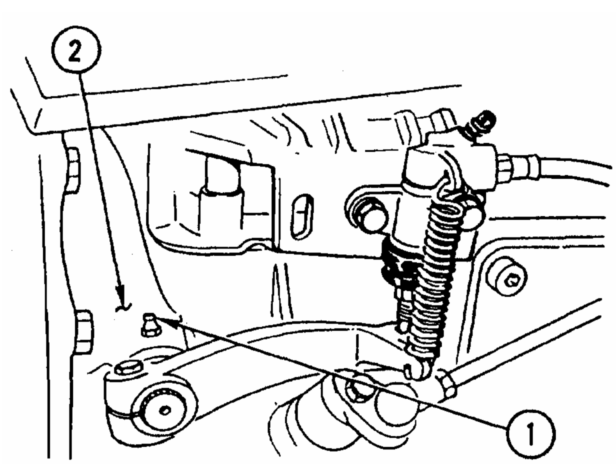


Note 17

CLUTCH RELEASE SHAFT (SEE/HMMH)

CAUTION
Damage can occur to clutch assembly if over-lubricated.

Apply two shots of GAA (Appendix C, Item 19) from standard-held grease gun to fitting (1) on clutch housing (2).



ANNUAL NOTES (CONTINUED):

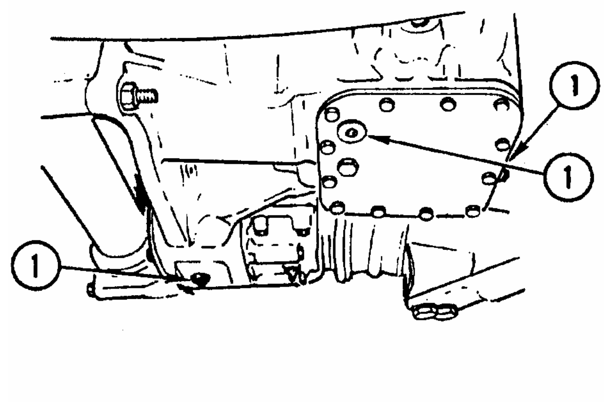
Note 18

TRANSMISSION OIL (SEE/HMMH)

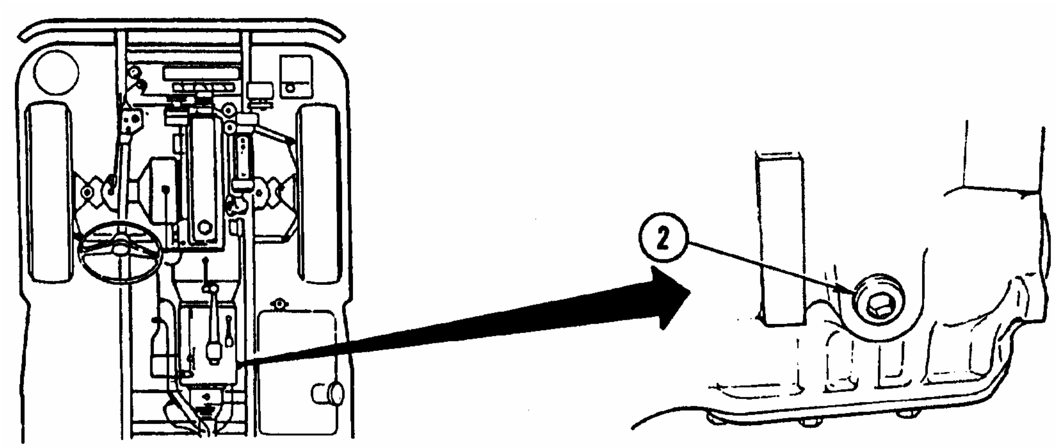
A Vehicle must be parked on level surface.

B All implements must be in transport position.

C Place suitable container under transmission drain plugs (1) and drain oil. Install drain plugs (1) and remove fill plug (2). Fill transmission with GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) to bottom of fill plug (2) port and install fill plug (2).



BOTTOM

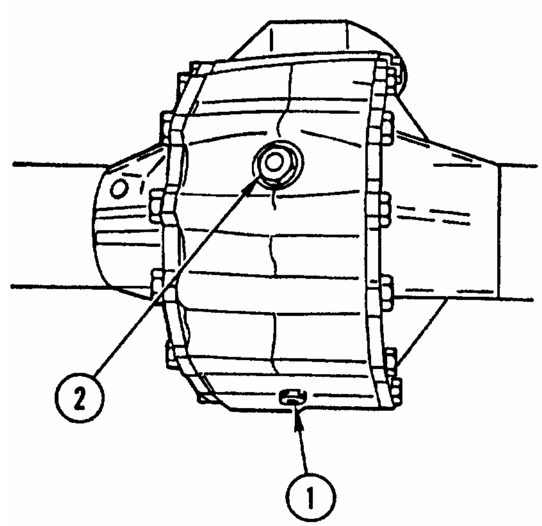


SIDE

Note 19

DIFFERENTIAL OIL FILLER PLUG/OIL DRAIN PLUG (SEE/HMMH)

Place suitable container under differential. Remove drain plug (1) and drain oil. Install drain plug (1) and remove fill plug (2). Fill differential with GO-80/90 (Appendix C, Item 27) or GO-75 (Appendix C, Item 26) through fill port (2). Oil level should be level with bottom of fill port (2). Install fill plug (2).



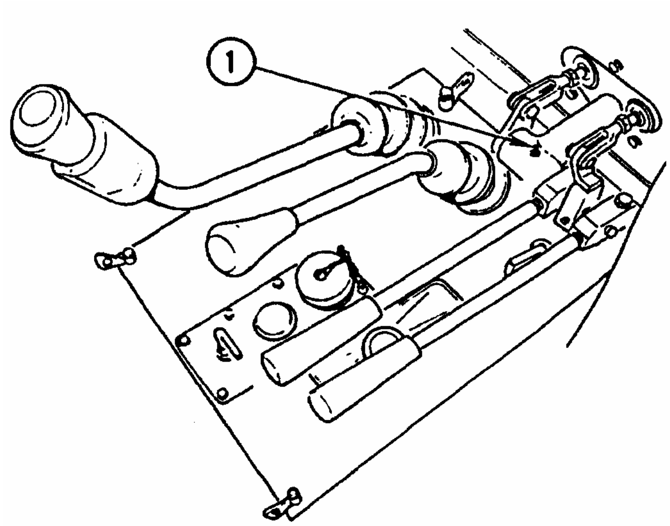
ANNUAL NOTES (CONTINUED):

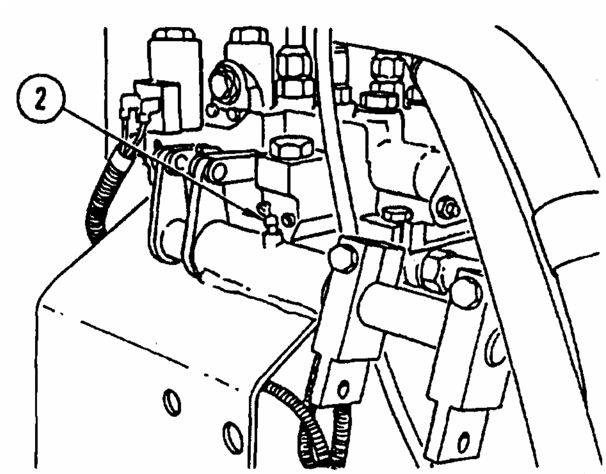
Note 20

BOOM AND BUCKET CONTROL LEVER LINKAGE (SEE/HMMH)

A Lubricate one fitting with GAA (Appendix C, Item 19) inside cab at boom and bucket control lever linkage (1).

B Lubricate one fitting with GAA (Appendix C, Item 19) outside cab at boom and bucket control lever linkage (2).

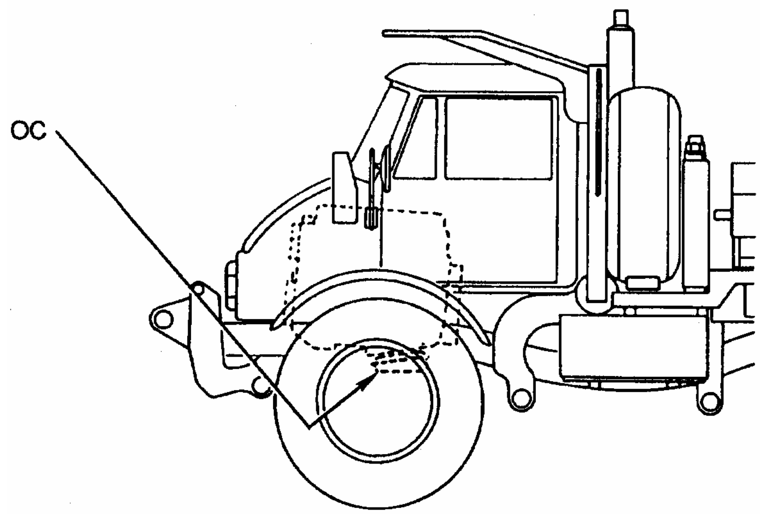




ON-CONDITION NOTES:

LUBRICANT ● INTERVAL

Engine Oil Drain (SEE/HMMH) (See Note 21)	OE/HDO, OEA	OC



ON-CONDITION NOTES (CONTINUED):

Note 21

ENGINE OIL DRAIN (SEE/HMMH)

WARNING
Hot oil causes burns and serious injury. Use care when checking or draining hot oil.

NOTE
Drain oil when notified by Army Oil Analysis Program (AOAP) laboratory. Unless notified by AOAP, engine oil must be changed quarterly.

A Remove inside engine hood (page 4-389).

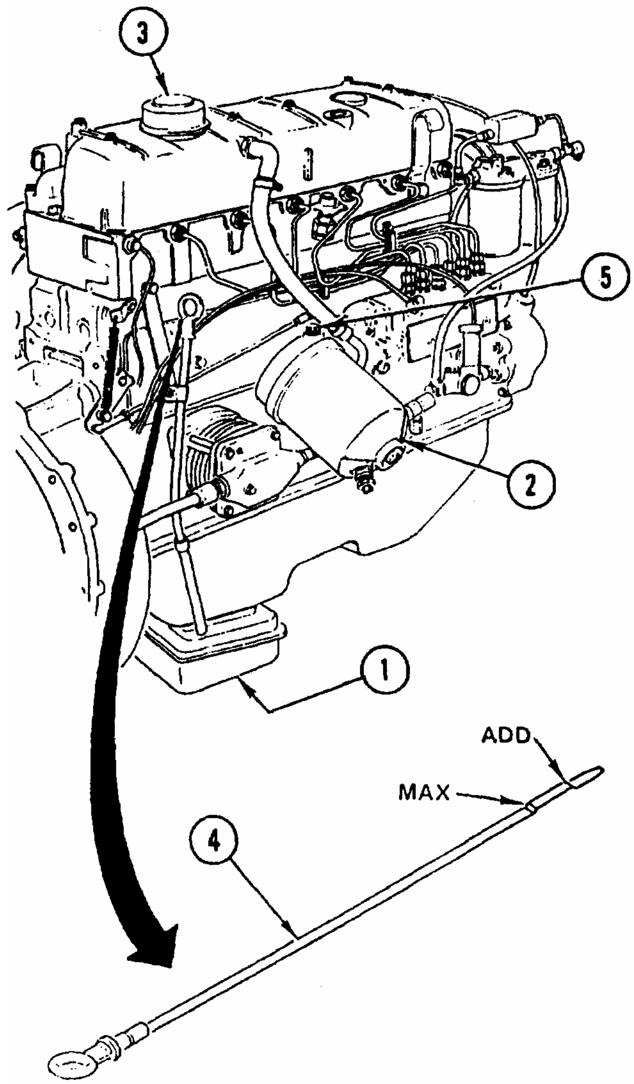
B Run engine until warm; stop engine. Place suitable container under engine. Remove drain plug (1) and drain oil. Install drain plug (1).

C Remove and discard oil filter element (2) (page 4-7). Clean filter base. Apply thin coating of clean oil to gasket on base of new filter element (2) and install on engine (page 4-7).

D Remove filler cap (3) and fill engine with OE/HDO or OEA until dipstick (4) indicates maximum (MAX) level. Remove filler plug (5) and fill filter bowl/canister with OE/HDO (Appendix C, Items 22, 23, 24, or 25) or OEA (Appendix C, Item 30).

E Start engine and check for oil leaks.

F Check oil level after engine has been shut down.



Section V. PAINTING AND RESTENCILING MARKINGS

GENERAL

Complete painting of the vehicle is authorized for and done by direct support maintenance or higher. Spot painting and restenciling vehicle markings are done by unit maintenance. Instructions for material preparation and painting are given in TM 43-0139, Painting Instructions for Field Use.

VEHICLE INTERIOR

Prepare surface in accordance with TM 43-0139 and MIL-STD-193.

VEHICLE EXTERIOR

Prepare surface in accordance with TM 43-0139 and MIL-STD-193. Coat surface with color forest green, black, or brown, specification MIL-C-46168.

NONSKID AREAS

Deck covering compound, non-slip, type III, MIL-D-23003 will be used to coat deck areas where personnel walk.

RESTENCILING MARKINGS

All stenciled markings on the SEE/HMMH are black. Use paint conforming to specification MIL-C-46168.

Section VI. GENERAL REPAIR AND CLEANING METHOD

OVERVIEW

This section describes general maintenance instructions that apply to all parts of this manual. To avoid repetition, these procedures will not be described in specific maintenance sections.

GENERAL REMOVAL INSTRUCTIONS

1. Work Required. Remove only those parts needing repair or replacement. Do not disassemble a component any further than needed.

2. Preparation. Before removing any part of the electrical, hydraulic, or air systems, make certain system is not energized or pressurized. Disconnect battery cables. Relieve all pressure from air system. Make sure brakes are locked and that all controls are in OFF position before starling any removal procedure.

3. Removal. Make sure there is enough clearance to remove part. Disassemble adjacent parts as needed to provide working clearance.

4. Lifting. Always use chain hoist, jack, or other aid when lifting heavy parts. Make certain load limit of lifting device exceeds weight being lifted. Position and rig lifting device before disconnecting part for removal.

5. Identification. Tag or mark all similar parts, such as electrical leads, before disconnecting and removing such parts. This will make proper assembly easier. Be sure to identify mating ends of electric lines, hydraulic lines, and air tubes as they are disconnected.

6. Position of Valves. Before removing valve handles, mark or diagram their positions when open and closed. This will help during assembly.

GENERAL DISASSEMBLY INSTRUCTIONS

1. Cleanliness. Work area must be kept as clean as possible. This will prevent injury or contamination of internal parts. This is especially true for valves, cylinders, and other hydraulic or air system parts.

2. Expendable Parts. As indicated in this manual, all gaskets, packings, and seals removed during repair must be discarded and replaced with new parts. These items are usually damaged during removal. In the same way, all Iockwire, cotter pins, and like items must be replaced at time of assembly.

3. Removing Seals. When removing gaskets, packings, or seals, do not use any metal tool that will scratch the surfaces next to these items.

4. Disassembly. Before disassembly of any item, study the illustration carefully. Note relationship of internal parts. Knowing details of a component will speed up disassembly and assembly and will help avoid mistakes.

5. Parts Protection. To prevent moisture and dirt from entering open housings, lines, and other openings, apply protective caps and plugs as soon as possible after disassembly. Wrap all removed parts in clean paper or coat parts with solid lubricant preservative.

GENERAL CLEANING INSTRUCTIONS

WARNING

- Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. Flash point is 100° -138°F (38°-50°C). If you become dizzy while using drycleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.
- Never use gasoline to clean parts. Gasoline is highly flammable. Serious personal injury could result if fuel ignites during cleaning.

CAUTION

- Petroleum solvents may damage parts that are in contact with hydraulic fluids.
- To prevent damage to equipment, do not clean tires, lubricant seals, rubber hoses, or electrical components with solvent mixture.

1. Cleaning Solvents. Use only approved cleaning solvents to clean parts. Drycleaning solvent SD-2 (P-D-680) is commonly used. Always work in a well-ventilated area.

WARNING

To prevent injury, compressed air used for cleaning and drying purposes will not exceed 30 psi (207 kPa). Use only with effective chip guarding and personal protective equipment (goggles/shield, gloves, etc.).

2. Removing Deposits. After soaking parts in solvent, wash away deposits by flushing or spraying. Where necessary, brush with a soft-bristle brush moistened in solvent. Use compressed air to dry all parts, except bearings. Bearings must be allowed to air dry.

3. Tools. Do not use abrasive wheels, or compounds in cleaning parts, unless called for in detailed instructions. These procedures may weaken a highly stressed part.

4. Ball and Roller Bearings. When cleaning ball or roller bearings, place them in a basket and suspend them in a container of drycleaning solvent. If needed, use a brush to remove bearing before solid particles are removed to prevent damaging races and balls. When bearings have been cleaned, coat them lightly with lubricating oil to remove solvent. Refer to TM 9-214 for additional instructions on cleaning bearings.

5. Rubber Parts. Do not clean rubber parts in drycleaning solvent. Clean by washing with a mild solution of soap and water. Wipe with a clean, dry, lint-free cloth.

WARNING

Steam cleaning creates hazardous noise levels and severe burn potential. Eye, skin, and ear protection are required.

6. Exterior Parts. Steam clean all exterior parts thoroughly before removing. This will make inspection and disassembly easier.

WARNING

- Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. Flash point is 100° -138° F (38° -50°C). If you become dizzy while using drycleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.
- Solvents used with spray gun must be used in spray booth with filter. Face shield must be used by personnel operating spray gun. Failure to do so could result in serious injury to personnel.

7. Engine, Cab, and Body. Use a spray gun and solvent mixture for cleaning exterior of engine, cab, and body. Allow mixture to remain on item surface for about 10 minutes before rinsing. Rinse with hot water under 80-120 pounds of pressure, if available. An ordinary garden hose with nozzle may be used if other equipment is not available. Rinse thoroughly.

8. Degreasing Machine. A degreasing machine may be used to remove heavy grease and oil accumulations from metal parts.

9. Passages. After removing parts from degreasing machine, and before coating with rust preventive, check all oil passages and cavities for dirt or blockage. A thin, flexible wire should be run through oil passages to make certain they are not clogged. Individual passages that are dirty may be cleared using a pressure spray gun and drycleaning solvent.

CAUTION

To prevent corrosion, parts should be dipped in rust preventive compound within 2 hours after degreasing.

10. Electrical Parts. Electrical parts, such as coils, junction blocks, switches, and igniters, which use insulating materials, should not be soaked or sprayed with cleaning solutions. Clean these parts with a clean, lint-free cloth moistened with drycleaning solvent.

11. Electrical Grounds. Clean electrical ground contacts with emery cloth.

12. Oil and Fuel Tank. Pay special attention to all warnings and cautions when working on fuel tank. Oil and fuel tanks should be flushed, using a spray gun and drycleaning solvent.

13. Battery. Exterior surfaces of the electrical system and battery should be cleaned with a weak solution of baking soda and water. Apply solution with a bristle brush to remove corrosion.

GENERAL CLEANING INSTRUCTIONS (CONT)

WARNING

• Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. Flash point is 100°-138°F (38°-50° C). If you become dizzy while using drycleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

CAUTION

To prevent damage to equipment, never use gasoline or other petroleum-base products to clean or preserve hydraulic system parts.

14 Hydraulic System. When cleaning hydraulic system parts, use drycleaning solvent SD-2 (P-D-680). Clean and dry parts thoroughly to make sure no residue remains. If a coating of preservative is required before assembly, apply a light film of solid lubricant preservative. If petroleum-free solvents are not available, use the same hydraulic fluid as used in the hydraulic system.

GENERAL INSPECTION INSTRUCTIONS

1. Sealing Surfaces. Inspect all surfaces in contact with gaskets, packings, or seals. Make sure there are no nicks, burrs, or scratches. If any defect is found, remove or repair it as outlined under General Repair Instructions in this manual.

2. Bearings. Check bearings for rusted or pitted balls, races, or separators. Check balls and races for brinnelling, abrasion, and serious discoloration. Refer to TM 9-214 for additional instructions for bearings. Following are causes for bearing rejection:
   - Cuts or grooves parallel to ball or roller rotation.
   - Fatigue pits (not minor machine marks or scratches).
   - Cracks.

3. Inspection. Inspection consists of checking for defects such as distortion, wear, cracks, and pitting. Parts under heavy load or pressure must be inspected more thoroughly. Clean all parts before inspection.

4. Drain Plugs. When removing drain plugs from transmission, engine, or hydraulic system components, inspect sediment adhering to plug. A buildup of grit and/or fine metal particles may indicate part failure. A few fine particles are normal. This inspection is effective in determining defective parts prior to internal inspection of parts.

5. Gears. Gear inspection cannot be described in detail here: there are too many differences in size and shape of gears. The following steps can be used to make a general visual inspection of all gears. Follow all steps listed in General Repair instructions for final inspection.
   - Normal Wear. Loss of metal from the surface of gear teeth. Wear must not prevent gears from meshing or performing properly.
   - Initial Pitting. This may occur when a pair of gears is first started in service. It may continue until most high spots have been reduced, as long as contact surfaces are not affected. This pitting is not necessarily serious.

- Destructive Pitting. This type of pitting occurs after initial pitting, often at an increasing rate. This will destroy contact area and reduce the gear's ability to carry a load. Rapid destruction will occur with use.
- Abrasive Wear. This damage is caused by the fine particles that may come from many sources: metal detached from gear teeth or bearings, abrasives not completely removed before assembly, sand or scale from castings, or other impurities in oil or air.
- Scoring. Slight scoring, scuffing, galling, or other surface damage is identified by tears or scratches in the direction of sliding. It starts in areas having the highest stress and speed. This is usually at the tip of the teeth.
- Burning. Burning is indicated by discoloration and loss of hardness due to excessive temperature. This is caused by too much friction resulting from overload, overspeed, lack of backlash, or faulty lubrication. If discoloring can be wiped off with clean cloth, such discoloring usually can be traced to oilburn-trains, which are not serious.
- Rolling. This damage occurs mainly on plastic gears. Rolling is when material is pushed out of shape without breaking off. This is caused by heavy, even loads; sliding; or overheating.
- Brinelling. This can be identified by tiny indentations or ridges on the shoulder or race of a bearing.

6. Splines. Inspect shaft splines for wear, pitting, rolling, peening, and fatigue cracks. In many cases, the same inspection procedure will apply to gears. However, the problem will often be much less pronounced. Have a magnetic particle inspection performed on splines, if needed.

7. Tubes, Hoses, Fittings, and Connections. Check all hose surfaces for broken or frayed fabric. Check for breaks caused by sharp kinks or rubbing against other parts of the truck. Inspect air tubes for kinks. Inspect the fitting threads for damage. Replace any part found defective. Following assembly and during initial operation, check for leaking fittings and connections by coating fittings and connections with soap solution. No leakage is permissible.

8. Electrical Parts. Inspect all wiring harnesses for chafed or burned insulation. Inspect all terminal connectors for loose connections and broken parts.

9. Metal Parts. Visually inspect all castings and weldments for cracks. Parts that carry a great load should receive magnetic particle inspection. Critical nonferrous parts may be inspected with fluorescent penetrant.

10. Brake Rotors. Check surfaces of brake rotors for cracks or badly scored finish and for glossy or heat spots. Check brake rotors for external or mating surface cracks and for balancing weight.

GENERAL REPAIR INSTRUCTIONS

WARNING

Drilling and grinding operations are hazardous to the eyes. Eye protection is required.

1. Burrs. Remove burrs from gear teeth with a fine-cut file or hand grinder. Remove burrs on closely fitted mating surfaces by lapping the surfaces with emery cloth.

2. Exterior Parts. Chassis and exterior painted parts may be resurfaced where paint is damaged, or where parts have been repaired, by using an abrasive disc driven by a flexible shaft. Paint metal surfaces as required.

3. Bearings. Remove residue and oil stain from bearing races with emery cloth.

GENERAL REPAIR INSTRUCTIONS (CONT)

NOTE

The following procedure is used with polished and machined steel parts not protected by cadmium, tin, copper, or other plating or surface treatment. Bare metal surfaces must be free of moisture when protective coating is applied.

4. Protective Parts. During repair operations, protect bare steel surfaces from rusting when not actually undergoing repair work. Dip parts in, or spray them with, corrosion preventive compound. The same protective coating may be applied to other metals to prevent rust. Aluminum parts may require protection in atmospheres having a high salt content. Steel parts must always be protected.

5. Welding. Welding and brazing may be used to repair cracks in external steel parts, such as brackets, panels, and light framework. These repairs should be made only when replacement parts are not available. Do not weld or braze castings, running pads, or parts under great stress, except in emergencies. When welding is required, refer to TM 9-237.

6. Stud Installation. When installing studs in engine block and axle housings, use a driver designed for the stud to be installed. A worn stud driver may damage the end thread. This makes it necessary to use a chasing die before a nut can be screwed on. This procedure will remove cadmium plating and allow corrosion, which will make future disassembly difficult and cause stud to be backed out with nut. Before driving a stud, inspect hole for chips and liquid. Blow out any foreign matter. Start stud by hand. If it will not start into hole, it is too large or has defective end thread. Before final insertion, coat thread with antiseize compound; turn stud in slowly to prevent overheating and galling of casting metal.

7. Electrical Parts. Replace all broken, worn, or burned electrical wiring. Wires with several broken strands must be replaced. Broken strands will increase the resistance of the wire and impair efficiency of electrical components, especially the ignition system. When soldering is required, refer to TB SIG 222.

8. Hoses. Replace all broken, frayed, crimped, or soft flexible lines and hoses. Replace stripped or damaged fittings. Replace entire flexible hose if fittings are damaged. Make sure hose clamps do not crimp hoses.

9. Fasteners. Replace any bolt, screw, nut, or fitting with damaged threads. Inspect tapped holes for thread damage. If cross-threading or galling is evident, retap the holes for the next oversize screw or stud. When retapping will weaken the part, or when the cost of the part makes retapping impractical, replace the damaged part. Chasing threads with the proper size tap or die may often be enough.

10. Dents. Straighten minor body dents by bumping with a soft-faced hammer while using a wooden block backing.

11. Sheet Metal Repair. Repair minor skin cracks by installing patches.

12. Mounting Holes. Reshape oval mounting holes to round. Drill to receive bushing with required inner diameter. Stake bushing in place with center punch.

GENERAL ASSEMBLY INSTRUCTIONS

1. Preparation. Remove grease from new parts before installation.

2. Packing Installation. Lubricate all packings with a thin coating of light lubricating oil before installation. Slightly stretch packing and place into position. Rotate component on flat surface or uniformly press the packing into position.

3. Pipe Joints. Use sealing pipe-joint compound or thread sealing tape when joining piping.

4. Gaskets. To provide added sealing for gasket, coat both sides with sealant. Remove all traces of previous gasket and sealant before installing new gasket.

5. Silicone Sealant (Sealing Compound).

WARNING

On direct contact, uncured silicone sealant irritates eyes. In case of contact, flush eyes with water and seek medical attention. Avoid prolonged contact with skin.

Silicone sealant is often used instead of a gasket to seal mating parts. Mating parts must be clean, dry, and free of oil or grease for proper adhesion. After silicone sealant has been applied, mating parts must be assembled within 15 minutes. Silicone sealant starts to set up in 15 minutes and takes 24 hours to completely cure. Excess silicone sealant should be wiped off after assembling mating parts.

6. Oil Seals. Install oil seals with seal lip facing toward lubricant, applying an even force to outer edge of seal. Coat oil seals evenly with grease before installing. If oil seals will be installed over keyed or splined shafts, use a guide. This will prevent sharp edge of keyway or splines from cutting the leather or neoprene seal. Construct guides of very thin-gage sheet metal and shape to required diameter. However, make certain guide edges are not sharp. Bend them sightly inward so they do not cut the seal.

7. Seal Rings. Coat seal rings with oil and carefully install into their bores. If seal rings must be installed over threaded parts, temporarily wrap the threads wifh tape to protect the seal ring.

8. Bearings and Shafts. During assembly of shafts and bearings in housings, first mount bearing on shaft, then install the assembly by applying force to shaft. When mounting bearings on shafts, always apply force to the inner races of the bearing.

9. Bearing Lubrication. Lubricate bearings before reassembly with the type of lubricant normally used in the related housing or container. This will provide lubrication' during the first run-in until lubricant from the system can reach the bearings.

GENERAL INSTALLATION INSTRUCTIONS

1. Preparation. Before installing any parts, make sure they are clean and that both mounting surfaces are clean and free of oil and grease (unless otherwise noted).

2. Installation. Make sure there is enough clearance to install part. Disassemble adjacent parts as needed to provide working clearance.

3. Lifting. Always use chain hoist, jack, or other aid when lifting heavy parts. Make certain load limit of lifting device exceeds weight being lifted. Position and rig lifting device before connecting part for installation.

GENERAL LUBRICATION INSTRUCTIONS

Keep a light coat of lubricating oil on parts during repair procedures to prevent rusting. Lubricate parts during repair and assembly as required. (See TM 5-2420-224-10 and Lubrication Instructions, page 2-14.)

GENERAL TORQUE VALUE INSTRUCTIONS

Use the torque values listed in the maintenance procedures, if they are given. When no torque values are given in the maintenance procedures, refer to the torque value guide in Appendix E.

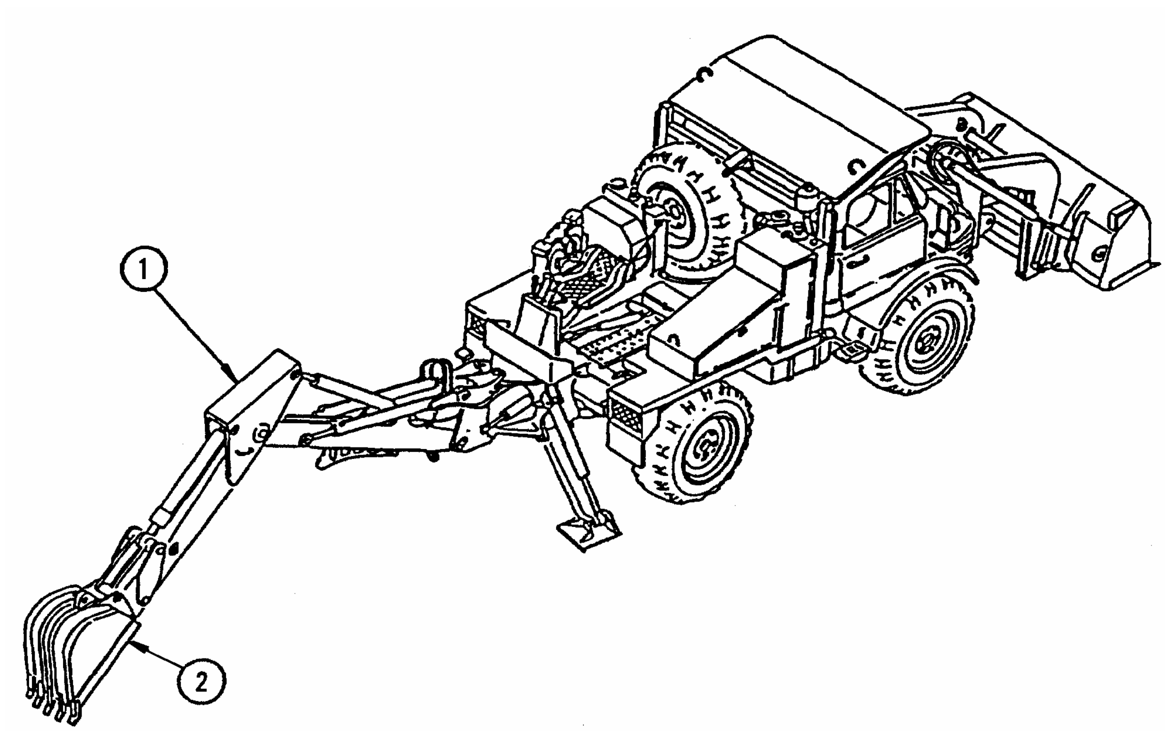
PREPARATION FOR MAINTENANCE

Some maintenance tasks are necessary to prepare the SEE/HMMH for many of the maintenance procedures in Chapter 4. These tasks are required for personnel safety and for ease of maintenance. These preparation steps are described below.

BLOCKING THE VEHICLE

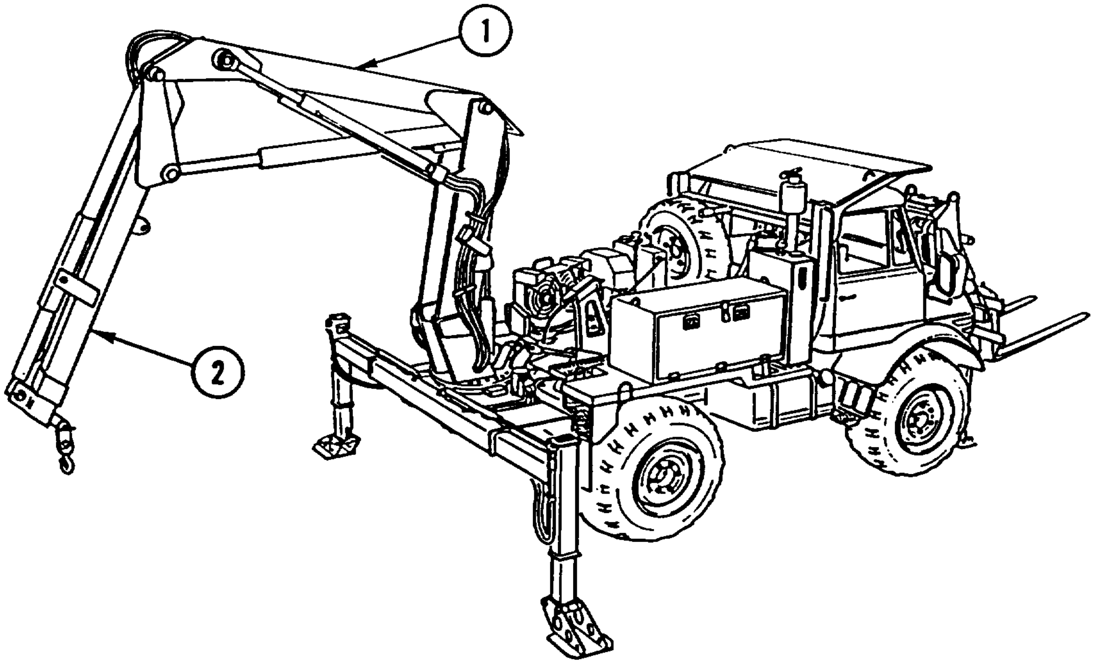
During maintenance procedures, the vehicle wheels must be chocked to prevent roll off. Chock all wheels both in front and behind each wheel.

THREE POINT STANCE (SEE)



To perform some maintenance procedures, the backhoe must be placed in a three-point stance (1). The bucket (2) may be extended as shown, or rolled under. The amount of extension will depend on the task being performed.

THREE-POINT STANCE (HMMH)

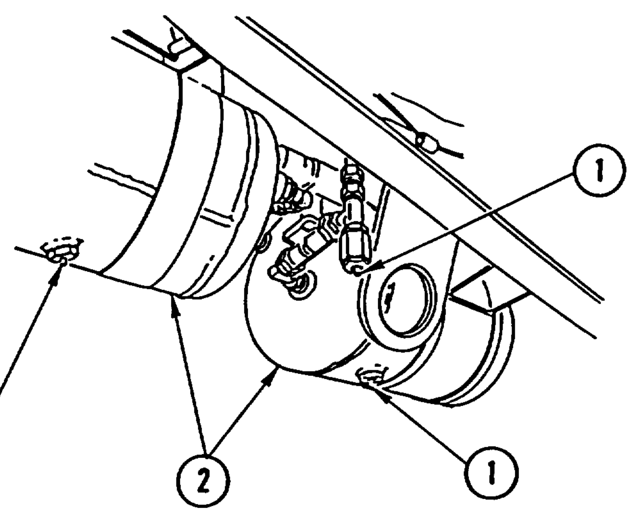


To perform some maintenance procedures, the crane must be placed in a three-point stance (1). The outer boom (2) is positioned on the ground using caution not to damage hook on boom end. The amount of extension will depend on the task being performed.

RELIEVING HYDRAULIC PRESSURE

Turn engine off. Move control levers in both directions 3-4 times.

RELIEVING AIR PRESSURE



Turn engine off. Depress air relief valves (1) and hold until all air has escaped from air tanks (2).

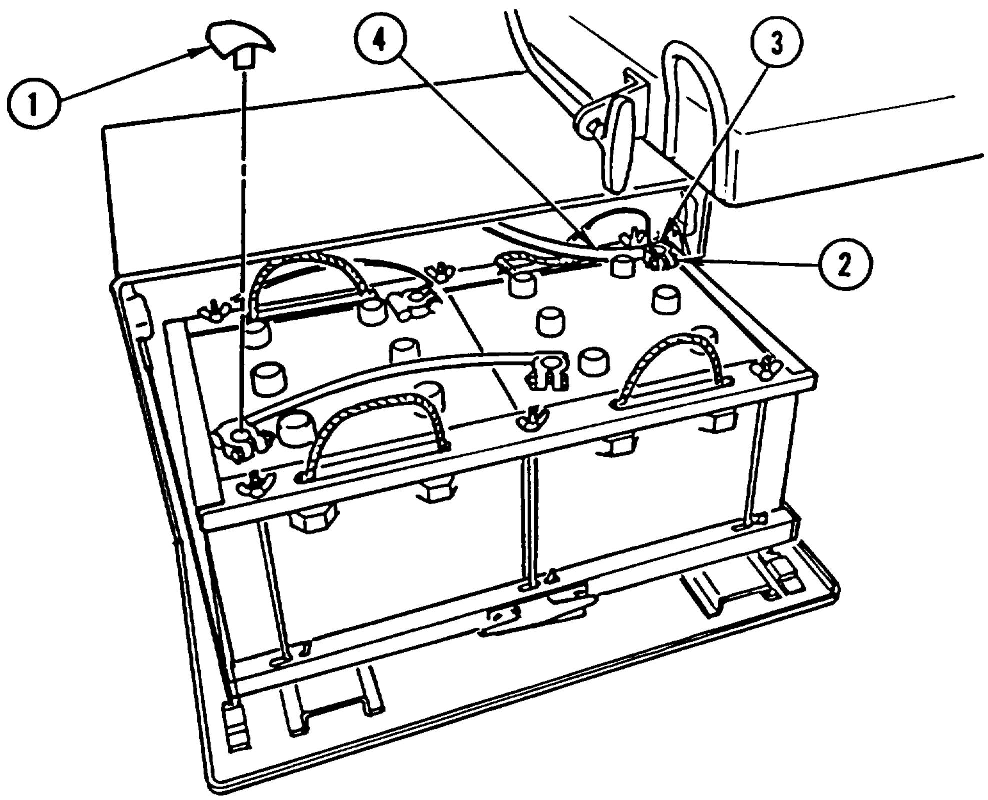
DISCONNECTING/CONNECTING BATTERIES

DISCONNECT

WARNING
All vehicle electrical switches must be OFF before disconnecting battery cables. Failure to do so could result in injury to personnel.

NOTE
Procedure is the same for all batteries.

1. Remove cover (1) from battery terminal (2).
2. Loosen nut (3) and remove cable (4) from battery terminal (2).



CONNECT

NOTE
Procedure is the same for all batteries.

1. Install cable (4) on battery terminal (2) and tighten nut (3).
2. Install cover (1) on battery terminal (2).

TUBE FITTINGS REPLACEMENT

REMOVAL

WARNING

Do not disconnect any air system lines or fittings unless vehicle engine is shut off and air system pressure is relieved. To do so could result in injury to personnel.

NOTE

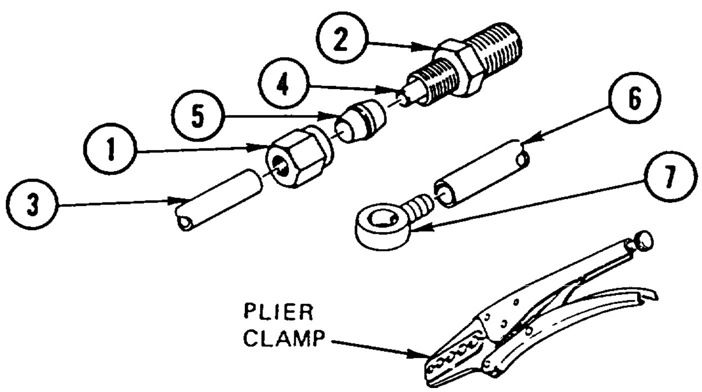
Steps 1 thru 3 are for compression fittings. Step 4 is for banjo type fittings.

1. Remove nut (1) from fitting (2).
2. Remove air tube (3) from fitting (2).

NOTE

If insert remains in fitting, do not remove.

3. Remove insert (4), ferrule (5), and nut (1) from air tube (3).
4. Remove fitting (6) from tube (7).



INSTALLATION

NOTE

- Steps 1 thru 3 are for compression fittings. Steps 4 and 5 are for banjo type fittings.
- Cut new tube 1/4-1/2 in. (6.4 -12.7 mm) longer than air tube being replaced.

1. Install nut (1), ferrule (5), and insert (4) on air tube (3).
2. Install air tube (3) in fitting (4).
3. Install nut (1) on fitting (2).
4. Hold tube (6) in plier clamp.
5. Install fitting (7) in tube (6) and drive in as far as it will go using plastic headed hammer.

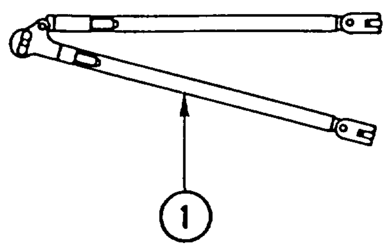
VEHICLE TOWING (SEE)

TOW BAR INSTALLATION

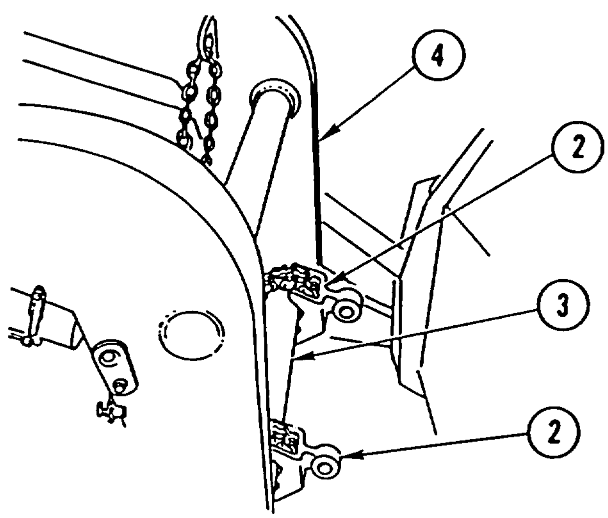
WARNING

- Tow bar weighs 120 pounds (55 kilograms). To avoid personal injury, always use two or more personnel to install tow bar.
- To avoid personal injury, do not allow any part of body to get between tow bar and front loader bucket.

1. Place front loader bucket in transport position (TM 5-2420-224-10).
2. Set parking brake (TM 5-2420-224-10) and block vehicle (page 2-22).

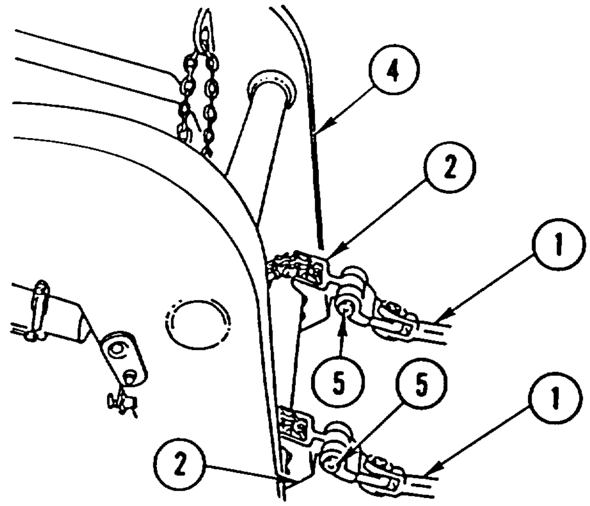


3. Prepare tow bar (1) (FM 20-22).

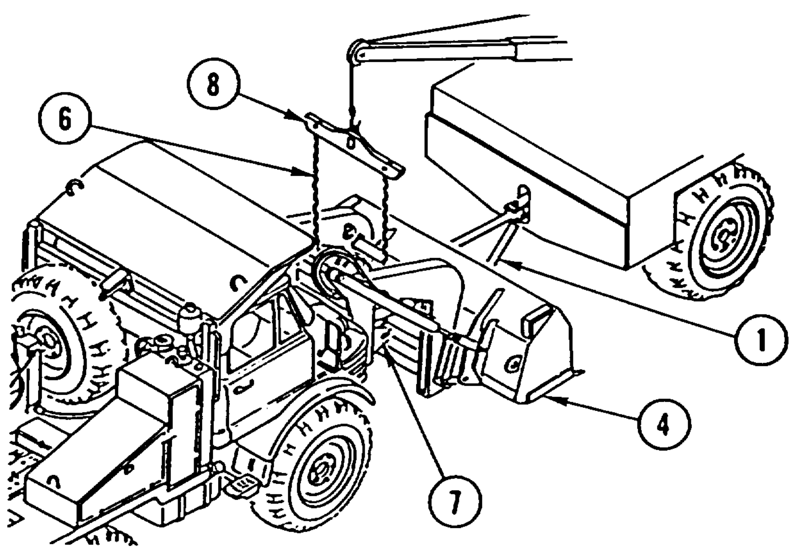


4. Attach two clamps (2) to crossbar (3) of front loader (4), perpendicular to ground to allow for clearance when turning.

VEHICLE TOWING (SEE) (CONT)



5. Attach tow bar (1) to two clamps (2) using 1.0-in. (24.4-mm) pin and clevis assemblies (5), with clevis tipping upward.



6. Extend tow bar (1) enough to clear front loader (4) and tow vehicle when turning.

7. Attach lift chains (6) to front lift points (7) and spreader bar (8).

8. Raise front loader (TM 5-2420-224-10) to allow access to tow bar connection to wrecker.

9. Attach tow bar (1) to wrecker.

10. Move wrecker boom forward or backward to obtain proper boom-to-vehicle alinement.

11. Connect spreader bar (8) to wrecker boom. Raise front of vehicle until tires are 10-12 in. (24.4-30.4 cm) off ground.

12. Place main shift lever in neutral, shift intermediate speed control in position H, Power Take-Off in neutral, range-shift lever in stage II, and disengage four-wheel drive lever (TM 5-2420-224-10).

VEHICLE TOWING (SEE) (CONT)

13. Release parking brake (TM 5-2420-224-10) and remove chocks.

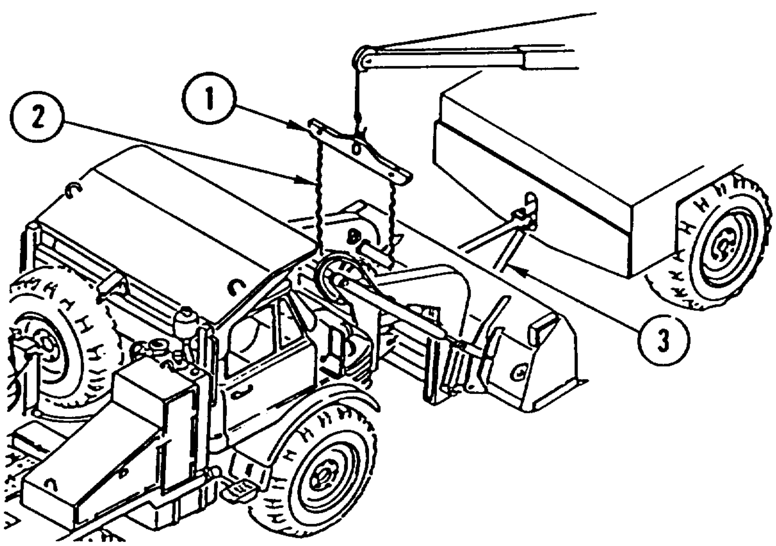
14. Lower front loader, engage lock, and close shutoff valve (TM 5-2420-224-10).

TOW BAR REMOVAL

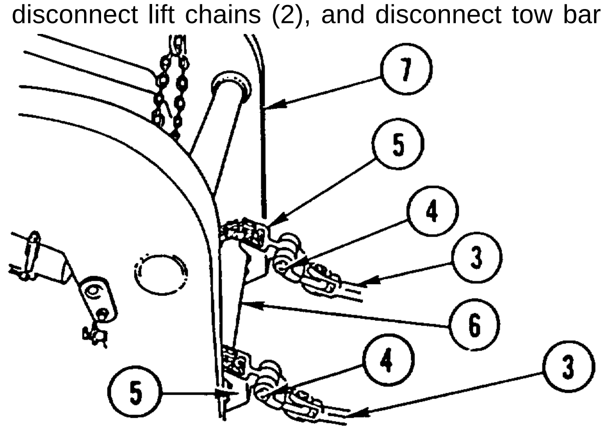
WARNING

- Tow bar weighs 120 pounds (55 kilograms). To avoid personal injury, always use two or more personnel to remove tow bar.
- To avoid personal injury, do no allow any part of body to get between tow bar and front loader bucket.

1. Set parking brake (TM 5-2420-224-10) and block vehicle (page 2-22).
2. Lower vehicle to ground.
3. Open shutoff valve, disengage lock, and raise front loader (TM 5-2420-224-10) to allow access to tow bar connection to wrecker.



4. Remove spreader bar (1), disconnect lift chains (2), and disconnect tow bar (3) from wrecker.



5. Remove pin and clevis assemblies (4) and tow bar (3) from two clamps (5).

VEHICLE TOWING (SEE) (CONT)

6. Remove two clamps (5) from crossbar (6) of front loader (7).

7. Lower front loader, engage lock, and close shutoff valve (TM 5-2420-224-10).

VEHICLE TOWING (HMMH

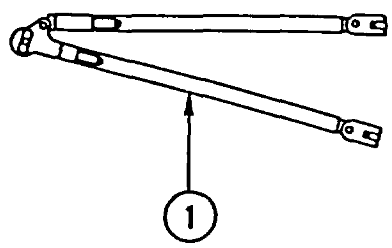
TOW BAR INSTALLATION

WARNING

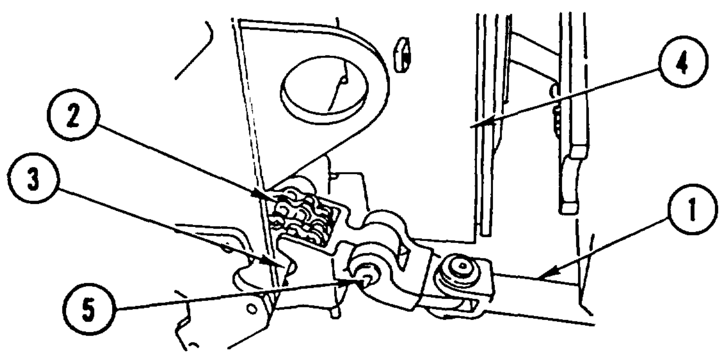
- Tow bar weighs 120 pounds (55 kilograms). To avoid personal injury, always use two or more personnel to remove tow bar.
- To avoid personal injury, do no allow any part of body to get between tow bar and forklift.

1. Place forklift in transport position (TM 5-2420-224-10).

2. Set parking brake (TM 5-2420-224-10) and block vehicle (page 2-22).



3. Prepare tow bar (1) (FM 20-22).

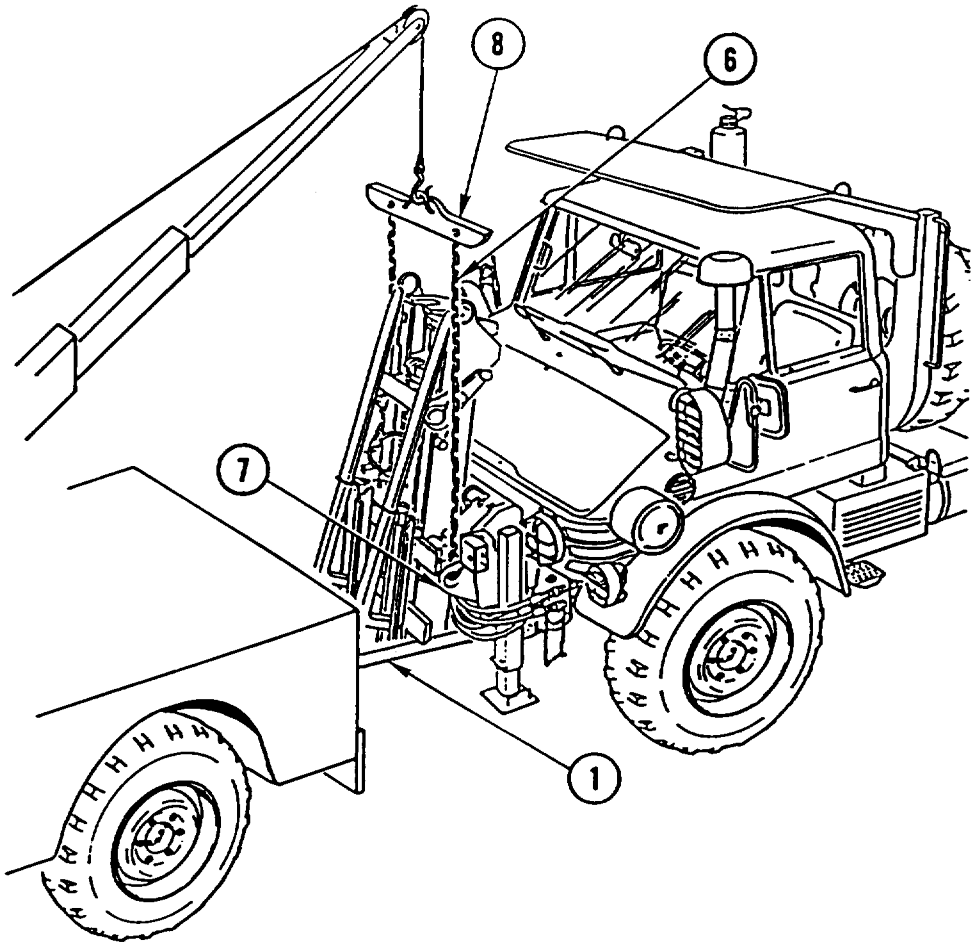


4. Attach two clamps (2) to crossbar (3) of forklift (4), perpendicular to ground to allow for clearance when turning.

5. Attach tow bar (1) to two clamps (2) using 1.0-in. (24.4-mm) pin and clevis assemblies (5).

6. Extend tow bar (1) enough to clear forklift (4) and tow vehicle when turning.

VEHICLE TOWING (HMMH) (CONT)



7. Attach lift chains (6) to front lift points (7) and spreader bar (8).

8. Attach tow bar (1) to wrecker.

9. Move wrecker boom forward or backward to obtain proper boom-to-vehicle alinement.

10. Connect spreader bar (8) to wrecker boom. Raise front of vehicle until tires are 10-12 in. (24.4-30.4 cm) off ground.

11. Place main shift lever in neutral, shift intermediate speed control in position H, Power Take-Off in neutral, range-shift lever in stage II, and disengage four-wheel drive lever (TM 5-2420-224-10).

12. Release parking brake (TM 5-2420-224-10) and remove chocks.

13. Close shutoff valve (TM 5-2420-224-10).

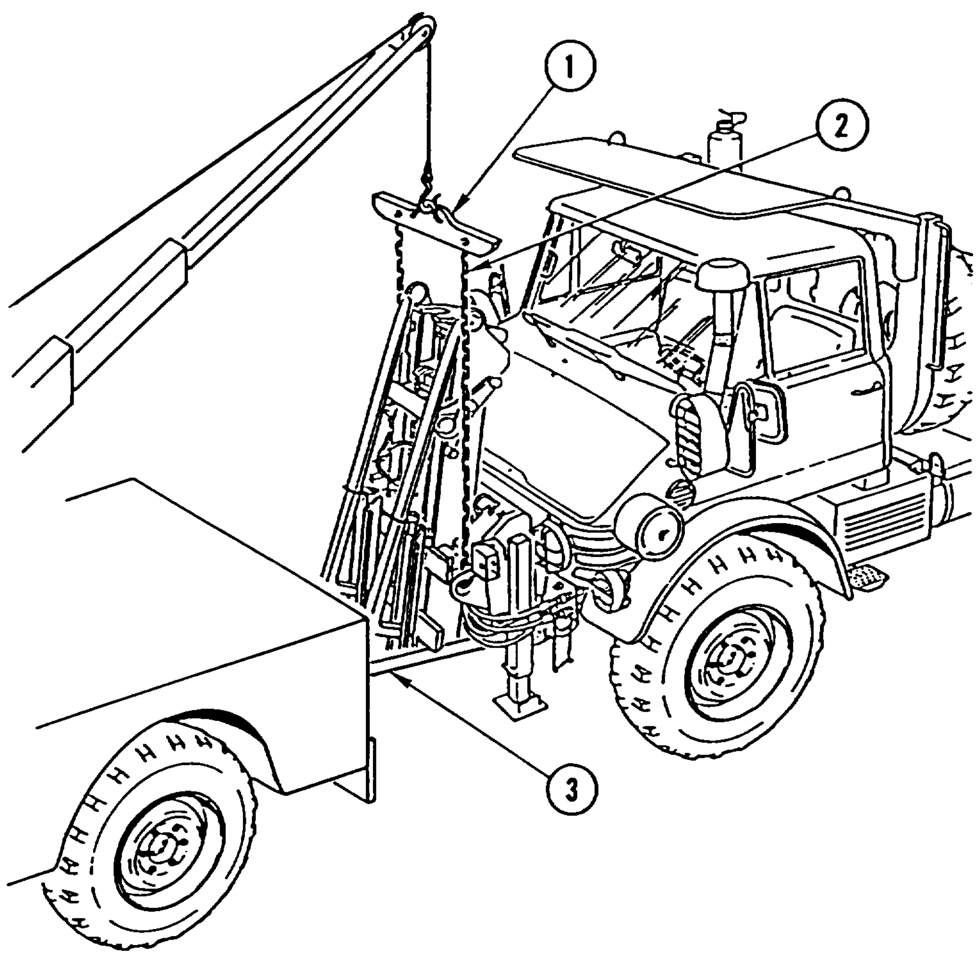
VEHICLE TOWING (HMMH) (CONT)

TOW BAR REMOVAL

WARNING

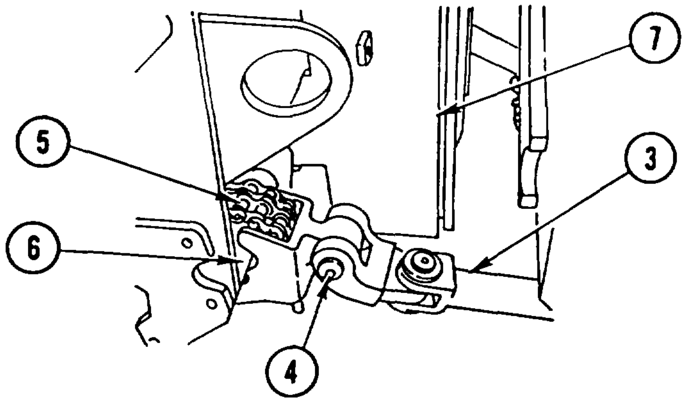
- Tow bar weighs 120 pounds (55 kilograms). To avoid personal injury, always use two or more personnel to remove tow bar.
- To avoid personal injury, do not allow any part of body to get between tow bar and forklift.

1. Set parking brake (TM 5-2420-224-10) and block vehicle (page 2-22).
2. Lower vehicle to ground.
3. Open shutoff valve (TM 5-2420-224-10).



4. Remove spreader bar (1), disconnect lift chains (2), and disconnect tow bar (3) from wrecker.

VEHICLE TOWING (HMMH)(CONT)



5. Remove pin and clevis assemblies (4) and tow bar (3) from two clamps (5).

6. Remove two clamps (5) from crossbar (6) of forklift (7).

7. Close shutoff valve (TM 5-2420-224-10).

Section VII. GENERAL HYDRAULIC SYSTEM REPAIR METHODS

OVERVIEW

This section contains repair methods for the hydraulic system. If special repair methods or procedures are required for the hydraulic system or related parts, these methods or procedures are included in the individual maintenance procedures in Chapter 4.

GENERAL REPAIR METHODS

WARNING

High pressure hydraulics [oil under 2450 psi (16,893 kPa)] operate this equipment. Never disconnect any hydraulic line or fitting without first dropping pressure to zero. A high pressure oil stream can pierce body and cause severe injury to personnel.

CAUTION

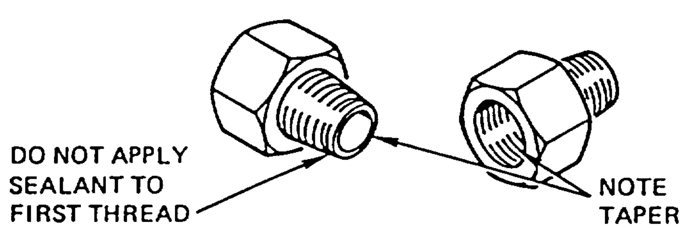
- Always clean around fittings before disconnecting or connecting hose of fittings. Make sure area is clean before installing hydraulic components. Failure to do so could result in damage to equipment.
- Cover, cap, or plug all openings, ports, and tube or hose ends when disconnected. Failure to do so could result in damage to equipment.

GENERAL REPAIR METHODS (CONT)

CAUTION

- Mate a fitting only with a fitting designed to mate. Because two fittings will screw together is no guarantee they will not leak. Never depend on trial and error. To do so could result in damage to equipment.
- Fittings must be installed and hand-tightened. If a fitting cannot be hand-tightened, it may be cross-threaded or have damaged threads. Use wrench only for final tightening. Failure to do so could result in damage to equipment.
- Do not use pipe dope as sealer on any fitting. Pipe dope can separate from fittings causing control valves and relief valves to become contaminated and fail.
- It is possible to screw a male NPT into a female straight thread, but fitting will leak. NPT has a slight taper.
- Do not attempt to use parts of a 37-degree flare fitting and a flareless fitting with each other. Fitting will leak.
- When connecting NPTs, use care not to overtighten. If overtightened, female pipe thread will split.
- Do not apply sealant to first thread of NPT fitting. If sealant enters hydraulic system, it may cause components to fail.
- Be careful when installing preformed packings. Sharp threads can nick packing, causing it to leak.
- Do not overtighten a flareless connection. Overtightening can cause leakage requiring replacement of entire tube assembly.
- When connecting a hose to fitting, always use two wrenches. Use one wrench to turn swivel nut onto fitting and other wrench to keep hose or tube from rotating. Failure to do so could result in damage to equipment.

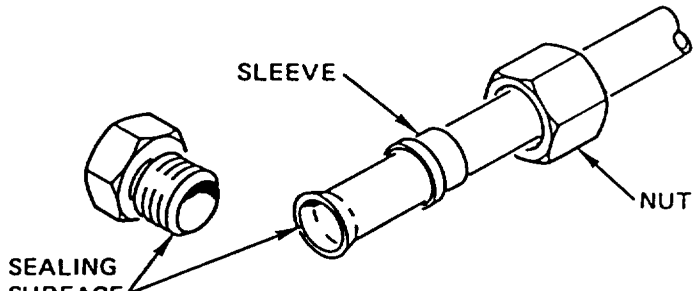
The following describes the types of fittings used in the vehicles. Refer to this information when performing hydraulic maintenance tasks.



NATIONAL PIPE THREAD (NPT)

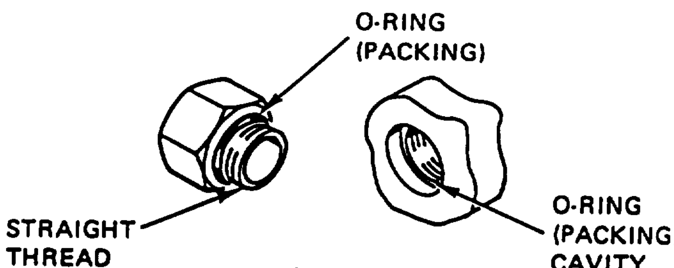
1. National Pipe Thread (NPT). This thread differs from others in that it is tapered. To obtain a proper seal with NPT, a sealant must be used. The sealant should be applied to male threads. Use care not to overtighten.

GENERAL REPAIR METHODS (CONT)



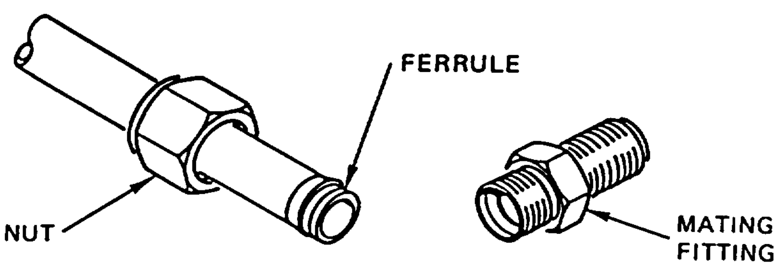
37° FLARE

2. 37-Degree Flare. The 37-degree flare connection has a male straight thread that mates with a female straight thread. The sealing surface for this connection is the angled nose at the end of the male fitting. The nose mates with a similar surface in the female 37-degree flare fitting. These sealing surfaces must be free of nicks and scratches to seal properly.



O-RING (PACKING) BOSS

3. O-Ring (Preformed Packing) Boss. The boss connection has a straight thread. The seal for this connection has a preformed packing that fits on top of the thread. This packing is squeezed in the extra space at the top of the female thread and seals the connection.



FLARELESS

4. Flareless. This fitting has a straight thread. The female fitting contains a ferrule that mates with a cavity in the male fitting. Use care not to overtighten to avoid damage to the ferrule.

5. Installation of Preformed Packings.

   a. Before installing a new packing, inspect threads and packing seat for nicks, cracks, and distortion.

   b. Make sure the packing is correct type and size. If not sure, check Repair Parts and Special Tools List (TM5-2420-224-24P).

   c. Before installing a new packing, apply coat of lubricating oil to packing (Appendix C, Item 22).

GENERAL REPAIR METHODS (CONT)

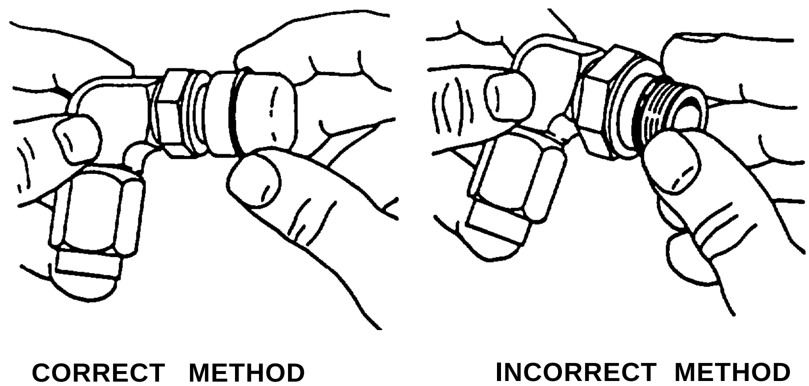
d. When installing a packing, always protect it from cuts or nicks. Do not install packing directly over threads. If available, install packing over a plastic or rubber thread guard supplied with new fittings. If no thread guard is available, protect packing by wrapping fitting threads with heavy, smooth, lint-free paper or tape.

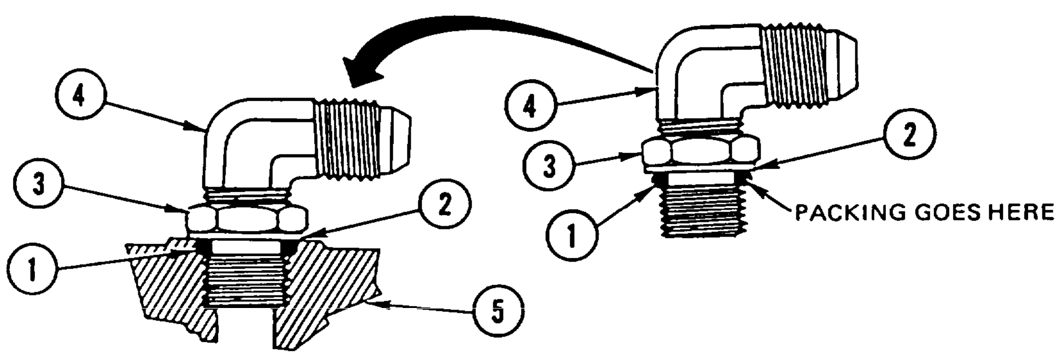
e. If a backup washer is used with the packing, it must be free of cuts, nicks, and distortion. An unserviceable backup washer can cause packing to distort or rupture when hydraulic pressure is applied, resulting in a leak.

f. Always make sure packing is not damaged, twisted, or distorted after installation.

6. Installation of Adjustable Fittings.

a. Apply coat of lubricating oil (Appendix C, Item 22) to new packing.





CAUTION
Packing must be located in groove and not on threads to prevent damage to packings.

b. Using suitable thread guard, install packing (1) and backup washer (2) in groove.

c. Turn lock nut (3) down until lock nut just contacts backup washer (2).

d. Install fitting (4) in boss (5) until backup washer (2) makes contact with boss.

e. Position fitting (4) in desired position by backing fitting out up to one full turn. Hold fitting (4) in desired position and tighten lock nut (3).

Section VIII. PREPARATION FOR STORAGE OR SHIPMENT

OVERVIEW

This section describes how to prepare vehicles for temporary storage and remove them from temporary storage.

ENTERING VEHICLES INTO TEMPORARY STORAGE

NOTE

Vehicles enter storage phases predicated on length of storage period and maintenance services required.

1. Phase I Preservation Tasks (Up to 30 Days):

   a. Place front loader and backhoe (SEE) or forklift and crane (HMMH) in transport position (TM 5-2420-224-10) with safety valves closed.

   b. Retract hydraulic piston rods into cylinders as far as possible. Clean and coat all exposed portions of attachment cylinders and hydraulic spool valves with solid lubricant preservative (Appendix C, Item 21). Exposed portions include:

   - Front loader lift cylinders (SEE)
   - Forklift lift, tilt, and rotating cylinders (HMMH)
   - Backhoe dipper, bucket, boom, swing, stabilizer, and tilt cylinders (SEE)
   - Crane external end extension, inner boom lift, mast locking, outer boom, and outrigger cylinders (HMMH)
   - Front loader/forklift control valve spools
   - Tilt and latch control valve spools
   - Backhoe control valve spools (SEE)
   - Crane valve bank spools (HMMH)

   c. Coat tools with solid lubricant preservative (Appendix C, Item 21):

   - Three carbide bits (SEE)
   - Clay spade (SEE)
   - Moil point (SEE)
   - Chisel point (SEE)
   - Set of impact sockets (HMMH)
   - 48-oz (1.4-kg) hammer
   - Adjustable wrench
   - Pinch bar

   d. Coat five hydraulic and chassis toolbox hinges with solid lubricant preservative (Appendix C, Item 21).

   e. Add diesel fuel additive (Appendix C, Item 1).

ENTERING VEHICLES INTO TEMPORARY STORAGE (CONT)

2. Phase II Preservation Tasks (After 30 Days):

   a. Operate engine for 6 minutes.

   b. Operate all lights and switch functions.

   c. Check fluid levels (TM 5-2420-224-10 and page 2-14).

   d. Operate hydraulic controls:

      - Front loader boom and bucket (SEE)
      - Forklift raise-lower, tilt, and rotate (HMMH)
      - Backhoe dipper, bucket, boom, swing, stabilizer, and tilt (SEE)
      - Crane external end extension, inner boom lift, mast locking, outer boom, and outrigger (HMMH)
      - Hammer drill, pavement breaker, and chain saw (SEE)
      - Impact wrench (HMMH)

   e. After operating hydraulic controls, coat all cylinder and spools with solid lubricant preservative (Appendix C, Item 21).

   f. Drive vehicle through all gear ranges and shift selector positions.

   g. Apply brakes [two panic stops at vehicle speed of 20 mph (32 kPh)].

   h. Check for Class III leaks. Repair as required.

   i. Add diesel fuel additive (Appendix C, Item 1).

3. Phase III Operational Tasks (After 90 Days):

   a. Perform Phase II Preservation Tasks.

   b. Apply lubricant to lubrication points (TM 5-2420-224-10 and page 2-14).

   c. Check fan belt, front hydraulic pump belt, and power steering pump belt for cracks and proper tension.

   d. Check for and replace any windshield wiper blades (page 4-482), tires (page 4-337), and rubber grommets and door and window seals (page 4-393) that show signs of weathering/deterioration.

   e. Check air cleaner elements for contamination (page 4-35).

   f. Bleed brake system (page 4-262).

   g. Clean fuel filters (page 4-48).

   h. Check that backhoe boom latch (SEE)/crane travel lock (HMMH) operate freely.

   i. Check that hose reel motor spring operates freely.

   j. Check that exhaust weather cap operates freely.

   k. Relieve air pressure (page 2-23).

REMOVING VEHICLES FROM TEMPORARY STORAGE

1. Wash and clean both interior and exterior of vehicle.
2. Perform PMCS (page 2-2).
3. Inspect for oil leaks. Repair as required.
4. Inspect for rust and deteriorated paint. Sand and paint as required (page 2-14.24).
5. Add diesel fuel additive (Appendix C, Item 1).

CHAPTER 3
TROUBLESHOOTING

SCOPE

This chapter contains information you need to troubleshoot the SEE/HMMH. It includes information on use of electrical test equipment, harness and wire repair, use of Simplified Test Equipment for Internal Combustion Engines-Reprogrammable (STE/ICE-R), a malfunction symptom index, and troubleshooting charts. The following sections are included in this chapter:

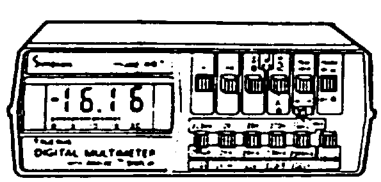
Section I. USING ELECTRICAL TEST EQUIPMENT

OVERVIEW

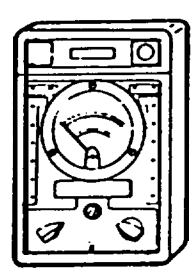
This section shows how to use a multimeter to find the causes of electrical problems that may develop in the vehicle. The three multimeters that are usually included in unit maintenance shop kits are:

- TS-352 B/U
- AN/PSM-45
- Simpson Model 160

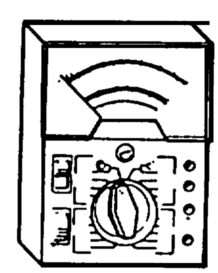
All of these multimeters do the same thing. This section shows how to test AC and DC voltages with these multimeters. These multimeters are used to check components for continuity, shorts, open circuits, and AC and DC voltages. The STE/ICE-R can also be used as a multimeter.



AN/PSM-45

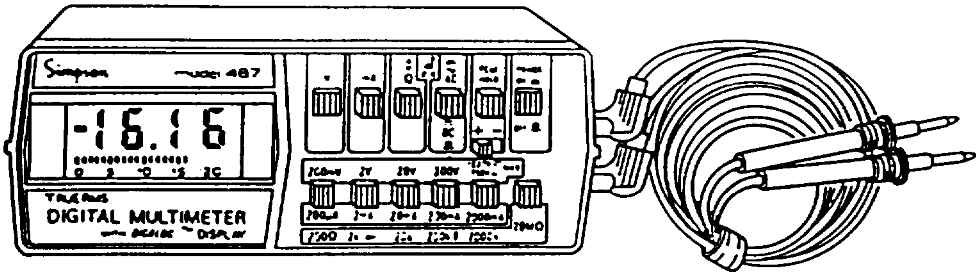


TS-352 B/U



SIMPSON 160

USING THE OHMS SCALE



Use the ohms (Ω) scale when testing electrical circuits for continuity, short circuits, and poor connections (high resistance). You must zero the multimeter before making continuity or resistance tests. The following procedures tell and show how to zero two of the three multimeters. The AN/PSM-45 zeroing procedure is contained in TM 11-6625-3052-14.

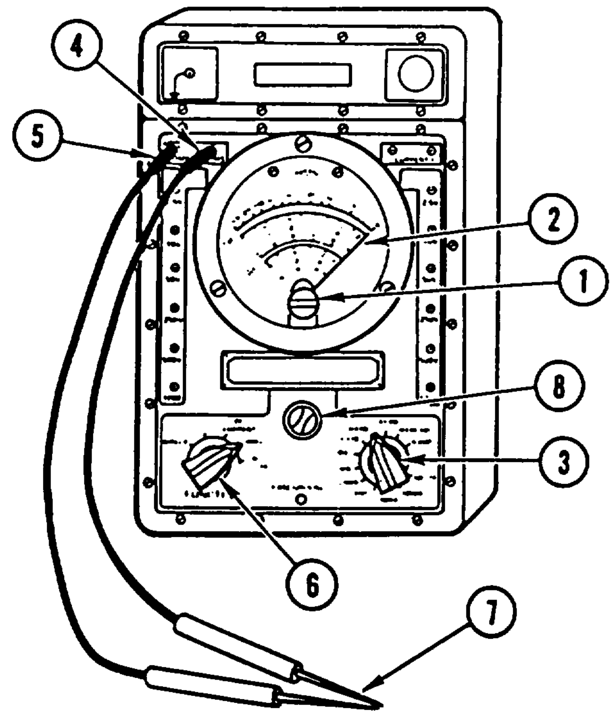
ZEROING THE AN/PSM-45 MULTIMETER

NOTE

For accurate readings, do not touch probe ends with fingers while zeroing the multimeter.

Refer to TM 11-6625-3052-14 for operating instructions for the AN/PSM-45 multimeter.

USING THE OHMS SCALE (CONT)



ZEROING THE TS-352 B/U MULTIMETER

NOTE

For accurate readings, do not touch probe ends with fingers while zeroing the multimeter.

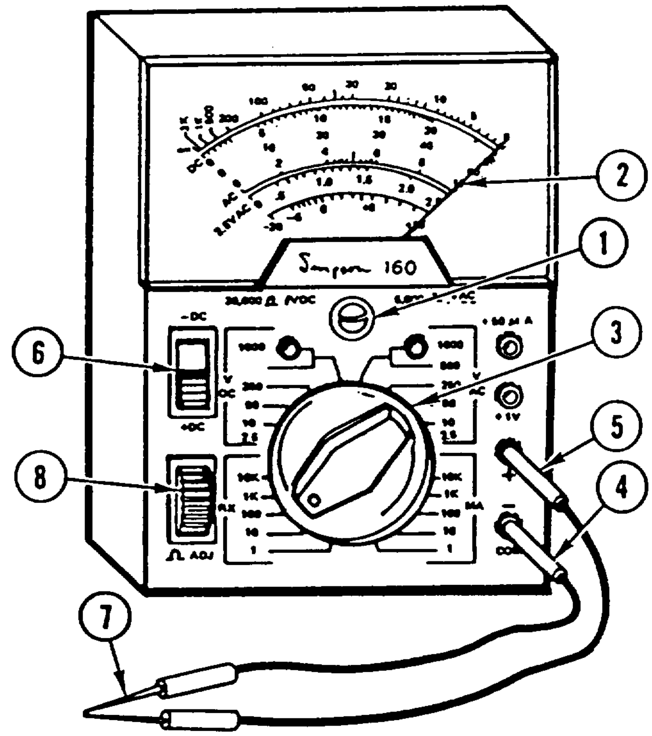
1. Using adjusting screw (1), set needle (2) to infinity (∞) prior to OHMS ZERO ADJ.
2. Set RANGE switch (3) to RX100.
3. Plug black (-) lead (4) in OHMS DC ±jack.
4. Plug red (+) lead (5) in upper left OHMS jack.
5. Set FUNCTION switch (6) to OHMS.
6. Hold two probe tips (7) firmly together.

NOTE

If needle will not zero, replace batteries in multimeter. If needle still will not zero, have multimeter repaired.

7. Zero multimeter by turning OHMS ADJ knob (8) until needle (2) is over 0 on OHMS scale.

USING THE OHMS SCALE (CONT)



ZEROING THE SIMPSON MODEL 160 MULTIMETER

NOTE

For accurate readings, do not touch probe ends with fingers while zeroing the multimeter.

1. Using adjusting screw (1), set needle (2) to infinity (∞) prior to OHMS ZERO ADJ.
2. Set selector switch (3) to RX100.
3. Plug black (-) lead (4) in COM jack.
4. Plug red (+) lead (5) in +jack.
5. Set +DC/-DC switch (6) to +DC.
6. Hold two probe tips (7) firmly together.

NOTE

If needle will not zero, replace batteries in multimeter. If needle still will not zero, have multimeter repaired.

7. Zero multimeter by turning OHMS ADJ knob (8) until needle (2) is over 0 on OHMS scale.

TESTING FOR CONTINUITY

Continuity tests are made to check for open circuits (breaks or disconnections) in leads, harnesses, connectors, and switches. Follow the instructions below to make a continuity check.

NOTE

The TS-352 B/U multimeter is shown in these instructions, but the procedures are similar for any of the multimeters.

1. Set and zero rnultimeter for OHMS RX1.

CAUTION

The multimeter can be damaged unless power is removed from the circuit being tested.

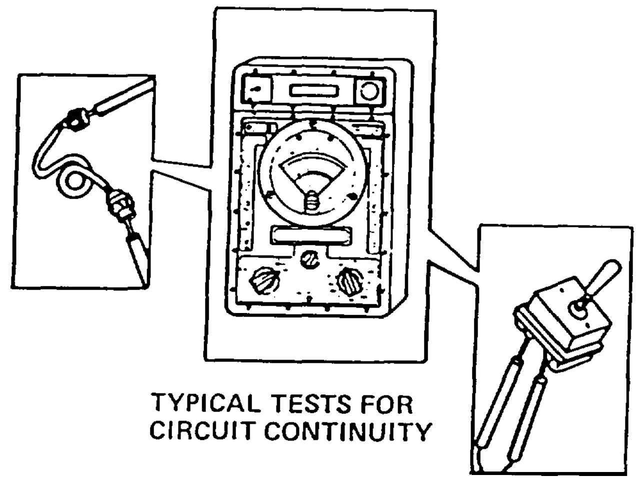
2. Disconnect circuit being tested from its power source. To be safe, disconnect the negative battery cables (page 2-24).

3. Connect multimeter probes to both terminals of circuit being tested. (See illustration.)

NOTE

All electrical circuits have a small amount of resistance. When testing a long cable, the needle may not quite reach the 0 point, even when the circuit is good.

4. Watch the multimeter needle for the following indications:
   - If needle swings to 0 on OHMS **(Ω)** scale, the circuit has continuity.
   - If needle stays at infinity **(∞),** circuit is open.
   - If needle jumps or flickers, there is a loose connection in the circuit being tested.



TYPICAL TESTS FOR CIRCUIT CONTINUITY

TESTING FOR SHORTS

A short (or short circuit) occurs when two circuits that should not be connected have come in contact with each other. A short also occurs when a circuit that should not touch ground has made contact with ground. Follow the instructions below to check for shorts in a circuit.

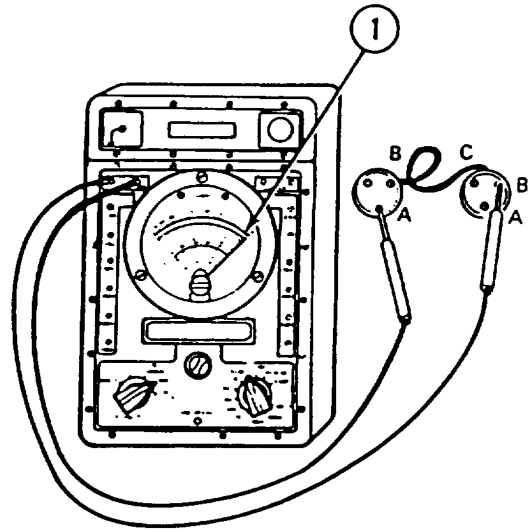
NOTE

The TS-352 B/U multimeter is shown in these instructions, but the procedures are similar for any of the multimeters.

1. Set and zero rnultimeter for OHMS RX100.

CAUTION
The multimeter can be damaged unless power is removed from the circuit being tested.

2. Disconnect circuit being tested from its power source. To be safe, check for voltage first (page 3-9).
3. Connect one multimeter probe to one circuit and the other probe to the other circuit, or ground (if checking for a short to ground). The example shows a check to see if wire A is shorted to wire B in a wiring harness.
4. Watch the multimeter needle (1) for the following indications:
   - If needle moves (even a little), circuits are shorted.
   - If needle does not move, set selector to X10K. If needle still does not move, circuits are not shorted.
   - If needle jumps or flickers, circuits are intermittently shorted. Bending or flexing a wiring harness, while checking for shorts, will often identify and locate intermittent shorts.



TYPICAL TEST FOR SHORTS

MEASURING RESISTANCE

1. Set and zero multimeter for OHMS RX1.

> **CAUTION**
>
> The multimeter can be damaged unless power is removed from the circuit being tested.

2. Disconnect circuit being tested from its power source. To be safe, check for voltage first (page 3-9).

NOTE

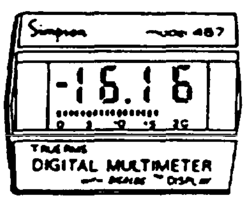
Zero multimeter every time you change ranges.

3. If test calls for an ohms range different than RX1 (or X1), set selector switch to that range (such as RX10 or X10).
4. Connect probes to circuit or item to be measured.
5. Read multimeter scale. If it is set to RX1 or X1 range, take reading directly from OHMS **(Ω)** scale. multimeter is set to a different range, multiply reading on scale according to the table below.

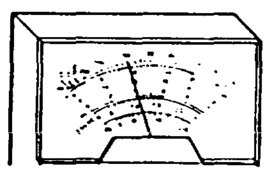
OHMS SWITCH SETTING	
X1 or RX1	Read number on scale
X10 or RX10	Multiply reading by 10
X100 or RX100	Multiply reading by 100
X1K or RX1K	Multiply reading by 1,000
X10K or RX10K	Multiply reading by 10,000
(REMEMBER: K=1,000)	

For example, the multimeters below indicate the following readings:

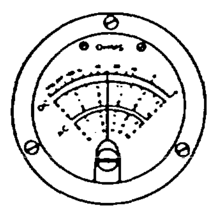
OHMS SWITCH SETTING	READING (OHMS)
X1 or RX1	4
X10 or RX10	40



AN/PSM-45



SIMPSON 160

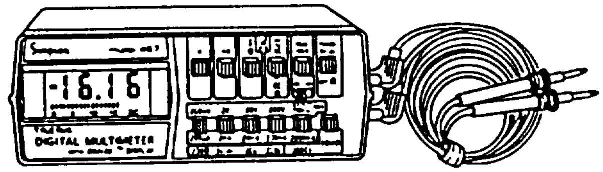


TS-352 B/U

USING THE DC VOLTS SCALE

SETTING THE METER

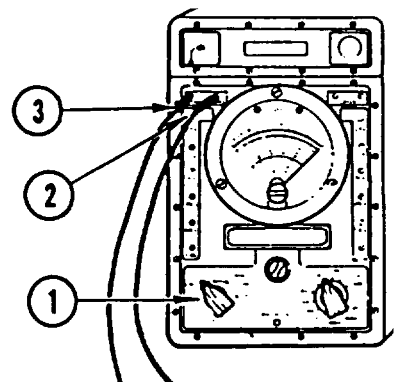
CAUTION
The multimeter must be set to a voltage range higher than that being measured or multimeter could be damaged.



AN/PSM-45

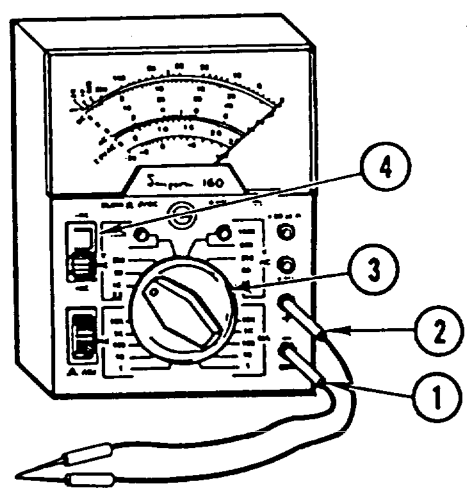
AN/PSM-45

1. Connect red lead to V-OHMS jack.
2. Connect black lead to COM jack.
3. Set multimeter switches as specified in TM 11-6625-3052-14.
4. Depress appropriate voltage range switch. If voltage being measured is unknown, select 1000 V range.



TS-352 B/U

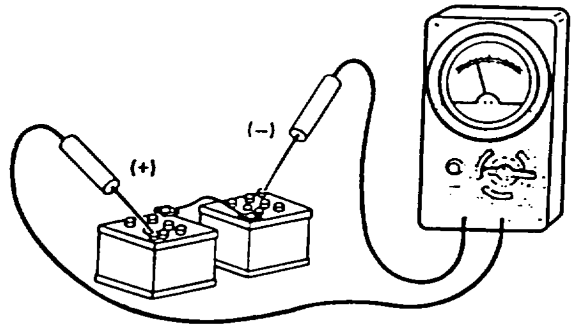
1. Set FUNCTION switch (1) to DIRECT.
2. Plug black (-) lead (2) in -DC/±AC/OHMS jack.
3. To measure 24 volts DC, plug red lead (3) in 50 V jack on left side of multimeter. (If measuring less than 10 volts DC, use 10 V jack. If measuring less than 2.5 volts DC, use 2.5 V jack.



SIMPSON 160

1. Plug black lead (1) in COM -jack.
2. Plug red lead (2) in +jack.
3. To measure 24 volts DC, set selector switch (3) to V/DC 50. (If measuring less than 10 volts DC, set selector switch to V/DC 10. If measuring less than 2.5 V/DC, set selector switch to V/DC 2.5.)
4. Set -DC/+DC switch (4) to +DC.

MEASURING DC VOLTAGE



TYPICAL DC MEASUREMENT

1. Set rnultirneter to the correct scale. (See USING THE DC VOLTS SCALE, page 3-8).

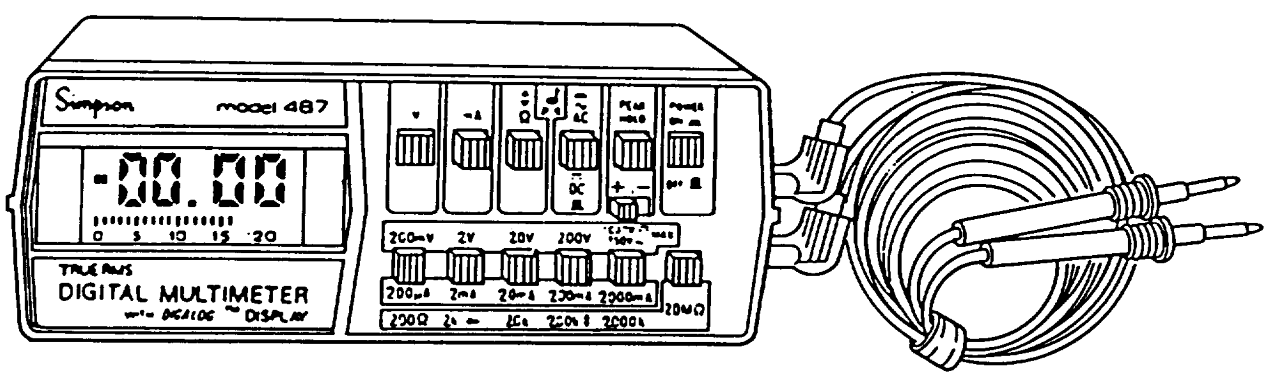
> **CAUTION**
> The multimeter must be set to a voltage range higher than that being measured or multimeter could be damaged.

2. Connect red probe to positive (+) side of circuit and black probe to negative (-) side. Example shows 24 volts DC being measured across batteries.

3. Read multimeter. (The following examples show how to read all three multimeters.) If needle moves off scale to left, reverse probes on circuit.

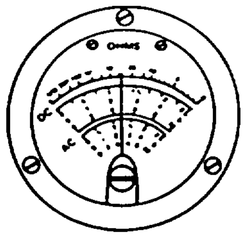
AN/PSM-45

Refer to TM 11-6625-3052-14 for proper use and explanations with the AN/PSM-45 multimeter.

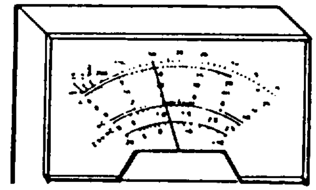


AN/PSM-45

MEASURING DC VOLTAGE (CONT)



TS-352 B/U



SIMPSON 160

TS-352 B/U

Read DC voltage scale for range in which red lead is plugged.

RANGE (VOLTS DC)		
50	0-5	(Multiply reading by 10)
10	0-10	(Read number on scale)
2.5	0-2.5	(Read number on scale)

The multimeter indicates the following readings:

RANGE (VOLTS DC)	**READING (VOLTS DC)**
50	20
10	4
2.5	1

SIMPSON 160

Read DC voltage scale for range at which selector switch is set.

SWITCH SETTING (VOLTS DC)		
50	0-50	(Read number on scale)
10	0-10	(Read number on scale)
2.5	0-25	(Divide reading by 10)

MEASURING DC VOLTAGE (CONT)

The multimeter indicates the following readings:

SWITCH SETTING (VOLTS DC)	READING (VOLTS DC)
50	20
10	4
2.5	1

NOTE

Proper operation of electrical components depends upon proper grounding. When troubleshooting devices that depend on screws or physical contact for their electrical ground (lamp sockets, transmitters, batteries, etc.), use a jumper wire from the device to the hull to check grounding.

Section II. WIRING HARNESS AND WIRE REPAIR

OVERVIEW

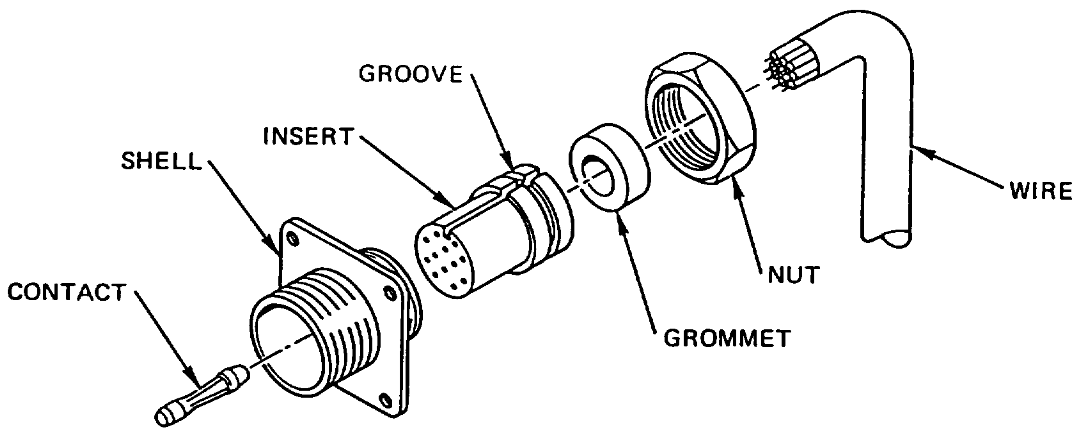
This section contains instructions for repair of wiring harnesses and wires (leads). Repair of wiring harnesses and wires consists of replacement of defective connectors, shells, and terminal, or taping cut or worn insulation and exposed wire conductors. Pages 3-12 thru 3-17 show exploded views of typical harness and wire connectors used on the vehicle, and give procedures for disassembly and assembly of connectors. When soldering is required, procedures in TB SIG 222 must be followed. If multiple pin connectors are disassembled, tag or label all wires to ensure correct connections are made at time of assembly.

The following procedures are contained in this section:

TYPICAL PANEL MOUNTING RECEPTACLE: DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

1. Unscrew nut from shell assembly and slide back on wire leads.
2. Push grommet back on wire leads.
3. Drive contacts out through rear of insert with pin extractor.
4. Push insert out through rear of shell.
5. Unsolder wire leads from contacts.



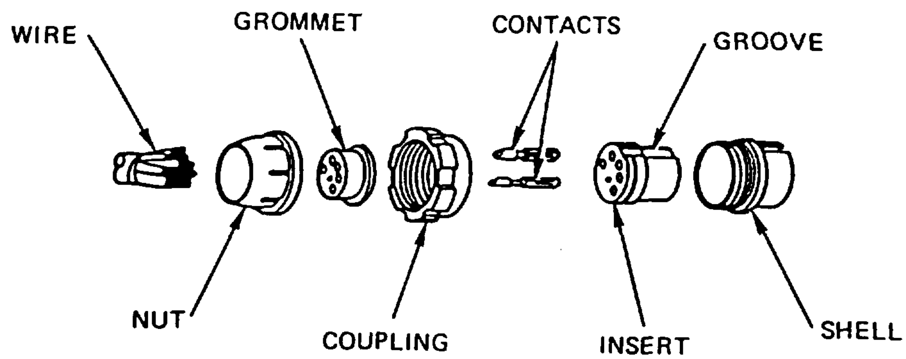
ASSEMBLY

1. Strip cable insulation equal to depth of solder wells of contacts.
2. Slide nut over wire leads.
3. Slide grommet over wire leads.
4. Insert wire leads into solder wells of contacts, and solder.
5. Push insert into shell from rear until seated. Groove in insert must be alined with guide in shell to ensure proper fit.
6. Push contacts into insert from rear until seated.
7. Push grommet down wire leads and over solder wells of contacts.
8. Screw nut onto shell assembly.

TYPICAL PLUG: DISASSEMBLY AND ASSEMBLY

DISASSEMBLY

1. Unscrew nut from shell assembly and slide back on wire leads.
2. Slide grommet back on wire leads.
3. Slide coupling nut off shell assembly.
4. Drive contacts out through rear of insert with pin extractor.
5. Push insert out through rear of shell.
6. Unsolder wire leads from contacts.

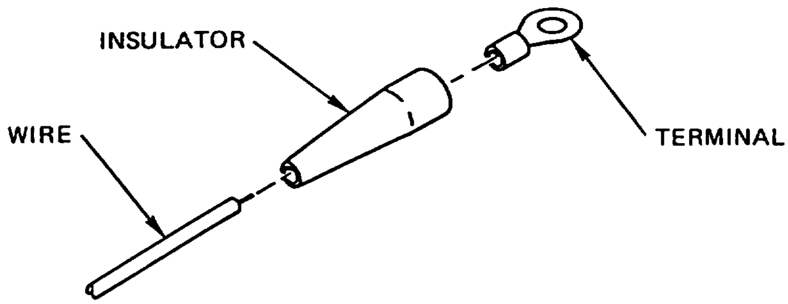


ASSEMBLY

1. Strip wire insulation equal to depth of solder wells of contacts.
2. Slide nut over wire leads.
3. Slide grommet over wire leads.
4. Insert wire leads into solder wells of contacts, and solder.
5. Push insert into shell from rear until seated. Groove in insert must be alined with guide in shell to ensure proper fit.
6. Push contacts into insert from rear until seated.
7. Slide coupling nut onto shell assembly.
8. Push grommet down wire leads and over solder wells of contacts.
9. Screw nut onto shell assembly.

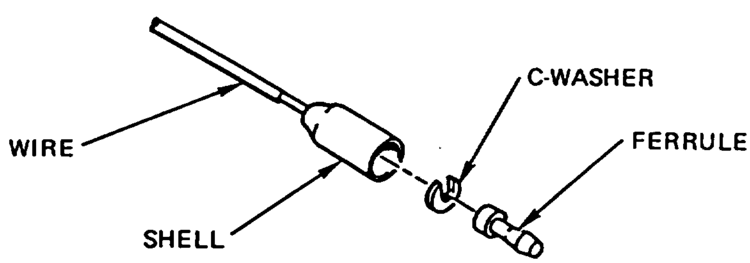
WIRE TERMINALS AND CONNECTORS REPLACEMENT

TERMINAL-TYPE WIRE CONNECTOR



1. Strip wire insulation equal to depth of terminal well.
2. Slide insulator over wire.
3. Insert wire into terminal well, and crimp.
4. Slide insulator over crimped end of terminal.

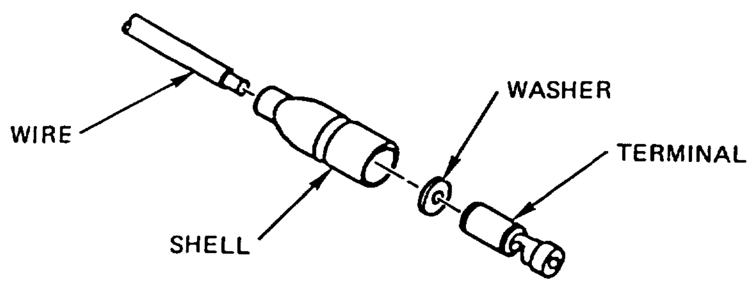
MALE WIRE CONNECTOR



1. Strip wire insulation equal to depth of ferrule well.
2. Slide shell over wire.
3. Insert wire into terminal well, and crimp.
4. Place C-washer over wire at crimped junction and slide shell over C-washer and terminal.

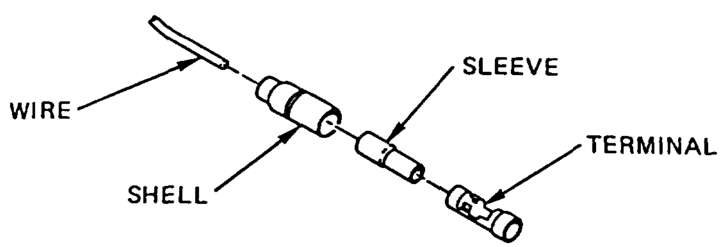
WIRE TERMINALS AND CONNECTORS REPLACEMENT (CONT)

FEMALE WIRE CONNECTOR (WITH WASHER)



1. Strip wire insulation approximately 1/8 in. (3 mm).
2. Slide shell and washer over wire.
3. Place wire in cylindrical end of terminal, and crimp.
4. Slide shell and washer over terminal.

FEMALE WIRE CONNECTOR (WITH SLEEVE)



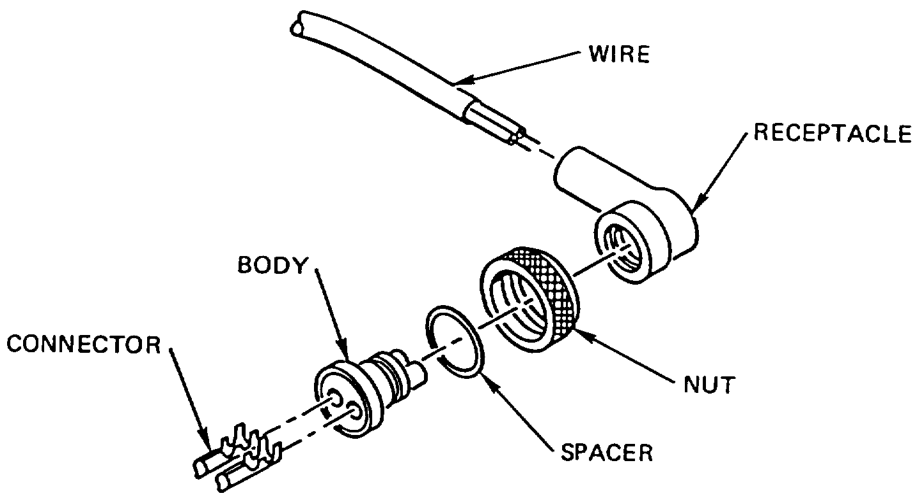
1. Strip wire insulation approximately 1/8 in. (3 mm).
2. Slide shell and sleeve over wire.
3. Place wire in cylindrical end of terminal, and crimp.
4. Slide shell and sleeve over terminal.

WIRE TERMINALS AND CONNECTORS REPLACEMENT (CONT)

THREADED PLUG

DISASSEMBLY

1. Pull receptacle off body and slide back on wires.
2. Push wires out of body and remove connectors from wires.
3. Remove body, spacer, nut, and receptacle from wires.

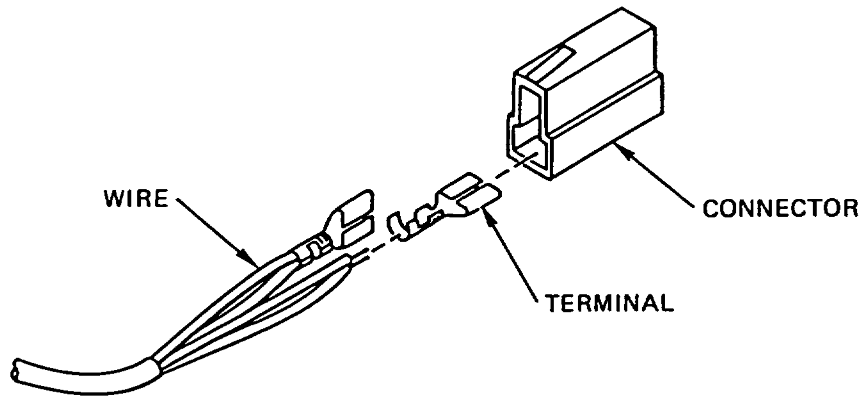


ASSEMBLY

1. Strip wire insulation approximately 1/8 in. (3 mm).
2. Slide receptacle, nut, spacer, and body over wires.
3. Install connectors on wires and insert into body.
4. Slide receptacle onto body.

WIRE TERMINALS AND CONNECTORS REPLACEMENT (CONT)

TYPICAL PLUG CONNECTOR



1. Strip wire insulation approximately 1/8 in. (3 mm).

2. Crimp terminal onto wire.

3. Insert terminal into connector.

Section III. USING STE/ICE-R WITH THE TRACTOR

OVERVIEW

This section contains information on the use of Simplified Test Equipment for Internal Combustion Engines Re-Programmable (STE/ICE-R) with the SEE/HMMH. Two types of testing are performed: Go and No-Go. Refer to the STE/ICE Technical Manual (TM 9-4910-571-12&P) when using STE/ICE-R.

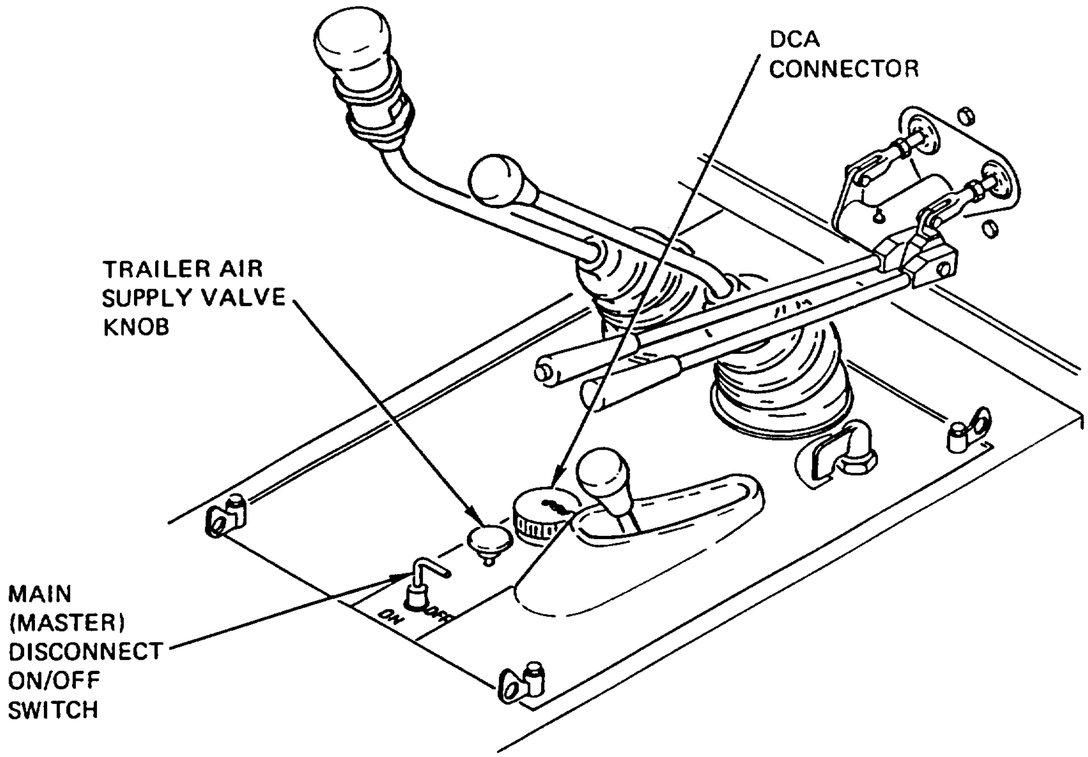
The following are contained in this section:

PRETEST INSPECTION

The daily preventive maintenance inspections and procedures must be performed on the SEE/HMMH before performing STE/ICE-R tests.

TEST HOOKUP

Connect the vehicle test meter (VTM) to the vehicle diagnostic connection assembly (DCA) with DCA cable W1.



Location of DCA Connector in Cab

CONFIDENCE TEST

Perform the confidence test as described in the STE/ICE Technical Manual (TM 9-4910-571-12&P).

STE/lCE-R vehicle test cards are provided for the tests to be performed on the SEE/HMMH. Complete test procedures and accepted standards are contained in these cards. The various tests are described in table 3-1. Typical STE/ICE-R error messages are described in table 3-2. Table 3-3 describes typical operator messages and actions to be taken. Table 3-4 lists the tractor test parameters and vehicle status during the test.

Table 3-1. STE/ICE-R Tests

Test Select No.	Test	
		CONTROL FUNCTIONS
01	Control	Interweaves (alternates rpm with next test measurement).
02	Control	Displays minimum value detected for next test.
03	Control	Displays maximum value detected for next test.
04	Control	Displays peak-to-peak value for next test.
06	Control	Interweaves two tests.
		ENGINE TESTS
10	ENGINE RPM	Measures average speed of engine crankshaft by means of pulse tachometer.
12	POWER TEST (RPM/SEC)	Measures engine's power producing potential in units of rpm/second.
14	COMPRESSION UNBALANCE	Evaluates relative cylinder compression and displays percentage difference between highest and lowest values in one engine cycle.
		FUEL SYSTEM TESTS
24*[1]	FUEL SUPPLY PRESSURE	Measures fuel pump outlet pressure.
26	FUEL FILTER PRESSURE DROP	Detects clogging by opening a differential pressure switch across secondary fuel filter.
		STARTING/CHARGING SYSTEMS TESTS
67	BATTERY VOLTAGE	Measures battery voltage at or near battery terminals.
68	STARTER MOTOR VOLTAGE	Measures voltage present at starter motor positive terminal.
69	STARTER NEGATIVE CABLE VOLTAGE DROP	Measures voltage drop on starter ground path. High voltage drop indicates ground path resistance.
70	STARTER SOLENOID VOLTAGE	Measures voltage present at starter solenoid positive terminal. Measures current through battery ground path shunt.
71*	STARTER CURRENT AVERAGE	Measures average current to or from starter.
72*	STARTER CURRENT FIRST PEAK	Tests condition of starting circuit and ability of starter to deliver sufficient starting current.
73*	BATTERY INTERNAL RESISTANCE	Evaluates battery condition by measuring voltage and current simultaneously.
74*	STARTER CIRCUIT RESISTANCE	Measures combined starter circuit and battery internal resistance.
75*	BATTERY INTERNAL RESISTANCE CHANGE	Measures rate of change of battery resistance to provide indication of battery condition.

Table 3-1. STE/ICE-R Tests (Cont)

Test Select No.	Test	
82	ALTERNATOR OUTPUT VOLTAGE	Measures alternator output voltage.
84	ALTERNATOR NEGATIVE CABLE VOLTAGE DROP	Measures voltage drop in alternator ground cable and connection between alternator ground connection and battery negative terminal. High voltage drop indicates excessive ground path resistance.

* Offset Test required.
[1] If fuel pressure transducer is not installed on engine, remove 1/4-in. pipe plug and install pressure transducer TK item 17. Then perform test TK 50 to determine fuel supply pressure.

Table 3-2. Error Messages

Display	Message
E000	Information not available
E001	Test nonexistent
E002	Transducer not connected
E003	Information not valid in DCA mode
E004	Vehicle Identification Data (VID) or number of cylinders not entered
E005	Offset not performed
E007	Number of cylinders conflicts with VID
E008	Test probe not connected
E009	Engine not running
E010	Bad VID
E011	Acceleration/deceleration time too long
E012	Tachometer pickup missing
E013	Bad data
E014	Wrong number of cylinders
E015	No longer used, turn in VTM to maintenance
E017	No ignition information received (SI)
E018	Test discontinued, excessive time
E020	First peak information not received
E021	Result not calculated, current is over range
E022	External voltage detected
E023	VTM internal power supply defective
E024	Test not applicable
E027	Compression unbalance constants error
E028	Can’t use this test with control function 06
E030	Speed transducer doesn’t agree with VID
E032	Cranking RPM varies too much
E033	Power test constants entry error
.9.9.9.9	Overload number exceeds display capability

Table 3-3. Operator Messages

Display	Message
PASS	Test successfully completed
CAL	Offset test in progress, release test button
CIP	Initiate CI power simulation
CYL	Enter number of cylinders or cylinder pairs
FAIL	Test failed
GO	Crank engine
OFF	If cranking, STOP! If CI power, DECELERATE!
UEH	Enter vehicle identification number
—	VTM accepting data or initial turn-on

Table 3-4. Test Parameters

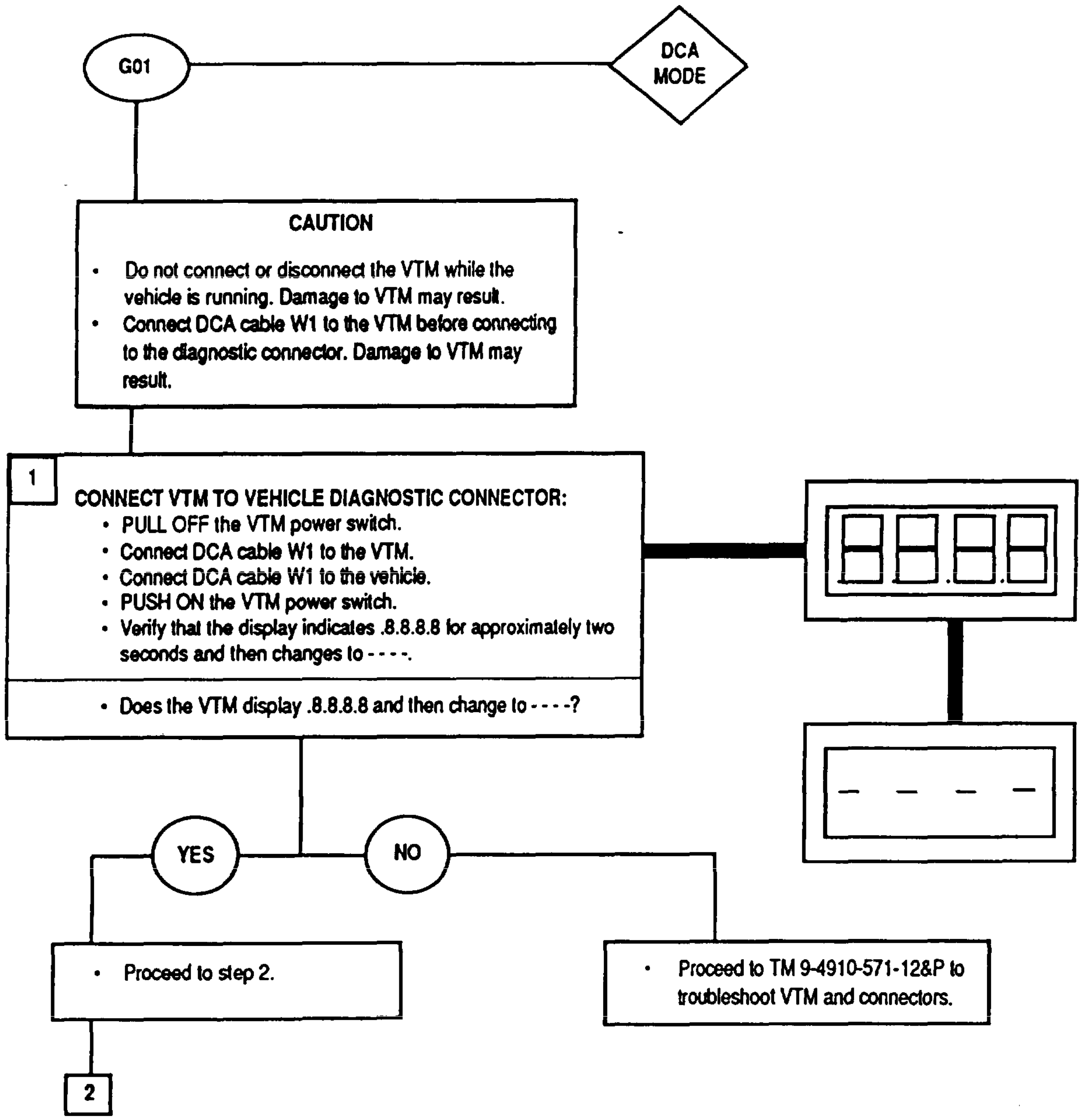
Test No.	Test	Operating Conditions	Min.	Norm	Max.	Units
10	ENGINE RPM	Engine at idle	700	—	750	rpm
12	POWER TEST	Engine running	2700	—	2900	rpm/sec
14	COMPRESSION UNBALANCE	Cranking	100	—	187	%
24*	FUEL SUPPLY PRESSURE	Cranking	15	—	40	psi
26	FUEL FILTER PRESSURE DROP	Engine running	—	PASS	—	—
67	BATTERY VOLTAGE	Engine stopped	23.5	—	—	volts
67	BATTERY VOLTAGE	Lights on, engine at idle	24.5	25.0	28.0	volts
68	STARTER MOTOR VOLTAGE	Cranking	19.0	—	—	volts
69	STARTER NEGATIVE CABLE VOLTAGE DROP	Cranking	—	—	0.8	volt
70	STARTER SOLENOID VOLTAGE	Cranking	18.0	—	—	volts
71	STARTER CURRENT AVERAGE	Cranking	—	200	—	amps
72*	STARTER CURRENT FIRST PEAK	Cranking	730	—	890	amps
73	BATTERY INTERNAL RESISTANCE	Cranking	—	—	25	milliohms
74	STARTER CIRCUIT RESISTANCE	Cranking	—	—	23	milliohms
75	BATTERY INTERNAL RESISTANCE CHANGE	Cranking	—	—	50.0	milliohms
82	ALTERNATOR OUTPUT VOLTAGE	Lights on, engine at idle	24.8	25.5	28.5	volts
84	ALTERNATOR NEGATIVE CABLE VOLTAGE DROP	Engine at idle	—	—	0.15	volt
84	ALTERNATOR NEGATIVE CABLE VOLTAGE DROP	Engine speed 1000-1200 rpm	—	—	0.30	volt

* If fuel pressure transducer is not installed on engine, remove 1/4-in. pipe plug and install pressure transducer TK item 17. Then perform test TK 50 to determine fuel supply pressure.

STE/ICE-R CI ENGINE GO-NO GO CHAIN

Run the STE/ICE-R Engine GO-NO GO Chain when called for in Table 3-5, Troubleshooting (page 3-70). Refer to STE/ICE-R Diagnostic Connector Assembly (DCA) Location (page 3-18) and TM 9-4910-571-12&P for setup and interpretation of test results.

Perform all Go (G) steps listed until a No-Go (NG) condition exists; then perform the NG steps indicated. Complete all repair or replacement tasks specified, using the List of Tasks (page iii) or Alphabetical Index (Index-1). Notify direct support maintenance if the condition persists.



G01

DCA MODE

2

RUN CONFIDENCE TEST:

- Dial 66 into TEST SELECT and press TEST.

- Does the VTM display and hold 0066?

YES

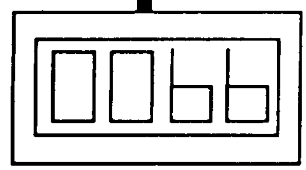
NO

- PULL OFF the VTM power switch.
- PUSH ON the VTM power switch.
- Verify that the display indicates .8.8.8.8 for approximately two seconds and then changes to - - - -.
- Re-dial 66 and press TEST.

- Does the VTM display and hold 0066?

YES

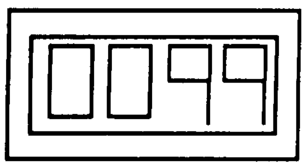
NO



- STE/ICE-R is bad. Replace.

- Dial 99 into TEST SELECT and press TEST.
- Look for this display:

1



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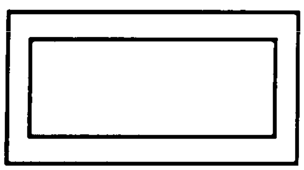

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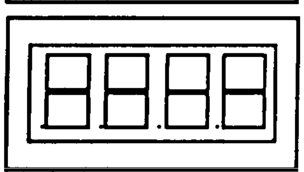
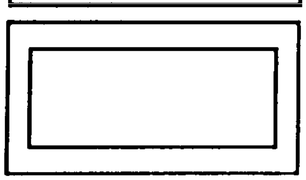
3



4



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TEST NO.	TEST
66/99	CONFIDENCE TEST

NOTE

At this point in the test, several numbers will appear on the display. Wait for readout display of PASS. The last set of numbers and PASS will flash alternately. The numbers must correspond to the numbers on VTM case. If they do not, return STE/ICE-R to direct support maintenance.

- Proceed to following page.

G01

DCA MODE

PASS

PROMPTING MESSAGE

- Does the VTM display PASS?

NOTE
The VTM can fail Cofidence Test if a bad transducer is connected to it. If the VTM fails Confidence Test when powered by W1 (DCA), removed all cables from the VTM and connect only W5, then clip W5 to the vehicle batteries. If it passes Confidence Test this way, there is a bad transducer in the vehicle's DCA. If it fails, the VTM has failed internally. Proceed to TM 9-4910-571-12&P to troubleshoot VTM and connectors again.

YES | NO

- Repeat step 2.

- Does the VTM display PASS?

YES | NO

- STE/ICE-R is bad. Replace.

3 MEASURE BATTERY VOLTAGE:
- Dial 67 into TEST SELECT and press and release TEST.
- Watch the display and verify that the battery voltage is above 23.5 V/DC.

Is the battery voltage above the limit?

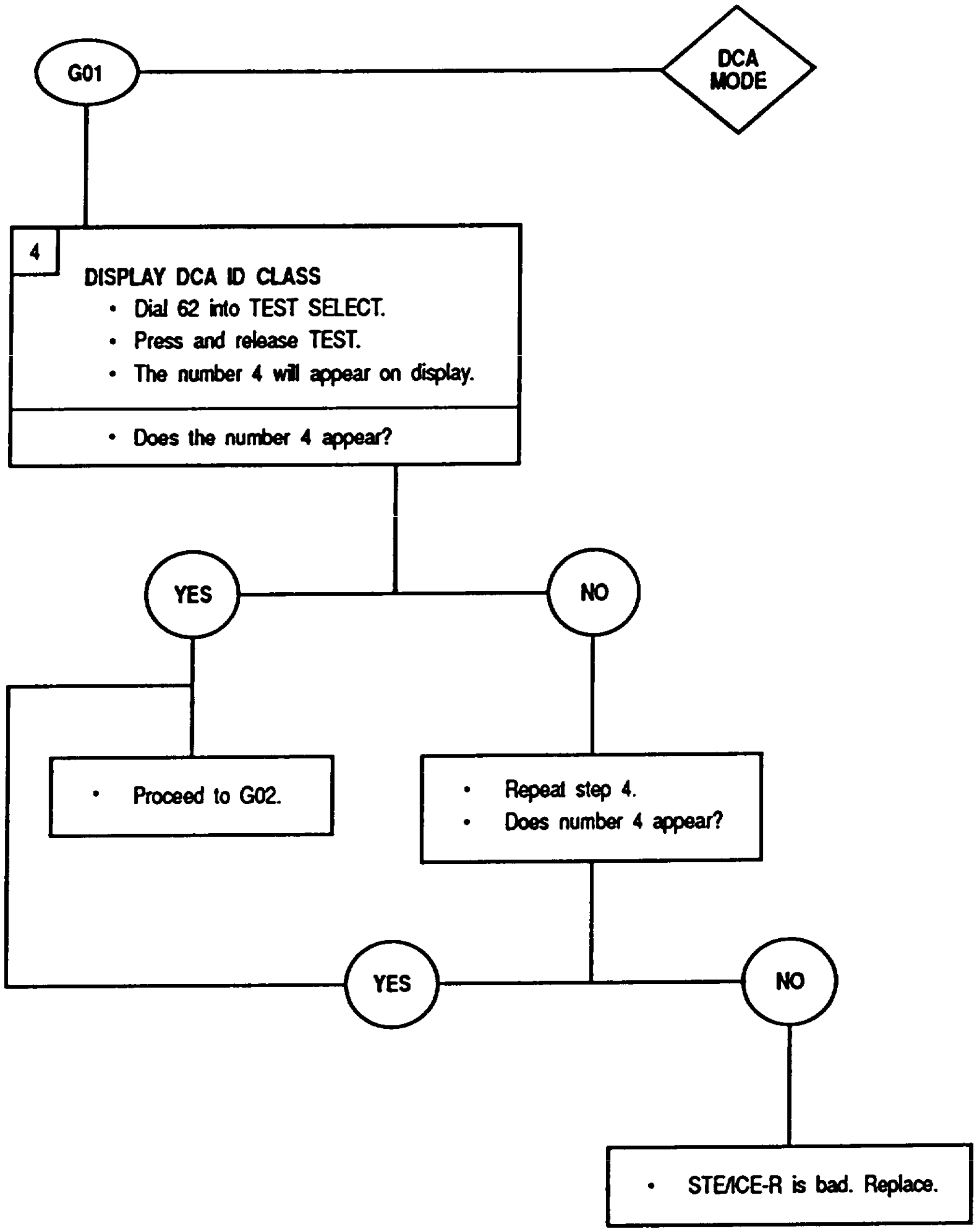
NOTE
After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

YES | NO

- Check VTM connections.
- Clean battery terminals.
- Check battery specific gravity.
- Charge battery, if necessary.

Proceed to next page.

- Repeat step 3.
- If problem continues, troubleshoot engine (p 3-65).


G01
DCA MODE
4
DISPLAY DCA ID CLASS
• Dial 62 into TEST SELECT.
• Press and release TEST.
• The number 4 will appear on display.
• Does the number 4 appear?
YES
NO
• Proceed to G02.
• Repeat step 4.
• Does number 4 appear?
YES
NO
• STE/ICE-R is bad. Replace.

G02

DCA MODE

1 **RUN STARTER CURRENT FIRST PEAK TEST:**

- Dial 72 into TEST SELECT.
- Press and hold TEST until CAL message appears.
- Release TEST.
- Wait for offset value to appear.

- Is the offset value within the limits of -150 to +150?

CAL

TEST NO.	TEST
72	STARTER CURRENT FIRST PEAK

YES

NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

2 **MEASURE STARTER CURRENT FIRST PEAK:**

- Place hand throttle in off position.
- Press TEST momentarily.
- Wait for prompting message GO to appear on display.

- Does VTM display GO message?

GO

YES

NO

- STE/ICE-R bad. Replace.

- When GO appears, crank engine until OFF or an error message is displayed.

OFF

NOTE

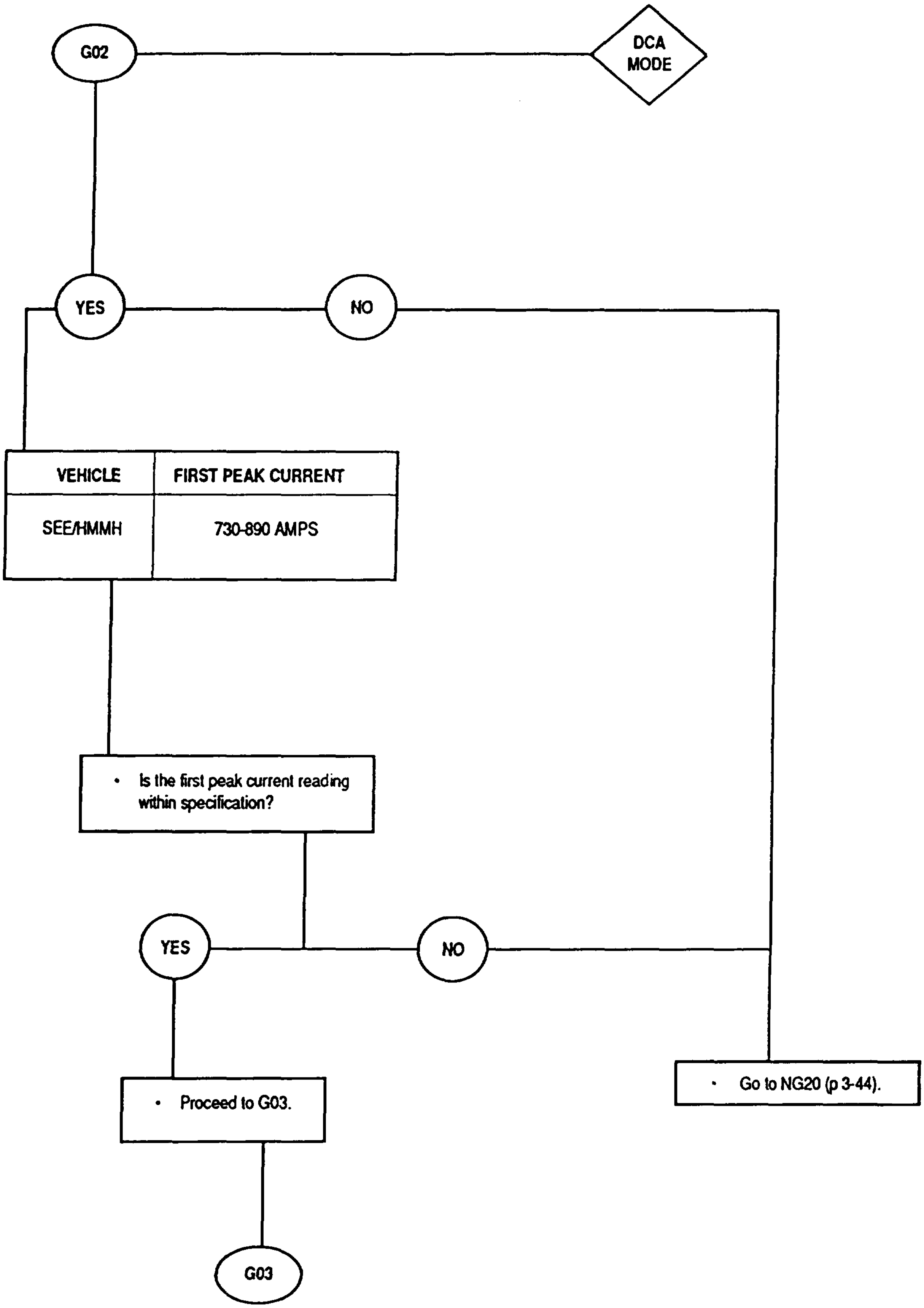
If engine does not crank, go to NG20 (p 3-44).

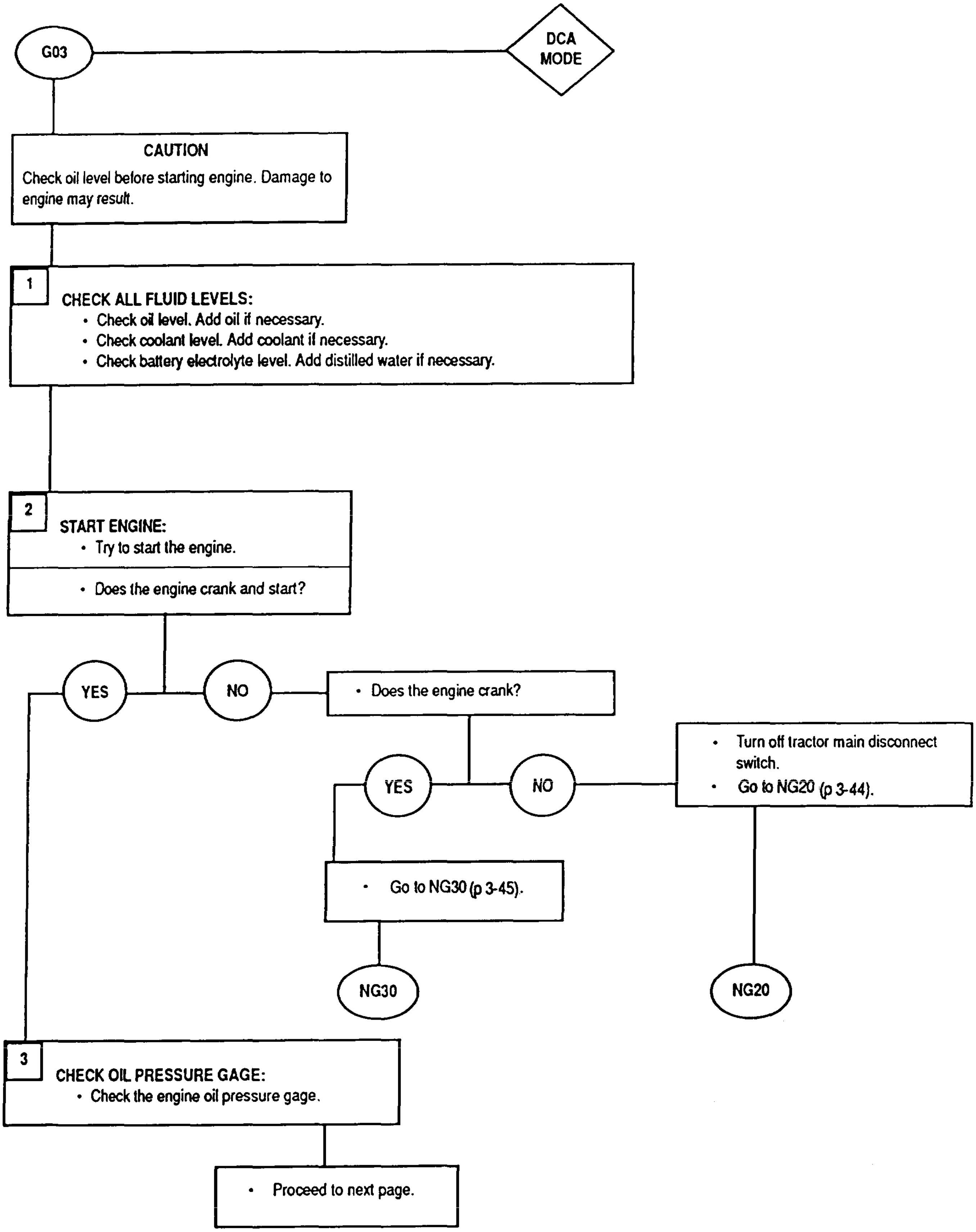
NOTE

While cranking the engine with bad or discharged batteries, it is possible for the VTM to lose power and come on again after the cranking is stopped, displaying - - - -. If this happens, go to NG81 (p 3-56).

- Is a number displayed?

- Proceed to next page.


G02
DCA MODE
YES
NO
VEHICLE
FIRST PEAK CURRENT
SEE/HMMH
730-890 AMPS
• Is the first peak current reading within specification?
YES
NO
• Proceed to G03.
• Go to NG20 (p 3-44).
G03


G03
DCA MODE
CAUTION
Check oil level before starting engine. Damage to engine may result.
1
CHECK ALL FLUID LEVELS:
• Check oil level. Add oil if necessary.
• Check coolant level. Add coolant if necessary.
• Check battery electrolyte level. Add distilled water if necessary.
2
START ENGINE:
• Try to start the engine.
• Does the engine crank and start?
YES
NO
• Does the engine crank?
YES
NO
• Turn off tractor main disconnect switch.
• Go to NG20 (p 3-44).
• Go to NG30 (p 3-45).
NG30
NG20
3
CHECK OIL PRESSURE GAGE:
• Check the engine oil pressure gage.
• Proceed to next page.

G03

DCA MODE

- Does the engine oil pressure gage read normal (between 29-73 psi, minimum 9 psi at low idle)?

YES

NO

- Stop engine immediately (TM 5-2420-224-10). Replace oil filter element (p 4-7). Start engine and repeat step 3. Troubleshoot engine if problem continues (p 3-65).

- Does the voltmeter gage read normal (24.5-28 V/DC)?

YES

NO

- Go to G04 (p 3-33).

G04

- Proceed to step 4.

4

G03

DCA MODE

4

CHECK GAGES:

- Check all other vehicle gages for normal reading using TM 5-2420-224-10.

- Do all gages show normal reading?

YES

- Proceed to G04.

G03

NO

- Stop engine (TM 5-2420-224-10).
- Refer to Troubleshooting Table (p 3-65) to locate and correct problem(s).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

G04

DCA MODE

1 SET ENGINE SPEED:

- Turn headlights on.
- Increase engine speed to 1000-1200 rpm.

- Does voltmeter gage read 24.5-28 V/DC?

YES

- Turn off headlights.
- Stop engine (TM 5-2420-224-10).
- Proceed to G05.

G05

NO

- Check wiring and voltmeter gage with the VTM.
- If necessary, repair or replace defective wire(s).
- If necessary, replace voltmeter gage (p 4-135).

- Problem corrected?

YES

Rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NO

- Turn off headlights.
- Stop engine (TM 5-2420-224-10).
- Go to NG50 (p 3-50).

NG50

G05

DCA MODE

1

CHECK FOR LEAKS AND COOLANT TEMPERATURE:

- Check the vehicle for oil, fuel, and coolant leaks. Repair any leaks.
- Warm up the engine to normal operating temperature (TM 5-2420-224-10).

- Does temperature gage read within the limits found in TM 5-2420-224-10 after a normal warmup period?

YES

- Proceed to step 2.

2

NO

- Troubleshoot engine and cooling system for high temperature (p 3-65). If no problems are found, notify direct support maintenance.

NOTE

After completing repair, rerun the GO-NO GO Chain test to verify that the problem is fixed and that no other problems exist.

G05

DCA MODE

2 CHECK OIL PRESSURE:

- Dial 10 into TEST SELECT and press TEST.
- Increase rpm to 2000.
- Watch the engine oil pressure gage.
- Verify that the oil pressure is normal (30-75 psi on engine oil pressure gage).

NOTE

If VTM does not operate, check DCA wiring and rpm sensor.

NOTE

Speeds given are approximate. If exact speed cannot be reached, check oil pressure at closest possible speed.

TEST NO.	TEST
10	ENGINE RPM

- Is the oil pressure within the limits specified?

YES

- Proceed to G06.

G06

NO

- Stop engine immediately (TM 5-2420-224-10).
- Replace oil filter element (p 4-7).
- Check oil pressure.

- Is oil pressure 30-75 psi?

YES

- Proceed to G06.

NO

- Troubleshoot engine (p 3-65).

G06

DCA MODE

TEST NO.	TEST
10	ENGINE RPM (AVERAGE)

1 CHECK GOVERNOR OPERATION:

- Watch the VTM display.
- Gradually increase the engine speed to governor speed 2900 ±100 rpm.

CAUTION

Do not allow engine speed to exceed 3100 rpm. Damage to engine may result.

- Is the engine high idle speed within limits?

NO

- Adjust accelerator linkage (p 4-68).
- Notify direct support maintenance to troubleshoot engine.

YES

2 CHECK THE ENGINE AT DECELERATOR SPEED:

- Release accelerator pedal to obtain engine idle speed of 700 ±50 rpm.

- Is engine speed within limits?

NO

- Adjust accelerator linkage (p 4-68).
- Notify direct support maintenance to troubleshoot engine.

YES

- Proceed to G07.

G07

G07

DCA MODE

CAUTION

Do not perform the power test if the engine temperature is above normal operating temperature. However, the engine should be at operating temperature before performing the power test. Damage to engine may result.

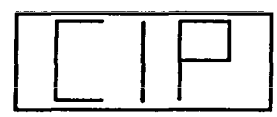
NOTE

Engine has to be running at idle before power test starts.

TEST NO.	TEST
12	POWER TEST (RPM/SEC)

1 **RUN POWER TEST:**

- Dial 12 into TEST SELECT and press and release TEST.
- Wait for prompting message CIP to appear.



PROMPTING MESSAGE

- Does VTM display CIP message?

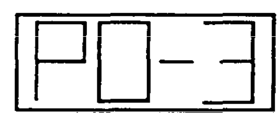
YES

- Proceed to step 2.

2

NO

- Does VTM display PO-3?



PROMPTING MESSAGE

YES

- Dial 02 into TEST SELECT and press TEST.
- Does VTM display CIP message?

YES

- Proceed to step 2.

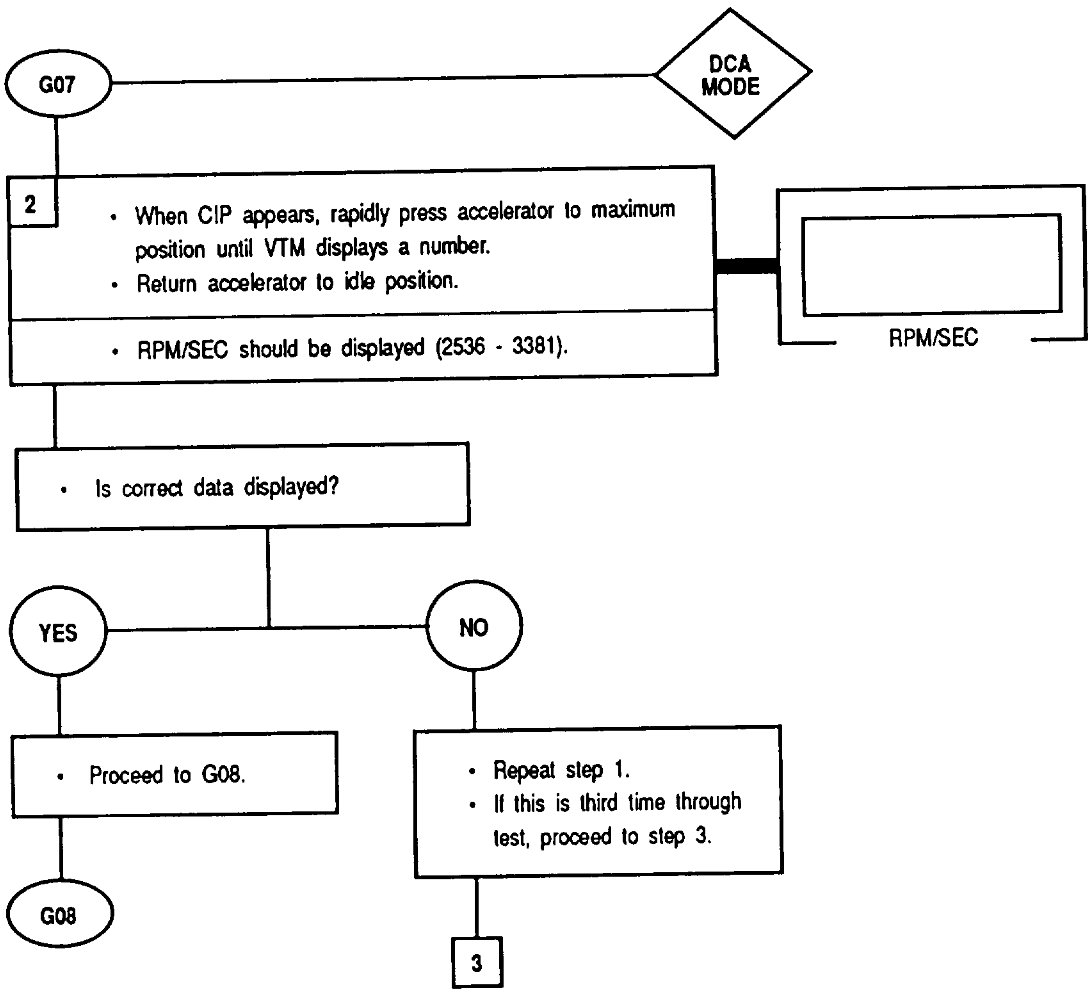
2

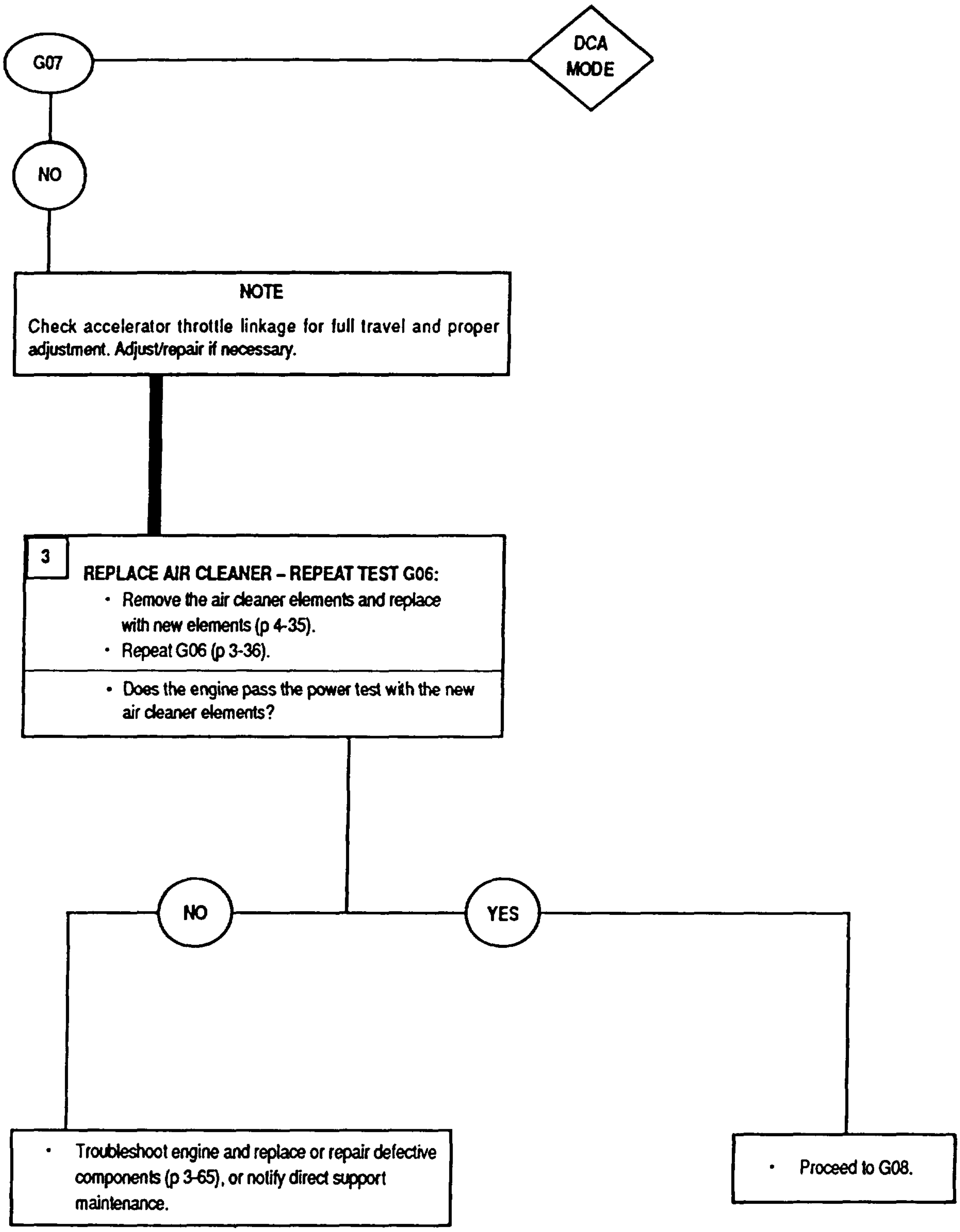
NO

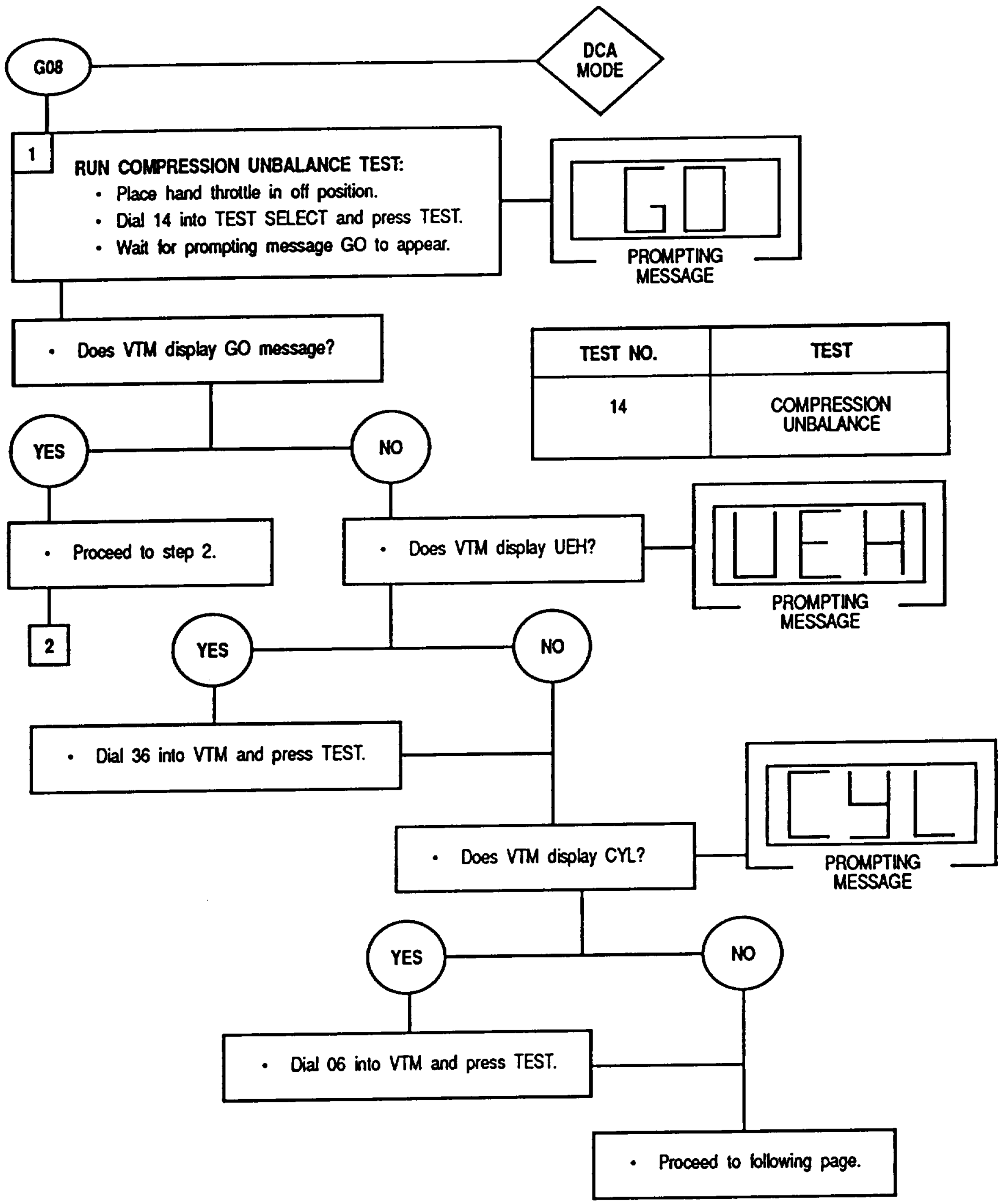
- Repeat step 1.
- If this is second time through test, replace STE/ICE-R.

NO

- STE/ICE-R is bad. Replace.


G07
DCA MODE
2
• When CIP appears, rapidly press accelerator to maximum position until VTM displays a number.
• Return accelerator to idle position.
• RPM/SEC should be displayed (2536 - 3381).
RPM/SEC
• Is correct data displayed?
YES
NO
• Proceed to G08.
G08
• Repeat step 1.
• If this is third time through test, proceed to step 3.
3


G07
DCA MODE
NO
NOTE
Check accelerator throttle linkage for full travel and proper adjustment. Adjust/repair if necessary.
3
REPLACE AIR CLEANER – REPEAT TEST G06:
• Remove the air cleaner elements and replace with new elements (p 4-35).
• Repeat G06 (p 3-36).
• Does the engine pass the power test with the new air cleaner elements?
NO
YES
• Troubleshoot engine and replace or repair defective components (p 3-65), or notify direct support maintenance.
• Proceed to G08.


G08
DCA MODE
1
RUN COMPRESSION UNBALANCE TEST:
• Place hand throttle in off position.
• Dial 14 into TEST SELECT and press TEST.
• Wait for prompting message GO to appear.
GO
PROMPTING MESSAGE
• Does VTM display GO message?
TEST NO.
TEST
14
COMPRESSION UNBALANCE
YES
NO
• Proceed to step 2.
2
• Does VTM display UEH?
UEH
PROMPTING MESSAGE
YES
NO
• Dial 36 into VTM and press TEST.
• Does VTM display CYL?
CYL
PROMPTING MESSAGE
YES
NO
• Dial 06 into VTM and press TEST.
• Proceed to following page.

G08

DCA MODE

- Does VTM display CU-1?

CU-1

PROMPTING MESSAGE

YES

NO

- STE/ICE-R is bad. Replace.

- Dial 02 into TEST SELECT and press TEST. Repeat for remaining constants in table below.

CU-1	CU-2	CU-3	CU-4	CU-5
02	56	74	04	65

- Does VTM display GO message?

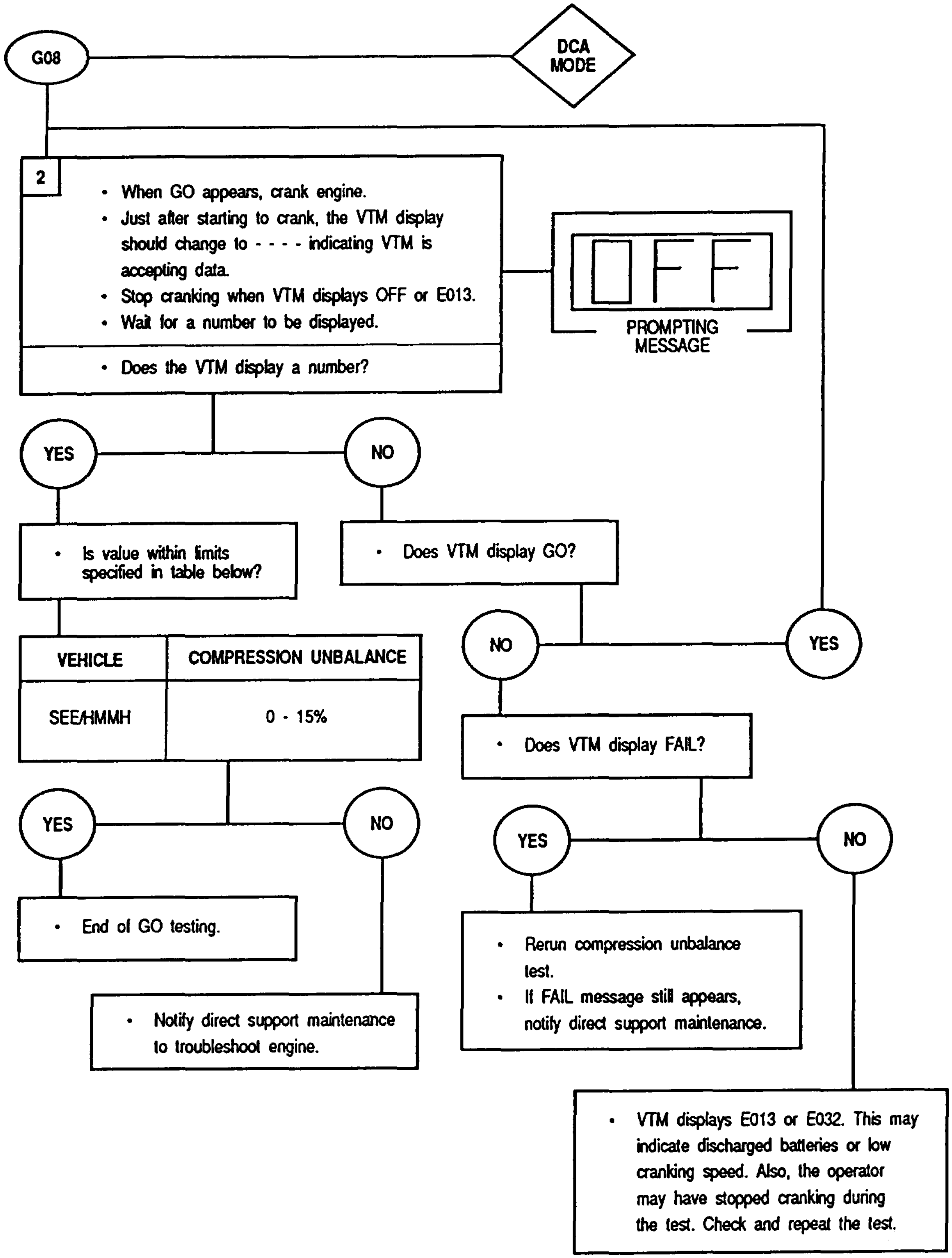
YES

NO

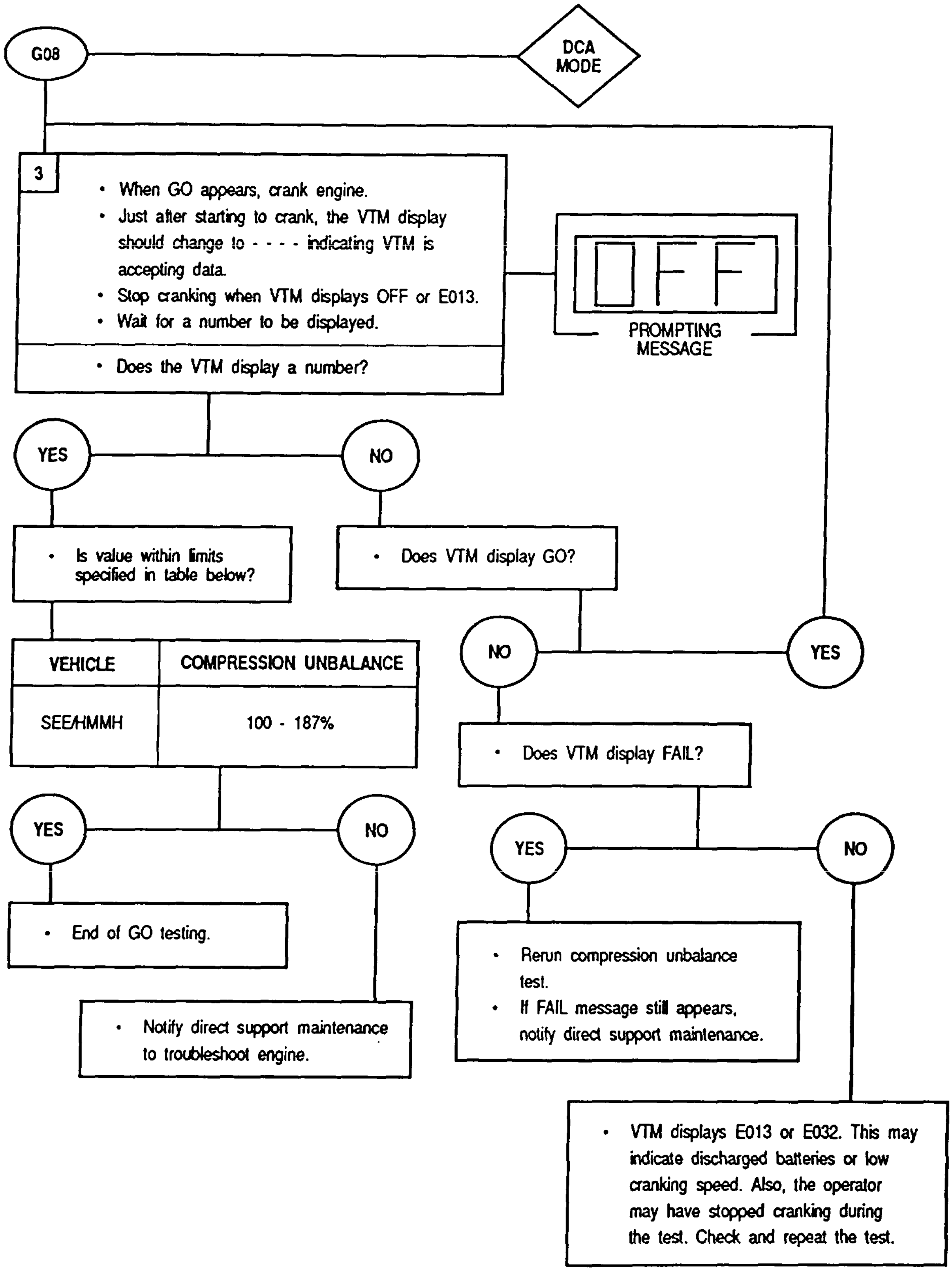
- Proceed to step 3.

3

- Repeat step 1.
- If this is second time through test, replace STE/ICE-R.



VEHICLE	COMPRESSION UNBALANCE
SEE/HMMH	0 - 15%


G08
DCA MODE
3
• When GO appears, crank engine.
• Just after starting to crank, the VTM display should change to - - - - indicating VTM is accepting data.
• Stop cranking when VTM displays OFF or E013.
• Wait for a number to be displayed.
• Does the VTM display a number?
OFF
PROMPTING MESSAGE
YES
NO
• Is value within limits specified in table below?
• Does VTM display GO?
VEHICLE
COMPRESSION UNBALANCE
SEE/HMMH
100 - 187%
NO
YES
• Does VTM display FAIL?
YES
NO
• End of GO testing.
• Notify direct support maintenance to troubleshoot engine.
YES
NO
• Rerun compression unbalance test.
• If FAIL message still appears, notify direct support maintenance.
• VTM displays E013 or E032. This may indicate discharged batteries or low cranking speed. Also, the operator may have stopped cranking during the test. Check and repeat the test.

NG20

DCA MODE

1 TRY TO CRANK ENGINE:

- Crank engine. Listen to starter motor.

- Does the starter sound like it is running over speed?

YES

NO

- Go to NG80 (p 3-52).

NG80

2 CHECK TEETH ON FLYWHEEL:

- Remove starter (p 4-117).
- Check for missing and/or damaged teeth on flywheel.

- Are all teeth good?

YES

- Replace starter (p 4-117)

NO

- Notify direct support maintenance to replace engine flywheel.

NOTE

After completing repair, rerun the GO-NO GO Chain test to verify that the problem is fixed and that no other problems exist.

NG30

DCA MODE

1

CHECK CRANKING SPEED:

- Place hand throttle in off position.
- Dial 10 into TEST SELECT and press TEST.
- Crank the engine and watch the readout display.
- Compare the result with the minimum cranking speed of 120 rpm.

TEST NO.	TEST
10	ENGINE RPM (AVERAGE)

- Is the cranking speed ok?

YES

NO

- Go to NG80 (p 3-52).

NG80

2

CHECK FUEL SUPPLY:

- Verify that there is fuel in the tank.
- If fuel filter pre-sediment bowl has been cleaned, or if fuel tank has been run dry, bleed air out of fuel system as necessary.
- Check for kinked, flattened, or broken fuel lines from the tank to the engine.

- Proceed to step 3.

3

NG30

DCA MODE

3

INSTALL TRANSDUCER-DO OFFSET:

- Stop engine (TM 5-2420-224-10).
- Remove plug from elbow on front of fuel pressure switch.
- Install pressure transducer (blue stripe).
- Connect P1 of the transducer cable W4 to J3 on the VTM.
- Connect P2 of the transducer cable to the connector on the pressure transducer.

- Proceed to step 4.

4

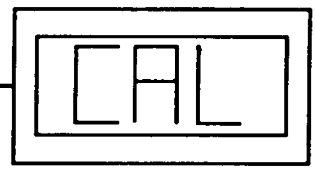
NG30

DCA MODE

TEST NO.	TEST
50	0-1000 PSI PRESSURE (0-6895 kPa)

4

- Dial 50 into TEST SELECT.
- Press and hold TEST until CAL message appears on the display.
- Release TEST.
- Wait for offset value to appear on the display.



- Is the offset value within the range of -150 to +150?

YES

- Proceed to step 5.

5

NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

NG30

DCA MODE

5 CHECK FUEL SUPPLY PRESSURE DURING CRANK:

- Press TEST momentarily.
- Crank the engine and watch the readout display.
- The number on the display should be above 7 psi (0.5 Bar).

- Is the fuel pressure above 7 psi (0.5 Bar)?

YES

- Turn engine off.
- Remove transducer from elbow. Install plug.
- If engine still does not start, troubleshoot the engine and take necessary corrective action (p 3-65).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NO

- Remove transducer from elbow. Install plug.

- Proceed to NG31.

NG31

NG31

DCA MODE

TEST NO.	TEST
26	FUEL FILTER PRESSURE DROP

- Dial 26 into TEST SELECT.
- Place hand throttle in idle position.
- While cranking engine, press and release TEST and observe VTM display.

PASS

PROMPTING MESSAGE

- Check fuel lines and hoses for restriction.
- If engine still does not start, troubleshoot engine and repair as necessary (p 3-65).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

FAIL

PROMPTING MESSAGE

- Replace fuel filter element (p 4-48).
- Attempt to start engine.
- If engine still does not start, notify direct support maintenance.

NG50

DCA MODE

1

CHECK ALTERNATOR OUTPUT VOLTAGE:

- Turn on lights and accessories.
- Set engine speed to 1000-1200 rpm.
- Dial 82 into TEST SELECT and press TEST.

- Is the voltage between 24.8 and 28.5 V/DC?

TEST NO.	TEST
82	ALTERNATOR OUTPUT VOLTAGE
84	ALTERNATOR NEGATIVE CABLE VOLTAGE DROP

YES

- Proceed to step 2.

2

NO

- Check for bad connections or broken cables in charging system output and ground circuits.

- If voltage is still not within the specified limits, replace alternator (p 4-112).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NG50

DCA MODE

2

CHECK ALTERNATOR NEGATIVE CABLE VOLTAGE DROP:

- Dial 84 into TEST SELECT and press TEST.
- Set engine speed to 1000-1200 rpm.

- Is the cable drop more than 0.30 V/DC?

YES

- Replace alternator (p 4-112).

NO

- Inspect and clean all ground cables from alternator, starter, engine, and batteries and check for integrity. Repair as necessary.

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NG80

DCA MODE

NOTE

While cranking the engine with bad or discharged batteries, it is possible for the VTM to lose power and come on again after the cranking has stopped, displaying - - - -. If this occurs, clean battery posts and clamps and try again.

1 **DO STARTER CIRCUIT RESISTANCE OFFSET:**

- Dial 74 into TEST SELECT.
- Press and hold TEST until CAL message appears on the display.
- Release TEST.
- Wait for offset value to appear.

PROMPTING MESSAGE

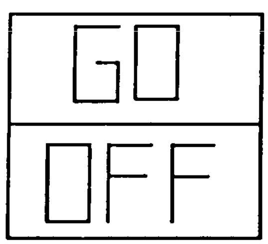
- Is the offset value within the limits of -150 to +150?

TEST NO.	TEST
74	STARTER CIRCUIT RESISTANCE

YES

NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.



PROMPTING MESSAGE

2 **CHECK STARTER CIRCUIT RESISTANCE:**

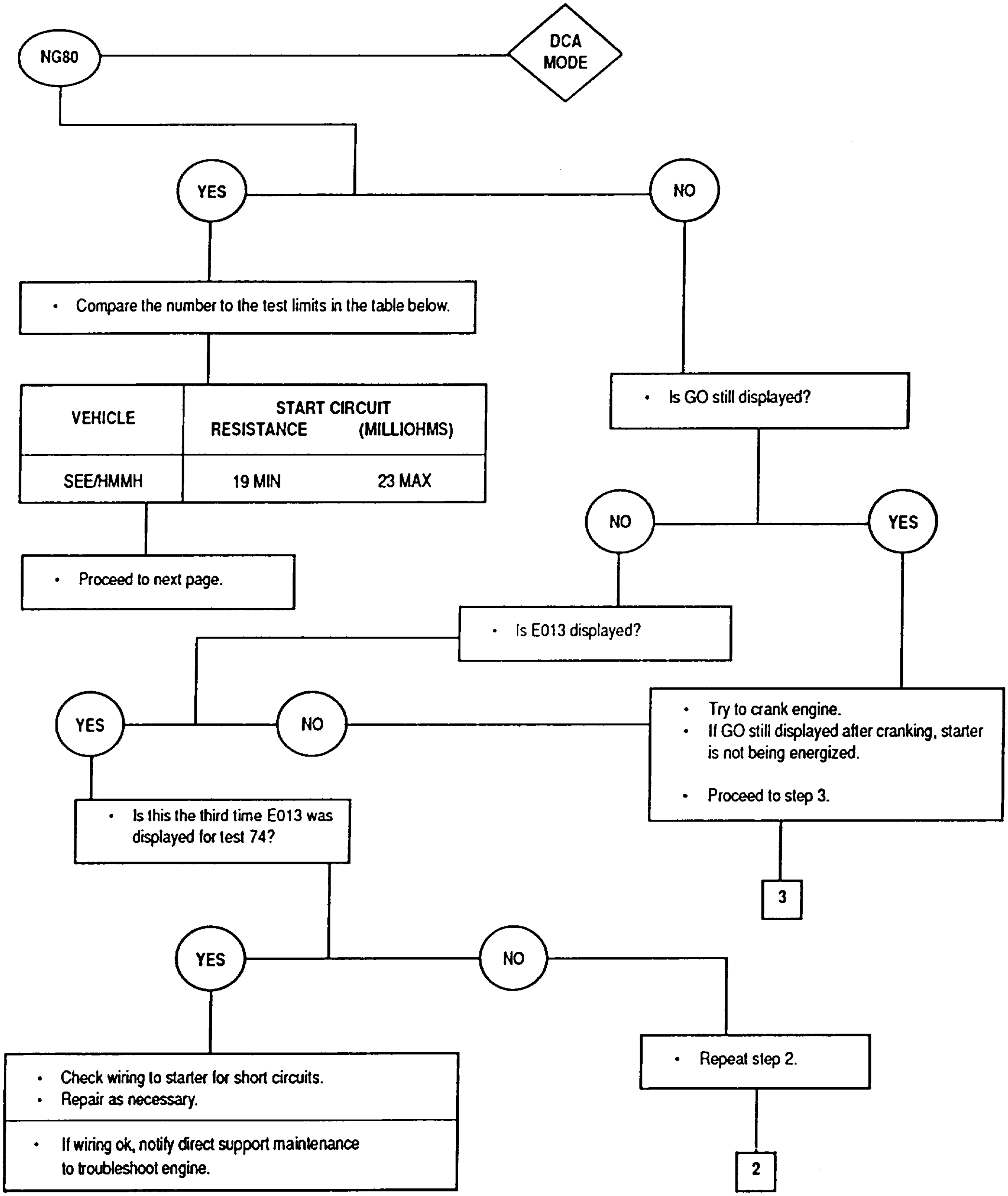
- Place hand throttle in off position.
- Press and release TEST.
- When GO appears, attempt to crank engine.
- Stop cranking the engine when the VTM displays OFF or an error message.

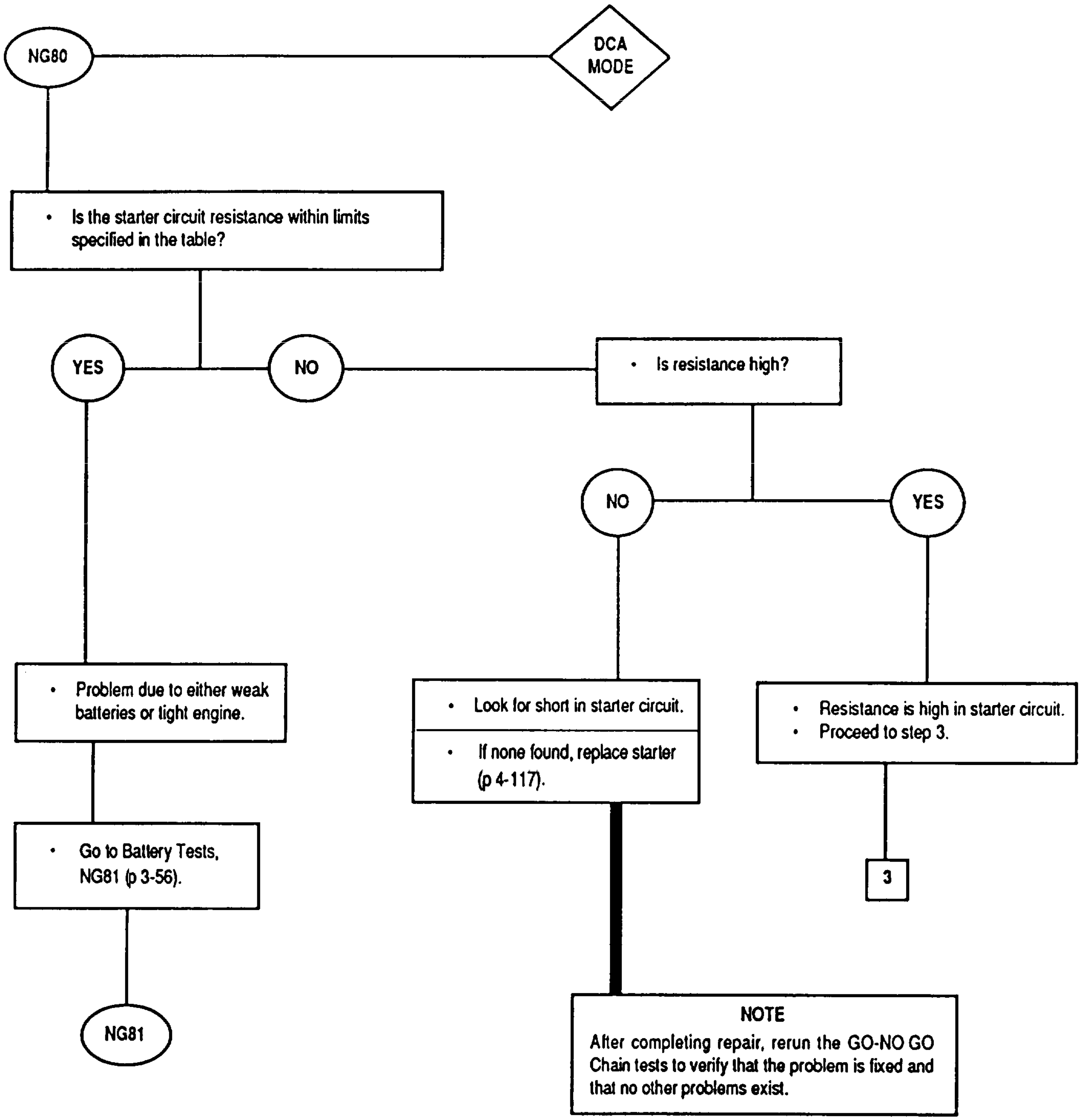
NOTE

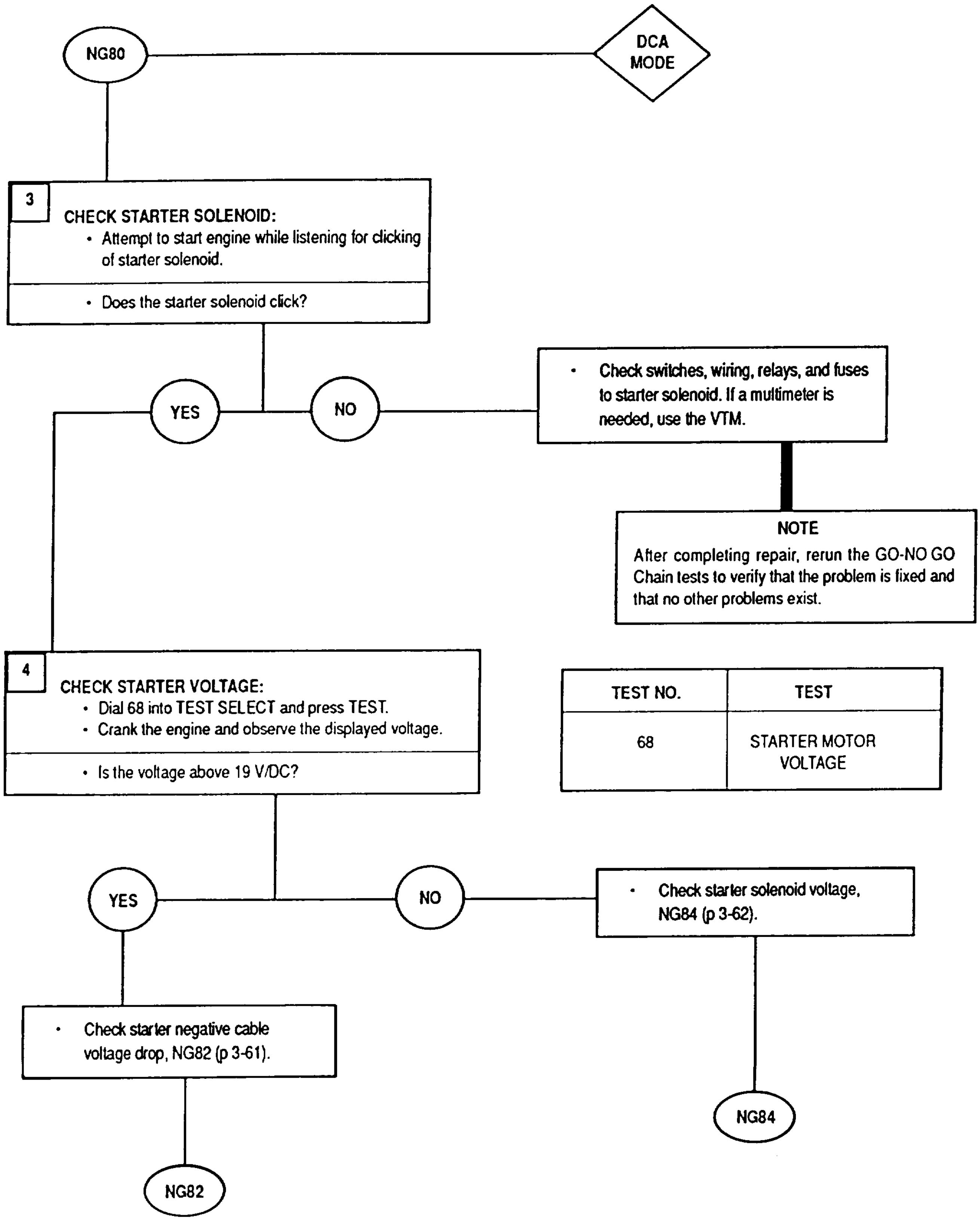
Error message indicates short circuit, frozen starter, or tight engine.

- Is a number displayed?

- Proceed to next page.


NG80
DCA MODE
YES
NO
• Compare the number to the test limits in the table below.
VEHICLE
START CIRCUIT RESISTANCE (MILLIOHMS)
SEE/HMMH
19 MIN
23 MAX
• Proceed to next page.
• Is GO still displayed?
NO
YES
• Is E013 displayed?
YES
NO
• Try to crank engine.
• If GO still displayed after cranking, starter is not being energized.
• Proceed to step 3.
3
• Is this the third time E013 was displayed for test 74?
YES
NO
• Check wiring to starter for short circuits.
• Repair as necessary.
• If wiring ok, notify direct support maintenance to troubleshoot engine.
• Repeat step 2.
2


NG80
DCA MODE
• Is the starter circuit resistance within limits specified in the table?
YES
NO
• Is resistance high?
NO
YES
• Problem due to either weak batteries or tight engine.
• Go to Battery Tests, NG81 (p 3-56).
NG81
• Look for short in starter circuit.
• If none found, replace starter (p 4-117).
• Resistance is high in starter circuit.
• Proceed to step 3.
3
NOTE
After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.



TEST NO.	TEST
68	STARTER MOTOR VOLTAGE

NG81

DCA MODE

- Dial 75 into TEST SELECT.
- Press and hold TEST until CAL message appears on the display.
- Release TEST.
- Wait for offset value to appear on the display.

- Is the offset value within the range of -225 to +225?

CAL

PROMPTING MESSAGE

NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

YES

1 MEASURE BATTERY INTERNAL RESISTANCE CHANGE:
- Push and release TEST.

- Does GO appear?

GO

PROMPTING MESSAGE

NO

- Error message is displayed.
- Refer to TM 9-4910-571-12&P, correct as necessary, and repeat step 1.

1

YES

TEST NO.	TEST
75	BATTERY INTERNAL RESISTANCE CHANGE

- Place hand throttle in off position.
- Engage starter motor until OFF appears on the display.

- Wait for display to change.

- Is test value displayed?

OFF

PROMPTING MESSAGE

- Proceed to next page.

NG81

DCA MODE

NO

- If display shows GO, there is a bad connection in the starter circuit. Check cables and connections to starter and retest. If display still shows GO, then you may have a very poor battery.

- If display shows .9.9.9.9 there may be a bad connection on a battery. Clean and tighten battery connections and retest.

- If display shows - - - -, or .9.9.9.9, a battery may be in a discharged state. Check battery electrolyte level, charge battery, and then retest.

- If display shows E013 three consecutive times, or - - - -, or .9.9.9.9, after a battery has been charged, replace battery (p 4-219).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

YES

- Proceed to next page.

NG81

DCA MODE

- Compare the number to the test limits in the table below.

TEST NO.	TEST
73	BATTERY INTERNAL RESISTANCE

VEHICLE	MAXIMUM RESISTANCE CHANGE
SEE/HMMH	50 MILLIOHMS/SEC

- Is the number within test limits?

YES

NO

- Proceed to following page.

YES:

- Dial 73 into TEST SELECT.
- Press and hold TEST until CAL message appears on the display.
- Release TEST.
- Wait for offset value to appear on the display.

CAL

PROMPTING MESSAGE

- Is the offset value within the range of -225 to +225?

YES

NO

- Proceed to TM 9-4910-571-12&P for offset fault isolation.

YES:

- Proceed to step 2.

2

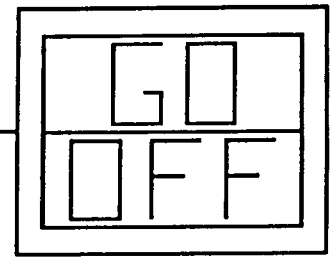
NG81

DCA MODE

2

MEASURE BATTERY INTERNAL RESISTANCE:

- Push and release TEST.
- Place hand throttle in off position.
- If GO appears, engage stater motor until OFF appears on VTM display.
- If error message appears, refer to TM 9-4910-571-12&P. Correct as necessary, and repeat test.



- Is test value displayed?

YES

NO

- Proceed to following page.

VEHICLE	MAXIMUM RESISTANCE CHANGE
SEE/HMMH	25 MILLIOHMS/SEC

- Is the battery resistance less than the above limit?

YES

- Notify direct support maintenance to troubleshoot engine.

NO

- Proceed to step 3.

3

NG81

DCA MODE

3

- Check battery electrolyte level.
- Clean battery terminals.
- Check battery specific gravity.
- Charge batteries if necessary.
- Repeat test.

NOTE

If batteries fail in freezing weather, turn headlights on for five seconds and retest. This will warm the batteries slightly.

- If batteries have been charged and battery resistance change is still greater than the limit, replace batteries (p 4-219).

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NG82

DCA MODE

1 CHECK STARTER NEGATIVE CABLE VOLTAGE DROP:

- Dial 69 into TEST SELECT.
- Press and release TEST.
- With throttle in off position, crank engine until value appears on the display.
- Compare the result with the maximum voltage drop of 0.8 volt.

TEST NO.	TEST
69	STARTER NEGATIVE CABLE VOLTAGE DROP

- Is value within limits?

YES

- Replace starter motor (p 4-117).

NO

- Inspect and clean all ground cables from starter, engine, and batteries and check for integrity. Repair if necessary.

NOTE

After completing repair, rerun the GO-NO GO Chain tests to verify that the problem is fixed and that no other problems exist.

NG84

DCA MODE

1 **CHECK STARTER SOLENOID VOLTAGE:**

- Dial 70 into TEST SELECT.
- Press and release TEST.
- With throttle in off position, crank engine until value appears on the display.
- Compare the result with the minimum voltage of 18 volts.

TEST NO.	TEST
70	STARTER SOLENOID VOLTAGE

- Is the starter solenoid voltage above 18 V/DC?

YES

- Proceed to NG82 (p 3-61).

NG82

NO

- Proceed to NG81 (p 3-56).

NG81

Section IV. TROUBLESHOOTING PROCEDURES

This section contains troubleshooting procedures for the SEE/HMMH.

PRELIMINARY TROUBLESHOOTING PROCEDURES

NOTE

Fluid leaks are classified as either Class I, Class II, or Class III:

Class I: Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

Class II: Leakage of fluid great enough to form drops, but not enough to cause drops to drip from the item being checked or observed.

Class III: Leakage of fluid great enough to form drops that fall from the item being checked or observed.

Before starting any specific troubleshooting procedures perform the following:

1. Visually check for ruptured oil hoses or tubes, and for Class II or Class III leaks.
2. Check for mechanical jamming or binding caused by rocks or other foreign matter.
3. Check fluid levels in subject area and service as required (TM 5-2420-224-10 and page 2-14).
4. Relieve hydraulic pressure (page 2-23) and air pressure (page 2-23) before opening any hydraulic or air lines.

ELECTRICAL TROUBLESHOOTING

WARNING

Do not remove, install, connect, or disconnect any electrical component unless vehicle MASTER disconnect switch is OFF. To do so could result in injury to personnel.

CAUTION

If checking for continuity, MASTER disconnect switch must be OFF to prevent damage to equipment.

NOTE

If checking for +24 VDC, MASTER disconnect switch must be ON.

Before starting detail troubleshooting procedures, review the wiring diagram to thoroughly familiarize yourself with the circuit(s) involved. Refer to SEE wiring diagram, NSN 7610-01-475-7996. Analyze the symptoms and conditions and use common sense and logic to determine the most likely cause of the problem, then troubleshoot that circuit first. The more information you have concerning the problem, the easier it will be to troubleshoot.

Isolate to the subsystem level (in cases where more than one subsystem is involved); next isolate the problem to a single circuit within the subsystem; then, isolate the problem to the faulty component using the troubleshooting symptom index.

Frayed, broken, loose, or corroded wiring is a common source of problems in any electrical circuit. Always make visual inspection before starting detail troubleshooting. Observe, in particular, contacts to ground. Components with case grounds are especially troublesome.

Most of the checks are made by voltage checks. Instructions prior to the step may instruct you to disconnect at test point from the potential malfunctioning component. Once the check has been made, either repair the component or go to the referenced step. When ready to make the prescribed check, apply power to the circuit (if required). A helper may be required if the switch or power source is out of reach.

When making continuity checks, make sure the test equipment is isolated from the power source.

Troubleshooting Symptom Index

Troubleshooting Symptom Index (Cont)

Troubleshooting Symptom Index (Cont)

Malfunction Number	Malfunction	Troubleshooting Procedure Page

TRANSMISSION

BRAKES AND AIR SYSTEM

STEERING

SUSPENSION

HYDRAULIC SYSTEM

FORKLIFT (HMMH)

Troubleshooting Symptom Index (Cont)

Malfunction Number	Malfunction	Troubleshooting Procedure Page

Troubleshooting Symptom Index (Cont)

Malfunction Number	Malfunction	Troubleshooting Procedure Page
FRONT LOADER (SEE)		
138.	FRONT LOADER OPERATES SLOW	3-315
139.	FRONT LOADER WILL NOT RAISE OR LOWER	3-316
140.	FRONT LOADER WILL NOT LOWER USING BUCKET SWITCH	3-316
141.	FRONT LOADER WILL NOT RAISE USING BUCKET SWITCH	3-317
142.	LOADER BOOM CYLINDER DRIFTS	3-317
143.	BUCKET ROLLBACK CYLINDER DRIFTS	3-320
144.	LOAD DROPS WITH CONTROL VALVE IN NEUTRAL	3-322
145.	CONTROL VALVE STICKS OR WORKS HARD	3-322

Table 3-5. Troubleshooting

Malfunction
Test or Inspection
Corrective Action

ENGINE

WARNING

Before starting engine, make sure all personnel are clear of engine. Failure to do so could result in injury to personnel.

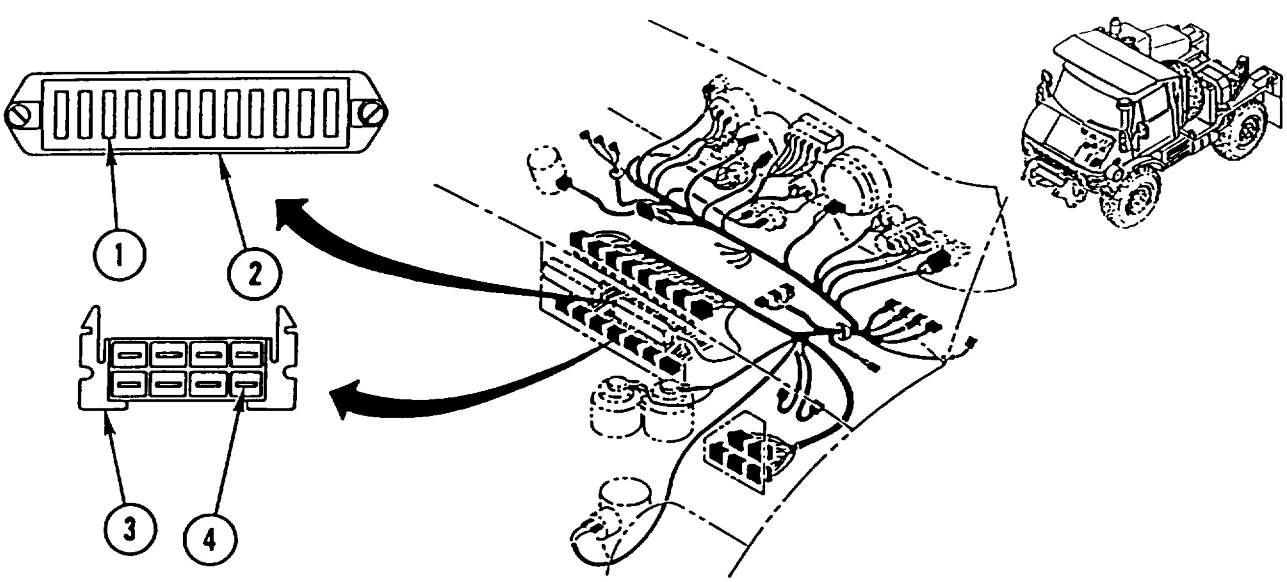
1. ENGINE WILL NOT CRANK.

NOTE

Refer to wiring diagram (page 3-77) for all wiring repair steps.

Step 1. Check for loose electrical connections on battery and starter.

- If electrical connections are loose, tighten connections.
- If electrical connections are tight, go to step 2.



Step 2. Check condition of fuse No. 3 (1), fuse box 1 (2).

- If fuse No. 3 is blown, replace fuse.
- If fuse No. 3 is good, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

NOTE

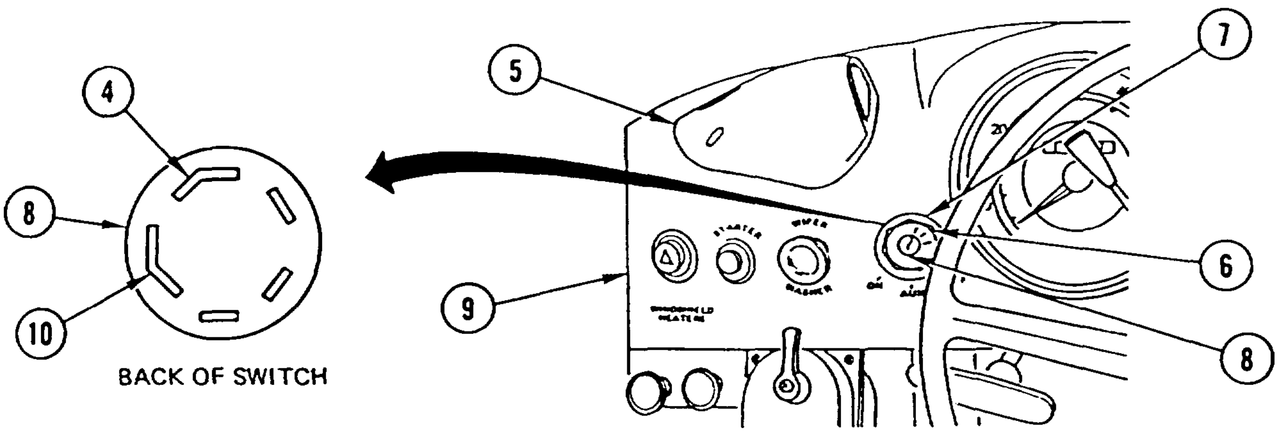
If STE/ICE-R Cl Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 3. Perform STE/ICE-R Cl Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, go to step 4.

Step 4. Disconnect connector D (3) and check for +24 VDC between wire 11 (4) and ground.

- If +24 VDC is not present, repair wiring 11 between starter and connector D.
- If +24 VDC is present, reconnect connector D and go to step 5.



Step 5. Remove defrost vent (5), nut (6), and washer (7) and pull ignition switch (8) out through opening in dashboard (9).

Step 6. Check for +24 VDC between wire 11 (4) and ground at ignition switch (8).

- If +24 VDC is not present, repair wiring 11 between connector D and ignition switch.
- If +24 VDC is present, go to step 7.

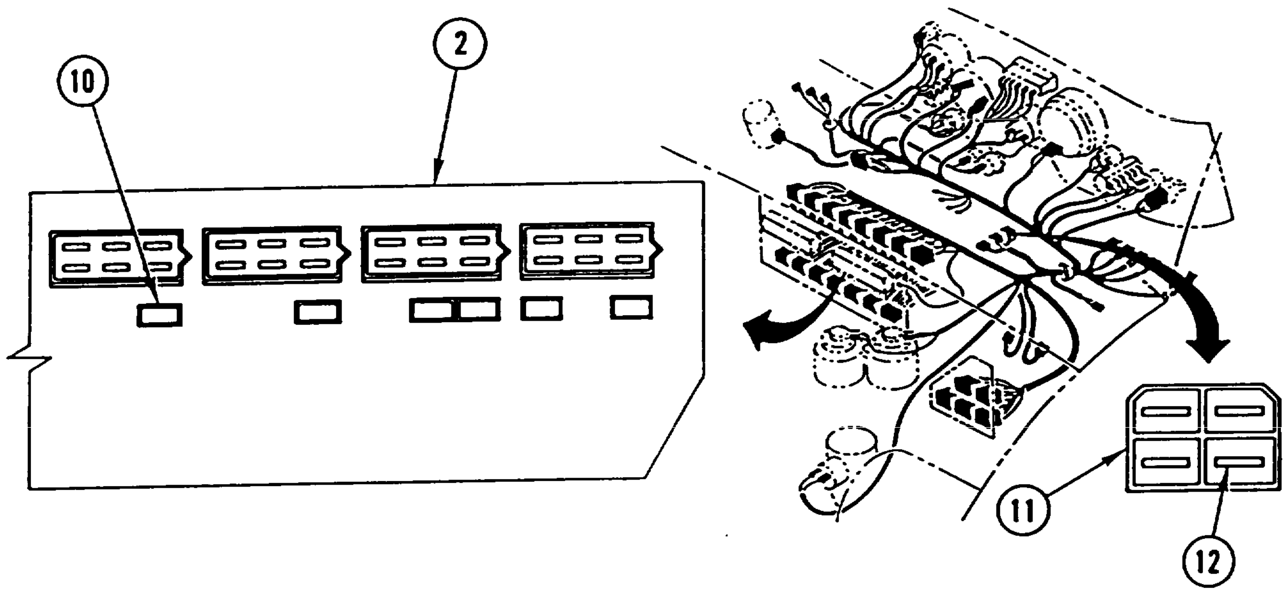
Step 7. Check for +24 VDC between wire 12 (10) and ground at ignition switch (8).

- If +24 VDC is not present, replace ignition switch (page 4-131).
- If +24 VDC is present, go to step 8.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 8. Check for +24 VDC between wire 12 (10) and ground at fuse box 1 (2).

- If +24 VDC is not present, repair wiring 12 between fuse box 1 and ignition switch.
- If +24 VDC is present, go to step 9.

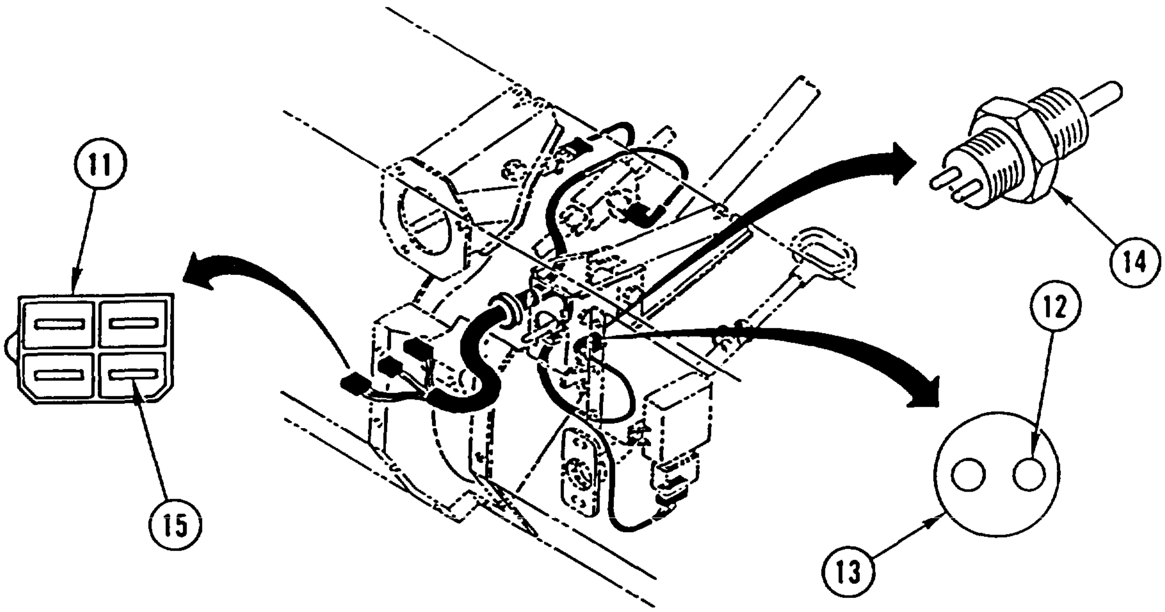
Step 9. Disconnect connector J (11) and check for +24 VDC between wire 214 (12) and ground.

- If +24 VDC is not present, repair wiring 214 between connector J and fuse box 1.
- If +24 VDC is present, reconnect connector J and go to step 10.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 10. Disconnect engine start switch connector (13) and check for +24 VDC between wire 214 (12) and ground.

- If +24 VDC is not present, repair wiring 214 between engine start switch and connector J.
- If +24 VDC is present, go to step 11.

Step 11. With engine start switch connector (13) disconnected and engine start switch (14) depressed, check for continuity across engine start switch.

- If there is no continuity, replace engine start switch (page 4-199).
- If there is continuity, reconnect engine start switch connector and go to step 12.

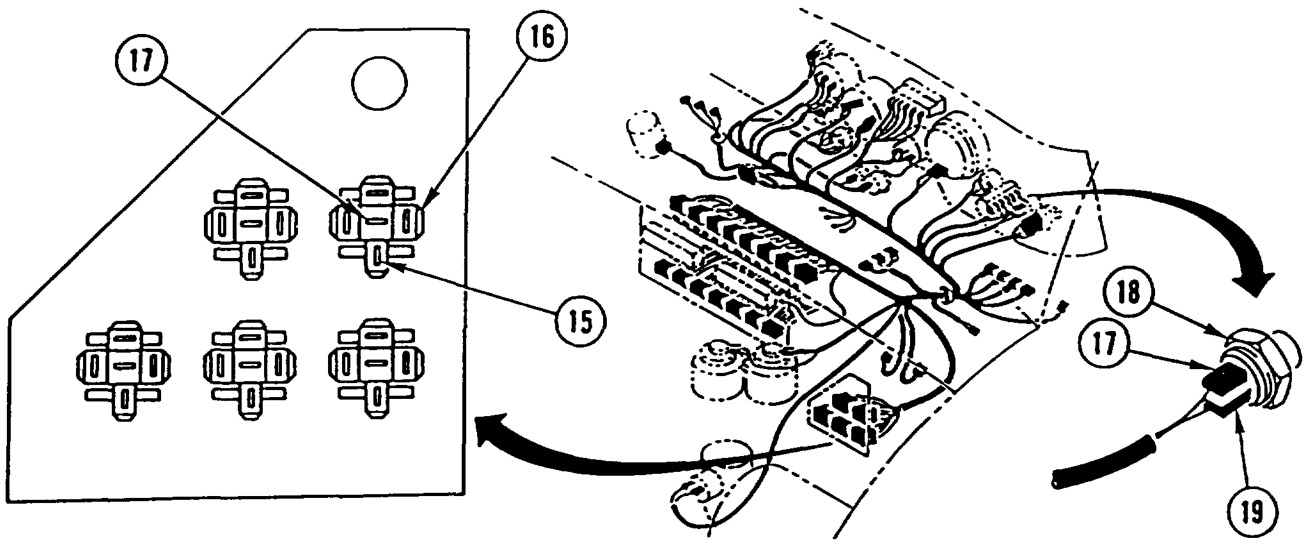
Step 12. Disconnect connector J (11). With engine start switch depressed, check for +24 VDC between wire 215 (15) and ground.

- If +24 VDC is not present, repair wiring 215 between engine start switch and connector J.
- If +24 VDC is present, reconnect connector J and go to step 13.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 13. With engine start switch depressed, check for +24 VDC between wire 215 (15) and ground at relay K2 (16).

- If +24 VDC is not present, repair wiring 215 between connector J and relay K2.
- If +24 VDC is present, go to step 14.

Step 14. With engine start switch depressed, check for +24 VDC between wire 211 (17) and ground at relay K2 (16).

- If +24 VDC is not present, replace relay K2.
- If +24 VDC is present, go to step 15.

Step 15. With engine start switch depressed, check for +24 VDC between wire 211 (17) and ground at starter switch (18).

- If +24 VDC is not present, repair wiring 211 between relay K2 and starter switch.
- If +24 VDC is present, go to step 16.

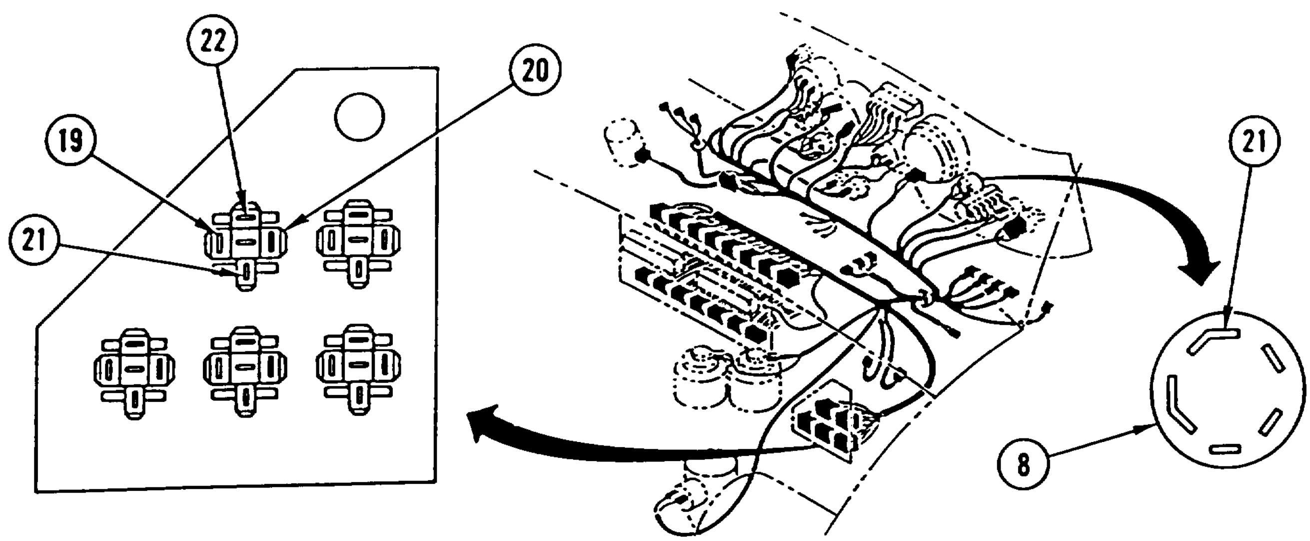
Step 16. With engine start switch and starter switch (18) depressed, check for +24 VDC between wire 212 (19) and ground at starter switch.

- If +24 VDC is not present, replace starter switch (page 4-133).
- If +24 VDC is present, go to step 17.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 17. With engine start switch and starter switch depressed, check for +24 VDC between wire 212 (19) and ground at relay K1 (20).

- If +24 VDC is not present, repair wiring 212 between starter switch and relay K1.
- If +24 VDC is present, go to step 18.

Step 18. Check for +24 VDC between wire 132 (21) and ground at iginition switch (8).

- If +24 VDC is not present, replace ignition switch (page 4-131).
- If +24 VDC is present, go to step 19.

Step 19. Check for +24 VDC between wire 132 (21) and ground at relay K1 (20).

- If +24 VDC is not present, repair wiring 132 between ignition switch and relay K1.
- If +24 VDC is present, go to step 20.

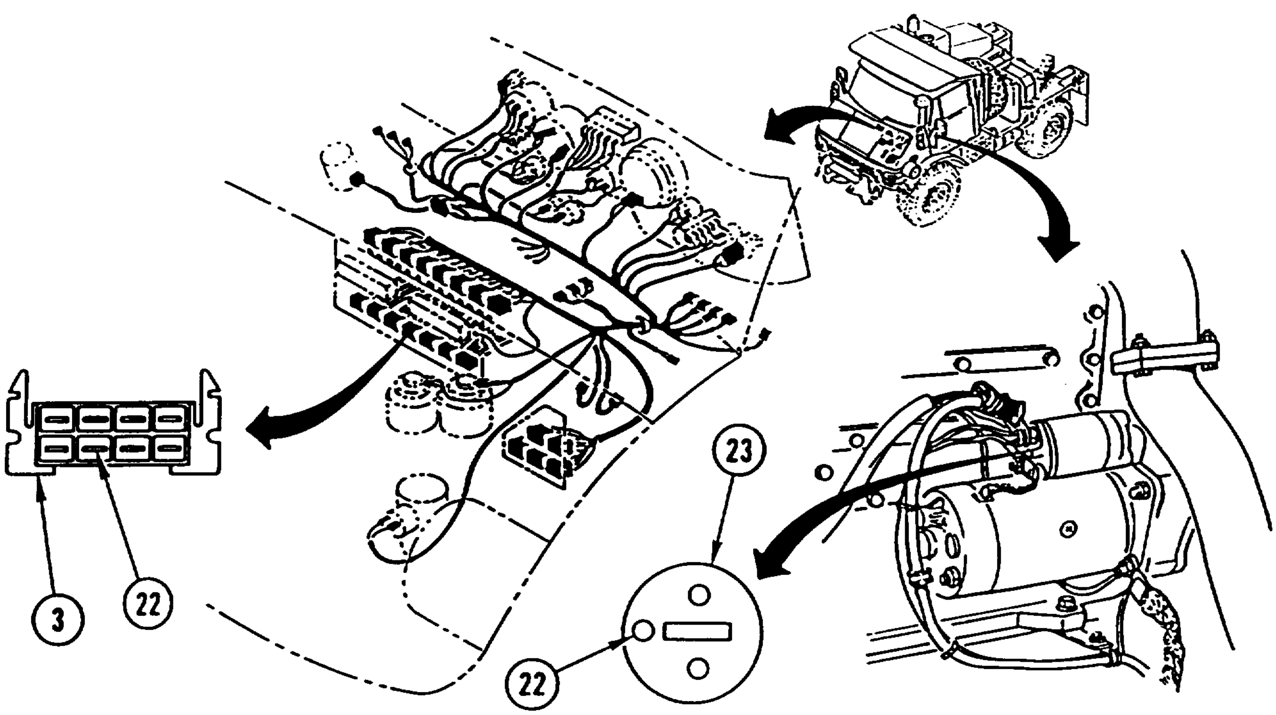
Step 20. With engine start switch and starter switch depressed, check for +24 VDC between wire 213 (22) and ground at relay K1 (20).

- If +24 VDC is not present, replace relay K1.
- If +24 VDC is present, go to step 21.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 21. Disconnect connector D (3). With engine start switch and starter switch depressed, check for +24 VDC between wire 213 (22) and ground.

- If +24 VDC is not present, repair wiring 213 between connector D and relay K1.
- If +24 VDC is present, reconnect connector D and go to step 22.

Step 22. With engine start switch and starter switch depressed, check for +24 VDC between wire 213 (22) and ground at starter (23).

NOTE

If starter is determined to be defective, perform Malfunction 2 prior to replacing starter.

- If +24 VDC is present, replace starter (page 4-117).
- If +24 VDC is not present, repair wiring 213 between starter and connector D.

Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ENGINE (CONT)

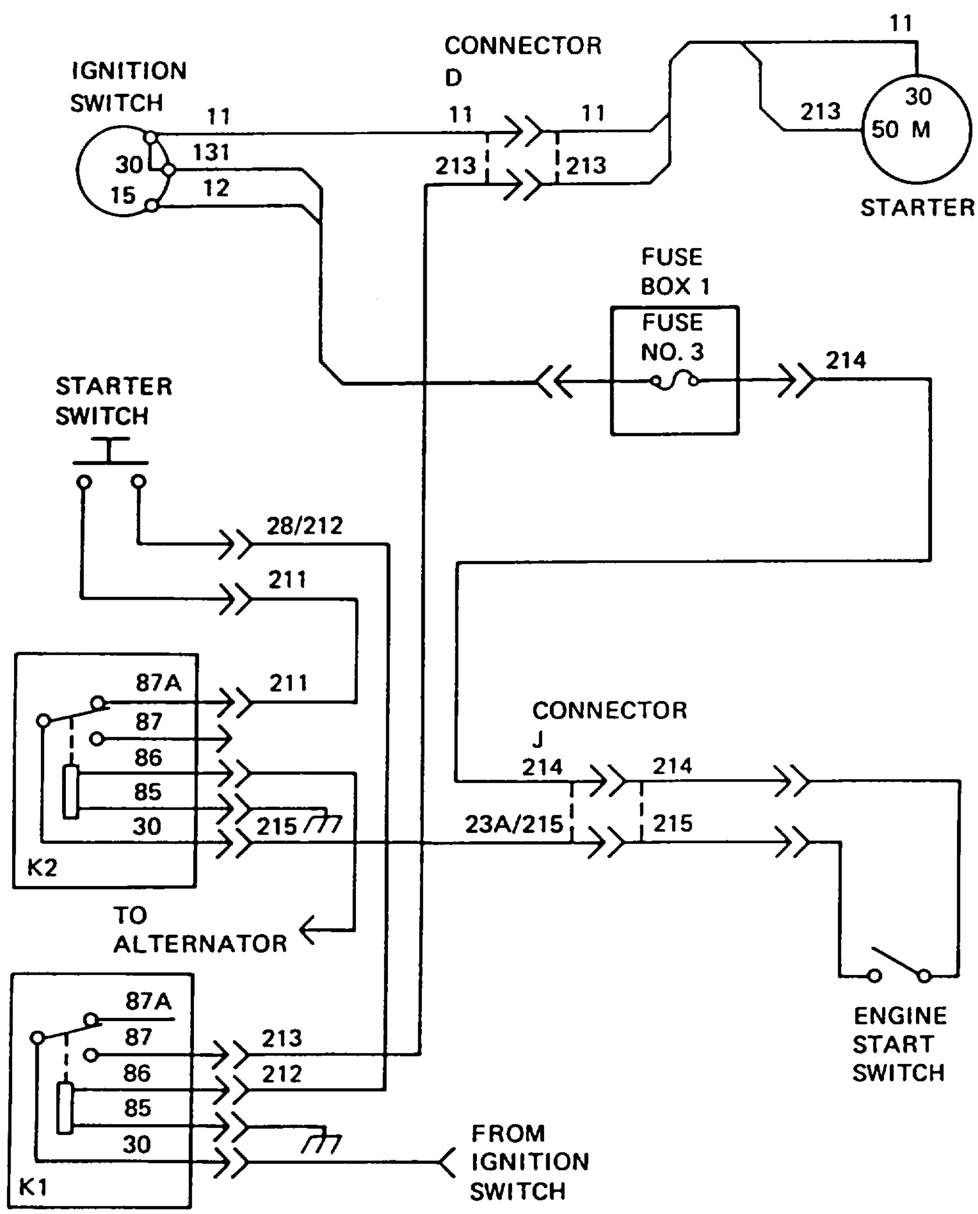
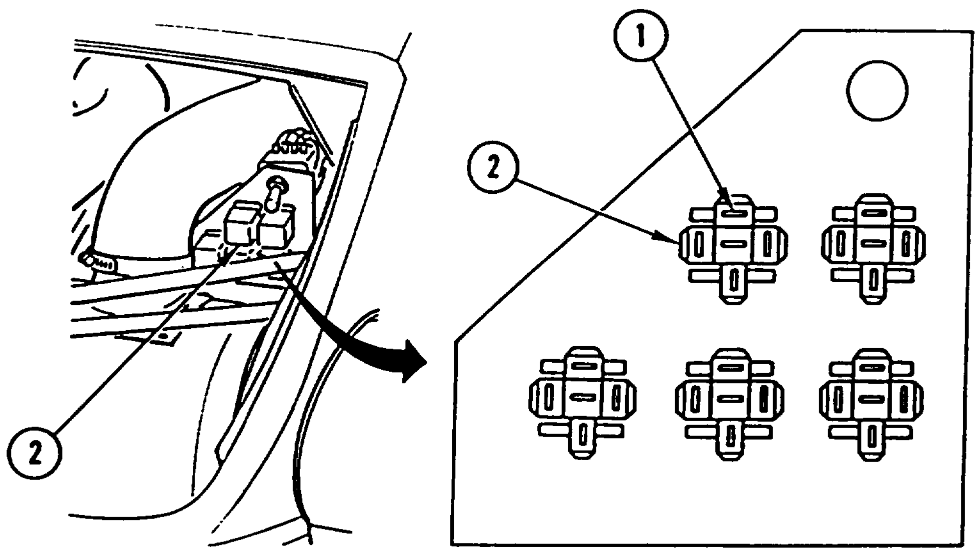


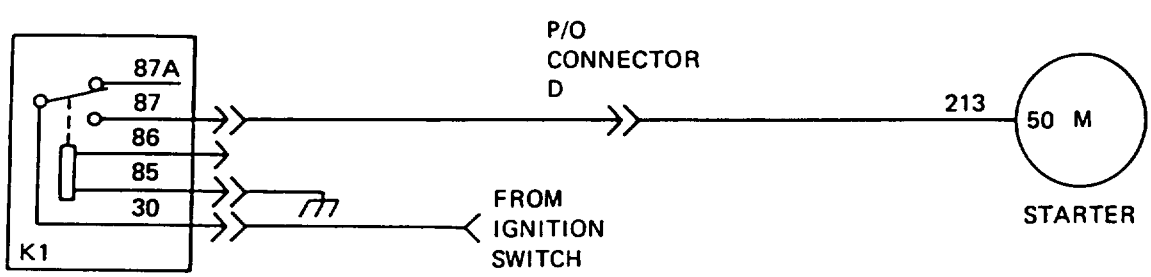
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Actlon

ENGINE (CONT)

2. STARTER CONTINUES TO RUN AFTER STARTER SWITCH RELEASED.





Check for +24 VDC between wire 213 (1) and ground at relay K1 (2).

- If +24 VDC is not present, replace starter solenoid (page 4-119).
- If +24 VDC is present, replace relay K1.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

3. ENGINE CRANKS SLOWLY.

Step 1. Check for loose and dirty battery connections.

- If battery connections are loose or dirty, tighten or clean connections.
- If battery connections are not loose or dirty, go to step 2.

NOTE

If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 2. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, notify direct support maintenance.

4. ENGINE CRANKS BUT WILL NOT START OR HARD TO START.

Step 1. Check if air cleaner restrictor indicator light is lit.

- If indicator light is lit, replace air cleaner element (page 4-35).
- If indicator light is not lit, go to step 2.

Step 2. Check for smoke from exhaust while cranking engine.

- If there is smoke while cranking engine, go to step 5.
- If there is no smoke while cranking engine, go to step 3.

WARNING

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

Step 3. Check for clogged fuel cap (vent).

- If fuel cap is clogged, clean vent or replace fuel cap (page 4-47).
- If fuel cap is not clogged, go to step 4.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

Step 4. Check for water/contamination in fuel tank.

- If there is water/contamination in fuel tank, drain fuel tank until only fuel drains out (page 4-40).
- If there is no water/contamination in fuel tank, go to step 5.

Step 5. Check for air leaks and damaged fuel lines.

- If there are air leaks or damaged fuel lines, tighten loose connections or replace fuel lines (pages 4-25, 4-44).
- If there are no air leaks or damaged fuel lines, go to step 6.

NOTE

If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 6. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Aiphabeticailindex (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, notify direct support maintenance.

5. ENGINE RUNS ROUGH OR LACKS POWER.

Step 1. Check If air cleaner restrictor indicator light is lit.

- If indicator light is lit, replace air cleaner element (page 4-35).
- If indicator light is not lit, go to step 2.

Step 2. Check for clogged exhaust system.

- If exhaust system is clogged, replace components as required (pages 4-80, 4-81, 4-85).
- If exhaust system is not clogged, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

WARNING
Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

Step 3. Check for clogged fuel cap (vent).

- If fuel cap is clogged, clean vent or replace fuel cap (page 4-47).
- If fuel cap is not clogged, go to step 4.

Step 4. Check for water/contamination in fuel tank.

- If there is water/contamination in fuel tank, drain fuel tank until only fuel drains out (page 4-40).
- If there is no water/contamination in fuel tank, go to step 5.

Step 5. Check for air leaks and damaged fuel lines.

- If there are air leaks or damaged fuel lines, tighten loose connections or replace fuel lines (pages 4-25, 4-44).
- If there are no air leaks or damaged fuel lines, go to step 6.

NOTE
If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 6. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, go to step 7.

Step 7. Check valve adjustment (page 4-5).

- If valves require adjustment, adjust valves to proper tolerances (page 4-5).
- If valves do not require adjustment, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

6. FUEL CONSUMPTION EXCESSIVE.

Step 1. Check if air cleaner restrictor indicator light is lit.

- If indicator light is lit, replace air cleaner element (page 4-35).
- If indicator light is not lit, go to step 2.

WARNING

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

Step 2. Check for loose and damaged fuel lines.

- If fuel lines are loose or damaged, lighten loose connections or replace fuel lines (pages 4-25, 4-44).
- If fuel lines are not loose or damaged, go to step 3.

Step 3. Check for clogged exhaust system.

- If exhaust system is clogged, replace components as required (pages 4-80, 4-81, 4-85).
- If exhaust system is not clogged, go to step 4.

NOTE

If STE/lCE-R Cl Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 4. Perform STE/ICE-R Cl Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, notify direct support maintenance.

7. DECELERATION SLOW OR UNEVEN.

Check accelerator linkage for proper adjustment and operation.

- If accelerator linkage is not adjusted or operating properly, adjust accelerator linkage (page 4-68).
- If accelerator linkage is adjusted and operating properly, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

8. IDLE SPEED ERRATIC.

WARNING

Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

Step 1. Check for air leaks and damaged fuel lines.

- If there are air leaks or damaged fuel lines, tighten loose connections or replace fuel lines (pages 4-25, 4-44).
- If there are no air leaks or damaged fuel lines, go to step 2.

NOTE

If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.

Step 2. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, notify direct support maintenance.

9. ENGINE KNOCKS WHEN COLD.

Step 1. Check for low engine oil level.

- If engine oil level is low, add oil (TM 5-2420-224-10).
- If engine oil level is not low, go to step 2.

Step 2. Check for stuck fuel injector nozzles by fully depressing accelerator several times to release needles.

- If problem continues, notify direct support maintenance.

10. OIL PRESSURE GAGE READS LOW OR NO OIL PRESSURE.

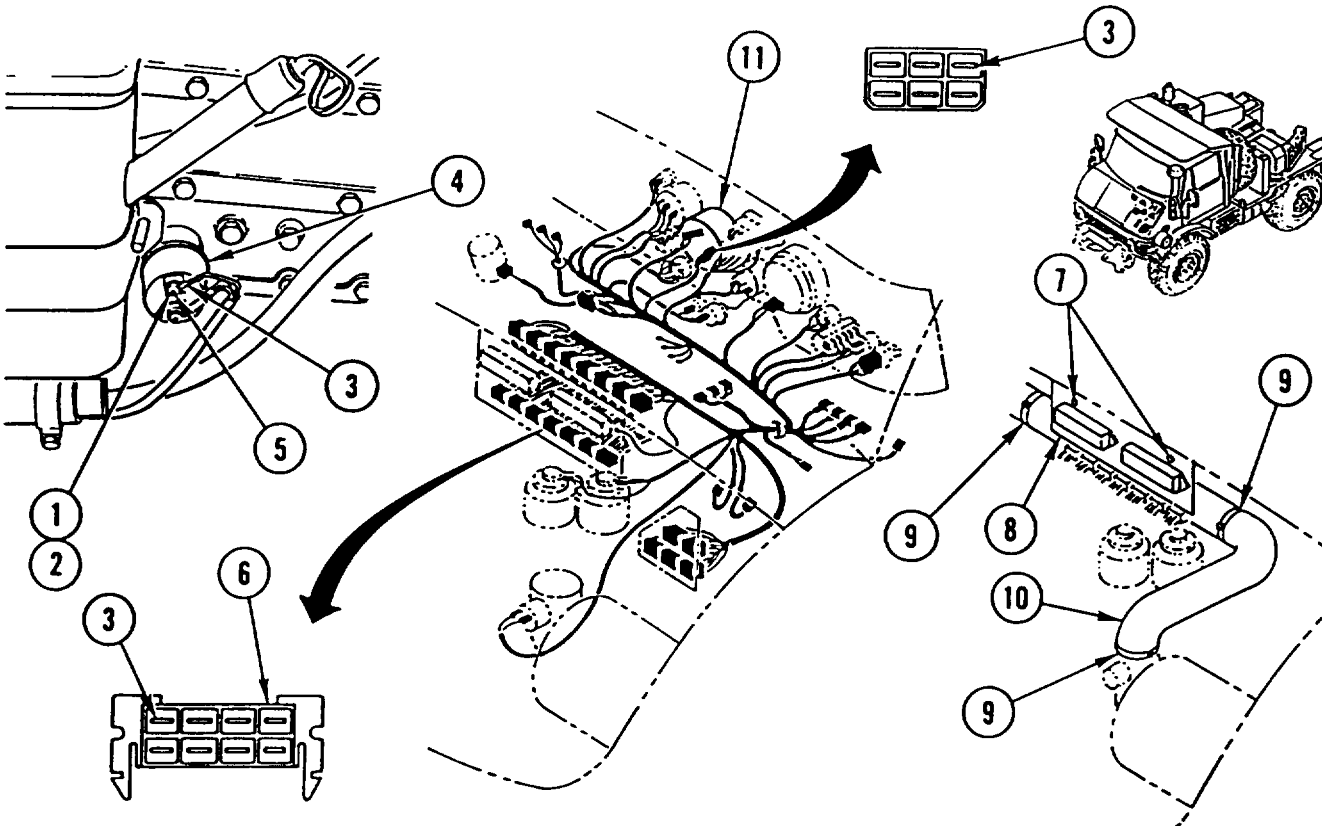
Step 1. Check for low engine oil level.

- If engine oil level is low, add oil (TM 5-2420-224-10).
- If engine oil level is not low, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)



Step 2. Remove nut (1) and lock washer (2) and disconnect wire 31P (3) from oil pressure sender (4). Check for resistance between terminal (5) and casing of oil pressure sender.

- If resistance is not present, replace oil pressure sender (page 4-202).
- If resistance is present, go to step 3.

Step 3. With wire 31P (3) disconnected from oil pressure sender (4), check for +24 VDC between wire 31P and ground at oil pressure sender.

- If +24 VDC is present, notify direct support maintenance.
- If +24 VDC is not present, go to step 4.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

Step 4. With wire 31P (3) disconnected from oil pressure sender, check for +24 VDC between wire 31P and ground at connector D (6).

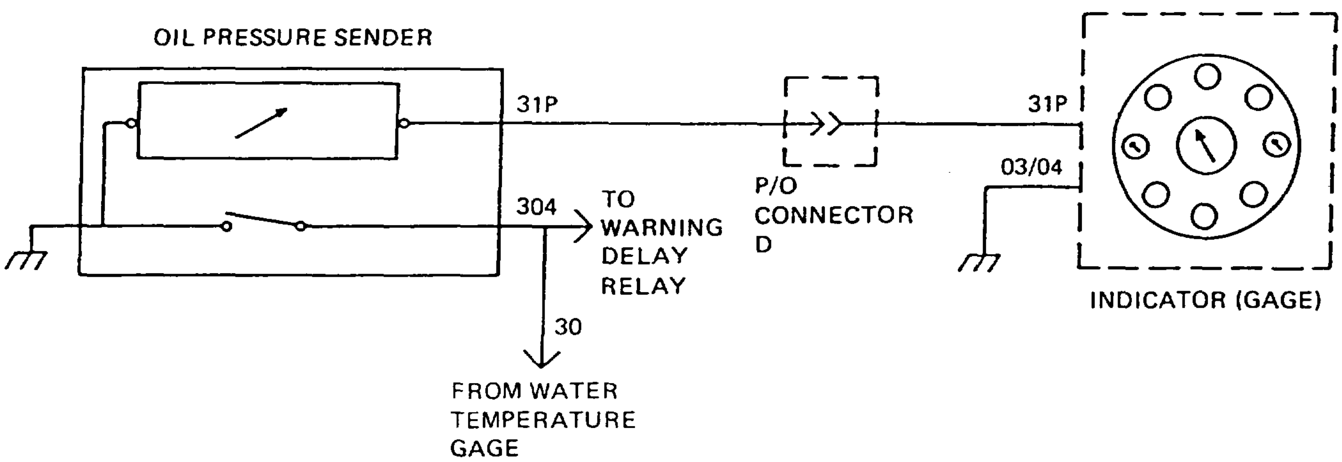
- If +24 VDC is present, repair wiring 31P between connector D and oil pressure sender.
- If +24 VDC is not present, go to step 5.

Step 5. Loosen two captive screws (7) and pull bracket (8) out enough to gain access to area behind bracket.

Step 6. Remove two clamps (9) and pipe assembly (10).

Step 7. With wire 31P (3) disconnected from oil pressure sender, check for +24 VDC between wire 31P and ground at indicator (gage) (11).

- If +24 VDC is not present, reconnect wire 31P at oil pressure sender and replace oil pressure gage (page 4-124).
- If +24 VDC is present, reconnect wire 31P at oil pressure sender and repair wiring 31P between indicator (gage) and connector D.



11. ENGINE USES TOO MUCH OIL.

Step 1. Check for loose and damaged oil hose.

- If oil hose is loose or damaged, tighten loose connections or replace oil hose (page 4-9).
- If oil hose is not loose or damaged, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ENGINE (CONT)

Step 2. Check for blue exhaust smoke.

- If there is blue exhaust smoke, replace valve cover gasket (page 4-3). If condition continues, notify direct support maintenance.
- If there is no blue exhaust smoke, notify direct support maintenance.

AIR INTAKE SYSTEM

12. AIR CLEANER RESTRICTOR INDICATOR LIGHT LIGHTS.

Step 1. Check for dirty air cleaner filters.

- If air cleaner filters are dirty, replace filters (page 4-35).
- If air cleaner filters are not dirty, go to step 2.

Step 2. Check for dirty and clogged vertical intake screen.

- If vertical intake screen is not dirty or clogged, replace air cleaner restrictor indicator switch (page 4-205).
- If vertical intake screen is dirty or clogged, clean screen.

EXHAUST SYSTEM

13. EXHAUST FUMES ENTER CAB.

Check for loose, damaged, and missing components in exhaust system.

- If components are loose, damaged, or missing, tighten loose connections or replace components (pages 4-80, 4-81, 4-85).
- If components are not loose, damaged, or missing, notify direct support maintenance.

14. EXHAUST NOISE EXCESSIVE.

Check for loose, damaged, and missing components in exhaust system.

- If components are loose, damaged, or missing, tighten loose connections or replace components (pages 4-80, 4-81, 4-85).
- If components are not loose, damaged, or missing, replace muffler (4-80).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

COOLING SYSTEM

15. LOSS OF ENGINE COOLANT.

Perform cooling system test (page 4-89).

16. ENGINE OVERHEATS.

Step 1. Check for low coolant level in radiator expansion tank.

- If coolant level in radiator expansion tank is low, add coolant as required (TM 5-2420-224-10).
- If coolant level in radiator expansion tank is not low, go to step 2.

Step 2. Check for leaking and damaged coolant hoses.

- If coolant hoses are leaking or damaged, tighten loose connections or replace coolant hoses (page 4-98).
- If coolant hoses are not leaking or damaged, go to step 3.

Step 3. Check for loose, worn, and missing fan belt.

- If fan belt is loose, worn, or missing, adjust or replace fan belt (page 4-106).
- If fan belt is not loose, worn, or missing, go to step 4.

Step 4. Check for clogged radiator cooling core by draining coolant from radiator.

- If coolant drains properly, replace coolant thermostat (page 4-100).
- If coolant does not drain properly, replace radiator (page 4-92).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM

WARNING

When replacing fuses, make sure only fuses of correct amperage are installed. Failure to do so could result in injury to personnel or damage to equipment.

NOTE

- Before starting troubleshooting, check for bad wire connections, blown fuses, and proper switch settings.
- During troubleshooting of circuits containing lamps, fuses, or relays, first check problem by replacing lamp, fuse, or relay with known good lamp, fuse, or relay. This may save time and effort.
- During troubleshooting, check all wiring In a circuit for damage (e.g., cuts, wear, bubbling, burning, etc.).
- Before performing voltage checks, make sure equipment is properly set up (e.g., to check for voltage at turn signal, make sure vehicle MASTER disconnect switch and ignition switch are ON and turn signal lever is switched to L or R position).

17. NO ELECTRICAL POWER.

NOTE

Refer to wiring diagram (page 3-90) for all wiring repair steps.

Step 1. Check batteries (TM 5-2420-220-10).

- If batteries are bad, charge (TM 5-2420-224-10) or replace (page 4-219) batteries.
- If batteries are good, go to step 2.

Step 2. Check for +24 VDC between positive battery terminal (1) and negative battery terminal (2) on batteries (3).

- If +24 VDC is not present, repair interbattery connect cable (4).
- If +24 VDC is present, go to step 3.

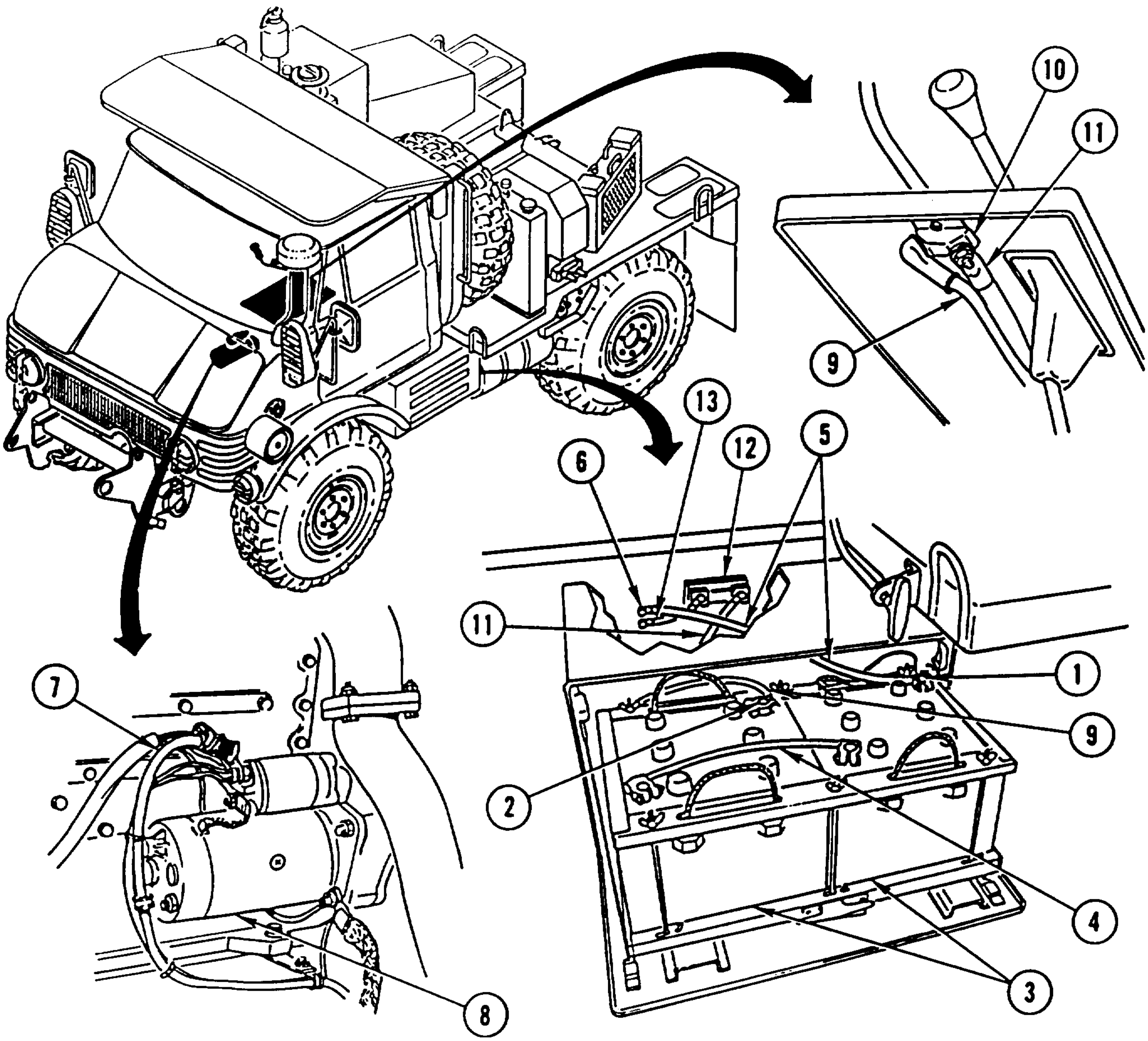
Step 3. Check for +24 VDC between positive battery cable (5) at frame positive stud (6) and ground at negative battery terminal (2).

- If +24 VDC is not present, repair positive battery cable.
- If +24 VDC is present, go to step 4.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 4. Check for +24 VDC between positive starter cable (7) at starter (8) and ground at negative battery terminal (2).

- If +24 VDC is not present, repair positive starter cable.
- If +24 VDC is present, go to step 5.

Step 5. Tilt cab (page 4-418).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 6. Check for continuity of negative battery cable (9) between negative battery terminal (1) and vehicle MASTER disconnect switch (10).

- If there is no continuity, repair negative battery cable.
- If there is continuity, go to step 7.

Step 7. With vehicle MASTER disconnect switch (10) ON, check for continuity across vehicle MASTER disconnect switch.

- If there is no continuity, replace vehicle MAIN (MASTER) disconnect switch (page 4-171).
- If there is continuity, go to step 8.

Step 8. With vehicle MASTER disconnect switch (10) OFF, check for continuity of ground cable (11) between vehicle MASTER disconnect switch and STE/ICE-R shunt (12).

- If there is no continuity, repair ground cable.
- If there is continuity, go to step 9.

Step 9. With vehicle MASTER disconnect switch (10) OFF, check for continuity across STE/ICE-R shunt (12).

- If there is no continuity, replace STE/ICE-R shunt (page 4-213).
- If there is continuity, repair ground cable (13).

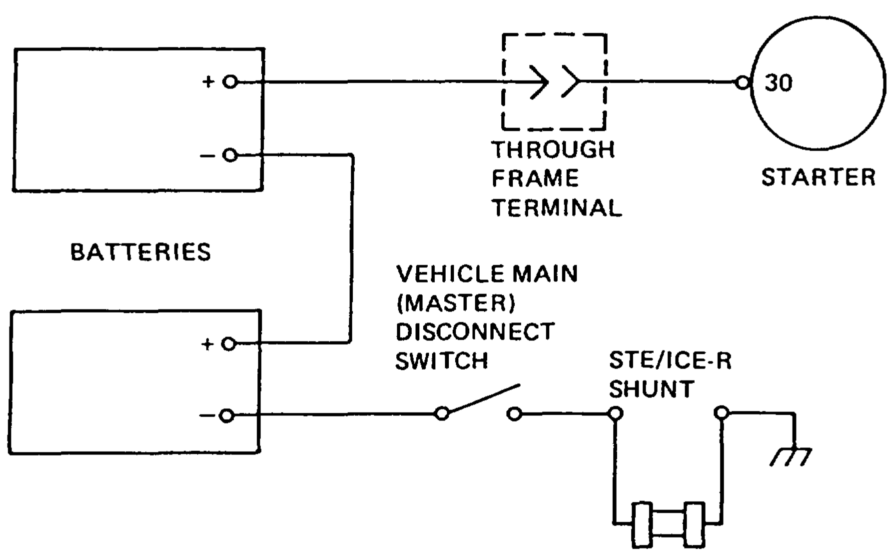


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

18. RIGHT FRONT AUXILIARY HEADLIGHT LOW BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to LO, and auxiliary light control switch in up position. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-93) for all wiring repair steps.

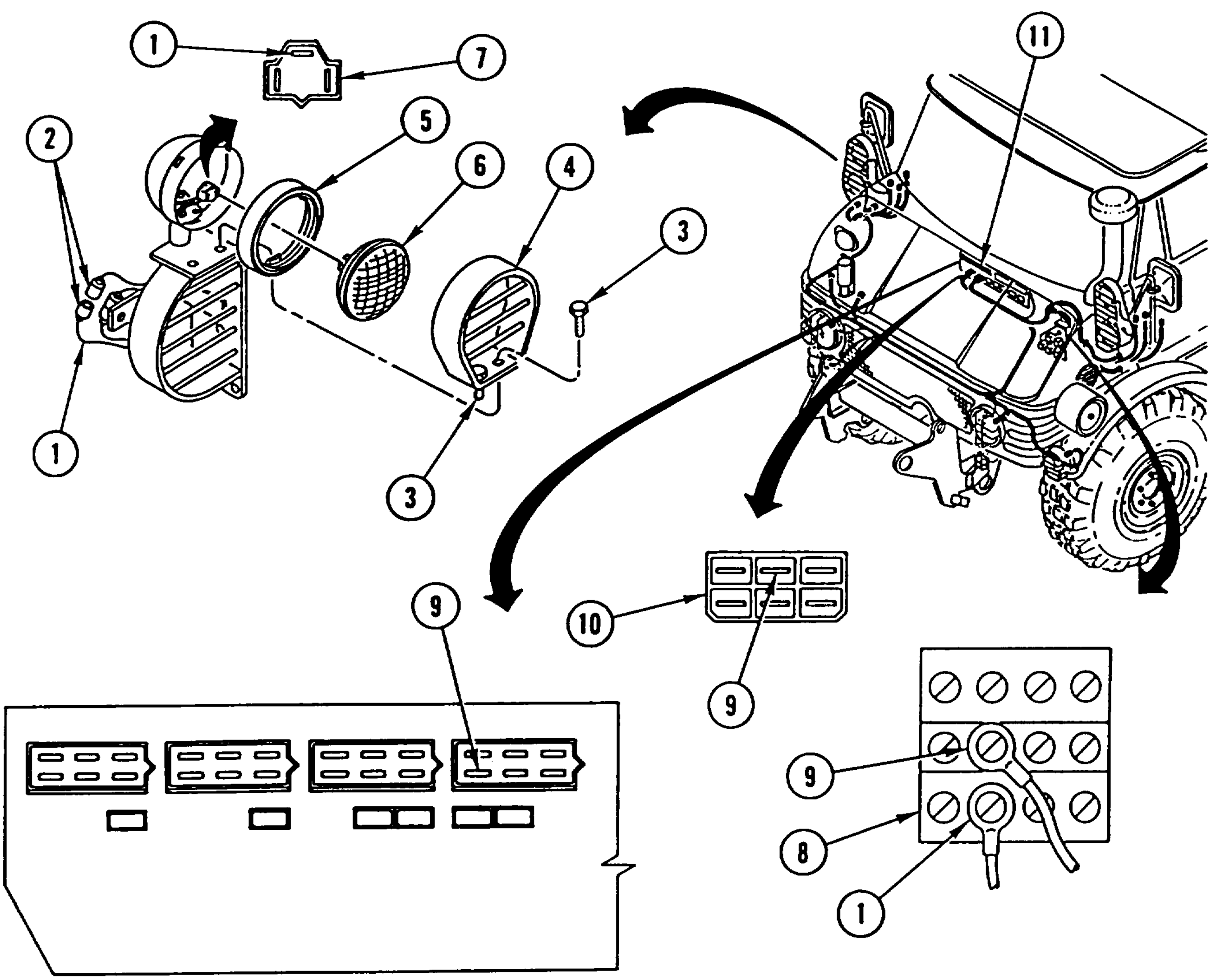


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 1. Check for +24 VDC between wire 42LR (1) and ground at auxiliary headlight connector (2).

- If +24 VDC is not present, go to step 4.
- If +24 VDC is present, go to step 2.

Step 2. Remove two bolts (3), lamp guard (4), mount (5), and lamp (6).

Step 3. Check for +24 VDC between wire 42LR (1) and ground at socket (7).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, repair wiring 42LR between socket and auxiliary headlight connector.

Step 4. Check for +24 VDC between wire 42LR (1) and ground at auxiliary light control switch (8).

- If +24 VDC is present, repair wiring 42LR between auxiliary headlight connector and auxiliary light control switch.
- If +24 VDC is not present, go to step 5.

Step 5. Check for +24 VDC between wire 41LR (9) and ground at auxiliary light control switch (8).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 6.

Step 6. Disconnect connector G (10) and check for +24 VDC between wire 41LR (9) and ground.

- If +24 VDC is present, repair wiring 41LR between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 7.

Step 7. Check for +24 VDC between wire 41LR (9) and ground at fuse box 2 (11).

- If +24 VDC is present, repair wiring 41LR between fuse box 2. and connector G.
- If +24 VDC is not present, repair wiring 41LR at fuse box 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

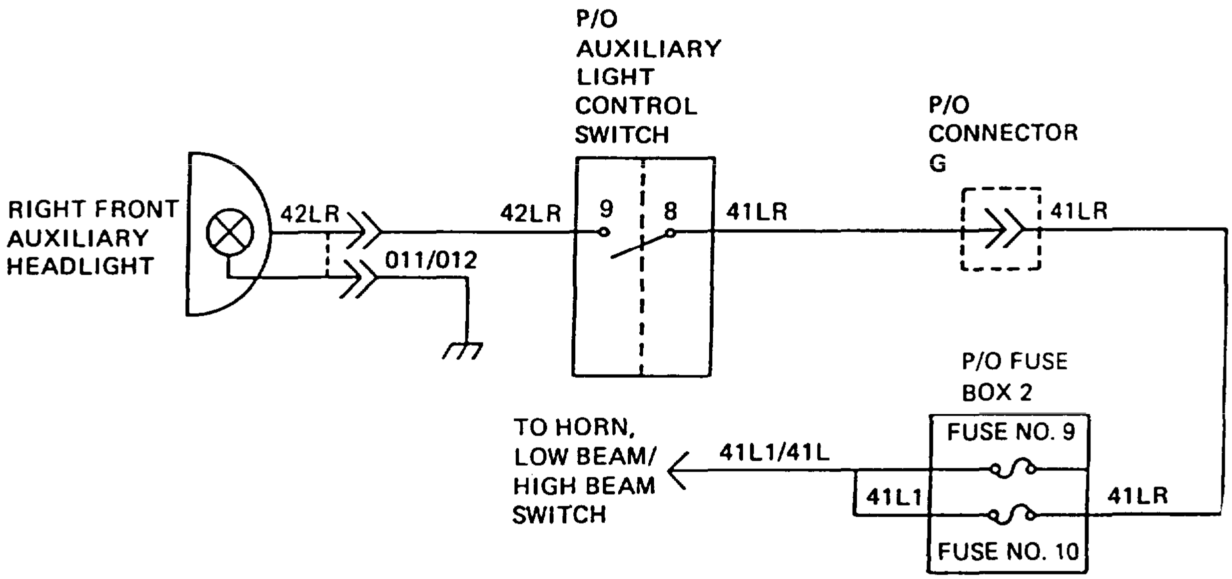


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

19. RIGHT FRONT AUXILIARY HEADLIGHT HIGH BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to HI, and auxiliary light control switch in up position. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 42HR (1) and ground at auxiliary headlight connector (2).

- If +24 VDC is not present, go to step 4.
- If +24 VDC is present, go to step 2.

Step 2. Remove two bolts (3), lamp guard (4), mount (5), and lamp (6).

Step 3. Check for +24 VDC between wire 42HR (1) and ground at socket (7).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, repair wiring 42HR between socket and auxiliary headlight connector.

Step 4. Check for +24 VDC between wire 42HR (1) and ground at auxiliary light control switch (8).

- If +24 VDC is present, repair wiring 42HR between auxiliary headlight connector and auxiliary light control switch.
- If +24 VDC is not present, go to step 5.

Step 5. Check for +24 VDC between wire 41HR (9) and ground at auxiliary light control switch (8).

- If +24 VDC is present, replace auxiliary light control switch (page 4-1 46).
- If +24 VDC is not present, go to step 6.

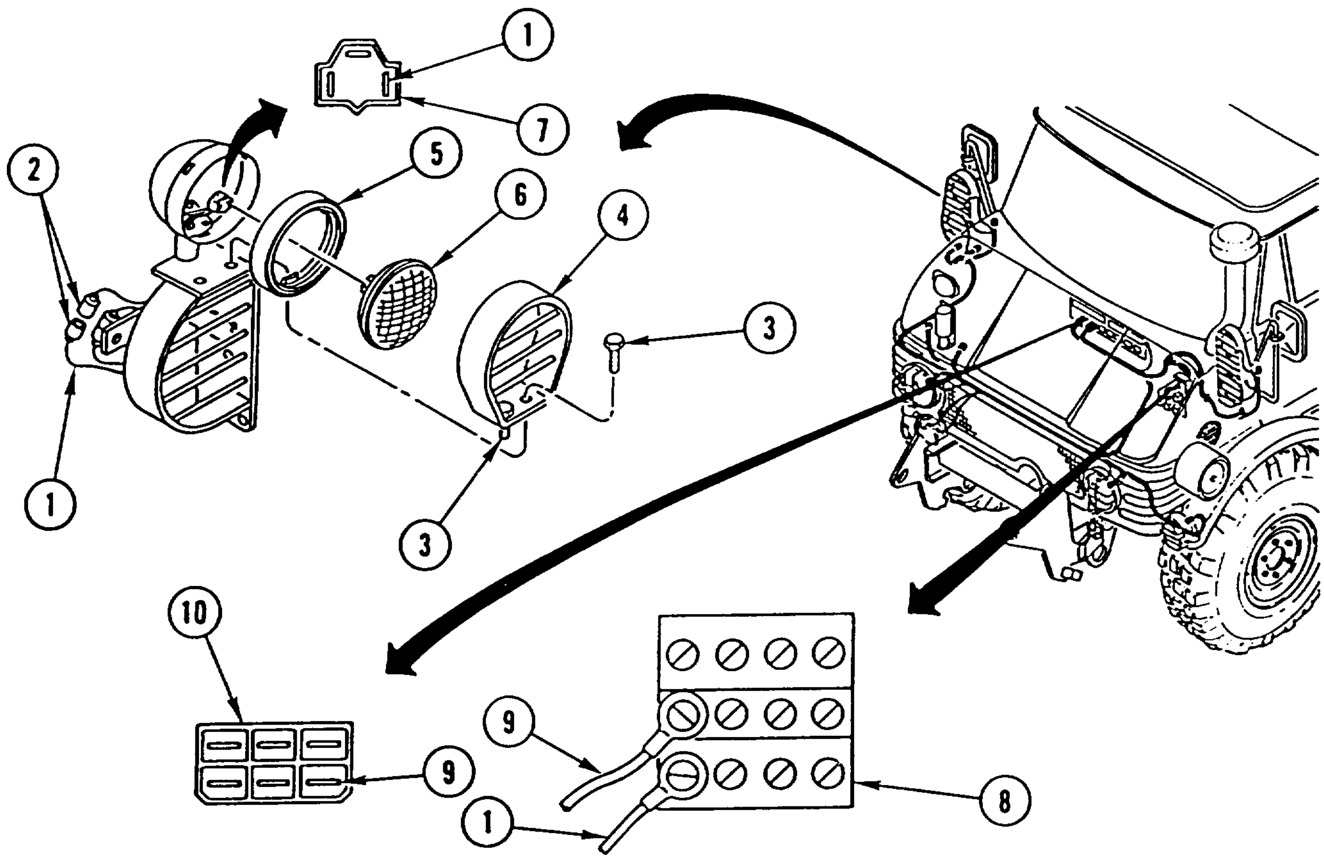
Step 6. Disconnect connector G (10) and check for +24 VDC between wire 41HR (9) and ground.

- If +24 VDC is present, repair wiring 41HR between connector G and auxiliary light control switch.
- If +24 VDC is not present, repair wiring 41HR between fuse box 2 and connector G.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



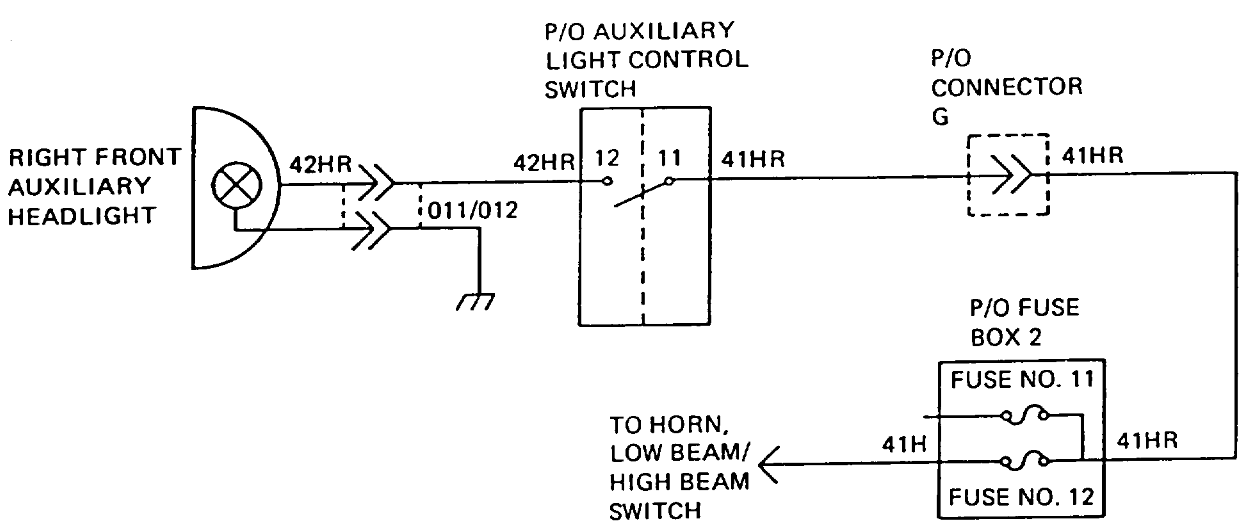


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

20. RIGHT FRONT HEADLIGHT LOW BEAM WILL NOT LIGHT.

NOTE

Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to LO, and auxiliary light control switch in down position. Failure to do so will cause erroneous results.

Refer to wiring diagram (page 3-98) for all wiring repair steps.

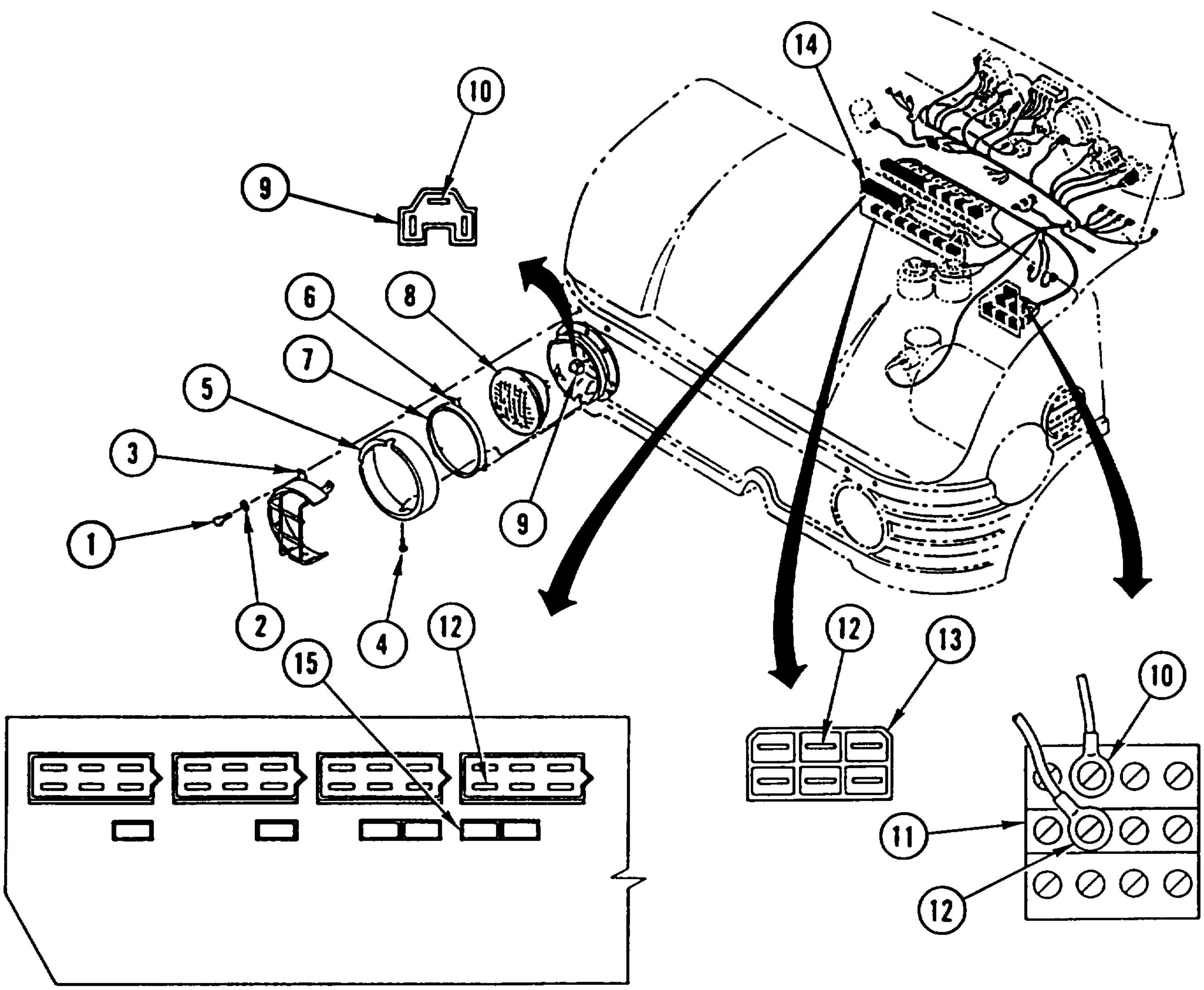


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 1. Remove three screws (1), three washers (2), and guard (3).

Step 2. Remove screw (4) and ring (5).

Step 3. Loosen three screws (6) and remove ring (7).

Step 4. Remove lamp (8) from socket (9).

Step 5. Check for +24 VDC between wire 41LR1 (10) and ground at socket (9).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, go to step 6.

Step 6. Check for +24 VDC between wire 41LR1 (10) and ground at auxiliary light control switch (11).

- If +24 VDC is present, repair wiring 41LR1 between auxiliary light control switch and socket.
- If +24 VDC is not present, go to step 7.

Step 7. Check for +24 VDC between wire 41LR (12) and ground at auxiliary light control switch (11).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 8.

Step 8. Disconnect connector G (13) and check for +24 VDC between wire 41LR (12) and ground.

- If +24 VDC is present, repair wiring 41LR between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 9.

Step 9. Check for +24 VDC between wire 41LR (12) and ground at fuse box 2 (14).

- If +24 VDC is present, repair wiring 41LR between fuse box 2 and connector G.
- If +24 VDC is not present, go to step 10.

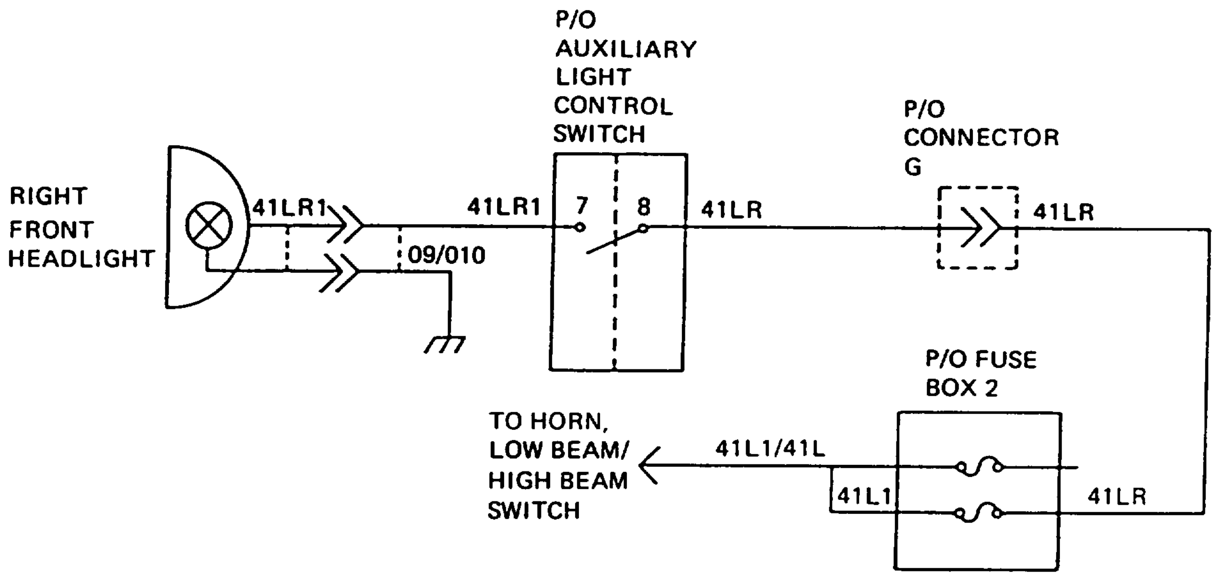
Step 10. Check for +24 VDC between wire 41L1 (15) and ground at fuse box 2 (14).

- If +24 VDC is present, replace fuse.
- If +24 VDC is not present, repair wiring 41L1.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



21. RIGHT FRONT HEADLIGHT HIGH BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to HI, and auxiliary light control switch in down position. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-100) for all wiring repair steps.

Step 1. Remove three screws (1), three washers (2), and guard (3).

Step 2. Remove screw (4) and ring (5).

Step 3. Loosen three screws (6) and remove ring (7).

Step 4. Remove lamp (8) from socket (9).

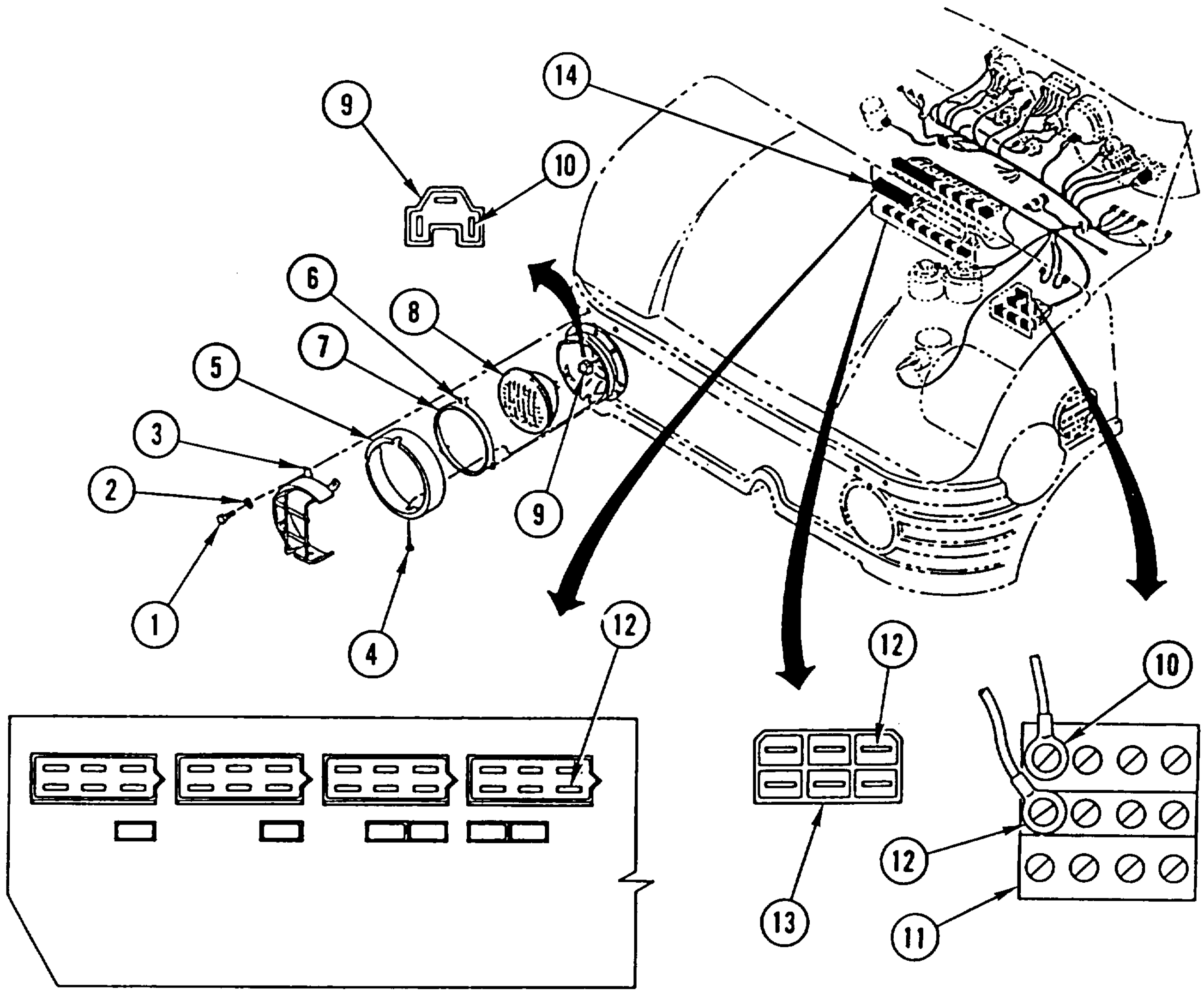
Step 5. Check for +24 VDC between wire 41HR1 (10) and ground at socket (9).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, go to step 6.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 6. Check for +24 VDC between wire 41HR1 (10) and ground at auxiliary light control switch (11).

- If +24 VDC is present, repair wiring 41HR1.
- If +24 VDC is not present, go to step 7.

Step 7. Check for +24 VDC between wire 41HR (12) and ground at auxiliary light control switch (11).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 8.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 8. Disconnect connector G (13) and check for +24 VDC between wire 41HR (12) and ground.

- If +24 VDC is present, repair wiring 41HR between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 9.

Step 9. Check for +24 VDC between wire 41HR (12) and ground at fuse box 2 (14).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41HR between fuse box 2 and connector G.

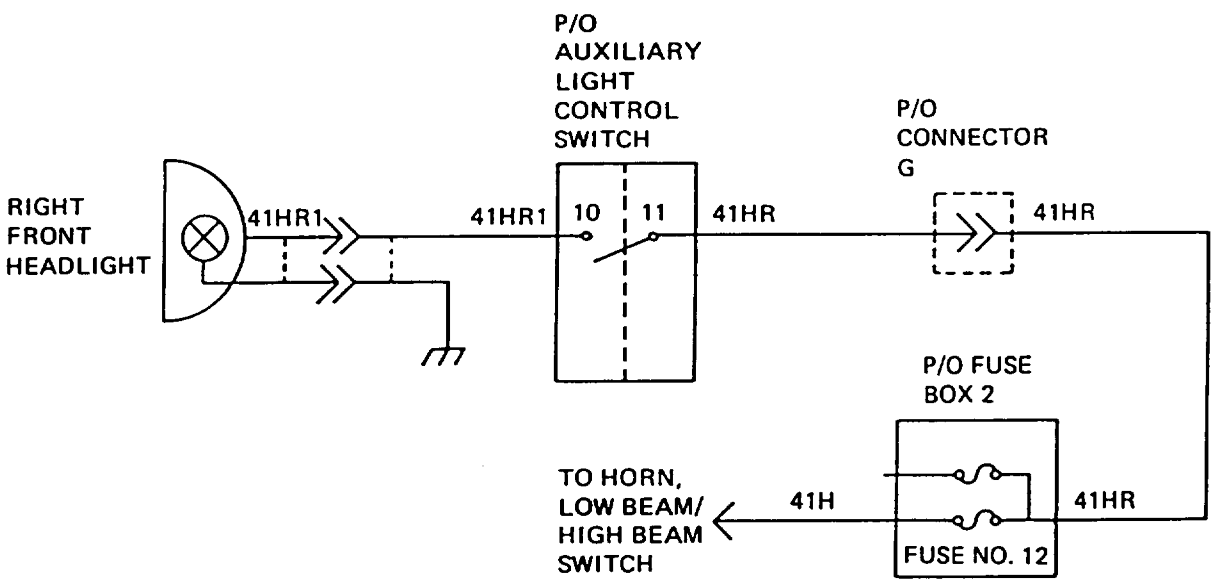


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

22. LEFT FRONT AUXILIARY HEADLIGHT LOW BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to LO, and auxiliary light control switch in up position. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-103) for all wiring repair steps.

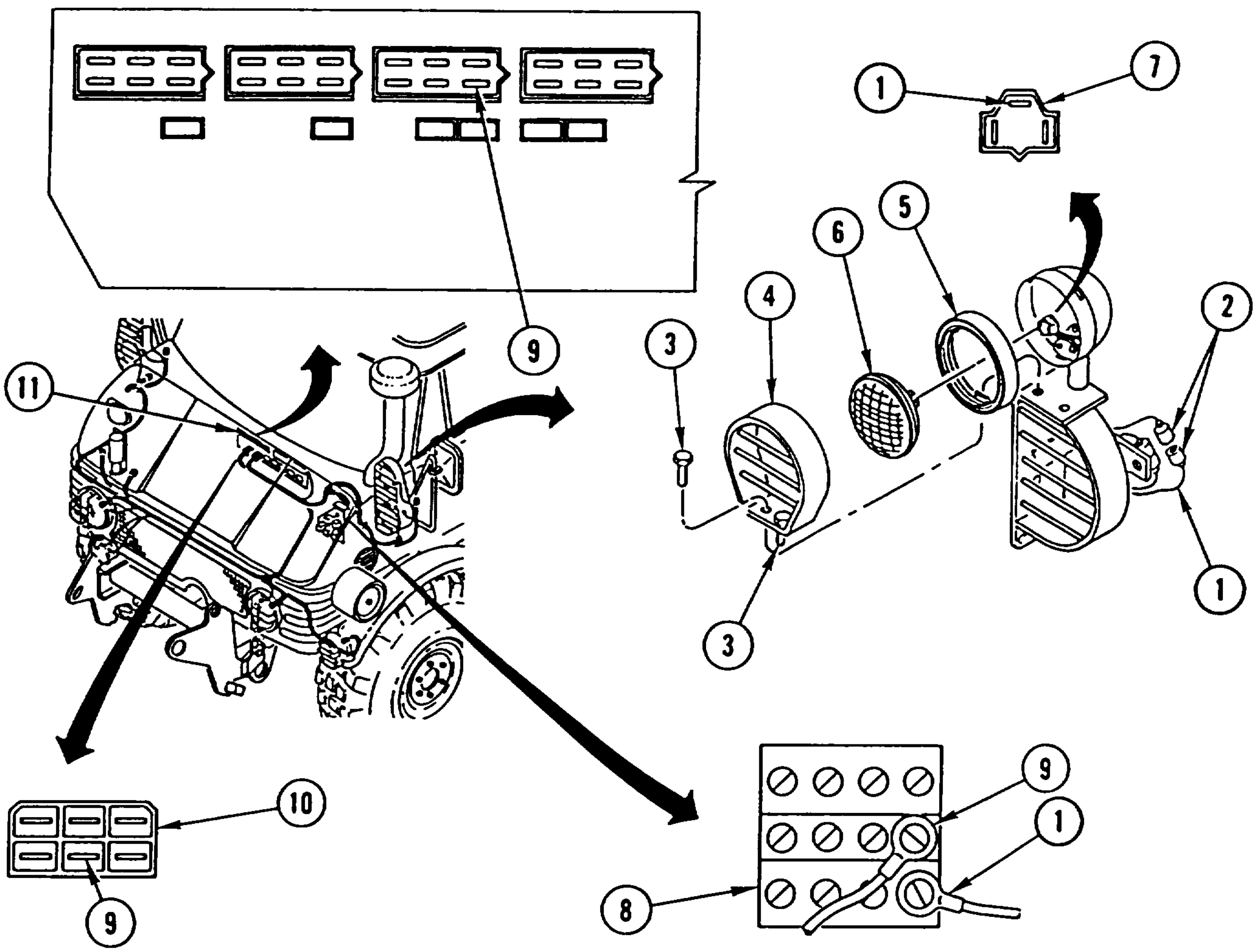


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 1. Check for +24 VDC between wire 42LL (1) and ground at auxiliary headlight connector (2).

- If +24 VDC is not present, go to step 4.
- If +24 VDC is present, go to step 2.

Step 2. Remove two bolts (3), lamp guard (4), mount (5), and lamp (6).

Step 3. Check for +24 VDC between wire 42LL (1) and ground at socket (7).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, repair wiring 42LL between socket and auxiliary headlight connector.

Step 4. Check for +24 VDC between wire 42LL (1) and ground at auxiliary light control switch (8).

If +24 VDC is present, repair wiring 42LL between auxiliary light control switch and auxiliary headlight connector.

If +24 VDC is not present, go to step 5.

Step 5. Check for +24 VDC between wire 41LL (9) and ground at auxiliary light control switch (8).

- If +24 VDC is present, replace auxliiary light control switch (page 4-146).
- If +24 VDC is not present, go to step 6.

Step 6. Disconnect connector G (10) and check for +24 VDC between wire 41LL (9) and ground.

- If +24 VDC is present, repair wiring 41LL between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 7.

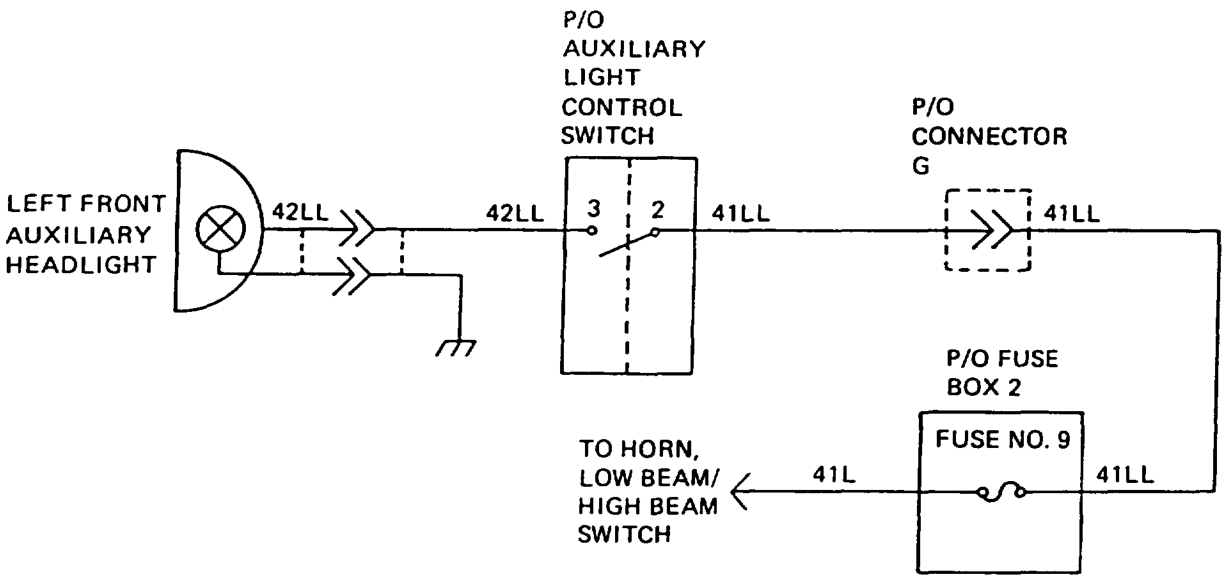
Step 7. Check for +24 VDC between wire 41LL (9) and ground at fuse box 2 (11).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41LL between fuse box 2 and connector G.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



23. LEFT FRONT AUXILIARY HEADLIGHT HIGH BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to HI, and auxiliary light control switch in up position. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-105) for all wiring repair steps.

Step 1. Check for +24 VDC between wire 42HL (1) and ground at auxiliary headlight connector (2).

- If +24 VDC is not present, go to step 4.
- If +24 VDC is present, go to step 2.

Step 2. Remove two bolts (3), lamp guard (4), mount (5), and lamp (6).

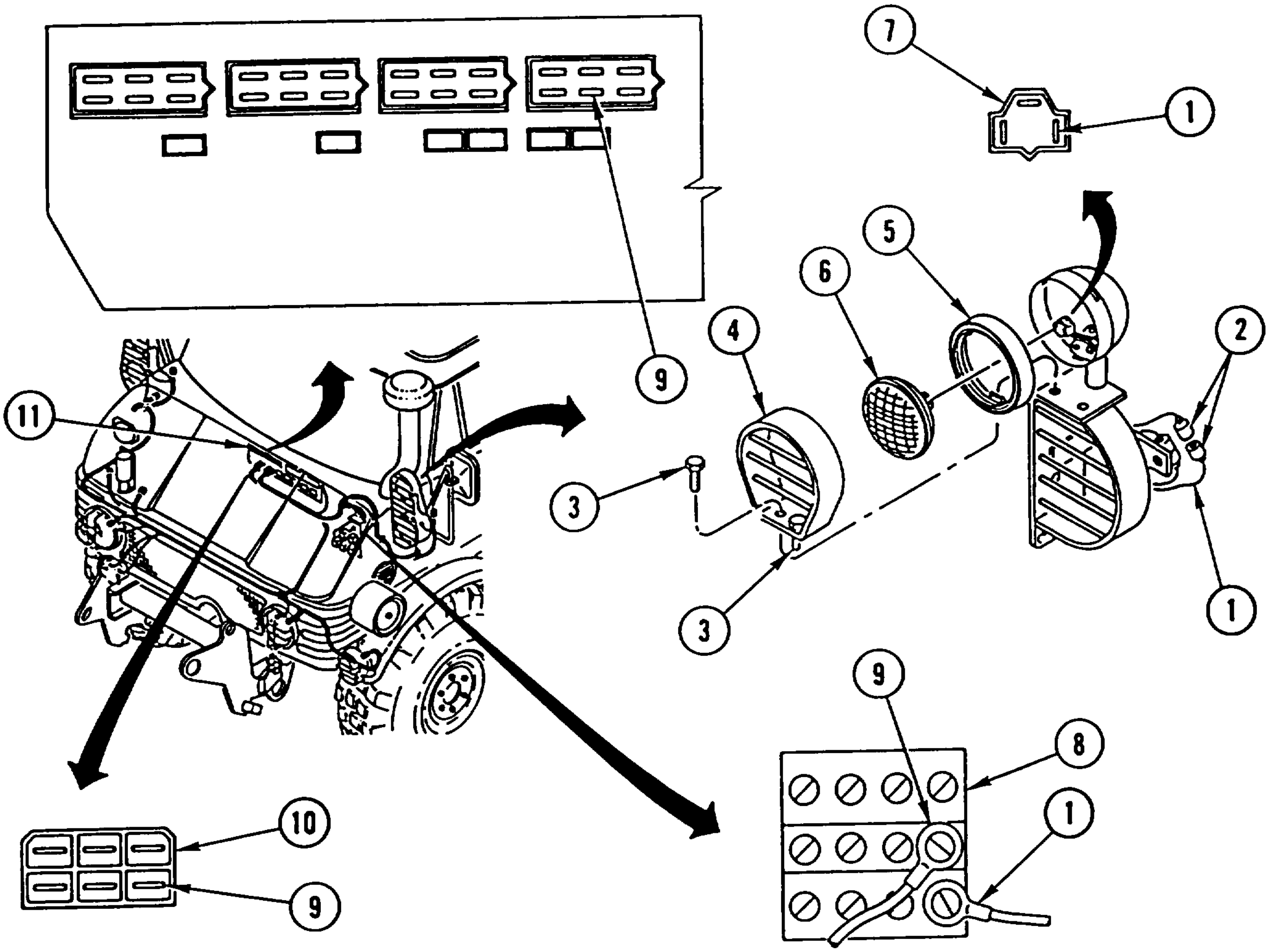
Step 3. Check for +24 VDC between wire 42HL (1) and ground at socket (7).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, repair wiring 42HL between socket and auxiliary headlight connector.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 4. Check for +24 VDC between wire 42HL (1) and ground at auxiliary light control switch (8).

- If +24 VDC is present, repair wiring 42HL betweem auxiliary headlight connector and auxiliary light control switch.
- If +24 VDC is not present, go to step 5.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 5. Check for +24 VDC between wire 41HL (9) and ground at auxiliary tight control switch (8).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 6.

Step 6. Disconnect connector G (10) and check for +24 VDC between wire 41HL (9) and ground.

- If +24 VDC is present, repair wiring 41HL between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 7.

Step 7. Check for +24 VDC between wire 41HL (9) and ground at fuse box 2 (11).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41HL between fuse box 2 and connector G.

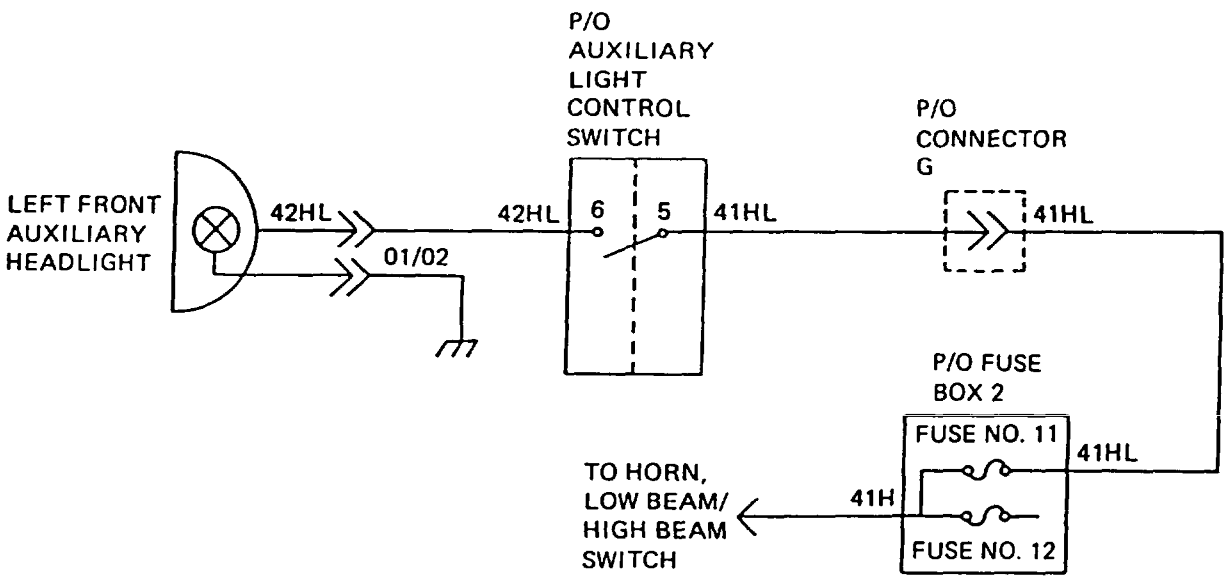


Table 3-5. Troubleshooting (Cont)

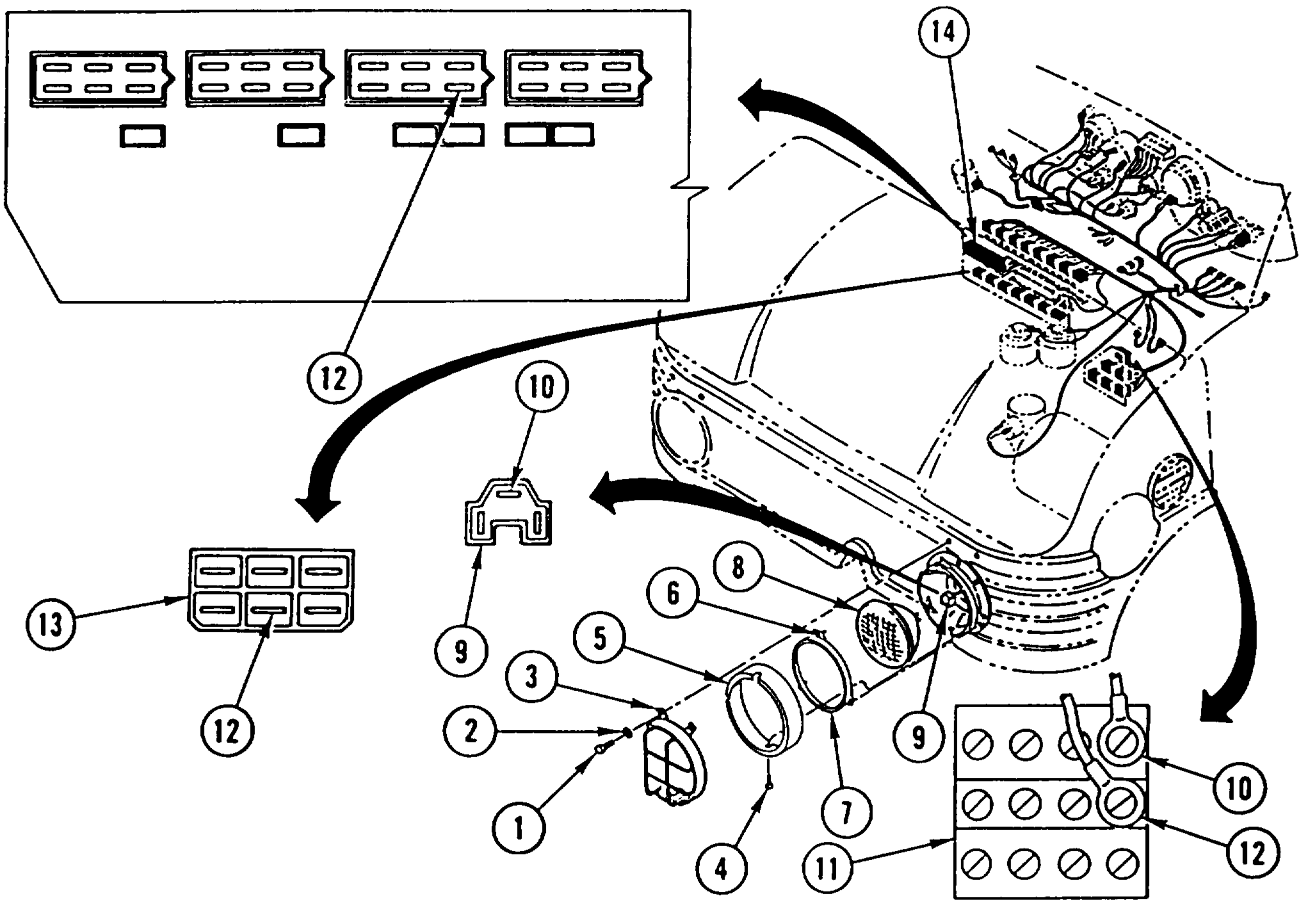
Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

24. LEFT FRONT HEADLIGHT LOW BEAM WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, horn, low beam/high beam switch set to LO, and auxiliary light control switch in down position. Faliure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.



Step 1. Remove three screws (1), three washers (2), and guard (3).

Step 2. Remove screw (4) and ring (5).

Step 3. Loosen three screws (6) and remove ring (7).

Step 4. Remove lamp (8) from socket (9).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 5. Check for +24 VDC between wire 41LL1 (10) and ground at socket (9).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, go to step 6.

Step 6. Check for +24 VDC between wire 41LL1 (10) and ground at auxiliary light control switch (11).

- If +24 VDC is present, repair wiring 41LL1.
- If +24 VDC is not present, go to step 7.

Step 7. Check for +24 VDC between wire 41LL (12) and ground at auxiliary light control switch (11).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 8.

Step 8. Disconnect connector G (13) and check for +24 VDC between wire 41LL (12) and ground.

- If +24 VDC is present, repair wiring 41LL between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 9.

Step 9. Check for +24 VDC between wire 41LL (12) and ground at fuse box 2 (14).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41LL between fuse box 2 and connector G.

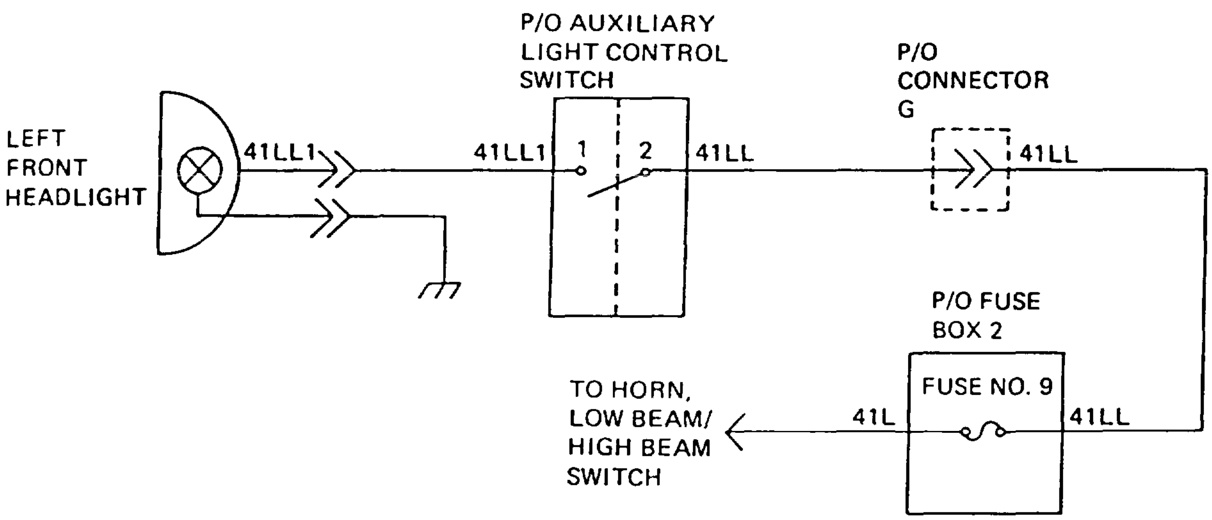


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

25. LEFT FRONT HEADLIGHT HIGH BEAM WILL NOT LIGHT.

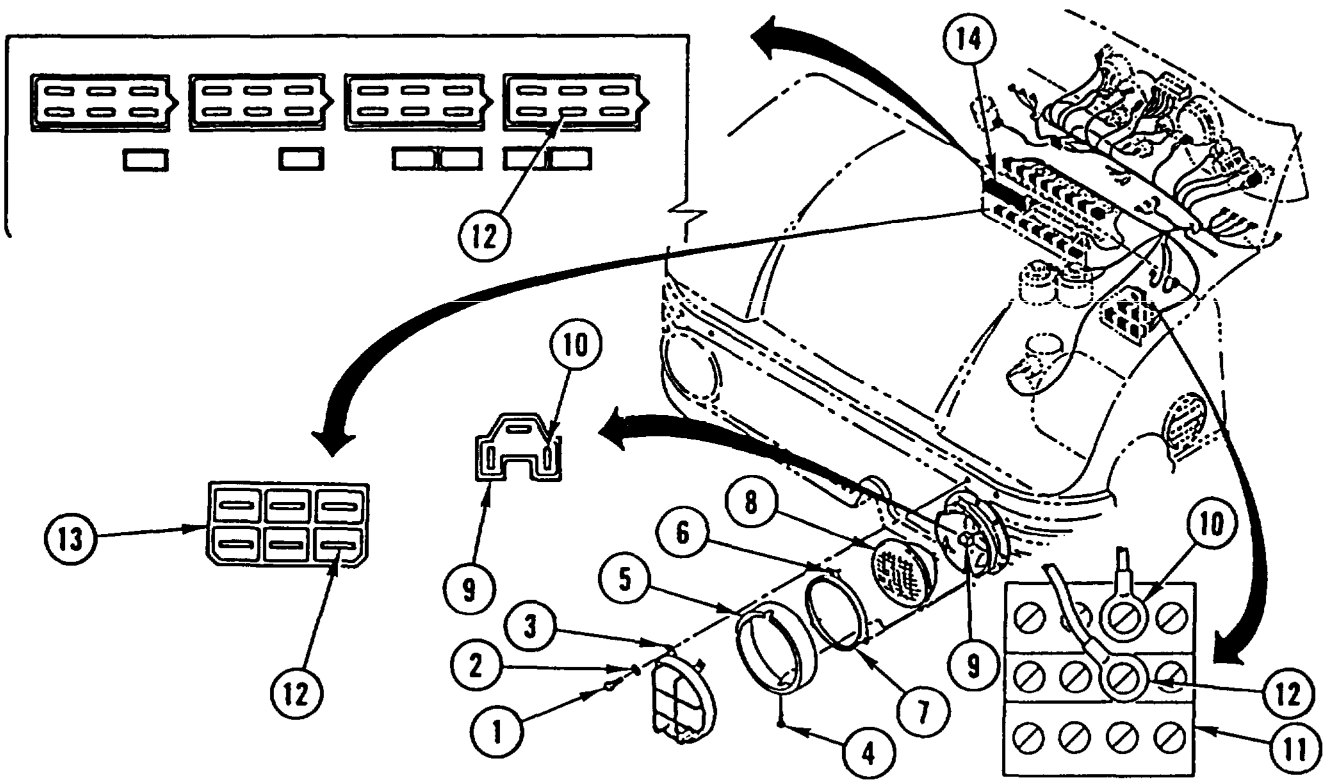
NOTE

- Vehicle MASTER disconnect switch must be ON. master light switch set to SER DRIVE, horn, low beam/high beam switch set to HI, and auxiliary light control switch in down position. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Remove three screws (1), three washers (2), and guard (3).

Step 2. Remove screw (4) and ring (5).

Step 3. Loosen three screws (6) and remove ring (7).



Step 4. Remove lamp (8) from socket (9).

Step 5. Check for +24 VDC between wire 41HL1 (10) and ground at socket (9).

- If +24 VDC is present, replace lamp.
- If +24 VDC is not present, go to step 6.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 6. Check for +24 VDC between wire 41HL1 (10) and ground at auxiliary light control switch (11).

- If +24 VDC is present, repair wiring 41HL1.
- If +24 VDC is not present, go to step 7.

Step 7. Check for +24 VDC between wire 41HL (12) and ground at auxiliary light control switch (11).

- If +24 VDC is present, replace auxiliary light control switch (page 4-146).
- If +24 VDC is not present, go to step 8.

Step 8. Disconnect connector G (13) and check for +24 VDC between wire 41HL (12) and ground.

- If +24 VDC is present, repair wiring 41HL between connector G and auxiliary light control switch.
- If +24 VDC is not present, reconnect connector G and go to step 9.

Step 9. Check for +24 VDC between wire 41HL (12) and ground at fuse box 2 (14).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41HL between fuse box 2 and connector G.

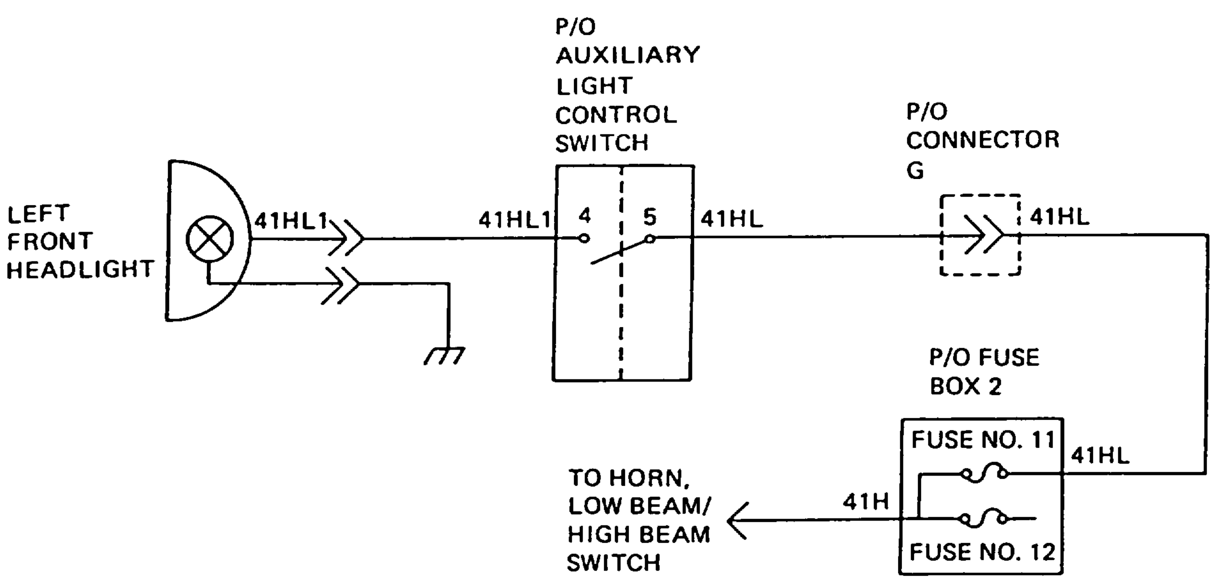


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRiIAL SYSTEM (CONT)

26. RIGHT FRONT TURN SIGNAL WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and turn signal lever switched to R position. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 45FR (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-183).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector G (4) and check for +24 VDC between wire 45FR (1) and ground.

- If +24 VDC is present, repair wiring 45FR between connector G and lamp.
- If +24 VDC is not present, reconnect connector G and go to step 3.

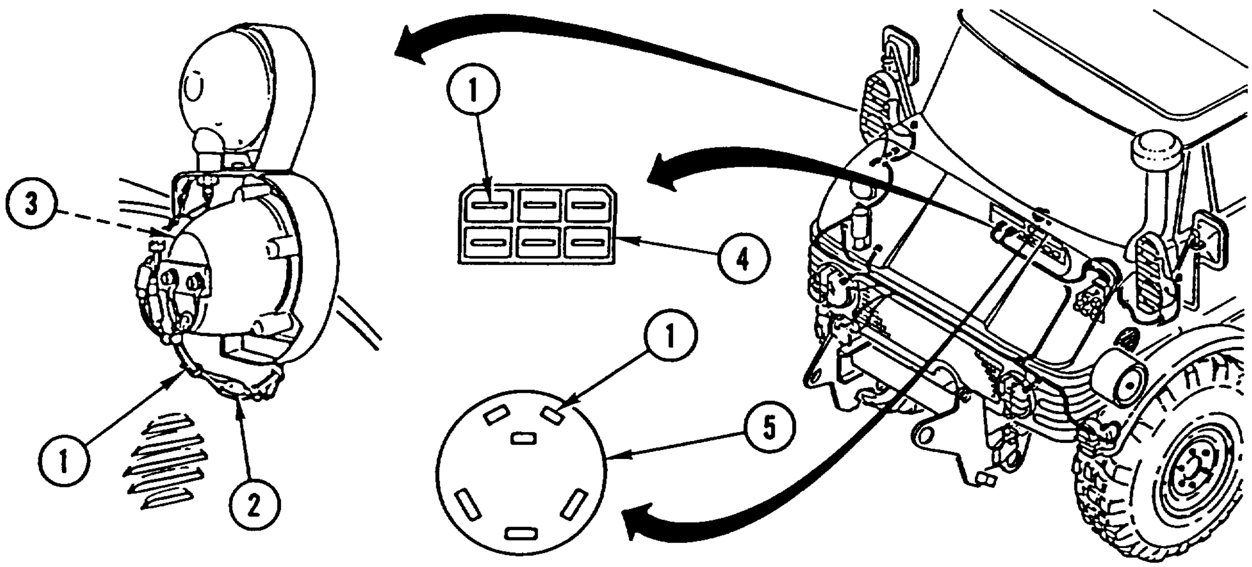
Step 3. Check for +24 VDC between wire 45FR (1) and ground at turn signal lever (5).

- If +24 VDC is not present, replace turn signal lever (page 4-1 22).
- If +24 VDC is present, repair wiring 45FR between turn signal lever and connector G.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)



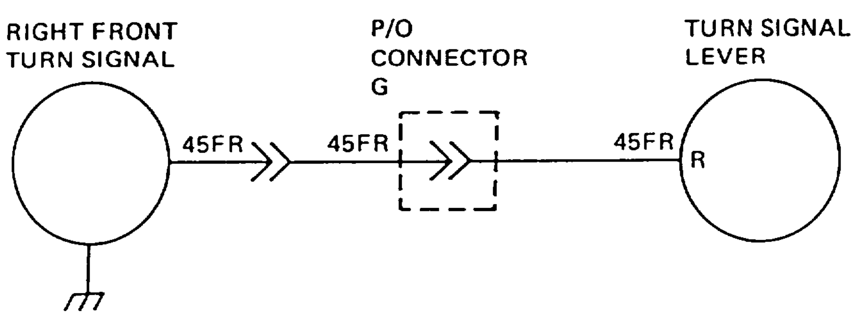


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

27. RIGHT FRONT MARKER LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to SER DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 41 Cl (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-183).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (4) and check for +24 VDC between wire 41C1 (1) and ground.

- If +24 VDC is present, repair wiring 41C1 between connector F and lamp.
- If +24 VDC is not present, reconnect connector F and go to step 3.

Step 3. Check for +24 VDC between wire 41C1 (1) and ground at fuse box 2 (5).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41C1 between fuse box 2 and connector F.

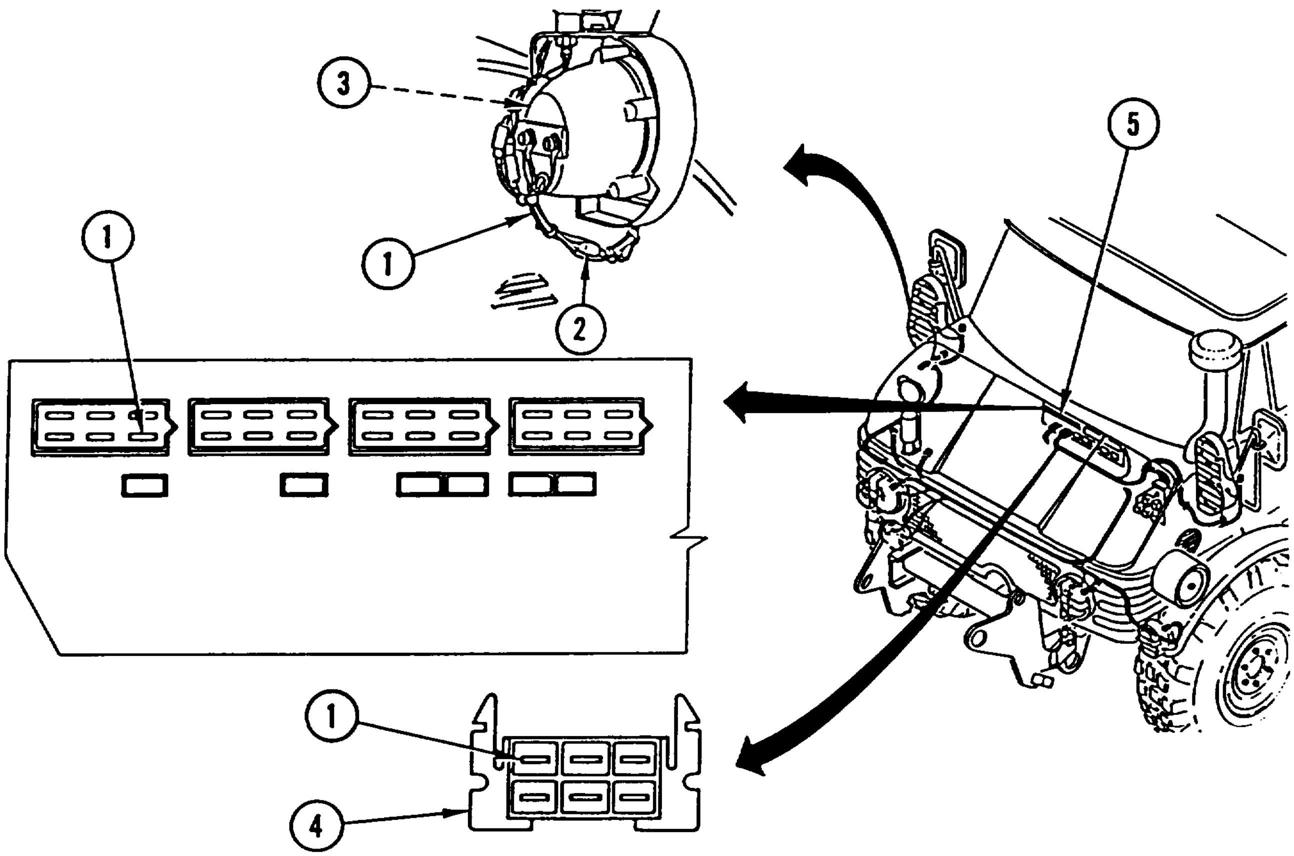
Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)



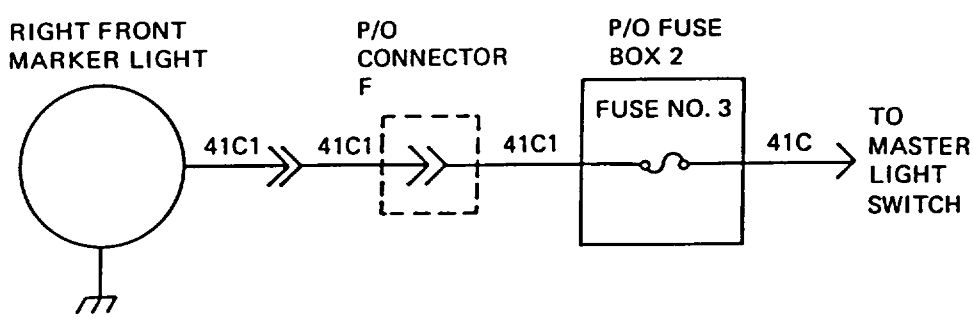


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

28. RIGHT FRONT BLACKOUT MARKER LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to BO MARKER. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 484 (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-181).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (4) and check for +24 VDC between wire 484 (1) and ground.

- If +24 VDC is present, repair wiring 484 between connector F and lamp.
- If +24 VDC is not present, reconnect connector F and go to step 3.

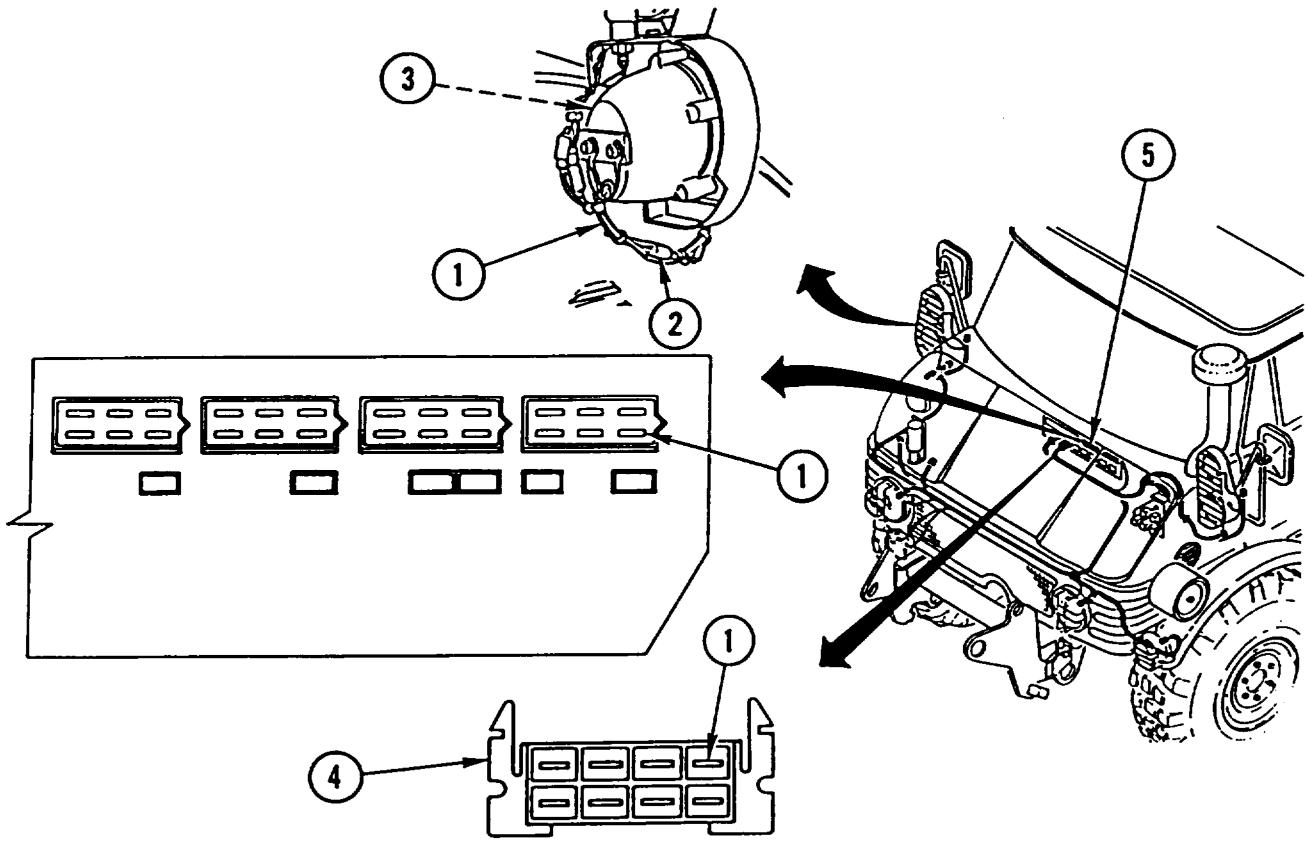
Step 3. Check for +24 VDC between wire 484 (1) and ground at fuse box 1 (5).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 484 between fuse box 1 and connector F.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



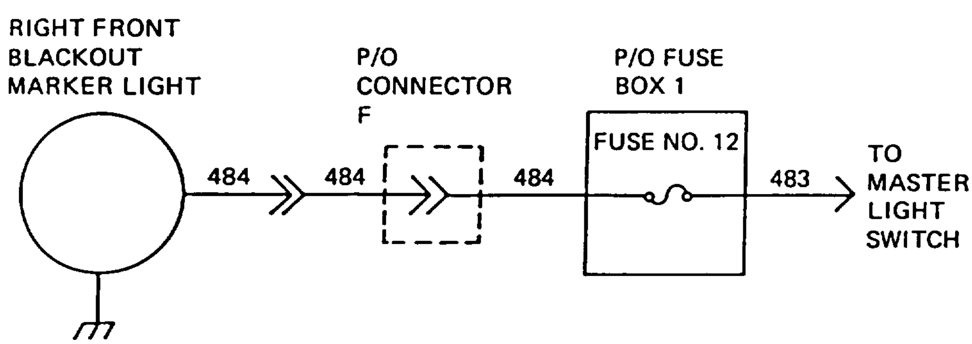


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

29. LEFT FRONT TURN SIGNAL WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and turn signal lever switched to L. Failure to do so will cause erroneous results.
- Refer to wiring diagram for ail wiring repair steps.

Step 1. Check for +24 VDC between wire 45FL (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-183).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector G (4) and check for +24 VDC between wire 45FL (1) and ground.

- If +24 VDC is present, repair wiring 45FL between connector G and lamp.
- If +24 VDC is not present, reconnect connector G and go to step 3.

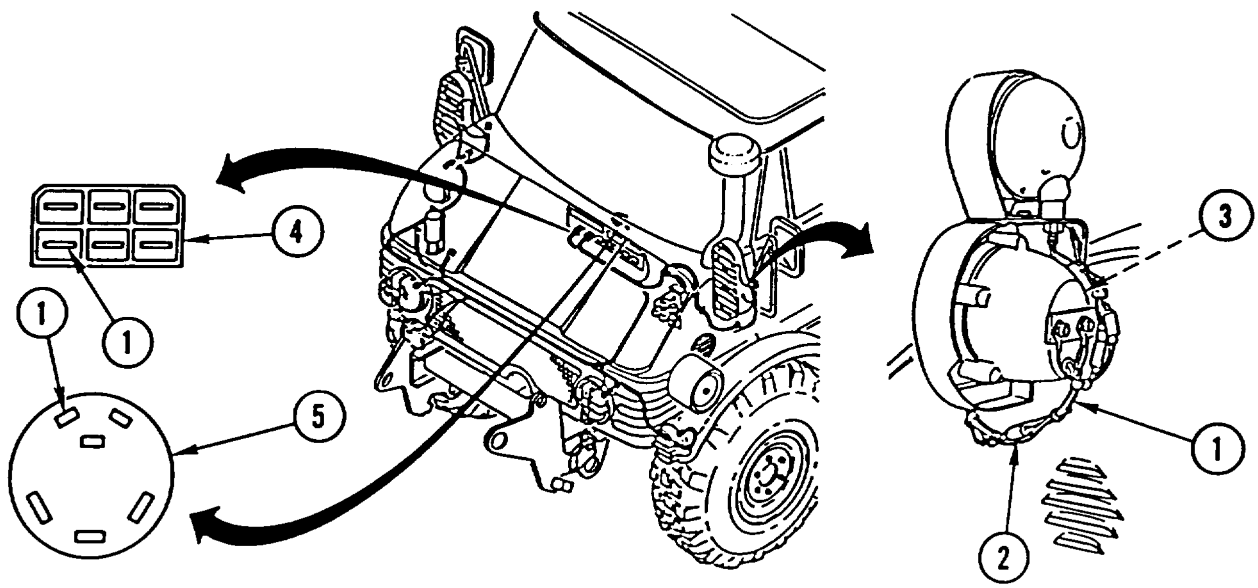
Step 3. Check for +24 VDC between wire 45FL (1) and ground at turn signal lever (5).

- If +24 VDC is not present, replace turn signal lever (page 4-1 22).
- If +24 VDC is present, repair wiring 45FL between turn signal lever and connector G.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



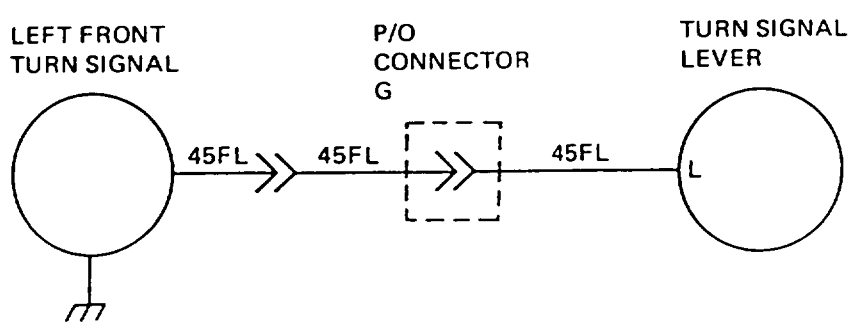


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

30. LEFT FRONT MARKER LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to SER DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 41C2 (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-183).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (4) and check for +24 VDC between wire 41C2 (1) and ground.

- If +24 VDC is present, repair wiring 41C2 between connector F and lamp.
- If +24 VDC is not present, reconnect connector F and go to step 3.

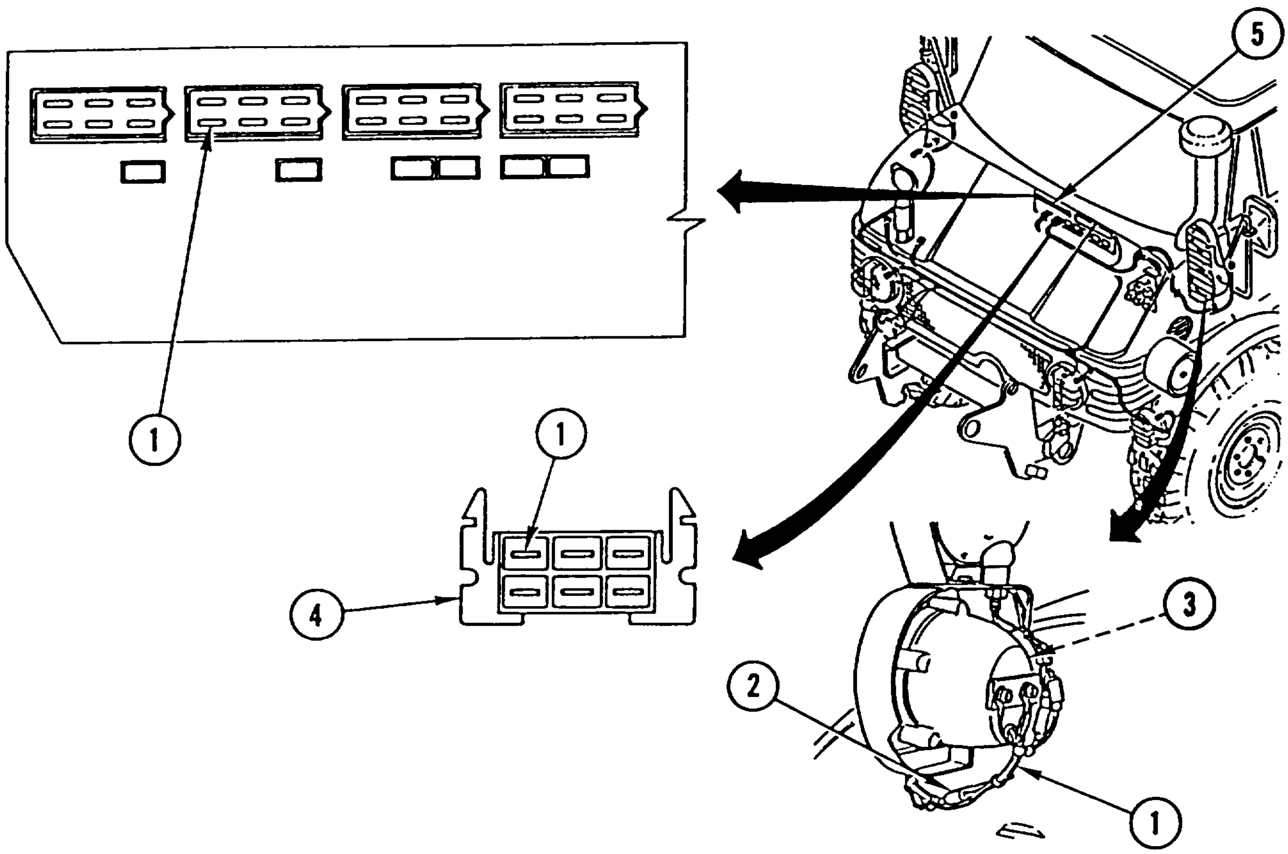
Step 3. Check for +24 VDC between wire 41C2 (1) and ground at fuse box 2 (5).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 41C2 between fuse box 2 and connector F.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)



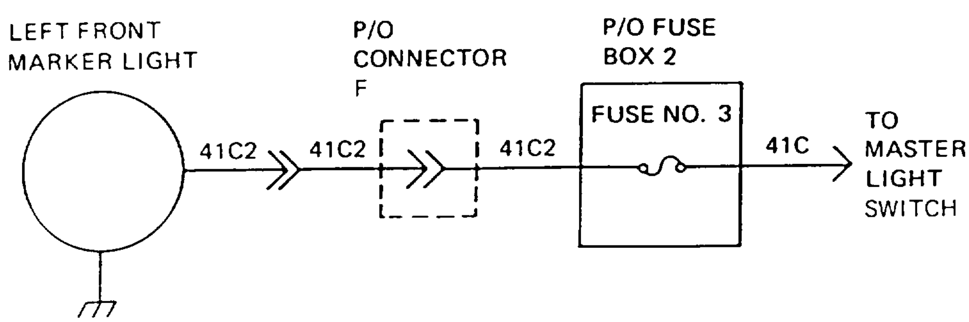


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

31. LEFT FRONT BLACKOUT MARKER LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to 60 MARKER. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

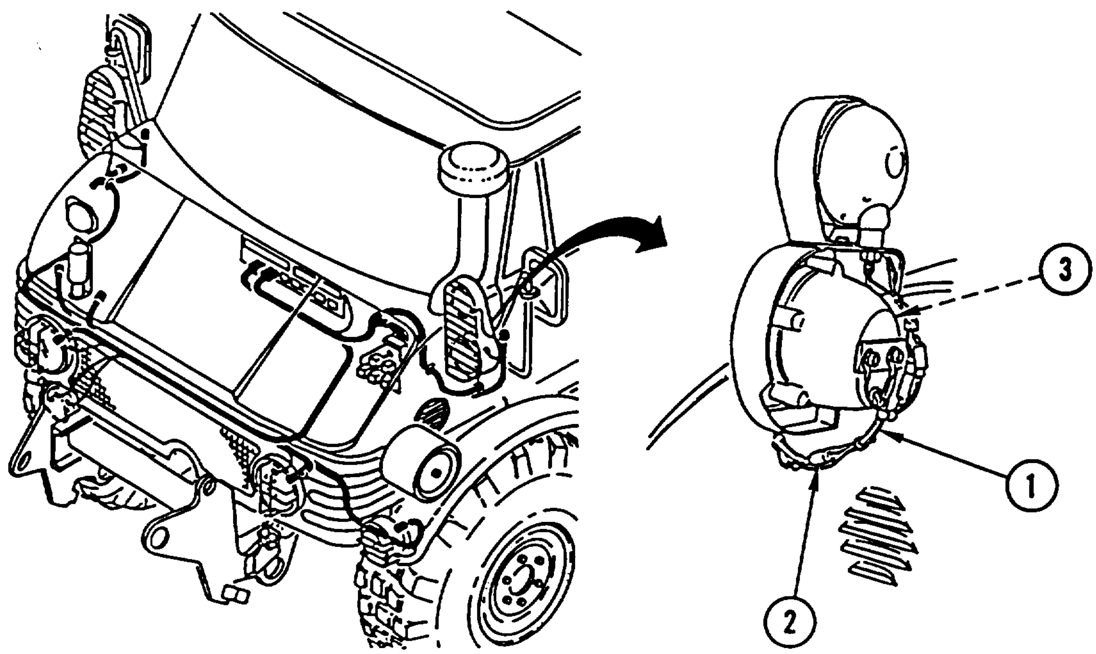
Check for +24 VDC between wire 485 (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-181).
- If +24 VDC is not present, repair wiring 485 between connector F and lamp.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



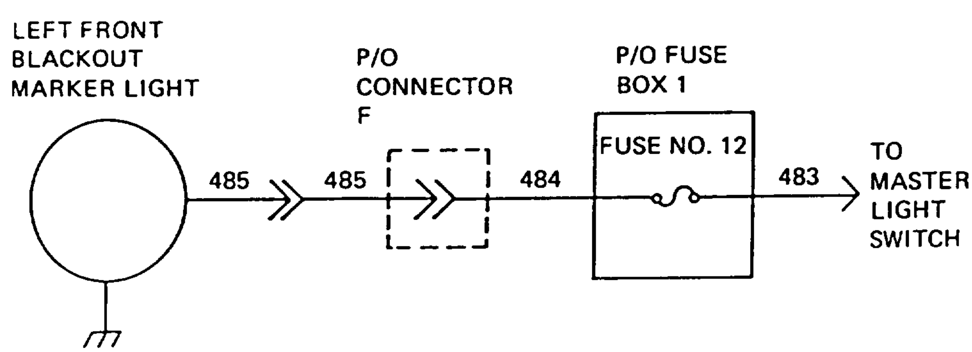


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

32. FRONT BLACKOUT LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light" switch set to BO DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 401 (1) and ground at quick disconnect (2).

- If +24 VDC is present, replace lamp (3) (page 4-181).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (4) and check for +24 VDC between wire 401 (1) and ground.

- If +24 VDC is present, repair wiring 401 between connector F and lamp.
- If +24 VDC is not present, reconnect connector F and go to step 3.

Step 3. Check for +24 VDC between wire 401 (1) and ground at fuse box 2 (5).

- If +24 VDC is present, repair wiring 401 between fuse box 2 and connector F.
- If +24 VDC is not present, go to step 4.

Step 4. Disconnect connector K (6) and check for +24 VDC between wire 40 (7) and ground.

- If +24 VDC is present, repair wiring 40 between connector K and fuse box 2.
- If +24 VDC is not present, reconnect connector K and go to step 5.

Step 5. Check for +24 VDC between wire 40 (7) and ground at master light switch (8).

- If +24 VDC is not present, replace master light switch (page 4-137j.
- If +24 VDC is present, repair wiring 40 between master light switch and connector K.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

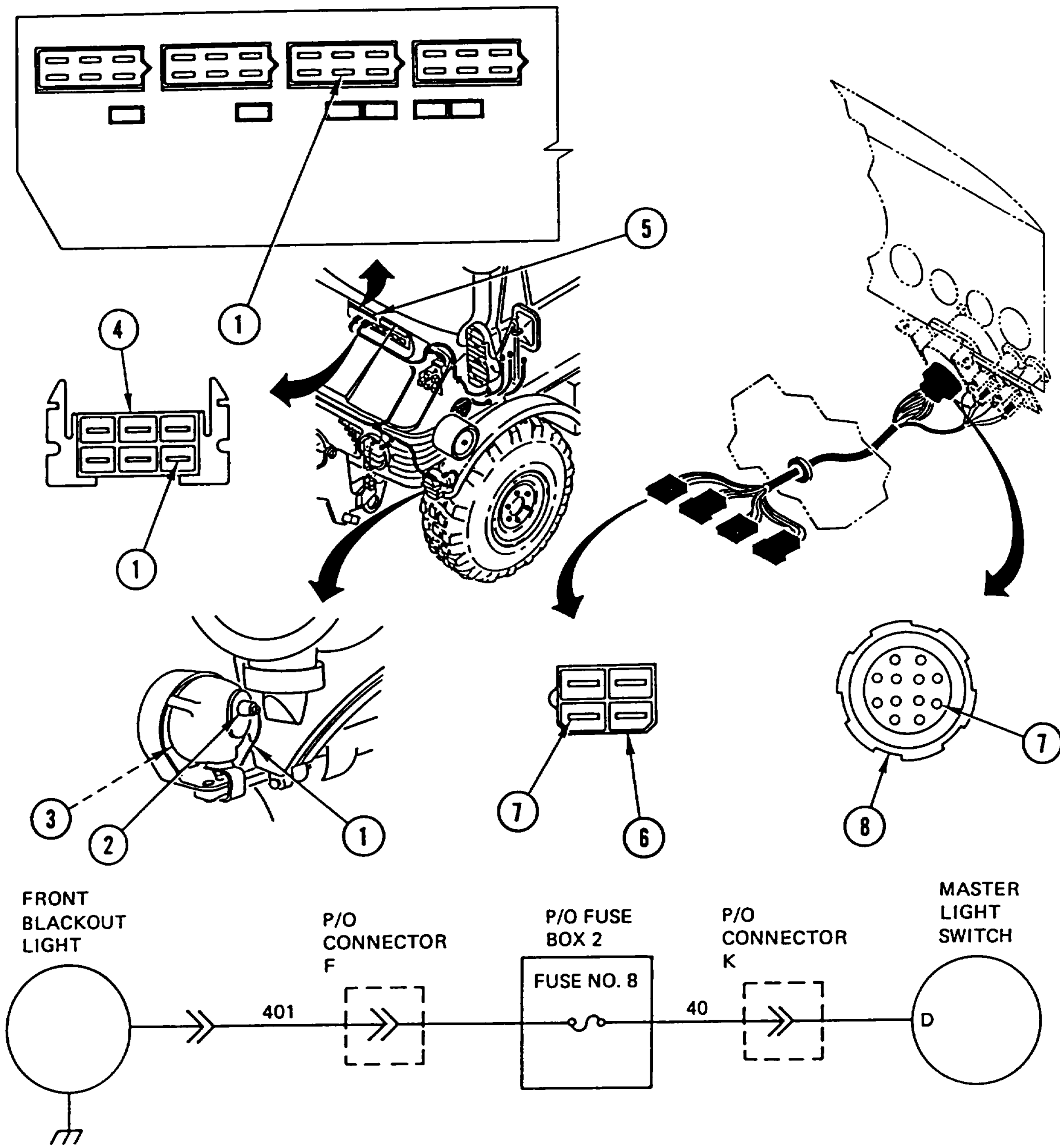


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

33. HORN WILL NOT SOUND.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and horn button depressed. Failure to do so will cause erroneous results.
- Refer to wiring diagram for ail wiring repair steps.

Step 1. Check for +24 VDC between wire 641 (1) and ground at horn (2).

- If +24 VDC is present, replace horn (page 4-218).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (3) and check for +24 VDC between wire 641 (1) and ground.

- If +24 VDC is present, repair wiring 641 between connector F and horn.
- If +24 VDC is not present, reconnect connector F and go to step 3.

Step 3. Remove two clamps (4) and intake pipe (5).

Step 4. Loosen two captive screws (6) and pull bracket (7) out enough to gain access to area behind bracket.

Step 5. Disconnect connector AD (8) and check for +24 VDC between wire 641 (1) and ground.

- If +24 VDC is present, repair wiring 641 between connector AD and connector F.
- If +24 VDC is not present, go to step 6.

Step 6. With connector AD (8) disconnected, check for +24 VDC between wire 64 (9) and ground at connector AD.

- If +24 VDC is present, replace horn, low beam/high beam switch (page 4-215).
- If +24 VDC is not present, reconnect connector AD and go to step 7.

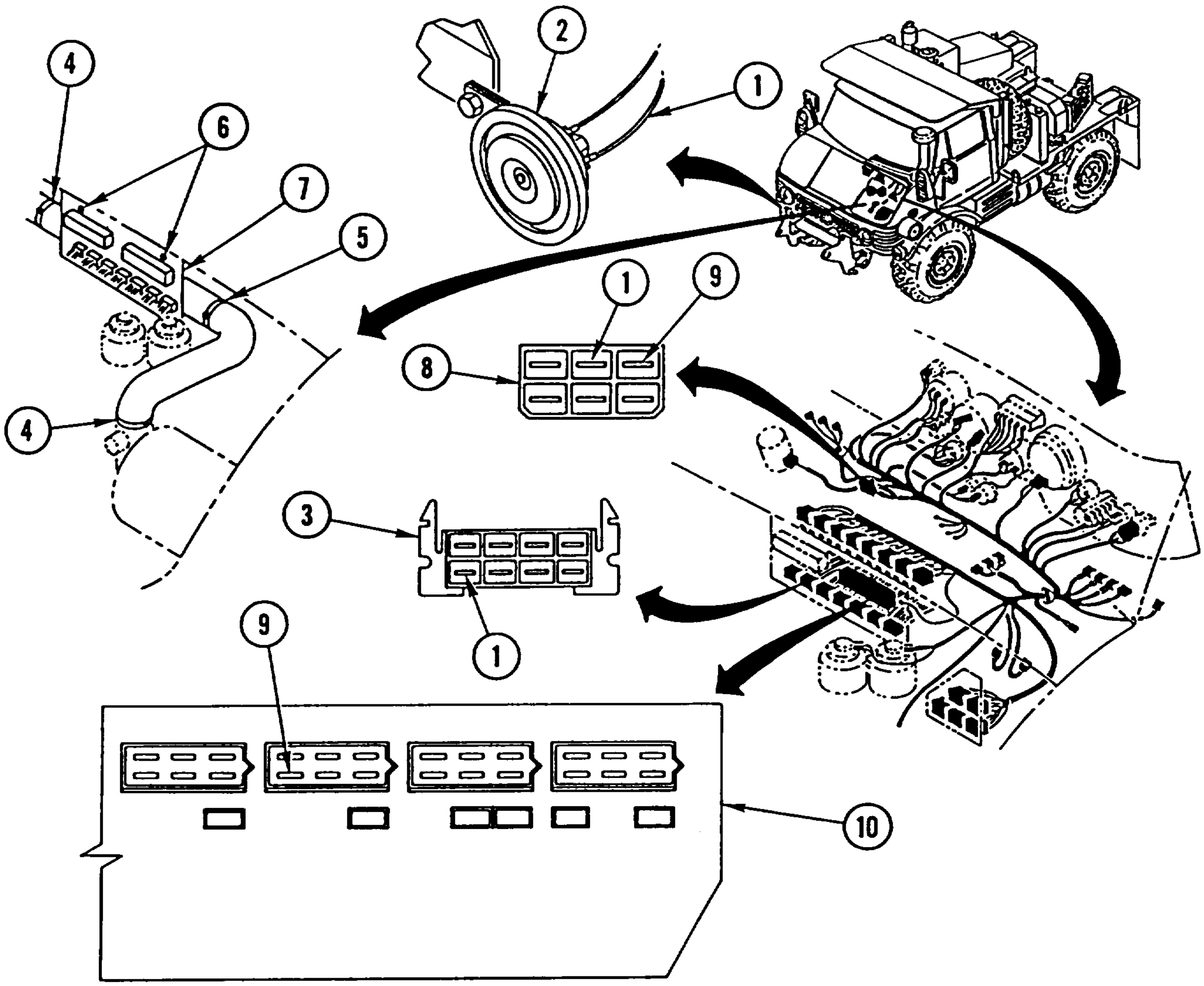
Step 7. Check for +24 VDC between wire 64 (9) and ground at fuse box 1 (10).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 64 between fuse box 1 and horn, low beam/high beam switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



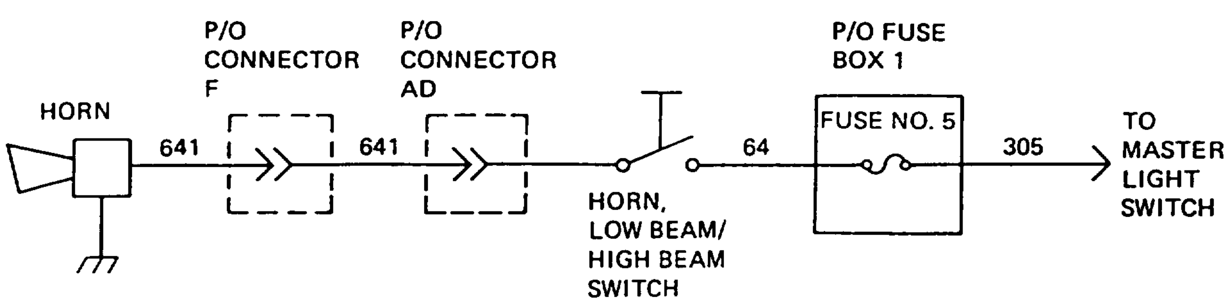


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

34. WINDSHIELD WASHER PUMP WILL NOT OPERATE.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and windshield wiper/washer switch engaged. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 638 (1) and ground at windshield washer pump connector (2).

- If +24 VDC is present, replace windshield washer pump (page 4-484).
- If +24 VDC is not present, go to step 2.

Step 2. Disconnect connector F (3) and check for +24 VDC between wire 638 (1) and ground.

- If +24 VDC is present, repair wiring 638 between connector F and windshield washer pump.
- If +24 VDC is not present, reconnect connector F and go to step 3.

Step 3. Remove defroster nozzle (4) and hose (5).

Step 4. Remove knob (6), nut (7), and windshield wiper/washer switch (8) from dashboard (9).

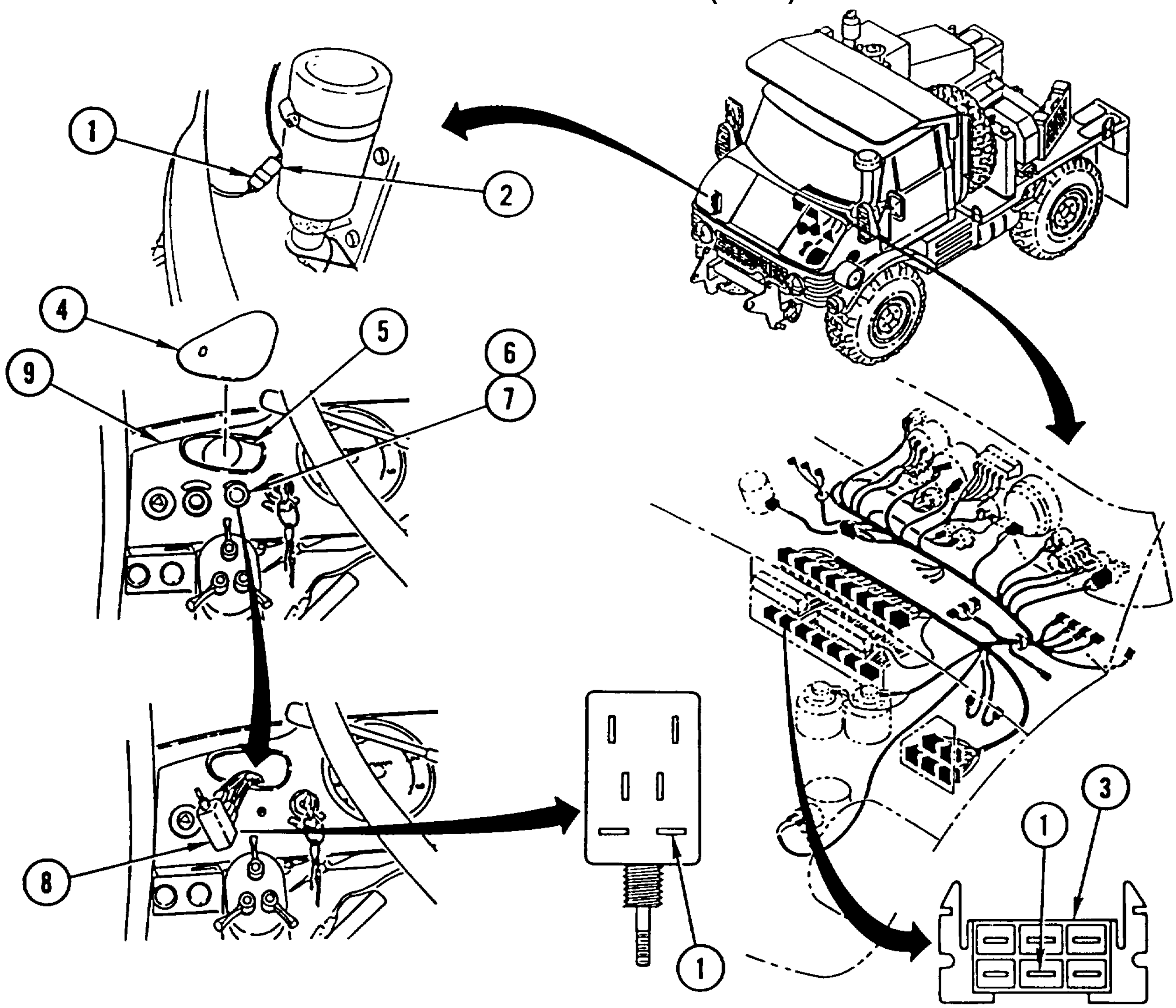
Step 5. Check for +24 VDC between wire 638 (1) and ground at windshield wiper/washer switch (8).

- If +24 VDC is not present, replace windshield wiper/washer switch (page 4-132).
- If +24 VDC is present, repair wiring 638 between windshield wiper/washer switch and connector F.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)



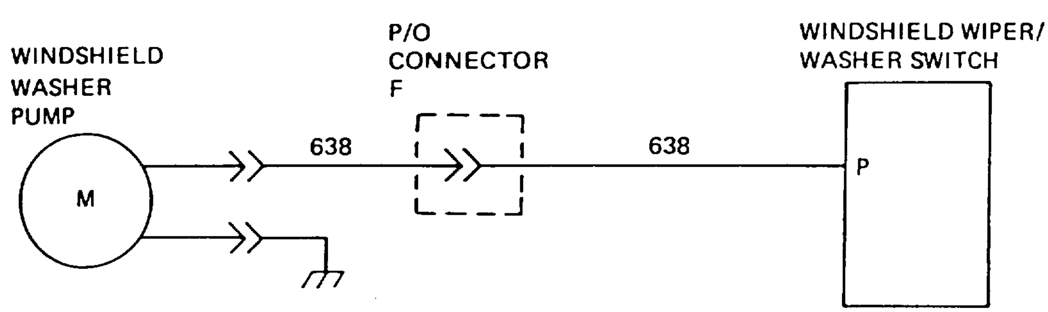


Table 3-5. Troubleshooting (Cont)

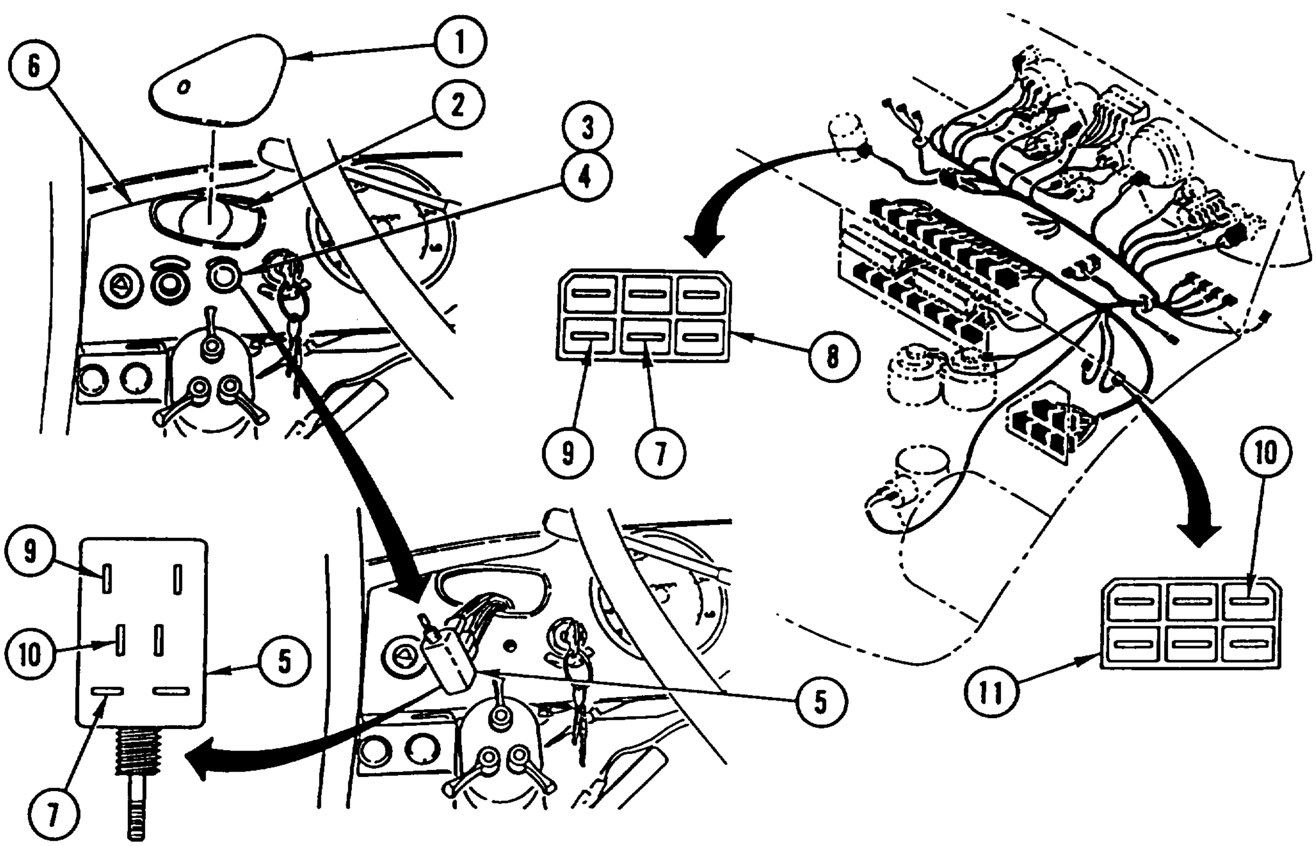
Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

35. WINDSHIELD WIPERS WILL NOT OPERATE.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and windshield wiper/washer switch pulled out once to activate wipers. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-130) for all wiring repair steps.



Step 1. Remove defroster nozzle (1) and hose (2).

Step 2. Remove knob (3), nut (4), and windshield wiper/washer switch (5) from dashboard (6).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 3. Check for +24 VDC between wire 632 (7) and ground at windshield wiper/washer switch (5).

- If +24 VDC is not present, repair wiring 63 between windshield wiper/washer switch and fuse box 1.
- If +24 VDC is present, go to step 4.

Step 4. Check for +24 VDC between wire 632 (7) and ground at windshield wiper/washer motor connector (8).

- If +24 VDC is not present, repair wiring 632 between windshield wiper/washer motor and windshield wiper/washer switch.
- If +24 VDC is present, go to step 5.

Step 5. Check for +24 VDC between wire 631 (9) and ground at windshield wiper/washer switch (5).

- If +24 VDC is not present, replace windshield wiper/washer switch.
- If +24 VDC is present, go to step 6.

Step 6. Check for +24 VDC between wire 631 (9) and ground at windshield wiper/washer motor connector (8).

- If +24 VDC is present, replace windshield wiper/washer motor (page 4-477).
- If +24 VDC is not present, repair wiring 631 between windshield wiper/washer switch and windshield wiper/washer motor. If problem continues, go to step 7.

NOTE

For steps 7 and 8, windshield wiper/washer switch must be pulled out twice to activate delay/intermittent operation.

Step 7. Check for +24 VDC between wire 635 (10) and ground at windshield wiper/washer switch (5).

- If +24 VDC is not present, replace windshield wiper/washer switch.
- If +24 VDC is present, go to step 8.

Step 8. Check for +24 VDC between wire 635 (10) and ground at windshield wiper/washer switch relay connector (11).

- If +24 VDC is present, replace windshield wiper/washer switch relay (page 4-140).
- If +24 VDC is not present, repair wiring 635.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

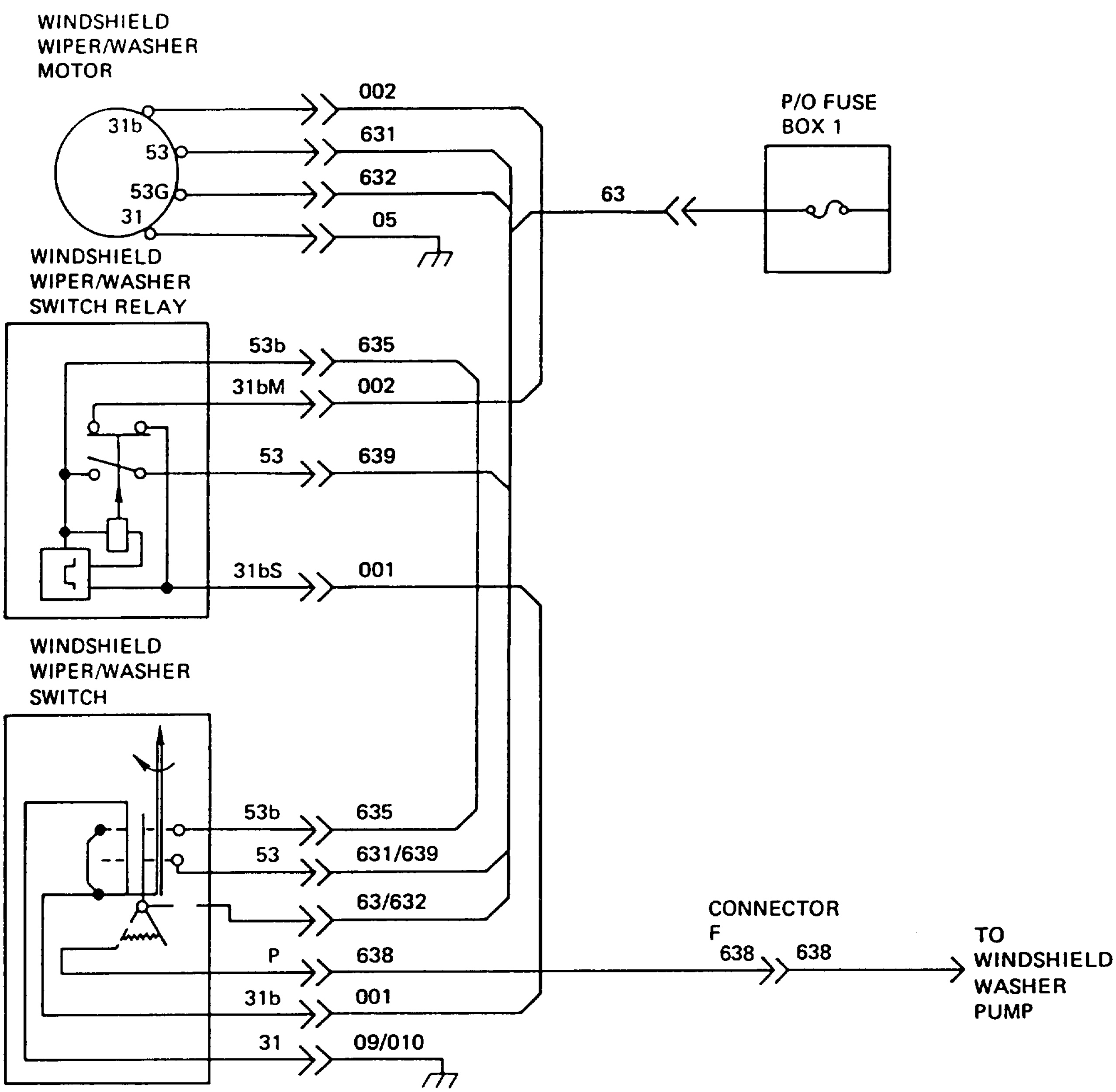


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

36. DOME LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to SER DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-132) for all wiring repair steps.

Remove dome light (1) and check for +24 VDC between wire 43 (2) and ground at dome light.

- If +24 VDC is present, replace two lamps (3).
- If +24 VDC is not present, repair wiring 43 between dome light and fuse box 1.

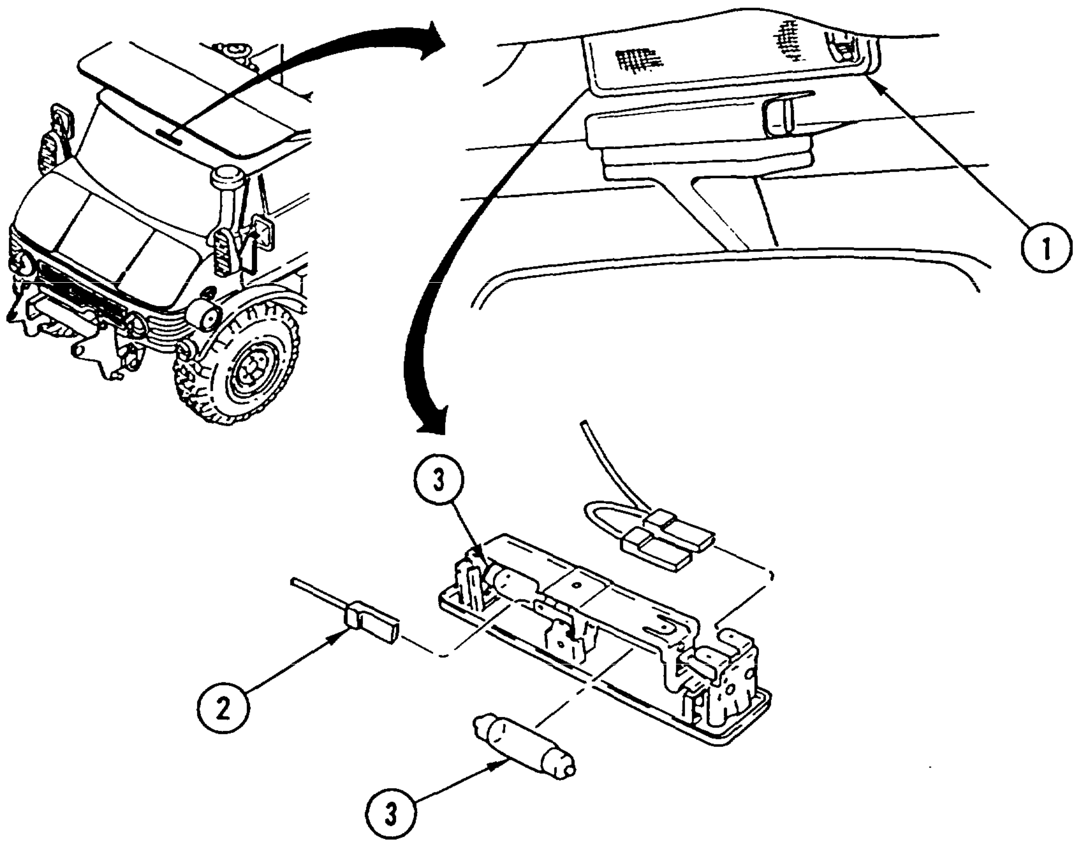


Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)

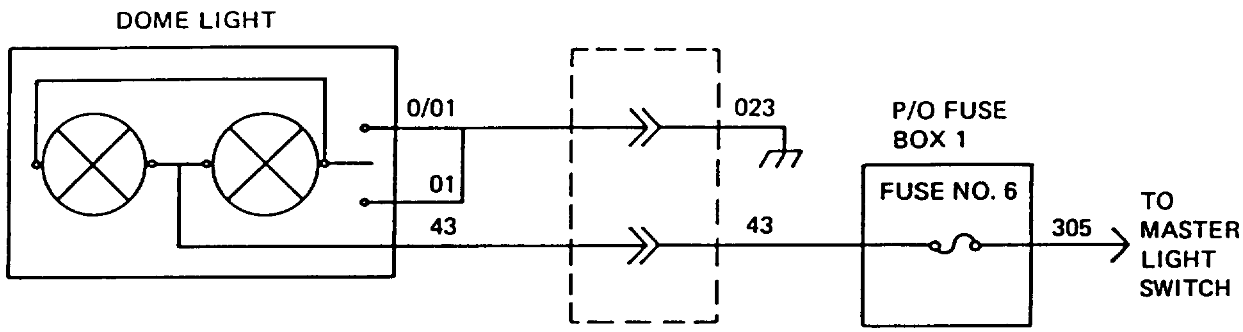


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

37. CAB HEATER FAN WILL NOT OPERATE.

NOTE

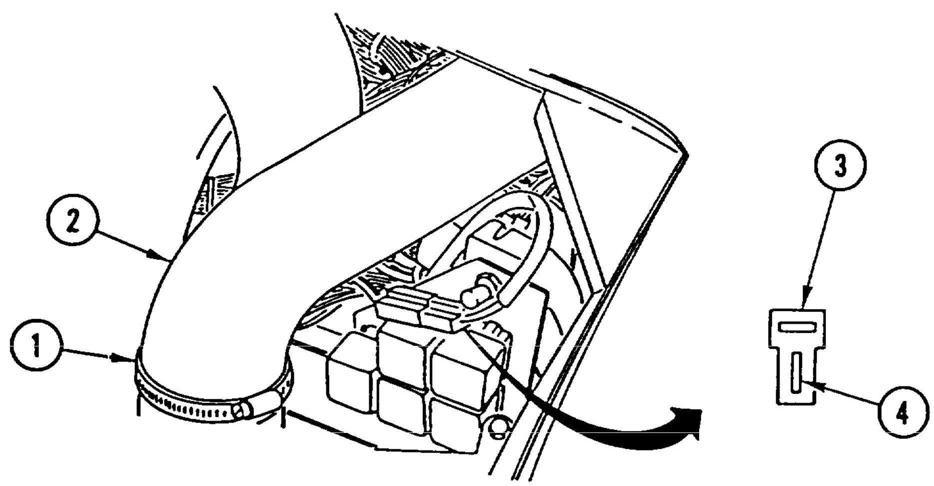
- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON.
- Failure to do so will cause erroneous results.

Refer to wiring diagram for all wiring repair steps.

Step 1. Remove clamp (1) and pipe (2).

Step 2. Disconnect connector AE (3) and check for +24 VDC between wire 61 (4) and ground.

- If +24 VDC is present, replace cab heater (page 4-490).
- If +24 VDC is not present, repair wiring 61 between cab heater and fuse box 1.



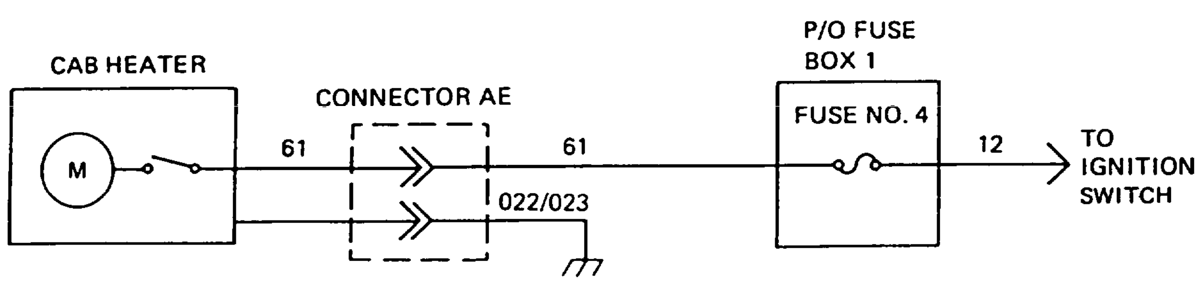


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

38. PANEL LIGHTS WILL NOT LIGHT.

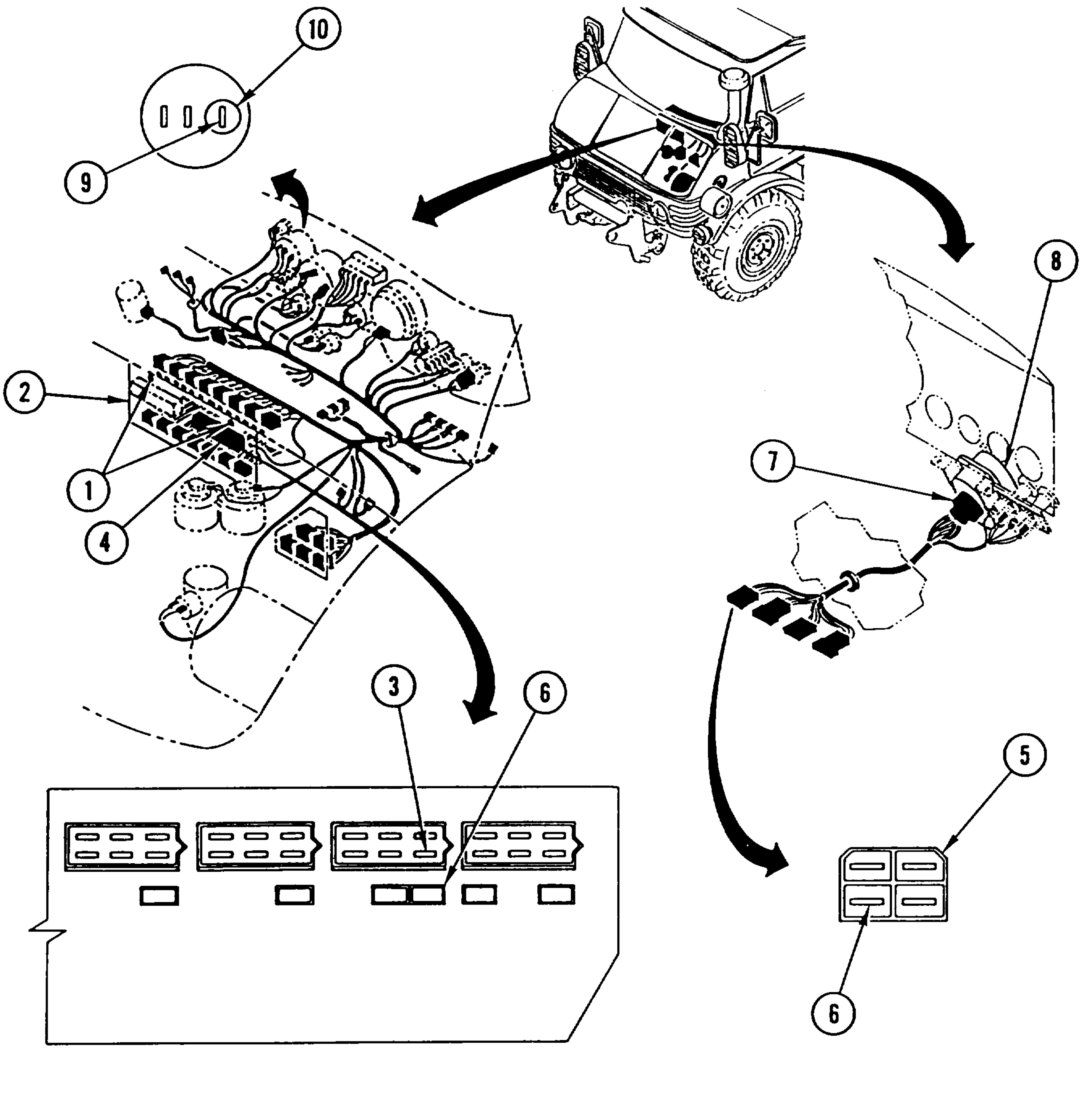


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-136) for all wiring repair steps.

Step 1. Check that all panel lights are lit.

- If only speedometer light is not lit, replace speedometer lamp (page 4-727).
- If only tachometer light is not lit, replace tachometer lamp (page 4-128).
- If only indicator (gage) light is not lit, replace indicator (gage) lamp (page 4-124).
- If tachometer light, indicator (gage) light, and voltmeter gage light are not lit, repair wiring 492 between speedometer and tachometer.
- If indicator (gage) light and voltmeter gage light are not lit, repair wiring 493 between tachometer and indicator (gage).
- If only voltmeter gage light is not lit, go to step 6.
- If no lights are lit, go to step 2.

Step 2. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 3. Check for +24 VDC between wire 491 (3) and ground at fuse box 1 (4).

- If +24 VDC is present, repair wiring 491 between fuse box 1 and speedometer.
- If +24 VDC is not present, go to step 4.

Step 4. Disconnect connector K (5) and check for +24 VDC between wire 49 (6) and ground.

- If +24 VDC is present, repair wiring 49 between connector K and fuse box 1.
- If +24 VDC is not present, reconnect connector K and go to step 5.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 5. Disconnect master light switch connector (7) and check for continuity between terminal A and terminal B of master light switch (8).

- If there is continuity, repair wiring 49 between master light switch and connector K.
- If there is no continuity, replace master light switch (page 4-137).

Step 6. Check for +24 VDC between wire 494 (9) and ground at voltmeter gage (10).

- If +24 VDC is present, replace voltmeter gage (page 4-135).
- If +24 VDC is not present, repair wiring 494 between indicator (gage) and voltmeter gage.

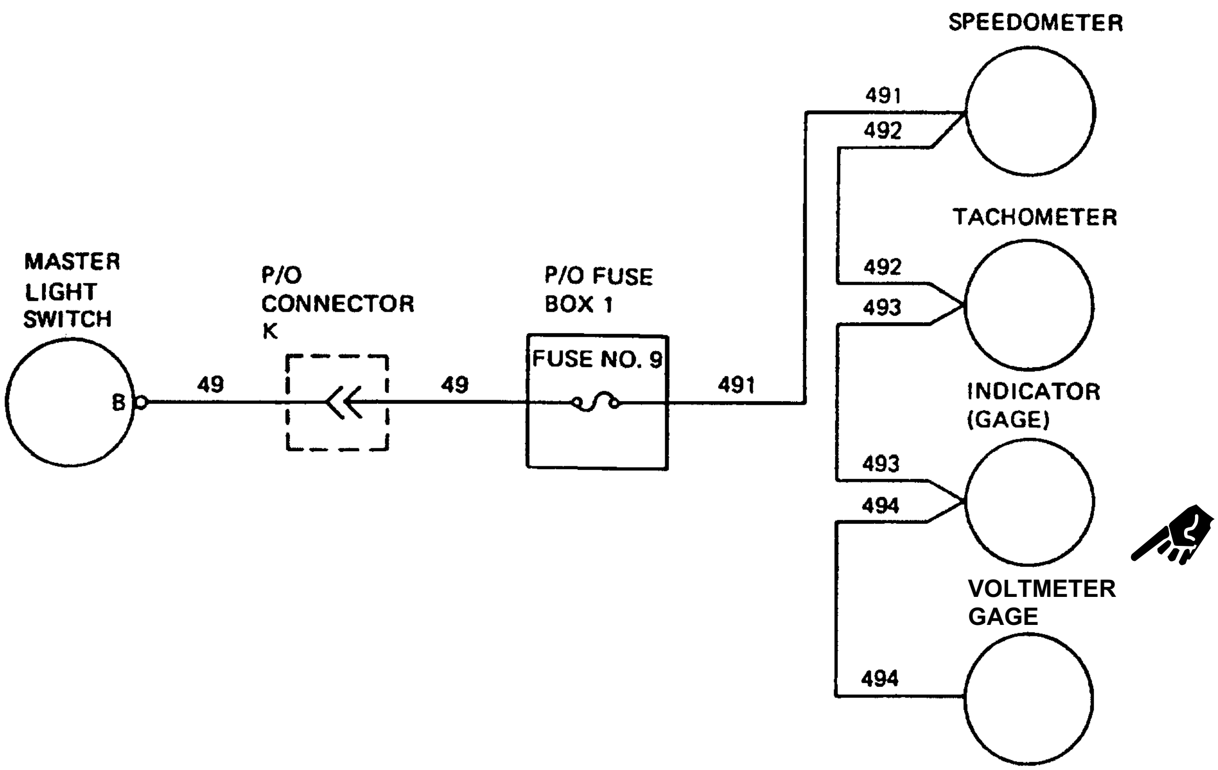


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

39. TACHOMETER SHOWS NO INDICATION.

NOTE

- If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.
- Refer to wiring diagram (page 3-138) for all wiring repair steps.

Step 1. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, go to step 2.

Step 2. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 3. Remove two clamps (3) and pipe assembly (4).

NOTE

For steps 4 thru 6, engine must be running.

Step 4. Check for +24 VDC between wire 31S (5) and ground at tachometer (6).

- If +24 VDC is present, go to step 6.
- If +24 VDC is not present, go to step 5.

Step 5. Disconnect connector D (7) and check for +24 VDC between wire 31S (5) and ground.

- If +24 VDC is not present, repair wiring 31S between connector D and alternator.
- If +24 VDC is present, repair wiring 31S between tachometer and connector D.

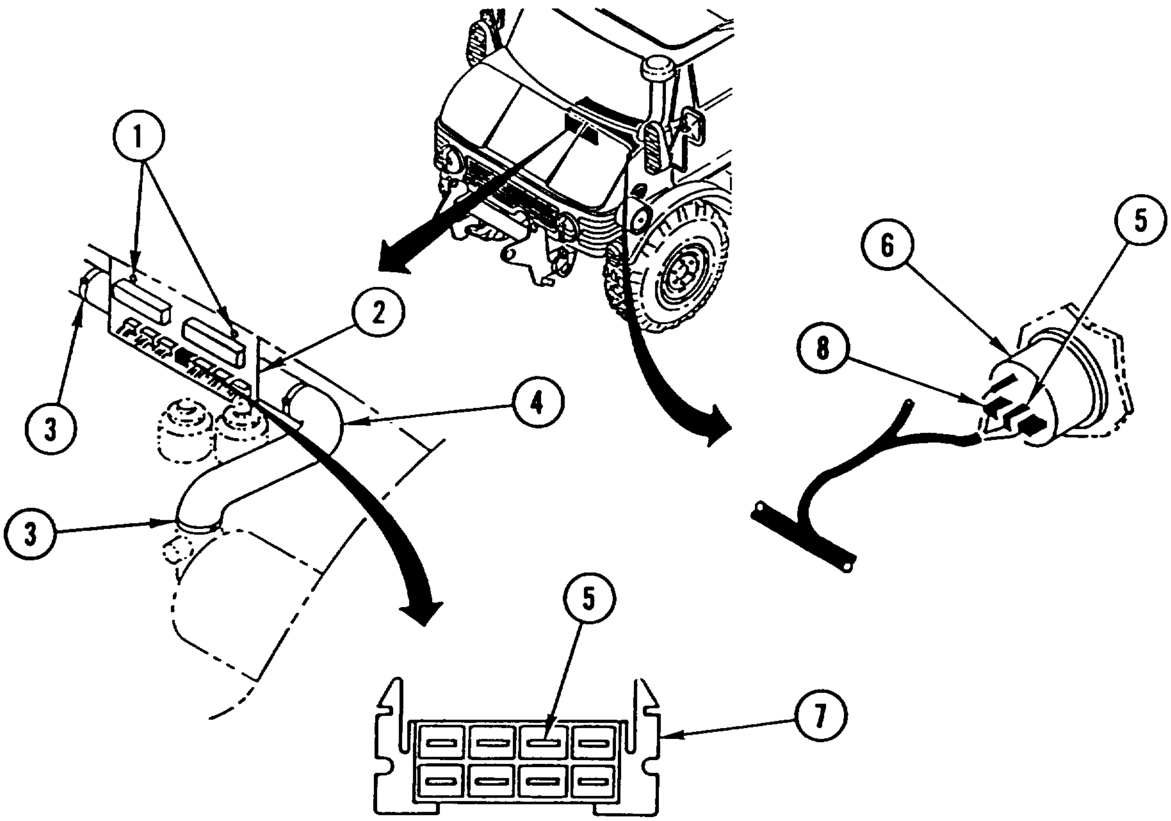
Step 6. Check for +24 VDC between wire 36 (8) and ground at tachometer (6).

- If +24 VDC is present, replace tachometer (page 4-128).
- If +24 VDC is not present, repair wiring 36 between tachometer and fuse box 1.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



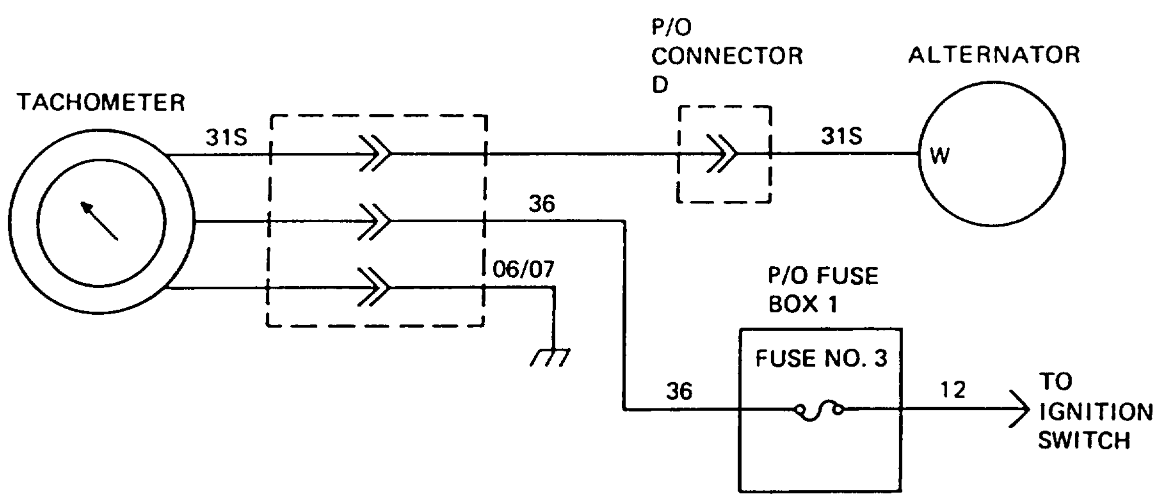


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

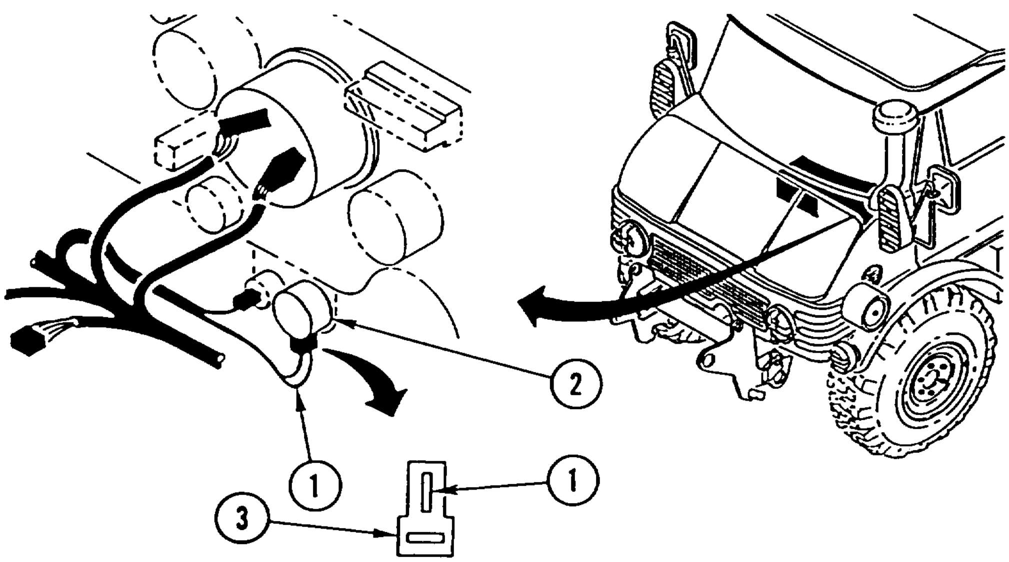
40. LOW PRESSURE WARNING BUZZER WILL NOT SOUND.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and air pressure relieved. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Check for +24 VDC between wire 33 (1) and ground at low pressure warning buzzer (2).

- If +24 VDC is present, disconnect connector (3) and replace low pressure warning buzzer.
- If +24 VDC is not present, repair wiring 33 between indicator (gage) and low pressure warning buzzer.



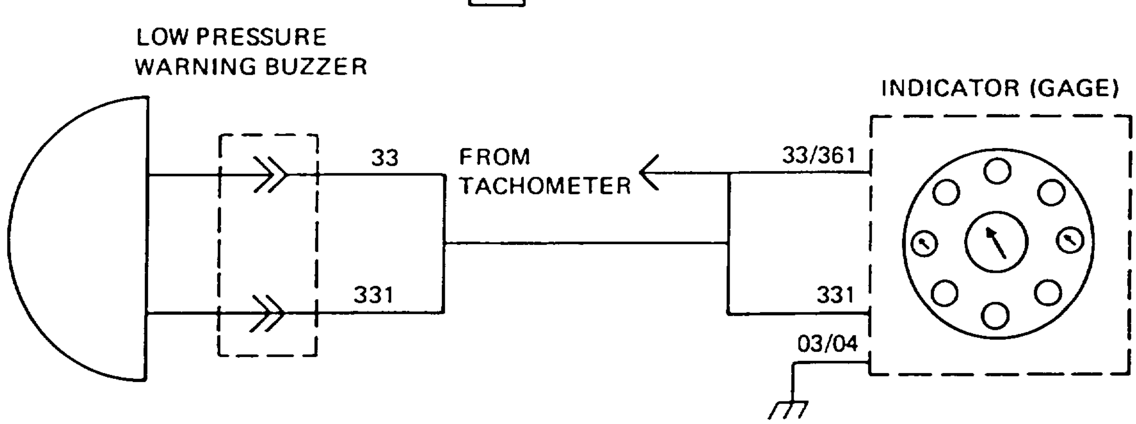


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

41. TURN SIGNAL INDICATOR LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and ignition switch set to ON. Place turn signal lever in position in which failure occurred. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 2. Remove two clamps (3) and pipe assembly (4).

Step 3. Check for +24 VDC between wire 391 (5) and ground at indicator (gage) (6).

- If +24 VDC is present, replace turn signal indicator lamp (7).
- If +24 VDC is not present, go to step 4.

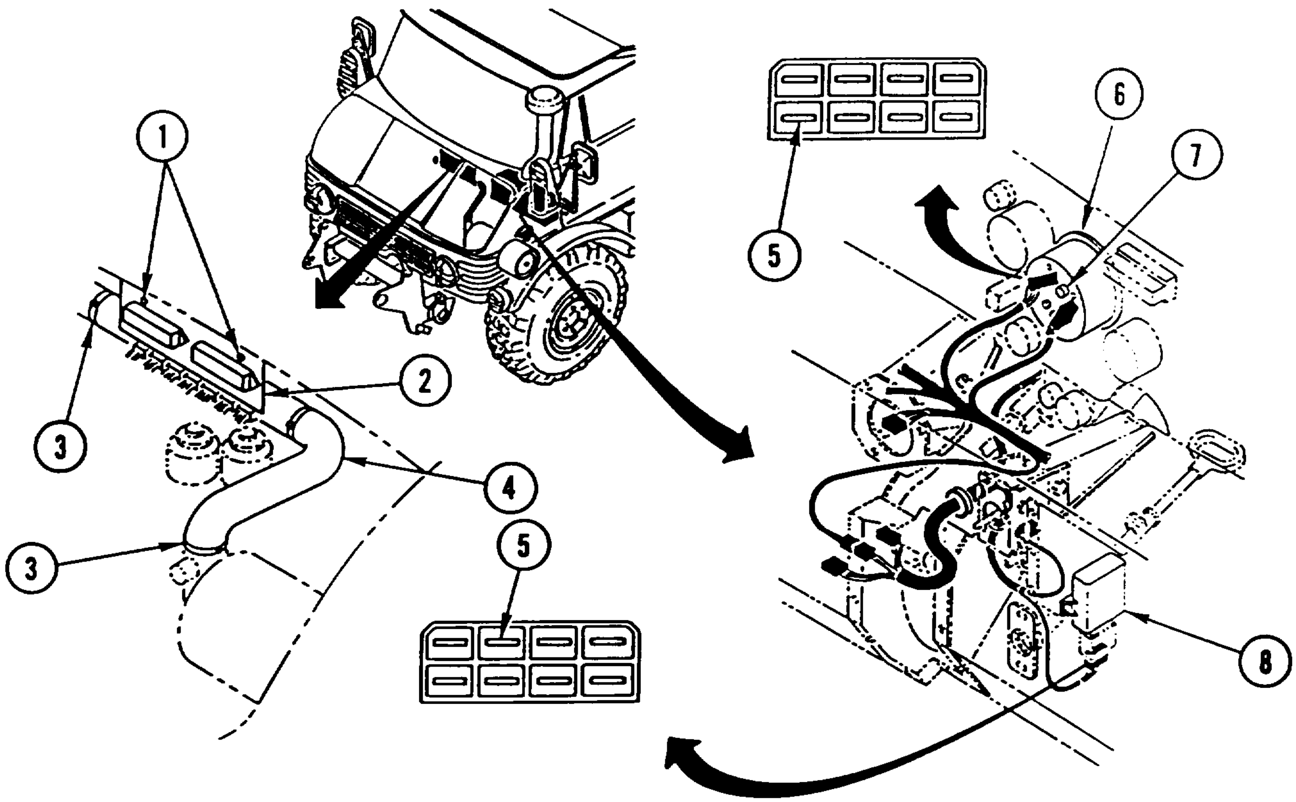
Step 4. Check for +24 VDC between wire 391 (5) and ground at turn signal flasher relay (8).

- If +24 VDC is not present, replace turn signal flasher relay (page 4-196).
- If +24 VDC is present, repair wiring 391.

Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)



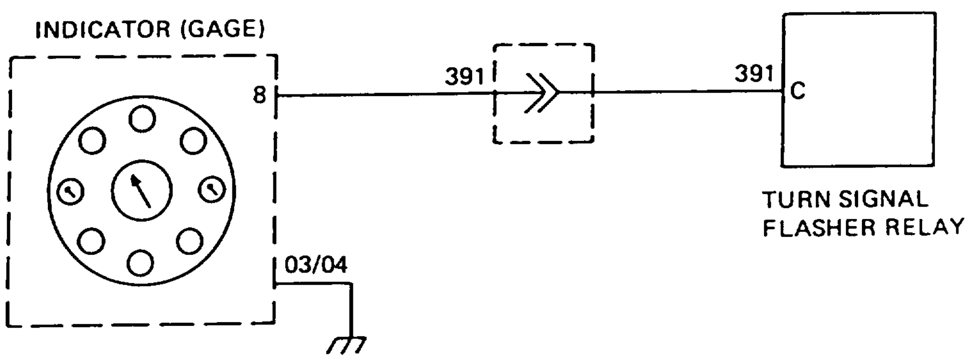


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

42. HIGH BEAM INDICATOR LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and horn, low beam/high beam switch set to HI. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 2. Remove two clamps (3) and pipe assembly (4).

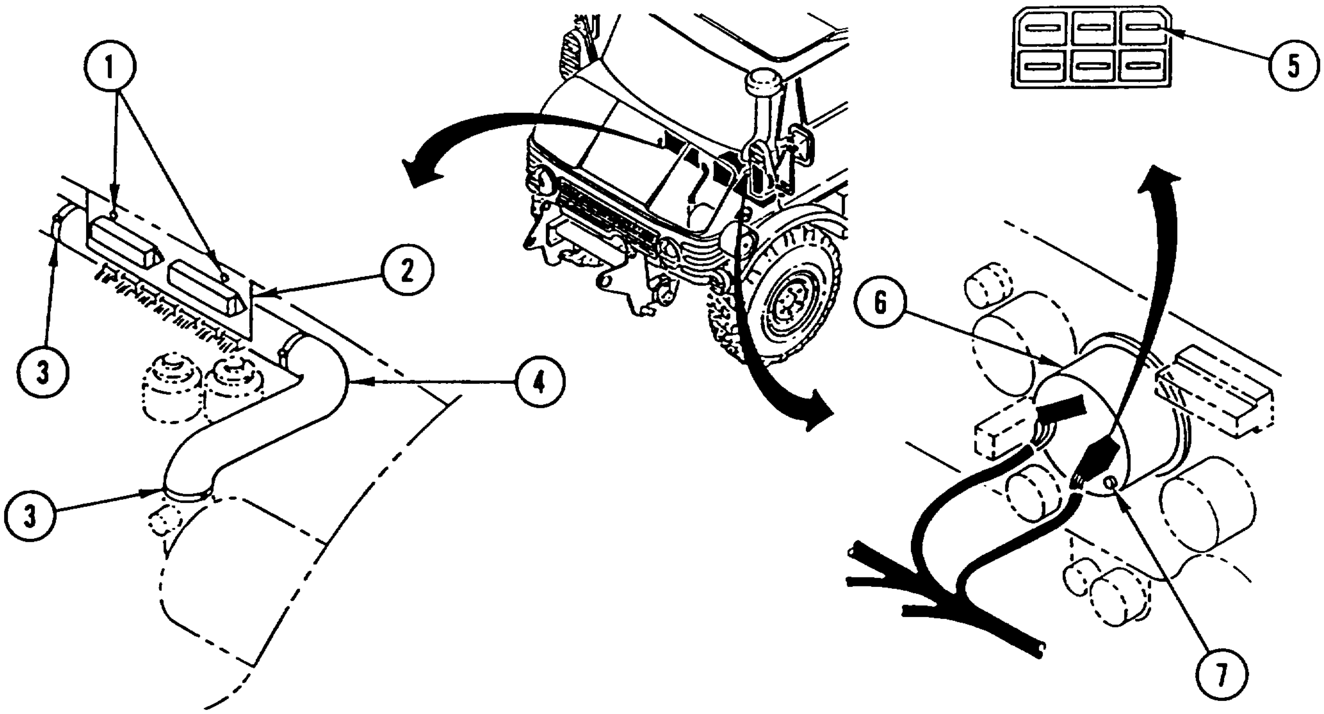
Step 3. Check for +24 VDC between wire 41HL1 (5) and ground at indicator (gage) (6).

- If +24 VDC is present, replace high beam indicator lamp (7).
- If +24 VDC is not present, repair wiring 41HL1.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



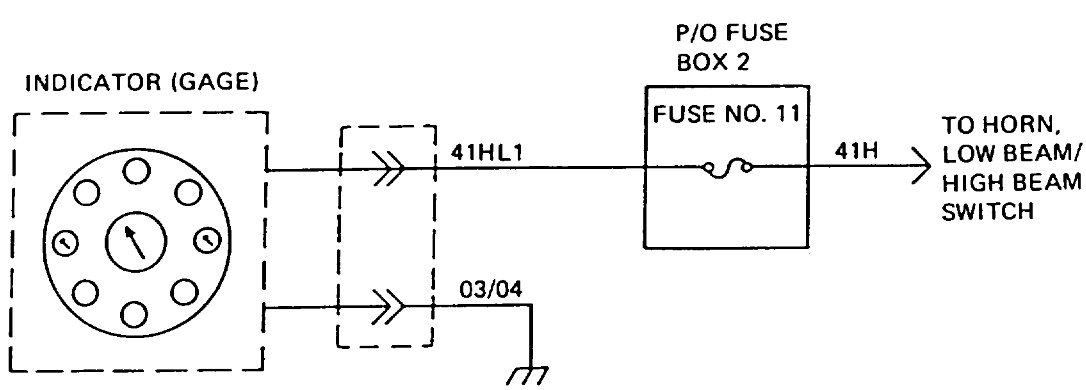


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

43. CHARGE INDICATOR LIGHT STAYS ON DURING OPERATION.

NOTE

- If STE/ICE-R CI Engine GO-NO GO Chain does not diagnose cause of problem, return to this troubleshooting table.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Perform STE/ICE-R CI Engine GO-NO GO Chain test procedures in the DCA diagnostic mode.

- If malfunction is found, refer to List of Tasks (page iii) or Alphabetical Index (page Index-1) and repair or replace damaged or faulty components.
- If malfunction is not found, go to step 2.

NOTE

For steps 2 and 3, engine must be running.

Step 2. Disconnect connector D (1) and check for +24 VDC between wire 34 (2) and ground.

- If +24 VDC is present, repair wiring 34 between connector D and indicator (gage).
- If +24 VDC is not present, reconnect connector D and go to step 3.

Step 3. Check for +24 VDC between wire 34 (2) and ground at suppressor filter (3).

- If +24 VDC is not present, replace suppressor filter (page 4-235).
- If +24 VDC is present, repair wiring 34 between connector D and suppressor filter.

Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)

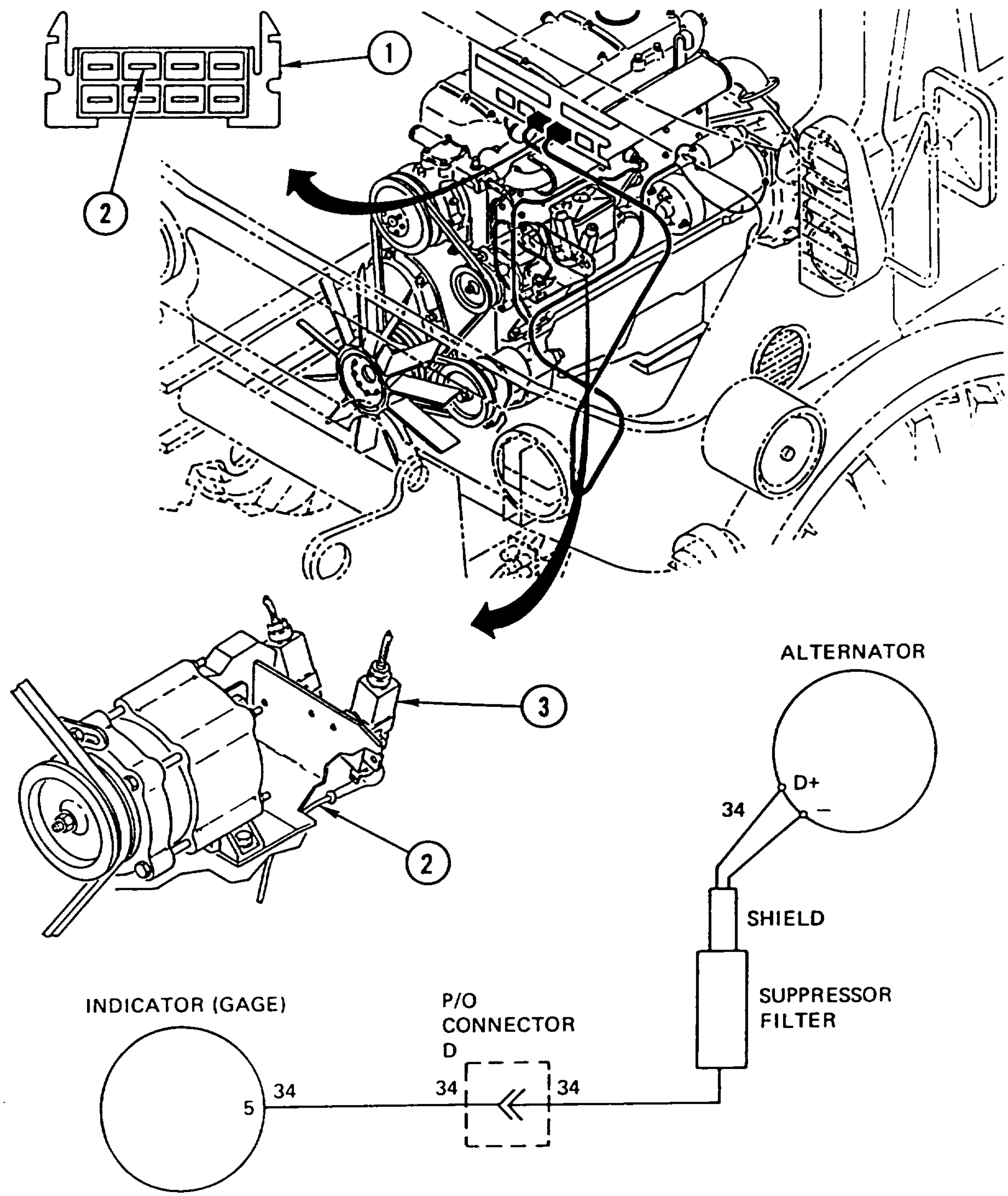


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

44. WATER TEMPERATURE GAGE SHOWS NO INDICATION.

NOTE

- Resistance will vary depending on water temperature.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Disconnect wire 31T (1) from water temperature sending unit (2) and check for resistance between terminal (3) and shell of water temperature sending unit (2).

- If there is no resistance, replace water temperature sending unit (page 4-203).
- If there is resistance, go to step 2.

Step 2. With wire 31T (1) disconnected from water temperature sending unit (2), check for +24 VDC between wire 31T and ground at water temperature sending unit.

- If +24 VDC is present, replace water temperature sending unit (page 4-203).
- If +24 VDC is not present, go to step 3.

Step 3. With wire 31T (1) disconnected from water temperature sending unit, check for +24 VDC between wire 31T and ground at connector D (4).

- If +24 VDC is present, repair wiring 31T between connector D and water temperature sending unit.
- If +24 VDC is not present, go to step 4.

Step 4. Loosen two captive screws (5) and pull bracket (6) out enough to gain access to area behind bracket.

Step 5. Remove two clamps (7) and pipe assembly (8).

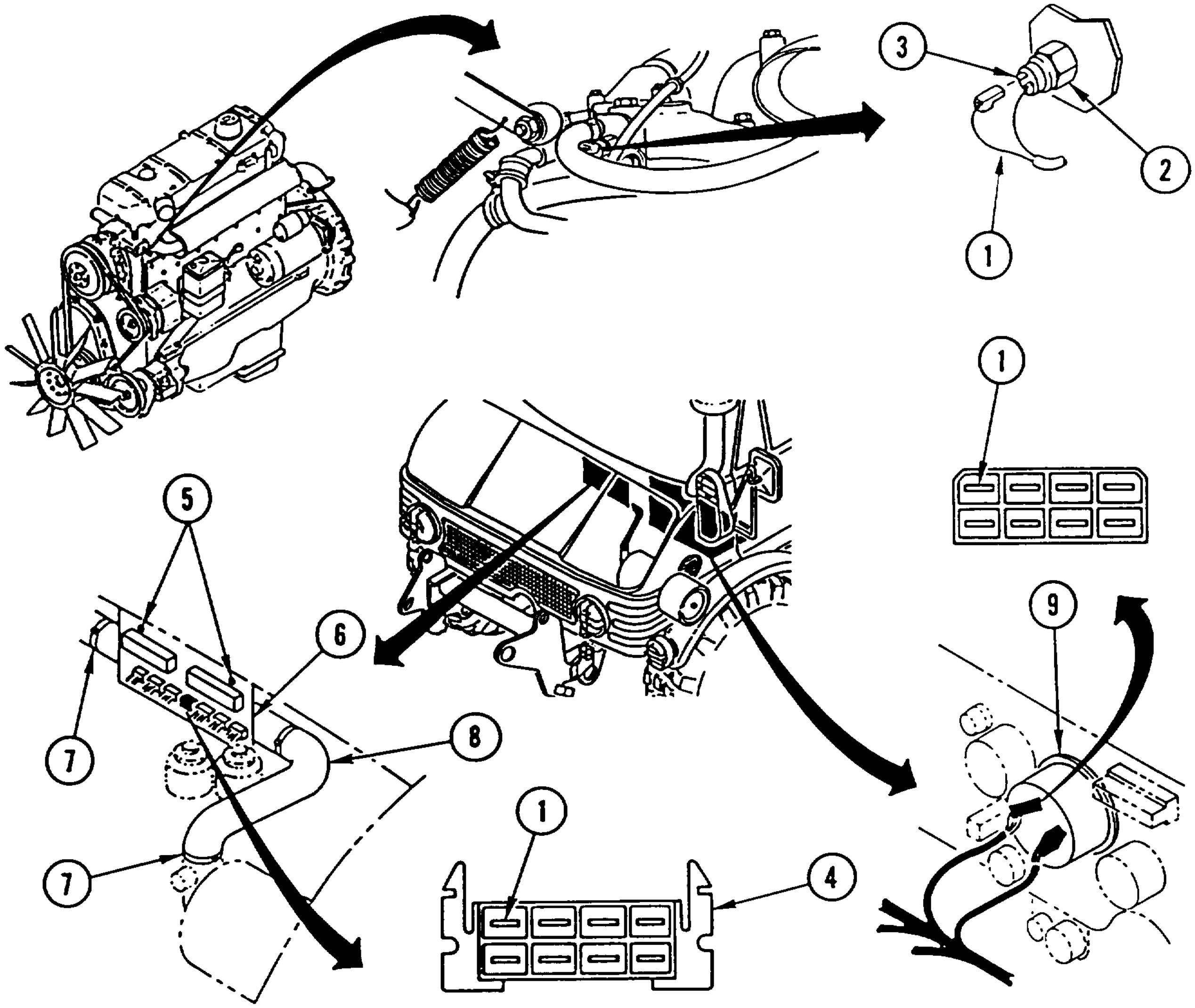
Step 6. With wire 31T (1) disconnected from water temperature sending unit, check for +24 VDC between wire 31T and ground at indicator (gage) (9).

- If +24 VDC is not present, reconnect wire 31T at water temperature sending unit and replace indicator (gage) (page 4-124).
- If +24 VDC is present, reconnect wire 31T at water temperature sending unit and repair wiring 31T between indicator (gage) and connector D.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



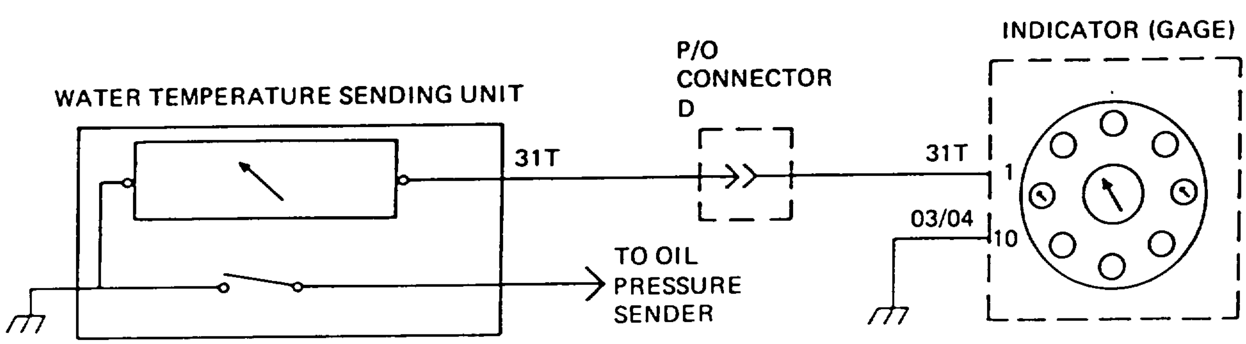


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

45. FUEL LEVEL GAGE SHOWS NO INDICATION.

WARNING
Diesel fuel is flammable. Do not perform this procedure near fire, flame, or sparks. Injury or death to personnel could result.

NOTE
Refer to wiring diagram for all wiring repair steps.

Step 1. Remove nut (1) and lock washer (2). Disconnect wire 30 (3) from fuel level gage (4) and check for +24 VDC between wire 30 and ground.

- If +24 VDC is present, replace fuel level gage (page 4-204).
- If +24 VDC is not present, go to step 2.

Step 2. With wire 30 (3) disconnected from fuel level gage, disconnect connector C (5) and check for +24 VDC between wire 30 and ground.

- If +24 VDC is present, repair wiring 30 between fuel level gage and connector C.
- If +24 VDC is not present, reconnect connector C and go to step 3.

Step 3. Loosen two captive screws (6) and pull bracket (7) out enough to gain access to area behind bracket.

Step 4. Remove two clamps (8) and pipe assembly (9).

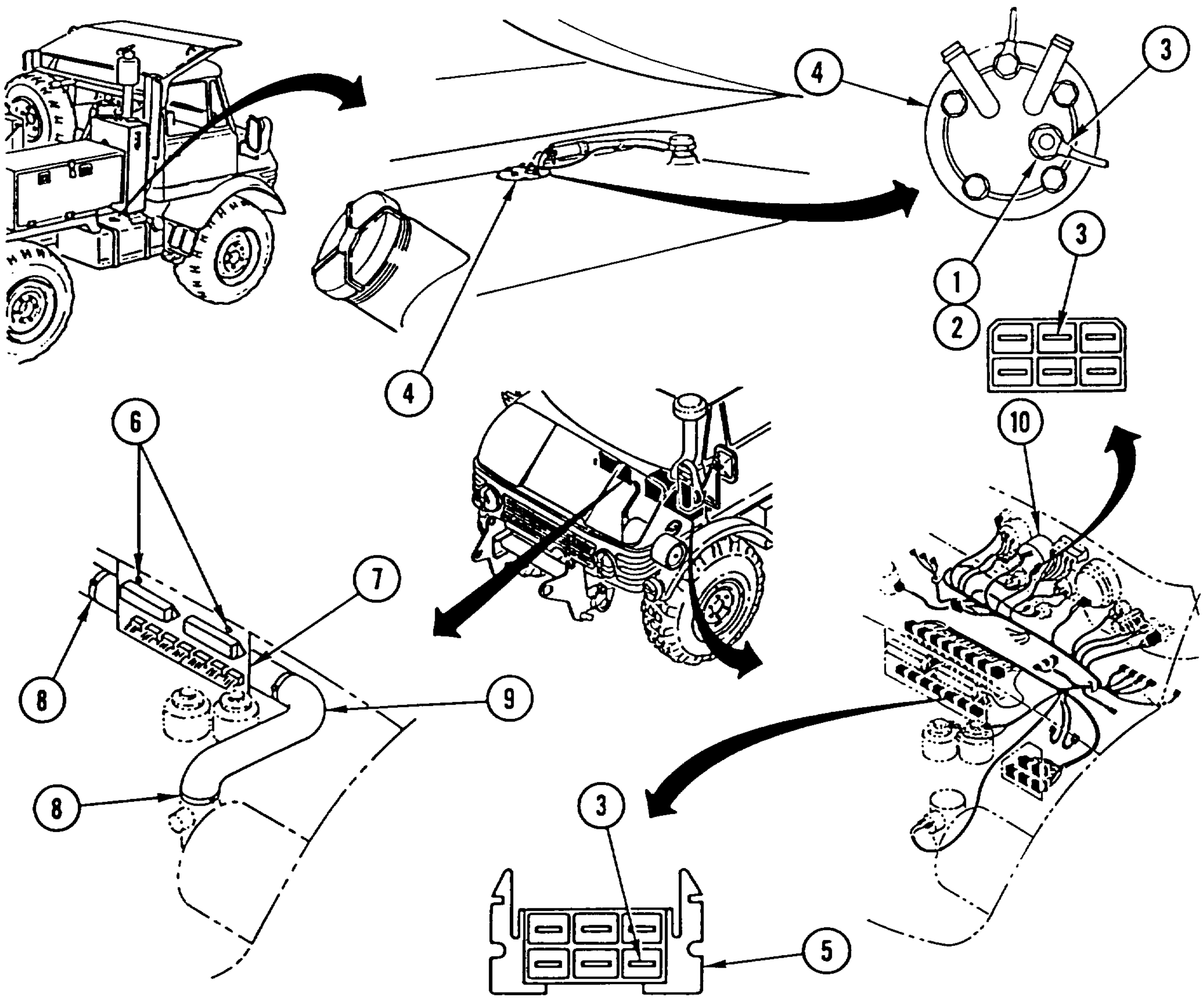
Step 5. With wire 30 (3) disconnected from fuel level gage, check for +24 VDC between wire 30 and ground at indicator (gage) (10).

- If +24 VDC is not present, reconnect wire 30 at fuel level gage and replace indicator (gage) (page 4-124).
- If +24 VDC is present, reconnect wire 30 at fuel level gage and repair wiring 30 between connector C and indicator (gage).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



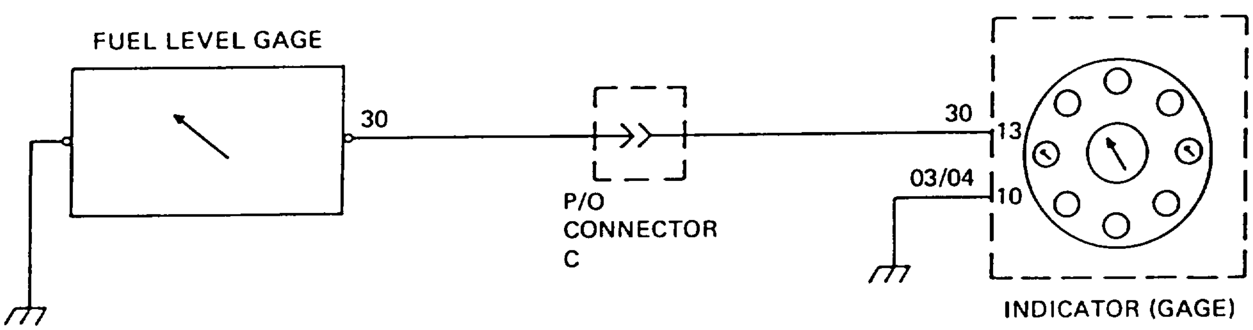


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

46. VOLTMETER GAGE SHOWS NO INDICATION.

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 2. Remove two clamps (3) and pipe assembly (4).

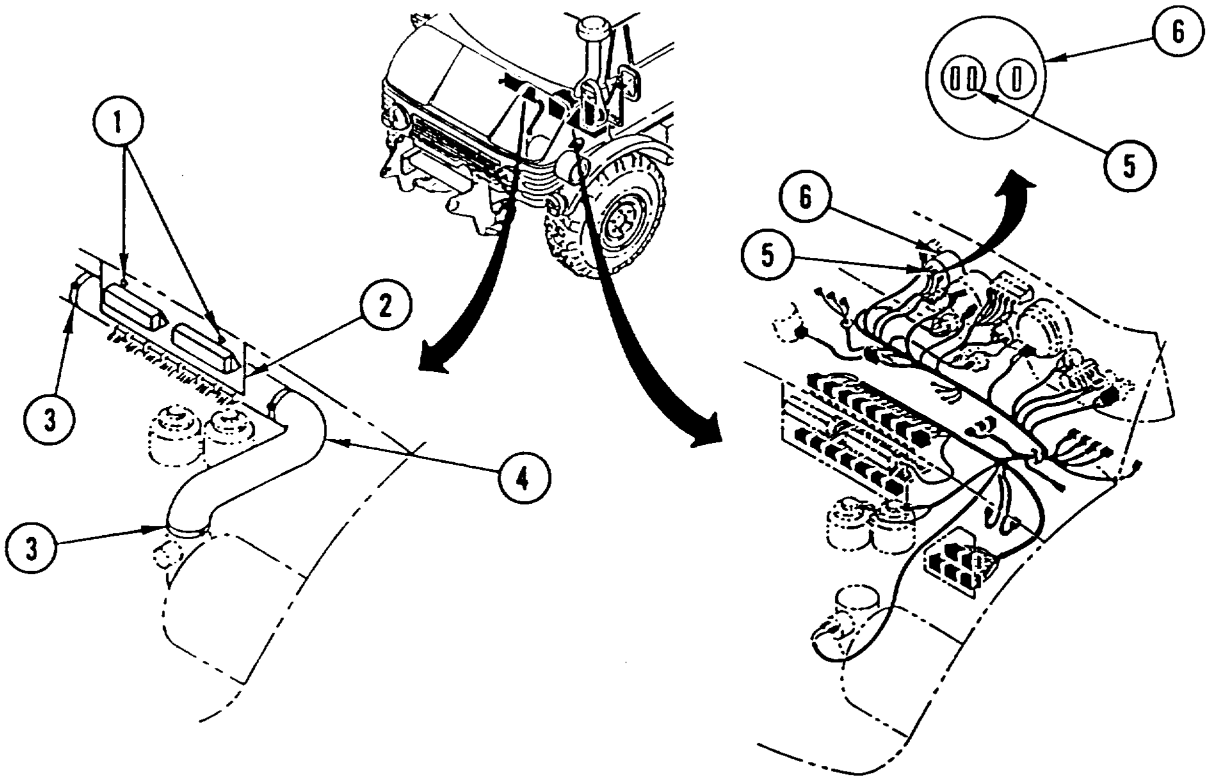
Step 3. Check for +24 VDC between wire 121 (5) and ground at voltmeter gage (6).

- If +24 VDC is present, replace voltmeter gage (page 4-135).
- If +24 VDC is not present, repair wiring 121 between voltmeter gage and ignition switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



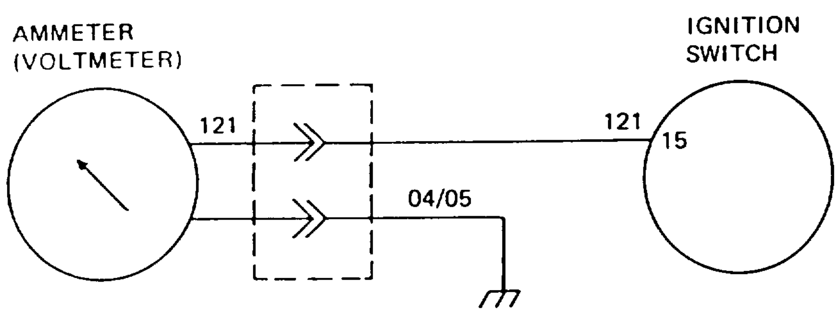


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or inspection
Corrective Action

Electrical SYSTEM (CONT)

47. COLD START SYSTEM WILL NOT OPERATE.

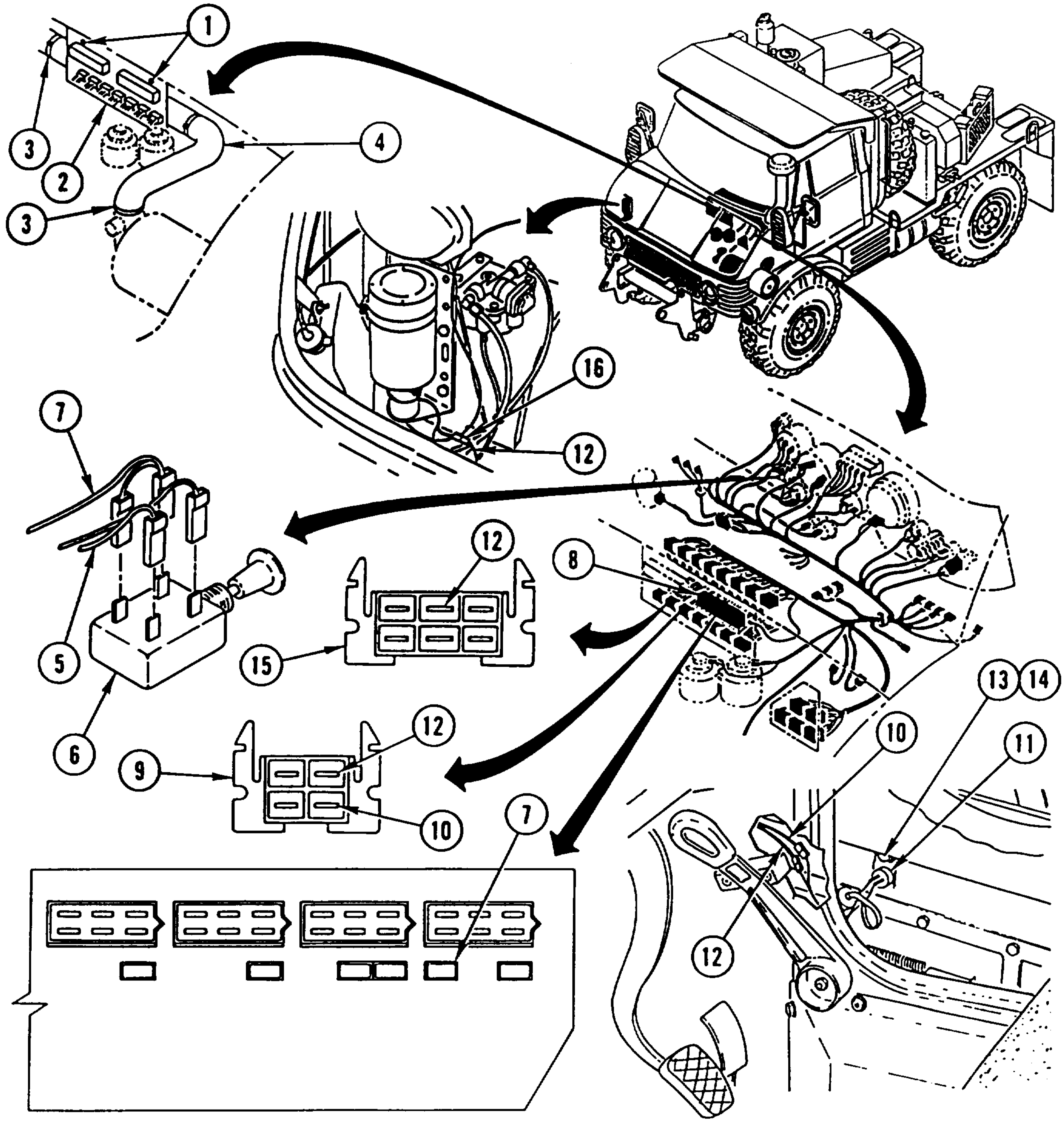


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Engine temperature must be below 32°F (0°C) and starter switch must be depressed for cold start system to operate.
- Refer to wiring diagram (page 3-155) for all wiring repair steps.

Step 1. Check ether supply bottle.

- If ether supply bottle is empty, replace bottle (page 4-55).
- If ether supply bottle is not empty, go to step 2.

Step 2. Loosen two captive screws (1) and pull bracket (2) out enough to gain access to area behind bracket.

Step 3. Remove two clamps (3) and pipe assembly (4).

Step 4. Check for +24 VDC between wire 28 (5) and ground at cold start switch (6).

- If +24 VDC is not present, repair wiring 28 between cold start switch and starter switch.
- If +24 VDC is present, go to step 5.

Step 5. Engage cold start switch (6) and check for +24 VDC between wire 283 (7) and ground at cold start switch.

- If +24 VDC is not present, replace cold start switch (page 4-136).
- If +24 VDC is present, go to step 6.

Step 6. Check for +24 VDC between wire 283 (7) and ground at fuse box 1 (8).

- If +24 VDC is not present, repair wiring 283 between fuse box 1 and cold start switch.
- If +24 VDC is present, go to step 7.

Step 7. Disconnect connector E (9) and check for +24 VDC between wire 284 (10) and ground.

- If +24 VDC is not present, repair wiring 284 between connector E and fuse box 1.
- If +24 VDC is present, reconnect connector E and go to step 8.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 8. Check for +24 VDC between wire 284 (10) and ground at engine temperature switch (11).

- If +24 VDC is not present, repair wiring 284 between engine temperature switch and connector E.
- If +24 VDC is present, go to step 9.

Step 9. Check for +24 VDC between wire 286 (12) and ground at engine temperature switch (11).

- If +24 VDC is not present, remove screw (13) and lock washer (14) and replace engine temperature switch (11).
- If +24 VDC is present, go to step 10.

Step 10. Disconnect connector E (9) and check for +24 VDC between wire 286 (12) and ground.

- If +24 VDC is not present, repair wiring 286 between connector E and engine temperature switch.
- If +24 VDC is present, reconnect connector E and go to step 11.

Step 11. Disconnect connector F (15) and check for +24 VDC between wire 286 (12) and ground.

- If +24 VDC is not present, repair wiring 286 between connector F and engine temperature switch.
- If +24 VDC is present, reconnect connector F and go to step 12.

Step 12. Disconnect connector W (16) and check for +24 VDC between wire 286 (12) and ground.

- If +24 VDC is present, replace cold start aid (page 4-55).
- If +24 VDC is not present, repair wiring 286 between connector W and connector F.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

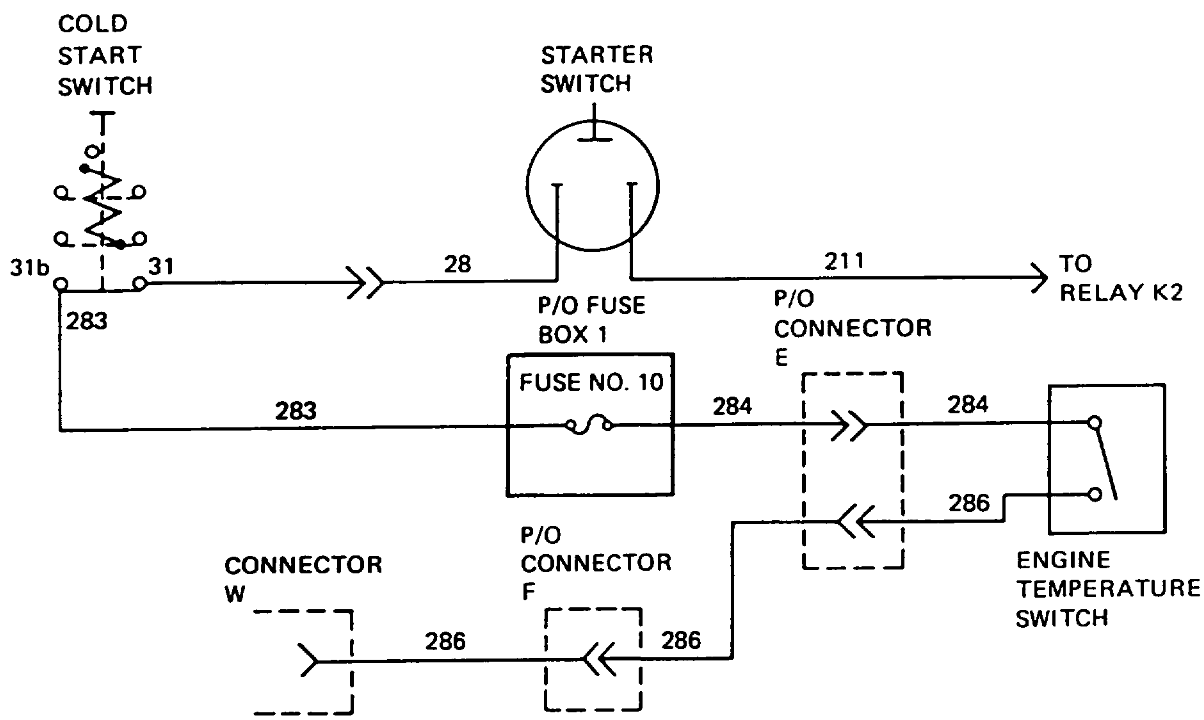


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

48. DRIVER SIDE WINDSHIELD HEATER WILL NOT OPERATE.

NOTE

Refer to wiring diagram (page 3-159) for all wiring repair steps.

Step 1. Pull windshield heater control switch 1 (1) and verify lamp (2) is lit.

- If lamp is lit, go to step 4.
- If lamp is not lit, go to step 2.

Step 2. Check for +24 VDC between wire 623 (3) and ground at windshield heater control switch 1 (1).

- If +24 VDC is present, replace lamp (2) and go to step 4.
- If +24 VDC is not present, go to step 3.

Step 3. Disconnect connector N (4) and check for +24 VDC between wire 623 (3) and ground.

- If +24 VDC is present, repair wiring 623 between connector N and windshield heater control switch 1.
- If +24 VDC is not present, repair wiring 623 between connector N and cab heater.

Step 4. Check for +24 VDC between wire 624 (5) and ground at windshield heater control switch 1 (1).

- If +24 VDC is not present, repace windshield heater control switch 1 (page 4-139).
- If +24 VDC is present, go to step 5.

Step 5. Disconnect connector N (4) and check for +24 VDC between wire 624 (5) and ground.

- If +24 VDC is present, repair wiring 624 between connector N and windshield heater control switch 1.
- If +24 VDC is not present, reconnect connector N and go to step 6.

Step 6. Check for +24 VDC between wire 624 (5) and ground at relay K5 (6).

- If +24 VDC is present, repair wiring 624 between connector N and relay K5.
- If +24 VDC is not present, go to step 7.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

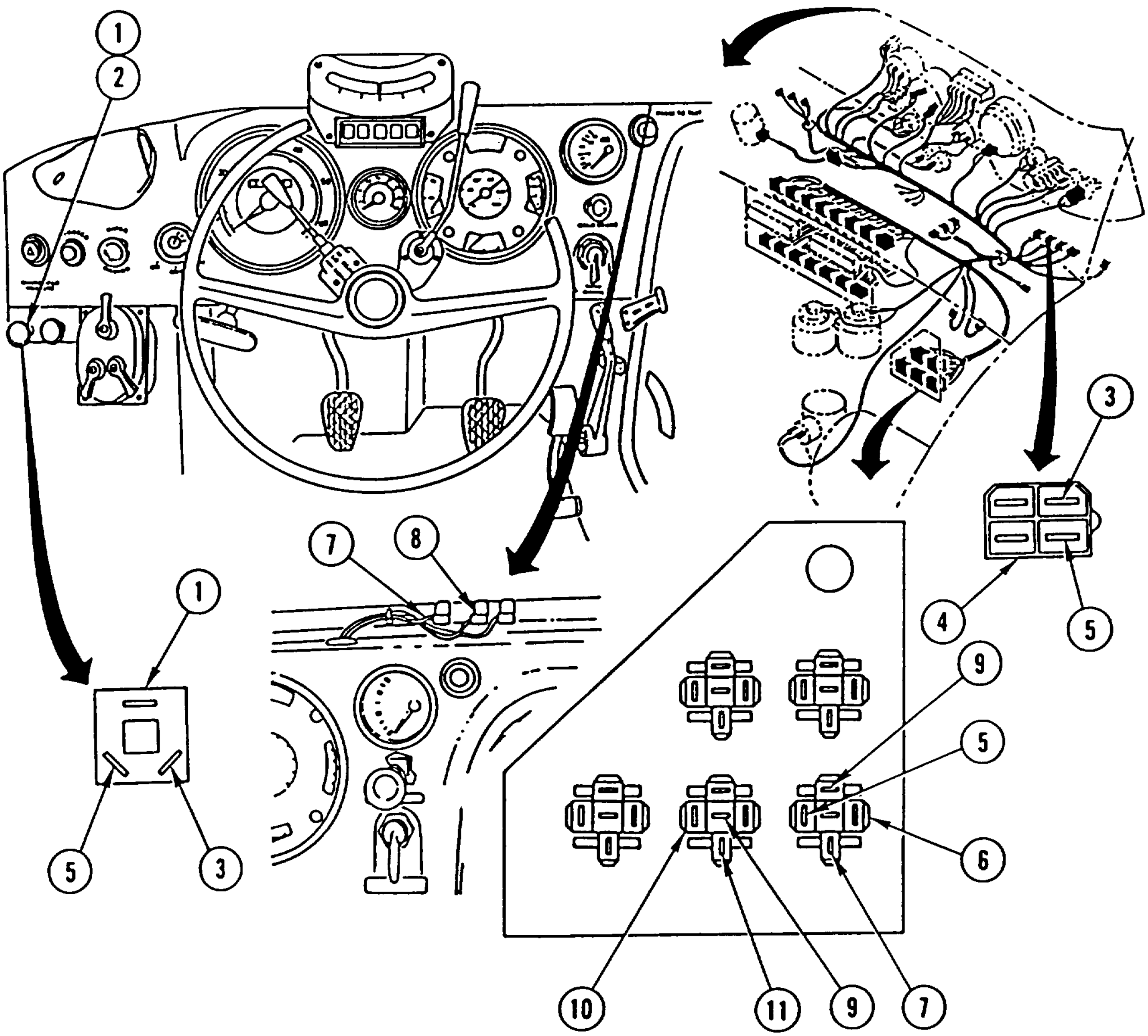


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 7. Check for +24 VDC between wire 622 (7) and ground at relay K5 (6).

- If +24 VDC is not present, go to step 9.
- If +24 VDC is present, go to step 8.

Step 8. Check for +24 VDC between wire 622 (7) and ground at windshield heater (8).

- If +24 VDC is present, notify direct support maintenance.
- If +24 VDC is not present, repair wiring 622 between windshield heater and relay K5.

Step 9. Check for +24 VDC between wire 626 (9) and ground at relay K5 (6).

- If +24 VDC is present, replace relay K5.
- If +24 VDC is not present, go to step 10.

Step 10. Check for +24 VDC between wire 626 (9) and ground at relay K4 (10).

- If +24 VDC is present, repair wiring 626 between relay K4 and relay K5.
- If +24 VDC is not present, go to step 11.

Step 11. Check for +24 VDC between wire 62 (11) and ground at relay K4 (10).

- If +24 VDC is present, replace relay K4.
- If +24 VDC is not present, repair wiring 62 between relay K4 and fuse box 2.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)

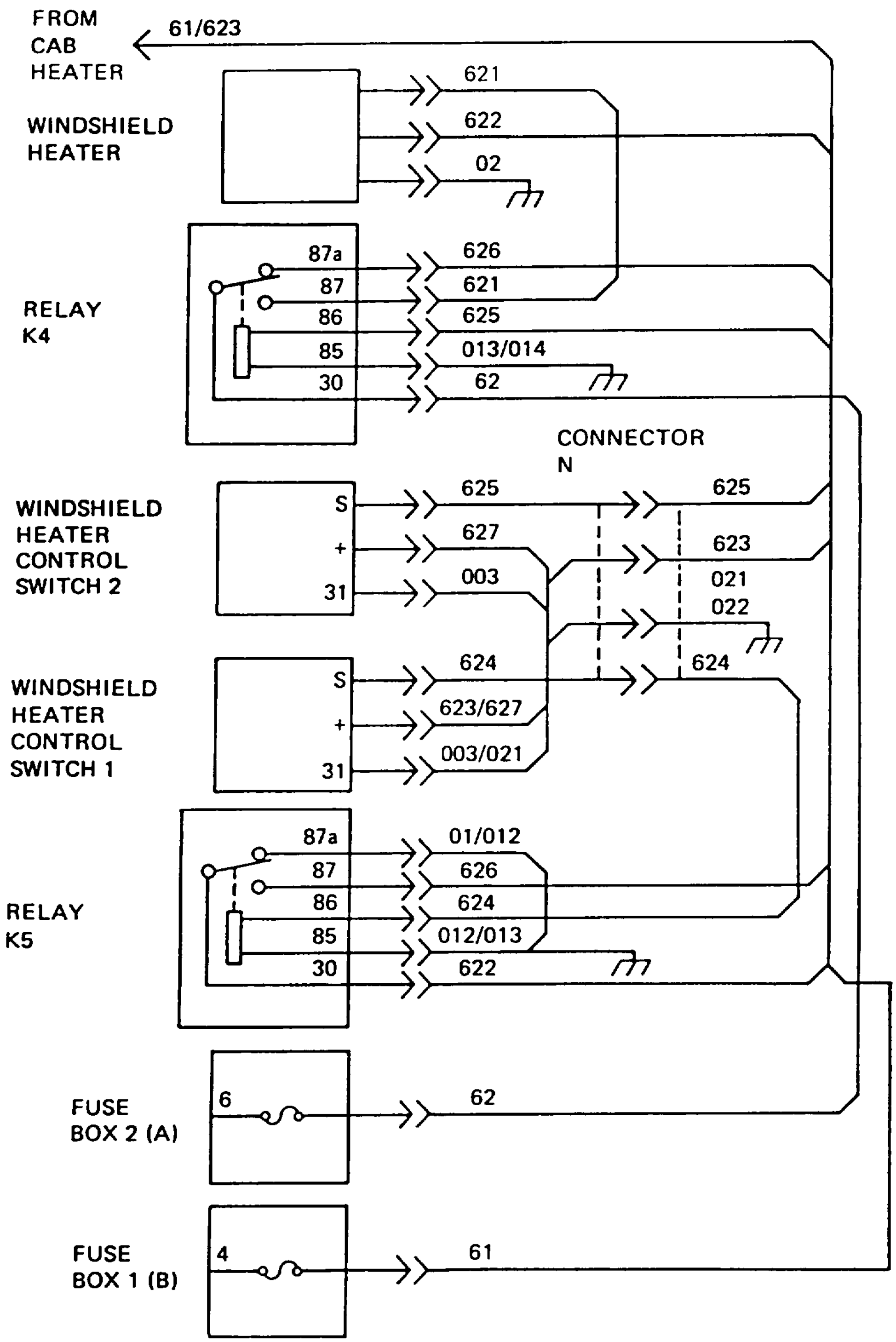


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

49. PASSENGER SIDE WINDSHIELD HEATER WILL NOT OPERATE.

NOTE

- Make sure driver side windshield heater is turned on first. If not, passenger side windshield heater will not operate.
- Perform the following steps only after proper operation of driver side windshield heater has been verified.
- Refer to wiring diagram (page 3-162) for ail wiring repair steps.

Step 1. Pull windshield heater control switch 1 (1) and then switch 2 (2) and verify lamp (3) is lit.

- If lamp is lit, go to step 3.
- If lamp is not lit, go to step 2.

Step 2. Check for +24 VDC between wire 627 (4) and ground at windshield heater control switch 2 (2).

- If +24 VDC is not present, repair wiring 627 between windshield heater control switch 1 and switch 2.
- If +24 VDC is present, replace lamp (3) and go to step 3.

Step 3. Check for +24 VDC between wire 625 (5) and ground at windshield heater control switch 2 (2).

- If +24 VDC is not present, replace windshield heater control switch 2 (page 4-139).
- If +24 VDC is present, go to step 4.

Step 4. Disconnect connector N (6) and check for +24 VDC between wire 625 (5) and ground.

- If +24 VDC is not present, repair wiring 625 between windshield heater control switch 2 and connector N.
- If +24 VDC is present, reconnect connector N and go to step 5.

Step 5. Check for +24 VDC between wire 625 (5) and ground at relay K4 (7).

- If +24 VDC is not present, repair wiring 625 between connector N and relay K4.
- If +24 VDC is present, go to step 6.

Step 6. Check for +24 VDC between wire 621 (8) and ground at relay K4 (7).

- If +24 VDC is not present, replace relay K4.
- If +24 VDC is present, go to step 7.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 7. Check for +24 VDC between wire 621 (8) and ground at windshield heater (9).

- If +24 VDC is not present, repair wiring 621 between windshield heater and relay K4.
- If +24 VDC is present, notify direct support maintenance.

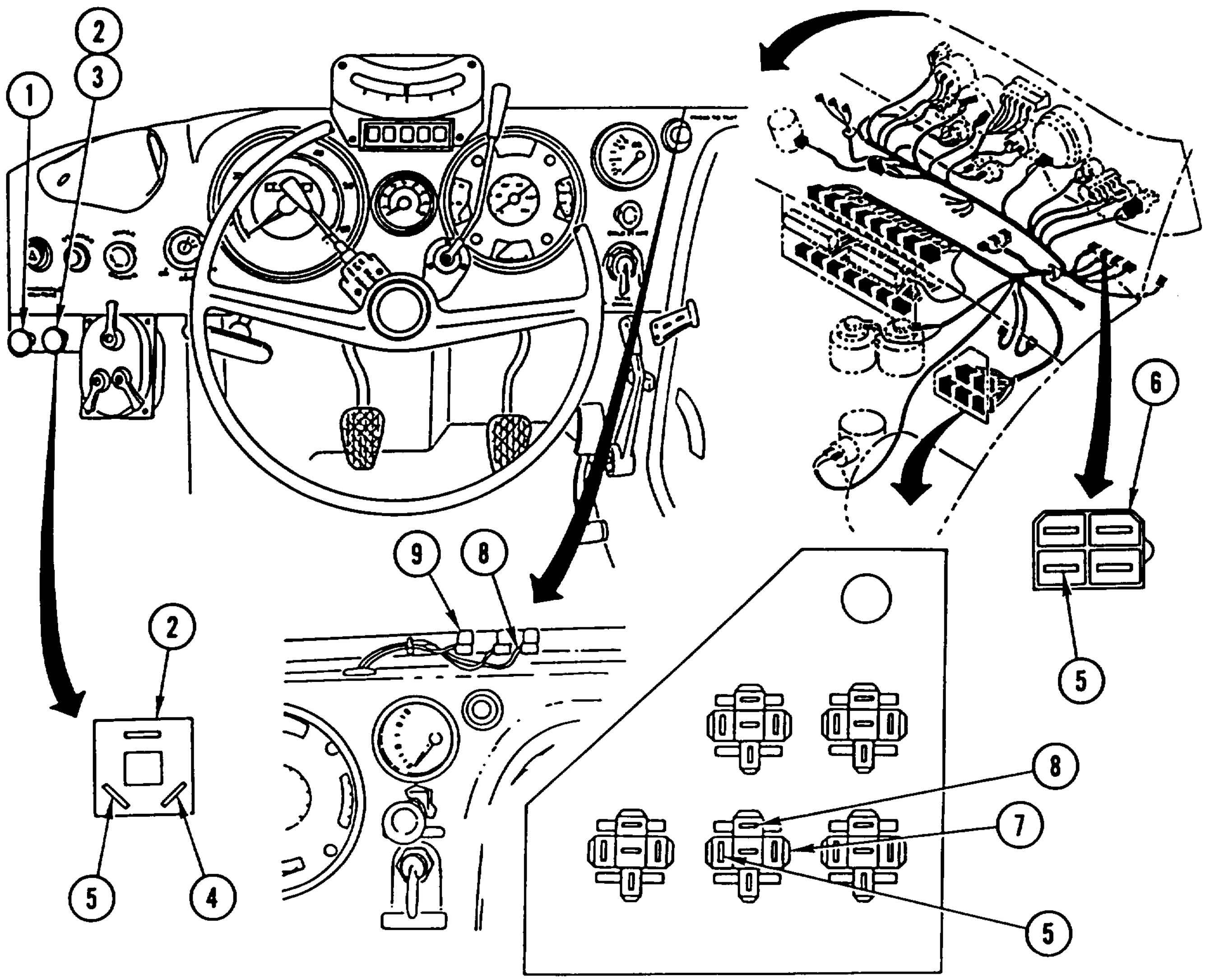


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

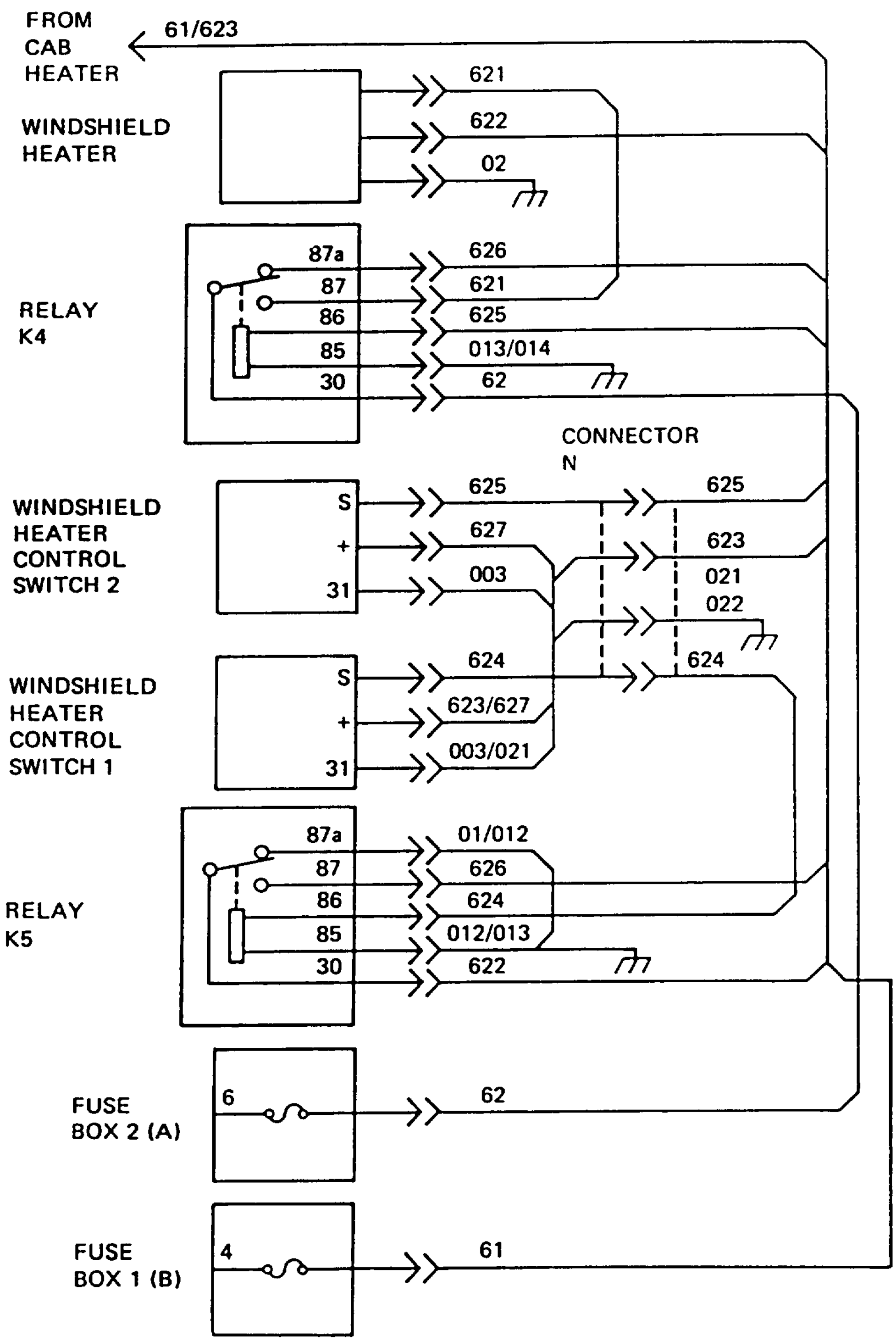


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

50. HAZARD WARNING LIGHTS WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, master light switch set to SER DRIVE, and hazard warning switch depressed. Failure to do so will cause erroneous results.
- Perform the following steps only after proper operation of turn signals has been verified.
- Refer to wiring diagram (page 3-166) for all wiring repair steps.

Step 1. Remove hazard warning switch (1) and check for +24 VDC between wire 45 (2) and ground.

- If +24 VDC is not present, repair wiring 45 between hazard warning switch and fuse box 1.
- If +24 VDC is present, go to step 2.

Step 2. Check for +24 VDC between wire 451 (3) and ground at hazard warning switch (1).

- If +24 VDC is not present, repair wiring 451 between hazard warning switch terminals 15 and 30.
- If +24 VDC is present, go to step 3.

Step 3. Check for +24 VDC at wire 46 (4) and wire 452 (5) and ground at hazard warning switch (1).

- If +24 VDC is not present, replace hazard warning switch.
- If +24 VDC is present, go to step 4.

Step 4. Check for +24 VDC between wire 461 (6) and ground at turn signal flasher relay (7).

- If +24 VDC is not present, replace turn signal flasher relay (page 4-196).
- If +24 VDC is present, go to step 5.

Step 5. Check for +24 VDC between wire 461 (6) and ground at hazard warning switch (1).

- If +24 VDC is not present, repair wiring 461 between turn signal flasher relay and hazard warning switch.
- If +24 VDC is present, go to step 6.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 6. Check for +24 VDC between wire 462 (8) and ground at turn signal lever (9).

- If +24 VDC is not present, repair wiring 462 between hazard warning switch and turn signal lever.
- If +24 VDC is present, go to step 7.

Step 7. Check for +24 VDC between wire 463 (10) and ground at hazard warning switch (1).

- If +24 VDC is not present, replace hazard warning switch.
- If +24 VDC is present, go to step 8.

Step 8. Check for +24 VDC between wire 463 (10) and ground at relay K3 (11).

- If +24 VDC is not present, repair wiring 463 between hazard warning switch and relay K3.
- If +24 VDC is present, go to step 9.

Step 9. Check for +24 VDC between wire 464 (12) and ground at relay K3 (11).

- If +24 VDC is not present, repair wiring 464 between turn signal lever and relay K3.
- If +24 VDC is present, go to step 10.

Step 10. Check for +24 VDC between wire 445 (13) and ground at relay K3 (11).

- If +24 VDC is not present, replace relay K3.
- If +24 VDC is present, go to step 11.

Step 11. Check for +24 VDC between wire 445 (13) and ground at brake light diode (14).

- If +24 VDC is not present, repair wiring 445 between relay K3 and brake light diode.
- If +24 VDC is present, go to step 12.

Step 12. Check for +24 VDC between wire 443 (15) and ground at brake light diode (14).

- If +24 VDC is not present, replace brake light diode (page 4-168).
- If +24 VDC is present, go to step 13.

Step 13. Check for +24 VDC between wire 443 (15) and ground at connector K (16).

- If +24 VDC is not present, repair wiring 443 between brake light diode and connector K.
- If +24 VDC is present, go to step 14.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 14. Check for +24 VDC between wire 444 (17) and ground at turn signal lever (9).

- If +24 VDC is present, replace turn signal lever (page 4-122).
- If +24 VDC is not present, repair wiring 444 between connector K and turn signal lever.

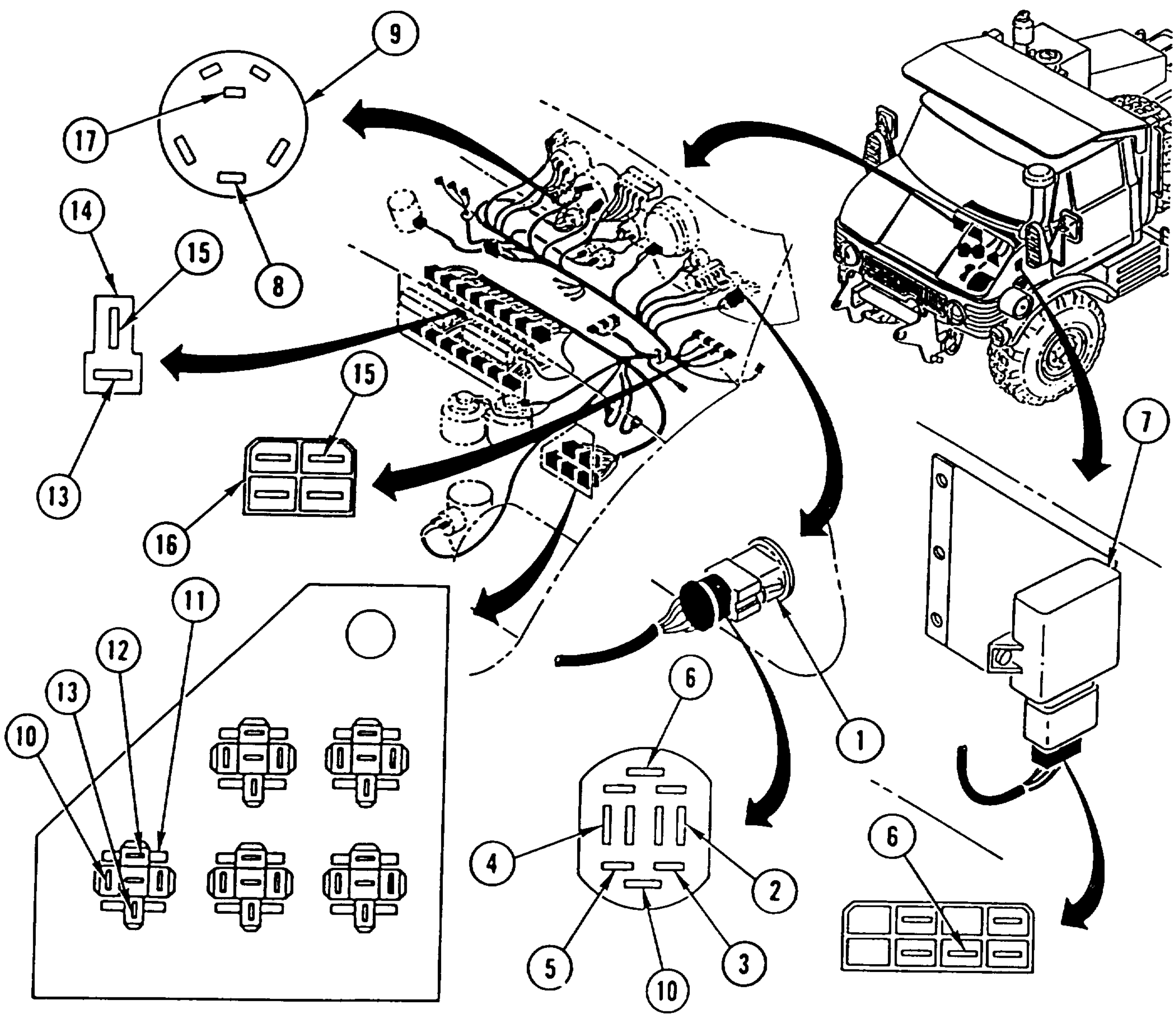
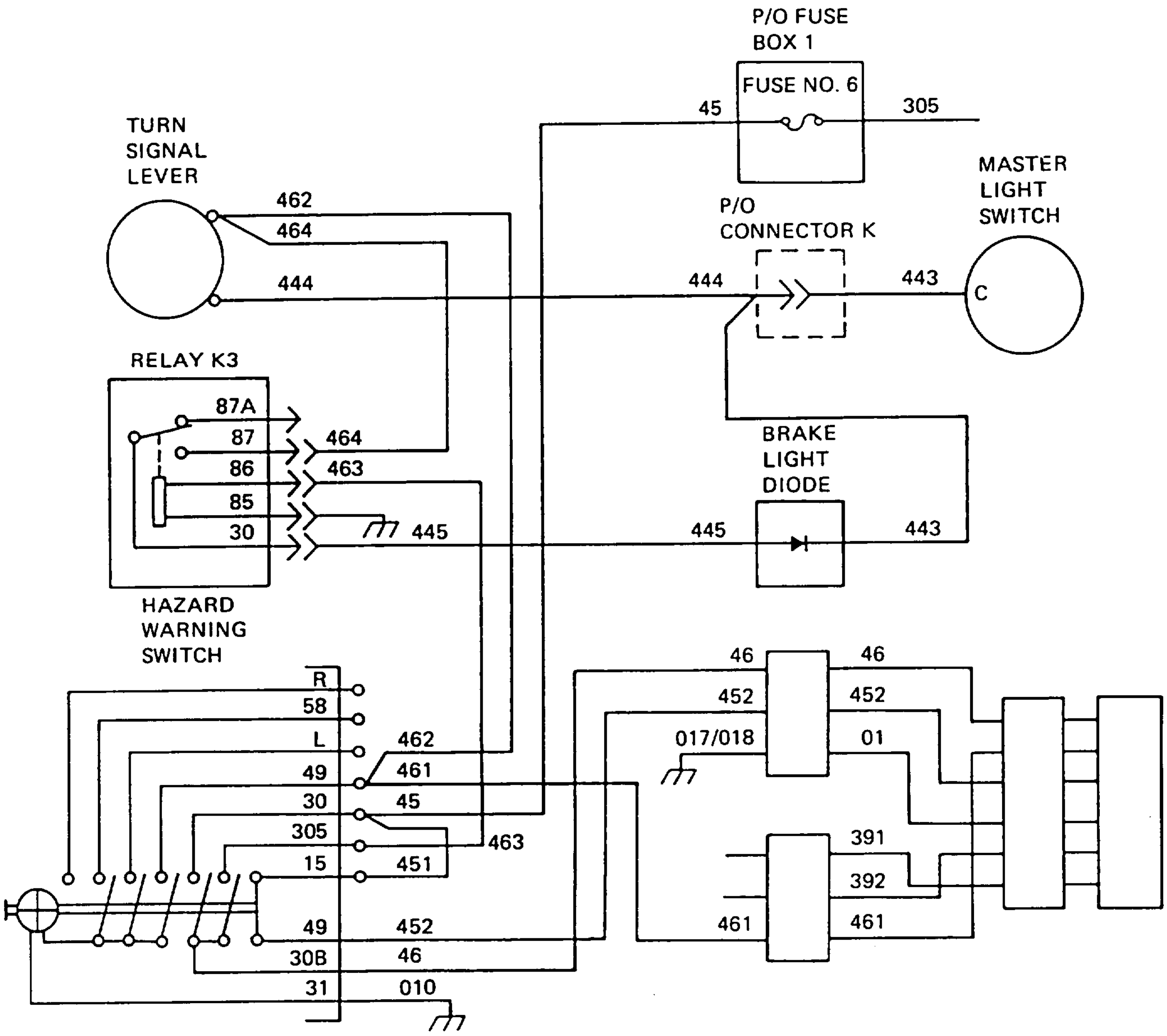


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



51. ALL INSTRUMENT CLUSTER PANEL LIGHT INDICATORS WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

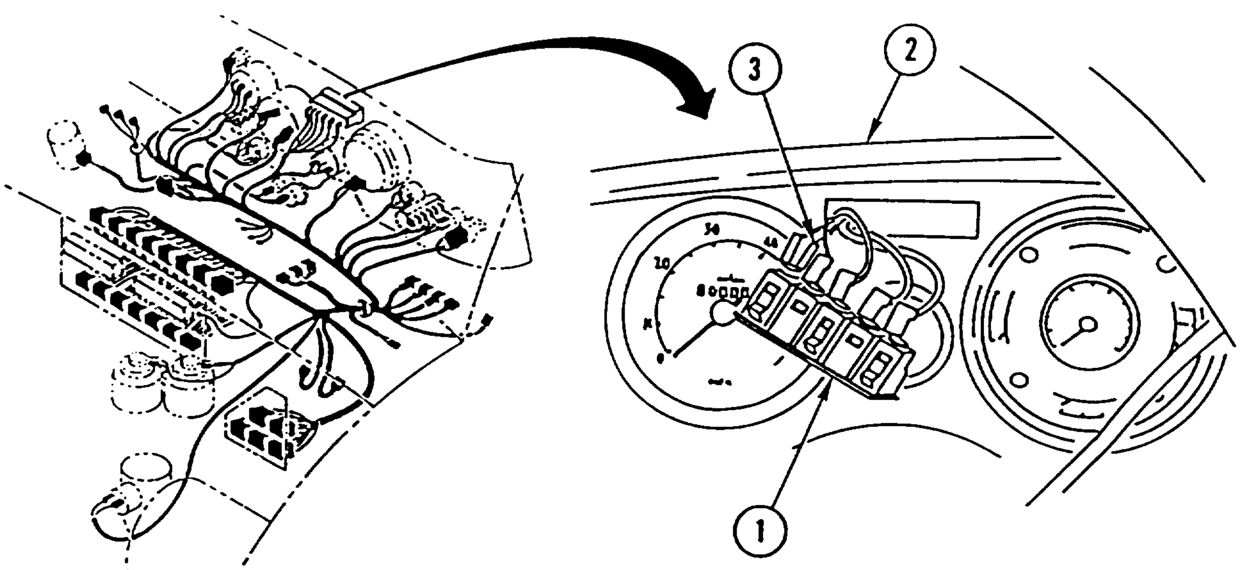
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Pull instrument cluster panel light (1) out of dashboard (2) and check for +24 VDC between wire 372 (3) and ground.

- If +24 VDC is present, replace instrument cluster panel light.
- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.



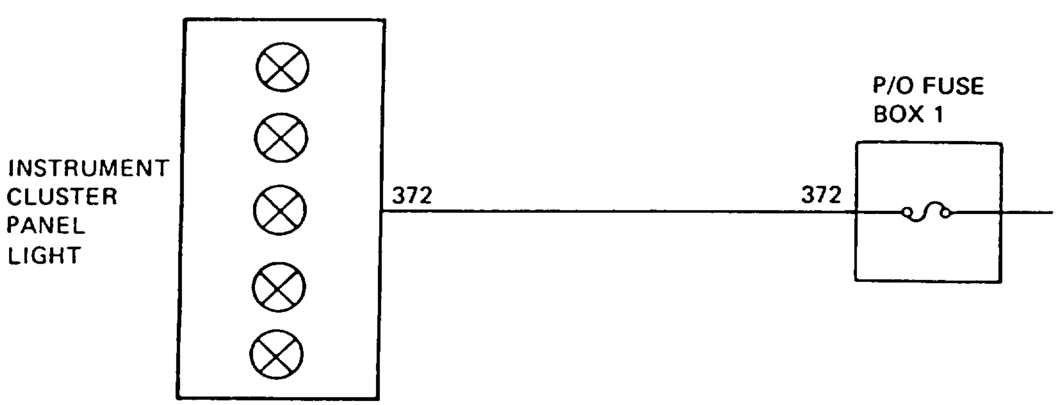


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

52. PTO INDICATOR LIGHT WILL NOT LIGHT.

NOTE

Refer to wiring diagram for all wiring repair steps.

Step 1. Pull instrument cluster panel light (1) out of dashboard (2).

Step 2. Remove PTO indicator lamp (3) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Perform steps 3 thru 5 with PTO lever engaged.

Step 3. Check for +24 VDC between wire 372 (4) and ground at instrument cluster panel light (1).

- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.
- If +24 VDC is present, go to step 4.

Step 4. Disconnect connector A (5) and check for +24 VDC between wire 22 (6) and ground.

- If +24 VDC is not present, repair wiring 22 between connector A and instrument cluster panel light.
- If +24 VDC is present, reconnect connector A and go to step 5.

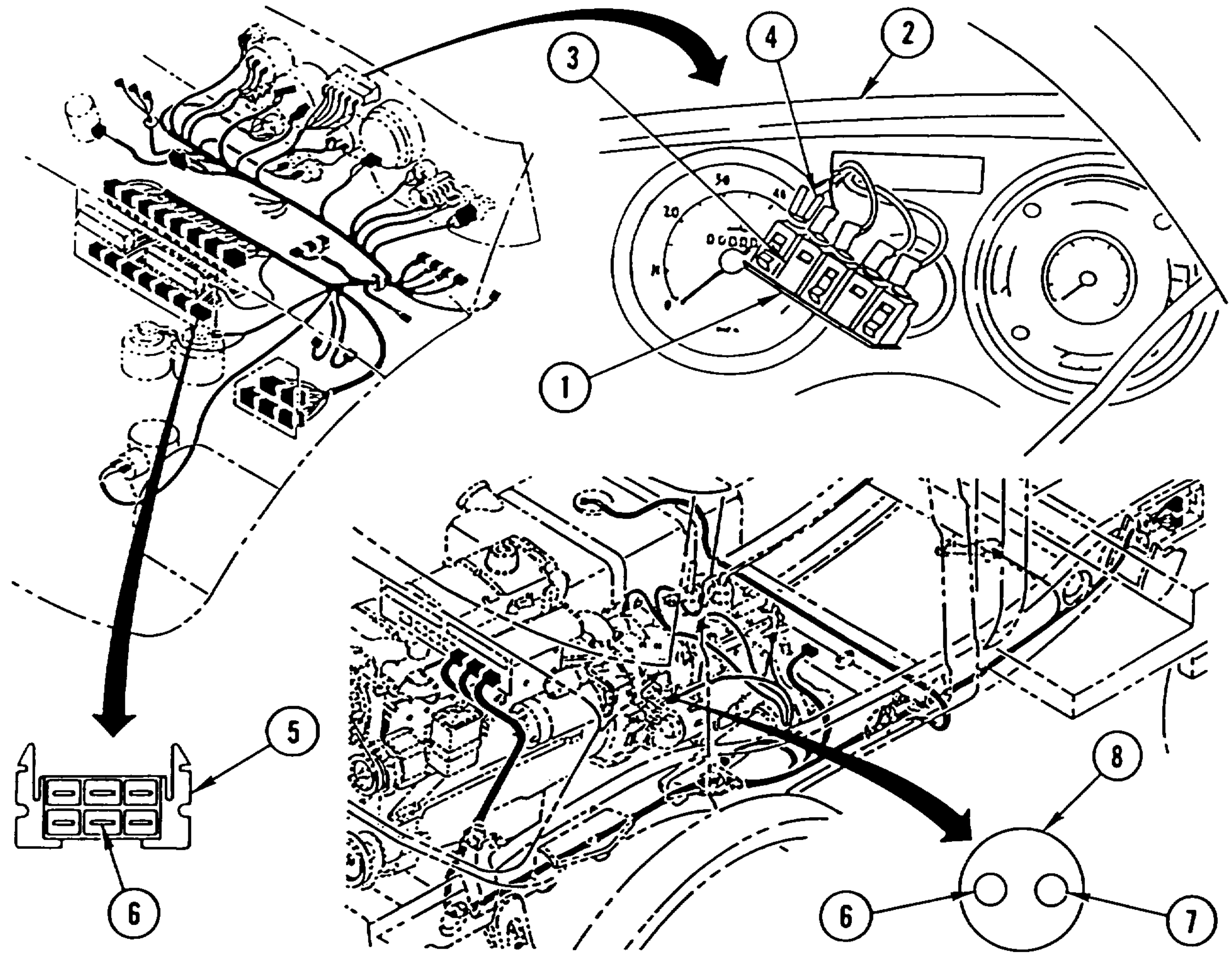
Step 5. Set master light switch to OFF and connect jumper between wire 22 (6) and wire 04 (7) at PTO indicator switch (8). Set master light switch to PANEL BRT and check if PTO indicator light is lit.

- If PTO indicator light is lit, replace PTO indicator switch (page 4-206).
- If PTO indicator light is not lit, repair wiring 22 between PTO indicator switch and connector A.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



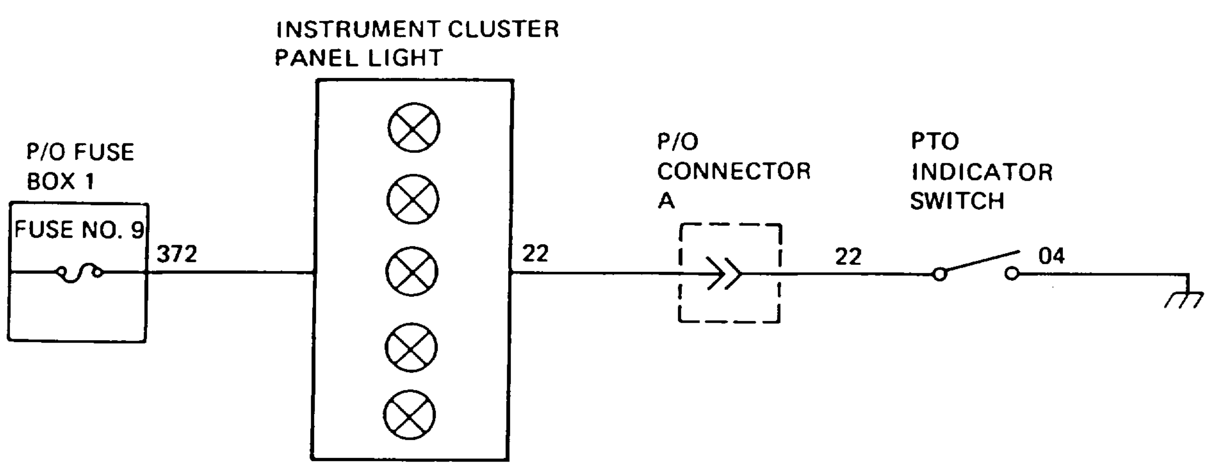


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

53. DIFFERENTIAL LOCK INDICATOR LIGHT WILL NOT LIGHT.

NOTE

Refer to wiring diagram for all wiring repair steps.

Step 1. Pull instrument cluster panel light (1) out of dashboard (2).

Step 2. Remove differential lock indicator lamp (3) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Perform steps 3 thru 5 with differential lock engaged.

Step 3. Check for +24 VDC between wire 372 (4) and ground at instrument cluster panel light (1).

- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.
- If +24 VDC is present, go to step 4.

Step 4. Disconnect connector C (5) and check for +24 VDC between wire 221 (6) and ground.

- If +24 VDC is not present, repair wiring 221 between connector C and instrument cluster panel light.
- If +24 VDC is present, reconnect connector C and go to step 5.

Step 5. Set master light switch to OFF and connect jumper between wire 221 (6) and wire 03 (7) at differential lock indicator switch (8). Set master light switch to PANEL BRT and check if differential lock indicator light is lit.

- If differential lock indicator light is lit, replace differential lock indicator switch (page 4-207).
- If differential lock indicator light is not lit, repair wiring 221 between differential lock indicator switch and connector C.

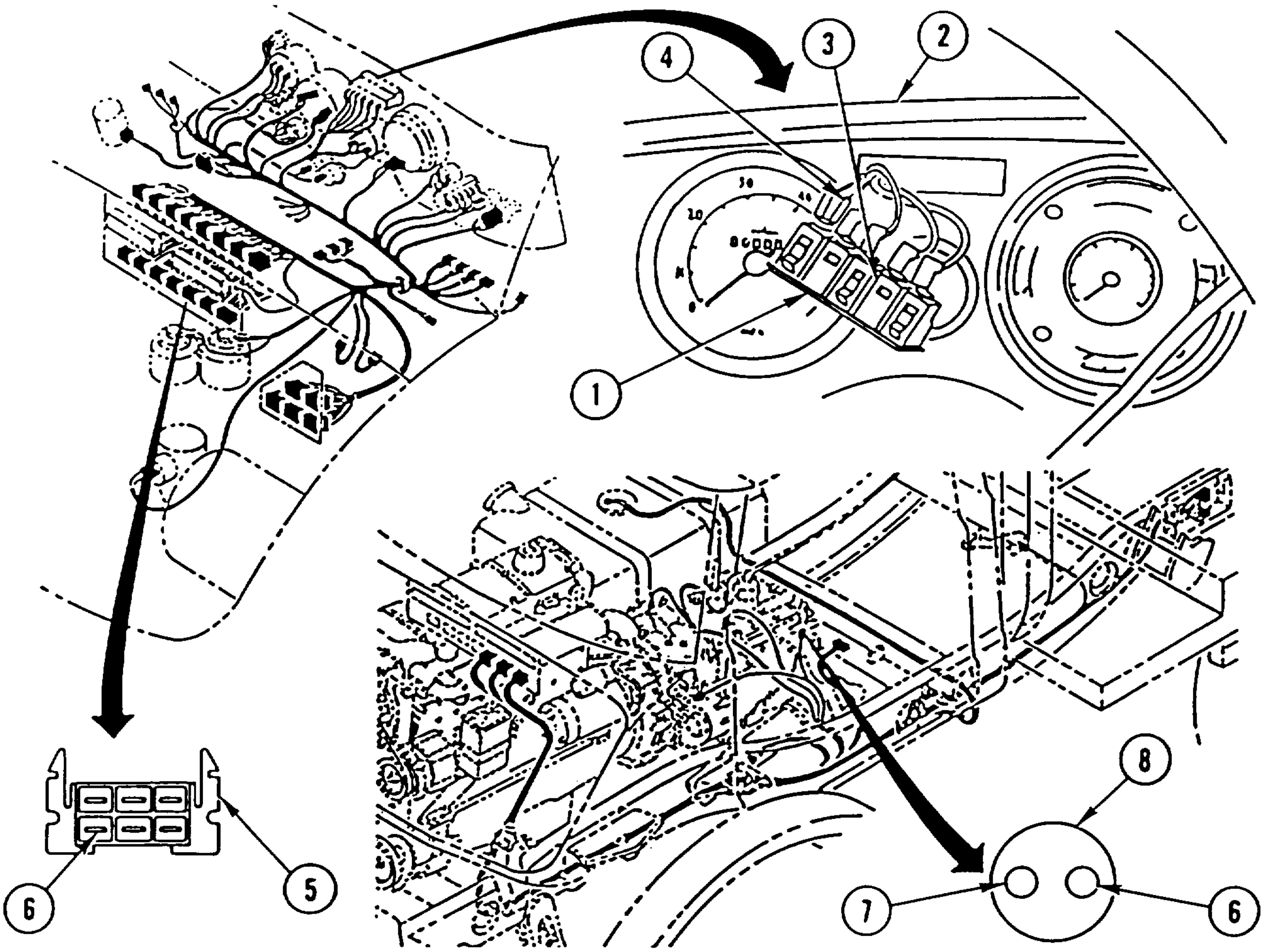
Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)



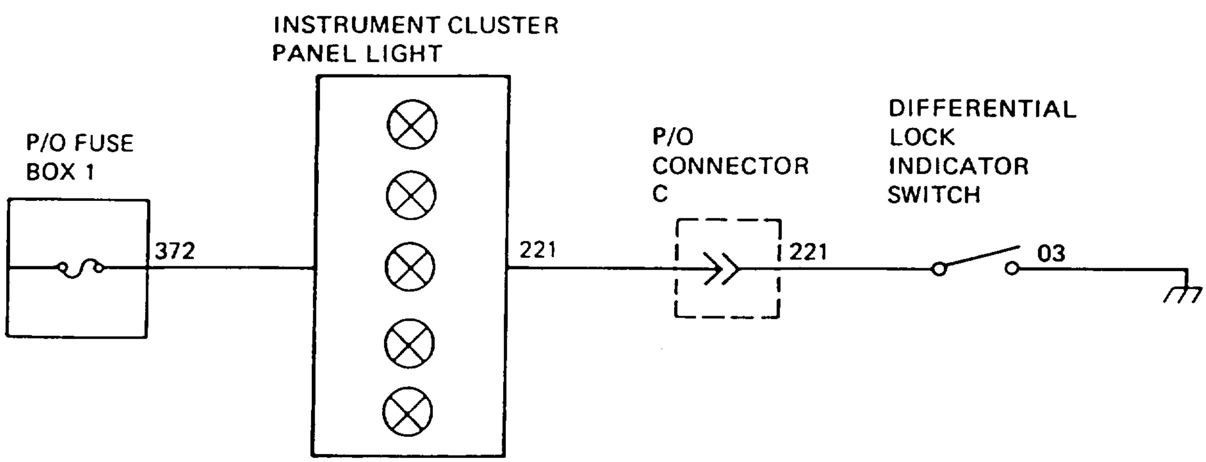


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

54. BRAKE INDICATOR LIGHT WILL NOT LIGHT WITH PARKING BRAKE APPLIED.

NOTE

Refer to wiring diagram (page 3-174) for all wiring repair steps.

Step 1. Pull instrument cluster panel light (1) out of dashboard (2).

Step 2. Remove brake indicator lamp (3) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Perform steps 3 thru 6 with parking brake applied.

Step 3. Check for +24 VDC between wire 372 (4) and ground at instrument cluster panel light (1).

- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.
- If +24 VDC is present, go to step 4.

Step 4. Disconnect connector C (5) and check for +24 VDC between wire 332 (6) and ground.

- If +24 VDC is not present, repair wiring 332 between connector C and instrument cluster panel light.
- If +24 VDC is present, reconnect connector C and go to step 5.

Step 5. Disconnect connector AF (7) and check for +24 VDC between wire 332 (6) and ground.

- If +24 VDC is not present, repair wiring 332 between connector C and connector AF.
- If +24 VDC is present, reconnect connector AF and go to step 6.

Step 6. Check for +24 VDC between wire 333 (8) and ground at parking brake switch (9).

- If +24 VDC is present, replace parking brake switch (page 4-210).
- If +24 VDC is not present, repair wiring 333 between connector AF and parking brake switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

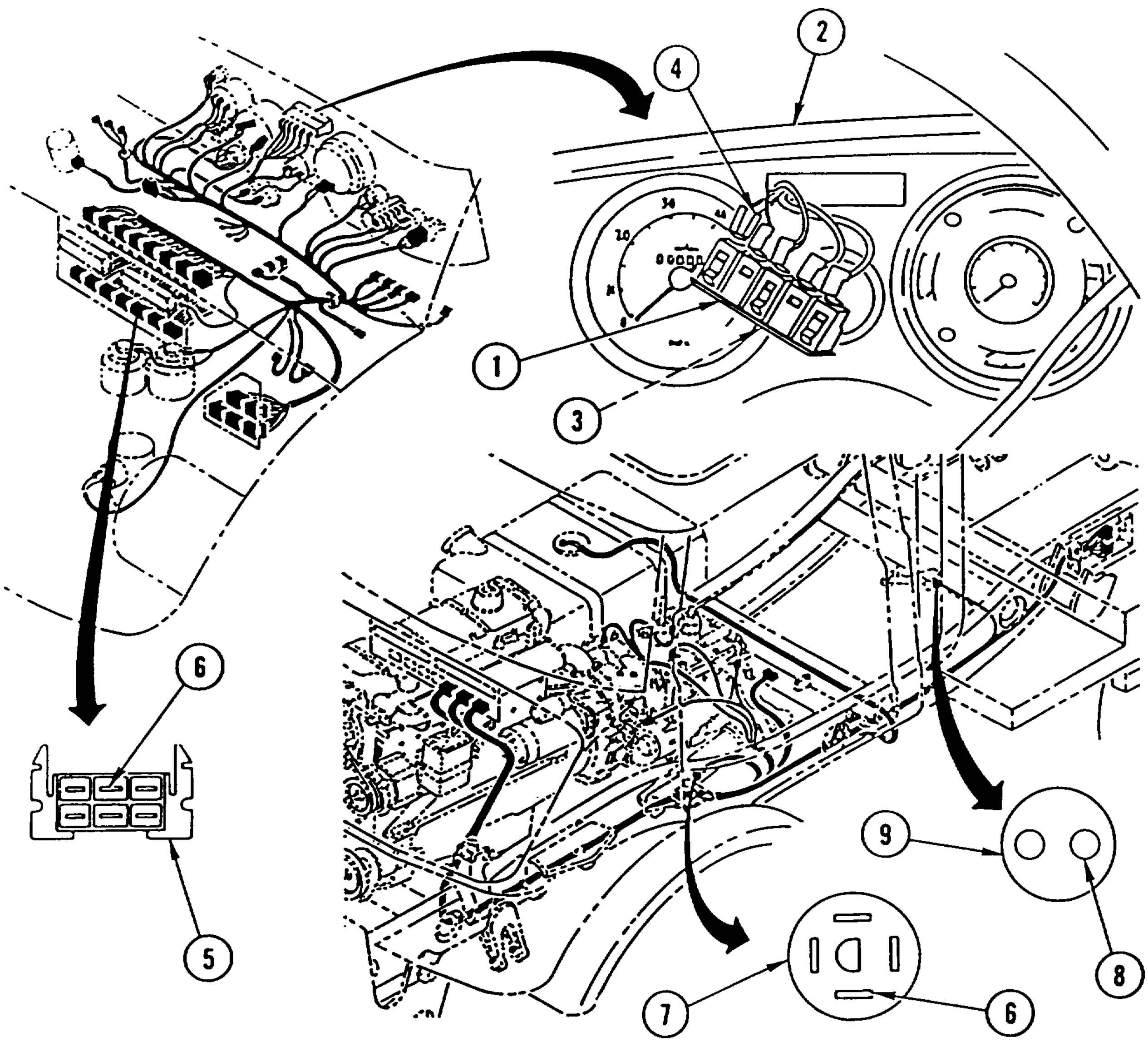


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

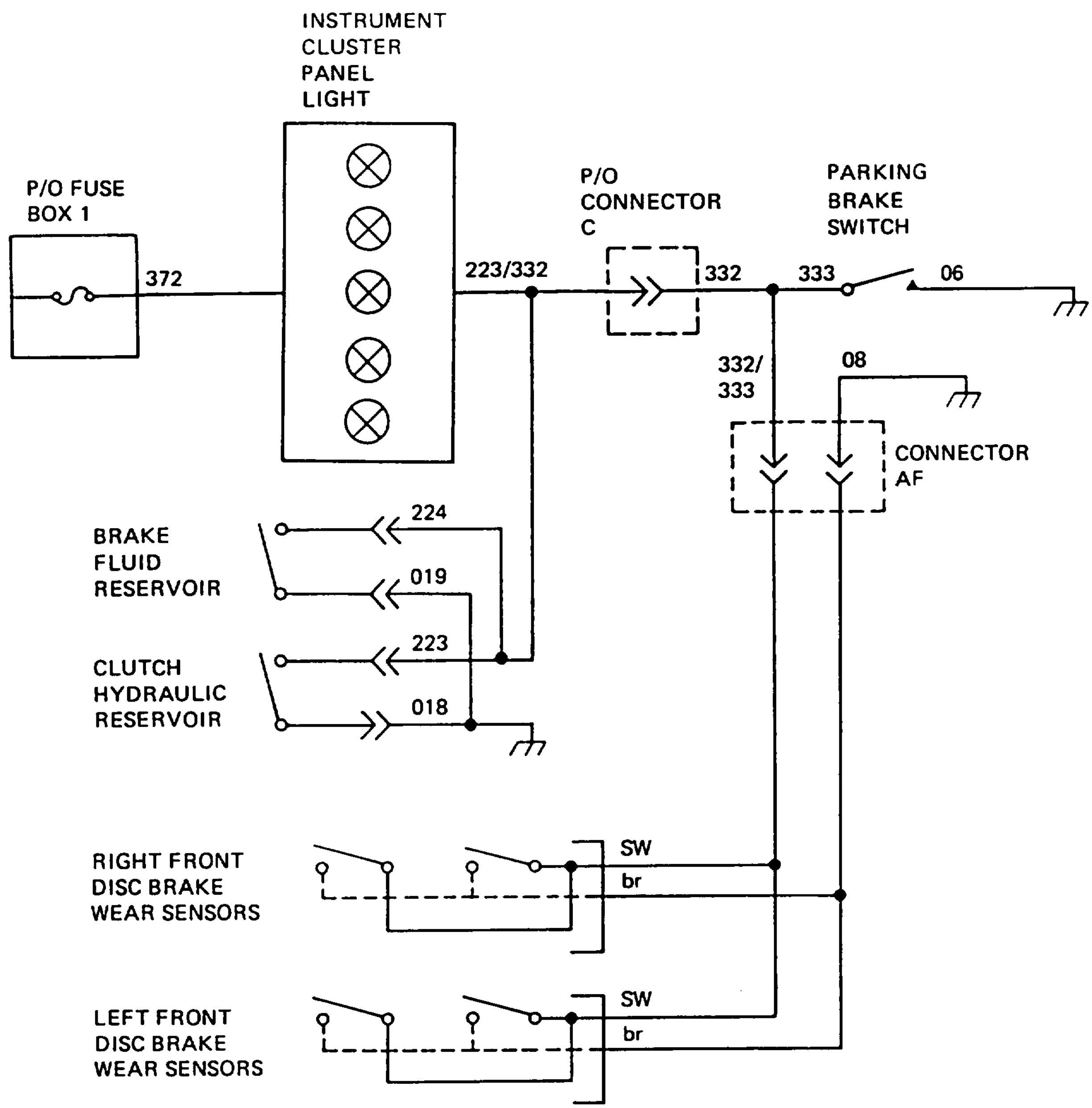


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

55. BRAKE INDICATOR LIGHT WILL NOT LIGHT WHEN BRAKE FLUID RESERVOIR OR CLUTCH HYDRAULIC RESERVOIR LOW.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-177) for all wiring repair steps.

Step 1. Set parking brake.

- if brake indicator light is not lit, perform Malfunction 54.
- if brake indicator light is lit, go to step 2.

NOTE

Perform steps 2 thru 5 with parking brake off.

Step 2. Disconnect wire 223 (1) and wire 224 (2) at reservoirs (3) and check for +24 VDC.

- If +24 VDC is present on only wire 223, repair wiring 224 between reservoirs.
- If +24 VDC is not present on either wire, repair wiring 223 between brake indicator light (in instrument cluster panel light) and reservoir.
- if +24 VDC is present on both wires, reconnect wire 223 and wire 224 and go to step 3.

Step 3. Disconnect wire 018 (4) and wire 019 (5) at reservoirs (3) and check for continuity to ground.

- If wire 018 is short to ground but wire 019 is not, repair wiring 019 between reservoirs.
- If both wires are open to ground, repair wiring 018 between reservoir and ground.
- If both wires are short to ground, reconnect wire 018 and wire 019 and go to step 4.

Step 4. Disconnect wire 223 (1), wire 224 (2), wire 018 (4), and wire 019 (5) at reservoirs (3).

Step 5. Remove filler opening caps (6 and 7) and check continuity between connectors (8 and 9) on each filler opening cap.

- Replace filler opening cap that shows an open between connectors.

Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)

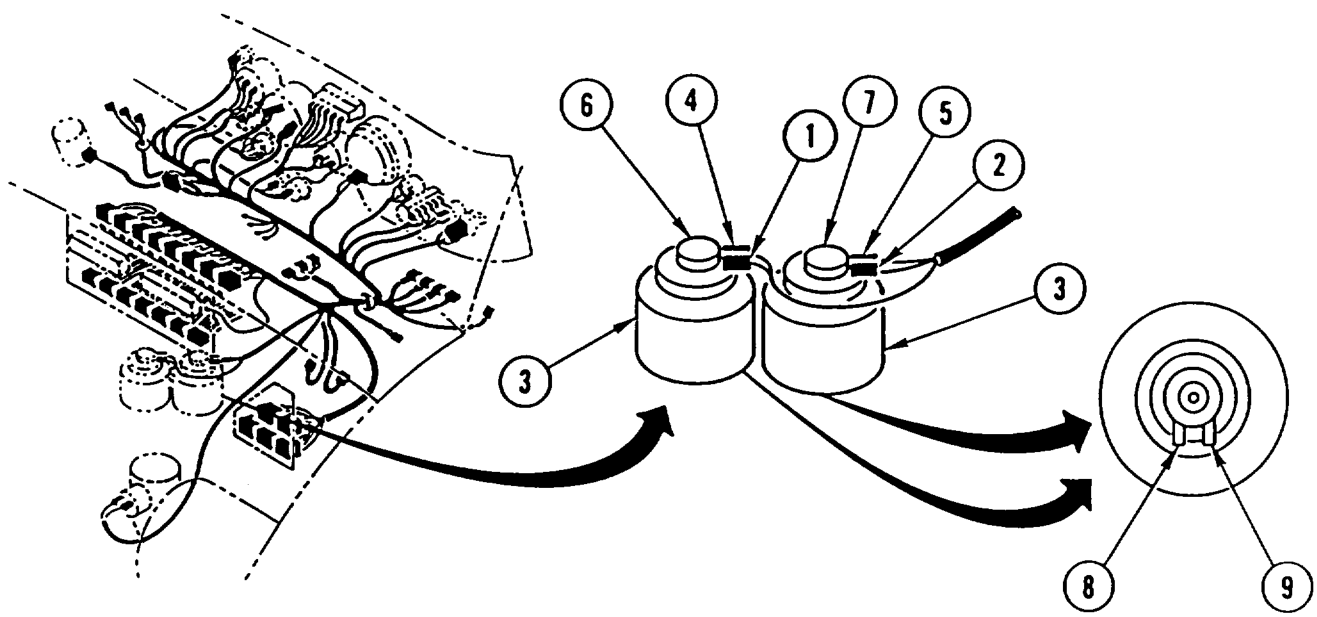


Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)

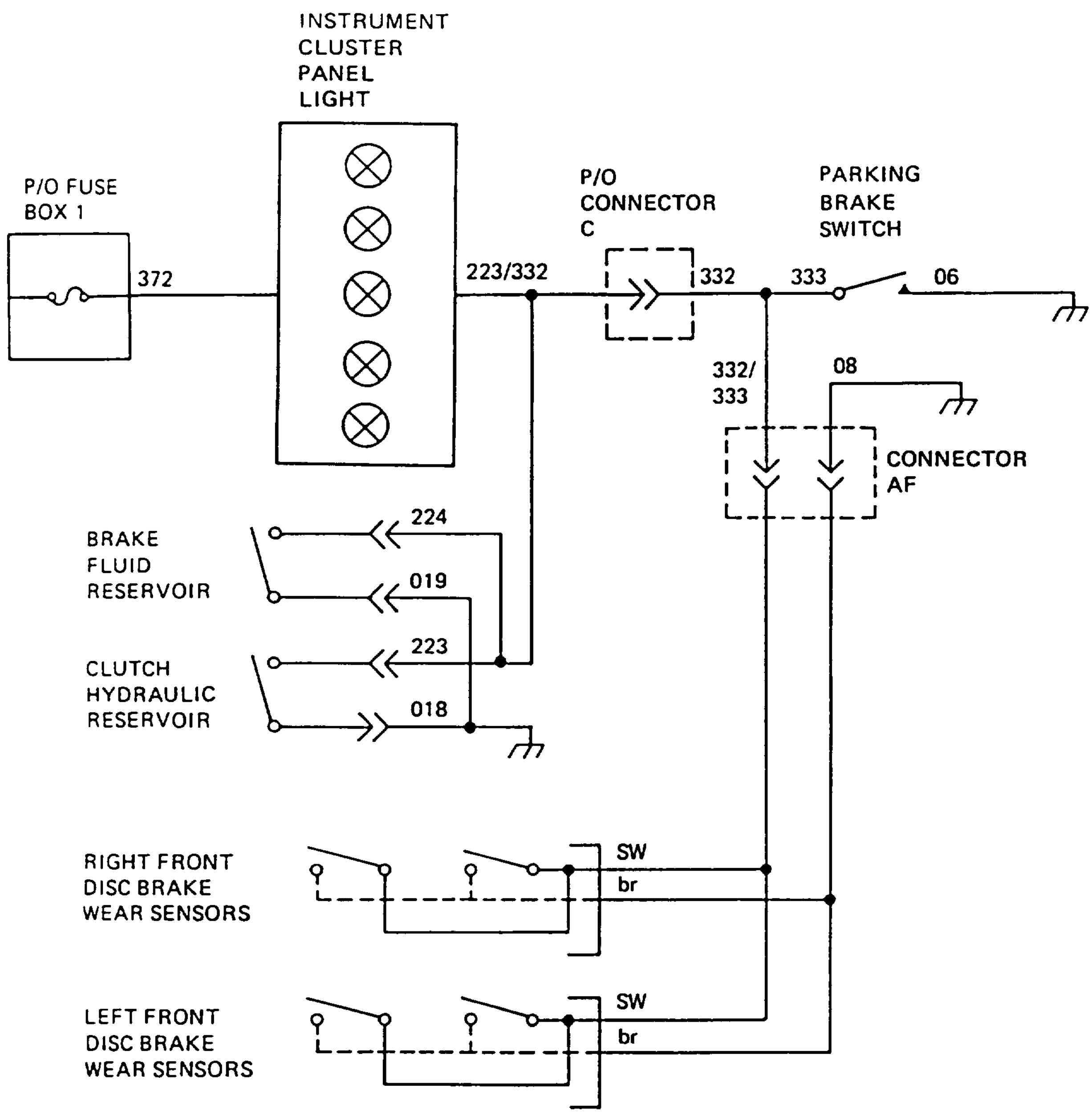


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

56. BRAKE INDICATOR LIGHT WILL NOT LIGHT WHEN FRONT DISC BRAKE PADS WORN OUT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-180) for all wiring repair steps.

Step 1. Set parking brake.

- If brake indicator light is not lit, perform Malfunction 54.
- If brake indicator light is lit, go to step 2.

NOTE

Perform steps 2 thru 4 with parking brake off.

Step 2. Disconnect connector AF (1) and check for +24 VDC between wire 332 (2) and ground.

- If +24 VDC is not present, repair wiring 332 between connector C and connector AF.
- If +24 VDC is present, reconnect connector AF and go to step 3.

Step 3. Disconnect leads (3) from disc brake pad indicator connector (4) at both front disc brake assemblies (5).

Step 4. Check for +24 VDC between disc brake pad indicator connector (4) and ground.

- If +24 VDC is not present, replace front disc brake pad indicator wiring harness (page 4-231).
- If +24 VDC is present, replace hook switches (6).

Table 3-5. Troubleshooting (Cont)

Malfunction	Test or Inspection	Corrective Action

ELECTRICAL SYSTEM (CONT)

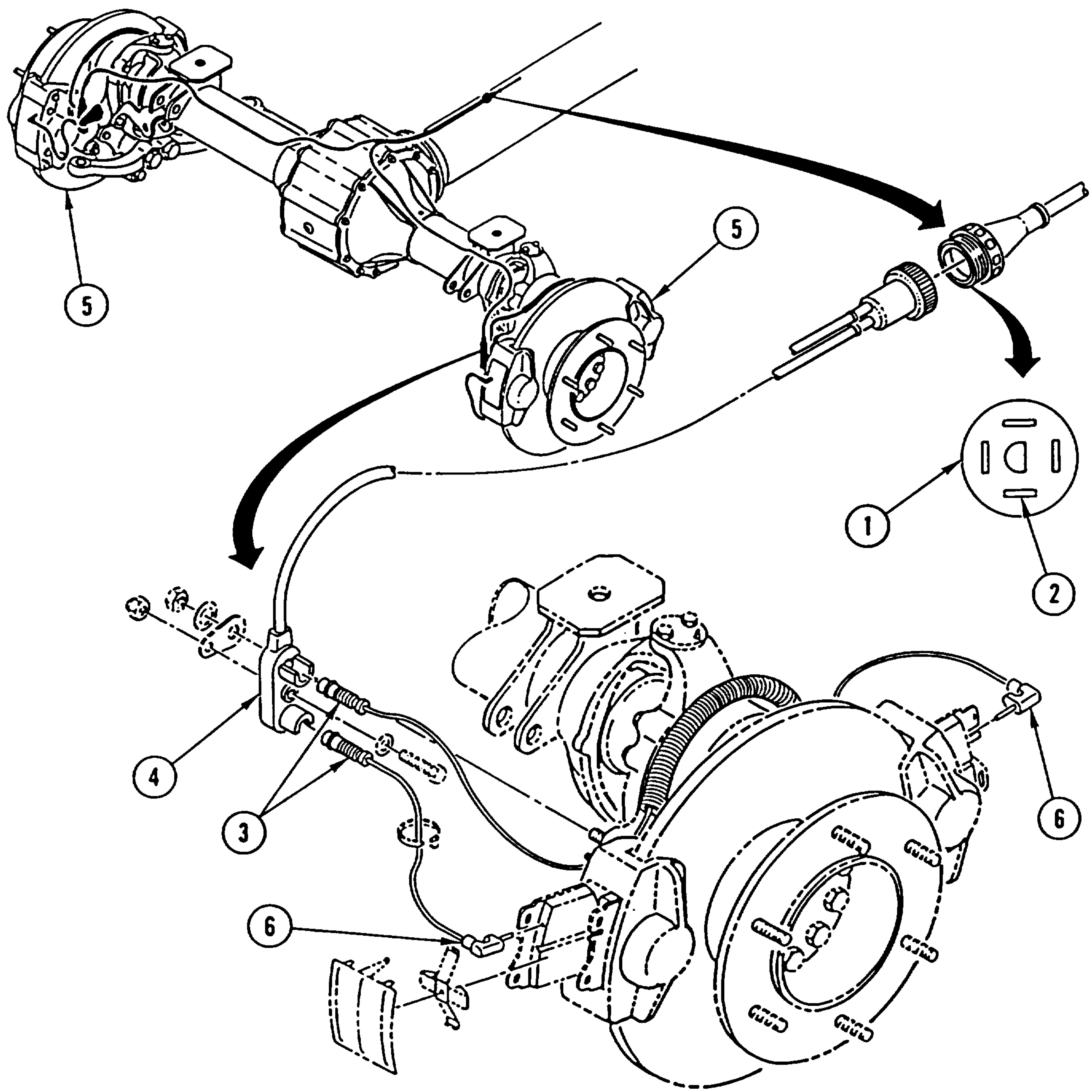


Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)

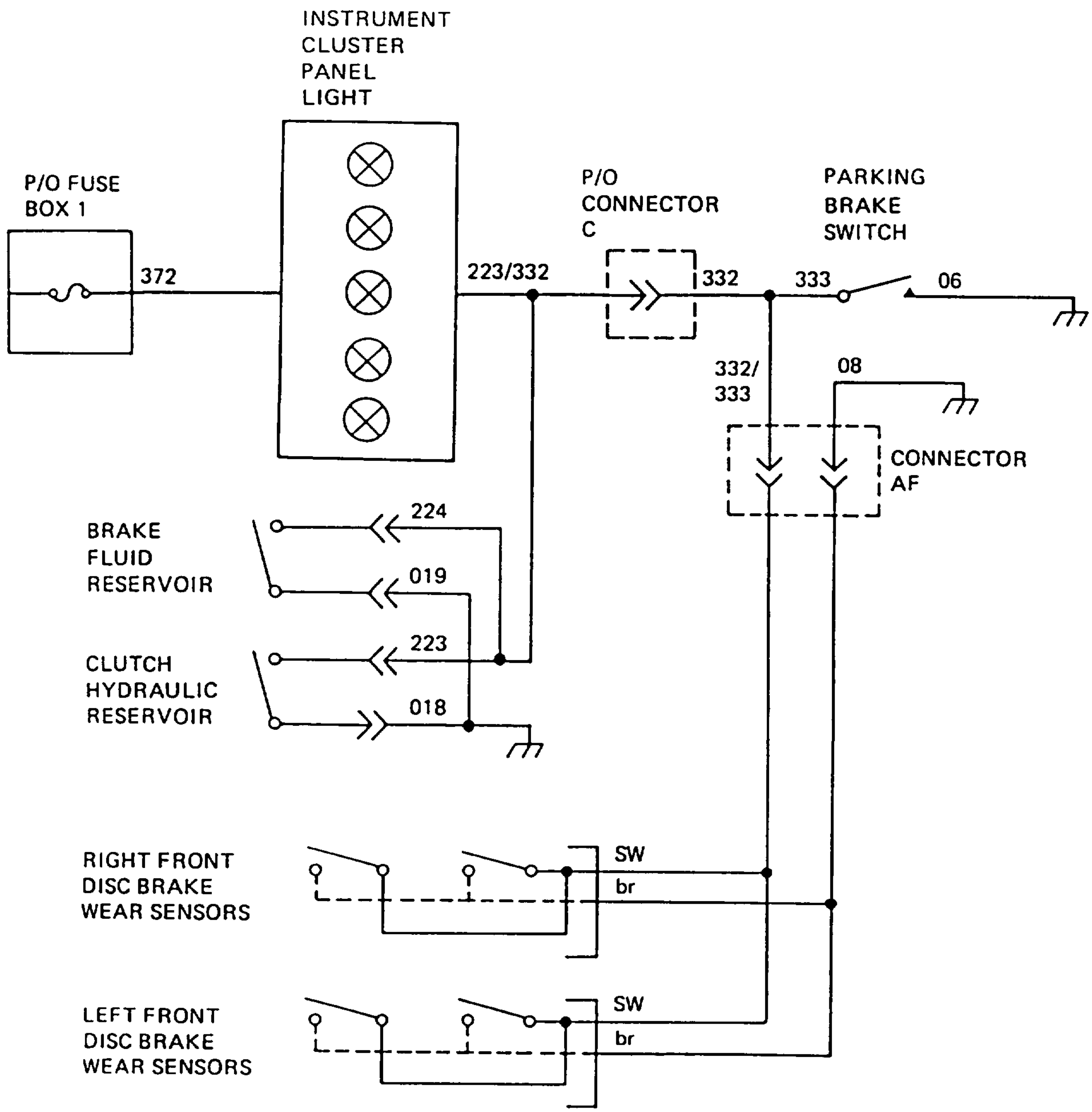


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

57. AIR CLEANER RESTRICTOR INDICATOR LIGHT WILL NOT LIGHT.

NOTE

Refer to wiring diagram (page 3-183) for all wiring repair steps.

Step 1. Pull instrument cluster panel light (1) out of dashboard (2).

Step 2. Remove air cleaner restrictor indicator lamp (3) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

NOTE

Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and master light switch set to PANEL BRT. Failure to do so will cause erroneous results.

Step 3. Check for +24 VDC between wire 372 (4) and ground at instrument cluster panel light (1).

- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.
- If +24 VDC is present, go to step 4.

Step 4. Set master light switch to OFF and connect jumper across air cleaner restrictor indicator switch terminals (5). Set master light switch to PANEL BRT and check if air cleaner restrictor indicator light is lit.

- If air cleaner restrictor indicator light is lit, replace air cleaner restrictor indicator switch (page 4-205).
- If air cleaner restrictor indicator light is not lit, repair wiring 371 between instrument cluster panel light and air cleaner restrictor indicator switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

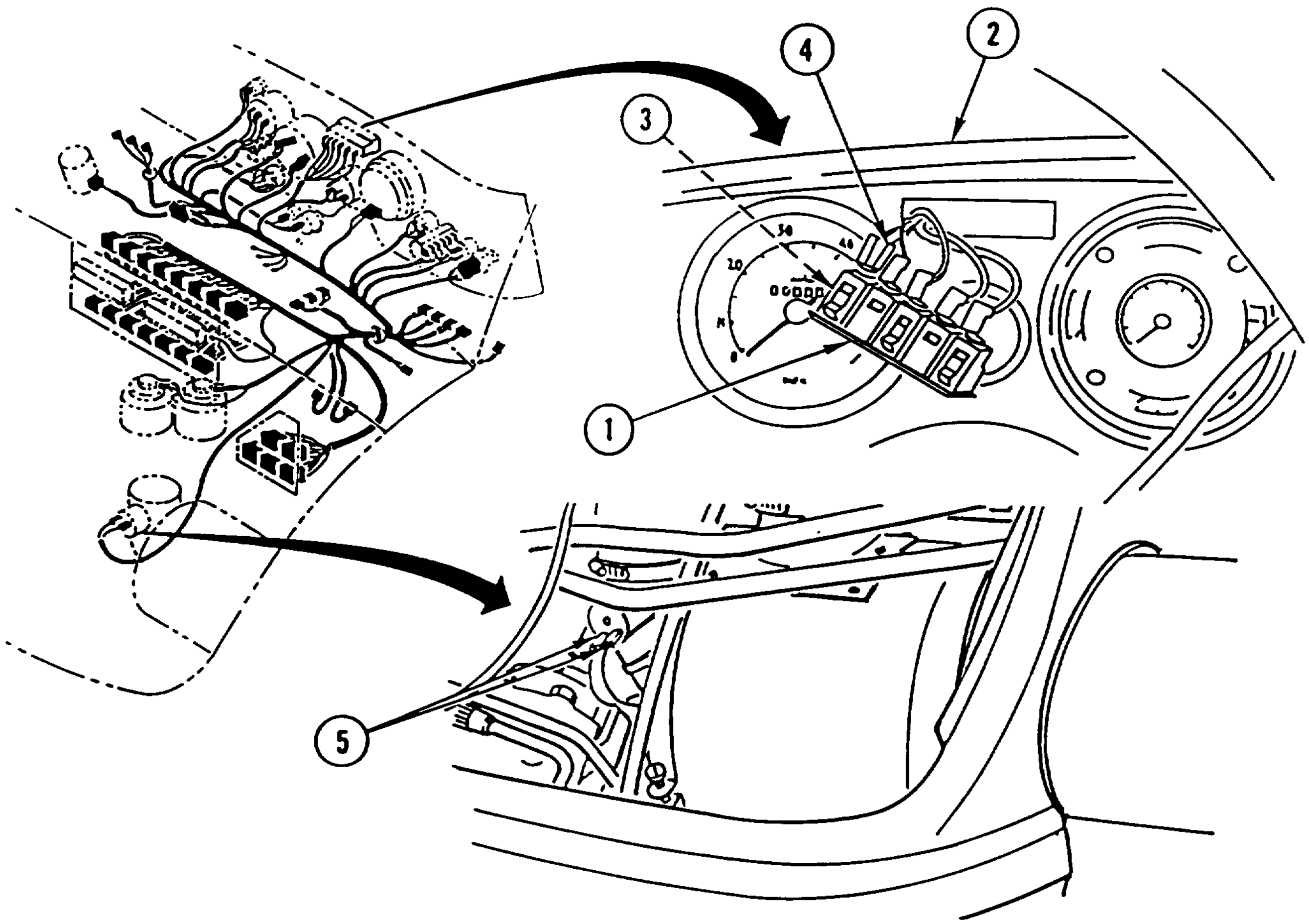


Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)

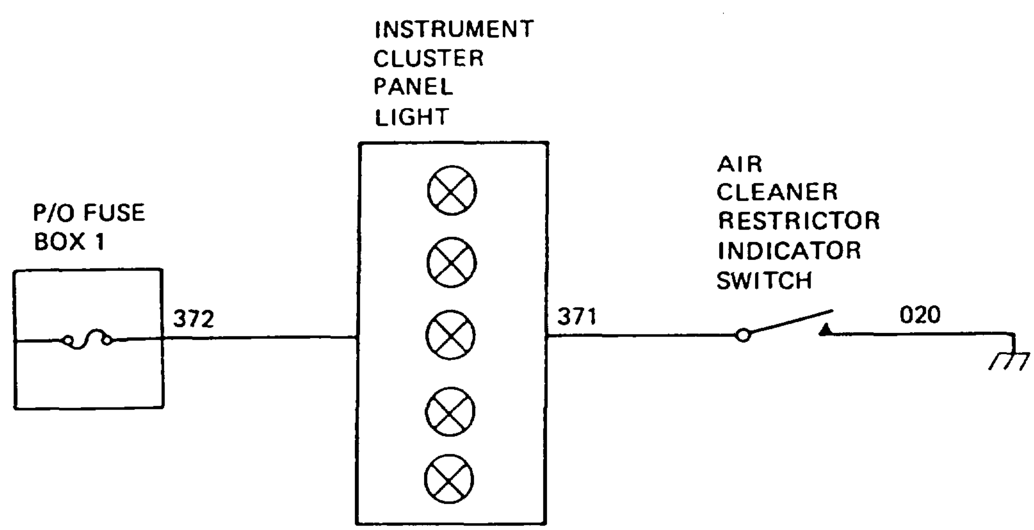


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

58. INTERMEDIATE SPEED INDICATOR LIGHT WILL NOT LIGHT.

NOTE

Refer to wiring diagram for all wiring repair steps.

Step 1. Pull instrument cluster panel light (1) out of dashboard (2).

Step 2. Remove intermediate speed indicator lamp (3) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

NOTE

Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and master light switch set to PANEL BRT, Failure to do so will cause erroneous results.

Step 3. Check for +24 VDC between wire 372 (4) and ground at instrument cluster panel light (1).

- If +24 VDC is not present, repair wiring 372 between instrument cluster panel light and fuse box 1.
- If +24 VDC is present, go to step 4.

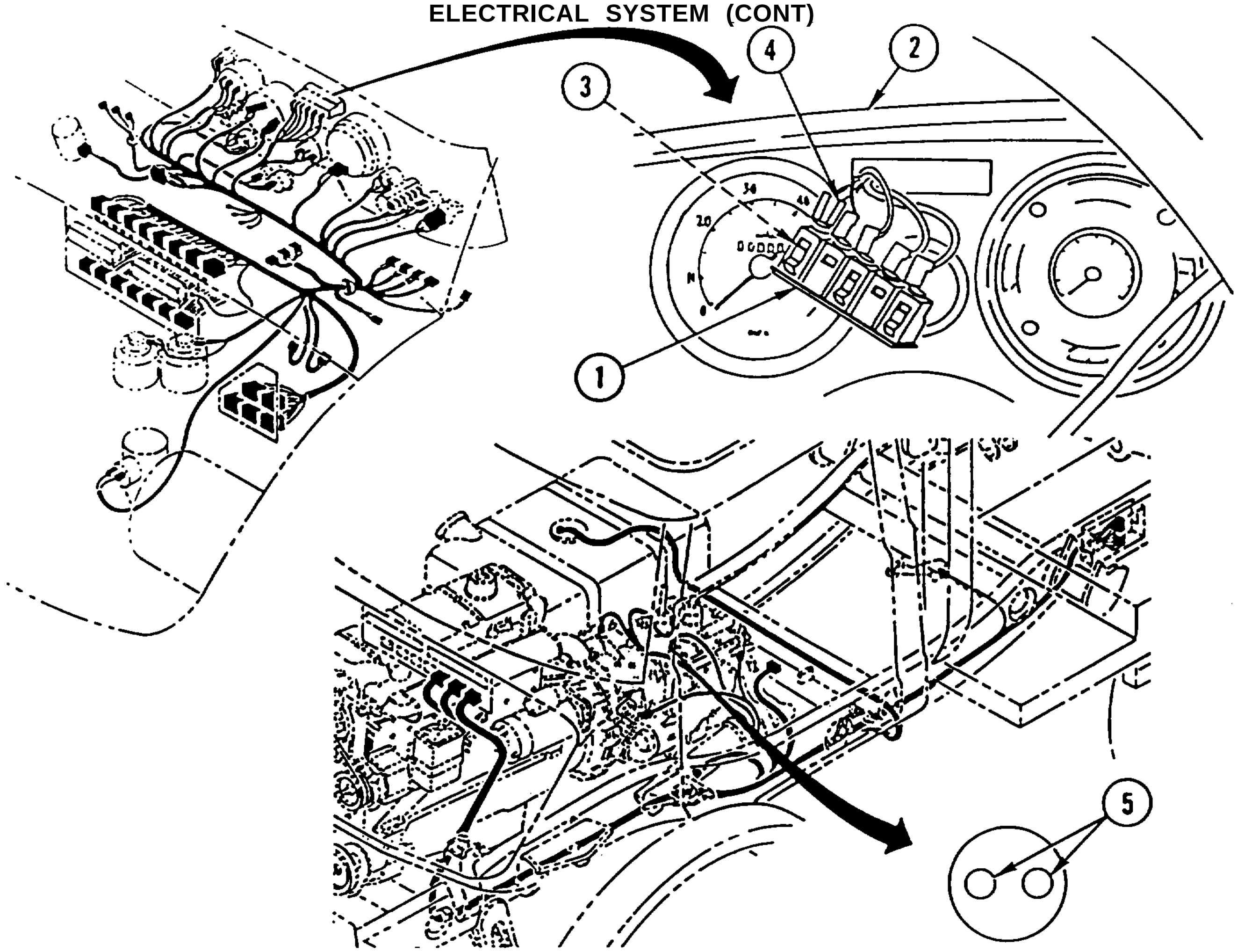
Step 4. Set master light switch to OFF and connect jumper across intermediate speed shift and indicator switch terminals (5). Set master light switch to PANEL BRT and check if intermediate speed indicator light is lit.

- If intermediate speed indicator light is lit, replace intermediate speed shift and indicator switch (page 4-209).
- If intermediate speed indicator light is not lit, repair wiring 222 between instrument cluster panel light and intermediate speed shift and indicator switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



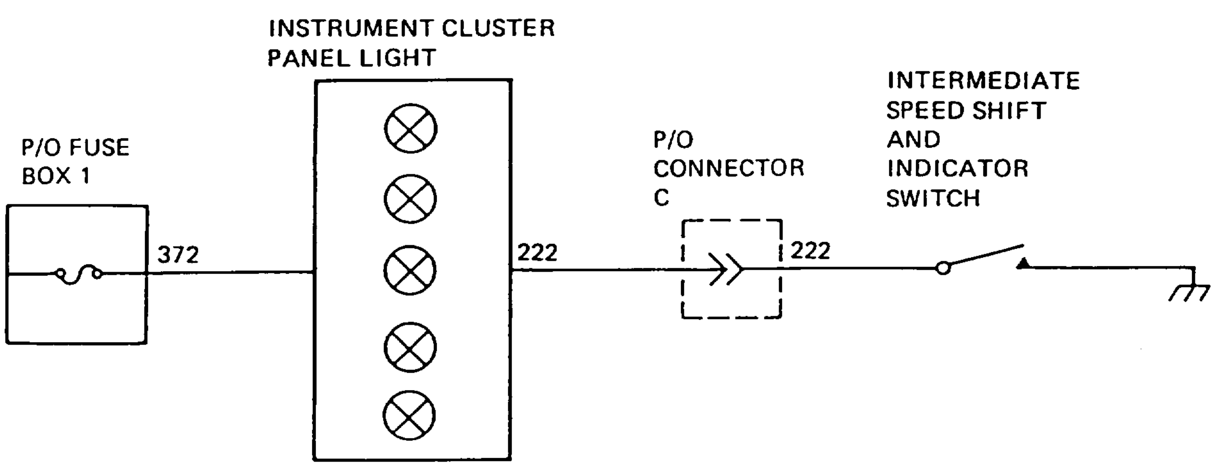


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

59. INTERMEDIATE SPEED WILL NOT ENGAGE.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and clutch pedal fully depressed. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Disconnect connector C (1) and check for +24 VDC between wire 23A (2) and ground.

- If +24 VDC is not present, repair wiring 23A between connector C and connector J.
- If +24 VDC is present, reconnect connector C and go to step 2.

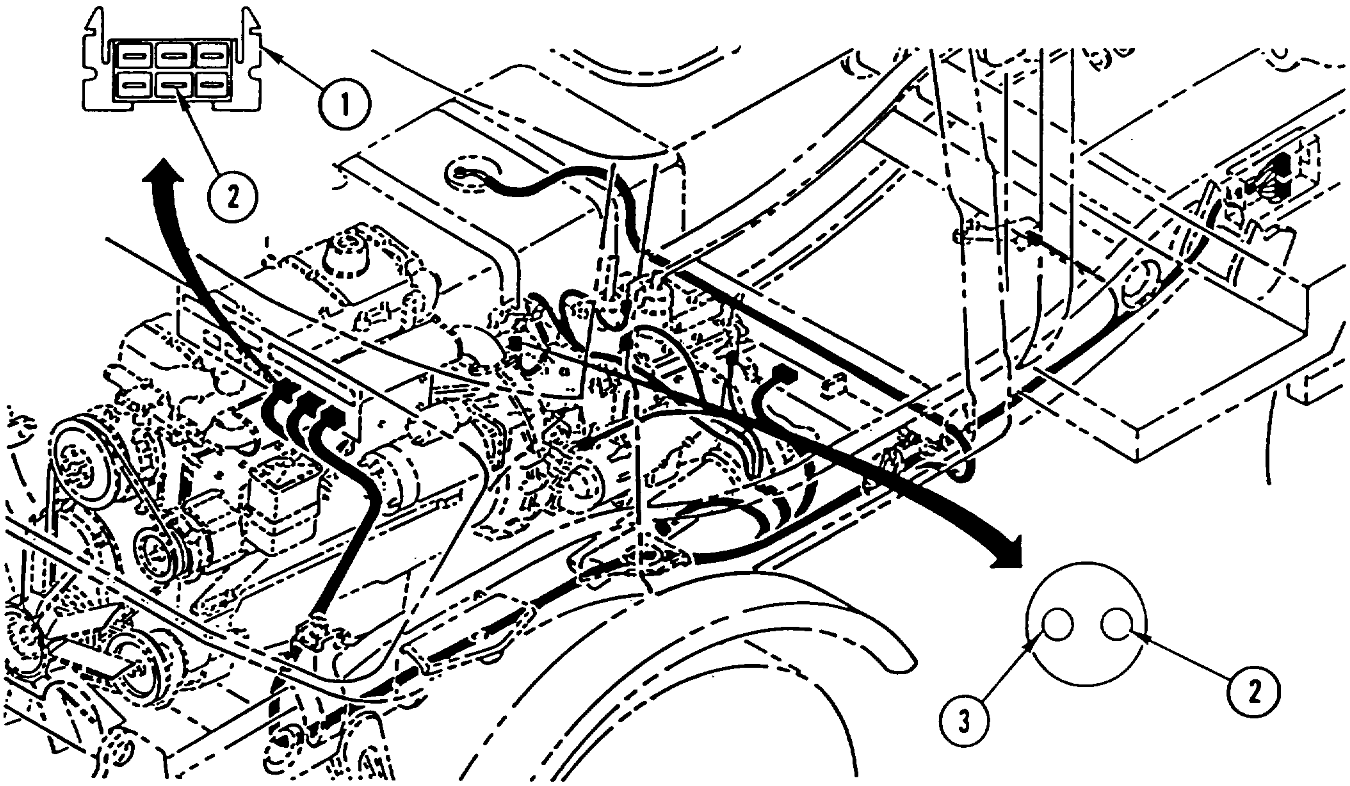
Step 2. Check for +24 VDC between wire 23A (2) and ground at air shift solenoid valve (3).

- If +24 VDC is not present, repair wiring 23A between connector C and air shift solenoid valve.
- If +24 VDC is present, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



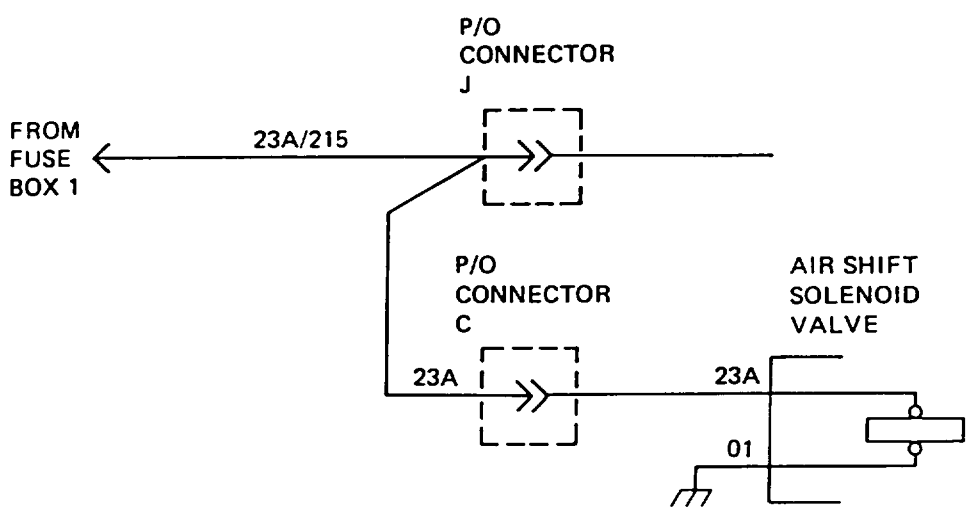


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

60. BRAKE LIGHTS WILL NOT LIGHT WHEN BRAKE PEDAL APPLIED.

NOTE

- Master light switch must be set to SER DRIVE or STOP LIGHT, brake pedal depressed, and turn signal lever off. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-191) for all wiring repair steps.

Step 1. Check for +24 VDC between wire 442 (1) and ground at brake light switch (2).

- If +24 VDC is present, go to step 7.
- If +24 VDC is not present, go to step 2.

Step 2. Check for +24 VDC between wire 441 (3) and ground at brake light switch (2).

- If +24 VDC is present, replace brake light switch (page 4-200).
- If +24 VDC is not present, go to step 3.

Step 3. Disconnect connector J (4) and check for +24 VDC between wire 441 (3) and ground.

- If +24 VDC is present, repair wiring 441 between connector J and brake light switch.
- If +24 VDC is not present, reconnect connector J and go to step 4.

Step 4. Loosen two captive screws (5) and pull bracket (6) out enough to gain access to area behind bracket.

Step 5. Remove two clamps (7) and pipe assembly (8).

Step 6. Check for +24 VDC between wire 441 (3) and ground at fuse box 1 (9).

- If +24 VDC is present, repair wiring 441 between fuse box 1 and connector J.
- If +24 VDC is not present, replace fuse.

Step 7. Check for +24 VDC between wire 444 (10) and ground at turn signal lever (11).

- If +24 VDC is present, replace turn signal lever (page 4-122).
- If +24 VDC is not present, go to step 8.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 8. Disconnect connector K (12) and check for +24 VDC between wire 444 (10) and ground.

- If +24 VDC is present, repair wiring 444 between connector K and turn signal lever.
- If +24 VDC is not present, reconnect connector K and go to step 9.

Step 9. Check for +24 VDC between wire 443 (13) and ground at master light switch (14).

- If +24 VDC is present, repair wiring 443 between master light switch and connector K.
- If +24 VDC is not present, go to step 10.

Step 10. Disconnect connector M (15) and check for +24 VDC between wire 442 (1) and ground.

- If +24 VDC is present, repair wiring 442 between connector M and master light switch.
- If +24 VDC is not present, reconnect connector M and go to step 11.

Step 11. Disconnect connector J (4) and check for +24 VDC between wire 442 (1) and ground.

- If +24 VDC is present, repair wiring 442 between connector J and connector M.
- If +24 VDC is not present, repair wiring 442 between connector J and brake light switch.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

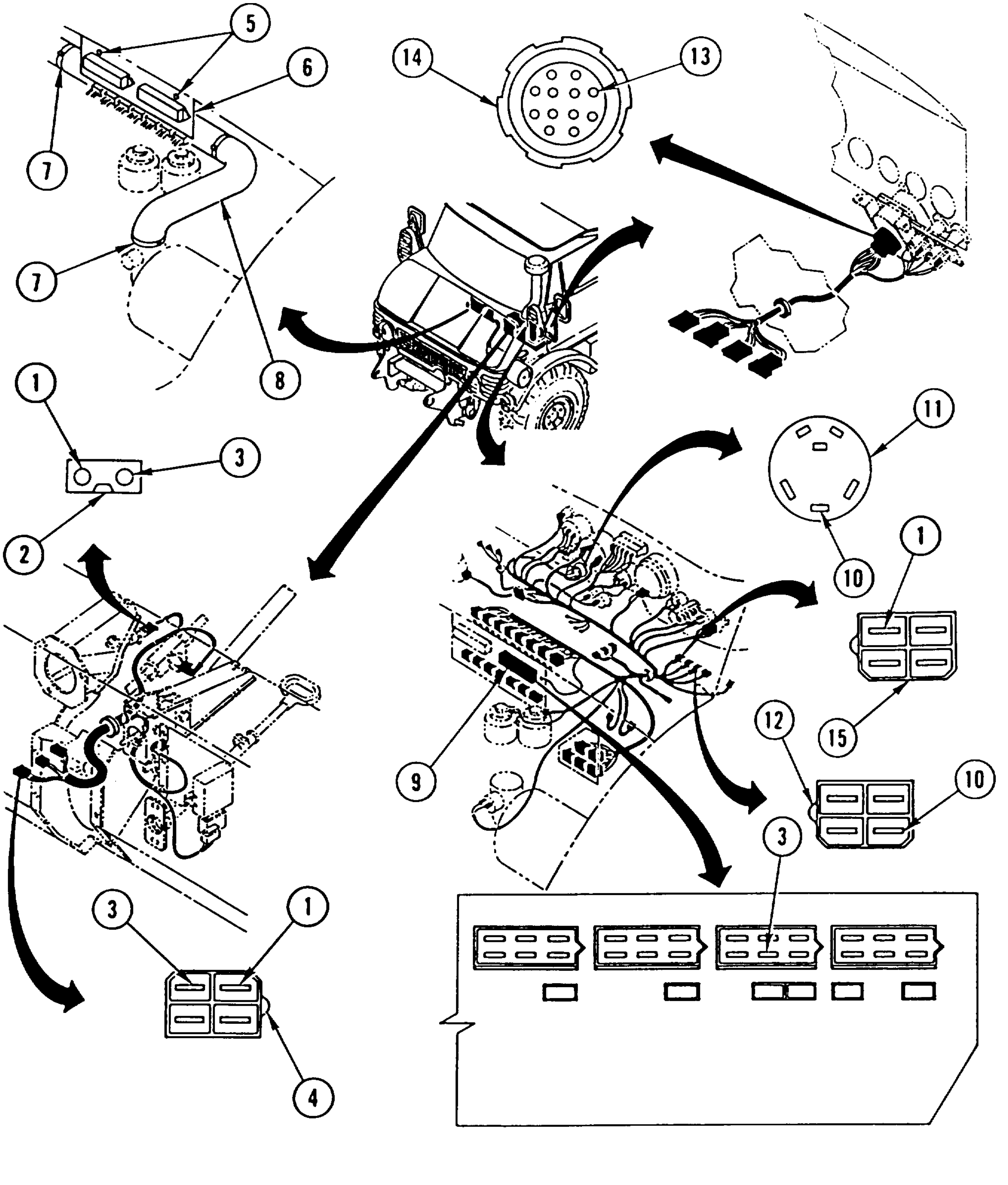


Table 3-5. Troubleshooting (Cont)

Malfunction Test or Inspection Corrective Action

ELECTRICAL SYSTEM (CONT)

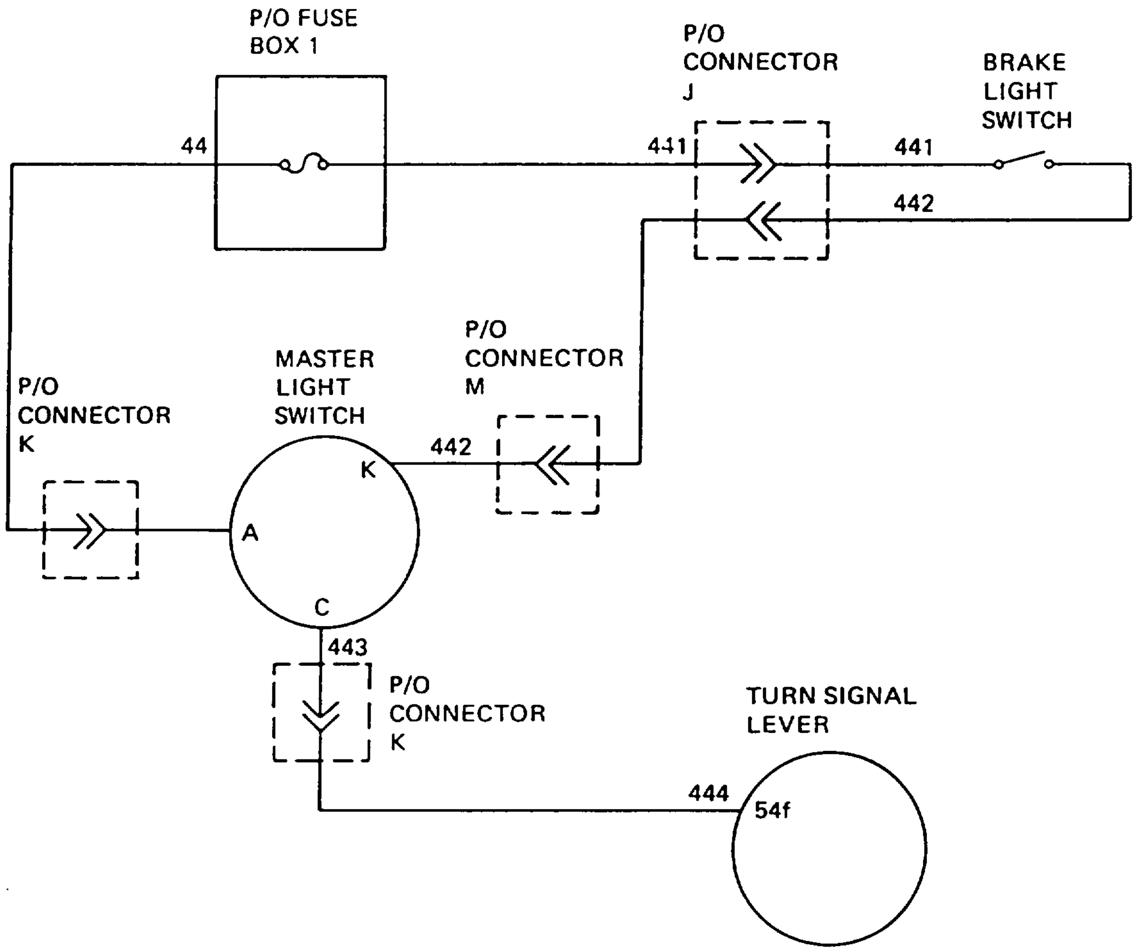


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

61. RIGHT BRAKE LIGHT WILL NOT LIGHT.

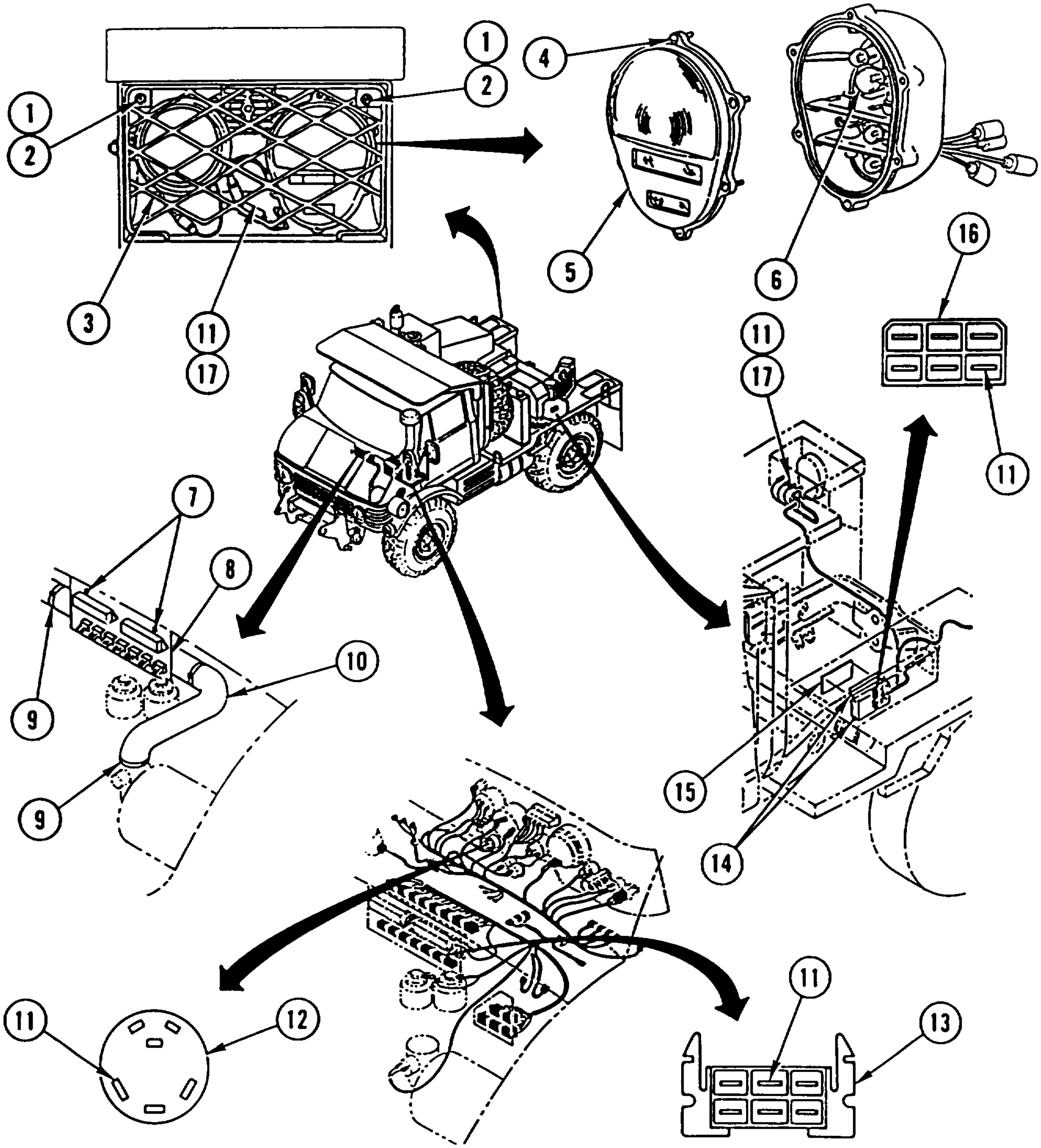


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and turn signal lever off. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-194) for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5)

Step 2. Remove brake lamp (6) and check for continuity.

- if there is
- if there is

Step 3. Loosen two captive screws (7) and pull bracket (8) out enough to gain access to area behind bracket.

Step 4. Remove two clamps (9) and pipe assembly (10).

Step 5. Check for +24 VDC between wire 4445R (11) and ground at turn signal lever (12).

- If +24 VDC is not present, replace turn signal lever (page 4-122).
- If +24 VDC is present, go to step 6.

Step 6. Disconnect connector B (13) and check for +24 VDC between wire 4445R (11) and ground.

- If +24 VDC is not present, repair wiring 4445R between connector B and turn signal lever.
- If +24 VDC is present, reconnect connector B and go to step 7.

Step 7. Release two clamps (14) and remove cover (15).

Step 8. Disconnect connector Y (16) and check for +24 VDC between wire 4445R (11) and ground.

- If +24 VDC is not present, repair wiring 4445R between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 9.

Table 3-5. Troubleshooting (Cont)

Malfunction

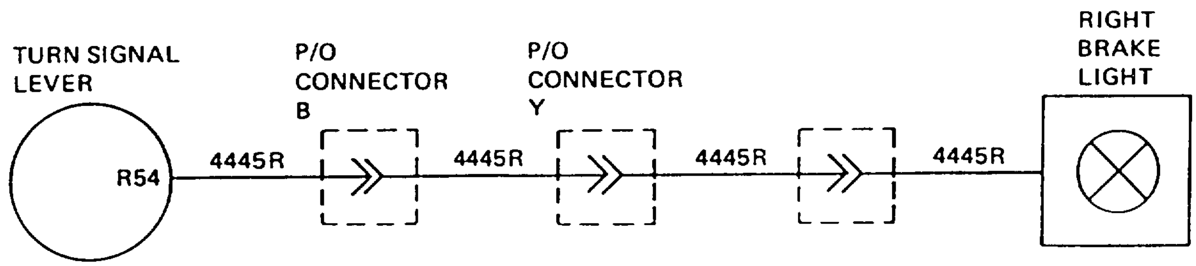
Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 9. Check for +24 VDC between wire 4445R (11) and ground at right brake light connector (17).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 4445R between brake light connector and connector Y.



62. RIGHT TAILLIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to STOP LIGHT. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-196) for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove right tail lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 41TR (8) and ground.

- If +24 VDC is not present, repair wiring 41TR between connector B and fuse box 2.
- If +24 VDC is present, reconnect connector B and go to step 4.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 41TR (8) and ground.

- If +24 VDC is not present, repair wiring 41TR between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 5. Check for +24 VDC between wire 41TR (8) and ground at right taillight connector (10).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 41TR between right taillight connector and connector Y.

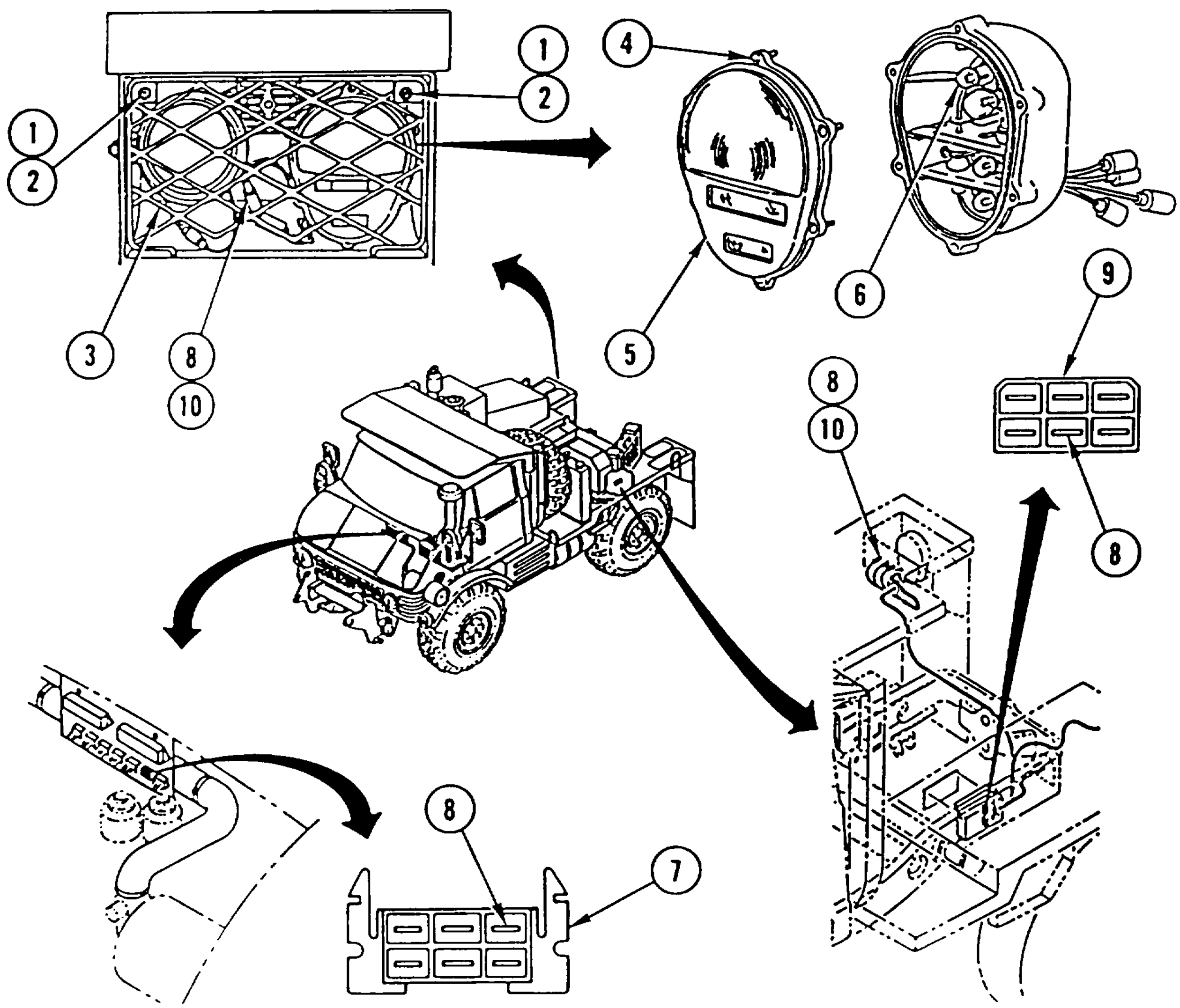
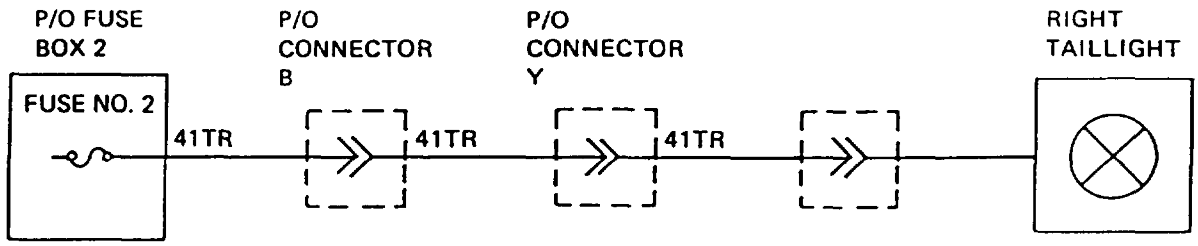


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



63. RIGHT BLACKOUT TAILLIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to 60 DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove right blackout tail lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 48 (8) and ground.

- If +24 VDC is not present, repair wiring 48 between connector B and fuse box 1.
- If +24 VDC is present, reconnect connector B and go to step 4.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 48 (8) and ground.

- If +24 VDC is not present, repair wiring 48 between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

Step 5. Check for +24 VDC between wire 48 (8) and ground at right blackout taillight connector (10).

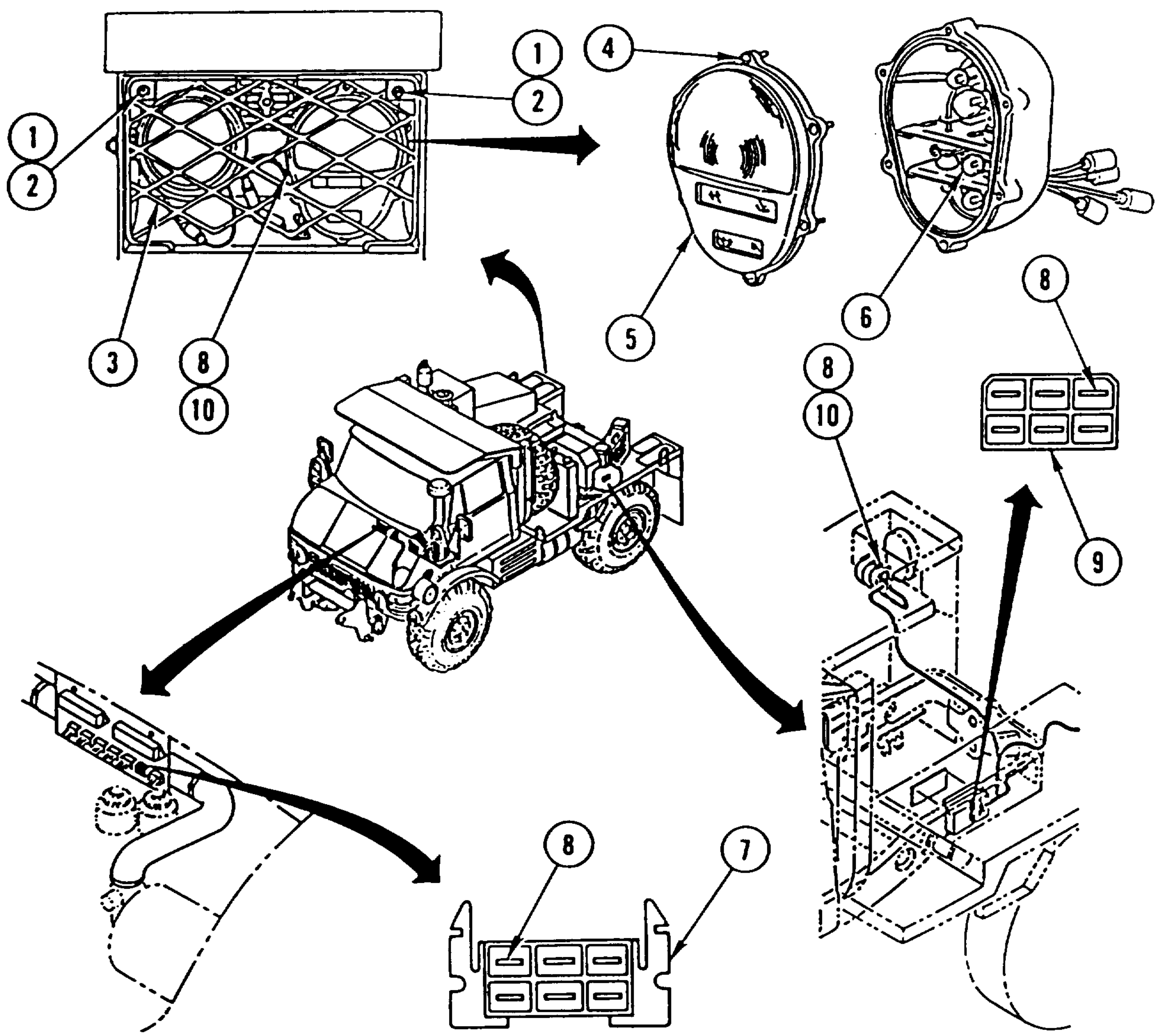
- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 48 between right blackout taillight connector and connector Y.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action



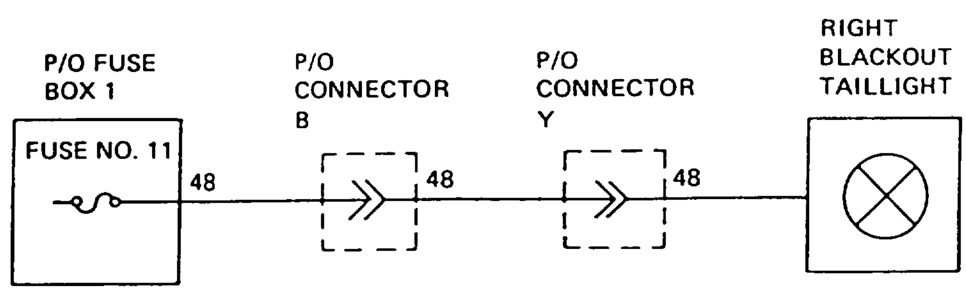


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

64. RIGHT BLACKOUT BRAKE LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to BO DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-200) for ail wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove right blackout brake lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is not present, reconnect connector B and go to step 6.
- If +24 VDC is present, reconnect connector B and go to step 4.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is not present, repair wiring 47 between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

Step 5. Check for +24 VDC between wire 47 (8) and ground at right blackout brake light connector (10).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 47 between right blackout brake light connector and connector Y.

Step 6. Loosen two captive screws (11) and pull bracket (12) out enough to gain access to area behind bracket.

Step 7. Remove two clamps (13) and pipe assembly (14).

Step 8. Disconnect connector M (15) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is present, repair wiring 47 between connector M and connector B.
- If +24 VDC is not present, reconnect connector M and go to step 9.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 9. Check for +24 VDC between wire 47 (8) and ground at master light switch connector (16).

- If +24 VDC is not present, replace master light switch (page 4-137).
- If +24 VDC is present, repair wiring 47 between master light switch connector and connector M.

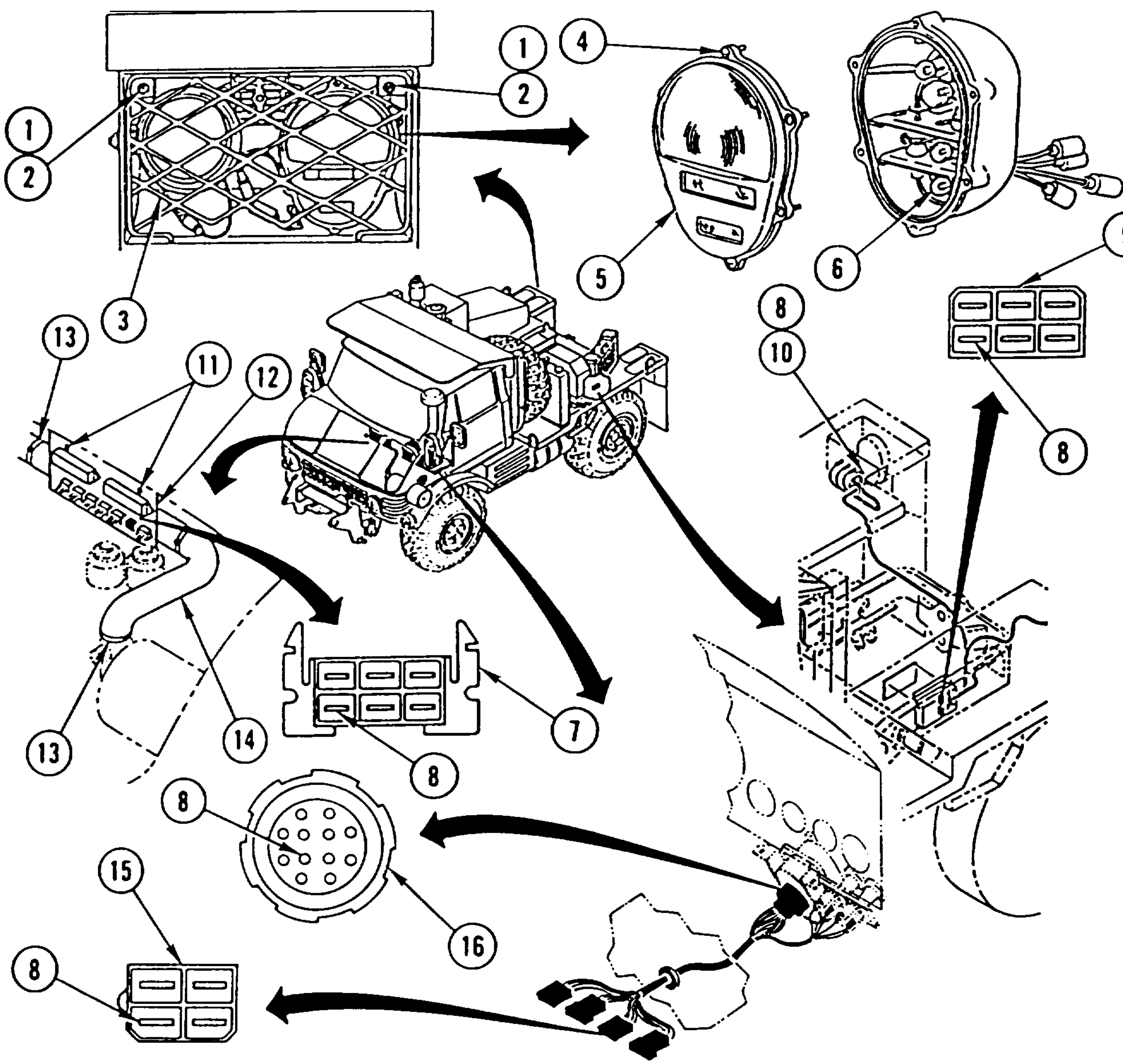
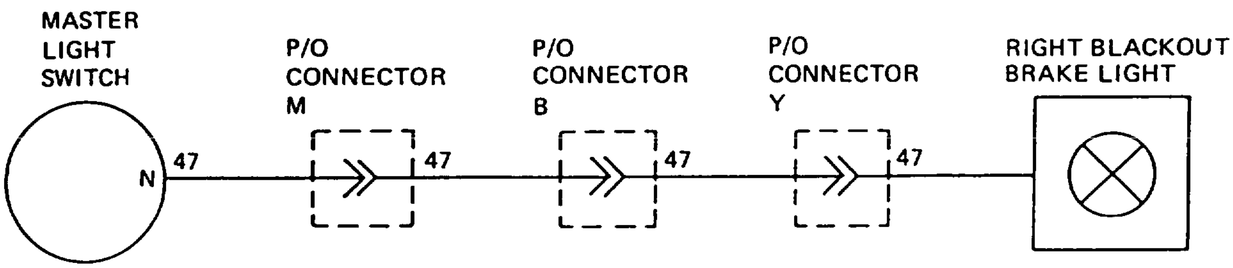


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



65. LEFT BRAKE LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, master light switch set to SER DRIVE, and turn signal lever off. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-202) for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove left brake lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Loosen two captive screws (7) and pull bracket (8) out enough to gain access to area behind bracket.

Step 4. Remove two clamps (9) and pipe assembly (10).

Step 5. Check for +24 VDC between wire 4445L (11) and ground at turn signal lever (12).

- If +24 VDC is not present, replace turn signal lever (page 4-122).
- If +24 VDC is present, go to step 6.

Step 6. Disconnect connector B (13) and check for +24 VDC between wire 4445L (11) and ground.

- If +24 VDC is not present, repair wiring 4445L between connector B and turn signal lever.
- If +24 VDC is present, reconnect connector B and go to step 7.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

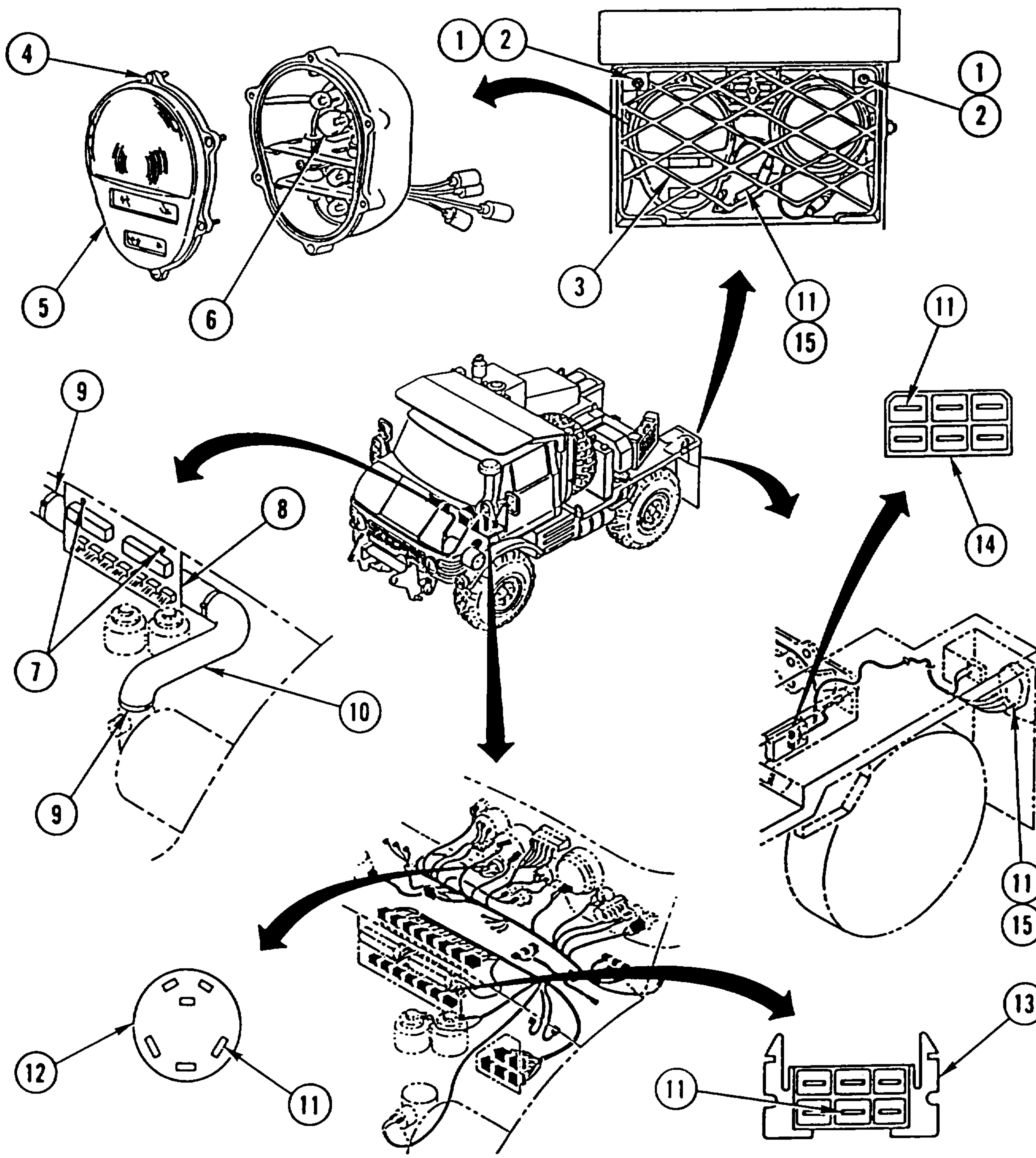


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

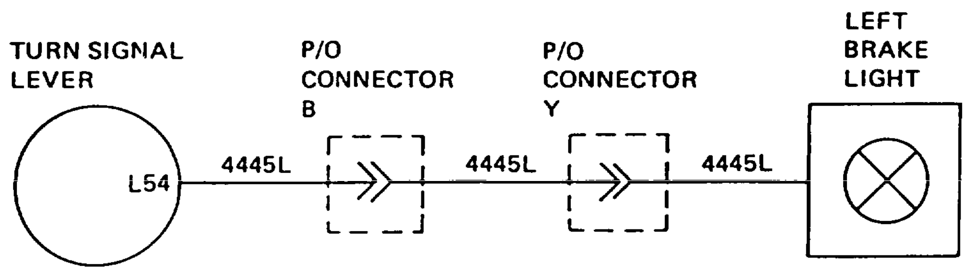
ELECTRICAL SYSTEM (CONT)

Step 7. Disconnect connector Y (14) and check for +24 VDC between wire 4445L (11) and ground.

- If +24 VDC is not present, repair wiring 4445L between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 8.

Step 8. Check for +24 VDC between wire 4445L (11) and ground at left brake light connector (15).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 4445L between left brake light connector and connector Y.



66. LEFT TAILLIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to STOP LiGHT. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-204) for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove left tail lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 41TL (8) and ground.

- If +24 VDC is not present, repair wiring 41TL between connector B and fuse box 2.
- If +24 VDC is present, reconnect connector B and go to step 4.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 41TL (8) and ground.

- If +24 VDC is not present, repair wiring 41TL between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

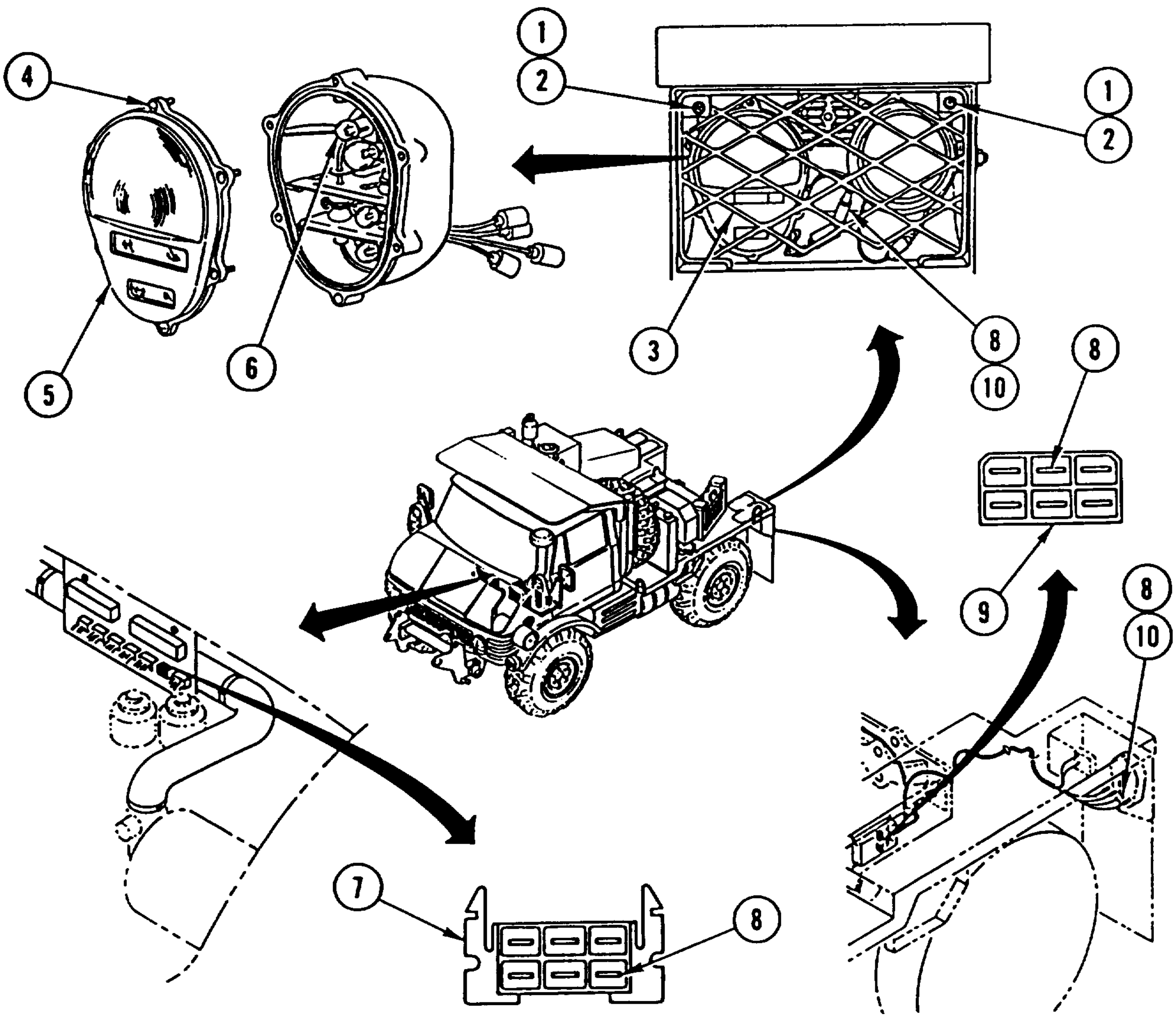
Step 5. Check for +24 VDC between wire 41TL (8) and ground at left taillight connector (10).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 41TL between left taillight connector and connector Y.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



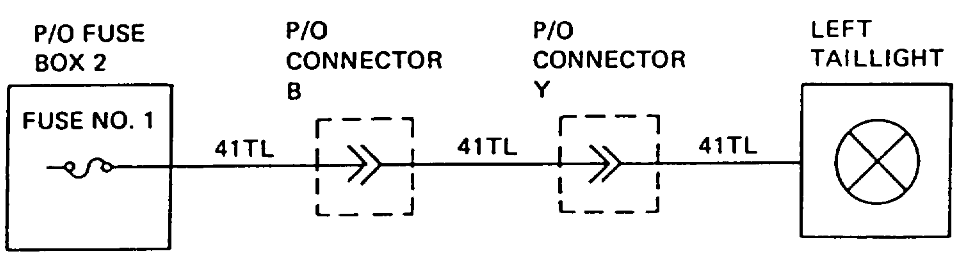


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

67. LEFT BLACKOUT TAILLIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to BO DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-206) for ail wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove left blackout tail lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 48 (8) and ground.

- If +24 VDC is not present, repair wiring 48 between connector B and fuse box 1.
- If +24 VDC is present, reconnect connector B and go to step 4.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 48 (8) and ground.

- If +24 VDC is not present, repair wiring 48 between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

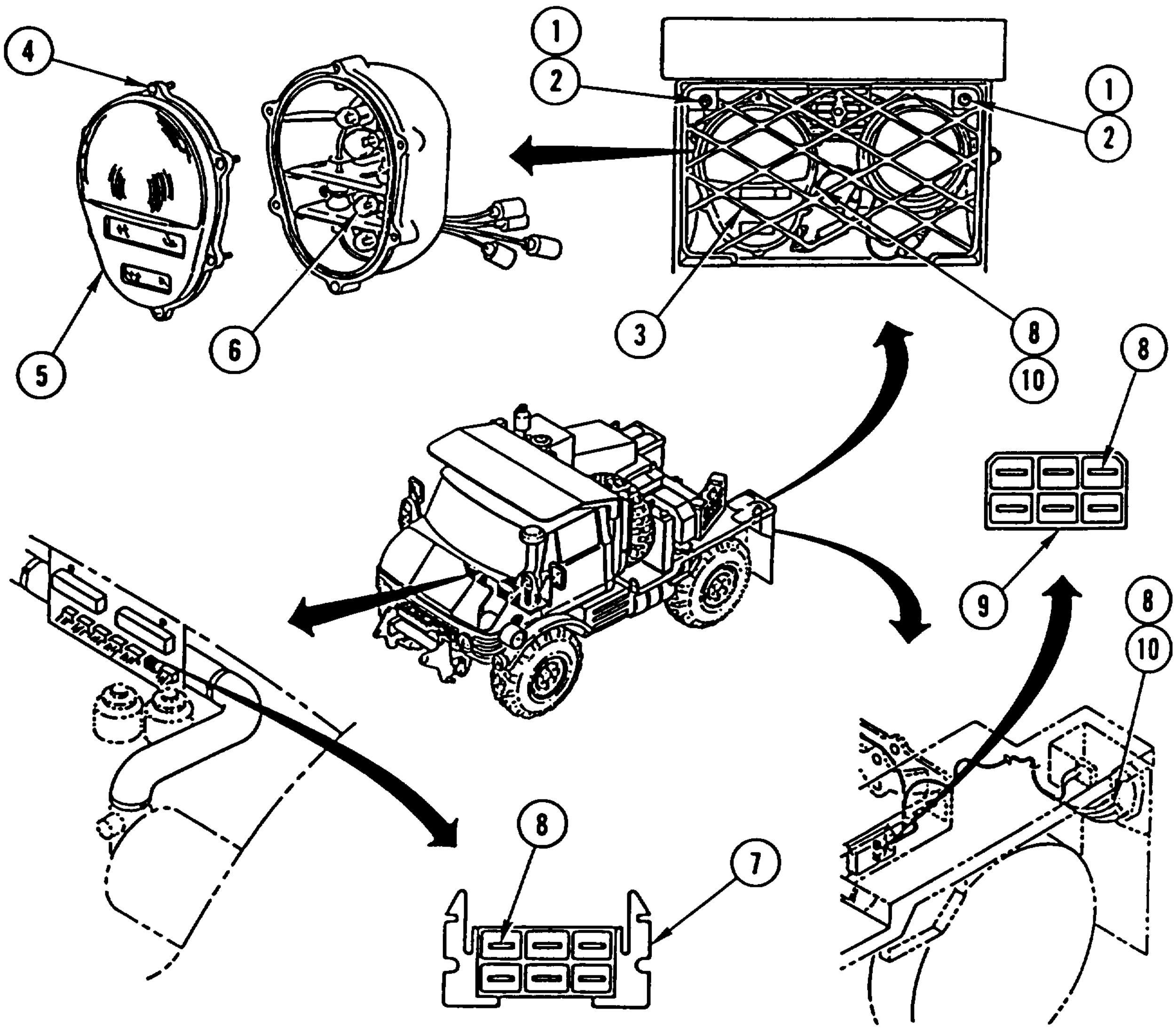
Step 5. Check for +24 VDC between wire 48 (8) and ground at left blackout taillight connector (10).

- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).
- If +24 VDC is not present, repair wiring 48 between left blackout taillight connector and connector Y.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



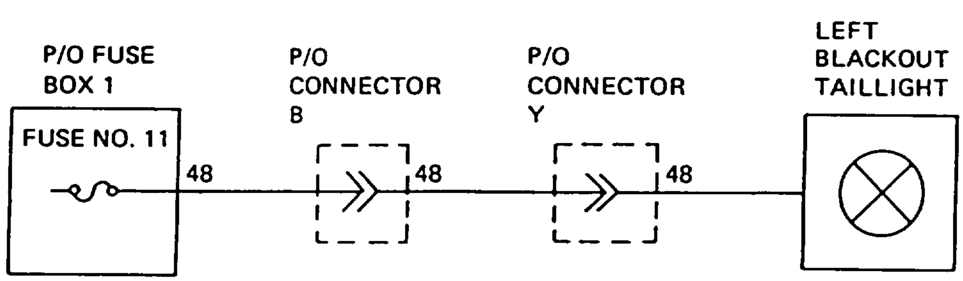


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

68. LEFT BLACKOUT BRAKE LIGHT WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON and master light switch set to BO DRIVE. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-209) for all wiring repair steps.

Step 1. Remove two screws (1), two washers (2), and guard (3). Loosen six screws (4) and remove retainer (5).

Step 2. Remove left blackout brake lamp (6) and check for continuity.

- If there is no continuity, replace lamp.
- If there is continuity, go to step 3.

Step 3. Disconnect connector B (7) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is present, reconnect connector B and go to step 4.
- If +24 VDC is not present, reconnect connector B and go to step 6.

Step 4. Disconnect connector Y (9) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is not present, repair wiring 47 between connector Y and connector B.
- If +24 VDC is present, reconnect connector Y and go to step 5.

Step 5. Check for +24 VDC between wire 47 (8) and ground at left blackout brake light connector (10).

- If +24 VDC is not present, repair wiring 47 between left blackout brake light connector and connector Y.
- If +24 VDC is present, replace rear composite stoplight/taillight (page 4-190).

Step 6. Loosen two captive screws (11) and pull bracket (12) out enough to gain access to area behind bracket.

Step 7. Remove two clamps (13) and pipe assembly (14).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

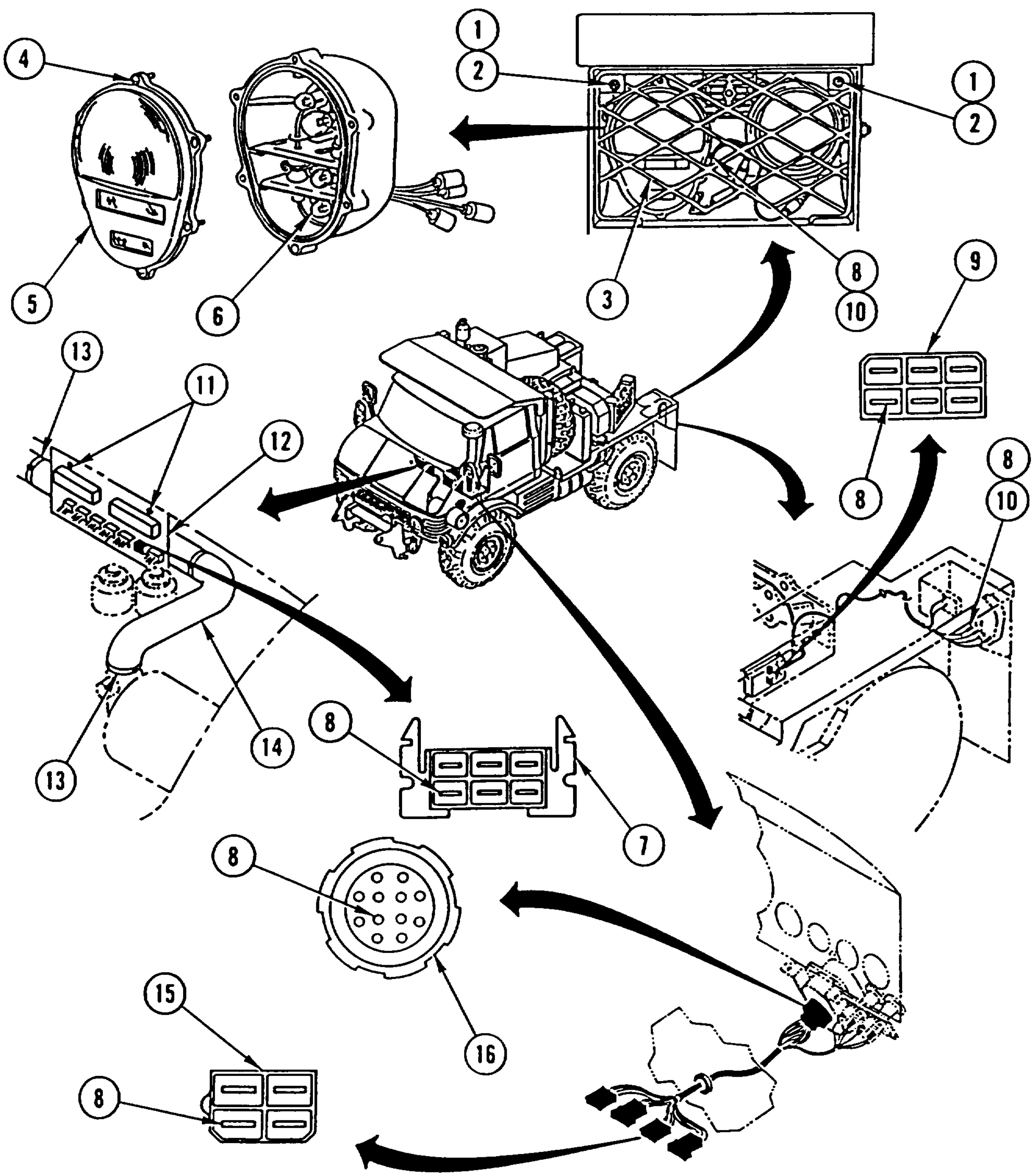


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 8. Disconnect connector M (15) and check for +24 VDC between wire 47 (8) and ground.

- If +24 VDC is present, repair wiring 47 between connector M and connector B.
- If +24 VDC is not present, reconnect connector M and go to step 9.

Step 9. Check for +24 VDC between wire 47 (8) and ground at master light switch connector (16).

- If +24 VDC is not present, replace master light switch (page 4-137).
- If +24 VDC is present, repair wiring 47 between master light switch connector and connector M.

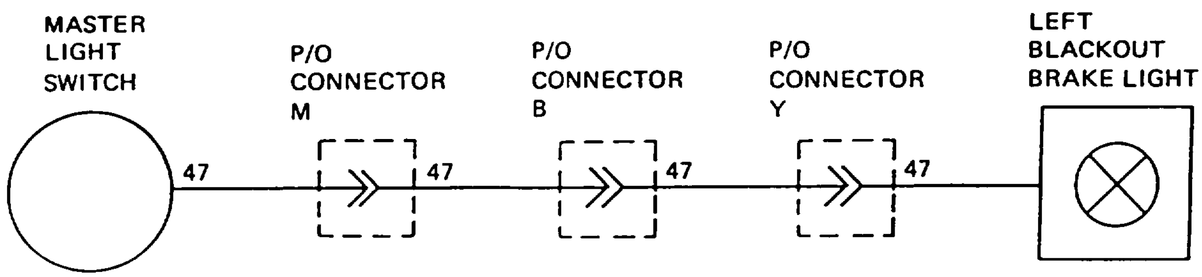


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

69. WORK LIGHTS WILL NOT LIGHT.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and master light switch set to STOP LIGHT. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Disconnect connector A (1) and check for +24 VDC between wire 421 (2) and ground.

- If +24 VDC is not present, reconnect connector A and go to step 5.
- If +24 VDC is present, reconnect connector A and go to step 2.

Step 2. Disconnect connector X (3) and check for +24 VDC between wire 421 (2) and ground.

- If +24 VDC is not present, repair wiring 421 between connector X and connector A.
- If +24 VDC is present, reconnect connector X and go to step 3

Step 3. Loosen nut (4), remove knob (5) and nut (6), and pull work light switch (7) out of cabinet (8) through opening.

Step 4. Install jumper wire across terminals on work light switch (7) and check if work lights are lit.

- If work lights are not lit, repair wiring 421 between work light switch and work lights.
- If work lights are lit, replace work light switch (page 4-162).

Step 5. Check for +24 VDC between wire 421 (2) and ground at fuse box 1 (9).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 421 between fuse box 1 and connector A.

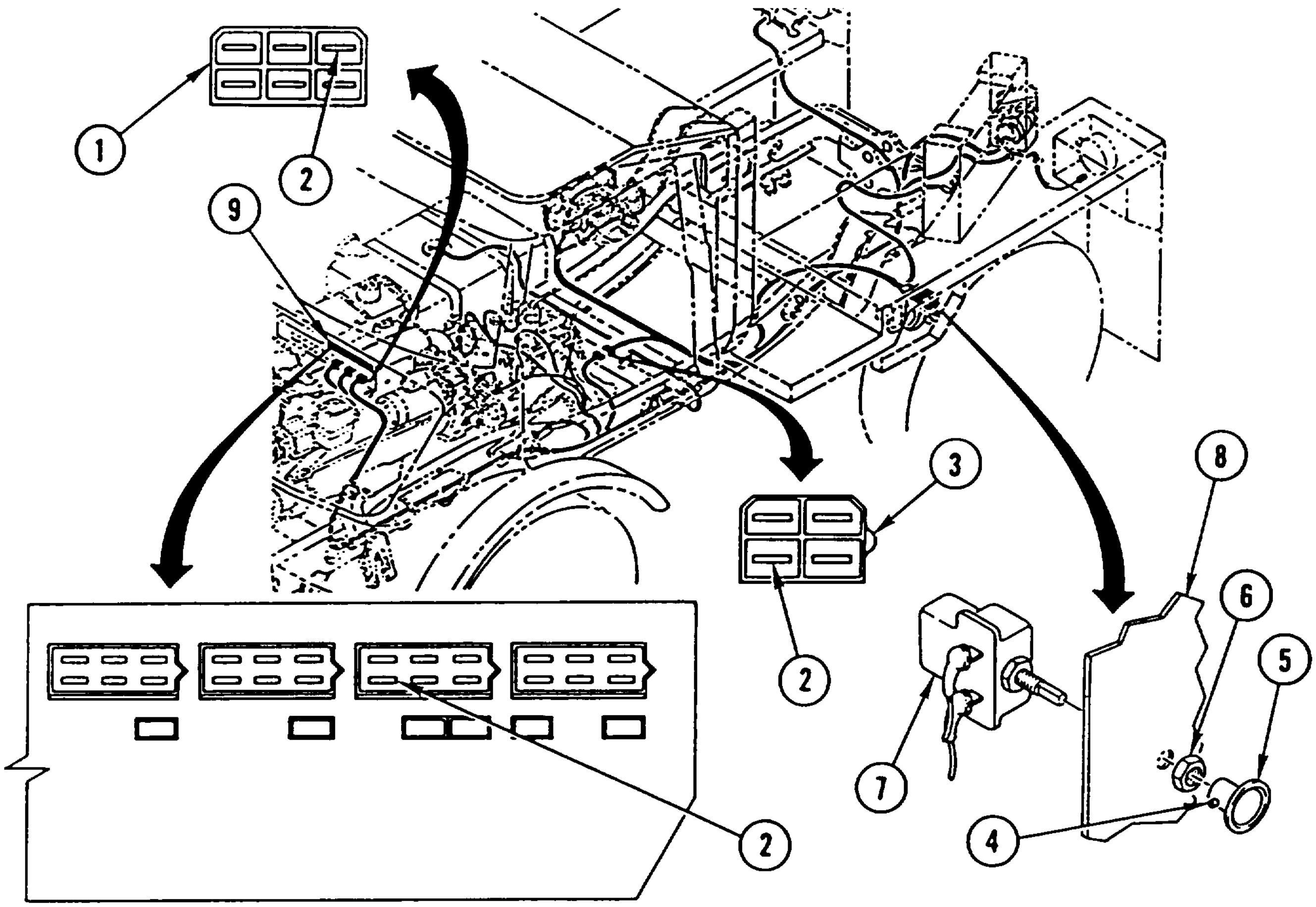
Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)



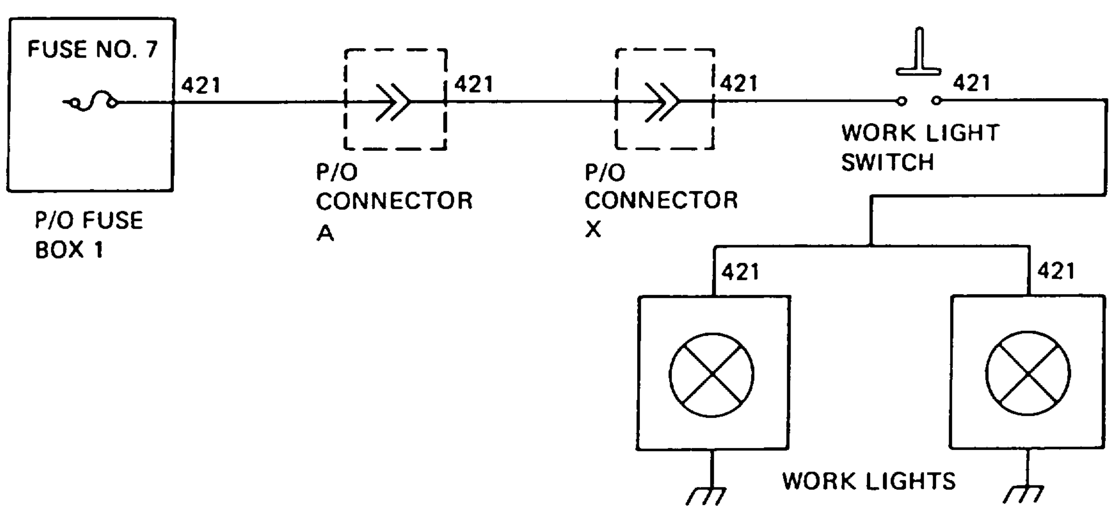


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

70. BACKUP ALARM WILL NOT SOUND.

NOTE

- Vehicle MASTER disconnect switch must be ON, ignition switch set to ON, and group shift lever shifted to R position. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Disconnect connector A (1) and check for +24 VDC between wire 35R (2) and ground.

- If +24 VDC is present, reconnect connect A and go to
- If +24 VDC is not present, reconnect connector A and go to step 2.

Step 2. Check for +24 VDC between wire 35R (2) and ground at fuse box 1 (3).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 35R between fuse box 1 and connector A.

Step 3. Check for +24 VDC between wire 35R (2) and ground at backup alarm switch (4).

- If +24 VDC is not present, repair wiring 35R between connector A and backup alarm switch.
- If +24 VDC is present, go to step 4.

Step 4. Check for +24 VDC between wire 35R1 (5) and ground at backup alarm switch (4).

- If +24 VDC is not present, replace backup alarm switch (page 4-208).
- If +24 VDC is present, go to step 5.

Step 5. Disconnect connector Z (6) and check for +24 VDC between wire 35R1 (5) and ground.

- If +24 VDC is not present, repair wiring 35R1 between connector Z and backup alarm switch.
- If +24 VDC is present, reconnect connector Z and go to step 6.

Step 6. Check for +24 VDC between wire 35R1 (5) and ground at backup alarm (7).

- If +24 VDC is present, replace backup alarm (page 4-214).
- If +24 VDC is not present, repair wiring 35R1 between connector Z and backup alarm.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

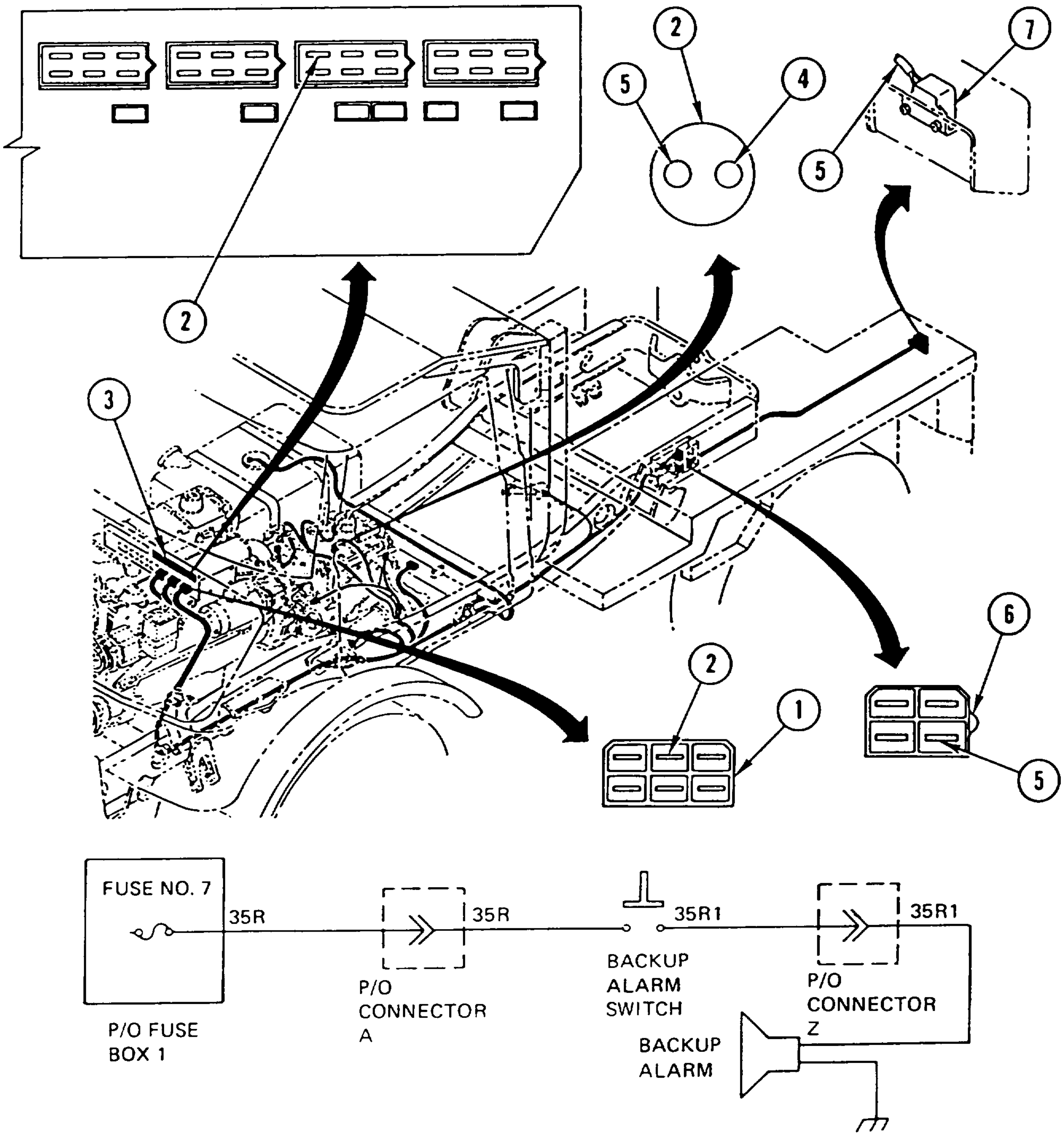


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

71. LOW OIL PRESSURE AND HIGH WATER TEMPERATURE ALARM WILL NOT SOUND WITH PRESS-TO-TEST SWITCH DEPRESSED.

NOTE

Refer to wiring diagram (page 3-217) for all wiring repair steps.

Step 1. Depress press-to-test switch (1) and listen for alarm to sound.

- If alarm sounds, go to step 12.
- If alarm does not sound, go to step 2.

Step 2. Disconnect wire 306 (2) and wire 07 (3) and remove nut (4) and press-to-test switch (1).

Step 3. Check for continuity between terminals of press-to-test switch (1) while pressing button.

- If there is no continuity, replace press-to-test switch.
- If there is continuity, install press-to-test switch and go to step 4. _

Step 4. Disconnect warning delay relay connector (5) and check for continuity between wire 306 (2) and ground with press-to-test switch (1) depressed.

- If there is no continuity, repair wiring 306 between warning delay relay and press-to-test switch.
- If there is continuity, go to step 5.

NOTE

For steps 5 thru 14, engine must be running.

Step 5. With warning delay relay connector (5) disconnected, check for +24 VDC between wire 343 (6) and ground at warning delay relay connector.

- If +24 VDC is not present, repair wiring 343 between warning delay relay connector and relay K2.
- If +24 VDC is present, go to step 6.

Step 6. With warning delay relay connector (5) disconnected, check for +24 VDC between wire 344 (7) and ground at warning delay relay connector.

- If +24 VDC is not present, repair wiring 344 at warning delay relay connector.
- If +24 VDC is present, go to step 7.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

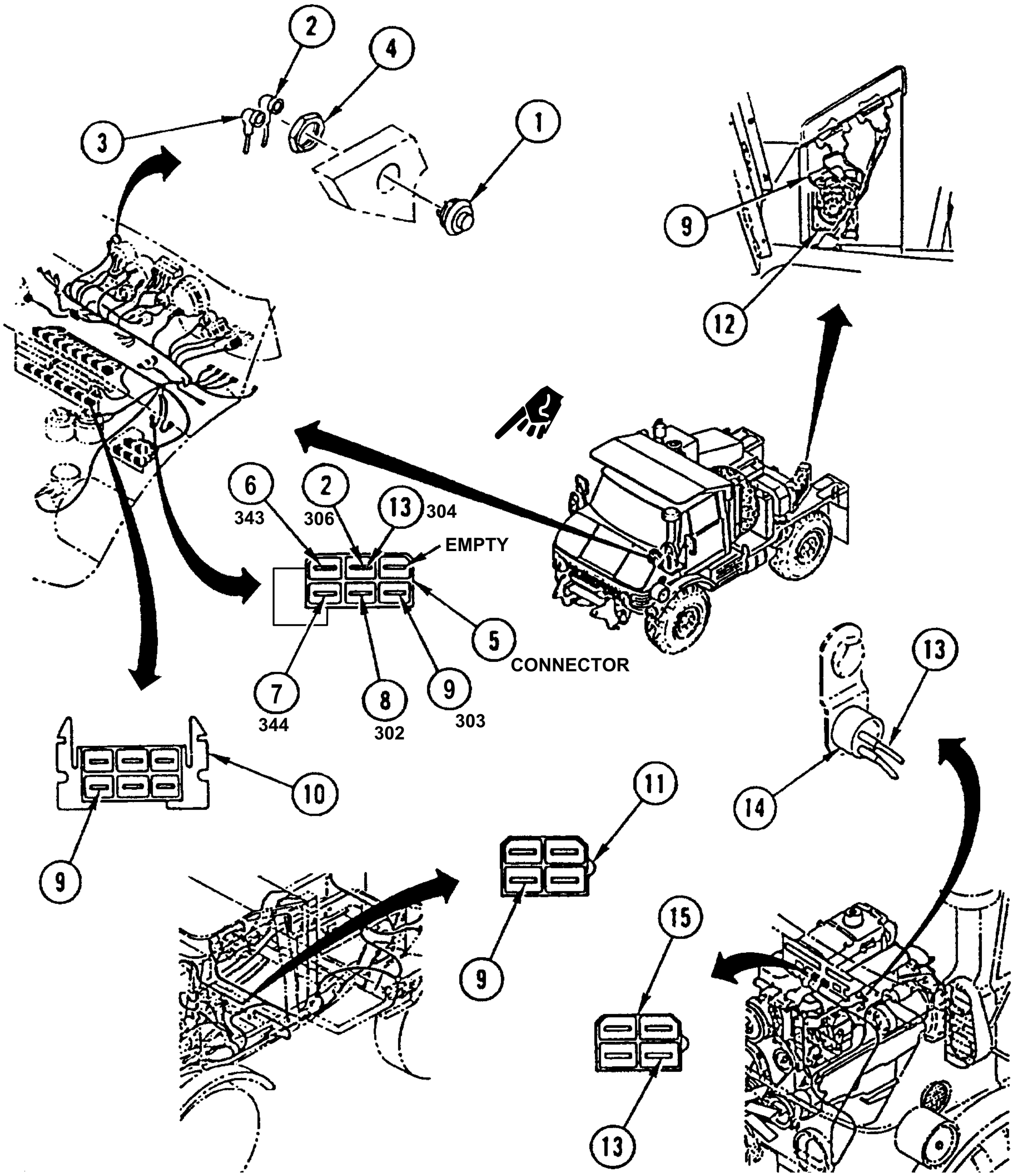


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 7. With warning delay relay connector (5) disconnected, check for +24 VDC between wire 302 (8) and ground at warning delay relay connector.

- If +24 VDC is not present, repair wiring 302 between warning delay relay connector and fuse box 1.
- If +24 VDC is present, reconnect warning delay relay connector and go to step 8.

Step 8. Check for +24 VDC between wire 303 (9) and ground at warning delay relay connector (5).

- If +24 VDC is not present, replace warning delay relay (page 4-141).
- If +24 VDC is present, go to step 9.

Step 9. Disconnect connector A (10) and check for +24 VDC between wire 303 (9) and ground.

- If +24 VDC is not present, repair wiring 303 between connector A and warning delay relay.
- If +24 VDC is present, reconnect connector A and go to step 10.

Step 10. Disconnect connector X (11) and check for +24 VDC between wire 303 (9) and ground.

- If +24 VDC is not present, repair wiring 303 between connector X and connector A.
- If +24 VDC is present, reconnect connector X and go to step 11.

Step 11. Check for +24 VDC between wire 303 (9) and ground at low oil pressure and high water temperature alarm (12).

- If +24 VDC is not present, repair wiring 303 between low oil pressure and high water temperature alarm and connector X.
- If +24 VDC is present, replace low oil pressure and high water temperature alarm (page 4-170).

Step 12. Connect jumper between wire 304 (13) and ground at oil pressure sender (14).

Step 13. Disconnect warning delay relay connector (5) and check for continuity between wire 304 (13) and ground.

- If there is continuity, reconnect warning delay relay connector, remove jumper, and replace oil pressure sender (page 4-202) or water temperature sending unit (page 4-203).
- If there is no continuity, reconnect warning delay relay connector and go to step 14.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 14. Disconnect connector E (15) and check for continuity between wire 304 (13) and ground.

- If there is continuity, repair wiring 304 between warning delay relay and connector E.
- If there is no continuity, repair wiring 304 between connector E and oil pressure sender.

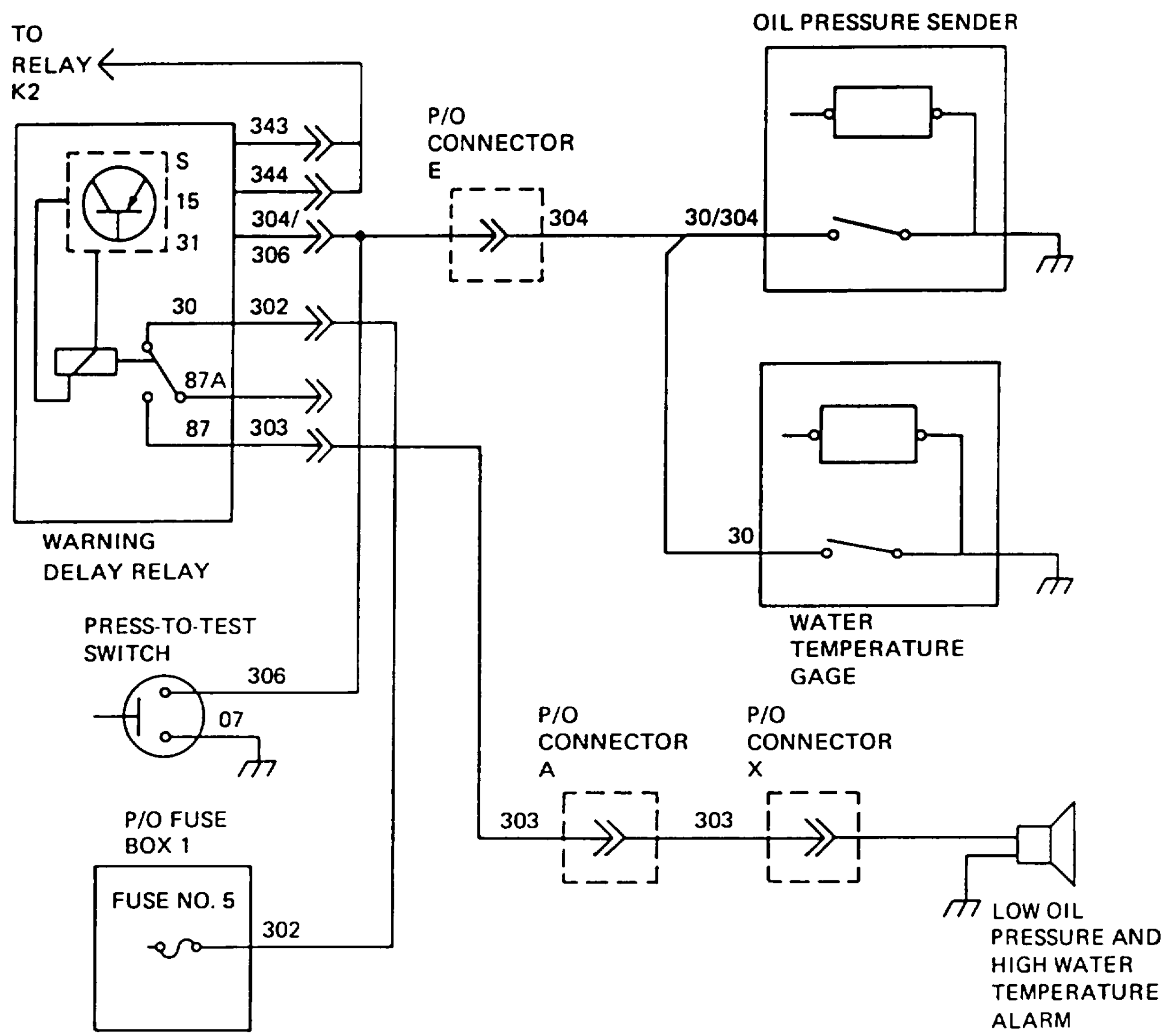


Table 3-5. Troubleshooting (Cont)

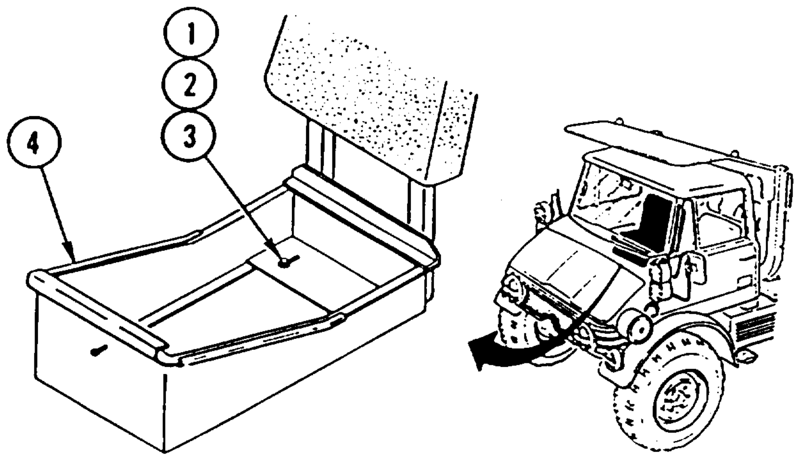
Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

72. Hydraulic Suspension LOCKOUT WILL NOT ENGAGE (HMMH).

NOTE

Electrical quick disconnect for forklift must be connected to vehicle.



Step 1. Remove four screws (1), four washers (2), four spring tension washers (3), and passenger seat (4).

NOTE

- For steps 2 thru 49, engine must be running and clutch depressed. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-235) for all wiring repair steps.

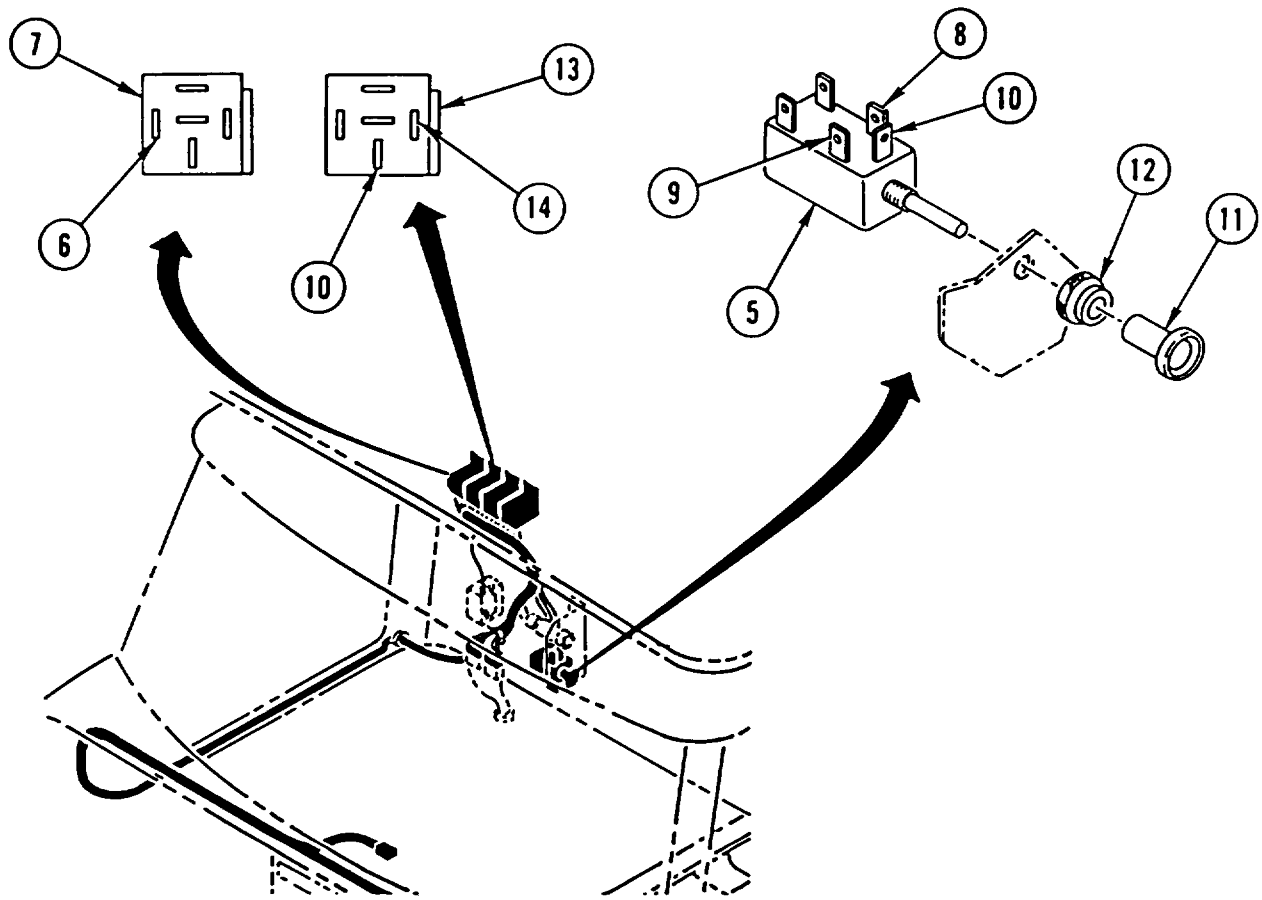
Step 2. Pull and release suspension lockout control switch (5).

- If indicator light lights when control switch is pulled but goes out when control switch is released, go to step 8.
- If indicator light is not lit but pump motor is running, go to step 14.
- If indicator light is lit, pump motor is running, but lockout is not engaged, go to step 16.
- if indicator light is lit but pump motor is not running, go to step 32.
- If indicator light is not lit and pump motor is not running, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 3. Check for +24 VDC between wire 286 (6) and ground at D+ relay (7).

- If +24 VDC is not present, go to step 37.
- If +24 VDC is present, go to step 4.

Step 4. Check for +24 VDC between wire 712 (8) and ground at control switch (5).

- If +24 VDC is not present, go to step 21.
- If +24 VDC is present, go to step 5.

Step 5. While holding control switch (5) completely out, check for +24 VDC between wire 714 (9) and ground at control switch.

If +24 VDC is not present, replace control switch (5) by removing wire 712 (8), wire 714 (9), wire 713 (10), knob (11), nut (12), and control switch.

If +24 VDC is present, release control switch and go to step 6.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 6. Check for +24 VDC between wire 713 (10) and ground at control switch (5).

- If +24 VDC is not present, replace control switch (5) by removing wire 712 (8), wire 714 (9), wire 713 (10), knob (11), nut (12), and control switch.
- If +24 VDC is present, go to step 7.

Step 7. Check for +24 between wire 713 (10) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring 713 between control switch and solenoid relay.
- If +24 VDC is present, go to step 8.

Step 8. Check wire 03 (14) at solenoid relay (13) for continuity to ground.

- If open to ground, repair wiring 03 between solenoid relay and NATO slave receptacle.
- If short to ground, go to step 9.

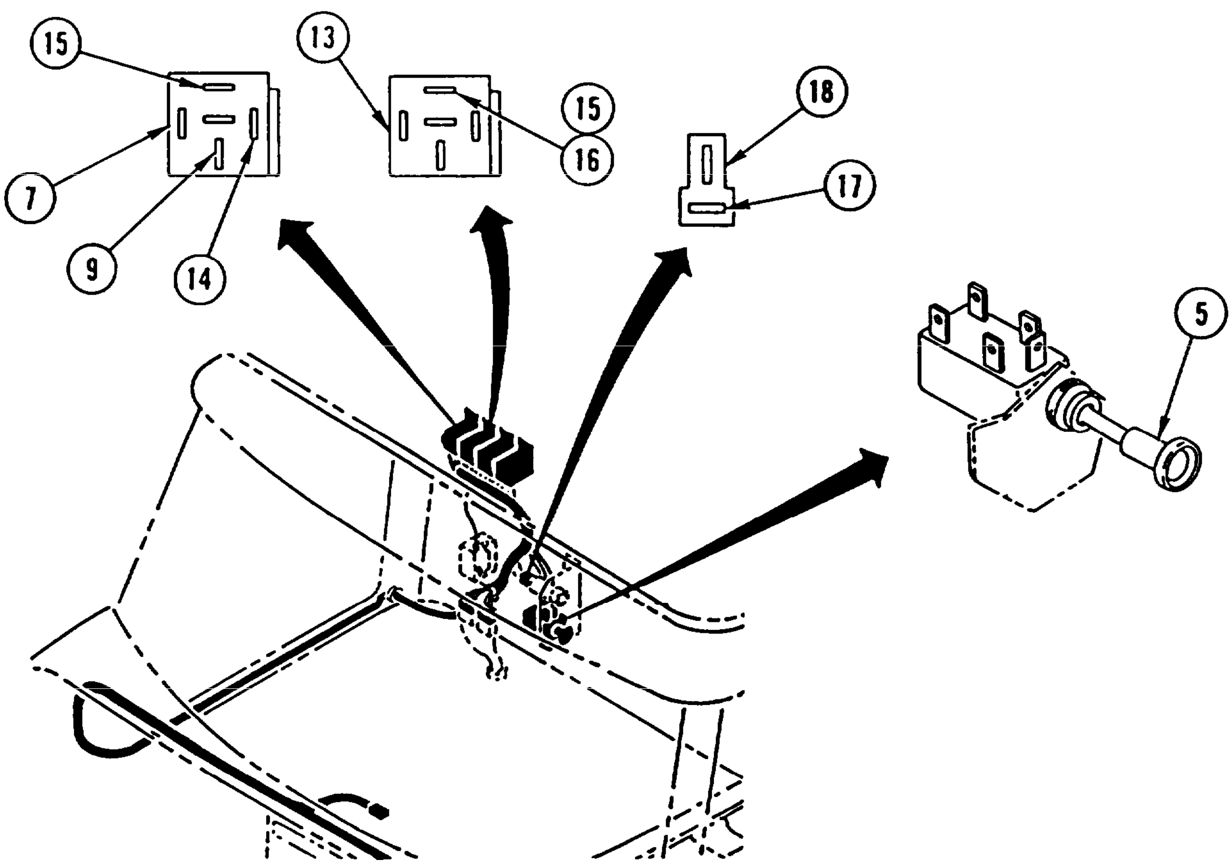


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 9. While holding control switch (5) completely out, check for +24 VDC between wire 714 (9) and ground at D+ relay (7).

- If +24 VDC is not present, repair wiring 714 between control switch and D+ relay.
- If +24 VDC is present, go to step 10.

Step 10. While holding control switch (5) completely out, check for +24 VDC between wire 72 (15) and ground at D+ relay (7).

- If +24 VDC is present, go to step 12.
- If +24 VDC is not present, go to step 11.

Step 11. Check wire 03 (14) at D+ relay (7) for continuity to ground.

- If open to ground, repair wiring 03 between D+ relay and ground at NATO slave receptacle.
- If short to ground, replace D+ relay.

Step 12. Check for +24 VDC between wire 72 (15) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring 72 between solenoid relay and D+ relay.
- If +24 VDC is present, go to step 13.

Step 13. Check for +24 VDC between wire 721 (16) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring 721 at solenoid relay.
- If +24 VDC is present, go to step 14.

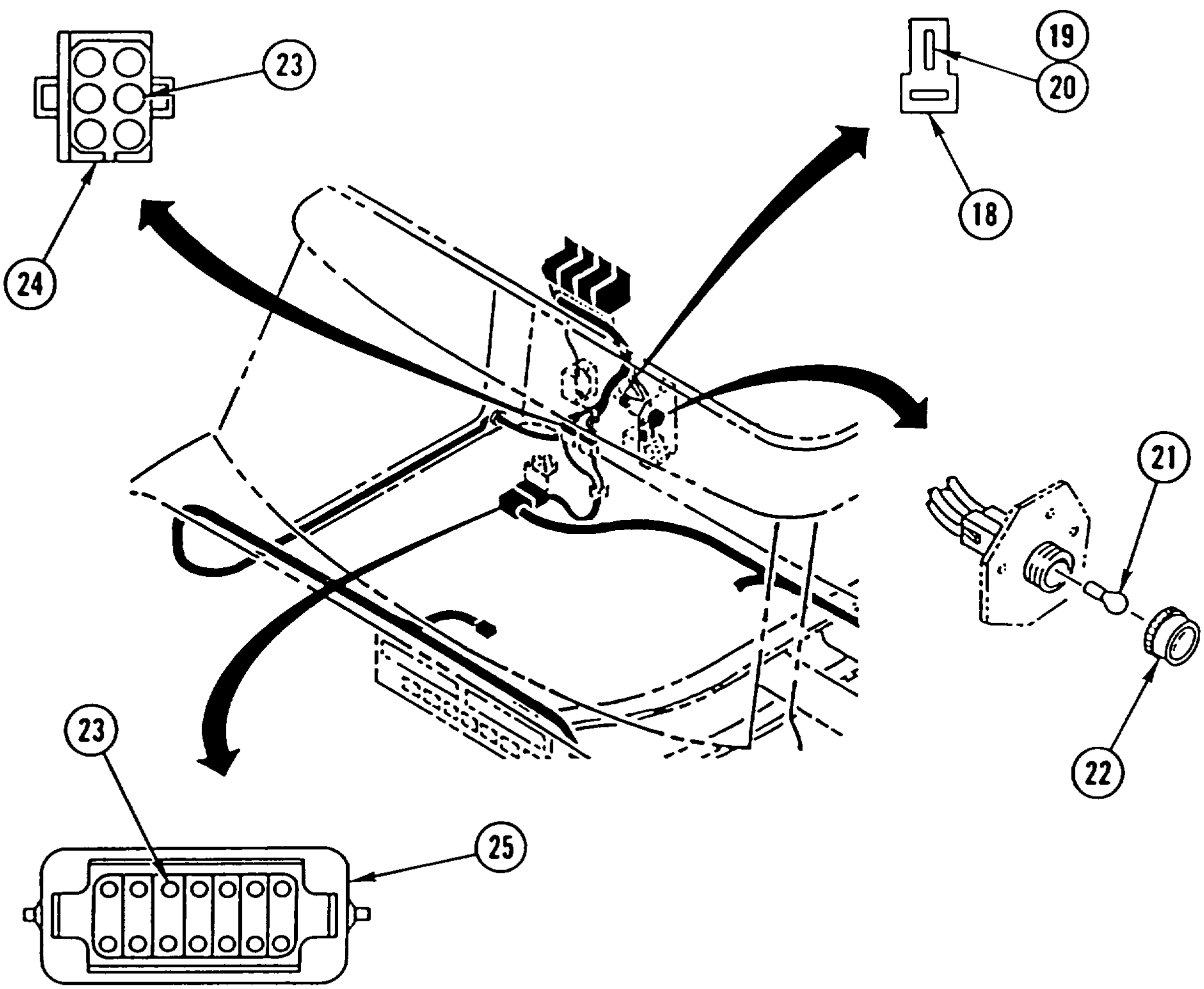
Step 14. Check for +24 VDC between wire 722 (17) and ground at indicator light (18).

- If +24 VDC is not present, repair wiring 722 between solenoid relay and indicator light.
- If +24 VDC is present, go to step 15.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 15. Check wire 0 (19) and wire 01 (20) at indicator light (18) for continuity to ground.

- If open to ground, repair wiring 0 and wiring 01 between indicator light and ground.
- If short to ground, replace lamp (21) by removing nut and lens assembly (22) and lamp.

Step 16. Check for +24 VDC between wire 10 (23) and ground at connector AB (24).

- If +24 VDC is not present, repair wiring 10 between indicator light and connector AB.
- If +24 VDC is present, go to step 17.

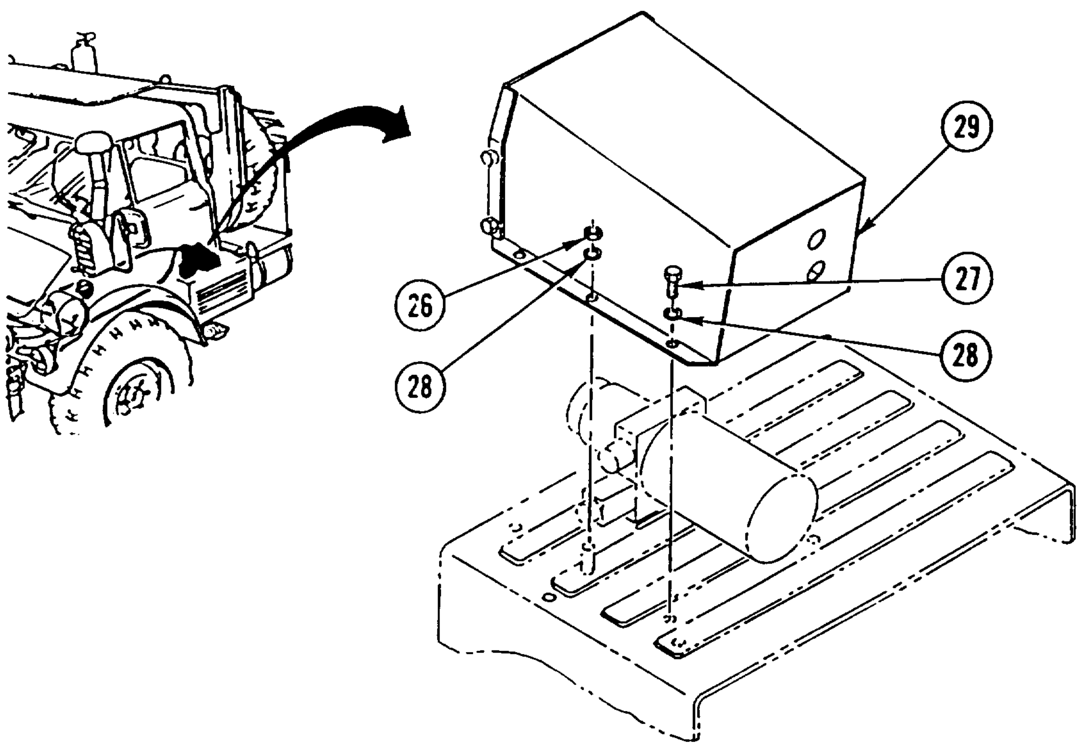
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 17. Check for +24 VDC between wire 10 (23) and ground at pin 10 of cab floor separation point (25).

- If +24 VDC **is** not present, repair wiring 10 between connector AB and cab floor separation point.
- If +24 VDC is present, go to step 18.

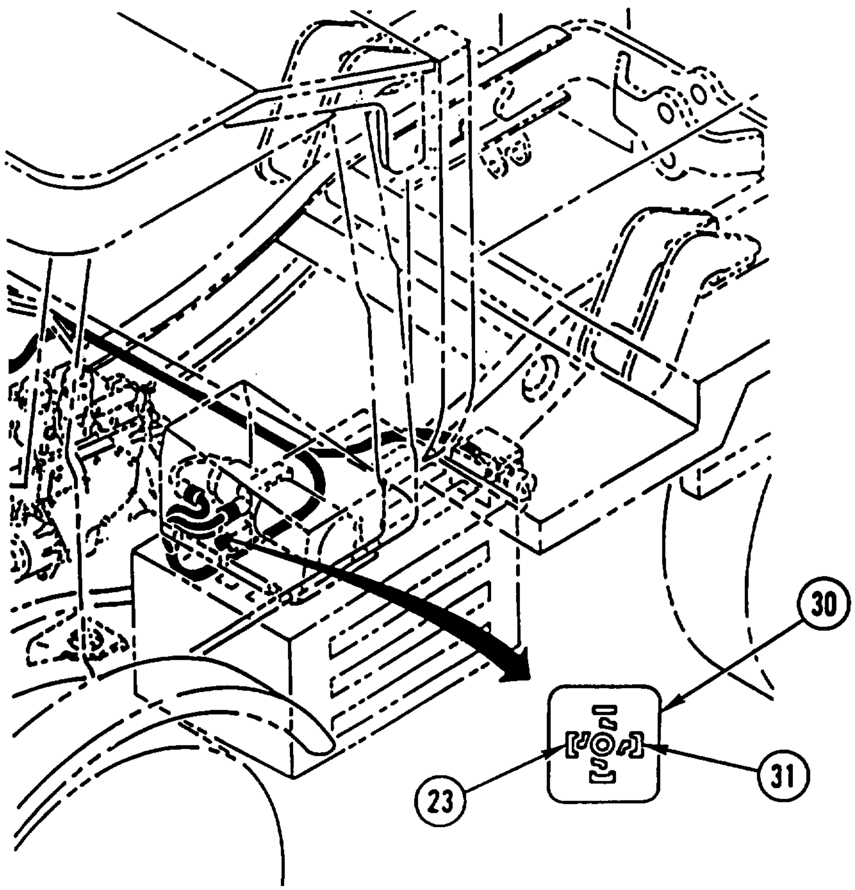


Step 18. Remove two nuts (26), four bolts (27), six washers (28), and cover (29).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspectlin
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 19. Check for +24 VDC between wire 10 (23) and ground at pin 1 of solenoid connector (30).

- If +24 VDC is not present, repair wiring 10 between cab floor separation point and solenoid connector.
- If +24 VDC is present, go to step 20.

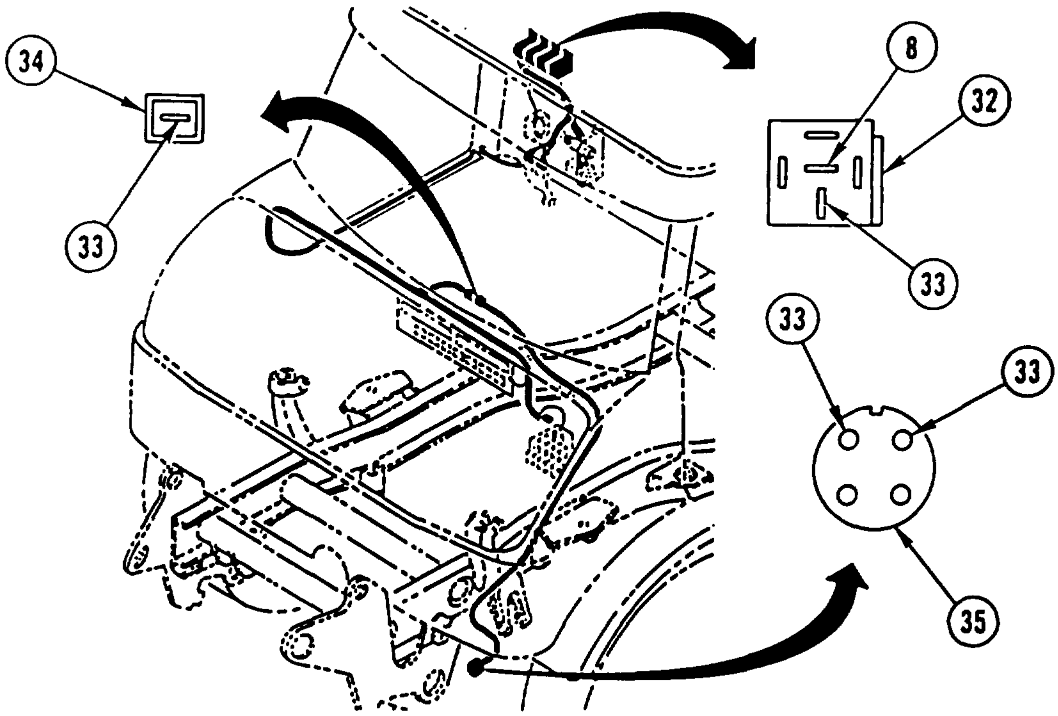
Step 20. Check wire 02 (31) at solenoid connector (30) for continuity to ground.

- If open to ground, repair wiring 02 between solenoid and ground at NATO slave receptacle.
- If short to ground, replace hydraulic suspension lockout pump (page 4-51 1).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 21. Check for +24 VDC between wire 712 (8) and ground at fast group relay (32).

- If +24 VDC is present, repair wiring 712 between fast group relay and control switch.
- If +24 VDC is not present, go to step 22.

Step 22. Check for +24 VDC between wire 71 (33) and ground at fast group relay (32).

- If +24 VDC is present, go to step 27.
- If +24 VDC is not present, go to step 23.

Step 23. Check for +24 VDC between wire 71 (33) and ground at connector AG (34).

- If +24 VDC is present, repair wiring 71 between fast group relay and connector AG.
- If +24 VDC is not present, go to step 24.

Step 24. Check for +24 VDC between wire 71 (33) and ground at pin 4 of forklift wiring harness connector (35).

- If +24 VDC is present, repair wiring 71 between connector AG and forklift wiring harness connector.
- If +24 VDC is not present, go to step 25.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 25. Check for +24 VDC between wire 71 (33) and ground at pin 1 of forklift wiring harness connector (35).

- If +24 VDC is present, repair wiring 71 between pin 1 and pin 4 of forklift wiring harness connector.
- If +24 VDC is not present, go to step 26.

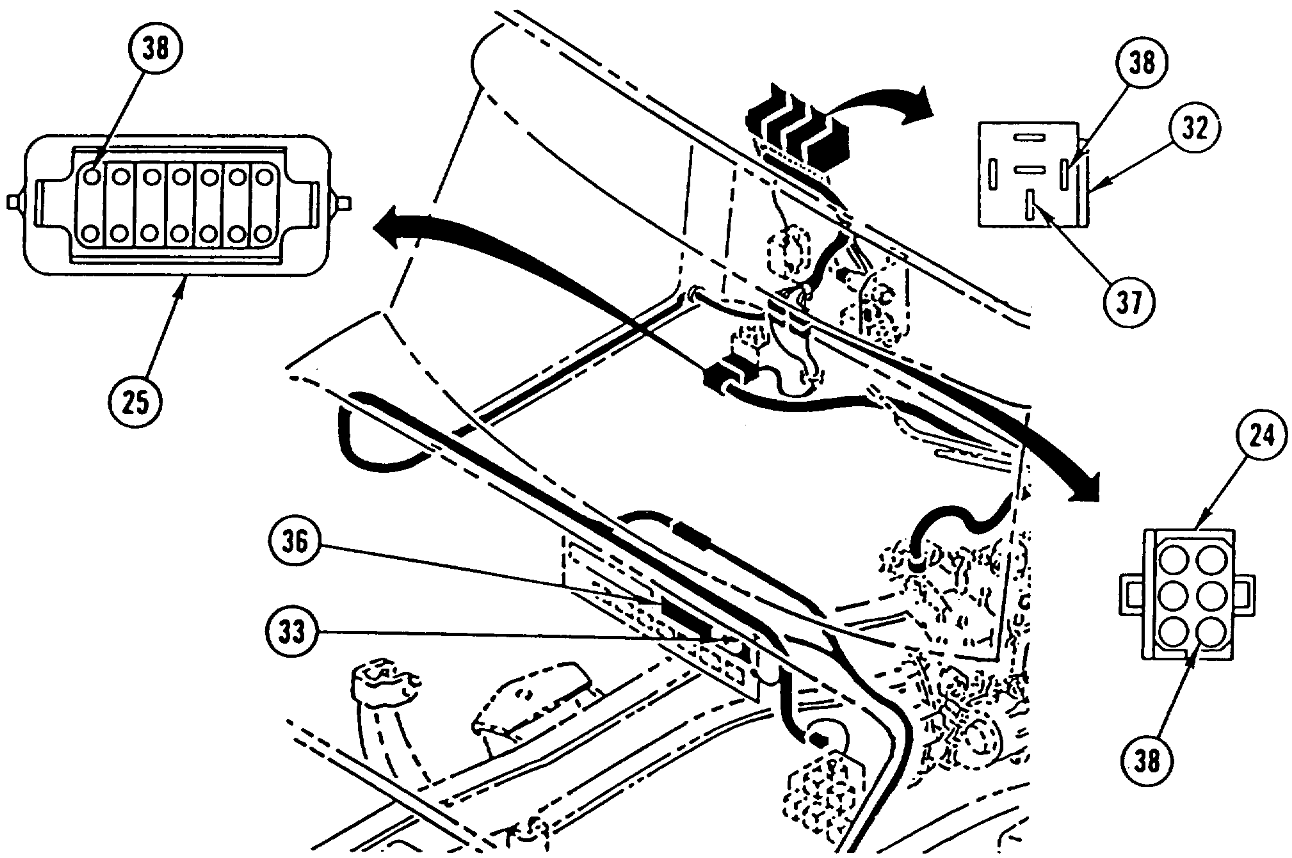


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 26. Check for +24 VDC between wire 71 (33) and ground at fuse box 1 (36).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring 71 between fuse box 1 and forklift wiring harness connector.

Step 27. Check for +24 VDC between wire 711 (37) and ground at fast group relay (32).

- If +24 VDC is not present, repair wiring 711 at fast group relay.
- If +24 VDC is present, go to step 28.

Step 28. Check wire 008 (38) at fast group relay (32) for continuity to ground.

- If open to ground, replace relay.
- If short to ground, go to step 29.

Step 29. Disconnect connector AB (24) and check wire 008 (38), on relay side of connector, for continuity to ground.

- If short to ground, repair wiring 008 between fast group relay and connector AB.
- If open to ground, reconnect connector AB and go to step 30.

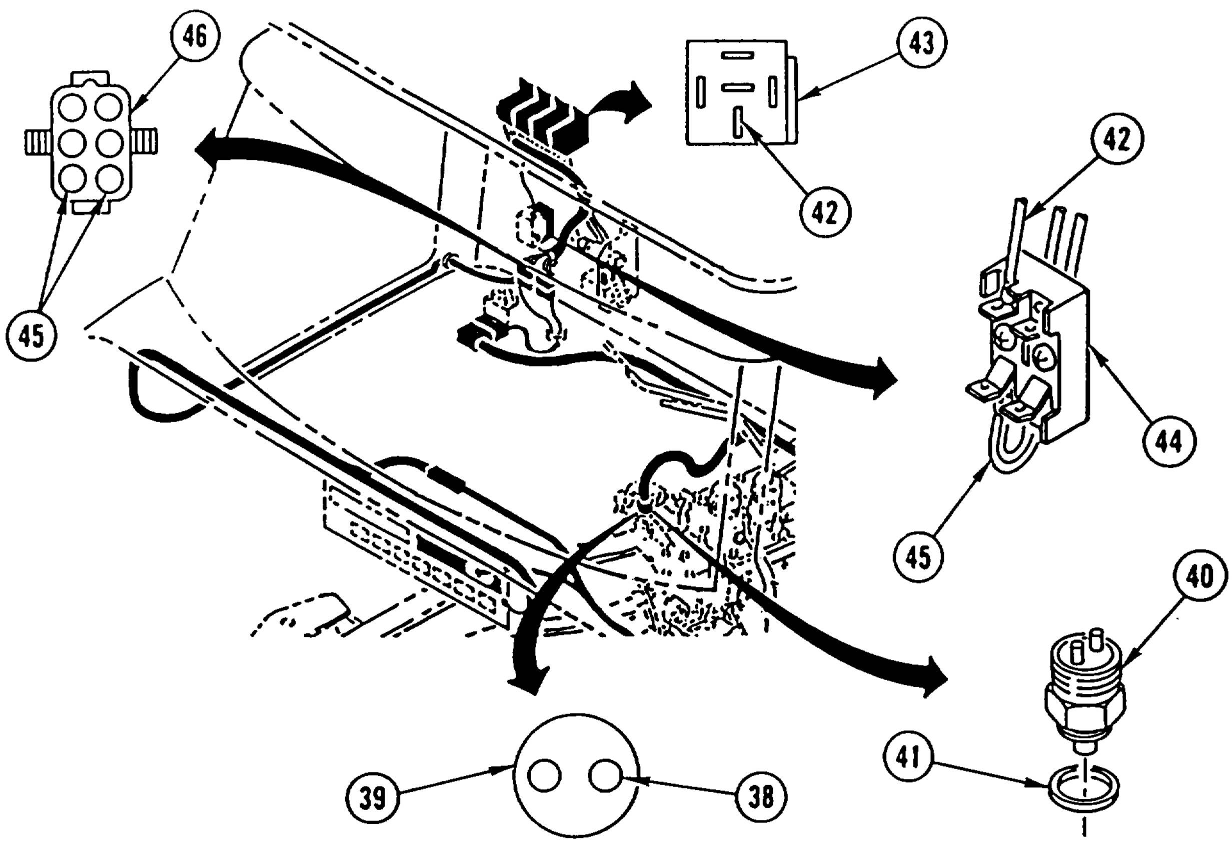
Step 30. Disconnect cab floor separation point (25) and check wire 008 (38), on cab side of connector, for continuity to ground.

- If short to ground, repair wiring 008 between connector AB and cab floor separation point.
- If open to ground, reconnect cab floor separation point and go to step 31.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 31. Disconnect intermediate speed shift and indicator switch connector (39) and check wire 008 (38) for continuity to ground.

- If open to ground, replace intermediate speed shift and indicator switch (40) by removing switch and washer (41).
- If short to ground, repair wiring 008 between cab floor separation point and intermediate speed shift and indicator switch connector.

Step 32. Check for +24 VDC between wire 113 (42) and ground at motor relay (43).

- If +24 VDC is present, go to step 38.
- If +24 VDC is not present, go to step 33.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step **33.** Check for +24 VDC between wire 113 (42) and ground at fuse box 3 (44).

- If +24 VDC is present, repair wiring 113 between motor relay and fuse box 3.
- If +24 VDC is not present, go to step 34.

Step 34. Check for +24 VDC between wire 2 and wire 9 (45) and ground at fuse box 3 (44).

- If +24 VDC is present, replace 16 amp fuse.
- If +24 VDC is not present, go to step 35.

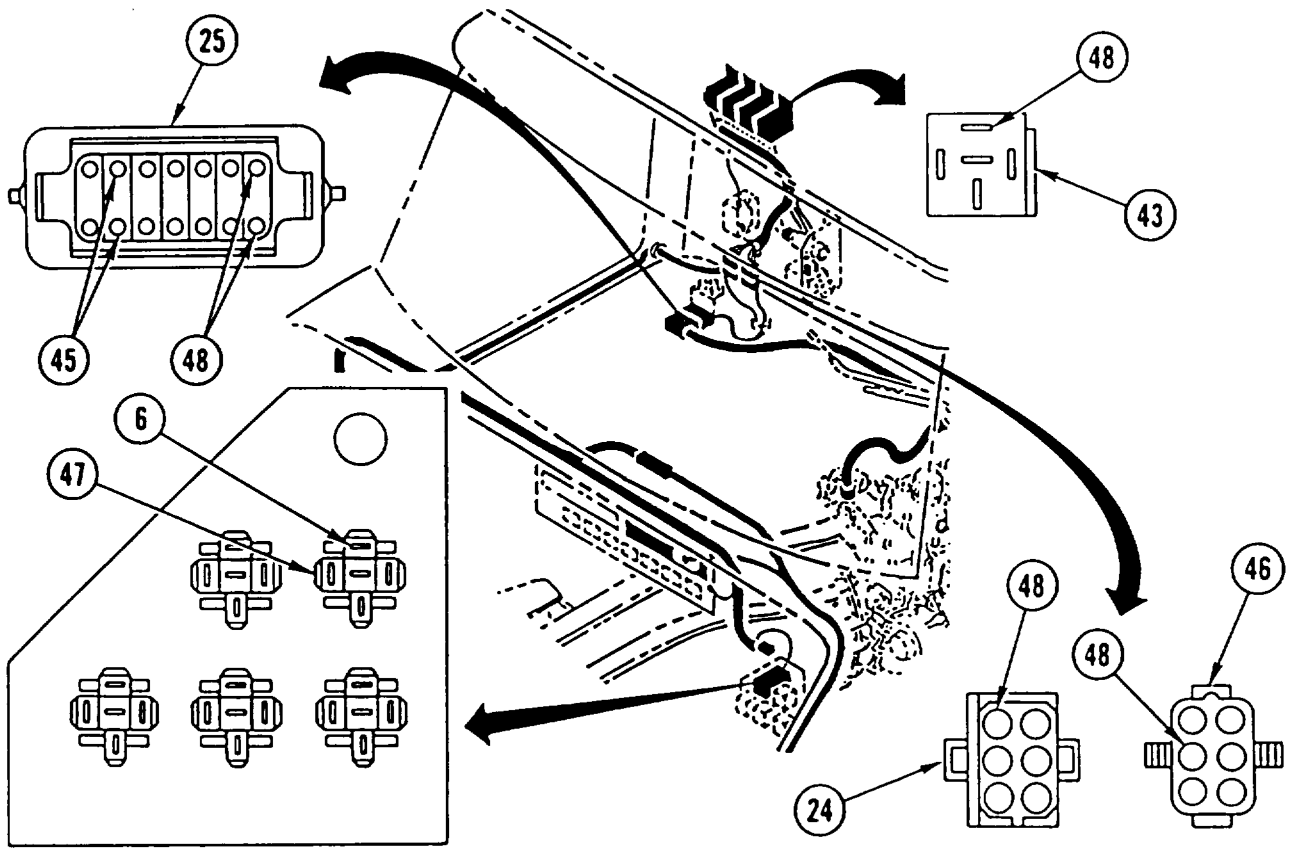
Step 35. Check for +24 VDC between wire 2 and wire 9 (45) and ground at connector AA (46).

- If +24 VDC is present, repair wiring 2 and wiring 9 between connector AA and fuse box 3.
- If +24 VDC is not present, go to step 36.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 36. Check for +24 VDC between wire 2 and wire 9 (45) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring 2 and wiring 9 between NATO slave receptacle and cab floor separation point.
- If +24 VDC is present, repair wiring 2 and wiring 9 between cab floor separation point and connector AA.

Step 37. Check for +24 VDC between wire 286 (6) and ground at relay K2 (47).

- If +24 VDC is not present, perform Malfunction 2.
- If +24 VDC is present, repair wiring 286 between D+ relay and relay K2.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 38. Check for +24 VDC between wire 7 and wire 14 (48) and ground at motor relay (43).

- If +24 VDC is not present, go to step 42.
- If +24 VDC is present, go to step 39.

Step 39. Check for +24 VDC between wire 7 and wire 14 (48) and ground at connector AA (46) and connector AB (24).

- If +24 VDC is not present, repair wiring 7 and wiring 14 between motor relay and connector AA and connector AB.
- If +24 VDC is present, go to step 40.

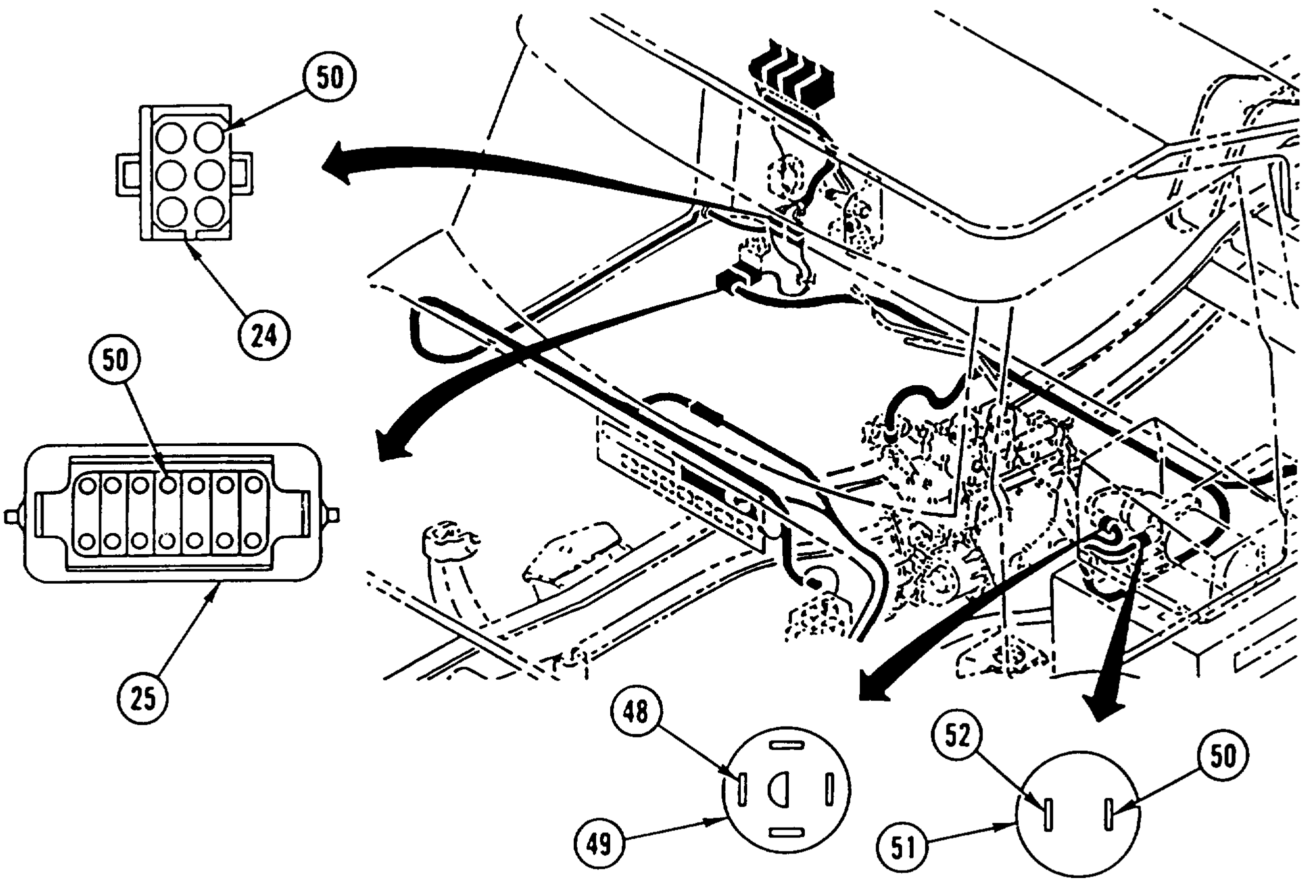
Step 40. Check for +24 VDC between wire 7 and wire 14 (48) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring 7 and wiring 14 between connector AA and connector AB and cab floor separation point.
- If +24 VDC is present, go to step 41.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 41. Check for +24 VDC between wire 7 and wire 14 (48) and ground at suspension lockout pump motor (49).

- If +24 VDC is not present, repair wiring 7 and wiring 14 between cab floor separation point and pump motor.
- If +24 VDC is present, replace hydraulic suspension tockout pump (page 4-51 1).

Step 42. Check for +24 VDC between wire 11 (50) and ground at connector AB (24).

- If +24 VDC is not present, repair wiring 11 between D+ relay and connector AB.
- If +24 VDC is present, go to step 43

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 43. Check for +24 VDC between wire 11 (50) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring 11 between connector AB and cab floor separation point.
- If +24 VDC is present, go to step 44.

Step 44. Check for +24 VDC between wire 11 (50) and ground at hydraulic switch (51),

- If +24 VDC is not present, repair wiring 11 between cab floor separation point and hydraulic switch.
- If +24 VDC is present, go to step 45.

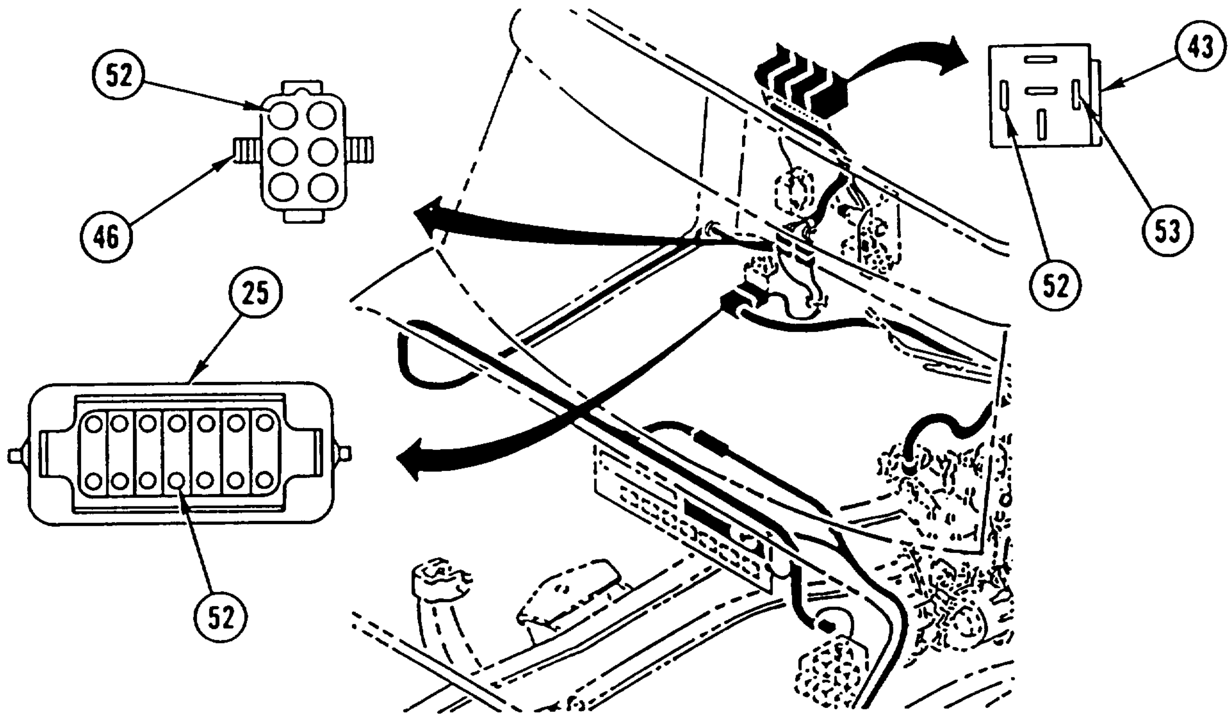
Step 45. Check for +24 VDC between wire 4 (52) and ground at hydraulic switch (51).

- If +24 VDC is not present, replace hydraulic suspension lockout pump (page 4-51 1).
- If +24 VDC is present, go to step 46.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 46. Check for +24 VDC between wire 4 (52) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring 4 between hydraulic switch and cab floor separation point.
- If +24 VDC is present, go to step 47.

Step 47. Check for +24 VDC between wire 4 (52) and ground at connector AA (46).

- If +24 VDC is not present, repair wiring 4 between cab floor separation point and connector AA.
- If +24 VDC is present, go to step 48.

Step 48. Check for +24 VDC between wire 4 (52) and ground at motor relay (43).

- If +24 VDC is not present, repair wiring 4 between connector AA and motor relay.
- If +24 VDC is present, go to step 49.

Step 49. Check wire 01 (53) at motor relay (43) for continuity to ground.

- If short to ground, replace motor relay.
- If open to ground, repair wiring 01 between motor relay and NATO slave receptacle.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRIAL SYSTEM (CONT)

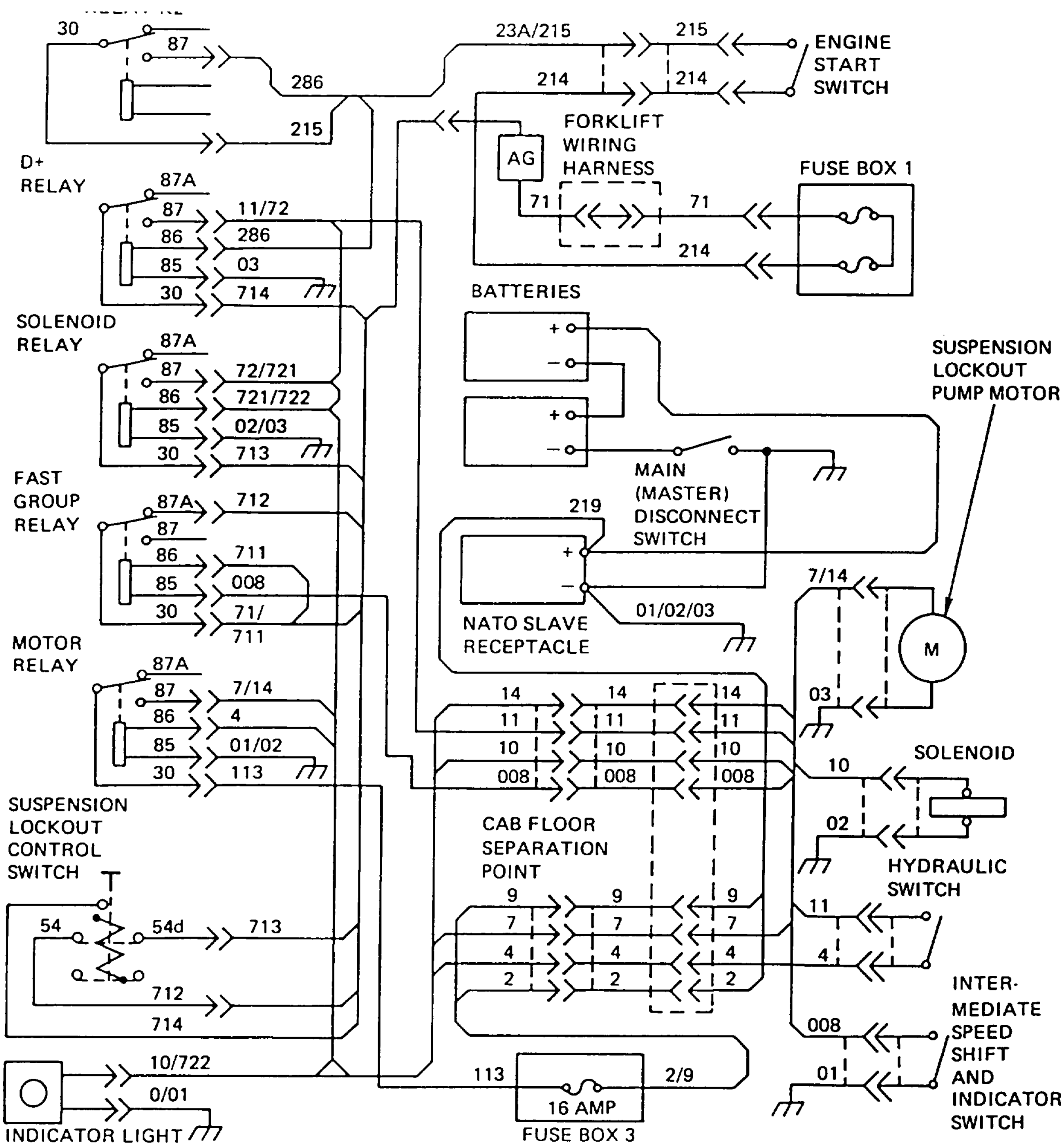


Table 3-5. Troubleshooting (Cont)

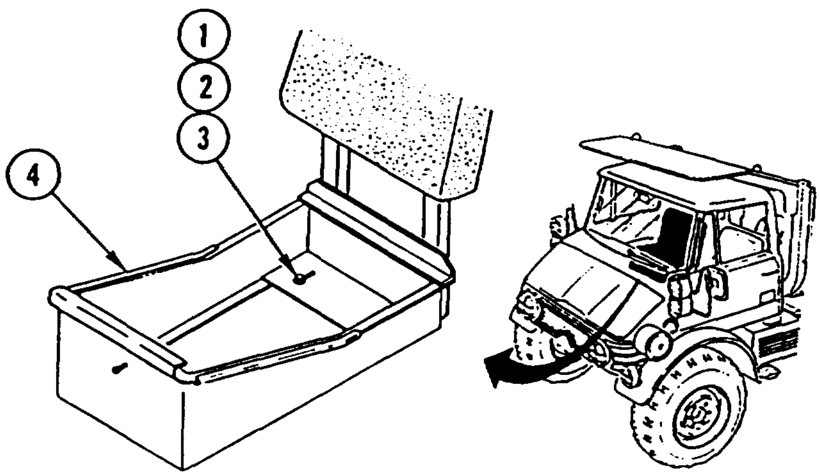
Malfunction
Test or Inspectlin
Corrective Act Ion

ELECTRICAL SYSTEM (CONT)

73. HYDRAULIC SUSPENSION LOCKOUT WILL NOT ENGAGE (HMMH) (REG. NO. UC053E THRU UC053K).

NOTE

- **Electrical quick disconnect for forklift must be connected to vehicle,**
- **Refer to wiring diagram (page 3-253) for all wiring repair steps.**

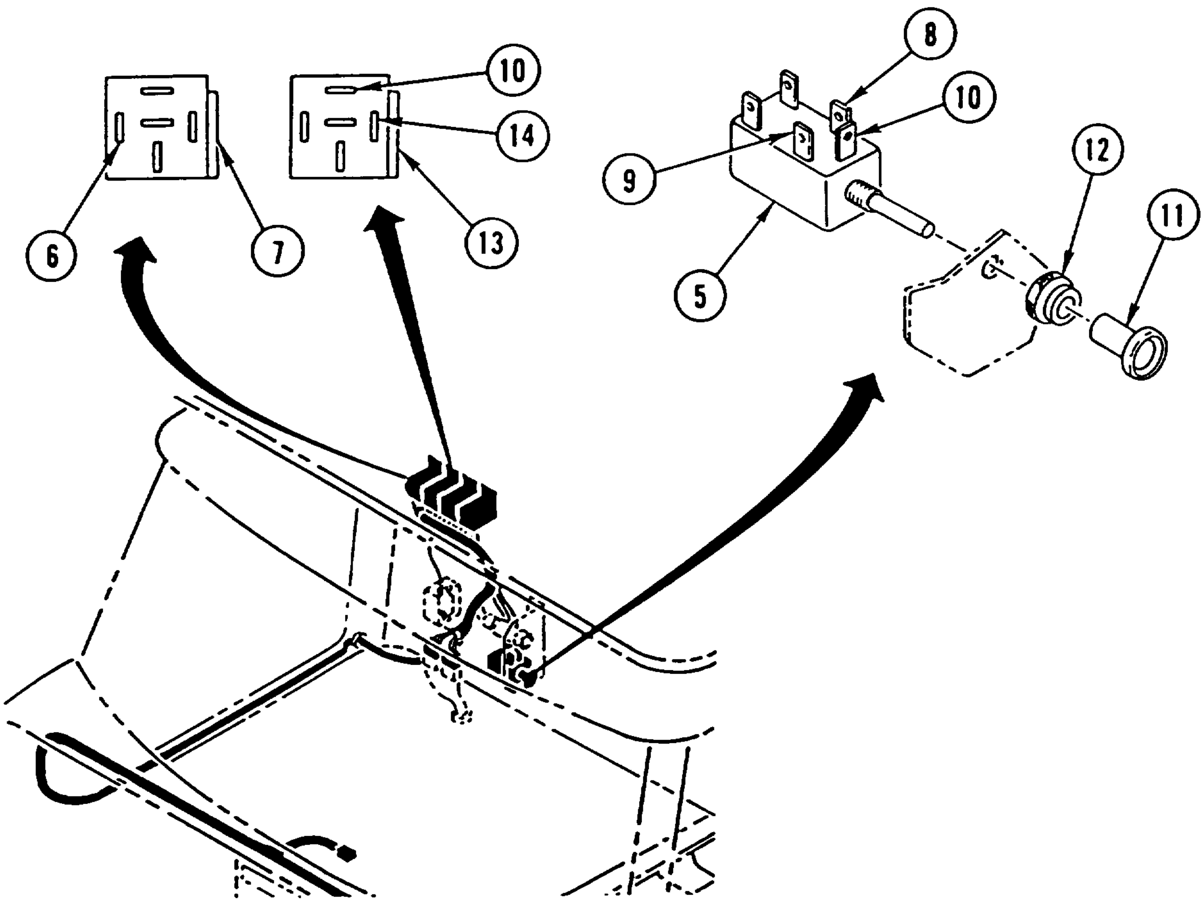


Step 1. Remove four screws (l), four washers (2), four spring tension washers (3), and passenger seat (4).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



NOTE

For steps 2 thru 48, engine must be running and clutch depressed. Failure to do so will cause erroneous results.

Step 2. Pull and release suspension lockout control switch (5).

- If indicator light lights when control switch is pulled but goes out when control switch is released, go to step 8.
- If indicator light is not lit but pump motor is running, go to step 14.
- If indicator light is lit, pump motor is running, but lockout is not engaged, go to step 17.
- If indicator light is lit but pump motor is not running, go to step 30.
- If indicator light is not lit and pump motor is not running, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 3. Check for +24 VDC between wire (6) and ground at D+ relay (7).

- If +24 VDC is not present, go to step 35.
- If +24 VDC is present, go to step 4.

Step 4. Check for +24 VDC between wire (8) and ground at control switch (5).

- If +24 VDC is not present, go to step 22.
- If +24 VDC is present, go to step 5.

Step 5. While holding control switch (5) completely out, check for +24 VDC between wire (9) and ground at control switch.

- If +24 VDC is not present, replace control switch (5) by removing wire (8), wire (9), wire (10), knob (11), nut (12), and control switch.
- If +24 VDC is present, release control switch and go to step 6.

Step 6. Check for +24 VDC between wire (10) and ground at control switch (5).

- If +24 VDC is not present, replace control switch (5) by removing wire (8), wire (9), wire (10), knob (11), nut (12), and control switch.
- If +24 VDC is present, go to step 7.

Step 7. Check for +24 VDC between wire (10) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring (10) between control switch and solenoid relay.
- If +24 VDC is present, go to step 8.

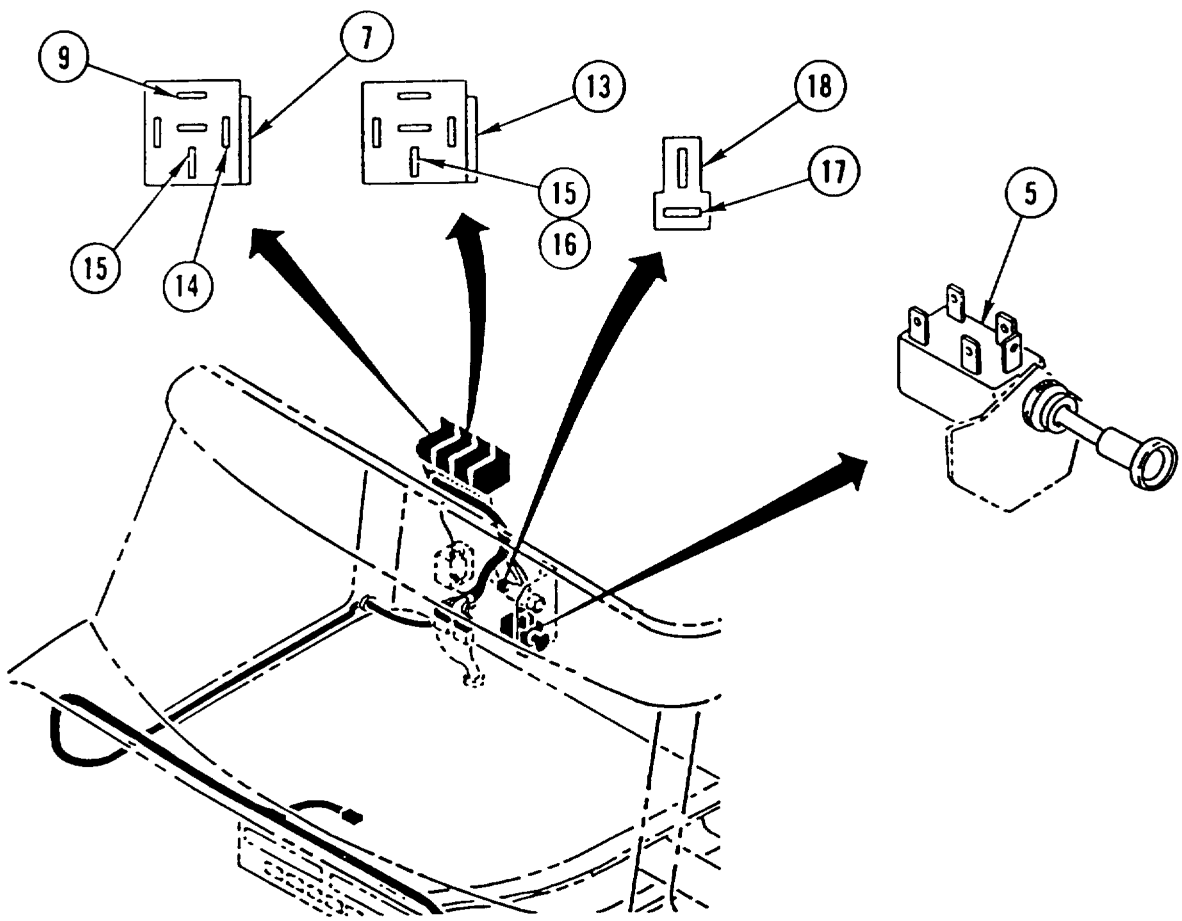
Step 8. Check wire (14) at solenoid relay (13) for continuity to ground.

- If open to ground, go to step 11.
- If short to ground, go to step 9.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 9. While holding control switch (5) completely out, check for +24 VDC between wire (9) and ground at D+ relay (7).

- If +24 VDC is not present, repair wiring (9) between control switch and D+ relay.
- If +24 VDC is present, go to step 10.

Step 10. While holding control switch (5) completely out, check for +24 VDC between wire (15) and ground at D+ relay (7).

- If +24 VDC is present, go to step 12.
- if +24 VDC is not present, go to step 11.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 11. Check wire (14) at D+ relay (7) for continuity to ground.

- If short to ground, replace D+ relay.
- If open to ground, repair wiring (14) between D+ relay and ground at fuse box 1.

Step 12. Check for +24 VDC between wire (15) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring (15) between solenoid relay and D+ relay.
- If +24 VDC is present, go to step 13.

Step 13. Check for +24 VDC between wire (16) and ground at solenoid relay (13).

- If +24 VDC is not present, repair wiring (16) at solenoid relay.
- If +24 VDC is present, go to step 14.

Step 14. Check for +24 VDC between wire (17) and ground at indicator light (18).

- If +24 VDC is not present, repair wiring (17) between solenoid relay and indicator light.
- If +24 VDC is present, go to step 15.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

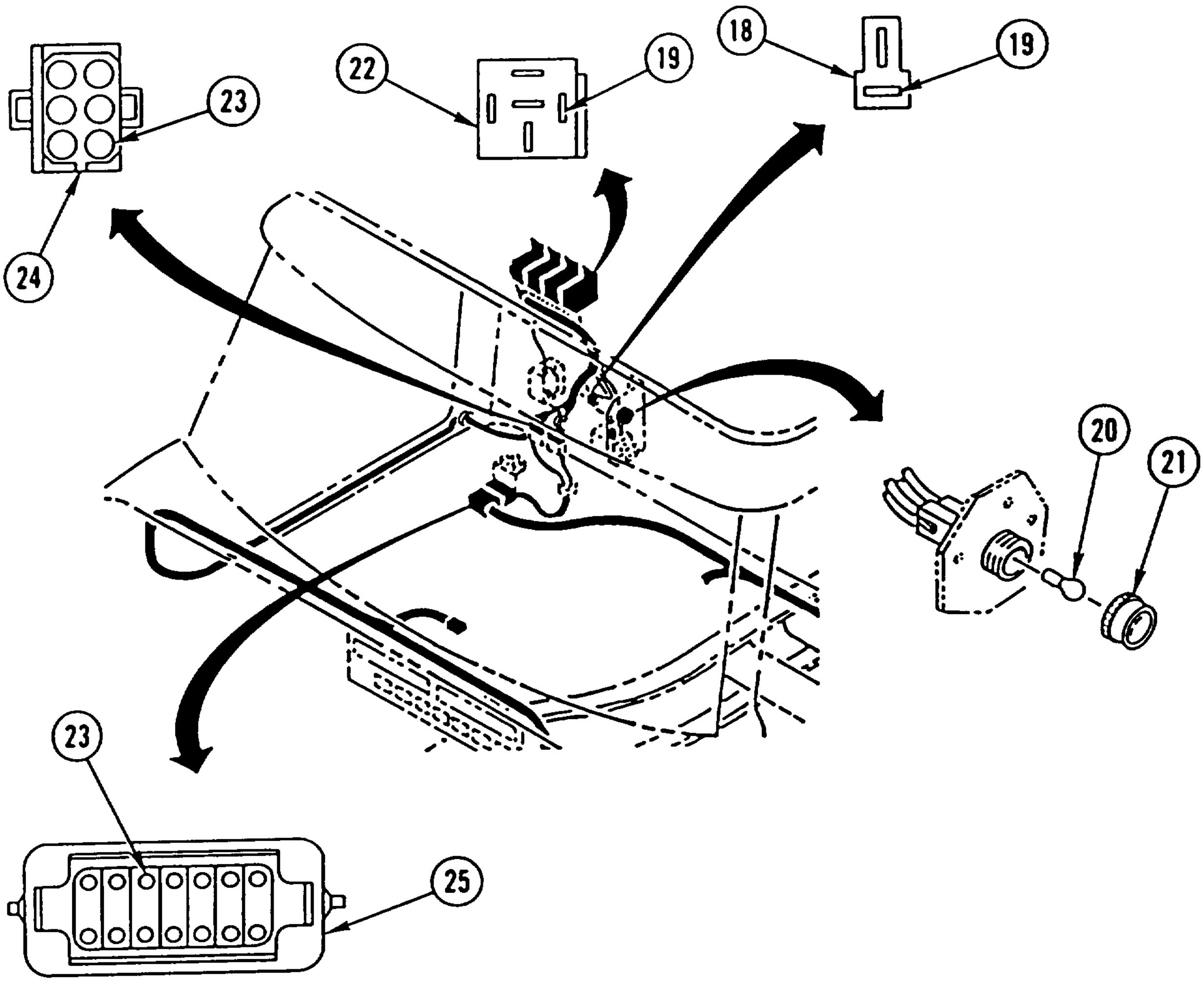


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 15. Check wire (19) at indicator light (18) for continuity to ground.

- If short to ground, replace lamp (20) by removing nut and lens assembly (21) and lamp.
- if open to ground, go to step 16.

Step 16. Check wire (19) at motor relay (22) for continuity to ground.

- If open to ground, go to step 48.
- If short to ground, repair wiring (19) between motor relay and indicator light.

Step 17. Check for +24 VDC between wire (23) and ground at connector AB (24).

- If +24 VDC is not present, repair wiring (23) between indicator light and connector AB.
- If +24 VDC is present, go to step 18.

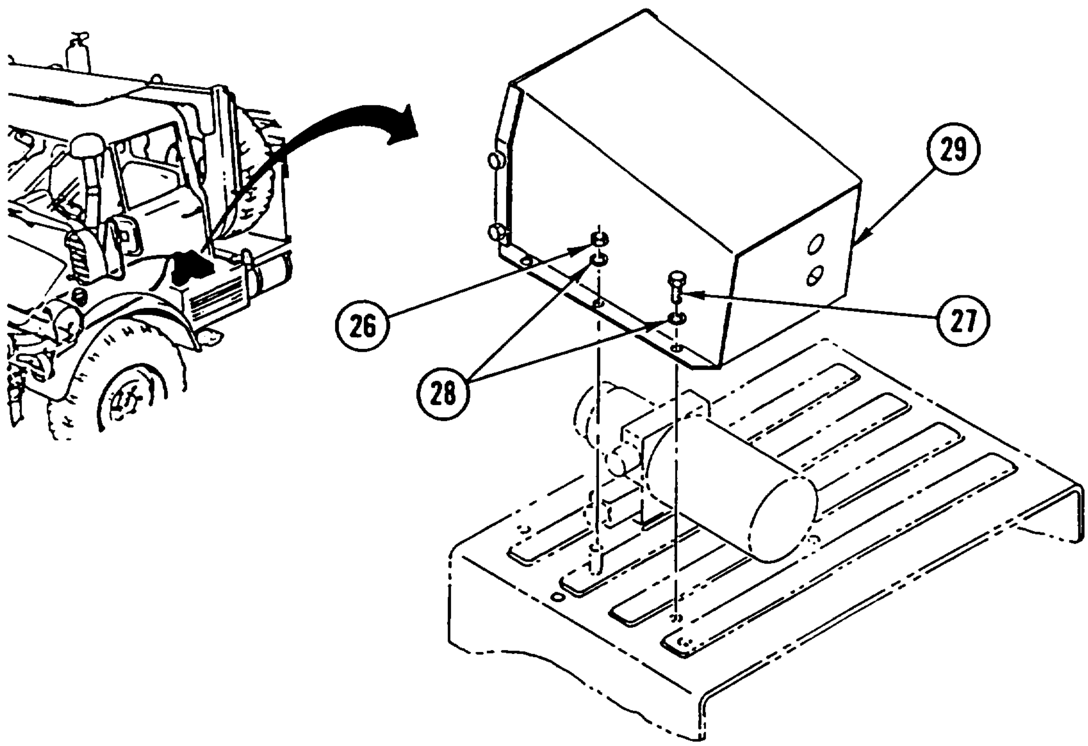
Step 18. Check for +24 VDC between wire (23) and ground at pin 10 of cab floor separation point (25).

- If +24 VDC is not present, repair wiring (23) between connector AB and cab floor separation point.
- If +24 VDC is present, go to step 19.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Actlon

ELECTRICAL SYSTEM (CONT)



Step 19. Remove two nuts (26), four bolts (27), six washers (28), and cover (29).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

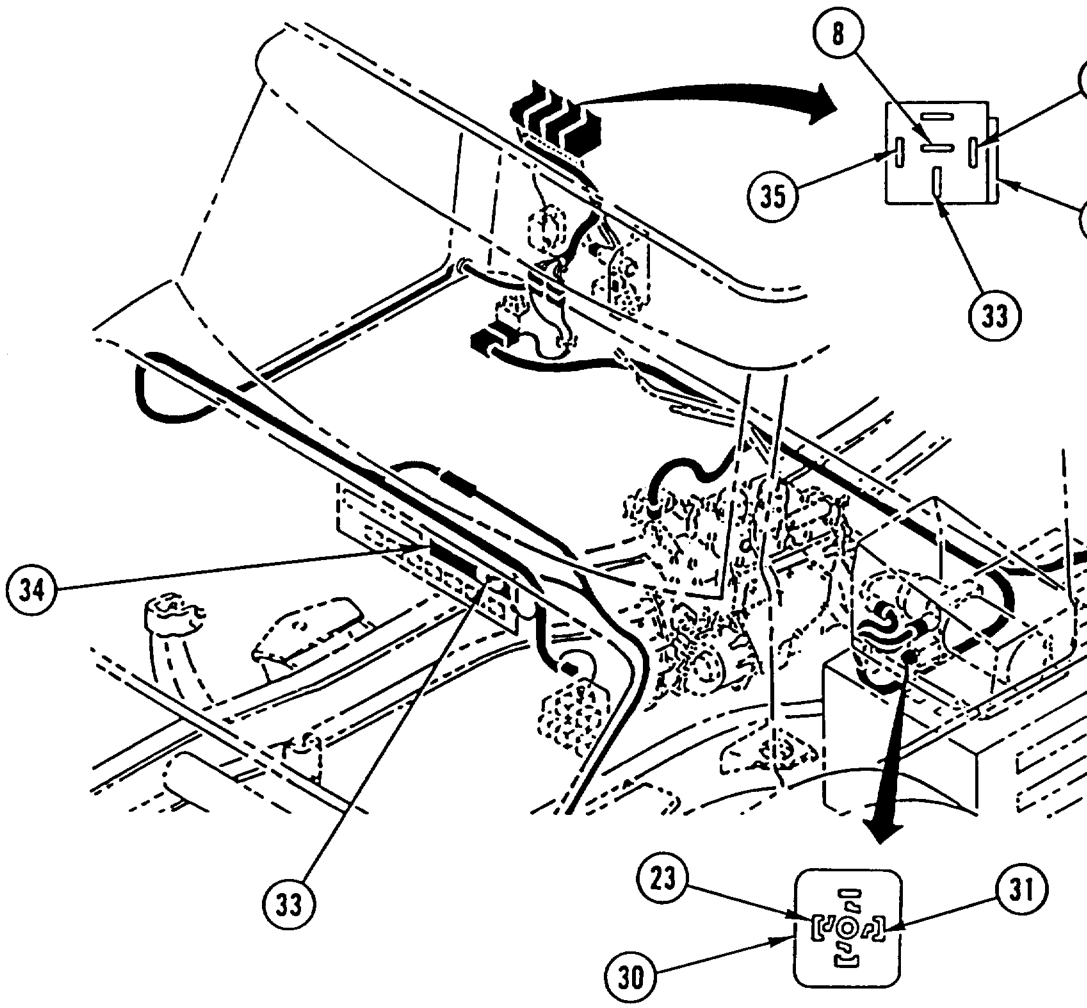


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 20. Check for +24 VDC between wire (23) and ground at pin 1 of solenoid connector (30).

- If +24 VDC is not present, repair wiring (23) between cab floor separation point and solenoid “connector.
- If +24 VDC is present, go to step 21.

Step 21. Check wire (31) at solenoid connector (30) for continuity to ground.

- If short to ground, replace hydraulic suspension lockout pump (page 4-511).
- If open to around, repair wiring (31) between solenoid and ground at NATO slave receptacle.

Step 22. Check for +24 VDC between wire (8) and ground at fast group relay (32).

- If +24 VDC is present, repair wiring (8) between fast group relay and control switch.
- If +24 VDC is not present, go to step 23.

Step 23. Check for +24 VDC between wire (33) and ground at fast group relay (32).

- If +24 VDC is present, go to step 25.
- If +24 VDC is not present, go to step 24.

Step 24. Check for +24 VDC between wire (33) and ground at fuse box 1 (34).

- If +24 VDC is not present, replace fuse.
- If +24 VDC is present, repair wiring (33) between fast group relay and fuse box 1.

Step 25. Check for +24 VDC between wire (35) and ground at fast group relay (32).

- If +24 VDC is not present, repair wiring (35) at fast group relay.
- If +24 VDC is present, go to step 26.

Step 26. Check wire (36) at fast group relay (32) for continuity to ground.

- If short to ground, go to step 27.
- If open to ground, replace relay.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

Electrical SYSTEM (CONT)

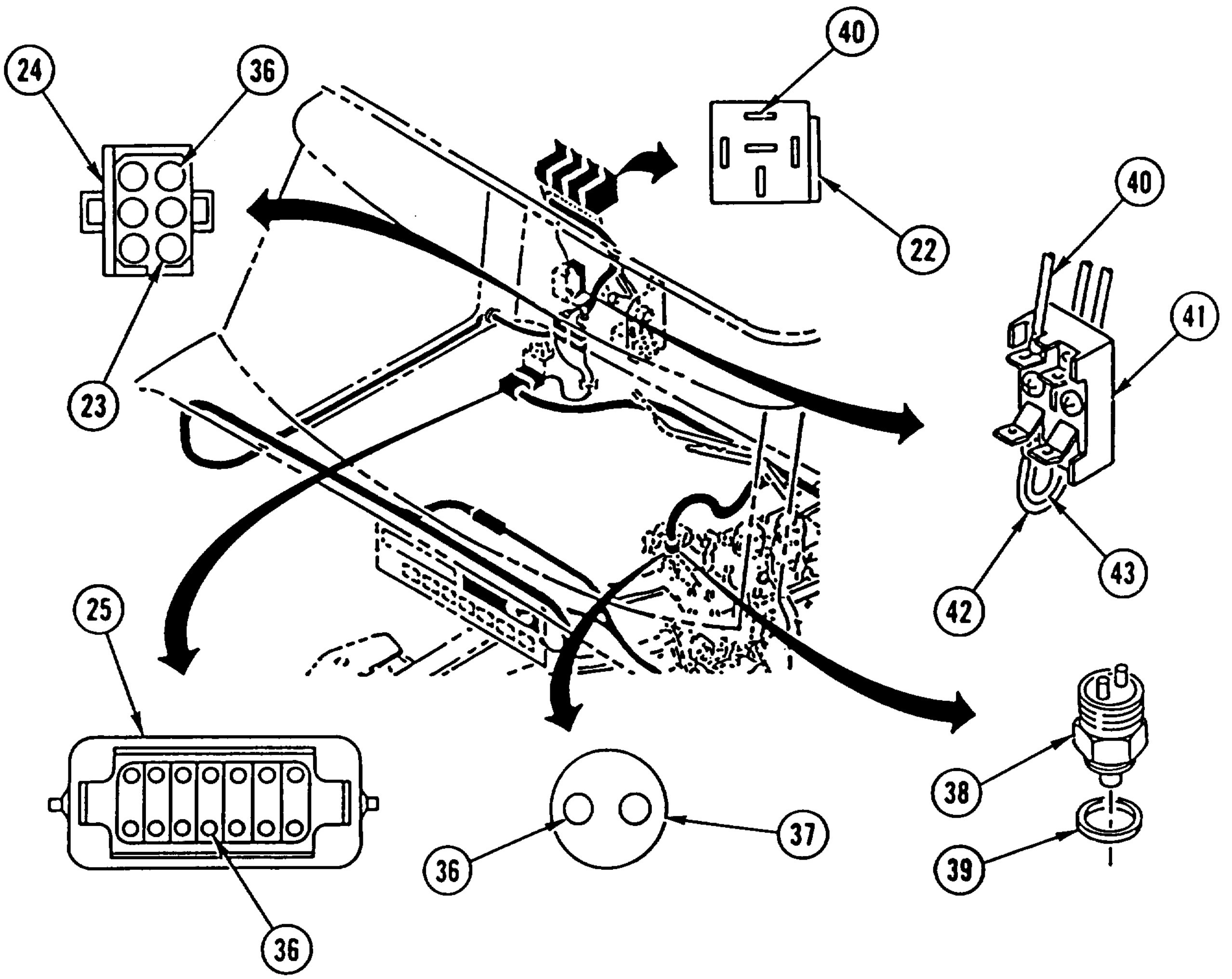


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 27. Disconnect connector AB (24) and check wire (36), on relay side of connector, for continuity to ground.

- If short to ground, repair wiring (36) between fast group relay and connector AB.
- If open to ground, reconnect connector AB and go to step 28.

Step 28. Disconnect cab floor separation point (25) and check wire (36), on cab side of connector, for continuity to ground.

- If short to ground, repair wiring (36) between connector AB and cab floor separation point.
- If open to ground, reconnect cab floor separation point and go to step 29.

Step 29. Disconnect intermediate speed shift and indicator switch connector (37) and check wire (36) for continuity to ground.

- If open to ground, replace intermediate speed shift and indicator switch (38) by removing switch and washer (39).
- If short to ground, repair wiring (36) between cab floor separation point and intermediate speed shift and indicator switch connector.

Step 30. Check for +24 VDC between wire (40) and ground at motor relay (22).

- If +24 VDC is present, go to step 37.
- If +24 VDC is not present, go to step 31.

Step 31. Check for +24 VDC between wire (40) and ground at fuse box 3 (41).

- If +24 VDC is present, repair wiring (40) between motor relay and fuse box 3.
- If +24 VDC is not present, go to step 32.

Step 32. Check for +24 VDC between wire (42) and wire (43) and ground at fuse box 3 (41).

- If +24 VDC is present, replace 16 amp fuse.
- If +24 VDC is not present, go to step 33.

Table 3-5. Troubleshooting (Cont)

Malfunction		
	Test or Inspection	
		Corrective Action

Electrical SYSTEM (CONT)

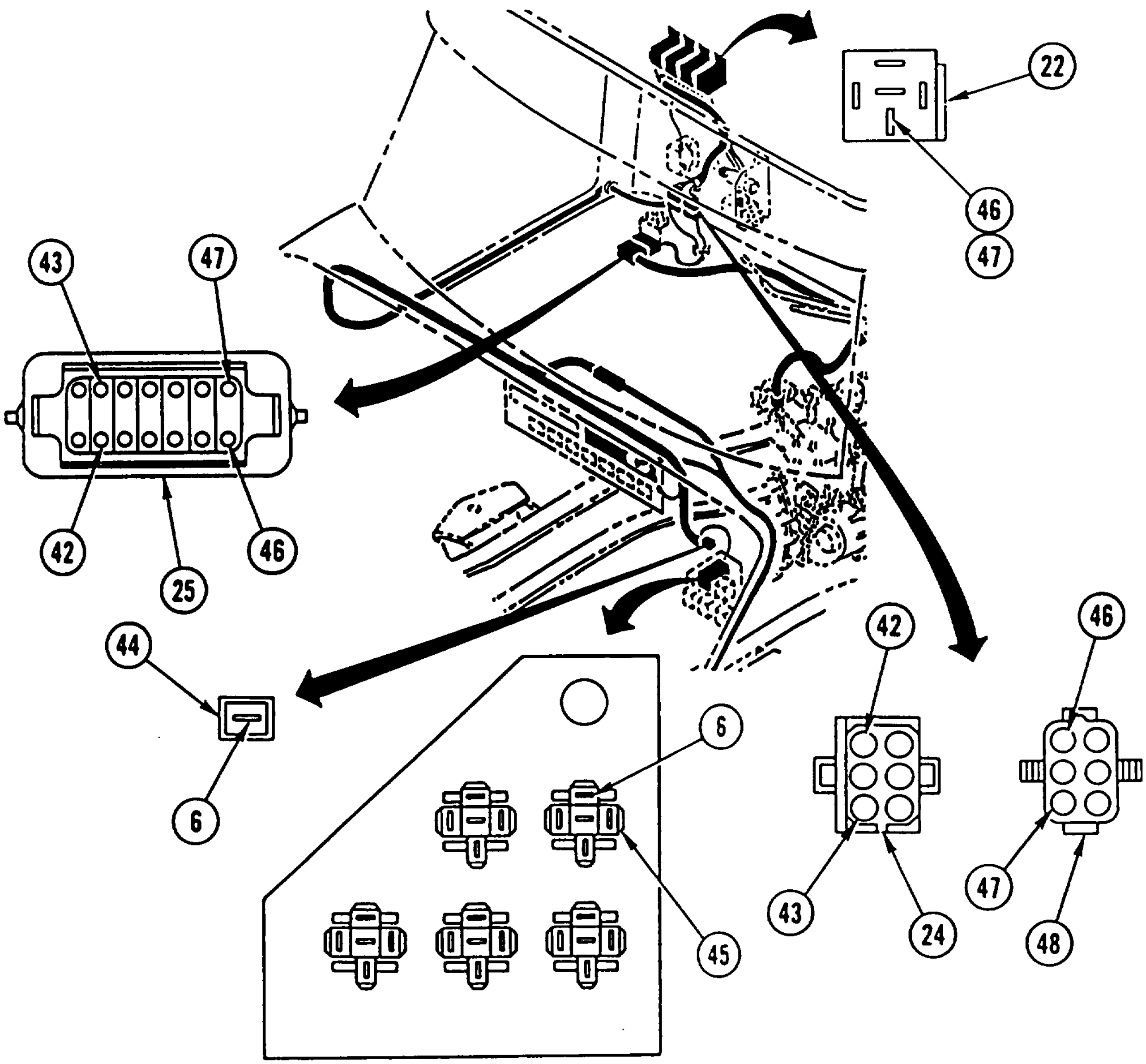


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 33. Check for +24 VDC between wire (42) and wire (43) and ground at connector AB (24).

- If +24 VDC is present, repair wiring (42) and wiring (43) between connector AB and fuse box 3.
- If +24 VDC is not present, go to step 34.

Step 34. Check for +24 VDC between wire (42) and wire (43) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring (42) and wiring (43) between NATO slave receptacle and cab floor separation point.
- If +24 VDC is present, repair wiring (42) and wiring (43) between cab floor separation point and connector AB.

Step 35. Check for +24 VDC between wire (6) and ground at conneotor W (44).

- If +24 VDC Is present, repair wiring (6) between D+ relay and connector W.
- If +24 VDC is not present, go to step 36.

Step 36. Check for +24 VDC between wire (6) and ground at relay K2 (45).

- If +24 VDC is not present, perform Malfunction 2.
- If +24 VDC is present, repair wiring 286 between connector W and relay K2.

Step 37. Check for +24 VDC between wire (46) and wire (47) and ground at motor relay (22).

- If +24 VDC is not present, go to step 41.
- If +24 VDC is present, go to step 38.

Step 38. Check for +24 VDC between wire (46) and wire (47) and ground at connector AA (48).

- If +24 VDC is not present, repair wiring (46) and wiring (47) between motor relay and connector AA.
- If +24 VDC is present, go to step 39.

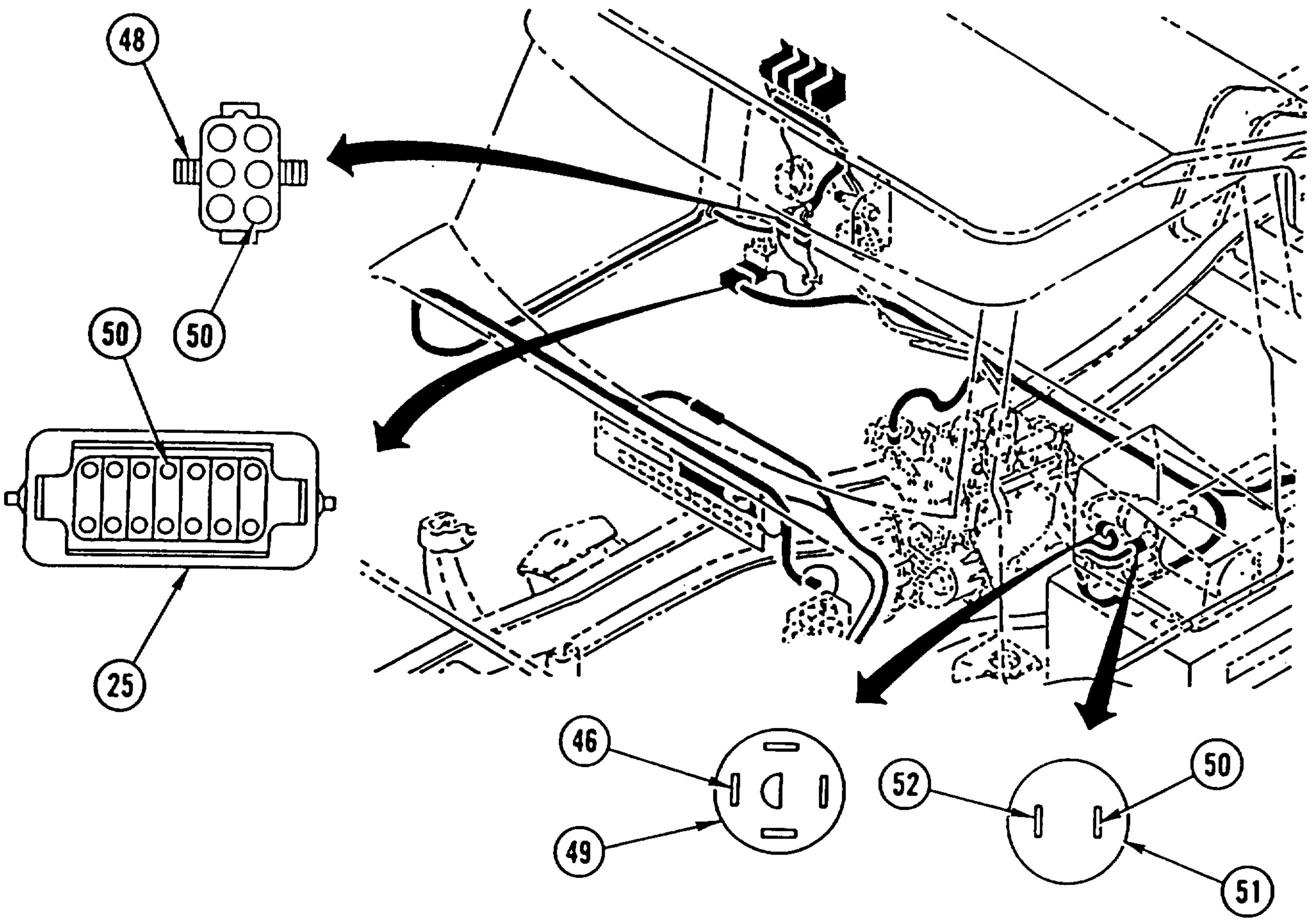
Step 39. Check for +24 VDC between wire (46) and wire (47) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring (46) and wiring (47) between connector AA and cab floor separation point.
- If +24 VDC is present, go to step 40.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Actlon

ELECTRICAL SYSTEM (CONT)



Step 40. Check for +24 VDC between wire (46) and wire (47) and ground at suspension lockout pump motor connector (49).

- If +24 VDC is not present, repair wiring (46) and wiring (47) between cab floor separation point and pump motor connector.
- If +24 VDC is present, replace hydraulic suspension lockout pump (page 4-51 1).

Step 41. Check for +24 VDC between wire (50) and ground at connector AA (48).

- If +24 VDC is not present, repair wiring (50) between D+ relay and connector AA.
- If +24 VDC is present, go to step 42.

Table 3-5. Troubleshooting (Cont)

Malfunction

Teat or InspectIon

Corrective ActIon

ELECTRICAL SYSTEM (CONT)

Step 42. Check for +24 VDC between wire (50) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring (50) between connector AA and cab floor separation point.
- If +24 VDC is present, go to step 43.

Step 43. Check for +24 VDC between wire (50) and ground at hydraulic switch (51).

- If +24 VDC is not present, repair wiring (50) between cab floor separation point and hydraulic switch.
- If +24 VDC is present, go to step 44.

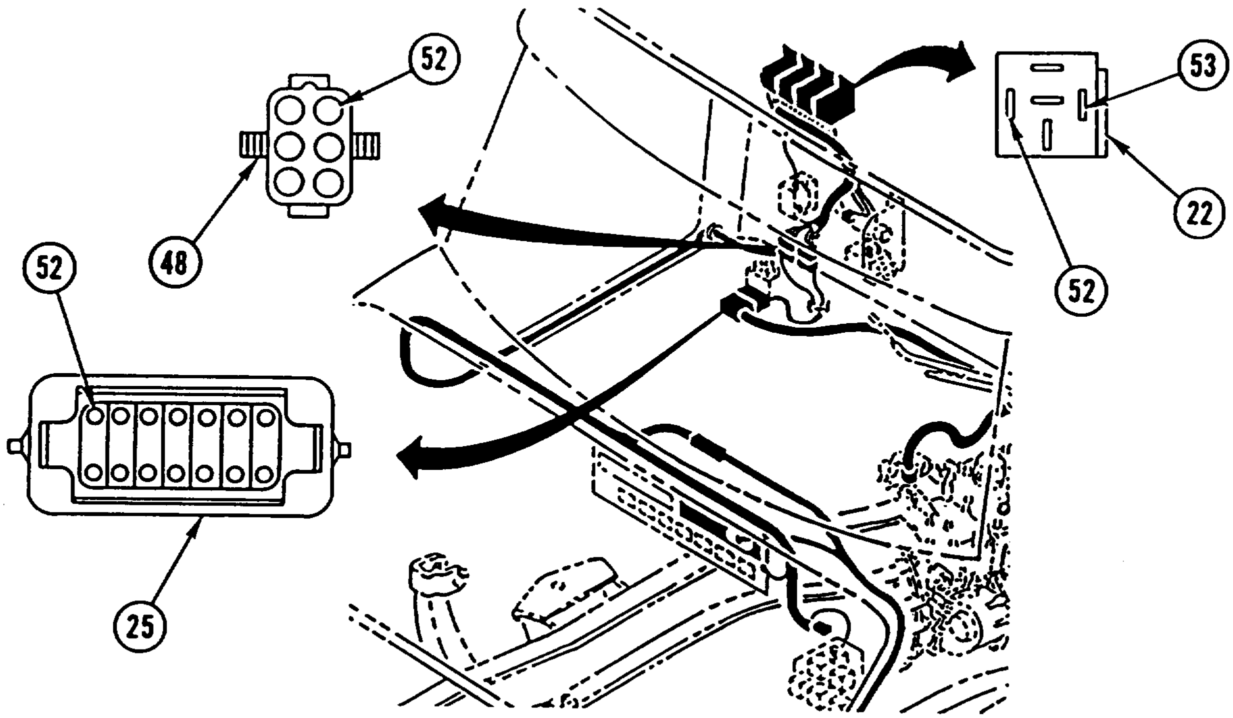
Step 44. Check for +24 VDC between wire (52) and ground at hydraulic switch (51).

- If +24 VDC is not present, replace hydraulic suspension lockout pump (page 4-511).
- If +24 VDC is present, go to step 45.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



Step 45. Check for +24 VDC between wire (52) and ground at cab floor separation point (25).

- If +24 VDC is not present, repair wiring (52) between hydraulic switch and cab floor separation point.
- If +24 VDC is present, go to step 46.

Step 46. Check for +24 VDC between wire (52) and ground at connector AA (48).

- If +24 VDC is not present, repair wiring (52) between cab floor separation point and connector AA.
- If +24 VDC is present, go to step 47.

Step 47. Check for +24 VDC between wire (52) and ground at motor relay (22).

- If +24 VDC is not present, repair wiring (52) between connector AA and motor relay.
- If +24 VDC is present, go to step 48.

Step 48. Check wire (53) at motor relay (22) for continuity to ground.

- If short to ground, replace motor relay.
- If open to ground, repair wiring (53) between motor relay and ground.

Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

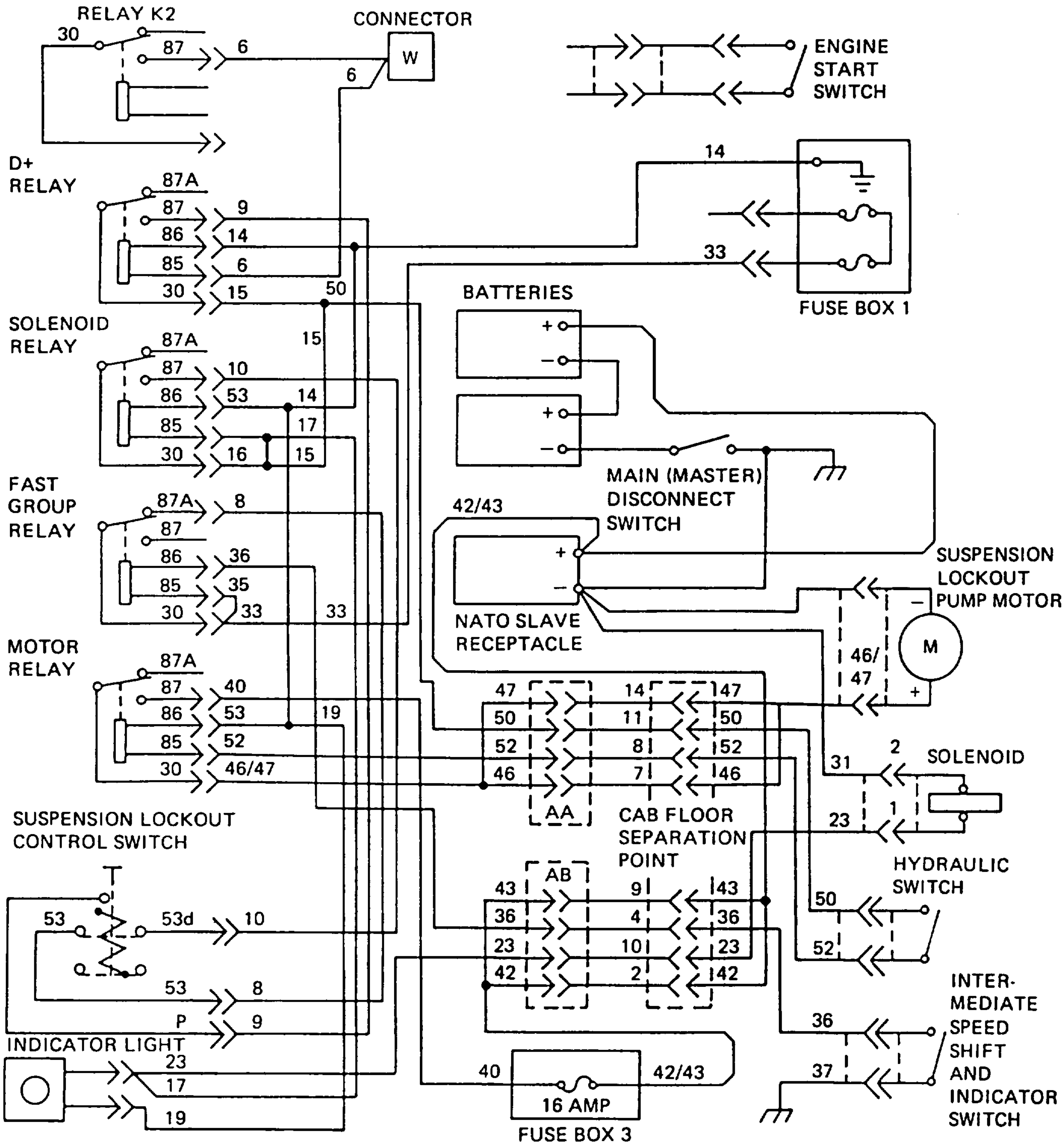


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

74. HYDRAULIC OIL COOLER FANS WILL NOT OPERATE.

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-256) for all wiring repair steps.

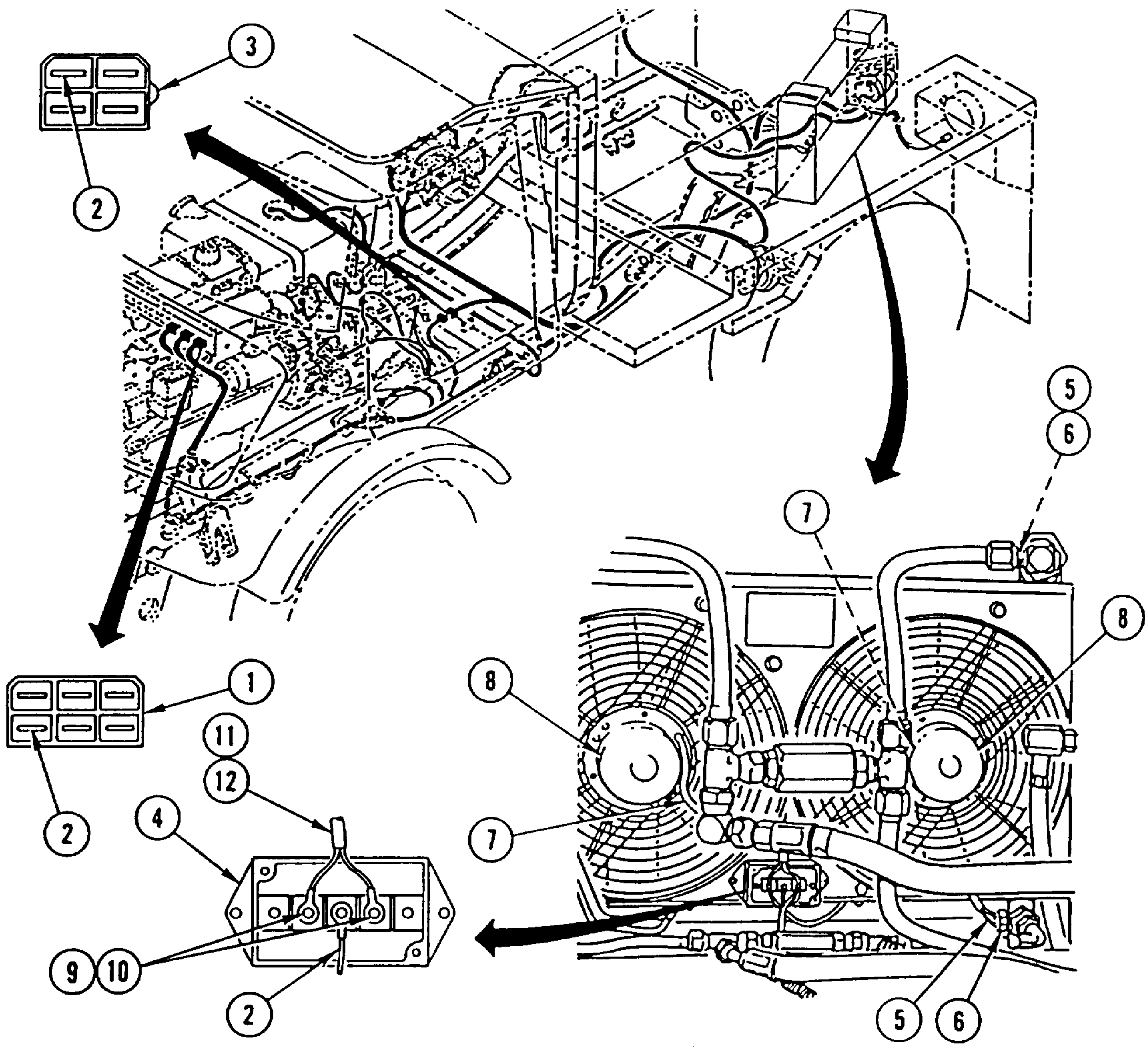


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 1. Disconnect connector A (1) and check for +24 VDC between wire 70 (2) and ground.

- If +24 VDC is not present, repair wiring 70 between connector A and fuse box 1.
- If +24 VDC is present, reconnect connector A and go to step 2.

Step 2. Disconnect connector X (3) and check for +24 VDC between wire 70 (2) and ground.

- If +24 VDC is not present, repair wiring 70 between connector X and connector A.
- If +24 VDC is present, reconnect connector X and go to step 3.

Step 3. Check for +24 VDC between wire 70 (2) and ground at hydraulic oil cooler terminal board (4).

- If +24 VDC is not present, repair wiring 70 between connector X and hydraulic oil cooler.
- If +24 VDC is present, go to step 4.

Step 4. Check for continuity of black and red wires (5) between hydraulic oil cooler terminal board (4) and hydraulic oil cooler thermal switches (6).

- if there is no continuity, repair black or red wire between hydraulic oil cooler thermal switches and hydraulic oil cooler terminal board.
- If there is continuity, go to step 5.

Step 5. Check for continuity of black and red wires (7) between hydraulic oil cooler terminal board (4) and fan motors (8).

- If there is no continuity, repair black or red wire between fan motors and hydraulic oil cooler terminal board.
- If there is continuity, go to step 6.

Step 6. Remove two screws (9) and two lock washers (10).

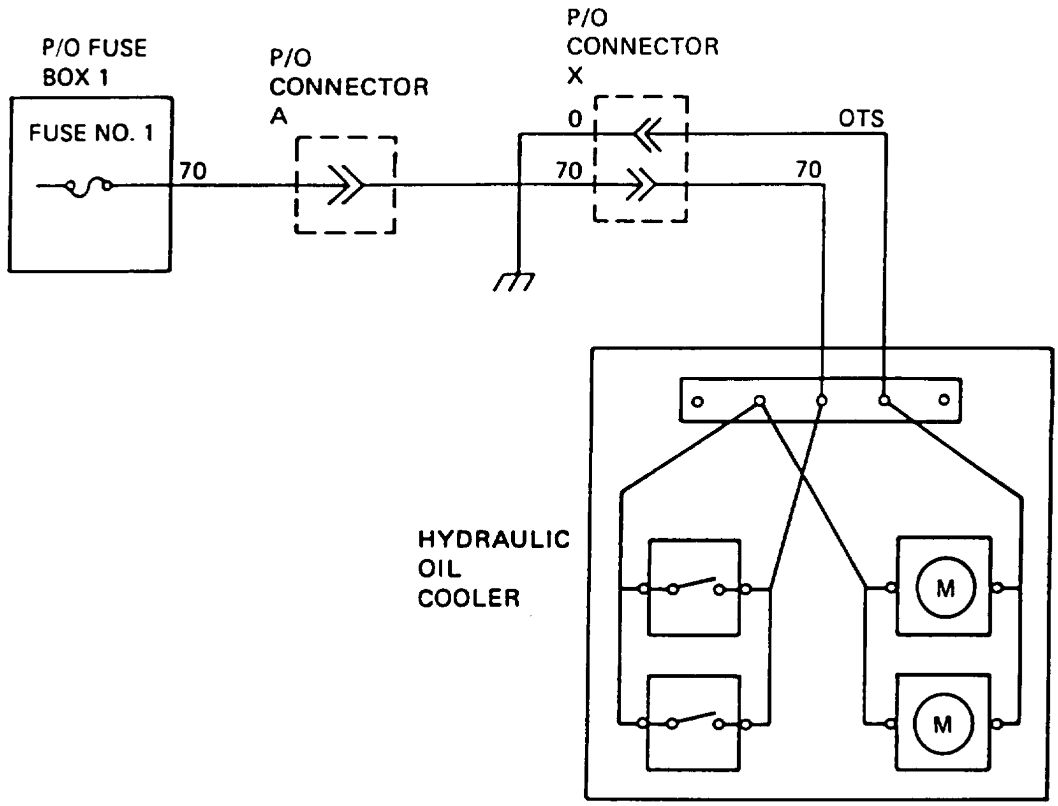
Step 7. Disconnect red wires (11 and 12) and short them to wire 70 (2).

- If fans do not operate, replace hydraulic oil cooler (page 4-722).
- If fans operate, replace both hydraulic oil cooler thermal switches (page 4-1 47).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



75. THROTTLE CONTROL SWITCH WILL NOT OPERATE (SEE).

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-258) for all wiring repair steps.

Step 1. Check for +24 VDC between wire 70T (1) and ground at tool switch (2).

- If +24 VDC is not present, repair wiring 70T between tool switch and connector X.
- If +24 VDC is present, go to step 2.

Step 2. With tool switch (2) pulled on, check for +24 VDC between wire 71V (3) and ground at tool switch.

- If +24 VDC is not present, replace tool switch (page 4-162).
- If +24 VDC is present, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 3. With tool switch (2) pulled on, check for +24 VDC between wire 71V (3) and ground at throttle control switch (4).

- If +24 VDC is not present, repair wiring 71 V between throttle control switch and tool switch.
- If +24 VDC is present, replace throttle control switch (page 4-1 54).

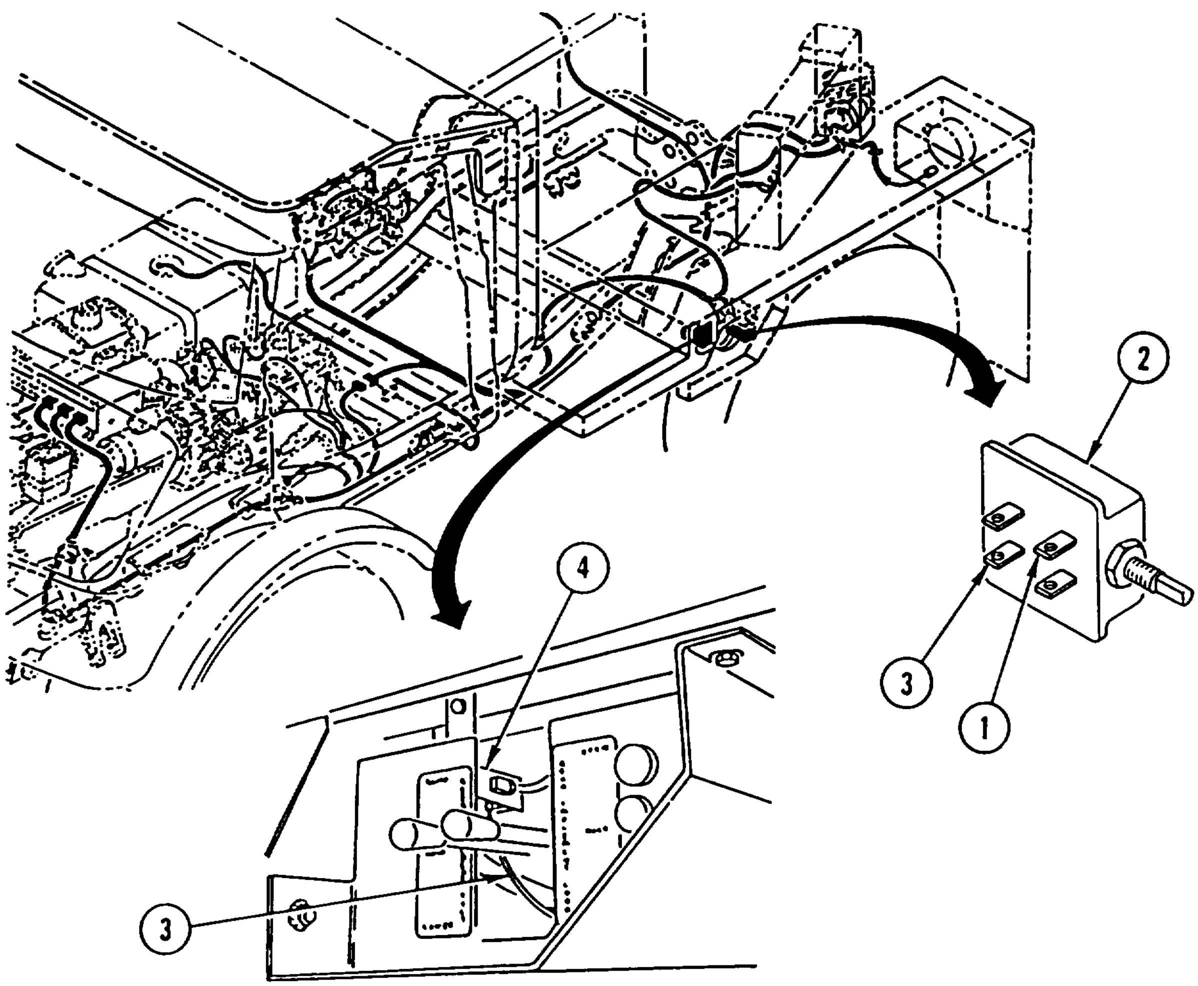
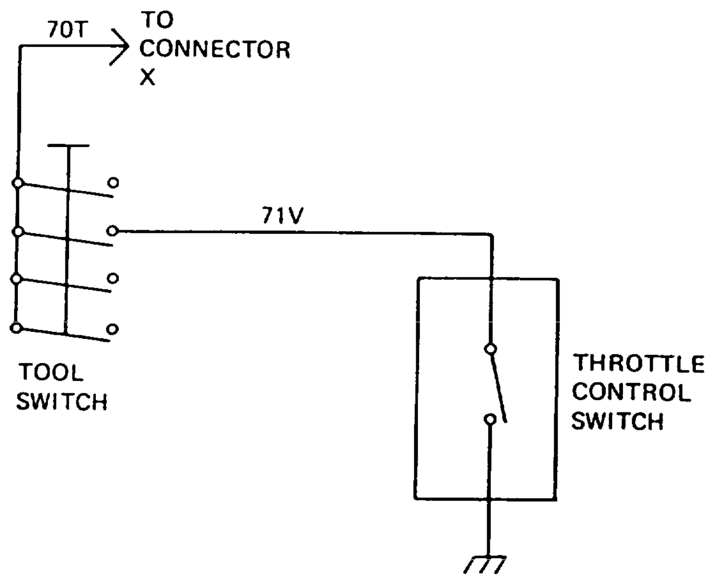


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



76. ALL MACHINE (HYDRAULIC) TOOLS WILL NOT OPERATE

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 70T (1) and ground at tool switch (2).

- If +24 VDC is not present, repair wiring 70T between tool switch and connector X.
- If +24 VDC is present, go to step 2.

Step 2. With tool switch (2) pulled on, check for +24 VDC between wire 71T (3) and ground at tool switch.

- If +24 VDC is not present, replace tool switch (page 4-162).
- If +24 VDC is present, go to step 3.

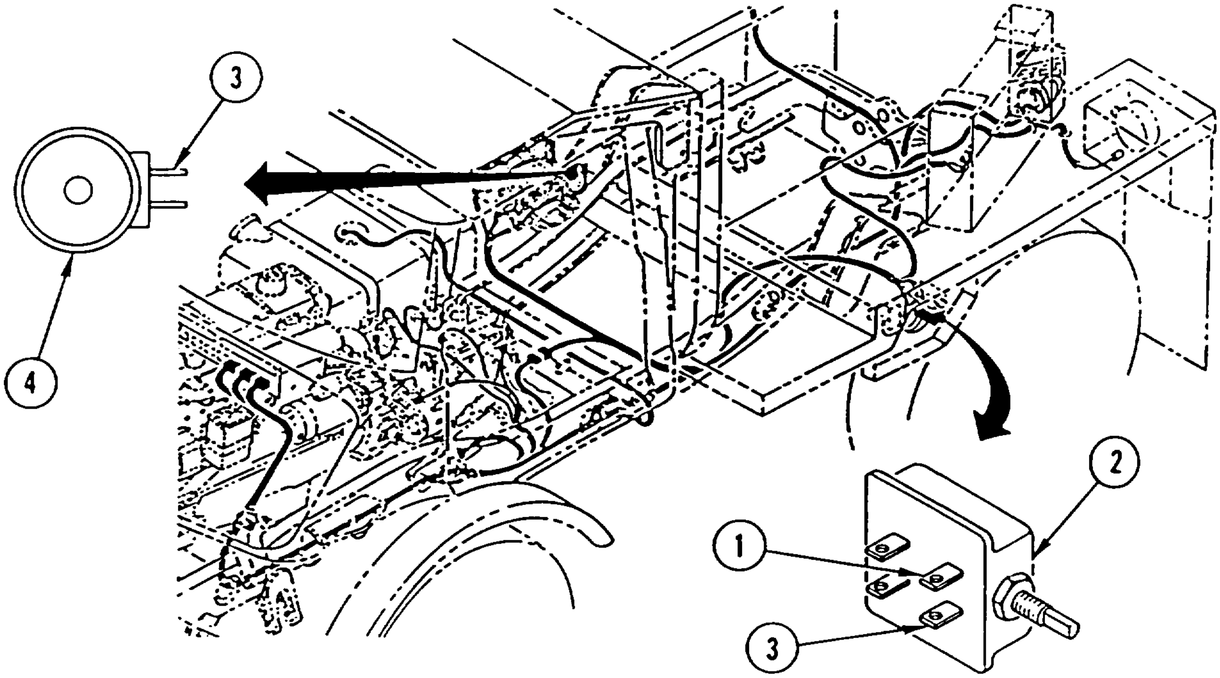
Step 3. With tool switch (2) pulled on, check for +24 VDC between wire 71T (3) and ground at machine tool solenoid (4).

- If +24 VDC is not present, repair wiring 71T between tool switch and machine tool solenoid.
- If +24 VDC is present, notify direct support maintenance.

Table 3-5. Troubleshootlng (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



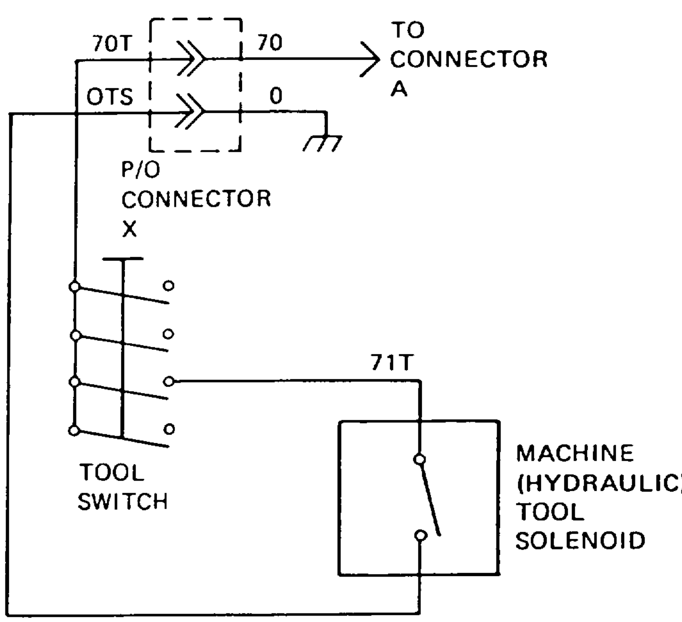


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Action

ELECTRICAL SYSTEM (CONT)

77. FRONT LOADER WILL NOT OPERATE USING BUCKET SWITCH (SEE).

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram for all wiring repair steps.

Step 1. Check for +24 VDC between wire 70S (1) and ground at bucket switch (2).

- If +24 VDC is not present, repair wiring 70S between bucket switch and connector X.
- If +24 VDC is present, go to step 2.

NOTE

Perform steps 2 and 3 for failure in down (ON) position. Perform steps 4 and 5 for failure in UP position.

Step 2. With bucket switch (2) in DN position, check for +24 VDC between wire 71 U (3) and ground at bucket switch.

- If +24 VDC is not present, replace bucket switch (page 4-1 51).
- If +24 VDC is present, go to step 3.

Step 3. With bucket switch (2) in DN position, check for +24 VDC between wire 71 U (3) and ground at bucket solenoid (4).

- If +24 VDC is not present, repair wiring 71 U between bucket switch and bucket solenoid.
- If +24 VDC is present, notify direct support maintenance.

Step 4. With bucket switch (2) in UP position, check for +24 VDC between wire 710 (5) and ground at bucket switch.

- If +24 VDC is not present, replace bucket switch (page 4-151).
- If +24 VDC is present, go to step 5.

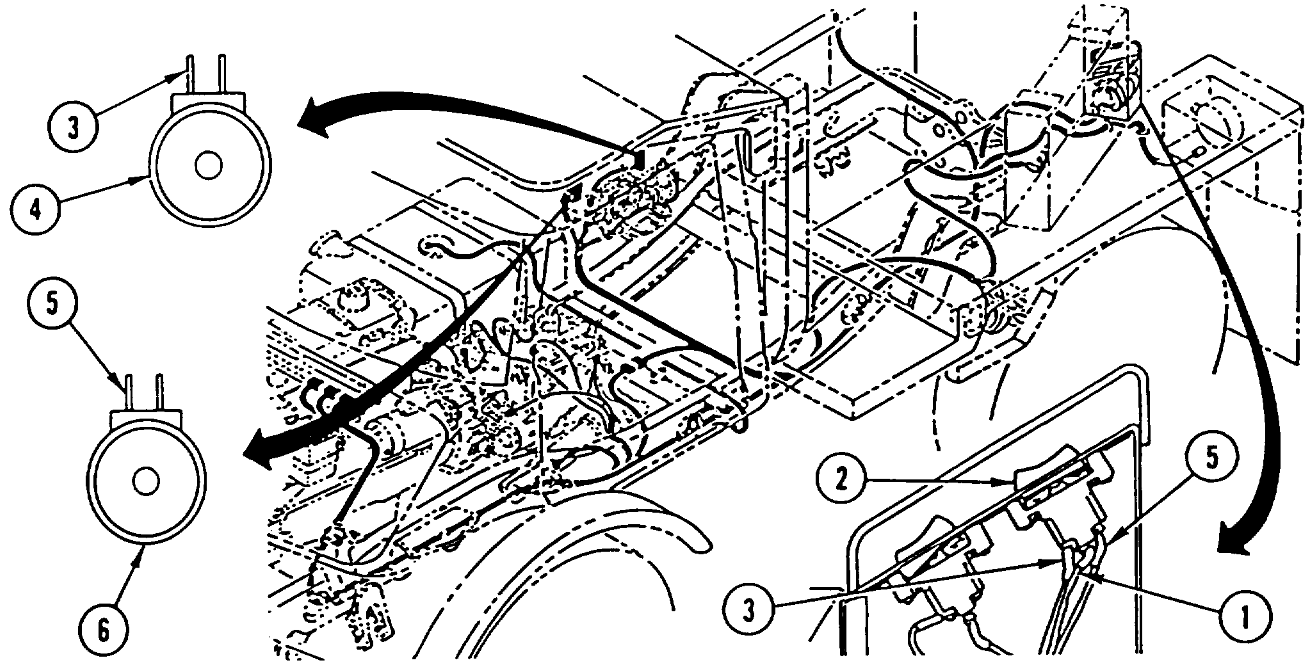
Step 5. With bucket switch (2) in UP position, check for +24 VDC between wire 71 D (5) and ground at bucket solenoid (6).

- If +24 VDC is not present, repair wiring 71 D between bucket switch and bucket solenoid.
- If +24 VDC is present, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)



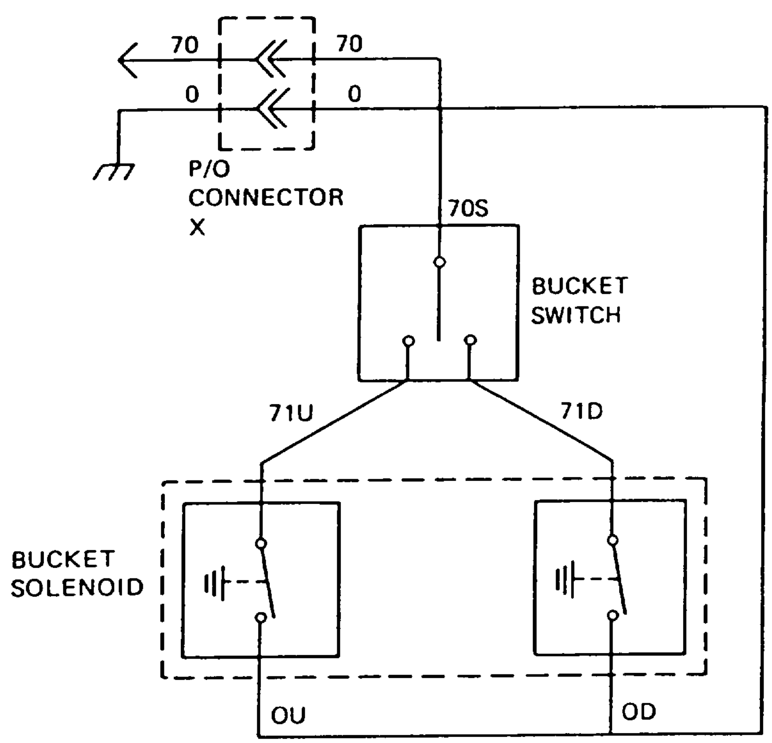


Table 3-5. Troubleshooting (Cont)

Malfunction

Test or Inspection

Corrective Actlon

ELECTRICAL SYSTEM (CONT)

78. THROTTLE CONTROL SWITCH WILL NOT OPERATE (HMMH).

NOTE

- Vehicle MASTER disconnect switch must be ON and ignition switch set to ON. Failure to do so will cause erroneous results.
- Refer to wiring diagram (page 3-264) for all wiring repair steps.

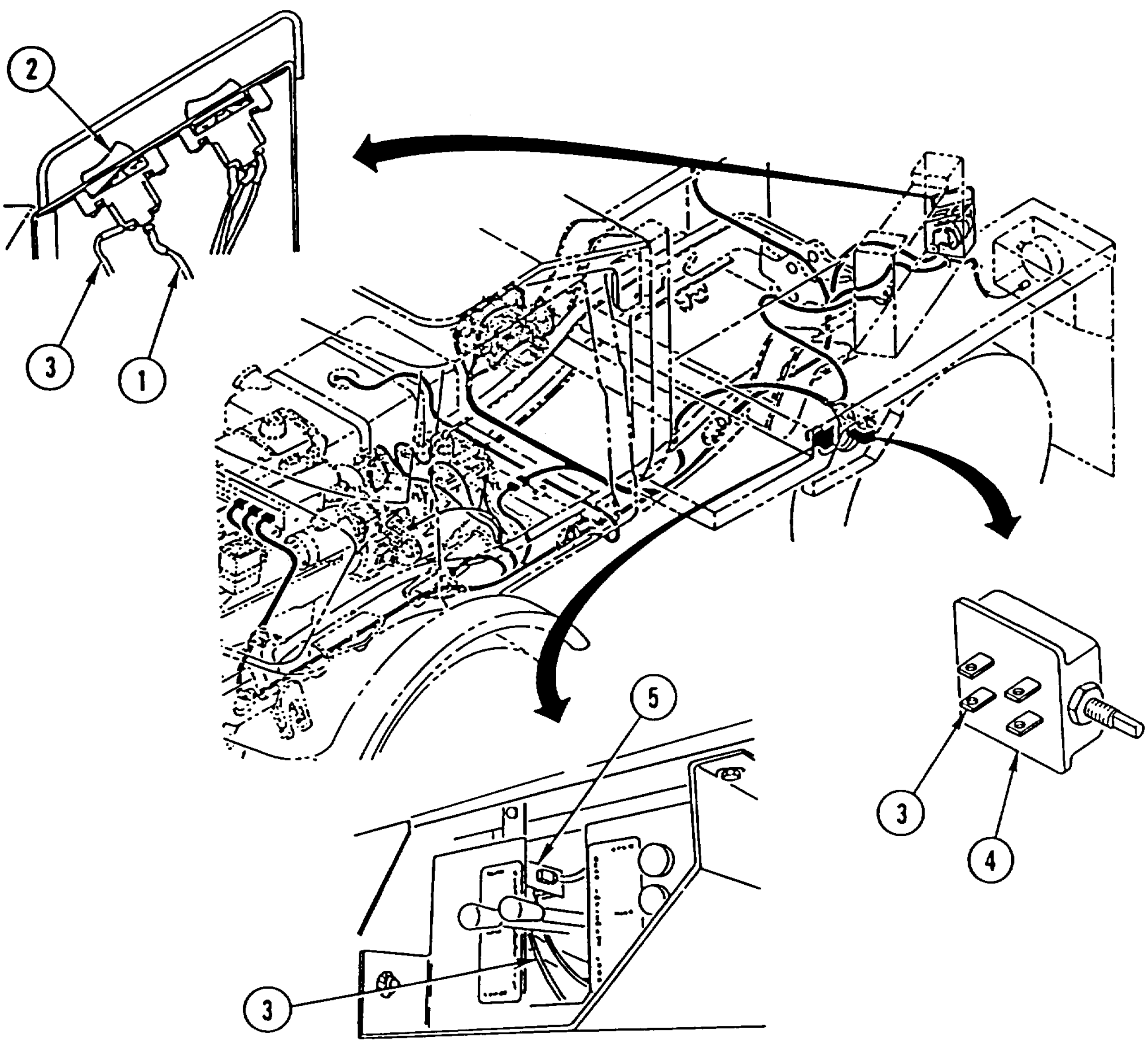


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRICAL SYSTEM (CONT)

Step 1. Check for +24 VDC between wire 70M (1) and ground at auxiliary throttle switch (2).

- If +24 VDC is not present, repair wiring 70M between auxiliary throttle switch and connector X.
- If +24 VDC is present, go to step 2.

Step 2. With auxiliary throttle switch (2) in CRANE position, check for +24 VDC between wire 73V (3) and ground at auxiliary throttle switch.

- If +24 VDC is not present, replace auxiliary throttle switch (page 4-156).
- If +24 VDC is present, go to step 3.

Step 3. With auxiliary throttle switch (2) in CRANE position, check for +24 VDC between wire 73V (3) and ground at tool switch (4).

- If +24 VDC is not present, repair wiring 73V between auxiliary throttle switch and tool switch.
- If +24 VDC is present, go to step 4.

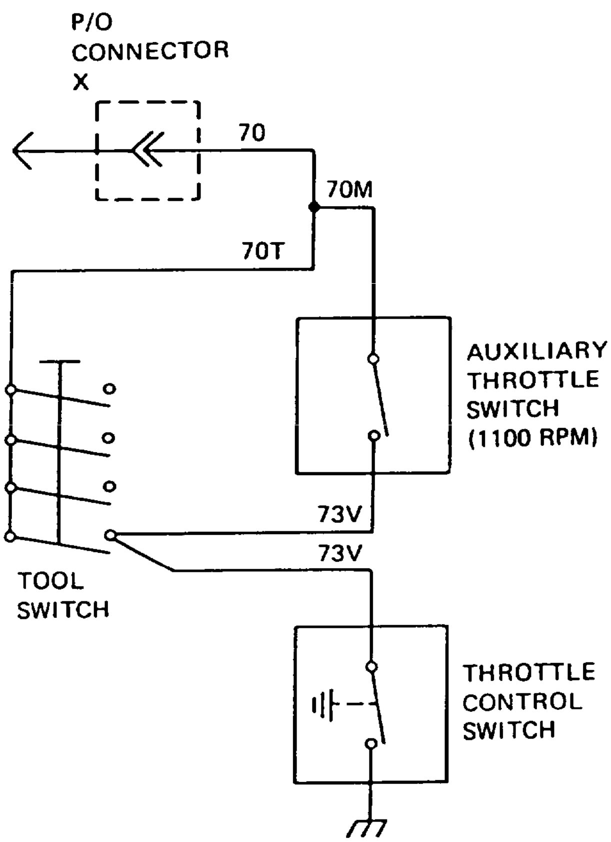
Step 4. With auxiliary throttle switch (2) in CRANE position, check for +24 VDC between wire 73V (3) and ground at throttle control switch (5).

- If +24 VDC is not present, repair wiring 73V between tool switch and throttle control switch.
- If +24 VDC is present, replace throttle control switch (page 4-158).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

ELECTRiIAL SYSTEM (CONT)



79. TRANSMISSION WILL NOT OPERATE IN ANY FORWARD OR REVERSE GEAR.

Check clutch slave cylinder for proper adjustment as follows:

a. Remove return spring (1) from slave cylinder (2) and clutch lever (3).

b. Loosen lock nut (4) and back out adjusting screw (5) completely.

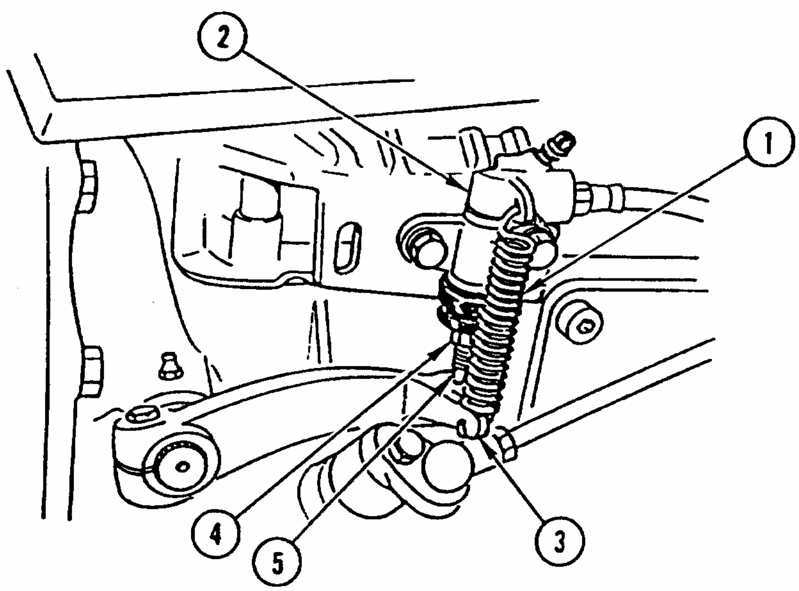
c. Move clutch lever (3) down until it stops. Clearance between clutch lever (3) and adjusting screw (5) must be 1/8 in. (3 +0.05 mm).

- If clutch slave cylinder is not property adjusted, adjust clutch slave cylinder (page 4-21).
- If clutch slave cylinder is property adjusted, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

TRANSMISSION (CONT)



80. TRANSMISSION SLIPS IN ALL RANGES.

Step 1. Check for "spongy" feeling while depressing clutch pedal.

- If clutch pedal feels spongy, bleed brake system (page 4-262).
- If clutch pedal does not feel spongy, go to step 2.

Step 2. Check for low oil level in clutch hydraulic reservoir.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 3.

Step 3. Check clutch master cylinder for leaking oil.

- If clutch master cylinder is leaking oil, replace clutch master cylinder (page 4-22).
- If clutch master cylinder is not leaking oil, go to step 4.

Step 4. Check clutch slave cylinder for leaking oil.

- If clutch slave cylinder is leaking oil, replace clutch slave cylinder (page 4-19).
- If clutch slave cylinder is not leaking oil, go to step 5.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

TRANSMISSION (CONT)

Step 5. Check clutch slave cylinder for proper adjustment as follows:

a. Remove return spring (1) from slave cylinder (2) and clutch lever (3).

b. Loosen lock nut (4) and back out adjusting screw (5) completely.

c. Move clutch lever (3) down until it stops. Clearance between clutch lever (3) and adjusting screw (5) must be 1/8 in. (3 +0.05 mm).

- If clutch slave cylinder is not properly adjusted, adjust clutch slave cylinder (page 4-21).
- If clutch slave cylinder is properly adjusted, notify direct support maintenance.

81. PTO WILL NOT ENGAGE.

Check for interference with shift lever.

- If there is no interference with shift lever, notify direct support maintenance.

82. ALL WHEEL DRiVE/DIFFERENTIAL LOCK WILL NOT ENGAGE/FSENGAGE.

Step 1. Check for low air pressure.

- If air pressure is less than 80 psi, go to Malfunction 89.
- If air pressure is 80 psi or greater, go to step 2.

Step 2. Check for loose and damaged air lines and fittings.

- If air lines and fittings are loose or damaged, notify direct support maintenance.
- If air lines and fittings are not loose or damaged, go to step 3.

Step 3. Check ail wheel drive selector valve for binding and proper operation,

- If all wheel drive selector valve is binding or not operating property, replace ali wheel drive selector valve (page 4-240).
- If all wheel drive selector valve is operating property and not binding, go *to* step 4.

Step 4. Check all wheel drive control cylinder for proper adjustment and operation.

- If all wheel drive control cylinder is not adjusted or operating property, adjust or replace all wheel drive control cylinder (page 4-243).
- If ail wheel drive control cylinder is adjusted and operating properly, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM

CAUTION

When repairing disc brakes, make sure stretch bolts for fastening brake caliper to wheel hub drive housing are always fitted at side where disc emerges from pads. Failure to do so could cause damage to equipment.

NOTE

Replace disc brake pads in sets for entire axle.

83. BRAKES FAIL OR BRAKE PEDAL SPONGY.

Step 1. Check for low brake fluid level in brake fluid reservoir.

- If brake fluid level is low, add silicone brake fluid (TM 5-2420-224-10).
- If brake fluid level is not low, go to step 2.

Step 2. Check for leaking and damaged hydraulic brake lines and fittings.

- If hydraulic brake lines and fittings are leaking or damaged, tighten or replace brake lines and fittings (pages 4-278, 4-280, 4-282, 4-284).
- If hydraulic brake lines and fittings are not leaking or damaged, go to step 3.

Step 3. Check for air in hydraulic brake system.

- If there is air in hydraulic brake system, bleed brake system (page 4-262).
- If there is no air in hydraulic brake system, replace brake master cylinder (page 4-276).

84. BRAKING UNEVEN.

Step 1. Check hydraulic brake lines for kinks and restrictions.

- If there are kinks or restrictions in hydraulic brake lines, replace brake lines (pages 4-278, 4-280, 4-282, 4-284).
- If there are no kinks or restrictions in hydraulic brake lines, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

NOTE

Step 2 is for front brakes only.

Step 2. Check dust cover for damage.

- If dust cover is damaged, replace dust cover (page 4-271).
- If dust cover is not damaged, go to step 3.

Step 3. Check for damaged spring clip and retaining pins.

- If spring clip or retaining pins are damaged, replace spring clip (page 4-268) or retaining pins (page 4-271).
- If spring clip or retaining pins are not damaged, go to step 4.

Step 4. Check for disc brake pads worn to 0.08 in. (2 mm) or less.

- If disc brake pads are worn, replace pads in sets (pages 4-268, 4-271).
- If disc brake pads are not worn, go to step 5.

Step 5. Check for oily disc brake pads.

- If disc brake pads are oily, replace pads in sets (pages 4-268, 4-271) and replace axle final drive outer seal (pages 4-247, 4-248).
- If disc brake pads are not oily, go to step 6.

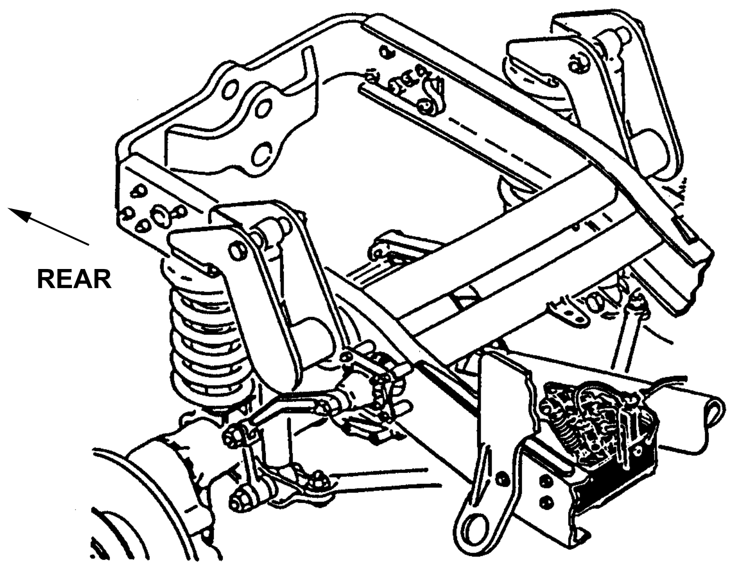
Step 6. Check for scored disc surface.

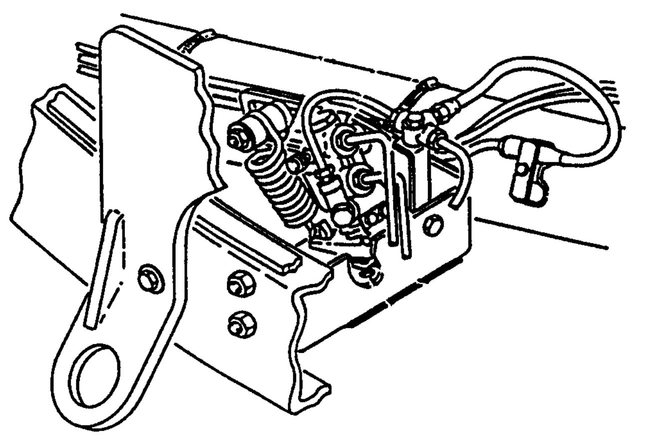
- If disc surface is scored, replace disc (page 4-265).
- If disc surface is not scored, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)





Step 7. Check brake pressure regulator (ALB valve) for leaks and loose, missing, or damaged hardware.

- If brake pressure regulator is leaking, contains damaged or missing hardware, replace brake pressure regulator lines and fittings (page 4-282).
- If brake pressure regulator does not have leaks, loose, missing or damaged hardware, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

85. BRAKES OVERHEAT.

Step 1. Check for sticking disc brake pads.

- If disc brake pads are sticking, replace pads in sets (pages 4-268, 4-271).
- If disc brake pads are not sticking, go to step 2.

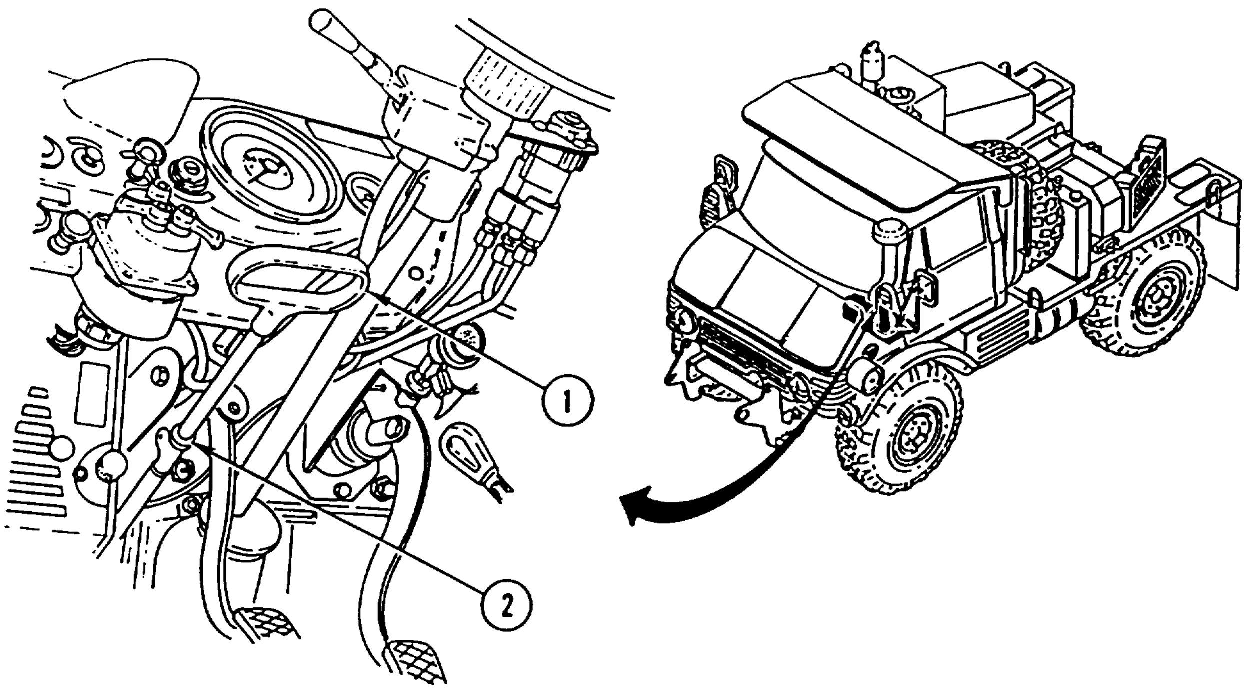
Step 2. Check for damaged spring clip, retaining pins, and wheel hub mounting.

- If spring clip, retaining pins, or wheel hub mounting are damaged, replace parts as required (pages 4-268, 4-271).
- If spring clip, retaining pins, or wheel hub mounting are not damaged, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)



NOTE

Step 3 is for rear axle only.

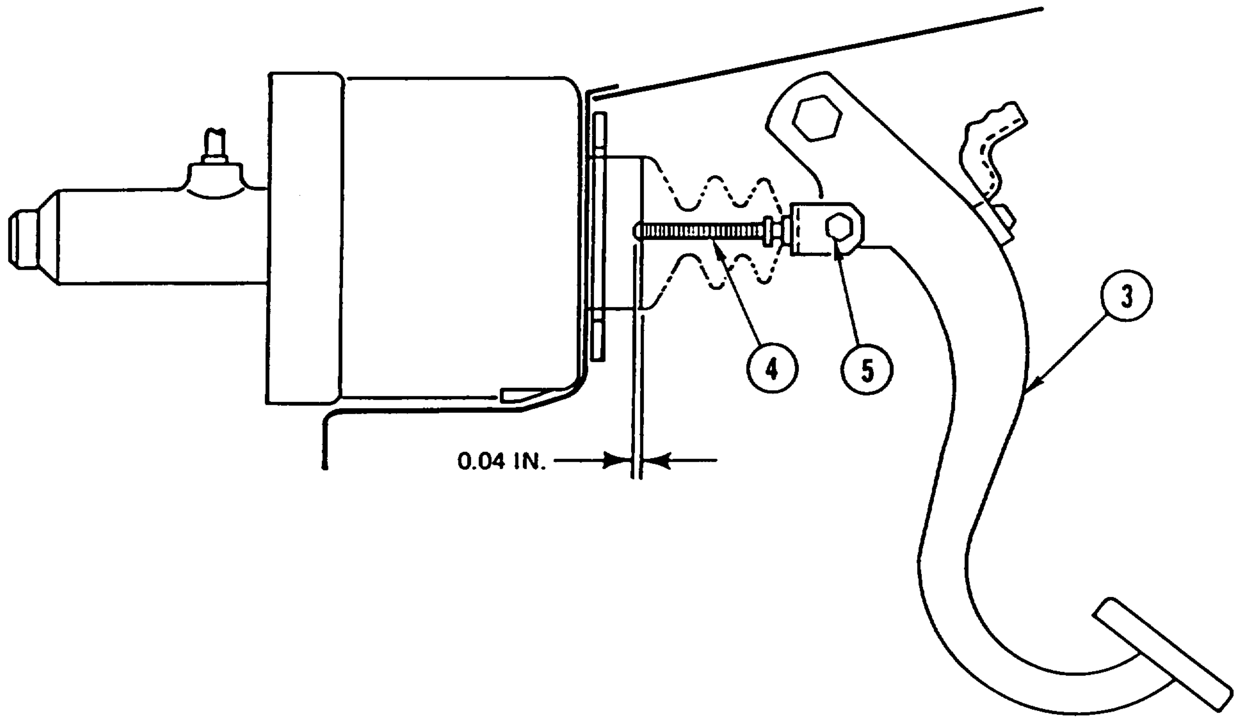
Step 3. Check parking brake adjustment by pulling parking brake handle (1) and measuring distance from parking brake handle to stop (2). Distance should be 7-9 in. (180-220 mm).

- If parking brake is not properly adjusted, adjust parking brake (page 4-254).
- If parking brake is properly adjusted, go to step 4.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)



Step 4. Check brake pedal (3) adjustment with brake pedal at neutral (brakes not applied). Piston rod (4) clearance must be 0.04 in. (1 mm).

- If piston rod clearance is not 0.04 in. (1 mm), adjust clearance by turning eccentric screw (5).
- If piston rod clearance is 0.04 in. (1 mm), go to step 5.

Step 5. Check for proper operation of air brake booster by depressing brake pedal and observing gage needle on dashboard for deflection.

- If air brake booster is not operating properly, replace air brake booster (page 4-295).
- If air brake booster is operating properly, notify direct support maintenance.

86. BRAKES SQUEAL.

Check for dirty, glazed, and worn disc brake pads.

- If disc brake pads are glazed or worn, replace pads in sets (pages 4-268, 4-271).
- If disc brake pads are dirty, clean pads.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

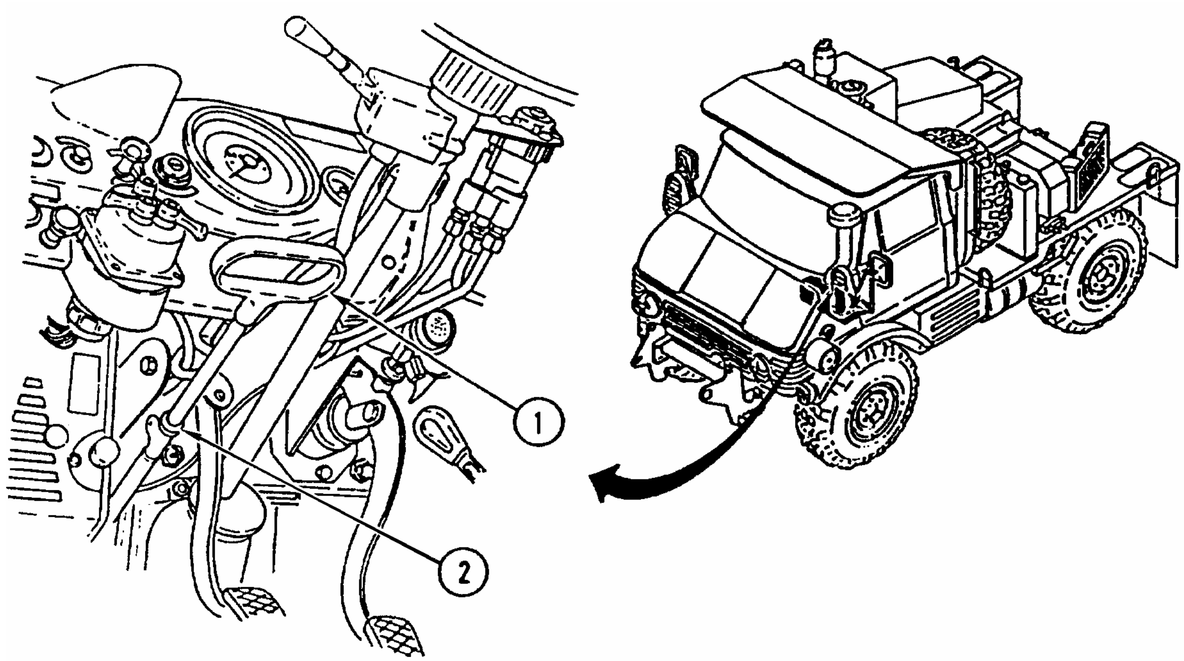
87. BRAKE INDICATOR LIGHT LIGHTS.

Step 1. Check for low brake fluid level in brake fluid reservoir.

- If brake fluid level is low, add silicone brake fluid (TM 5-2420-224-10).
- If brake fluid level is not low, go to step 2.

NOTE

Step 2 is for rear axle only.



Step 2. Check parking brake adjustment by pulling parking brake handle (1) and measuring distance from parking brake handle to stop (2). Distance should be 7-9 in. (180-220 mm).

- If parking brake is not properly adjusted, adjust parking brake (page 4-254).
- If parking brake is properly adjusted, go to step 3.

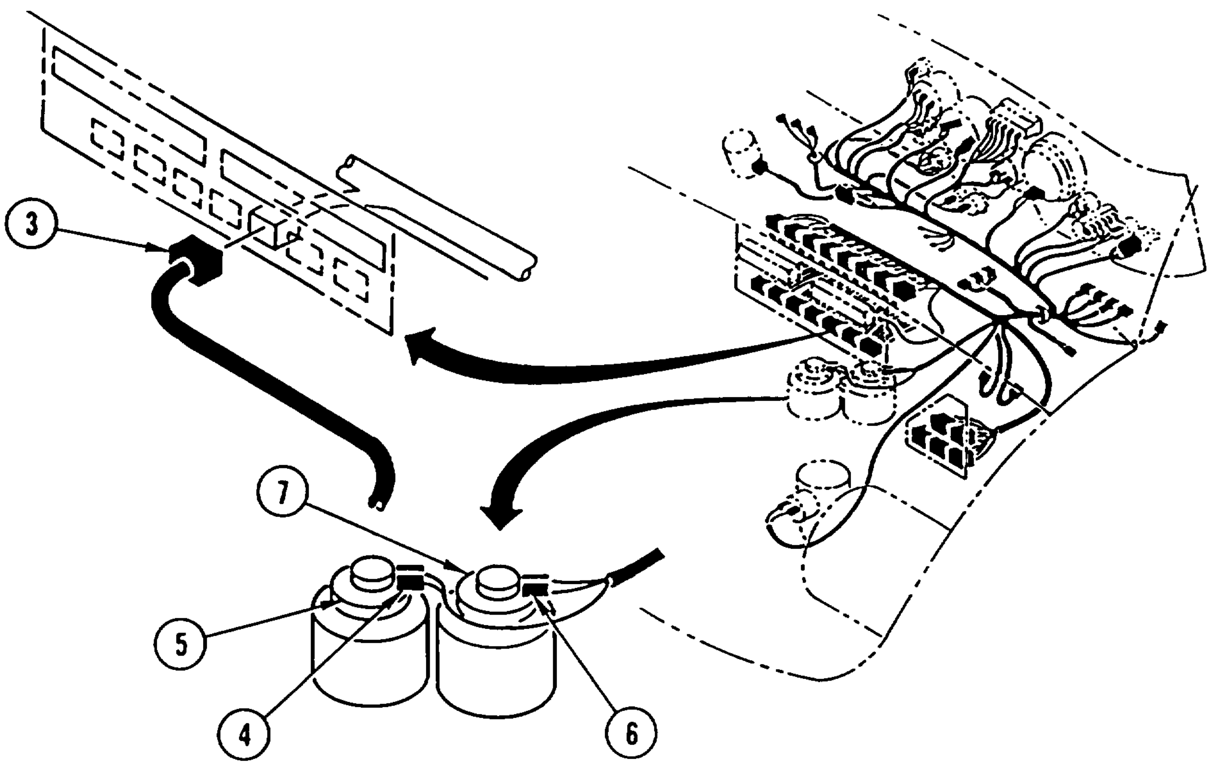
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

Step 3. Check for disc brake pads worn to 0.08 in. (2 mm) or less.

- If disc brake pads are worn, replace pads in sets (pages 4-268, 4-271).
- If disc brake pads are not worn, go to step 4.



Step 4. Disconnect connector C (3) and check if brake indicator light is lit.

- If brake indicator light is not lit, reconnect connector C and go to step 7.
- If brake indicator light is lit, reconnect connector C and go to step 5.

Step 5. Disconnect wire 224 (4) from filler opening cap (5) and check if brake indicator light is lit.

- If brake indicator light is not lit, replace filler opening cap.
- If brake indicator light is lit, reconnect wire 224 and go to step 6.

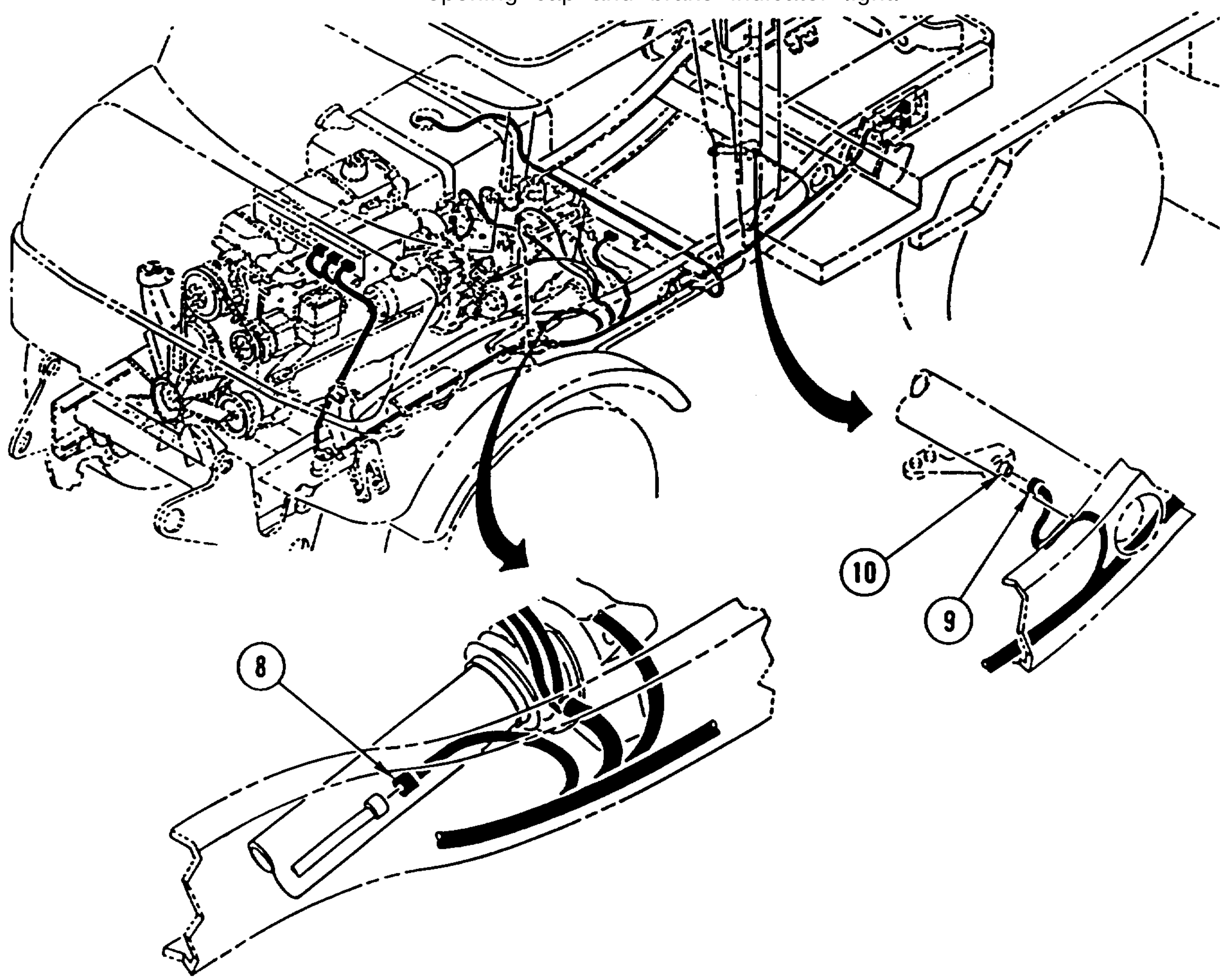
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

Step 6. Disconnect wire 223 (6) from filler opening cap (7) and check if brake indicator light is lit.

- If brake indicator light is not lit, replace filler opening cap.
- If brake indicator light is lit, repair wiring 223 between filler opening cap and brake indicator light.



Step 7. Disconnect connector AF (8) and check if brake indicator light is lit.

- If brake indicator light is not lit, reconnect connector AF and go to step 9.
- If brake indicator light is lit, reconnect connector AF and go to step 8.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

Step 8. Disconnect parking brake switch connector (9) from parking brake switch (10) and check if brake indicator light is lit.

- If brake indicator light is not lit, replace parking brake switch (page 4-210).
- If brake indicator light is lit, repair wiring 332 and wiring 333 between connector C, connector AF, and parking brake switch connector.

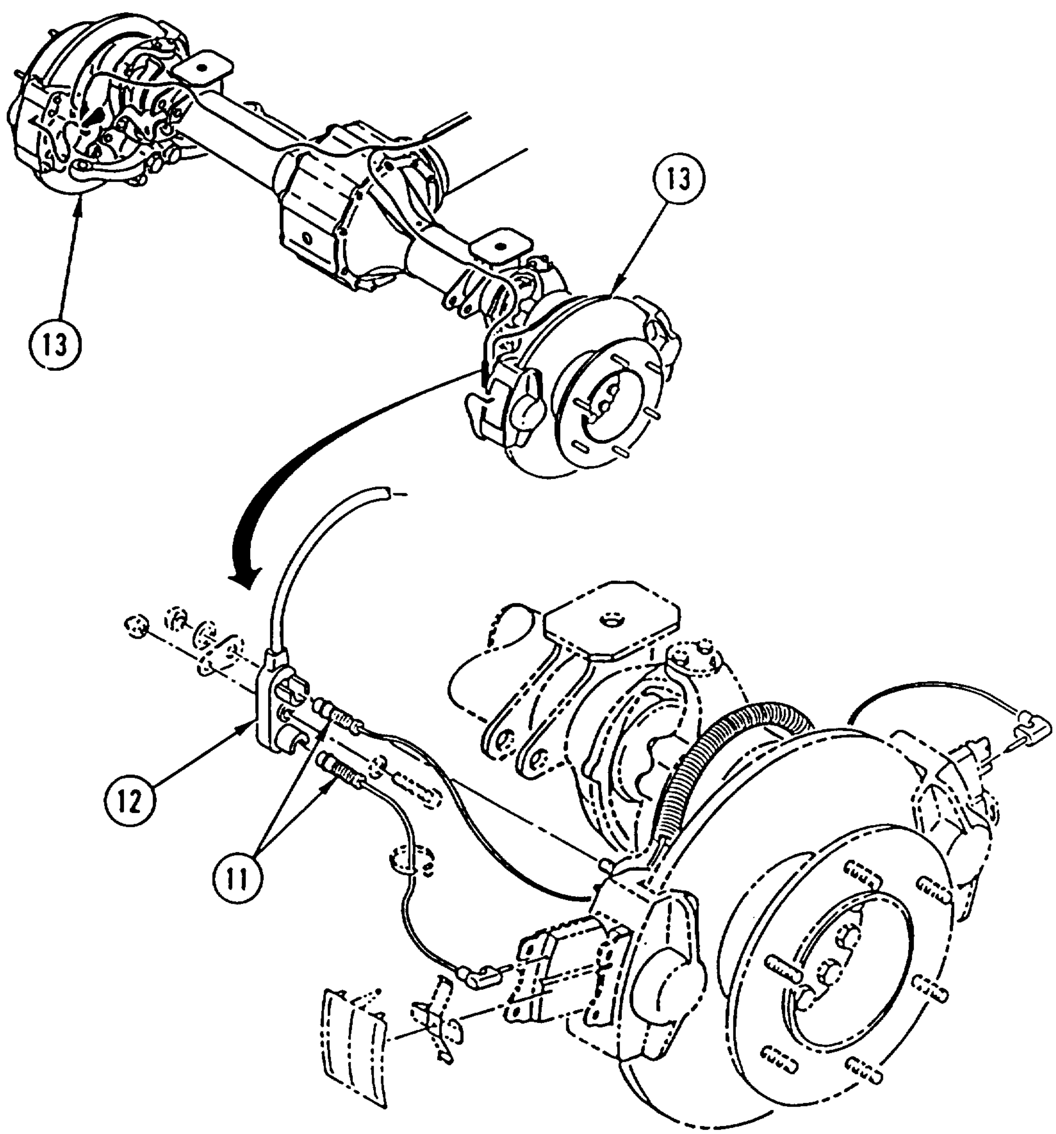


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

Step 9. Disconnect hook switch leads (11) from front disc brake pad indicator wiring harness (12) at both front brake assemblies (13) and check if brake indicator light is lit.

- If brake indicator light is lit, replace front disc brake pad indicator wiring harness (page 4-231).
- If brake indicator light is not lit, go to step 10.

Step 10. With hook switch leads (11) disconnected, check continuity between hook switch leads and ground.

- Replace hook switch that shows short to ground.

88. TRAILER BRAKE SYSTEM FAILS OR BRAKING WEAK.

NOTE

Brake lever must be fully actuated and dual brake gage indicating normal pressure.

Step 1. Check for leaking and damaged brake hose couplings.

- If brake hose couplings are leaking or damaged, tighten or replace couplings (page 4-324).
- If brake hose couplings are not leaking or damaged, go to step 2.

Step 2. Check for air leaks around trailer air supply valve.

- If there are air leaks around trailer air supply valve, replace trailer air supply valve (page 4-331).
- If there are no air leaks around trailer air supply valve, go to step 3.

Step 3. Check for air leaks around trailer hand brake valve.

- If there are air leaks around trailer hand brake valve, replace trailer hand brake valve (page 4-326).
- If there are no air leaks around trailer hand brake valve, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

89. AIR SYSTEM HAS NO EFFECT ON BRAKING (HARD BRAKING).

Step 1. Start engine. Check for low pressure in air tanks by waiting until red warning light goes out or until dual brake gage indicates pressure of 75-106 psi.

- If dual brake gage indicates 75-106 psi, replace air brake booster (page 4-295).
- If dual brake gage indicates less than 75-106 psi, go to step 2.

Step 2. Stop engine. Check for leaks in air system by observing brake fluid reservoir air pressure indicator. If reservoir pressure drops suddenly, there are leaks in air system.

- If there are leaks in air system, tighten or replace loose lines or connectors (pages 4-302, 4-303, 4-304, 4-307, 4-310, 4-313, 4-315, 4-318, 4-320, 4-324, 4-327, 4-329, 4-333). If problem continues, notify direct support maintenance.
- If there are no leaks in air system, go to step 3.

Step 3. Check fluid regulating valve adjustment as follows:

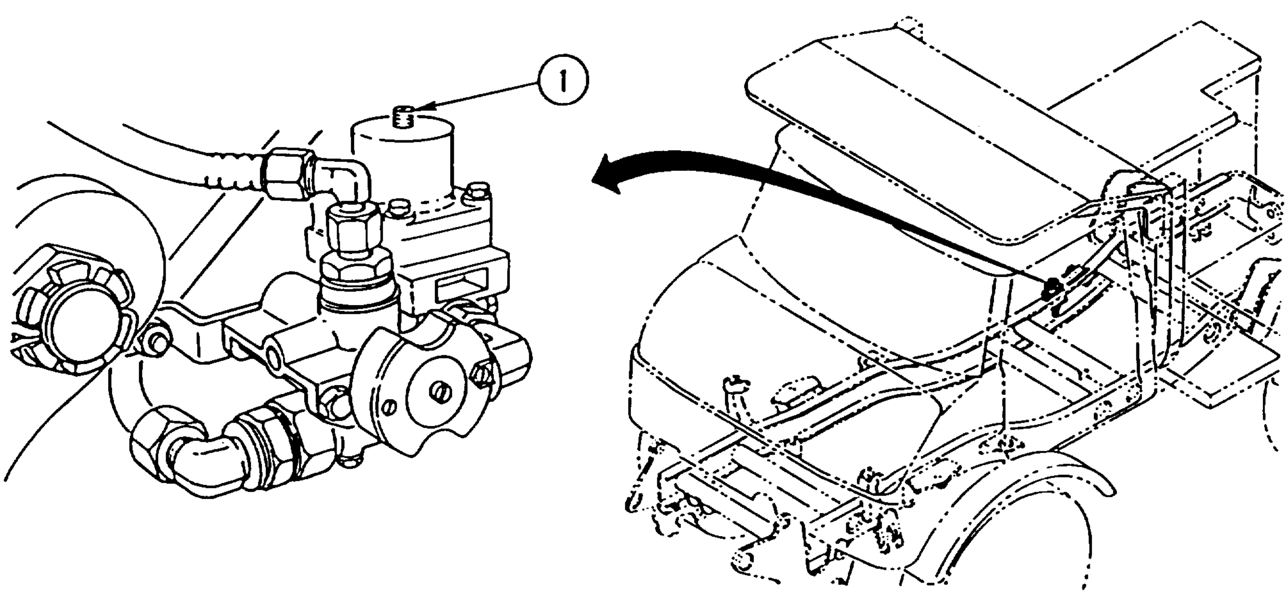


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BRAKES AND AIR SYSTEM (CONT)

NOTE

When fluid regulating valve reaches cut-out pressure, there will be an audible "pop."

a. Start and run engine at idle until fluid regulating valve reaches cut-out pressure.

b. Read pressure on dual brake gage. Reading must be approximately 106 psi.

- If reading is not approximately 106 psi, turn fluid regulating valve adjusting screw (1) 1/4-turn to right to increase pressure, or 1/4-turn to left to decrease pressure. Relieve air pressure (page 2-23) from air tanks to approximately 80 psi and repeat steps a and b until cut-out pressure is approximately 106 psi. If correct cut-out pressure cannot be attained, replace fluid regulating valve (page 4-306).
- If problem continues, notify direct support maintenance.

STEERING

90. STEERING WHEEL HARD TO MOVE FULL RIGHT AND FULL LEFT.

Step 1. Check for low oil level in power steering tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check for loose and damaged V-belt on power steering pump.

- If V-belt is loose or damaged, tighten or replace V-belt (page 4-356).
- If V-belt is not loose or damaged, go to step 3.

Step 3. Check for damaged power steering lines.

- If power steering lines are damaged, replace power steering lines (page 4-357).
- If power steering lines are not damaged, go to step 4.

Step 4. Check for clogged power steering filter element.

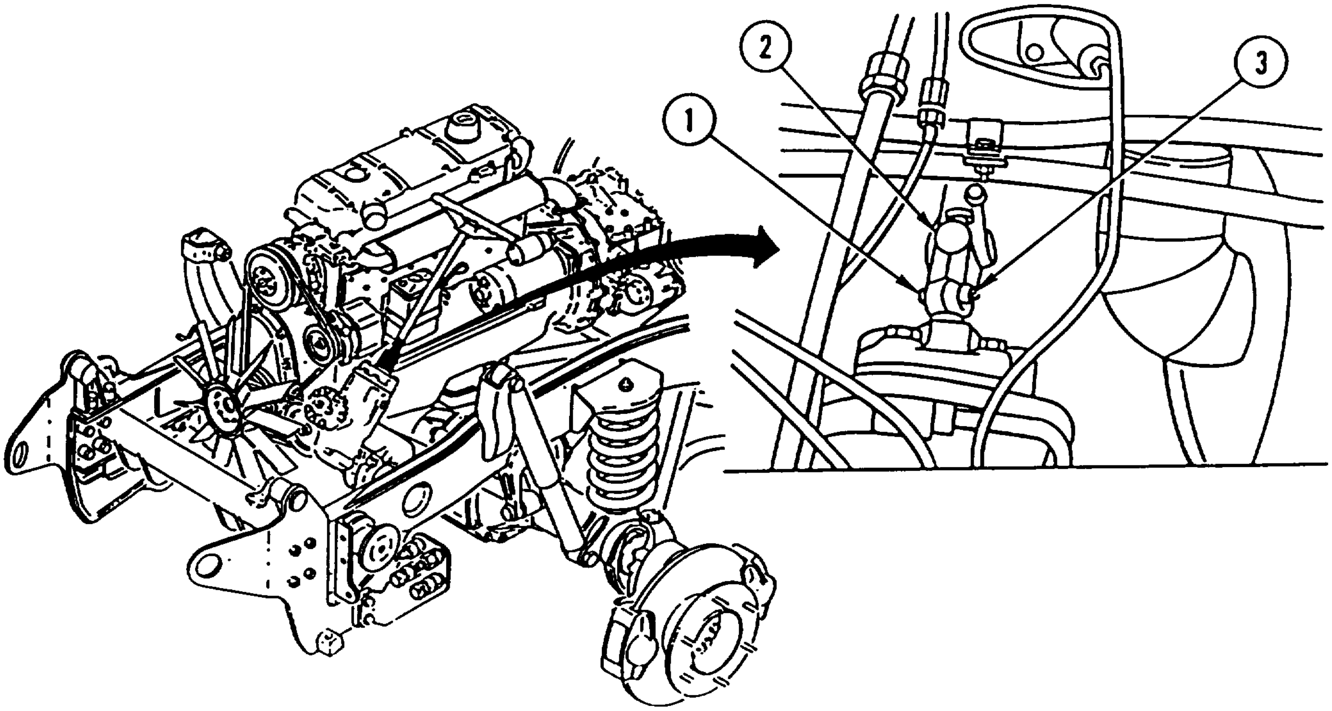
- If filter element is clogged, replace filter element (page 4-359).
- If filter element is not clogged, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

STEERING (CONT)

91. STEERING WHEEL HAS TOO MUCH PLAY.



Step 1. Check for loose screw (1) in steering shaft universal joint (2).

- If screw in steering shaft universal joint is loose, tighten fastening nut (3).
- If screw in steering shaft universal joint is not loose, go to step 2.

Step 2. Check for play in drag link and tie rod ball joints.

- If there is play in drag link or tie rod ball joints, replace tie rod or drag link ball joints (pages 4-338, 4-346).
- If there is no play in drag link or tie rod ball joints, go to step 3.

Step 3. Check power steering gear adjustment as follows:

a. Make sure vehicle is parked on level surface with front wheels straight ahead.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

STEERING (CONT)

NOTE

Maximum distance of rotation is 0.75 in. (18.75 mm).

b. Rotate steering wheel left or right until slight resistance is felt.

- If power steering gear is out of adjustment, adjust power steering gear (page 4-354).
- If problem continues, notify direct support maintenance.

92. STEERING WHEEL VIBRATES AND/OR VEHICLE WANDERS.

Step 1. Check for play in drag link and tie rod ball joints.

- If there is play in drag link or tie rod ball joints, replace tie rod or drag link ball joints (pages 4-338, 4-346).
- If there is no play in drag link or tie rod ball joints, go to step 2.

Step 2. Check for unbalanced wheels.

- If wheels are not properly balanced, balance wheels statically and dynamically.
- If wheels are properly balanced, go to step 3.

Step 3. Check tie rod adjustment.

- If tie rod requires adjustment, adjust tie rod (page 4-341).
- If tie rod does not require adjustment, go to step 4.

Step 4. Check for foam in power steering tank.

- If there is foam in power steering tank, tighten suction line connections and add oil (TM 5-2420-224-10).
- If there is no foam in power steering tank, notify direct support maintenance.

93. POWER STEERING PUMP NOISY.

Step 1. With engine running, check for low oil level in power steering tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

STEERING (CONT)

Step 2. Check for foam in power steering tank.

- If there is foam in power steering tank, tighten suction line connections and add oil (TM 5-2420-224-10).
- If there is no foam in power steering tank, notify direct support maintenance.

94. POWER STEERING SYSTEM LOSING OIL.

Step 1. Check for loose cover on power steering tank.

- If cover on power steering tank is loose, tighten cover fastenings.
- If cover on power steering tank is tight, go to step 2.

Step 2. Check for leaking and damaged power steering tank, lines, and pump.

- If power steering tank or lines are leaking or damaged, tighten loose connections or replace power steering tank or lines.
- If power steering pump is not leaking or damaged, notify direct support maintenance.

SUSPENSION

95. CLUNKING OR CREAKING ON TURNS OR STOPS.

Step 1. Check for loose and bent front axle torsion bar.

- If front axle torsion bar is loose or bent, tighten loose connections or replace front axle torsion bar (page 4-376).
- If front axle torsion bar is not loose or bent, go to step 2.

Step 2. Check for bent front control arm.

- If front control arm is bent, replace front control arm (page 4-374).
- If front control arm is not bent, go to step 3.

Step 3. Check for oil leaking from shock absorbers.

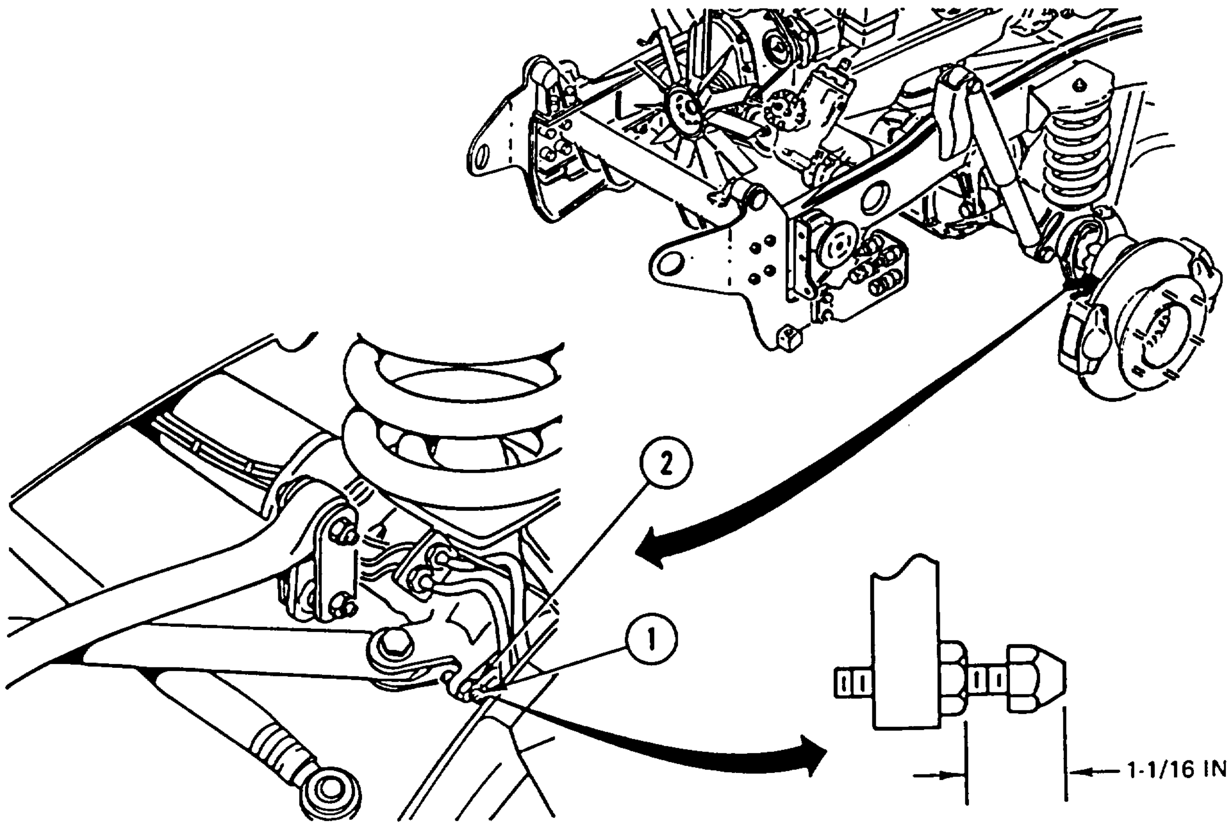
- If shock absorbers are leaking oil, replace shock absorbers (pages 4-368, 4-369, 4-372).
- If shock absorbers are not leaking oil, go to step 4.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

Suspension (CONT)

Step 4. Check for loose front propeller shaft U-joint.



- If front propeller shaft U-joint is not loose, adjust front axle stops as follows:

  (1) Measure length of stop bolt (1). Length must be 1-1/16 ±1/16 in. (27 ±1.5 mm). if measurement is not within tolerance, loosen lock nut (2) and adjust stop bolt (1) to required length.

  (2) Tighten lock nut (2).

- If front propeller shaft U-joint is loose, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

SUSPENSION (CONT)

96. HYDRAULIC SUSPENSION LOCKOUT SYSTEM WILL NOT ENGAGE (HMMH).

Step 1. Check for low oil level in hydraulic suspension lockout system.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check for oil leaks and damaged lines in hydraulic suspension lockout system.

- If there are oil leaks or damaged lines in hydraulic suspension lockout system, tighten loose connections or replace lines (pages 4-650, 4-652).
- If there are no oil leaks or damaged lines in hydraulic suspension lockout system, perform Malfunction 72 or Malfunction 73.

97. ONE SIDE OF HYDRAULIC SUSPENSION LOCKOUT WILL NOT ENGAGE (HMMH).

Check for oil leaks and damaged lines in hydraulic suspension lockout system.

- If there are no oil leaks or damaged lines in hydraulic suspension lockout system, tighten loose connections or replace lines (pages 4-650, 4-652).
- If there are oil leaks or damaged lines in hydraulic suspension lockout system, replace front shock absorbers (page 4-369).

HYDRAULIC SYSTEM

98. HYDRAULIC PUMP NOISY.

NOTE

Steps 1 thru 3 are the same for both front and rear hydraulic pumps.

Step 1. Check for loose mounting capscrews on hydraulic pump.

- If mounting capscrews are loose, tighten capscrews.
- If mounting capscrews are tight, go to step 2.

Step 2. Check for low oil level in hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 3.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

HYDRAULIC SYSTEM (CONT)

Step 3. Check for loose and damaged hydraulic pump lines.

- If hydraulic pump lines are loose or damaged, tighten loose connections or replace hydraulic pump lines (pages 4-584, 4-590). If problem continues, notify direct support maintenance.
- If hydraulic pump lines are not loose or damaged, replace hydraulic tank filter (pages 4-709, 4-720).

99. HYDRAULIC OIL FOAMY (FRONT LOADER/FORKLIFT, BACKHOE/CRANE, AND HYDRAULIC TOOLS OPERATE ERRATICALLY).

Step 1. Check for low oil level in front or rear hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check for water in hydraulic oil.

- If there is water in hydraulic oil, replace hydraulic oil (TM 5-2420-224-10) and make sure fill caps are tight.
- If there is no water in hydraulic oil, go to step 3.

Step 3. Check for loose or damaged hydraulic pump lines.

- If hydraulic pump lines are not loose or damaged, replace front or rear hydraulic tank filter (pages 4-709, 4-720).
- If hydraulic pump lines are loose or damaged, tighten loose connections or replace hydraulic pump lines (pages 4-584, 4-590). If problem continues, notify direct support maintenance.

100. HYDRAULIC OIL OVERHEATS.

Step 1. Check for low oil level in front or rear hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check fan shroud for debris that could block air flow.

- If there is debris in fan shroud, remove debris.
- If there is no debris in fan shroud, perform Malfunction 74.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH)

101. FORKLIFT WILL NOT MOVE (EMPTY).

Step 1. Check installation of quick-disconnect connectors.

- If quick-disconnect connectors are not properly installed, install quick-disconnect connectors properly.
- If quick-disconnect connectors are properly installed, go to step 2.

Step 2. Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 3.

Step 3. Check for damaged lift cylinder inlet line.

- If lift cylinder inlet line is damaged, replace inlet line (page 4-628).
- If lift cylinder inlet line is not damaged, notify direct support maintenance.

102. FORKLIFT WILL NOT LIFT LOAD.

Check for improperly lubricated mast channels.

- If mast channels are not properly lubricated, lubricate mast channels (page 2-14).
- If mast channels are properly lubricated, notify direct support maintenance.

103. LIFT CYLINDER DRIFTS DOWN.

Check hydraulic supply lines for loose and damaged connectors.

- If connectors are loose or damaged, tighten loose connectors or replace hydraulic supply lines (page 4-628).
- If connectors are not loose or damaged, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

104. MASTER PLUNGER DRIFTS UP WHEN LOAD LIFTED, THEN STOPS.

Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, bleed lift cylinder (page 4-630).

105. TILT CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both tilt cylinders.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-620).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged tilt cylinder packings as follows:

a. Start engine.

b. Tilt forklift forward until forklift stops moving. Stop engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

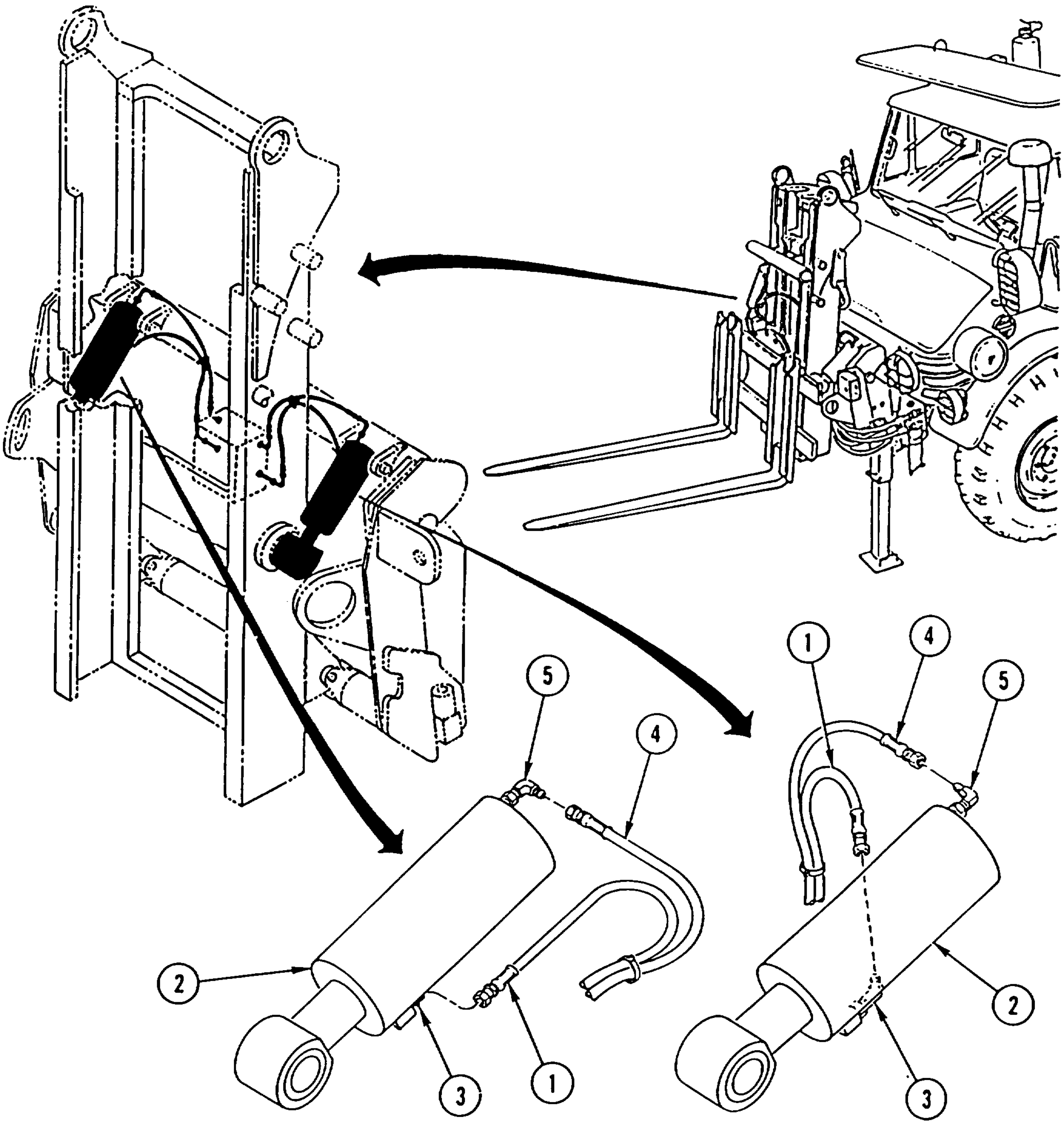


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

NOTE

Use threaded plugs in hoses in steps c and g. Failure to do so will result in spilled hydraulic oil.

c. Disconnect hose (1) at rod end of tilt cylinder (2) and install threaded plug. Start and run engine at idle.

NOTE

During steps d and h, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

d. Move forklift control lever to tilt forward position. Hold lever in tilt forward position and have assistant check for leaks from fitting (3) at rod end of tilt cylinder (2).

- If there is excessive leakage from fitting, replace tilt cylinder (page 4-686).
- If there is not excessive leakage from fitting, go to step e..

e. Stop engine. Remove threaded plug and connect hose (1) at rod end of tilt cylinder (2).

f. Start and run engine at idle. Move forklift control lever to tilt back position.

g. Stop engine. Disconnect hose (4) at cylinder end of tilt cylinder (2) and install threaded plug.

h. Start and run engine at idle. Move forklift control lever to tilt back position. Hold lever in tilt back position and have assistant check for leaks from fitting (5) at cylinder end of tilt cylinder (2).

- If there is excessive leakage from fitting, replace tilt cylinder (page 4-686).
- If there is not excessive leakage from fitting, notify direct support maintenance.

106. ROTATOR CYLINDER DRIFTS.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-624).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged rotator cylinder packings as follows:

a. Start engine.

b. Rotate forklift to right until forklift stops moving. Stop engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

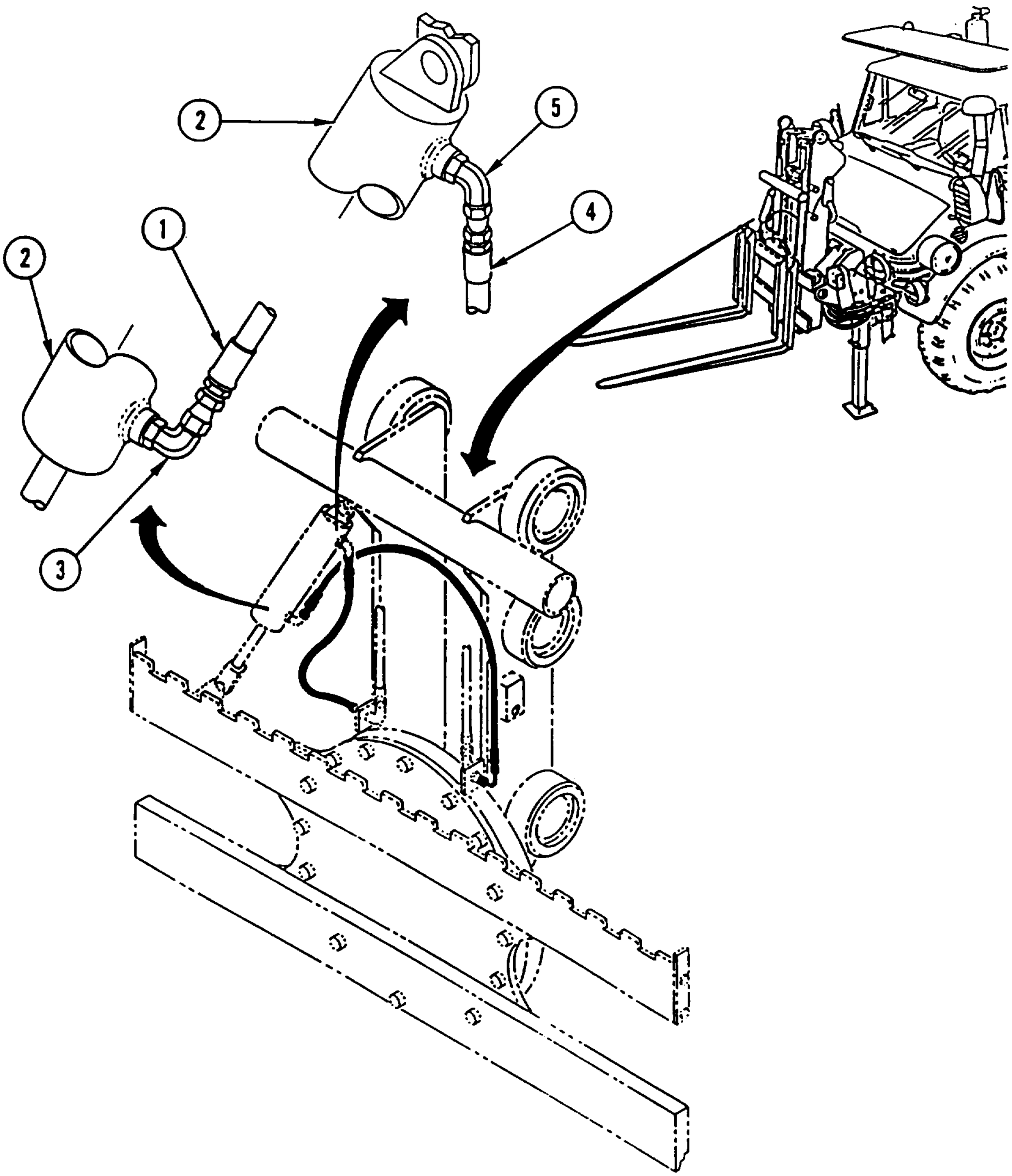


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

NOTE

Use threaded plugs in hoses for steps c and g. Failure to do so will result in spilled hydraulic oil.

c. Disconnect hose (1) at rod end of rotator cylinder (2) and install threaded plug. Start and run engine at idle.

NOTE

During steps d and h, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

d. Move forklift control lever to rotate right position. Hold lever in rotate right position and have assistant check for leaks from fitting (3) at rod end of rotator cylinder (2).

- If there is excessive leakage from fitting, replace rotator cylinder (page 4-688).
- If there is not excessive leakage from fitting, go to step e.

e. Stop engine. Remove threaded plug and connect hose (1) at rod end of rotator cylinder (2).

f. Start and run engine at idle. Move forklift control lever to rotate left position.

g. Stop engine. Disconnect hose (4) at cylinder end of rotator cylinder (2) and install threaded plug.

h. Start and run engine at idle. Move forklift control lever to rotate left position. Hold lever in rotate left position and have assistant check for leaks from fitting (5) at cylinder end of rotator cylinder (2).

- If there is excessive leakage from fitting, replace rotator cylinder (page 4-688).
- If there is not excessive leakage from fitting, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

107. FORKLIFT TILTS WITH ROTATE BUTTON DEPRESSED.

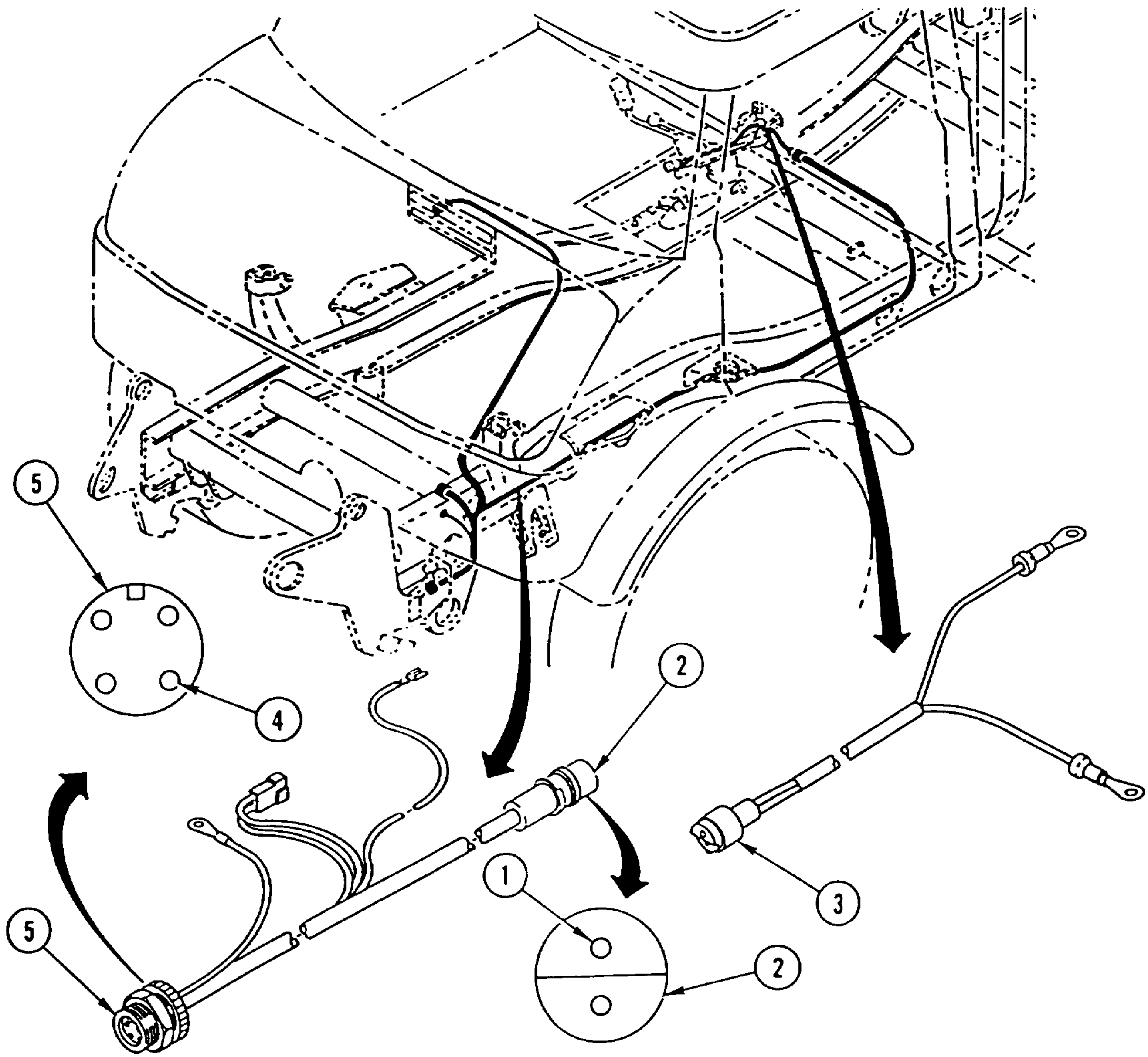


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

Step 1. Check for +24 VDC between pin 1 (1) and ground at connector (2).

- If +24 VDC is not present, repair wiring between connector (2) and fuse box 1.
- If +24 VDC is present, go to step 2.

Step 2. Check for continuity to ground between pins of connector (3).

- If open to ground, repair wiring harness.
- If short to ground, go to step 3.

Step 3. Check for +24 VDC between pin 3 (4) and ground at forklift connector (5) with rotate button pushed.

- If +24 VDC is not present, repair wiring between connector (2) and forklift connector.
- If +24 VDC is present, go to step 4.

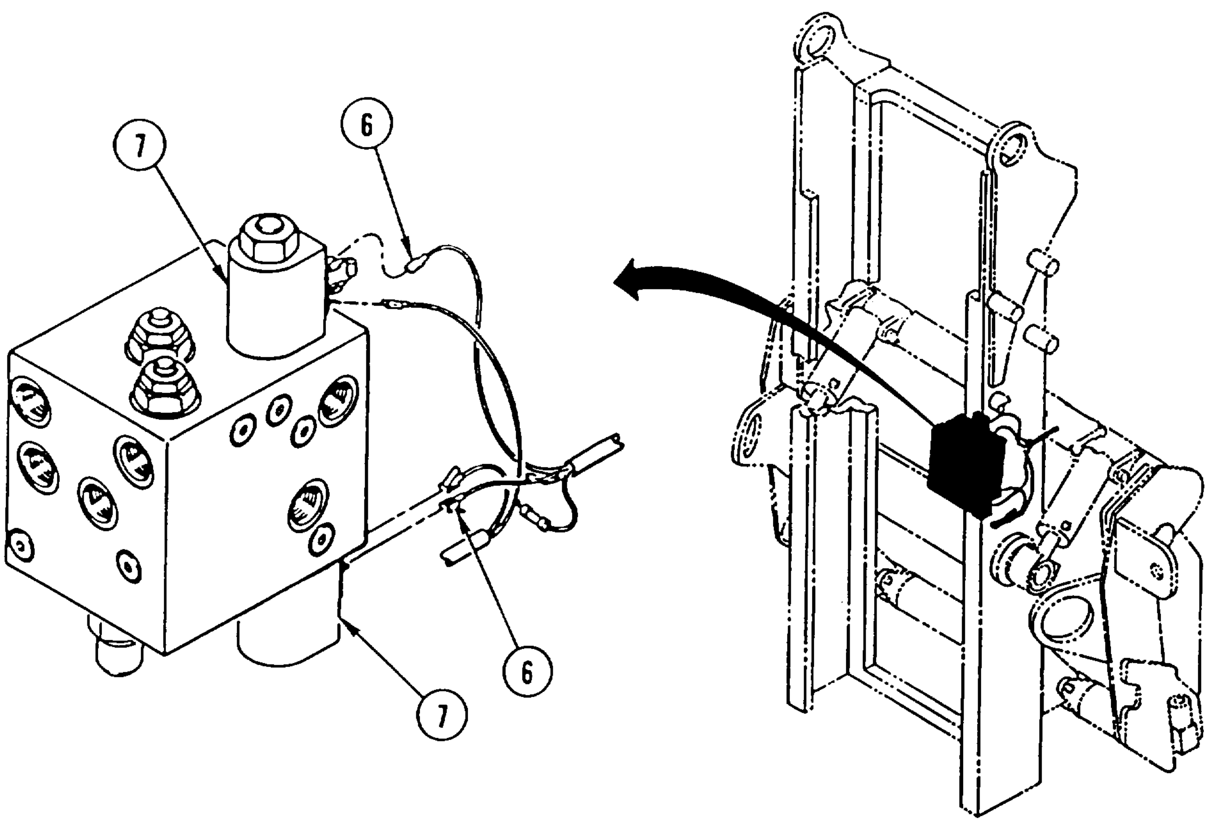


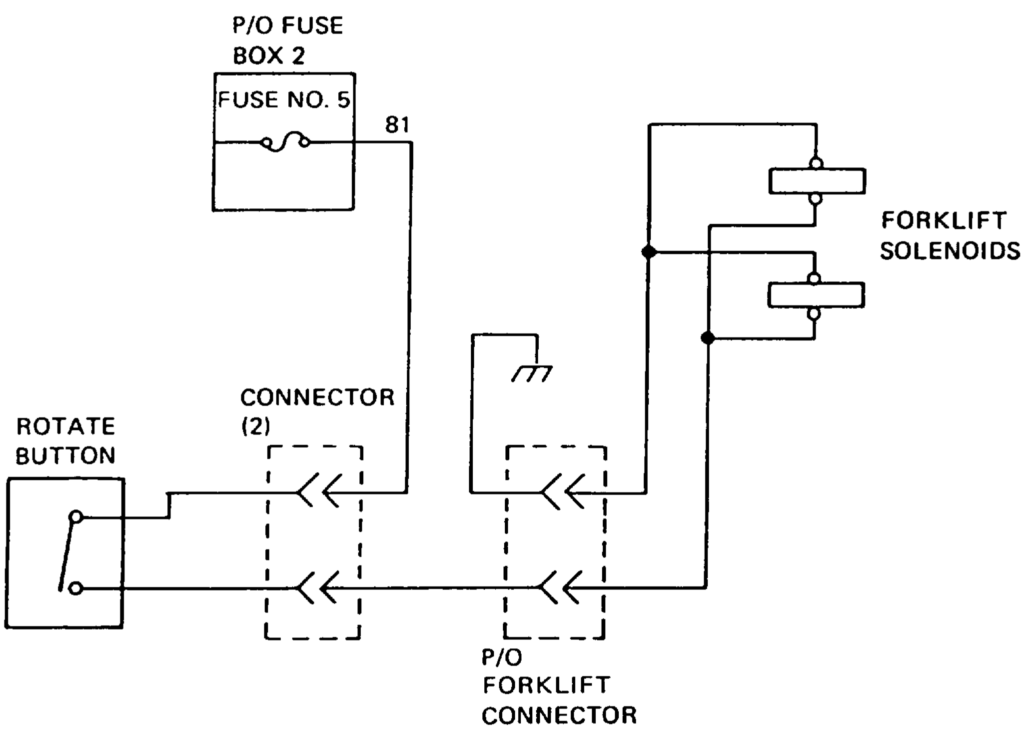
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FORKLIFT (HMMH) (CONT)

Step 4. Check for +24 VDC between wire (6) and ground at forklift rotator solenoids (7) with rotate button pushed.

- If +24 VDC is present, notify direct support maintenance.
- If +24 VDC is not present, repair wiring between forklift rotator solenoids and forklift connector.



HD45 HAMMER DRILL (SEE)

108. HAMMER DRILL WILL NOT OPERATE.

Attempt to operate a different hydraulic tool.

- If alternate tool operates, replace hammer drill.
- if alternate tool does not operate, perform Malfunction 76.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

HD45 HAMMER DRILL (SEE) (CONT)

109. HAMMER DRILL OVERHEATS.

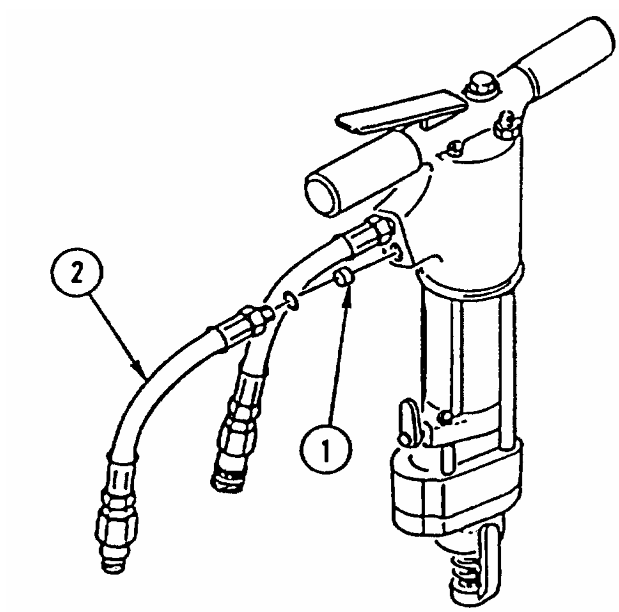
Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, perform Malfunction 100.

110. HAMMER DRILL OPERATES SLOWLY OR INEFFECTIVELY.

Step 1. Check for damaged hydraulic lines.

- If hydraulic lines are damaged, replace hydraulic lines (page 4-586).
- If hydraulic lines are not damaged, go to step 2.



Step 2. Check for blocked plug (1) by removing hose (2) and plug and checking for foreign matter.

- If plug is blocked, remove foreign matter.
- If plug is not blocked, install plug and hose and go to step 3.

Step 3. Attempt to operate a different hydraulic tool.

- If alternate tool operates at normal speed, replace hammer drill.
- If alternate tool does not operate at normal speed, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

IMPACT WRENCH (HMMH)

111. IMPACT WRENCH PERFORMS POORLY OR HAS LOW IMPACT.

Step 1. Check for damaged hydraulic lines.

- If hydraulic lines are damaged, replace hydraulic lines (page 4-586).
- If hydraulic lines are not damaged, go to step 2.

Step 2. Check for low engine speed by pulling hydraulic tool switch out and checking engine rpm on tachometer. Engine speed should be 2000 rpm.

- If engine speed is not 2000 rpm, adjust air cylinder (page 4-77).
- If engine speed is 2000 rpm, notify direct support maintenance.

112. IMPACT WRENCH OVERHEATS.

Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, perform Malfunction 100.

113. OIL LEAKS AT HAMMER CASE.

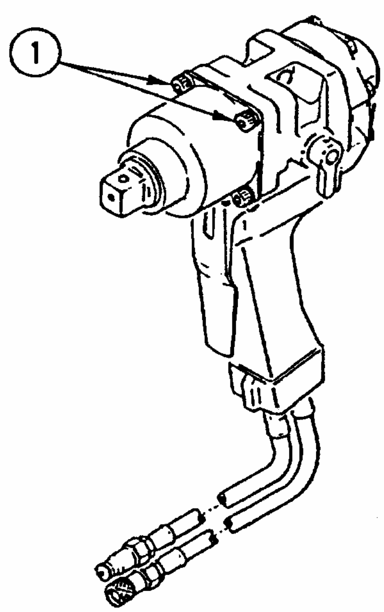


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

IMPACT WRENCH (HMMH) (CONT)

Check for loose hammer case socket head capscrews (1).

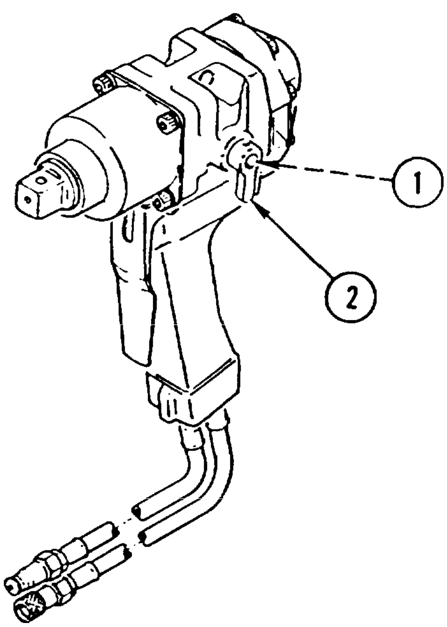
- If hammer case socket head capscrews are loose, tighten capscrews to 13-15 lb-ft (17.6-18.3 N.m).
- If hammer case socket head capscrews are tight, notify direct support maintenance.

114. IMPACT WRENCH WILL NOT OPERATE.

Check for damaged hose couplers.

- If hose couplers are damaged, repair tool hose couplers (page 4-471).
- If hose couplers are not damaged, perform Malfunction 76.

115. IMPACT WRENCH WILL NOT OPERATE IN ONE DIRECTION ONLY.



Check for loose and missing setscrew (1) in directional control lever (2).

- If setscrew in directional control lever is loose or missing, tighten or replace setscrew.
- If setscrew in directional control lever is not loose or missing, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BR67 PAVEMENT BREAKER (SEE)

116. PAVEMENT BREAKER WILL NOT OPERATE.

Step 1. Check for damaged hydraulic lines.

- If hydraulic lines are damaged, replace hydraulic lines (page 4-586).
- If hydraulic lines are not damaged, go to step 2.

Step 2. Attempt to operate a different hydraulic tool.

- If alternate tool operates, replace pavement breaker.
- If alternate tool does not operate, perform Malfunction 76.

117. PAVEMENT BREAKER WILL NOT OPERATE EFFECTIVELY.

Check for damaged hydraulic lines.

- If hydraulic lines are damaged, replace hydraulic lines (page 4-586).
- If hydraulic lines are not damaged, notify direct support maintenance.

118. PAVEMENT BREAKER OVERHEATS.

Step 1. Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, perform Malfunction 100.

CHAIN SAW (SEE)

119. CHAIN SAW WILL NOT OPERATE.

Step 1. Check for leaking and damaged hydraulic lines.

- If hydraulic lines are leaking or damaged, tighten loose connections or replace hydraulic lines (page 4-586).
- If hydraulic lines are not leaking or damaged, go to step 2.

Step 2. Attempt to operate a different hydraulic tool.

- If alternate tool operates, replace chain saw.
- If alternate tool does not operate, perform Malfunction 76.

120. CHAIN SAW CUTS SLOWLY OR NOT AT ALL.

Check for worn and damaged chain.

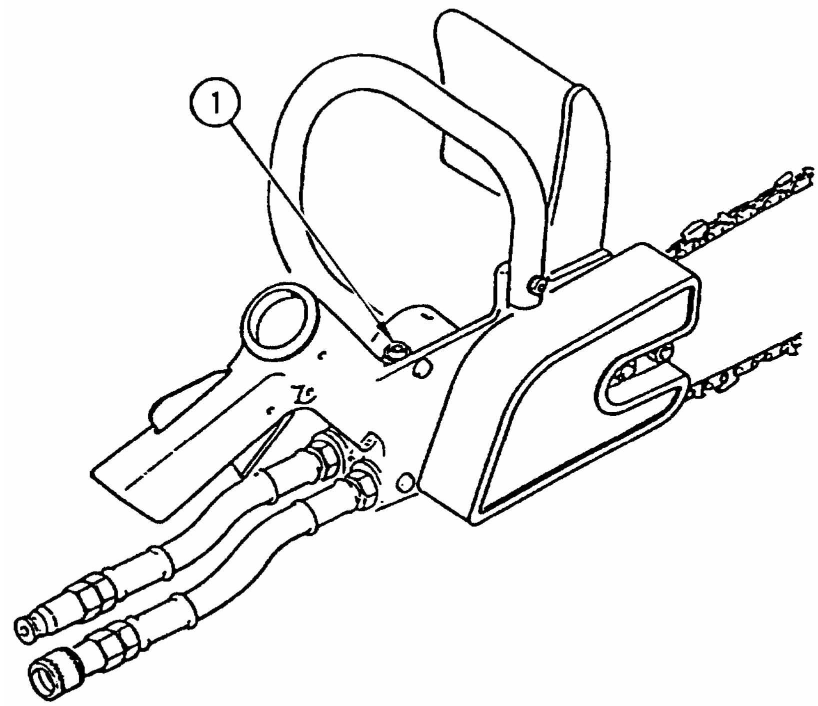
- If chain is worn or damaged, replace chain saw chain (page 4-744).
- If chain is not worn or damaged, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CHAIN SAW (SEE) (CONT)

121. BAR TURNS COLOR.



Step 1. Check for proper automatic chain oiler (1) operation by operating chain saw and checking for oil delivery from chain oiler.

- If automatic chain oiler is not operating properly, adjust chain oiler by turning counterclockwise to increase oil flow.
- If automatic chain oiler is operating properly, go to step 2.

Step 2. Check for worn and damaged chain.

- If chain is worn or damaged, replace chain saw chain (page 4-744).
- If chain is not worn or damaged, adjust chain saw chain tension (TM 5-2420-224-10).

122. CHAIN SAW OVERHEATS.

Check for low oil level in front hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, perform Malfunction 100.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE)

123. ALL BACKHOE FUNCTIONS SLUGGISH.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-590, 4-592, 4-594, 4-596, 4-598, 4-600, 4-602, 4-604, 4-606, 4-608, 4-610, 4-612, 4-614, 4-616, 4-618).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check engine rpm on tachometer. Engine speed should be 2000 rpm.

- If engine speed is not 2000 rpm, adjust air cylinder (page 4-76).
- If engine speed is 2000 rpm, notify direct support maintenance.

124. BOOM CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both boom cylinders.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-610).
- If hydraulic lines are not loose or damaged, go to step 2.

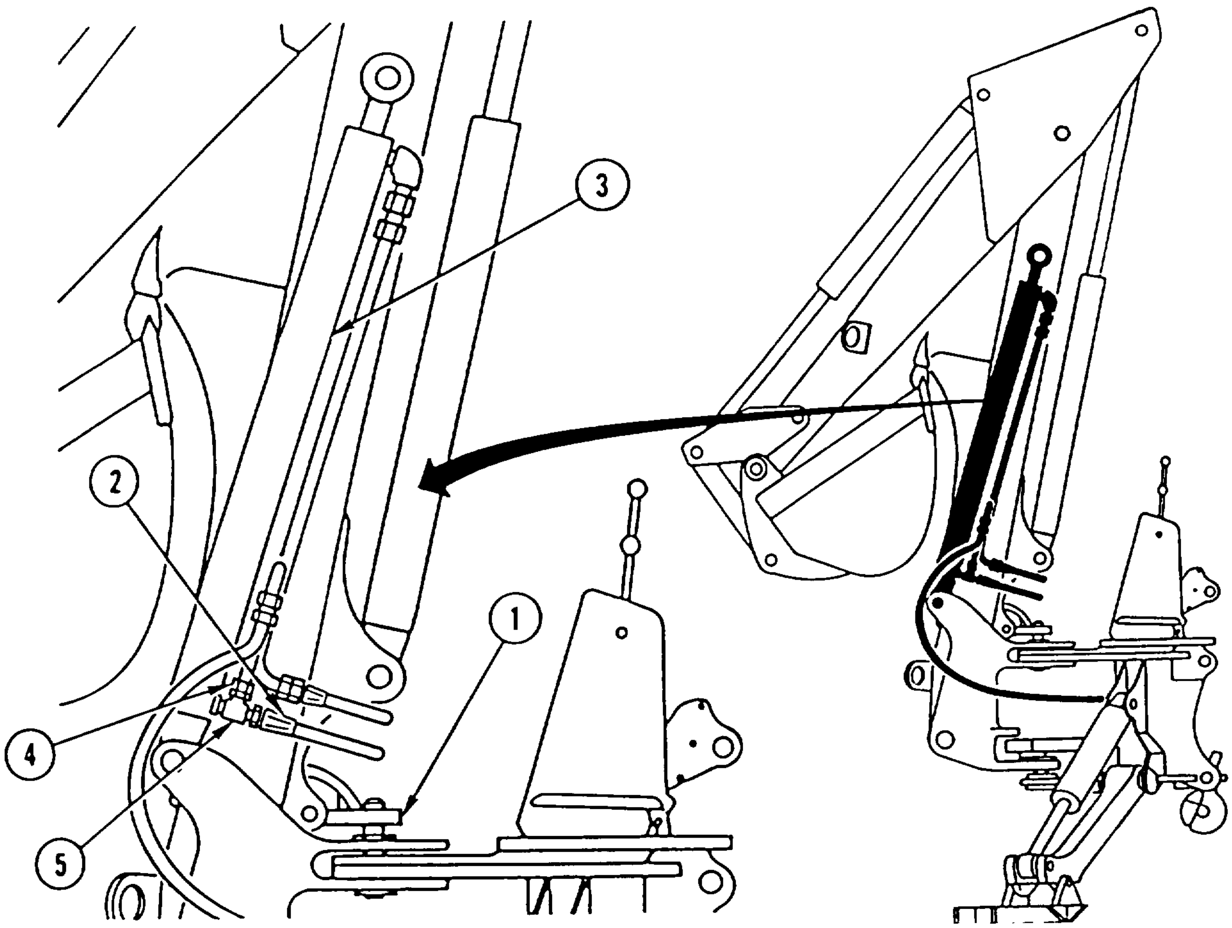
Step 2. Check for damaged boom cylinder packing as follows:

a. Start engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)



b. Place boom in position illustrated and engage backhoe boom latch (1). Stop engine.

NOTE

Use threaded plug in tube. Failure to do so will result in spilled hydraulic oil.

c. Remove hose (2) from cylinder end of boom cylinder (3). Disconnect tube (4) from fitting (5) and install threaded plug.

d. Start engine. Set engine RPM switch to HI.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

NOTE

During step e, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

e. Pull boom control lever and check for leaks from boom cylinder (3).

- If there is excessive leakage from boom cylinder, replace boom cylinder (page 4-658).
- If there is not excessive leakage from boom cylinder, notify direct support maintenance.

125. BUCKET CYLINDER DRIFTS.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-616).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged bucket cylinder packing as follows:

a. Start engine. Pull boom control lever inward until bucket is above floor.

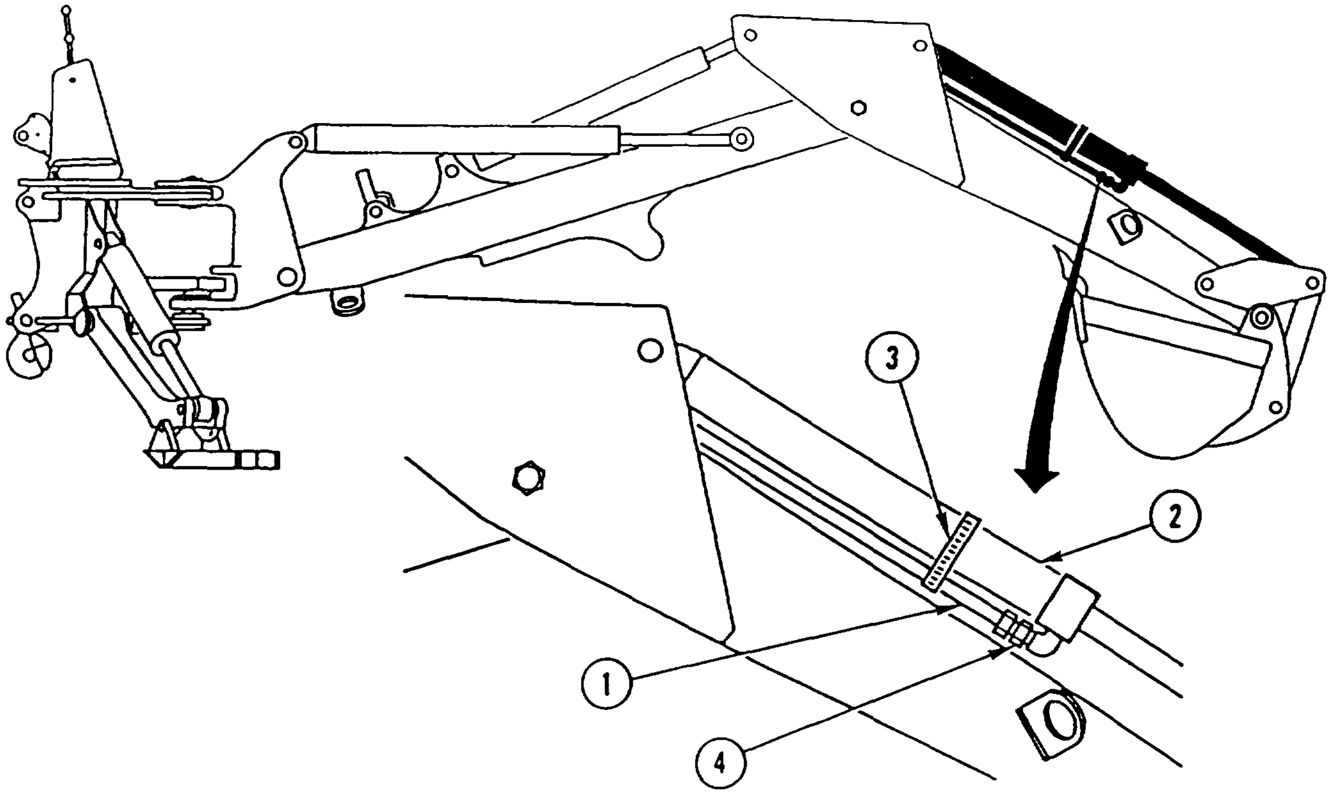
b. Pull bucket control lever inward until bucket stops moving.

c. Push boom control lever outward until bucket is on floor. Stop engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)



NOTE

Use threaded plug in tube. Failure to do so will result in spilled hydraulic oil.

d. Disconnect tube (1) from rod end of bucket cylinder (2) and loosen clamp (3) holding tube (1). Move tube away from fitting (4) and install threaded plug.

e. Start engine. Set engine RPM switch to HI.

NOTE

During step f, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

f. Pull bucket control lever inward and check for leaks from fitting (4).

- If there is excessive leakage from fitting, replace bucket cylinder (page 4-668).
- If there is not excessive leakage from fitting, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

126. DIPPER CYLINDER DRIFTS.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-614).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged dipper cylinder packing as follows:

a. Start engine. Place backhoe in transport position.

b. Pull dipper control lever inward to move dipper against boom until dipper stops moving. Stop engine.

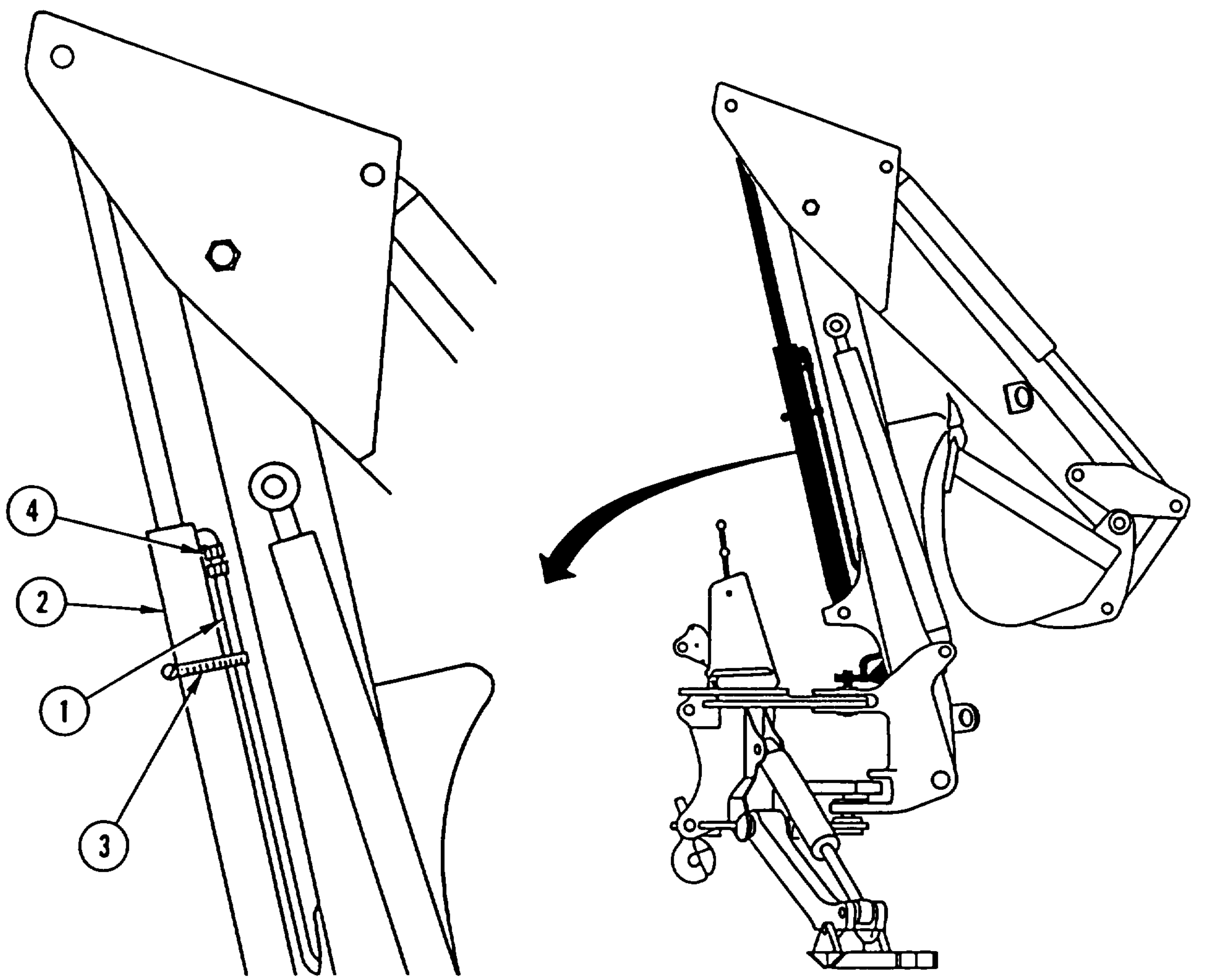


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

NOTE

Use threaded plug in tube. Failure to do so will result in spilled hydraulic oil.

c. Disconnect tube (1) from rod end of dipper cylinder (2) and loosen clamp (3) holding tube (1). Move tube away from fitting (4) and install threaded plug.

d. Start engine. Set engine RPM switch to HI.

NOTE

During step e, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

e. Pull dipper control lever inward and check for leaks from fitting (4).

- If there is excessive leakage from fitting, replace dipper cylinder (page 4-670).
- If there is not excessive leakage from fitting, notify direct support maintenance.

127. SWING CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both swing cylinders.

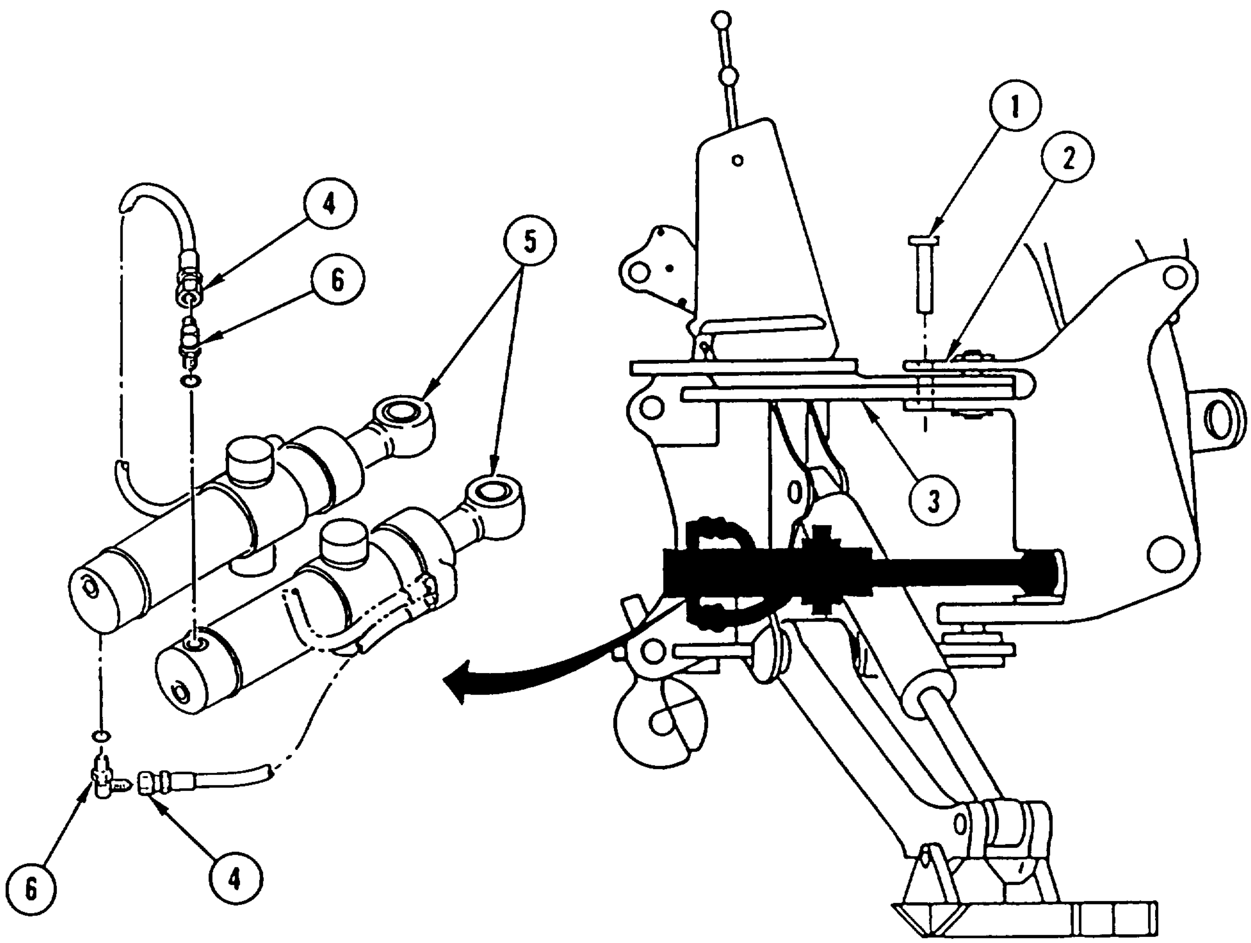
Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-606).
- If hydraulic lines are not loose or damaged, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)



Step 2. Check for damaged swing cylinder packing as follows:

NOTE

The pin, 8-10 in. (200-250 mm) in length, 1-1/2 in. (37.5 mm) in diameter, must be made from rolled stock.

a. Start engine. Place swing tower in center position and install pin (1) through swing tower (2) and backhoe mounting frame (3) to hold swing tower (2) in center position.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

NOTE

Use threaded plug in hose. Failure to do so will result in spilled hydraulic oil.

b. Stop engine. Disconnect hose (4) from closed end of swing cylinder (5) and install threaded plug.

c. Start and run engine at 2000 rpm.

NOTE

During step d, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

d. Move swing control lever to move backhoe (to left for left swing cylinder or to right for right swing cylinder). Hold lever in position and check for leaks from fitting (6) at closed end of swing cylinder.

- If there is excessive leakage from fitting, replace swing cylinder (page 4-660).
- If there is not excessive leakage from fitting, notify direct support maintenance.

128. STABILIZER CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both stabilizer cylinders.

Step 1. Check for loose and damaged hydraulic lines.

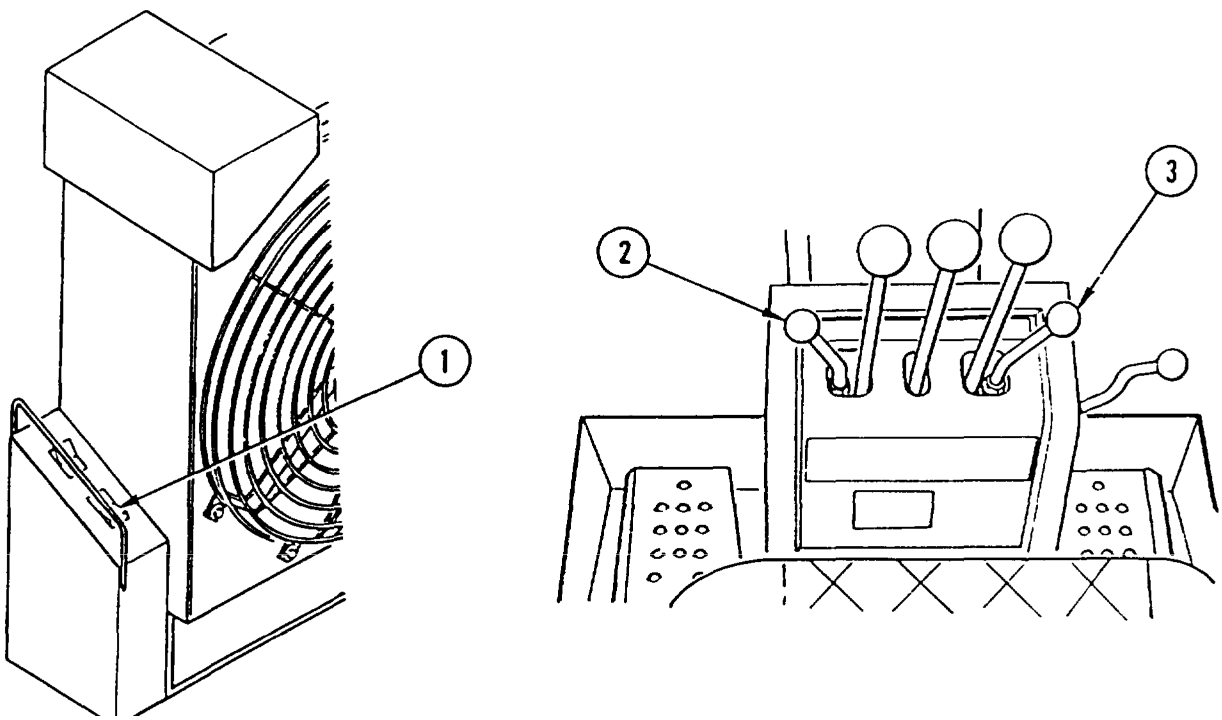
- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-600, 4-602, 4-604).
- If hydraulic lines are not loose or damaged, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

Step 2. Check for damaged stabilizer cylinder packing as follows:



a. Start engine. Set engine RPM switch (1) to HI.

b. Lift backhoe from three-point stance, roll bucket up, and fold dipper in toward boom.

c. Push both stabilizer control levers (2 and 3) outward to lower stabilizers until stabilizer cylinder rods are fully extended. Allow control levers (2 and 3) to return to neutral.

d. Stop engine.

e. Push left (2) or right (3) stabilizer control lever outward. If backhoe moves, immediately release either left or right stabilizer control lever.

- if backhoe moves, replace defective stabilizer cylinder (page 4-673).
- If backhoe does not move, notify direct support maintenance.

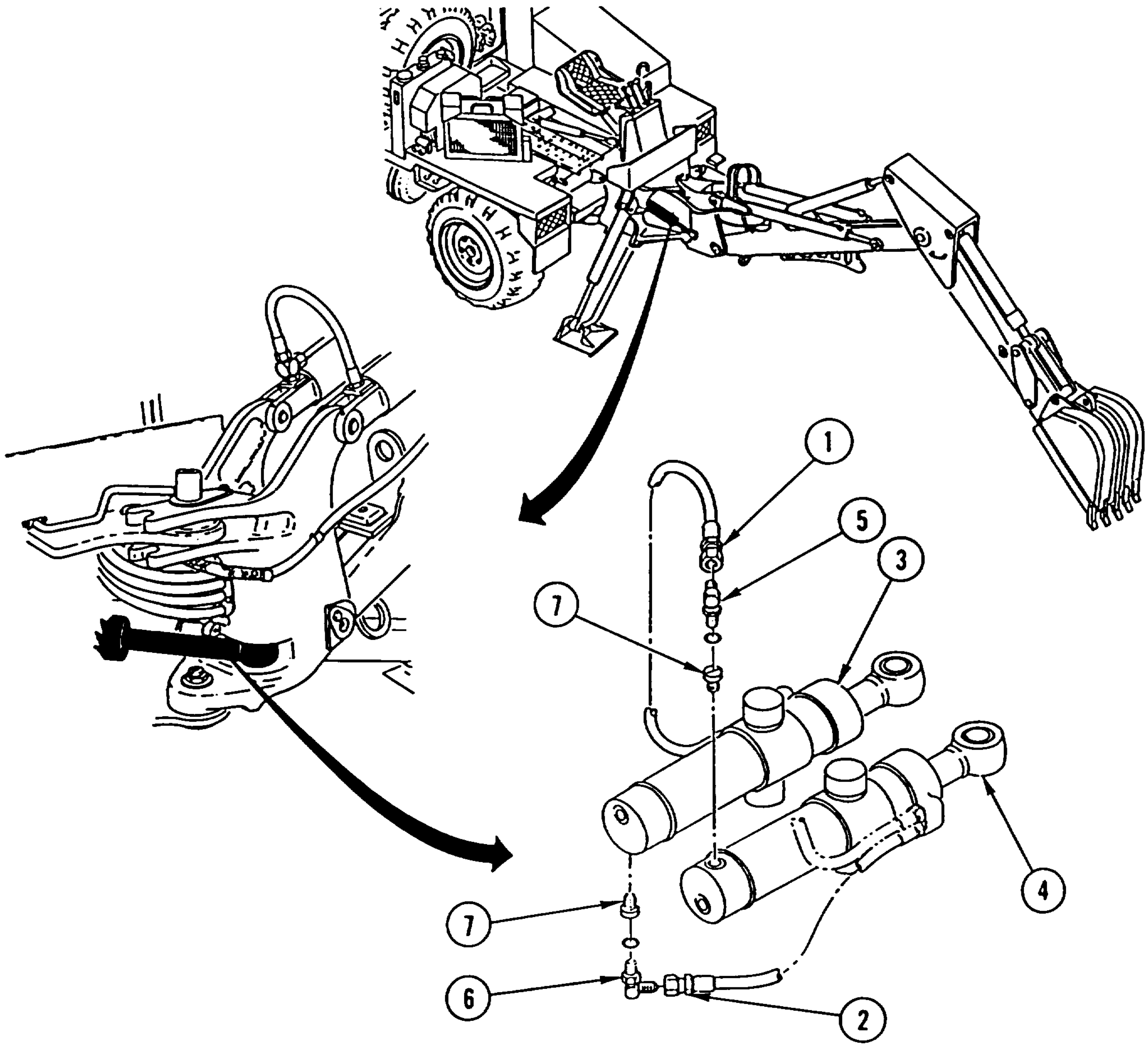
129. BACKHOE SHOWS ERRATIC MOVEMENTS WHILE SWINGING.

Check for incorrectly installed and missing restrictors in closed ends of swing cylinders as follows:

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspectlon
Corrective Action

BACKHOE (SEE) (CONT)



a. Disconnect two hoses (1 and 2) at closed ends of swing cylinders (3 and 4).

b. Remove two fittings (5 and 6) and remove restrictors (7).

- If restrictor was incorrectly installed or is missing, install restrictor with small end toward swing cylinder.
- If restrictor is not missing, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

130. BOOM LOWERS TOO FAST.

Check for incorrectly installed and missing restrictor in B port of boom section, backhoe control valve, as follows:

a. Lower bucket to floor.

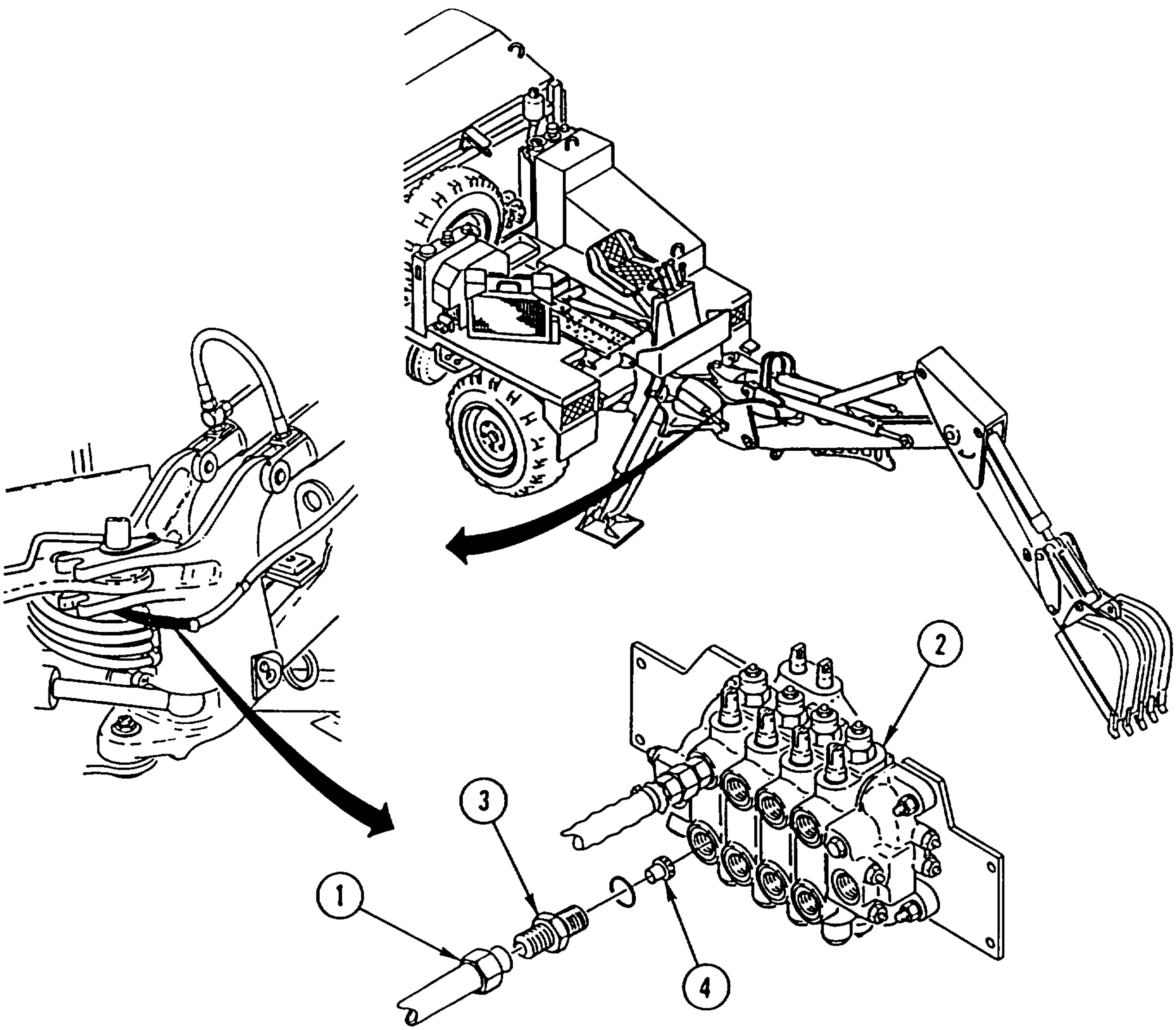


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

BACKHOE (SEE) (CONT)

b. Disconnect tube (1) at B port of boom section (2) and remove fitting (3) and restrictor (4) from B port.

- If restrictor was incorrectly installed or is missing, install restrictor with large end toward boom section.
- If restrictor is not missing, notify direct support maintenance.

CRANE (HMMH)

131. CRANE CONTROLS WILL NOT RESPOND.

Step 1. Check for low oil level in rear hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-632, 4-634, 4-636, 4-638, 4-640, 4-642, 4-644, 4-646, 4-648).
- If hydraulic lines are not loose or damaged, notify direct support maintenance.

132. CRANE OPERATION SLOWS DOWN.

Step 1. Check for low oil level in rear hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check engine rpm on tachometer. Engine speed should be 1100 rpm.

- If engine speed is not 1100 rpm, adjust air cylinder (page 4-77).
- If engine speed is 1100 rpm, go to step 3.

Step 3. Check condition of rear hydraulic tank filters.

- If rear hydraulic tank filters are unserviceable, change rear hydraulic tank filters (page 4-720).
- If rear hydraulic tank filters are serviceable, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CRANE (HMMH) (CONT)

133. CRANE OPERATION UNUSUALLY NOISY.

Step 1. Check for low oil level in rear hydraulic tank.

- If oil level is low, add oil (TM 5-2420-224-10).
- If oil level is not low, go to step 2.

Step 2. Check for improperly lubricated cylinder pivot pins.

- If pivot pins are not properly lubricated, lubricate pivot pins (TM 5-2420-224-10).
- If pivot pins are properly lubricated, go to step 3.

Step 3. Check condition of rear hydraulic tank filters.

- If rear hydraulic tank filters are unserviceable, change rear hydraulic tank filters (page 4-720).
- If rear hydraulic tank filters are serviceable, go to step 4.

Step 4. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-632, 4-634, 4-636, 4-638, 4-640, 4-642, 4-644, 4-646, 4-648).
- If hydraulic lines are not loose or damaged, notify direct support maintenance.

134. VERTICAL OUTRIGGER CYLINDER YIELDS OR DRIFTS.

NOTE
Step is the same for both vertical outrigger cylinders.

Check for leaking and damaged hydraulic lines.

- If hydraulic lines are leaking or damaged, tighten loose connections or replace hydraulic lines (page 4-648).
- If hydraulic lines are not leaking or damaged, replace vertical outrigger cylinder (page 4-700).

135. HORIZONTAL OUTRIGGER CYLINDER WILL NOT RETRACT.

NOTE
Step is the same for both horizontal outrigger cylinders.

Check for leaking and damaged hydraulic lines.

- If hydraulic lines are leaking or damaged, tighten loose connections or replace hydraulic lines (page 4-646).
- If hydraulic lines are not leaking or damaged, replace horizontal outrigger cylinder (page 4-698).

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

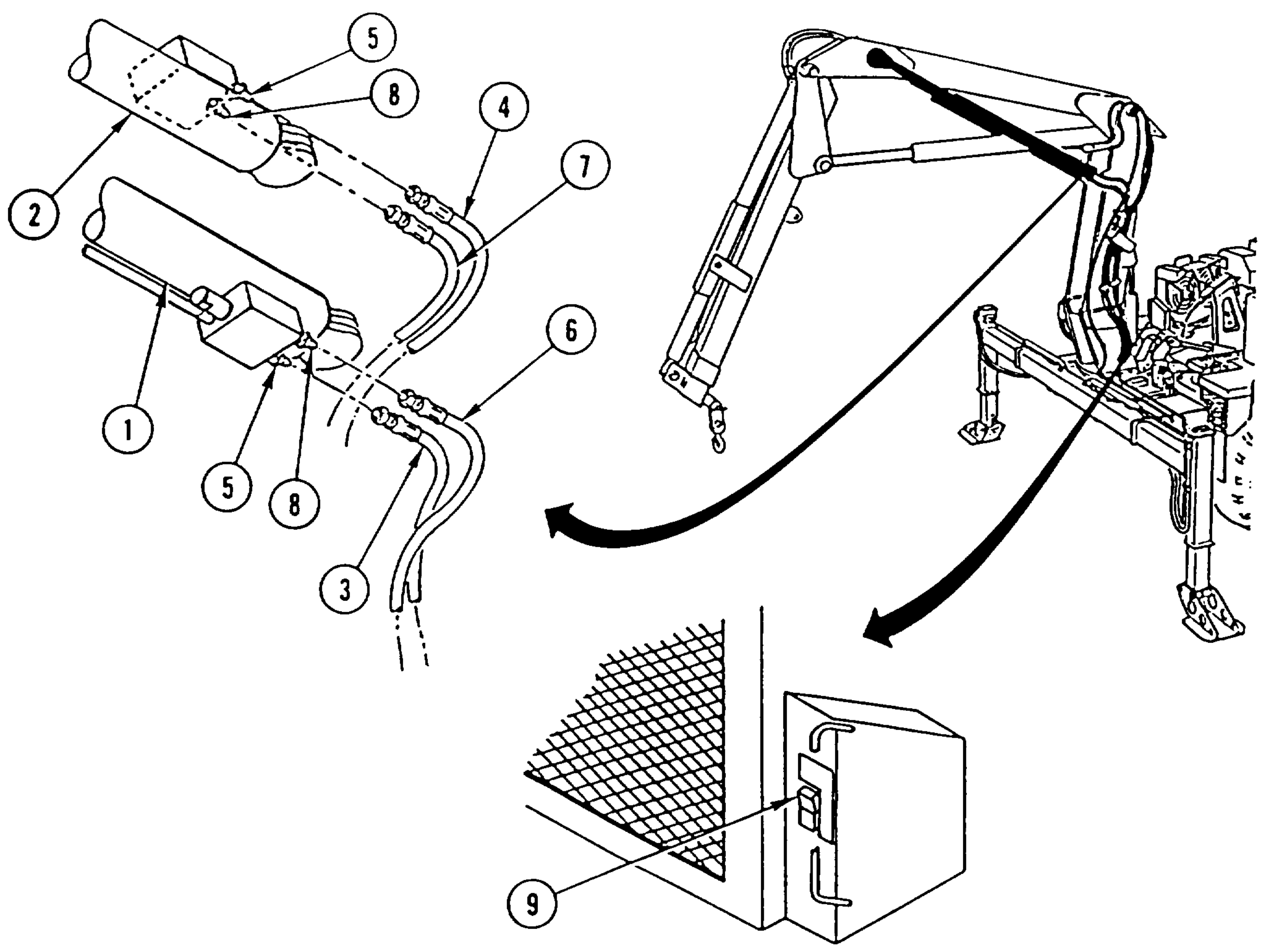
CRANE (HMMH) (CONT)

136. INNER BOOM LIFT CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both inner boom lift cylinders except as noted.

Step 1. Check for damaged packings and seals in inner boom lift cylinder as follows:



a. Start engine. Extend inner boom lift cylinders (1 and 2) to end of stroke.

b. Stop engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CRANE (HMMH) (CONT)

NOTE

- Step c is for passenger side inner boom lift cylinder.
- Step d is for driver side inner boom lift cylinder.
- Use threaded plugs in hoses in steps c, d, h, and i. Failure to do so will result in spilled hydraulic oil.

c. Remove lower hose (3) from passenger side inner boom lift cylinder (1) and install threaded plug in hose.

d. Remove upper hose (4) from driver side inner boom lift cylinder (2) and install threaded plug in hose.

e. Start engine. Move control lever to extend inner boom lift cylinders (1 and 2) and check for oil leak from fittings (5).

- If there is leakage from fittings, replace inner boom lift cylinder (page 4-692).
- If there is no leakage from fittings, stop engine and go to step f.

f. Remove threaded plugs from hoses (3 and 4) and install hose on inner boom lift cylinders (1 and 2).

g. Start engine, retract inner boom lift cylinder completely, and stop engine.

NOTE

- Step h is for passenger side inner boom lift cylinder.
- Step i is for driver side inner boom lift cylinder.

h. Remove upper hose (6) from passenger side inner boom lift cylinder (1) and install threaded plug.

i. Remove lower hose (7) from driver side inner boom lift cylinder (2) and install threaded plug.

j. Start engine. Retract inner boom lift cylinders (1 and 2) and check for oil leak from fittings (8).

- If there is leakage from fittings, replace inner boom lift cylinder (page 4-692).
- If there is no leakage from fittings, go to step 2.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CRANE (HMMH) (CONT)

Step 2. Check inner boom lift cylinder holding valves as follows:

a. Start engine. Set auxiliary throttle switch (9) to CRANE.

b. Lift load. Allow control lever to go to neutral.

c. Set auxiliary throttle switch (9) to IDLE. Stop engine.

d. Move control lever to attempt to lower load to floor.

- If load lowers any amount, replace inner boom lift cylinder (page 4-692).
- If load does not lower, notify direct support maintenance.

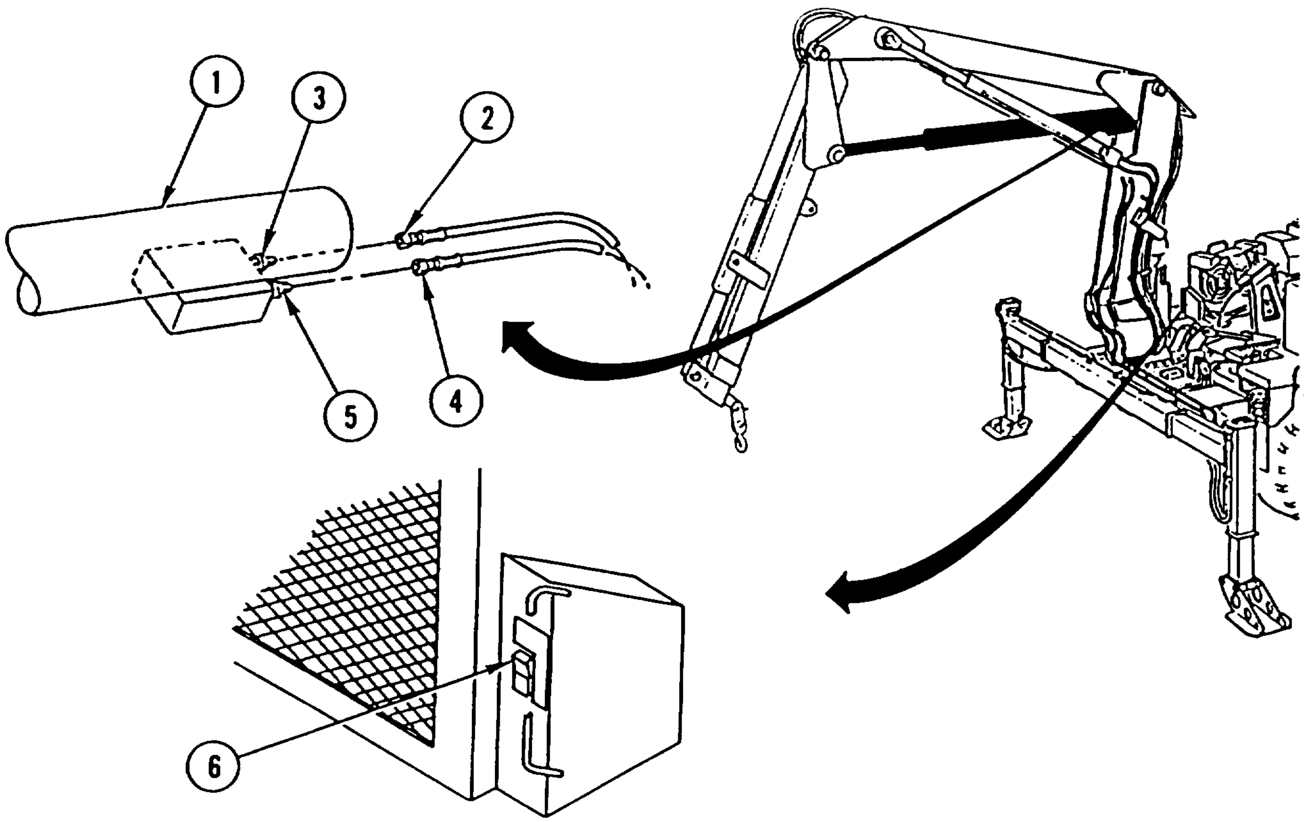
Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CRANE (HMMH) (CONT)

137. OUTER BOOM CYLINDER DRIFTS WHEN LOADED AND CONTROLS IN NEUTRAL.

Step 1. Check for damaged packings and seals in outer boom cylinder as follows:



a. Start engine. Extend outer boom cylinder (1) to end of stroke.

b. Stop engine.

NOTE

Use threaded plugs in hoses in steps c and g. Failure to do so will result in spilled hydraulic oil.

c. Remove hose (2) from outer boom cylinder (1) and install threaded plug in hose.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

CRANE (HMMH) (CONT)

d. Start engine. Move control lever to extend outer boom cylinder (1) and check for oil leak from fitting (3).

- If there is leakage from fitting, replace outer boom cylinder (page 4-696).
- If there is no leakage from fitting, stop engine and go to step e.

e. Remove threaded plug from hose (2) and install hose on outer boom cylinder (1).

f. Start engine, retract outer boom cylinder completely, and stop engine.

g. Disconnect hose (4) from outer boom cylinder (1) and install threaded plug.

h. Start engine. Retract outer boom cylinder (1) and check for oil leak from fitting (5j.

- If there is leakage from fitting, replace outer boom cylinder (page 4-696).
- If there is no leakage from fitting, go to step 2.

Step 2. Check outer boom cylinder holding valve as follows:

a. Start engine. Set auxiliary throttle switch (6) to CRANE.

b. Lift load. Allow control lever to go to neutral.

c. Set auxiliary throttle switch (6) to IDLE. Stop engine.

d. Move control lever to attempt to lower load to floor.

- If load lowers any amount, replace outer boom cylinder (page 4-696).
- If load does not lower, notify direct support maintenance.

FRONT LOADER (SEE)

138. FRONT LOADER OPERATES SLOW.

Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-569, 4-572, 4-574, 4-576, 4-578, 4-580, 4-582, 4-584, 4-586, 4-588).
- If hydraulic lines are not loose or damaged, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

139. FRONT LOADER WILL NOT RAISE OR LOWER.

Step 1. Check quick-disconnect connectors for correct installation.

- If quick-disconnect connectors are not correctly installed, install connectors correctly.
- If quick-disconnect connectors are correctly installed, go to step 2.

Step 2. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-569, 4-572, 4-578, 4-580, 4-582, 4-584, 4-586, 4-588).
- If hydraulic lines are not loose or damaged, notify direct support maintenance.

140. FRONT LOADER WILL NOT LOWER USING BUCKET SWITCH.

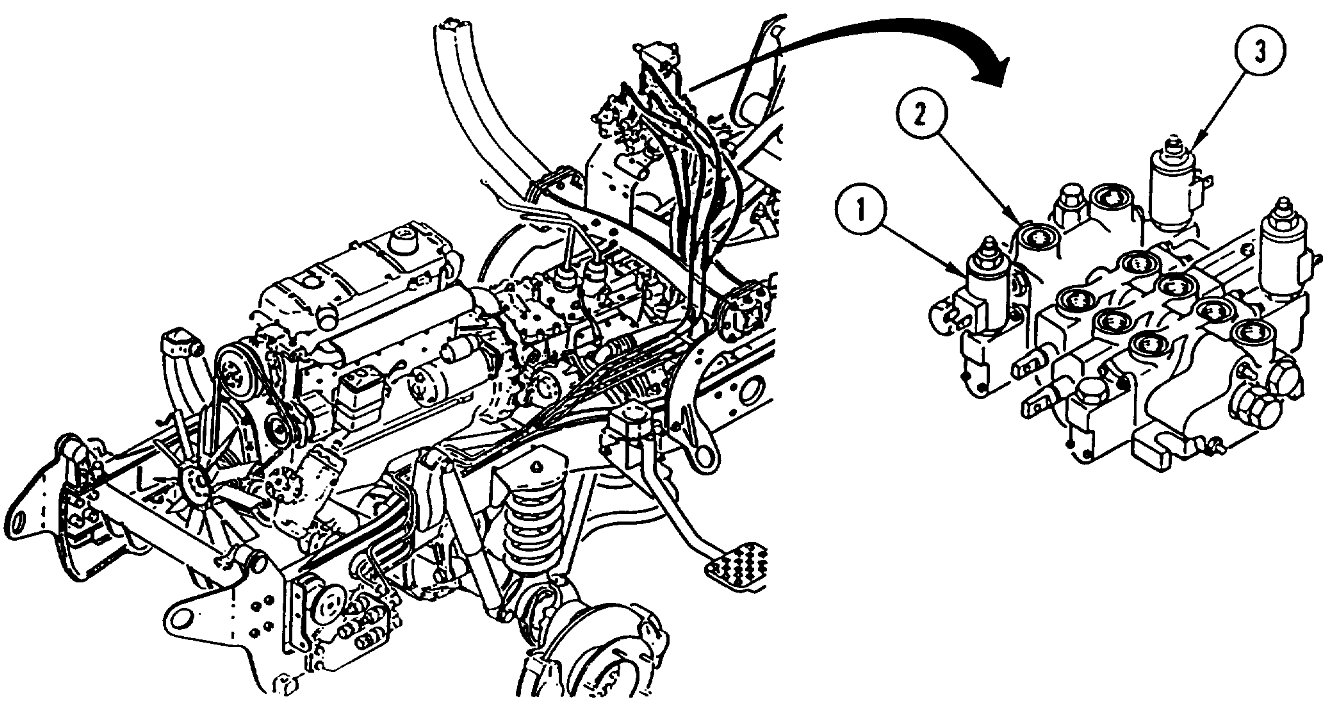


Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

Set hand throttle to 1200 rpm and depress button on solenoid (1) of control valve (2).

- If front loader lowers, perform Malfunction 77.
- If front loader does not lower, notify direct support maintenance.

141. FRONT LOADER WILL NOT RAISE USING BUCKET SWITCH.

Set hand throttle to 1200 rpm and depress button on solenoid (3) of oontrol valve (2).

- If front loader raises, perform Malfunction 77.
- If front loader does not raise, notify direct support maintenance.

142. LOADER BOOM CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both loader boom cylinders.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-569, 4-572).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged loader boom cylinder packing as follows:

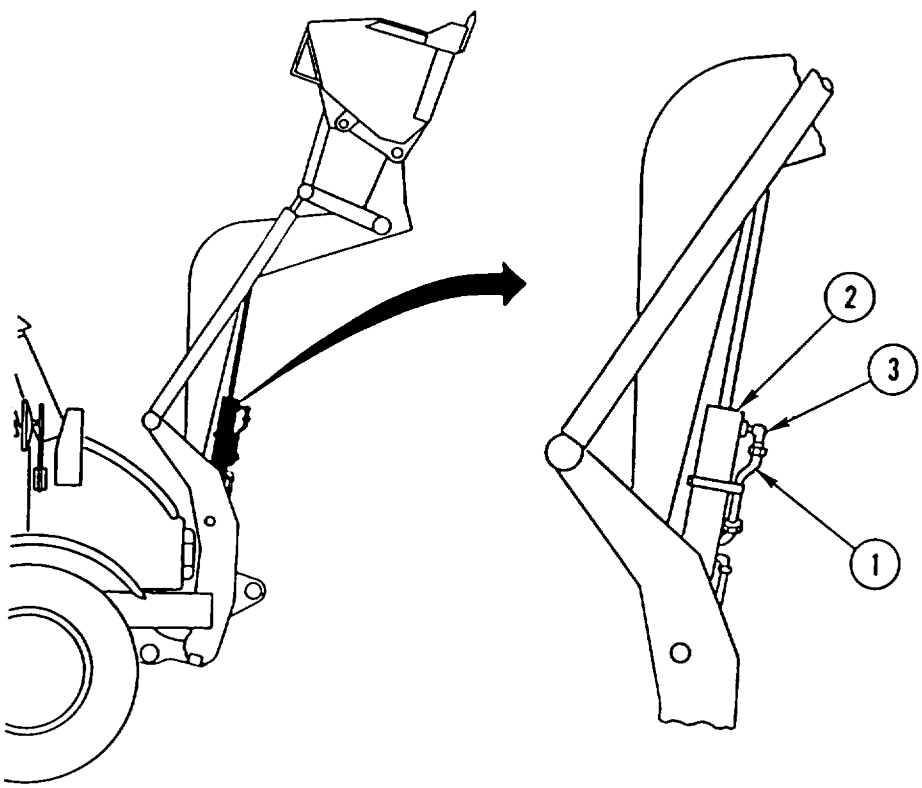
a. Start engine. Place front loader in fully raised position.

b. Stop engine.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)



NOTE

Use threaded plugs in hoses in steps c and i. Failure to do so will result in spilled hydraulic oil.

c. Support loader bucket to keep loader lift arm in position. Disconnect hose (1) at rod end of each loader boom cylinder (2) and install threaded plug.

d. Start and run engine at idle.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

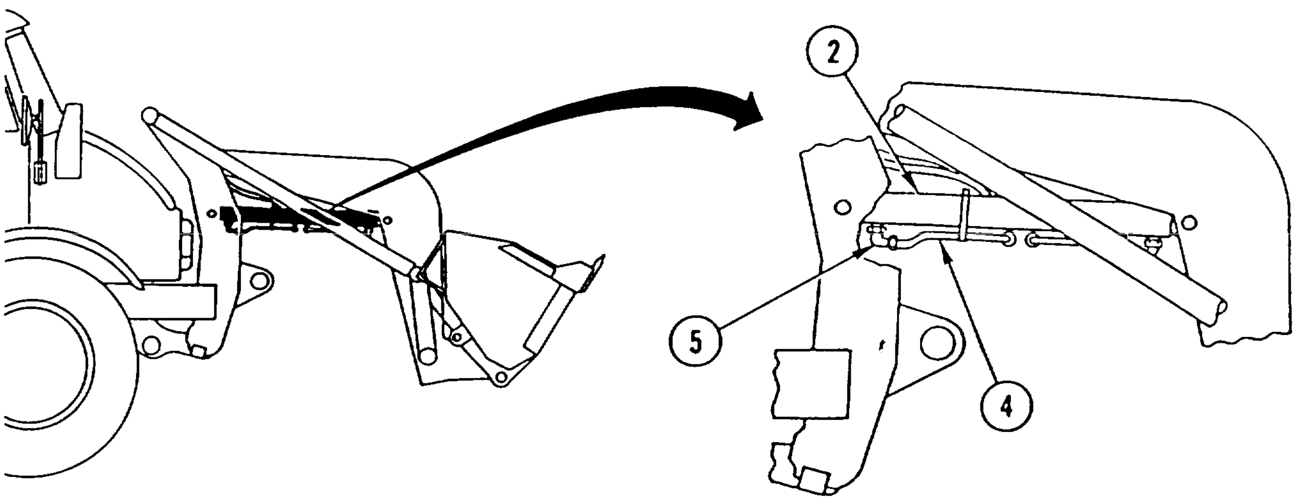
NOTE

During steps e and j, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

e. Move loader control lever to raise position. Hold lever in raise position and have assistant check for leaks from fitting (3) at rod end of loader boom cylinder (2).

- If there is excessive leakage from fitting, replace loader boom cylinder (page 4-654).
- If there is not excessive leakage from fitting, go to step f.

f. Stop engine. Remove threaded plug and connect hose (1).



g. Start engine. Place front loader in transport position.

h. Stop engine.

i. Disconnect hose (4) at cylinder end of loader boom cylinder (2) and install threaded plug.

j. Start and run engine at idle. Move loader control lever to lower position. Hold lever in lower position and have assistant check for leaks from fitting (5) at cylinder' end of loader boom cylinder (2).

- If there is excessive leakage from fitting, replace loader boom cylinder (page 4-654).
- If there is not excessive leakage from fitting, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

143. BUCKET ROLLBACK CYLINDER DRIFTS.

NOTE

Steps 1 and 2 are the same for both bucket rollback cylinders.

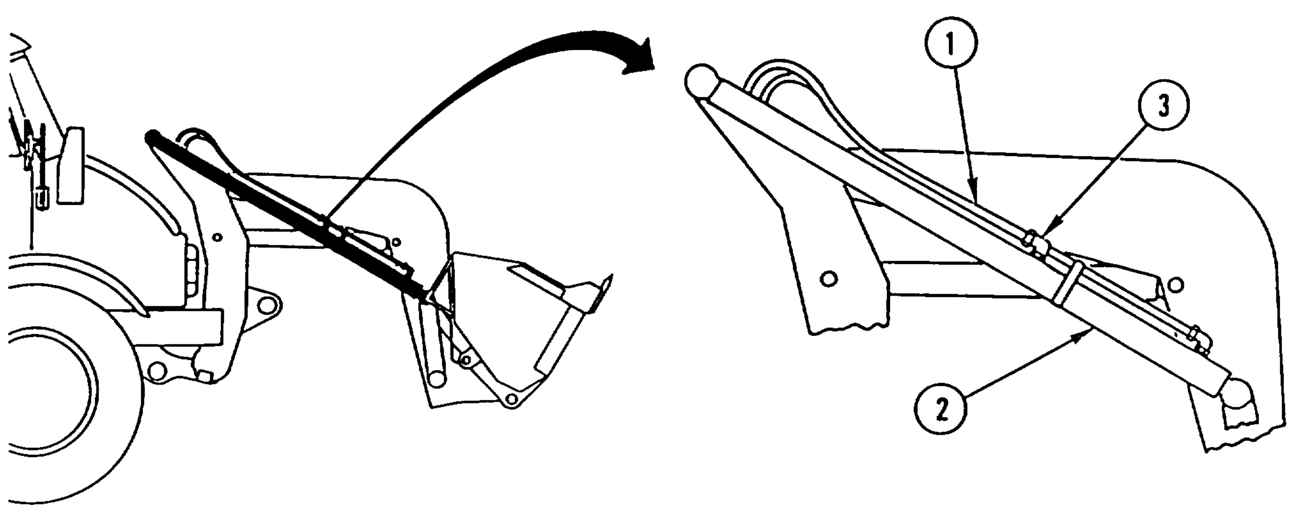
Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (pages 4-574, 4-576).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check for damaged bucket rollback cylinder packing as follows:

a. Start engine. Place bucket in full rollback position.

b. Stop engine.



NOTE

Use threaded plugs in hoses in steps c and i. Failure to do so will result in spilled hydraulic oil.

c. Support bucket in full rollback position. Disconnect hose (1) from rod end of each bucket rollback cylinder (2) and install threaded plugs.

d. Start and run engine at idle.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

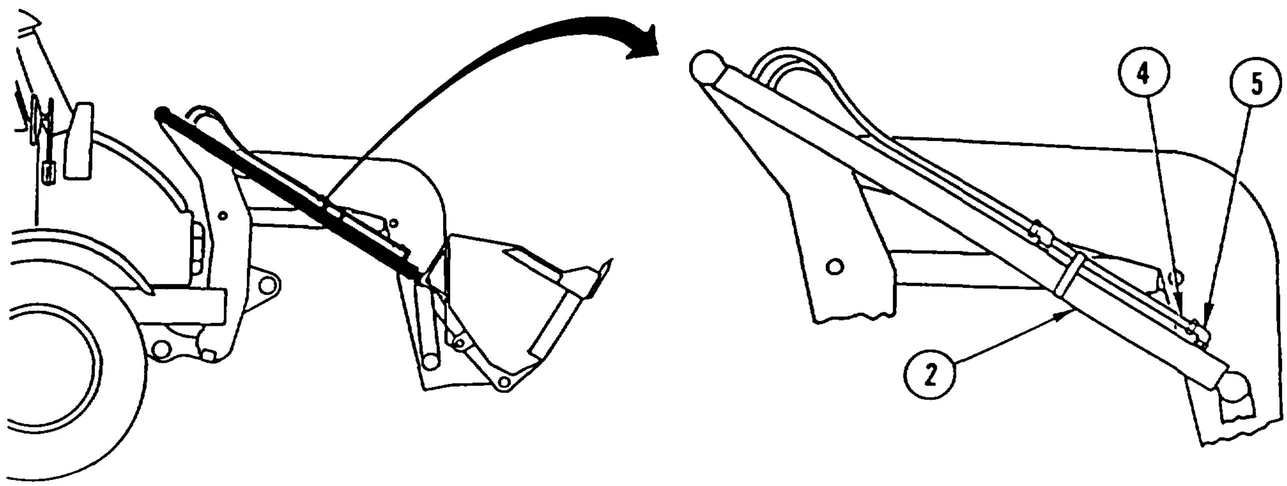
NOTE

During steps e and j, there may be a small amount of hydraulic oil leaking, either drops or a small stream the diameter of a pencil lead. This is normal. Use drip pan to catch oil.

e. Move bucket control lever to rollback position. Hold lever in rollback position and have assistant check for leaks from fitting (3) at rod end of each bucket rollback cylinder (2).

- If there is excessive leakage from fitting, replace bucket rollback cylinder (page 4-656).
- If there is not excessive leakage from fitting, go to step f.

f. Stop engine. Remove threaded plugs and connect hose (1).



g. Start engine. Place front loader in transport position.

h. Place bucket in dump position. Stop engine.

i. Disconnect hose (4) from cylinder end of each bucket rollback cylinder (2) and install threaded plugs.

j. Start and run engine at idle. Move bucket control lever to dump position. Hold lever in dump position and have assistant check for leaks from fitting (5) at cylinder end of each bucket rollback cylinder (2).

- If there is excessive leakage from fitting, replace bucket rollback cylinder (page 4-656).
- If there is not excessive leakage from fitting, notify direct support maintenance.

Table 3-5. Troubleshooting (Cont)

Malfunction
Test or Inspection
Corrective Action

FRONT LOADER (SEE) (CONT)

144. LOAD DROPS WITH CONTROL VALVE IN NEUTRAL.

Step 1. Check for loose and damaged hydraulic lines.

- If hydraulic lines are loose or damaged, tighten loose connections or replace hydraulic lines (page 4-582).
- If hydraulic lines are not loose or damaged, go to step 2.

Step 2. Check control linkages for proper adjustment.

- If control linkages are not properly adjusted, adjust control linkages (page 4-532).
- If control linkages are properly adjusted, go to step 3.

Step 3. Check load drop rate as follows:

a. Load bucket with 1,000 lb.

b. Start engine and cycle oil until oil is at operating temperature of 120° F (49° C).

c. Lift load 3-4 ft (0.9-1.2 m) off ground. Stop engine.

NOTE

Maximum allowable drop is 1 ft.

d. Allow load to stay suspended for 10 minutes.

- If load drops more than 1 ft, replace relief valve (page 4-568).
- If problem continues, notify direct support maintenance.

145. CONTROL VALVE STICKS OR WORKS HARD.

Check control linkages for proper adjustment.

- If control linkages are not properly adjusted, adjust control linkages (page 4-532).
- If control linkages are properly adjusted, notify direct support maintenance.

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PUBLICATION/FORM NUMBER	DATE	TITLE
TM 5-2420-224-20-1	28 July 1993	Unit Maintenance Manual for Tractor, Wheeled, 4 X 4 DED Small Emplacement Excavator (SEE) and Tractor, Wheeled, 4 X 4 DED High Mobility Material Handler (HMMH)

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended changes, if possible).*
	3-15			3-16		Damage to many lands: Condemn. Adding "Condemn" to figure title would add clarity to the procedure.

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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE
1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1,000 Millimeters = 39.37 Inches
1 Kilometer = 1,000 Meters = 0.621 Miles

WEIGHTS
1 Gram = 0.001 Kilograms = 1,000 Milligrams = 0.035 Ounces
1 Kilogram = 1,000 Grams = 2.2 Lb
1 Metric Ton = 1,000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE
1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1,000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE
1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

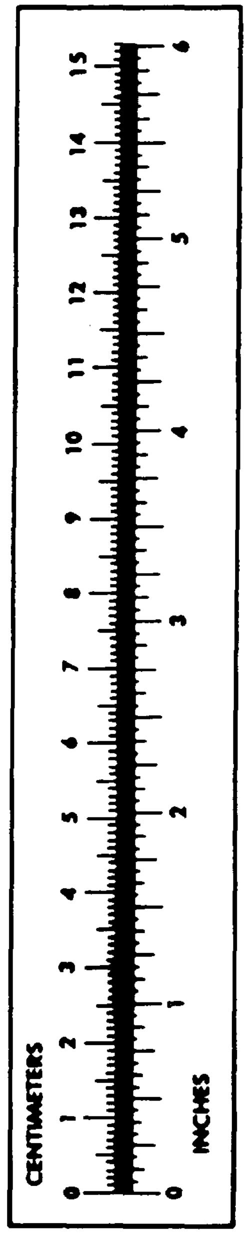
CUBIC MEASURE
1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

TEMPERATURE
5/9 (°F -32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Cesius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° +32 = F°

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds Per Square Inch	Kilopascals	6.895
Miles Per Gallon	Kilometers Per Liter	0.425
Miles Per Hour	Kilometers Per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds Per Square Inch	0.145
Kilometers Per Liter	Miles Per Gallon	2.354
Kilometers Per Hour	Miles Per Hour	0.621



PIN: 068064-000