

TECHNICAL MANUAL  
VOLUME 1 OF 2  
TROUBLE SHOOTING  
DIRECT SUPPORT AND GENERAL SUPPORT LEVEL

5-TON, 6X6, M39 SERIES TRUCKS  
(MULTIFUEL)

TRUCK, CHASSIS: M40A2C,  
M61A2, M6A2; TRUCK, CARGO:  
M54A2, M54A2C, M55A2; TRUCK,  
DUMP: M51A2; TRUCK, TRACTOR:  
M52A2; TRUCK, WRECKER, MEDIUM: 543a2

**NOTE:**

THE STYLE OF THIS TM IS  
EXPERIMENTAL. IT IS BEING TRIED  
BY THE ARMY ONLY ON  
A LIMITED BASIS

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 symptoms. 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.

Dry cleaning solvent is flammable. Do not use near an open flame. Keep a fire extinguisher nearby when solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and damage to equipment.

Eye shields must be worn when using compressed air. Eye injury can occur if eye shields are not used.

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.

Fuel coming out of an injector nozzle under pressure can go through the skin. This can cause blood poisoning. Keep hands away from injector nozzle when doing the next step.

# TM 9-2320-211-34-1 T.O. 36A12-1C-422-2-1

TECHNICAL MANUAL  
NO. 9-2320-211-34-1  
TECHNICAL ORDER  
NO. 36A12-1C-422-2-1

DEPARTMENTS OF THE ARMY  
AND  
THE AIR FORCE  
WASHINGTON, DC, 25 February 1981

## TECHNICAL MANUAL VOLUME 1 OF 2 TROUBLESHOOTING

DIRECT SUPPORT AND GENERAL SUPPORT LEVEL

### 5-TON, 6X6, M39 SERIES TRUCKS (MULTIFUEL)

	Model	NSN without Winch	NSN with Winch
Truck, Chassis	M40A2C	2329-00-969-4114	
	M61A2	2320-00-055-9264	2320-00-965-0321
	M63A2	2320-00-226-6251	2320-00-285-3757
Truck, Cargo	M54A2	2320-00-055-9266	2320-00-055-9265
	M54A2C	2320-00-926-0874	2320-00-926-0874
	M55A2	2320-00-073-8476	2320-00-055-9259
Truck, Dump	M51A2	2320-00-055-9262	2320-00-055-9263
Truck, Tractor	M52A2	2320-00-055-9260	2320-00-055-9261
Truck, Wrecker, Medium	M543A2		2320-00-055-9258

Current as of 25 Jul 80.

\*This manual together with TM 9-2320-211-34-2-1, 25 February 1981; TM 9-2320 -21-34 -2-2, 25 February 1981; TM 9-2320-211-34-2-3, 25 February 1981 and TM 9-2320-211-34-2-4, 25 February 1981 supersedes so much of TM 9-2320-211-35, 13 September 1964 as pertains to multifuel vehicles including all changes.

**REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS**

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

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# CHAPTER 1

## GENERAL INFORMATION

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1-1. SCOPE. This volume shows you how to do troubleshooting at the direct support 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.

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. TEST EQUIPMENT PROCEDURES INDEX. The test equipment procedures index, and instructions on how to use it are in chapter 4. This index tells you where to find electrical and mechanical tests which you can use to do your troubleshooting. It also tells you what equipment you will need to do the tests. If you have a STE/ICE (Simplified Test Equipment/Internal Combustion Engine) Set (NSN 4910-00-124-2554), you may use it, where applicable, to do your troubleshooting. Refer to TM 9-4910-571-12 & P.

2-4. TROUBLESHOOTING ROAD MAPS. 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.

2-5. 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.

2-6. SAMPLE TROUBLESHOOTING PROCEDURE. A sample troubleshooting procedure is in chapter 7. This sample procedure will help you see the way detailed troubleshooting procedures are to be used.



## CHAPTER 3

# TROUBLESHOOTING INDEX

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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 (figure 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 direct support 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. This column tells you where to find the summary troubleshooting procedure for each listed system. Some systems do not have summary troubleshooting procedures, so the column will be left blank for those systems.

e. System Support Diagrams Column. This column tells you where to find support diagrams for each listed system. Some systems do not have support diagrams, so the column will be left blank for those systems.

	SYSTEM	TROUBLE-SHOOTING ROADMAPS	FAULT SYMPTOM INDEXES	SUMMARY TROUBLE-SHOOTING PROCEDURES	SYSTEM SUPPORT DIAGRAMS
1	ENGINE	Figure 5-1	Table 6-1		
2	FUEL	Figure 5-2	Table 6-2		Figure 11-1
3	COOLING	Figure 5-3	Table 6-3		
4	ELECTRICAL	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	STEERING	Figure 5-7	Table 6-7		
8	FRONT WINCH	Figure 5-8	Table 6-8		
9	REAR WINCH	Figure 5-9	Table 6-9		
10	M543A2 WRECKER	Figure 5-10	Table 6-10		
11	DEEP WATER FORDING	Figure 5-11	Table 6-11		

Figure 3-1. Troubleshooting Index

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## CHAPTER 4

### TEST EQUIPMENT PROCEDURES INDEX

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4-1. GENERAL. This chapter has a test equipment procedures index which tells you where to find the tests you need to do your troubleshooting.

4-2. INDEX. The test equipment procedures index is divided into three columns that list test equipment, tests, and figure numbers. The following breakdown tells you what is in each column.

a. Test Equipment Column. This column tells you what kind of equipment you need to do your troubleshooting tests.

b. Tests Column. This column tells you what tests are given in this manual. Next to each piece of test equipment are listed the tests that you can do with that equipment. This column also gives troubleshooting tests which can be done without using test equipment.

c. Figure Column. This column tells you where you can find the tests in this manual.

TEST EQUIPMENT		TESTS	FIGURE
1	COMPRESSION TESTER GAGE	Engine Cylinder Compression	9-1
2	MULTIMETER AN/URM-105C	Refer to TM 9-2320-211-20	
3	DIAL INDICATOR GAGE	Steering Knuckle End Play	17-1
4	OIL PRESSURE TEST SET	Power Steering Pump Pressure	19-1
		Power Cylinder Pressure	19-1
5	PRESSURE GAGE	Swing Motor Swivel valve pressure	23-1
6		Fuel Injector Nozzle	12-1
7			
8			

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Figure 4-1. Test Equipment Procedures Index



## CHAPTER 5

# TROUBLESHOOTING ROADMAPS

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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 5-11 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.

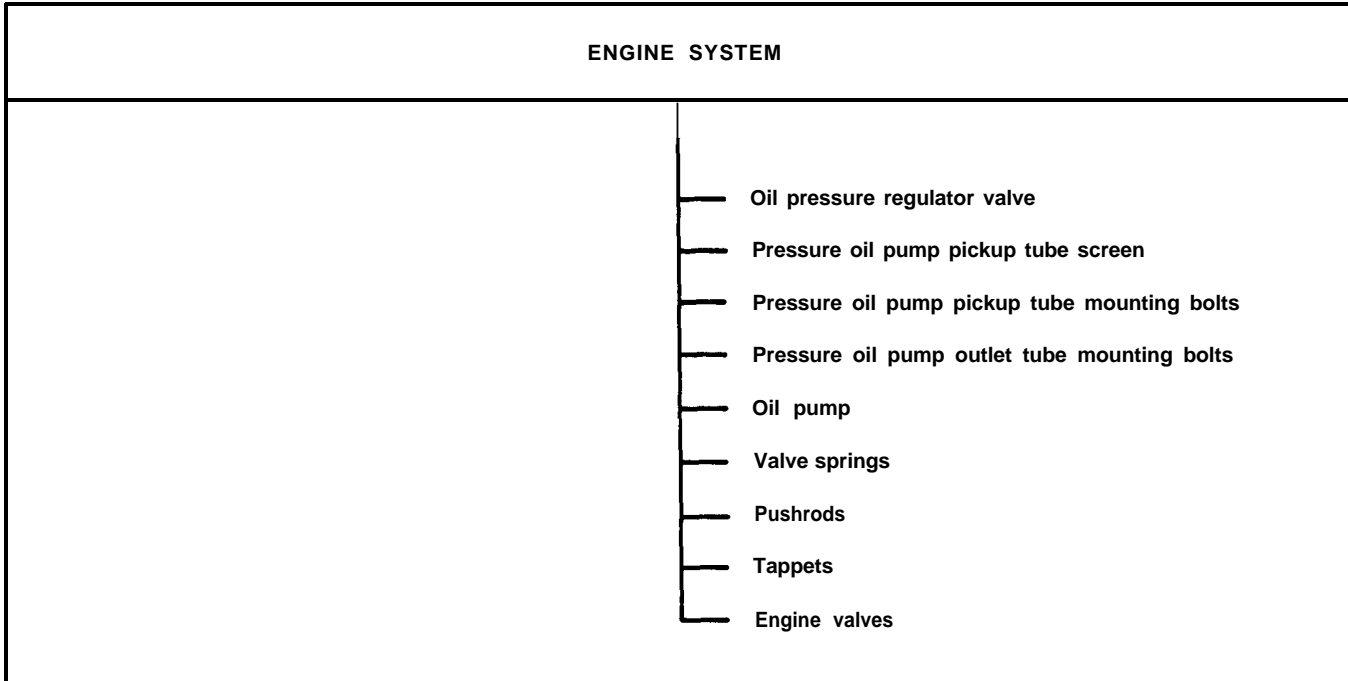


Figure 5-1. Troubleshooting Roadmap, Engine System

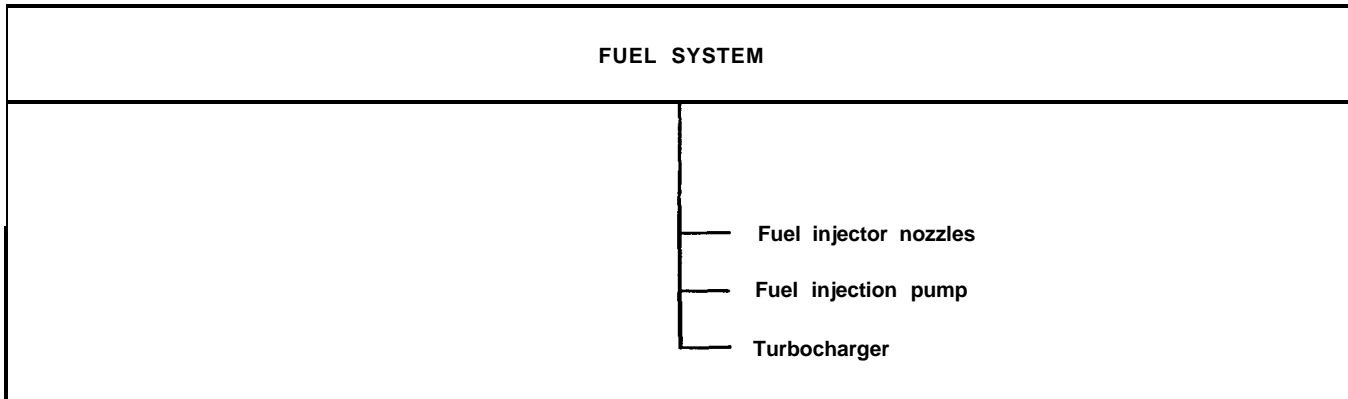
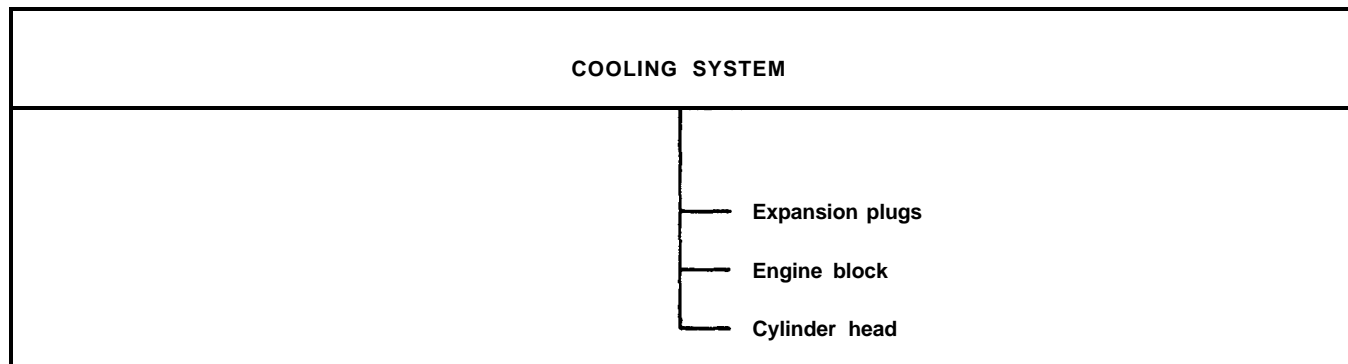
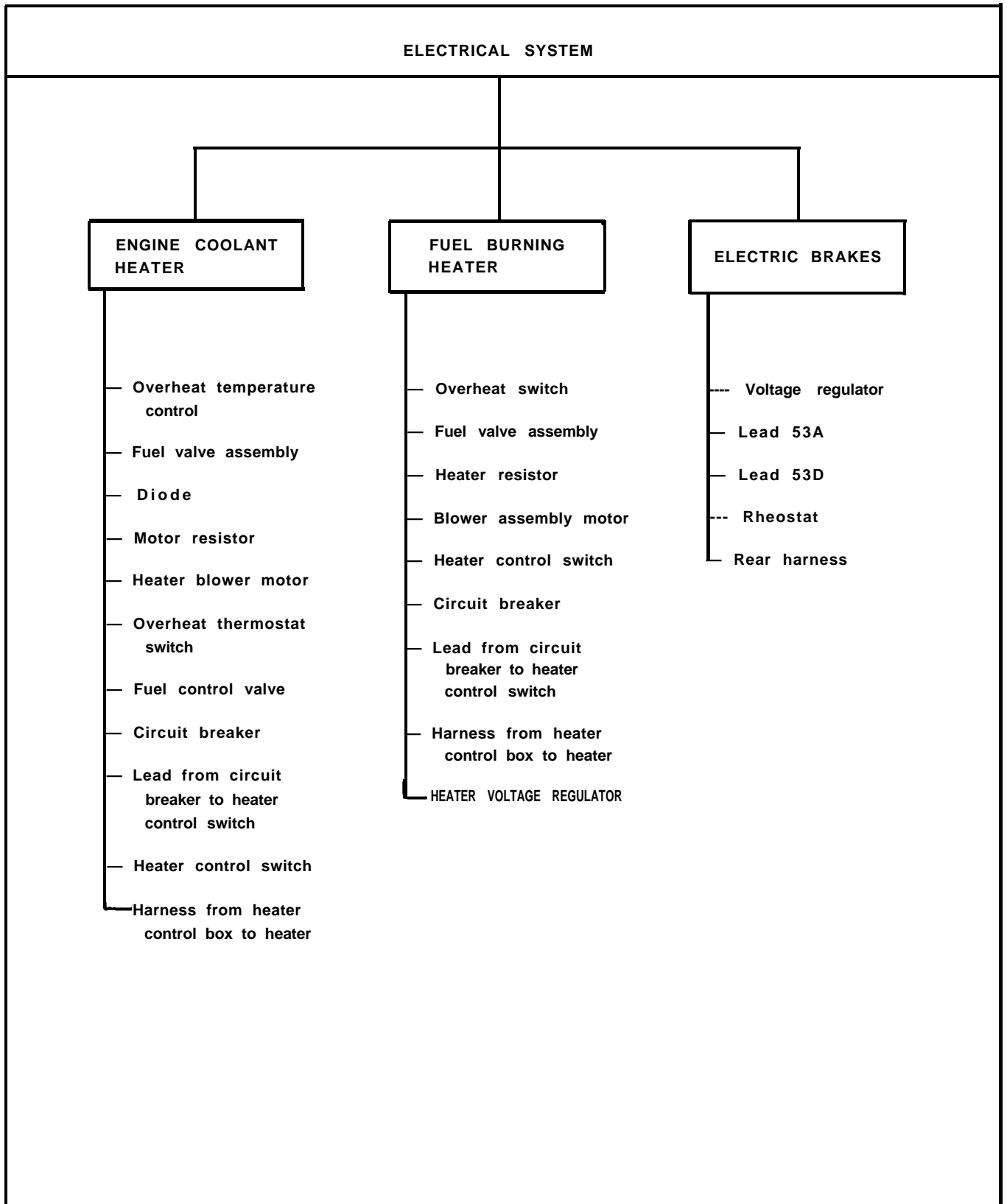


Figure 5-2. Troubleshooting Roadmap, Fuel System



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Figure 5-3. Troubleshooting Roadmap, Cooling System



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Figure 5-4. Troubleshooting Roadmap, Electrical System

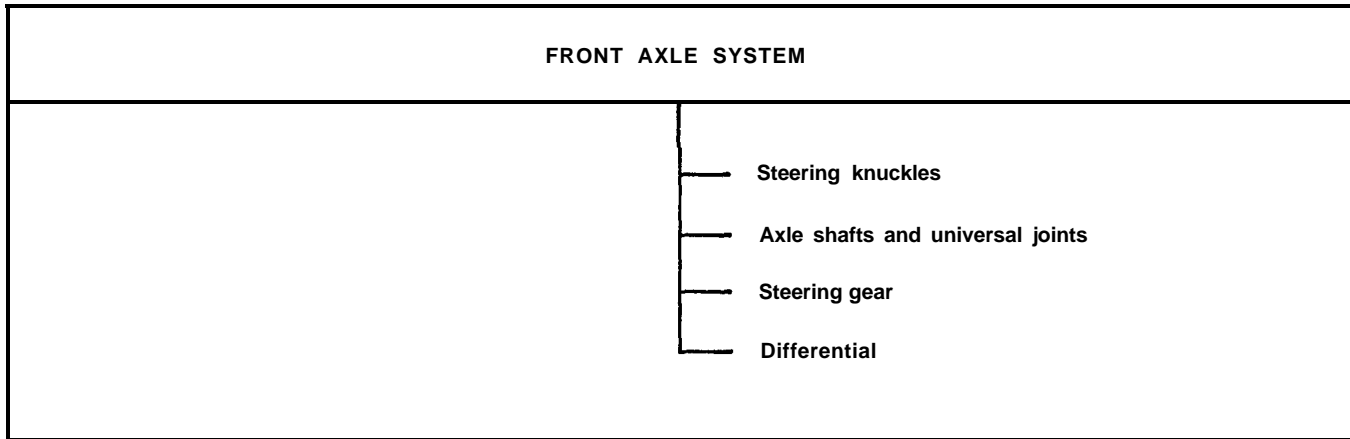


Figure 5-5. Troubleshooting Roadmap, Front Axle System

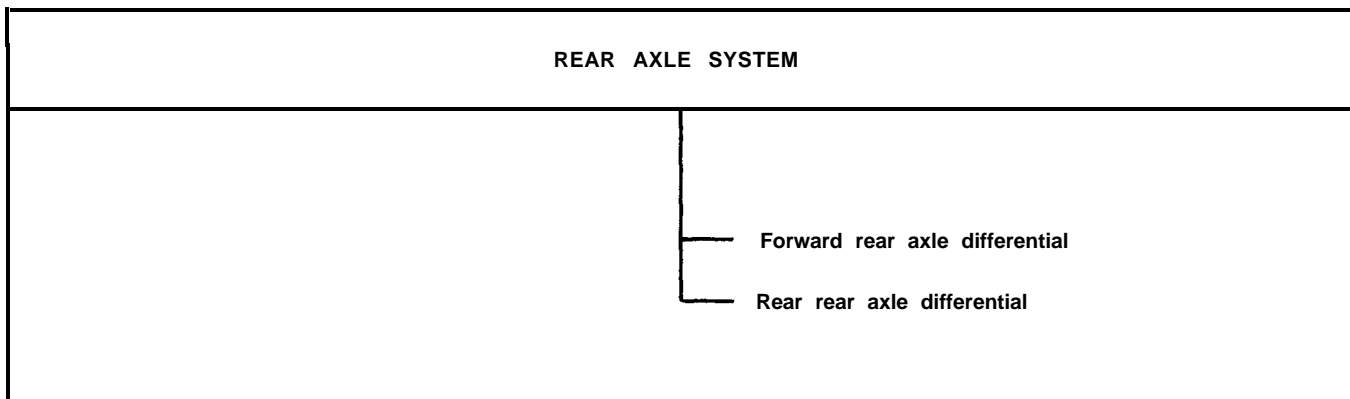
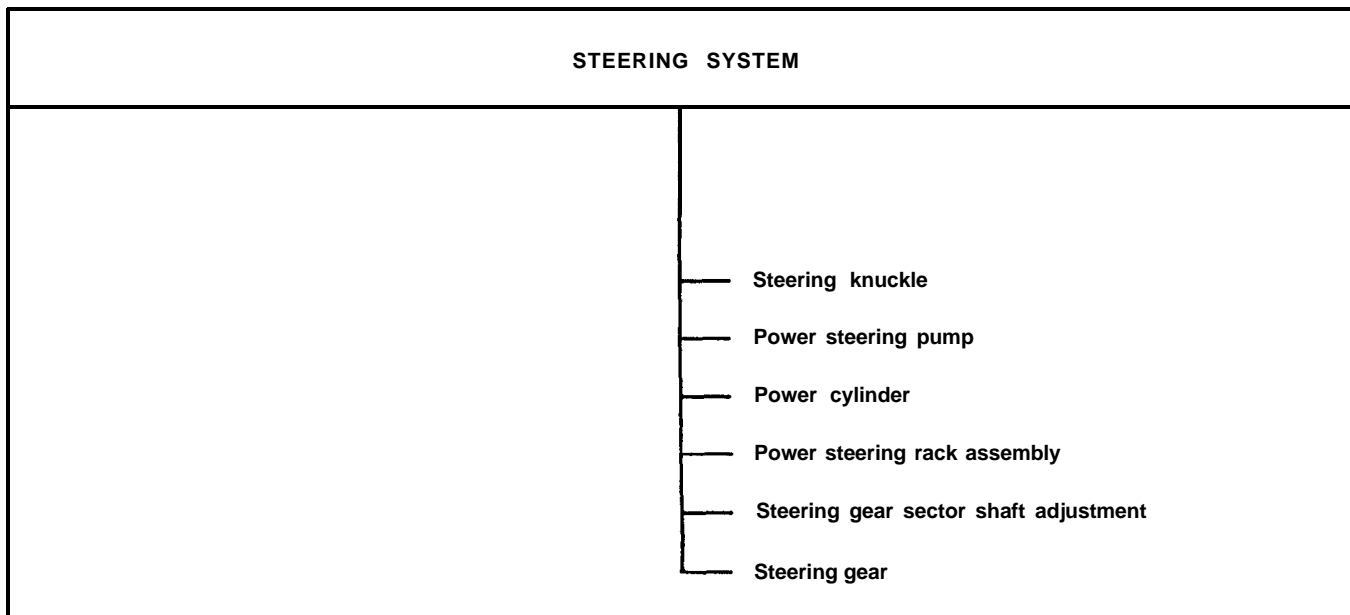


Figure 5-6. Troubleshooting Roadmap, Rear Axle System



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Figure 5-7. Troubleshooting Roadmap, Steering System

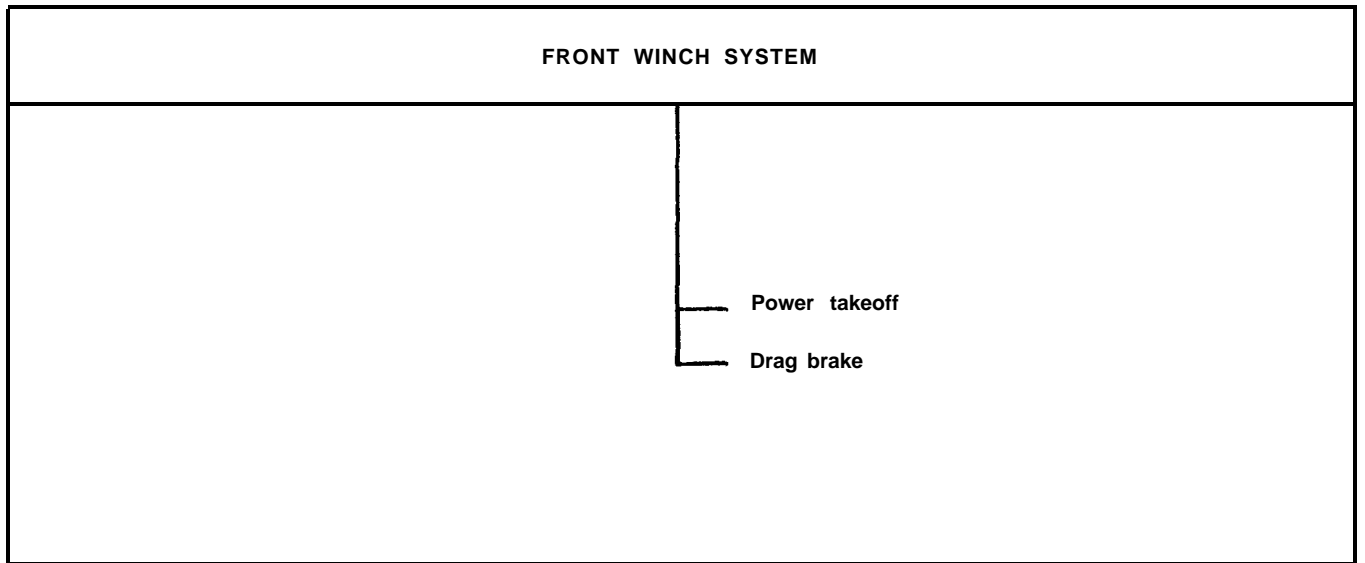
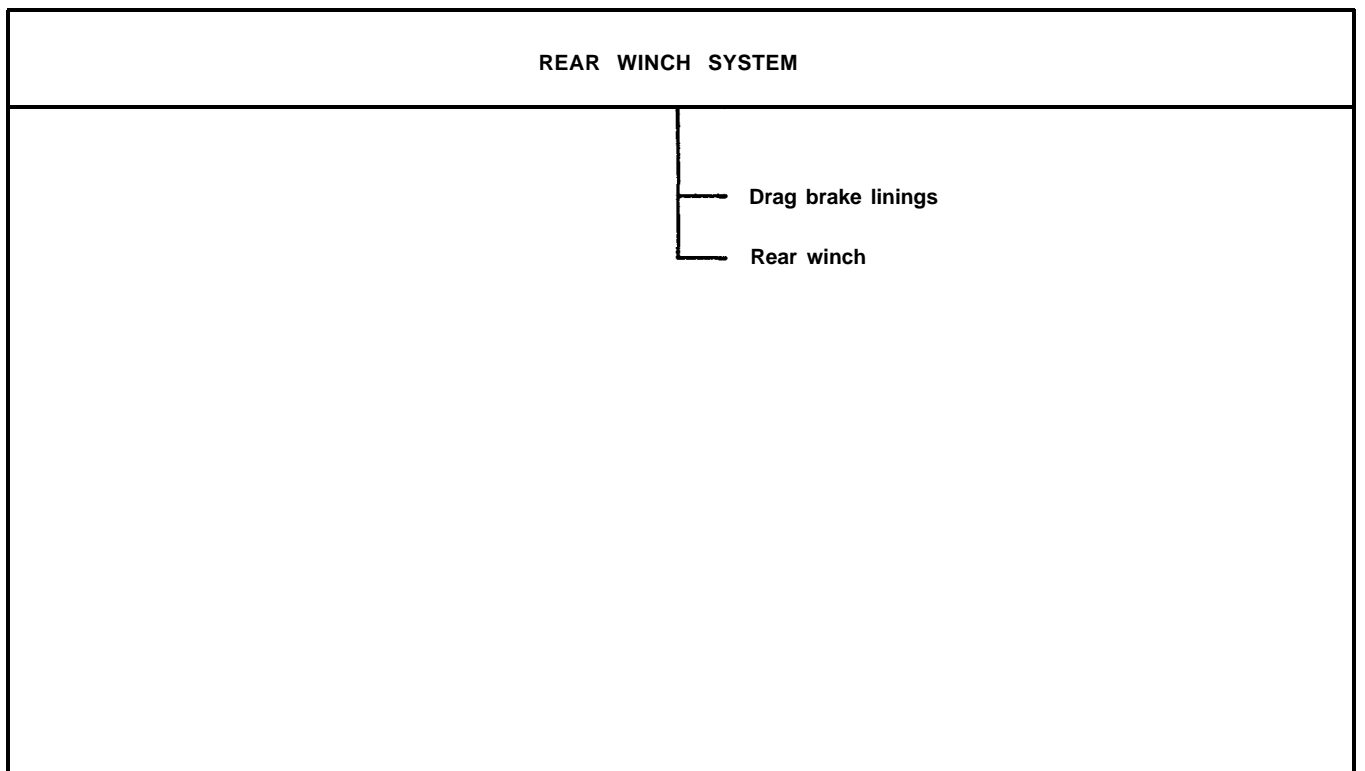


Figure 5-8. Troubleshooting Roadmap, Front Winch System



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Figure 5-9. Troubleshooting Roadmap, Rear Winch System

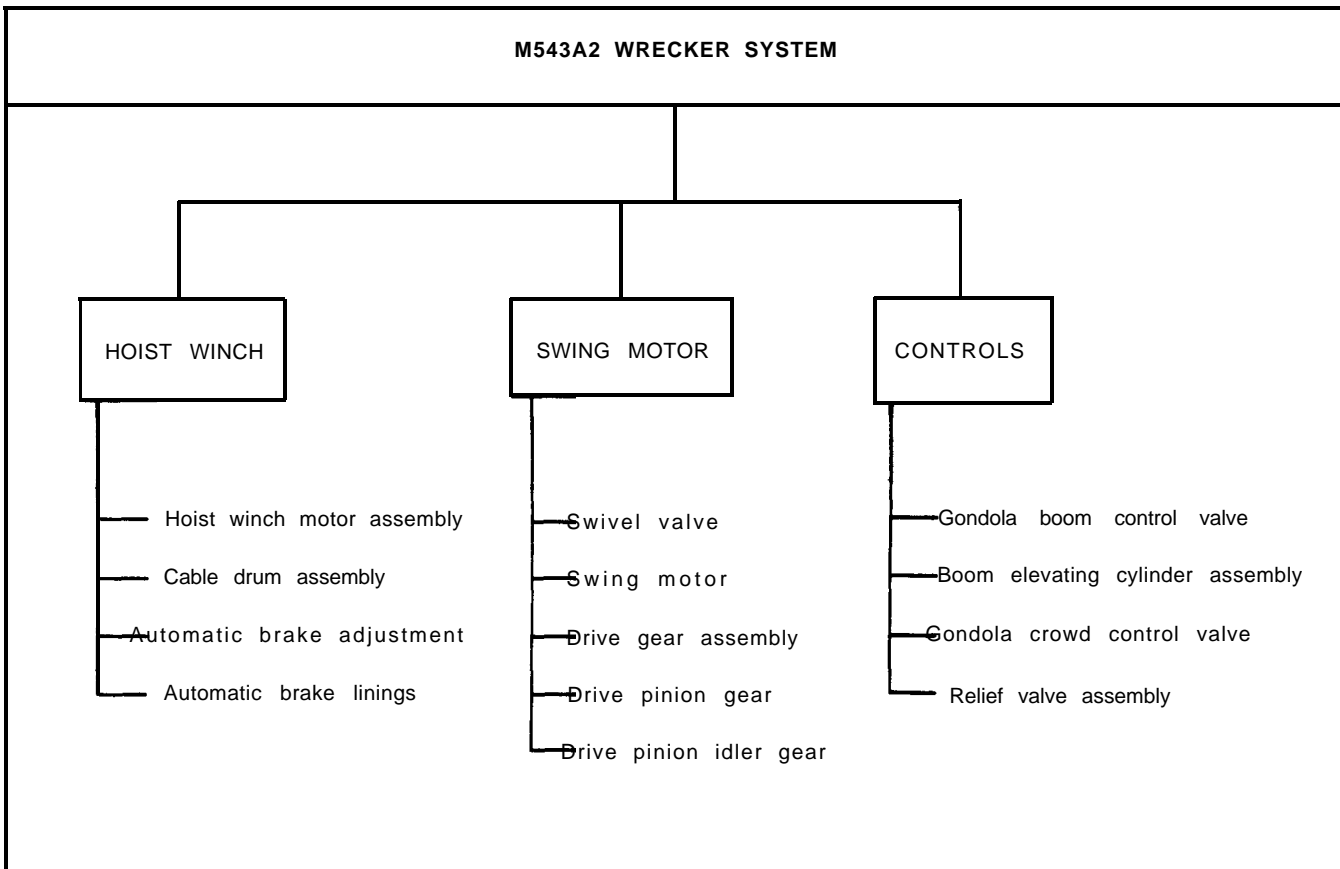
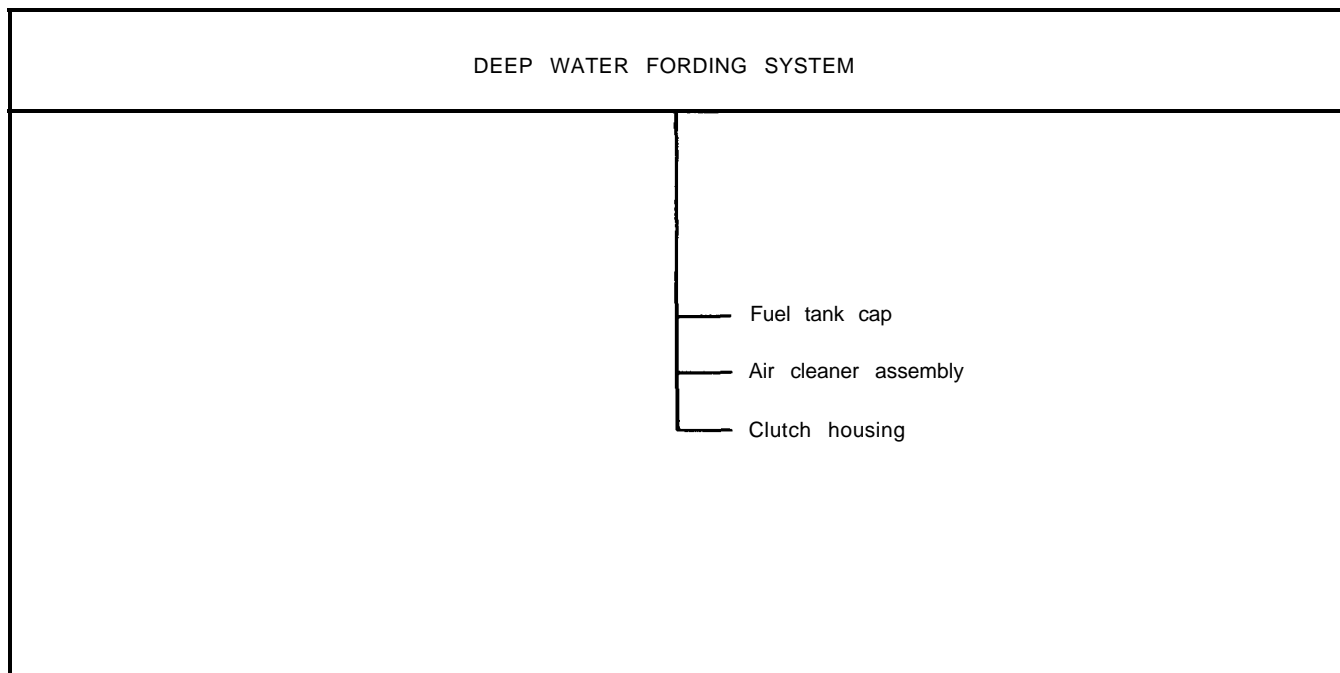


Figure 5-10. Troubleshooting Roadmap, M543A2 Wrecker System



TA 120901

Figure 5-11. Troubleshooting Roadmap, Deep Water Fording System

## CHAPTER 6

### FAULT SYMPTOM INDEXES

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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 6-11) 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. This column tells you where to find the summary troubleshooting procedures for each symptom.
- 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.

FAULT SYMPTOM INDEX

TABLE 6-1. ENGINE SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Low oil pressure	—	Figure 8-1	1	—	•		
—	2. Engine runs rough	—	Figure 8-2	1	Checking cylinder compression gage assembly	•		
—	3. Hard starting	—	Figure 8-3	1	Checking cylinder compression gage assembly	•		

FAULT SYMPTOM INDEX

TABLE 6-2. FUEL SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Engine cranks but does not start	—	Figure 10-1	2	—	•		
—	2. Engine runs rough and lacks power	—	Figure 10-2	1	—	•		
—	3. Poor fuel mileage	—	Figure 10-3	1	—	•		

TA 120902



FAULT SYMPTOM INDEX

TABLE 6-3. COOLING SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT			
					SPECIAL TOOLS	STANDARD TOOLS	MATERIALS	TIME
—	1. Engine temperature gage reads above 195° F while running	—	Figure 13-1	1	—	•		

FAULT SYMPTOM INDEX

TABLE 6-4. ELECTRICAL SYSTEM									
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D					
		SUMMARY	DETAILED		TEST EQUIPMENT			MATERIALS	TIME
					MULTIMETER	HYDROMETER	STANDARD TOOLS		
ENGINE COOLANT HEATER	1. Engine coolant heater overheats and continues burning		Figure 14-1		•		•		
	2. Engine coolant heater does not give off enough heat	—	Figure 14-2		•		•		
	3. Engine coolant heater does not start	—	Figure 14-3		•		•		
FUEL BURNING HEATER	4. Fuel burning heater overheats and continues burning	—	Figure 14-4		•		•		
	5. Fuel burning heater does not give off enough heat	—	Figure 14-5		•				
	6. Fuel burning heater does not start	—	Figure 14-6		•		•		
ELECTRIC BRAKES	7. When hydraulic brakes are applied, towed load does not have enough braking action	—	Figure 14-7		•				

FAULT SYMPTOM INDEX

TABLE 6-5. FRONT AXLE SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Front axle makes noise	—	Figure 16-1	1	Dial indicator	•		
—	2. Shimmy	—	Figure 16-2	1	Dial indicator	•		

FAULT SYMPTOM INDEX

TABLE 6-6. REAR AXLE SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Rear axle makes noise	—	Figure 18-1	1	—	•		
—	2. Too much backlash when driving	—	Figure 18-2	1	—	•		

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TABLE 6-7. STEERING SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Hard steering	—	Figure 19-1	2	Power steering oil pressure test set		•	
—	2. Shimmy	—	Figure 19-2	1	—		•	

TABLE 6-8. FRONT WINCH SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Winch does not pull load	—	Figure 20-1	1	—	•		
—	2. Winch does not hold load	—	Figure 20-2	1	—	•		
—	3. Winch drum spins too fast when unwinding cable	—	Figure 20-3	1	—	•		

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TABLE 6-9. REAR WINCH SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
—	1. Winch does not hold load	—	Figure 21-1	1	—	•		

FAULT SYMPTOM INDEX

TABLE 6-10. M543A2 WRECKER SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT			TIME
					SPECIAL TOOLS	STANDARD TOOLS	MATERIALS	
HOIST WINCH	1. Hoist winch does not pull load	—	Figure 22-1	1	—	•		
	2. Hoist winch pulls load slowly	—	Figure 22-2	1	—	•		
	3. Hoist winch does not hold load	—	Figure 22-3	1	—	•		
	4. Jerky operation as hoist winch pulls load	—	Figure 22-4	1	—	•		
SWING MOTOR	5. Crane does not swing	—	Figure 22-5	2	Pressure gage	•		
	6. Crane swings slowly	—	Figure 22-6	2	Pressure gage	•		
	7. Jerky operation as crane swings	—	Figure 22-7	2	Pressure gage	•		
CONTROLS	8. Boom comes down too fast	—	Figure 22-8	1	—	•		
	9. Boom does not extend or extends and retracts slowly	—	Figure 22-9	1	—	•		
	10. Jerky operation as boom extends or retracts	—	Figure 22-10	1	—	•		

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FAULT SYMPTOM INDEX

TABLE 6-11. DEEP WATER FORDING SYSTEM								
SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
		SUMMARY	DETAILED	PERSONS	TEST EQUIPMENT		MATERIALS	TIME
					SPECIAL TOOLS	STANDARD TOOLS		
	1. Engine stalls while fording		Figure 24-1	1		•		
	2. Clutch slips after leaving water		Figure 24-2	1		•		

TA 120908

## CHAPTER 7

# SAMPLE TROUBLESHOOTING PROCEDURES

---

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

7-2. SAMPLE DETAILED PROCEDURE. (See figure 7-1.) The sample detailed procedure given is the fuel system troubleshooting procedure for the symptom, STARTER MOTOR WILL NOT CRANK ENGINE. 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 to the "how-to-do-it" instructions.

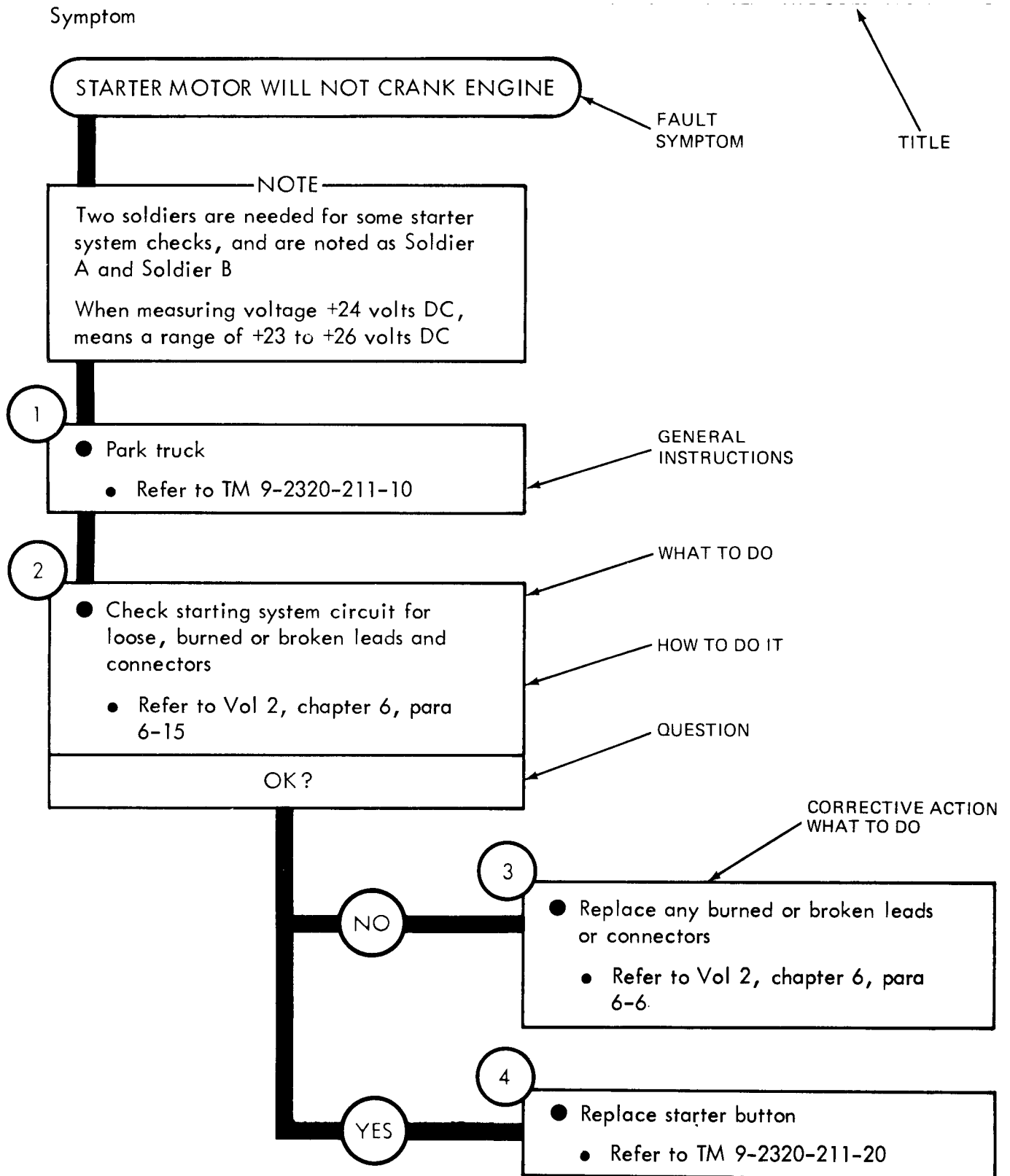
a. Box number 1 gives general instructions on getting the truck ready before you start to troubleshoot.

b. Box number 2 gives fault isolation test instructions. In this case you are told to check starting system circuit for loose, burned, or broken leads and connections. These tests or checks, are often referred to in detailed troubleshooting procedures to help you find the problem and fix it. After you do the tests or checks you read the question at the bottom of box number 2. If the starter system is not okay, 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 burned or broken leads or connectors. The corrective action is what you do to fix the fault, which is to replace any burned or broken leads or connectors. If the engine still doesn't start after you do this, it could mean that there are other faults in the system. 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 4 is an example of this.

STARTER SYSTEM TROUBLESHOOTING



TA 120799

Figure 7-1. Sample Troubleshooting Procedure



## CHAPTER 8

# ENGINE SYSTEM TROUBLESHOOTING

---

8-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Engine System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

8-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

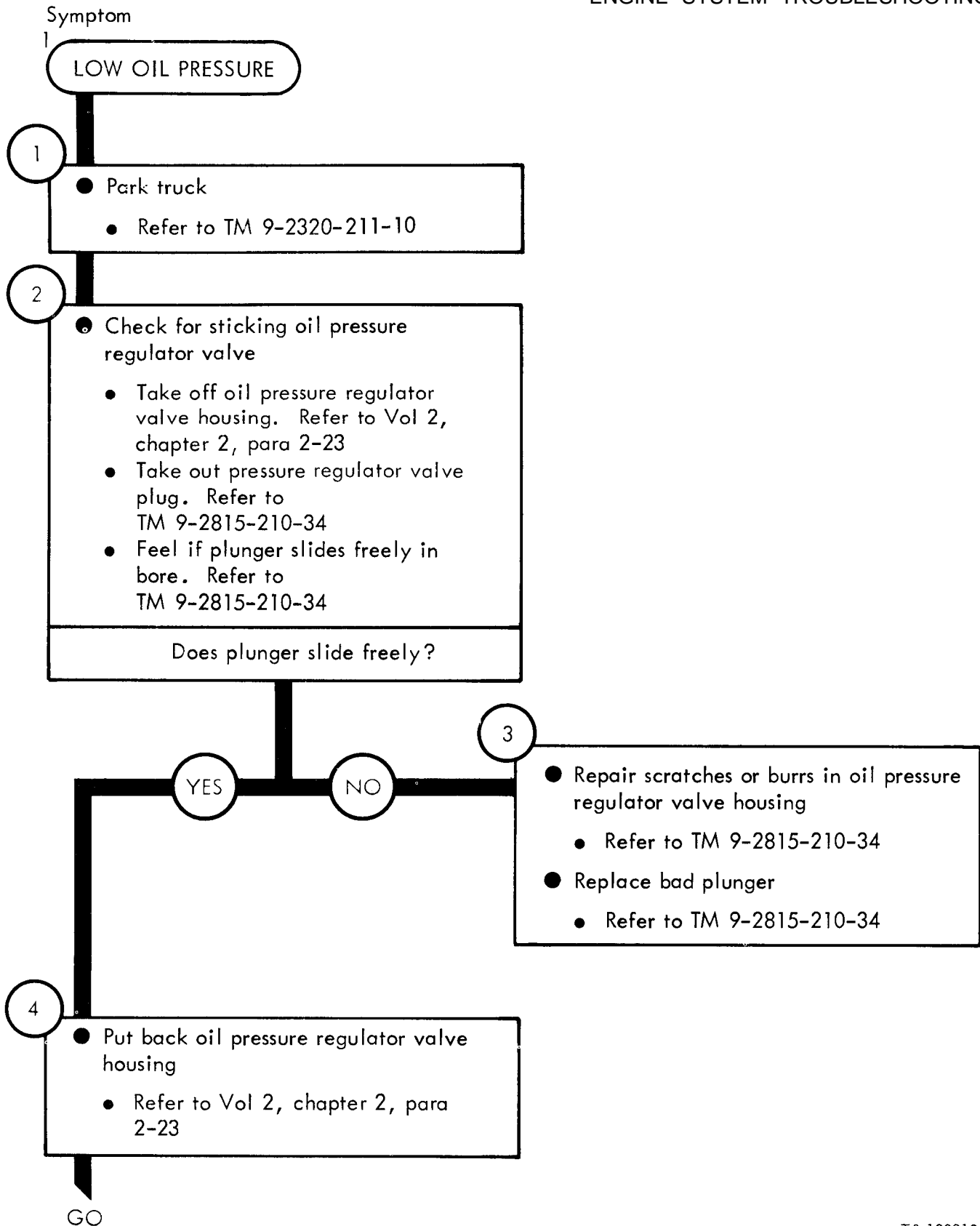
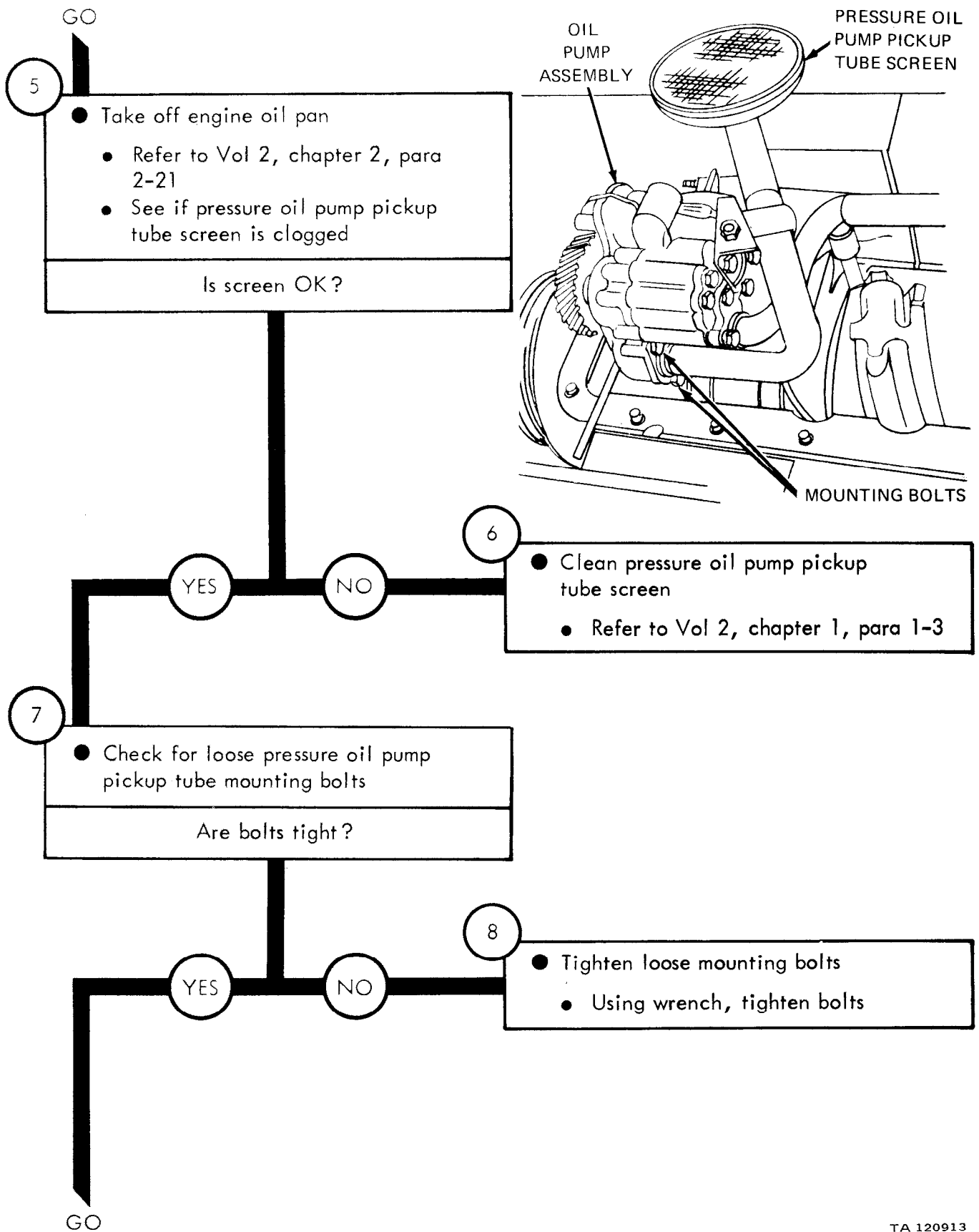


Figure 8-1 (Sheet 1 of 4)



TA 120913

Figure 8-1 (Sheet 2 of 4)

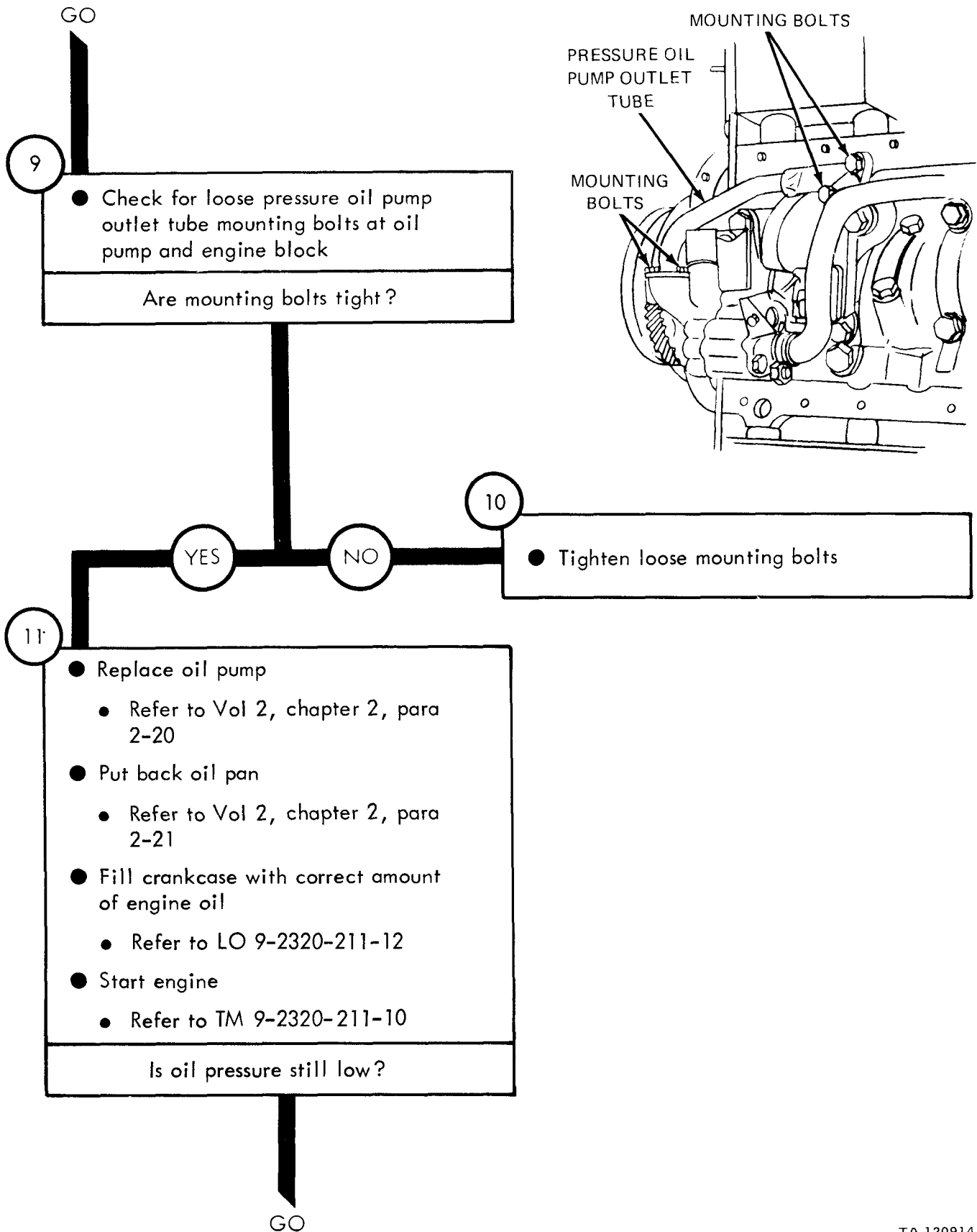


Figure 8-1 (Sheet 3 of 4)

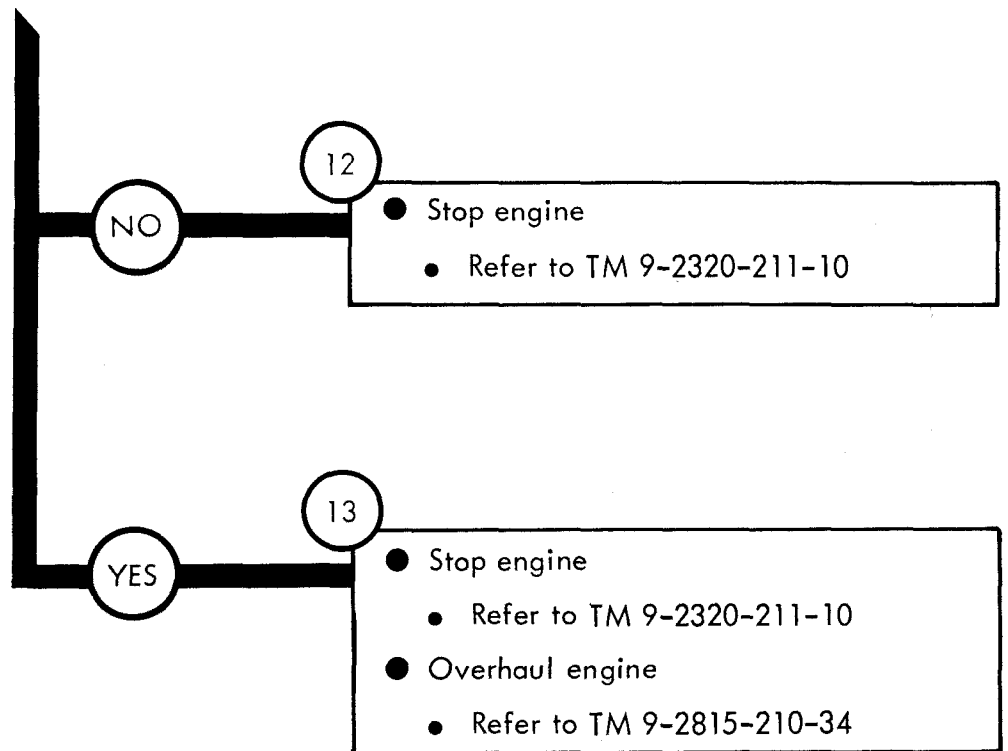


Figure 8-1 (Sheet 4 of 4)

Symptom

2 ENGINE RUNS ROUGH

1

- Park truck
- Refer to TM 9-2320-211-10

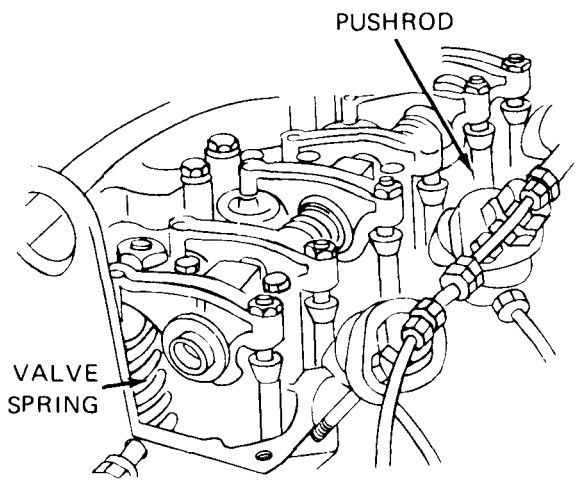
2

- Take off engine cylinder head rocker covers
- Refer to TM 9-2320-211-10

3

- Check valve springs and pushrods
- Look for broken valve springs
- Look for bent pushrods

Are valve springs and pushrods OK?



YES

NO

4

- Replace broken valve springs
- Refer to TM 9-2815-210-34
- Replace bent push rods
- Refer to Vol 2, chapter 2, para 2-14

Figure 8-2 (Sheet 1 of 2)

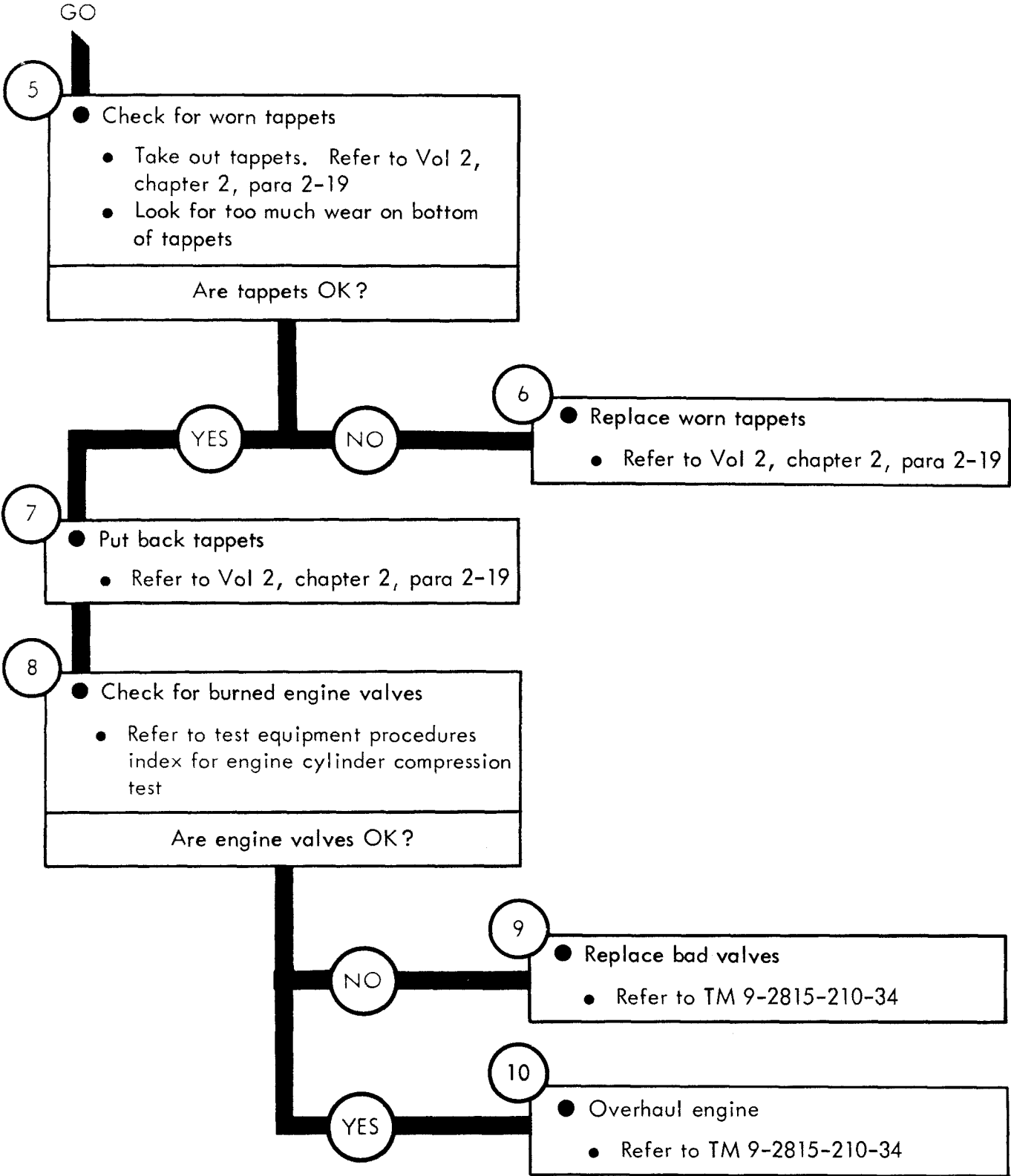
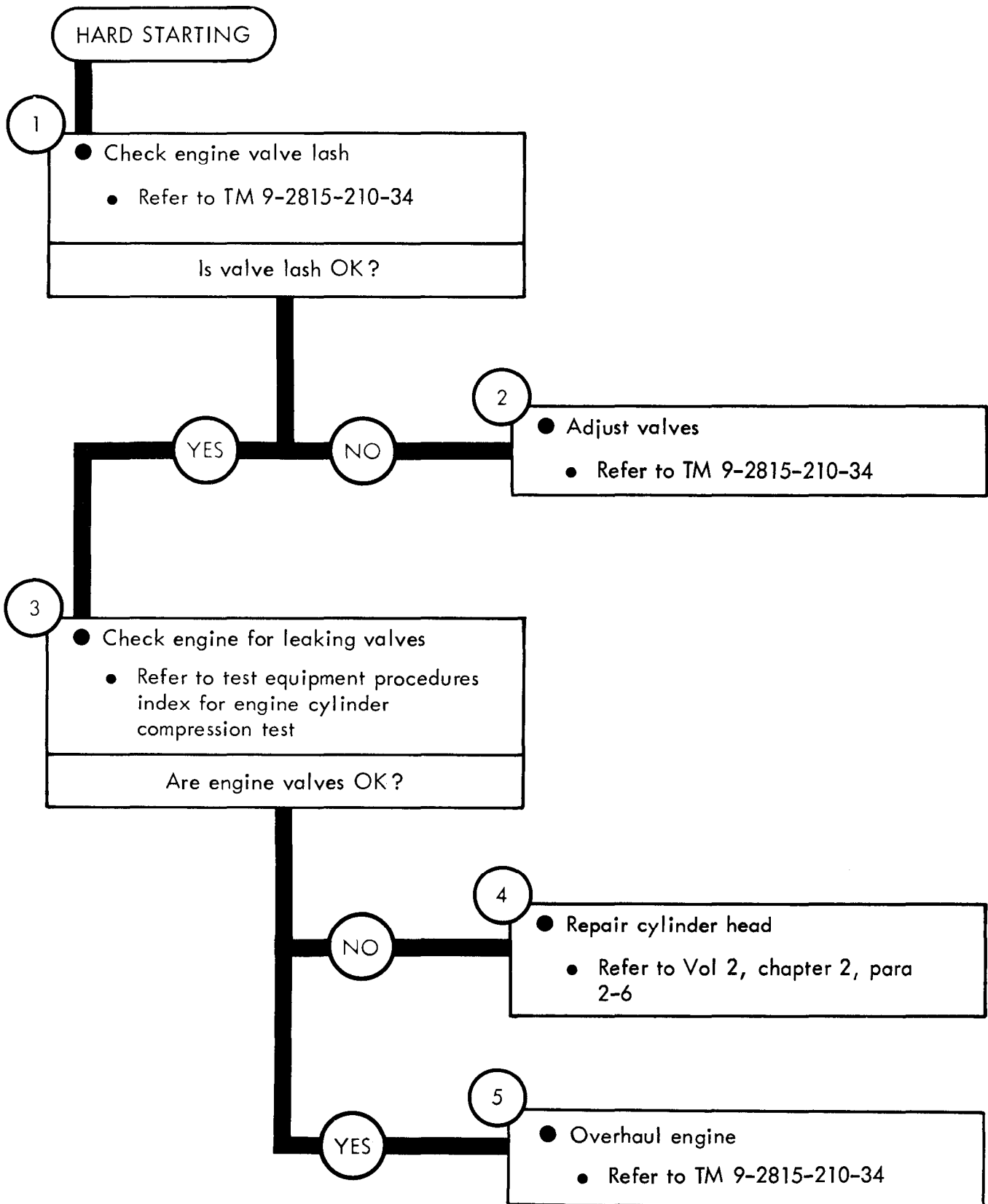


Figure 8-2 (Sheet 2 of 2)

TA 120917



TA 120918

Figure 8-3



## CHAPTER 9

# ENGINE SYSTEM TEST PROCEDURES

---

9-1. GENERAL. This chapter gives test procedures for the tests given in chapter 8, for the Engine System.

9-2. TEST SET-UP. Instructions for setup of test equipment and parts to be tested are given before the test procedures. Illustrations are used, when needed, to show you how to hook up the test equipment to the part to be tested.

9-3. TEST PROCEDURE. Detailed step-by-step instructions, in flow chart form, are given for each test. The procedure calls out the type of test and the condition of the truck system for each part of testing. The step-by-step test will lead you to the bad component or to a fault symptom within a related system. Reference is made to the fault symptom index, chapter 6, if the test shows a fault in another system.

ENGINE CYLINDER COMPRESSION TEST

1

- Start engine and warm up to operating temperature
  - Refer to TM 9-2320-211-10
- Turn off engine
  - Refer to TM 9-2320-211-10

2

- Take out all 6 fuel injector nozzle and holder assemblies
  - Refer to Vol 2, chapter 4, para 4-3

3

- Put compression gage onto number one fuel injector opening in cylinder head
  - Using new fuel injector nozzle to head gasket, put on adapter
  - Put compression gage onto adapter

4

- Crank engine for 5 seconds
  - Refer to TM 9-2320-211-10
- Note: Keep fuel shutoff in off position
- Read compression from gage and write down reading

GO

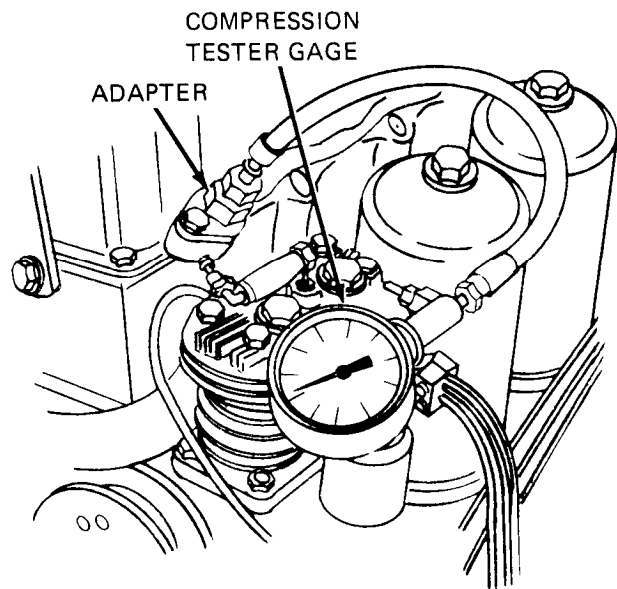
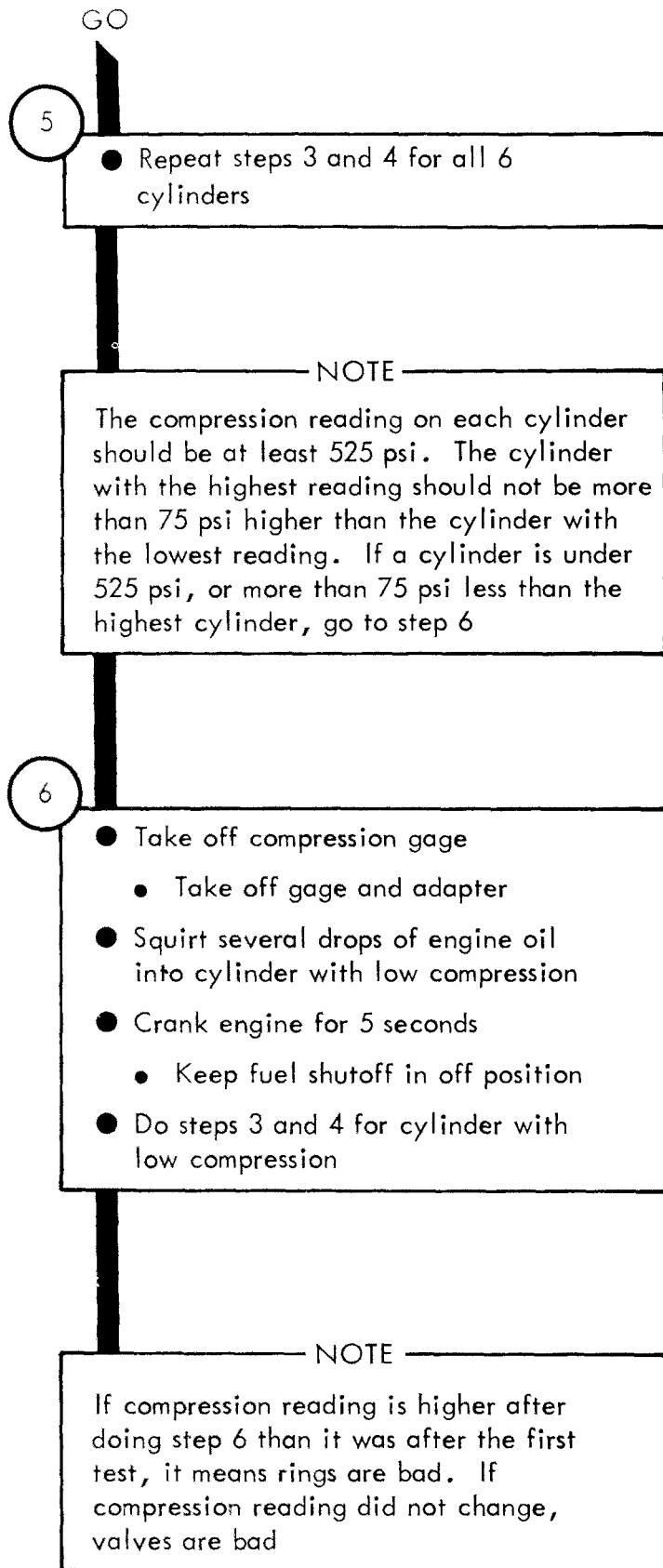


Figure 9-1 (Sheet 1 of 2)



TA 120920

Figure 9-1 (Sheet 2 of 2)



## CHAPTER 10

### FUEL SYSTEM TROUBLESHOOTING

---

10-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Fuel System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

10-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

Symptom

1 ENGINE CRANKS BUT 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

NOTE

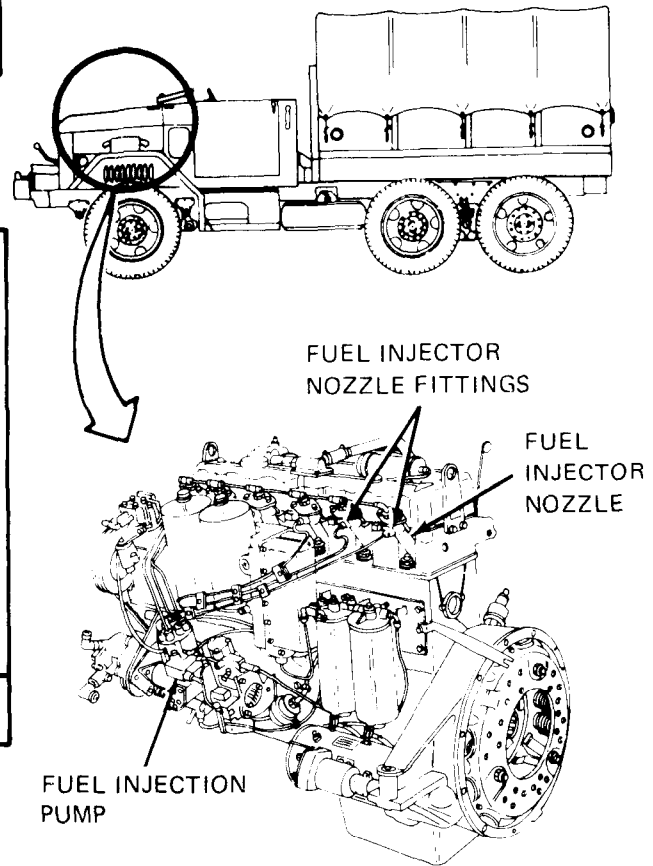
The following procedure will need the use of two soldiers. The lead soldier will be called Soldier A. The helper will be called Soldier B

1

- Check for fuel supply from fuel injection pump
- SOLDIER A ● Loosen one fuel injector nozzle fitting but do not take it off
- SOLDIER B ● Crank engine for 5 seconds. Refer to TM 9-2320-211-10
- SOLDIER A ● See if fuel comes out of fuel injector nozzle fitting

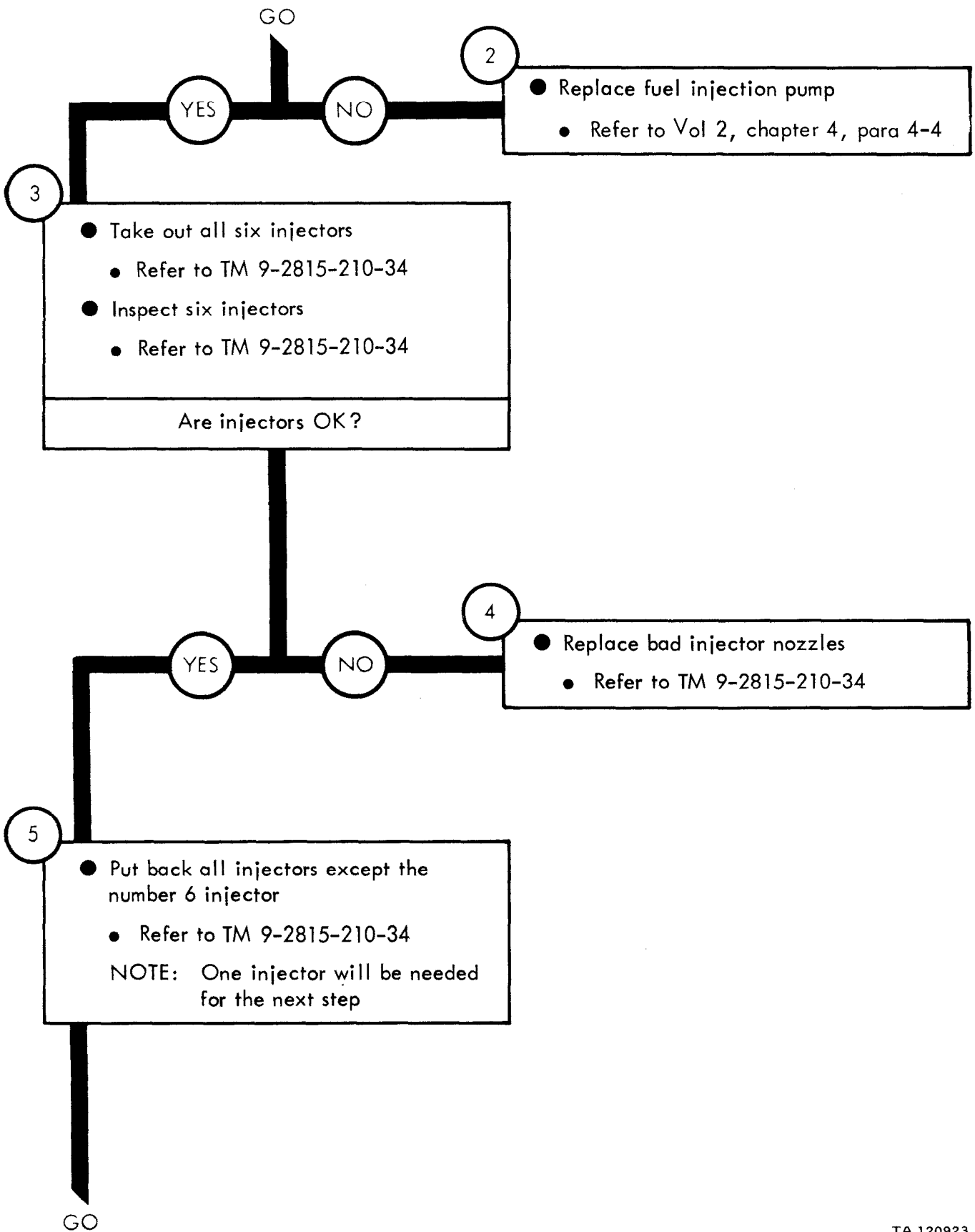
Does fuel come out of fitting?

GO



TA 120921

Figure 10-1 (Sheet 1 of 3)



TA 120923

Figure 10-1 (Sheet 2 of 3)

GO

WARNING

Fuel coming out of an injector nozzle under pressure can go through the skin. This can cause blood poisoning. Keep hands away from injector nozzle when doing the next step

6

- Put number 6 fuel injector nozzle onto fuel supply tube
- SOLDIER A ● Connect nozzle to fuel supply tube. See figure 11-1
- SOLDIER B ● Crank engine for 5 seconds
- SOLDIER A ● See if correct fuel spray pattern comes from injector nozzle. See figure 11-1

Is fuel spray pattern OK?

NO

7

- Replace fuel injection pump
- Refer to Vol 2, chapter 4, para 4-4

YES

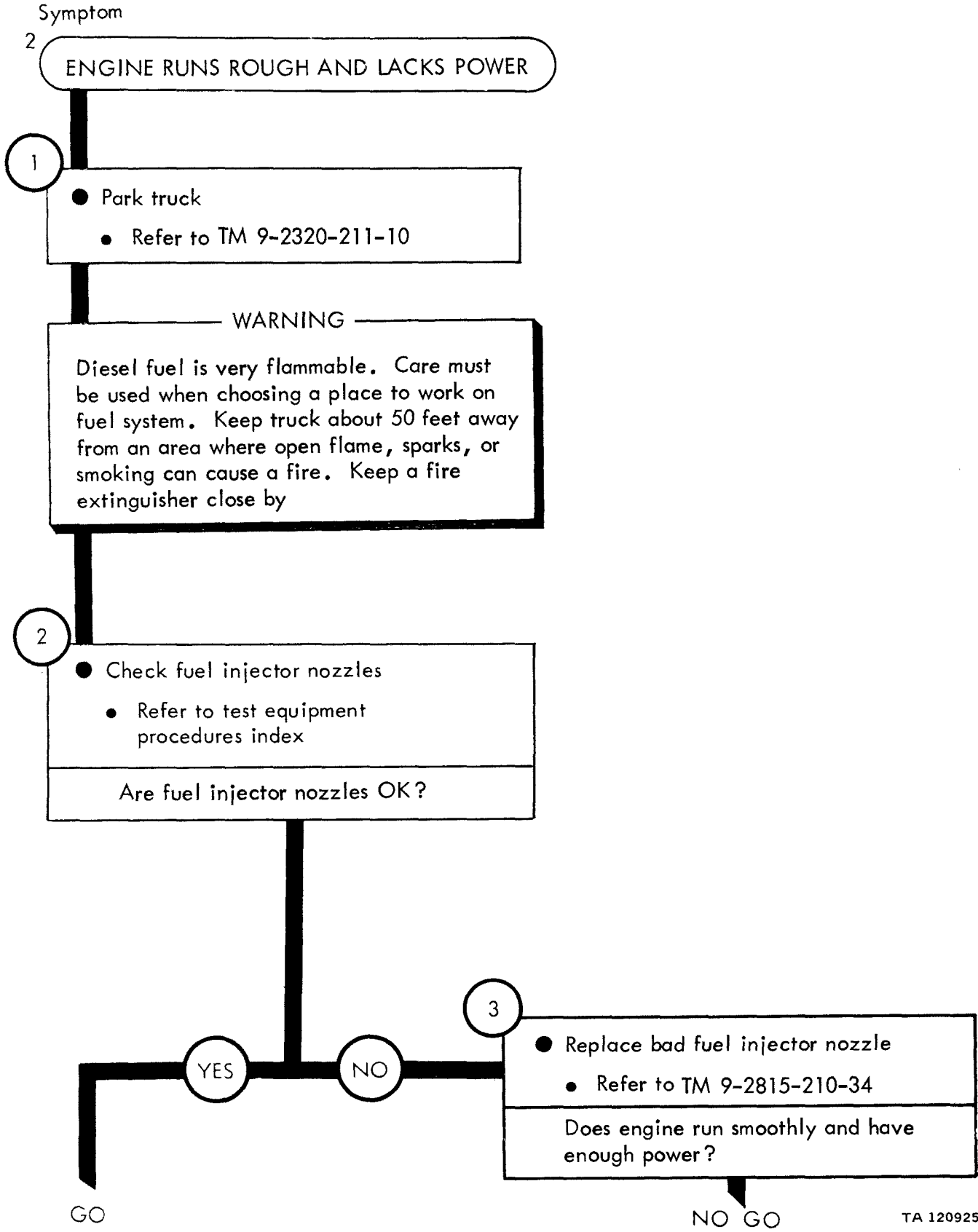
8

- Adjust fuel injection pump timing
- Refer to Vol 2, chapter 4, para 4-5

TA 120924

Figure 10-1 (Sheet 3 of 3)





TA 120925

Figure 10-2 (Sheet 1 of 2)

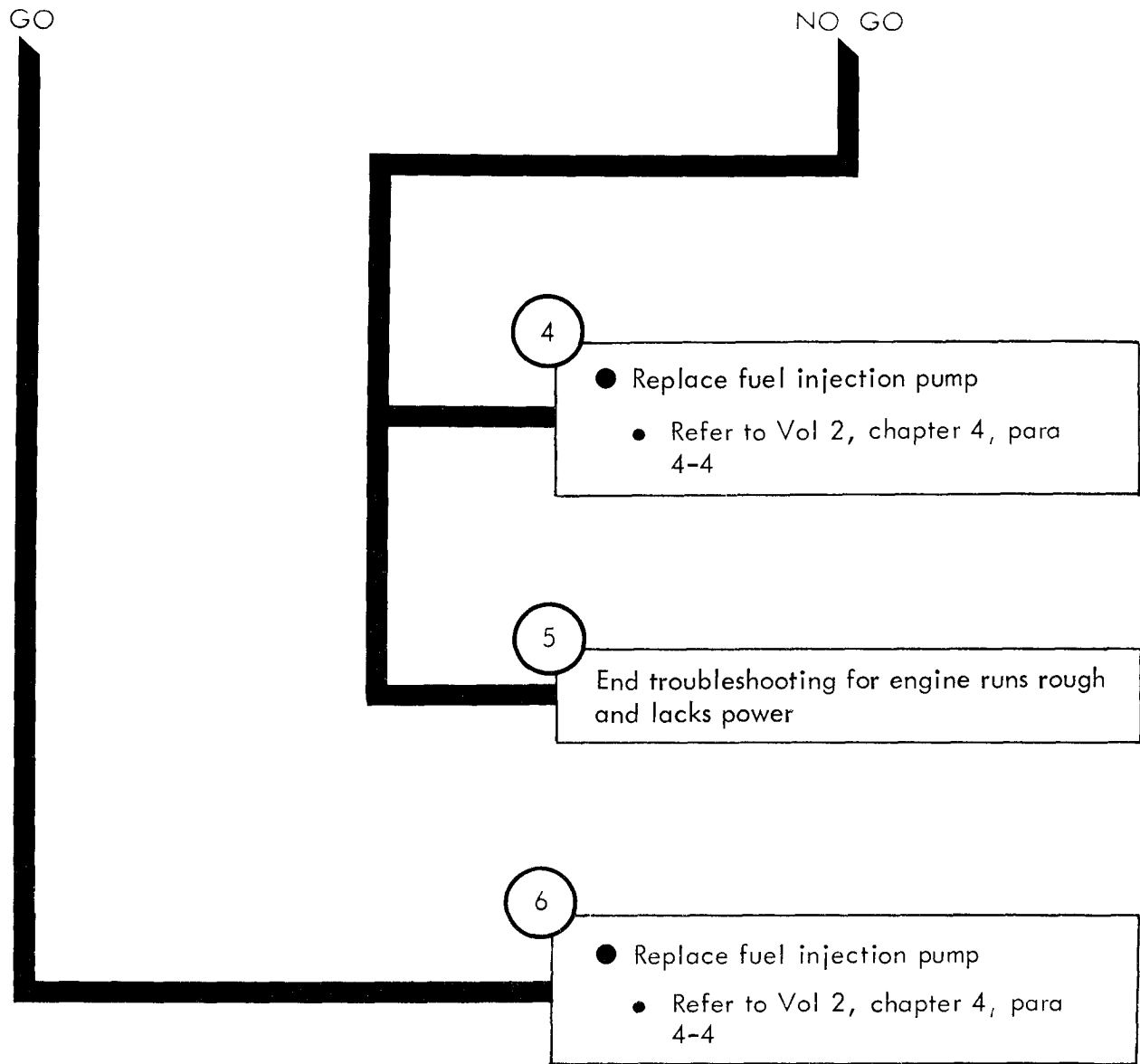
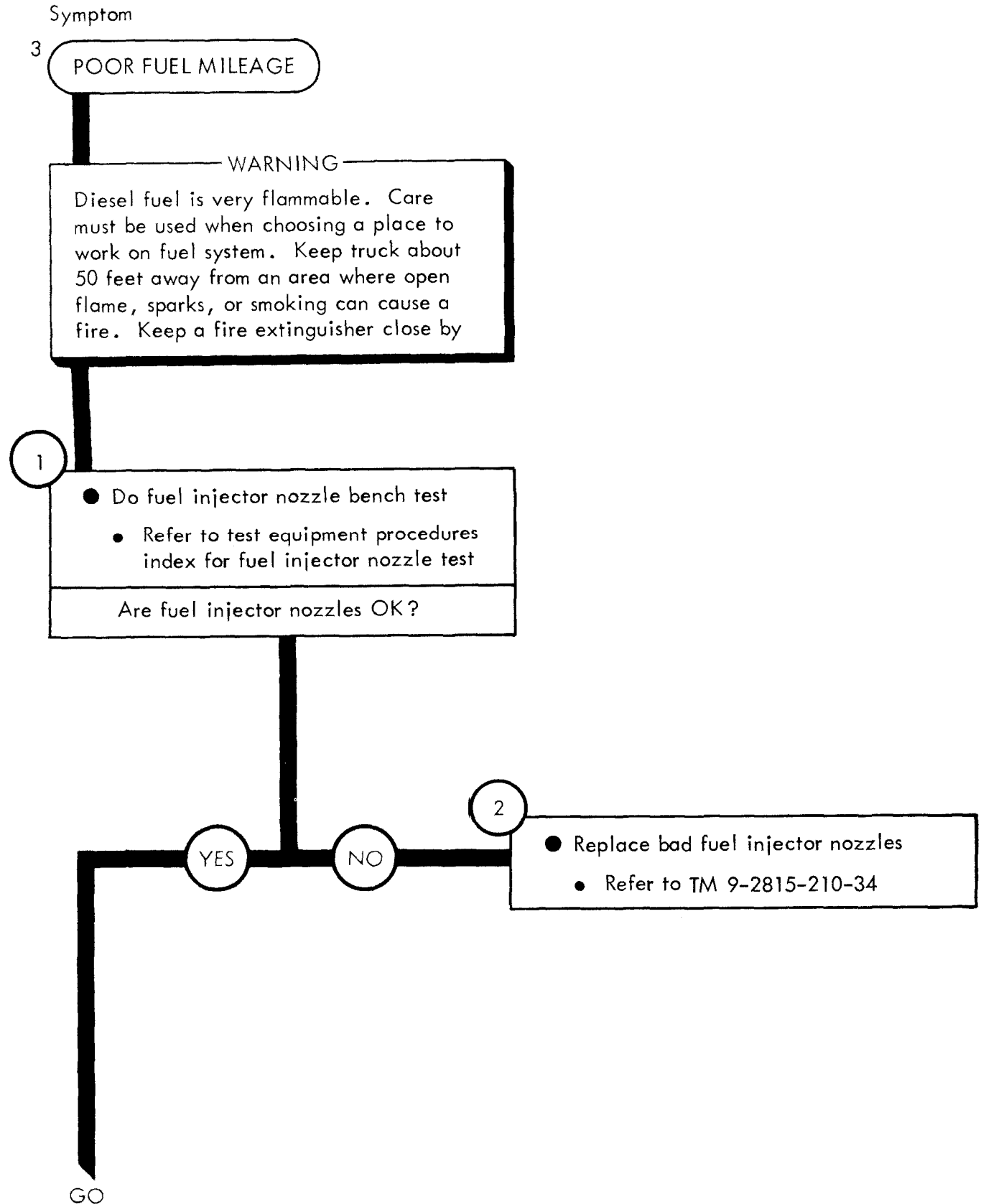


Figure 10-2 (Sheet 2 of 2)



TA 120927

Figure 10-3 (Sheet 1 of 3)

GO

3

- Retighten fuel injector nozzles

NOTE

The next step is done only on the LDT - 465 - IC turbocharged engine. For engines without turbocharger, go to step 7

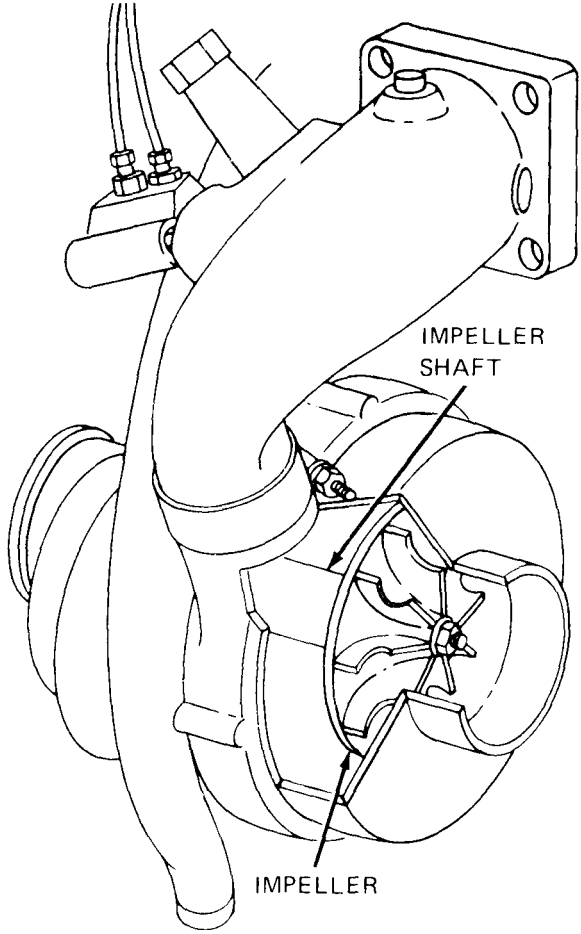
4

- Check turbocharger for sticking shaft and bent or broken impeller blades
- Take off turbocharger air cleaner to impeller air tube. Refer to TM 9-2320-211-20
- Turn turbocharger impeller by hand several times
- Feel for sticking impeller shaft

Note: Impeller should turn freely with no rubbing or sticking

- See if impeller blades are bent or broken

Is turbocharger OK?



NO

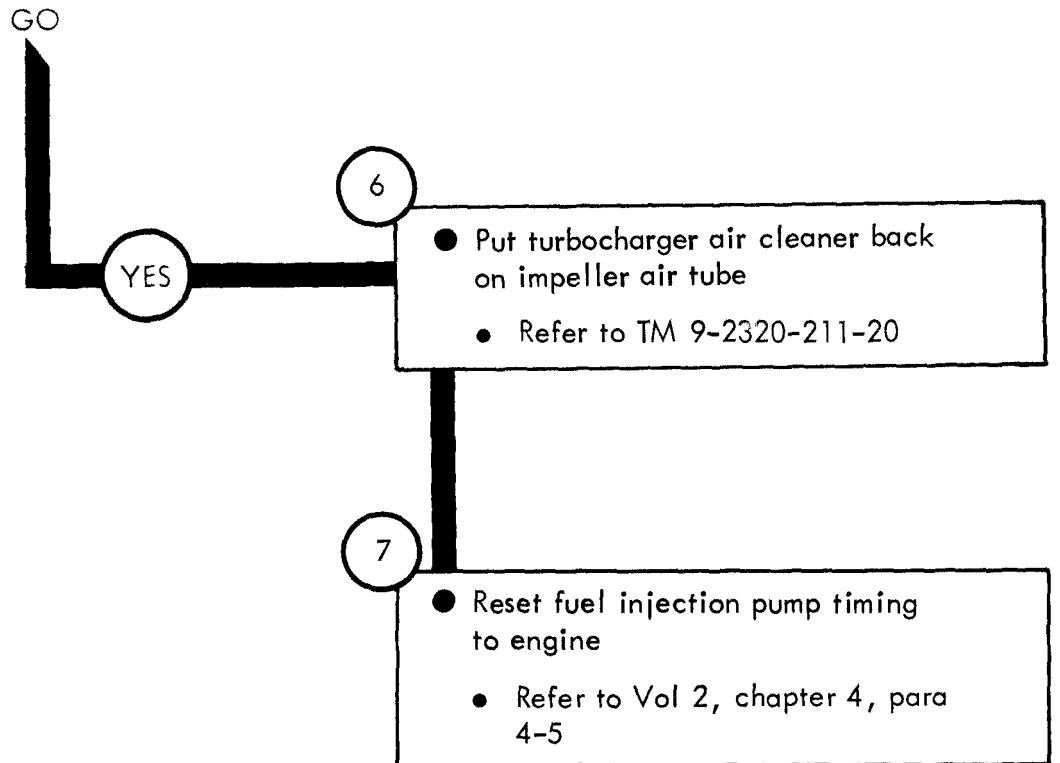
5

- Replace turbocharger
- Refer to TM 9-2815-210-34

GO

TA 120928

Figure 10-3 (Sheet 2 of 3)





## CHAPTER 11

# FUEL SYSTEM SUPPORT DIAGRAMS

---

11-1. GENERAL. This chapter gives the diagrams you need when doing troubleshooting procedures in chapter 10. Figure 3-1 is a complete listing of all support diagrams used in this manual.

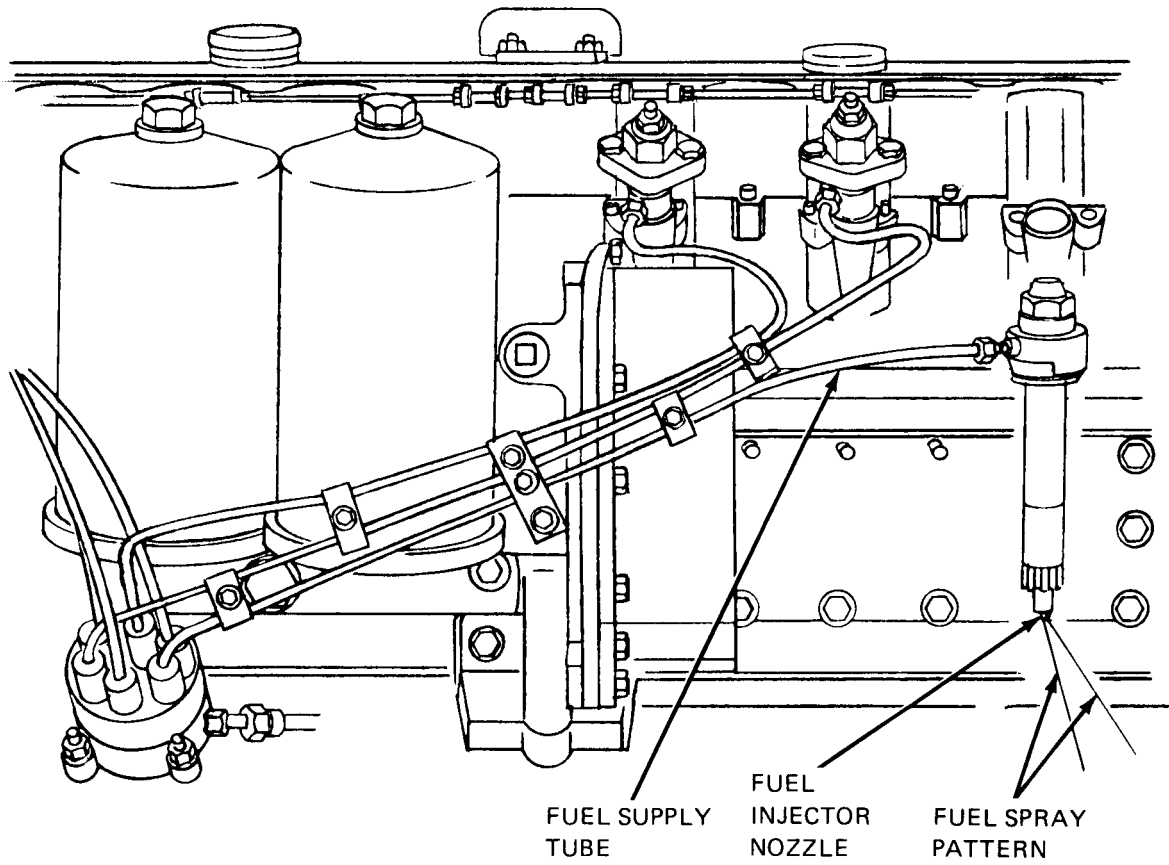


Figure 11-1. Fuel Injectors and Fuel Lines

TA 120930



## CHAPTER 12

# FUEL SYSTEM TEST PROCEDURES

---

12-1. GENERAL. This chapter gives test procedures for the tests given in chapter 10, for the Fuel System.

12-2. TEST SET-UP. Instructions for setup of test equipment and parts to be tested are given before the test procedures. Illustrations are used, when needed, to show you how to hook up the test equipment to the part to be tested.

12-3. TEST PROCEDURE. Detailed step-by-step instructions, in flow chart form, are given for each test. The procedure calls out the type of test and the condition of the truck system for each part of testing. The step-by-step test will lead you to the bad component or to a fault symptom within a related system. Reference is made to the fault symptom index, chapter 6, if the test shows a fault in another system.

FUEL INJECTOR NOZZLE TEST

1

- Start and warm up engine
  - Refer to TM 9-2320-211-10

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 can cause a fire. Keep a fire extinguisher close by

NOTE

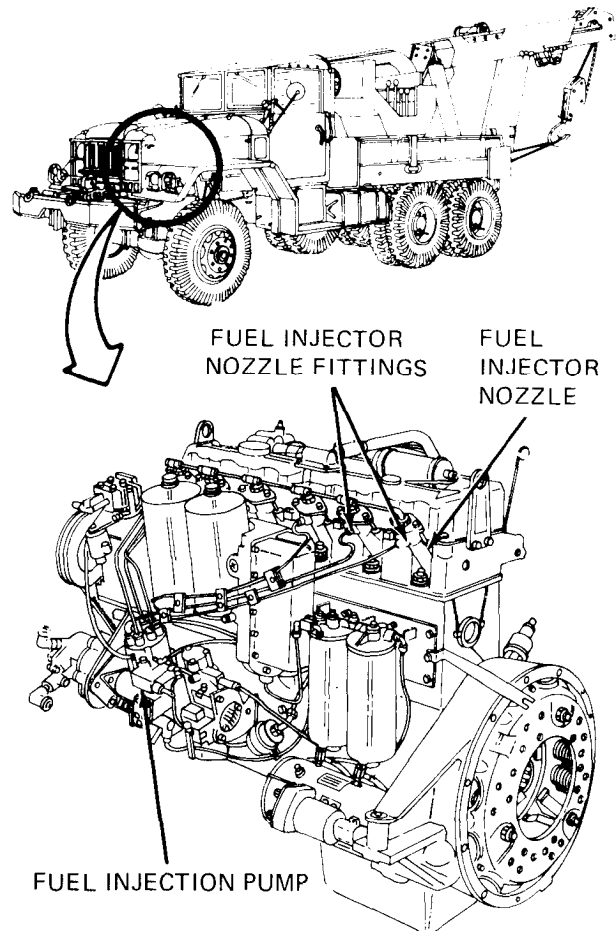
Put rag under line fittings before loosening to catch any fuel which drips out

2

- Loosen fuel injector nozzle fitting of one fuel injector nozzle and see if engine runs rougher
  - Note: If engine runs rougher the injector nozzle is OK
- Tighten fuel injector nozzle fitting
  - Note: Do procedure for each fuel injector nozzle fitting

3

- Stop engine
  - Refer to TM 9-2320-211-10



TA 120931

Figure 12-1

## CHAPTER 13

# COOLING SYSTEM TROUBLESHOOTING

---

13-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Cooling System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

13-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

COOLING SYSTEM TROUBLESHOOTING

Symptom

1 ENGINE TEMPERATURE GAGE READS ABOVE 195°F WHILE RUNNING

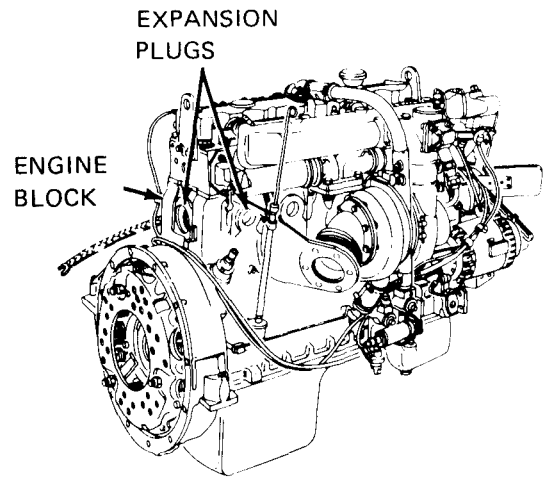
1

- Park truck
- Refer to TM 9-2320-211-10

2

- Check expansion plugs for water leaks
  - Look for signs of rust or water stains coming from expansion plugs
  - Look for cracks in engine block around expansion plugs

Are expansion plugs and engine block OK?



3

- Replace bad expansion plugs
  - Refer to TM 9-2815-210-34
- Replace cracked engine block
  - Refer to TM 9-2815-210-34

YES

NO

GO

Figure 13-1 (Sheet 1 of 2)

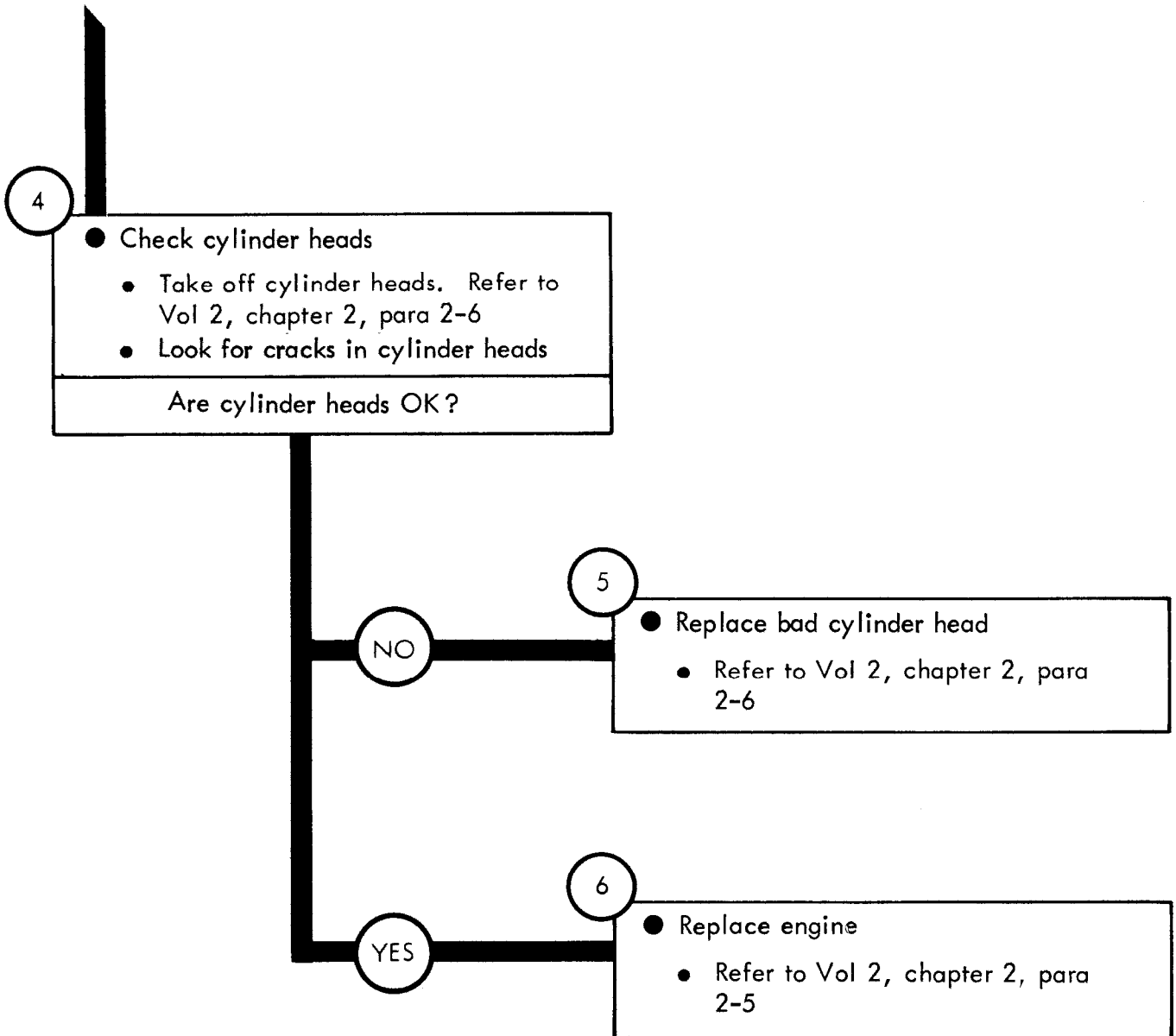


Figure 13-1 (Sheet 2 of 2)



## CHAPTER 14

# ELECTRICAL SYSTEM TROUBLESHOOTING

---

14-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Electrical System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

14-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

Symptom

1 ENGINE COOLANT HEATER OVERHEATS AND CONTINUES BURNING

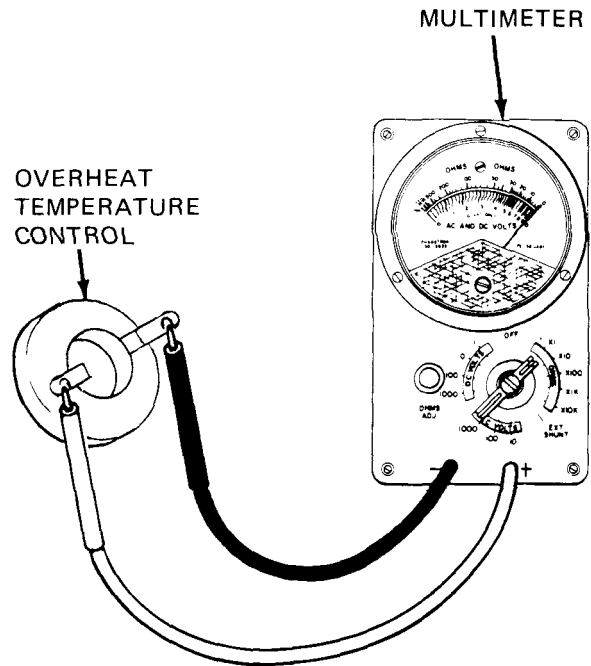
NOTE

When measuring voltage +24 volts DC means a range of +23 to +26 volts DC

- 1
- Park truck
    - Refer to TM 9-2320-211-10

- 2
- Check overheat temperature control for continuity
    - Take out overheat temperature control Refer to Vol 2, chapter 19, para 19-19
    - Set multimeter to check continuity. Refer to TM 9-2320-211-20
    - Put multimeter - lead on contact of overheat temperature control
    - Put multimeter + lead on other end of overheat temperature control
    - Read multimeter. Multimeter should measure zero ohms
- Does multimeter measure zero ohms?

GO



TA 120934

Figure 14-1 (Sheet 1 of 2)



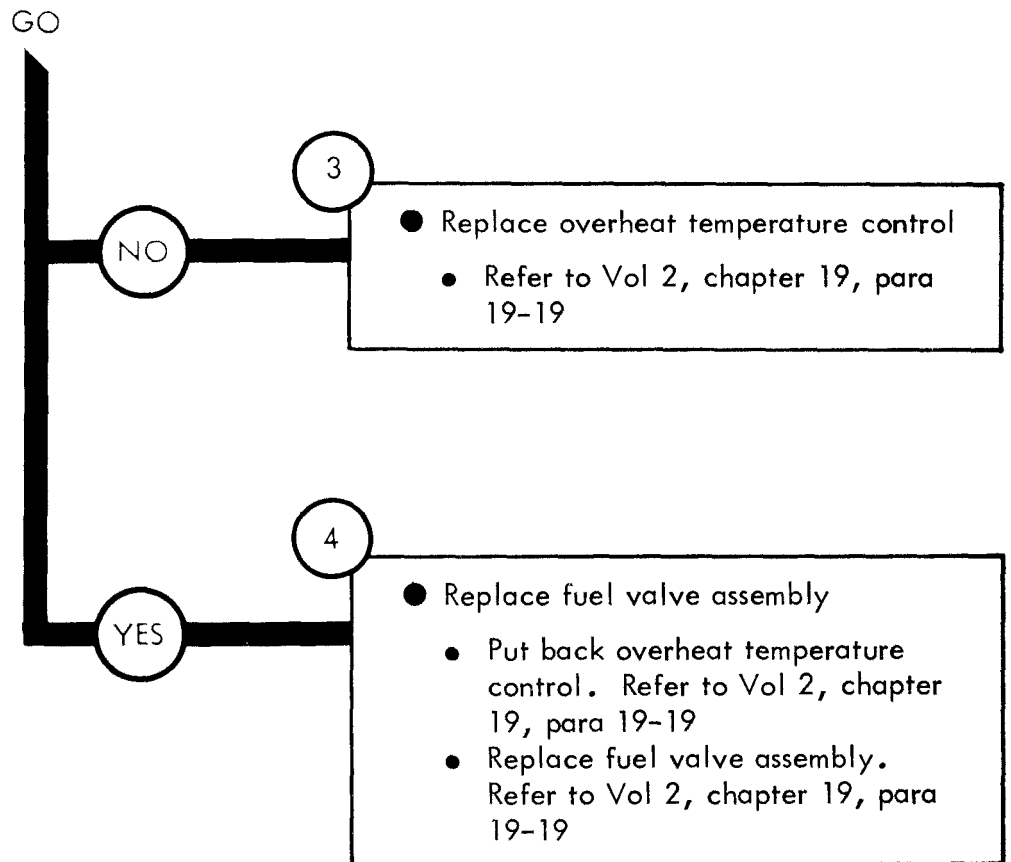


Figure 14-1 (Sheet 2 of 2)

Symptom

2 ENGINE COOLANT HEATER DOES NOT GIVE OFF ENOUGH HEAT

NOTE

When checking voltage +24 volts DC means a range of +23 to +26 volts DC

1

- Park truck
- Refer to TM 9-2320-211-10

2

- Check diode for resistance
  - Remove diode from holder. Refer to Vol 2, chapter 19, para 19-19
  - Set multimeter to measure resistance
  - Put multimeter - lead on one end of diode
  - Put multimeter + lead on other end of diode

GO

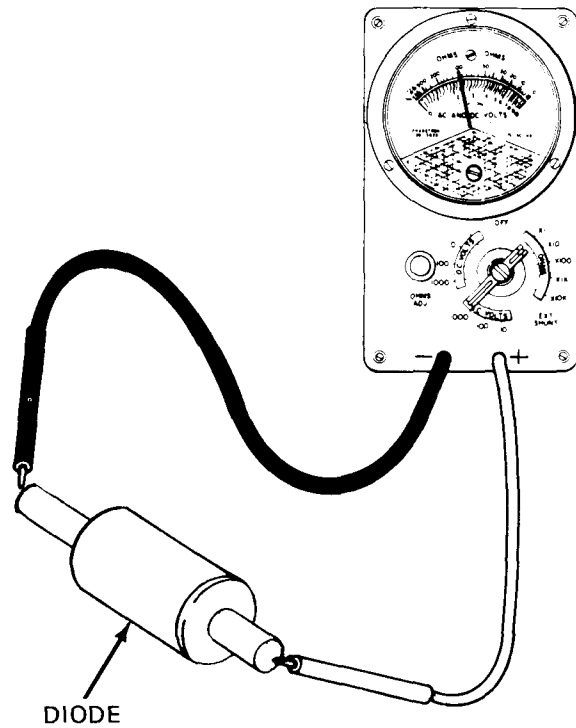


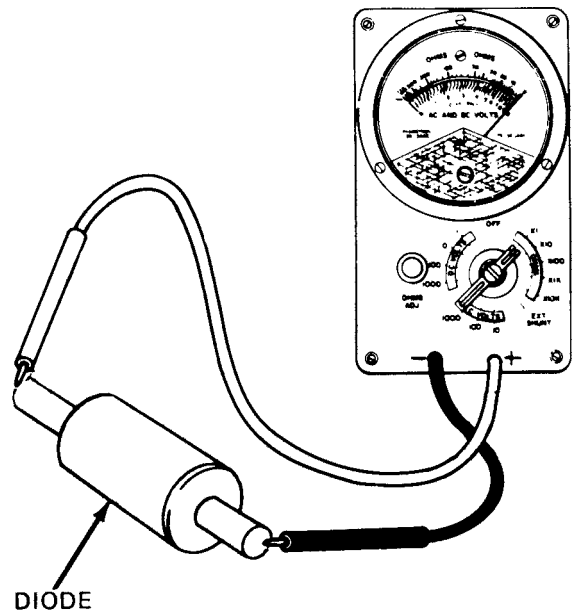
Figure 14-2 (Sheet 1 of 6)

TA 120936

GO

- Read multimeter
- Place multimeter - lead where + lead was and + lead where - lead was in last test
- Read multimeter. Multimeter should have measured resistance in one test and no resistance in the other test

Did both resistance tests check out OK?



DIODE

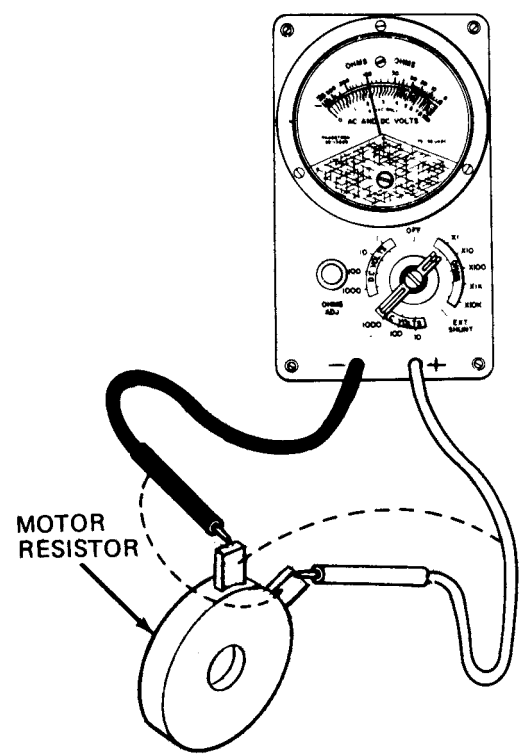
YES NO

- Replace diode
- Refer to Vol 2, chapter 19, para 19-19

4

- Check resistance of motor resistor
- Pull leads off both contacts of motor resistor. Refer to Vol 2, chapter 19, para 19-19. Put multimeter + lead on one contact of resistor
- Put multimeter - lead on one other contact of resistor
- Read multimeter. Multimeter should measure zero ohms
- Put multimeter - lead on contact where multimeter + lead was and + lead where - lead was for last test
- Read multimeter. Multimeter should measure zero ohms

Did multimeter measure zero ohms for both tests?



MOTOR RESISTOR

GO

TA 120937

Figure 14-2 (Sheet 2 of 6)

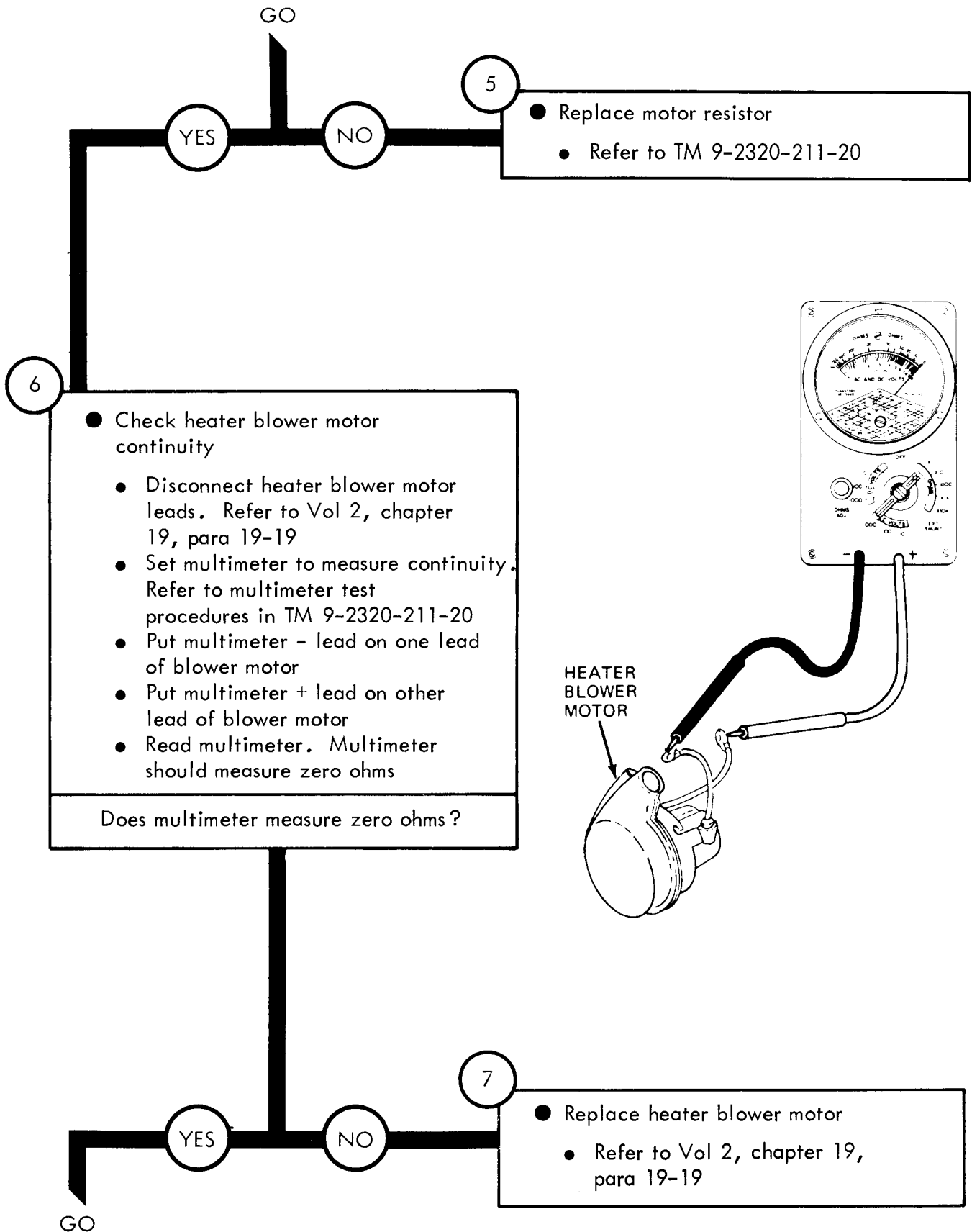


Figure 14-2 (Sheet 3 of 6)

TA 120938

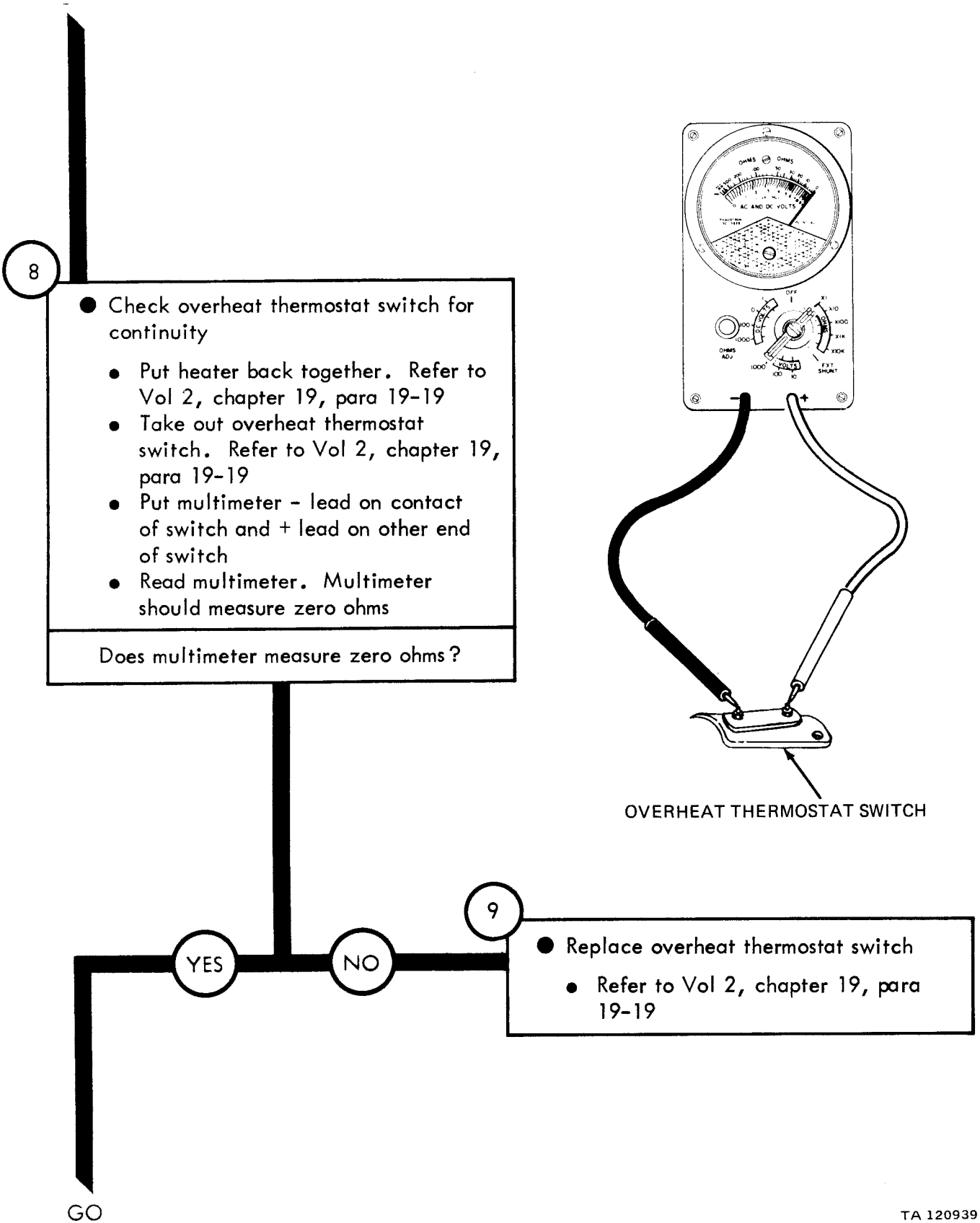


Figure 14-2 (Sheet 4 of 6)

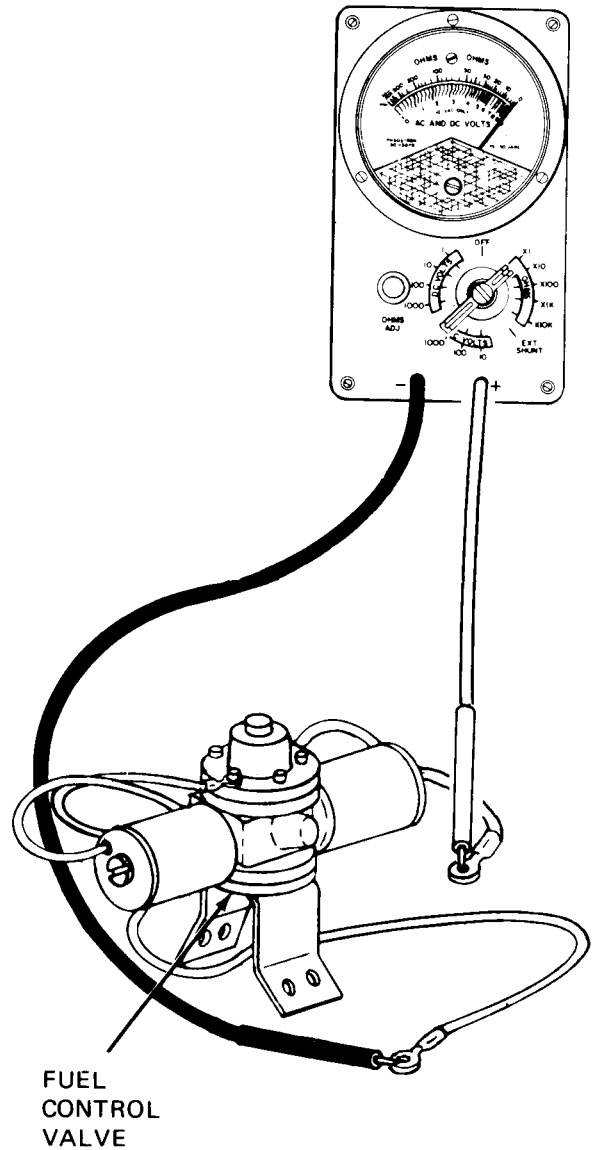
GO

10

- Check for +24 volts DC through fuel control valve
  - Start heater. Refer to TM 9-2320-211-20
  - Set multimeter to measure +24 volts DC
  - Put multimeter - lead on fuel control valve lead at terminal strip
  - Put multimeter + lead on fuel control valve lead at overheat thermostat switch
  - Read multimeter. Multimeter should measure +24 volts DC?

Does multimeter measure +24 volts DC?

GO



TA 120940

Figure 14-2 (Sheet 5 of 6)

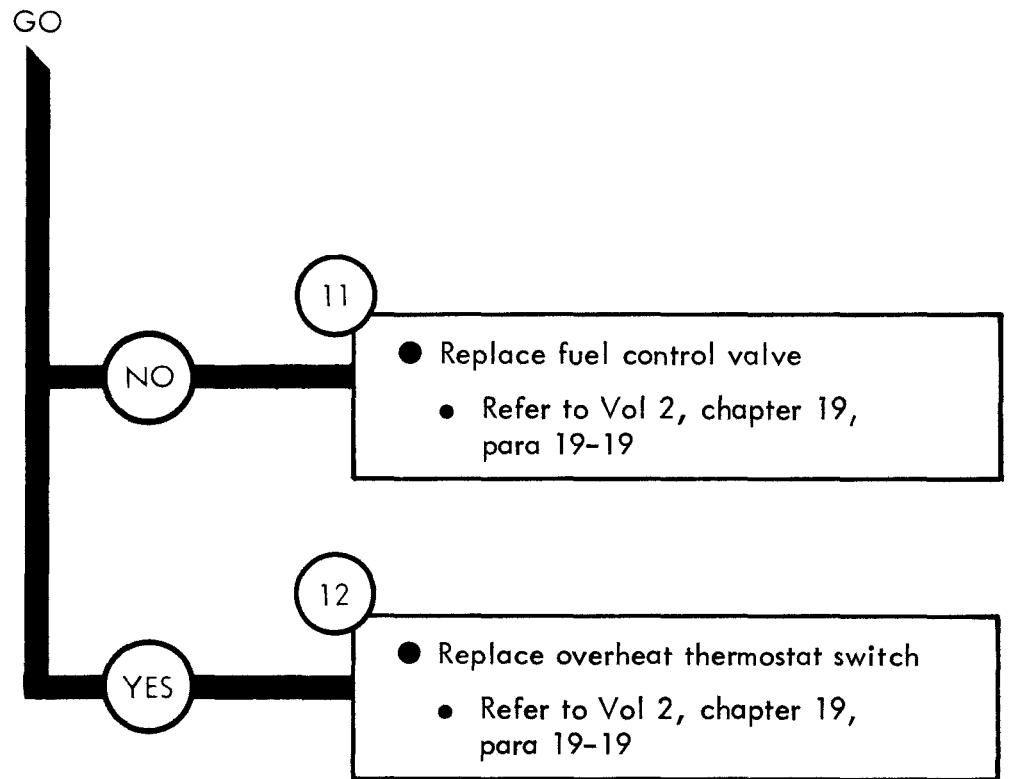
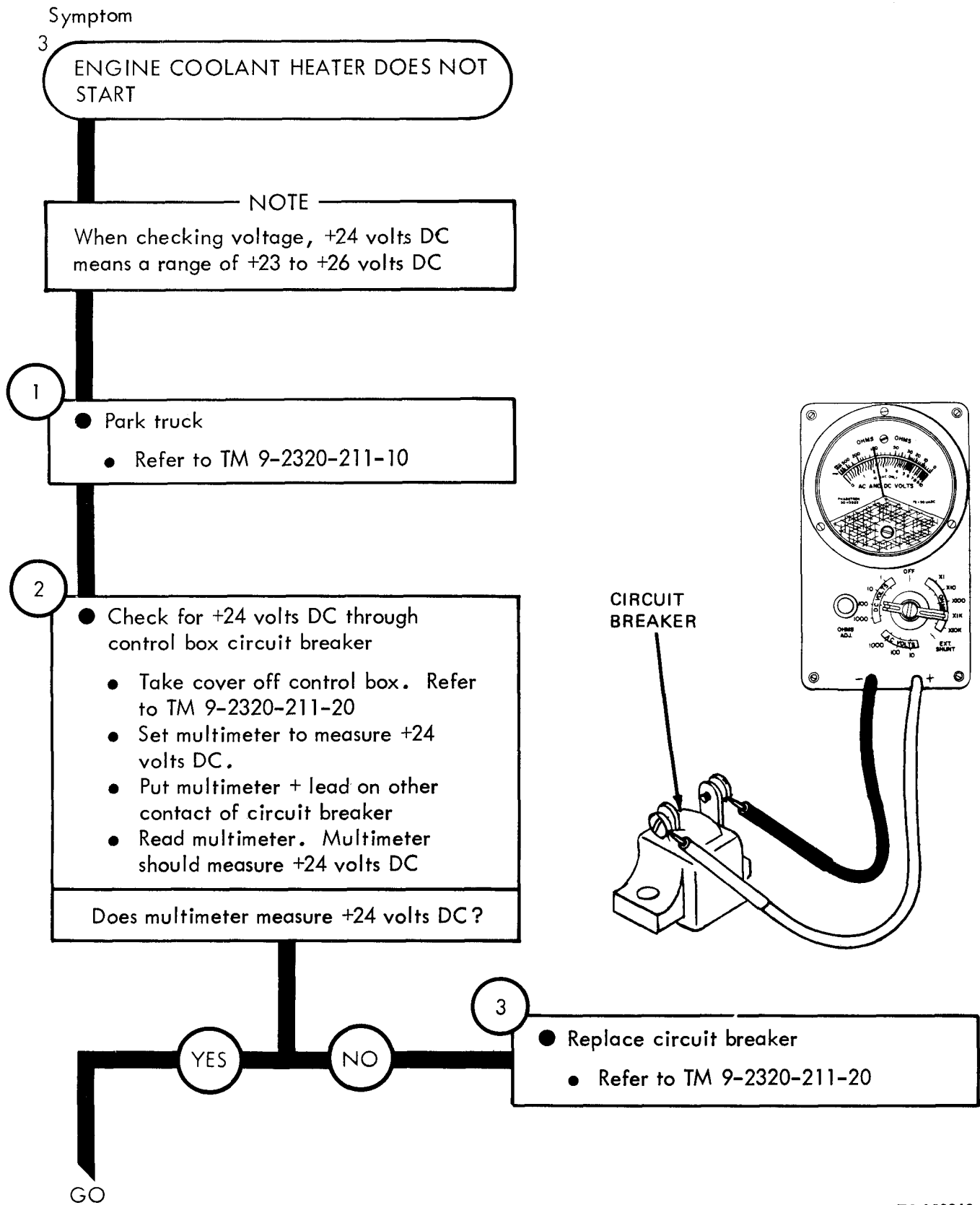


Figure 14-2 (Sheet 6 of 6)



TA 120942

Figure 14-3 (Sheet 1 of 5)

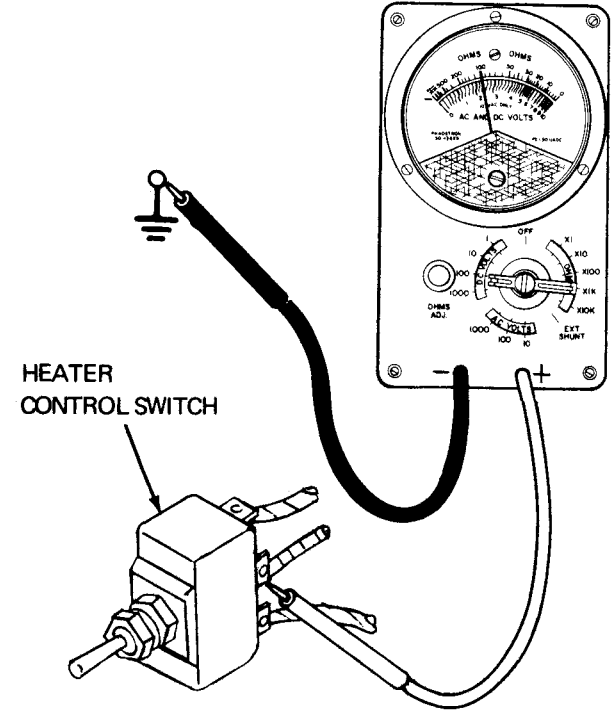


GO

4

- Check for +24 volts DC to control switch
  - Put multimeter + lead on lead from circuit breaker at heater control switch
  - Put multimeter - lead on a good ground
  - Read multimeter. Multimeter should measure +24 volts DC

Does multimeter measure +24 volts DC?



YES

NO

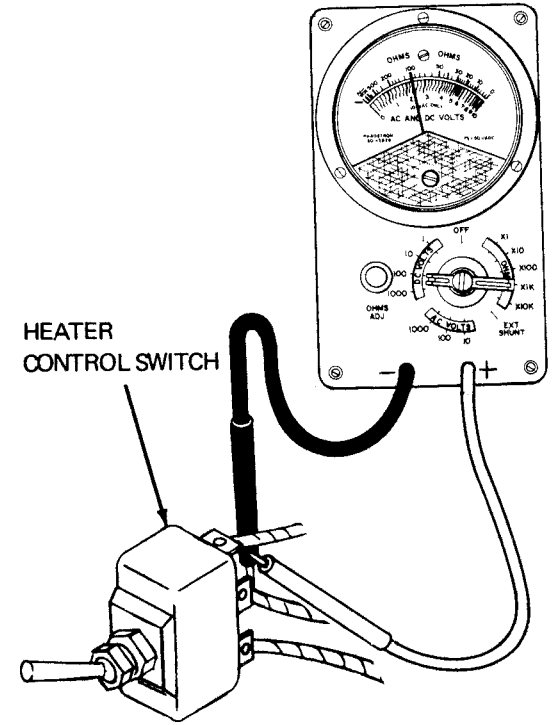
5

- Repair or replace lead from circuit breaker to heater control switch
- Refer to TM 9-2320-211-20

6

- Check for +24 volts DC through heater control switch when set to start
  - Put multimeter - lead on contact 14 of heater control switch and + lead on contact 21
  - Place heater control switch to start and hold it there
  - Read multimeter while switch is held at start
  - Multimeter should measure +24 volts DC

Does multimeter measure +24 volts DC?



GO

TA 120943

Figure 14-3 (Sheet 2 of 5)

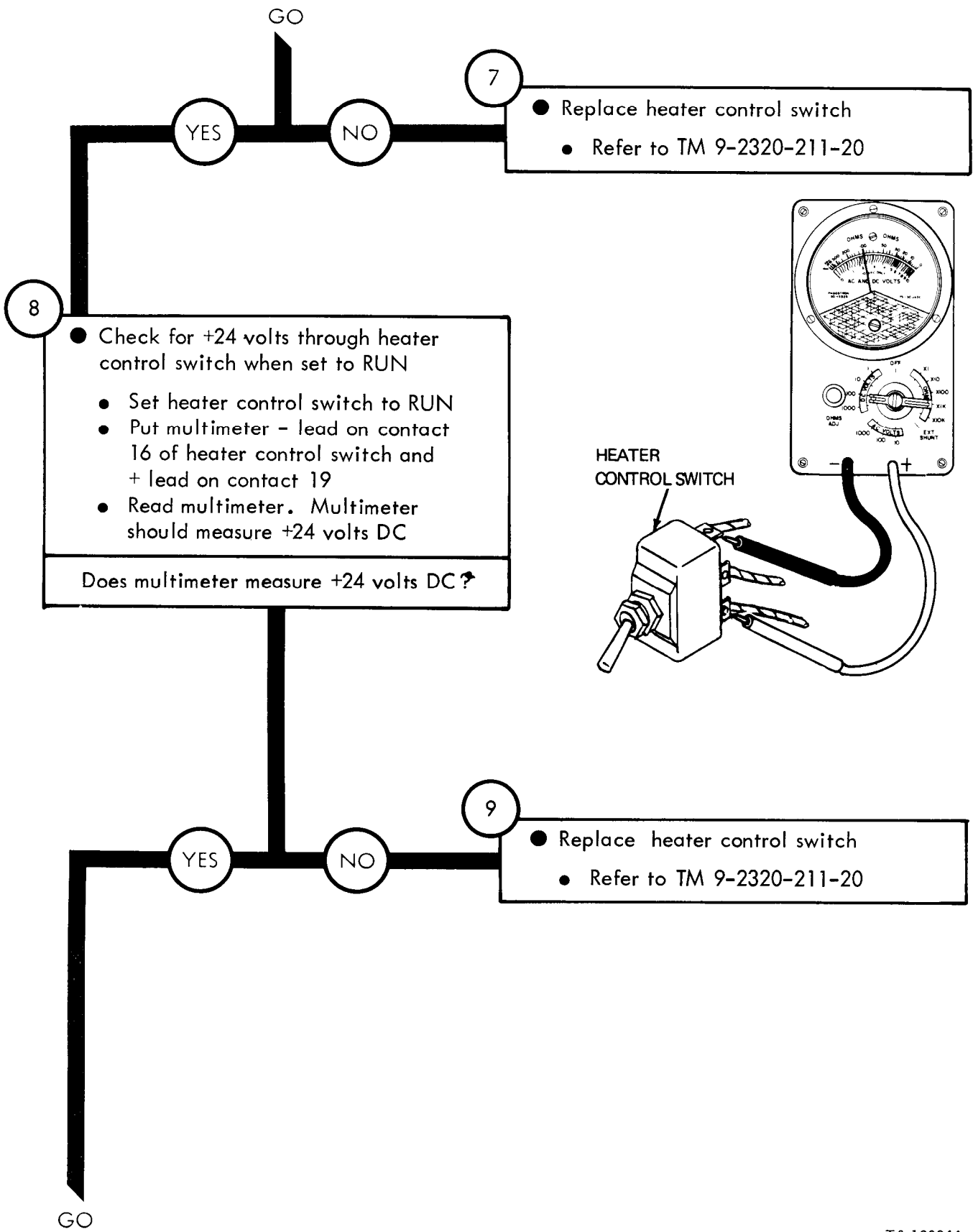
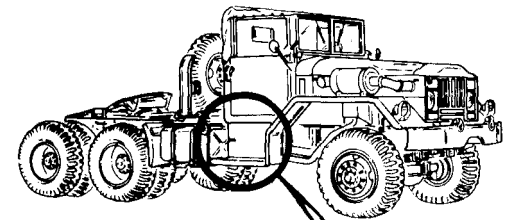


Figure 14-3 (Sheet 3 of 5)

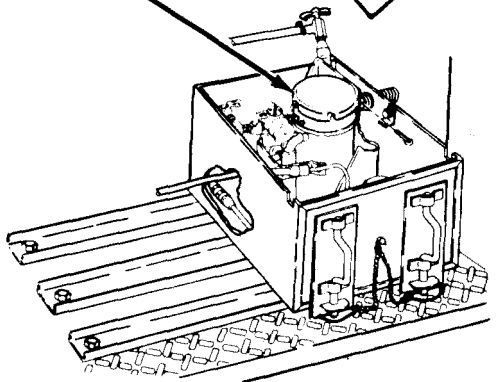
TA 120944

GO

- Check harness from heater control box to heater for continuity
  - Set heater control switch to OFF
  - Unscrew and take off harness plug from control box receptacle
  - Unscrew and take off harness plug from heater
  - Set multimeter to measure continuity

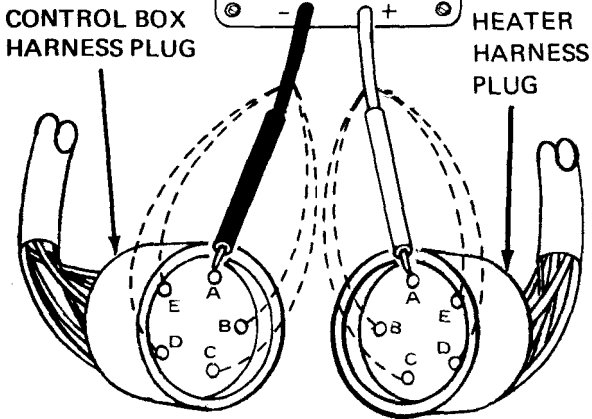
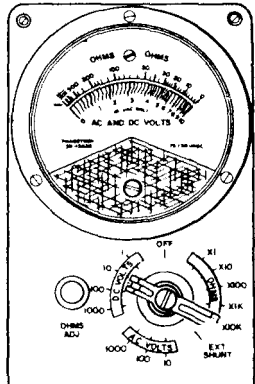


ENGINE COOLANT HEATER



- Place multimeter - lead on control box harness plug contact A
- Place multimeter + lead on heater harness plug contact A
- Read multimeter. Multimeter should indicate continuity
- Do this test for contacts B, C, D, and E of both harness plugs
- Read multimeter after each contact tested. Multimeter should measure zero ohms for each test

Does multimeter measure zero ohms for each contact tested ?



GO

TA 120945

Figure 14-3 (Sheet 4 of 5)

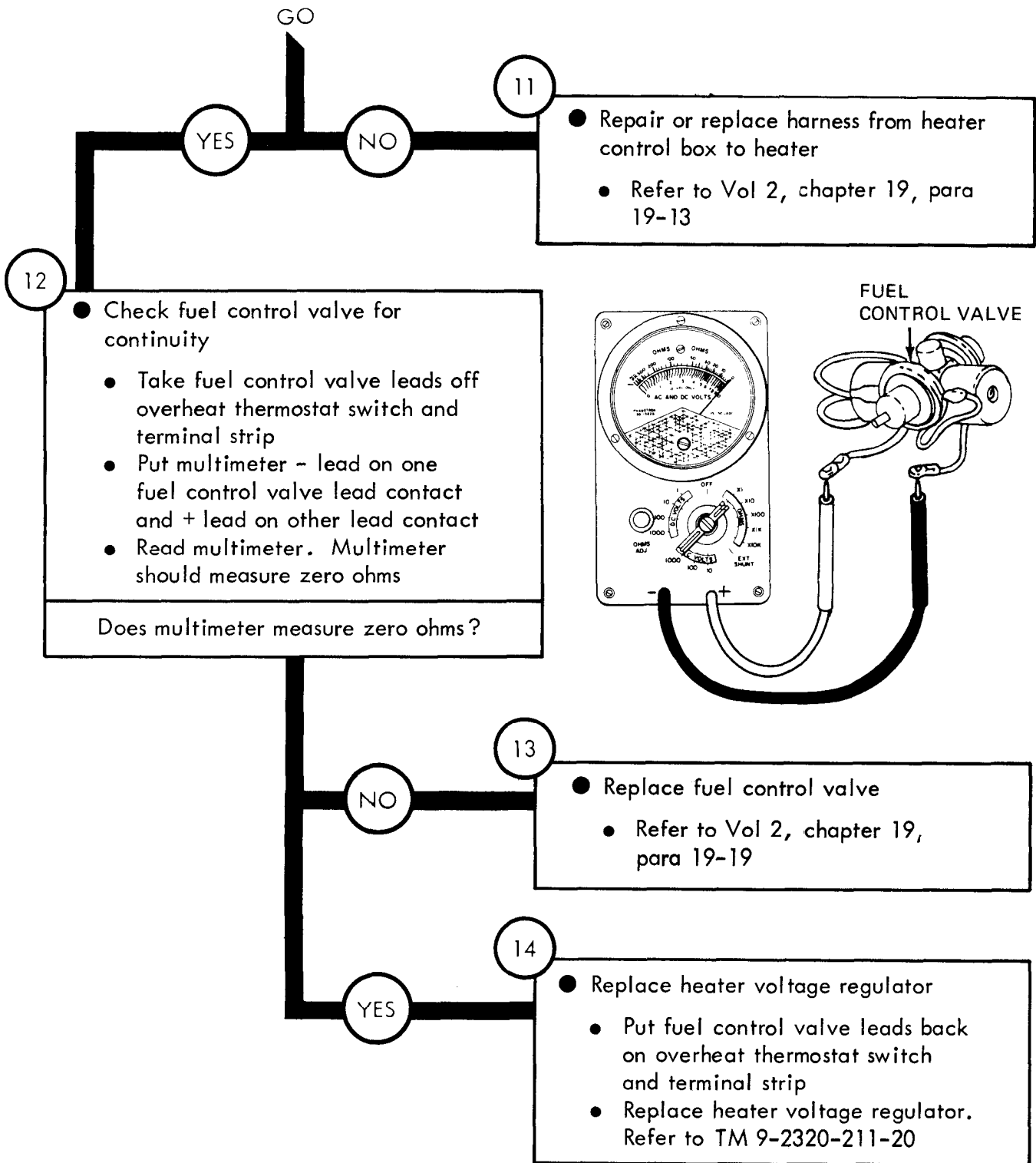


Figure 14-3 (Sheet 5 of 5)

TA 120946

Symptom

4

FUEL BURNING HEATER OVERHEATS AND CONTINUES BURNING

NOTE

When measuring voltage +24 volts DC means a range of +23 to +26 volts DC

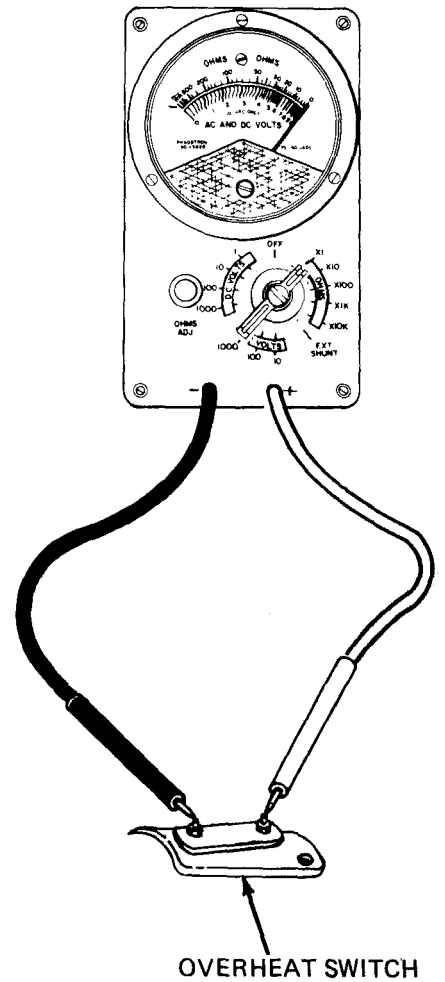
1

- Park truck
- Refer to TM 9-2320-211-10

2

- Check overheat switch for continuity
    - Take out overheat switch. Refer to Vol 2, chapter 19, para 19-9
    - Set multimeter to check continuity
    - Put multimeter - lead on contact of overheat switch and + lead on other end of overheat switch
    - Read multimeter. Multimeter should measure zero ohms
- Does multimeter measure zero ohms?

GO



TA 120947

Figure 14-4 (Sheet 1 of 2)

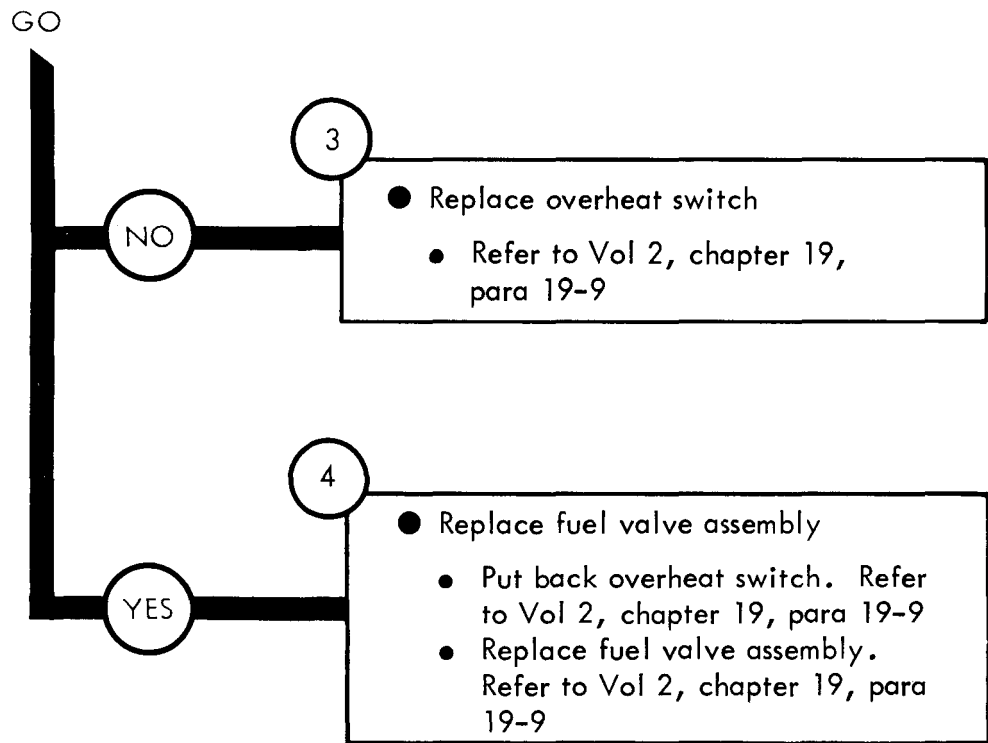


Figure 14-4 (Sheet 2 of 2)

Symptom

5

FUEL BURNING HEATER DOES NOT GIVE OFF ENOUGH HEAT

NOTE

When checking voltage +24 volts DC means a range of +23 to +26 volts DC

1

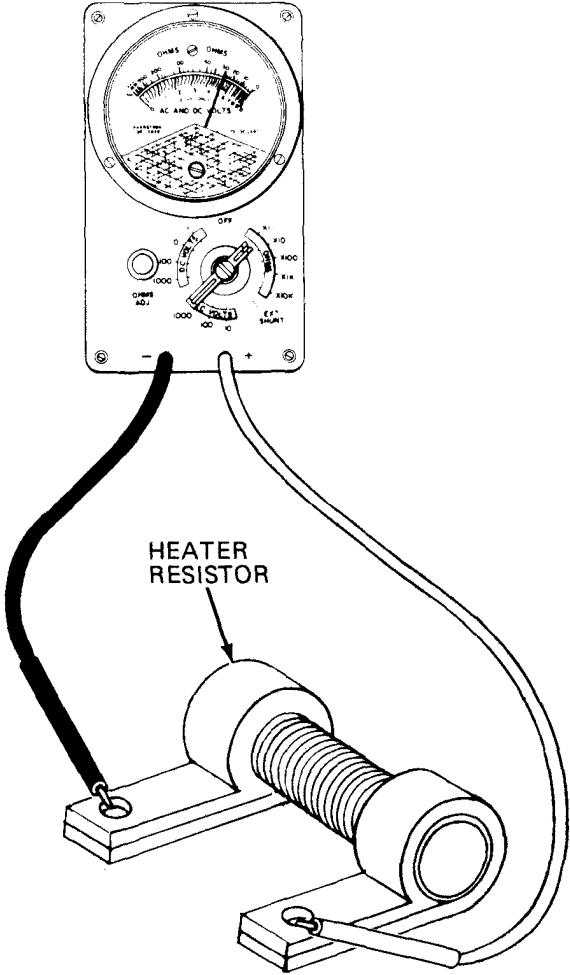
- Park truck
- Refer to TM 9-2320-211-10

2

- Check resistance of heater resistor
  - Pull lead off both contacts of heater resistor
  - Set multimeter to measure resistance
  - Put multimeter - lead on one contact of resistor and + lead on other contact of heater resistor
  - Read multimeter. Multimeter should measure resistance
  - Put multimeter - lead on contact where multimeter + lead was and multimeter + lead where multimeter - lead was for last test. Multimeter should measure resistance

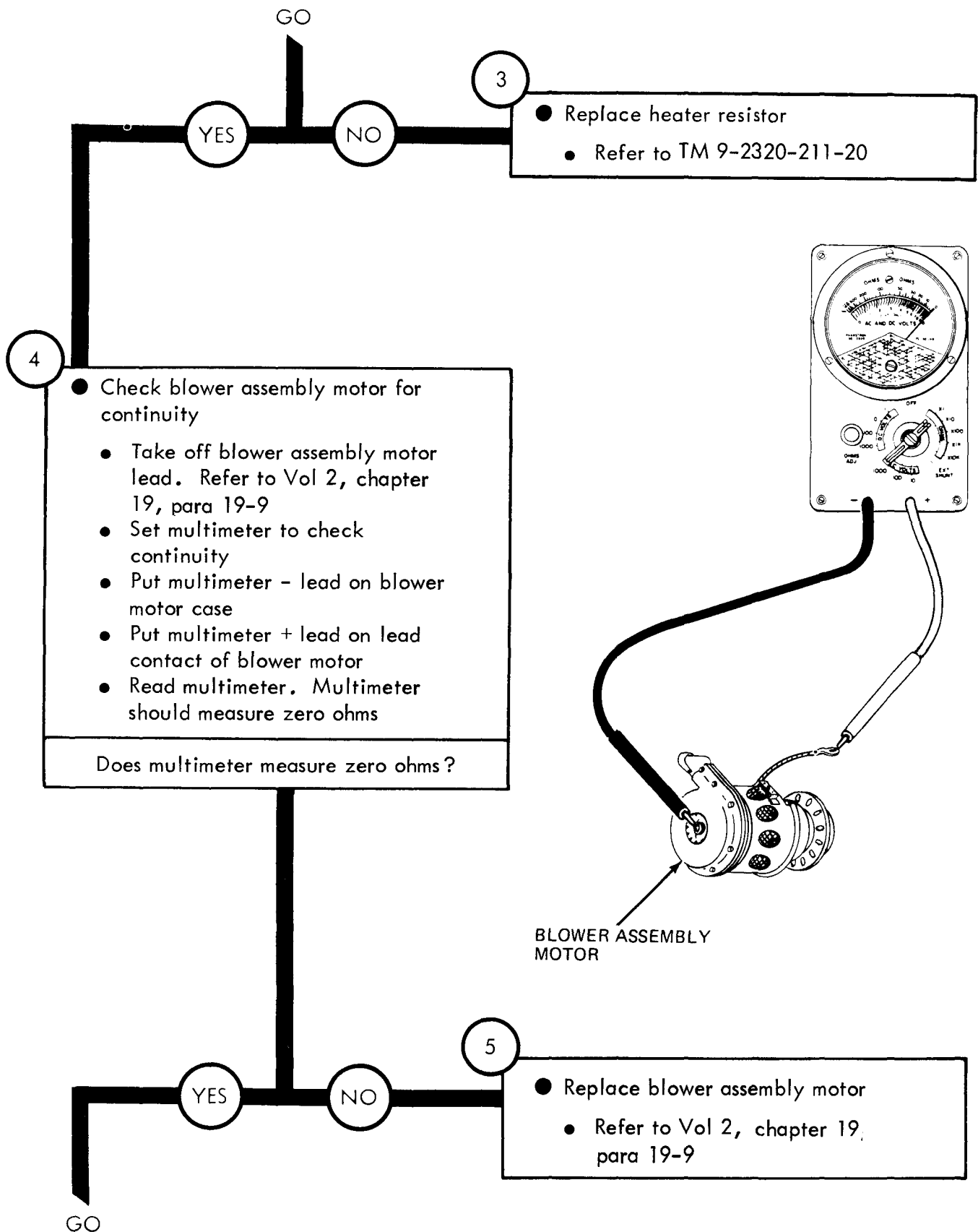
Did multimeter measure resistance for both tests?

GO



TA 120949

Figure 14-5



TA 120950

Figure 14-5 (Sheet 2 of 4)



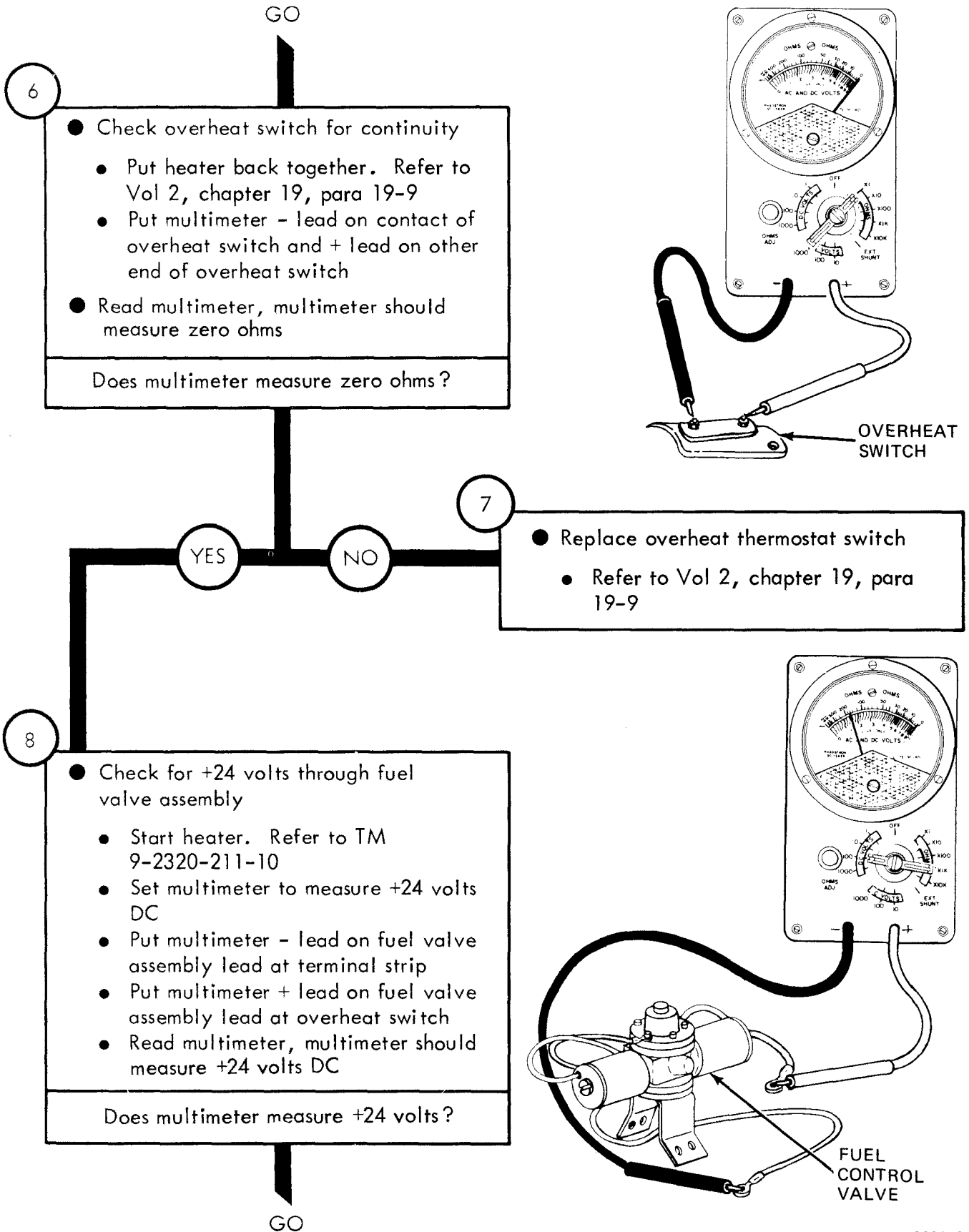


Figure 14-5 (Sheet 3 of 4)

TA 120951

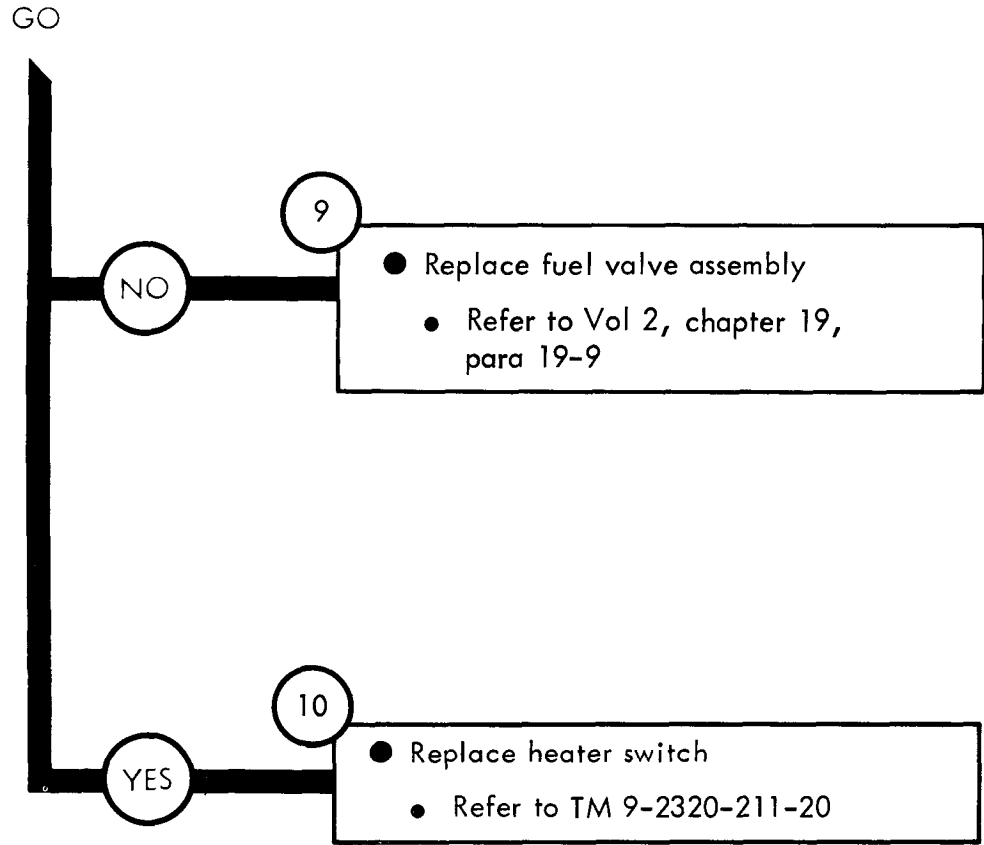


Figure 14-5 (Sheet 4 of 4)

TA 120952

Symptom

6 FUEL BURNING HEATER DOES NOT START

NOTE

When measuring voltage +24 volts DC means a range of +23 to +26 volts DC

1

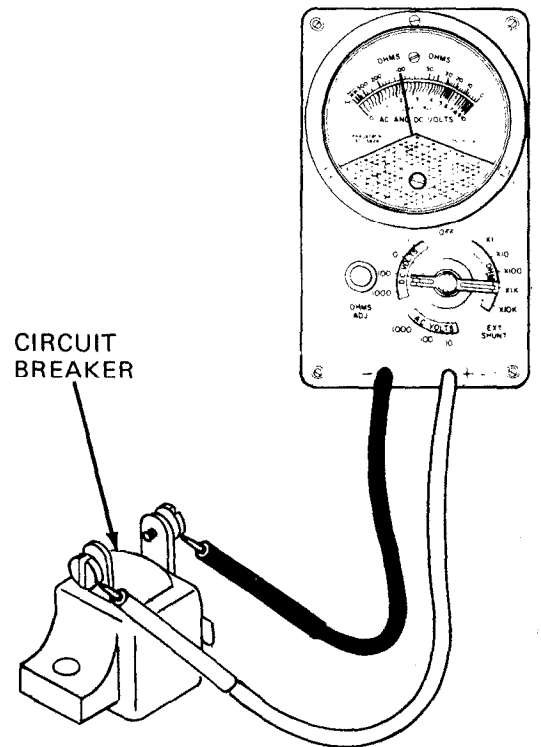
- Park truck
- Refer to TM 9-2320-211-10

2

- Check for +24 volts DC through control box circuit breaker
  - Take off control box cover. Refer to TM 9-2320-211-20
  - Set multimeter to measure +24 volts DC
  - Put multimeter - lead on one contact of circuit breaker
  - Put multimeter + lead on other contact of circuit breaker
  - Read multimeter. Multimeter should measure +24 volts DC

Does multimeter measure +24 volts DC?

GO



TA 120953

Figure 14-6 (Sheet 1 of 6)

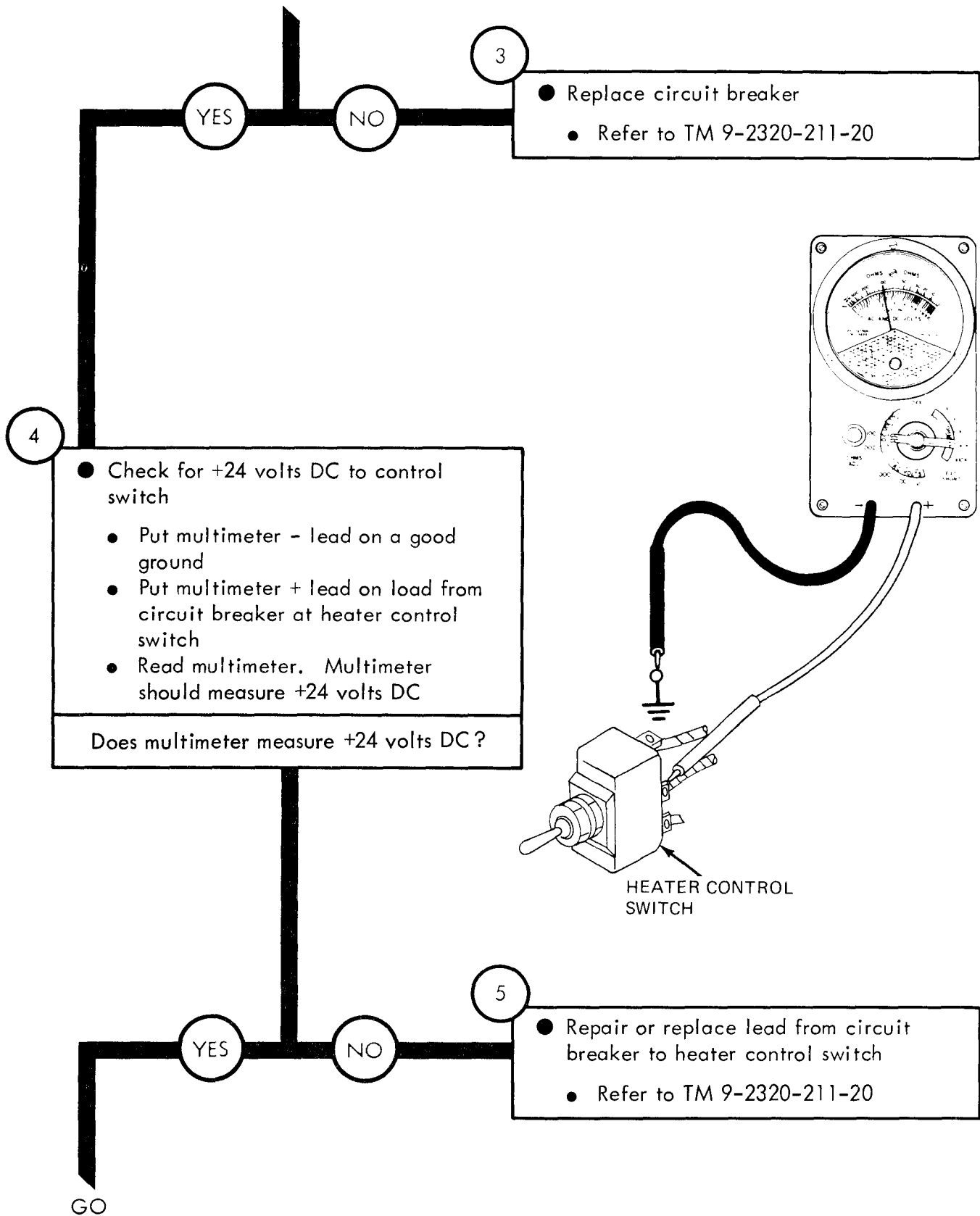


Figure 14-6 (Sheet 2 of 6)

TA 120954

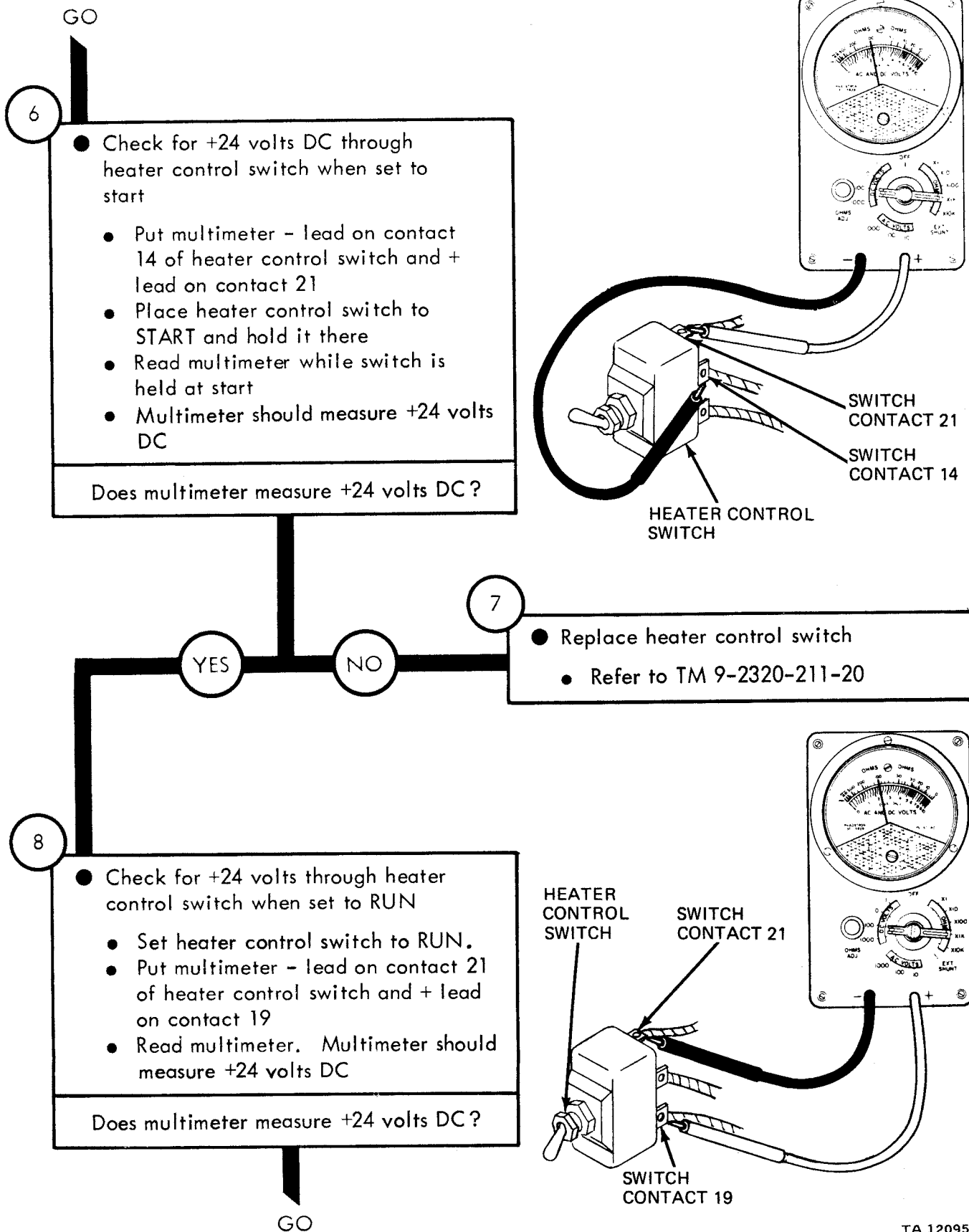


Figure 14-6 (Sheet 3 of 6)

TA 120955

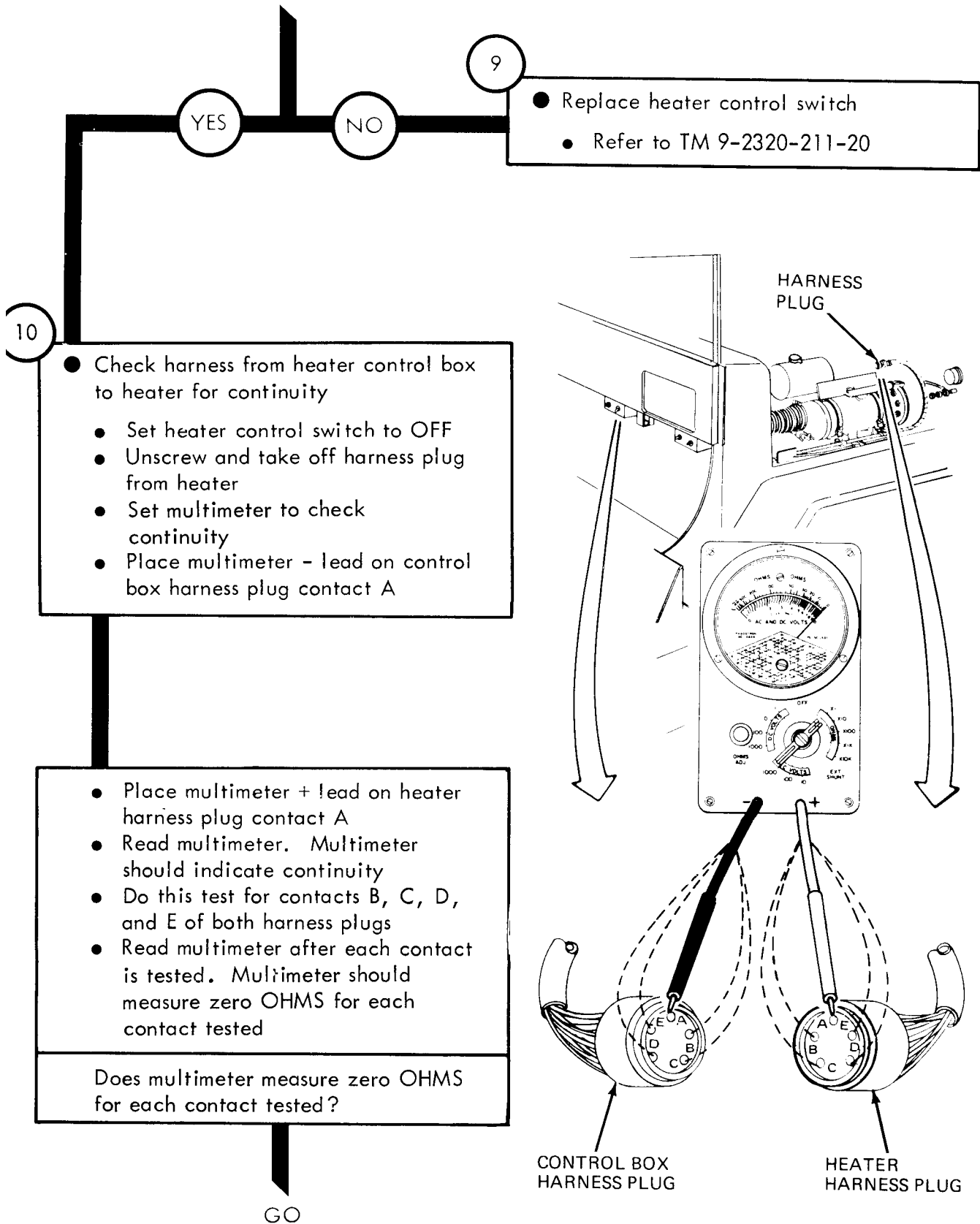


Figure 14-6 (Sheet 4 of 6)

TA 120956

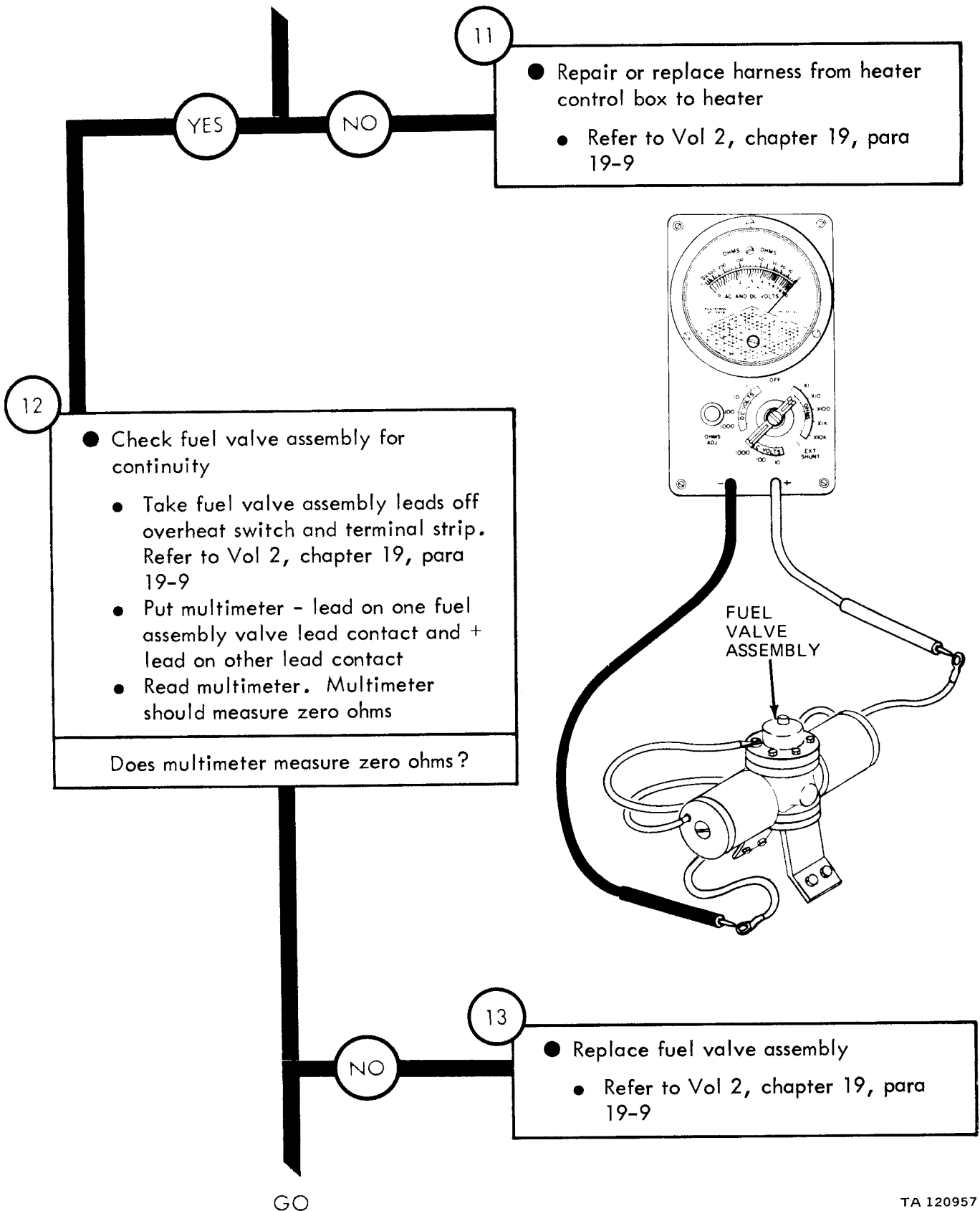


Figure 14-6 (Sheet 5 of 6)

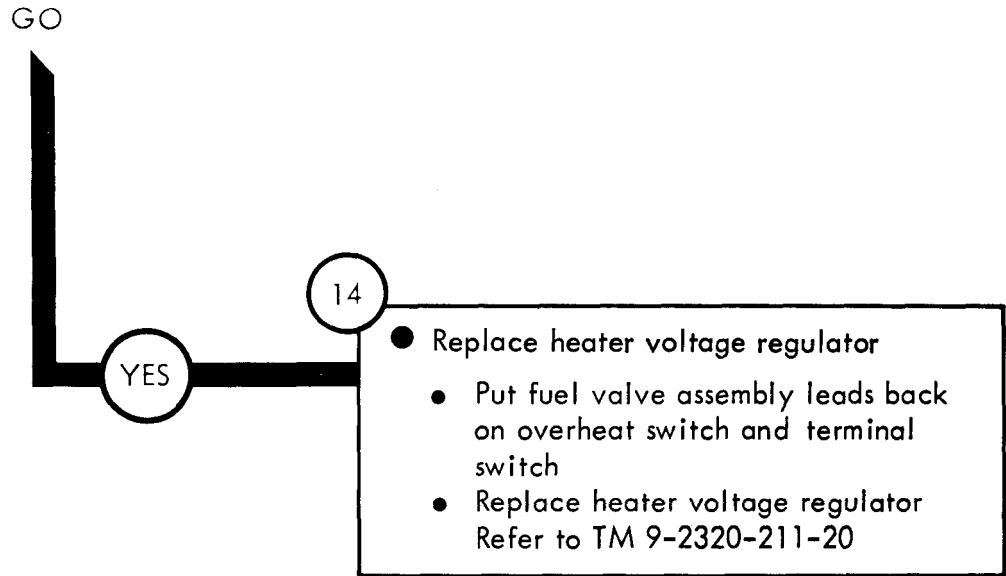


Figure 14-6 (Sheet 6 of 6)



Symptom

7 WHEN HYDRAULIC BRAKES ARE APPLIED, TOWED LOAD DOES NOT HAVE ENOUGH BRAKING ACTION

NOTE

Two soldiers are needed for some electric brake test and are noted as Soldier A and Soldier B  
 When measuring voltage +24 volts DC means a range of +23 to +26 volts DC

1

- Park truck
- Refer to TM 9-2320-211-10

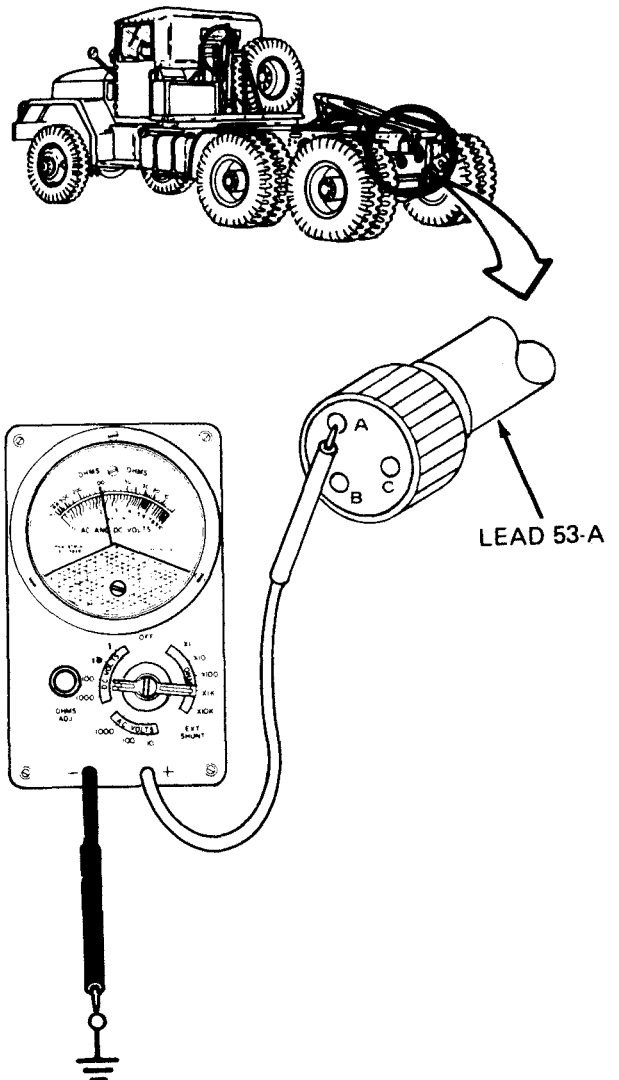
2

- Check for +24 volts DC to controller assembly
  - Start engine refer to TM 9-2320-211-10
  - Unscrew and take off harness plug from controller assembly receptacle
  - Set rheostat to highest setting
  - Set multimeter to measure +24 volts DC

- Put multimeter - lead on a good ground
- Put multimeter + lead on lead 53A contact of harness plug
- Read multimeter. Multimeter should measure +24 volts DC

Does multimeter measure +24 volts DC?

GO



TA 120959

Figure 14-7 (Sheet 1 of 8)

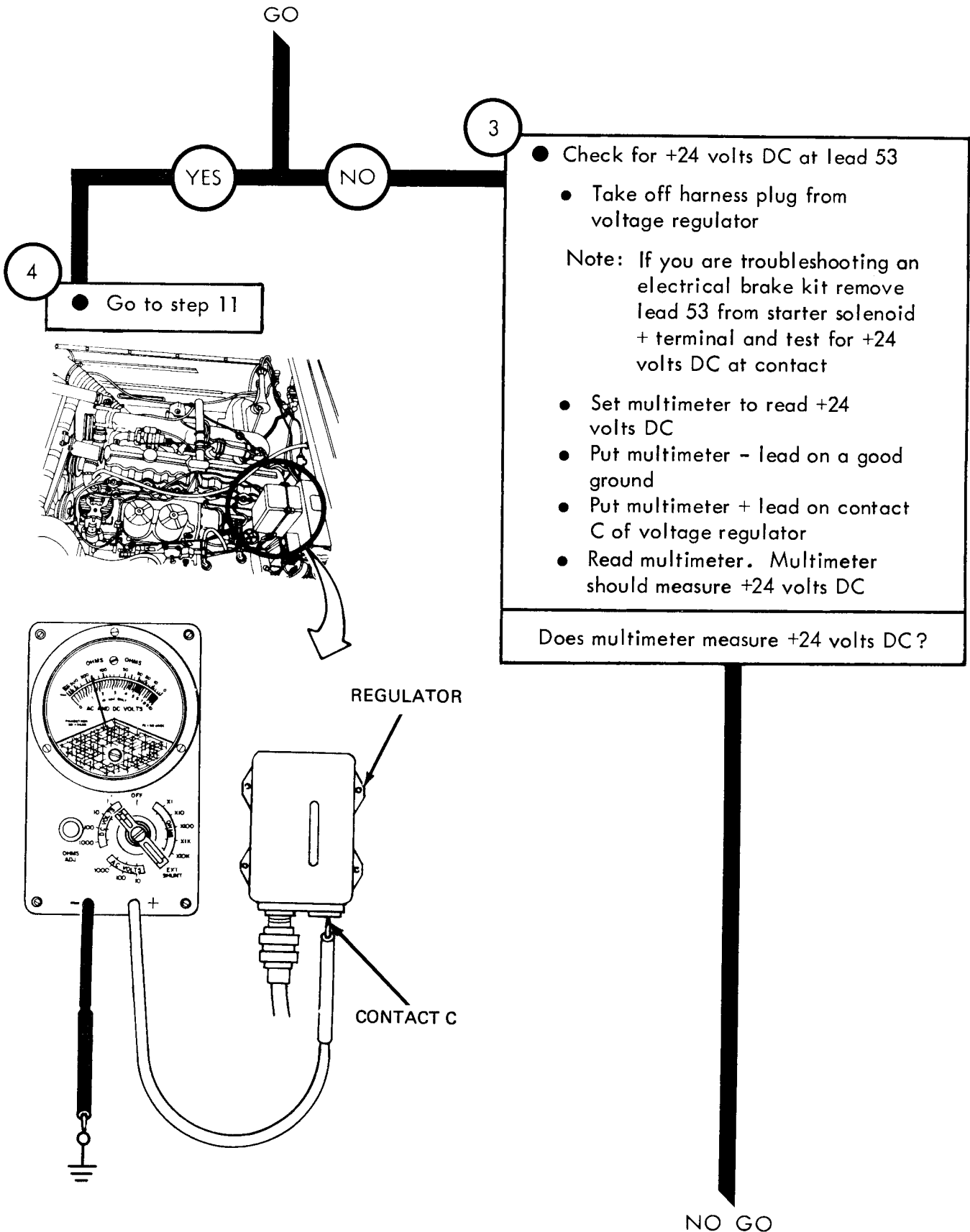


Figure 14-7 (Sheet 2 of 8)

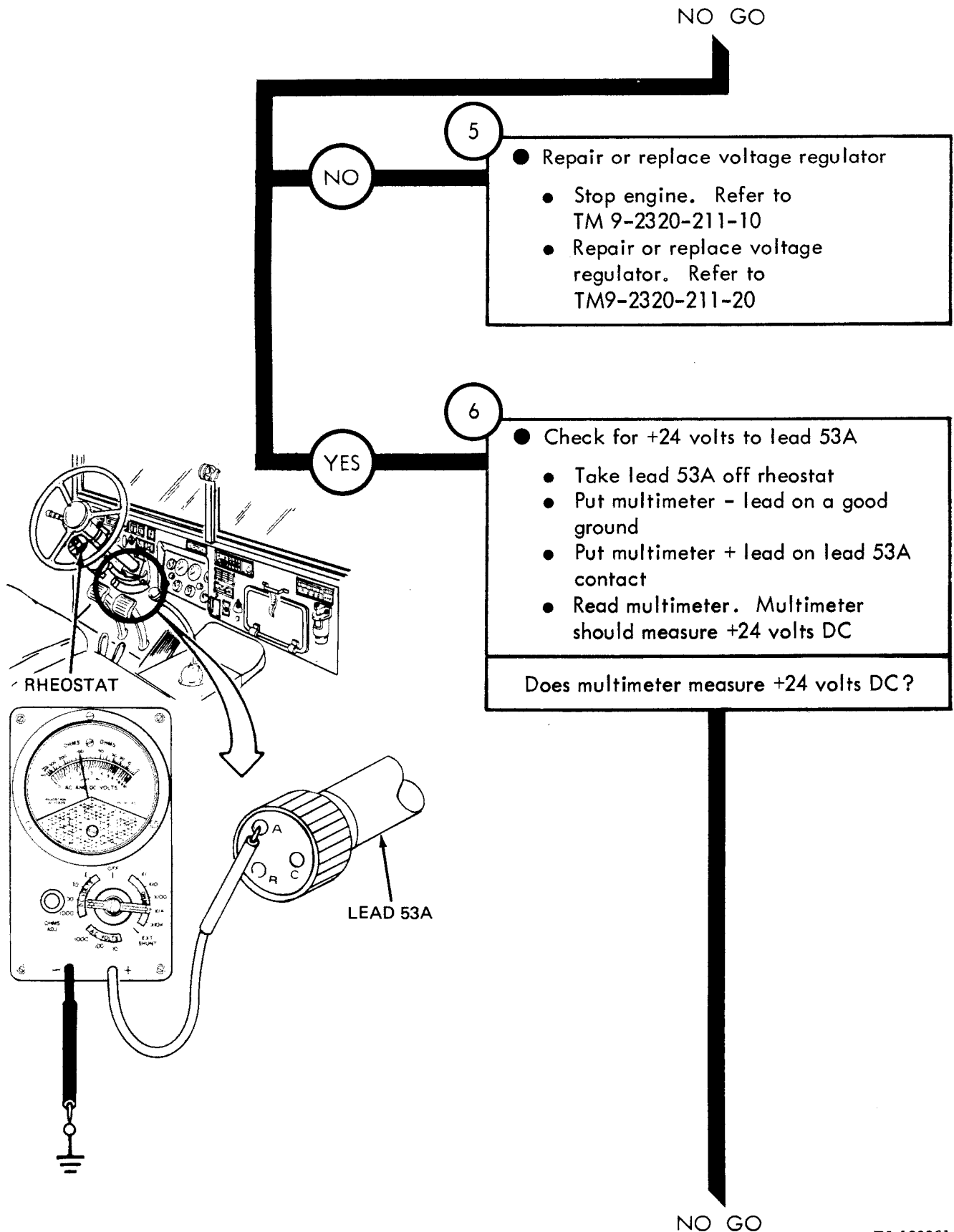


Figure 14-7 (Sheet 3 of 8)

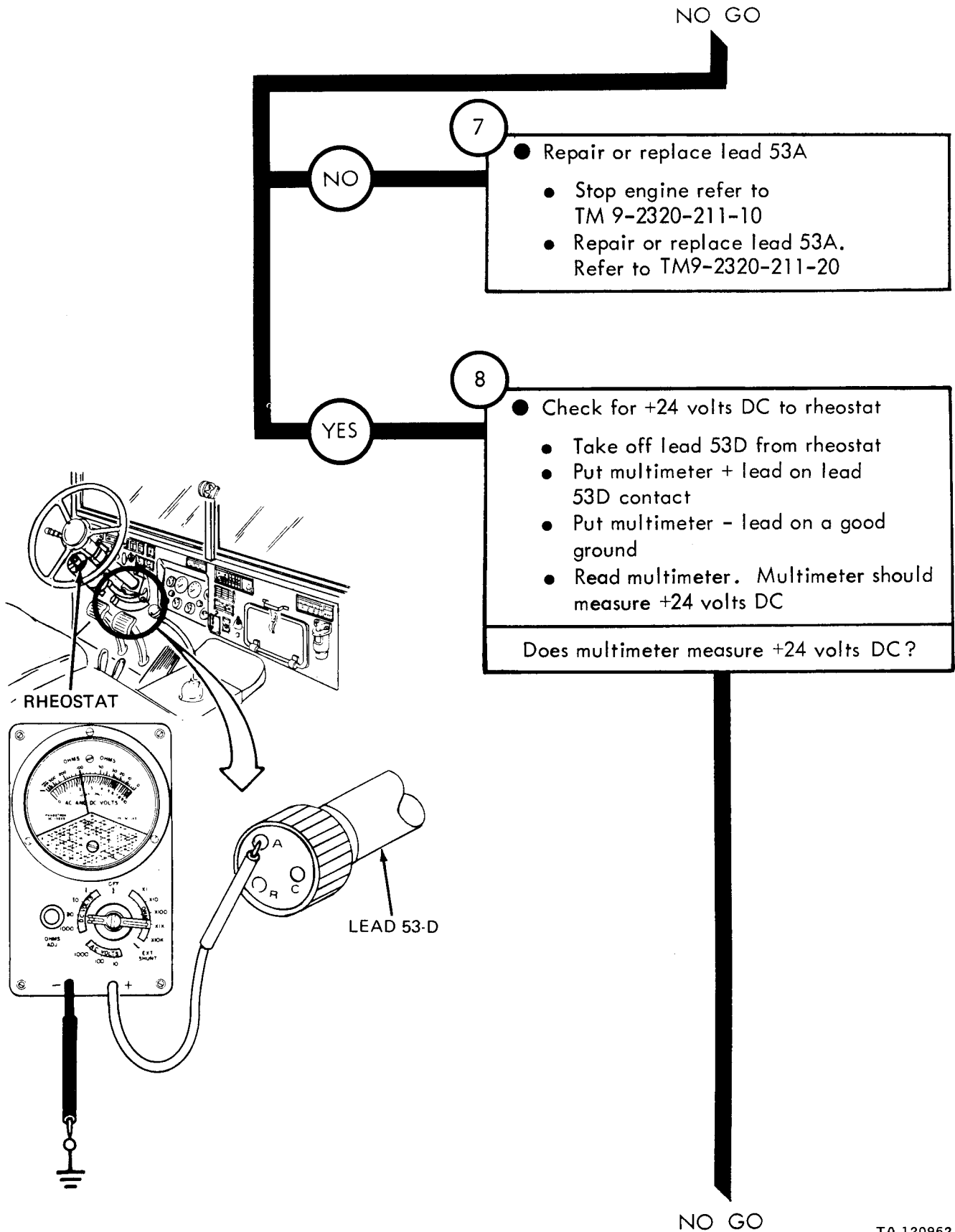
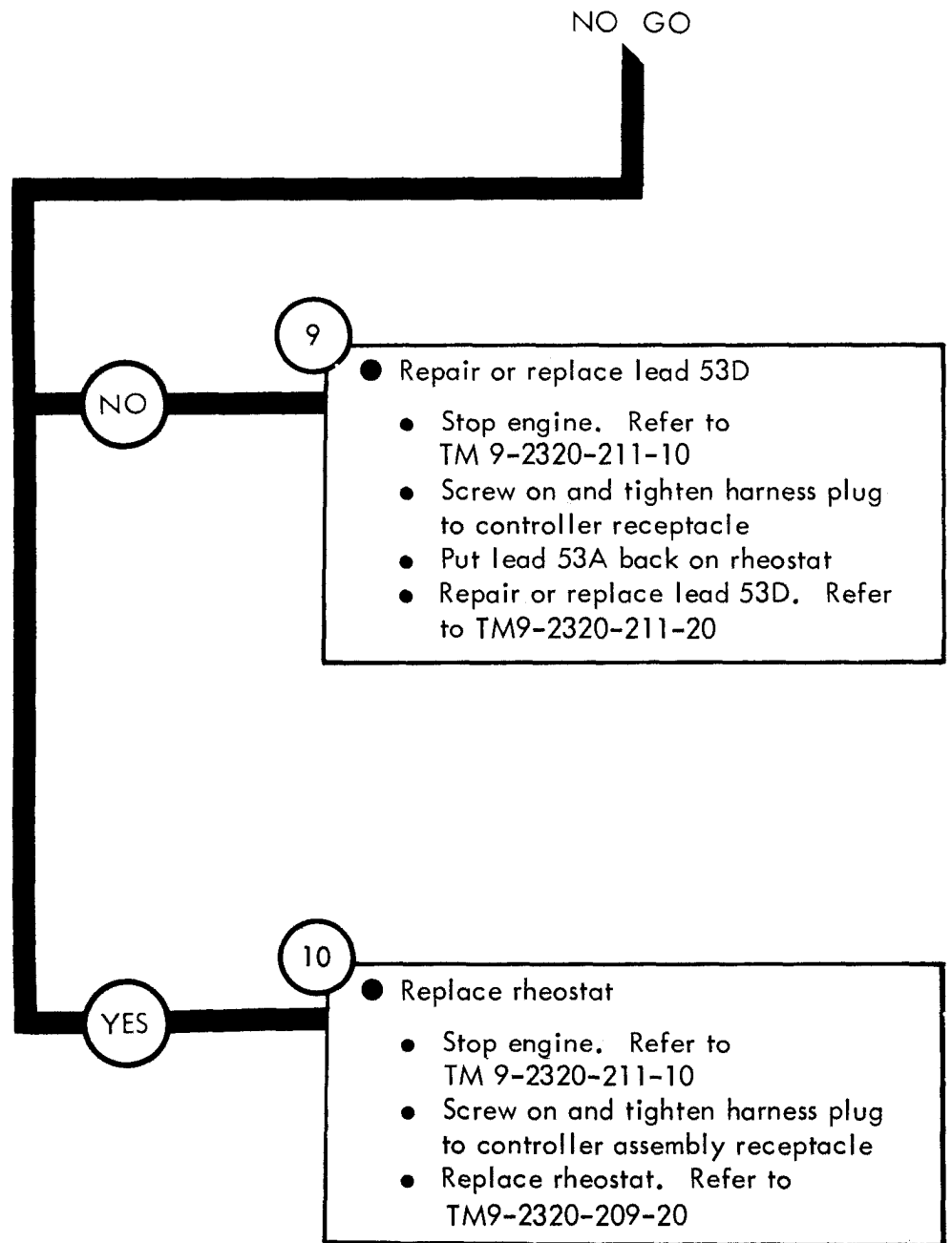


Figure 14-7 (Sheet 4 of 8)



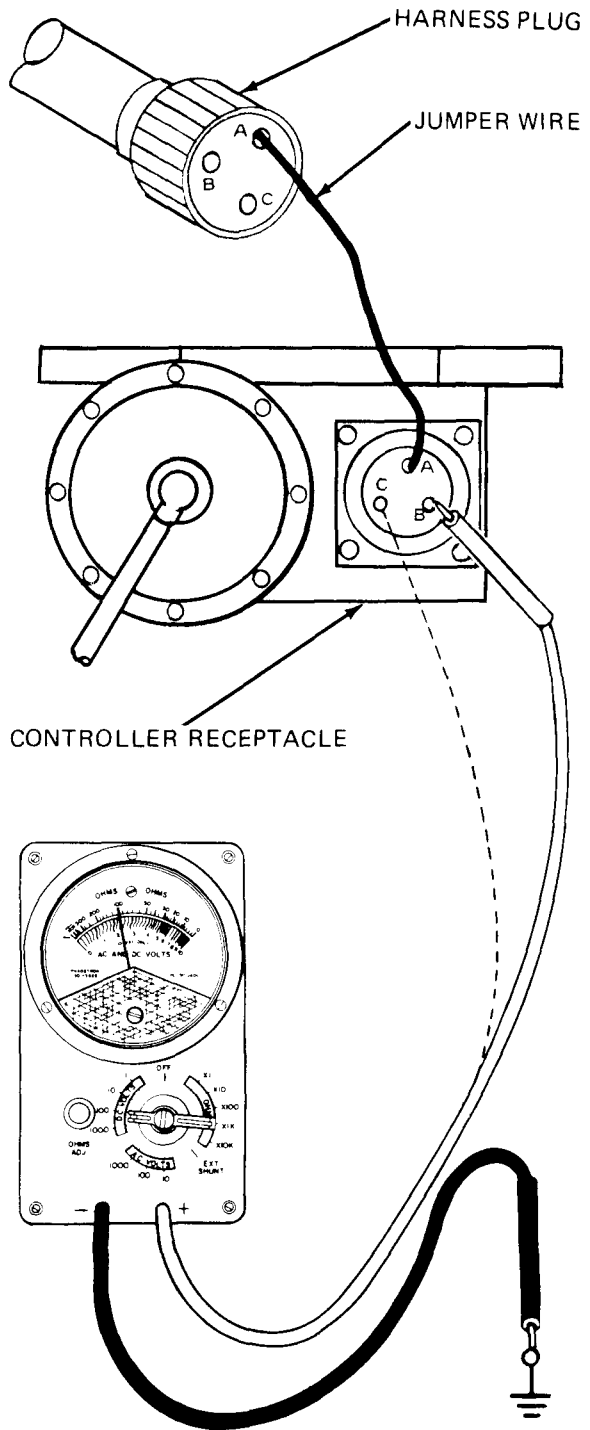
TA 12096:

Figure 14-7 (Sheet 5 of 8)

From step 4

11

- Check for +24 volts DC through controller assembly
- SOLDIER B: ● Put a jumper wire from harness plug contact A to controller assembly receptacle contact A
- Put multimeter + lead on contact B of controller assembly receptacle
  - Put multimeter - lead on a good ground and keep it there
- SOLDIER A: ● Step on brake pedal and hold it down
- SOLDIER B: ● While soldier A steps on brake pedal read multimeter. Multimeter should measure +24 volts DC



- With Soldier A still holding down brake pedal put multimeter + lead on controller assembly contact C
- Read multimeter. Multimeter should measure +24 volts DC

Does multimeter measure +24 volts DC for both tests?

GO

TA 120964

Figure 14-7 (Sheet 6 of 8)

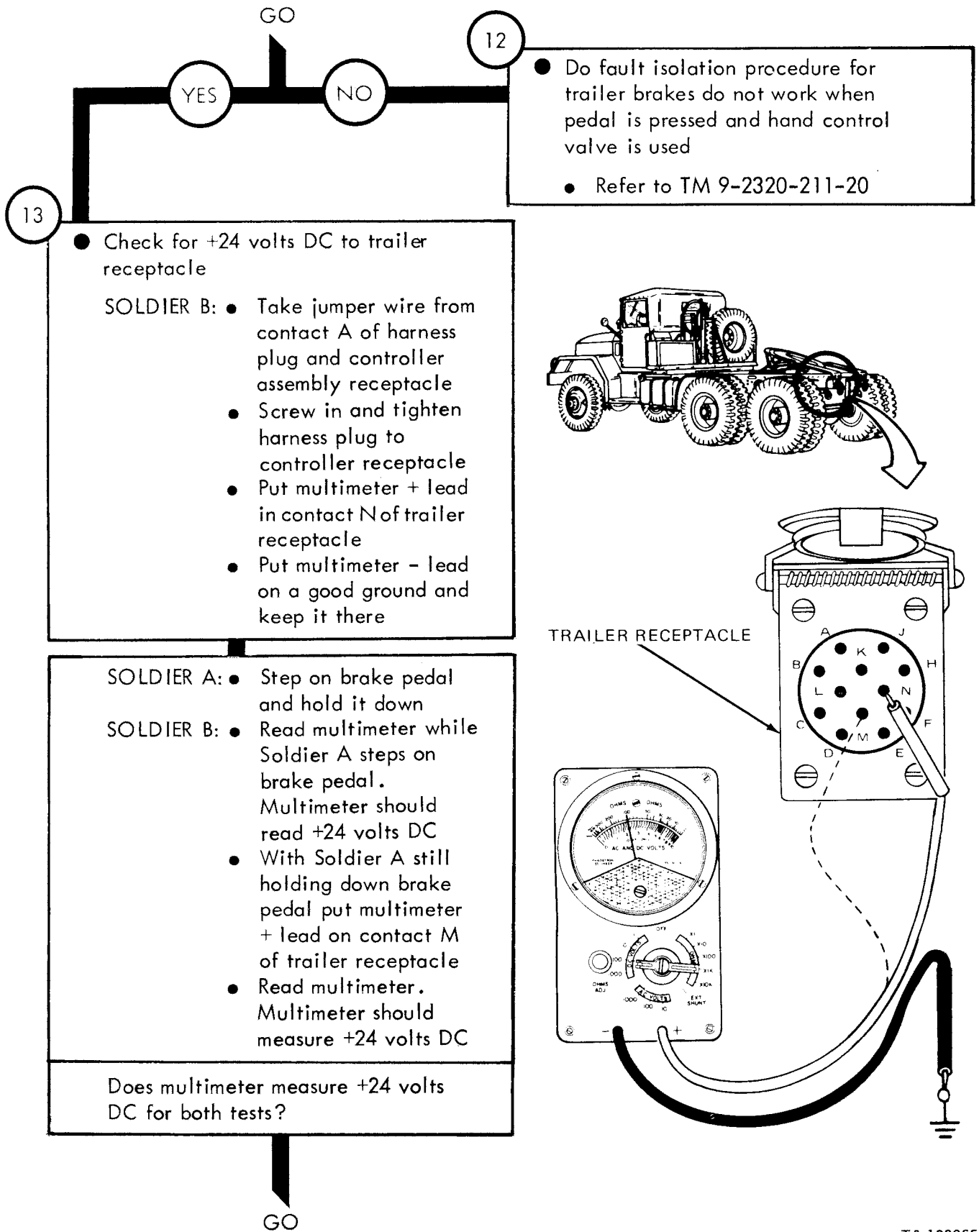


Figure 14-7 (Sheet 7 of 8)

TA 120965

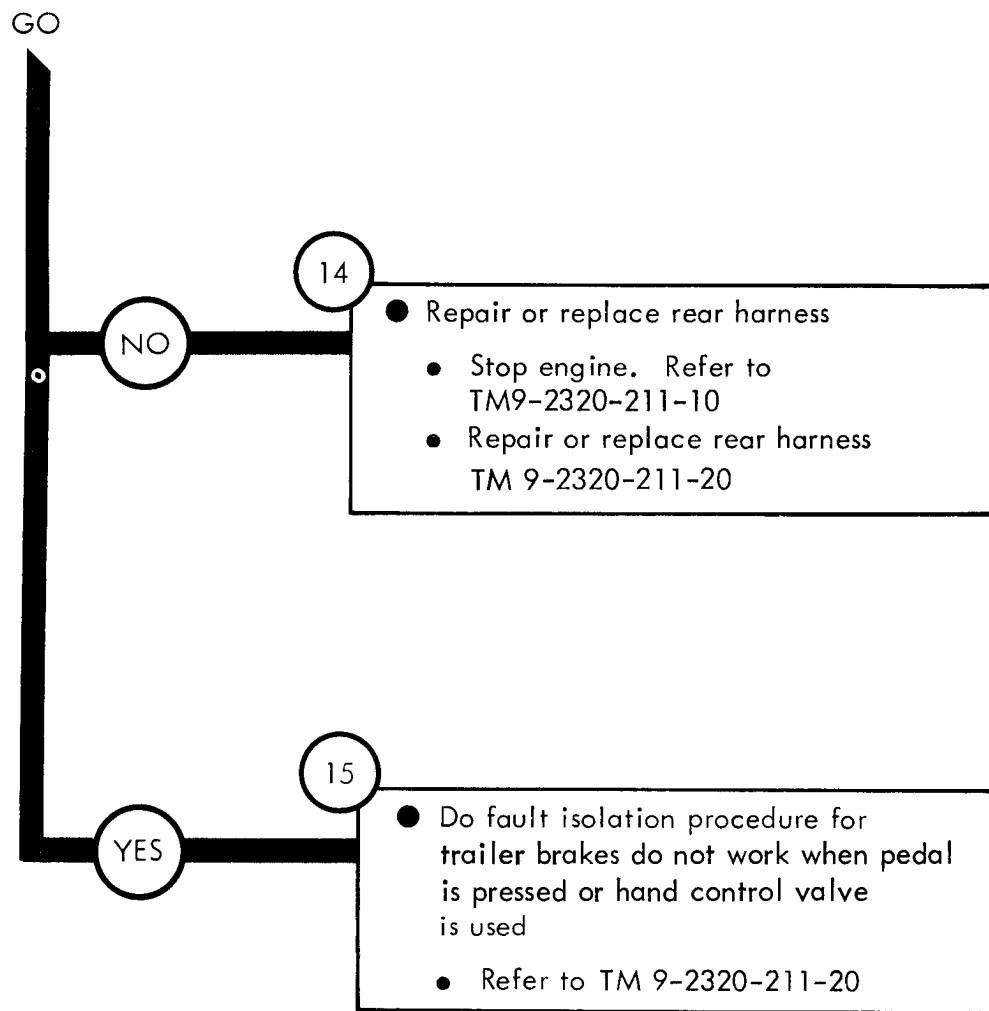


Figure 14-7 (Sheet 8 of 8)



## CHAPTER 15

# ELECTRICAL SYSTEM TEST PROCEDURES

---

15-1. TEST PROCEDURES. Test procedures for the electrical system consist of procedures for using voltmeters. Refer to TM 9-2320-209-20 for these procedures.



## CHAPTER 16

### FRONT AXLE SYSTEM TROUBLESHOOTING

---

16-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Front Axle System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

16-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

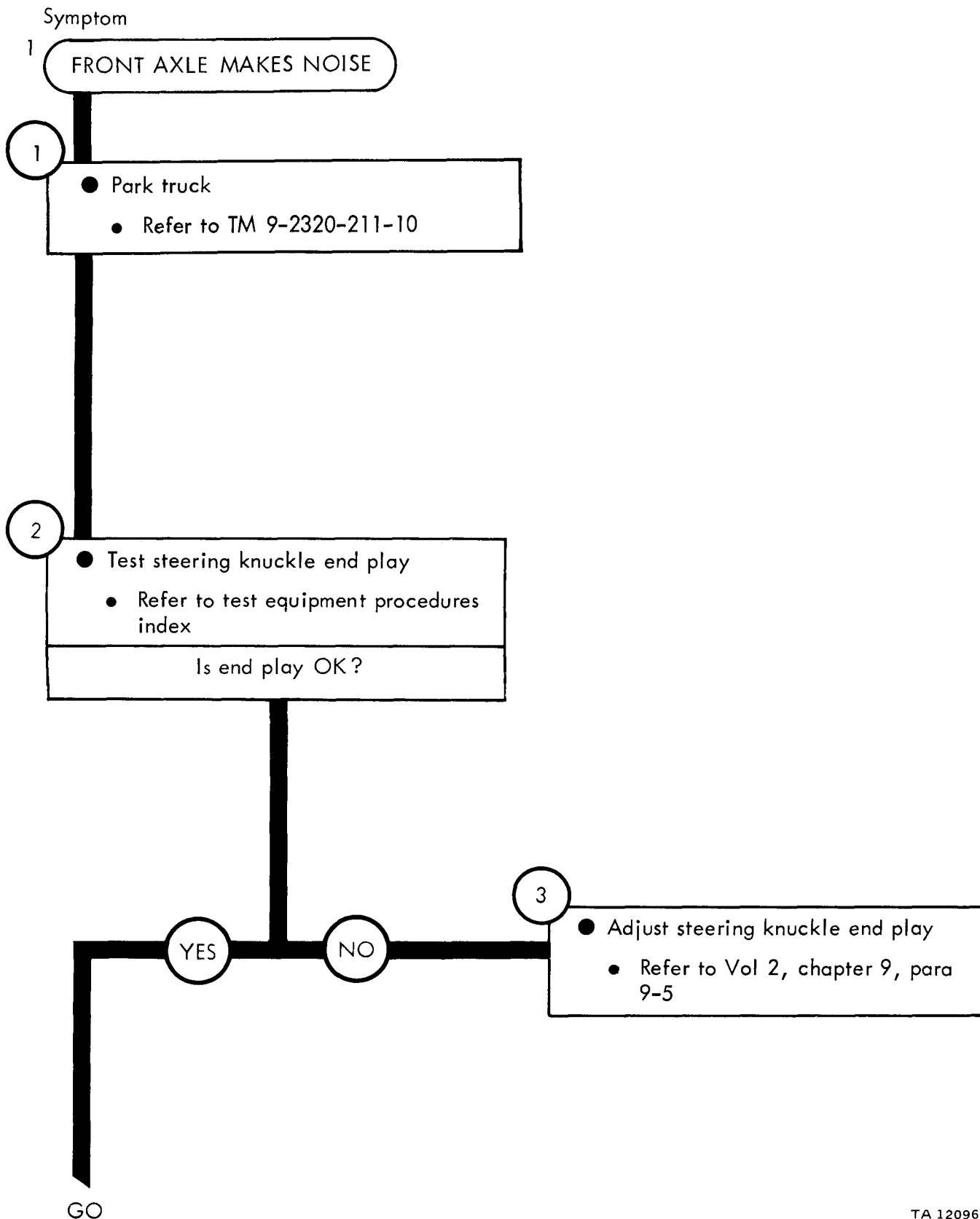
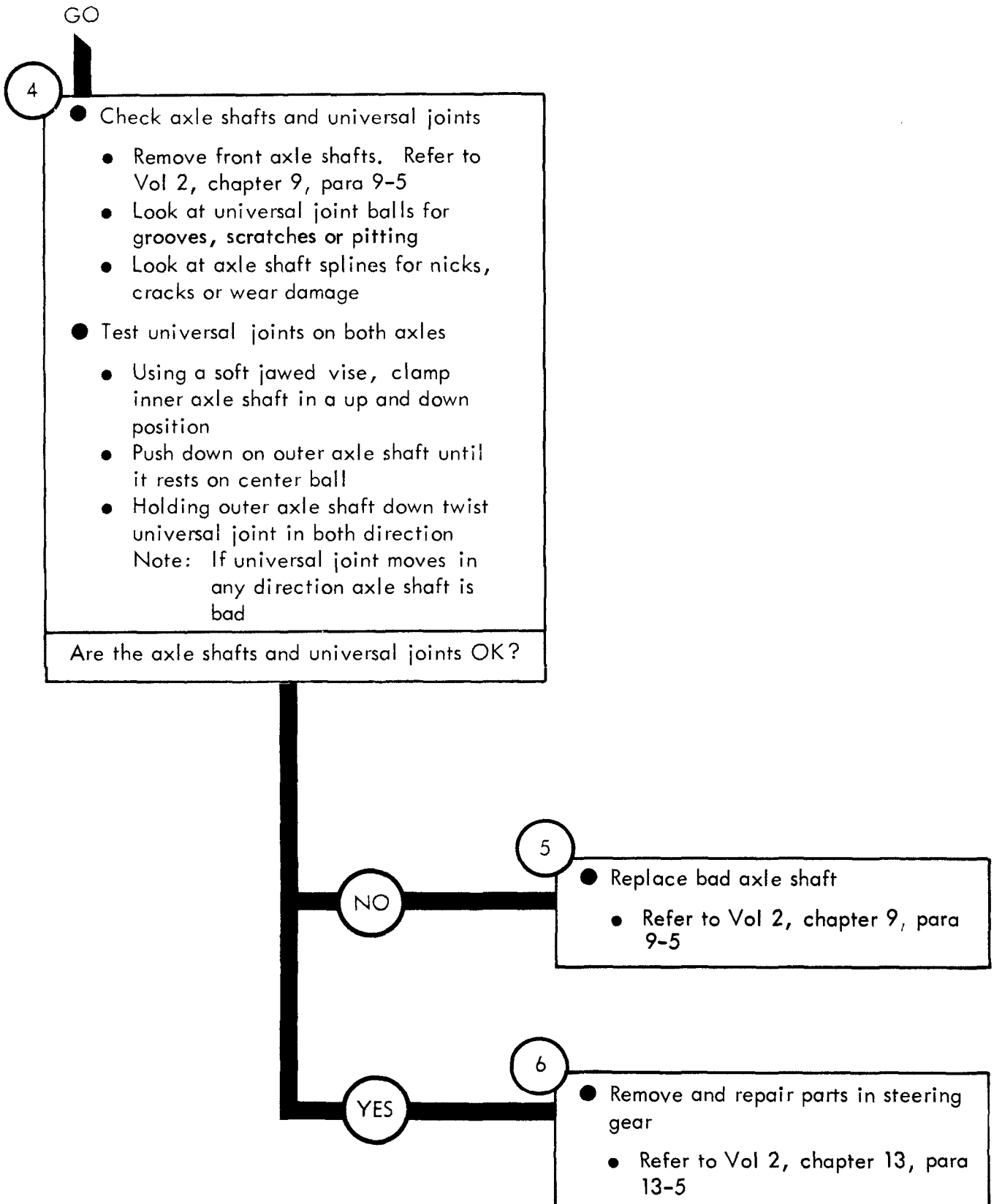


Figure 16-1 (Sheet 1 of 2)



TA 120968

Figure 16-1 (Sheet 2 of 2)

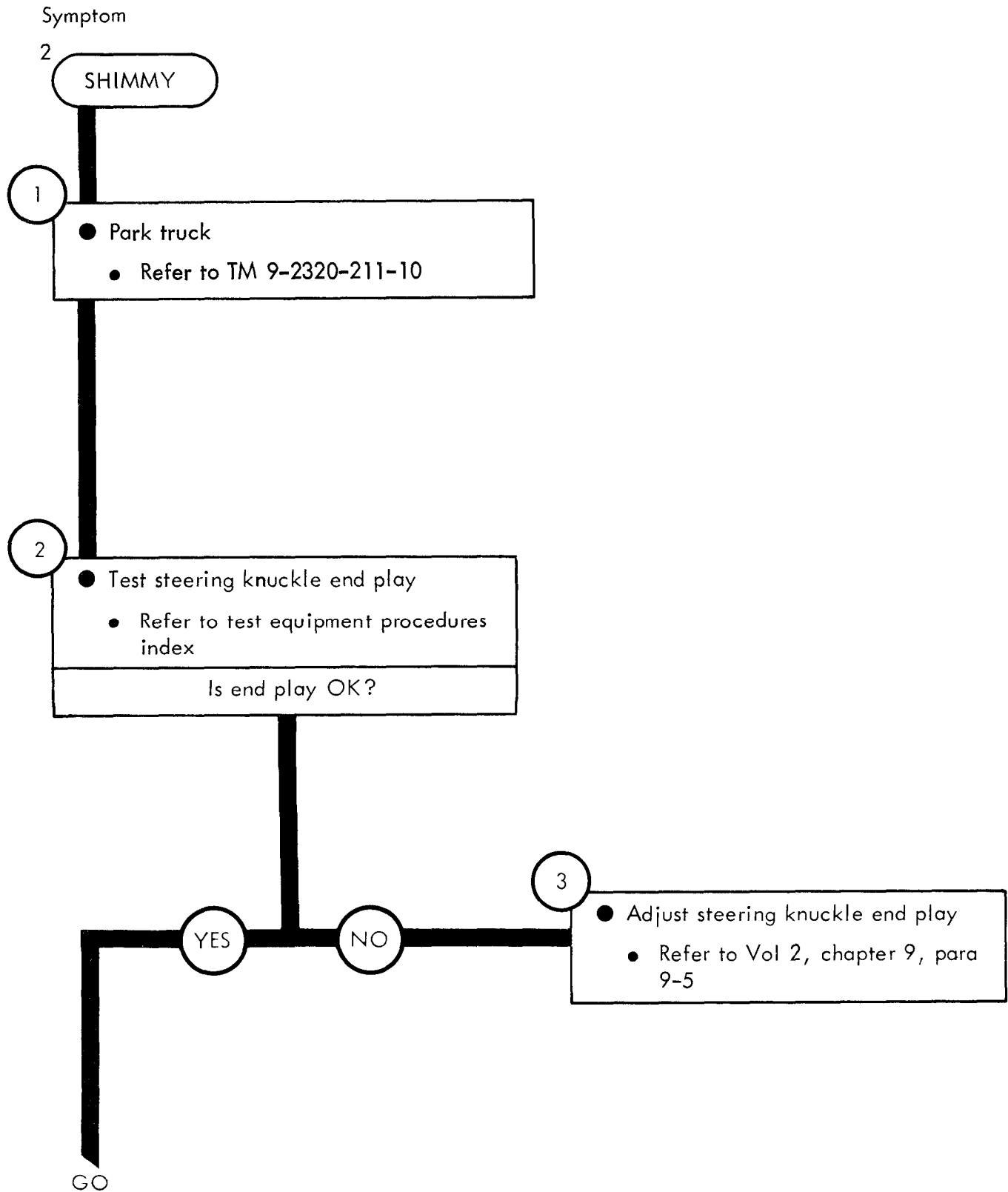
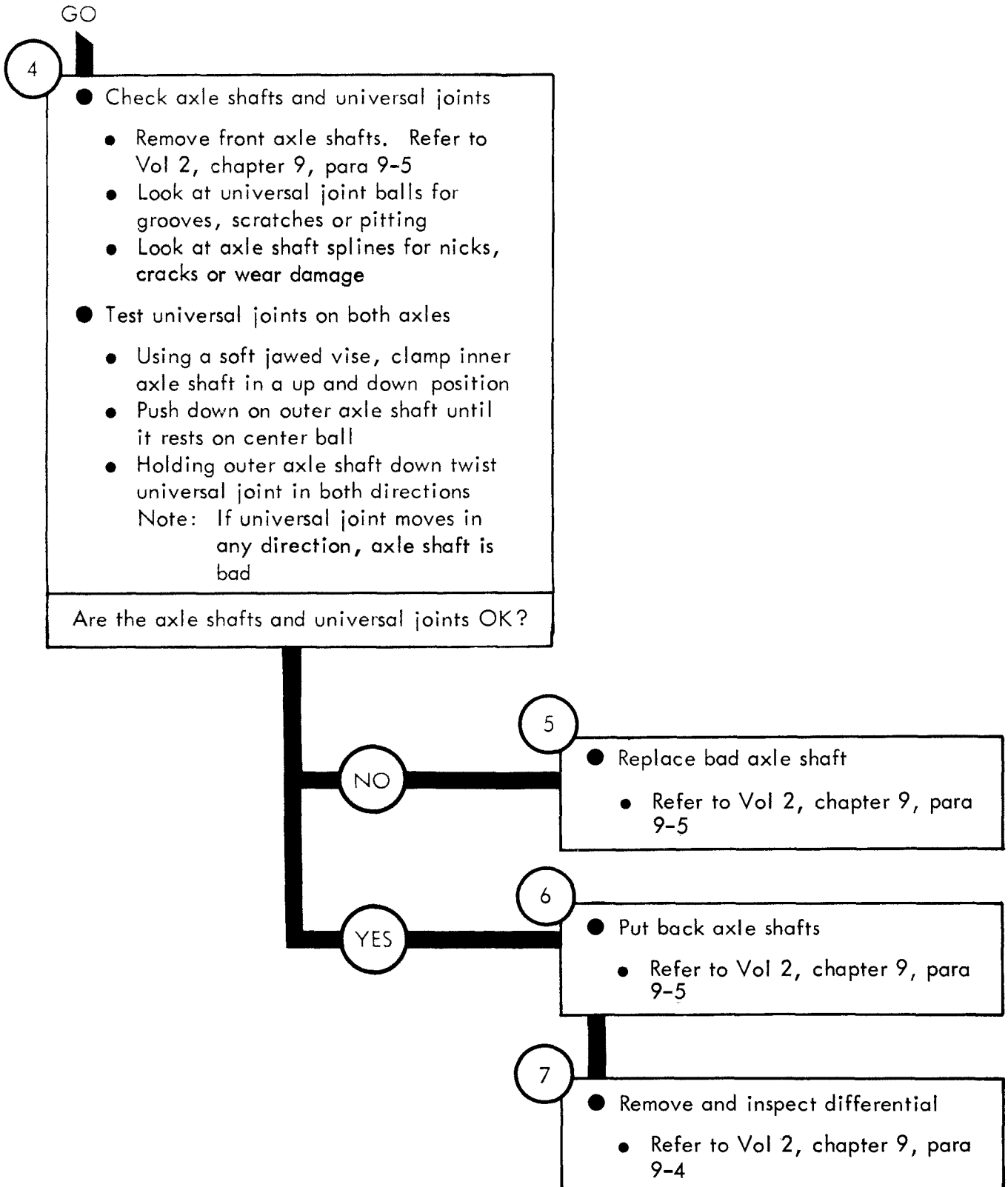


Figure 16-2 (Sheet 1 of 2)



TA 120970

Figure 16-2 (Sheet 2 of 2)





## CHAPTER 17

# FRONT AXLE SYSTEM TEST PROCEDURES

---

17-1. GENERAL. This chapter gives test procedures for the tests given in chapter 16, for the Front Axle System.

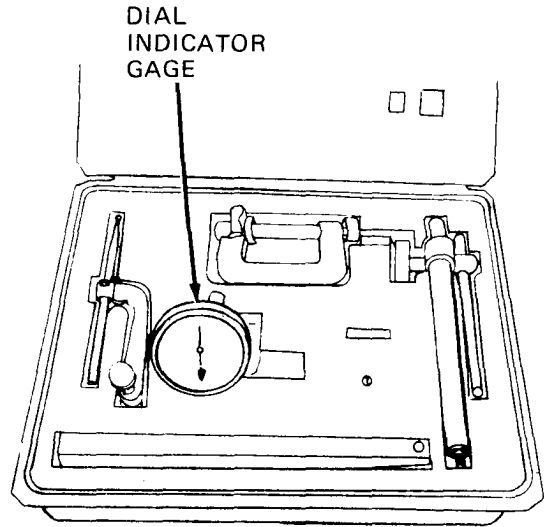
17-2. TEST SET-UP. Instructions for setup of test equipment and parts to be tested are given before the test procedures. Illustrations are used, when needed, to show you how to hook up the test equipment to the part to be tested.

17-3. TEST PROCEDURE. Detailed step-by-step instructions, in flow chart form, are given for each test. The procedure calls out the type of test and the condition of the truck system for each part of testing. The step-by-step test will lead you to the bad component or to a fault symptom within a related system. Reference is made to the fault symptom index, chapter 6, if the test shows a fault in another system.

GENERAL INSTRUCTIONS

1

- Check dial indicator and accessories
  - Gage - Look to see that glass and needle are not broken
  - Accessories - Look to see that all mounting accessories are in case and not damaged



STEERING KNUCKLE END PLAY TEST - To measure steering knuckle end play

NOTE

Steering knuckle end play should be checked on both wheels

GO

TA 120971

Figure 17-1 (Sheet 1 of 2)

GO

1

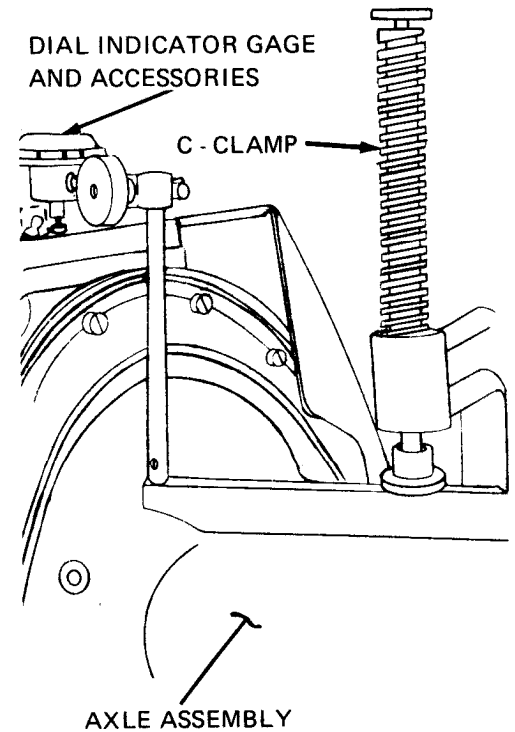
- Set up dial indicator as follows
  - Assemble dial indicator and clamp it to axle assembly using a six-inch C clamp
  - Set moveable pointer of dial indicator on steering knuckle arm just behind grease fitting

2

- Test steering knuckle end play as follows
  - Set moveable pointer on dial indicator to 0
  - Using jack, raise front wheel off ground. Refer to TM 9-2320-211-10
  - Look at dial indicator to see if reading is between 0.005 and 0.013 inch

3

- Take dial indicator off of axle
  - Unscrew C-clamp and take off gage
  - Take apart dial indicator accessories and put back in case



TA 120972

Figure 17-1 (Sheet 2 of 2)



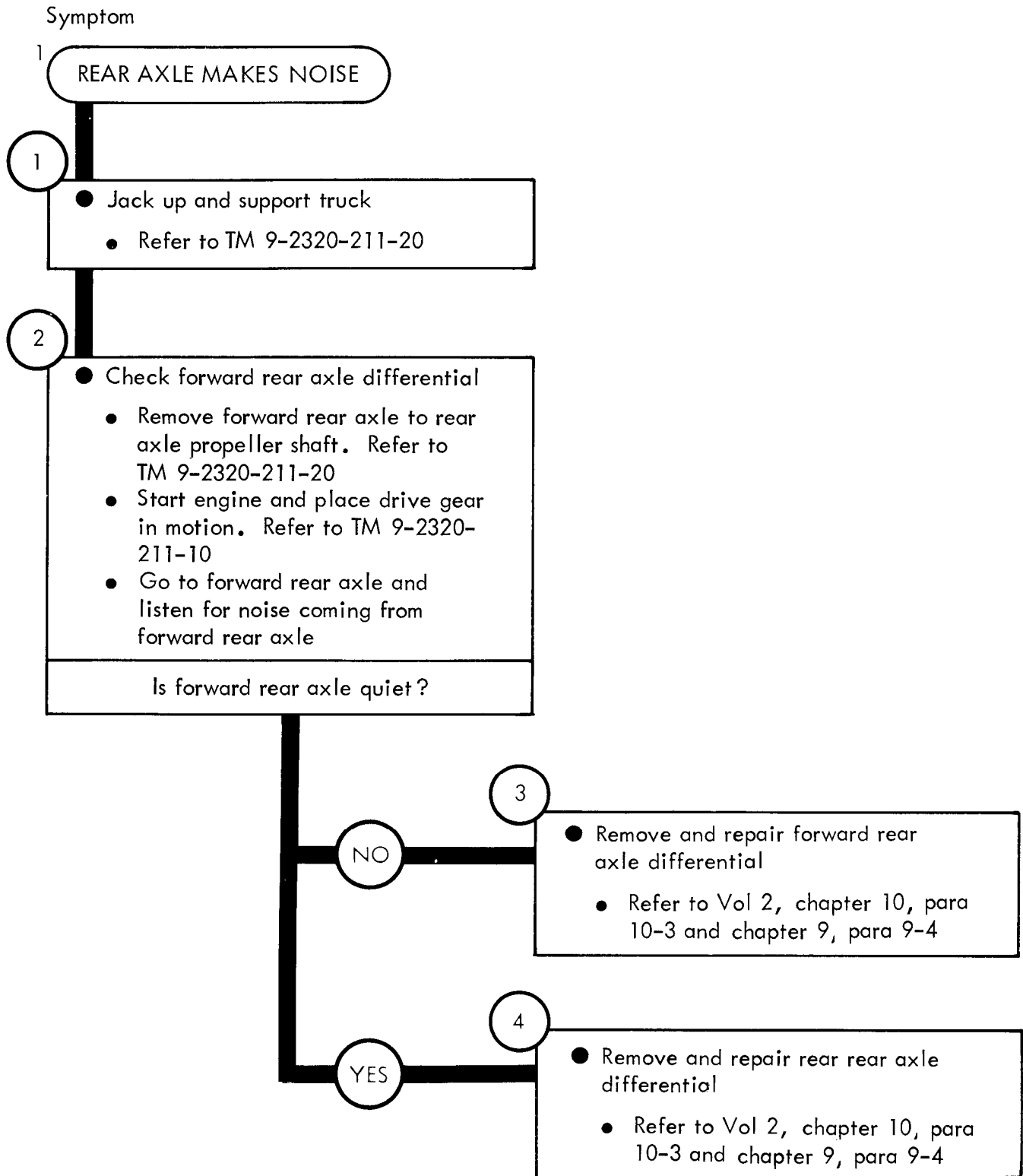
## CHAPTER 18

### REAR AXLE SYSTEM TROUBLESHOOTING

---

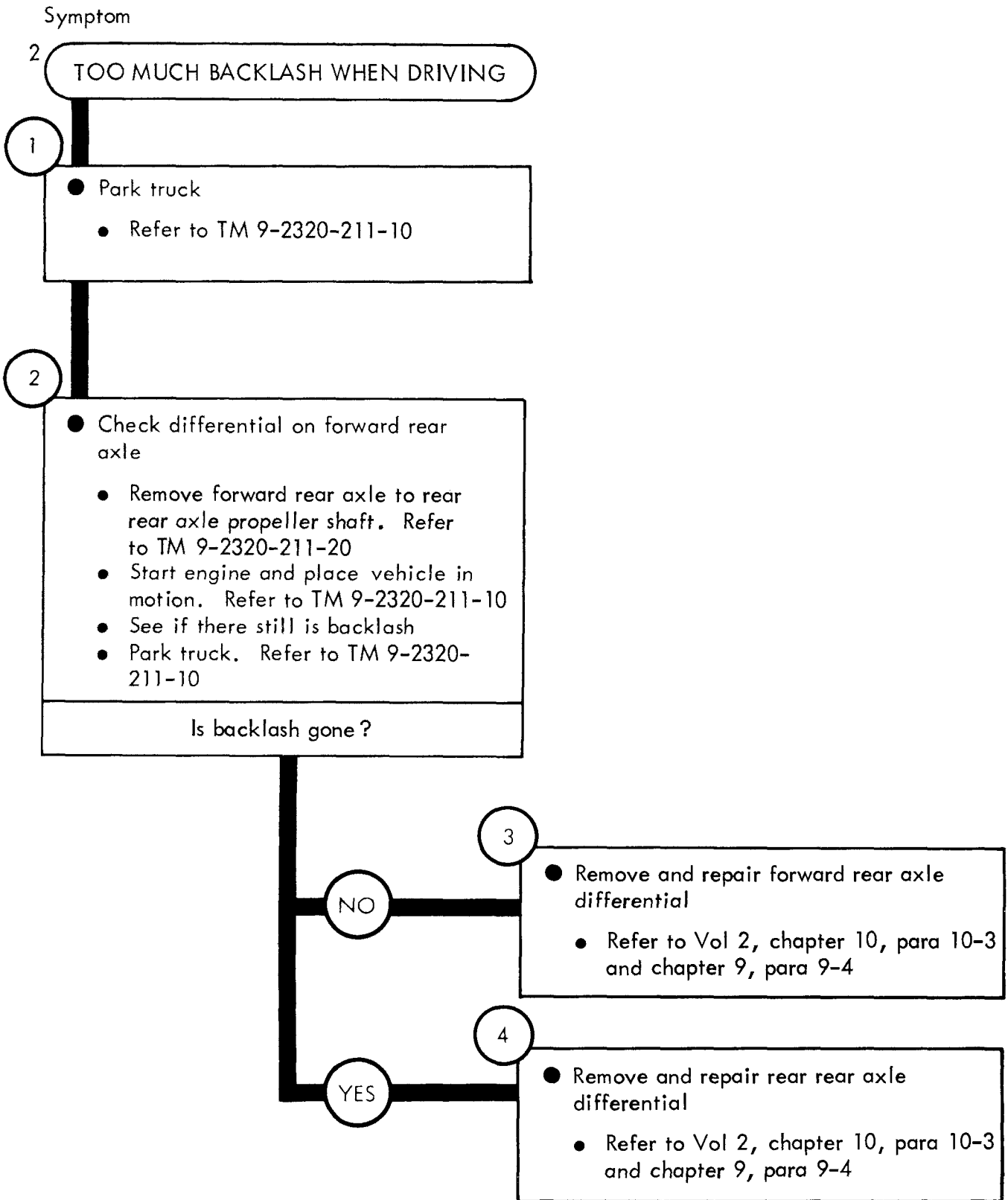
18-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Rear Axle System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

18-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.



TA 120973

Figure 18-1



TA 120974

Figure 18-2





## CHAPTER 19

### STEERING SYSTEM TROUBLESHOOTING

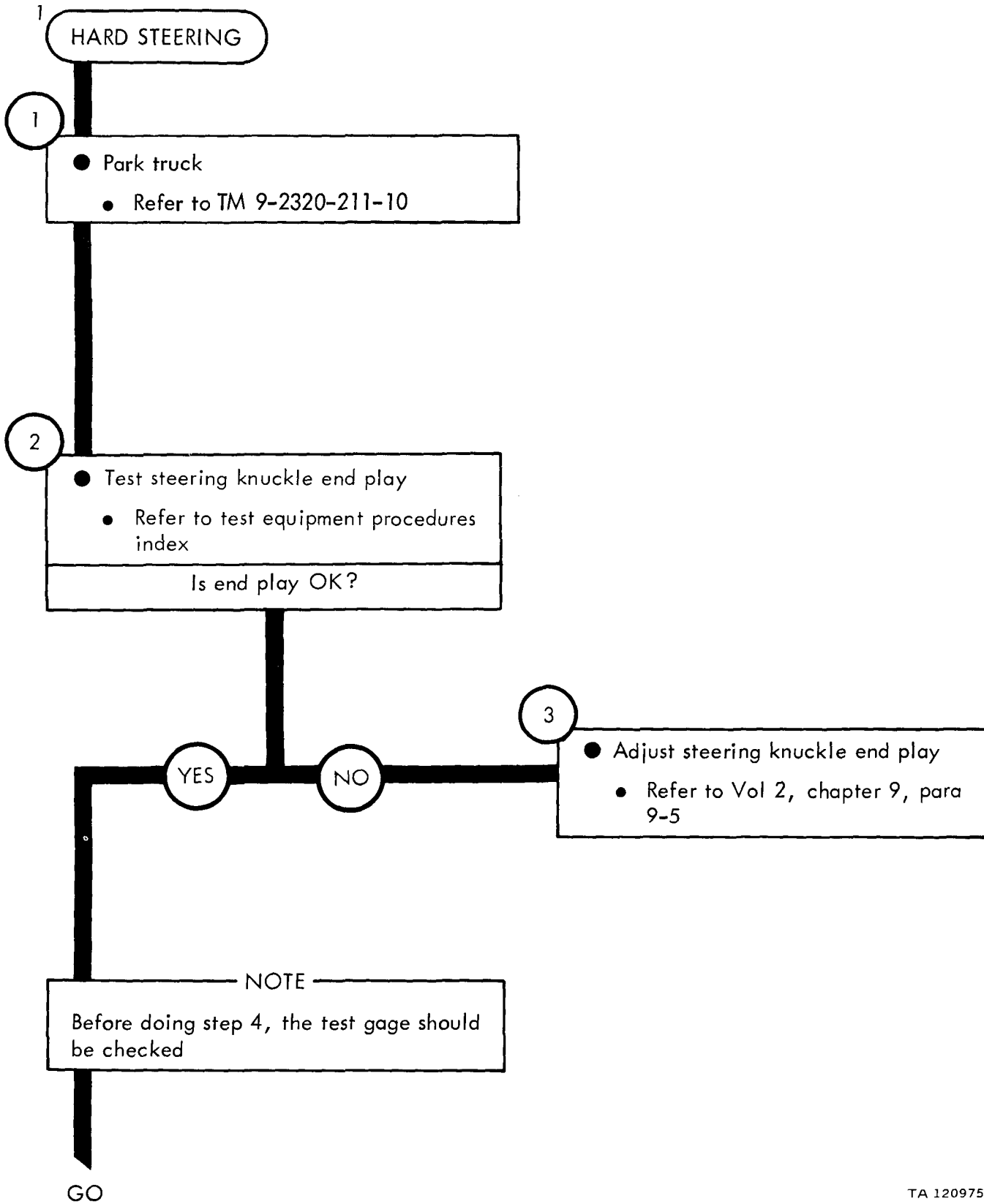
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19-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Steering System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

19-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

STEERING SYSTEM TROUBLESHOOTING

Symptom



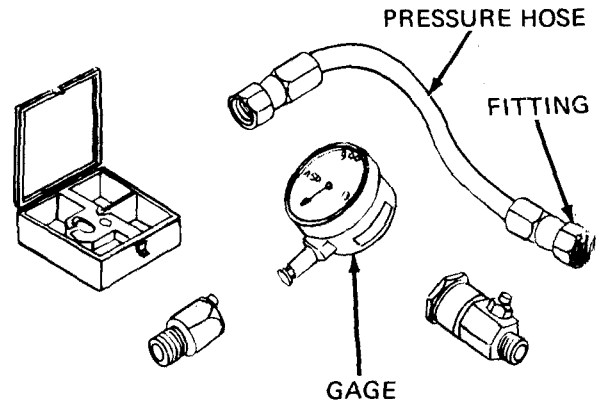
TA 120975

Figure 19-1 (Sheet 1 of 7)

GO

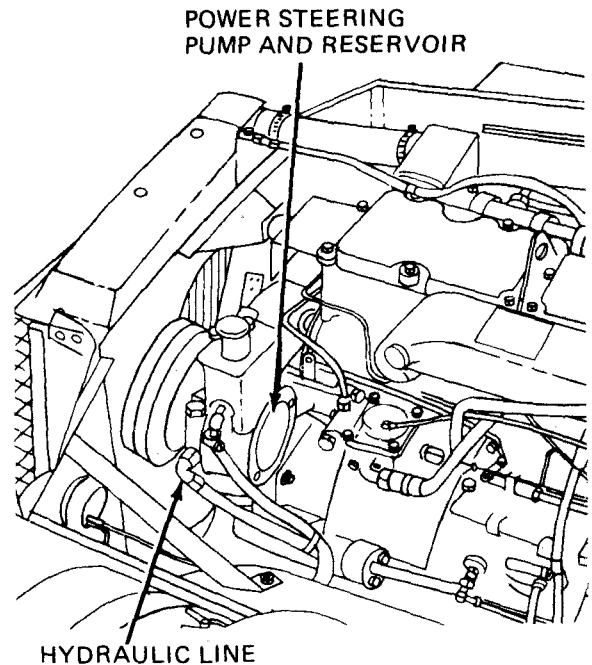
4

- Check power steering oil pressure test set before using
  - Gage - Look to see that the glass and needle are not broken
  - Pressure hose - Look to see that there are no holes, cracks, or sharp bends
  - Fittings - Feel if fittings are tight on both ends. Look to see that the input end is dirt free



5

- Set up pressure test on power steering pump
  - Put a can, or bucket, under power steering pump
  - Unscrew and take off hydraulic line from power steering pump and put lines in can or bucket
  - Put test set on power steering pump fitting and tighten
  - Put hydraulic line on test set adapter and tighten
  - Remove can or bucket from under pump and fill power steering fluid reservoir. Refer to LO 9-2320-211-12



GO

TA 120976

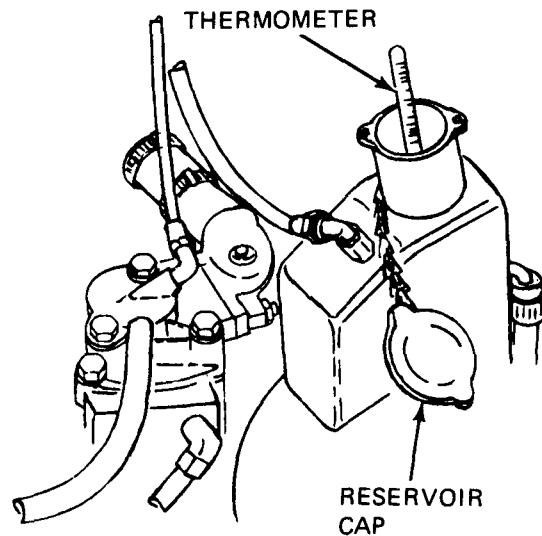
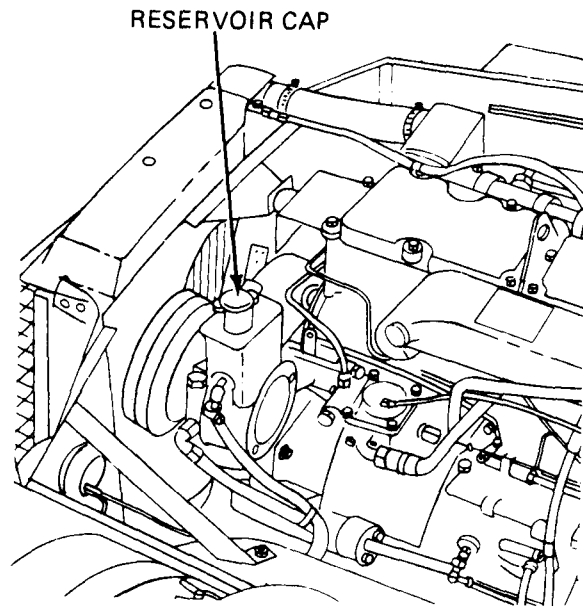
Figure 19-1 (Sheet 2 of 7)

GO

6

- Set power steering system to operating temperature
  - Start engine, and let it run at idle speed. Refer to TM 9-2320-211-10
  - Take off power steering pump reservoir cap
  - Put a thermometer in reservoir
  - Let engine run until thermometer shows a temperature range of 120 to 150°F

Note: When power steering oil reaches temperature range take out thermometer. Put back reservoir cap and tighten

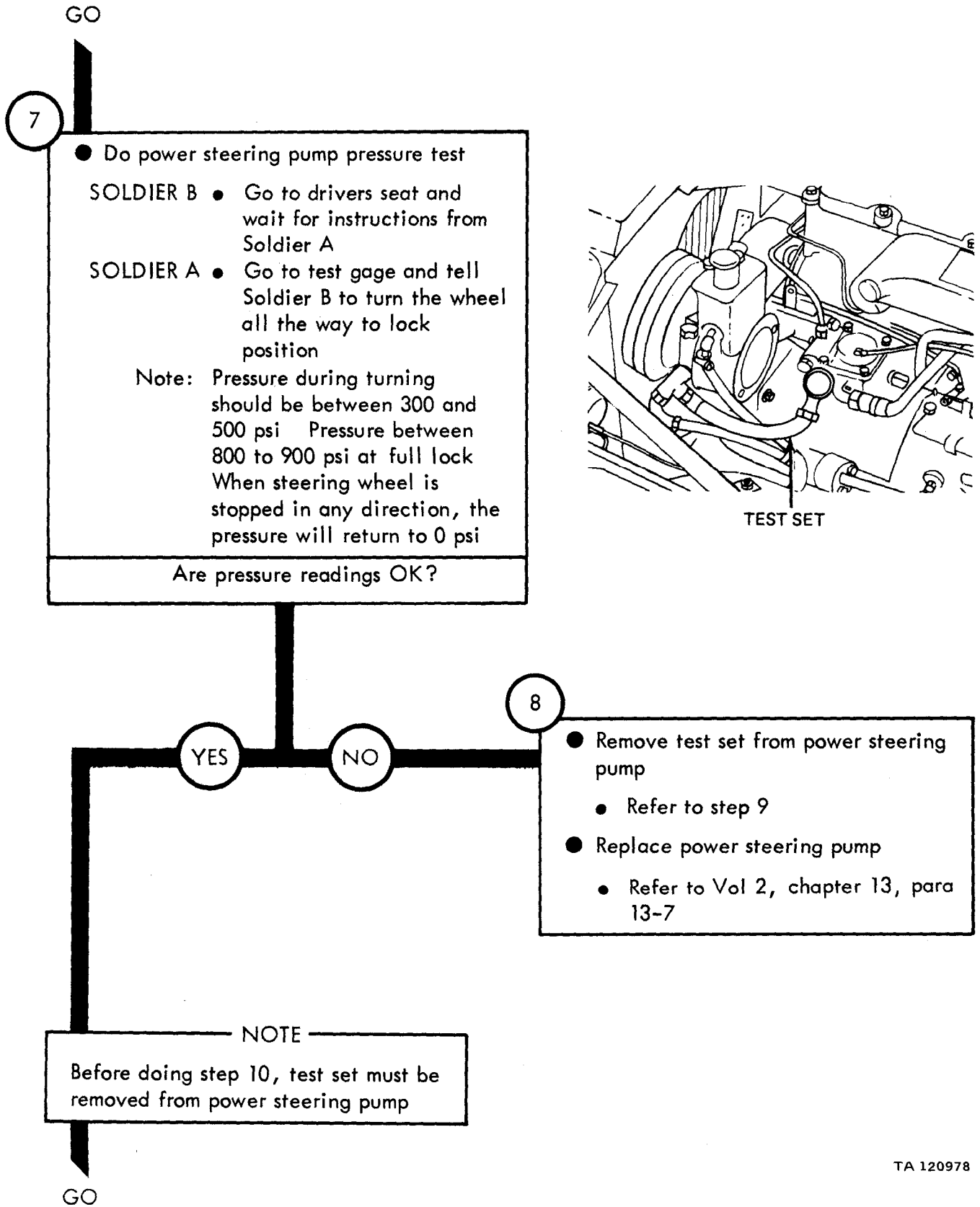


NOTE

The next step will need the use of two soldiers. The lead soldier will be called Soldier A, and the helper will be called Soldier B

GO

Figure 19-1 (Sheet 3 of 7)



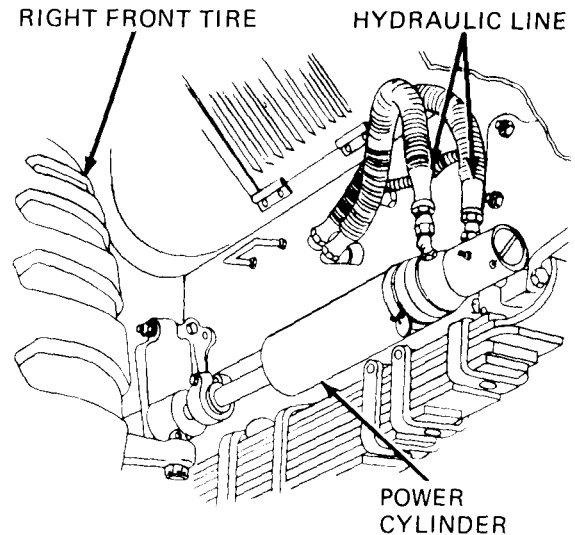
TA 120978

Figure 19-1 (Sheet 4 of 7)

GO

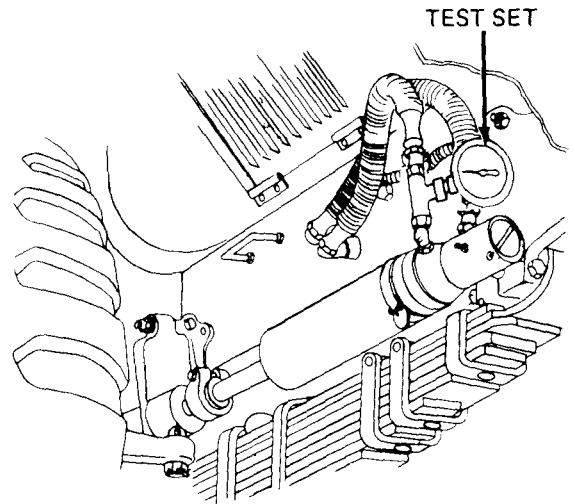
9

- Remove test set from power steering pump
  - Put a can, or bucket, under power steering pump
  - Unscrew and take off hydraulic line from test set, and put in can or bucket
  - Unscrew and take off test set from power steering pump
  - Screw hydraulic line on power steering pump, and tighten
  - Take can, or bucket, out from under power steering pump



10

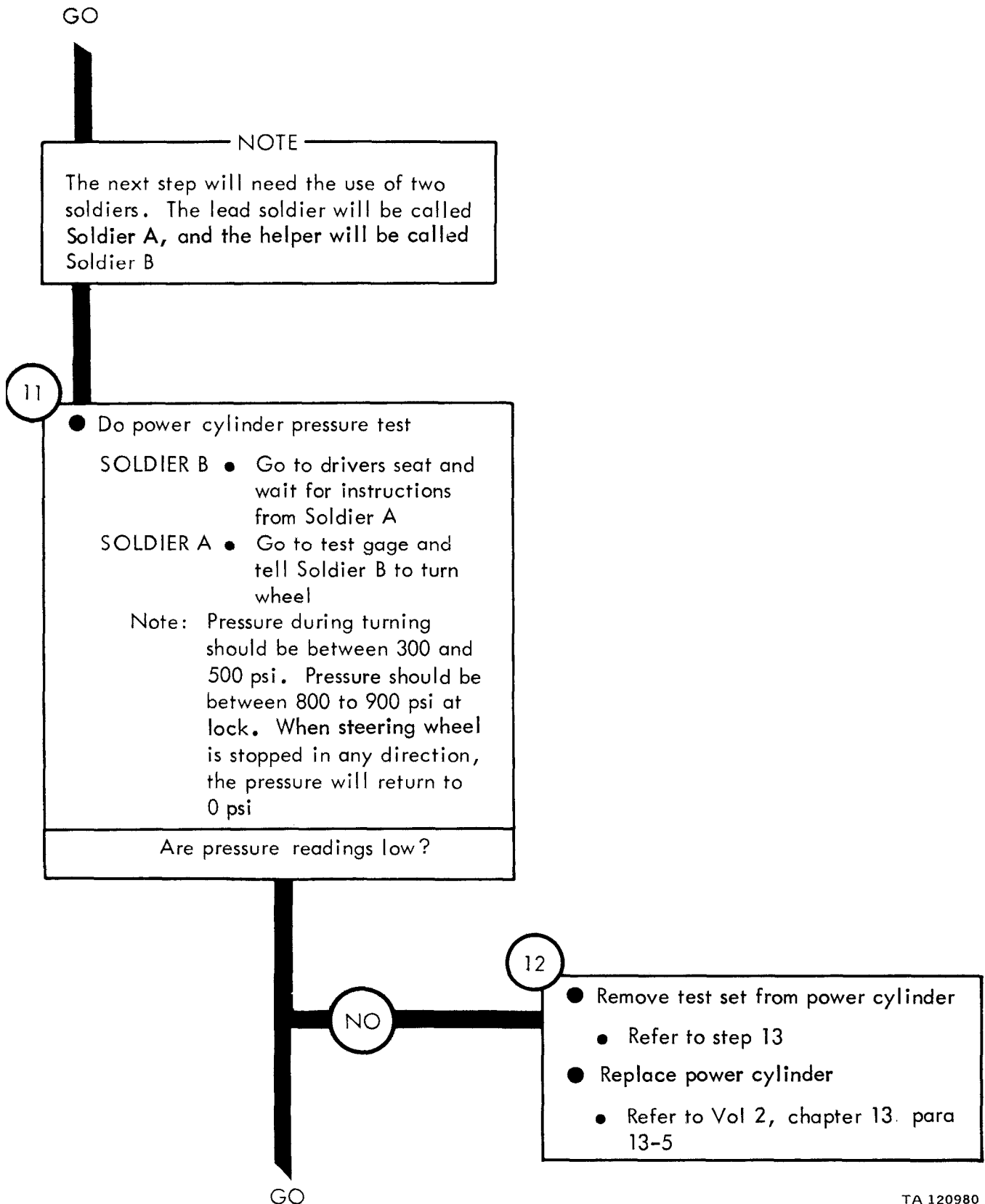
- Set up pressure test on power cylinder
  - Put a can, or bucket, under power cylinder
  - Unscrew and take off hydraulic line from power cylinder and put fitting end in a can or bucket
  - Note: This test will have to be done to both hydraulic lines going to power cylinder
  - Put test set on power cylinder and tighten
  - Put hydraulic line on adapter and tighten
  - Fill power steering fluid reservoir Refer to LO 9-2320-211-12
- Set power steering system to operating temperature
  - Refer to step 6



GO

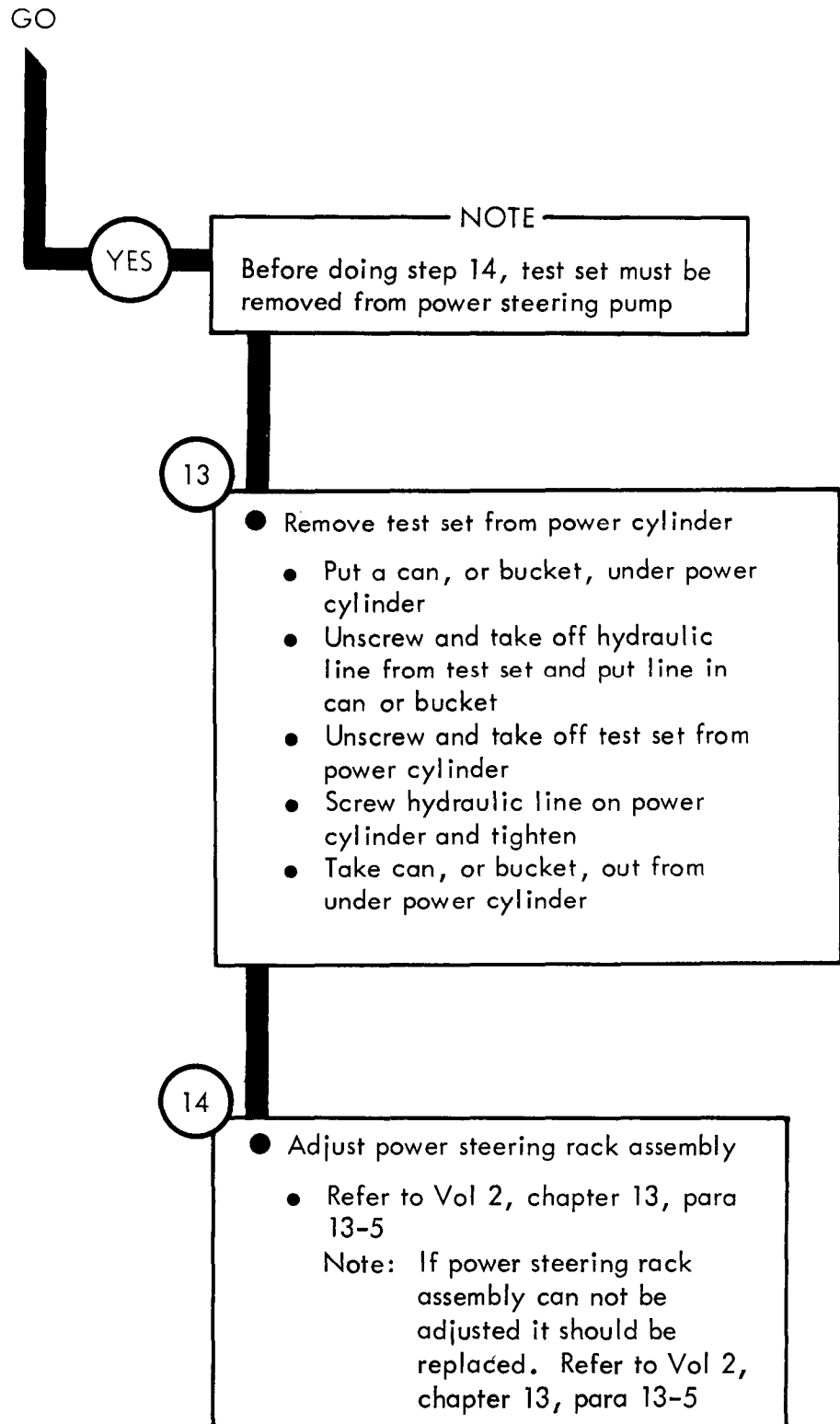
TA 120979

Figure 19-1 (Sheet 5 of 7)



TA 120980

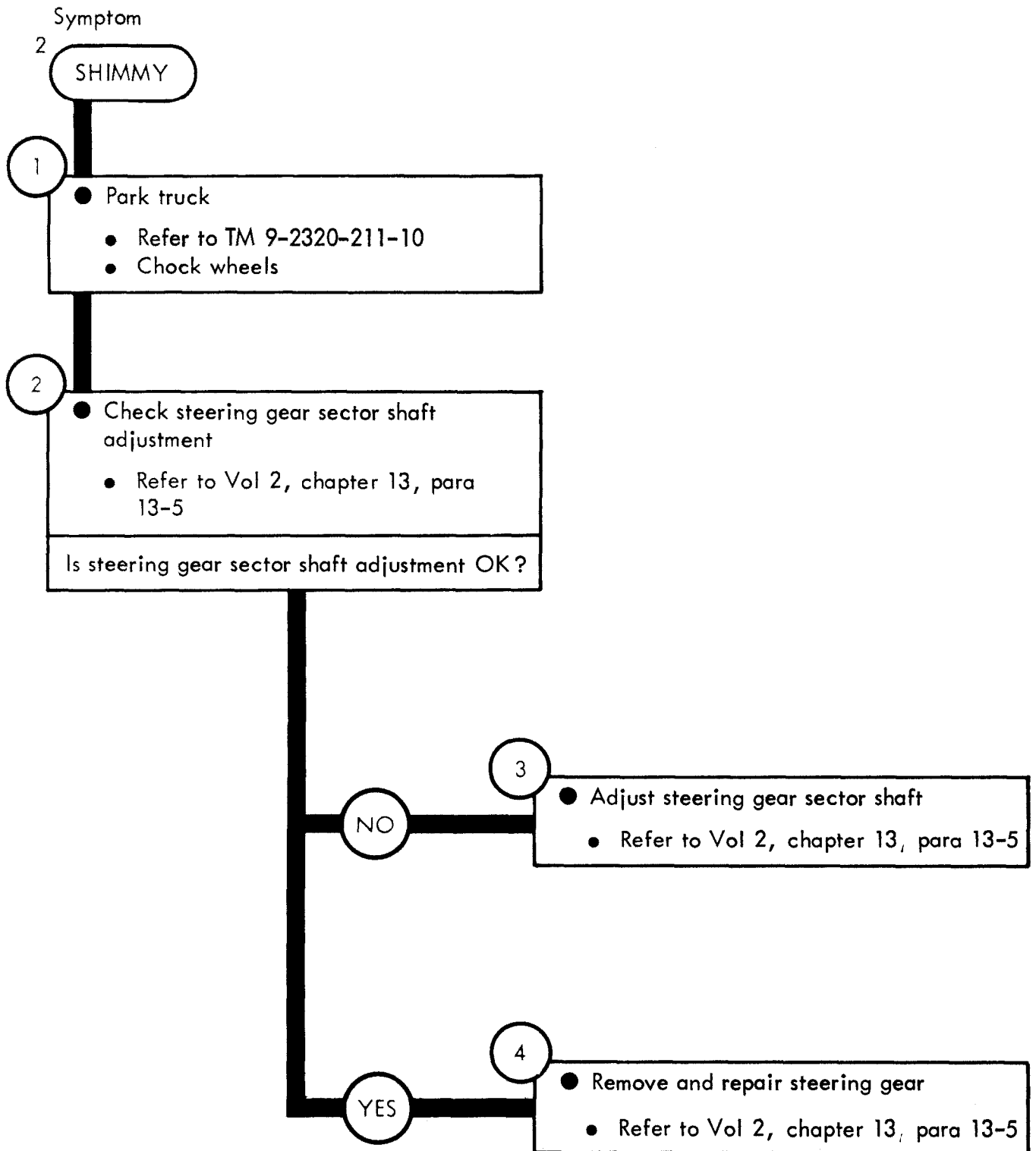
Figure 19-1 (Sheet 6 of 7)



TA 120981

Figure 19-1 (Sheet 7 of 7)





TA 120982

Figure 19-2



## CHAPTER 20

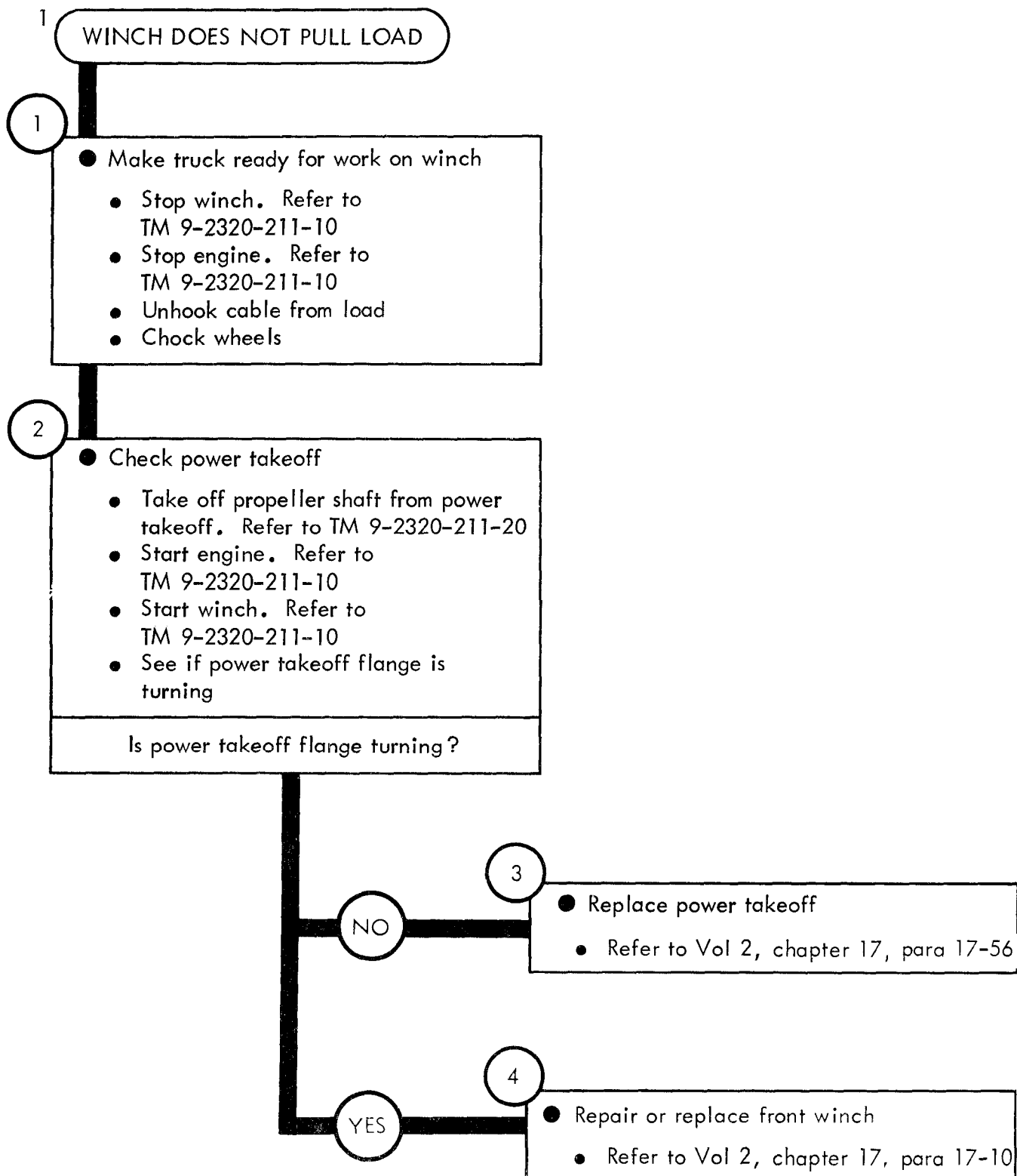
# FRONT WINCH SYSTEM TROUBLESHOOTING

---

20-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Front Winch System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

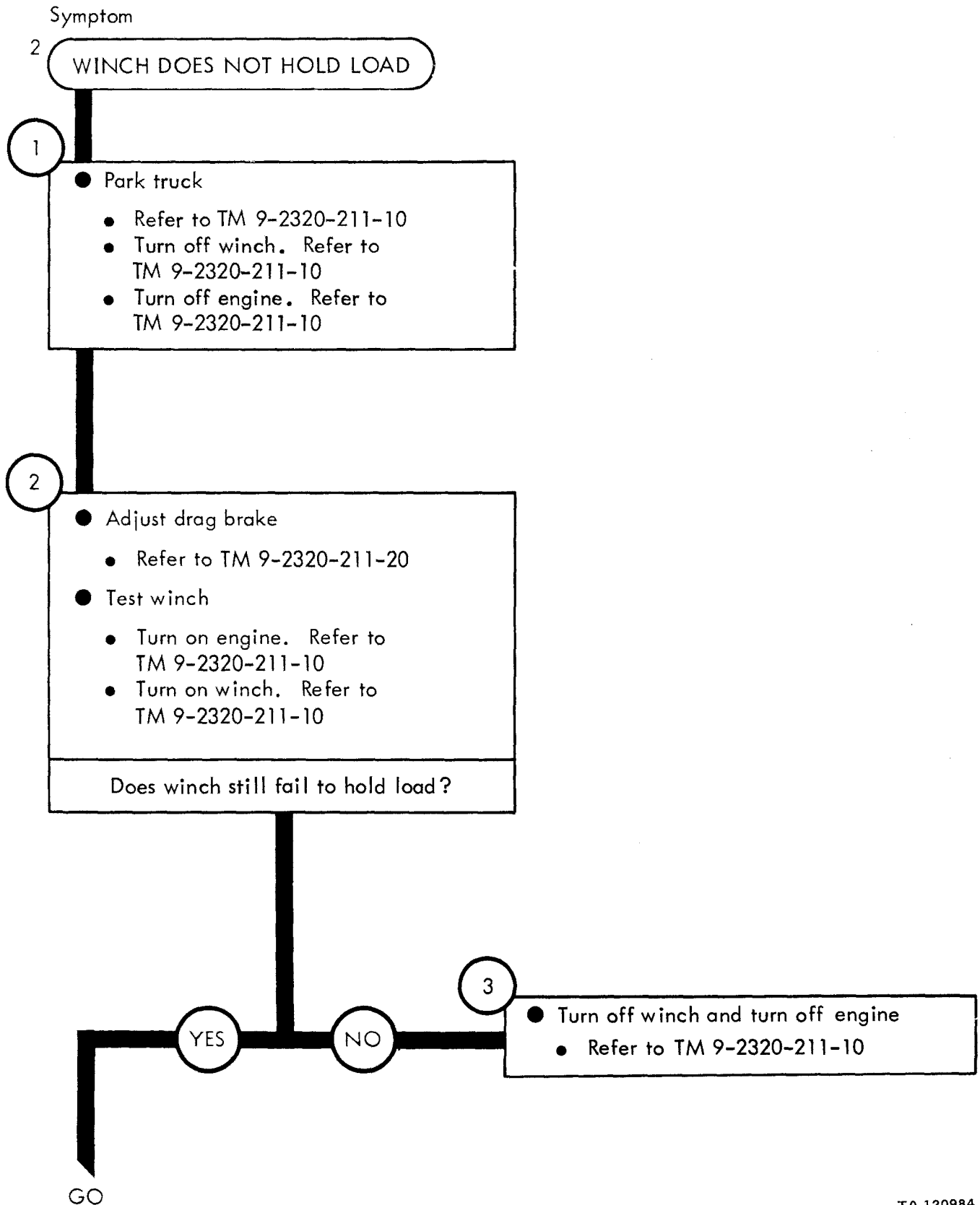
20-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

Symptom



TA 120983

Figure 20-1



TA 120984

Figure 20-2 (Sheet 1 of 2)

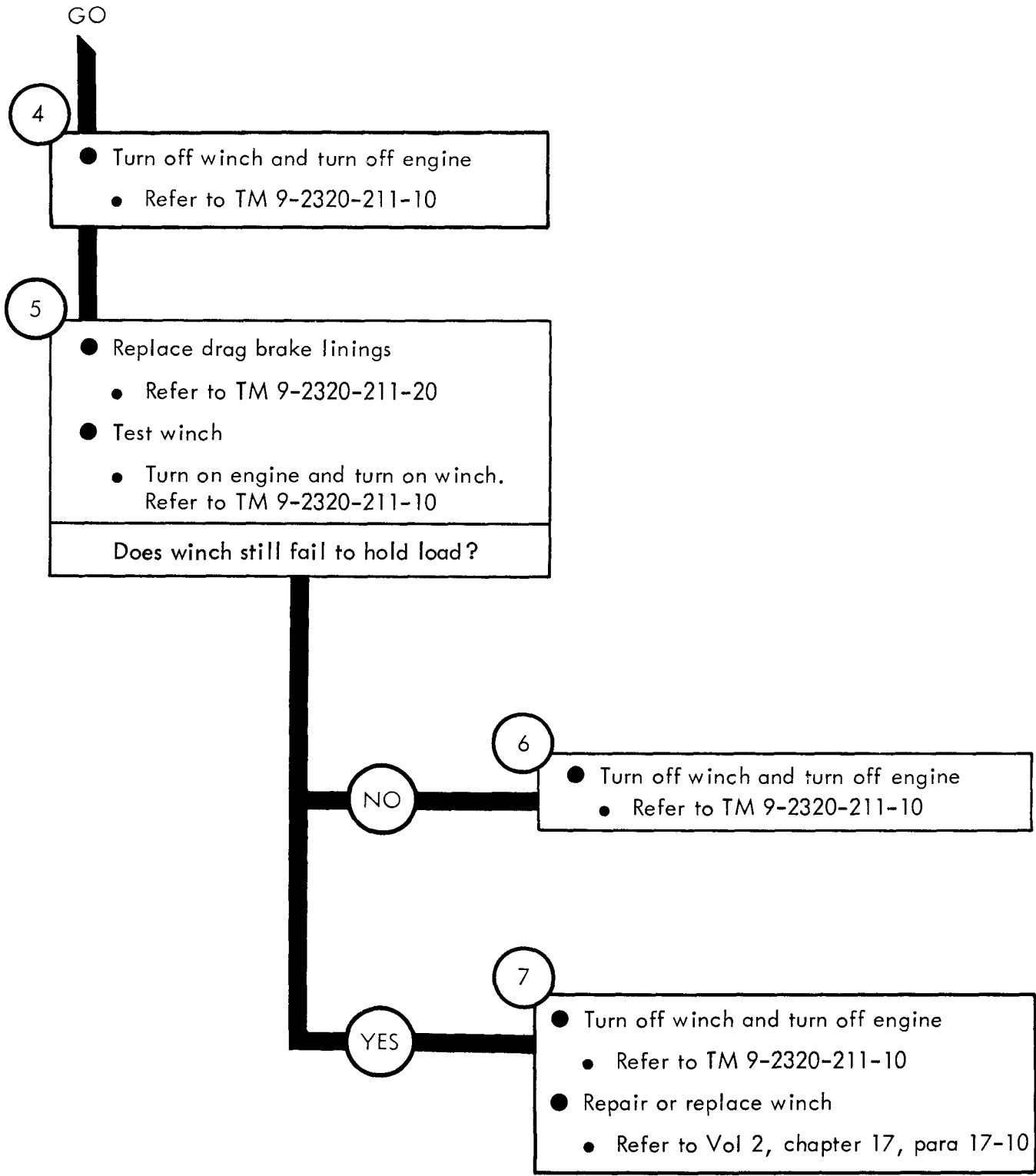
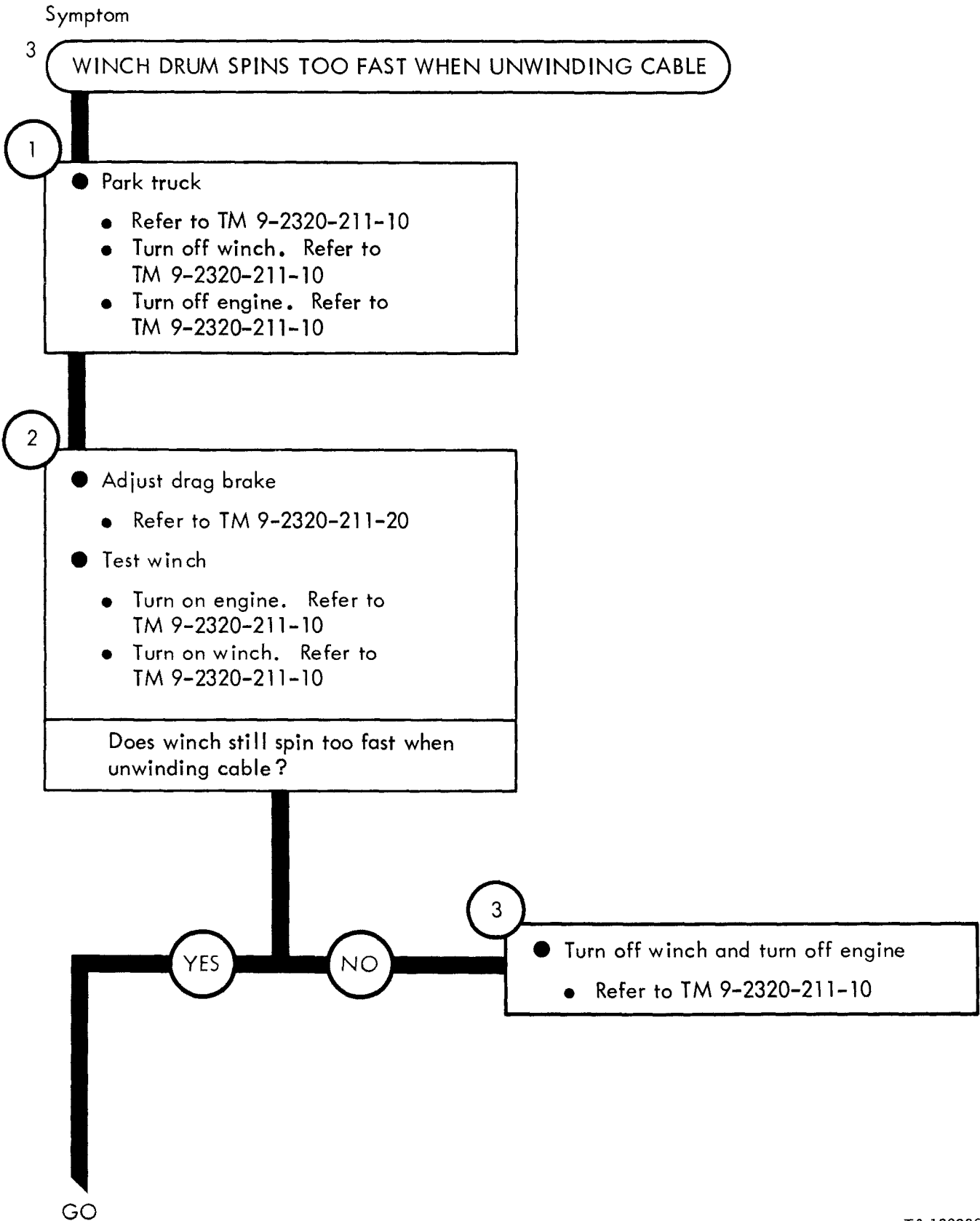


Figure 20-2 (Sheet 2 of 2)



TA 120986

Figure 20-3 (Sheet 1 of 2)

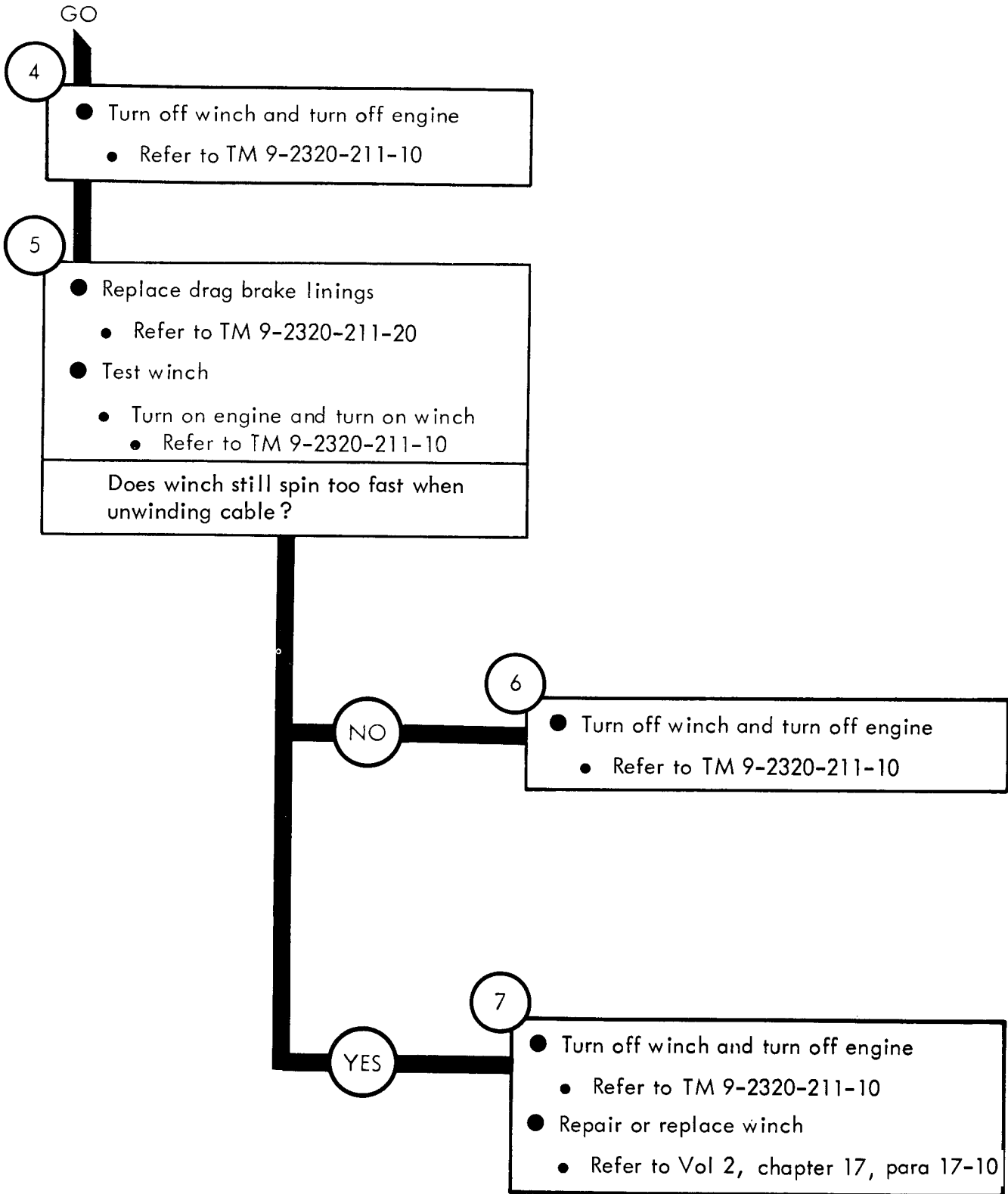


Figure 20-3 (Sheet 2 of 2)



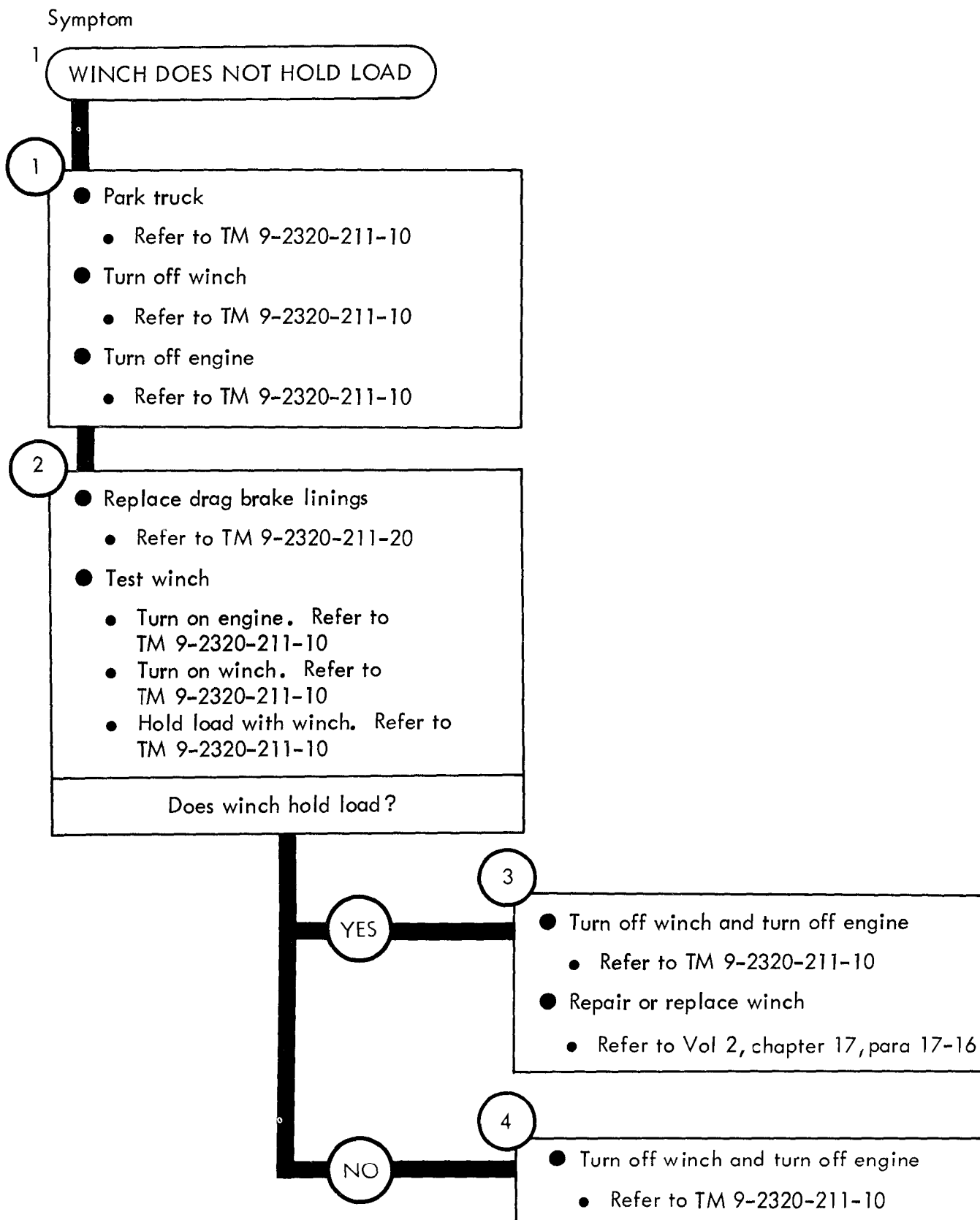
## CHAPTER 21

### REAR WINCH SYSTEM TROUBLESHOOTING

---

21-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Rear Winch System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

21-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.



TA 120988

Figure 21-1

## CHAPTER 22

### M543A2 WRECKER SYSTEM TROUBLESHOOTING

---

22-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the M543A2 Wrecker System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

22-20 EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

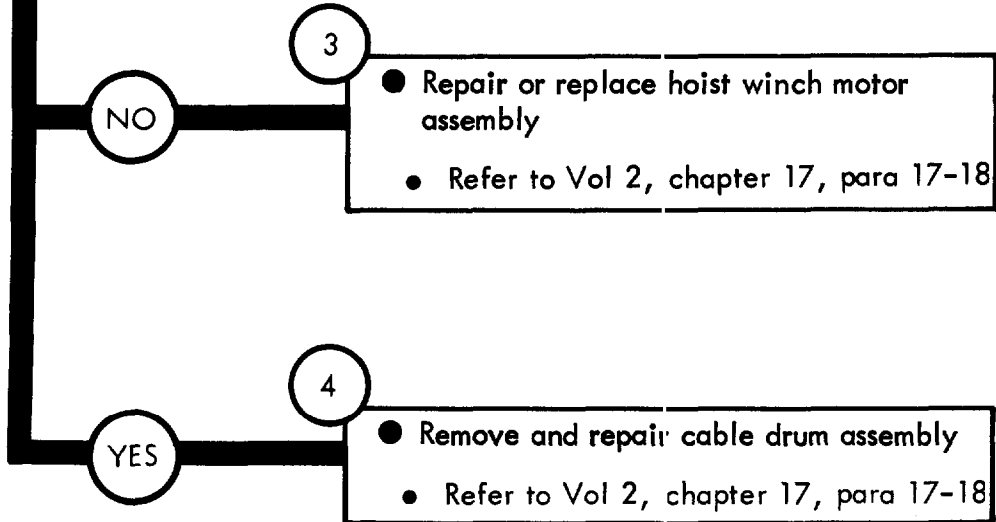
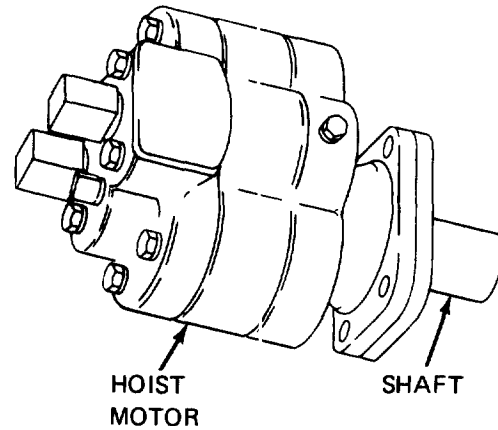
M543A2 WRECKER SYSTEM TROUBLESHOOTING

Symptom

1 HOIST WINCH DOES NOT PULL LOAD

- 1
- Make truck ready for work on wrecker
    - Remove load
    - Park truck. Refer to TM 9-2320-211-10
    - Chock wheels

- 2
- Check hoist winch motor assembly
    - Remove hoist winch motor. Refer to Vol 2, chapter 17, para 17-18
    - Feel for a loose or broken shaft
    - Feel if shaft turns freely
- Is motor OK?



TA 120989

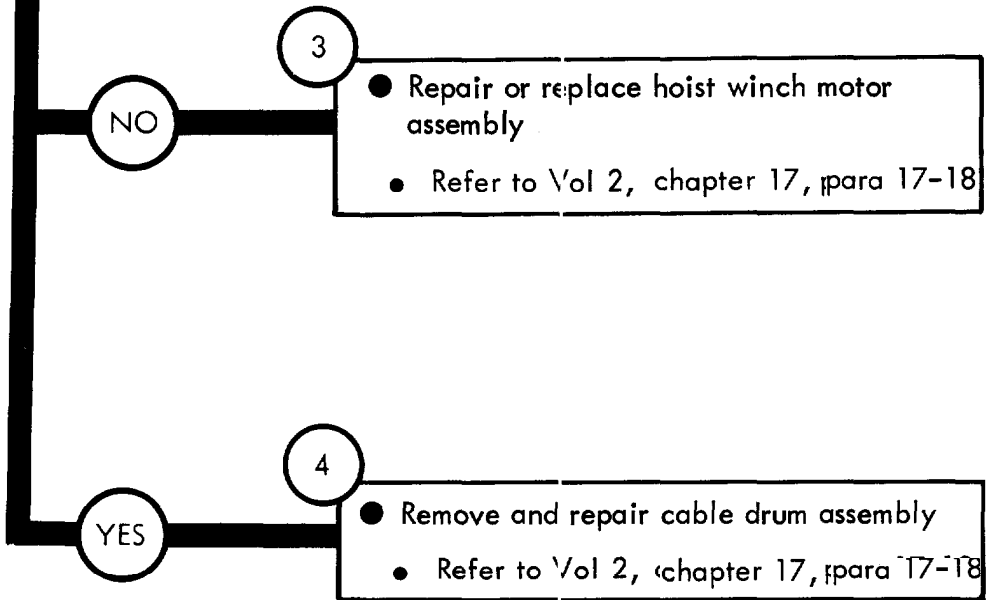
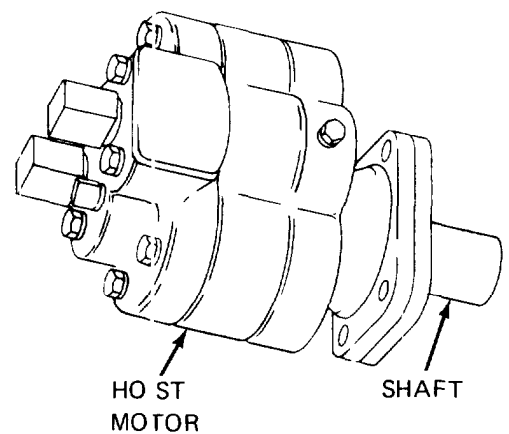
Figure 22-1

Symptom

2  
**HOIST WINCH PULLS LOAD SLOWLY**

- 1
- Make truck ready for work on wrecker
    - Remove load
    - Park truck. Refer to TM 9-2320-211-10
    - Chock wheels

- 2
- Check hoist winch motor assembly
    - Remove hoist winch motor. Refer to Vol 2, chapter 17, para 17-18
    - Feel for a loose shaft
    - Feel if shaft turns freely
- Is motor OK?



TA 120990

Figure 22-2

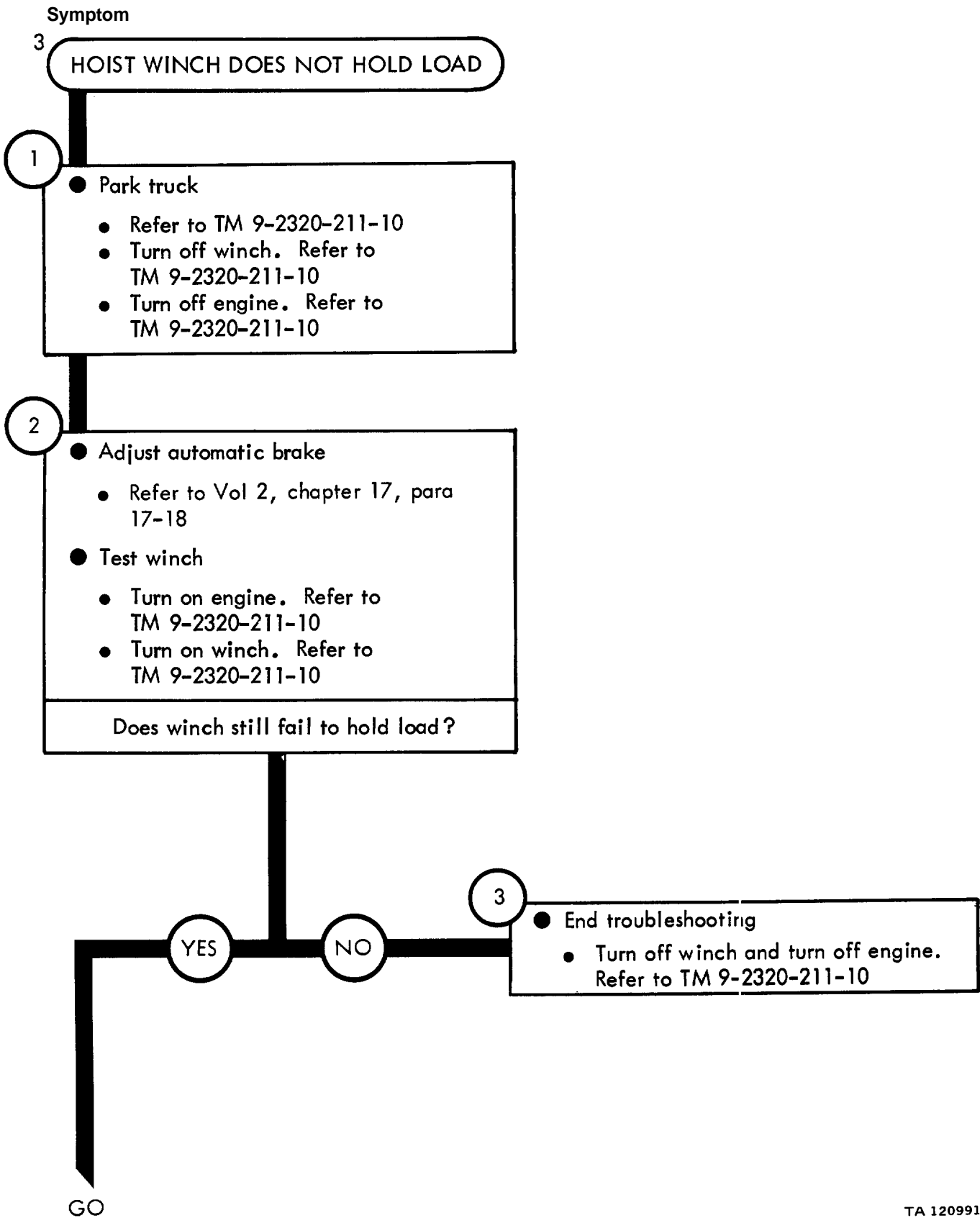


Figure 22-3 (Sheet 1 of 2)

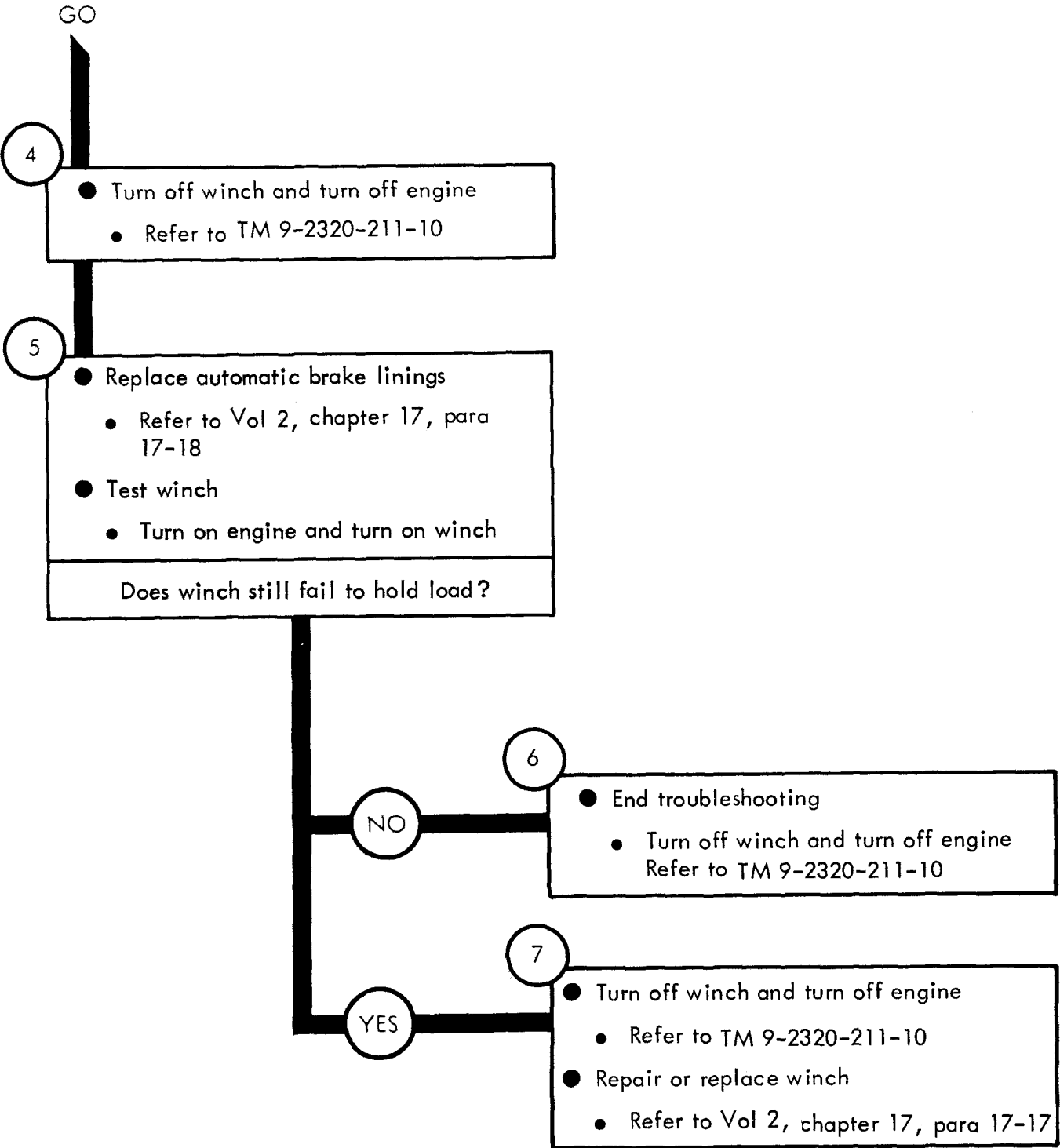


Figure 22-3 (Sheet 2 of 2)

Symptom

4

JERKY OPERATION AS HOIST WINCH PULLS LOAD

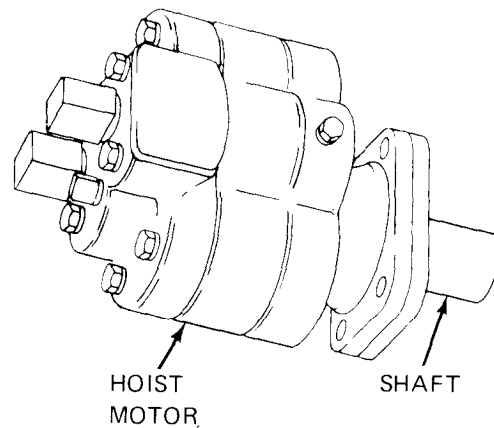
1

- Make truck ready for work on wrecker
  - Remove load
  - Park truck. Refer to TM 9-2320-211-10
  - Chock wheels

2

- Check hoist winch motor assembly
  - Remove hoist winch motor. Refer to Vol 2, chapter 17, para 17-17
  - Feel if shaft turns

Is motor OK?



3

- Repair or replace hoist winch motor assembly
  - Refer to Vol 2, chapter 17, para 17-17

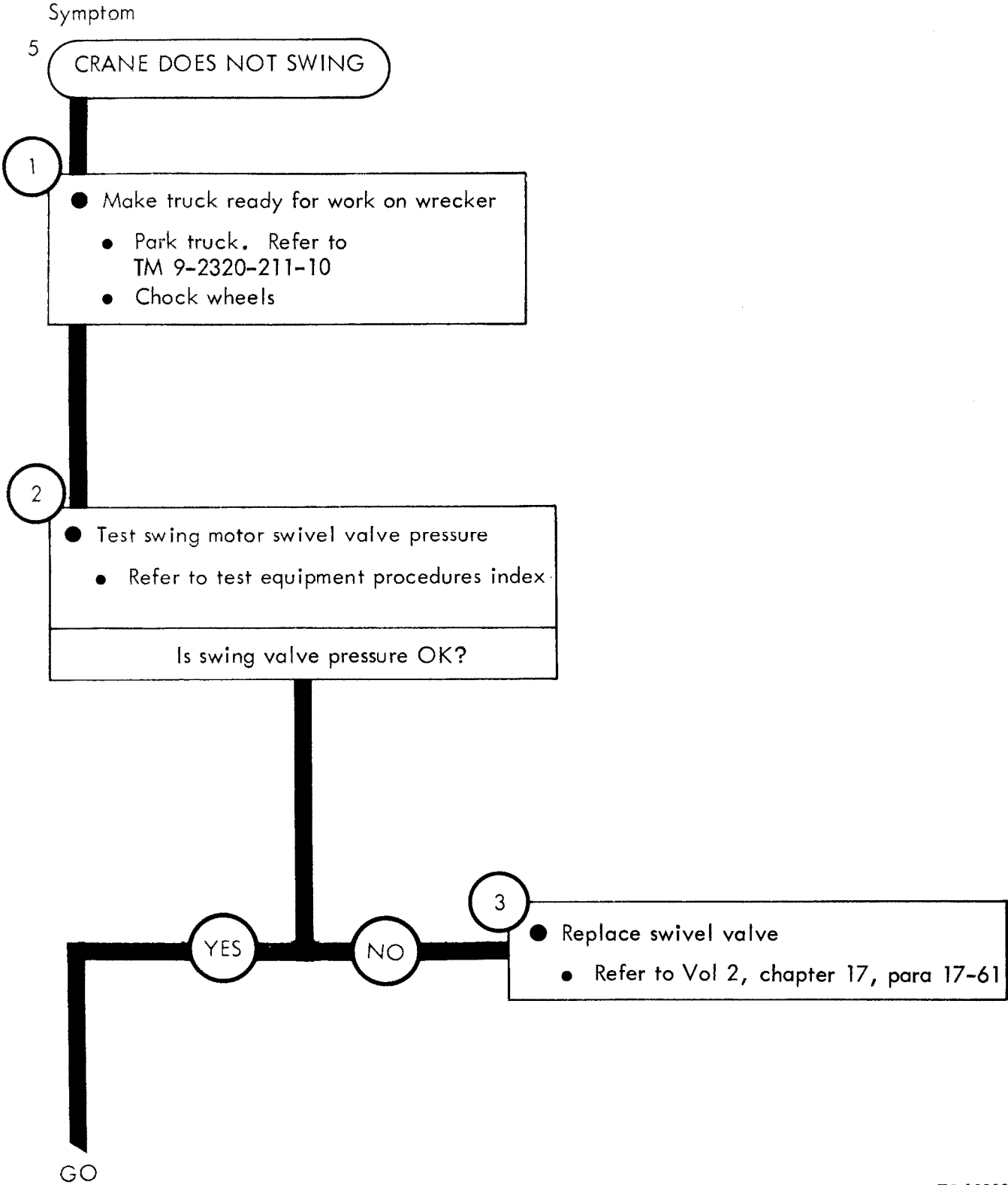
4

- Remove and repair cable drum assembly
  - Refer to Vol 2, chapter 17, para 17-18

TA 120993

Figure 22-4





TA 120994

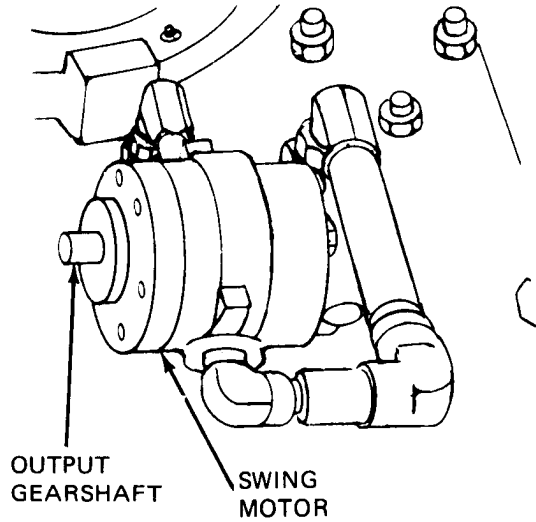
Figure 22-5 (Sheet 1 of 2)

GO

4

- Check swing motor
  - Remove drive gear assembly. Refer to Vol 2, chapter 17, para 17-36
  - Look to see if swing motor output gearshaft is broken
  - Feel for a loose or broken output gearshaft
  - Start engine and operate swing motor. Refer to TM 9-2320-211-10
  - See if output gearshaft turns

Is swing motor OK?



NO

5

- Repair, or replace swing motor
  - Refer to Vol 2, chapter 17, para 17-36

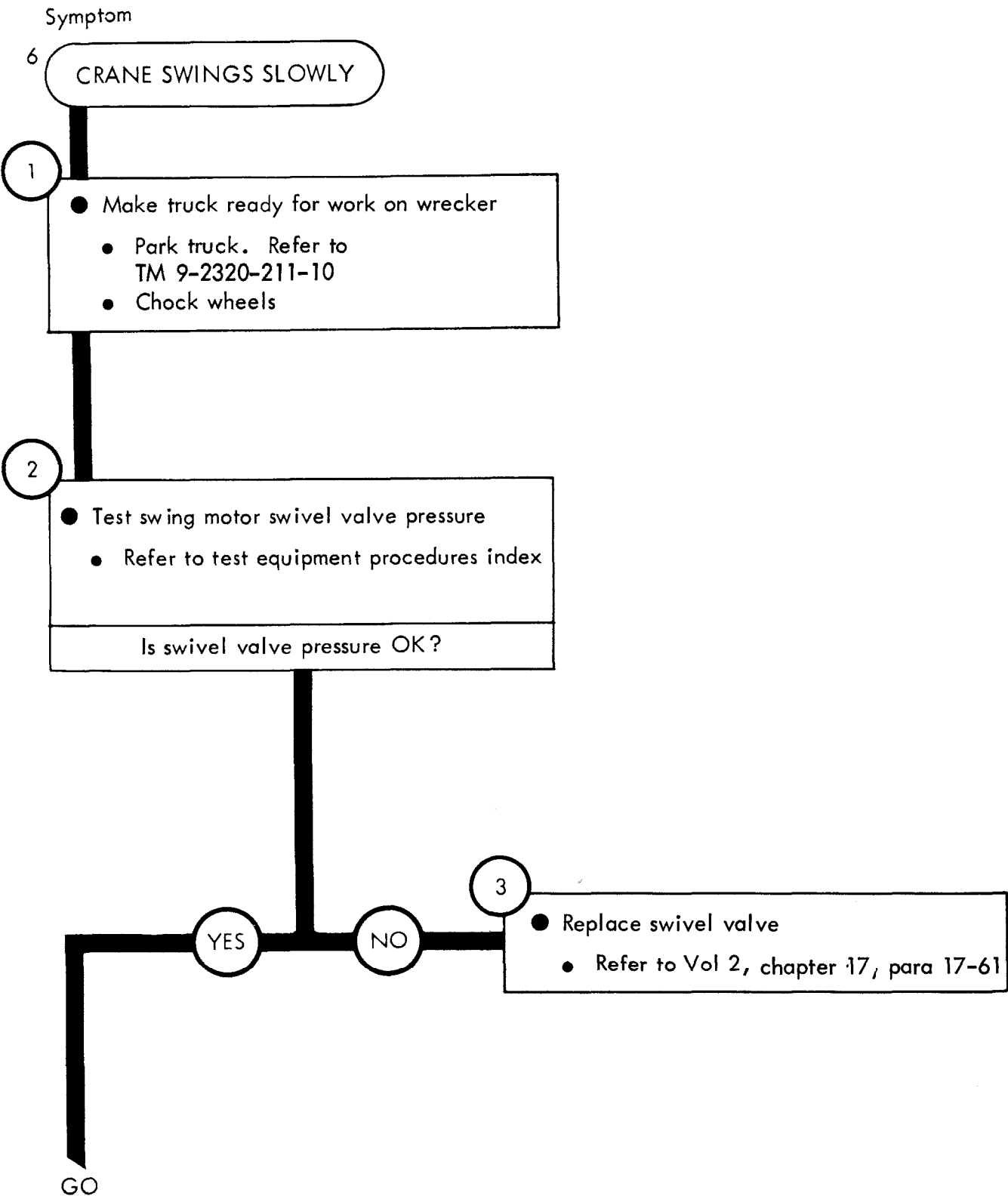
YES

6

- Repair or replace drive gear assembly
  - Refer to Vol 2, chapter 17, para 17-36
- Put back drive gear assembly
  - Refer to Vol 2, chapter 17, para 17-36

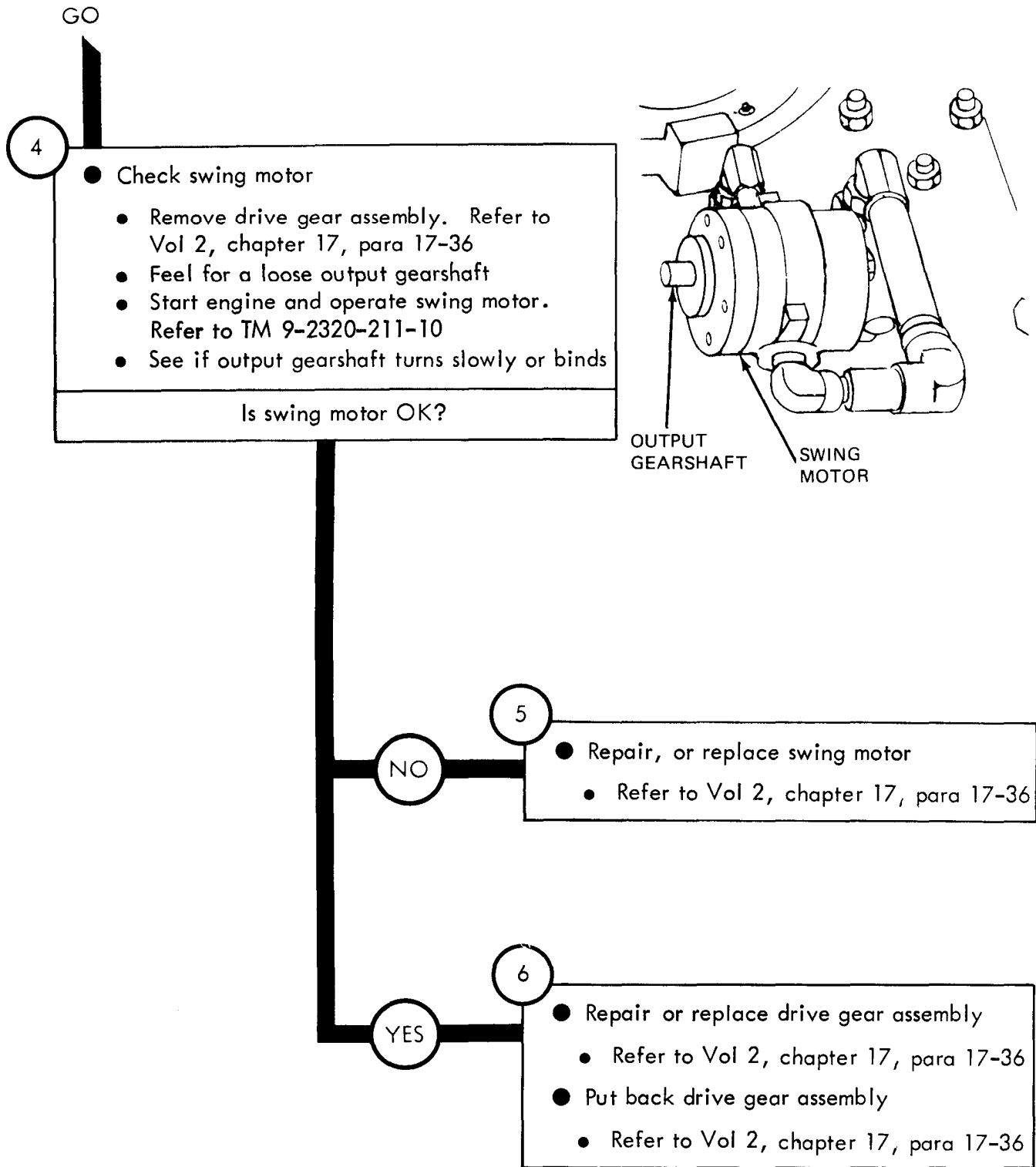
TA 120995

Figure 22-5 (Sheet 2 of 2)



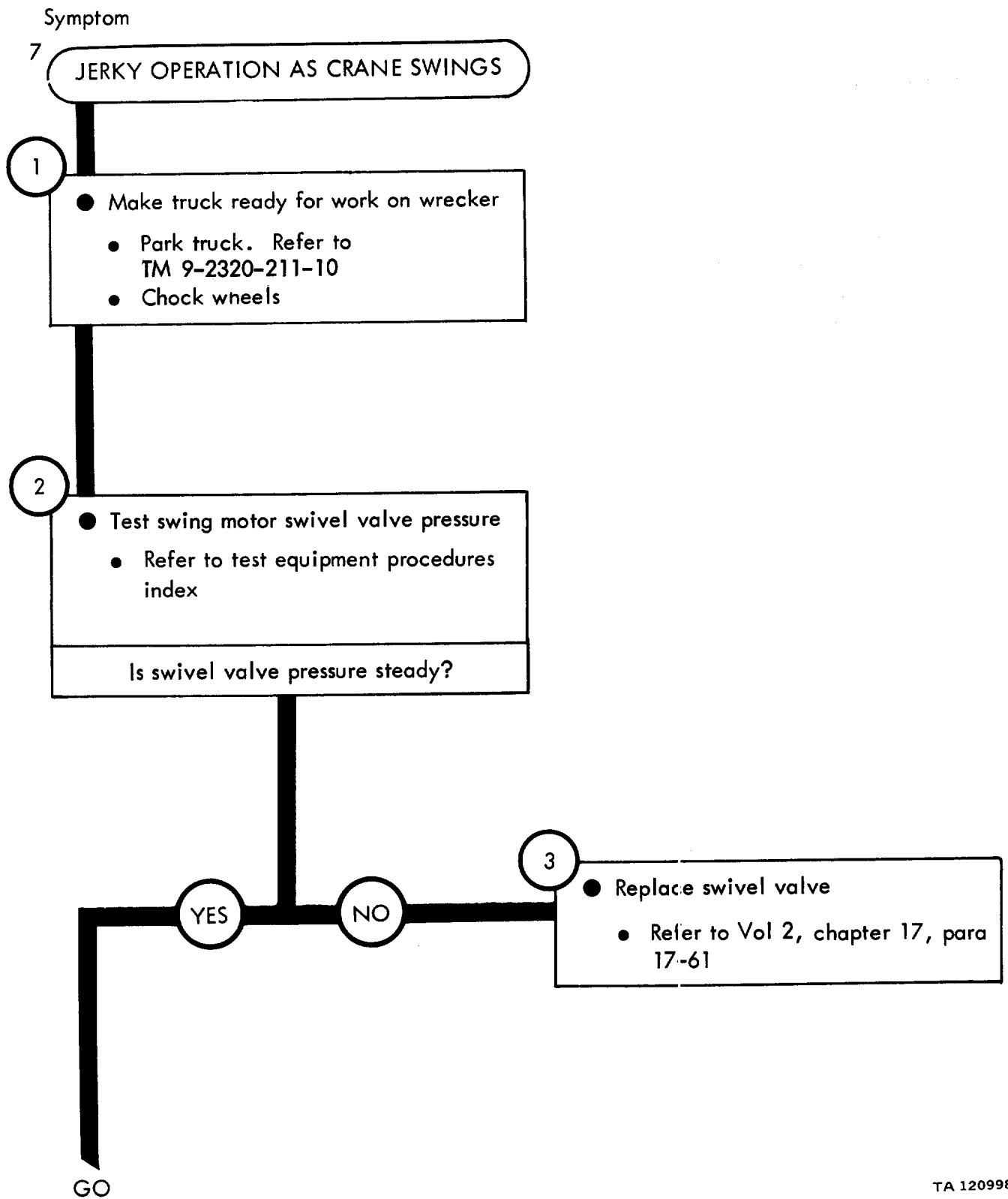
TA 120996

Figure 22-6 (Sheet 1 of 2)



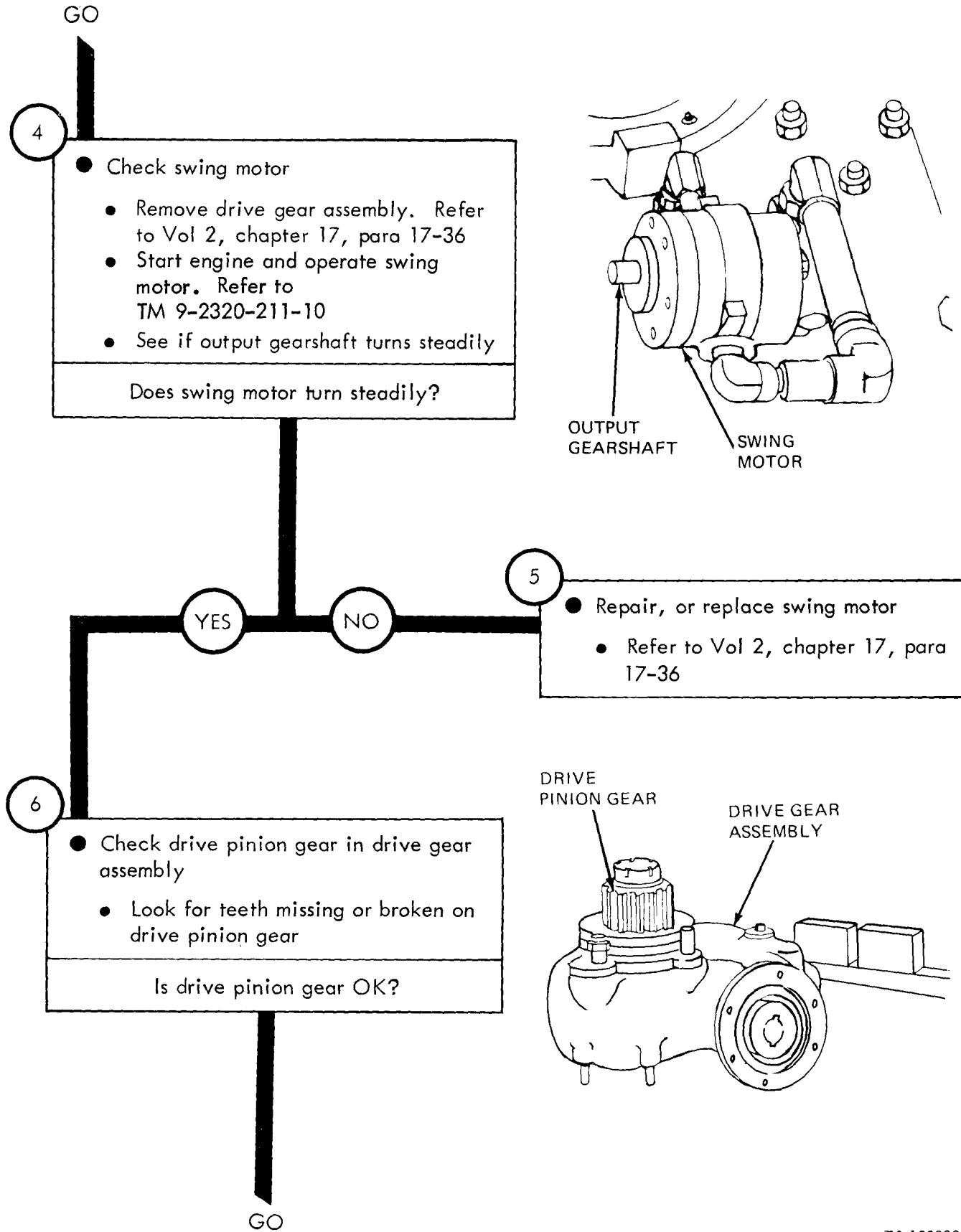
TA 120997

Figure 22-6 (Sheet 2 of 2)



TA 120998

Figure 22-7 (Sheet 1 of 4)

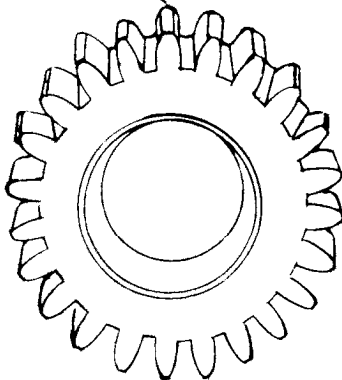


TA 120999

Figure 22-7 (Sheet 2 of 4)

GO

PINION IDLER GEAR



NO GO

7

- Replace drive pinion gear
  - Refer to Vol 2, chapter 17, para 17-34
- Check drive pinion idler gear
  - Remove pinion idler gear. Refer to Vol 2, chapter 17, para 17-34
  - Look for missing teeth on gear

Is drive pinion idler gear OK?

YES

8

- Put back drive pinion idler gear
  - Refer to Vol 2, chapter 17, para 17-34
- Put back drive gear assembly
  - Refer to Vol 2, chapter 17, para 17-34
- Put back swing motor
  - Refer to Vol 2, chapter 17, para 17-36

NO

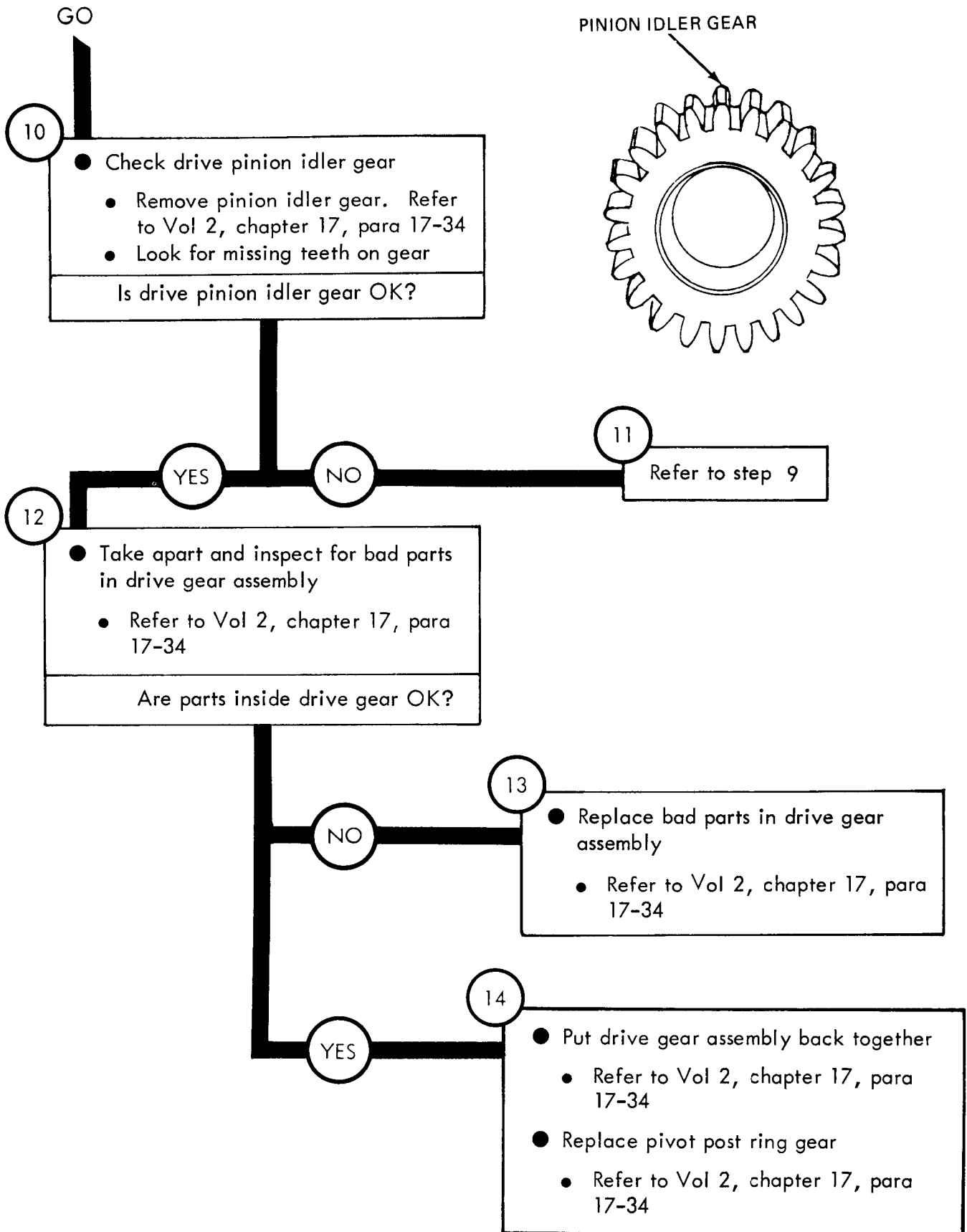
9

- Replace drive pinion idler gear
  - Refer to Vol 2, chapter 17, para 17-34
- Put back drive gear assembly
  - Refer to Vol 2, chapter 17, para 17-34
- Put back swing motor
  - Refer to Vol 2, chapter 17, para 17-36

GO

TA 121000

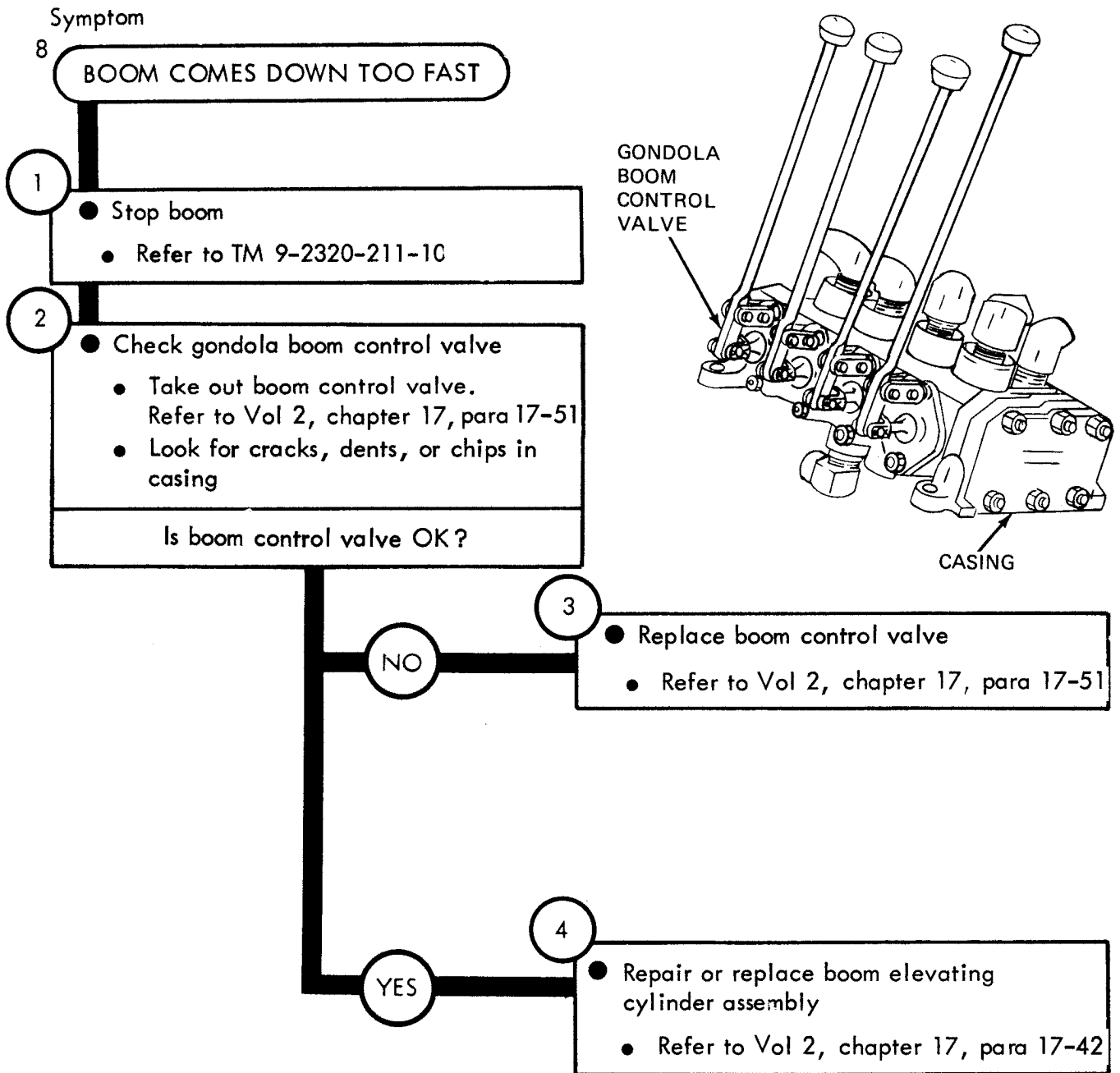
Figure 22-7 (Sheet 3 of 4)



TA 121001

Figure 22-7 (Sheet 4 of 4)





TA 121002

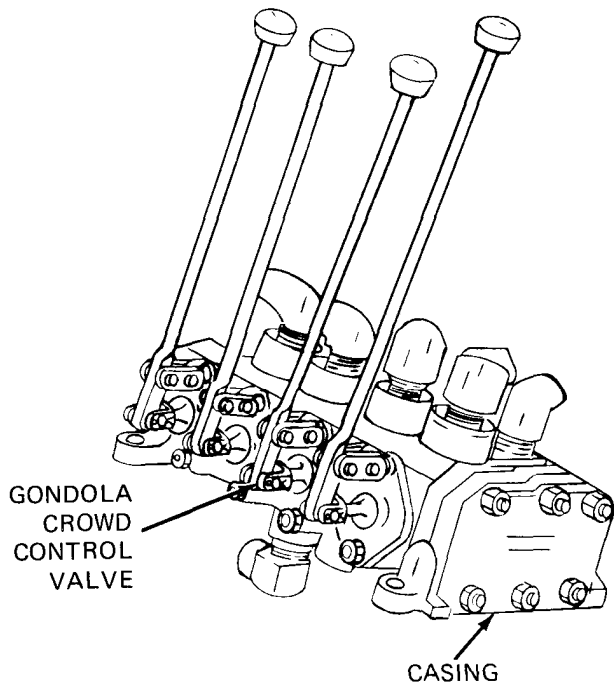
Figure 22-8

Symptom

9 BOOM DOES NOT EXTEND OR EXTENDS AND RETRACTS SLOWLY

- 1
- Turn off boom
    - Refer to TM 9-2320-211-10
  - Take load off boom

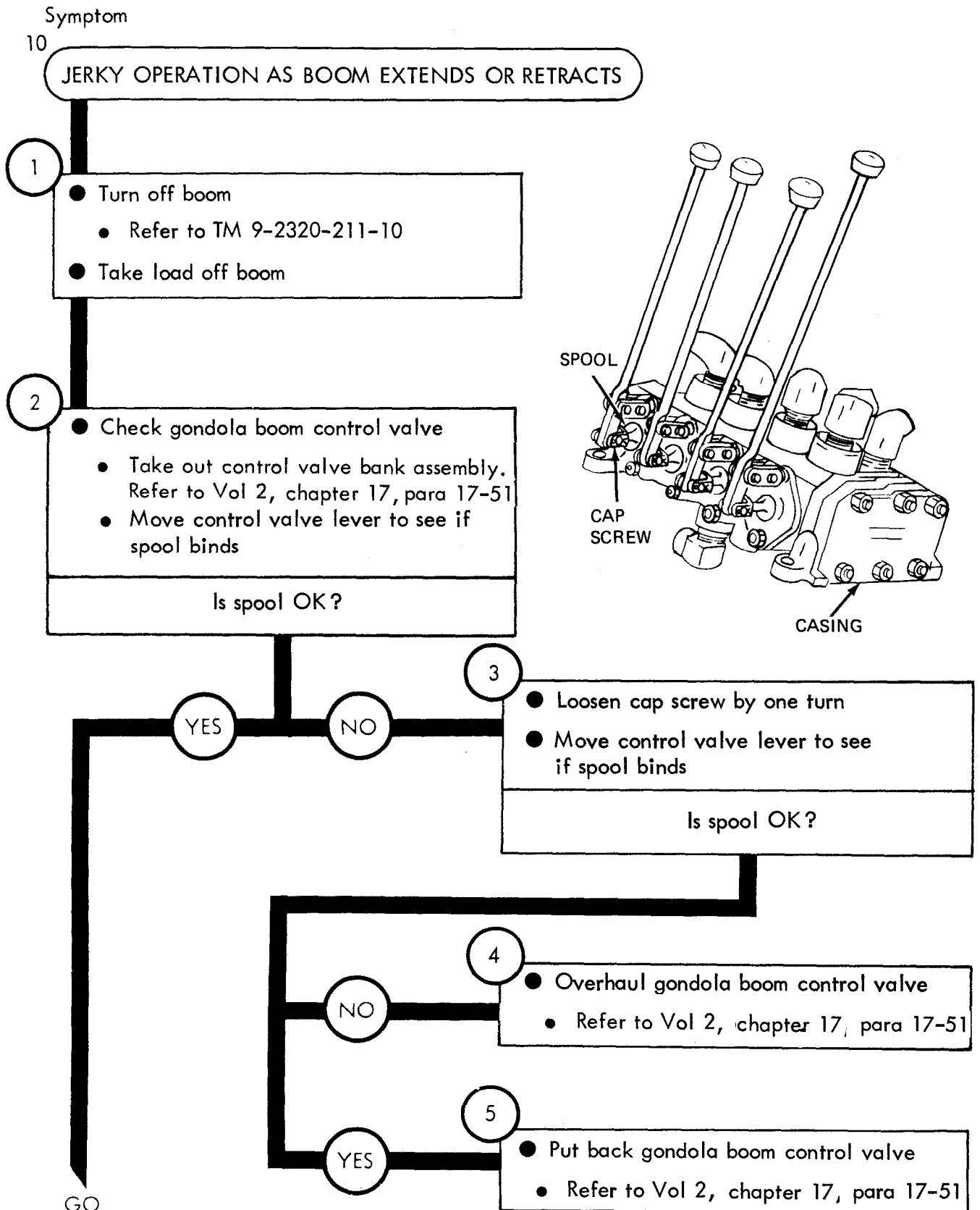
- 2
- Check gondola crowd control valve
    - Take out control valve bank assembly. Refer to Vol 2, chapter 17, para 17-51
    - Feel for hydraulic oil leakage
    - Look for cracked casing
- Is gondola crowd control valve OK?



- NO
- 3
- Repair or replace gondola crowd control valve
    - Refer to Vol 2, chapter 17, para 17-51
- YES
- 4
- Put back control valve bank assembly
    - Refer to Vol 2, chapter 17, para 17-51
  - Repair or replace boom crowd cylinder assembly
    - Refer to Vol 2, chapter 17, para 17-41

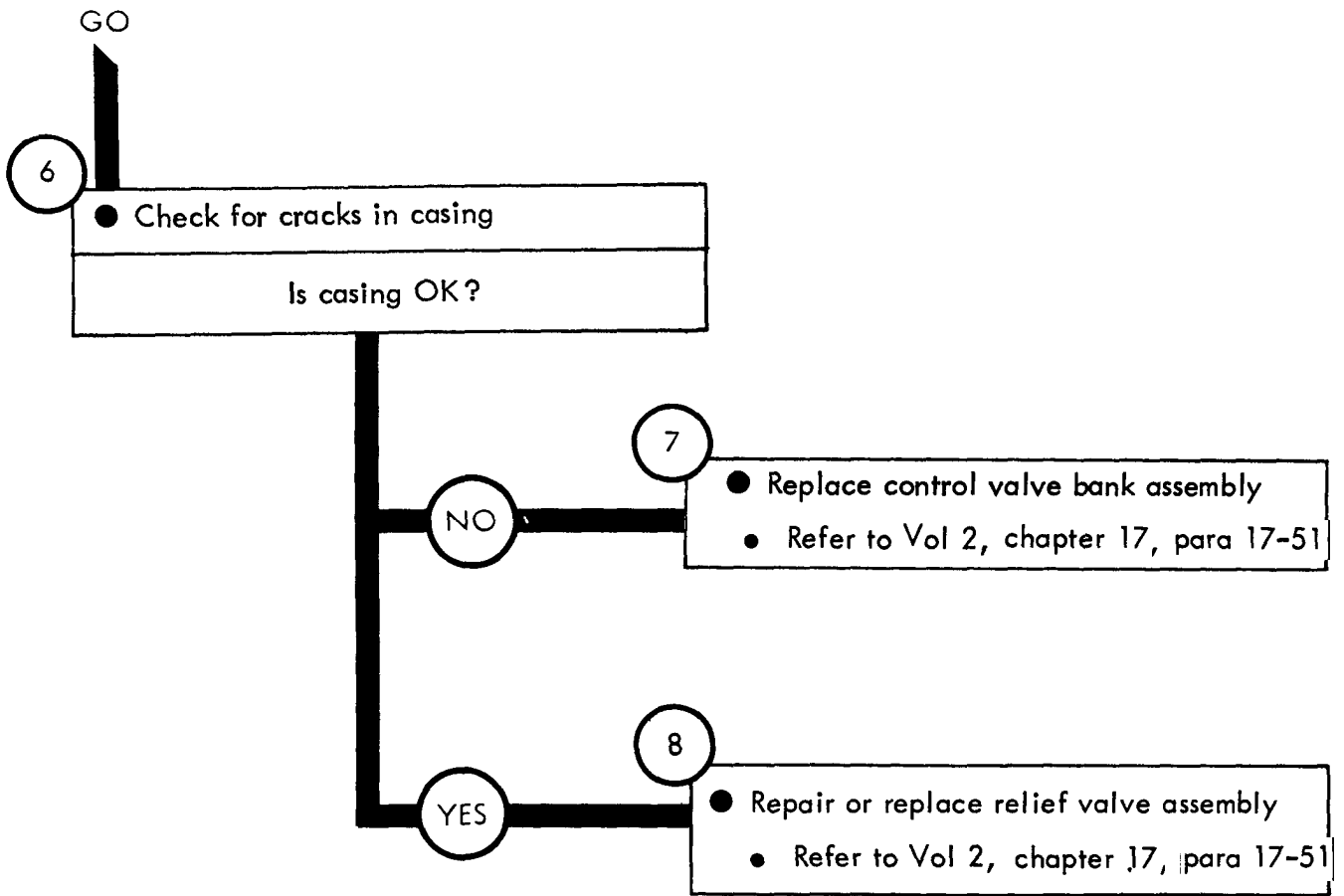
TA 121003

Figure 22-9



TA 121004

Figure 22-10 (Sheet 1 of 2)



TA 121005

Figure 22-10 (Sheet 2 of 2)

## CHAPTER 23

### M543A2 WRECKER SYSTEM TEST PROCEDURES

---

23-1. GENERAL. This chapter gives test procedures for the tests given in chapter 22, for the M543A2 Wrecker System.

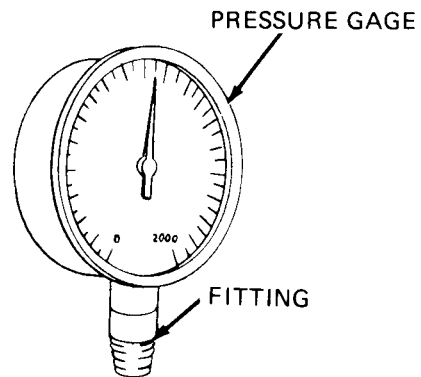
23-2. TEST SET-UP. Instructions for setup of test equipment and parts to be tested are given before the test procedures. Illustrations are used, when needed, to show you how to hook up the test equipment to the part to be tested.

23-3. TEST PROCEDURE. Detailed step-by-step instructions, in flow chart form, are given for each test. The procedure calls out the type of test and the condition of the truck system for each part of testing. The step-by-step test will lead you to the bad component or to a fault symptom within a related system. Reference is made to the fault symptom index, chapter 6, if the test shows a fault in another system.

GENERAL INSTRUCTIONS

1

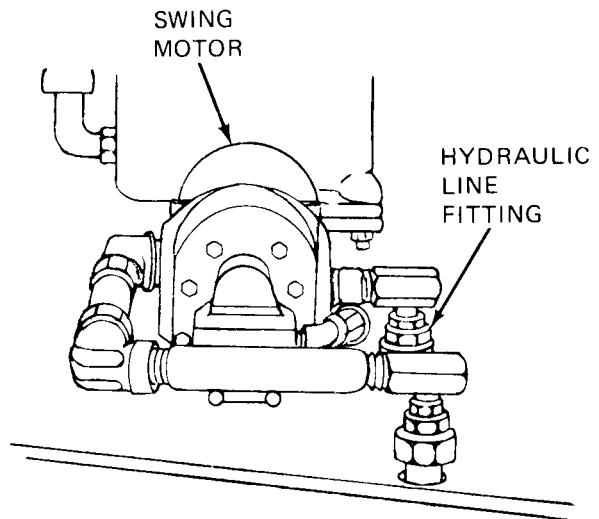
- Check pressure gage before using
  - Gage - make sure that glass and needle are not broken
  - Fitting - make sure fitting is tight on gage. See if fitting end is dirt free



SWING MOTOR SWIVEL VALVE PRESSURE TEST - To check output pressure from swivel valve to swing motor

1

- Set up gage as follows
  - Unscrew and take off hydraulic line fitting to swing motor
  - Screw in suitable T-fitting adapter and tighten
  - Screw in test gage and tighten
  - Screw in hydraulic line and tighten



GO

TA 121006

Figure 23-1 (Sheet 1 of 3)

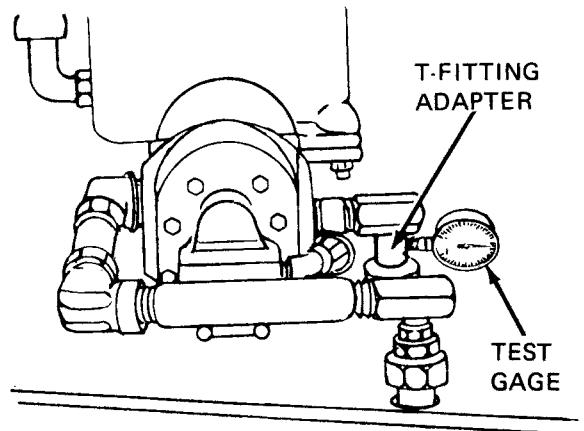
GO

NOTE

The next step will need the use of two soldiers. The lead soldier will be called Soldier A, and the helper will be called Soldier B

2

- Test pressure from swivel valve to swing motor
- SOLDIER B ● Start engine and engage wrecker crane drive. Refer to TM 9-2320-211-10
- Go to gondola and wait for instructions from SOLDIER A
- SOLDIER A: ● Look at pressure gage
- Tell SOLDIER B to swing boom



GO

TA 121007

Figure 23-1 (Sheet 2 of 3)

GO

- SOLDIER B ● Swing boom to the left as far as it will go. Refer to TM 9-2320-211-10
- SOLDIER A ● See if pressure gage reads between 700 and 750 psi during operation, and between 1100 and 1200 psi at stop
  - Tell Soldier B, to shut down from wrecker operation
- SOLDIER B ● Return boom to center position shut down from hoist and wrecker crane operation. Refer to TM 9-2320-211-10

NOTE

Before answering question in fault isolation procedure, test gage must be removed from swing motor hydraulic line

3

- Take out pressure gage
  - Unscrew and take out test gage
  - Crack loose hydraulic line fitting
  - Crack loose T-fitting adapter

- Hold a bucket, or can, under fittings
- Unscrew and take out hydraulic line and T-fitting adapter
- Screw hydraulic line back on fitting and tighten

TA 121008

Figure 23-1 (Sheet 3 of 3)



## CHAPTER 24

### DEEP WATER FORDING SYSTEM TROUBLESHOOTING

---

24-1. EQUIPMENT ITEMS COVERED. This chapter gives equipment troubleshooting procedures for the Deep Water Fording System, for which there are authorized corrective maintenance tasks at the direct support and general support maintenance level.

24-2. EQUIPMENT ITEMS NOT COVERED. All equipment items for which corrective maintenance is authorized at the direct support and general support maintenance level are covered in this chapter.

DEEP WATER FORDING SYSTEM TROUBLESHOOTING

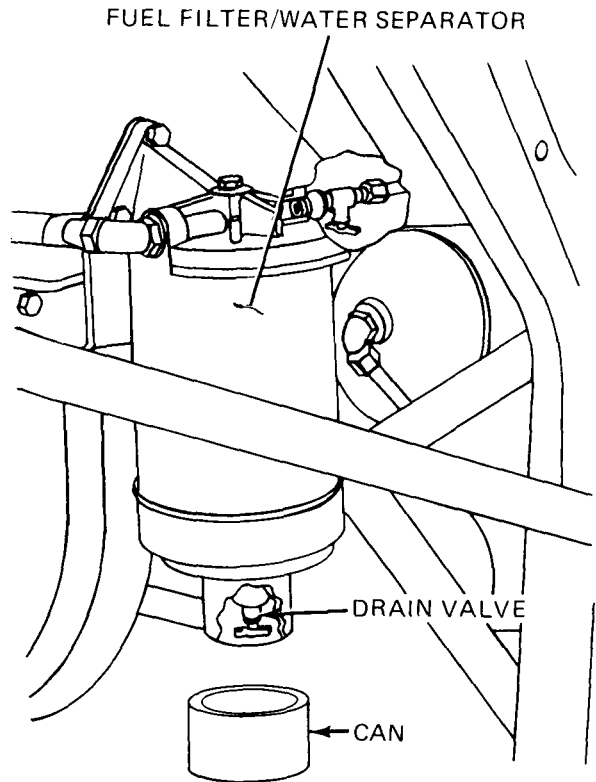
Symptom

1 ENGINE STALLS WHILE FORDING

- 1
- Park truck
  - Refer to TM 9-2320-211-10

--- CAUTION ---  
Do not start engine after truck has been removed from water. If water has entered engine assembly serious damage may occur if engine is started. Engine must be overhauled. Refer to direct support maintenance

- 2
- Check for water in fuel
    - Hold a can or bucket under fuel filter/water separator drain valve
    - Open fuel filter/water separator drain valve
    - Fill the can half way
    - Tighten fuel filter/water separator drain valve
    - Look for signs of water in diesel fuel in can
- Is diesel fuel OK?

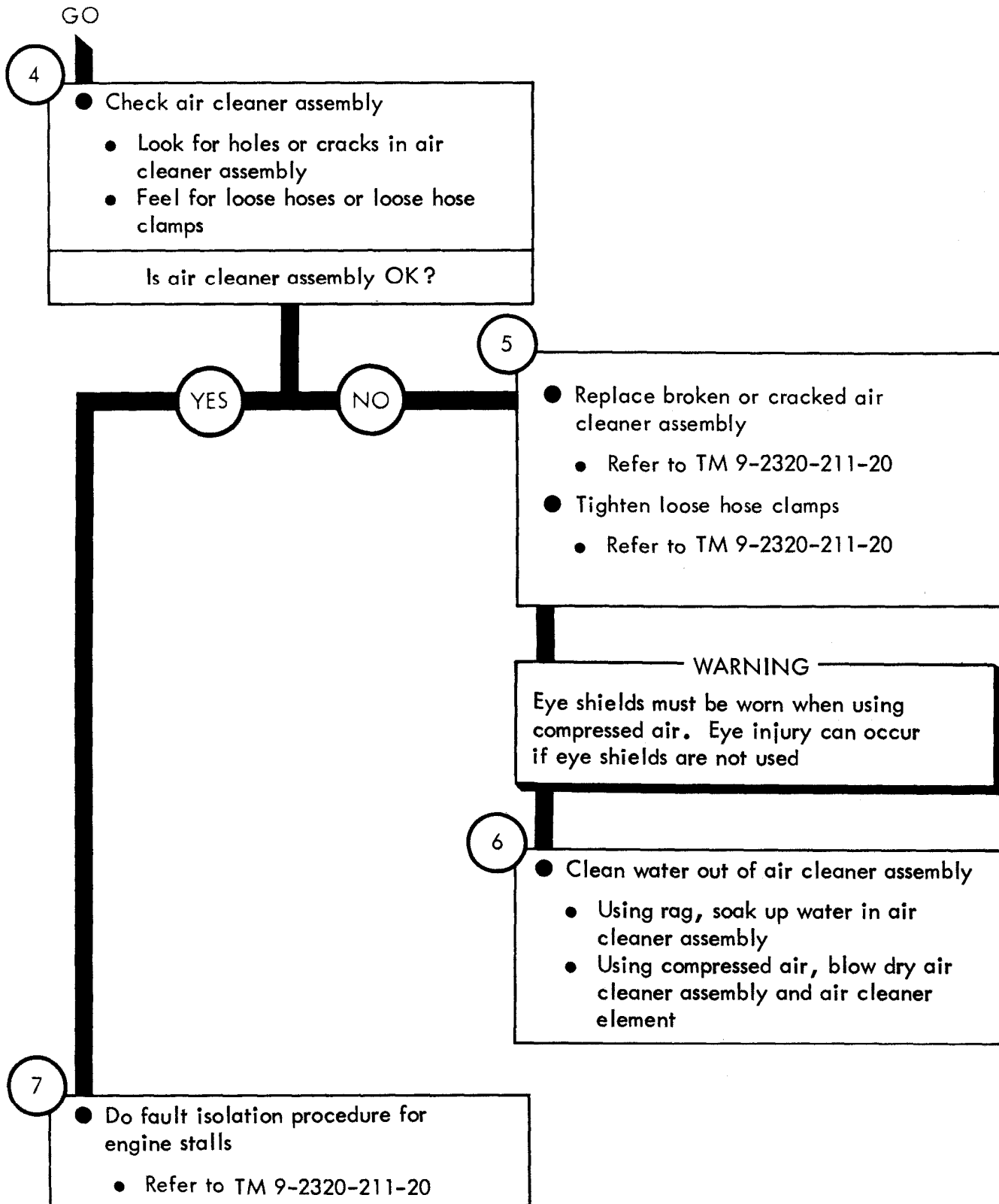


- 3
- Replace bad diesel fuel
    - Refer to TM 9-2320-211-10
  - Replace fuel tank cap
    - Refer to TM 9-2320-211-10

GO

TA 121009

Figure 24-1 (Sheet 1 of 2)



TA 121010

Figure 24-1 (Sheet 2 of 2)

Symptom

2

CLUTCH SLIPS AFTER LEAVING WATER

1

- Park truck
  - Refer to TM 9-2320-211-10

— WARNING —

Eyeshields must be worn when using compressed air. Eye injury can occur if eye shields are not used

2

- Drain water from transmission clutch housing
  - Remove clutch housing inspection cover. Refer to TM 9-2320-211-20
  - Allow all water to drain
  - Using compressed air, blow dry clutch
  - Put back clutch housing inspection cover. Refer to TM 9-2320-211-20

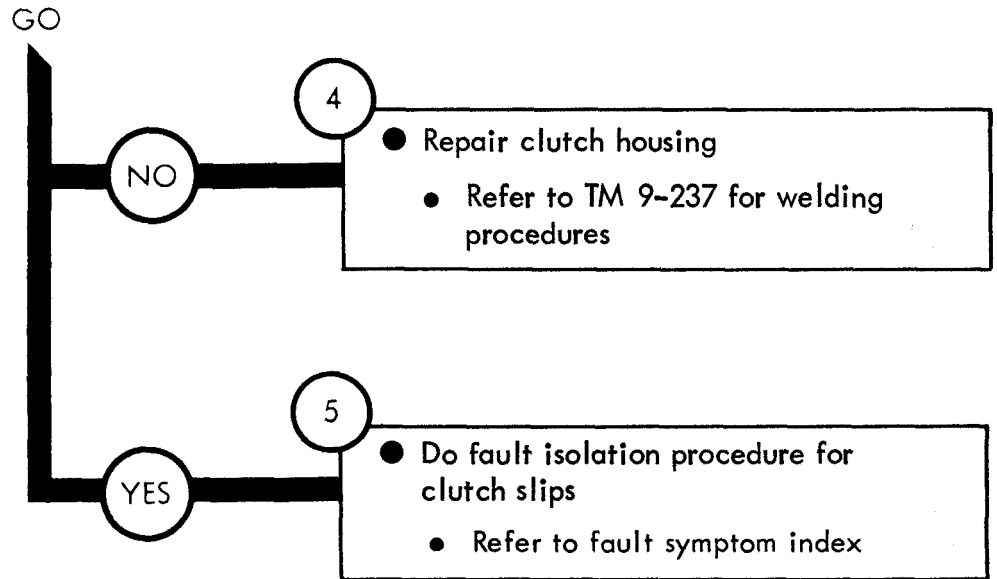
3

- Check clutch housing
  - Look for holes or cracks

Is transmission clutch housing OK?

GO

Figure 24-2 (Sheet 1 of 2)



TA 121012

Figure 24-2 (Sheet 2 of 2)



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

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 TM 9-2320-211-34-1

PUBLICATION DATE  
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PUBLICATION TITLE  
 DIR. & GEN. SUPPORT  
 TROUBLESHOOTING MANUAL

BE EXACT... PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
6-2			6-1
8-6		8-2 (Sheet 1 of 2)	
14-10		14-3 (Sheet 1 of 5)	

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

Symptom 2, detailed procedure refers to Figure 8-3. Should refer to Figure 8-2.

Change illustration callouts.  
 Reason: callouts for PUSHROD and VALVE SPRING are reversed.

Put NOTE before Box ① to read "When checking voltage, +24 volts DC means a range of +23 to +26 volts DC"

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER  
 SP4 Jane Idone Autovon 222-2224

SIGN HERE  
 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 = 1000 Millimeters = 39.37 Inches  
 1 Kilometer = 1000 Meters = 0.621 Miles

### 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

### WEIGHTS

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces  
 1 Kilogram = 1000 Grams = 2.2 Lb  
 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

### CUBIC MEASURE

1 Cu Centimeter = 1000 Cu Millimeters = 0.06 Cu Inches  
 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

### LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces  
 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

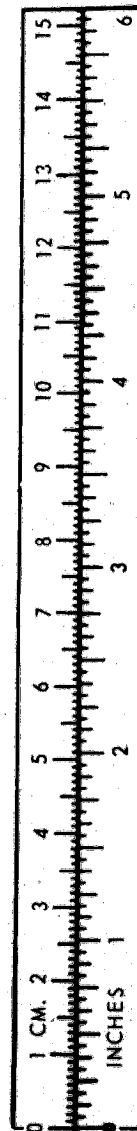
### TEMPERATURE

$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$   
 212<sup>o</sup> Fahrenheit is equivalent to 100<sup>o</sup> Celsius  
 90<sup>o</sup> Fahrenheit is equivalent to 32.2<sup>o</sup> Celsius  
 32<sup>o</sup> Fahrenheit is equivalent to 0<sup>o</sup> Celsius  
 $9/5 C^{\circ} + 32 = F^{\circ}$

### 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



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