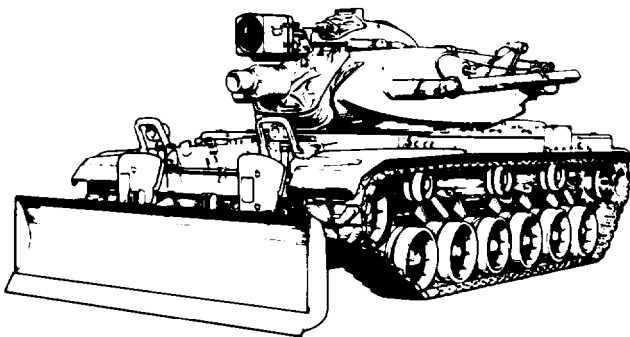

TECHNICAL MANUAL

TROUBLESHOOTING

4-1

ORGANIZATIONAL MAINTENANCE
VOLUME 2 OF 5
CHAPTER 4



COMBAT ENGINEER VEHICLE,
FULL-TRACKED, M728
2350-00-795-1797
(HULL)

This copy is a reprint which includes current
pages from Changes 1 through 4.

TA141002

Technical Manual
No. 9-2350-222-20-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 20 February 1981

ORGANIZATIONAL MAINTENANCE
COMBAT ENGINEER VEHICLE
FULL TRACKED, M728
NSN (2350-00-795-1 797)
(HULL)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Tank-Automotive Command, Attn: AMSTA-MBC, Warren, Michigan 48397-5000. A reply will be furnished to you.

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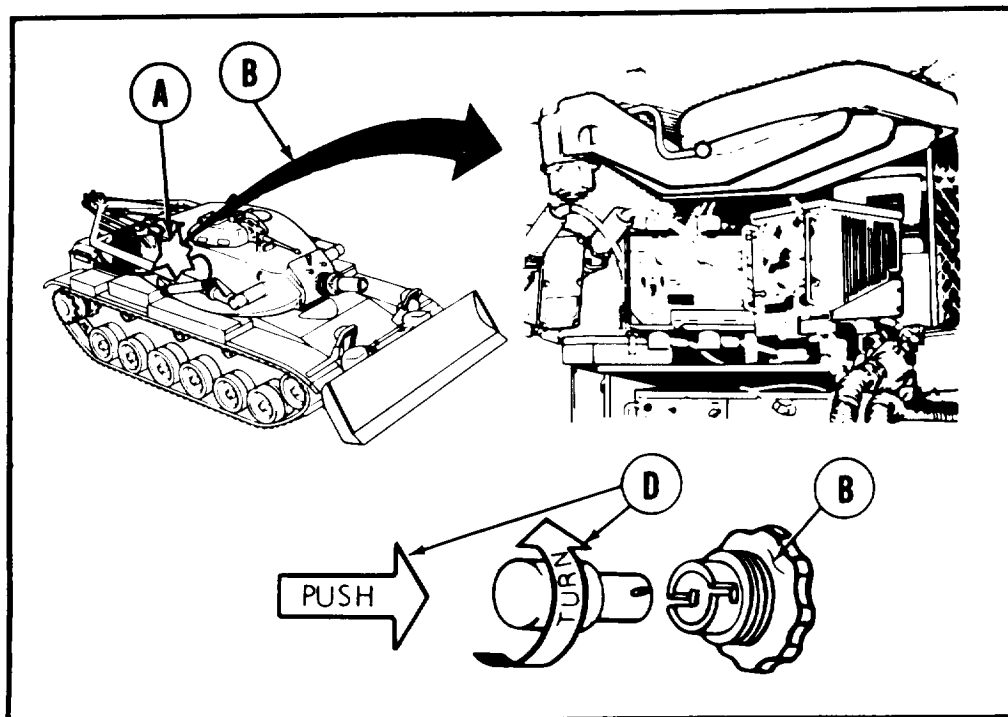
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HOW TO USE THIS MANUAL:

- This manual is divided into chapters.
- Chapters are by functional group code and are presented in same order as the RPSTL (Repair Parts and Special Tool List).
- Procedure indexes are on procedures that are four pages or more, and indicate how the procedure is set up, i.e., disassembly, removal, cleaning and inspection, etc.
- All references within this technical manual refer to page numbers.
- Steps are numbered and are to be performed in that order.
- Be sure to read all NOTES, WARNINGS, AND CAUTIONS.
- Locator views are included wherever necessary. These will help you locate the item for which the procedure is referencing.
- Jagged circle (✱) on locator (A) indicates a cutout and means the item is inside the vehicle.
- A (—) symbol represents the outside surface (B) of a piece of equipment that cannot be shown in its entirety.
- Callouts are shown by a circle with a letter inside.
- Locator arrows (C) are black and mechanical motion arrows (D) are white.
- Broken leader arrow (---) indicates the item is either inside or under the vehicle and cannot be seen.



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HOW TO USE THIS MANUAL - Continued

- Certain sections of the manual have detailed 'how to use' instructions at the beginning of the section - for example, troubleshooting.
- A maintenance information index is located in back of this manual. It is set up in alphabetical order and maintenance function, for example, disassemble, clean, inspect, repair, remove, install, assemble, and test.
- An illustrated list of manufactured items, or better known as fabricated tools, is located in back of this manual. It is nothing more than direction on how to fabricate tools that are listed throughout the manual.

CHAPTER 4

TROUBLESHOOTING

GENERAL

Troubleshooting is the step-by-step process of identifying, locating, isolating, and repairing equipment malfunctions or breakdowns. This section contains instructions and information which will assist the technician in troubleshooting the M728 hull. The Detailed Troubleshooting Procedures cover the most frequent failures and a wide variety of other failures that can be identified and dealt with effectively, using the information in this section.

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USER GUIDE	4-2
TROUBLESHOOTING SYSTEM INDEX	4-20
TROUBLESHOOTING SUBJECT INDEX	4-21
VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE	4-25
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DETAILED TROUBLESHOOTING PROCEDURES	4-131
SYMPTOMS 1 THRU 87	

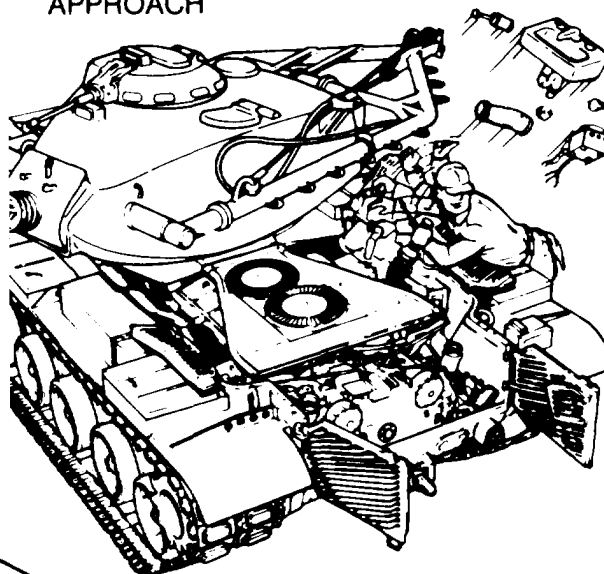
TROUBLESHOOTING

USER GUIDE

NOTE

The **TROUBLESHOOTING USER GUIDE** which follows is presented in the same format as the detailed troubleshooting procedure you will be using to identify and correct the trouble in the M728 vehicle.

SHOTGUN APPROACH



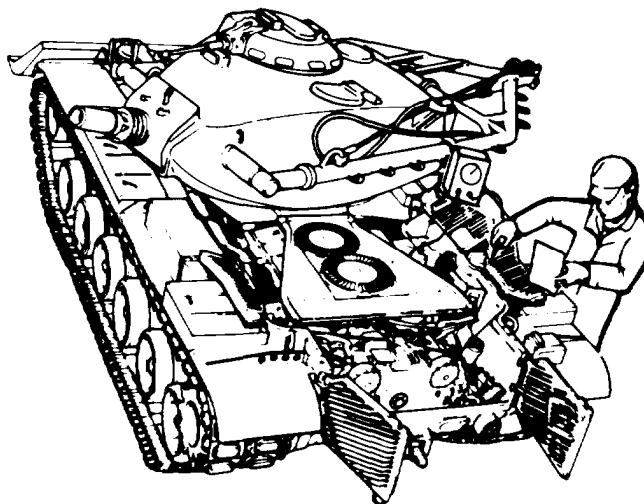
1

Check the four key steps that make good troubleshooting - (Troubleshooting without the **SHOTGUN APPROACH**).

- Identify the trouble.
- Find the right troubleshooting procedure.
- Determine the test equipment, special tools, and number of technicians needed to perform the troubleshooting procedure.
- Use the detailed troubleshooting procedure to locate, isolate, and repair the trouble.

How do you "identify" the trouble spot?

USER GUIDE APPROACH



NOTE

This line indicates the procedure is continued on the next page.

TA141623

TROUBLESHOOTING

USER GUIDE

(Continued)

NOTE

This line indicates the procedure is continued from the previous page.

2

To identify the trouble spot, check DA Form 2404 filled out by the crew.

- Check what the crew has entered on DA Form 2404.
 - Question the crew to get as much information as possible about the trouble —
- Example:
- Was the powerplant warning lamp on?
 - Was the engine running?
 - Did the other gages work?
 - Make sure there was no crew error in following the Operator Procedure listed in TM 9-2350-222-10

-WARNING

**Do not attempt to operate the vehicle if there is any chance the trouble may harm personnel or damage equipment.
(Example: Brakes do not Hold.)**

- If necessary, operate the vehicle to help identify the trouble.

Now that you have an idea what the trouble is, how do you find the right troubleshooting procedure?

EQUIPMENT INSPECTION AND MAINTENANCE WORKSHEET									
1. BASIC DATA					2. INSPECTION AND MAINTENANCE				
A CO 171 - 3 rd PLT		CEV MYIS			3. TIME PERIOD				
J30331		1703			20 JUNE 81 PMCS				
4. IN NUMBER		5. APP. CABLE REFERENCE			6. DATE				
9-2350-212-10		NOV 81							
INSTRUCTIONS: This form is to be filled in by the TM operator or the inspecting personnel following the inspection stated in paragraph 12. Complete from as follows: COLUMN 4 - Mark the status number. COLUMN 5 - Mark the application - column status symbol. COLUMN 6 - Enter deficiencies and short-circuits. ALL INSPECTIONS AND EQUIPMENT FUNCTIONS REQUIRED WITH EXEMPTIONS MUST BE FINISHED IN ACCORDANCE WITH DOWNSHIP POLICY AND STANDARDS. IN THE "NO" CATEGORY									
7. SIGNATURE (Person performing inspection)		8. SIGNATURE (Inspection Supervisor)			9. TIME				
R Jones SPS									
10. ITEM STATUS		11. DEFICIENCIES AND SHORTCOMINGS			12. CORRECTIVE ACTION			13. TOTAL HOURS CORRECTED	
49		☒ Engine oil pressure gage does not show pressure.							

DA FORM 2404
1 JAN 77

TROUBLESHOOTING USER GUIDE (Continued)

NOTE

The circled number at the top left corner of each block is a step number.

3

Check the TROUBLESHOOTING SYSTEM INDEX to find the proper system/subsystem.

- Turn to the TROUBLESHOOTING SYSTEM INDEX (page 4-20).
- Find the system in which your trouble occurs.
- Find the subsystem in which your trouble occurs.

TROUBLESHOOTING SYSTEM INDEX	
VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE	PAGE 4-20
• Powerplant, starting • Powerplant, running • Powerplant, stopping • Final Drive • Transmission • Brakes • Steering • Hull Power • Generator/Regulator	
INDICATOR SYMPTOM AND RESOURCE TABLE	PAGE 4-21
• Gage • Lamp	
SUPPORT SYSTEM SYMPTOM AND RESOURCE TABLE	PAGE 4-22
• Communications • Drain Valve • Fire Extinguisher • Gas Particulate • Vehicle Lighting (internal) • Vehicle Lighting (external) • Periscopes • Personnel Heater • Smoke Generator • Water Fording • Hydraulics	

NOTE

- Most troubleshooting procedures contain many branches (paths).
- You will not follow every possible branch.
- The branch you follow will depend on your answer to each question block.
- If your answer is no, follow this branch.
- If your answer is yes, follow this branch.

Were you able to find the proper system/subsystem in which your trouble occurs?

YES

NO

4

If you have trouble locating the proper system/subsystem, check the TROUBLESHOOTING SUBJECT INDEX.

- See Step 8 .

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TROUBLESHOOTING USER GUIDE (Continued)

5

Find the right Troubleshooting Procedure.

- Note the SYMPTOM and RESOURCE TABLE listed for the SYSTEM/SUBSYSTEM in which your trouble occurs.
- Turn to the page number indicated for the above table.
- Find the same subsystem.
- Check the symptom titles listed under this subsystem until you find the one that describes your trouble.

Have you found the proper symptom title?

6

Notify your supervisor.

NO

7

- Determine the test equipment, special tools and number of technicians required.

YES

- See Step 13.

TM 9-2350-222-20-1-2

TROUBLESHOOTING SYSTEM INDEX

VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE	PAGE 4-25
● Powerplant, starting	
● Powerplant, running	
● Powerplant, stopping	
● Final Drive	
● Transmission	
● Brakes	
● Steering	
● Hull Power	
● Generator/Regulator	
● Gage	
● GEAR	

SUPPORT SYSTEM SYMPTOM AND RESOURCE TABLE	PAGE 4-26
● Communications	
● Drain Valve	
● Fire Extinguisher	
● Gas Particulate	
● Vehicle Lighting (internal)	
● Vehicle Lighting (external)	
● Periscope	
● Personnel Heater	
● Smoke Generator	
● Water Fording	
● Hydraulics	

4-25

TM 9-2350-222-20-1-2

VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE
(Continued)

SYMPTOM NO. SUBSYSTEM	SYMPTOM TITLE	PAGE	TESTS REQUIRED				NUMBER OF TECH NICIANS
			MULTIMETER OR TESTER	SPECIAL EQUIPMENT	FAIRLY CATED	TURN	
HULL POWER CONTINUED							
29	No power at under control on master control panel	4-522	X				1
30	No power at slave receptacle (Master battery lamp light)	4-524	X				1
GENERATOR/REGULATOR							
31	Generator/regulator system in not working (24 engine)	4-526	X				2
32	Generator/regulator system in not working (33 engine)	4-530	X				2
GAUGE							
33	Engine oil pressure gage will not show pressure (Powerplant warning lamp not on engine running, all other gages read normal (24 engine)	4-576	X				2
34	Engine oil pressure gage will not show pressure (Powerplant warning lamp not on engine running, all other gages read normal (33 engine)	4-581	X				2
35	Engine oil temperature gage shows high or no temperature (Powerplant warning lamp not on engine running, all other gages read normal (24 engine)	4-607	X				2
36	Engine oil temperature gage shows high or no temperature (Powerplant warning lamp not on engine running, all other gages read normal (33 engine)	4-620	X				2
37	Transmission oil pressure gage shows no pressure (Engine running, all other gages read normal (24 engine)	4-637	X				2
38	Transmission oil pressure gage shows no pressure (Engine running, all other gages read normal (33 engine)	4-651	X				2

4-27

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TROUBLESHOOTING USER GUIDE (Continued)

FROM STEP

4

8

If you cannot locate the proper system/subsystem in the SYSTEM INDEX, find an item listed in the TROUBLESHOOTING SUBJECT INDEX that pertains to your trouble.

- Turn to the TROUBLESHOOTING SUBJECT INDEX (page 4-21).
- Check the subjects listed in this index until you find one that pertains to your trouble.

Can you find an item that pertains to your trouble?

TM 9-2350-222-20-1-2

TROUBLESHOOTING SUBJECT INDEX			
SUBJECT	SYMPTOM AND REFERENCE TABLE	PAGE	SYMPTOM NUMBER
Accelerator Linkage	VEHICLE OPERATION	4-25	7
Air Cleaners	VEHICLE OPERATION	4-25	12-14
Batteries	VEHICLE OPERATION	4-25	2-3
Battery Terminal Indicator Wagon	INDICATOR	4-27	40-50
Brake - Drive Light	SUPPORT SYSTEM	4-29	64-66
Brake - Master Light	SUPPORT SYSTEM	4-29	66-67
Brake - Master Air Cleaner	VEHICLE OPERATION	4-25	12-14
Brake - Master Gas Particulate	SUPPORT SYSTEM	4-29	74
Brake - Master Personal Heater	SUPPORT SYSTEM	4-29	74
Brake Linkage	VEHICLE OPERATION	4-25	22-24
Brake - Parking	VEHICLE OPERATION	4-25	74-76
Brake - Service	VEHICLE OPERATION	4-25	74-76
Brake - Hydraulic	SUPPORT SYSTEM	4-29	42-47
Communication	SUPPORT SYSTEM	4-29	50
Control Light	SUPPORT SYSTEM	4-29	54
Drive Valve - Fuel	SUPPORT SYSTEM	4-29	54
Drive Valve - Rear	SUPPORT SYSTEM	4-29	52
Drive Light	SUPPORT SYSTEM	4-29	60-7
Electrical Power - Hub	VEHICLE OPERATION	4-25	27-30
Engine	VEHICLE OPERATION	4-25	1-10
Engine Fuel Pump	VEHICLE OPERATION	4-25	2-11
Engine Fuel Shut-Off Handle	VEHICLE OPERATION	4-25	18
Engine Fuel Shut-Off Switch	VEHICLE OPERATION	4-25	17
Engine Oil - Compression	VEHICLE OPERATION	4-25	18
Engine Oil - Pressure Gauge	INDICATOR	4-27	52
Engine Oil - Temperature	VEHICLE OPERATION	4-25	15
Engine Oil - Temperature Gauge	INDICATOR	4-27	53
Exhaust - 1st and 2nd Handles	SUPPORT SYSTEM	4-29	54
Fan Motor - Air Cleaner	VEHICLE OPERATION	4-25	12-14
Fuel Drive	VEHICLE OPERATION	4-25	19
Fuel Extinguisher	SUPPORT SYSTEM	4-29	53-55
Fuel Pump - Hand Handle	SUPPORT SYSTEM	4-29	53-55
Fuel Pump - Electrical	VEHICLE OPERATION	4-25	5-6
Fuel Pump - Engine	VEHICLE OPERATION	4-25	2-11
Fuel Pump - Personal Heater	SUPPORT SYSTEM	4-29	74
Fuel Shut-Off Handle	VEHICLE OPERATION	4-25	18
Fuel Shut-Off Switch	VEHICLE OPERATION	4-25	17
Fuel Tank - Electrical Fuel Pump	VEHICLE OPERATION	4-25	5-6
Fuel Water Separator	VEHICLE OPERATION	4-25	10

4-21

9

Notify your supervisor.

YES

NO

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TROUBLESHOOTING USER GUIDE (Continued)

10

Find the right Troubleshooting Procedure.

- Check the **SYMPTOM** and **RESOURCE TABLE** listed for the subject you have selected.
- Note the symptom number(s) listed for your subject.
- Turn to the page number indicated for the **SYMPTOM** and **RESOURCE TABLE**.

[illegible]

TROUBLESHOOTING USER GUIDE (Continued)

STEP 10 CONTINUED

- Find the same symptom number(s).
- The title listed for this number is the symptom title that describes your trouble.

NOTE

If there is more than one symptom number listed, review the symptom title for each number until you find the title that describes your trouble.

VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE (Continued)									
SYMPTOM NUMBER		SYMPTOM TITLE		TEST EQUIPMENT		SPECIAL TOOLS		TECHNICIANS REQUIRED	
SYMPTOM NUMBER		SYMPTOM TITLE		TEST EQUIPMENT		SPECIAL TOOLS		TECHNICIANS REQUIRED	
1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1001	1001	1001	1001	1001	1001	1001	1001	1001	1001
1002	1002	1002	1002	1002	1002	1002	1002	1002	1002
1003	1003	1003	1003	1003	1003	1003	1003	1003	1003
1004	1004	1004	1004	1004	1004	1004	1004	1004	1004
1005	1005	1005	1005	1005	1005	1005	1005	1005	1005
1006	1006	1006	1006	1006	1006	1006	1006	1006	1006
1007	1007	1007	1007	1007	1007	1007	1007	1007	1007
1008	1008	1008	1008	1008	1008	1008	1008	1008	1008
1009	1009	1009	1009	1009	1009	1009	1009	1009	1009
1010	1010	1010	1010	1010	1010	1010	1010	1010	1010
1011	1011	1011	1011	1011	1011	1011	1011	1011	1011
1012	1012	1012	1012	1012	1012	1012	1012	1012	1012
1013	1013	1013	1013	1013	1013	1013	1013	1013	1013
1014	1014	1014	1014	1014	1014	1014	1014	1014	1014
1015	1015	1015	1015	1015	1015	1015	1015	1015	1015
1016	1016	1016	1016	1016	1016	1016	1016	1016	1016
1017	1017	1017	1017	1017	1017	1017	1017	1017	1017
1018	1018	1018	1018	1018	1018	1018	1018	1018	1018
1019	1019	1019	1019	1019	1019	1019	1019	1019	1019
1020	1020	1020	1020	1020	1020	1020	1020	1020	1020
1021	1021	1021	1021	1021	1021	1021	1021	1021	1021
1022	1022	1022	1022	1022	1022	1022	1022	1022	1022
1023	1023	1023	1023	1023	1023	1023	1023	1023	1023
1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
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1026	1026	1026	1026	1026	1026	1026	1026	1026	1026
1027	1027	1027	1027	1027	1027	1027	1027	1027	1027
1028	1028	1028	1028	1028	1028	1028	1028	1028	1028
1029	1029	1029	1029	1029	1029	1029	1029	1029	1029
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1031	1031	1031	1031	1031	1031	1031	1031	1031	1031
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1037	1037	1037	1037	1037	1037	1037	1037	1037	1037
1038	1038	1038	1038	1038	1038	1038	1038	1038	1038
1039	1039	1039	1039	1039	1039	1039	1039	1039	1039
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1074	1074	1074	1074	1074	1074	1074	1074	1074	1074
1075	1075	1075	1075	1075	1075	1075	1075	1075	1075
1076	1076	1076	1076	1076	1076	1076	1076	1076	1076
1077	1077	1077	1077	1077	1077	1077	1077	1077	1077
1078	1078	1078	1078	1078	1078	1078	1078	1078	1078
1079	1079	1079	1079	1079	1079	1079	1079	1079	1079
1080	1080	1080	1080	1080	1080	1080	1080	1080	1080
1081	1081	1081	1081	1081	1081	1081	1081	1081	1081
1082	1082	1082	1082	1082	1082	1082	1082	1082	1082
1083	1083	1083	1083	1083	1083	1083	1083	1083	1083
1084	1084	1084	1084	1084	1084	1084	1084	1084	1084
1085	1085	1085	1085	1085	1085	1085	1085	1085	1085
1086	1086	1086	1086	1086	1086	1086	1086	1086	1086
1087	1087	1087	1087	1087	1087	1087	1087	1087	1087
1088	1088	1088	1088	1088	1088	1088	1088	1088	1088
1089	1089	1089	1089	1089	1089	1089	1089	1089	1089
1090	1090	1090	1090	1090	1090	1090	1090	1090	1090
1091	1091	1091	1091	1091	1091	1091	1091	1091	1091
1092	1092	1092	1092	1092	1092	1092	1092	1092	1092
1093	1093	1093	1093	1093	1093	1093	1093	1093	1093
1094	1094	1094	1094	1094	1094	1094	1094	1094	1094
1095	1095	1095	1095	1095	1095	1095	1095	1095	1095
1096	1096	1096	1096	1096	1096	1096	1096	1096	1096
1097	1097	1097	1097	1097	1097	1097	1097	1097	1097
1098	1098	1098	1098	1098	1098	1098	1098	1098	1098
1099	1099	1099	1099	1099	1099	1099	1099	1099	1099

Have you found the proper symptom title?

12

- Determine the test equipment, special tools, and number of technicians required.

See Step 13 .

11

Notify your supervisor.

NO

YES

TROUBLESHOOTING USER GUIDE (Continued)

FROM STEP

7 OR 12

13

Determine the test equipment, special tools, and number of technicians needed to perform the troubleshooting procedure.

- Locate the **RESOURCES REQUIRED** columns.
- An (X) in column B indicates that you will need test equipment. Either a multimeter or a STE/ICE set can be used. You do not need both.
- An (X,*) in column B indicates that the procedure test should be performed with the STE/ICE set. However, if a STE/ICE set is not available, troubleshooting may still be accomplished by using the alternate method provided in the Detailed Troubleshooting Procedure.
- Check column C to determine if you will need special tools.
- Check column D to determine if you will need fabricated tools.

NOTE

- The numbers listed in column C are reference code numbers.
- If column C has a reference code number listed, turn to Chapter 3, Section 1 (page 3-1).
- Locate the same reference code number in this section. This code will indicate which special tool is needed.

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VEHICLE OPERATION SYMPTOM AND RESOURCE TABLE
(Continued)

SYMPTOM NO. SUBSYSTEM	SYMPTOM TITLE	PAGE	RESOURCES REQUIRED				NUMBER OF TECH NICIANS
			MULTIMETER OR STE/ICE	SPECIAL TOOLS	FABRICATED TOOLS		
			A	B	C	D	E
28	No power at battery outlet on master control panel	4.522	X				1
30	No power at slave receptacle (Master battery lamp lights)	4.524	X				1
GENERATOR REGULATOR							
10	Generator regulator system is not working (2A engine)	4.526	X				2
11	Generator regulator system is not working (2D engine)	4.530	X				2
INDICATOR SYMPTOM AND RESOURCE TABLE							
12	Engine oil pressure gauge will not show pressure (Powerplant warning lamp not on engine running - all other gauges read normal (2A engine))	4.576	X				2
12	Engine oil pressure gauge will not show pressure (Powerplant warning lamp not on engine running - all other gauges read normal (2D engine))	4.581	X				2
13	Engine oil temperature gauge shows high or no temperature (Powerplant warning lamp not on engine running - all other gauges read normal (2A engine))	4.587	X				2
13	Engine oil temperature gauge shows high or no temperature (Powerplant warning lamp not on engine running - all other gauges read normal (2D engine))	4.591	X				2
14	Transmission oil pressure gauge shows no pressure (Engine running - all other gauges read normal (2A engine))	4.611	X,*				2
14	Transmission oil pressure gauge shows no pressure (Engine running - all other gauges read normal (2D engine))	4.611	X,*				2

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TROUBLESHOOTING
USER GUIDE
(Continued)

STEP **13** CONTINUED

NOTE

- The numbers listed in column D are figure numbers.
- If column D has a figure number listed, turn to APPENDIX F (page F-1).
- Locate the same figure number in this appendix. This figure will indicate which fabricated tool is needed.

- Check column E to determine how many technicians are required to perform the procedure.

Now that you have identified the trouble; found the right troubleshooting procedure; and obtained the test equipment, special tools, and number of technicians required: What is the last step to good troubleshooting?

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