TM 9-2320-209-10-3
TO 36A12-1B-1091-3

TECHNICAL MANUAL

# TROUBLESHOOTING

OPERATOR LEVEL

## 2½-TON, 6x6, M44A1 AND M44A2 SERIES TRUCKS (MULTIFUEL)

TRUCK, CARGO: M35A1, M35A2, M35A2C, M36A2; TRUCK, TANK, FUEL: M49A1C, M49A2C; TRUCK, TANK, WATER: M50A1, M50A2, M50A3; TRUCK, VAN, SHOP: M109A2, M109A3; TRUCK, REPAIR SHOP: M185A2, M185A3; TRUCK, TRACTOR: M275A1, M275A2; TRUCK, DUMP: M342A2; TRUCK, MAINTENANCE, PIPELINE CONSTRUCTION: M756A2; TRUCK, MAINTENANCE, EARTH BORING AND POLESETTING: M764

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
SEPTEMBER 1980

## WARNING

### EXHAUST GASES CAN BE DEADLY

Exposure to exhaust gases produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and 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 insure the safety of personnel whenever fuel burning heater(s) or engine of any vehicle is operated for maintenance purposes or tactical use.

Do not operate heater or engine of vehicle in an enclosed area unless it is adequately ventilated.

Do not idle engine for long periods without maintaining adequate ventilation in personnel compartments.

Do not drive any vehicle with inspection plates or cover plates removed unless necessary for maintenance purposes.

Be alert at all times during vehicle operation for exhaust odors and exposure svmptoms. If either are 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 physical exercise; if necessary, administer artificial respiration.

If exposed, seek prompt medical attention for possible delayed onset of acute lung congestion. Administer oxygen if available.

The best defense against exhaust gas poisoning is adequate ventilation.

## WARNING

Serious or fatal injury to personnel may result
if the following instructions are not complied with.

Use extreme care when removing radiator cap, especially when temperature gage shows above 180°F.

Always wear leather gloves when handling winch cable. Never allow cable to slip through hands. Do not operate winch with less than four turns of cable on drum.

Do not drive truck until the low air pressure warning buzzer is silent and the air pressure gage shows at least 65 PSI. This is the minimum pressure required for safe braking action.

Do not use hand throttle to drive the vehicle.

Do not park truck with front transmission gearshift lever in gear.

If your vehicle class number is greater than the bridge class number, do not cross.

TECHNICAL MANUAL
NO. 9-2320-209-10-3
TECHNICAL ORDER
NO. 36A12-1B-1091-3

DEPARTMENTS OF THE ARMY
AND
THE AIR FORCE
Washington, DC, 26 September 1980

TECHNICAL MANUAL

# TROUBLESHOOTING
## OPERATOR LEVEL
## 2½-TON 6X6, M44A1 AND M44A2 SERIES TRUCKS
## (MULTIFUEL)

| Model | | NSN without Winch | NSN with Winch |
|---|---|---|---|
| Truck, Cargo | M35A1 | 2320-00-542-5633 | 2320-00-542-5634 |
| | M35A2 | 2320-00-077-1616 | 2320-00-077-1617 |
| | M35A2C | 2320-00-926-0873 | 2320-00-926-0875 |
| | M36A2 | 2320-00-077-1618 | 2320-00-077-1619 |
| Truck, Tank, Fuel | M49A1C | 2320-00-440-3349 | 2320-00-440-3346 |
| | M49A2C | 2320-00-077-1631 | 2320-00-077-1632 |
| Truck, Tank, Water | M50A1 | 2320-00-440-8307 | 2320-00-440-8305 |
| | M50A2 | 2320-00-077-1633 | 2320-00-077-1634 |
| | M50A3 | 2320–00–937-4036 | 2320-00-937-5264 |
| Truck, Van, Shop | M109A2 | 2320-00-440-8313 | 2320-00-440-8308 |
| | M109A3 | 2320-00-077-1636 | 2320-00-077-1637 |
| Truck, Repair Shop | M185A2 | 4940–00–987-8799 | 4940-00-987-8800 |
| | M185A3 | 4940-00-077-1638 | 4940-00-077-1639 |
| Truck, Tractor | M275A1 | 2320-00-446-2479 | |
| | M275A2 | 2320-00-077-1640 | 2320-00-077-1641 |
| Truck, Dump | M342A2 | 2320-00-077-1643 | 2320-00-077-1644 |
| Truck, Maintenance, Pipeline Construction | M756A2 | | 2320-00-904-3277 |
| Truck, Maintenance, Earth Boring and Polesetting | M764 | | 2320-00-937-5980 |

**Current as of 1 February 1980**

This manual, together with TM 9-2320-209-10-1, 26 September 1980; TM 9-2320-209-10-2, 26 September 1980; and TM 9-2320-209-10-4, 26 September 1980, supersedes TM 9-2320-209-10/1, 29 October 1976.

**REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS**

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedure, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Tank Automotive Materiel Readiness Command, ATTN: DRSTA-MB, Warren, Michigan 48090. A reply will be furnished to you.

# CHAPTER 1

# GENERAL INFORMATION

1-1. SCOPE. This volume tells you how to do troubleshooting at the operator's level of maintenance. The amount of troubleshooting you can do is based on what the Maintenance Allocation Chart says you can fix. Because of this, the only trouble symptoms you will find here are those that could be caused by faulty things you can fix.

1-2. ORGANIZATION. When you do PMCS, or when you drive the truck and find that something is wrong, write down what is wrong. Then check the fault symptom index to see if the trouble (fault symptom) you noted is in the index. If it is, you can do troubleshooting to find the fault and fix it. If the symptom is not in the index, tell organizational maintenance.

1-3. TROUBLESHOOTING APPROACH. In order to find out what is causing the problem in the truck, you must use a good approach. A good approach just means a way of doing troubleshooting so you can find the problem and not get confused or lost. The following chapter describes how you can use the materials in this volume to troubleshoot with a good approach.

# CHAPTER 2

# TROUBLESHOOTING APPROACH

2-1. GENERAL APPROACH. This chapter gives you instructions on how to use the troubleshooting material to help you find and fix the trouble. In every system of the truck there can be faults or problems which will cause certain symptoms. Symptoms can be such things as unusual noise, vibration, or even complete failure of a system. This volume gives information for each system on which you can do troubleshooting to find faults and fix them. Before you troubleshoot a system, you should look at the troubleshooting indexes which will lead you to the information you need to help make your troubleshooting faster and easier. If you follow the instructions the right way, you will find those troubles you can fix. But, if you fix something and the trouble is still there, it means there is more than one trouble. If this happens, start all over again to find the other trouble.

2-2. TROUBLESHOOTING INDEX. The troubleshooting index, and instructions on how to use it are in chapter 3. Go to this index first because it tells you where to find troubleshooting roadmaps, fault symptom indexes, summary troubleshooting charts and support diagrams for each system.

2-3. TROUBLESHOOTING ROADMAPS. Troubleshooting roadmaps for each system are in chapter 5. If the system is made up of subsystems, these subsystems are also on the roadmap. Under the subsystem is a list of things which are the most likely causes of a fault symptom in that subsystem. If you have enough skill, you can troubleshoot these things on the truck without using the detailed troubleshooting procedures. So if you know enough about the truck to work on your own, use the roadmap for the system with the problem before you check the fault symptom index.

2-4. FAULT SYMPTOM INDEX. Fault symptom indexes and instructions on how to use them are in chapter 6. For each system of the truck, there is an index which gives you a list of the fault symptoms for that system. The index also tells you where to find the detailed troubleshooting procedures and what resources (tools/people) you need to do each procedure.

2-5. SAMPLE TROUBLESHOOTING PROCEDURE. A sample troubleshooting procedure is in chapter 7. This sample procedure will help you see the way detailed trouble-shooting procedures are to be used.

# CHAPTER 3

# TROUBLESHOOTING INDEX

3-1. GENERAL. This chapter has a troubleshooting index which covers every system of the truck on which you can do troubleshooting. The index tells you where to find all the other information you need to do your troubleshooting procedures.

3-2. INDEX. The troubleshooting index (fig. 3-1) is divided into five columns that list systems, troubleshooting roadmaps, fault symptoms, summary troubleshooting procedures, and system support diagrams. The following breakdown tells you what is in each column.

a. System Column. This column gives a list of systems on the truck for which troubleshooting can be done at the operator's maintenance level.

b. Troubleshooting Roadmaps Column. This column tells you where to find the troubleshooting roadmap for each listed system. These roadmaps are given in chapter 5.

c. Fault Symptom Index Column. This column tells you where to find the troubleshooting fault symptom index for each listed system. Fault symptom indexes are given in chapter 6.

d. Summary Troubleshooting Procedures Column. Summary troubleshooting procedures are not needed at this level of maintenance because they would be the same as the detailed troubleshooting procedures, so this column is not used. The detailed troubleshooting procedures found by using the fault symptom indexes will get you to the cause of the trouble quickly.

e. System Support Diagrams Column. The detailed troubleshooting procedures in this volume will give you all the information you need to find the bad part or problem with the truck. So, because support diagrams are not needed, this column is not used.

| | SYSTEM | TROUBLE-SHOOTING ROADMAPS | FAULT SYMPTOM INDEXES | SUMMARY TROUBLE-SHOOTING PROCEDURES | SYSTEM SUPPORT DIAGRAMS |
|---|---|---|---|---|---|
| 1 | FUEL | Figure 5-1 | Table 6-1 | | |
| 2 | COOLING | Figure 5-2 | Table 6-2 | | |
| 3 | TRANSMISSION | Figure 5-3 | Table 6-3 | | |
| 4 | TRANSFER | Figure 5-4 | Table 6-4 | | |
| 5 | FRONT AXLE | Figure 5-5 | Table 6-5 | | |
| 6 | REAR AXLE | Figure 5-6 | Table 6-6 | | |
| 7 | BRAKES | Figure 5-7 | Table 6-7 | | |
| 8 | WHEELS | Figure 5-8 | Table 6-8 | | |
| 9 | STEERING | Figure 5-9 | Table 6-9 | | |
| 10 | OUTRIGGER, TRUCK M764 | Figure 5-10 | Table 6-10 | | |
| 11 | FRONT WINCH | Figure 5-11 | Table 6-11 | | |
| 12 | REAR WINCH, TRUCK M764 | Figure 5-12 | Table 6-12 | | |
| 13 | REAR WINCH, TRUCK M756A2 | Figure 5-13 | Table 6-13 | | |
| 14 | DUMP TRUCK | Figure 5-14 | Table 6-14 | | |
| 15 | HOT WATER HEATER | Figure 5-15 | Table 6-15 | | |
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Figure 3-1. Troubleshooting Index

# CHAPTER 4

# TEST EQUIPMENT PROCEDURES INDEX

4-1. INDEX. There is no test equipment needed at the operator maintenance level to do troubleshooting, so, no test equipment procedures index is given.

# CHAPTER 5

# TROUBLESHOOTING ROADMAPS

5-1. GENERAL. This chapter gives troubleshooting roadmaps for every system of the truck for which you have detailed troubleshooting procedures. Figures 5-1 through 5-15 cover all the roadmaps for the detailed procedures.

5-2. ROADMAPS . Each roadmap gives a list of things which are most likely to cause a fault symptom in a system or subsystem. At least one of the items listed will be found to be bad when you do the detailed troubleshooting procedures for that system.

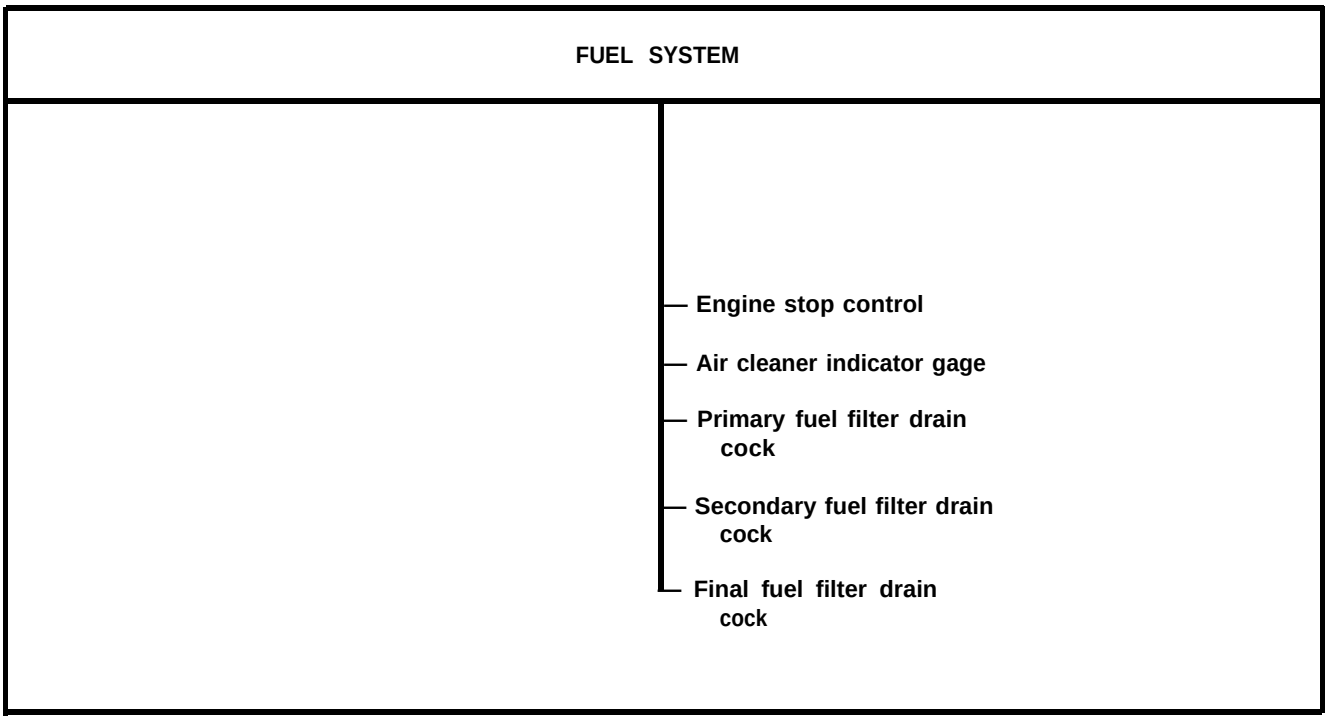


**Figure 5-1. Troubleshooting Roadmap, Fuel System**

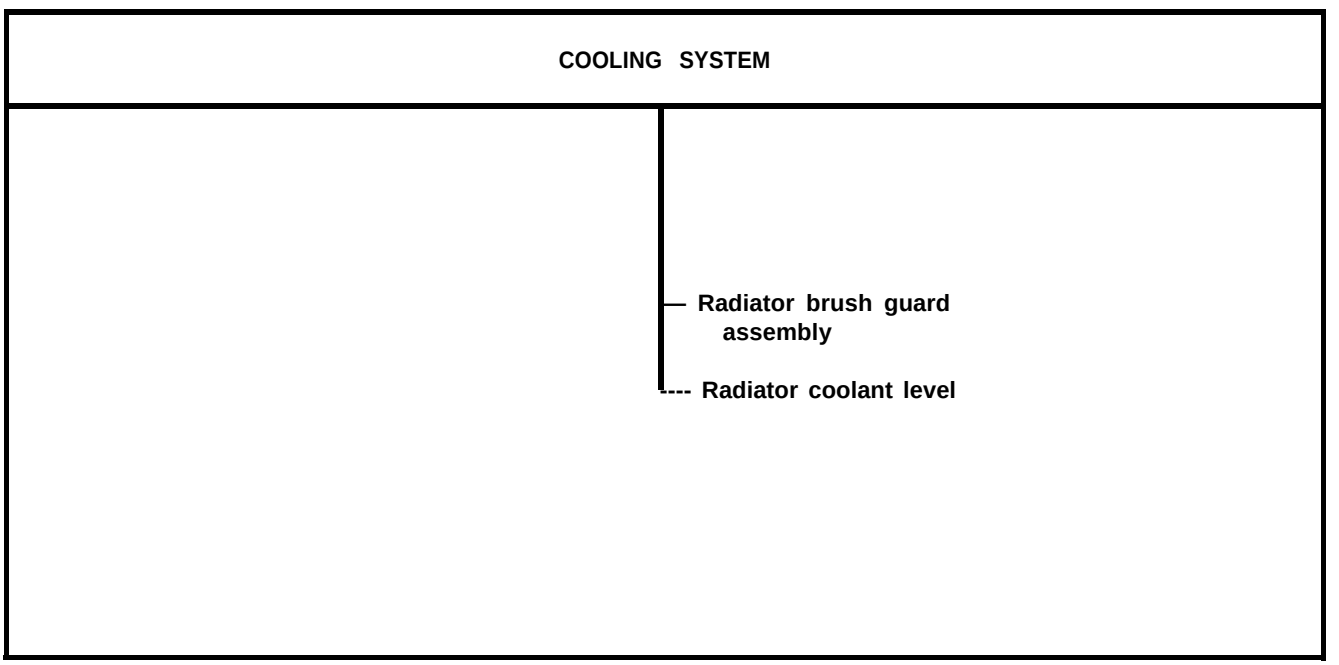


**Figure 5-2. Troubleshooting Roadmap, Cooling System**

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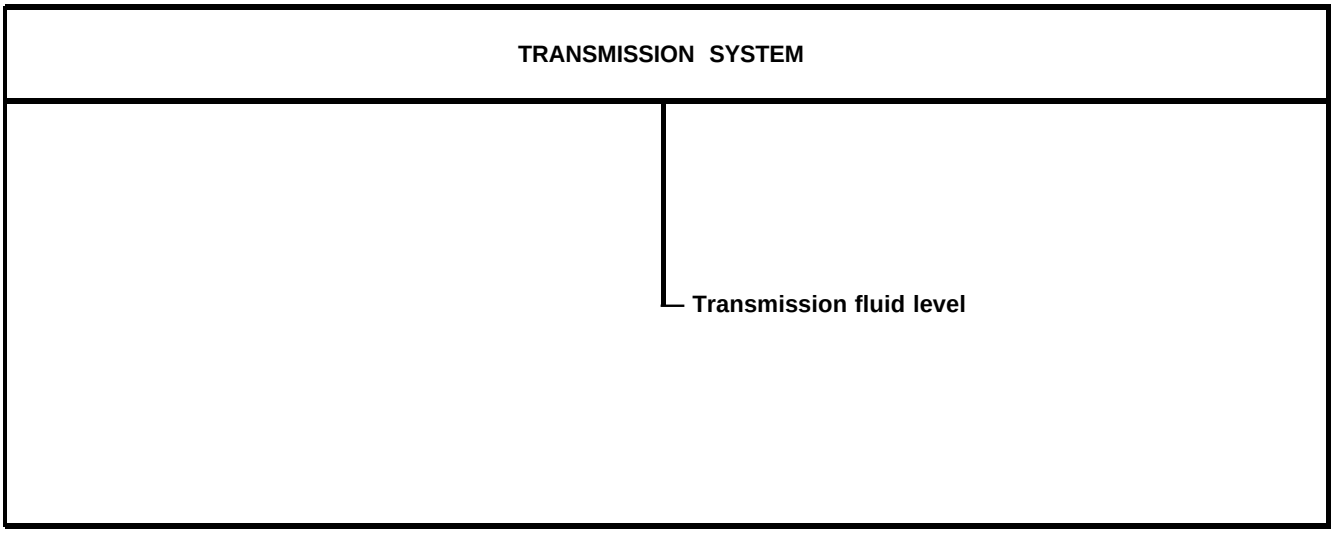


**Figure 5-3. Troubleshooting Roadmap, Transmission System**

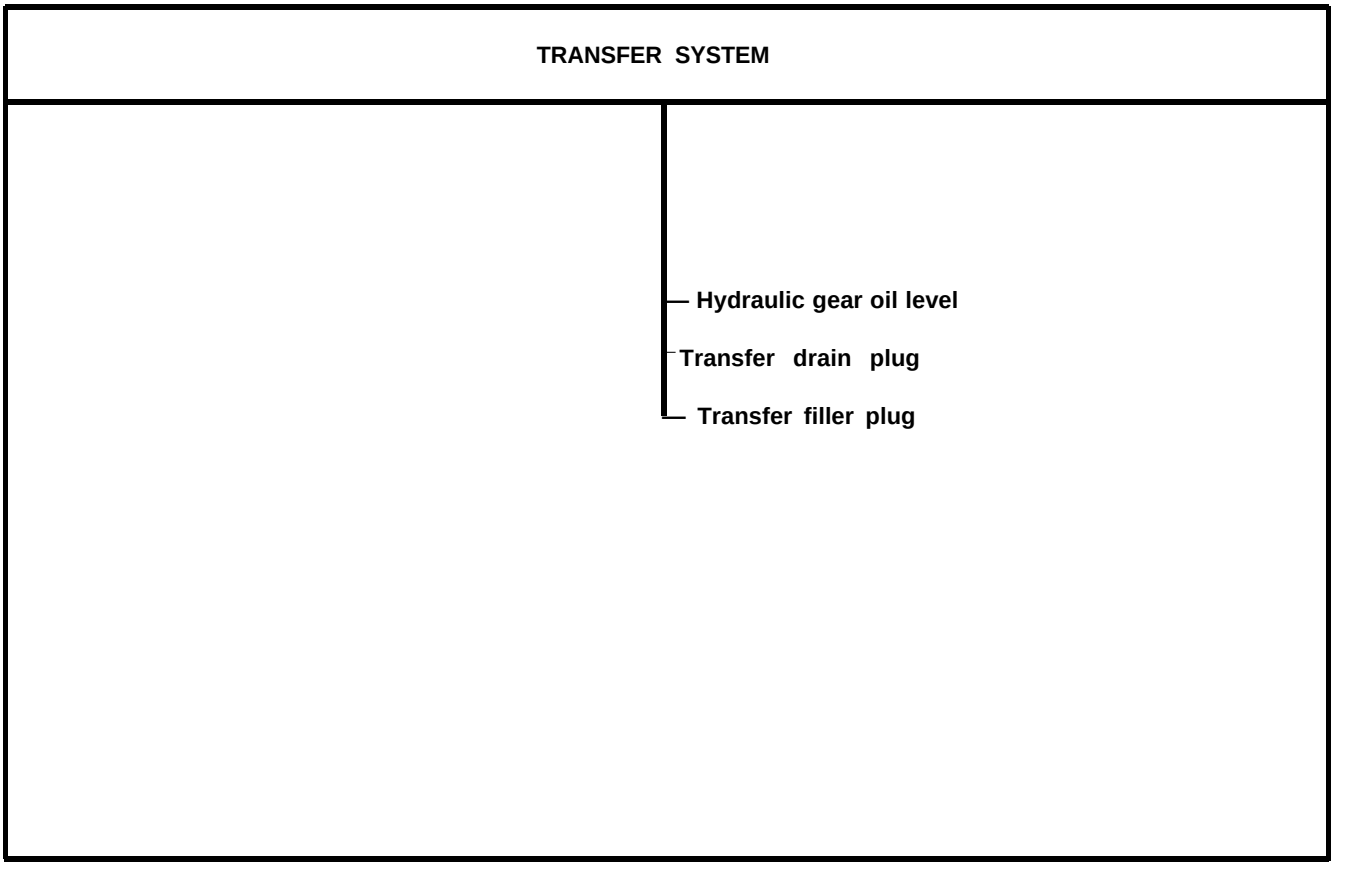


**Figure 5-4. Troubleshooting Roadmap, Transfer System**

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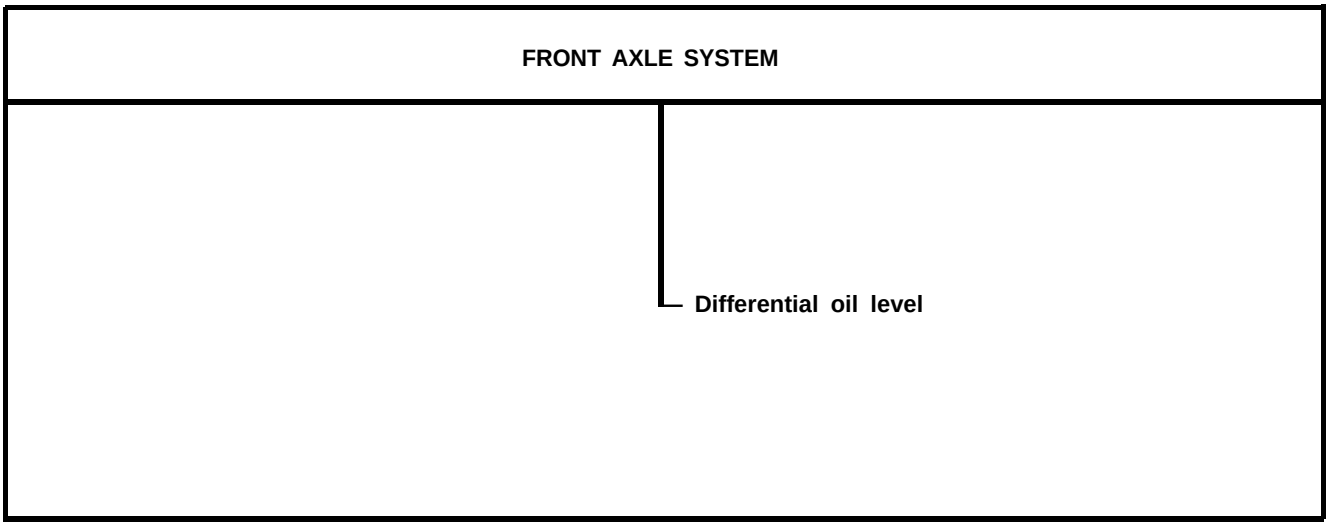


Figure 5-5. Troubleshooting Roadmap, Front Axle System

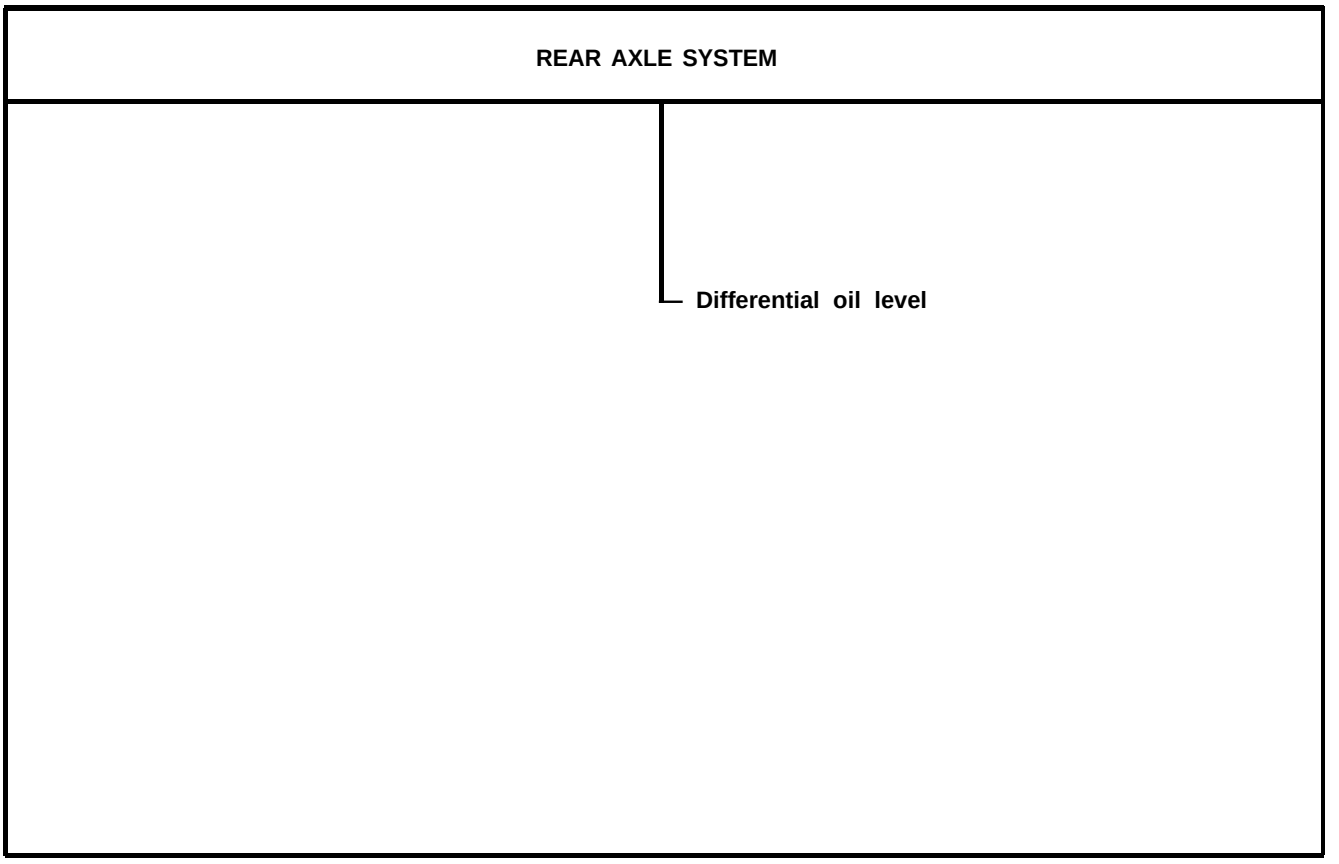


Figure 5-6. Troubleshooting Roadmap, Rear Axle System

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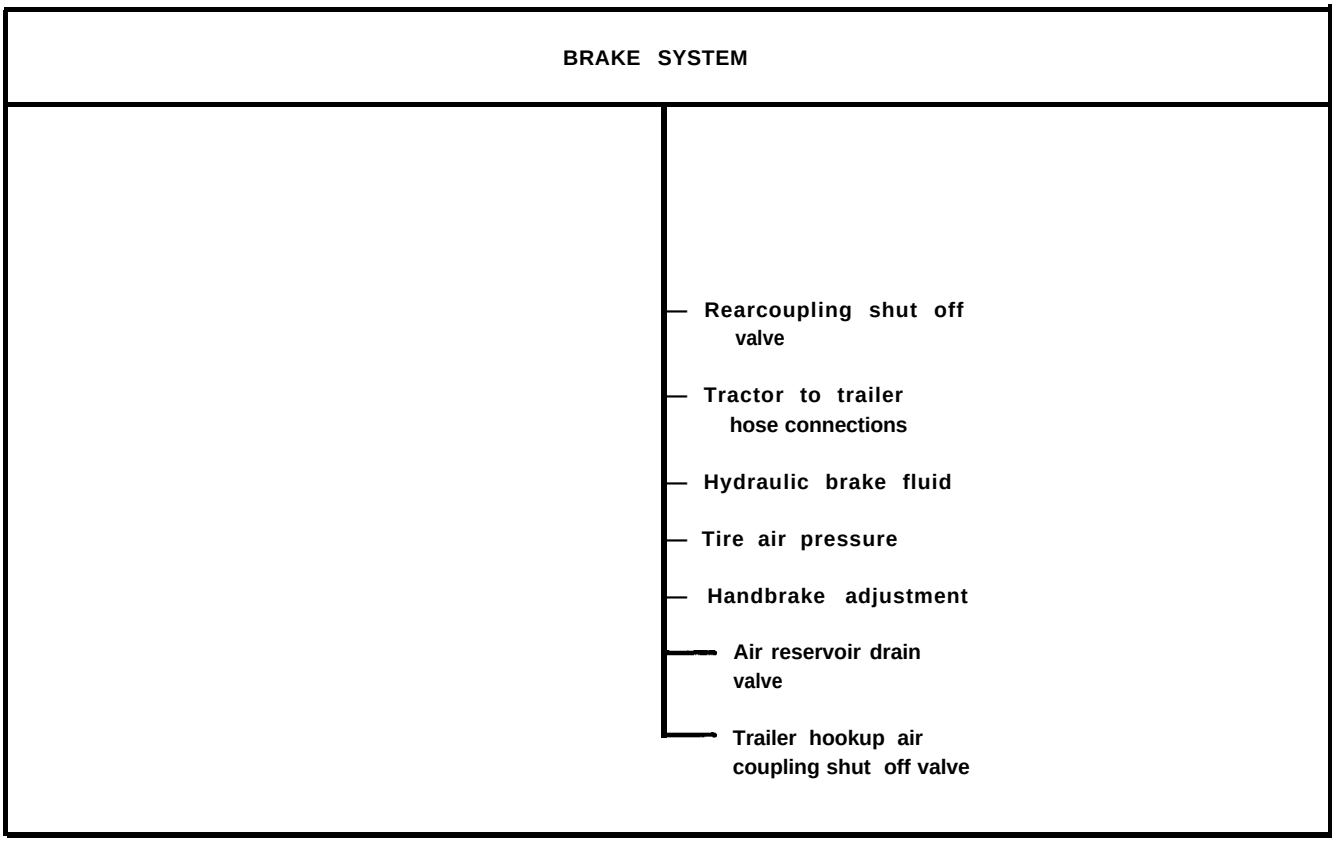


Figure 5-7. Troubleshooting Roadmap, Brake System

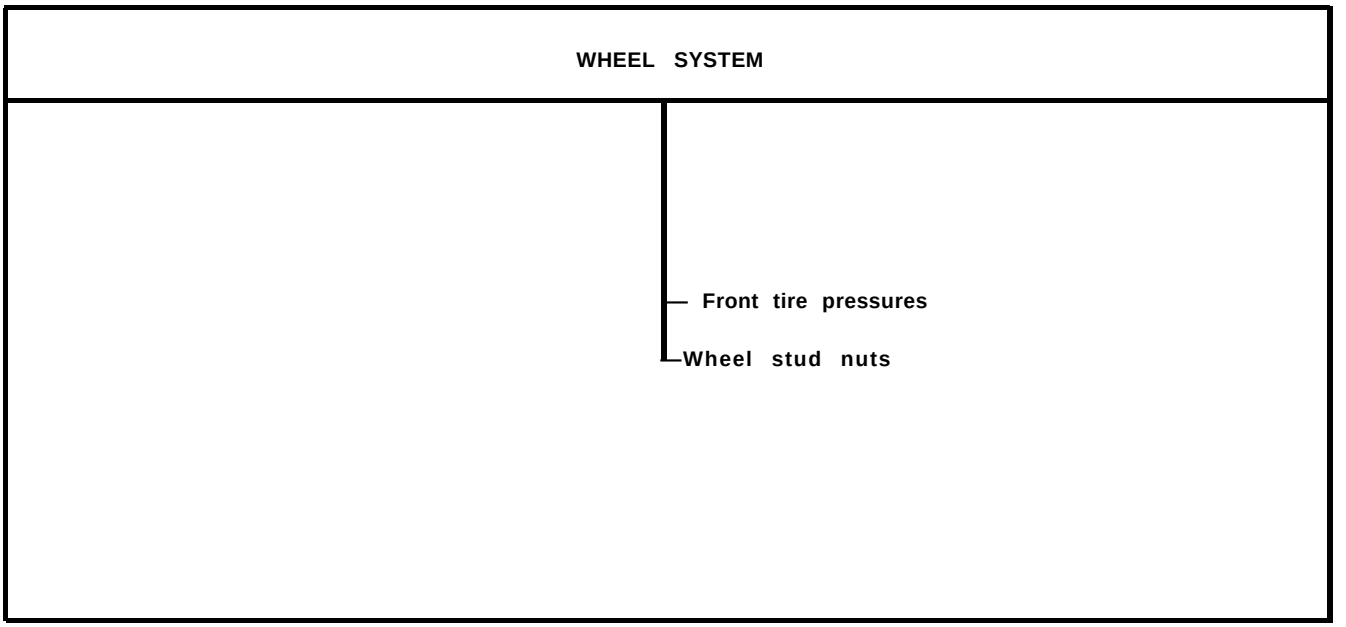


Figure 5-8. Troubleshooting Roadmap, Wheel System

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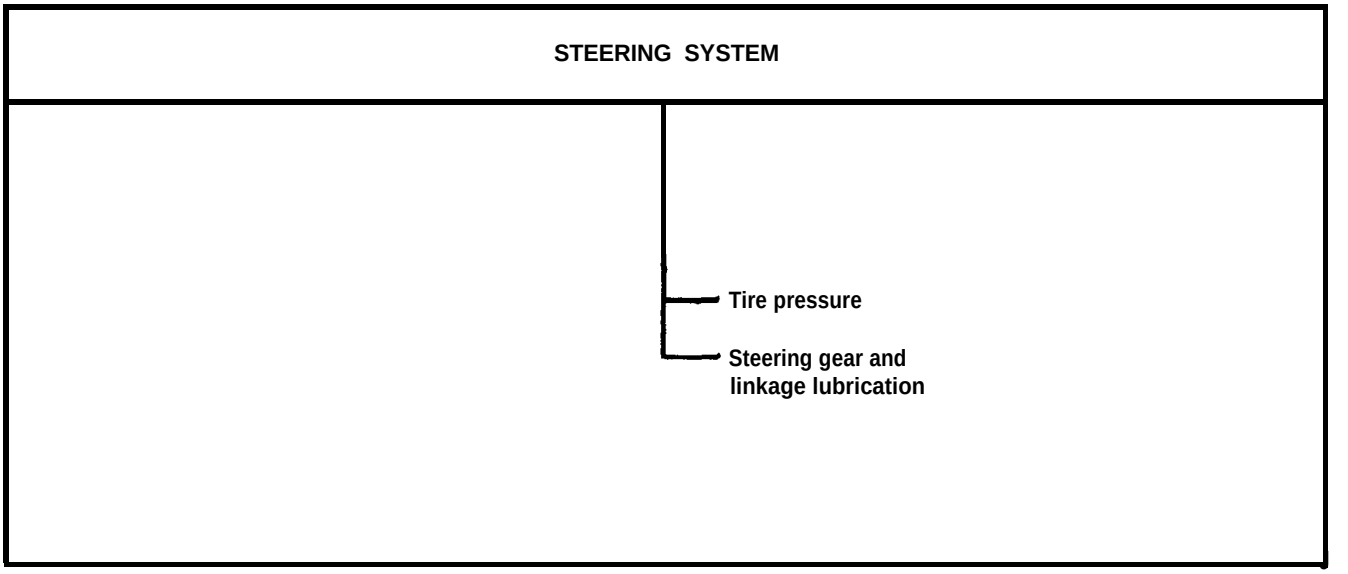


Figure 5-9. Troubleshooting Roadmap, Steering System

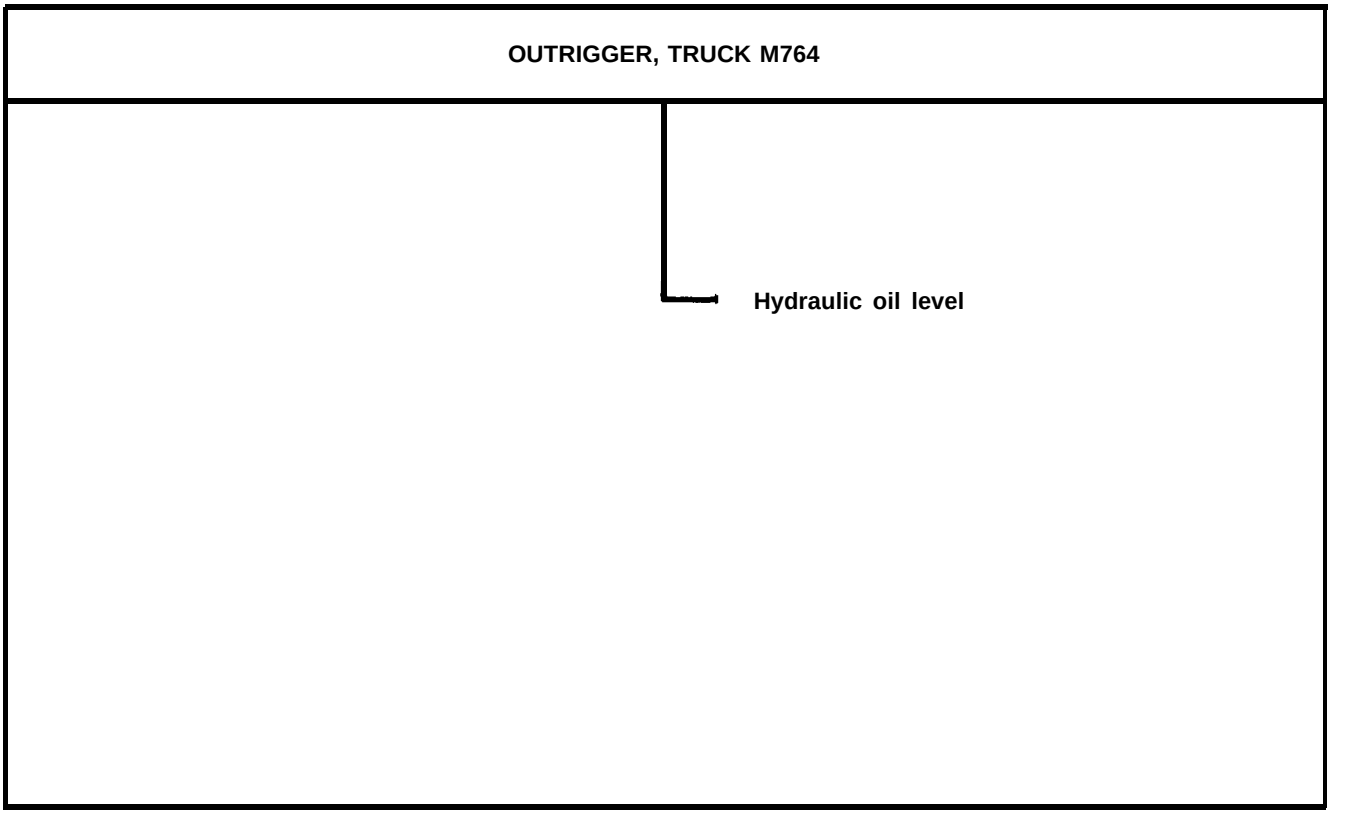


Figure 5-10. Troubleshooting Roadmap, Outrigger, Truck M764

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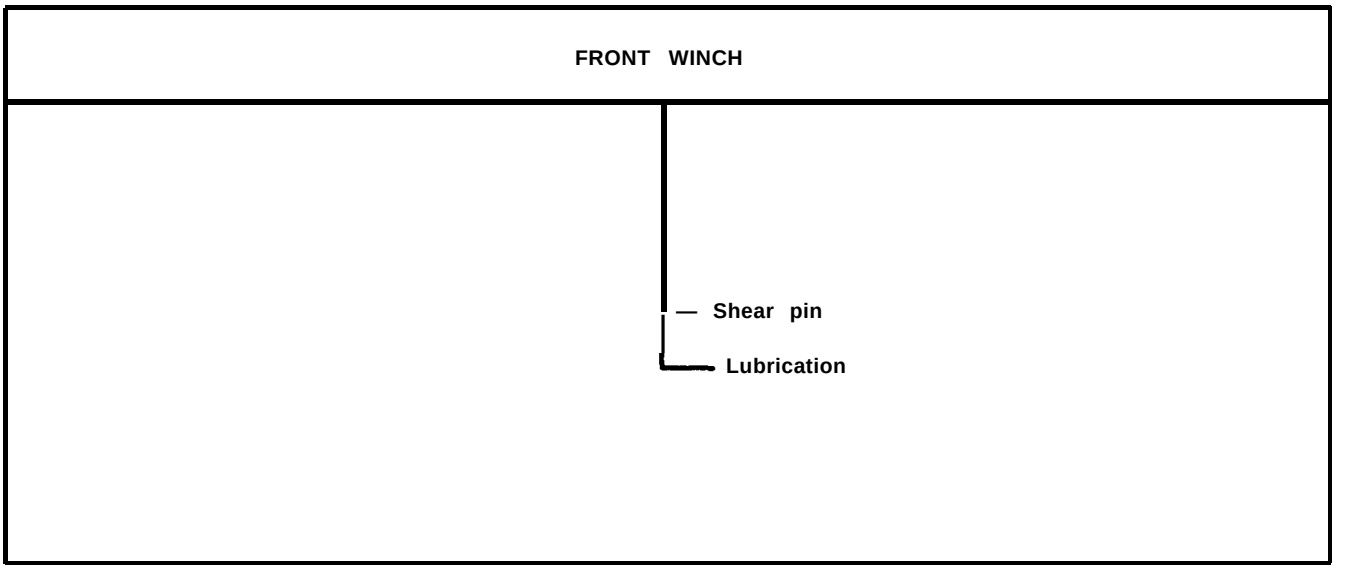


**Figure 5-11. Troubleshooting Roadmap, Front Winch**

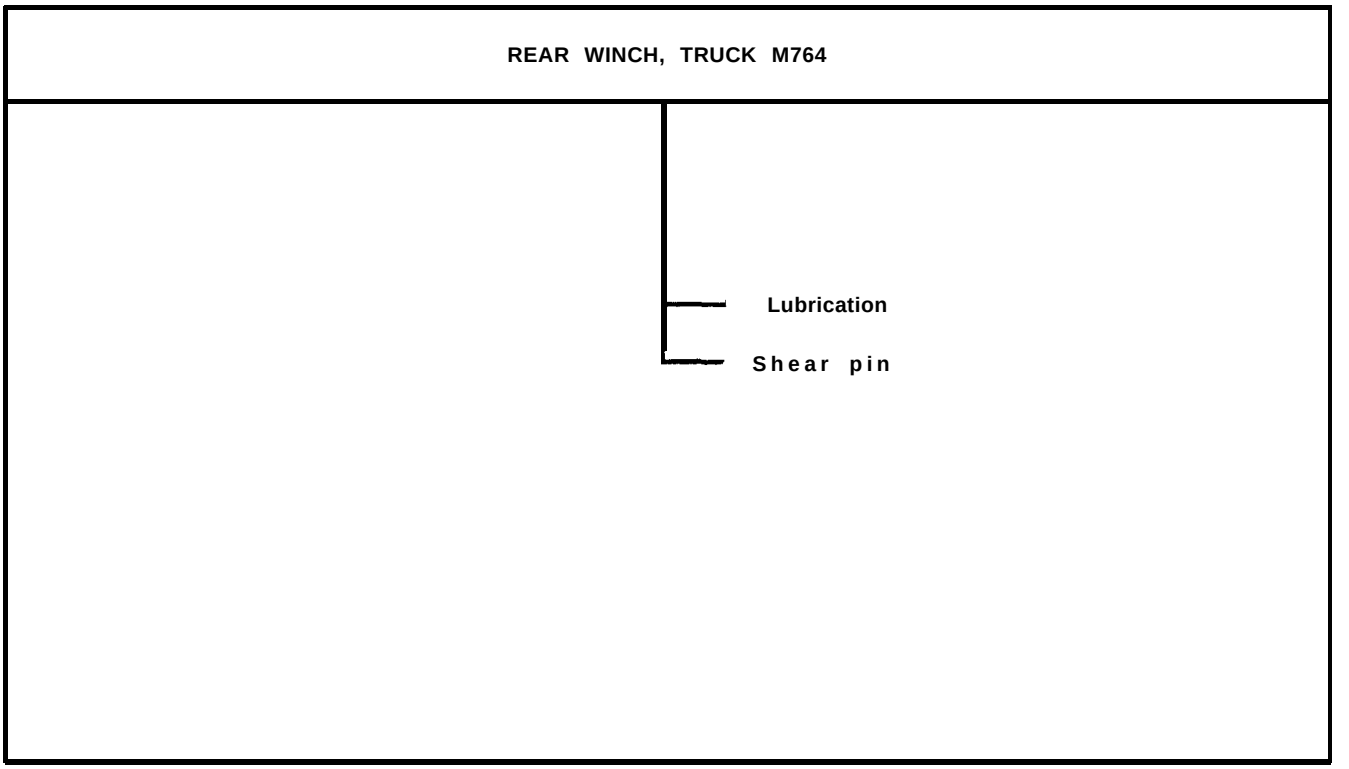


**Figure 5-12. Troubleshooting Roadmap, Rear Winch, Truck M764**

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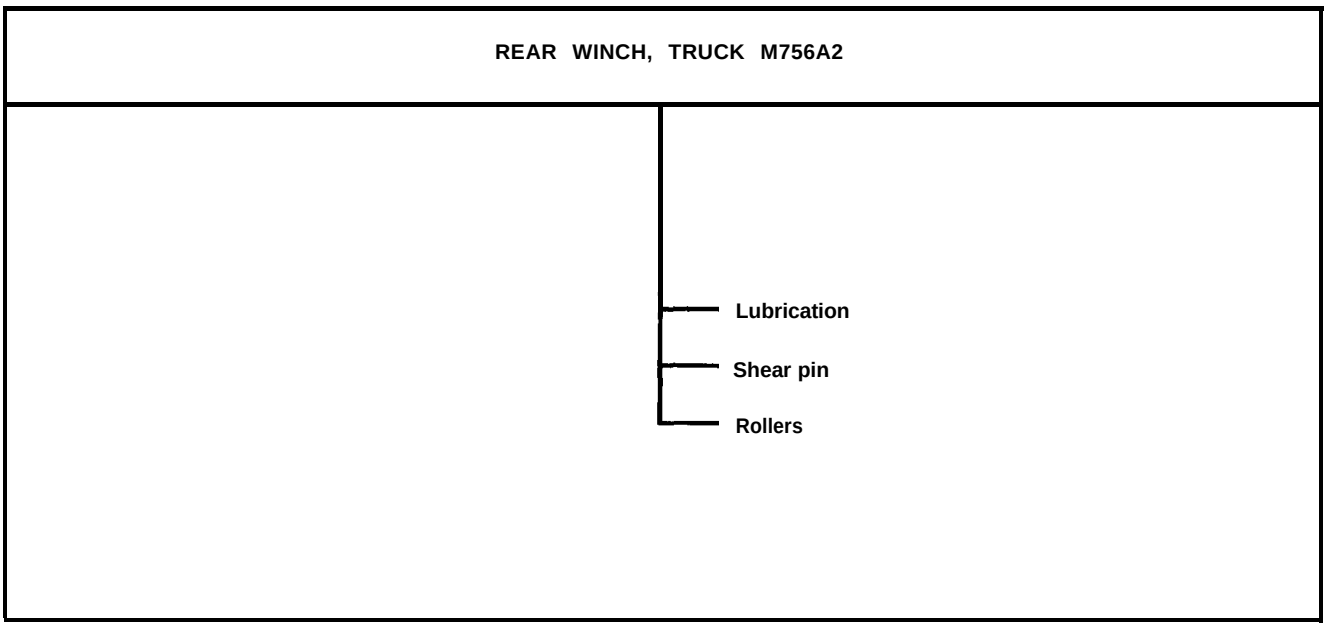


**Figure 5-13. Troubleshooting Roadmap, Rear Winch, Truck M756A2**

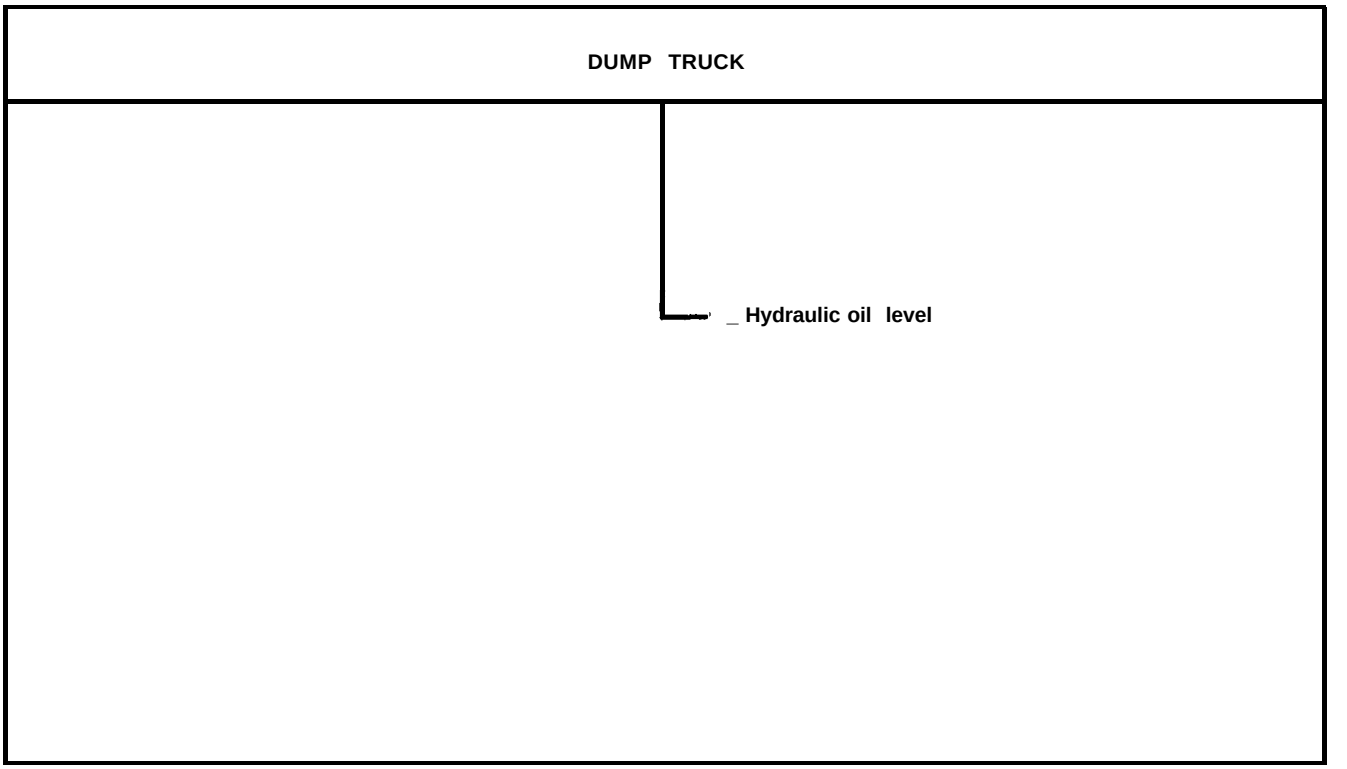


**Figure 5-14. Troubleshooting Roadmap, Dump Truck**

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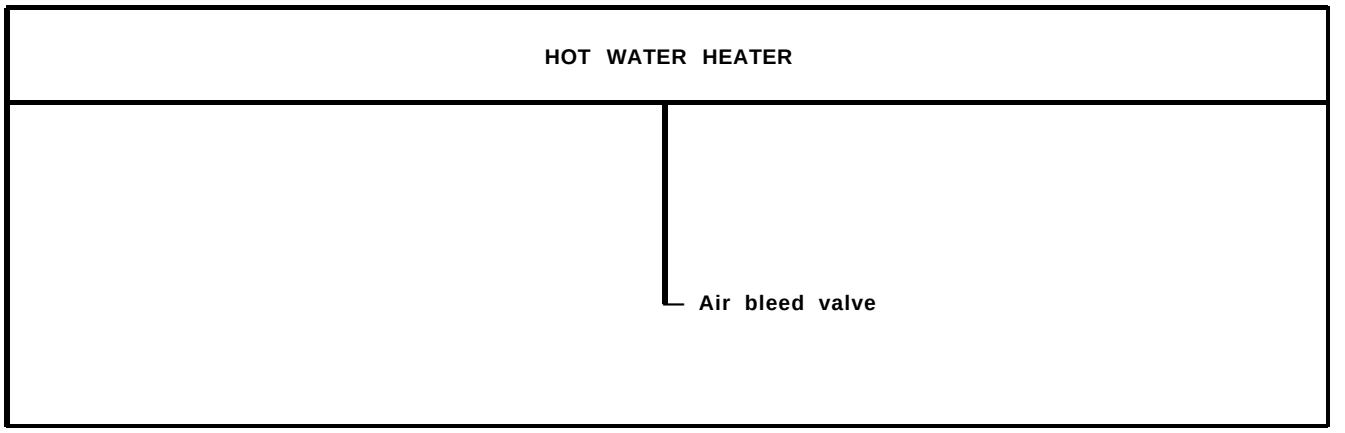


**Figure 5-15. Troubleshooting Roadmap, Hot Water Heater**

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# CHAPTER 6

# FAULT, SYMPTOM INDEXES

6-1. GENERAL. This chapter gives troubleshooting fault symptom indexes for every system of the truck for which you have detailed troubleshooting procedures. These indexes are in table form (tables 6-1 through 6- 15) which gives you a quick way to check what material you have to use to do your troubleshooting.

6-2. INDEXES. Each index is divided into columns which give you information you need to help you do troubleshooting procedures. The following breakdown tells you what is in each column.

a. Subsystem Column. If the main system is divided into subsystems, the subsystems will be listed in this column.

b. Symptom Column. This column lists the symptoms, or problems for which detailed troubleshooting procedures are given.

c. Summary Column. No summary troubleshooting procedures are needed at the operator's level of troubleshooting, so, the summary column is not used.

d. Detailed Column. This column tells you where to find the detailed troubleshooting procedure for each symptom.

e. Persons Column. This column tells you how many people are needed to do the troubleshooting procedure.

f. Special Tools Column. Any tools needed to do the troubleshooting procedure which are not included in your common tool kit are listed in this column.

g. Standard Tools Column. A dot in this column means that tools found in your common tool kit are needed to do the troubleshooting procedure.

h. Materials Column. This column tells you what materials are needed to do the troubleshooting procedure. These materials and how they will be issued will be decided by your maintenance officer.

i. Time Column. This column tells you how much time you will need to do the detailed troubleshooting procedure. The time will be decided by your maintenance officer.

**TABLE 6-1. FUEL SYSTEM**

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Engine is hard starting, or cranks and does not start | — | Figure 8-1 | 1 | — | • | | |
| — | 2. Engine runs rough and lacks power, or gets poor fuel mileage | — | Figure 8-2 | 1 | — | • | | |

**TABLE 6-2. COOLING SYSTEM**

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Engine temperature gage reads above 200°F while running | — | Figure 9-1 | 1 | — | • | | |

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TABLE 6-3. TRANSMISSION SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SUMMARY | DETAILED | PERSONS | TEST EQUIPMENT: SPECIAL TOOLS | TEST EQUIPMENT: STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Transmission makes noise | — | Figure 10-1 | 1 | — | • | | |
| — | 2. Transmission leaks oil | — | Figure 10-2 | 1 | — | • | | |

TABLE 6-4. TRANSFER SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SUMMARY | DETAILED | PERSONS | TEST EQUIPMENT: SPECIAL TOOLS | TEST EQUIPMENT: STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Transfer makes noise | — | Figure 11-1 | 1 | — | • | | |
| — | 2. Transfer leaks oil | — | Figure 11-2 | 1 | — | • | | |

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TABLE 6-5. FRONT AXLE SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Front axle makes noise | — | Figure 12-1 | 1 | — | • | | |

TABLE 6-6. REAR AXLE SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Rear axle makes noise | — | Figure 13-1 | 1 | — | • | | |

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TABLE 6-7. BRAKE SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Brake pedal sinks close to floor board | | Figure 14-1 | 1 | — | • | | |
| — | 2. Truck pulls to one side when brakes are put on | — | Figure 14-2 | 1 | Tire inflation gage | | | |
| — | 3. Buzzer does not shut off and air pressure gage reads below 65 PSI | — | Figure 14-3 | 1 | . | • | | |
| — | 4. Buzzer does not shut off and air pressure gage reads below 60 PSI on trucks M275AI and M275A2 | — | Figure 14-4 | 1 | - | • | | |
| — | 5. Hand brake does not hold parked truck | — | Figure 14-5 | 1 | - | • | | |
| — | 6. Trailer brakes do not work when pedal is pressed or hand control lever is used | — | Figure 14-6 | 1 | - | • | | |

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TABLE 6-8. WHEEL SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Shimmy | — | Figure 15-1 | 1 | — | • | | |
| — | 2. Hard steering | — | Figure 15-2 | 1 | Tire inflation gage | | | |

TABLE 6-9. STEERING SYSTEM

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Hard steering | — | Figure 16-1 | 1 | Tire inflation gage | | | |

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TABLE 6-10. OUTRIGGER, TRUCK M764

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Both outriggers do not extend or retract | — | Figure 17-1 | 1 | — | | | |

TABLE 6-11. FRONT WINCH

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Winch does not pull load | — | Figure 18-1 | 1 | — | " | | |
| — | 2. Winch makes noise | — | Figure 18-2 | 1 | — | | | |

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TABLE 6-12. REAR WINCH, TRUCK M764

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Winch makes noise | — | Figure 19-1 | 1 | — | | | |
| — | 2. Winch does not pull load | — | Figure 19-2 | 1 | — | • | | |

TABLE 6-13, REAR WINCH, TRUCK M756A2

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | TEST EQUIPMENT | | | |
| | | SUMMARY | DETAILED | PERSONS | SPECIAL TOOLS | STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Winch makes noise | — | Figure 20-1 | 1 | — | | | |
| — | 2. Winch does not pull load | — | Figure 20-2 | | — | • | | |
| — | 3. Tailboard roller binds, or does not turn | — | Figure 20-3 | 1 | — | | | |

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TABLE 6-14 DUMP TRUCK

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SUMMARY | DETAILED | PERSONS | TEST EQUIPMENT: SPECIAL TOOLS | TEST EQUIPMENT: STANDARD TOOLS | MATERIALS | TIME |
| — | 1. Dump body does not rise | — | Figure 21-1 | 1 | — | | | |

TABLE 6-15 HOT WATER HEATER

| SUBSYSTEM | SYMPTOM | TS PROCEDURE | | RESOURCES REQ'D | | | | |
|---|---|---|---|---|---|---|---|---|
| | | SUMMARY | DETAILED | PERSONS | TEST EQUIPMENT: SPECIAL TOOLS | TEST EQUIPMENT: STANDARD TOOLS | MATERIALS | |
| — | 1. Heater and defroster do not work right | — | Figure 22-1 | 1 | — | • | | |

TA 113516

# CHAPTER 7

# SAMPLE TROUBLESHOOTING PROCEDURE

7-1. GENERAL. This chapter gives a sample troubleshooting procedure. The purpose of the sample procedure is to help you see how the detailed troubleshooting procedures are used to find faults in a system.

7-2. SAMPLE PROCEDURE. The sample procedure given is the fuel system troubleshooting procedure for the symptom, ENGINE IS HARD STARTING, OR CRANKS AND DOES NOT START. This symptom is one you will have when you try to start your truck and certain parts on the truck are not working correctly. In each numbered box, instructions are given which tell you what to do, and how to do it. A large dot is placed next to the "what to do" instructions, and small dots next the the "how to do it" instructions.

a. Box number (1) gives general instructions on getting the truck ready before you start to troubleshoot.

b. Box number (2) gives a fault isolation test instruction. In this case, you are told to see if the engine stop (ENG STOP) control handle is pushed in. After you do this simple test, you read the question at the bottom of box number (2). If the ENG STOP control handle is pulled out, the answer to the question is (NO) , so you go to the next box.

c. Box number (3) gives you a corrective action. In this case, the fault is the ENG STOP control handle being pulled out. The corrective action is what you do to fix the fault, which is simply to push the handle back in. If the engine still doesn't start after you do this, it could mean that there are other faults in the fuel system besides the ENG STOP control handle. When this happens, go back to the beginning of the procedure and do each step again until you find the other faults.

d. Sometimes the corrective actions given for a fault will tell you what to do to fix the fault, but will not give you detailed instructions on how to fix it. Instead, you will be told to refer to another volume in this manual for these instructions. Box number (5) is an example of this. If the answer to the questions that all the fault isolation test instruction boxes ask is (YES) , it means that the symptom cannot be corrected at the operator level of maintenance. When this happens you are given the instruction "Tell Organizational Maintenance."

Symptom 1

ENGINE IS HARD STARTING, OR CRANKS AND DOES NOT START

WARNING

Diesel fuel is very flammable. Care must be used when choosing a place to work on fuel system. Keep truck about 50 feet away from an area where open flame, sparks, or smoking may cause a fire. Keep a fire extinguisher close by

1

- Make truck ready for work on fuel system
  - Find a well ventilated area
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

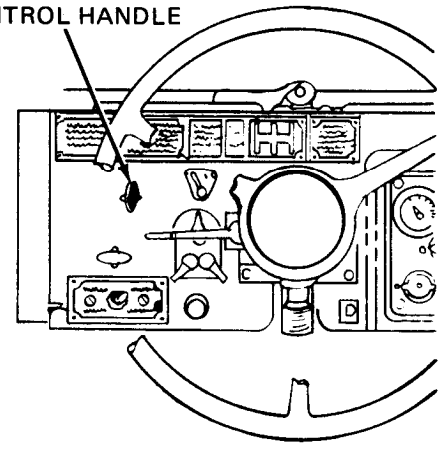
GENERAL INSTRUCTIONS

2

- Check engine stop control
  - See if ENG STOP control handle has been pushed in

FAULT ISOLATION TEST INSTRUCTION

Is ENG STOP control handle OK?




YES

NO

3

- Reset engine stop control
  - Push in and turn ENG STOP control handle until it stops

CORRECTIVE ACTION

GO

TA 113531

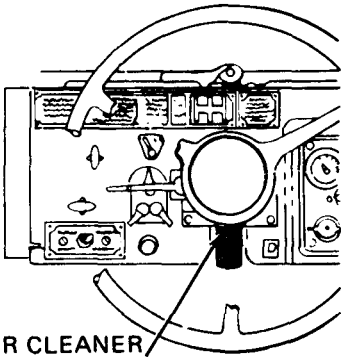
Figure 7-1 (Sheet 1 of 3)

GO

4

- Check air cleaner indicator gage
  - Turn on engine. Refer to Vol 1, chapter 4, para 4-6b
  - Look for red band showing on gage
  - Turn off engine. Refer to Vol 1, chapter 4, para 4-6e

Does red band fail to show?

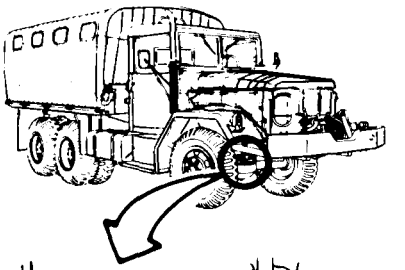


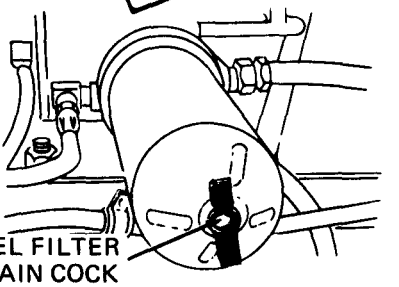

YES

NO

5

- Replace dirty air cleaner element
  - Refer to Vol 4, chapter 2, para 2-4

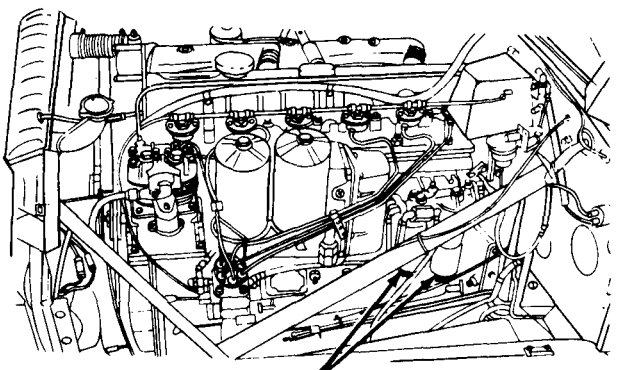





6

- Check primary, secondary and final fuel filter drain cocks
  - Look for fuel leaking from drain cocks
  - Feel for loose drain cocks

Are drain cocks OK?




GO

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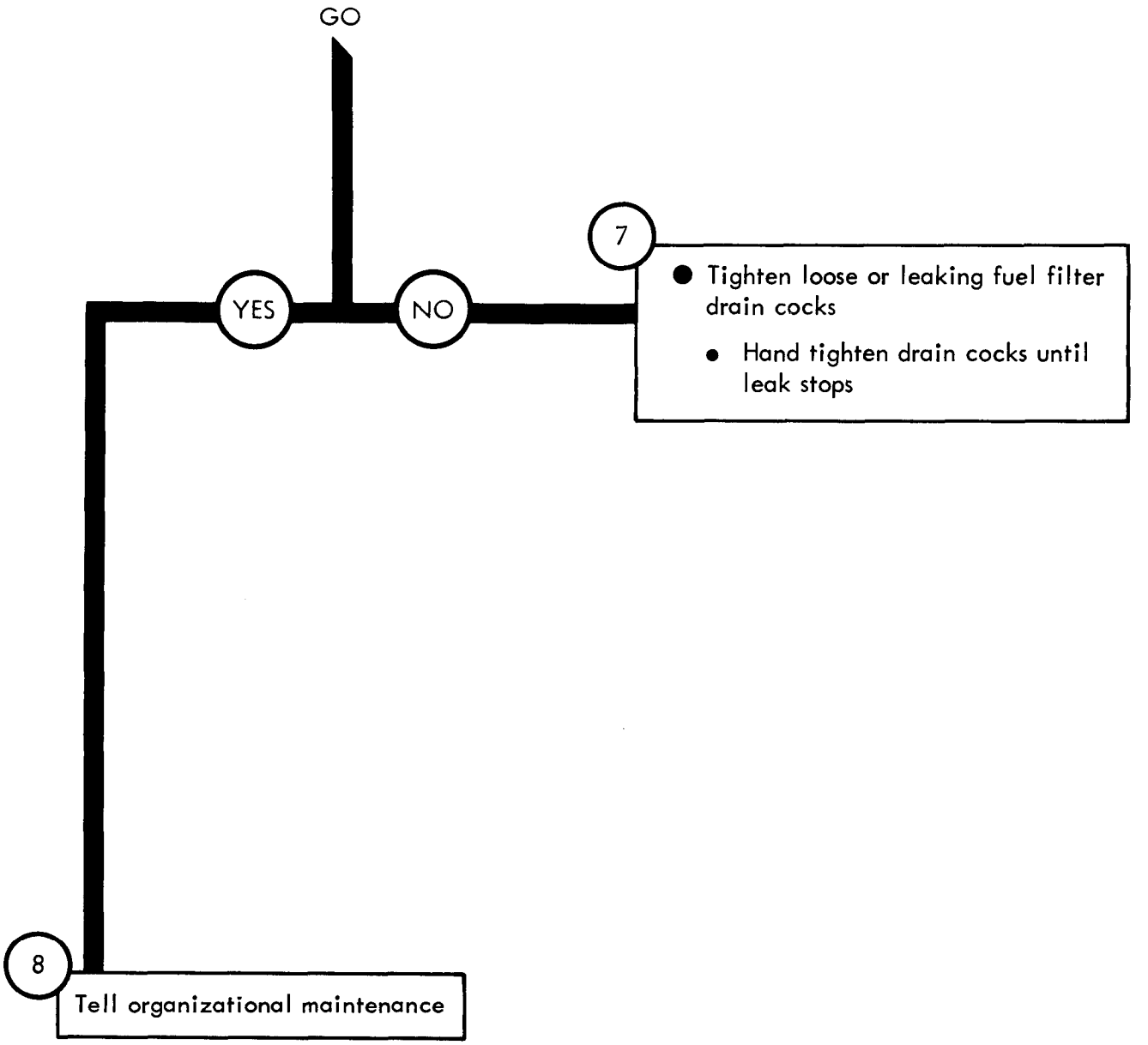
Figure 7-1 (Sheet 2 of 3)




TA 113533

Figure 7-1 (Sheet 3 of 3)

# CHAPTER 8
# FUEL SYSTEM TROUBLESHOOTING PROCEDURES

8-1. GENERAL. Detailed troubleshooting procedures for the fuel system are given in this chapter.

8-2. PROCEDURES . These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

Symptom

1 ENGINE IS HARD STARTING, OR CRANKS AND DOES NOT START

**WARNING**

Diesel fuel is very flammable. Care must be used when choosing a place to work on fuel system. Keep truck about 50 feet away from an area where open flame, sparks, or smoking may cause a fire. Keep a fire extinguisher close by

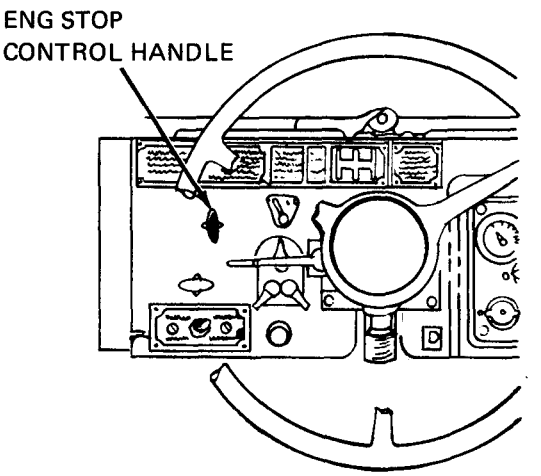
1

- Make truck ready for work on fuel system
  - Find a well ventilated area
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

2

- Check engine stop control
  - See if ENG STOP control handle has been pushed in

Is ENG STOP control handle OK?




YES

NO

3

- Reset engine stop control
  - Push in and turn ENG STOP control handle until it stops

GO

TA 113534



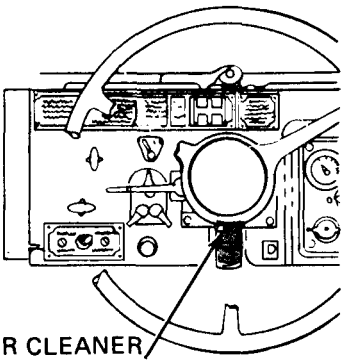
Figure 8-1 (Sheet 1 of 3)

GO

4

- Check air cleaner indicator gage
  - Turn on engine. Refer to Vol 1, chapter 4, para 4-6b
  - Look for red band showing on gage
  - Turn off engine. Refer to Vol 1, chapter 4, para 4-6e

Does red band fail to show?



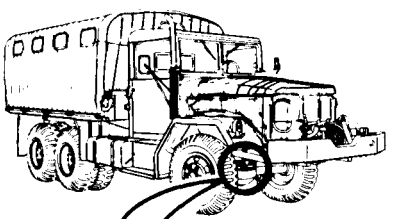
AIR CLEANER INDICATOR GAGE

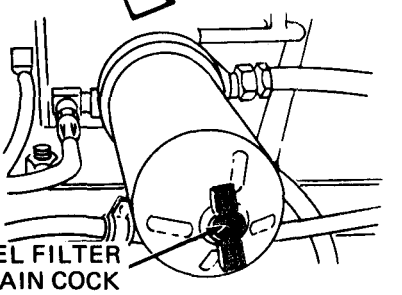
YES

NO

5

- Replace dirty air cleaner element
  - Refer to Vol 4, chapter 2, para 2-4



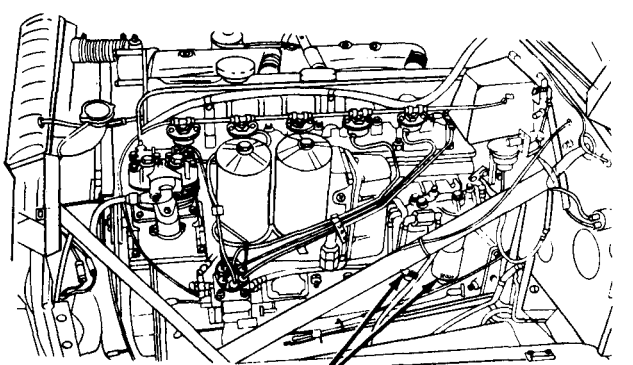


PRIMARY FUEL FILTER DRAIN COCK

6

- Check primary, secondary and final fuel filter drain cocks
  - Look for fuel leaking from drain cocks
  - Feel for loose drain cocks

Are drain cocks OK?

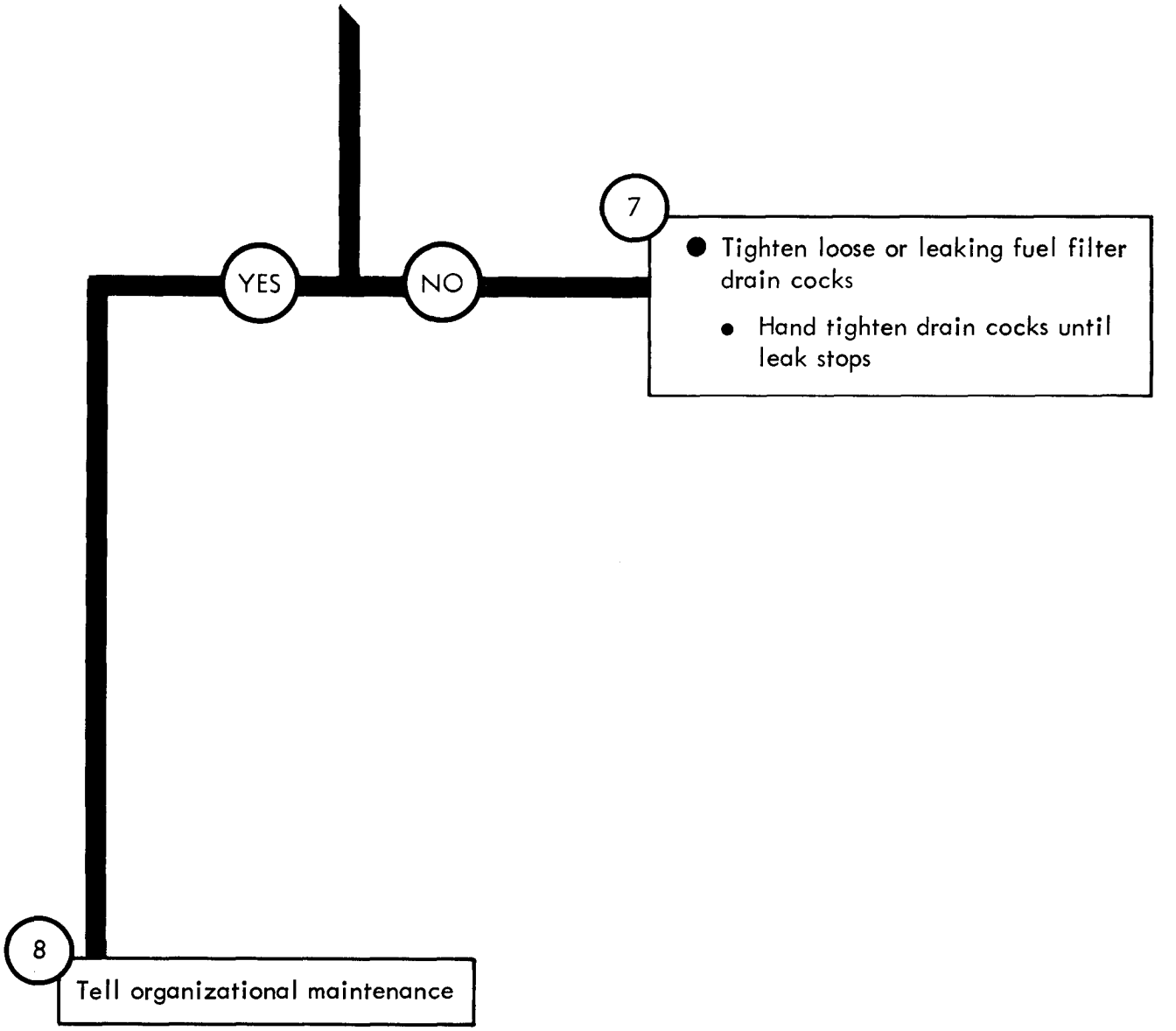


SECONDARY AND FINAL FUEL FILTER DRAIN COCKS

GO

TA 113535

Figure 8-1 (Sheet 2 of 3)




TA 113536



Figure 8-1 (Sheet 3 of 3)

Symptom

2 ENGINE RUNS ROUGH AND LACKS POWER, OR GETS POOR FUEL MILEAGE

WARNING

Diesel fuel is very flammable. Care must be used when choosing a place to work on fuel system. Keep truck about 50 feet away from an area where open flame, sparks, or smoking may cause a fire. Keep a fire extinguisher close by

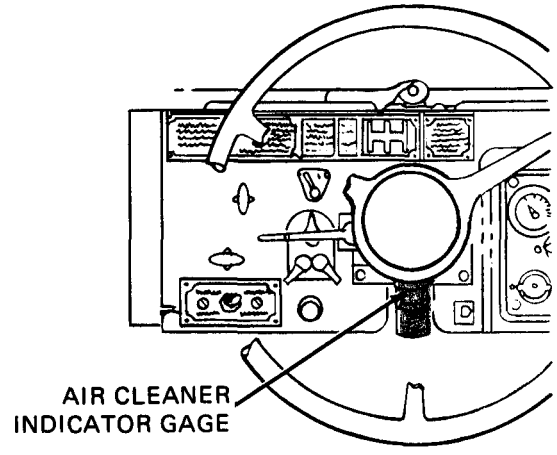
1

- Make truck ready for work on fuel system
  - Find a well ventilated area
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

- Check air cleaner indicator gage
  - Turn on engine. Refer to Vol 1, chapter 4, para 4-6b
  - Look for red band showing on gage
  - Turn off engine. Refer to Vol 1, Chapter 4, para 4-6e

Is red band hidden?

GO




TA 113537

Figure 8-2 (Sheet 1 of 2)

GO

YES

NO

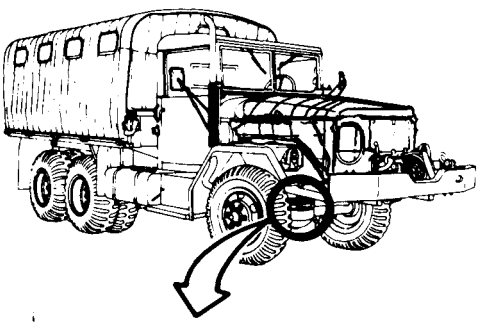
3

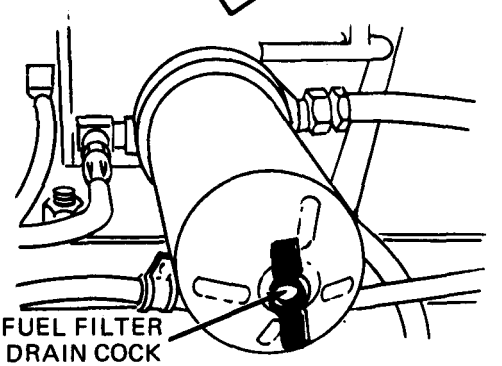
- Replace dirty air cleaner element
  - Refer to Vol 4, chapter 2, para 2-4

4

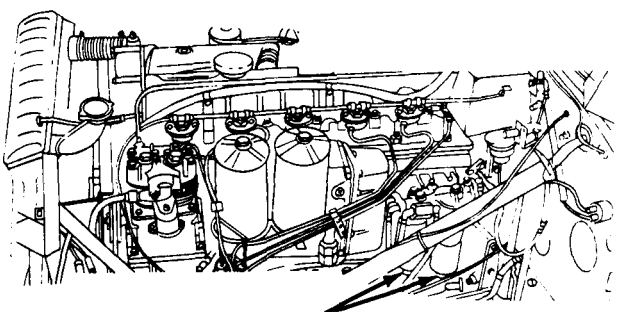
- Check primary, secondary and final fuel filter drain cocks
  - Look for fuel leaking from drain cocks
  - Feel if drain cocks are loose

Are the drain cocks OK?





PRIMARY FUEL FILTER DRAIN COCK



SECONDARY AND FINAL FUEL FILTER DRAIN COCKS

YES

NO

5

- Tighten loose or leaking fuel filter drain cocks
  - Hand tighten drain cocks until leak stops

6

Tell organizational maintenance

TA 113538



8-2 (Sheet 2 of 2)

# CHAPTER 9

# COOLING SYSTEM TROUBLESHOOTING PROCEDURES

9-1. GENERAL. Detailed troubleshooting procedures for the cooling system are given in this chapter.

9-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

Symptom

1 ENGINE TEMPERATURE GAGE READS ABOVE 200° WHILE RUNNING

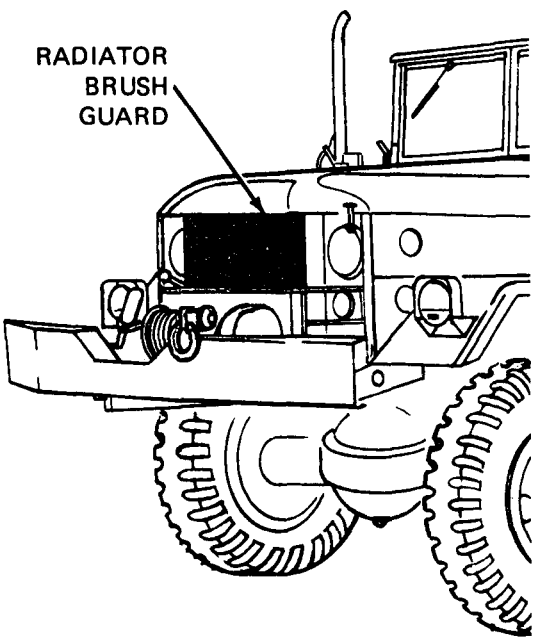
1

- Make truck ready for work on cooling system
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e
  - Chock wheels

2

- Check radiator brush guard assembly
  - Look for anything that will block the air flow to the radiator

Is front radiator guard clear?




YES

NO

3

- Clean blockage away from radiator
  - Clear away blockage
  - Blow away blockage with compressed air

GO

TA 113539



Figure 9-1 (Sheet 1 of 3)

GO

WARNING

Engine cooling system runs under pressure, and at a temperature of 165°F, to 195°F. If filler cap is taken off before pressure is set free scalding coolant will blow out. Due to high temperature of coolant, bad burns can occur if contact is made with skin

4

- Check radiator coolant level
  - Using rag, grab radiator filler cap and turn to the left until it reaches stop
  - Wait about 30 seconds, or until all pressure has been set free
  - Using rag, push down on cap and turn to left. Take off cap
  - Look inside radiator and see if coolant level is within two inches from top

Is radiator coolant level OK?

GO

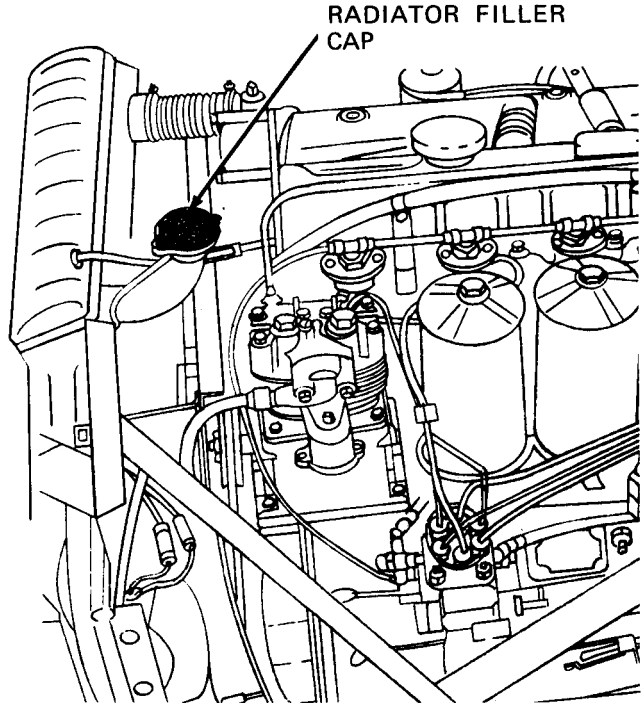



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Figure 9-1 (Sheet 2 of 3)

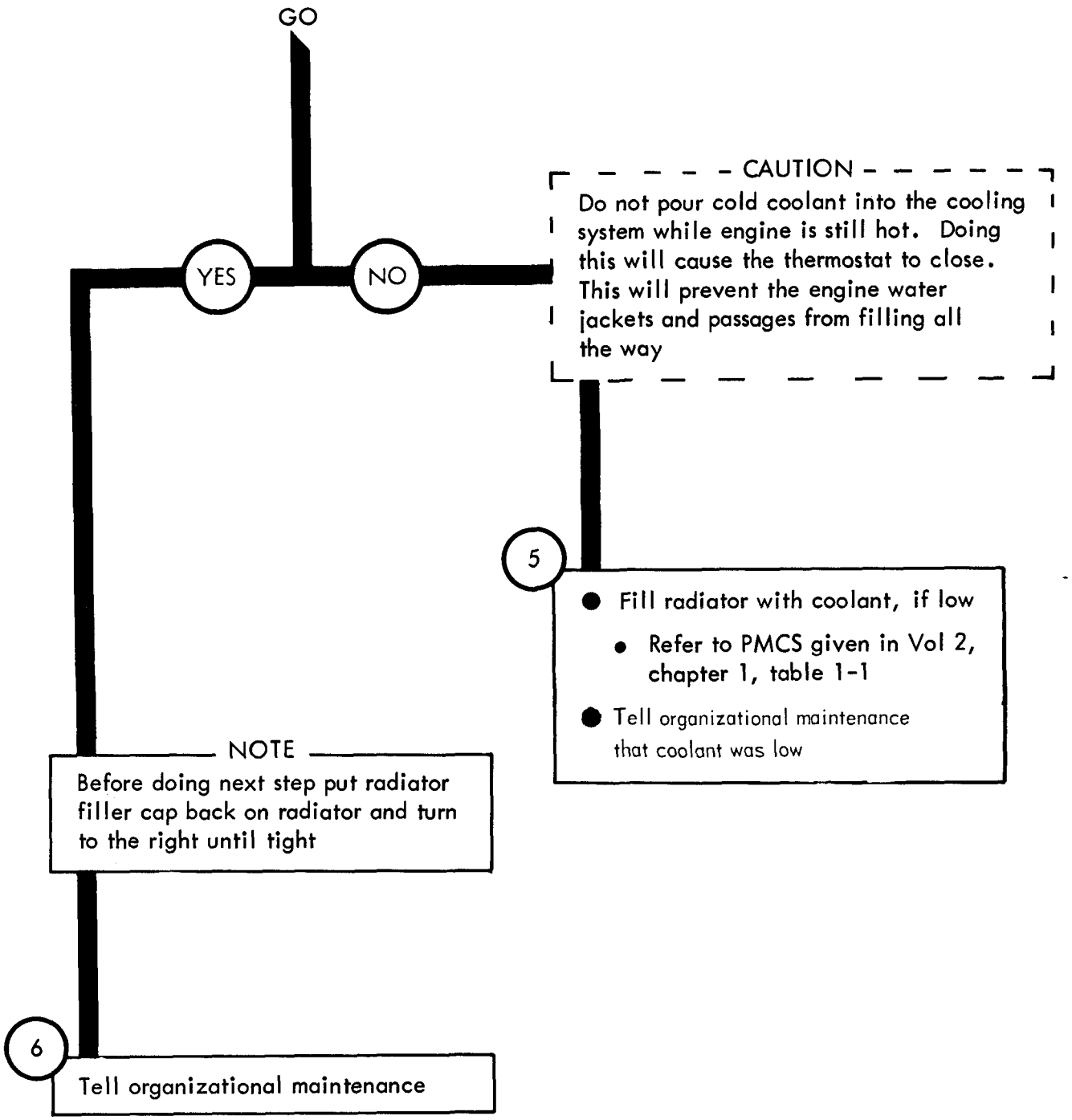


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Figure 9-1 (Sheet 3 of 3)

# CHAPTER 10

# TRANSMISSION SYSTEM TROUBLESHOOTING PROCEDURES

10-1. GENERAL. Detailed troubleshooting procedures for the transmission system are given in this chapter.

10-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

TRANSMISSION SYSTEM TROUBLESHOOTING

Symptom

1 TRANSMISSION MAKES NOISE

1

- Make truck ready for work on transmission
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

WARNING

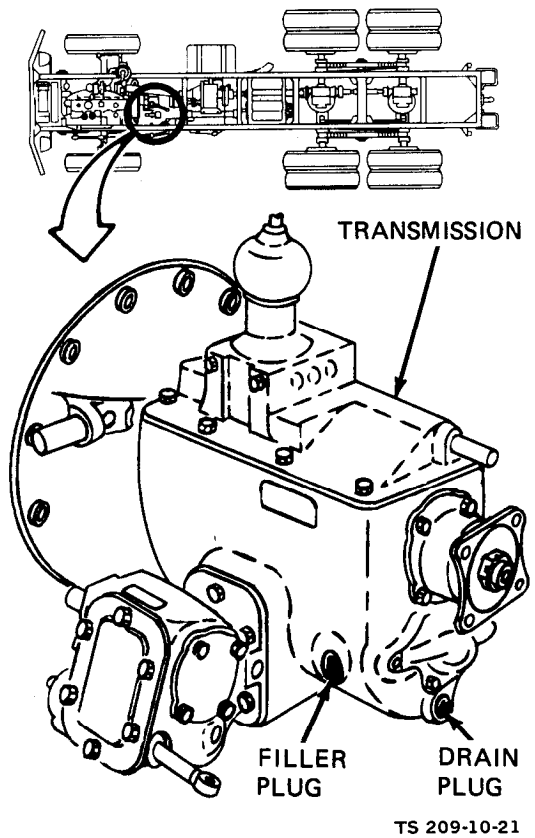
Transmission casing and gear oil get very hot when truck is being run. After truck is stopped, wait until it has had time to cool off before doing any work on transmission

2

- Check transmission fluid level and leakage
  - Crawl under truck
  - See if drain plug is leaking
  - Using 1/2 inch plug wrench and adjustable wrench unscrew and take out transmission filler plug
  - Put finger in filler plug hole and feel if oil level is up to filler plug hole

Is fluid OK?

GO

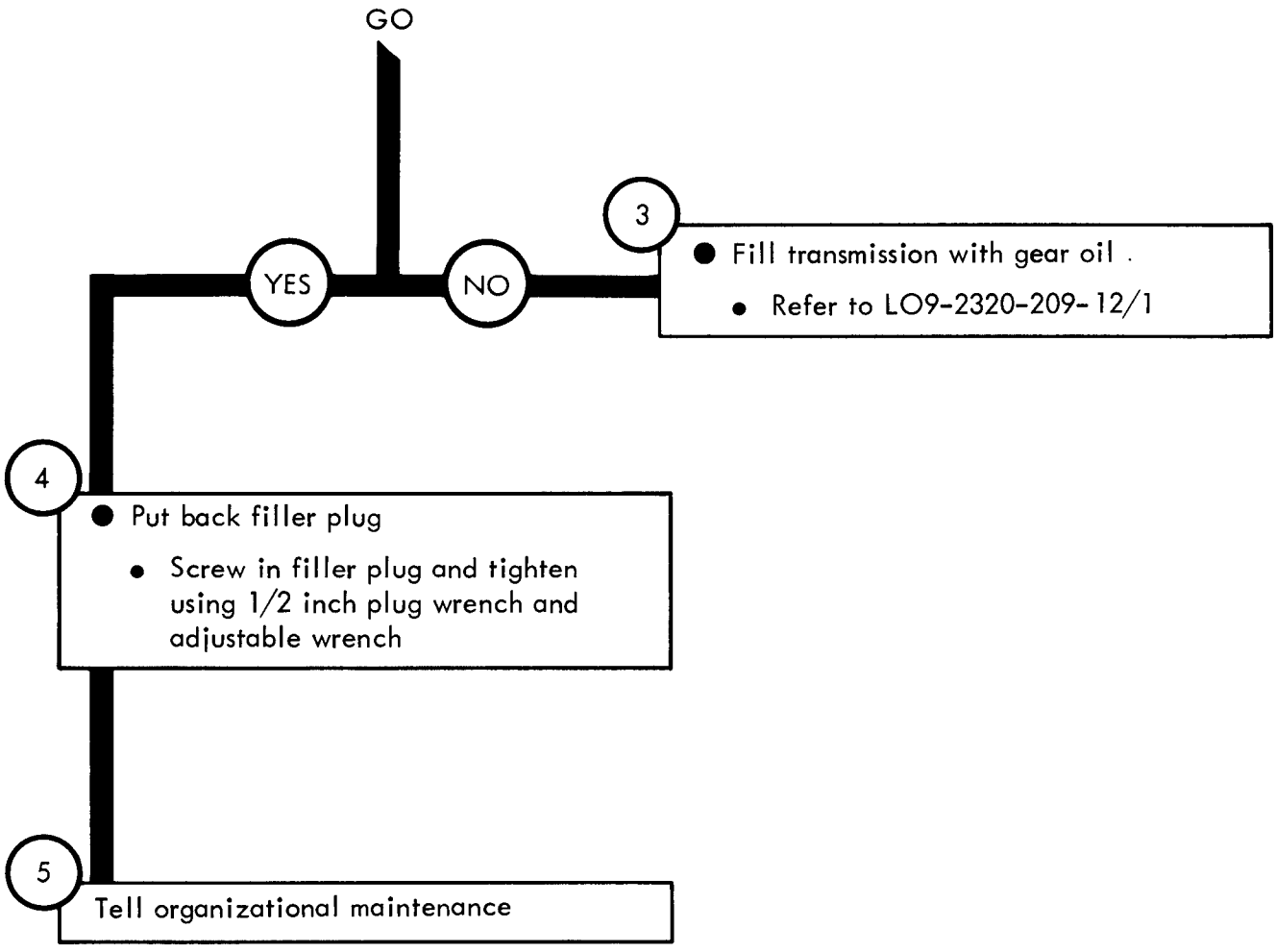



TS 209-10-21

TA 113542



Figure 10-1 (Sheet 1 of 2)




TA 113543

Figure 10-1 (Sheet 2 of 2)

Symptom

2 TRANSMISSION LEAKS OIL

1
- Make truck ready for work on transmission
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

2
- Check transmission drain and filler plugs
  - Crawl under truck
  - Look for signs of oil leaking from plugs

Are plugs OK?

YES

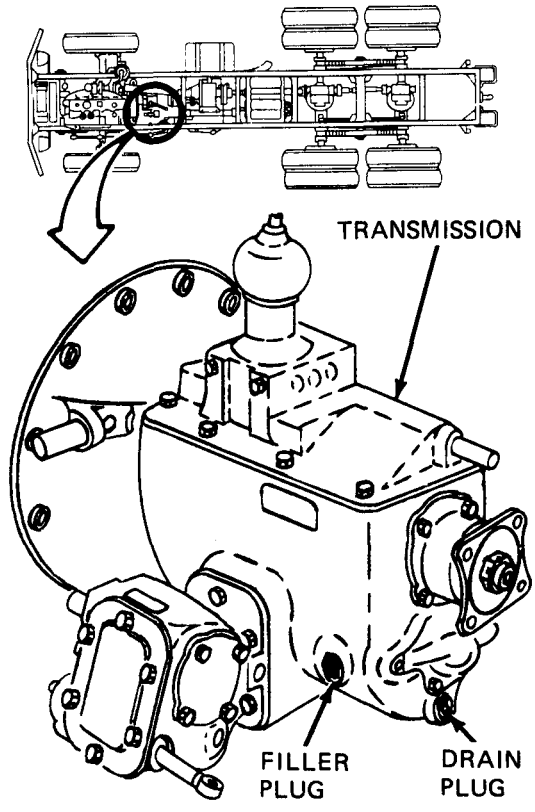
NO

3
- Tighten leaking plugs
  - Using 1/2 inch plug wrench and adjustable wrench, tighten transmission drain plug

Note: Before doing next step oil level in transmission must be topped off. Refer to LO 9-2320-209-12/1

  - Using 1/2 inch plug wrench and adjustable wrench, tighten transmission filler plug

4 Tell organizational maintenance




TA 113544



Figure 10-2

# CHAPTER 11

# TRANSFER SYSTEM TROUBLESHOOTING PROCEDURES

11-1. GENERAL. Detailed troubleshooting procedures for the transfer system are given in this chapter.

11-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

## TRANSFER SYSTEM TROUBLESHOOTING

Symptom

1 TRANSFER MAKES NOISE

1

- Make truck ready for work on transfer
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

**WARNING**

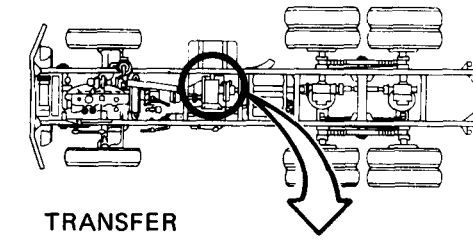
Transfer casing and gear oil get very hot when truck is being run. After truck is stopped, wait until it has had time to cool off before doing any work on transfer

2

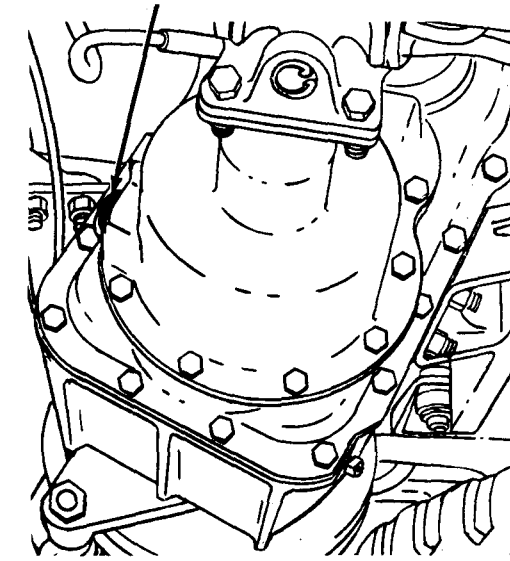
- Check hydraulic gear oil level in transfer
  - Crawl under truck
  - Using 1/2 inch plug wrench and adjustable wrench, unscrew and take off transfer case filler plug
  - Put finger in filler plug hole to feel if transfer is full

Is transfer case full?

GO



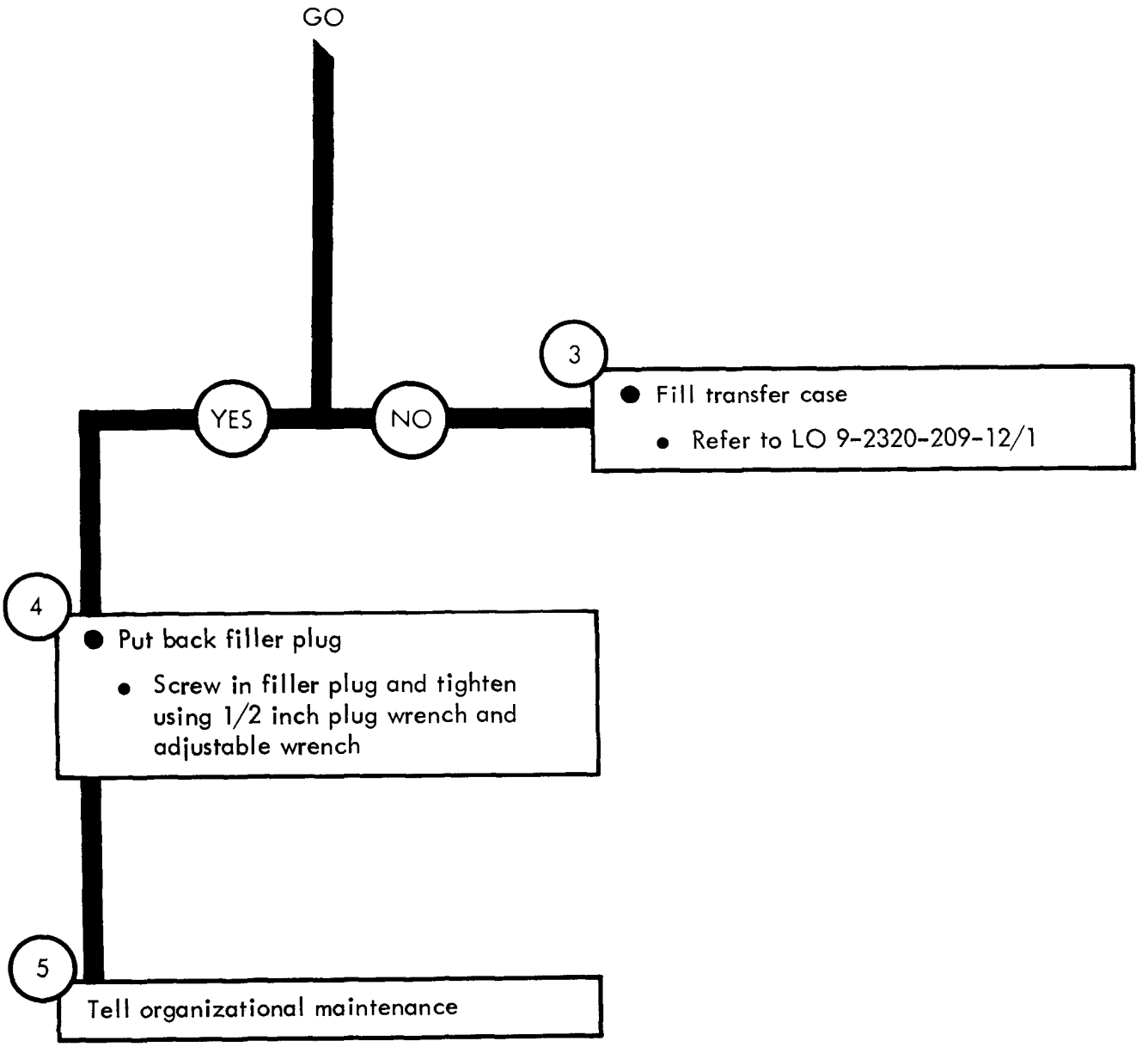
TRANSFER FILLER PLUG



TA 113545



Figure 11-1 (Sheet 1 of 2)




TA 113546

Figure 11-1 (Sheet 2 of 2)

Symptom 2

**TRANSFER LEAKS OIL**

1

- Make truck ready for work on transfer
  - Park truck. Refer to Vol 1, chapter 4, para 4-6e

2

- Check transfer drain and filler plugs
  - Crawl under truck
  - Look for signs of leaking hydraulic gear oil from plugs

Are plugs OK?

YES

NO

3

- Tighten loose plugs
  - Using 1/2 inch plug wrench and adjustable wrench, tighten drain plug

Note: Before doing next step top off hydraulic gear oil in transfer. Refer to LO 9-2320-209-12/1

  - Using 1/2 inch plug wrench and adjustable wrench, tighten filler plug

4

Tell organizational maintenance

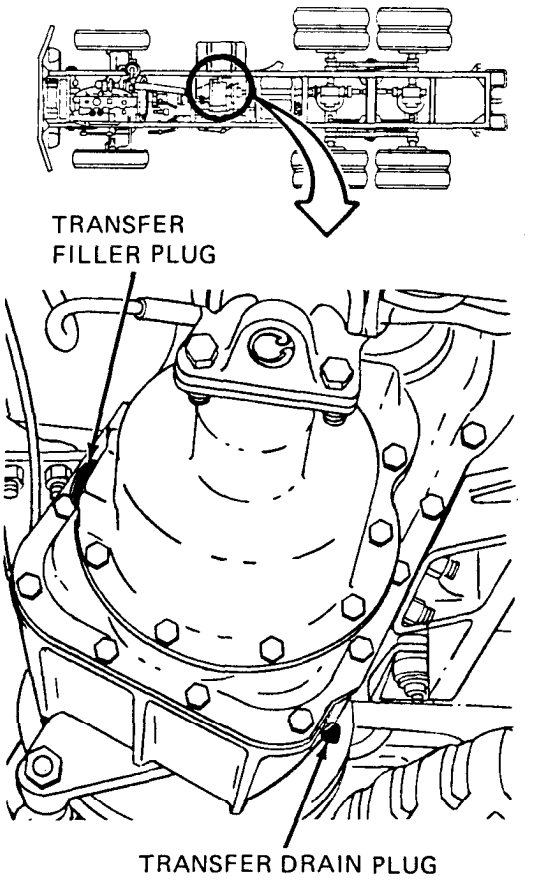




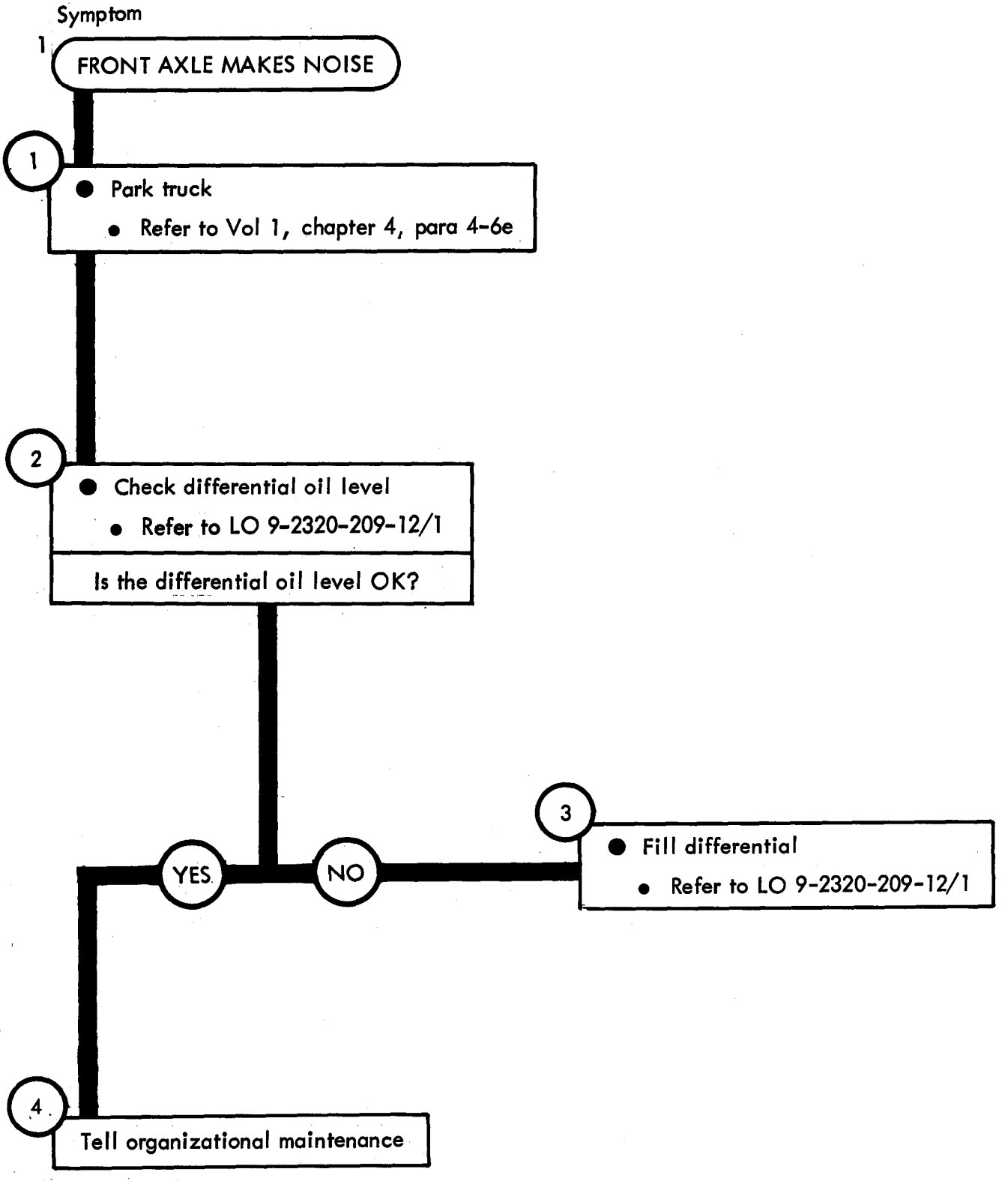

Figure 11-2

# CHAPTER 12
# FRONT AXLE SYSTEM TROUBLESHOOTING PROCEDURES

12-1. GENERAL. Detailed troubleshooting procedures for the front axle system are given in this chapter.

12-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

FRONT AXLE SYSTEM TROUBLESHOOTING




TA 113548



Figure 12-1

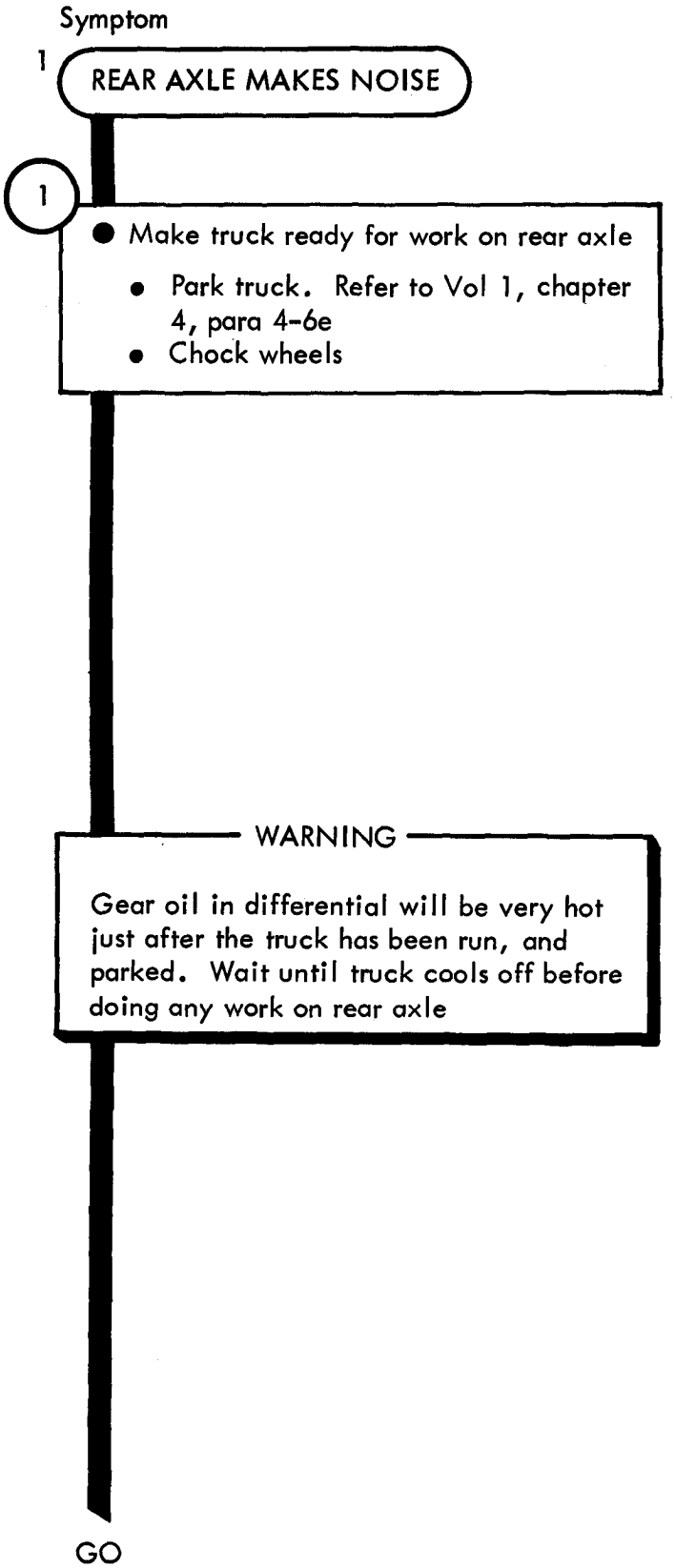
# CHAPTER 13

# REAR AXLE SYSTEM TROUBLESHOOTING PROCEDURES

13-1. GENERAL. Detailed troubleshooting procedures for the rear axle system are given in this chapter.

13-2.PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

REAR AXLE SYSTEM TROUBLESHOOTING




TA 113549



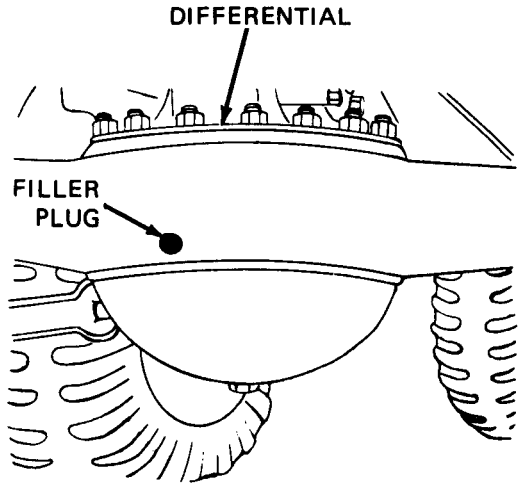
Figure 13-1 (Sheet 1 of 2)

GO

2

- Check differential oil level
  - Crawl under truck
  - Using plug wrench and adjustable wrench unscrew and take out differential filler plug
  - Put finger in filler plug hole to feel if differential is full

Is the differential oil level OK?




YES

NO

3

- Fill differential
  - Refer to LO 9-2320-209-12/1

4

- Put back filler plug
  - Using plug wrench and adjustable wrench screw in filler plug

5

Tell organizational maintenance

TA 113550

Figure 13-1 (Sheet 2 of 2)

# CHAPTER 14
# BRAKE SYSTEM TROUBLESHOOTING PROCEDURES

14-1. GENERAL. Detailed troubleshooting procedures for the brake system are given in this chapter.

14-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

BRAKE SYSTEM TROUBLESHOOTING

Symptom 1

BRAKE PEDAL SINKS CLOSE TO FLOORBOARD

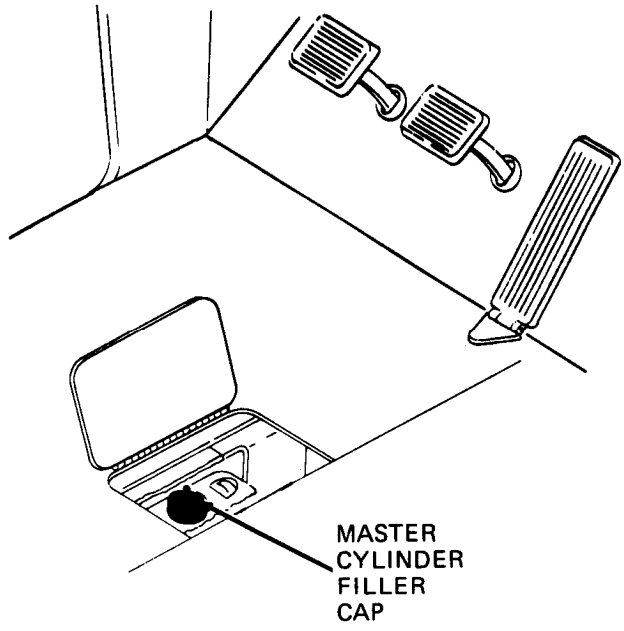
1

- Park truck
  - Refer to Vol 1, chapter 4, para 4-6e

2

- Check hydraulic brake fluid in master cylinder
  - Using screwdriver, open master cylinder access hatch on driver's side of cab floor.
  - Using adjustable wrench, unscrew and take off master cylinder filler cap
  - Using a flashlight, shine light into master cylinder reservoir to see if fluid level is low

Is hydraulic brake fluid level OK?




YES

NO

CAUTION

To be sure that the brake system works right use a non-petroleum base hydraulic fluid only

3

- Fill master cylinder reservoir
  - Refer to LO 9-2320-209-12/1
- Tell organizational maintenance that fluid level was low

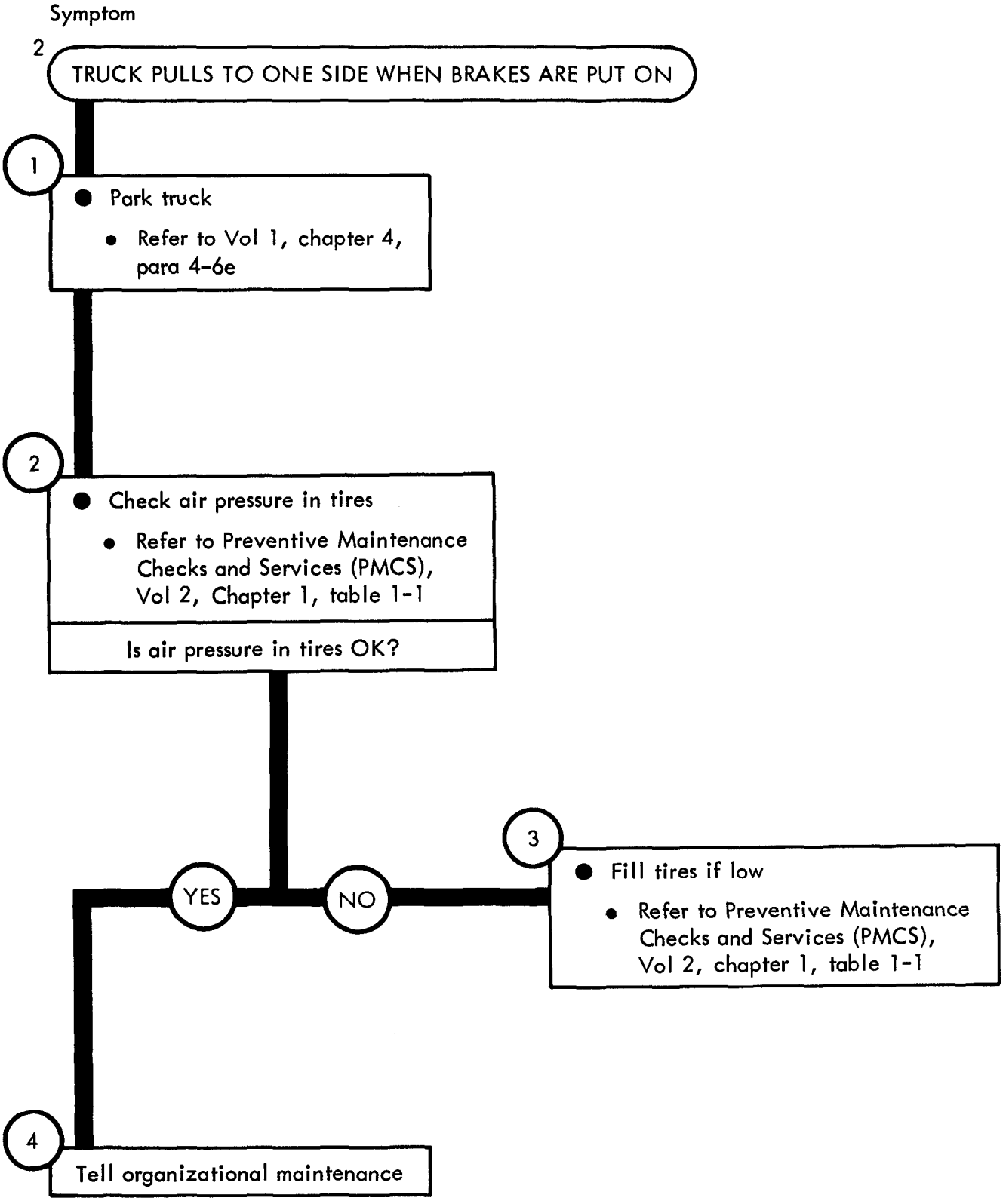
4

Tell organizational maintenance

TA 113551



Figure 14-1




TA 113552

Figure 14-2

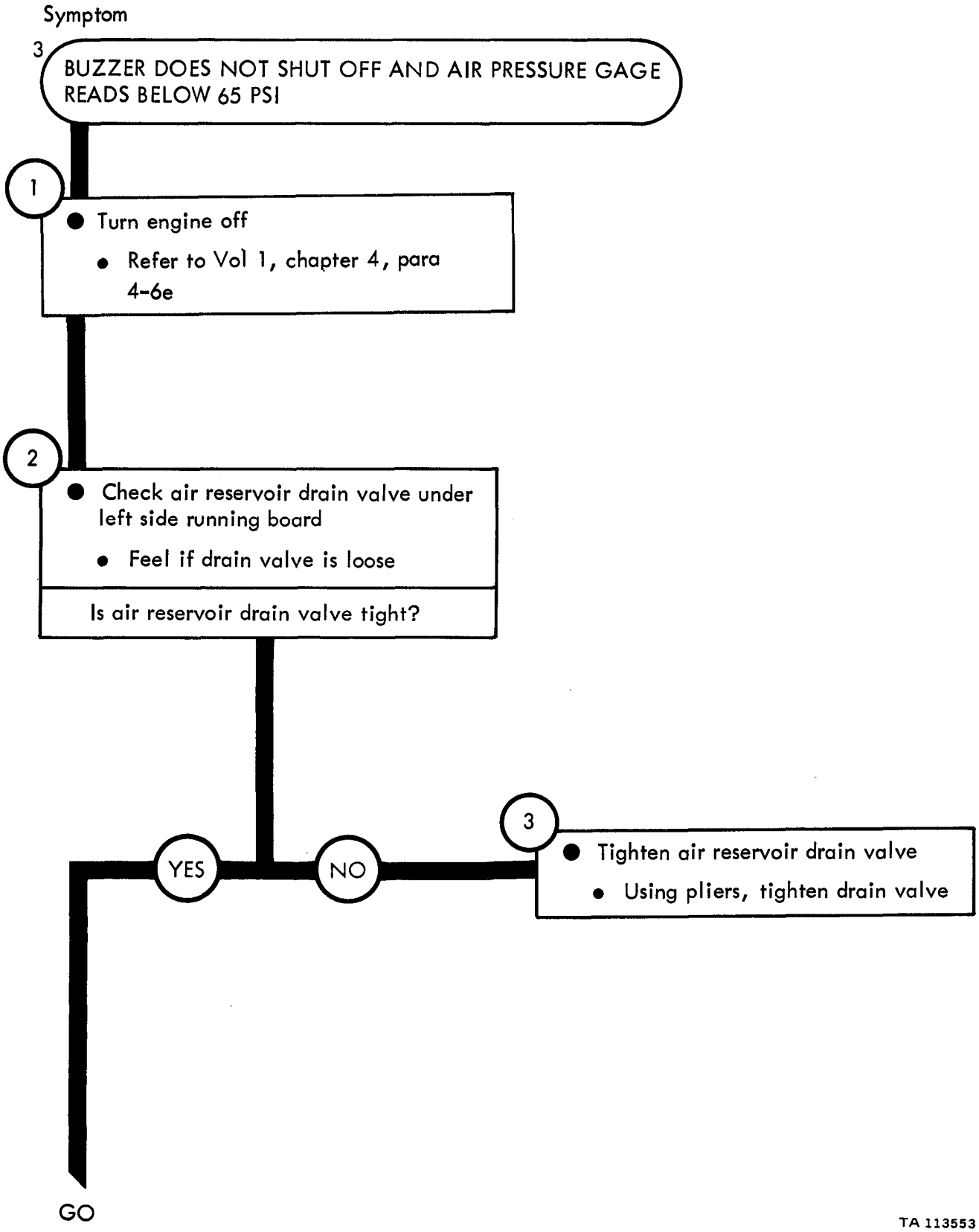




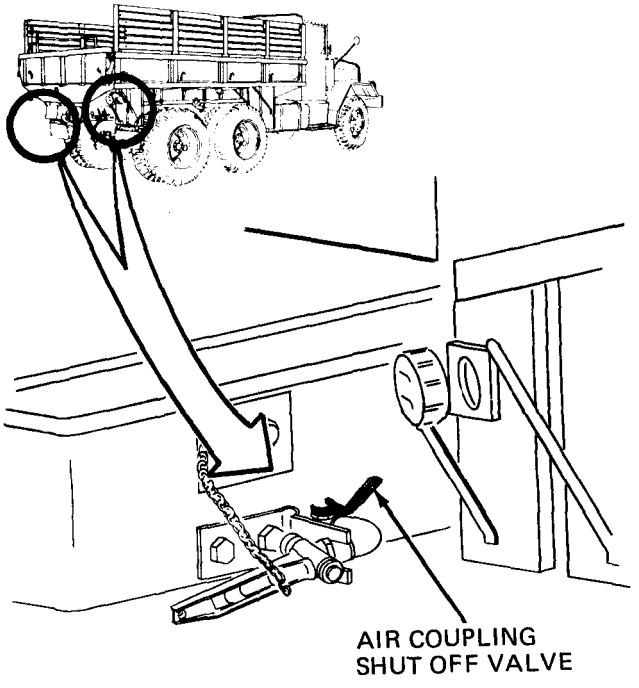

Figure 14-3 (Sheet 1 of 2)

GO

4

- Check both rear air coupling shut off valves
  - Go to rear of truck
  - Make sure the air coupling shut off valves are off

Are air coupling shut off valves off?




YES

NO

5

- Shut off air coupling valves
  - Turn valve to off position

6

Tell organizational maintenance

TA 113554

Figure 14-3 (Sheet 2 of 2)

Symptom

4 BUZZER DOES NOT SHUT OFF AND AIR PRESSURE GAGE READS BELOW 60 PSI ON TRUCKS M275A1 AND M275A2

1
- Turn engine off
  - Refer to Vol 1, chapter 4, para 4-6e

2
- Check air reservoir drain valve under left side running board
  - Feel if drain valves are loose

Is air reservoir drain valve tight?

YES

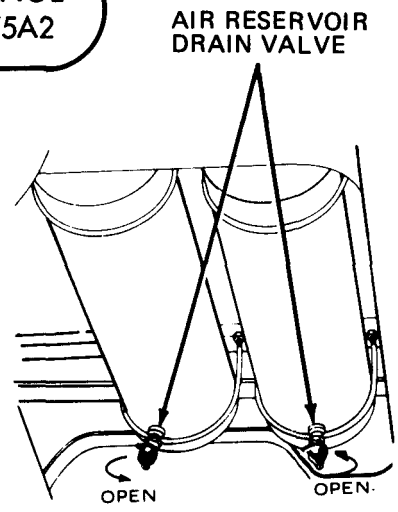
NO

3
- Tighten air reservoir drain valve
  - Using pliers, tighten drain valve

4
- Check both rear air coupling shut-off valves
  - Go to rear of truck
  - Make sure the air coupling shut off valves are off

Are air coupling shutoff valves off?

GO



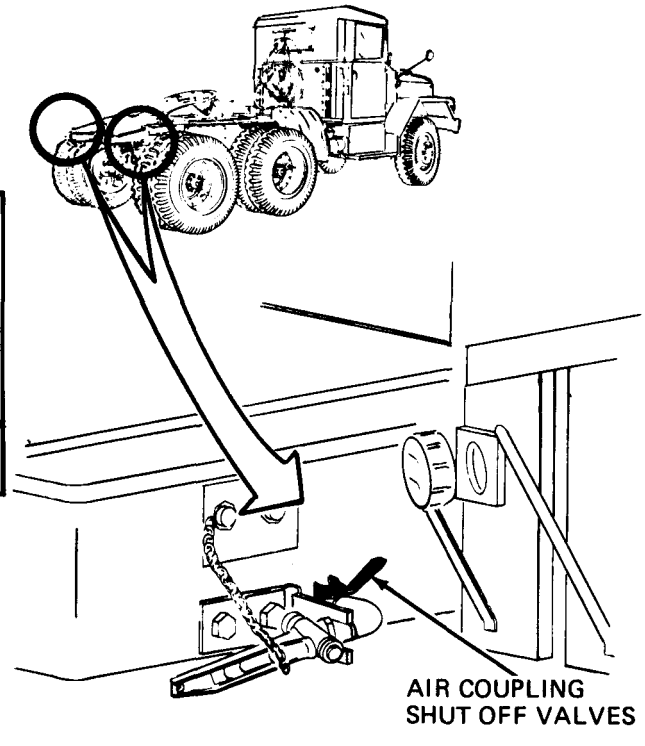






Figure 14-4 (Sheet 1 of 2)

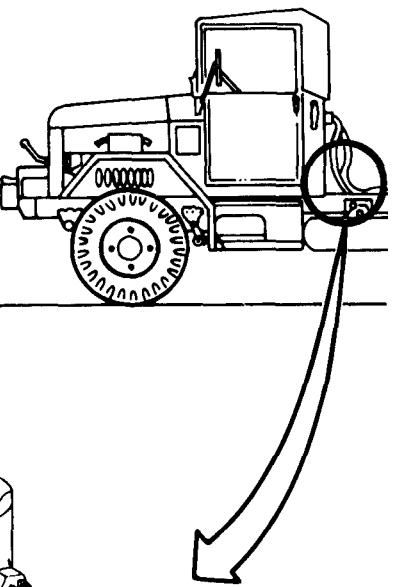
GO

YES

NO

5

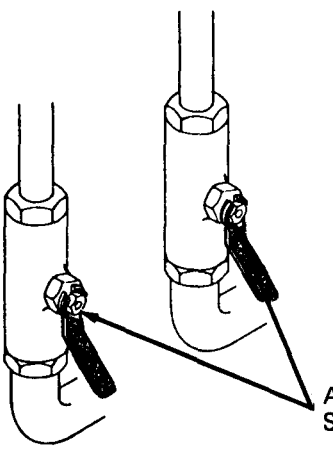
- Shut off air coupling valves
  - Turn valve to off position



6

- Check trailer hook-up air coupling shut off valves
  - Make sure air coupling shut off valves are off

Are the air coupling shut off valves off?



AIR COUPLING SHUT OFF VALVES

YES

NO

7

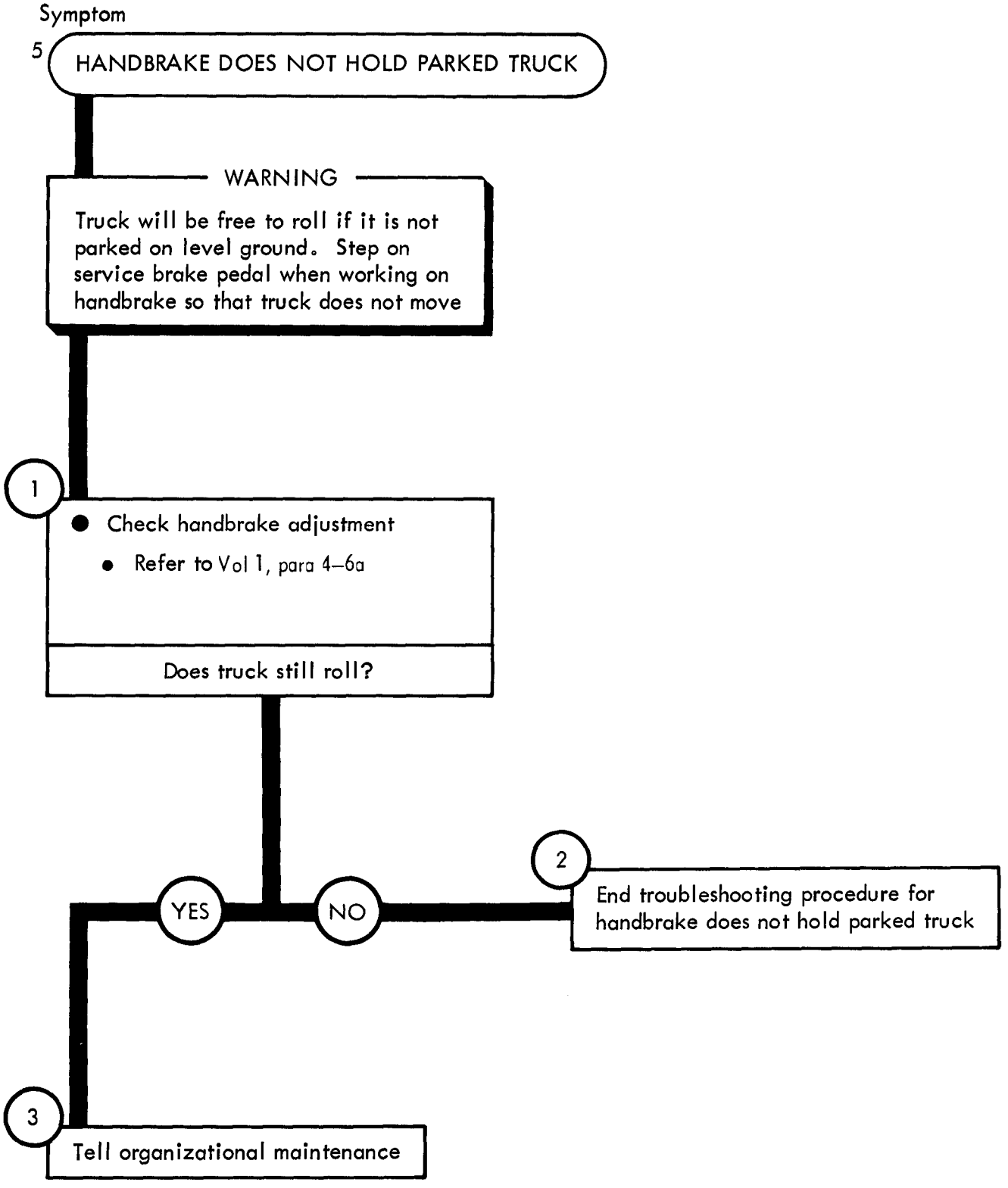
- Shut off air coupling valves
  - Turn valve to off position

8

Tell organizational maintenance

TA 113556

Figure 14-4 (Sheet 2 of 2)




TA 113557



Figure 14-5

Symptom 6

TRAILER BRAKES DO NOT WORK WHEN PEDAL IS PRESSED OR HAND CONTROL LEVER IS USED

1

- Park truck
  - Refer to Vol 1, chapter 4, para 4-6e

2

- Check rear air coupling shut off valves
  - Make sure shut off valves are in on position

Are the air coupling shut off valves on?

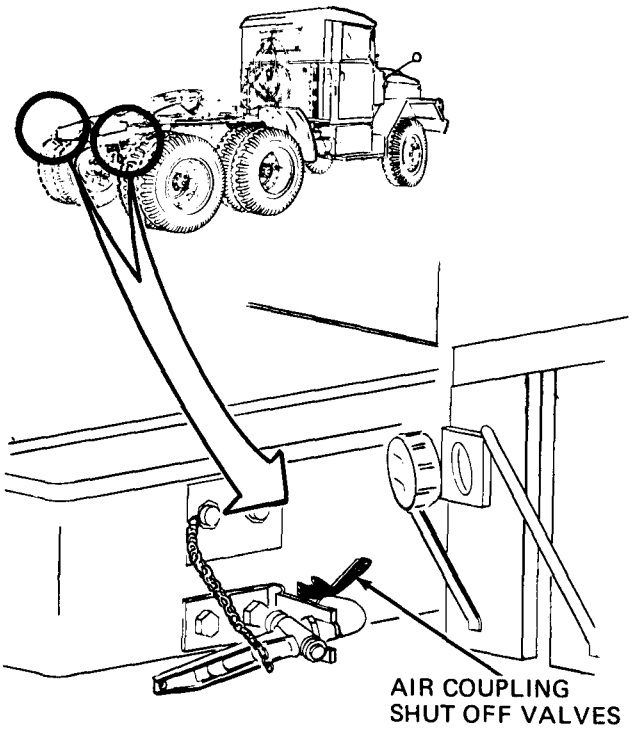
YES

NO

3

- Turn air coupling shut off valves on

GO




TA 113558

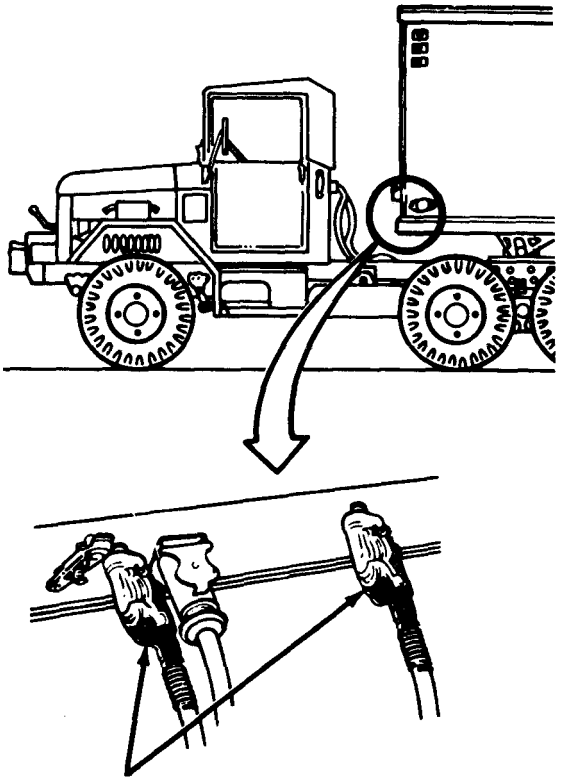
Figure 14-6 (Sheet 1 of 2)

GO

4

- Check tractor-to-trailer hose connections
  - Feel for air leaking around hose connection

Is hose connection OK?



TRACTOR TO TRAILER HOSE CONNECTIONS

YES

NO

5

- Tighten leaking tractor-to-trailer hose connections

  Note: If hose connection cannot be tightened, tell organizational maintenance

6

Tell organizational maintenance

TA 113559



Figure 14-6 (Sheet 2 of 2)

# CHAPTER 15
# WHEEL SYSTEM TROUBLESHOOTING PROCEDURES

15-1. GENERAL. Detailed troubleshooting procedures for the wheel system are given in this chapter.

15-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

WHEEL SYSTEM TROUBLESHOOTING

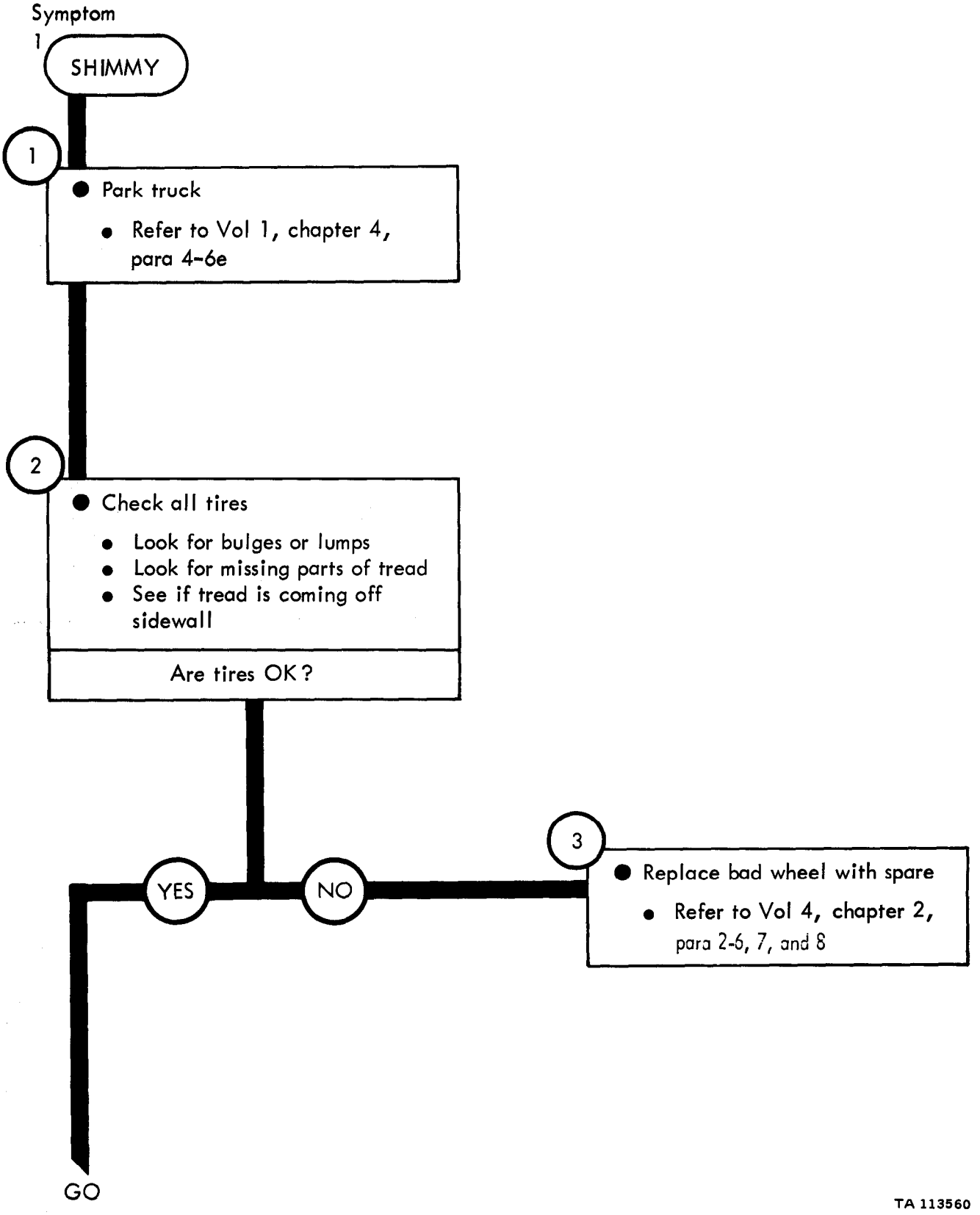
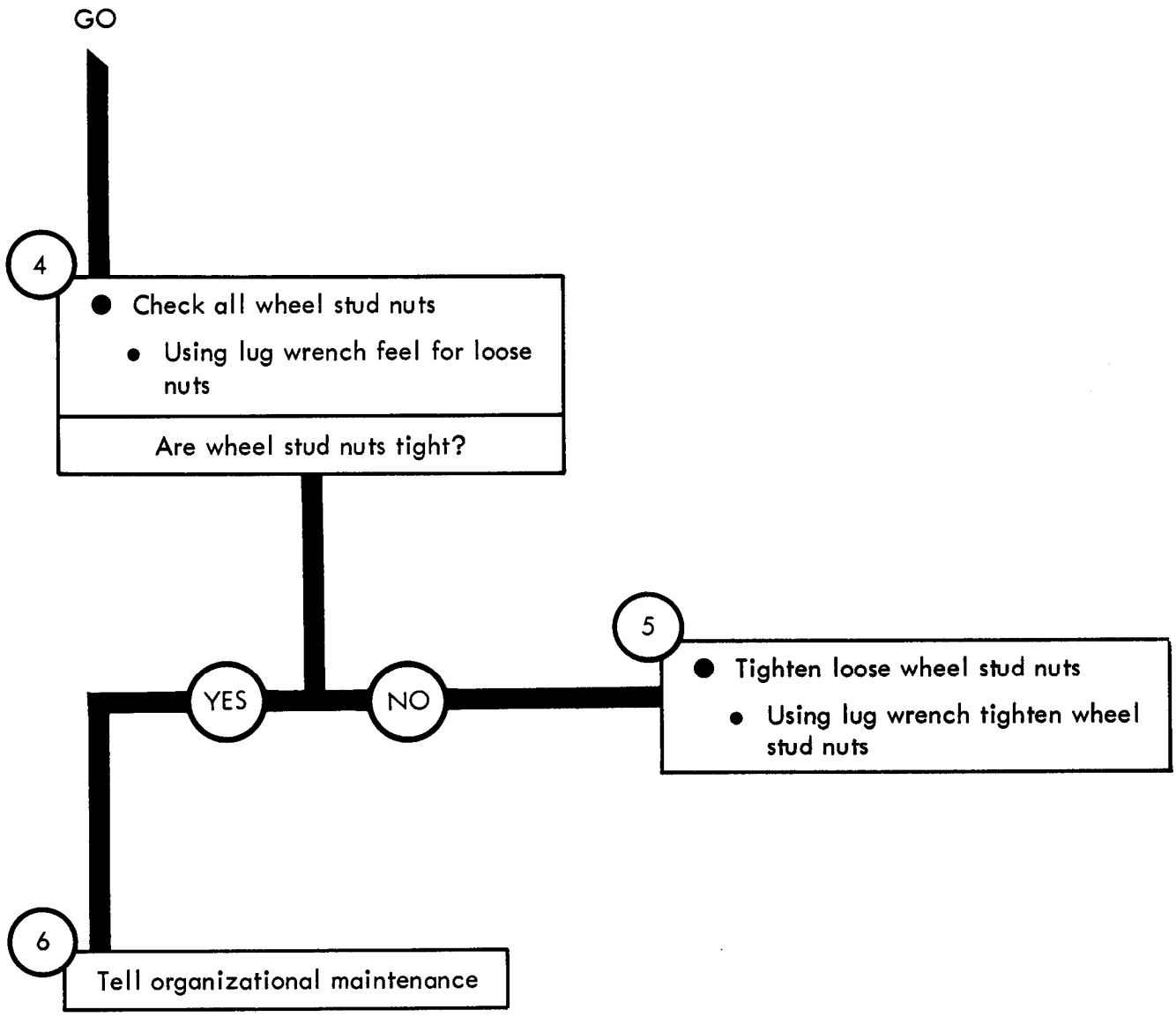





Figure 15-1 (Sheet 1 of 2)




TA 113561

Figure 15-1 (Sheet 2 of 2)

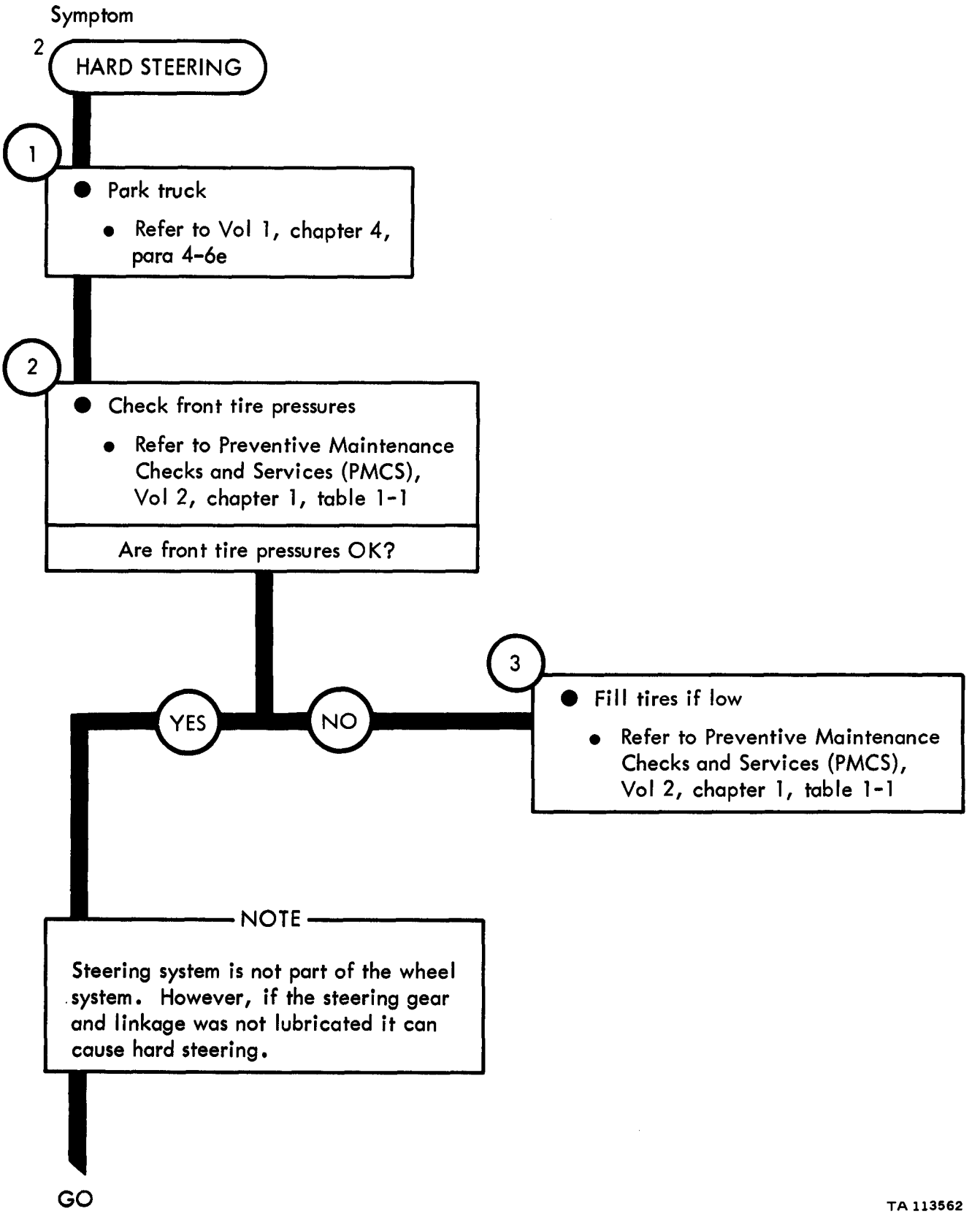
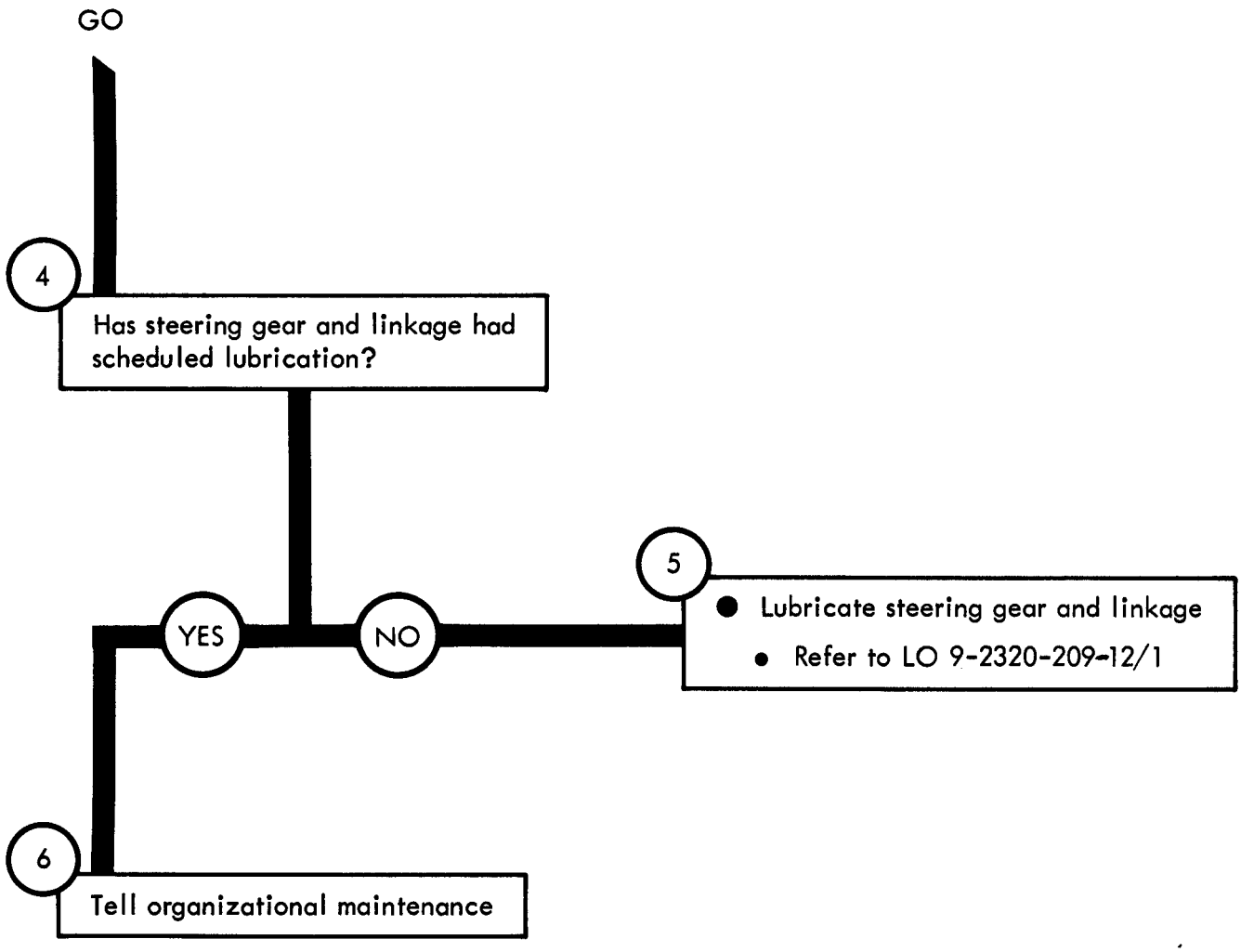





Figure 15-2 (Sheet 1 of 2)




TA 113563

Figure 15-2 (Sheet 2 of 2)

# CHAPTER 16
# STEERING SYSTEM TROUBLESHOOTING PROCEDURES

16-1. GENERAL. Detailed troubleshooting procedures for the steering system are given in this chapter.

16-2. PROCEDURES . These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

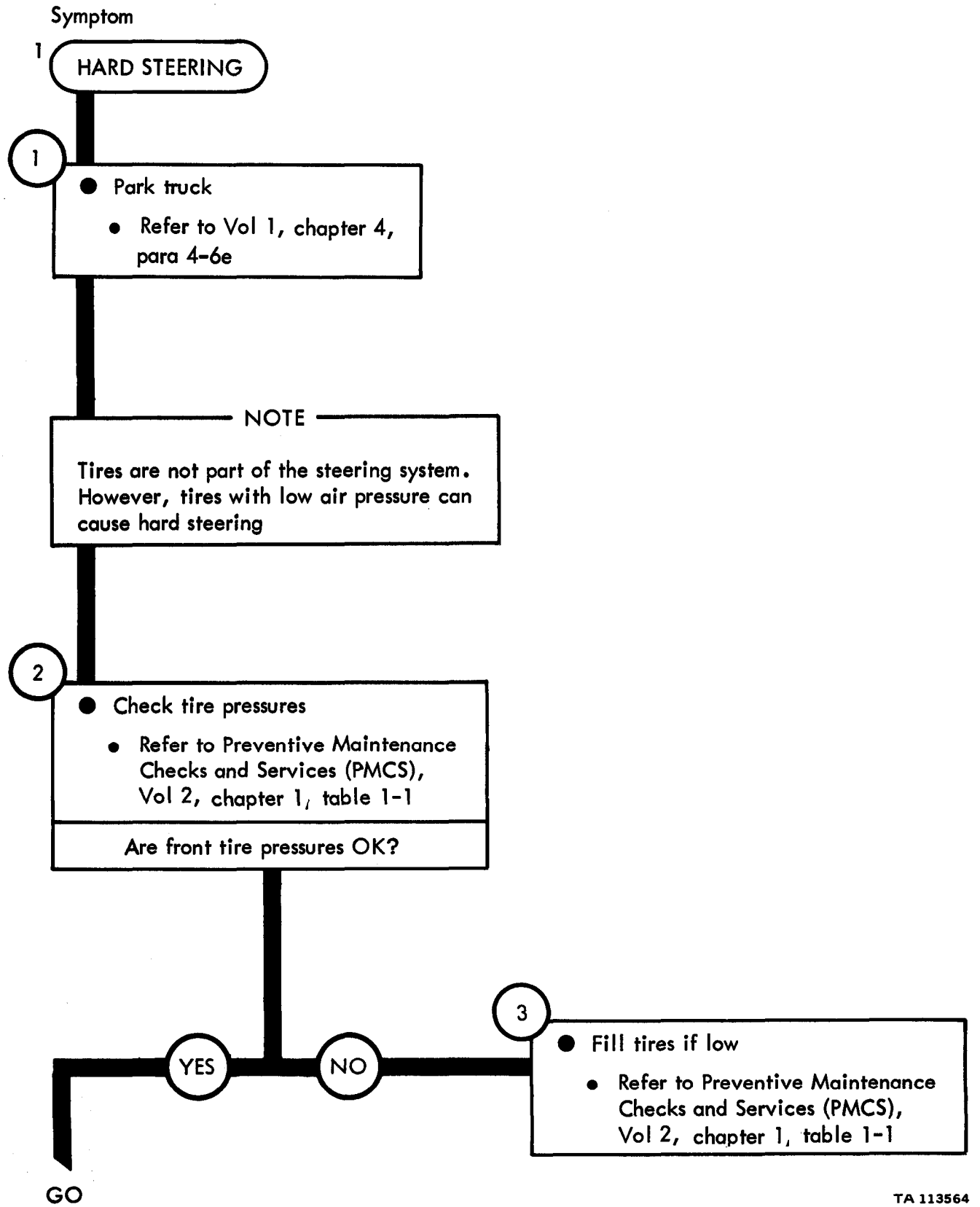
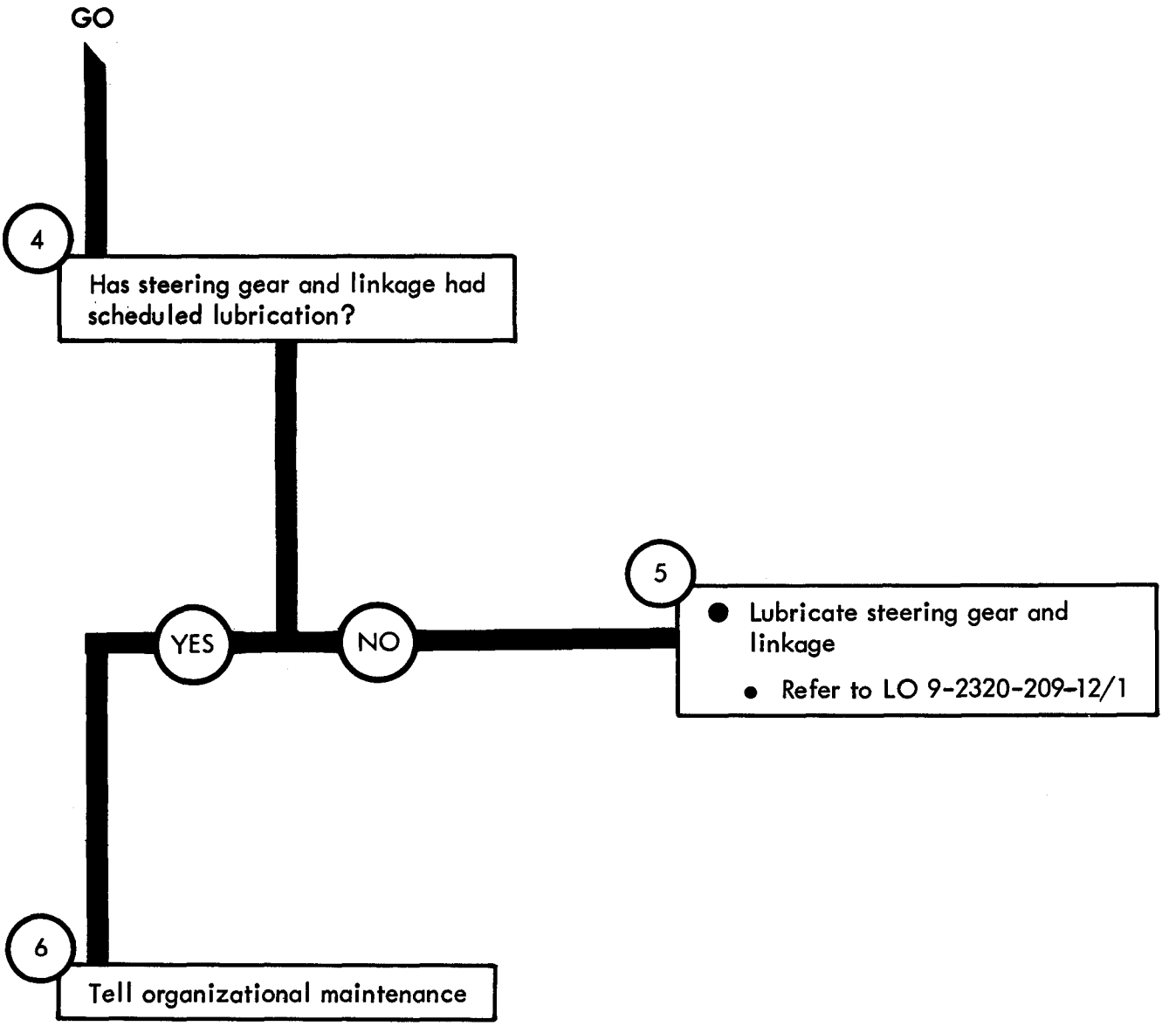





Figure 16-1 (Sheet 1 of 2)




TA 113565

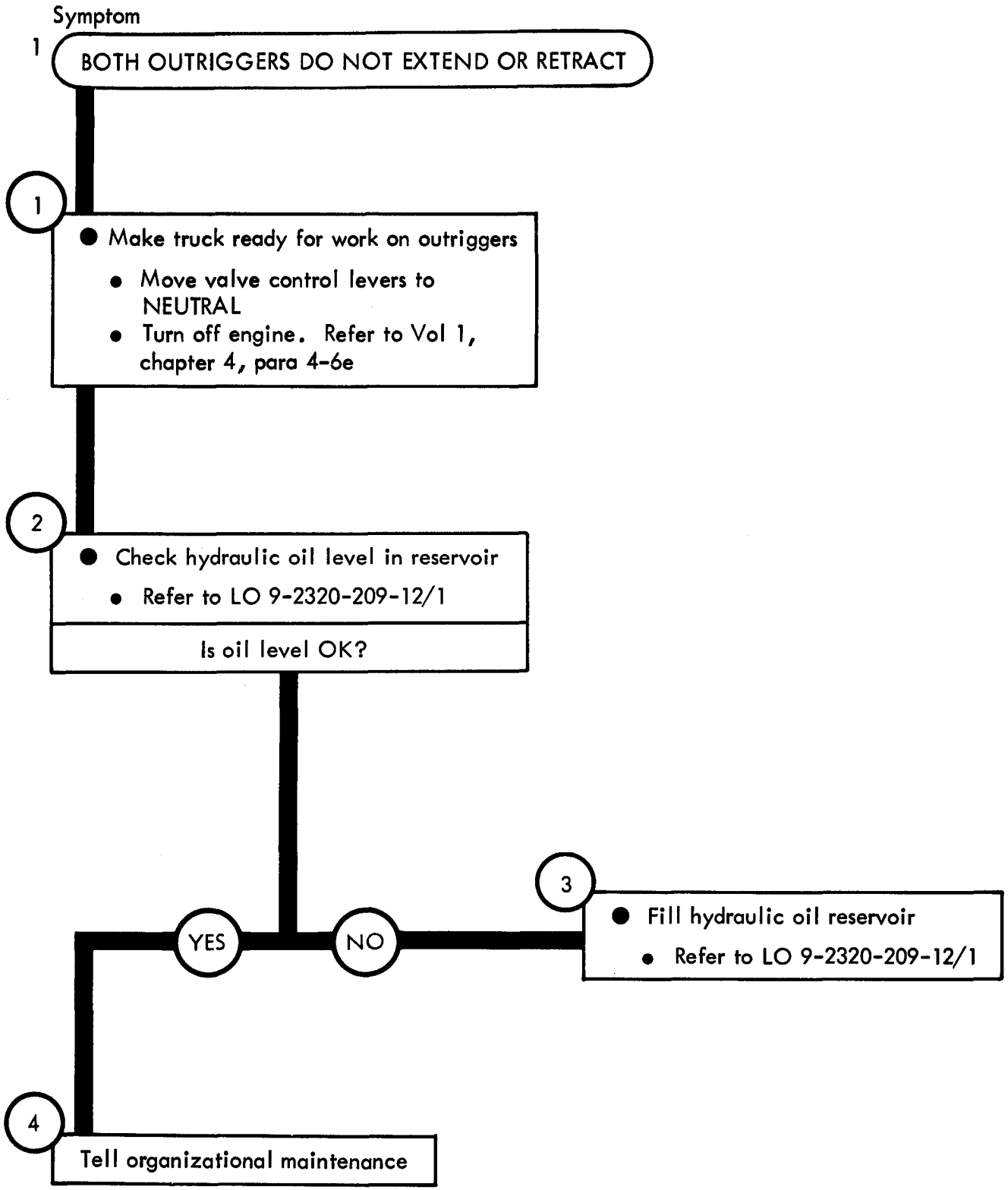
Figure 16-1 (Sheet 2 of 2)

# CHAPTER 17
# OUTRIGGER TROUBLESHOOTING PROCEDURES, TRUCK M764

17-1. GENERAL. Detailed troubleshooting procedures for the outrigger, truck M764 are given in this chapter.

17-2. PROCEDURES . These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

OUTRIGGER TROUBLESHOOTING, TRUCK M764




TA 113566



Figure 17-1

# CHAPTER 18
# FRONT WINCH TROUBLESHOOTING PROCEDURES

18-1. GENERAL. Detailed troubleshooting procedures for the front winch are given in this chapter.

18-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

## FRONT WINCH TROUBLESHOOTING

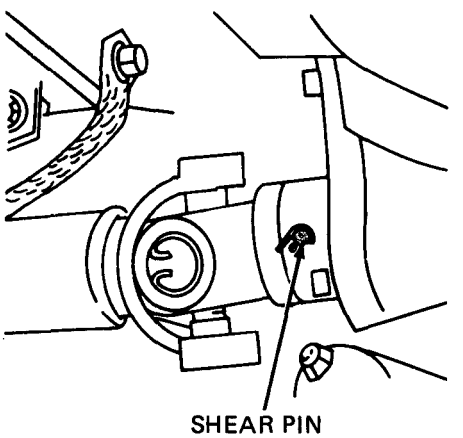
Symptom

1 WINCH DOES NOT PULL LOAD

1
- Make truck ready for work on winch
  - Turn off winch. Refer to Vol 1, chapter 4, para 4-7e
  - Chock wheels

2
- Check shear pin
  - Look for a broken shear pin

Is shear pin OK?




YES

NO

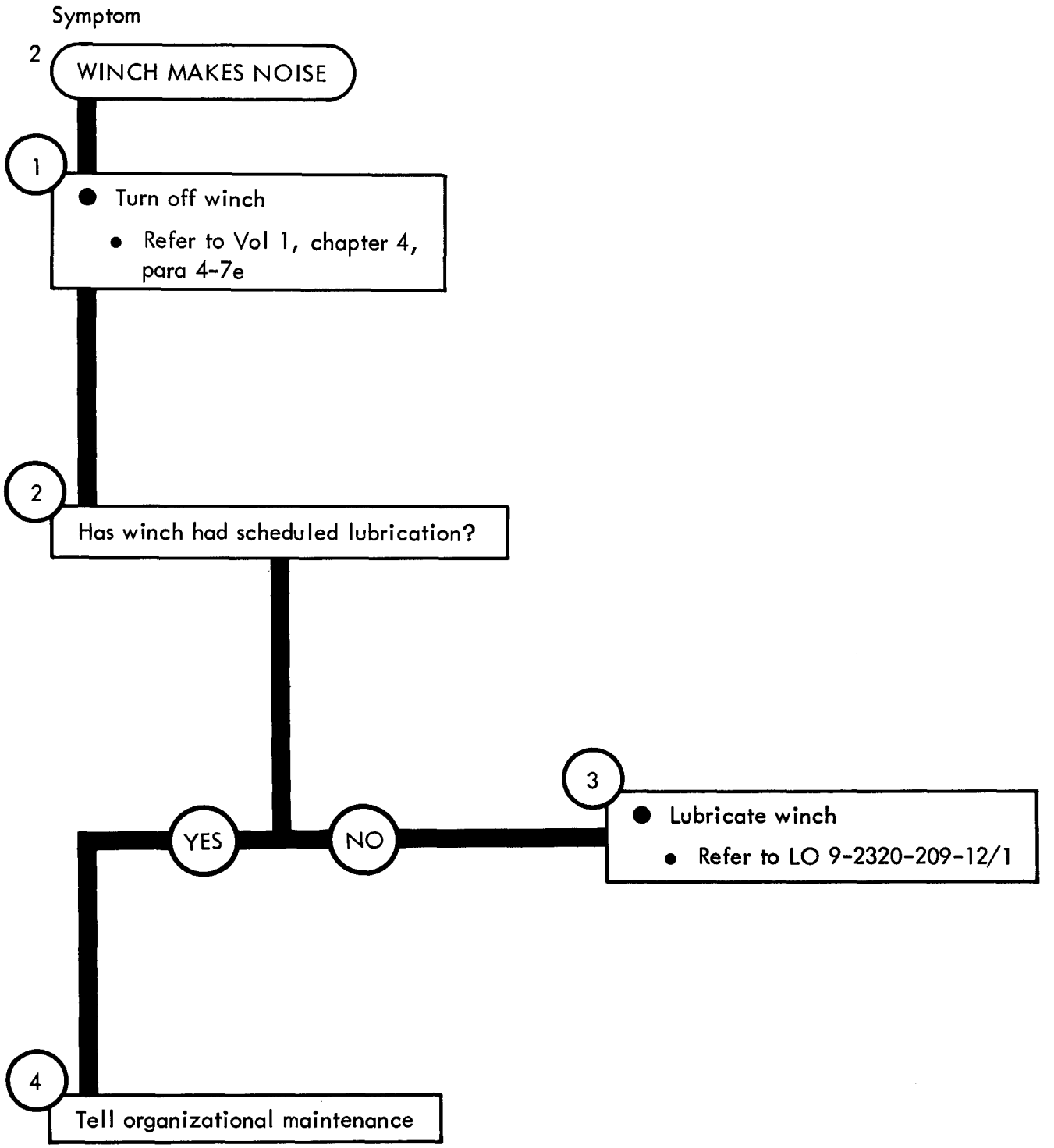
3
- Replace broken shear pin
  - Refer to Vol 4, chapter 2, para 2-10

4 Tell organizational maintenance

TA 113567



Figure 18-1



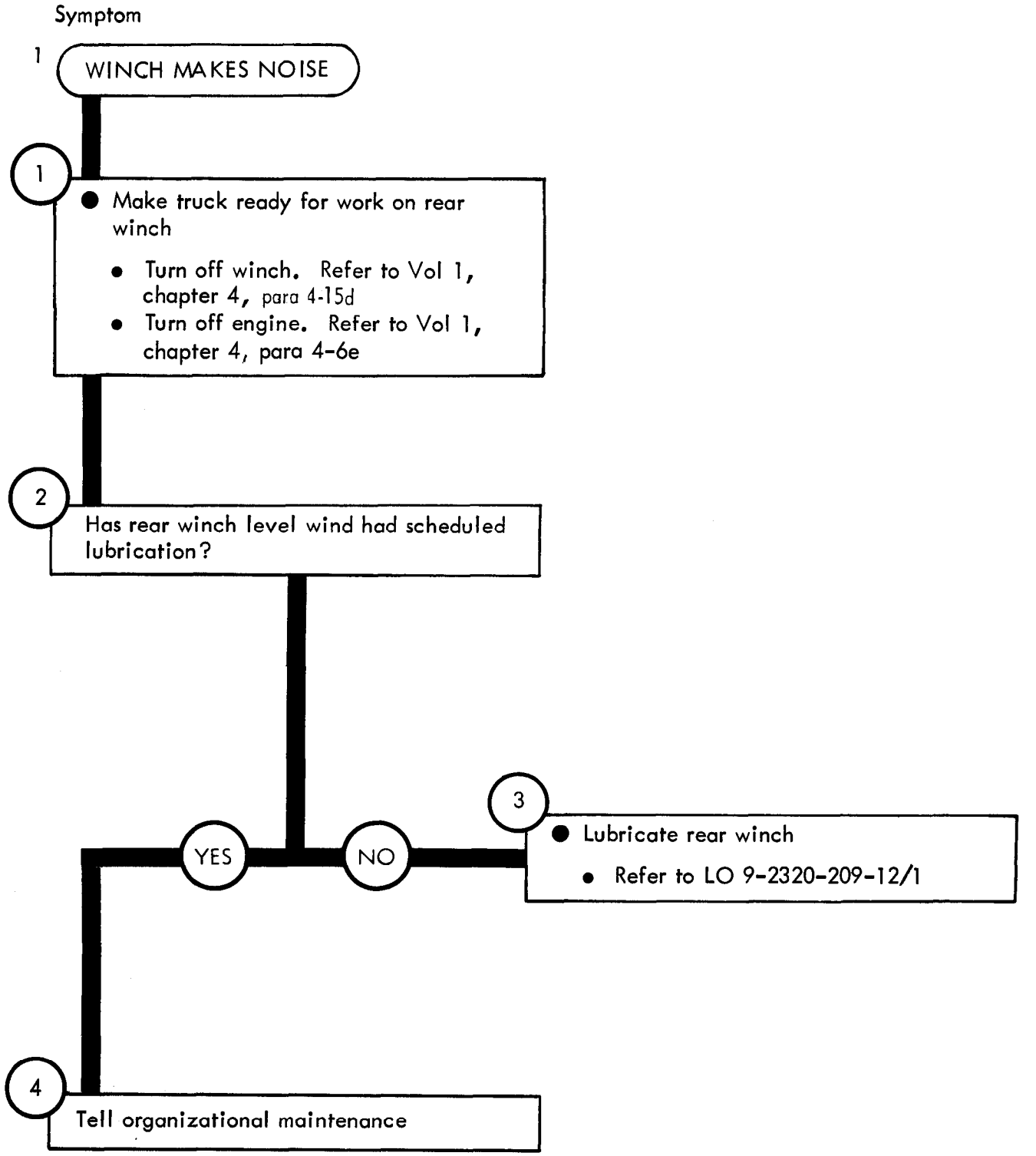

TA 113568

Figure 18-2

# CHAPTER 19
# REAR WINCH TROUBLESHOOTING PROCEDURES, TRUCK M764

19-1. GENERAL. Detailed troubleshooting procedures for the rear winch, truck M764 are given in this chapter.

19-2. PROCEDURES . These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.




TA 113569



Figure 19-1

Symptom

2 WINCH DOES NOT PULL LOAD

1
- Make truck ready for work on rear winch
  - Turn off winch. Refer to Vol 1, chapter 4, para 4-15d
  - Turn off engine. Refer to Vol 1, chapter 4, para 4-6e
  - Chock wheels

2
- Check shear pin
  - Look for a broken shear pin

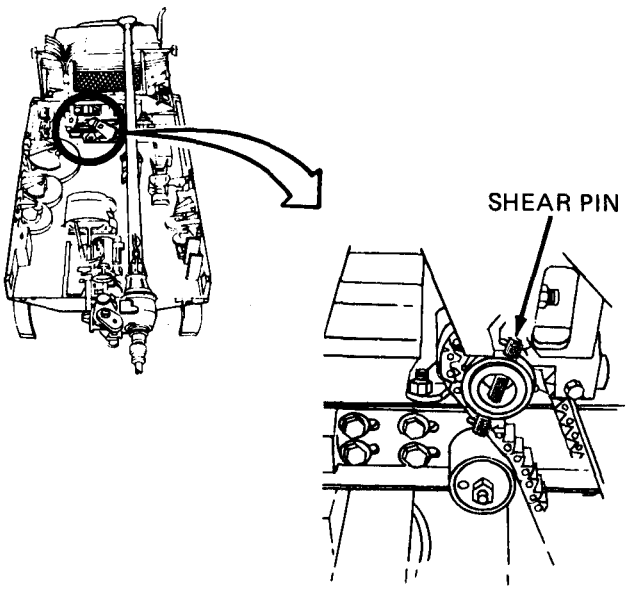
Is shear pin OK?

YES

NO

3
- Replace broken shear pin
  - Refer to Vol 4, chapter 2, para 2-12

4 Tell organizational maintenance




TA 113570

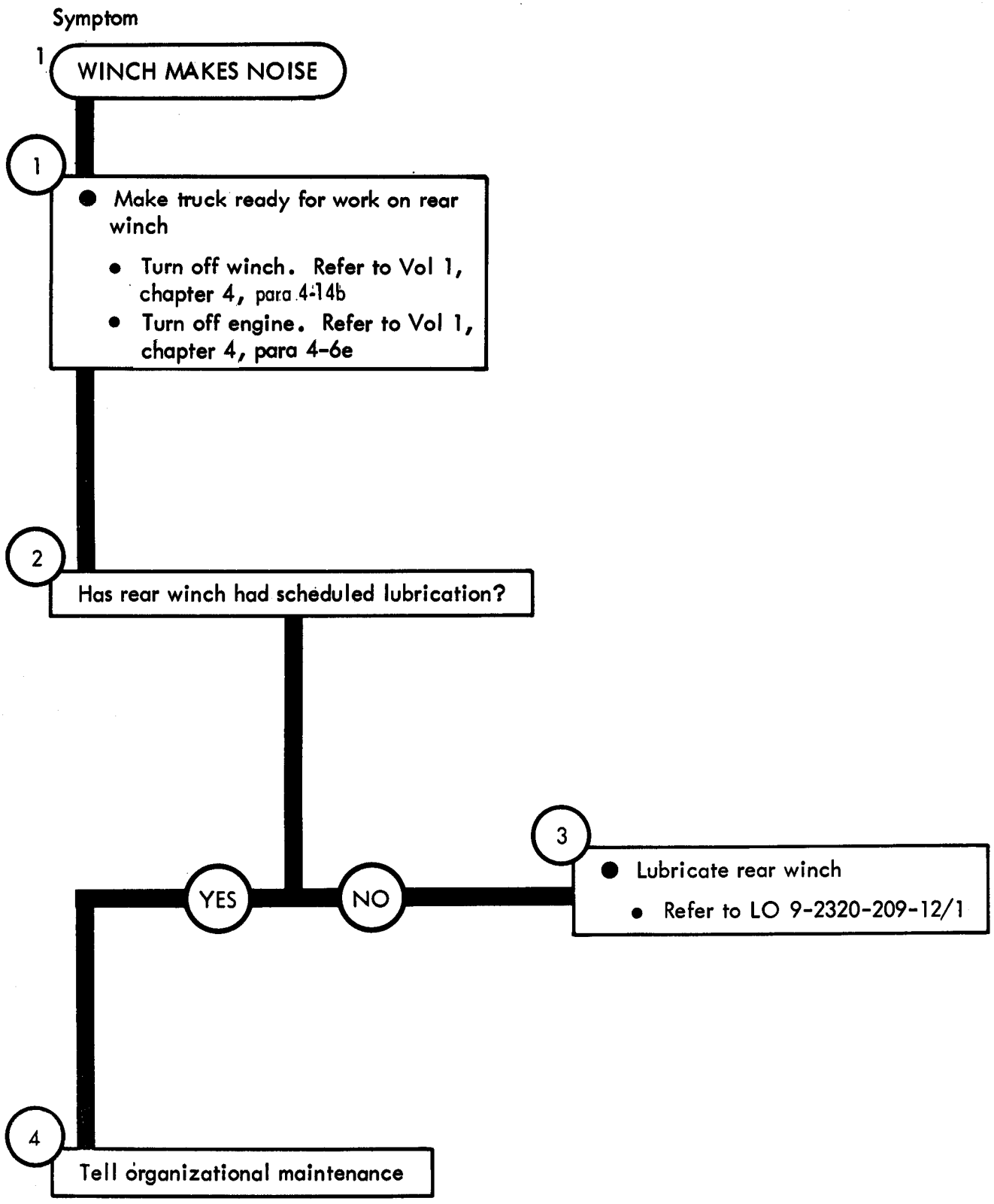
Figure 19-2

# CHAPTER 20
# REAR WINCH TROUBLESHOOTING PROCEDURES, TRUCK M756A2

20-1. GENERAL. Detailed troubleshooting procedures for the rear winch, truck M756A2 are given in this chapter.

20-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

REAR WINCH TROUBLESHOOTING, TRUCK M756A2




TA 113571



Figure 20-1

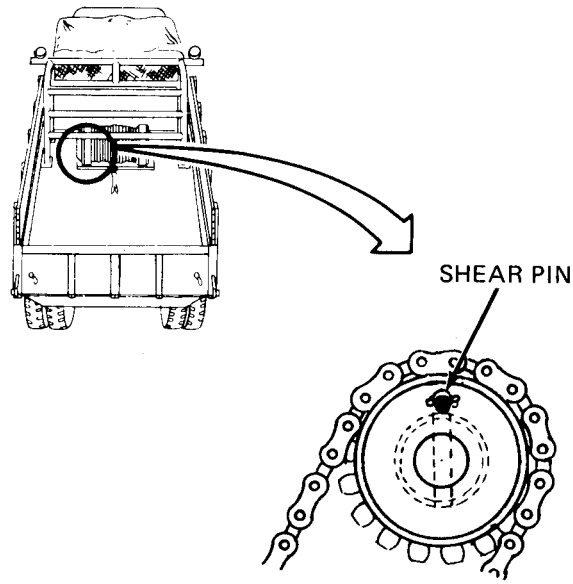
Symptom

2 WINCH DOES NOT PULL LOAD

1
- Make truck ready for work on winch
  - Turn off winch. Refer to Vol 1, chapter 4, para 4-14b
  - Turn off engine. Refer to Vol 1, chapter 4, para 4-6e
  - Chock wheels

2
- Check shear pin
  - Look for a broken shear pin

Is shear pin OK?




YES

NO

3
- Replace broken shear pin
  - Refer to Vol 4, chapter 2, para 2-11

4 Tell organizational maintenance

TA 113572

Figure 20-2

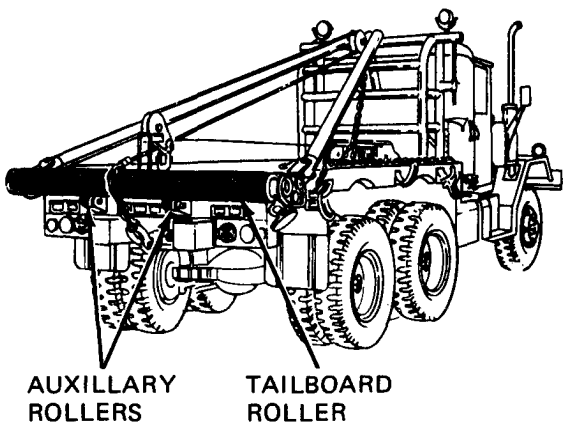
Symptom

3 TAILBOARD ROLLER BINDS, OR DOES NOT TURN

1
- Turn off winch
  - Refer to Vol 1, chapter 4, para 4-14b

2
- Check auxillary rollers
  - Look for anything stuck in rollers that can cause binding

Are auxillary rollers clear?




YES / NO

3 Clear blockage away from rollers

4 Have auxillary rollers had scheduled lubrication?

YES / NO

5
- Lubricate auxillary rollers
  - Refer to LO 9-2320-209-12/1

6 Tell organizational maintenance

TA 113573



Figure 20-3

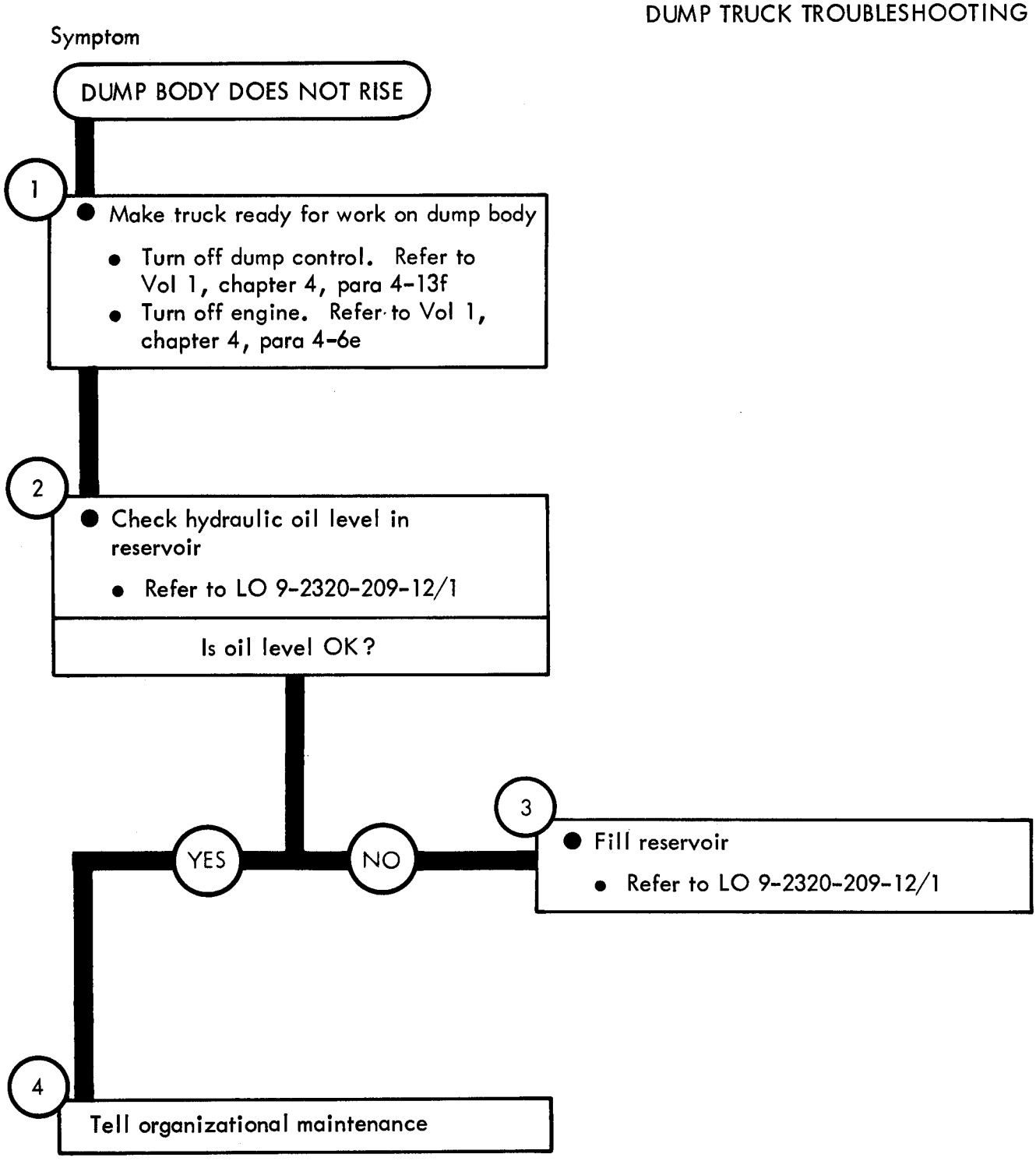
# CHAPTER 21

# DUMP TRUCK TROUBLESHOOTING PROCEDURES

21-1. GENERAL. Detailed troubleshooting procedures for the dump truck are given in this chapter.

21-2. PROCEDURES. These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

DUMP TRUCK TROUBLESHOOTING




TA 113574



Figure 21-1

# CHAPTER 22
# HOT WATER HEATER TROUBLESHOOTING PROCEDURES

22-1. GENERAL. Detailed troubleshooting procedures for the hot water heater are given in this chapter.

22-2. PROCEDURES . These troubleshooting procedures are used the same way as the sample troubleshooting procedure given in chapter 7.

HOT WATER HEATER TROUBLESHOOTING

Symptom

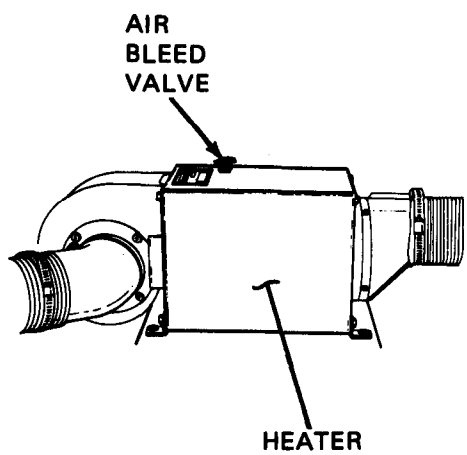
1 HEATER AND DEFROSTER DO NOT WORK RIGHT

1
- Park truck
- Refer to Vol 1, chapter 4, para 4-6e

2 Has heater been bled?

YES NO

3
- Bleed system
- Start engine. Refer to Vol 1, chapter 4, para 4-6b
- Open air bleed valve
- Leave air bleed valve open until all the air is out of the system
- Tighten air bleed valve
- Stop engine. Refer to Vol 1, chapter 4, para 4-6e




4 Tell organizational maintenance

TA 113575



Figure 22-1

By Order of the Secretaries of the Army and the Air Force:

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General, United States Army
Chief of Staff

Official:

J.C. PENNINGTON
Major General, United States Army
The Adjutant General

LEW ALLEN, JR., General, USAF
Chief of Staff

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|---|---|---|---|
| 6-4 | | | 6-6 |
| 9-3 | | 9-1 (Sheet 2 of 3) | |
| 8-6 | | 8-2 (Sheet 2 of 2) | |

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TS PROCEDURE DETAILED figure 15-1 should be figure 13-1.

Box ④, fourth step reads "... and see if coolant level is up to the top." Should be changed to read "... and see if coolant level is within two inches of top."

Box ⑤, "Tighten drain cocks until leak stops" should be changed to read "Hand tighten drain cocks until leak stops."

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER
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Jane Idone

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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 Kilo Meter = 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° Celsius
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 |
| Millimeters | 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 |