TECHNICAL MANUAL

VOLUME 1 OF 2

TROUBLESHOOTING

DIRECT SUPPORT AND GENERAL SUPPORT LEVEL

ENGINE ASSEMBLY

NSN 2815-00-050-8681

DETROIT DIESEL MODEL GM3-53

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

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

DECEMBER 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 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 the engine is operated for maintenance purposes.

Do not operate engine in an enclosed area unless it is adequately ventilated.

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

Be alert at all times during engine operation for exhaust odors and exposure symptoms. If either are present, immediately ventilate working area. If symptoms persist, remove affected personnel from working area 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.

Smoking, flames, sparks and glowing or hot objects are not allowed within 50 feet of work area during maintenance of fuel system components. Fuel can explode, causing injury to personnel and damage to equipment.

TECHNICAL MANUAL
NO. 9-2815-214-34-1

TECHNICAL ORDER
NO. 38G1-74-2-1

DEPARTMENTS OF THE ARMY
AND
THE AIR FORCE
WASHINGTON, DC, 17 DECEMBER 1980

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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, ATTN: DRSTA-MB, Warren, Michigan 48090. A reply will be furnished to you.

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* This manual together with TM 9-2815-214-34-2, 17 December 1980, supersedes TM 9-2815-214-34, 2 March 1970.

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CHAPTER 1

GENERAL INFORMATION

1-1. SCOPE. This volume shows you how to do troubleshooting at the direct support and general 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 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 engine, 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 engine 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 mean's 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 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 9-4910-571-34&P.

2-4. 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 engine without using the detailed troubleshooting procedures. So if you know enough about the engine 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 engine, 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

3-1. GENERAL. This chapter has a troubleshooting index which covers every system of the engine 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 engine for which troubleshooting can be done at the direct support and general 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 ROADMAP	FAULT SYMPTOM INDEX	SUMMARY TROUBLE-SHOOTING PROCEDURES	SYSTEM SUPPORT DIAGRAMS
1	ENGINE	Figure 5-1	Table 6-1		

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Figure 3-1. Troubleshooting Index

CHAPTER 4

TEST EQUIPMENT PROCEDURES INDEX

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 (figure 4-1) 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	FUEL PRESSURE GAGE	Fuel Pump Pressure	9-2
2		Fuel Injector	9-3
3	COMPRESSION GAGE	Engine Cylinder Compression	9-4
4			
5			
6			
7			
8			

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Figure 4-1. Test Equipment Procedures Index

CHAPTER 5

TROUBLESHOOTING ROADMAP

5-1. GENERAL. This chapter gives a troubleshooting roadmap for every system of the engine for which you have detailed troubleshooting procedures. Figure 5-1 covers the roadmap for the detailed procedures.

5-2. ROADMAP. The 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.

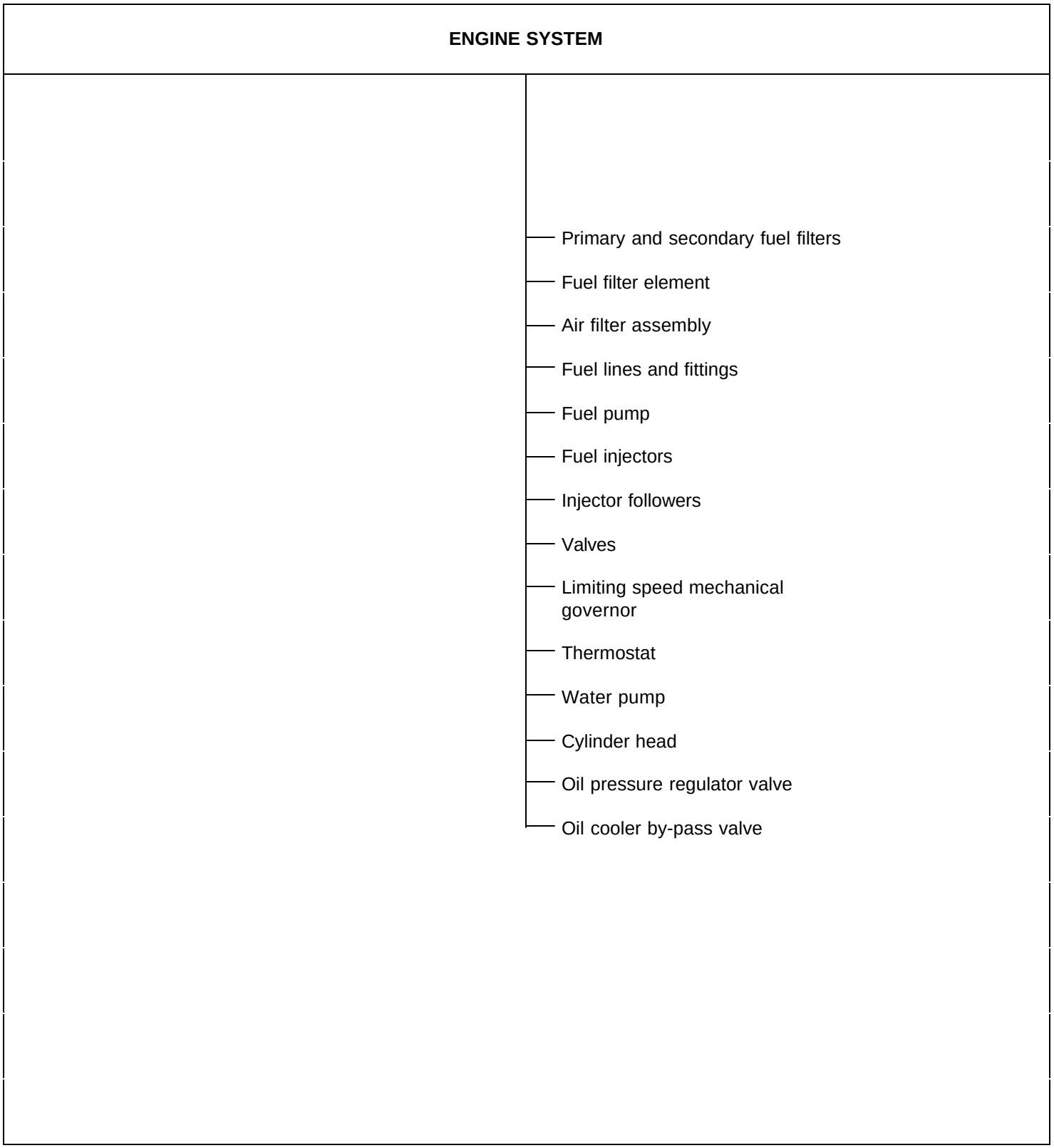

Figure 5-1. Troubleshooting Roadmap, Engine System

CHAPTER 6

FAULT SYMPTOM INDEX

6-1. GENERAL. This chapter gives troubleshooting fault symptom index for every symptom of the engine for which you have detailed troubleshooting procedure. The index is in table form (table 6-1) which gives you a quick way to check what material you have to use to do your troubleshooting.

6-2. INDEX. 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 shop officer.

TABLE 6-1. ENGINE SYSTEM

SUBSYSTEM	SYMPTOM	TS PROCEDURE		RESOURCES REQ'D				
					TEST EQUIPMENT			
		SUMMARY	DETAILED	PERSONS	SPECIAL TOOLS	STANDARD TOOLS	MATERIALS	TIME
-	1. Engine does not start	-	Figure 8-1	1	-	•		
-	2. Engine runs too fast	-	Figure 8-2	1	-	•		
-	3. Engine temperature gage reads above 200°F while running	-	Figure 8-3	1	-	•		
-	4. Low oil pressure	-	Figure 8-4	1	-	•		
-	5. Engine lacks power	-	Figure 8-5	1	-	•		

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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 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 starter 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 broke 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.

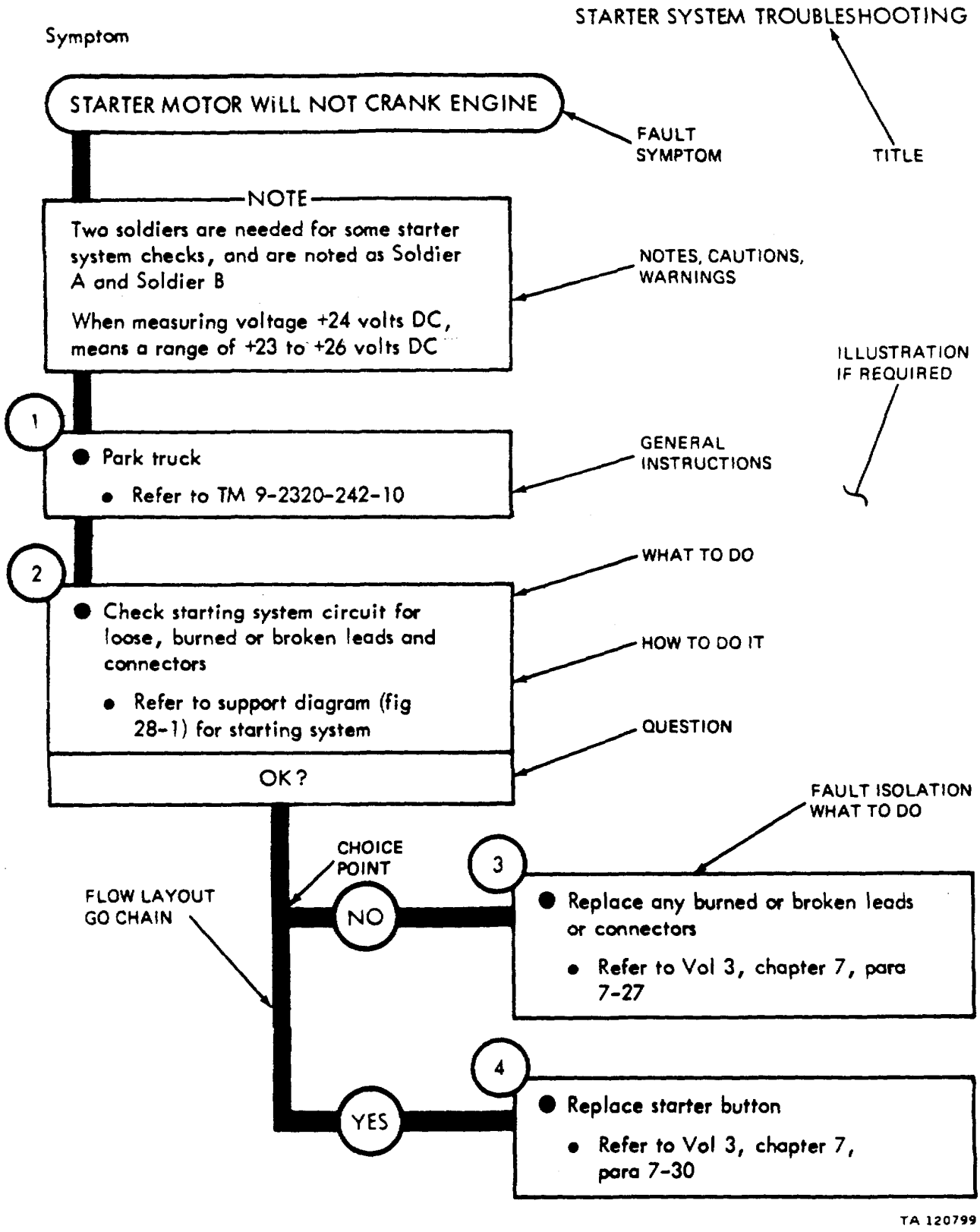
STARTER SYSTEM TROUBLESHOOTING
Symptom
STARTER MOTOR WILL NOT CRANK ENGINE
FAULT SYMPTOM
TITLE
NOTE
Two soldiers are needed for some starter system checks, and are noted as Soldier A and Soldier B
When measuring voltage +24 volts DC, means a range of +23 to +26 volts DC
NOTES, CAUTIONS, WARNINGS
ILLUSTRATION IF REQUIRED
1
● Park truck
• Refer to TM 9-2320-242-10
GENERAL INSTRUCTIONS
2
WHAT TO DO
● Check starting system circuit for loose, burned or broken leads and connectors
• Refer to support diagram (fig 28-1) for starting system
HOW TO DO IT
OK?
QUESTION
FAULT ISOLATION WHAT TO DO
CHOICE POINT
3
FLOW LAYOUT GO CHAIN
NO
● Replace any burned or broken leads or connectors
• Refer to Vol 3, chapter 7, para 7-27
4
YES
● Replace starter button
• Refer to Vol 3, chapter 7, para 7-30
TA 120799

Figure 7-1

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 organizational maintenance level are covered in this chapter.

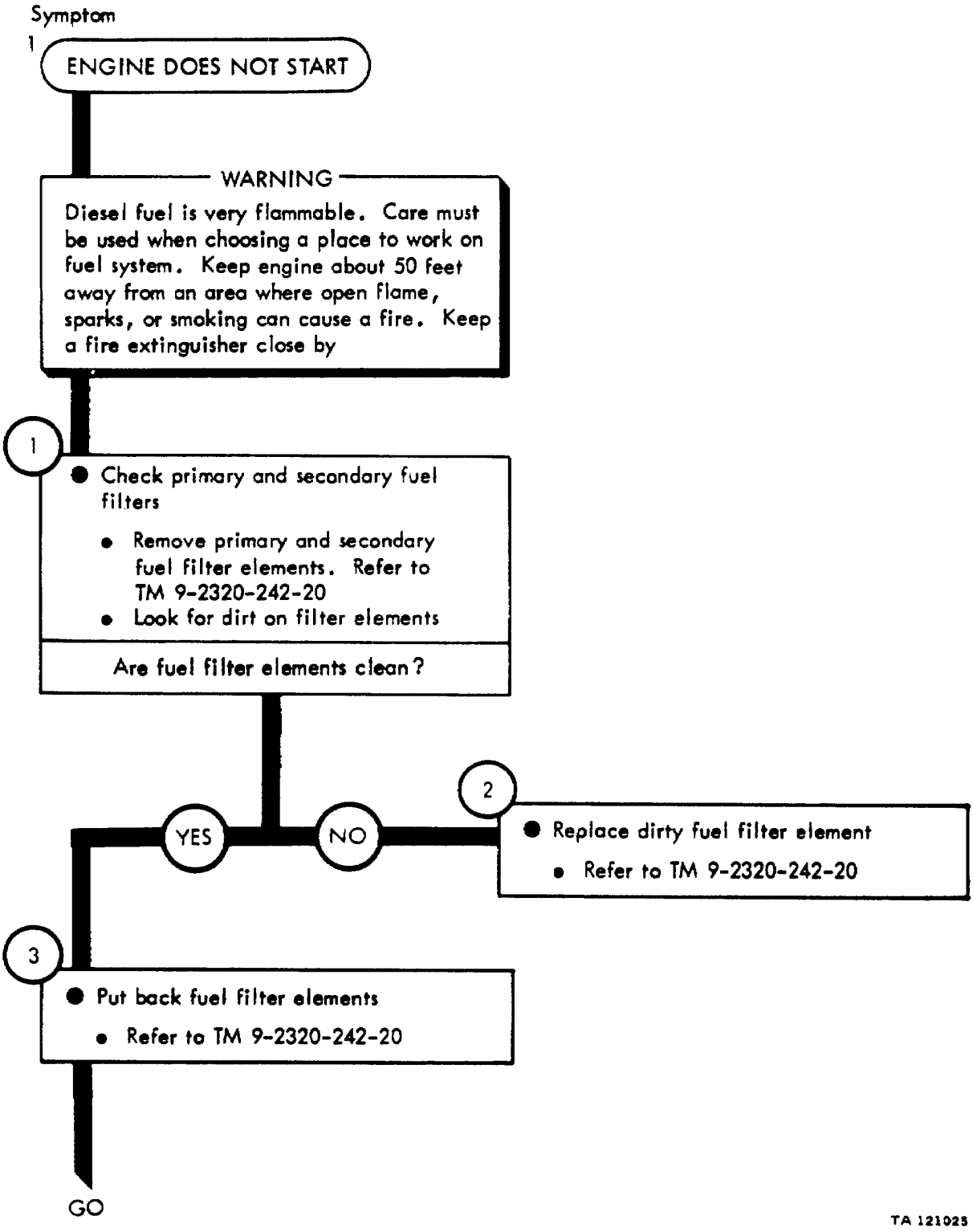

Figure 8-1 (Sheet 1 of 4)

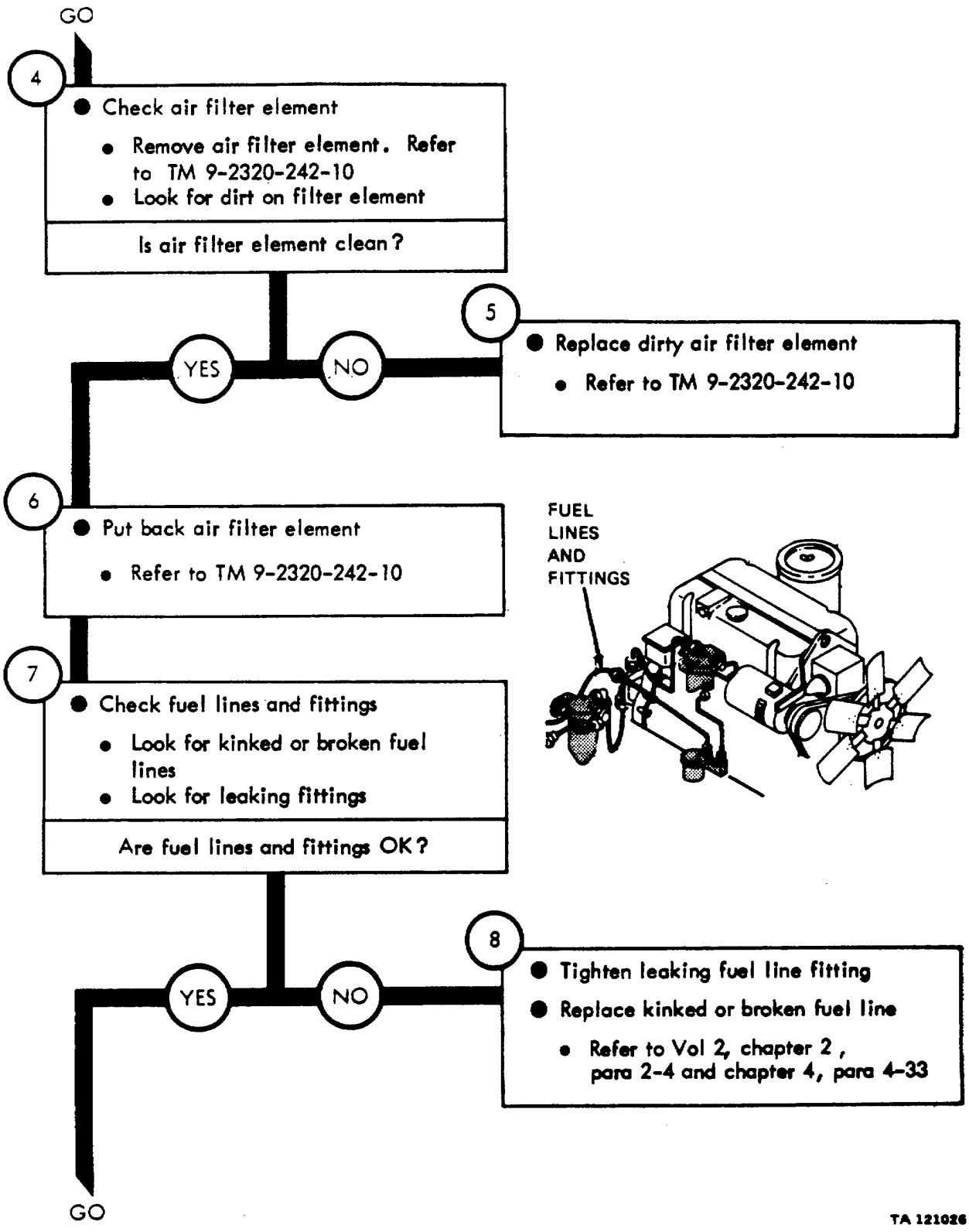

Figure 8-1 (Sheet 2 of 4)

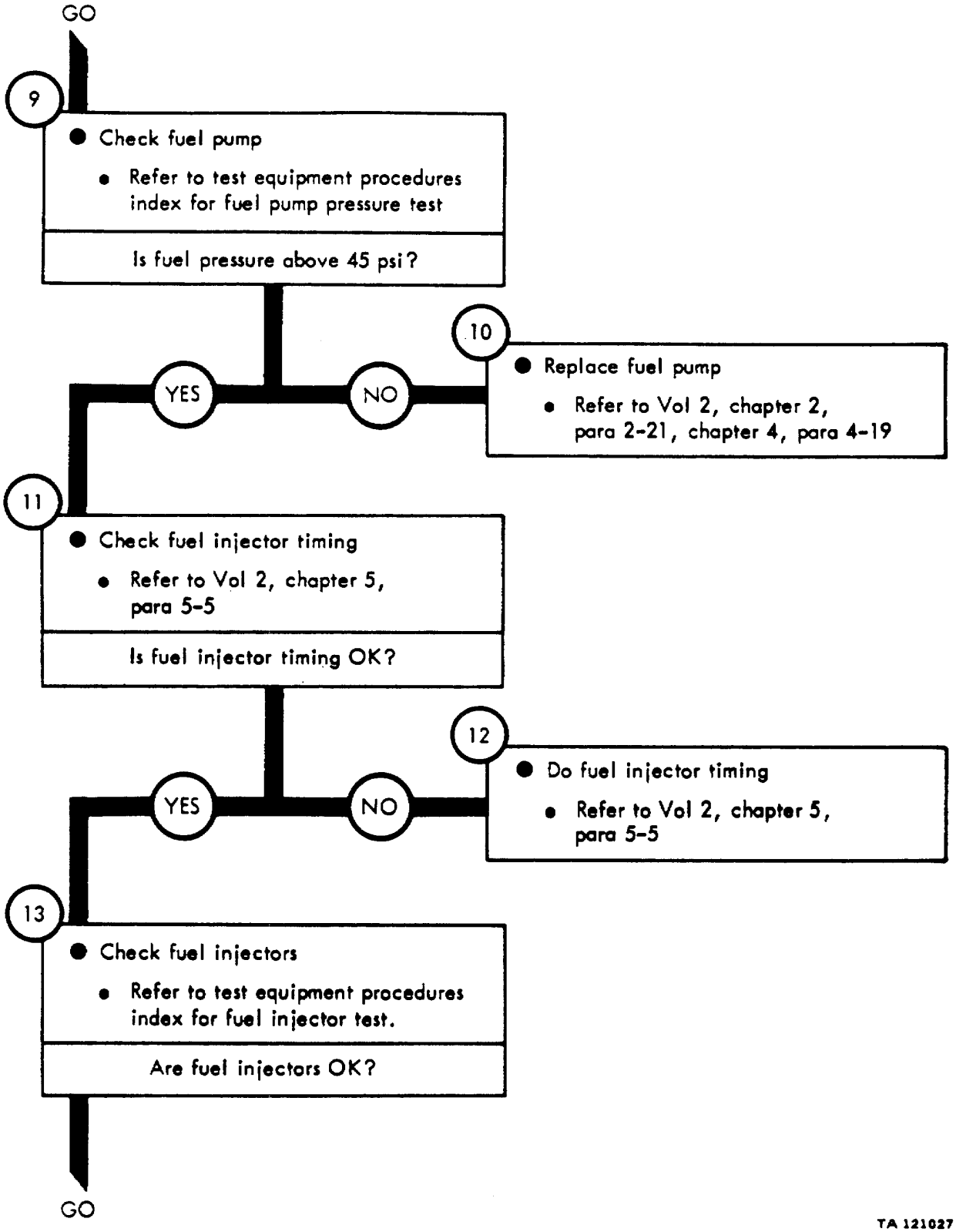

Figure 8-1 (Sheet 3 of 4)

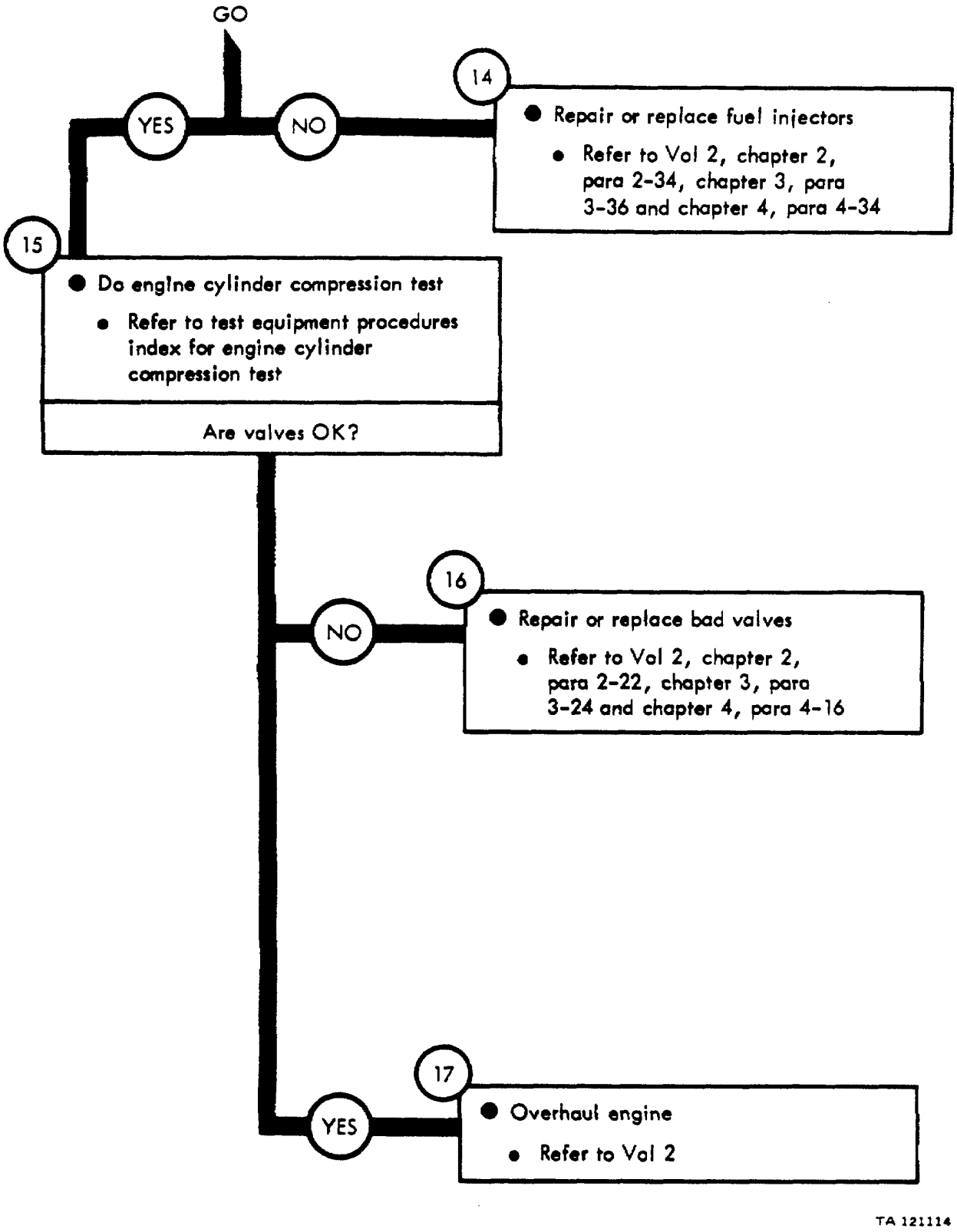

Figure 8-1 (Sheet 4 of 4)

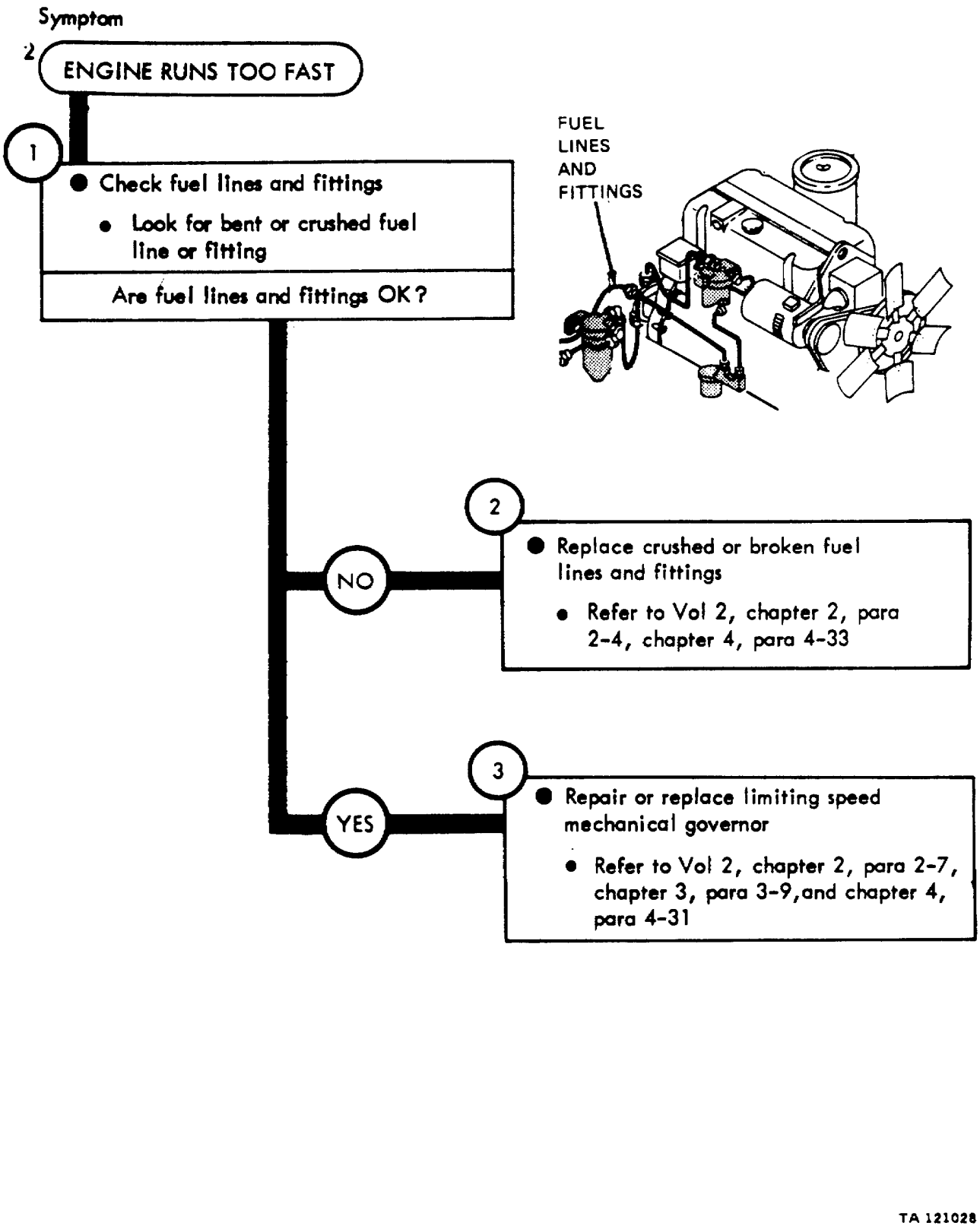
Symptom
2
ENGINE RUNS TOO FAST
1
● Check fuel lines and fittings
• Look for bent or crushed fuel line or fitting
Are fuel lines and fittings OK?
FUEL LINES AND FITTINGS
NO
2
● Replace crushed or broken fuel lines and fittings
• Refer to Vol 2, chapter 2, para 2-4, chapter 4, para 4-33
YES
3
● Repair or replace limiting speed mechanical governor
• Refer to Vol 2, chapter 2, para 2-7, chapter 3, para 3-9, and chapter 4, para 4-31
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Figure 8-2

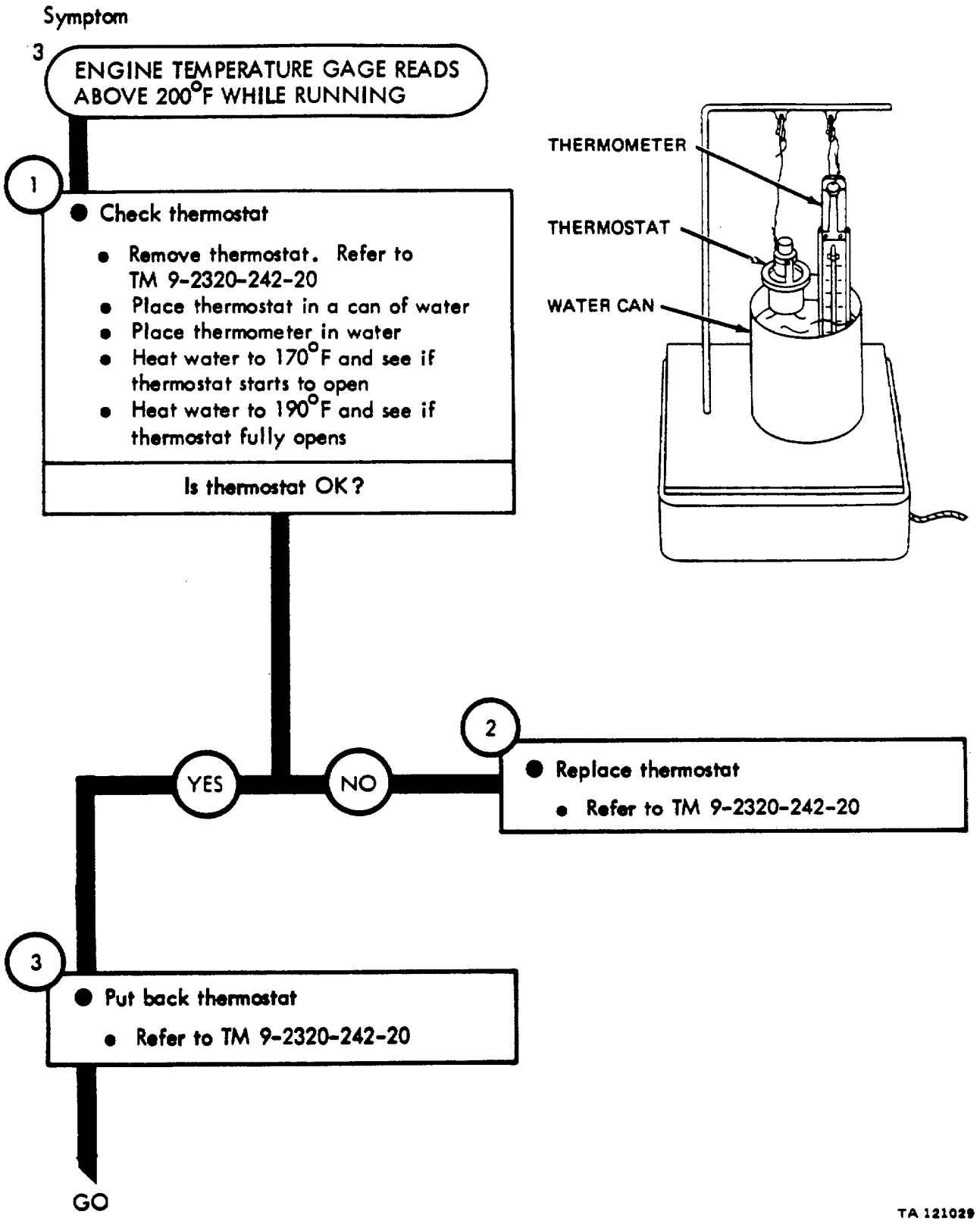
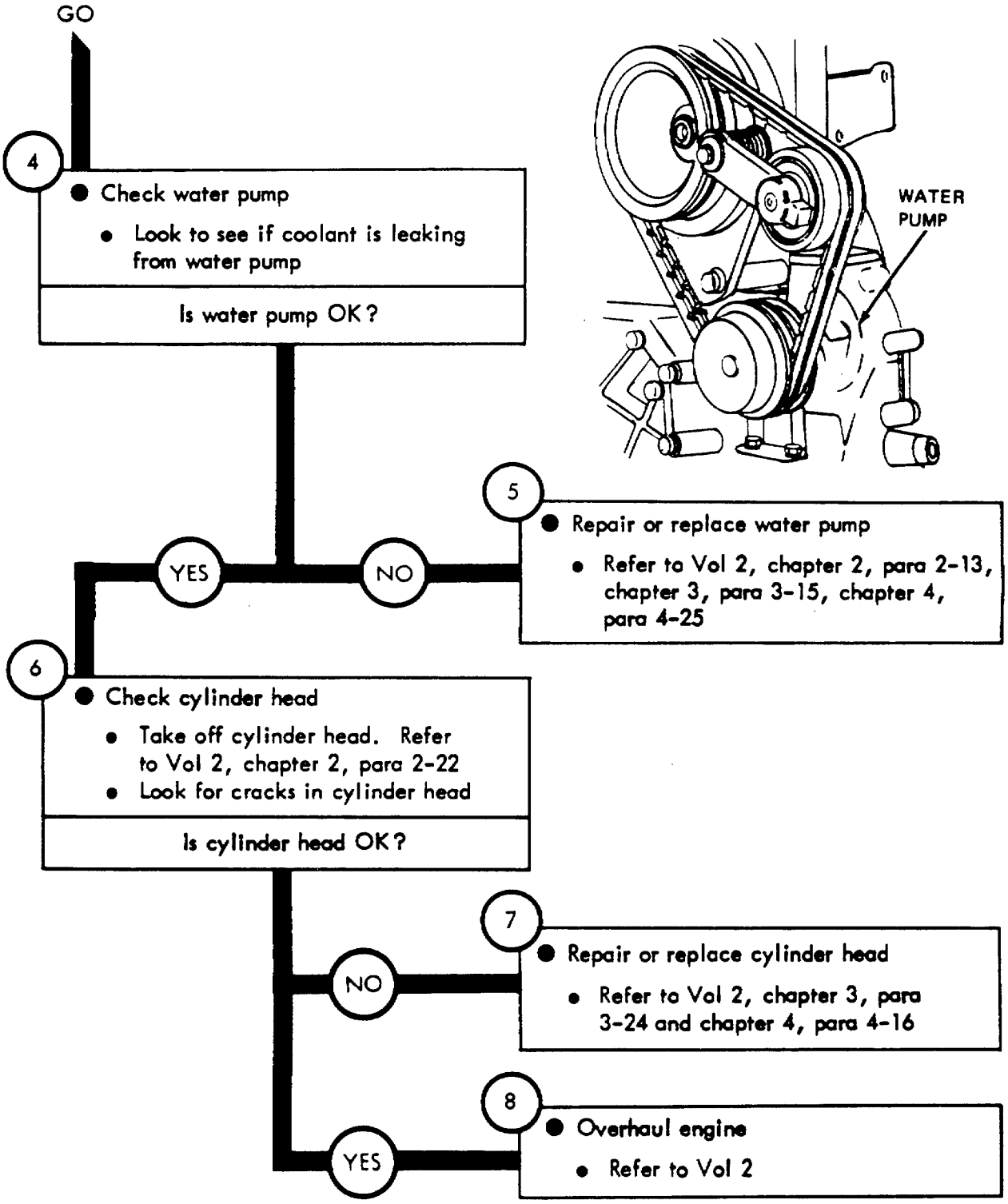


Figure 8-3 (Sheet 1 of 2)



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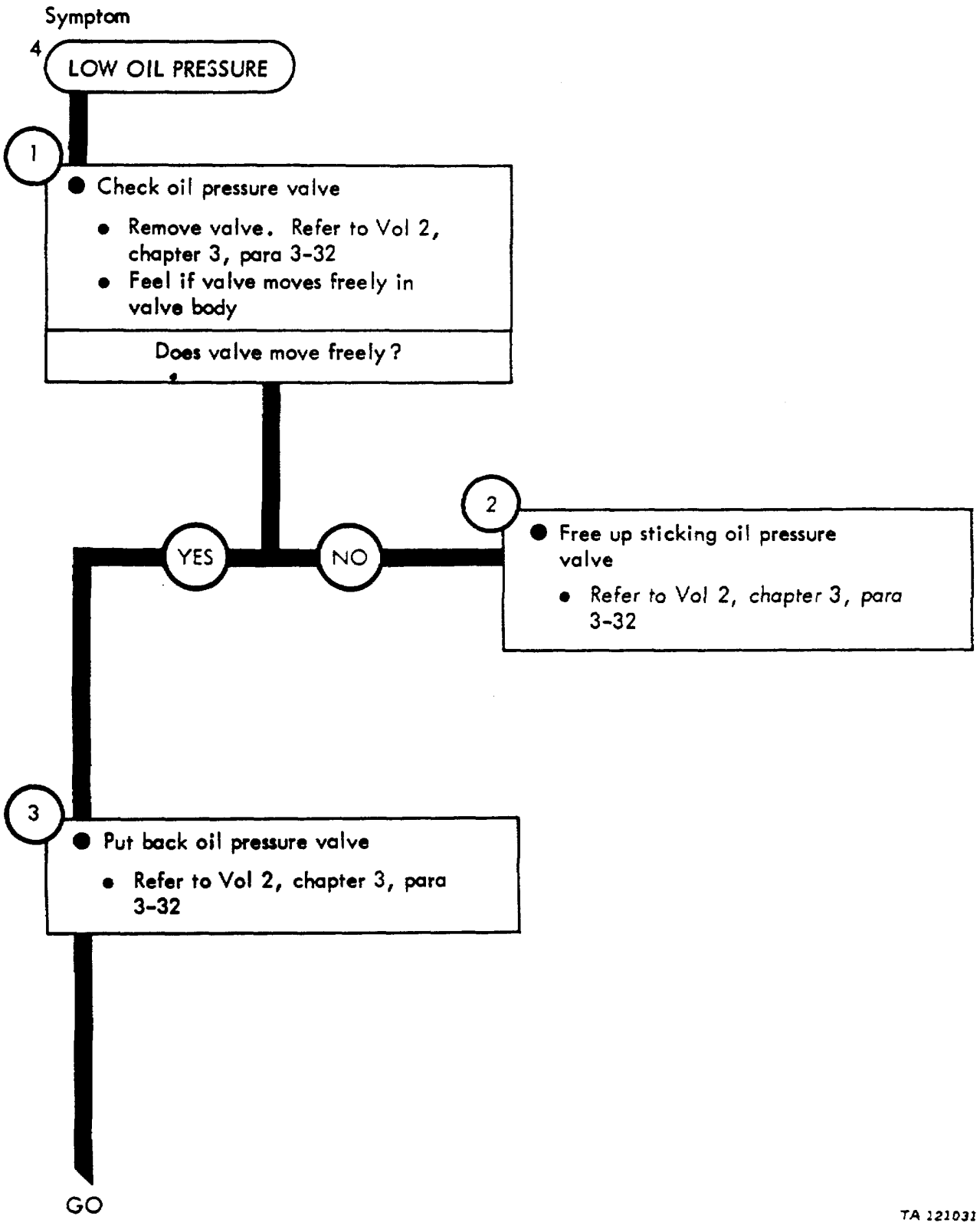

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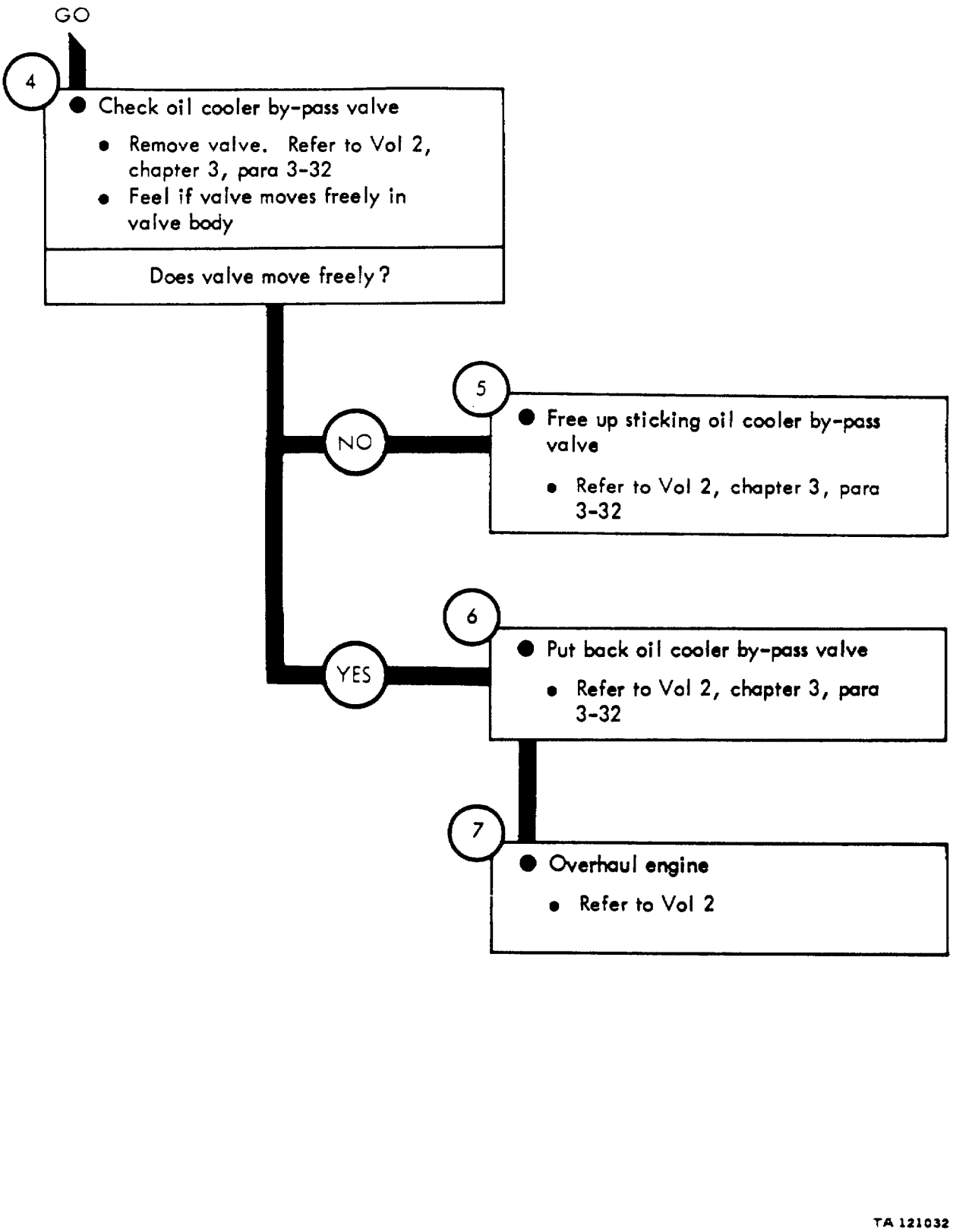

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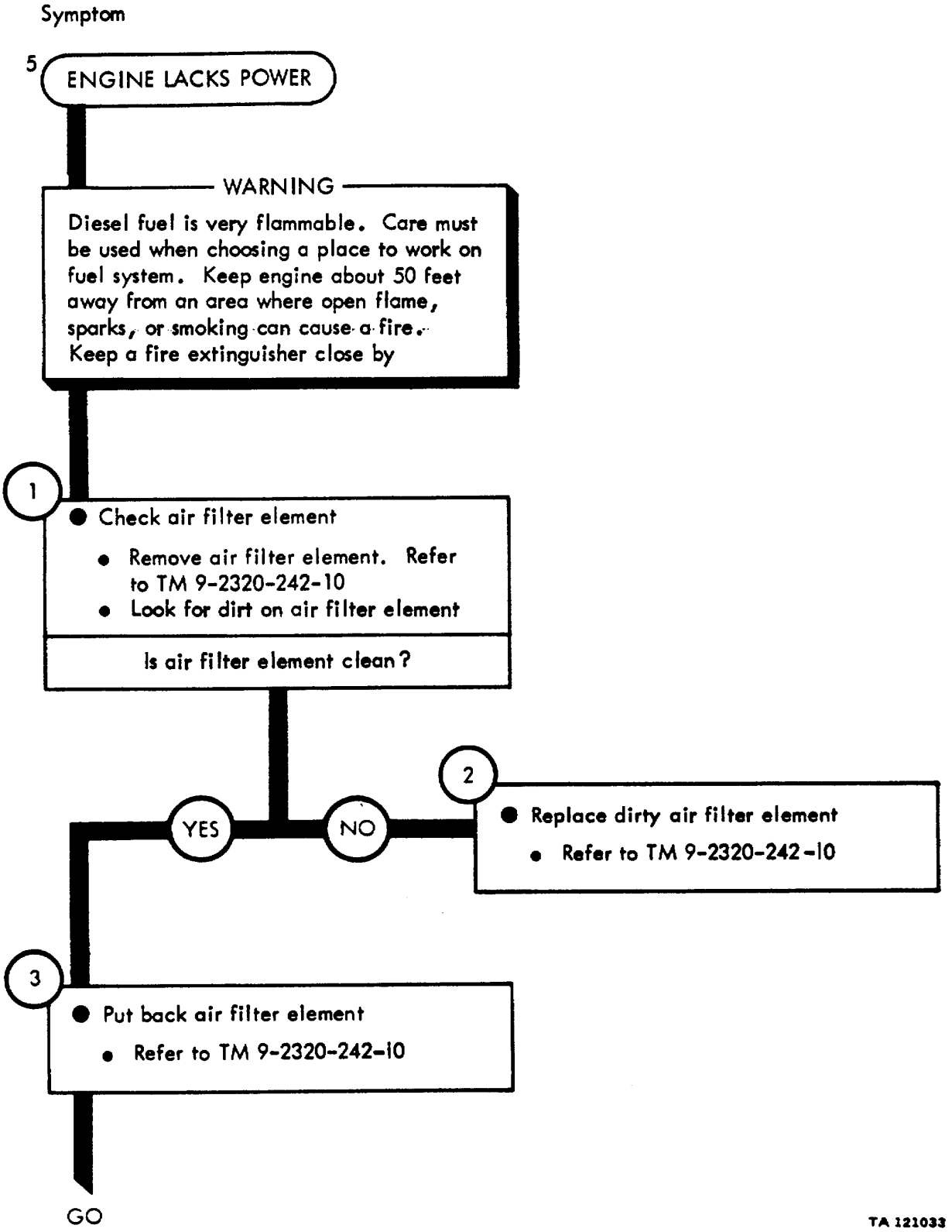
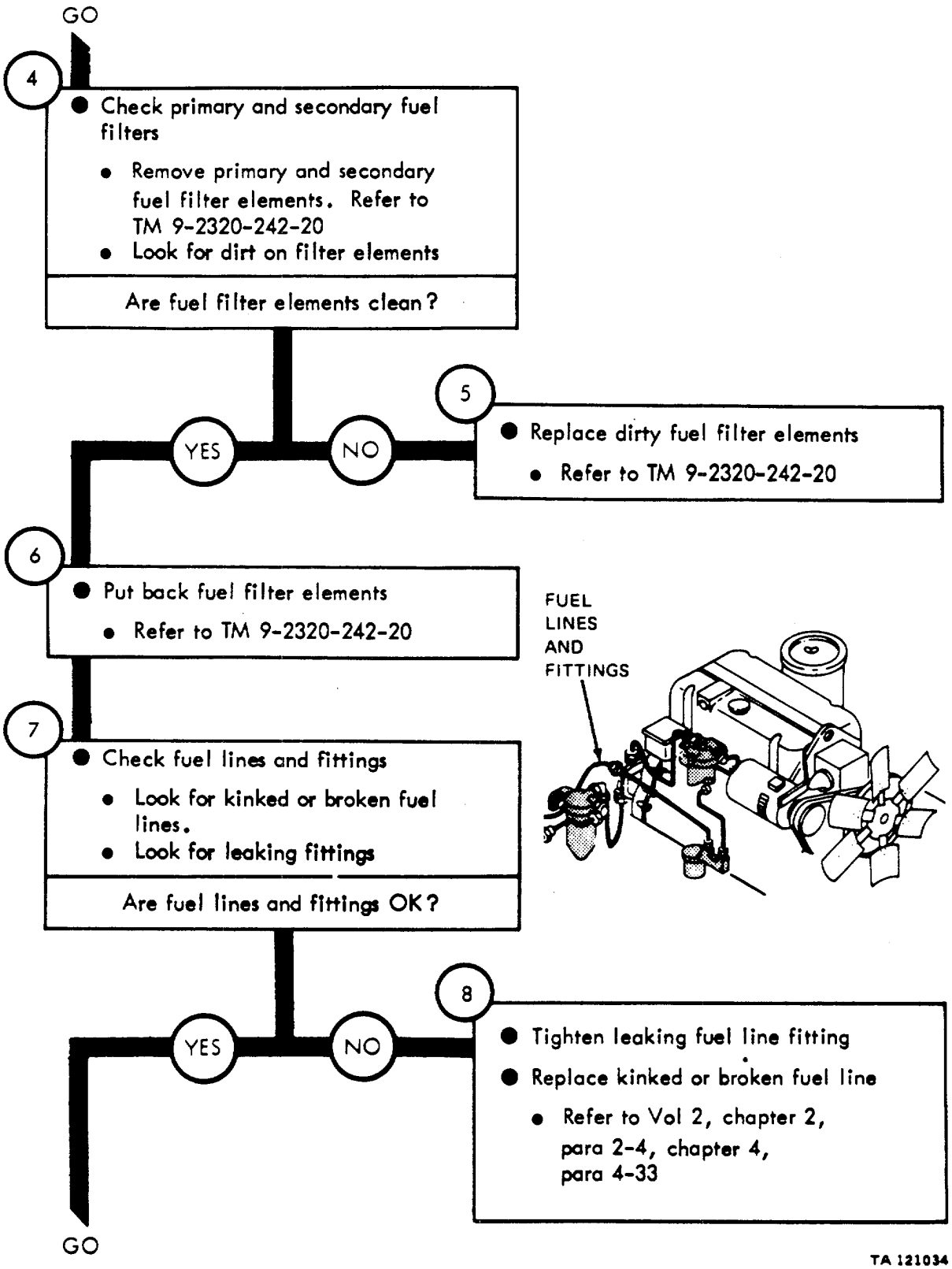


Figure 8-5 (Sheet 1 of 3)



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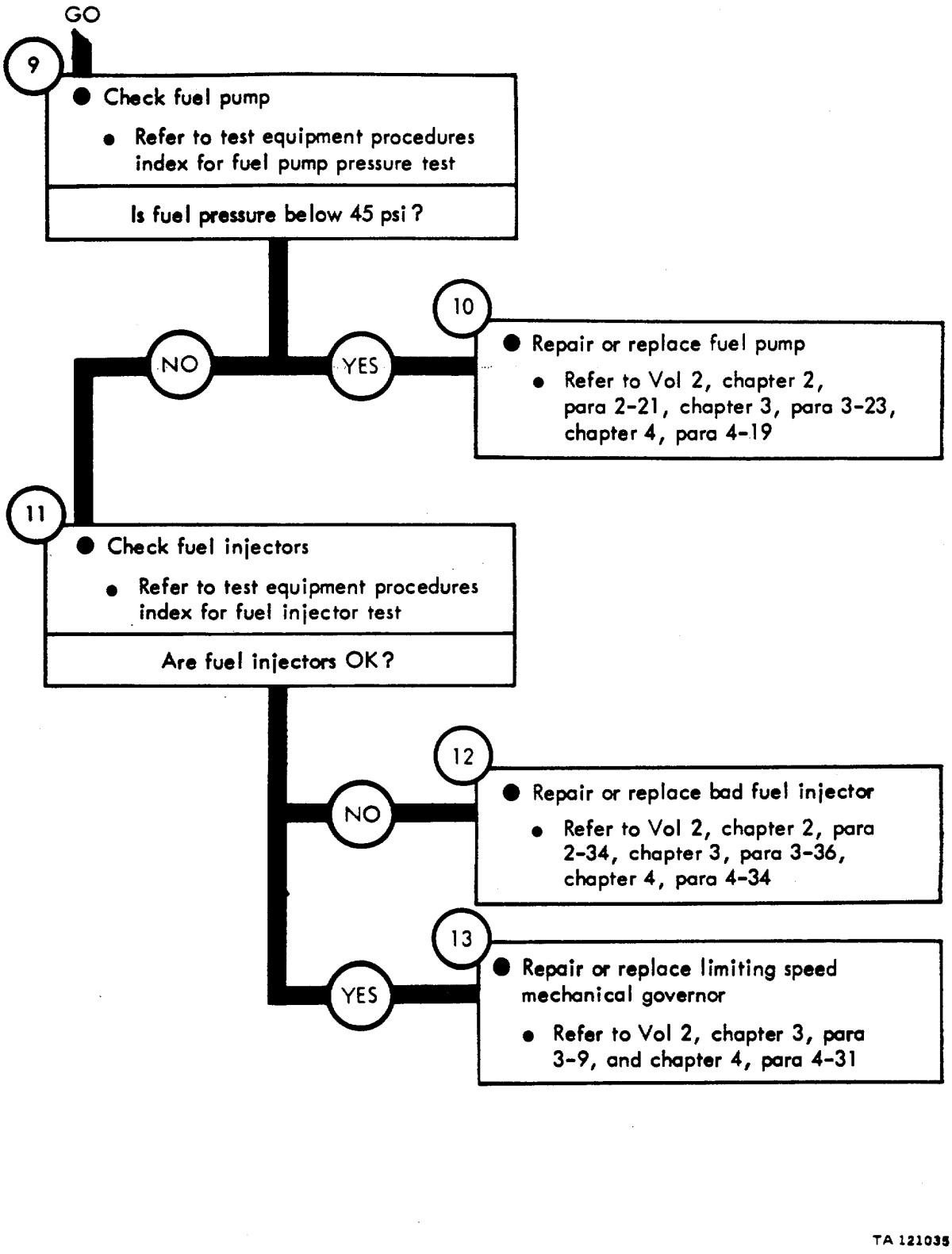

Figure 8-5 (Sheet 3 of 3)

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 engine 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 system index, chapter 6, if the test shows a fault in another system.

GENERAL INSTRUCTIONS

- Set up pressure gage
  - Disconnect one pressure line from gage and replace it with a plug of proper size
  - Using 3/4-inch wrench tighten plug
- Check pressure gage
  - Gage - See that glass and pointer are not broken
  - Fittings - Make sure fittings are tight on gage. See if fittings are free of dirt

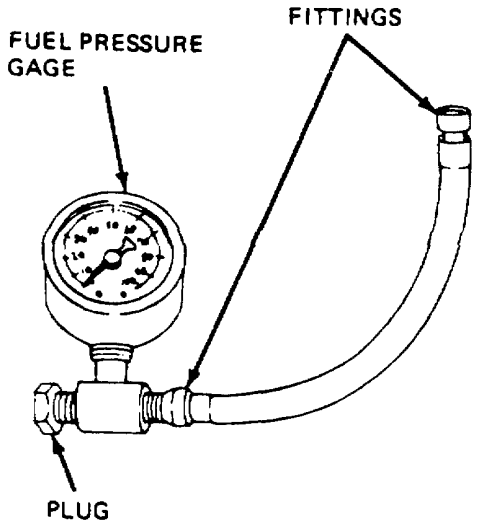

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Figure 9-1

FUEL PUMP PRESSURE TEST – To measure fuel pump pressure at the fuel pump

NOTE

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

1

- Set up pressure test as follows

  SOLDIER A:
  - Using 1/4-inch allen wrench unscrew plug on secondary fuel filter
  - Using suitable adapter screw fuel pressure hose into plug and tighten using 3/4-inch wrench

GO

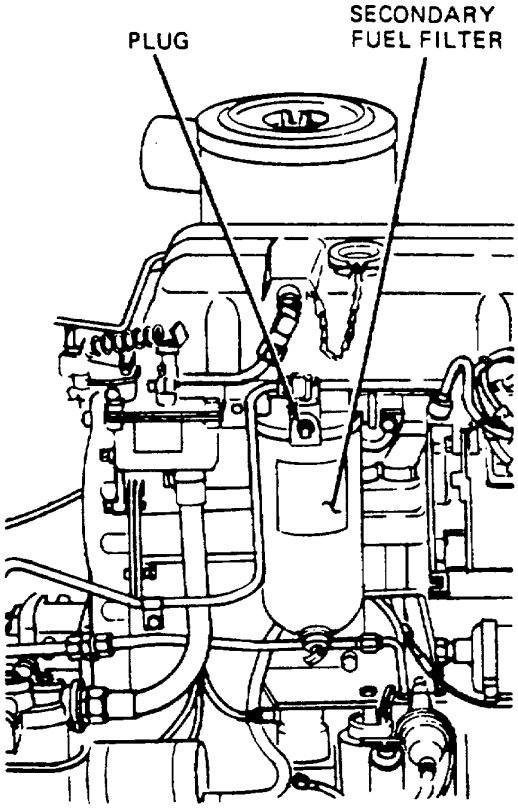

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Figure 9-2 (Sheet 1 of 3)

GO

2

- Test fuel pump pressure

SOLDIER A:
- Tell Soldier B to start engine

SOLDIER B:
- Start engine. Refer to Vol 2, chapter 5, para 5-5

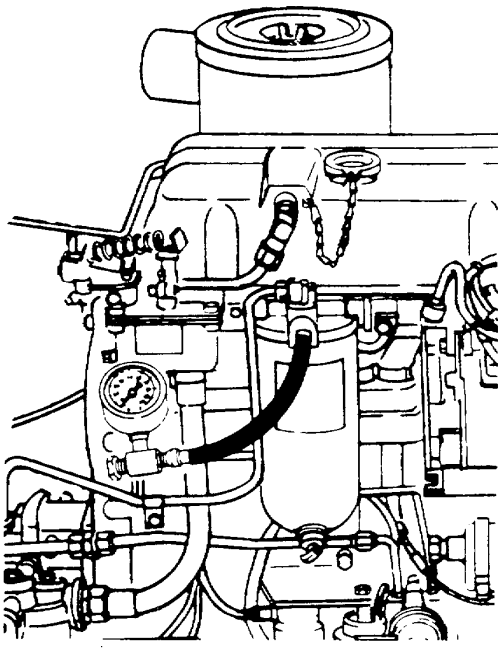
SOLDIER A:
- Look at pressure gage
- Tell Soldier B to run engine up to 2800 rpm

SOLDIER B:
- Run engine up to 2800 rpm

SOLDIER A:
- See if pressure reads between 45 and 70 psi
- Tell Soldier B to stop engine

SOLDIER B:
- Stop engine. Refer to Vol 2, chapter 5, para 5-5

GO



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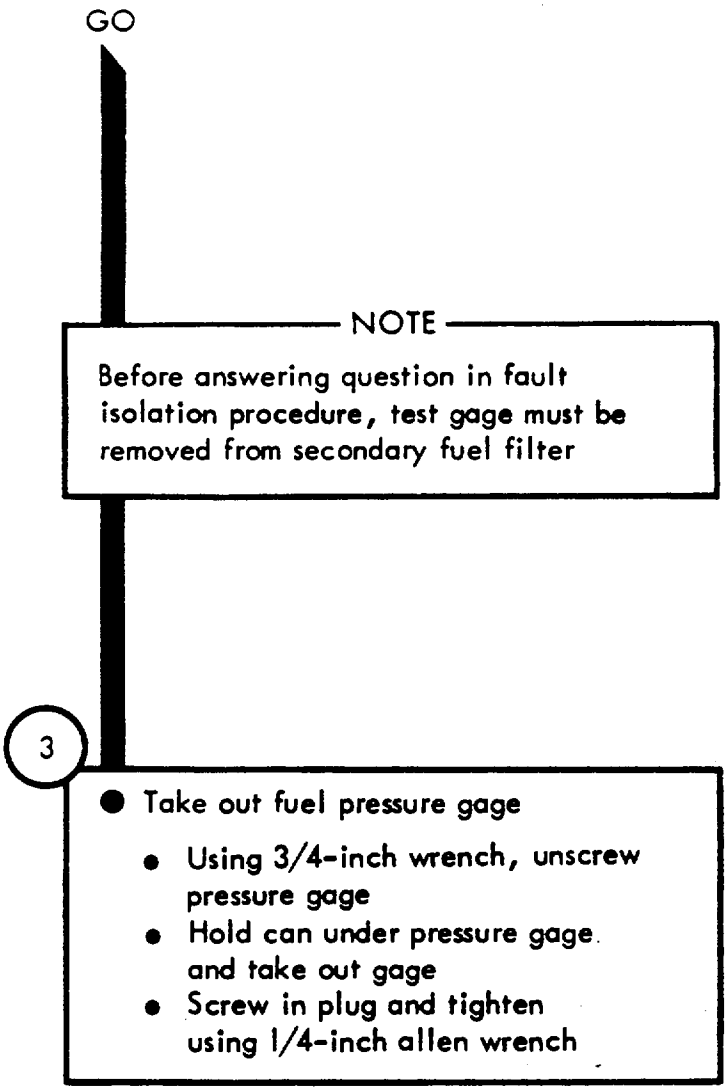

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Figure 9-2 (Sheet 3 of 3)

FUEL INJECTOR TEST - To find out if any fuel injectors are not working

1

- Start and warm up engine
  - Refer to Vol 2, chapter 5, para 5-5
- Stop engine
  - Refer to Vol 2, chapter 5, para 5-5
- Take off rocker arm cover and throw away gasket
  - Refer to Vol 2, chapter 2, para 2-5
- Start engine
  - Refer to Vol 2, chapter 5, para 5-5

2

- Hold down injector follower of one cylinder with screwdriver so that fuel injector does not work

  Note: Check fuel injector of each cylinder. If an injector is OK engine will run rougher when injector follower is held down

3

- Stop engine
  - Refer to Vol 2, chapter 5, para 5-5
- Put on new gasket and put back valve rocker arm cover
  - Refer to Vol 2, chapter 4, para 4-35

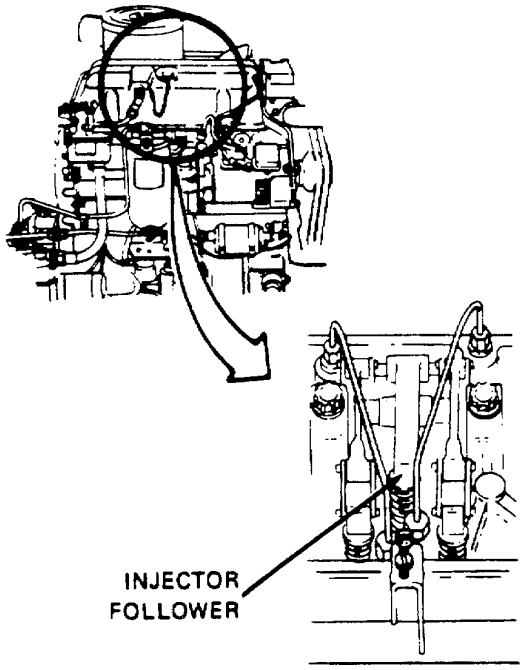

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Figure 9-3

ENGINE CYLINDER COMPRESSION TEST - To find out if any cylinder is bad

1
- Start engine and warm up to operating temperature
  - Refer to Vol 2, chapter 5, para 5-5
- Turn off engine
  - Refer to Vol 2, chapter 5, para 5-5

2
- Take out all 3 fuel injector nozzle and holder assemblies
  - Refer to Vol 2, chapter 2, para 2-34

3
- Put compression gage onto number one fuel injector opening in cylinder head
  - Using new fuel injector nozzle to head gasket, put in adapter
  - Put compression gage into adapter

4
- Crank engine for 5 seconds
  - Refer to Vol 2, chapter 5, para 5-5

  Note: Keep fuel shutoff in off position

  - Read compression from gage and write down reading

GO

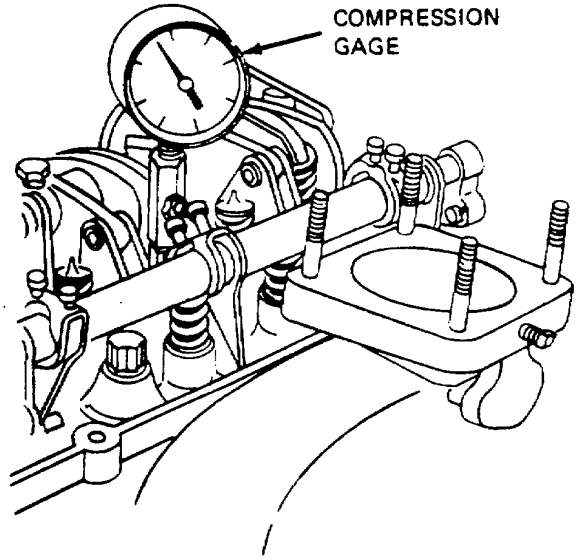

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Figure 9-4 (Sheet 1 of 2)

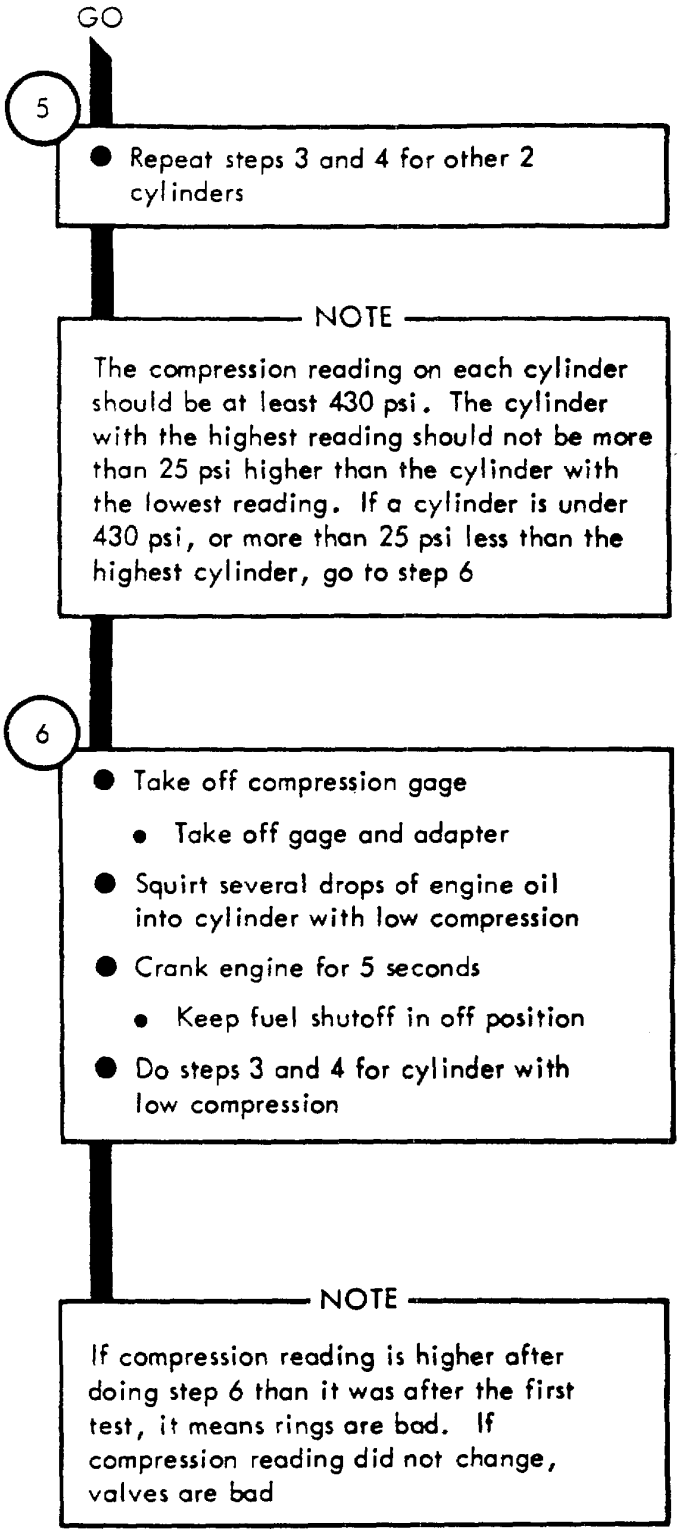

Figure 9-4 (Sheet 2 of 2)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

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27 July 1980

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-2815-214-34-1	15 June 1980	ENGINE ASSEMBLY GM3-53 DIR. & GEN. SUPP. TROUBLESHOOTING

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
6-2			6-1
8-7		8-3 (Sheet 1 of 2)	
9-8		9-4 (Sheet 2 of 2)	

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

Symptom 3, detailed procedure refers to figure 5-4. Should refer to figure 5-3.

Change illustration callouts. Reason: callouts for THERMOSTAT and THERMOMETER are reversed.

NOTE, first sentence reads "The compression reading on each cylinder should be at least 525 psi." Should read "The compression reading on each cylinder should be at least 430 psi."

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

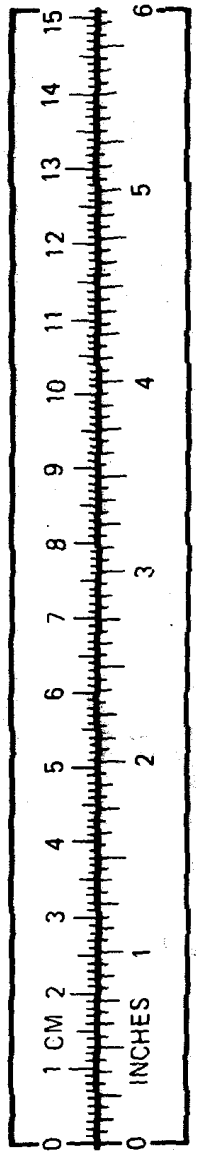
TEMPERATURE

5/9 (°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
Quarts.	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.45
Short Tons	Metric Tons	0.0907
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
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0 155
Square Meters	Square Feet .	10.764
Square Meters	Square Yards	1.195
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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