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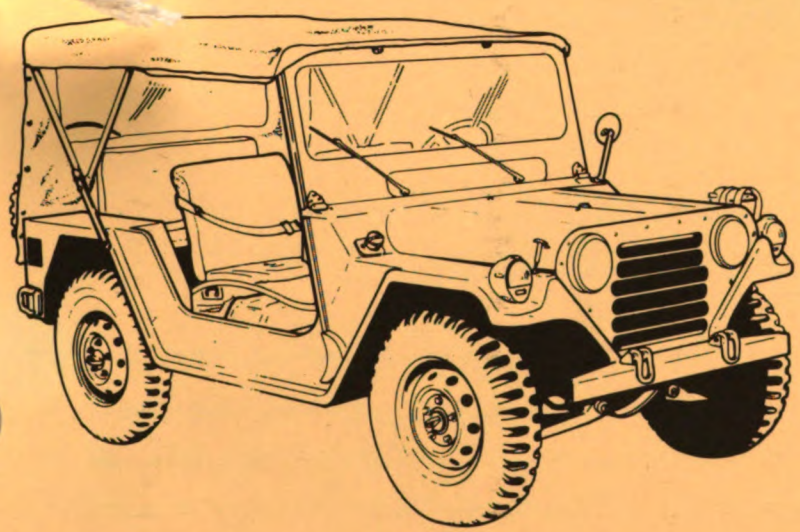
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TECHNICAL MANUAL

ORGANIZATIONAL MAINTENANCE

TRUCK, 1/4-TON, 4X4, M151A2 SERIES



TRUCK, UTILITY: 1/4-TON, 4X4, M151A2 (2320-00-177-9258);

TRUCK, UTILITY: 1/4-TON, 4X4, M825 (2320-00-177-9257) WITH 106MM RECOILLESS RIFLE;

TRUCK, AMBULANCE, FRONT LINE: 1/4-TON, 4X4, M718A1 (2310-00-177-9256).

This copy is a reprint which includes current pages from Changes 1 and 2.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

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WARNING

EXHAUST GASES CAN KILL!

1. DO NOT operate your vehicle engine in enclosed area.
2. DO NOT idle vehicle engine with cab windows closed.
3. DO NOT drive vehicle with inspection plates or cover plates removed.
4. BE ALERT at all times for exhaust odors.
5. BE ALERT for exhaust poisoning symptoms, they are:

   Headache

   Dizziness

   Sleepiness

   Loss of Muscular Control

6. If YOU SEE another person with exhaust poisoning symptoms:

   Remove person from area.

   Expose to open air.

   Keep person warm.

   Do not permit person to move.

   Administer artificial respiration, if necessary.*

*For artificial respiration, refer to FM 21-11.



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CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *1 August 1988*

ORGANIZATIONAL MAINTENANCE MANUAL FOR

TRUCK, UTILITY: 1/4-TON, 4X4, M151A2 (2320-00-177-9258), M151A2 (2320-01-264-4819) WITH ROLLOVER PROTECTION SYSTEM (ROPS);

TRUCK, UTILITY: 1/4-TON, 4X4, M825 (2320-00-177-9257) WITH 106-MM RECOILLESS RIFLE;

TRUCK, AMBULANCE, FRONTLINE: 1/4-TON, 4X4, M718A1 (2310-00-177-9256).

TM 9-2320-218-20-1-1, 14 May 1982, is changed as follows:

1. Remove old pages and insert new pages as indicated.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration.
4. File this change sheet in front of this publication for reference purposes.

Remove pages	Insert pages
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1-7 and 1-8	1-7 and 1-8
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5-1 and 5-2	5-1 and 5-2		

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-38, Unit Maintenance requirements for Truck, Utility, 1/4 Ton, 4x4, M151 Series, M718 Series.

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TM 9-2320-218-20-1-1
C1

CHANGE NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D C , *3 June 1983*

Organizational Maintenance Manual
for

TRUCK, UTILITY 1/4-TON, 4X4, M151A2
(2320-00-177-9258)
TRUCK, UTILITY 1/4-TON, 4X4, M825
(2320-00-177-9257)
106-MM RECOILLESS RIFLE:
TRUCK, AMBULANCE, FRONTLINE
1/4-TON, 4X4, M718A1
(2310-00-177-9256)

TM 9-2320-218-20-1-1, 14 May 1982, is changed as follows:

Cover 1. Lower right corner. Insert date, "MAY 1982".

Page i, following Washington, D.C., insert date, "14 May 1982".

Supersession Note should read:

*This manual, together with TM 9-2320-218-20-1-2, 14 May 1982, supersedes that portion of TM 9-2320-218-20, 23 September 1971, as pertains to M151A2, M825, and M718A1 vehicles.

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TM 9-2320-218-20-1-1
C 1

By Order of the Secretary of the Army:

E.C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-38, Organizational Maintenance requirements for Truck, ¼-Ton, 4X4, M151A2 Series.

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WARNING

EXHAUST GASES CAN KILL!

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3. DO NOT drive vehicle with inspection plates or cover plates removed.
4. BE ALERT at all times for exhaust odors.
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6. If YOU SEE another person with exhaust poisoning symptoms:

   Remove person from area.

   Expose to open air.

   Keep person warm.

   Do not permit person to move.

   Administer artificial respiration, if necessary.*

*For artificial respiration, refer to FM 21-11.

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SUMMARY WARNINGS

WARNING

- After Nuclear, Biological, or Chemical (NBC) exposure of this vehicle, all air filters shall be handled with extreme caution. Unprotected personnel may experience injury or death if residual toxic agents or radioactive material are present. Servicing personnel will wear protective overgarments, mask, hood, and chemical protective gloves and boots. All contaminated air filters will be placed into double lined plastic bags and moved immediately to a temporary segregation area away from the work site. Oil contained in reservoir of oil bath type air filters is also to be taken to a segregation area and disposed of in accordance with FM 3-5. If contaminated by radioactive dust, the company NBC team will measure the radiation before removal. The NBC team will determine the extent of safety procedures required. The temporary segregation area will be marked with the appropriate NBC signs. Final disposal of contaminated air filters will be in accordance with local Standard Operating Procedures (SOP).

- Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.

- Do not loosen or disconnect any fuel line if engine is hot. Fuel vapors are highly flammable and will cause severe injury if ignited.

- Do not remove radiator cap before releasing internal pressure when radiator is too hot to touch. Internal pressure will blow out scalding fluid and vapor, causing severe injury.

- Do not connect or disconnect the VTM while the vehicle engine is running. Spark may ignite battery gases and cause injury to personnel and/or damage to equipment.

- Hydraulic jack is used for raising and lowering, and is not used to support vehicle. Never work under vehicle unless wheels are blocked and properly supported. Severe injury will result if vehicle suddenly shifts or moves.

- Hot engine parts can cause severe burns. Be sure engine surface is not hot.

- When hooking up tachometer dwell meter for testing, make sure battery leads are securely connected. Failure to do so will result in severe injury.

- Do not crank engine while looking into the carburetor; personnel injury may result if engine fires.

- No smoking. Do not use styrofoam cup to catch fuel.

- Fuel vapors are extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel vapor is ignited.

- Fuel that leaks from fuel lines is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel is ignited.

- Compressed air source will not exceed 30 psi. When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight.

- Do not touch hot exhaust pipes or muffler with bare hands. Severe injury can result.

- Use caution when testing thermostat. Hot water will cause severe burns.

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

- Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and don't smoke while servicing batteries. Severe injury will result if acid contacts eyes or skin.

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SUMMARY WARNINGS (Cont'd)

- Always wear safety goggles and rubber gloves, remove all jewelry such as rings, dog tags, bracelets, etc., and do not smoke while servicing batteries. Acid (electrolyte) contacting eyes and skin, or jewelry contacting terminals, will result in severe injury.
- Negative battery cable must always be disconnected first and reconnected last. This will prevent accidental short circuiting of wiring, damage to equipment, or injury to personnel.
- Use pliers to remove lamp door springs. Do not use screwdriver. Spring is under tension and will fly off and cause severe injury if incorrectly removed.
- Do not allow sparks or open flame near fuel tank when removing or installing fuel level sending unit. Explosion and fire will result.
- Always wear safety goggles when bleeding brakes. Severe eye injury will result if brake fluid comes in contact with eyes.
- Do not use any tool other than brake spring pliers when removing brakeshoe retracting springs. Springs can pop off and cause severe injury if proper tool is not used.
- Cleaning fluids are flammable and toxic. Keep them away from sparks and open flame. Use only in well-ventilated area and avoid prolonged inhalation of fumes or skin contact with fluids. Wear synthetic rubber gloves and protective clothing and goggles.
- The height and width of vehicles when prepared for rail transportation must not exceed the limitations indicated by the loading table in AR 700-15. Whenever possible, local transportation officers must be consulted about the limitations of the particular railroad lines to be used for the movement in order to avoid delays, dangerous conditions, or damage to equipment.
- Handle exhaust manifold gaskets carefully. Edges are very sharp and may cause injury to personnel.
- NBC contaminated filters must be handled using adequate precautions (FM 3-5) and must be disposed of by trained personnel.
- NBC contaminated oil contained in the reservoir of oil bath type air filters will be handled and disposed of by trained personnel (FM 3-5).
- Do not reuse wheel spindle cotter pin or substitute with any cotter pin other than NSN 5315-00-011-9120. Failure to use correct new cotter pin may result in wheel assembly falling off vehicle during operation, causing injury to personnel.
- Do not use a dry brush or compressed air to clean brakeshoes. There may be asbestos dust on brakeshoes which can be dangerous to your health if you breathe it. (Brakeshoe must be wet, and a soft bristle brush must be used.)

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TECHNICAL MANUAL

NO. 9-2320-218-20-1-1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 14 MAY 1982

ORGANIZATIONAL MAINTENANCE MANUAL

TRUCK, UTILITY: 1/4-TON, 4X4, M151A2 (2320-00-177-9258), M151A2 (2320-01-264-4819) WITH ROLLOVER PROTECTION SYSTEM (ROPS);

TRUCK, UTILITY: 1/4-TON, 4X4, M825 (2320-00-177-9257), 106MM RECOILLESS RIFLE;

TRUCK, AMBULANCE, FRONTLINE: 1/4-TON, 4X4, M718A1 (2310-00-177-9256).

Current as of 1 June 1981

This manual is published in two parts. TM 9-2320-218-20-1-1 contains chapters 1 through 5, and TM 9-2320-218-20-1-2 contains chapters 6 through 12, appendixes A, B, C, D, E, F, and G. Each volume contains a separate table of contents and index.

Approved for public release ; distribution is unlimited.

* This manual, together with TM 9-2320-218-20-1-2, 14 May 1982, supersedes that portion of TM 9-2320-218-20, 23 September 1971, as pertains to M151A2, M825, and M718A1 vehicles.

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ORGANIZATIONAL MAINTENANCE MANUAL

TRUCK, 1/4-TON, 4X4, M151A2, M825, AND M718A1 VEHICLES

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a better way to improve the procedures, 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-MB, Warren, Michigan 48397-5000. A reply will be furnished to you.

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HOW TO USE THIS MANUAL

As a maintenance technician, you are responsible for maintaining the equipment covered in this manual. The best way to do this is with the aid of your maintenance manual. A sample of how to use this manual is provided below.

PROBLEM: An operator reports that his 1/4-ton ambulance fails to crank or cranks slowly.

1. *How do you start?*
   Turn to the cover of your manual.
   On the right-hand side you will find a listing for "SERVICE, TROUBLESHOOTING, AND GENERAL MAINTENANCE". Beside this is a page number and a black marker. Follow either to the first page in the service and troubleshooting chapter. This is on page 3-1.

2. *What is the quickest way to find the solution to the problem?*
   Turn to page 3-29.
   This is the "MECHANICAL TROUBLESHOOTING symptom index". Follow the numerical listing under "ENGINE" until you see the malfunction "Engine fails to crank". Now go to the page number listed directly right of the malfunction.

3. *What caused the problem?*
   Turn to page 3-32.
   Here you find the most likely causes of the problem. After following each step in the order listed, and after finding the problem say, the batteries are defective, go to the designated paragraph referenced for replacement, repair or servicing.

4. *How do you fix the problem?*
   Turn to paragraph 5-26.
   This is the battery servicing maintenance procedure. It is arranged step-by-step so everything you need to know to maintain the batteries is covered. Now you are ready to correct the problem.

Your maintenance manual is easy to use. It will help you eliminate mistakes and provide the most efficient methods for maintaining equipment. Also, you are made aware of the warnings and cautions you need to know for personnel and equipment safety.

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CHAPTER 1
INTRODUCTION

1-1. Overview

a. This chapter provides standard maintenance forms, records, and reports and physical descriptions of components.

b. This information is divided into the following sections:

Section I. General Information (page 1-1)
Section II. Description and Data (page 1-2)

Section I. GENERAL INFORMATION

1-2. Scope

a. This technical manual contains organizational maintenance level instructions for the 1/4-ton, M151A2 series vehicles.

b. Models included are:

M151A2, truck, utility (2320-00-177-9258)
M151A2, truck, utility, w/rollover protection system (ROPS) (2320-01-264-4819)
M825, truck, utility, w/106MM recoilless rifle (2320-00-177-9257)
M718A1, truck, ambulance, frontline (2310-00-177-9256)

1-3. Maintenance Forms and Records

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System.

1-4. Destruction of Army Equipment to Prevent Enemy Use

Procedures for destruction of Army equipment to prevent enemy use are found in TM 750-244-6

1-5. Preparation for Storage and Shipment

Storage and shipment instructions are found in chapter 12 of this book.

1-6. Reporting Equipment Improvement Recommendations (EIR's)

"EIR's" can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure, just simply tell why the design is unfavorable or why a procedure is difficult. EIR's may be submitted on SF 368 (Quality Deficiency Report). Mail directly to: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MP, Warren, Michigan 48397-5000. A reply will be furnished directly to you.

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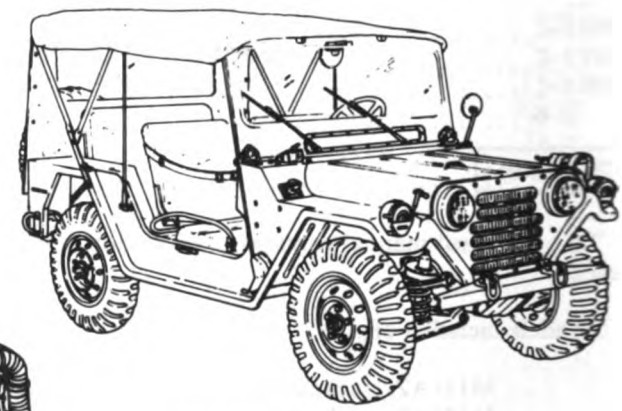
Section II. DESCRIPTION AND DATA

1-7. Equipment Capabilities, Characteristics, and Features

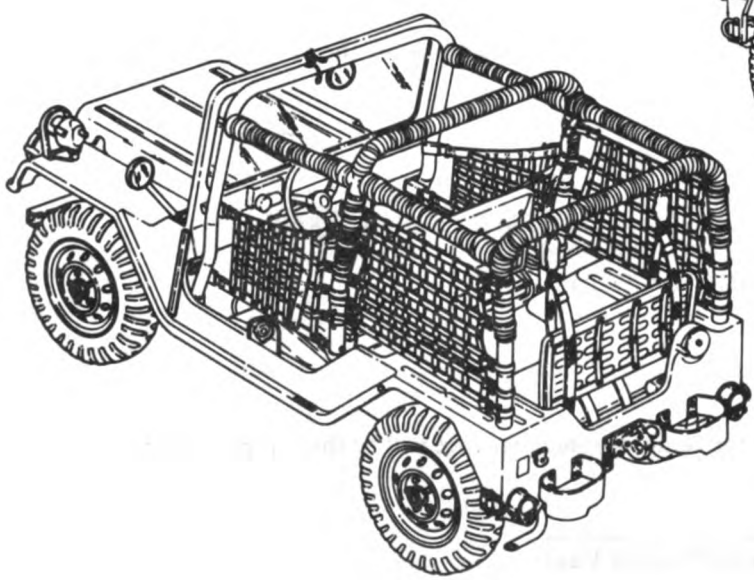
Each model of the M151A2 series has different functions and features. All are for use over all types of roads as well as cross-country terrain. With four driving wheels, front wheel drive may be engaged whenever conditions require. These trucks are powered by a four-cylinder, in-line, gasoline engine. Illustrations of these models, their purpose, dimensions, and weights follow.

UTILITY TRUCK: M151A2

Purpose: This vehicle is a general purpose personnel and/or cargo carrier. It provides space for four men, including the driver, with equipment.



UTILITY TRUCK: M151A2



UTILITY TRUCK: M151A2 (W/ROPS)

SHIPPING DIMENSIONS AND WEIGHTS

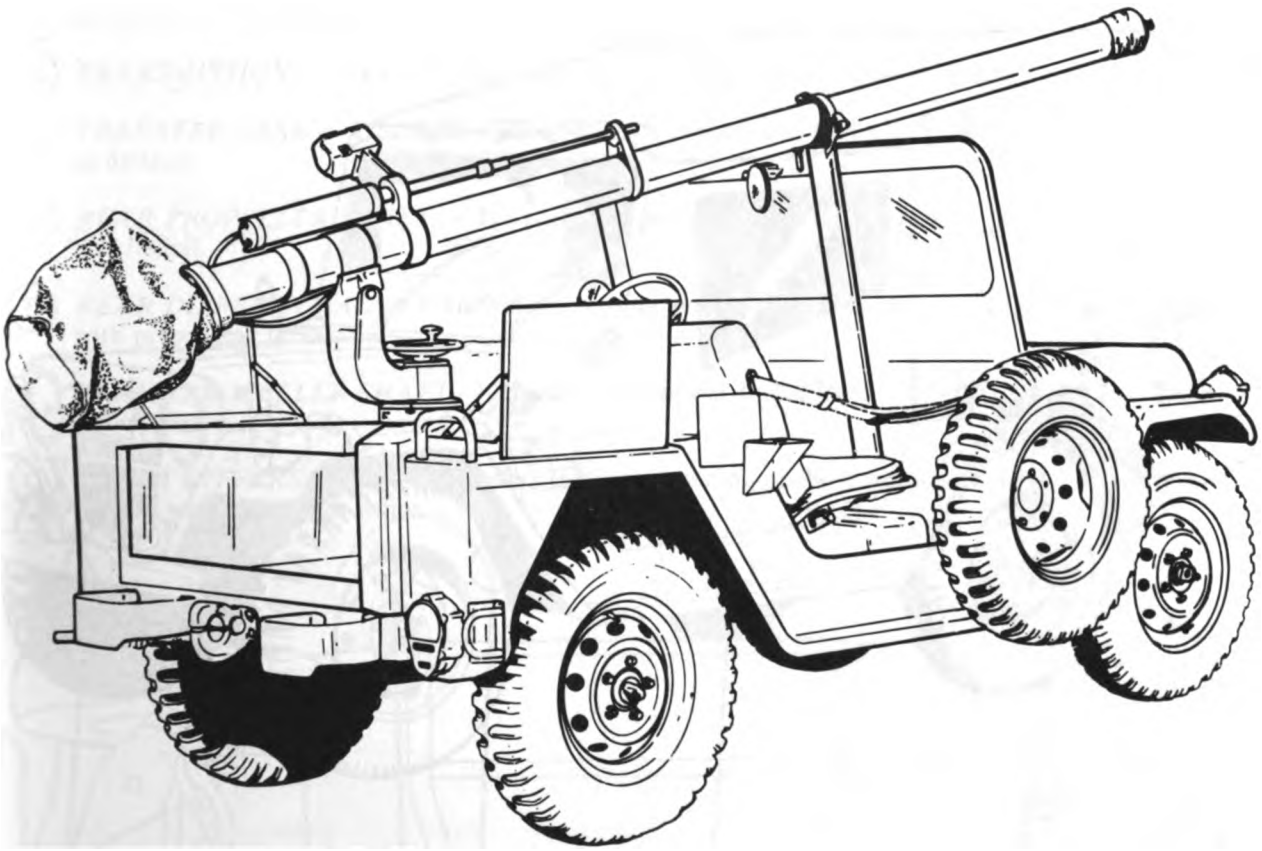
Overall Length	132.7 in. (337.05 cm.)
Overall Height	71.0 in. (180.34 cm)
Overall Width	64.3 in. (163.32 cm.)
Shipping Cubage	350 cu. ft. (9.8 cu. m.) reducible to 260 cu. ft. (7.28 cu. m.)
Shipping Weight	2,370 lb (1,075.98 kg.)
Shipping Weight W/Rollover Protection System (ROPS)	2,570 lb (1,166.78 kg.)

TA 158240

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UTILITY TRUCK: M825 (With 106MM Recoilless Rifle)

Purpose. Equipped with a 106MM recoilless rifle on a M79 rifle mount, provisions are made for carrying six rounds of ammunition and weapon tools. This arrangement creates a mobile weapon system.



SHIPPING DIMENSIONS AND WEIGHTS

Overall Length	143.5 in. (364.49 cm.)	Shipping Cubage	405 cu. ft. (reducible to 284 cu. ft.)
Overall Height	77.2 in. (196.08 cm.)	*Shipping Weight W/O Rifle	2590 lbs. (1174.86 kg.)
Overall Width	76.5 in. (194.31 cm.)		

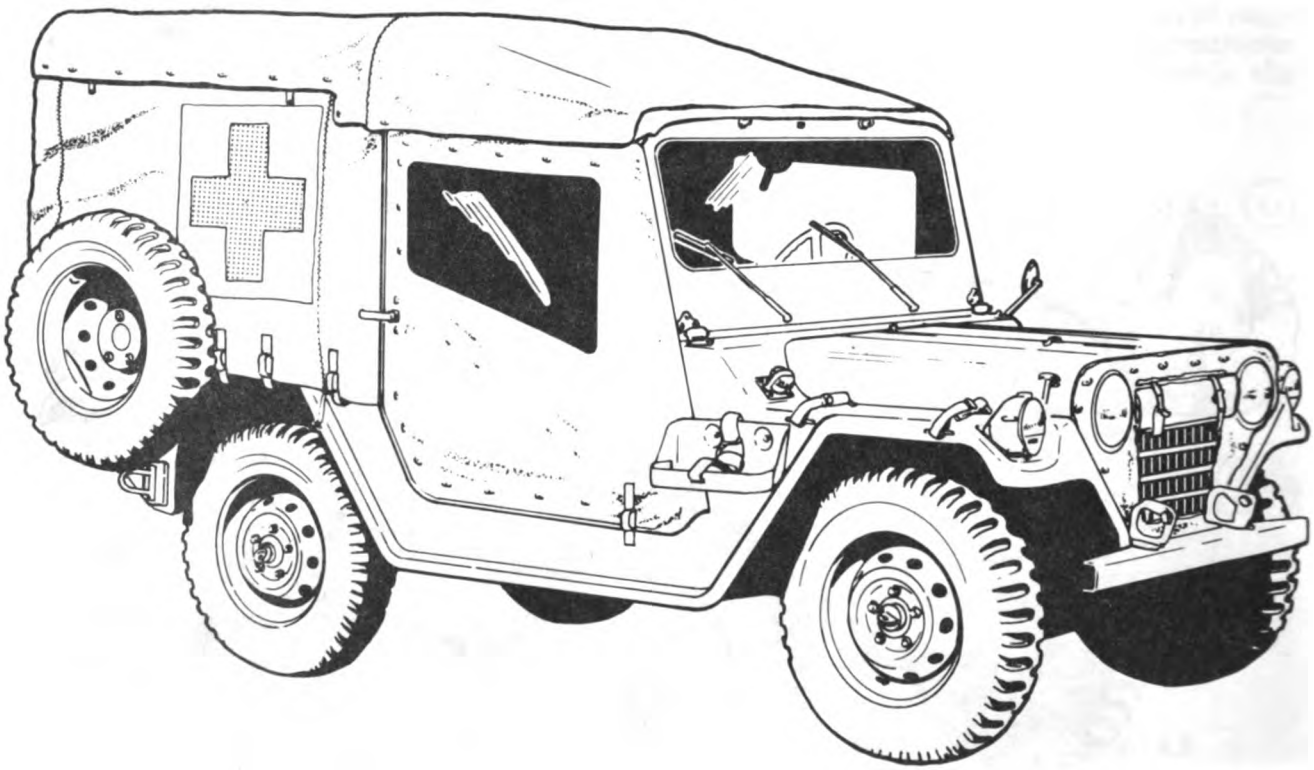
* With 106MM recoilless rifle, the 825 model is 490 lbs. (222.46 kg.) heavier.

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AMBULANCE TRUCK, FRONT LINE: M718A1

Purpose: Designed to carry ambulatory and litter patients, the cargo area of these vehicles is longer and higher. Thus, litters and patients can be accommodated.



SHIPPING DIMENSIONS AND WEIGHTS

Overall Length	143.0 in. (363.22 cm.)	Shipping Cubage	455 cu. ft. (reducible to 285 cu. ft.)
Overall Height	76.3 in. (193.80 cm.)	Shipping Weight	2750 lbs. (1248.5 kg.)
Overall Width	72.0 in. (182.88 cm.)		

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1-8. Location and Description of Major Exterior Components

The exterior components described below are common to all of the vehicles covered in this book. Special body differences are found in TM 9-2320-218-10 or table 1-1, Differences Between Models, in this manual.

(A) *ENGINE* — Provides power for the vehicle.

(B) *TRANSMISSION* — Transmits engine power to transfer case at different speeds.

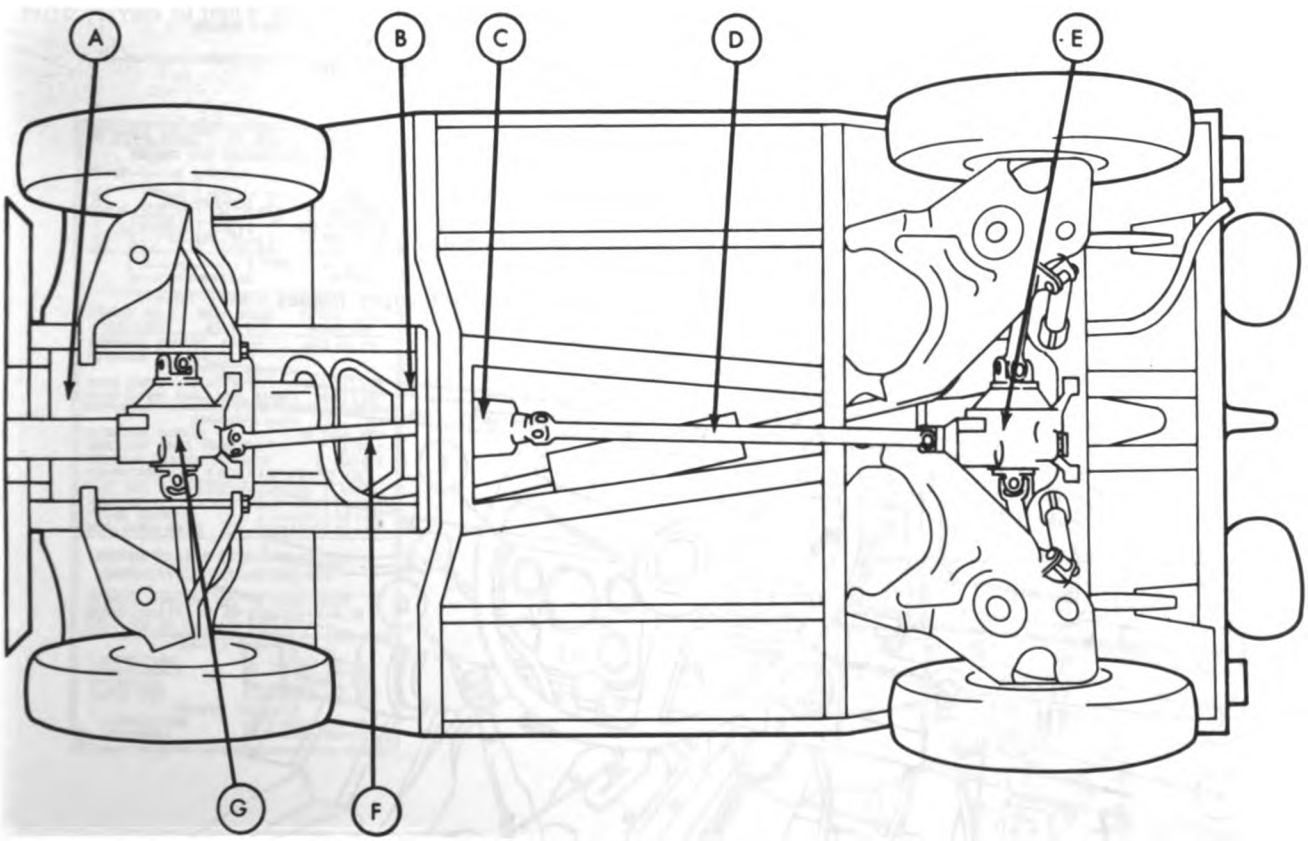
(C) *TRANSFER CASE* — Transmits engine power from transmission to both front and rear propeller shafts as desired.

(D) *REAR PROPELLER SHAFT* — Transmits the power to the rear wheel drive shafts through the differential.

(E) *REAR DIFFERENTIAL* — Transfers the turning action of the rear propeller shaft into a driving motion with preset gear ratios.

(F) *FRONT PROPELLER SHAFT* — Transmits the power to the front wheel drive shafts through the differential.

(G) *FRONT DIFFERENTIAL* — Transfers the turning action of the front propeller shaft into a driving motion with preset gear ratios.



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1-9. Location and Description of Major Interior Components

The major interior components shown below are common to the vehicles covered in this manual. Components not covered here can be found in TM 9-2320-218-10 or the applicable maintenance chapters of this book.

(A) *STEERING WHEEL* — Manual control for turning vehicle.

(B) *INSTRUMENT PANEL* — Houses controls and indicators.

(C) *TRANSMISSION SELECT LEVER* — Manual control for shifting gears.

(D) *PARKING BRAKE CONTROL LEVER* — Manual control to engage transmission drum type brake which prevents transmission output shaft from turning.

(E) *TRANSFER SHIFT LEVER* — Manual control to shift in or out of four-wheel drive.

(F) *ACCELERATOR PEDAL* — Foot control for determining engine speed.

(G) *BRAKE PEDAL* — Foot control for stopping vehicle.

(H) *CLUTCH PEDAL* — Foot control to disengage clutch and allow shifting of transmission to different gear ratios.

(I) *DIMMER SWITCH* — Foot switch to operate the low or high beam of headlights when in service drive.

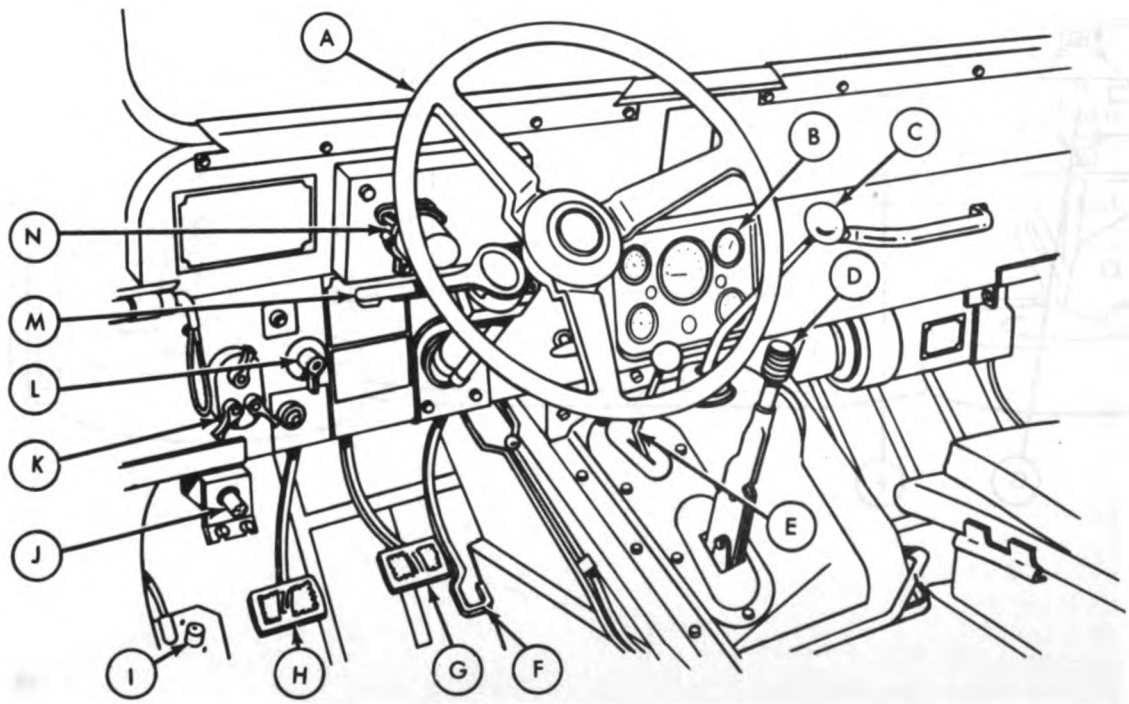
(J) *STARTER SWITCH* — When depressed, starter is engaged to crank the engine.

(K) *LIGHT SWITCH* — Controls operation of vehicle lights.

(L) *IGNITION SWITCH* — Energizes the electrical system.

(M) *TURN SIGNAL LEVER* — Controls left and right turn signal lights.

(N) *WIPER MOTOR SWITCH* — Activates wiper motor which controls wiper blades.



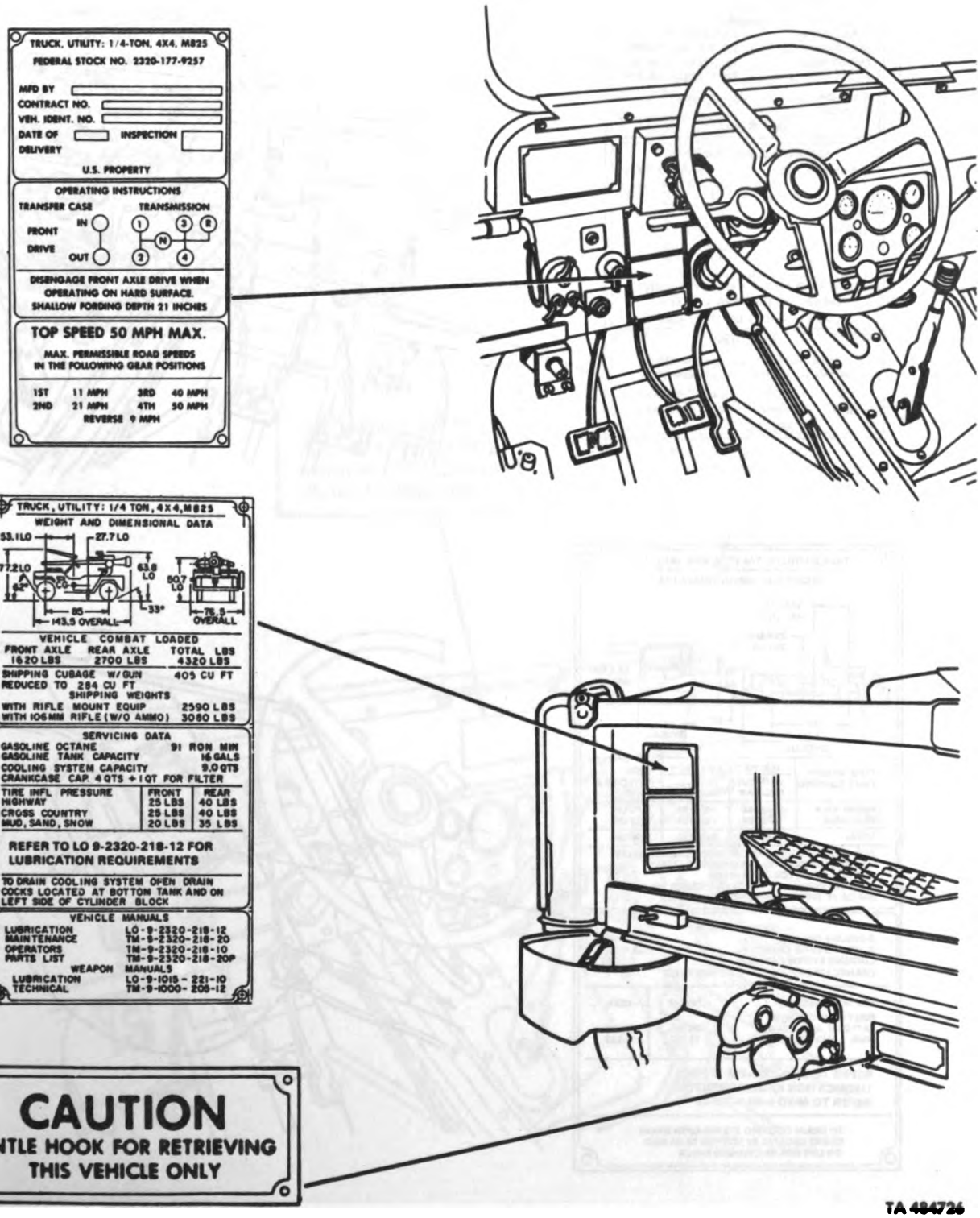
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1-10. Location and Contents of Caution, Data, and Warning Plates

a. The location and content of caution, data, and warning plates are provided in this paragraph. If any of these plates are worn, broken, painted over, missing or unreadable, they must be replaced.

b. Following are plates on the M825, M151A2, and M718A1 vehicles.



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1-10. Location and Contents of Caution, Data, and Warning Plates (Cont'd)

TRUCK, UTILITY: 1/4-TON, 4X4, M151A2

FEDERAL STOCK NO. 2320-177-9258

MFD BY

CONTRACT NO.

VEH. IDENT. NO.

MANUALS

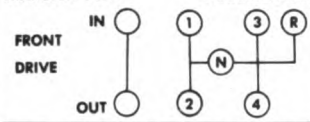
LUBRICATION	LO 9-2320-218-12
MAINTENANCE	TM 9-2320-218-20
OPERATORS	TM 9-2320-218-10
PARTS LIST	TM 9-2320-218-20P

DATE OF DELIVERY INSPECTION

U.S. PROPERTY

OPERATING INSTRUCTIONS

TRANSFER CASE TRANSMISSION



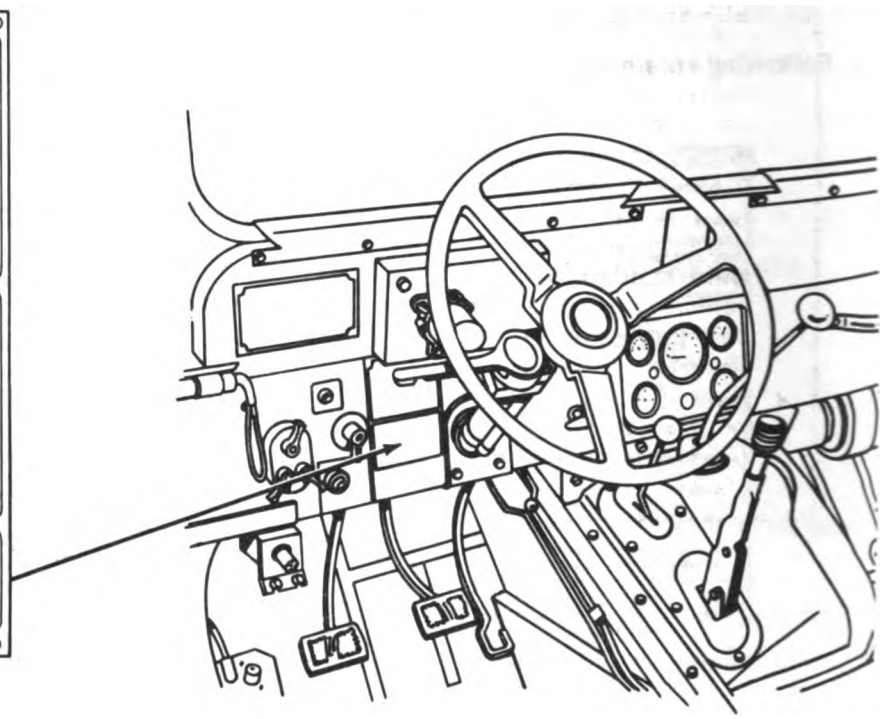
DISENGAGE FRONT AXLE DRIVE WHEN OPERATING ON HARD SURFACE. SHALLOW FORDING DEPTH 21 INCHES

CAUTION

MAX. PERMISSIBLE ROAD SPEEDS IN THE FOLLOWING GEAR POSITIONS

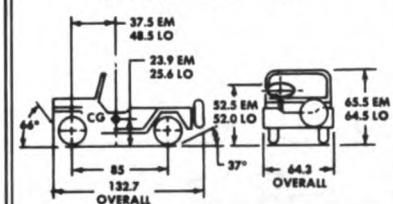
1ST	11 MPH	3RD	40 MPH
2ND	21 MPH	4TH	65 MPH

REVERSE 9 MPH



TRUCK UTILITY: 1/4 TON, 4X4, M151A2

WEIGHT AND DIMENSIONAL DATA



CURB WEIGHT, FULLY EQUIPPED	LESS PAYLOAD & CREW		WITH PAYLOAD & CREW
	WITHOUT ROLLBAR	WITH ROLLBAR	
FRONT AXLE	1362 LBS	1380 LBS	1478 LBS
REAR AXLE	1078 LBS	1260 LBS	1762 LBS
TOTAL	2440 LBS	2640 LBS	3240 LBS

PAYLOAD W/ROLLBAR 600 LBS, W/O ROLLBAR 800 LBS
MAX TOWED LOAD TRAILER W/BRAKES 1170 LBS
VERTICAL PINTLE LOAD 60-110 LBS
SHIPPING CUBAGE EM 350 CU.FT. REDUCED TO 260 CU. FT. SHIPPING WEIGHT (DRY) 2370 LBS

SERVICING DATA

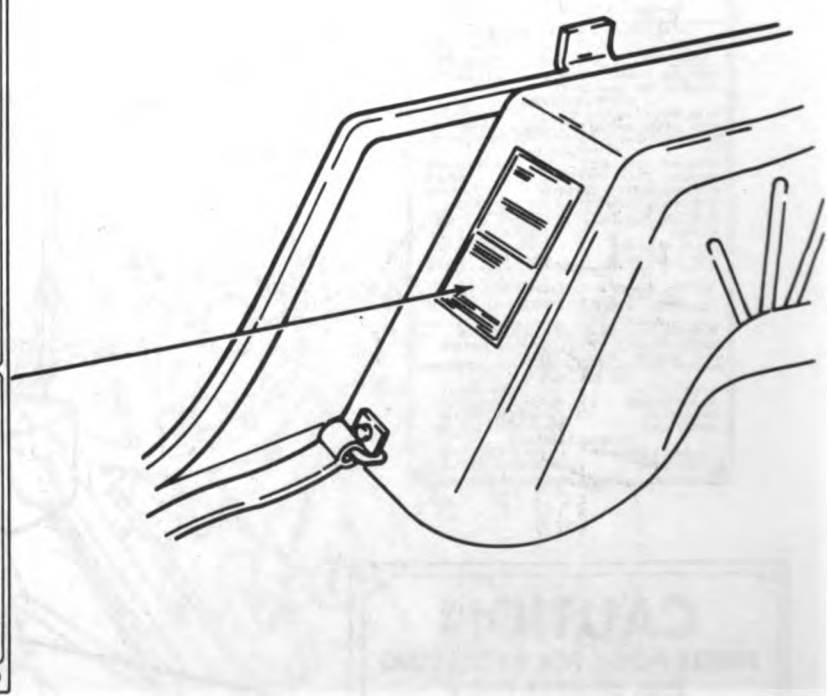
GASOLINE OCTANE	91 RON MIN
GASOLINE TANK CAPACITY	15.8 GALS.
COOLING SYSTEM CAPACITY	9.0 QTS

CRANKCASE CAP. 4 QTS. + 1 QT. FOR FILTER

TIRE INFL PRESSURE	FRONT	REAR
FULLY EQUIPPED WITH PAYLOAD AND CREW	20 LBS	20 LBS
MUD, SAND, SNOW	15 LBS	15 LBS

REFER TO LO 9-2320-218-12 FOR LUBRICATION REQUIREMENTS
REFER TO MWO 9-2320-218-34

TO DRAIN COOLING SYSTEM OPEN DRAIN COCKS LOCATED AT BOTTOM TANK AND ON LEFT SIDE OF CYLINDER BLOCK



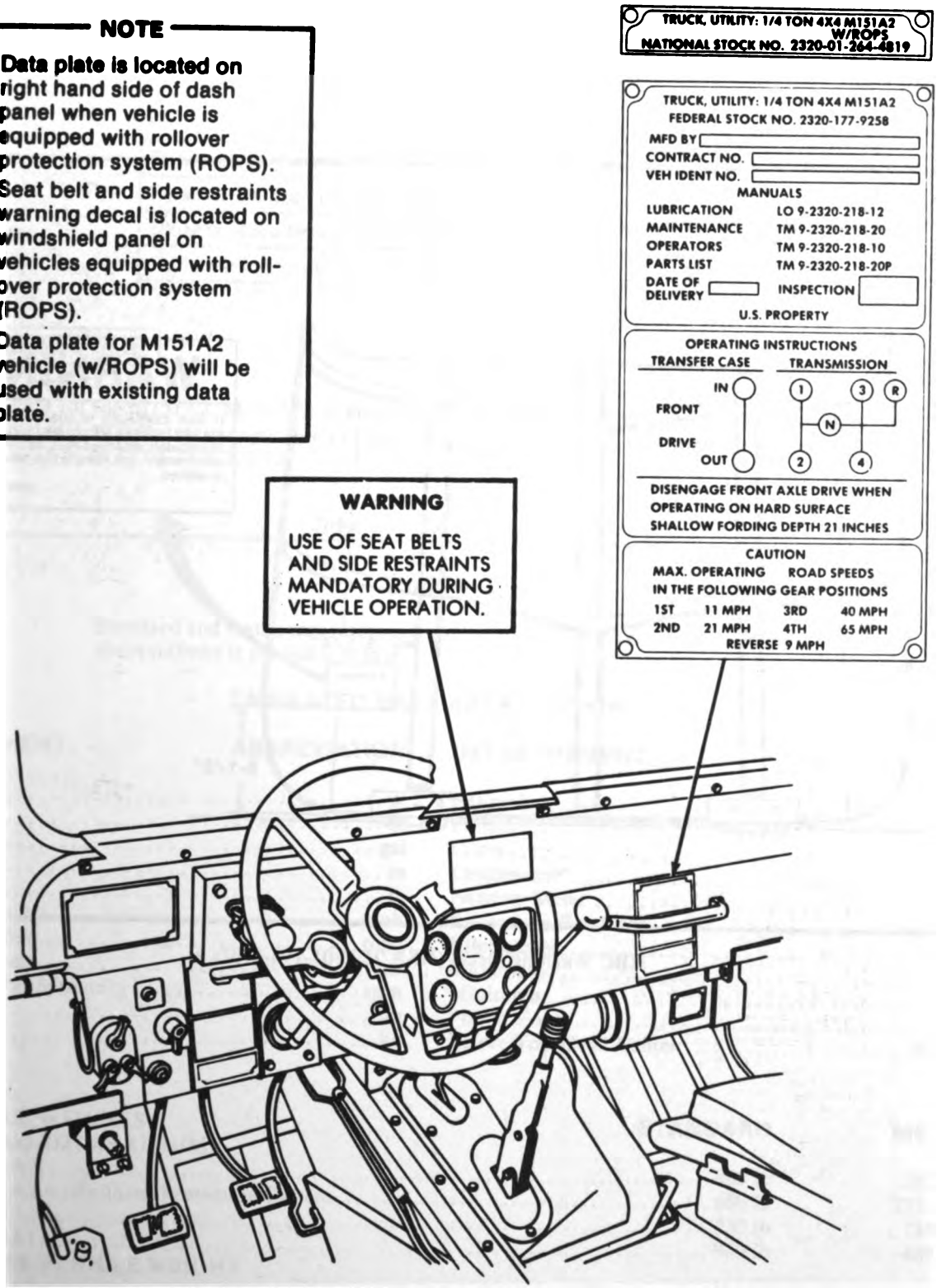
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1-10. Location and Contents of Caution, Data, and Warning Plates (Cont'd)

NOTE

- Data plate is located on right hand side of dash panel when vehicle is equipped with rollover protection system (ROPS).
- Seat belt and side restraints warning decal is located on windshield panel on vehicles equipped with roll-over protection system (ROPS).
- Data plate for M151A2 vehicle (w/ROPS) will be used with existing data plate.

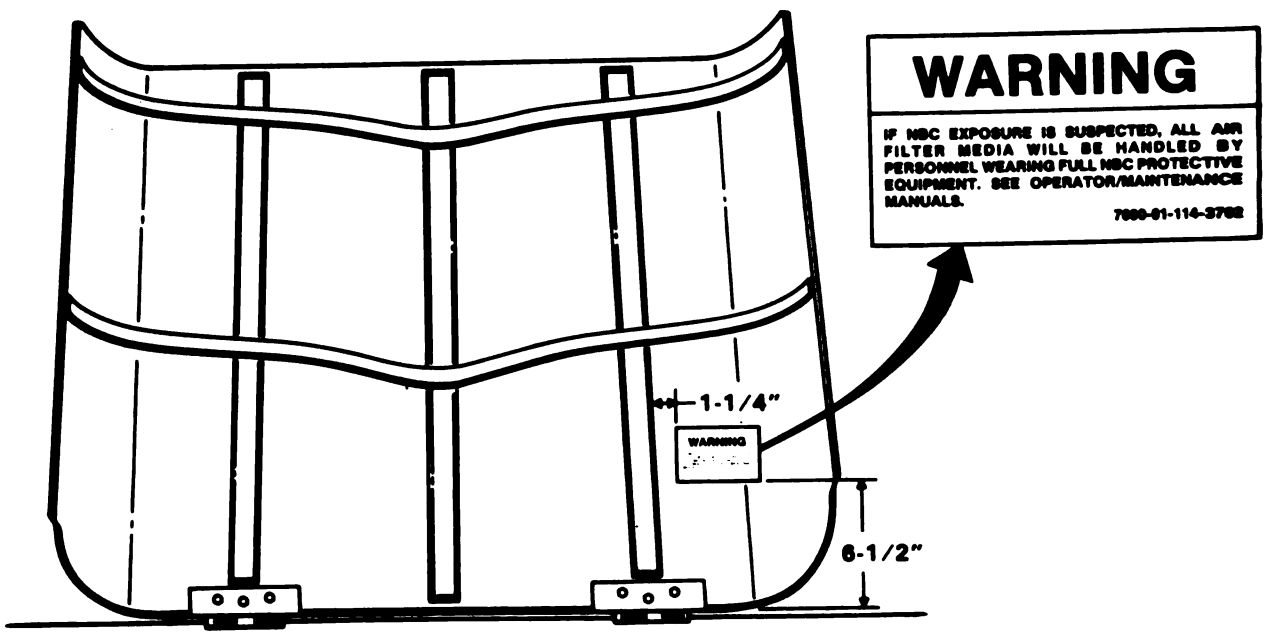


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1-10. Location and Contents of Caution, Data, and Warning Plates (Cont'd)

Follow dimensions shown for correct placement of decal.



NBC Warning Decal (NSN 7690-01-114-3702)

TA 484729

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1-11. Differences Between Models

See table 1-1 for the major differences between the M151A2 series vehicles covered in this manual.

Table 1-1. Differences Between Models

Equipment/Function	M151A2	M825	M718A1
Personnel/Cargo Operations	X		
106MM Recoilless Rifle		X	
Ambulance Operations			X

1-12. Tabulated Data

Tabulated data for the M151A2, M151A2 (w/ROPS), M825, and M718A1 vehicles can be found in table 1-2. This information includes only that data applicable to organizational maintenance. Information not covered can be found in TM 9-2320-218-10 or LO 9-2320-218-12.

Table 1-2. Tabulated Data

NOTE

Standard and metric measurements will be used in this table. A list of their abbreviations is provided below.

TABULATED DATA ABBREVIATIONS

MEASUREMENT	ABBREVIATION	MEASUREMENT	ABBREVIATION
Pints	pt	Fahrenheit	F
Quarts	qt	Celsius	C
Gallons	gal	Liters	l
Inches	in	Centimeters	cm
Pounds	lb	Newton Meter	N•m
Miles Per Hour	mph	Kilometers Per Hour	km per hour
Miles Per Gallon	mpg	Kilopascals	kPa
Per Square Inch	psi	Maximum	max
Revolutions Per Minute	rpm	Minimum	min
Horsepower	hp	Pound Foot	lb-ft
Kilograms	kg	Before Top Dead Center	BTDC

(a) VEHICLE WEIGHTS	STANDARD	METRIC
1. PAYLOAD (MAXIMUM)		
M151A2	800 lb	363.2 kg
M151A2 w/Rollover Protection System	600 lb	272.40 kg
M825	1,730 lb	785.4 kg
M718A1	900 lb	408.6 kg
2. GROSS VEHICLE WEIGHT		
M151A2	3,240 lb	1,470.96 kg
M825	4,320 lb	1,953.28 kg
M718A1	3,650 lb	1,657.10 kg

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Table 1-2. Tabulated Data (Cont'd)

	STANDARD	METRIC
3. GROSS VEHICLE WEIGHT (SHIPPING)		
M151A2	2,370 lb	1,076.0 kg
M151A2 w/Rollover Protection System (ROPS)	2,570 lb	1,166.78 kg
M825 w/Rifle	3,080 lb	1,398.3 kg
M825 w/Equip., No Rifle	2,590 lb	1,175.9 kg
M718A1	2,615 lb	1,187.21 kg
(b) ENGINE		
1. Model	General Army design	
2. Horsepower Rating	65 hp @ 4000 rpm	
3. Torque Rating	128 lb-ft @ 1800 rpm/172.8 N•m @ 1800 rpm	
4. Firing Order	1-3-4-2	
5. Valve Arrangement	Overhead	
6. Valve Clearance:		
Intake	0.015 in	0.381 mm
Exhaust	0.015 in	0.381 mm
7. Compression Ratio	7.5:1	
8. Weights:		
Power Plant	528 lb	239.7 kg
Eng. w/Flywheel and Accessories	328 lb	148.9 kg
Eng. w/Flywheel and wo/Accessories	257 lb	116.7 kg
(c) CLUTCH		
Type	Single dry disc	
(d) CAPACITIES		
1. Cooling System	9.0 qt	8.51 liters
2. Engine Oil:		
Capacity (less filter)	4 qt	3.78 liters
Filter	1 qt	0.946 liters
3. Air Cleaner, Oil Bath	2.5 pt	1.18 liters
4. Fuel Tank	15.8 gal	59.8 liters
5. Differential (each)	2 pt	.95 liters
6. Transmission	5.5 pt	2.60 liters
7. Windshield Washer Reservoir	3 qt	2.84 liters
(e) FUEL SYSTEM		
1. Fuel Filter	In-line and in-tank (Saran)	
2. Fuel Pump	Mechanical	
3. Carburetor:		
Type	Single barrel	
Make	Zenith	
Choke	Manual	
(f) COOLING SYSTEM		
1. Fan Type	4-blade	
2. Radiator:		
Type	Plate, fin, and tube	
Capacity	4.0 qt	3.78 liters
Cap Pressure	7.0 psi	48.27 kPa
3. Thermostat:		
Location	Cylinder head	
Opening Range	176°-183° F	80°-84°C
Fully Open	202° F	94°C
4. Pump, Water:		
Type	Centrifugal	
Location	Front of cylinder block	

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Table 1-2. Tabulated Data (Cont'd)

	STANDARD	METRIC
5. Drive Belts:		
Quantity	3	
Type	"V" wedge	
Width	0.47 in	12 mm
Length	35.25 in	89.5 cm
(g) ELECTRICAL SYSTEM		
1. Batteries:		
Type	2 HN, waterproof	
Voltage	12 volts	
Number Used	2	
Plates Per Cell	11	
Series Voltage	24 volts	
2. Spark Plugs:		
Size		14 mm
Gap	0.032-0.036 in	0.81-0.91 mm
3. Generator — 60 amp:		
Model	3002 A-A	
Part No.	10929868	
National Stock Number	NSN 2920-00-909-2483	
Voltage Rating	28 volts	
Ampere Rating	60 amps	
Operating Range	800-2500 rpm	
Type	Internal rectification	
4. Starter Motor:		
Make	Prestolite	
Optional	Delco-Remy	
Type	Series wound	
Voltage	24 DC	
(h) IGNITION SYSTEM		
1. Standard Ignition:		
Distributor Make	Prestolite	
Rotation-Rotor End	Clockwise	
Type of Advance	Centrifugal	
Breaker Point Opening	0.017-0.022 in	0.43-0.56 mm
Cam Angle	39-46°	
Voltage	24 volts	
Timing	6°BTDC	
Spark Plug Gap	0.032-0.036 in	0.81-0.91 mm
Engine Firing Order	1-3-4-2	
Ignition Coil Location	Distributor housing	
2. Solid-State Ignition (Prestolite):		
Rotation-Distributor End	Clockwise	
Type of Advance	Centrifugal	
Voltage	24 Volt	
Timing	6°BTDC	
Rotor	Heavy-duty	
Control Module Breakerless Inductive Discharge (B.I.D.)	Adjustable	
Trigger Wheel to Magnetic Pick-Up Clearance (Air Gap)	0.010 in preferred	0.25 mm preferred
Spark Plug Size		14 mm
Spark Plug Gap	0.032-0.036 in	0.81-0.91 mm
Firing Order	1-3-4-2	
Ignition Coil Location	Distributor housing	

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Table 1-2. Tabulated Data (Cont'd)

	STANDARD	METRIC
3. Solid-State Ignition (Swiss Control):		
Rotation Distributor End	Clockwise	
Type of Advance	Centrifugal	
Voltage	24 volts	
Timing	6 °BTDC	
Rotor	Magnetic	
Control Module Breakerless Inductive Discharge (B.I.D.)	Non-adjustable	
Spark Plug Size		14 mm
Spark Plug Gap	0.032-0.036 in.	0.81-0.91 mm
Firing Order	1-3-4-2	
Ignition Coil Location	Distributor housing	
(i) TRANSMISSION		
1. Type	Selective synchromesh	
2. Speeds	4 forward — 1 reverse	
(j) TRANSFER		
Type	Single speed	
(k) 1. Toe-in	1/32 to 5/32 in.	0.79 to 3.97 mm
2. Steering Wheel:		
Size	17.25 in dia., 44 cm diagonal	
Type	Three-spoke	
(l) PROPELLER SHAFTS		
1. Type of Joint	Cardan	
2. Drive	Front and rear	
(m) SUSPENSION		
1. Type	Independent, four-wheel	
2. Spring Type	Coil	
3. Front Shock Absorbers:		
Quantity	2	
Type	Hydraulic, telescopic	
Action	Two-way, direct (jounce & rebound control)	
Stops	Internal, hydraulic (jounce & rebound) or mechanical (external) (jounce & internal rebound)	
4. Rear Shock Absorbers:		
Quantity	2	
Type	Hydraulic, telescopic	
Action	Two-way, direct (jounce & rebound control)	
Stops	Internal, hydraulic (rebound only) or (mechanical internal rebound only)	
(n) SPECIAL PURPOSE KITS		
1. Winterization (-65° F)	M151A2 and M151A2 (w/ROPS)	
2. Hardtop	M151A2 and M151A2 (w/ROPS)	
3. Machine Gun Mount	M151A2 and M151A2 (w/ROPS)	
4. Door and Side Curtain	M151A2 and M151A2 (w/ROPS)	
5. Mounting, M16 rifle	M151A2, M151A2 (w/ROPS), and M825	
6. Deep Water Fording	M151A2, M151A2 (w/ROPS), and M718A1	
7. 100-Amp Alternator	M151A2, M151A2 (w/ROPS), and M825	
8. 180-Amp Alternator	M151A2, M151A2 (w/ROPS), M718A1, and M825	
9. Heater, Hot Water (-25° F)	M151A2, M151A2 (w/ROPS), and M718A1	
10. Vehicle Lifting	M151A2, M151A2 (w/ROPS), M718A1, and M825	
11. Convoy Warning Light	M151A1C, M151A2, M151A2 (w/ROPS), M718A1, M825	

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CHAPTER 2
PRINCIPLES OF OPERATION

2-1. Overview

a. This chapter explains how components of the 1/4-ton vehicles work together. A functional description of these components and their related parts will be covered in the following sections:

Section I. Electrical System Operation (page 2-2)
Section II. Power System Operation (page 2-10)
Section III. Control System Operation (page2-18)

2-2. Principles of Operation Reference Index

PARA	SYSTEM/COMPONENT	PAGE
Section I	ELECTRICAL SYSTEM OPERATION	
2-3	General	2-2
2-4	Electrical Terms and Definitions	2-2
2-5	Ignition System Operation	2-3
2-6	Starting System Operation	2-4
2-7	Generating System Operation (60 AMP Alternator)	2-5
2-8	Battery System Operation	2-6
2-9	Lighting System Operation	2-7
2-10	Directional Signal System Operation	2-8
2-11	Indicator, Gage, and Warning System Operation	2-9
Section II	POWER SYSTEM OPERATION	
2-12	General	2-10
2-13	Air Intake System Operation	2-10
2-14	Fuel System Operation	2-12
2-15	Exhaust System Operation	2-14
2-16	Cooling System Operation	2-15
2-17	Lubrication System Operation	2-16
2-18	Power Train Operation	2-17
Section III	CONTROL SYSTEM OPERATION	
2-19	General	2-18
2-20	Accelerator Control System Operation	2-18
2-21	Parking Brake Control System Operation	2-19
2-22	Service Brake Control System Operation	2-20
2-23	Steering Control System Operation	2-21

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Section I. ELECTRICAL SYSTEM OPERATION

2-3. General

a. Nearly every component of the vehicles covered in this manual has something to do with the electrical system. These components and their electrical connections are discussed as part of the following electrical sub-systems:

Ignition System Operation (para 2-5)
Starting System Operation (para 2-6)
Generating System Operation (60 AMP Alternator) (para 2-7)
Battery System Operation (para 2-8)
Lighting System Operation (para 2-9)
Directional Signal System Operation (para 2-10)
Indicator, Gage, and Warning System Operation (para 2-11)

b. For information not covered in this section, refer to chapter 3, section V "Electrical Systems Troubleshooting", or appendix G, where you will find a complete wiring diagram showing the relationship of the systems listed above.

2-4. Electrical Terms and Definitions

The following electrical terms and definitions will be frequently referred to throughout this section and should be learned before proceeding.

(A) *CIRCUIT* — The complete path of an electric current through a wire component or point.

(B) *CIRCUIT BREAKER* — An automatic switch that stops current flow in a circuit when there is an electrical overload.

(C) *RELAY* — An electromagnetic device that is controlled by other devices (such as switches) to control the flow of current in the same or a different circuit.

(D) *GROUND* — A common return for an electric circuit which has the lowest voltage level on the vehicle. At the point where the ground exists, current flows through the vehicle to the chassis ground.

(E) *FEMALE CONNECTOR* — One half of a circuit connector which fits over the other half of the connector. It can connect a circuit to a component or circuit breaker.

(F) *MALE CONNECTOR* — One half of a circuit connector which fits inside the other half of the connector.

(G) *HARNESS* — A group of similarly routed wires with other devices and connectors that are bound and routed together to prevent damage.

(H) *TERMINAL* — Fastener at end of wire used to connect the wire to an electrically-powered device.

(I) *SPLICE* — A permanent physical connection of two or more circuit wires.

(J) *POLARITY* — The condition of having a positive or negative flow of electrical current in a circuit.

(K) *REVERSE POLARITY* — The condition in which a circuit is connected opposite of that which was intended.

(L) *SENDING UNIT* — A device that transmits a signal to a gage or indicator showing the condition of the system being monitored. Sending units are normally used in cooling and lubricating systems.

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(M) *DIRECT CURRENT (D.C. signal)* — Current that flows from a battery or rectified alternator in one direction only.

(N) *ALTERNATING CURRENT (A.C. signal)* — Current in a circuit attached to this signal will flow alternately in one direction, then in the other direction.

2-5. Ignition System Operation

The ignition system is identical for all vehicles covered in this manual and consists of the following major components and circuitry:

(A) *SPARK PLUGS* — Energized by the coil, spark plugs ignite air/fuel mixture in cylinder head to initiate combustion.

(B) *SPARK PLUG CABLES* — Transmit high voltage from the ignition coil to the spark plugs.

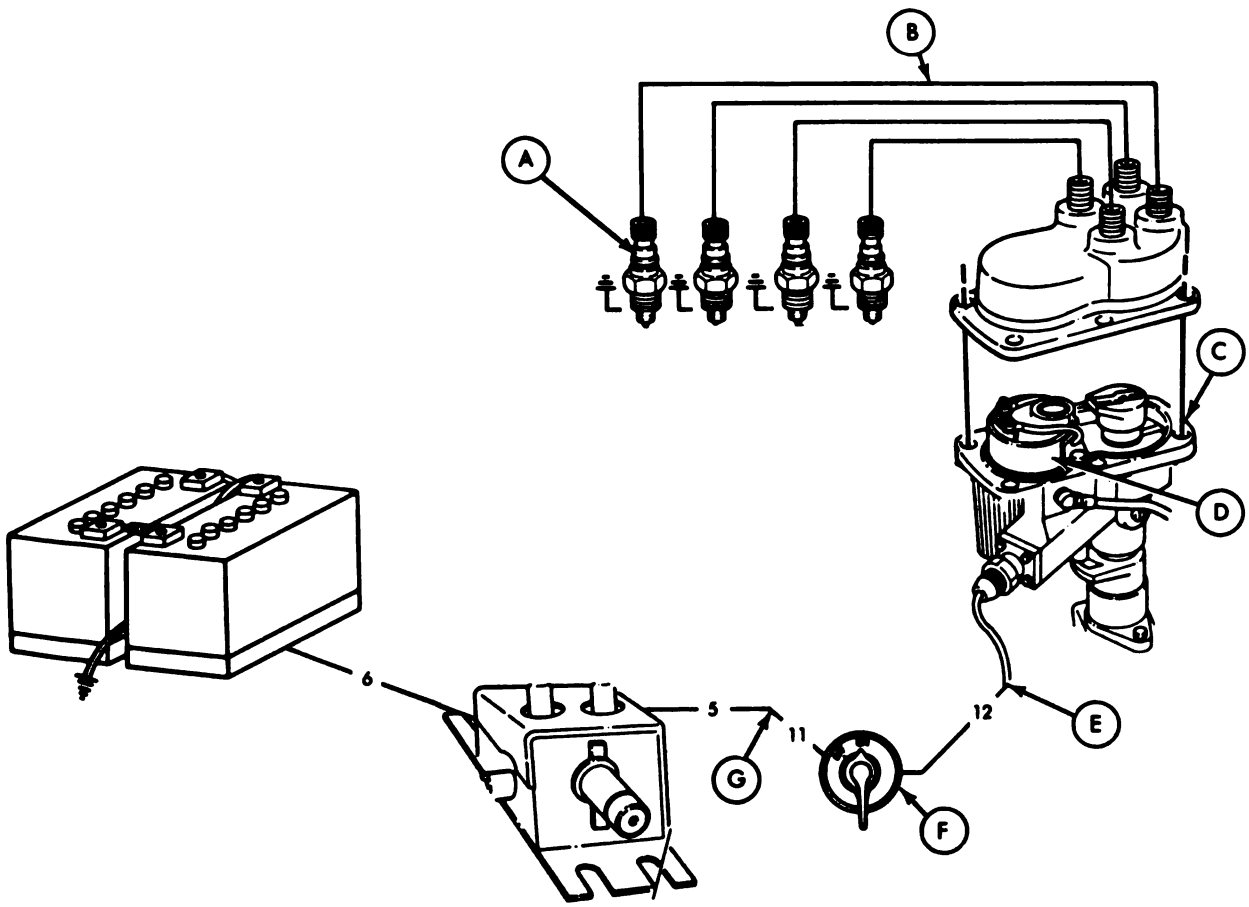
(C) *DISTRIBUTOR* — Allows transmission of high voltage to one spark plug at a time in a given order.

(D) *IGNITION COIL* — Multiplies battery voltage to ignition system (inside distributor housing).

(E) *CIRCUIT 12* — Conducts battery power from ignition switch to ignition system.

(F) *IGNITION SWITCH* — Provides battery power to ignition system and instruments.

(G) *CIRCUIT 5/11* — Provides battery power to ignition switch.



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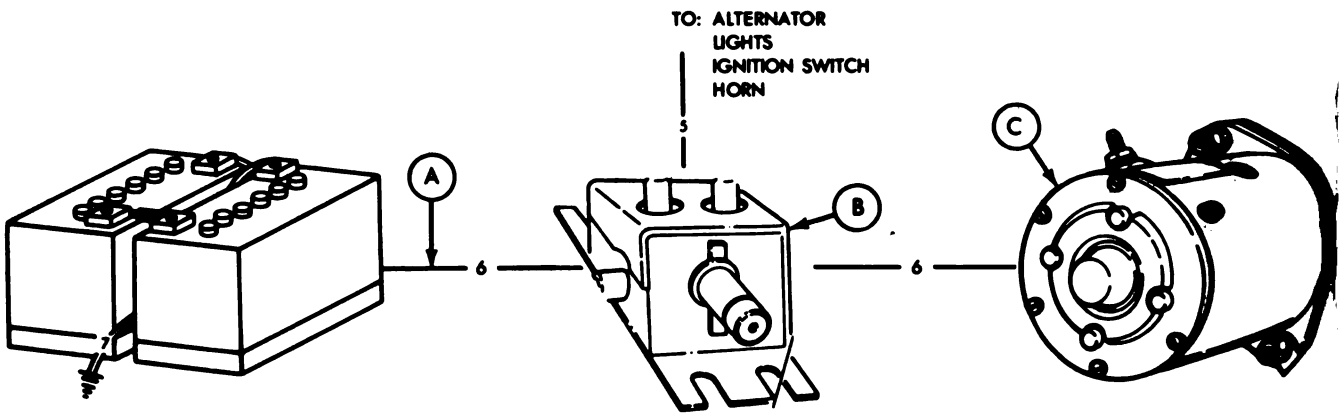
2-6. Starting System Operation

The starting system is identical for all vehicles covered in this manual, and consists of the following major components and circuitry:

(A) *CIRCUIT 6* — Connects 24-volt battery power to starter motor when starter switch is depressed.

(B) *STARTER SWITCH* — Connects 24-volt battery power to the starter motor through circuit 6 when depressed.

(C) *STARTER MOTOR* — Cranks the engine during starting.



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2-7. Generating System Operation (60 AMP Alternator)

The 60-amp alternator system is standard on all M151A2 vehicles, and consists of the following components and circuitry:

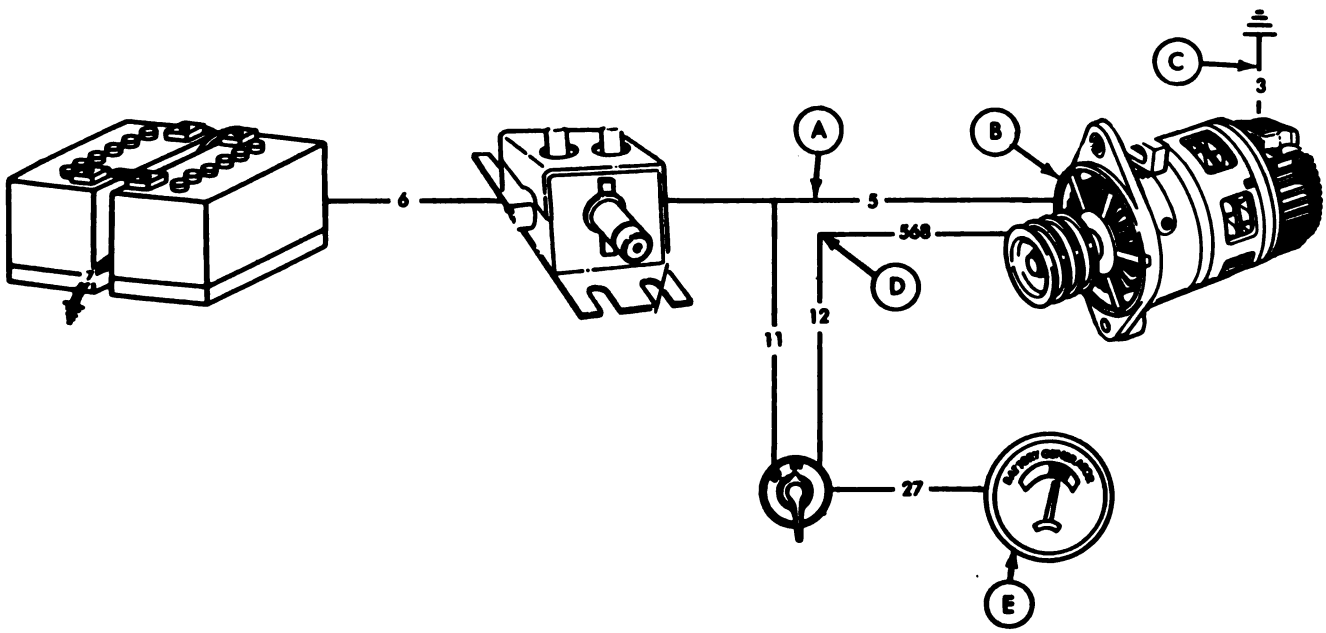
(A) *CIRCUIT 5* — Recharging circuit from alternator to batteries.

(B) *ALTERNATOR* — Provides 28±1 volts used to charge the vehicle batteries and to assist batteries in carrying the electrical load of the vehicle.

(C) *CIRCUIT 3* — Provides a ground circuit to the alternator.

(D) *CIRCUIT 12/568* — Directs vehicle voltage to the field circuit in alternator which stimulates generation of current.

(E) *BATTERY-GENERATOR INDICATOR* — Indicates electrical system voltage. It is connected to the electrical system through circuit 27.



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2-8. Battery System Operation

The battery system is identical for all vehicles covered in this manual, and consists of the following major components and circuitry:

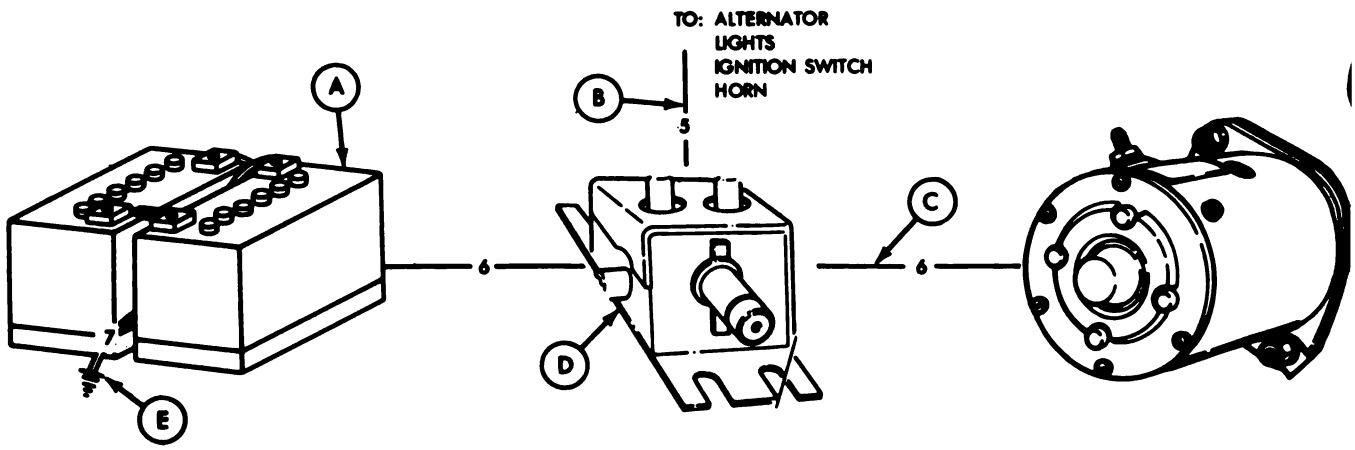
(A) *BATTERIES* — Two 2HN batteries are connected in series to provide 24-volts DC power for all electrical systems.

(B) *CIRCUIT 5* — Provides 24-volt battery power to vehicle electrical system.

(C) *CIRCUIT 6* — Provides 24-volt battery power to the starting system.

(D) *STARTER SWITCH* — Connects batteries to the starter motor when depressed.

(E) *CIRCUIT 7* — Connects the battery system to the starter negative terminal and chassis ground.



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2-9. Lighting System Operation

The lighting system is identical on all vehicles covered in this manual, and consists of the following major components nd circuitry:

(A) *SERVICE HEADLIGHTS* — Powered through circuit 16 from the light switch to circuit 17 for high beam and circuit 18 for low beam.

(B) *BLACKOUT DRIVE LAMP* — Powered through circuit 19 from light switch.

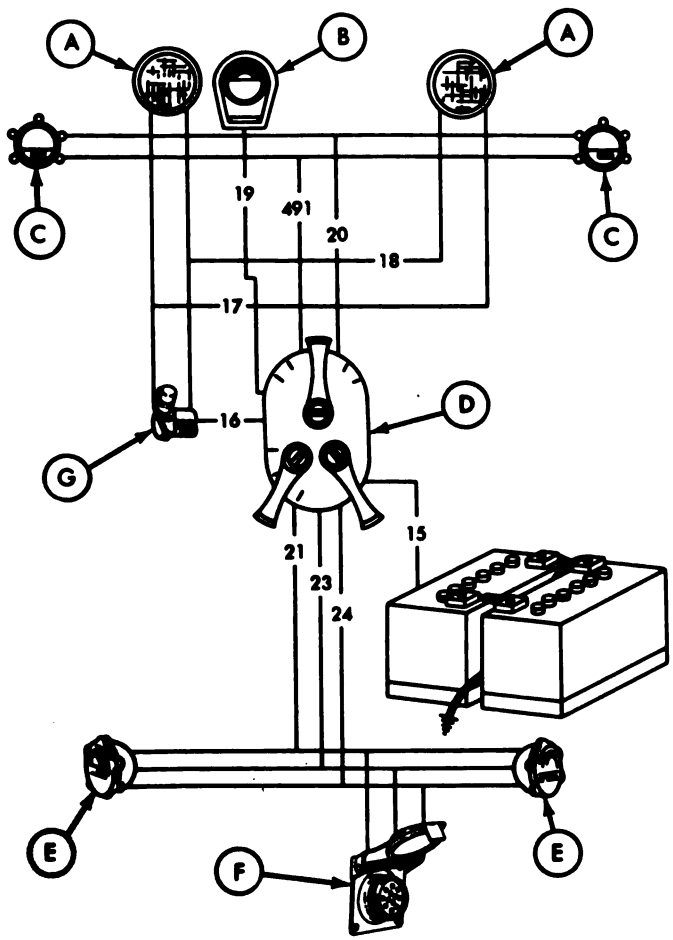
(C) *FRONT COMPOSITE LAMPS* — Combination marker lamps powered through circuit 491 and B.O. marker lamps powered through circuit 20.

(D) *LIGHT SWITCH* — A multi-position switch that controls all vehicle lighting. It is powered from the batteries through circuit 15.

(E) *REAR COMPOSITE LAMPS* — Combination tail lamps powered through circuit 21, B.O. stop lamps powered through circuit 23 and B.O. tail lamps powered through circuit 24. Each of these circuits originate at light switch.

(F) *TRAILER RECEPTACLE* — Provides power hookup for trailer lights.

(G) *DIMMER SWITCH* — A two-position, foot-operated switch that connects circuit 16 with either circuit 17 high beam or circuit 18 low beam.



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2-10. Directional Signal System Operation

The directional signal system is identical for all vehicles covered in this manual, and consists of the following major components and circuitry:

(A) *FRONT COMPOSITE LAMP* — Receives power from directional signal switch through circuits 460 and 461 to indicate turning direction.

(B) *LIGHT SWITCH* — Provides battery power to the directional signal switch through circuit 467, and to the stoplight switch through circuit 75.

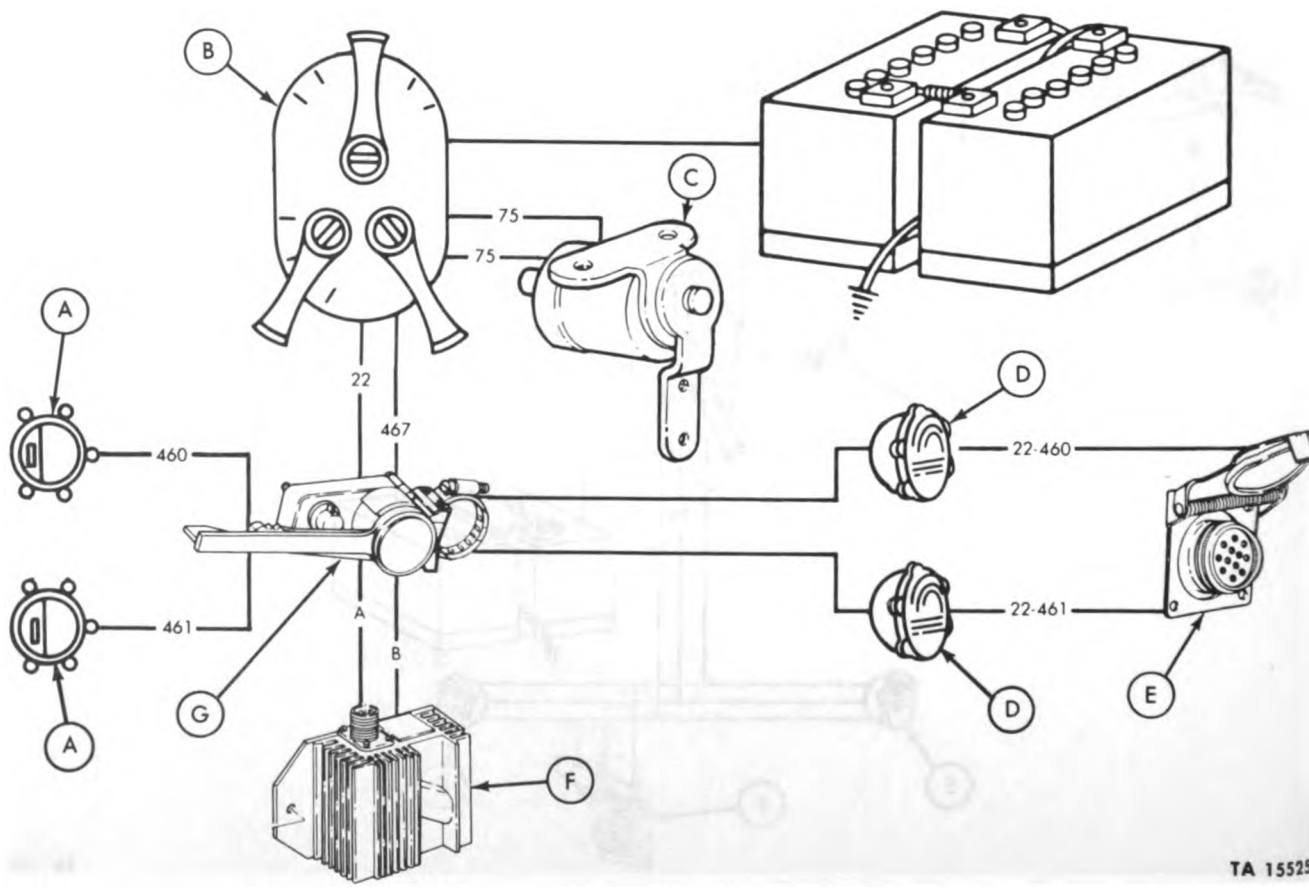
(C) *STOPLIGHT SWITCH* — Closing this switch allows power to flow from the light switch through circuit 75 to circuit 22 to the directional signal switch.

(D) *REAR COMPOSITE LAMP* — Receives power from directional signal switch through circuits 22-460 and 22-461 to indicate turning direction.

(E) *TRAILER RECEPTACLE* — Receives power from directional signal switch through circuits 22-460 and 22-461, to indicate turning direction.

(F) *TURN SIGNAL FLASHER* — The application of a load through circuits 460 and 22-460, or 461 and 22-461, causes the flasher to send intermittent voltage to the signal lamps connected to these circuits.

(G) *DIRECTIONAL SIGNAL SWITCH* — A three-position switch that directs power to the composite and signal lamps through circuits 460, 461, 22-460, and 22-461, to indicate direction of turn.



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2-11. Indicator, Gage, and Warning System Operation

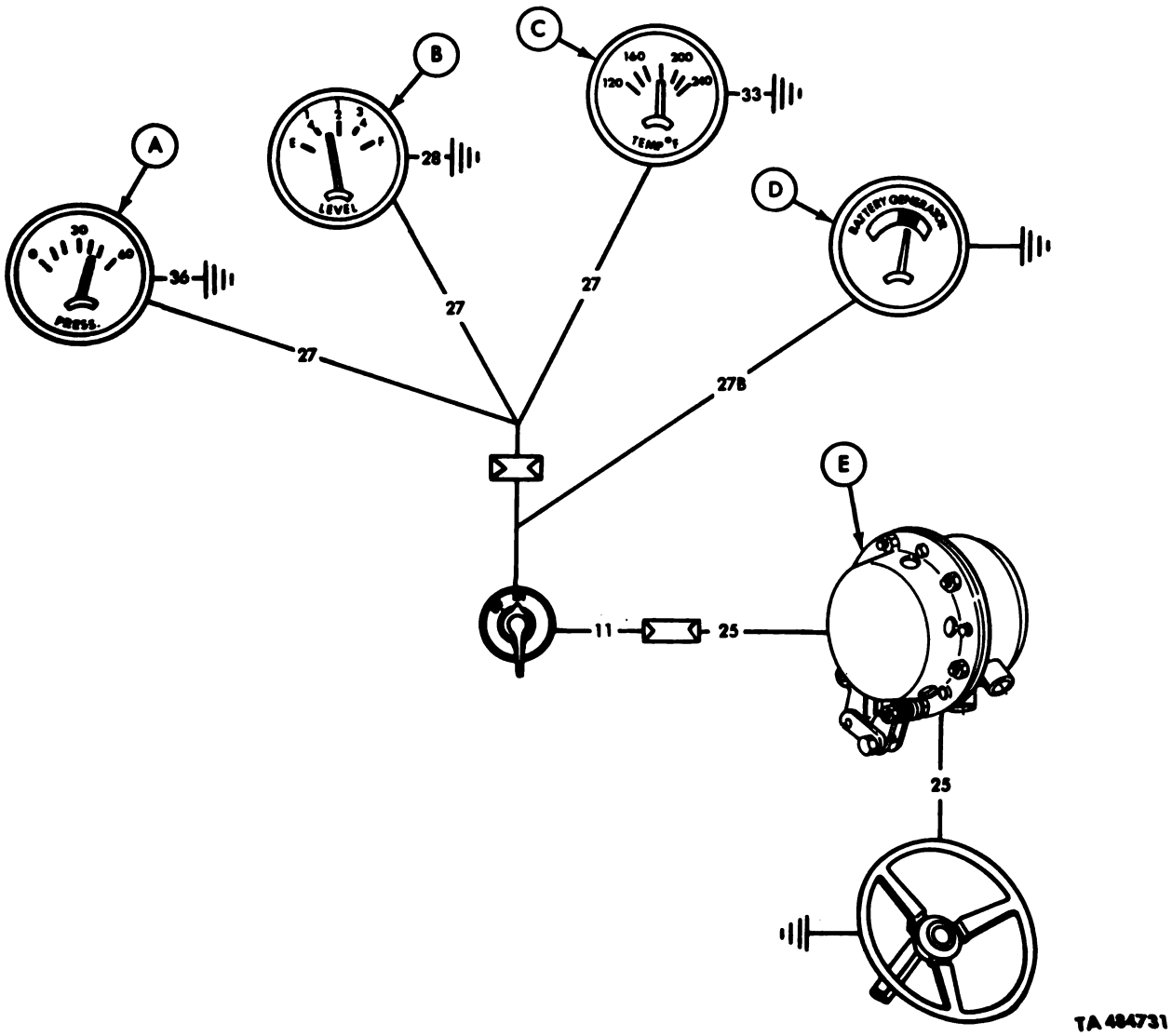
(A) *OIL PRESSURE INDICATOR* — Operates in a similar manner to the temperature indicator. Circuit 36 completes the circuit to ground through the oil pressure transmitter located in the engine block.

(B) *FUEL INDICATOR* — Consists of a fuel gage powered by circuit 27. Circuit 28 connects the gage to the fuel level transmitter located in the fuel tank.

(C) *ENGINE TEMPERATURE INDICATOR* — Consists of a temperature gage powered by circuit 27. Circuit 33 connects the gage to the temperature transmitter located in the engine cylinder head which reacts to variations in engine temperature by increasing or decreasing resistance in the ground circuit.

(D) *BATTERY-GENERATOR INDICATOR* — Indicates system voltage. It is connected to the batteries through circuit 27B and to chassis ground through the instrument cluster.

(E) *HORN SYSTEM* — Consists of circuit 25 which supplies system power, and an electric horn which is controlled through the horn switch located in the steering column.



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Section II. POWER SYSTEM OPERATION

2-12. General

a. The power system includes those components that give all vehicles covered in this manual the power to move.

b. Each of these components will be described as part of the following system:

Air Intake System Operation (para 2-13)
Fuel System Operation (para 2-14)
Exhaust System Operation (para 2-15)
Cooling System Operation (para 2-16)
Lubrication System Operation (para 2-17)
Power Train Operation (para 2-18)

2-13. Air Intake System Operation

The air intake system channels and cleans air going to the carburetor chamber, where it is combined with fuel to provide fire power for the engine. This is not identical on all vehicles covered in this manual. Newer models have a fuel vapor canister and a different air cleaner for emission control.

(A) *AIR CLEANER* — Filters dirt or dust from air before it enters carburetor.

(B) *CANISTER VAPOR PURGE HOSE* — Directs gas vapor from canister to air cleaner (newer models only).

(C) *FUEL PUMP VENTILATION HOSE* — Vents gas vapors from fuel pump to air cleaner.

(D) *INTAKE MANIFOLD* — Carries air/fuel mixture to combustion chambers.

(E) *FUEL TANK VENTILATION LINE* — Vents gas vapors from fuel tank to vapor canister.

(F) *FUEL VAPOR CANISTER* — Stores gas vapors until engine is started (newer models only).

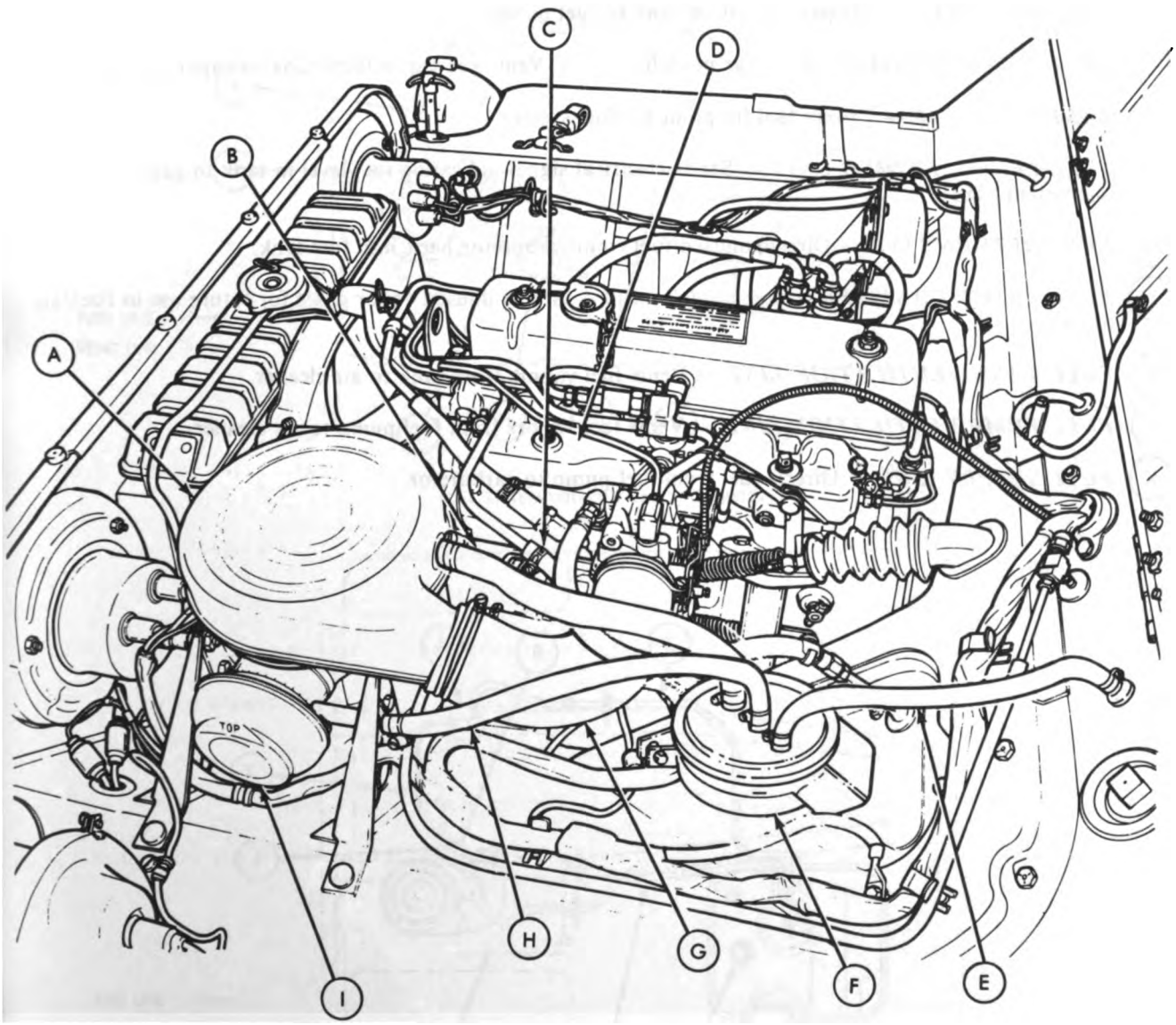
(G) *CARBURETOR TO AIR CLEANER HOSE* — Routes clean air to carburetor.

(H) *CANISTER AIR SUPPLY HOSE* — Brings air to canister (newer models only).

(I) *AIR CLEANER CAP* — Acts as initial entrance point for air to air cleaner and fuel vapor canister.

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2-13. Air Intake System Operation (Cont'd)



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2-14. Fuel System Operation

a. The fuel system stores, cleans, and supplies fuel to the carburetor, where it is mixed with air to provide a suitable mixture for combustion.

b. The fuel system is not identical for all models. A fuel vapor canister has been added to newer models to prevent fuel vapor from escaping into the atmosphere.

(A) *FUEL PUMP* — Driven by camshaft, the fuel pump draws fuel from tank and pumps it to the carburetor.

(B) *IN-LINE FUEL FILTER* — Filters dirt from fuel before it enters the carburetor.

(C) *FUEL INLET LINE* — Directs fuel from tank to fuel pump.

(D) *TANK VENTILATION LINE (newer models only)* — Vents gas vapor from tank to vapor canister.

(E) *TANK FUEL CAP* — Covers fuel fill point for fuel system.

(F) *FUEL LEVEL SENDING UNIT* — Sends electrical signal indicating fuel level in tank to gage on instrument panel.

(G) *FUEL RETURN LINE* — Directs unused fuel from carburetor back into fuel tank.

(H) *FUEL VAPOR CANISTER (newer models only)* — Stores unused vapor gases for future use in fuel/air mixture.

(I) *FUEL TANK VENTILATION LINE* — Vents fuel vapors from tank to air cleaner.

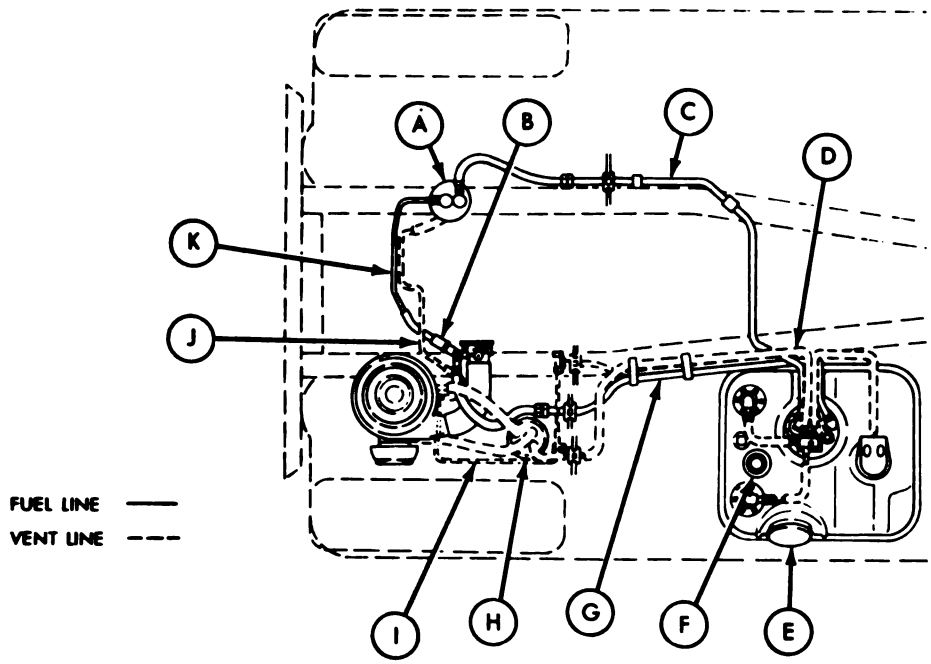
(J) *FUEL PUMP VENTILATION LINE* — Vents fuel vapors from fuel pump to air cleaner.

(K) *FUEL SUPPLY LINE* — Directs fuel from fuel pump to carburetor.

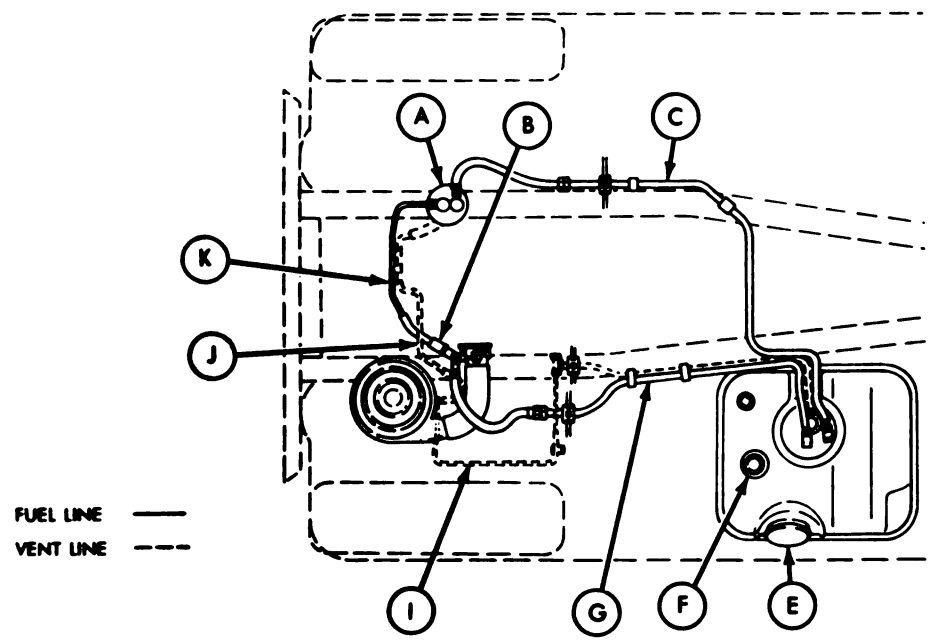
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2-14. Fuel System Operation (Cont'd)

FUEL SYSTEM WITH VAPOR CANISTER



FUEL SYSTEM WITHOUT VAPOR CANISTER



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2-15. Exhaust System Operation

The exhaust system directs used engine gases away from the vehicle for all models covered in this manual. Major components of the exhaust system are:

(A) *EXHAUST MANIFOLD* — Collects exhaust from cylinder head ports and directs it to front exhaust pipe.

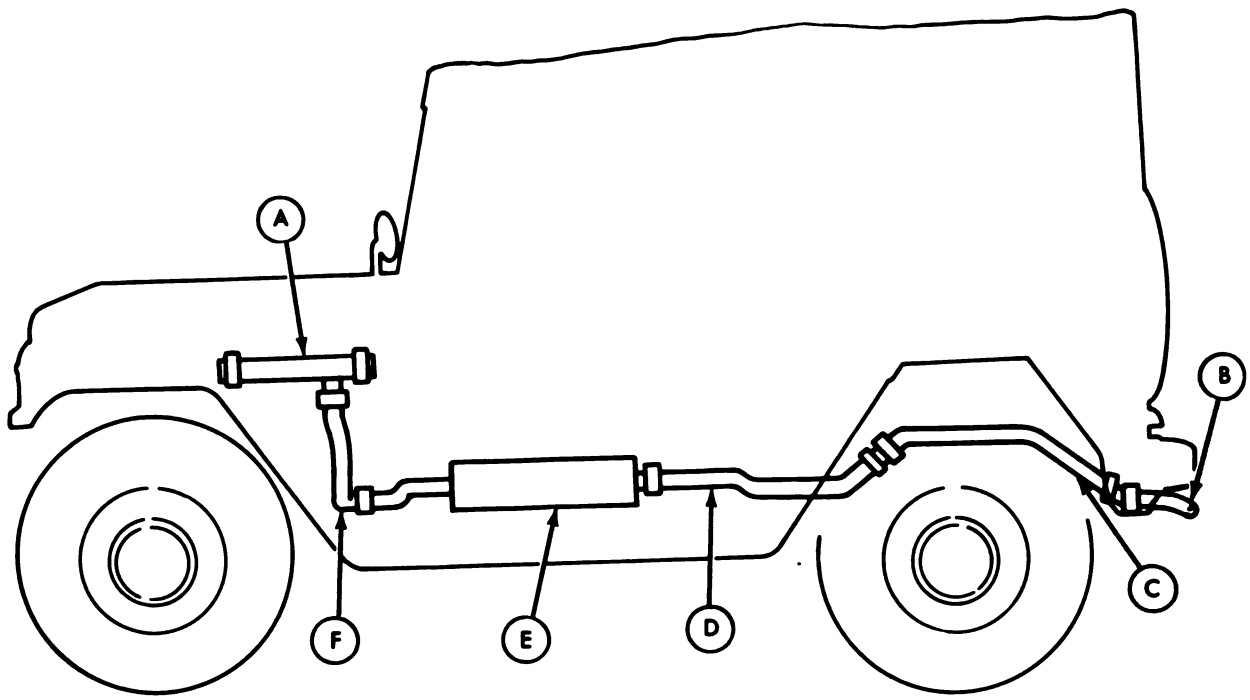
(B) *TAILPIPE EXTENSION* — Directs exhaust away from vehicle.

(C) *REAR MUFFLER OUTLET PIPE* — Pre-directs exhaust to tailpipe extension.

(D) *MUFFLER OUTLET PIPE* — Directs exhaust to rear muffler outlet pipe.

(E) *MUFFLER* — Quiets exhaust noises.

(F) *FRONT EXHAUST PIPE* — Directs exhaust to muffler.



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2-16. Cooling System Operation

The cooling system takes away waste heat from the engine. This system is identical on all models covered in this manual. Major components of the cooling system are:

(A) *UPPER RADIATOR HOSE* — Directs flow of coolant from thermostat housing to radiator.

(B) *FAN BLADES* — A four-blade fan pulls air through radiator to remove waste heat from coolant.

(C) *RADIATOR* — Directs coolant through a series of fins or baffles so outside air can remove waste heat from coolant.

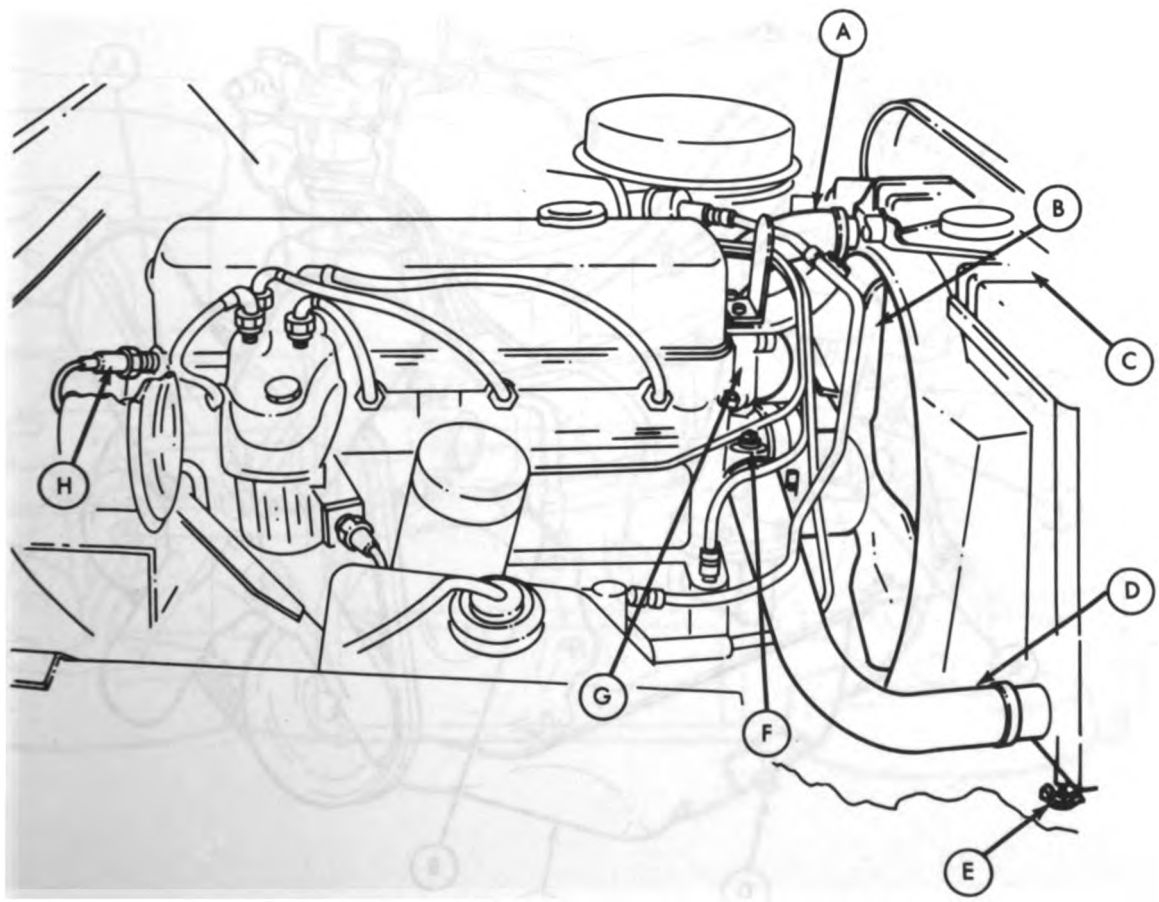
(D) *LOWER RADIATOR HOSE* — Directs flow of coolant to water pump from radiator.

(E) *RADIATOR DRAINCOCK* — Permits draining of coolant from bottom of radiator.

(F) *WATER PUMP* — Provides a flow of coolant to circulate through rest of cooling system.

(G) *THERMOSTAT HOUSING* — Houses thermostat which shuts off coolant flow to radiator until temperature reaches 176° to 183°F (80° to 84°C). Coolant is then directed to the radiator through the upper hose.

(H) *TEMPERATURE GAGE SENDING UNIT* — Sends signal indicating coolant temperature to gage on instrument panel.



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2-17. Lubrication System Operation

The lubrication system provides lubricating oil for internal moving engine parts and is identical on all vehicles covered in this manual. Major components of the lubricating system are:

(A) *OIL FILLER CAP* — Covers engine oil fill point.

(B) *CRANKCASE VENTILATION LINE* — Directs hot oil fumes to carburetor for burning.

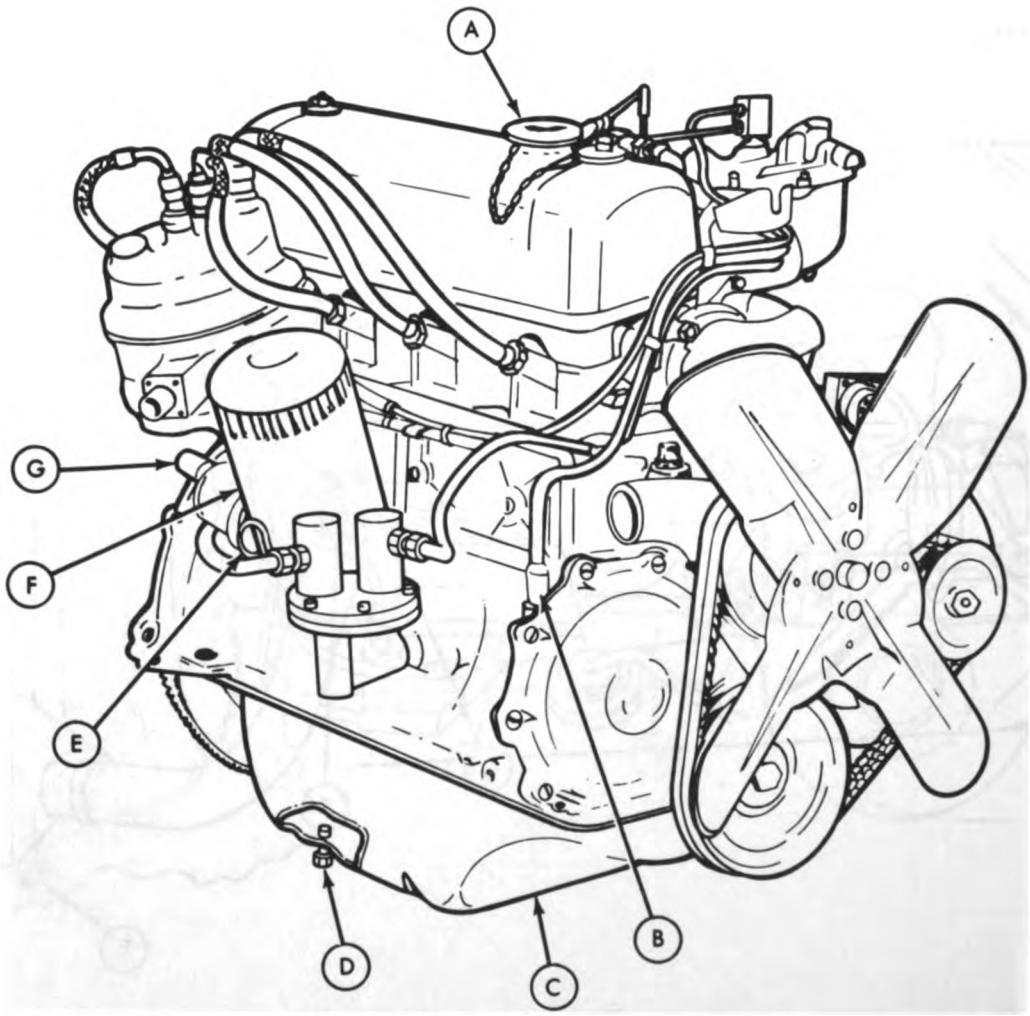
(C) *OIL PAN* — Storage point for engine oil.

(D) *OIL PAN DRAIN PLUG* — Draining point for engine oil.

(E) *OIL DIPSTICK* — Engine oil level indicator stick.

(F) *OIL FILTER* — Removes dirt and dust from oil, thereby reducing engine wear.

(G) *OIL PRESSURE SENDING UNIT* — Sends an electrical signal that indicates engine oil pressure to gage on instrument panel.



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2-18. Power Train Operation

The power train system is the same on all vehicles in this manual. This system transmits engine power throughout the vehicle to put it in motion. Major components of the power train system are:

(A) *ENGINE* — Provides horsepower needed to move power train components.

(B) *TRANSMISSION* — Adapts engine horsepower to meet different driving conditions.

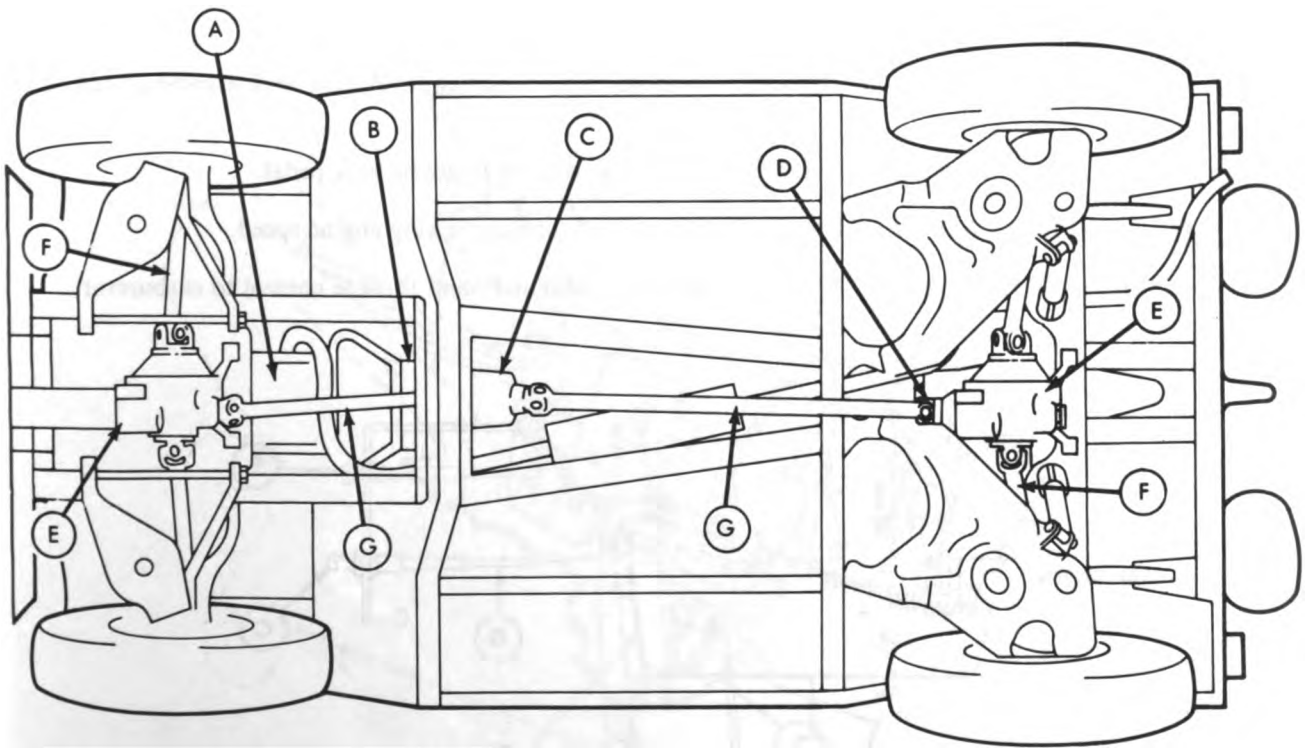
(C) *TRANSFER* — Adapts driving power to front and rear wheel drive shafts.

(D) *UNIVERSAL JOINTS* — Flexible connections between two propeller shafts that permit one to drive the other even though at different angles.

(E) *DIFFERENTIALS* — Adapt power to left and right wheel drive shafts independently so vehicle can make turns without skidding.

(F) *WHEEL DRIVE SHAFTS* — Adapt power from differentials to rotate wheels.

(G) *PROPELLER SHAFTS* — Connect the transfer output to front and rear differentials.



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Section III. CONTROL SYSTEM OPERATION

2-19. General

a. The control system includes those controls and their related parts that are essential to the operation of the vehicle. These controls all originate from the cab and are common to all vehicles.

b. Each of these controls and their related parts will be described as part of the following systems:

Accelerator Control System Operation (para 2-20).
Parking Brake Control System Operation (para 2-21).
Service Brake Control System Operation (para 2-22).
Steering Control System Operation (para 2-23).

2-20. Accelerator Control System Operation

The accelerator system permits the operator to control vehicle speed and engine power, and is identical on all models in this manual. Major components of the accelerator system are:

(A) *CHOKE CABLE* — Links choke control to carburetor choke.

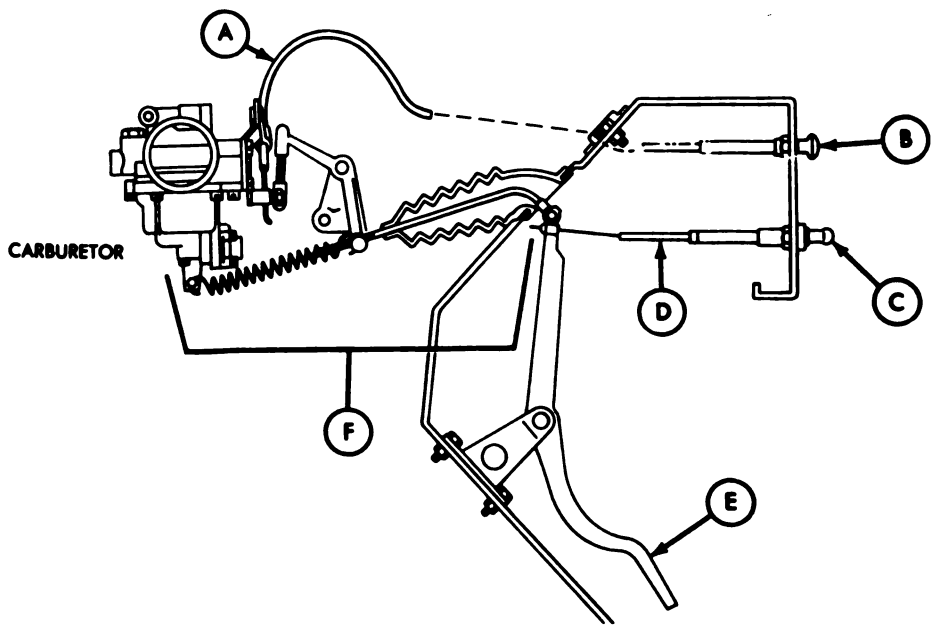
(B) *CHOKE CONTROL* — Allows operator to close carburetor choke plate and increase fuel-to-air ratio during cold engine operation.

(C) *HAND THROTTLE CONTROL* — Operator's control for setting or locking engine speed at any desired rpm.

(D) *HAND THROTTLE CABLE* — Links hand throttle control to accelerator pedal.

(E) *ACCELERATOR PEDAL* — Operator's foot control for determining engine speed.

(F) *ACCELERATOR LINKAGE* — Links accelerator pedal and hand throttle control to carburetor.



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2-21. Parking Brake Control System Operation

a. Mechanically actuated brake system performs the following functions for all vehicles covered in this manual:

(1) Keeps vehicle still once it has stopped.

(2) Assists in emergency stopping if there is a service brake system failure.

b. The major components of the parking brake system are:

(A) *PARKING BRAKE HAND LEVER ADJUSTING CAP* — Permits operator to make minor tension adjustment of parking brake.

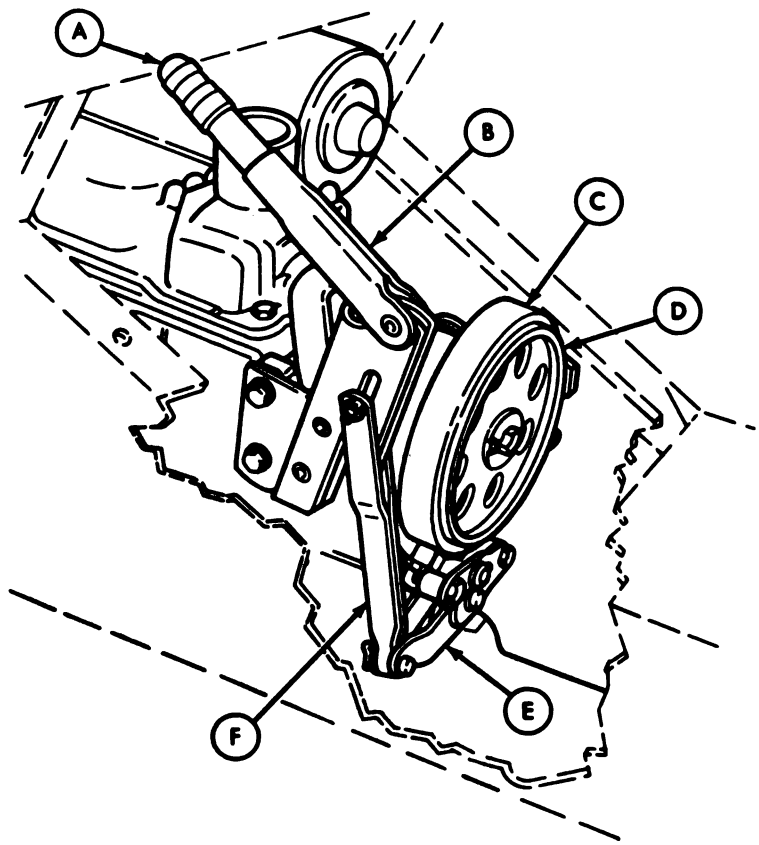
(B) *PARKING BRAKE HAND LEVER* — Permits operator to engage the parking brake.

(C) *PARKING BRAKE BAND AND SHOE ASSEMBLY* — Stops parking brakedrum when brake lever is engaged.

(D) *PARKING BRAKEDRUM* — Attached to rear output shaft of transfer, the drum prevents transfer output shaft from turning when parking brake is engaged.

(E) *BAND TENSION LEVER* — Tightens band around drum.

(F) *PARKING BRAKE LINK* — Connects band tension lever to parking brake hand lever.



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2-22. Service Brake Control System Operation

The service brake control system, identical on all vehicles, uses mechanical linkage to master cylinder, and hydraulic actuated brakeshoes to all four wheels.

(A) *WHEEL CYLINDER* — Converts hydraulic pressure to mechanical force to spread brakeshoes against brakedrum.

(B) *HYDRAULIC BRAKE LINES* — Direct brake fluid under pressure to all four wheel cylinders from master cylinder.

(C) *MASTER BRAKE CYLINDER FILLER CAP* — Covers brake fluid fill point.

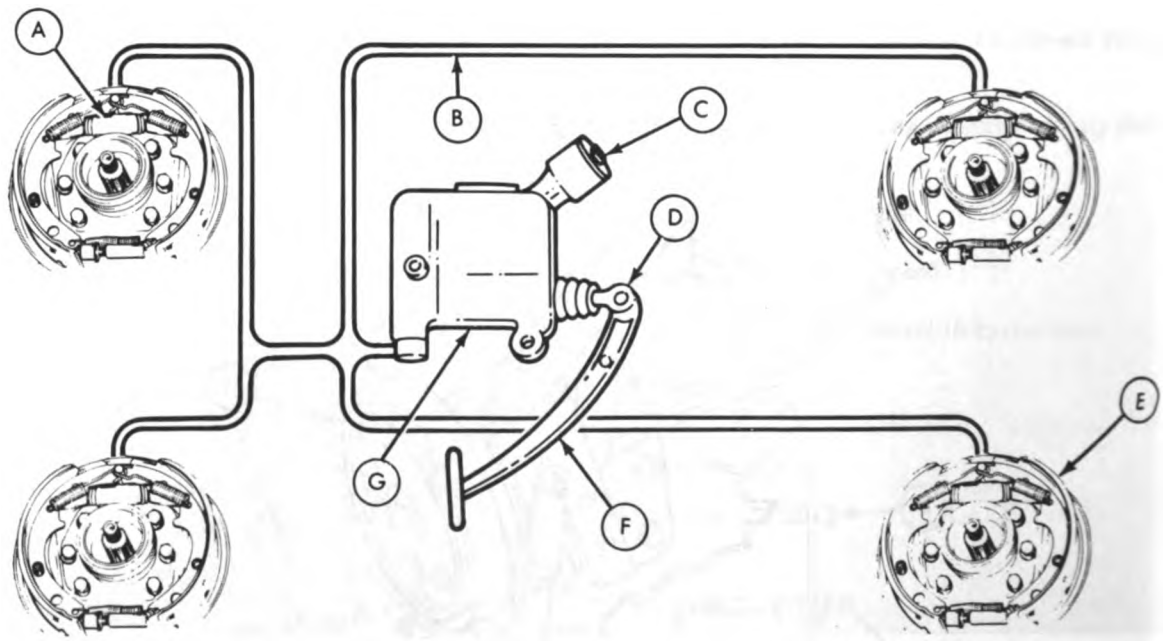
(D) *BRAKE LINKAGE* — Directs brake pedal pressure to master cylinder plunger.

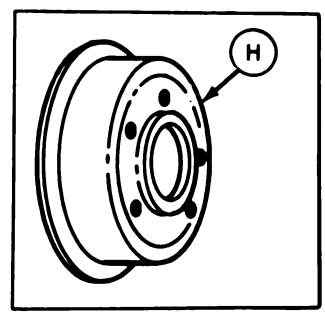
(E) *BRAKESHOES* — Apply friction to brakedrum when brake pedal is depressed.

(F) *BRAKE PEDAL* — Operator control for stopping vehicle.

(G) *MASTER CYLINDER/RESERVOIR* — Stores brake fluid, and converts mechanical pedal pressure to hydraulic pressure.

(H) *BRAKEDRUM* — Brake mechanism housing that stops turning when brakeshoes are applied.





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2-23. Steering Control System Operation

The steering control system is identical for all models covered in this manual.

(A) *STEERING GEAR* — Multiplies and transfers steering wheel turning action to steering arm.

(B) *STEERING COLUMN* — Transmits turning effort from steering wheel to steering gear.

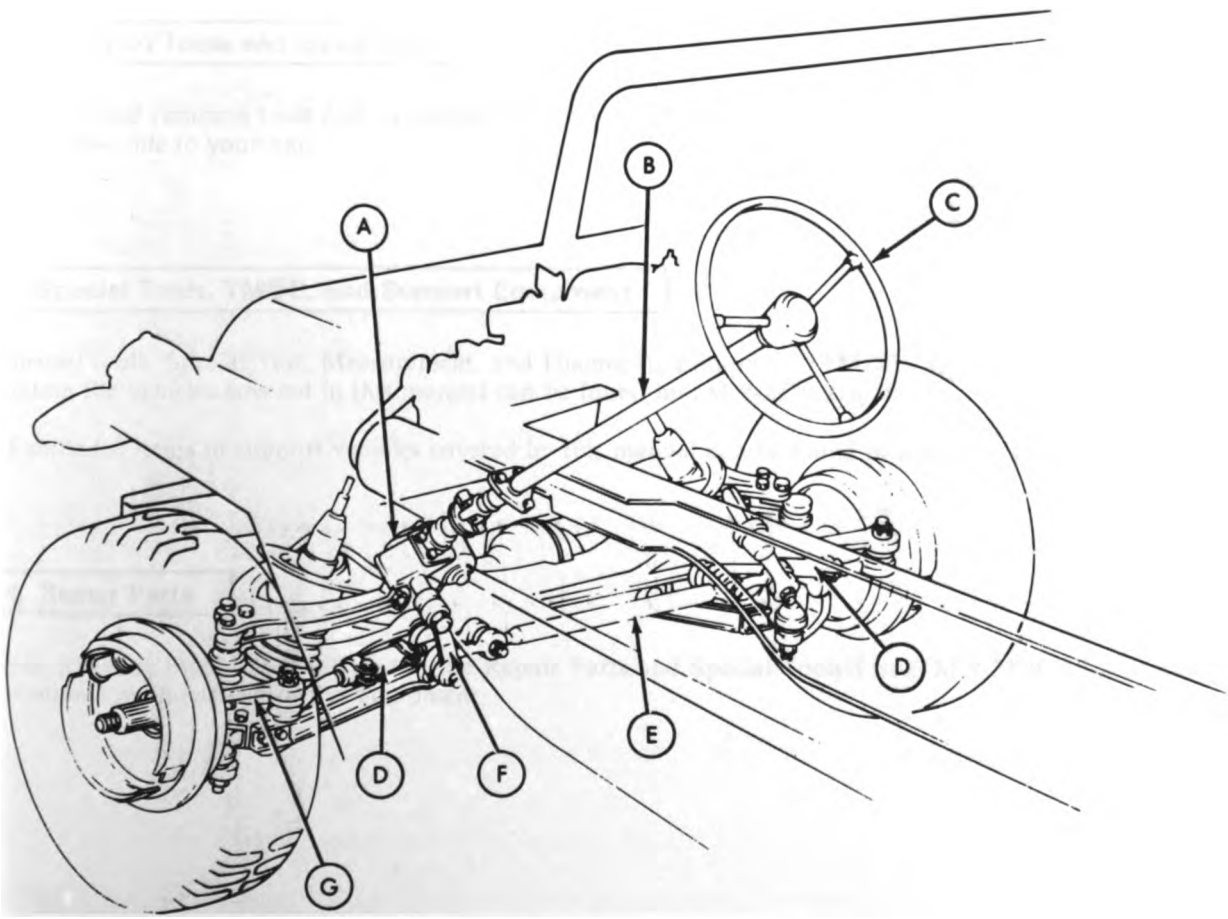
(C) *STEERING WHEEL* — Allows operator to turn steering column.

(D) *TIE ROD END ASSEMBLIES* — Connects left and right wheel spindle support arms.

(E) *IDLER ARM ROD ASSEMBLY* — Supports right center of tie rod assembly.

(F) *STEERING ARM (pitman arm)* — Transfers steering torque from steering gear, and supports left center of tie rod assembly.

(G) *WHEEL SPINDLE SUPPORT ARM* — Allows wheels to be turned by tie rod assembly.



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CHAPTER 3

SERVICE, TROUBLESHOOTING, AND GENERAL MAINTENANCE

3-1. Overview

This chapter provides service and troubleshooting instructions you need to keep the vehicles covered in the anual in good working order. This information is covered in the following sections:

Section I. Repair Parts, Special Tools, TMDE, and Support Equipment (page 3-1)
Section II. Service Upon Receipt (page 3-2)
Section III. Preventive Maintenance Checks and Services (page 3-3)
Section IV. Mechanical Systems Troubleshooting (page 3-29)
Section V. Electrical Systems Troubleshooting (page 3-61)
Section VI. STE/ICE Troubleshooting (Simplified Test Equipment for Internal Combustion Engines) (page 3-158)
Section VII. General Maintenance Instructions (page 3-249)

Section I. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

3-2. Common Tools and Equipment

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment MTOE) applicable to your unit.

3-3. Special Tools, TMDE, and Support Equipment

a. Special tools, Special Test, Measurement, and Diagnostic Equipment (TMDE), and support equipment used o maintain the vehicles covered in this manual can be found in TM 9-2320-218-20P.

b. Fabricated items to support vehicles covered by this manual can be found in appendix E.

3-4. Repair Parts

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (TM 9-2320-218-20P) covering organizational maintenance for this equipment.

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Section II. SERVICE UPON RECEIPT

3-5. General

a. Upon receipt of a new, used, or reconditioned vehicle, you must determine if the vehicle has been properly prepared for service. The following steps should be followed:

(1) Inspect all assemblies, subassemblies, and accessories to be sure they are in proper working order.

(2) Secure, clean, lubricate, or adjust as needed.

(3) Check all Basic Issue Items (TM 9-2320-218-10) to be sure every item is present, in good condition, properly mounted, or stowed.

(4) Follow general procedures for all services and inspections given in TM 9-2320-218-10.

b. The operator will assist when performing service upon receipt inspections.

c. See TM 9-2320-218-10 when testing equipment for proper operation.

3-6. General Inspection and Servicing Instructions

Use TM 9-2320-218-10 and LO 9-2320-218-12 as well as other sections of this manual when servicing and inspecting equipment.

3-7. Specific Inspection and Servicing Instructions

The following steps should be taken while performing specific inspections and services:

(1) Do the S (six-month, or 6,000 mile) preventive maintenance checks and services listed in section III in this chapter.

(2) Lubricate the vehicle according to LO 9-2320-218-12. Do not lubricate gear cases and engine unless processing tag states that the oil is unsuitable for 500 miles of operation. If oil is suitable, just check level.

(3) Schedule a semiannual service on DD Form 314 (Preventive Maintenance Schedule and Record). Arrange for an oil change at 500 miles.

(4) If vehicle is delivered with a dry charged battery, activate it according to TM 9-6140-200-14.

(5) Check vehicle coolant level and determine if solution is proper for climate (see TB 750-651 for preparation of antifreeze solutions).

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Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-8. General

The best way to maintain vehicles of any type is to inspect them regularly. This enables correction of minor faults before they result in serious damage, failure, or injury. This section contains systematic instructions for inspection, adjustment, and correction of vehicle components to avoid costly repairs or major breakdowns. These are preventive maintenance checks and services (PMCS).

3-9. Intervals

Organizational maintenance, assisted by operator/crew, will perform the checks and services contained in table 3-1 at the following intervals:

a. SEMIANNUALLY (S). Every 6 months or 6,000 miles (9,654 km), whichever comes first.

b. ANNUALLY (A). Every 12 months or 12,000 miles (19,308 km), whichever comes first.

c. BIENNIALLY (B). Every 24 months or 24,000 miles (38,616 km), whichever comes first.

d. Perform all (S) inspections in addition to (A) inspections at the time of the annual inspection. Perform all (A) and (S) inspections in addition to (B) inspections at the time of the biennial inspection.

3-10. Reports and Records

All vehicle faults will be reported on DA Form 2404, Equipment Inspection and Maintenance Worksheet.

3-11. General Services and Inspection Procedures

a. While performing specific PMCS procedures, make sure items are correctly assembled, secure, serviceable (not worn or leaking) and are adequately lubricated as defined below.

(1) An item is CORRECTLY ASSEMBLED when it is in the proper position and all parts are installed.

(2) An item is SECURE when wires, nuts, washers, hoses, or attaching hardware cannot be moved by hand.

(3) An item is UNSERVICEABLE if it is worn beyond repair and/or will not perform its designed function.

(4) An item is WORN if there is too much play between joining parts or when marking data, warning, or caution plates are not readable.

(5) LEAKS. TM 9-2320-218-10 contains definitions of Class I, II, and III leaks and their effect on vehicle operation.

(6) An item is ADEQUATELY LUBRICATED if it meets the requirements specified by the lubrication order, LO 9-2320-218-12.

b. The instruction "inspect" refers to a visual inspection.

c. The instruction "tighten" means tighten with a wrench to the given torque value, even if the item appears to be secure. Refer to appendix F for torque limits not specified in PMCS table or maintenance procedures.

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WARNING

Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.

d. The instruction "clean" means use drycleaning solvent (SD-2, Specification P-D 680), to clean grease or oil from metal parts. Use soap and water to clean rubber and plastic materials. After the item is cleaned, rinsed, and dried, apply a light grade of oil to unprotected metal surfaces to prevent rusting.

3-12. Specific PMCS Procedures

a. The preventive maintenance for which you are responsible appears in table 3-1. The checks and services are arranged in logical order to require minimum time and effort.

b. The following columns read across on the PMCS schedule which follows:

(1) ITEM NUMBER. Provides logical order for PMCS. Also used as a source number to record PMCS results on DA Form 2404.

(2) INTERVALS. Shows a bullet (●) opposite each item number to indicate when that check is to be performed.

(3) ITEM TO BE INSPECTED. Lists the system, common name, or location of the item to be inspected.

(4) PROCEDURES. Provides instructions for servicing, inspecting, replacing, or adjusting. In some cases, provides instructions for having item repaired at a higher level.

NOTE

Always do your preventive maintenance checks and services in the order listed. Once it gets to be a habit, you will be able to spot anything wrong in a hurry.

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Table 3-1. Preventive Maintenance Checks and Services

S—Semiannually A—Annually B—Biennially

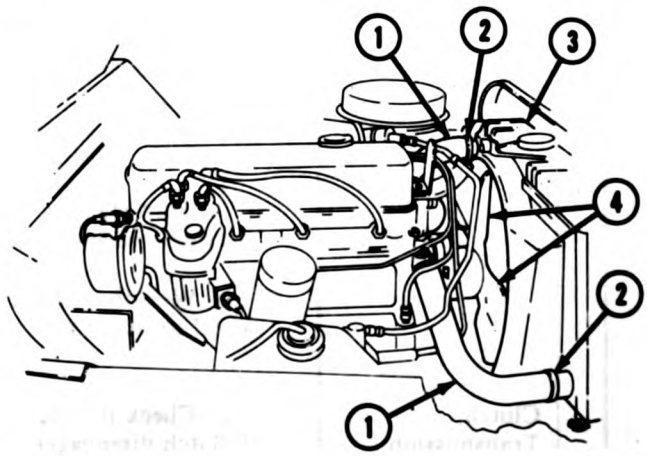
Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					PRIOR TO ROAD TEST
					Perform all before-operation checks listed in TM 9-2320-218-10, "Preventive Maintenance Checks and Services".
					ROAD TEST
					Perform all during-operation checks listed in TM 9-2320-218-10, in addition to those provided below. Drive the vehicle at least five miles (8 km), over varied terrain and on and off road. This will provide ample time to check reported malfunctions, and to locate unreported malfunctions.
1	●			Starter	*a.* Notice if starter makes unusual noises.
	●				*b.* Notice if starting motor engages smoothly and turns the engine with normal cranking speed.
					NOTE
					If STE/ICE is available, perform starter test in accordance with chapter 3, section VI.
2	●			Engine	*a.* In starting and warming engine, observe that it starts easily and that throttle and choke control action is satisfactory.
	●				*b.* Listen for any unusual engine noise at idle and operating speeds, and under acceleration.
	●				*c.* When operating the vehicle, notice if it has normal power and acceleration in each speed range.
					NOTE
					If STE/ICE is available, perform power test in accordance with chapter 3, section VI.
3	●			Steering	*a.* Check vehicle response to steering wheel action. Vehicle should respond instantly, with minimum free play (movement of wheel before engaging steering gear). With the vehicle moving forward, free play should not exceed 1/2 inch or 1.3 centimeters in either direction. Excessive free play may indicate worn steering gear or linkage. Measure free play at outside diameter of steering wheel.
	●				*b.* Turn steering wheel left, then right, to detect hard steering, steering backlash, or shimmy.
	●				*c.* With the vehicle on straight, level terrain, lightly hold steering wheel to detect pull or wander.
4	●			Clutch, Transmission, and Transfer	*a.* Check if clutch pedal return spring action is satisfactory. Note if clutch disengages completely or if it has a tendency to drag.

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
	•				*b.* Put transmission lever in neutral and depress clutch pedal. Listen for unusual noise which may indicate a defective release bearing.
	•				*c.* Note operation of transfer in all output combinations. Check ease of shifting. Listen for unusual noise and check for lubrication leakage which may indicate malfunction.
					AFTER ROAD TEST
					Perform all after-operation, weekly and monthly checks in TM 9-2320-218-10 PMCS. Then make the following inspections in the order given, including kit items on vehicles so equipped.
4.1	•			Parking Brake Operation	*a.* Select a road or hard surface with sufficient space for driving and stopping distance. Draw a visible line across the road surface, leaving sufficient space for stopping.
	•				*b.* Position vehicle at a starting point. Attain a vehicle speed of approximately 5 mph (8.045 km/h). When rear wheels cross marked line, depress clutch and apply parking brake.
	•				*c.* Measure stopping distance from marked line to rear wheels. Stopping distance must not exceed 5 ft. (1.525 m).
5	•			Cooling System	*a.* Inspect hoses (1) and clamps (2) for wear and serviceability. Tighten loose clamps as required.
	•				*b.* Inspect radiator (3) for clogging, bent fins, or protruding objects. Clean clogged radiator and remove protruding objects.
	•				*c.* Test coolant for corrosion with test kit NSN 6630-00-169-1506, using instructions provided with the kit. If you find evidence of excessive corrosion, or every four years, drain and flush radiator and cylinder block. Refill cooling system and add rust inhibitor, unless antifreeze containing rust inhibitor is used. Test antifreeze and add as required.
	•				*d.* Inspect fan blades (4) for security, cracks, and missing or loose bolts. Replace the fan assembly if you find evidence of cracking or damage.



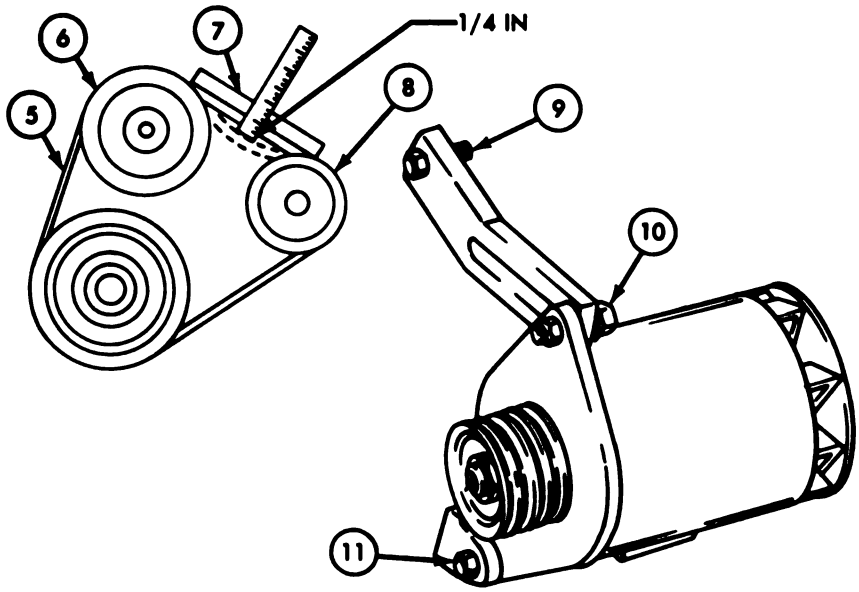
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
6	•			Fan and Alternator Belts	*a.* Check belts (5) for proper tension and adjust as required. With a straight edge (7) on the water pump and alternator pulleys (6) and (8), deflection on the belt(s) midpoint should approach, but not exceed 1/4 in. (.6 cm).
	•				*b.* Tighten two alternator mounting bolts (11), 60-75 lb-ft (81-102 N•m).
	•				*c.* Tighten adjustment arm bolt (10), 35-40 lb-ft (47-54 N•m).
	•				*d.* Tighten adjustment arm bolt (9) to engine block, 47-56 lb-ft (63-75 N•m).



NOTE

If STE/ICE is available, perform alternator output test in accordance with chapter 3, section VI.

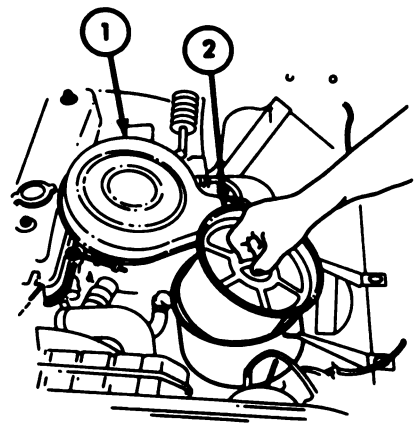
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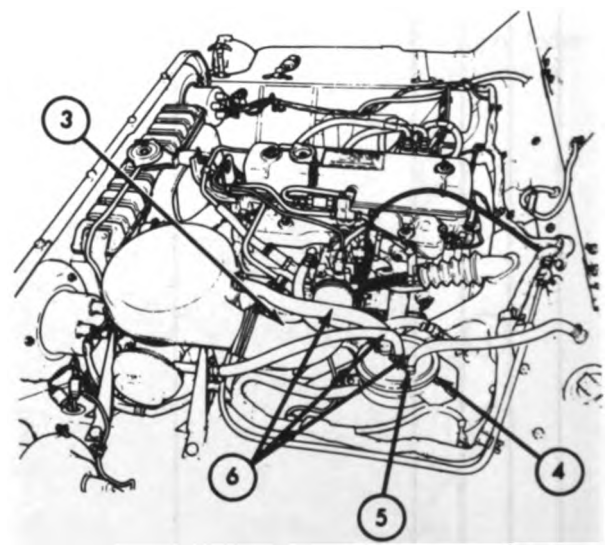
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
7	•			Air Intake and Evaporative Control Systems	*a.* Check air cleaner (1) and air intake hose (3) for security and/or damage.
	•				*b.* Check air cleaner element (2) for contamination; clean if necessary. Inspect for proper oil level; add oil as required (refer to LO 9-2320-218-12).
					NOTE The carbon canister is installed only on vehicles with emission controls.
	•				*c.* Check carbon canister (4) for exterior damage or leaks. Check hose clamps (5) at canister for tightness; tighten as required. Check condition of hoses (6) and (3).
			•		*d.* Replace carbon canister (4).



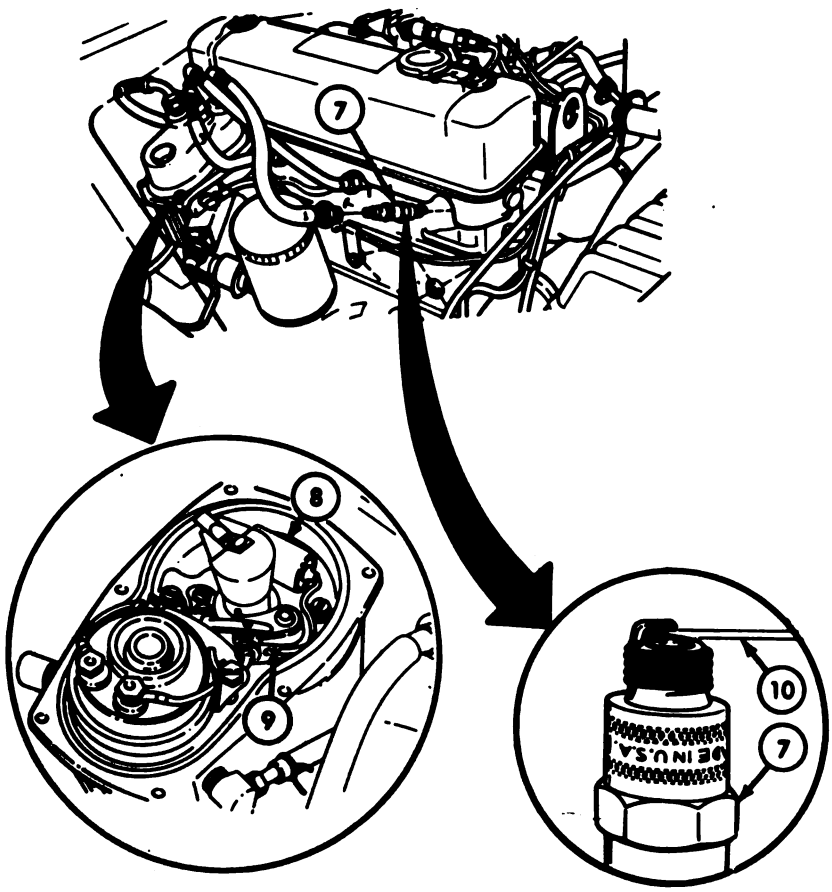


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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

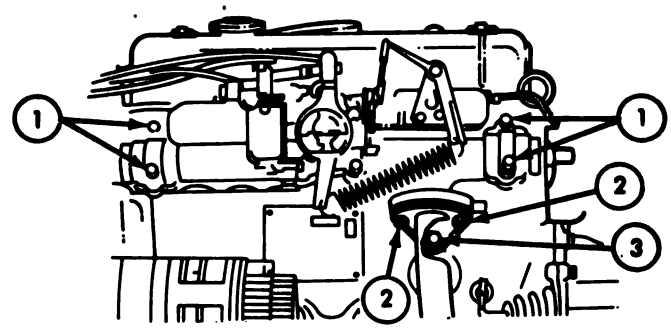
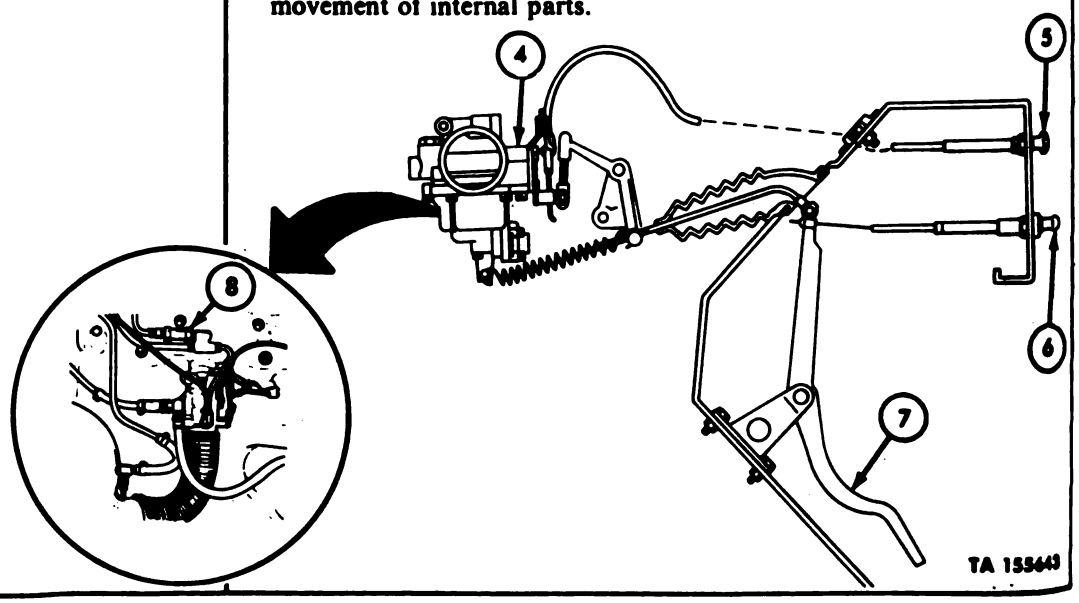
S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
.8	●			Ignition System	*a.* Visually inspect ignition system components for serviceability.
	●				*b.* If observed engine performance shows excessive loss of power, misfire, or exhaust smoke, isolate the difficulty by troubleshooting.
		●			*c.* On vehicles with standard ignition system, replace spark plugs (7), ignition points (9), and condenser (8).
			●		*d.* On vehicles with solid-state ignition systems, replace spark plugs (7).
					NOTE Spark plug gap (10) is 0.032 to 0.036 in. (0.081 to 0.091 cm).
					
9	●			Engine	*a.* Perform engine oil change and/or filter change as required by LO 9-2320-218-12.
		●			*b.* Adjust carburetor, ignition timing, and valve lash.
	●				*c.* Inspect carburetor for fuel leaks. Repair any leaks. TA 155642

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biannually

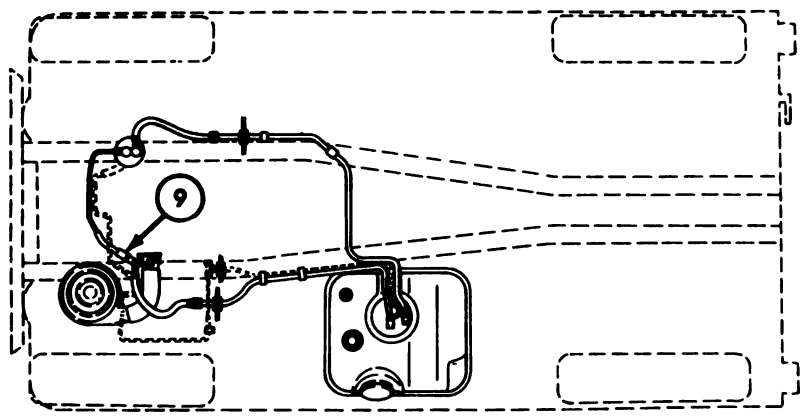
Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					NOTE If STE/ICE is available, perform compression and cylinder balance test in accordance with chapter 3, section VI.
	•				*d.* Tighten exhaust manifold locating bolt (3). 20-30 lb-ft (27-41 N•m).
	•				*e.* Tighten four exhaust manifold-to-exhaust ports capscrews (1). 18-23 lb-ft (24-31 N•m).
	•				*f.* Tighten two front exhaust pipe-to-exhaust manifold nuts (2). 15-20 lb-ft (20-27 N•m).
	•				*g.* Inspect all exhaust manifold connections for leaks.
					
10	•			Linkage and Lines	*a.* Inspect choke control (5), throttle control (6), and accelerator pedal (7) linkage to ensure that choke and throttle valves on the carburetor (4) open fully. Adjust the linkage as required.
		•			*b.* Clean and inspect crankcase ventilation valve (8) for free movement of internal parts.
					

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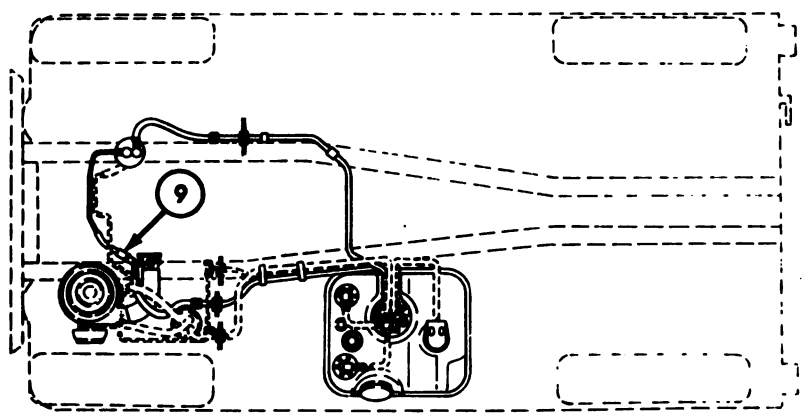
Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
11	●			Fuel and Vent Systems	*a.* Inspect fuel lines and ventilation lines in engine compartment and under vehicle for leaks. Check lines and connections for leaks, and inspect all metal tube assemblies for cracks, dents, and sharp bends.
	●				*b.* Raise driver's seat and inspect fuel tank for leaks and/or exterior damage.
		●			*c.* Replace in-line fuel filter (9).



VEHICLE WITHOUT VAPOR CANISTER



VEHICLE WITH VAPOR CANISTOR

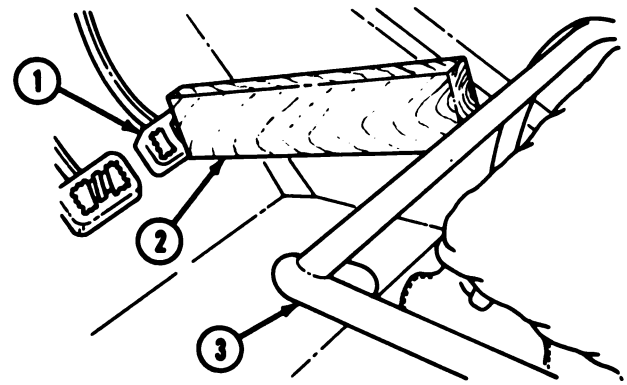
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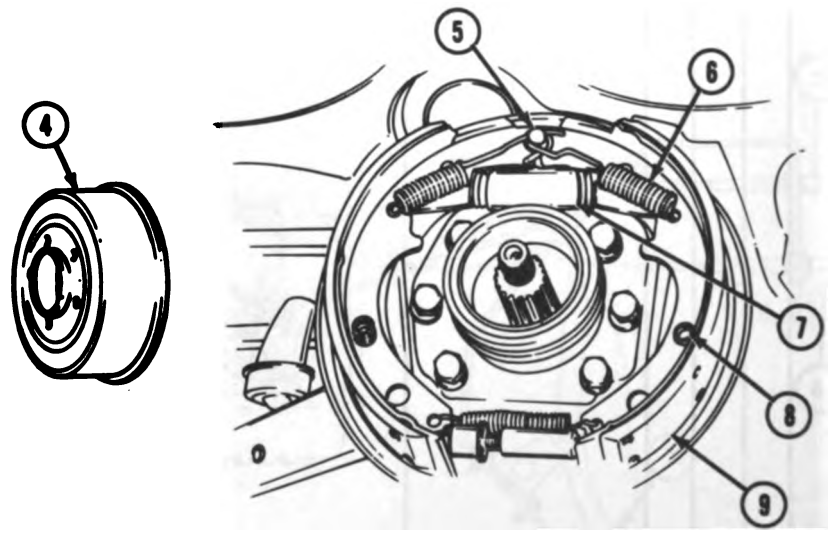
Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
12	•			Wiring	Check front wiring harness for loose connections or worn insulation. Repair as required.
13	•			Service Brake System	*a.* Check operation of wheel cylinders. Raise vehicle and ensure each wheel can be turned by hand. Depress brake pedal (1) to the floor as far as possible and place a block of wood (2), approximately 16 to 18 in. (40.64 to 45.72 cm) long, between brake pedal (1) and driver's seat frame (3). Wheels should now be locked and unable to be turned. Remove wood block (2).



b. Remove all four wheel and tire assemblies from vehicle. Inspect for wear and condition of brakedrum (4), lining on shoe (9), holddown (8), shoe anchor (5), and retracting springs (6). Also inspect wheel cylinder (7) for leaks and proper size.



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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

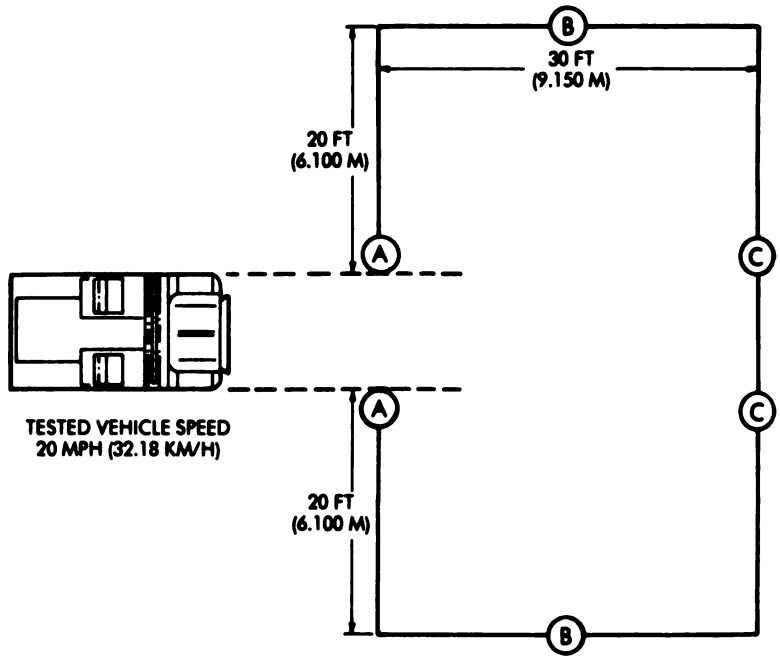
S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
	●				*c.* Check brake hoses for leaks or cracks. Pay extremely close attention to all flexible hydraulic brake lines. Check for wear, pinching, or interference where the brake hose is close to the frame. If any of these are found, carefully inspect hose for serviceability, and repair or reposition to prevent failure. When any hose is worn, chafed, cracked, crimped, or abraded, resulting in hose damage through the outer casing to the first ply of fabric, that hose assembly must be replaced. If there is any evidence of hose leakage or internal damage such as bulges, that hose must be replaced.
13.1	●			Vehicle Service Brake Road Test	**WARNING** Direct all personnel to stay clear of vehicle path during road test. Loss of vehicle control will cause serious or fatal injury. *a.* Check brake pedal free travel. *b.* Check master cylinder fluid level. *c.* Check tires for correct air pressure and tread depth. *d.* Drive vehicle at speed of 3 to 5 mph (4.8 to 6.0 km/h) free from obstructions. Apply brakes gently. If vehicle fails to stop, use parking brake to bring vehicle to complete stop. Proceed to step h. *e.* Make several stops at low speed before continuing with road test. *f.* Position two observers on the road, one on each side of vehicle, a minimum of 20 feet (6.1 m) from path of vehicle, at a point where maximum observation can detect the braking operation of the tested vehicle (see brake road test diagram). *g.* Make several stops from a speed of 20 mph (32.18 km/h) and have vehicle operator and observers record unusual service braking conditions. *h.* For any malfunction, refer to mechanical troubleshooting.

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					

Brake Road Test Diagram

(A) BRAKE PRESSURE APPLIED AT START OF 30 FT (9.150 M) MARKED AREA

(B) OBSERVERS

(C) END OF 30 FT (9.150 M) MARKED AREA

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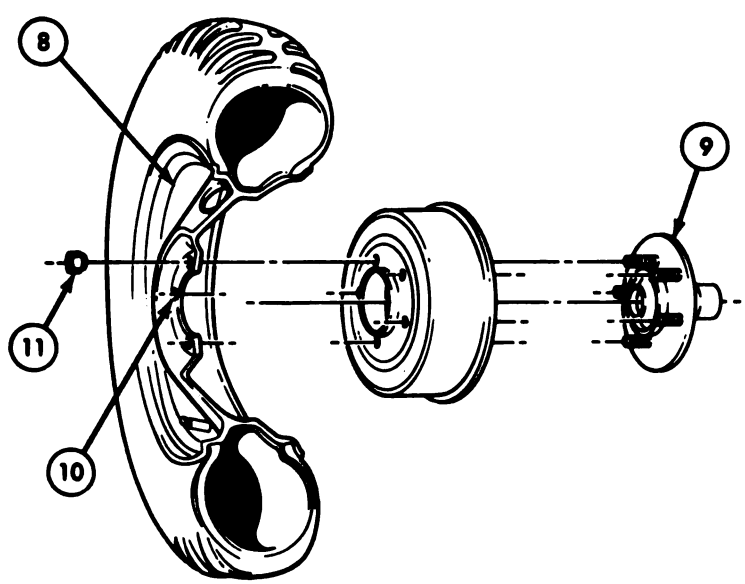
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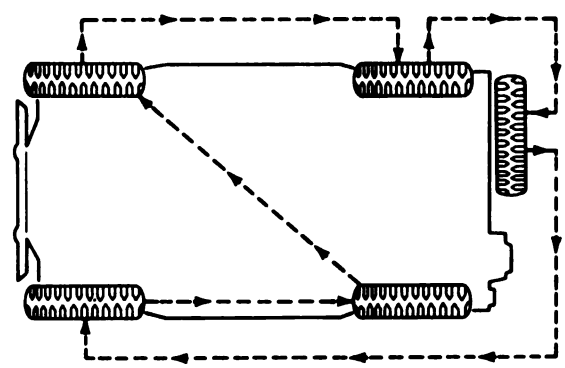
S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
14	•			Wheels and Tires	*a.* Inspect wheels (8) for bent, cracked, worn or elongated mounting stud holes (10). Also inspect mounting studs (9) and wheel nuts (11) for worn or stripped threads.
	•				*b.* Tighten wheel nuts (11), 80-110 lb-ft (109-149 N•m).
	•				*c.* Inspect tires for normal wear occurring from routine over-the-road tire scrubbing and friction.
	•				*d.* Inspect tires for unusual uneven wear occurring at a rapid rate resulting in reduced steering performance. Rapid, uneven tire wear is usually caused by a mechanical maladjustment or misalinement of vehicle steering components.

NOTE

- If tires show unequal wear, rotate tires as shown in accordance with TM 9-2610-200-24.
- For abnormal tire wear, refer to "Troubleshooting", TM 9-2320-218-10.





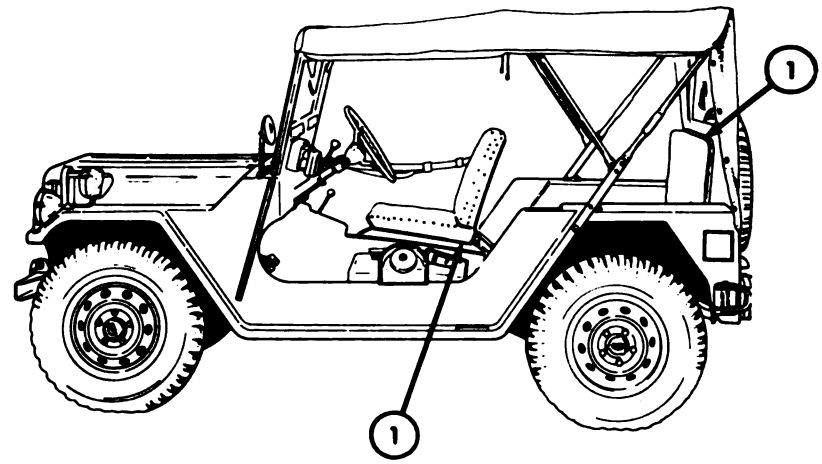
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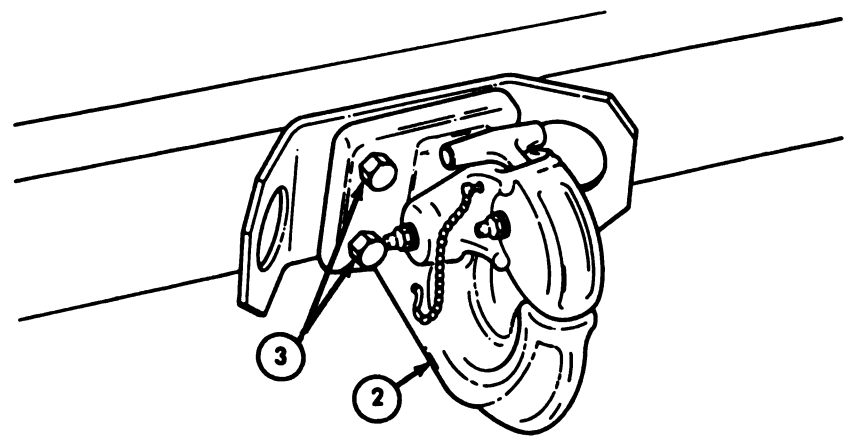
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
15	●			Body and Accessories	*a.* Examine condition of paint, and touch up as required.
	●				*b.* Examine seat cushions for tears, open seams, and wear.
	●				*c.* Examine seat frames (1) for cracks, breaks, and bent condition. Also check operation of front seat adjusting mechanism. It should be free and smooth through entire adjustment travel.
	●				*d.* Check operation of pintle hook (2).
	●				*e.* Check retaining pin and attaching chain for security.
	●				*f.* Tighten four pintle hook capscrews (3), 60-80 lb-ft (81-108 N•m).
	●				*g.* Check markings and name, caution, and identification plates for legibility.





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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
15.1	e			Vehicle	*a.* Inspect vehicle for evidence of rust and corrosion. **NOTE** Rust and corrosion have been classified into four stages. *Stage 1:* Red, black, or white corrosion deposits on surface accompanied by etching and pitting. Base metal is sound. *Stage 2:* Powdered granular or scaled condition resulting in corrosion of material from the surface. Base metal is sound. *Stage 3:* Surface condition and corrosion deposits are similar to stage 2 except metal in corroded area is unsound and small pin holes may be present. *Stage 4:* Corrosion has advanced to point where surface has been penetrated. No metal remains at point of severest corrosion. Rust holes exist in surface area or metal is completely missing along edge. **NOTE** • Using inspection light, inspect entire vehicle, paying particular attention to areas where dirt and/or moisture collect. • Any seam beginning to split and/or expand must be repaired, as well as metal surfaces that have begun to pit and/or flake.
	●			Vents and Plugs	Remove vents and plugs that will enable closer inspection of sheet metal.
	●			Hood and Fenders	Open and check perimeter of hood. Proceed to top seams of fenders, and inspect front fenders and wheelhouse seams through fender openings.
	●			Frame	Inspect for flaking of paint and metal.
	●			Battery Box, Radiator Supports, and Headlights	Inspect for flaking of paint and metal.
	●			Side Panels	Check both sides of vehicle for bubbling and/or discolored paint. If rust is discovered, determine if it is surface rust or rust developing from the inside moving to the outside.

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

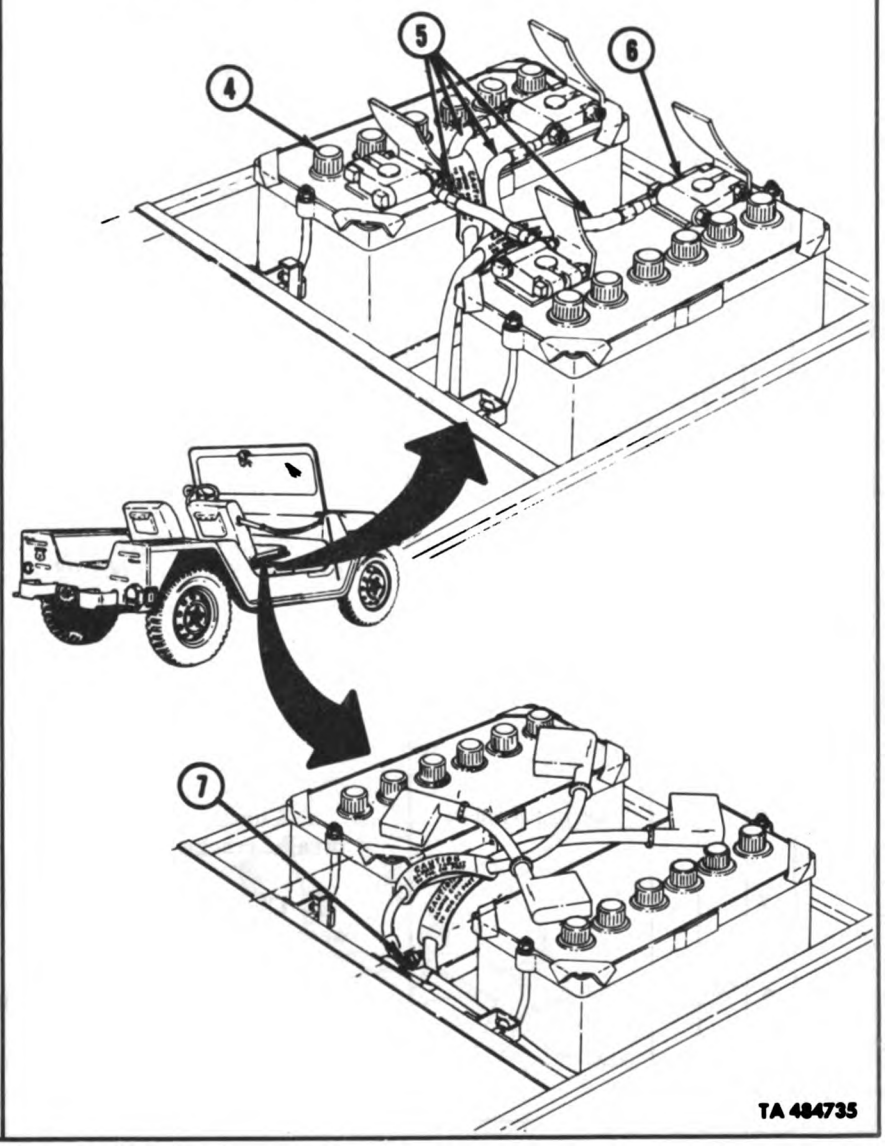
S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					NOTE If a seam has begun to discolor, it must be repaired along with all other rust damage.
	•			Doors	Check all seams, doorjambs, and doglegs. Look for split seams, discolored, chipped, and bubbled paint. If rust appears under bubbled paint, rust has worked its way through the metal and must be repaired.
					NOTE If necessary, raise vehicle on hoist to inspect underside.
	•			Quarter Panel, Floor, Taillights, and Vehicle Underside	Inspect quarter panel, floor extensions, seams, taillight openings, vehicle underside, and rollover protection system (ROPS) mounting points.
	•				*b.* Repair vehicle rust and corrosion damage using the following standards: *1.* Vehicles with stage 1 or stage 2 rust and corrosion damage will be cleaned, primed, topcoated, and rustproofed as necessary (refer to TB 43-0213). *2.* Vehicles with stage 3 or stage 4 rust and corrosion damage will be repaired and painted or have assemblies replaced with new assemblies if repair is uneconomical. All repaired vehicles shall be rustproofed (refer to TB 43-0213).
					WARNING • Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and do not smoke when servicing batteries. Severe injury will result if acid contacts eyes or skin. • Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.
					NOTE Test batteries only after engine has been stopped for five minutes or more. Remove passenger seat and battery cover for access to batteries.

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

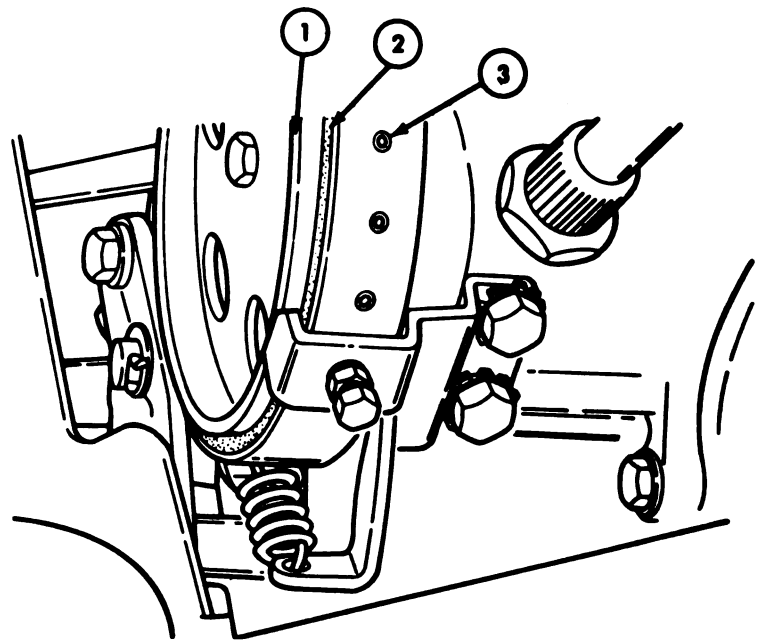
S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
16	•			Batteries	*a.* Unscrew the six filler caps (4) on each battery. Check and record specific gravity of each cell.
	•				*b.* Inspect cables (5) and clamps (6) for tightness and condition.
	•				*c.* Clean, repaint, or replace battery carrier as necessary.
	•				*d.* Inspect battery junction terminal (7) for looseness, corrosion, and damage.
					NOTE If STE/ICE is available, perform battery condition test in accordance with chapter 3, section VI.
					

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

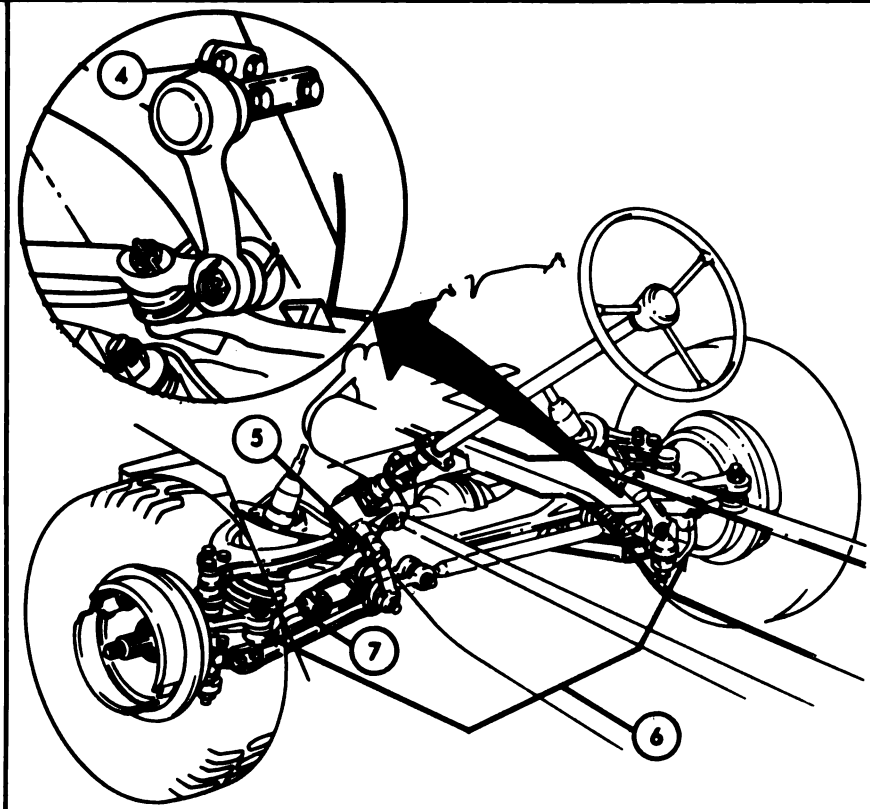
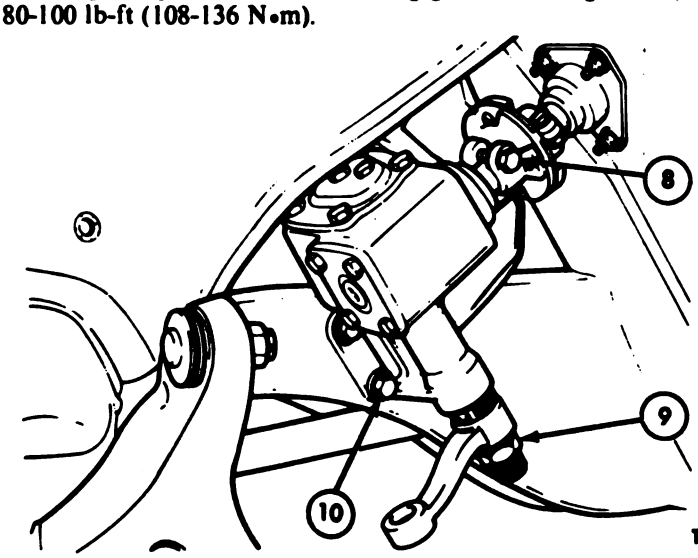
Item No.	Interval S	A	B	Item To Be Inspected	Procedures
17	●			Parking Brake	*a.* Inspect for correct clearance of .010 in. (.025 mm) between band assembly (2) and parking brakedrum (1).
	●				*b.* Replace band assembly if thickness is less than 1/8 in. (3 mm) or if any rivet (3) is missing.
					
18	●			Steering System	*a.* Check linkage assembly (6), tie rod (7), and pitman arm (5) for breaks, cracks, wear, and unserviceability.
	●				*b.* Check toe-in adjustment on wheels with tires showing uneven wear. Adjust toe-in.
	●				*c.* Perform vehicle turning radius check (TM 9-2320-218-20-1-2).
	●				*d.* Tighten three idler arm bracket-to-frame nuts (4), 24-36 lb-ft (33-49 N•m).

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

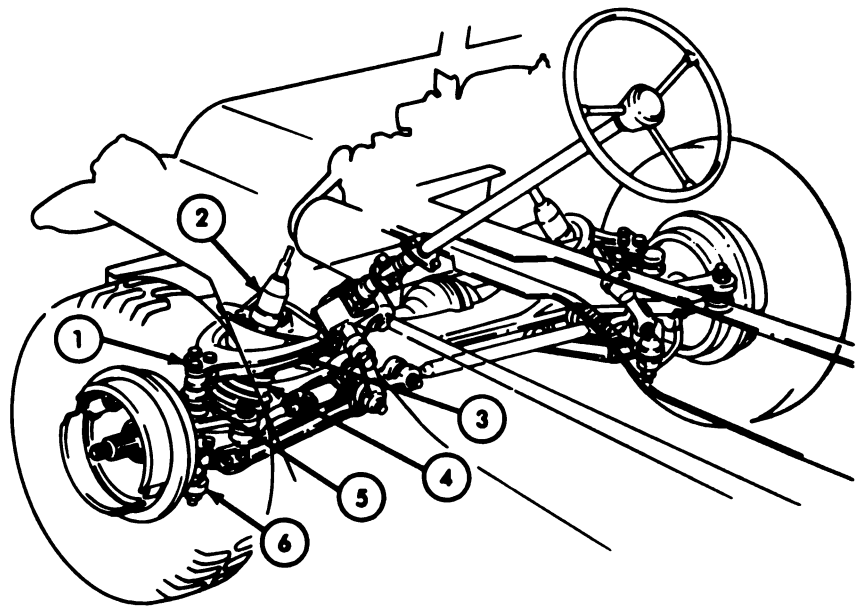
Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					
	●				*e.* Tighten steering gear to column shaft flange coupling bolt (8), 26-34 lb-ft (35-46 N•m).
	●				*f.* Tighten three steering gear capscrews (10), 24-36 lb-ft (33-49 N•m).
	●				*g.* Tighten pitman arm to steering gear mounting nut (9), 80-100 lb-ft (108-136 N•m).
					

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
19		•		Front Suspension	*a.* Tighten twelve upper and lower front suspension ball joint mounting capscrews (1), 35-40 lb-ft (47-54 N•m).
		•			*b.* Check upper (5) and lower (6) ball joints for damage and wear. Ball joints should be replaced if they show any signs of vertical or lateral free play, and broken or cracked seal boot.
		•			*c.* Inspect suspension arms (3), springs (4), shock absorbers (2), and brackets for damage.



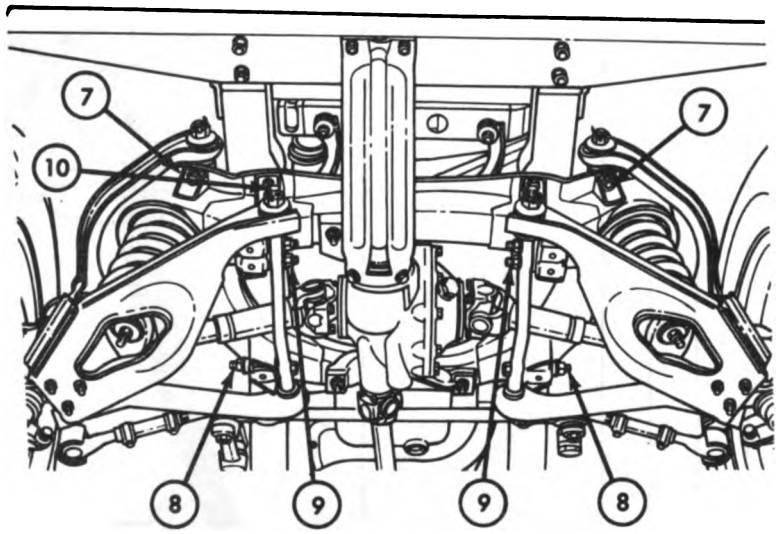
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
		●			*d.* Tighten four front suspension upper control arm mounting nuts (7), 75-85 lb-ft (102-115 N•m).
		●			*e.* Tighten two front suspension rear lower control arm mounting bolts (8), 45-65 lb-ft (61-88 N•m).
		●			*f.* Tighten four front suspension front lower control arm bolts (9), 40-55 lb-ft (54-74 N•m).
		●			*g.* Tighten eight front suspension crossmember bolts (10), 27-37 lb-ft (36-50 N•m).



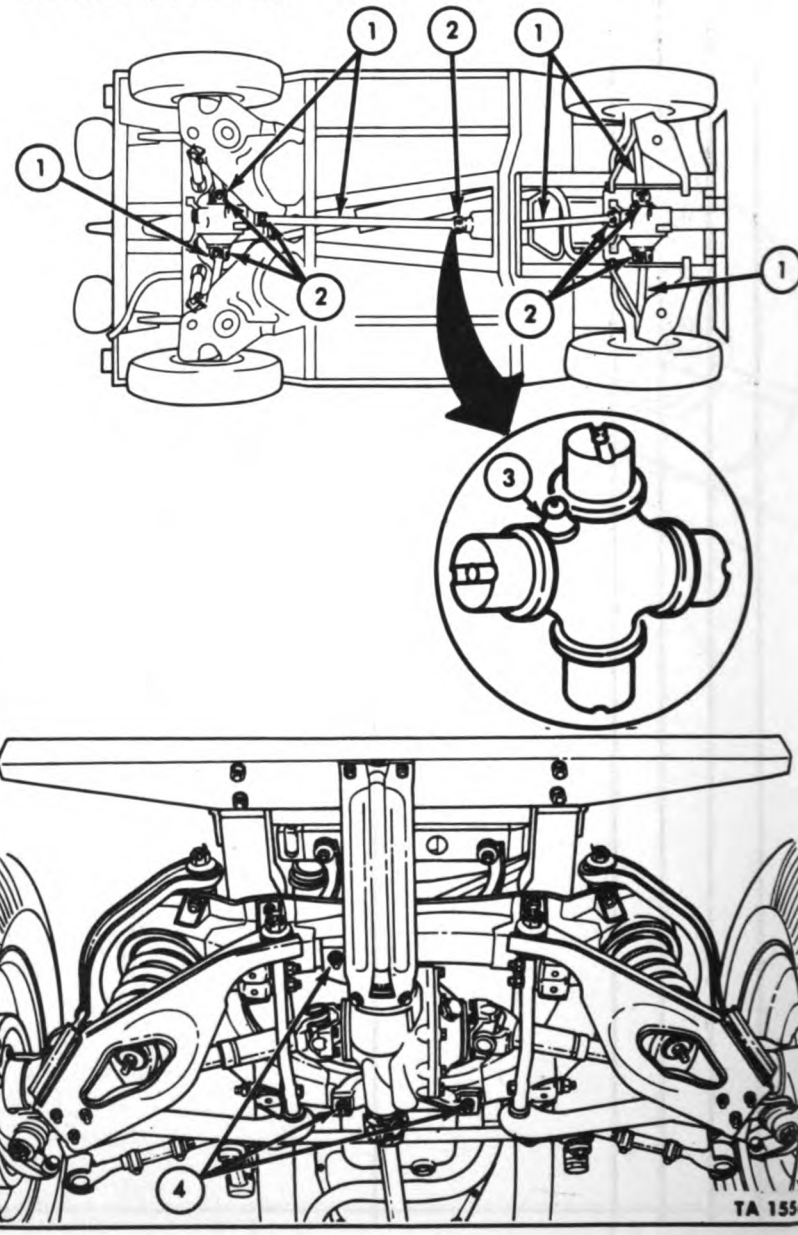
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
20	•			Propeller Shafts, U-Joints, and Differentials	*a.* Inspect for bent shafts (1), loose U-joints (2), damaged seals, or damaged lubricant fittings (3).
	•				*b.* Tighten eight front and rear propeller shaft bolts, 15-20 lb-ft (20-27 N•m).
	•				*c.* Tighten sixteen front and rear wheel drive shaft U-bolt nuts.
	•				*d.* Tighten six front and rear differential mounting bolts (4), 30-40 lb-ft (41-54 N•m).

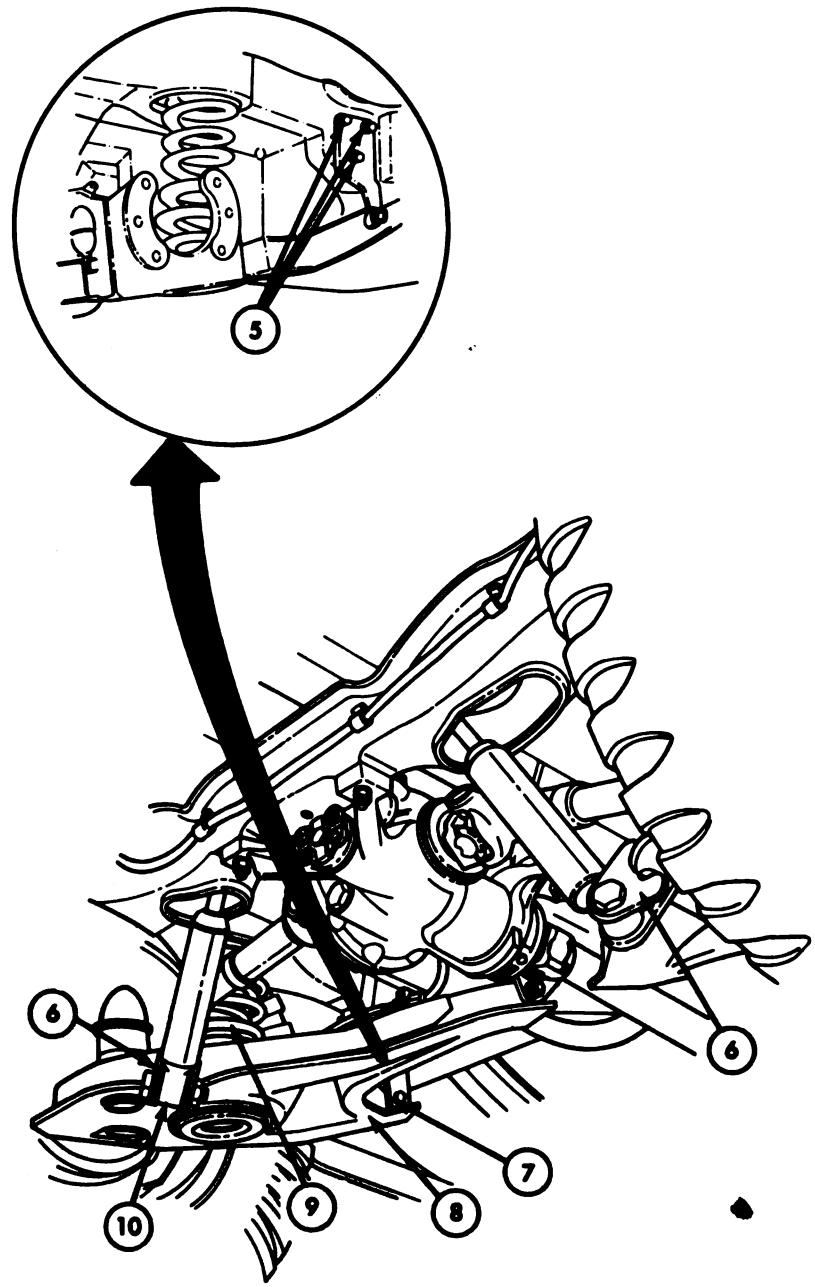


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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
21	•			Rear Suspension	*a.* Inspect suspension arms (8), springs (9), shock absorbers (10), and brackets (6) for damage.
	•				*b.* Tighten four rear suspension arm pivot capscrews (7), 60-70 lb-ft (81-95 N•m).
	•				*c.* Tighten six rear suspension bracket to body bolts (5), 40-55 lb-ft (54-74 N•m).

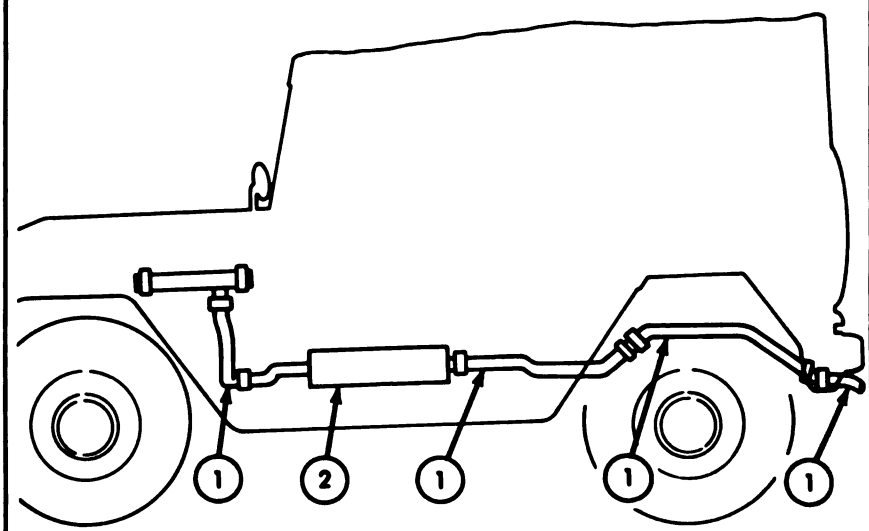


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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
					WARNING Do not touch hot exhaust pipes or muffler with bare hands. Severe injury can result.
22	●			Exhaust System	Inspect muffler (2) and exhaust pipes (1) for damage and leaks. Check pipe joints for smudges, which indicate an exhaust leak.
23	●			Lubrication	Perform complete vehicle lubrication as required by LO 9-2320-218-12. **NOTE** Make the following inspections of kit equipment only as required on vehicles so equipped.



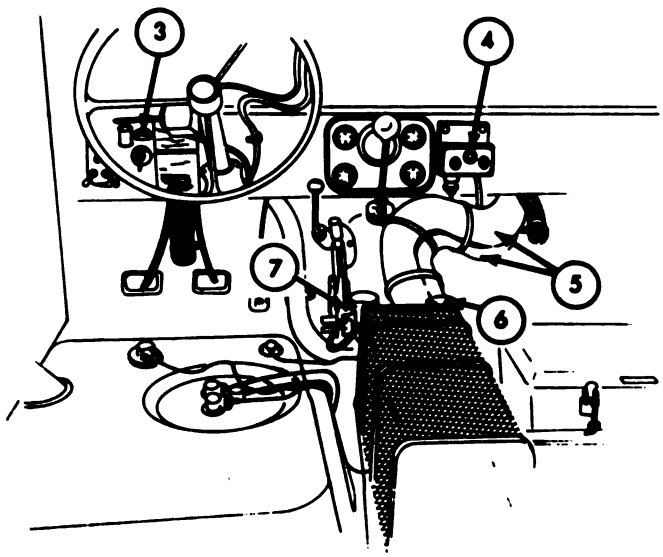
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
24	●			Winterization Kit	*a.* Check tightness of hose clamps, duct mounting and connections, electrical connections, mounting and attaching screws, and controls. Also check ducts (5) for obstructions and condition.
	●				*b.* Check operation of heater and fuel pump. Indicator light (4) should come on within two minutes. Heavy exhaust smoke indicates a heater malfunction.
	●				*c.* Check operation of battery compartment damper actuator handle (6). Damper (in diverter box) should close when compartment temperature reaches about 100°F (38°C), and open when temperature reaches about 70°F (21°C).
	●				*d.* Check operation of exhaust diverter control handle (7).
	●				*e.* Check operation of defroster. You should feel hot air from both nozzles (below windshield) when the damper control handle (6) and the defroster control handle (3) are both pulled out.



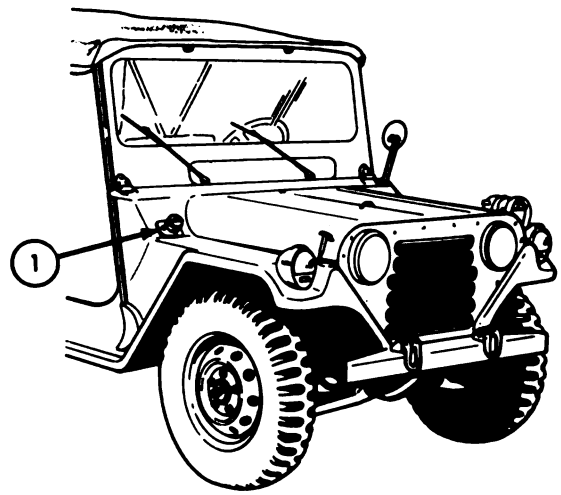
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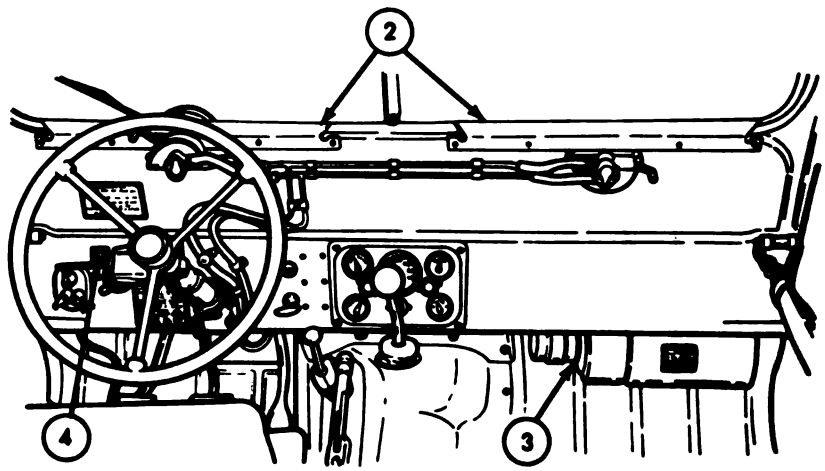
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
	•				*f.* Inspect slave receptacle (1) for secure mounting and connections. Check cable for frayed insulation or loose connections. Repair as required.
25	•			Hot Water Heater Kit	*a.* Inspect heater wiring and electrical components, heater switch (4), and blower motor (3), for operation, loose connections, and frayed wiring.
	•				*b.* Inspect for loose defroster nozzles on defroster outlet (2). Tighten as necessary.





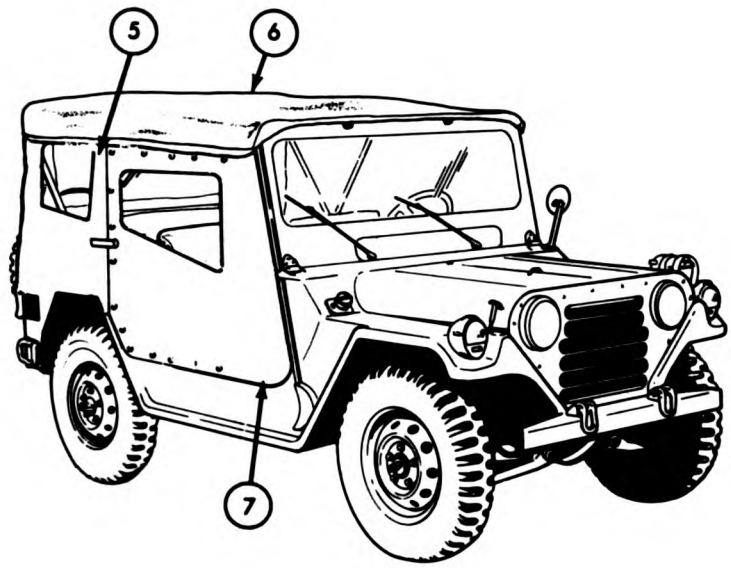
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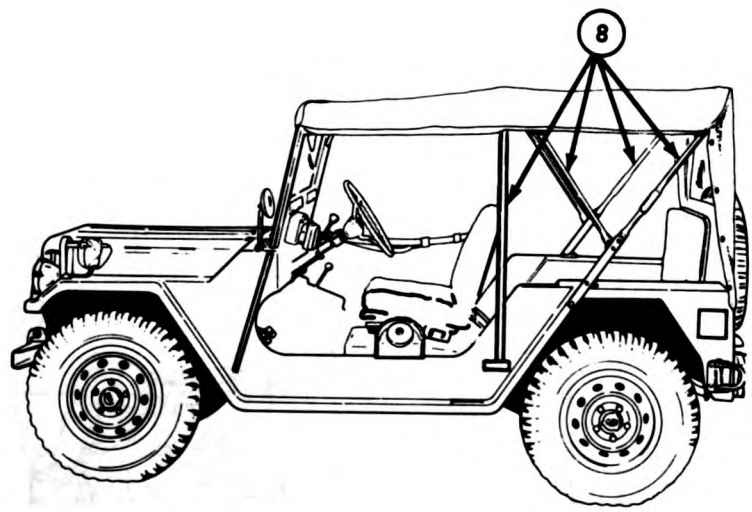
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
26	•			Door and Side Curtain Kit	Inspect top (6), door (7), and side (5) canvas, and rod assemblies (8) for damage and security of mounting. Tighten or repair as required.





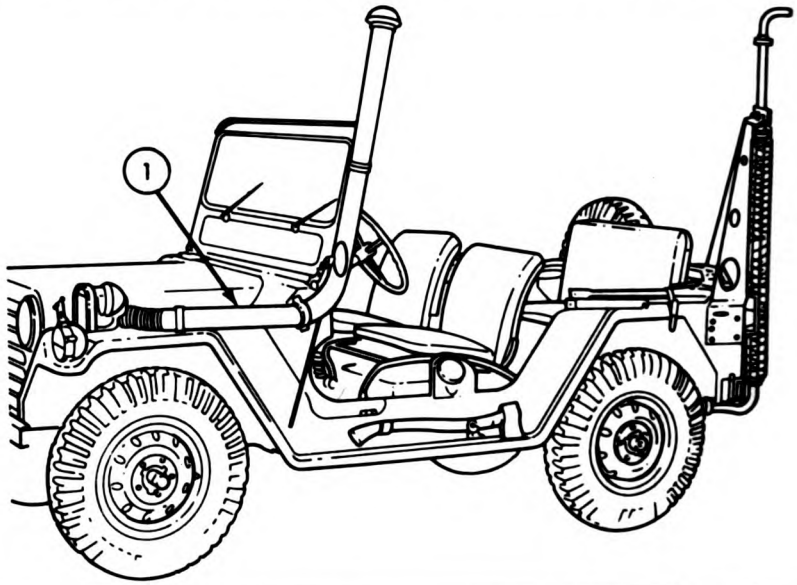
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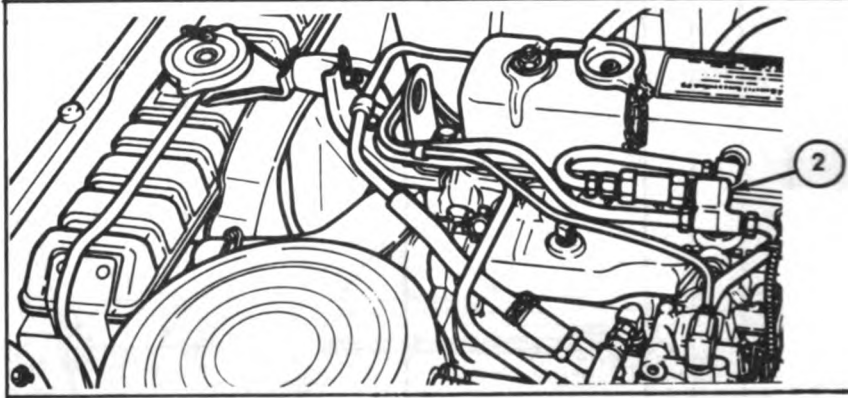
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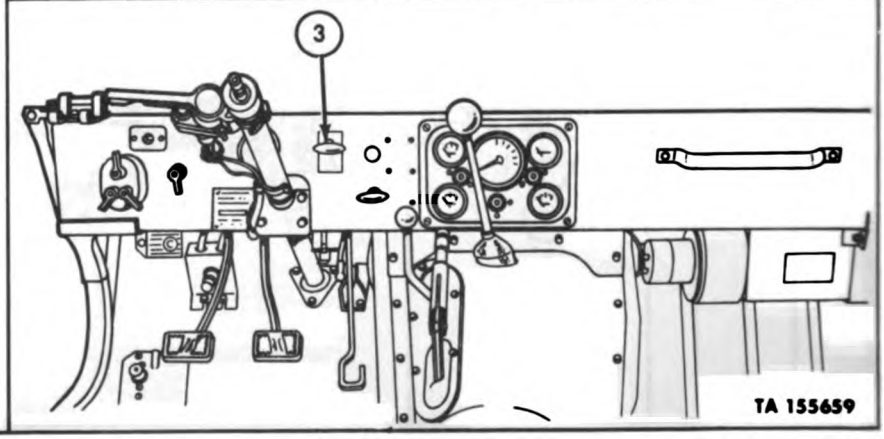
Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
27	•			Deepwater Fording Kit	*a.* Inspect air intake tube (1) for secure attachment to body and tight connection to air cleaner.
	•				*b.* Verify operation of fording valve (2), controls (3), and linkage.



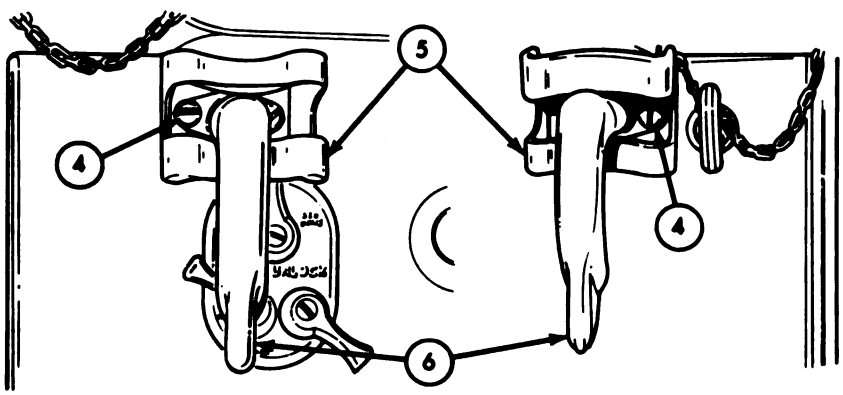
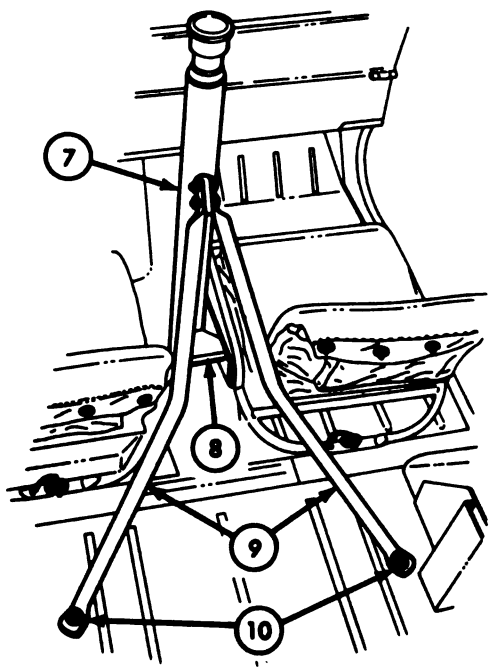




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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

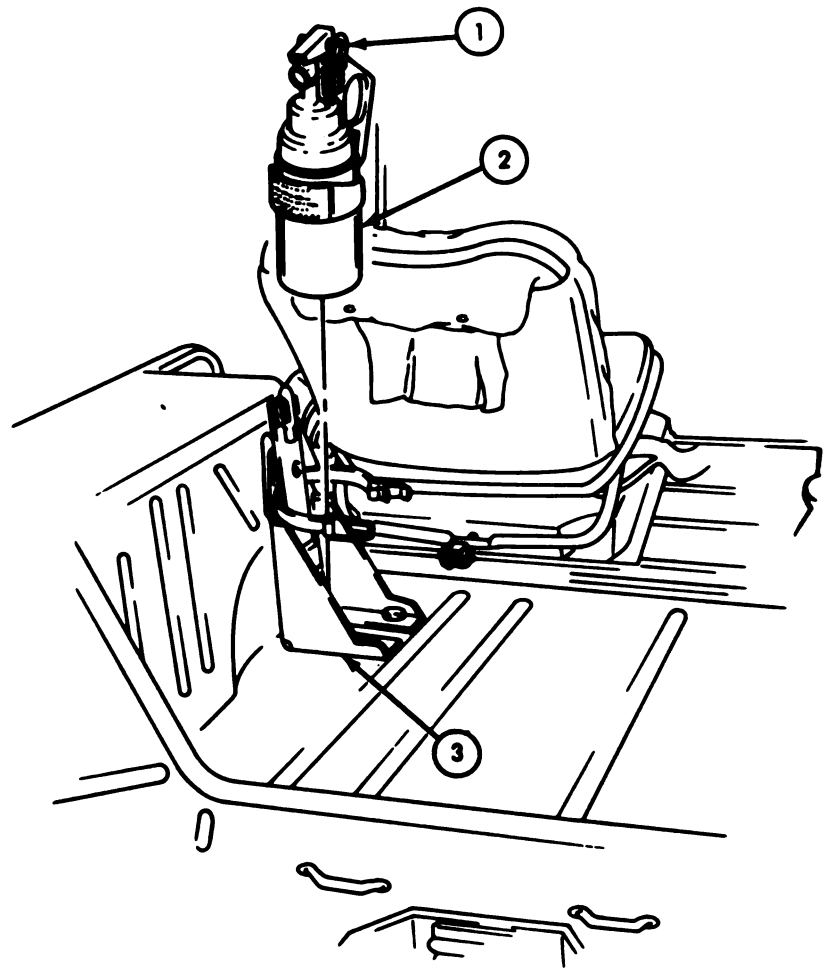
S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item To Be Inspected	Procedures
28	•			M16/14 Rifle Mounting Kit	Inspect attaching screws (4), catches (6), and support assemblies (5) for secure attachment. 
29	•			M4 Gun Mount Pedestal	*a.* Check condition of pedestal gun mount (7).
	•				*b.* Check attaching bolts (10), upright socket (8), and braces (9) for secure attachment.  TA 155660

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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	A	B	Item To Be Inspected	Procedures
30	•			Decontamination Kit	*a.* Inspect kit cylinder (2) for damage. Check if lead seal (1) is intact, indicating kit has not been pressurized (used).
	•				*b.* Inspect mounting bracket (3) for damage and secure attachment. Also check condition of retaining clamp.
					
					FINAL ROAD TEST
31	•			Final Road Test	Conduct a final road test over varied terrain after the PMCS and required repairs are complete. Pay particular attention to items which were repaired or adjusted. Correct any defects or malfunctions that may occur during this test.

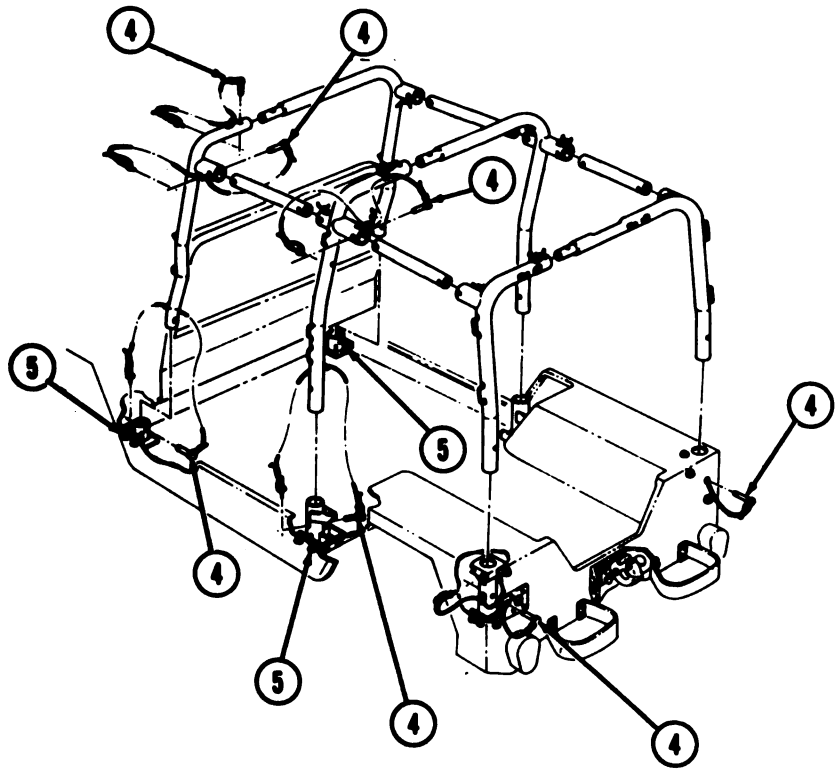
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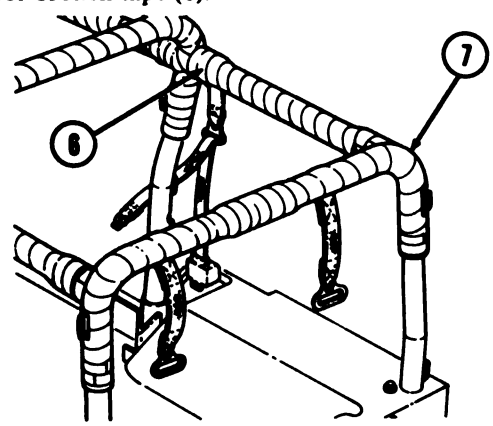
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually **A—Annually** **B—Biennially**

Item No.	Interval S	Interval A	Interval B	Item to be Inspected	Procedures
32	•			Rollover protection system (ROPS)	*a.* Inspect all rollbar connecting points for pin assembly (4) installation and security. Install and secure as required.
	•				*b.* Check all mounting hardware nuts (5) for tightness. Tighten 30-40 lb-ft (41-54 N·m).
	•				*c.* Inspect for torn, rotted, and missing impact padding (7). Replace as required.
	•				*d.* Check for broken tape (6).





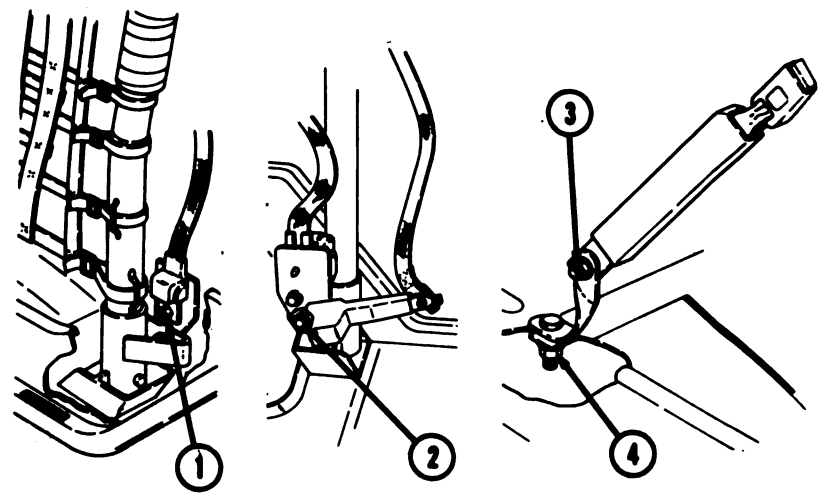
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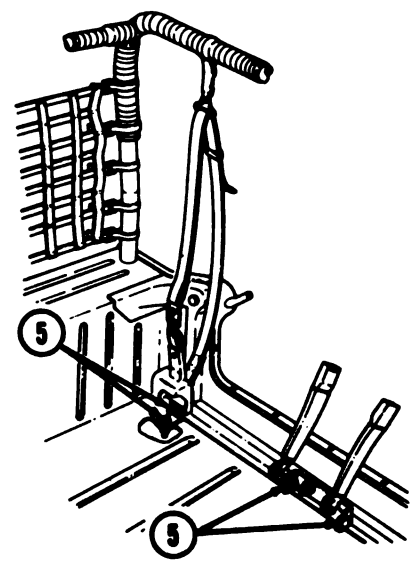
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item to be Inspected	Procedures
	●				*e.* Check for looseness of front seatbelt assembly hardware.
	●				*f.* Tighten shoulder belt retractor nut (1) 60 lb-ft (81 N·m).
	●				*g.* Tighten retractor bracket screw (2) 90 lb-ft (122 N·m).
	●				*h.* Tighten floor anchor bracket nut (4) 60 lb-ft (81 N·m).
	●				*i.* Tighten seat belt buckle nut (3) 90 lb-ft (122 N·m).
	●				*j.* Check for looseness of rear seat belt assembly hardware.
	●				*k.* Tighten all nuts (5) 30-40 lb-ft (41-54 N·m).





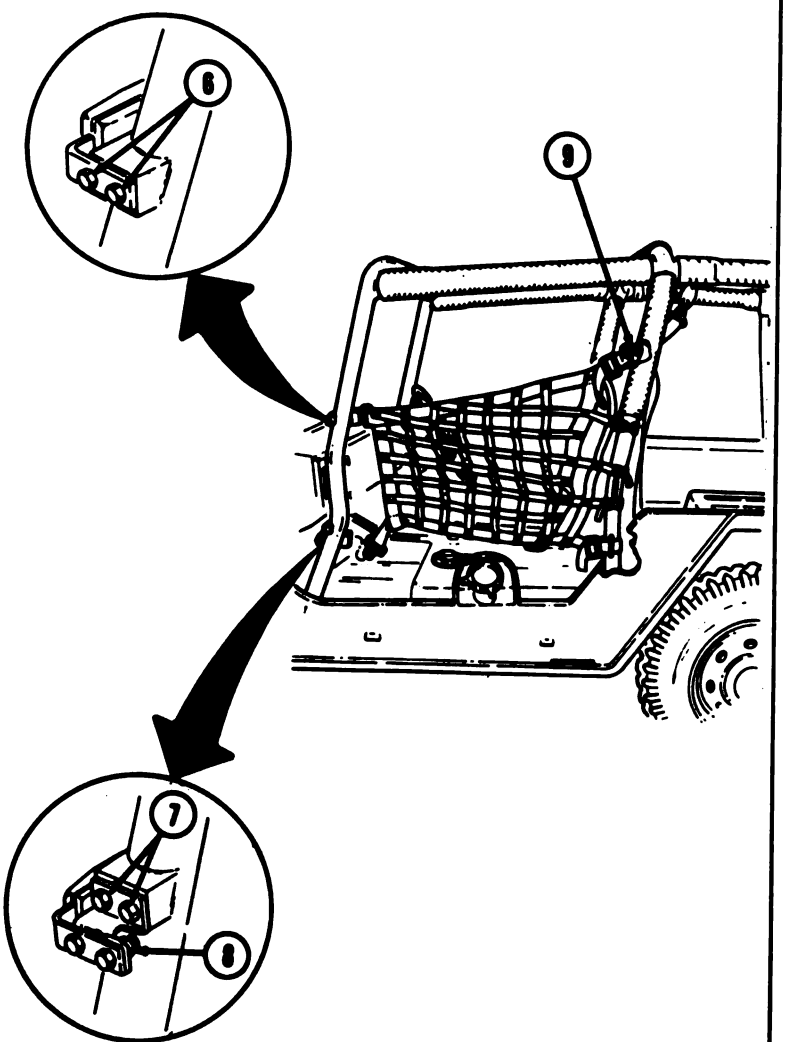
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Table 3-1. Preventive Maintenance Checks and Services (Cont'd)

S—Semiannually A—Annually B—Biennially

Item No.	Interval S	Interval A	Interval B	Item to be Inspected	Procedures
	●				*l.* Inspect front restraint hardware for looseness.
	●				*m.* Tighten top strap buckle nut (9) 90 lb-ft (122 N·m).
	●				*n.* Tighten buckle bracket screws (7) 24 lb-ft (32 N·m).
	●				*o.* Tighten buckle nuts (8) 24 lb-ft (32 N·m).
	●				*p.* Tighten buckle screws (6) 24 lb-ft (32 N·m).



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Section IV. MECHANICAL SYSTEMS TROUBLESHOOTING

3-13. General

a. This section contains troubleshooting information and tests for locating and correcting malfunctions which may develop on the vehicles covered in this manual that are beyond the scope of operator/crew maintenance. Each symptom or malfunction given for an individual component or system is followed by the step(s) you should take to determine the cause and then corrective action you must take to remedy the problem.

b. Before taking any action to correct a possible malfunction, the following rules should be followed:

(1) Question operator to obtain any information that might help you determine the cause of the problem.

(2) Never overlook the chance that the problem could be of simple origin. The problem could be corrected with minor adjustment.

(3) Use all senses to observe and locate troubles.

(4) Use test instruments or gages to help you determine and isolate problems.

(5) Always isolate the system where the malfunction occurs and then locate the defective component.

(6) Use standard automotive theories and principles when troubleshooting the vehicles in this manual.

c. Table 3-3 lists possible malfunctions that may occur in the vehicle or in individual units or systems of the vehicle. This table covers mechanical troubleshooting only. Troubleshooting procedures for the electrical systems can be found in table 3-5. Troubleshooting using Simplified Test Equipment for Internal Combustion Engines (STE/ICE) can be found in section VI of this chapter.

Table 3-2. Mechanical Troubleshooting Symptom Index

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
	ENGINE	
1.	Engine fails to crank	3-32
2.	Engine cranks but fails to start	3-32
3.	Engine starts but fails to keep running	3-34
4.	Engine runs, but misfires	3-34
5.	Poor acceleration and/or lack of power	3-35
6.	Engine will not idle or idles erratically	3-36
7.	Excessive oil consumption	3-37
8.	Sharp metallic knock occurring during acceleration or when operating under heavy load	3-37
9.	Unusual engine noises	3-38
10.	Low or high oil pressure	3-38
11.	Oil leakage at tappet or rocker arm covers	3-39
	CLUTCH	
12.	Clutch chatter	3-39
13.	Clutch grabbing	3-40

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Table 3-2. Mechanical Troubleshooting Symptom Index (Cont'd)

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
14.	Clutch slipping or dragging	3-40
15.	Gear clash	3-40
	FUEL SYSTEM	
16.	Carburetor floods	3-40
17.	Excessive fuel consumption	3-41
	EXHAUST SYSTEM	
18.	Exhaust noise	3-42
	COOLING SYSTEM	
19.	Engine overheats (according to temperature gage)	3-42
20.	Loss of coolant	3-44
21.	Engine not reaching normal operating temperature (according to temperature gage)	3-44
	TRANSMISSION	
22.	Excessive noise during shifting	3-45
23.	Transmission oil leakage	3-45
24.	No shift lever response, or hard shifting	3-46
25.	Transmission shifts out of gear	3-46
	TRANSFER CASE	
26.	Hard shifting of transfer	3-46
27.	Transfer will not shift out of front axle drive (shift lever locked)	3-47
28.	Front axle will not disengage when lever is in disengaged position	3-47
	PROPELLER SHAFTS	
29.	Excessive noise or vibration	3-47
	DIFFERENTIALS AND DRIVE COMPONENTS	
30.	Excessive noise in differential (front or rear)	3-47
31.	Differential oil leakage	3-48
32.	Excessive play	3-48
	SPRINGS AND SHOCK ABSORBERS	
33.	Continuous wandering or swaying (poor control)	3-48
34.	Vehicle tilts to one side on level terrain	3-49
	WHEELS AND TIRES	
35.	Uneven tire wear	3-49

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Table 3-2. Mechanical Troubleshooting Symptom Index (Cont'd)

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
	SERVICE BRAKES	
36.	One or more brakeshoes drag	3-50
37.	All brakes drag	3-50
38.	Excessive pedal travel	3-50
39.	Brake pedal gradually goes to floor when applied	3-51
	PARKING BRAKE	
40.	Parking brake does not hold	3-51
41.	Parking brake drags and overheats	3-52
	STEERING	
42.	Excessive play in steering wheel	3-52
43.	Erratic or hard steering	3-52
44.	Shimmy or wobble	3-53
45.	Vehicle wanders or pulls to one side	3-54
	HOT WATER HEATER -25°F (-32°C)	
46.	Cool or cold air at outlets (engine at normal operating temperature)	3-55
47.	Cool or cold air at outlets (engine below normal operating temperature)	3-55
48.	No air flow at defroster (blower motor operative)	3-55
49.	Blower motor does not operate, or operates in high speed only	3-56
	100-AMPERE ALTERNATOR KIT	
50.	No alternator output	3-56
51.	Drive belt squeal	3-56
52.	High or low alternator output	3-56
53.	Batteries use too much water	3-57
	180-AMPERE BATTERY CHARGING SYSTEM	
	DEEPWATER FORDING KIT	
54.	Excessive smoke from vehicle exhaust	3-57
55.	Stalling or loss of power (after fording)	3-57
56.	Stalling in water	3-58
57.	Water in engine	3-58
58.	Engine cranks but will not start after fording	3-59
	HARDTOP KIT	
59.	Excessive rattles	3-59
60.	Excessive air leaks	3-59
61.	Water leaks	3-60
62.	Door not latching	3-60
63.	Door glass sticking	3-60

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Table 3-3. Mechanical Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

ENGINE

1. ENGINE FAILS TO CRANK

Step 1. Test speeific gravity of electrolyte in each battery (para 5-26).
Add distilled water or recharge batteries, if necessary.

Step 2. Examine battery posts for breaks, looseness, and damage.

Replace any battery having broken, loose, or damaged posts (para 5-31).

NOTE

If STE/ICE is available, perform NG20 — no crank — no start (chapter 3, section VI).

Step 3. Test batteries for proper voltage.

See table 3-5, Electrical Troubleshooting, malfunction 21.

Step 4. Test starter motor for electrical malfunction. See table 3-5, Electrical Troubleshooting, malfunction 9.

Step 5. Remove starter and visually check starter drive and ring gear for broken or missing teeth.

a. If starter teeth are damaged, replace starter drive (para 5-17).

b. If ring gear is damaged, notify DS maintenance.

c. If engine still fails to crank, notify DS maintenance.

END OF TESTING!

2. ENGINE CRANKS BUT FAILS TO START

NOTE

If choke has been used excessively, fuel may flood the combustion chambers and cause hard starting.

Step 1. Push choke all the way in, open throttle, and crank engine to clear out excessive fuel.

If flooding continues, see step 2.

Step 2. Check choke linkage (para 4-41).

If linkage is incorrectly adjusted, adjust (para 4-41).

Step 3. Check spark plugs and ignition timing (paras 4-15 and 4-17).

(Timing may be set with STE/ICE if engine will not start.)

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Check in-tank fuel filter for restriction.

If restricted or damaged, clean or replace as necessary (para 4-30).

Step 5. Check fuel lines and connections for leaks, obstructions, and damage

a. Tighten leaking connections.

b. Replace obstructed or damaged lines (para 4-25).

WARNING

- Do not perform steps 5 and 6 near fire, flames, or sparks.
- Do not loosen or disconnect any fuel line if engine is hot. Fuel vapors are highly flammable and will cause severe injury if ignited.

Step 6. Place ignition switch in OFF position and disconnect fuel inlet pressure line at in-line filter (para 4-25).

Step 7. Place disconnected fuel line end in jar to catch fuel and engage foot start switch until engine cranks two or three revolutions.

a. If fuel did not reach carburetor, test fuel pump pressure. If fuel pump is defective, replace (para 4-29).

b. If fuel did not reach carburetor and fuel pump is not defective, replace obstructed or damaged line (para 4-25).

c. If fuel was pumped through line, replace fuel filter (para 4-31).

d. Reconnect fuel line, place ignition switch to ON position. If engine still fails to start, check ignition system for electrical malfunction (see table 3-5, Electrical Troubleshooting malfunction 1).

NOTE

If STE/ICE is available, perform NG10 — engine crank — no start (chapter 3, section VI).

Step 8. Test for low cylinder compression (para 4-4).

a. If compression is normal, replace carburetor (para 4-32).

b. If compression is low, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. ENGINE STARTS BUT FAILS TO KEEP RUNNING

Step 1. Check spark plugs, idle speed, idle mixture, and ignition timing for proper adjustment.

a. Adjust as necessary (paras 4-15, 4-16, and 4-17).

b. If proper adjustment cannot be obtained, replace component as necessary (paras 4-15, 4-32, and 5-7).

Step 2. Check choke linkage (para 4-41).

If linkage adjustment is incorrect, adjust linkage (para 4-41).

Step 3. Check in-tank fuel filter for restriction.

If restricted or damaged, clean or replace as necessary (para 4-30).

Step 4. Check in-line fuel filter for restriction.

If restricted, replace (para 4-31).

Step 5. Check fuel lines and connections for leaks, obstructions, and damage.

a. Tighten leaking connections.

b. Clean or replace obstructed and damaged lines (para 4-25).

NOTE

If STE/ICE is available, perform NG40 — engine will not idle (chapter 3, section VI).

Step 6. Test fuel pump pressure (para 4-29).

If pump is defective, replace (para 4-29).

Step 7. Check for dirt and water in fuel tank and lines.

Drain dirt and water from fuel tank and lines (paras 4-34 and 4-35).

END OF TESTING!

4. ENGINE RUNS, BUT MISFIRES

Step 1. Check spark plugs, idle speed, idle mixture, and ignition timing (paras 4-15, 4-16, 4-17 and table 3-5, malfunction 1).

Step 2. Check carburetor choke linkage for binding.

If binding or damaged, repair or replace as necessary (para 4-41).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check in-tank fuel filter for restriction.

If restricted or damaged, clean or replace as necessary (para 4-30).

Step 4. Check fuel lines and connections for leaks, obstructions, and damage.

a. Tighten leaking connections.

b. Clean or replace obstructed and damaged lines (para 4-25).

Step 5. Test fuel pump pressure (para 4-29).

If pump is defective, replace (para 4-29).

Step 6. Check exhaust system for restrictions.

If exhaust system has a restriction, replace exhaust manifold (para 4-11) or other exhaust system components (chapter 4, section VI) as necessary.

Step 7. Check intake manifold for leaks.

a. If manifold leaks, replace manifold gaskets (para 4-10).

b. If manifold still leaks, replace (para 4-10).

Step 8. Test for low cylinder compression (para 4-4).

If compression is low, notify DS maintenance.

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Step 9. Check valves for proper adjustment.

Adjust as necessary (para 4-6).

END OF TESTING!

5. POOR ACCELERATION AND/OR LACK OF POWER

Step 1. Check engine temperature gage reading.

If temperature gage indicates overheating, troubleshoot cooling system, malfunction 19.

Step 2. See malfunction 3, steps 1 through 7.

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check exhaust system for restrictions and damage.

If exhaust system component is causing restriction, replace. See paragraph 4-11 for exhaust manifold and chapter 4, section VI for other exhaust system components.

Step 4. Service air cleaner (para 4-28).

If air induction hose is collapsed, replace (para 4-27).

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Step 5. Test cylinder compression (para 4-4).

If compression is low, notify DS maintenance.

Step 6. Check valve clearance (para 4-6).

a. If valves are out of adjustment, adjust (para 4-6).

b. If valve spring is broken, notify DS maintenance.

END OF TESTING!

6. ENGINE WILL NOT IDLE OR IDLES ERRATICALLY

NOTE

If STE/ICE is available, perform NG40 — engine will not idle (chapter 3, section VI).

Step 1. Check idle speed and idle mixture (para 4-16).

Adjust as necessary (para 4-16).

Step 2. Start engine and check carburetor mounting point and intake manifold for air leaks. Apply a small amount of oil at carburetor mounting point and intake manifold flanges.

If oil is pulled into intake manifold, tighten flange nuts or replace gaskets (para 4-10).

Step 3. Check crankcase ventilation valve for restriction.

a. If ventilation valve is plugged, clean to open (para 4-7).

b. If metering valve is still restricted, replace (para 4-7).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Check vent lines and connections for leaks, obstructions, and damage.

a. Tighten leaking connections.

b. Clear or replace obstructed or damaged lines (para 4-8).

END OF TESTING!

7. EXCESSIVE OIL CONSUMPTION

Step 1. Check crankcase for overfilling. Remove dipstick for reading. Make sure dipstick has been correctly read (TM 9-2320-218-10).

If dipstick has been correctly read and indicates excessive oil, drain crankcase to safe operating level (LO 9-2320-218-12).

Step 2. Check for external oil leaks. Wipe off edges of engine cover, oil pan, oil filter, and other external engine surfaces. Start engine and observe for oil leaks.

Tighten nuts, capscrews, and oil filter, and replace gaskets as necessary. If leaking continues, notify DS maintenance.

Step 3. Check crankcase ventilation valve for proper operation.

If not operating properly, replace (para 4-7).

Step 4. Drain crankcase and refill with proper grade of oil (para 4-20).

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Step 5. Test cylinder compression (para 4-4).

If compression test indicates low or unbalanced compression between cylinders, notify DS maintenance.

8. A SHARP METALLIC KNOCK OCCURRING DURING ACCELERATION OR WHEN OPERATING UNDER HEAVY LOAD

Step 1. Check engine temperature gage reading.

If engine is overheating, check cooling system (malfunction 19).

Step 2. Check for oil in the air intake system (para 4-28).

If oil is in intake system, replace crankcase ventilation valve (para 4-7).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

If STE/ICE is available, perform NG50 — power test fault isolation (chapter 3, section VI).

Step 3. Check spark plug type and ignition timing.

a. If wrong plugs, install correct set (para 4-15).

b. Adjust ignition timing as necessary (para 4-17).

Step 4. Test cylinder compression (para 4-4).

If cylinder compression is low, notify DS maintenance.

END OF TESTING!

9. UNUSUAL ENGINE NOISES

Step 1. Check distributor for unusual noises.

If distributor is noisy, replace (para 5-7).

Step 2. Check fuel pump for unusual noises.

If fuel pump is noisy, replace (para 4-29).

Step 3. Check valves for proper adjustment (para 4-6).

a. If valves are out of adjustment, adjust (para 4-6).

b. If valve spring(s) are broken, or unusual engine noises still exist, notify DS maintenance.

END OF TESTING!

10. LOW OR HIGH OIL PRESSURE

NOTE

If STE/ICE is available, perform NG05 — low oil pressure check (chapter 3, section VI).

Step 1. Check engine oil level (LO 9-2320-218-12).

If oil is low, fill to proper level (LO 9-2320-218-12).

Step 2. Check oil pressure gage and sending unit for proper operation (table 3-5, Electrical Troubleshooting).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Drain and replace engine oil (para 4-20).

If oil pressure is still low or high, notify DS maintenance.

END OF TESTING!

11. OIL LEAKAGE AT TAPPET OR ROCKER ARM COVERS

Step 1. Check tappet cover for loose holddown nuts or defective gasket.

Tighten holddown nuts or replace gasket (para 4-7).

Step 2. Check rocker arm cover for loose holddown nuts or defective gasket.

Tighten holddown nuts or replace gasket (para 4-6).

Step 3. Check crankcase ventilation metering valve for restriction.

a. If valve is plugged, clean to open (para 4-7).

b. If valve is still restricted, replace (para 4-7).

END OF TESTING!

CLUTCH

12. CLUTCH CHATTER

Step 1. Check clutch linkage for proper adjustment and binding condition.

Adjust clutch linkage and correct any binding condition (para 4-12).

Step 2. Check engine mounts.

a. If loose, tighten. If defective, replace (para 4-9).

b. If engine mounts are secure, and linkage is adjusted properly and clutch still chatters, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

13. CLUTCH GRABBING

Check clutch linkage for proper adjustment and binding.

a. Adjust clutch linkage and correct any binding condition (para 4-12).

b. If linkage is properly adjusted and clutch still grabs, notify DS maintenance.

END OF TESTING!

14. CLUTCH SLIPPING OR DRAGGING

Step 1. Check clutch linkage for proper adjustment and binding.

Adjust clutch linkage, and correct any binding condition (para 4-12).

Step 2. Check clutch pedal free play (para 4-12).

Adjust pedal free play (para 4-12).

Step 3. If clutch is still slipping, notify DS maintenance.

END OF TESTING!

15. GEAR CLASH

See malfunction 14, steps 1 and 2.

NOTE

Gear clash, caused by the clutch disk spinning, often is confused with clutch dragging. If transmission gears are in neutral, a clutch disk releasing properly spins under its own weight and momentum. When shifting from neutral to first speed, or to reverse, wait for clutch to stop turning to avoid gear clash. If symptom definitely is gear clash, notify DS maintenance.

END OF TESTING!

FUEL SYSTEM

16. CARBURETOR FLOODS

Step 1. Check carburetor choke linkage for any binding condition.

If choke linkage is binding or damaged, repair or replace as necessary (para 4-41).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Check idle fuel mixture and idle speed for proper adjustment (para 4-16).

If not adjusted properly, adjust (para 4-16).

If unable to adjust, replace carburetor (para 4-32).

Step 3. Check carburetor choke plate for binding.

a. If choke does not move freely, lubricate.

b. If choke plate is still binding, replace carburetor (para 4-32).

END OF TESTING!

17. EXCESSIVE FUEL CONSUMPTION

Step 1. Check spark plugs, idle speed, idle mixture, and ignition timing (paras 4-15, 4-16, and 4-17).

Step 2. Check carburetor choke plate for binding.

a. If choke does not move freely, lubricate.

b. If choke is still binding, replace carburetor (para 4-32).

Step 3. Check air cleaner for proper servicing (para 4-28).

If not properly serviced, service (para 4-28).

Step 4. Check carburetor choke plate for full open position (para 4-32).

If choke is not full open, adjust (para 4-41).

Step 5. Check fuel lines, fuel connections, fuel tank, fuel pump, and fuel filter for leaks.

Tighten leaking connections. Replace defective lines or components (paras 4-25, 4-23 or 4-24, 4-29, 4-30, and 4-31).

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Step 6. Test cylinder compression (para 4-4).

If compression is poor or uneven, notify DS maintenance.

Step 7. Check valves for proper adjustment (para 4-6).

a. If valves are out of adjustment, adjust (para 4-6).

b. If valve spring is broken, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

EXHAUST SYSTEM

18. EXHAUST NOISE

Step 1. Check exhaust system for holes, cracks, and breaks.

If cracked or broken, replace (chapter 4, section VI).

Step 2. Check exhaust system for leaking gaskets and broken brackets.

a. If gasket is leaking, replace (chapter 4, section VI).

b. If bracket is broken, replace (chapter 4, section VI).

END OF TESTING!

COOLING SYSTEM

WARNING

Do not remove radiator cap before releasing internal pressure when radiator is hot to touch. Internal pressure will blow out scalding fluid and vapor, causing severe injury (para 4-53).

19. ENGINE OVERHEATS (according to temperature gage)

NOTE

- If STE/ICE is available, perform NG30 — high coolant temperature (chapter 3, section VI).
- Release pressure on hot engine by placing thick cloth over cap and turning counterclockwise to first stop.

Step 1. Let engine cool, check coolant level.

If coolant level is low, add coolant (para 4-53).

Step 2. Look for air flow obstructions at radiator core.

Remove any obstructions from radiator (para 4-53).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check radiator, draincocks, hoses, and connections for leaks.

a. Tighten loose hose connections.

b. Replace defective hoses (paras 4-54 and 4-55).

c. Tighten or close draincock. If defective, replace draincock (para 4-62).

d. If radiator is leaking, replace (para 4-56).

Step 4. Check thermostat housing and gasket for leaks.

Replace as necessary (para 4-60).

Step 5. Check thermostat for proper operation (para 4-60).

Replace if defective (para 4-60).

Step 6. Check for loose or broken water pump drive belts (para 4-59).

Adjust or replace as necessary (para 4-59).

Step 7. Check fan for cracked blades.

If defective, replace fan blade assembly (para 4-58).

Step 8. Check cooling system for clogging.

Clean and flush system (para 4-53). If still clogged, repair or replace component as necessary (chapter 4, section VII).

Step 9. Check water pump for leaks.

If leaking, replace (para 4-61).

Step 10. Check distributor timing (para 4-17).

If timing is not correct, adjust (para 4-17).

Step 11. Look for coolant leaks at cylinder head, head gasket, and cylinder block.

NOTE

Coolant leak is identified by wetness, rust, or coolant stain on side of block.

If leakage is observed, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

20. LOSS OF COOLANT

Step 1. Check radiator, draincock, hoses, and connections for leaks.

a. Tighten loose hose clamps. If defective, replace clamps.

b. Replace defective hoses (paras 4-54 and 4-55).

c. Tighten or close draincock. If defective, replace (para 4-62).

d. If radiator is leaking, replace (para 4-56).

Step 2. Check water pump and gasket for leaks.

a. If gasket is leaking, replace (para 4-61).

b. If water pump housing is cracked or warped, replace pump (para 4-61).

Step 3. Check thermostat housing and gasket for leaks.

a. If gasket is leaking, replace (para 4-60).

b. If housing is cracked or warped, replace housing (para 4-60).

Step 4. Check engine block freeze plugs for leaks.

If leaking, notify DS maintenance.

Step 5. Pull oil level gage (dipstick) and check for evidence of coolant in oil.

NOTE

Coolant in oil is identified by coolant stream or bubbles on dipstick, thin oil, and indication of overfilling.

If found, notify DS maintenance.

END OF TESTING!

21. ENGINE NOT REACHING NORMAL OPERATING TEMPERATURE (according to temperature gage)

Step 1. Remove and test thermostat for proper operation (para 4-60).

Replace if defective (para 4-60).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

Step 2. Test temperature gage, sending unit, and electrical circuits for malfunction.

See table 3-5, Electrical Troubleshooting, malfunction 37.

END OF TESTING!

TRANSMISSION

22. EXCESSIVE NOISE DURING SHIFTING

Step 1. Check clutch linkage adjustment.

Adjust as necessary (para 4-12).

Step 2. Check transmission oil for contamination and correct fluid level.

a. If fluid is contaminated, drain and refill (LO 9-2320-218-12).

b. If fluid level is low, add fluid (LO 9-2320-218-12).

Step 3. Inspect drain plug and gasket for leaks.

a. If leaking, replace gasket, and tighten drain plug 25-35 lb-ft (33-47 N•m).

b. If leaking continues or is seen elsewhere on transmission, notify DS maintenance.

Step 4. Inspect propeller shaft universal joints for looseness, wear, and damage.

a. Check universal joints for worn bearings, and replace if necessary (paras 6-5 and 6-13).

b. Check propeller shaft flanges for loose mounting bolts. Tighten loose bolts as necessary (paras 6-4 and 6-12).

c. If noise still exists, notify DS maintenance.

END OF TESTING!

23. TRANSMISSION OIL LEAKAGE

Step 1. Check transmission fluid level.

If fluid level is too high, drain to proper level (LO 9-2320-218-12).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Inspect drain plug and gasket for leaks.

a. If leaking, replace gasket, and tighten drain plug 25-35 lb-ft (33-47 N•m).

b. If leaking continues or is seen elsewhere on transmission, notify DS maintenance.

END OF TESTING!

24. NO SHIFT LEVER RESPONSE, OR HARD SHIFTING

Step 1. Check transmission fluid level.

If fluid level is low, add fluid (LO 9-2320-218-12).

Step 2. Drain and refill with proper lubricant (LO 9-2320-218-12).

Step 3. Make sure clutch linkage is connected and adjusted, and reverse shifter arm pivot bolt above and behind transmission fill plug is secure.

a. If not, connect and adjust linkage, and secure pivot bolt (para 4-12).

b. If still no response, notify DS maintenance.

END OF TESTING!

25. TRANSMISSION SLIPS OUT OF GEAR

Notify DS maintenance.

END OF TESTING!

TRANSFER CASE

26. HARD SHIFTING OF TRANSFER

Step 1. Check transmission/transfer fluid level.

If fluid level is low, add fluid (LO 9-2320-218-12).

Step 2. Drain and refill with proper lubricant (LO 9-2320-218-12).

If transfer is still hard to shift, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

27. TRANSFER WILL NOT SHIFT OUT OF FRONT AXLE DRIVE (shift lever locked)

Step 1. Make sure clutch linkage is connected and adjusted.

If not, connect and adjust linkage (para 4-12).

Step 2. Check for binding between front and rear propeller shafts (torsional windup).

Raise front end until wheels are free to rotate. If front axle drive does not disengage, notify DS maintenance.

END OF TESTING!

28. FRONT AXLE WILL NOT DISENGAGE WHEN TRANSFER SHIFT LEVER IS IN DISENGAGED POSITION

Notify DS maintenance.

END OF TESTING!

PROPELLER SHAFTS

29. EXCESSIVE NOISE OR VIBRATION

Step 1. Make sure universal joints are properly lubricated.

Lubricate if necessary (LO 9-2320-218-12).

Step 2. Check universal joints for looseness, wear, and damage.

a. Check shaft flanges for loose mounting bolts. Tighten loose bolts (paras 6-4 and 6-12).

b. Check universal joint components for wear and damage. Repair or replace as necessary (paras 6-5 and 6-13).

END OF TESTING!

DIFFERENTIALS AND DRIVE COMPONENTS

30. EXCESSIVE NOISE IN DIFFERENTIAL (front or rear)

Step 1. Check differential lubricant level.

If lubricant is low, add lubricant (LO 9-2320-218-12).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Make sure universal joints are properly lubricated.

Lubricate as necessary (LO 9-2320-218-12).

Step 3. Check universal joints for looseness, wear, and damage.

a. Check shaft flanges for loose mounting bolts. Tighten loose bolts (paras 6-4 and 6-12).

b. Check universal joint components for wear and damage. Repair or replace as necessary (paras 6-5 and 6-13).

Step 4. Check engine mounts for looseness, and mounting cushions for damage and wear.

a. Tighten loose mounts, and replace damaged or worn mounting cushions (para 4-9).

b. If excessive noise still exists, replace differential (para 6-8).

END OF TESTING!

31. DIFFERENTIAL OIL LEAKAGE

Step 1. Inspect drain plug and gasket for defects.

a. If leaking, replace defective drain plug and gasket. Tighten drain plug 25-35 lb-ft (33-47 N•m).

b. If leaking continues, go to step 2.

Step 2. Inspect seals for leaks.

a. If leaking, replace seals (paras 6-9 and 6-10).

b. If leaking continues, replace differential (para 6-8).

END OF TESTING!

32. EXCESSIVE PLAY

See malfunction 30, steps 1 through 4.

If play is still excessive, replace differential (para 6-8).

END OF TESTING!

SPRINGS AND SHOCK ABSORBERS

33. CONTINUOUS WANDERING OR SWAYING (poor control)

Check shock absorbers and bushings for loose mounting, leaks, and damage.

If loose, leaking, or damaged, replace (paras 7-8 or 7-12).

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

34. VEHICLE TILTS TO ONE SIDE ON LEVEL TERRAIN

Step 1. Check coil springs for breaks, distortions, and damage.

If spring is broken, distorted or damaged, replace (paras 7-4 or 7-13).

Step 2. Check shock absorbers for leaks or damage.

If leaking or damaged, replace shock absorber (paras 7-8 or 7-12).

END OF TESTING!

WHEELS AND TIRES

35. UNEVEN TIRE WEAR

Step 1. Check tires for proper pressure.

Adjust as necessary (TM 9-2320-218-10).

Step 2. Inspect tires for defects.

Replace defective tires (para 9-4).

Step 3. Check front-end alinement (toe-in) (para 6-19).

Adjust as necessary (para 6-19).

Step 4. Check suspension arms for damage.

If damaged, replace (paras 7-5 and 7-14).

Step 5. Check brakeshoes for proper adjustment.

Adjust brakeshoes as necessary (para 8-10).

Step 6. Check shock absorbers, ball joints, tie rod ends, and center link for damage and wear.

If damaged or worn, replace component (paras 7-7, 7-8, 7-12, 9-12 and 9-11).

Step 7. Check wheel bearings for correct adjustment.

a. Adjust wheel bearings as required (para 9-5).

b. Replace defective wheel bearings (para 9-5).

c. If uneven tire wear continues, replace wheels, tires, and brakedrums as necessary (paras 9-4 and 9-6).

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

SERVICE BRAKES

36. ONE OR MORE BRAKESHOES DRAG

Step 1. Check brakeshoes for proper adjustment by raising vehicle and rotating wheel. Excessive drag or no drag indicates brakeshoes are out of adjustment. Properly adjusted brakeshoes should have slight drag.

Adjust as necessary (para 8-16).

Step 2. Check brake lines for bends or restrictions.

If bent or restricted, replace as necessary (para 8-16).

Step 3. Check brake assemblies for proper retraction, leakage, dirt, damaged brakeshoe return springs, and defective brake wheel cylinders.

Remove brakedrum (para 9-6), and remove any dirt or lining particles. If brakeshoe return spring is damaged, replace (para 8-12). Replace defective wheel cylinder (para 8-13). Install brakedrum (para 9-6).

END OF TESTING!

37. ALL BRAKES DRAG

Check brake pedal for proper adjustment.

Adjust as necessary (para 8-10).

END OF TESTING!

38. EXCESSIVE PEDAL TRAVEL

Step 1. Check brake pedal for proper adjustment.

Adjust as necessary (para 8-10).

Step 2. Check brake fluid level.

Add fluid if needed and check lines, hoses, connections, and cylinders for fluid leaks (LO 9-2320-218-12).

If leaking, replace as necessary (paras 8-13 and 8-16).

Step 3. Check brake system for air.

Bleed brake system as necessary (para 8-11).

Step 4. Check brakeshoe adjustment.

Adjust as necessary (para 8-10).

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

39. BRAKE PEDAL GRADUALLY GOES TO FLOOR WHEN APPLIED

Step 1. Check brake fluid level.
Add fluid if needed (LO 9-2320-218-12).

Step 2. Check brake system for air.
Bleed brake system as necessary (para 8-11).

Step 3. Check lines, hoses, connections, and cylinders for leaks.
a. If leaking, replace as necessary (paras 8-13 and 8-14).
b. If brake pedal still goes to floor, replace master cylinder (para 8-15).

END OF TESTING!

39.1. VEHICLE PULLS TO ONE SIDE WHEN BRAKES ARE APPLIED

Step 1. Check for brakedrum out-of-round.
Replace out-of-round brakedrum (para 9-6).

Step 2. Check for faulty wheel cylinder.
Replace faulty wheel cylinder (para 8-13).

Step 3. Check for worn wheel bearings.
Replace worn wheel bearings (para 9-5).

END OF TESTING!

39.2. BRAKES GRAB

Check for faulty wheel cylinder.
Replace faulty wheel cylinder (para 8-13).

END OF TESTING!

39.3. BRAKES INOPERATIVE

Check for faulty master cylinder.
Replace faulty master cylinder (para 8-15).

END OF TESTING!

PARKING BRAKE

40. PARKING BRAKE DOES NOT HOLD

Step 1. Check for improper lever adjustment.
Adjust as necessary (para 8-4).

Step 2. Check brake band for proper adjustment.
Adjust as necessary (para 8-4).

Step 3. Check brake lining for wear.
Replace lining if worn down to rivets (para 8-5).

Step 4. Check brakedrum for wear.
If worn, replace (para 8-6).

Step 5. Check brake linkage for binding or sticking.
If binding or sticking, repair or replace (para 8-7).

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

41. PARKING BRAKE DRAGS AND OVERHEATS

Step 1. Check for improper lever adjustment.

Adjust as necessary (para 8-4).

Step 2. Check brake band adjustment.

Adjust as necessary (para 8-4).

Step 3. Check brake linkage for binding or sticking.

If binding or sticking, repair or replace (para 8-7).

END OF TESTING!

STEERING

42. EXCESSIVE PLAY IN STEERING WHEEL

Step 1. Inspect pitman arm at steering gear for looseness and damage.

a. If loose, tighten mounting nut 80-110 lb-ft (108-149 N•m).

b. If damaged, replace (para 9-10).

Step 2. Inspect tie rods for looseness and damage.

a. If loose, tighten slotted nuts 30-36 lb-ft (41-47 N•m).

b. If damaged, replace (para 9-12).

Step 3. Inspect center link and idler arm assembly for looseness and damage.

a. If loose, tighten tie rod end and pitman arm mounting nuts 35-45 lb-ft (47-61 N•m).

b. If damaged, replace (para 9-11).

Step 4. Check steering gear mounting bolts for looseness.

a. If loose, tighten 24-36 lb-ft (32-48 N•m).

b. If excessive play in steering still exists, notify DS maintenance.

END OF TESTING!

43. ERRATIC OR HARD STEERING

Step 1. Check tires for proper pressure.

Adjust as necessary (TM 9-2320-218-10).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Inspect steering linkage for adequate lubrication.

Lubricate as necessary (LO 9-2320-218-12).

Step 3. Check front wheel toe-in for proper adjustment (para 6-19).

Adjust as necessary (para 6-19).

Step 4. Inspect pitman arm for looseness and damage.

a. If loose, tighten steering gear shaft mounting nut 80-100 lb-ft (109-136 N•m).

b. If damaged, replace (para 9-10).

Step 5. Inspect center link and idler arm assembly for looseness and damage.

a. If loose, tighten tie rod end and pitman arm mounting nuts 35-45 lb-ft (47-61 N•m).

b. If damaged, replace (para 9-11).

Step 6. Check steering gear mounting bolts for looseness.

If loose, tighten 24-36 lb-ft (32-48 N•m).

Step 7. Check front end for loose wheel bearings and ball joints. Raise wheels off ground. Grasp each tire at top and bottom, and push inward and outward.

a. If wheel has excessive play, adjust or replace bearings as necessary (para 9-5).

b. If ball joints have excessive play, tighten mounting nuts or replace as necessary (para 7-7).

c. If erratic or hard steering still exists, notify DS maintenance.

END OF TESTING!

44. SHIMMY OR WOBBLE

Step 1. Check wheel nuts for proper torque.

Tighten loose capnuts 80-100 lb-ft (108-136 N•m).

Step 2. Inspect wheels for bends and damage.

Replace bent or damaged wheels (para 9-4).

Step 3. Inspect wheel bearings for looseness and damage (para 9-5).

a. Adjust loose wheel bearings (para 9-5).

b. Replace defective wheel bearings (para 9-5).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. See malfunction 42, steps 1 through 4.

Step 5. Check front wheel toe-in alinement (para 6-19).

Adjust as necessary (para 6-19).

Step 6. Inspect front wheels for loose bearings or damage. Raise wheels off ground. Grasp each tire at top and bottom, and push inward and outward.

a. If wheel has excessive play, adjust or replace bearings as necessary (para 9-5).

b. If wheel is bent or damaged, replace (para 9-5).

Step 7. Check suspension arms for looseness.

If suspension arms are loose, tighten (paras 7-5 and 7-6).

Step 8. Check front crossmember for looseness.

a. If crossmember is loose, tighten mounting bolts 27-37 lb-ft (36-50 N•m).

b. If shimmy or wobble still exists, notify DS maintenance.

END OF TESTING!

45. VEHICLE WANDERS OR PULLS TO ONE SIDE

Step 1. See malfunction 36, steps 1 through 3.

Step 2. Check tires for proper pressure.

Adjust as necessary (TM 9-2320-218-10).

Step 3. Check shock absorbers for loose mounting, leaks, and damage.

a. If leaking or damaged, replace (paras 7-8 and 7-12).

b. If loose, tighten (paras 7-8 and 7-12).

Step 4. Check suspension arms for looseness and damage.

a. If suspension arms are loose, tighten (paras 7-5 and 7-6).

b. If suspension arms are damaged, replace (paras 7-5 and 7-6).

Step 5. Check tie rod ends and ball joints for wear and damage.

If tie rod ends or ball joints are worn or damaged, replace (paras 9-12 and 7-7).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 6. Inspect wheel spindle arm for wear and damage.

a. If worn or damaged, replace (para 6-15).

b. If vehicle still wanders or pulls, notify DS maintenance.

END OF TESTING!

HOT WATER HEATER -25°F (-32°C)

46. COOL OR COLD AIR AT OUTLETS (engine at normal operating temperature)

Step 1. Check position of shutoff cocks for full open.

If partially open or fully closed, rotate counterclockwise to open.

Step 2. Check for collapsed hot water hoses.

If collapsed, replace (para 11-29).

Step 3. Check for air in hot water hoses.

a. Bleed system of air at return line connected to shutoff cock.

b. If heater still has cool or cold air at outlets, replace heater (para 11-27).

END OF TESTING!

47. COOL OR COLD AIR AT OUTLETS (engine below normal operating temperature)

Step 1. Test for proper antifreeze solution in radiator (para 4-53).

If amount of antifreeze is not correct, drain and refill cooling system with proper solution (para 4-53).

Step 2. Check thermostat for proper operation (para 4-60).

Replace thermostat if defective (para 4-60).

END OF TESTING!

48. NO AIR FLOW AT DEFROSTER (blower motor operative)

Check for proper hose ducting and hose connection.

If not connected, connect (para 11-29).

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

49. BLOWER MOTOR DOES NOT OPERATE, OR OPERATES IN HIGH SPEED ONLY

See table 3-5, Electrical Troubleshooting, malfunctions 45 and 46.

END OF TESTING!

100-AMPERE ALTERNATOR KIT

50. NO ALTERNATOR OUTPUT

See table 3-5, Electrical Troubleshooting, malfunction 17.

END OF TESTING!

51. DRIVE BELT SQUEAL

Step 1. Inspect drive belts for looseness or glazing.

a. If loose, tighten (para 4-59).

b. If glazed, replace (para 4-59).

Step 2. Check alternator for freedom of rotation.

a. Loosen all drive belts and turn alternator shaft by hand (para 4-59).

b. If shaft will not turn freely or alternator is seized, replace alternator (para 5-21).

END OF TESTING!

52. HIGH OR LOW ALTERNATOR OUTPUT

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

See table 3-5, Electrical Troubleshooting, malfunctions 18 or 19.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

53. BATTERIES USE TOO MUCH WATER

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

See table 3-5, Electrical Troubleshooting, malfunction 22.

END OF TESTING!

180-AMPERE BATTERY CHARGING SYSTEM

NOTE

See TM 11-2300-351-13-3 when troubleshooting this system.

END OF TESTING!

DEEPWATER FORDING KIT

54. EXCESSIVE SMOKE FROM VEHICLE EXHAUST

Step 1. Check carburetor air inlet for any restriction.

If restricted or clogged, clean (para 4-27).

Step 2. Check fording valve operation by disconnecting vent inlet lines and verifying valve operation (para 11-55).

If valve is defective, replace (para 11-55).

END OF TESTING!

55. STALLING OR LOSS OF POWER (after fording)

Step 1. Check carburetor air intake hose for any restriction.

If restricted or clogged, clean (para 11-58).

Step 2. Check exhaust extension tailpipe for any restriction.

If restricted or clogged, clean (para 11-59).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Check fording valve operation by disconnecting vent inlet lines and verifying valve operation (para 11-55).

a. If valve is defective, replace (para 11-57).

b. If problem still exists, see malfunction 5.

END OF TESTING!

56. STALLING IN WATER

Step 1. Check carburetor mounting point and intake manifold for air leaks. Apply a small amount of oil at carburetor mounting point and intake manifold flanges.

If oil is pulled into intake manifold, tighten flange nuts or replace gaskets (para 4-10).

Step 2. Check exhaust system for leaks.

If leaking, tighten flange nuts or replace gaskets (chapter 4, section VI and para 11-59).

Step 3. Check fording valve operation by disconnecting vent inlet lines and verifying valve operation (para 11-55).

If valve is defective, replace (para 11-55).

Step 4. Check ignition system for wetness.

a. If wet, remove components as necessary and dry wet ignition parts.

b. If "O" rings are leaking or defective, replace (chapter 5, section I).

END OF TESTING!

57. WATER IN ENGINE

CAUTION

Before making any test or inspections, change oil and oil filter. See LO 9-2320-218-12. Make sure cylinders are free of water before rotating engine.

Step 1. Check carburetor mounting point and intake manifold for air leaks. Apply a small amount of oil at carburetor mounting point and intake manifold flanges.

If oil is pulled into intake manifold, tighten flange nuts or replace gaskets (para 4-10).

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 2. Start engine and check fording valve operation by disconnecting vent inlet lines. Suction must be evident for valve to be operational when valve is in open position.

a. If valve is defective, replace (para 11-55).

b. If problem still exists, notify DS maintenance.

END OF TESTING!

58. ENGINE CRANKS BUT WILL NOT START AFTER FORDING

Step 1. Check for water in fuel.

a. If water is in fuel, drain tank (paras 4-34 and 4-35).

b. Fill fuel tank.

Step 2. Inspect fuel tank cap gasket for breaks and damage.

a. If broken or damaged, replace fuel tank cap gasket (para 4-33).

b. If engine still does not start, see malfunction 2, steps 2 through 9 .

END OF TESTING!

HARDTOP KIT

59. EXCESSIVE RATTLES

Inspect for loose parts or joints.

a. Tighten loose parts or joints as necessary.

b. If rattles still exist, notify DS maintenance.

END OF TESTING!

60. EXCESSIVE AIR LEAKS

Inspect for loose parts or joints.

a. Tighten loose parts or joints as necessary.

b. If air leaks still exist, notify DS maintenance.

END OF TESTING!

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Table 3-3. Mechanical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

61. WATER LEAKS

Inspect for loose parts or joints.

a. Tighten loose parts or joints as necessary.

b. If water leaks still exist, notify DS maintenance.

END OF TESTING!

62. DOOR NOT LATCHING

Check door latch and handle, latch and handle stops, and springs for damage and wear.

If latch or handle, latch or handle stops, or springs are damaged or worn, replace (paras 11-41, 11-42, and 11-43).

END OF TESTING!

63. DOOR GLASS STICKING

Step 1. Check glass track for dirt and small objects.

Remove dirt and objects from track.

Step 2. Check glass frame and track for bends and corrosion.

a. If glass track is bent or corroded, replace track (para 11-48).

b. If glass frame is bent, replace glass (para 11-48).

c. If glass frame is corroded, remove from door and clean (para 11-48)

END OF TESTING!

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Section V. ELECTRICAL SYSTEMS TROUBLESHOOTING

3-14. General

a. This section provides information to diagnose and correct malfunctions of the electrical system. Because of its complexity, the electrical system is divided into the following functional systems:

Ignition system (page 3-79)
Starting system (page 3-90)
Generating system, 60 amp (page 3-94)
Generating system, 100 amp (page 3-99)
Battery system (page 3-103)
Lighting system (page 3-106)
Directional signal system (page 3-119)
Indicator, gage, and warning system (page 3-128)
Windshield wiper (page 3-143)
Hot water heater -25°F (-32°C) system (page 3-146)
Radio interference (page 3-152)
Winterization kit -65°F (-54°C) (page 3-153)

b. Operation of each of these systems can be found in chapter 2, and a wiring schematic showing the interrelationship of these systems can be found in appendix G of this manual.

c. Each malfunction symptom given for an individual component or system is followed by step(s) you should take to determine the cause and then corrective action you must take to remedy the problem.

d. Before taking any action to correct a possible malfunction, the following rules should be followed:

(1) Question operator to obtain any information that might help you determine the cause of the problem.

(2) Never overlook the chance that the problem could be of simple origin. The problem could be corrected with minor adjustment.

(3) Use all senses to observe and locate troubles.

(4) Use test instruments or gages to help you determine and isolate problems.

(5) Always isolate the system where the malfunction occurs and then locate the defective component.

(6) Use standard automotive theories and principles when troubleshooting the vehicles covered in this manual.

e. Table 3-5 lists electrical malfunctions that may occur in individual units or systems of the vehicle. This table covers electrical troubleshooting only. Troubleshooting procedures for the mechanical systems can be found in table 3-3, section IV.

3-15. Test Equipment

a. In troubleshooting the electrical system, the lightweight Simpson 160, TS 352 B/U, or AN/URM-105 multimeters will be used to make resistance or continuity tests, and voltage or low ampere current tests. Any one of these meters may be found in the common no. 1 or no. 2 organizational maintenance automotive shop sets.

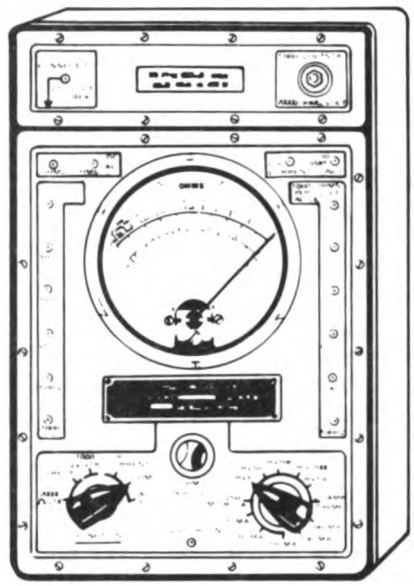
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3-15. Test Equipment (Cont'd)

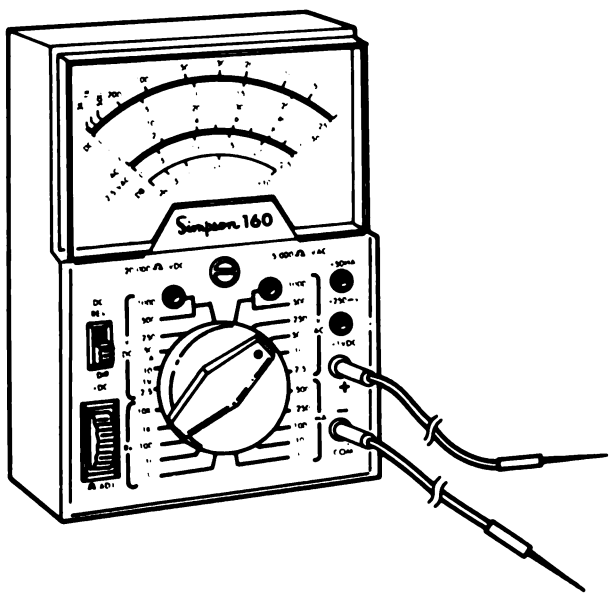
NOTE

The Simpson 160 is only available in new shop sets as a substitute for the TS-352 B/U or the AN/URM-105. The electrical testing instructions which follow show use of all of these instruments, as any of the three can be used.

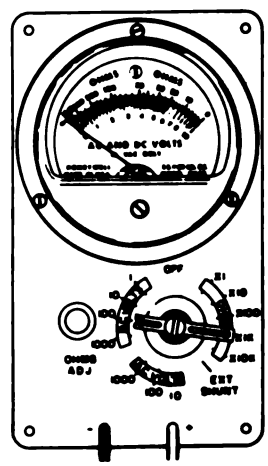
TS-352 B/U



SIMPSON 160



AN/URM-105

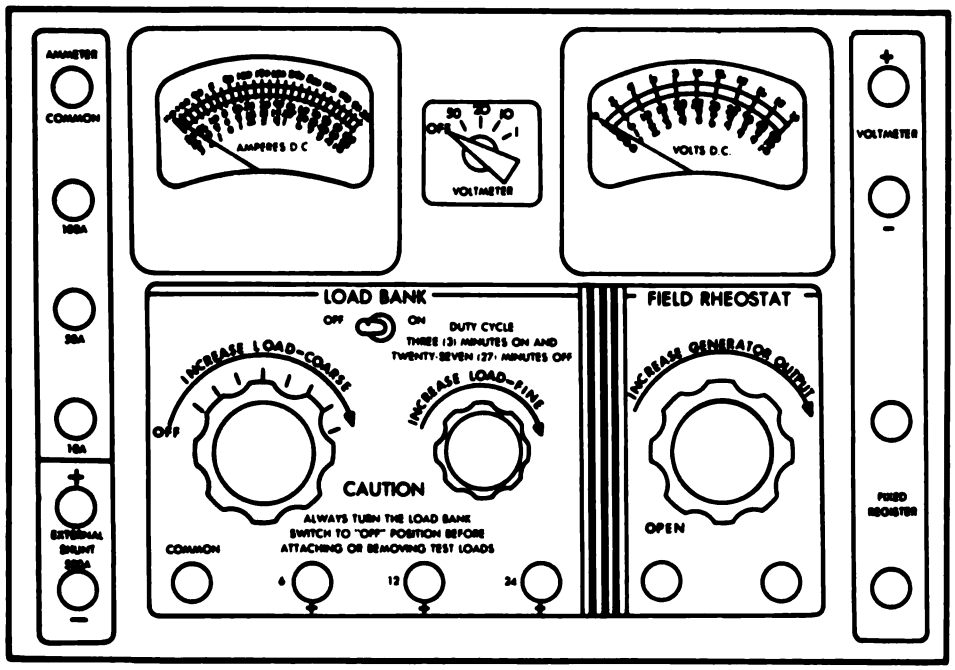


b. There are four types of low voltage circuit testers (LVCT) in general use (EMC 1060, TV-100, Allen 30-92, and RAM 62F151), and are used in this text to measure large current draw. Only one test set is illustrated because all are similar, and the test in this section can be performed equally well with any of these testers.

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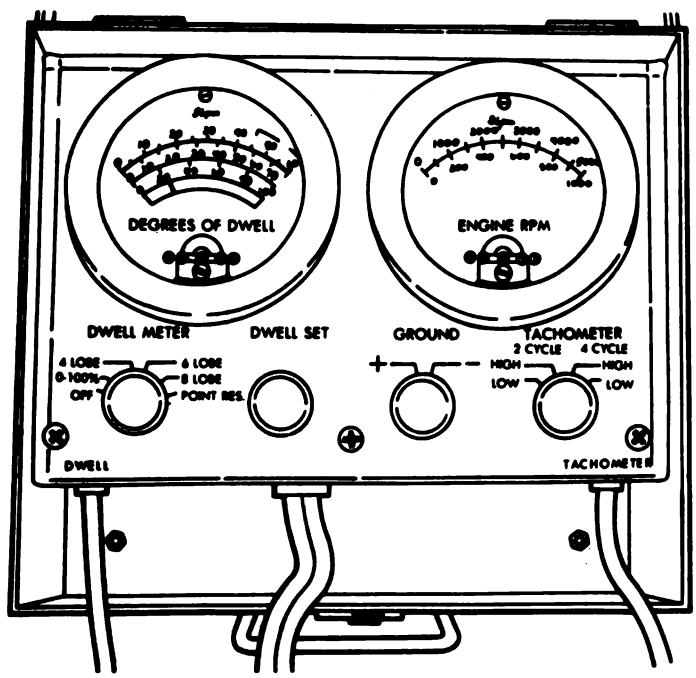
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3-15. Test Equipment (Cont'd)



LOW VOLTAGE CIRCUIT TESTER

c. The Simpson Electric Company, model TDS-2, tachometer and dwell test set is used in this text to measure engine rpm and dwell in the ignition system.



SIMPSON TDS-2

TA 155663

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3-16. Instructions for Using the Multimeter

a. General. Each of the test instruments discussed here must be set up and "zeroed" before making any tests.

NOTE

If needle will not "zero" on any instrument after following the procedures below, replace the batteries. If the needle still will not "zero" after replacing the batteries, turn the meter in for repair.

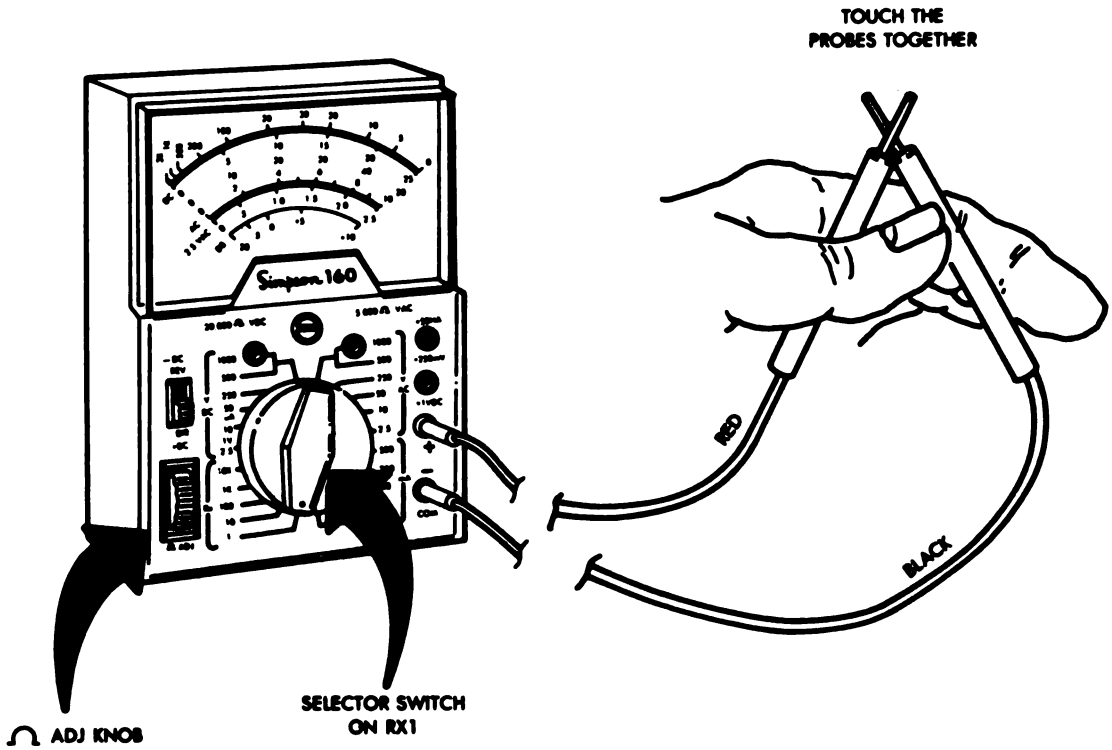
b. Zeroing the Simpson 160. Perform the following steps to zero this meter.

Step 1. Set selector switch on "RX1" position.

Step 2. Put black probe in "COM" jack.

Step 3. Put red probe in "+" jack.

Step 4. Touch red and black probes together and turn "ADJ" knob until needle is over the "0" on the top scale.



ZEROING SIMPSON 160

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3-16. Instructions for Using the Multimeter (Cont'd)

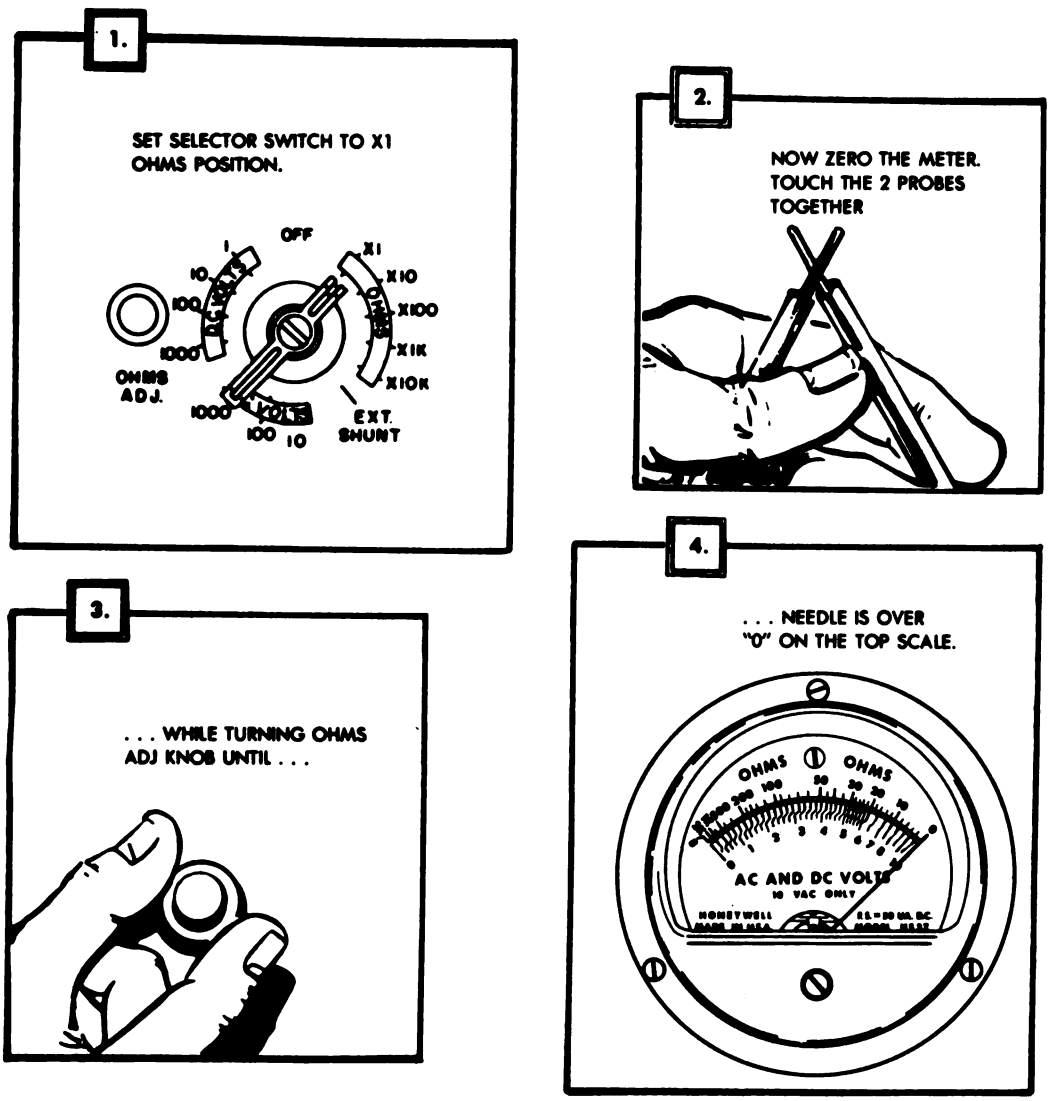
c. Zeroing the AN/URM-105. Perform the following steps to zero this meter.

Step 1. Set selector switch on "X1" ohms position.

Step 2. Put black probe in "-" jack.

Step 3. Put red probe in "+" jack.

Step 4. Touch red and black probes together and turn "ADJ" knob until needle is over the "0" on the top scale.



ZEROING AN/URM-105

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3-16. Instructions for Using the Multimeter (Cont'd)

d. Zeroing the TS-352 B/U. Perform the following steps to zero this meter:

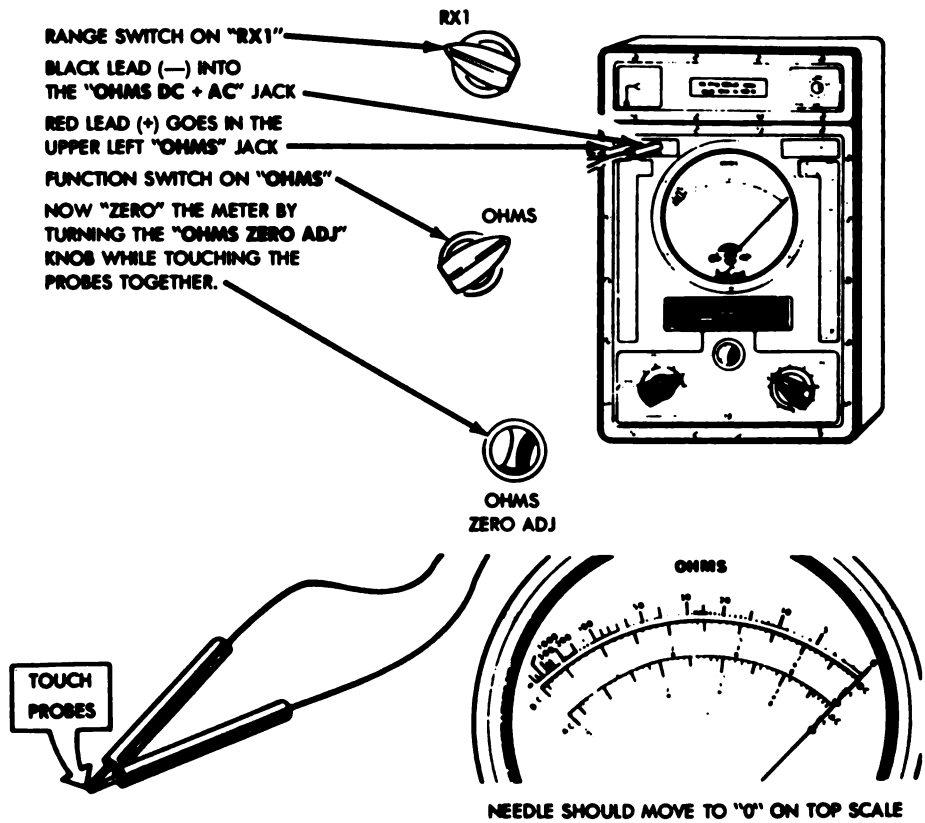
Step 1. Set range switch on "RX1" position.

Step 2. Put black probe into the "OHMS -DC+AC" jack.

Step 3. Put red probe into the "+" jack.

Step 4. Turn function switch to "OHMS" position.

Step 5. Touch red and black probes together and turn "OHMS ZERO ADJ" knob until the needle is over the "0" on the top scale.



ZEROING TS 352 B/U

e. Using the Ohms Scale. Once zeroed, the multimeter ohms scale can be used to make tests for continuity, shorts and resistance.

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3-16. Instructions for Using the Multimeter (Cont'd)

NOTE

Tests for continuity, shorts, and resistance are done identically using any of the multimeters discussed here.

f. Testing for Continuity (all three meters). Continuity tests are made to check for breaks in a circuit (such as switch, light bulb, or electrical cable as shown). To make a continuity check, do the following steps:

Step 1. Zero the multimeter.

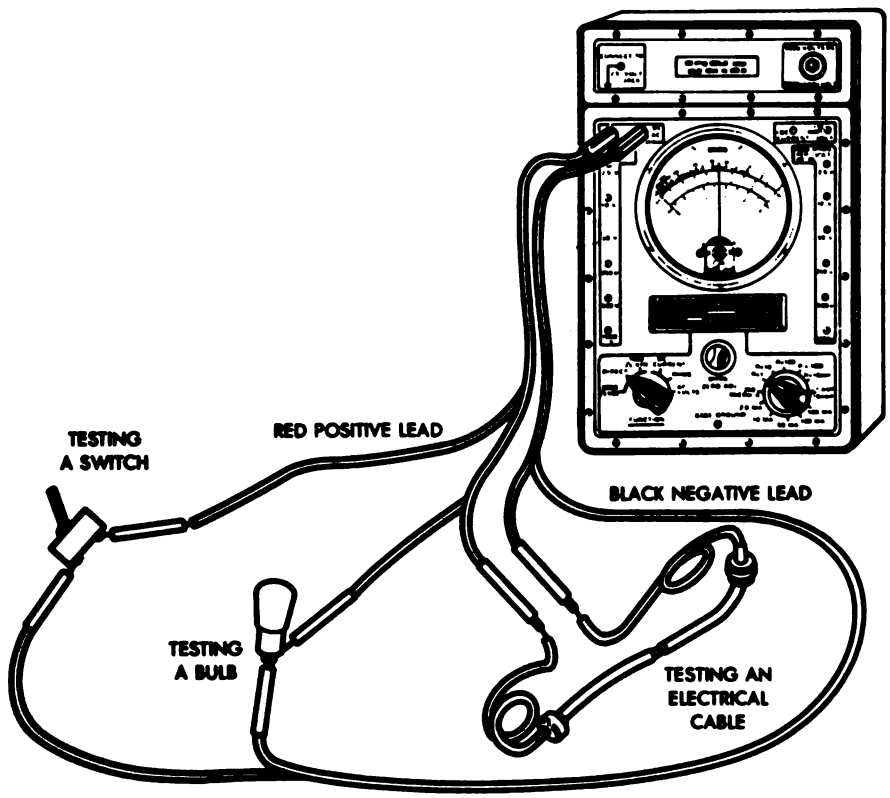
CAUTION

Failure to perform the next step can damage multimeter.

Step 2. Disconnect circuit being tested.

Step 3. Connect meter probes to both terminals of circuit being tested. (The TS-352 B/U is illustrated, but all meters are connected the same way.)

Step 4. Look at meter needle. If the needle swings over the "0" on the top of the scale, the circuit has continuity. If the needle does not move, the circuit is open (broken). If the needle jumps or flickers, there is a loose connection in the circuit being tested.



TESTING FOR CONTINUITY

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3-16. Instructions for Using the Multimeter (Cont'd)

g. Testing for Shorts (all three meters). A short circuit occurs when two circuits that should not be connected have metal-to-metal contact with each other, or when a circuit that should not touch ground, has metal-to-metal contact with ground. To check for shorts, do the following steps:

Step 1. Zero multimeter.

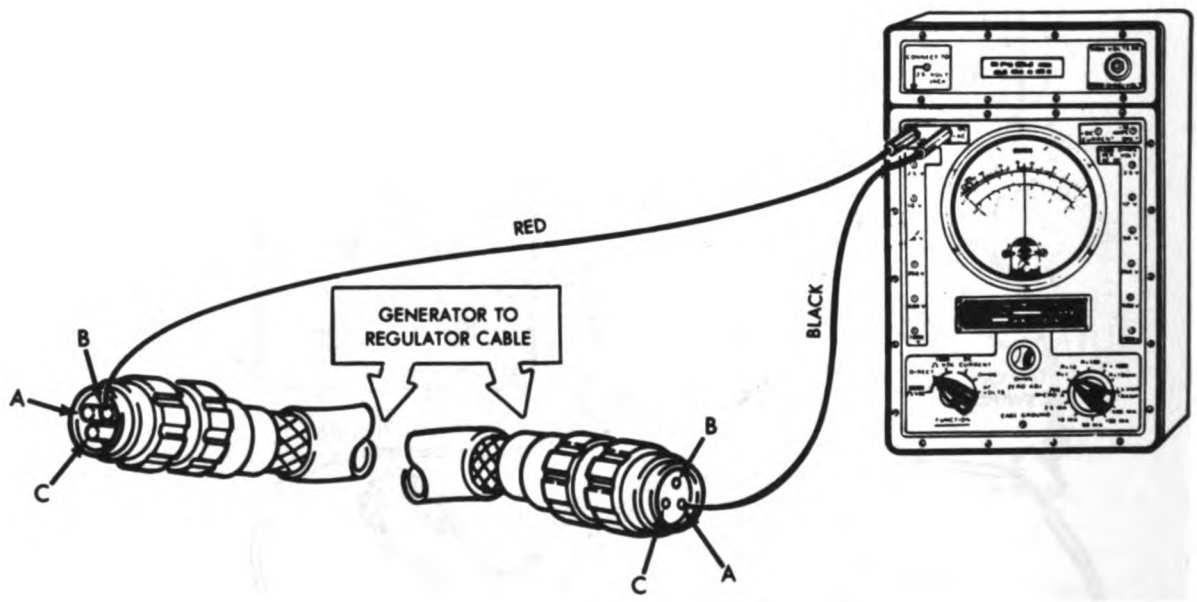
CAUTION

Failure to perform next step can damage multimeter.

Step 2. Disconnect circuit being tested.

Step 3. If checking for a short to ground, connect one probe to one circuit and the other to a ground. If checking for a short between two circuits, connect one probe to each circuit being tested.

Step 4. Look at meter needle. If the needle swings over the "0" on the top scale, the circuit is shorted. If the needle doesn't move, there is no short. If needle jumps or flickers, there is an intermittent short in the circuit being tested.



TESTING FOR SHORTS

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3-16. Instructions for Using the Multimeter (Cont'd)

h. Testing Resistance (all three meters). To measure resistance in a circuit do the following steps:

Step 1. Set up and "zero" test meter.

CAUTION

Failure to perform the next step can damage the multimeter.

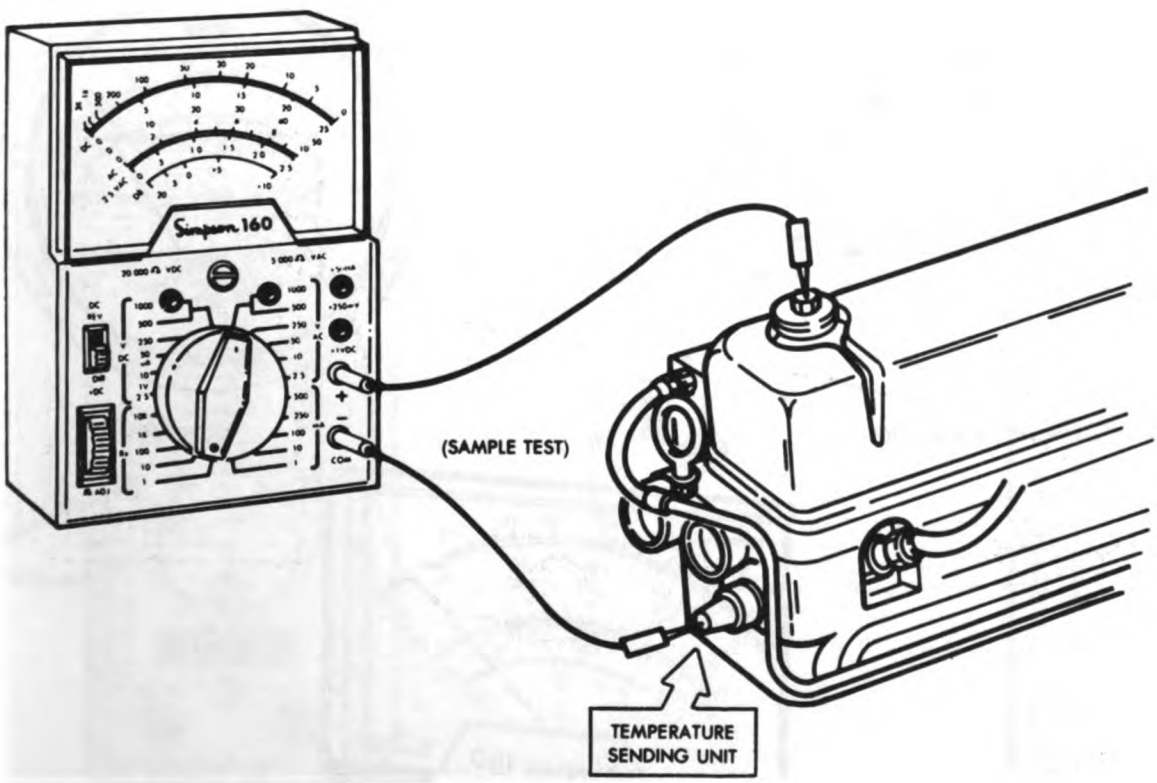
Step 2. Disconnect the circuit being tested.

Step 3. If the test in this manual calls for an "OHMS RANGE" different than "RX1 or X1", set the selector switch to that range (like "RX10 or X10").

NOTE

Zero the meter whenever you change ranges.

Step 4. Connect probes across the circuit or item or element to be measured. (The following illustration shows measuring resistance of a temperature sending unit.)



TESTING RESISTANCE

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3-16. Instructions for Using the Multimeter (Cont'd)

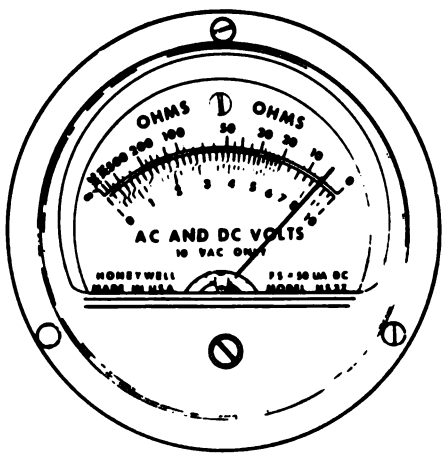
Step 5. Read the meter. If the meter switch is on the "RX1 or X1" range, the reading is taken from the top scale. If the meter switch is on a different range, multiply the reading on the scale according to the table below:

Ohms Switch Setting	You Do
X1 or RX1	Read number on scale
X10 or RX10	Multiply reading by 10
X100 or RX100	Multiply reading by 100
X1K or RX1K	Multiply reading by 1000
X10K or RX10K	Multiply reading by 10,000

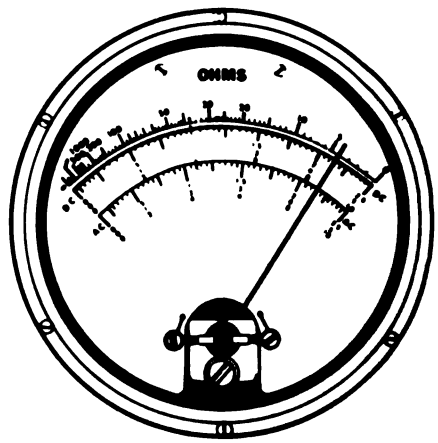
(Remember: K= 1000)

For example, the meter ohm switch will show the following readings on the multimeters as shown below:

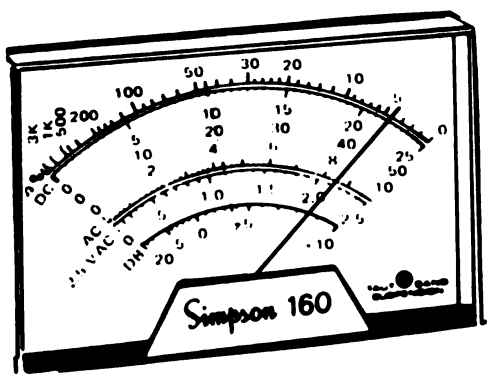
Ohms Switch Setting	Meter Indicates	Actual Resistance
X1 or RX1	4 ohms	4 ohms
X10 or RX10	4 ohms	40 ohms
X100 or RX100	4 ohms	400 ohms



AN/URM-105



TS-352 B/U



READING OHMS SCALE

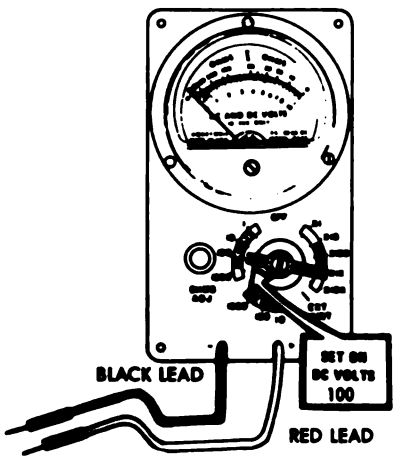
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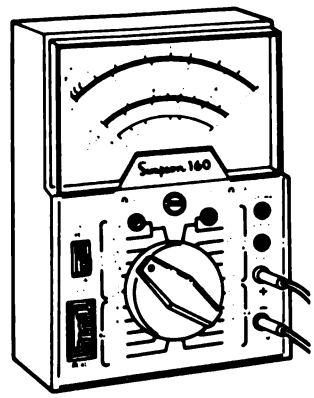
3-16. Instructions for Using the Multimeter (Cont'd)

i. Using the DC Volt Scale with the AN/URM-105 and Simpson 160. Before using these multimeters to measure DC voltage, do the following step:

Step 1. Set meter switch to DC volt range given in test procedure. (To measure 24-volts DC on the AN/URM-105, set switch on "100 DC volts" range, and on the Simpson 160, set switch on "50 V DC" range as shown below.)



AN/URM-105 DC VOLT SCALE



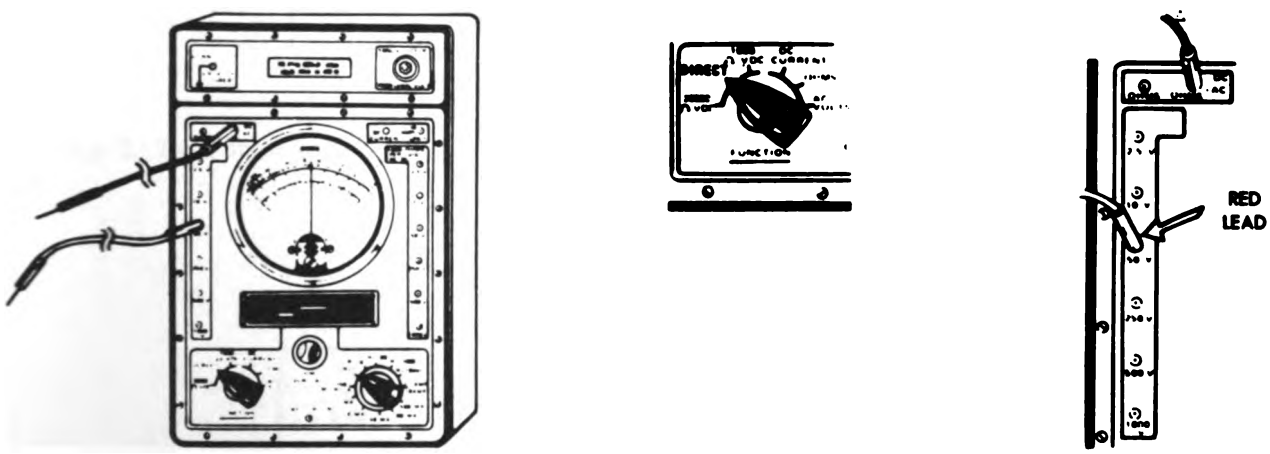
SIMPSON 160 DC VOLT SCALE

j. Using DC Volt Scale with the TS-352 B/U. Before using this multimeter to measure DC voltage, do the following steps:

Step 1. Set function switch to "direct" (range switch can be at any position).

Step 2. Put black lead in "DC/+AC/OHMS" jack.

Step 3. To measure 24 volts DC, plug red lead into "50 V" jack on left side of meter. If measuring less than 10 volts DC, use "10 V" jack. If measuring less than 2.5 volts DC, use "2.5 V" jack.



TS 352 B/U DC VOLT SCALE

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3-16. Instructions for Using the Multimeter (Cont'd)

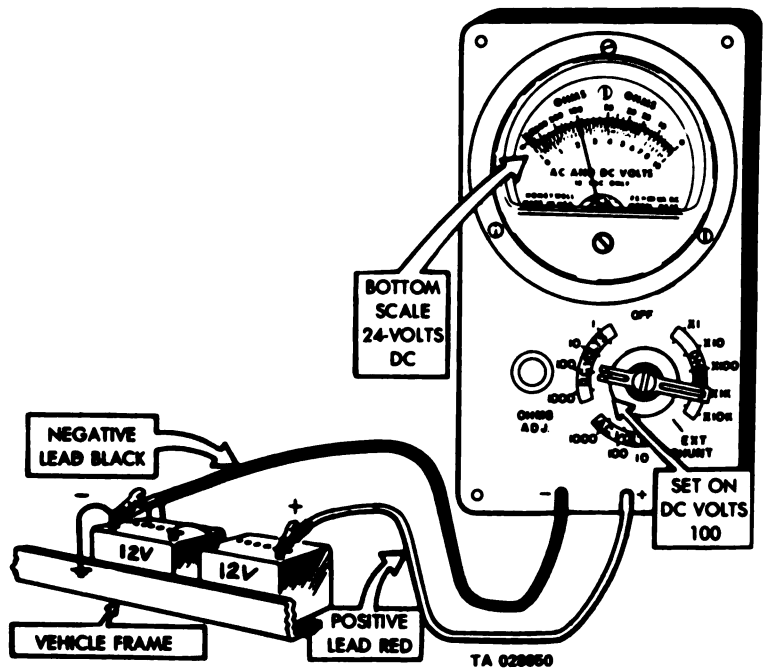
k. Measuring DC Voltage (all three meters). To measure DC voltage, do the following steps:

Step 1. Set up the multimeter as described in *i* or *j*.

NOTE

If you are not sure of the voltage to be measured on the vehicle, always start on the highest range of the meter you are using. This will protect the meter from damage.

Step 2. With all three multimeters, connect the red probe to the positive (+) side of circuit and the black probe to the negative (-) side. The following example shows 24 volts DC being measured across the batteries.



MEASURING DC VOLTAGE

Step 3. Read the meter. (The following examples show how to read all three multimeters.) If the needle tries to move off scale to the left, reverse the probes on the circuit.

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3-16. Instructions for Using the Multimeter (Cont'd)

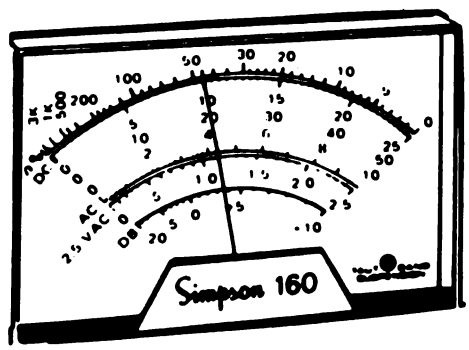
l. Reading the Simpson 160. Do the following step to read the Simpson 160:

Step 1. Read the "DC volts" scale for the range corresponding to the selector switch position. (See illustration below.)

SWITCH SETTING	SCALE
V DC 50	0-50
V DC 10	0-10
V DC 2.5	0-25 (AND DIVIDE BY 10)

Step 2. Then observe the following readings on the meter as shown below.

SWITCH SETTING	READING
V DC 50	20 VOLTS DC
V DC 10	4 VOLTS DC
V DC 2.5	1 VOLT DC



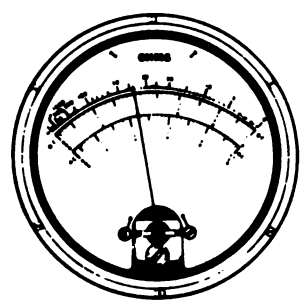
m. Reading the TS-352 B/U. Do the following steps to read this meter for DC voltage.

Step 1. Read the "DC" volts scale for the range corresponding to the red lead position.

RANGE	SCALE
50V	0-5 (AND MULTIPLY BY 10)
10V	0-10
2.5V	0-25

Step 2. Then observe the reading on the meter as shown below.

RANGE	READING
50V	20 VOLTS DC
10V	4 VOLTS DC
2.5V	1 VOLT DC



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3-16. Instructions for Using the Multimeter (Cont'd)

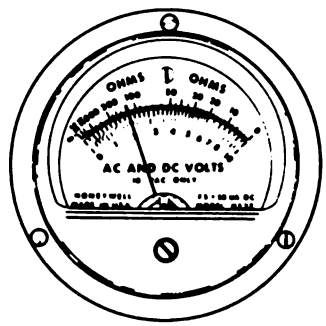
n. Reading the AN/URM-105. Do the following steps to read this meter for DC voltage.

Step 1. Read the upper, black, straight-lined portion of the "AC and DC volts" scale for the range corresponding to the selector switch position.

SWITCH SETTING	SCALE
1000 DC VOLTS	0-10 (AND MULTIPLY BY 100)
100 DC VOLTS	0-10 (AND MULTIPLY BY 10)
10 DC VOLTS	0-10
1 DC VOLT	0-10 (AND MULTIPLY BY 10)

Step 2. Then observe the reading on the meter as shown below.

SWITCH SETTING	READING
100 DC VOLTS	20 VOLTS DC
10 DC VOLTS	2 VOLTS DC
1 DC VOLT	.2 VOLTS DC



3-17. Instructions for Using the Low Voltage Circuit Tester (LVCT)

a. General. The low voltage circuit tester (LVCT) is equipped to perform as voltmeter, ammeter, fixed and changing ohm resistance unit, and load bank. The applicable function of the ammeter will be addressed in this section.

b. Ammeter. Two binding posts are provided for connecting an external shunt assembly to extend the ammeter range to 500 amperes. The external shunt reduces amperes to the LVCT but allows full amperage to be read on the LVCT meter. The shunt has two small wires and two large wires, and should be attached as follows:

Step 1. Connect the small black shunt wire to the negative shunt post of the LVCT.

Step 2. Connect the small red shunt wire to the positive shunt post of the LVCT.

Step 3. Disconnect the battery ground cable from the battery negative ground post.

Step 4. Connect the large red shunt cable to the battery ground cable.

Step 5. Connect the large black shunt cable to the negative battery post.

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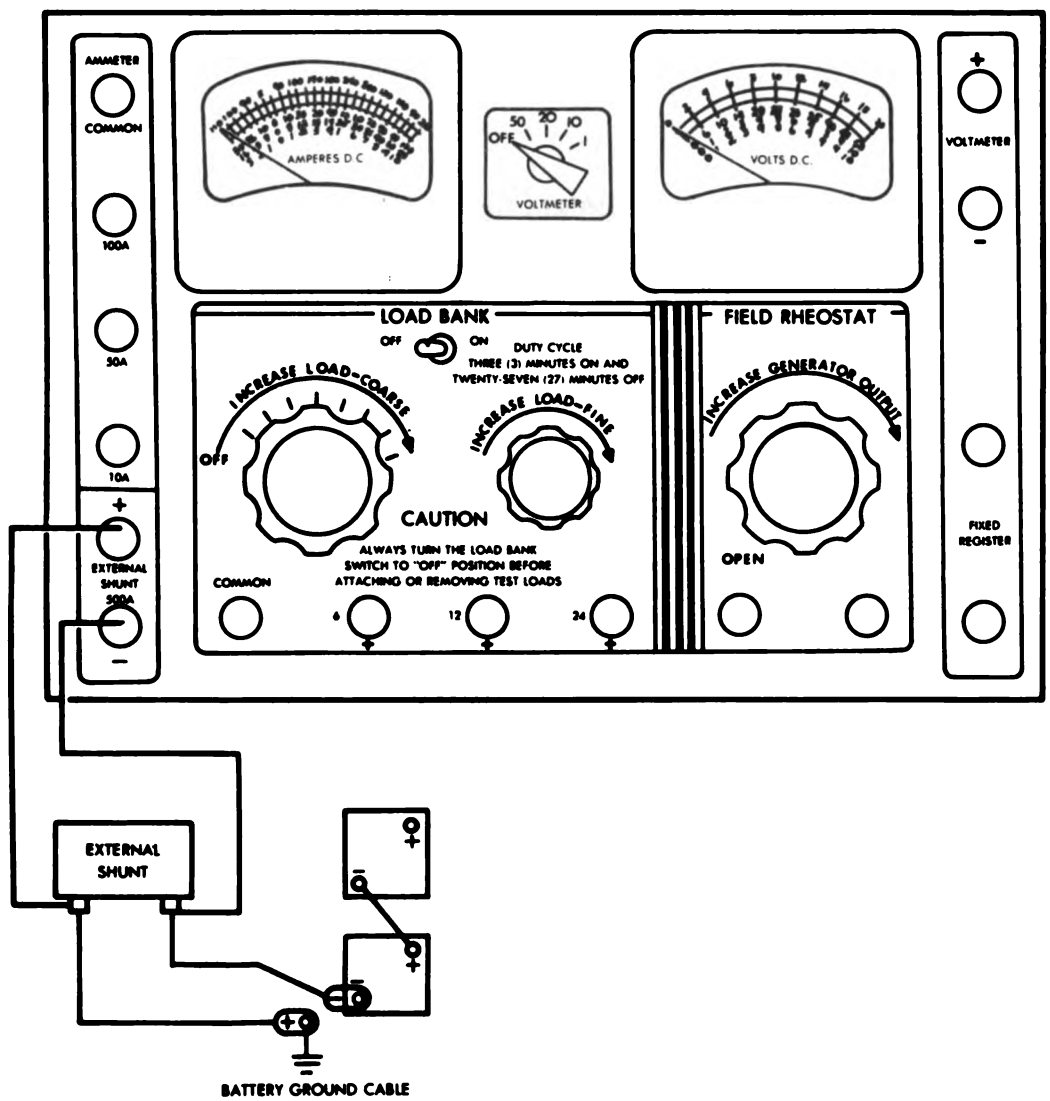
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3-17. Instructions for Using the Low Voltage Circuit Tester (LVCT) (Cont'd)

NOTE

- Zero on the ampere meter scale is one-third of the way from left side of scale to permit reading current in either direction without changing leads.
- Read amperes on zero to 500 scale.

c. Additional operating instructions for the LVCT can be found in TM 9-4910-509-10.



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3-18. Instructions for Using the Tachometer and Dwell Test Set

a. General. The model TDS-2 tachometer and dwell test set has three measuring circuits for measuring engine speed, distributor cam dwell, and distributor points resistance. The set requires power from either the vehicle battery or an external source.

b. Tachometer and Dwell Test. The tach and degrees of dwell using vehicle battery power source are addressed in this text. Prepare test set for testing tach and dwell as follows:

Step 1. Set ground switch to negative (-) if the vehicle has a negative ground.

Step 2. Set dwell meter switch according to the number of cylinders in the vehicle to be tested.

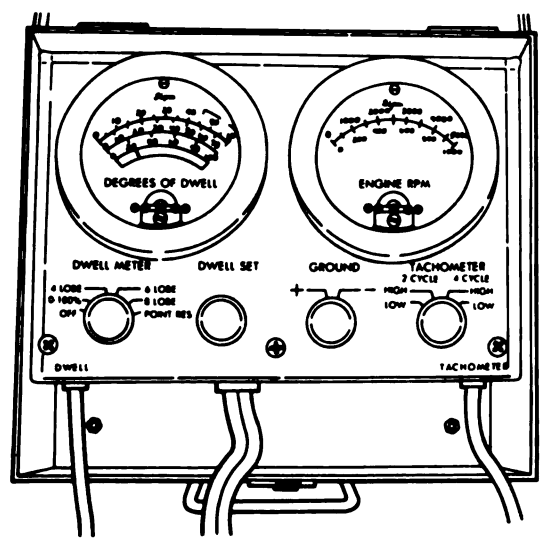
TEST	CYLINDERS	SETTING	METER SCALE
Dwell	4	4 lobe	0-90°
Dwell	6	6 lobe	0-60°
Dwell	8	8 lobe	0-60°
Dwell	All	0-100%	0-100%
Point resistance	All	Point resistance	Green or red

Step 3. Set tachometer switch according to whether testing a two-cycle or four-cycle engine, and the desired rpm range required.

TEST	CYCLE	RPM SETTING	METER SCALE
Tach	4	Low	0-1000
Tach	4	High	0-5000
Tach	2	Low	0-1000
Tach	2	High	0-5000

Step 4. Using dwell set control knob, aline dwell meter pointer to zero after meter connection is complete.

Step 5. Connect test set power source leads to vehicle battery, dwell lead to distributor, and tach lead to spark plug cable according to test set instructions.



c. Additional operating instructions for the tach and dwell test set are found in TM 9-4910-500-12. TA 155676

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Table 3-4. Electrical Troubleshooting Symptom Index

MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
	IGNITION SYSTEM	
1.	Engine will not start (standard and solid-state ignition)	3-79
2.	Engine starts hard or stalls easily (standard ignition)	3-83
3.	Engine starts hard or stalls easily (solid-state ignition)	3-84
4.	Engine misfires at high speed or under load, or is hard to start (standard ignition)	3-85
5.	Engine runs unevenly (standard ignition)	3-86
6.	Engine runs unevenly (solid-state ignition)	3-87
7.	Engine has spark knock under load, overheats, is hard to start, or lacks power	3-88
8.	Engine runs unevenly, misfires at high speed, or spark knocks under load	3-89
	STARTING SYSTEM	
9.	Starter motor inoperative	3-90
10.	Starter motor cranks engine slowly	3-91
	GENERATING SYSTEM (60 AMP)	
11.	Batteries run down in service	3-94
12.	Batteries hot or boiling, corrected specific gravity of all cells is 1.280	3-95
13.	No alternator output	3-96
14.	Batteries use excessive water	3-98
15.	Battery indicator in HIGH RED position	3-98
16.	Alternator output voltage low	3-98
	GENERATING SYSTEM (100 AMP)	
17.	No alternator output	3-99
18.	Low alternator output (less than 27 volts)	3-102
19.	High alternator output (more than 29 volts)	3-102
20.	Battery-generator indicator stays in red or yellow band with engine at 1500 rpm	3-102
	BATTERY SYSTEM	
21.	Engine will not crank. Some electrical systems inoperative or weak	3-103
22.	Batteries are hot, electrolyte is boiling, or excessive use of water	3-105
23.	Specific gravity will not increase to 1.280 under charge	3-105
24.	All vehicle electrical systems inoperative	3-105
	LIGHTING SYSTEM	
25.	Vehicle lights flicker, are dim, or intermittent	3-106
26.	Lamps burn out prematurely	3-107
27.	Headlamp inoperative (one side)	3-107
28.	Headlamps inoperative (both sides)	3-110
29.	Blackout lamp inoperative	3-112
30.	Rear lights inoperative	3-114
31.	Trailer lights inoperative	3-116
32.	Stoplight inoperative	3-117
33.	Lamps will not light	3-118

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Table 3-4. Electrical Troubleshooting Symptom Index (Cont'd)

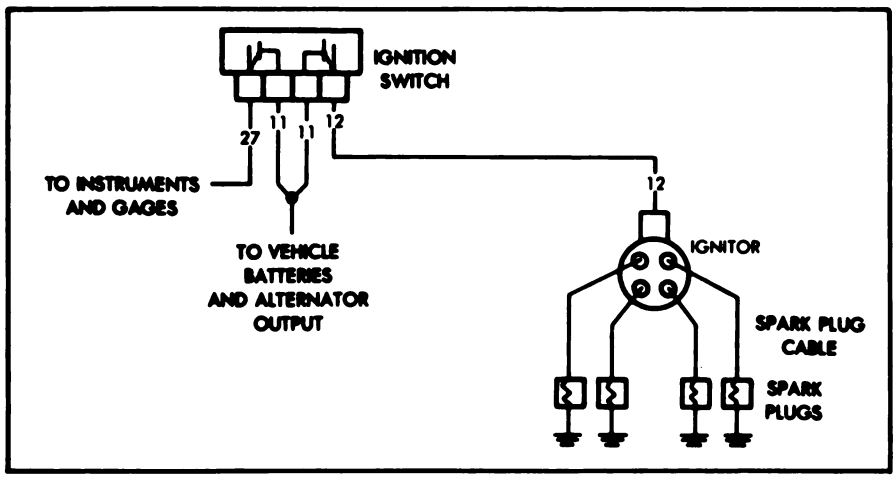
MALFUNCTION NO.	MALFUNCTION	TROUBLESHOOTING PROCEDURE PAGE
	DIRECTIONAL SIGNAL SYSTEM	
34.	Individual lamps do not light with directional switch in any position	3-120
35.	No lamps operative with directional control unit in any position	3-124
36.	Directional signal system operates incorrectly in one or more positions of control lever	3-127
	INDICATOR, GAGE, AND WARNING SYSTEM	
37.	All gages inoperative	3-129
38.	One gage inoperative	3-132
39.	Oil pressure gage inoperative	3-132
40.	Temperature gage inoperative (coolant)	3-134
41.	Fuel gage inoperative	3-136
42.	Battery-generator indicator inoperative	3-138
43.	Horn inoperative	3-140
	WINDSHIELD WIPER	
44.	Windshield wiper inoperative in either speed	3-143
	HOT WATER HEATER -25°F (-32°C)	
45.	Blower motor will not work in high or low speed	3-146
46.	Blower motor works in high speed only	3-151
47.	Blower motor works in low speed only	3-151
	RADIO INTERFERENCE	
48.	Radio interference	3-152
	WINTERIZATION KIT -65°F (-54°C)	
49.	Diverter actuator assembly does not operate	3-153
50.	Slave receptacle inoperative	3-157

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Table 3-5. Electrical Troubleshooting

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

IGNITION SYSTEM



1. ENGINE WILL NOT START (standard and solid-state ignition)

NOTE

If STE/ICE is available, perform NG10 — engine crank — no start (chapter 3, section VI).

Test 1. Check fuel level.

Test 2. Secondary circuit voltage test.

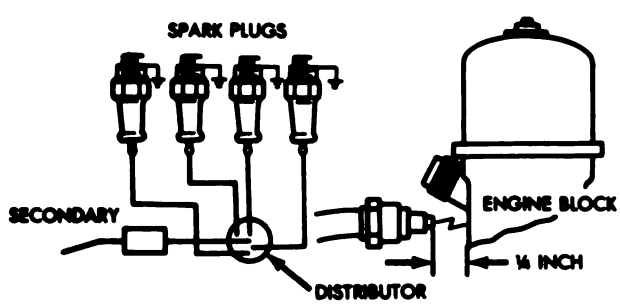
Step 1. Remove spark plug cables from spark plugs.

Step 2. Position the spark plug cable ¼ inch from cylinder head and crank engine with ignition switch in ON position.

Step 3. Observe each cable in turn to see if spark jumps gap between cable and cylinder head.

a. If spark jumps gap, turn ignition to OFF position, remove plugs and clean or replace as necessary (para 4-15).

b. If no or weak spark is evident, turn ignition to OFF position and go to test 3.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Primary circuit resistance test.

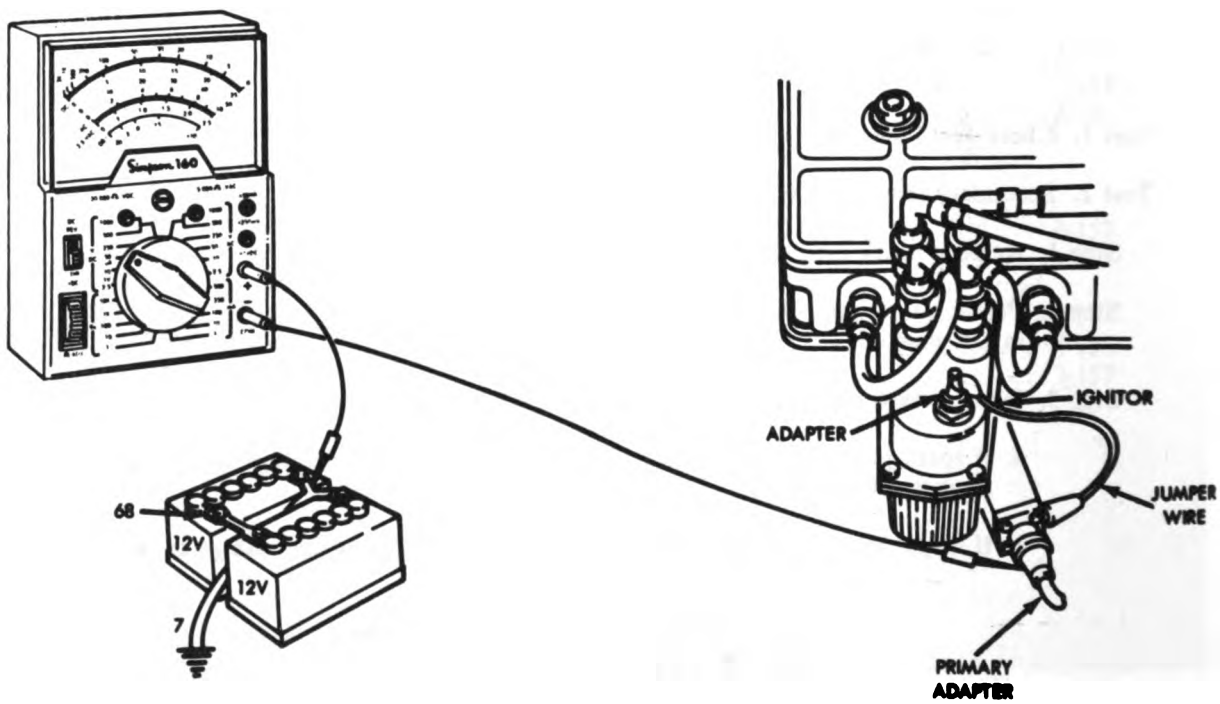
Step 1. Install distributor adapters and jumper wire as shown.

Step 2. Set multimeter to 50-volt range and connect between the battery negative terminal and the primary distributor adapter.

Step 3. Turn ignition switch to ON position and switch meter to progressively lower settings until voltage is indicated.

a. If a reading of 0.2 volts or more is observed, primary circuit is normal. Test control module (malfunctions 2 and 3).

b. A reading below 0.2 volts indicates a faulty ignition switch or primary circuit. Turn ignition switch to OFF position and go to test 4.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

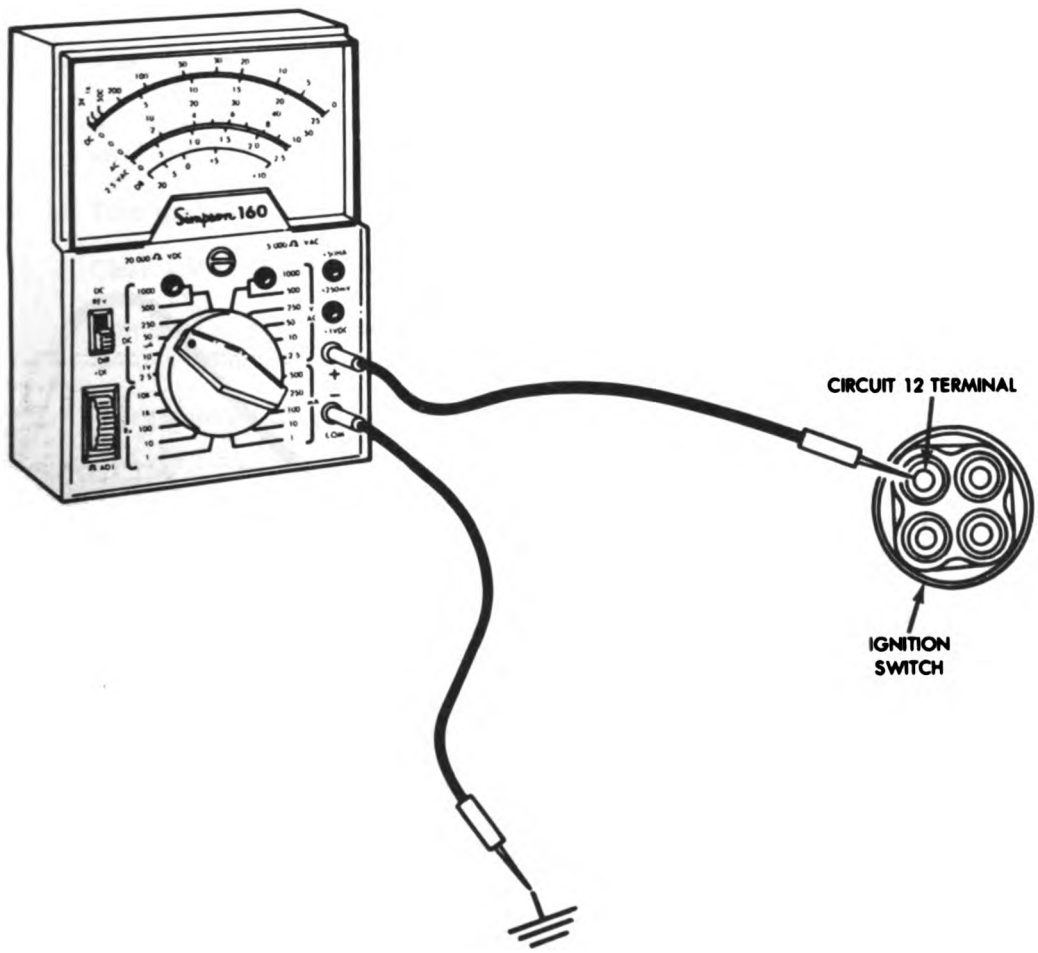
Test 4. Ignition switch voltage test.

Step 1. Set multimeter to 50-volt range, and connect negative lead to ground.

Step 2. Disconnect circuit 12 connector from ignition switch, and connect positive lead of multimeter to switch terminal.

Step 3. Turn ignition switch to ON, and observe multimeter.

Meter should indicate battery voltage. If no voltage, turn ignition switch OFF and go to test 5.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

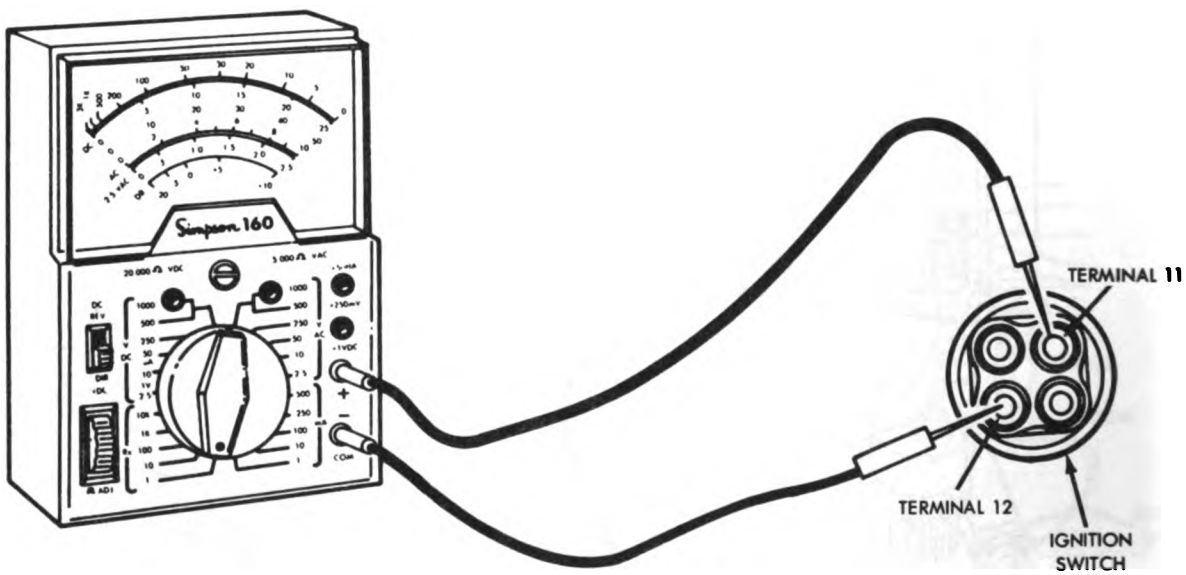
Test 5. Ignition switch continuity test.

Step 1. Disconnect circuit 11 and 12 connectors from ignition switch, and place switch to ON position.

Step 2. Set multimeter for RX1, connect positive lead to circuit 11 of ignition switch, and connect meter negative lead to circuit 12 of ignition switch.

a. If meter indicates infinite or high resistance, switch is defective. Place ignition switch in OFF position and replace ignition switch (para 5-71).

b. If meter indicates zero resistance, there is an open circuit between the ignition switch and the battery. Place ignition switch in OFF position and repair or replace circuit 11 wire (para 5-50).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. ENGINE STARTS HARD OR STALLS EASILY (standard ignition)

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Test 1. Breaker point resistance test.

Step 1. Install distributor adapter, connect multimeter to adapter and engine ground, and set to 50-volt range.

Step 2. Turn ignition switch to ON position, and crank engine intermittently until multimeter reads zero or very low value.

Step 3. Progressively switch multimeter to lower settings until a reading is obtained.

a. A reading of 0.2 volts or less indicates a normal primary circuit.

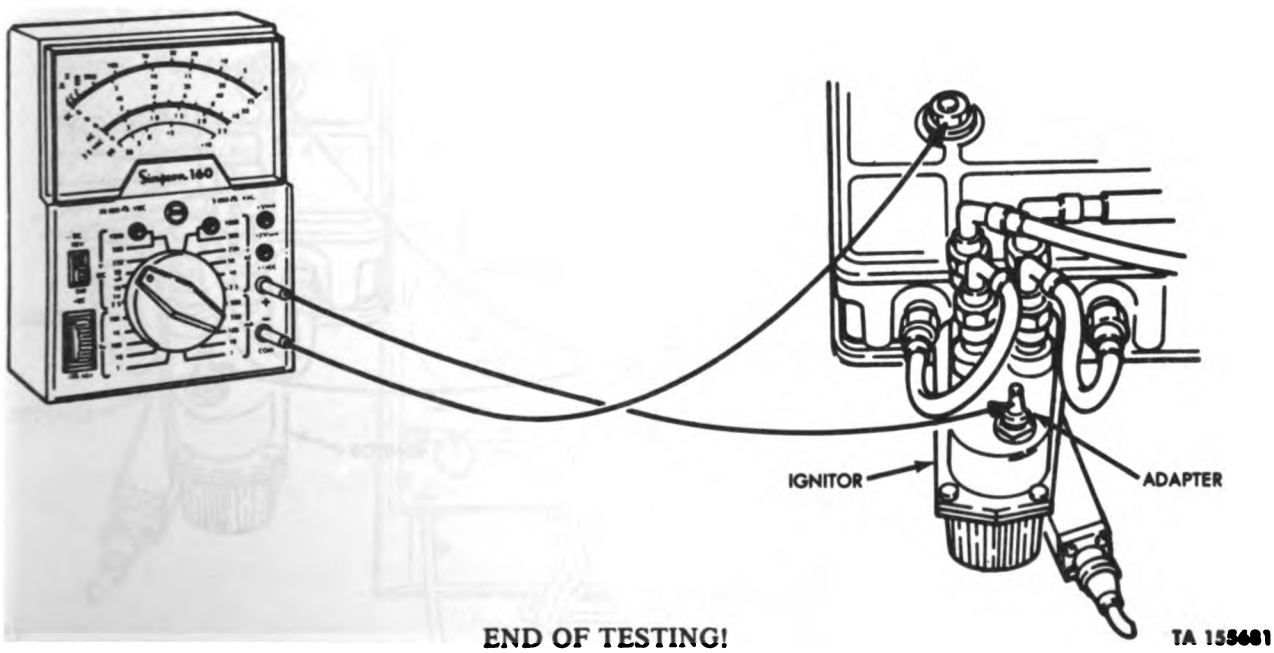
b. A reading of more than 0.2 volts indicates a poor distributor ground, or burned or pitted breaker points.

c. Turn ignition switch to OFF position.

d. Clean and tighten distributor ground or replace breaker point (para 5-7).

e. If breaker points are unserviceable, replace standard ignition components with solid-state ignition components (para 5-6).

f. Test secondary circuit voltage, (malfunction 1, test 2).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

3. ENGINE STARTS HARD OR STALLS EASILY (solid-state ignition)

NOTE

If STE/ICE is available, perform NG50 — power test fault isolation (chapter 3, section VI).

Test 1. Control module test.

Step 1. Install secondary circuit adapter on distributor.

Step 2. Set multimeter to 50-volt range.

Step 3. Connect meter positive lead to adapter terminal, and negative lead to ground.

Step 4. Turn ignition switch to ON position and observe multimeter.

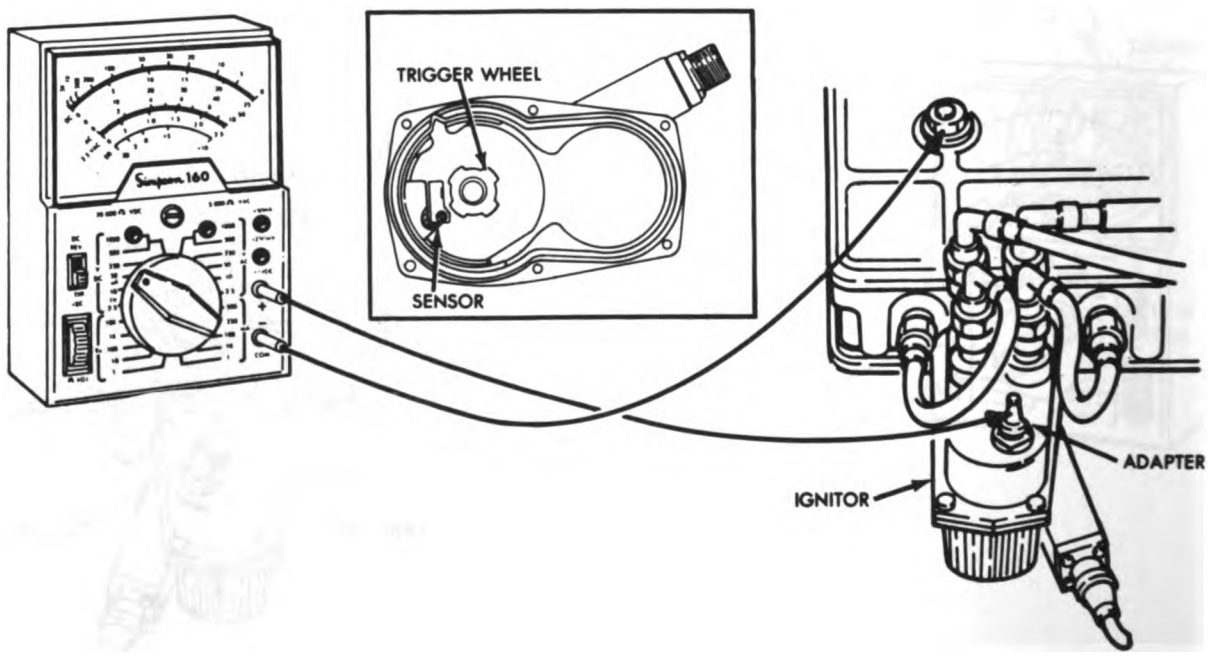
a. If meter shows no voltage, switch to progressively lower scales until a reading is obtained.

b. If meter indicates any voltage less than 4.0 volts, connections are normal.

If multimeter indicates 24 volts, proceed to step 5.

Step 5. Rotate engine until a reading of 4 volts or less is obtained, or distributor rotor makes one complete revolution. If a reading of 4.0 volts or less cannot be obtained, turn ignition switch to OFF position and replace control module (para 5-6).

Step 6. Remove distributor cover and rotate engine until none of the trigger wheel teeth are alined with center of sensor. Install cover (para 5-4).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 7. Turn ignition switch to ON position and observe meter.

a. Meter should indicate battery voltage.

b. If no voltage is indicated, go to step 8.

Step 8. Remove the green lead from coil negative terminal and connect the meter positive lead to the negative terminal of the coil and the meter negative lead to ground. With ignition switch in ON position, observe meter.

If meter indicates battery voltage, turn ignition switch to OFF position and replace solid-state ignition kit components (para 5-6).

Step 9. After solid-state ignition kit components have been replaced, repeat step 8.

If battery voltage is not indicated, replace ignition coil kit components (para 5-9).

END OF TESTING!

4. ENGINE MISFIRES AT HIGH SPEED OR UNDER LOAD, OR IS HARD TO START (standard ignition)

NOTE

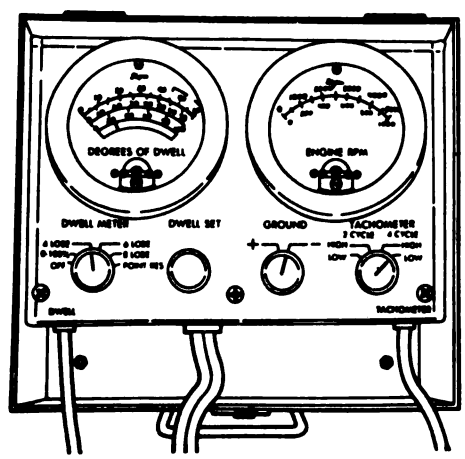
If STE/ICE is available, perform NG50 — power test fault isolation (chapter 3, section VI).

Test 1. Perform breaker point dwell test.

Step 1. Put ground switch in negative (-) position.

Step 2. Put dwell meter switch in 4 LOBE position. This selects 0-90° meter scale.

Step 3. Put tachometer switch in 4 cycle LOW position. This selects 0-1000 rpm range. For 0-5000 rpm range, set to 4 cycle HIGH position.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Connect power source leads to vehicle battery, black lead to negative(-) terminal post, and red lead to positive (+) terminal post.

Step 5. Turn dwell set knob to zero dwell meter pointer.

Step 6. Remove plug in distributor cover, and screw in distributor primary adapter.

Step 7. Connect red dwell lead to distributor primary adapter.

Step 8. Disconnect any spark plug cable.

Step 9. Connect spark plug adapter to spark plug cable and spark plug.

Step 10. Connect blue tachometer lead to spark plug adapter.

NOTE

Do not allow clip of tachometer lead to contact any metallic part of adapter or vehicle.

Step 11. Start engine, set engine speed at idle, and observe dwell meter.

a. A reading of 39° to 46° dwell angle indicates normal point gap setting. A setting of more than 46° may cause hard starting. A setting of less than 39° may cause engine to misfire at high rpm or during heavy load conditions.

b. If breaker points are out of adjustment or unserviceable, replace standard ignition components with solid-state ignition components (para. 5-6).

NOTE

Ignition timing must be checked whenever point gap is adjusted (para. 4-17).

END OF TESTING!

5. ENGINE RUNS UNEVENLY (standard ignition)

NOTE

If STE/ICE is available, perform NG90 — ignition system tests (chapter 3, section VI).

Test 1. Dwell variation test.

Step 1. Connect test equipment the same as in malfunction 4, start engine, and set engine speed at idle.

Step 2. Slowly increase engine speed to 1500 rpm while observing dwell meter for variation in point dwell.

a. A point dwell variation of 3° or less indicates distributor shaft and bushing are within specification.

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

b. A variation of more than 3° indicates a defective shaft, bushing, or weak breaker point spring. Stop engine and replace distributor (para 5-7).

END OF TESTING!

6. ENGINE RUNS UNEVENLY (solid-state ignition)

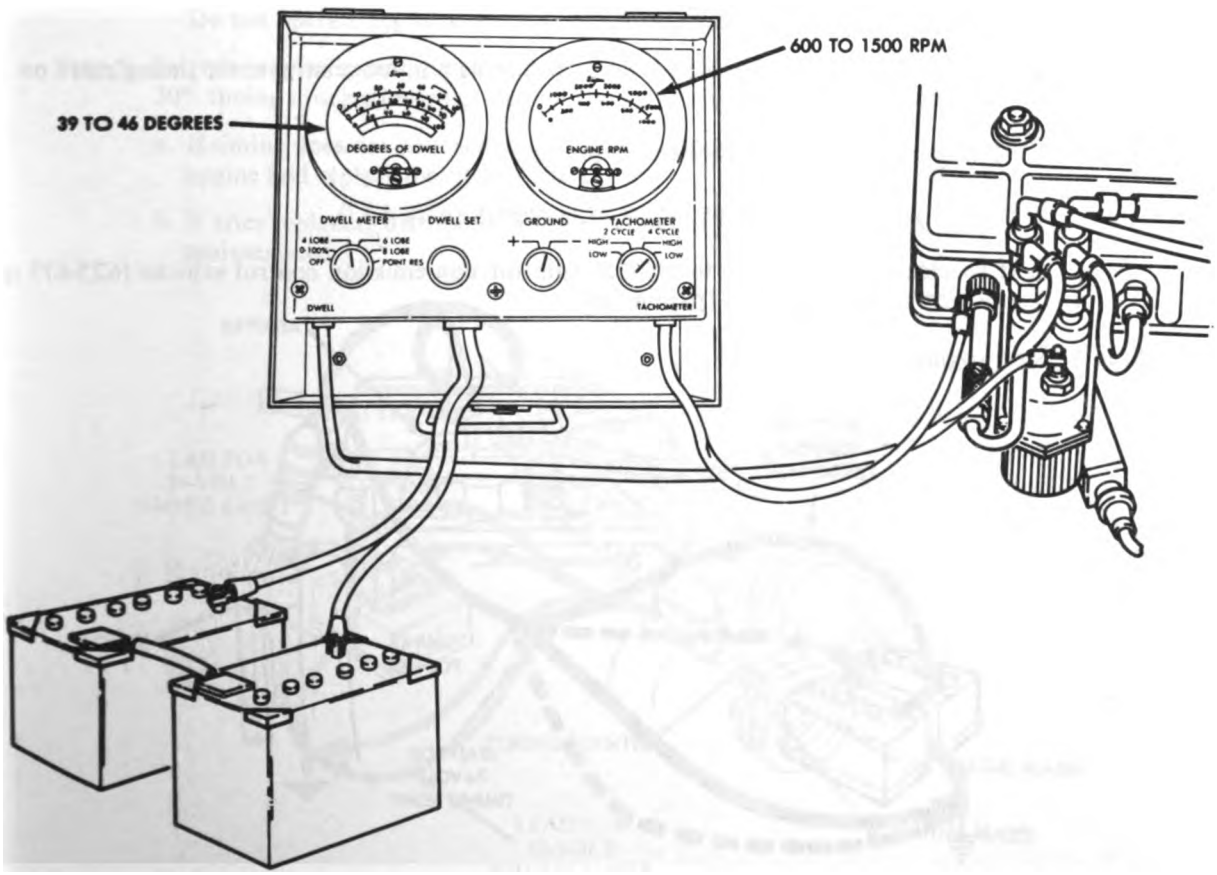
Test 1. Dwell variation test.

Step 1. Adjust sensor gap (para 5-6) (Prestolite control module only).

Step 2. Install secondary voltage adapter, dwell meter and tachometer (malfunction 4, test 1).

Step 3. Start engine and slowly increase engine RPM to 1500 while observing dwell meter for the highest and lowest dwell indications.

A variation of more than 3 degrees indicates that the distributor shaft or bushing is worn excessively, stop engine and replace distributor (para 5-7).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. ENGINE HAS SPARK KNOCK UNDER LOAD, OVERHEATS, IS HARD TO START, OR LACKS POWER

NOTE

If STE/ICE is available, perform NG50 — power test fault isolation (chapter 3, section VI).

Test 1. Ignition timing test.

Step 1. Clean crankshaft pulley timing notch and pointer.

Step 2. Remove #1 spark plug cable and install timing adapter between spark plug and cable.

Step 3. Attach timing light positive lead to adapter and timing light negative lead to ground.

Step 4. Install distributor secondary adapter and attach tachometer positive lead on adapter and negative lead to ground (malfunction 4, test 1).

Step 5. Mark 6° timing notch with white chalk.

Step 6. Start engine and adjust idle to 500-550 rpm for non-emission control vehicles (625-675 rpm for emission control vehicles) (para 4-16).

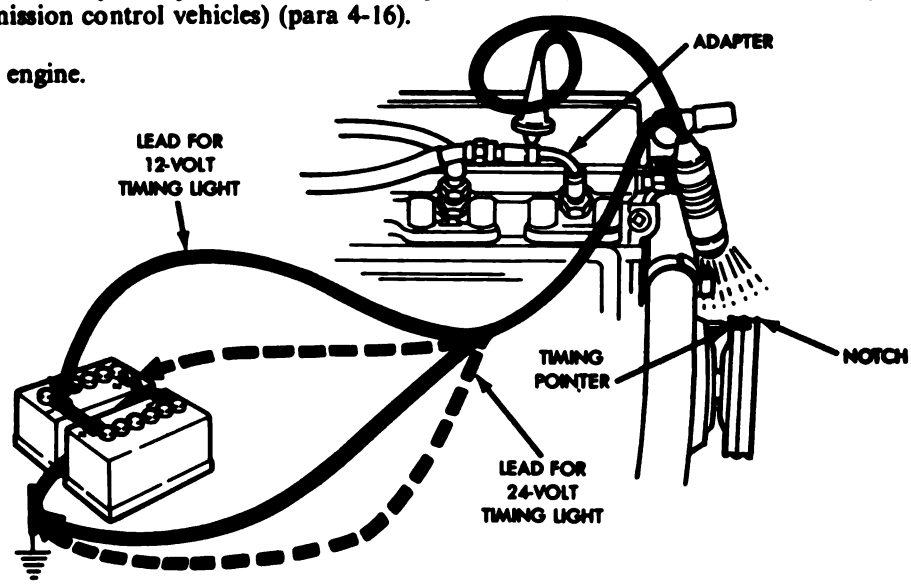
Step 7. Focus timing light beam on pointer and determine its position relative to the timing mark on the crankshaft pulley.

a. Timing mark should be alined with pointer.

b. If mark is out of alinement, adjust as necessary (para 4-17).

c. If necessary, readjust idle to 500-550 rpm for non-emission control vehicles (625-675 rpm for emission control vehicles) (para 4-16).

Step 8. Stop engine.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

8. ENGINE RUNS UNEVENLY, MISFIRES AT HIGH SPEED, OR SPARK KNOCKS UNDER LOAD.

NOTE

- If STE/ICE is available, perform NG50 — power test fault isolation (chapter 3, section VI).
- To perform the following test, crankshaft pulley must be marked with a 30° notch (see para 4-17).

Test 1. Ignition timing advance test.

Step 1. Connect tachometer, adapter, and timing light as connected in malfunction 7, test 1.

Step 2. Start engine and adjust idle to 500-550 rpm for non-emission control vehicles (625-675 rpm for emission control vehicles).

Step 3. Slowly increase engine speed to 1500 rpm while observing the 6° timing notch with timing light. Timing notch should advance smoothly.

Step 4. Maintain a constant 1500 rpm while observing the 6° timing notch with a timing light. Timing notch should maintain a steady position.

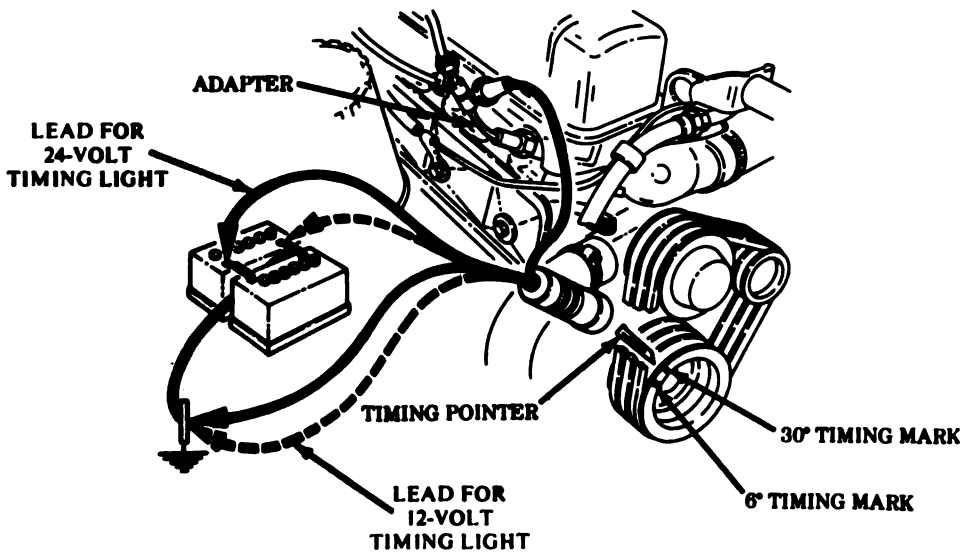
CAUTION

Do not operate engine at maximum rpm for more than 10 seconds.

Step 5. Increase engine speed to maximum rpm while observing 30° timing notch with timing light. 30° timing notch should advance to timing pointer.

a. If timing does not advance smoothly, maintain a steady position, or increase to 30° notch, stop engine and replace distributor (para 5-7).

b. If after replacing distributor a timing advance problem still exists, stop engine and notify DS maintenance.



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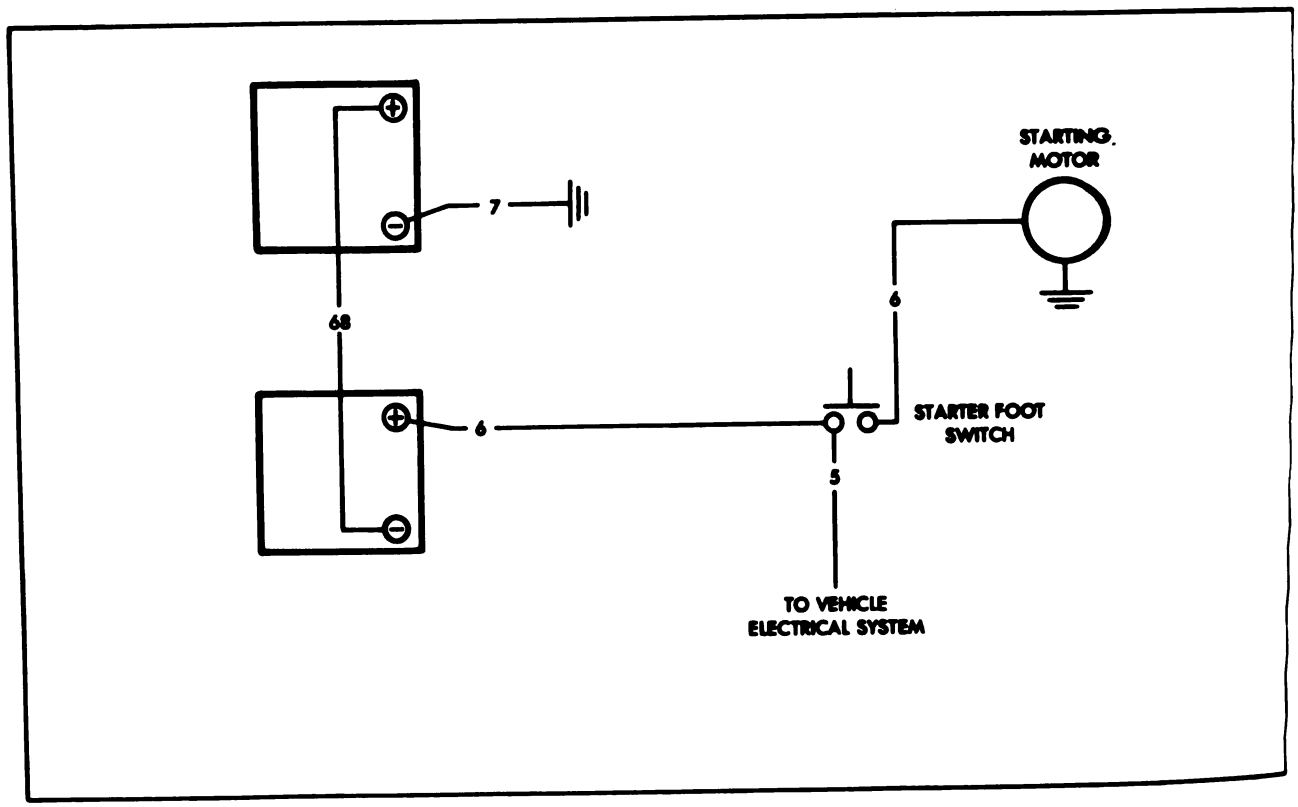
END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

STARTING SYSTEM



9. STARTER MOTOR INOPERATIVE

NOTE

If STE/ICE is available, perform NG20 — no crank — no start (chapter 3, section VI).

Test 1. Check for voltage at starter.

Step 1. Set multimeter to 50-volt range.

Step 2. Connect multimeter positive lead to starter motor positive terminal, and multimeter negative lead to ground.

Step 3. Depress starter foot switch while observing multimeter. Meter should read at least 24 volts.

a. If 24 volts is not indicated, proceed to test 2.

b. If 24 volts is indicated, replace starter (para 5-16).

Test 2. Check starter switch. (malfunction 10, test 7).

END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

10. STARTING MOTOR CRANKS ENGINE SLOWLY

NOTE

If STE/ICE is available, perform NG80 — starter circuit tests (chapter 3, section VI).

Test 1. Check batteries for overheating.

Step 1. Crank engine for 15 seconds. Check batteries for overheating by placing hand near battery terminals. If battery terminal is hot, a loose or corroded connection exists.

Clean all loose or corroded connections to bright metal; then tighten (para 5-29).

Test 2. Test batteries for specific gravity.

Step 1. Perform a specific gravity test (para 5-26). Batteries must test 1.225 or greater, temperature corrected, and each cell must test within 25 points of the others. Batteries in tropical use must test greater than 1.180.

a. Charge all batteries not meeting requirements above (para 5-26) and check specific gravity again.

b. If 25 point variation still exists within any battery, it is defective and must be replaced (para 5-31).

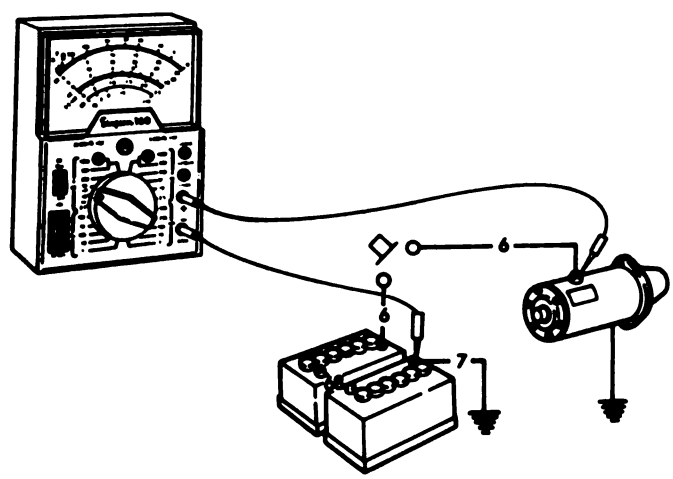
Test 3. Test starter motor voltage.

Step 1. Set multimeter to 50-volt range.

Step 2. Connect meter positive lead to positive terminal of motor and meter negative lead to negative cable 7 terminal.

Step 3. Crank engine and observe voltage as indicated on meter. Voltage should exceed 22 volts.

If voltage is low, clean and tighten connections.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 4. Starter motor current draw.

Step 1. Be sure batteries are fully charged (para 5-26).

Step 2. Disconnect the ground cable from the grounded battery.

Step 3. Connect external shunt to low voltage circuit tester.

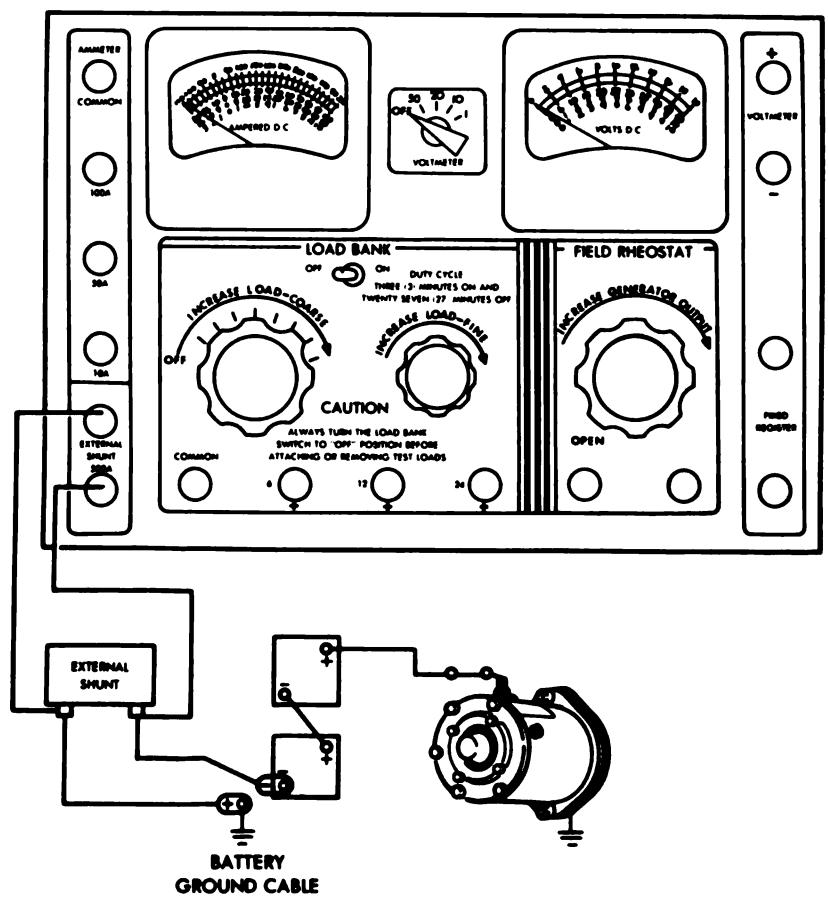
Step 4. Connect large negative shunt lead to negative post of battery that was grounded, and large positive lead to end of ground cable.

Step 5. With ignition switch off, engage starter switch and read ammeter.

a. Ignore initial reading from first few revolutions of engine (could be as high as 160 amps).

b. Normal current draw under load is 30-60 amps.

c. If current draw is other than 30-60 amps, replace starter (para 5-16).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 5. Test the negative cable 7 voltage drop from the batteries to the starting motor.

Step 1. Set multimeter to 10-volt range.

Step 2. Connect meter positive lead to the end plate of starting motor, and negative lead to grounding point at batteries as shown below.

Step 3. Crank engine and observe meter. A voltage reading exceeding 0.2 volts indicates a loose or corroded connection.

Clean and tighten cable connections at batteries, starter, and chassis.

Test 6. Test the circuit 6 positive cable voltage drop from batteries to starter motor.

Step 1. Set multimeter to 10-volt range.

Step 2. Connect positive meter lead to positive terminal point on the batteries, and negative lead to the positive terminal on the starting motor as shown.

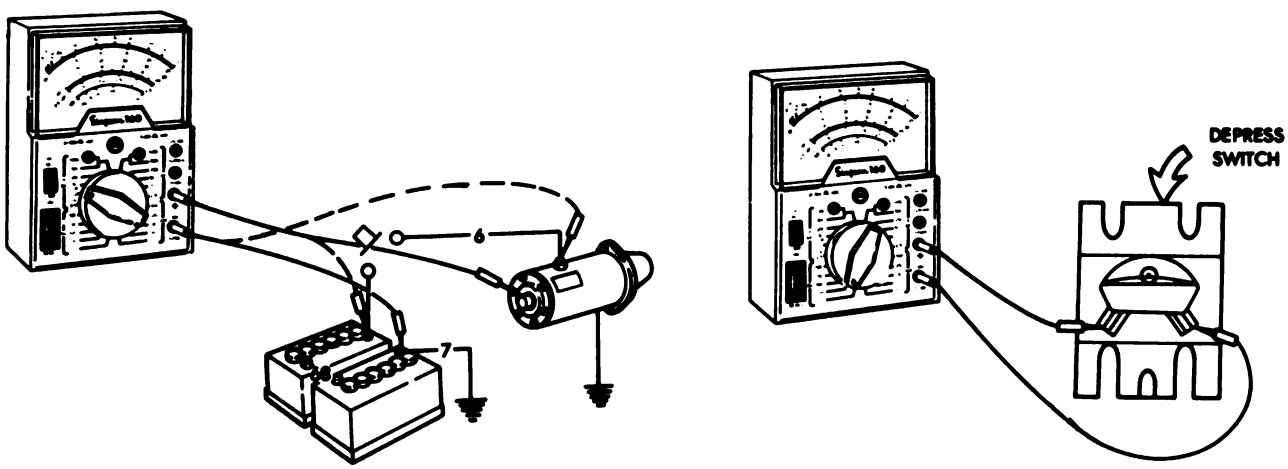
Step 3. Crank engine and observe meter. A voltage reading exceeding 0.2 volts indicates a loose or corroded connection.

Clean and tighten cable connections at batteries, starter switch, and starting motor (paras 5-25, 5-53, and 5-70).

Test 7. Perform starter switch test.

Step 1. Disconnect battery ground cable and remove starter switch from vehicle (para 5-70).

Step 2. Set multimeter to RX1. Connect meter across switch and depress switch. If there is any measurable resistance, replace switch (para 5-70).



END OF TESTING!

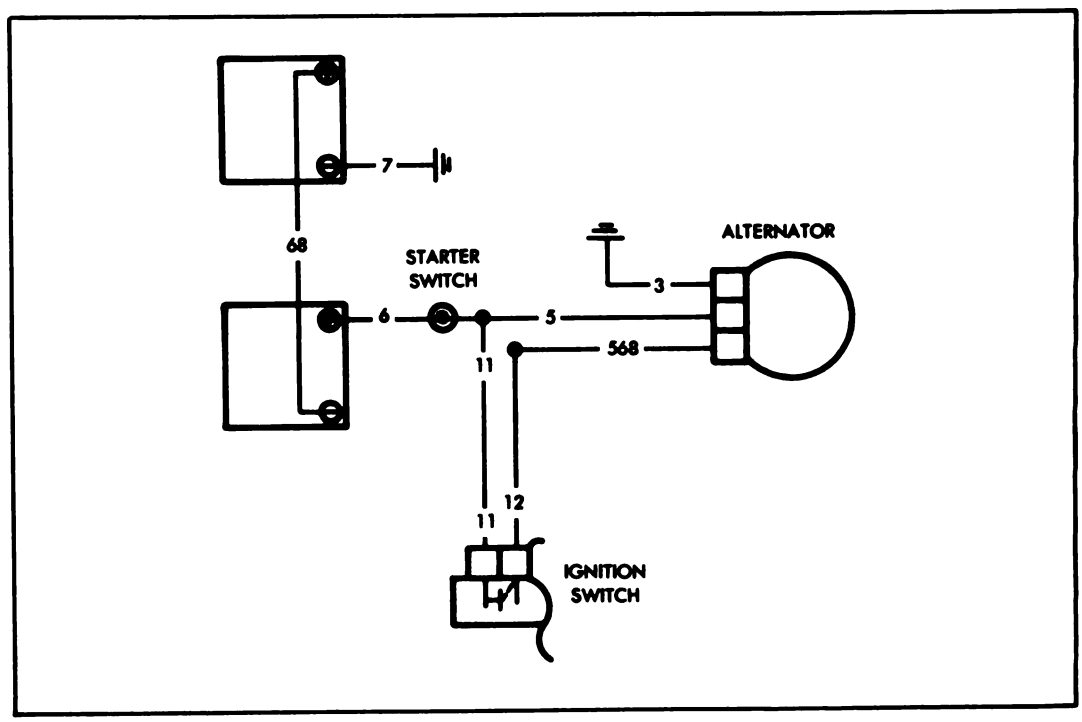
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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

GENERATING SYSTEM (60 AMP)



11. BATTERIES RUN DOWN IN SERVICE

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Check for loose, broken, or missing alternator belts.

a. Adjust loose belts (para 4-59).

b. Replace broken or missing belts (para 4-59).

Test 2. Test charging voltage (malfunction 12, test 1).

If proper voltage is indicated, problem is not in generating system. See battery system troubleshooting.

END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

2. BATTERIES HOT OR BOILING, CORRECTED SPECIFIC GRAVITY OF ALL CELLS IS 1.280

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Test charging voltage.

Step 1. Set multimeter to 50-volt range.

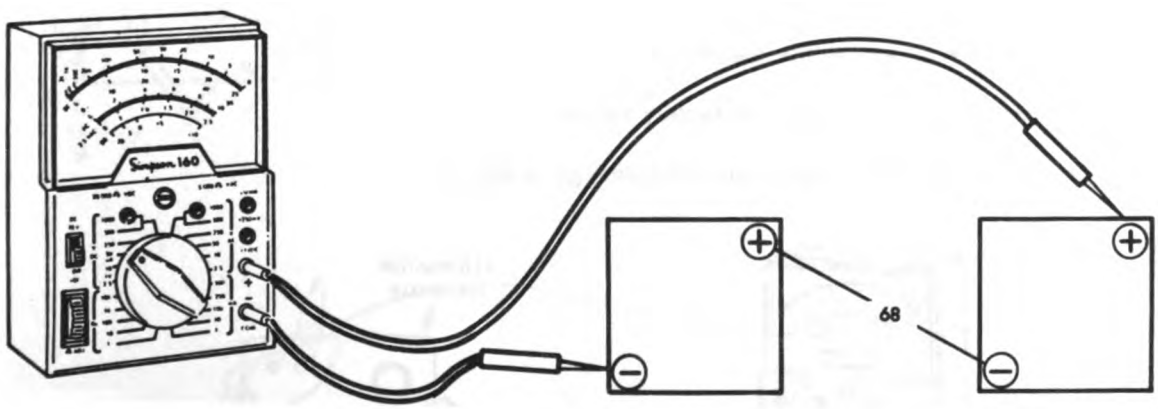
Step 2. Install tachometer (malfunction 4, test 1).

Step 3. Connect multimeter directly across battery terminal posts. Positive lead to positive post and negative lead to negative post as shown.

Step 4. Start and allow engine to stabilize at 1000-1200 rpm.

Meter should indicate 28 ± 1 volt. If not, adjust voltage regulator (para 5-21).

If voltage cannot be adjusted, stop engine (TM 9-2320-218-10) and replace alternator (para 5-21).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

13. NO ALTERNATOR OUTPUT

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Check for loose, broken, or missing alternator belts.

a. Adjust loose belts (para 4-59).

b. Replace broken or missing belts (para 4-59).

Test 2. Test alternator circuit 568 for voltage.

Step 1. Disconnect circuit 568 wire at alternator.

Step 2. Set multimeter on 50-volt range.

Step 3. Connect meter positive lead to circuit 568 wire and negative lead to vehicle chassis as shown.

Step 4. Place ignition switch to ON position.

a. Meter should indicate battery voltage.

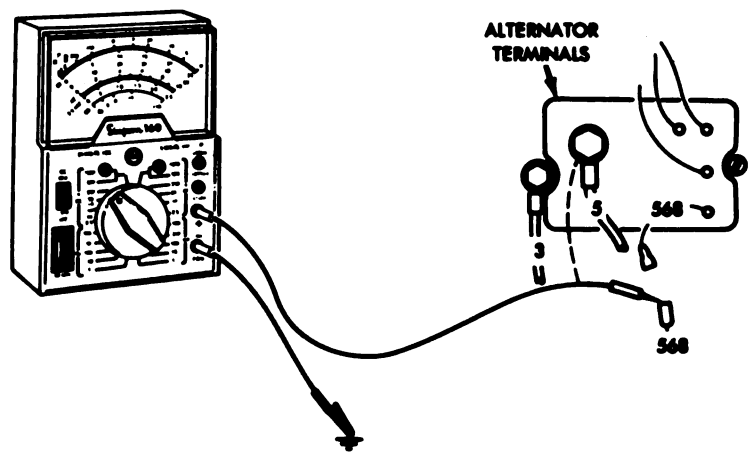
b. If battery voltage is indicated, place ignition switch to OFF position and replace alternator (para 5-21).

c. If battery voltage is not indicated, go to step 5.

Step 5. Touch meter positive lead to circuit 5.

a. Meter should indicate battery voltage.

b. If battery voltage is not indicated, go to step 6.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

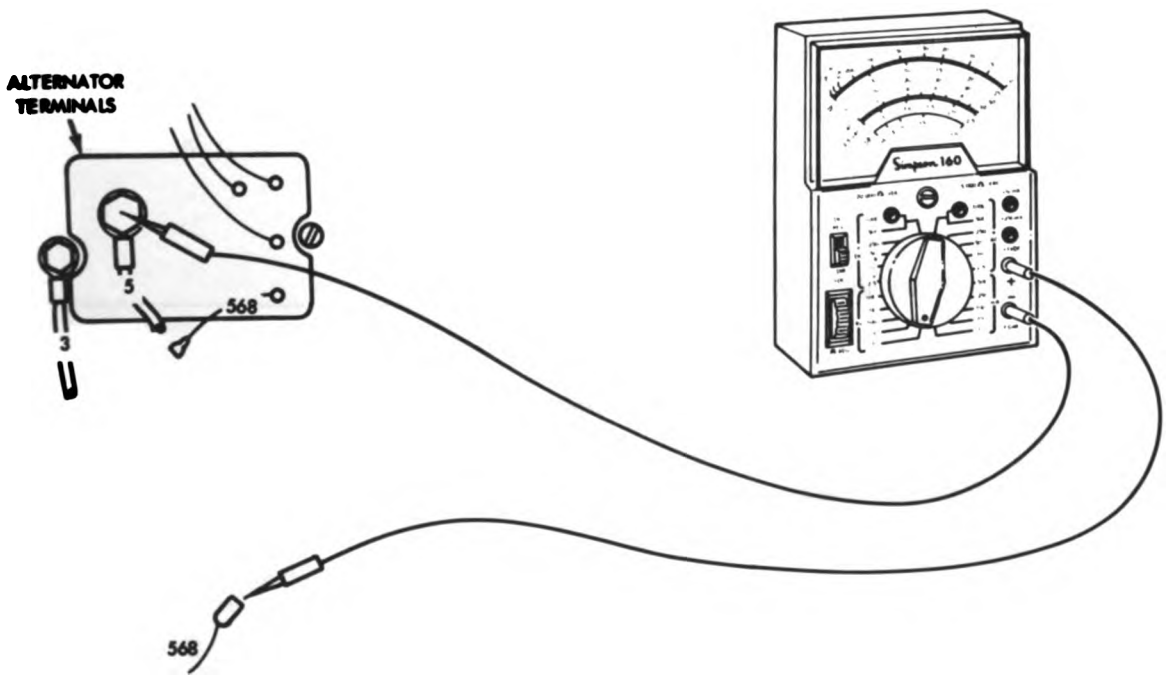
Step 6. Place ignition switch to OFF position, disconnect battery positive lead, and set multimeter on RX1 for continuity reading.

Step 7. Connect meter positive lead to circuit 568 wire and negative lead to circuit 5 alternator terminal as shown and place ignition switch to ON position.

Step 8. Meter should read continuity. If continuity IS NOT indicated, there is an OPEN circuit.

Check ignition switch (malfunction 1 test 5).

Step 9. Turn igntion switch to OFF position.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

14. BATTERIES USE EXCESSIVE WATER

NOTE

If STE/ICE is available, perform NG81 — battery tests or NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Test charging voltage (malfunction 12, test 1).

END OF TESTING!

15. BATTERY INDICATOR IN HIGH RED POSITION

NOTE

If STE/ICE is available, perform NG81 — battery tests or NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Test charging voltage (malfunction 12, test 1).

Test 2. Test battery indicator gage (malfunction 42, test 1).

If gage is not defective, replace alternator (para 5-21).

END OF TESTING!

16. ALTERNATOR OUTPUT VOLTAGE LOW

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Check for loose, broken, or missing alternator belts.

a. Adjust loose belts (para 4-59).

b. Replace broken or missing belts (para 4-59).

Test 2. Test charging voltage (malfunction 12, test 1).

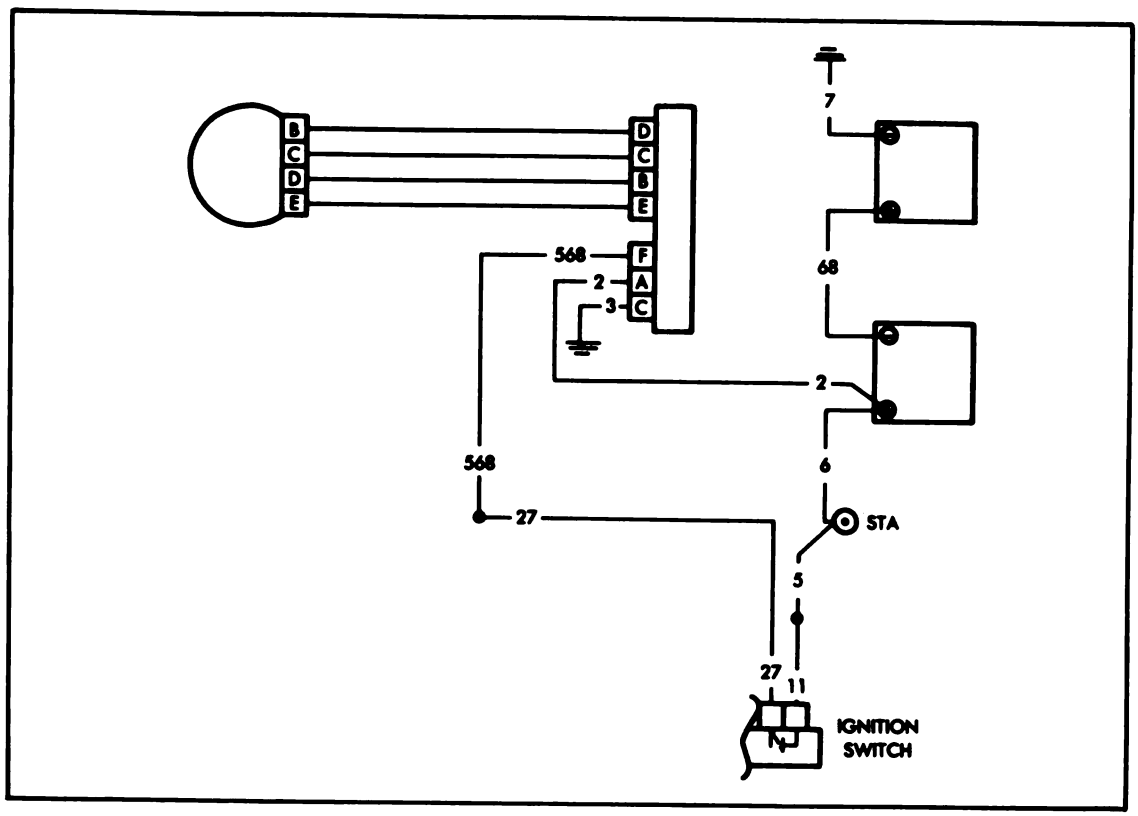
END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

GENERATING SYSTEM (100 AMP)



17. NO ALTERNATOR OUTPUT

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Check for loose, broken, or missing alternator belts.

a. Adjust loose belts (para 4-59).

b. Replace broken or missing belts (para 4-59).

Test 2. Check alternator for freedom of rotation.

Step 1. Loosen all drive belts (para 4-59).

Step 2. Turn alternator shaft by hand.

If shaft will not turn freely or alternator is seized, replace alternator (para 5-21). TA 155697

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Check for loose or disconnected connections.

Tighten all loose connections.

Test 4. Check voltage regulator.

Step 1. With engine OFF, and ignition switch in OFF position, disconnect connector S at voltage regulator.

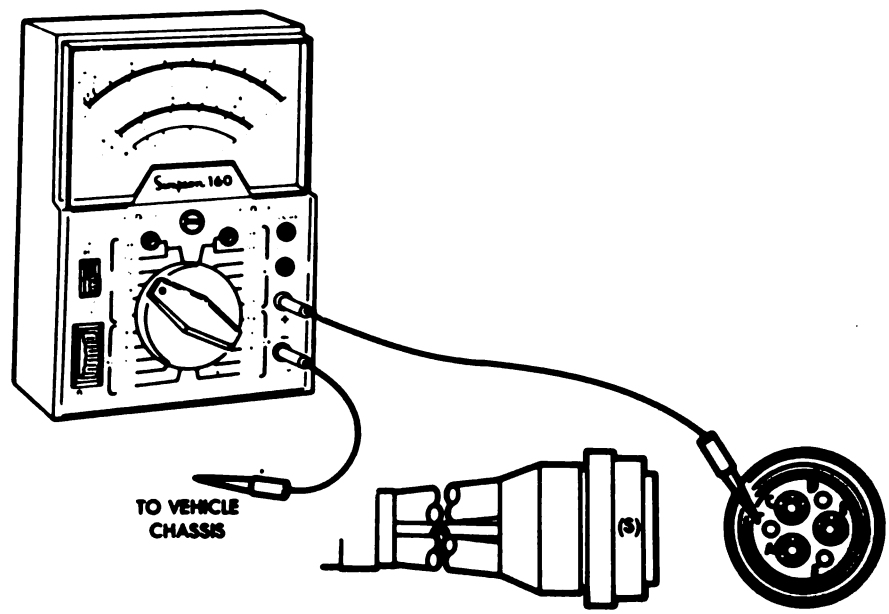
Step 2. Set multimeter on 50-volt range.

Step 3. Place ignition switch to ON position.

Step 4. Connect meter positive lead to pin F (circuit 568 to ignition switch). Connect negative lead to vehicle chassis.

a. If meter indicates battery voltage, go to step 5.

b. If voltage is not present, check ignition switch (malfunction 1, test 5).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Connect connector S at voltage regulator.

Step 6. Connect meter positive lead to battery positive terminal and negative lead to vehicle chassis.

NOTE

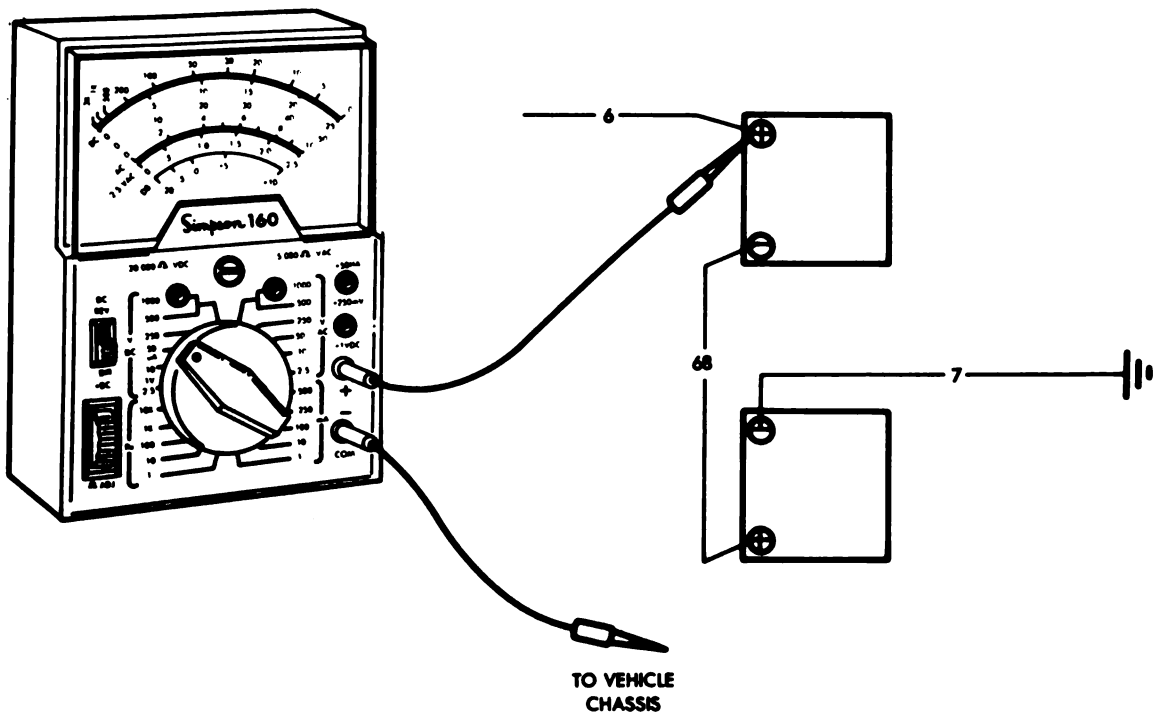
Check multimeter reading before, during, and after engine starting.

Step 7. Start engine.

a. Meter should read battery voltage before starting, drop during starting, and read 28±1 volts when engine is running.

b. If meter does not read 28+1 volts with engine running, adjust voltage regulator (para 11-65).

c. If voltage regulator cannot be adjusted, stop engine and replace regulator (para 11-65).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

18. LOW ALTERNATOR OUTPUT (less than 27 volts)

Test 1. Check for loose, broken, or missing alternator belts.

a. Adjust loose belts (para 4-59).

b. Check voltage regulator (malfunction 17, test 4).

c. Test battery voltage (malfunction 21, test 2).

END OF TESTING!

19. HIGH ALTERNATOR OUTPUT (more than 29 volts)

Test 1. Check voltage regulator (malfunction 17, test 4).

Test 2. Test battery voltage (malfunction 21, test 2).

END OF TESTING!

20. BATTERY-GENERATOR INDICATOR STAYS IN RED OR YELLOW BAND WITH ENGINE AT 1500 RPM

Test 1. Check indicator (malfunction 42, test 1).

Test 2. Check voltage regulator (malfunction 17, test 4).

Test 3. Check for loose or disconnected connections.

Tighten all connections.

END OF TESTING!

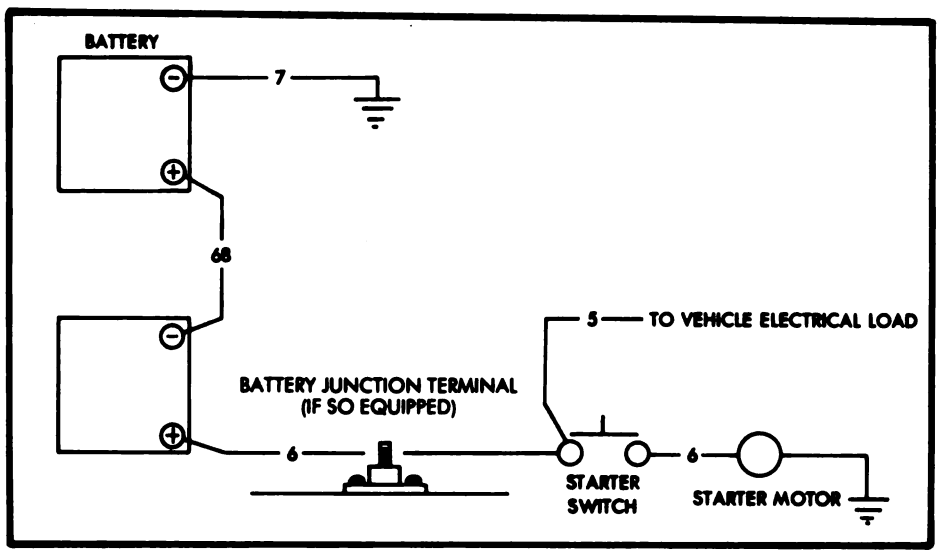
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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

BATTERY SYSTEM



21. ENGINE WILL NOT CRANK. SOME ELECTRICAL SYSTEMS INOPERATIVE OR WEAK.

NOTE

If STE/ICE is available, perform NG81 — battery tests (chapter 3, section VI).

Test 1. Do the following steps to inspect the batteries:

Step 1. Visually check batteries for cracks and corroded or broken terminal posts.

a. Replace any cracked, broken, or leaking batteries, or batteries with loose or broken terminal posts (para 5-31).

b. Clean corroded terminal posts to bright metal.

Step 2. Check for loose, broken, or worn terminals and cables.

a. Tighten any loose terminal or cable (para 5-25).

b. Replace any terminal or cable that is broken or worn (para 5-25).

Step 2.1. Check for loose or broken battery junction terminal.

a. Tighten loose terminal nuts (para 5-32.1).

b. Replace broken terminal (para 5-32.1).

Step 3. Check electrolyte level in each battery cell (para 5-26).

Fill each cell to level just above plates with distilled water (para 5-26). TA 484737

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Perform a specific gravity test (para 5-26). Batteries must test 1.225 or greater, temperature corrected, and each cell must test greater than 1.200.

a. Charge all batteries not meeting requirements above and check specific gravity again (para 5-26).

b. If 25 point variation still exists within any cell, the battery is defective and must be replaced (para 5-31).

Test 2. Test batteries under load to determine adequate current capability and voltage drop during a 15-second amperage load.

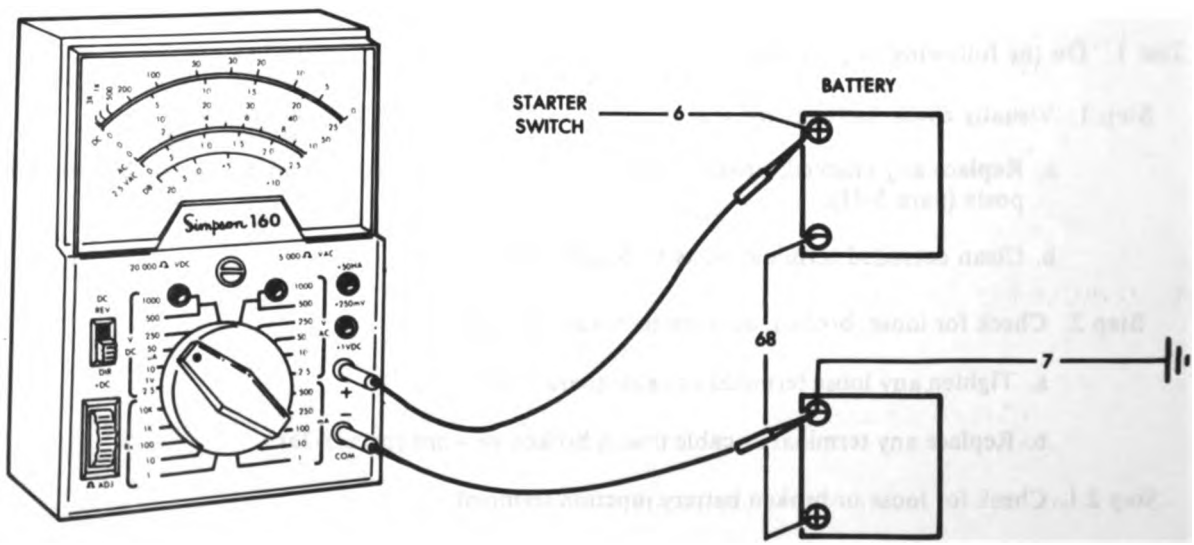
Step 1. Set multimeter to 50-volt range.

Step 2. Connect meter positive lead to battery positive terminal 6, and negative lead to the ground strap. Meter should not read less than 24 volts.

Step 3. With meter still connected as above, place the headlight switch to ON position for 15 seconds (head lights on bright). Meter should not read less than 23 volts or 1 volt drop from step 2 reading above.

a. Recharge batteries when voltage reading is less than 23 volts (para 5-26).

b. If voltage is still less than 23 volts, test batteries individually, and replace if less than 9 volts (para 5-31).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

22. BATTERIES ARE HOT, ELECTROLYTE IS BOILING, OR EXCESSIVE USE OF WATER

NOTE

If STE/ICE is available, perform NG60 — charging circuit tests (chapter 3, section VI).

Test 1. Check electrolyte temperature and specific gravity (para 5-26).

a. If temperature is over 120°F (49°C) and specific gravity is 1.280 or greater, batteries are being overcharged. Go to alternator system troubleshooting (malfunction 12, test 1).

b. If temperature is over 120°F (49°C), but specific gravity is 1.235-1.250, recharge the battery (para 5-26).

END OF TESTING!

23. SPECIFIC GRAVITY WILL NOT INCREASE TO 1.280 UNDER CHARGE

NOTE

If STE/ICE is available, perform NG81 — battery tests (chapter 3, section VI).

Test 1. Check the rate of charging.

Step 1. Place the battery on charge assuring that cells are gassing freely (para 5-26). Maintain charge rate slightly below heavy gassing.

If specific gravity does not recover to 1.280 in 25 hours of charging, replace the battery (para 5-31).

END OF TESTING!

24. ALL VEHICLE ELECTRICAL SYSTEMS INOPERATIVE

NOTE

If STE/ICE is available, perform NG81 — battery tests (chapter 3, section VI).

Test 1. Check the connection of the battery cables.

Step 1. Assure the battery cables are correctly connected to batteries. (See wiring diagram preceding malfunction 21.)

If cables are not correctly connected, reconnect properly (para 5-25).

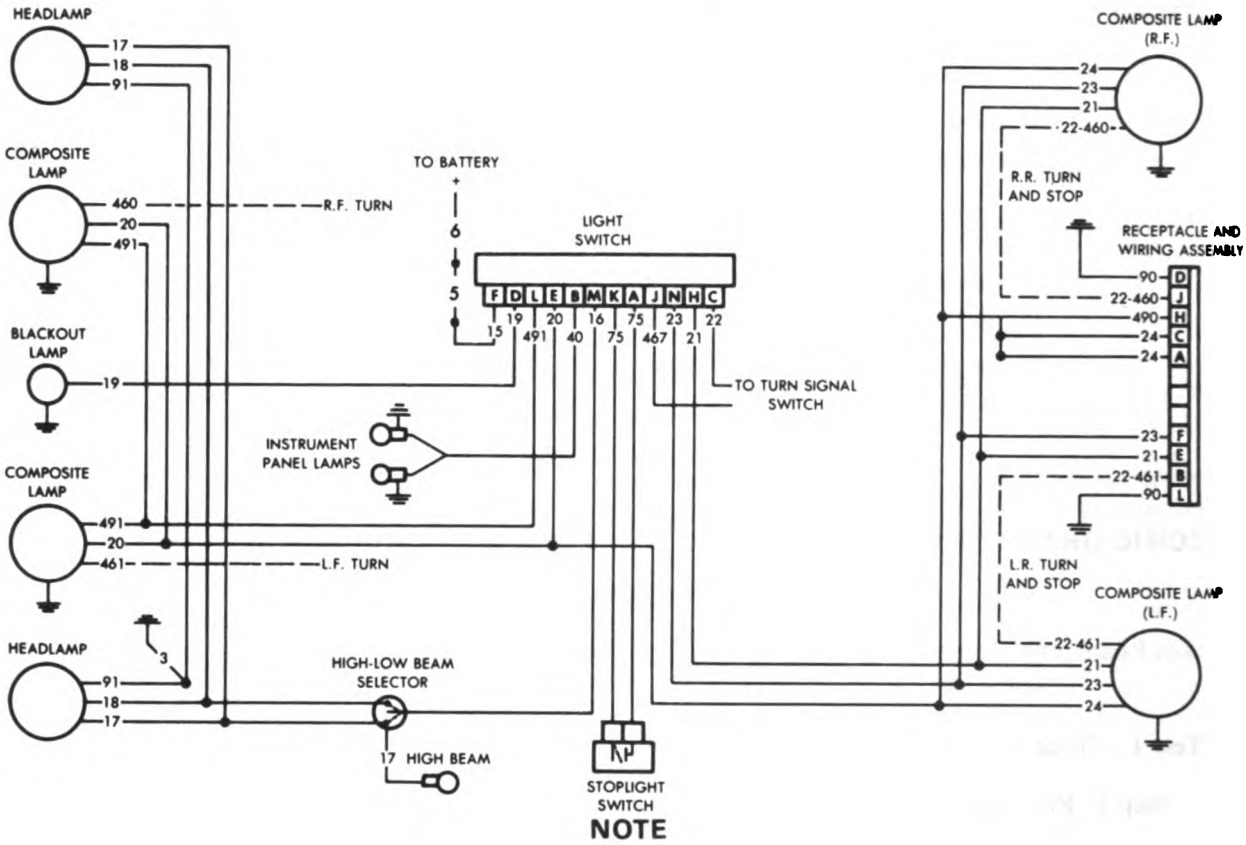
END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

LIGHTING SYSTEM



NOTE

Before attempting to troubleshoot the lighting system, refer to TM 9-2320-218-10 to become familiar with the lighting arrangement for each switch position and the nomenclature for each light.

25. VEHICLE LIGHTS FLICKER, ARE DIM, OR INTERMITTENT

Test 1. Visually inspect connectors for loose or corroded condition.

Step 1. Inspect connectors at light switch, service lamp connections and harness connections for loose or corroded connectors and terminals.

Clean or tighten connectors or terminals as required.

Step 2. Inspect all ground connections at lamps or chassis for loose or corroded condition.

Clean and tighten as necessary.

Step 3. Check all harness and lamp wiring for continuity.

Repair or replace as necessary (para 5-50).

END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

26. LAMPS BURN OUT PREMATURELY

Test 1. Check electrical system for excessively high voltage.

Step 1. Set multimeter for 50-volt range. Disconnect one of the circuit 18 wires at the headlamp, and attach the meter positive lead to circuit 18, and negative lead to ground.

Step 2. Start vehicle and place light switch in service headlamp position.

Step 3. Observe meter for a reading between 24 to 28 volts. If no voltage is observed, cycle dimmer switch. If voltage is excessive, stop engine, place light switch in OFF position, and see malfunction 12, test 1.

END OF TESTING!

27. HEADLAMP INOPERATIVE (one side)

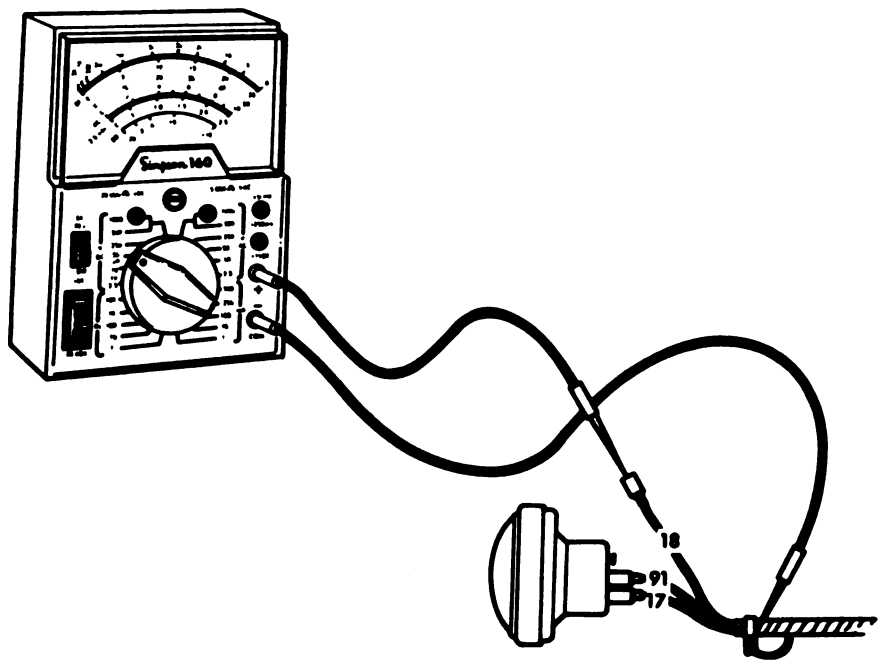
Test 1. Service headlamp connector voltage test.

Step 1. Connect multimeter and position light switch the same as in malfunction 26.

Step 2. Observe meter for voltage reading of 24 to 28 volts.

a. If no voltage is present, go to test 3.

b. If voltage is present, perform test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Test headlight resistance.

Step 1. Place light switch to OFF position.

Step 2. Set multimeter to RX1 for resistance reading as shown.

Step 3. Connect meter negative lead to terminal 91 of the headlight and connect positive lead to terminal 18 as shown.

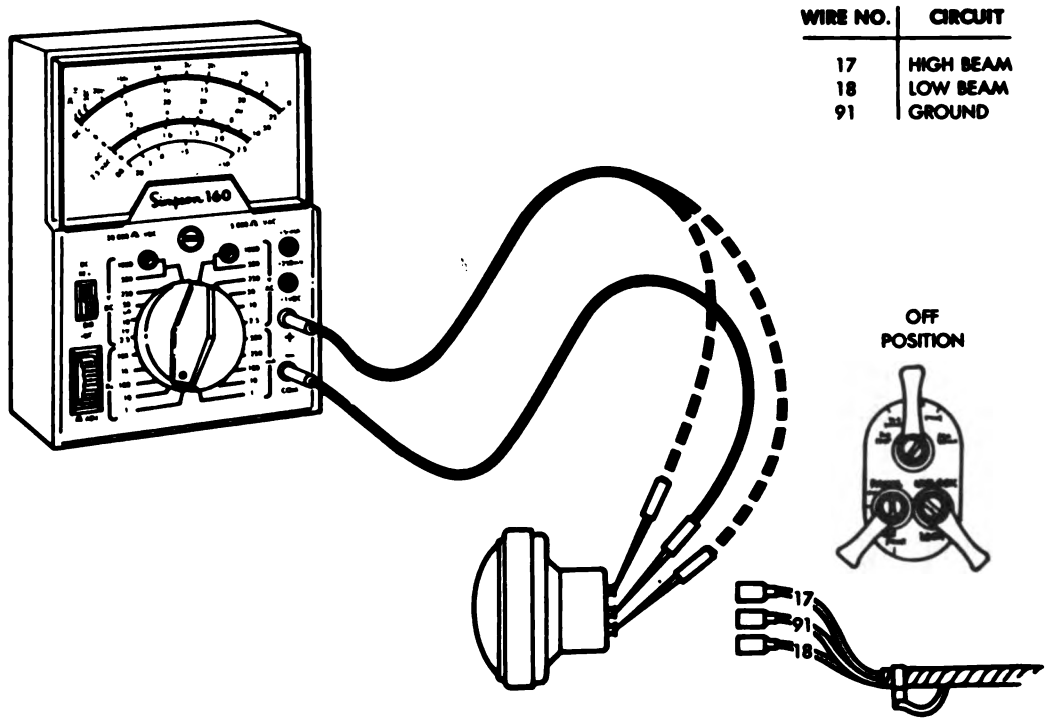
a. The meter needle should move past center scale. If not, replace the headlight (para 5-35).

b. If needle does move past center scale, go to step 4.

Step 4. Connect meter negative lead to headlight terminal 91 and positive lead to headlight terminal 17.

a. Meter needle should read past center scale. If not, replace headlight (para 5-35).

b. If replacement lamp does not light, go to step 5.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 5. Visually inspect headlamp body pin connector for corrosion and loose connections.

a. Clean corroded parts.

b. Tighten loose connections.

Test 3. Headlamp wire harness continuity test.

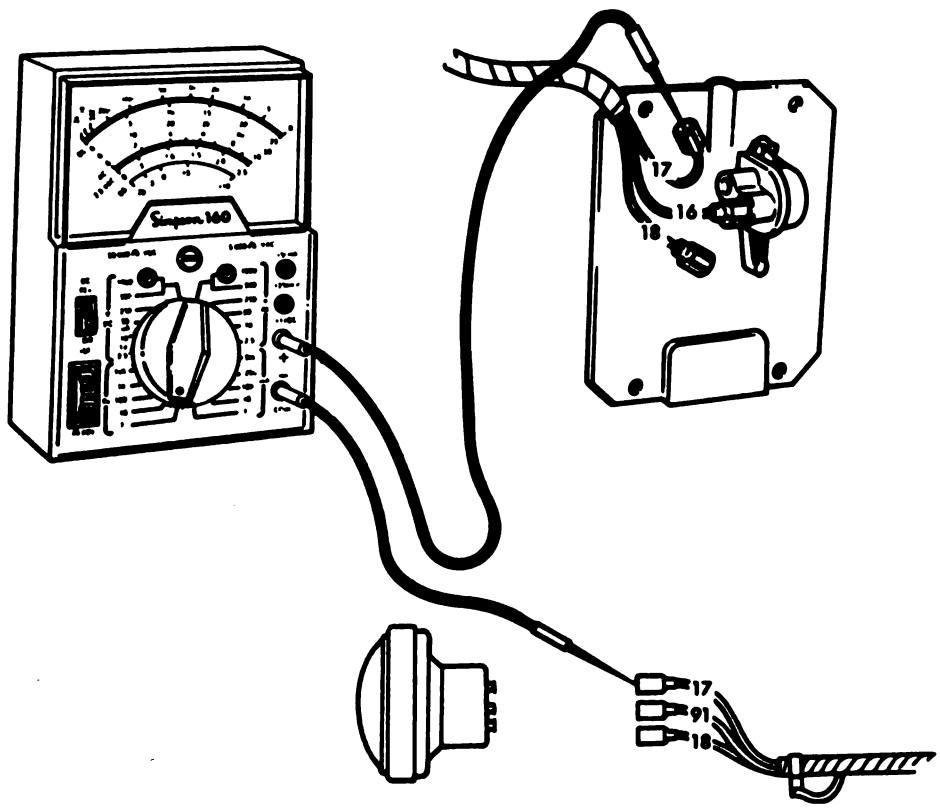
Step 1. Remove beam selector switch (para 5-67).

Step 2. Set multimeter to RX1 scale. Disconnect circuit 17 at service headlamp. Connect meter to circuit 17 connector and dimmer switch circuit 17 wire.

Step 3. Observe meter for continuity.

a. If continuity is present, check for loose or corroded connection at dimmer switch.

b. If continuity is not present, check circuit 17 for broken wire and repair or replace as necessary (para 5-50).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

28. HEADLAMPS INOPERATIVE (both sides)

Test 1. Test headlamp connector for voltage at both sides (malfunction 27, tests 1 through 3).

Test 2. Test light switch and connector voltage (malfunction 33, test 1).

Test 3. Test headlamp beam selector switch.

Step 1. Remove beam selector switch (para 5-67).

Step 2. Disconnect circuit 17 wire and circuit 18 wire at beam selector switch.

Step 3. Set multimeter to 50-volt range.

Step 4. Place light switch to ON position.

Step 5. Connect meter positive lead to terminal 17 on the switch. Connect negative lead to vehicle chassis ground as shown and observe meter for voltage reading.

Step 6. If voltage is not present, cycle switch and observe meter.

Step 7. With negative lead connected to ground, connect the positive lead to exposed terminal 18 on the switch, and observe meter for voltage reading.

Step 8. If voltage is not indicated, cycle switch and observe meter.

a. If battery voltage was indicated at terminals 17 and 18 on the switch but not at headlamp connector, the wiring harness from headlamps to switch is defective.

b. If battery voltage WAS NOT indicated at terminals 17 and 18 on the switch, go to step 9.

Step 9. Disconnect circuit 16 wire from the beam selector switch.

Step 10. Place light switch to SERVICE DRIVE position.

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

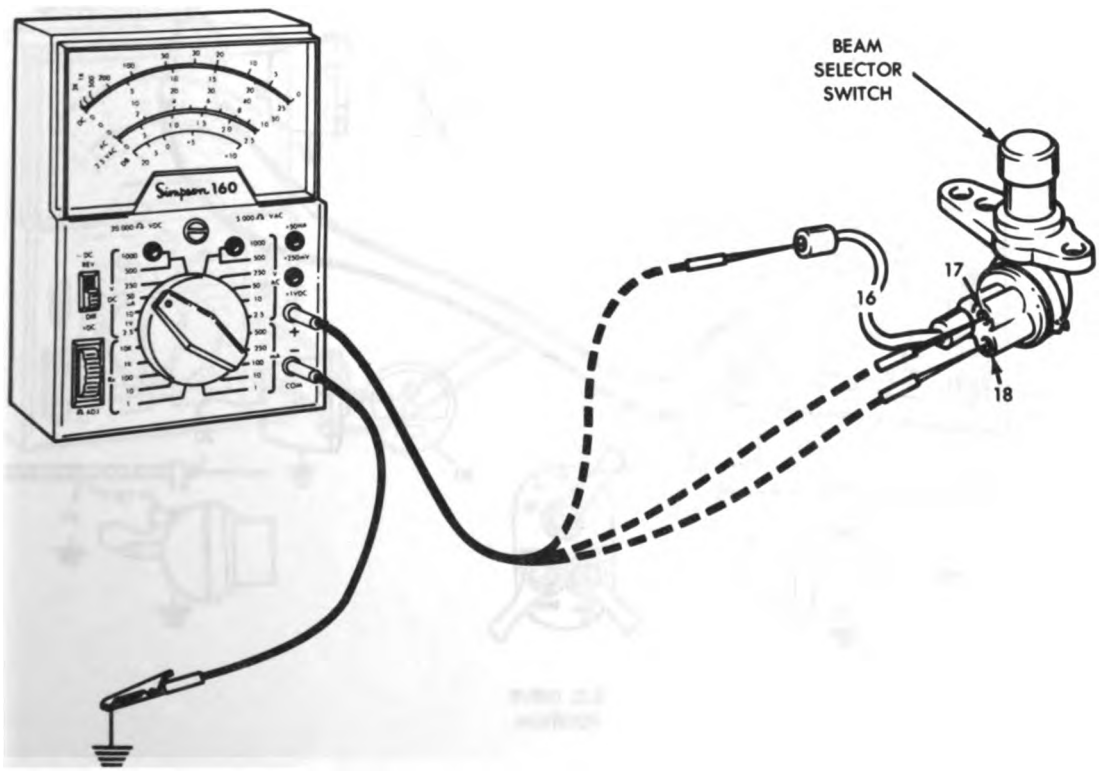
Step 11. With negative lead connected to ground, connect the positive lead to circuit 16 wire (not the switch terminals), meter should indicate battery voltage.

a. If battery voltage is indicated, place light switch in OFF position and replace the headlamp beam selector switch (para 5-67).

b. If battery voltage is not indicated, go to light switch and connector voltage test (malfunction 33, test 1).

WIRE NO.	CIRCUIT
16	LIGHT SWITCH TO SELECTOR SWITCH
17	HIGH BEAM
18	LOW BEAM





END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

29. BLACKOUT LAMP INOPERATIVE

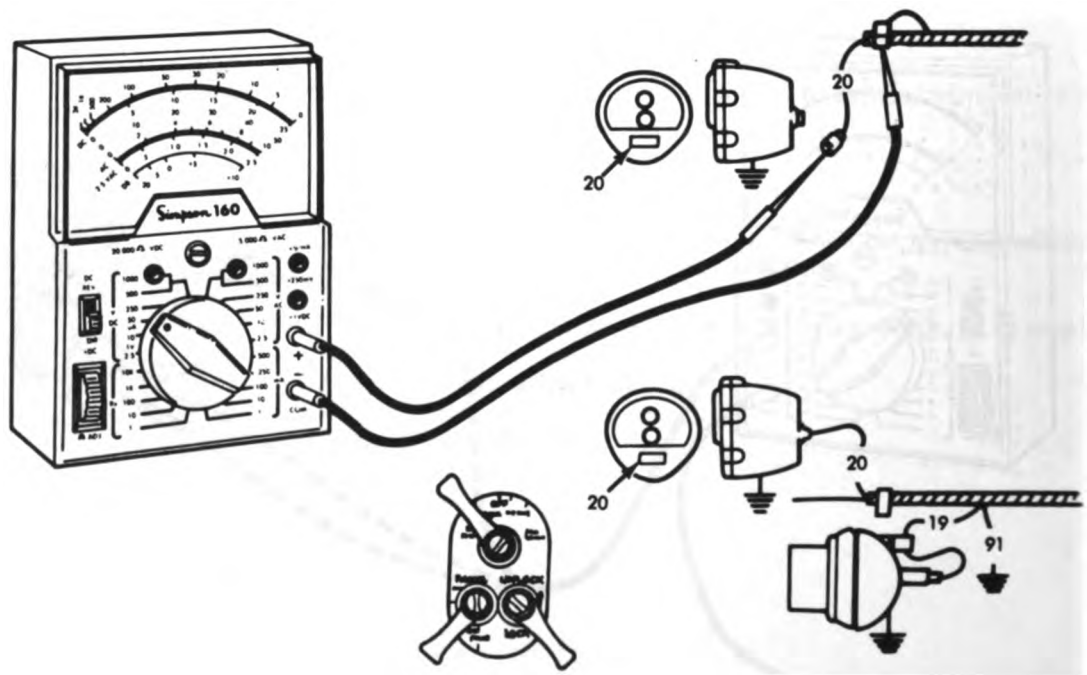
Test 1. Blackout lamp connector voltage test.

Step 1. Set multimeter to 50-volt range. Disconnect circuit 20 wire from B.O. lamp. Connect meter positive lead to circuit 20 wire and negative lead to ground.

Step 2. Set light switch to B.O. drive position, and observe meter for battery voltage.

a. If voltage is present, check for corroded terminals or sockets, and clean or repair as necessary. Replace bulb (para 5-37).

b. If no voltage is present, go to test 2.



B.O. DRIVE POSITION

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Circuit 20 continuity test.

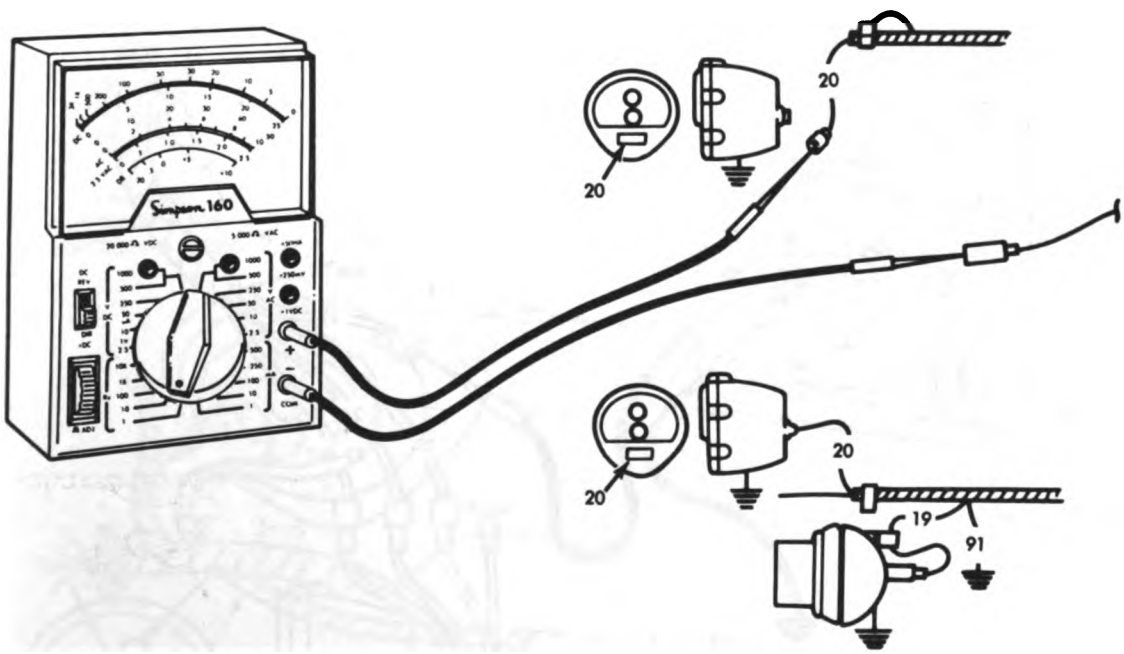
Step 1. Disconnect circuit 20 wire at both the lamp and the light switch.

Step 2. Set multimeter to RX1, and connect one lead of meter to lamp end and the other lead to switch end of circuit 20.

Step 3. Observe meter for zero reading.

a. If infinite or high resistance reading is observed, repair or replace circuit 20 wire (para 5-50).

b. If zero reading is observed, go to light switch test (malfunction 33, test 1).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

30. REAR LIGHTS INOPERATIVE.

Test 1. Rear lamp connector voltage test.

Step 1. Disconnect circuit corresponding to inoperative lamp.

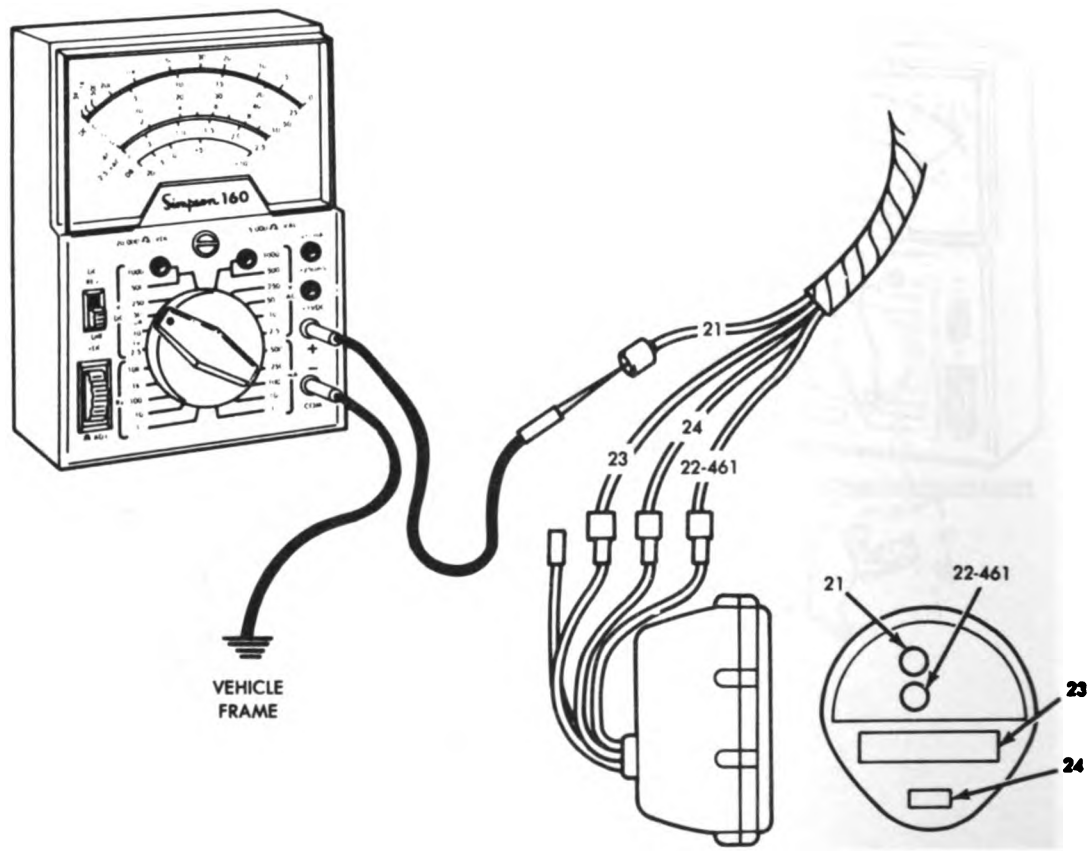
Step 2. Set multimeter to 50-volt range. Connect meter positive lead to disconnected circuit, and meter negative lead to ground.

Step 3. Place light switch in position which normally lights lamp, and observe meter.

a. If 24-28 volts is observed, replace bulb (para 5-41).

b. If lamp still does not light, check for dirty or corroded socket or ground wire.

c. If no voltage, go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

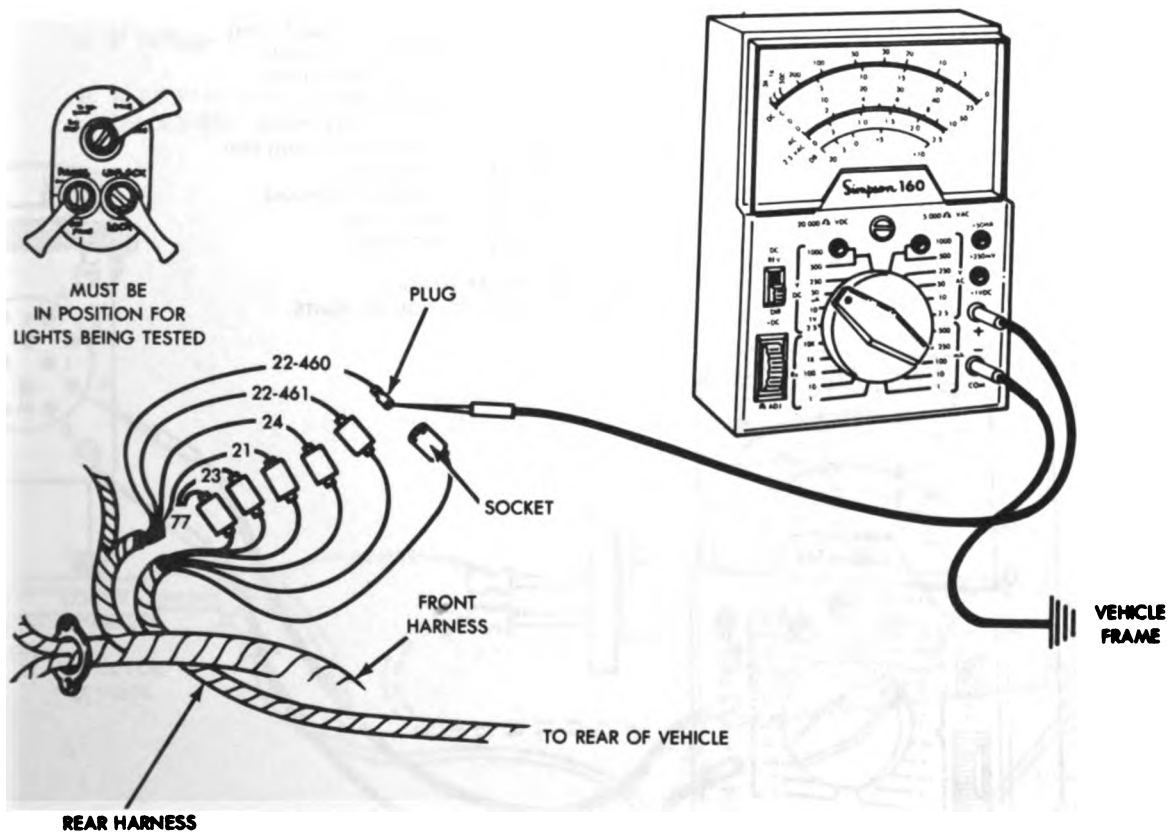
Test 2. Chassis harness connector voltage test.

Step 1. Disconnect rear chassis harness connectors, and connect multimeter negative lead to ground and positive lead to appropriate pin of inoperative circuit.

Step 2. Set multimeter to 50-volt range, and turn light switch to position which should power inoperative lamp.

a. If battery voltage is indicated, inspect rear harness for broken, pinched, or grounded wires.

b. If no voltage is present, place light switch in OFF position and perform light switch test (malfunction 33, test 1).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

31. TRAILER LIGHTS INOPERATIVE

Test 1. Trailer connector voltage test.

Step 1. Set multimeter to 50-volt range, and turn light switch to position that would normally power inoperative lamp.

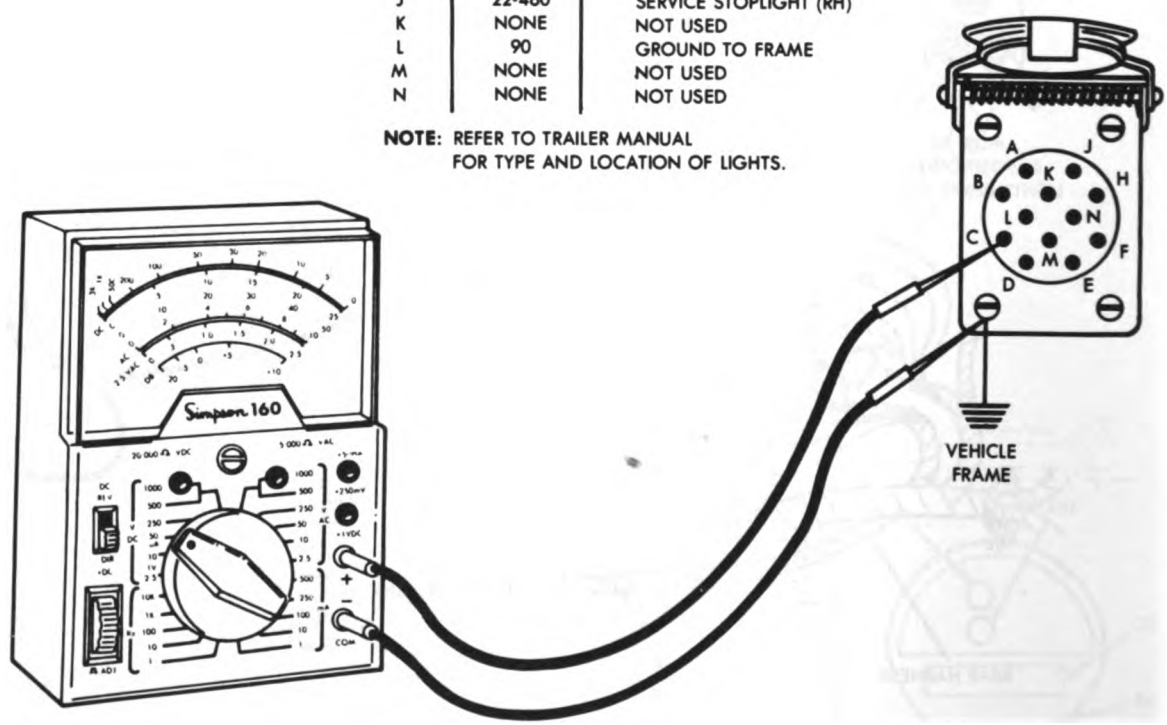
Step 2. Connect multimeter positive lead to the pin of inoperative circuits, negative lead to ground, and observe meter.

a. If voltage is present, check ground connection for loose or corroded condition.

b. If no voltage is present, perform chassis harness connector voltage test (malfunction 30, test 2).

PIN	WIRE NO.	CIRCUIT
A	24A	REAR B.O. MARKER (LH)
B	22-461	SERVICE STOPLIGHT (LH)
C	24B	REAR B.O. MARKER (RH)
D	90	GROUND TO FRAME
E	21	SERVICE REAR LIGHT
F	23	B.O. STOPLIGHT
H	490	B.O. MARKER LIGHTS
J	22-460	SERVICE STOPLIGHT (RH)
K	NONE	NOT USED
L	90	GROUND TO FRAME
M	NONE	NOT USED
N	NONE	NOT USED

NOTE: REFER TO TRAILER MANUAL FOR TYPE AND LOCATION OF LIGHTS.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

32. STOPLIGHT INOPERATIVE

Test 1. Stoplight switch voltage test.

Step 1. Place light switch to stoplight position, and disconnect harness wires from stoplight switch.

Step 2. Set multimeter to 50-volt range and attach multimeter positive lead to one of the circuit 75 terminals, and meter negative lead to ground, and observe meter for battery voltage.

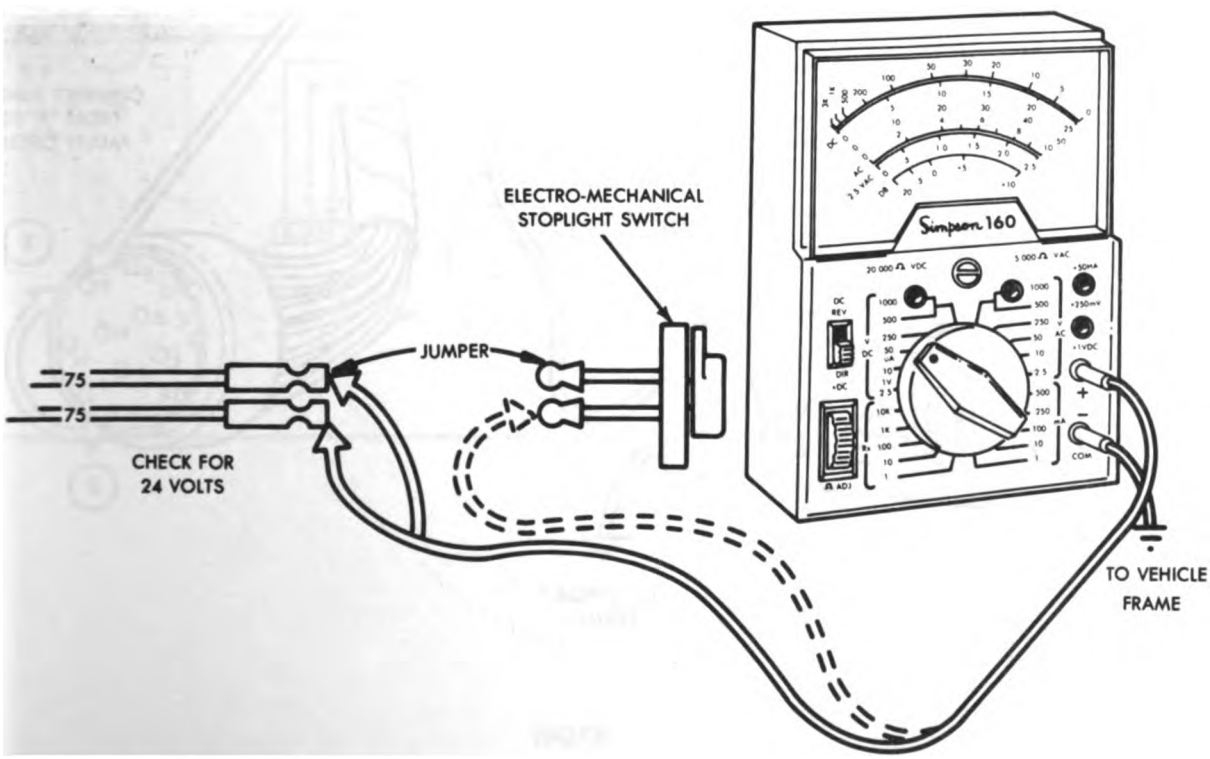
a. If no voltage, switch meter positive lead to other circuit 75 terminal, and observe for battery voltage.

b. If no voltage is present at either terminal, perform light switch connector voltage test (malfunction 33, test 1).

Step 3. Place jumper between battery side of connector and switch. Depress brake pedal and test other terminal of switch for voltage.

a. If voltage is present, switch is serviceable. Place light switch in OFF position.

b. If no voltage is present, place light switch in OFF position and replace stoplight switch (para 5-69).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

33. LAMPS WILL NOT LIGHT

Test 1. Light switch and connector voltage test.

Step 1. Disconnect harness from light switch (para 5-68).

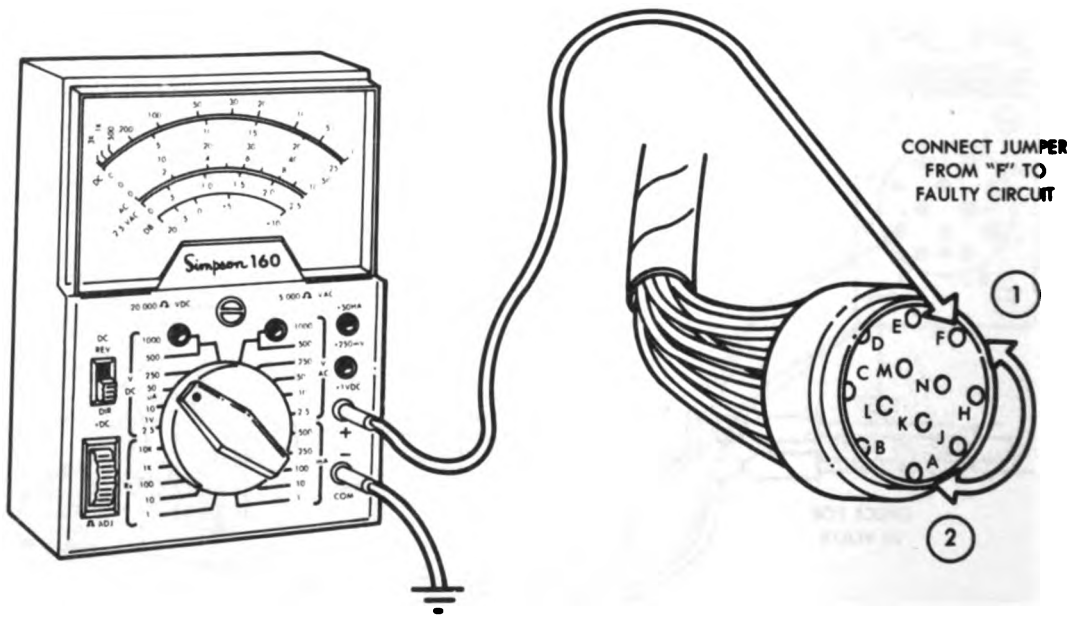
Step 2. Set multimeter to 50-volt range, and connect meter positive lead to pin F of harness and meter negative lead to vehicle ground.

a. Meter should read 24-28 volts.

b. If voltage is observed, connect a jumper between pin F and socket of inoperative lamp circuit.

c. If lamp lights, replace switch (para 5-68).

d. If voltage is not observed at pin F, check circuits 5 and 15 for broken wires and loose or corroded terminals. (See wiring diagram preceding malfunction 25.)



END OF TESTING!

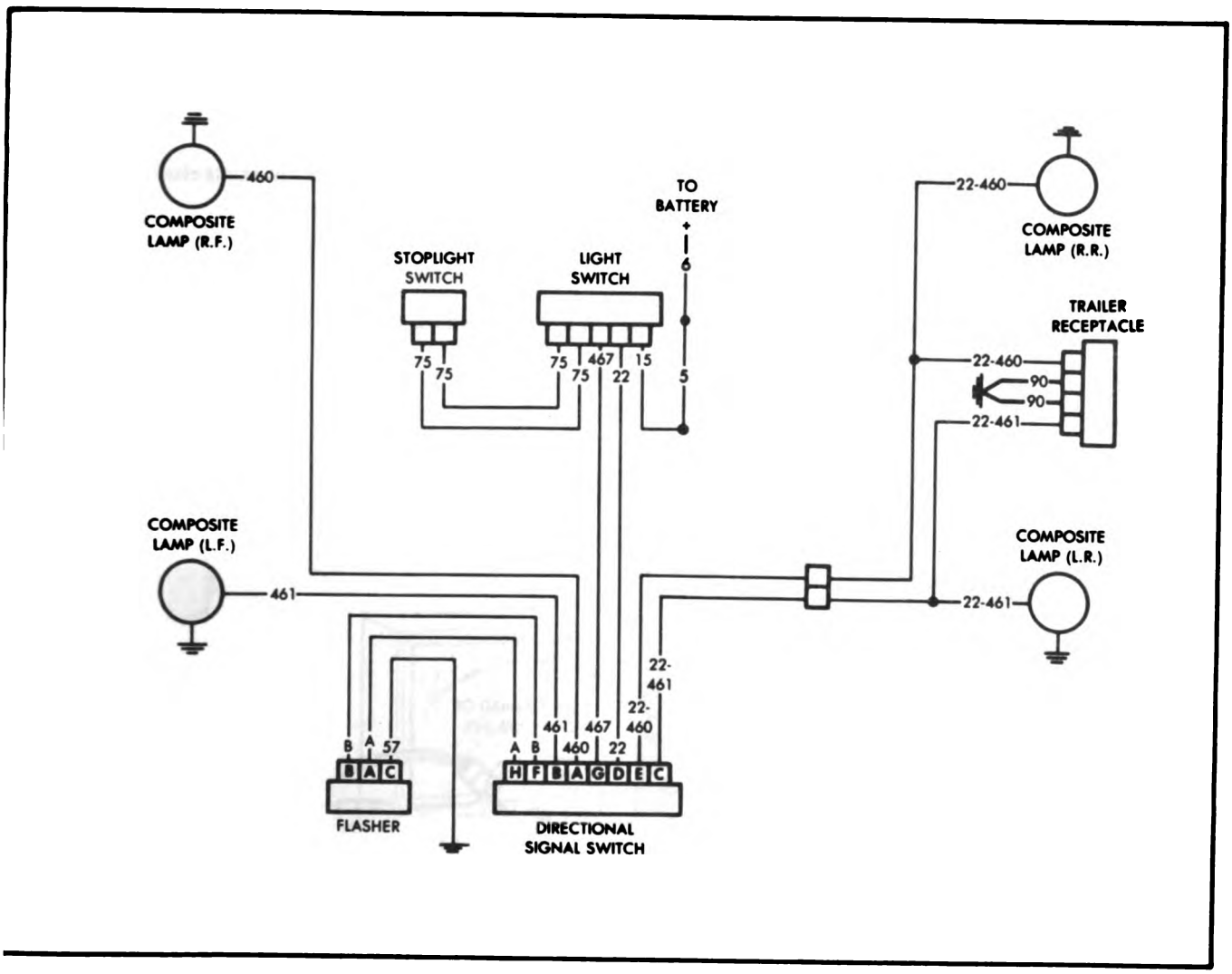
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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

DIRECTIONAL SIGNAL SYSTEM



NOTE

Before attempting to troubleshoot the directional signal system, the light switch must be in STOPLIGHT position.

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

34. INDIVIDUAL LAMPS DO NOT LIGHT WITH DIRECTIONAL SWITCH IN ANY POSITION

Test 1. Lamp continuity test.

Step 1. Disconnect circuit wire at affected lamp. Set multimeter to RX1. Attach meter positive lead to lamp side of circuit and negative lead to chassis ground.

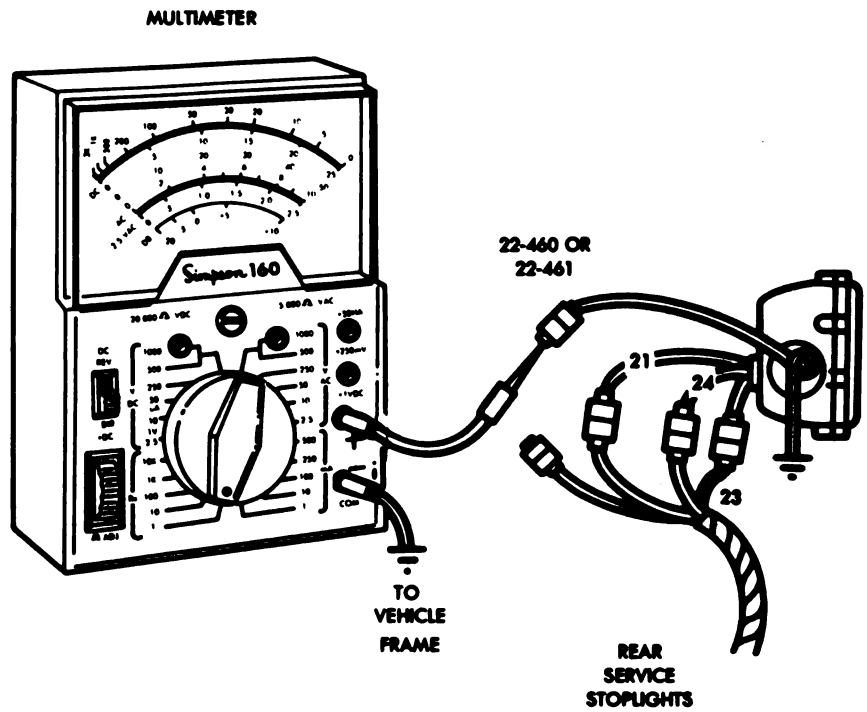
Step 2. Meter should read approximately 5 ohms.

a. If meter reads approximately 5 ohms, lamp is serviceable and problem exists elsewhere in circuit.

b. If meter shows an infinite or very high reading, bulb is probably defective. Replace bulb (paras 5-39 and 5-41).

c. If after replacing bulb, lamp still does not light, check ground circuit for loose or corroded connection.

d. If problem still exists, go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Wire harness voltage test.

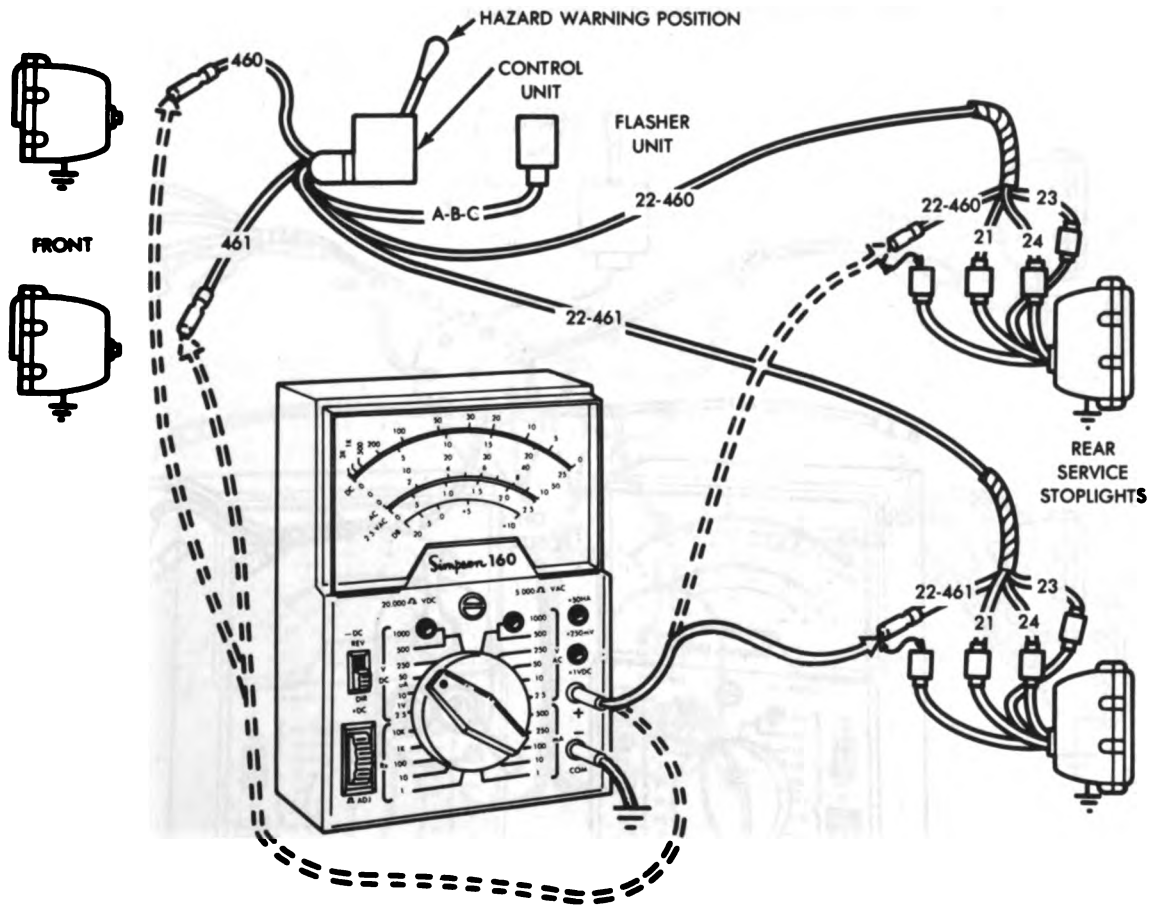
Step 1. Set multimeter to 50-volt range, and disconnect circuit from inoperative lamp.

Step 2. Connect multimeter positive lead to harness end of circuit and negative lead to ground.

Step 3. Set light switch and turn signal switch to position that normally illuminates lamp, and observe meter.

a. Meter should deflect to or beyond 24 volts 1 to 2 times per second.

b. If meter does not deflect, or deflects slowly or erratically, place light switch in OFF position, and go to test 4.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Wire harness short circuit test.

Step 1. Place light switch to OFF position, and set multimeter to RX1 position.

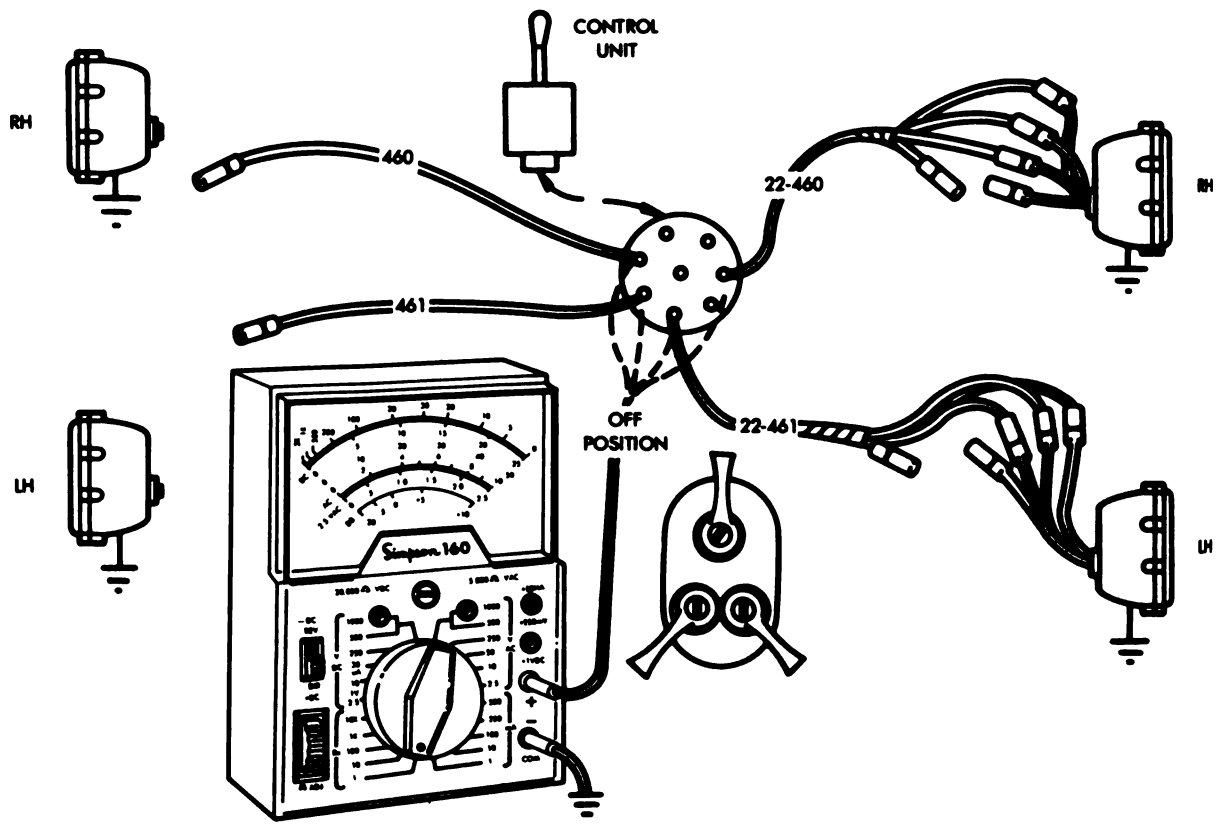
Step 2. Disconnect affected circuit.

Step 3. Connect multimeter negative lead to ground near directional signal control unit, and connect positive lead to the cable connector pin of the affected circuit.

a. Observe meter for any deflection of needle.

b. If meter does not show an infinite resistance, the circuit is shorted to ground.

c. If circuit shows infinite reading, go to test 4.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 4. Circuit continuity test.

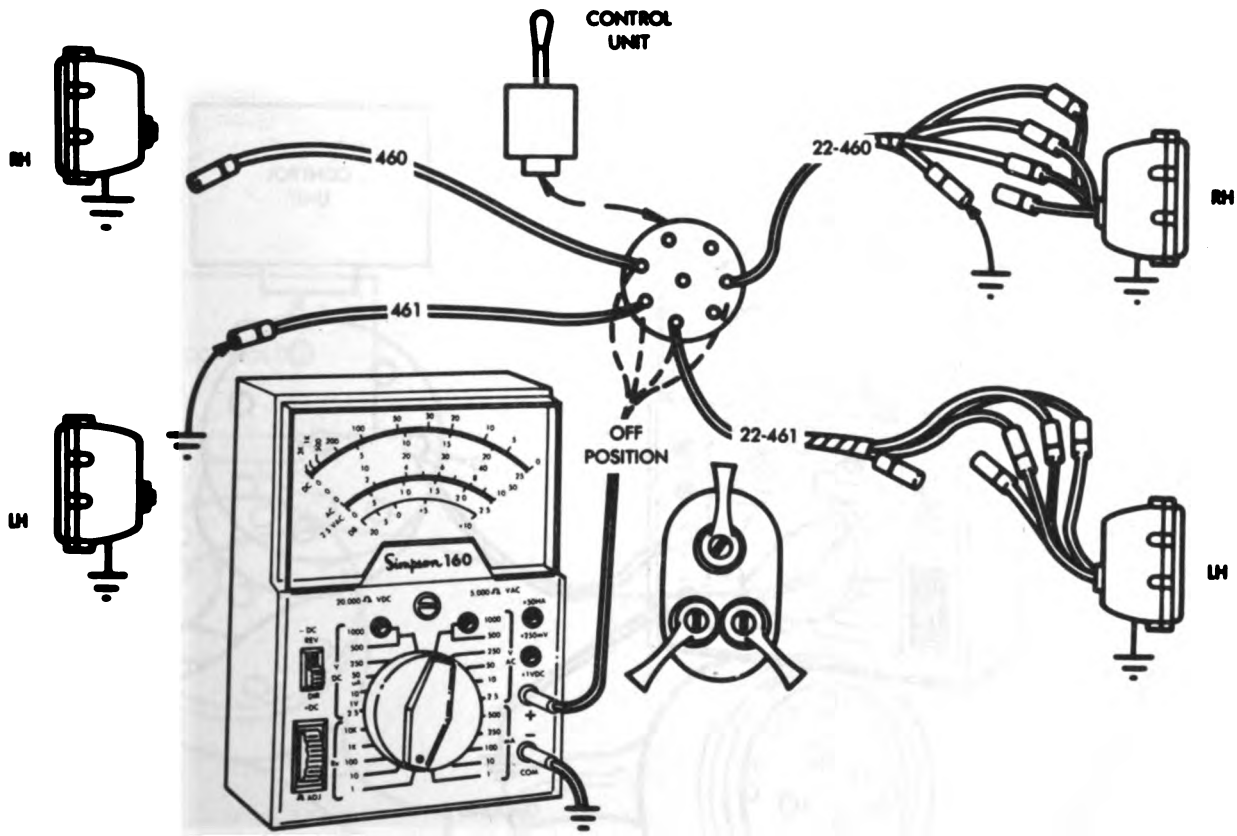
Step 1. Connect a jumper lead between the lamp end of defective circuit and the vehicle chassis.

Step 2. Set multimeter to RX1. Connect positive lead to control unit end of defective circuit, and negative lead to vehicle chassis.

a. Meter should indicate zero resistance.

b. If open or high resistance circuit is indicated, repair or replace circuit as necessary.

c. If turn signals still do not function properly, go to flasher and control unit test (malfunction 36, test 1).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

35. NO LAMPS OPERATIVE WITH DIRECTIONAL CONTROL UNIT IN ANY POSITION.

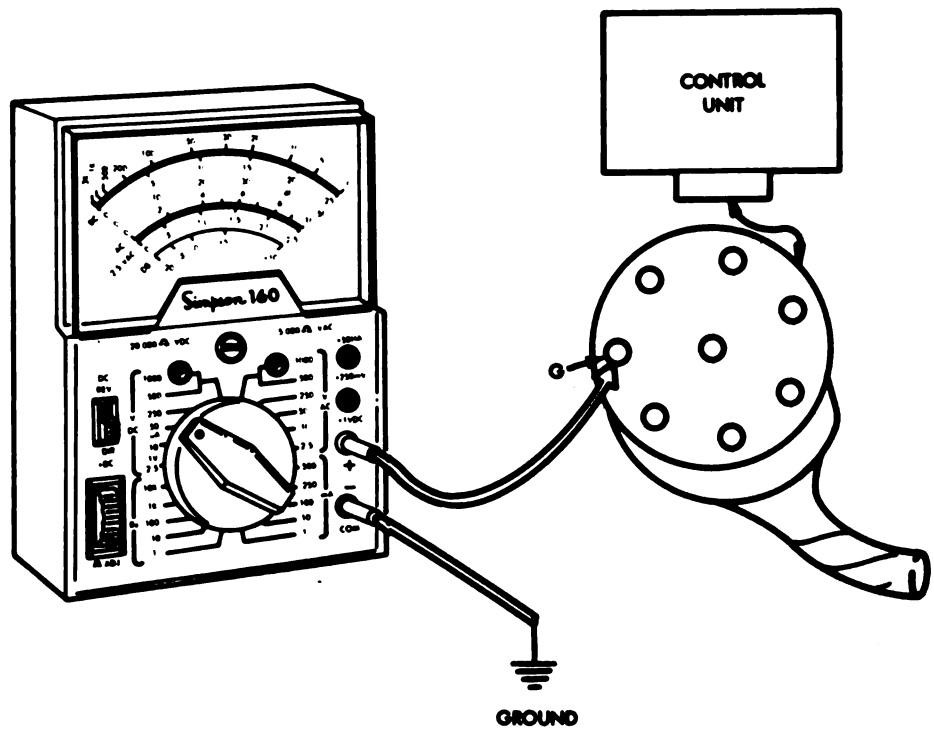
Test 1. Directional signal control unit voltage test.

Step 1. Set multimeter to 50-volt range, and disconnect harness from directional control unit. Set light switch to SERVICE DRIVE position.

Step 2. Connect meter positive lead to terminal G (circuit 467). Connect negative lead to vehicle ground, and observe meter.

a. If 24 volts are present, and directional signals do not work, place light switch in OFF position and go to flasher harness continuity test (test 3).

b. If no voltage is present, place light switch in OFF position and go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Circuit 467 continuity test.

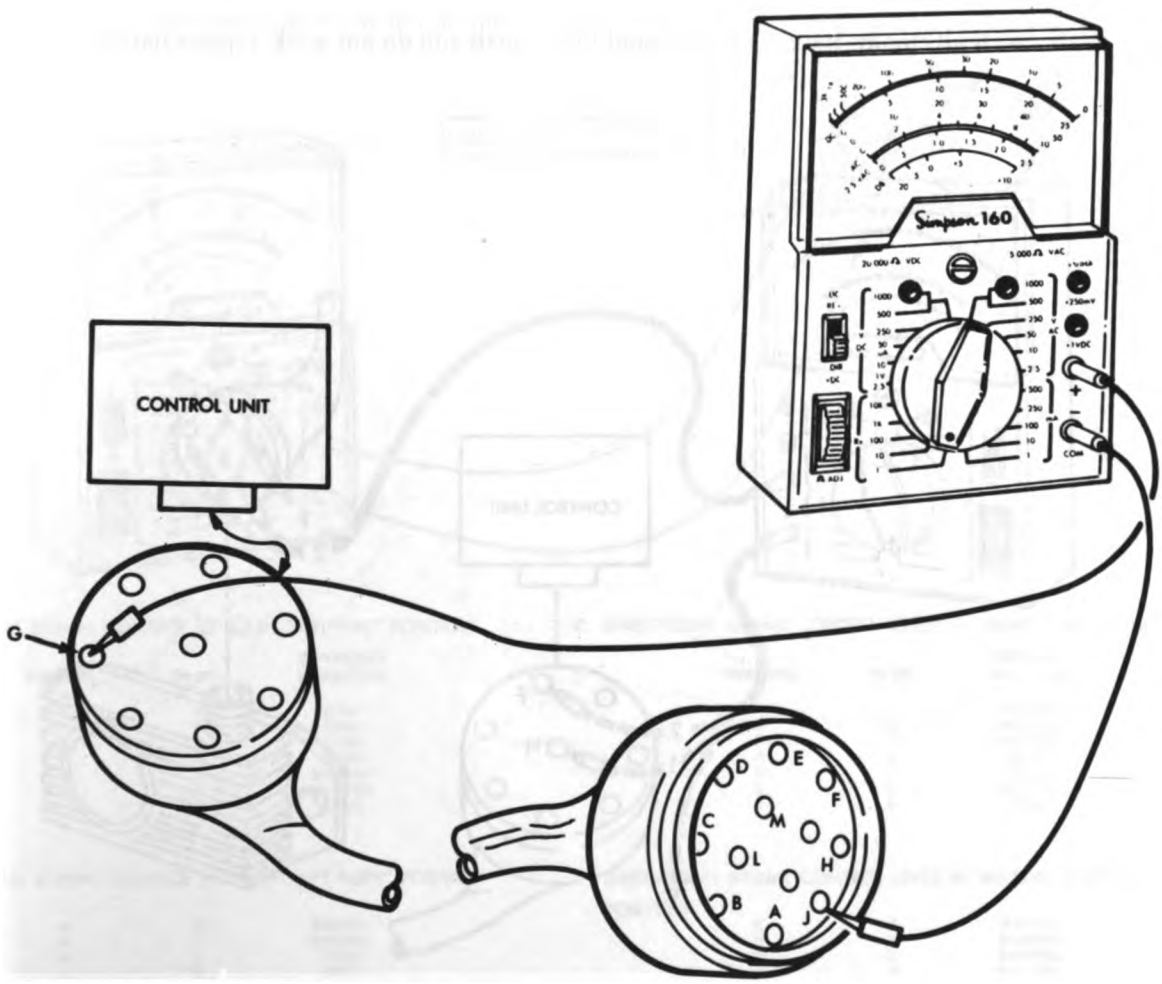
Step 1. Disconnect wire harness at both light switch and directional control unit.

Step 2. Set multimeter to RX1 scale. Connect positive lead to terminal G of control unit harness connector, and negative lead to terminal J of the light switch harness connector.

Step 3. Observe meter for zero resistance reading.

a. If zero resistance reading is observed, test light switch. (See malfunction 33, test 1).

b. If open or high resistance circuit is observed, repair or replace circuit 467 wire as required.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Flasher harness continuity test.

Step 1. Disconnect wire harness at flasher and control unit.

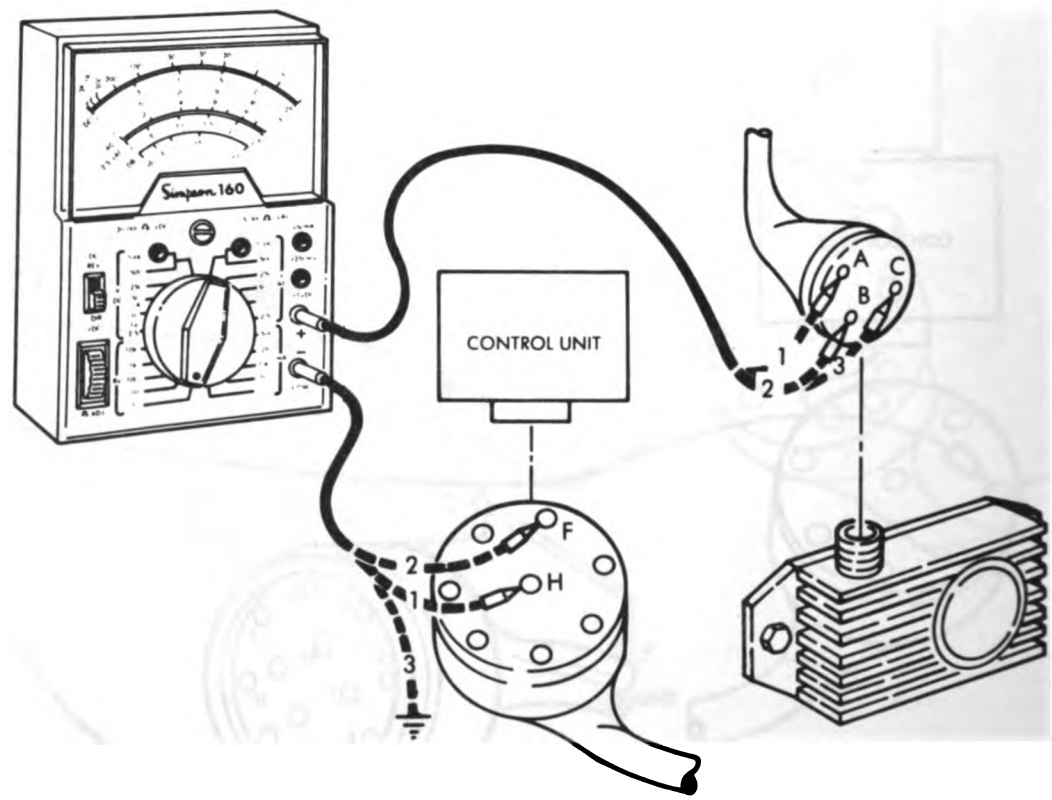
Step 2. Set multimeter to RX1, connect positive lead to terminal A of flasher harness connector. Connect negative lead to terminal H of control unit harness connector, and observe meter for continuity.

Step 3. Connect meter negative lead to terminal F of control unit harness connector, positive lead to terminal B of flasher harness connector, and observe meter for continuity.

Step 4. Connect meter positive lead to terminal C of the flasher harness connector. Connect meter negative lead to ground, and observe meter for continuity.

a. If any circuit does not have continuity, repair or replace (para 5-50).

b. If all circuits have continuity, and turn signals still do not work, replace flasher (para 5-44).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

B. DIRECTIONAL SIGNAL SYSTEM OPERATES INCORRECTLY IN ONE OR MORE POSITIONS OF CONTROL LEVER

Test 1. Test directional signal control unit continuity.

Step 1. Place ignition switch to OFF position.

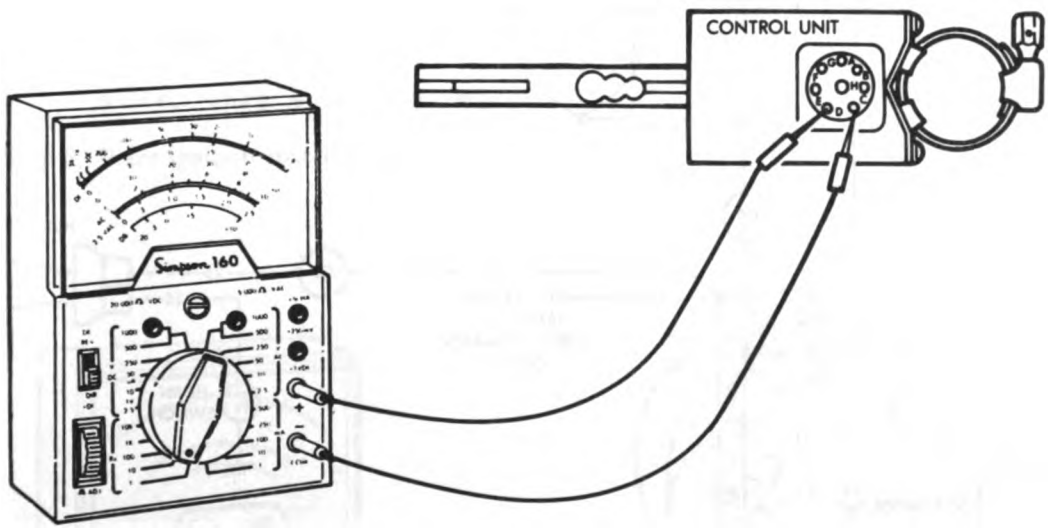
Step 2. Remove harness connector from control unit.

Step 3. Remove indicator lamp from signal control (para 5-72).

Step 4. Set multimeter to RX1 for continuity reading.

Step 5. Set control lever in each of the four operating positions and test as shown.

If any circuit does not test as shown below, replace directional signal control unit (para 5-72).



DIRECTIONAL SIGNAL CONTROL LEVER IN "NEUTRAL" POSITION

FROM PIN:	TO PIN:	CONTINUITY INDICATION:
H	A	OPEN
H	B	OPEN
H	C	OPEN
H	E	OPEN
D	C	SHORTED
D	E	SHORTED
F	G	OPEN

C. DIRECTIONAL SIGNAL CONTROL LEVER IN "RIGHT TURN" POSITION

FROM PIN:	TO PIN:	CONTINUITY INDICATION:
F	G	SHORTED
H	A	SHORTED
H	E	SHORTED
H	B	OPEN
H	C	OPEN
D	C	SHORTED
D	E	OPEN

DIRECTIONAL SIGNAL CONTROL LEVER IN "LEFT TURN" POSITION

H	B	SHORTED
H	C	SHORTED
H	A	OPEN
H	E	OPEN
F	G	SHORTED
D	E	SHORTED
D	C	OPEN

D. DIRECTIONAL SIGNAL CONTROL LEVER IN "HAZARD WARNING" POSITION

H	A	SHORTED
H	B	SHORTED
H	C	SHORTED
H	E	SHORTED
D	E	OPEN
D	C	OPEN
F	G	SHORTED

END OF TESTING!

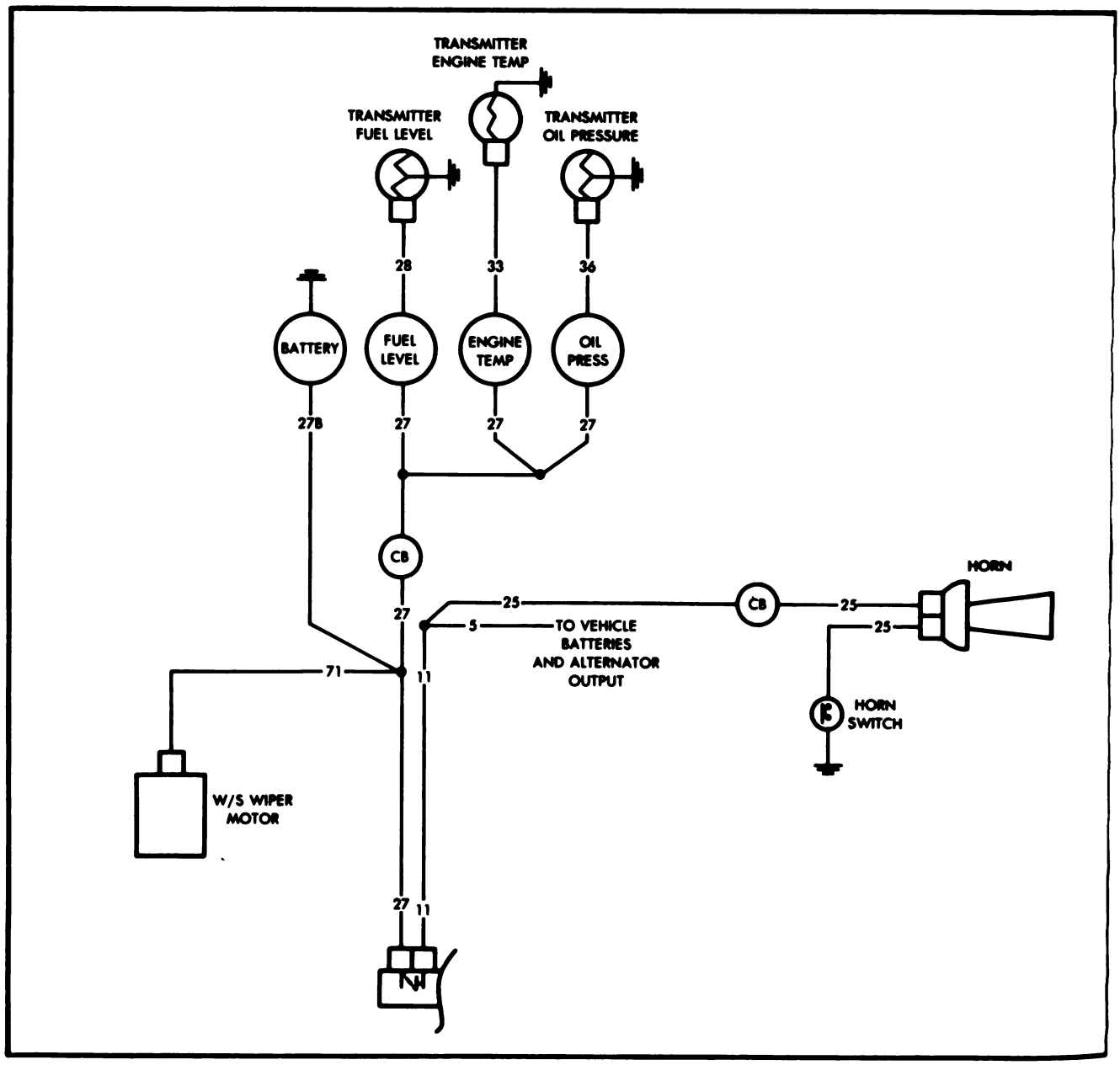
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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

INDICATOR, GAGE, AND WARNING SYSTEM



NOTE

When instrument panel is removed from dash panel, connect a jumper wire from instrument panel to vehicle chassis to provide a return circuit (ground circuit) for the indicator lights and gage actuators.

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Table 3-5. Electrical Troubleshooting Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

7. ALL GAGES INOPERATIVE

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

Test 1. Indicator system voltage test.

Step 1. Remove instrument cluster from vehicle (para 5-58).

Step 2. Disconnect circuit 27 at instrument cluster.

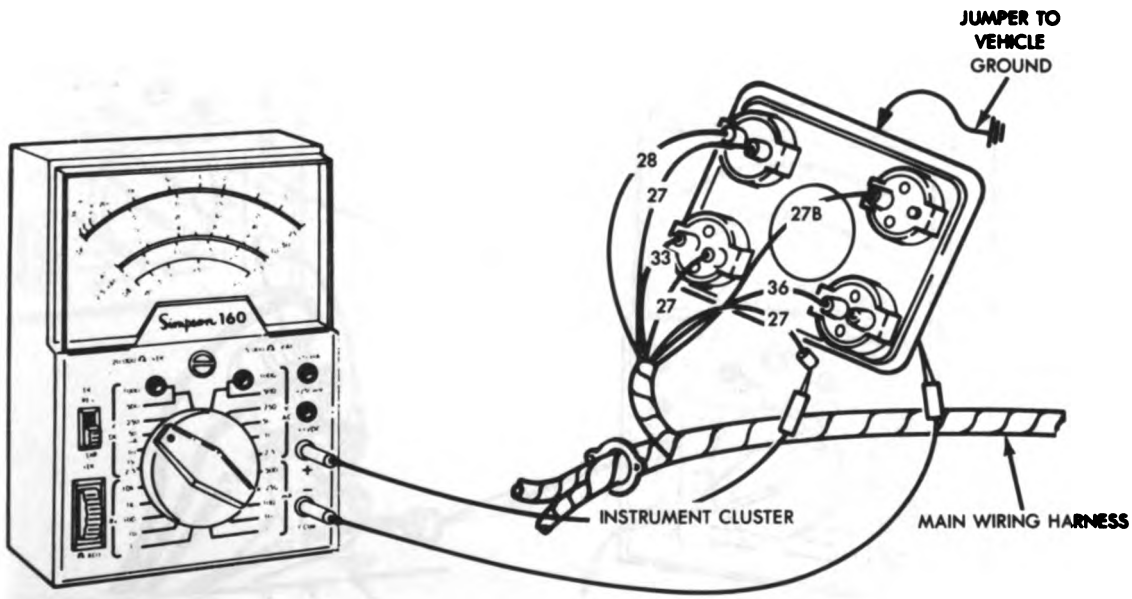
Step 3. Set multimeter to 50-volt range. Connect positive lead to circuit 27 (harness side), and negative lead to ground.

Step 4. Place ignition switch to ON position, and observe multimeter for battery voltage indication.

a. If voltage is present, check ground circuit when instrument cluster is installed in vehicle.

b. If no voltage is present, go to test 2.

Step 5. Place ignition switch to OFF position.



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Table 3-5. Electrical Troubleshooting Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Instrument cluster feed wire test.

Step 1. Set multimeter and ignition switch as in test 1.

Step 2. Disconnect circuit 27 (load side) from circuit breaker, and touch multimeter positive lead to terminal of circuit breaker, negative lead to ground, and observe meter for battery voltage indication.

a. If battery voltage is indicated, place ignition switch to OFF position and repair or replace circuit 27 between instrument cluster harness and circuit breaker (see para 5-50).

b. If battery voltage is not indicated, go to test 3.

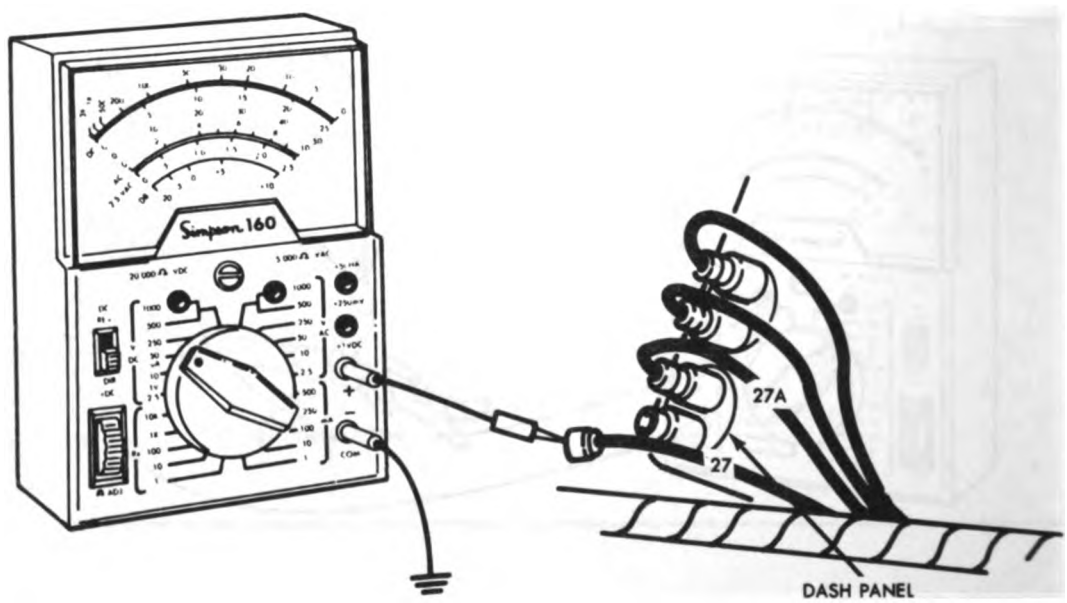
Test 3. Instrument cluster circuit breaker test.

Step 1. Set multimeter and ignition switch as in test 1.

Step 2. Remove circuit 27 wire from battery side of circuit breaker, and connect positive lead of meter to wire.

a. If 24 volts is indicated, place ignition switch in OFF position and replace circuit breaker (para 5-66).

b. If 24 volts is not indicated, go to test 4.



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Table 3-5. Electrical Troubleshooting Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

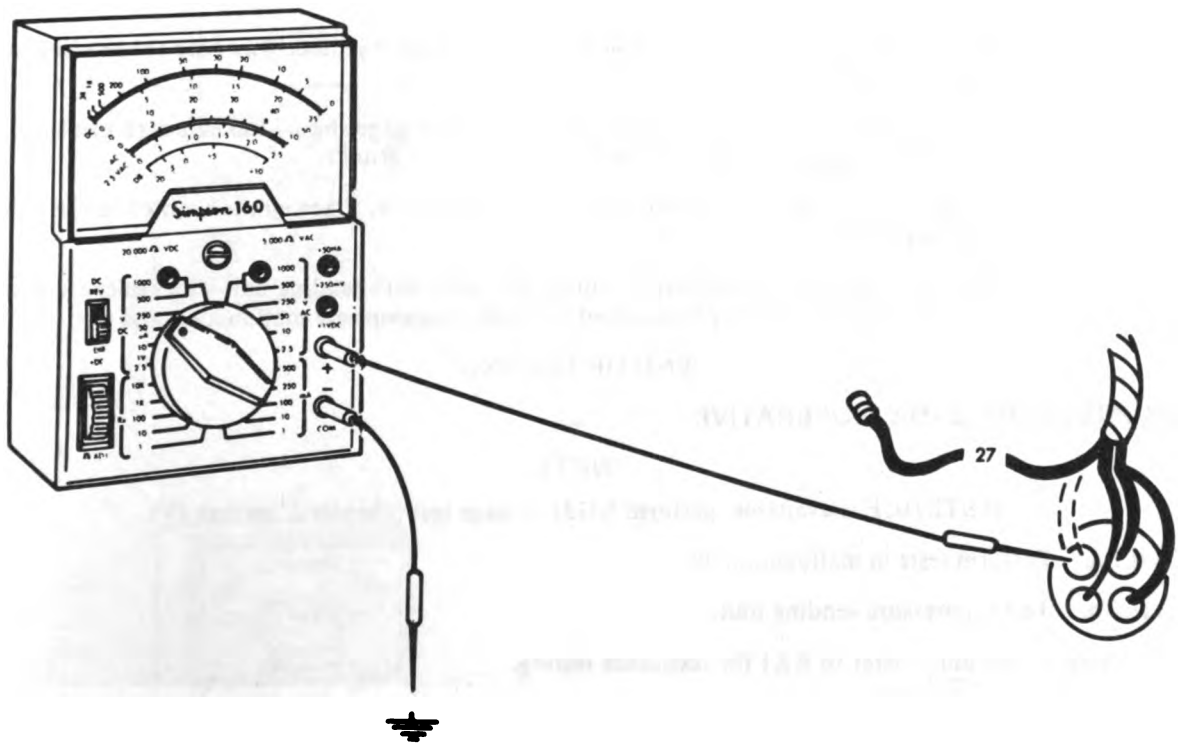
Test 4. Circuit breaker feed wire test.

Step 1. Set multimeter and ignition switch to position as in test 1.

Step 2. Disconnect circuit 27 wire from ignition switch, and connect meter positive lead to switch terminal 27.

a. If battery voltage is indicated, circuit 27 is defective between circuit breaker and ignition switch. Place ignition switch in OFF position and repair or replace circuit 27 (para 5-50).

b. If battery voltage is not indicated, see malfunction 1, test 5.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

38. ONE GAGE INOPERATIVE

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

Test 1. Gage function test.

Step 1. Disconnect sending unit wire from inoperative gage, turn ignition switch to ON position, and observe gage.

Step 2. Check fuel gage for full indication, oil pressure gage for maximum pressure, and temperature gage indicator movement.

If gages do not function as indicated above, and voltage is present at gage feed, gage is defective. Place ignition switch in OFF position and replace gage (para. 5-59).

If no voltage is present, place ignition switch in the "OFF" position and perform tests in malfunction 37.

Step 3. With ignition switch and gages set as in step 1, connect a jumper wire between sending unit terminal of gage and ground.

a. Fuel level gage should indicate empty; oil pressure gage should indicate zero pressure, and temperature gage should indicate maximum temperature.

b. If gages do not react as stated above, gage is defective. Place ignition switch in OFF position and replace gage (para. 5-59).

c. If gages react as stated in step 2, but do not work with sending unit wire attached, place ignition switch in OFF position and go to next appropriate malfunction and test.

END OF TESTING!

39. OIL PRESSURE GAGE INOPERATIVE

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section IV).

Test 1.a. Perform tests in malfunction 38.

Test 1.b. Test oil pressure sending unit.

Step 1. Set multimeter to RX1 for resistance testing.

Step 2. Disconnect circuit 36 wire from sending unit, and connect meter positive lead to sending unit number 36 terminal. Connect meter negative lead to engine ground.

If meter reads more than 1 ohm resistance, replace oil pressure sending unit (para. 5-65).

Step 3. Observe meter and start engine. Meter should read 6 to 10 ohms with engine at idle.

If meter reading is not 6 to 10 ohms, or meter needle moves erratically, replace oil pressure sending unit (para. 5-65).

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Table 3-5. Electrical Troubleshooting (Cont'd)

ALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Test circuit 36 wire voltage.

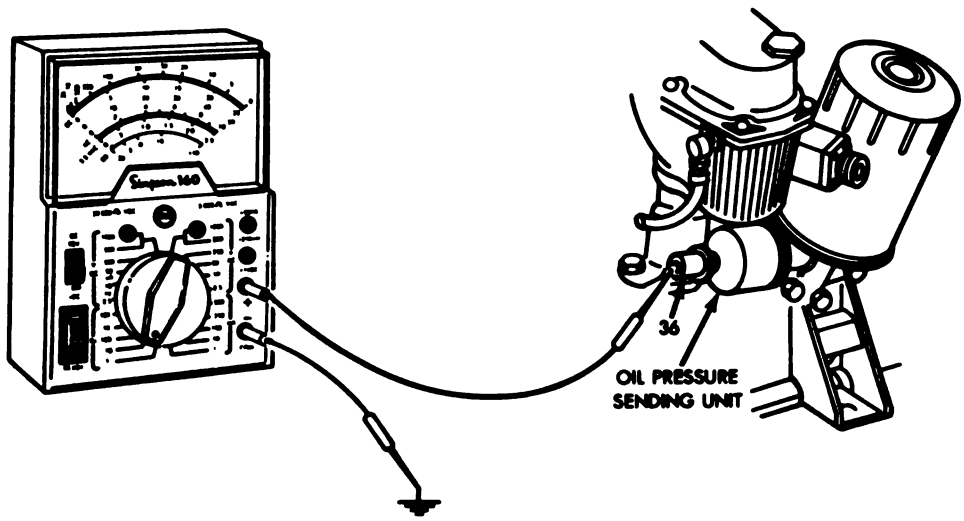
Step 1. Set multimeter to 50-volt range.

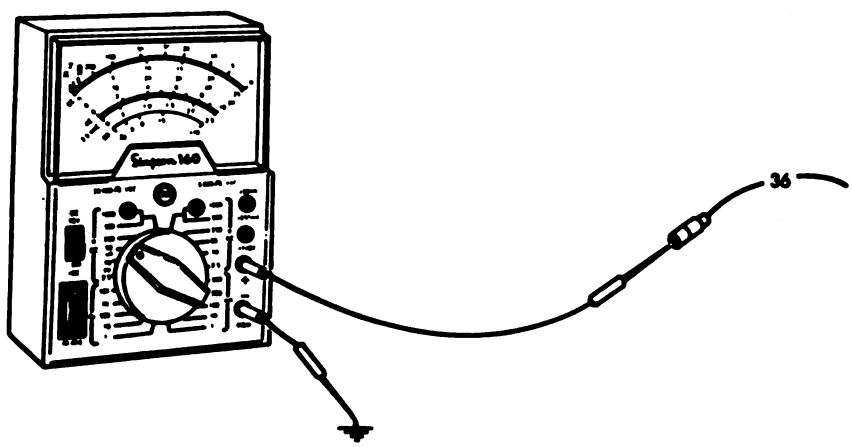
Step 2. Connect meter positive lead to disconnected circuit 36 wire at sending unit, and negative lead to engine ground.

Step 3. Place ignition switch to ON position. Meter should indicate not more than 3 1/2 - 4 volts.

a. If no voltage is present, circuit 36 wire is defective. Place igniton switch in OFF position and repair or replace circuit 36 wire as required (para 5-50).

b. If more than 3 1/2 - 4 volts was read, place ignition switch in OFF position and replace oil pressure gage (para 5-59).





END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

40. TEMPERATURE GAGE INOPERATIVE (coolant)

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

Test 1. Perform tests in malfunction 38.

Test 2. Test the coolant temperature gage sending unit.

Step 1. Allow engine to cool to outside air temperature.

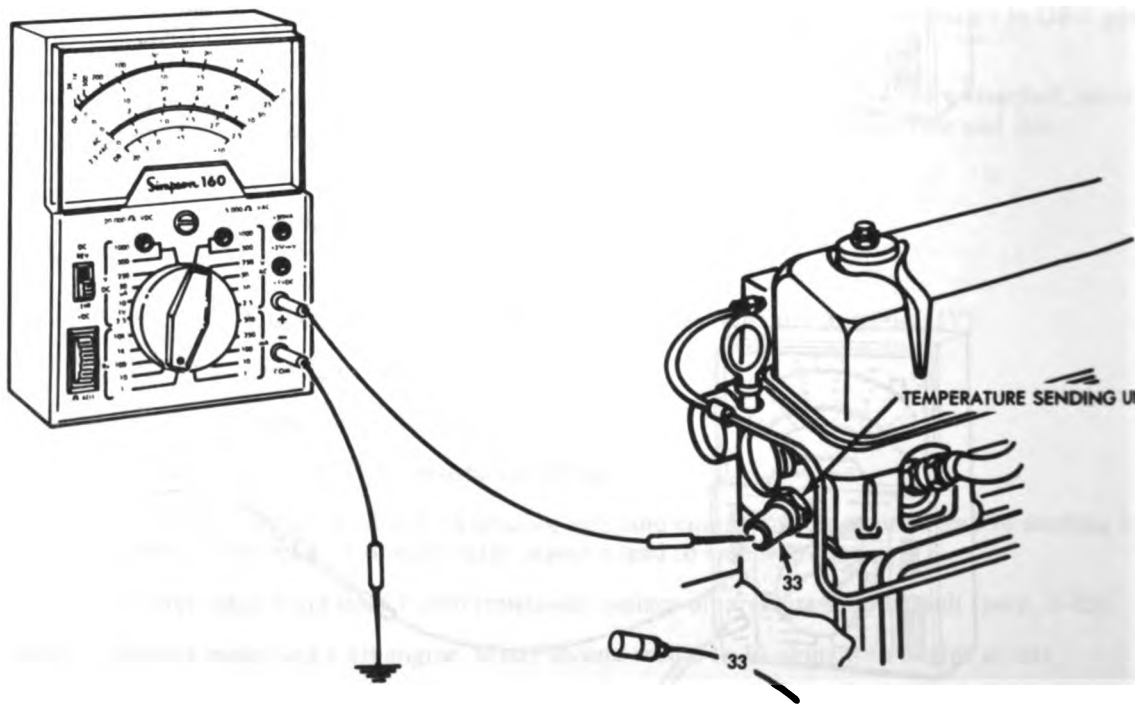
Step 2. Set multimeter to RX1 for resistance reading.

Step 3. Disconnect circuit 33 wire from temperature sending unit.

Step 4. Start vehicle engine.

Step 5. Connect meter negative lead to vehicle engine ground, and connect positive lead to sending unit terminal 33 as shown. The meter reading should decrease as engine temperature increases.

If resistance does not show any decrease as temperature increases, stop vehicle engine and replace the sending unit (para 5-64).



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Table 3-5. Electrical Troubleshooting Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

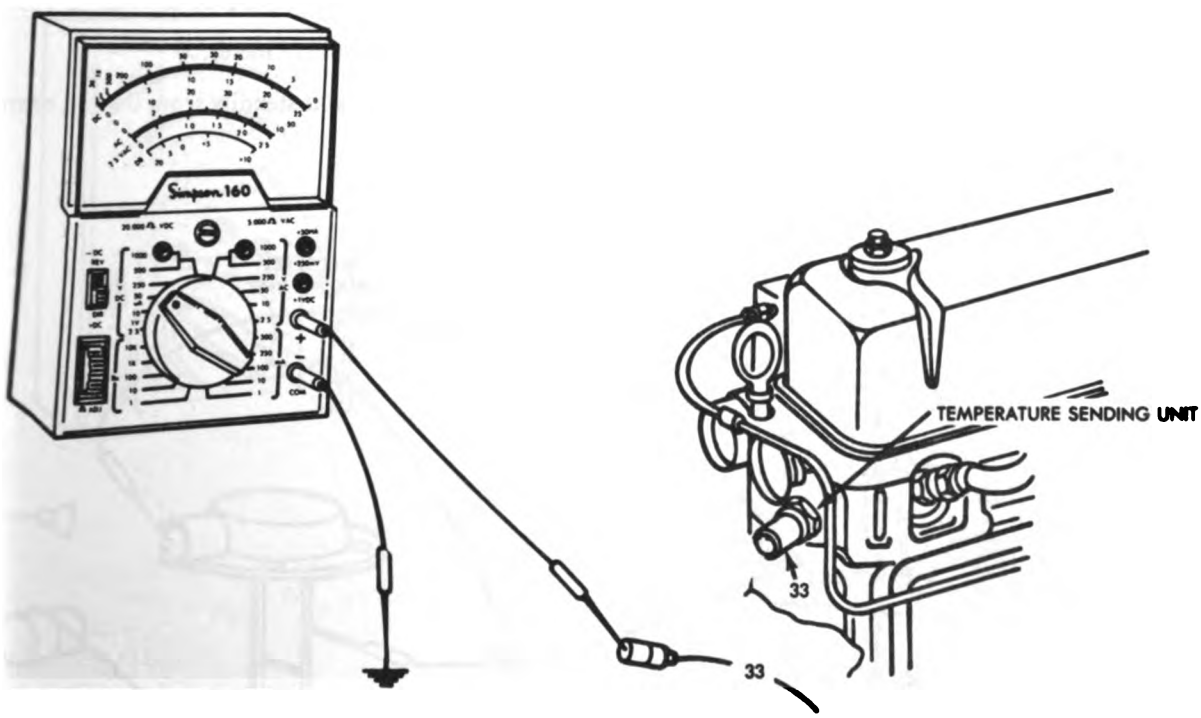
Test 3. Circuit 33 wire voltage.

Step 1. Set multimeter to 50-volt range.

Step 2. Connect meter positive lead to disconnected circuit 33 wire, and negative lead to engine ground.

Step 3. Place ignition switch to ON position. Meter should read battery voltage.

If no voltage is present, place ignition switch in OFF position and repair or replace circuit 33 wire as required (para 5-50).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

41. FUEL GAGE INOPERATIVE

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

CAUTION

Be very careful when making electrical tests near the fuel tank. When components are removed, cover the tank opening with tape and make electrical tests as far from this area as possible.

Test 1. Perform tests in malfunction 38.

Test 2. Fuel level sending unit test.

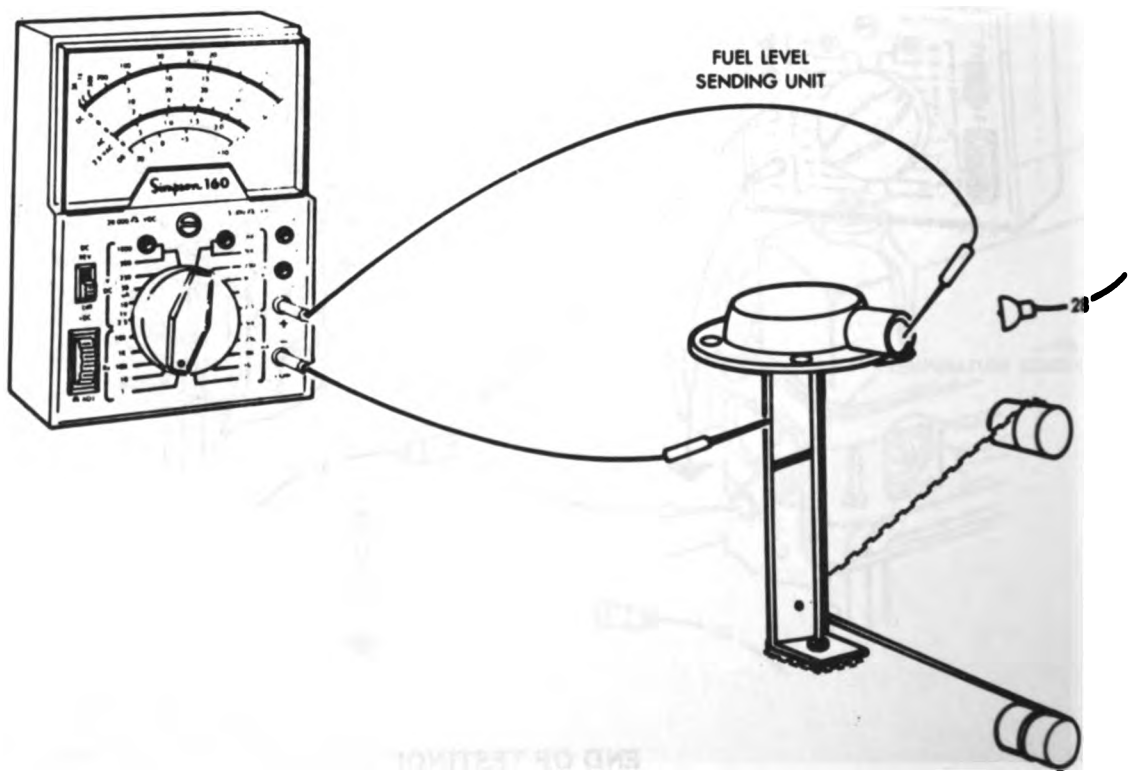
Step 1. Remove fuel sending unit from vehicle (para. 5-63).

Step 2. Set multimeter to RX1 for resistance reading.

Step 3. Connect meter positive lead to sending unit terminal, and negative lead to sending unit body.

Step 4. Move sending unit arm slowly from bottom to top and observe meter.

Resistance indication on meter should increase smoothly and steadily from 0 to 30 ohms. If not, replace defective sending unit (para. 5-63).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Test circuit 28 wire.

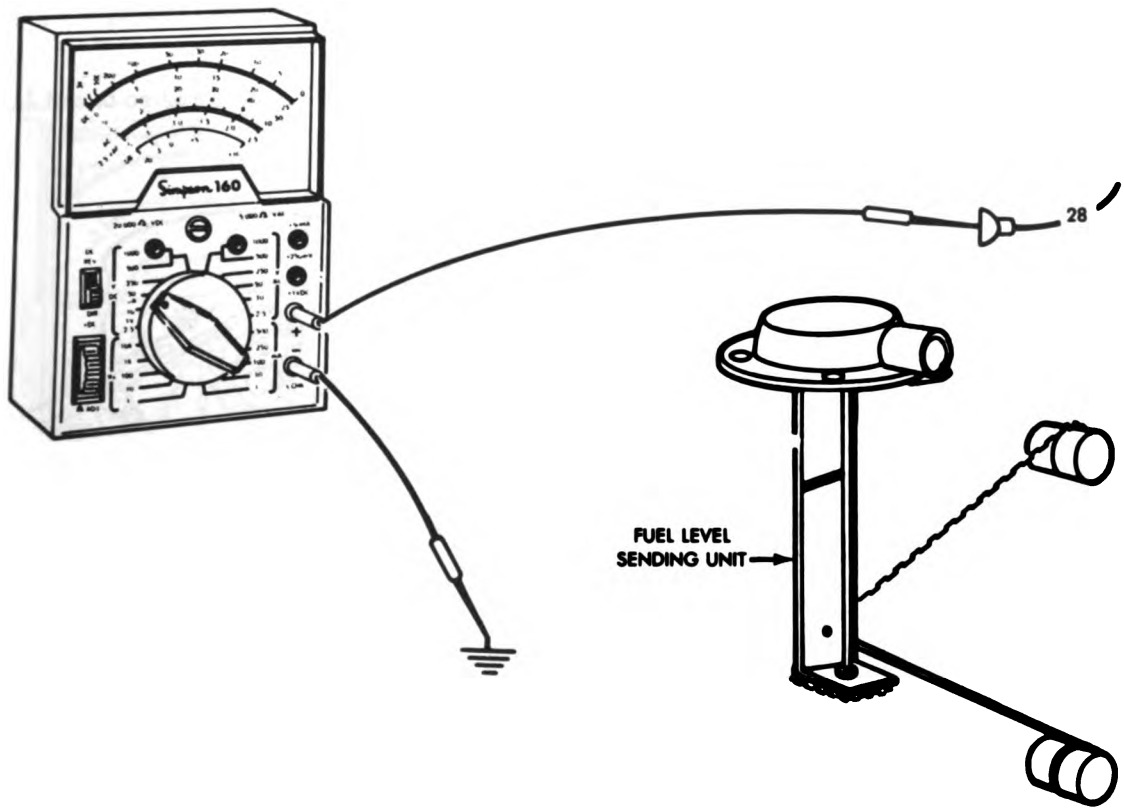
Step 1. Set multimeter to 50-volt range.

Step 2. Connect meter positive lead to disconnected circuit 28 wire at sending unit, and negative lead to engine ground.

Step 3. Place ignition switch to ON position. Meter should indicate not more than 3 1/2 - 4 volts.

a. If no voltage is present, circuit 28 wire is defective. Place ignition switch in OFF position and repair or replace circuit 28 wire as required (para 5-50).

b. If voltage is higher than 3 1/2-4 volts, place ignition switch in OFF position and replace fuel gage (para 5-59).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

42. BATTERY-GENERATOR INDICATOR INOPERATIVE

NOTE

If STE/ICE is available, perform NG31 — gage test (chapter 3, section VI).

Test 1. Battery-generator indicator voltage test.

Step 1. Remove instrument cluster (para 5-58).

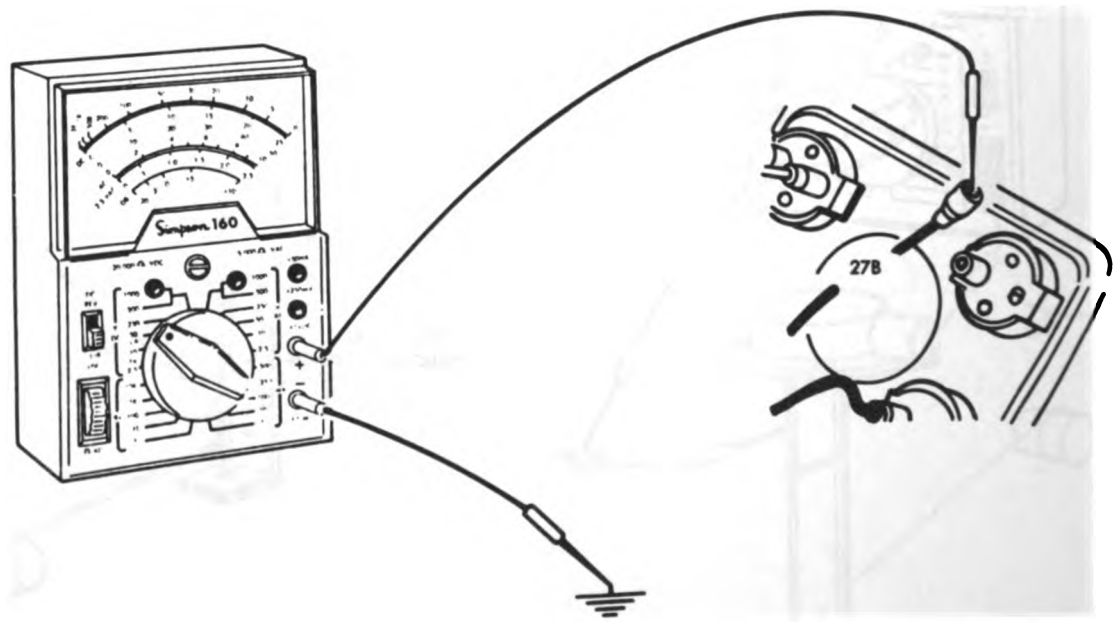
Step 2. Set multimeter to 50-volt range.

Step 3. Disconnect circuit 27B from indicator, connect meter positive lead to circuit 27B at battery indicator, and negative lead to chassis ground point.

Step 4. Place ignition switch to ON position and observe meter.

a. If battery voltage is indicated, check gage for proper grounding to panel. If gage is grounded properly, gage is defective. Place ignition switch in OFF position and replace gage (para 5-59).

b. If no voltage is indicated, place ignition switch in OFF position and go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Battery indicator feed wire continuity test (circuit 27B).

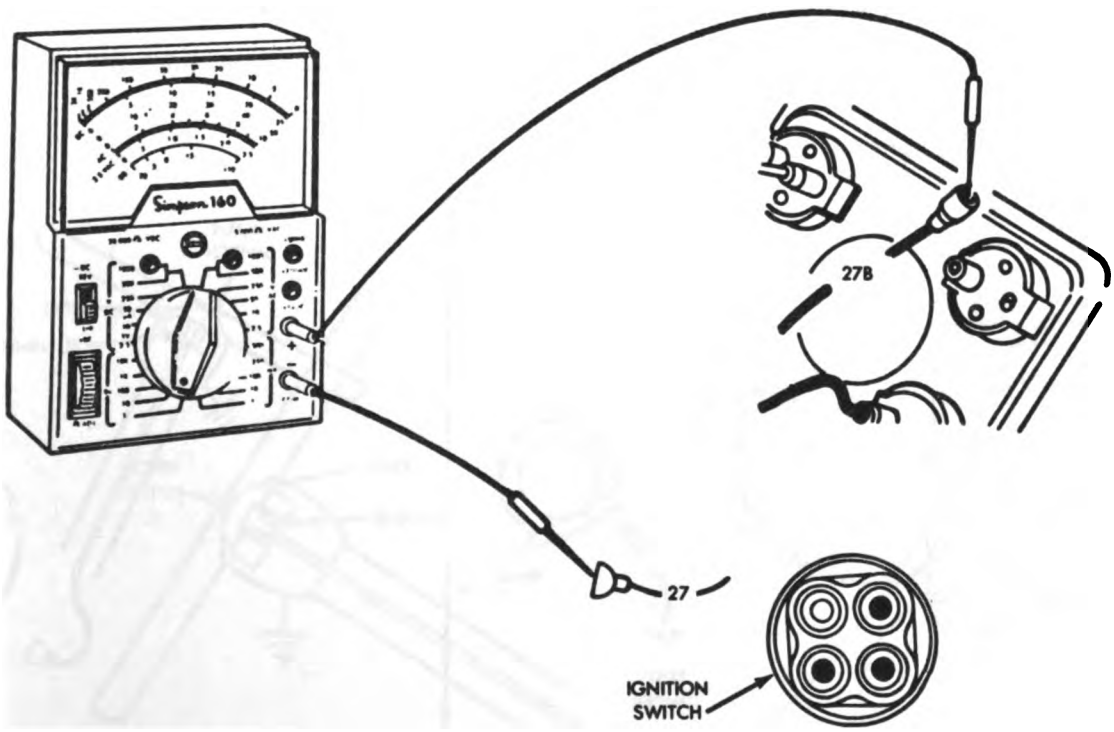
Step 1. Disconnect circuit 27 from ignition switch, and circuit 27B from gage.

Step 2. Attach multimeter negative lead to ignition switch end of circuit 27, and positive lead to battery indicator end of circuit 27B.

a. If meter indicates infinite or high resistance, circuit 27B is defective. Repair or replace as required (para 5-50).

b. If ohmmeter indicates zero resistance, perform ignition switch test (malfunction 1, test 5).

Step 3. Set multimeter to RX1, and observe meter.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

43. HORN INOPERATIVE

Test 1. Horn circuit voltage test (circuit 25).

Step 1. Disconnect both wires from horn, set multimeter to 50-volt range and connect meter negative lead to ground.

Step 2. Connect multimeter positive lead alternately to both circuit 25 wires, and observe meter.

a. If either wire indicates 24 volts, connect this wire to horn terminal, and connect a jumper between other horn terminal and ground. Horn should sound. If horn does not sound, it is defective. Replace horn (para 5-74).

b. If 24 volts are not indicated at either circuit 25 wire in step 2, go to test 4.

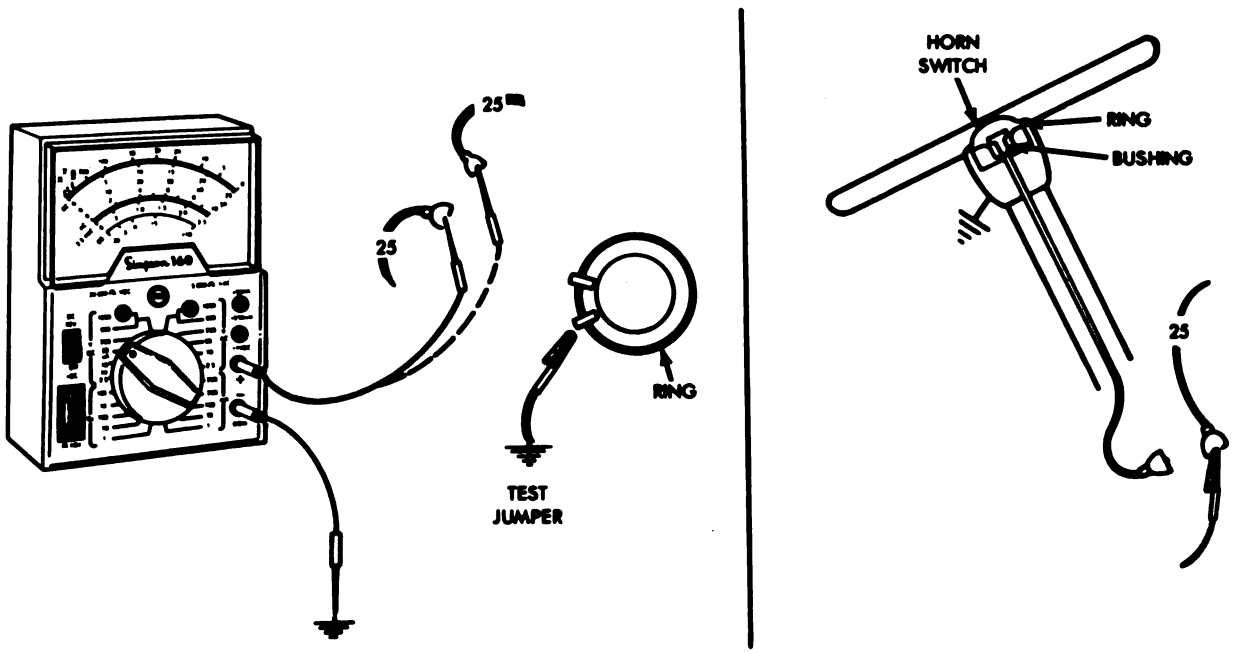
c. If horn sounds, go to test 2.

Test 2. Horn ground circuit test.

Step 1. Disconnect circuit 25 at steering column, and ground to vehicle chassis. Horn should sound.

a. If horn does not sound, circuit 25 between horn and steering column is defective. Replace or repair as required (para 5-50).

b. If horn sounds, go to test 3.



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Table 3-5. Electrical Troubleshooting (Cont'd)

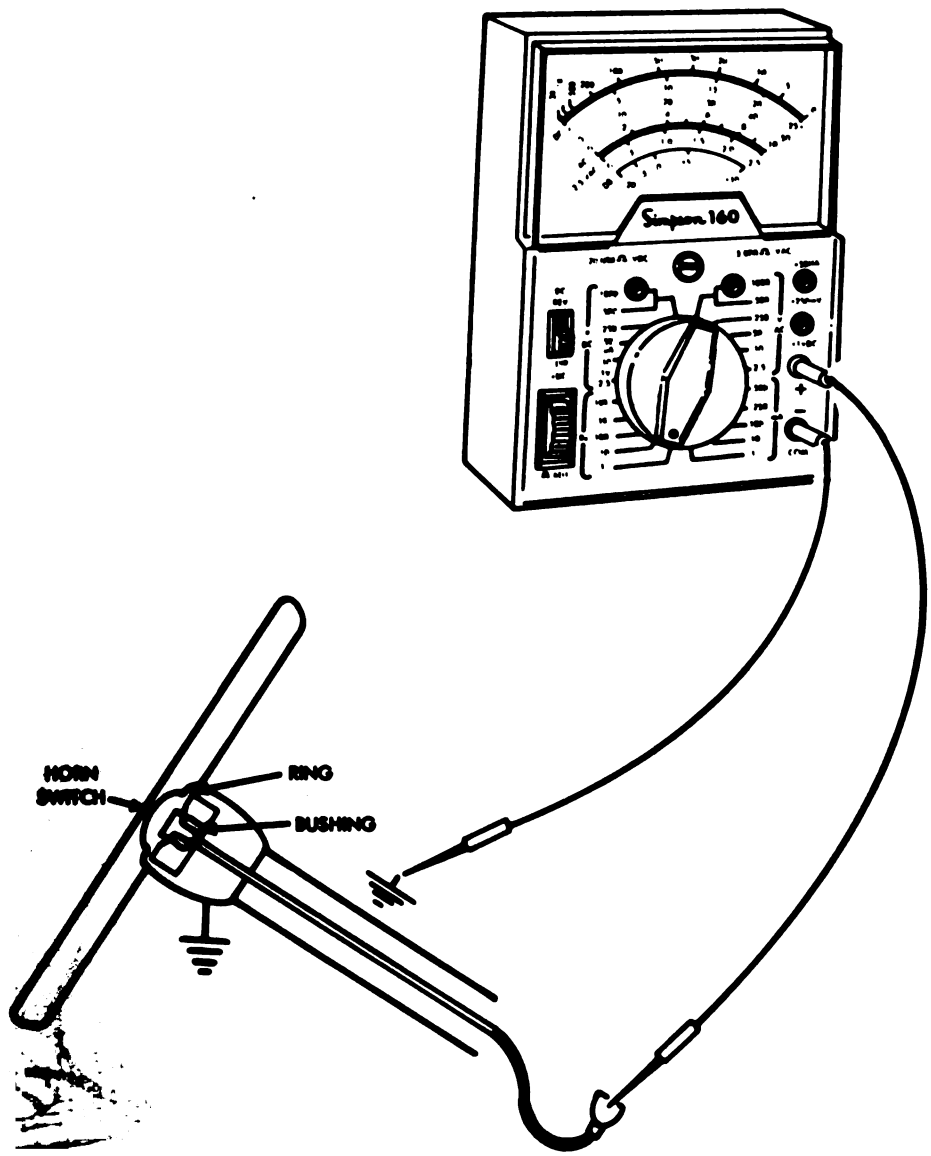
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Horn switch test.

Step 1. Connect the multimeter positive lead to circuit 25 on the steering column, and the meter negative lead to ground.

Step 2. Set meter for RX1. Depress horn button, and observe meter.

With the horn button depressed, the meter should indicate zero resistance. If a high resistance, or infinite resistance is indicated, repair or replace horn switch (para 5-73).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 4. Horn feed wire test.

Step 1. Disconnect circuit 25 wire from the load side of the circuit breaker.

Step 2. Set multimeter to 50-volt range.

Step 3. Connect meter positive lead to circuit breaker, and negative lead to ground, and observe meter.

a. If meter indicates 24 volts, circuit 25 wire is open between circuit breaker and horn. Repair or replace as required (para 5-50).

b. If meter indicates no voltage, go to test 5.

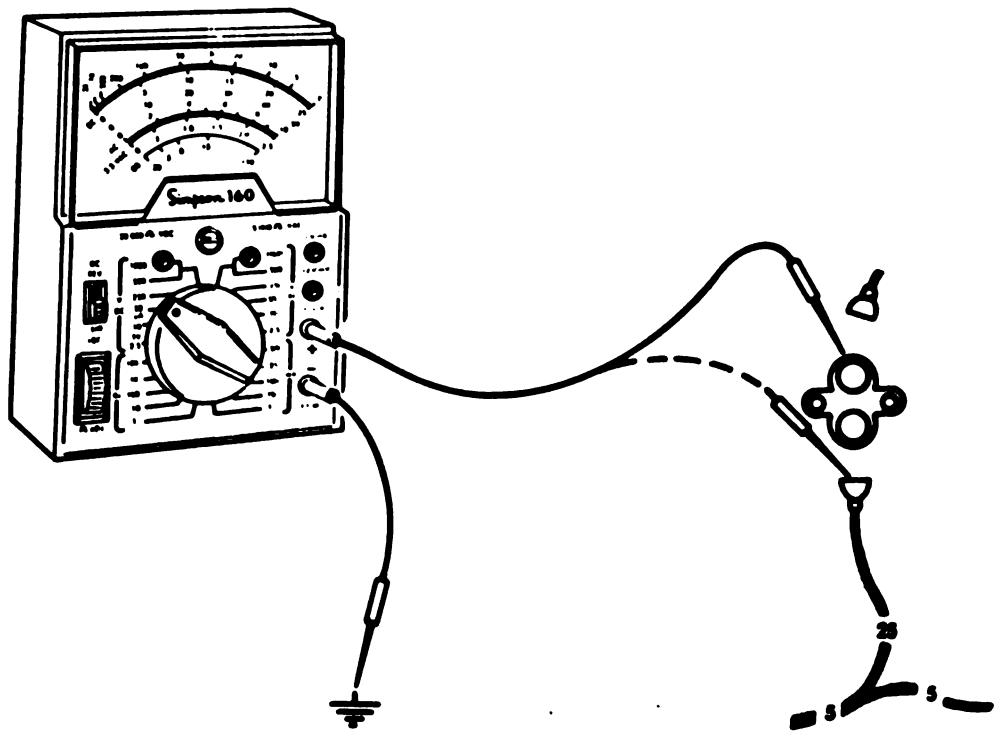
Test 5. Circuit breaker test.

Step 1. Remove circuit 25 from battery side of circuit breaker.

Step 2. Connect multimeter positive lead to circuit 25 wire and negative lead to ground. Set multimeter to 50-volt range, and observe meter.

a. If meter indicates 24 volts, circuit breaker is defective. Replace circuit breaker (para 5-66).

b. If 24 volts is not indicated, circuit 25 wire is open between breaker and battery. Repair or replace as required (para 5-50).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WINDSHIELD WIPER

4. WINDSHIELD WIPER INOPERATIVE IN EITHER SPEED

Test 1. Visual inspection.

Step 1. Inspect windshield wiper motor for loose mounting bolts.

Step 2. Inspect mechanical linkage for binding or interference.

Step 3. Inspect electrical connections for loose or corroded condition.

Tighten all loose connections. Correct any binding condition, then test wipers for proper operation.

NOTE

The motor incorporates an inherent circuit protector which may be tripped if motor is overheated. Perform following tests with wiper motor at normal temperatures.

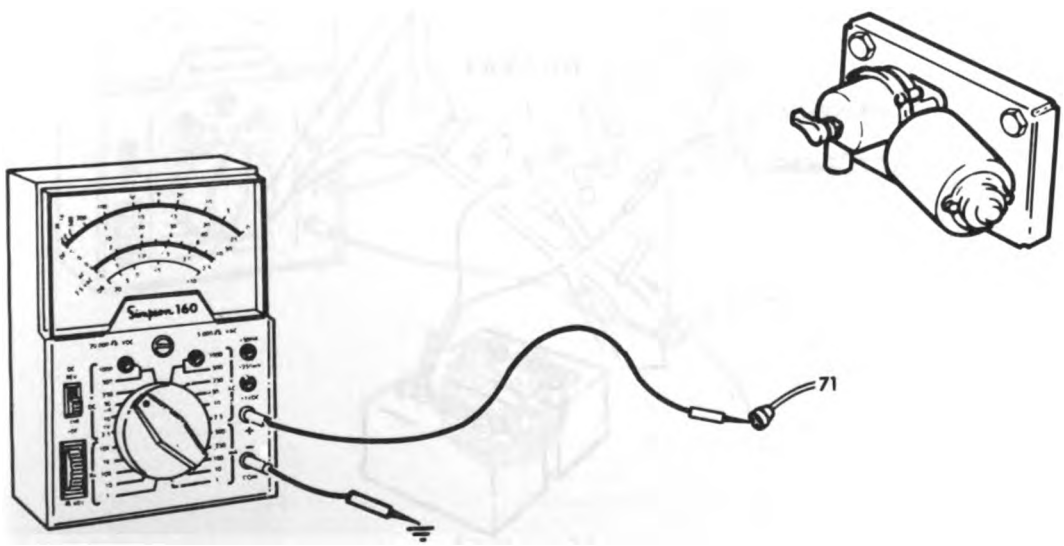
Test 2. Wiper motor connector voltage test.

Step 1. Disconnect circuit 71 connector at motor assembly.

Step 2. Set multimeter to 50-volt range. Connect positive lead to circuit 71 at harness end of connector, and negative lead to a good ground. Turn ignition switch to ON, and observe meter.

a. If meter indicates 24 volts, place ignition switch to OFF position and go to test 3.

b. If meter indicates no voltage, place ignition switch in OFF position and go to test 4.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Motor ground test.

Step 1. Scrape protective coating from wiper motor housing enough for jumper wire contact (test point A).

Step 2. Place ignition switch and wiper switch in ON position.

Step 3. Connect jumper wire from battery negative post to test point A.

a. If windshield wipers do not operate, replace wiper motor (para 10-18).

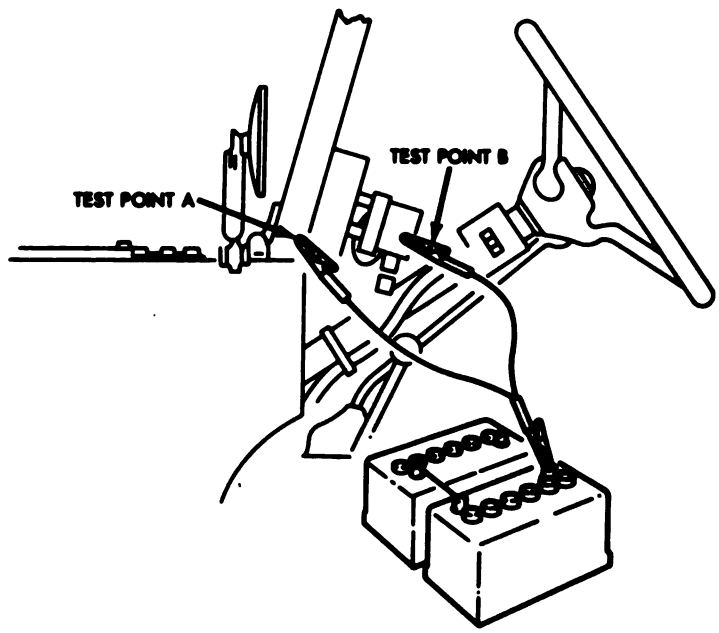
b. If windshield wipers operate, go to step 4.

Step 4. Scrape protective coating from windshield housing enough for jumper wire contact (test point B).

Step 5. Connect jumper wire from battery negative post to test point B.

a. If windshield wipers operate, an open circuit exists between windshield frame and body. Place ignition switch in OFF position. Remove windshield hinges and clean all paint, corrosion, and other foreign matter from hinge pins and mounting surfaces of hinges; then reassemble and install hinge (para 10-21).

b. If windshield wipers do not operate, an open circuit exists between frame and wiper motor. Place ignition switch in OFF position. Remove wiper motor and attaching hardware. Clean mating surfaces of brackets, then reassemble and install (para 10-18).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 4. Windshield wiper motor feed wire continuity test (circuits 71 and 27).

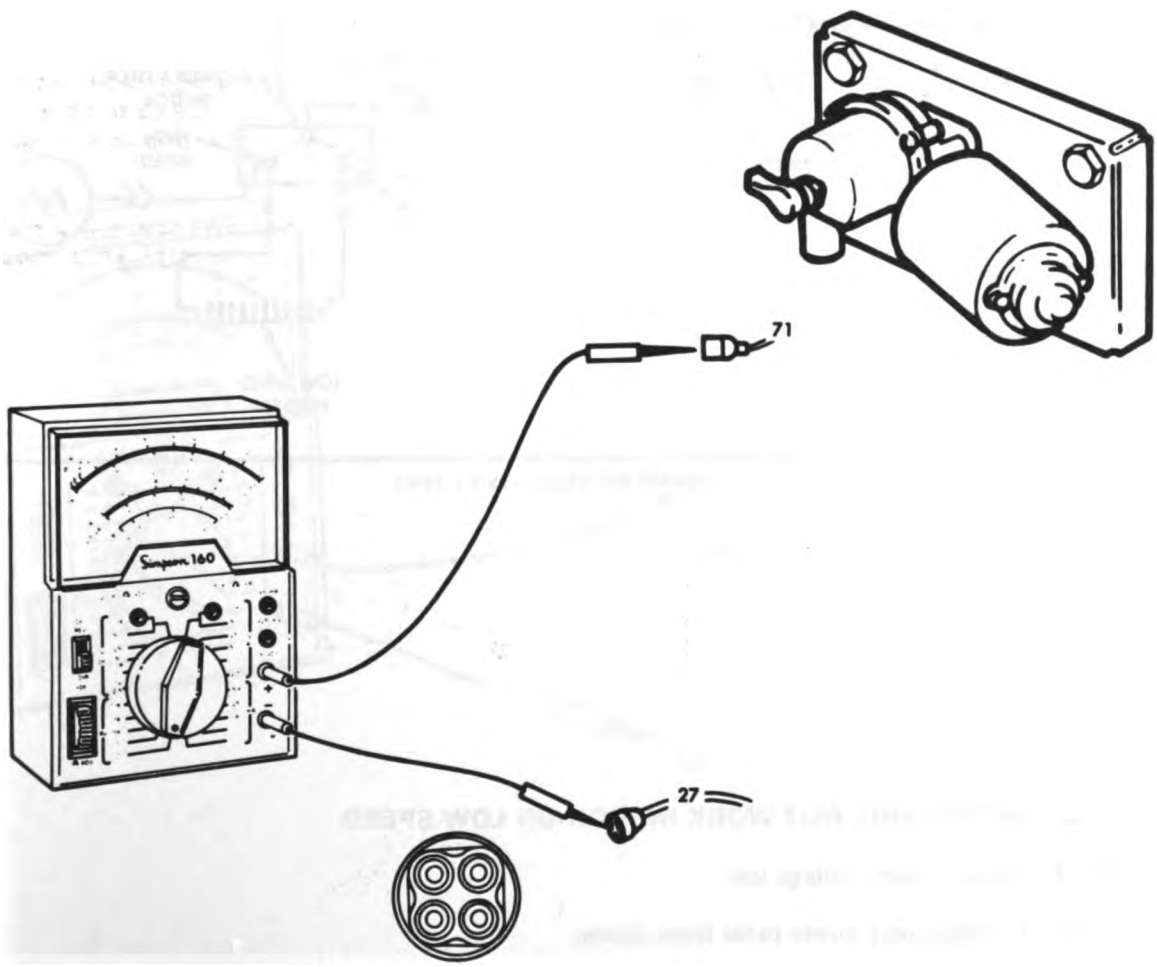
Step 1. Disconnect circuit 71 connector at wiper motor and connect positive lead of multimeter to circuit 71 at harness connector.

Step 2. Disconnect circuit 27 connector at ignition switch, and connect the negative lead of the meter to circuit 27 at harness connector.

Step 3. Set multimeter to RX1, and observe meter.

a. If meter indicates infinite resistance, circuit 27 or 71 is open. Repair or replace as required (para 5-50).

b. If meter indicates zero resistance, circuits 27 and 71 are intact. Go to ignition switch test (malfunction 1, test 5).



END OF TESTING!

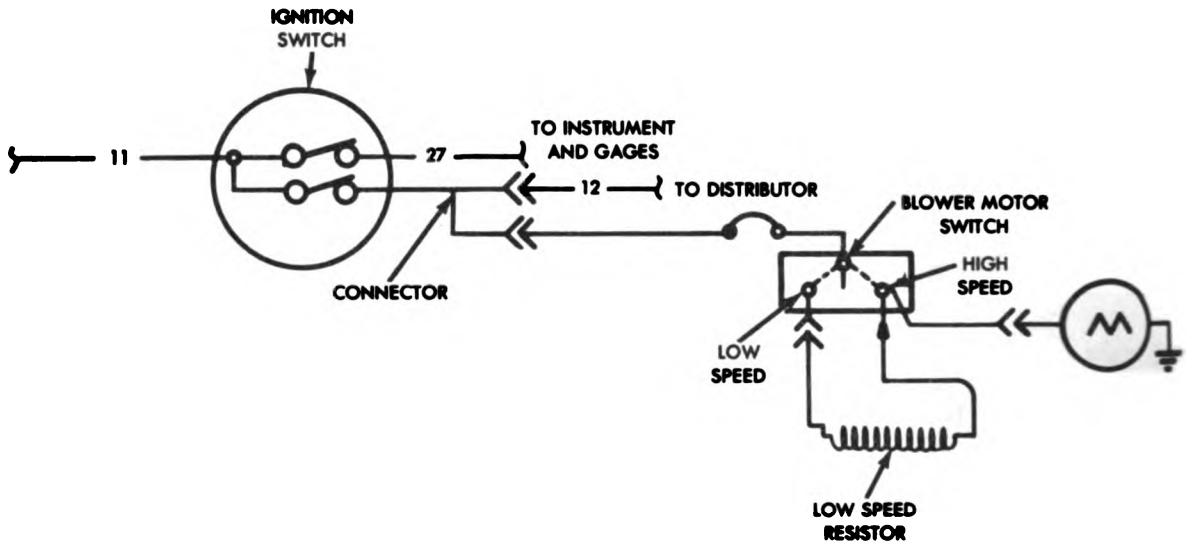
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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

HOT WATER HEATER -25°F (-32°C)



HEATER ELECTRICAL -25°F (-32°C)

45. BLOWER MOTOR WILL NOT WORK IN HIGH OR LOW SPEED

Test 1. Blower motor voltage test.

Step 1. Disconnect power cable from motor.

Step 2. Set multimeter to 50-volt range. Connect meter positive lead to cable pin connector, and negative lead to ground.

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Table 3-5. Electrical Troubleshooting (Cont'd)

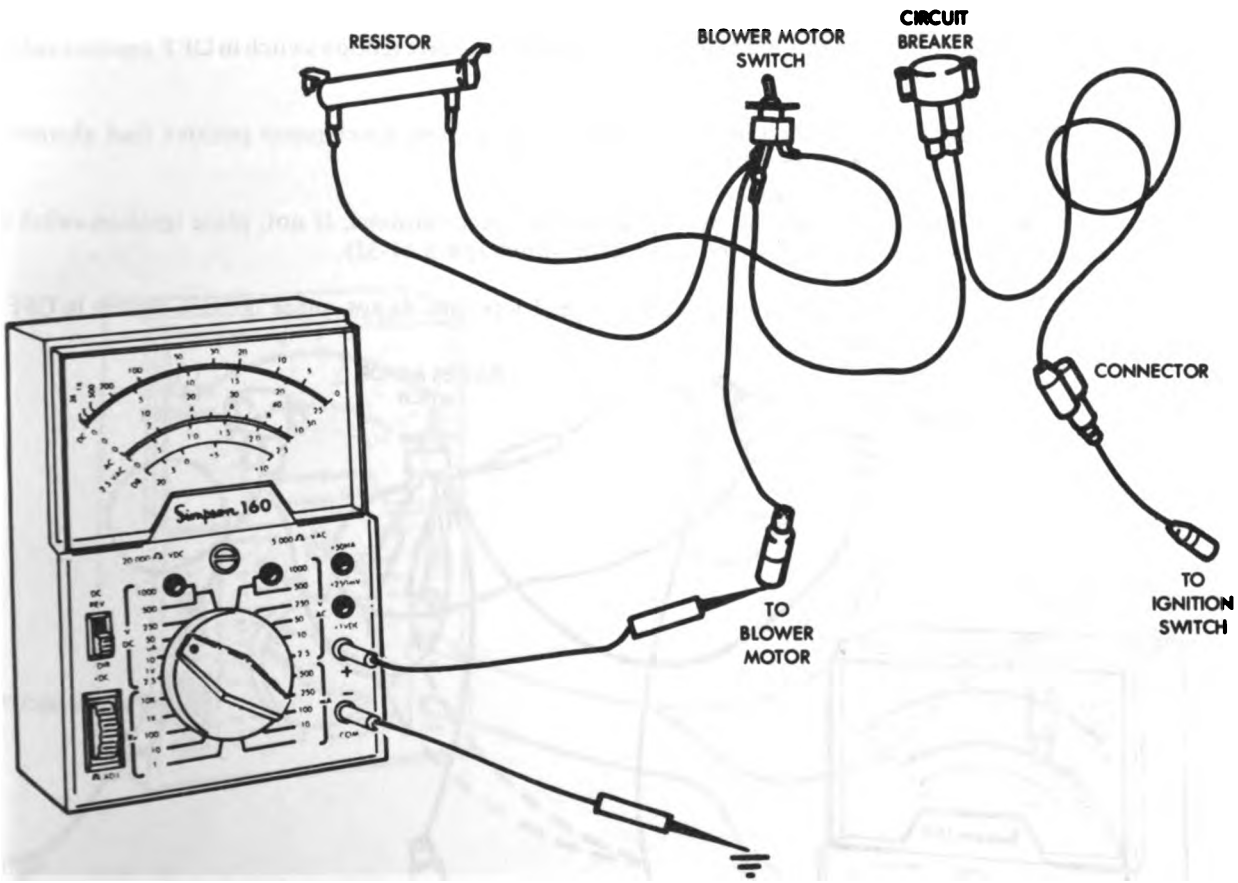
MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 3. Place ignition switch to ON position. Place heater switch to high position, and observe multimeter.

a. Meter should indicate battery voltage.

b. If battery voltage is indicated, place ignition switch in OFF position and replace motor (para 11-35).

c. If no voltage is indicated, place ignition switch in OFF position and go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 2. Blower motor switch test.

Step 1. Set multimeter to 50-volt range, and connect negative lead to ground.

Step 2. Place ignition switch to ON and blower motor switch to HIGH-SPEED position.

Step 3. Touch meter positive lead alternately to the power terminal and high-speed terminal of the blower motor switch.

a. If voltage is indicated at power terminal but not at high-speed terminal, place ignition switch in OFF position and replace blower motor switch (para 11-32).

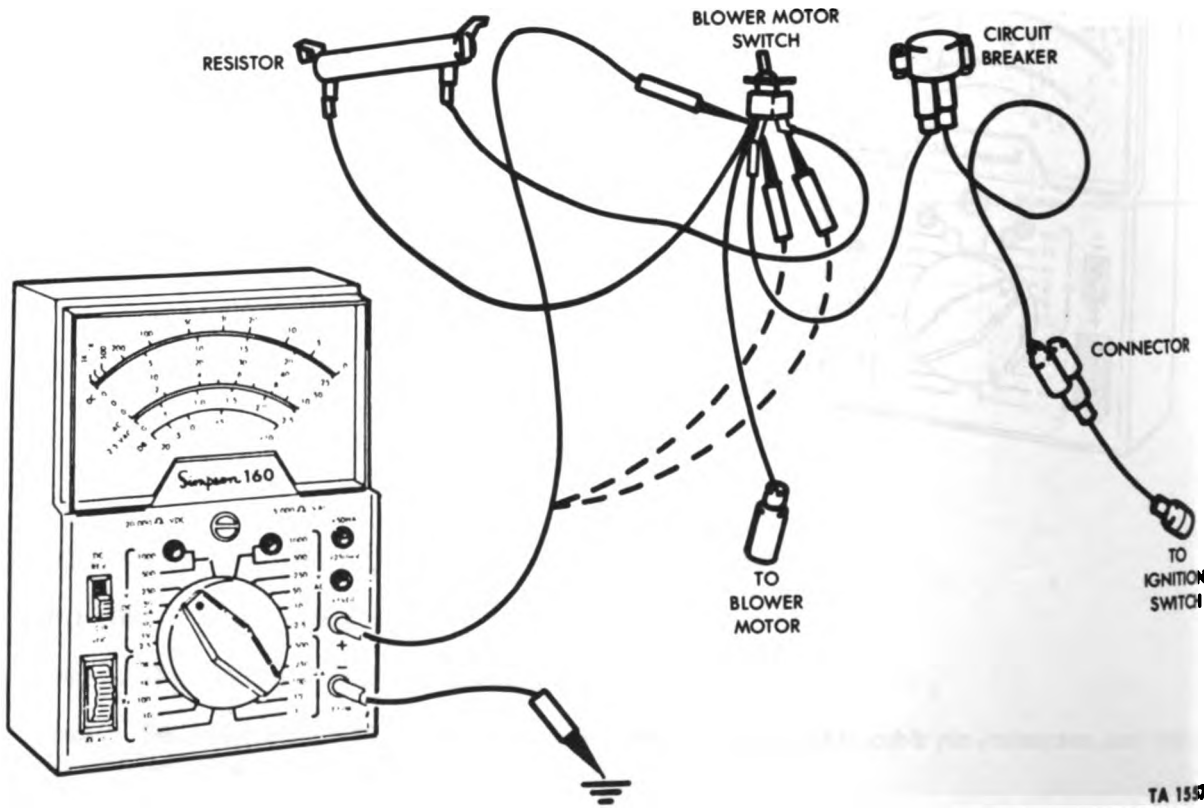
b. If battery voltage is indicated at both terminals but not at motor, place ignition switch in OFF position and replace blower motor cable.

c. If battery power is not indicated at power terminal, place igntion switch in OFF position and go to test 3.

Step 4. Place blower motor switch in LOW-SPEED position and touch meter positive lead alternately to low speed and high speed terminals of switch.

a. Meter should indicate battery voltage at low speed terminal. If not, place ignition switch in OFF position and replace blower motor switch (para 11-32).

b. Meter should indicate voltage at high-speed terminal. If not, place ignition switch in OFF position and go to test 3.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Circuit breaker voltage test.

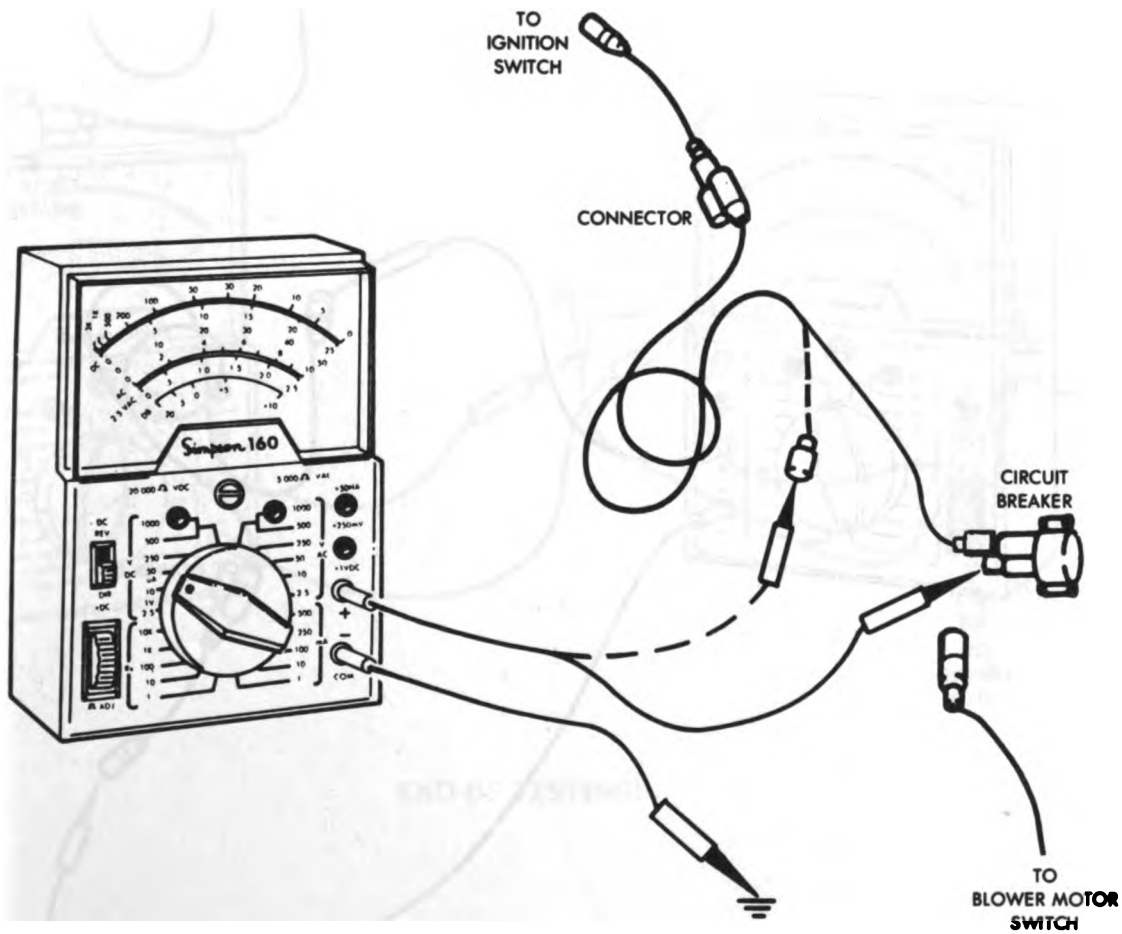
Step 1. Set multimeter to 50-volt range. Disconnect blower motor switch cable from breaker, and connect meter positive lead to terminal of breaker.

Step 2. Connect meter negative lead to ground, turn ignition switch to ON, and observe meter.

Step 3. Disconnect ignition switch cable from breaker, and touch meter positive lead to pin of cable.

a. If battery voltage is indicated in step 3 but not step 2, place ignition switch in OFF position and replace breaker (para 11-34).

b. If voltage is not indicated in step 3, place ignition switch in OFF position and go to test 4.



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

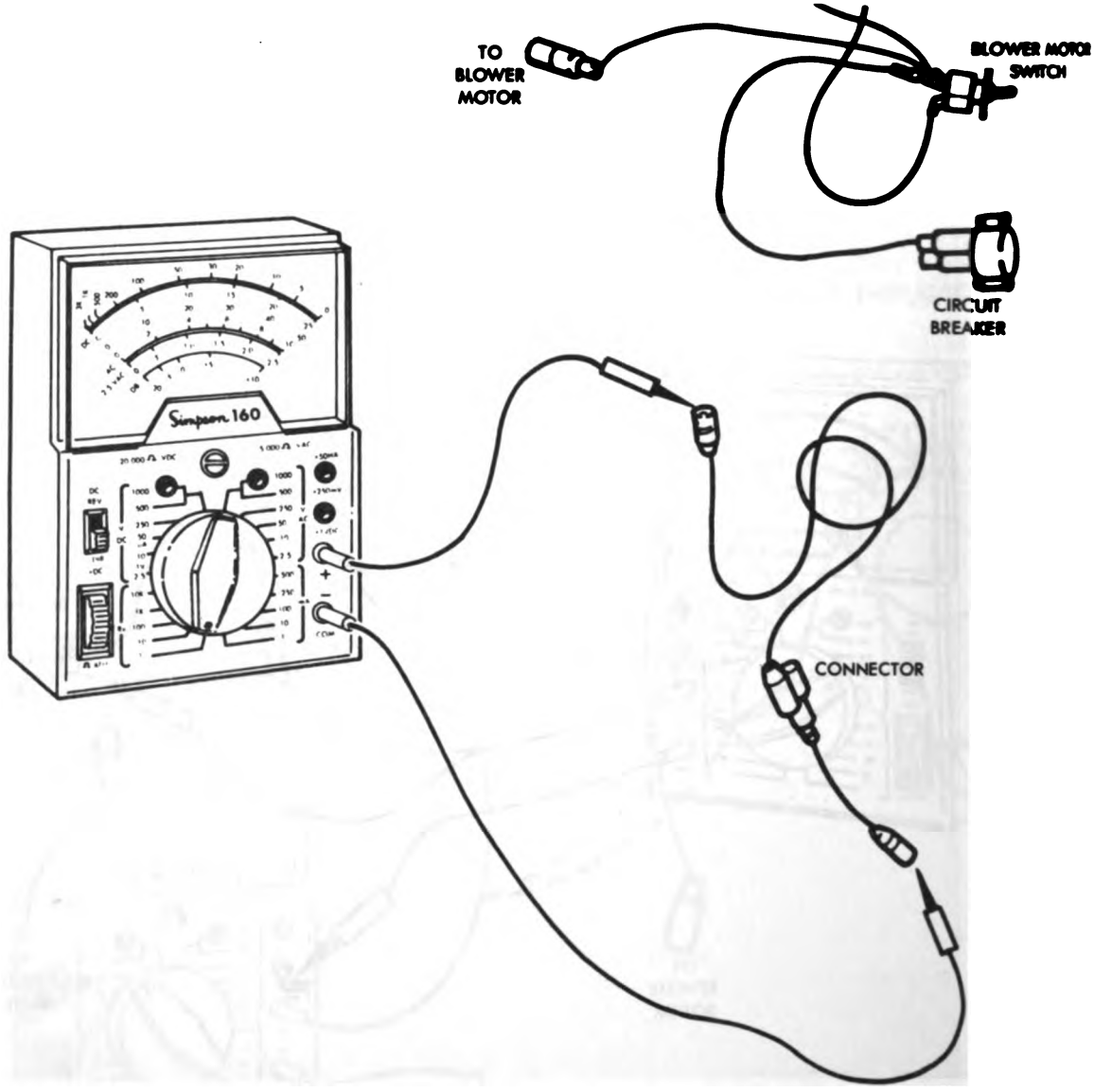
Test 4. Circuit breaker feed wire continuity test.

Step 1. Disconnect circuit breaker feed wire at ignition switch and circuit breaker.

Step 2. Set multimeter to RX1, connect positive lead to switch side of feed wire, and negative lead to circuit breaker side of feed wire, and observe meter.

a. If meter indicates high or infinite resistance, repair or replace circuit breaker feed wire.

b. If meter indicates zero resistance, perform ignition switch test (malfunction 1, test 5).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

. BLOWER MOTOR WORKS IN HIGH SPEED ONLY

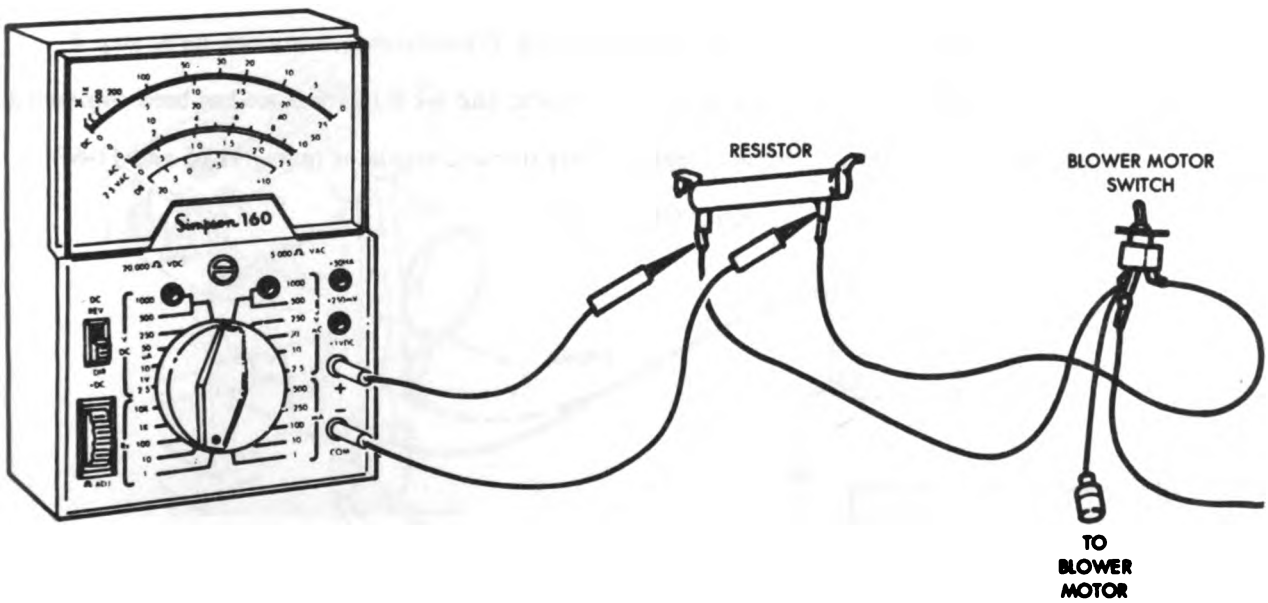
Test 1. Check blower motor switch (malfunction 45, test 2).

Test 2. Low-speed resistor test.

Step 1. Set multimeter to RX1.

Step 2. Touch meter positive lead to power side of resistor, and negative lead to load side of resistor.

Meter should indicate 5 ohms. If high or infinite resistance is indicated, replace resistor (para 11-33).



END OF TESTING!

7. BLOWER MOTOR WORKS IN LOW SPEED ONLY

Test 1. Check blower motor switch (malfunction 45, test 2).

END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

RADIO INTERFERENCE

48. RADIO INTERFERENCE

NOTE

Radio interference may arise from one or more sources on the vehicle. If testing equipment is not available for checking such sources, perform the checks described below progressively until interference has been eliminated, or notify support maintenance.

Step 1. Remove spark plugs and replace with new plugs (para 4-15).

If interference is corrected, cease troubleshooting. If interference continues, go to step 2.

Step 2. Remove spark plug cables, and replace with new cables (para 5-10).

If interference is corrected, cease troubleshooting. If interference continues, go to step 3.

Step 3. Inspect ground strap for security and for corroded conditon. Clean or tighten as required.

If inteference is corrected, cease troubleshooting. If interference continues, go to step 4.

Step 4. Remove drive belts from alternator, start vehicle, and see if interference has been eliminated.

If step 4 eliminates interference, replace alternator and regulator (paras 11-65 and 11-66).

END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

WINTERIZATION KIT -65°F (-54°C)

DIVERTER ACTUATOR ASSEMBLY DOES NOT OPERATE

Test 1. Test actuator assembly.

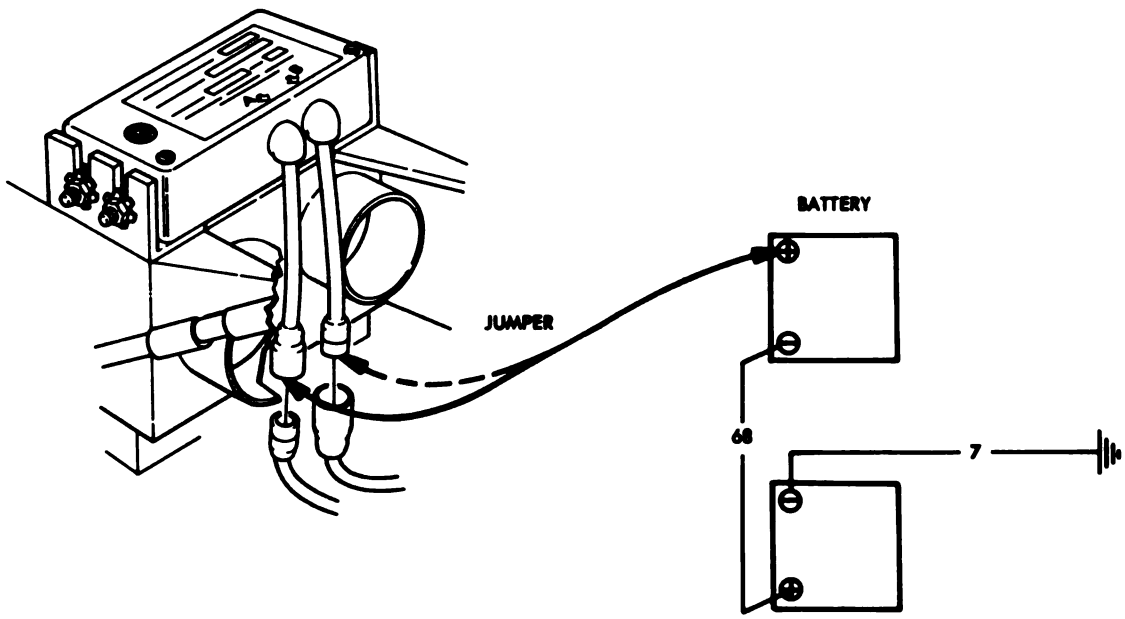
Step 1. Unplug actuator connectors from thermostat connectors.

Step 2. Connect a jumper wire between the battery positive terminal clamp and actuator connector.

Step 3. Alternately touch each actuator connector and observe damper.

a. If actuator operates normally, go to test 3.

b. If actuator does not operate, go to test 2.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

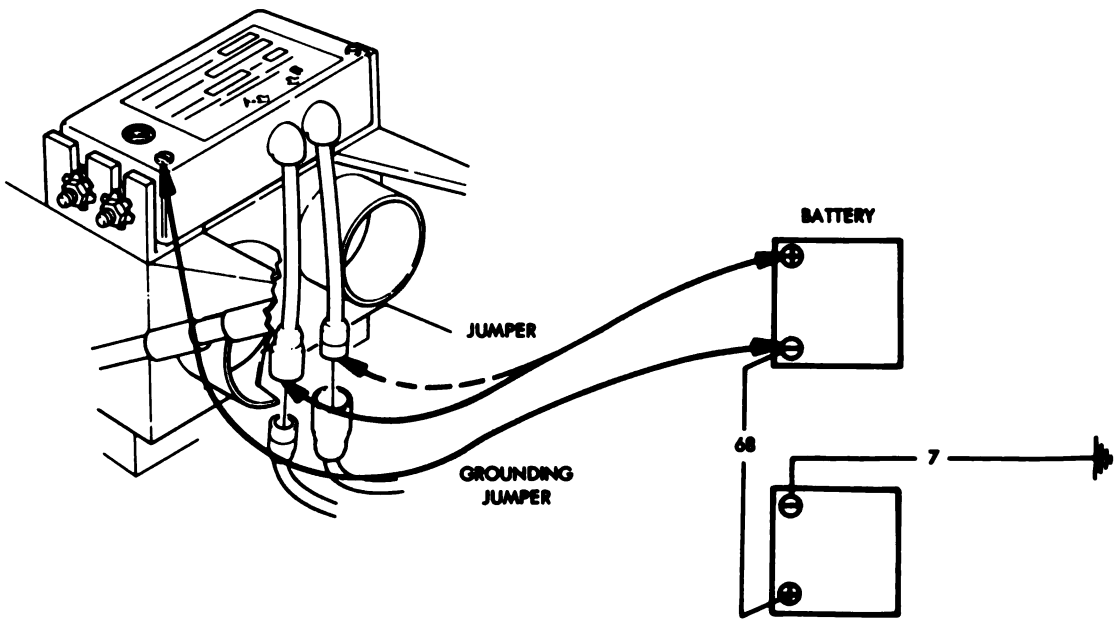
Test 2. Test actuator for improper grounding.

Step 1. Connect jumper wire between the battery negative terminal clamp and to a bare metal screw head on actuator assembly.

Step 2. Alternately touch each actuator connector with jumper wire as in test 1.

a. If actuator operates normally with grounding jumper in use, remove paint under one actuator mounting nut and star lockwasher. Tighten nuts.

b. If actuator does not operate with grounding jumper in use, replace diverter actuator assembly (para 11-13).



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 3. Test for voltage at thermal switch circuit breaker.

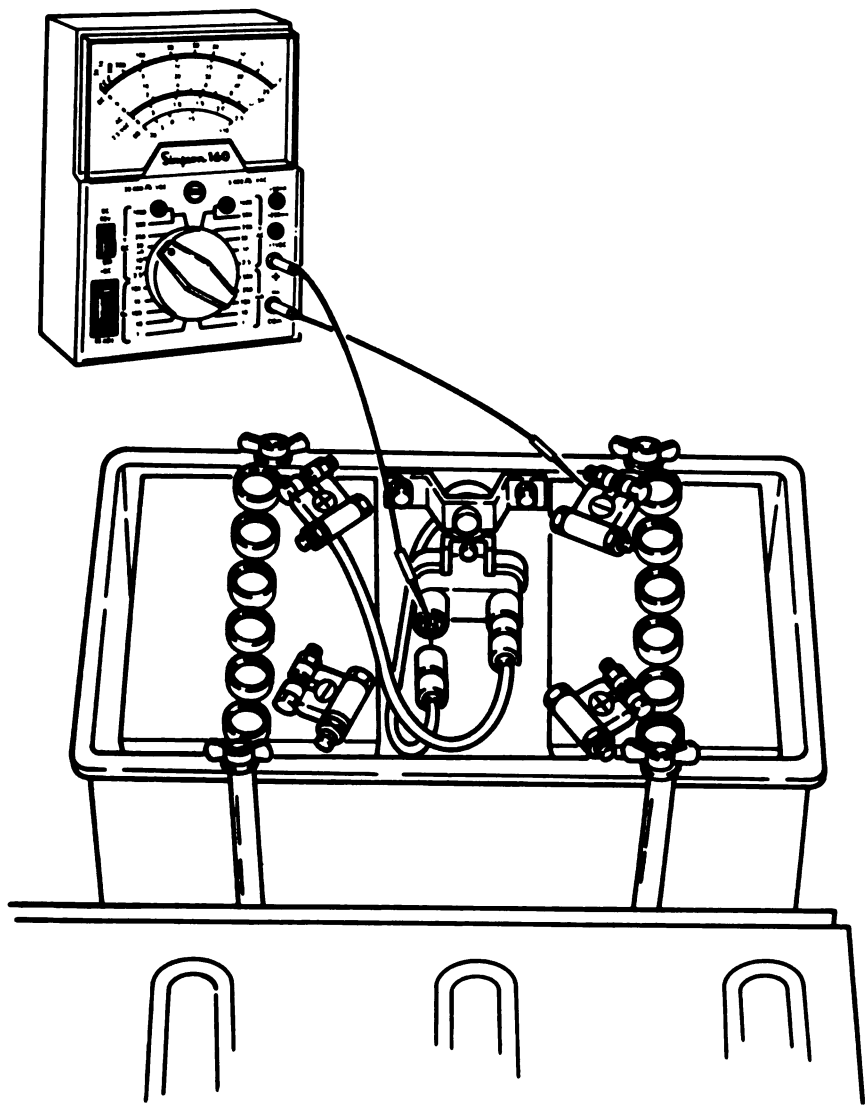
Step 1. Unplug thermostat connector from circuit breaker.

Step 2. Set multimeter to 50-volt range.

Step 3. Connect meter positive lead to circuit breaker terminal. Connect meter negative lead to vehicle ground and observe meter.

a. If battery voltage is indicated, replace thermostat (para 11-15).

b. If battery voltage is not indicated, go to test 4.



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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Test 4. Test for voltage at battery to circuit breaker electrical lead.

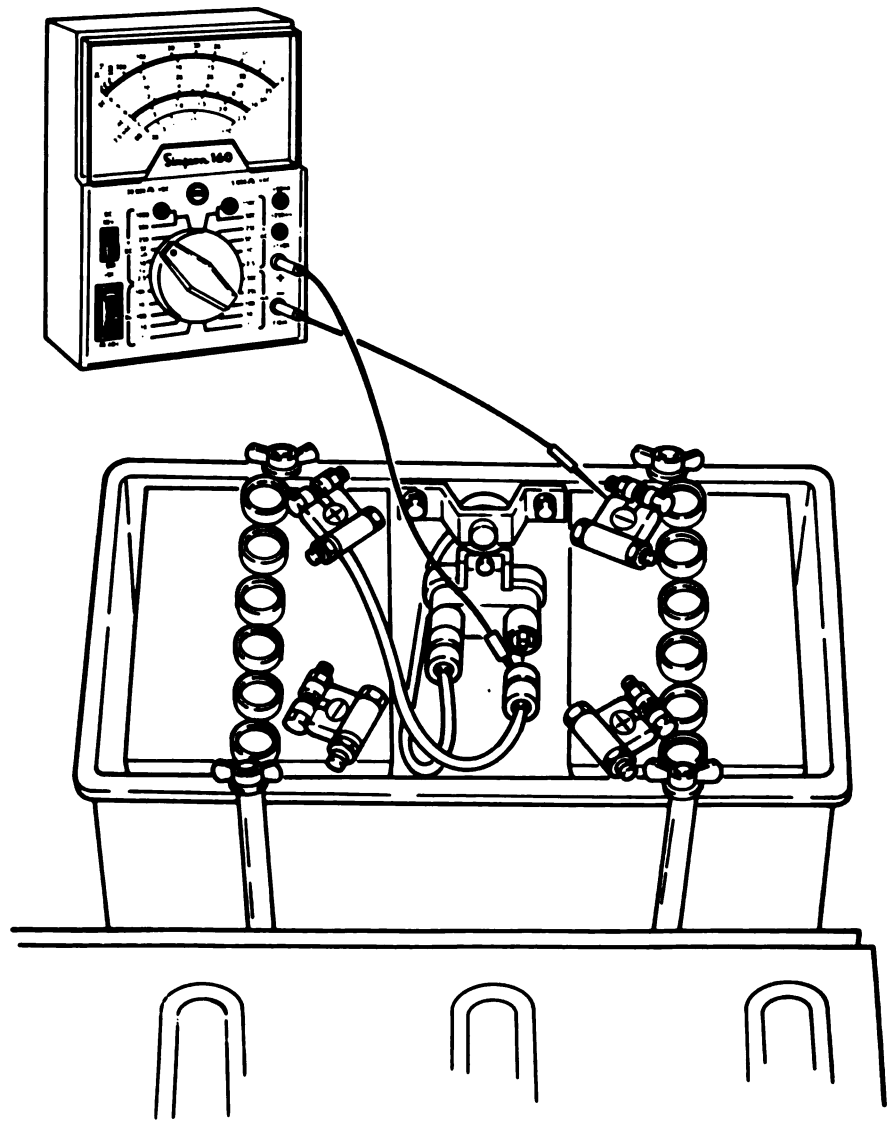
Step 1. Unplug electrical lead connector from circuit breaker.

Step 2. Set multimeter to 50-volt range.

Step 3. Connect meter positive lead to electrical lead terminal. Connect meter negative lead to vehicle ground and observe meter.

a. If battery voltage is indicated, replace thermal switch circuit breaker (para 11-15).

b. If battery voltage is not indicated, replace battery to circuit breaker electrical lead (para 11-15).



END OF TESTING!

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Table 3-5. Electrical Troubleshooting (Cont'd)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

50. SLAVE RECEPTACLE INOPERATIVE

Step 1. Check for improper polarity.

See instructions for use of cold starting kit (FM 9-207).

Step 2. Check for improper grounding.

a. Tighten loose ground cable connection.

b. Scrape paint from cowl panel for better ground connection.

Step 3. Check for improper connection at battery.

a. Tighten cable connection at battery.

b. If still inoperative, replace slave receptacle (para 11-14).

END OF TESTING!

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Section VI. STE/ICE TROUBLESHOOTING (SIMPLIFIED TEST EQUIPMENT FOR INTERNAL COMBUSTION ENGINES)

3-19. General

a. This section is applicable only if STE/ICE is available. The section contains information and tests which may be used with STE/ICE to locate malfunctions that may develop in the vehicle. The tests can be used during troubleshooting, PMCS, or after replacing parts to isolate malfunctions, anticipate failures, and to make sure that proper repairs have been made.

b. STE/ICE is used primarily with the vehicle electrical system. These tests cannot cover all possible troubles which may occur. If a particular malfunction is not covered, refer to table 3-4, electrical troubleshooting symptom index, and locate the troubleshooting procedure for the malfunction observed. To obtain the maximum number of observed symptoms of the malfunction, question the operator.

3-20. STE/ICE Tests, Set-Up Procedures, and Chain Test Index

a. STE/ICE Tests: The STE/ICE testing capabilities that may be applied to the M151A2 series PMCS, are listed in table 3-9 and are included in table 3-11. Test capabilities that may be applied to troubleshooting are specified in table 3-10.

b. STE/ICE Set-Up Procedure: STE/ICE set up and internal checks (tests no. G01, table 3-9) must be performed prior to performing tests.

c. The STE/ICE GO-chain index (table 3-9) contains a list of GO test numbers and titles. Refer to this table for locating a specific GO-chain test.

d. The STE/ICE NO-GO chain index (table 3-10) contains a list of NO-GO test numbers and titles. Refer to this table for locating a specific NO-GO chain test.

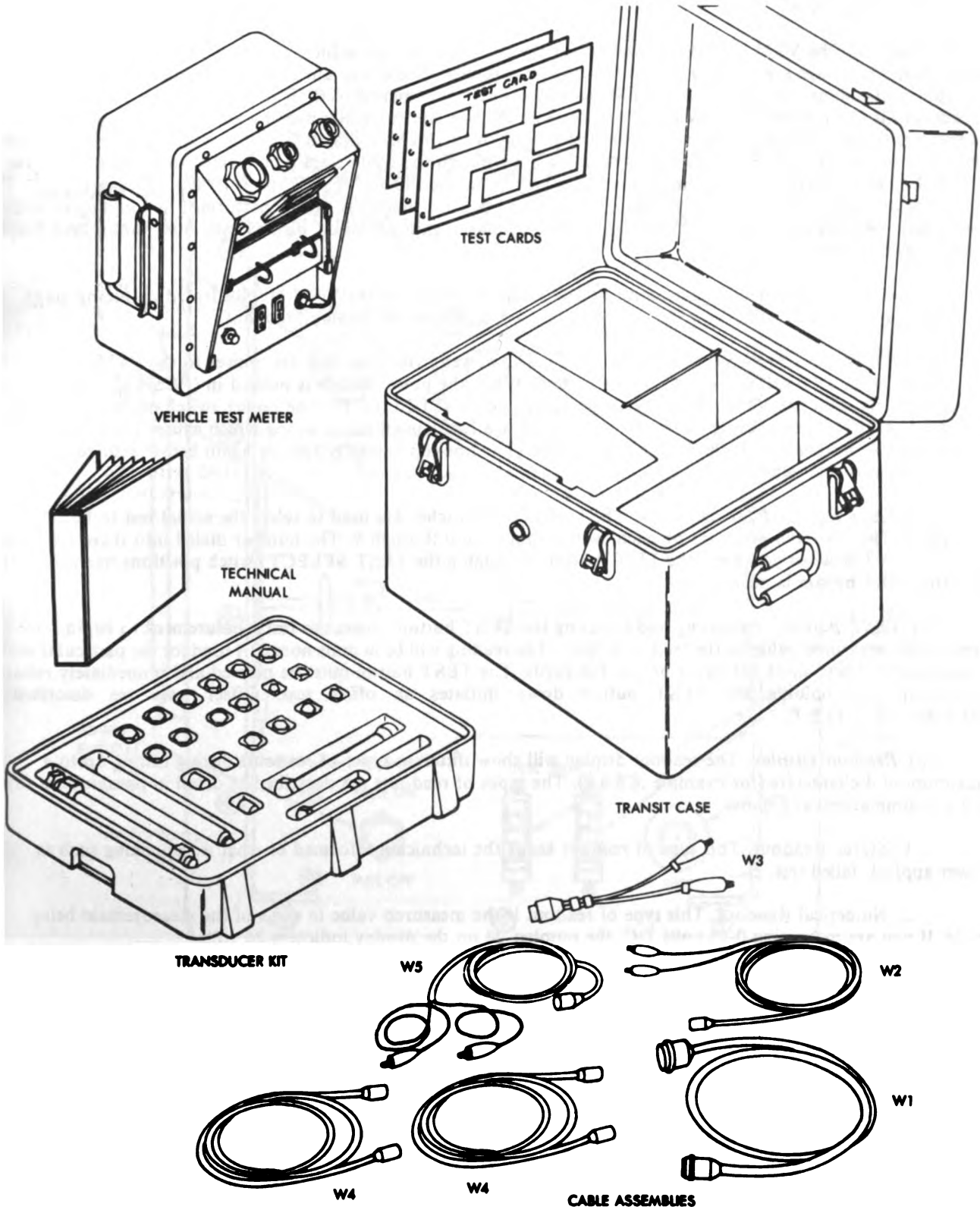
3-21. STE/ICE Description and Operation

a. General. The following describes the operation of the simplified test equipment for internal combustion engines (STE/ICE) system and contains detailed operating procedures. It is used to test the serviceability of 1/4 ton vehicles and to perform primary fault detection and isolation. After the technician has identified a faulty part or subsystem, he is referred to a paragraph number for replacement or repair procedures for individual parts.

b. Description and Operation. STE/ICE is a testing system that performs tests and measurements on internal combustion engines. STE/ICE measures standard voltage, current, resistance, pressure, temperature, and speed values. Special tests, such as compression balance tests and starter system evaluations, are performed by STE/ICE. Standard equipment including vacuum pressure gage, compression gage, low-current tester, and multimeter are features of the STE/ICE set. STE/ICE is portable and operates on either 12 or 24-volt vehicle batteries or equivalent power source. The STE/ICE system consists of a vehicle test meter (VTM), a transducer kit (TK), four electrical cables, a transit case, and technical publications.

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3-21. STE/ICE Description and Operation (Cont'd)



Simplified Test Equipment/Internal Combustion Engine (STE/ICE) System. TA 155752

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3-21. STE/ICE Description and Operation (Cont'd)

c. Vehicle Test Meter

(1) General. The VTM provides a method for the technician to test vehicle electrical and mechanical components. Readings are either pass/fail indications or digital displays in units familiar to the technician (psi, rpm, volts, ohms, amps, etc.). The VTM interfaces with the vehicle directly with a transducer(s) from the transducer kit (TK). Additional tests can also be done that involve manually probing and/or connecting transducers to appropriate test points. Operating power for the VTM is drawn from the vehicle batteries or some equivalent battery source. Power is routed to the VTM through the cable clamps connected to the battery. The STE/ICE general purpose testing capabilities that may be applied to the vehicle are: 0-1000 psi pressure, 0-45 volts DC, and 0-40k ohms resistance. The following control functions can be performed in conjuction with the special tests: interleave (displays rpm with next test), display maximum value, display minimum value, and display peak-to-peak value.

(2) Controls and Indicators. The controls and readout display on the VTM are illustrated on facing page. The following paragraphs describe how the controls are used, and how the display functions.

(a) Power Switch (PUSH ON/PULL OFF). The power switch controls DC power to the VTM. The VTM can operate from a 12-volt or 24-volt battery system. When the power switch is pushed in (PUSH ON), the VTM power is on. To shut the VTM off, pull out the power switch (PULL OFF). The power switch contains a 4-amp circuit breaker. The power switch will pop out automatically if something is wrong which causes the VTM to use more power than it should. If the switch pops, check your hookup carefully and try again before returning the VTM to support maintenance.

(b) TEST SELECT Switches. The TEST SELECT switches are used to select the actual test to be performed. There are ten positions on each switch numbered 0 through 9. The number dialed into these switches is read by the VTM when you press the TEST button. Changing the TEST SELECT switch positions has no effect until the TEST button is pushed.

(c) TEST Button. Depressing and releasing the TEST button causes the test measurement to begin. Observe the measured value on the readout display. The reading will be in units normally used for the particular vehicle measurement. These units are listed on the flip cards. The TEST button must be pressed and immediately released. Depressing and holding the TEST button down initiates an offset test. Offset tests are described in TM 9-4910-571-12 & P.

(d) Readout Display. The readout display will show different types of readouts during testing up to a maximum of 4-characters (for example .8.8.8.8). The types of readouts are described in detail in paragraph c. (3) and are summarized as follows:

1. Status Readout. This type of readout keeps the technician informed of what is happening such as power applied, failed test, etc.

2. Numerical Readout. This type of readout is the measured value in units of the measurement being made. If you are measuring 0-45 volts DC, the number 24 on the display indicates 24 volts.

3. Error Readout. This type of readout indicates that the wrong test number was selected, the transducer is not connected, or the VTM is faulty.

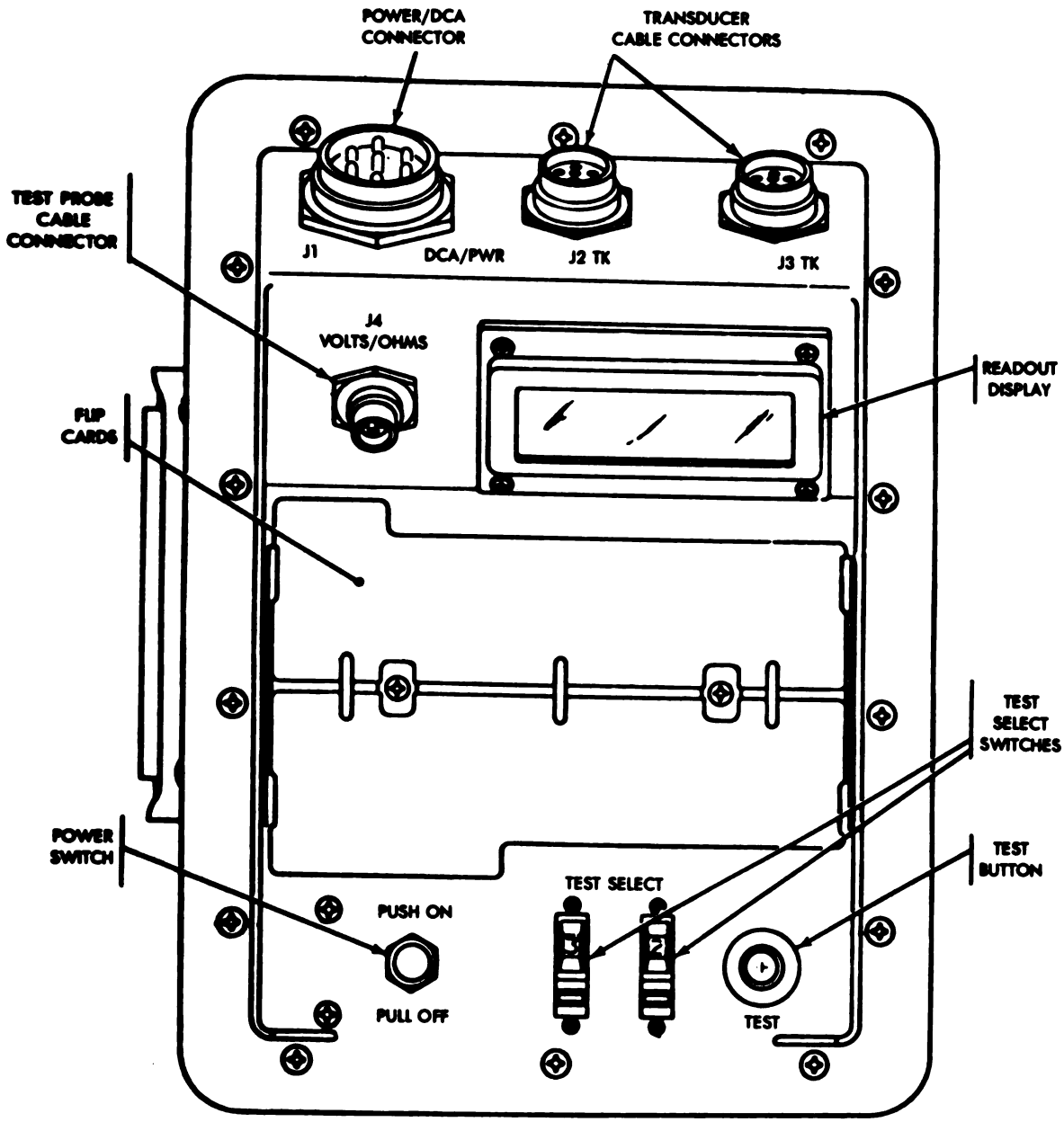
(e) Flip Cards. The flip cards list the 2-digit test number system for selecting the various tests. The cards also summarize the test and operating instructions contained herein.

(f) Power /DCA connector J1. Connector J1 connects the VTM to the vehicle batteries using the power cable W5.

(g) Transducer Cable Connectors, J2, J3. Connector J2 or J3 connects the VTM to any transducer in the transducer kit. Operating power is supplied to the transducer and signals from the transducers are supplied to the VTM through the cable. Connectors J2 and J3 are identical and can be interchanged with each other or used in combination.

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3-21. STE/ICE Description and Operation (Cont'd)



VTM controls and readout display.

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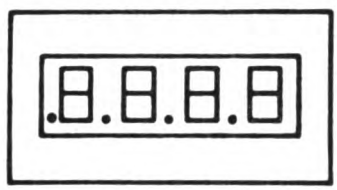
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3-21. STE/ICE Description and Operation (Cont'd)

(h) Test Probe Cable Connector J4. Connector J4 connects test leads to the VTM when doing manual voltage and resistance tests.

(3) Readouts. The following paragraphs describe the different types of readouts that can occur during testing.

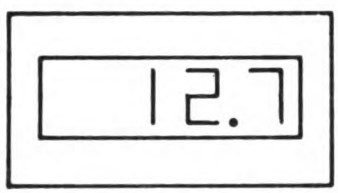
(a) Status Readout. A status readout keeps the technician informed of what is happening. For example, .8.8.8.8 is displayed each time the power switch is pushed on. It means that power is applied, and that all elements of the display are operative. It changes to ---- 1.5 seconds later, indicating that the VTM is ready to be used for testing. The status readout displays are described in table 3-6.



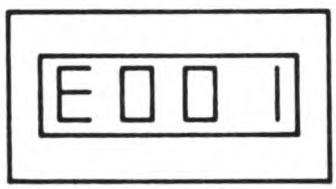
(b) Prompting Message. A prompting message is a technician action message. It is a signal for you to do something such as crank the engine. For example, UEH tells you to enter the vehicle type identification number into the VTM. After the technical action is performed, the test will automatically continue. Prompting messages are listed in table 3-7.



(c) Numerical Readout. A numerical readout is the measured value in units of the measurement being made. For example, if you are measuring 0-45 volts DC, 12.7 is volts DC. If you are measuring 0-25 psi pressure, 12.7 is psi. The units for each test are listed on the flip card. The numbers displayed on the VTM are always positive, unless there is a minus sign shown to make them negative.



(d) Error Readout. E001 is a typical error readout. There are 17 different error readouts. All error readouts start with E. An error readout is a warning that you forgot to connect the transducer, selected a wrong test number, failed to start the engine, etc. All of the error messages mean that you must correct the problem before continuing testing. If the error message does not go away after corrective action, refer to TM 9-4910-571-12 & P.



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3-21. STE/ICE Description and Operation (Cont'd)

(e) Confidence Error Readouts. C004 is a typical error readout resulting from the detection of a faulty VTM during confidence test. There are 44 of these codes. They are used by DS maintenance as an aid in repairing a faulty VTM.

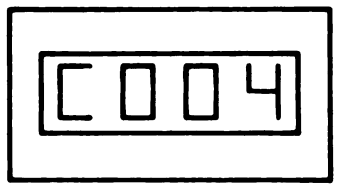


Table 3-6. Status Readouts

VTM Readout	Interpretation
.8.8.8.8	A readout of .8.8.8.8 appears for 1 to 2 seconds each time the power is applied to the VTM. It means that there is power to the VTM, and that all elements of the readout display are operative.
—	A readout of — indicates the following: (1) After power turn-on, it signifies that the VTM is ready for testing. (2) During a compression unbalance test, it signifies testing is in progress. (3) During battery condition test, it signifies battery may be in discharged state.
.9.9.9.9	A readout of .9.9.9.9 indicates that the VTM is reading a test value beyond the range of its measurement capability. Either the wrong test number is selected for the parameter being measured, or there is a fault in the vehicle. During battery condition test, it signifies bad connections, discharged, or bad batteries.
PASS FAIL	A PASS or FAIL readout is the result of a test that checks the condition of a component being measured. A PASS/FAIL readout means just that - the component either passes the test or fails the test.
LO	A LO readout is a result of the engine speed falling below 1600 rpm during SI power test. It is a power test fail message.

Table 3-7. Prompting Messages

VTM Readout	Interpretation
UEH	Signal to technician to enter vehicle type identification number (VID) on the TEST SELECT switches. Vehicle ID numbers are found under TEST DATA on the flip card on the vehicle test cards.
SIP	Signal to operator to apply full throttle in an SI power test.
GO	Signal to technician to crank engine in compression balance or first peak tests. During battery condition test, indicates weak battery in series pair of batteries being tested.
OFF	Signal to technician to stop cranking in compression balance test.
CAL	Signal to the technician to release the TEST button during an offset test.
66	Numbers are used for prompting messages in several tests. In the confidence test 66 signals the operator to dial in 99.

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3-21. STE/ICE Description and Operation (Cont'd)

Table 3-8. Error Readouts

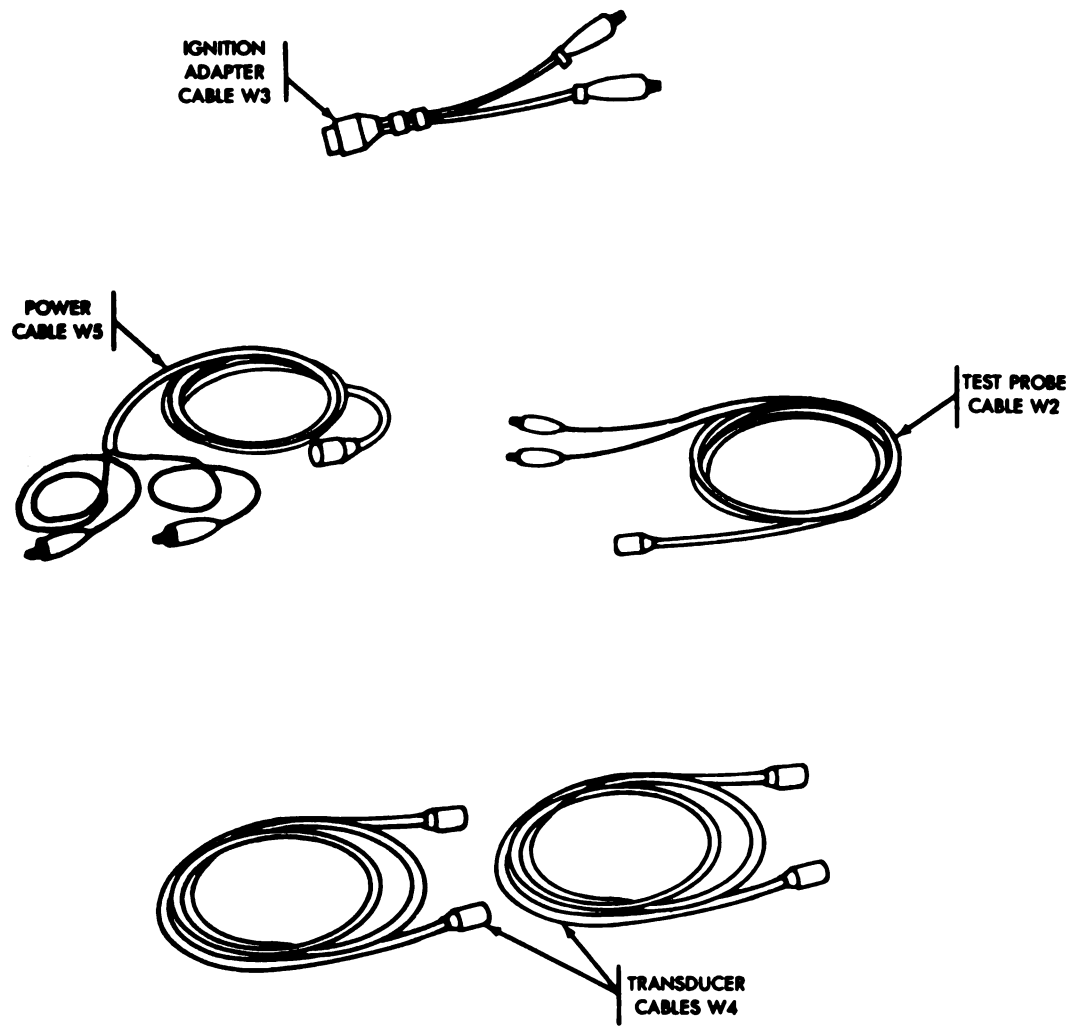
VTM Readout	Interpretation
E000	Occurs if you request the VTM for information it does not have. For example, if you request the vehicle ID and it has not been entered.
E001	Indicates that a non-existent test number has been dialed into the TEST SELECT switches.
E002	Indicates that the required transducer is not connected.
E004	Indicates that a vehicle identification number or number of cylinders information has not been entered.
E005	Indicates that the transducer offset test was not performed.
E007	Indicates a conflict between the vehicle identification number (VID) dialed in and the number of cylinders dialed in. It may occur in response to either VID entry or number-of-cylinders entry.
E008	Indicates the VTM is not receiving the required voltage signal for the test selected. This error code is related only to starter and compression balance tests.
E009	Indicates that the engine was not running at the start of the spark ignition (SI) full power simulation.
E010	Indicates that a wrong vehicle identification number was dialed into the VTM.
E011	Indicates that the throttle control was operated incorrectly during power test taking too much time to either accelerate or decelerate.
E012	Indicates that the SI ignition adapter is missing.
E013	Indicates bad data was taken for the test in progress. Repeat the test one time.
E017	Indicates the engine is not running at the proper speed for dwell test or that the ignition adapter is not properly connected.
E018	Indicates that an engine RPM or AC frequency test was terminated automatically to protect the VTM. Termination is only after several minutes of no-signal operation. Most likely the VTM was left on the vehicle and the engine stalled.

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3-21. STE/ICE Description and Operation (Cont'd)

d. Cable Assemblies.

(1) General. The cable assemblies are shown below and are referred to by the cable number and by a name which describes how the cable is used. If necessary, the two transducer cables (W4) can be joined with the adapter supplied in the transducer kit to make one long cable.



Cable assemblies.

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3-21. STE/ICE Description and Operation (Cont'd)

(2) Installation. When cables are connected, large key on the cable connector mates with a keyway on the transducer connector or the VTM connector for proper installation. The illustration below shows how the key and keyway should be lined up. If you experience any difficulty during testing and suspect that a cable is bad, refer to TM 9-4910-571-12 & P for checking cable continuity.

e Transducer Kit.

(1) General. The transducer kit contains a pressure and a vacuum transducer and the necessary adapters (bushing, plugs, tees, etc.). Also included in the kit is a current probe for measuring current and a test probe cable for measuring voltage and resistance. All fittings do not have part number markings. The legend will help to identify the items. Before installing any transducer kit item on the vehicle, be sure to clean the mounting surfaces. This is particularly important if you are going to open fuel lines or tap into manifolds. Dirt particles entering the engine can cause damage to both the engine and the transducer kit item. The transducers should be kept clean, free of dirt and grease, and handled with reasonable care.

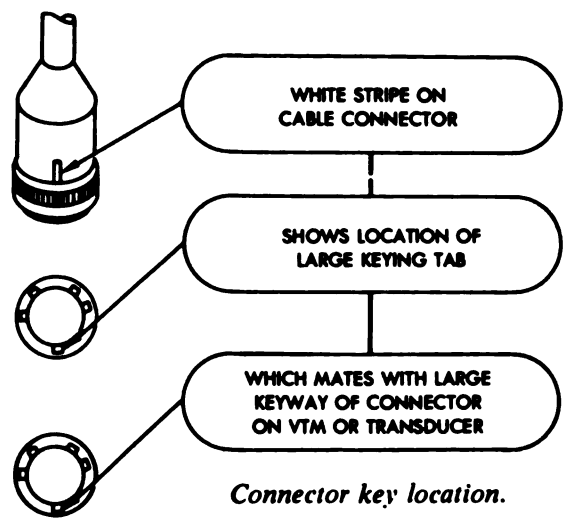
(2) Pressure Transducers. The pressure transducers have a small breather hole on the side of the housing which should be kept unplugged. Do not use high pressure.

(3) Threaded Adapters. Observe threaded fittings carefully to avoid engaging straight threads with pipe threads. Each measurement device (transducer) in the transducer kit has its own identification resistor. The VTM uses this identification resistor to check that the correct transducer is connected for the measurement being made. If the correct transducer is not connected, error code E002 will be displayed.

3-22. Vehicle Testing

a. General. To troubleshoot a vehicle problem, the technician can use the STE/ICE (vehicle test meter and transducer kit).

b. Offset Tests. The STE/ICE VTM performs a test after setting the TEST SELECT switches to the test number and pressing the TEST button. For some tests, an offset test is required before the test itself can be performed. This is done by selecting the number of the desired test and holding the TEST button down until the VTM displays the prompting message CAL.

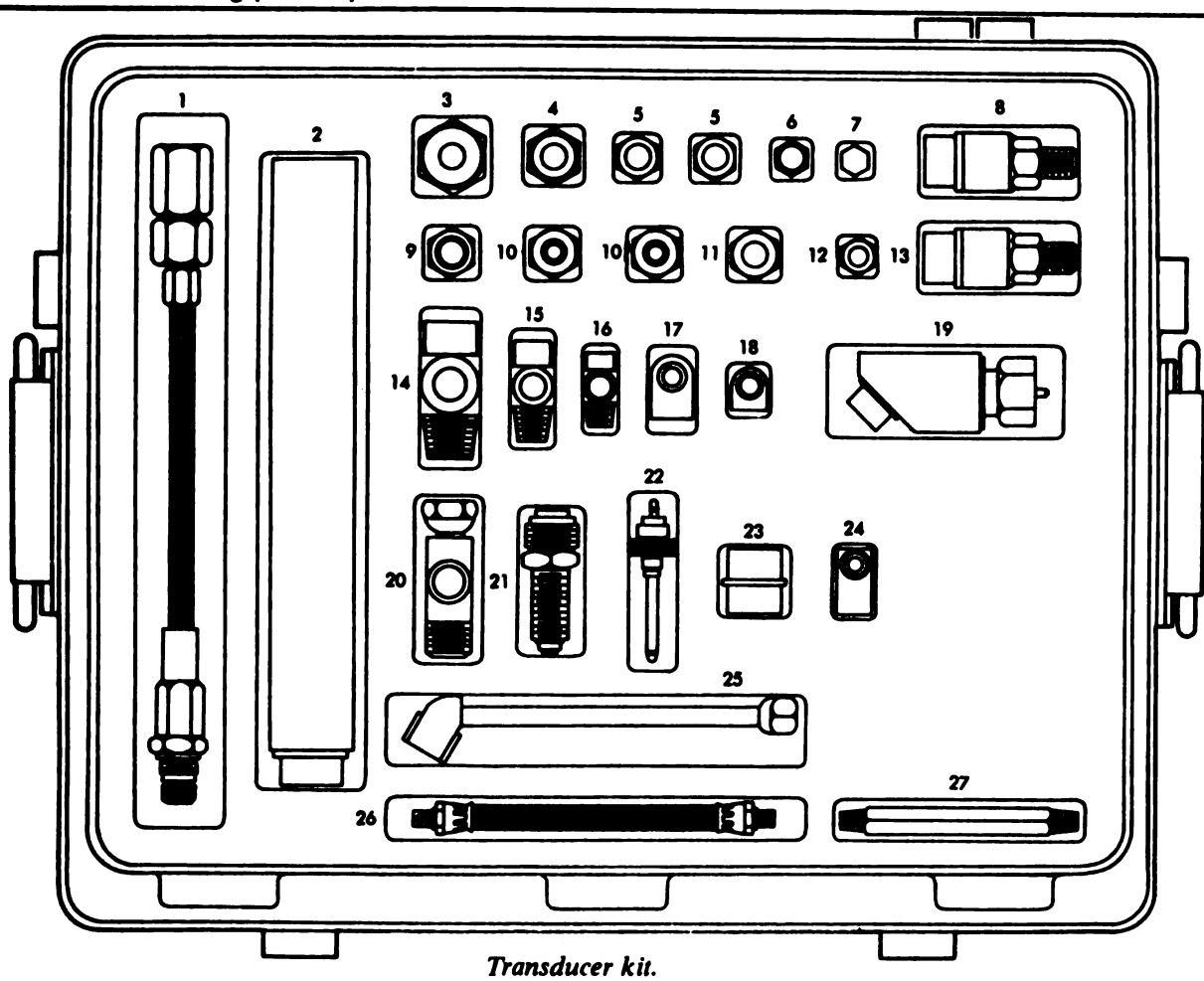


Connector key location.

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3-22. Vehicle Testing (Cont'd)



Transducer kit.

ITEM NO.	TK NO.	PART NUMBER	QTY	ITEM
1	10	11669227	1	Hose & Fitting Ass'y. (Spark Plug Adapter)
2	11	12258878	1	Current Probe
3	12	12258853-1	1	Pipe Thread Reducer, 3/4 MPT to 1/4 FPT
4	13	12258853-3	1	Pipe Thread Reducer, 1/2 MPT to 1/4 FPT
5	14	12258853-2	2	Pipe Thread Reducer, 3/8 MPT to 1/4 FPT
6	15	444620	1	Hex Head Plug, 1/4 MPT
7	16	5327970	1	Hex Head Plug, 1/8 MPT
8	17	12258876	1	Pressure Transducer, 0-1000 PSI
9	21	12258881	1	Snubber
10	20	3204X2	2	Adapter, 1/8 MPT to 1/4 FPT
11	19	3204X2	1	Coupling Reducer, 1/8 FPT to 1/4 FPT
12	18	234X5	1	Male Connector, 5/16 Tube to 1/4 MPT
13	22	12258877	1	Pressure Transducer, -30 in. Hg to 25 PSIG
14	23	444152	1	Street Tee, 1/2 Pipe Thread
15	24	3750X4	1	Street Tee, 1/4 Pipe Thread
16	25	5470X2	1	Street Tee, 1/8 Pipe Thread
17	26	12258879-2	1	Street Elbow, 1/4 Pipe Thread
18	27	12258879-1	1	Street Elbow, 1/8 Pipe Thread
19	34	12258875	1	Pulse Tachometer
20	32	12258880	1	Fuel Line Adapter
21	31	MS53099-2	1	Tachometer Drive Adapter
22	30	7540877	1	Ignition Adapter
23	29	MS3119E14-19	1	Adapter (connector-to-connector)
24	28	12258762	1	Tee, Inverted Flare
25	33	8840543	1	Air Chuck
26	35	11669236	1	Hose Assembly, 1/8 MPT
27	36	12258852	1	Pipe Nipple, 1/8 MPT

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3-22. Vehicle Testing (Cont'd)

The offset test nulls out characteristic differences in the VTM, test leads, and transducers. It zeros the meter. Once the offset is performed, the VTM automatically corrects for the offset before displaying measured values. The displayed offset value should be checked against limits on the vehicle test card. If the displayed value is outside these limits, either the transducer or the test cable is faulty and must be replaced. This is another form of self-test. The offset is performed when each transducer is connected. All tests requiring offset are identified by a star (*) on the flip cards and by OFFSET LIMITS on the vehicle test cards. The offset test is performed with the test probe cable or transducer connected to the VTM. Care should be taken to see that no stimulus is applied to the transducer. Test probe cable leads should be shorted together. To perform an offset test, dial the test number into the TEST SELECT switches. Press and hold the TEST button until the prompting message CAL appears on the display. In a few seconds after release of the TEST button, a number will appear. This is the measured offset value associated with the test probe cable or transducer and cable.

c. Control Tests. These tests are used to change (or control) the way a vehicle test is displayed, or the way it is run. There are five (5) control tests:

01 Interleave (displays RPM with next test)
02 Display minimum value for next test.
03 Display maximum value for next test.
04 Display peak-to-peak value for next test.
05 Initiate full power simulation.

Control tests 01, 02, 03, and 04 specify the action to be taken by the next test only. A subsequent test will reset the control.

(1) Interleave (Test 01). This test alternately measures engine speed and a second parameter such as fuel pressure or alternator voltage. To initiate interleave, dial 01 into the TEST SELECT switches and press and release the TEST button. The prompting message PASS will signal the technician to dial in the second test number and again press and release the TEST button.

(2) Minimum Value (Test 02). This test displays the minimum value measured during a test. To initiate a minimum value display, dial 02 into the TEST SELECT switches and press and release the TEST button. The prompting message PASS will signal the technician to dial in the desired test number and again press and release the TEST button. The minimum value is displayed and updated whenever a lower minimum value is measured. Entering 02 and the test number again will reset the process and a new minimum value will be displayed.

(3) Maximum Value (Test 03). This test displays the maximum value measured during a test. To initiate a maximum value display, dial 03 into the TEST SELECT switches and press and release the TEST button. The prompting message PASS will signal the technician to dial in the desired test number and again press and release the TEST button. The maximum value is displayed and updated whenever a higher maximum value is measured. Entering 03 and the test number again will reset the process and a new maximum value will be displayed.

(4) Peak-to-Peak Value (Test 04). This test displays the peak-to-peak value of dwell (16), 45 volts DC (89), 1500 amps DC (90) and battery volts (67). Electrical peak-to-peak is for measuring dwell variation. To initiate a peak-to-peak measurement, dial 04 into the TEST SELECT switches and press the TEST button. The prompting message PASS will signal the operator to dial in one of the four test numbers (16, 89, 90, 67) and again press the TEST button.

(5) Full Power Simulation (Test 05). This test lets you test SI engines under full power operating conditions. Test 05 differs from the previous four control tests in several ways. First it must be preceded by a VID entry (Test 60). After VID has been entered, and the engine is warm and idling, 05 is dialed into the TEST SELECT switches, and the TEST button is pressed. The prompting message SIP will signal the operator to press the accelerator to the floor. The VTM will monitor engine speed during acceleration and at approximately 3500 RPM, the VTM will begin full power simulation. Simulation will continue until the operator releases the accelerator. A PASS message is displayed when the simulation starts. A measurement can now be made during power simulation by dialing the desired test number and pressing the TEST button. New test and control functions can be selected until the accelerator is released. The 05 control feature provides a more accurate indication of engine performance than does testing under unloaded conditions.

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Table 3-9. SI Engine Go-Chain Index, TK Mode

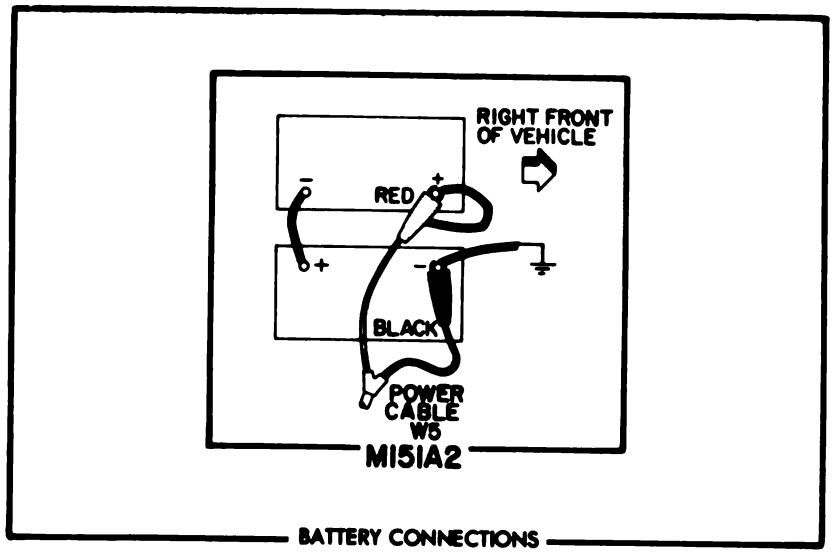
GO TEST NUMBER	TEST TITLE	PAGE NUMBER
G01	VTM Connections and Checkout	3-170
G02	Hook up for W3 cable	3-176
G03	Starter Current First Peak Test	3-177
G04	Engine Start — Lubrication Check	3-179
G05	Charging Circuit and Battery Voltage Test	3-181
G06	Engine Warmup/Coolant Check/Oil Pressure Test	3-183
G07	Idle Speed Check/Power Test	3-185
G08	Compression Unbalance Test	3-187

Table 3-10.SI Engine NO-GO Chain Index, TK Mode

NO-GO TEST NUMBER	TEST TITLE	PAGE NUMBER
NG05	Low Oil Pressure Check	3-189
NG10	Engine Crank — No Start	3-191
NG20	No Crank — No Start	3-202
NG30	High Coolant Temperature	3-203
NG31	Gage Test	3-204
NG40	Engine Will Not Idle	3-206
NG50	Power Test Fault Isolation	3-214
NG60	Charging Circuit Tests	3-222
NG70	Engine Crank — No Speed Indication Fault Isolation	3-228
NG80	Starter Circuit Tests	3-232
NG81	Battery Tests	3-238
NG90	Ignition System Tests	3-242
NG120	Battery Compartment — Positive Side Voltage Drop Checks	3-244
NG121	Battery Compartment — Negative Side Voltage Drop Checks	3-245
NG140	Intake Manifold Leak Test	3-246
NG150	Engine Tightness Test	3-247

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Table 3-11. STE/ICE Go-Chain Tests



G01 VTM CONNECTIONS AND CHECKOUT — TK MODE

WARNING

Do not connect or disconnect the VTM while the vehicle engine is running. Spark may ignite battery gases and cause injury and/or damage to equipment.

CAUTION

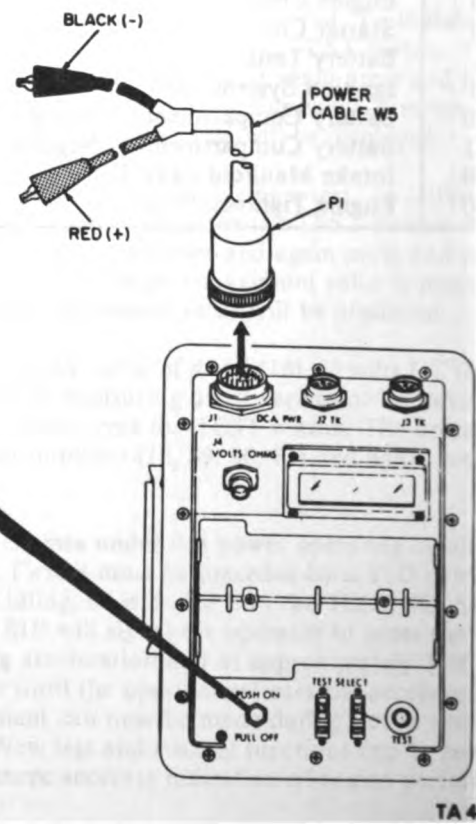
Connect P1 of power cable W5 to J1 on the VTM before connecting the clip leads to the battery.

1 ● **CONNECT BATTERY POWER TO VTM:**

- PULL OFF the power switch on the VTM.
- Connect P1 of the power cable W5 to J1 on the VTM.
- Connect the red clip lead of cable W5 to the positive terminal of the vehicle battery.
- Connect the black clip lead of cable W5 to the negative terminal of the vehicle battery.

● Proceed to step 2.

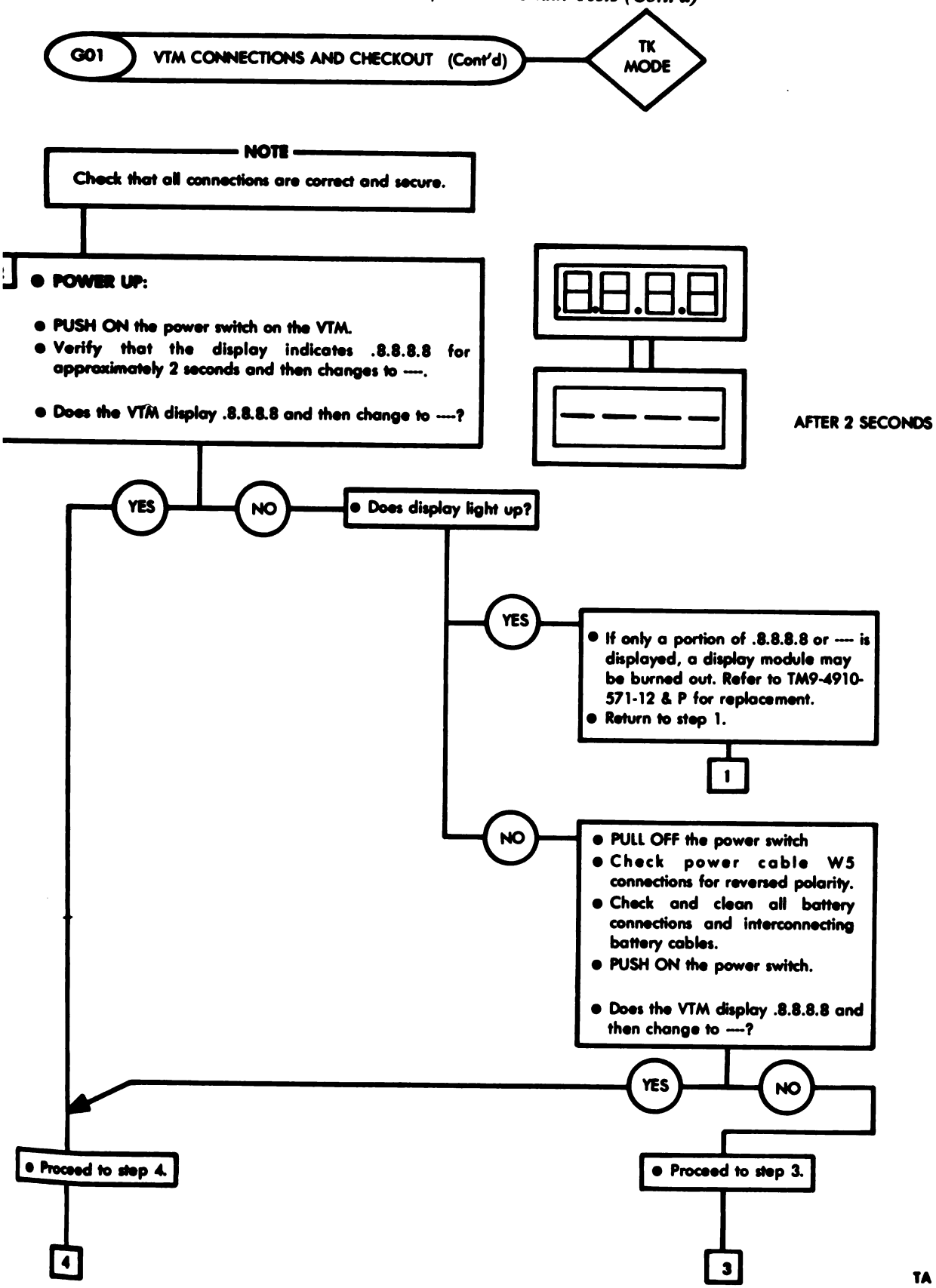
2



TA 043739

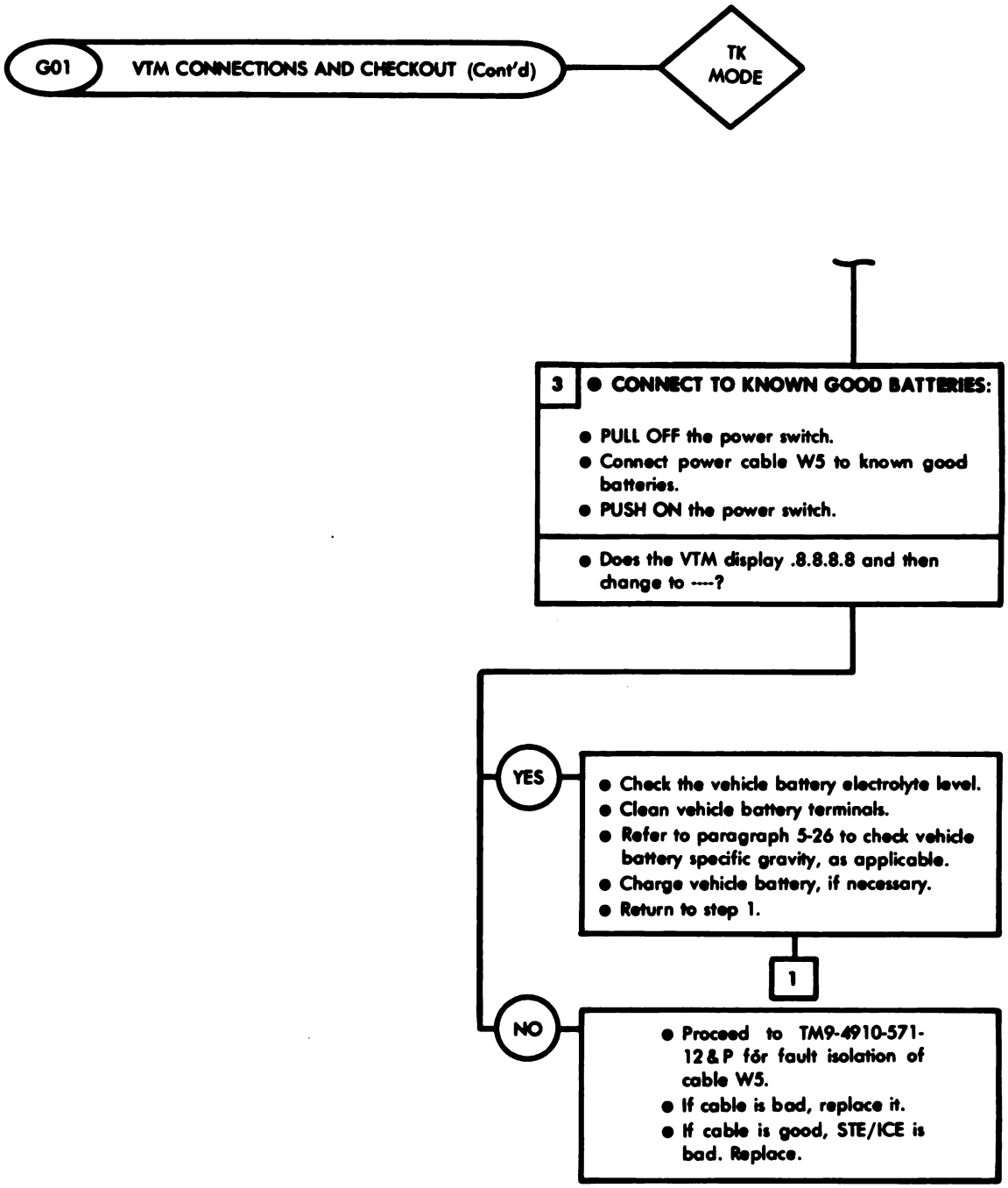
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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



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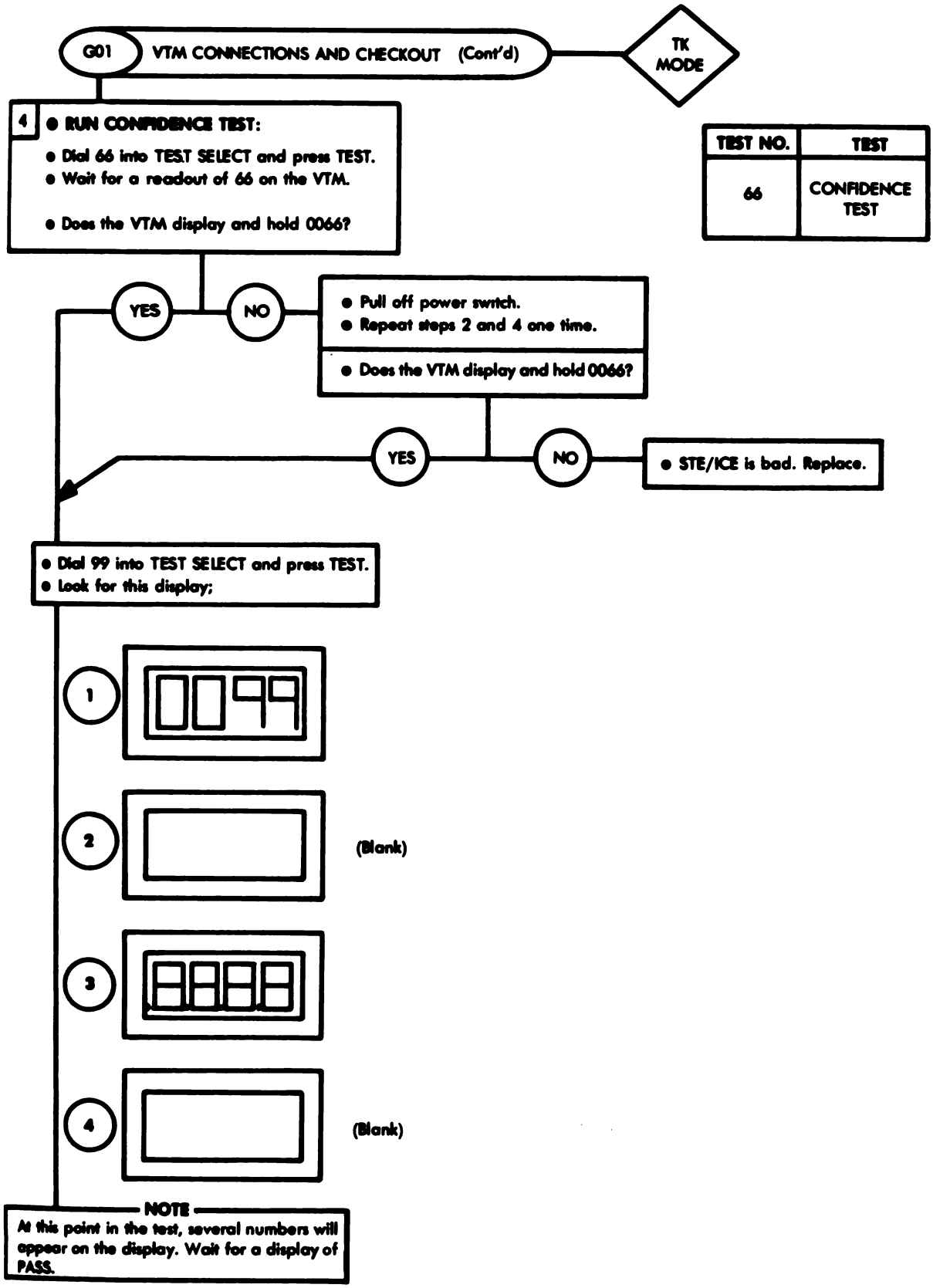
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155868

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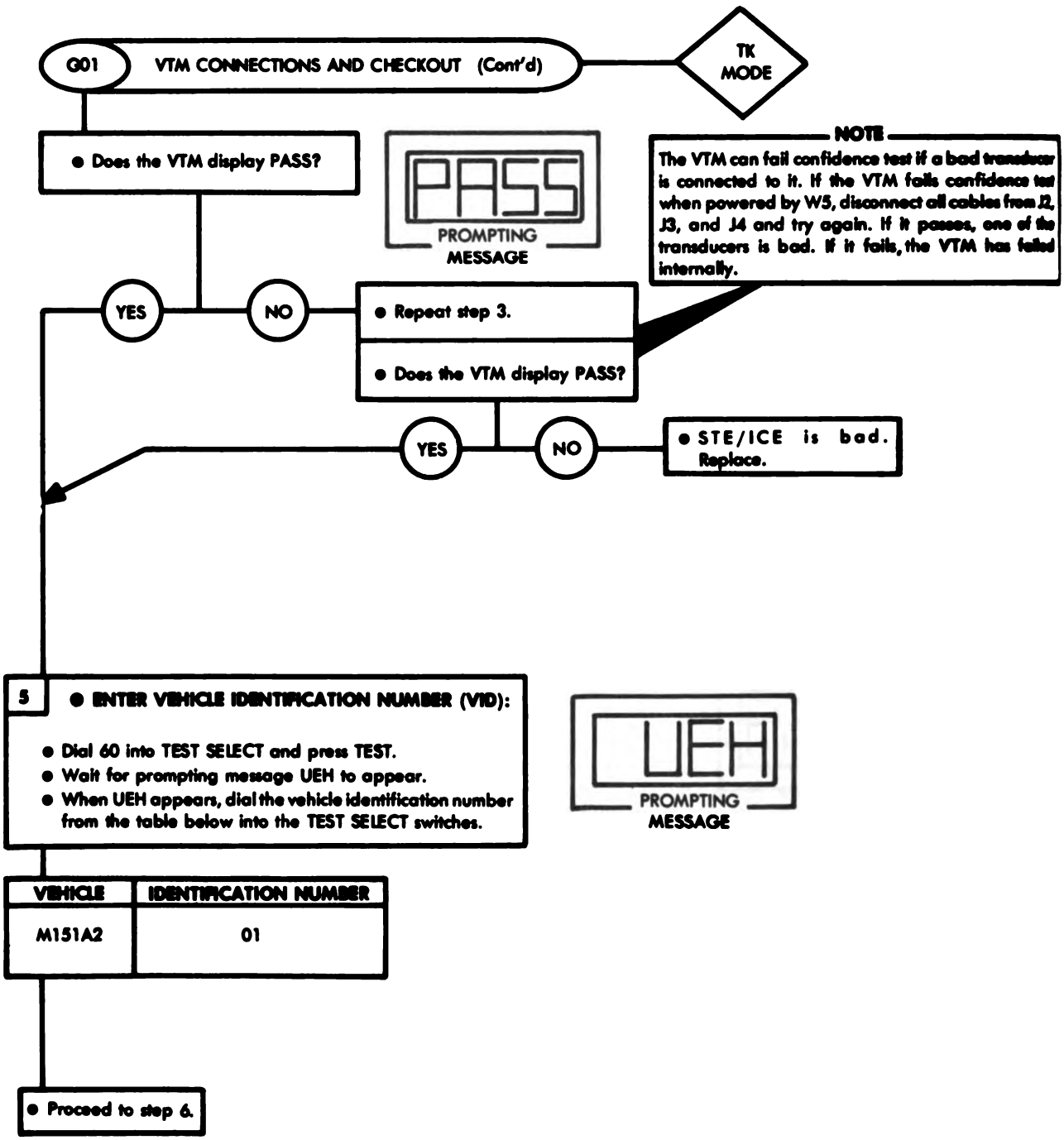
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155869

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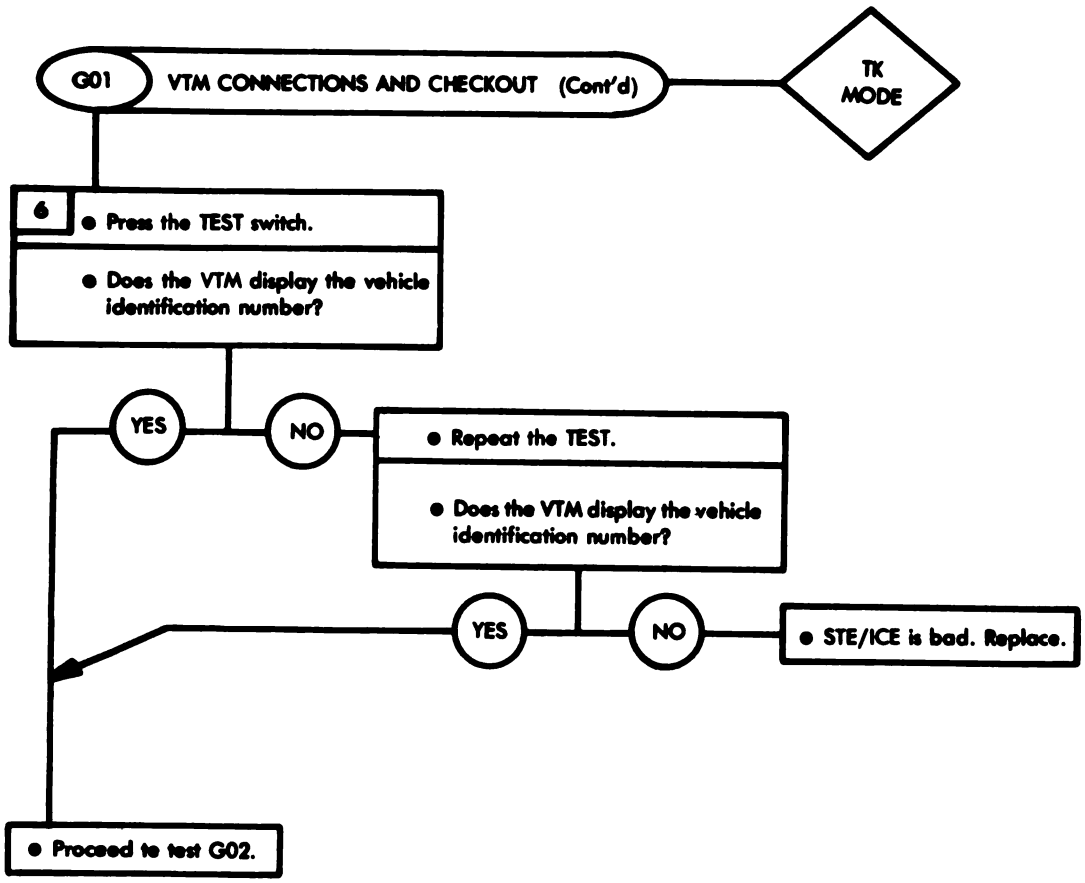
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 158670

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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155871

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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)

G02

HOOK UP FOR W3 CABLE

TK MODE

WARNING

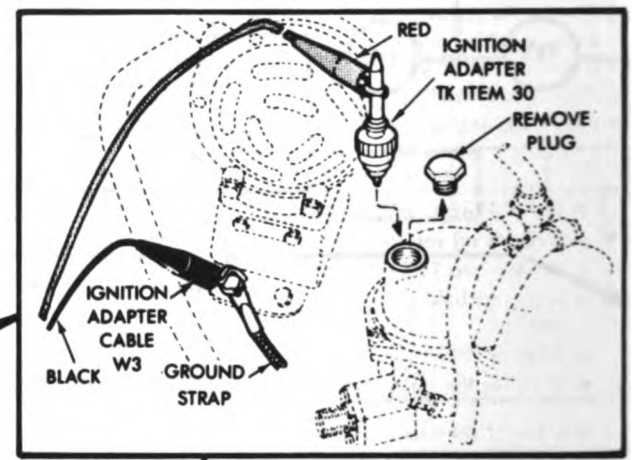
Turn vehicle engine off before installing cables and/or ignition adapter.

1 ● **CONNECT CABLES W3 AND W4 TO VTM:**

- Connect P1 of transducer cable W4 to J2 on VTM.
- Connect P2 of transducer cable W4 to P1 of ignition adapter cable W3.

2 ● **MAKE CONNECTIONS TO VEHICLE:**

- Connect the clip leads of ignition adapter cable W3 as indicated for RPM measurement.



NOTE

Remove plug from top of distributor.

Install the ignition adapter TK 30 in place of removed plug.

Connect the red clip lead of ignition adapter cable W3 to the adapter.

Connect the black clip lead of W3 to a good ground.

CAUTION

Install ignition adapter TK 30 hand tight only.

NOTE

A poor ground can cause erratic VTM readings.

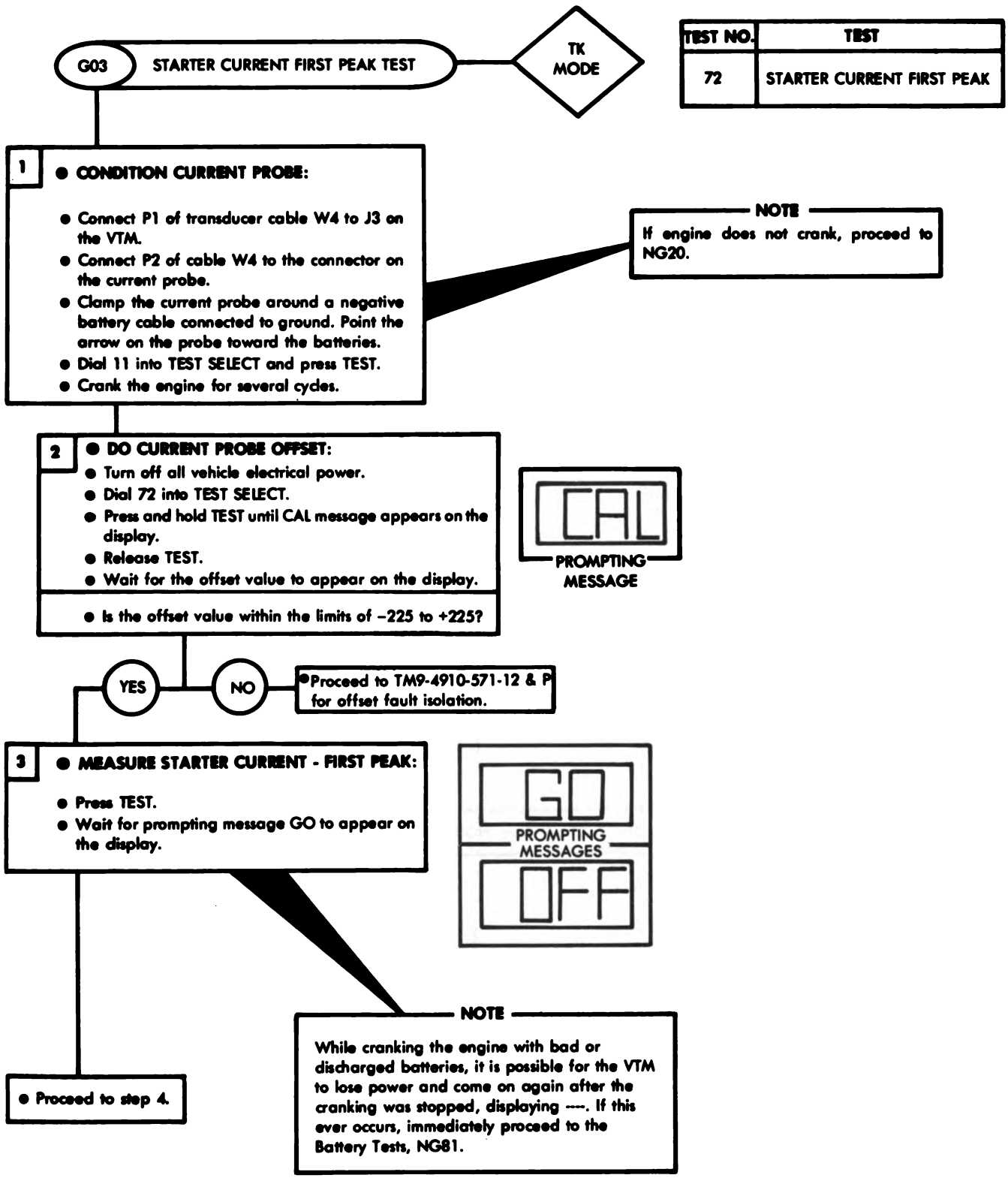
- Proceed to test G03.

G03

TA 158872

Digitized by Google

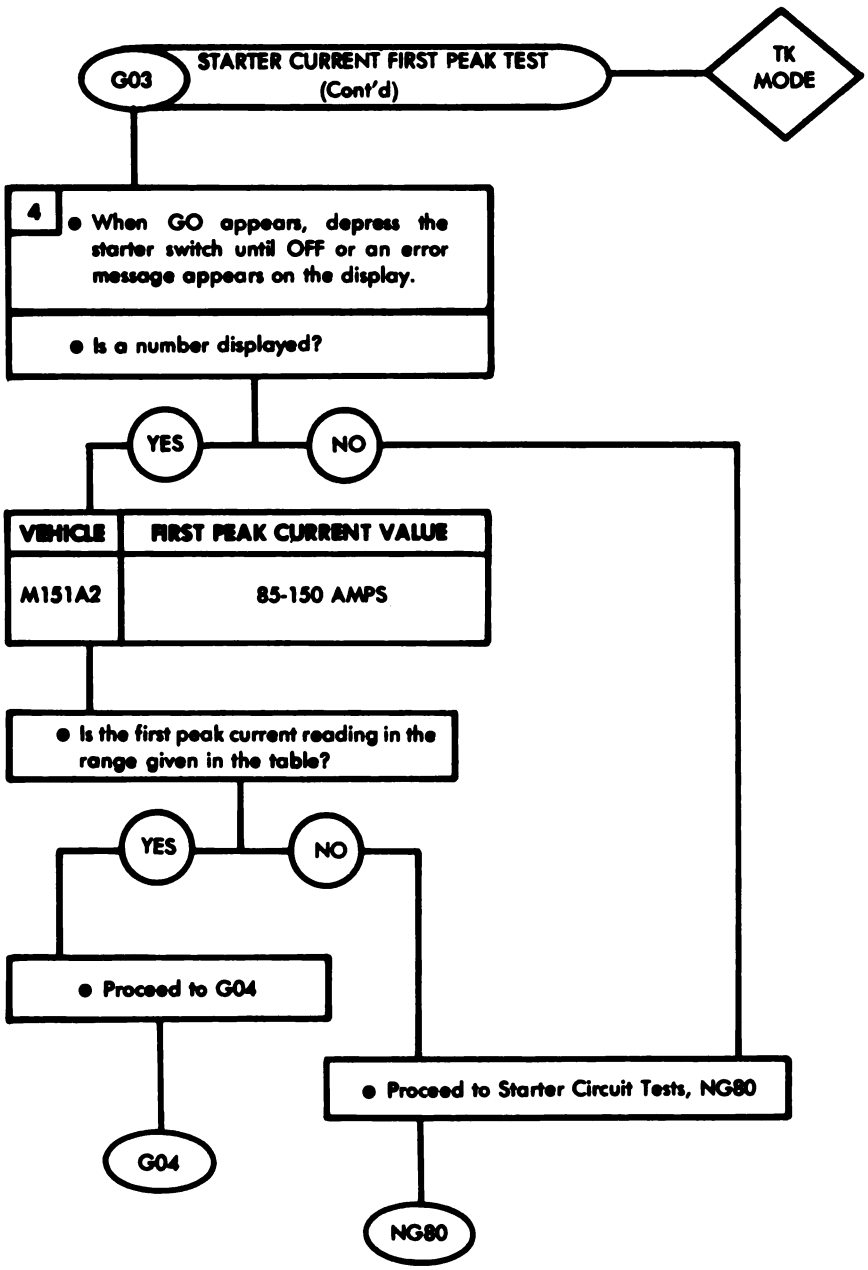
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155873

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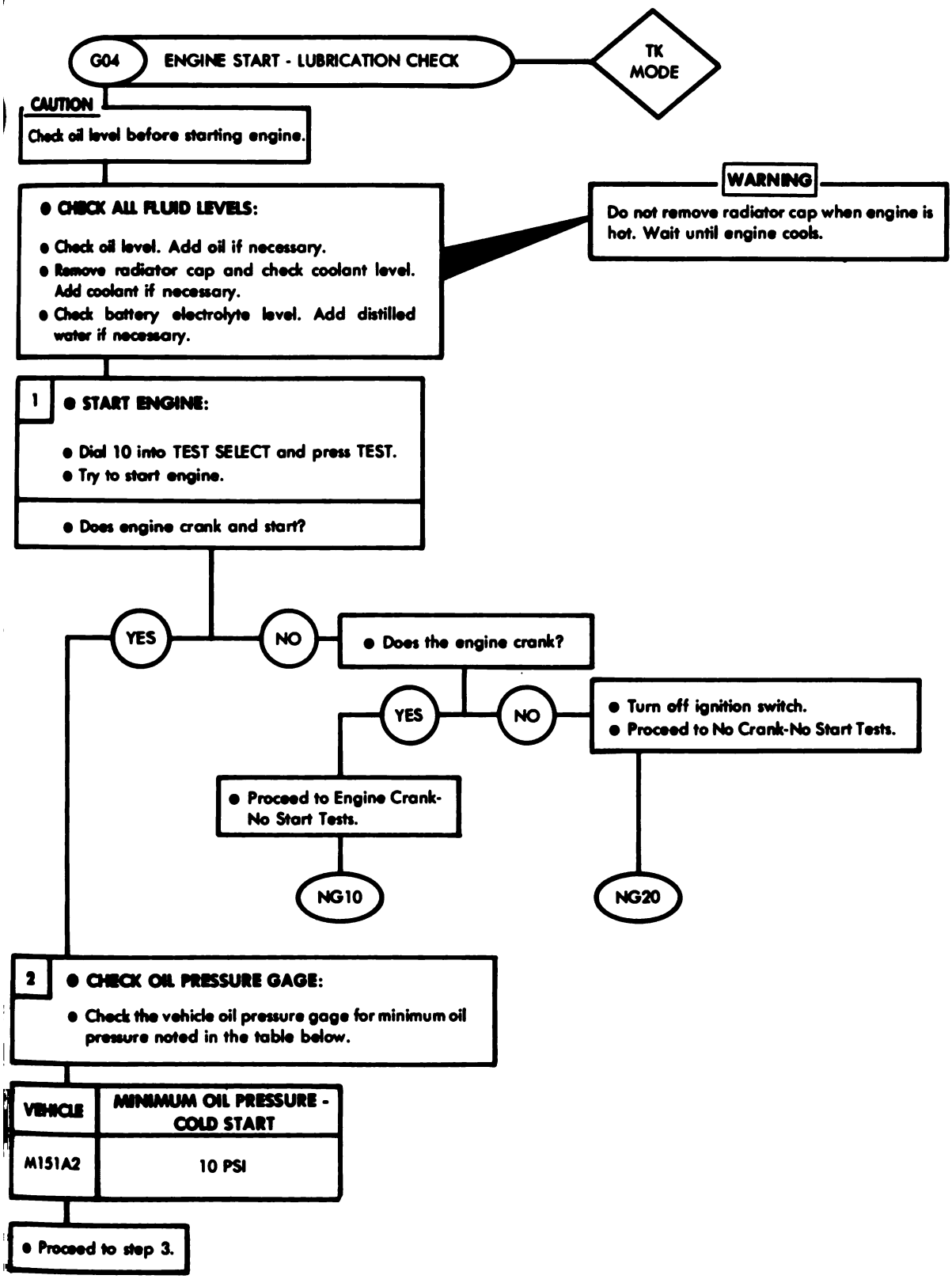
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 138674

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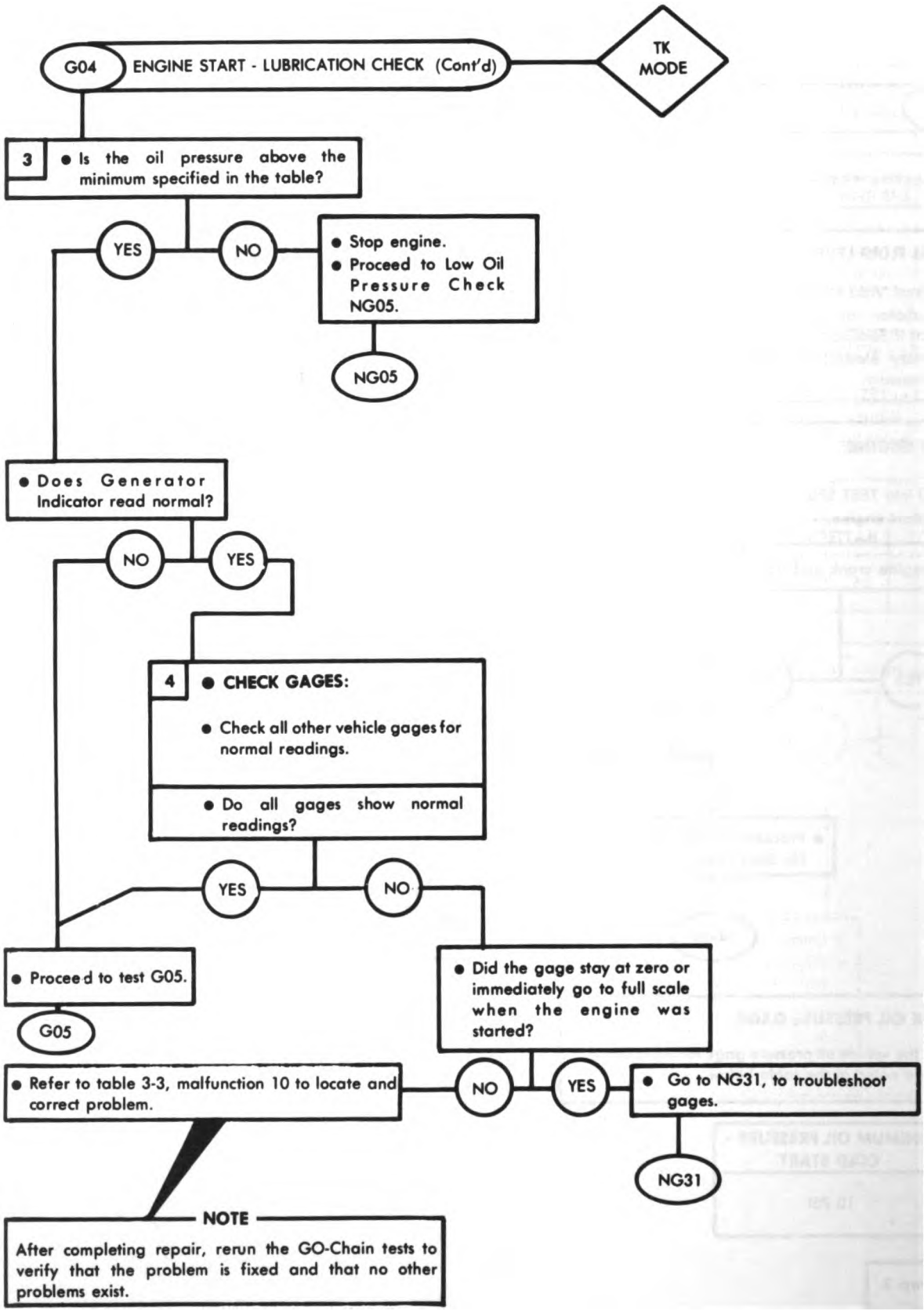
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155875

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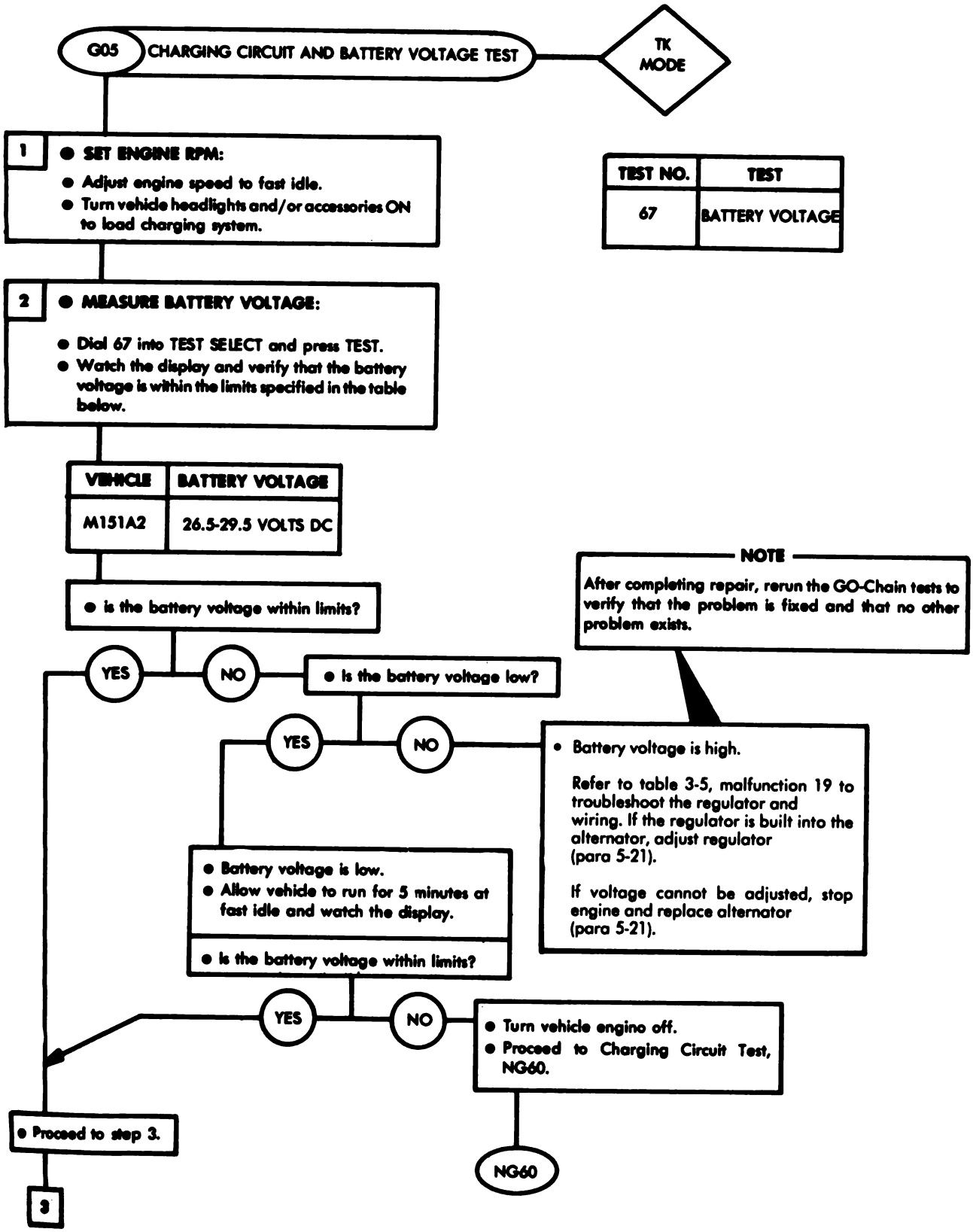
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155876

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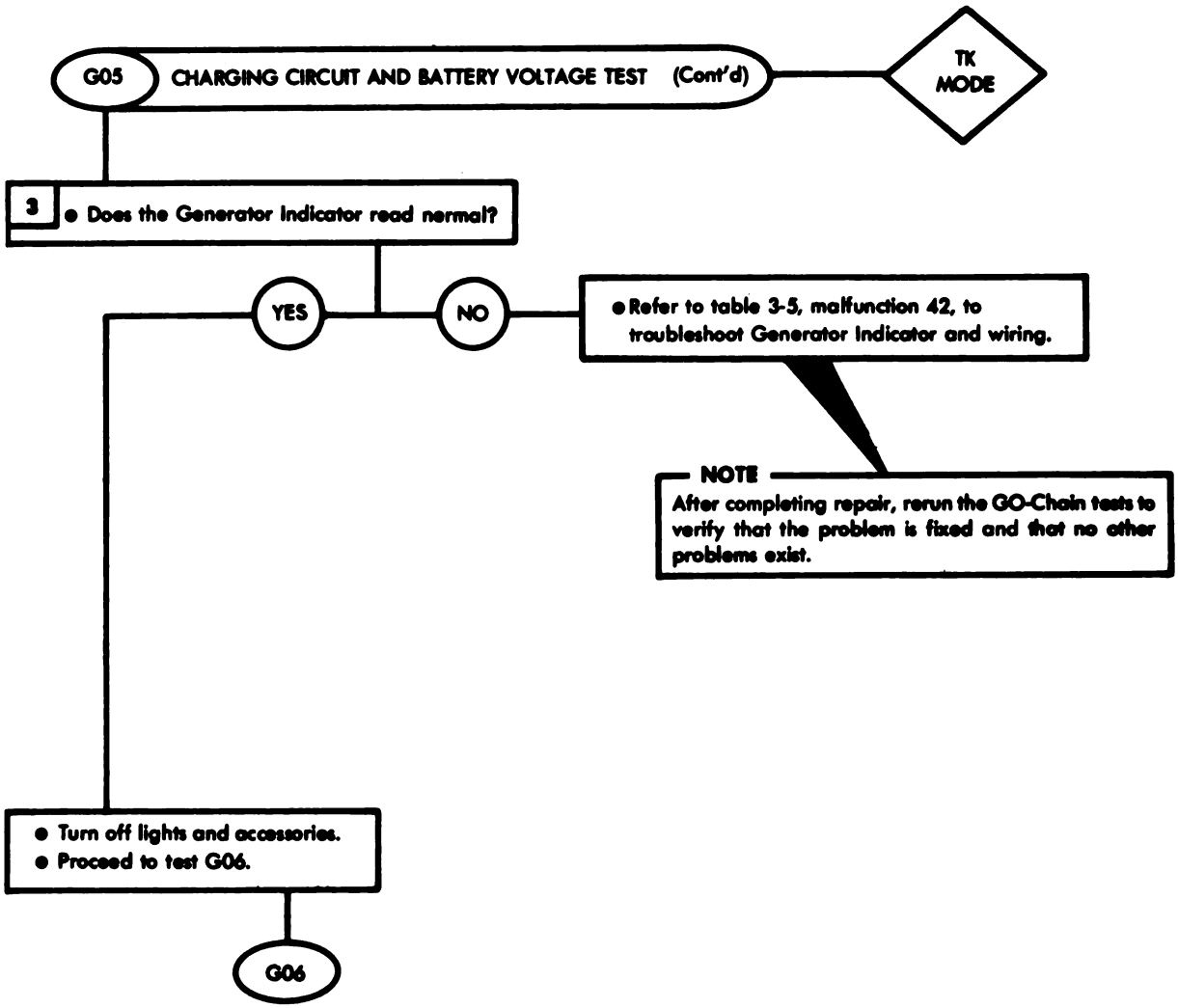
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155877

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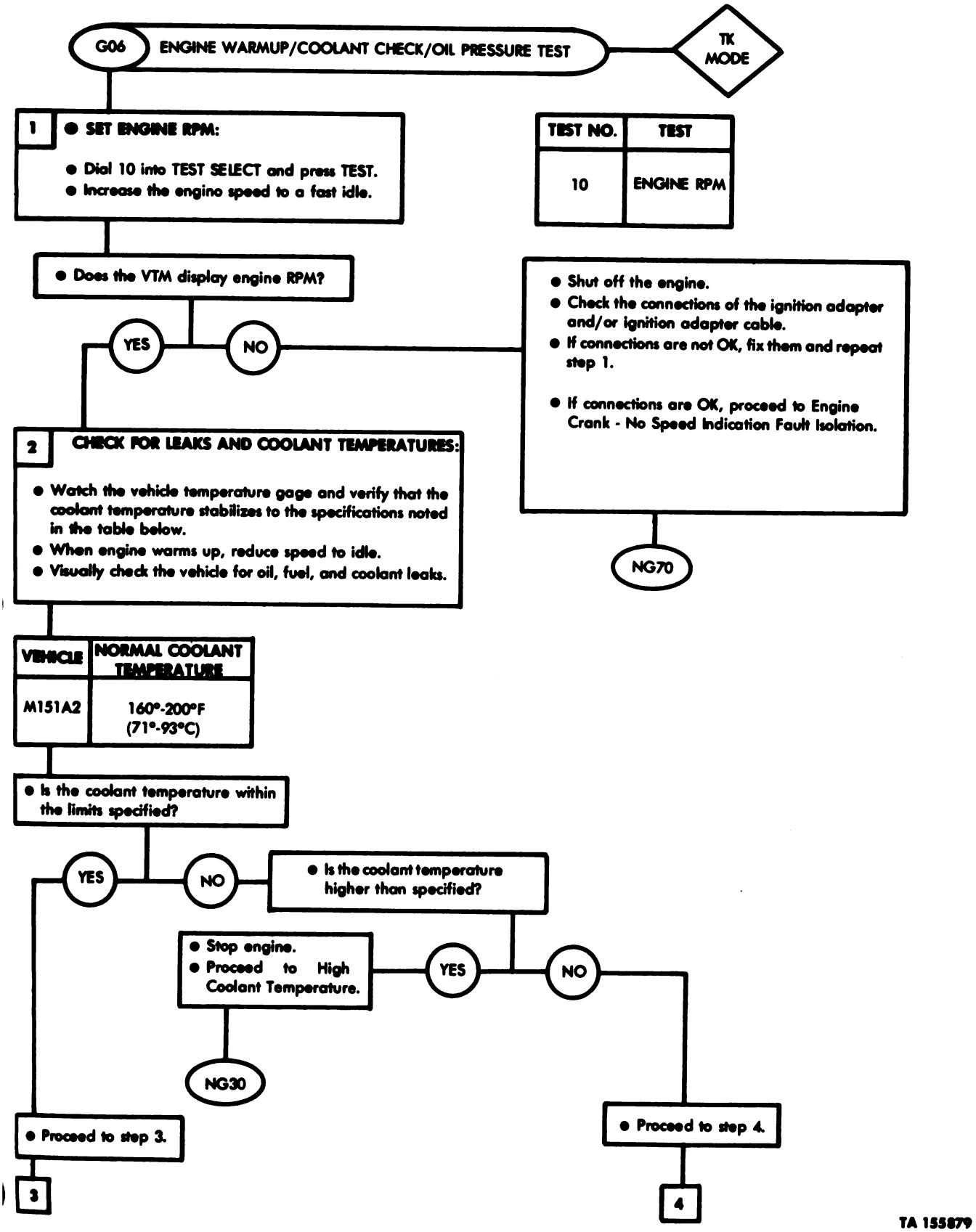
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 188878

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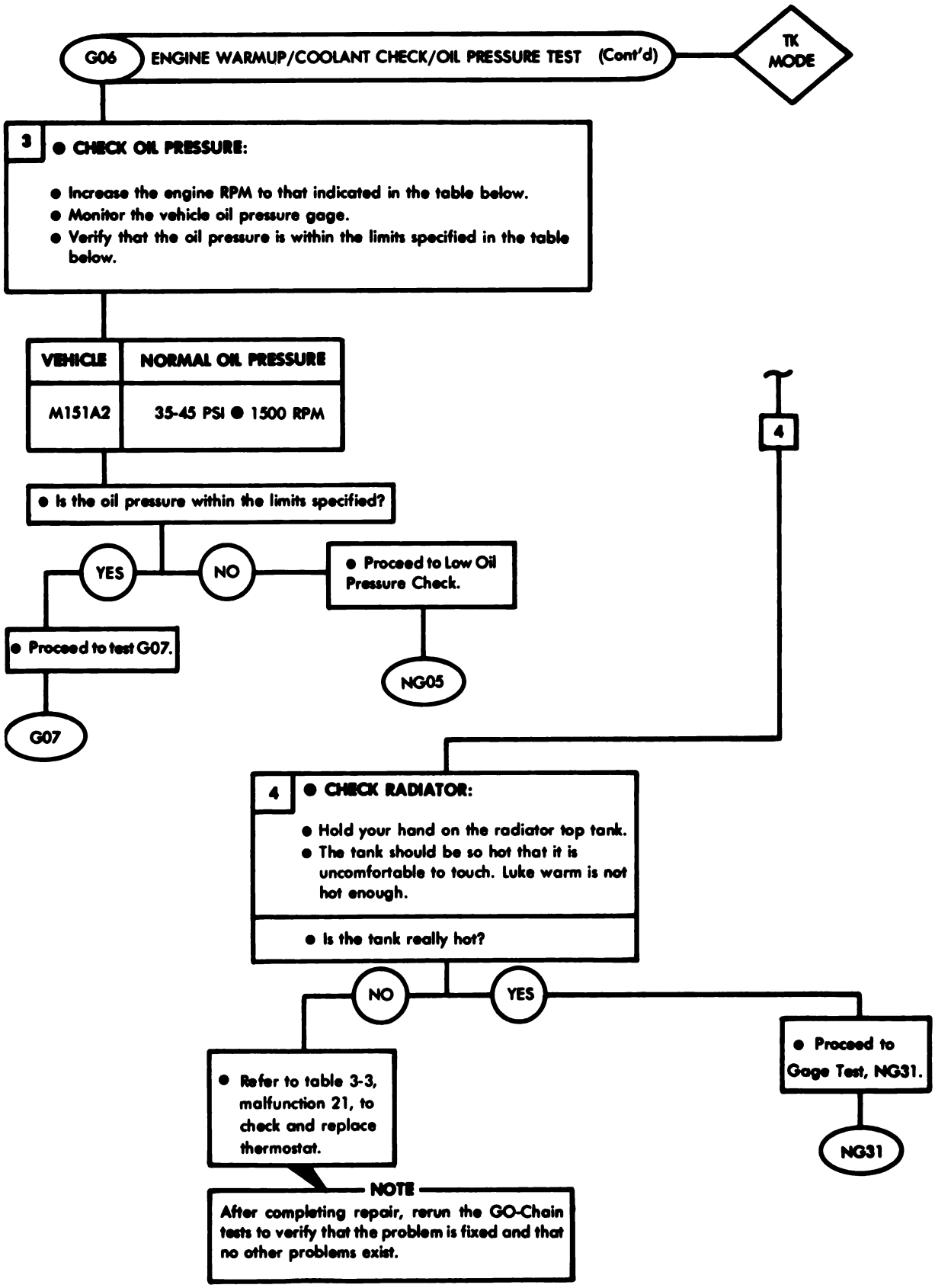
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155879

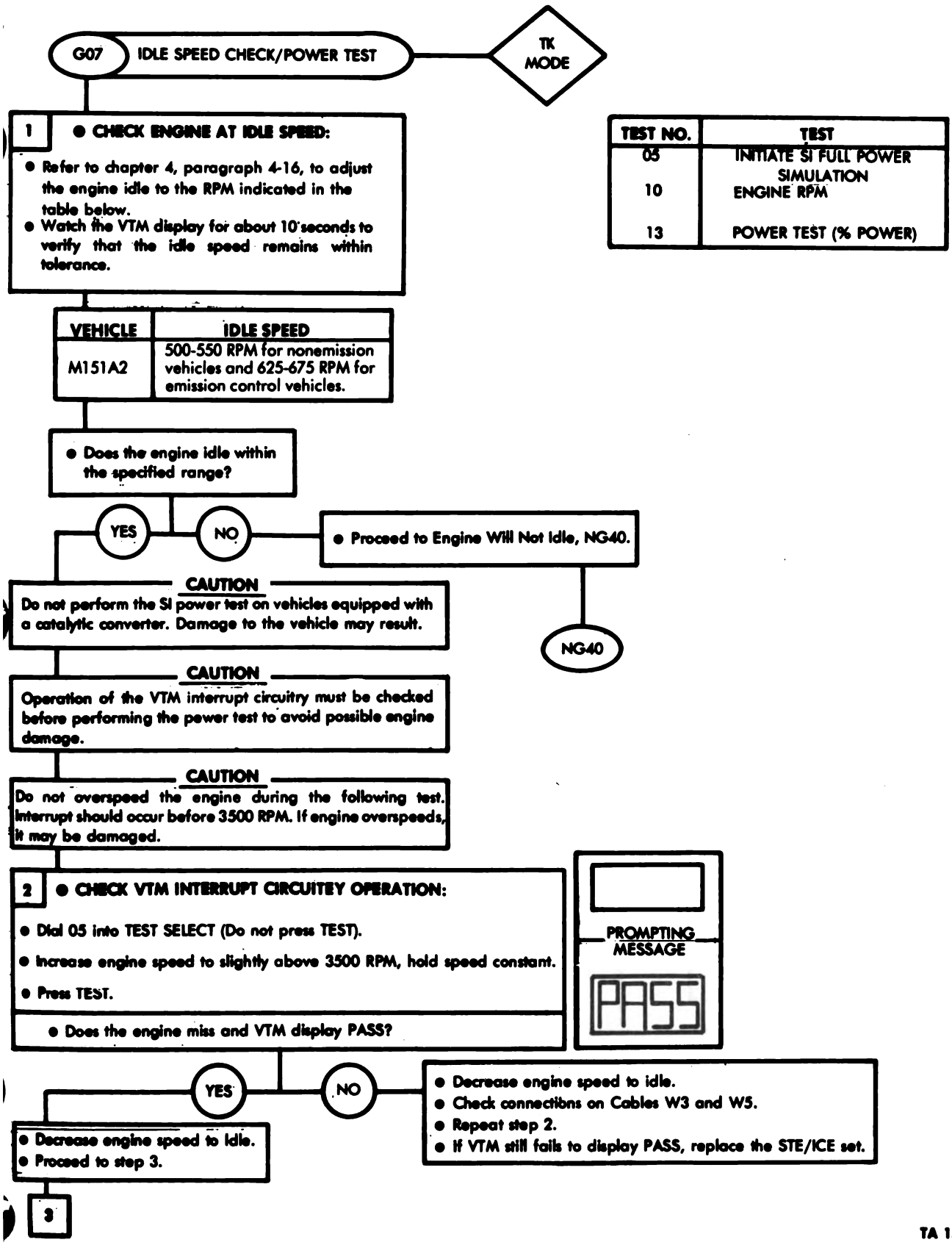
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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



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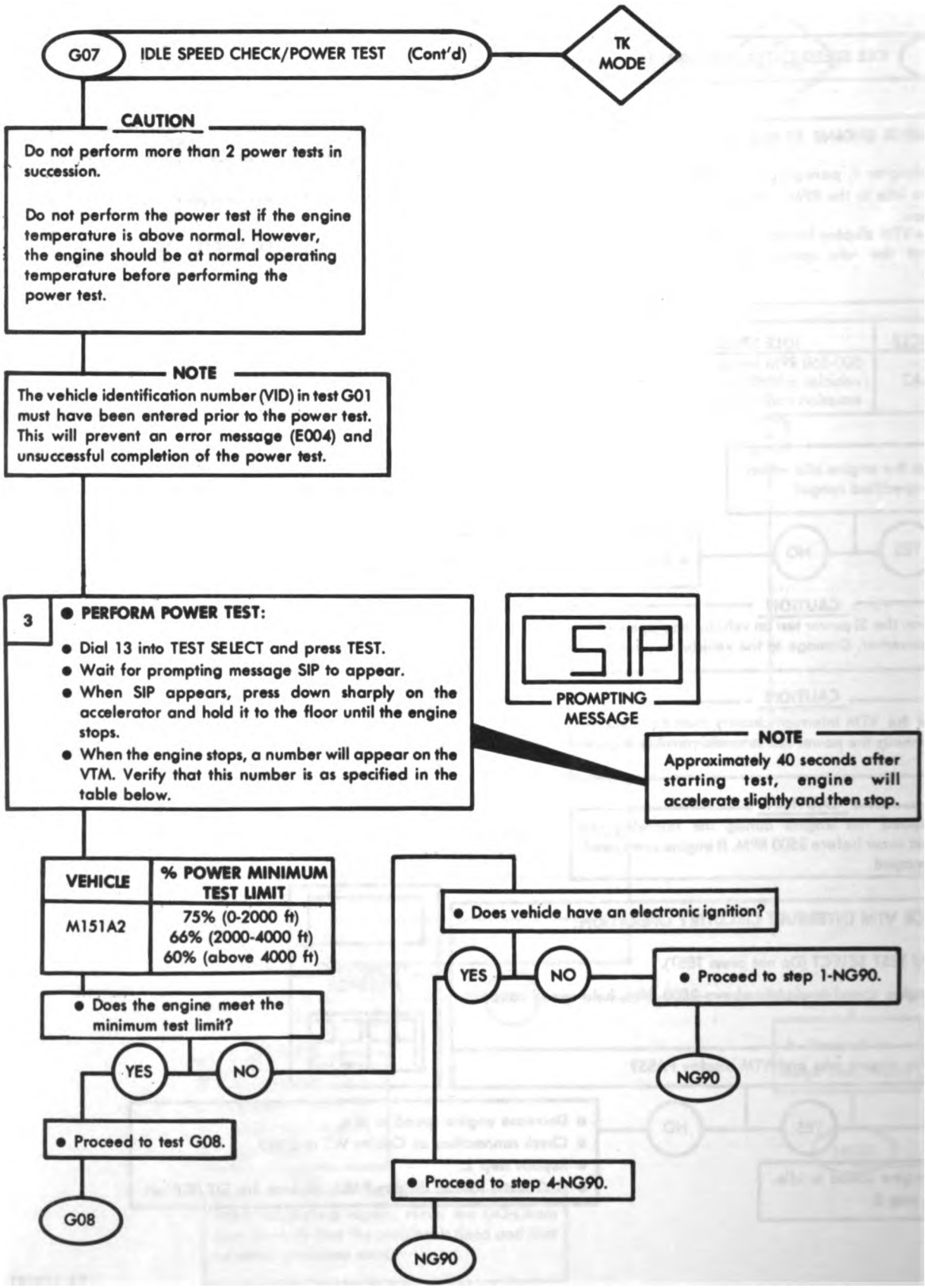
Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



TA 155881

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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)

G08 COMPRESSION UNBALANCE TEST

TK MODE

CAUTION

Do not perform more than 2 compression unbalance tests in a row or vehicle batteries may be discharged.

Engine must be at normal operating temperature before performing compression unbalance test.

TEST NO.	TEST
14	COMPRESSION UNBALANCE

NOTE

Before running compression unbalance test, the vehicle should be run for a short period at high idle to clear all cylinders of carbon deposits which are a result of running power test. Turn engine off.

NOTE

The compression unbalance test takes approximately 15 seconds to run.

NOTE

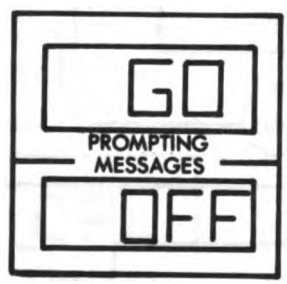
During this test the VTM must disable the ignition to keep the engine from starting. Be sure the ignition adapter cable W3 is connected. This connection is shown in Test G02.

1

- **RUN COMPRESSION UNBALANCE TEST:**
- Dial 14 into TEST SELECT and press TEST.
- Wait for prompting message GO to appear.

- When GO appears, crank the engine.
- Just after starting to crank, the VTM display should change to --- indicating VTM is accepting data.
- Stop cranking when VTM displays OFF or E013.
- Wait for a number to be displayed.

- Does the VTM display a number?



YES

NO

- Does VTM display GO?

NO

YES

- Does VTM display FAIL?

- Proceed to next page.

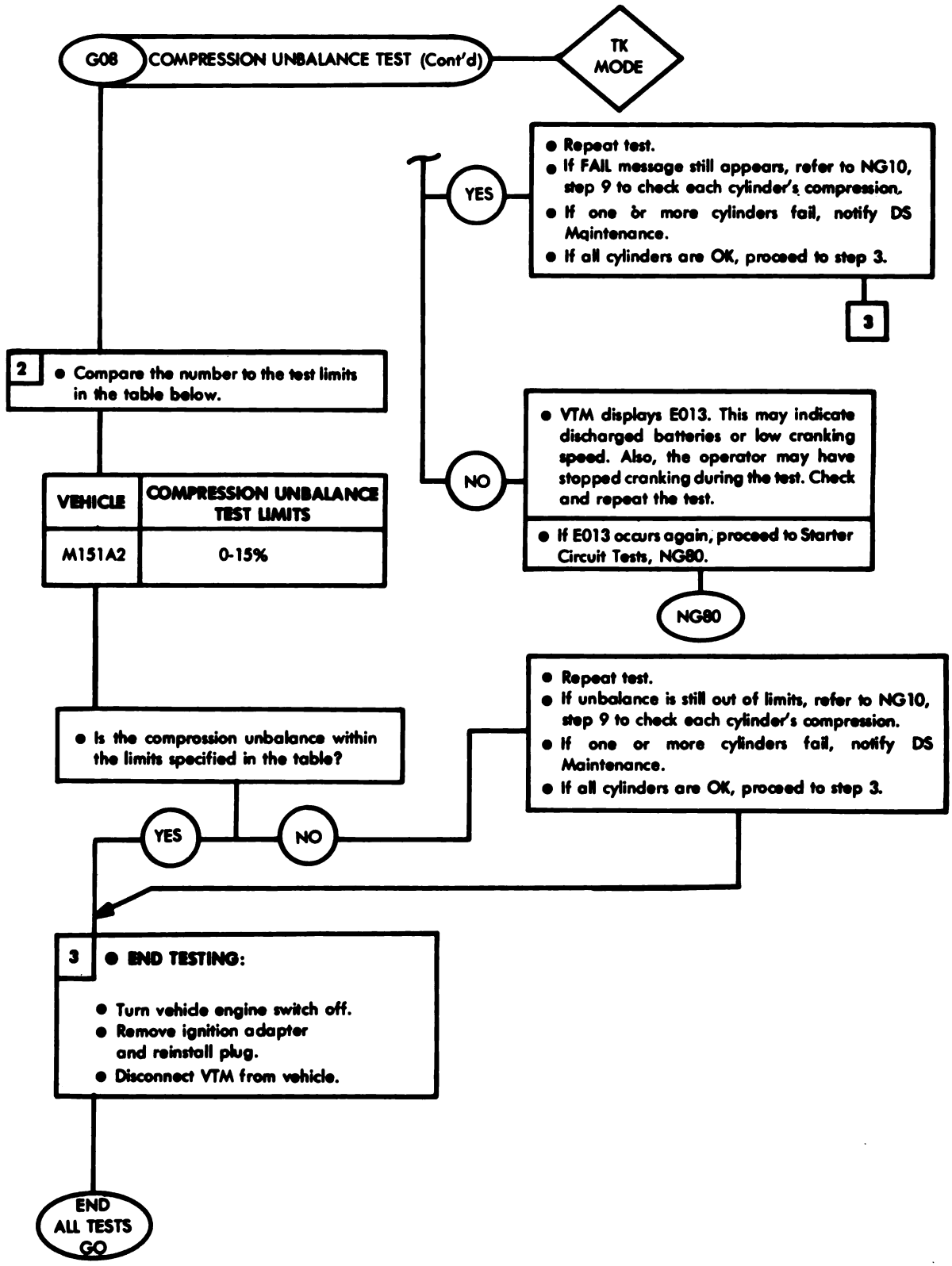
- Proceed to step 2.

2

TA 155883

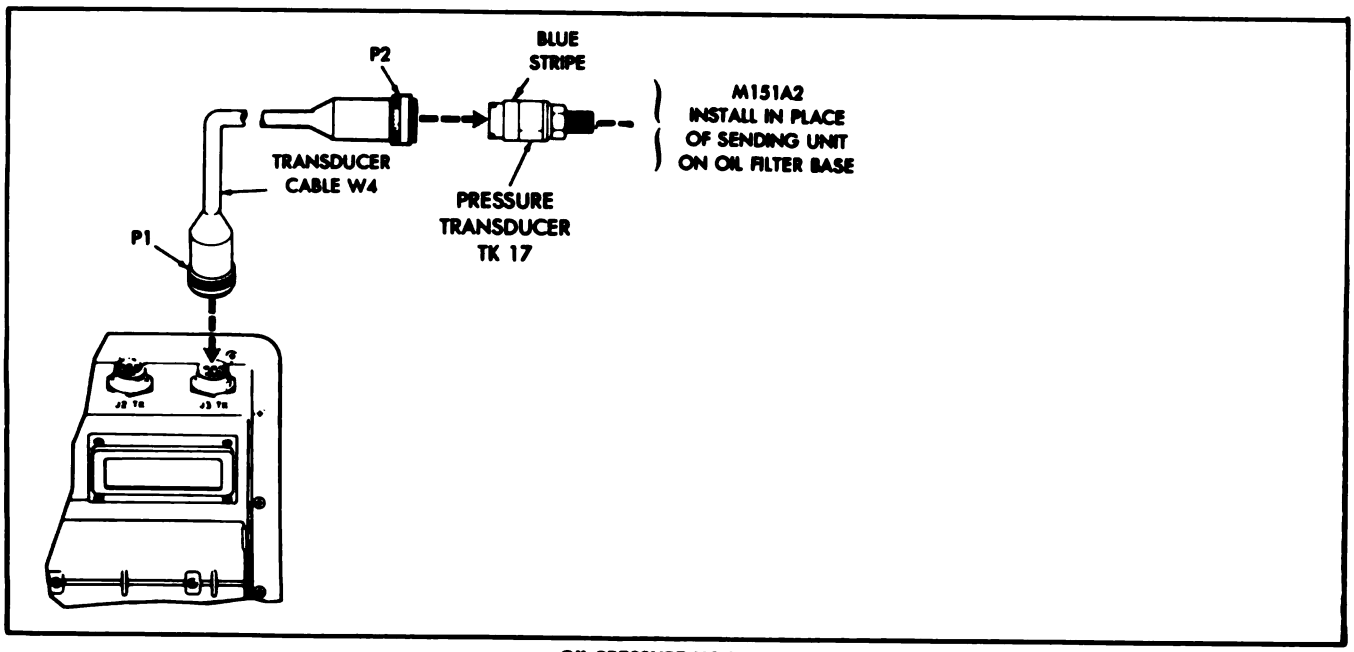
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Table 3-11. STE/ICE Go-Chain Tests (Cont'd)



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Table 3-12. STE/ICE NO-GO Chain Tests.



OIL PRESSURE HOOKUP

NG05 LOW OIL PRESSURE CHECK — TK MODE

TEST NO.	TEST
50	0-1000 PSI PRESSURE

1 ● **CONNECT TRANSDUCER — DO OFFSET TEST:**

- Stop vehicle engine.
- Remove oil pressure sending unit.
- Install pressure transducer TK 17 (blue stripe) in place of sending unit on engine.
- Connect P1 of the transducer cable W4 to J2 or J3 on the VTM.
- Connect P2 of the transducer cable to the connector on the pressure transducer.

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



PROMPTING MESSAGE

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

YES — NO → ● Proceed to TM 9-4910-571-12 & P

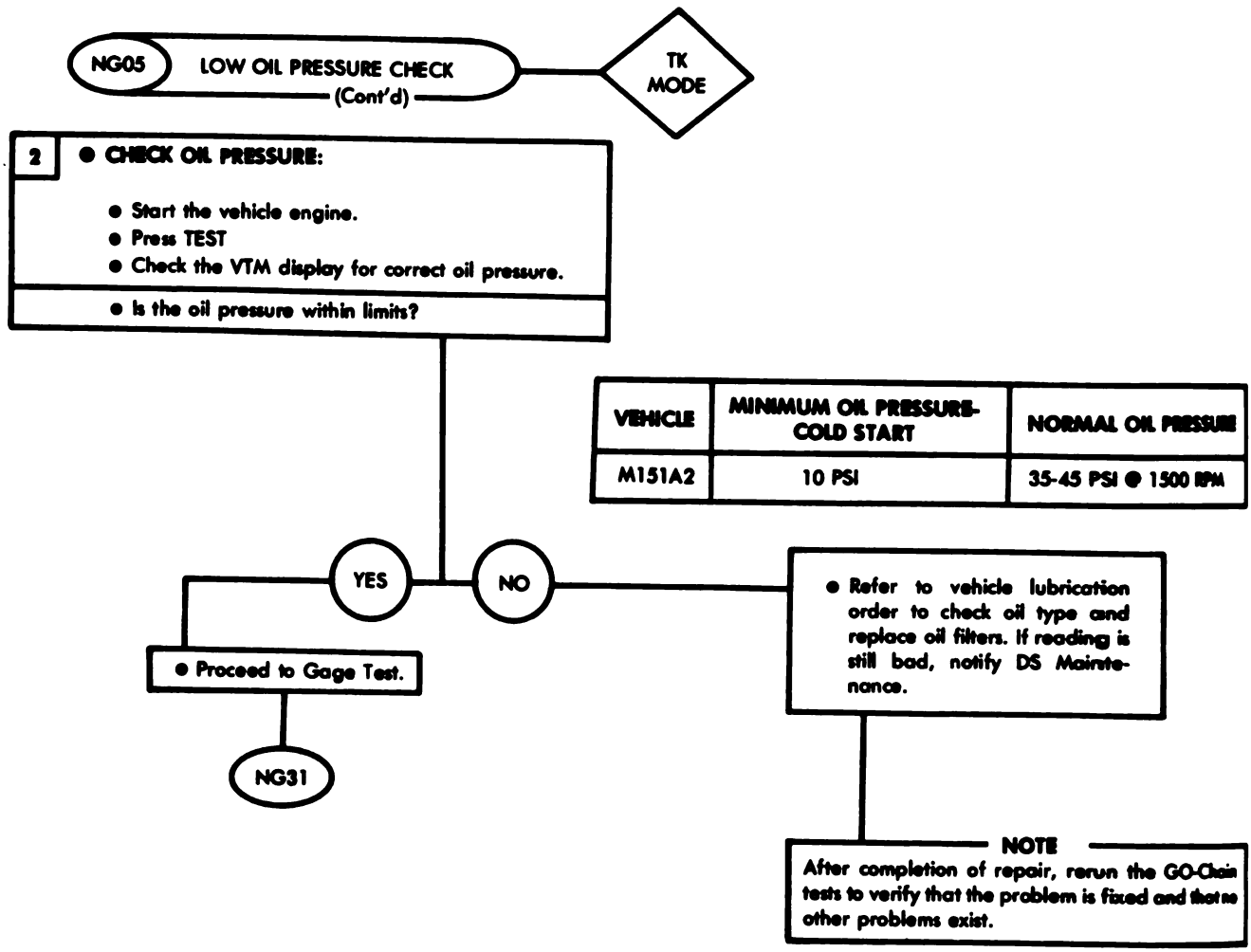
- Proceed to step 2

2

TA 155885

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

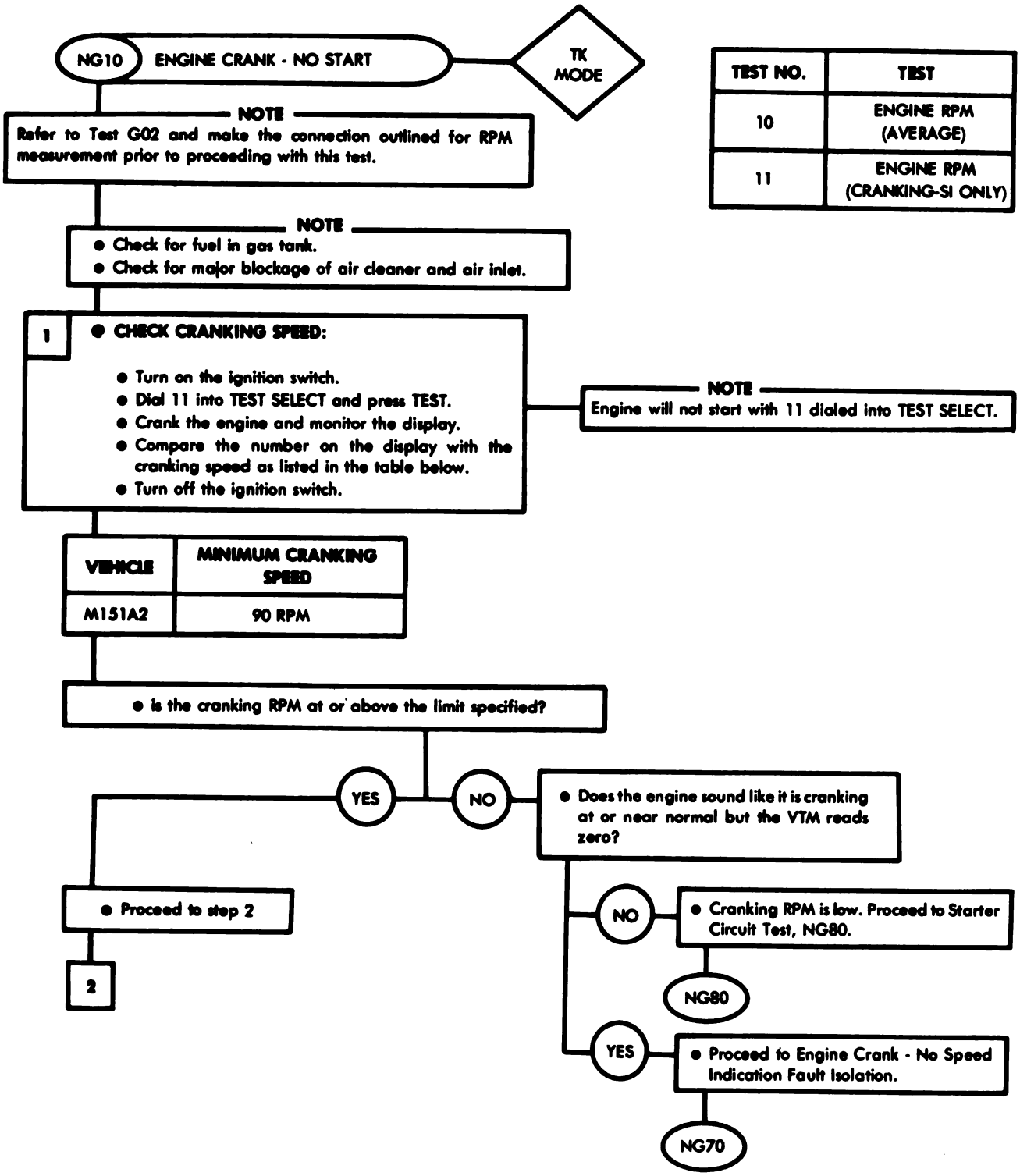


VEHICLE	MINIMUM OIL PRESSURE-COLD START	NORMAL OIL PRESSURE
M151A2	10 PSI	35-45 PSI @ 1500 RPM

TA 155206

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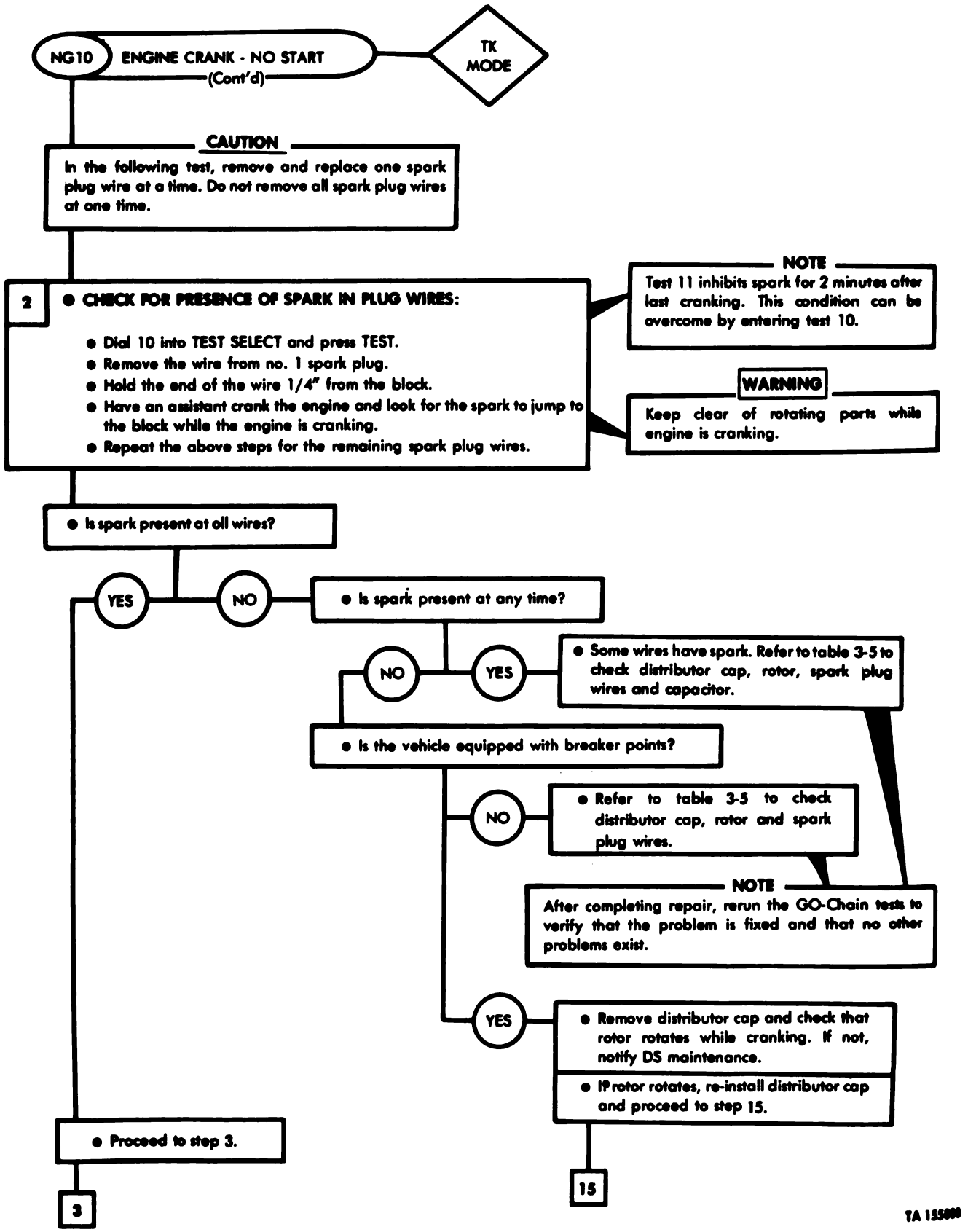
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155887

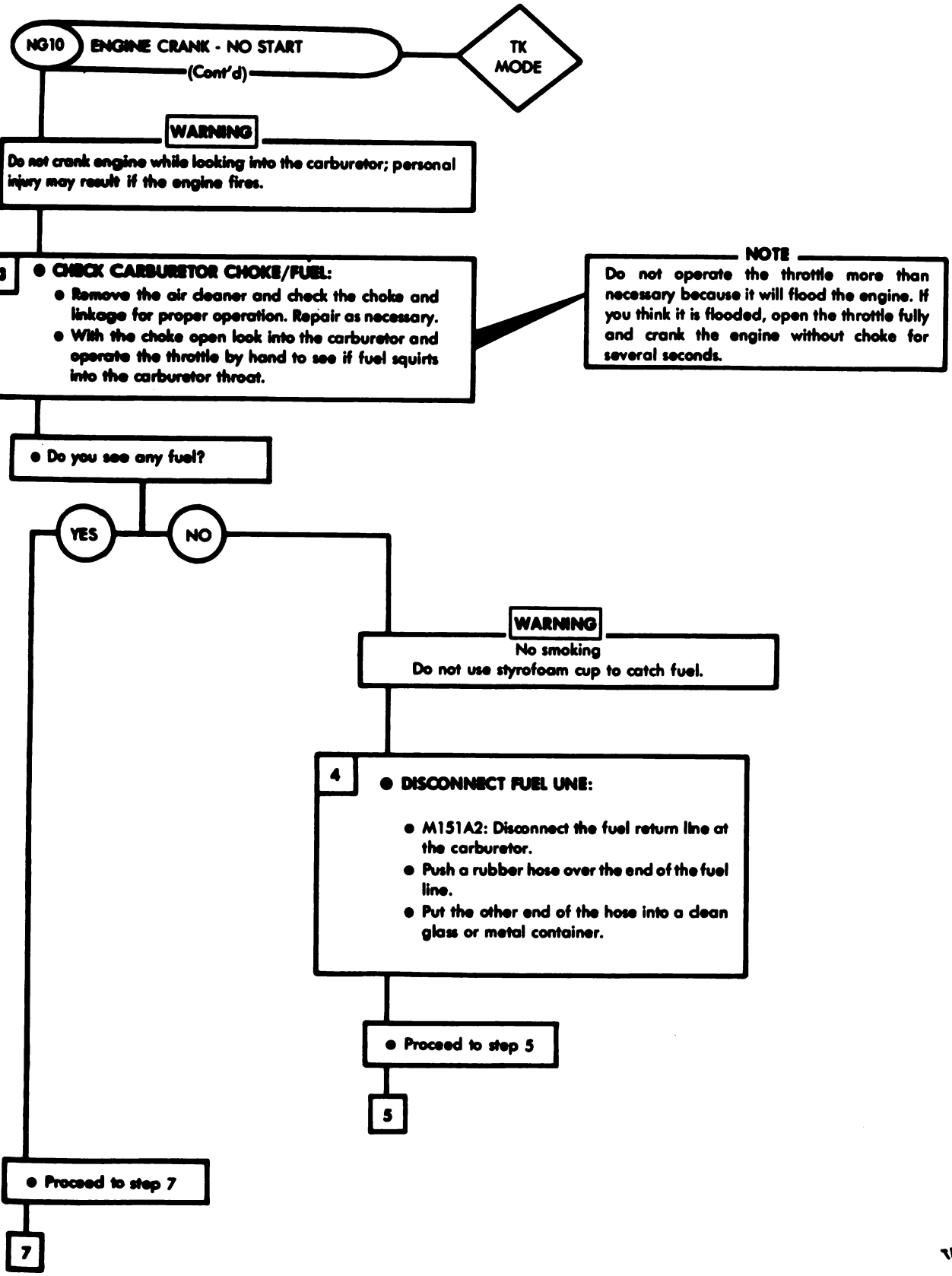
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



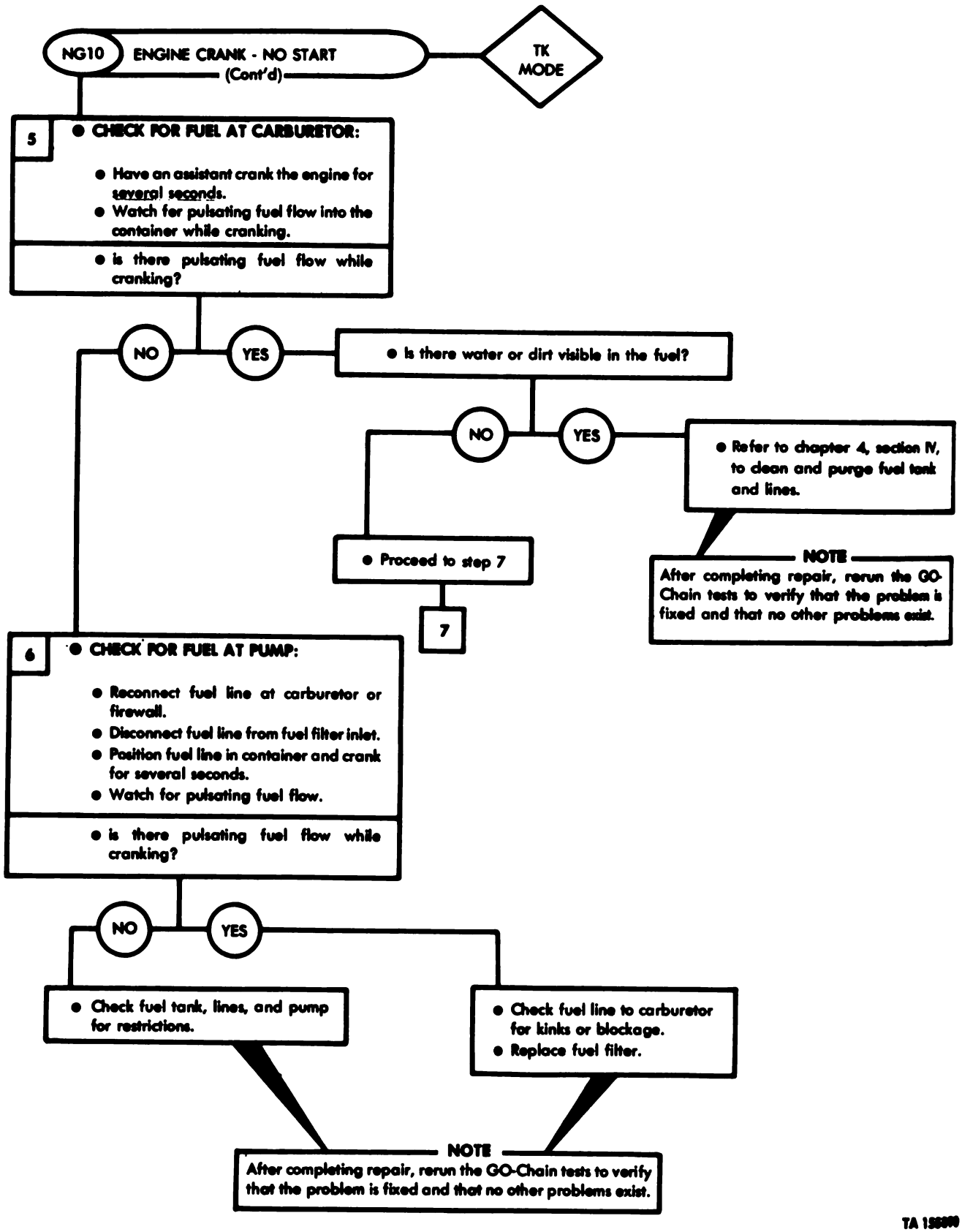
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



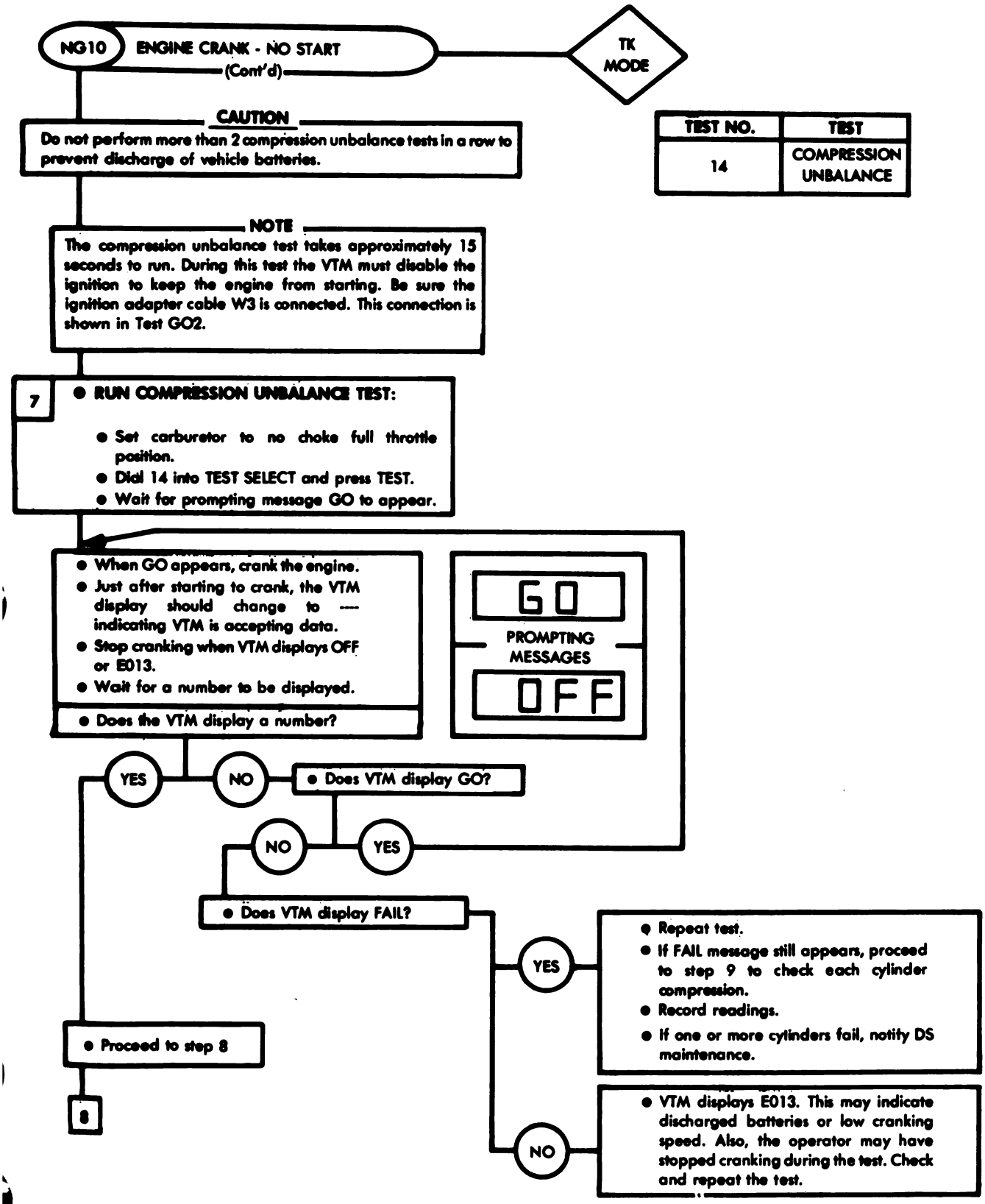
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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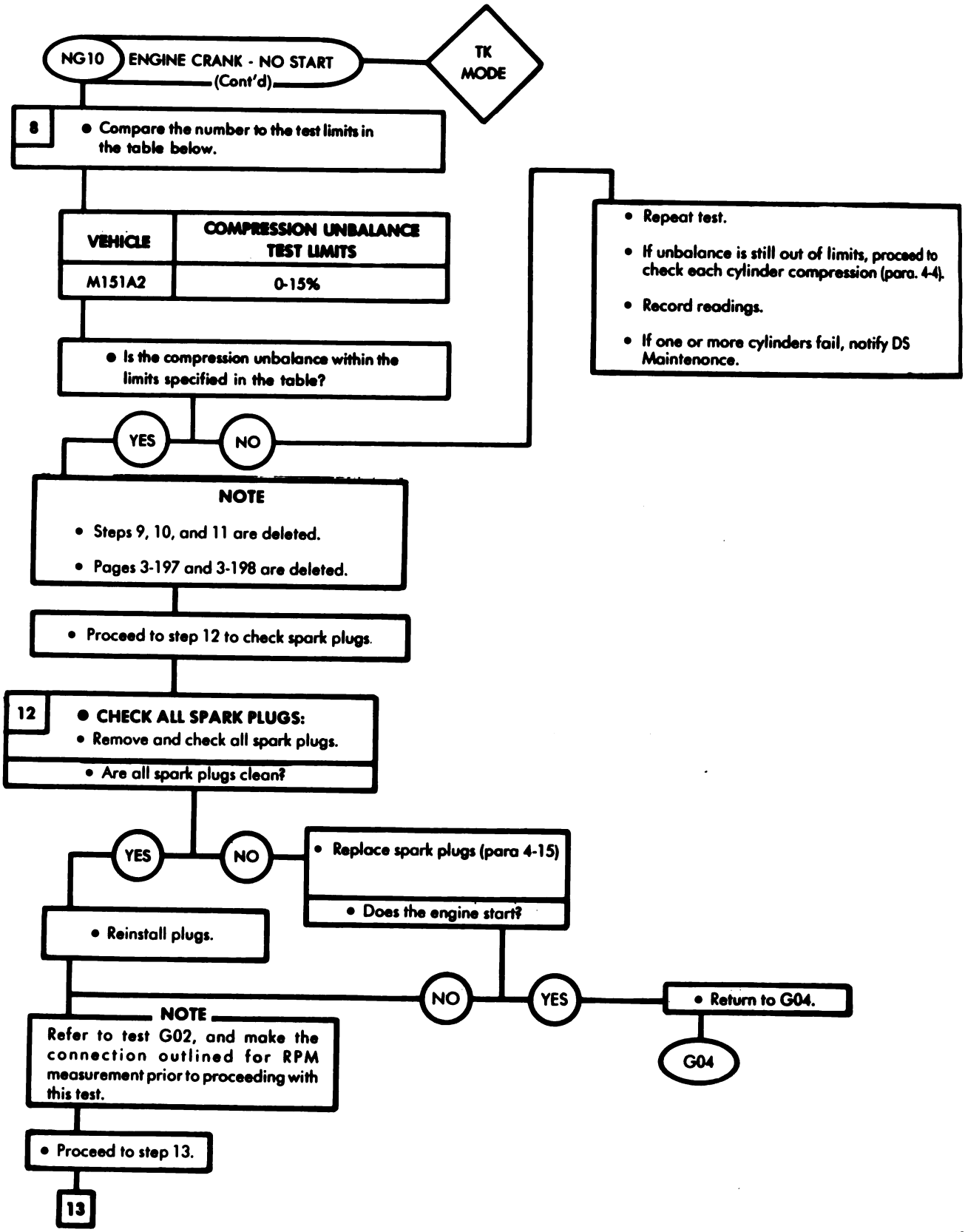
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155891

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG10 ENGINE CRANK - NO START (Cont'd)

TK MODE

TEST NO.	TEST
03	DISPLAY MAXIMUM VALUE DETECTED FOR NEXT TEST
50	0-1000 PSIG PRESSURE

NOTE

If vehicle passed the compression unbalance test, perform step 11 only once.

If vehicle failed the compression unbalance test, perform step 11 once for each cylinder, moving the hose and fitting assembly and transducer from one cylinder to the next between measurements.

11 ● CHECK CYUNDER COMPRESSION:

- Set carburetor to no-choke full throttle position.
- Dial 03 into TEST SELECT and press TEST.
- Wait for prompting message PASS to appear.



PROMPTING MESSAGE

- Dial 50 into TEST SELECT and press TEST.
- With the ignition off, crank the engine for several seconds. Watch the VTM display.
- Record readings.
- Compare the number on the display with the cylinder compression spec. in the table below.

VEHICLE	CYLINDER COMPRESSION
M151A2	90-140 PSI

NOTE

If compression unbalance test fails or is out of limits, but individual cylinder checks show compression is OK, starter motor may have a shorted or open winding. If starter motor cranks engine well enough, go to step 12. If starter performance seems questionable or slow, replace the starter motor.

● Is the cylinder compression within limits?

YES

NO ● Notify DS Maintenance.

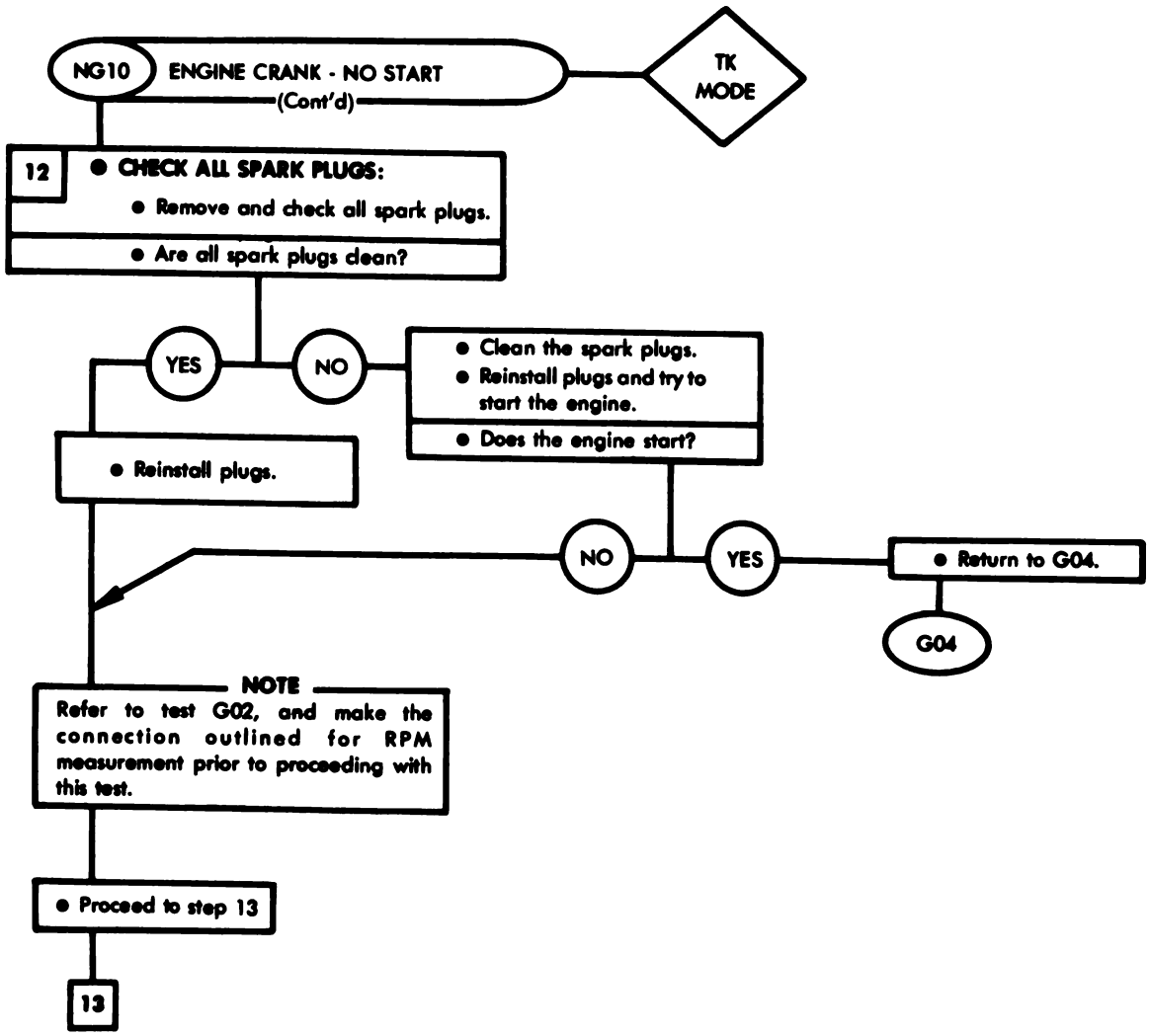
● Proceed to step 12

12

TA 155893

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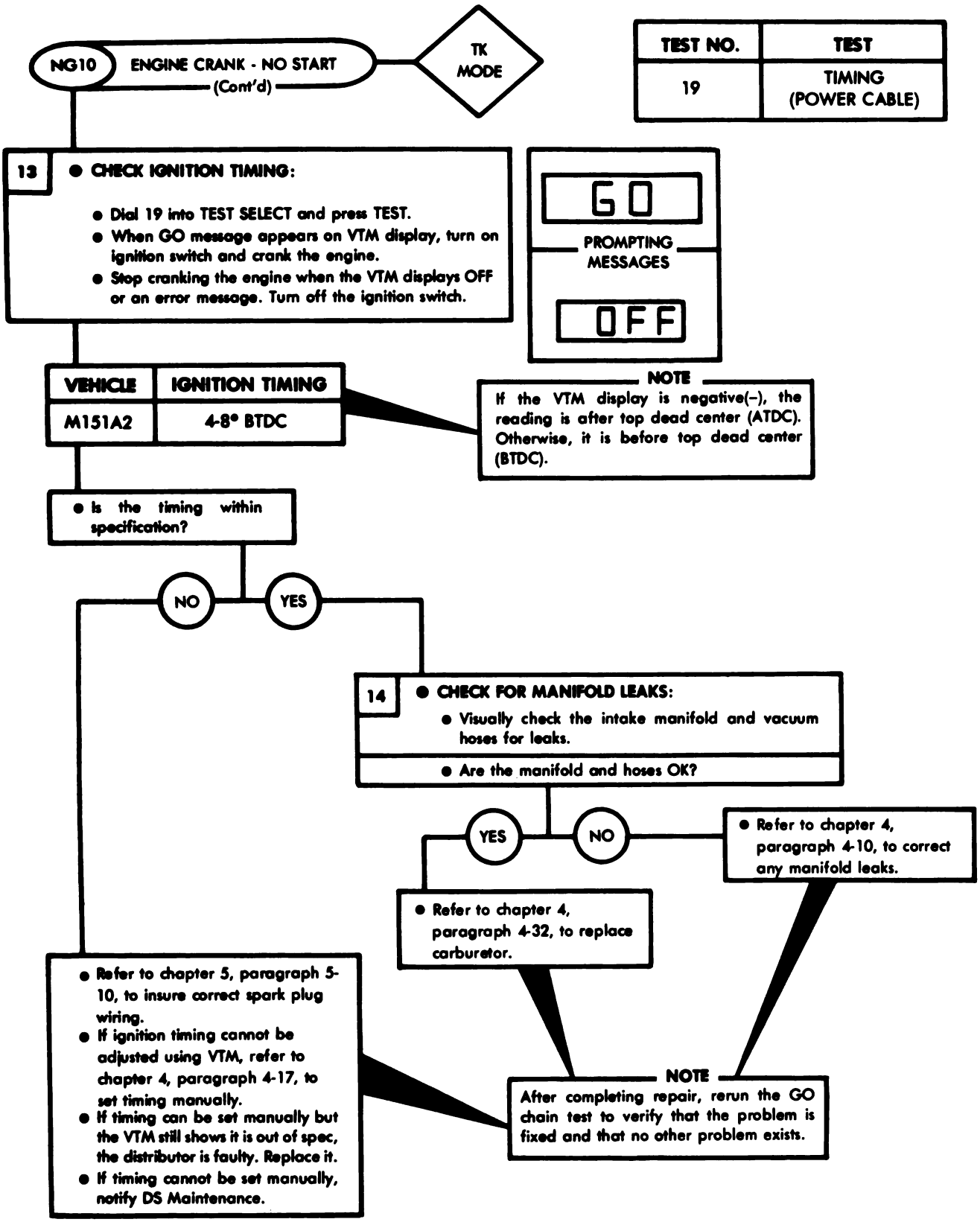
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155894

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155895

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG10 ENGINE CRANK - NO START (Cont'd)

TK MODE

TEST NO.	TEST
17	POINTS VOLTAGE
89	0-45 VOLTS DC

15 ● INSTALL TEST PROBE CABLE (W2) - DO OFFSET:

- Connect P1 of test probe cable W2 to J4 on VTM.
- Short the red and black clip leads of W2 together.
- Dial 89 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST.
- Wait for offset value to appear on display.

CAL

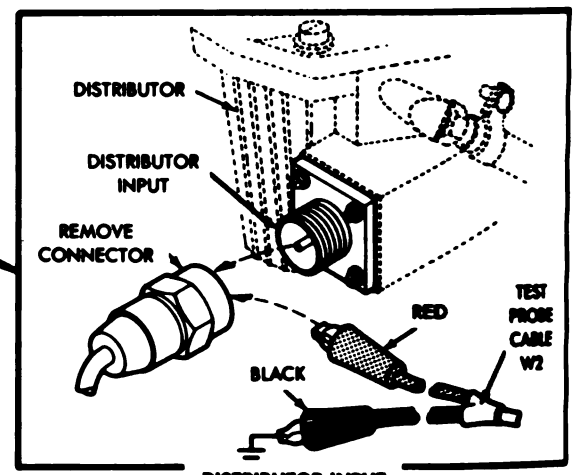
PROMPTING MESSAGE

● Is the offset value within the limits of −6.8 to +6.8?

YES — NO → ● Replace STE/ICE set.

16 ● CHECK DISTRIBUTOR INPUT VOLTAGE:

- Remove the primary input connector to the distributor.
- Hold the red clip lead on W2 on the center conductor of the connector as shown.
- Connect the black clip lead of the cable to a good ground.
- Set the ignition switch to ON.
- Press TEST.



DISTRIBUTOR INPUT VOLTAGE — M151A2

● Is the reading on the VTM display near battery voltage?

YES — NO → ● Voltage is low. Check ignition switch and primary wiring.

● Re-connect the primary input connector to the distributor.

NOTE

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

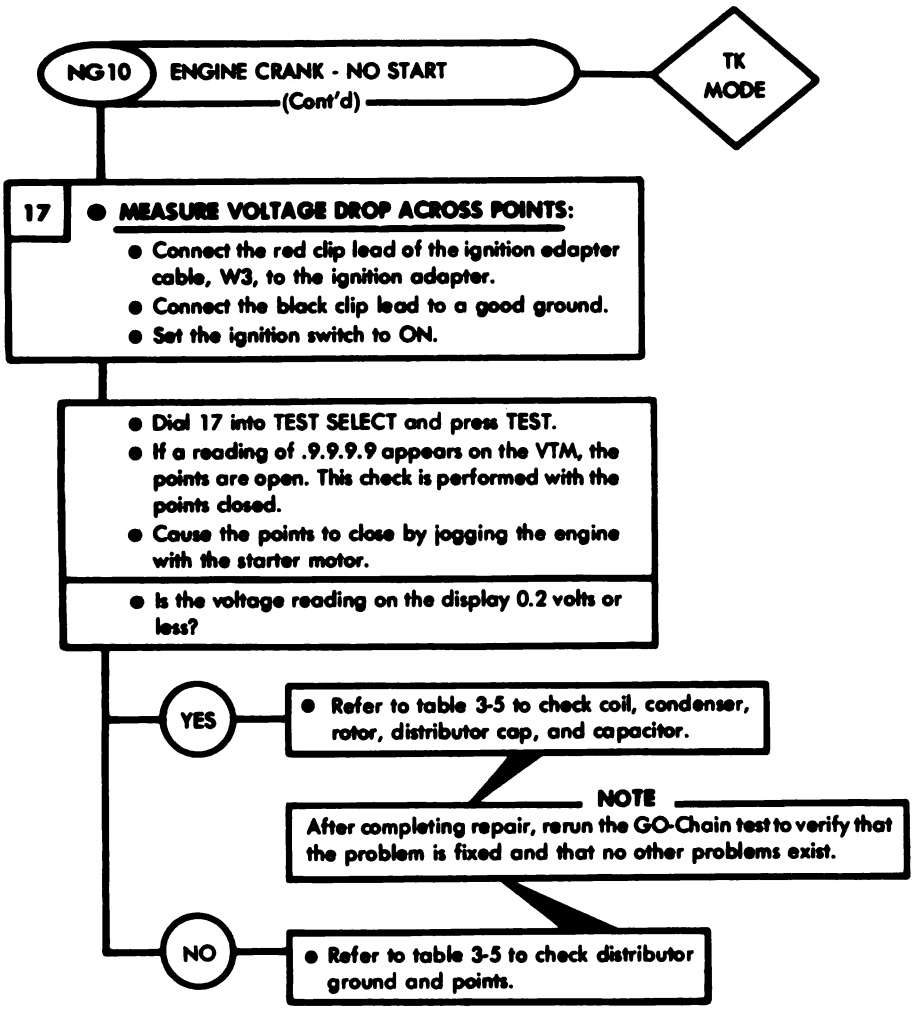
● Proceed to step 17.

17

TA 155096

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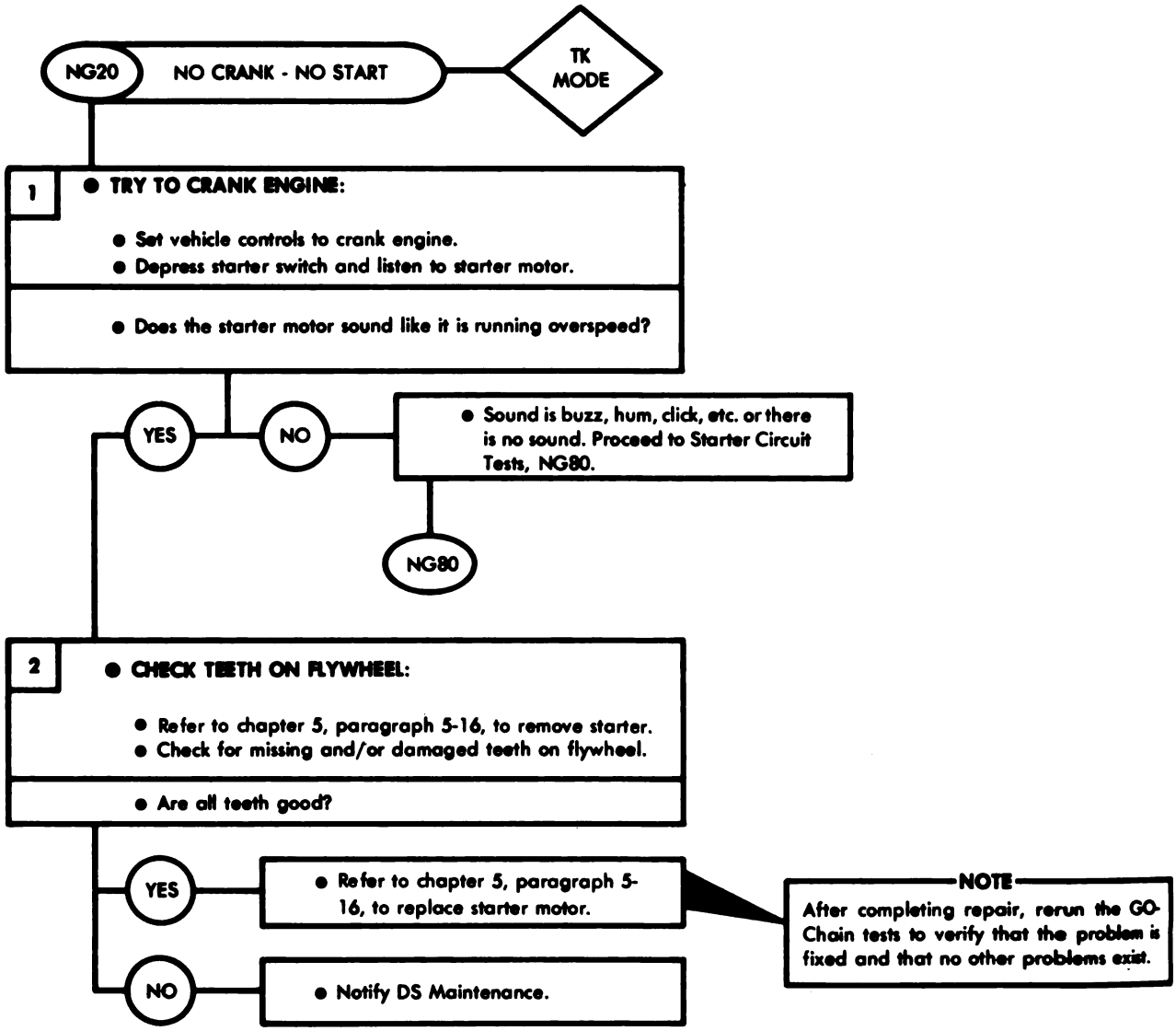
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155897

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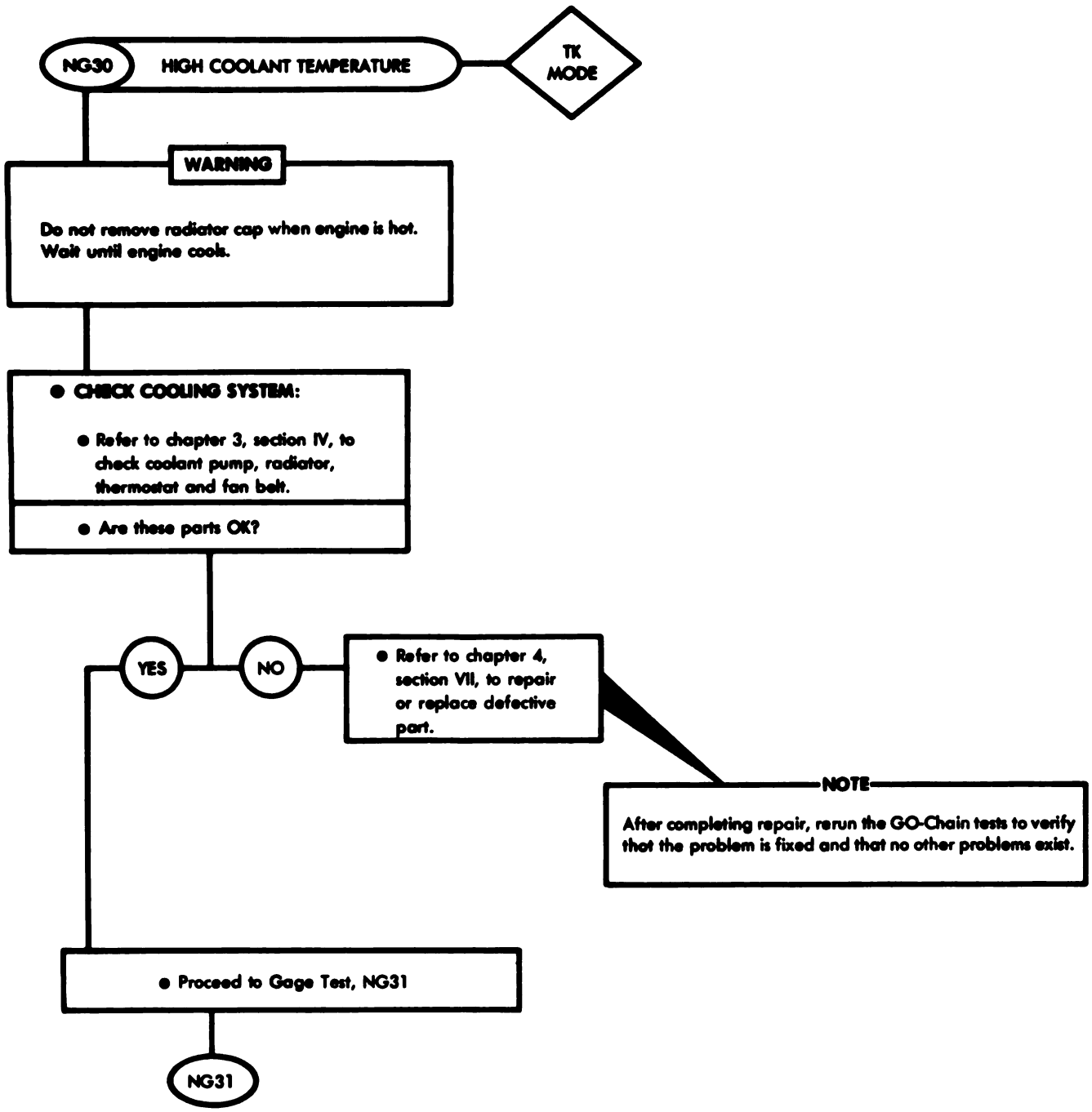
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155898

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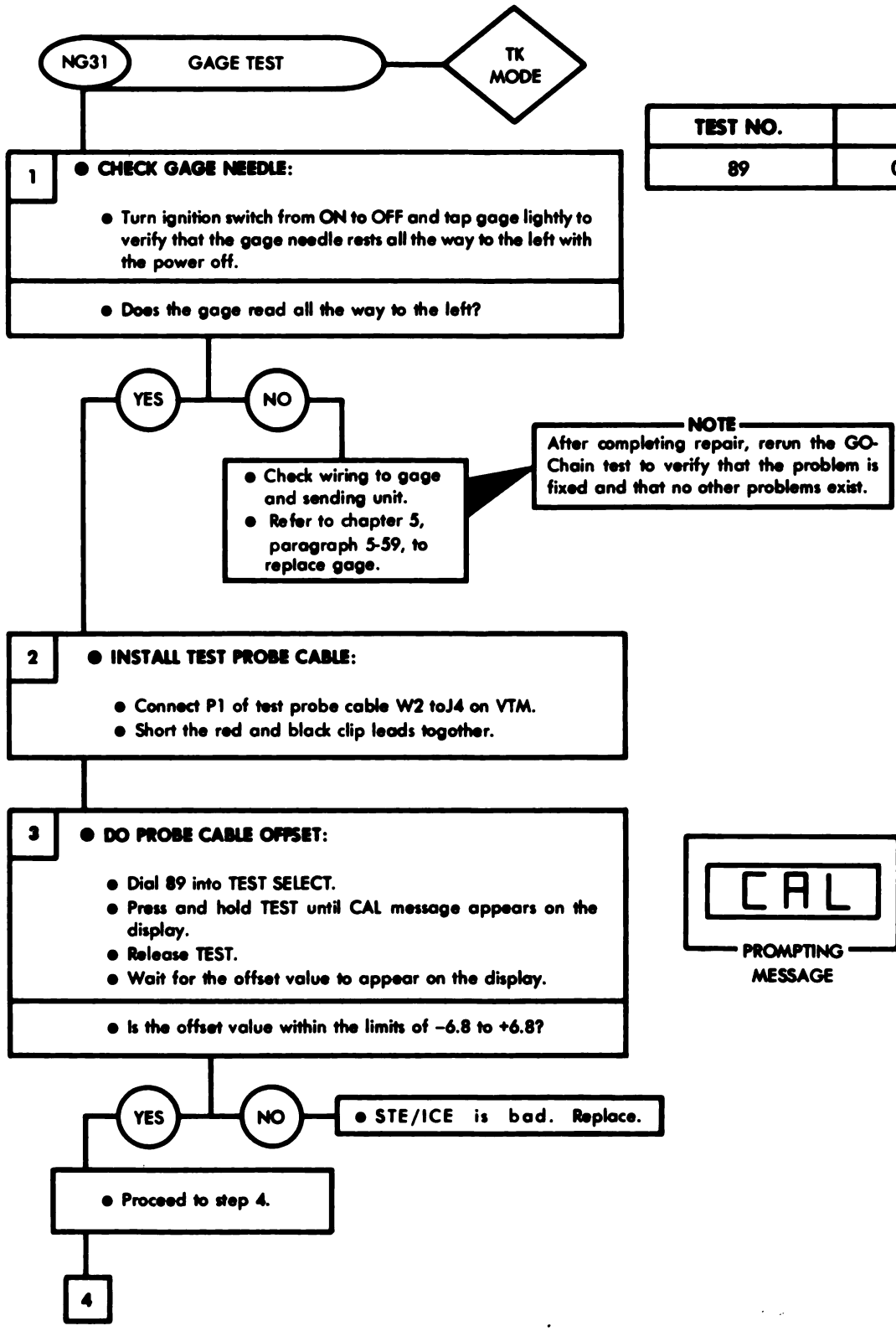
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155899

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 159900

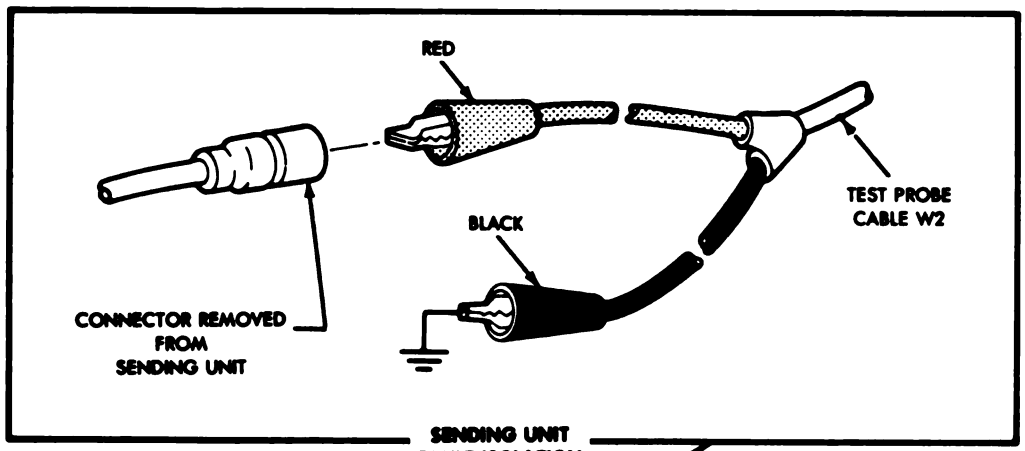
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG31 GAGE TEST (Cont'd)

TK MODE

TEST NO.	TEST
89	0-45 VOLTS DC



SENDING UNIT FAULT ISOLATION

4 ● ISOLATE FAULT TO SENDING UNIT OR GAGE:

- Remove the connector from the sending unit on the vehicle.
- Connect the red clip lead of W2 to the connector removed from the sending unit.
- Connect the black clip lead to a good ground.
- Press TEST.
- Turn vehicle ignition switch ON.

● Does the VTM indicate the battery voltage?

YES → ● Refer to chapter 5, section VII, to replace the sending unit.

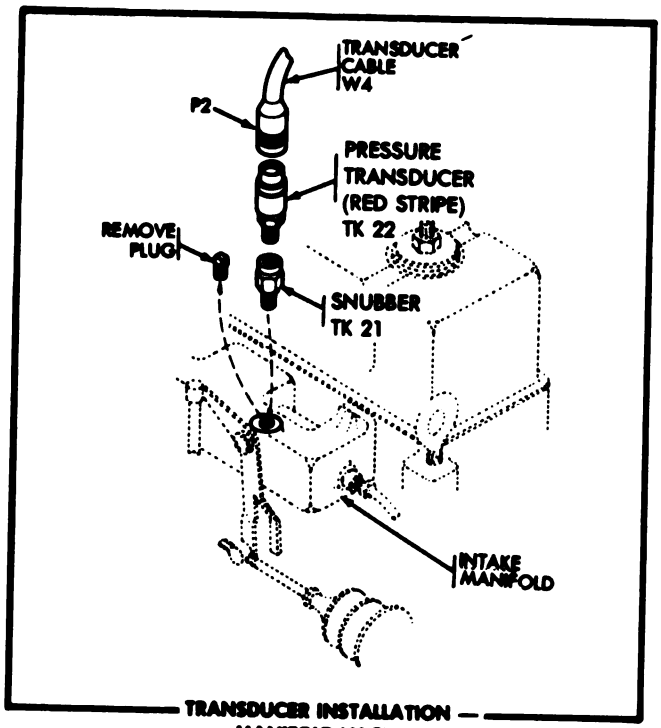
NO → ● Refer to chapter 3, table 3-5, and isolate fault to wiring harness or gage.

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

TA 155901

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TRANSDUCER INSTALLATION — MANIFOLD VACUUM

NG40 ENGINE WILL NOT IDLE — TK MODE

1 ● INSTALL TRANSDUCER:

- Remove the plug from the top of the intake manifold.
- Install the snubber and pressure transducer (red stripe) in place at removed plug as shown.
- Connect P1 of transducer cable W4 to J2 on the VTM.
- Connect P2 of the transducer cable to the transducer.

● Proceed to step 2.

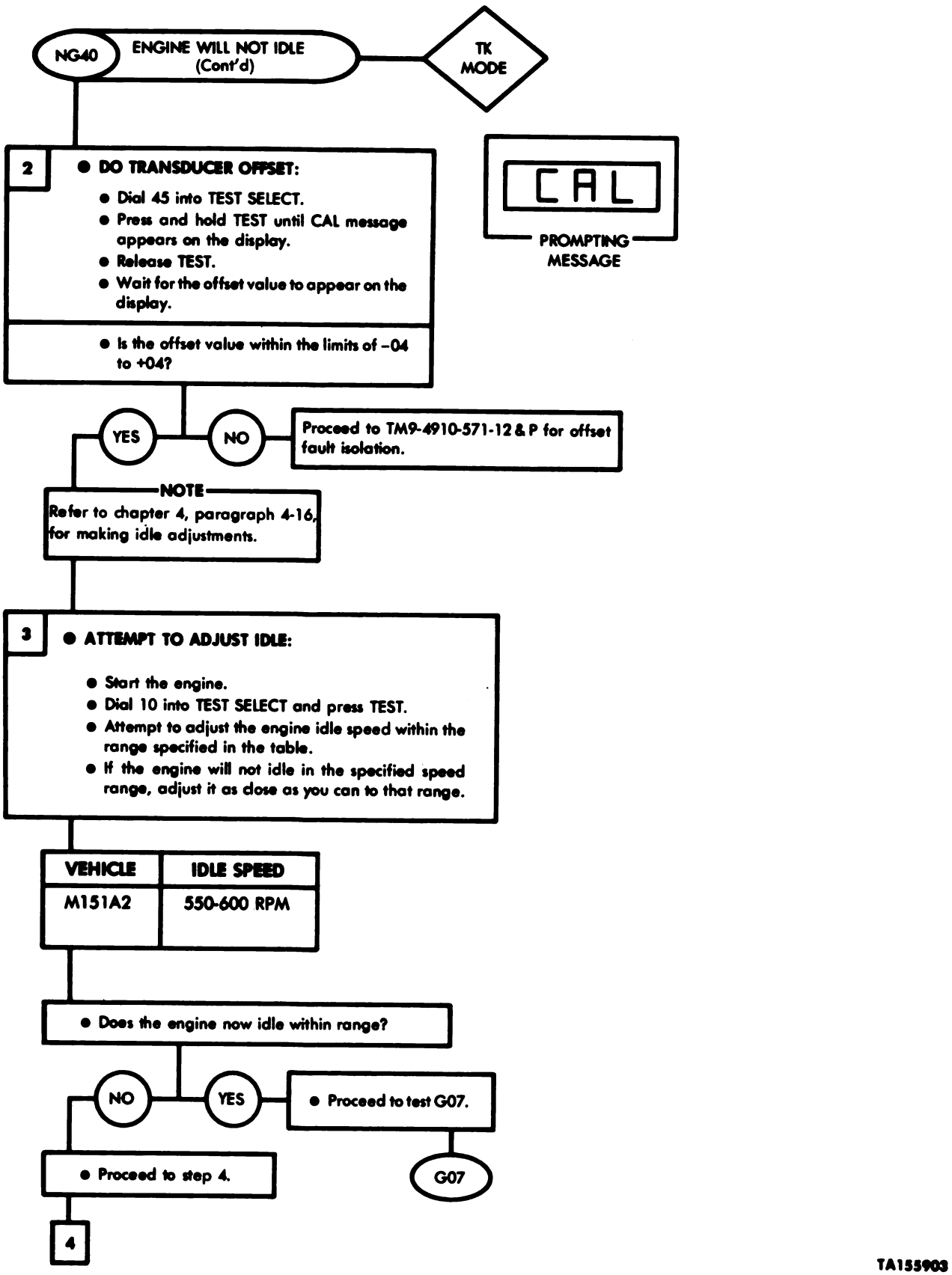
2

TEST NO.	TEST
10	ENGINE RPM (AVERAGE)
45	0-30 IN. HG. VACUUM

TA 159902

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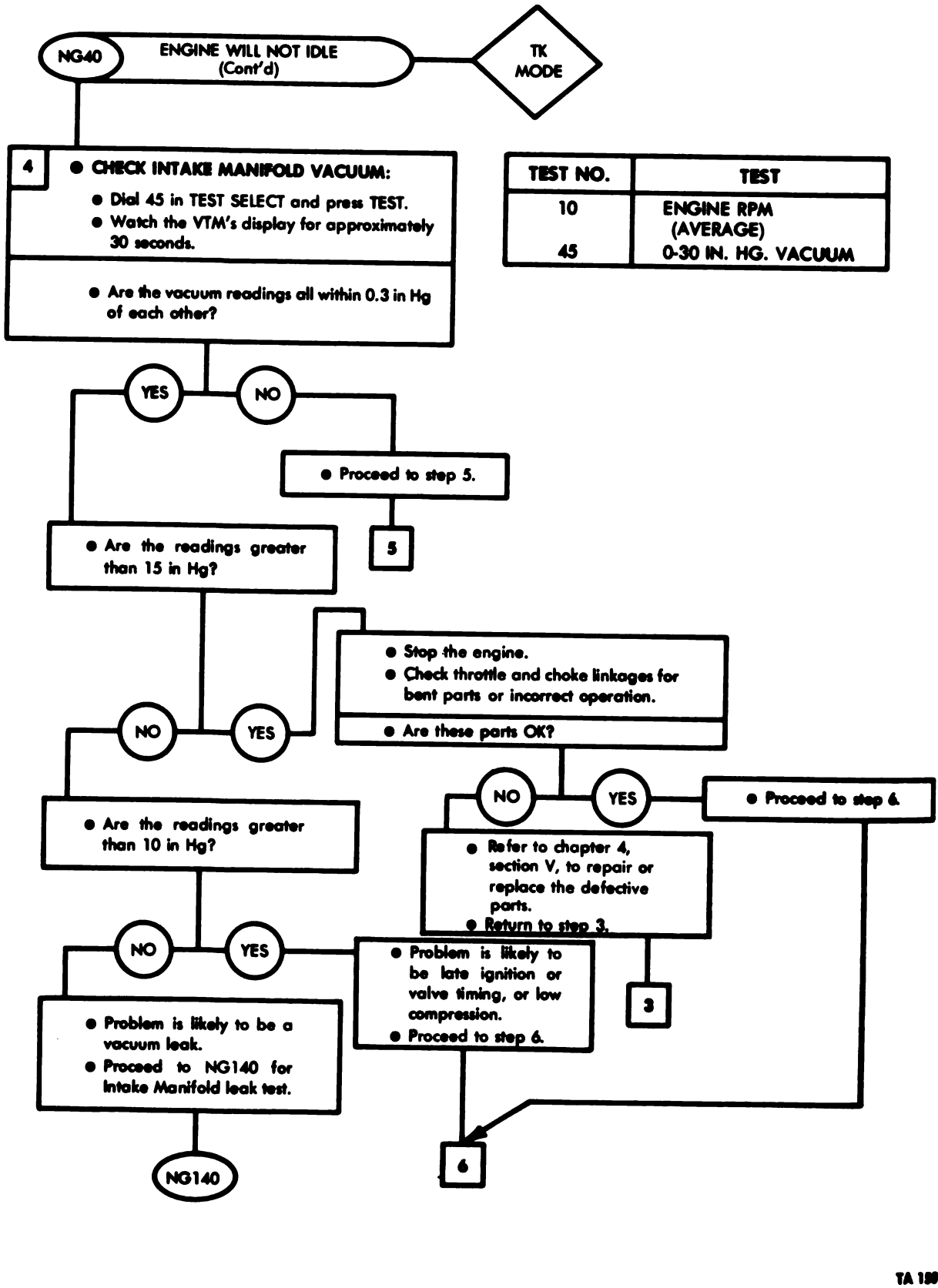
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA155903

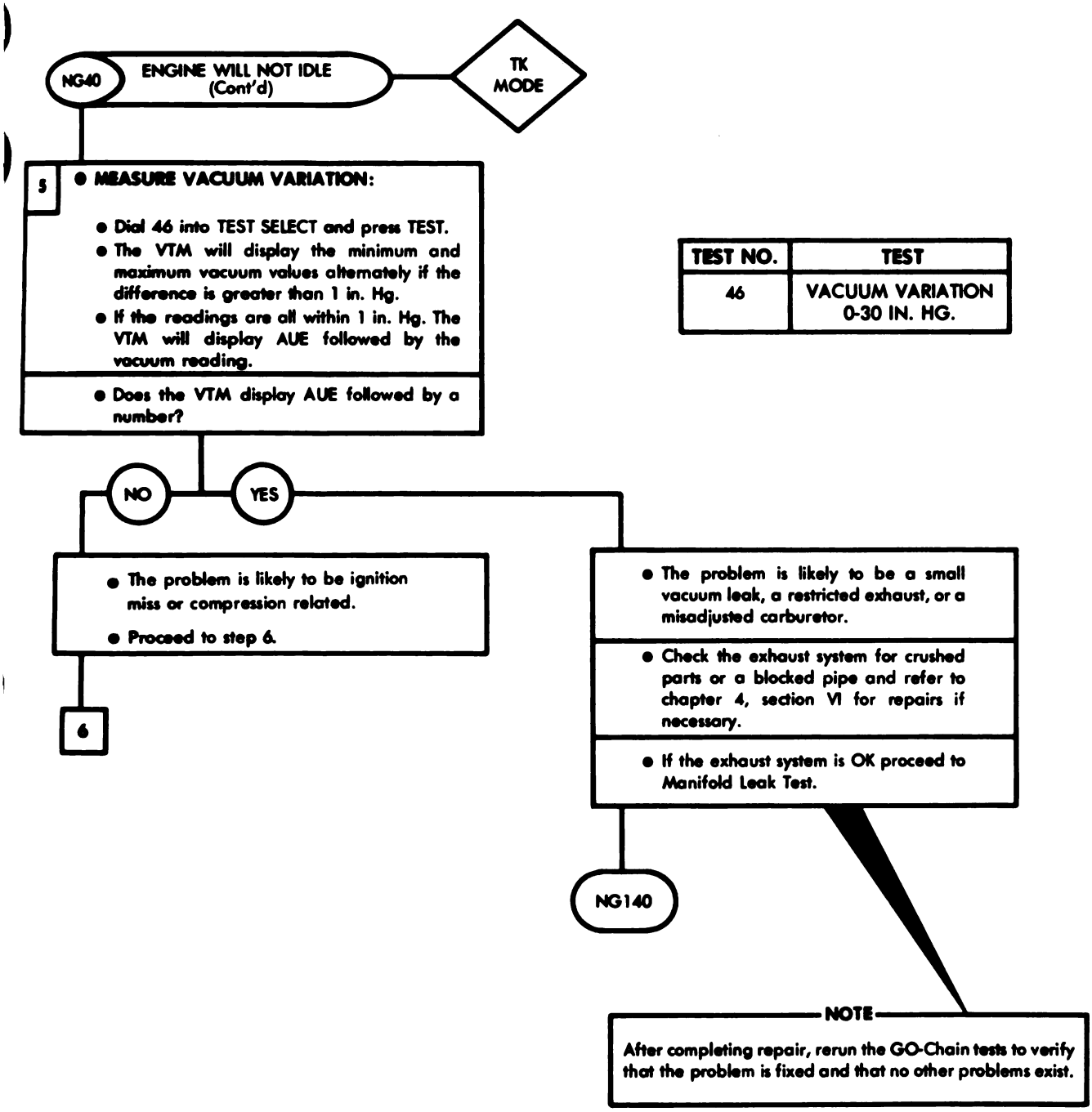
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

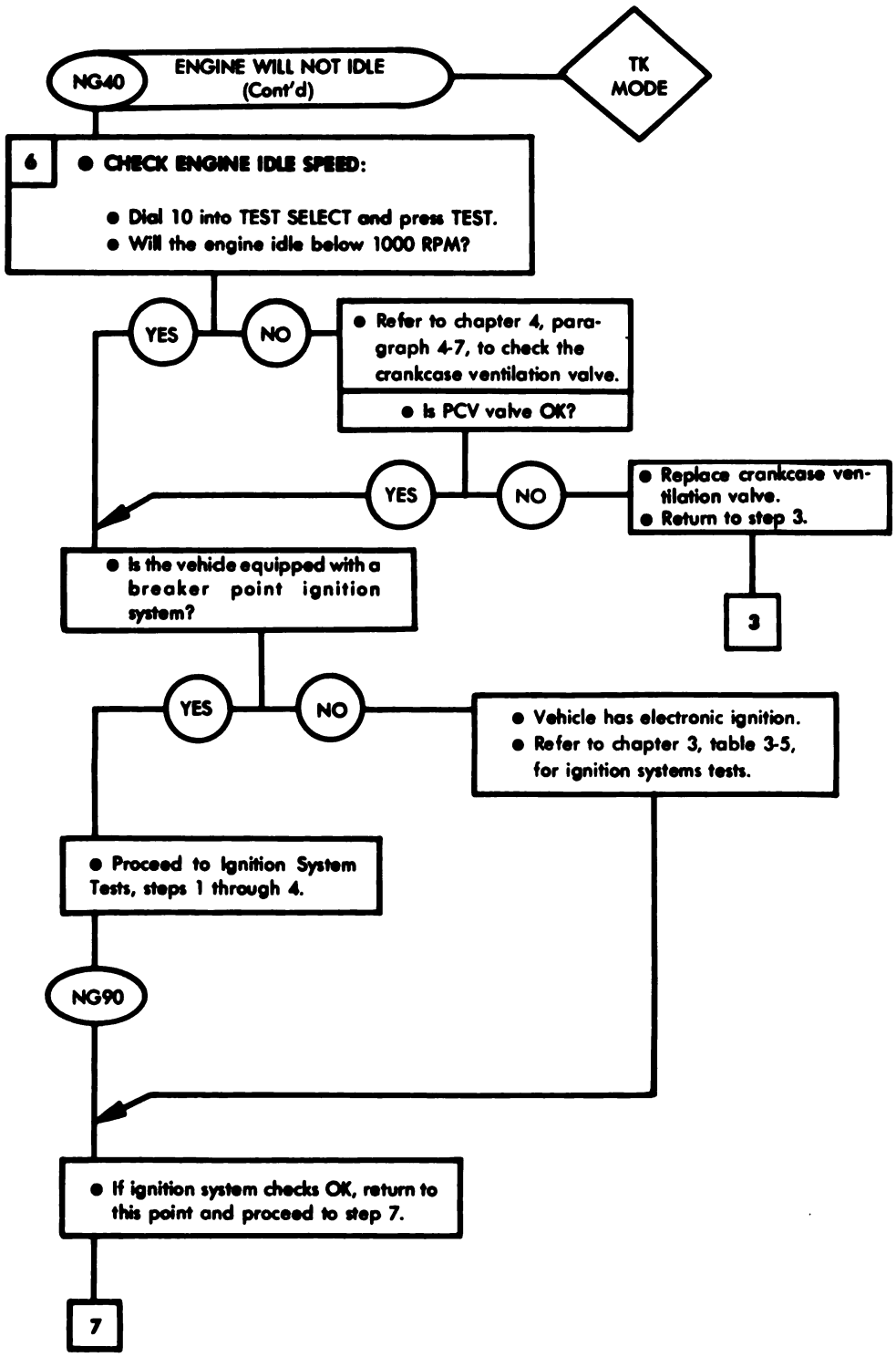


TEST NO.	TEST
46	VACUUM VARIATION 0-30 IN. HG.

TA 155905

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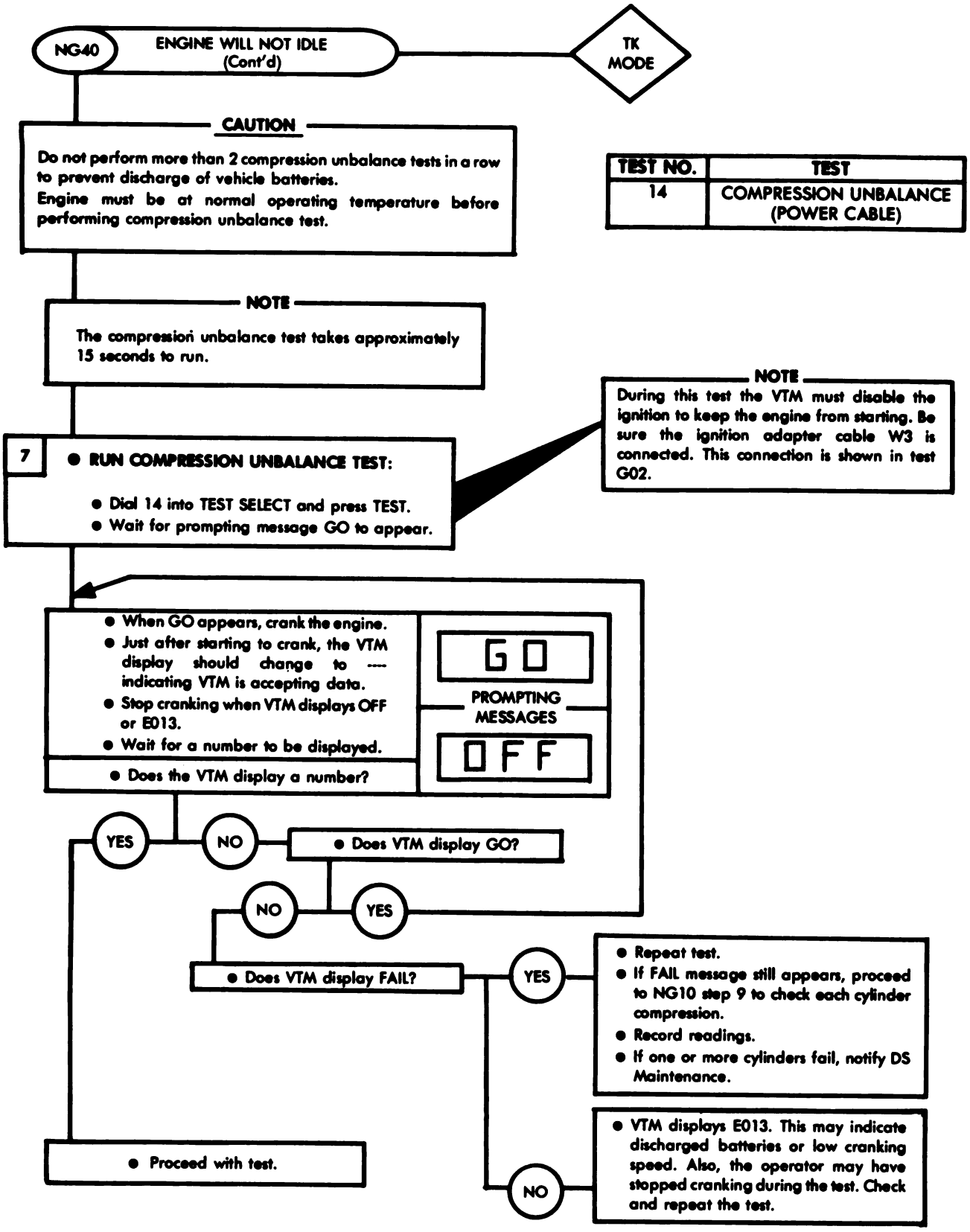
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 159906

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155907

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG40 ENGINE WILL NOT IDLE (Cont'd) — TK MODE

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

VEHICLE	COMPRESSION UNBALANCE TEST LIMITS
M151A2	0-15%

- Is the compression unbalance within the limits specified in the table?

YES / NO

- Repeat test.
- If unbalance is still out of limits, proceed to NG10 step 9 to check each cylinder compression.
- Record readings.
- If one or more cylinders fail, notify DS Maintenance.

- Proceed to step 8.

NOTE

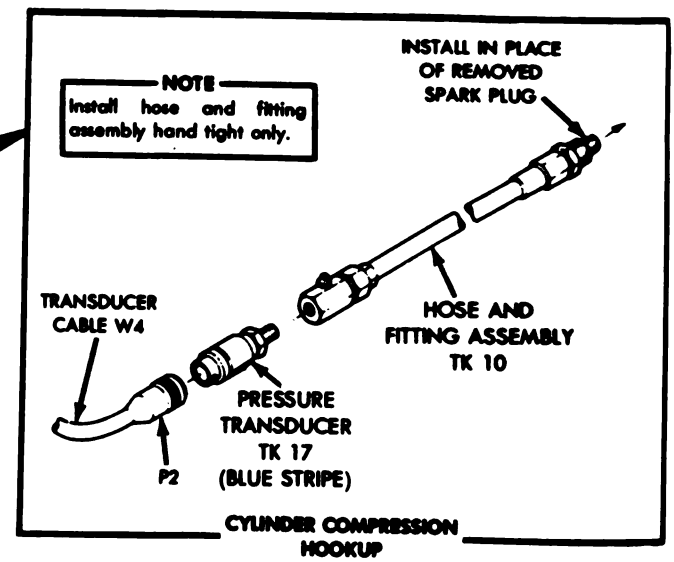
Do the following steps for only one cylinder.

8

- **INSTALL ADAPTER AND TRANSDUCER:**
  - Remove a spark plug and install the hose and fitting assembly in its place.
  - Install pressure transducer TK item 17 (blue stripe) onto the hose and fitting assembly.
  - Connect P1 of transducer cable W4 to J2 or J3 on the VTM.
  - Connect P2 of the transducer cable to the connector on the transducer.

- Proceed to step 9.

9

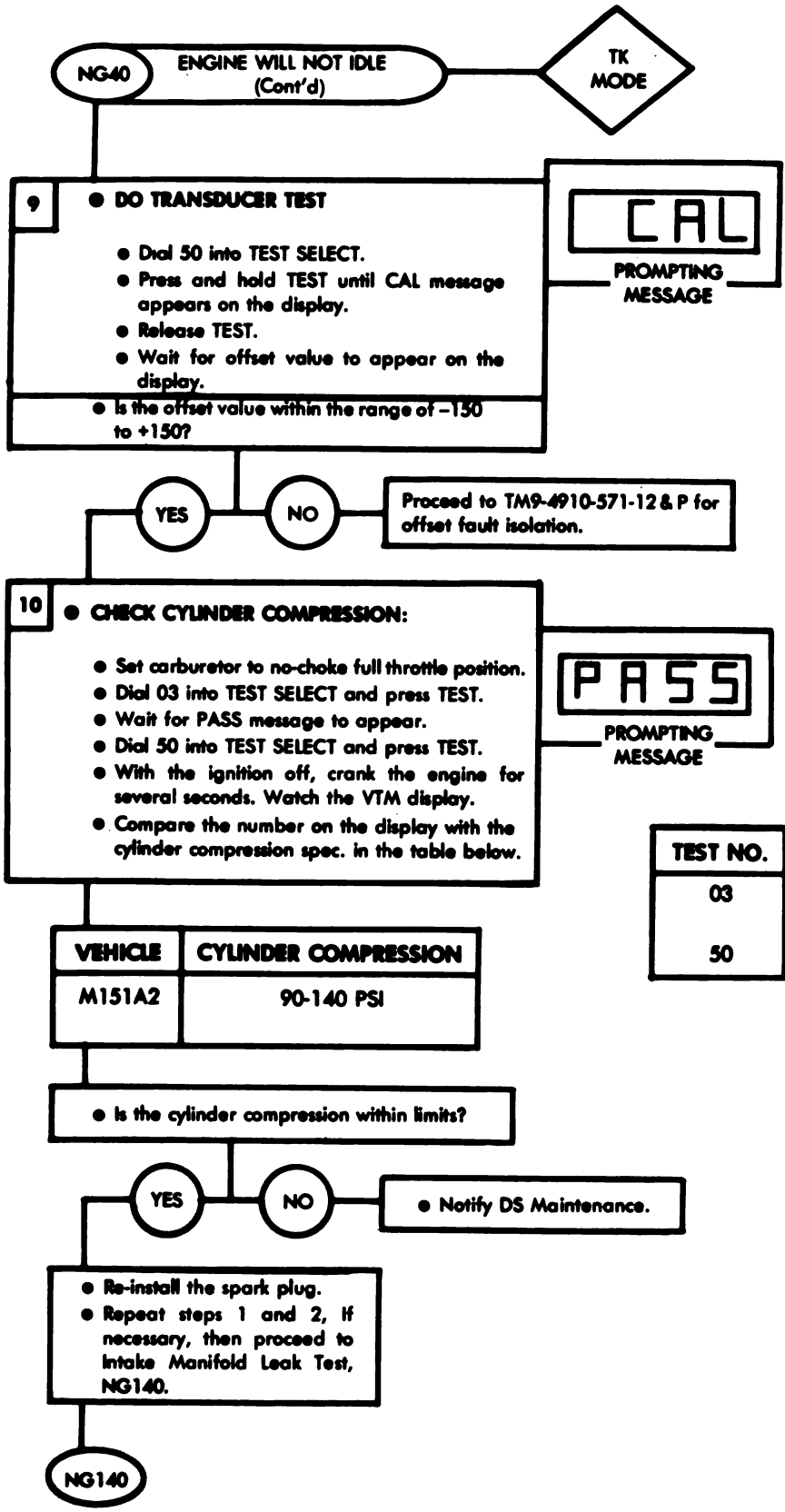


CYLINDER COMPRESSION HOOKUP

TA 159988

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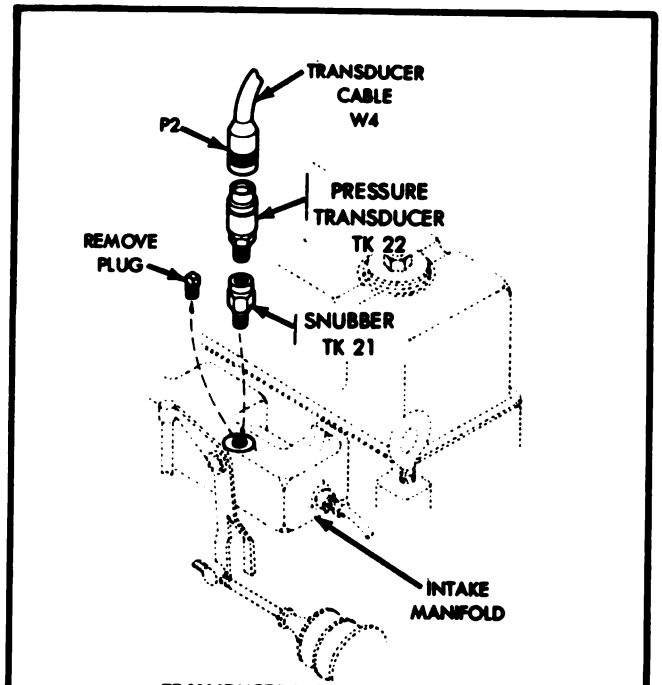
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155909

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TRANSDUCER INSTALLATION — MANIFOLD VACUUM

NG50 POWER TEST FAULT ISOLATION — TK MODE

CAUTION

Failure to use snubber in the following test will damage the transducer.

1 ● **INSTALL TRANSDUCER:**

- Remove the plug from the top of the intake manifold.
- Install the snubber and pressure transducer (red stripe) in place of removed plug as shown.
- Connect P1 of transducer cable W4 to J2 on the VTM.
- Connect P2 of the transducer cable to the connector on the transducer.

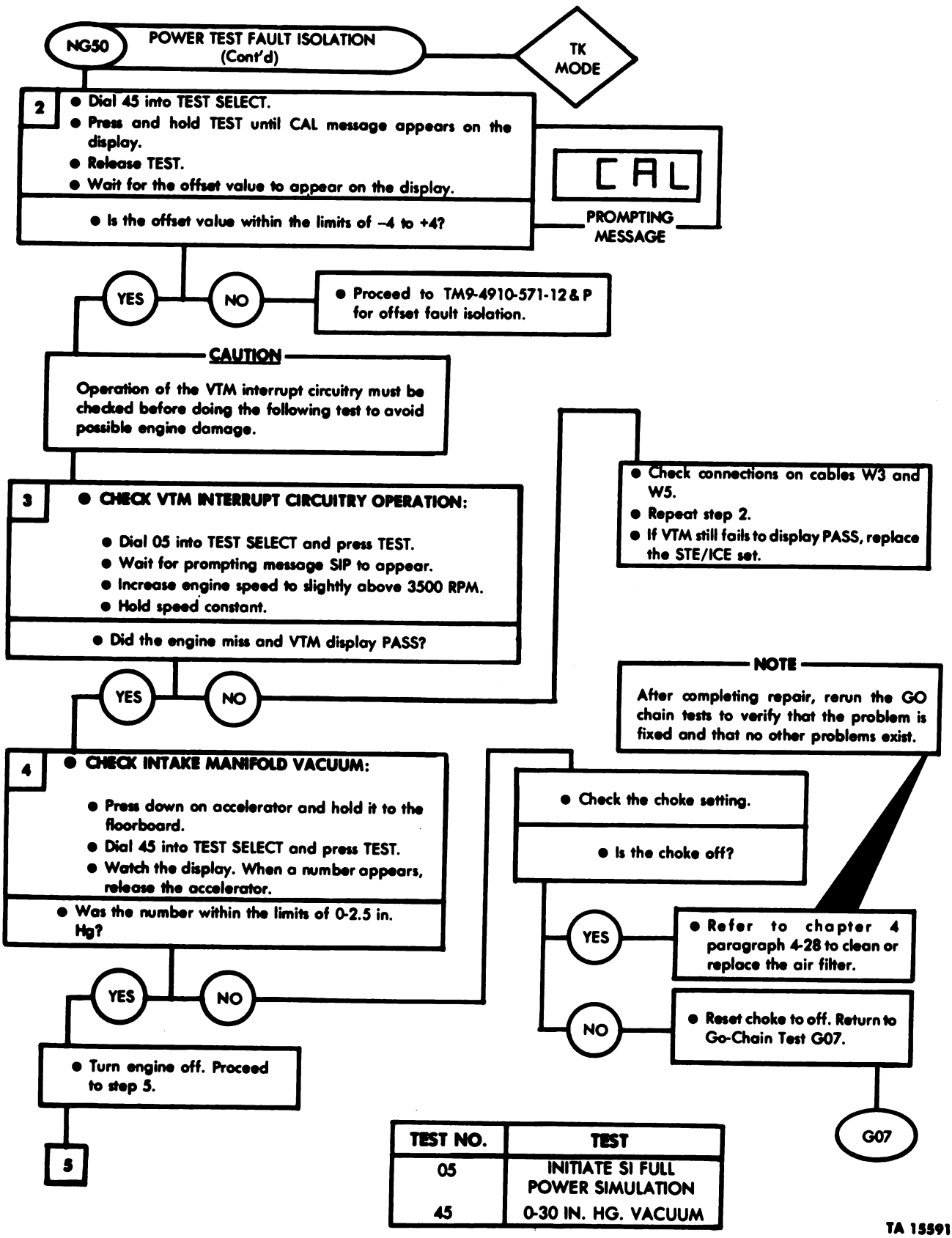
● Proceed to step 2.

2

TA 189710

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

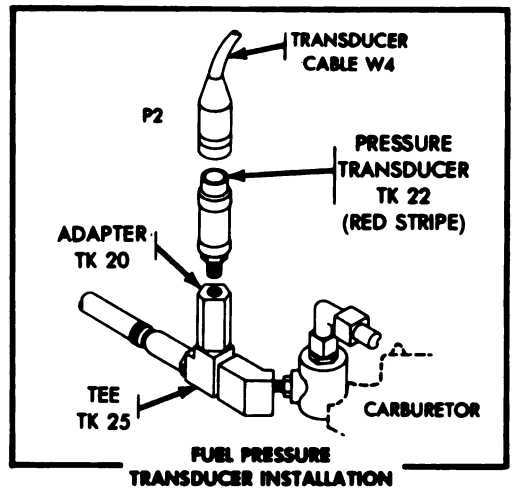


TEST NO.	TEST
05	INITIATE SI FULL POWER SIMULATION
45	0-30 IN. HG. VACUUM

TA 155911

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



FUEL PRESSURE TRANSDUCER INSTALLATION

NG50 POWER TEST FAULT ISOLATION (Cont'd)

TK MODE

5

- **INSTALL TRANSDUCER:**
  - Remove the fuel line at the carburetor (see illustration).
  - Install pressure transducer (red stripe) and necessary fittings as shown.
  - Connect P1 of transducer cable W4 to J2 on the VTM.
  - Connect P2 of the transducer cable W4 to the connector on the transducer.

CAUTION

Do not overtighten fittings into the fuel pump or carburetor because they may crack pump or carburetor body.

6

- **DO TRANSDUCER OFFSET:**
  - Dial 49 into TEST SELECT.
  - Press and hold TEST until CAL message appears on display.
  - Release TEST.
  - Wait for the offset value to appear on display.

CAL

PROMPTING MESSAGE

- Is the offset value within the limits of −4 to +4?

YES

- Proceed to step 7.

7

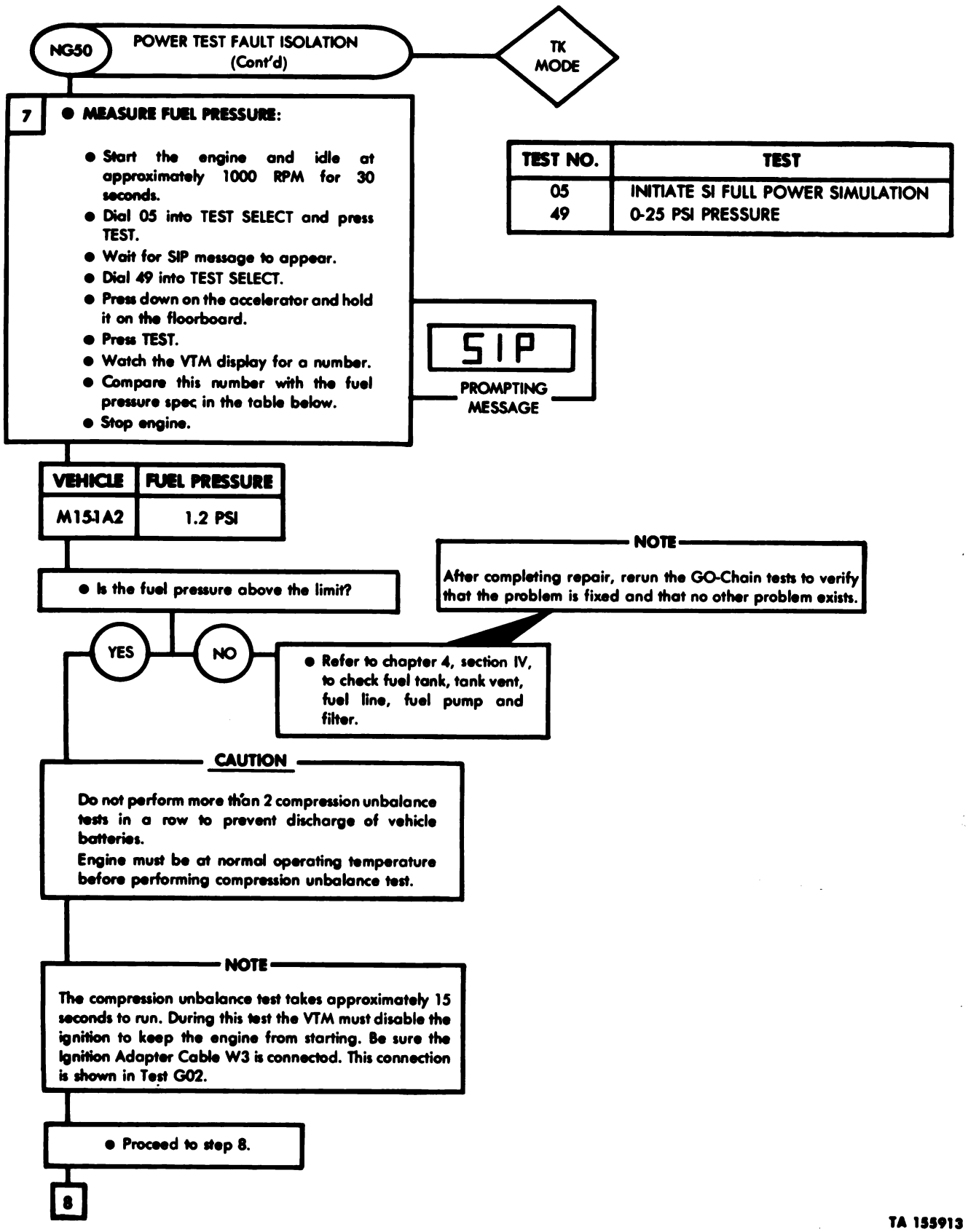
NO

- Proceed to TM9-4910-571-12&P for offset fault isolation.

TA 159912

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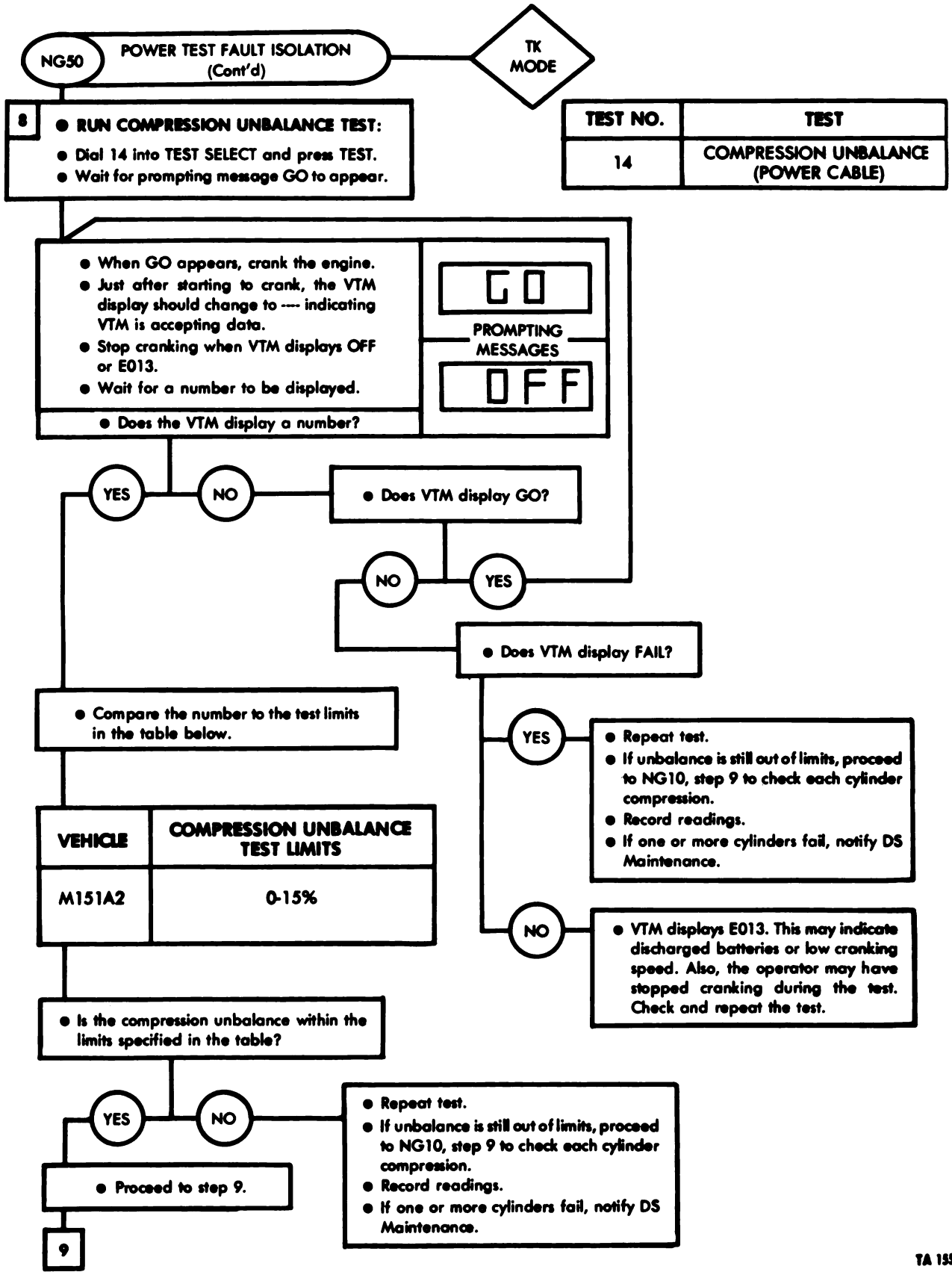
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155913

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG50 POWER TEST FAULT ISOLATION (Cont'd)

TK MODE

9 ● CHECK FOR EXHAUST SYSTEM BLOCKAGE:

● Check the exhaust system for crushed parts or blocked pipe.

● Is the exhaust system OK?

YES

NO

● Refer to chapter 4, section VI, to replace parts.

NOTE

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

NOTE

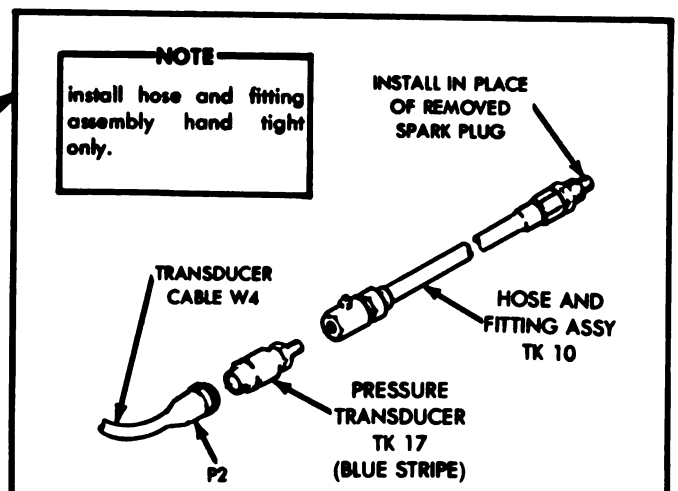
Do the following steps for only one cylinder.

10 ● INSTALL ADAPTER AND TRANSDUCER:

- Remove a spark plug and install the hose and fitting assembly in its place.
- If the vehicle has failed the compression balance test, remove all spark plugs.
- Install pressure transducer (blue stripe) onto the hose and fitting assembly.
- Connect P1 of transducer cable W4 to J2 or J3 on the VTM.
- Connect P2 of the transducer cable to the connector on the transducer.

NOTE

install hose and fitting assembly hand tight only.



CYLINDER COMPRESSION HOOKUP

11 ● DO TRANSDUCER OFFSET:

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



PROMPTING MESSAGE

● Is the offset value within the range of −150 to +150?

YES

NO

● Proceed to TM9-4910-571-12&P for offset fault isolation.

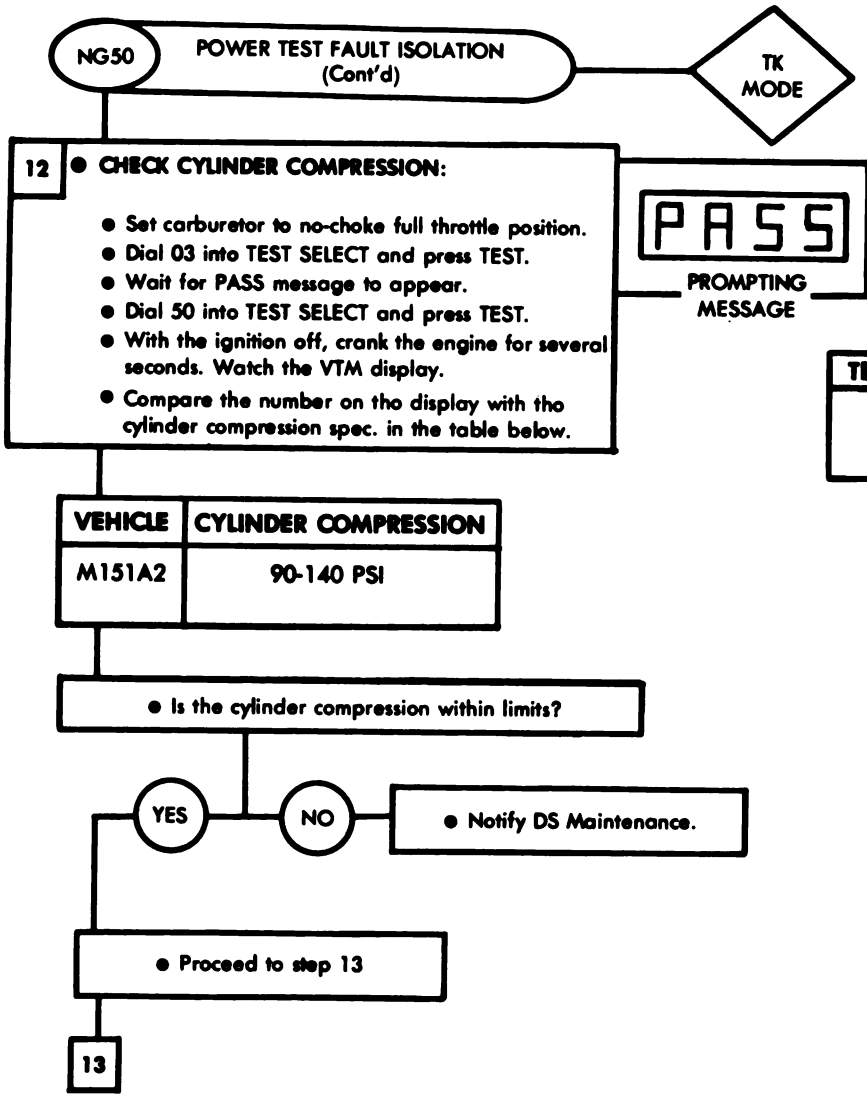
● Proceed to step 12.

12

TA 155915

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

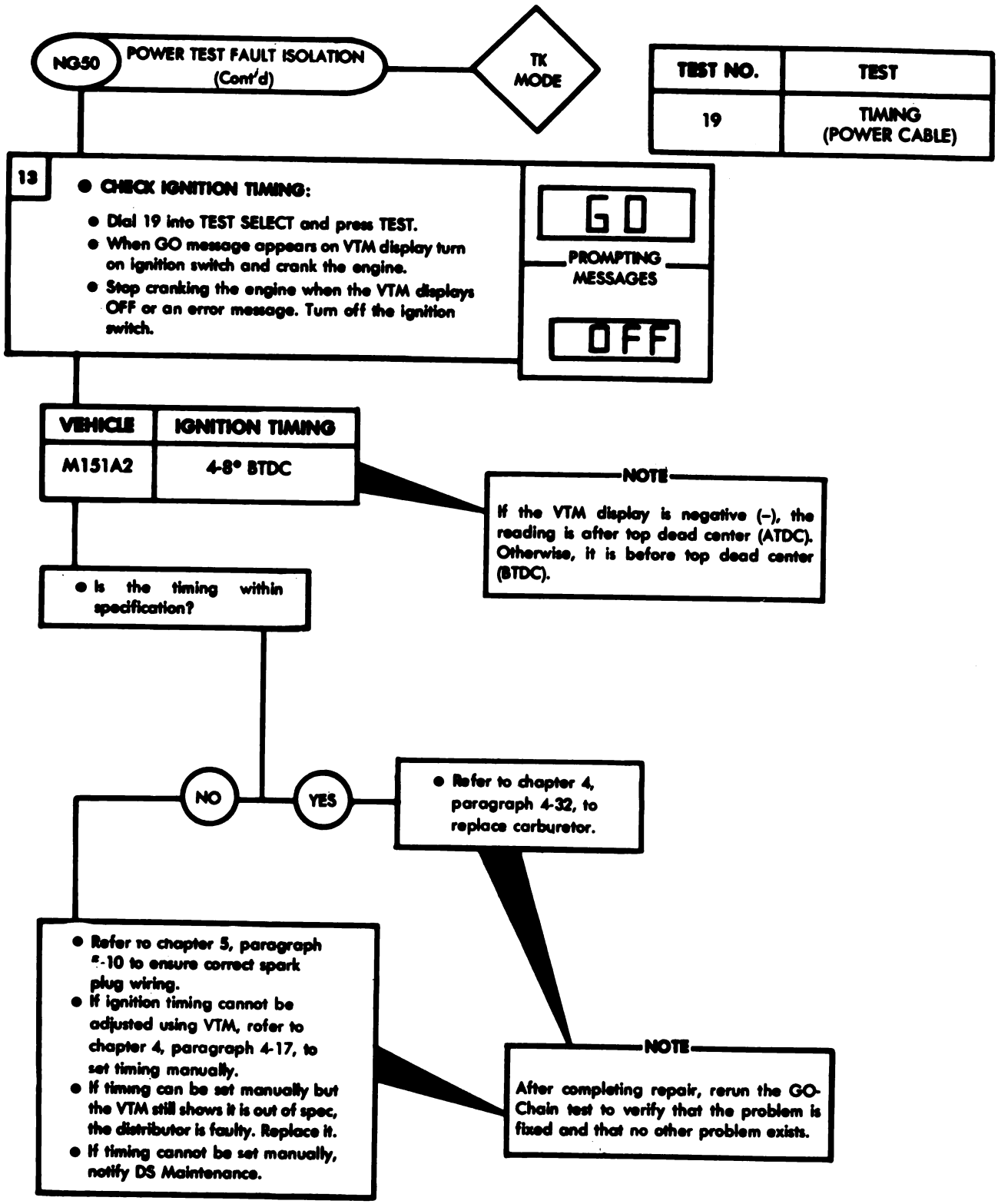


TEST NO.	TEST
03	DISPLAY MAXIMUM VALUE DETECTED FOR NEXT TEST
50	0-1000 PSI

TA 159916

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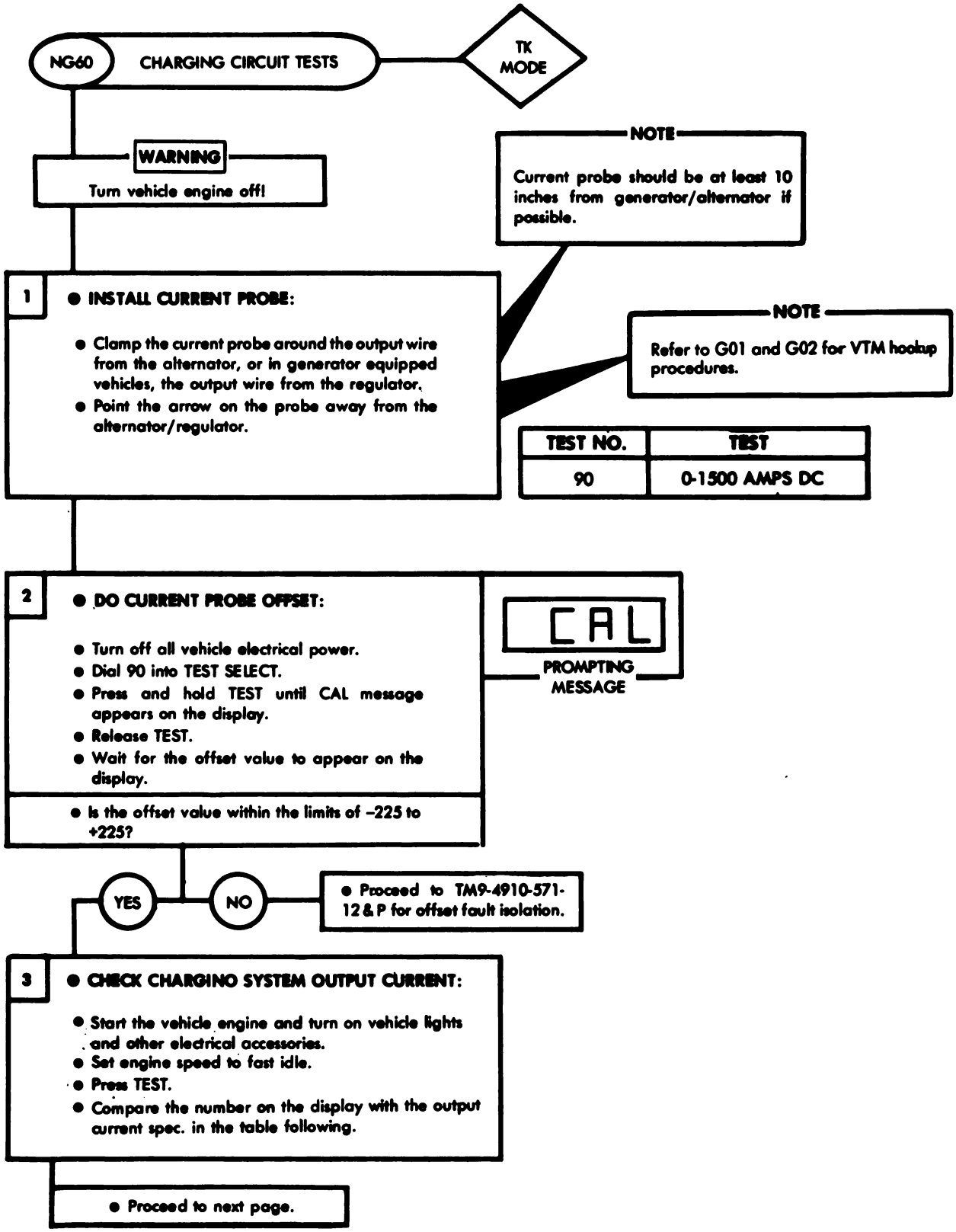
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155917

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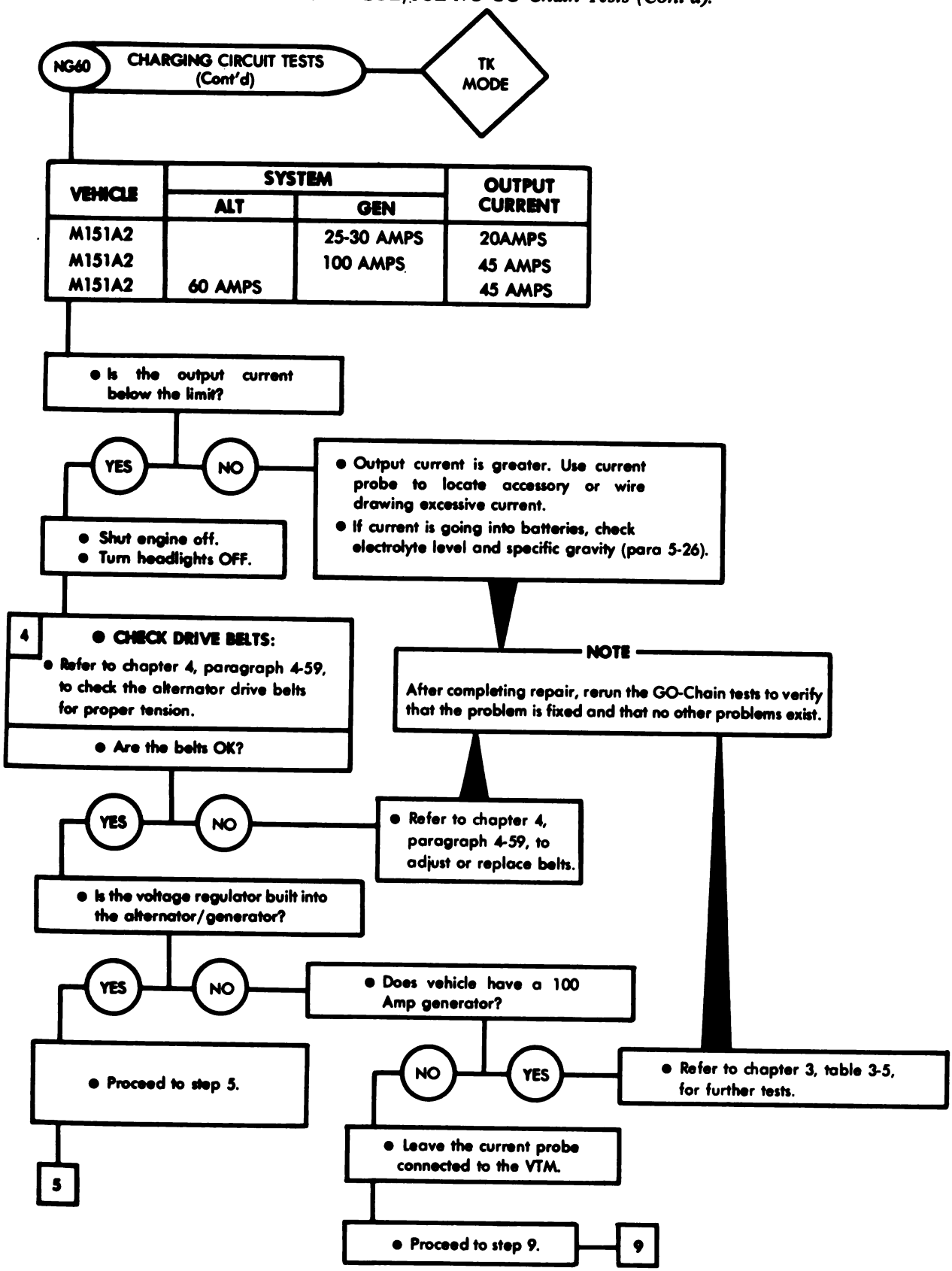
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 189718

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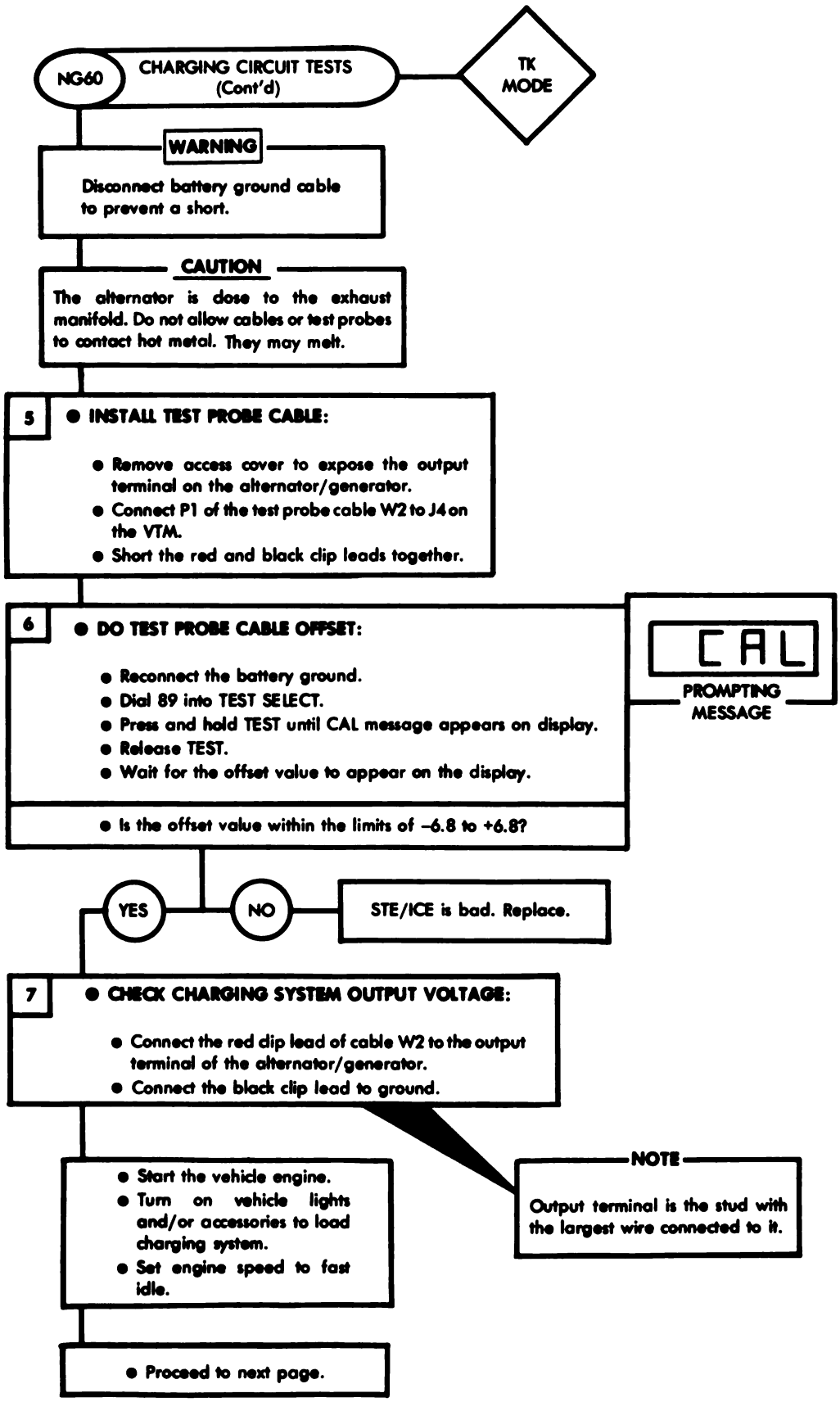
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155919

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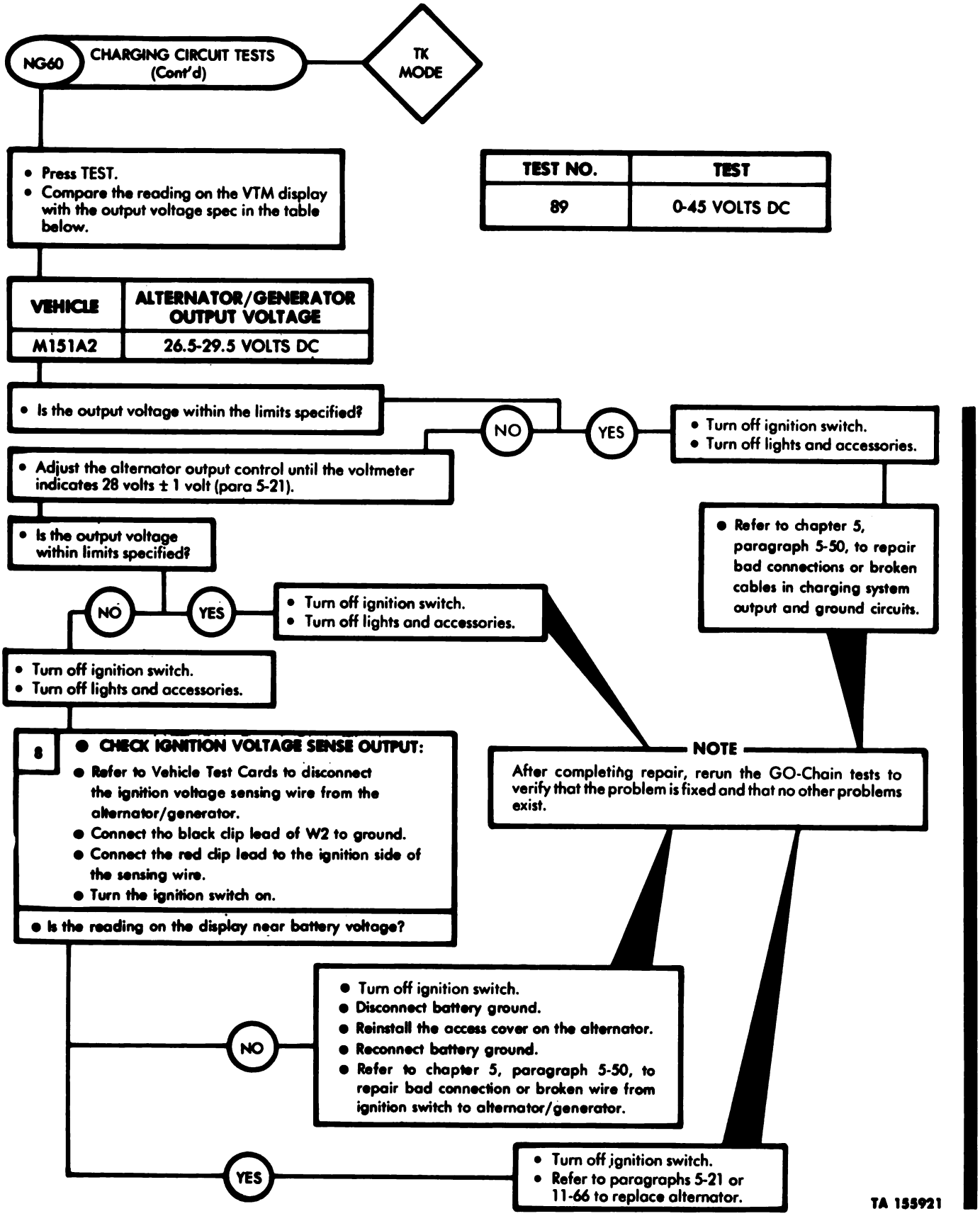
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 159930

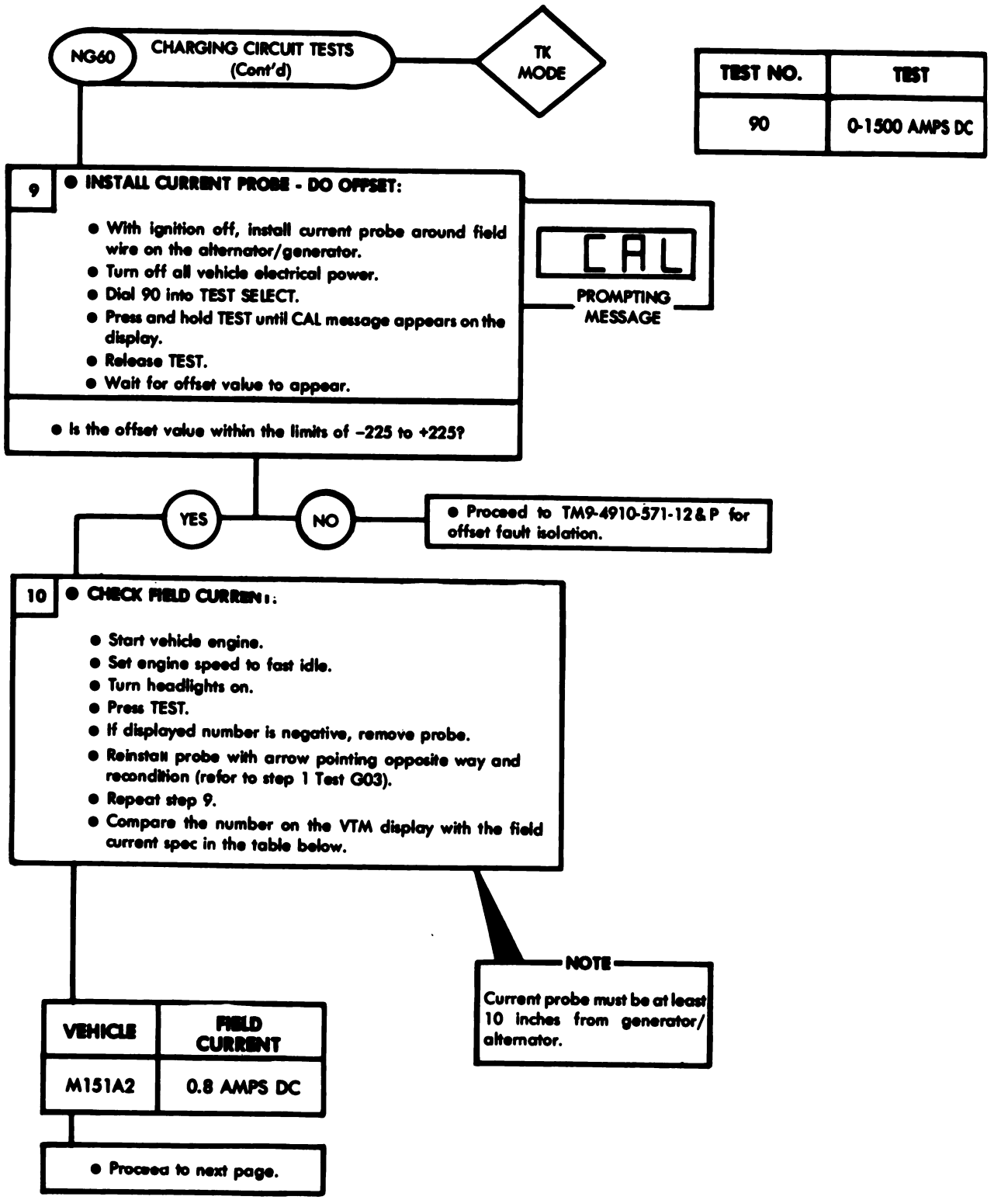
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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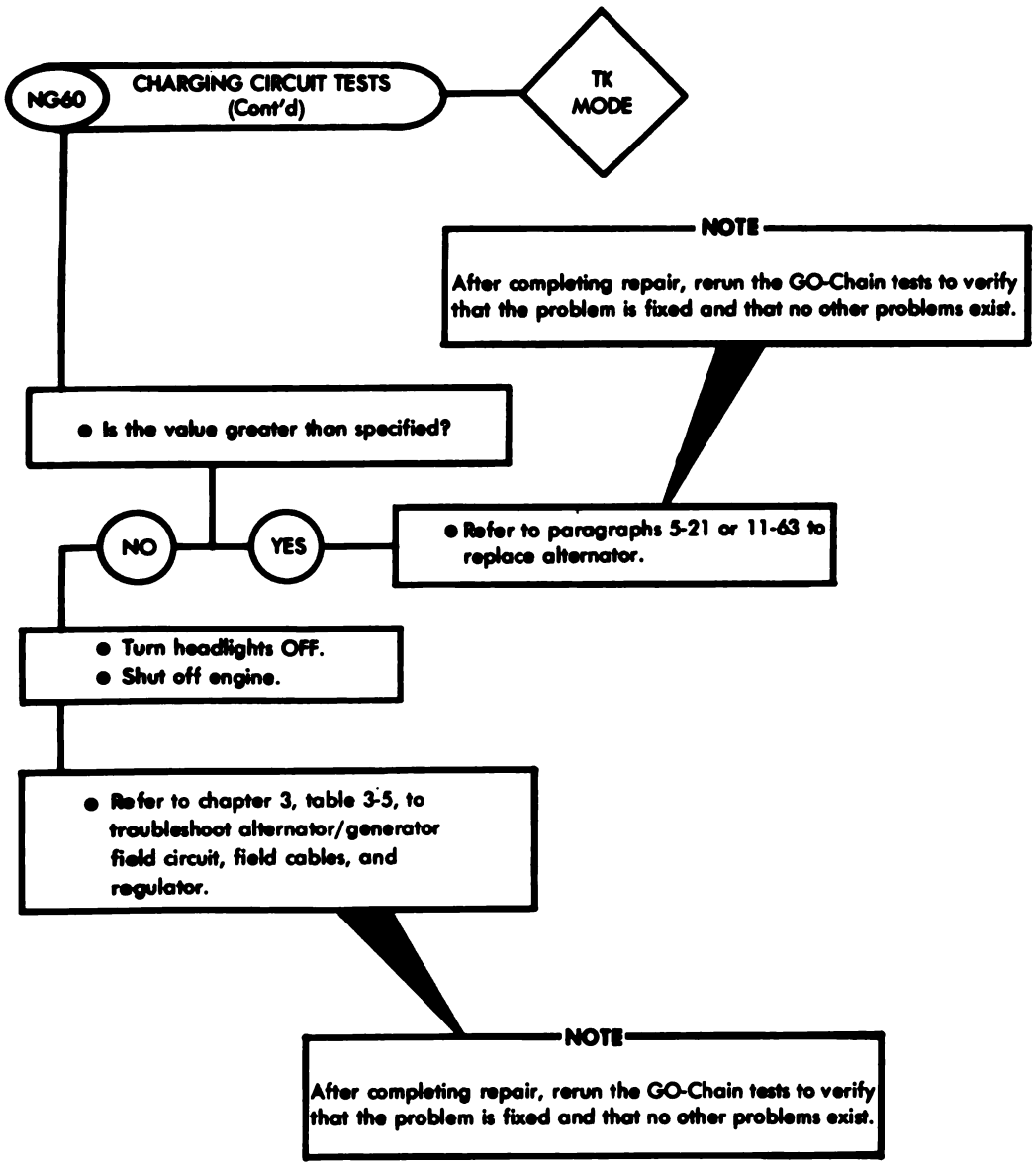
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 158922

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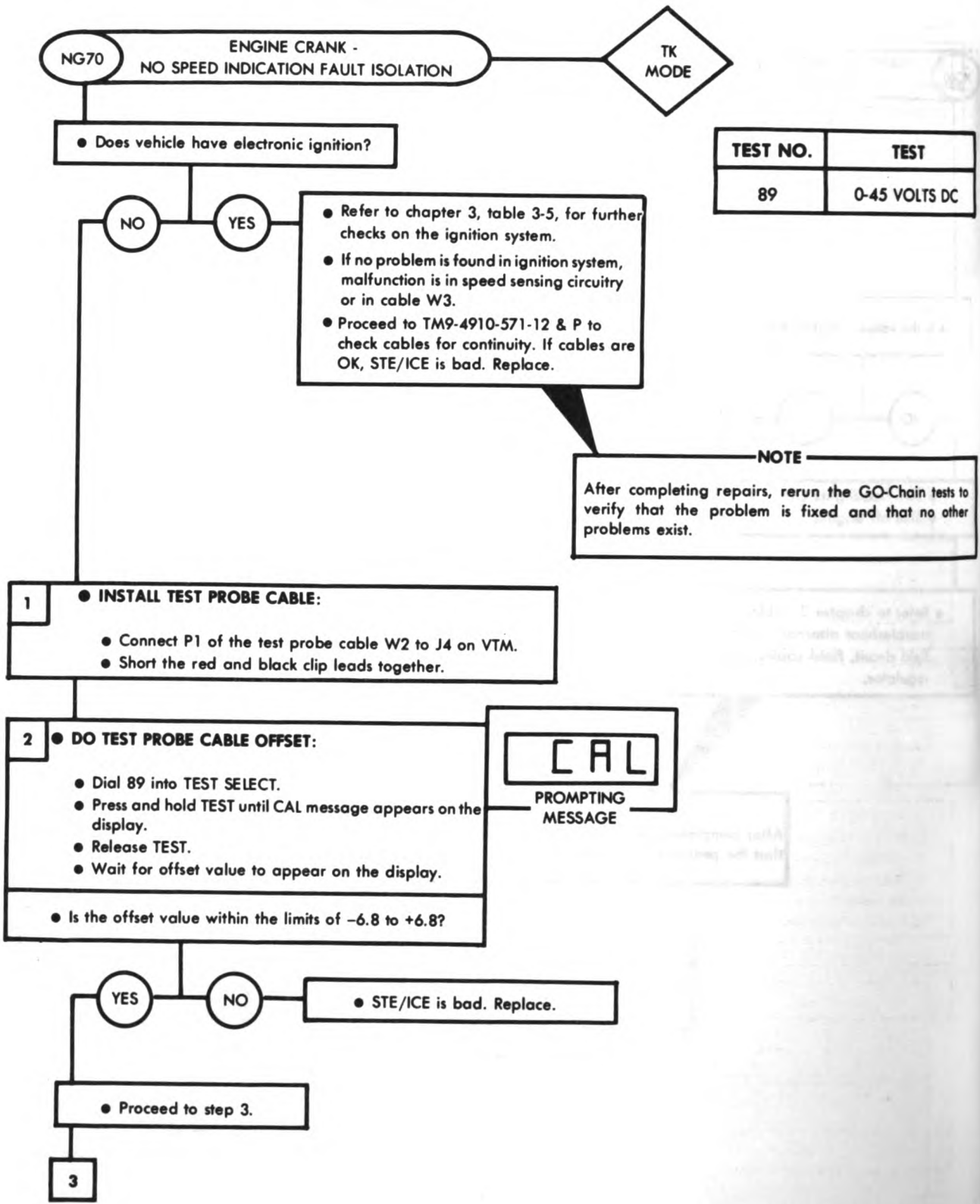
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155923

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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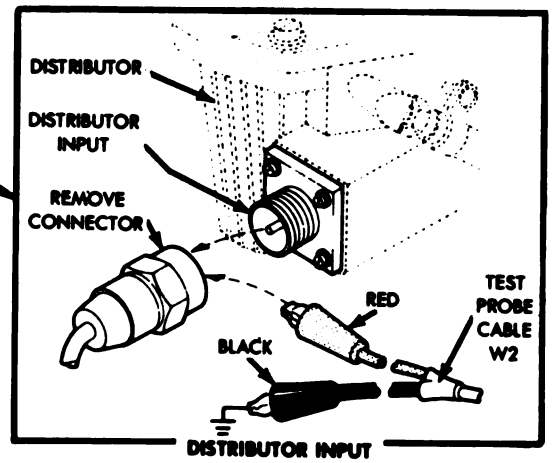
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG70 ENGINE CRANK - NO SPEED INDICATION FAULT ISOLATION (Cont'd)

TK MODE

3 ● CHECK DISTRIBUTOR INPUT VOLTAGE:

- Remove the primary input connector to the distributor.
- Hold the red clip lead of W2 to the center conductor of the connector as shown.
- Connect the black clip lead to a good ground.
- Set the ignition switch to ON.
- Press TEST.



DISTRIBUTOR INPUT VOLTAGE — M151A2

- Is reading on the VTM display near battery voltage?

YES / NO

- Voltage is low. Refer to chapter 3, table 3-5, to check ignition switch and primary wiring.

NOTE

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

- Turn off the ignition switch.
- Re-connect the primary input connector to the distributor.

4 ● MEASURE VOLTAGE DROP ACROSS POINTS:

- Connect the red lead to cable W2 of the ignition adapter.
- Connect the black clip lead to a good ground.
- Set the ignition switch to ON.

- Press TEST.
- If the displayed reading is close to battery voltage, the points are open. This check is performed with the points closed.
- Cause the points to close by briefly engaging the starter motor.

- Is the voltage reading on the display 0.2 volts or less?

YES / NO

- Check distributor ground and points.

NOTE

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

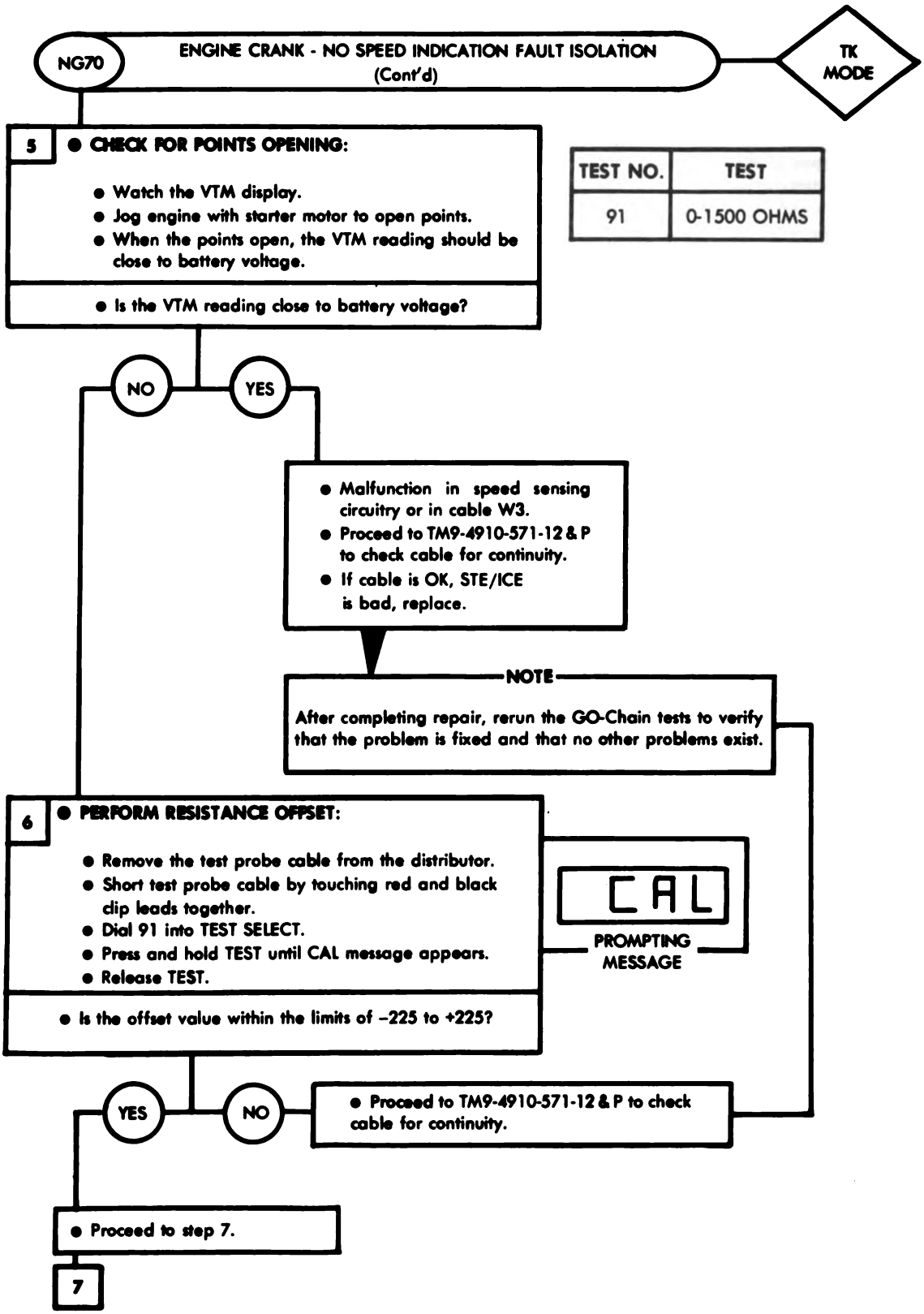
- Proceed to step 5.

5

TA 155925

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TEST NO.	TEST
91	0-1500 OHMS

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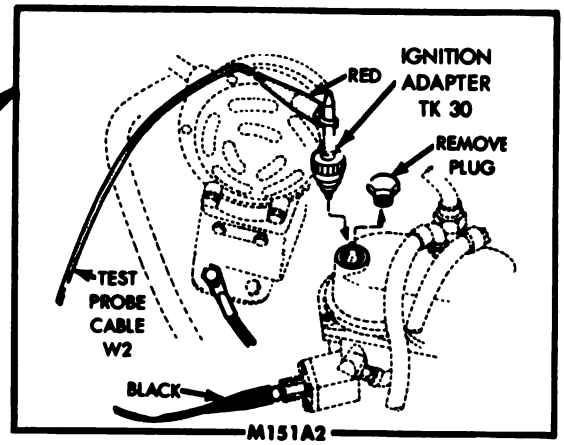
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

NG70 ENGINE CRANK - NO SPEED INDICATION FAULT ISOLATION (Cont'd)

TK MODE

7 ● CHECK RESISTANCE OF COIL PRIMARY:

- Disconnect the primary input cable to the distributor as in step 3.
- Connect red lead of the test probe cable W2 to the ignition adapter.
- Connect the black lead of the test probe cable to primary input pin on the distributor as shown.
- Compare the reading on the VTM with the specification in the table below.



VEHICLE	COIL PRIMARY RESISTANCE	
	NORMAL RANGE COLD	NORMAL RANGE HOT
M151A2	5 to 8 OHMS	9 to 12 OHMS

● Is the coil primary resistance within specification?

NO ● Refer to chapter 5, paragraph 5-9, to replace coil.

NOTE

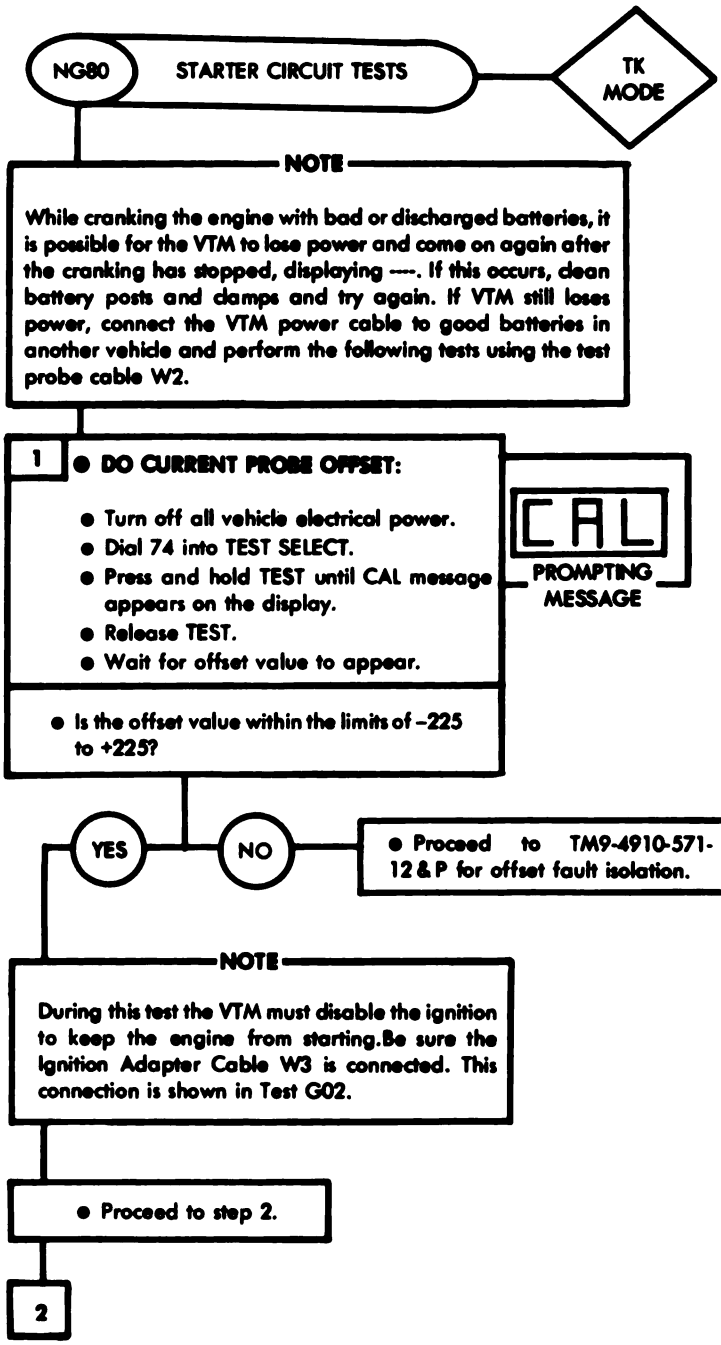
After completing repair, rerun the GO-Chain tests to verify that the problem is fixed and that no other problems exist.

YES ● Refer to chapter 5, paragraph 5-5, to replace points. Notify DS maintenance to replace capacitor.

TA 155927

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

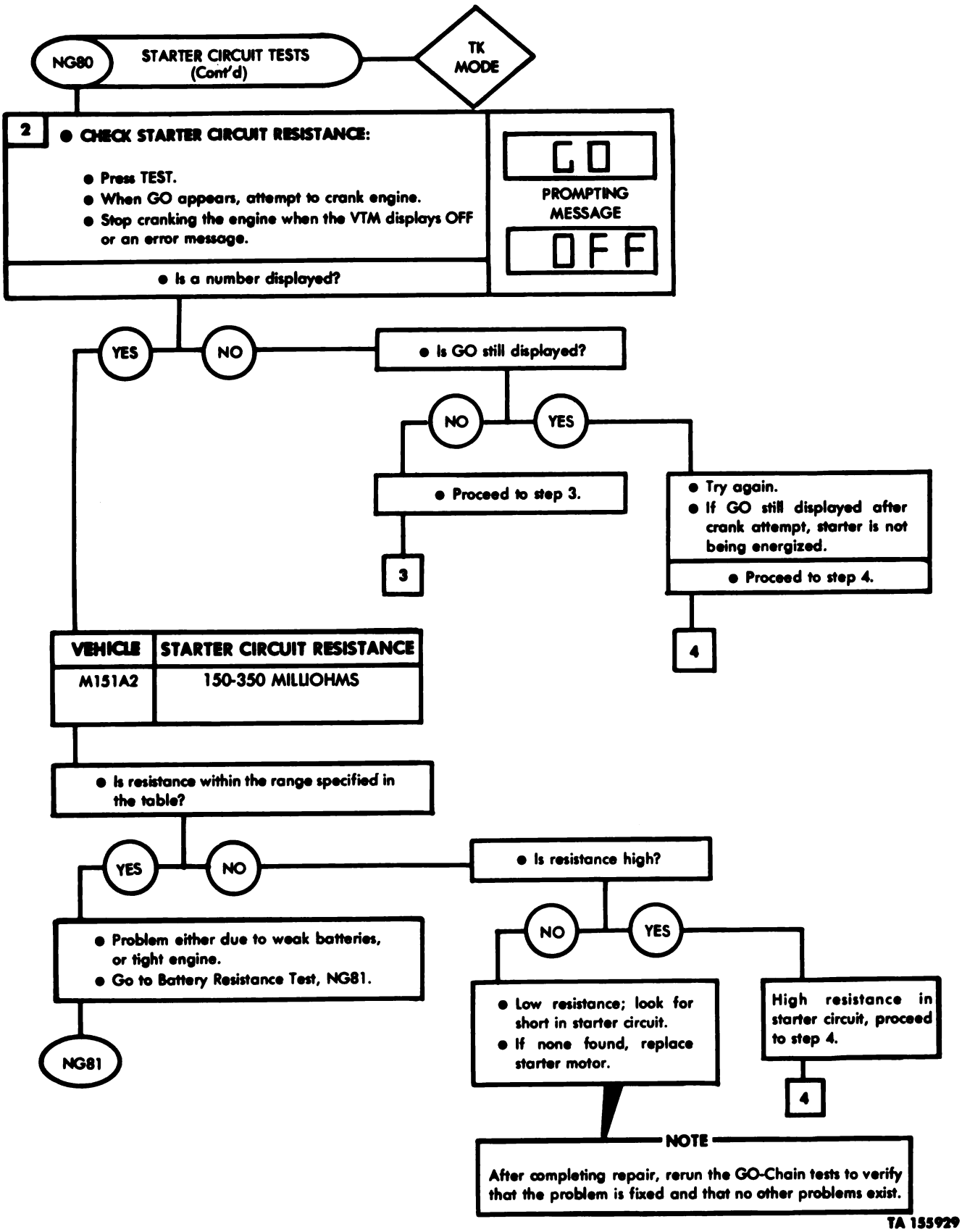


TEST NO.	TEST
74	STARTER CIRCUIT RESISTANCE

TA 159928

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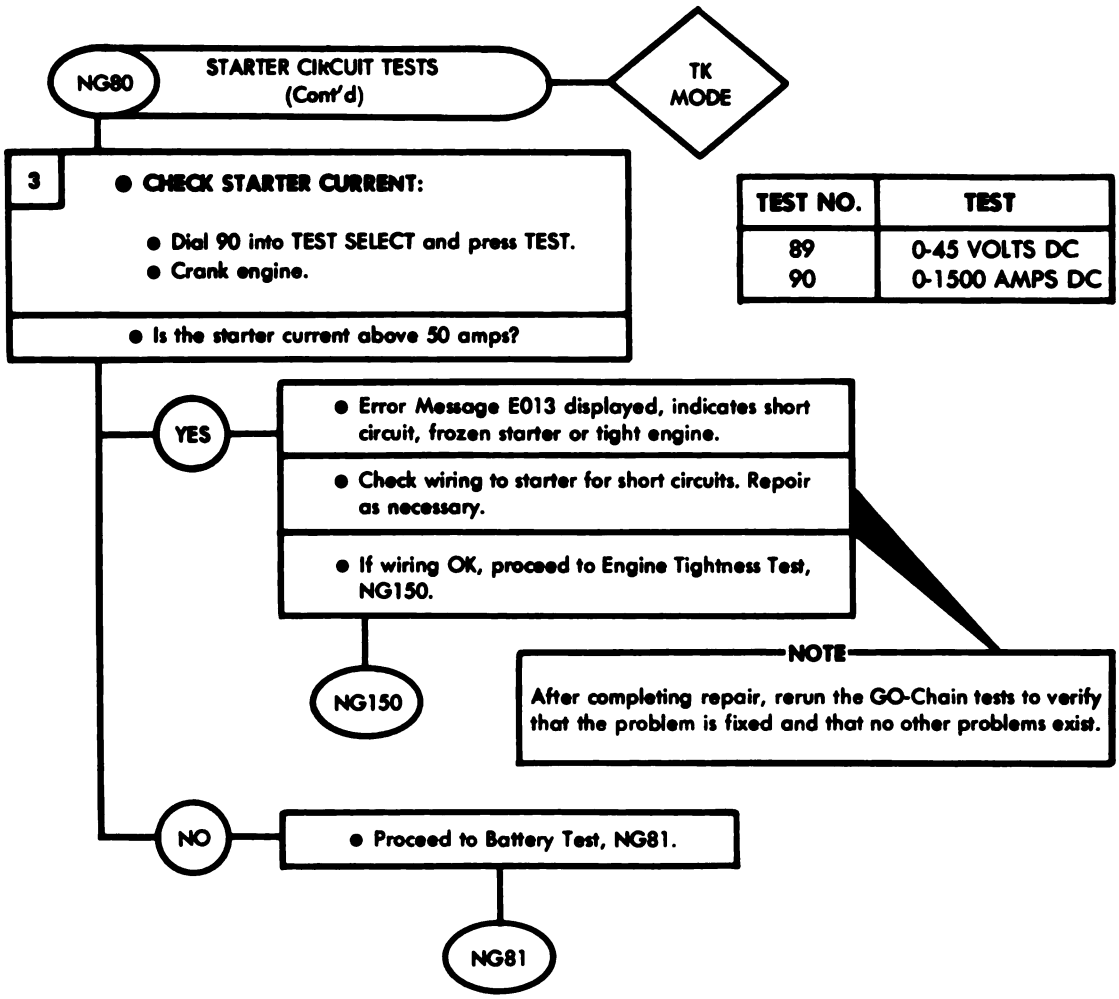
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155929

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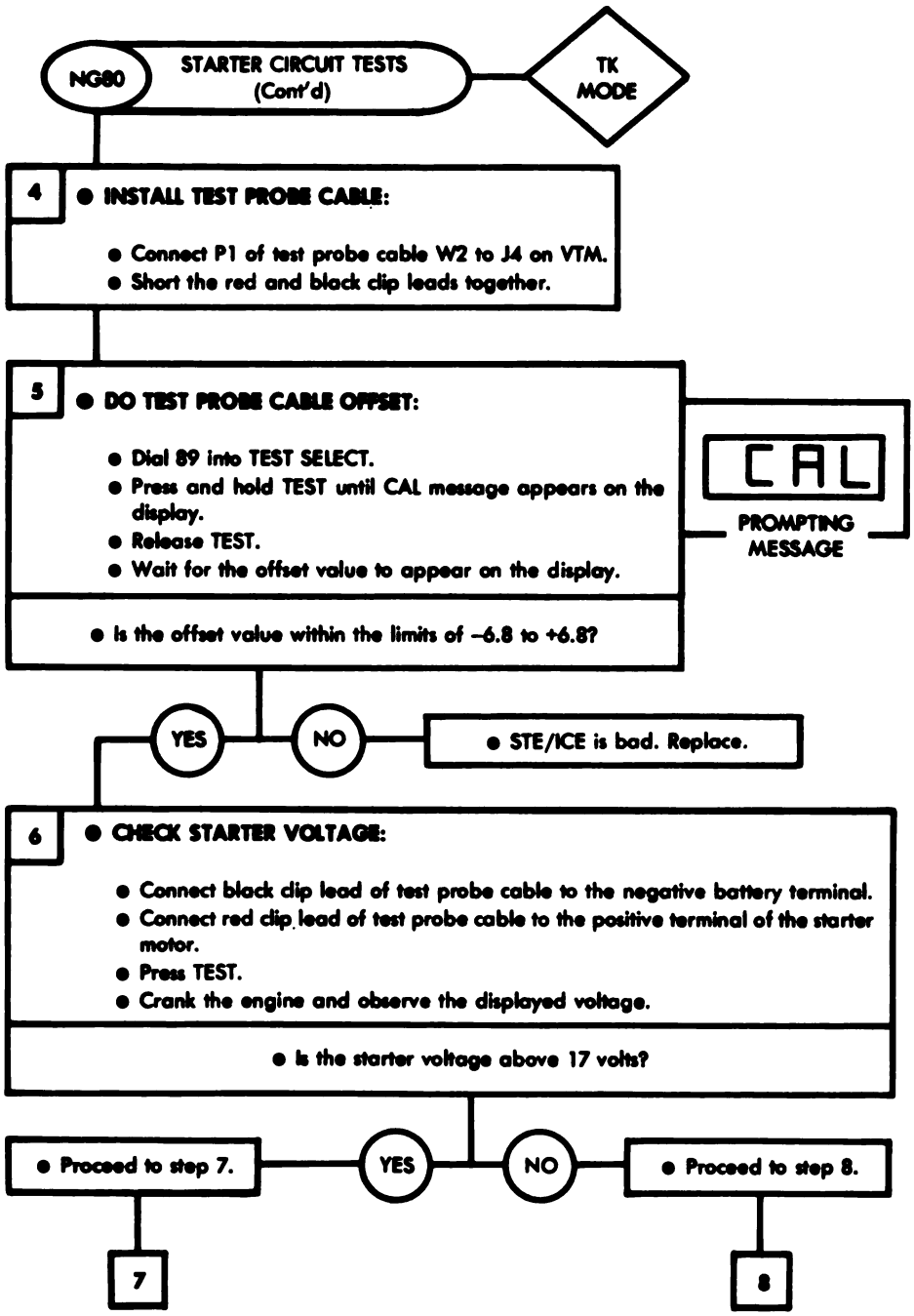
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 159930

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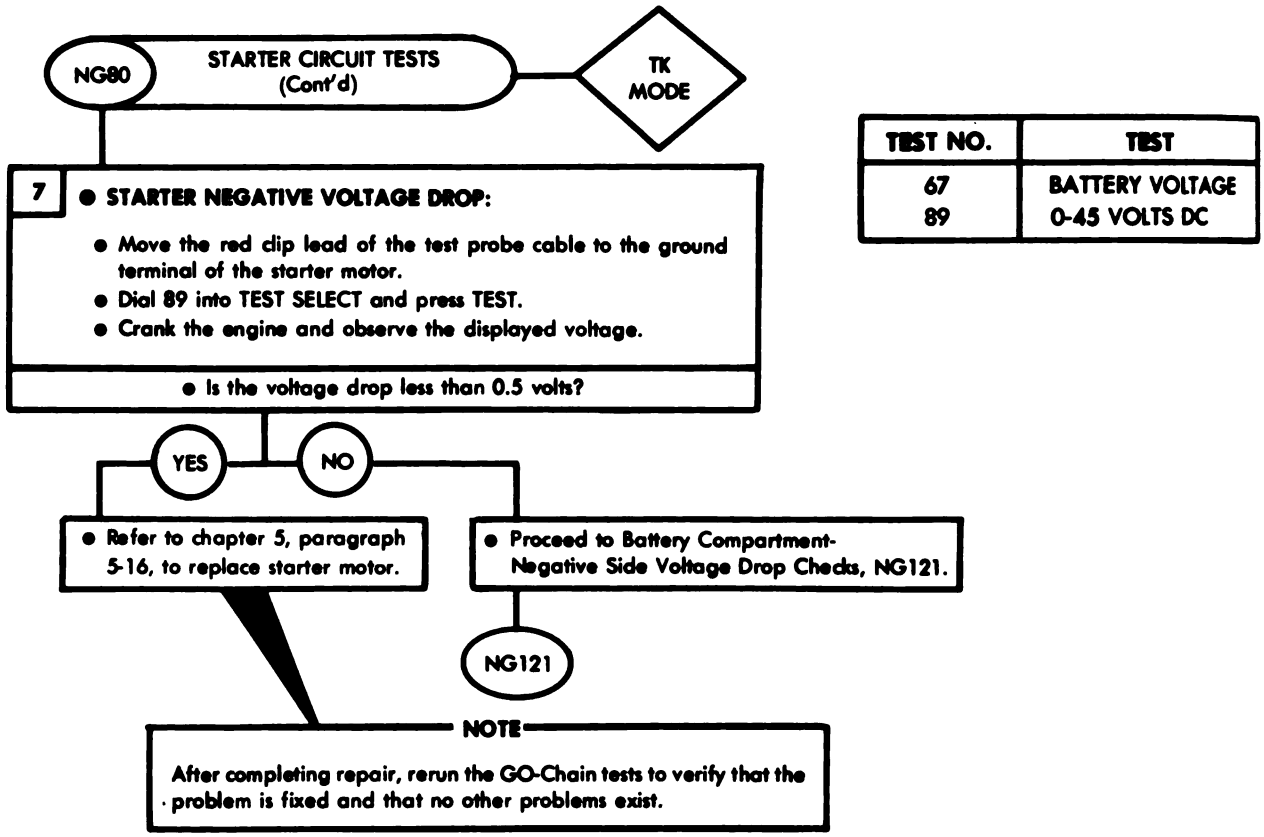
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155931

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

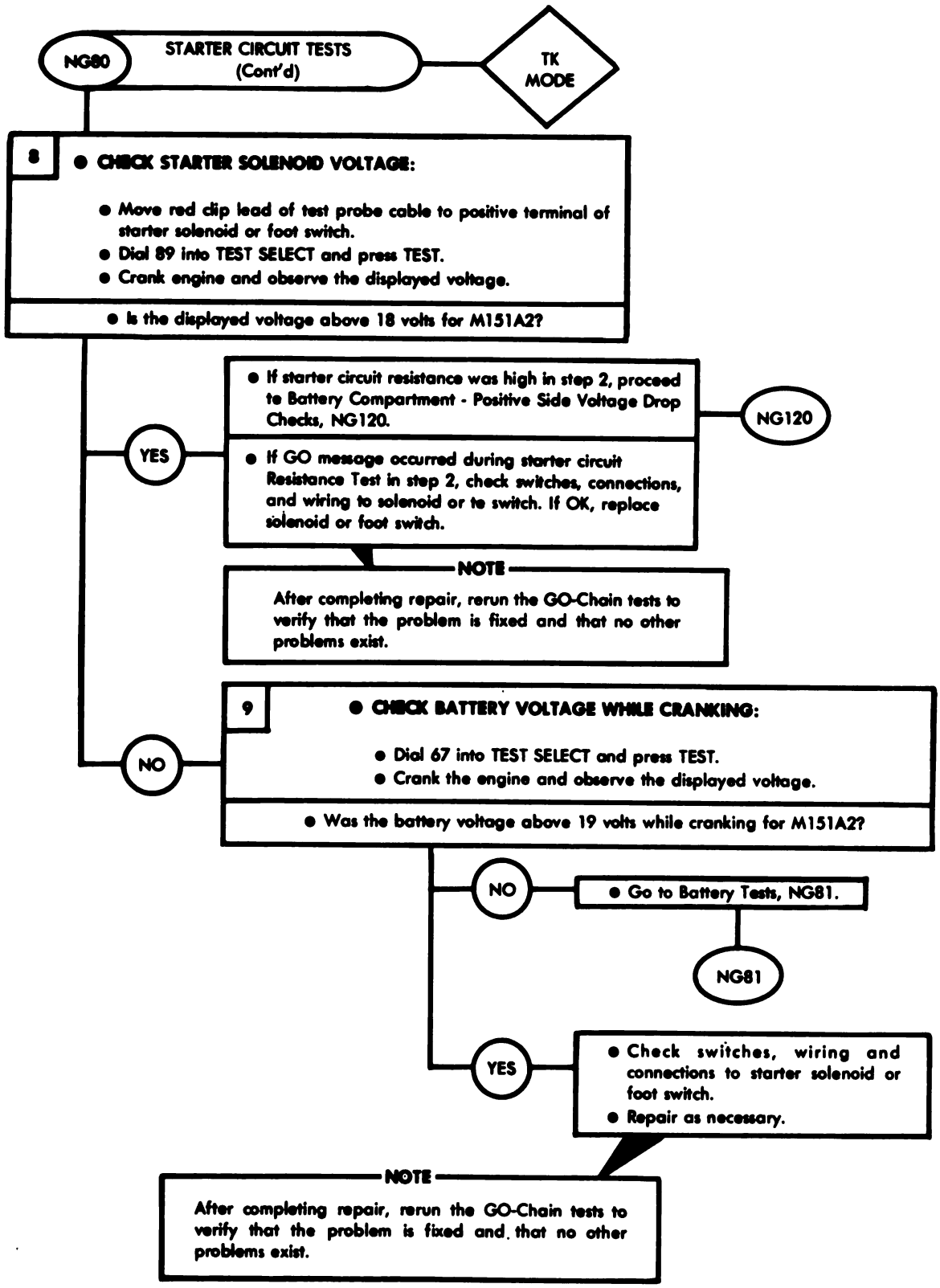


TEST NO.	TEST
67 89	BATTERY VOLTAGE 0-45 VOLTS DC

TA 159932

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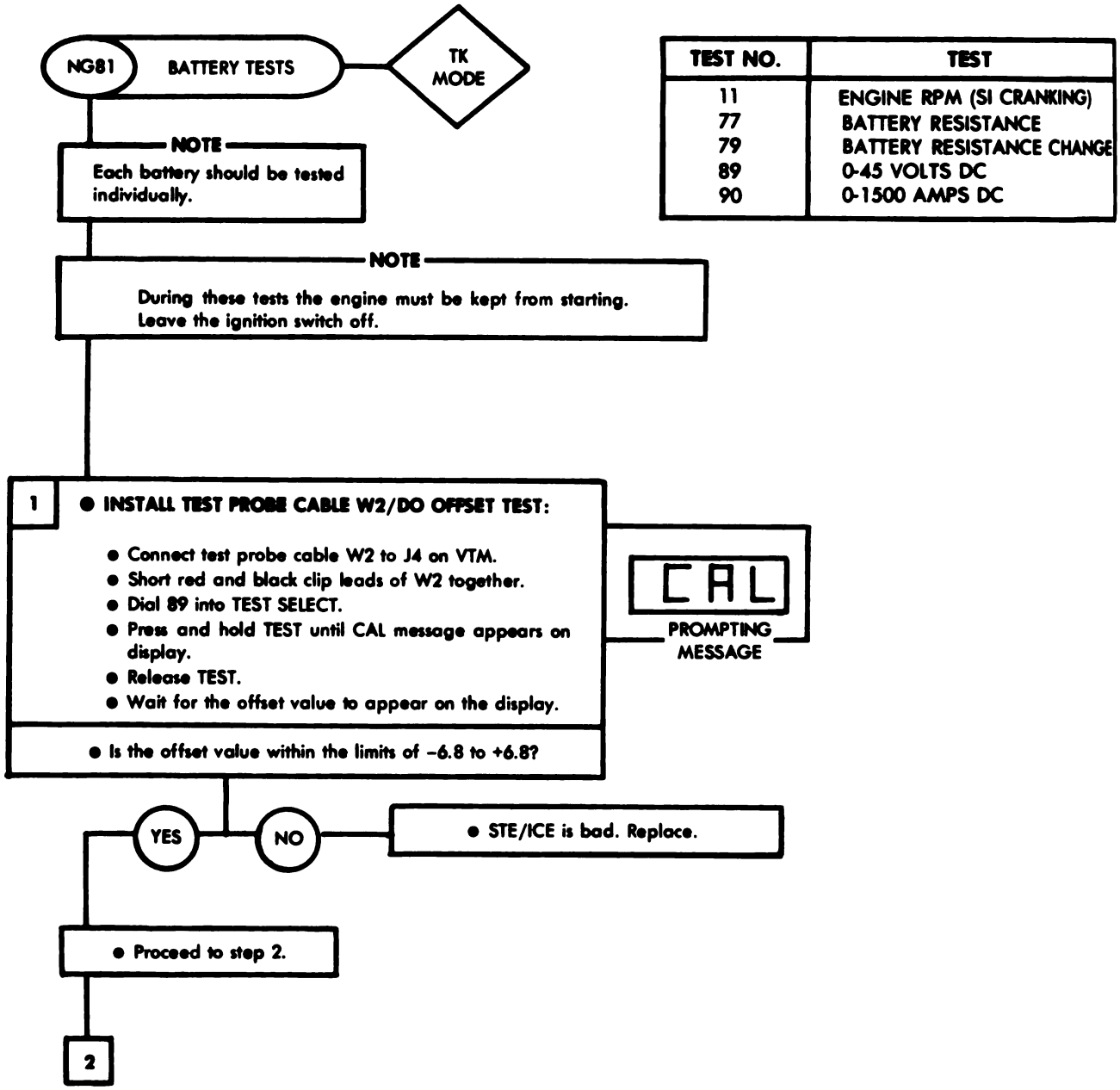
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155933

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

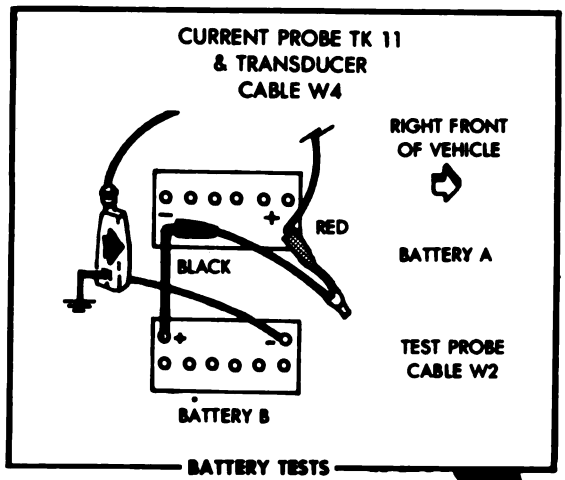


TEST NO.	TEST
11	ENGINE RPM (SI CRANKING)
77	BATTERY RESISTANCE
79	BATTERY RESISTANCE CHANGE
89	0-45 VOLTS DC
90	0-1500 AMPS DC

TA 155934

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



NG81 BATTERY TESTS (Cont'd)

TK MODE

NOTE

The current probe is kept in the same place for testing each battery.
The test probe cable W2 is first connected to battery A for testing battery A.
The test probe cable W2 is then connected to battery B for testing battery B.

2 ● **CONNECT CABLE W2:**

- Connect red clip lead of cable W2 to positive post of battery being tested.
- Connect black clip lead of cable W2 to negative post of battery being tested.

3 ● **CONDITION CURRENT PROBE - DO OFFSET:**

- Clamp the current probe around negative battery cable connected to ground. Point the arrow on the probe toward the batteries.
- Dial 11 into TEST SELECT and press TEST.
- Attempt to crank the engine for several cycles.

- Turn off all vehicle electrical power.
- Dial 90 into TEST SELECT.
- Press and hold TEST until CAL message appears on display.
- Release TEST
- Wait for offset value to appear.



PROMPTING MESSAGE

- Is the offset value within the limits of −225 to +225?

YES

NO

- Proceed to TM9-4910-571-12&P for offset fault isolation.

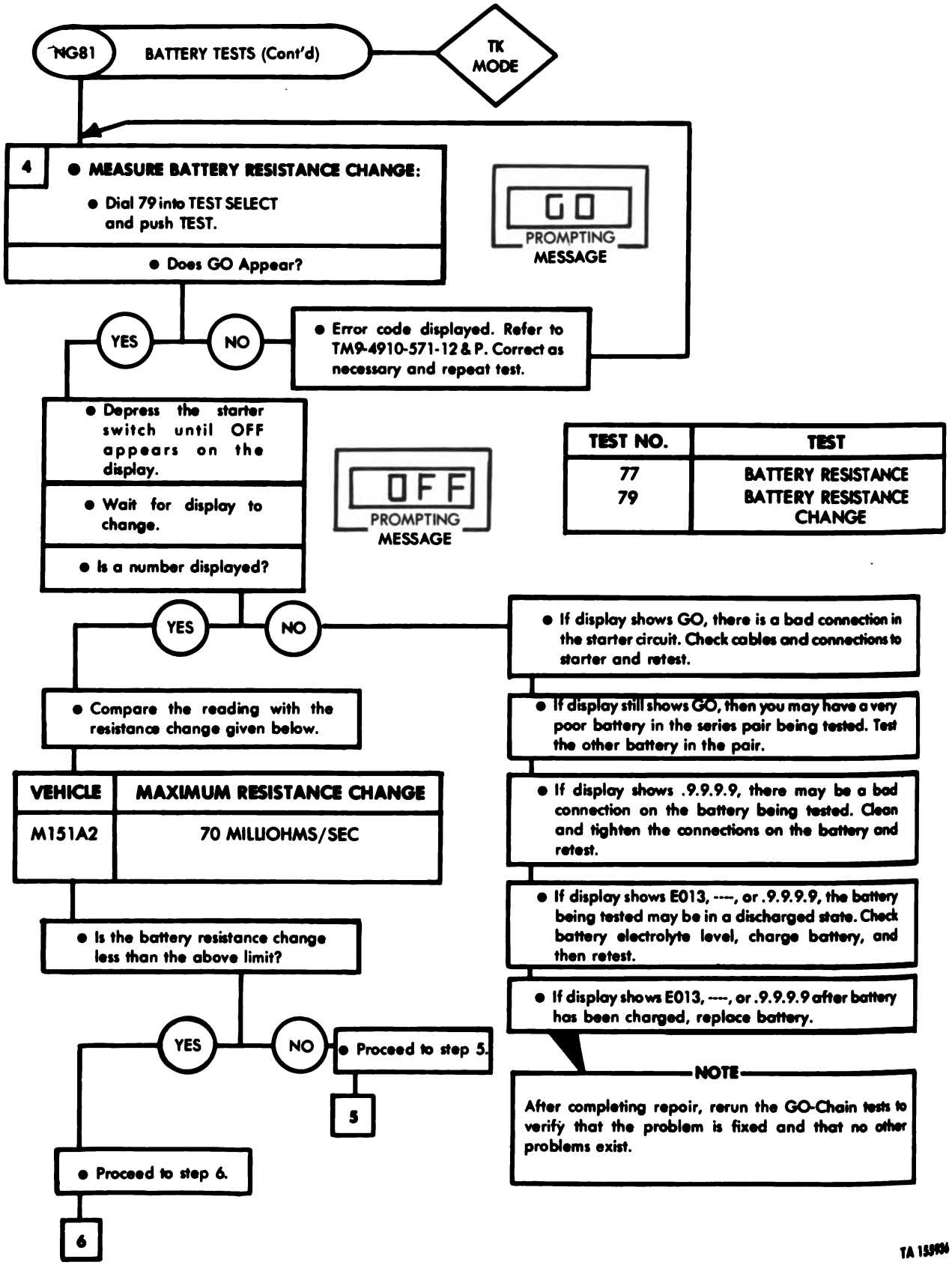
- Proceed to step 4.

4

TA 155935

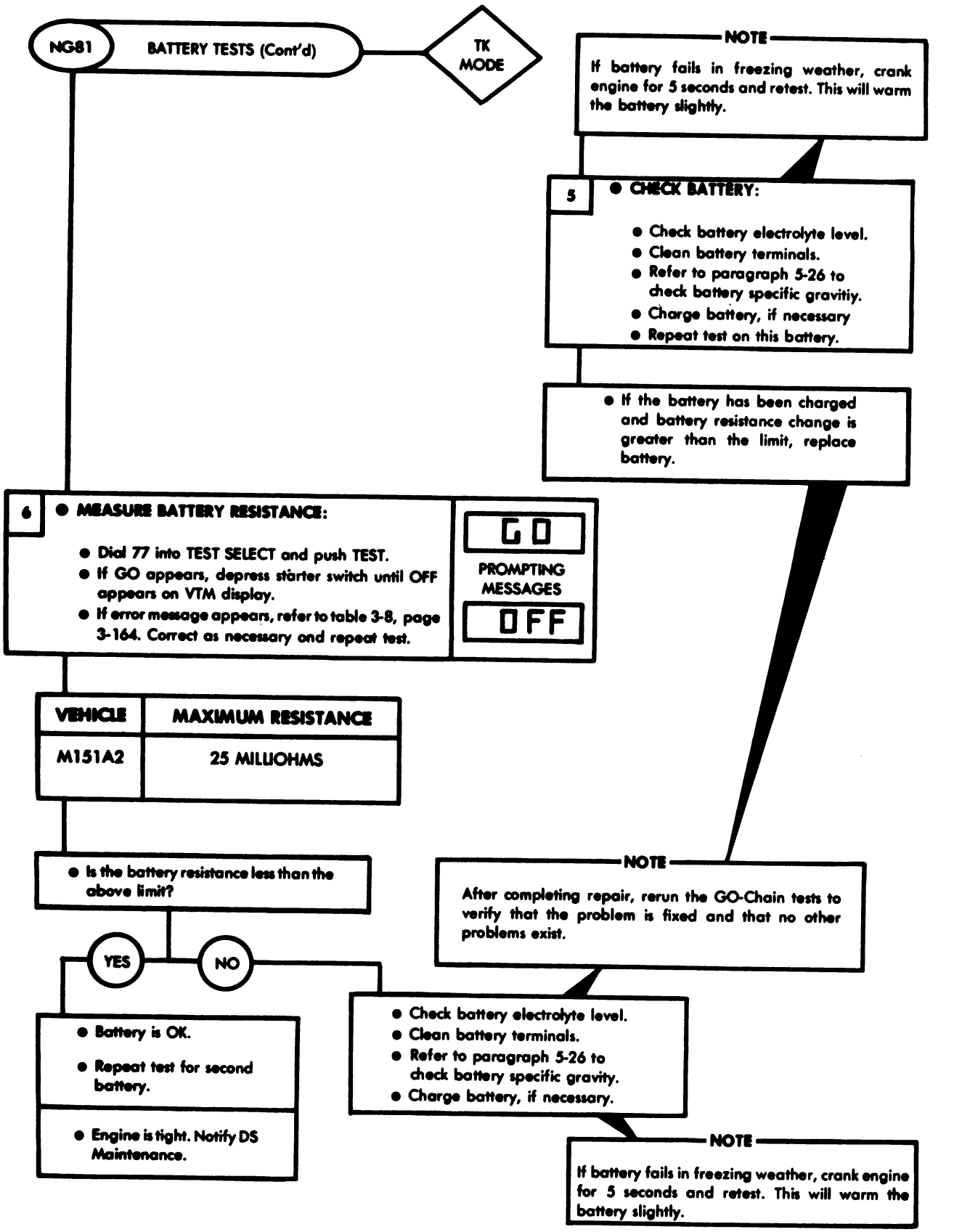
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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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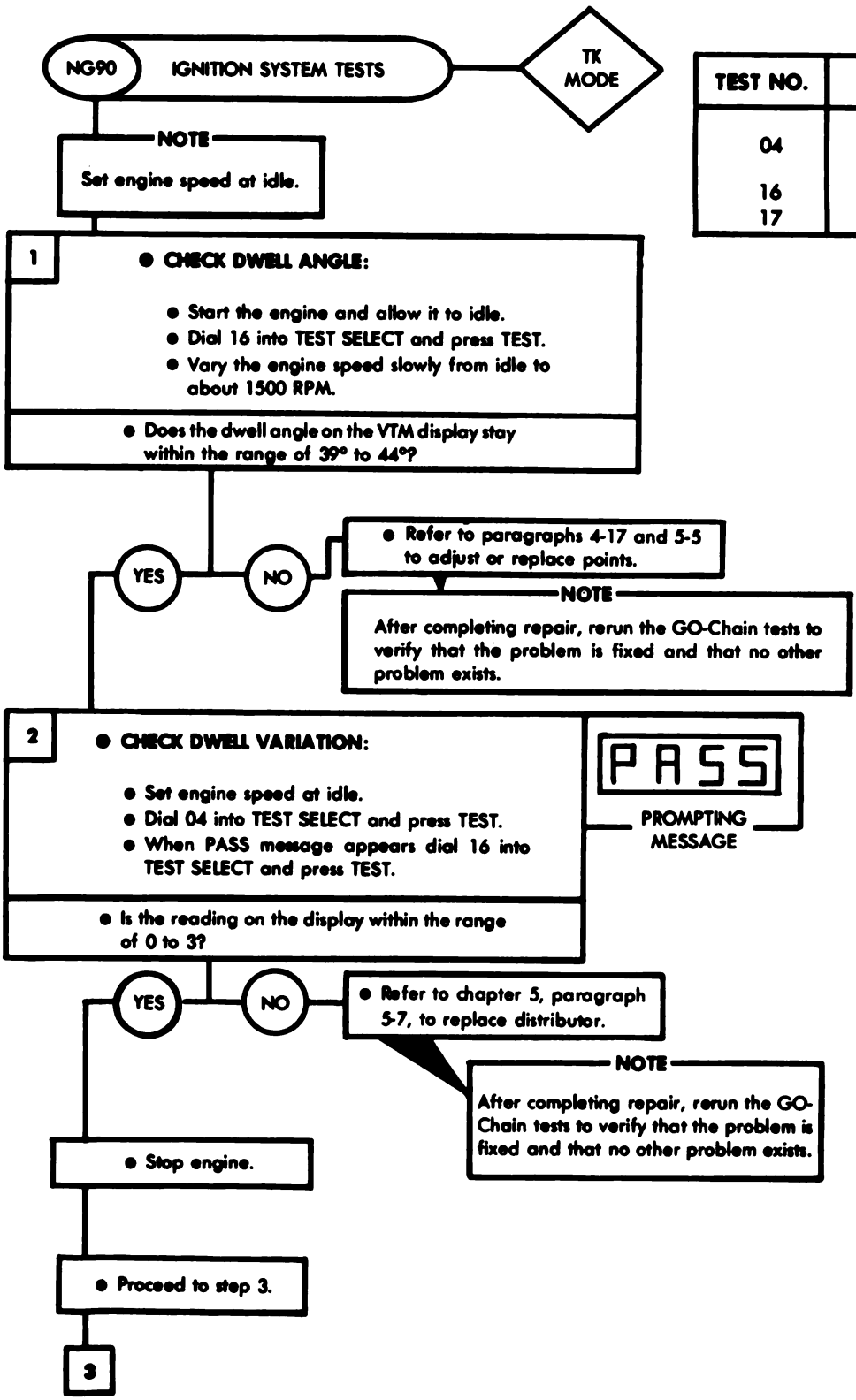
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



TA 155937

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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).

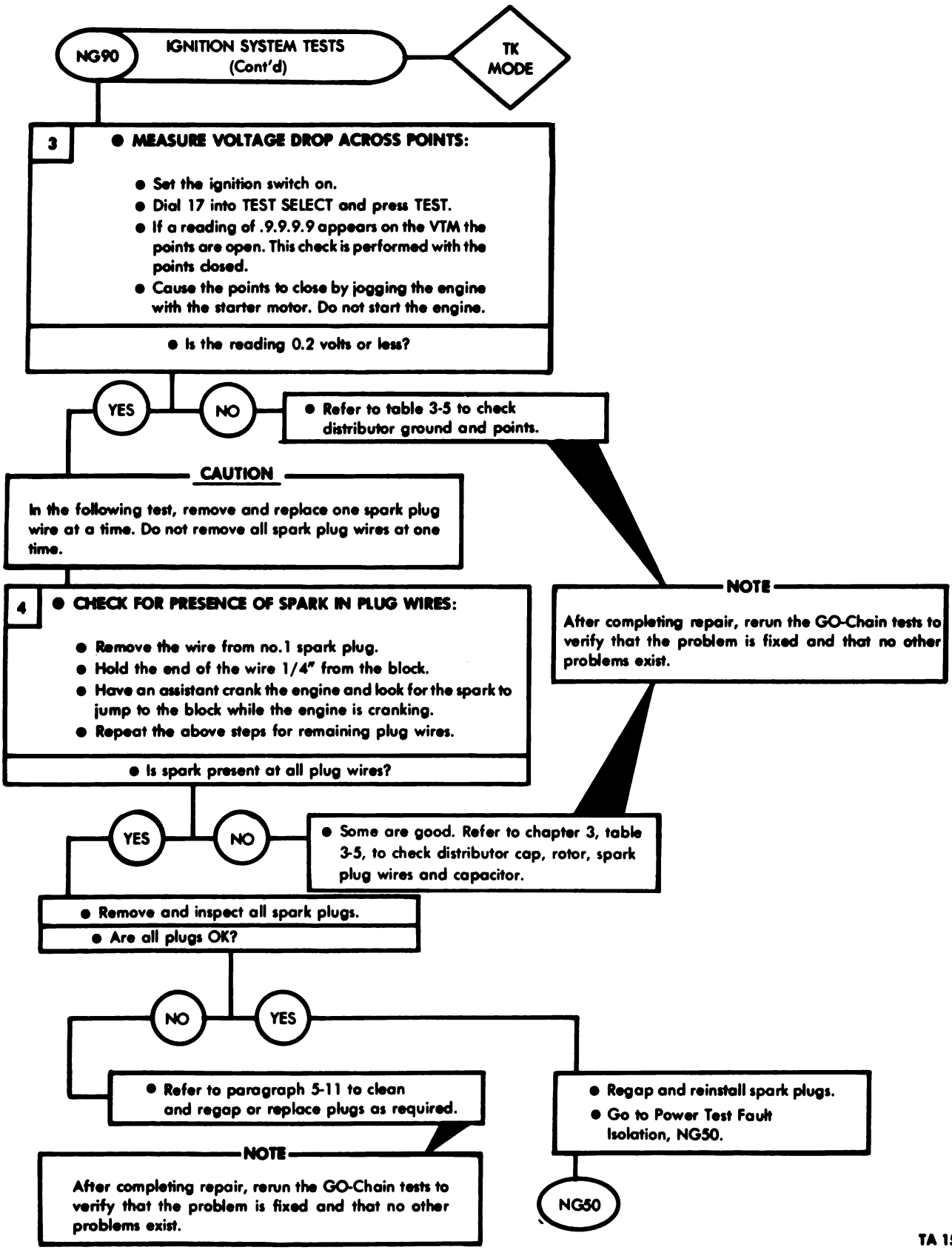


TEST NO.	TEST
04	DISPLAY PEAK-TO-PEAK VALUE FOR NEXT TEST
16	DWELL ANGLE
17	POINTS VOLTAGE

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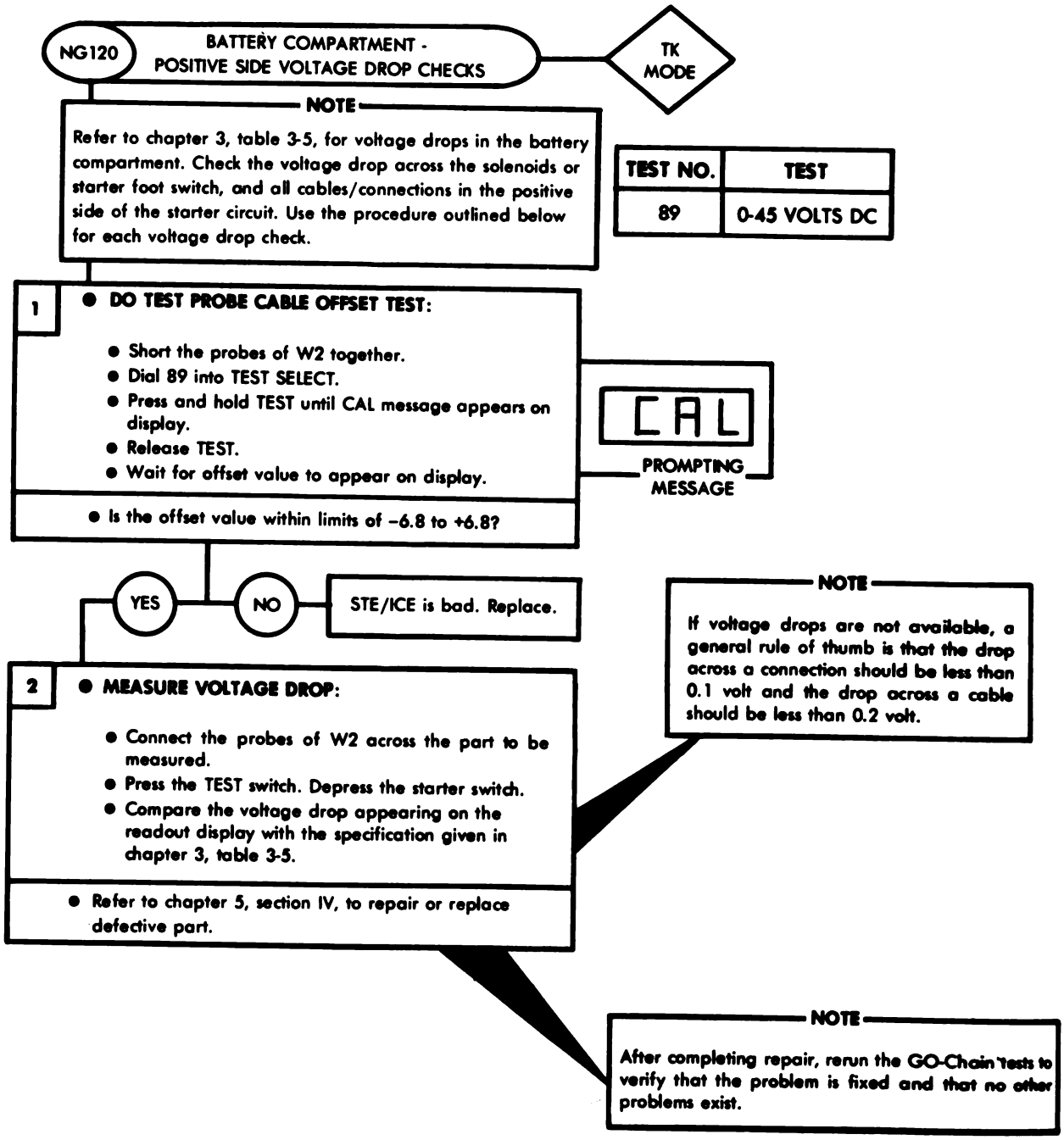
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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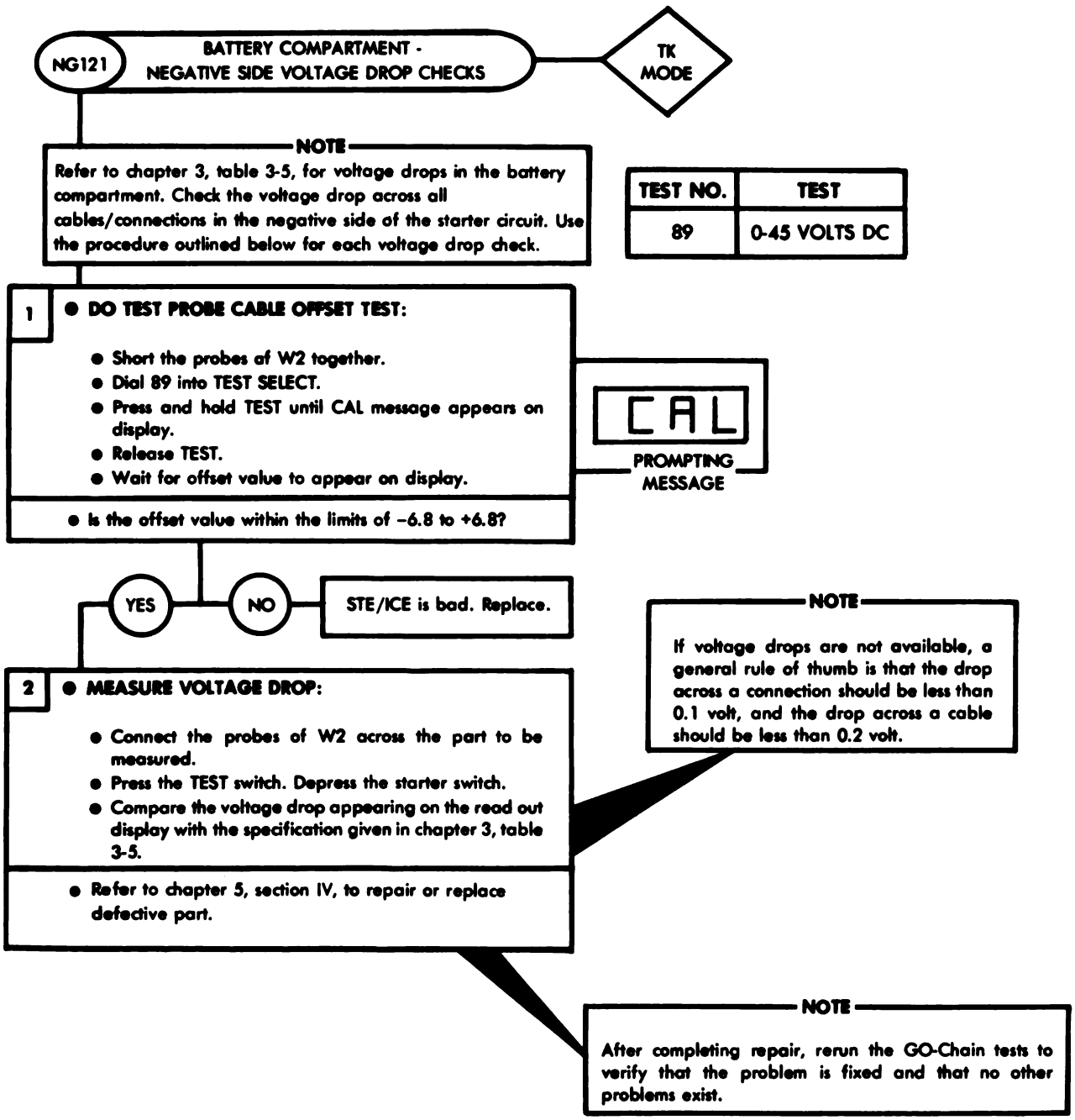
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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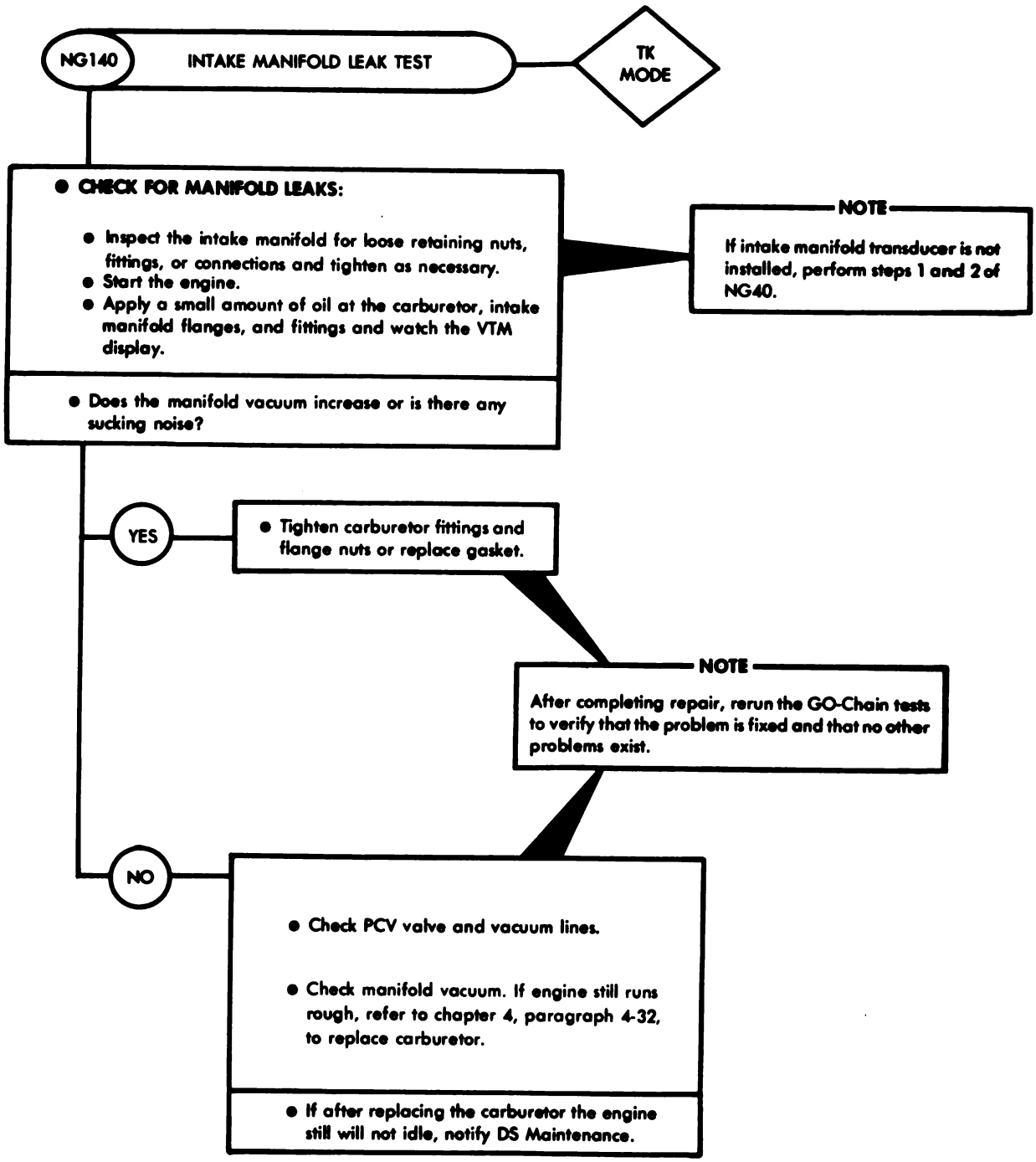
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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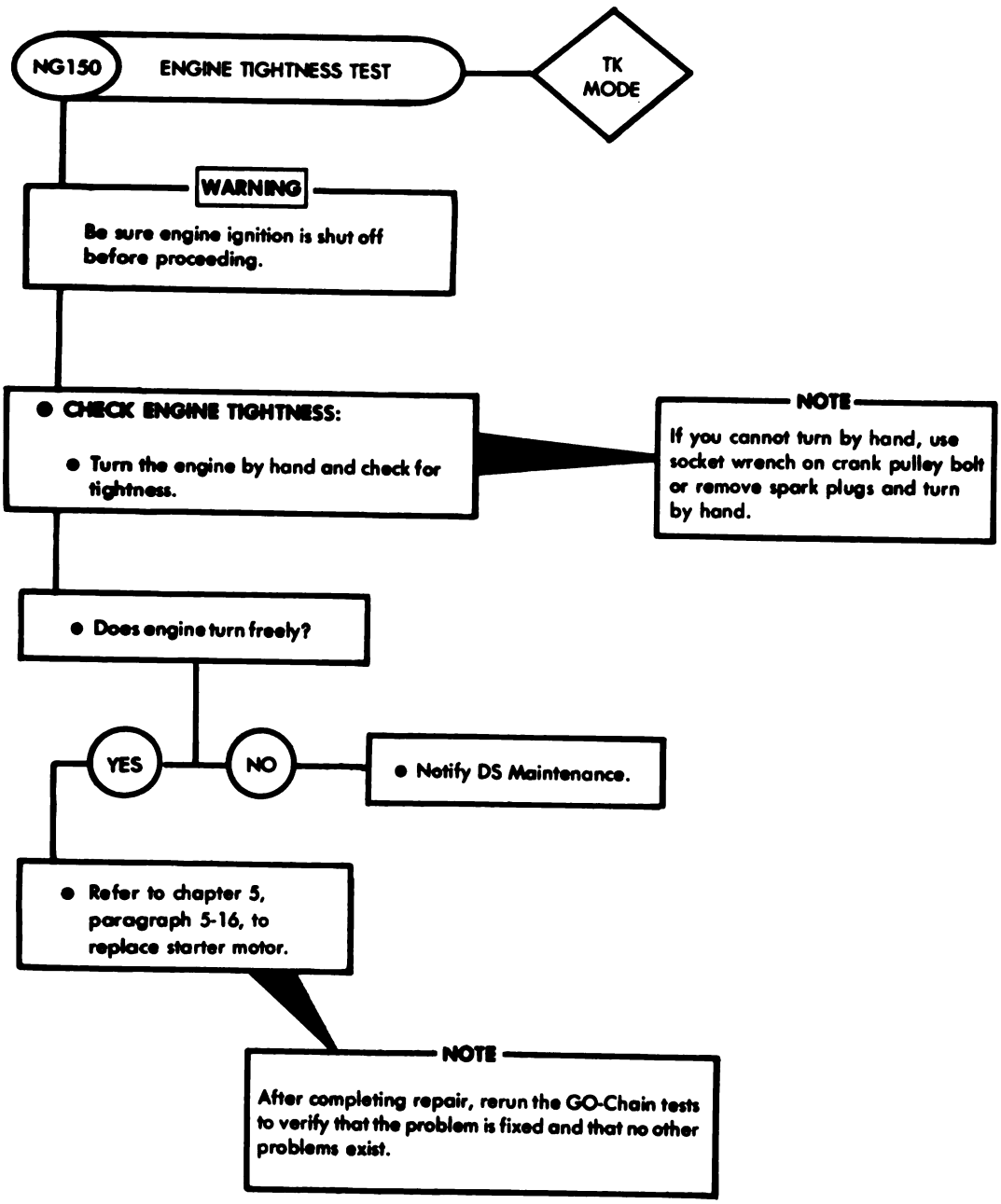
Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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Table 3-12. STE/ICE NO-GO Chain Tests (Cont'd).



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Section VII GENERAL MAINTENANCE INSTRUCTIONS

3-23. General

This section provides general instructions for raising the vehicle for maintenance. The methods provided in this section for raising and supporting the vehicle are recommended, but will depend on the availability of hoisting and supporting equipment.

3-24. Vehicle Raising and Supporting Instructions

This task covers:

a. Raising Front of Vehicle
b. Lowering Front of Vehicle
c. Raising Rear of Vehicle
d. Lowering Rear of Vehicle
e. Raising Entire Vehicle
f. Lowering Entire Vehicle

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
Hydraulic jack
Four trestles

Special Environmental Conditions
Vehicle on level surface.

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
Hydraulic jack is not used to support vehicle. Never work under vehicle unless wheels are blocked and it is properly supported.

Manual References
TM 9-2320-218-10

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3-24. Vehicle Raising and Supporting Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

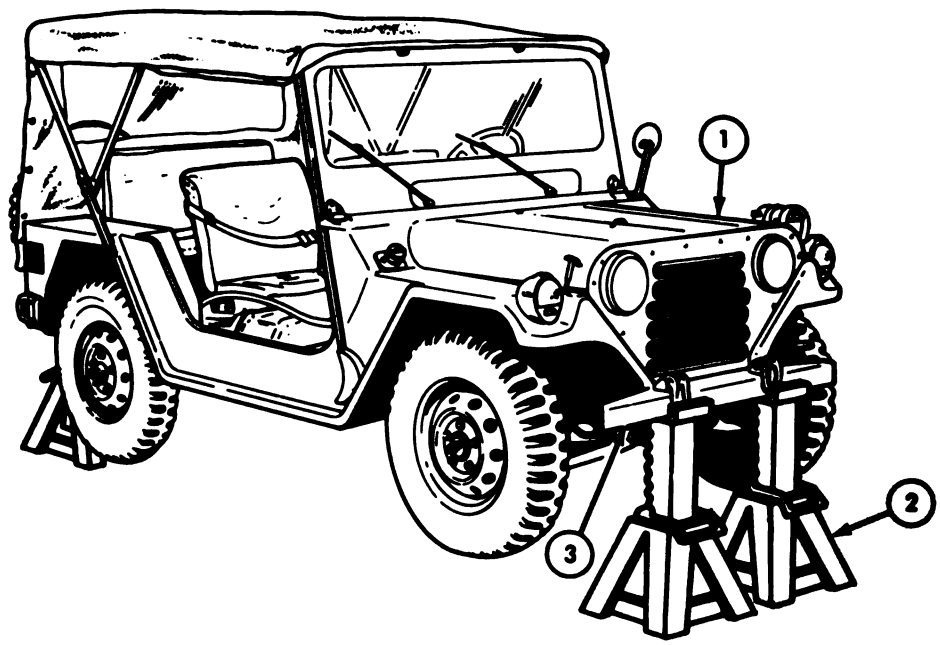
Hydraulic jack is used for raising and lowering, and is not used to support vehicle. Never work under vehicle unless wheels are blocked and it is properly supported. Severe injury will result if vehicle suddenly shifts or moves.

a. RAISING FRONT OF VEHICLE

1.	Vehicle (1)	Raise front end using hydraulic jack, and support each end of front bumper (3) with trestle (2).	Make sure rear wheels are blocked.

b. LOWERING FRONT OF VEHICLE

2.	Vehicle (1)	*a.* Raise with hydraulic jack until weight is removed from two trestles (2). *b.* Remove two trestles (2), and lower.	

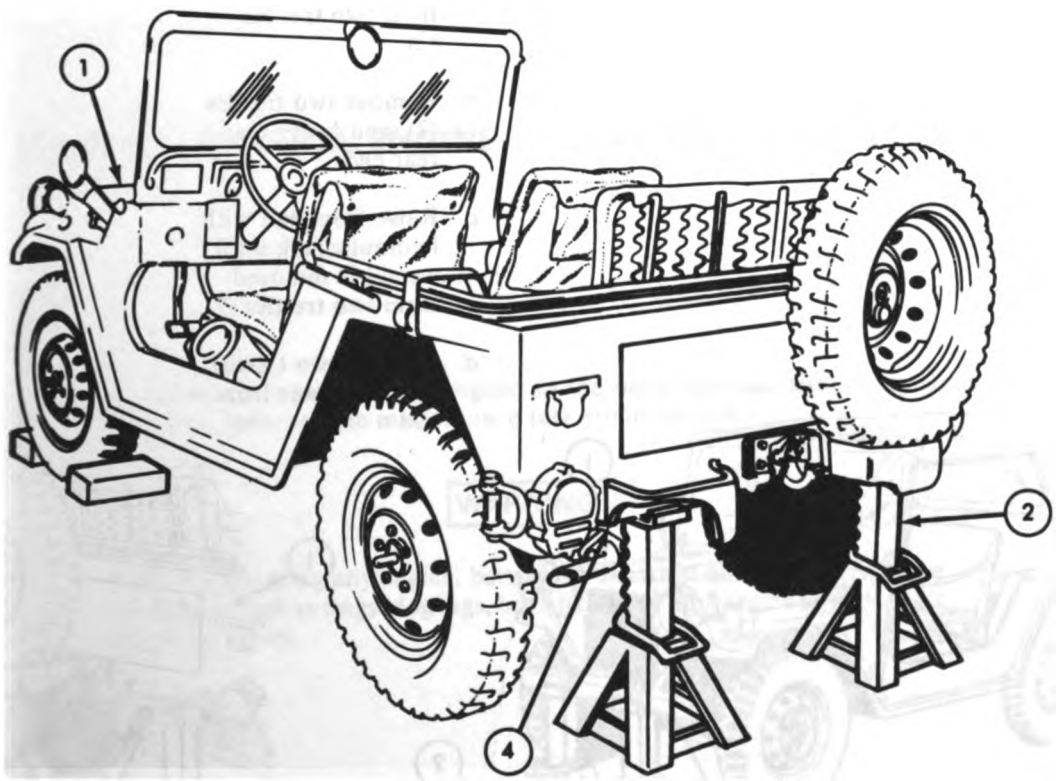


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3-24. Vehicle Raising and Supporting Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. RAISING REAR OF VEHICLE		
3.		Vehicle (1)	Raise rear end using hydraulic jack, and support each end of rear cross sill assembly (4) with trestle (2).	Make sure front wheels are blocked.
		d. LOWERING REAR OF VEHICLE		
4.		Vehicle (1)	*a.* Raise with hydraulic jack until weight is removed from two trestles (2). *b.* Remove two trestles (2), and lower.	

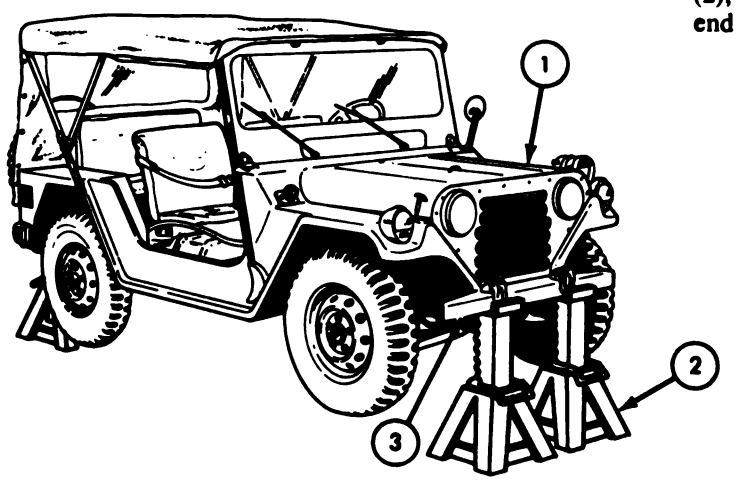


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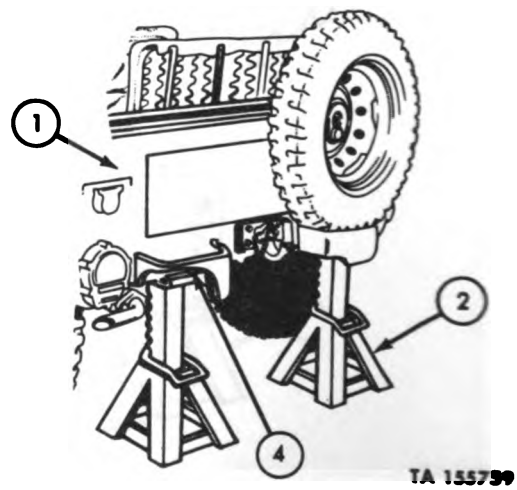
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3-24. Vehicle Raising and Supporting Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		e. RAISING ENTIRE VEHICLE		
5.		Vehicle (1)	*a.* Raise front end using hydraulic jack, and support each end of front bumper (3) with trestle (2). *b.* Raise rear end using hydraulic jack, and support each end of rear cross sill assembly (4) with trestle (2).	
		f. LOWERING ENTIRE VEHICLE		
6.		Vehicle (1)	*a.* Raise rear end with hydraulic jack until weight is removed from two trestles (2). *b.* Remove two trestles (2), and lower rear rear end. *c.* Raise front end with hydraulic jack until weight is removed from two trestles (2). *d.* Remove two trestles (2), and lower front end.	



END OF TASK!



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CHAPTER 4

ENGINE AND ENGINE SYSTEMS MAINTENANCE

4-1. Overview

a. This chapter provides maintenance information for the engine and engine systems. Components covered can be found in one of the following sections:

Section I. General Engine Testing and Maintenance (page 4-1)
Section II. Engine Tune-Up Instructions (page 4-55)
Section III. Engine Oil System Maintenance (page 4-75)
Section IV. Air Intake and Fuel System Maintenance (page 4-80)
Section V. Accelerator System Maintenance (page 4-125)
Section VI. Exhaust System Maintenance (page 4-141)
Section VII. Cooling System Maintenance (page 4-167)

b. Each section is preceded by a list that provides a breakdown of the procedures covered in that section and provides a paragraph and page number leading you to each task.

Section I. GENERAL ENGINE TESTING AND MAINTENANCE

4-2. General

This section provides maintenance procedures assigned to the organizational level for general engine testing and maintenance. To find a specific task, see the maintenance task summary below.

WARNING

Before performing any engine, battery, or electrical maintenance, remove all jewelry such as rings, dog tags, bracelets, etc. Failure to do so may result in severe injury.

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4-3. General Engine and Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-4.	Cylinder Compression Test Testing	4-4
4-5.	Manifold Vacuum Test Testing	4-7
4-6.	Valve Adjustment a. Rocker Arm Cover Removal b. Valve Adjustment c. Rocker Arm Cover Installation	4-10
4-7.	Crankcase Ventilation Valve and Valve Push Rod Cover a. Crankcase Ventilation Valve Removal b. Valve Push Rod Cover Removal c. Cleaning and Inspection d. Crankcase Ventilation Valve Installation e. Valve Push Rod Cover Installation	4-13
4-8.	Crankcase and Distributor Vent Lines a. Carburetor to Intake Manifold Vent Line Removal b. Crankcase Vent Valve to Rocker Cover Vent Line Removal c. Distributor Vent Lines Removal d. Crankcase Vent Line Removal e. Fuel Pump Vent Line Removal f. Inspection g. Fuel Pump Vent Line Installation h. Crankcase Vent Line Installation i. Distributor Vent Lines Installation j. Crankcase Vent Valve to Rocker Cover Vent Line Installation k. Carburetor to Intake Manifold Vent Line Installation	4-16

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4-3. General Engine and Maintenance Task Summary (Cont'd)

TASK PARA	PROCEDURES	PAGE NO.
4-9.	Engine Mounting Brackets and Cushions a. Removal b. Installation	4-28
4-10.	Intake Manifold a. Removal b. Installation	4-34
4-11.	Exhaust Manifold a. Removal b. Cleaning and Inspection c. Installation	4-40
4-12.	Clutch Linkage Maintenance and Adjustment a. Removal b. Disassembly c. Cleaning and Inspection d. Reassembly e. Installation f. Free Travel Check g. Adjustment	4-44

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4-4. Cylinder Compression Test

This task covers:

Testing

INITIAL SETUP:

Applicable Models
All

Test Equipment
Cylinder compression gage

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic
One assistant

Manual References
TM 9-2320-218-10

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Engine at normal operating temperature.
Para 4-6	Valves adjusted.
Para 4-15	Spark plugs removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not run engine unless work area is well ventilated.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

Make sure all "condition description" requirements have been done in the order listed.

TESTING

1.	Instrument panel (1)	Hand throttle control cable (3)	Pull out to full open position.
2.		Choke control cable (2)	Push in against the instrument panel (1).
3.		Compression gage (5)	*a.* Insert into no. 1 cylinder spark plug hole (4).

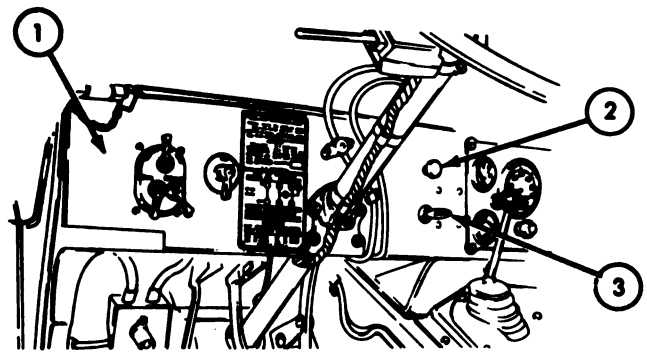
NOTE

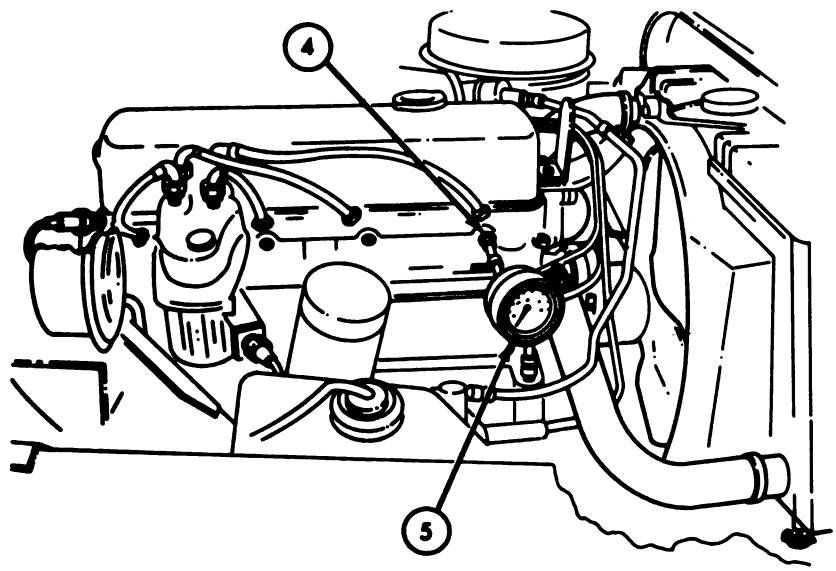
Assistant will crank engine.

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4-4. Cylinder Compression Test (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			b. Crank engine several times.	Ignition switch remains off while cranking.
			c. Record highest compression reading.	
			d. Repeat step 3 for each cylinder.	See table 4-1 for results of test.
4.	Instrument panel (1)	Hand throttle control (3)	Push all the way in.	





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4-4. Cylinder Compression Test (Cont'd)

Table 4-1. Compression Gage Reading Malfunction Guide

Reading	*Probable Malfunction*	*Corrective Action*
85 psi or higher	Normal	
Low reading on two cylinders beside each other	Improperly tightened cylinder head bolts	Tighten cylinder head bolts 60-65 lb-ft (82-89 N•m)
	Faulty head gasket	Notify DS maintenance to replace head gasket
Compression reading uniformly low	Leakage at valves, piston, rings, or incorrect valve timing	Notify DS maintenance
Compression readings vary more than 25 psi between lowest and highest cylinder		Notify DS maintenance
Compression reading lower than 85 psi (after correction by tightening cylinder head bolts and/or new head gasket)		Notify DS maintenance

END OF TASK!

FOLLOW-ON TASK: Install spark plugs (para 4-15).

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4-5. Manifold Vacuum Test

This task covers:

Testing

INITIAL SETUP:

Applicable Models
All

Test Equipment
Vacuum gage

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Engine run until minimum operating temperature of 160°F (70°C) is reached.
Para 4-16	Carburetor idle speed and idle mixture adjusted.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not run engine unless work area is well ventilated.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Exhaust gases can kill! Do not run engine unless in a well-ventilated area.

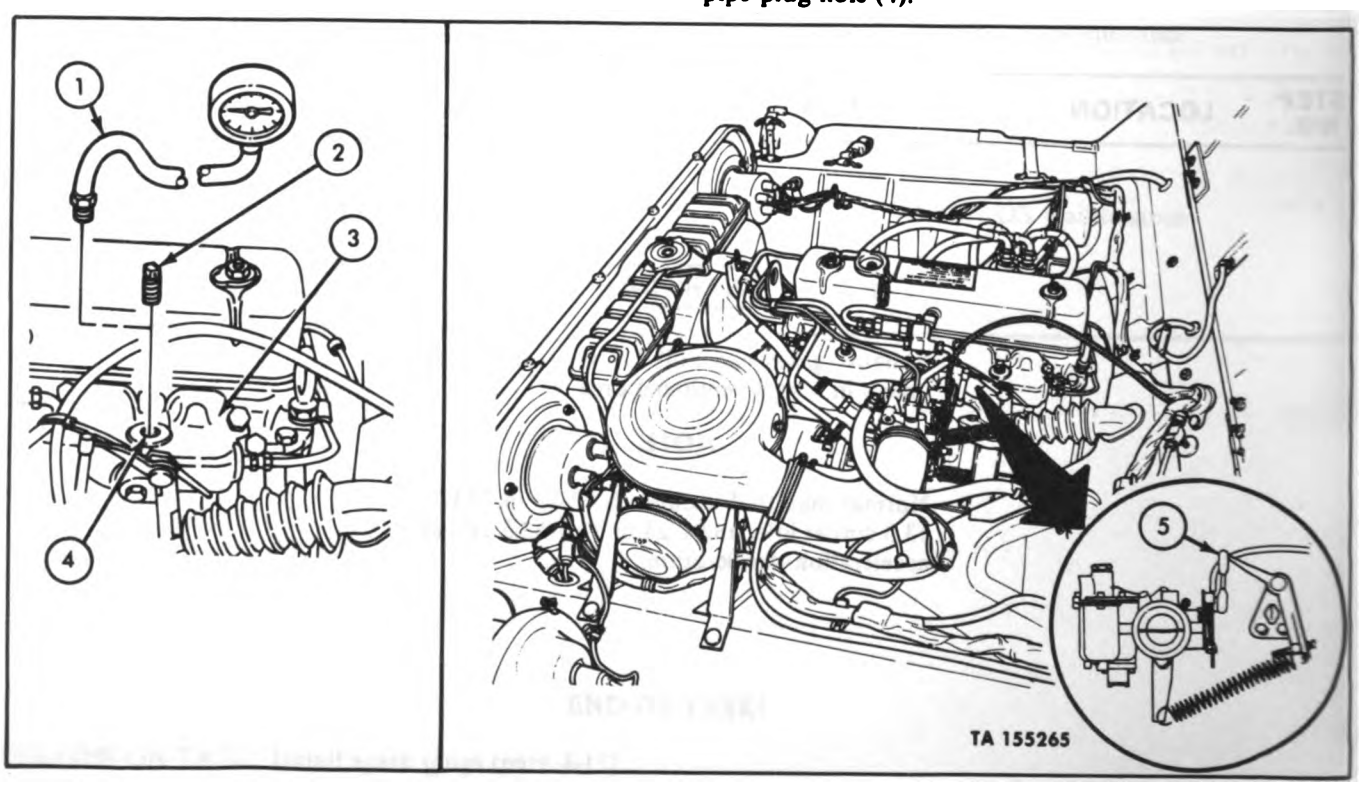
NOTE

Normal manifold vacuum is 17-21 in. (43.2-53.3 cm) at idle, and 2-25 in. (5.1-63.5 cm) at acceleration-deceleration.

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4-5. Manifold Vacuum Test (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		TESTING		
1.	Rear of intake manifold (3)	Pipe plug (2)	Remove.	Keep for installation.
2.		Vacuum gage (1)	Install in manifold pipe plug hole (4).	Be sure of airtight connection.
3.		Engine	Start and run until minimum operating temperature of 160°F (70°C) is reached.	
4.		Vacuum gage (1)	*a.* Record idle speed vacuum reading.	
5.			*b.* Open and close carburetor throttle (5) and record high and low vacuum reading.	See table 4-2 for test results.
6.		Vacuum gage (1)	Remove.	
7.		Pipe plug (2)	Install in manifold pipe plug hole (4).	



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4-5. Manifold Vacuum Test (Cont'd)

Table-4-2. Manifold Vacuum Malfunction Guide

Vacuum Reading	*Probable Malfunction*	*Corrective Action*
Readings are for sea level operations. Add one in. for each 1000 ft. (305 m) increase in altitude.		
Idle Speed		
Steady 17-21 in. (43.2-53.3 cm)	Normal	
Steady 10 in. (25.4 cm)	Incorrect valve timing	Notify DS maintenance
Slow movement 12-16 in. (30.5-40.6 cm)	Poor carburetion	See paragraph 4-16
Low steady reading	Carburetor gasket leak	See paragraph 4-32
	Worn or poorly fitted piston rings or scored pistons and cylinder walls	
	Intake manifold gasket leak	See paragraph 4-10
Drifting regularly between 5 and 19 in. (12.7-48.3 cm)	Compression leak between cylinders	Notify DS maintenance
Throttle Opened and Closed Quickly		
Two in. (5.1 cm) at opening and quickly return to 25 in. (63.5 cm)	Normal	
Rapid fluctuation when accelerated	Weak valve springs	Notify DS maintenance
Drops 4 or 5 in. (10.2 or 12.7 cm) momentarily	Sticking valve	Notify DS maintenance
Does not drop to 2 in. (5.1 cm) or return to 25 in. (63.5 cm)	Worn piston rings	Notify DS Maintenance
	Improper intake valve setting	See paragraph 4-6
	Carburetor restriction	See paragraph 4-32
	Air cleaning restriction	See paragraph 4-28
	Exhaust system restriction	See paragraph 4-44

END OF TASK!

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4-6. Valve Adjustment

This task covers:

a. Rocker Arm Cover Removal
b. Valve Adjustment
c. Rocker Arm Cover Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Feeler gage
Torque wrench (0-200 lb-in)

Materials/Parts
Two seals
Gasket

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work in well-ventilated area.

General Safety Instructions
Do not run engine unless work area is well ventilated.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. ROCKER ARM COVER REMOVAL

NOTE

Make sure engine is off when performing steps 1 and 2.

1.	Rocker arm cover (1) to cylinder head (6).	Two nuts (3), retainers (2), and seals (4)	Remove.	Discard seals (4).
2.		Rocker arm cover (1) and gasket (5)	Remove.	Discard gasket (5).

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4-6. Valve Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

b. VALVE ADJUSTMENT

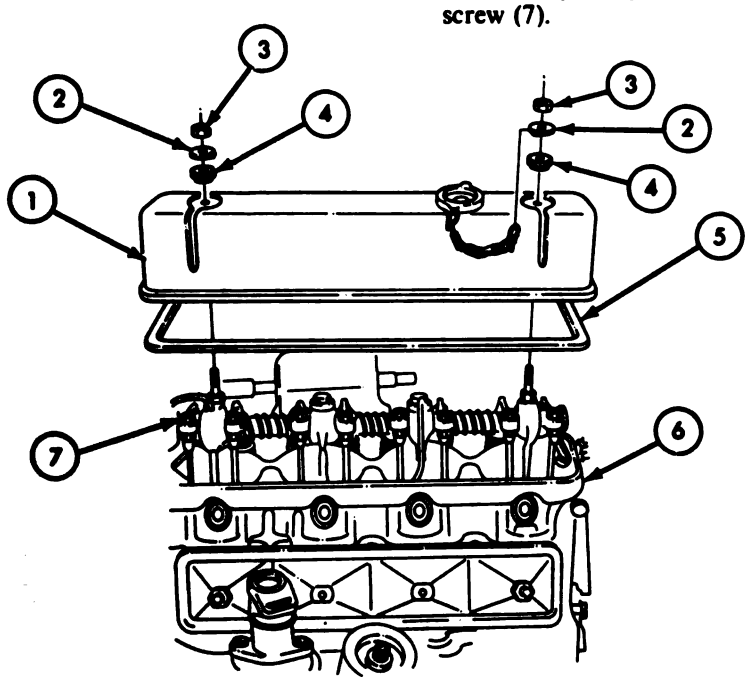
WARNING

Exhaust gases can kill! Do not run engine unless in a well-ventilated area.

NOTE

- Adjusting screw torque drag should not be less than 60 lb-in (6.8 N•m).
- Engine must be running at idle and at normal operating temperature of 160°F (70°C) when adjusting valves.

3.		Engine	Start and let idle until normal operating temperature is reached.	See TM 9-2320-218-10.
4.			Adjust valves as follows: *a.* Tighten adjusting screw (7) to clear threads. *b.* Loosen adjusting screw (7).	

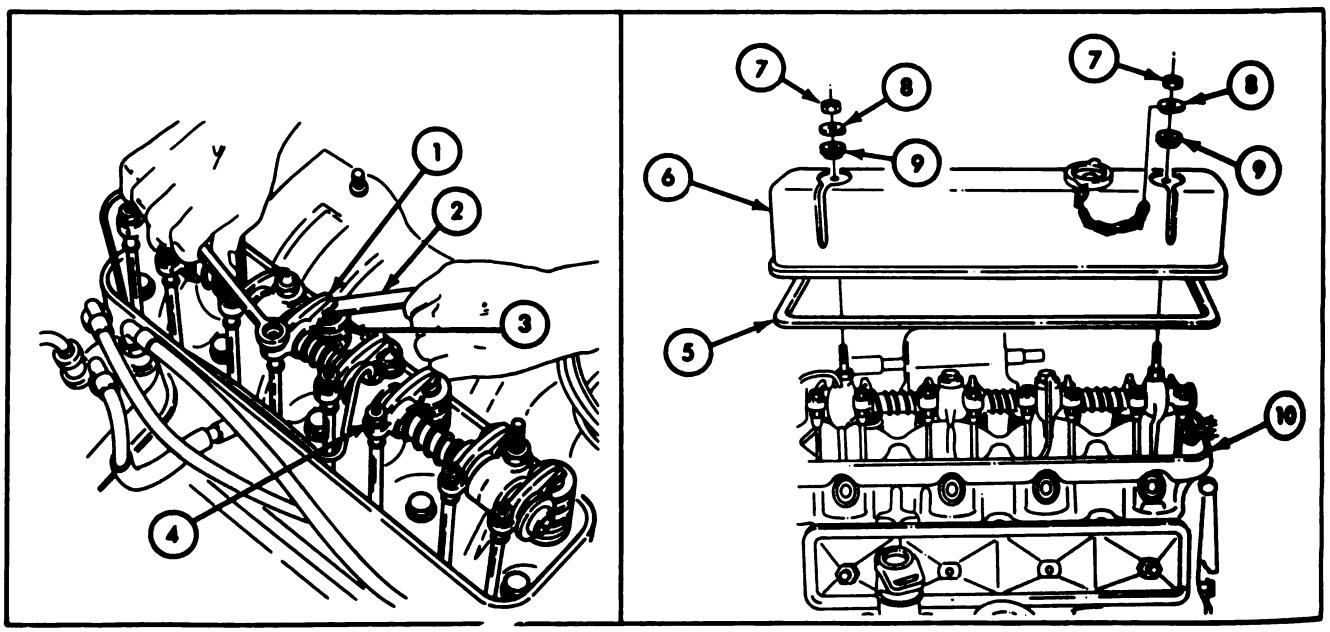


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4-6. Valve Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			c. Insert 0.015 inch (0.38 mm) feeler gage (2) between rocker arm (1) and top of valve (3).	
			d. Tighten or loosen adjusting screw (4) until slight drag is felt when moving feeler gage (2), and valve chatter goes away.	
			e. Repeat for all eight valves (3).	
			f. Shut off engine.	See TM 9-2320-218-10.
		c. ROCKER ARM COVER INSTALLATION		
5.		New gasket (5) and rocker arm cover (6)	Secure to cylinder head (10) with two new seals (9), retainers (8), and nuts (7).	Tighten nuts (7) 36-48 lb-in (4-5 N•m).



END OF TASK!

FOLLOW-ON TASK: Road test for proper vehicle performance.

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4-7. Crankcase Ventilation Valve and Valve Push Rod Cover Maintenance

This task covers:

a. Crankcase Ventilation Valve Removal
b. Valve Push Rod Cover Removal
c. Cleaning and Inspection
d. Crankcase Ventilation Valve Installation
e. Valve Push Rod Cover Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Drycleaning solvent
Sealing compound (NSN 8030-00-543-8384)
Valve push rod cover gasket and seal kit

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 5-7	Distributor removed.

Special Environmental Conditions
Work in well-ventilated area.

General Safety Instructions
Keep fire extinguisher nearby when using drycleaning solvent.

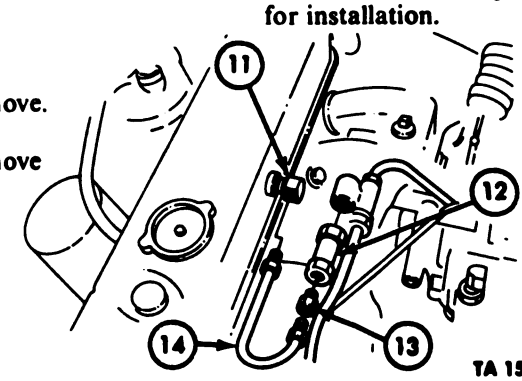
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

CAUTION

Crankcase ventilation valve must be properly removed and installed to avoid damaging internal crimp. Always position wrench at point closest to connection being turned. Damage to ventilation system will result if valve or crimp is twisted or overtightened.

a. CRANKCASE VENTILATION VALVE REMOVAL

1.	Rocker arm cover elbow (11) and valve adapter (13)	Rocker arm cover vent tube (14)	Remove.	Note disconnection points for installation.
2.		Adapter (13)	Remove.	
3.		Crankcase ventilation valve (12)	Remove	



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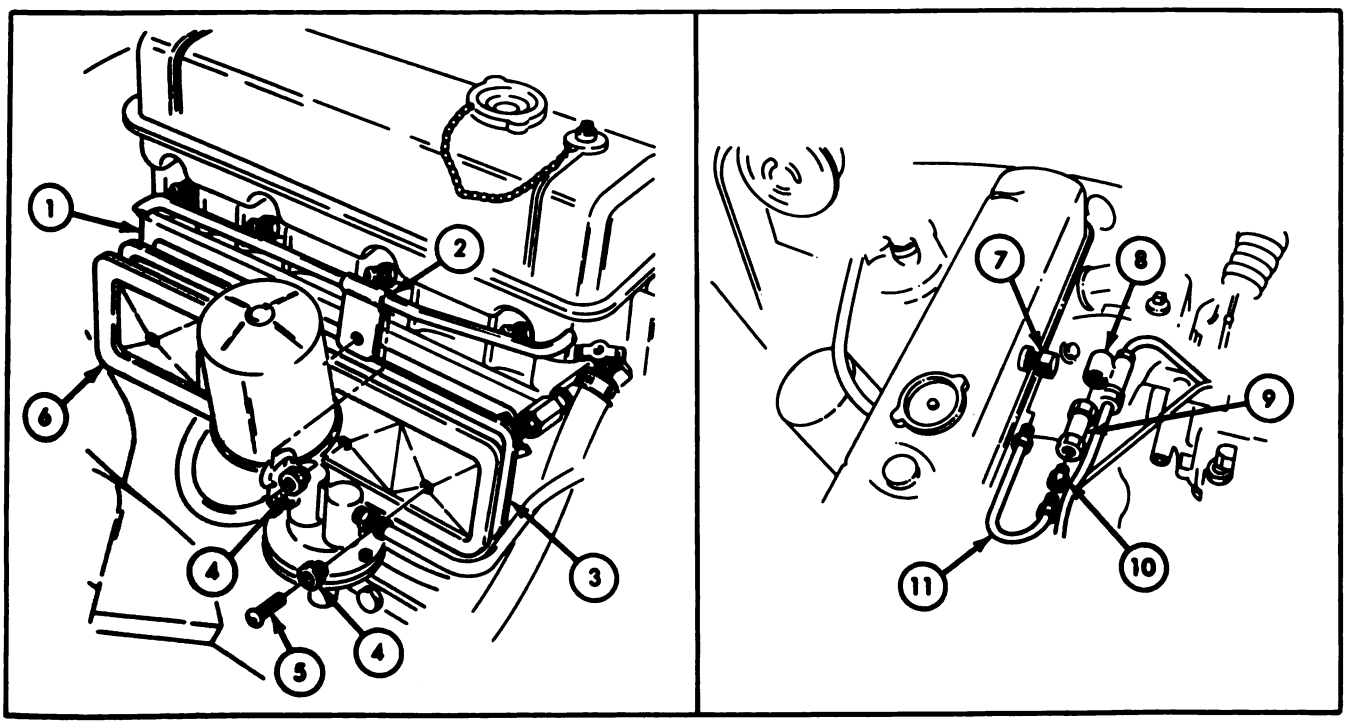
4-7. Crankcase Ventilation Valve and Valve Push Rod Cover Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. VALVE PUSH ROD COVER REMOVAL			
4.	Push rod cover (6) to cylinder block (1)	Four screws (5), seals (4), and one vent line clamp (2)	Remove.	Discard seals (4).
5.		Push rod cover (6) and gasket (3)	Remove from cylinder block (1).	Discard gasket (3).
	c. CLEANING AND INSPECTION			
		WARNING		
		Drycleaning solvent is flammable and must not be used near an open flame. A fire extinguisher will be kept nearby when solvent is used. Use only in well-ventilated areas. Failure to do so will result in injury to personnel and/or damage to equipment.		
		NOTE		
		If valve is clogged or inner parts are not moving freely, valve should be cleaned and inspected or replaced.		
6.		Crankcase ventilation valve (9)	*a.* Soak in drycleaning solvent.	
			b. Shake to determine if valve plunger is free.	Replace valve (9) if plunger does not move.
7.		Push rod cover (6)	*a.* Remove old gasket (3) material.	
			b. Check for cracks, dents, and distortion.	Replace if cracked, dented, or distorted.
	d. CRANKCASE VENTILATION VALVE INSTALLATION			
8.		Crankcase ventilation valve (9)	Install on intake manifold fitting (8) and tighten.	

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4-7. Crankcase Ventilation Valve and Valve Push Rod Cover Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
9.		Adapter (10)	Install on ventilation valve (9) and tighten.	
10.		Rocker arm cover vent tube (11)	Install on marked locations on rocker arm cover fitting (7) and adapter (10), and tighten.	
		e. VALVE PUSH ROD COVER INSTALLATION		
11.		New gasket (3)	Apply sealing compound to cover (6) side.	
12.		New gasket (3) and cover (6)	Place on cylinder block (1) and secure with one vent line clamp (2), four new seals (4), and four screws (5).	Vent line clamp (2) will be secured at second hole from front edge of cover (6). Place seal (4) between clamp (2) and cover (6).



END OF TASK!

FOLLOW-ON TASK: Install distributor (para 5-7).

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4-8. Crankcase and Distributor Vent Lines Maintenance

This task covers:

a. Carburetor to Intake Manifold Vent Line Removal
b. Crankcase Vent Valve to Rocker Cover Vent Line Removal
c. Distributor Vent Lines Removal
d. Crankcase Vent Line Removal
e. Fuel Pump Vent Line Removal
f. Inspection
g. Fuel Pump Vent Line Installation
h. Crankcase Vent Line Installation
i. Distributor Vent Lines Installation
j. Crankcase Vent Valve to Rocker Cover Vent Line Installation
k. Carburetor to Intake Manifold Vent Line Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
None

General Safety Instructions
None

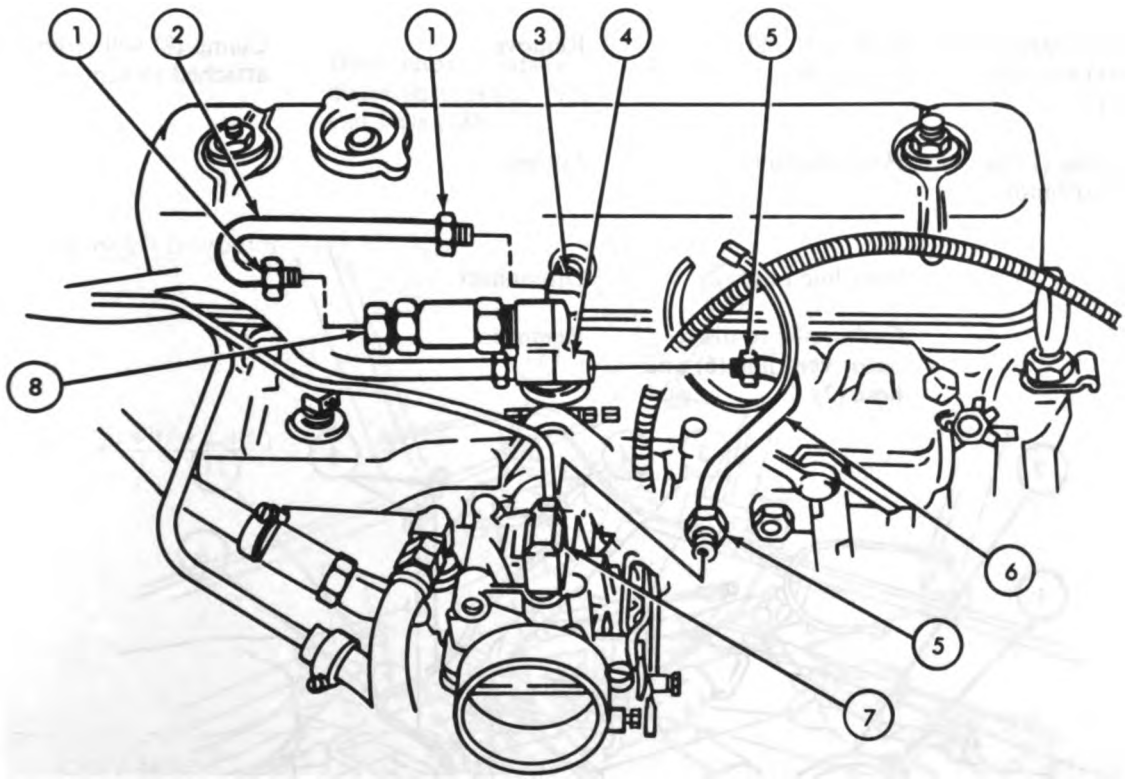
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. CARBURETOR TO INTAKE MANIFOLD VENT LINE REMOVAL		
1.	Vent line (6) to carburetor elbow (7) and intake manifold adapter (4)	Two vent line fittings (5)	Disconnect.	
2.		Vent line (6)	Remove.	

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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

b. CRANKCASE VENT VALVE TO ROCKER COVER VENT LINE REMOVAL

3.	Vent line (2) to rocker cover elbow (3) and crankcase vent valve adapter (8)	Two vent line fittings (1)	Disconnect.
4.		Vent line (2)	Remove.



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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

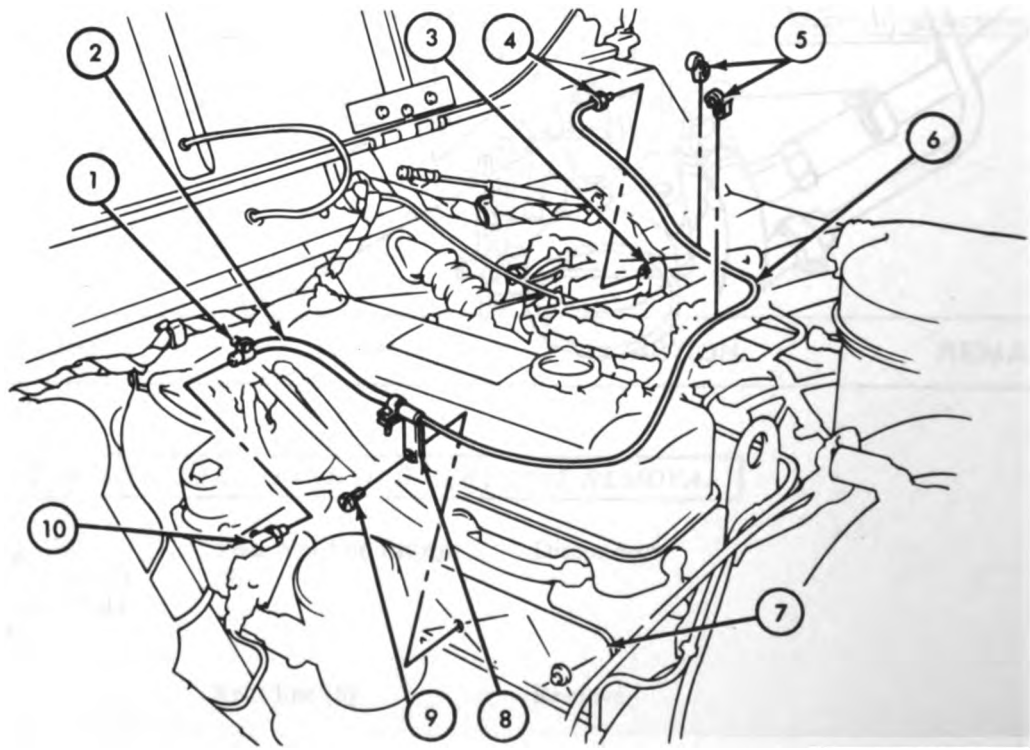
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

c. DISTRIBUTOR VENT LINES REMOVAL

NOTE

The two distributor vent lines will be removed with rubber hoses attached.

5.	Carburetor to distributor vent line (6) to carburetor elbow (3)	Vent line fitting (4)	Disconnect.	
6.		Two retainer clips (5)	Remove.	
7.	Carburetor to distributor vent line (6) to push rod cover (7)	Screw (9) and clamp (8)	Remove.	Clamp (8) will remain attached to vent line (6).
8.	Vent line hose (2) to front of distributor (10)	Hose clamp (1)	Loosen.	
9.		Vent line hose (2)	Disconnect.	
10.		Carburetor to distributor vent line (6) and hose (2)	Remove.	

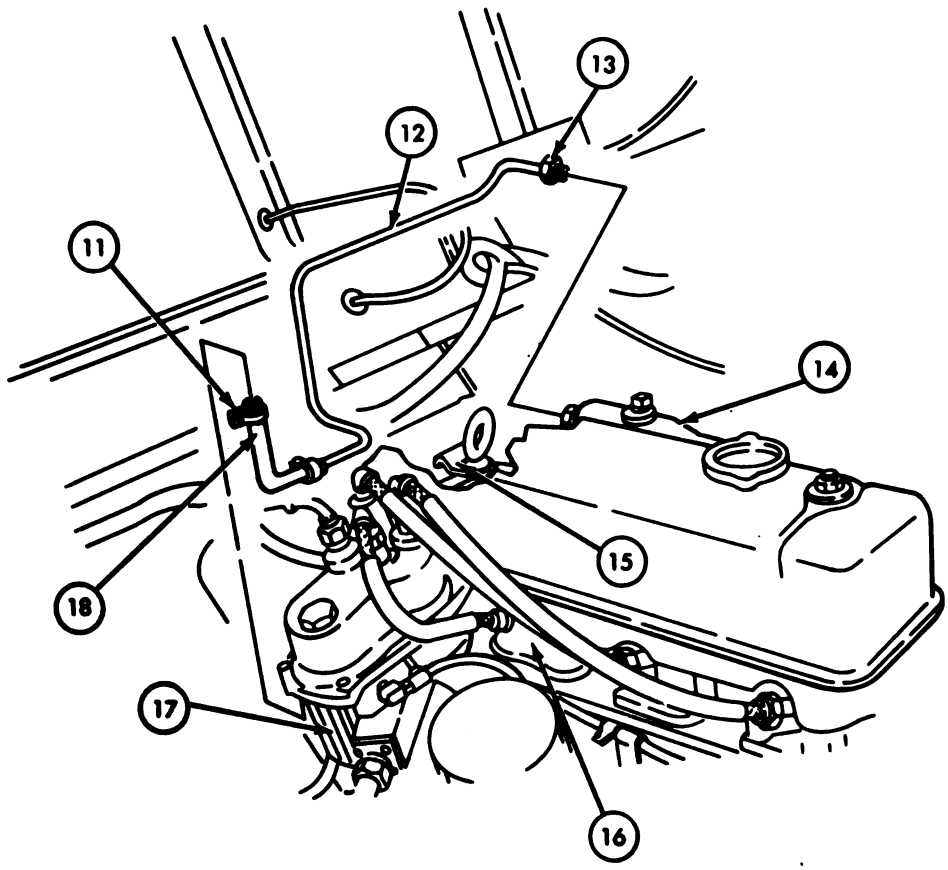


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
11.	Vent line hose (18) to rear of distributor (17)	Hose clamp (11)	Loosen.	
12.		Vent line hose (18)	Disconnect.	
13.	Distributor to intake manifold vent line (12) to rear of intake manifold (14)	Vent line fitting (13)	Disconnect.	
14.	Vent line retainer clip (15) to rear of cylinder head (16)	Distributor to intake manifold vent line (12)	Disconnect.	
15.		Distributor to intake manifold vent line (12) and hose (18)	Remove.	

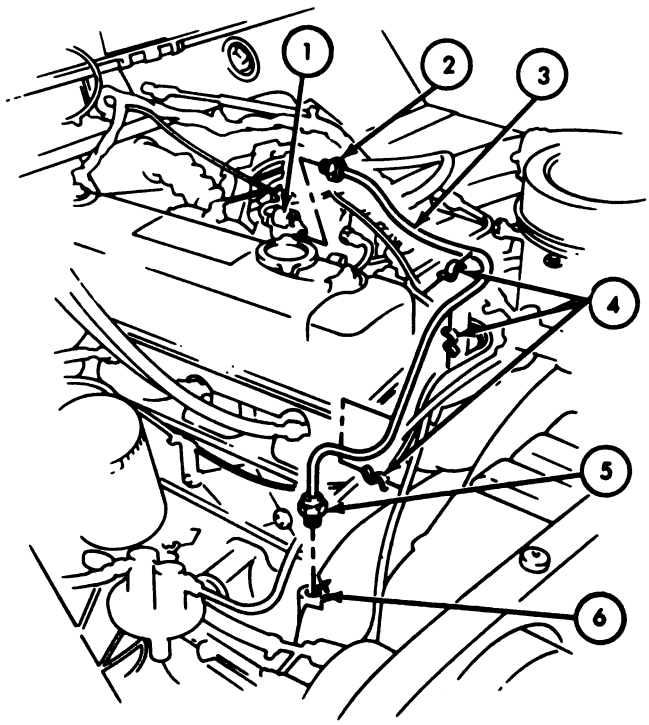


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	d. CRANKCASE VENT LINE REMOVAL			
16.	Vent line (3) to intake manifold adapter (1)	Vent line fitting (2).	Disconnect.	
17.		Three retainer clips (4)	Remove.	
18.	Vent line (3) to crankcase vent adapter (6)	Vent line fitting (5)	Disconnect.	
19.		Vent line (3)	Remove.	



e. FUEL PUMP VENT LINE REMOVAL

NOTE

Fuel pump vent line will be removed with two rubber hoses attached.

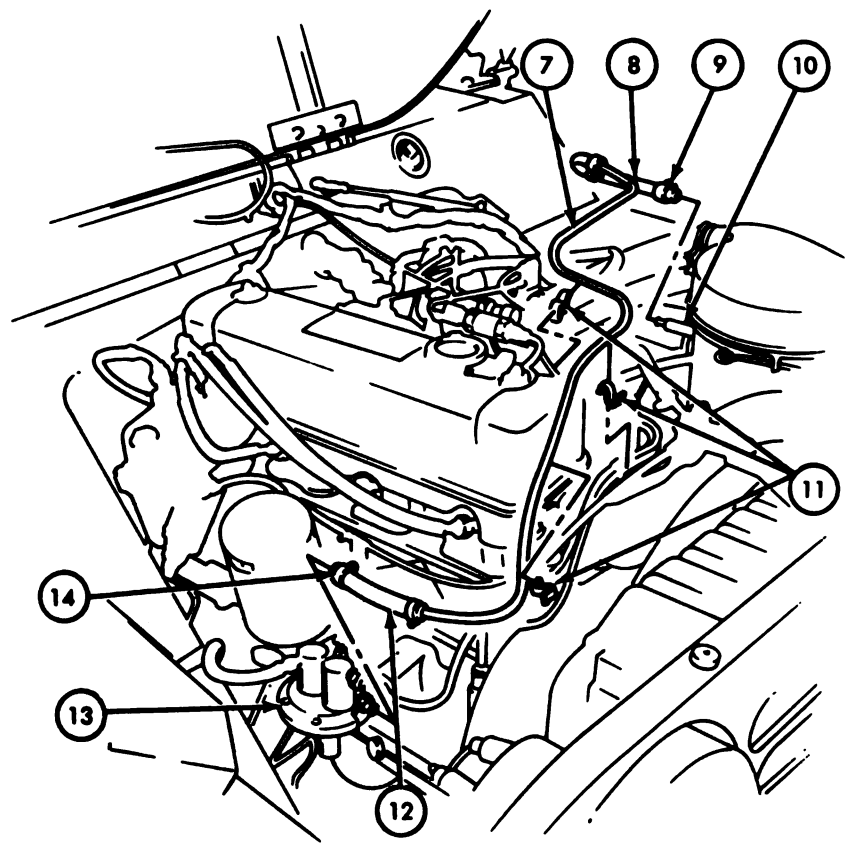
20.	Vent line hose (8) to air cleaner tee fitting (10)	Hose clamp (9)	Loosen.	

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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
21.		Vent line hose (8)	Disconnect from air cleaner tee fitting (10).	
22.		Three retainer clips (11)	Remove.	
23.	Vent line hose (12) to fuel pump (13)	Hose clamp (14)	Loosen.	
24.		Vent line hose (12)	Disconnect from fuel pump (13).	
25.		Vent line (7) and hoses (8) and (12)	Remove.	



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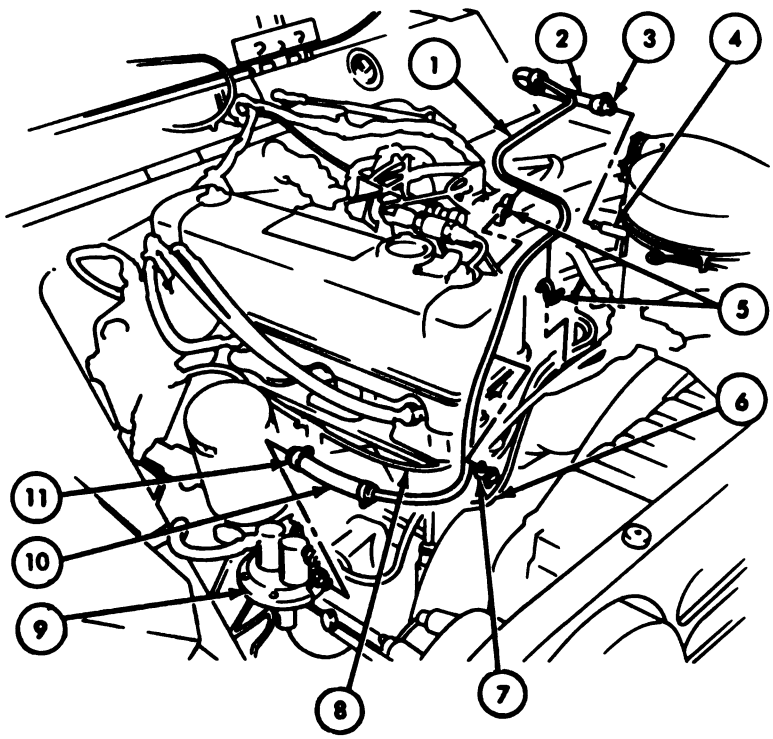
4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		f. INSPECTION		
26.		All vent lines	Inspect for cracks and kinks.	Replace if cracked or kinked.
		CAUTION		
		Use care when installing vent lines. Start all fittings by hand to prevent cross threading. Excessive bending or kinking of vent lines will restrict ventilation and vehicle performance.		
		g. FUEL PUMP VENT LINE INSTALLATION		
27.		Vent line (1) and hoses (2) and (10)	Place on engine in approximate position.	
28.		Vent line hose (10)	Secure to fuel pump (9) with hose clamp (11).	
29.		Vent line (1)	*a.* Secure to crankcase vent line (6) with retainer clip (7). *b.* Secure to distributor vent line (8) and crankcase vent line (6) with two retainer clips (5).	

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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
30.		Vent line hose (2)	Secure to air cleaner tee fitting (4) with hose clamp (3).	

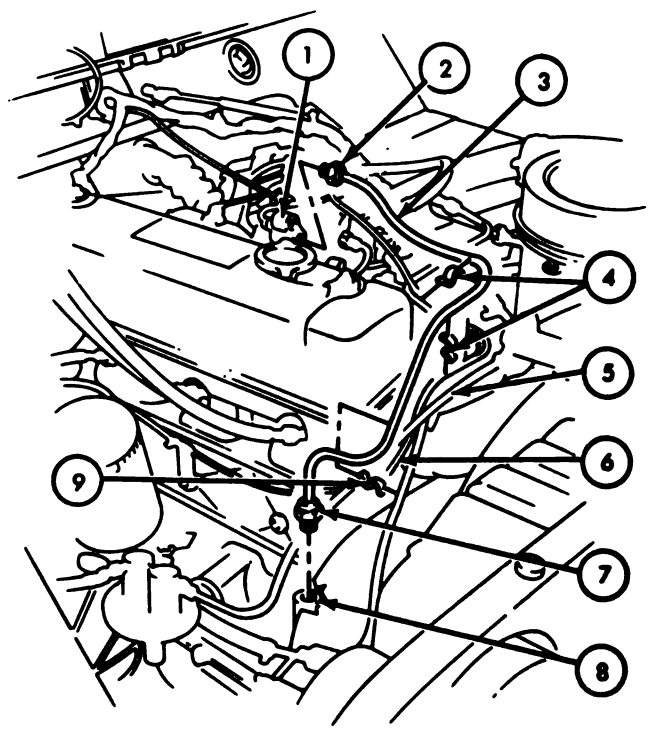


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		h. CRANKCASE VENT LINE INSTALLATION		
31.		Vent line (3)	*a.* Place on engine in approximate position.	
			b. Secure to crankcase vent adapter (8) with fitting (7).	Do not overtighten.
			c. Secure to intake manifold adapter (1) with fitting (2).	Do not overtighten.
			d. Secure to fuel pump vent line (5) with retainer clip (9).	
			e. Secure to distributor vent line (6) and fuel pump vent line (5) with two retainer clips (4).	

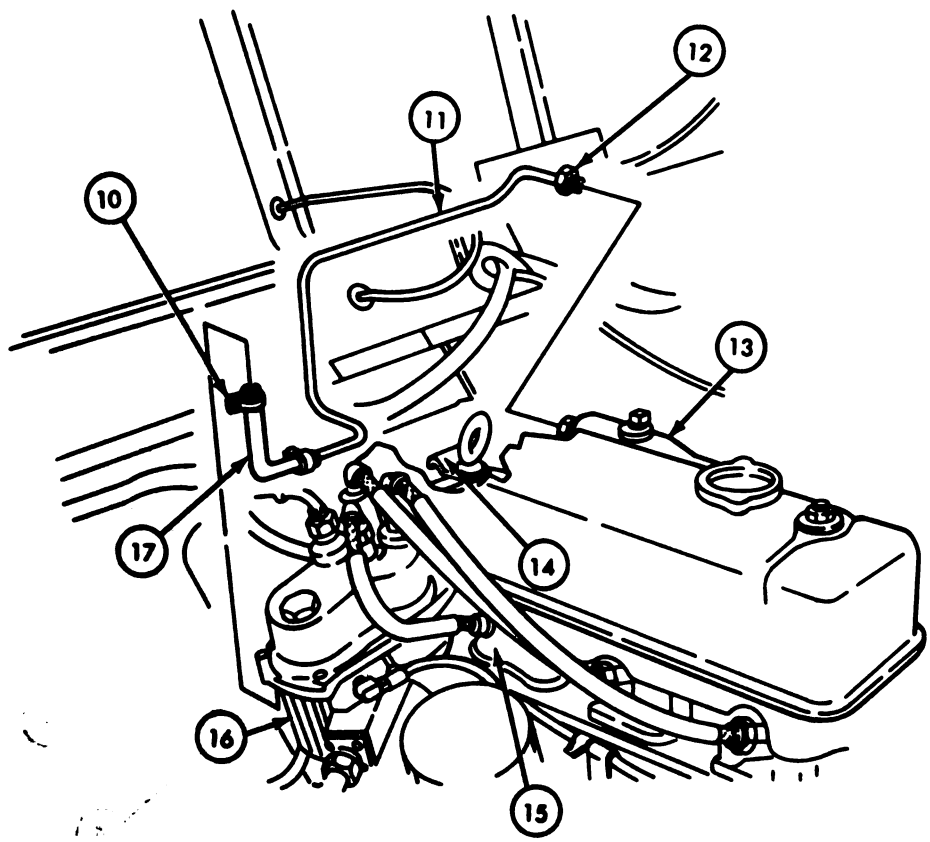


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		i. DISTRIBUTOR VENT LINES INSTALLATION		
32.		Distributor to intake manifold vent line (11)	*a.* Place on engine in approximate position.	
			b. Secure to rear of intake manifold (13) with fitting (12).	Do not overtighten.
			c. Secure to rear of cylinder head (15) by snapping into retainer clip (14).	
33.		Vent line hose (17)	Secure to rear of distributor (16) with hose clamp (10).	

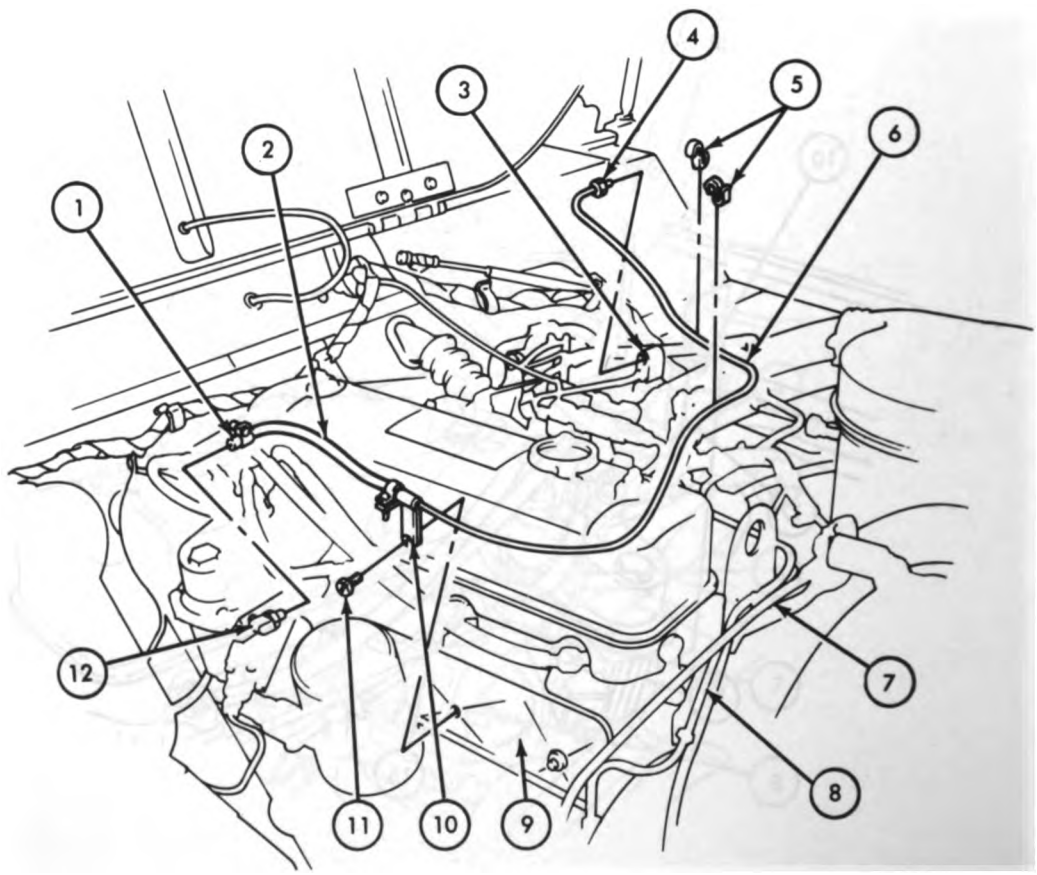


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
34.		Distributor to carburetor vent line (6)	Place on engine in approximate position.	
35.		Vent line hose (2)	Secure to front of distributor (12) with hose clamp (1).	
36.		Distributor to carburetor vent line (6)	*a.* Secure to push rod cover (9) with clamp (10) and screw (11).	
			b. Secure to crankcase vent line (7) and fuel pump vent line (8) with two retainer clips (5).	
			c. Secure to carburetor elbow (3) with fitting (4).	Do not overtighten.

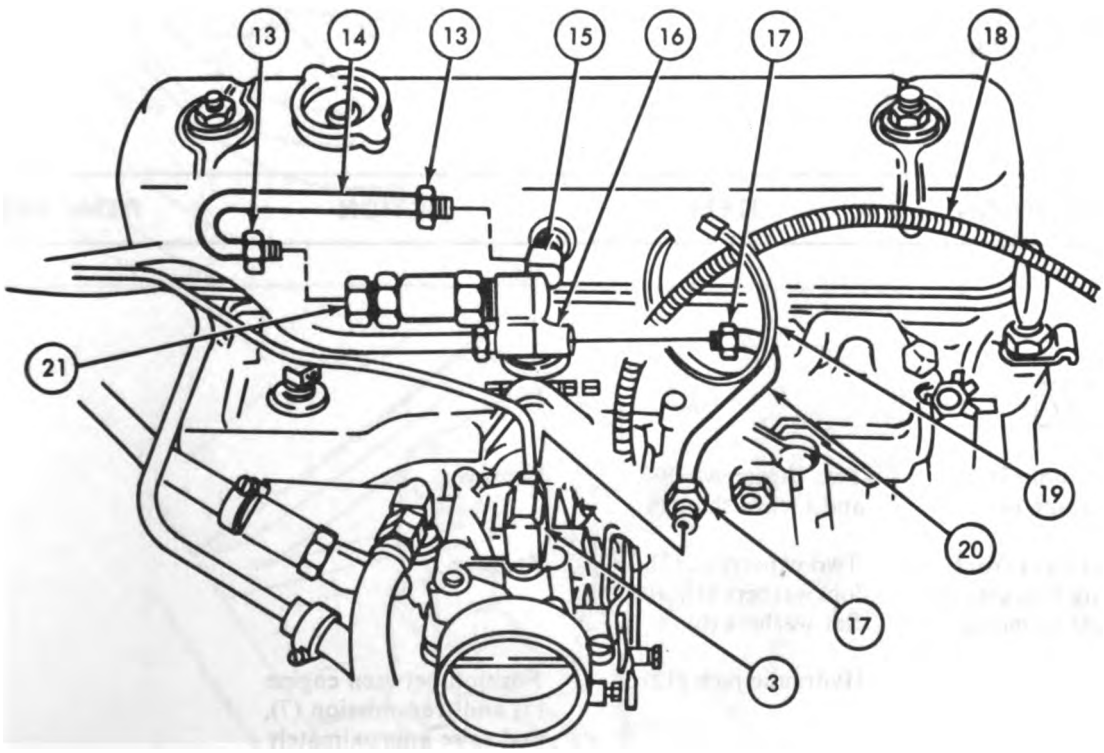


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4-8. Crankcase and Distributor Vent Lines Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		j. CRANKCASE VENT VALVE TO ROCKER COVER VENT LINE INSTALLATION		
37.		Vent line (14)	Secure to rocker cover fitting (15) and crankcase vent valve adapter (21) with two fittings (13).	Do not overtighten.
		k. CARBURETOR TO INTAKE MANIFOLD VENT LINE INSTALLATION		
		NOTE Make sure to route vent line (20) through choke cable tie down strap (19) to ensure proper operation of choke cable (18).		
38.		Vent line (20)	Secure to carburetor elbow (3) and intake manifold adapter (16) with two fittings (17).	Do not overtighten.



END OF TASK!

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4-9. Engine Mounting Brackets and Cushions Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Hydraulic jack
Torque wrench (0-175 lb-ft)

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 10-14	Transmission cover panel removed.

Special Environmental Conditions
None

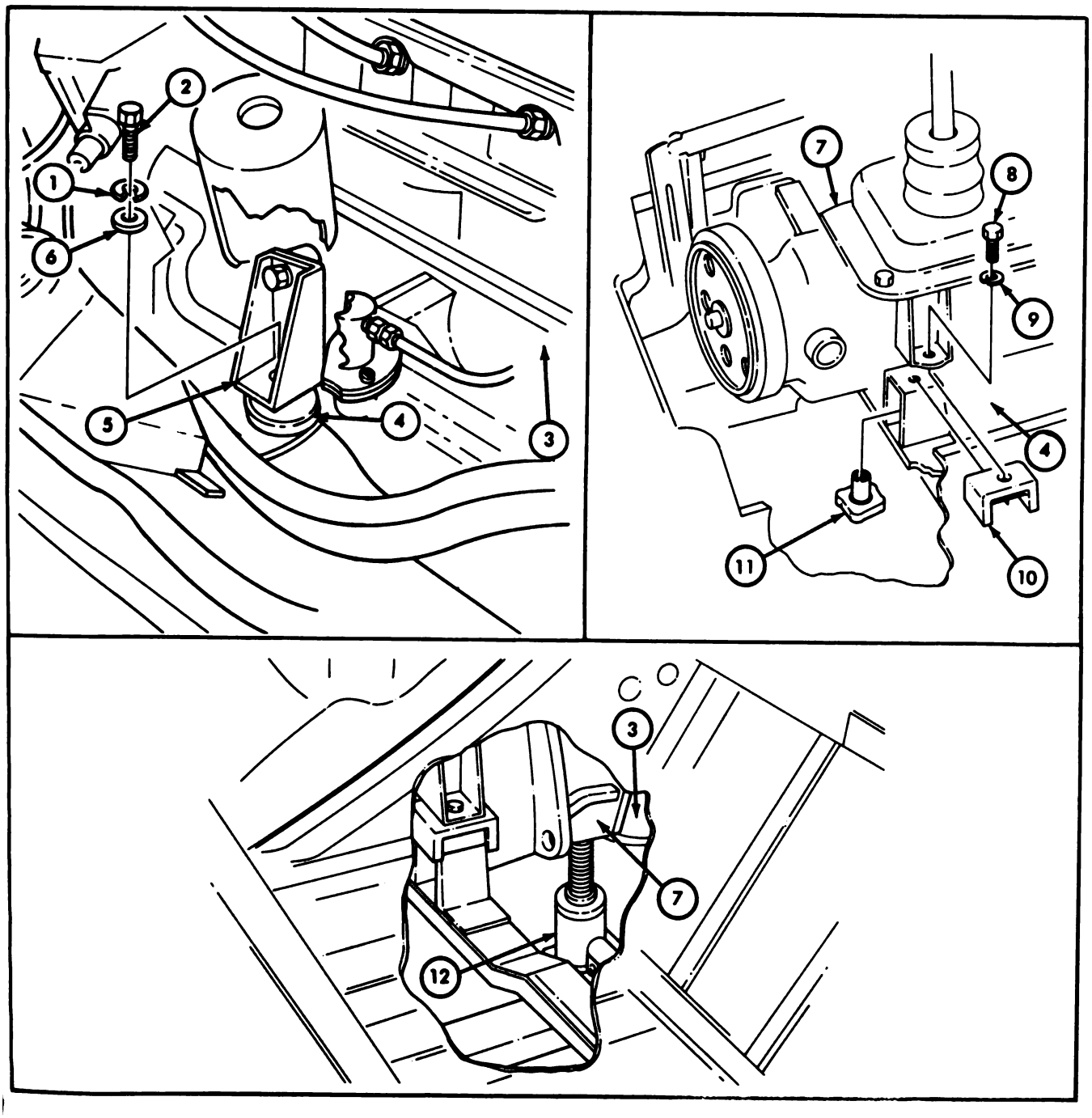
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Transmission (7) to vehicle frame (4)	Two capscrews (8) and lockwashers (9)	Remove.	
2.	Left and right front mounting brackets (5) to vehicle frame (4)	Two capscrews (2), lockwashers (1), and flat washers (6)	Remove.	
3.		Hydraulic jack (12)	Position between engine (3) and transmission (7), and raise approximately 1 in. (25 mm).	

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4-9. Engine Mounting Brackets and Cushions Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.		Two rear upper mount cushions (10) and lower mount cushions (11)	Remove.	Note positioning of cushions (10) and (11) for installation.



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4-9. Engine Mounting Brackets and Cushions Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.		Two front upper cushions (5) and lower cushions (4)	Remove.	Note positioning of cushions (5) and (4) for installation.
		NOTE It is not necessary to remove the two mounting brackets when replacing mounting cushions.		
6.	Right mounting bracket (6) to engine (3)	Two capscrews (1) and lockwashers (2)	Remove.	
7.		Right mounting bracket (6)	Remove.	
8.	Left mounting bracket (9) to engine (3)	Clutch return spring (7), two capscrews (10), and lockwashers (11)	Remove.	
9.		Left mounting bracket (9).	Remove.	
b. INSTALLATION				
10.		Right front mounting bracket (6)	Secure to right side of engine (3) with two lockwashers (2) and capscrews (1).	
11.		Left front mounting bracket (9)	Secure to left side of engine (3) with two lockwashers (11) and capscrews (10).	
12.		Clutch return spring (7)	Secure to clutch release rod (8) and left front mounting bracket (9).	

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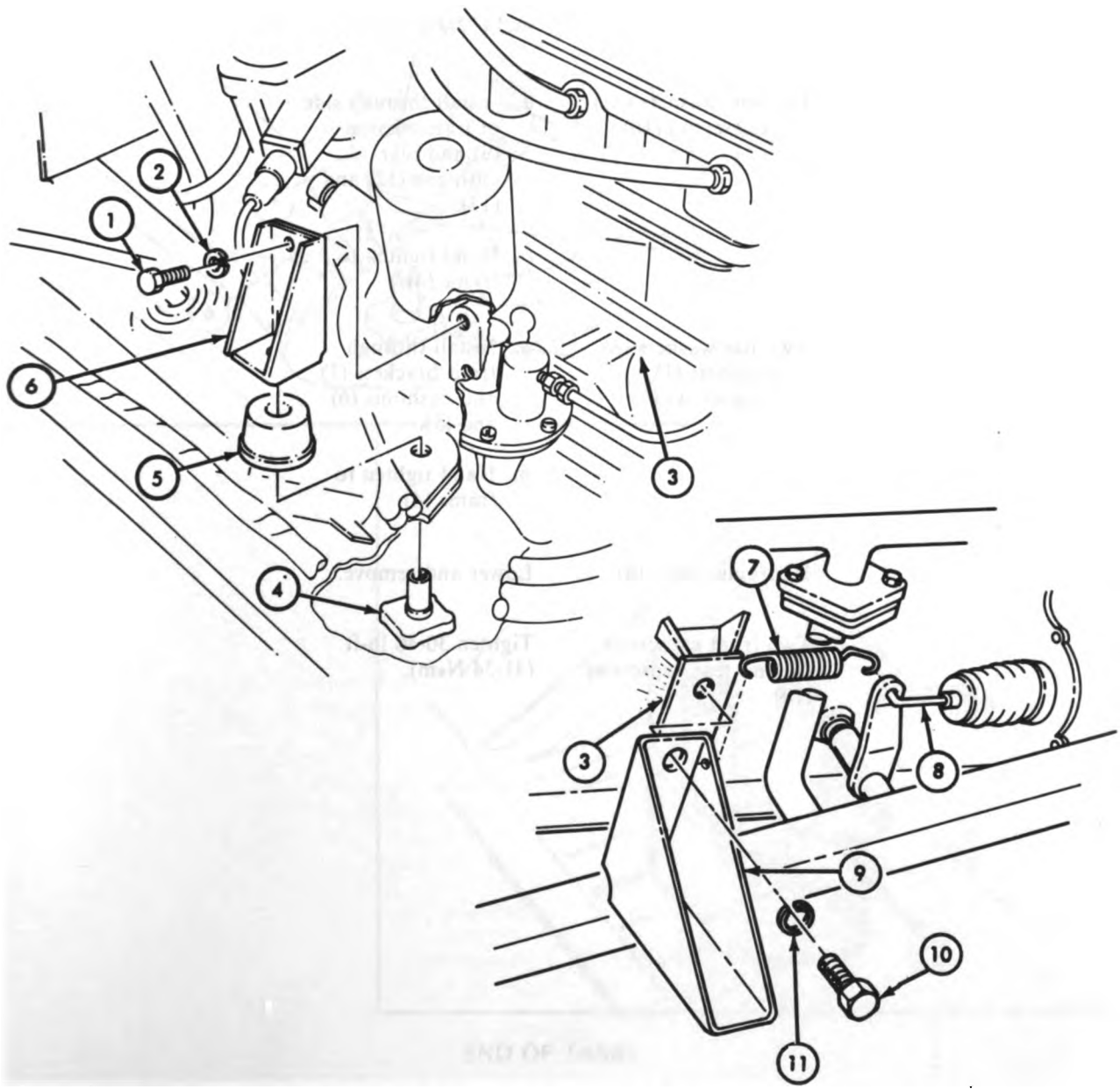
4-9. Engine Mounting Brackets and Cushions Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

If replacement of mounting cushions is required, replace with engine mount kit.

13.		Two front lower cushions (4) and upper cushions (5)	Position on vehicle frame under two brackets (6).



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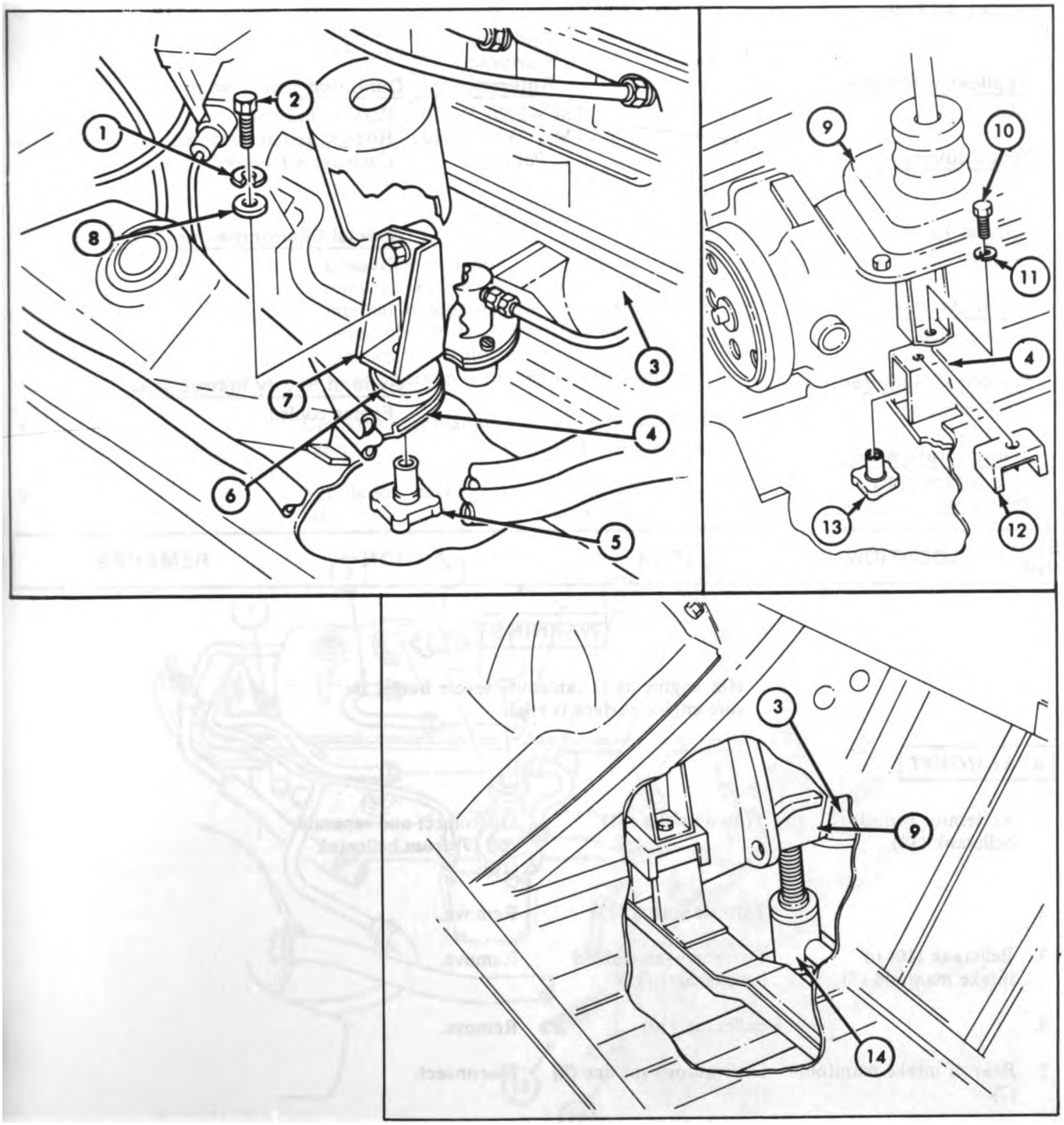
4-9. Engine Mounting Brackets and Cushions Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
14.		Two rear lower cushions (13) and upper cushions (12)	Position on vehicle frame (4) at each side of transmission (9).	
15.		Hydraulic jack (14)	Lower until transmission (9) and engine (3) rest on front and rear upper cushions (6) and (12).	
16.		Two lockwashers (11) and capscrews (10)	*a.* Install through side of transmission (9) and rear cushions (12) and (13). *b.* Hand tighten to frame (4).	
17.		Two flat washers (8), lockwashers (1), and capscrews (2)	*a.* Install through front brackets (7) and cushions (6) and (5). *b.* Hand tighten to frame (4).	
18.		Hydraulic jack (14)	Lower and remove.	
19.		Two front capscrews (2) and rear capscrews (10)	Tighten 30-40 lb-ft (41-54 N•m).	

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4-9. Engine Mounting Brackets and Cushions Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Install transmission cover panel (para 10-14).

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4-10. Intake Manifold Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Materials/Parts
Two gaskets

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 4-32	Carburetor removed.

Special Environmental Conditions
None

General Safety Instructions
Engine cooled.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Hot engine parts can cause severe burns. Be sure engine surface is cool.

a. REMOVAL

1.	Acclerator rod (9) to bellcrank (10)	Trunnion clip (11)	Disconnect and separate rod (9) from bellcrank (10).
2.		Throttle spring (13)	Remove.
3.	Bellcrank (10) to intake manifold (7)	Two screw-assembled lockwashers (12)	Remove.
4.		Bellcrank (10)	Remove.
5.	Rear of intake manifold (7)	Distributor vent line (8)	Disconnect.

NOTE

Note locations of three vent lines for installation.

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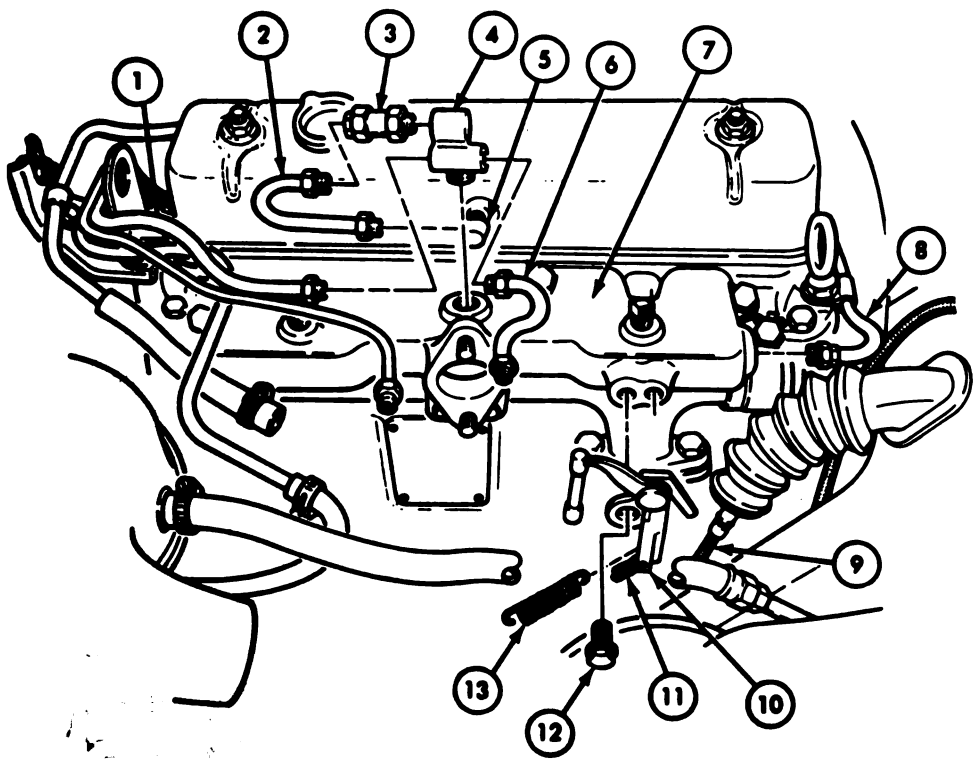
4-10. Intake Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
6.	Top of intake manifold (7) at fitting (4)	Rocker cover vent line (2), carburetor vent line (6), and cylinder block vent line (1)	Disconnect.	
7.		Rocker cover vent line (2)	Disconnect from rocker cover elbow (5).	

CAUTION

Crankcase ventilation valve must be properly removed and installed to avoid damaging internal crimp. Always position wrench at point closest to connection being turned. Damage to ventilation system will result if valve or crimp is twisted or overtightened.

8.		Crankcase ventilation valve (3)	Remove from ventilation valve fitting (4).	
9.		Ventilation valve fitting (4)	Remove from intake manifold (7).	



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4-10. Intake Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
10.	Intake manifold (2) to cylinder head (1)	Two capscrews (3) and locking tab washer (4)	Bend tabs on washer (4) down and remove.	
11.		Four capscrews (5), lockwashers (6), and flat washers (7)	Remove.	
12.		Intake manifold (2) and two gaskets (8)	Remove.	Discard two gaskets (8).

b. INSTALLATION

NOTE

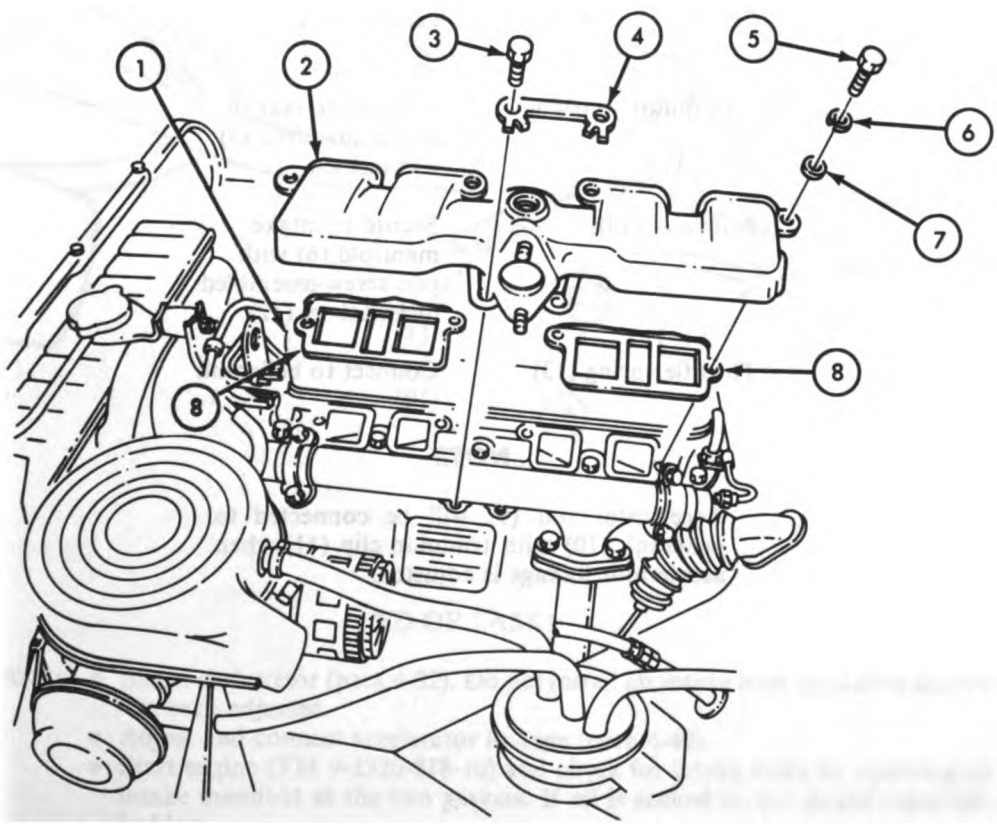
If new intake manifold is being installed, transfer all hardware from old manifold.

13.		Two new gaskets (8) and intake manifold (2)	*a.* Position on cylinder head (1).	
			b. Install four flat washers (7), lockwashers (6), and capscrews (5) through top four manifold holes and tighten.	Tighten capscrews (5) 10-15 lb-ft (14-20 N•m).

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4-10. Intake Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE If any tabs on locking tab washer are broken, locking tab washer must be replaced.	
			c. Install locking tab washer (4) and two capscrews (3) through two lower manifold holes and tighten.	Tighten capscrews (3) 8-10 lb-ft (11-14 N•m).
14.		Four upper capscrews (5)	Tighten 23-28 lb-ft (31-38 N•m).	
15.		Two lower capscrews (3)	Tighten 12-16 lb-ft (16-22 N•m) and bend tabs on tab washer (4) up to lock.	



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4-10. Intake Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
16.		Ventilation valve fitting (4)	Install on intake manifold (7) and tighten.	

CAUTION

Crankcase ventilation valve must be properly removed and installed to avoid damaging internal crimp. Always position wrench at point closest to connection being turned. Damage to ventilation system will result if valve or crimp is twisted or overtightened.

17.		Crankcase ventilation valve (3)	Install in ventilation valve fitting (4) and tighten.	
18.		Cylinder block vent line (1) and carbutor vent line (6)	Connect to ventilation valve fitting (4) and tighten.	
19.		Rocker cover vent line (2)	Connect to rocker cover elbow (5) and crankcase ventilation valve (3), and tighten.	
20.		Distributor vent line (8)	Connect to rear of intake manifold (7) and tighten.	
21.		Bellcrank (10)	Secure to intake manifold (6) with two screw-assembled lockwashers (12).	
22.		Throttle spring (13)	Connect to bellcrank (10).	

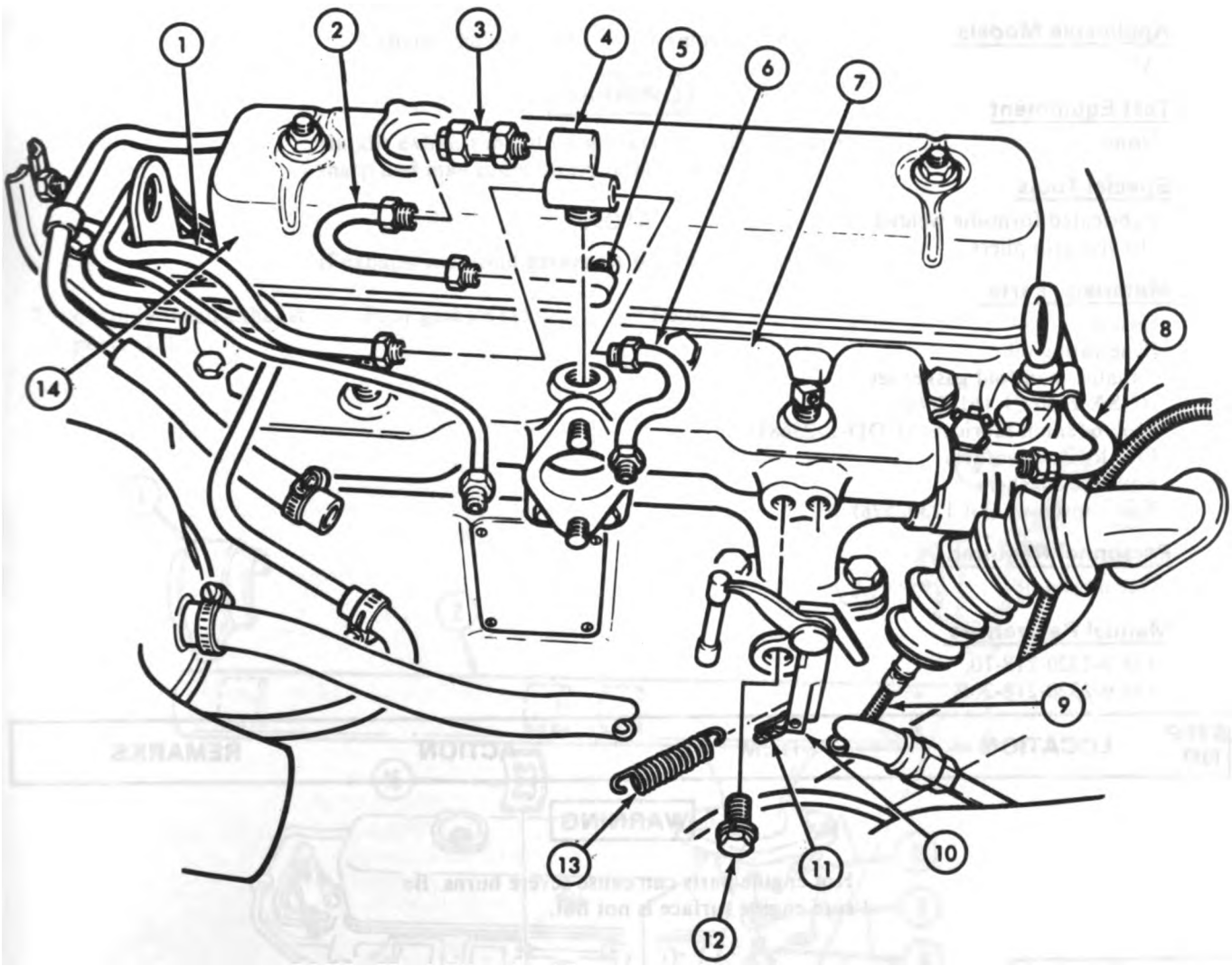
NOTE

Accelerator rod (9) will be connected to bellcrank (10) with trunnion clip (11) when accelerator linkage is adjusted.

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4-10. Intake Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Install carburetor (para 4-32). Do not install air intake hose until after accelerator linkage has been adjusted.
- Adjust and connect accelerator linkage (para 4-40).
- Start engine (TM 9-2320-218-10) and check for intake leaks by squirting oil around the intake manifold at the two gaskets. If oil is sucked in, the intake manifold or gasket is leaking.

TA 155287

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4-11. Exhaust Manifold Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Installation
d. Torque Procedures

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Fabricated form-die welded
to vise grip pliers

Materials/Parts
Gasket
Penetrating oil
Exhaust manifold gasket set
(NSN 2530-01-161-7668)
Molybdenum lubricant (DOD-L-25681)
Five locktab washers
Four lockwashers
Two capscrews (kit 12302578)

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		WARNING		
		Hot engine parts can cause severe burns. Be sure engine surface is not hot.		
	a. REMOVAL			
1.	Front exhaust pipe (9) to exhaust manifold (2)	Two nuts (10) and washers (11)	Remove and pull pipe (9) away from manifold (2).	Use penetrating oil to help loosen nuts (10).
2.		Gasket (12)	Remove.	Discard gasket (12).
3.	Exhaust manifold flange (6) to cylinder head (14)	Locating bolt (8) and lockwasher (7)	Remove.	
4.	Two exhaust manifold clamps (1) and (3)	Four locktab washers (4)	Open tabs.	

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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Exhaust manifold (2) to engine	Four capscrews (5), locktab washers (4), and two mounting clamps (1) and (3)	Remove.	Discard locktab washers (4).
6.		Exhaust manifold (2)	Remove.	

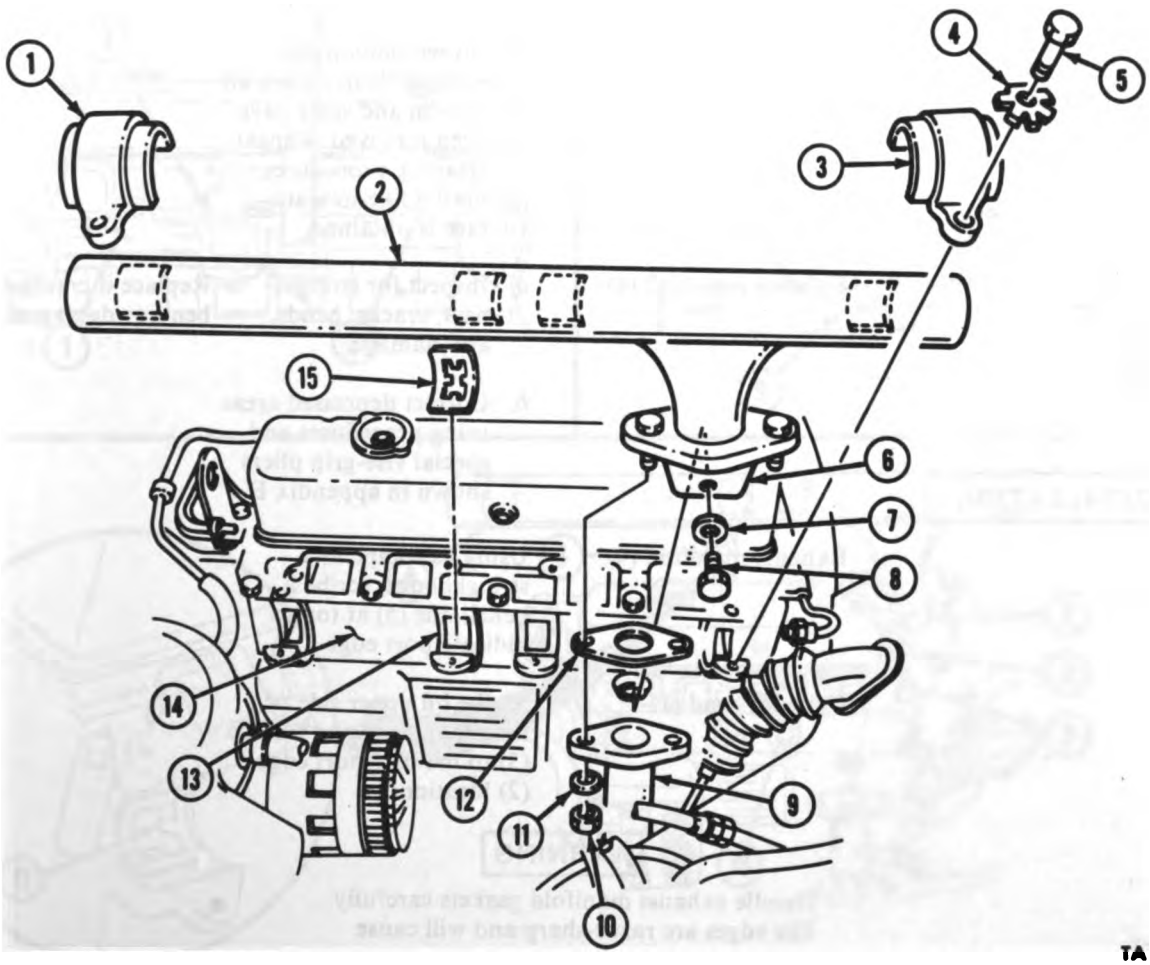
WARNING

Handle exhaust manifold gaskets carefully. Edges are very sharp and may cause injury to personnel.

NOTE

If exhaust manifold gasket set is installed, perform step 7.

7.	Cylinder head exhaust ports (13)	Four gaskets (15)	Remove.	Discard gaskets (15).



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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. CLEANING AND INSPECTION		**CAUTION** • Install plugs in intake and exhaust ports of cylinder head to prevent foreign matter from entering the engine. • All carbon deposits and scale must be removed from exhaust manifold mounting surface of cylinder head. These surfaces must be cleaned to a like-new condition. Thorough cleaning is required to allow the new exhaust manifold gaskets to seal properly.	
8.		Cylinder head (1)	*a.* Use wire brush to remove carbon and scale deposits from exhaust manifold mounting surface (3). *b.* Inspect mounting surface (3) to ensure all carbon and scale have been removed. Repeat cleaning procedures until a like-new surface is obtained.	
9.		Exhaust manifold (4)	*a.* Inspect for straightness, cracks, bends, and damage. *b.* Correct depressed areas using procedures and special vise-grip pliers shown in appendix E.	Replace if cracked, bent, or damaged.
	c. INSTALLATION			
10.		Exhaust manifold (4)	Using steel tape as a straight edge, scribe a pencil line (5) at top to indicate port edge.	
11.		Cylinder head (1)	Scribe on upper side of manifold attaching surface (3) to indicate port edge (2) locations.	

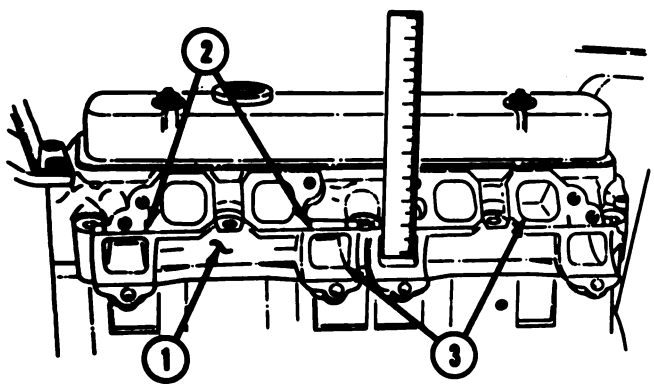
WARNING

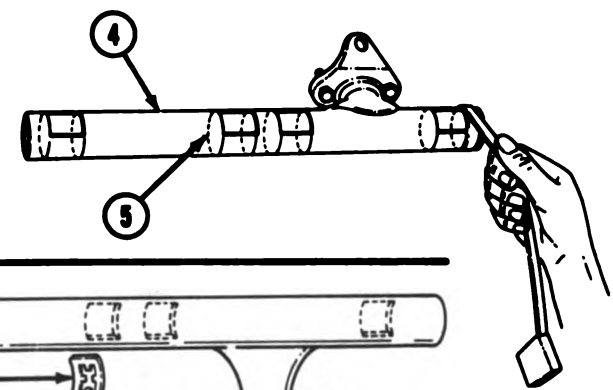
Handle exhaust manifold gaskets carefully. The edges are razor-sharp and will cause injury to personnel.

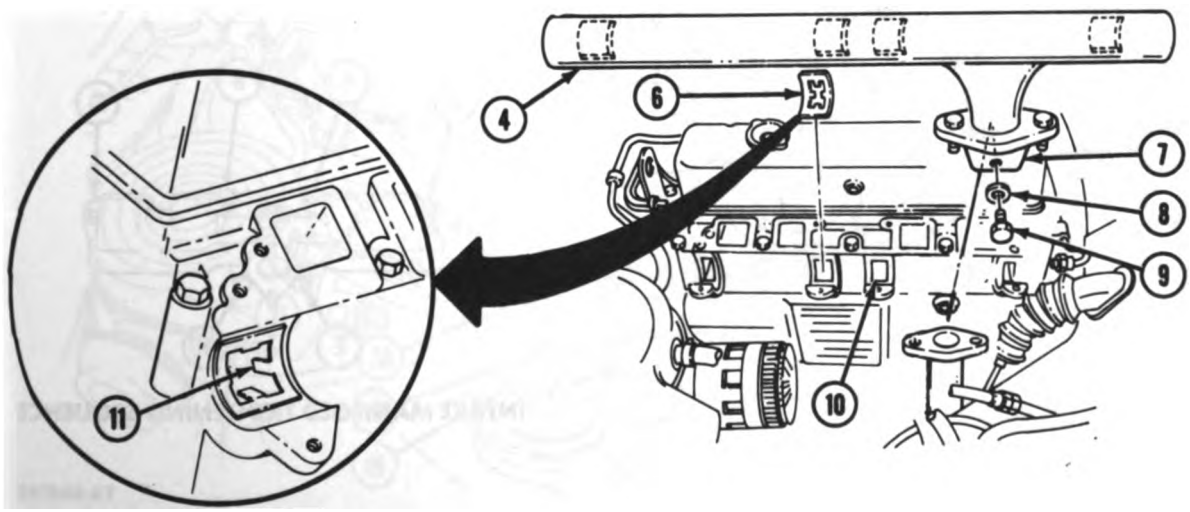
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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE • Use 1.250 in. (25.65 mm) length capscrews for vehicles equipped with new type reinforced cylinder head. • Gaskets must be preformed by hand to conform to the curvature of exhaust manifold.	
12.		Four new gaskets (6)	*a.* Position cylinder head exhaust ports (10). *b.* Bend tabs (11) inward to secure.	
13.		Exhaust manifold flange (7)	*a.* Position on cylinder head (1) and secure with flat washer (8) and locating bolt (9).	Finger tighten locating bolt (9).
			b. Aline cylinder head (1) and manifold (4) scribe marks.	All alinement marks must be adjusted to within 1/8-in. (3.17 mm).





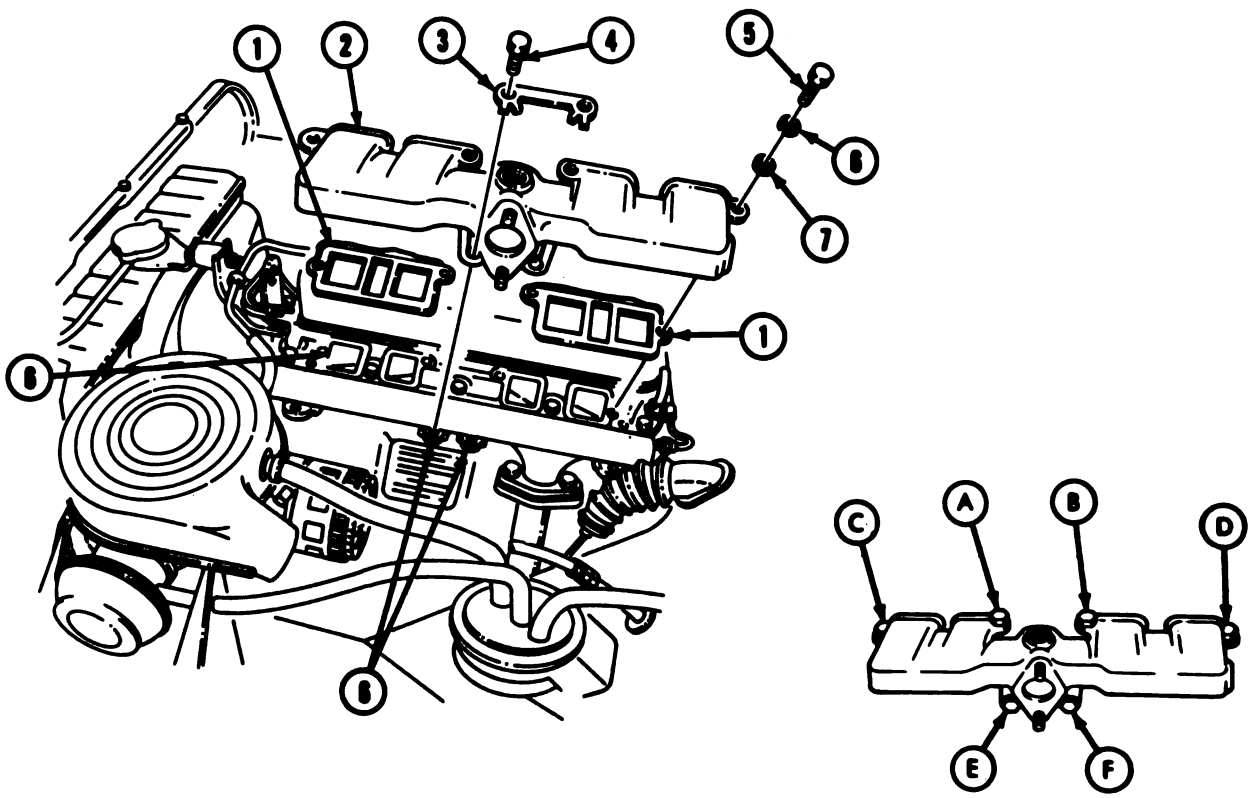


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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE • When installing intake manifold (2), discard two existing capscrews (4) and locktab washer (3). • Coat gaskets and screw threads with molybdenum lubricant.		
14.		Intake manifold (2) and two new gaskets (1)	Install on cylinder head (9) with four screws (5), new lockwashers (6), and washers (7).	
15.		Two new capscrews (4) and new locktab washer (3)	Install in center lower manifold screw holes (8).	Tighten screws (4) and (5) 23-28 lb-ft (31-38 N•m) in sequence shown.



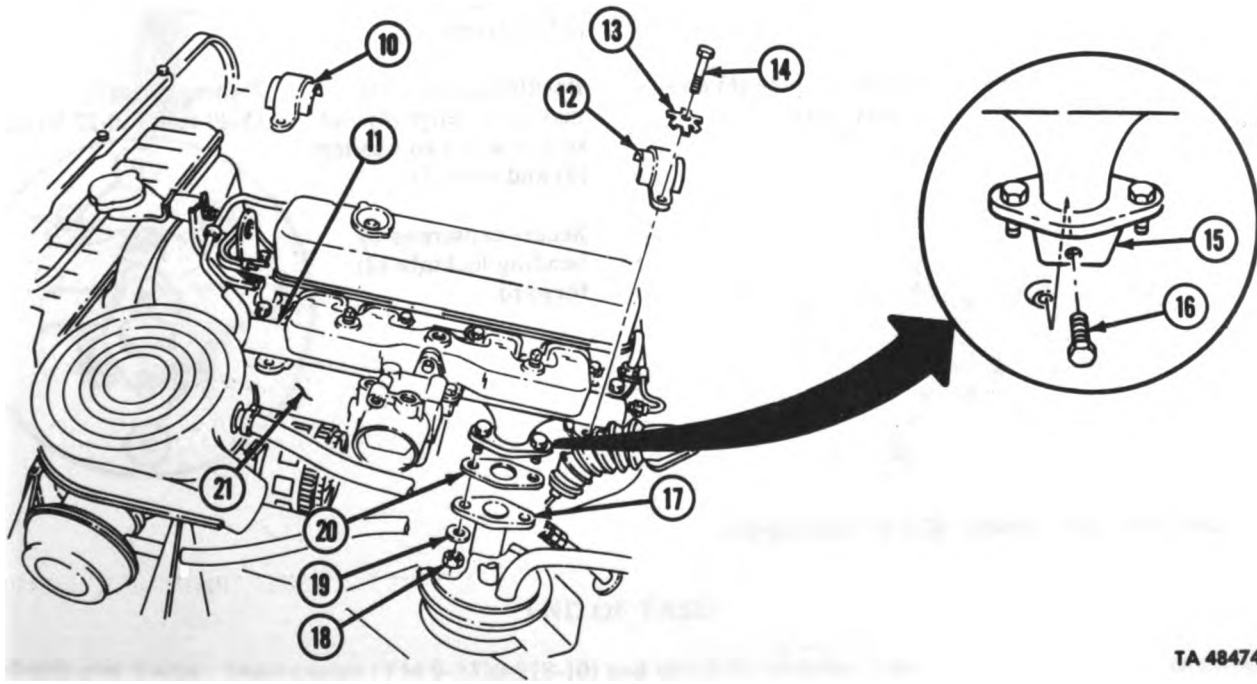
INTAKE MANIFOLD TIGHTENING SEQUENCE

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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE		
		Coat capscrew threads with molybdenum lubricant (DOD-L-25681).		
16.		Exhaust manifold (11)	Secure to cylinder head (21) with two clamps (10) and (12), four new lock-tab washers (13), and four capscrews (14).	Tighten all capscrews (14) 18-23 lb-ft (24-31 N•m).
17.		Locating bolt (16)	Tighten 20-30 lb-ft (27-41 N•m).	
18.		Exhaust pipe (17)	Secure to exhaust manifold flange (15) with new gasket (20), two washers (19), and nuts (18).	Tighten nuts (18) 15-20 lb-ft (20-27 N•m).
		NOTE		
		• When installing carburetor, coat new gasket with molybdenum lubricant. • Tighten all securing nuts 17-23 lb-ft (23-31 N•m).		
19.		Carburetor and new gasket	Install (para 4-32).	



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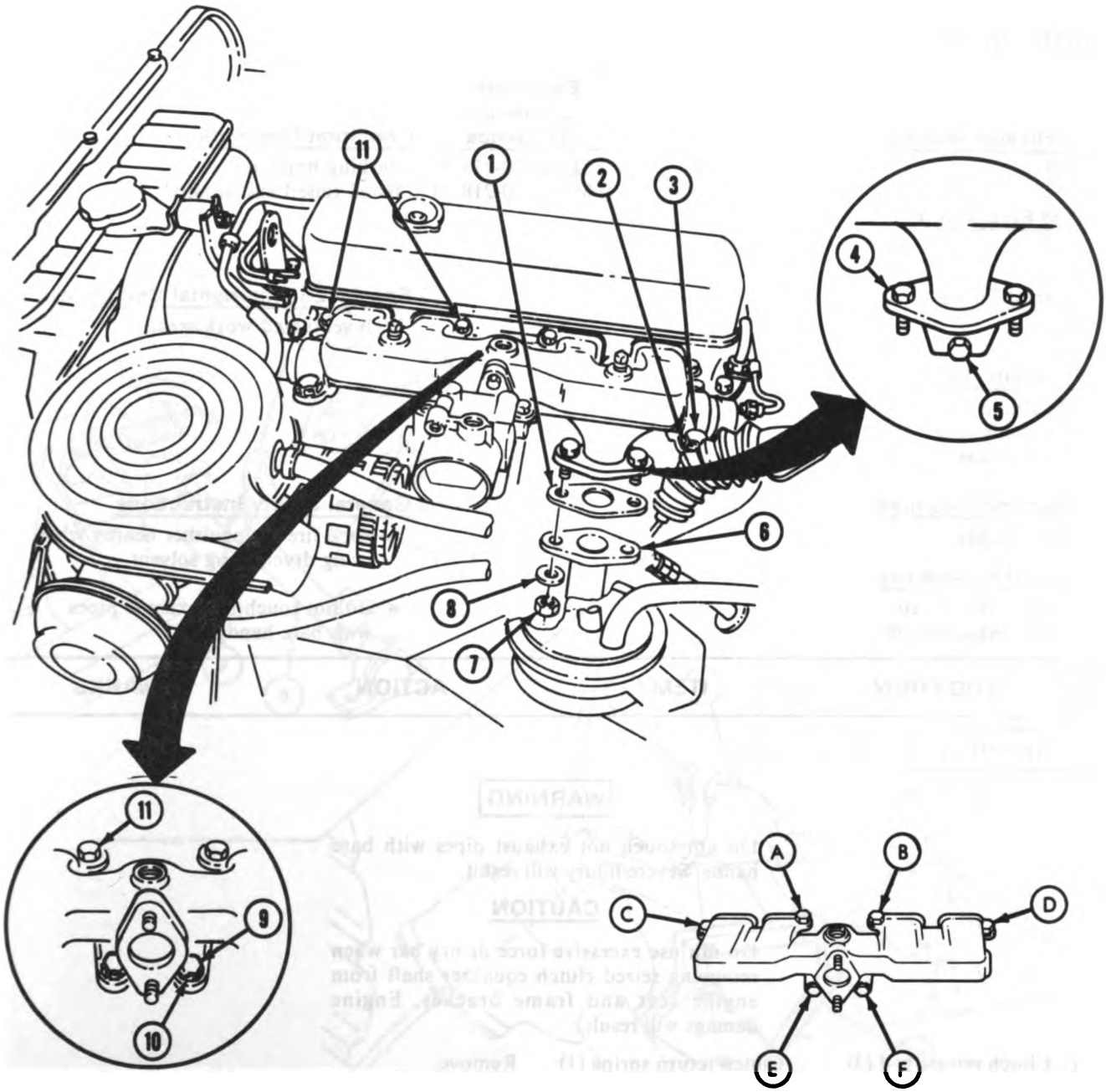
4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		d. TORQUE PROCEDURES		
20.		Engine	*a.* Start (TM 9-2320-218-10) and allow to run until normal operating temperature of 170°-190° F is reached.	
			b. Stop and allow to cool.	
21.		Exhaust manifold flange (4)	Remove two nuts (7) and washers (8).	
22.		Exhaust pipe (6)	Lower.	
23.		Locating bolt (5)	Loosen, but do not remove.	
24.		Two intake manifold retaining capscrews (9) and four retaining capscrews (11)	Retighten.	Tighten capscrews (9) and (11) 23-28 lb-ft (31-38 N•m) in sequence shown.
25.		Exhaust manifold retaining capscrews (3)	Retighten.	Tighten capscrews (3) 18-23 lb-ft (24-31 N•m).
26.		Locating bolt (5)	Tighten 20-30 lb-ft (27-41 N•m).	
27.		Exhaust pipe (6) and gasket (1)	Position on exhaust manifold flange (4) and secure with two washers (8) and nuts (7).	Tighten nuts (7) 15-20 lb-ft (20-27 N•m).
28.			Secure capscrews by bending locktabs (2) forward.	

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4-11. Exhaust Manifold Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



INTAKE MANIFOLD TIGHTENING SEQUENCE

END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check for exhaust leaks.

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4-12. Clutch Linkage Maintenance and Adjustment

This task covers:

a. Removal
b. Disassembly
c. Cleaning and Inspection
d. Reassembly
e. Installation
f. Free Travel Check
g. Adjustment

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Retaining clip
Retaining ring
GAA grease

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Well-ventilated work area.

General Safety Instructions
- Keep fire extinguisher nearby when using drycleaning solvent.
- Do not touch hot exhaust pipes with bare hands.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. REMOVAL

WARNING

Do not touch hot exhaust pipes with bare hands. Severe injury will result.

CAUTION

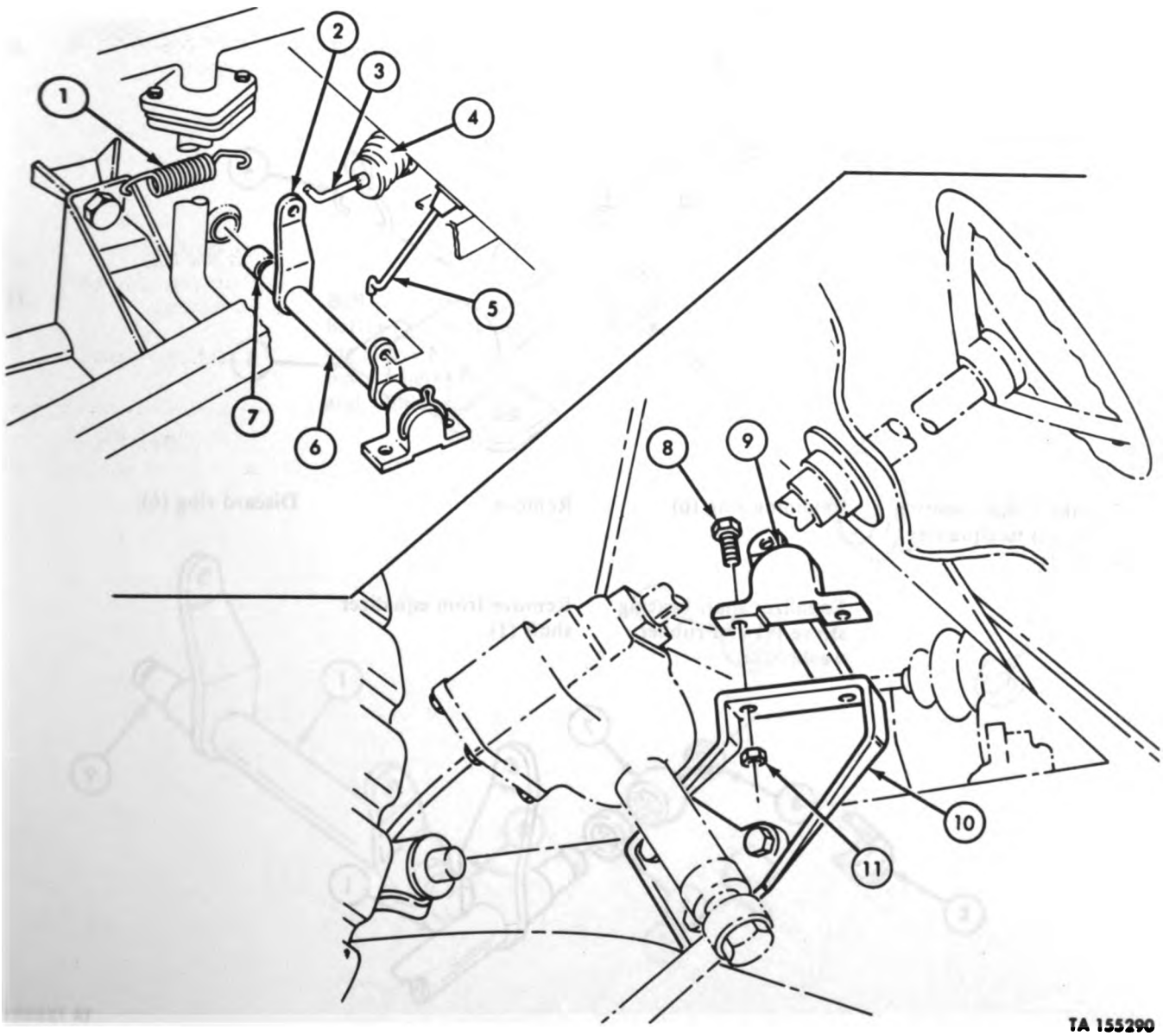
Do not use excessive force or pry bar when removing seized clutch equalizer shaft from engine seat and frame bracket. Engine damage will result.

1.	Clutch release rod (3) to clutch equalizer shaft (6)	Clutch return spring (1)	Remove.
2.		Clutch release rod (3)	Remove from equalizer shaft arm (2).
3.	Clutch release rod (3)	Rubber seal (4)	Disconnect from engine and slide off.

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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Clutch equalizer shaft bracket (9) to vehicle frame (10)	Two locknuts (11) and bolts (8).	Remove.	
5.		Equalizer shaft (6)	*a.* Remove from engine by pulling directly away. *b.* Tilt engine end (7) down and rearward to remove from clutch cross shaft rod (5).	

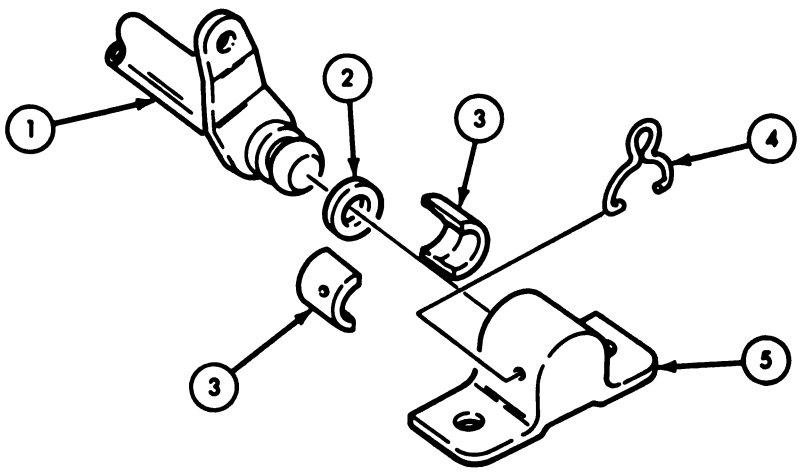


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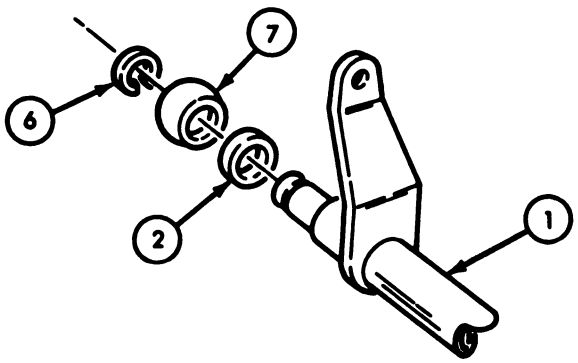
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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. DISASSEMBLY			
6.	Equalizer shaft bracket (5) to equalizer shaft (1)	Retaining clip (4)	Spread and remove.	Discard clip (4).
7.		Equalizer shaft bracket (5), ball socket bushing halves (3), and rubber washer (2)	Remove from equalizer shaft (1).	



8.	Equalizer shaft bearing sleeve (7) to equalizer shaft (1)	Retaining ring (6)	Remove.	Discard ring (6).
9.		Equalizer shaft bearing sleeve (7) and rubber washer (2)	Remove from equalizer shaft (1).	



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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

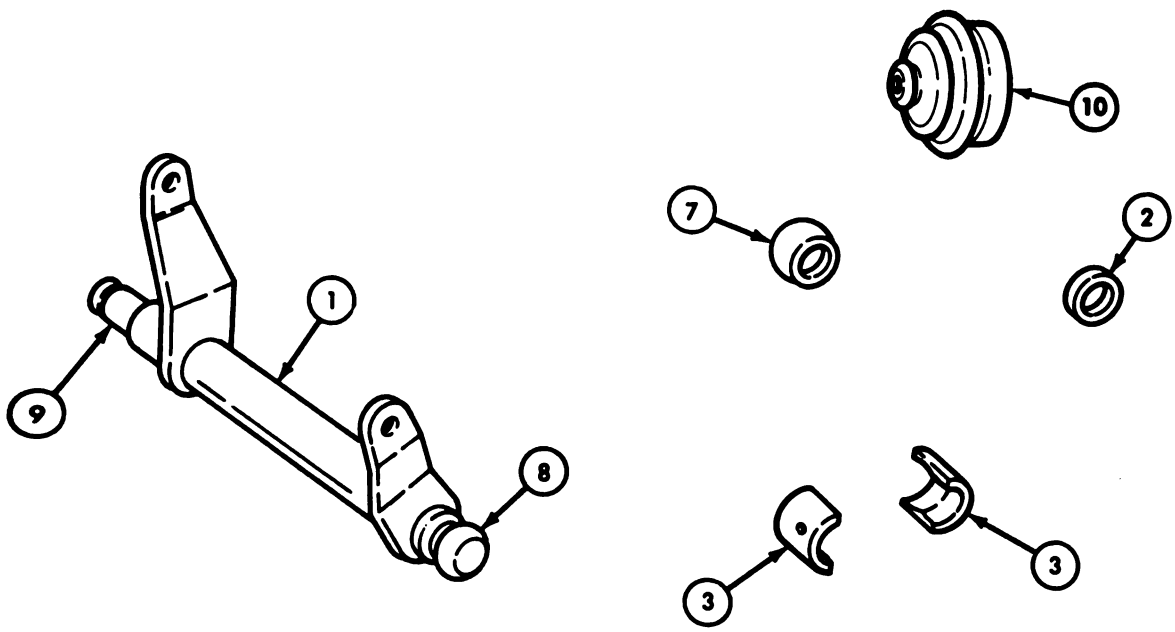
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

c. CLEANING AND INSPECTION

WARNING

Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
10.		Equalizer shaft (1)	*a.* Clean with dry-cleaning solvent.	
			b. Inspect ball (8) and bearing seat (9) for burrs, scratches, and wear that could deteriorate plastic bushings.	Replace if badly scratched, burred or worn.
11.		Ball socket bushing halves (3), shaft bearing sleeve (7), rubber washers (2), and rubber seal (10)	Inspect for deterioration and wear.	If deteriorated or badly worn, replace.

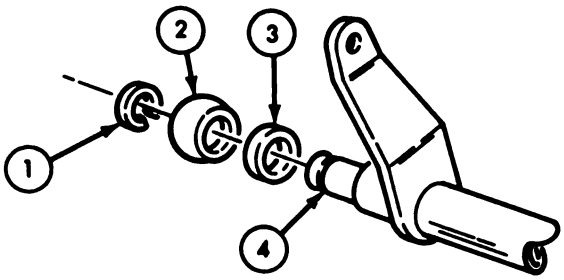


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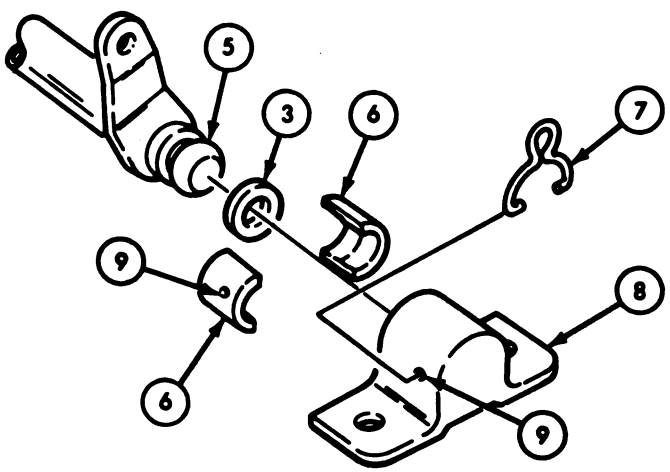
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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	d. REASSEMBLY			
12.		Rubber washer (3), bearing sleeve (2), and new retaining ring (1)	Install on flat end of equalizer shaft (4).	



13.		Equalizer shaft bracket (8)	Lubricate bushing seat with GAA grease.	
14.		Rubber washer (3) and ball socket bushing halves (6)	Install on ball end of equalizer shaft (5).	
15.		Equalizer shaft bracket (8)	*a.* Aline holes in side of bracket (8) and bushing halves (6). *b.* Slide over bushing halves (6).	
16.		New retaining clip (7)	Install in holes (9) of equalizer shaft bracket (8) and bushing halves (6).	



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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

e. INSTALLATION

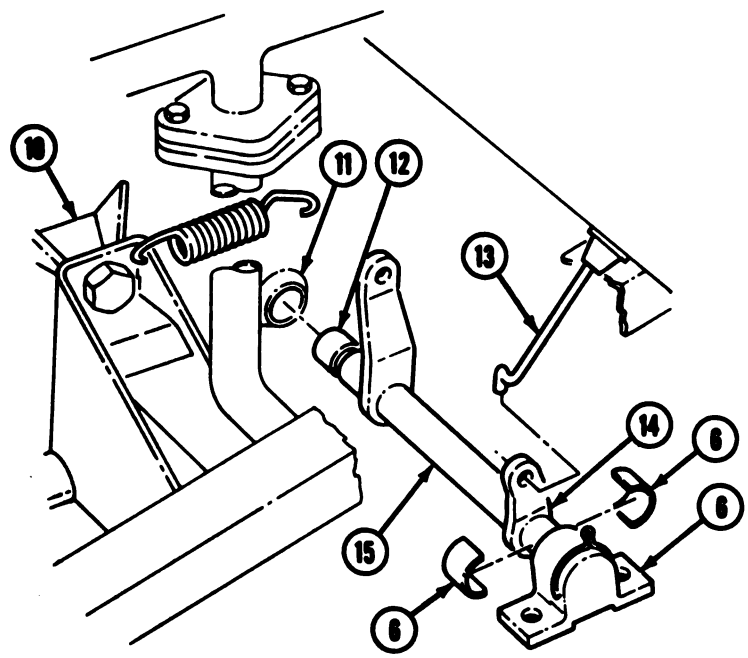
CAUTION

Do not score or scratch plastic bearing against engine when turning to connect rod or to seat bearing. A deformed plastic bearing may not seat.

NOTE

The engine bearing seat (11), shaft bearing sleeve (12), shaft bracket bushing seat (8), and shaft bushing halves (6) should be lubricated with GAA grease before installation.

17.	Lower left side of engine (10)	Equalizer shaft assembly (15)	*a.* Turn bracket end (8) forward and upward.	
			b. Connect outer shaft lever (14) to cross-shaft rod (13).	Insert rod (13) from outer side of shaft lever (14).
			c. Pull left, turn bearing sleeve end (12) to engine bearing seat (11), and allow to enter hole in engine.	

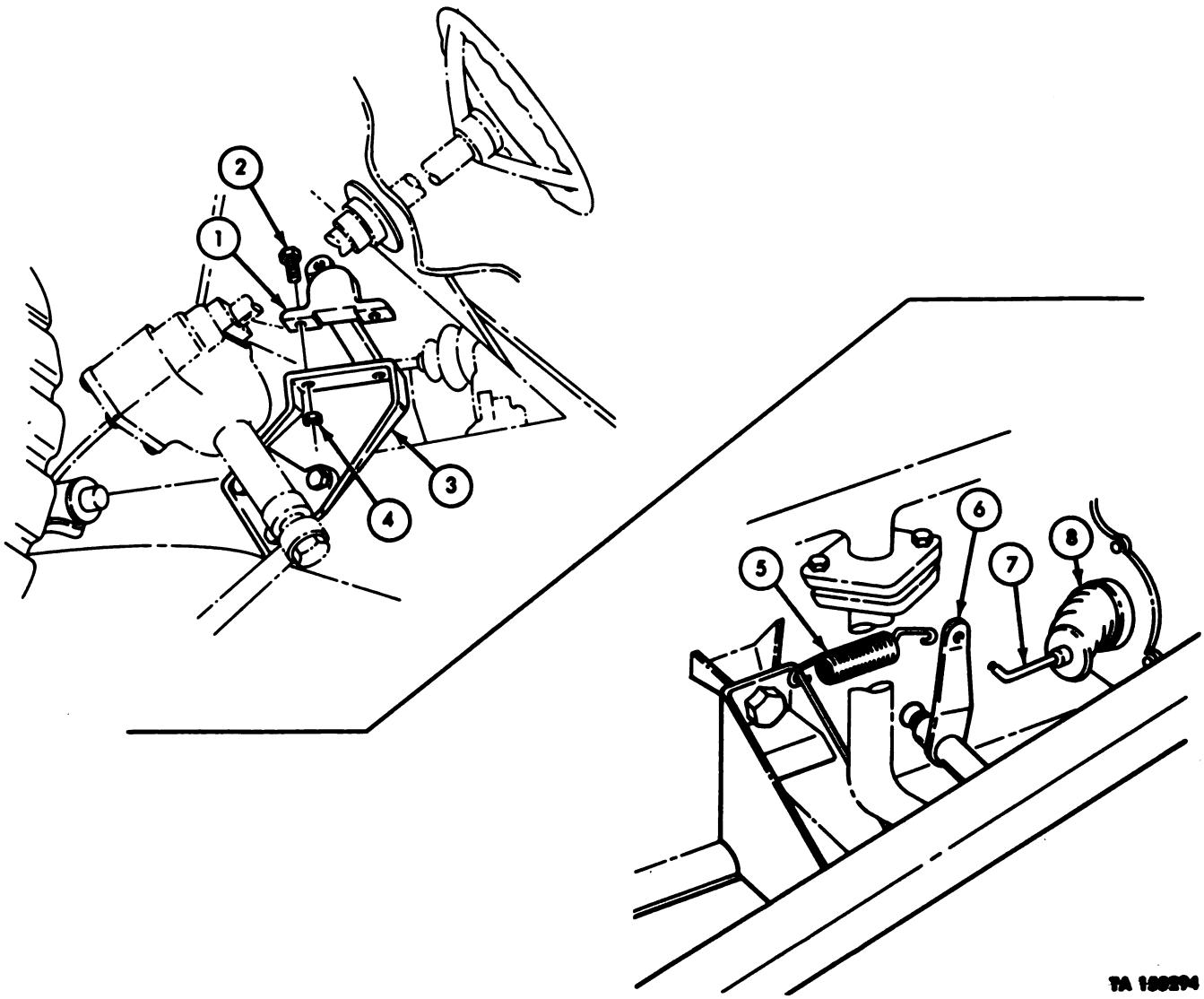


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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
18.		Equalizer shaft bracket (1)	Secure to vehicle frame bracket (3) with two bolts (2) and lock-nuts (4).	Tighten 13-19 lb-ft (18-26 N•m).
19.		Rubber seal (8)	Slide over clutch release rod (7), and install on engine.	
20.		Clutch release rod (7)	Place end in equalizer shaft arm (6), and hook clutch return spring (5) in groove.	

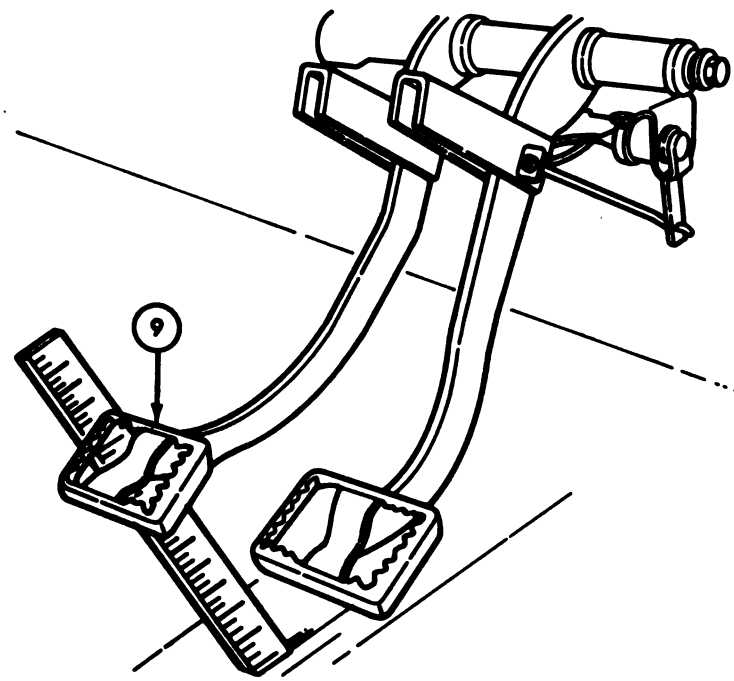


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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		f. FREE TRAVEL CHECK		
21.		Clutch pedal (9)	Depress until clutch engagement is felt, then release and measure the distance of travel.	Use a straight edge ruler. Clutch pedal free travel must be 1⅛ to 1½ in. (28.6 to 38.1 mm). If not 1⅛ to 1½ in. (28.6 to 38.1 mm), adjust.

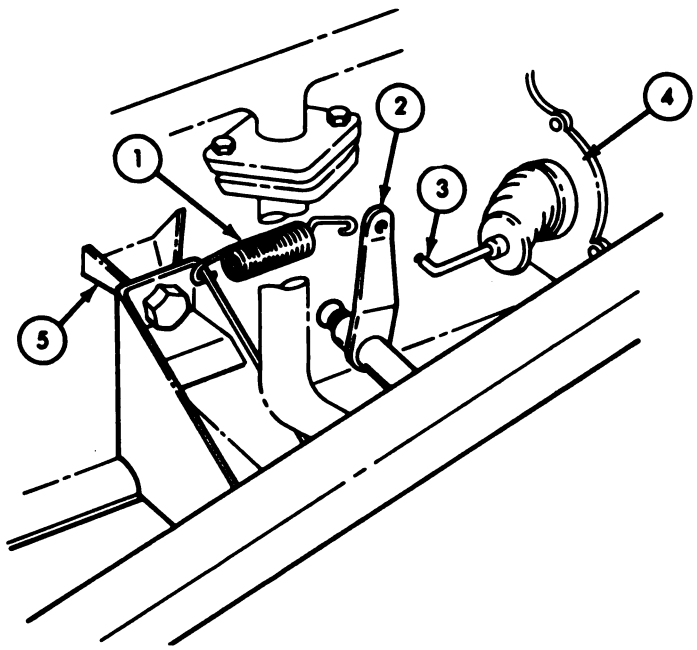


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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	g. ADJUSTMENT			
22.	Left side of engine (5)	Clutch return spring (1) and clutch release rod (3)	Disconnect from equalizer shaft arm (2).	
23.	Left side of engine (5)	Clutch release rod (3)	Turn counterclockwise out of engine (4) to decrease free travel, and clockwise into engine (4) to increase free travel.	Turn rod (3) one complete turn at a time until adjustment is made.

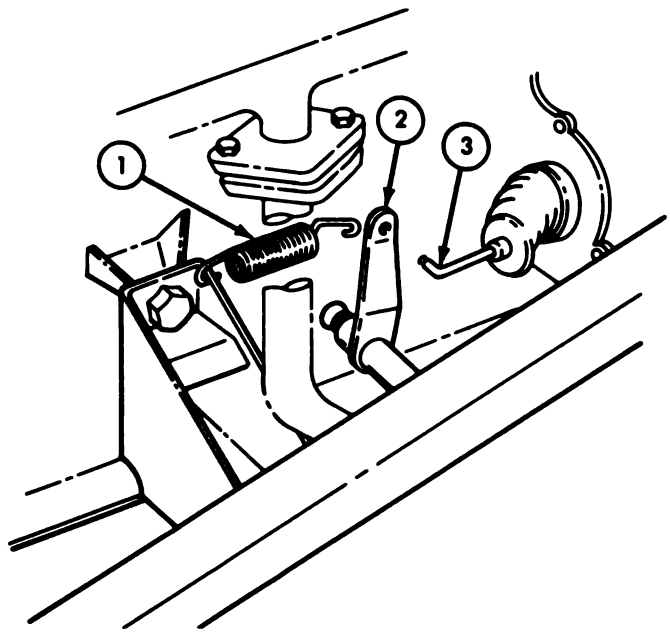


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4-12. Clutch Linkage Maintenance and Adjustment (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
24.		Clutch release rod (3)	*a.* Connect to clutch equalizer shaft arm (2). *b.* Check for free travel. If not correct, continue adjustment.	See task *f* of this paragraph.
25.		Clutch return spring (1)	Connect to release rod (3).	



END OF TASK!

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Section II. ENGINE TUNE-UP INSTRUCTIONS

4-13. General

This section provides maintenance procedures assigned to the organizational level for engine tune-up. When performing a complete tune-up, make sure all instructions provided in this section are performed in the order presented. To find a specific task, see the maintenance task summary below:

4-14. Engine Tune-Up Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-15.	Spark Plug Maintenance a. Removal b. Inspection and Cleaning c. Setting Gap d. Installation	4-56
4-15.1.	Spark Plug and Adapter Assembly Maintenance a. Removal b. Inspection c. Installation	4-58.2
4-16.	Carburetor Adjustments a. Tachometer-Dwell Hookup b. Non-Emission Control Vehicles c. Emission Control Vehicles d. Tachometer-Dwell Removal	4-60
4-17.	Ignition Timing a. Tachometer-Dwell Hookup b. DELETED c. Approximate Ignition Timing Adjustment d. Precise Ignition Timing Adjustment e. Tachometer-Dwell Removal	4-64

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4-15. Spark Plug Maintenance

This task covers:

a. Removal
b. Inspection
c. Setting Gap
d. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Four spark plug gaskets

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10
TM 9-2320-218-10

Condition Description
Parking brake set.
Hood raised and secured.

Special Environmental Conditions
None

General Safety Instructions
Allow engine to cool before removing spark plugs.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. REMOVAL

WARNING

Allow engine to cool before removing spark plugs. Hot engine will cause severe burns.

NOTE

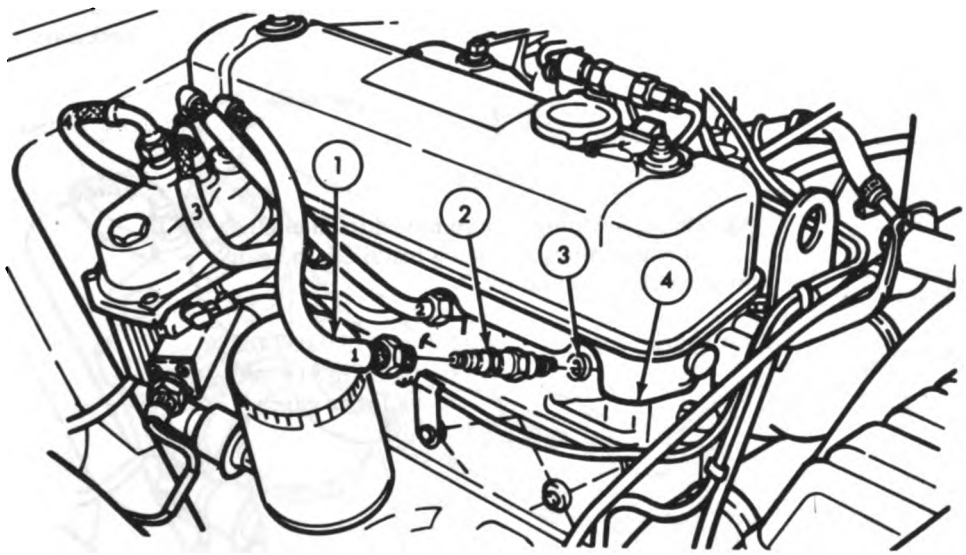
Remove all dirt from cylinder head recess around spark plugs before removal.

1.		Four spark plug cables (1)	Disconnect from four spark plugs (2).	Note location of cables (1) for installation.

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4-15. Spark Plug Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
2.	Cylinder head (4)	Four spark plugs (2) and gaskets (3)	Remove.	Discard four gaskets (3).

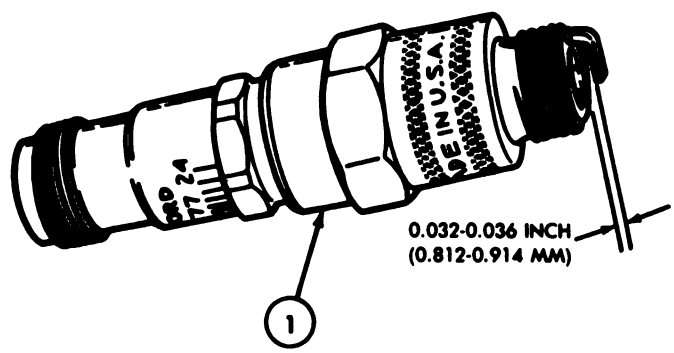


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4-15. Spark Plug Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSPECTION		
3.		Four spark plugs (1)	*a.* Inspect for carbon deposits, burnt or corroded electrodes, and signs of lead fouling or overheating.	Clean or replace as necessary.
			b. Inspect for wet oil deposits and excessive gasoline odor.	If wet oil deposits or excessive gas odor are evident, replace as necessary.
		c. SETTING GAP		
			NOTE Anytime spark plugs are removed from engine or new spark plugs are being installed, the gap must be checked and set.	
4.		Four spark plugs (1)	Set gap to 0.032-0.036 in. (0.812-0.914 mm) using feeler gage.	

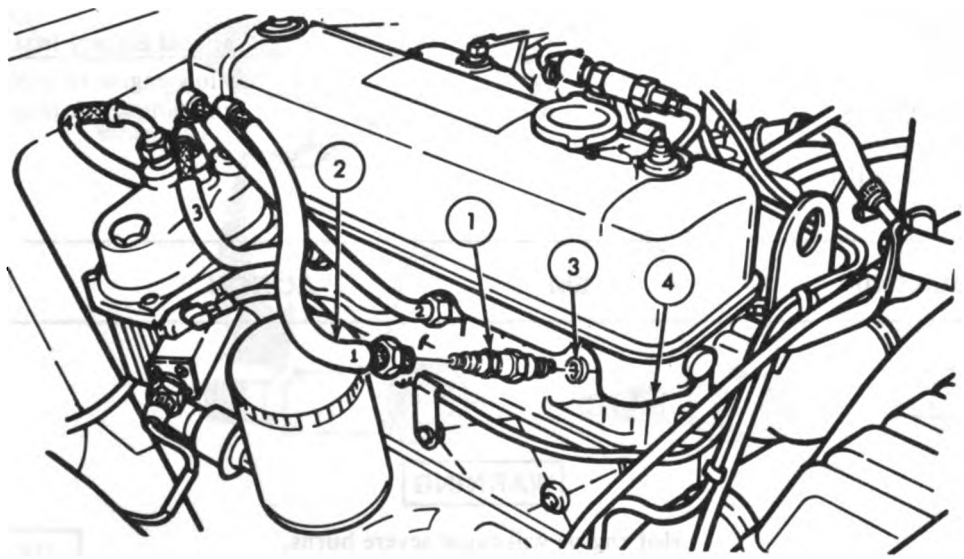


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4-15. Spark Plug Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	d. INSTALLATION			
5.		Four new gaskets (3) and spark plugs (1)	Install in cylinder head (4) and tighten.	Start threads by hand to avoid cross threading. Tighten 18-20 lb-ft (24-27 N•m).
6.		Four spark plug cables (2)	Connect to spark plugs (1) at marked locations.	Tighten cables (2) finger tight, and tighten an additional ¼ to ½ turn to seal.



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check for proper vehicle performance. TA 155300

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4-15.1. Spark Plug and Adapter Assembly Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
None

General Safety Instructions
Allow engine to cool before removing spark plugs.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. REMOVAL.

WARNING

Hot engine will cause severe burns.

NOTE

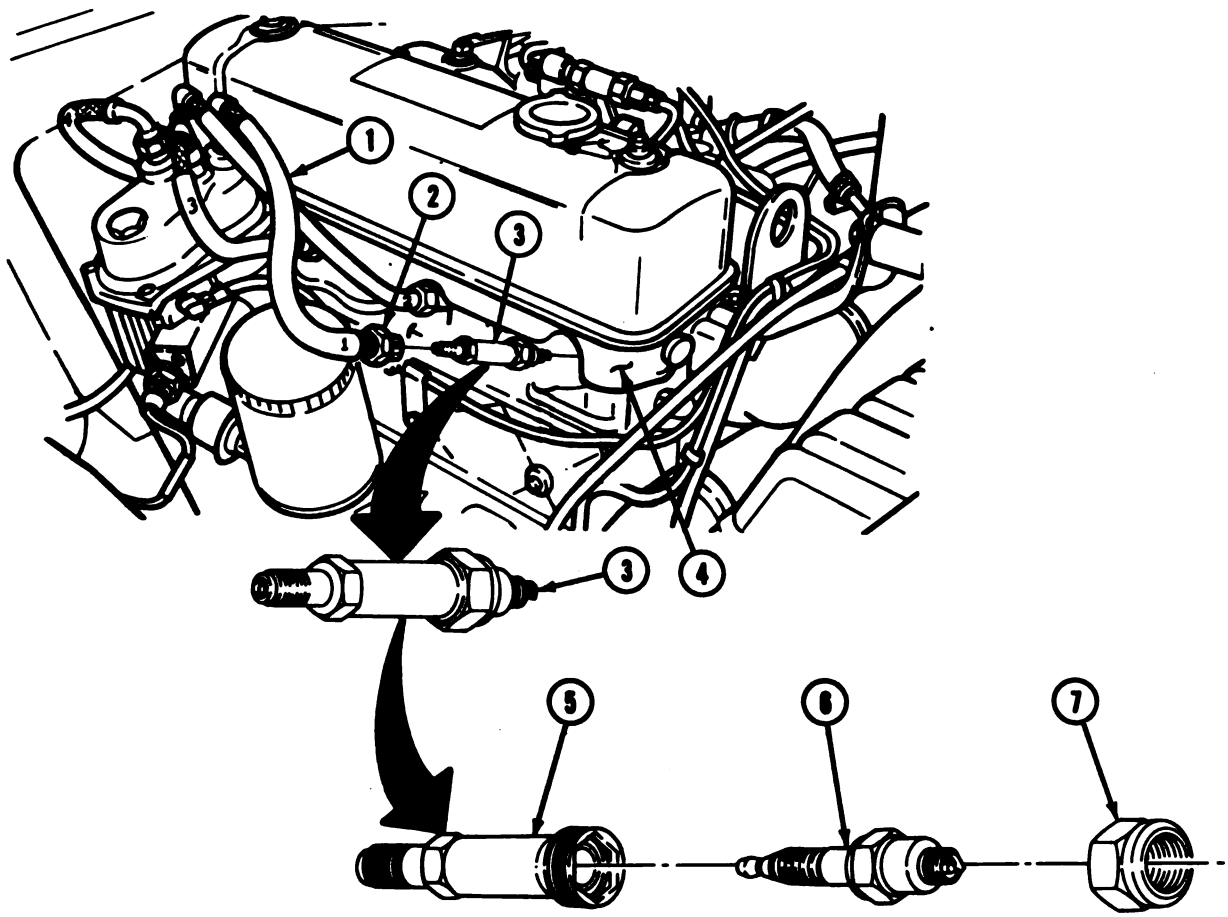
Remove all dirt from cylinder head recess around spark plug adapters before removal.

1.	Four spark plug and adapter assemblies (3)	Four spark plug cables (1).	Loosen nuts (2) and disconnect.	Note location of cables (1) for installation.
2.	Cylinder head (4)	Four spark plug and adapter assemblies (3)	Remove.	
3.	Four adapters (5)	Caps (7)	Remove.	
4.		Spark plugs (6)	Remove.	

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4-15.1. Spark Plug and Adapter Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



b. INSPECTION

5.		Four spark plugs (6)	*a.* Inspect for carbon, burnt or corroded electrodes, and indication of lead fouling or overheating.	Clean or replace as necessary.
			b. Inspect for wet oil deposits and excessive gasoline order.	If wet oil deposits or excessive gasoline odor are evident, replace as necessary.

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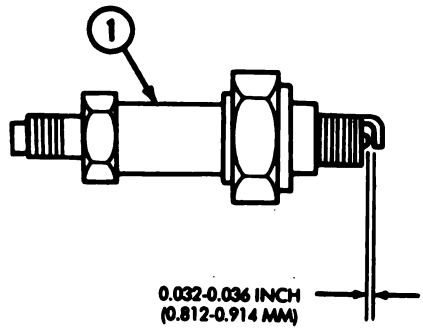
4-15.1. Spark Plug and Adapter Assembly Maintenance (Cont'd)

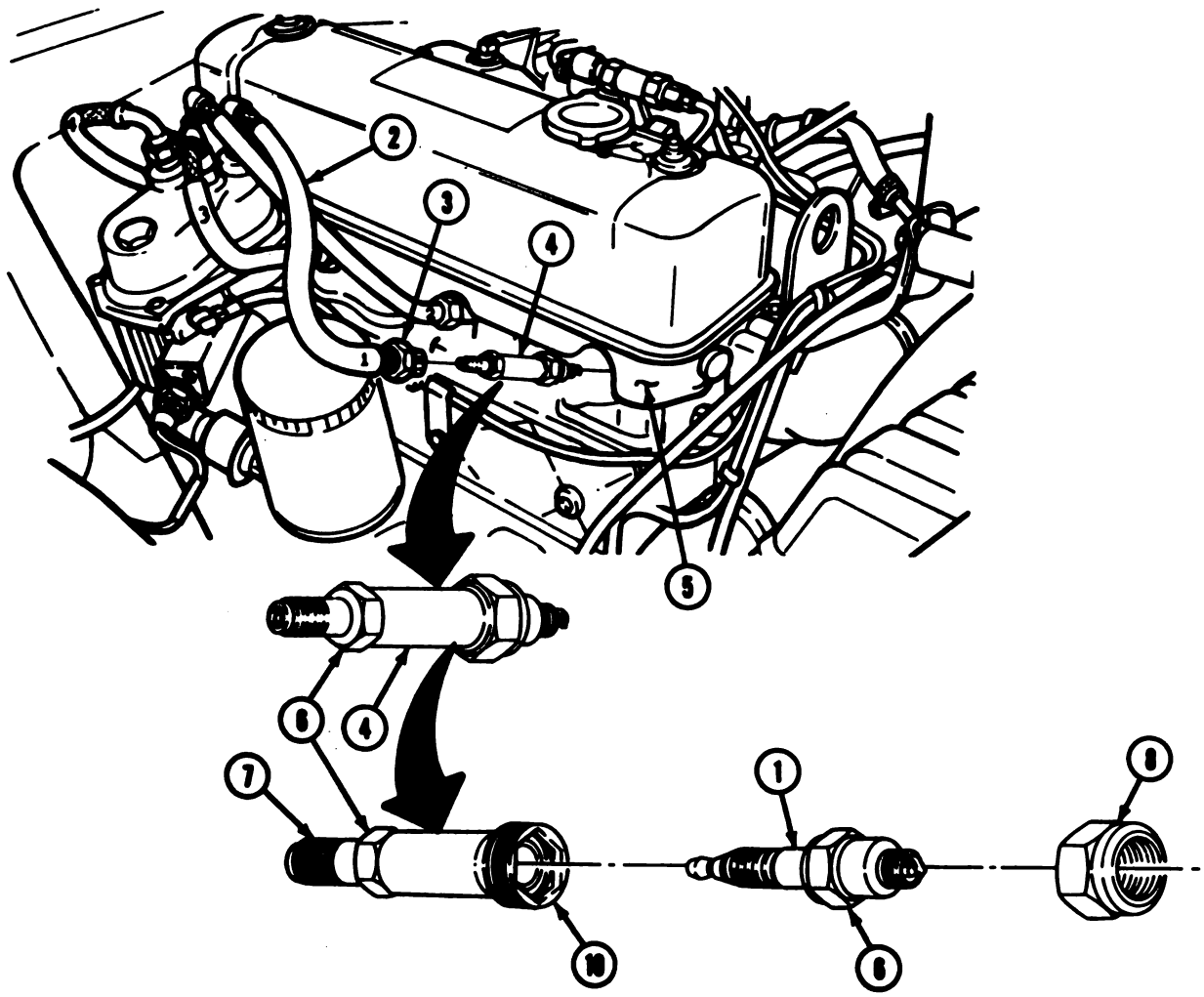
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. INSTALLATION		
			NOTE Ensure spark plug hex is completely seated in adapter hex while cap is installed.	
6.		Spark plug (1)	*a.* Install in adapter (7) with plug hex (9) firmly seated in adapter hex (10).	
			b. Install cap (8).	Finger tighten only.
7.		Spark plug and adapter assembly (4)	Secure in vise at exterior hex (6).	Tighten cap (8) 17-20 lb-ft (23-27 N•m).
			NOTE When spark plugs are removed from engine or new spark plugs are being installed, gap must be checked and set.	
8.		Four spark plugs (1)	Set gap to 0.032-0.036 in. (0.812-0.914 mm) using feeler gage.	
9.		Four spark plug and adapter assemblies (4)	Install in cylinder head (5).	Tighten assemblies (4) 27-30 lb-ft (37-41 N•m).
10.		Four spark plug cables (2)	Connect to adapter assemblies (4) and tighten cable nuts (3) finger tight.	Tighten cable nuts (3) one half additional turn.

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4-15.1. Spark Plug and Adapter Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check for proper vehicle performance.

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4-16. Carburetor Adjustments

This task covers:

a. Tachometer-Dwell Hookup
b. Non-Emission Control Vehicles
c. Emission Control Vehicles
d. Tachometer-Dwell Removal

INITIAL SETUP:

Applicable Models
All

Test Equipment
Tachometer-Dwell Meter

Special Tools
None

Materials/Parts
Seal plug

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Make sure all tachometer-dwell leads are securely connected.
- Do not run engine unless work area is well ventilated.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. TACHOMETER-DWELL HOOKUP		
		WARNING		
		When hooking up tachometer-dwell meter for testing, make sure all leads are securely connected. Failure to do so will result in severe injury.		
1.	Distributor cover (5)	Cover plug (11)	Remove.	
2.		Tachometer-dwell test set (1)	*a.* Connect test set battery leads (8) to battery terminals (9).	Make sure positive (red) cable is connected to positive battery post, and negative (black) battery cable is connected to negative battery post.
			b. Connect dwell lead (10) to distributor cover (5) using proper adapter (4).	

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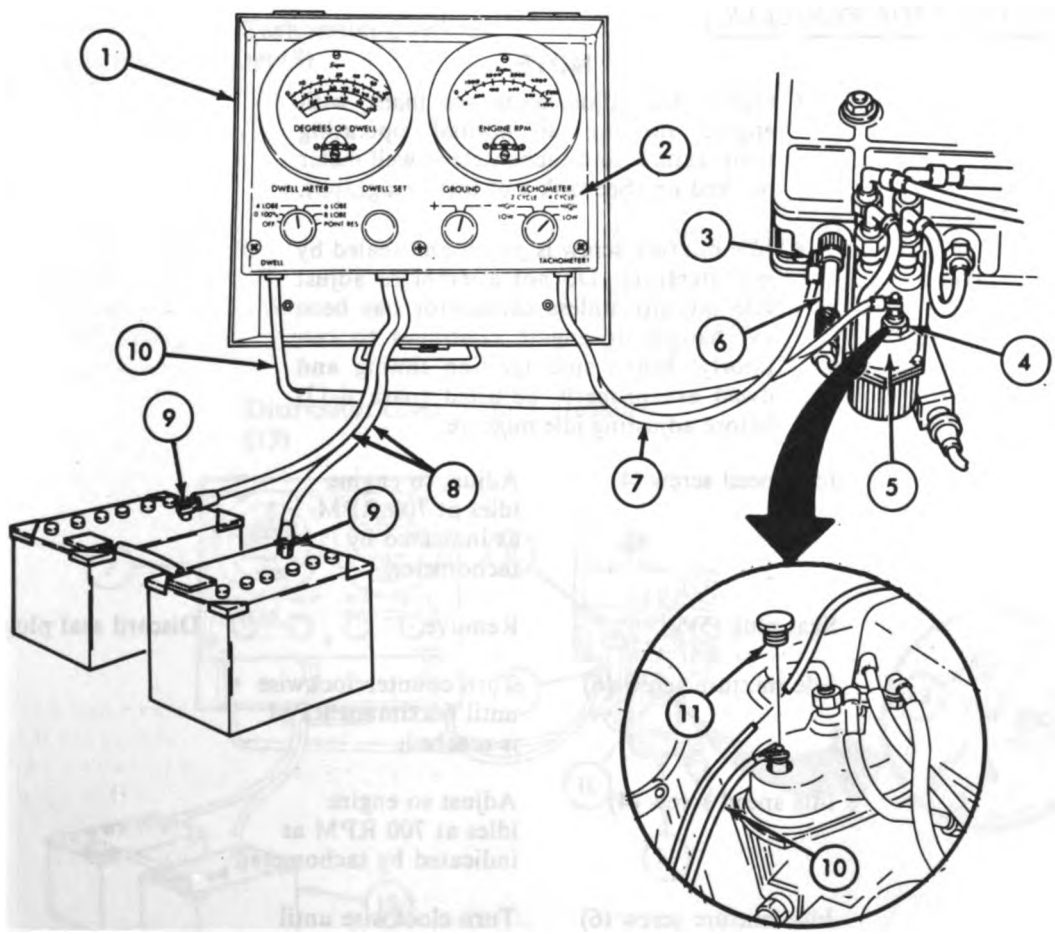
4-16. Carburetor Adjustments (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			c. Connect tachometer lead (7) to tab (3) of properly attached spark plug adapter (6).	
			d. Set tachometer on 4-cycle low (2).	

WARNING

Exhaust gases can kill. do not run engine unless work area is well ventilated.

	e. Start engine to read RPM.	See TM 9-2320-218-10.



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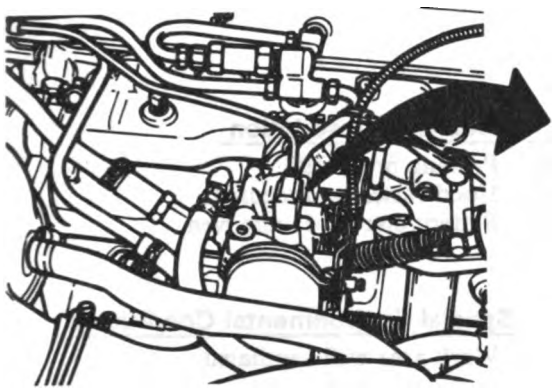
4-16. Carburetor Adjustments (Cont'd)

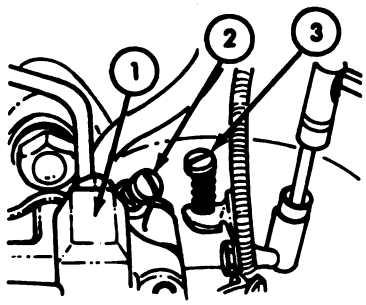
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. NON-EMISSION CONTROL VEHICLES		
		NOTE Carburetor adjustments are made with engine running at normal operating temperature, and the tachometer-dwell meter hooked up. (See task *a* of this paragraph.)		
3.	Carburetor (1)	Idle mixture screw (2)	Slowly screw in until seated, then back out until engine runs smoothly.	Approximately one full turn.
4.		Idle speed screw (3)	Adjust so engine idles at 500-550 RPM as indicated by tachometer.	
5.		Idle mixture screw (2)	Adjust to obtain smoothest idle.	
		c. EMISSION CONTROL VEHICLES		
		NOTE • Carburetor adjustments are made with engine running at normal operating temperature and tachometer-dwell meter hooked up (See task *a* of this paragraph). • Idle mixture screw is preset and sealed by manufacturer. Do not attempt to adjust idle mixture unless carburetor has been overhauled or engine continues to run poorly. Make sure ignition timing and dwell are properly adjusted (para 4-17) before adjusting idle mixture.		
6.		Idle speed screw (4)	Adjust so engine idles at 700 RPM as indicated by tachometer.	
7.		Seal plug (5)	Remove.	Discard seal plug (5).
8.		Idle mixture screw (6)	Turn counterclockwise until maximum RPM is reached.	
9.		Idle speed screw (4)	Adjust so engine idles at 700 RPM as indicated by tachometer.	
10.		Idle mixture screw (6)	Turn clockwise until engine idles at 625-675 RPM as indicated by tachometer.	

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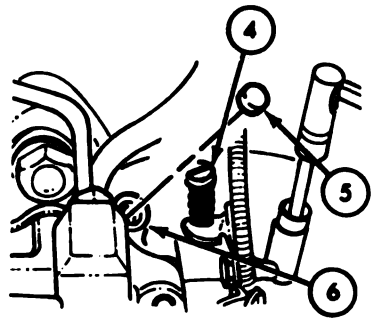
4-16. Carburetor Adjustments (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
11.		New seal plug (5)	Install.	





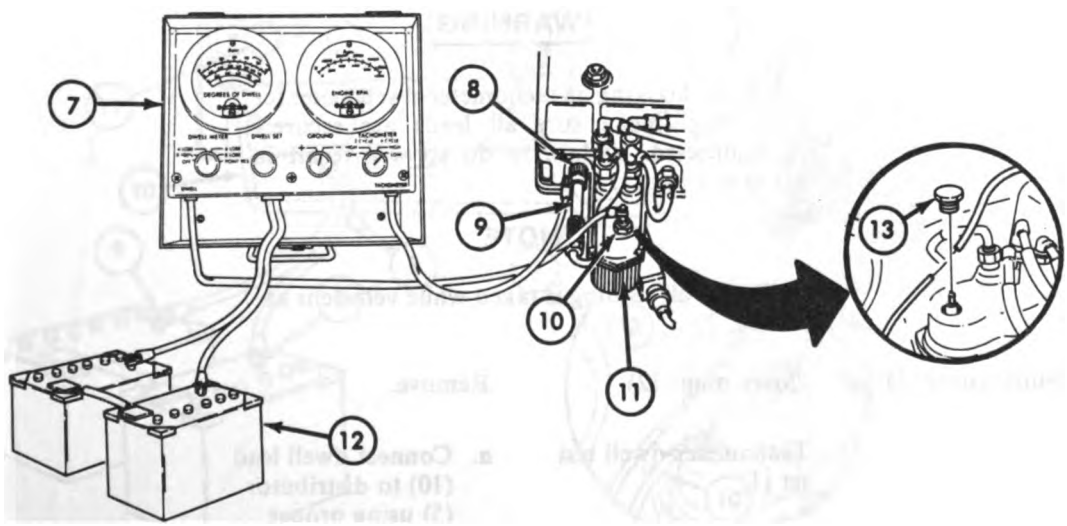
NON-EMISSION CONTROL VEHICLES



EMISSION CONTROL VEHICLES

d. TACHOMETER-DWELL REMOVAL

12.	Tachometer-dwell test set (7)	*a.* Disconnect from distributor (11), spark plug adapter (9), and battery (12).	
		b. Remove adapter (10) from distributor (11).	
		c. Remove adapter (9) from spark plug (8).	
13.	Distributor cover plug (13)	Install.	



END OF TASK!

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4-17. Ignition Timing

This task covers:

a. *Tachometer-Dwell Hookup*
b. *DELETED*
c. *Approximate Ignition Timing Adjustment*
d. *Precise Ignition Timing Adjustment*
e. *Tachometer-Dwell Removal*

INITIAL SETUP:

Applicable Models
All

Test Equipment
Tachometer-Dwell meter
Timing light

Special Tools
None

Materials/Parts
Chalk
Four lockwashers

Personnel Required
One mechanic
One assistant (task *c* only)

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
TM 9-2320-218-10	Battery box cover removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions

- Make sure all tachometer-dwell leads are securely connected.
- Do not run engine unless work area is well ventilated.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. TACHOMETER-DWELL HOOKUP

WARNING

When hooking up tachometer-dwell meter for testing, make sure all leads are securely connected. Failure to do so will result in severe injury.

NOTE

The dwell reading is taken while vehicle is at idle.

1.	Distributor cover (5)	Cover plug (12)	Remove.
2.		Tachometer-dwell test set (1)	*a.* Connect dwell lead (10) to distributor (5) using proper adapter (4).

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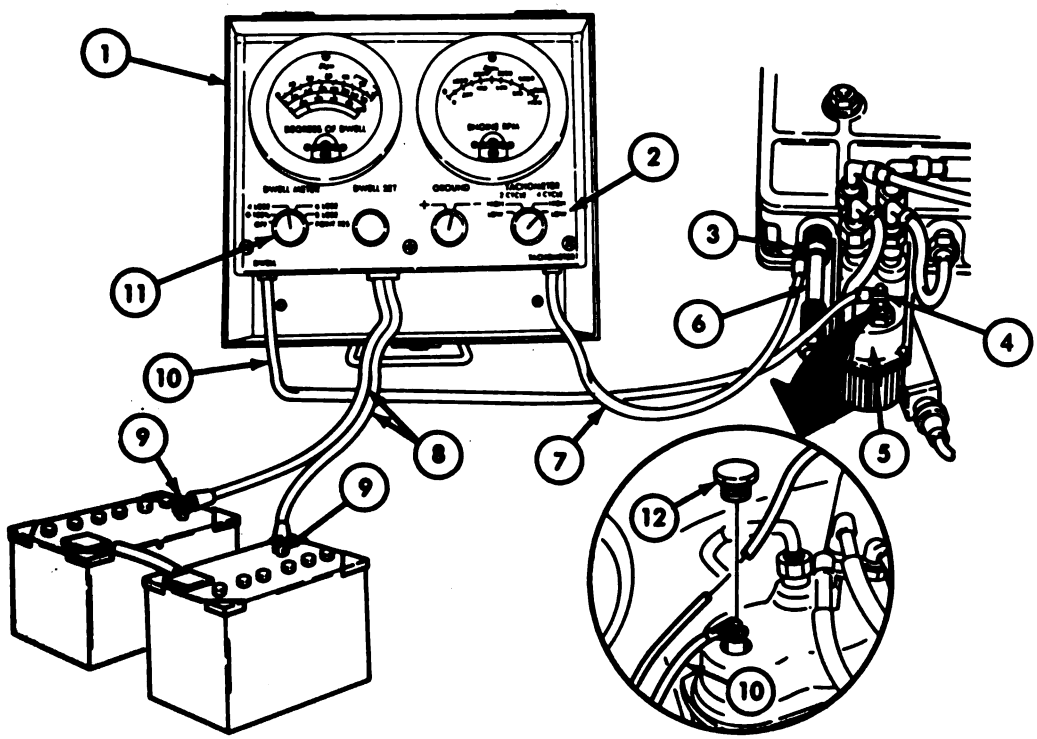
4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			b. Connect tachometer lead (7) to tab (3) of properly attached spark plug adapter (6)	
			c. Connect battery leads (8) to battery terminals (9).	
			d. Set dwell meter on 4 lobe (11).	
			e. Zero the dwell meter (1).	Use dwell set knob.
			f. Set tachometer on 4-cycle low (2).	

WARNING

Exhaust gases can kill. Do not run engine unless work area is well ventilated.

			g. Start engine to read dwell.	See TM 9-2320-218-10.



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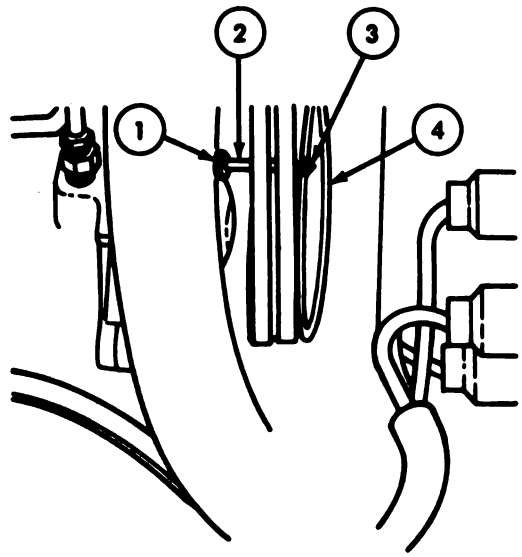
4-17. Ignition Timing (Cont'd)

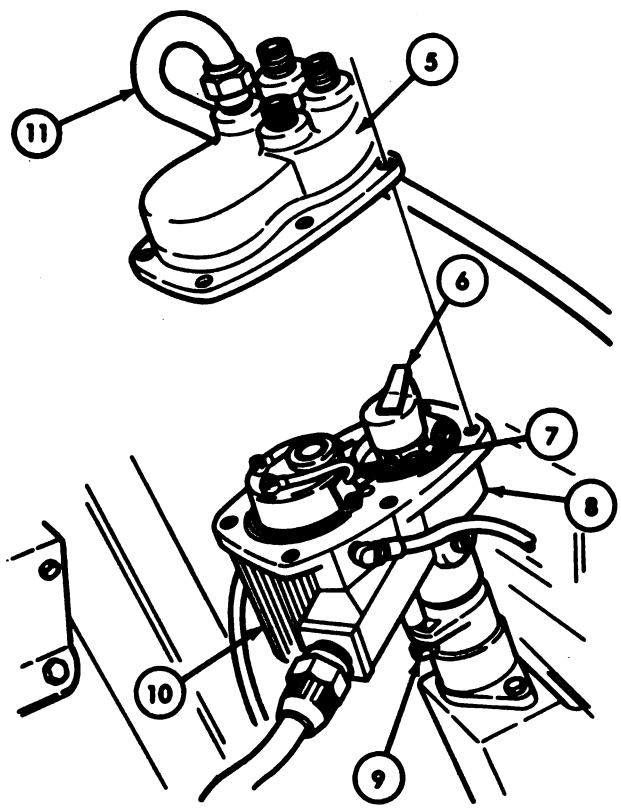
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. APPROXIMATE IGNITION TIMING ADJUSTMENT		
		NOTE		
		This procedure is done only when a timing light is not available for proper engine performance. After approximate ignition timing is completed, perform the precise timing procedure (task *d* of this paragraph).		
7.		Distributor cover (5)	*a.* Scribe a line from the no. 1 spark plug cable (11) to distributor housing (8).	Use chalk.
			b. Remove.	See paragraph 5-4.
8.			Time engine as follows:	
			a. Have assistant crank engine and line up timing notch (3) on crankshaft pulley (4) with pointer (2) on timing gear cover (1).	Make sure rotor (6) points toward chalk mark on distributor housing (8). If rotor points away from chalk mark, rotate crankshaft one complete turn (360°). This is no. 1 cylinder position.
			b. Loosen distributor to adapter mounting screw (9) and rotate distributor (10) counterclockwise until points (7) just start to open.	
			c. Tighten distributor to adapter mounting screw (9).	
			d. Install distributor cover (5).	See paragraph 5-4.

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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





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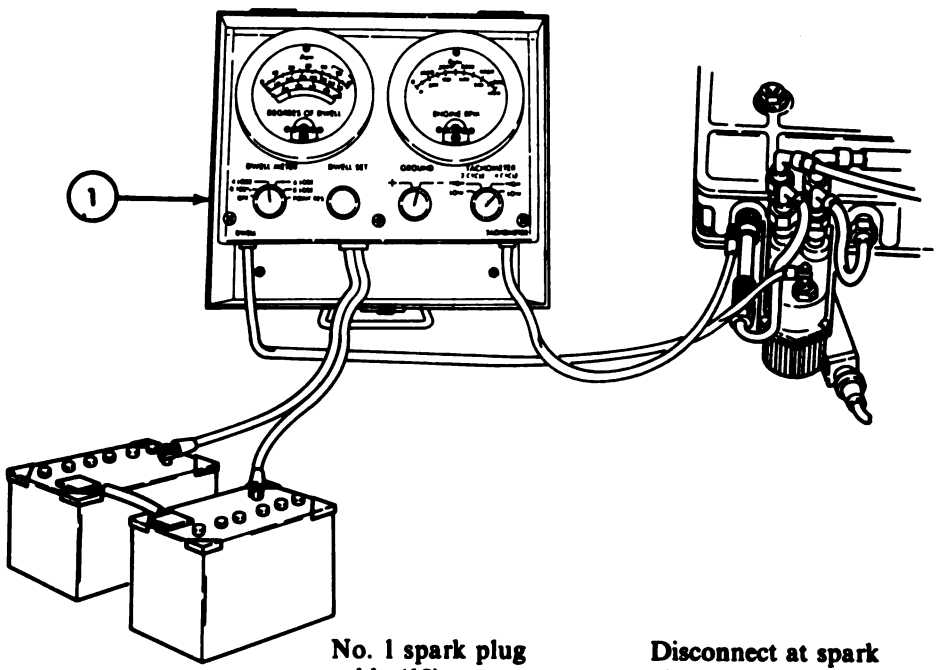
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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

d. PRECISE IGNITION TIMING ADJUSTMENT

9.		Tachometer-dwell test set (1)	Connect to proper test points.	See task *a* of this paragraph.



10.		No. 1 spark plug cable (10)	Disconnect at spark plug (12).	
11.		Timing light adapter (11)	Connect between spark plug (12) and spark plug cable (10).	

NOTE

12-volt and 24-volt timing lights are used on the vehicles covered in this manual. Positive (red) terminals are positioned to different batteries, depending on light's voltage rating. Positive leads are red, and negative leads are black.

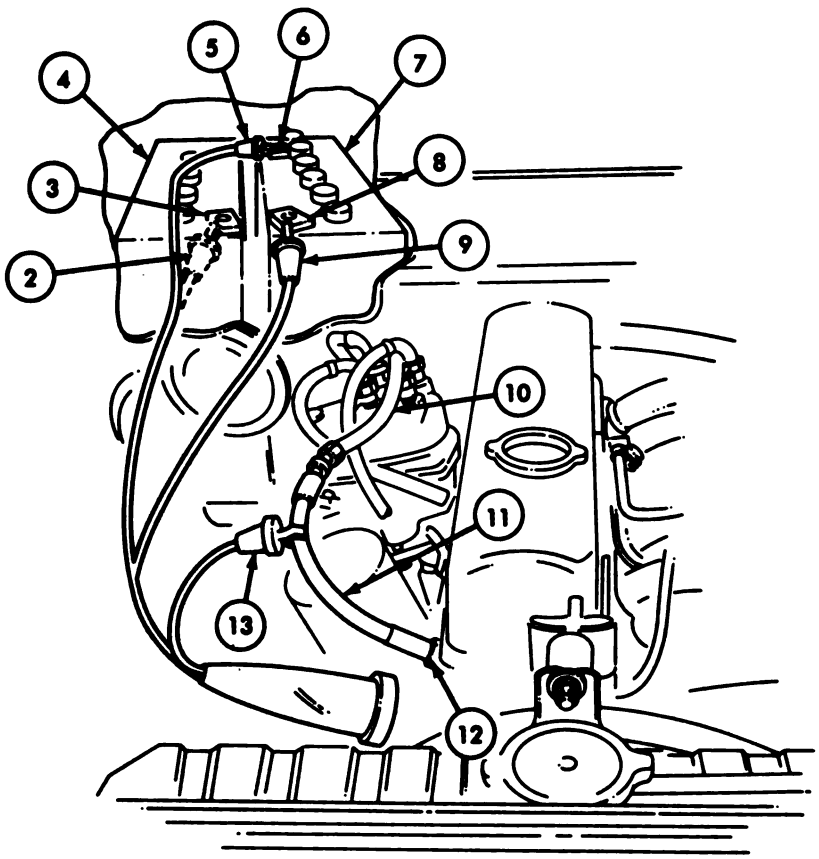
12.		24-volt timing light positive lead (9)	Connect to positive post (8) on left battery (7).	
13.		24-volt timing light negative lead (2)	Connect to negative post (3) on right battery (4).	
14.		12-volt timing light positive lead (9)	Connect to positive post (8) on left battery (7).	

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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
15.		12-volt timing light negative lead (5)	Connect to negative post (6) on left battery (7).	
16.		12-volt or 24-volt, 5-foot high tension lead (13)	Connect to timing light adapter (11).	

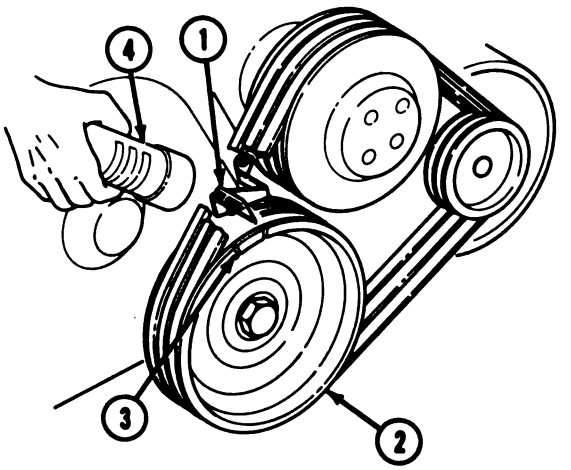


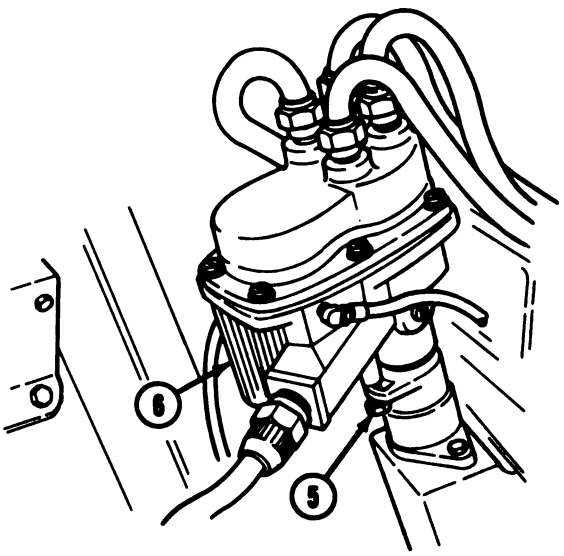
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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
17.			Check engine timing as follows:	
			a. Start engine and bring to normal operating temperature.	See TM 9-2320-218-10.
			b. Check and adjust idle speed as necessary.	See paragraph 4-16.
			c. Focus timing light (4) toward pointer (1) on engine.	
			d. If notch (3) on crankshaft pulley (2) alines with pointer (1), timing is correct.	
			e. If notch (3) on crankshaft pulley (2) does not aline with pointer (1), loosen distributor-to-adapter bolt (5) and turn distributor assembly (6) by hand until notch (3) alines with pointer (1).	
			f. Tighten distributor to adapter bolt (5).	
			g. Recheck timing.	





NOTE

- To perform following test, crankshaft pulley must be marked with a 30° notch.
- If crankshaft pulley is not marked with a 30° notch, perform steps 18 through 18.6.

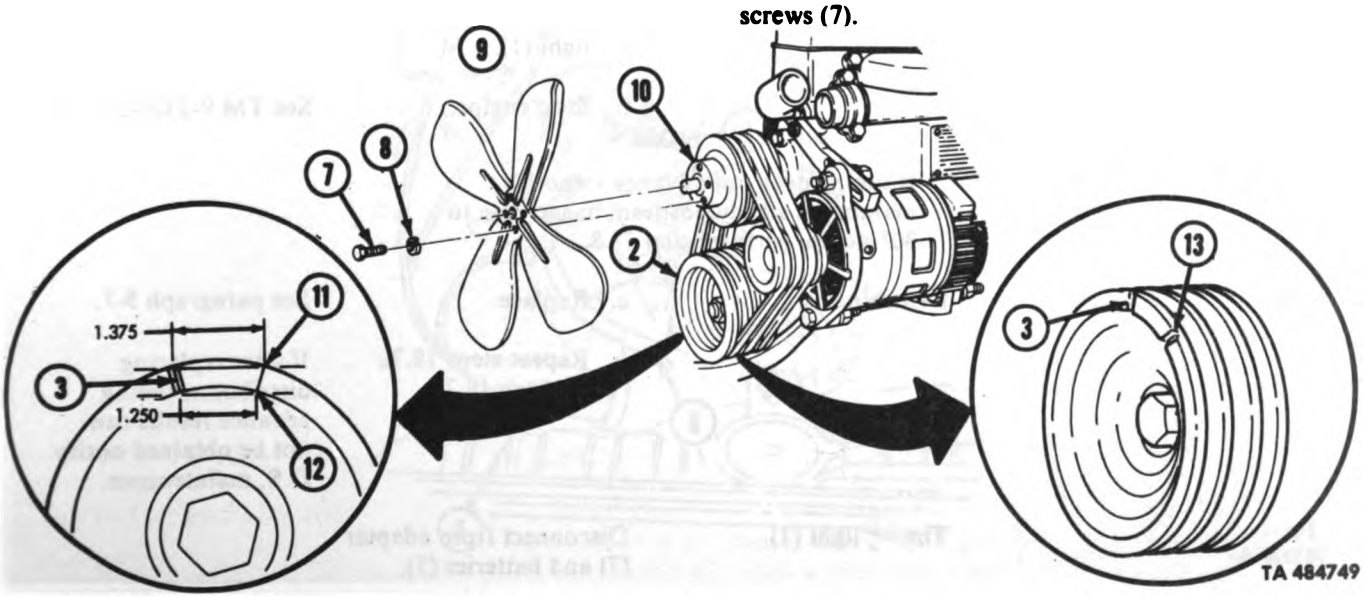
18.	Battery ground cable	Disconnect.	See paragraph 5-27.
18.1.	Radiator brush guard	Remove.	See paragraph 5-15.
18.2. Fan pulley (10)	Four capscrews (7), lockwashers (8), and fan blade (9)	Remove.	Discard lockwashers (8).

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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE Do not remove drive belts and radiator fan pulley.	
18.3.		Crankshaft pulley (2)	*a.* Scribe a locator mark (11) 1-3/8 in. (34.9 mm) clockwise from 6° timing notch (3) on outer edge of pulley (2) face.	
			b. Scribe a locator mark (12) 1-1/4 in. (31.7 mm) clockwise from 6° timing notch (3) on inner edge of pulley (2) face.	
			c. Cut a groove across pulley (2) at marked locations (11) and (12).	Use a three corner file.
			d. Mark 6° notch (3) and 30° notch (13) with chalk.	
18.4.		Radiator fan blade (9)	Install on fan pulley (10) with four new lockwashers (8) and screws (7).	Tighten 15-20 lb-ft (20-27 N·m).



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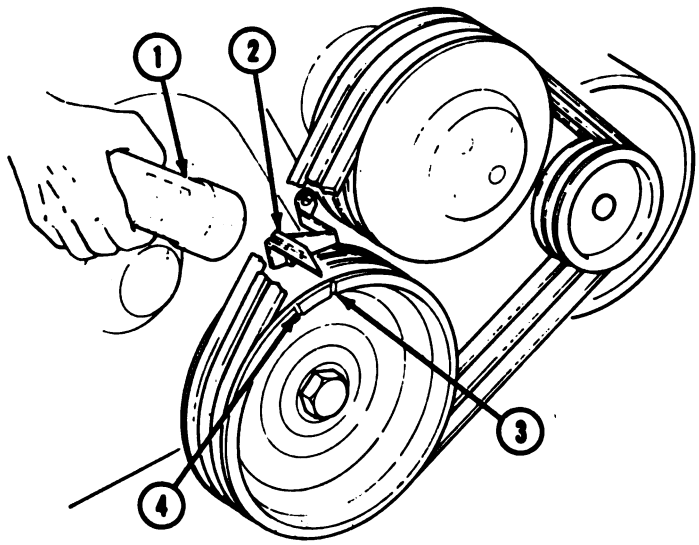
4-17. Ignition Timing (Cont'd)

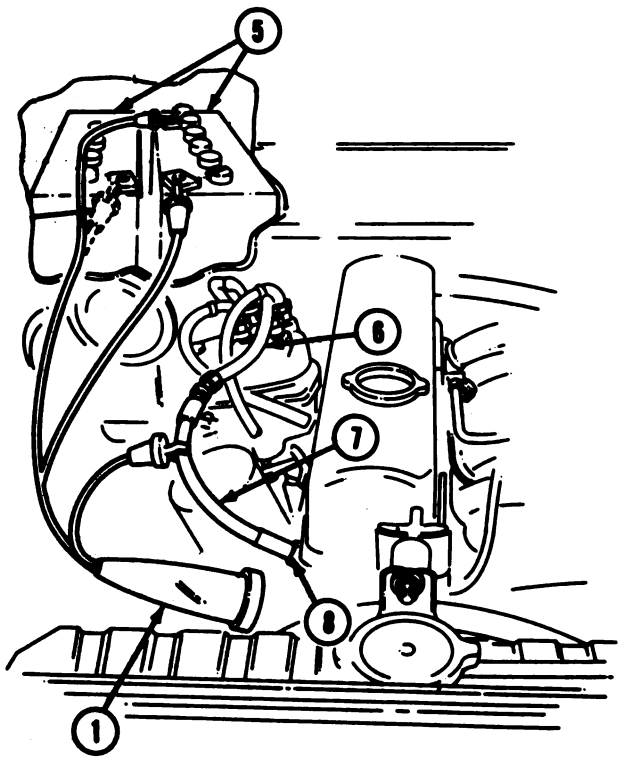
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
18.5.		Radiator brush guard	Install.	See paragraph 10-15.
18.6.		Battery ground cable	Connect.	See paragraph 5-27.
18.7.			Check timing advance as follows:	
			a. Start engine and bring to normal operating temperature.	See TM 9-2320-218-10.
			b. Slowly increase engine speed to 1500 rpm while observing 6° timing notch (4) with timing light (1).	6° timing notch (4) should advance smoothly.
			c. Maintain a constant 1500 rpm while observing 6° timing notch (4) with timing light (1).	6° timing notch (4) should maintain a steady position.
		CAUTION Do not operate engine at maximum rpm for more than 10 seconds.		
			d. Increase engine speed to maximum rpm while observing 30° timing notch (3) with timing light (1).	30° timing notch (3) should advance to timing pointer (2).
			e. Stop engine.	See TM 9-2320-218-10.
		NOTE If timing does not advance smoothly, maintain a steady position, or increase to 30° notch, perform step 18.8.		
18.8.		Distributor	*a.* Replace.	See paragraph 5-7.
			b. Repeat steps 18.7a through 18.7e.	If after replacing distributor, timing advance results cannot be obtained notify D.S. maintenance.
19.		Timing light (1)	Disconnect from adapter (7) and batteries (5).	

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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
20.		Timing light adapter (7)	Remove from between spark plug cable (6) and spark plug (8).	
21.		No. 1 spark plug cable (6)	Connect to spark plug (8).	



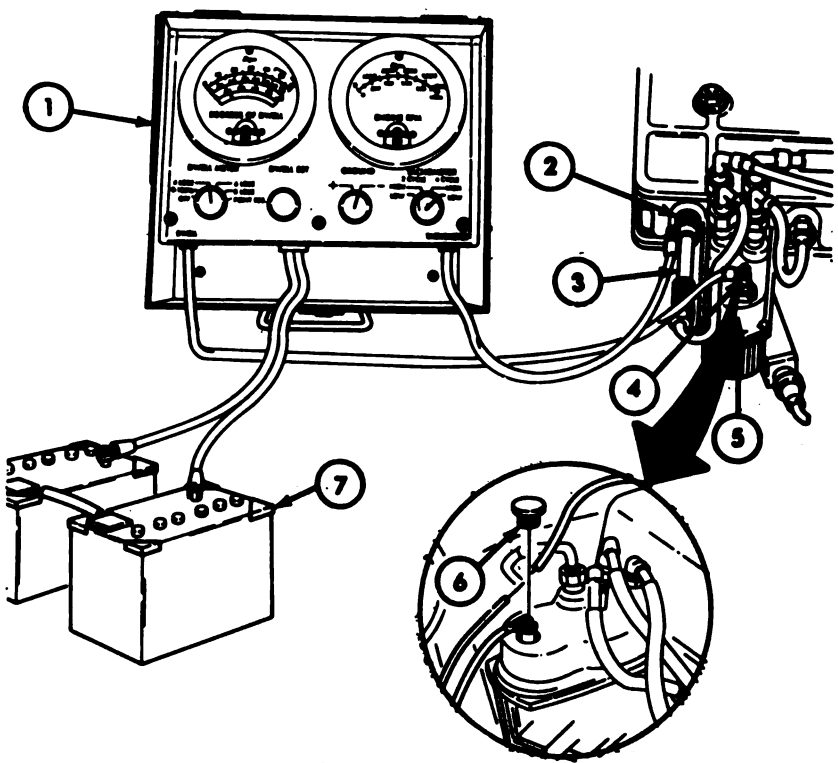


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4-17. Ignition Timing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		e. TACHOMETER-DWELL REMOVAL		
22.		Tachometer-dwell test set (1)	*a.* Disconnect from distributor (5), spark plug adapter (3), and battery (7). *b.* Remove adapter (4) from distributor (5). *c.* Remove adapter (3) from spark plug (2).	
23.		Distributor cover plug (6)	Install.	



END OF TASK!

FOLLOW-ON TASKS:
- Install battery box cover (TM 9-2320-218-10).
- Start engine (TM 9-2320-218-10) and check for proper vehicle performance.

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Section III. ENGINE OIL SYSTEM MAINTENANCE

4-18. General

This section provides maintenance procedures assigned to the organizational level for the engine oil system. To find a specific task, see the maintenance task summary below:

4-19. Engine Oil System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-20.	Engine Oil Servicing a. Draining Oil b. Oil Filter Removal c. Oil Filter Installation d. Replenishing Oil	4-76

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4-20. Engine Oil Servicing

This task covers:

a. Draining Oil
b. Oil Filter Removal
c. Oil Filter Installation
d. Replenishing Oil

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Materials/Parts
6-quart container
Oil filter
OE/HDO oil

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
LO 9-2320-218-12

Special Environmental Conditions
Vehicle on level surface.

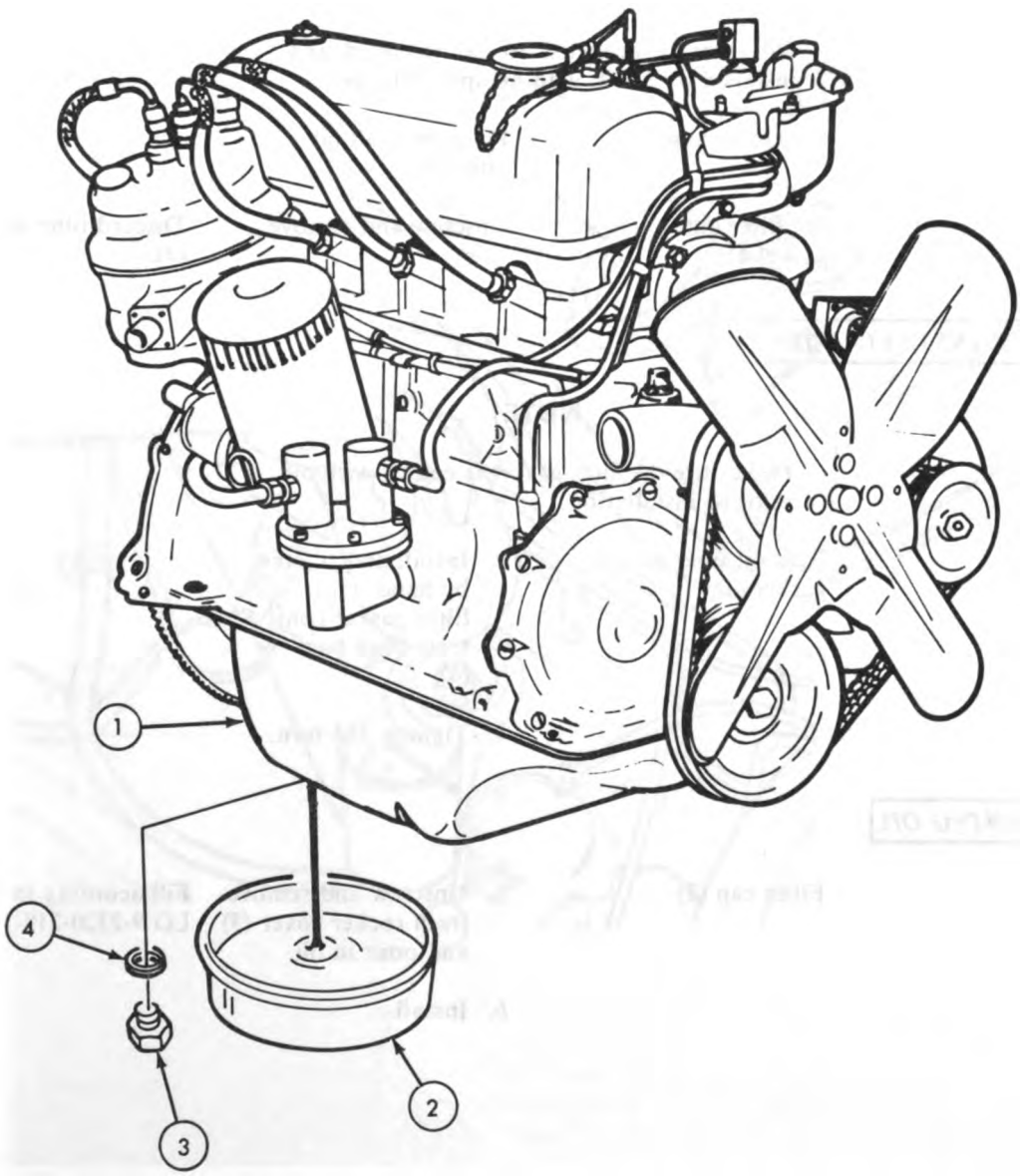
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			a. DRAINING OIL	
			NOTE Engine should be warm when draining oil.	
1.		6-quart container (2)	Place beneath drain plug (3).	
2.	Oil pan (1)	Drain plug (3) and gasket (4)	*a.* Remove and allow oil to completely drain into container (2).	Discard gasket (4).
			b. Install drain plug (3) and new gasket (4), and tighten.	

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4-20. Engine Oil Servicing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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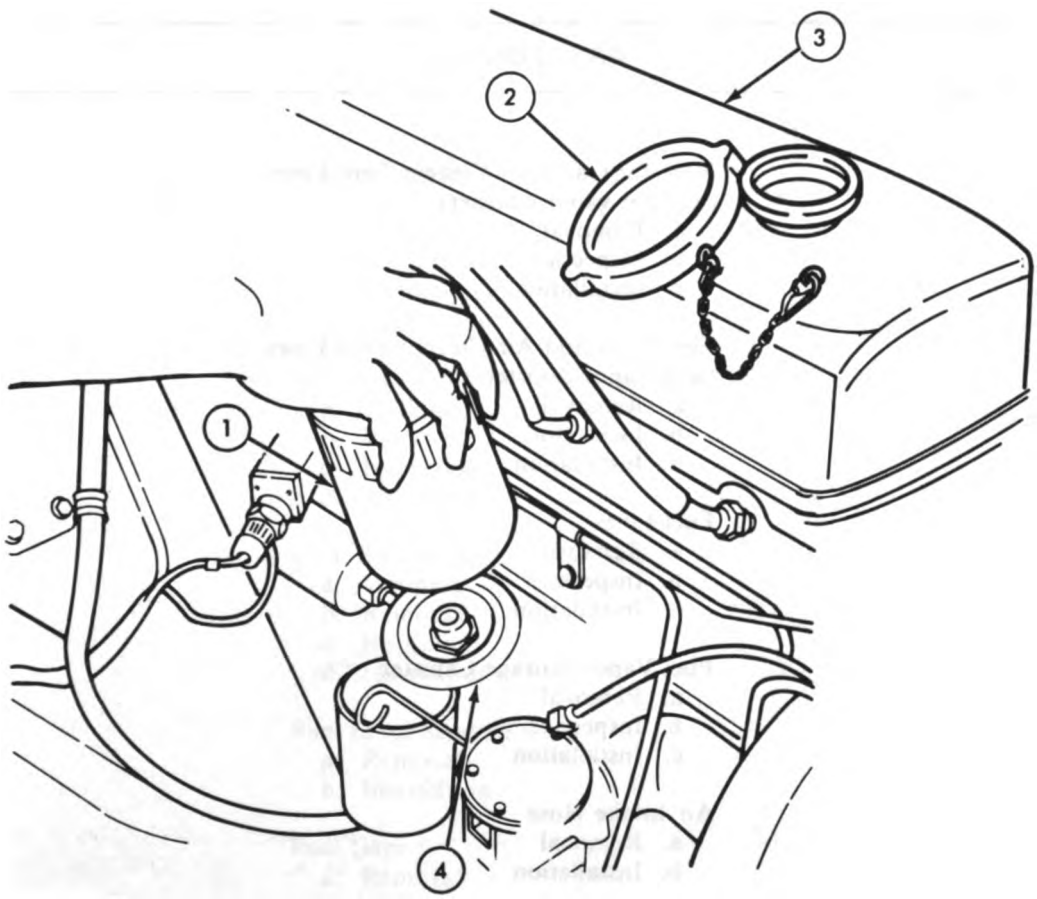
4-20. Engine Oil Servicing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. OIL FILTER REMOVAL		
		NOTE Oil filter is designed to be removed and installed by hand, with no special tools.		
3.		6-quart container	Place beneath oil filter (1).	
4.		Oil filter and gasket (1)	Unscrew and remove.	Discard filter and gasket (1).
		c. OIL FILTER INSTALLATION		
		NOTE Make sure oil filter gasket is coated with oil prior to installation.		
5.		New oil filter and gasket (1)	*a.* Install and tighten by hand until filter gasket contacts filter base (4). *b.* Tighten 3/4 turn.	
		d. REPLENISHING OIL		
6.		Filler cap (2)	*a.* Unscrew and remove from rocker cover (3) and pour in oil. *b.* Install.	Fill acording to LO 9-2320-218-12.

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4-20. Engine Oil Servicing (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and inspect for leaks at oil filter and drain plug.

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Section IV. AIR INTAKE AND FUEL SYSTEM MAINTENANCE

4-21. General

This section provides maintenance procedures assigned to the organizational level for the air intake and fuel system. To find a specific task, see the maintenance task summary below:

4-22. Air Intake and Fuel System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-23.	Fuel Tank and Air Cleaner Vent Lines (without vapor canister) a. Removal b. Inspection c. Installation	4-82
4-24.	Fuel Tank and Air Cleaner Vent Lines (with vapor canister) a. Removal b. Inspection c. Installation	4-85
4-25.	Fuel Lines a. Removal b. Inspection c. Installation	4-88
4-26.	Fuel Vapor Storage Canister a. Removal b. Inspection c. Installation	4-92
4-27.	Air Intake Hose a. Removal b. Installation	4-94
4-28.	Air Cleaner Servicing and Replacement Instructions a. Element and Oil Cup Removal b. Cleaning and Inspection c. Element and Oil Cup Installation d. Air Cleaner Assembly Removal e. Air Cleaner Assembly Installation	4-96
4-29.	Mechanical Fuel Pump a. Testing b. Removal c. Installation	4-102

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4-22. Air Intake and Fuel System Maintenance Task Summary (Cont'd)

TASK PARA	PROCEDURES	PAGE NO.
4-30.	Fuel Tank Fuel Filter a. Removal b. Cleaning and Inspection c. Installation	4-106
4-31.	In-Line Fuel Filter a. Removal b. Installation	4-108
4-32.	Carburetor a. Removal b. Installation	4-110
4-33.	Fuel Tank Cap and Strainer a. Removal b. Cleaning and Inspection c. Installation	4-114
4-34.	Fuel Tank (without vapor canister) a. Draining b. Removal c. Inspection d. Installation	4-116
4-35.	Fuel Tank (with vapor canister) a. Draining b. Removal c. Inspection d. Installation	4-120
4-36.	Fuel Level Sending Unit a. Removal b. Installation	4-124
4-37.	Fuel Gage a. Removal b. Installation	4-124

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4-23. Fuel Tank and Air Cleaner Vent Lines (without vapor canister) Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel vapors are extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel vapor is ignited.

NOTE

The removal and installation procedures for all vent lines are basically the same.

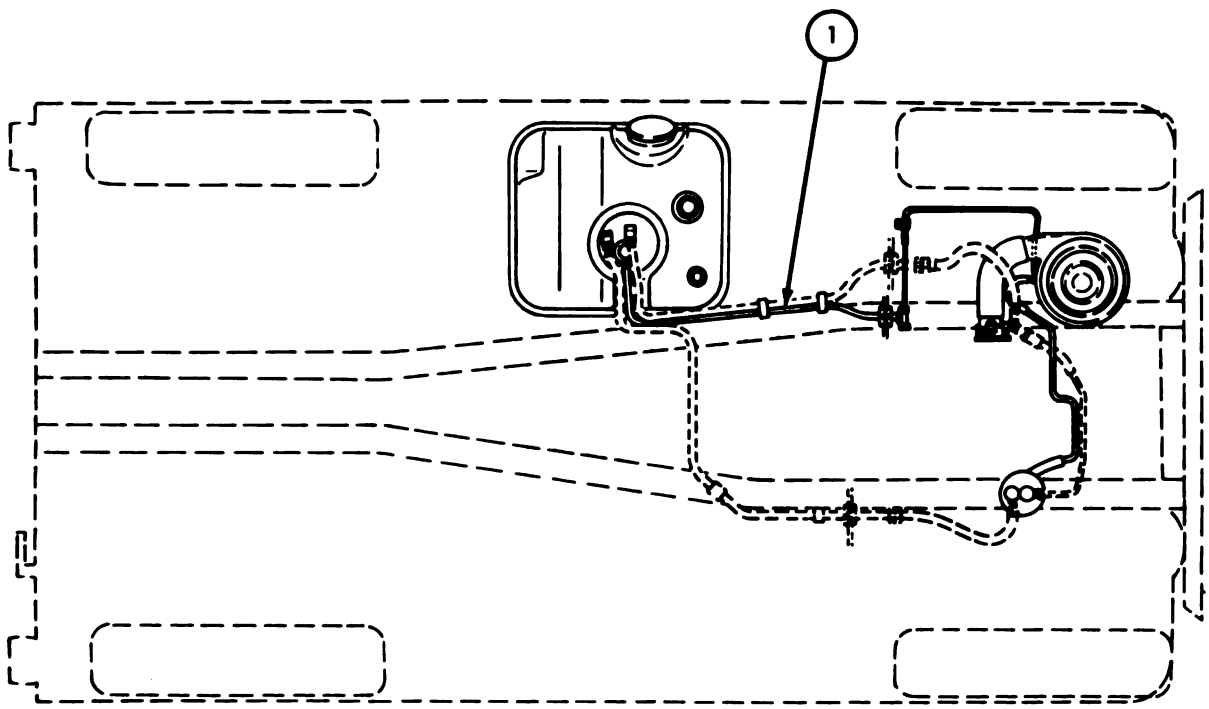
a. REMOVAL

1.		Vent line (1)	*a.* Disconnect fitting at each end of vent line being removed.	If more than one vent line is being removed, note disconnection points for installation.

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4-23. Fuel Tank and Air Cleaner Vent Lines (without vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			b. Remove all clamps and grommets to remove lines.	
		b. INSPECTION		
2.		Vent line (1)	Inspect for cracks and kinks.	Replace if cracked or kinked.

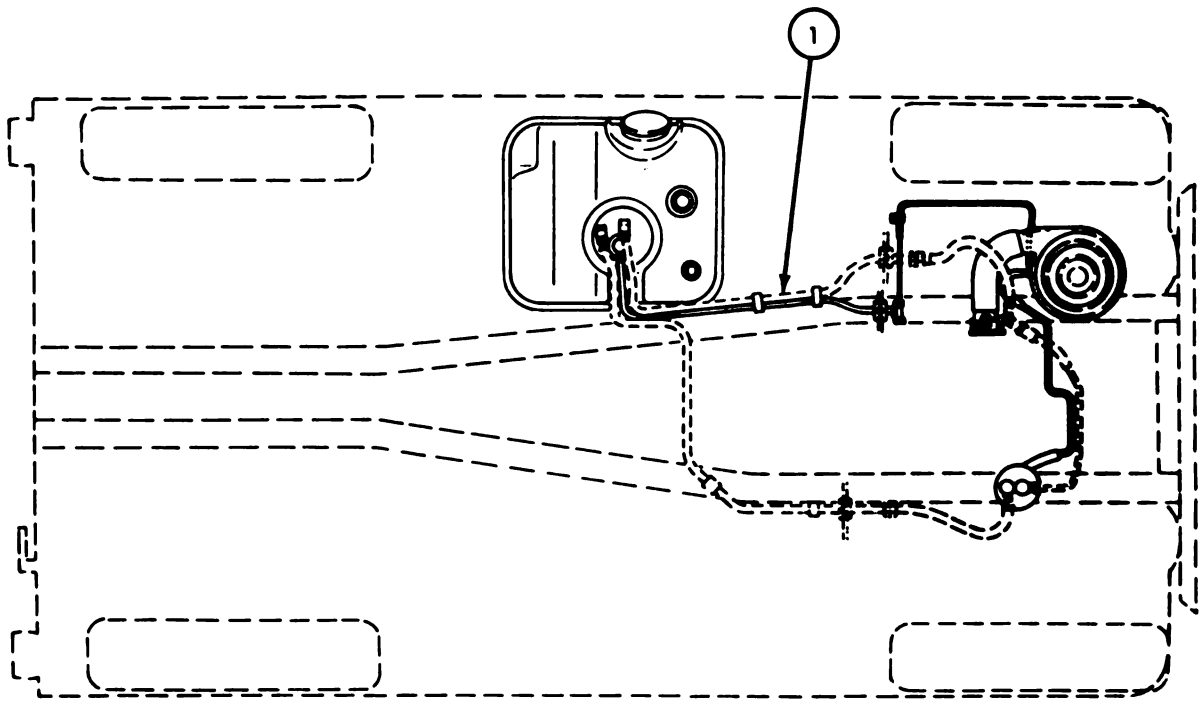


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4-23. Fuel Tank and Air Cleaner Vent Lines (without vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. INSTALLATION		
			CAUTION Use care when installing vent lines. Start all fittings by hand to prevent cross threading. Excessive bending or kinking of vent lines will restrict ventilation and affect vehicle performance.	
3.		Vent line (1)	*a.* Install grommets.	
			b. Connect fitting at each end of vent line (1) to marked location and tighten with suitable wrench.	Do not overtighten.
			c. Install all clamps.	



END OF TASK!

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4-24. Fuel Tank and Air Cleaner Vent Lines (with vapor canister) Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel vapors are extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel vapors are ignited.

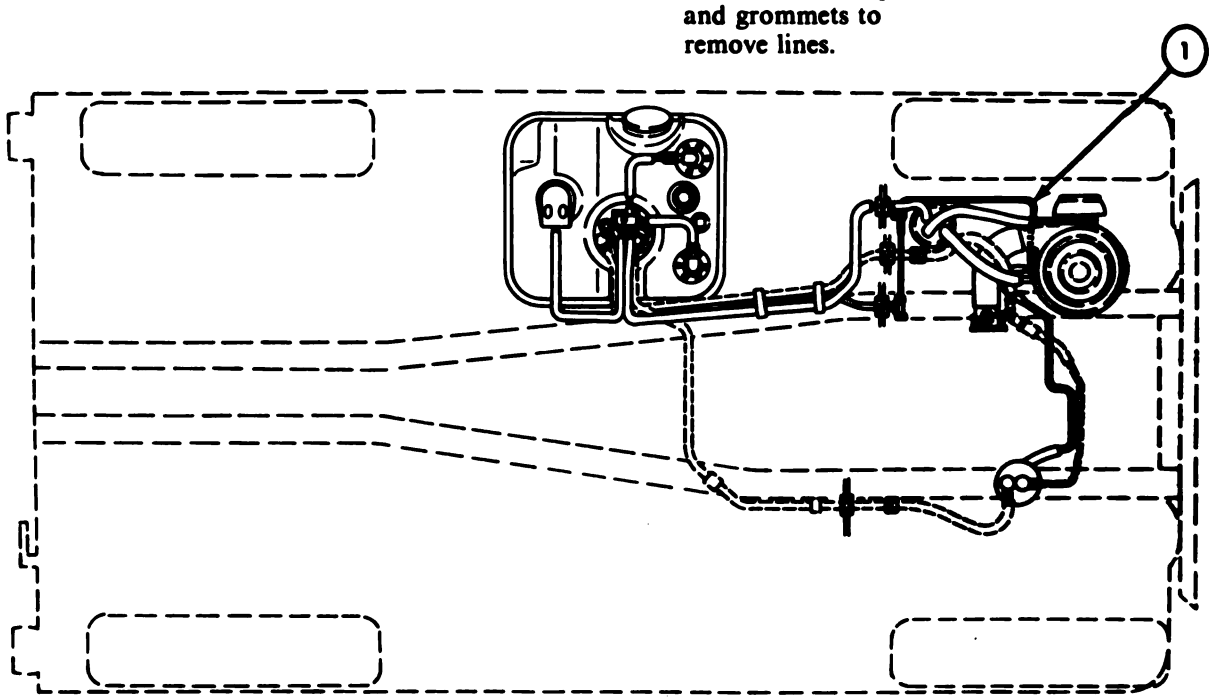
NOTE

The removal and installation procedures for all vent lines are basically the same.

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4-24. Fuel Tank and Air Cleaner Vent Lines (with vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.		Vent line (1)	*a.* Disconnect fitting at each end of vent line being removed.	If more than one vent line is being removed, note disconnection points for installation.
			b. Remove all clamps and grommets to remove lines.	



		b. INSPECTION		
2.		Vent line (1)	Inspect for cracks and kinks.	Replace if cracked or kinked.
		c. INSTALLATION		

CAUTION

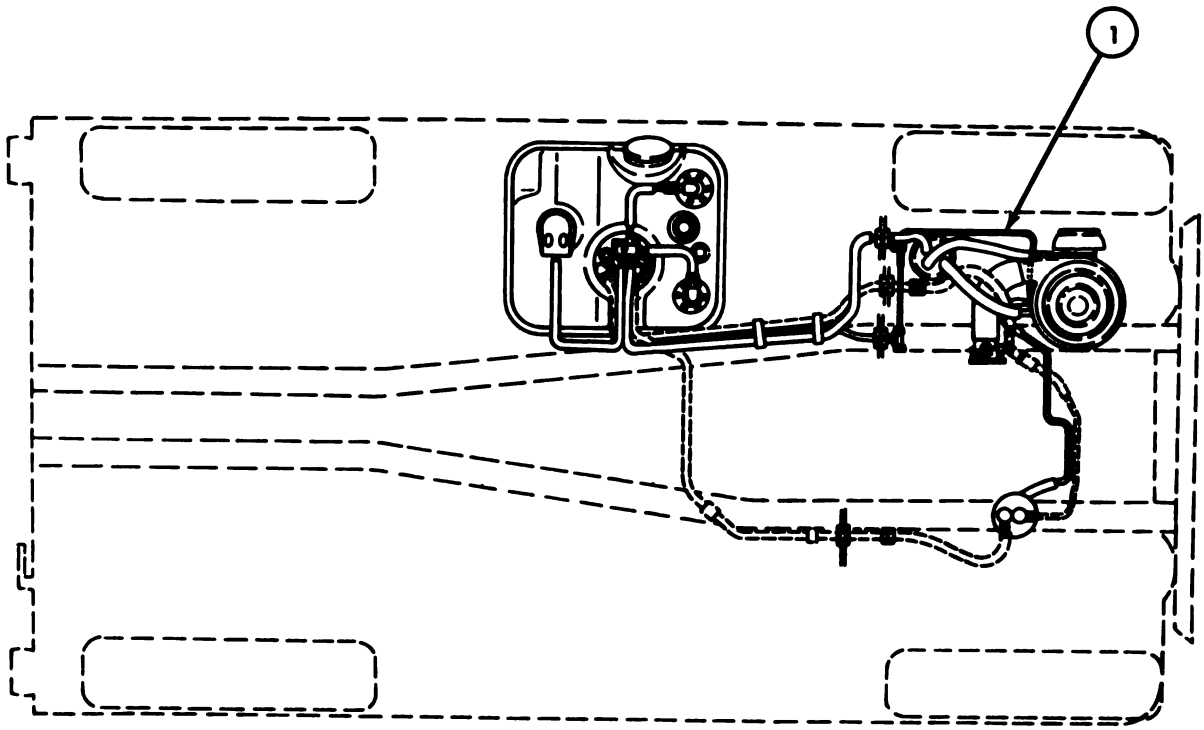
Use care when installing vent lines. Start all fittings by hand to prevent cross threading. Excessive bending or kinking of vent lines will restrict ventilation and affect vehicle performance.

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4-24. Fuel Tank and Air Cleaner Vent Lines (with vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.		Vent line (1)	*a.* Install grommets.	
			b. Connect fitting at each end of vent line (1) to marked location and tighten with suitable wrench.	Do not overtighten.
			c. Install all clamps.	



END OF TASK!

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4-25. Fuel Lines Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel that leaks from fuel lines is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel is ignited.

NOTE

The removal and installation procedures for all fuel lines are basically the same.

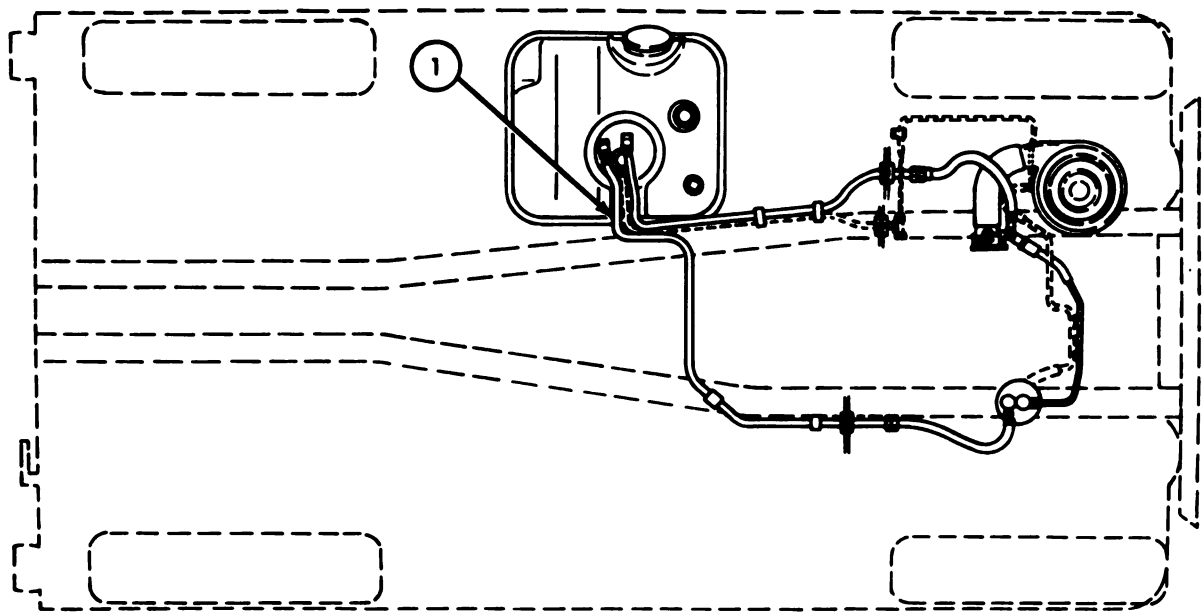
a. REMOVAL

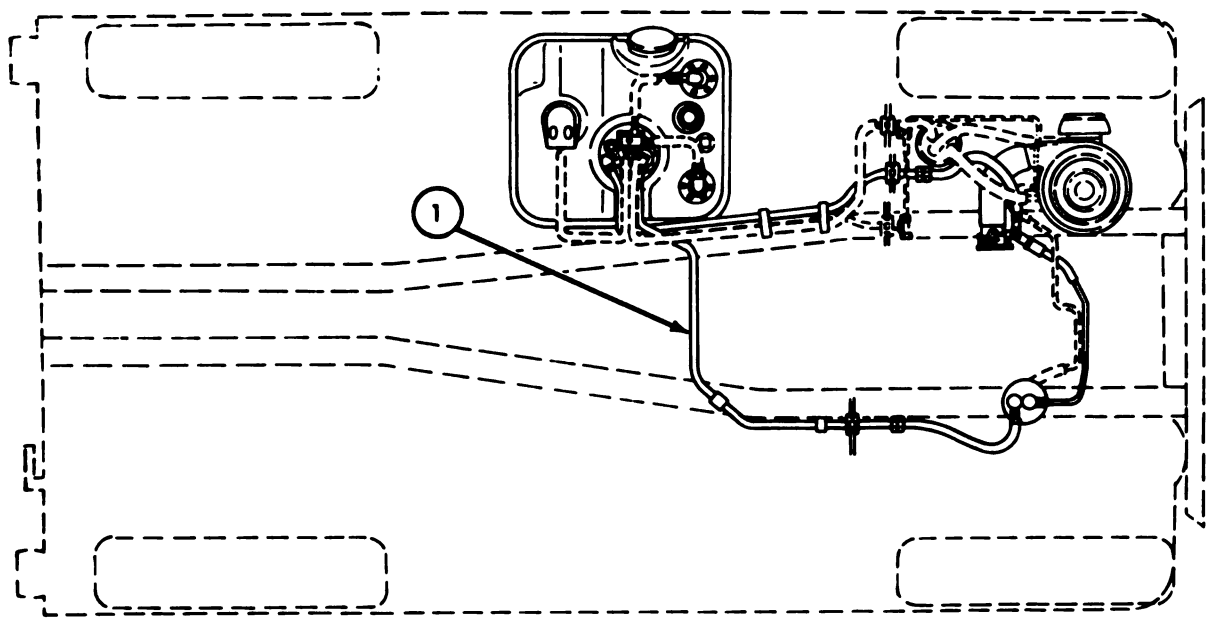
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
1.		Fuel line (1)	*a.* Disconnect fitting at each end of fuel line being removed. *b.* Remove all clamps and grommets to remove lines.	If more than one fuel line is being removed, note disconnection points for installation.

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4-25. Fuel Line Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





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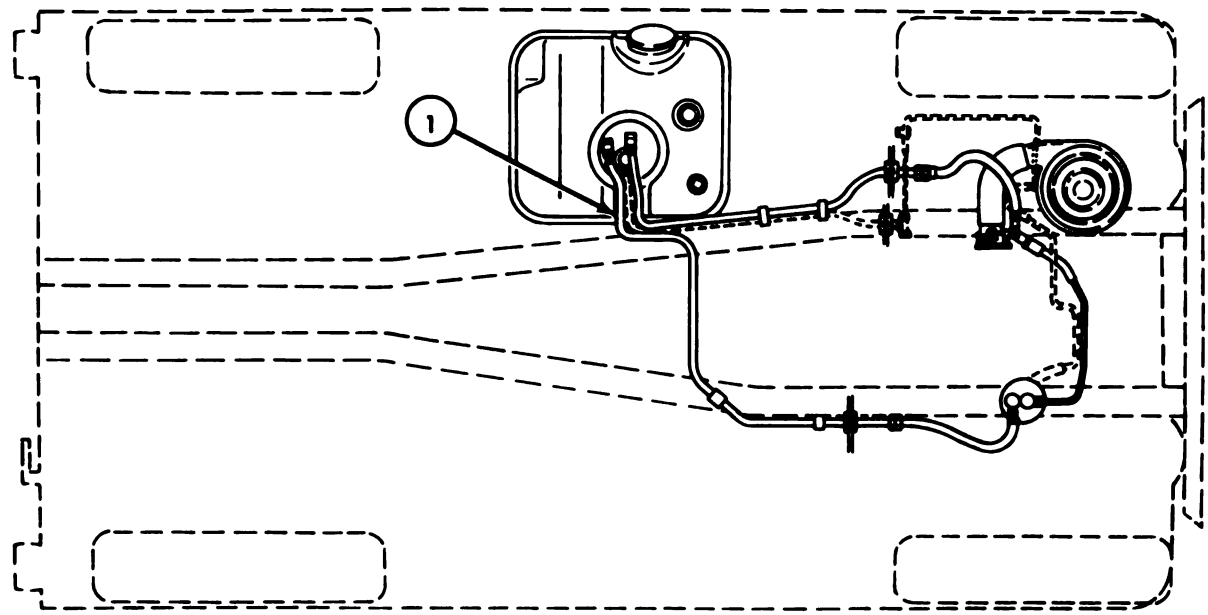
4-25. Fuel Line Maintenance (Cont'd)

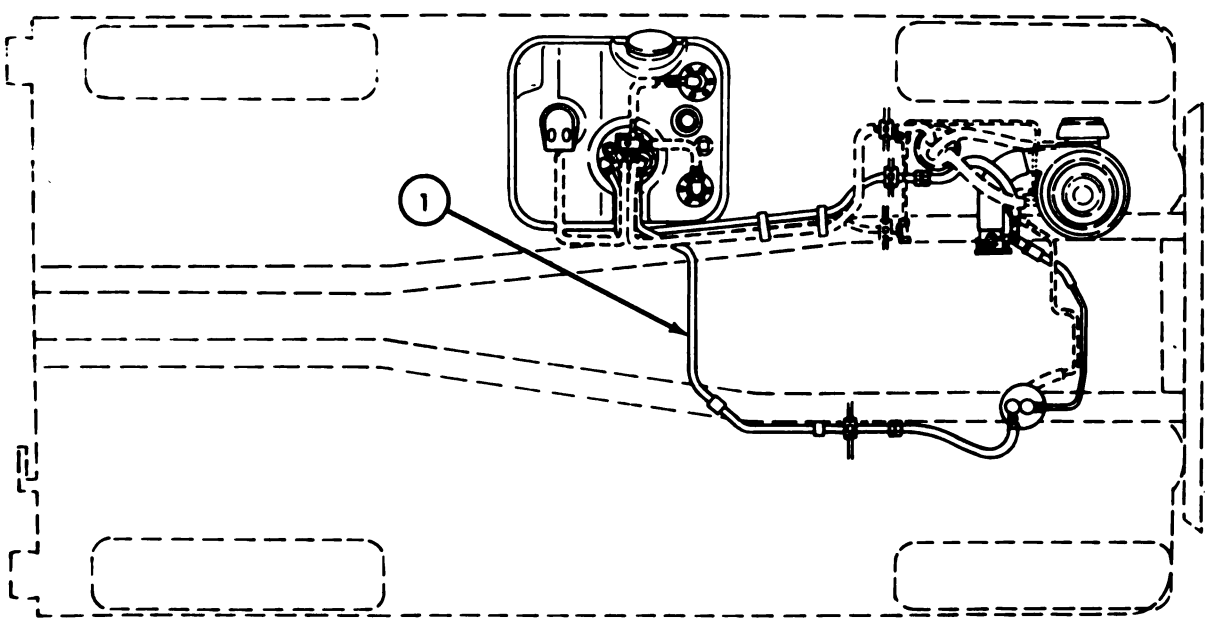
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSPECTION		
2.		Fuel line (1)	Inspect for cracks, leaks and kinks.	Replace if cracked, leaking or kinked.
		c. INSTALLATION		
			CAUTION Use care when installing fuel lines. Start all fittings by hand to prevent cross threading. Excessive bending or kinking of fuel lines will restrict fuel flow and affect vehicle performance.	
3.		Fuel line (1)	*a.* Install grommets.	
			b. Connect fitting at each end of fuel line (1) to marked location, and tighten with suitable wrench.	Do not overtighten.
			c. Install all clamps.	

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4-25. Fuel Line Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





END OF TASK!

TA 155317

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4-26. Fuel Vapor Storage Canister Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All emission control equipped vehicles	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
Work area well ventilated.

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
Do not work on vehicle near sparks or open flame.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel vapors are extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury will result if fuel is ignited.

a. REMOVAL

1.	Three hoses (1) to fuel vapor storage canister (3)	Three hose clamps (2)	Loosen and detach three hoses (1) from canister (3).	Note location of three hoses (1) for installation.
2.	Fuel vapor storage canister (3) to mounting bracket (4)	Mounting bracket bolt (5)	Loosen and slide canister (3) from bracket (4).	Do not remove bolt (5).

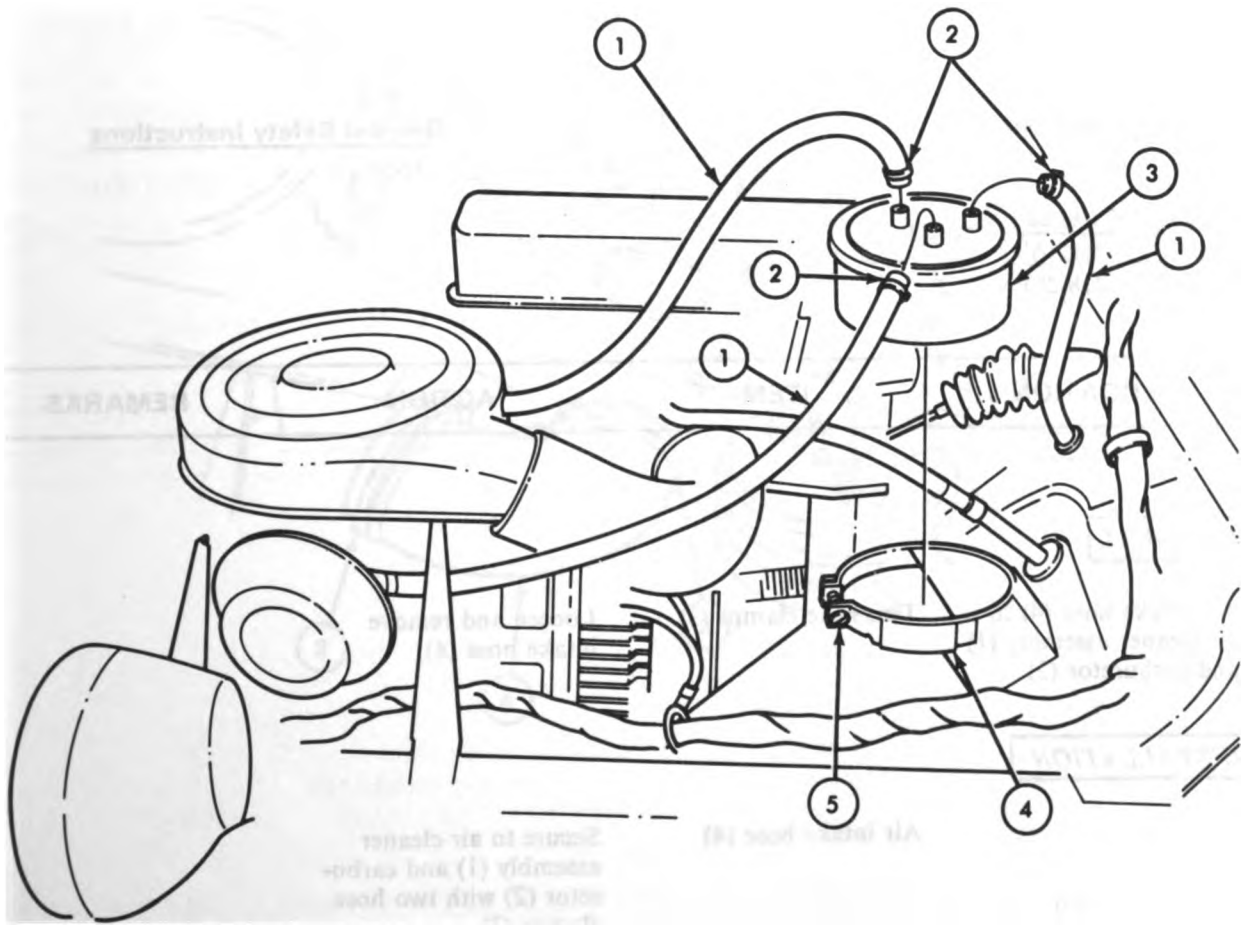
b. INSPECTION

3.		Fuel vapor storage canister (3)	Inspect for cracks, breaks and leaks.	Replace if cracked, broken or leaking.

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4-26. Fuel Vapor Storage Canister Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. INSTALLATION		
4.		Fuel vapor storage canister (3)	Position in mounting bracket (4) and tighten mounting bracket bolt (5).	
5.		Three hoses (1)	Secure to fuel vapor storage canister (3) at marked locations with three hose clamps (2).	



END OF TASK!

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4-27. Air Intake Hose Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
None

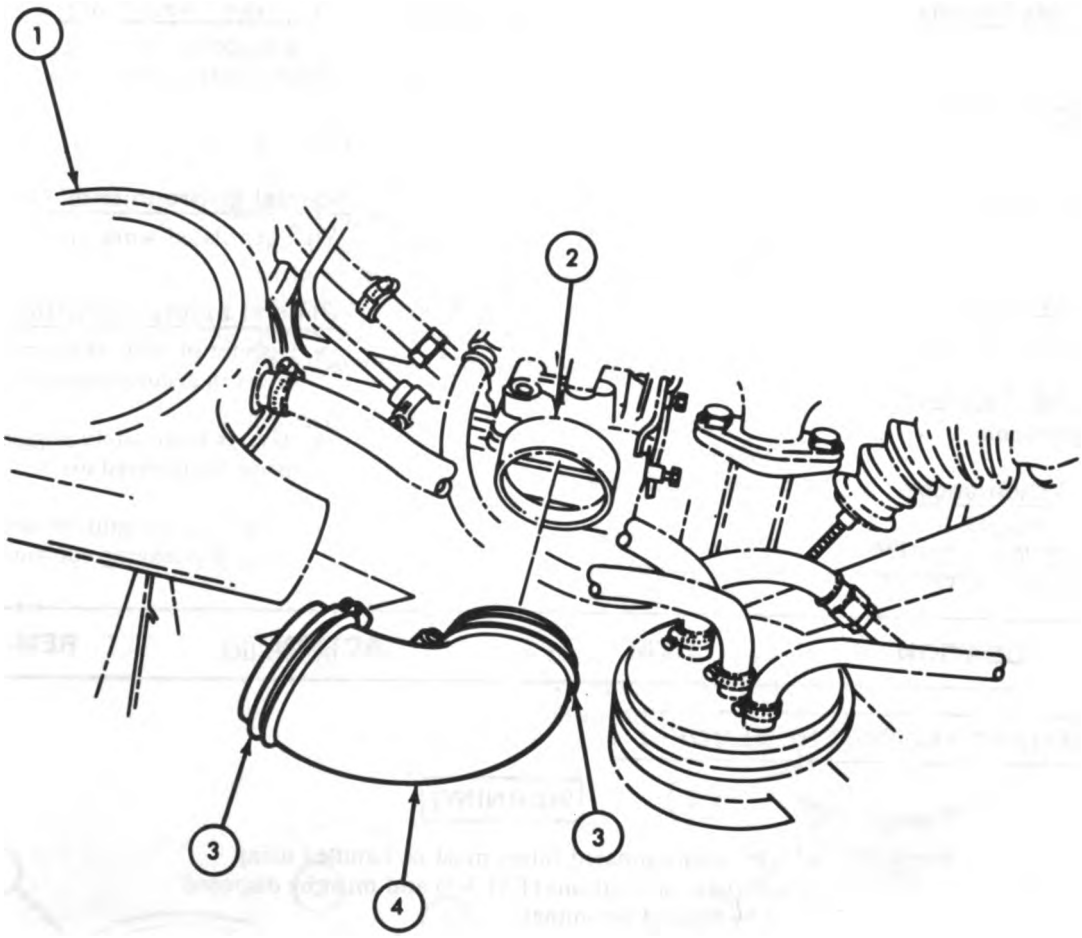
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Air intake hose (4) to air cleaner assembly (1) and carburetor (2)	Two hose clamps (3)	Loosen and remove intake hose (4).	
		b. INSTALLATION		
2.		Air intake hose (4)	Secure to air cleaner assembly (1) and carburetor (2) with two hose clamps (3).	

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4-27. Air Intake Hose Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

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4-28. Air Cleaner Servicing and Replacement Instructions

This task covers:

a. Element and Oil Cup Removal
b. Cleaning and Inspection
c. Element and Oil Cup Installation
d. Air Cleaner Assembly Removal
e. Air Cleaner Assembly Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Drycleaning solvent

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
LO 9-2320-218-12

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Well-ventilated work area.

General Safety Instructions
- Dispose of NBC contaminated oil and filters in accordance with FM 3-5.
- Always wear safety goggles when using compressed air.
- Keep fire extinguisher nearby when using drycleaning solvent.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. ELEMENT AND OIL CUP REMOVAL

WARNING

- NBC contaminated filters must be handled using adequate precautions (FM 3-5) and must be disposed of by trained personnel.
- NBC contaminated oil contained in the reservoir of oil bath type air filters will be handled and disposed of by trained personnel (TM 3-5).

NOTE

Step 1 applies only to vehicles equipped with fuel vapor storage canister.

1.	Vapor purge hose (3) to upper air cleaner (1)	Hose clamp (2)	Loosen and detach hose (3).	
2.	Air intake hose (8) to upper air cleaner (1)	Hose clamp (7)	Loosen and detach hose (8).	
3.	Upper air cleaner (1) to air cleaner canister (9)	Cover clamp (4)	Loosen.	

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4-28. Air Cleaner Servicing and Replacement Instructions (Cont'd)

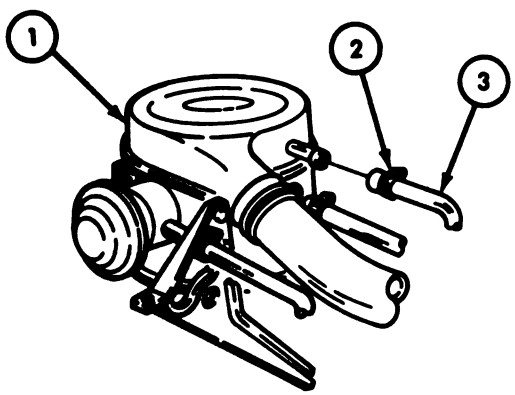
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Air cleaner canister (9)	Upper air cleaner (1), gasket (10), filter element (5), and oil cup (6)	Remove.	Discard used oil in oil cup (6).

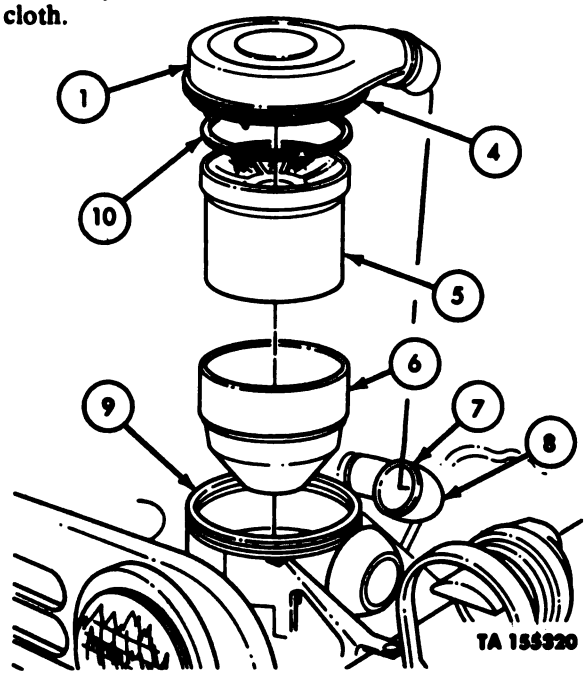
b. CLEANING AND INSPECTION

WARNING

- Compressed air source will not exceed 30 psi. When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight.
- Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.

5.		Filter element (5)	*a.* Clean with drycleaning solvent and compressed air.	
			b. Inspect filter mesh for breaks and corrosion.	Replace if broken or corroded.
6.		Oil cup (6)	Clean with drycleaning solvent and dry with clean cloth.	





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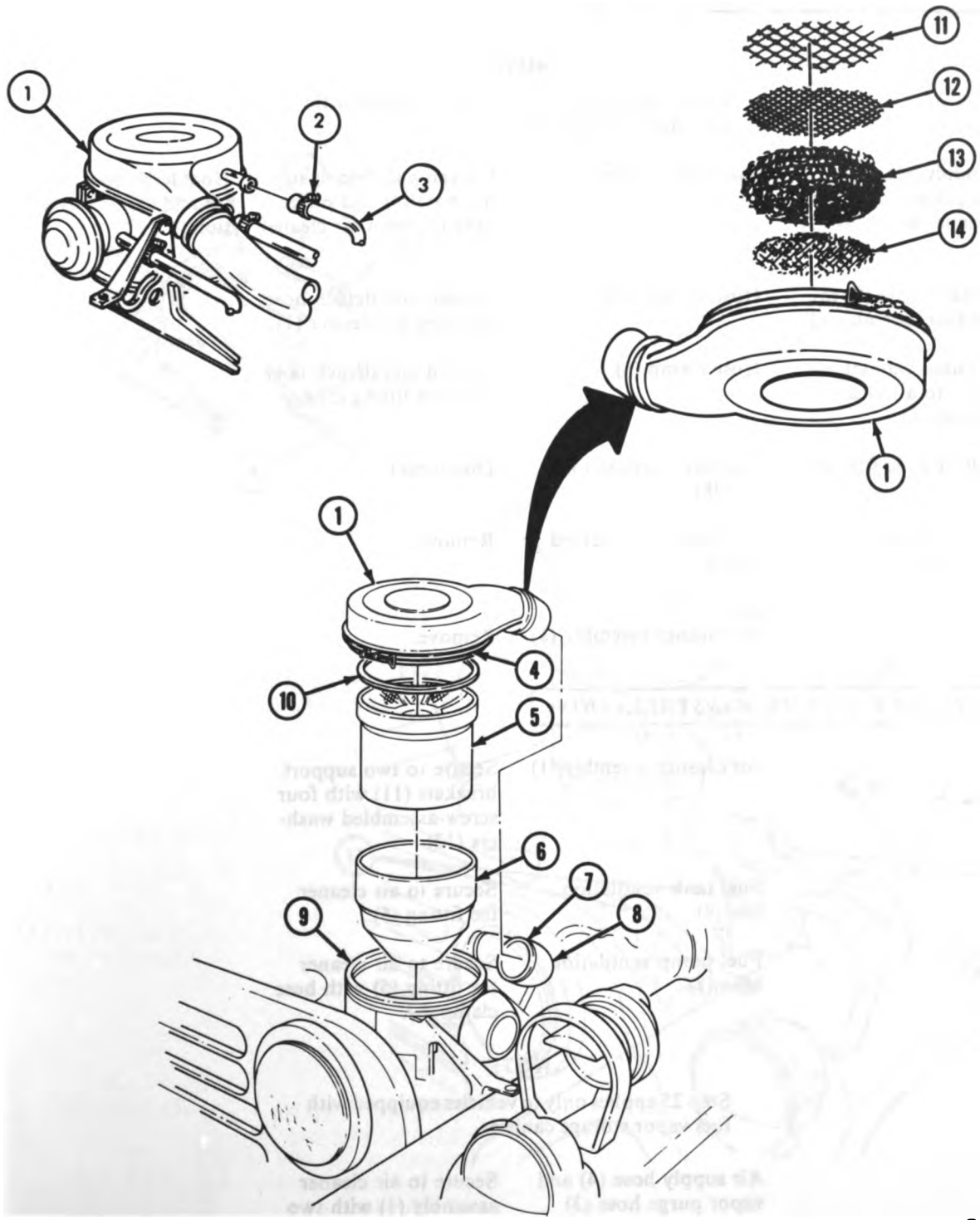
4-28. Air Cleaner Servicing and Replacement Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		WARNING		
		• Compressed air source will not exceed 30 psi (207 kPa). When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight. • Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.		
7.		Course mesh screen (11), fine mesh screen (12), horse hair filter (13), and upper air cleaner cover (1)	Disassemble and clean with drycleaning solvent and dry with compressed air.	
8.		Fiberglass filter (14) (if equipped)	Clean with soap and water.	Air dry.
9.		Mesh screens (11) and (12)	Inspect for breaks and corrosion.	
		c. ELEMENT AND OIL CUP INSTALLATION		
10.		Filter (14), filter (13), screen (12), and screen (11)	Install in upper air cleaner assembly (1).	
11.		Oil cup (6)	*a.* Position in air cleaner canister (9).	
			b. Fill to proper level with oil.	See LO 9-2320-218-12.
12.		Filter element (5)	Position in oil cup (6).	
13.		Gasket (10) and upper air cleaner cover (1)	Secure to air cleaner canister (9) with cover clamp (4).	Make sure gasket (10) is properly seated.
		NOTE Step 14 applies only to vehicles equipped with fuel vapor storage canister.		
14.		Vapor purge hose (3)	Secure to upper air cleaner cover (1) with hose clamp (2).	
15.		Air intake hose (8)	Secure to upper air cleaner cover (1) with hose clamp (7).	

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4-28. Air Cleaner Servicing and Replacement Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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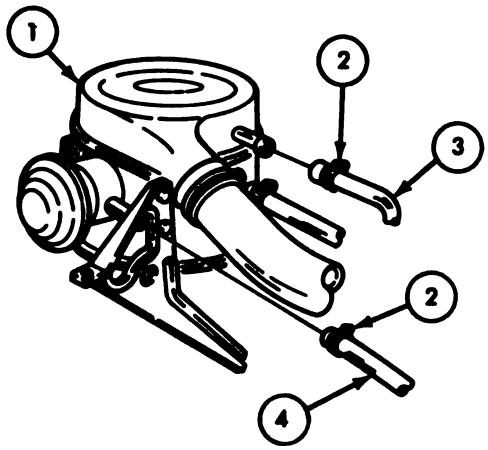
4-28. Air Cleaner Servicing and Replacement Instructions (Cont'd)

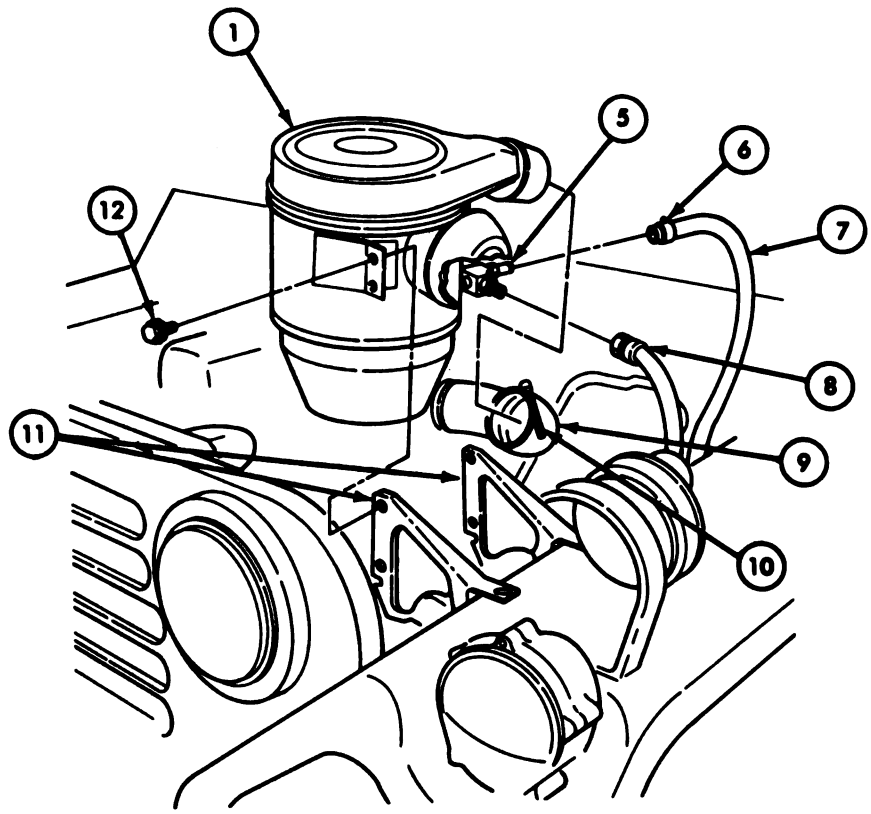
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	d. AIR CLEANER ASSEMBLY REMOVAL			
		NOTE Step 16 applies only to vehicles equipped with fuel vapor storage canister.		
16.	Air supply hose (4) and vapor purge hose (3) to air cleaner assembly (1)	Two hose clamps (2)	Loosen and detach supply hose (4) and purge hose (3) from air cleaner (1).	Note location of two hoses (4) and (3) for installation.
17.	Air intake hose (9) to air cleaner assembly (1)	Hose clamp (10)	Loosen and detach hose (9) from air cleaner (1).	
18.	Fuel pump ventilation hose (7) to air cleaner tee fitting (5)	Hose clamp (6)	Loosen and detach hose (7) from fitting (5).	
19.	Air cleaner tee fitting (5)	Fuel tank ventilation line (8)	Disconnect.	
20.	Air cleaner assembly (1) to two support brackets (11)	Four screw-assembled washers (12)	Remove.	
21.		Air cleaner assembly (1)	Remove.	
	e. AIR CLEANER ASSEMBLY INSTALLATION			
22.		Air cleaner assembly (1)	Secure to two support brackets (11) with four screw-assembled washers (12).	
23.		Fuel tank ventilation line (8)	Secure to air cleaner tee fitting (5).	
24.		Fuel pump ventilation hose (7)	Secure to air cleaner tee fitting (5) with hose clamp (6).	
		NOTE Step 25 applies only to vehicles equipped with fuel vapor storage canister.		
25.		Air supply hose (4) and vapor purge hose (3)	Secure to air cleaner assembly (1) with two hose clamps (2).	

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4-28. Air Cleaner Servicing and Replacement Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
26.		Air intake hose (9)	Secure to air cleaner assembly (1) with hose clamp (10).	





END OF TASK!

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4-29. Mechanical Fuel Pump Maintenance

This task covers:

a. Testing
b. Removal
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
Tester, internal combustion engine (vacuum and fuel pressure, 0-8 lb pressure and 0-27 in. vacuum)

Special Tools
None

Materials/Parts
Gasket

Personnel Required
One mechanic
One assistant (task *a* only)

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

NOTE

Assistant is required for task a.

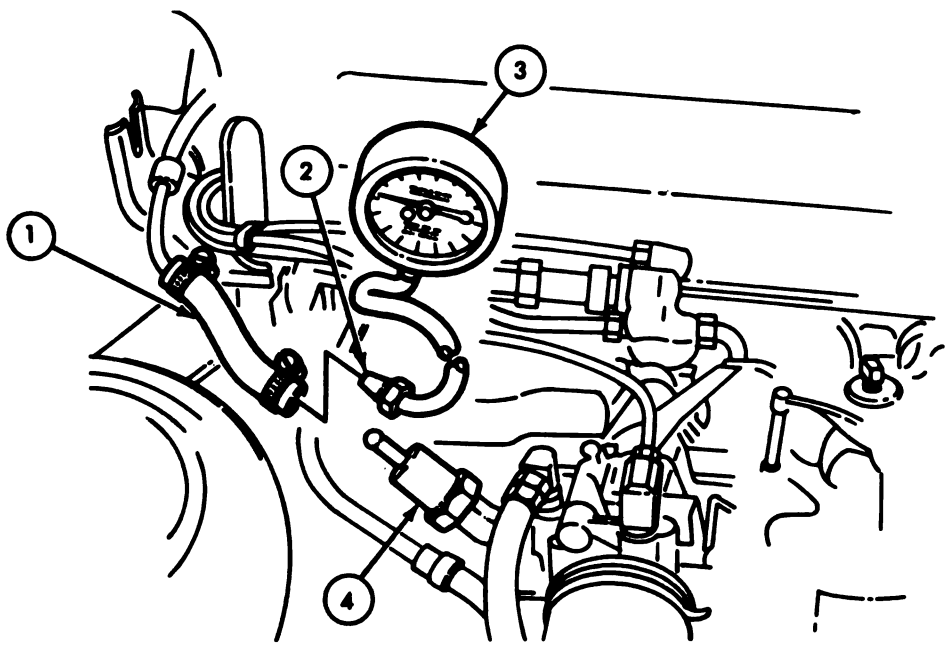
a. TESTING

1.			Test fuel pump as follows:	
			a. Disconnect fuel line (1) at fuel filter (4).	
			b. Hold tapered adapter (2) of fuel pump gage (3) against fuel line (1) while assistant cranks engine for 10 seconds.	Ignition switch off.

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4-29. Mechanical Fuel Pump Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			c. Take fuel pressure reading.	Pressure reading should be 5-6 psi (34.0-40.8 kPa). If reading is below 5-6 psi (34.0-40.8 kPa), replace fuel pump.
			d. Secure fuel line (1) to fuel filter (4).	



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4-29. Mechanical Fuel Pump Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
2.	Fuel pump (2)	Fuel inlet hose (1) and fuel outlet hose (5)	Disconnect.	Note location of hoses (1) and (5) for proper installation.
3.	Ventilation line (6) to fuel pump (2)	Hose clamp (7)	Loosen and detach ventilation line (6) from fuel pump (2).	
4.	Fuel pump (2) to engine block (3)	Two capscrews (10), lockwashers (9), and flat washers (8)	Remove.	
5.		Fuel pump (2) and gasket (4)	Remove.	Discard gasket (4).
	c. INSTALLATION			
6.		New gasket (4) and fuel pump (2)	Secure to engine block (3) with two flat washers (8), lockwashers (9), and capscrews (10).	
7.		Ventilation line (6)	Connect to fuel pump (2), and secure with hose clamp (7).	

CAUTION

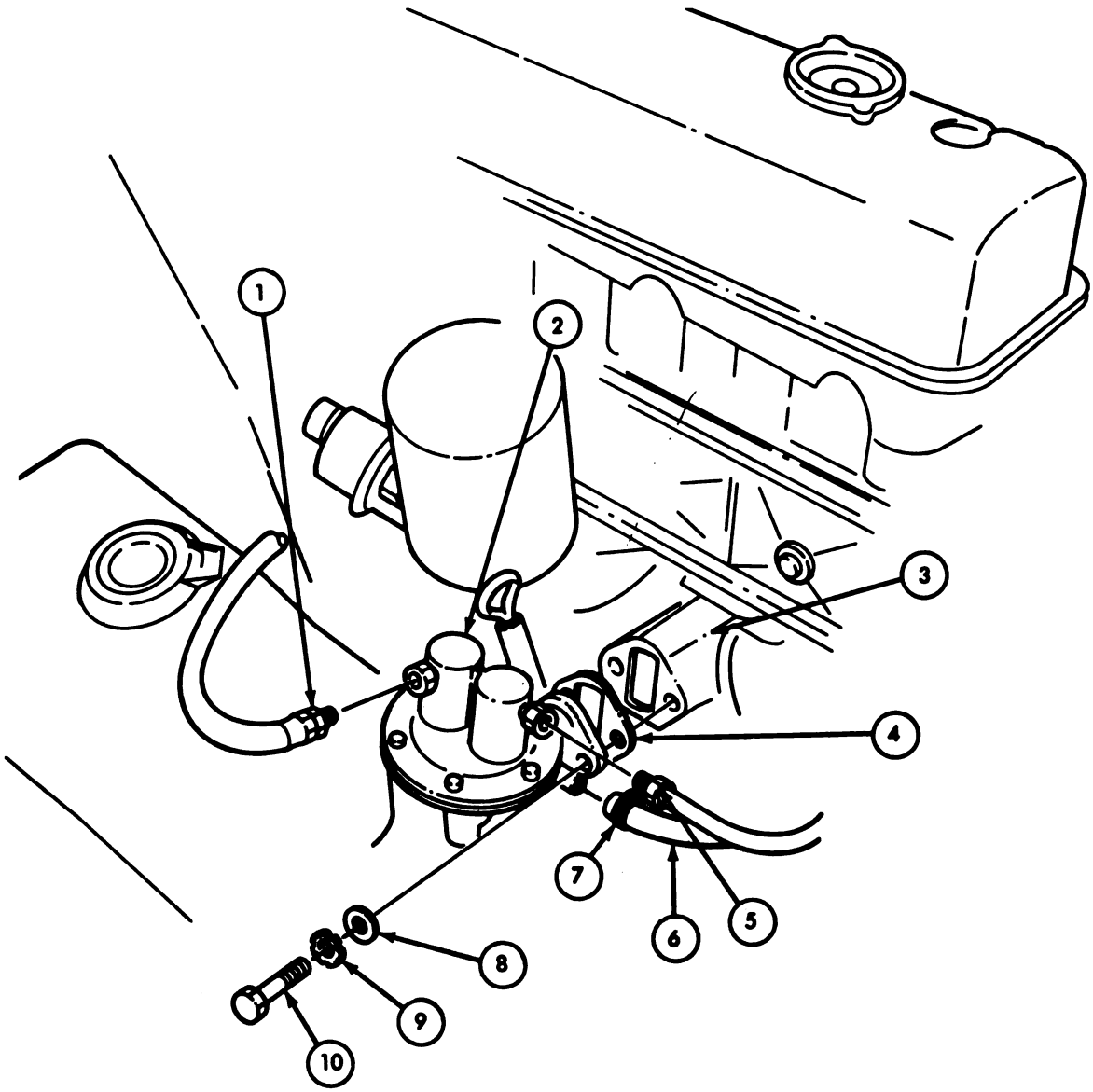
- Use care when installing fuel lines. Bending or kinking of fuel lines will restrict fuel flow and affect vehicle performance. Start all male fittings by hand to prevent cross threading.
- Position fuel pump inlet hose to allow easy removal of engine oil dipstick without causing hose kink. No contact is permissible between hose and dipstick.

8.		Fuel inlet hose (1) and fuel outlet hose (5)	Secure to marked locations of fuel pump (2).	
9.		Fuel pump (2)	Check for proper pressure.	See *a* of this task.

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4-29. Mechanical Fuel Pump Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

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4-30. Fuel Tank Fuel Filter Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All models not equipped with fuel vapor canister	TM 9-2320-218-10 Para 10-10	Parking brake set. Driver's seat removed.

Test Equipment
None

Special Tools
Safety goggles

Special Environmental Conditions
Work area well ventilated.

Materials/Parts
Gasket
Drycleaning solvent

Personnel Required
One mechanic

General Safety Instructions
- Do not work on vehicle near sparks or open flame.
- Wear goggles when working with compressed air.
- Keep fire extinguisher nearby when using drycleaning solvent.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

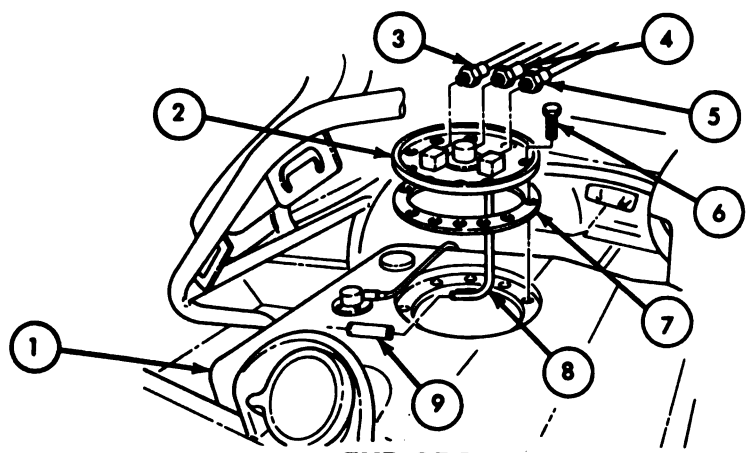
a. REMOVAL

1.	Fuel tank cover (2)	Fuel tank ventilation line (4), inlet line (5), and return line (3)	Disconnect.	Note locations for installation.
2.	Fuel tank cover (2) to fuel tank (1)	Twelve assembled bolts (6)	Remove.	
3.		Fuel tank cover (2) and gasket (7)	Remove.	Discard gasket (7).
4.	Fuel tank cover pick-up tube (8)	Fuel tank filter (9)	Remove.	

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4-30. Fuel Tank Fuel Filter Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. CLEANING AND INSPECTION		
		WARNING		
		• Compressed air source will not exceed 30 psi. When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight. • Drycleaning solvent is flammable and must not be used near an open flame. A fire extinguisher will be kept nearby when solvent is used. Use only this in well-ventilated areas. Failure to do so may result in injury to personnel and/or damage to equipment.		
5.		Fuel tank filter (9)	*a.* Clean with dry-cleaning solvent and compressed air.	
			b. Inspect filter for tears and corrosion.	Replace filter (9) if torn or corroded.
		c. INSTALLATION		
6.		Fuel tank filter (9)	Position on pick-up tube (8) of fuel tank cover (2).	
7.		New gasket (7) and fuel tank cover (2)	Secure to fuel tank (1) with twelve assembled bolts (6).	
8.		Fuel tank ventilation line (4), inlet line (5), and return line (3)	Connect to marked locations on fuel tank cover (2).	



END OF TASK!

FOLLOW-ON TASK: Install driver's seat (para 10-10).

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4-31. In-Line Fuel Filter Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Sealer (NSN 8040-00-221-3811)

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

a. REMOVAL

WARNING

Do not disconnect fuel supply line from fuel filter when engine is hot. Fuel will leak when disconnected and ignite, causing injury.

1.	Fuel supply line (1) to fuel filter (3)	Hose clamp (2)	Loosen and detach fuel supply line (1) from filter (3).	

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4-31. In-Line Fuel Filter Maintenance (Cont'd)

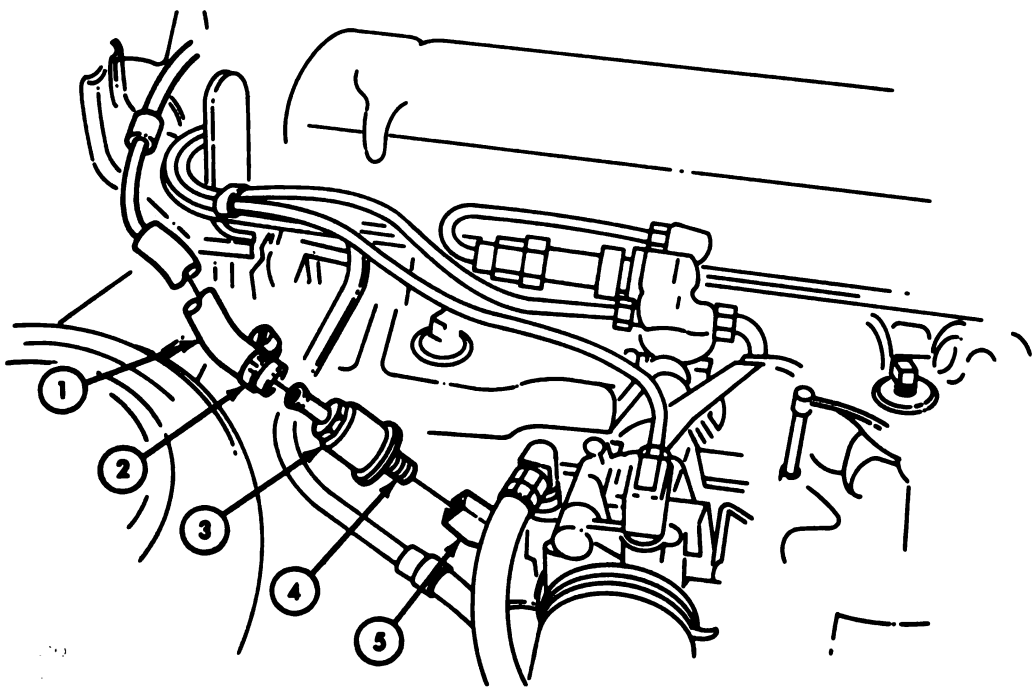
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
2.		Fuel filter (3)	Unscrew and remove from carburetor inlet elbow (5).	

b. INSTALLATION

CAUTION

Use care when installing fuel filter. Start threads by hand to prevent cross threading. Do not overtighten.

3.	Fuel filter (3)	*a.* Apply sealer to threads (4).	
		b. Secure to carburetor inlet elbow (5).	
4.	Fuel supply line (1)	Connect to fuel filter (3) and secure with hose clamp (2).	



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and inspect for leaks at fuel filter.

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4-32. Carburetor Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque adapter (Appendix E)

Materials/Parts
Gasket
Two lockwashers

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 9-2320-218-20-1-2

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 4-27	Air intake hose removed.
Para 4-31	In-line fuel filter removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

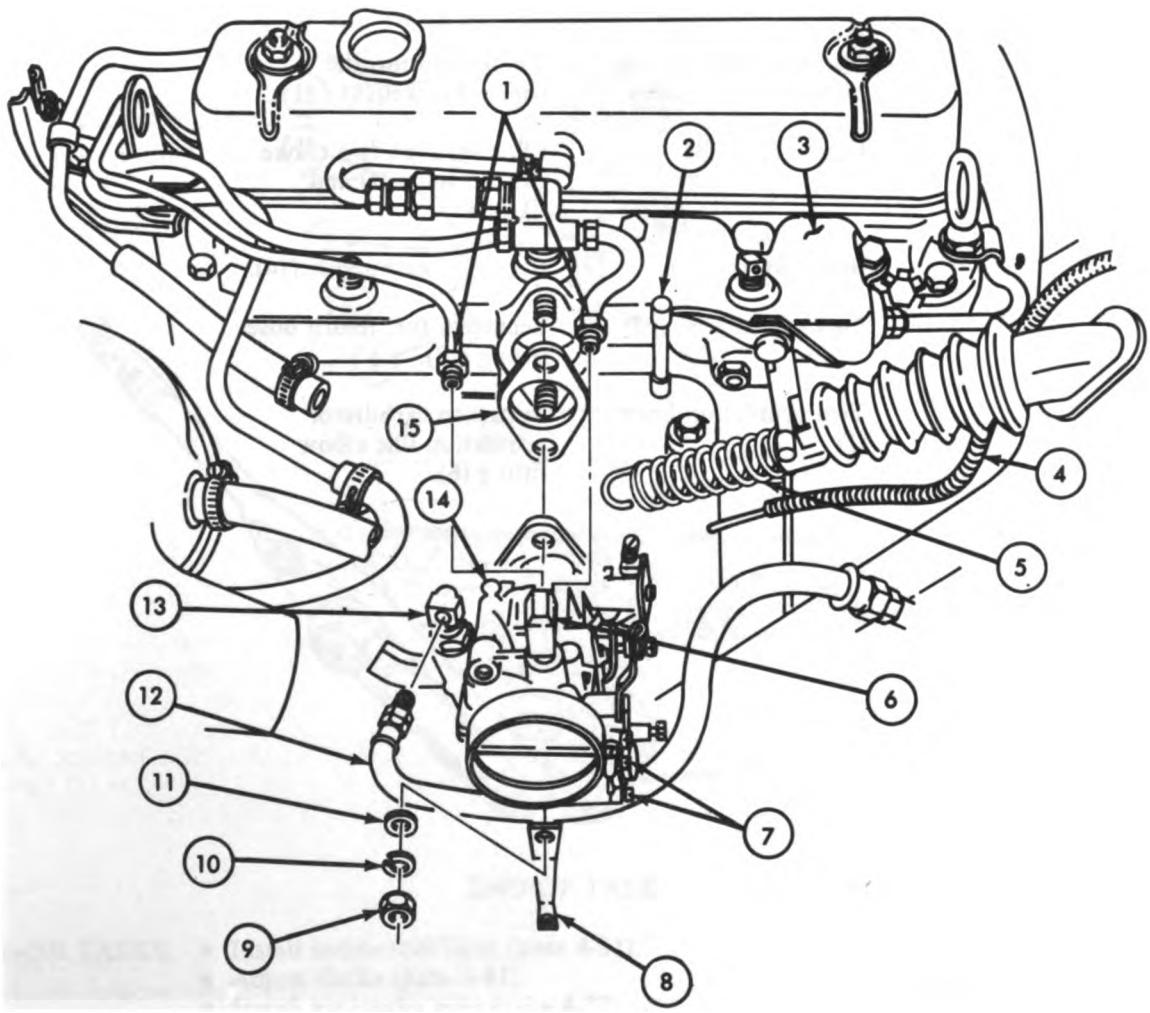
a. REMOVAL

1.	Carburetor ventilation line elbow fitting (6)	Two ventilation lines (1)	Disconnect.	Note location of ventilation lines (1) for installation.
2.	Carburetor fuel return hose fitting (13)	Fuel return hose (12)	Disconnect.	
3.	Throttle spring bracket (8)	Throttle return spring (5)	Disconnect.	Note location of spring (5) for proper installation.
4.	Rear of carburetor (14)	Bellcrank rod (2)	Disconnect.	

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4-32. Carburetor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Carburetor (14)	Two choke cable clamps (7)	Loosen and slide choke cable (4) out.	
6.	Carburetor (14) to intake manifold (3)	Two nuts (9), lockwashers (10), flat washers (11), and throttle spring bracket (8)	Remove.	Discard lockwashers (10).
7.		Carburetor (14) and gasket (15)	Remove from intake manifold (3).	Discard gasket (15).



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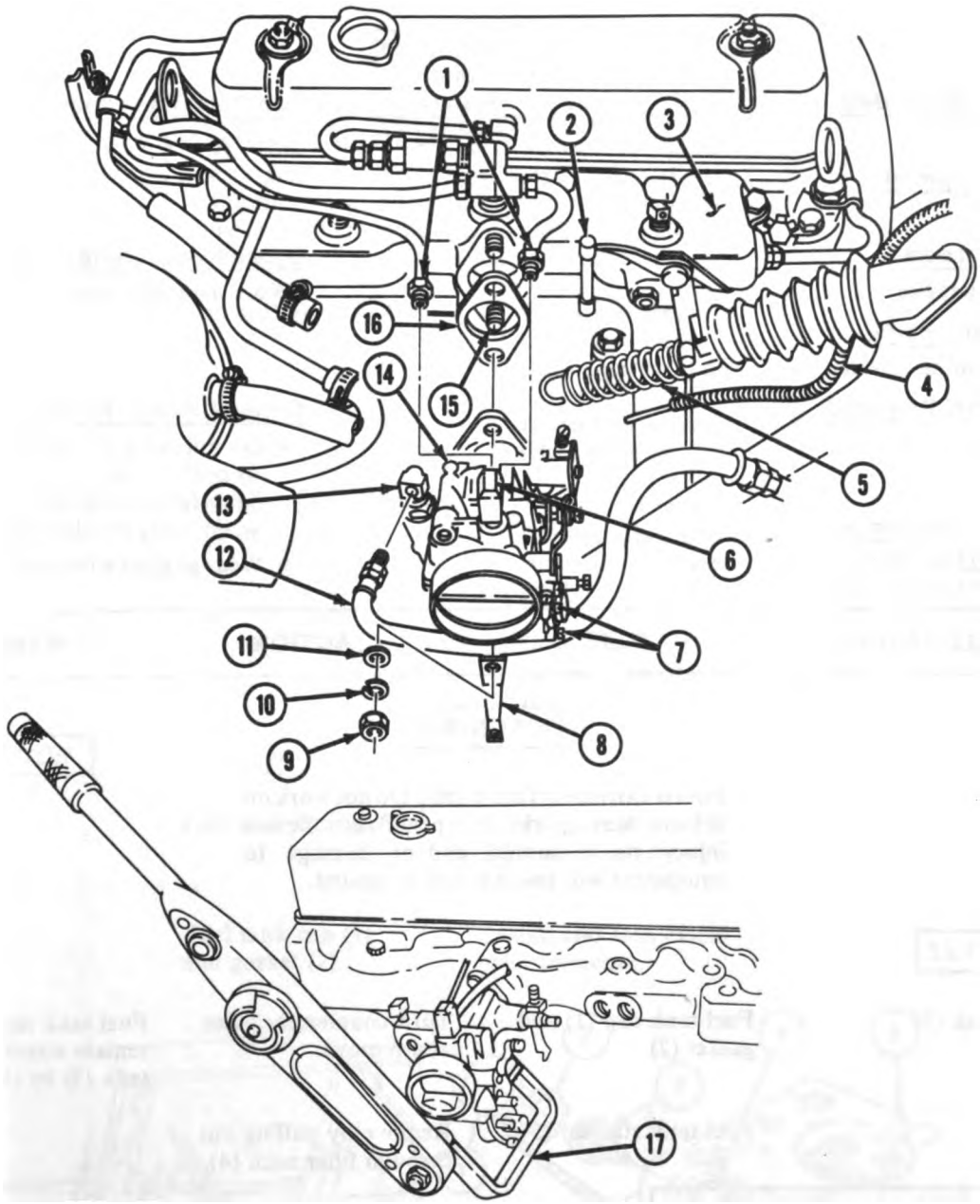
4-32. Carburetor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
		NOTE		
		If new carburetor is installed, use all fittings from old carburetor.		
8.		New gasket (16) and carburetor (14)	Position on intake manifold (3) and secure with throttle spring bracket (8), two flat washers (11), new lockwashers (10), and nuts (9).	Install throttle spring bracket (8) on lower stud (15) of manifold (3). Tighten 65-85 lb-in (7.3-9.6 N•m).
9.		Throttle return spring (5)	Connect to throttle spring bracket (8).	
10.		Choke cable (4)	Slide through two choke cable clamps (7) and tighten.	
11.		Bellcrank rod (2)	Secure to carburetor (14).	
12.		Fuel return hose (12)	Secure to fuel return hose fitting (13).	
13.		Two ventilation lines (1)	Secure to carburetor ventilation line elbow fitting (6).	

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4-32. Carburetor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Install in-line fuel filter (para 4-31).
- Adjust choke (para 4-41).
- Install air intake hose (para 4-27).
- Start engine (TM 9-2320-218-10) and adjust carburetor as necessary (para 4-16).

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4-33. Fuel Tank Cap and Strainer Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10

Condition Description
Parking brake set.

Test Equipment
None

Special Tools
Safety goggles

Special Environmental Conditions
Work area well ventilated.

Materials/Parts
Drycleaning solvent

Personnel Required
One mechanic

General Safety Instructions
- Do not work on vehcile near sparks or open flame.
- Keep fire extinguisher nearby when using drycleaning solvent.
- Wear goggles when using compressed air.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

a. REMOVAL

1.	Fuel tank (5)	Fuel tank cap (1) and gasket (2)	Turn counterclockwise and remove.	Fuel tank cap (1) will remain attached to fuel tank (5) by chain (6).
2.		Fuel tank strainer (3)	Remove by pulling out through filler neck (4).	

b. CLEANING AND INSPECTION

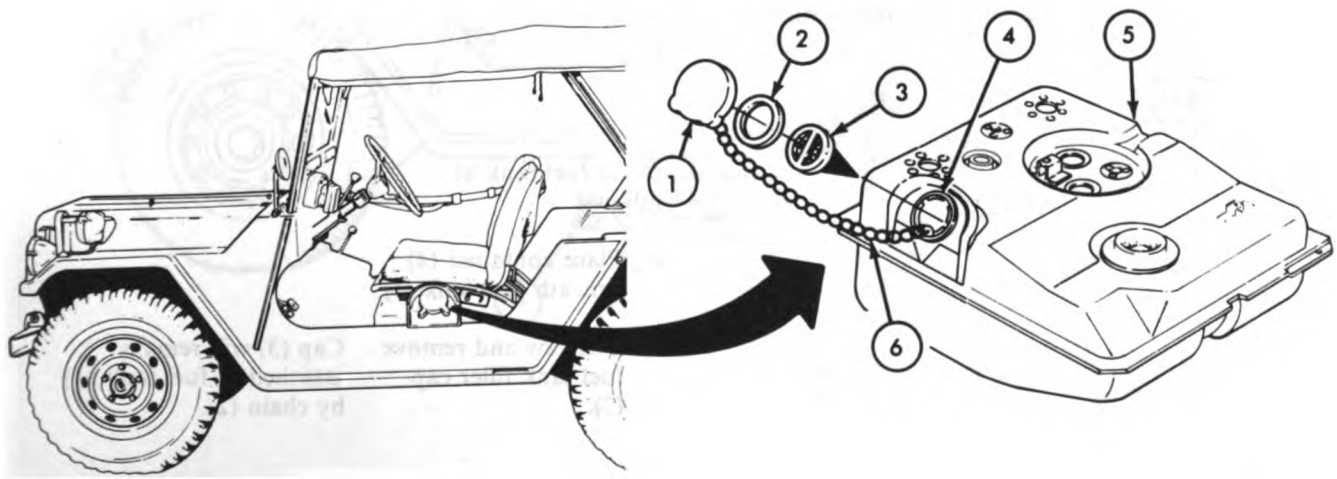
WARNING

Compressed air source will not exceed 30 psi. When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight.

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4-33. Fuel Tank Cap and Strainer Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			WARNING Drycleaning solvent is flammable and will not be used near an open flame. A fire extinguisher will be kept nearby when the solvent is used. Use only in well-ventilated places. Failure to do this may result in injury to personnel and/or damage to equipment.	
3.		Fuel tank strainer (3)	*a.* Clean with drycleaning solvent and compressed air.	
			b. Inspect for tears and corrosion.	Replace if torn or corroded.
4.		Fuel tank cap (1)	*a.* If equipped with fording valve, make sure valve operates freely.	
			b. Inspect gasket (2) for tears and dryness.	Replace if torn or dried out.
		c. INSTALLATION		
5.		Fuel tank strainer (3)	Position in filler neck (4) with pointed end facing downward.	
6.		Fuel tank cap (1) and gasket (2)	Install and turn clockwise to secure.	



END OF TASK!

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4-34. Fuel Tank (without vapor canister) Maintenance

This task covers:

a. Draining
b. Removal
c. Inspection
d. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
20-gallon container

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 10-10	Parking brake set. Driver's seat removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

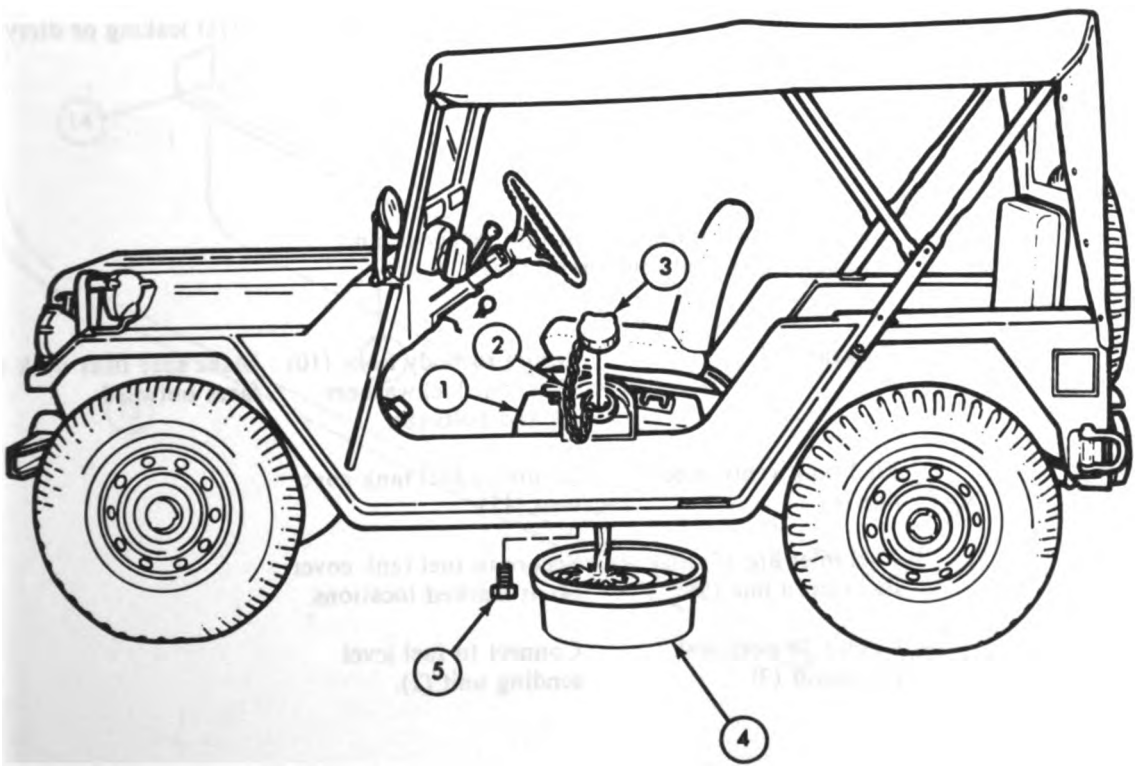
a. DRAINING

1.			Drain fuel tank as follows: *a.* Place container (4) beneath fuel tank (1). *b.* Unscrew and remove fuel tank filler cap (3).	Cap (3) will remain attached to fuel tank (1) by chain (2).

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4-34. Fuel Tank (without vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			c. Remove fuel tank drain plug (5) and allow fuel to drain.	
			d. Reinstall drain plug (5) and fuel tank filler cap (3) after draining is completed.	



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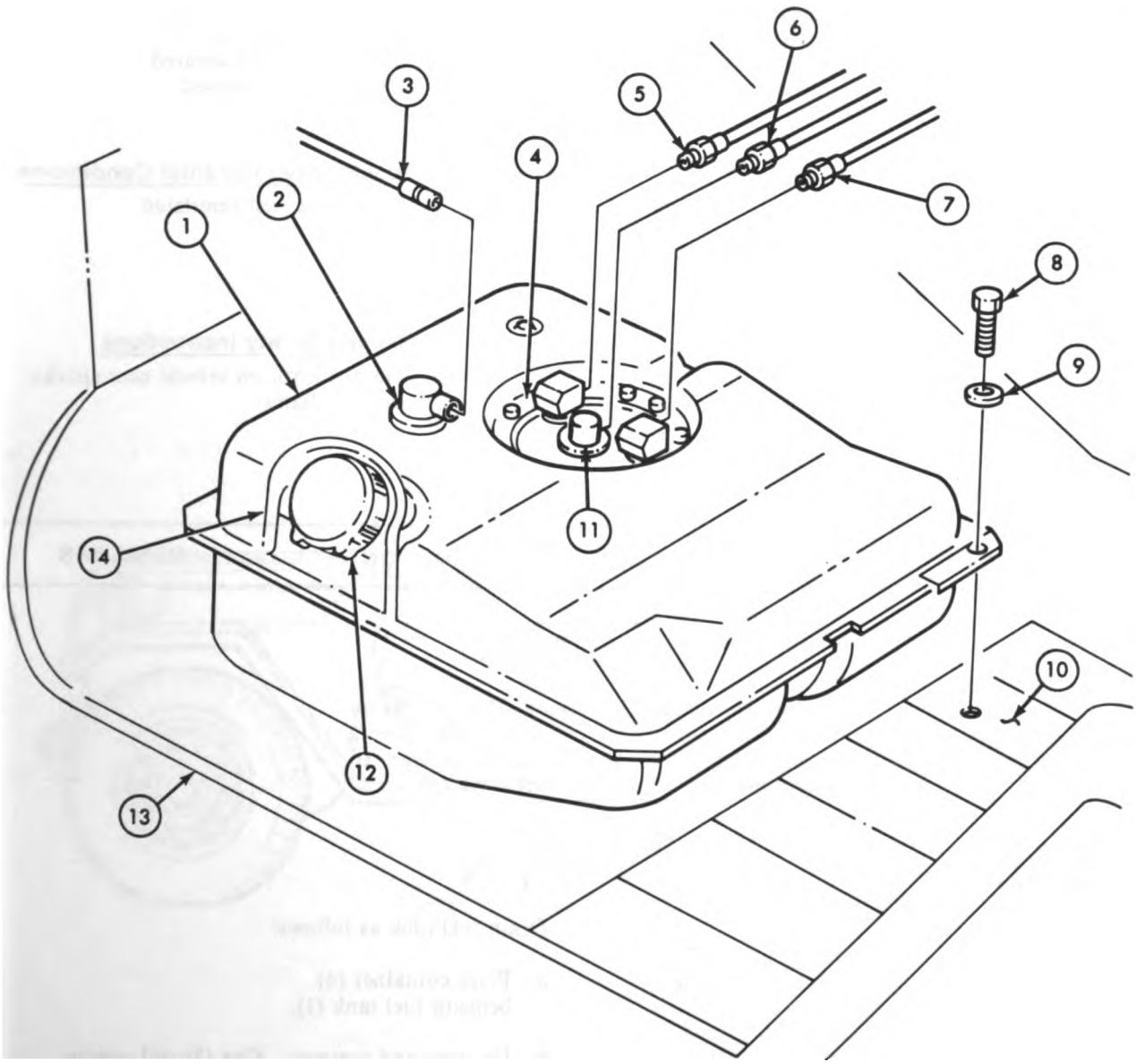
4-34. Fuel Tank (without vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
2.	Fuel tank cover (4)	Fuel inlet line (7) and fuel return line (5)	Disconnect.	Note locations for installation.
3.	Fuel tank cover vent (11)	Fuel tank ventilation line (6)	Disconnect.	
4.	Fuel level sending unit (2)	Circuit 28 electrical connector (3)	Disconnect.	
5.	Fuel tank (1) to vehicle body floor (10)	Four bolts (8) and lockwashers (9)	Remove.	
6.		Fuel tank (1)	Carefully lift out of vehicle.	
	c. INSPECTION			
7.		Fuel tank (1)	Inspect for leaks and dirt inside tank.	Replace or clean fuel tank (1) if leaking or dirty.
	d. INSTALLATION			
		NOTE Make sure splash guard (14) is above and forward of body side panel (13).		
8.		Fuel tank (1)	Secure to body floor (10) with four lockwashers (9) and bolts (8).	Make sure filler neck (12) faces outward.
9.		Fuel tank ventilation line (6)	Secure to fuel tank cover vent (11).	
10.		Fuel inlet line (7) and fuel return line (5)	Secure to fuel tank cover (4) at marked locations.	
11.		Circuit 28 electrical connector (3)	Connect to fuel level sending unit (2).	

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4-34. Fuel Tank (without vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Install driver's seat (para 10-10).

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4-35. Fuel Tank (with vapor canister) Maintenance

This task covers:

a. Draining
b. Removal
c. Inspection
d. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
20-gallon container

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 10-10	Driver's seat removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
Do not work on vehicle near sparks or open flame.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Fuel is extremely flammable. Do not work on vehicle near sparks or open flame. Severe injury to personnel and/or damage to equipment will result if fuel is ignited.

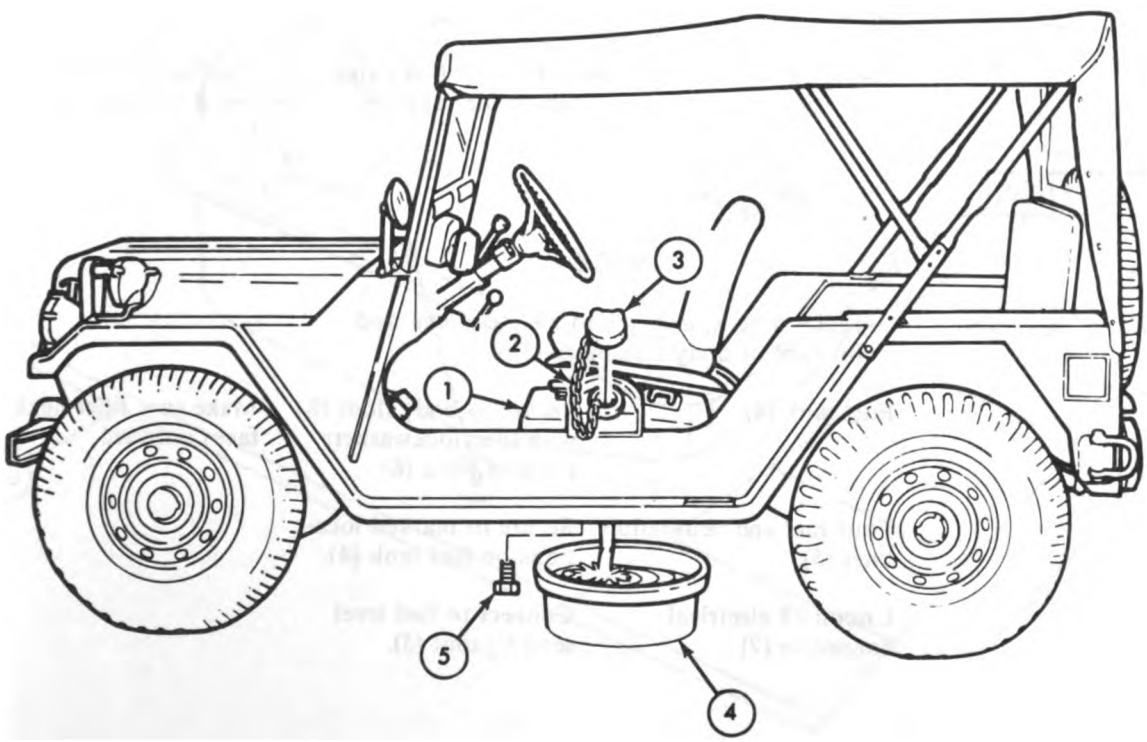
a. DRAINING

1.			Drain fuel tank as follows:	
			a. Place container (4) beneath fuel tank (1).	
			b. Unscrew and remove fuel tank filler cap (3).	Cap (3) will remain attached to fuel tank (1) by chain (2).

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4-35. Fuel Tank (with vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			c. Remove fuel tank drain plug (5) and allow fuel to drain.	
			d. Reinstall drain plug (5) and fuel tank filler cap (3) after draining is completed.	



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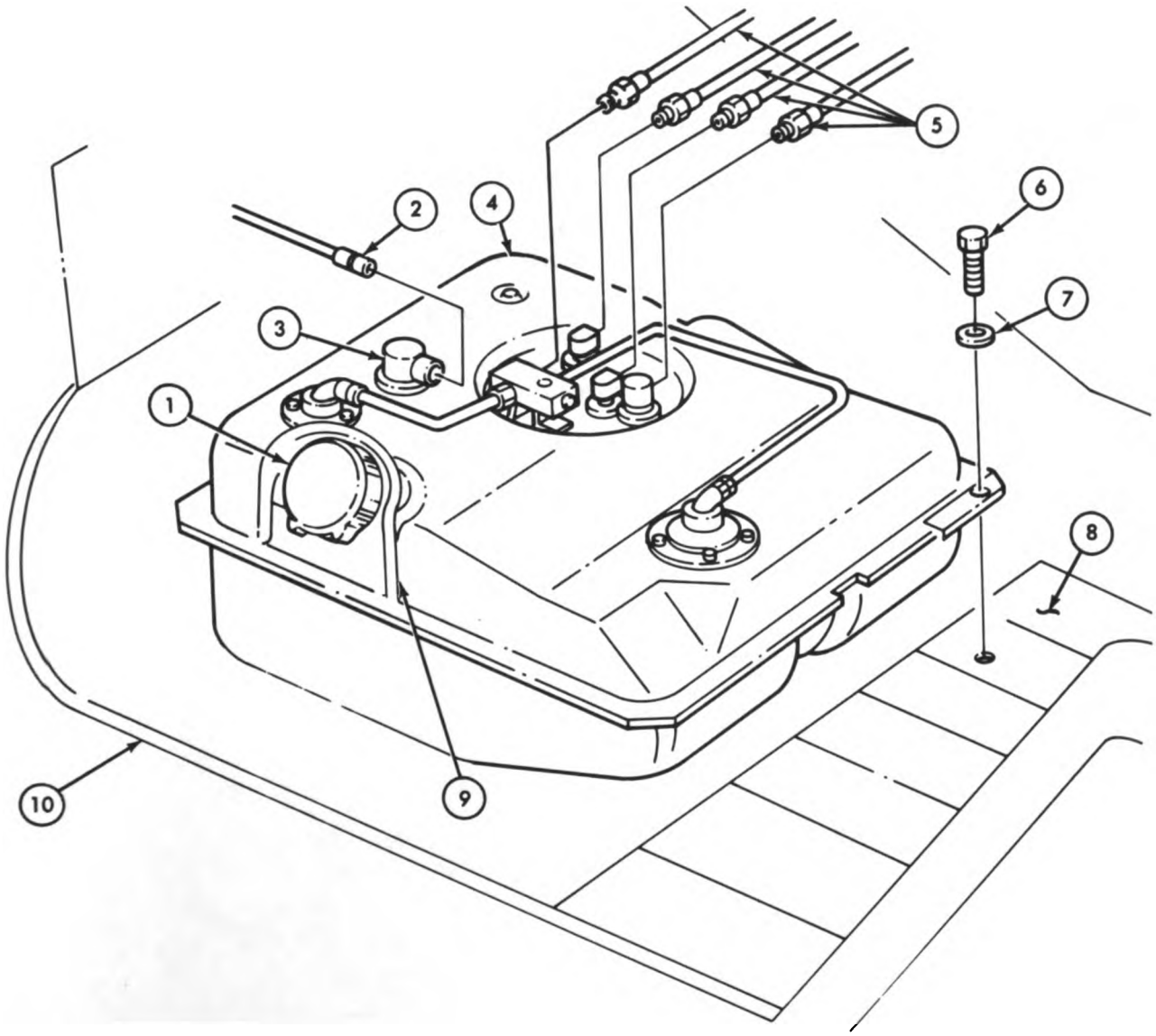
4-35. Fuel Tank (with vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
2.	Fuel level sending unit (3)	Electrical connector (2)	Disconnect.	
3.	Top of fuel tank (4)	Four fuel and ventilation lines (5)	Disconnect.	Note location of four lines (5) for installation.
4.	Fuel tank (4) to vehicle body floor (8)	Four bolts (6), and lockwashers (7)	Remove.	
5.		Fuel tank (4)	Carefully lift out of vehicle.	
	c. INSPECTION			
6.		Fuel tank (4)	Inspect for leaks and dirt inside tank.	Replace or clean fuel tank (4) if leaking or dirty.
	d. INSTALLATION			
		NOTE Make sure splash guard (9) is above and forward of body side panel (10).		
7.		Fuel tank (4)	Secure to body floor (8) with four lockwashers (7), and bolts (6).	Make sure filler neck (1) faces outward.
8.		Four fuel and ventilation lines (5)	Secure to marked locations on fuel tank (4).	
9.		Circuit 28 electrical connector (2)	Connect to fuel level sending unit (3).	

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4-35. Fuel Tank (with vapor canister) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Install driver's seat (para 10-10).

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4-36. Fuel Level Sending Unit Maintenance

Procedures for the removal and installation of the fuel level sending unit can be found in paragraph 5-63.

4-37. Fuel Gage Maintenance

Procedures for removal and installation of the fuel gage can be found in paragraph 5-59.

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Section V. ACCELERATOR SYSTEM MAINTENANCE

4-38. General

This section provides maintenance procedures assigned to the organizational level for the accelerator system. To find a specific procedure, see the maintenance task summary below:

4-39. Accelerator System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-40.	Accelerator Pedal and Linkage a. Adjustment b. Removal c. Installation	4-126
4-41.	Choke Control Cable a. Adjustment b. Removal c. Installation	4-132
4-42.	Throttle Control Cable a. Adjustment b. Removal c. Installation	4-136

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4-40. Accelerator Pedal and Linkage Maintenance

This task covers:

a. Adjustment
b. Removal
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 4-27	Parking brake set. Air intake hose removed (task *a* only).

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

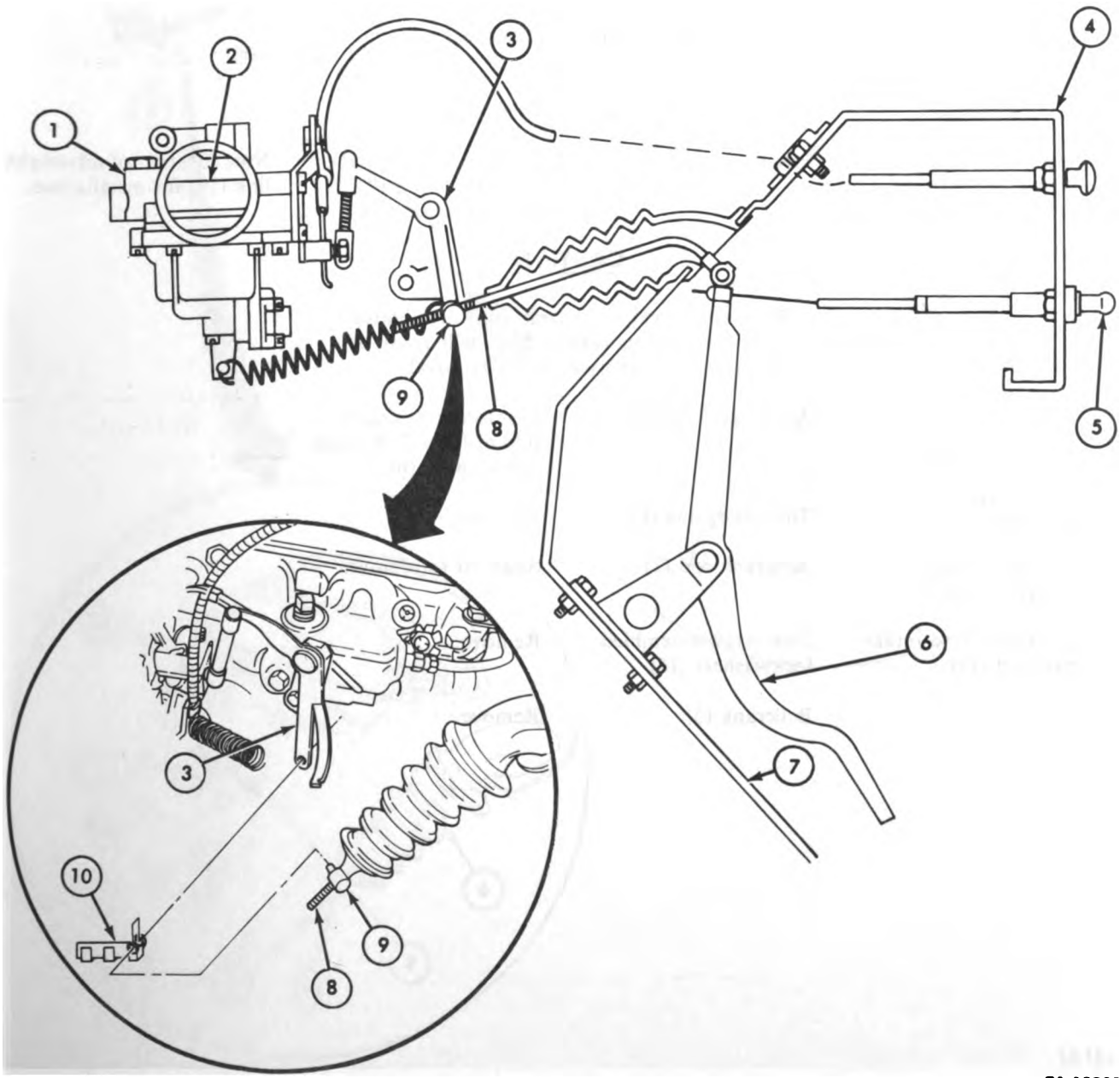
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. ADJUSTMENT		
1.	Accelerator rod (8) to throttle bellcrank (3)	Trunnion clip (10)	Remove and separate accelerator rod (8) from bellcrank (3).	
2.	Instrument panel (4)	Hand throttle control (5)	Pull out until accelerator pedal (6) rests on floorboard (7).	
3.	Carburetor (1)	Throttle bellcrank (3)	Push down to fully open throttle plate (2).	

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4-40. Accelerator Pedal and Linkage Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Accelerator rod (8)	Adjustable link (9)	*a.* Adjust to slip fit in bellcrank (3) and turn one additional turn clockwise. *b.* Secure to bellcrank (3) with trunnion clip (10).	



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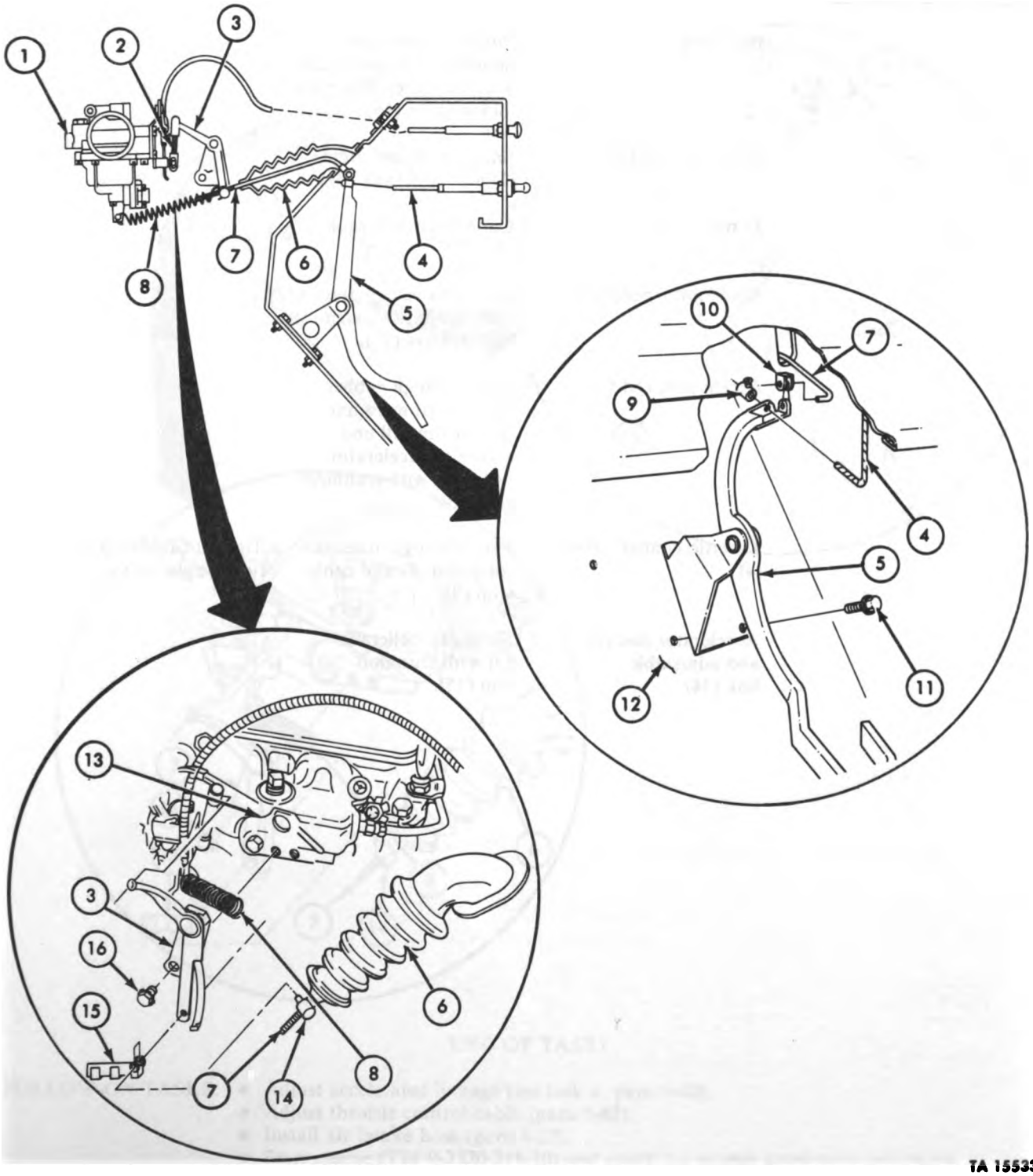
4-40. Accelerator Pedal and Linkage Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
5.	Accelerator rod (7) to accelerator pedal (5)	Trunnion clip (10)	Remove and separate rod (7) from pedal (5).	Retain trunnion clip (10) for re-use.
6.	Throttle control cable (4) to accelerator pedal (5)	Cable stop (9)	Loosen and slide throttle control cable (4) from stop (9) and pedal (5).	Retain cable stop (9) for re-use.
7.	Accelerator pedal (5) to vehicle floor (12)	Two screw-assembled lockwashers (11)	Remove.	
8.		Accelerator pedal (5)	Remove.	
9.	Accelerator rod (7) to throttle bellcrank (3)	Trunnion clip (15)	Remove and separate accelerator rod (7) from bellcrank (3).	Note location of adjustable link (14) for installation.
		CAUTION		
		Use extreme care when removing accelerator rod. Damage to rubber boot will result if excessive force is used during removal.		
10.		Accelerator rod (7)	Remove from engine side of firewall through rubber boot (6).	
11.	Bellcrank (3)	Throttle spring (8)	Remove.	
12.	Bellcrank (3) to carburetor (1)	Bellcrank rod (2)	Snap off to remove.	
13.	Bellcrank (3) to intake manifold (13)	Two screw-assembled lockwashers (16)	Remove.	
14.		Bellcrank (3)	Remove.	

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4-40. Accelerator Pedal and Linkage Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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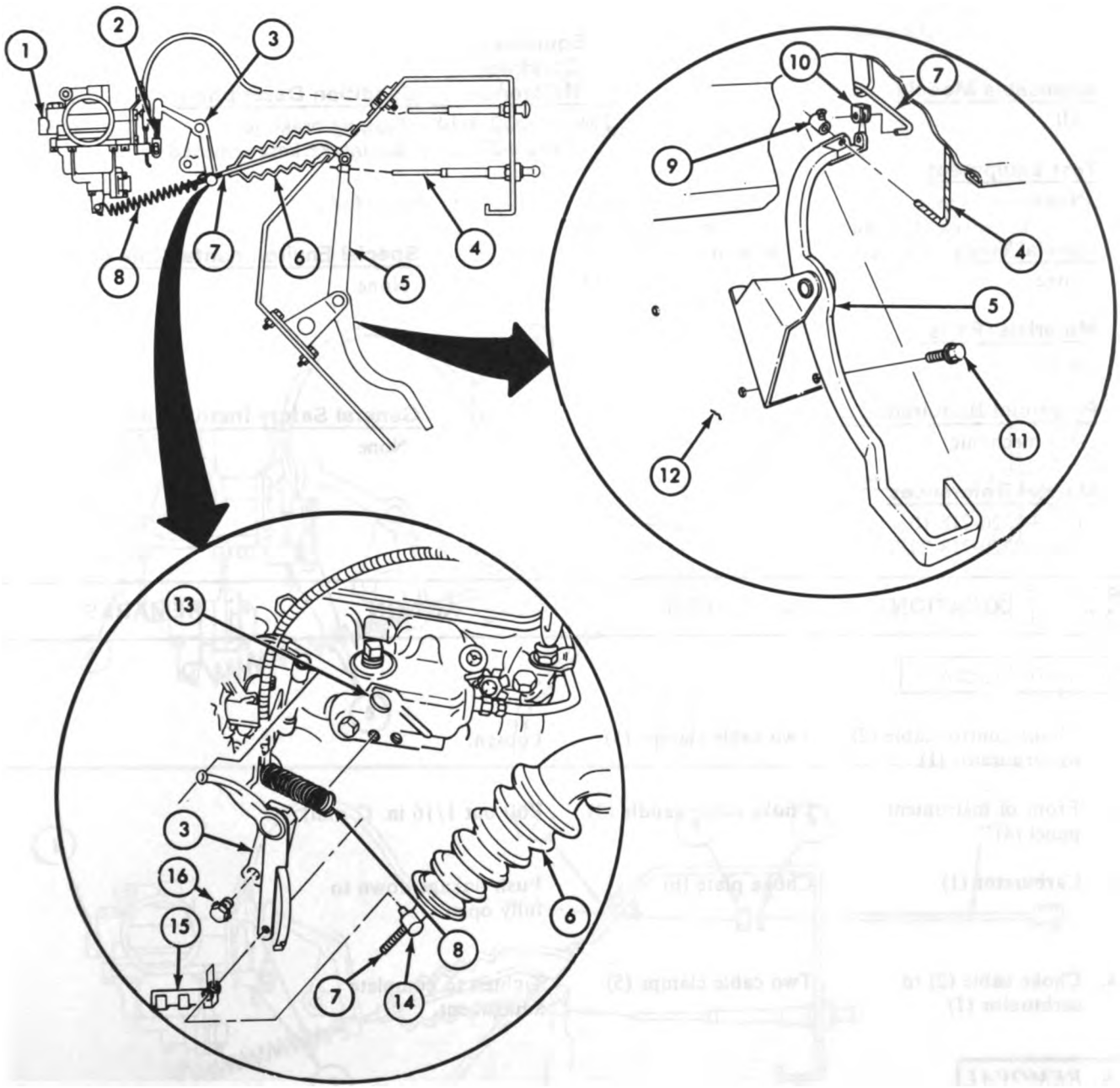
4-40. Accelerator Pedal and Linkage Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	c. INSTALLATION			
15.		Bellcrank (3)	Position on intake manifold (13) and secure with two screw-assembled lockwashers (16)	
16.		Bellcrank rod (2)	Snap on to carburetor (1) and bellcrank (3).	
17.		Throttle spring (8)	Connect to bellcrank (3).	
18.		Accelerator pedal (5)	Secure to vehicle floor (12) with two screw-assembled lockwashers (11).	
19.		Accelerator rod (7)	Feed through rubber boot (6) from engine side of firewall and secure to accelerator pedal (5) with trunnion clip (10).	
20.		Throttle control cable (4)	Feed through accelerator pedal (5) and cable stop (9).	Tighten cable stop (9) finger tight only.
21.		Accelerator rod (7) and adjustable link (14)	Secure to bellcrank (3) with trunnion clip (15).	

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4-40. Accelerator Pedal and Linkage Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Adjust accelerator linkage (see task *a*, para 4-40).
- Adjust throttle control cable (para 4-42).
- Install air intake hose (para 4-27).
- Start engine (TM 9-2320-218-10) and check for proper accelerator operation.

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4-41. Choke Control Cable Maintenance

This task covers:

a. Adjustment
b. Removal
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 4-27	Parking brake set. Air intake hose removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

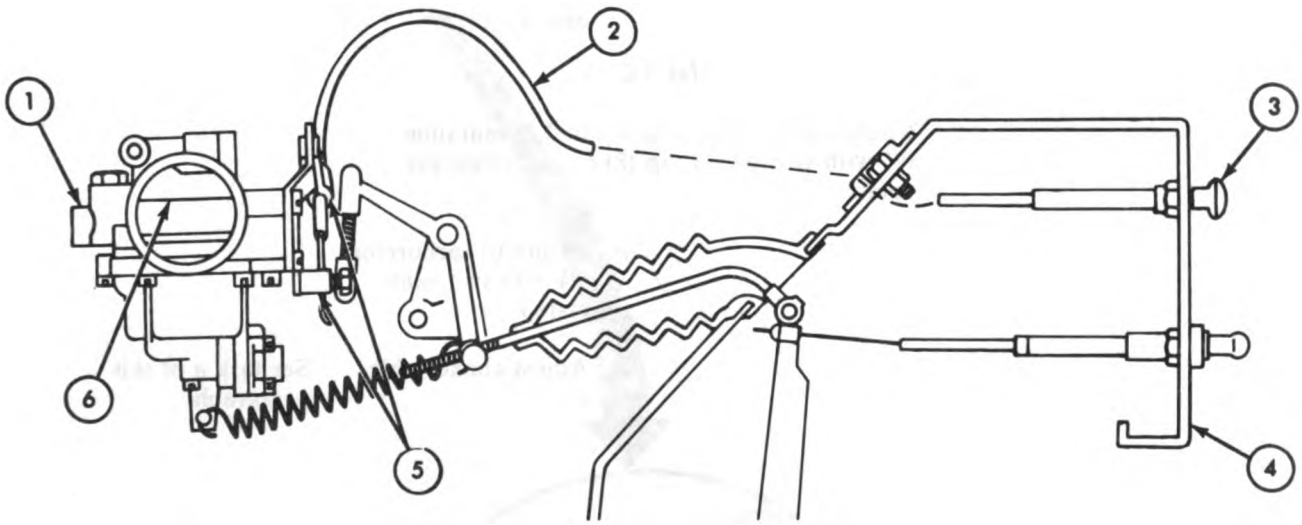
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

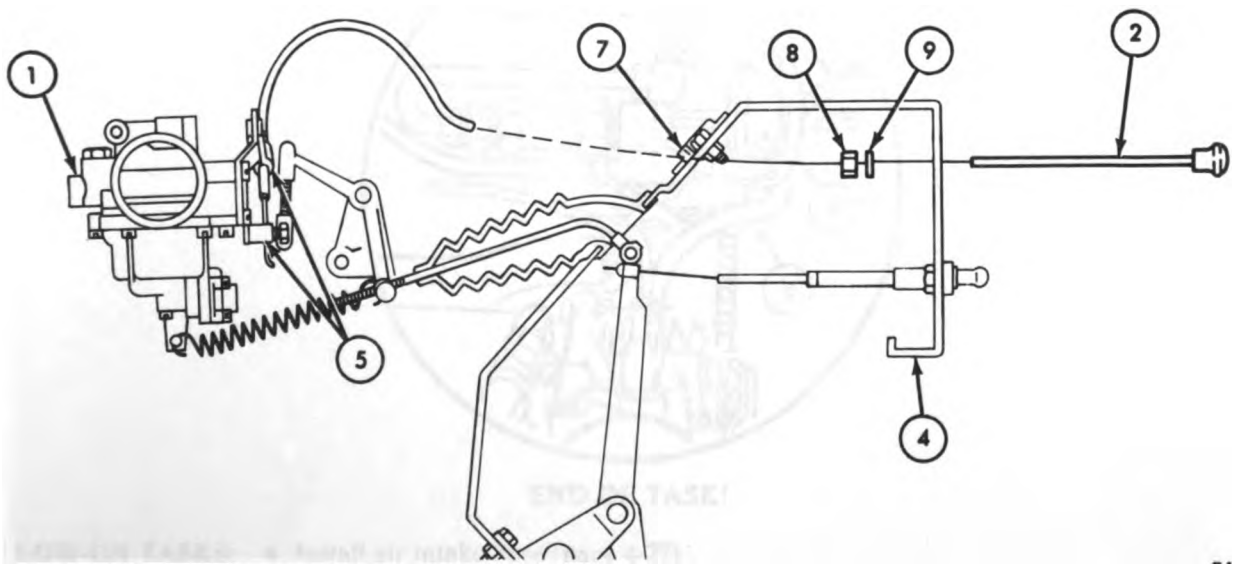
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. ADJUSTMENT			
1.	Choke control cable (2) to carburetor (1)	Two cable clamps (5)	Loosen.	
2.	Front of instrument panel (4)	Choke cable handle (3)	Pull out 1/16 in. (2 mm).	
3.	Carburetor (1)	Choke plate (6)	Push linkage down to fully open.	
4.	Choke cable (2) to carburetor (1)	Two cable clamps (5)	Tighten to complete adjustment.	
	b. REMOVAL			
5.	Choke cable (2) to carburetor (1)	Two cable clamps (5)	Loosen and slide choke cable (2) through clamps (5).	

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4-41. Choke Control Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
6.	Choke cable (2) to rear of instrument panel (4)	Nut (8) and lockwasher (9)	Remove.	Nut (8) and lockwasher (9) will remain around cable (2).
		NOTE Step 7 will be performed in driver's compartment.		
7.		Choke cable (2)	Slide out through firewall grommet (7) and instrument panel (4).	Make sure to catch nut (8) and lockwasher (9) when removing cable (2).





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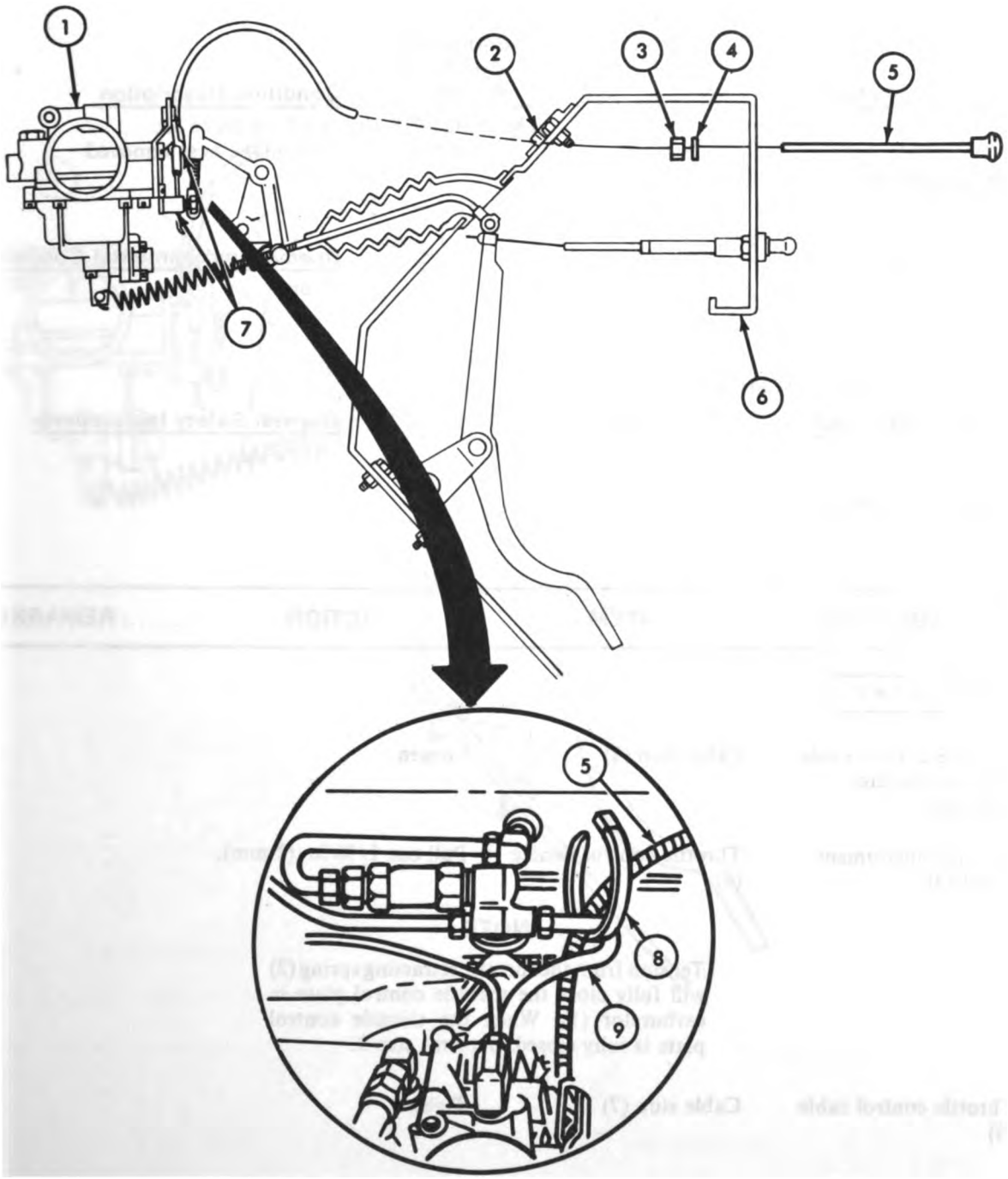
4-41. Choke Control Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
c. INSTALLATION				
8.		Choke cable (5)	Slide through front of instrument panel (6).	
9.		Lockwasher (4) and nut (3)	Slide over choke cable (5), and thread remainder of cable (5) through firewall grommet (2).	
10.		Choke cable (5)	*a.* Secure to instrument panel (6) with lockwasher (4) and nut (3).	
			NOTE Choke cable (5) must be secured to vent tube (9) with tie-down strap (8) to ensure proper routing.	
			b. Secure to carburetor (1) with two cable clamps (7).	
			c. Adjust choke cable (5).	See task *a* of this paragraph.

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4-41. Choke Control Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Install air intake hose (para 4-27).
- Start engine (TM 9-2320-218-10) and check for proper choke operation and fast idle.

TA 155338

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4-42. Throttle Control Cable Maintenance

This task covers:

a. Adjustment
b. Removal
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
GAA grease
Throttle control cable (8754130)

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 4-27	Parking brake set. Air intake hose removed.

Special Environmental Conditions
None

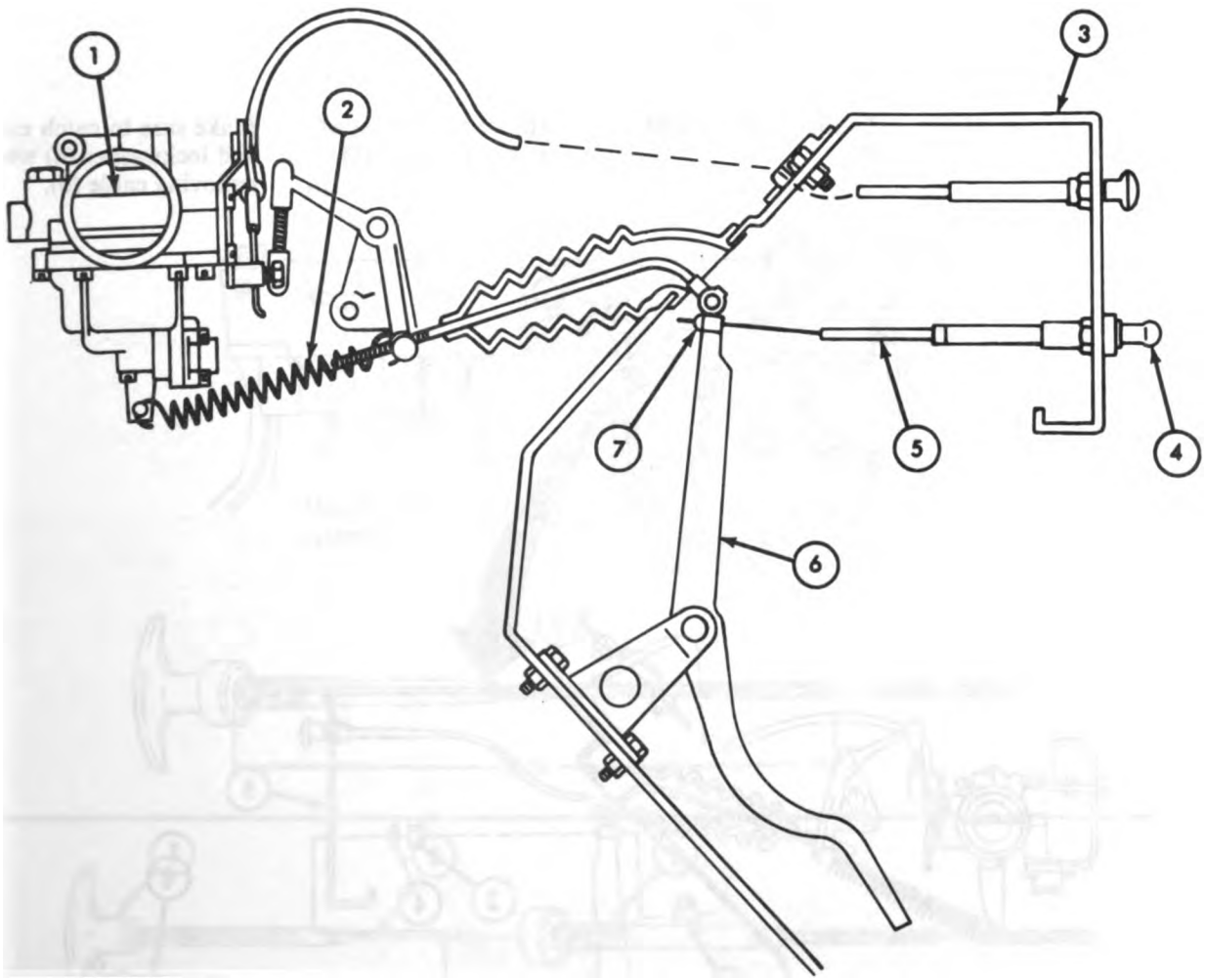
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. ADJUSTMENT		
1.	Throttle control cable (5) to accelerator pedal (6)	Cable stop (7)	Loosen.	
2.	Front of instrument panel (3)	Throttle control handle (4)	Pull out 1/16 in. (2 mm).	
		NOTE Tension from the throttle retracting spring (2) will fully close the throttle control plate in carburetor (1). When the throttle control plate is fully closed, perform step 3.		
3.	Throttle control cable (5)	Cable stop (7)	Tighten.	

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4-42. Throttle Control Cable Maintanance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

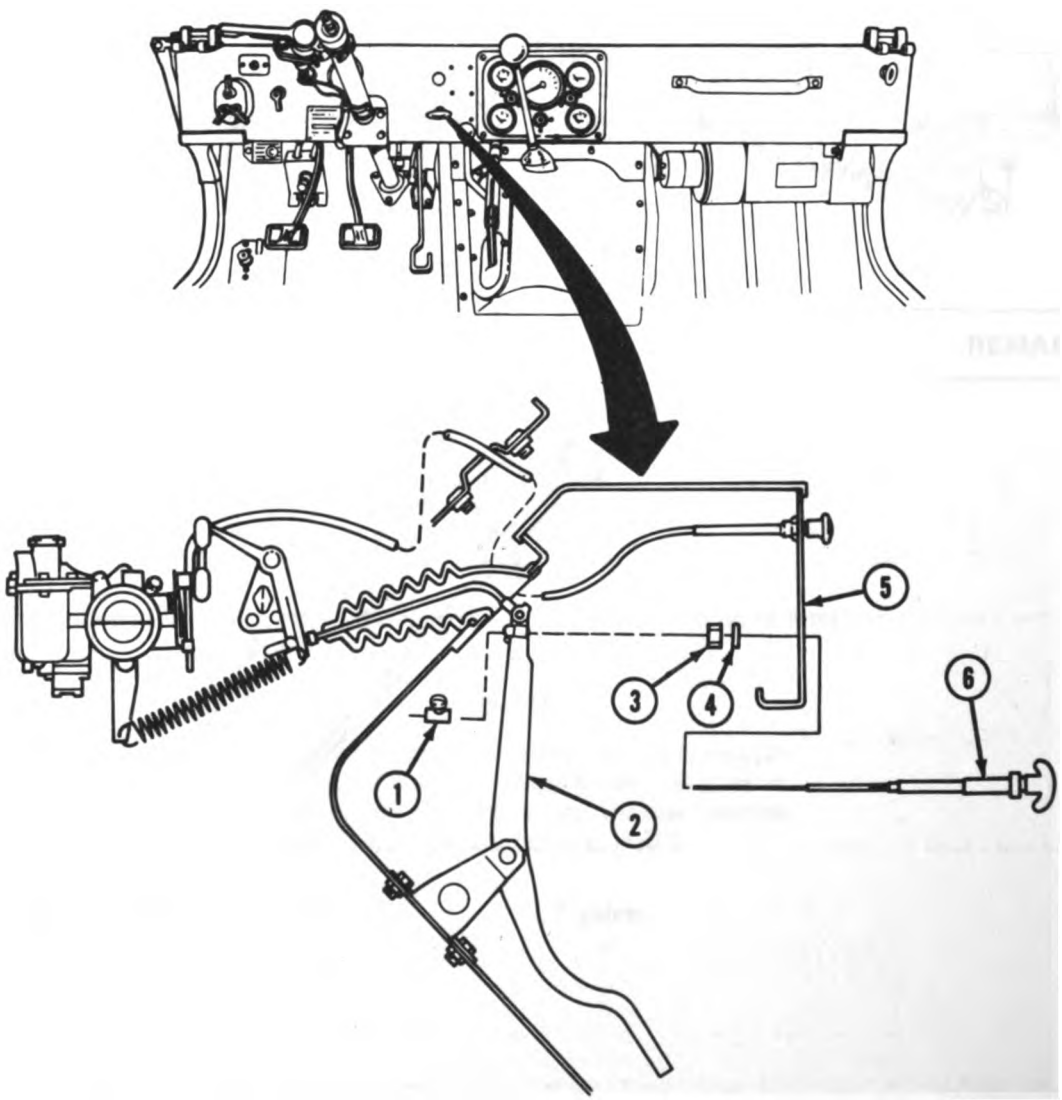


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4-42. Throttle Control Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
4.	Throttle control cable (6) to accelerator pedal (2)	Cable stop (1)	Loosen and slide cable (6) out of cable stop (1) and through accelerator pedal (2).	
5.	Throttle control cable (6) to rear of instrument panel (5)	Nut (3) and lockwasher (4)	Remove.	
6.		Throttle control cable (6)	Remove from front of instrument panel (5).	Make sure to catch nut (3) and lockwasher (4) when removing cable (6).



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4-42. Throttle Control Cable Maintanance (Cont'd)

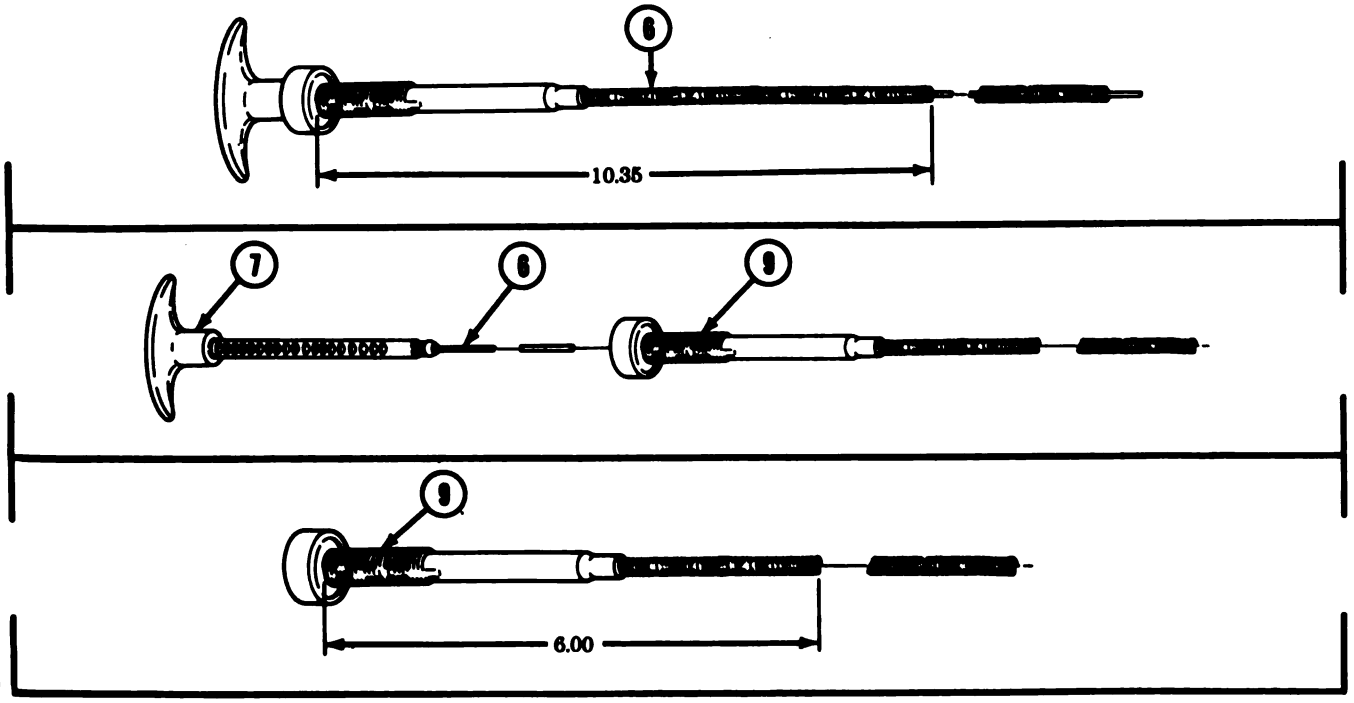
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

c. INSTALLATION

NOTE

If throttle control cable requires replacement, use cable 8754130 and preparation steps 6.1 through 6.5.

6.1.		Throttle control cable (6)	*a.* Measure 10.35 in. (265.9 mm). *b.* Cut.
6.2.		Handle (7) and core (8) assembly	Remove from conduit (9).
6.3.		Conduit (9)	*a.* Measure 6 in. (152.4 mm). *b.* Cut.
6.4.		Core (8) and conduit (9)	Remove sharp edges and burrs.
6.5.		Handle (7) and core (8) assembly	Lubricate core (8) with GAA grease and install in conduit (9).

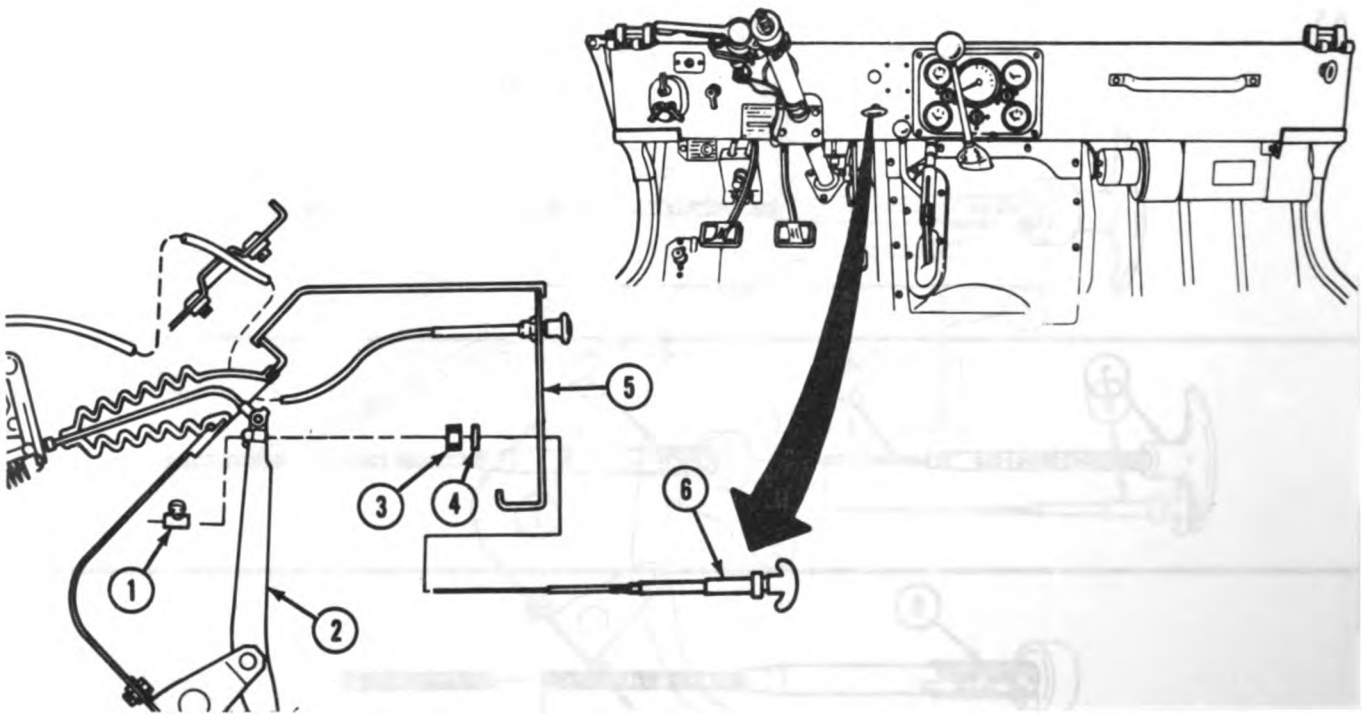


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4-42. Throttle Control Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
7.		Throttle control cable (6)	Slide through front of instrument panel (5).	
8.		Lockwasher (4) and nut (3)	Slide over throttle control cable (6) behind instrument panel (5).	
9.		Throttle control cable (6)	*a.* Feed through accelerator pedal (2) and install cable stop (1).	Install stop (1) finger tight only.
			b. Secure to rear of instrument panel (5) with lockwasher (4) and nut (3).	
			c. Adjust throttle cable (6).	See task *a* of this paragraph.



TA 484755

END OF TASK!

FOLLOW-ON TASKS:
- Install air intake hose (para 4-27).
- Start engine (TM 9-2320-218-10) and check for proper operation of throttle control cable.

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Section VI. EXHAUST SYSTEM MAINTENANCE

4-43. General

This section provides maintenance procedures assigned to the organizational level for the exhaust system. To find a specific procedure, see the maintenance task summary below:

4-44. Exhaust System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-45.	Muffler Inlet Pipe a. Removal b. Installation	4-142
4-46.	Muffler a. Removal b. Inspection c. Installation	4-146
4-47.	Front Outlet Pipe a. Removal b. Installation	4-151
4-48.	Rear Outlet Pipe a. Removal b. Installation	4-156
4-49.	Tailpipe Extension a. Removal b. Installation	4-162
4-50.	Rear Outlet Pipe Hanger Modification and Installation a. Removal b. Hanger modification c. Installation	4-164

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4-45. Muffler Inlet Pipe Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.
Para 6-4	Front propeller shaft removed.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Special Environmental Conditions
Vehicle on level surface.

Materials/Parts
Two gaskets
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipes or muffler with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust pipes or muffler with bare hands. Severe injury will result.

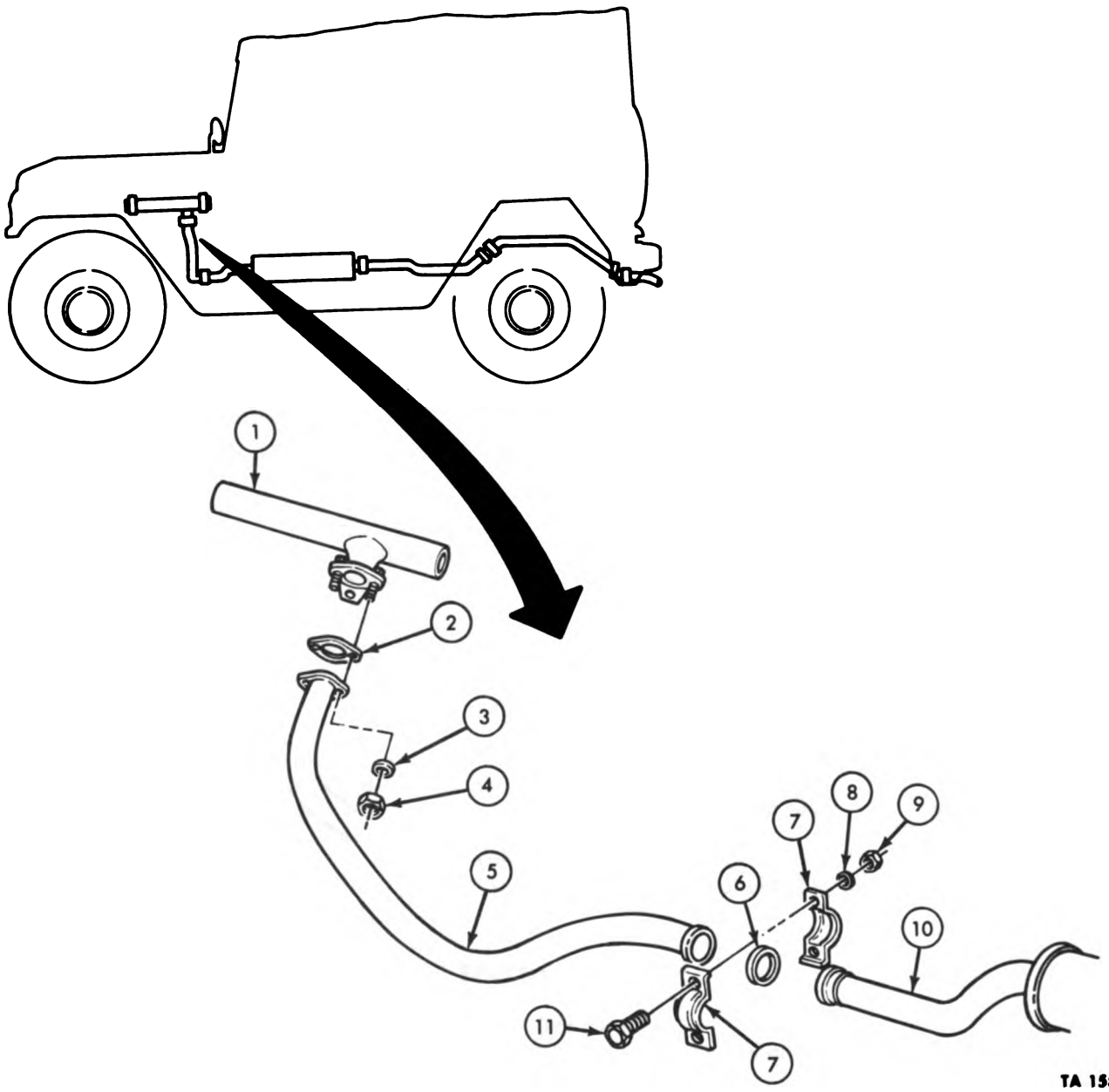
a. REMOVAL

1.	Muffler inlet pipe (5) to exhaust manifold (1)	Two nuts (4) and lockwashers (3)	Remove.	
2.		Muffler inlet pipe (5) and gasket (2)	Remove from exhaust manifold (1).	Discard gasket (2).
3.	Front muffler clamp halves (7)	Two locknuts (9), washers (8), and bolts (11)	Remove.	

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4-45. Muffler Inlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Muffler inlet pipe (5) to muffler inlet (10)	Muffler clamp halves (7)	Remove.	
5.		Muffler inlet pipe (5) and gasket (6)	Remove from muffler inlet (10).	Discard gasket (6).
6.		Muffler inlet pipe (5)	Remove from vehicle.	



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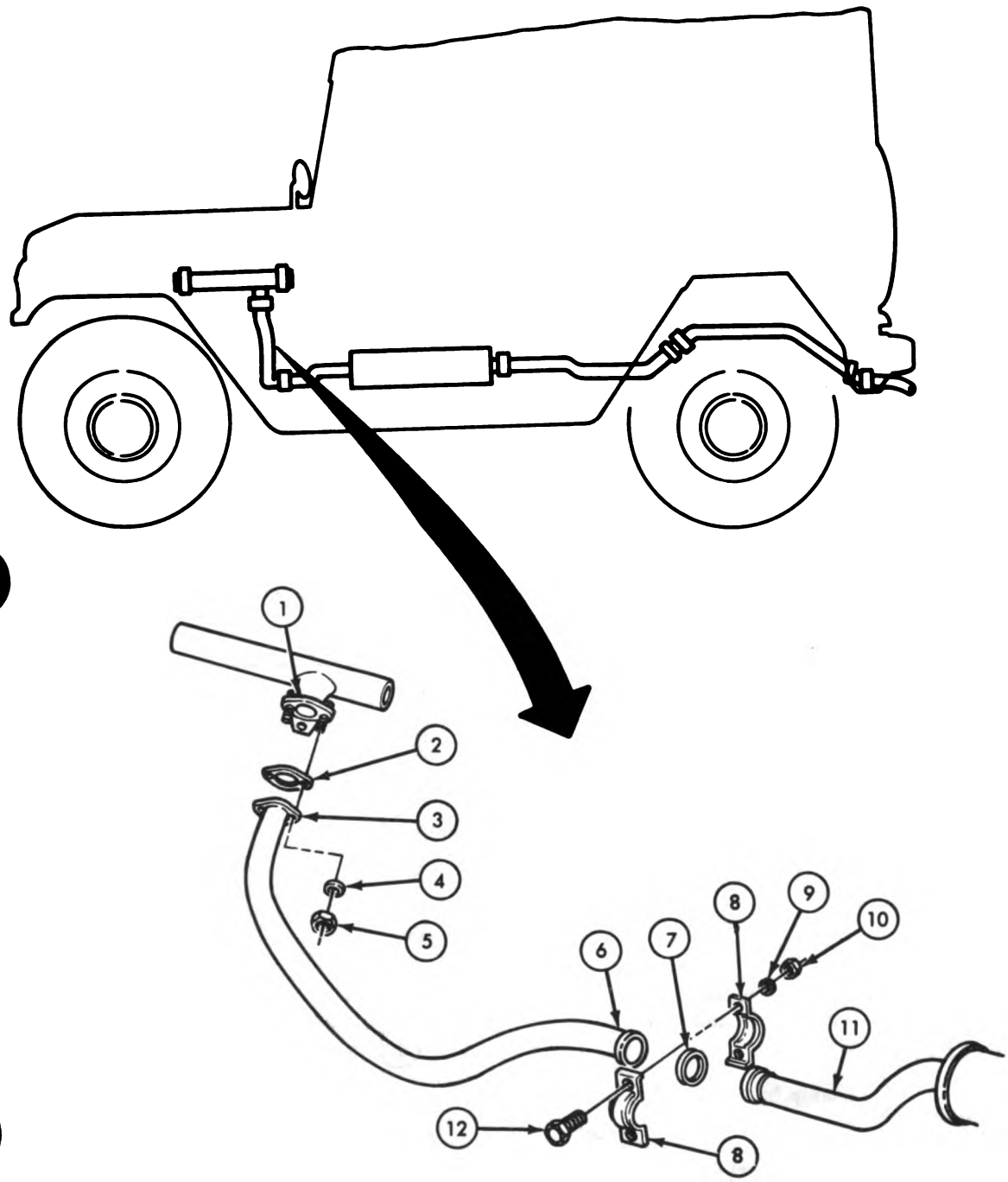
4-45. Muffler Inlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE Thoroughly clean connecting flange surfaces before installing new gaskets.	
	b. INSTALLATION			
7.		New exhaust manifold gasket (2)	Place on exhaust manifold mating flange (1).	Dab on small amount of GAA grease to hold gasket (2) in place.
8.		Muffler inlet pipe mating flange (3)	*a.* Position to exhaust manifold mating flange (1).	
			b. Secure with two lockwashers (4) and nuts (5).	Finger tighten only.
9.		New muffler inlet gasket (7)	Place on muffler inlet mating flange (11).	Dab on small amount of GAA grease to hold gasket in place.
10.		Muffler inlet pipe mating flange (6)	Position to muffler inlet mating flange (11).	
11.		Muffler clamp halves (8)	*a.* Place halves (8) over muffler inlet pipe mating flange (6) and muffler inlet mating flange (11).	Make sure clamp halves (8) are properly seated.
			b. Secure with two bolts (12), washers (9), and locknuts (10).	Finger tighten only.
12.		Two lockwashers (4) and nuts (5)	Tighten 15-20 lb-ft (24 N•m).	
13.		Two bolts (12), washers (9), and locknuts (10)	Tighten 8-12 lb-ft (10-16 N•m).	

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4-45. Muffler Inlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Install front propeller shaft (see para 6-4).
- Start engine (TM 9-2320-218-10) and check for exhaust leaks (table 3-3, malfunction 18).

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4-46. Muffler Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	Para 6-4	Rear propeller shaft removed.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Special Environmental Conditions
Vehicle on level surface.

Materials/Parts
Two gaskets
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipe or muffler with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust pipes or muffler with bare hands. Severe injury will result.

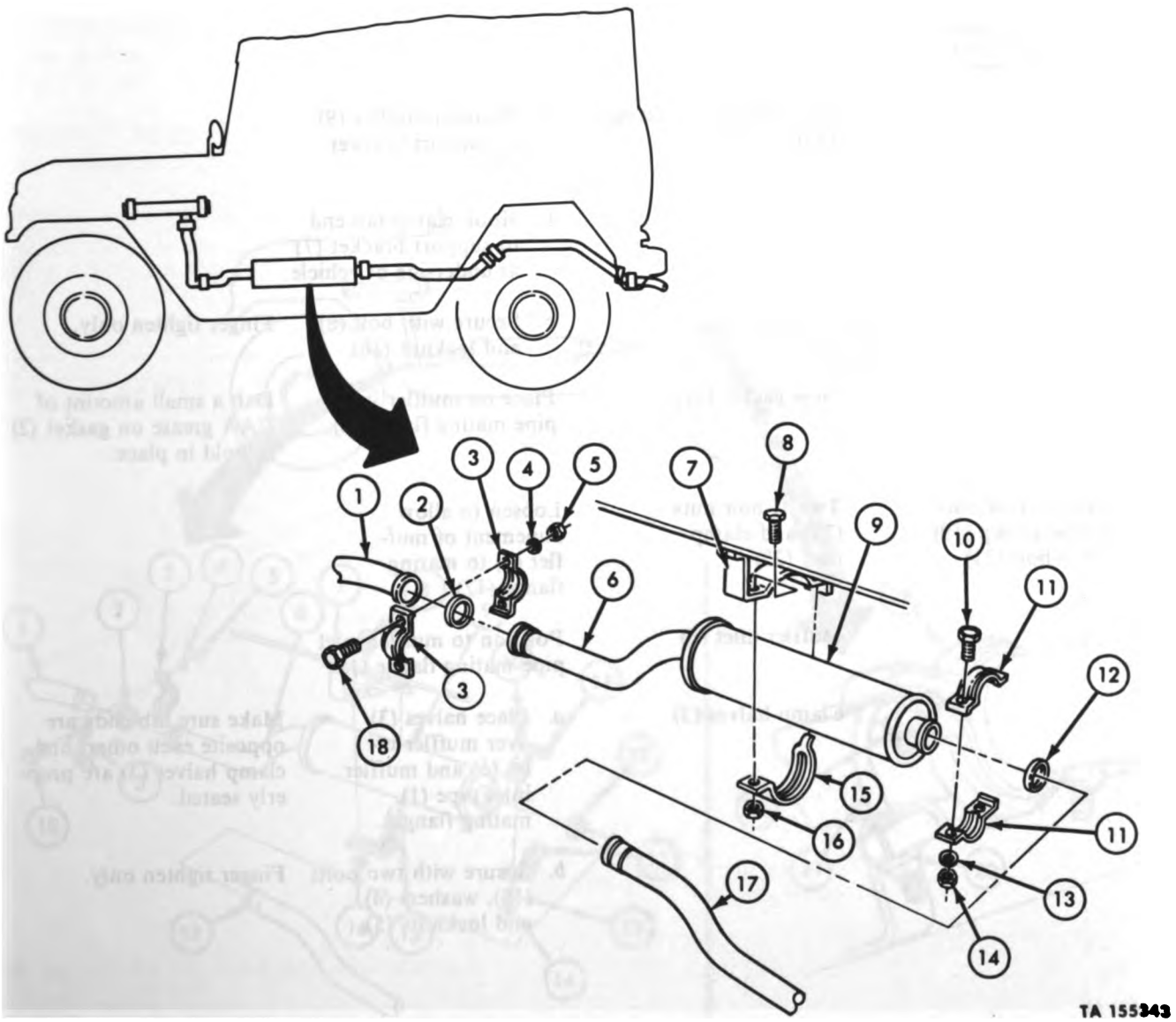
a. REMOVAL

1.	Front muffler clamp halves (3)	Two locknuts (5), washers (4), and bolts (18)	Remove.	
2.	Muffler inlet (6) to muffler inlet pipe (1)	Clamp halves (3)	Remove.	
3.		Muffler inlet (6) and gasket (2)	Remove from muffler inlet pipe (1).	Discard gasket (2).
4.	Rear muffler clamp halves (11)	Two locknuts (14), washers (13), and bolts (10)	Remove.	

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4-46. Muffler Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Muffler (9) to outlet pipe (17)	Clamp halves (11)	Remove.	
6.	Muffler retainer clamp (15) to support bracket (7)	Locknut (16) and bolt (8)	Remove.	
7.		Muffler retainer clamp (15)	Remove from support bracket (7).	
8.		Muffler (9) and gasket (12)	Remove from vehicle.	Discard gasket (12).



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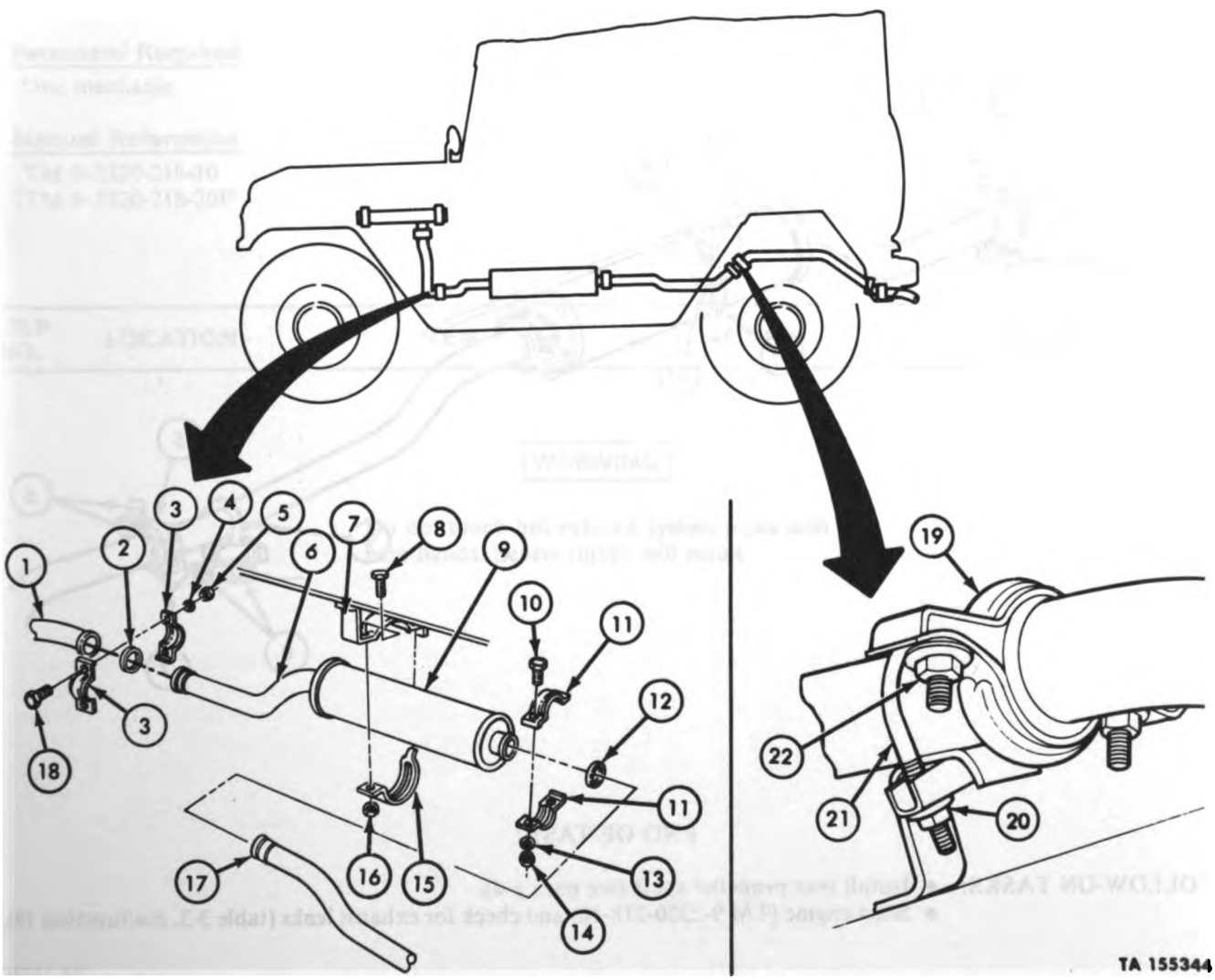
4-46. Muffler Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE Thoroughly clean connecting flange surfaces before installing new gaskets.	
	b. INSPECTION			
9.		Muffler (9)	Inspect for cracks, holes, metal fatigue, and corrosion.	Replace if cracked, evidence of holes, metal fatigue or corrosion.
	c. INSTALLATION			
10.		Muffler retainer clamp (15)	*a.* Position muffler (9) to support bracket (7).	
			b. Hook clamp tab end to support bracket (7) at underside of vehicle.	
			c. Secure with bolt (8) and locknut (16).	Finger tighten only.
11.		New gasket (2)	Place on muffler inlet pipe mating flange (6).	Dab a small amount of GAA grease on gasket (2) to hold in place.
12.	Forward rear outlet pipe clamp (19) and U-bolt (21)	Two U-bolt nuts (20) and clamp nuts (22)	Loosen to allow alinement of muffler (9) to mating flange (17).	
13.		Muffler inlet (6)	Position to muffler inlet pipe mating flange (1).	
14.		Clamp halves (3)	*a.* Place halves (3) over muffler inlet (6) and muffler inlet pipe (1) mating flanges.	Make sure tab ends are opposite each other, and clamp halves (3) are properly seated.
			b. Secure with two bolts (18), washers (4), and locknuts (5).	Finger tighten only.

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4-46. Muffler Maintenance (Cont'd)

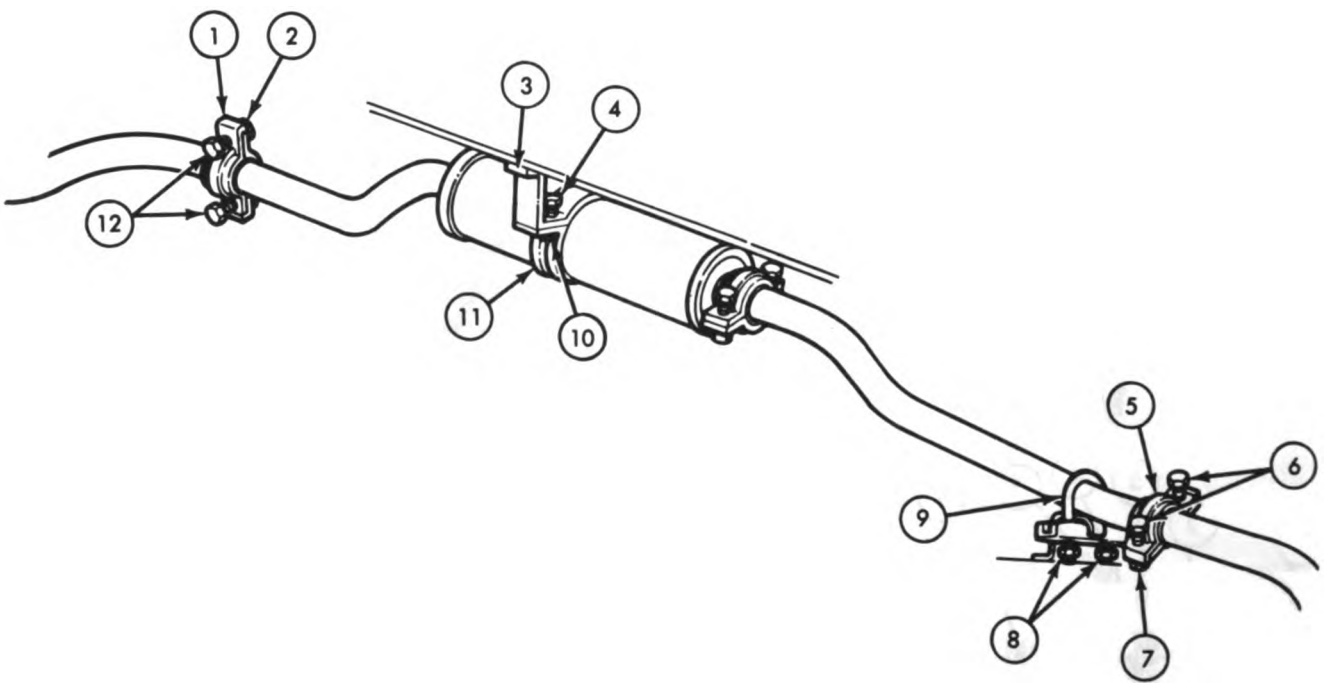
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
15.		New gasket (12)	Place on outlet pipe mating flange (17).	Dab a small amount of GAA grease on gasket (12) to hold in place.
16.		Muffler (9)	Position to front outlet pipe mating flange (17).	
17.		Clamp halves (11)	*a.* Place halves (11) over muffler (9) and front outlet pipe (17) mating flanges.	Make sure tab ends are opposite each other and clamp halves (11) are properly seated.
			b. Secure with two bolts (10), washers (13), and locknuts (14).	Finger tighten only.



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4-46. Muffler Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
18.	Forward rear outlet pipe clamp (5)	Two bolts (6) and nuts (7)	Tighten 8 to 12 lb-ft (10 to 16 N•m).	
19.	Front outlet pipe U-bolt (9)	Two nuts (8)	Tighten.	
20.	Muffler inlet clamp (1)	Two bolts (12), and locknuts (2)	Tighten.	Tighten 8 to 12 lb-ft (10 to 16 N•m).
21.	Muffler retainer clamp (11) to support bracket (3)	Bolt (4) and locknut (10)	Tighten securely.	



END OF TASK!

FOLLOW-ON TASKS:
- Install rear propeller shaft (see para 6-4).
- Start engine (TM 9-2320-218-10) and check for exhaust leaks (table 3-3, malfunction 18).

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4-47. Front Outlet Pipe Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
Para 3-24

Condition Description
Vehicle raised and supported.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Special Environmental Conditions
Vehicle on level surface.

Materials/Parts
Two gaskets
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipes or muffler with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust system pipes with bare hands. Severe injury will result.

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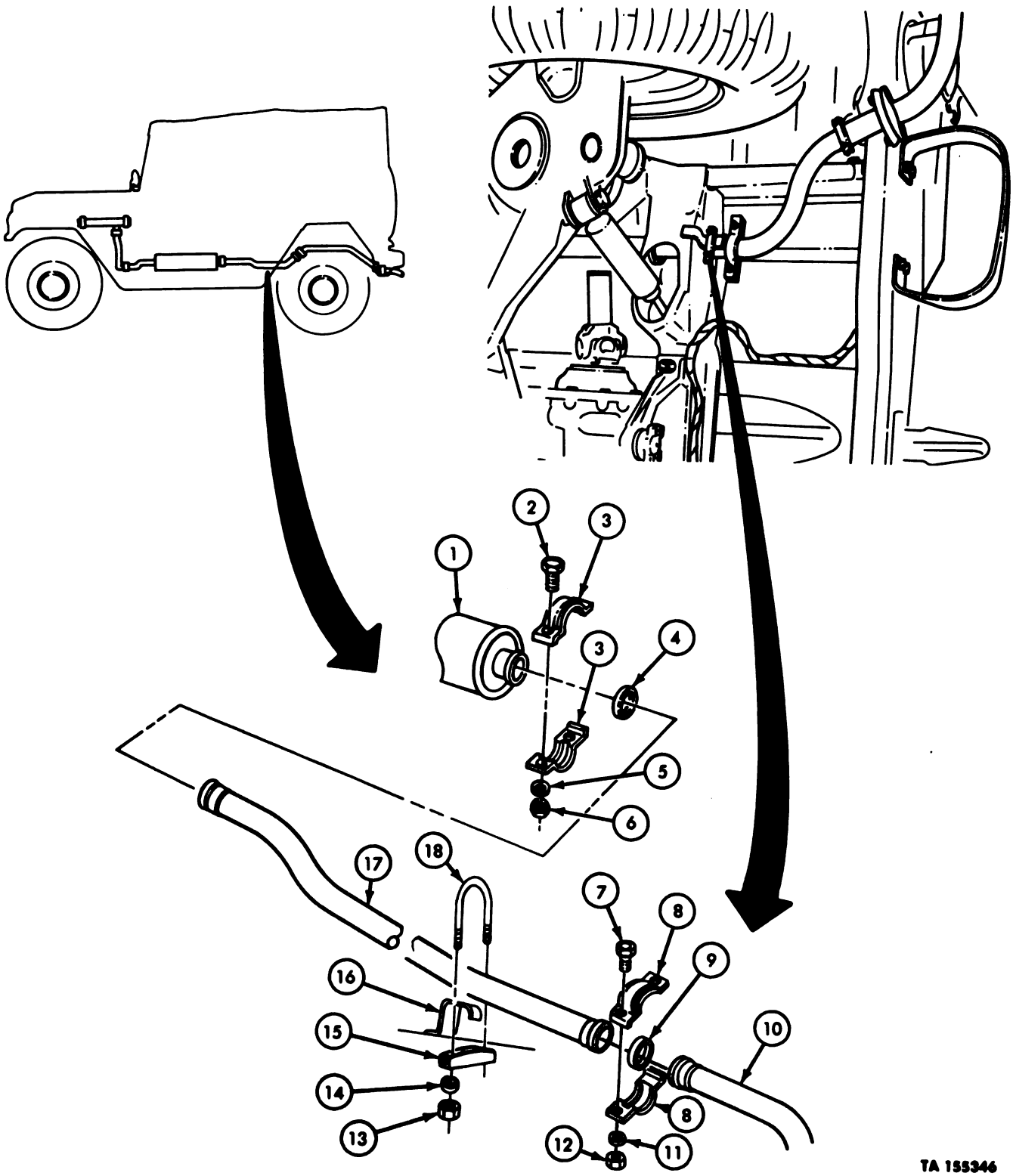
4-47. Front Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Rear muffler clamp halves (3)	Two locknuts (6), washers (5), and bolts (2)	Remove.	
2.	Muffler (1) to front outlet pipe (17)	Clamp halves (3)	Remove.	
3.	Forward rear outlet pipe clamp halves (8)	Two locknuts (12), washers (11), and bolts (7)	Remove.	
4.	Front outlet pipe (17) to rear outlet pipe (10)	Clamp halves (8)	Remove.	
5.	U-bolt (18) and clamp (15) to support bracket (16)	Two locknuts (13) and washers (14)	Remove.	
6.		U-bolt (18) and clamp (15)	Remove from support bracket (16).	
7.		Front outlet pipe (17) and gaskets (4) and (9)	Remove from vehicle.	Discard gaskets (4) and (9).

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4-47. Front Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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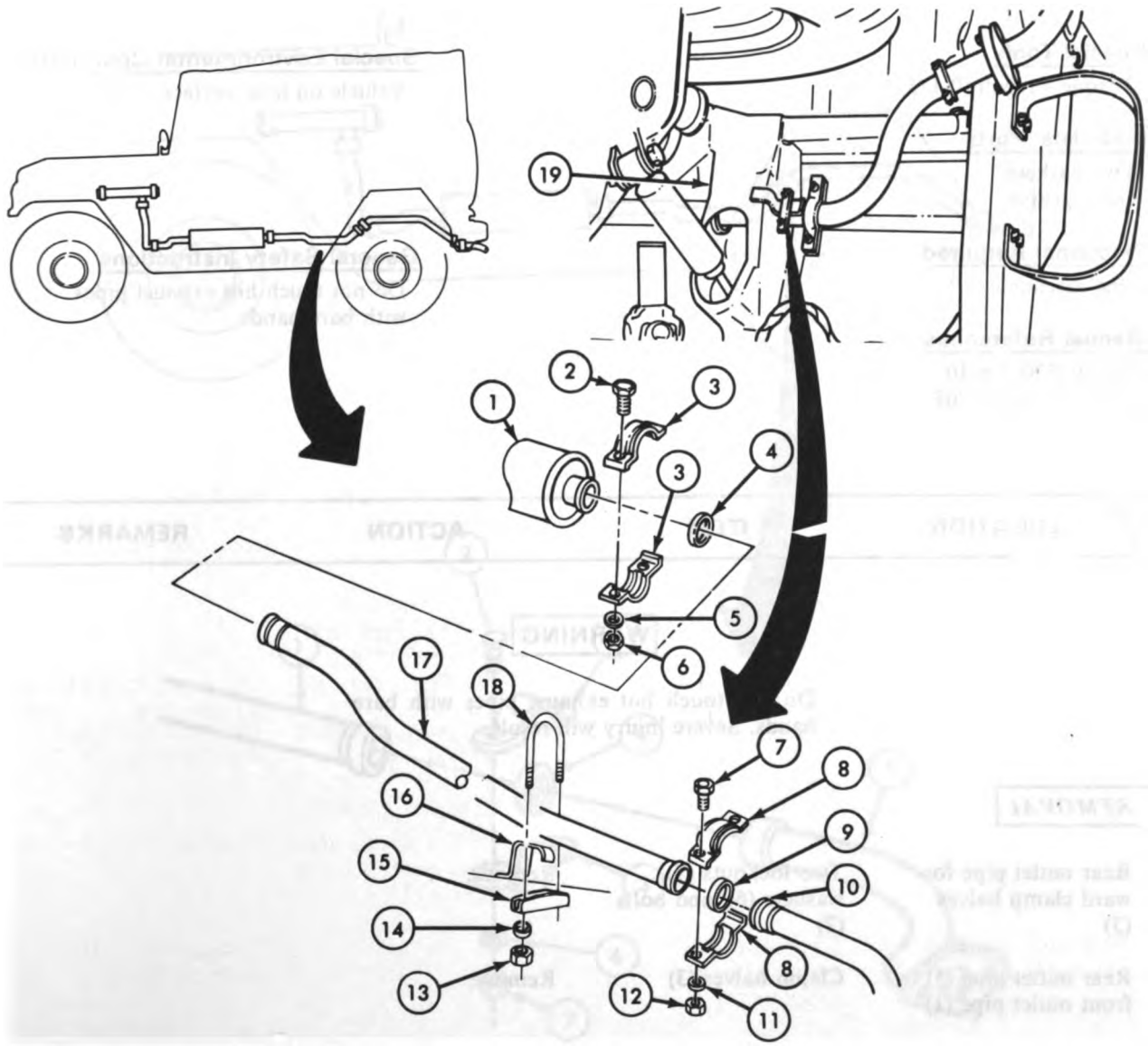
4-47. Front Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE		
		Thoroughly clean connecting flange surfaces before installing new gaskets.		
	b. INSTALLATION			
8.		New gasket (4)	Place on muffler mating flange (1).	Dab a small amount of GAA grease on gasket (4) to hold in place.
9.		Front outlet pipe (17)	*a.* Place through rear crossmember (19).	
			b. Position to muffler (1).	
10.		Clamp halves (3)	*a.* Place halves (3) over front outlet pipe (17) and muffler (1) mating flanges.	Make sure tab ends are opposite each other and clamp (3) is properly seated.
			b. Secure with two bolts (2), washers (5), and locknuts (6).	Finger tighten only.
11.		New gasket (9)	Place on rear outlet pipe mating flange (10).	Dab a small amount of GAA grease on gasket (9) to hold in place.
12.		Front outlet pipe (17)	Position to rear outlet pipe mating flange (10).	
13.		Clamp halves (8)	*a.* Place halves (8) over front outlet pipe (17) and rear outlet pipe (10) mating flanges.	Make sure clamp halves (8) are properly seated.
			b. Secure with two bolts (7), washers (11), and locknuts (12).	Finger tighten only.
14.	Rear muffler clamp halves (3)	Two bolts (2), washers (5), and locknuts (6)	Tighten.	Tighten 8 to 12 lb-ft (10 to 16 N•m).
15.	Rear outlet pipe forward clamp halves (8)	Two bolts (7), washers (11), and locknuts (12)	Tighten.	Tighten 8 to 12 lb-ft (10 to 16 N•m).

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4-47. Front Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
16.		U-bolt (18)	*a.* Place over front outlet pipe (17) and position clamp (15) under support bracket (16). *b.* Secure with two washers (14) and locknuts (13).	



END OF TASK!

FOLLOW-ON TASKS:
- Lower vehicle (para 3-24).
- Start engine (TM 9-2320-218-10) and check for exhaust leaks (table 3-3, malfunction 18).

TA 155347

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4-48. Rear Outlet Pipe Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	Para 3-24	Rear of vehicle raised and supported.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Special Environmentel Conditions
Vehicle on level surface.

Materials/Parts
Two gaskets
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipes with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust pipes with bare hands. Severe injury will result.

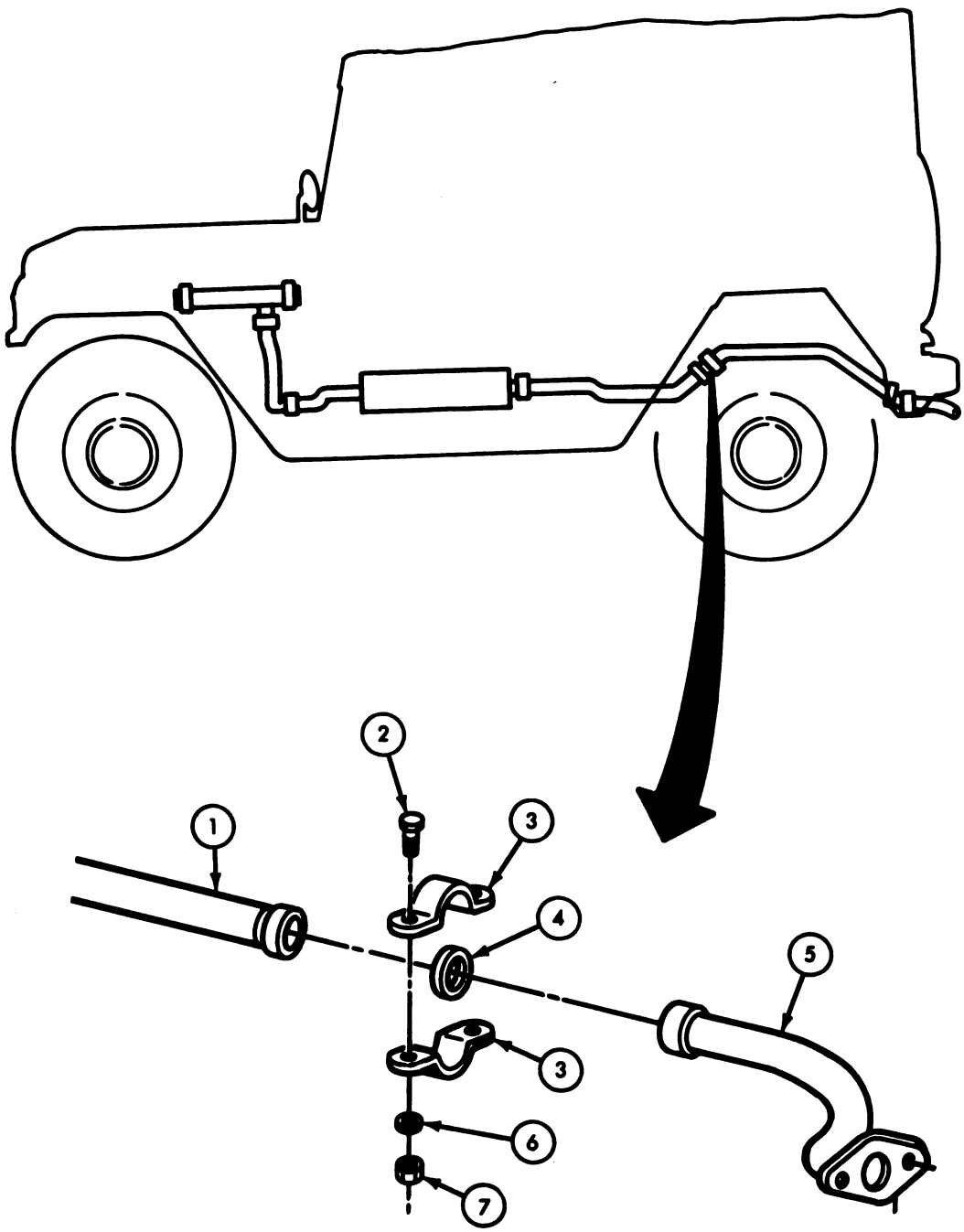
a. REMOVAL

1.	Rear outlet pipe forward clamp halves (3)	Two locknuts (7), washers (6), and bolts (2)	Remove.	
2.	Rear outlet pipe (5) to front outlet pipe (1)	Clamp halves (3)	Remove.	
3.		Rear outlet pipe (5) and gasket (4)	Remove from front outlet pipe (1).	Discard gasket (4) and clean gasket surface of front outlet pipe (1).

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4-48. Rear Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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4-48. Rear Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	U-bolt (3) and clamp (8) to rear hanger (2)	Two locknuts (10) and washers (9)	Remove.	Check rear hanger (2) for breaks. Replace if broken. (See para 4-50.)
5.		U-bolt (3) and clamp (8)	Remove from rear hanger (2) and rear outlet pipe (1).	
6.		Rear outlet pipe (1) and tailpipe extension (5)	Remove from vehicle.	
7.	Rear outlet pipe (1) to tailpipe extension (5)	Two locknuts (7) and bolts (6)	Remove.	
8.		Rear outlet pipe (1) and gasket (4)	Remove from tailpipe extension (5).	Discard gasket (4).

NOTE

Thoroughly clean connecting flange surfaces before installing new gaskets.

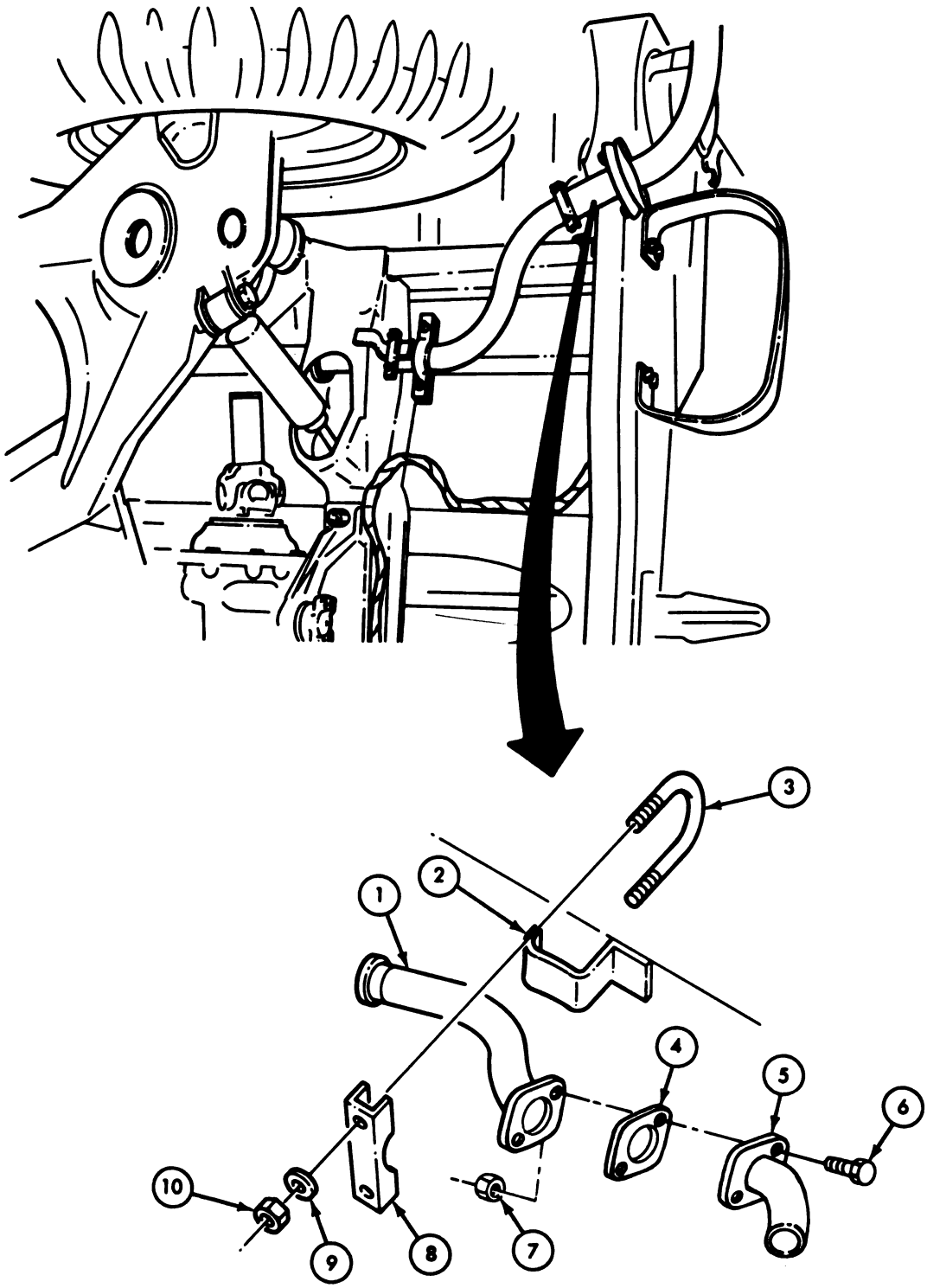
b. INSTALLATION

9.	New rear outlet pipe rear gasket (4)	Place on tailpipe extension mating flange (5).	Dab a small amount of GAA grease on gasket (4) to hold in place.
10.	Rear outlet pipe (1)	*a.* Position to tailpipe extension mating flange (5).	
		b. Secure with two bolts (6) and locknuts (7).	Tighten 12 to 15 lb-ft (16 to 20 N•m).
11.	Rear outlet pipe (1) and tailpipe extension (5)	Position under rear body.	

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4-48. Rear Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



TA 155349

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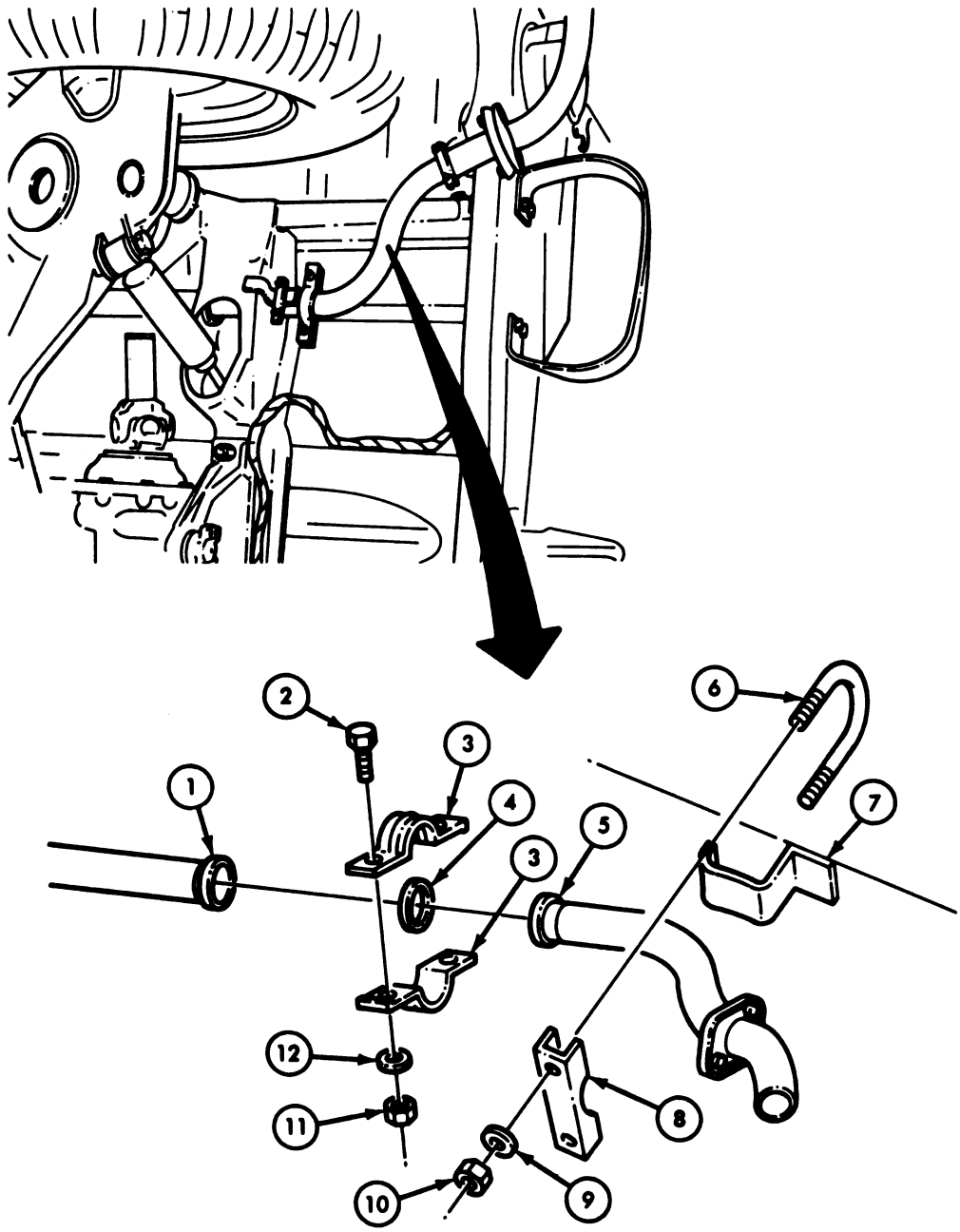
4-48. Rear Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
12.		U-bolt (6)	*a.* Place over rear hanger (7) and rear outlet pipe (5).	
			b. Attach U-bolt clamp (8) and secure with two washers (9), and locknuts (10).	Finger tighten only.
13.		New rear outlet pipe front gasket (4)	Place on front outlet pipe mating flange (1).	Dab a small amount of GAA grease on gasket (4) to hold in place.
14.		Rear outlet pipe (5)	Position to front outlet pipe mating flange (1).	
15.		Clamp halves (3)	*a.* Place halves (3) over rear outlet pipe (5) and front outlet pipe (1) mating flanges.	Make sure clamp halves (3) are properly seated.
			b. Secure with two bolts (2), washers (12), and locknuts (11).	Tighten 12 to 15 lb-ft (16 to 20 N•m).
16.	U-bolt (6) and clamp (8) to rear hanger (7)	Two locknuts (10)	Tighten securely.	

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4-48. Rear Outlet Pipe Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Lower vehicle (para 3-24).
- Start engine (TM 9-2320-218-10) and check for exhaust leaks (table 3-3, malfunction 18).

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4-49. Tailpipe Extension Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Special Environmental Conditions
None

Materials/Parts
Gasket

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipes with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust pipes with bare hands. Severe injury will result.

a. REMOVAL

1.	Tailpipe extension (3) to rear outlet pipe (1)	Two locknuts (5) and bolts (4)	Remove.	
2.		Tailpipe extension (3) and gasket (2)	Remove from rear outlet pipe (1).	Discard gasket (2) and clean gasket surface of rear outlet pipe (1).

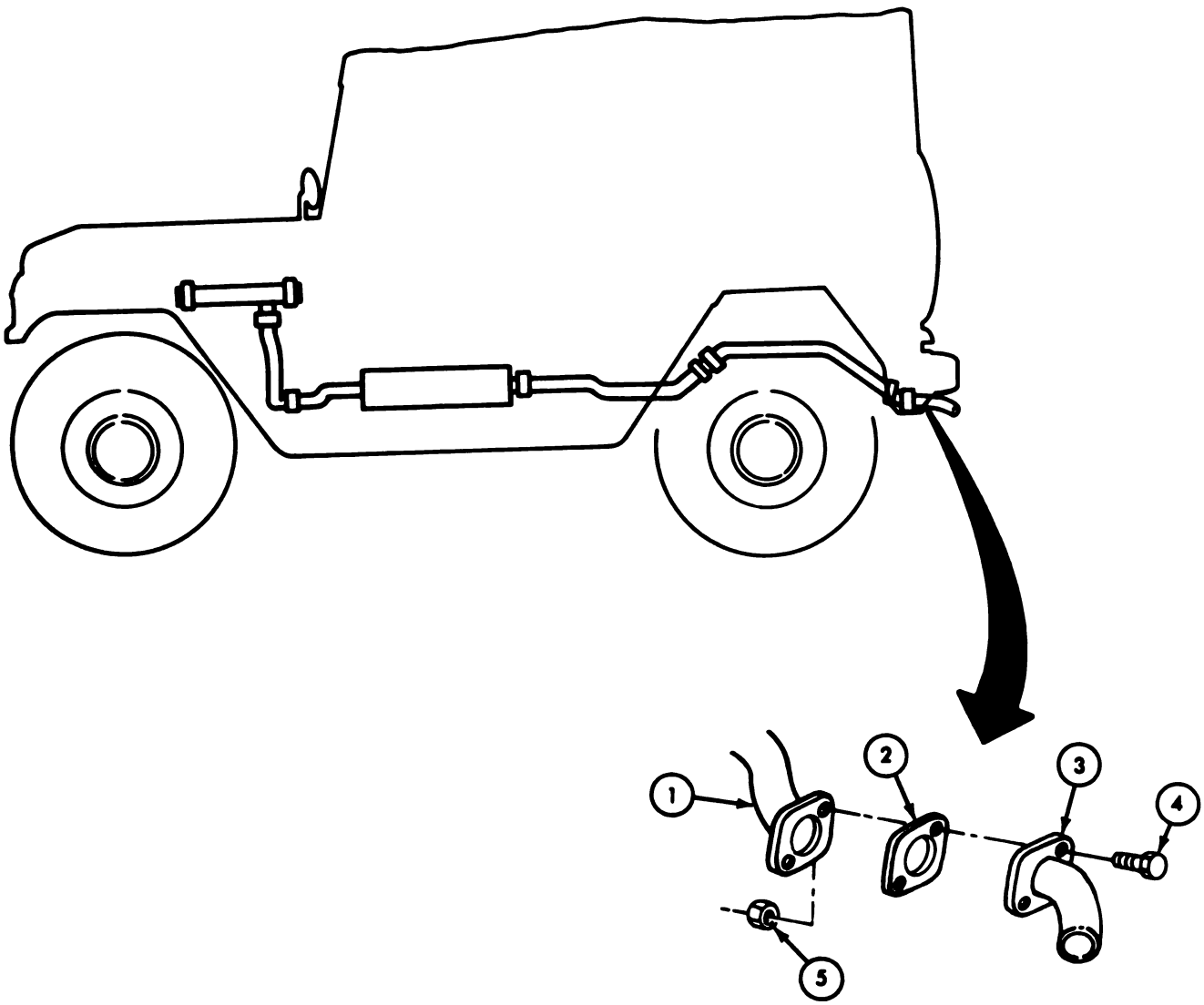
b. INSTALLATION

3.		New gasket (2)	Place on rear outlet pipe mating flange (1).	

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4-49. Tailpipe Extension Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.		Tailpipe extension (3)	*a.* Position to rear outlet pipe mating flange (1).	
			b. Secure with two bolts (4) and locknuts (5).	Tighten 12 to 15 lb-ft (16 to 20 N•m).



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check for exhaust leaks (table 3-3, malfunction 18).

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4-50. Rear Outlet Pipe Hanger Modification and Installation

This task covers:

a. Removal
b. Hanger modification
c. Installation

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
Para 3-24

Condition Description
Rear of vehicle raised and supported.

Test Equipment
None

Special Tools
Drill and 11/32-inch drill bit

Special Environmental Conditions
Vehicle on level ground.

Materials/Parts
Exhaust pipe rear hanger (fabricated in accordance with appendix E)

Personnel Required
One mechanic

General Safety Instructions
Do not touch hot exhaust pipes with bare hands.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not touch hot exhaust pipes with bare hands. Severe injury will result.

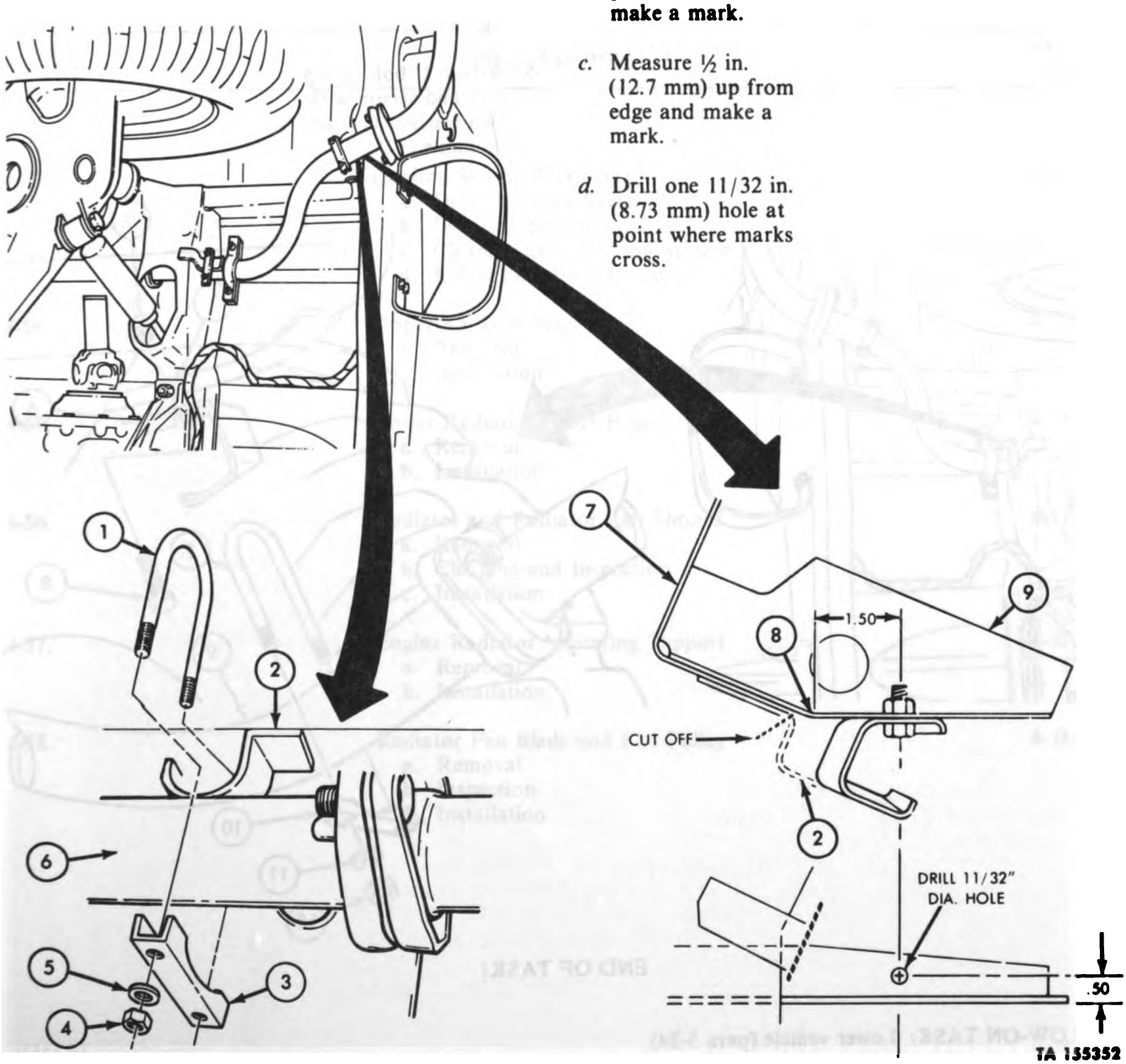
a. REMOVAL

1.	U-bolt (1) and clamp (3) to rear hanger (2)	Two locknuts (4) and washers (5)	Remove.
2.		U-bolt (1) and clamp (3)	Remove from rear hanger (2) and rear outlet pipe (6).
3.		Exhaust pipe rear hanger (2)	Remove by cutting off at rear cross sill assembly (7) as shown.

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4-50. Rear Outlet Pipe Hanger Modification and Installation (Cont'd)

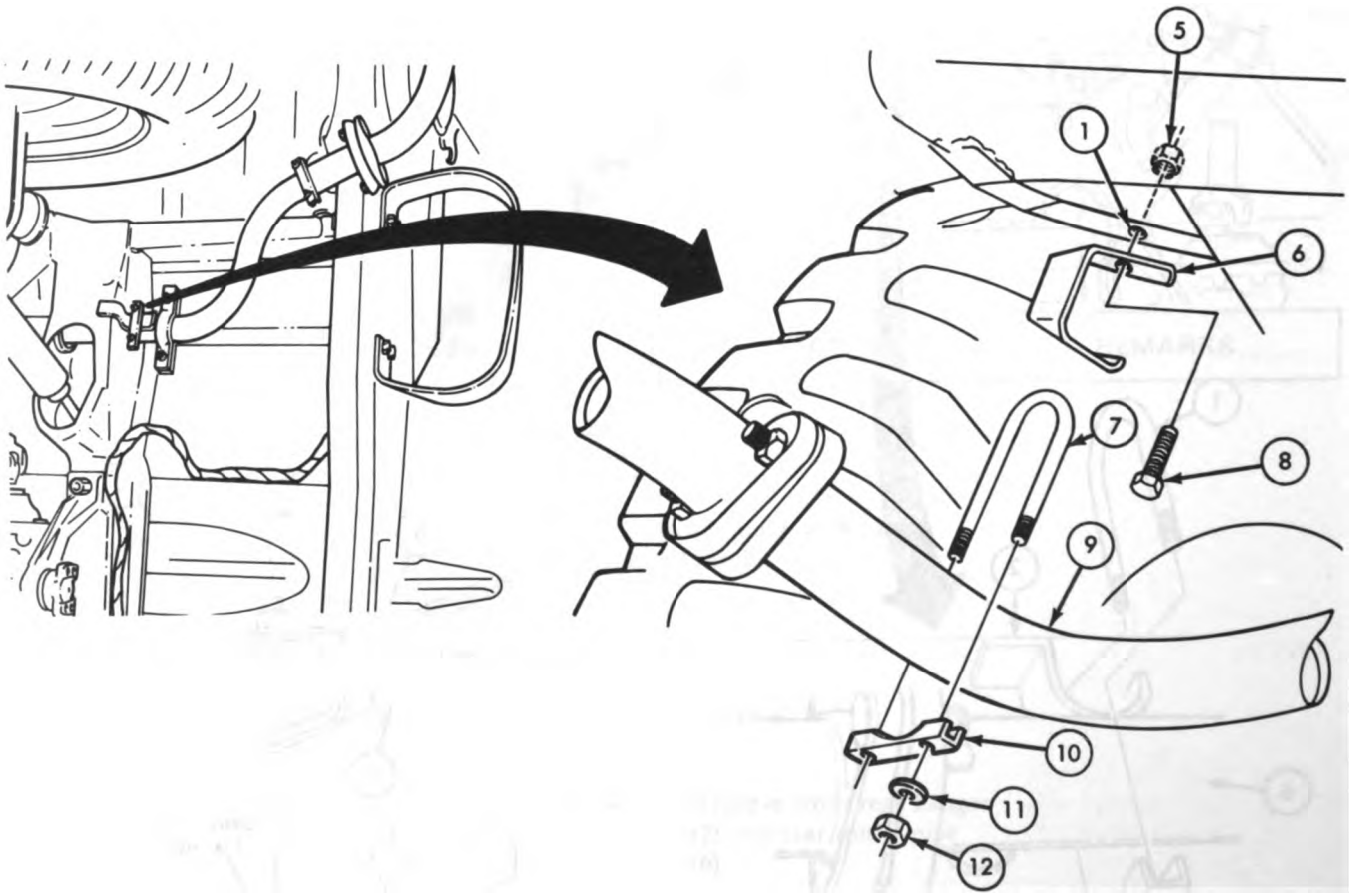
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. HANGER MODIFICATION		
4.		Gusset (9)	*a.* Clean off all dirt, rust, scaling metal, and other material. *b.* Measure 1½ in. (38.1 mm) from angle point (8) and make a mark. *c.* Measure ½ in. (12.7 mm) up from edge and make a mark. *d.* Drill one 11/32 in. (8.73 mm) hole at point where marks cross.	



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4-50. Rear Outlet Pipe Hanger Modification and Installation (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
c. INSTALLATION				
5.		Fabricated exhaust pipe rear hanger (6)	*a.* Position to hole in gusset (1). *b.* Secure with bolt (8) and locknut (5).	
6.		U-bolt (7)	*a.* Place over rear hanger (6) and rear outlet pipe (9). *b.* Attach U-bolt clamp (10) and secure with two washers (11) and locknuts (12).	



END OF TASK!

FOLLOW-ON TASK: Lower vehicle (para 3-24).

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Section VII. COOLING SYSTEM MAINTENANCE

4-51. General

This section provides maintenance procedures assigned to the organizational level for the cooling system. To find a specific task, see the maintenance task summary below:

4-52. Cooling System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
4-53.	Cooling System Servicing a. Depressurizing System b. Draining System c. Cleaning and Flushing System d. Filling and Testing System	4-169
4-54.	Upper Radiator Inlet Hose a. Removal b. Installation	4-174
4-55.	Lower Radiator Outlet Hose a. Removal b. Installation	4-176
4-56.	Radiator and Radiator Fan Shroud a. Removal b. Cleaning and Inspection c. Installation	4-178
4-57.	Engine Radiator Mounting Support a. Removal b. Installation	4-182
4-58.	Radiator Fan Blade and Fan Pulley a. Removal b. Inspection c. Installation	4-184

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4-52. Cooling System Maintenance Task Summary (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4-59.		Drive Belts a. Adjustment b. Removal c. Inspection d. Installation		4-186
4-60.		Thermostat a. Removal b. Testing c. Installation		4-190
4-61.		Water Pump a. Removal b. Inspection c. Installation		4-194
4-62.		Radiator Drain Cock a. Removal b. Installation		4-196
4-63.		Coolant Temperature Sending Unit a. Removal b. Installation		4-198

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4-53. Cooling System Servicing Instructions

This task covers:

a. Depressurizing System
b. Draining System
c. Cleaning and Flushing System
d. Filling and Testing System

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
Antifreeze tester
Drainage container (5 gallon)
Water can (2 gallon)

Special Environmental Conditions
None

Materials/Parts
Cleaning compound kit (NSN 6850-00-598-7328)
Antifreeze

Personnel Required
One mechanic

General Safety Instructions
Do not remove radiator cap before releasing internal pressure when radiator is hot.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 750-254

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. DEPRESSURIZING SYSTEM

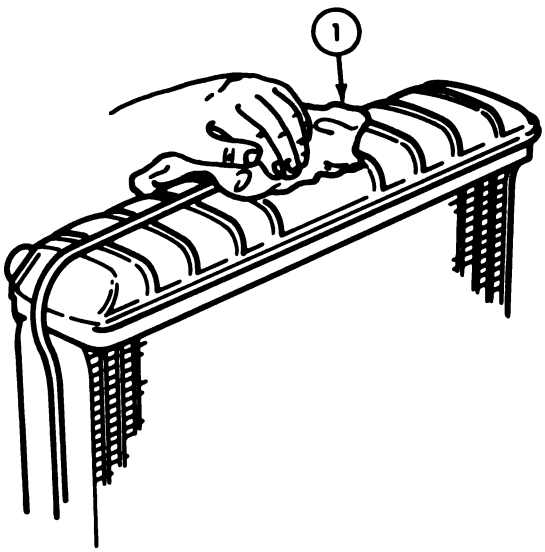
WARNING

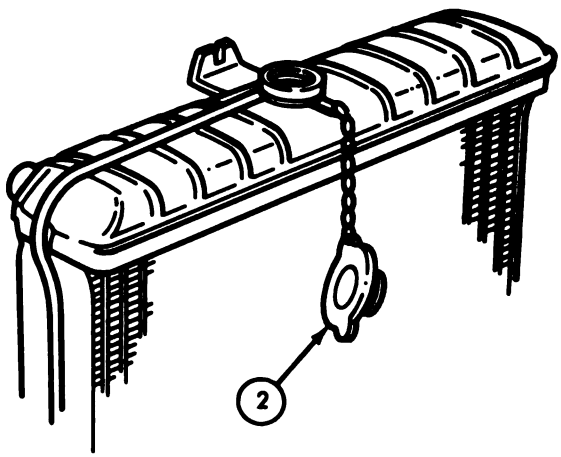
Do not remove radiator cap before releasing internal pressure when radiator is hot to touch. Internal pressure will blow out scalding fluid and vapor, causing severe injury.

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4-53. Cooling System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
1.			If radiator cap (2) must be removed when engine is hot:	
			a. Place thick cloth (1) over cap (2) and turn counterclockwise to its first stop.	Allows pressure to escape.
			b. After pressure has escaped, press and turn cap (2) counterclockwise again and remove.	





b. DRAINING SYSTEM

2.			Drain cooling system as follows:	
			a. If engine is hot, release pressure from system and remove radiator cap (2).	
			b. Place container beneath draincock (3) at left rear of engine block.	
			c. Open draincock (3) and allow coolant to drain.	
			d. Close draincock (3).	TA 155354

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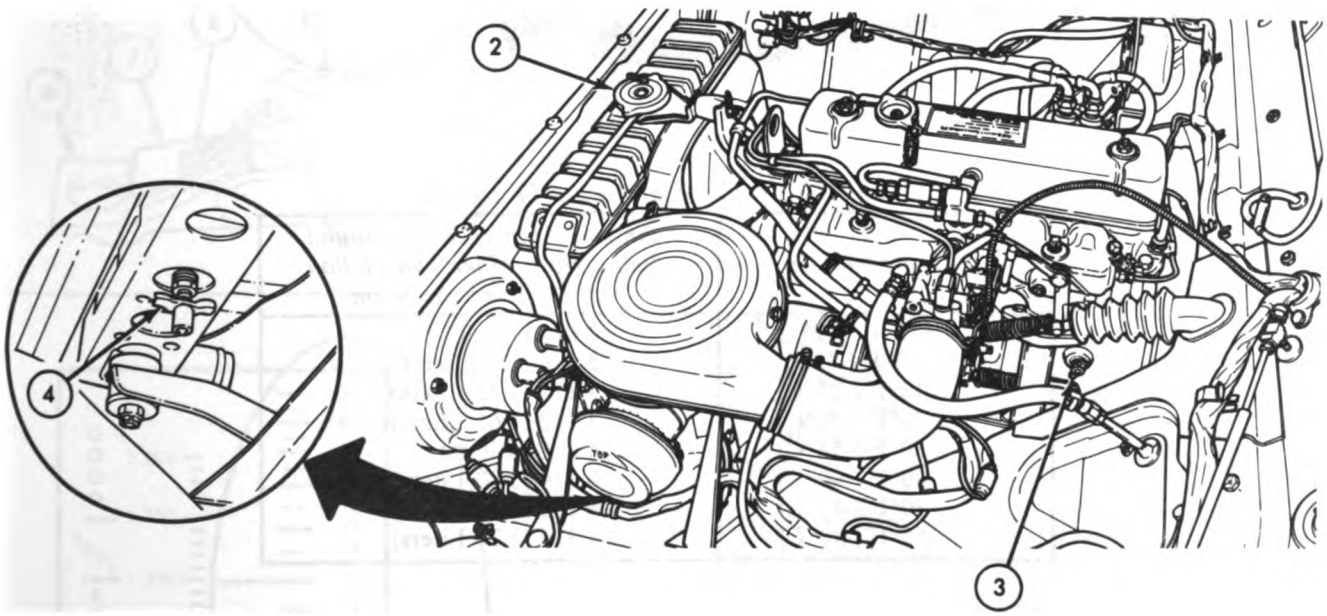
4-53. Cooling System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			e. Place container beneath radiator draincock (4).	
			f. Open draincock (4) and allow coolant to drain.	
			g. Close draincock (4).	

c. CLEANING AND FLUSHING SYSTEM

NOTE

All cleaning and flushing instructions authorized for organizational maintenance can be found in TM 750-254.



d. FILLING AND TESTING SYSTEM

NOTE

- When filling cooling system, always check antifreeze protection with antifreeze tester.
- The cooling system for the vehicles covered in this manual has a 9 quart (8.5 liter) capacity.

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4-53. Cooling System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.			Fill cooling system as follows:	
			a. Make sure two draincocks (3) and (4) are closed.	

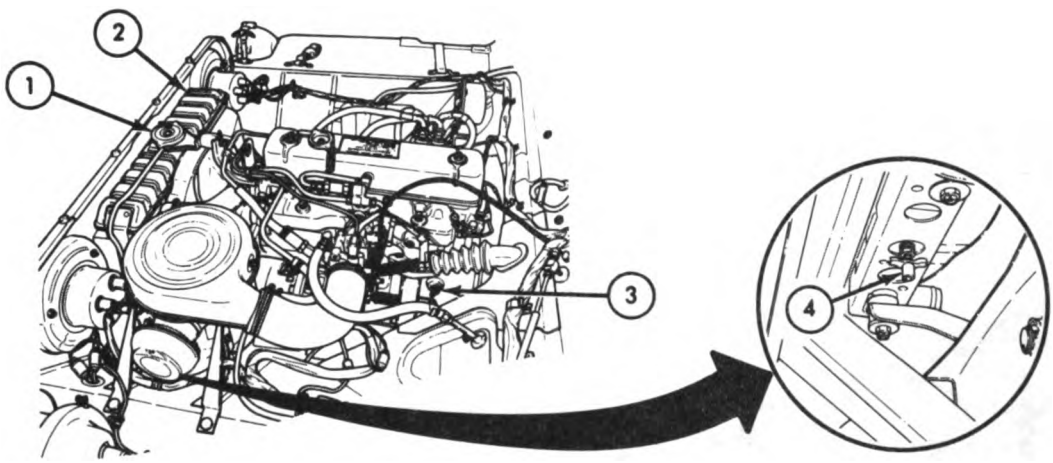


Table 4-3. Table of Antifreeze Protections

Protection To	*Pints of Antifreeze Compound Required to Make One Gallon of Antifreeze Solution*
+10°F (-12°C)	2 (94 Liters)
0°F (-18°C)	2 3/4 (1.3 Liters)
-10°F (-23°C)	3 1/4 (1.52 Liters)
-20°F (-29°C)	3-1/2 (1.65 Liters)
-30°F (-34°C)	4 (1.89 Liters)
-40°F (-40°C)	4 1/4 (2.00 Liters)
-50°F (-45°C)	4 1/2 (2.12 Liters)
-55°F (-48°C)	4 3/4 (2.24 Liters)

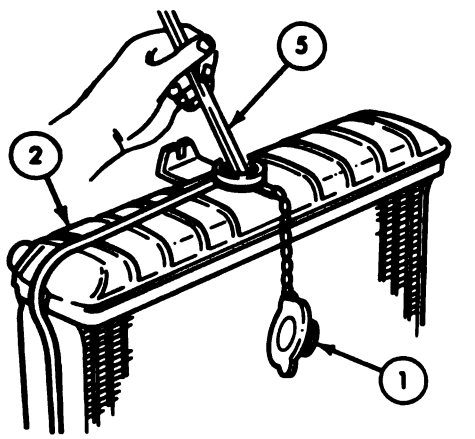
	b. Fill system with prepared antifreeze solution.	See table 4-3 for preparation of antifreeze solutions.
	c. Start vehicle and let idle until engine temperature reaches 177°F (80°C).	Thermostat starts to open.
	d. Check coolant level and fill as necessary.	Make sure engine is still running.

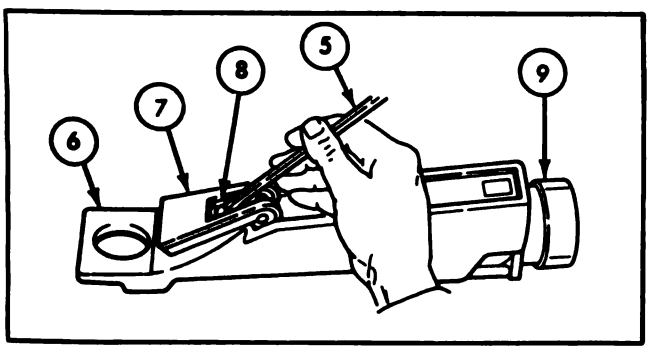
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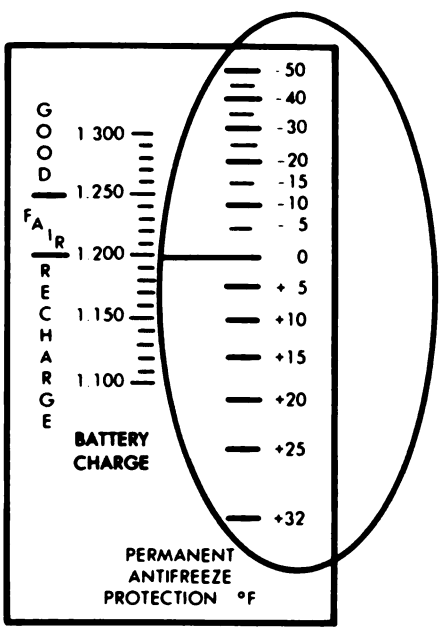
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4-53. Cooling System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			e. Shut off engine.	
4.			Test cooling system with optical antifreeze tester (6) as follows:	
			a. Clean tester plastic cover (7) measuring window (8), and eyepiece lens (9).	Use oil-free cloth.
			b. Swing plastic cover (7), down until it rests against measuring window (8).	
			c. Using tube dipstick (5), draw antifreeze solution from radiator (2).	
			d. Place a few drops onto test measuring window (8).	
			e. Point tester (6) to bright light source.	
			f. Look through eyepiece lens (9) and observe a rectangle with antifreeze protection reading scale on right side.	
			g. Read scale where the area of shadow and light meet.	
			h. After reading is taken, clean window (8) and plastic cover (7).	
			i. Reinstall radiator cap (1) after correct antifreeze protection is obtained.	







END OF TASK!

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4-54. Upper Radiator Inlet Hose Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 4-53	Parking brake set. Coolant drained as necessary.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

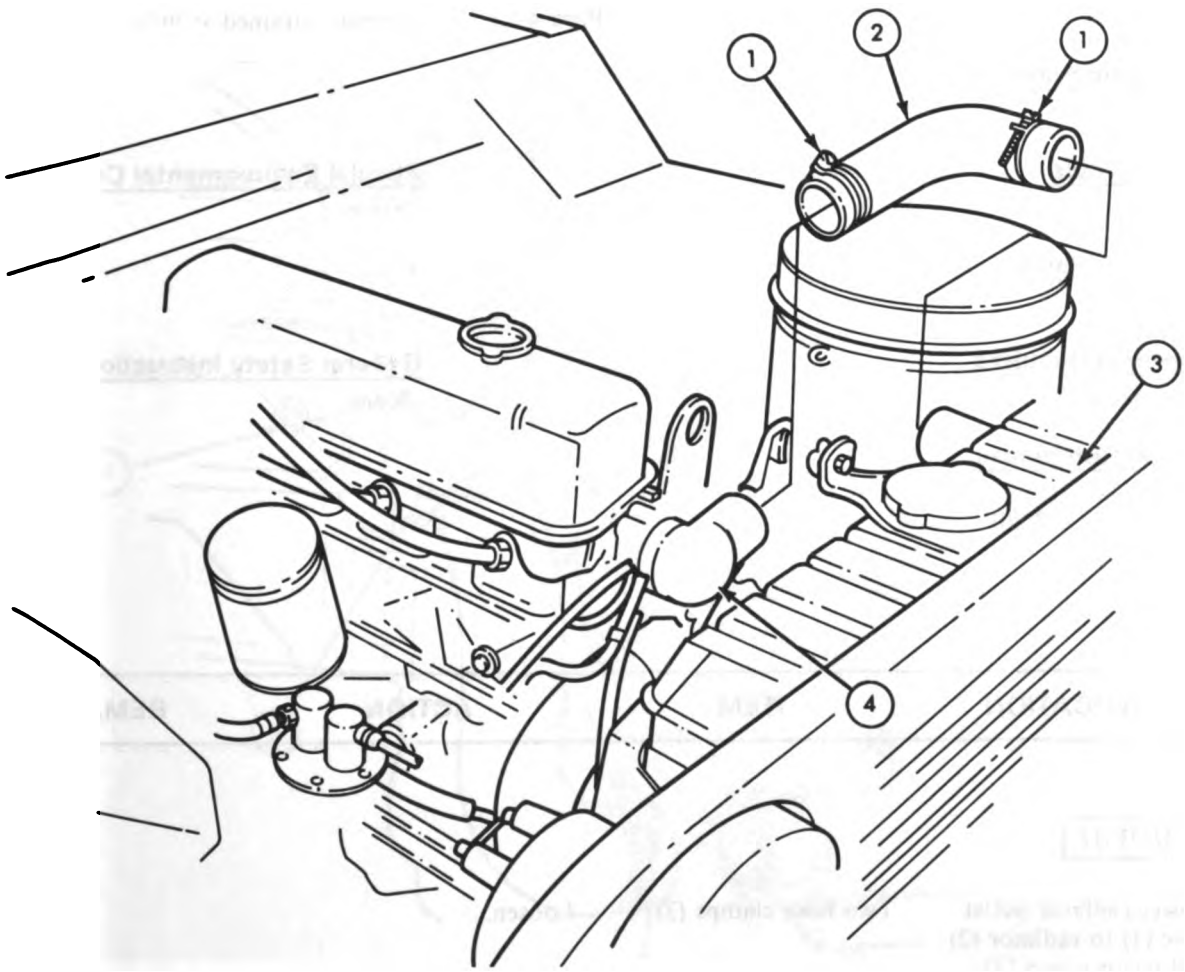
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Upper radiator inlet hose (2) to radiator (3) and thermostat housing (4)	Two hose clamps (1)	Loosen.	
2.		Upper radiator hose (2)	Remove.	
		b. INSTALLATION		
3.		Upper radiator hose (2)	Attach to radiator (3) and thermostat housing (4), and secure with two clamps (1).	

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4-54. Upper Radiator Inlet Hose Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Fill cooling system and inspect for leaks (para 4-53).

TA 155358

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4-55. Lower Radiator Outlet Hose Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10 Para 4-53

Condition Description
Parking brake set.
Coolant drained.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

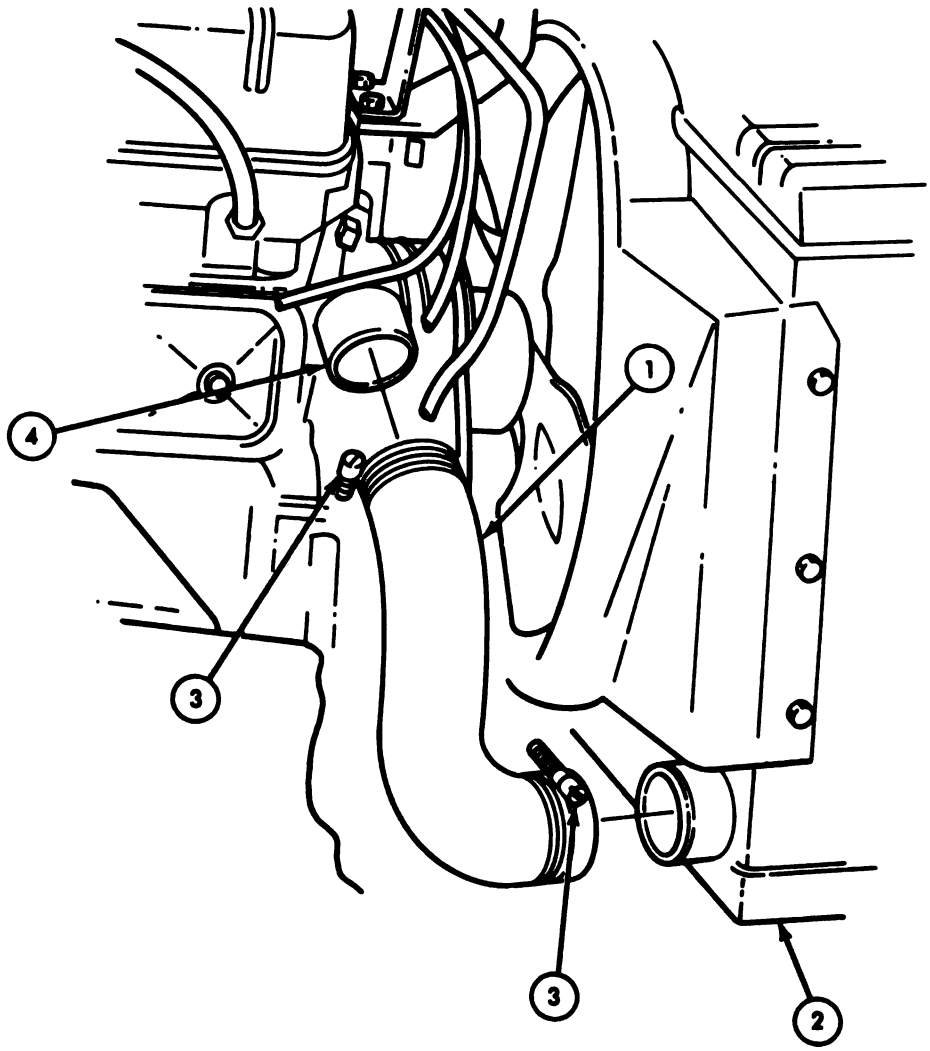
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Lower radiator outlet hose (1) to radiator (2) and water pump (4)	Two hose clamps (3)	Loosen.	
2.		Lower radiator hose (1)	Remove.	
		b. INSTALLATION		
3.		Lower radiator hose (1)	Attach to radiator (2) and water pump (4), and secure with two clamps (3).	

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4-55. Lower Radiator Outlet Hose Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Fill cooling system and inspect for leaks (para 4-53).

TA 155359

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4-56. Radiator and Radiator Fan Shroud Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10
Para 4-53
Para 4-54

Condition Description
Parking brake set.
Cooling system drained.
Upper radiator hose removed.

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)
Safety goggles

Special Environmental Conditions
None

Materials/Parts
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Always wear safety goggles when using compressed air.

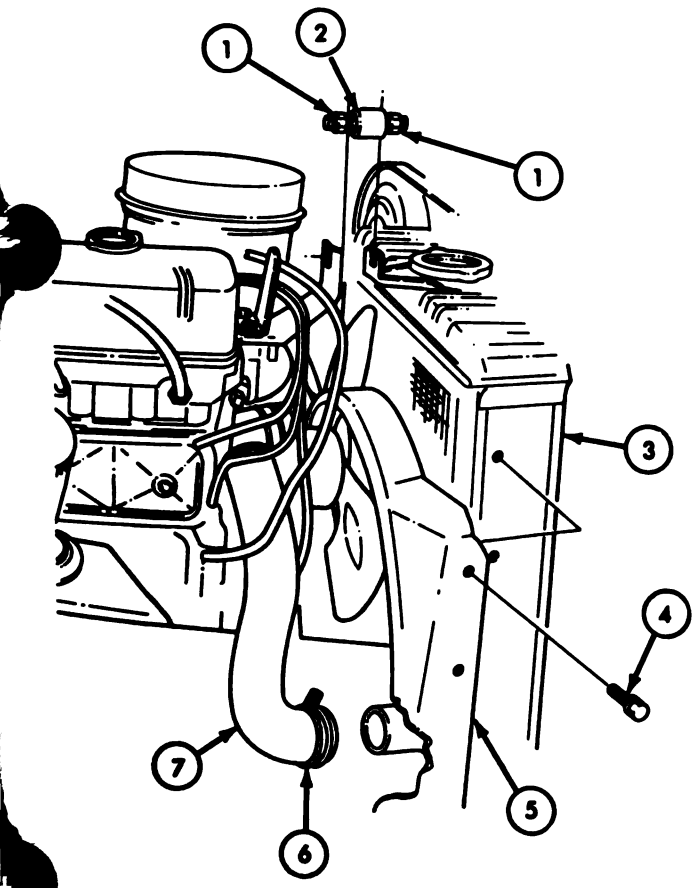
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 750-254

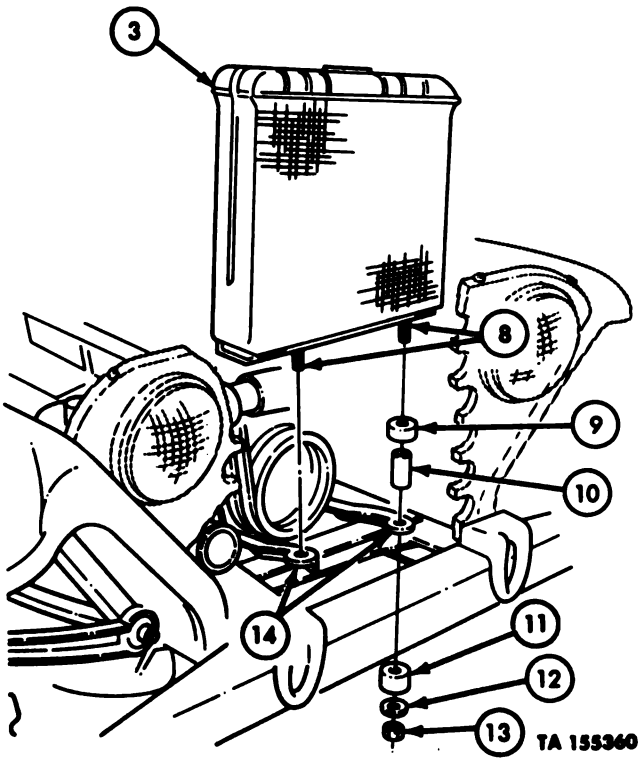
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Lower radiator outlet hose (7) to radiator (3)	Hose clamp (6)	Loosen and detach hose (7) from radiator (3).	
2.	Radiator fan shroud (5) to radiator (3)	Six screw-assembled lockwashers (4)	Remove.	
3.		Fan shroud (5)	Pull away from radiator (3).	
4.	Upper radiator insulator (2)	Two nuts (1)	Loosen.	Do not remove nuts (1).
5.		Upper radiator insulator (2)	Remove.	
6.	Radiator (3) to two lower support brackets (14)	Two locknuts (13), washers (12), insulators (11), and spacers (10)	Remove.	

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4-56. Radiator and Radiator Fan Shroud Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			CAUTION Use extreme care when lifting radiator from engine compartment. Radiator core can be easily damaged by fan shroud.	
7.		Radiator (3)	*a.* Lift out of vehicle. *b.* Remove two insulators (9) and studs (8).	
8.		Radiator fan shroud (5)	Remove.	





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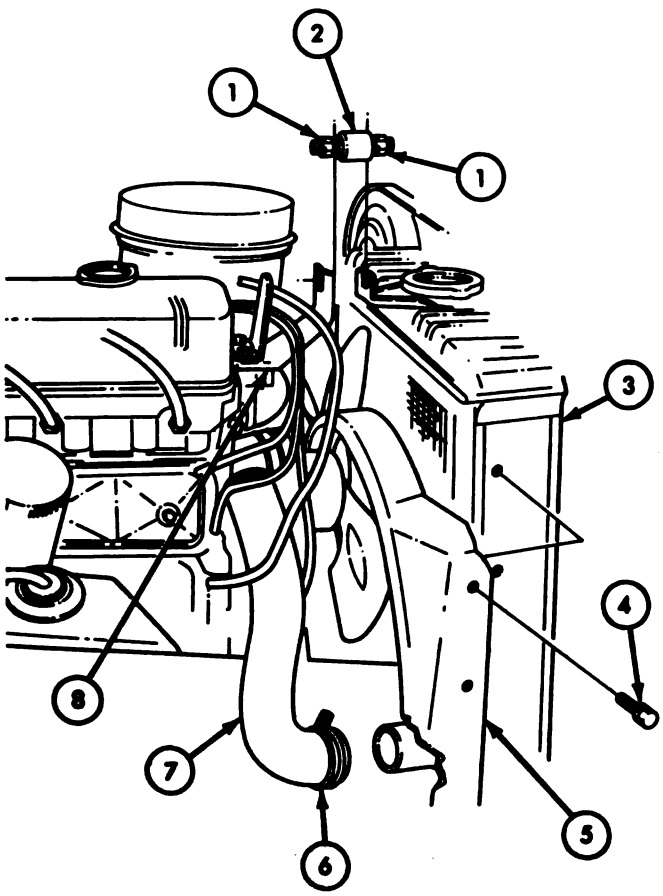
4-56. Radiator and Radiator Fan Shroud Maintenance (Cont'd)

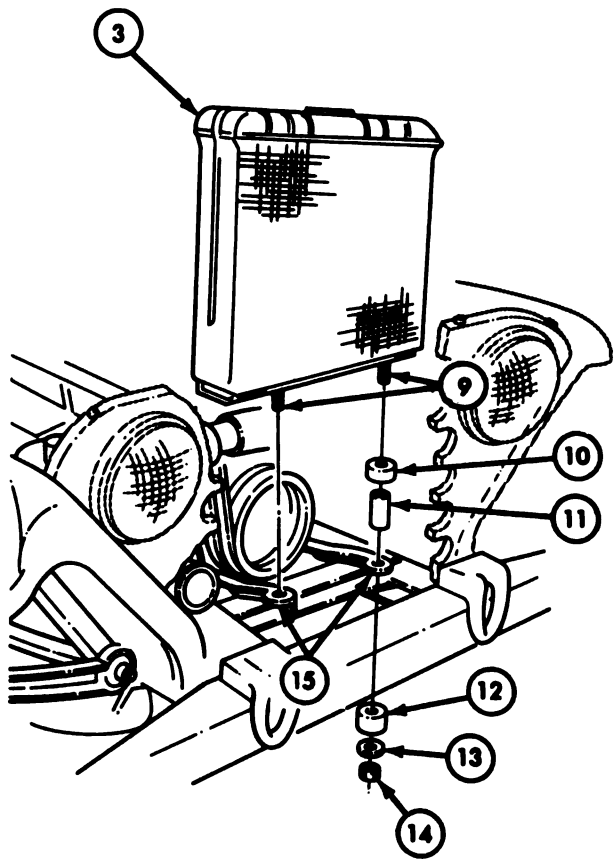
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. CLEANING AND INSPECTION		
		WARNING		
		Compressed air source will not exceed 30 psi. When cleaning with compressed air, eyeshields must be worn. Failure to wear eyeshields may result in injury to the eyes and loss of sight.		
		CAUTION		
		Do not use excessive air or water pressure when cleaning radiator passages. Radiator damage will result.		
9.	Radiator (3)	*a.* Remove dirt, trash, and insects imbedded in air passages when using compressed air or low pressure water stream.	See TM 750-254.	
		b. Inspect radiator (3) for bends, breaks and punctures.	Notify DS maintenance if bent, broken or punctured.	
		c. Inspect soldered seams at hose connections and filler cap for cracks, splits and breaks.	Notify DS maintenance if cracked, split or broken.	
		c. INSTALLATION		
10.	Two studs (9)	Position in radiator (3)		
11.	Two insulators (10)	Position on radiator studs (9).	Use a small amount of GAA grease to hold insulators (10) in place.	
12.	Fan shroud (5)	Position over engine.		
13.	Radiator (3)	Lower onto two support brackets (15), and secure with two spacers (11), insulators (12), washers (13), and locknuts (14).	Tighten locknuts (14) 5-11 lb-ft (7-15 N•m).	

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4-56. Radiator and Radiator Fan Shroud Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
14.		Fan shroud (5)	Secure to radiator (3) with six screw-assembled lockwashers (4).	
15.		Upper radiator insulator (2)	Position between mounting bracket (8) and radiator (3), and tighten two nuts (1).	Tighten nuts (1) 7-11 lb-ft (9-15 N•m).
16.		Lower radiator outlet hose (7)	Secure to radiator (3) with hose clamp (6).	





END OF TASK!

FOLLOW-ON TASKS:
- Install upper radiator hose (para 4-54).
- Fill cooling system and inspect for leaks (para 4-53).

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4-57. Engine Radiator Mounting Support Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	Para 4-56	Radiator removed.
	Para 5-23	Alternator mounting bracket removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
Lock tab washer

Personnel Required
One mechanic

General Safety Instructions
None

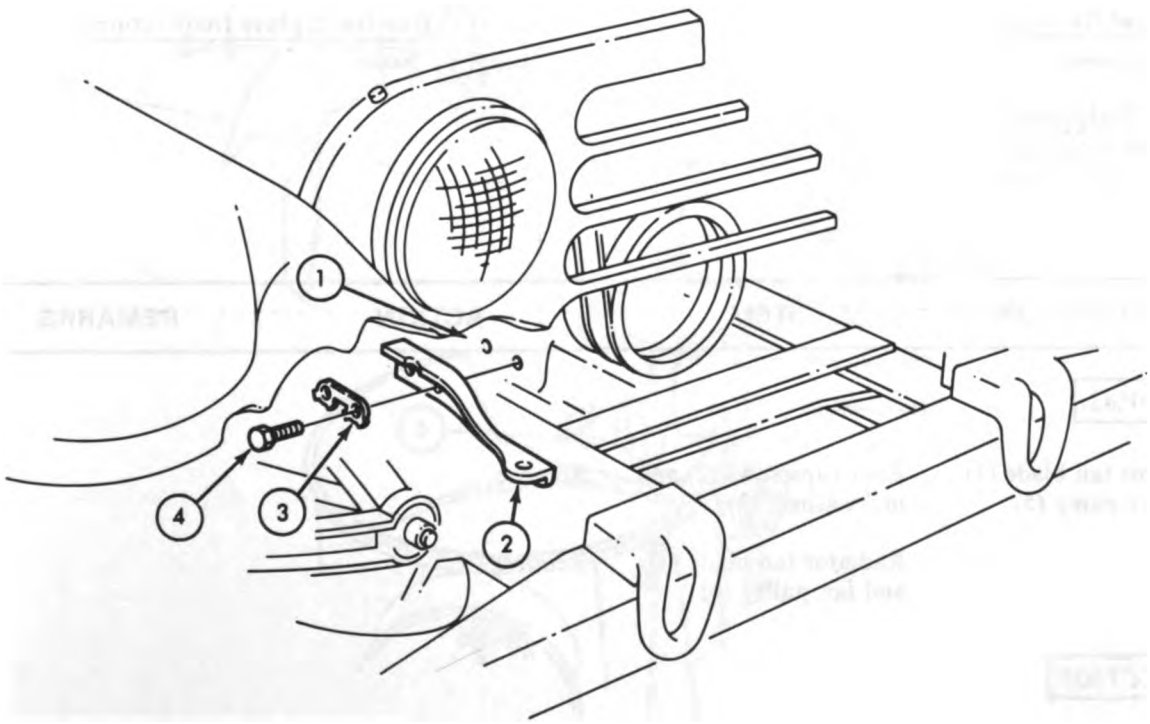
Manual References
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
		NOTE		
		Left engine radiator mounting support becomes detached when alternator bracket and radiator are removed in condition description above.		
1	Right mounting support (2) to engine (1)	Lock tab washer (3)	Bend tabs away from capscrews (4).	
2.		Two capscrews (4) and one lock tab washer (3)	Remove from right mounting support (2).	Discard lock tab washer (3).

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4-57. Engine Radiator Mounting Support Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.		Right mounting support (2)	Remove from engine (1).	
b. INSTALLATION				
4.		Right mounting support (2)	Secure to right front corner of engine (1) with new lock tab washer (3) and two capscrews (4).	Tighten 55-70 lb-ft (75-95 N•m).
5.		Lock tab washer (3)	Bend tabs up around capscrews (4).	



END OF TASK!

FOLLOW-ON TASKS:
- Install alternator mounting bracket (para (5-23).
- Install radiator (para 4-56).

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4-58. Radiator Fan Blade and Fan Pulley Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Special Tools
None

Special Tools
Torque wrench (0-175 lb-ft)

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
Para 4-53	Cooling system drained.
Para 4-56	Radiator and radiator shroud removed.
Para 4-59	Drive belts removed.

Special Environmental Conditions
None

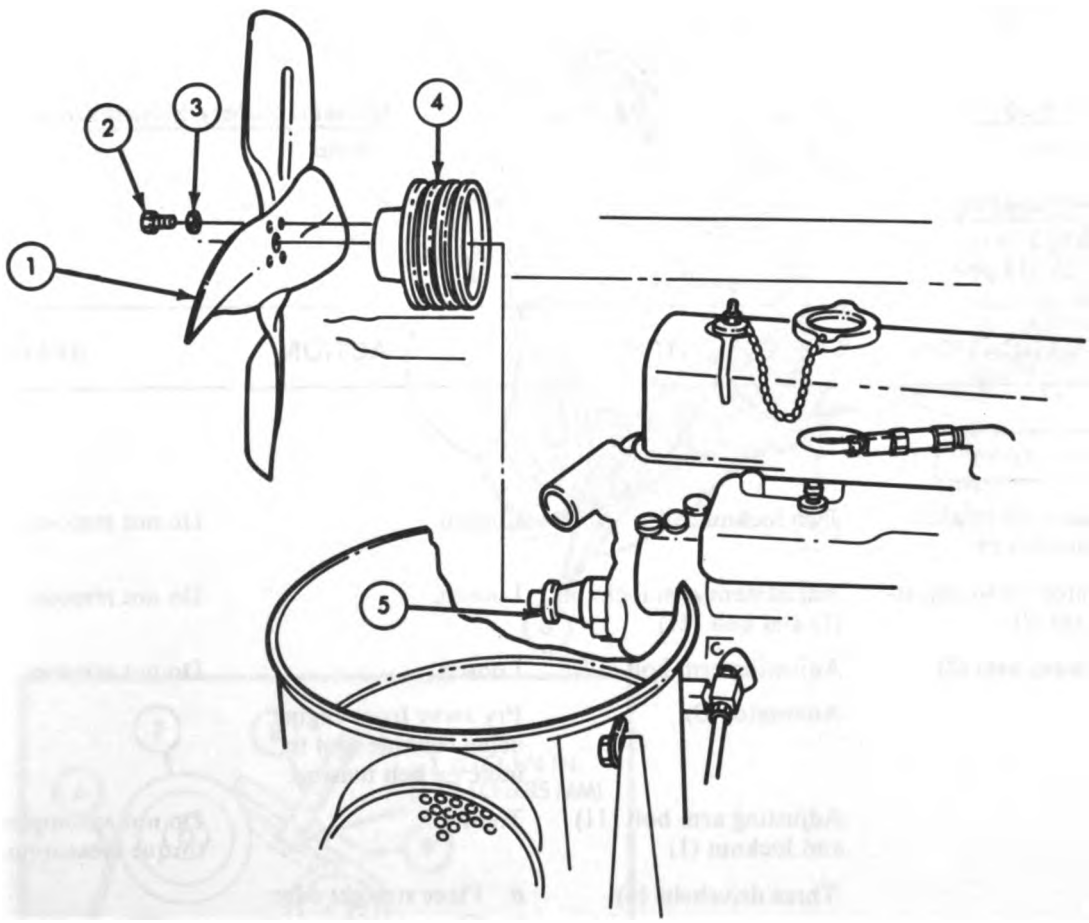
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Radiator fan blade (1) to water pump (5)	Four capscrews (2) and lockwashers (3)	Remove.	
2.		Radiator fan blade (1) and fan pulley (4)	Remove.	
	b. INSPECTION			
3.		Radiator fan blade (1)	Inspect for cracks, breaks, and rusted or corroded condition.	Remove rust traces and corrosion. Replace fan if cracked or broken.
4.		Fan pulley (4)	Inspect for cracks and warped condition.	Replace if warped or cracked.

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4-58. Radiator Fan Blade and Fan Pulley Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. INSTALLATION		
5.		Fan pulley (4)	Position on water pump (5).	
6.		Radiator fan blade (1)	Position against fan pulley (4) and secure with four lockwashers (3) and capscrews (2).	Tighten capscrews (2) 15-20 lb-ft (20-27 N•m).



END OF TASK!

FOLLOW-ON TASKS:
- Install drive belts and adjust (para 4-59).
- Install radiator shroud and radiator (para 4-56).
- Fill cooling system and inspect for leaks (para 4-53).

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4-59. Drivebelts Maintenance

This task covers:
a. Adjustment
b. Removal
c. Inspection
d. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
Pry bar
Ruler

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

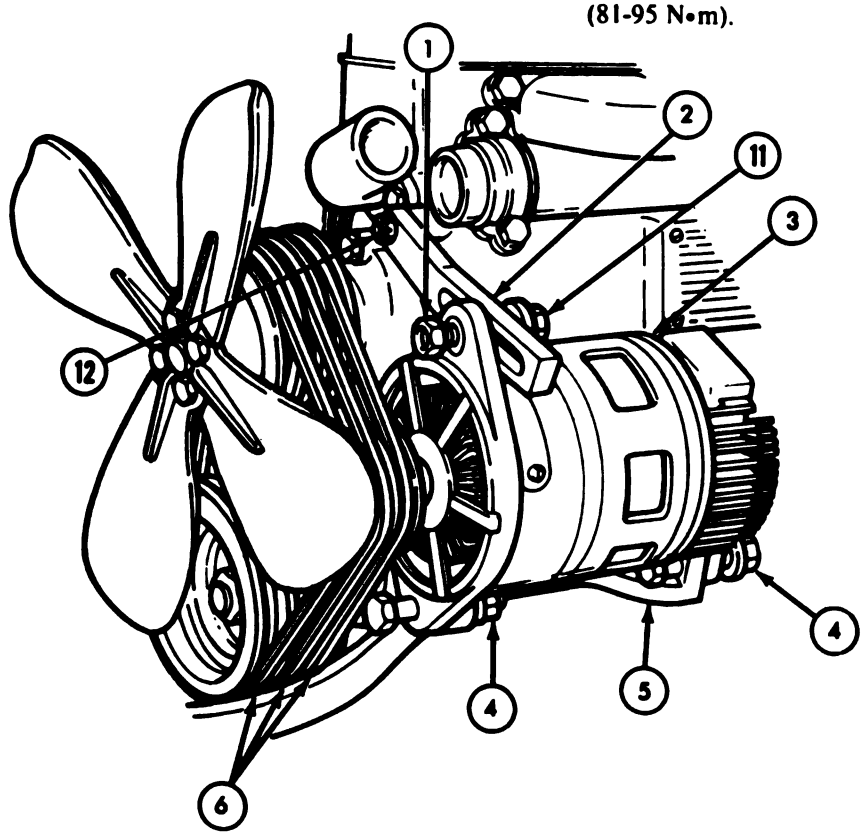
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

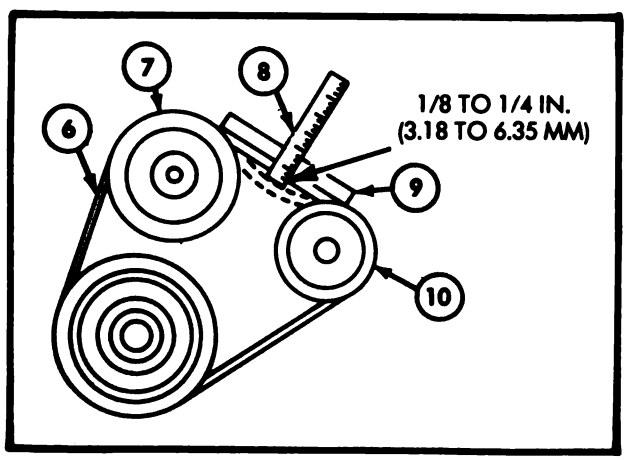
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. ADJUSTMENT		
1.	Alternator (3) to alternator bracket (5)	Two locknuts (4)	Loosen.	Do not remove.
2.	Alternator (3) to adjustment arm (2)	Adjustment arm locknut (1) and bolt (11)	Loosen.	Do not remove.
2.1.	Adjustment arm (2)	Adjusting arm bolt (12)	Loosen.	Do not remove.
3.		Alternator (3)	Pry away from engine using suitable tool to increase belt tension.	
4.		Adjusting arm bolt (11) and locknut (1)	Tighten.	Do not accomplish torque measurements.
5.		Three drivebelts (6)	*a.* Place straight edge (9) across fan and alternator pulleys (7) and (10).	
			b. Measure belt deflection with ruler (8).	Correct belt deflection should be no more than ¼ in. (.6 cm) and no less than ⅛ in. (.3 cm).

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4-59. Drivebelts Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.1.		Adjusting arm bolt (11) and locknut (1)	Tighten.	Tighten bolt (11) 35-40 lb-ft (48-54 N•m) and tighten locknut (1) 35-40 lb-ft (48-54 N•m).
5.2.		Adjusting arm bolt (12)	Tighten.	Tighten 47-56 lb-ft (64-76 N•m).
5.3.		Two locking nuts (4)	Tighten.	Tighten 60-70 lb-ft (81-95 N•m).





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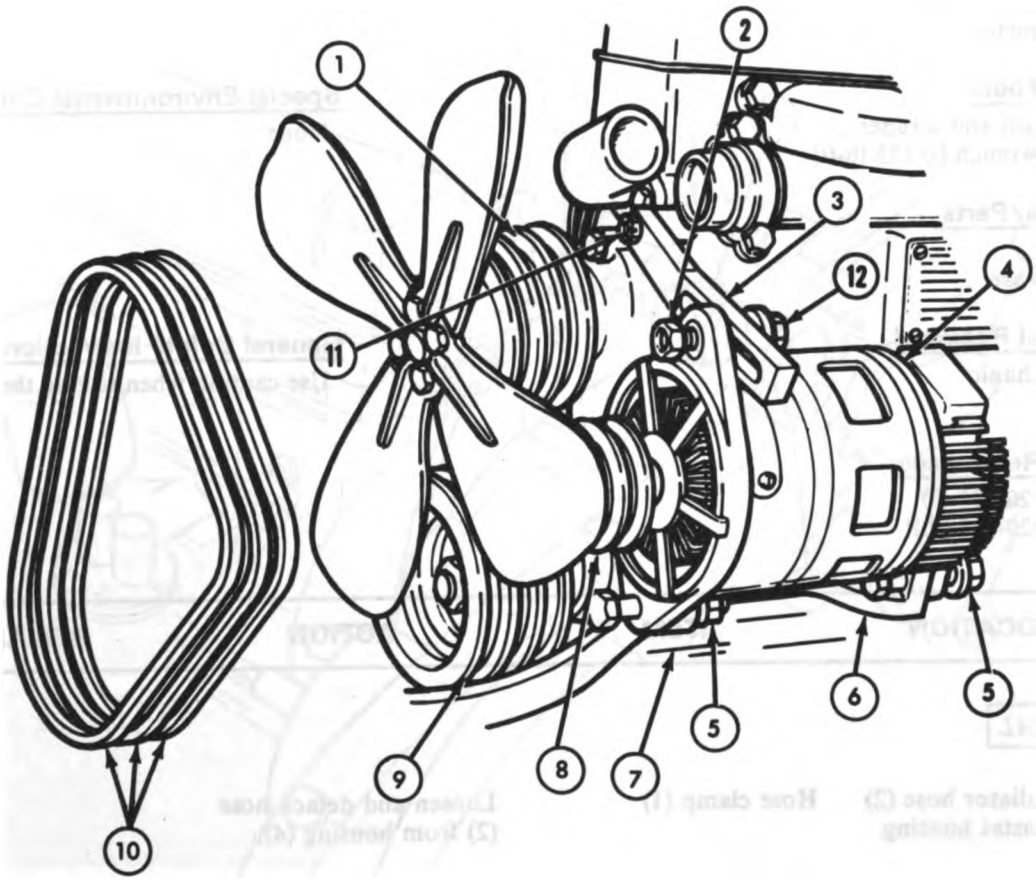
4-59. Drivebelts Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. REMOVAL			
6.	Alternator (4) to alternator bracket (6)	Two mounting locknuts (5)	Loosen.	Do not remove.
7.	Alternator (4) to adjustment arm (3)	Adjusting arm locknut (2) and bolt (12)	Loosen.	Do not remove.
7.1.	Adjustment arm (3)	Adjusting arm bolt (11)	Loosen.	Do not remove.
8.		Three drivebelts (10)	Remove by pushing alternator (4) toward engine (7).	
	c. INSPECTION			
		NOTE If any one drivebelt does not pass the inspection given in step 9, all three drivebelts must be replaced.		
9.		Three drivebelts (10)	Inspect for cracks, splits, breaks, and wear.	Replace if cracked, split, broken or worn.
	d. INSTALLATION			
10.		Three drivebelts (10)	*a.* Place over engine pulley (9), fan pulley (1), and alternator pulley (8).	If four grooves on pulley (9), install belts (10) on three grooves closest to engine.
			b. Adjust belt tension.	See task *a* of this paragraph, steps 3, 4, and 5.

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4-59. Drivebelts Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

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4-60. Thermostat Maintenance

This task covers:

a. Removal
b. Testing
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 4-53	Parking brake set. Coolant drained as necessary.

Test Equipment
Thermometer

Special Tools
Wire brush and scraper
Torque wrench (0-175 lb-ft)

Special Environmental Conditions
None

Materials/Parts
Gasket
GAA grease

Personnel Required
One mechanic

General Safety Instructions
Use caution when testing thermostat.

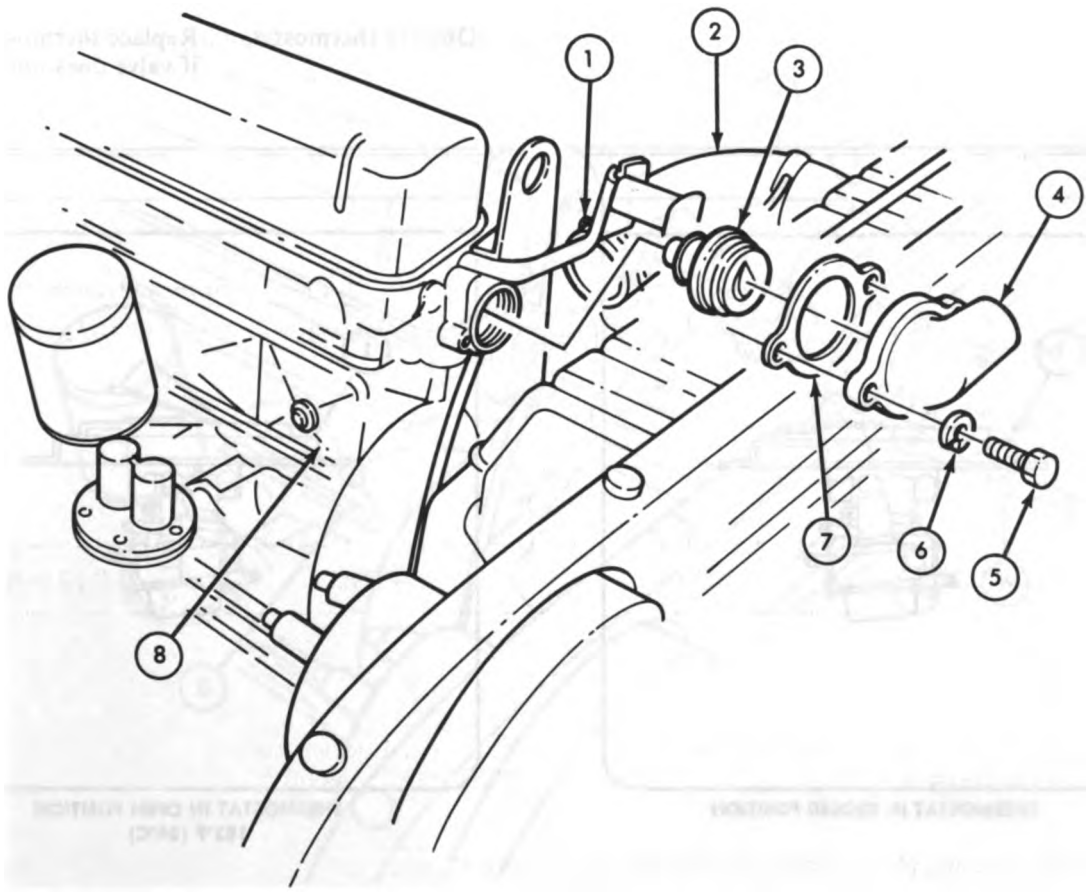
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Upper radiator hose (2) to thermostat housing (4)	Hose clamp (1)	Loosen and detach hose (2) from housing (4).	
2.	Thermostat housing (4) to engine (8)	Two capscrews (5) and lockwashers (6)	Remove.	
3.	Front of engine (8)	Thermostat housing (4)	Remove.	
4.		Thermostat (3) and gasket (7)	*a.* Remove.	Discard gasket (7).
			b. Clean gasket surfaces on housing (4) and engine (8).	

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4-60. Thermostat Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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4-60. Thermostat Maintenance (Cont'd)

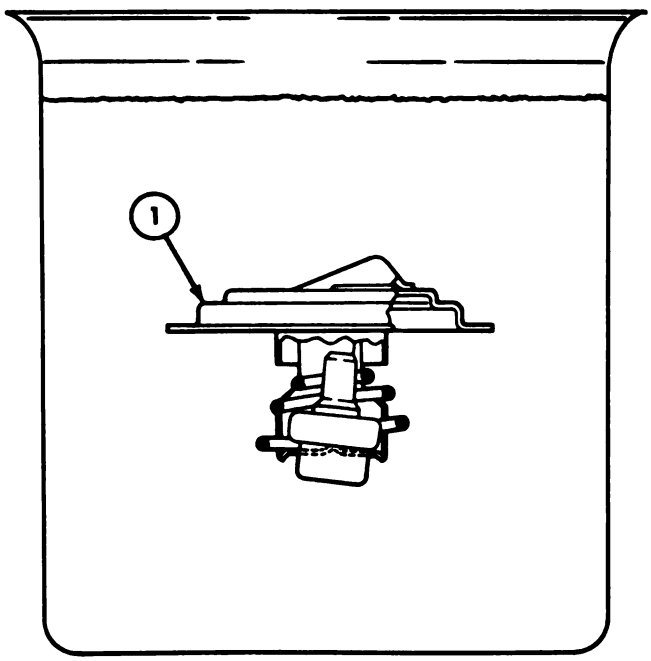
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

b. TESTING

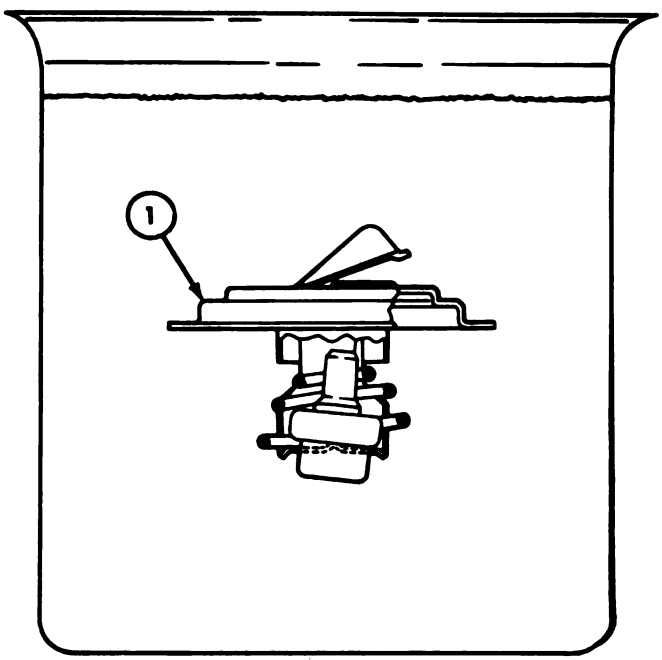
WARNING

Use caution when testing thermostat. Hot water will cause severe burns.

5.		Thermostat (1)	*a.* Place in 183°F (84°C) water.	Use thermometer.
			b. Observe thermostat.	Replace thermostat (1) if valve does not open.



THERMOSTAT IN CLOSED POSITION



THERMOSTAT IN OPEN POSITION
183°F (84°C)

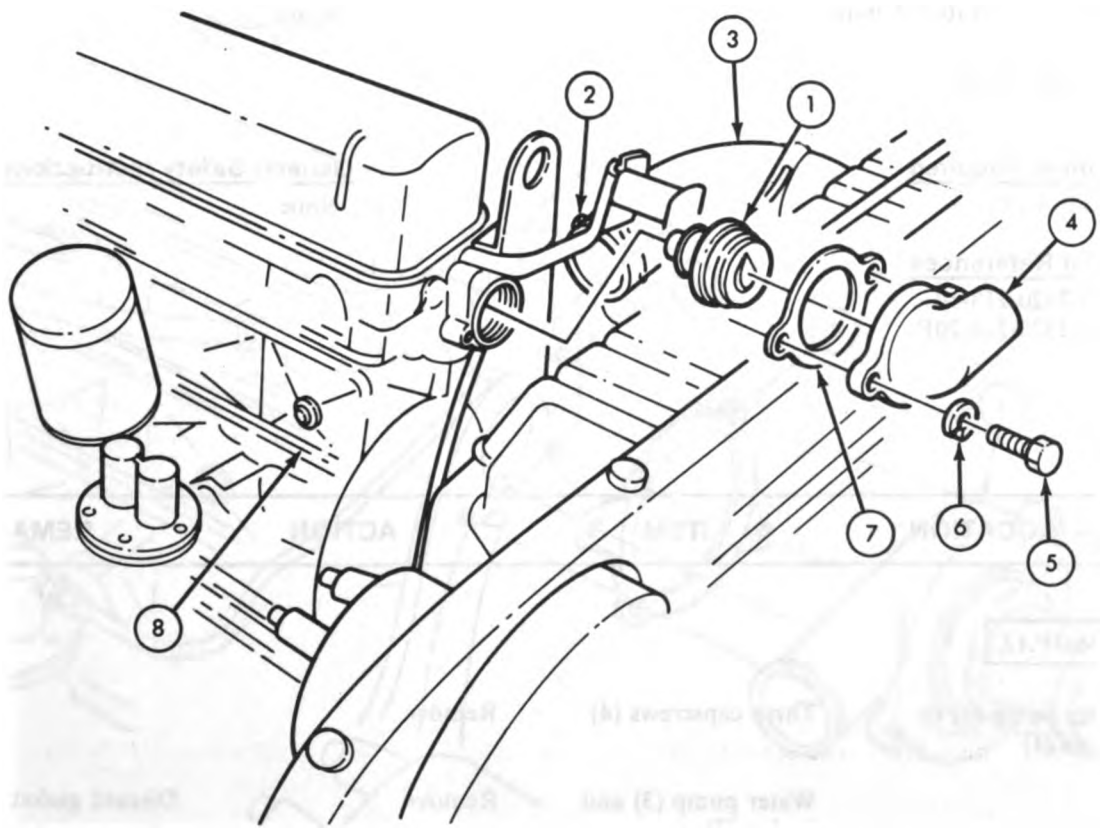
c. INSTALLATION

6.	Thermostat (1)	Install in engine (8).	Make sure valve sensor points toward engine (8).
7.	New gasket (7)	Position over thermostat (1), and aline two holes.	Use a small amount of GAA grease to hold gasket (7) in position. TA 155366

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4-60. Thermostat Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
8.		Thermostat housing (4)	Install over thermostat (1), and secure with two lockwashers (6), and capscrews (5).	Tighten capscrews (5) 10-15 lb-ft (14-20 N•m).
9.		Upper radiator hose (3)	Connect to thermostat housing (4), and secure with hose clamp (2).	



END OF TASK!

FOLLOW-ON TASKS:
- Refill cooling system (para 4-53).
- Start engine (TM 9-2320-218-10) and inspect for coolant leaks.
- Check temperature indicator gage for proper engine warm-up temperature.

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4-61. Water Pump Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Materials/Parts
Gasket

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
Para 4-55	Lower radiator hose removed.
Para 4-58	Radiator fan and fan pulley removed.

Special Environmental Conditions
None

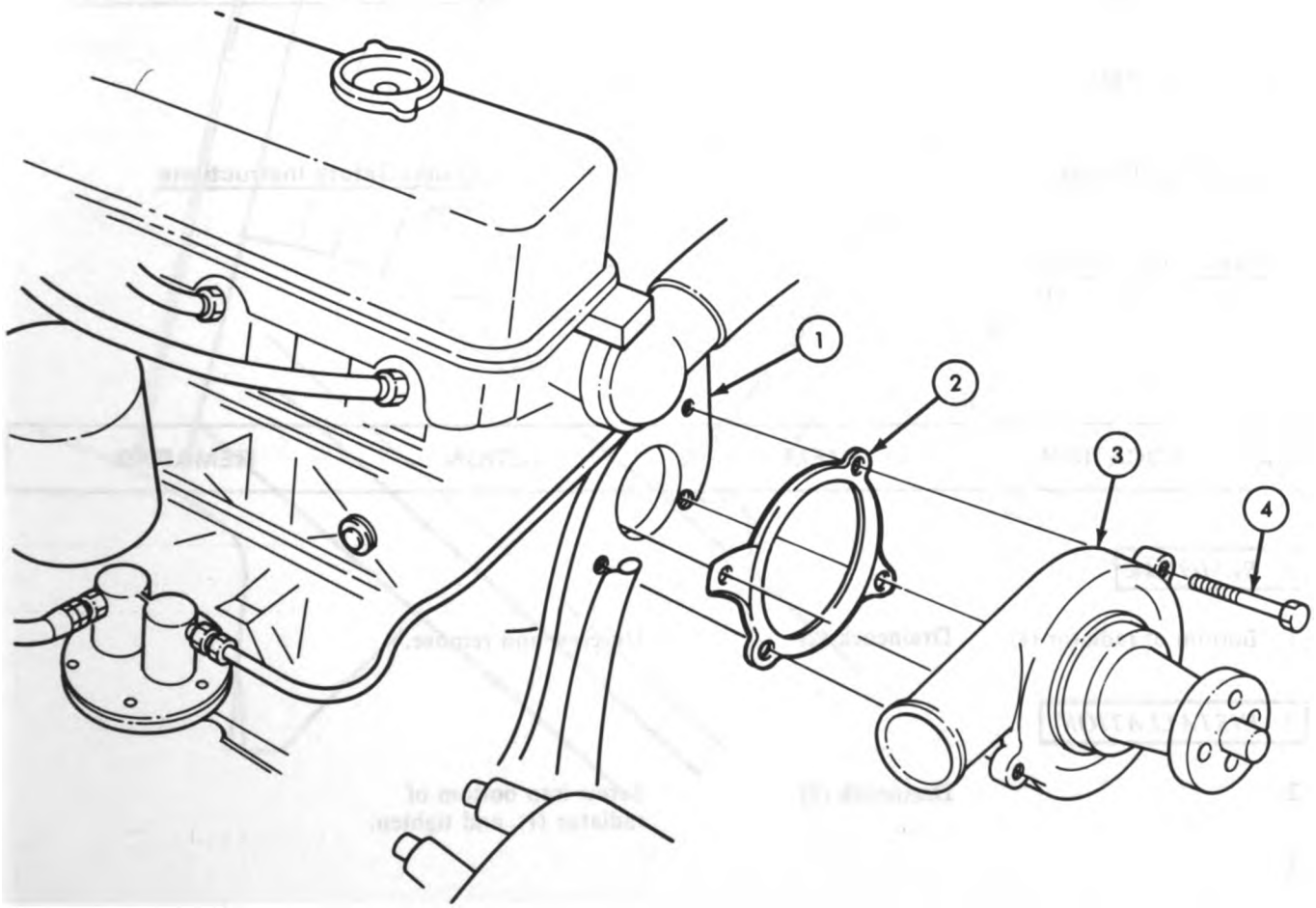
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Water pump (3) to engine (1)	Three capscrews (4)	Remove.	
2.		Water pump (3) and gasket (2)	Remove.	Discard gasket (2).
		b. INSPECTION		
3.		Water pump (3)	Inspect for corrosion, cracks, and broken blades.	Replace if corroded, cracked, or if blades are broken.

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4-61. Water Pump Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
c. INSTALLATION				
4.		New gasket (2) and water pump (3)	Position on engine (1) and secure with three capscrews (4).	Tighten capscrews (4) 10-15 lb-ft (14-20 N•m).



END OF TASK!

FOLLOW-ON TASKS:
- Install fan pulley and fan (para 4-58).
- Install lower radiator hose (para 4-55).

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4-62. Radiator Draincock Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	Para 4-53	Coolant drained.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

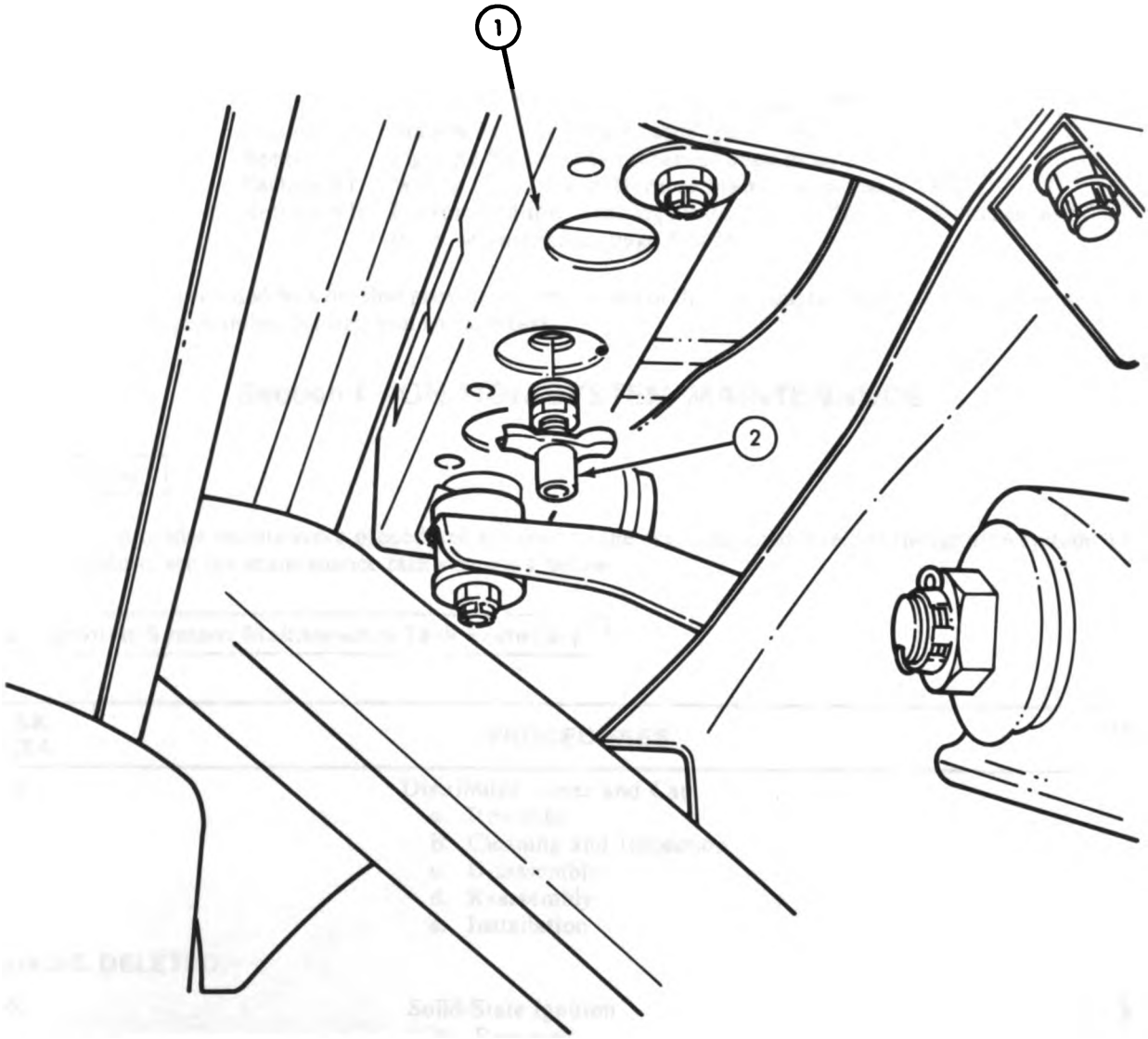
Manual References
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Bottom of radiator (1)	Draincock (2)	Unscrew and remove.	
		b. INSTALLATION		
2.		Draincock (2)	Screw into bottom of radiator (1), and tighten.	

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4-62. Radiator Draincock Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Fill cooling system and inspect for leaks (para 4-53).

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4-63. Coolant Temperature Sending Unit

Procedures for removal and installation of the coolant temperature sending unit can be found in paragraph 5-64.

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CHAPTER 5
ELECTRICAL SYSTEMS MAINTENANCE

5-1. Overview

a. This chapter provides maintenance of electrical system components. Components covered can be found in one of the following sections:

Section I. Ignition System Maintenance (page 5-1)
Section II. Starting System Maintenance (page 5-29)
Section III. Generating System Maintenance (page 5-37)
Section IV. Battery System Maintenance (page 5-46)
Section V. Lighting System Maintenance (page 5-70)
Section VI. Wiring Circuits and Harness Maintenance (page 5-99)
Section VII. Instrumentation, Sending Units, Circuit Breakers, Switches, and Horn Maintenance (page 5-140)

b. Each section is preceded by a list that provides a breakdown of the procedures covered in that section and provides a paragraph and page number leading you to each task.

Section I. IGNITION SYSTEM MAINTENANCE

5-2. General

This section provides maintenance procedures assigned to the organizational level for the ignition system. To find a specific procedure, see the maintenance task summary below.

5-3. Ignition System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-4.	Distributor Cover and Cap a. Removal b. Cleaning and Inspection c. Disassembly d. Reassembly e. Installation	5-2
Para 5-5. DELETED.		
5-6.	Solid-State Ignition a. Removal b. Installation c. Adjustment	5-10
5-7.	Distributor a. Removal b. Installation	5-16
5-8.	Distributor Mounting Adapter a. Removal b. Installation	5-20
5-9.	Ignition Coil a. Removal b. Installation	5-22

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5-3. Ignition System Maintenance Task Summary (Cont'd)

TASK PARA	PROCEDURES	PAGE NO.
5-9.1.	Ignition Coil Capacitor a. Removal b. Inspection c. Testing d. Installation	5-24.2
5-10.	Spark Plug Cables a. Removal b. Installation	5-26
5-11.	Spark Plugs a. Removal b. Cleaning and Inspection c. Setting Gap d. Installation	5-28
5-12.	Ignition Timing a. DELETED b. Ignition Timing (All)	5-28
5-13.	Ignition Switch a. Removal b. Installation	5-28

5-4. Distributor Cover and Cap Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Disassembly
d. Reassembly
e. Installation

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10
TM 9-2320-218-10
Para 5-27

Condition Description
Parking brake set.
Hood raised and secured.
Negative battery ground cable disconnected.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
Four terminal seal washers
Dust and oil-free cloth

Personnel Required
One mechanic

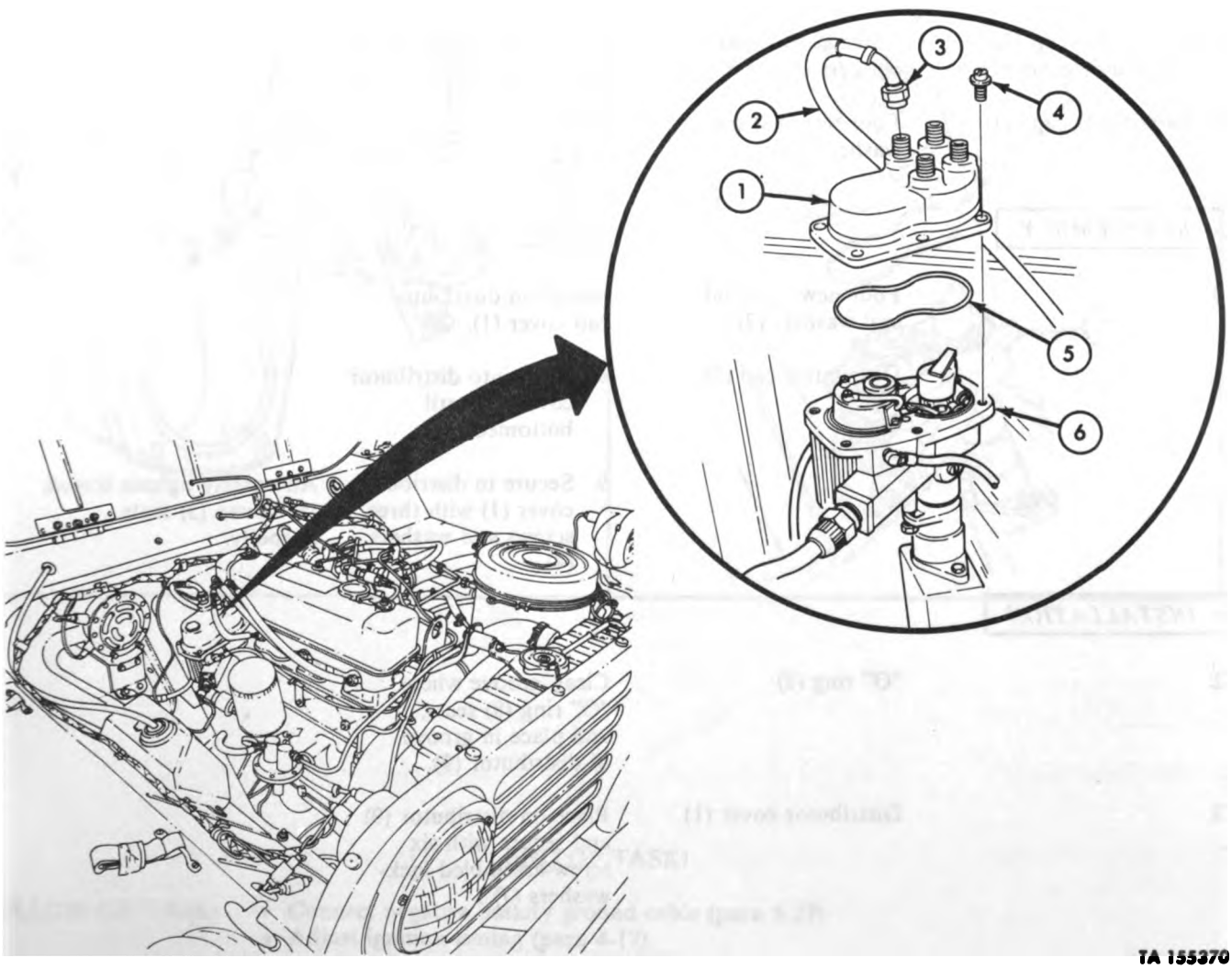
General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

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5-4. Distributor Cover and Cap Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Distributor (6)	Distributor cover (1)	Tag for proper spark plug cable (2) identification.	
2.	Distributor cover (1)	Four spark plug cables (2)	Unscrew cable nuts (3) and disconnect.	
3.		Six screw-assembled lockwashers (4).	Remove.	
4.	Distributor (6)	Distributor cover (1)	Remove.	
5.	Distributor cover (1)	"O" ring (5)	Remove.	



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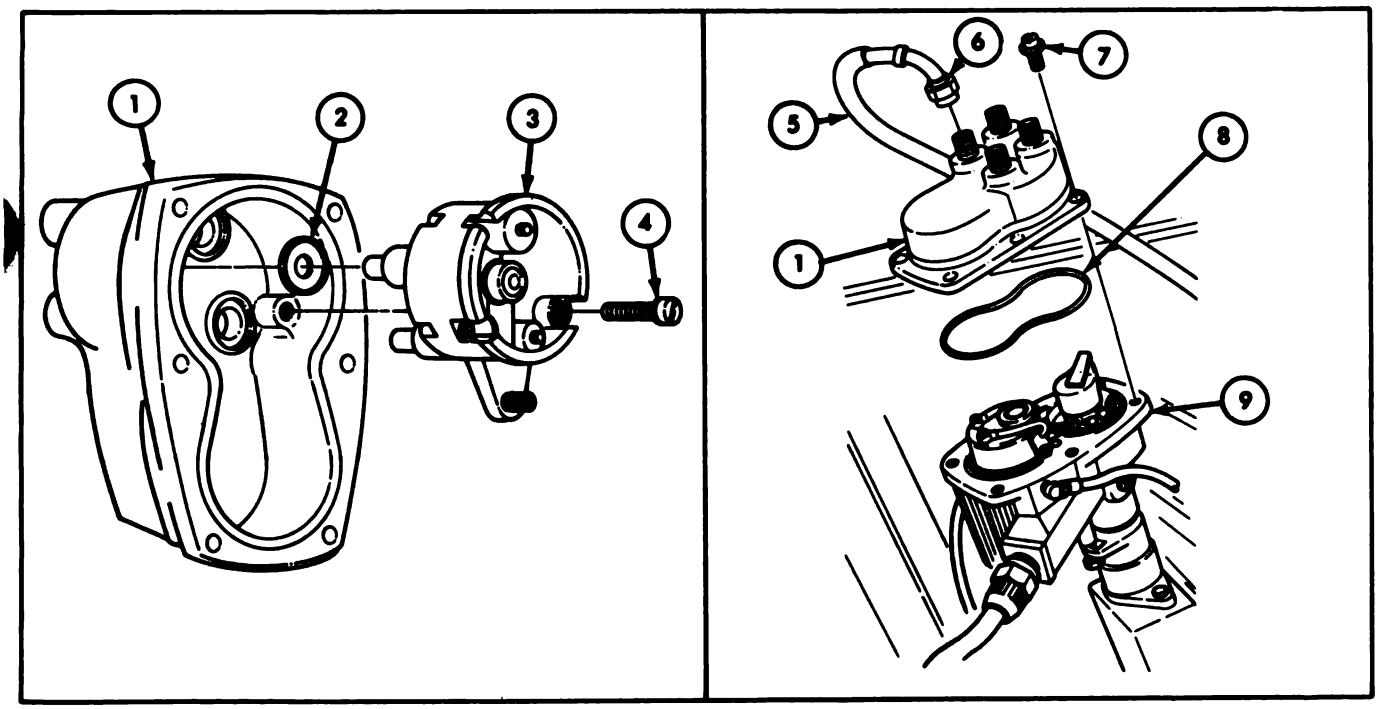
5-4. Distributor Cover and Cap Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. CLEANING AND INSPECTION			
6.		Distributor cover (1) and distributor cap (3)	*a.* Wipe clean.	Use dust and oil-free cloth.
			b. Inspect for cracks, pitting, and burrs.	Replace if cracked, pitted or burred.
7.		"O" ring (8)	Inspect for cracks, breaks, and flat spots.	Replace if cracked, broken, or flattened.
	c. DISASSEMBLY			
8.	Distributor cap (3) to distributor cover (1).	Three screws and washers (4)	Remove and pull cap (3) out of cover (1).	
9.	Distributor cap (1)	Four terminal seal washers (2)	Remove.	Discard.
	d. REASSEMBLY			
10.		Four new terminal seal washers (2)	Install on distributor cap cover (1).	
11.		Distributor cap (3)	*a.* Press into distributor cover (1) until bottomed.	
			b. Secure to distributor cover (1) with three screws and washers (4).	Alternately tighten screws (4) so cap (3) seats properly.
	e. INSTALLATION			
12.		"O" ring (8)	Clean groove where "O" ring (8) seats, and place in groove of distributor (9).	
13.		Distributor cover (1)	Place on distributor (9) and secure with six screw-assembled lock-washers (7).	

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5-4. Distributor Cover and Cap Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
14.		Four spark plug cables (5)	Connect to marked locations on distributor cover (1) and secure with four cable nuts (6).	Tighten cable nuts (6) finger tight, and then an additional 1/4-1/2 turn with 3/4 in. (19 mm) open-end wrench.



END OF TASK!

FOLLOW-ON TASK:
- Connect negative battery ground cable (para 5-27).
- Adjust ignition timing (para 4-17).

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5-6. Solid-State Ignition Maintenance

This task covers:

a. Removal
b. Installation
c. Adjustment

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All equipped with solid-state ignition	TM 9-2320-218-10	Parking brake set.
	Para 5-4	Distributor cover removed.
	Para 5-9	Ignition coil removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
Solid-state ignition kit
GAA grease
PL-S lubrication oil

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

- This procedure is for the Prestolite and Swiss Controls solid-state ignition kits. When maintenance difference exists, a note will precede the step.
- If solid-state ignition kit is replaced, submit QDR (SF 368) along with failed kit to manufacturer.
- If standard ignition components need to be replaced, use solid-state ignition kit components.

a. REMOVAL

1.	Distributor (5)	Rotor (1)	Remove from trigger wheel (3).	
2.	Module (6) to distributor (5)	Snap ring clip (2)	Remove and pull module (6) out of distributor (5).	If module (6) is replaced, submit QDR (SF 368) along with failed module (6) to manufacturer.

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5-6. Solid-State Ignition Maintenance (Cont'd)

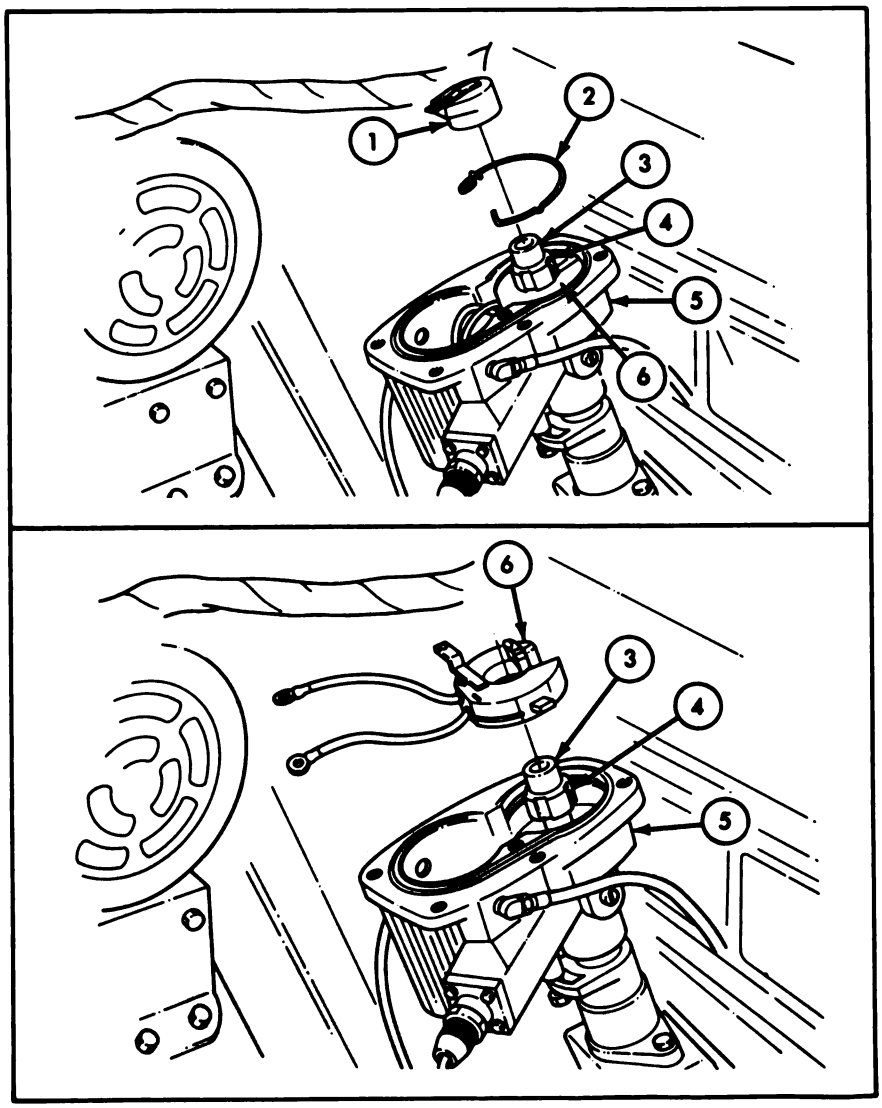
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

CAUTION

Before removing Prestolite trigger wheel (3), make sure rotor flat (4) location is marked on distributor. housing (5) to ensure correct installation. Not doing this will distort ignition timing. Do not crank engine when trigger wheel is removed.

NOTE

Do not remove the trigger wheel when installing a Swiss Controls ignition kit.



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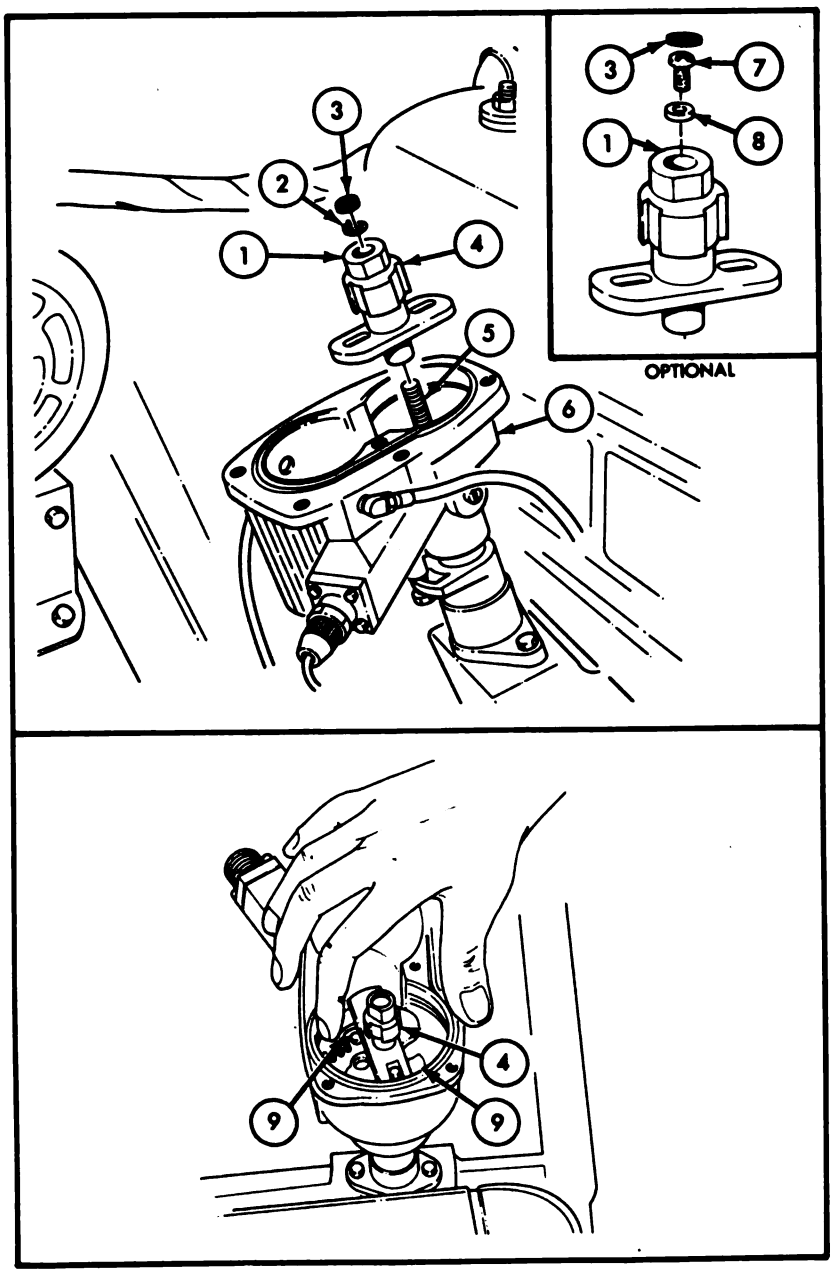
5-6. Solid-State Ignition Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.	Trigger wheel (1) to distributor (6)	Lubrication wick (3) and snap ring (2)	Remove and pull trigger wheel (1) out of distributor (6).	Discard trigger wheel (1).
		NOTE Step 4 applies to optional method of removing trigger wheel from the distributor shaft.		
4.	Trigger wheel (1) to distributor (6)	Lubrication wick (3) Allen screw (7), and sleeve (8)	Remove and pull trigger wheel (1) out of distributor (6).	
	b. INSTALLATION			
		NOTE The solid-state ignition kit and ignitor or module are warranted by the manufacturer. Upon installation of new components, note in vehicle log book component serial number, date of government acceptance, contract number, vehicle mileage at time of installation, date of installation, and name and address of manufacturer. Fill our warranty registration card and send to manufacturer immediately upon installation.		
5.		Distributor shaft (5)	Wipe lightly with GAA grease.	
6.		New trigger wheel (1)	*a.* Install over distributor shaft (5) so rotor flat (4) alines with mark on distributor (6). *b.* Secure with snap ring (2).	Distributor weights (9) must be spread apart for trigger wheel (1) to seat properly.
		NOTE Step 7 only applies to optional method of attaching trigger wheel to distributor shaft.		
7.		New trigger wheel (1)	*a.* Install over distributor shaft (5) so rotor flat (4) alines with mark on distributor (6).	Distributor weights (9) must be spread apart for trigger wheel (1) to seat properly.

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5-6. Solid-State Ignition Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			b. Secure with sleeve (8) and Allen screw (7).	
8.		Lubrication wick (3)	Lubricate with one or two drops of PL-S oil and install on trigger wheel (1).	



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5-6. Solid-State Ignition Maintenance (Cont'd)

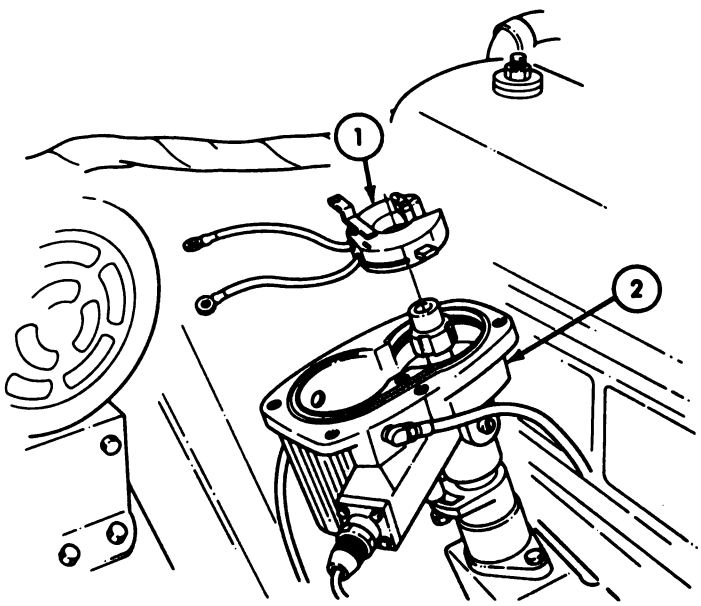
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
9.		New module (1)	Place in distributor (2) and secure with snap ring (4).	
10.		Rotor (3)	Install on trigger wheel (5).	

c. ADJUSTMENT

NOTE

No adjustment is required for Swiss Controls ignition kit. Adjustment is required for the Prestolite ignition kit covered in step 10.

11. Sensor assembly (9)	Sensor assembly adjusting screw (8)	*a.* Loosen and adjust air gap between sensor assembly (9) and trigger wheel contact (7) to .009-.012 inch (.228-.305 mm). *b.* Tighten adjusting screw (8) once correct gap is measured.	Use gage (6) included in ignition kit.

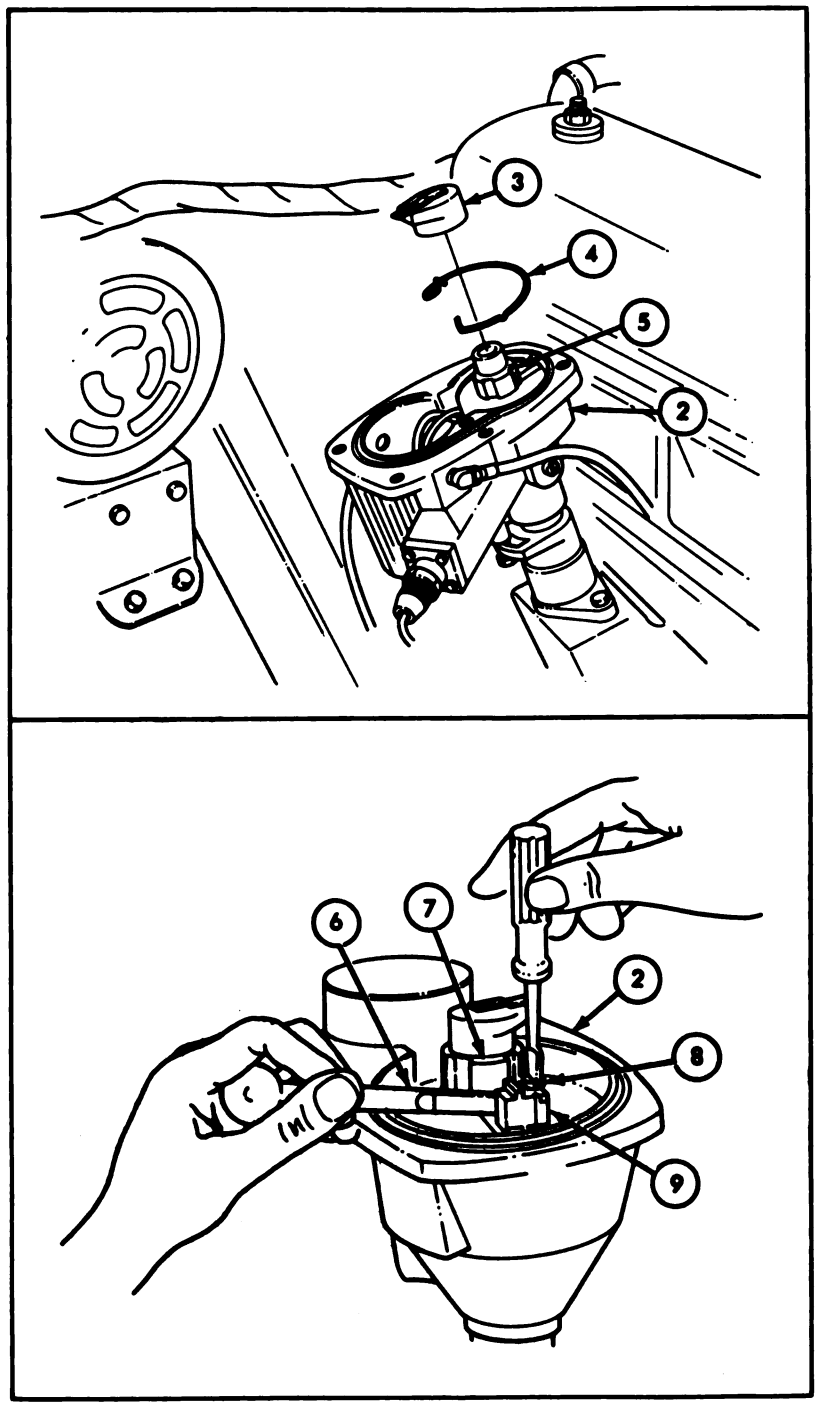


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5-6. Solid-State Ignition Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- **Install ignition coil (para 5-9).**
- **Install distributor cover (para 5-4).**

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5-7. Distributor Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
"O" ring

Personnel Required
One mechanic

General Safety Instructions
None

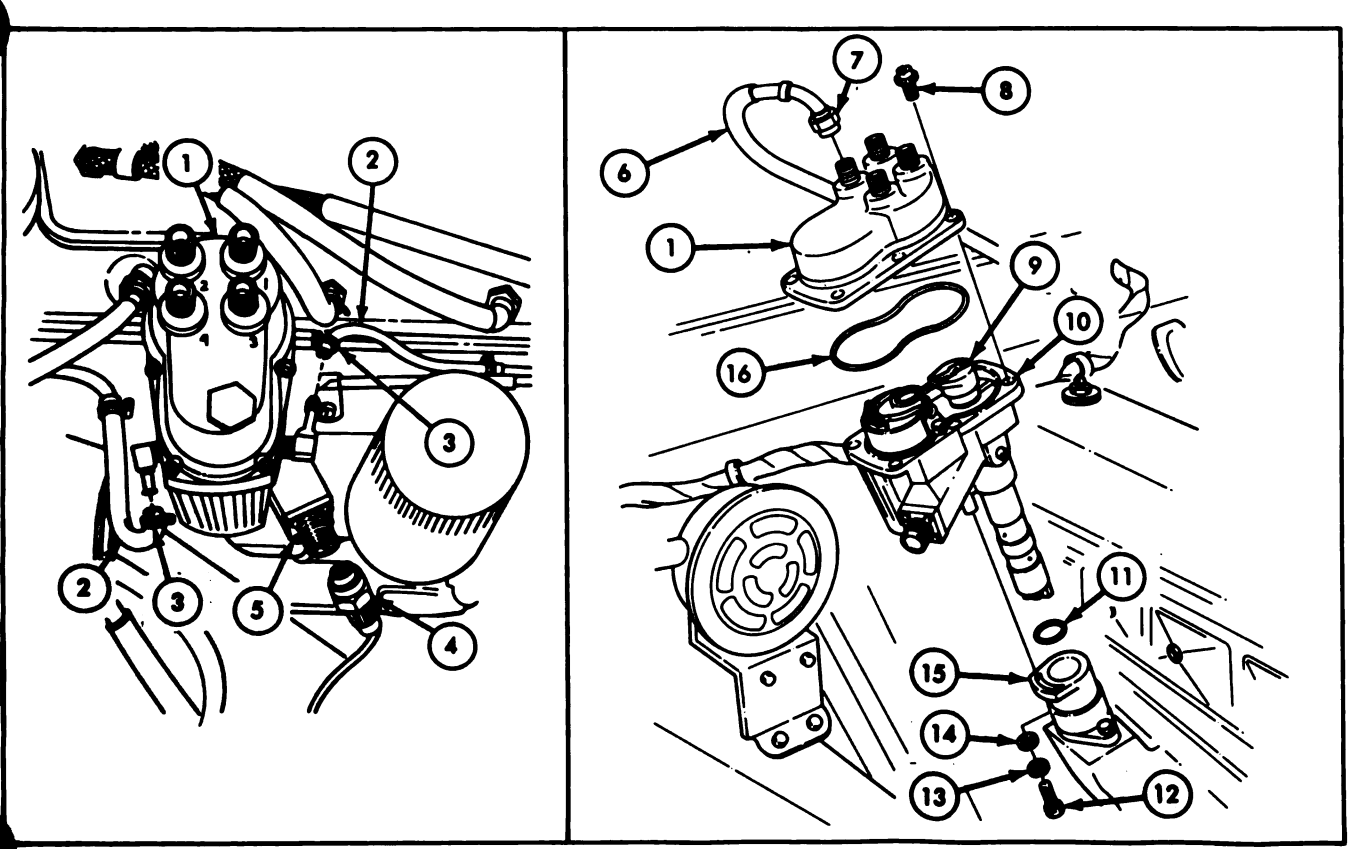
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Distributor (10)	Distributor cover (1)	Tag for proper spark plug cable (6) identification.	
2.	Distributor cover (1)	Four spark plug cables (6)	Unscrew cable nuts (7) and disconnect.	
3.	Capacitor receptacle (5)	Primary cable connector (4)	Disconnect.	
4.	Distributor (10)	Two vent hoses (2)	Loosen two clamps (3) and disconnect hoses (2).	Note location for installation.
5.	Distributor cover (1) to distributor (10)	Six screw-assembled lockwashers (8)	Remove.	
6.	Distributor (10)	Distributor cover (1) and "O" ring (16)	Remove.	

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5-7. Distributor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		CAUTION To ensure distributor installation is the same as removal, the position of the distributor rotor must be marked on engine block and distributor before removal.		
7.		Distributor rotor (9)	Mark position.	
8.	Distributor (10) to mounting adapter (15)	Mount screw (12), lockwasher (13), and flat washer (14)	Remove.	
9.		Distributor (10)	Lift out of mounting adapter (15) and remove "O" ring (11).	Discard "O" ring (11).



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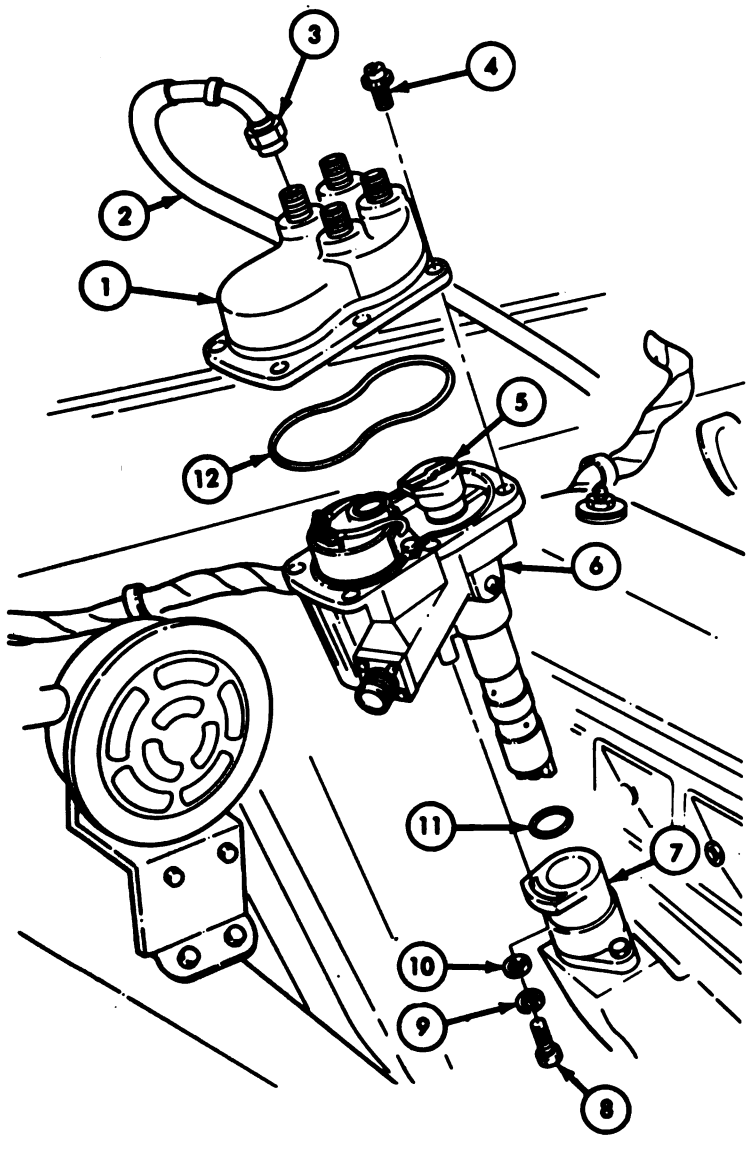
5-7. Distributor Maintenance (Cont'd)

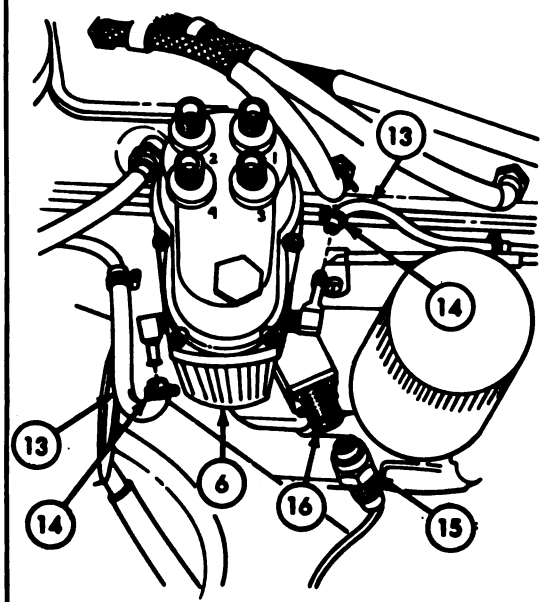
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			NOTE If distributor intermediate drive shaft is removed or disturbed, refer to para 5-8.	
		b. INSTALLATION		
10.		New "O" ring (11)	Install on distributor (6).	
11.		Distributor (6)	*a.* Position in mounting adapter (7) with distributor rotor (5) in the same position as in step 7.	
			NOTE Make sure distributor is flush against mounting adapter.	
			b. Secure with flat washer (10), lock-washer (9), and mount screw (8).	
12.		Two vent hoses (13)	Connect to distributor (6) and secure with two clamps (14).	
13.		"O" ring (12) and distributor cover (1)	Place on distributor (6) and secure with six screw-assembled lock-washers (4).	
14.		Primary cable connector (15)	Connect to capacitor receptacle (16).	
15.		Four spark plug cables (2)	Connect to marked locations on distributor cover (1) and secure with four cable nuts (3).	Tighten cable nuts (3) fingertight, and then an additional 1/4-1/2 turn with 3/4 in. (19 mm) open-end wrench.

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5-7. Distributor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





END OF TASK!

FOLLOW-ON TASK: Adjust ignition timing (para 4-17).

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5-8. Distributor Mounting Adapter Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
OE/HDO oil
"O" ring
Two lockwashers

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-7	Parking brake set. Distributor removed.

Special Environmental Conditions
None

General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Distributor mounting adapter (4) to engine (6)	Two capscrews (2) and lockwashers (3)	Remove.	Discard lockwashers (3).
2.		Distributor mounting adapter (4)	Lift out of engine (6).	Do not allow intermediate drive shaft (1) to fall out.
3.	Distributor mounting adapter (4)	"O" ring (5)	Remove.	Discard "O" ring (5).
4.		Intermediate drive shaft (1)	Remove.	
	b. INSTALLATION			

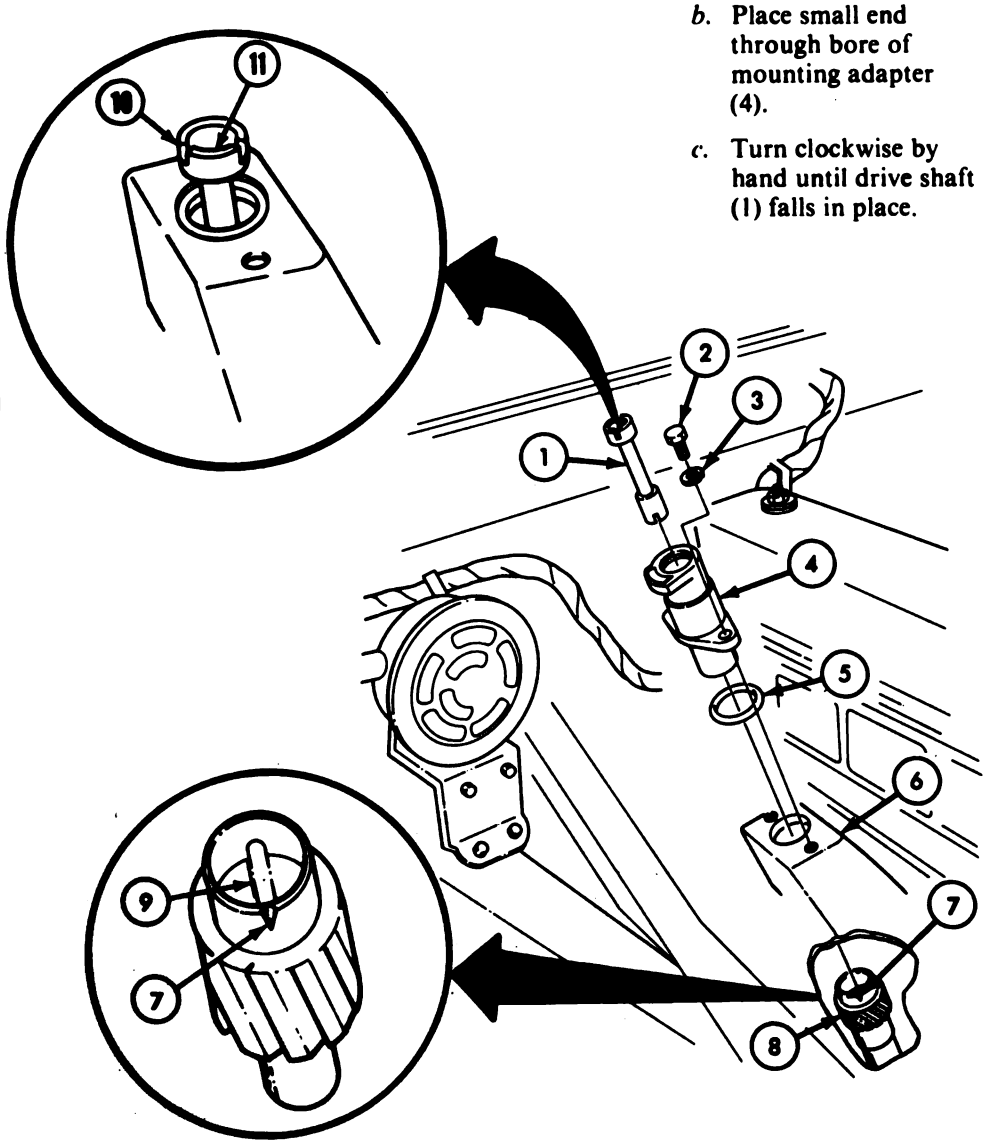
NOTE

If engine has been cranked with the distributor intermediate drive shaft removed, the notch (7) on top of oil pump shaft (8) must face toward front of engine to enable proper timing to be reset. Make sure keyway (9) is alined with notch (7). Crank engine to turn oil pump shaft (8).

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5-8. Distributor Mounting Adapter Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.		New "O" ring (5)	Install on mounting adapter (4).	
6.		Distributor mounting adapter (4)	Secure to engine (6) with two new lockwashers (3) and capscrews (2).	
7.		Intermediate drive shaft (1)	*a.* Coat with light film of OE/HDO oil.	
			b. Place small end through bore of mounting adapter (4).	Offset portion (11) of upper shaft (10) faces front of engine.
			c. Turn clockwise by hand until drive shaft (1) falls in place.	



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END OF TASK!

FOLLOW-ON TASK: Install distributor (para 5-7).

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5-9. Ignition Coil Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque wrench (0-200 lb-in)

Materials/Parts
Coil kit

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10 Para 5-4

Condition Description
Parking brake set.
Distributor cover removed.

Special Environmental Conditions
None

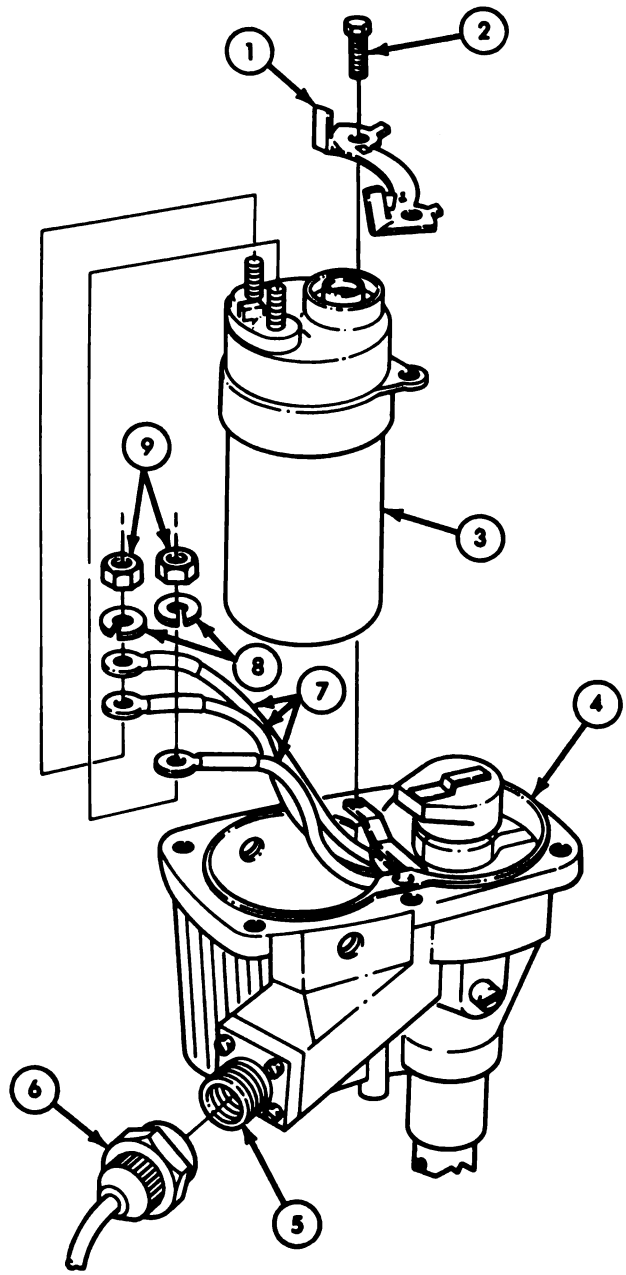
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Capacitor receptacle (5)	Primary circuit connector (6)	Disconnect.	
		NOTE When performing step 2, note that Swiss Control solid-state ignition distributor has three wire connections to coil and one ground wire connection. Prestolite solid-state ignition has three wire connections, and standard ignition has two wire connections.		
2.	Coil wires (7) to ignition coil (3)	Two nuts (9) and lockwashers (8)	Remove and detach wires (7) from coil (3).	
3.	Ignition coil (3) to distributor (4)	Two mounting screws (2) and locktab (1)	Remove and pull coil (3) out of distributor (4).	Discard locktab (1).

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5-9. Ignition Coil Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
4.		Ignition coil (3)	Place in distributor (4) and position new locktab (1) over mounting holes.	Locktab (1) will also hold wires (7) in place.



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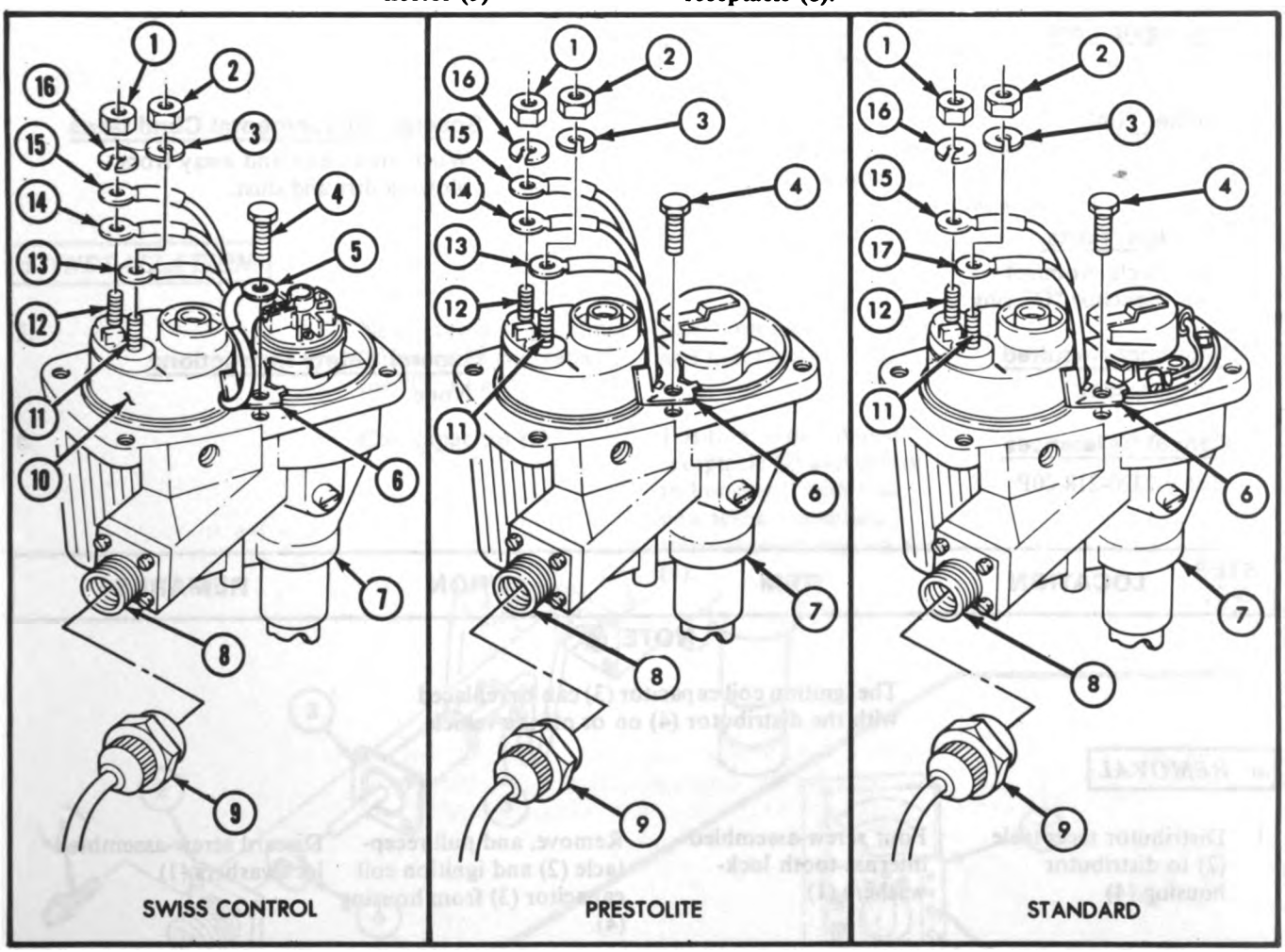
5-9. Ignition Coil Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE		
		Steps 5, 6, 7, and 8 apply only to Swiss Control solid-state ignition.		
5.		Locktab (6) and black control module ground wire (5)	Secure to distributor (7) at negative side of coil (10) with mounting screw (4).	Tighten 40-50 lb-in (4.5-5.6 N•m).
6.		Locktab (6)	Secure at remaining locktab hole with mounting screw (4).	Tighten 40-50 lb-in (4.5-5.6 N•m).
7.		Green control module negative wire (13)	Secure to coil negative terminal (11) with lockwasher (3) and nut (2).	
8.		Red control module positive wire (14) and black capacitor wire (15)	Secure to coil positive terminal (12) with lockwasher (16) and nut (1).	
		NOTE		
		Steps 9, 10, and 11 apply only to Prestolite solid-state ignition.		
9.		Locktab (6)	Secure to distributor (7) with two mounting screws (4).	Tighten 40-50 lb-in (4.5-5.6 N•m).
10.		Green control module negative wire (13)	Secure to coil negative terminal (11) with lockwasher (3) and nut (2).	
11.		Red control module positive wire (14) and black capacitor wire (15)	Secure to coil positive terminal (12) with lockwasher (16) and nut (1).	
		NOTE		
		Steps 12, 13, and 14 apply only to standard ignition.		
12.		Locktab (6)	Secure to distributor (7) with two mounting screws (4).	Tighten 40-50 lb-in (4.5-5.6 N•m).
13.		Condenser wire (17)	Secure to coil negative terminal (11) with lockwasher (3) and nut (2).	

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5-9. Ignition Coil Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
14.		Capacitor wire (15)	Secure to coil positive terminal (12) with lockwasher (16) and nut (1).	
		NOTE Step 15 is required for both solid state and standard ignition.		
15.		Primary circuit connector (9)	Connect to distributor receptacle (8).	



END OF TASK!

FOLLOW-ON TASKS:
- Adjust ignition timing (para 4-17).
- Install distributor cover (para 5-4)

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5-9.1. Ignition Coil Capacitor Maintenance

This task covers:

a. Removal
b. Inspection
c. Testing
d. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	Para 5-9	Ignition coil removed.

Test Equipment
Multimeter

Special Tools
None

Special Environmental Conditions
Work area clean and away from blowing dirt and dust.

Materials/Parts
Receptacle grommet
Coil capacitor "O" ring

Personnel Required
One mechanic

General Safety Instructions
None

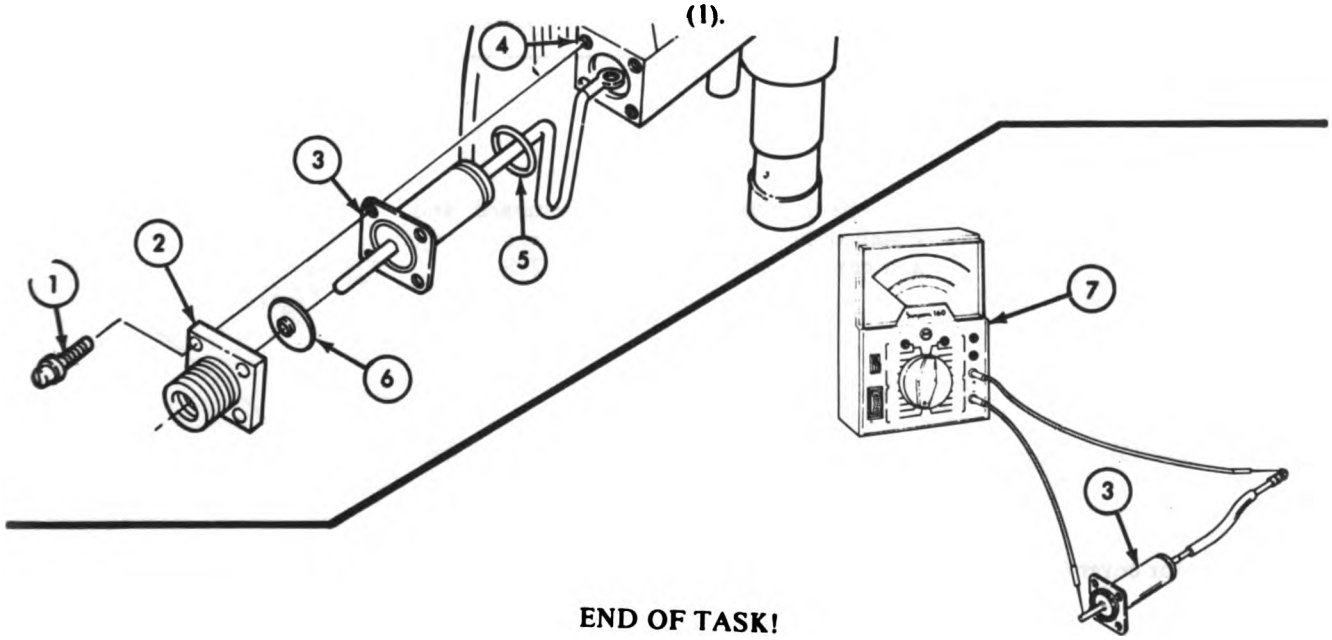
Manual References
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE		
		The ignition coil capacitor (3) can be replaced with the distributor (4) on or off the vehicle.		
		a. REMOVAL		
1.	Distributor receptacle (2) to distributor housing (4)	Four screw-assembled internal tooth lockwashers (1)	Remove, and pull receptacle (2) and ignition coil capacitor (3) from housing (4).	Discard screw-assembled lockwashers (1).
2.		Receptacle grommet (6) and coil capacitor "O" ring (5)	Remove from receptacle (2) and coil capacitor (3).	Discard grommet (6) and "O" ring (5).
		b. INSPECTION		
3.		Coil capacitor (3)	Inspect for loose or frayed terminal, and broken solder.	Replace capacitor (3) if lead is loose or frayed, or solder is broken.

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5-9.1. Ignition Coil Capacitor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
c. TESTING			**NOTE** When there are no apparent defects, the capacitor will be tested for resistance with a multimeter (7).	
4.		Ignition coil capacitor (3)	Test for resistance as follows:	
			a. "Zero" and set multimeter (7) to RX1 range.	
			b. Touch probes to either end of capacitor (3).	If multimeter (7) indicator reads any resistance, replace capacitor (3).
d. INSTALLATION				
5.		New receptacle grommet (6) and new coil capacitor "O" ring (5)	Install on receptacle (2) and coil capacitor (3).	
6.		Coil capacitor (3)	Position to distributor receptacle (2) and secure to housing () with four new screw-assembled internal tooth lockwashers (1).	



END OF TASK!

FOLLOW-ON TASK: Install ignition coil (para 5-9).

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5-10. Spark Plug Cables Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

All spark plug cables are removed and installed the same. Cable lengths are different, and can be found in TM 9-2320-218-20P.

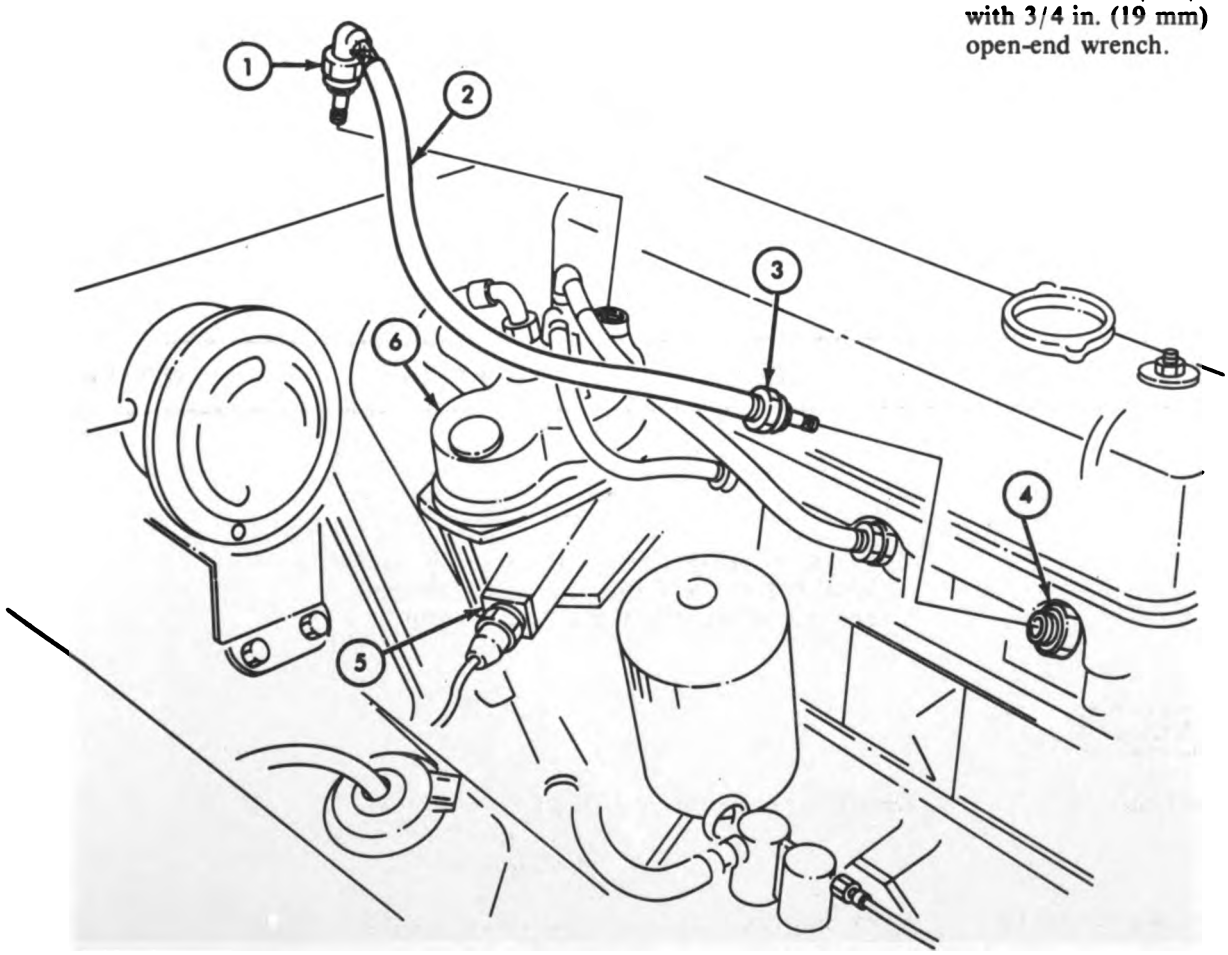
a. REMOVAL

1.	Distributor (5)	Distributor cover (6)	Tag for proper spark plug cable (2) identification.
2.	Distributor cover (6)	Spark plug cable (2)	Unscrew cable nut (1) and disconnect.
3.	Spark plug (4)	Spark plug cable (2)	Unscrew nut (3) and disconnect.

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5-10. Spark Plug Cables Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
			NOTE The spark plug cables must follow a smooth, natural path from spark plugs to distributor cover. Do not allow cables to become twisted or stressed during or after installation.	
4.		Spark plug cable (2)	*a.* Connect to spark plug (4) and secure with with cable nut (3).	
			b. Connect to distributor cover (6) and secure with cable nut (1).	Tighten cable nuts (1) and (3) finger tight, and then an additional 1/4-1/2 turn with 3/4 in. (19 mm) open-end wrench.



END OF TASK!

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5-11. Spark Plug Maintenance

Procedures for the removal, inspection, cleaning, setting gap, and installation of the spark plugs can be found in paragraph 4-15.

5-12. Ignition Timing Maintenance

Procedures for ignition timing can be found in paragraph 4-17.

5-13. Ignition Switch Maintenance

Procedures for the removal and installation of the ignition switch can be found in paragraph 5-71.

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Section II. STARTING SYSTEM MAINTENANCE

5-14. General

This section provides maintenance procedures assigned to the organizational level for the starting system. To find a specific procedure, see the maintenance task summary below.

5-15. Starting System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-16.	Starter Motor a. Removal b. Installation	5-30
5-17.	Starter Drive a. Removal b. Installation	5-32
5-18.	Starter Switch a. Removal b. Installation	5-34

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5-16. Starter Motor Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Starter to flywheel housing gasket

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable removed.
Para 10-14	Transmission cover panel removed.

Special Environmental Conditions
None

General Safety Instructions
- Make sure battery ground cable is disconnected.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

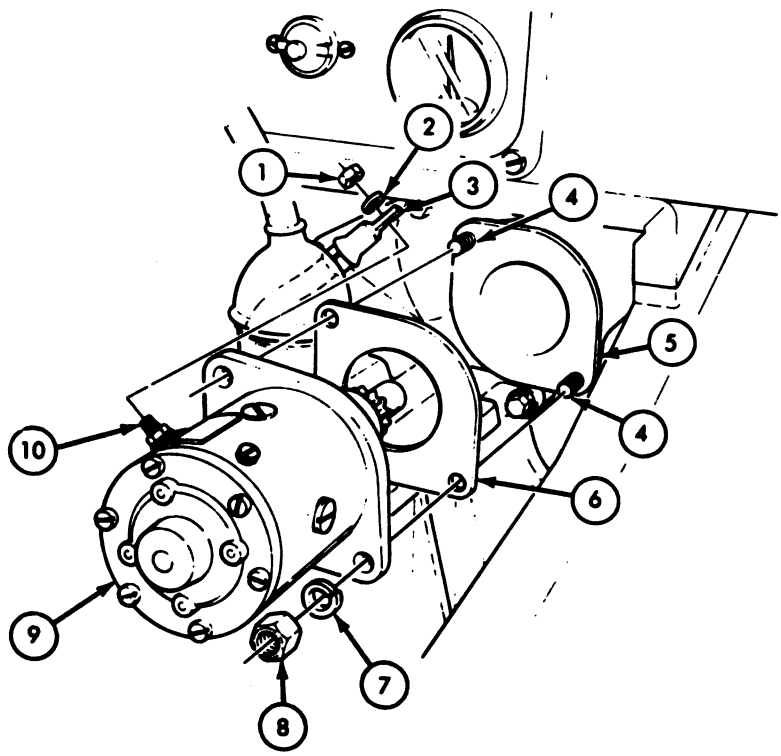
a. REMOVAL

1.	Starter cable (3) to starter (9)	Nut (1) and lockwasher (2)	Remove and disconnect starter circuit 6 wire (3) from starter terminal post (10).	
2.	Starter (9) to flywheel housing (5)	Two nuts (8) and lockwashers (7)	Remove.	

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5-16. Starter Motor Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.		Starter (9) and starter gasket (6)	Remove from flywheel housing (5).	Discard gasket (6). Scrape starter (9) and flywheel housing (5) mating surfaces clean of gasket (6) remains.
b. INSTALLATION				
4.		New gasket (6) and starter (9)	Secure to starter studs (4) on flywheel housing (5) with two lockwashers (7) and nuts (8).	
5.		Starter circuit 6 wire (3)	Connect to terminal (10) on starter (9) and secure with lockwasher (2) and nut (1).	



END OF TASK!

FOLLOW-ON TASKS:
- Install transmission cover panel (para 10-14).
- Connect negative battery ground cable (para 5-27).

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5-17. Starter Drive Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 5-16	Parking brake set. Starter motor removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Starter drive (1) to starter (5)	Screw (7)	Push back drive spring (2) and loosen screw (7).	
			NOTE Do not lose woodruff key when removing starter drive from starter.	
2.		Starter drive (1)	Slide off starter shaft (3), and remove woodruff key (4).	Save key (4) for re-use.

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5-17. Starter Drive Maintenance (Cont'd)

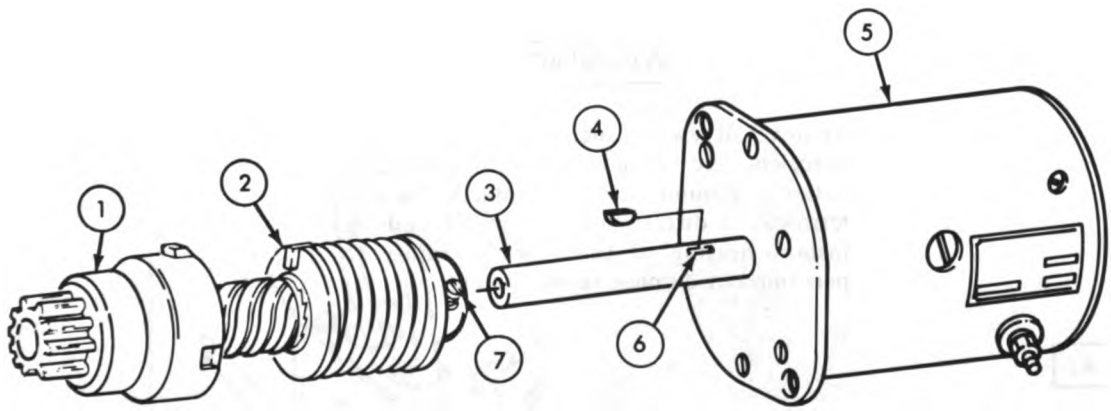
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

b. INSTALLATION

CAUTION

If the pinion and barrel assembly is accidentally rotated manually to a fully extended locked position on the screw shaft, do not attempt to force it in the reverse direction. The unit can be installed on the vehicle with pinion and barrel locked in extended position. It will release as soon as the engine operates at a speed high enough to demesh the detent pin in the pinion.

3.		Woodruff key (4)	Place in keyway (6) on starter shaft (3).
4.		Starter drive (1)	Slide on starter shaft (3) over woodruff key (4), and secure with screw (7).



END OF TASK!

FOLLOW-ON TASK: Install starter motor (para 5-16).

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5-18. Starter Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
- Make sure battery ground cable is disconnected.
- Remove all jewelry.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel or damage to equipment.

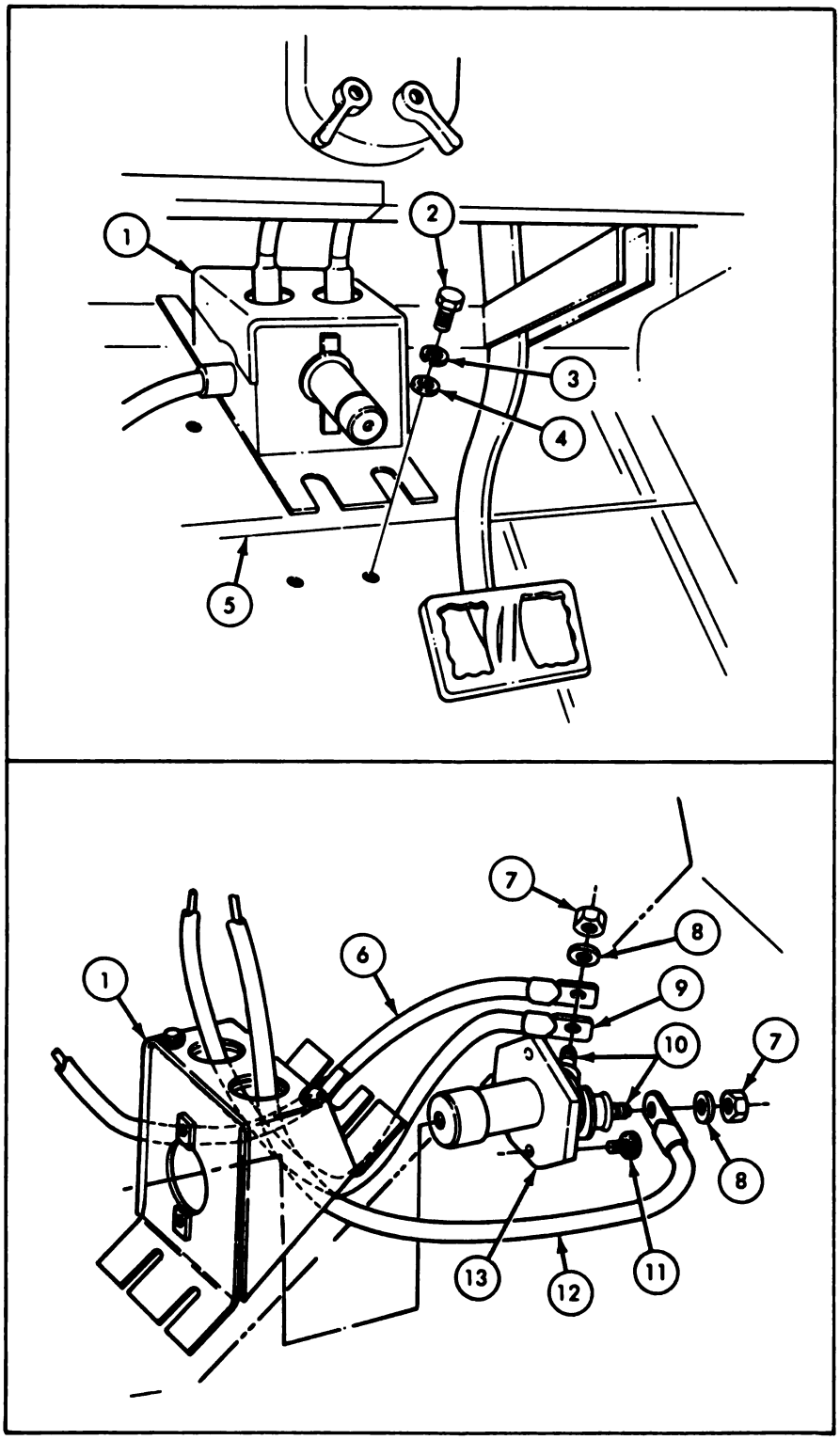
a. REMOVAL

1.	Starter switch bracket (1) to firewall (5)	Four capscrews (2), lockwashers (3), and flat washers (4)	Remove and pull switch bracket (1) clear of firewall (5).	
2.	Starter switch terminals (10)	Two nuts (7) and lockwashers (8).	Remove and disconnect two circuit 6 wires (9) and (12), and one circuit 5 wire (6).	Note wire locations for installation.
3.	Starter switch (13) to switch bracket (1)	Two screw-assembled lockwashers (11)	Remove and detach switch (13) from bracket (1).	

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5-18. Starter Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

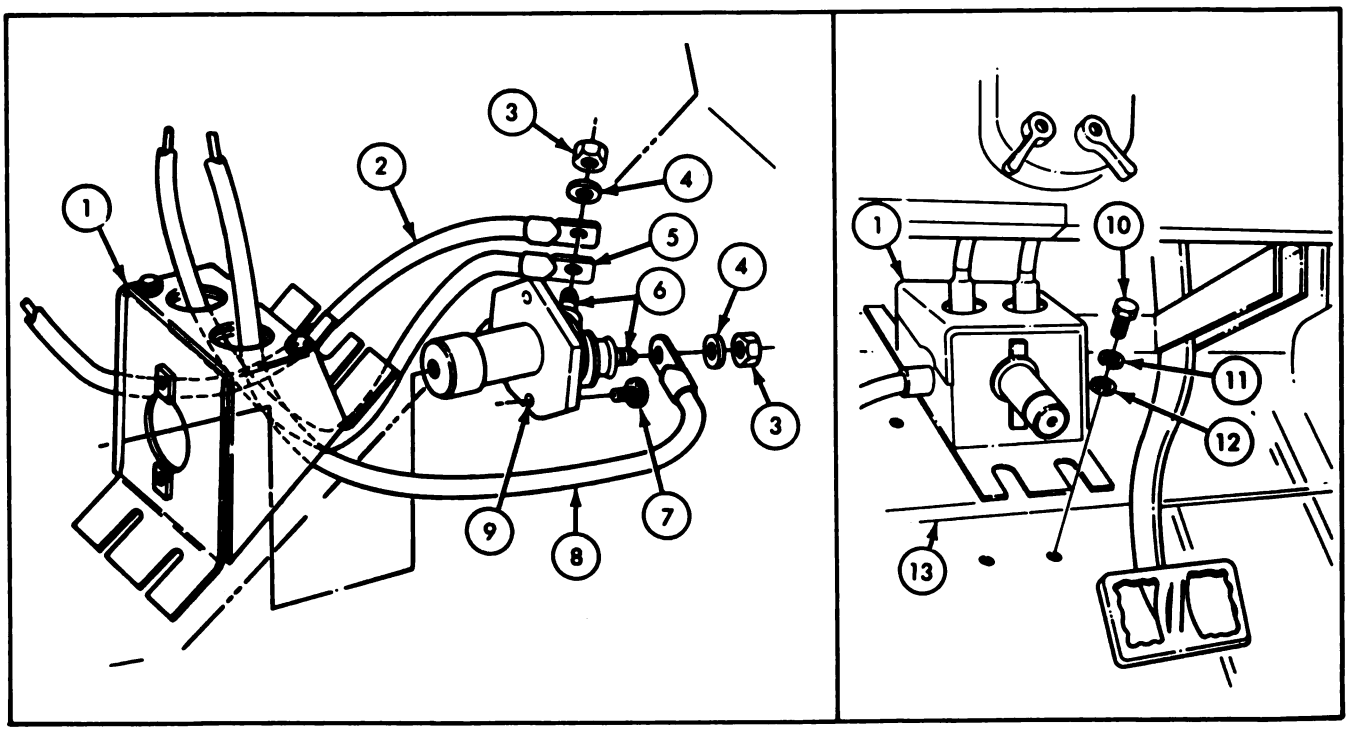


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5-18. Starter Switch Maintanance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
4.		Starter switch (9)	Place in bracket (1), and secure with two screw-assembled lockwashers (7).	
5.		One circuit 5 wire (2) and two circuit 6 wires (5) and (8)	Connect to starter switch terminals (6), and secure with two lockwashers (4) and nuts (3).	Connect to same terminals as disconnected.
6.		Starter switch bracket (1)	Secure to firewall (13) with four flat washers, (12), lockwashers (11), and capscrews (10).	



END OF TASK!

FOLLOW-ON TASKS: Connect negative battery ground cable (para 5-27).

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Section III. GENERATING SYSTEM MAINTENANCE

5-19. General

This section provides maintenance procedures assigned to the organizational level for the generating system. To find a specific procedure, see the maintenance task summary below.

5-20. Generating System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-21.	Alternator (60 Ampere) a. Removal b. Installation c. Voltage Regulator Adjustment	5-38
5-22.	Alternator (60 Ampere) Pulley a. Removal b. Installation	5-42
5-23.	Alternator Adjusting Arm and Mounting Bracket a. Removal b. Installation	5-44

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5-21. Alternator (60 Ampere) Maintenance

This task covers:

a. *Removal*
b. *Installation*
c. *Voltage Regulator Adjustment*

INITIAL SETUP:

Applicable Models
All

Test Equipment
Multimeter

Special Tools
None

Materials/Parts
Sealing compound (NSN 8030-01-054-0740)
Adhesive sealant (NSN 8030-00-833-9563)
Two lockwashers
Two locknuts

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10
Para 4-59
Para 4-28
Para 5-27

Condition Description
Parking brake set.
Drivebelts removed.
Air cleaner removed.
Negative battery ground cable disconnected.

Special Environmental Conditions
None

General Safety Instructions
Make sure battery ground cable is disconnected.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

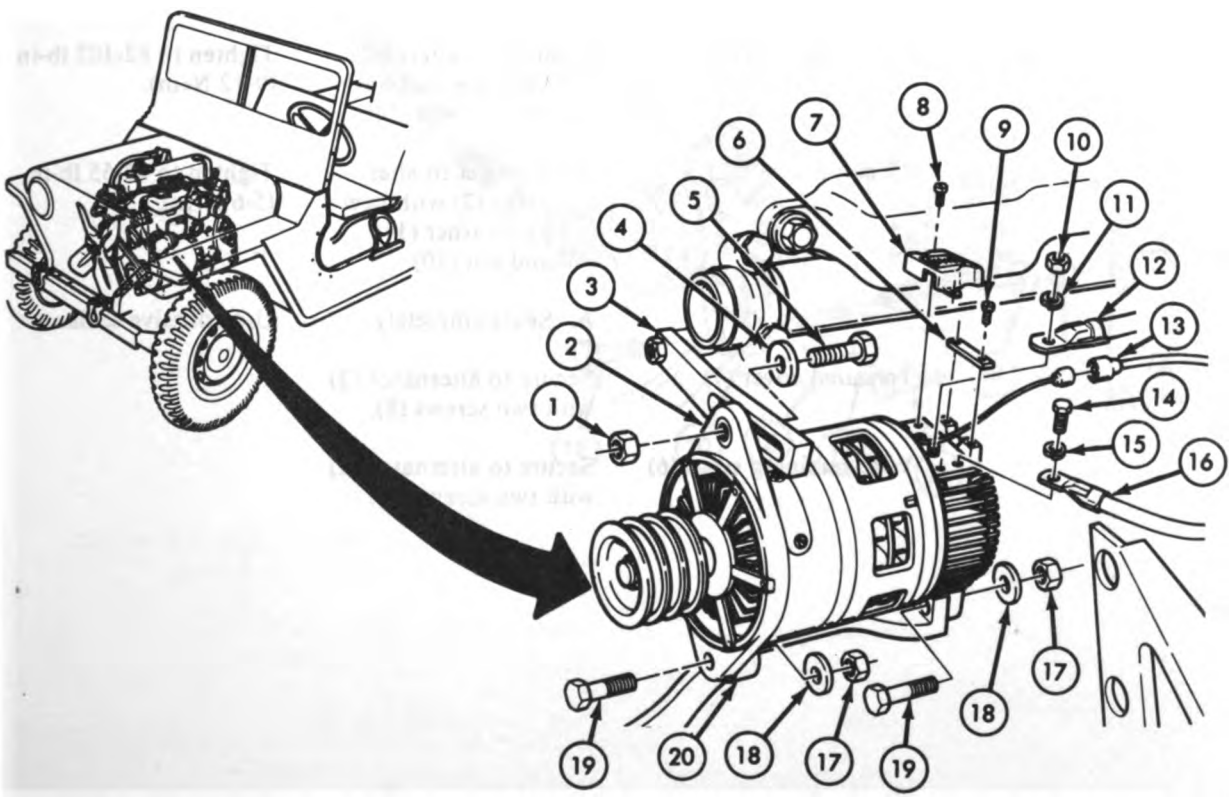
a. REMOVAL

1.	Terminal cover (7) to alternator (2)	Two screws (8)	Remove and pry terminal cover (7) loose from sealant.	
2.	Wire retaining strap (6) to alternator (2)	Two screws (9)	Remove and lift strap (6) off.	

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5-21. Alternator (60 Ampere) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE Remove sealant before removing circuit 5 wire. After removal, make sure terminal area is thoroughly cleaned.		
3.	Circuit 5 wire (12) to alternator (2)	Nut (10) and lockwasher (11)	Remove and disconnect circuit 5 wire (12).	Discard lockwasher (11).
4.	Circuit 3 wire (16) to alternator (2)	Bolt (14) and lockwasher (15)	Remove and disconnect circuit 3 wire (16).	Discard lockwasher (15).
5.	Rear of alternator (2)	Circuit 568 wire connector (13)	Disconnect.	
6.	Alternator (2) to adjusting arm (3)	Nut (1), washer (4), and bolt (5)	Remove.	
7.	Alternator (2) to alternator bracket (20)	Two locknuts (17), flat washers (18), and capscrews (19)	Remove and lift alternator (2) off bracket (20).	



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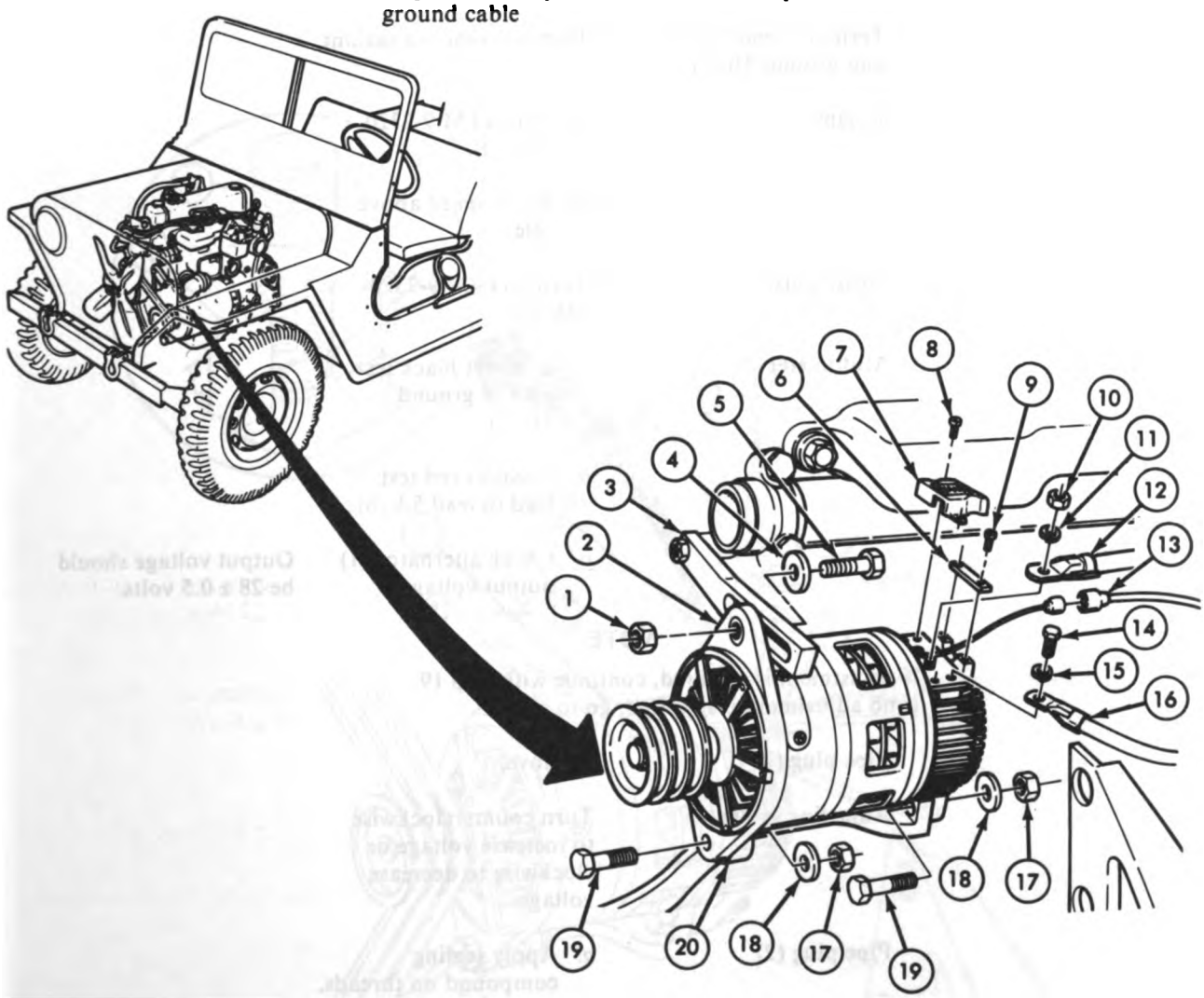
5-21. Alternator (60 Ampere) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
8.		Alternator (2)	*a.* Secure to bracket (20) with two capscrews (19), flat washers (18), and new locknuts (17).	Finger tighten locknuts (17).
			NOTE Adjustment arm bolt hole in alternator is threaded. Make sure bolt (5) is bottomed before nut (1) is installed.	
			b. Secure to adjusting arm (3) with washer (4), bolt (5), and locknut (1).	Finger tighten bolt (5) and locknut (1).
9.		Circuit 568 wire connector (13)	Reconnect.	
			NOTE Make sure wire connecting points are thoroughly clean before connections are made.	
10.		Circuit 3 wire (16)	Connect to alternator (2) with new lockwasher (15) and bolt (14).	Tighten to 82-102 lb-in (9-12 N•m).
11.		Circuit 5 wire (12)	*a.* Connect to alternator (2) with new lockwasher (11) and nut (10).	Tighten to 45-55 lb-in (5-6 N•m).
			b. Seal completely.	Use adhesive sealant.
12.		Terminal cover (7)	Secure to alternator (2) with two screws (8).	
13.		Wire retaining strap (6)	Secure to alternator (2) with two screws (9).	

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5-21. Alternator (60 Ampere) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
13.1.		Drivebelts	Install and adjust (para 4-59).	
13.2.		Air cleaner	Install (para 4-28).	
13.3.		Negative battery ground cable	Connect (para 5-27).	



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5-21. Alternator (60 Ampere) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. VOLTAGE REGULATOR ADJUSTMENT		
14.	Alternator (1)	Two screws (5), lockwashers (4), and terminal cover (3)	Remove.	Discard lockwashers (4).
15.		Terminal lead 5A (6) and ground 3B (7)	Remove adhesive sealant.	
16.		Engine	*a.* Start (TM 9-2320-218-10).	
			b. Raise speed above idle.	
17.		Headlights	Turn on (TM 9-2320-218-10).	
18.		Multimeter	*a.* Connect black test lead to ground 3B (7).	
			b. Connect red test lead to lead 5A (6).	
			c. Check alternator (1) output voltage.	Output voltage should be 28 ± 0.5 volts.

NOTE

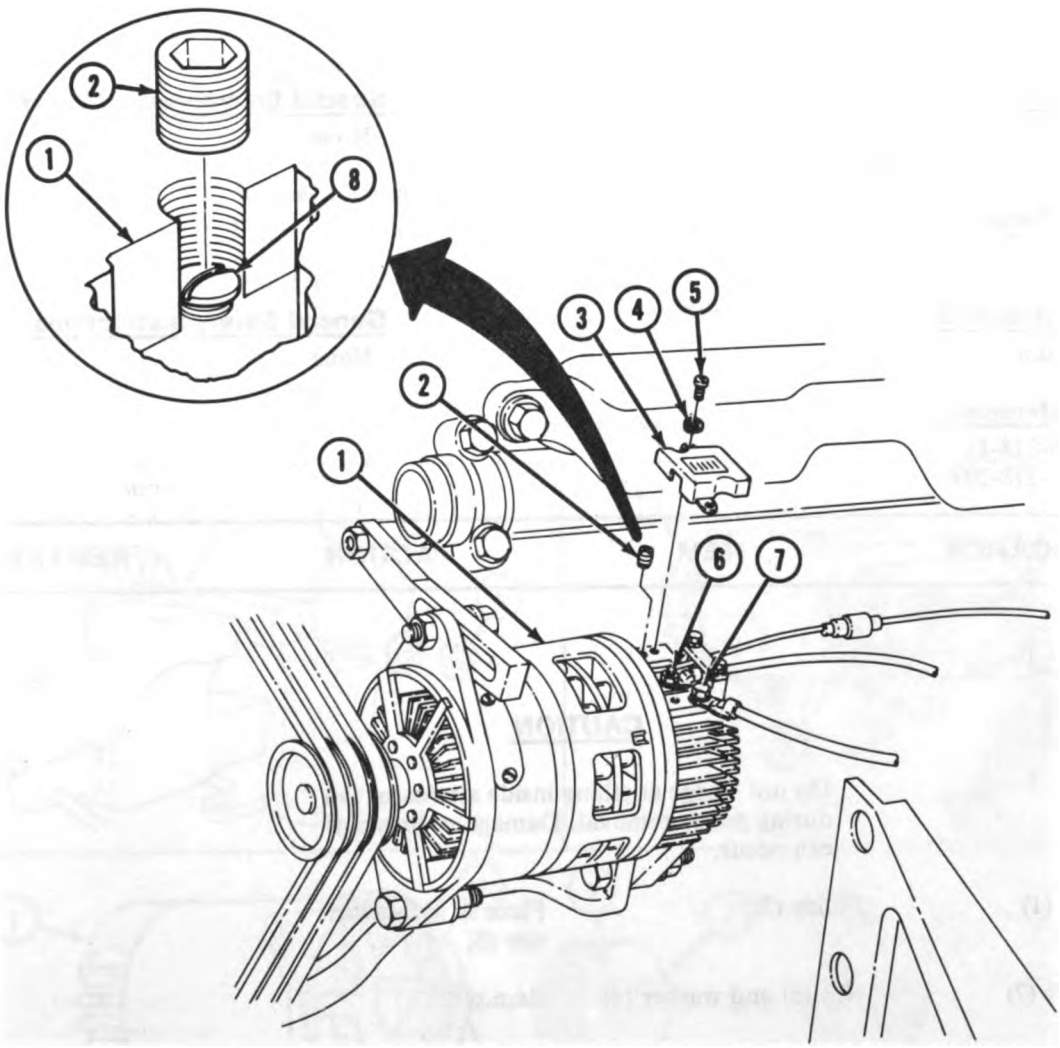
If adjustment is required, continue with step 19.
If no adjustment is required, go to step 23.

19.		Pipe plug (2)	Remove.	
20.		Adjusting screw (8)	Turn counterclockwise to increase voltage or clockwise to decrease voltage.	
21.		Pipe plug (2)	*a.* Apply sealing compound on threads.	
			b. Install in alternator (1).	Tighten 30-40 lb-in. (3-5 N•m).
22.		Headlights	Turn off (TM 9-2320-218-10).	
23.		Engine	Stop (TM 9-2320-218-10).	
24.		Terminal connections (6) and (7)	Coat with adhesive sealant.	

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5-21. Alternator (60 Ampere) Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
25.		Terminal cover (3)	Install on alternator (1) with two new lockwashers (4) and screws (5).	



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END OF TASK!

FOLLOW-ON TASKS:
- Install and adjust drivebelts (para 4-58).
- Install air cleaner (para 4-28).
- Connect negative battery ground cable (para 5-27).

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5-22. Alternator (60 Ampere) Pulley Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Pulley puller
Torque wrench (0-175 lb-ft)

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10
Para 5-21

Condition Description
Parking brake set.
Alternator removed.

Special Environmental Conditions
None

General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. REMOVAL

CAUTION

Do not wedge anything inside alternator fan during pulley removal. Damage or breakage can occur.

1.	Alternator (1)	Pulley (2).	Place in soft-jawed vise (3).	
2.	Pulley shaft (7)	Nut (5) and washer (4)	Remove.	
3.		Alternator (1) and pulley (2)	*a.* Remove from vise (3).	
			b. Position puller (6) to pulley (2) and shaft (7).	
			c. Remove pulley (2).	

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5-22. Alternator (60 Ampere) Pulley Maintenance (Cont'd)

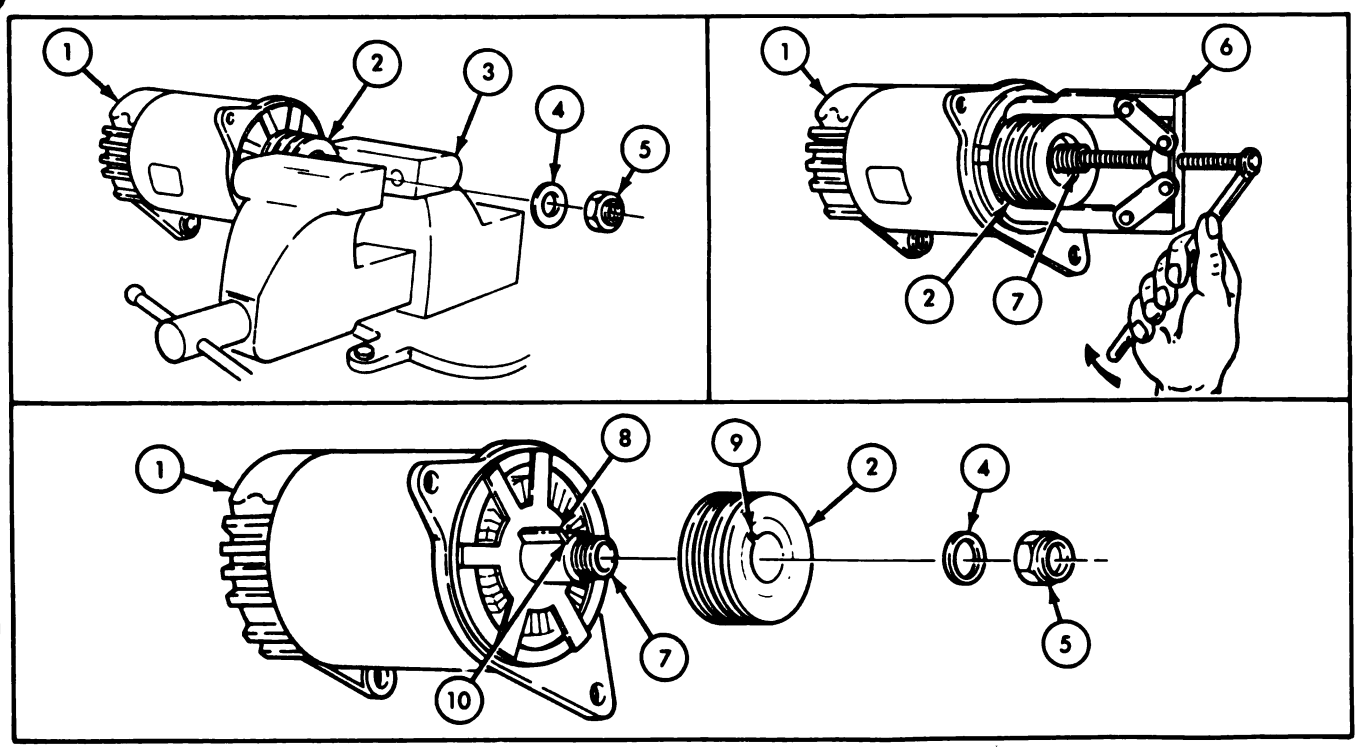
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

Do not remove woodruff key (8) from pulley shaft (7) unless it is absolutely necessary.

b. INSTALLATION

4.		Woodruff key (8)	Position to shaft keyway (10) with flat edge up.	
5.		Pulley (2)	Position to shaft (7) so pulley keyway (9) fits to shaft keyway (10).	
6.	Pulley shaft (7)	Washer (4) and nut (5)	Install.	Finger tighten only.
7.		Pulley (2)	Place in soft-jawed vise (3) so pulley (2) will not move.	
8.	Pulley shaft (7)	Nut (5)	Tighten to 40-50 lb-ft (54-67 N•m).	



END OF TASK!

FOLLOW-ON TASK: Install alternator (para 5-21).

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5-23. Alternator Adjusting Arm and Mounting Bracket Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque wrench (0-175 lb-ft)

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-21	Parking brake set. Alternator removed.

Special Environmental Conditions
None

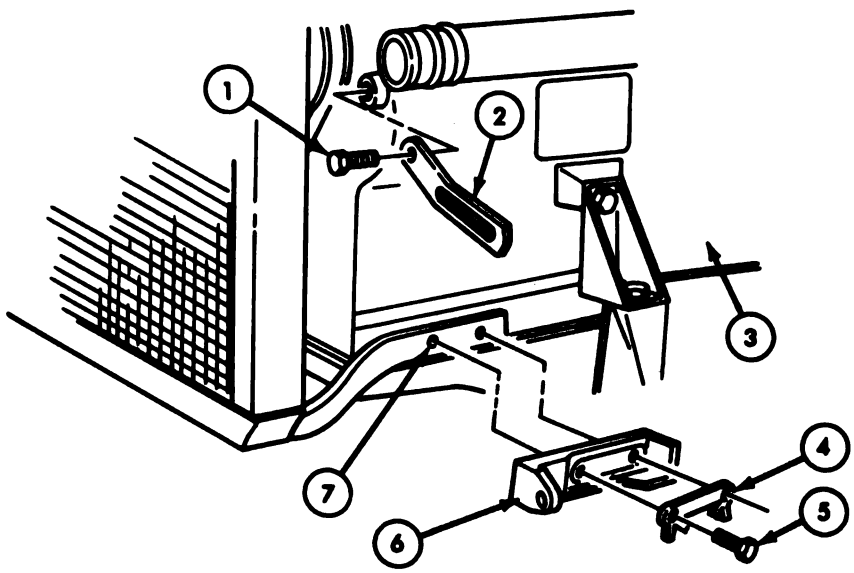
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Alternator adjusting arm (2) to engine block (3)	Bolt (1)	Remove.	
2.		Adjusting arm (2)	Remove from engine block (3).	
3.	Alternator mounting bracket (6) to engine block (3)	Locking tab washer (4)	Bend all tabs down.	
		NOTE Alternator mounting bracket also secures left radiator support bracket to engine.		
4.		Two capscrews (5) and tab washer (4)	Remove.	
5.		Mounting bracket (6)	Remove from engine block (3).	

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5-23. Alternator Adjusting Arm and Mounting Bracket Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
		NOTE		
		If any tabs on tab washer are broken, replace the washer.		
6.		Left radiator support (7) and mounting bracket (6)	Secure to engine block (3) with locking tab washer (4) and two capscrews (5).	Tighten 50-70 lb-ft (68-95 N•m).
7.		Locking tab washer (4)	Bend tabs up to lock capscrews (5).	
8.		Adjusting arm (2)	Secure to engine block (3) with bolt (1).	Tighten 47-56 lb-ft (64-77 N•m).



END OF TASK!

FOLLOW-ON TASK: Install alternator (para 5-21).

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Section IV. BATTERY SYSTEM MAINTENANCE

5-24. General

This section provides maintenance procedures assigned to the organizational level for the battery system. To find a specific procedure, see the maintenance task summary below.

NOTE

A battery junction terminal kit (12302542) has been developed providing a terminal to connect leads of accessory items (radios, slave receptacles, etc.). This will allow vehicle battery connections to remain in place when accessory items are installed.

5-25. Battery System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-26.	Battery System Servicing Instructions a. Reading Battery Indicator b. Checking Specific Gravity c. Adding Water d. Cleaning e. Inspection f. Charging	5-48
5-27.	Negative Battery Ground Cable a. Disconnection from Battery b. Reconnection to Battery c. Removal d. Installation	5-54
5-28.	Positive Battery Cable a. Removal b. Inspection c. Installation d. Removal (W/Battery Junction Terminal) e. Inspection f. Installation (W/Battery Junction Terminal)	5-58
5-29.	Battery Interconnecting Cable a. Removal b. Installation	5-62
5-30.	Battery Terminal Clamp a. Removal b. Cleaning c. Installation	5-64

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5-25. Battery System Maintenance Task Summary (Cont'd)

TASK PARA	PROCEDURES	PAGE NO.
5-31.	Battery Replacement a. Removal b. Installation.	5-66
5-32.	Battery Box Tray a. Removal b. Cleaning and Inspection c. Installation	5-68
5-32.1.	Battery Junction Terminal a. Removal b. Installation	5-68.2

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5-26. Battery System Servicing Instructions

This task covers:

a. Reading Battery Indicator
b. Checking Specific Gravity
c. Adding Water
d. Cleaning
e. Inspection
f. Charging

INITIAL SETUP:

Applicable Models
All

Test Equipment
Official battery tester

Special Tools
Rubber gloves

Materials/Parts
Baking soda solution
Oil-free cloth

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 9-6140-200-14

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable disconnected. (tasks *b, c, d, e,* and *f*).

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing batteries.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

- Battery acid (electrolyte) is extremely harmful. Always wear safety goggles and rubber gloves, and do not smoke when servicing batteries. Severe injury will result if acid contacts eyes or skin.
- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

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5-26. Battery System Servicing Instructions (Cont'd)

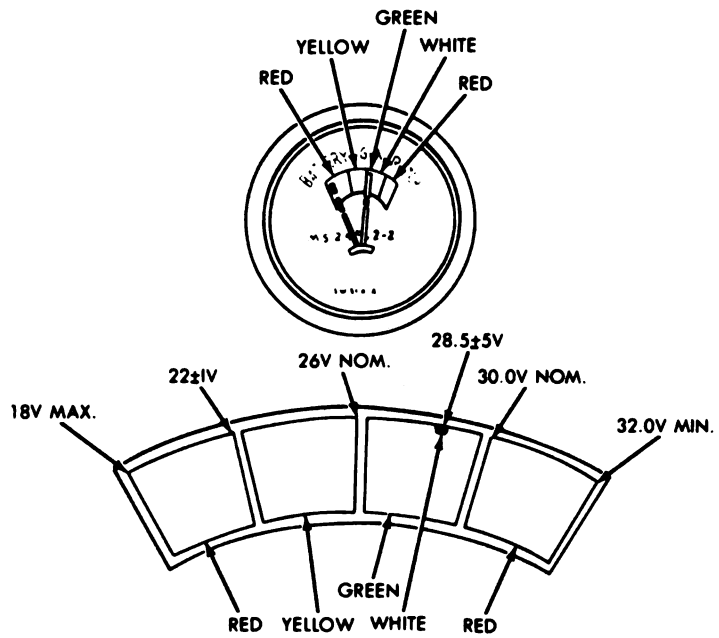
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

The battery-generator indicator (voltmeter) is located on the instrument panel, and is used to indicate battery system condition.

a. READING BATTERY INDICATOR

1.		Ignition switch	Turn to on position and observe the following meter readings:	See TM 9-2320-218-10.



INDICATION	BATTERY SYSTEM CONDITION
A. ENGINE OFF, IGNITION SWITCH "ON":	
1. LEFT RED	DEAD OR DEFECTIVE BATTERY; SHORT IN SYSTEM
2. LOW YELLOW	DISCHARGE OR DEFECTIVE BATTERY
3. MID YELLOW — VERY LOW GREEN	FULLY CHARGED BATTERY, NORMAL INDICATION
4. RIGHT RED	OVERCHARGED BATTERY
B. ENGINE RUNNING, HIGH IDLE:	
1. MOVES TO RIGHT	BATTERY BEING CHARGED, NORMAL
2. STOPS IN WHITE	MAXIMUM ALLOWABLE CHARGING VOLTAGE
3. STOPS IN LOW TO MID GREEN	NOMINAL LINE HAUL CHARGING VOLTAGE
C. ENGINE OFF AFTER IDLE:	
IGNITION SWITCH "ON":	
1. FALLS INTO OR BELOW LOW YELLOW	DEFECTIVE BATTERY CELL (LIGHTS OR ACCESSORIES ON)

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5-26. Battery System Servicing Instructions (Cont'd)

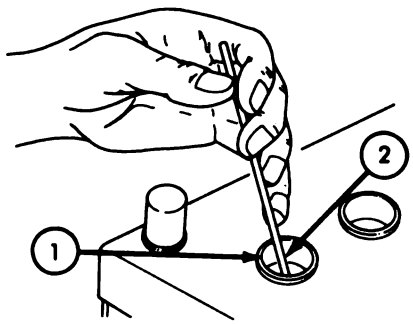
STEP NO.	LOCATION	ITEM	ACTION	REMARKS

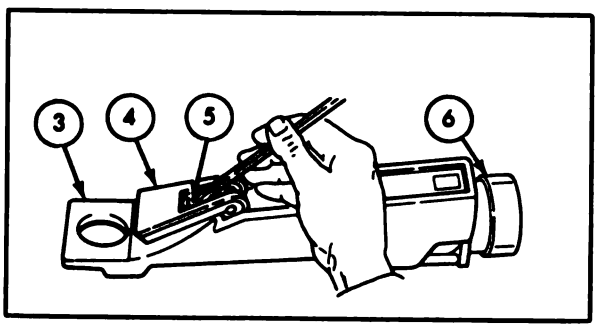
b. CHECKING SPECIFIC GRAVITY

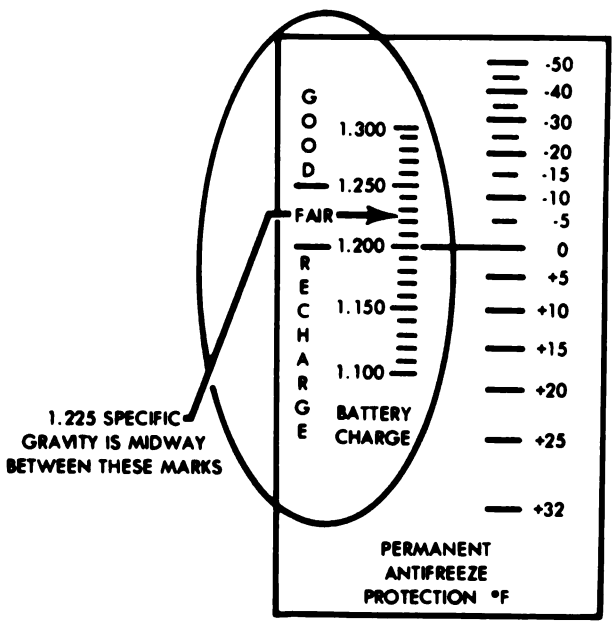
NOTE

Battery cells are to be tested separately before any water is added. There is no need to adjust for temperature when checking specific gravity.

2.







Check specific gravity with optical battery tester (3) as follows:

a. Clean tester plastic cover (4), measuring window (5), and eyepiece lens (6). — Use oil-free cloth.

b. Swing plastic cover (4), down until it rests against measuring window (5).

c. Insert black dipstick (2) into battery cell (1).

d. Place a few drops of electrolyte onto tester measuring window (5).

e. Point tester (3) to bright light source.

f. Look through eyepiece lens (6) and observe a rectangle with a battery charge reading scale on the left side.

g. Read the scale where the area of the shadow and light meet.

h. After reading is taken, clean window (5) and plastic cover (4). — Use oil-free cloth.

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5-26. Battery System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

- If temperature of electrolyte is over 120° F (49° C), and specific gravity is 1.280 or greater, batteries are being overcharged.
- If temperature of electrolyte is over 120° F (49° C), and specific gravity is 1.235-1.250, recharge the battery (para 5-26*f*).
- If specific gravity does not recover to 1.280 in 25 hours, replace battery (para 5-31).

c. ADDING WATER

CAUTION

Filling battery cells with undistilled water can shorten battery life.

NOTE

When adding water in cold weather, change battery to prevent freezing.

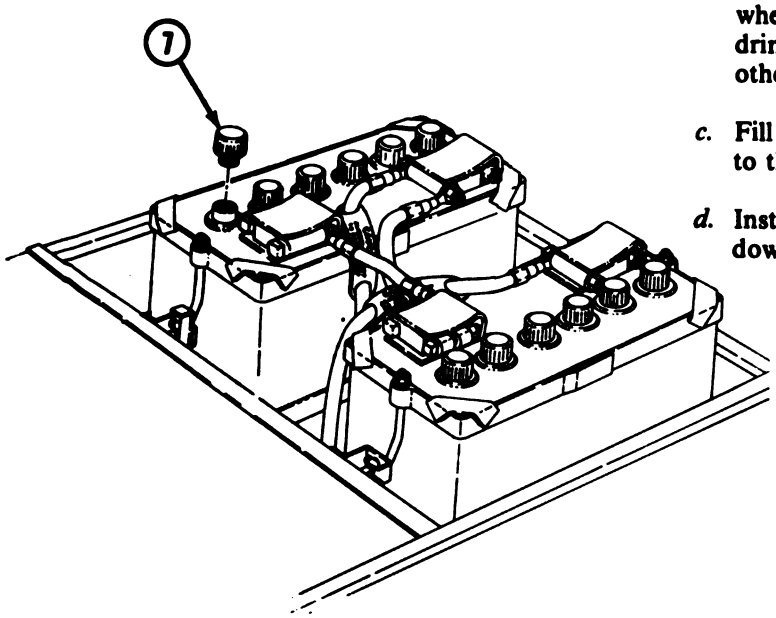
3. Add water to battery cell as follows:

a. Remove each filler cap (7).

b. Use distilled water when available. Use drinking water otherwise.

c. Fill each cell up to the fill ring. — Do not overfill.

d. Install and tighten down filler caps (7).



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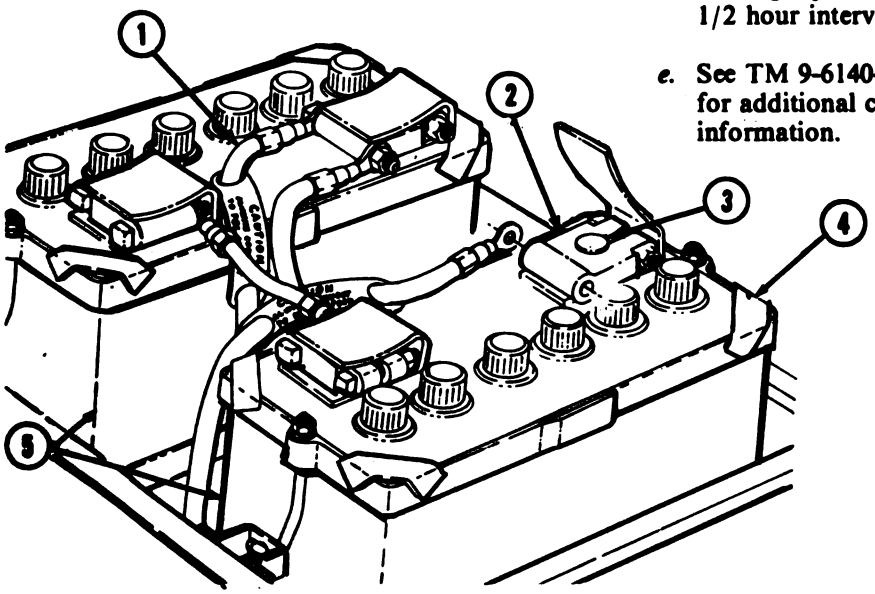
5-26. Battery System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	d. CLEANING			
			NOTE For additional information on battery cleaning, see TM 9-6140-200-14.	
4.		Two batteries (5), cables (1), and terminals (3)	Clean as follows:	
			a. Remove batteries (5) from vehicle.	See para 5-31.
			b. Apply baking soda water solution.	Neutralizes acid and corrosion.
			c. Let solution set for a few minutes.	
			d. Clean with wire brush, and wipe dry with a clean cloth.	
			e. Install batteries (5) in vehicle.	See para 5-31.
5.		Battery terminal clamps (2)	Remove from batteries (5).	See para 5-30.
6.		Battery terminals (3) and terminal clamps (2)	Clean to bare metal with terminal cleaning tool.	
7.		Battery terminal clamps (2)	Install on batteries (5).	See para 5-30.
	e. INSPECTION			
8.		Two batteries (5), terminals (3), cables (1), clamps (2), and tiedown (4)	Inspect for cracks, breaks and excessive corrosion	Replace if cracked, broken or corroded.
	f. CHARGING			
			CAUTION Disconnect both battery cables when charging an individual battery or a set of batteries while still in vehicle.	

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5-26. Battery System Servicing Instructions (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
9.			Charge batteries (5) as follows: *a.* Place on slow charge at not more than 10 amperes. *b.* Charge until cells gas freely or electrolyte exceeds 120°F (49°C). *c.* Reduce charge rate by 1/2 on each occurrence to remain within these restrictions, topping off at 1 ampere rate. *d.* To fully charge, top off until each cell has less than 25 points variation and an average specific gravity of 1.280 to 1.290, measured in three readings spaced at 1/2 hour intervals. *e.* See TM 9-6140-200-14 for additional charging information.	



END OF TASK!

FOLLOW-ON TASKS: Install negative battery ground cable (para 5-27).

TA 484760

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5-27. Negative Battery Ground Cable Maintenance

This task covers:

a. Disconnection from Battery
b. Reconnection to Battery
c. Removal
d. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Saftey goggles
Rubber gloves

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
Para 10-10	Passenger seat removed.
TM 9-2320-218-10	Battery box cover removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing battery system components.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

- Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.
- The negative battery ground cable must always be disconnected first and reconnected last. This will prevent accidental short circuiting of wiring, damage to equipment, or injury to personnel.

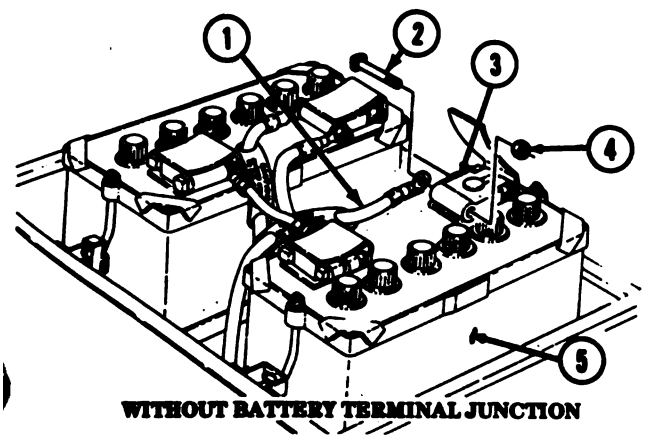
CAUTION

All battery terminals must be protected by rubber insulators. If insulator is missing, battery could short out against vehicle body or battery box cover.

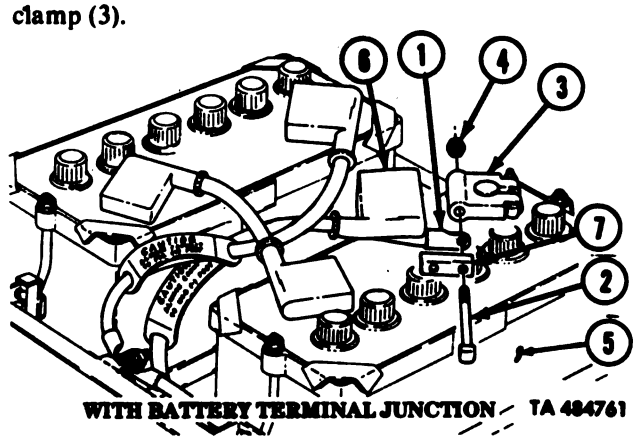
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5-27. Negative Battery Ground Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. DISCONNECTION FROM BATTERY			
1.	Negative battery ground cable (1) to terminal clamp (3)	Nut (4) and bolt (2)	Remove and pull cable (1) away from clamp (3).	Disconnect from clamp (3) on right battery (5) only, and make sure cable (1) cannot make contact with clamp (3).
		NOTE For vehicles equipped with battery terminal junction, perform steps 1.1 and 1.2.		
1.1.		Terminal clamp boot cover (6)	Remove from clamp (3) and slide back on cable (1).	
1.2.	Negative battery ground cable (1) to terminal clamp (3)	Nut (4), bolt (2), and support bracket (7)	Remove, and pull cable (1) away from clamp (3).	Disconnect from right battery (5) only, and make sure cable (1) cannot make contact with clamp (3).
	b. RECONNECTION TO BATTERY			
2.		Negative battery ground cable (1)	Secure to negative terminal clamp (3) with cable bolt (2) and nut (4).	Make sure cable (1) is secured to head end of bolt (2).
		NOTE For vehicles equipped with battery terminal junction, perform steps 2.1 and 2.2.		
2.1.		Negative battery ground cable (1)	Secure to negative terminal clamp (3) with support bracket (7), bolt (2) and nut (4).	Make sure cable (1) is secured to head end of bolt (2).
2.2.		Boot cover (6)	Install on terminal clamp (3).	



WITHOUT BATTERY TERMINAL JUNCTION



WITH BATTERY TERMINAL JUNCTION TA 484761

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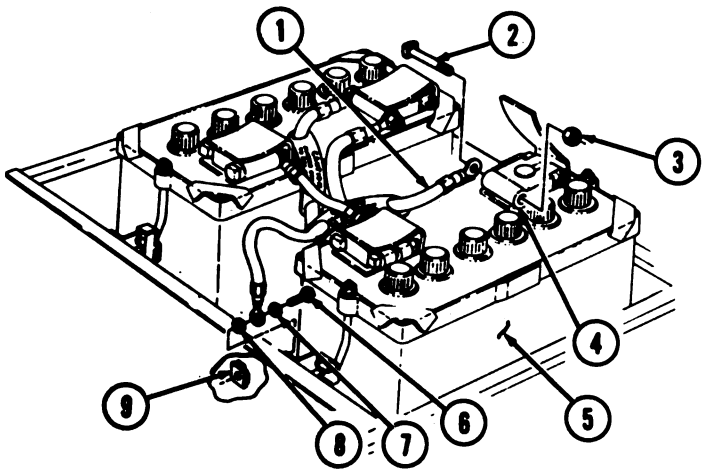
5-27. Negative Battery Ground Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	c. REMOVAL			
3.	Negative battery ground cable (1) to terminal clamp (4) of right battery (5)	Nut (3) and bolt (2)	Remove and pull cable (1) away from clamp (4).	
		NOTE		
		For vehicles equipped with battery junction terminal, perform steps 3.1, 3.2, and 3.3.		
3.1.	Negative battery ground cable (1) to terminal clamp (4) of right battery (5)	Terminal boot cover (10)	Remove from clamp (4) and slide back on cable (1).	
3.2.		Nut (3), bolt (2), and support bracket (11)	Remove and pull cable (1) away from clamp (4).	
3.3.	Cable (1)	Boot cover (10)	Remove.	
4.	Negative battery ground cable (1) to vehicle body (9)	Bolt (6) and two lockwashers (7) and (8)	Remove.	
5.		Ground cable (1)	Remove.	
	d. INSTALLATION			
		NOTE		
		• Make sure ground cable connection point is free of rust or corrosion.		
		• Make sure cables are properly positioned to avoid contact with battery box cover.		
6.		Ground cable (1)	*a.* Secure to vehicle body (9) with internal/external tooth lockwasher (8), external tooth lockwasher (7), and bolt (6).	Position external tooth lockwasher (7) at bolt side of cable (1).
			b. Secure to negative terminal clamp (4) of right battery (5) with bolt (2) and nut (3).	Make sure cable (1) is secured to head end of bolt (2).
		NOTE		
		For vehicles equipped with battery junction terminal, perform steps 6.1, 6.2, and 6.3.		
6.1.		Terminal boot cover (10)	Install on ground cable (1).	

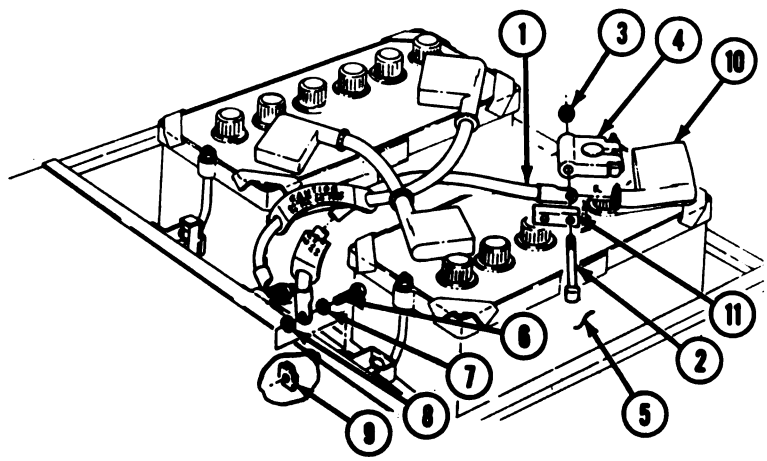
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5-27. Negative Battery Ground Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
6.2.		Ground cable (1)	Secure to negative terminal clamp (4) of right battery (5) with support bracket (11), bolt (2) and nut (3).	Make sure cable (1) is secured to head end of bolt (2).
6.3.		Terminal boot cover (10)	Install on terminal clamp (4).	



WITHOUT BATTERY TERMINAL JUNCTION



WITH BATTERY TERMINAL JUNCTION

END OF TASK!

FOLLOW-ON TASKS:
- Install battery box cover (TM 9-2320-218-10).
- Install passenger seat (para 10-10).
- Check for proper operation of electrical system components (TM 9-2320-218-10).

TA 484762

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5-28. Positive Battery Cable Maintenance

This task covers:

a. *Removal*
b. *Inspection*
c. *Installation*
d. *Removal (W/ Battery Junction Terminal)*
e. *Inspection*
f. *Installation (W/ Battery Junction Terminal)*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Safety goggles
Rubber gloves

Materials/Parts
Lockwasher

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10
Para 5-27

Condition Description
Parking brake set.
Negative battery ground cable disconnected.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing battery system components.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

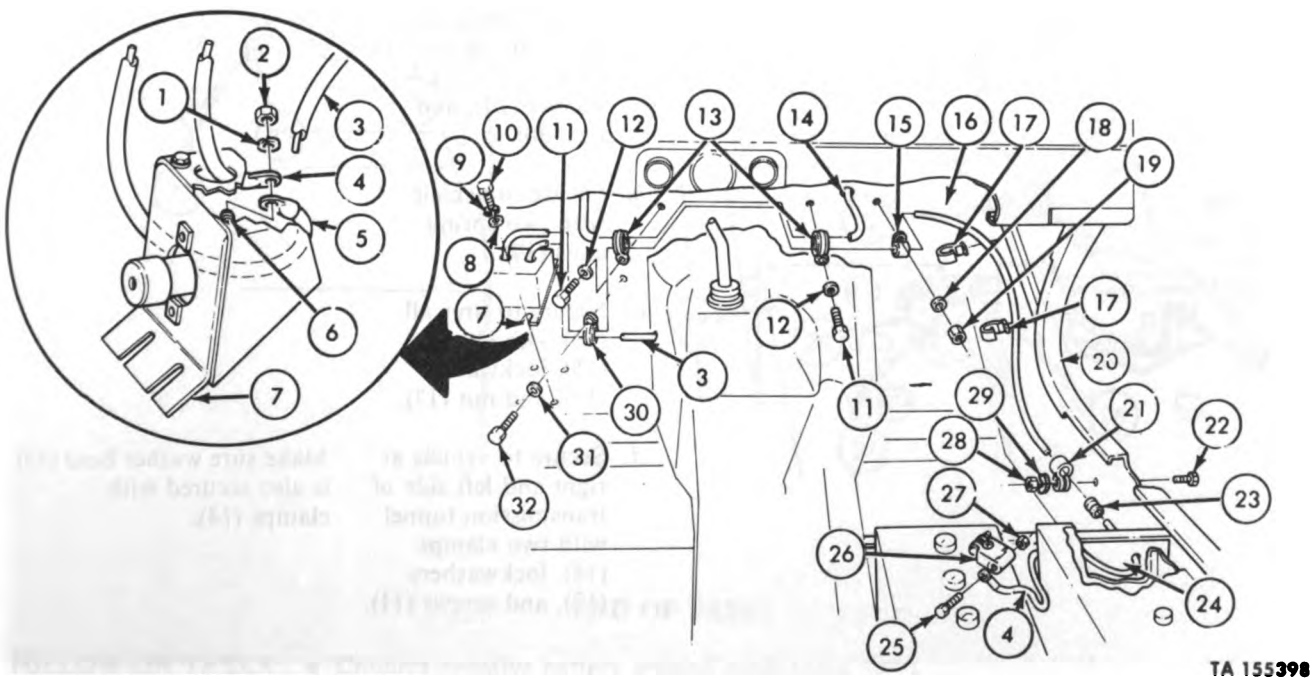
a. REMOVAL

1.	Positive battery cable (4) to battery terminal clamp (26)	Nut (27) and bolt (25)	Remove and pull cable (4) from clamp (26).	
2.	Positive battery cable (4) to right body sill (20)	Nut (28), lockwasher (29), screw (22), and clamp (21)	Remove and pull cable (4) out through grommet (23) on battery box (24).	Discard lockwasher (29).

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5-28. Positive Battery Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.	Right body sill (20)	Two spring clips (17) and positive battery cable (4)	Remove.	
4.	Positive battery cable (4) to firewall (16)	Nut (19), lockwasher (18) and clamp (15)	Remove.	
5.	Positive battery cable (4) to right and left side of transmission tunnel on firewall (16)	Two screws (11), lockwashers (12) and clamps (13)	Remove.	Two clamps (13) also secure washer hose (14) to firewall (16).
6.	Positive battery cable (4) to firewall (16) above accelerator pedal	Screw (32), lockwasher (31), and clamp (30)	Remove.	Clamp (30) also secures starter motor wire (3) to firewall (16).
7.	Starter switch bracket (7) to firewall (16)	Four capscrews (10), lockwashers (9),and flatwashers (8)	Remove.	
8.		Starter switch bracket (7)	Pull away from firewall (16).	
9.	Positive battery cable (4) to starter switch (6)	Nut (2) and lockwasher (1)	Remove and disconnect cable (4) from switch (6).	Circuit 5 (5) is also disconnected at this step.
10.		Positive battery cable (4)	Remove.	



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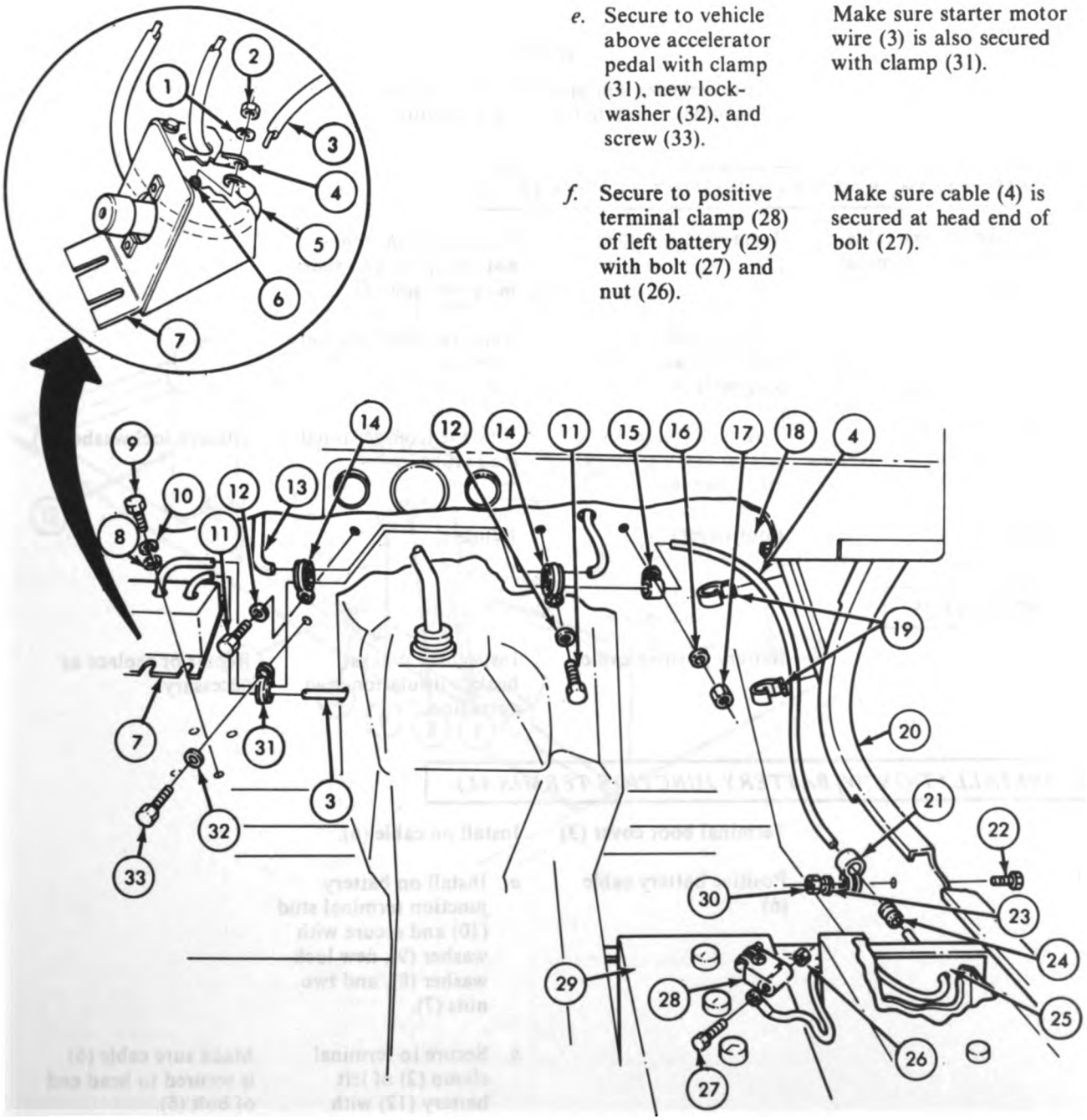
5-28. Positive Battery Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSPECTION			
11.		Positive battery cable (4)	Inspect for cracks, broken insulation,and corrosion.	Repair or replace as necessary.
	c. INSTALLATION			
2.		Positive battery cable (4)	Secure to starter switch (6) with nut (2) and lock-washer (1).	Make sure circuit 5 (5) is also secured to switch (6) during this step.
13.		Starter switch bracket (7)	Secure to firewall (18) with four flat-washers (8), lock-washers (10), and capscrews (9).	
14.		Positive battery cable (4)	Install as follows:	
			a. Route over transmission tunnel and feed through grommet (24) at battery box (25) and secure to right body sill (20) with clamp (21), screw (22), lock-washer (23), and nut (30).	
			b. Secure to vehicle with two spring clips (19).	
			c. Secure to firewall (18) with clamp (15), lockwasher (16), and nut (17).	
			d. Secure to vehicle at right and left side of transmission tunnel with two clamps (14), lockwashers (12), and screws (11).	Make sure washer hose (13) is also secured with clamps (14).

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5-28. Positive Battery Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			e. Secure to vehicle above accelerator pedal with clamp (31), new lockwasher (32), and screw (33).	Make sure starter motor wire (3) is also secured with clamp (31).
			f. Secure to positive terminal clamp (28) of left battery (29) with bolt (27) and nut (26).	Make sure cable (4) is secured at head end of bolt (27).



END OF TASK!

FOLLOW-ON TASKS:
- **Connect negative battery ground cable (para 5-27).**
- **Check operation of electrical system components (TM 9-2320-218-10).**

TA 155399

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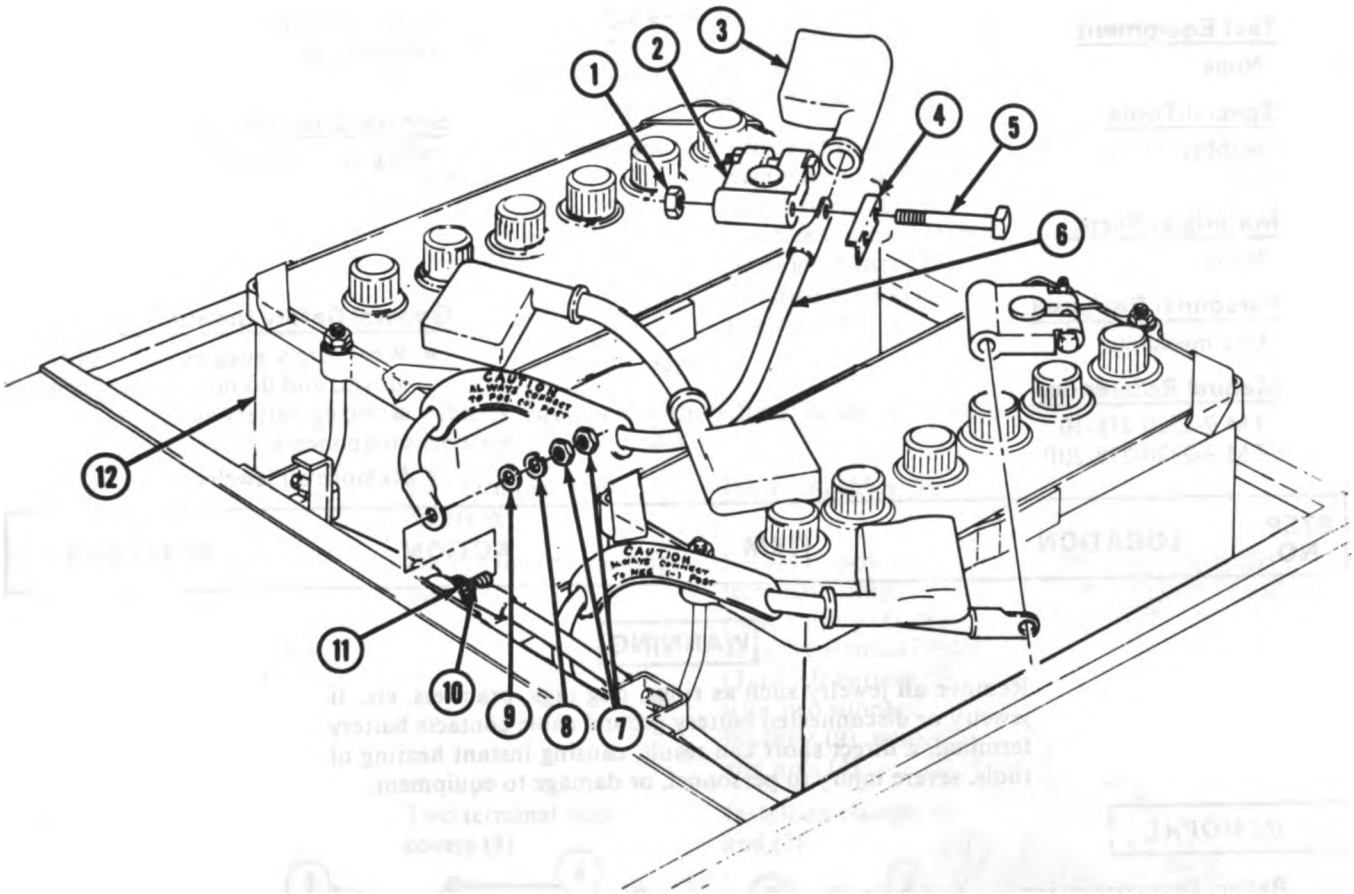
5-28. Positive Battery Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE For vehicles equipped with battery junction terminal, perform following procedures.		
		d. REMOVAL (W/ BATTERY JUNCTION TERMINAL)		
15.	Positive battery cable (6) to battery terminal clamp (2)	Terminal boot cover (3)	Remove from terminal clamp (2) and slide back on cable (6).	
16.		Nut (1), bolt (5), support bracket (4), and cable (6)	Remove from terminal clamp (2).	
17.	Battery junction terminal (11)	Two nuts (7), lockwasher (8), washer (9), and cable (6)	Remove from terminal stud (10).	Discard lockwasher (8).
18.	Cable (6)	Boot cover (3)	Remove.	
		e. INSPECTION		
19.		Battery positive cable (6)	Inspect for cracks, broken insulation, and corrosion.	Repair or replace as necessary.
		f. INSTALLATION (W/ BATTERY JUNCTION TERMINAL)		
20.		Terminal boot cover (3)	Install on cable (6).	
21.		Positive battery cable (6)	*a.* Install on battery junction terminal stud (10) and secure with washer (9), new lockwasher (8), and two nuts (7).	
			b. Secure to terminal clamp (2) of left battery (12) with bolt (5), support bracket (4), and nut (1).	Make sure cable (6) is secured to head end of bolt (5).
22.		Terminal boot cover (3)	Install on terminal clamp (2).	

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5-28. Positive Battery Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Connect negative battery ground cable (para 5-27).
- Check operation of electrical system components (TM 9-2320-218-10).

TA 484763

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5-29. Battery Interconnecting Cable Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Rubber gloves

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10
Para 5-27

Condition Description
Parking brake set.
Negative battery ground cable disconnected.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing battery system components.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

a. REMOVAL

1.	Battery interconnecting cable (2) to two terminal clamps (3) and (7)	Two nuts (4) and bolts (1)	Remove.
2.		Battery interconnecting cable (2)	Remove.

NOTE

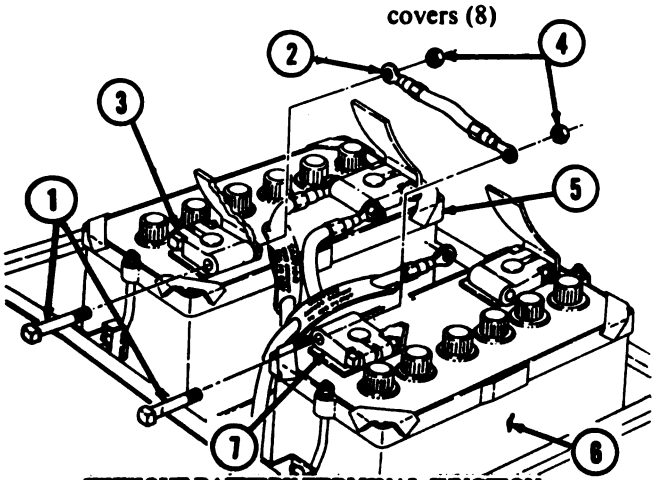
For vehicles equipped with battery junction terminal, perform steps 2.1, 2.2, and 2.3.

2.1.	Battery interconnecting cable (2) to two terminal clamps (3) and (7)	Two terminal boot covers (8)	Remove from clamps (3) and (7) and slide back on cable (2).
2.2.		Two nuts (4), bolts (1), support brackets (9), and cable (2)	Remove.
2.3.	Cable (2)	Two boot covers (8)	Remove.

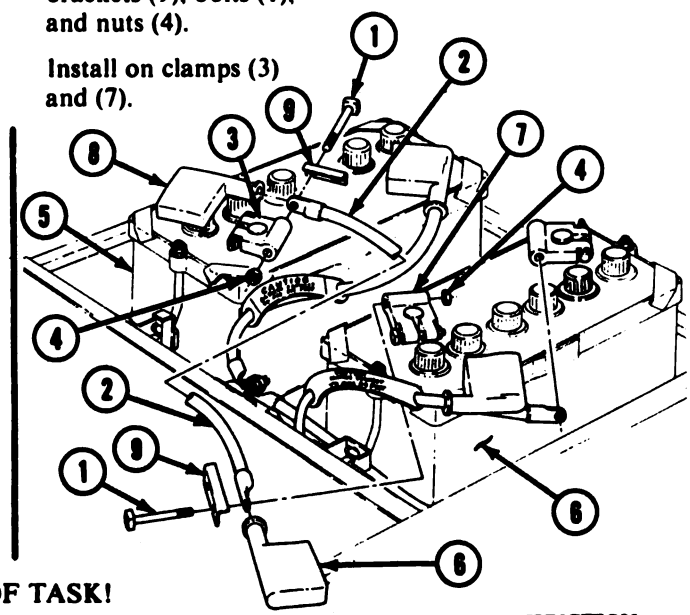
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5-29. Battery Interconnecting Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
		CAUTION		
		Make sure two batteries are positioned properly and secured before installing interconnecting cable. Cable must be installed to positive terminal clamp of right battery and negative terminal clamp of left battery. Damage to equipment could result if cable is improperly installed.		
3.		Battery interconnecting cable (2)	Secure to positive terminal clamp (7) of right battery (6) and negative terminal clamp (3) of left battery (5) with two bolts (1) and nuts (4).	Make sure cable (2) is secured under head end of bolts (1) on inboard side of clamps (7) and (3).
		NOTE		
		For vehicles equipped with battery junction terminal, perform steps 3.1, 3.2, and 3.3.		
3.1.		Two terminal boot covers (8)	Install on cable (2).	
3.2.		Battery interconnecting cable (2)	Secure to positive terminal clamp (7) of right battery (6) and negative terminal clamp (3) of left battery (5) with two support brackets (9), bolts (1), and nuts (4).	Make sure cable (2) is secured under head end of bolts (1).
3.3.		Two terminal boot covers (8)	Install on clamps (3) and (7).	



WITHOUT BATTERY TERMINAL JUNCTION



WITH BATTERY TERMINAL JUNCTION

END OF TASK!

FOLLOW-ON TASK: Connect negative battery ground cable (para 5-27).

TA 484764

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5-30. Battery Terminal Clamp Maintenance

This task covers:

a. Removal
b. Cleaning
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Rubber gloves

Materials/Parts
GAA grease

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 9-6140-200-14

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable disconnected.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing battery components.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating to tools, severe injury to personnel, or damage to equipment.

NOTE

All battery terminal clamps are removed and installed identically.

a. REMOVAL

1.	Battery cable (9) to terminal clamp (2)	Nut (3) and bolt (10)	Remove and pull cable (9) from clamp (2).	

NOTE

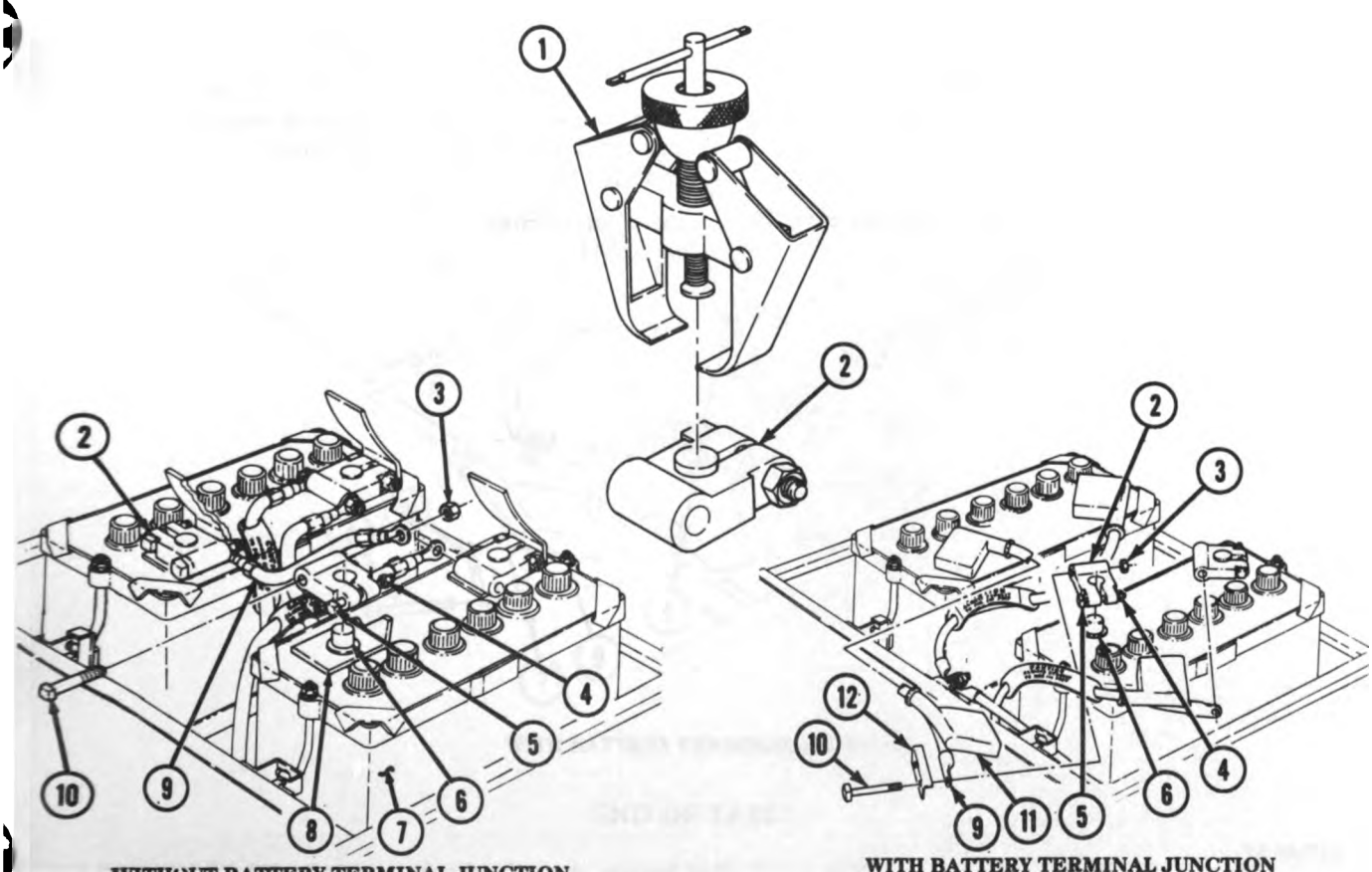
For vehicles equipped with battery junction terminal, perform steps 1.1 and 1.2.

1.1.		Terminal boot cover (11)	Remove from clamp (2) and slide back on cable (9).	

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5-30. Battery Terminal Clamp Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
1.2.		Nut (3), bolt (10), support bracket (12) and cable (9)	Remove.	
2.	Terminal clamp (2) to battery (7)	Nut (4) and bolt (5)	Loosen.	Do not remove.
		CAUTION When removing terminal clamp, use terminal clamp puller only. Damage to battery and clamp will result if clamp is forced off.		
3.		Terminal clamp (2) and rubber insulator (8)	Remove using terminal clamp puller (1).	
b. CLEANING				
4.		Terminal clamp (2) and battery terminal (6)	Clean to bare metal with battery terminal cleaner.	



WITHOUT BATTERY TERMINAL JUNCTION

WITH BATTERY TERMINAL JUNCTION

TA 484765

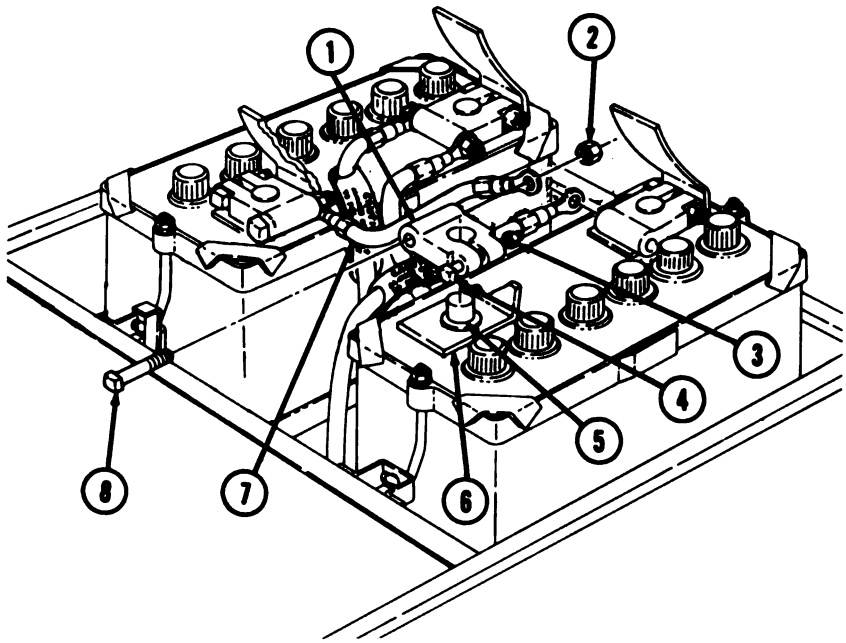
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5-30. Battery Terminal Clamp Maintenance (Cont'd)

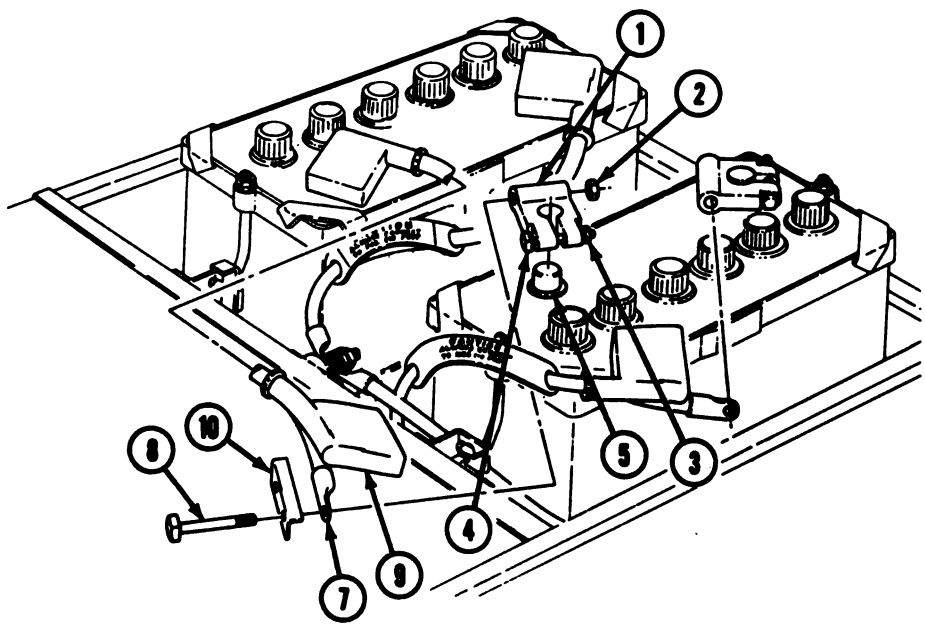
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	c. INSTALLATION			
		CAUTION		
		Do not use hammer when installing terminal clamp on battery. Damage to the battery will result if clamp is forced on.		
5.		Rubber insulator (6) and terminal clamp (1)	Place on battery terminal (5) and tighten bolt (4). and nut (3).	Coat terminal (5) and clamp (1) with GAA grease.
6.		Battery cable (7)	Secure to terminal clamp (1) with bolt (8) and nut (2).	Make sure cable (7) is secured under head end of bolt (8) on inboard side of clamp (1).
		NOTE		
		For vehicles equipped with battery, junction terminal, perform steps 6.1, 6.2, and 6.3.		
6.1.		Terminal clamp (1)	Place a battery terminal (5) and tighten bolt (4) and nut (3).	Coat terminal (5) and clamp (1) with GAA grease.
6.2.		Battery cable (7)	Secure to terminal clamp (1) with bolt (8) support bracket (10), and nut (2).	Make sure cable (7) is secured under head end of bolt (8).
6.3.		Terminal bolt cover (9)	Install on terminal clamp (1).	

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5-30. Battery Terminal Clamp Maintenance (Cont'd)				
STEP NO.	LOCATION	ITEM	ACTION	REMARKS



WITHOUT BATTERY TERMINAL JUNCTION



WITH BATTERY TERMINAL JUNCTION

END OF TASK!

TA 484766

FOLLOW-ON TASK: Connect negative battery ground cable (para 5-27).

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5-31. Battery Replacement

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Battery lifting strap
Safety goggles
Rubber gloves

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 9-6140-200-14

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-30	Parking brake set. All terminal clamps and cables removed.

Special Environmental Conditions
Work area well ventilated.

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing batteries.
- Do not wear jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

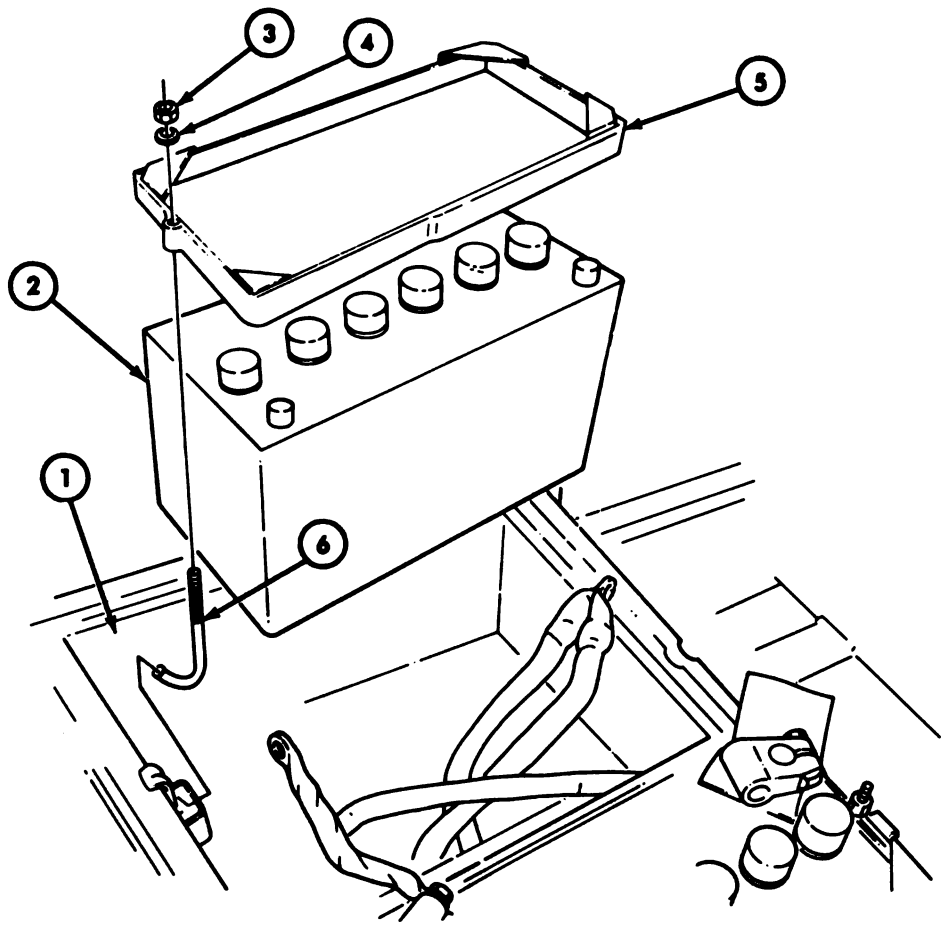
a. REMOVAL

1.	Battery (2) to battery box (1)	Two hold down nuts (3), washers (4), frame (5), and two hold down bolts (6)	Remove.	
2.		Battery (2)	Remove from battery box (1).	Use battery lifting strap.

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5-31. Battery Replacement (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
			NOTE Install batteries with battery posts facing toward each other.	
3.		Battery (2)	*a.* Place in battery box (1).	Use battery lifting strap. Do not tip battery.
			b. Secure to battery box (1) and frame (5), with two hold down bolts (6), washers (4), and nuts (3).	



END OF TASK!

FOLLOW-ON TASK: Install all terminal clamps and cables (para 5-30).

TA 155402

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5-32. Battery Box Tray Maintenance

This task covers:

a. Removal
b. Cleaning and Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Wire brush
Safety goggles
Rubber gloves

Materials/Parts
Baking soda solution

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P
TM 9-6140-200-14

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-31	Parking brake set. Batteries removed.

Special Environmental Conditions
None

General Safety Instructions
- Wear safety goggles and rubber gloves, and do not smoke when servicing battery system components.
- Remove all jewelry.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

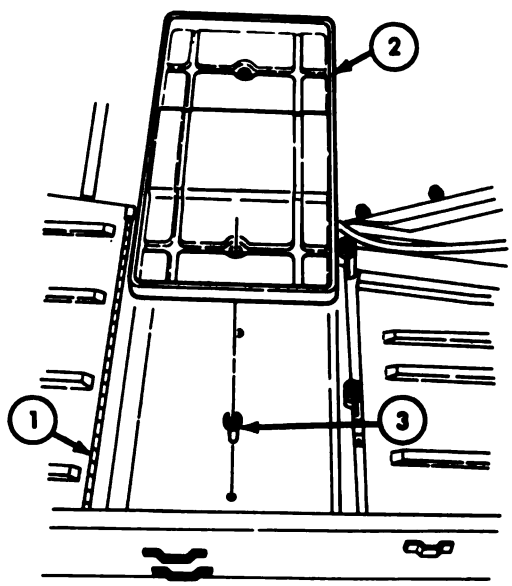
a. REMOVAL

1.	Battery box (1)	Battery box tray (2)	Lift out of battery box (1).	

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5-32. Battery Box Tray Maintanance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. CLEANING AND INSPECTION		
		NOTE		
		For additional information on battery box tray cleaning, see TM 9-6140-200-14.		
2.		Battery box tray (2)	*a.* Clean with baking soda solution and wire brush.	Neutralizes and removes acid and corrosion.
			b. Wipe dry with clean cloth.	
			c. Inspect for excessive corrosion.	Replace tray (2) if corroded beyond use.
			d. Clean and inspect two rubber drain tubes (3) for tears and acid damage.	Replace if torn or eaten away.
		c. INSTALLATION		
3.		Battery box tray (2)	Place in battery box (1).	Make sure two drain tubes (3) are not kinked.



END OF TASK!

FOLLOW-ON TASK: Install batteries (para 5-31).

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5-32.1. Battery Junction Terminal Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Five lockwashers

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10

Equipment Condition	Reference	Condition Description
	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Passenger seat and battery box cover removed.
	Para 5-27	Negative battery ground cable disconnected.

Special Environmental Conditions
None

General Safety Instructions
Remove all jewelry and disconnect battery ground cable before working in battery compartment.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

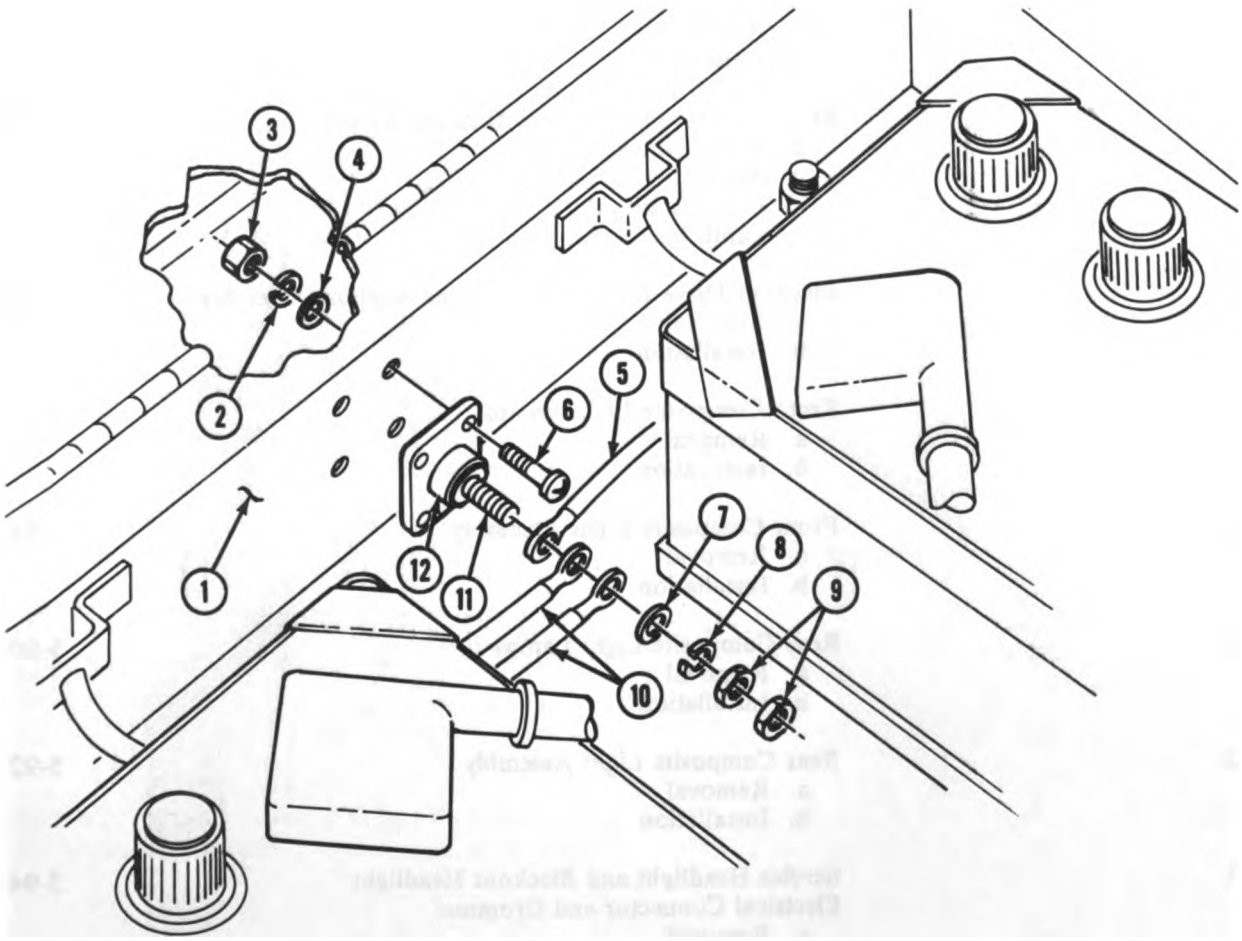
a. REMOVAL

1.	Battery junction terminal (12)	Two nuts (9), lockwasher (8), washer (7), and all cables (5) and (10)	Remove from junction terminal stud (11).	Discard lockwasher (8).
2.	Battery compartment (1)	Four nuts (3), lockwashers (2), washers (4), screws (6), and junction terminal (12)	Remove.	Discard lockwashers (2).

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5-32.1. Battery Junction Terminal Maintenance

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
3.		Battery junction terminal (12)	Position on battery compartment wall (1) and secure with four screws (6), washers (4), lockwashers (2), and nuts (3).	
4.		All cables (5) and (10)	Position on junction terminal stud (11) and secure with washer (7), lockwasher (8), and two nuts (9).	



END OF TASK!

FOLLOW-ON TASKS:
- Install battery box cover and passenger seat (TM 9-2320-218-10).
- Connect negative battery ground cable (para 5-27).

TA 484767

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Section V. LIGHTING SYSTEM MAINTENANCE

5-33. General

This section provides maintenance procedures assigned to the organizational level for the lighting system. To find a specific procedure, see the maintenance task summary below.

5-34. Lighting System Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-35.	Service Headlight Beam Unit a. Removal b. Installation c. Adjustment	5-72
5-36.	Service Headlight Assembly a. Removal b. Installation	5-78
5-37.	Blackout Drive Light Beam Unit and Lamp a. Beam Unit Removal b. Beam Unit Installation c. Lamp Removal d. Lamp Installation	5-80
5-38.	Blackout Drive Light Assembly and Support Assembly a. Removal b. Installation	5-84
5-39.	Front Composite Light Lamps a. Removal b. Installation	5-86
5-40.	Front Composite Light Assembly a. Removal b. Installation	5-88
5-41.	Rear Composite Light Lamps a. Removal b. Installation	5-90
5-42.	Rear Composite Light Assembly a. Removal b. Installation	5-92
5-43.	Service Headlight and Blackout Headlight Electrical Connector and Grommet a. Removal b. Installation	5-94
5-44.	Solid-State Flasher a. Removal b. Installation	5-96

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5-34. Lighting System Maintenance Task Summary (Cont'd)

TASK PARA	PROCEDURES	PAGE NO.
5-45.	Main Light Switch a. Removal b. Installation	5-98
5-46.	Headlight Beam Selector Switch a. Removal b. Installation	5-98
5-47.	Stoplight Switch a. Removal b. Installation	5-98

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5-35. Service Headlight Beam Unit Maintenance

This task covers:

a. Removal
b. Installation
c. Adjustment

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic
One assistant

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Special Environmental Conditions
- Work area darkened for adjustment procedure.
- Vehicle on level surface.

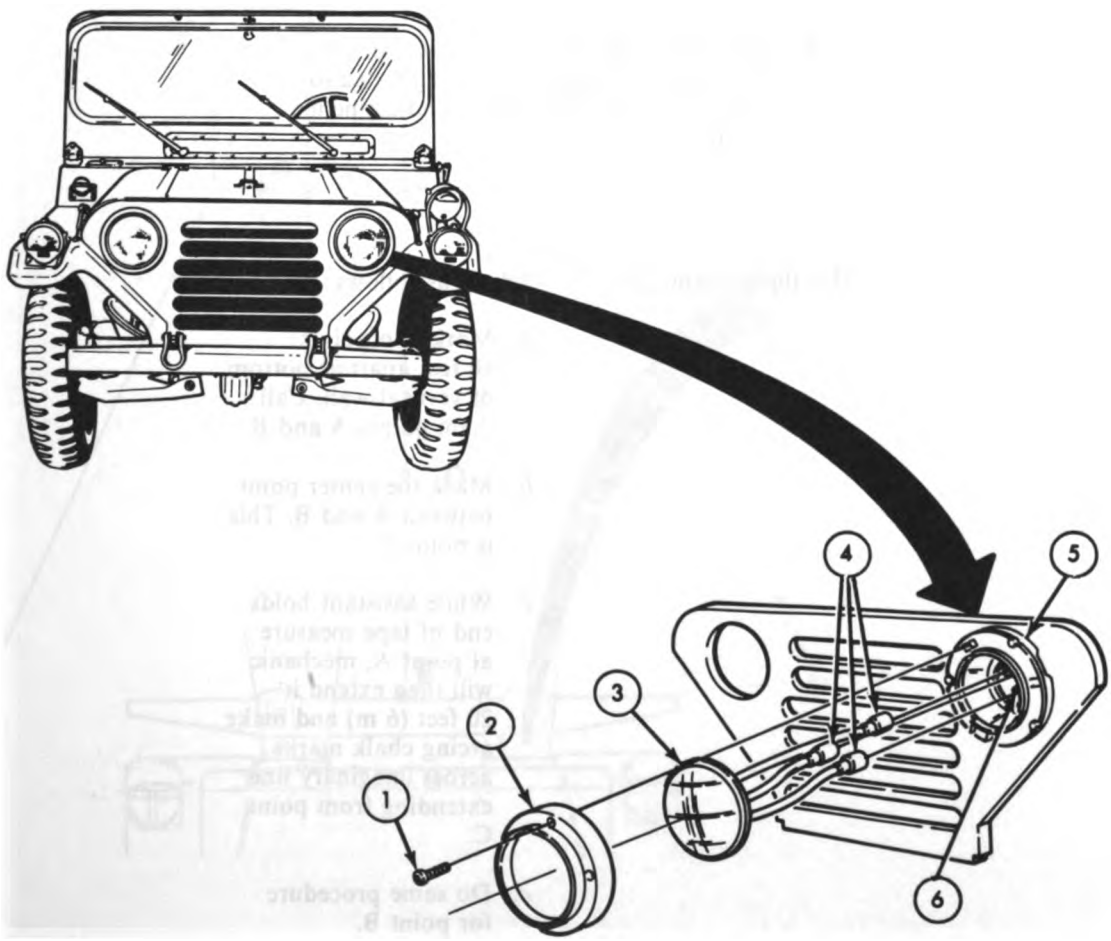
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Retaining ring (2) to mounting ring (5)	Three screws (1)	Remove.	
2.		Retaining ring (2)	Remove from mounting ring (5).	
3.		Beam unit (3)	Pull out from mounting ring (5).	
4.	Beam unit (3)	Three electrical connectors (4)	Disconnect from headlamp connectors (6).	Note locations of connections for installation.
5.		Beam unit (3)	Remove.	

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5-35. Service Headlight Beam Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
6.	Beam unit (3)	Three electrical connectors (4)	Connect to marked headlamp connectors (6).	
		NOTE Make sure the word "top" is positioned at top of beam unit (3) during steps 7 and 8.		
7.		Beam unit (3)	Position in mounting ring (5), and secure with retaining ring (2) and three screws (1).	



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5-35. Service Headlight Beam Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

c. ADJUSTMENT

NOTE

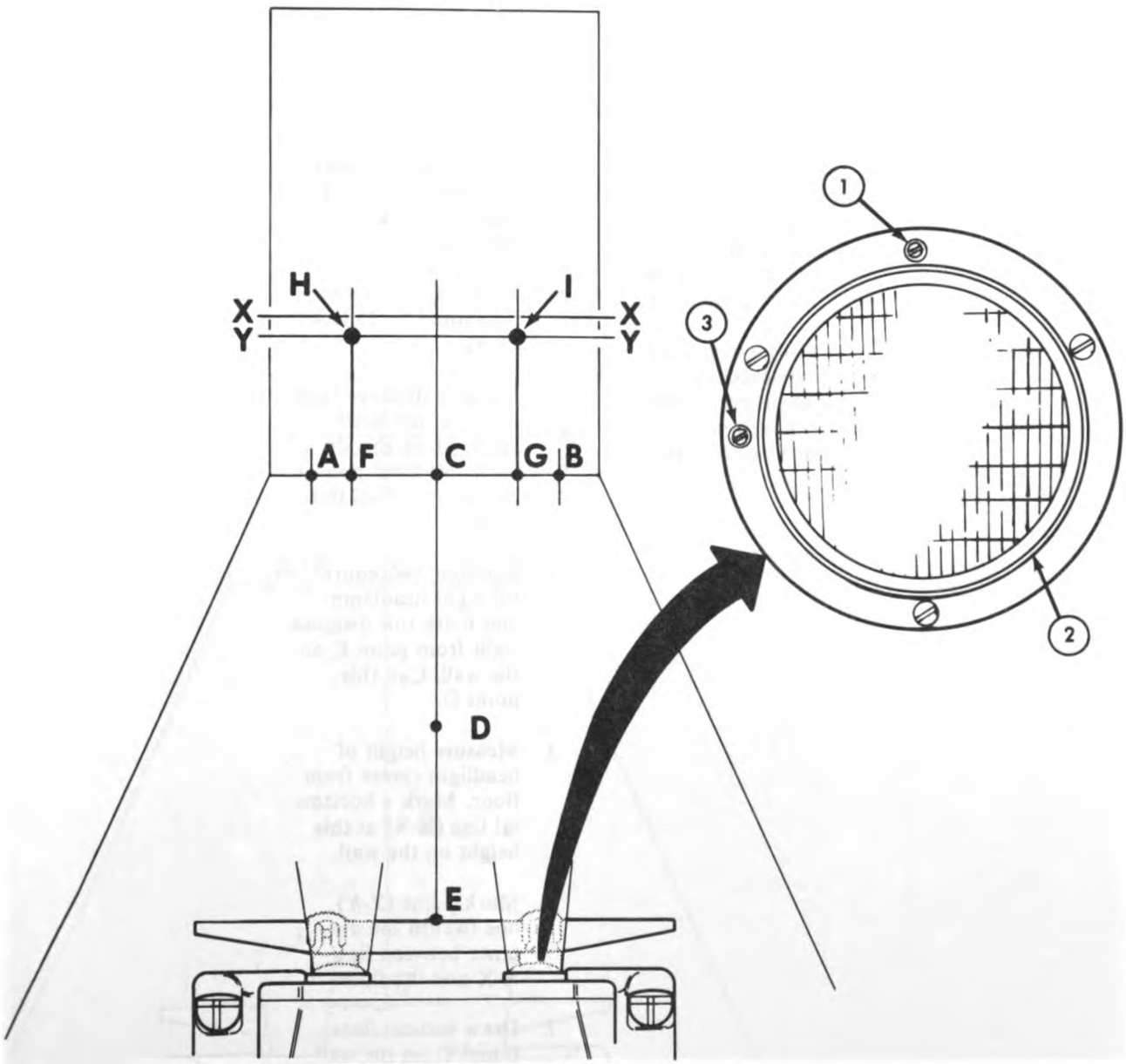
- Use service headlamp aiming chart where available. When chart is not available, adjustment will be made as described below.
- Headlamp beam direction is changed by two lamp adjusting screws. Screw (1) adjusts beam direction up and down. Screw (3) adjusts beam directional left and right.
- Make sure vehicle is on a level surface, completely unloaded, and tires inflated to proper pressure before starting adjustment procedure.

8.		Headlight beam (2)	Adjust as follows: *a.* Mark two points 10 feet apart at bottom of vertical wall. Call them points A and B. *b.* Mark the center point between A and B. This is point C. *c.* While assistant holds end of tape measure at point A, mechanic will then extend it 20 feet (6 m) and make arcing chalk marks across imaginary line extending from point C. *d.* Do same procedure for point B. *e.* Mark the point where arcing lines meet as point D.	

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5-35. Service Headlight Beam Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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5-35. Service Headlight Beam Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			f. While asistant holds end of tape measure at point C, extend tape 25 feet (7 m) away from wall so tape crosses over point D. The 25 foot (7 m) mark is point E.	
			g. Position front center of vehicle at point E. Measure left and right sides to ensure straight-on positioning of vehicle. Distances should be 25 feet (7 m).	
			h. Measure distance from center of left headlamp. Mark this distance left from point C on the wall. Call this point F.	
			i. Do same procedure for right headlamp and mark this distance right from point C on the wall. Call this point G.	
			j. Measure height of headlight center from floor. Mark a horizontal line (X-X) at this height on the wall.	
			k. Mark a line (Y-Y) one twelfth the distance between line X-X and the floor.	
			l. Draw vertical lines F and G on the wall. Mark points where these lines and line Y-Y meet as points H and I.	

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5-35. Service Headlight Beam Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

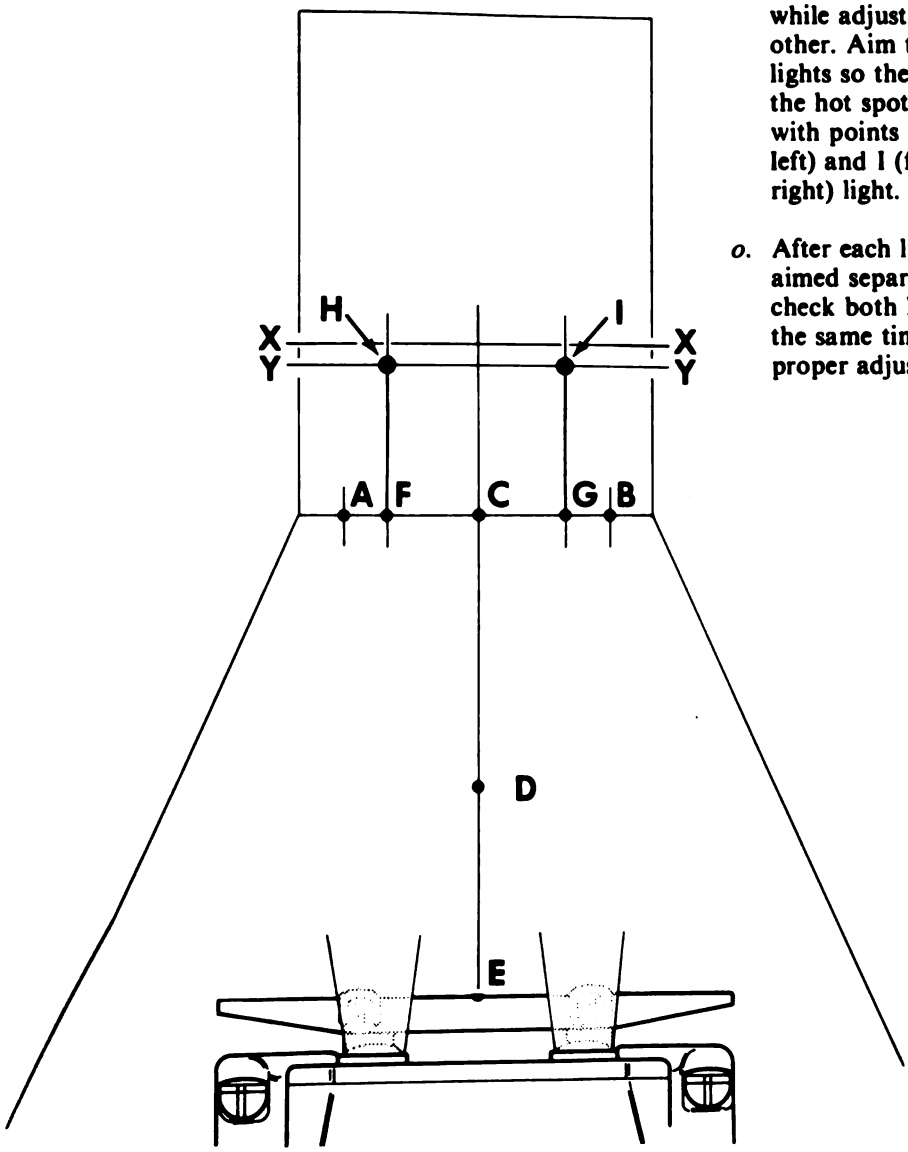
NOTE

Make sure beam units are clean before proceeding.

m. Turn on low beam lights.

n. Cover one headlight while adjusting the other. Aim the headlights so the center of the hot spot registers with points H (for the left) and I (for the right) light.

o. After each light is aimed separately, check both lights at the same time for proper adjustment.



END OF TASK!

FOLLOW-ON TASK: Check operation of beam unit (TM 9-2320-218-10).

TA 155406

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5-36. Service Headlight Assembly Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Darkened area for service headlight testing.

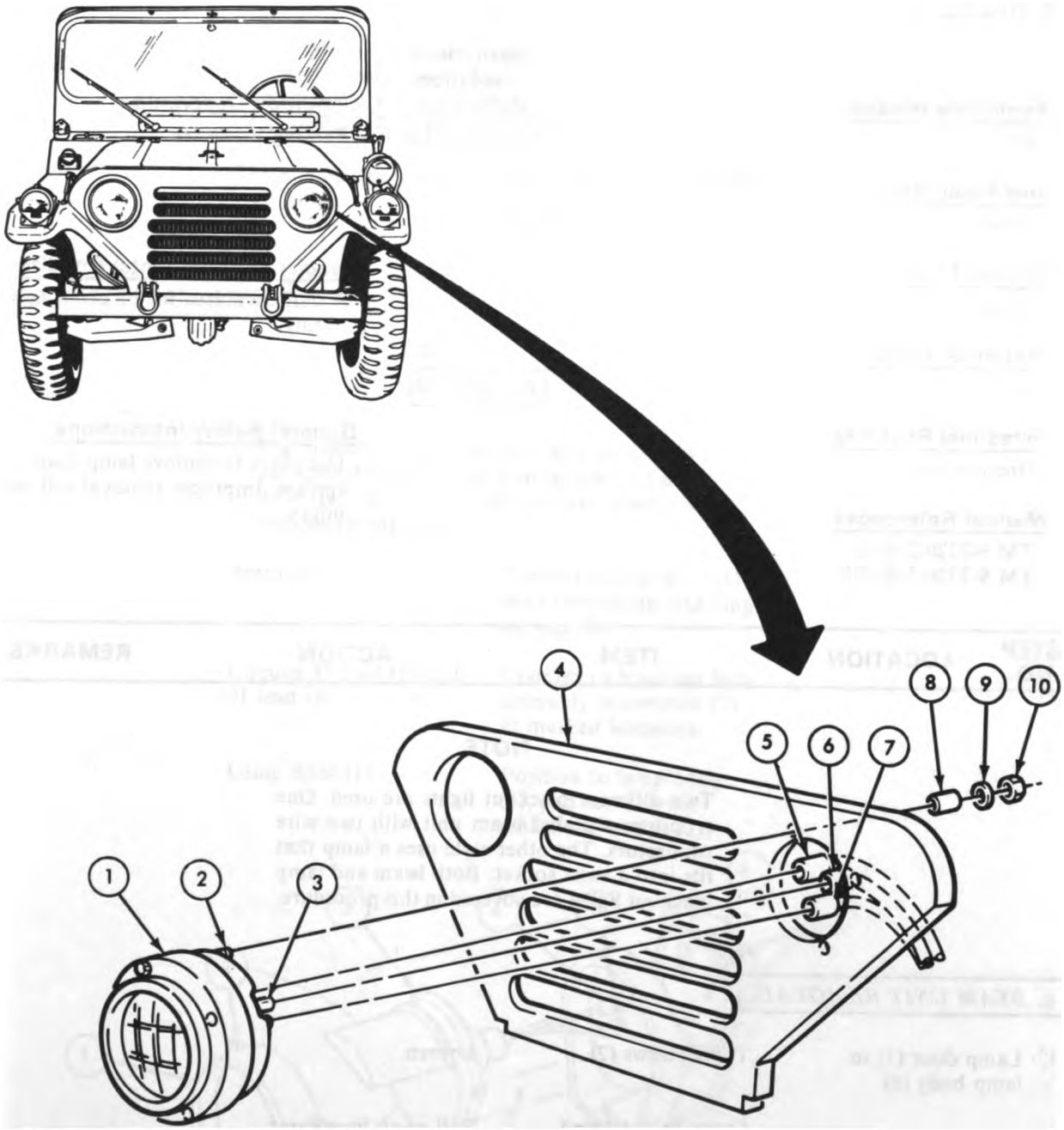
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Outside rear of head light housing (1)	Circuits 17 (5), 18 (6), and 91 (7) connectors	Disconnect from head-light connectors (3).	Note locations of connections for installation.
2.	Shock mount studs (2) to brush guard (4)	Three nuts (10), lock-washers (9), and shock mounts (8)	Remove.	
3.		Headlight assembly (1)	Remove from brush guard (4).	
	b. INSTALLATION			
4.		Three shock mounts (8)	Place over shock mount studs (2).	
5.		Headlight assembly shock mount studs (2)	Secure to brush guard (4) with three lock-washers (9) and nuts (10).	
6.		Circuits 17 (5), 18 (6), and 91 (7) connectors	Connect to marked headlight connectors (3).	

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5-36. Service Headlight Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Check operation of headlight (TM 9-2320-218-10)
- Check headlight adjustment (para 5-35).

TA 155407

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5-37. Blackout Drive Light Beam Unit and Lamp Maintenance

This task covers:

a. Beam Unit Removal
b. Beam Unit Installation
c. Lamp Removal
d. Lamp Installation

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10

Condition Description
Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
A darkened area for blackout light testing.

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
Use pliers to remove lamp door springs. Improper removal will cause injury.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

Two different blackout lights are used. One style uses a sealed beam unit with two wire connectors. The other style uses a lamp that fits into a twist socket. Both beam and lamp blackout lights are covered in this procedure.

a. BEAM UNIT REMOVAL

1.	Lamp door (1) to lamp body (6)	Three screws (2)	Loosen.	
2.		Lamp door (1) and beam unit (3)	Pull away from lamp body (6).	
3.	Inside lamp body (6)	Circuits 91 lead (4) and 19 lead (5)	Disconnect from blackout light assembly connectors (7).	Note disconnection points for installation.

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5-37. Blackout Drive Light Beam Unit and Lamp Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Use pliers to remove lamp door springs. Do not use screwdriver. Spring is under tension and will fly off and cause severe injury if incorrectly removed.

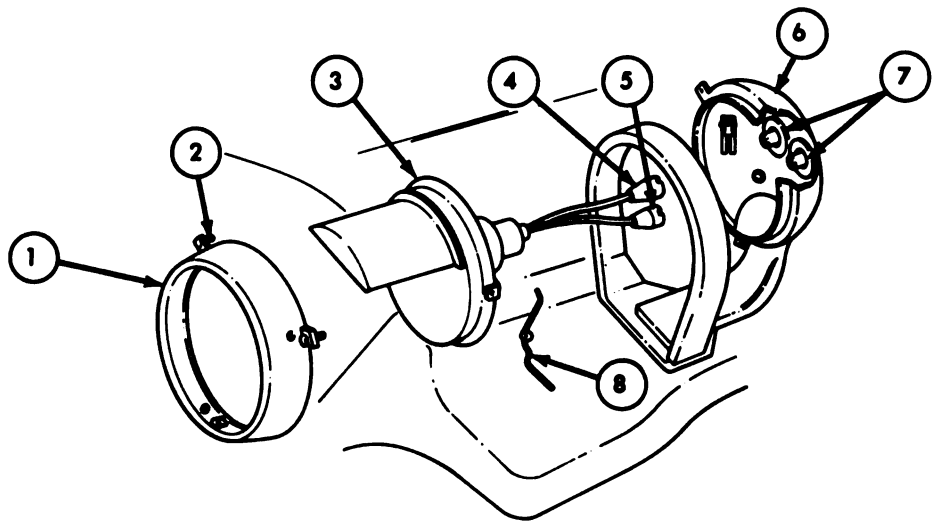
4.	Lamp door (1)	Three lamp retaining springs (8)	Remove and detach beam unit (3) from lamp door (1).

b. BEAM UNIT INSTALLATION

WARNING

Use pliers to install lamp door springs. Do not use screwdriver. Spring is under pressure and will fly off and cause severe injury if incorrectly installed.

5.		Beam unit (3)	Secure to lamp door (1) with three lamp retaining springs (8).
6.		Circuits 19 lead (5) and 91 lead (4)	Connect to blackout light assembly connectors (7) at marked locations.
7.		Lamp door (1)	Position to lamp body (6), and secure with with three screws (2).



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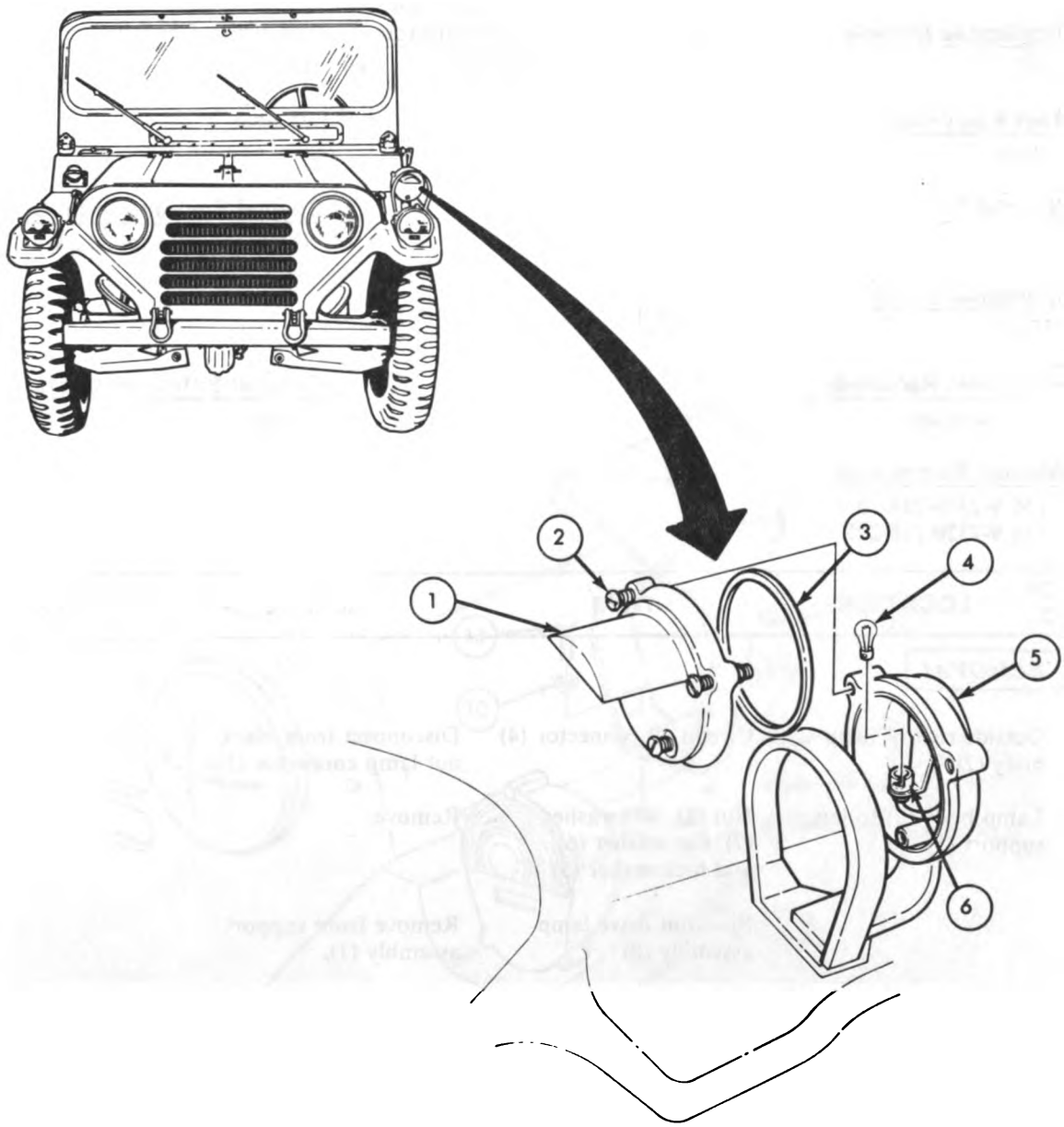
5-37. Blackout Drive Light Beam Unit and Lamp Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. LAMP REMOVAL		
8.	Door assembly (1) to lamp housing (5)	Three screws (2)	Loosen.	
9.		Door assembly (1) and gasket (3)	Remove from lamp housing (5).	
10.	Socket (6)	Lamp (4)	Turn counterclockwise and remove.	
		d. LAMP INSTALLATION		
11.		Lamp (4)	Install in socket (6) and turn clockwise to secure.	
12.		Gasket (3)	Place on door assembly (1).	
13.		Door assembly (1) and and gasket (3)	Place on lamp housing (5) and tighten three screws (2) to secure.	

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5-37. Blackout Drive Light Beam Unit and Lamp Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Check operation of blackout drive lamp (TM 9-2320-218-10).

TA 155409

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5-38. Blackout Drive Light Assembly and Support Assembly Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
Darkened area for blackout light testing.

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

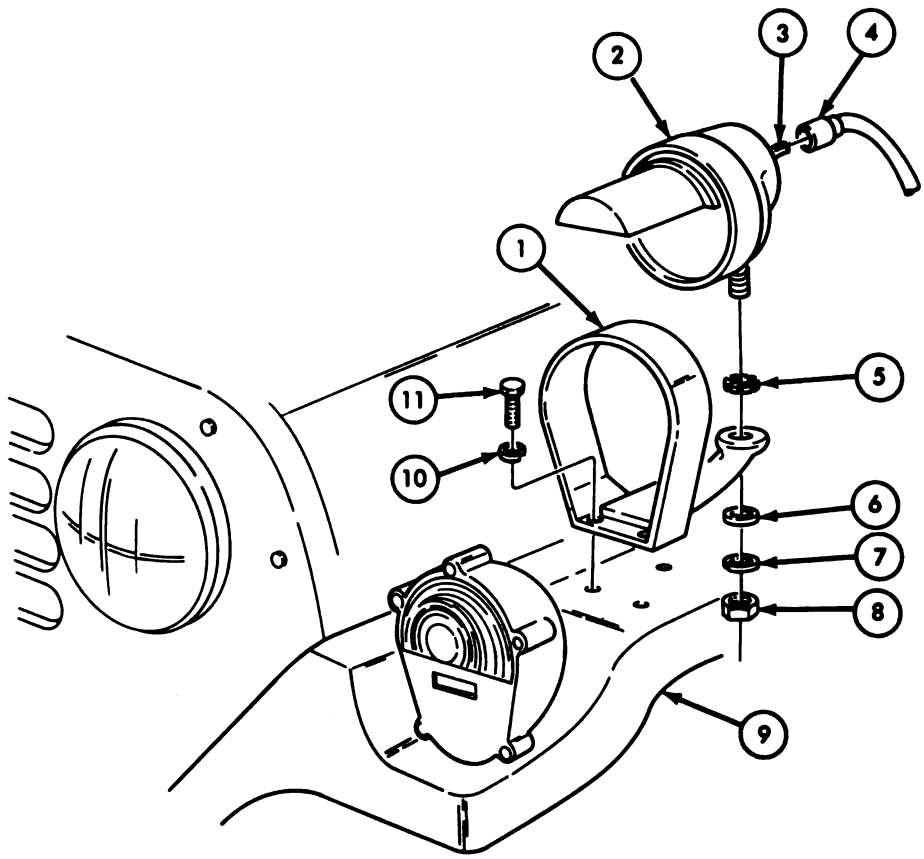
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Outside rear of lamp body (2)	Circuit 19 connector (4)	Disconnect from blackout lamp connector (3).	
2.	Lamp body (2) to lamp support (1)	Nut (8), lockwasher (7), flat washer (6), and lockwasher (5)	Remove.	
3.		Blackout drive lamp assembly (2)	Remove from support assembly (1).	
4.	Support assembly (1) to fender (9)	Three capscrews (11) and lockwashers (10)	Remove.	
5.		Support assembly (1)	Remove from fender (9).	
	b. INSTALLATION			
6.		Support assembly (1)	Secure to fender (9) with three capscrews (11) and lockwashers (10).	Tighten 8-11 lb-ft (10-15 N•m).

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5-38. Blackout Drive Light Assembly and Support Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
7.		Blackout drive lamp assembly (2)	Position to support assembly (1), and secure with lockwasher (5), flat washer (6), lockwasher (7), and nut (8).	
8.		Circuit 19 connector (4)	Connect to blackout lamp connector (3) at outside rear of lamp body (2).	



END OF TASK!

FOLLOW-ON TASK: Check operation of blackout drive lamp (TM 9-2320-218-10).

TA 155410

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5-39. Front Composite Light Lamps Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.

Special Environmental Conditions
Darkened area for composite lamp testing.

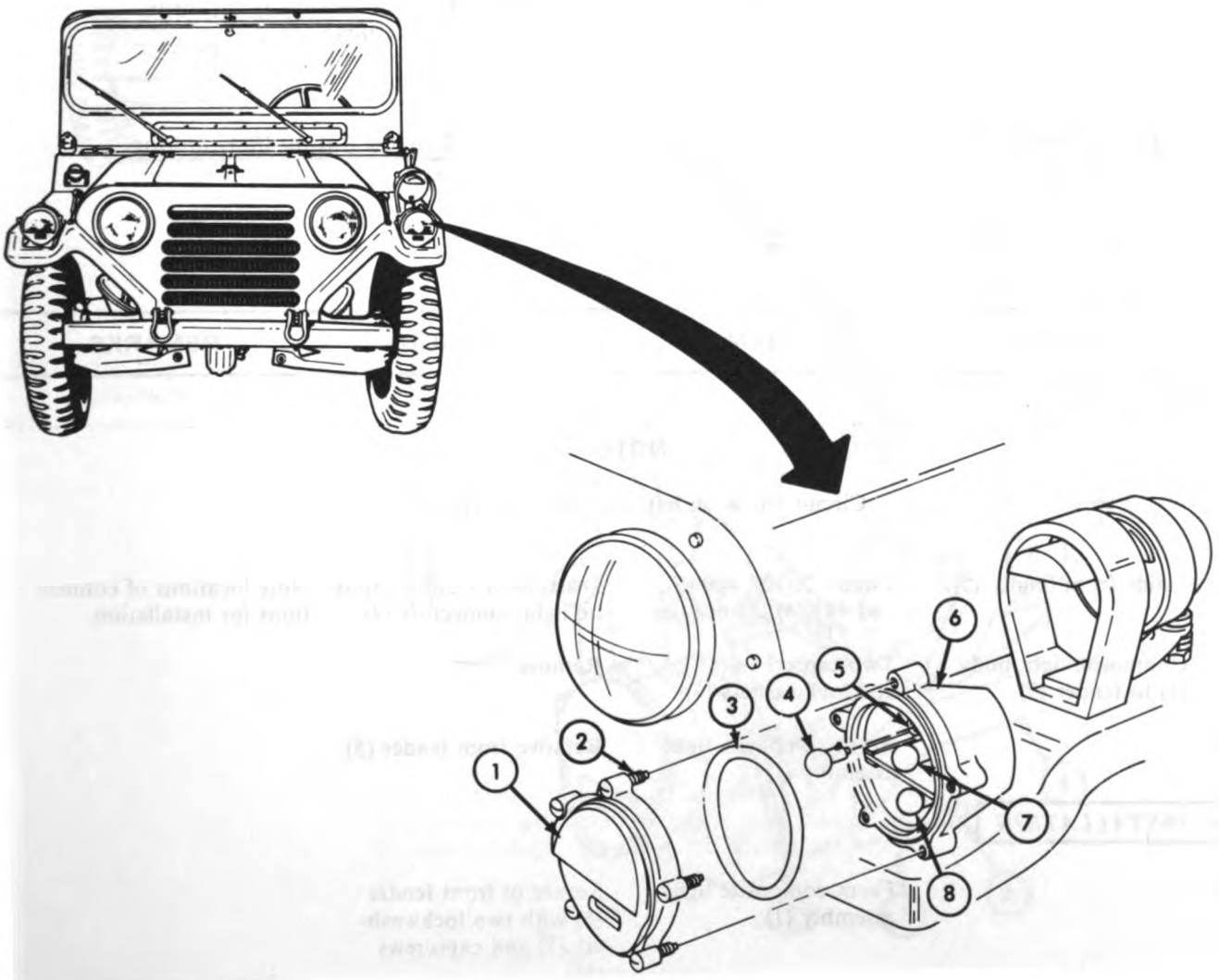
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Lamp door and lens (1) to lamp body (6)	Five screws (2)	Loosen.	
2.		Lamp door and lens (1), and preformed seal (3)	Remove from lamp body (6).	
		NOTE The parking lamp (4), turn signal lamp (7), and front marker lamp (8) are removed and installed in the same way. Steps 3 and 4 cover the parking lamp (4) only.		
		Parking lamp (4)	Press into lamp socket (5) and turn counterclockwise to remove.	

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5-39. Front Composite Light Lamps Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
4.		Parking lamp (4)	Press into lamp socket (5), and turn clockwise to install.	
5.		Preformed seal (3), and lamp door and lens (1)	Secure to composite lamp body (6) with five screws (2).	Make sure preformed seal (3) is properly seated.



END OF TASK!

FOLLOW-ON TASK: Test operation of front composite light lamps (TM 9-2320-218-10).

TA 155411

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5-40. Front Composite Light Assembly Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
Darkened area for composite light testing.

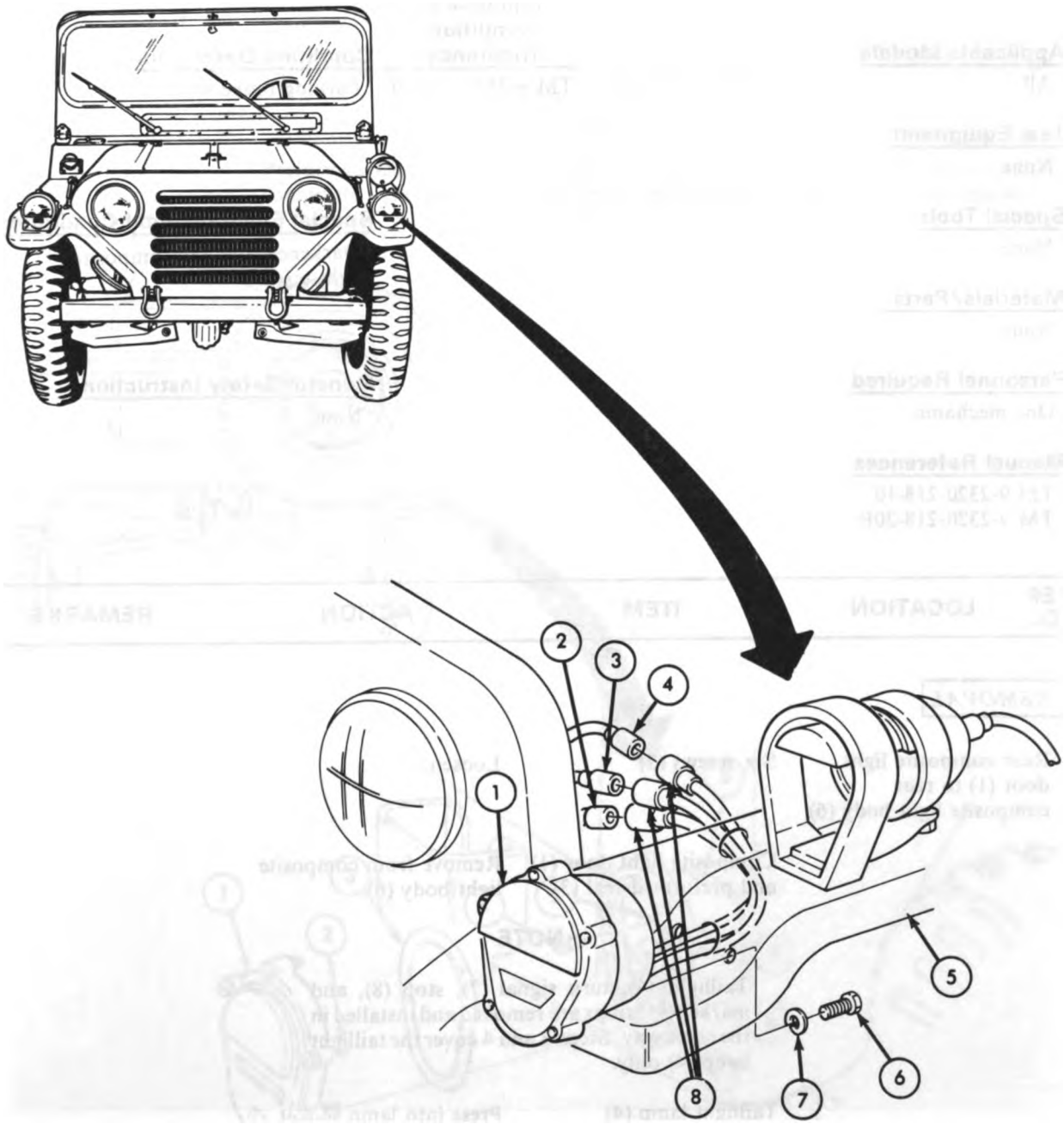
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
		NOTE		
		Circuit 461 is on left, and 460 is on right.		
1.	Inside front fender (5)	Circuit 20 (2), 460 (3), and 491 (4) connectors	Disconnect from composite light connectors (8).	Note locations of connections for installation.
2.	Composite light body (1) to fender (5)	Two capscrews (6) and lockwashers (7)	Remove.	
3.		Front composite light assembly (1)	Remove from fender (5).	
	b. INSTALLATION			
4.		Front composite light assembly (1)	Secure to front fender (5) with two lockwashers (7) and capscrews (6).	
5.		Circuit 20 (2), 460 (3), and 491 (4) connectors.	Connect to composite light connectors (8) at marked locations.	

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5-40. Front Composite Light Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Check operation of front composite light assembly (TM 9-2320-218-10).

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5-41. Rear Composite Light Lamps Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.

Special Environmental Conditions
Darkened area for composite light testing.

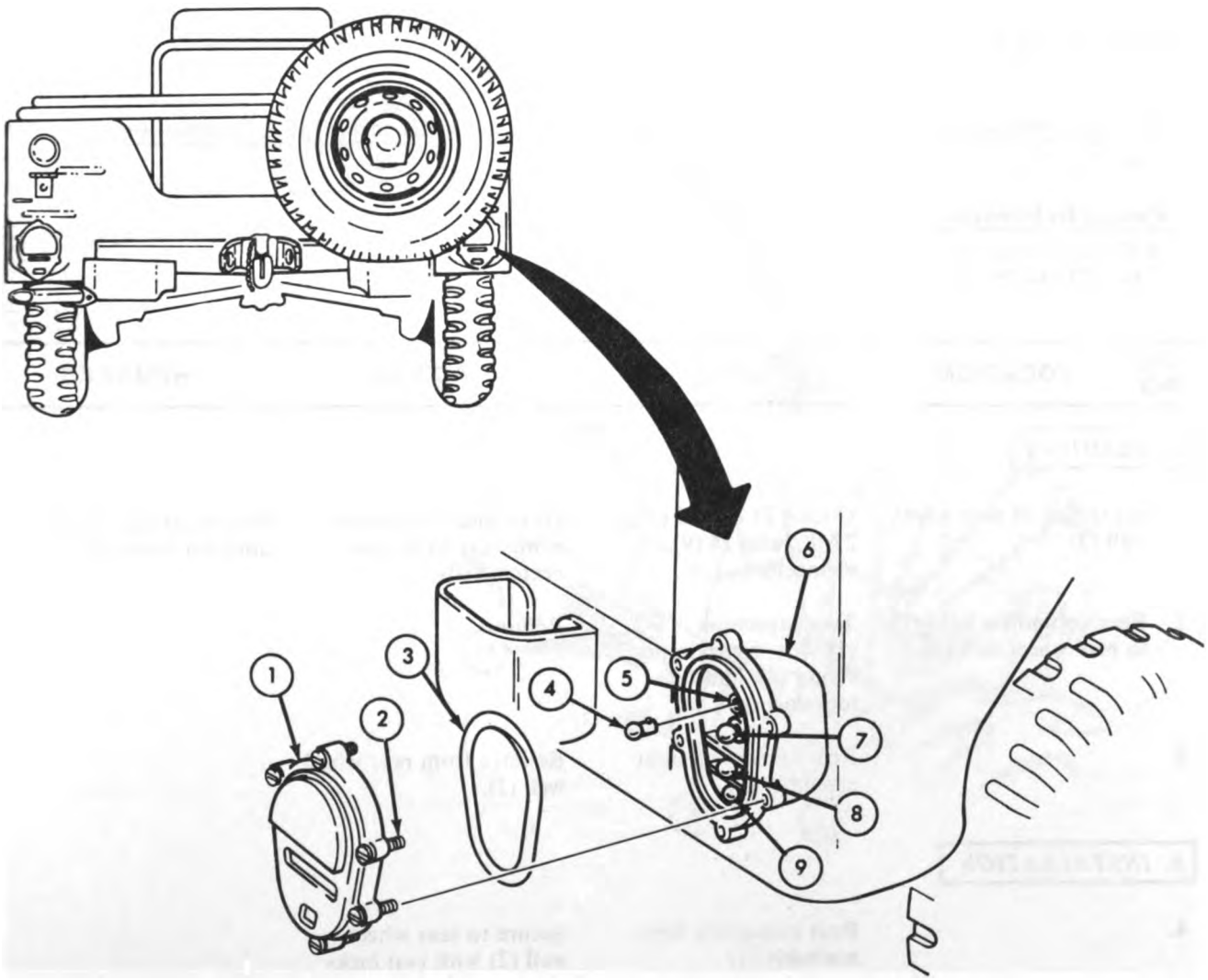
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Rear composite light door (1) to rear composite light body (6)	Six screws (2)	Loosen.	
2.		Composite light door (1) and preformed seal (3).	Remove from composite light body (6).	
		NOTE		
		Taillight (4), turn signal (7), stop (8), and marker (9) lamps are removed and installed in the same way. Steps 3 and 4 cover the taillight lamp (4) only.		
3.		Taillight lamp (4)	Press into lamp socket (5) and turn counter-clockwise to remove.	

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5-41. Rear Composite Light Lamps Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
4.		Taillight lamp (4)	Press into lamp socket (5) and turn clockwise to install.	
5.		Preformed seal (3) and composite light door (1)	Secure to composite light body (6) with six screws (2).	Make sure preformed seal (3) is properly seated.



END OF TASK!

FOLLOW-ON TASK: Check rear composite light lamps for proper operation (TM 9-2320-218-10).

TA 155413

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5-42. Rear Composite Light Assembly Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 10-34	Parking brake set. Rear composite light cable guard removed.

Special Environmental Conditions
Darkened area for composite light testing.

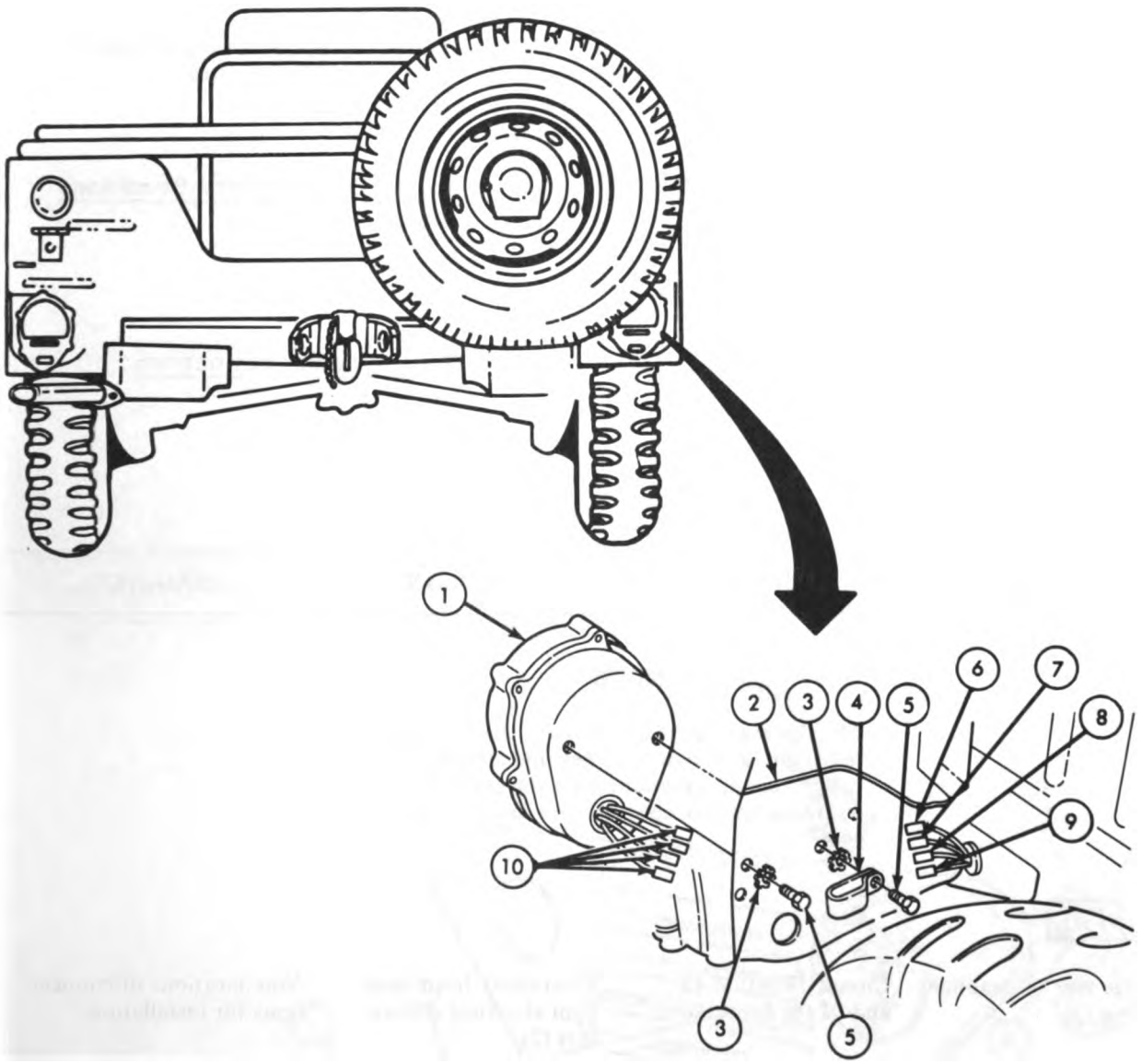
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Underside of rear wheel well (2)	Circuit 21 (6), 22 (7), 23 (8), and 24 (9) connectors	Disconnect from rear composite light connectors (10).	Note locations of connections for installation.
2.	Rear composite light (1) to rear wheel well (2)	Two capscrews (5), one wire retainer clamp (4), and two lockwashers (3)	Remove.	
3.		Rear composite light assembly (1)	Remove from rear wheel well (2).	
	b. INSTALLATION			
4.		Rear composite light assembly (1)	Secure to rear wheel well (2) with two lockwashers (3), one wire retainer clamp (4), and two capscrews (5).	

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5-42. Rear Composite Light Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.		Circuit 21 (6), 22 (7), 23 (8), and 24 (9) connectors	Connect to rear composite light connectors (10) at marked locations.	



END OF TASK!

FOLLOW-ON TASKS:
- Check rear composite light assembly for proper operation (TM 9-2320-218-10).
- Install light cable guard (para 10-34).

TA 155414

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5-43. Service Headlight and Blackout Headlight Electrical Connector and Grommet Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	Para 5-35	Service headlight beam unit removed.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

Maintenance procedures for the service headlight and blackout headlight electrical connectors and grommets are the same. This maintenance task covers the service headlight only.

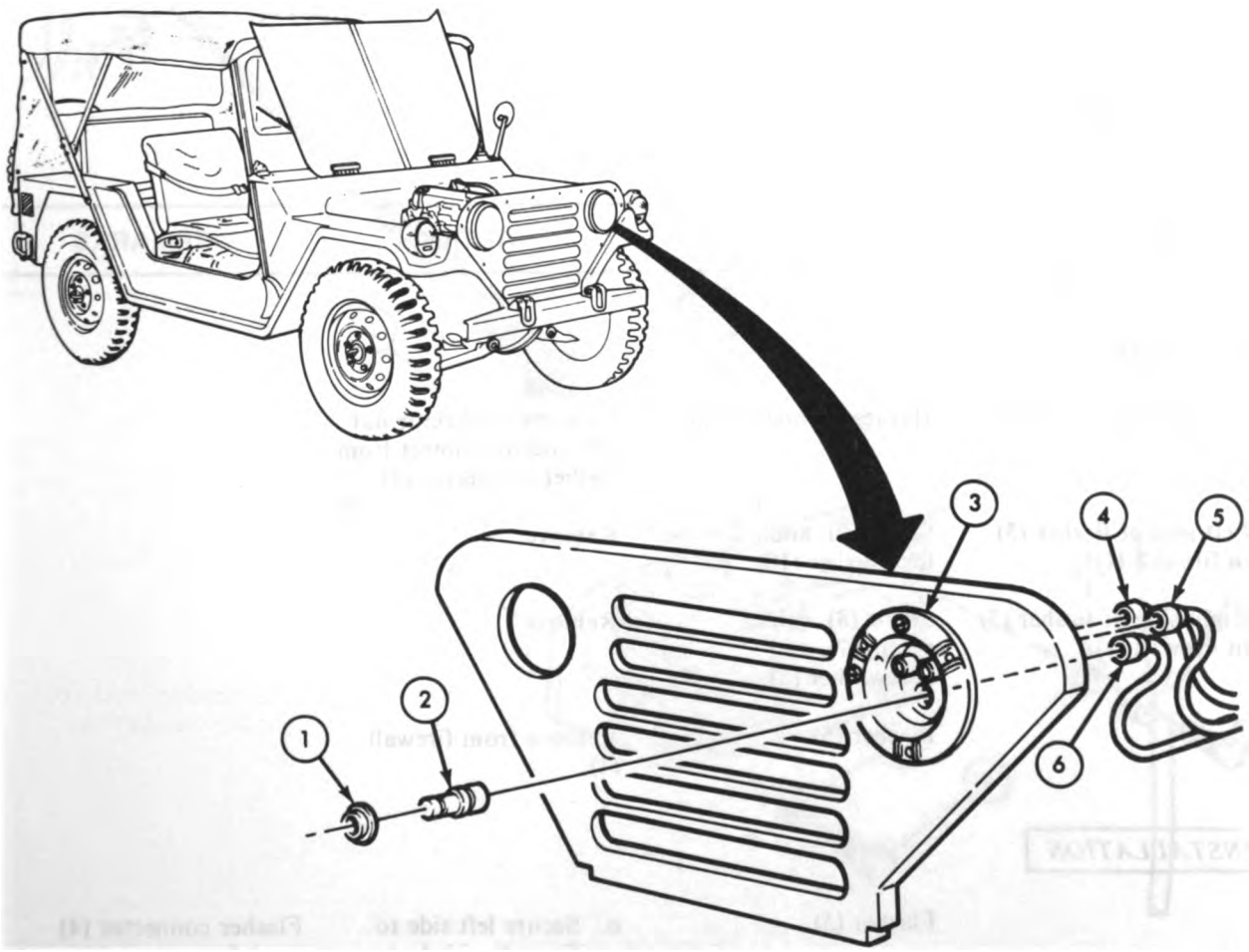
a. REMOVAL

1.	Outside rear of headlight housing (3)	Circuit 17 (4), 18 (5), and 91 (6) connectors	Disconnect from headlight electrical connectors (2).	Note locations of connections for installation.
2.		Three electrical connectors (2) and grommets (1)	Push toward inside of headlight housing (3) and remove.	
3.		Three grommets (1)	Remove from headlight electrical connectors (2).	

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5-43. Service Headlight and Blackout Headlight Electrical Connector and Grommet Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
4.		Three grommets (1)	Install onto headlamp connectors (2).	
5.		Three grommets (1) and electrical connectors (2)	Install through hole in headlamp housing (3) from inside toward outside.	
6.		Circuit 17 (4), 18 (5), 91 (6) connectors	Connect to headlight electrical connectors (2) at marked locations.	



FOLLOW-ON TASK: Install service headlight beam unit (para 5-35).

TA 155415

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5-44. Solid-State Flasher Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

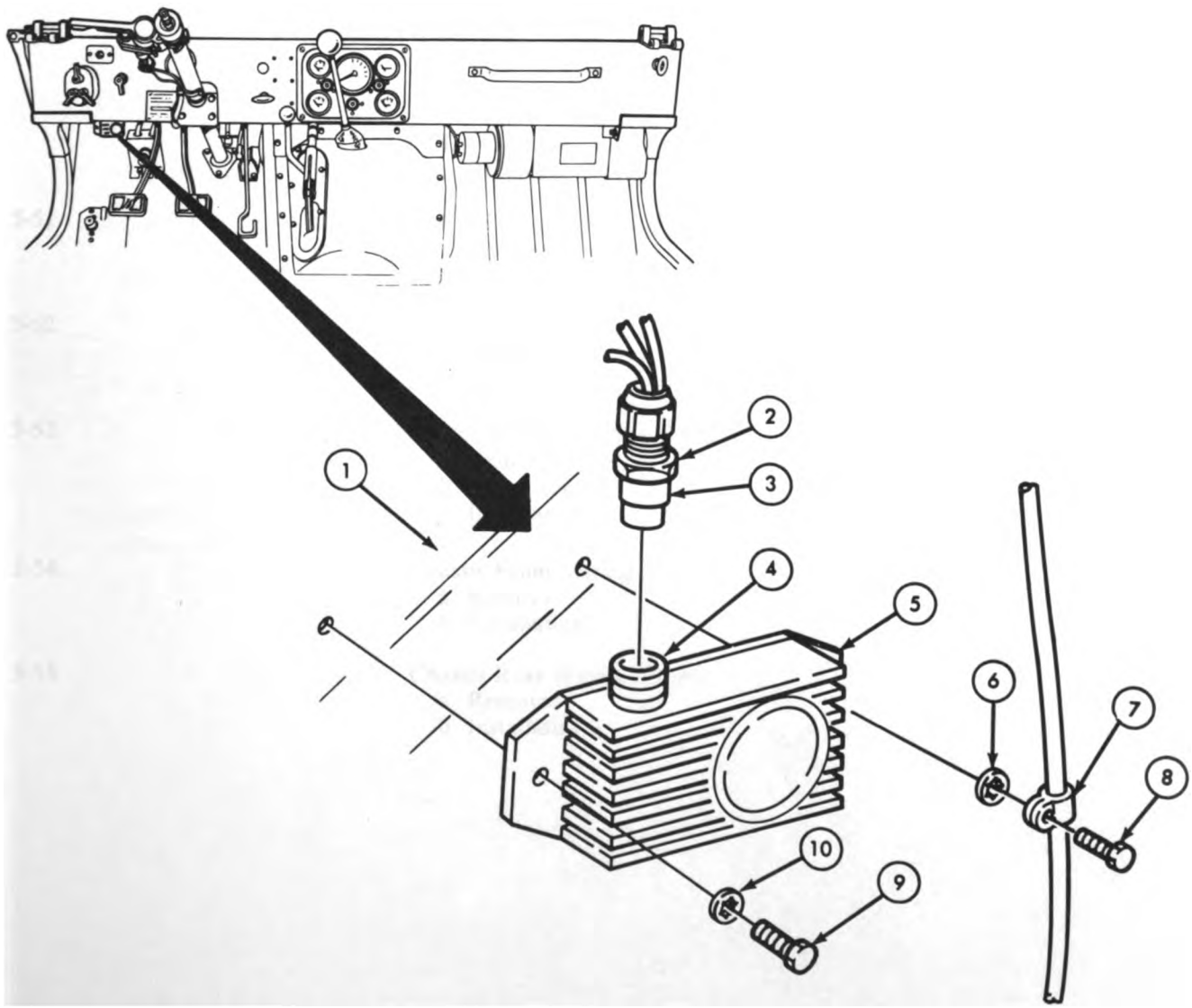
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Left firewall (1) inside vehicle	Harness connector (3)	Unscrew connector nut (2), and disconnect from flasher connector (4).	
2.	Left side of flasher (5) to firewall (1)	Screw (9), and lockwasher (10)	Remove.	
3.	Right side of flasher (5) to firewall (1)	Screw (8), cable clamp (7), and lockwasher (6)	Remove.	
4.		Flasher (5)	Remove from firewall (1).	
	b. INSTALLATION			
5.		Flasher (5)	*a.* Secure left side to firewall with lockwasher (10), and screw (9).	Flasher connector (4) must face upward.

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5-44. Solid-State Flasher Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
			b. Secure right side with lockwasher (6), cable clamp (7), and screw (8).	
6.		Harness connector (3)	Connect to flasher connector (4) and secure by tightening connector nut (2).	



END OF TASK!

FOLLOW-ON TASK: Check turn signal flasher for proper operation (TM 9-2320-218-10).

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5-45. Main Light Switch Maintenance

Procedures for removal and installation of main light switch are given in paragraph 5-68.

5-46. Headlight Beam Selector Switch Maintenance

Procedures for removal and installation of headlight beam selector switch are given in paragraph 5-67.

5-47. Stoplight Switch Maintenance

Procedures for removal and installation of stoplight switch are found in paragraph 5-69.

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Section VI. WIRING CIRCUITS AND HARNESS MAINTENANCE

5-48. General

This section provides maintenance procedures assigned to the organizational level for wiring circuits and harnesses. To find a specific task, see the maintenance task summary below.

5-49. Wiring Circuits and Harness Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-50.	Harness Wiring and Connector Repair a. Terminal-Type Connector Repair b. Male Cable Connector Repair c. Female Cable Connector Repair d. Plug Assembly Repair e. Receptacle Assembly Repair	5-100
5-51.	Trailer Electrical Receptacle a. Removal b. Installation	5-104
5-52.	Power Plant Ground Cable a. Removal b. Installation	5-106
5-53.	Starter Switch to Starter Cable a. Removal b. Inspection c. Installation	5-108
5-54.	Chassis Front Wiring Harness a. Removal b. Installation	5-112
5-55.	Chassis Rear Wiring Harness a. Removal b. Installation	5-128

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5-50. Harness Wiring and Connector Repair

This task covers:

a. Terminal-Type Connector Repair
b. Male Cable Connector Repair
c. Female Cable Connector Repair
d. Plug Assembly Repair
e. Receptacle Assembly Repair

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Soldering iron

Materials/Parts
Solder

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable disconnected.

Special Environmental Conditions
None

General Safety Instructions
Do not wear any jewelry when repairing wiring.

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Remove all jewelry such as rings, dog tags, bracelets, etc. If jewelry or disconnected battery ground cable contacts battery terminal, a direct short can result, causing instant heating of tools, severe injury to personnel, or damage to equipment.

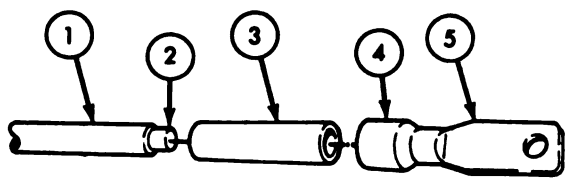
NOTE

If wiring harness is damaged beyond repair, replace the harness.

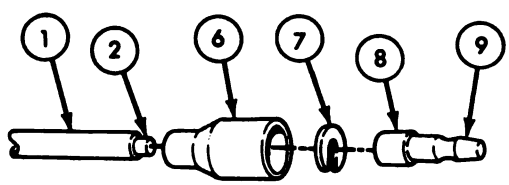
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5-50. Harness Wiring and Connector Repair (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. TERMINAL-TYPE CONNECTOR REPAIR		
1.		Cable insulation (1)	Strip from cable (2) to equal depth of terminal well (4).	
2.		Insulator (3)	Slide over cable insulation (1).	
3.		Cable (2)	Insert into terminal well (4) and crimp.	
4.		Insulator (3)	Slide over crimped end of terminal (5).	



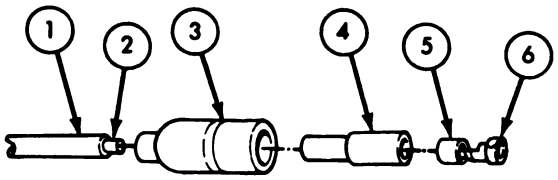
		b. MALE CABLE CONNECTOR REPAIR		
5.		Cable insulation (1)	Strip from cable (2) to equal depth of terminal well (8).	
6.		Shell (6)	Slide over cable insulation (1).	
7.		Cable (2)	Insert into terminal well (8) and crimp.	
8.		"C" washer (7)	Place over crimped junction at terminal (9).	
9.		Shell (6)	Slide over "C" washer (7) and terminal (9).	



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5-50. Harness Wiring and Connector Repair (Cont'd)

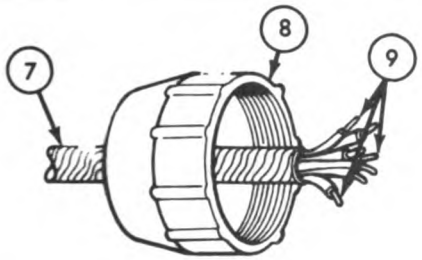
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		c. FEMALE CABLE CONNECTOR REPAIR		
10.		Cable insulation (1)	Strip to equal depth of terminal well (5).	
11.		Shell (3) and sleeve (4)	Slide over cable insulation (1).	
12.		Cable (2)	Insert into terminal well (5) and crimp.	
13.		Shell (3) and sleeve (4)	Slide over terminal (6).	
				
		d. PLUG ASSEMBLY REPAIR		
14.		Cable insulation (7)	Strip equal to depth of solder wells (11) on inserts (12).	
15.		Cable ends (9)	*a.* Slide through grommet retaining nut (8).	
			NOTE Put cable ends in corresponding lettered holes in grommet (10) to prevent cross wiring when soldering.	
			b. Slide through grommet (10), and coupling nut (14).	
			c. Place into solder wells (11) and solder.	
16.		Grommet (10)	Slide over inserts (12) and press into shell assembly (13) until seated.	
17.		Grommet retaining nut (8)	Screw into shell assembly (13) until seated.	

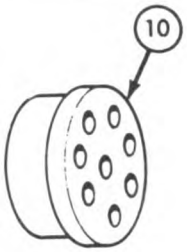
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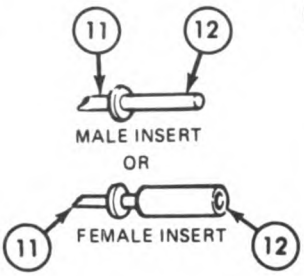
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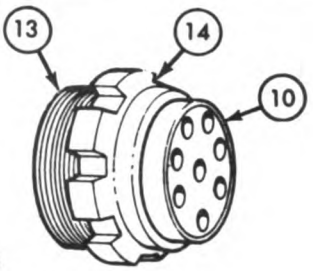
5-50. Harness Wiring and Connector Repair (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



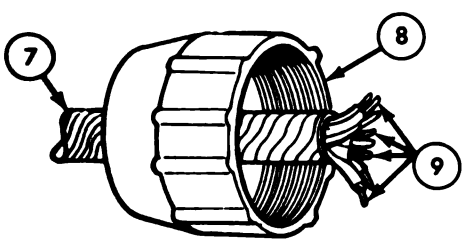


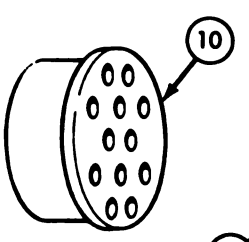


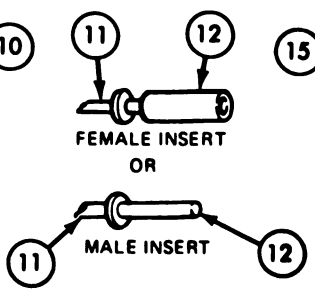


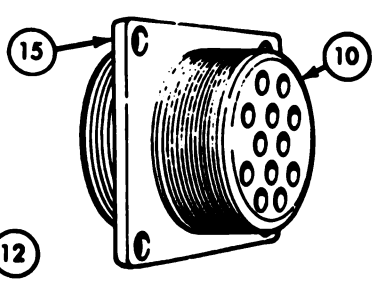
e. RECEPTACLE ASSEMBLY REPAIR

18.		Cable insulation (7)	Strip equal to depth of solder wells (11) on inserts (12).
19.		Cable ends (9)	*a.* Slide through grommet retaining nut (8).
			NOTE Put cable ends in corresponding lettered holes in grommet (10) to prevent cross wiring when soldering.
			b. Slide through grommet (10).
			c. Place into solder wells (11) and solder.
20.		Grommet (10)	Slide over inserts (12) and press into receptacle assembly (15) until seated.
21.		Grommet retaining nut (8)	Screw into receptacle (15) until seated.









END OF TASK!

FOLLOW-ON TASK: Connect negative battery ground cable (para 5-27).

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5-51. Trailer Electricel Receptacle Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

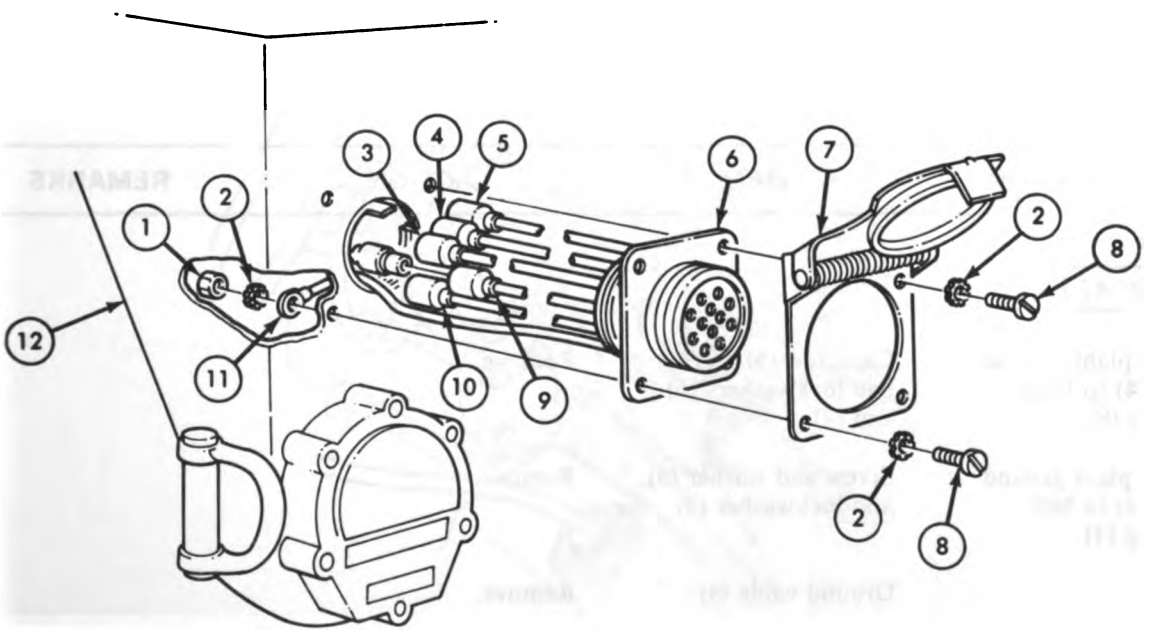
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Trailer receptacle (6) to vehicle body (12)	Four screws (8), nuts (1), and eight lockwashers (2)	Remove.	Disconnects ground cable (11).
2.		Trailer receptacle (6)	*a.* Pull away from vehicle (12).	
			b. Remove cover (7).	
3.		Circuits 21 (3), 22-460 (4), 22-461 (5), 23 (9), and 24 (10) connectors	Disconnect.	Note locations of disconnection for proper reconnection.
4.		Trailer receptacle (6)	Remove.	

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5-51. Trailer Electrical Receptacle Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
5.		Circuits 21 (3), 22-460 (4), 22-461 (5), 23 (9), and 24 (10).	Connect to proper connectors.	
6.		Trailer receptacle (6) and cover (7)	Secure to vehicle body with six lockwashers (2), three screws (8), and nuts (1).	Make sure to position all lockwashers (2) directly against trailer receptacle (7) and vehicle body (12).
7.		Ground cable (11)	Secure to vehicle body (12) at remaining receptacle hole with capscrew (8),two lockwashers (2), and one nut (1).	Make sure to position ground cable (11) directly against vehicle body (12).



END OF TASK!

TA 155420

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5-52. Power Plant Ground Cable Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10	Hood raised and secured.

Special Environmental Conditions
None

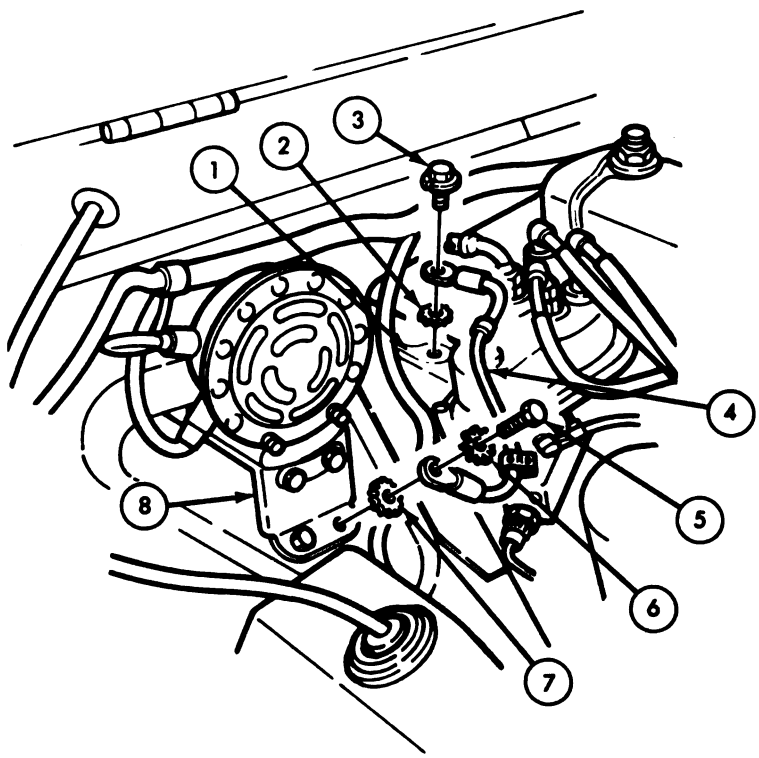
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Power plant ground cable (4) to horn bracket (8)	Capscrew (5) and two lockwashers (6) and (7).	Remove.	
2.	Power plant ground cable (4) to bell housing (1)	Screw and washer (3), and lockwasher (2)	Remove.	
3.		Ground cable (4)	Remove.	

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5-52. Power Plant Ground Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
4.		Ground cable (4)	*a.* Secure to bell housing (1) with lockwasher (2), and screw and washer (3).	Make sure lockwasher (2) is between cable (4) and bell housing (1).
			b. Secure to horn bracket (8) with two lockwashers (6) and (7), and cap-screw (5).	Make sure the larger lockwasher (7) is between cable (4) and bracket (8).



END OF TASK!

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5-53. Starter Switch to Starter Cable Maintenance

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10 Para 10-14 Para 5-27	Parking brake set. Transmission cover panel removed. Negative battery ground cable disconnected.

Special Environmental Conditions
None

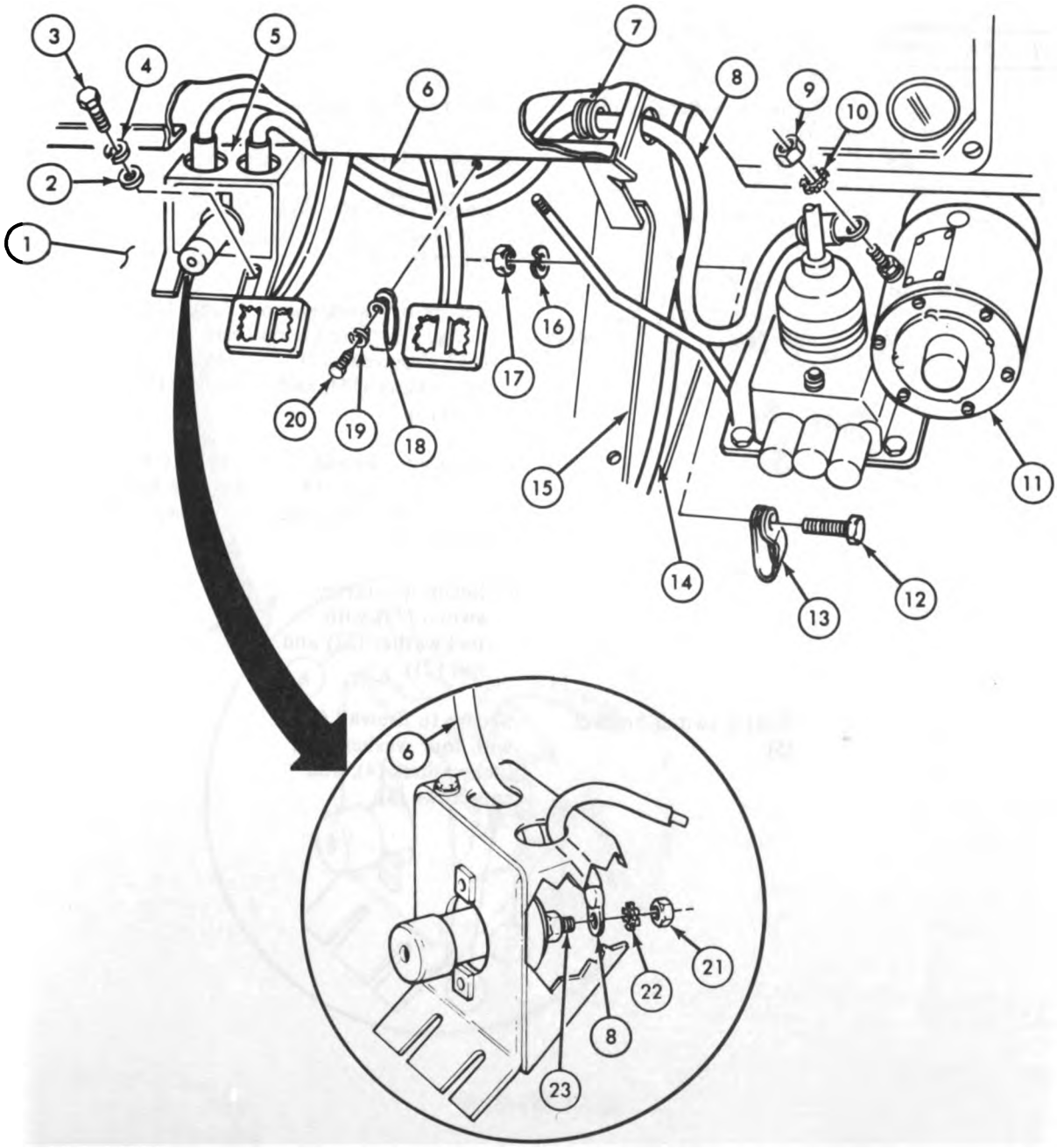
General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Starter switch bracket (5) to firewall (1)	Four capscrews (3), lockwashers (4), and flat washers (2)	Remove and pull bracket (5) from firewall (1).	
2.	Circuit 6 starter cable (8) to starter switch (23)	Nut (21) and lockwasher (22)	Remove and pull cable (8) from switch (23).	
3.	Circuit 6 starter cable (8) to left firewall (1)	Screw (20), lockwasher (19) and clamp (18)	Remove.	Clamp (18) also secures positive battery cable (6) to firewall (1).
4.	Circuit 6 starter cable (8) to starter (11)	Nut (9) and lockwasher (10)	Remove.	
5.	Circuit 6 starter cable (8) to transmission tunnel (15)	Capscrew (12), clamp (13), lockwasher (16), and nut (17)	Remove.	Clamp (13) also secures rear wiring harness (14) to transmission tunnel (15).

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5-53. Starter Switch to Starter Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
6.		Circuit 6 starter cable (8)	Pull through grommet (7) at transmission tunnel (15) and remove from vehicle.	



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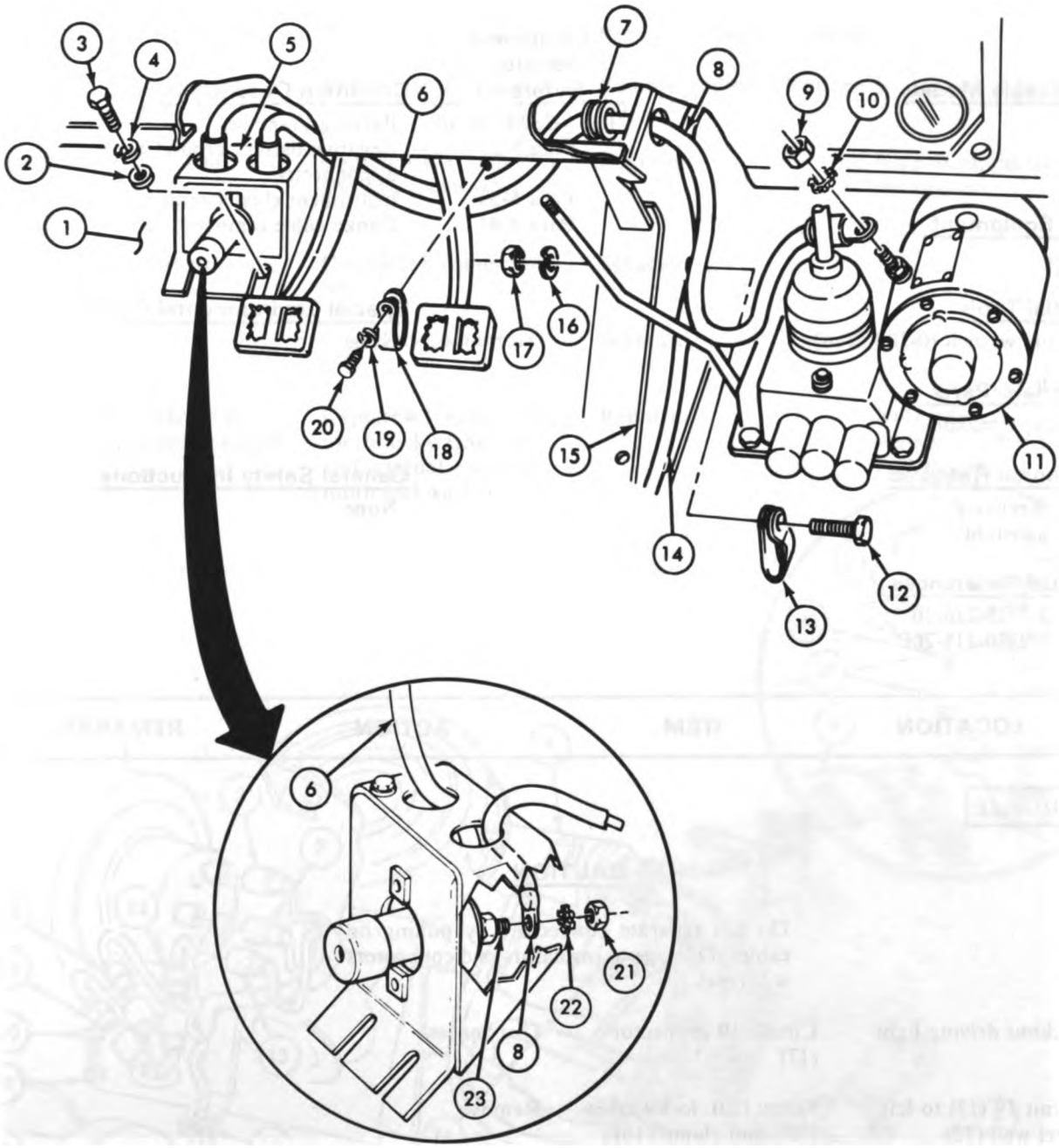
5-53. Starter Switch to Starter Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSPECTION				
6.		Circuit 6 starter cable (8)	Inspect for corrosion and breaks in insulation.	Replace if corroded or broken.
c. INSTALLATION				
7.		Circuit 6 starter cable (8)	*a.* Feed through grommet (7) at transmission tunnel (15).	
			b. Secure to starter (11) with lockwasher (10) and nut (9).	
			c. Secure to transmission tunnel (15) with clamp (13), capscrew (12), lockwasher (16), and nut (17).	Clamp (13) also secures rear wiring harness (14) to transmission tunnel (15).
			d. Secure to firewall (1) with clamp (18), lockwasher (19), and screw (20).	Clamp (18) also secures positive battery cable (6) to firewall (1).
			e. Secure to starter switch (23) with lockwasher (22) and nut (21).	
8.		Starter switch bracket (5)	Secure to firewall (1) with four washers (2), lockwashers (4), and capscrews (3).	

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5-53. Starter Switch to Starter Cable Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASKS:
- Install transmission cover panel (para 10-14).
- Connect negative battery ground cable (para 5-27).

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5-54. Chassis Front Wiring Harness Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
Torque wrench (0-200 lb-in)

Materials/Parts
Adhesive sealant

Personnel Required
One mechanic
One assistant

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
Para 5-27	Negative battery ground cable disconnected.
Para 5-58	Instrument cluster removed.
Para 4-41	Choke cable removed.

Special Environmental Conditions
None

General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

a. REMOVAL

CAUTION

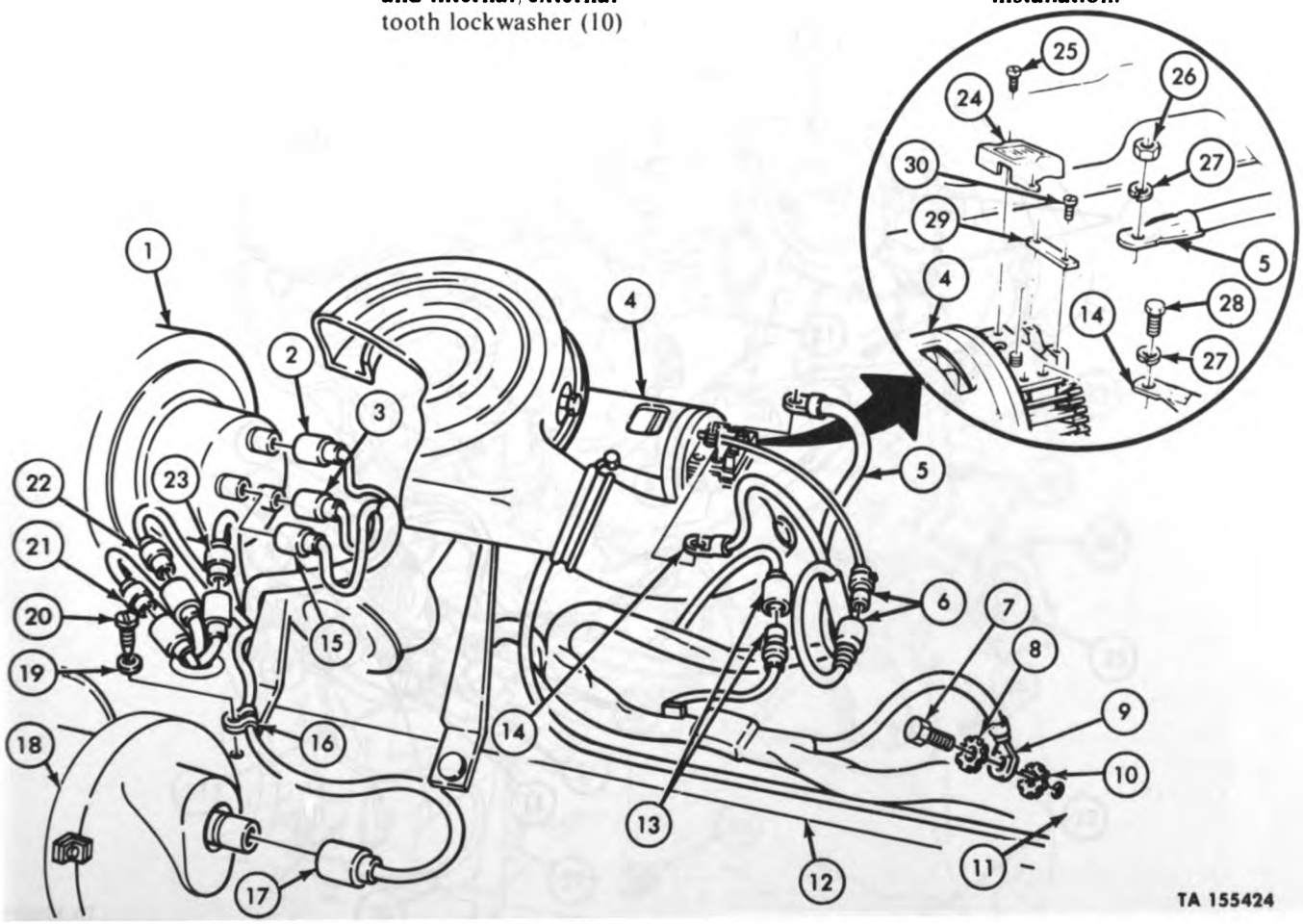
Do not separate connectors by pulling on cables. Damage to insulators and connectors will result.

1.	Blackout driving light (18)	Circuit 19 connector (17)	Disconnect.	
2.	Circuit 19 (17) to left wheel well (12)	Screw (20), lockwasher (19), and clamp (16)	Remove.	
3.	Left headlamp assembly (1)	Circuit 17 (3), 18 (15), and 91 (2) connectors	Disconnect.	Note locations for installation.
4.	Left composite light assembly	Circuit 20 (21), 490 (22), and 491 (23) connectors	Separate.	

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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

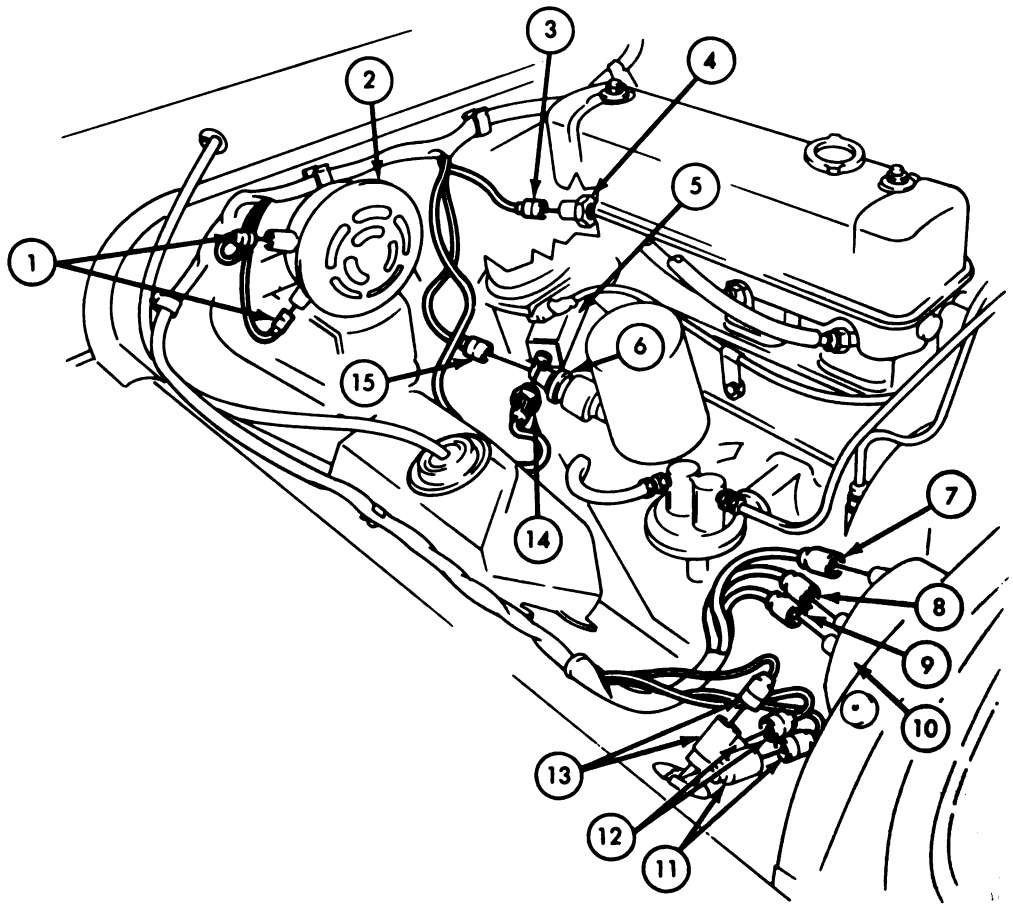
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Terminal cover (24) to alternator (4)	Two screws (25)	Remove.	
6.		Terminal cover (24)	Remove from alternator (4).	
7.	Wire retaining strap (29) to alternator (4)	Two screws (30)	Remove and detach strap (29).	
8.	Circuit 3 (14) and circuit 5 (5) to alternator (4)	Capscrew (28), nut (26), and two lockwashers (27)	Remove.	Note locations for installation.
9.	Rear of alternator (4)	Circuit 568 connectors (6)	Separate.	
10.		Circuit 25 connectors (13)	Separate.	
11.	Ground cable (9) to left side of firewall (11)	Capscrew (7), external tooth lockwasher (8), and internal/external tooth lockwasher (10)	Remove.	Note position of lockwashers (8) and (10) for installation.



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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
12.	Right headlamp assembly (10)	Circuit 17 (7), 18 (8), and 91 (9) connectors	Disconnect.	Note locations for installation.
13.	Right composite light assembly	Circuit 20 (11), 460 (12), and 491 (13) connectors	Separate.	
14.	Oil pressure transmitter (6)	Circuit 36 connector (15)	Disconnect.	
15.	Distributor assembly (5)	Circuit 12 connector (14)	Unscrew and disconnect.	
16.	Horn assembly (2)	Two circuit 25 connectors (1)	Disconnect.	
17.	Coolant temperature transmitter (4)	Circuit 33 connector (3)	Disconnect.	

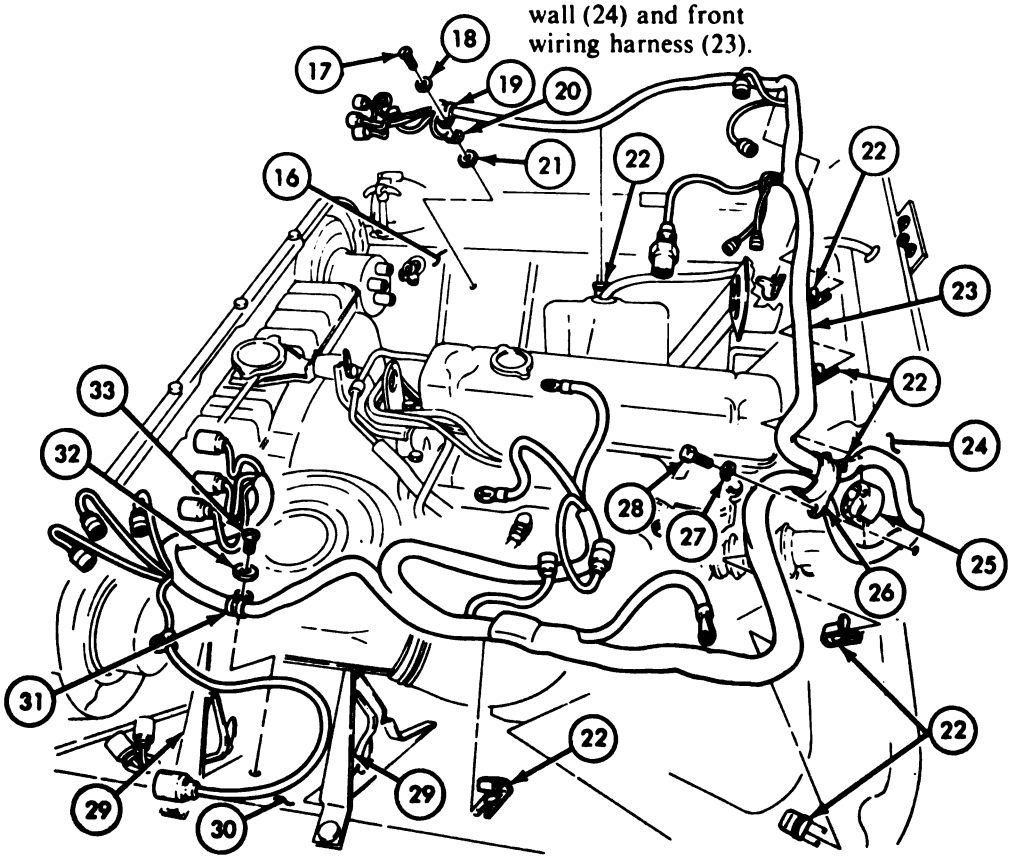


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
18.	Right cable clamp (19) to right wheel well (16)	Screw (17) and lockwashers (18) and (21)	Remove and detach clamp (19) and ground wire (20).	Note position of lockwashers (18) and (21) for installation.
19.	Left cable clamp (31) to left wheel well (30)	Screw (33) and lockwasher (32)	Remove and separate clamp (31) from front wiring harness (23).	
20.		Front wiring harness (23)	Lift out of eight spring clips (22), pull out from two air cleaner brackets (29), and drape over top of engine.	
21.	Grommet retainer (26) to firewall (24)	Two capscrews (28) and lockwashers (27)	Remove.	
22.		Grommet retainer (26)	Pull away from firewall (24) and slide off of front wiring harness (23).	
23.		Rubber grommet (25)	Remove from firewall (24) and front wiring harness (23).	

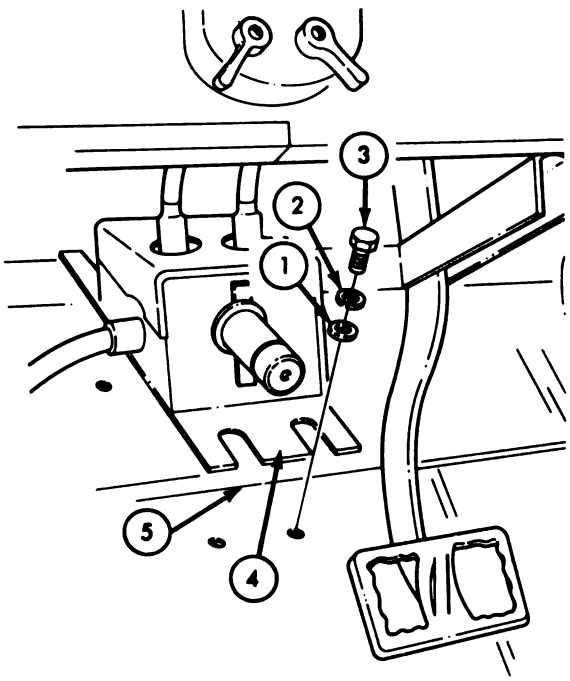


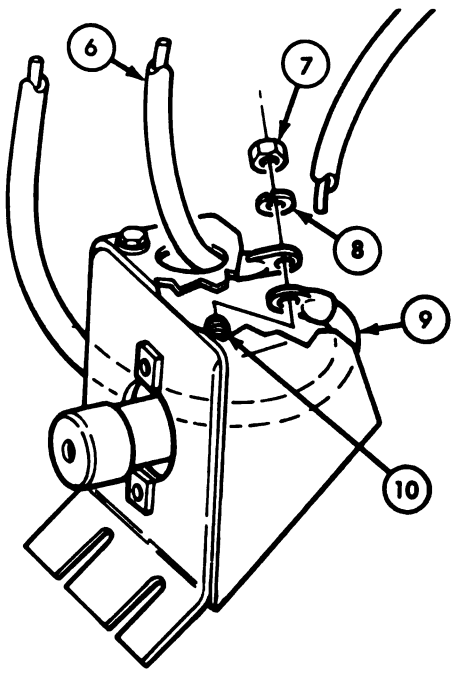
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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
24.	Starter switch bracket (4) to floor panel (5)	Four capscrews (3), lockwashers (2), and flat washers (1)	Remove and pull starter switch bracket (4) from floor panel (5).	
		NOTE The positive battery cable is separate from the front wiring harness and should not be removed.		
25.	Positive battery cable (6) and circuit 5 terminal (9) to starter switch (10)	Nut (7) and lockwasher (8)	*a.* Remove and disconnect circuit 5 terminal (9) from starter switch (10).	Note location for installation.
			b. Reinstall finger tight to secure positive battery cable (6) to switch (10).	





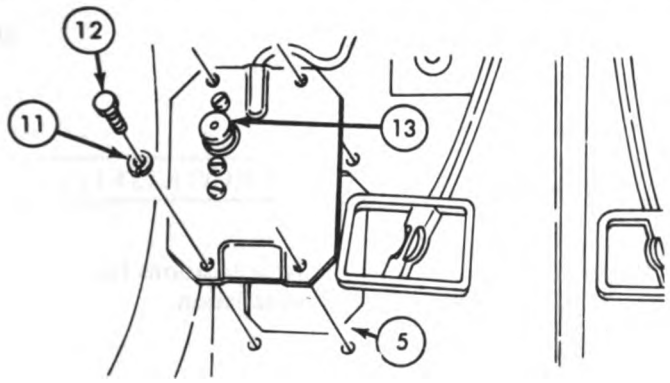
26.	Headlight beam selector switch (13) to floor panel (5)	Four capscrews (12) and lockwashers (11)	Remove and pull selector switch (13) away from floor panel (5).	
27.	Headlight beam selector switch (13)	Circuit 16 (14), 17 (15), and 18 (16) connectors	Disconnect.	Note locations for installation.

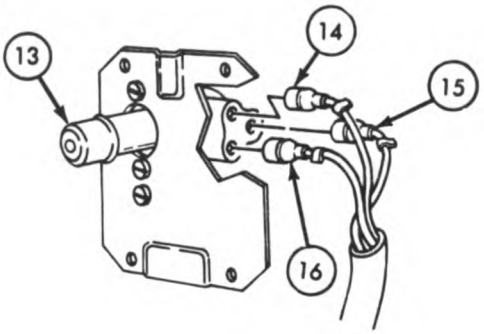
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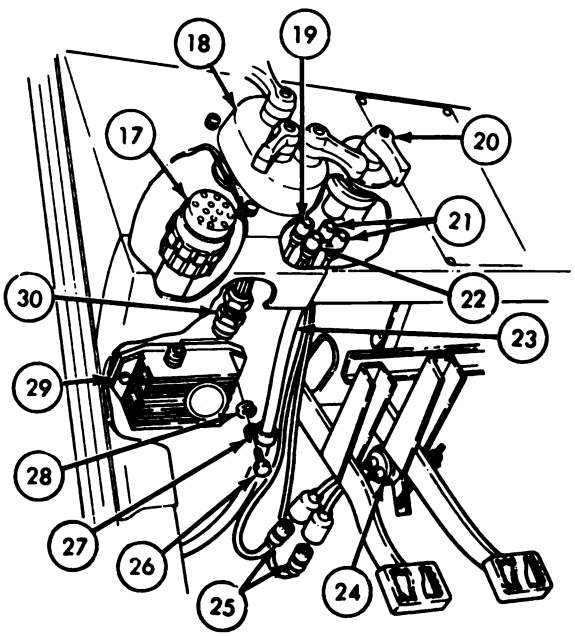
5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





28. Front harness (23) to solid-state flasher (29)	Capscrew (26), lockwasher (28), and clamp (27)	Remove.	
29. Front harness (23) to main light switch (18)	Main light switch connector plug (17)	Unscrew and disconnect.	
30. Solid-state flasher (29)	Solid-state flasher connector plug (30)	Unscrew and disconnect.	
31. Ignition switch (20)	Circuits 27 (19), 12 (22), and two circuit 11 (21) connectors	Disconnect.	Note locations for installation.
32. Stoplight switch (24)	Two circuit 75 connectors (25)	Separate.	



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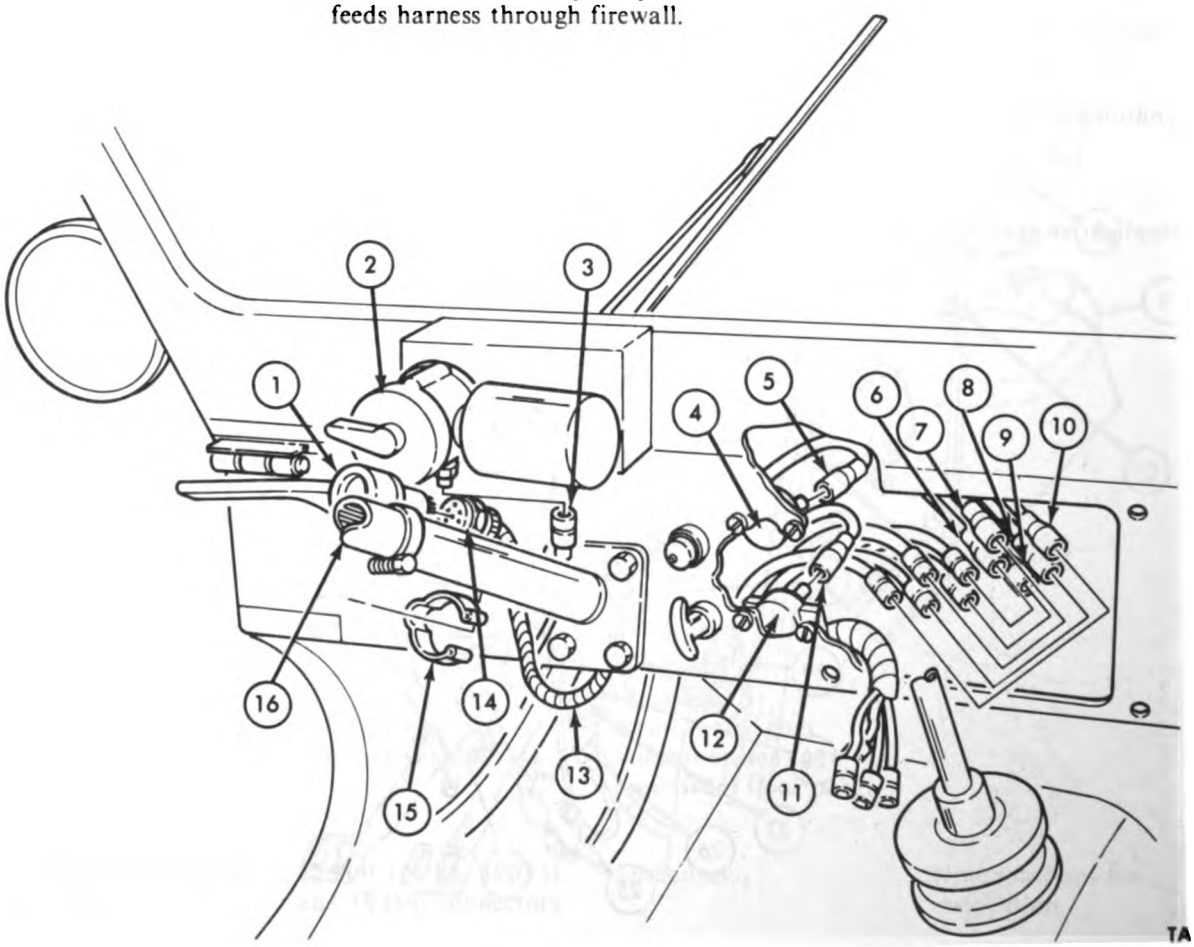
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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
33.	Directional signal switch (1)	Multiple connector plug (14)	Unscrew and disconnect.	
34.	Steering column (16)	Spring clip (15)	Remove.	
35.	Windshield wiper motor (2)	Circuit 71 connector (3)	Disconnect.	
36.	Two circuit breakers (4) and (12)	Two circuit 25 (5) and two circuit 27 (11) connectors	Disconnect.	Note locations for installation.
37.	Front harness (13) to rear harness	Circuit 21 (6), 22-460 (7), 22-461 (8), 23 (9), and 24-490 (10) connectors	Separate.	

NOTE

Mechanic will remove front harness through instrument cluster opening, while assistant feeds harness through firewall.



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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
38.		Front wiring harness (13)	Remove through instrument cluster opening (17).	

b. INSTALLATION

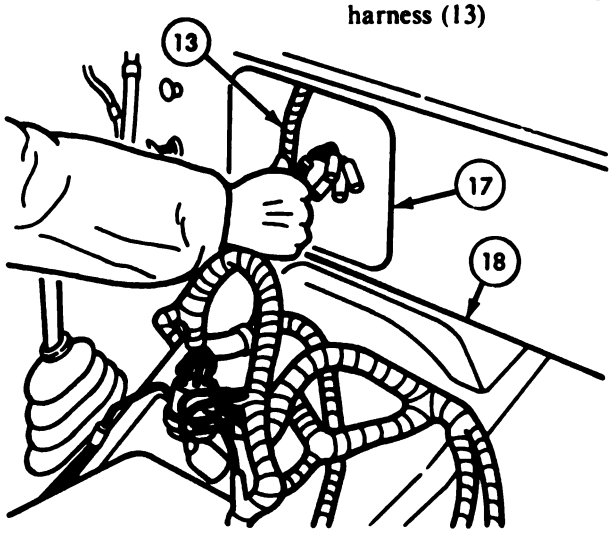
CAUTION

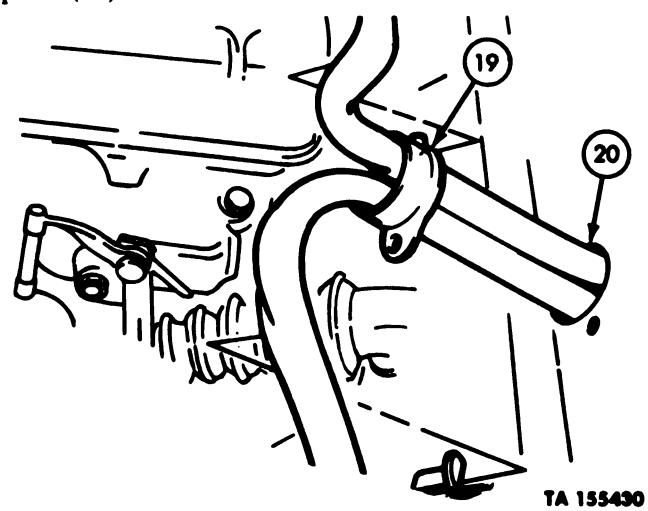
Use care when installing wiring harness. Damage to connectors and insulation will result if excessive force is used to pull harness through firewall.

NOTE

Assistant will feed wiring harness through instrument cluster opening, while mechanic routes harness in engine compartment.

39.	Engine section of front wiring harness (13)	*a.* Pull through firewall opening (20). *b.* Insert through grommet retainer (19) and slide retainer (19) to firewall opening (20). *c.* Drape around engine compartment in approximate position.	
40.	Crew compartment section of front wiring harness (13)	Route to approximate position beneath dash panel (18).	



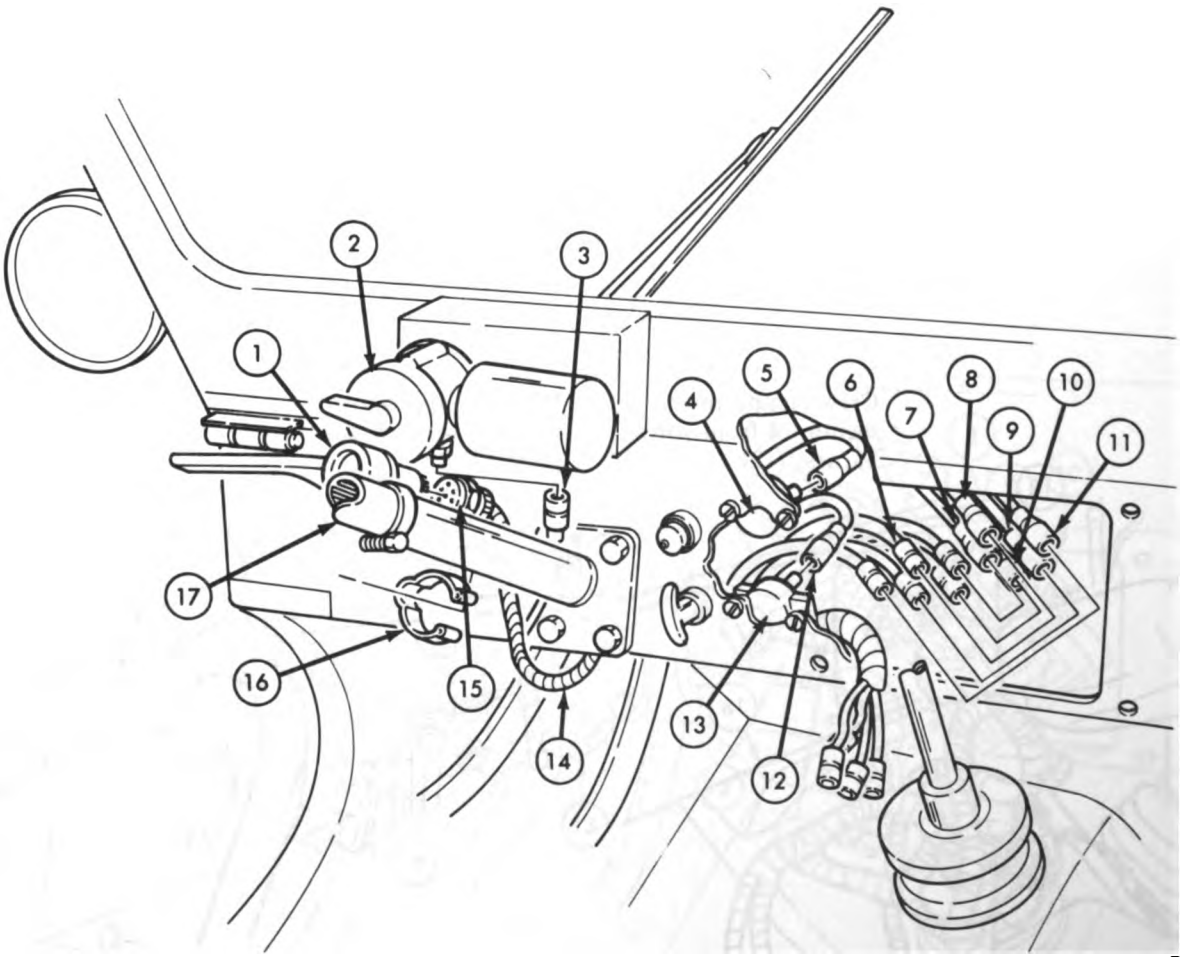


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
41.		Circuit 21 (7), 22-460 (8), 22-461 (9), 23 (10) and 24-490 (11) connectors	Connect to rear harness (6) located at instrument cluster opening.	
42.		Two circuit 25 connectors (5)	Connect to circuit breaker (4).	
43.		Two circuit 27 connectors (12)	Connect to circuit breaker (13).	
44.		Circuit 71 connector (3)	Connect to windshield wiper motor (2).	
45.		Directional signal switch connector plug (15)	Secure to directional signal switch (1).	
46.		Spring clip (16)	Snap on to center of steering column (17).	Secures harness (14) to column (17).

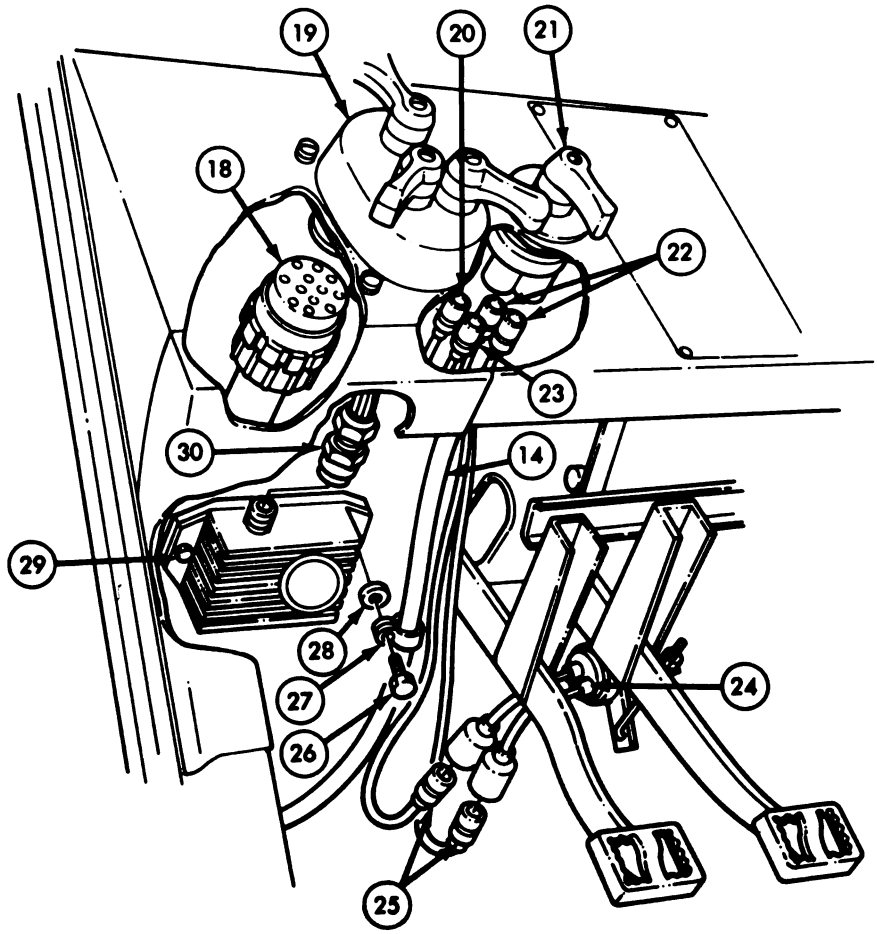


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
47.		Two circuit 75 connectors (25)	Connect to stoplight switch (24).	
48.		Solid-state flasher connector plug (30)	Secure to solid-state flasher (29).	
49.		Circuits 27 (20), 12 (23), and two circuit 11 (22) connectors	Connect to marked locations on ignition switch (21).	Circuit 27 (20) connects to terminal B, 12 (23) to D, and two 11 (22) connectors to A and C.
50.		Main light switch connector plug (18)	Secure to main light switch (19).	
51.		Front wiring harness (14)	Secure to solid-state flasher (29) with clamp (27), lockwasher (28), and capscrew (26).	

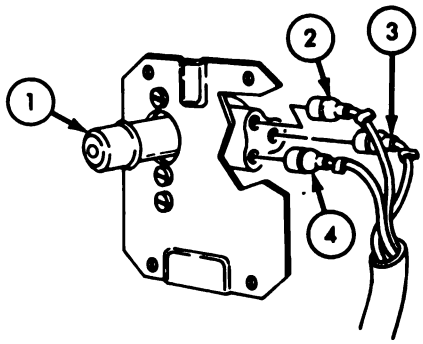


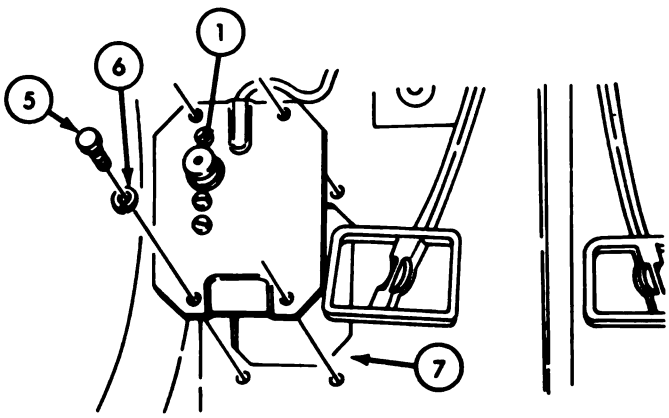
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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
52.		Circuit 16 (2), 17 (3), and 18 (4) connectors	Connect to marked locations on headlight beam selector switch (1).	Circuit 17 (3) connects to terminal L, and circuit 18 (4) to H.
53.		Headlight beam selector switch (1)	Secure to floor panel (7) with four lockwashers (6) and capscrews (5).	





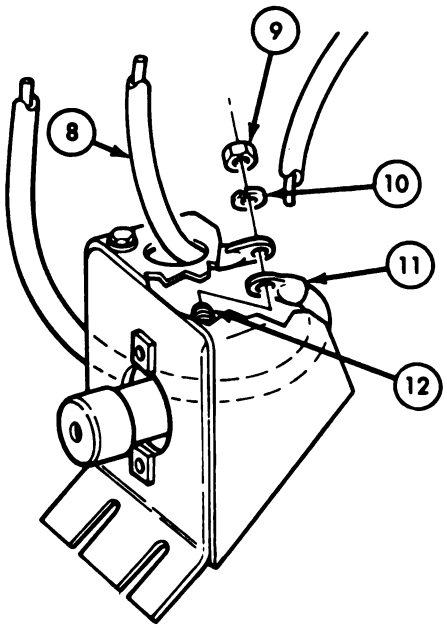
54.		Circuit 5 terminal (11)	Remove nut (9) and lockwasher (10), and secure to starter switch (12) with lockwasher (10) and nut (9).	Circuit 5 (11) must be installed at the same location as the positive battery cable (8).
55.		Starter switch bracket (16)	Secure to floor panel (7) with four flat washers (13), lockwashers (14), and capscrews (15).	

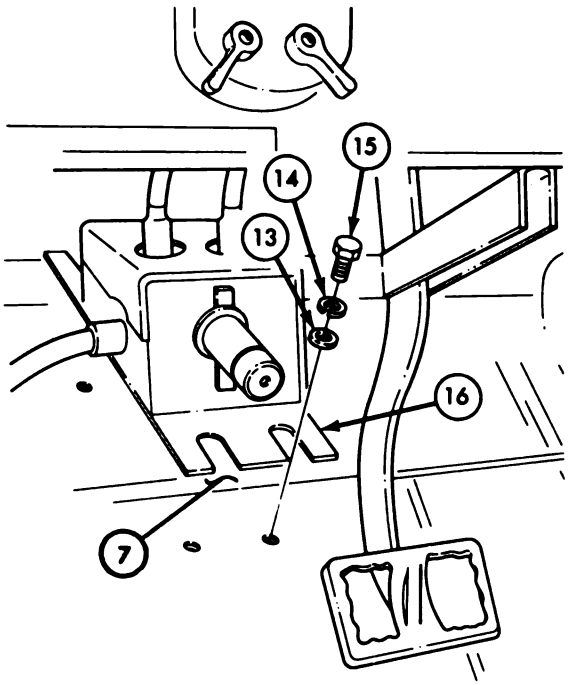
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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

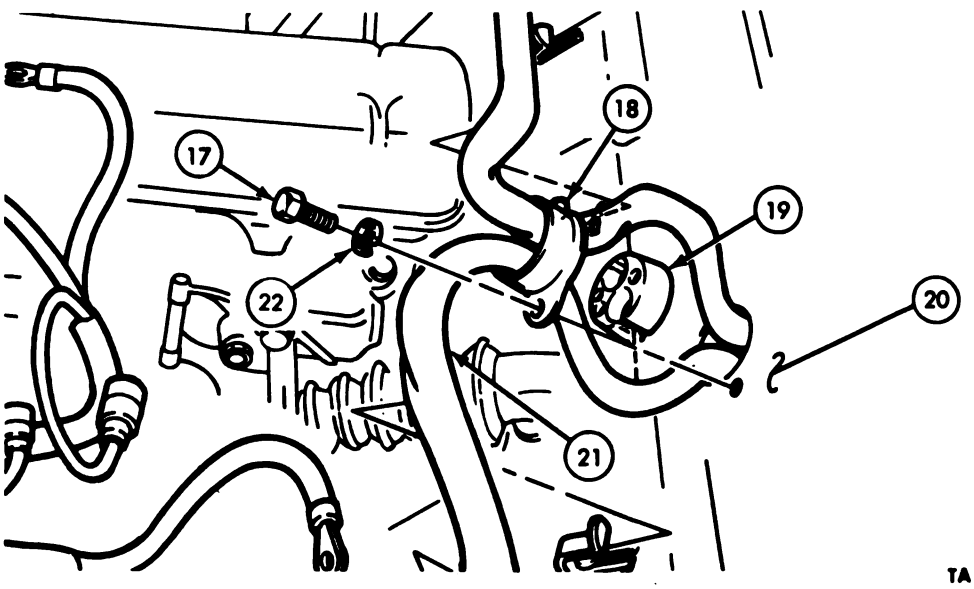
STEP NO.	LOCATION	ITEM	ACTION	REMARKS





56. Front wiring harness (21) — Install into rubber grommet (19).

57. Rubber grommet (19) and grommet retainer (18) — Secure to firewall (20) with two lockwashers (22) and capscrews (17).

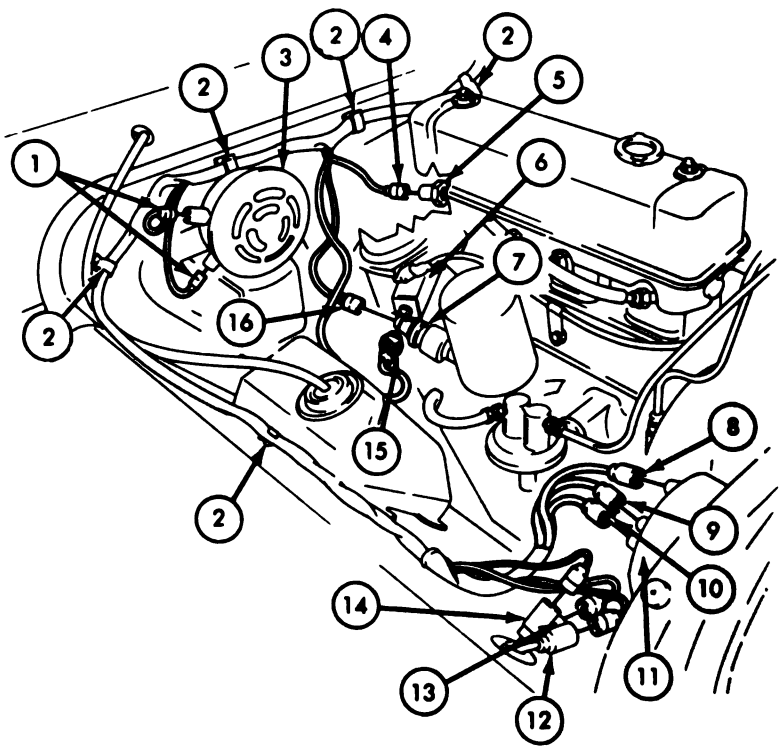


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
58.		Front wiring harness	Secure to vehicle with eight spring clips (2).	
59.		Circuit 33 connector (4)	Connect to coolant temperature transmitter (5).	
60.		Two circuit 25 connectors (1)	Connect to horn assembly (3).	
61.		Circuit 12 connector (15)	Secure to distributor assembly (6).	
62.		Circuit 36 connector (16)	Connect to oil pressure transmitter (7).	
63.		Circuit 20 (12), 460 (13), and 491 (14) connectors	Connect to matched right composite light assembly connectors.	
64.		Circuit 17 (8), 18 (9), and 91 (10) connectors	Connect to marked locations on right headlamp assembly (11).	

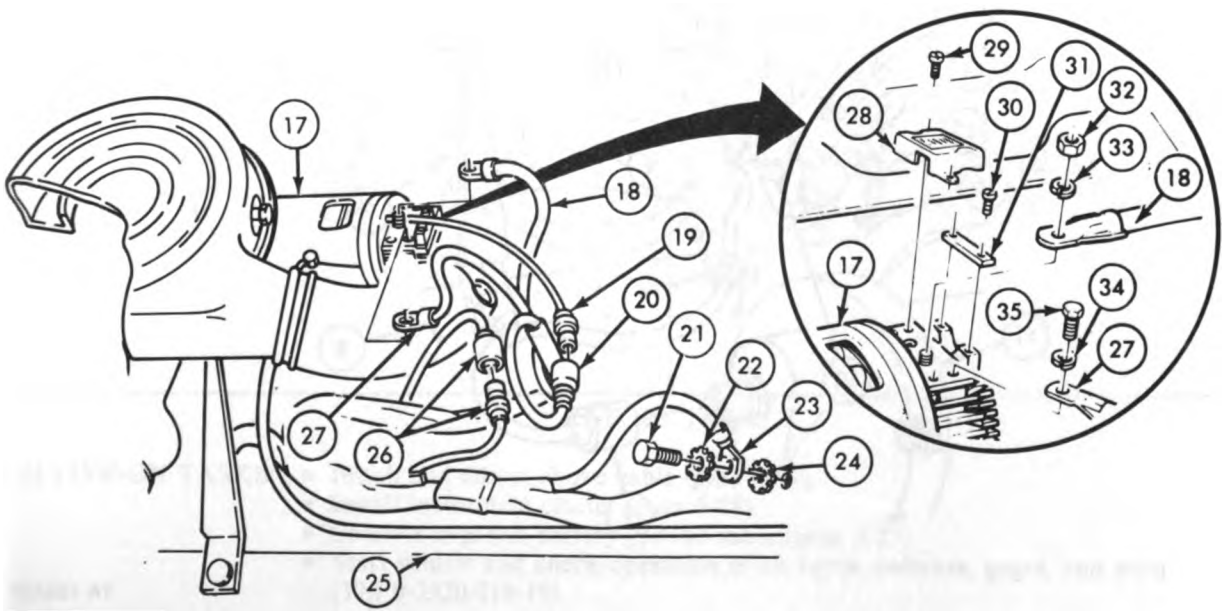


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
65.		Ground cable (23)	Secure to left side of firewall (25) with two lockwashers (22) and (24), and capscrew (21).	Make sure the larger lockwasher (24) is positioned between the cable (23) and firewall (25).
66.		Circuit 25 wire connector (26)	Reconnect at rear of alternator (17).	
67.		Circuit 568 wire connector (20)	Connect to alternator circuit 568 wire (19).	
68.		Circuit 3 terminal (27)	Secure to marked location on alternator (17) with lockwasher (34) and capscrew (35).	Tighten to 82-102 lb-in (9-12 N•m).
69.		Circuit 5 terminal (18)	*a.* Secure to marked location on alternator (17) with lockwasher (33), and nut (32).	Tighten to 45-55 lb-in (5-6.2 N•m).
			b. Seal completely.	Use adhesive sealant.
70.		Wire retaining strap (31)	Secure to alternator (17) with two screws (30).	
71.		Terminal cover (28)	Secure to alternator (17) with two screws (29).	

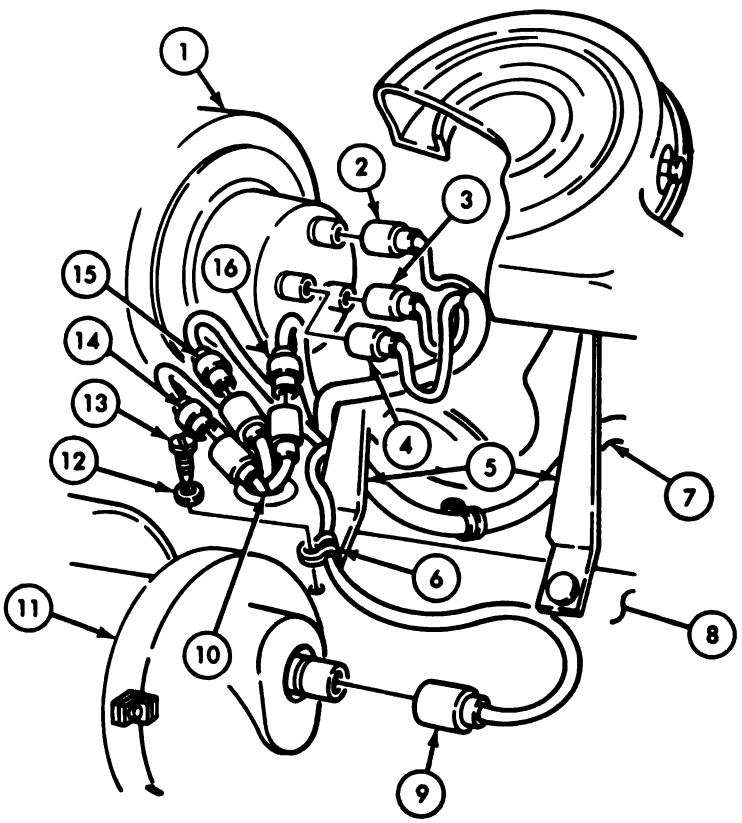


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
72.		Left branch of front front wiring harness (7)	Route through upper openings in two air cleaner brackets (5).	
73.		Circuit 20 (14), 461 (15), and 491 (16) connectors	Connect to matching left composite light connectors (10).	
74.		Circuit 17 (3), 18 (4), and 91 (2) connectors	Connect to marked locations of left headlamp assembly (1).	
75.		Circuit 19 connector (9)	*a.* Connect to blackout driving light (11). *b.* Secure to left fender (8) with clamp (6), lockwasher (12), and screw (13).	

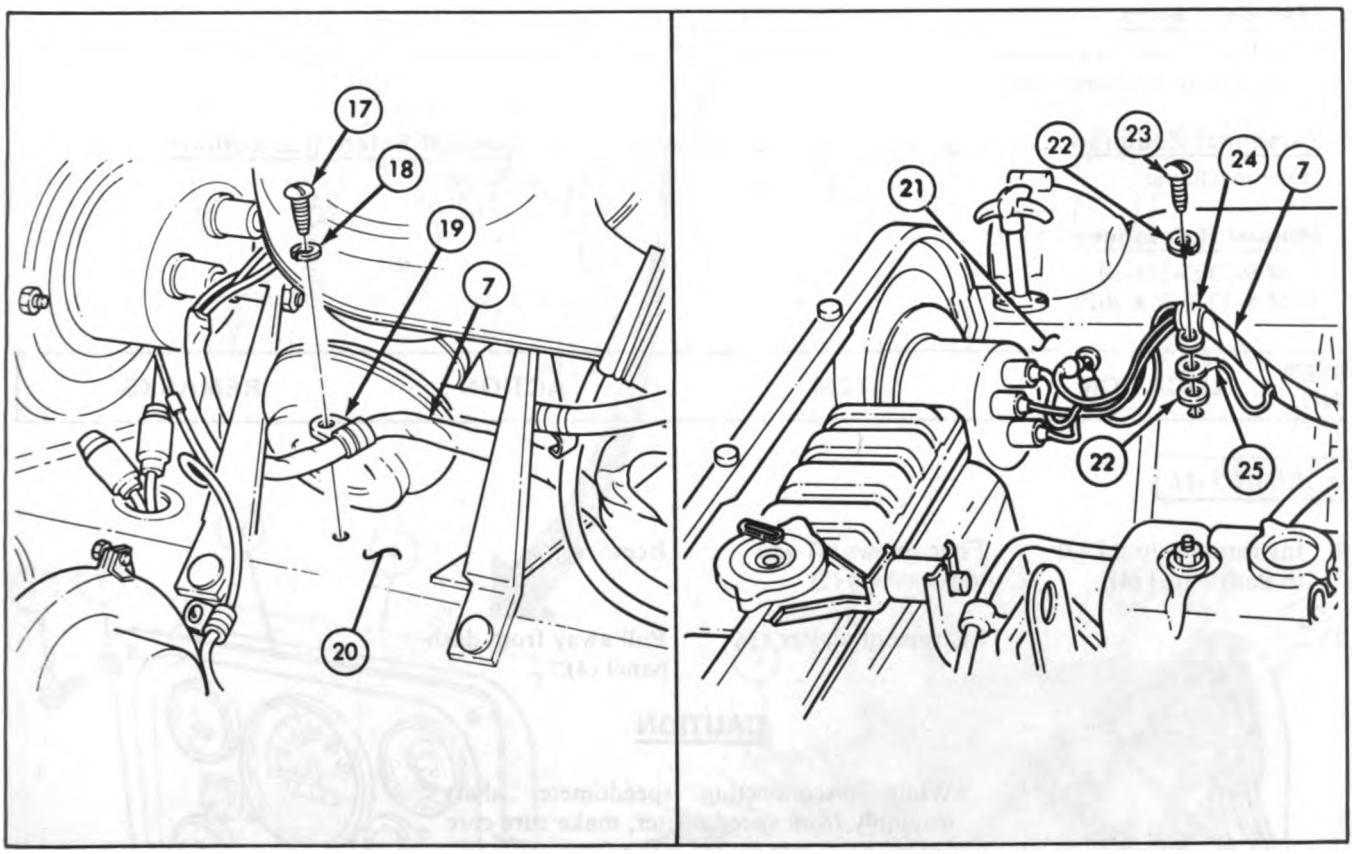


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5-54. Chassis Front Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
76.		Front wiring harness (7)	*a.* Secure to left wheel well (20) with clamp (19), lockwasher (18), and screw (17).	
			NOTE The right wiring harness clamp must also secure ground wire to the vehicle body.	
			b. Secure to right wheel well (21) with clamp (24), two lockwashers (22), and screw (23).	Be sure to position ground wire (25) under clamp (24). Lockwasher (22) must be between ground wire (25) and right wheel well (21).



END OF TASK!

FOLLOW-ON TASKS:
- Install and adjust choke cable (para 4-41).
- Install instrument cluster (para 5-58).
- Connect negative battery ground cable (para 5-27).
- Start vehicle and check operation of all lights, switches, gages, and horn (TM 9-2320-218-10).

TA 155438

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5-55. Chassis Rear Wiring Harness Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
Mechanics wire (seven feet)
Two plastic retaining straps

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference	Condition Description
TM 9-2320-218-10	Parking brake set.
TM 9-2320-218-10 Para 5-27	Front seats removed. Negative battery ground cable disconnected.
Para 10-14	Transmission cover panel removed.
Para 10-34	Rear composite light cable guards removed.

Special Environmental Conditions
None

General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.	
2.		Instrument cluster (3)	Pull away from dash panel (4).	

CAUTION

While disconnecting speedometer shaft assembly from speedometer, make sure core cable (10) is not pulled away from shaft (9). This can cause core separation from transmission transfer.

3.	Behind instrument cluster (3)	Speedometer shaft assembly (9)	Loosen shaft nut (8) and disconnect from speedometer (7).	

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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

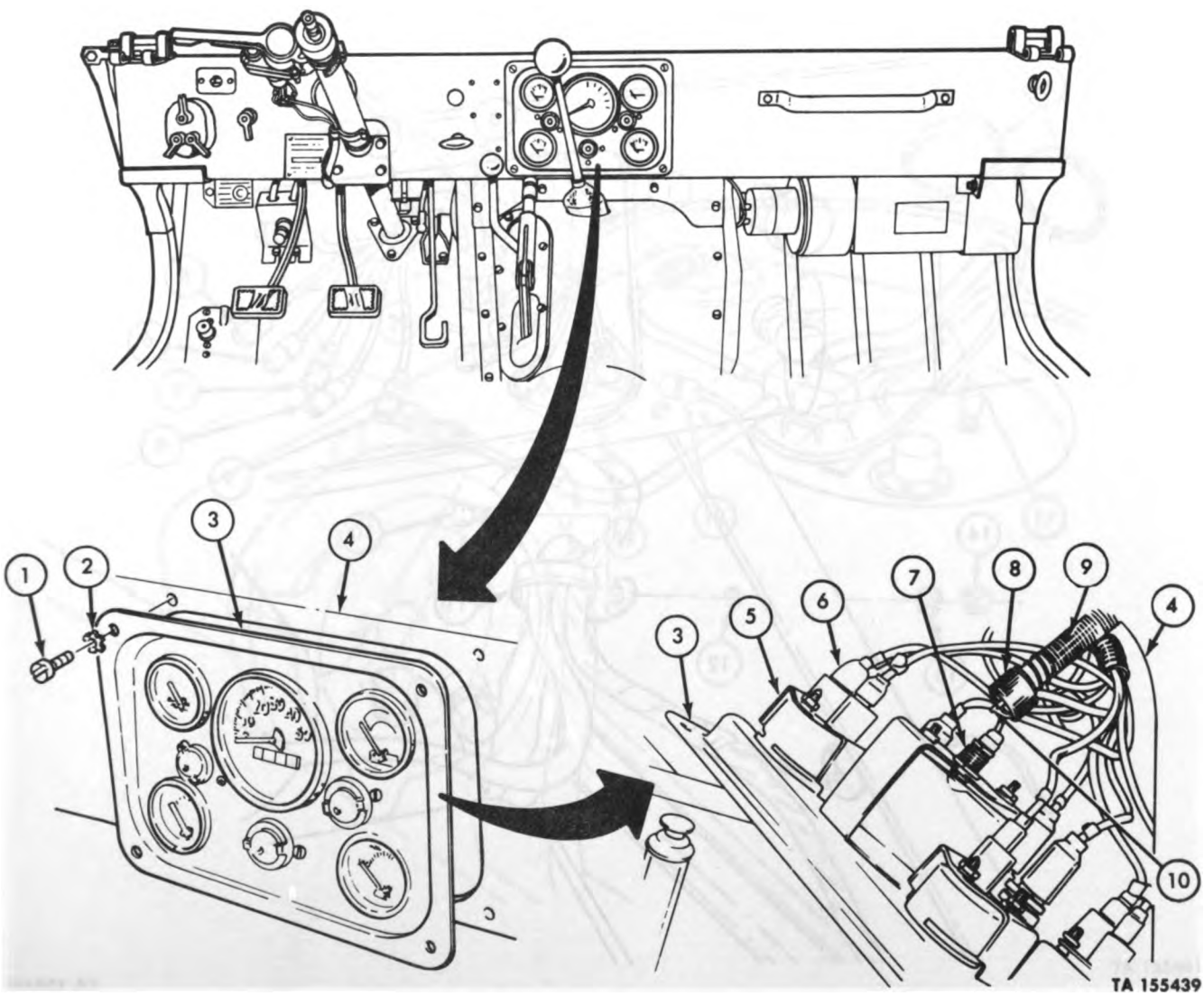
CAUTION

Do not separate connectors by pulling on cables. Damage to insulators or connectors will result.

NOTE

Make sure to note all cable tag numbers for installation.

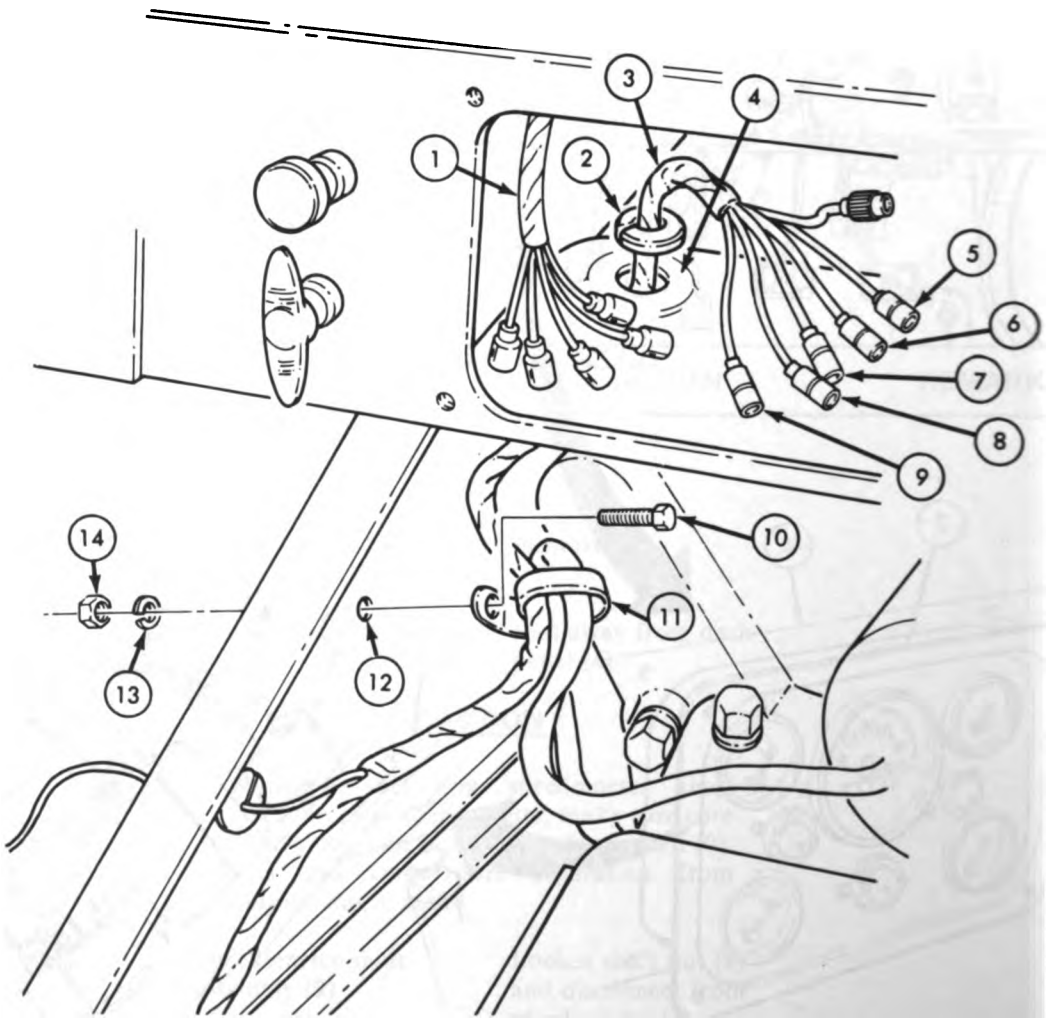
4.	Fuel gage (5)	Circuit 28 connector (6)	Disconnect.	



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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Front harness (1) to rear harness (3)	Circuit 21 (5), 22-460 (6), 22-461 (7), 23 (8), and 24-490 (9) connectors	Separate.	
6.	Rear wiring harness (3) to transmission tunnel (4)	Grommet (2)	Remove.	
7.		Rear wiring harness (3)	Push through hole in transmission tunnel (4).	
8.	Rear wiring harness (3) to left transmission tunnel wall (12)	Nut (14), lockwasher (13), capscrew (10), and cable clamp (11)	Remove.	

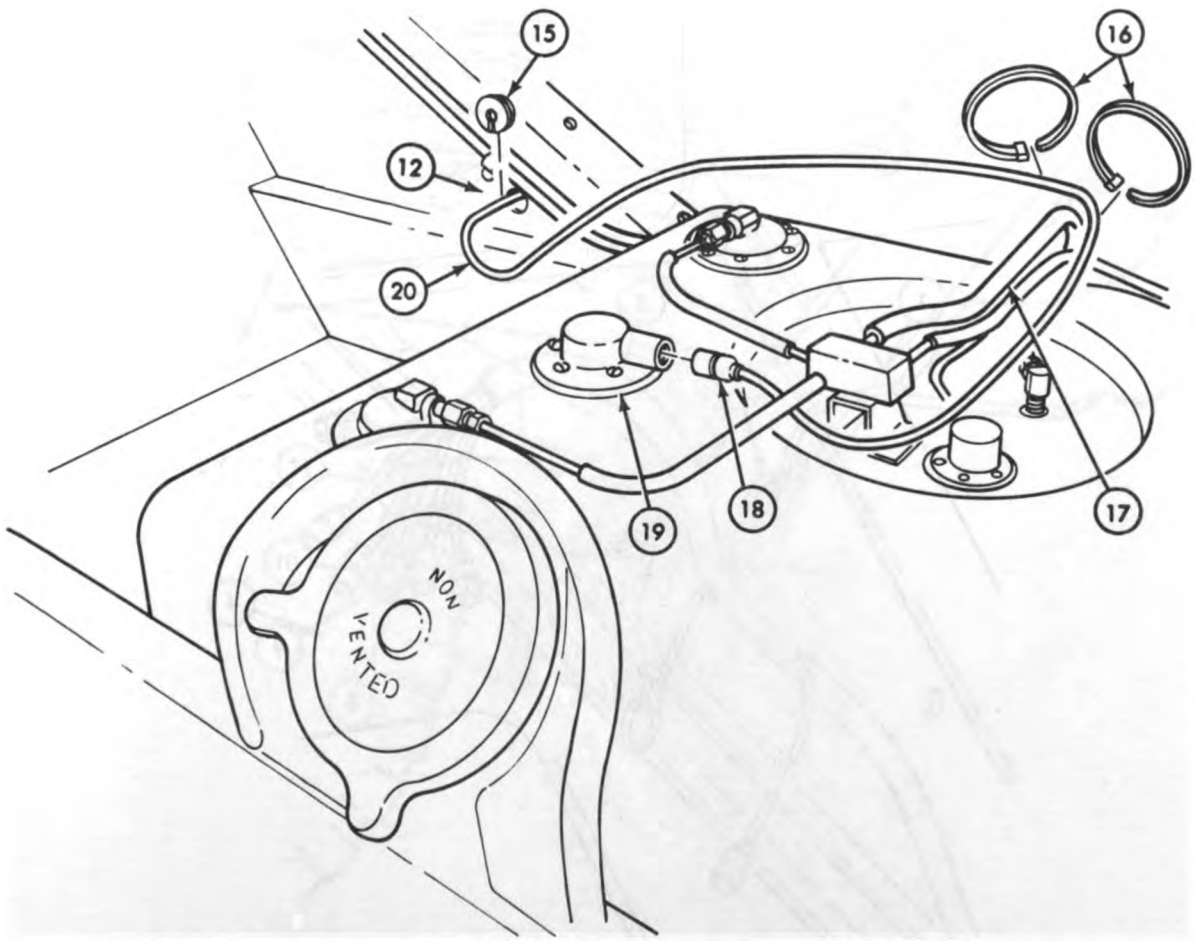


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
9.	Fuel level sending unit (19)	Circuit 28 connector (18)	Disconnect.	
10.	Circuit 28 (20) to fuel line (17)	Two retainer straps (16)	Cut and remove.	Discard straps (16).
11.	Circuit 28 (20) to left transmission tunnel wall (12)	Grommet (15)	Remove.	
12.		Circuit 28 (20)	Push through opening on left transmission tunnel wall (12).	

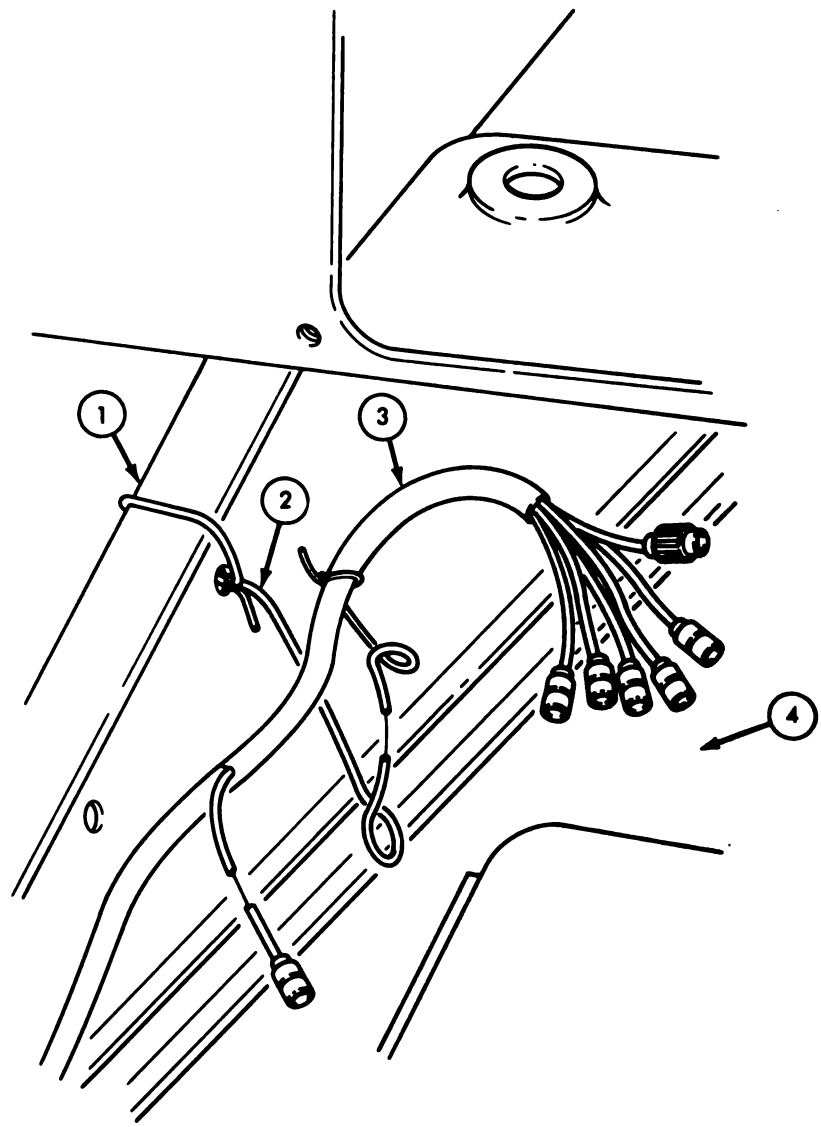


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE The rear wiring harness is routed to the rear of vehicle through the left transmission tunnel wall (1).		
13.	Front section of rear wiring harness (3)	Seven feet of mechanic's wire (2)	*a.* Secure to harness (3) at transmission tunnel (4). *b.* Secure to left transmission tunnel wall (1).	

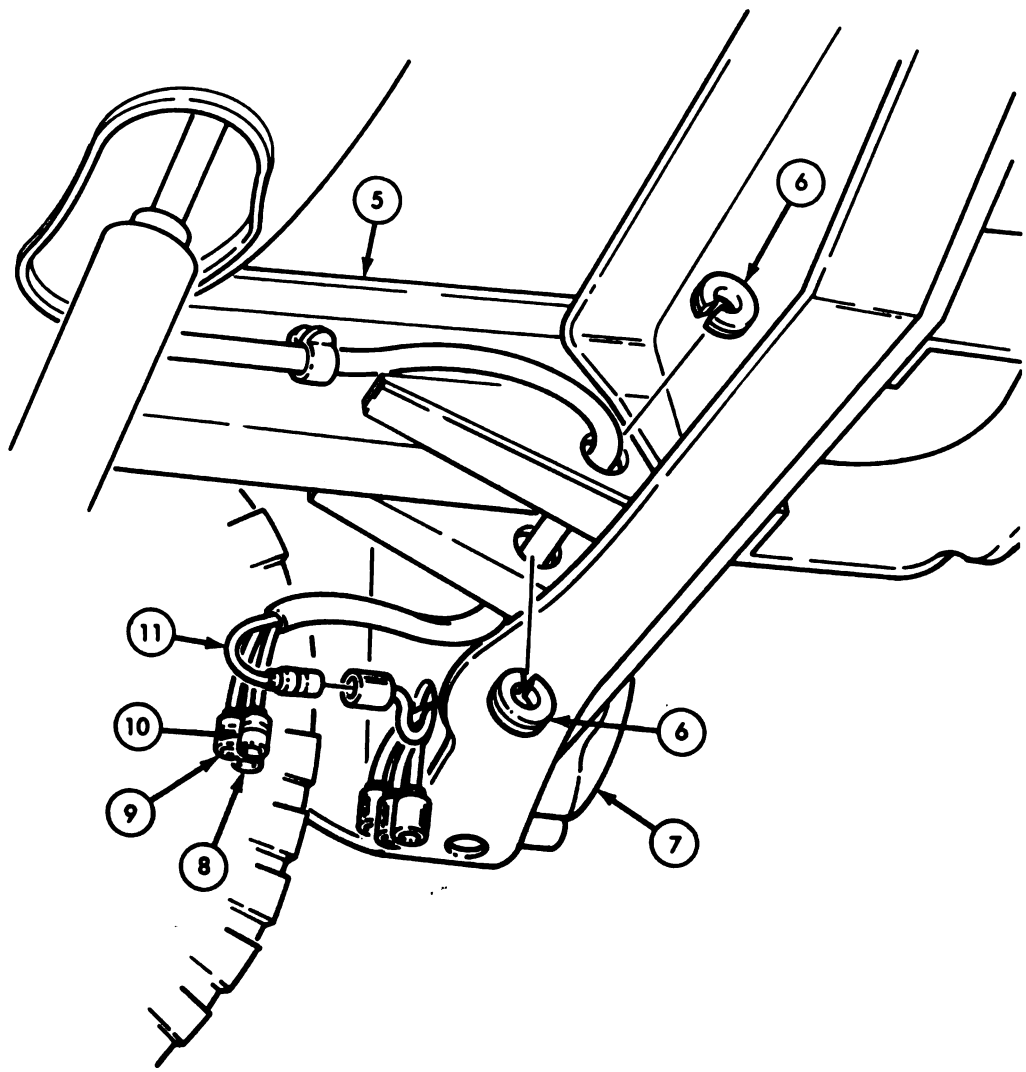


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
14.	Right rear composite light (7)	Circuit 21 (8), 22-460 (9), 23 (10), and 24 (11) connectors	Separate.	
15.	Right rear body rail (5)	Two grommets (6)	Remove.	

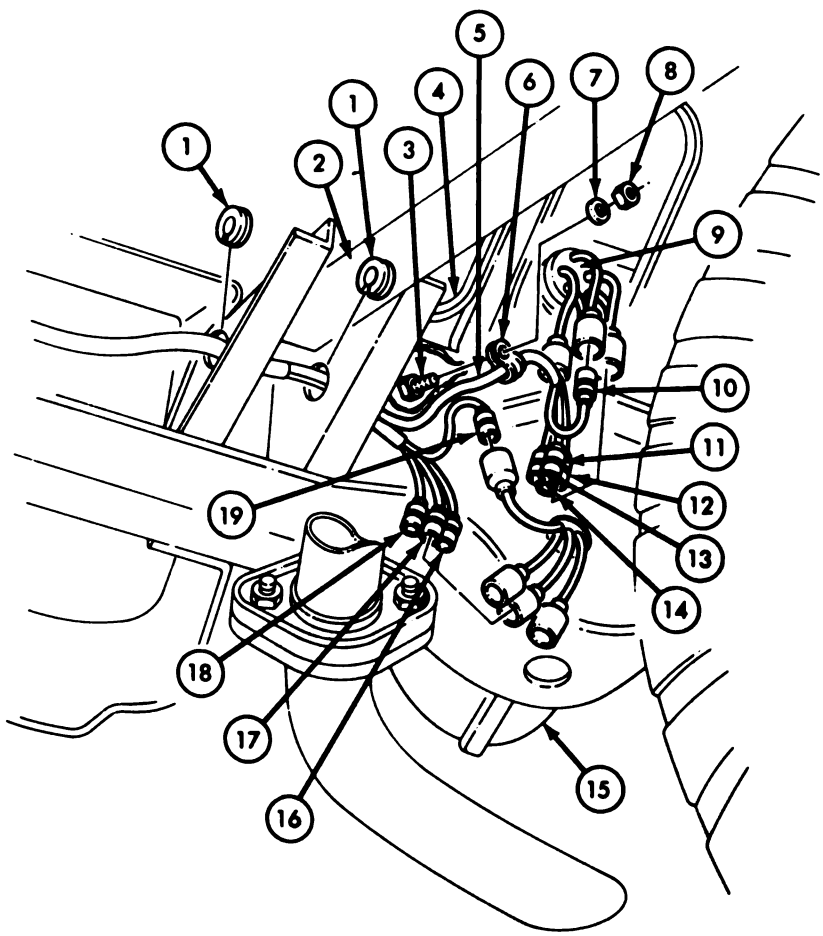


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
16.	Left rear body rail (2)	Two grommets (1)	Remove.	
17.	Trailer receptacle (9)	Circuit 21 (10), 22-460 (11), 22-461 (12), 23 (13) and 24 (14) connectors	Separate.	
18.	Left rear composite light (15)	Circuit 21 (16), 22-461 (17), 23 (18) and 24 (19) connectors.	Separate.	
19.	Left rear section of rear wiring harness (5) to vehicle body (4)	Screw (3), nut (8), lockwasher (7), and clamp (6)	Remove.	

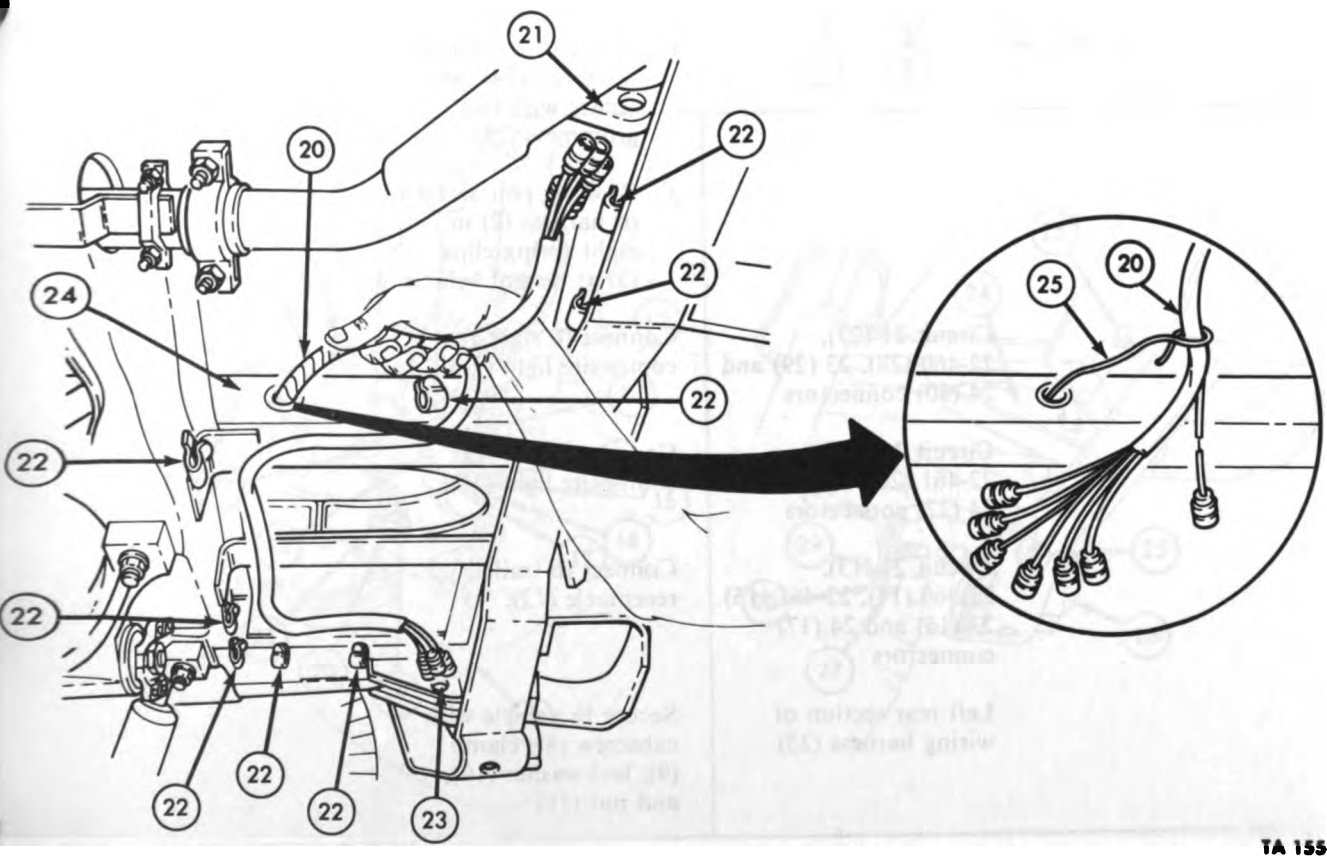


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
20.		Rear wiring harness (20)	*a.* Remove from eight spring clips (22). *b.* Push through both body rails (21) and (23) to center of vehicle.	
			NOTE Wire attached in step 13 will be used to pull new harness through body rail during installation. Make sure wire remains attached to left transmission tunnel wall during removal.	
			c. Remove by pulling out from rear of left center body rail (24).	
21.		Seven feet of mechanic's wire (25)	Unhook from harness (20) only.	



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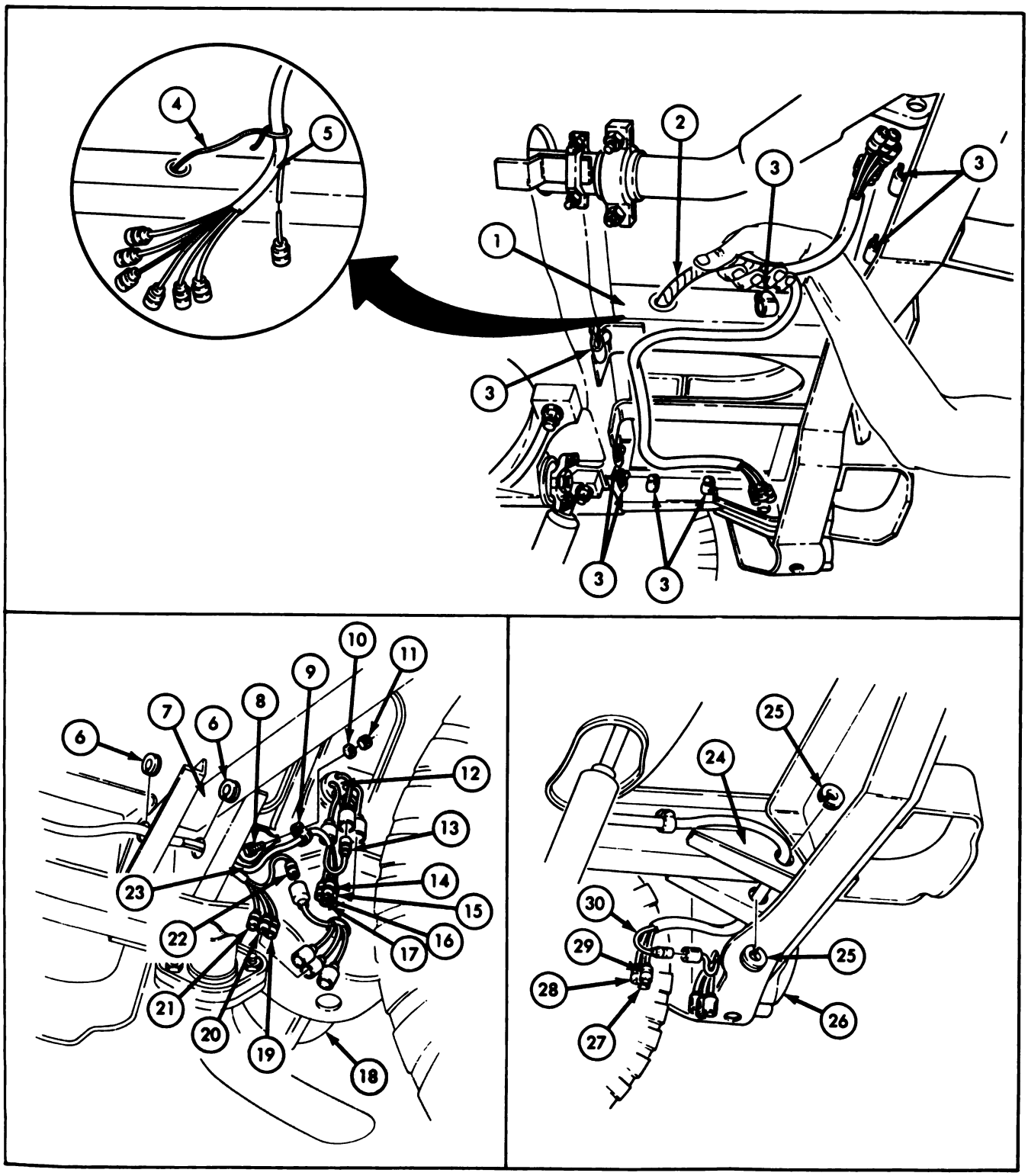
5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
22.		Rear wiring harness (5)	Position on vehicle as follows: *a.* Connect mechanic's wire (4) to front section of harness (5). *b.* Using wire (4), pull harness (5) through left center body rail (1) to approximate position. *c.* Unhook and remove wire (4). *d.* Route through left body rail (7), and secure with two grommets (6). *e.* Route through right body rail (24), and secure with two grommets (25). *f.* Position rear section of harness (2) in eight spring clips (3) at rear of vehicle.	
23.		Circuit 21 (27), 22-460 (28), 23 (29) and 24 (30) connectors	Connect to right rear composite light (26).	
24.		Circuit 21 (19), 22-461 (20), 23 (21), and 24 (22) connectors	Connect to left rear composite light (18).	
25.		Circuit 21 (13), 22-460 (14), 22-461 (15), 23 (16) and 24 (17) connectors	Connect to trailer receptacle (12).	
26.		Left rear section of wiring harness (23)	Secure to vehicle with capscrew (8), clamp (9), lockwasher (10), and nut (11).	

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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

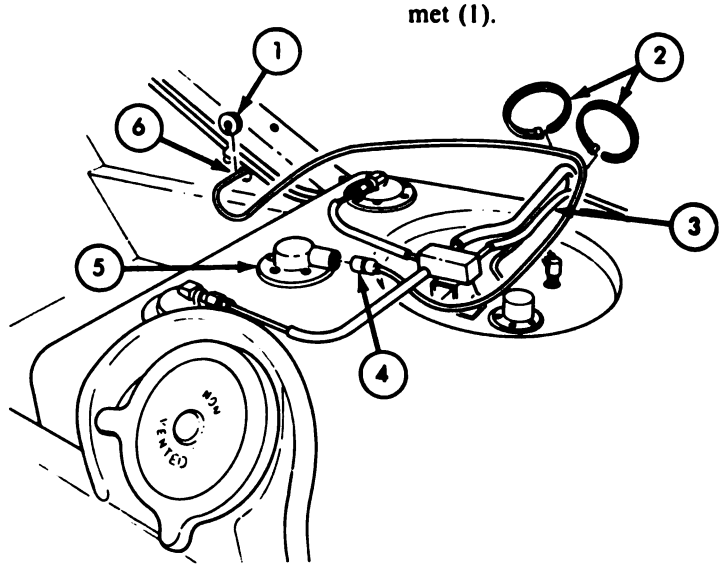


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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
27.		Circuit 28 connector (4)	*a.* Push through opening at left transmission tunnel wall (6). *b.* Secure to fuel line (3) with two new retainer straps (2). *c.* Connect to fuel level sending unit (5). *d.* Secure to left transmission tunnel wall (6) with grommet (1).	
28.		Front section of rear harness (9)	*a.* Push up through hole in transmission tunnel (10). *b.* Secure to transmission tunnel (10) with grommet (8).	
29.		Circuit 21 (11), 22-460 (12), 22-461 (13), 23 (14) and 24-490 (15) connectors	Secure to front harness connectors (7).	
30.		Rear wiring harness (9)	Secure to left transmission tunnel wall (6) with capscrew (16), clamp (17), lockwasher (18), and nut (19).	

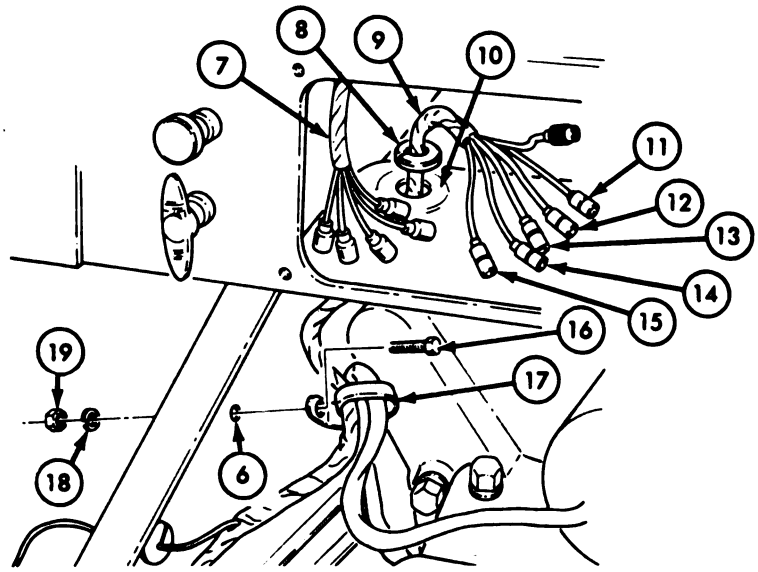


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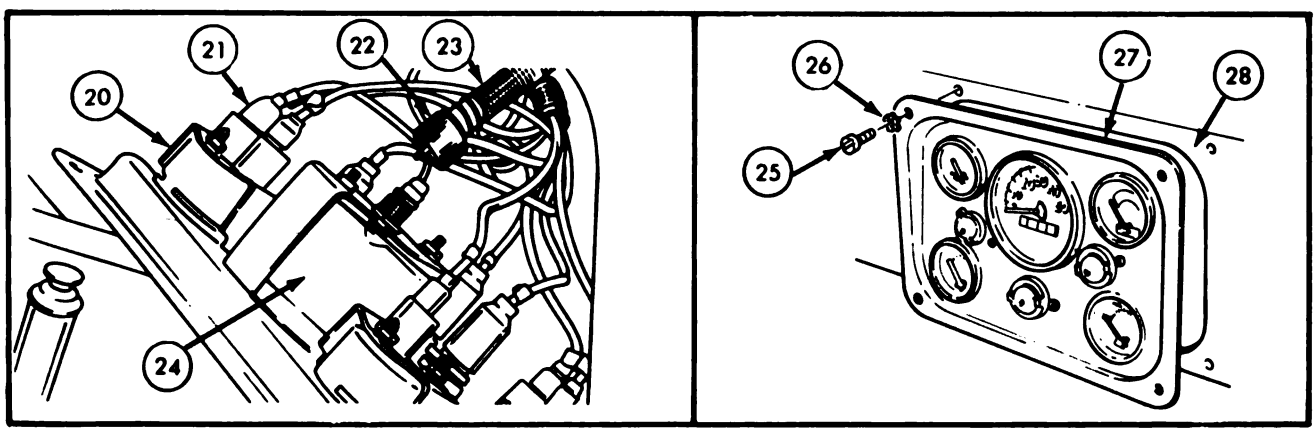
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5-55. Chassis Rear Wiring Harness Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



31.		Circuit 28 connectors (21)	Connect to fuel gage (20).
32.		Speedometer shaft assembly (23)	Position to speedometer (24) and secure with shaft nut (22).
33.		Instrument cluster (27)	Position to dash panel (28) and secure with four lockwashers (26) and screws (25).



END OF TASK !

FOLLOW-ON TASKS:
- Install two rear composite light cable guards (para 10-34).
- Install transmission cover panel (para 10-14).
- Connect negative battery ground cable (para 5-27).
- Start vehicle and check operation of all lights, instruments, and switches (TM 9-2320-218-10).

TA 155448

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Section VII. INSTRUMENTATION, SENDING UNITS, CIRCUIT BREAKERS, SWITCHES, AND HORN MAINTENANCE

5-56. General

This section provides maintenance procedures assigned to the organizational level for the instrumentation, sending units, circuit breakers, switches, and horn. To find a specific procedure, see the maintenance task summary below.

5-57. Instrumentation, Sending Units, Circuit Breakers, Switches, and Horn Maintenance Task Summary

TASK PARA	PROCEDURES	PAGE NO.
5-58.	Instrument Cluster a. Removal b. Installation	5-142
5-59.	Fuel, Temperature, Battery, and Oil Pressure Gages a. Removal b. Installation	5-146
5-60.	Instrument Cluster Lamps and Lenses a. Removal b. Installation c. Lamp Removal d. Lamp Installation	5-150
5-61.	Speedometer Assembly (Non-electrical) a. Removal b. Installation	5-156
5-62.	Speedometer Cable (Drive Shaft) (Non-electrical) a. Removal b. Inspection c. Installation	5-160
5-63.	Fuel Level Sending Unit a. Removal b. Installation	5-166
5-64.	Coolant Temperature Sending Unit a. Removal b. Installation	5-168

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5-57. Instrumentation, Sending Units, Circuit Breakers, Switches, and Horn Maintenance Task Summary

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5-65.		Oil Pressure Transmitter a. Removal b. Installation		5-170
5-66.		Circuit Breaker a. Removal b. Installation		5-172
5-67.		Headlight Beam Selector Switch a. Removal b. Installation		5-176
5-68.		Main Light Switch a. Removal b. Installation		5-178
5-69.		Stoplight Switch a. Removal b. Installation		5-182
5-70.		Starting Switch a. Removal b Installation		5-186
5-71.		Ignition Switch a. Removal b. Installation		5-188
5-72.		Directional Signal Switch a. Removal b. Installation c. Lamp Removal d. Lamp Installation		5-192
5-73.		Horn Switch a. Removal b. Installation		5-194
5-74.		Horn Assembly a. Removal b. Installation		5-198
5-75.		Windshield Wiper Motor and Switch a. Removal b. Installation		5-200

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5-58. Instrument Cluster Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Test Equipment
None

Special Tools
None

Materials/Parts
None

Personnel Required
One mechanic

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

Equipment Condition Reference
TM 9-2320-218-10

Condition Description
Parking brake set.

Special Environmental Conditions
None

General Safety Instructions
None

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

CAUTION

If gages are to be tested with instrument cluster pulled away from dash panel, instrument cluster must be grounded to dash panel, otherwise polarity of gages will be reversed.

a. REMOVAL

1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.	
2.		Instrument cluster (3)	Pull away from dash panel (4).	

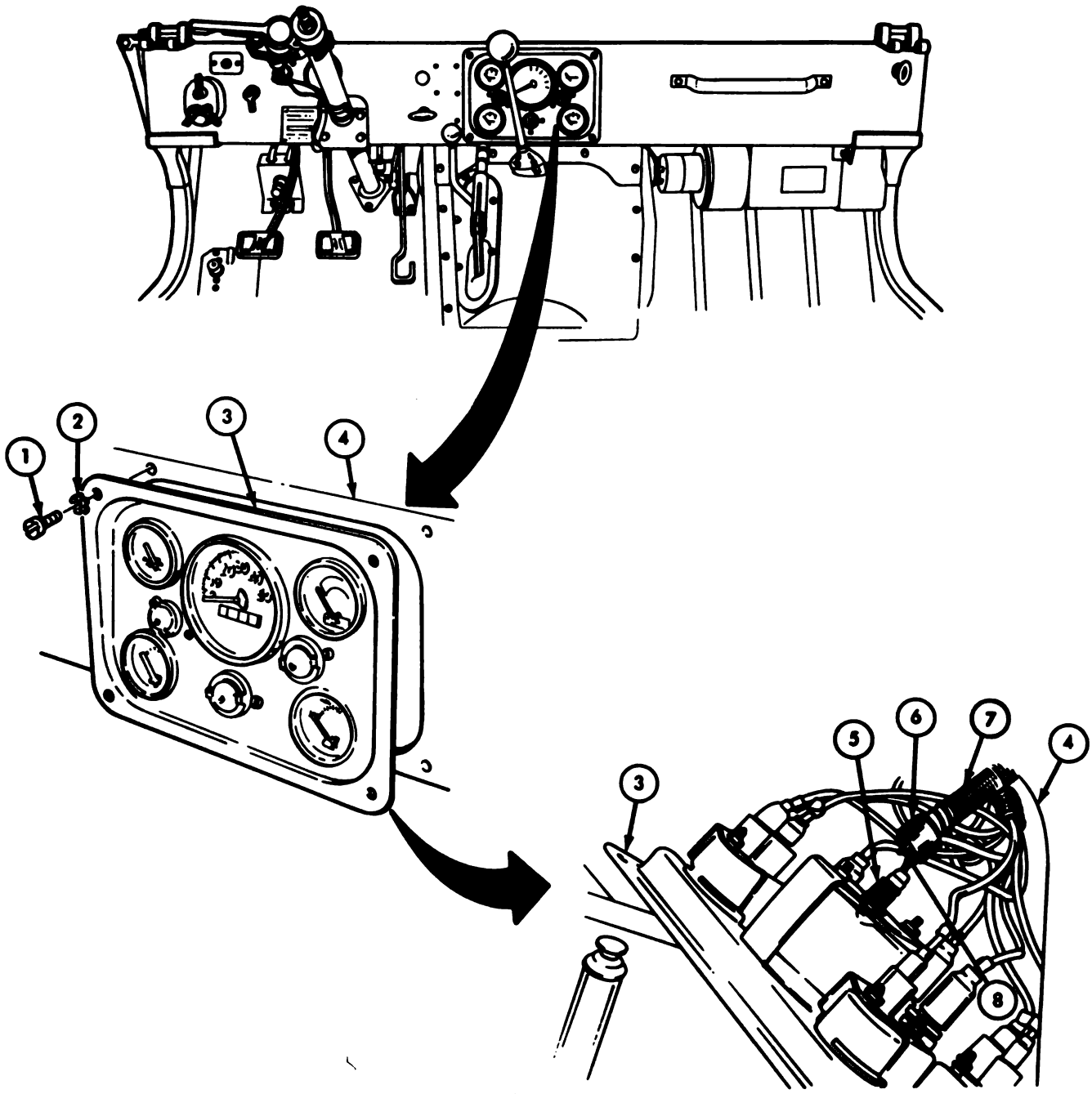
CAUTION

While disconnecting speedometer shaft assembly from speedometer, make sure core cable (8) is not pulled away from shaft (7). This can cause core separation from transmission transfer.

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5-58. Instrument Cluster Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
3.	Behind instrument cluster (3)	Speedometer shaft assembly (7)	Loosen shaft nut (6) and disconnect from speedometer (5).	



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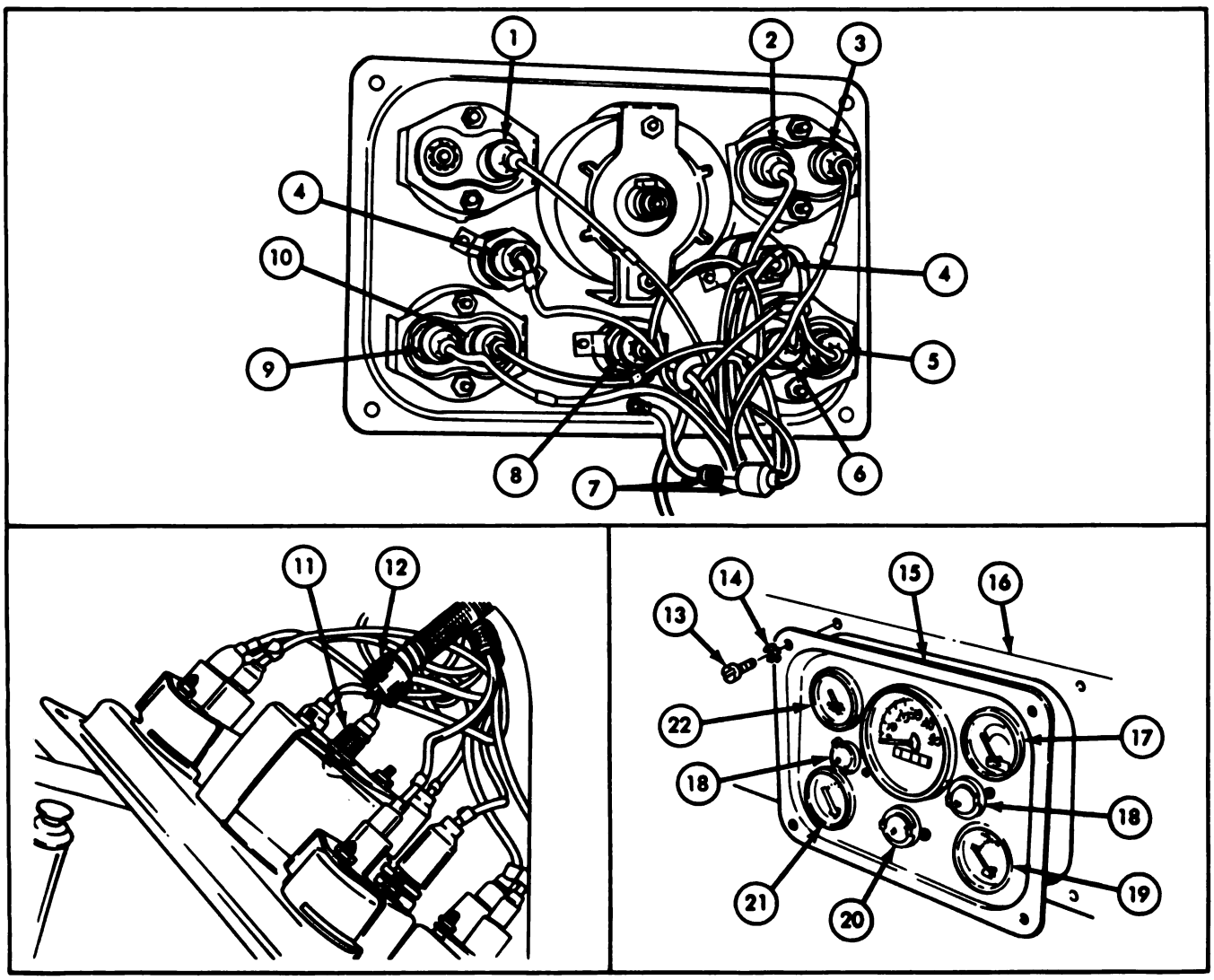
5-58. Instrument Cluster Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		NOTE Make note of all electrical disconnection locations to ensure proper reconnection.		
4.	Fuel gage (22)	Circuit 27 (2) and 28 (3) connectors	Disconnect.	
5.	Battery-generator indicator (17)	Circuit 27B connector (1)	Disconnect.	
6.	Engine temperature gage (19)	Circuit 27 (9) and 33 (10) connectors	Disconnect.	
7.	Oil pressure gage (21)	Circuit 27 (6) and 36 (5) connectors	Disconnect.	
8.	Headlight high beam indicator (20)	Circuit 17 connector (8)	Disconnect.	
9.	Two instrument cluster lights (18)	Circuit 40 connector (4)	Disconnect from each.	
10.		Circuit 57 ground connector (7)	Separate.	
11.		Instrument cluster (15)	Remove.	
	b. INSTALLATION			
		NOTE Connect all electrical connectors to same points where disconnected. If necessary, refer to electrical wiring diagram in appendix G.		
12.	Behind instrument cluster (15)	Circuit 57 ground connector (7)	Secure halves together.	
13.		Two circuit 40 connectors (4)	Connect to two instrument cluster lights (18).	
14.		Circuit 17 connector (8)	Connect to headlight high beam indicator (20).	
15.		Circuit 27 (6) and 36 (5) connectors	Connect to oil pressure gage (21).	
16.		Circuit 27 (9) and 33 (10) connectors	Connect to engine temperature gage (19).	
17.		Circuit 27B connector (1)	Connect to battery-generator indicator (17).	

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5-58. Instrument Cluster Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
18.		Circuit 27 (2) and 28 (3) connectors	Connect to fuel gage (22).	
19.		Speedometer shaft assembly nut (12)	Position to speedometer (11) and secure.	
20.		Instrument cluster (15)	Position on dash panel (16) and secure with four lockwashers (14) and screws (13).	



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check if all gages work properly.

TA 155450

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5-59. Fuel, Temperature, Battery, and Oil Pressure Gages Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

The fuel (1), engine temperature (12), and oil pressure (13) gages are removed the same way. The battery-generator indicator gage (11) is also removed the same way except it has only one circuit connector to be disconnected. This procedure covers the fuel gage (1) removal and installation.

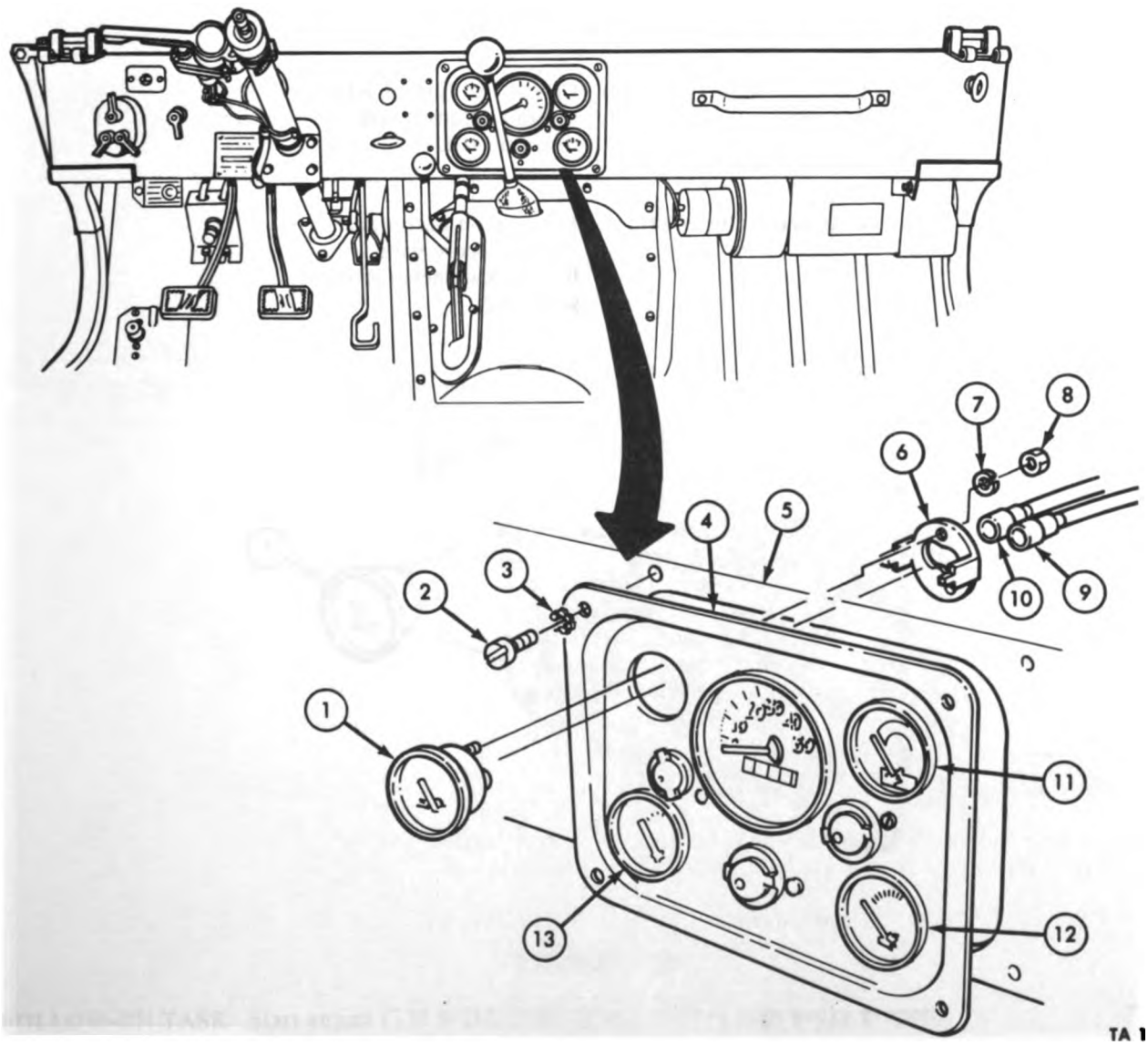
a. REMOVAL

1.	Instrument cluster (4) to dash panel (5)	Four screws (2) and lockwashers (3)	Remove.	
2.		Instrument cluster (4)	Pull away from dash panel (5).	
3.	Fuel gage (1)	Circuit 27 (10) and 28 (9) connectors	Disconnect.	Note location of disconnections for installation.

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5-59. Fuel, Temperature, Battery, and Oil Pressure Gages Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		CAUTION Place hand in front of gage to prevent gage from falling out when nuts and washers are removed.		
4.	Retainer bracket (6) to fuel gage (1)	Two nuts (8) and lockwashers (7)	Remove.	
5.		Retainer bracket (6) and fuel gage (1)	Remove from instrument cluster (4).	



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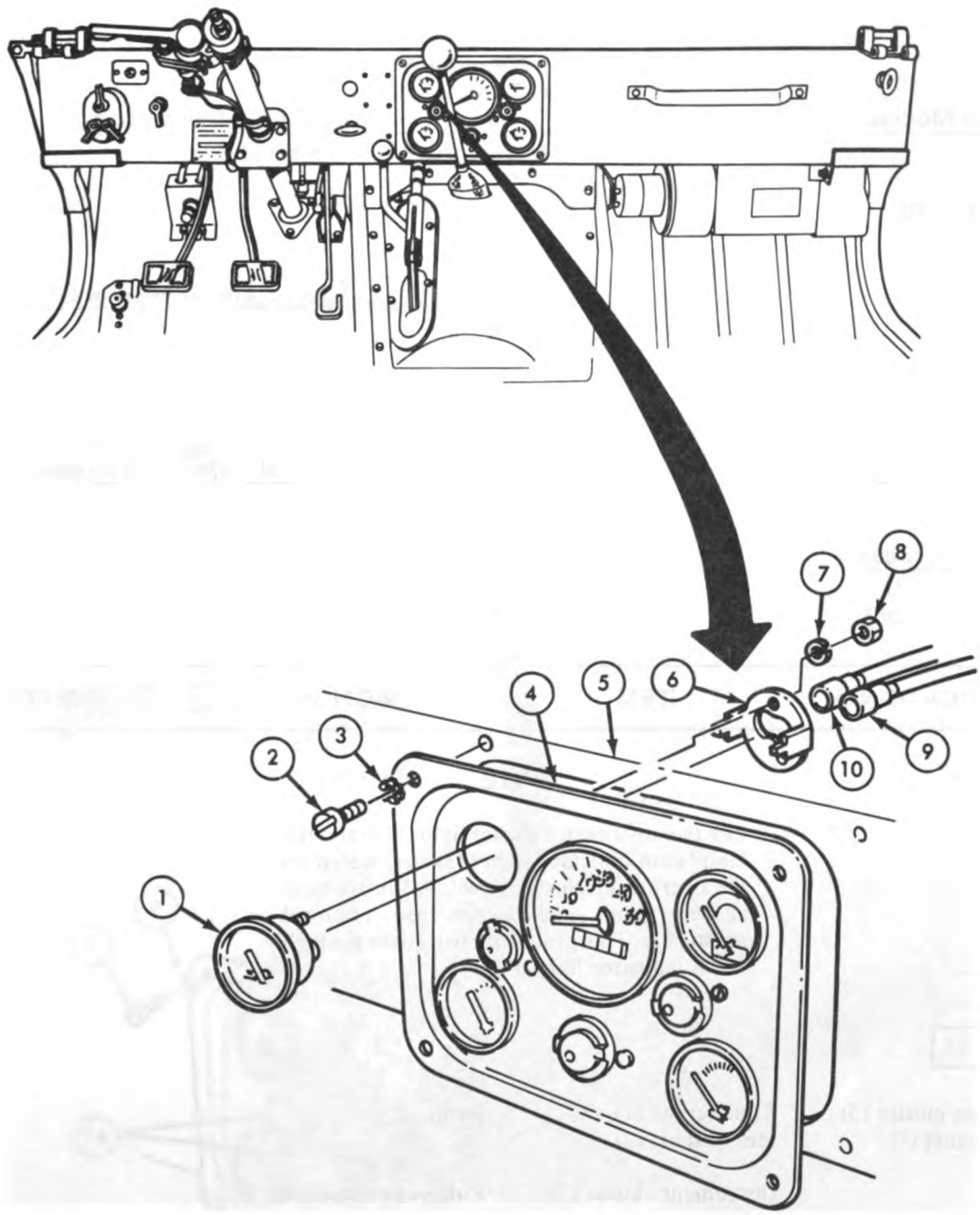
5-59. Fuel, Temperature, Battery, and Oil Pressure Gages Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
6.		Fuel gage (1)	Insert in hole from front of instrument cluster (4).	
7.		Retainer bracket (6)	*a.* Position on fuel gage (1) from back of cluster (4). *b.* Secure with two lockwashers (7) and nuts (8).	
8.		Circuit 27 (10) and 28 (9) connectors	Connect to fuel gage (1) at same points where disconnected.	
9.		Instrument cluster (4)	Position on dash panel (5) and secure with four lockwashers (3) and screws (2).	

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5-59. Fuel, Temperature, Battery, and Oil Pressure Gages Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and check if gage works properly.

TA 155452

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5-60. Instrument Cluster Lamps and Lenses Maintenance

This task covers:

a. Removal
b. Installation
c. Lamp Removal
d. Lamp Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

The two instrument cluster lights (14) and the high beam indicator light (13) are located on the instrument cluster panel. All instrument cluster lights and lamps are removed identically. This procedure will cover the high beam indicator light only.

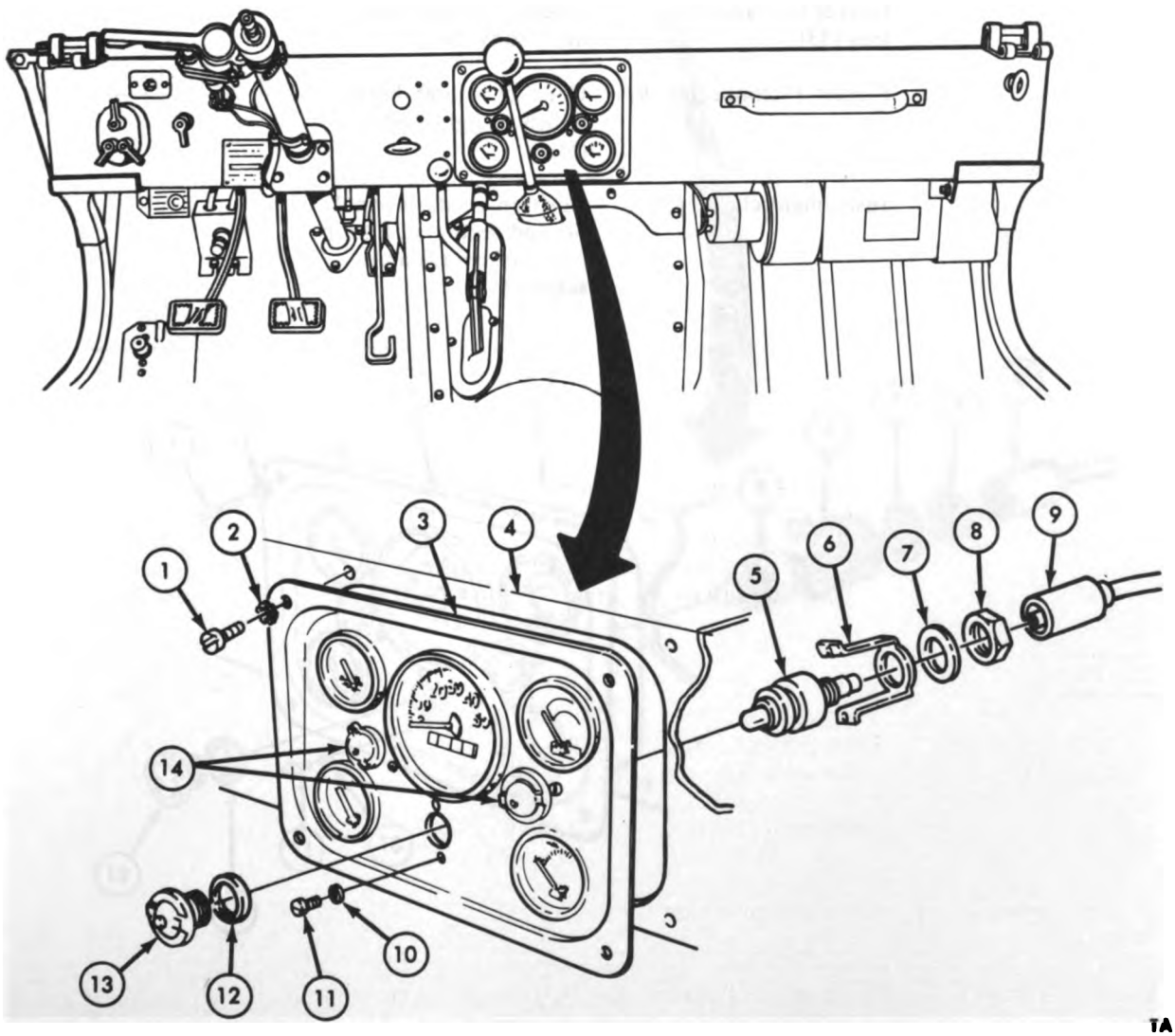
a. REMOVAL

1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.
2.		Instrument cluster (3)	Pull away from dash panel (4).
3.	High beam indicator light body (5)	Circuit 17 connector (9)	Disconnect.
4.	High beam indicator light body (5)	Lamp lens (13) and gasket (12)	Unscrew and remove.

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5-60. Instrument Cluster Lamps and Lenses Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Indicator mounting bracket (6) to instrument cluster panel (3)	Two screws (11) and lockwashers (10)	Remove.	
6.		Indicator light body (5) and mounting bracket (6)	Remove.	
7.	Indicator light body (5) to mounting bracket (6)	Nut (8) and washer (7)	Remove.	
8.		Indicator light body (5)	Remove from mounting bracket (6).	



TA 155453

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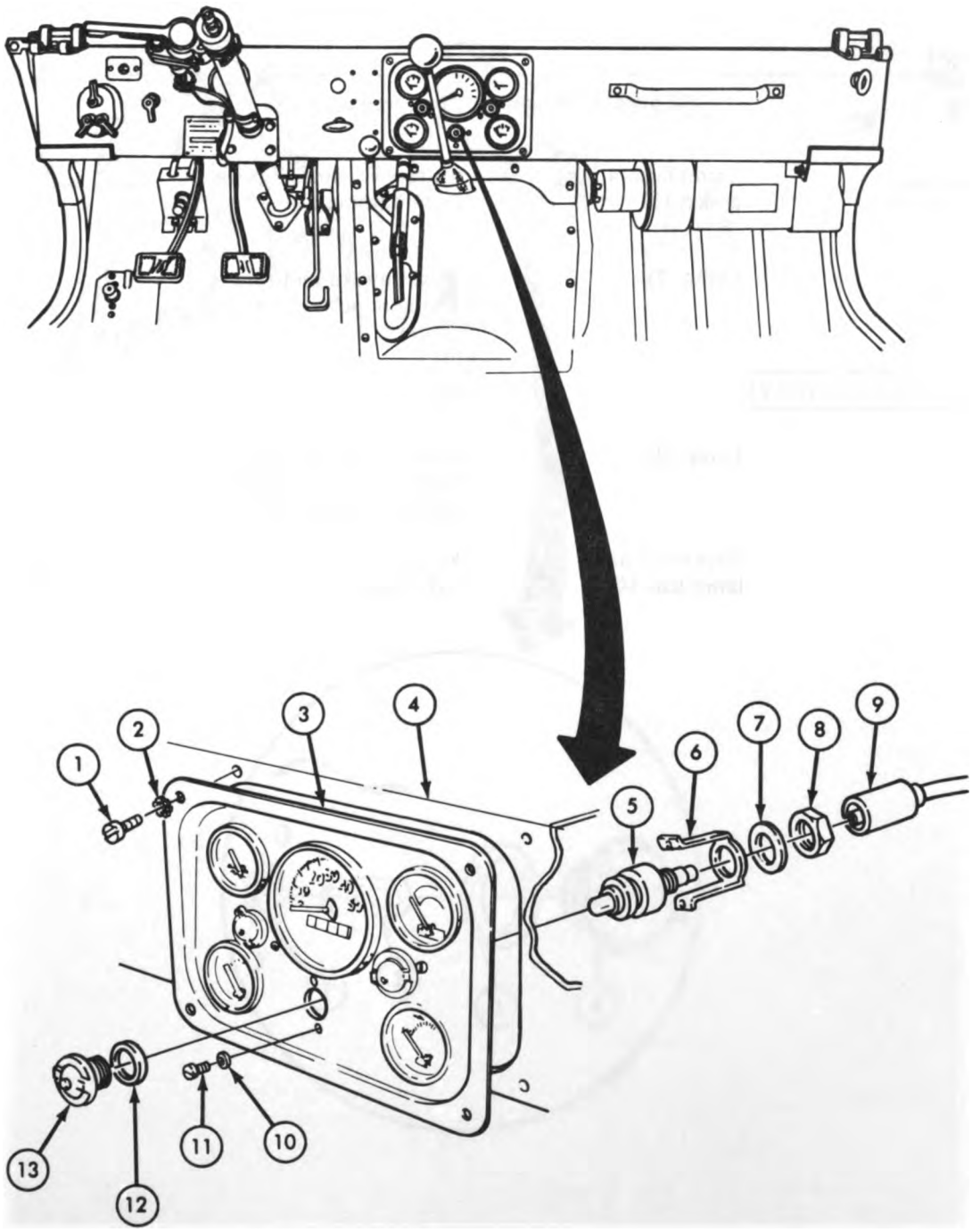
5-60. Instrument Cluster Lamps and Lenses Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
9.		Indicator light body (5)	Place in mounting bracket (6) and secure with washer (7) and nut (8).	
10.		Indicator light body (5) and mounting bracket (6)	*a.* Position to rear of instrument cluster (3) and aline holes. *b.* Secure with two lockwashers (10) and screws (11).	
11.		Gasket (12) and lamp lens (13)	Screw into indicator light body (5).	
12.		Circuit 17 connector (9)	Connect to high beam indicator light body (5).	
13.		Instrument cluster (3)	Position on dash panel (4) and secure with four lockwashers (2) and screws (1).	

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5-60. Instrument Cluster Lamps and Lenses Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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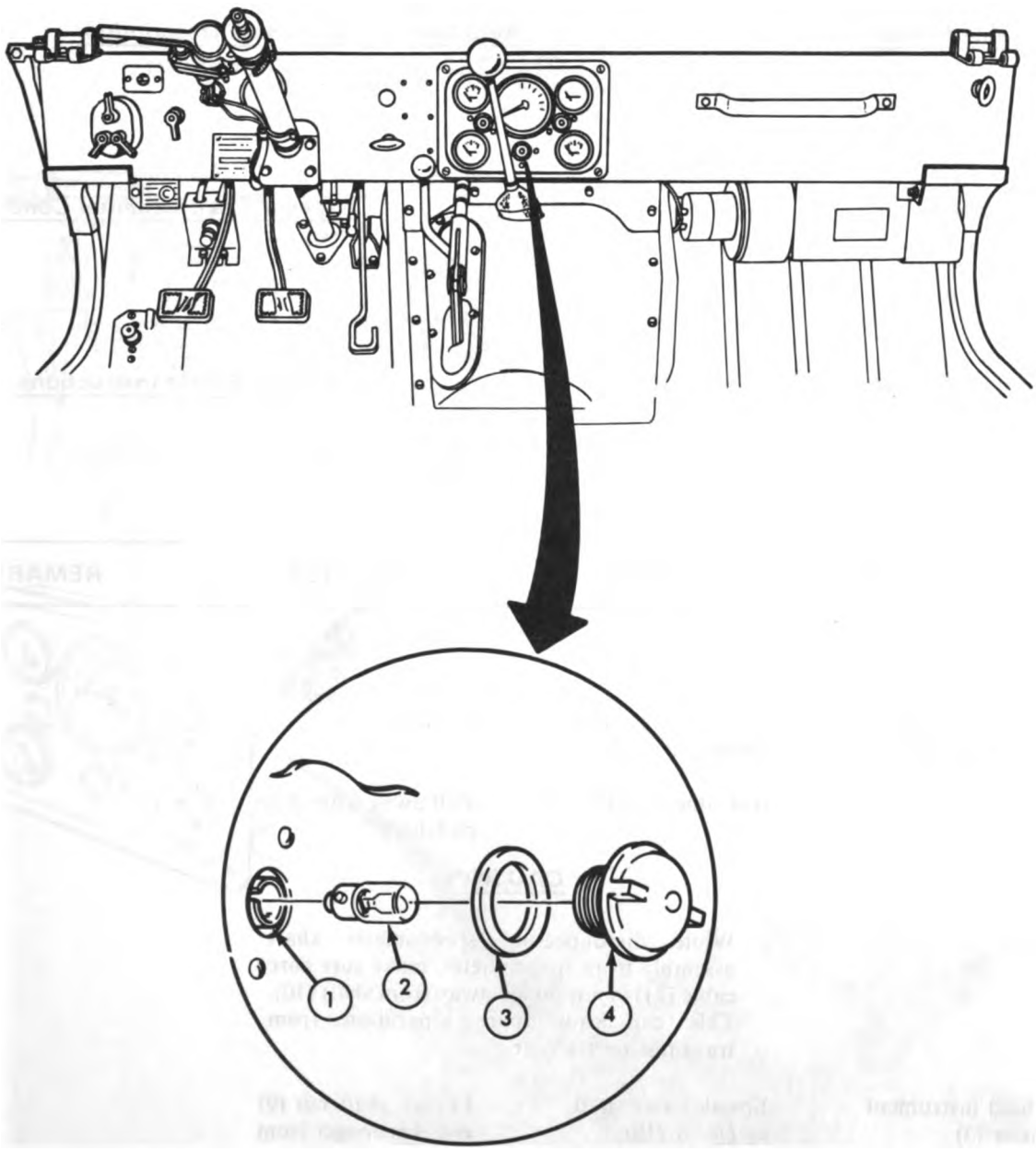
5-60. Instrument Cluster Lamps and Lenses Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	c. LAMP REMOVAL			
		NOTE		
		All panel light lamps are removed identically.		
14.		Lamp lens (4) and gasket (3)	Unscrew from indicator light body (1).	
15.		Lamp (2)	Push inward and turn counterclockwise to remove.	
	d. LAMP INSTALLATION			
16.		Lamp (2)	Push into indicator light body (1) and turn clockwise to install.	
17.		Gasket (3) and lamp lens (4)	Screw into indicator light body (1).	

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5-60. Instrument Cluster Lamps and Lenses Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Turn on headlights (TM 9-2320-218-10) and test high beam indicator for proper operation.

TA 155455

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5-61. Speedometer Assembly Maintenance (Non-electrical)

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

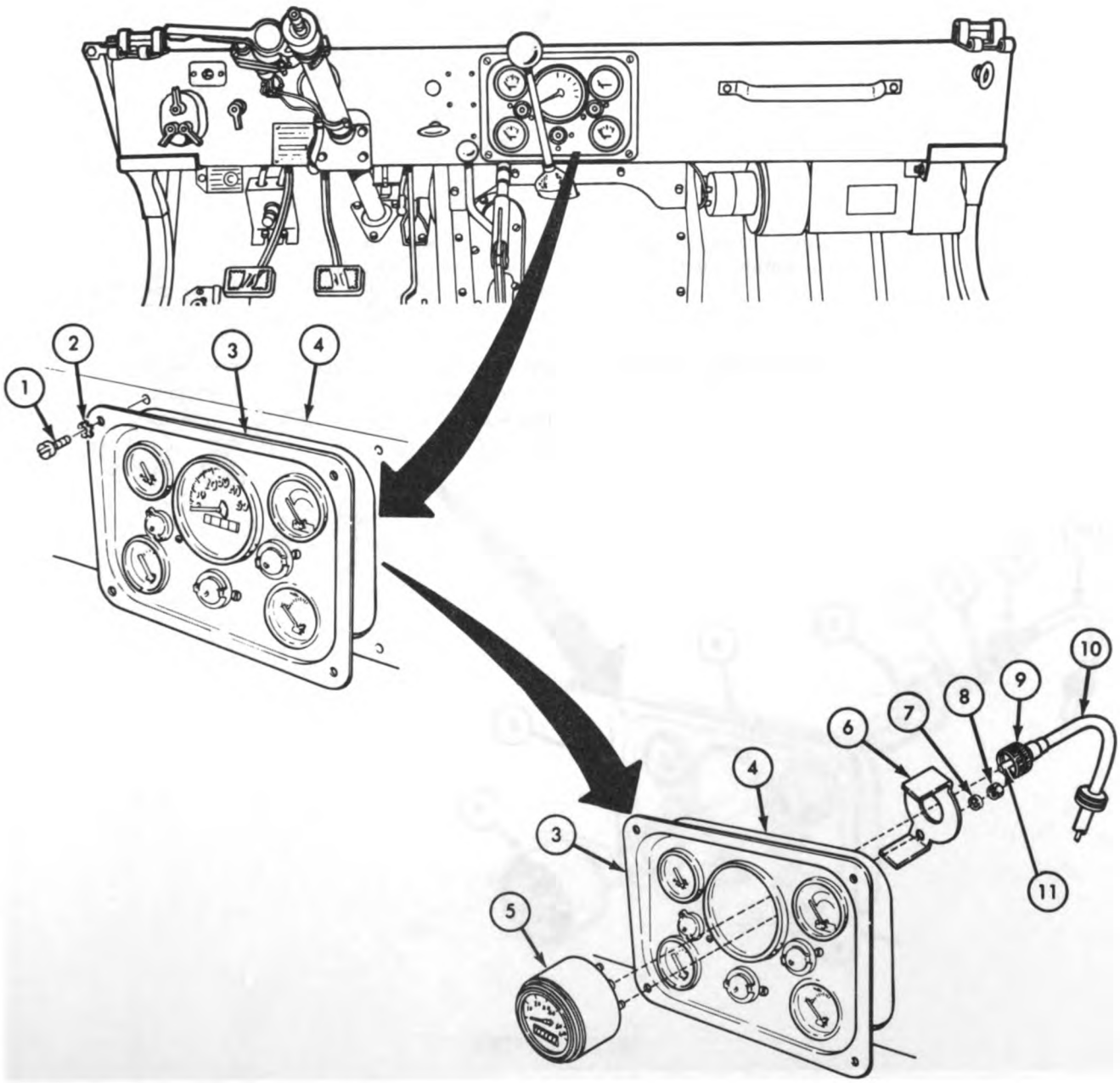
Manual References
TM 9-2320-218-10

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.	
2.		Instrument cluster (3)	Pull away from dash panel (4).	
		CAUTION		
		While disconnecting speedometer shaft assembly from speedometer, make sure core cable (11) is not pulled away from shaft (10). This can cause core separation from transmission transfer.		
3.	Behind instrument cluster (3)	Speedometer shaft assembly (10)	Loosen shaft nut (9) and disconnect from speedometer (5).	
		CAUTION		
		Place hand in front of speedometer to prevent it from falling out when nuts and lockwashers are removed.		

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5-61. Speedometer Assembly Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Retainer bracket (6) to speedometer (5)	Two nuts (8) and lockwashers (7)	Remove.	
5.		Retainer bracket (6) and speedometer (5)	Remove from instrument cluster (3).	



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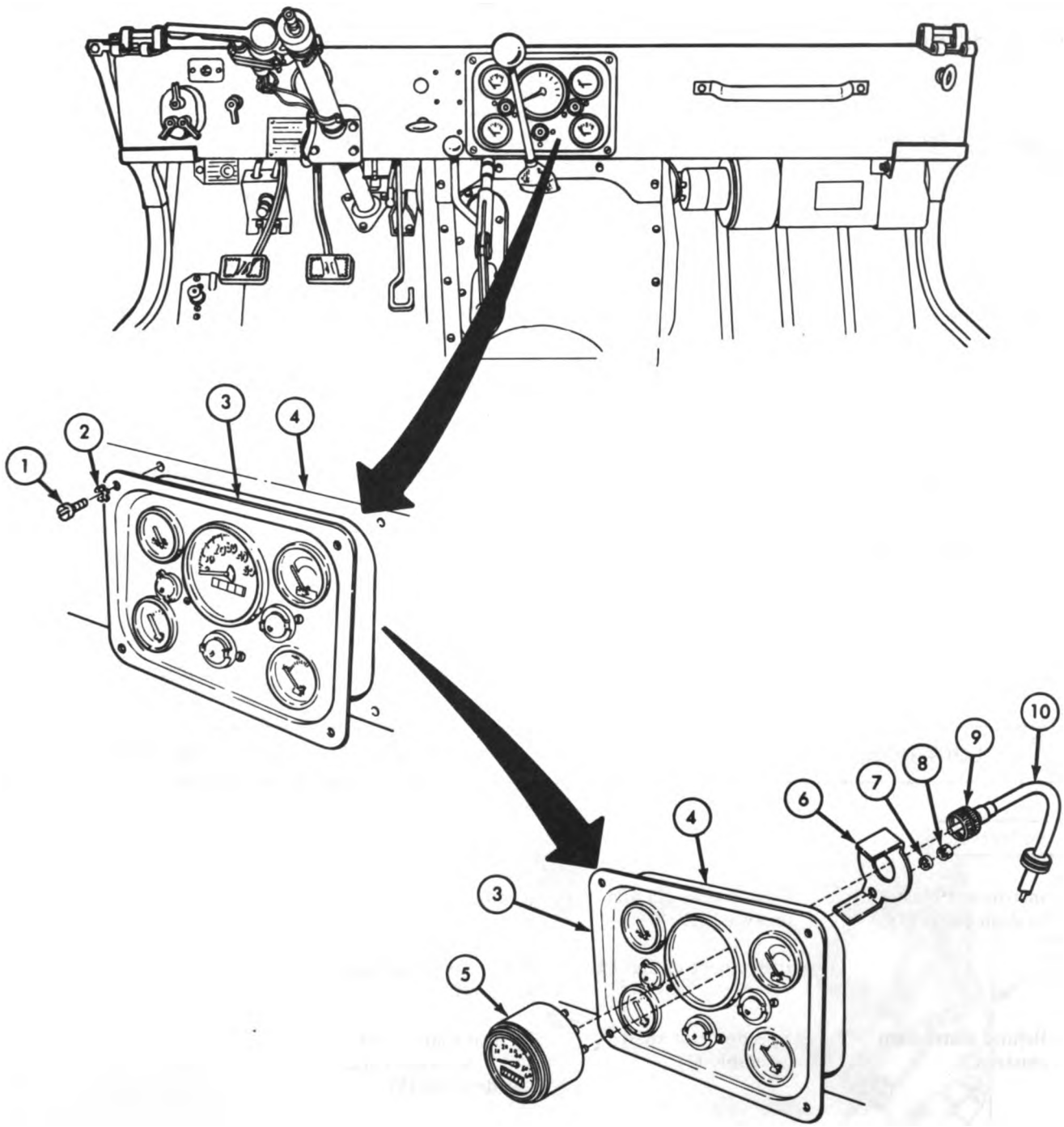
5-61. Speedometer Assembly Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
6.		Speedometer (5)	Insert in hole from front of instrument cluster (3).	Make sure speedometer (5) seats properly.
7.		Retainer bracket (6)	*a.* Position on speedometer from back of cluster (3).	
			b. Secure with two lockwashers (7) and nuts (8).	
8.		Speedometer shaft assembly (10)	Position to speedometer (5) and secure with shaft nut (9).	
9.		Instrument cluster (3)	Position on dash panel (4) and secure with four lockwashers (2) and screws (1).	

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5-61. Speedometer Assembly Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Start engine (TM 9-2320-218-10) and test speedometer for proper operation.

TA 155608

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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical)

This task covers:

a. Removal
b. Inspection
c. Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 10-14	Parking brake set. Transmission cover panel removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
GAA grease

Personnel Required
One mechanic

General Safety Instructions
None

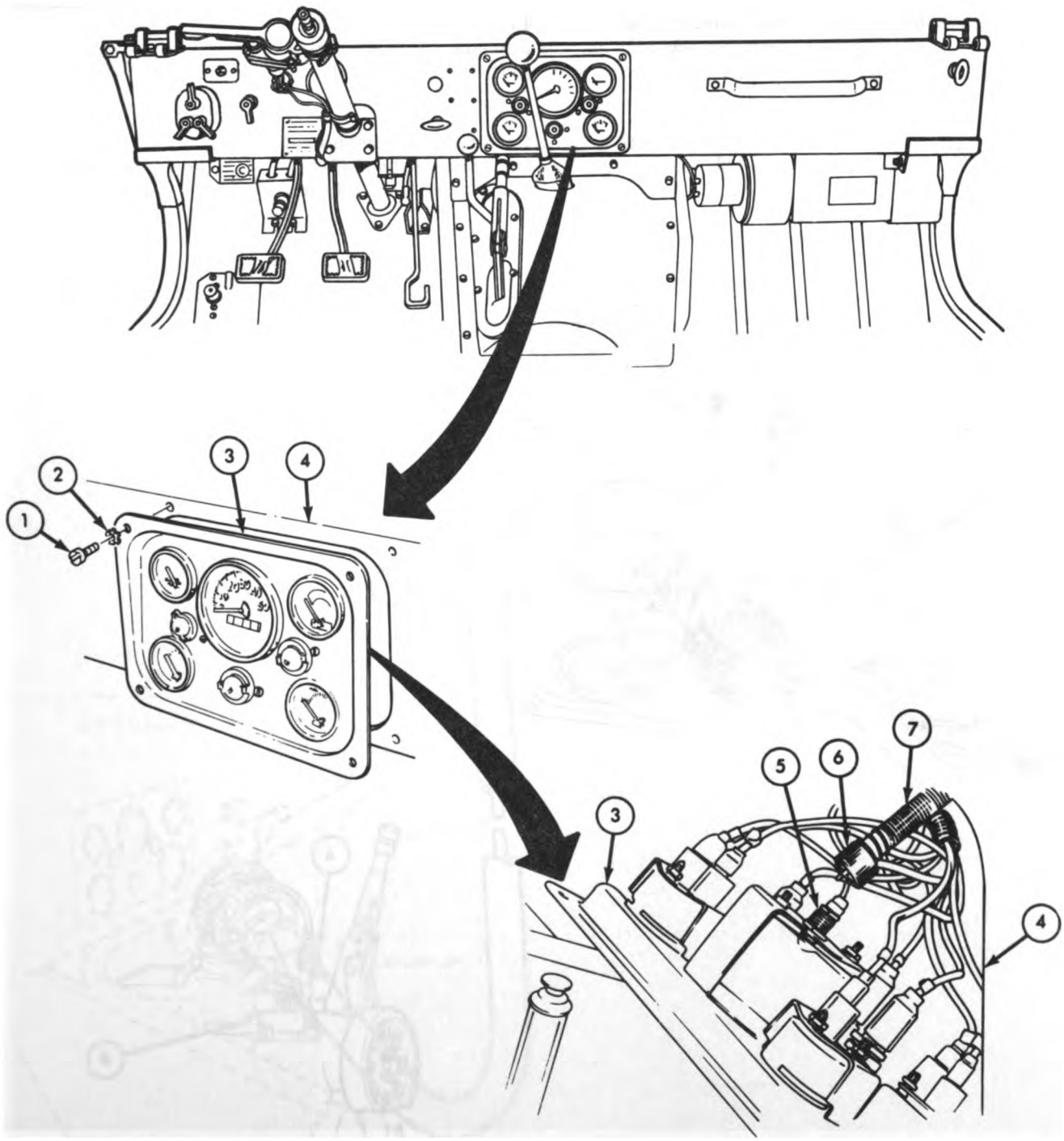
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.	
2.		Instrument cluster (3)	Pull away from dash panel (4).	
3.	Behind instrument cluster (3)	Speedometer shaft assembly (7)	Loosen shaft nut (6) and disconnect from speedometer (5).	

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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

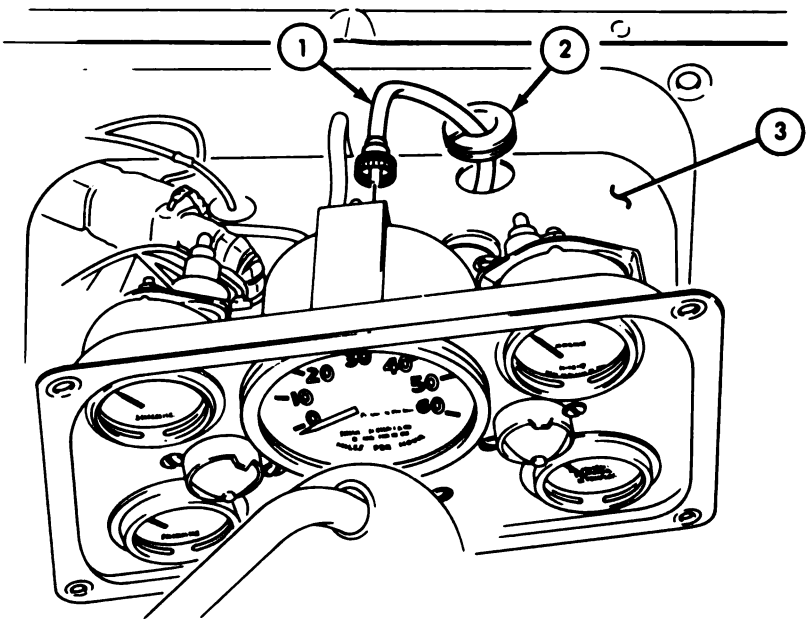


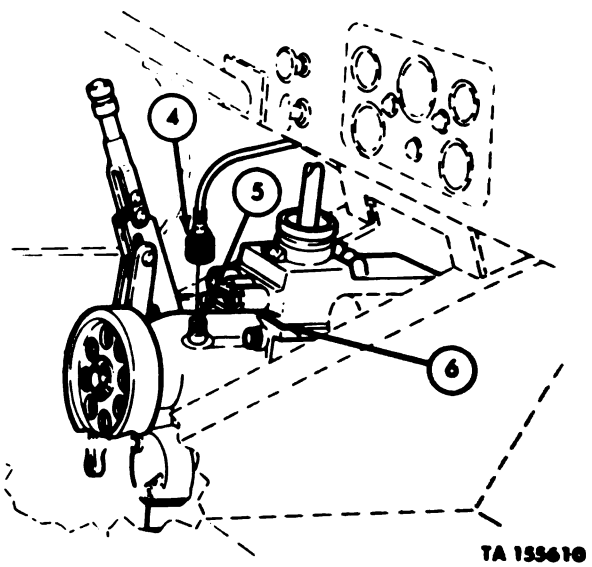
TA 155609

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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
4.	Transmission shield (3)	Rubber grommet (2)	Remove.	
5.	Top of transfer case (6)	Speedometer shaft assembly (1)	Loosen shaft nut (4) and disconnect from driven gear bearing and seal assembly (5).	
6.		Speedometer shaft assembly (1)	Push through hole in transmission shield (3) and remove from vehicle.	

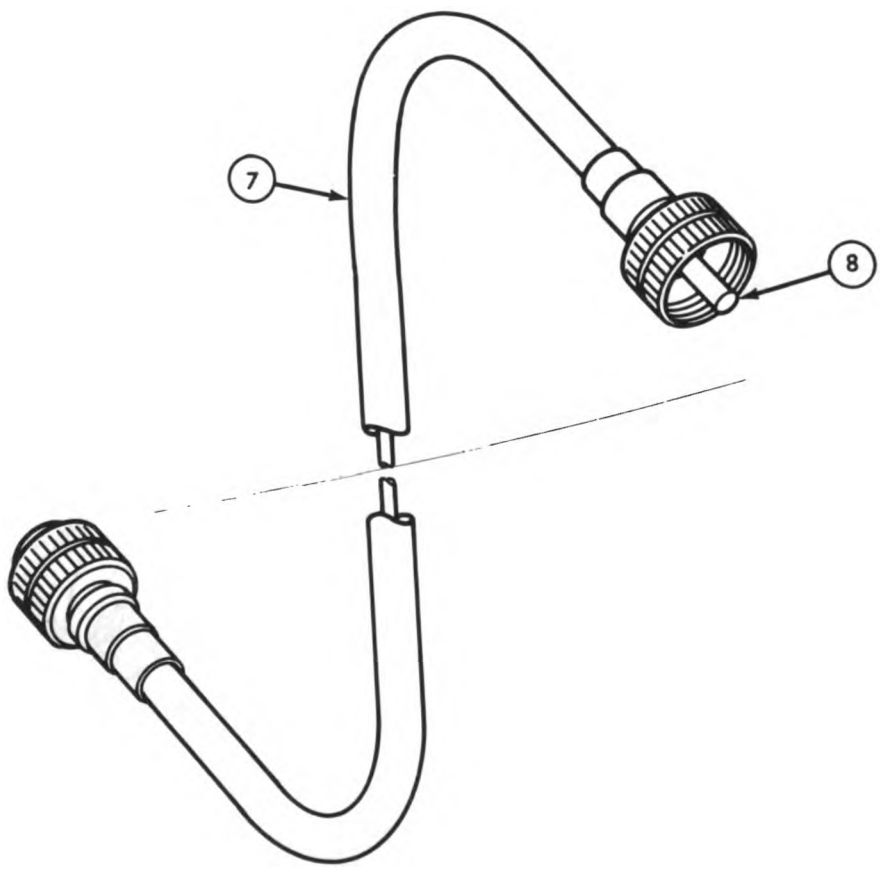




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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSPECTION		
7.		Shaft cable housing (7)	Inspect for cracks, splits, breaks, and wear.	Replace shaft assembly if cracked, split, broken, or worn.
8.		Shaft core (8)	*a.* Pull from cable housing (7).	
			b. Inspect for frays, breaks, and wear.	Replace shaft core (8) if frayed, broken, or worn.
			c. Coat with thin film of GAA grease and insert into cable housing (7).	



TA 155611

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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

c. INSTALLATION

CAUTION

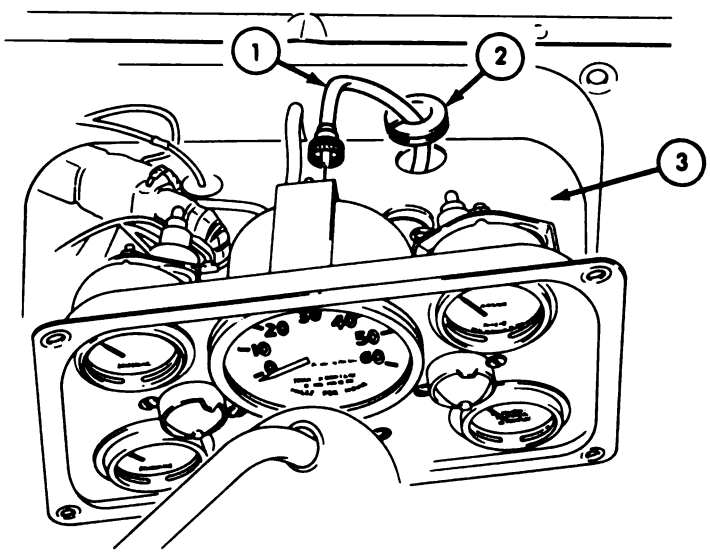
Do not bend or kink shaft assembly sharply when routing into position.

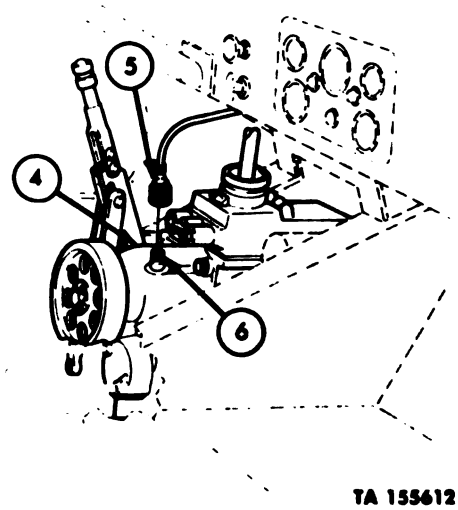
9. Rubber grommet (2) — Secure in hole in transmission shield (3).

10. Speedometer shaft assembly (1)

a. Position to driven gear bearing and seal assembly (6) at top of transfer case (4) and secure with shaft nut (5).

b. Thread through hole in transmission shield (3).



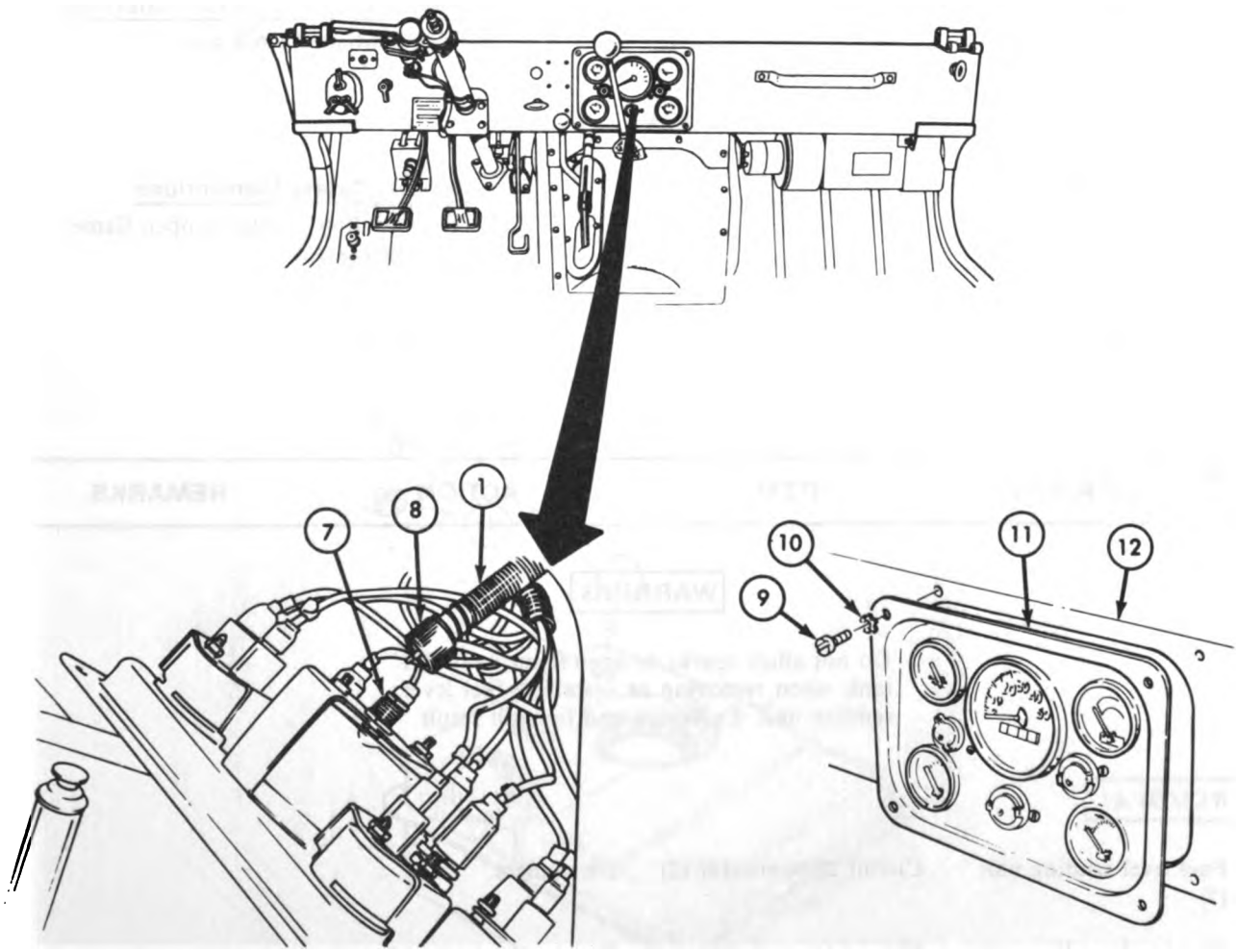


TA 155612

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5-62. Speedometer Cable (Drive Shaft) Maintenance (Non-electrical) (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
11.		Speedometer shaft assembly (1)	Position to speedometer (7) and secure with shaft nut (8).	
12.		Instrument cluster (11)	Position on dash panel (12) and secure with four lockwashers (10) and screws (9).	



END OF TASK!

FOLLOW-ON TASKS:
- Install transmission cover panel (para 10-14).
- Start engine (TM 9-2320-218-10) and test speedometer for proper operation.

TA 155613

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5-63. Fuel Level Sending Unit Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 10-10	Parking brake set. Driver's seat removed.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
Well-ventilated work area.

Materials/Parts
Gasket

Personnel Required
One mechanic

General Safety Instructions
Do not allow sparks or open flame near fuel tank.

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

WARNING

Do not allow sparks or open flame near fuel tank when removing or installing fuel level sending unit. Explosion and fire will result.

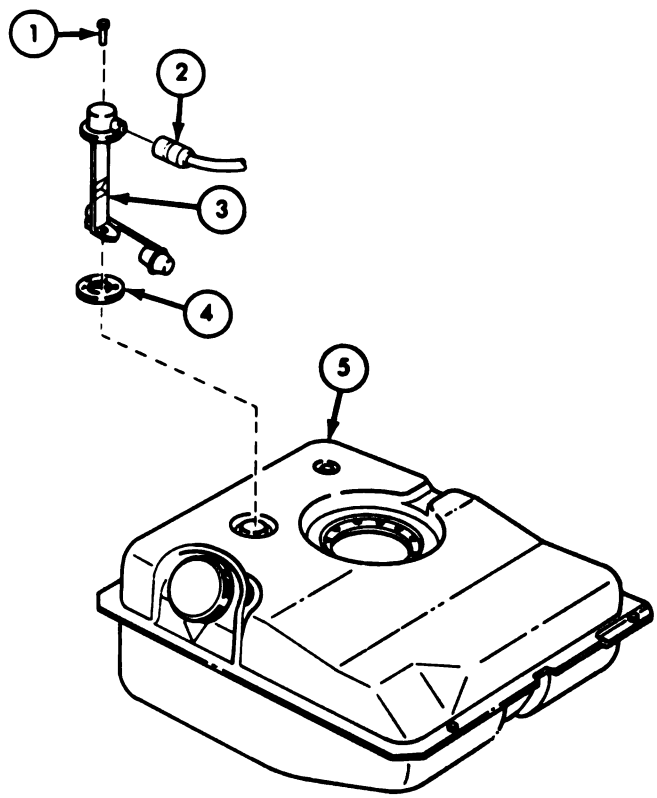
a. REMOVAL

1.	Fuel level sending unit (3)	Circuit 28 connector (2)	Disconnect.	
2.	Fuel level sending unit (3) to fuel tank (5)	Five screw-assembled lockwashers (1)	Remove.	
3.		Fuel level sending unit (3) and gasket (4)	Remove by lifting from fuel tank (5).	Discard gasket (4).

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5-63. Fuel Level Sending Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
		NOTE		
		Clean surface around opening on fuel tank and gasket surface on fuel level sending unit before installing sending unit and gasket. Do not allow foreign material to enter fuel tank.		
4.		New gasket (4)	Position on fuel tank (5) at sending unit opening.	Make sure gasket (4) is seated properly.
5.		Fuel level sending unit (3)	Insert in fuel tank (5) and secure with five screw-assembled lockwashers (1).	
6.		Circuit 28 connector (2)	Connect to fuel level sending unit (3).	



END OF TASK!

FOLLOW-ON TASKS:
- Install driver's seat (para 10-10).
- Start engine (TM 9-2320-218-10) and test fuel level sending unit for proper operation.

TA 155614

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5-64. Coolant Temperature Sending Unit Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.
	Para 4-53	Coolant drained as necessary.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

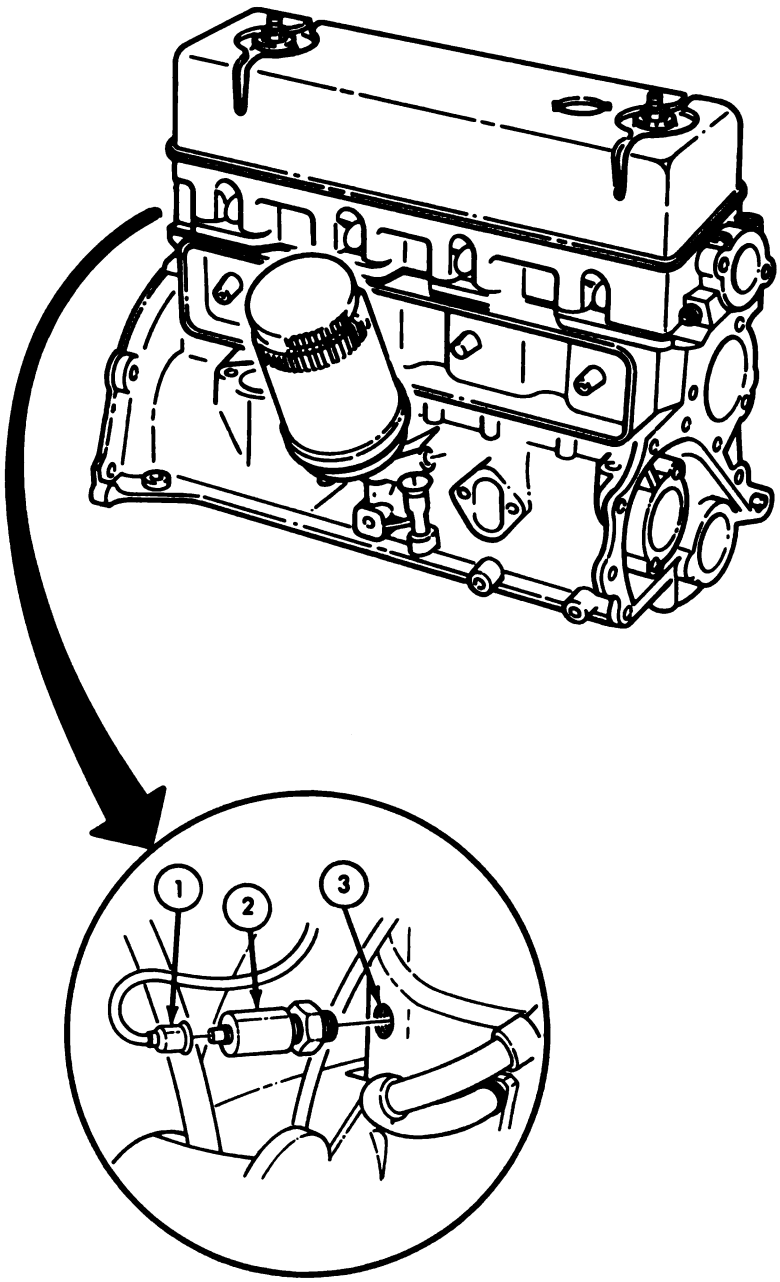
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Temperature sending unit (2)	Circuit 33 connector (1)	Disconnect.	
2.	Rear of cylinder head (3)	Temperature sending unit (2)	Unscrew and remove.	
		b. INSTALLATION		
3.		Temperature sending unit (2)	Screw into rear of cylinder head (3) and tighten.	
4.		Circuit 33 connector (1)	Secure to temperature sending unit (2).	

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5-64. Coolant Temperature Sending Unit Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK:
- Refill cooling system to proper level (para 4-53).
- Start engine (TM 9-2320-218-10) and check sending unit for proper operation.

TA 155615

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5-65. Oil Pressure Transmitter Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference | **Condition Description**
TM 9-2320-218-10 | Parking brake set.
TM 9-2320-218-10 | Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

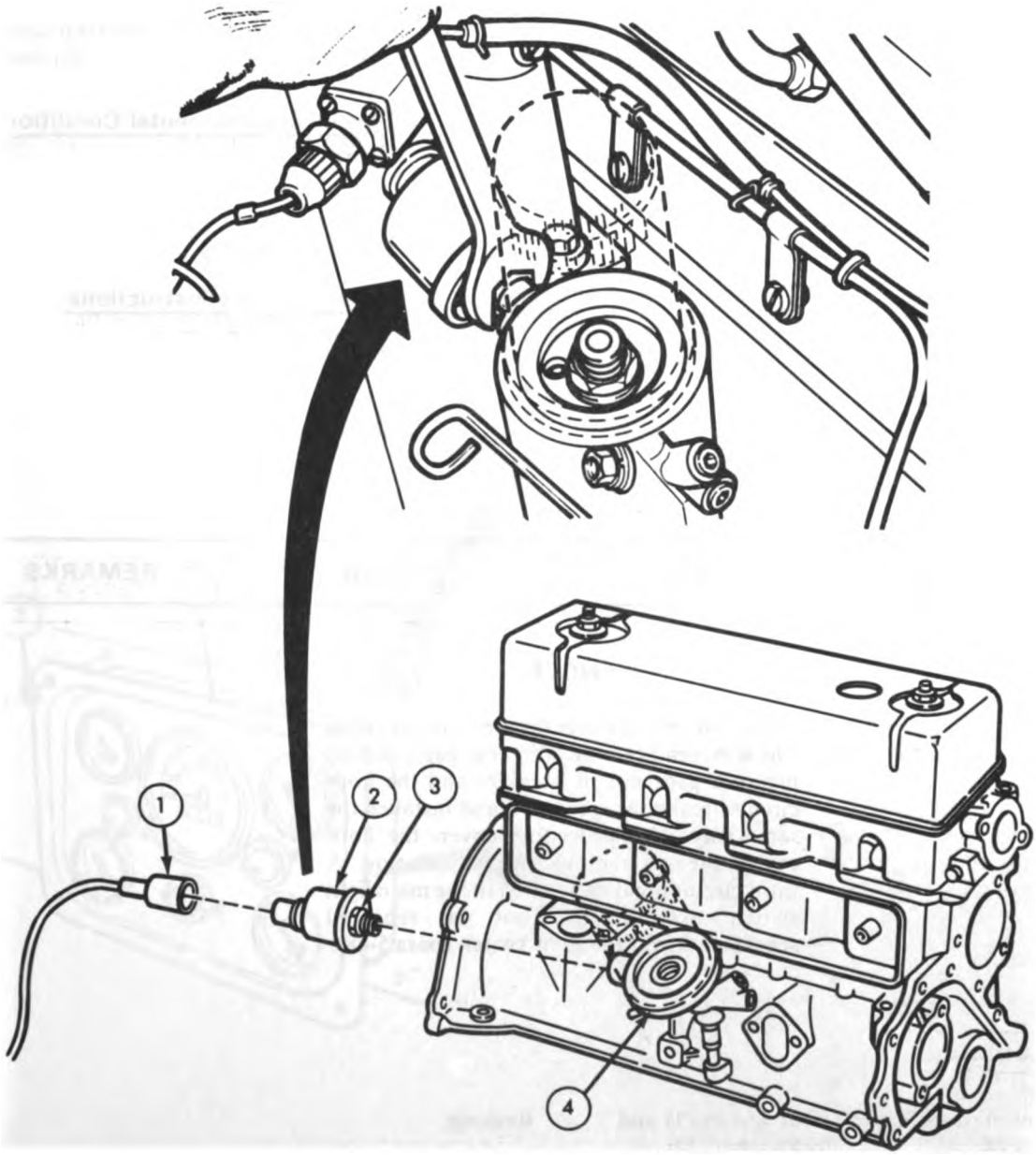
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Oil pressure transmitter (2)	Circuit 36 connector (1)	Disconnect.	
2.	Oil pressure transmitter (2) to oil filter mounting base (4)	Oil pressure transmitter nut (3)	Loosen.	
3.		Oil pressure transmitter (2)	Unscrew and remove from oil filter mounting base (4).	
	b. INSTALLATION			
4.		Oil pressure transmitter (2)	Screw into oil filter mounting base (4) by hand.	

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5-65. Oil Pressure Transmitter Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.		Oil pressure transmitter nut (3)	Wrench tighten.	
6.		Circuit 36 connector (1)	Connect to oil pressure transmitter (2).	



END OF TASK!

FOLLOW-ON TASKS: Start engine (TM 9-2320-218-10) and check oil pressure transmitter for proper operation.

TA 155616

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5-66. Circuit Breaker Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS

NOTE

All ¼-ton vehicles have three circuit breakers. The temperature indicator, fuel gage, and oil pressure gage circuit breaker; and the horn circuit breaker are removed and installed the same way. This procedure covers the horn circuit breaker removal and installation. A third circuit breaker, located in the main light switch assembly, cannot be replaced separately from the light switch (para 5-68).

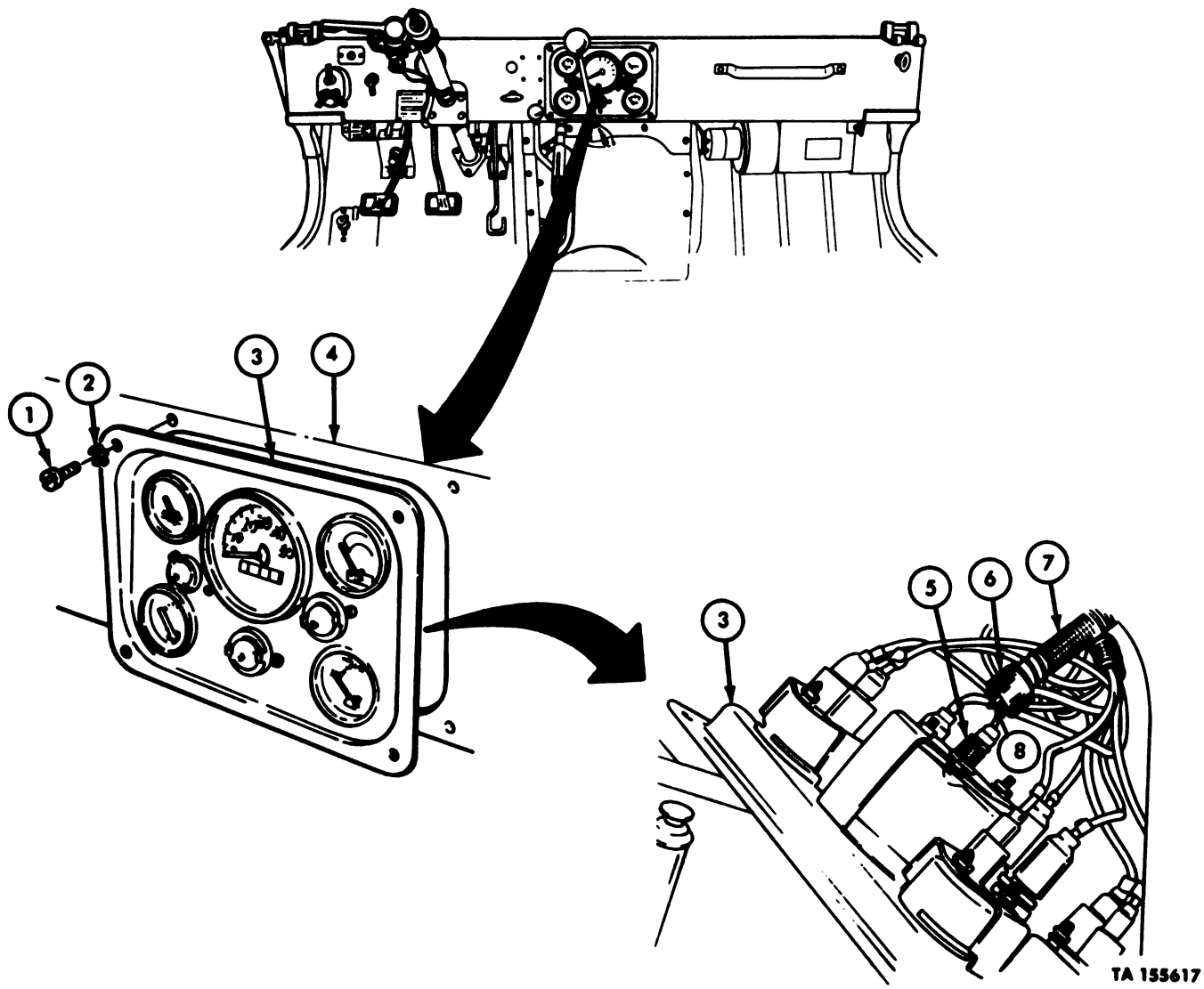
a. REMOVAL

1.	Instrument cluster (3) to dash panel (4)	Four screws (1) and lockwashers (2)	Remove.	
2.		Instrument cluster (3)	Pull away from dash panel (4).	

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5-66. Circuit Breaker Maintenance (Cont'd)

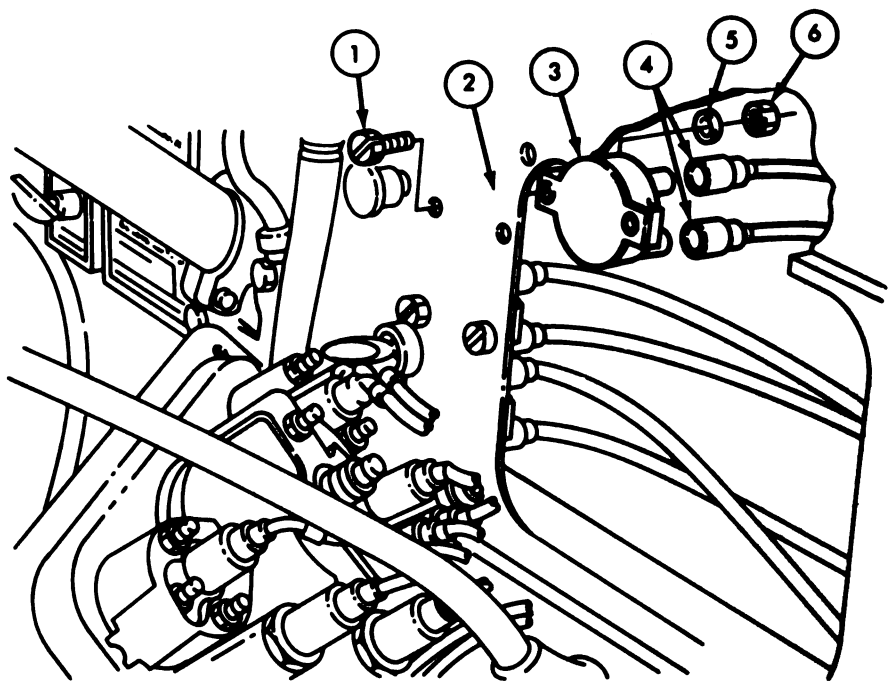
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		CAUTION While disconnecting speedometer shaft assembly from speedometer, make sure core cable (8) is not pulled away from shaft(7). This can cause core separation from transfer.		
3.	Behind instrument cluster (3)	Speedometer shaft assembly (7)	Loosen shaft nut (6) and disconnect from speedometer (5).	
4.		Instrument cluster (3)	Pull down and to the right.	



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5-66. Circuit Breaker Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.	Horn circuit breaker (3)	Two circuit 25 (4) connectors.	Disconnect.	
6.	Horn circuit breaker (3) to dash panel (2)	Two nuts (6), washers (5), and screws (1).	Remove.	
7.		Horn circuit breaker (3)	Remove from dash panel (2).	
	b. INSTALLATION			
8.		Horn circuit breaker (3)	Position to backside of dash panel (2) and secure with two screws (1), washers (5), and nuts (6).	
9.		Two circuit 25 (4) connectors	Connect to horn circuit breaker (3).	

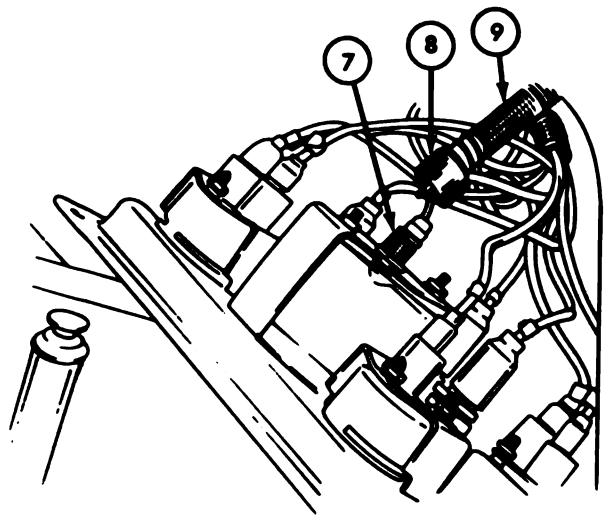


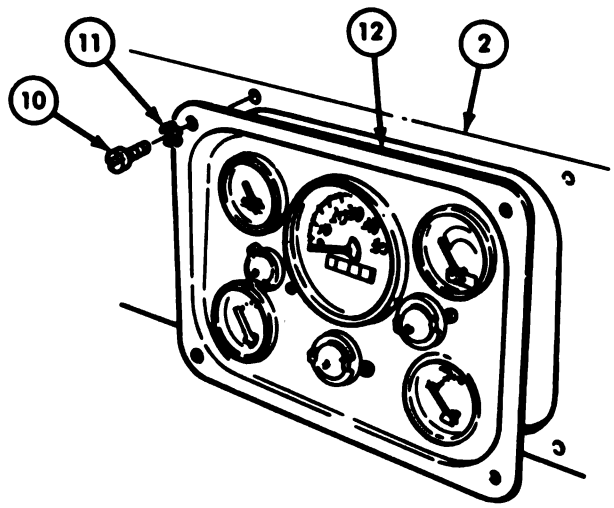
TA 155618

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5-66. Circuit Breaker Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
10.		Speedometer shaft assembly (9)	Position to speedometer (7) and secure with shaft nut (8).	
11.		Instrument cluster (12)	Position to dash panel (2) and secure with four lockwashers (11) and screws (10).	





END OF TASK!

FOLLOW-ON TASK: Sound horn (TM 9-2320-218-10) and check for proper operation of circuit breaker.

TA 155619

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5-67. Headlight Beam Selector Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10

Condition Description
Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

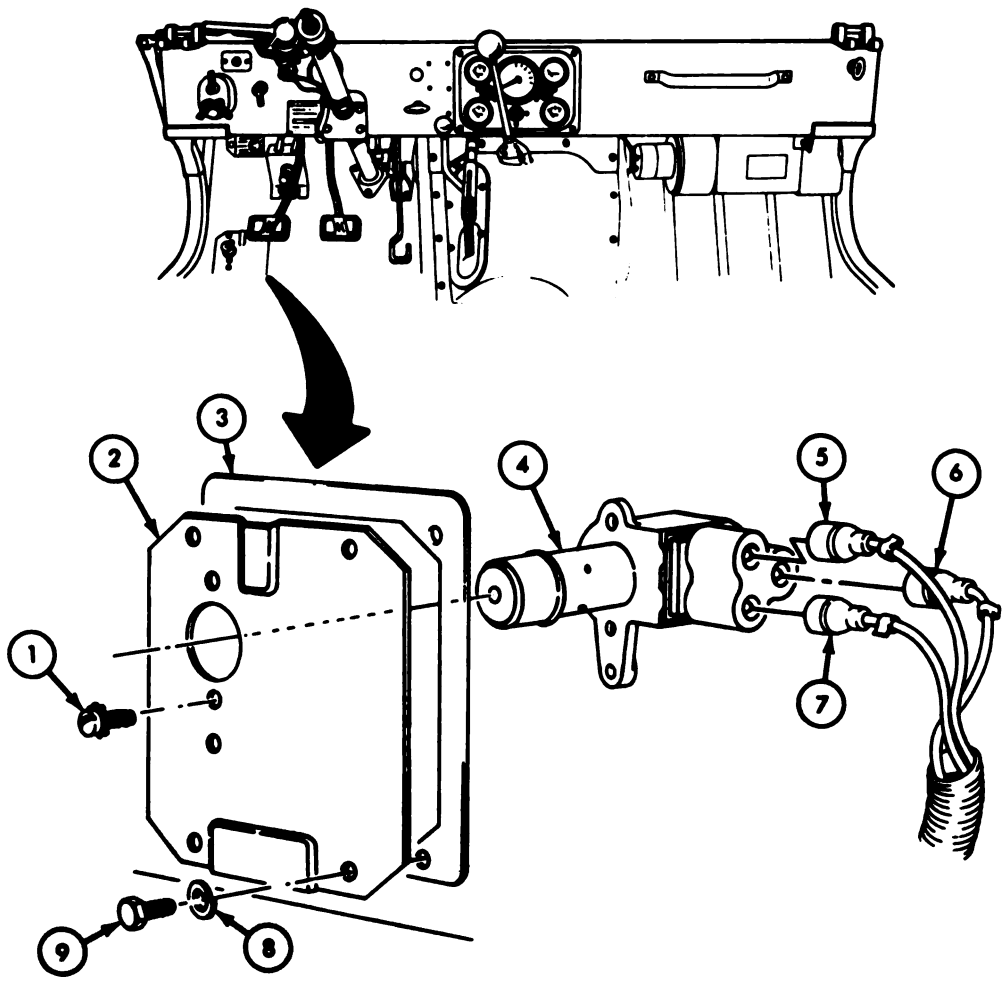
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Selector switch cover (2) to floor panel (3)	Four capscrews (9) and lockwashers (8)	Remove.	
2.		Selector switch cover (2)	Pull away from floor panel (3).	
3.	Selector switch (4)	Circuit 16 (5), 17 (6), and 18 (7) connectors	Disconnect.	Note locations of disconnections for proper reconnection.
4.	Selector switch (4) to selector switch cover (2)	Three screw-assembled lockwashers (1)	Remove.	
5.		Selector switch (4)	Remove from selector switch cover (2).	

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5-67. Headlight Beam Selector Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
6.		Selector switch (4)	Position to selector switch cover (2) and secure with three screw-assembled lockwashers (1).	
7.		Circuit 16 (5), 17 (6), and 18 (7) connectors	Connect to selector switch (4).	Circuit 17 connects to terminal L and 18 to H.
8.		Selector switch (4) and cover (2)	Position to floor panel (3) and secure with four lockwashers (8) and capscrews (9).	



END OF TASK!

FOLLOW-ON TASK: Turn on headlights (TM 9-2320-218-10) and test selector switch for proper operation.

TA 155620

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5-68. Main Light Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Condition
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

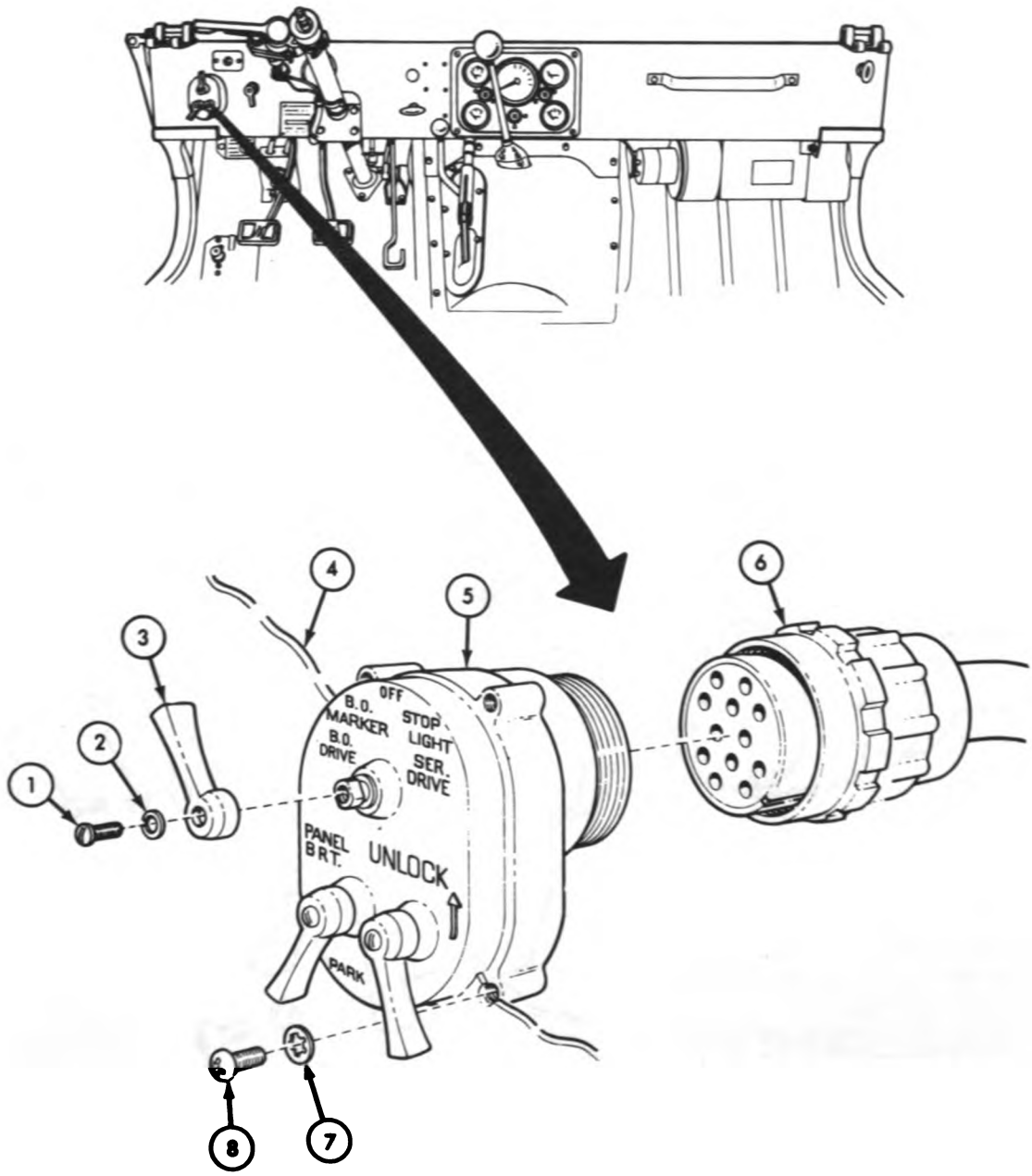
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Upper control lever (3) to light switch (5)	Screw (1) and lockwasher (2)	Remove.	
2.		Upper control lever (3)	Remove from light switch (5).	
3.	Light switch (5) to dash panel (4)	Four screws (8) and lockwashers (7)	Remove.	
4.		Light switch (5) with switch cable connector (6)	Push through dash panel (4) and lower below panel (4).	
5.		Light switch cable connector (6)	Unscrew connector nut (6) and disconnect from light switch (5).	

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5-68. Main Light Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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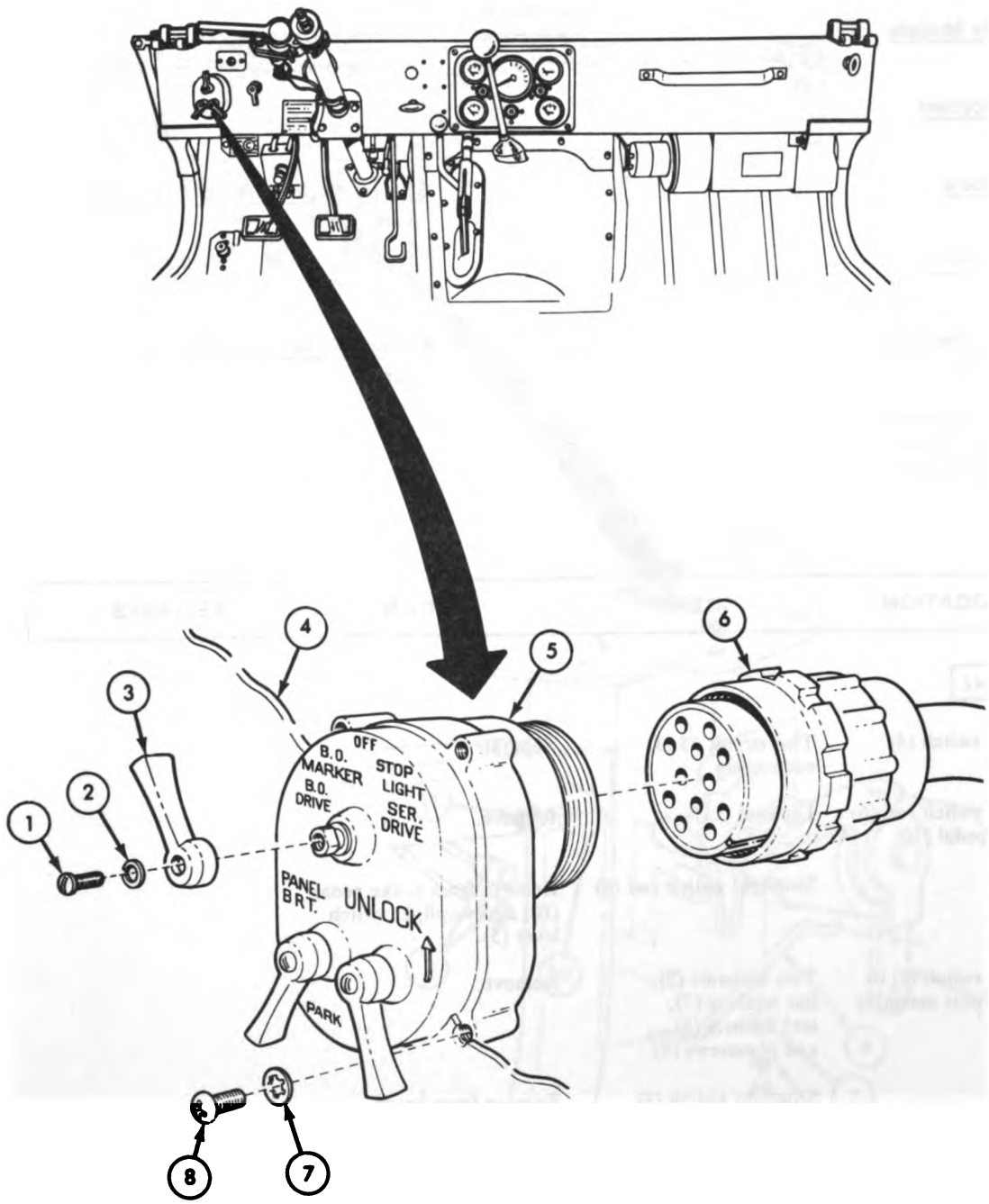
5-68. Main Light Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
6.		Light switch (5)	*a.* Tilt upward and push through hole from back side of dash panel (4).	Make sure switch (5) is positioned so two lower levers are at the bottom.
			b. Secure to dash panel (4) with four lockwashers (7) and screws (8).	
7.		Upper control lever (3)	Position to light switch (5) and secure with lockwasher (2), and screw (1).	
8.		Light switch cable connector (6)	Connect to light switch (5) and tighten connector nut (6).	Make sure connector (6) notch alines with switch (5) notch.

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5-68. Main Light Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Test light switch for proper operation (TM 9-2320-218-10).

TA 155622

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5-69. Stoplight Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

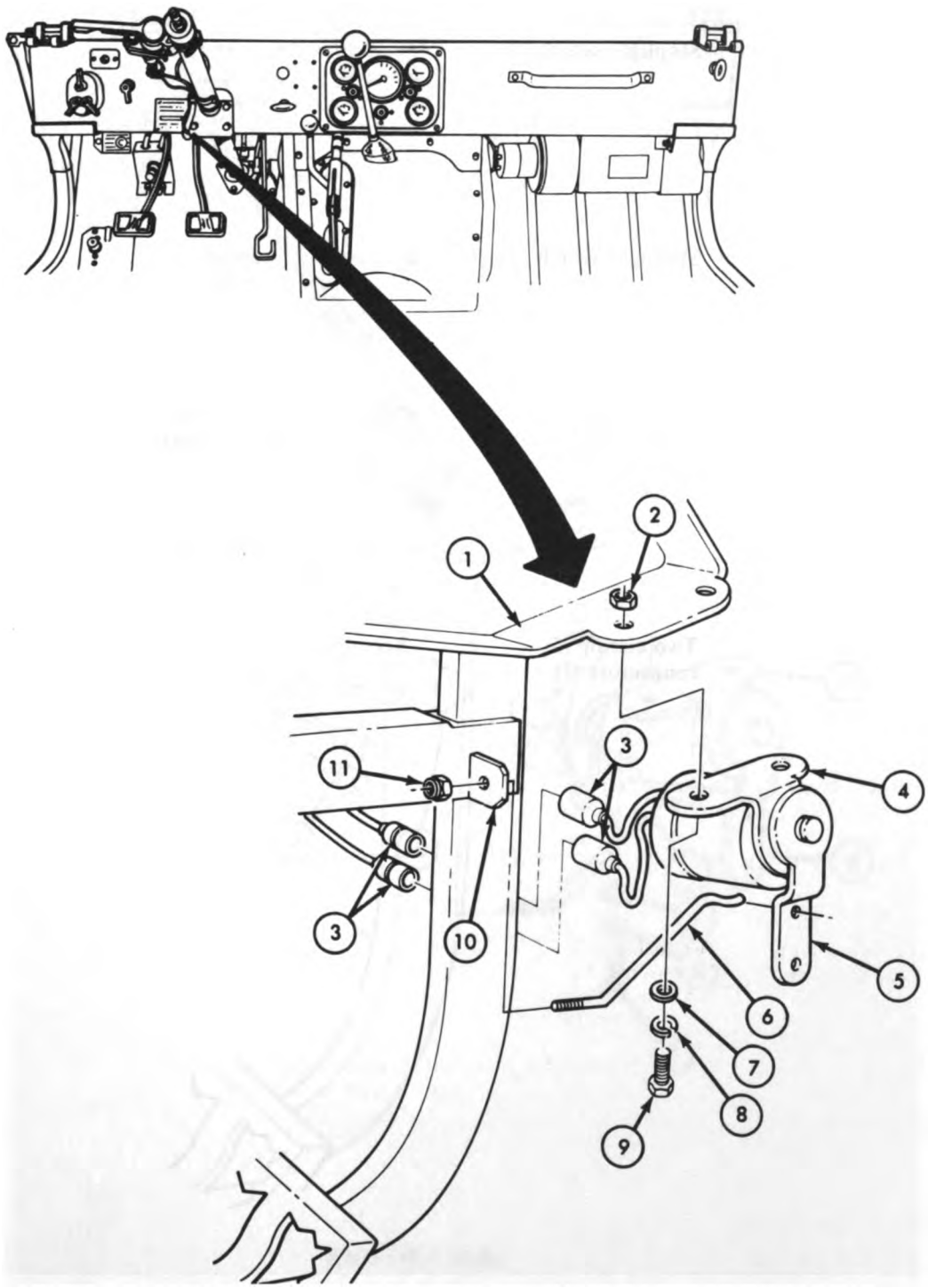
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		a. REMOVAL		
1.	Stoplight switch (4)	Two circuit 75 (3) connectors	Separate.	
2.	Stoplight switch rod (6) to brake pedal (10)	Locknut (11)	Remove.	
3.		Stoplight switch rod (6)	Remove from brake pedal (10) and stoplight switch lever (5).	
4.	Stoplight switch (4) to brake support assembly (1)	Two locknuts (2), flat washers (7), lockwashers (8), and capscrews (9)	Remove.	
5.		Stoplight switch (4)	Remove from brake support assembly (1).	

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5-69. Stoplight Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



TA 155623

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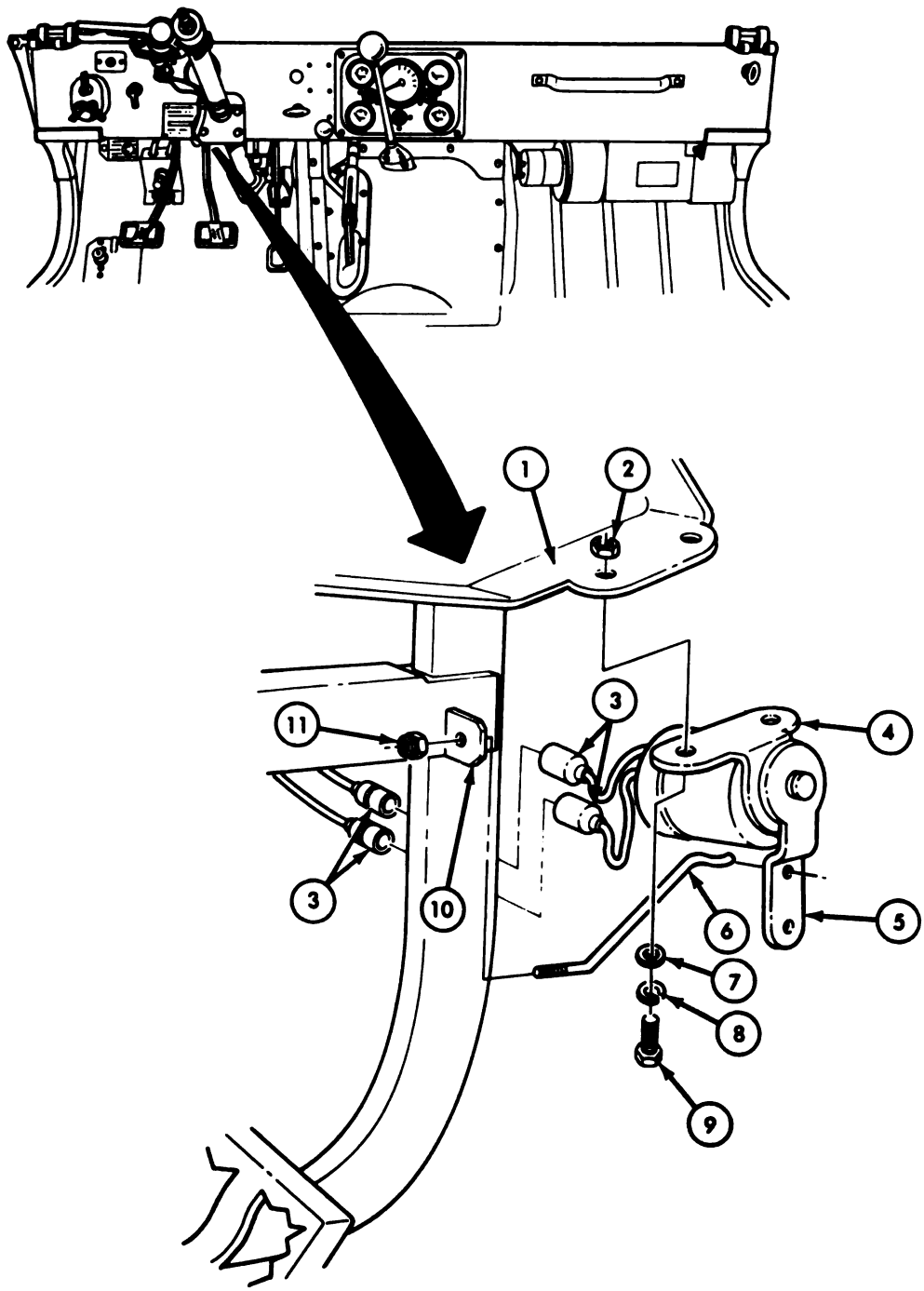
5-69. Stoplight Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
b. INSTALLATION				
6.		Stoplight switch (4)	Position to brake support assembly (1) and secure with two capscrews (9), lockwashers (8), flat washers (7), and locknuts (2).	
7.		Stoplight switch rod (6)	*a.* Insert curved end through top hole in stoplight switch lever (5).	
			b. Insert threaded end through hole in brake pedal (10).	
			c. Secure threaded end with locknut (11).	
8.		Two circuit 75 connectors (3)	Reconnect.	

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5-69. Stoplight Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Test stoplights (TM 9-2320-218-10) for proper stoplight switch operation.

TA 155624

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5-70. Starting Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10 Para 5-27	Parking brake set. Negative battery ground cable disconnected.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
Make sure negative battery ground cable is disconnected.

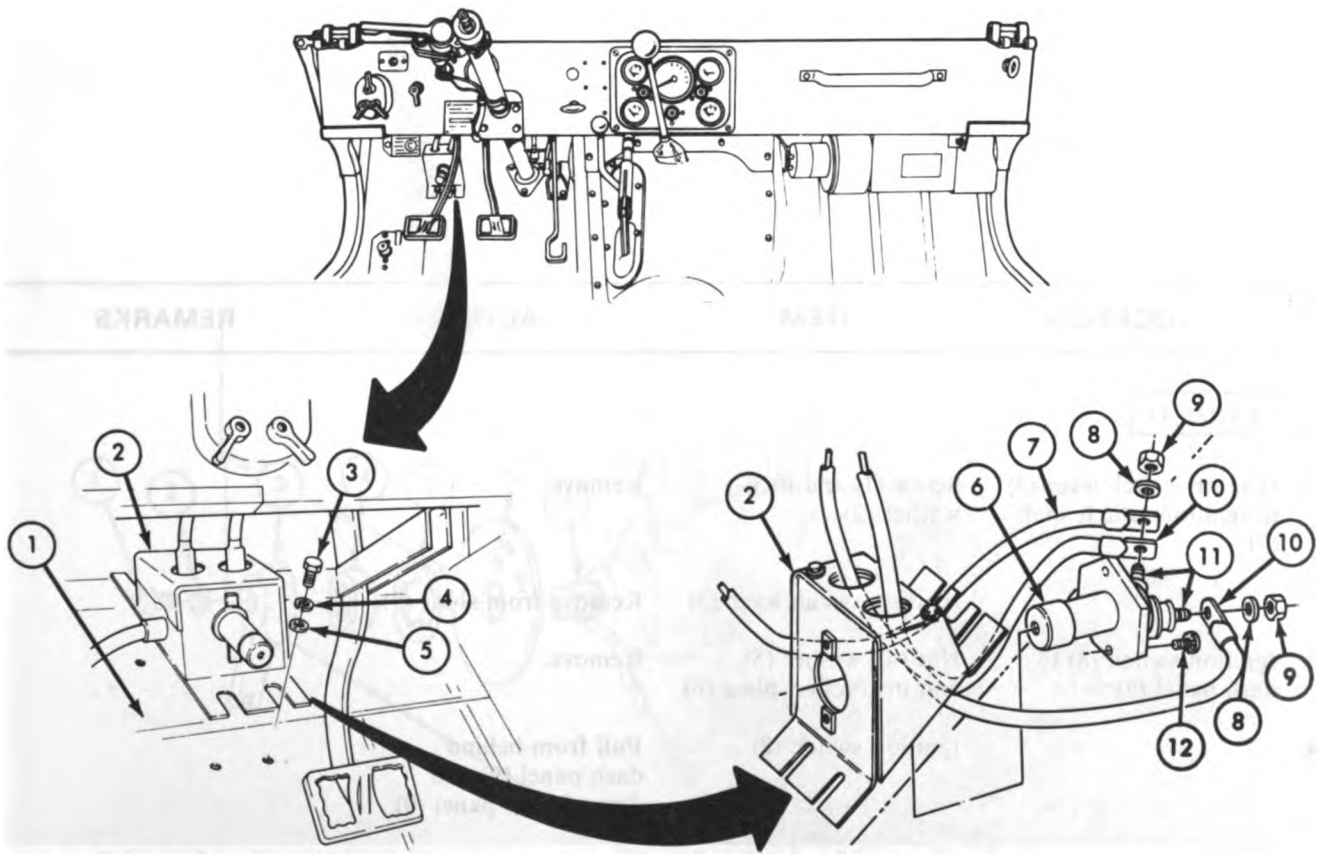
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Starting switch bracket (2) to firewall (1)	Four capscrews (3), lockwashers (4), and flat washers (5)	Remove.	
2.	Firewall (1)	Starting switch bracket (2)	Detach.	
3.	Two starting switch terminal posts (11)	Two nuts (9) and lockwashers (8)	Remove and disconnect two circuit 6 leads (10) and one circuit 5 lead (7).	Note location of disconnections for installation.
4.	Starting switch (6) to starting switch bracket (2)	Two screw-assembled lockwashers (12)	Remove.	
5.	Starting switch bracket (2)	Starting switch (6)	Remove.	

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5-70. Starting Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
6.		Starting switch (6)	Secure to starting switch bracket (2)with two screw-assembled lock washers (12).	
7.		Two circuit 6 leads (10) and one circuit 5 lead (7)	Secure to two switch terminal posts (11) with two lockwashers (8) and nuts (9).	Make sure circuits 6 (10) and 5 (7) are installed at marked locations.
8.		Starting switch bracket (2)	Secure to firewall (1) with four flat washers (5), lockwashers (4), and capscrews (3).	



END OF TASK!

FOLLOW-ON TASKS:
- Connect negative battery ground cable (para 5-27).
- Turn on ignition switch (TM 9-2320-218-10) and check for proper operation of starting switch.

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5-71. Ignition Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models
All

Equipment Condition Reference
TM 9-2320-218-10

Condition Description
Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

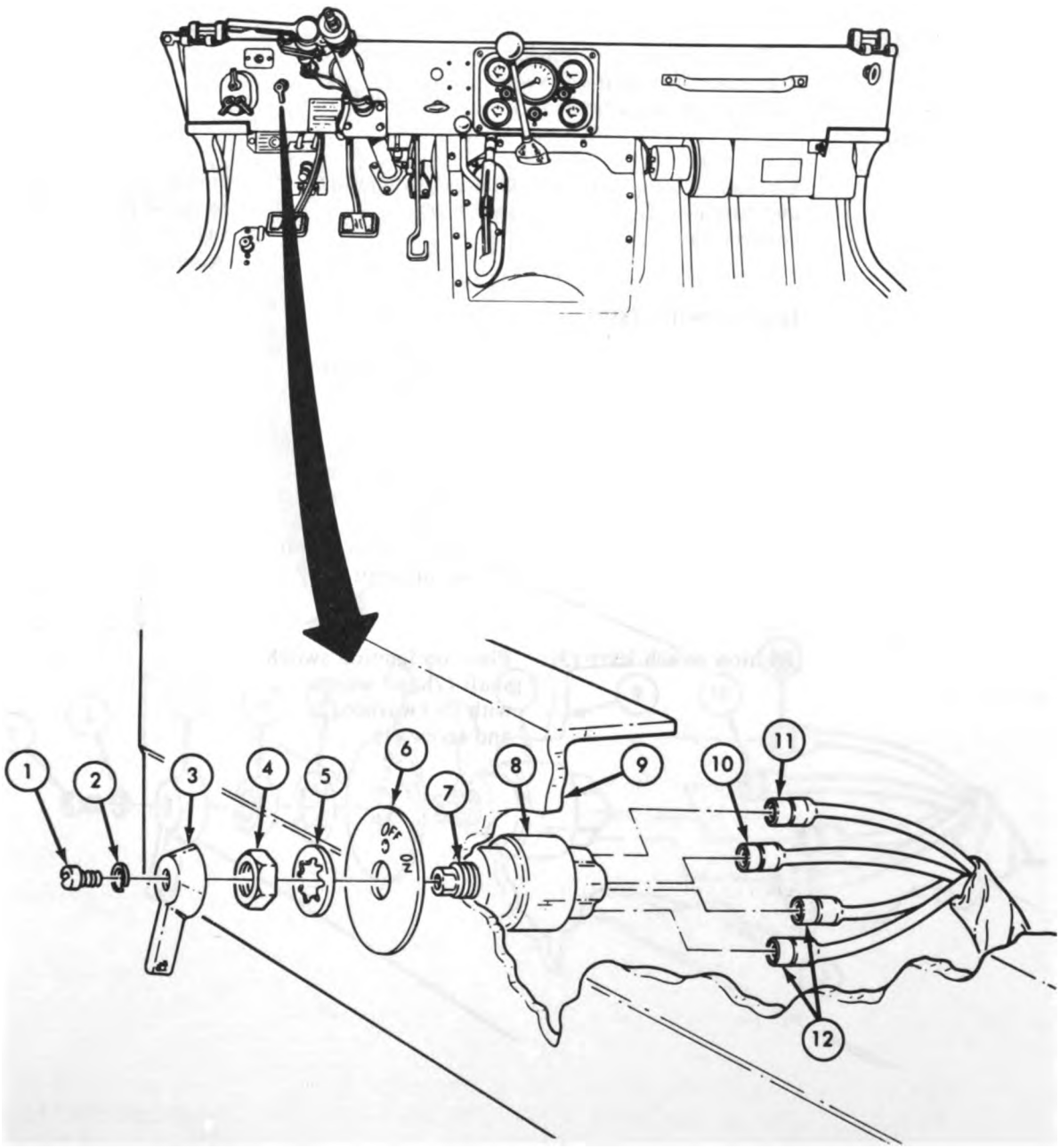
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Ignition switch lever (3) to ignition switch shaft (7)	Screw (1) and lockwasher (2)	Remove.	
2.		Ignition switch lever (3)	Remove from shaft (7).	
3.	Ignition switch (8) to dash panel (9)	Nut (4), washer (5), and instruction plate (6)	Remove.	
4.		Ignition switch (8)	Pull from behind dash panel (9) and down below panel (9).	
5.	Ignition switch (8)	Circuits 27 (10), 12 (11), and two 11 (12) connectors	Disconnect.	Note locations of disconnections for proper reconnection.

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5-71. Ignition Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



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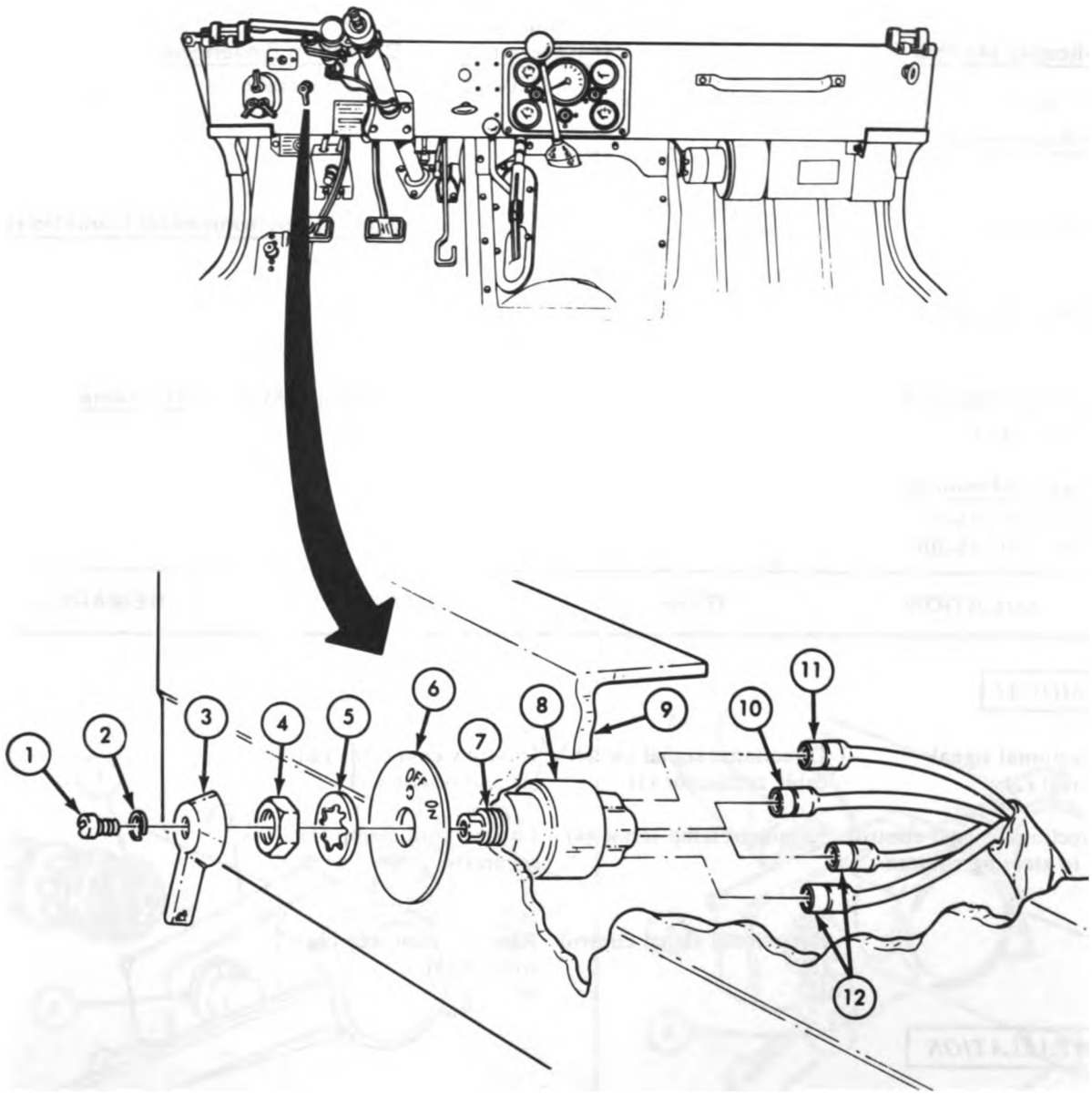
5-71. Ignition Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
		b. INSTALLATION		
		NOTE		
		There are other combinations in connecting circuits to ignition switch, however, the following is recommended.		
6.		Circuits 27 (10), 12 (11), and two 11 (12) connectors	Connect to ignition switch (8).	Circuit 27 (10) connects to terminal B, 12 (11) to D, and two 11 (12) connectors to A and C.
7.		Ignition switch (8)	*a.* Push shaft (7) through hole from backside of dash panel (9).	
			b. Secure to panel (9) by installing instruction plate (6), lockwasher (5), and nut (4), on shaft (7).	
8.		Ignition switch lever (3)	Place on ignition switch shaft (7) and secure with lockwasher (2) and screw (1).	

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5-71. Ignition Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Check ignition switch for proper operation (TM 9-2320-218-10).

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5-72. Directional Signal Switch Maintenance

This task covers:

a. Removal
b. Installation
c. Lamp Removal
d. Lamp Installation

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
Lamp

Personnel Required
One mechanic

General Safety Instructions
None

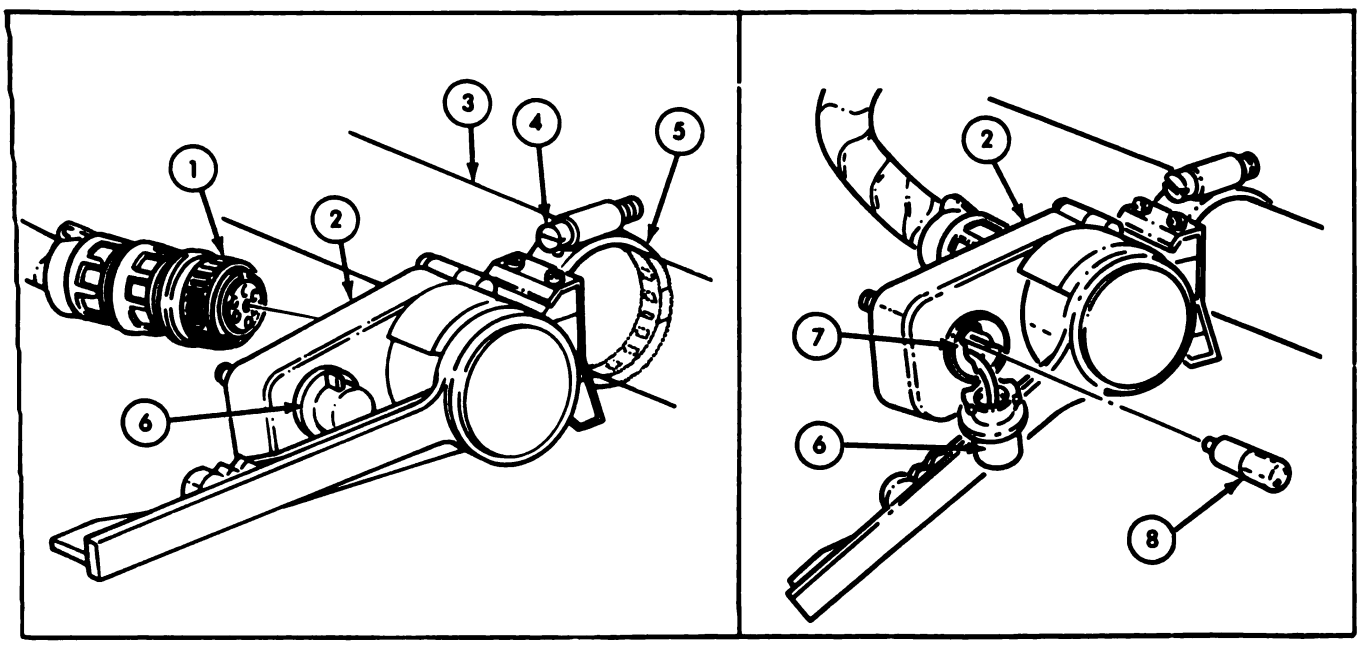
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Directional signal control (2)	Directional signal switch cable connector (1)	Unscrew connector nut (1) and disconnect.	
2.	Directional signal control (2) to steering column (3)	Retainer clamp screw (4)	Loosen until clamp (5) separates.	
3.		Directional signal control (2)	Remove from steering column (3).	
	b. INSTALLATION			
4.		Directional signal control (2)	*a.* Position to upper steering column (3).	Make sure clamp (5) is around steering column (3).
			b. Secure by tightening retainer clamp screw (4).	

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5-72. Directional Signal Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
5.		Directional signal control cable connector (1)	Connect to directional control (2), and tighten connector nut (1).	
	c. LAMP REMOVAL			
6.	Directional signal control (2)	Lens (6)	Turn counterclockwise and remove from control (2).	Lens (6) is attached to cord.
7.		Lamp (8)	Turn counterclockwise and remove from control (2).	Discard lamp (8).
	d. LAMP INSTALLATION			
8.		New lamp (8)	Place in directional control lamp socket (7) and turn clockwise to secure.	
9.		Lens (6)	Place in directional signal control (2) and turn clockwise to secure.	



END OF TASK!

FOLLOW-ON TASK: Test directional signal switch for proper operation (TM 9-2320-218-10).

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5-73. Horn Switch Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

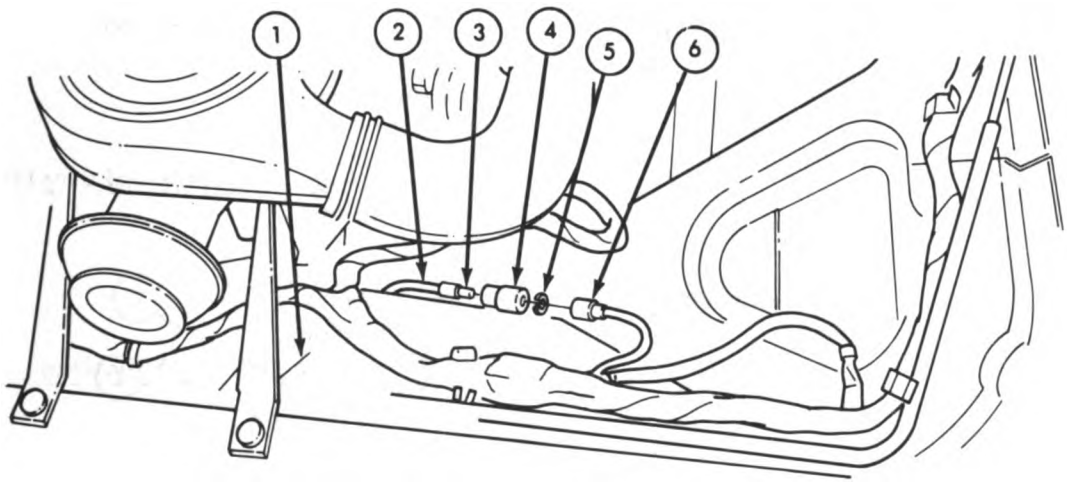
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

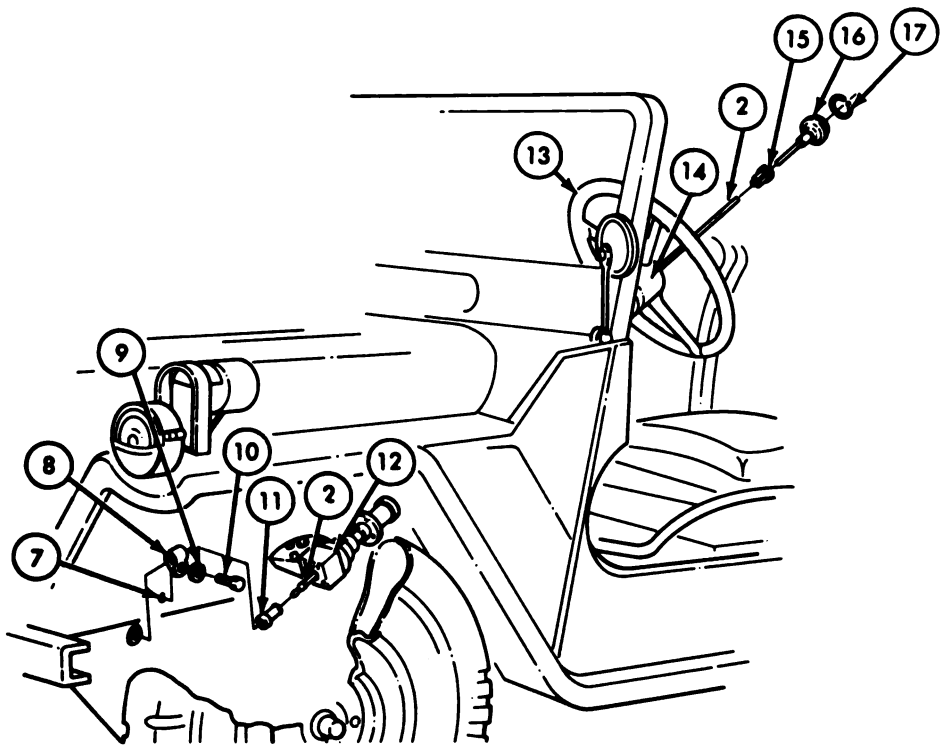
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Left side engine compartment (1)	Circuit 25 connector (6)	Separate from horn switch cable (2).	
2.	Horn switch circuit 25 connector (6)	Terminal (3)	Push through rubber shell (4) until retaining washer (5) is exposed.	
3.		Retaining washer (5)	Remove from terminal (3).	
4.		Rubber shell (4)	Slide off horn switch cable (2).	
5.	Cable retainer clip (8) to left wheel well (7)	Capscrew (10) and lockwasher (9)	Remove.	
6.	Center of steering wheel (13)	Horn switch snap ring (17)	Remove.	

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5-73. Horn Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
7.		Horn switch (16), cable (2), and bushing (15)	Pull from steering column (14) to remove.	
8.	Lower end steering column (12)	Horn switch grommet (11)	Remove.	





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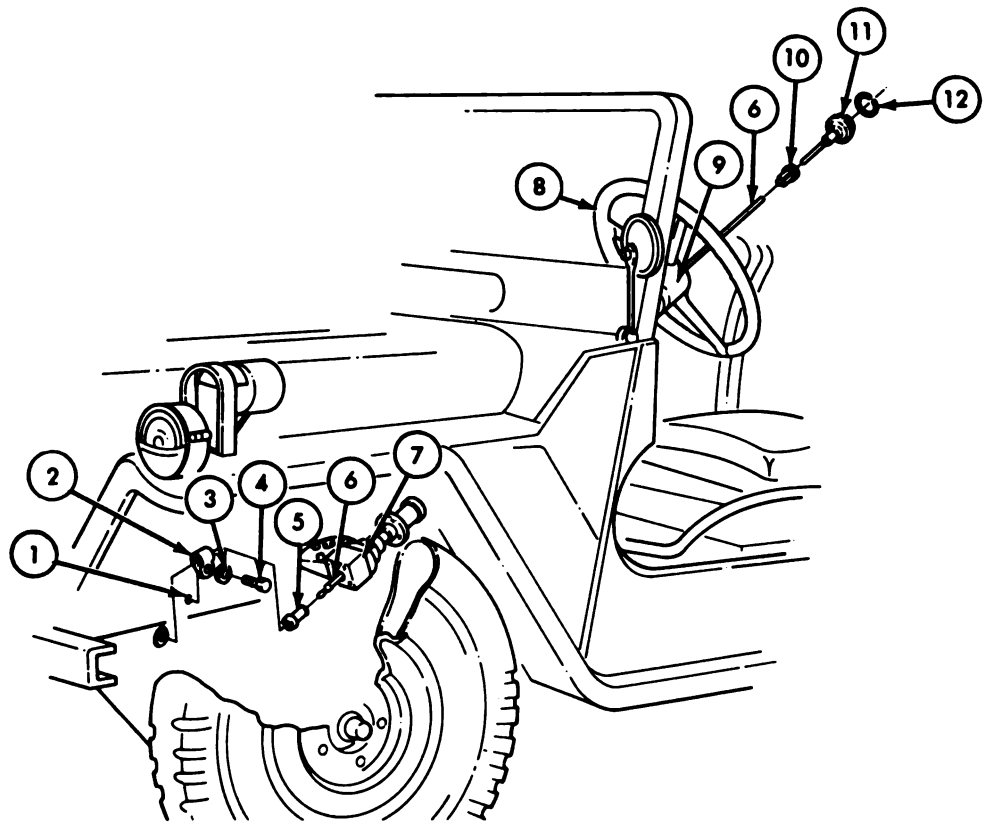
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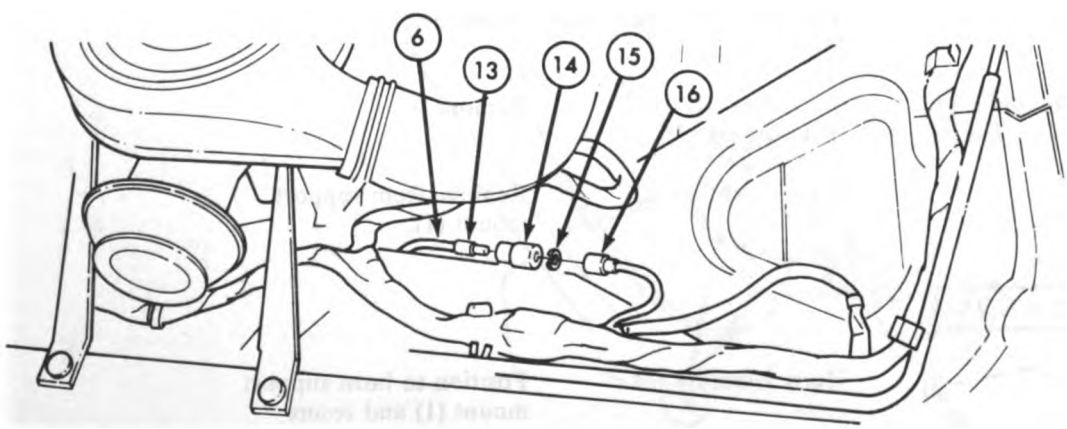
STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	b. INSTALLATION			
9.		Horn switch bushing (10)	Install on cable (6) and slide up to horn switch (11).	
10.		Horn switch (11)	*a.* Feed cable (6) through steering column (9) and install in center of steering wheel (8). *b.* Secure with snap-ring (12).	
11.		Horn switch grommet (5)	Slide over cable (6) and install in end of steering gear (7).	
12.		Clip (2)	Insert cable (6) through clip (2) and secure to wheel well (1) with lockwasher (3) and capscrew (4).	
13.		Cable terminal (13)	Push through rubber shell (14) until exposed.	
14.		Retaining washer (15)	Install on terminal (13).	
15.		Rubber shell (14)	Pull over retaining washer (15).	
16.		Circuit 25 connector (16)	Connect to horn switch cable (6).	

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5-73. Horn Switch Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS





END OF TASK!

FOLLOW-ON TASK: Sound horn to test switch for proper operation (TM 9-2320-218-10).

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5-74. Horn Assembly Maintenance

This task covers:

a. Removal *b. Installation*

INITIAL SETUP:

Applicable Models	Equipment Condition Reference	Condition Description
All	TM 9-2320-218-10	Parking brake set.
	TM 9-2320-218-10	Hood raised and secured.

Test Equipment
None

Special Tools
None

Special Environmental Conditions
None

Materials/Parts
None

Personnel Required
One mechanic

General Safety Instructions
None

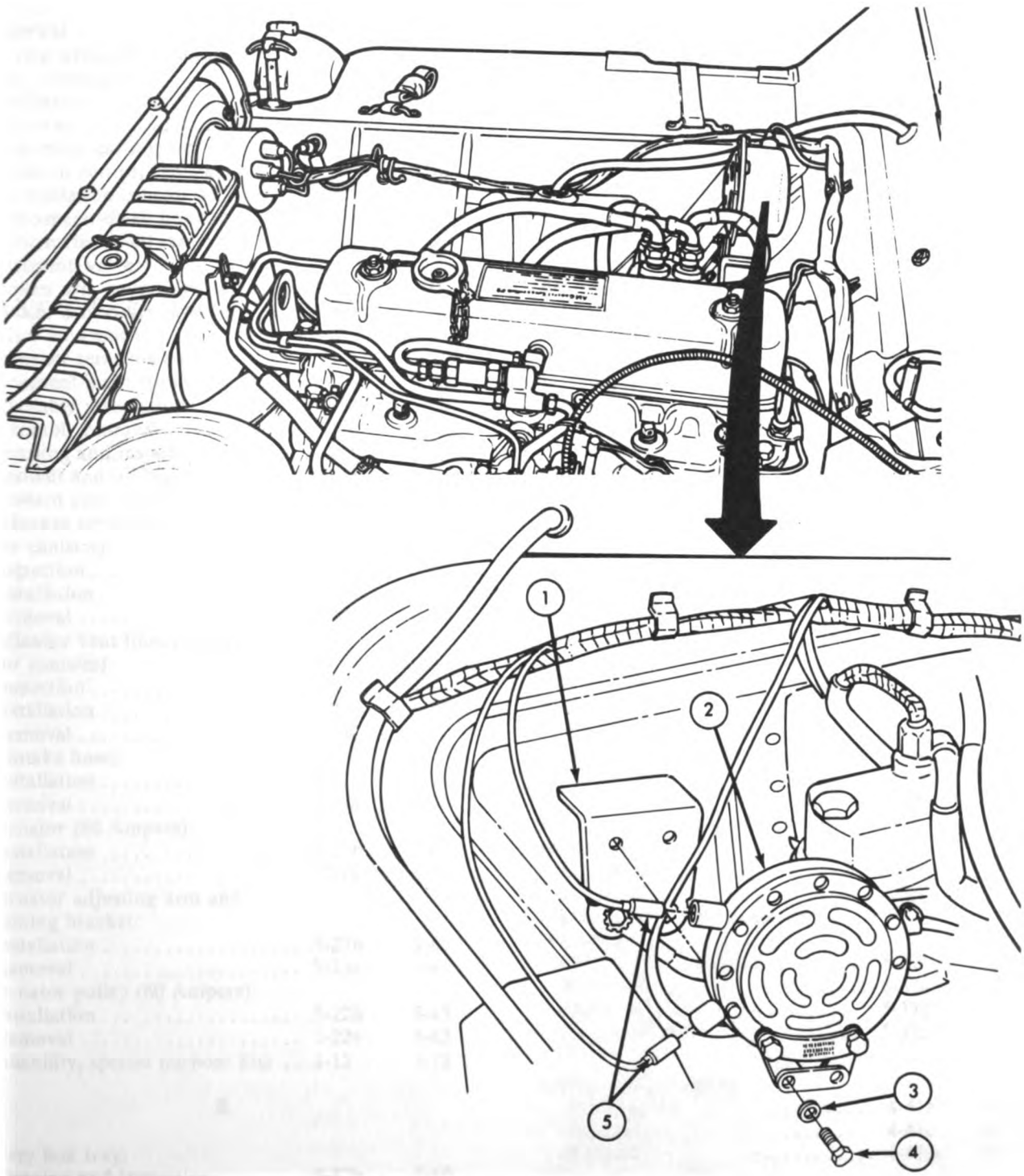
Manual References
TM 9-2320-218-10
TM 9-2320-218-20P

STEP NO.	LOCATION	ITEM	ACTION	REMARKS
	a. REMOVAL			
1.	Horn assembly (2)	Two circuit 25 connectors (5)	Disconnect.	
2.	Horn assembly (2) to horn support mount (1)	Two screws (4) and lockwashers (3)	Remove.	
3.		Horn assembly (2)	Remove from support mount (1).	
	b. INSTALLATION			
4.		Horn assembly (2)	Position to horn support mount (1) and secure with two lockwashers (3) and screws (4).	
5.		Two circuit 25 connectors (5)	Connect to horn assembly (2).	

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5-74. Horn Assembly Maintenance (Cont'd)

STEP NO.	LOCATION	ITEM	ACTION	REMARKS



END OF TASK!

FOLLOW-ON TASK: Test horn for proper operation (TM 9-2320-218-10).

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5-75. Windshield Wiper Motor and Switch Maintenance

The procedure for removal and installation of the windshield wiper motor and switch can be found in para 10-18.

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THE METRIC SYSTEM AND EQUIVALENTS

LINEAR MEASURE

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1,000 Millimeters = 39.37 Inches
1 Kilometer = 1,000 Meters = 0.621 Miles

WEIGHTS

1 Gram = 0.001 Kilograms = 1,000 Milligrams = 0.035 Ounces
1 Kilogram = 1,000 Grams = 2.2 Lb
1 Metric Ton = 1,000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1,000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles

CUBIC MEASURE

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

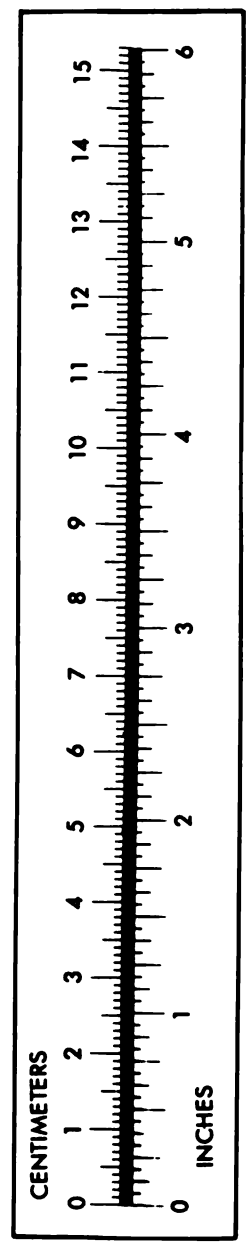
TEMPERATURE

5 9 (°F -32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Cesius
32° Fahrenheit is equivalent to 0° Celsius
9 5 C° +32 = F°

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds Per Square Inch	Kilopascals	6.895
Miles Per Gallon	Kilometers Per Liter	0.425
Miles Per Hour	Kilometers Per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds Per Square Inch	0.145
Kilometers Per Liter	Miles Per Gallon	2.354
Kilometers Per Hour	Miles Per Hour	0.621



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