

DEPARTMENT OF THE ARMY  
TECHNICAL MANUAL

TM 9-8030

DEPARTMENT OF THE AIR  
FORCE TECHNICAL ORDER

TO 36A-1-411

OPERATION AND  
ORGANIZATIONAL  
MAINTENANCE

$\frac{3}{4}$ -TON 4 x 4

CARGO TRUCK M37

$\frac{3}{4}$ -TON 4 x 4

COMMAND TRUCK M42

$\frac{3}{4}$ -TON 4 x 4

AMBULANCE TRUCK M43

AND  $\frac{3}{4}$ -TON 4 x 4

TELEPHONE INSTALLATION

LIGHT MAINTENANCE

AND CABLE SPLICING

TRUCK V-41 ( )/GT

Compliments of Militarytrucks.ca



DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MAY 1955

TECHNICAL MANUAL  
No. 9-8030  
TECHNICAL ORDER  
No. 36A-1-411

DEPARTMENTS OF THE ARMY AND  
THE AIR FORCE  
WASHINGTON 25, D. C., 2 May 1955

**OPERATION AND ORGANIZATIONAL MAINTENANCE: ¾-TON  
4 x 4 CARGO TRUCK M37; ¾-TON 4 x 4 COMMAND  
TRUCK M42; ¾-TON 4 x 4 AMBULANCE TRUCK M43; AND  
¾-TON 4 x 4 TELEPHONE INSTALLATION LIGHT MAINTENANCE  
AND CABLE SPLICING TRUCK V-41 ( )/GT**

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\*This manual supersedes TM 9-840, 6 December 1950; TB 9-840-1, 6 June 1952; TB 9-840-2, 8 September 1952; TB 9-840-3, 16 January 1953; TB 9-840-4, 6 November 1952; TB 9-840-7, 13 March 1953; and those portions of TB ORD 487, 3 February 1953, pertaining to materiel covered herein.

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# CHAPTER 1

## INTRODUCTION

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### Section I. GENERAL

#### 1. Scope

*a.* These instructions are published for information and guidance of the personnel to whom this materiel is issued. They contain information on the operation and organizational maintenance of the materiel, as well as descriptions of major units and their functions in relation to other components of the materiel.

*b.* The appendix contains a list of current references, including supply manuals, forms, technical manuals, and other available publications applicable to the materiel.

*c.* This manual differs from TM 9-840, as shown in (1), (2), and (3) below.

- (1) Adds information on command truck M42, ambulance truck M43, telescope installation, light maintenance, and cable splicing truck V-41 ( )/GT troubleshooting, and design changes.
- (2) Revises information on shifting transfer, special tools, lubrication, preventive maintenance, troubleshooting, engine description and maintenance in vehicle, engine removal and installation, ignition timing, and starting system.
- (3) Deletes reference to utility truck M42.

#### 2. Organizational Maintenance Allocation

In general, the prescribed organizational maintenance responsibilities will apply as reflected in the allocation of tools and spare parts in the appropriate columns of the current ORD 7 supply manual pertaining to these vehicles and in accordance with the extent of disassembly prescribed in this manual for the purpose of cleaning, lubricating, or replacing authorized spare parts. In all cases where the nature of repair, modification, or adjustment is beyond the scope or facilities of the using organization, the supporting ordnance maintenance unit should be informed, in order that trained personnel with suitable tools and equipment may be provided or other proper instructions issued.

*Note.* The replacement of certain assemblies, that is, the engine, clutch (pressure plate, disk, and release bearing), transmission (with or without power-take-off), transfer, and front and rear axles, is normally an ordnance

maintenance operation, but may be performed in an emergency by the using organization, provided approval for performing these replacements is obtained from the supporting ordnance officer. A replacement assembly, any tools needed for the operation which are not carried by the using organization, any necessary special instructions regarding associated accessories, etc., may be obtained from the supporting ordnance maintenance unit.

### 3. Forms, Records, and Reports

*a. General.* Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of materiel in the hands of troops and for delivery of materiel requiring further repair to ordnance shops in arsenals, depots, etc. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

*b. Authorized Forms.* The forms generally applicable to units operating and maintaining these vehicles are listed in the appendix.

For a current and complete listing of all forms, refer to DA Pam 310-20. For instructions on use of these forms, refer to FM 9-10.

*c. Field Report of Accidents.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in the SR 385-10-40 series of special regulations. These reports are required whenever accidents involving injury to personnel or damage to materiel occur.

*d. Report of Unsatisfactory Equipment or Materials.* Any suggestions for improvement in design and maintenance of equipment and spare parts, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials, or technical inaccuracies noted in Department of the Army publications, will be reported through technical channels, as prescribed in SR 700-45-5, to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

*Note.* Do not report all failures that occur. Report only REPEATED or RECURRENT failures or malfunctions which indicate unsatisfactory design or material. However, reports will always be made in the event that exceptionally costly equipment is involved. See also SR 700-45-5 and printed instructions on DA Form 468.

## Section II. DESCRIPTION AND DATA

### 4. Description

a. This manual covers the  $\frac{3}{4}$ -ton 4 x 4 cargo truck M37 (fig. 1),  $\frac{3}{4}$ -ton 4 x 4 command truck M42 (fig. 2),  $\frac{3}{4}$ -ton 4 x 4 ambulance truck M43 (fig. 3), and  $\frac{3}{4}$ -ton 4 x 4 telephone installation light maintenance and cable splicing truck V-41 ( )/GT (fig. 4).

b. All models are equipped with a liquid cooled, six-cylinder, "L" headtype gasoline engine, located at the front of the vehicle. Power is transmitted through the clutch and the four-speed transmission. A short propeller shaft connects the transmission to the two-range transfer unit. Power is then transmitted to both front and rear axles by propeller shafts.

c. Front and rear springs are of the semielliptic-type. Hydraulic-type shock absorbers are used to control flexing of both front and rear springs.

d. The steering gear is the worm- and sector-type.

e. A 24-volt electrical system supplies current for starting, ignition, lights, and horn. The electrical system is completely waterproofed. The lighting system includes service headlights, blackout driving light, marker lights, service and blackout tail and stop lights, and instrument panel lights.

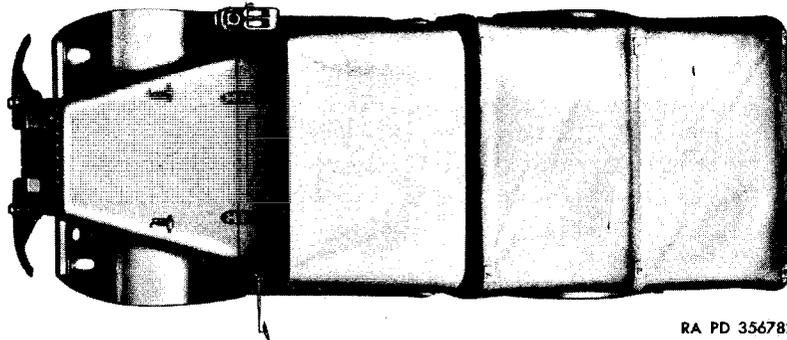
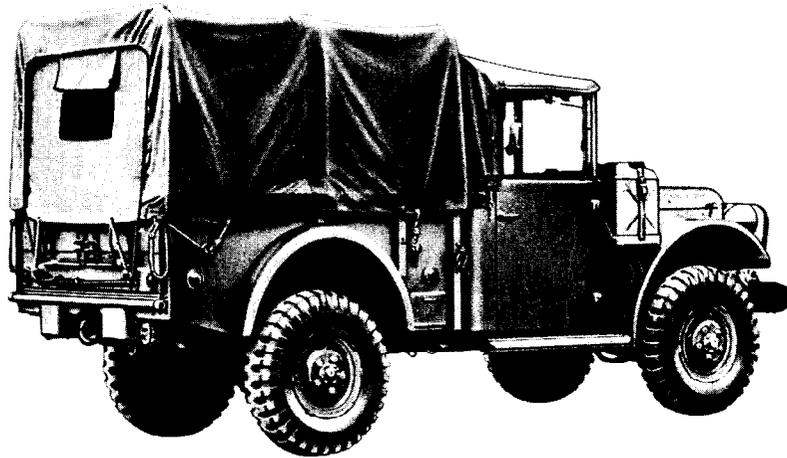
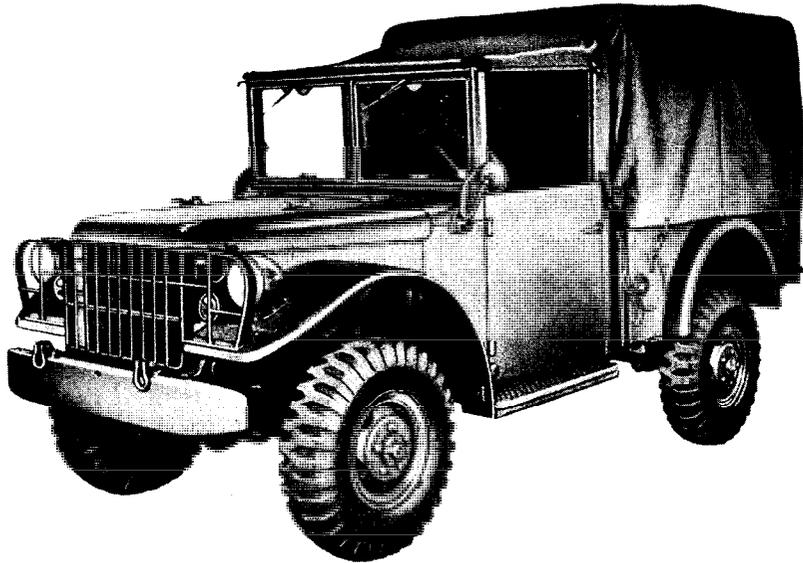
### 5. Differences Between Models

#### a. Chassis.

- (1) *Wheel base.* Wheel base of the cargo truck M37 and the command truck M42 is 112 inches; wheel base of the ambulance truck M43 and the telephone maintenance truck V-41 is 126 inches.
- (2) *Rear propeller shafts.* The rear propeller shaft in the ambulance truck M43 and the telephone maintenance truck V-41 is longer than that used in the cargo truck M37 and command truck M42.
- (3) *Springs.* Front springs for the cargo truck M37, the command truck M42, and the ambulance truck M43 have 7 leaves; front springs for the telephone maintenance truck V-41 have 8 leaves. Rear springs for the cargo truck M37 and the command truck M42 have 11 leaves; rear springs for the ambulance truck M43 and the telephone maintenance truck V-41 have 13 leaves.

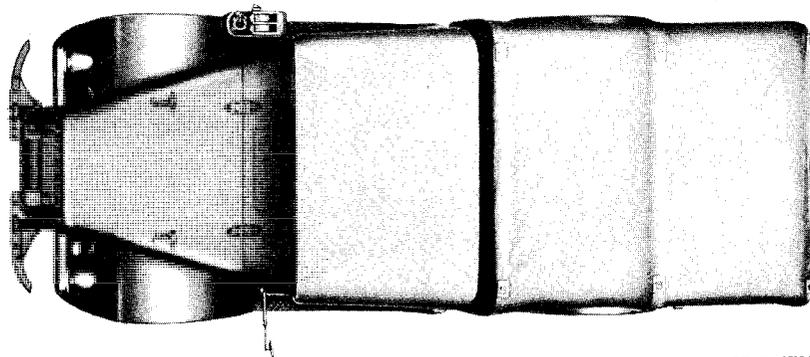
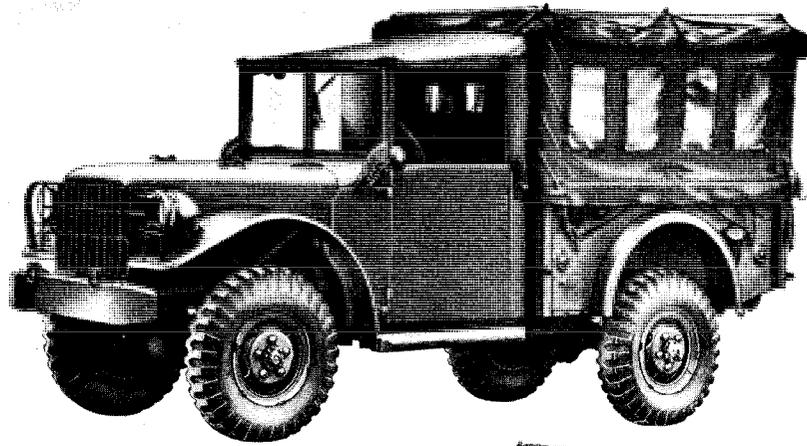
#### b. Cab and Bodies.

- (1) *Cab.* The cargo truck M37, command truck M42, and telephone maintenance truck V-41 are equipped with a steel cab with soft top which is separated from the body.
- (2) *Bodies.*



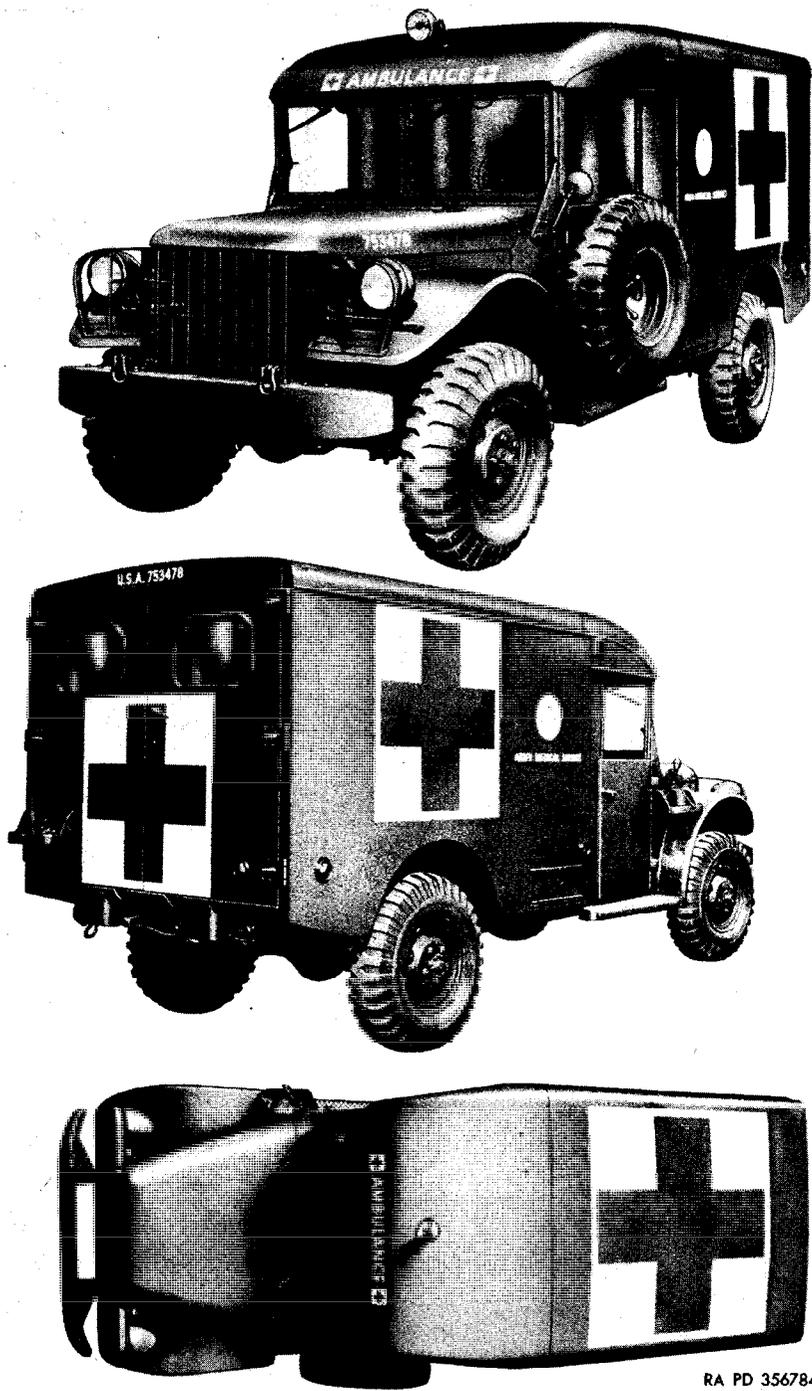
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*Figure 1. 1/4-ton 4 x 4 cargo truck M37.*



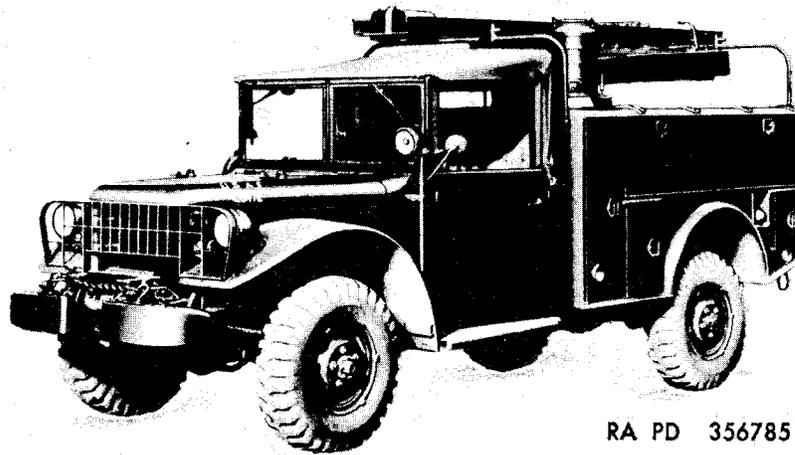
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*Figure 2. 1/4-ton 4 x 4 command truck M42.*



RA PD 356784

*Figure 3. 1/4-ton 4 x 4 ambulance truck M43.*



RA PD 356785

Figure 4.  $\frac{3}{4}$ -ton 4 x 4 telephone installation light maintenance and cable splicing truck V-41 ( )/GT.

- (a) *Cargo truck M37.* The cargo truck M37 (fig. 1) has an open-type steel body with folding troop seats, removable front rack, seat back, and supports. The spare wheel is mounted on a bracket attached to the front panel. An auxiliary seat, attached to the front panel at the right of the spare wheel locking bracket (fig. 5), is usable when the spare wheel is removed. A roof paulin, supported by bows, covers the cargo compartment. Canvas front and rear end curtains are provided with windows.
- (b) *Command truck M42* (fig. 2). The command truck M42 is slightly different from the cargo truck M37 ((a) above). This difference is made by the installation of a conversion kit consisting of body side curtains with windows, a split-type rear end curtain, map light, and folding table.
- (c) *Ambulance truck M43.* The ambulance truck M43 (fig. 3) has a panel-type closed steel body consisting of the driver's compartment and the patient's compartment with a connecting partition door. The spare wheel is mounted on a carrier at the left side of the driver's compartment (fig. 6). A spotlight is mounted on the roof of the driver's compartment.
- (d) *Telephone maintenance truck V-41.* The telephone maintenance truck V-41 (fig. 4) has an all steel body which incorporates compartments for stowage of tools and supplies. The spare wheel is located in the right side front compartment of the body (fig. 7). A spotlight is mounted on a support at the left front fender.

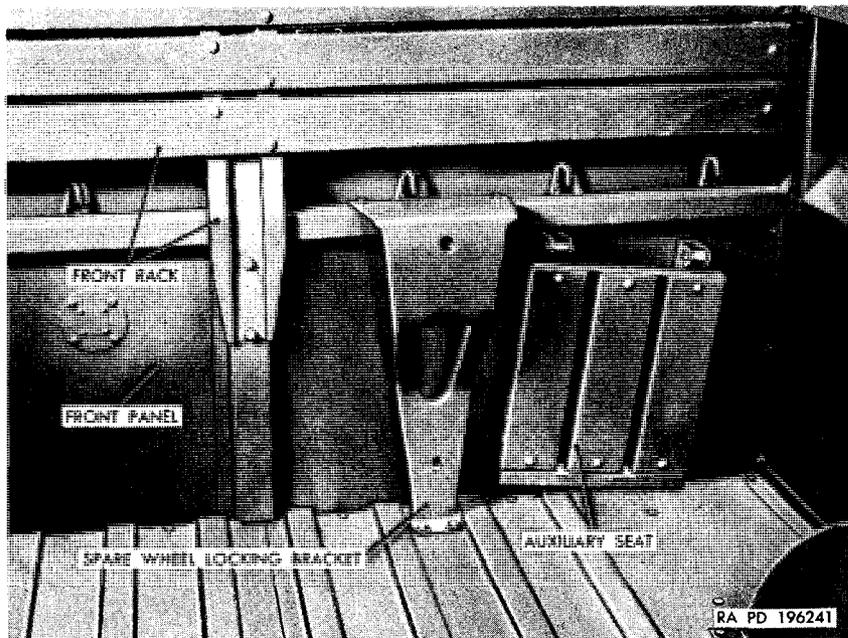


Figure 5. Front body panel and related parts (cargo truck M37)

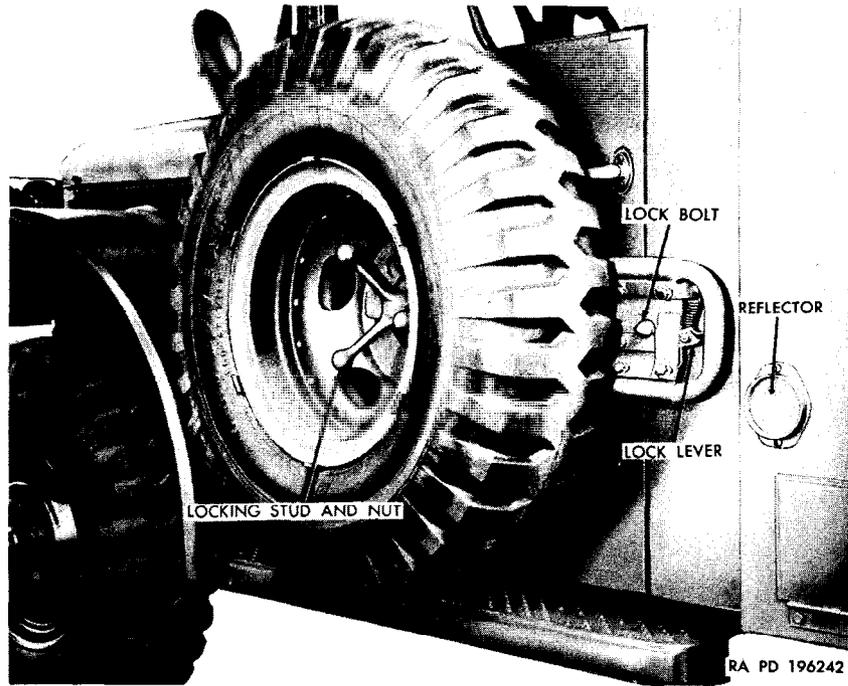
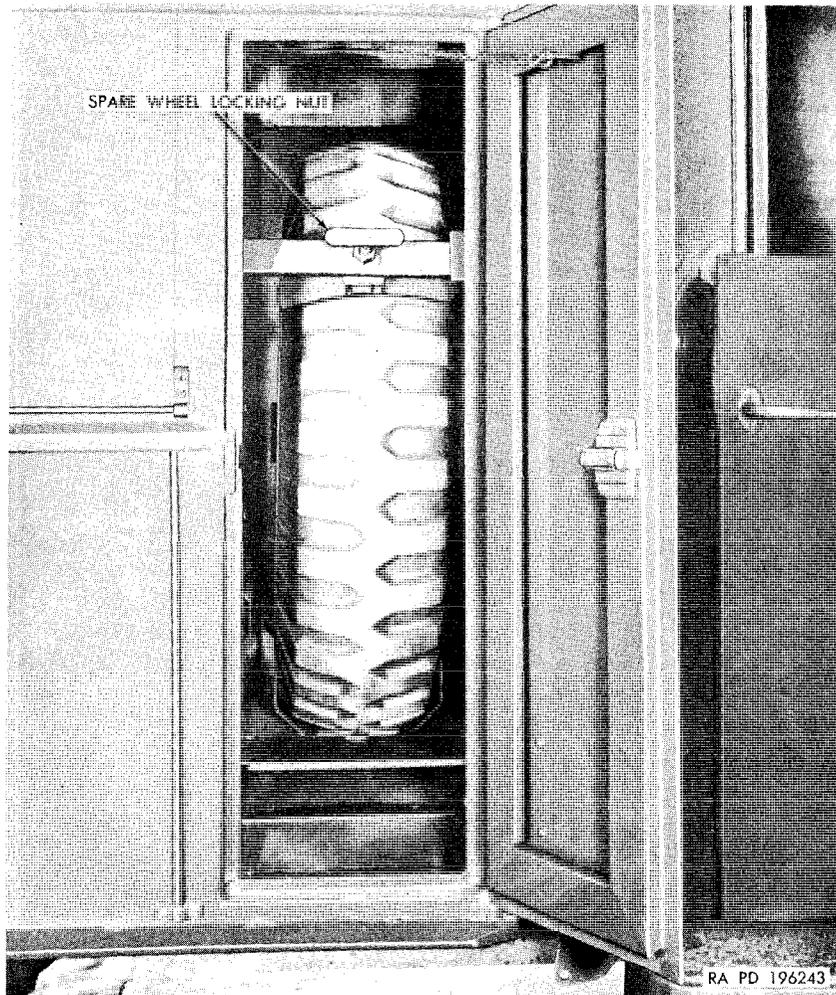


Figure 6. Hinged-type spare wheel carrier (ambulance truck M43).



*Figure 7. Spare wheel stowage compartment (telephone maintenance truck V-41).*

## **6. Design Changes**

*a. General.* A number of design changes have been incorporated in production for improving performance or in the interest of economy. The deleted, changed, or added items are listed in *b*, *c*, and *d* below along with the engine or serial number to which they apply.

*b. Items Deleted.*

- (1) The carburetor air cleaner shroud, crankcase ventilation shutoff valves and controls, throttle fording plate, and crankcase ventilation valve dual control plate were discontinued on all models starting with engine No. T245-34268.

- (2) The battery-to-radio cable and the radio receptacle in the body front panel (cargo truck M37 and command truck M42) were discontinued starting with serial No. 80022762.
- (3) The electrical auxiliary power receptacle, located on the right side of the instrument panel, was discontinued on all models starting with serial No. 80028130.
- (4) The auxiliary power receptacle and cable on the cowl left-side panel was discontinued on all models starting with serial No. 80028262.
- (5) The trailer coupling receptacle on the light switch was discontinued on all models starting with serial No. 80027855.
- (6) The use of sealing compound on battery and starter terminals was discontinued on all models starting with serial No. 80015189.
- (7) The fire extinguisher and bracket were discontinued on all models starting with serial No. 80050153.
- (8) The fuel tank drain plug was discontinued on all models starting with serial No. 80042080.
- (9) The engine priming system was discontinued starting with serial No. 80026807 on cargo truck M37, command truck M42, and telephone maintenance truck V-41, and with serial No. 80027049 on ambulance truck M43.

*c. Items Added.*

- (1) A lubrication elbow and plug were incorporated in the distributor on all models starting with engine No. T245-37442, replacing the 1/8-inch pipe plug in the distributor base.
- (2) The hood safety catch was incorporated on all models starting with serial No. 80017625.

*d. Items Changed.*

- (1) The distributor and brake master cylinder vent line fittings were relocated on the air cleaner elbow on all models starting with engine No. T245-7352.
- (2) The fuel gage, oil pressure gage, water temperature gage, and the water temperature gage sending unit were changed from 6- to 24-volt units on all models starting with serial No. 80009427, replacing the 6-volt units and resistors.
- (3) A clutch housing pan flanged-type drain plug and gasket replaced the 3/4-inch pipe plug on all models starting with engine No. T245-8184.
- (4) An improved clutch housing pan gasket is used on all models starting with engine No. T245-12530.
- (5) An improved clutch housing pan plate and seal assembly is used on all models starting with engine No. T245-11336.
- (6) The fuel tank vent valve is mounted on the fuel tank cover on all models starting with serial No. 80010922, replacing the vent valve in the fuel tank cover.

- (7) The locking-type throttle control handle was incorporated on all models starting with serial No. 80030242, replacing the friction button-type control.
- (8) A new type fuel pump gasket is used on all models starting with engine No. T245-21023.
- (9) A fuel filter was incorporated in the fuel tank starting with serial No. 80042293 on the cargo truck M37 and the command truck M42; and serial No. 80043170 on the ambulance truck M43, replacing the fuel filter located on the generator regulator support bracket.
- (10) An improved starter and starter switch was incorporated on all models starting with engine No. T245-18745.
- (11) The starter pedal bracket was relocated on all models starting with serial No. 80009081.
- (12) An ignition filter was incorporated in the distributor starting with serial No. 80027049 on the cargo truck M37, command truck M42, and telephone maintenance truck V41; and with serial No. 80025704 on the ambulance truck M43, replacing the ignition filter located on the cowl front panel.
- (13) A new type battery holddown cover was incorporated on all models starting with serial No. 80015189.
- (14) The battery location in the ambulance truck M43 was changed from the left side compartment to the space under the attendant's seat in the driver's compartment starting with serial No. 80025984.
- (15) The hinged-type spare wheel carrier was incorporated on ambulance truck M43 starting with serial No. 80019180, replacing the rigid-type carrier.
- (16) The mechanical jack was issued on all models starting with serial No. 80026822, replacing the hydraulic jack.

## **7. Data, Caution, and Instruction Plates**

*a. General.* Various data, caution, and instruction plates provide pertinent information regarding identification and/or operating instructions for the vehicles. These plates are located on the instrument panel in the driver compartment (fig. 8), in the engine compartment (fig. 9), and in the patient compartment of the ambulance truck M43 (figs. 10 and 11).

*b. Winch Caution Plate (A, fig. 8).* This plate provides a diagram of the power-take-off shift lever positions, specifies the winch capacity, and cautions the operator concerning proper operation.

*c. Transmission and Transfer Gearshift Instruction Plate (B, fig. 8).* This plate provides a diagram of the various positions for the transmission and transfer shifting levers, and cautions the operator regarding maximum permissible road speeds.

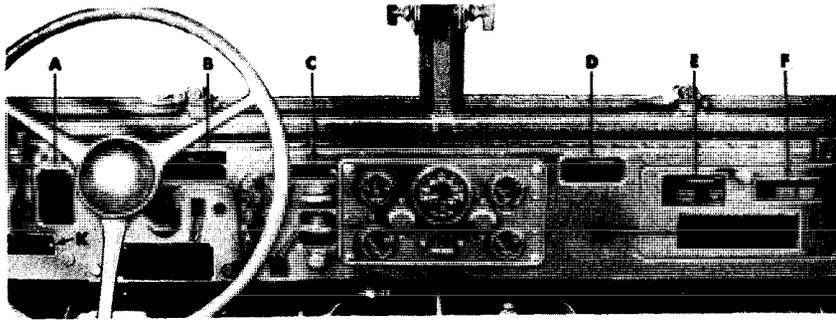


Figure 8. Data, caution, and instruction plates in driver compartment.

d. *Throttle Fording Instruction Plate* (C, fig. 8). This plate (on vehicles so equipped) provides instructions for use of the throttle for fording operation.

e. *U. S. Property Conversion Identification Plate* (D, fig. 8). This plate identifies the command truck M42 and lists the ordnance number. The plate is a component of the conversion kit used for converting a cargo truck M37 to a command truck M42.

f. *U. S. Property Identification Plate* (E, fig. 8). This plate provides the ordnance stock and serial numbers, manufacturer's serial, part, and contract numbers, year and model designation, and date of inspection.

g. *Responsible Agency Plate* (F, fig. 8). This plate indicates the responsible procurement and depot maintenance units for chassis, body, and equipment.

h. *Weight and Dimension Data Plate* (G, fig. 8). This plate provides information on dimensions, weight distribution, payload, and towed load.

i. *Crankcase Ventilation Valve Dual Control Plate* (H, fig. 8). This plate (on vehicles so equipped) fits over the crankcase vent valve control and provides instructions for use of this control for fording operation.

j. *Servicing Data Instruction Plate* (J, fig. 8). This plate provides information on fuel, engine oil, lubricants, and tire inflation requirements.

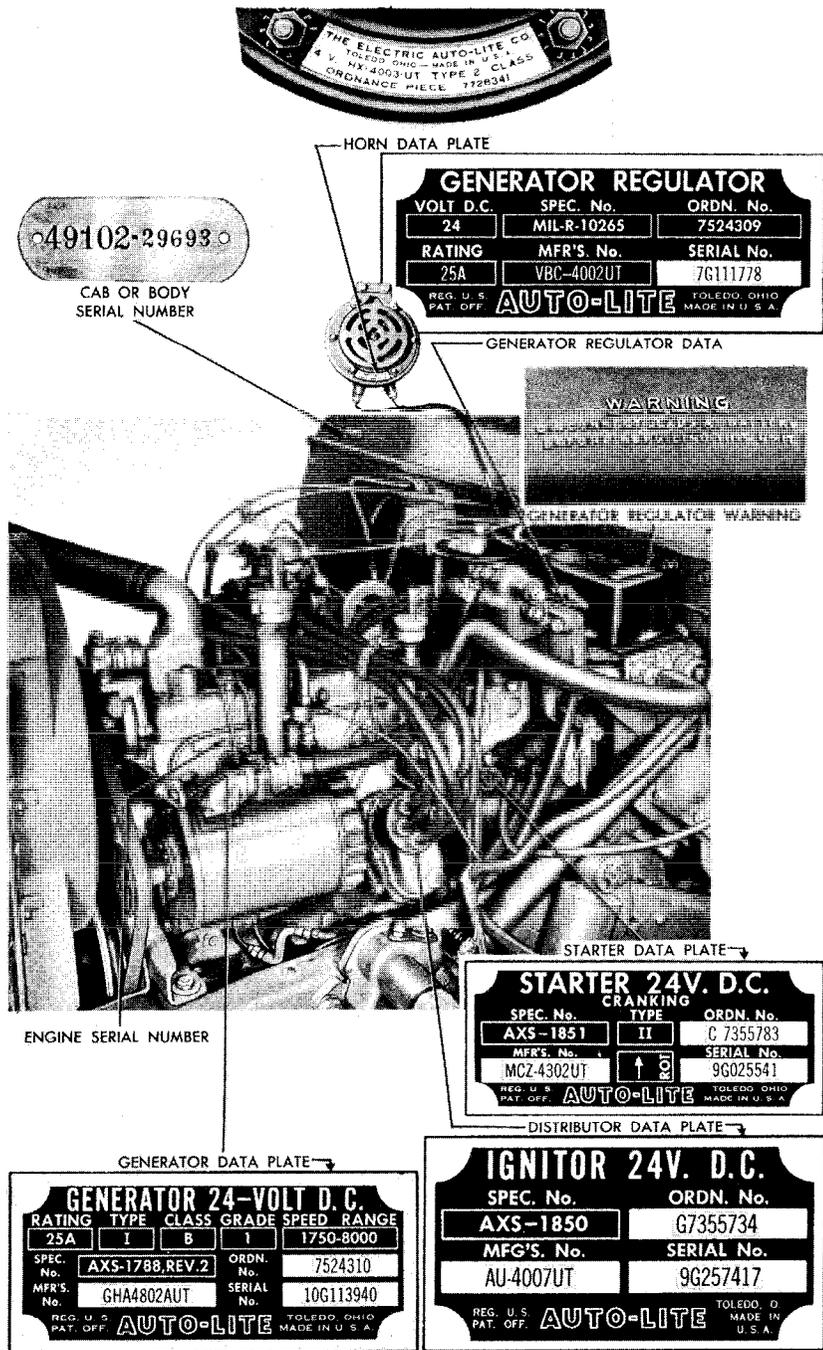
k. *Publications Data Plate* (K, fig. 8). This plate lists publications and lubrication order pertinent to the vehicles.

l. *Horn Data Plate* (fig. 9). This plate provides identification information on the horn.

m. *Starter Data Plate* (fig. 9). This plate provides identification information on the starter and direction of rotation.

n. *Distributor (Igniter) Data Plate* (fig. 9). This plate provides identification information on the distributor.

o. *Generator Regulator Data Plate* (fig. 9). This plate provides identification information on the generator regulator.



RA PD 196245

Figure 9. Data plates, serial numbers, and generator regulator warning in engine compartment.

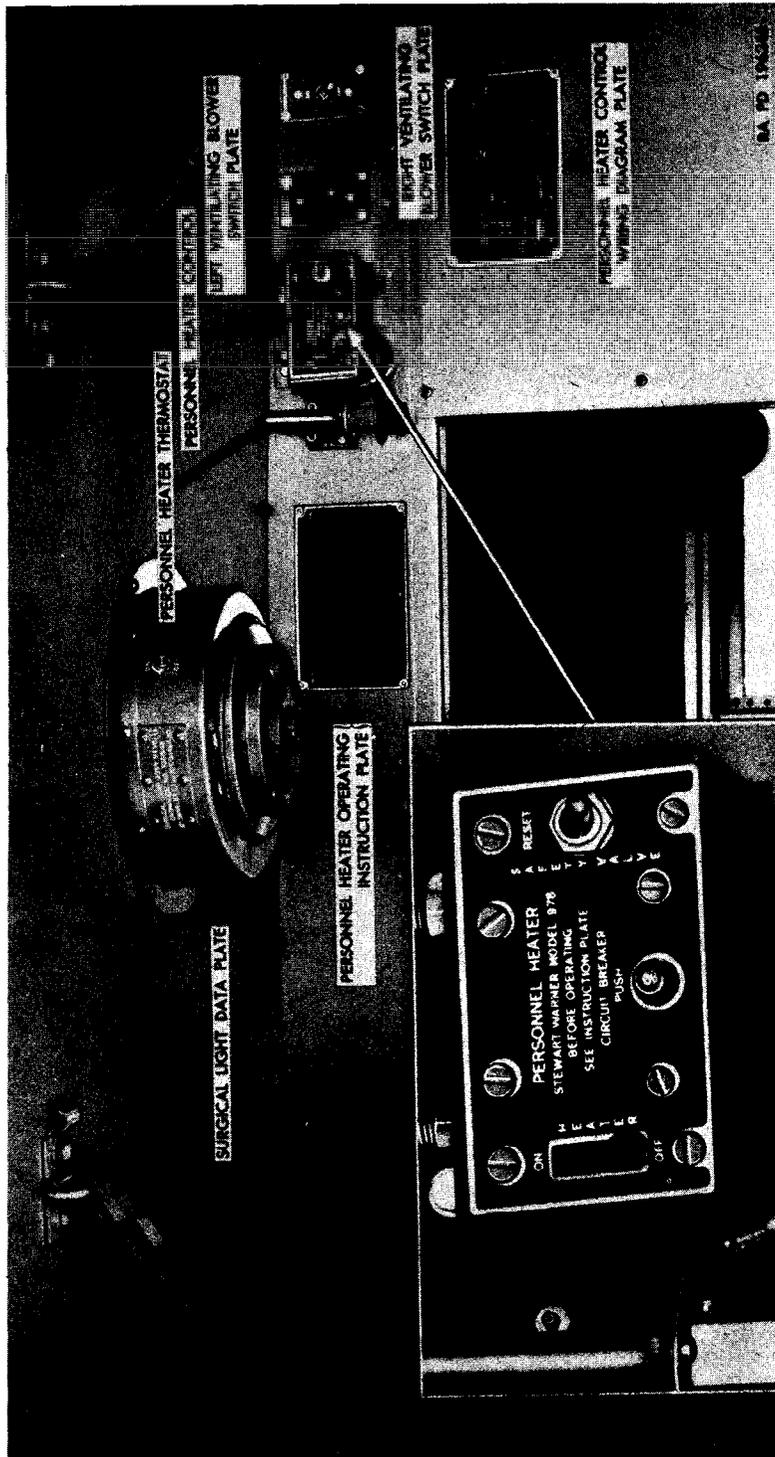


Figure 10. Data and instruction plates in patient compartment (ambulance truck M4S).

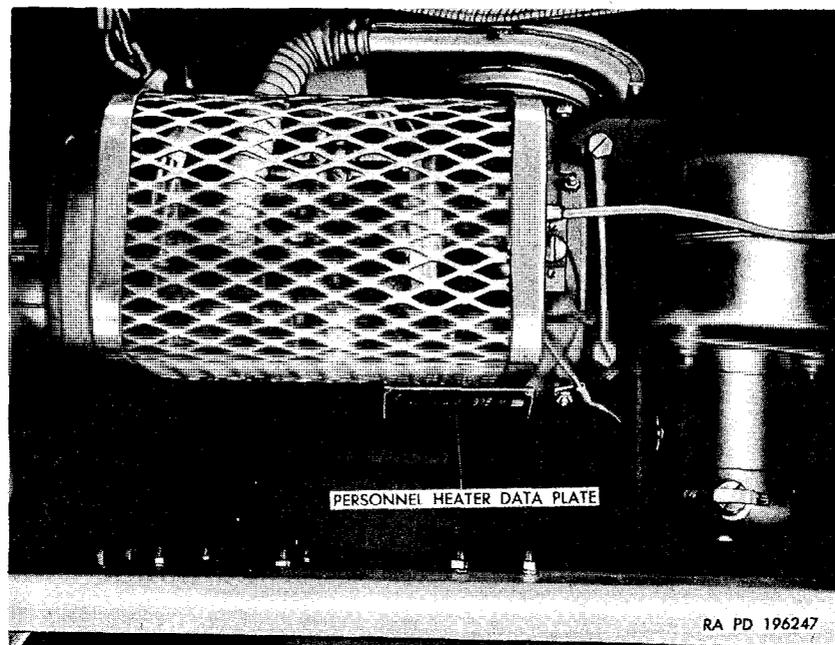


Figure 11. Personnel heater data plate in patient compartment (ambulance truck M43).

*p. Generator Regulator Warning* (fig. 9). This warning reads "WARNING—Disconnect leads at battery before servicing this unit."

*q. Generator Data Plate* (fig. 9). This plate provides identification information on the generator.

*r. Engine Serial Number* (fig. 9). This number identifies the particular engine.

*s. Cab or Body Serial Number Plate* (fig. 9). This plate identifies the cab or ambulance body model and serial number.

*t. Surgical Light Data Plate (Ambulance Truck M43)* (fig. 10). This plate provides identification information on the surgical light.

*u. Personnel Heater Operating Instruction Plate (Ambulance Truck M43 Only)* (fig. 10). This plate provides operating instructions for the personnel heater.

*v. Personnel Heater Control Plate (Ambulance Truck M43 only)* (fig. 10). This plate identifies the heater controls.

*w. Ventilating Blower Switch Plates (Ambulance Truck M43)* (fig. 10). These two plates identify the toggle switch positions.

*x. Personnel Heater Control Wiring Diagram Plate (Ambulance Truck M43)* (fig. 10). This plate illustrates the wiring hook-up of the thermostat and the heater control.

*y. Oil Filter Decalcomania* (fig. 80). This decalcomania provides information on the servicing of the oil filter.

2. *Personnel Heater Data Plate (Ambulance Truck M43)* (fig. 11).  
This plate provides identification information of the personnel heater.

## 8. Tabulated Data

### a. General Data.

#### Capacities:

Cooling system.....	17 qt
Crankcase (refill).....	5 qt
(When replacing oil filter or filter element, add 1 qt.)	
Differential (each):	
Fill.....	3 qt
Refill.....	2½ qt
Fuel tank.....	24 gal
Steering gear.....	1 pt
Transfer.....	5 pt
Transmission:	
With power-take-off (through engine No. T245-3955).....	10½ pt
(after engine No. T245-3955).....	7 pt
Without power-take-off (through engine No. T245-3955).....	9 pt
(after engine No. T245-3955).....	6 pt
Winch clutch housing.....	1 qt
Winch worm housing.....	1 qt
Crew.....	2
Cylinders (in line).....	6
Dimensions:	
Height:	
Cargo truck M37.....	7 ft 2½ in.
Command truck M42.....	7 ft 2½ in.
Ambulance truck M43.....	7 ft 7⅞ in.
Telephone maintenance truck V-41.....	7 ft 9½ in.
Length:	
Cargo truck M37, w/o winch.....	15 ft 4¾ in.
Cargo truck M37, w/winch.....	15 ft 9⅞ in.
Command truck M42, w/o winch.....	15 ft 4¾ in.
Command truck M42, w/winch.....	15 ft 9⅞ in.
Ambulance truck M43.....	16 ft 6¾ in.
Telephone maintenance truck V-41.....	16 ft 6¾ in.
Width (all models).....	6 ft 1½ in.
Electrical system (all models).....	24 volt
Engine.....	Dodge Model T245
Ground clearance.....	10¾ in.
Loading height (fully loaded):	
Cargo truck M37.....	29¼ in.
Command truck M42.....	29¼ in.
Ambulance truck M43.....	30¾ in.
Telephone maintenance truck V-41.....	30¾ in.
Number of batteries.....	2
Passengers (including crew):	
Cargo truck M37.....	2
Command truck M42.....	2 to 8
Ambulance truck M43:	
With 4 litter patients.....	6
With 6 seated patients.....	8
Telephone maintenance truck V-41.....	2

Pintle height (all models except ambulance truck M43) :					
Empty .....		25 $\frac{1}{8}$ in.			
Loaded.....		21 $\frac{7}{8}$ in.			
Weight :					
Gross :	<i>Cross-Country</i>	<i>Highway</i>			
Cargo truck M37 (w/o winch).....	7,417 lb	7,917 lb			
Cargo truck M37 (w/winch).....	7,647 lb	8,147 lb			
Command truck M42 (w/o winch).....	7,417 lb	7,917 lb			
Command truck M42 (w/winch).....	7,647 lb	8,147 lb			
Ambulance truck M43.....		8,550 lb			
Telephone maintenance truck V-41.....	8,450 lb	8,950 lb			
Net :					
Cargo truck M37 (w/o winch).....	5,687 lb				
Cargo truck M37 (w/winch).....	5,917 lb				
Command truck M42 (w/o winch).....	5,687 lb				
Command truck M42 (w/winch).....	5,917 lb				
Ambulance truck M43.....	7,150 lb				
Telephone maintenance truck V-41.....	6,950 lb				
Payload (all models except ambulance truck M43) :					
Cross-country .....		1,500 lb			
Highway.....		2,000 lb			
Payload (ambulance truck M43).....		1,400 lb			
Wheel base :					
Cargo truck M37, command truck M42.....		112 in.			
Ambulance truck M43, telephone maintenance truck V-41.....		126 in.			
<i>b. Performance.</i>					
Allowable speed :					
Transfer :	<i>1st</i>	<i>2d</i>	<i>3d</i>	<i>4th</i>	<i>Reverse</i>
High range.....	9	18	33	55	7—mph
Low range.....	4	9	17	28	4—mph
Angle :					
Approach :					
Cargo truck M37, command truck M42 (w/o winch).....					44°
Ambulance truck M43, telephone maintenance truck V-41 (w/o winch) .....					47°
Cargo truck M37, command truck M42, telephone maintenance truck V-41 (w/winch).....					38°
Departure.....					32°
Cruising range (loaded).....					225 miles
Engine horsepower (brake hp) :					
At 1,600 rpm.....					57
At 3,400 rpm.....					94
Fording depth (max.) :					
W/o fording kit.....					42 in.
W/fording kit.....					84 in.
Fuel consumption (loaded) (aprx.).....					9 mpg
Grade ascending ability (max.) limited by traction.....					68 percent
Recommended towed load (max.) :					
Cross-country .....					4,000 lb
Highway.....					6,000 lb
Turning circle (diam.) right or left (min.).....					50 ft
Winch capacity.....					7,500 lb

*c. Detailed Data References.* Additional detailed tabular data pertaining to individual components and systems are contained in the following paragraphs:

	<i>Paragraph</i>
Battery and lighting system.....	166b
Brake system.....	213b
Clutch.....	186b
Cooling system.....	147b
Engine.....	109b
Front axle.....	202b
Fuel and air intake and exhaust systems.....	132b
Generating system.....	163b
Ignition system.....	123b
Instruments, gages, and horn.....	177b
Propeller shafts.....	199b
Rear axle.....	209b
Springs and shock absorbers.....	242b
Starting system.....	157b
Steering gear and controls.....	230b
Transfer.....	195b
Transmission and power-take-off.....	190b
Wheels, hubs, and tires.....	225b
Winch and winch drive shaft.....	180b

## CHAPTER 2

### OPERATING INSTRUCTIONS

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#### Section I. SERVICE UPON RECEIPT OF MATERIEL

#### 9. Purpose

*a.* When a new or reconditioned vehicle is first received by the using organization, it is necessary for the organizational mechanics to determine whether the vehicle has been properly prepared for service by the supplying organization and is in condition to perform any mission to which it may be assigned when placed in service. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment (par. 69-72) to be sure every item is present, in good condition, clean, and properly mounted or stowed.

*b.* In addition, perform a break-in of at least 500 miles on all new or reconditioned vehicles and a sufficient number of miles on used vehicles to completely check their operation, according to procedures in paragraph 11.

*c.* Whenever practicable, the vehicle driver will assist in the performance of these services.

#### 10. Preliminary Services

*a. General procedures.*

- (1) Uncrate vehicle, if crated. Remove metal strapping, plywood, tape, seals, wrapping paper, and dehydrant bags. If any exterior surfaces are coated with rust-preventive compound, remove it with dry-cleaning solvent or volatile mineral spirits.
- (2) Read Processing Record for Storage and Shipment of Vehicles and Boxed Engines (DA Form 9-3) and follow all precautions checked thereon. This tag should be in the driver's compartment attached to the steering wheel or ignition switch.
- (3) Crank engine with the starter at least two revolutions, before turning the ignition on, to test for hydrostatic lock. (This precaution is necessary because there might be an excess of preservative oil in the combustion chambers or possibly, coolant may have leaked into them.)

*Note.* If the vehicle has been driven to the using organization, most or all of the foregoing procedures should have been performed.

- (4) Follow the "before-operation" procedures described in table II.

*b. Specific Procedures.* Perform the "D" (6-month or 6,000-mile) preventive maintenance service (table III), with the variations listed in (1) through (5) below.

- (1) Line out the other services on DA Form 461 and write in "New (or rebuilt) vehicle reception."
- (2) Before starting engine, tighten cylinder-head cap screws with a torque-indicating wrench in sequence prescribed in paragraph 115*b*.
- (3) Perform item 27 (table III) before starting the road test. If a processing tag (*a*(2) above) on the engine or vehicle states that the engine contains oil that is suitable for 500 miles of operation, and of the correct seasonal viscosity, check the level but do not change the oil; otherwise, change the oil. Lubricate all points, regardless of interval, except as noted in (5) below. Check the levels of lubricant in all gear housings. If the gear lubricant is known to be of the correct seasonal grade, do not change it; otherwise, change it.
- (4) When engine has been thoroughly warmed up to operating temperature, check the tightness of the cylinder-head cap screws with a torque-indicating wrench to the torque and in the sequence prescribed in paragraph 115*b*.
- (5) Perform item 39 (table III). Look at the wheel bearings. If lubrication appears to be adequate, do not clean and repack. Do not adjust brakes unless necessary.

## 11. Break-In

*a. General.* After the preliminary service has been performed, the break-in period (500 miles) may be accomplished in normal service of the vehicle under the supervision of a competent driver.

*Note.* If the vehicle was driven to the using organization, include the mileage traveled in the break-in mileage.

*b. Precautions.* Precautions (1) through (4) below will be observed during the break-in period.

- (1) Do not drive at excessive speeds.
- (2) Do not skip speeds when shifting gears.
- (3) Accelerate the engine slowly and gradually.
- (4) Do not load the engine or power train to capacity.

*c. Service After 500 Miles.* After 500 miles of vehicle operation, perform the "C" (1,000-mile) preventive-maintenance service (table III), with the variations listed in (1) and (2) below.

- (1) Line out the other services on DA Form 461 and write in "New (or rebuilt) vehicle 500-mile service."
- (2) Change the engine oil (par. 73).

*d. Service After 1,000 Miles.* When the vehicle has been driven 1,000 miles, it will be placed on the regular preventive-maintenance schedule and will be given the first regular "C" (1,000-mile) preventive-maintenance service (table III).

## **12. Correction of Deficiencies**

*a.* Ordinary deficiencies disclosed during the preliminary inspection and servicing or during the break-in period, will be corrected by the using organization or a higher maintenance echelon.

*b.* Serious deficiencies, which appear to involve unsatisfactory design or material, will be reported on DA Form 468, Unsatisfactory Equipment Report. The commander of the using organization will submit the completed form (in accordance with SR 700-45-5) to the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, or to the chief of appropriate technical service for other than ordnance equipment.

## **Section II. CONTROLS AND INSTRUMENTS**

### **13. General**

This section describes, locates, and illustrates the various controls and instruments provided for the proper operation of the vehicle.

### **14. Windshield Adjusting Arms and Locking Handles**

*a. Adjusting Arms.* Two windshield adjusting arms (A, fig. 12) are provided for opening and closing each windshield.

*b. Locking Handles.* A windshield locking handle (M, fig. 12) is provided to secure each windshield in the closed position.

### **15. Steering Wheel**

The steering wheel (B, fig. 12), when turned to the left or right, controls the directional movement of the vehicle.

### **16. Horn Button**

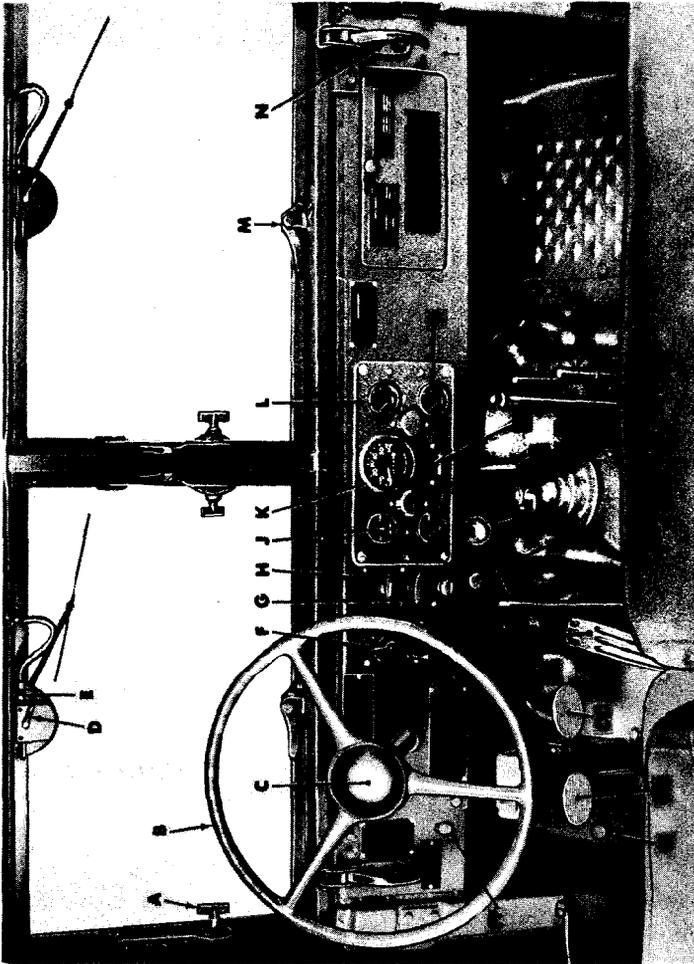
Depress the horn button (C, fig. 12) to sound the horn.

### **17. Windshield Wiper Handle and Control Knob**

The windshield wiper handle (D, fig. 12) is provided for manual operation of the wiper blade. The windshield wiper control knob (E, fig. 12) controls the operation of the wiper motor.

### **18. Light Switch**

*a. General.* The light switch (F, fig. 12) is used to select the vehicle driving lights (fig. 13) for various driving conditions or parking.

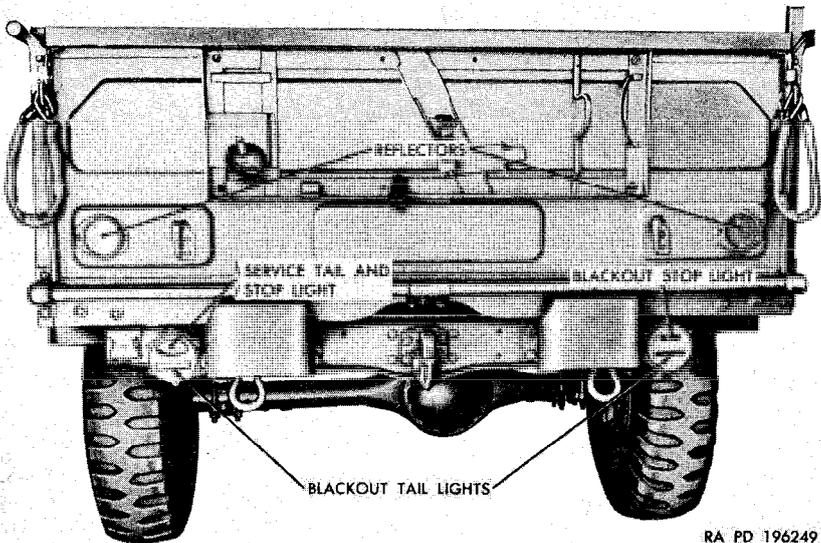
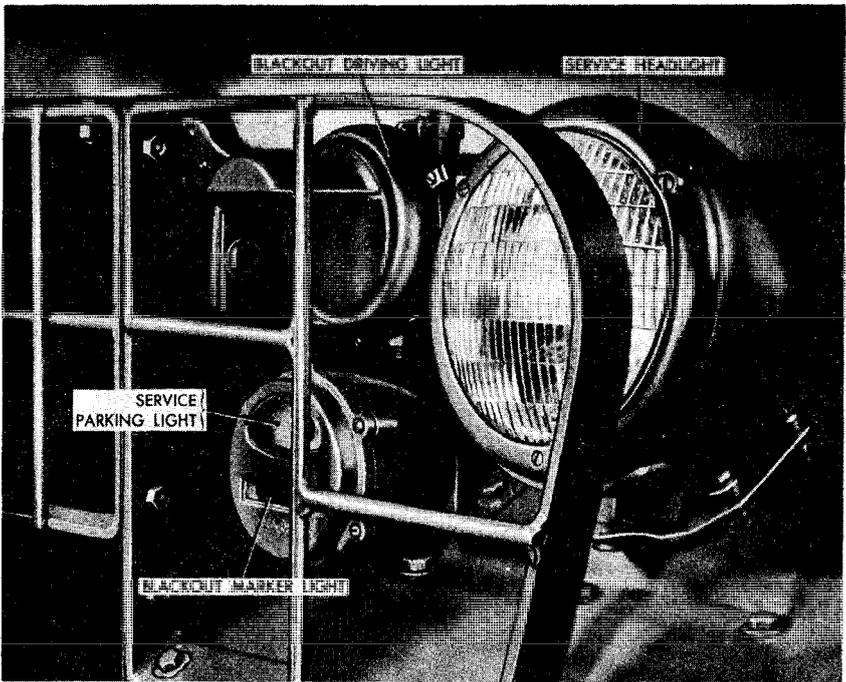


**KEY**

- A—WINDSHIELD ADJUSTING ARM
- B—STEERING WHEEL
- C—HORN BUTTON
- D—WINDSHIELD WIPER HANDLE
- E—WINDSHIELD WIPER CONTROL KNOB
- F—LIGHT SWITCH
- G—CRANKCASE VENTILATION VALVE DUAL CONTROL
- H—THROTTLE CONTROL
- J—AMMETER OR BATTERY GENERATOR INDICATOR
- K—SPEEDOMETER
- L—FUEL GAGE
- M—WINDSHIELD LOCKING HANDLE
- N—WINDSHIELD SUPPORT FRAME CLAMP HANDLE
- P—OIL PRESSURE GAGE
- Q—TRANSFER SHIFT CONTROL LEVER (FRONT)
- R—TRANSFER DE-CLUTCH CONTROL LEVER (REAR)
- S—HAND BRAKE LEVER
- T—SERVICE HEADLIGHT HIGH BEAM INDICATOR
- U—COWL VENTILATOR HANDLE
- V—WATER TEMPERATURE GAGE
- W—TRANSMISSION GEAR SHIFT LEVER
- X—STARTER PEDAL
- Y—CHOKE CONTROL
- Z—POWER-TAKE-OFF SHIFT LEVER
- AA—ACCELERATOR PEDAL
- BB—IGNITION SWITCH
- CC—BRAKE PEDAL
- DD—CLUTCH PEDAL
- EE—DIMMER SWITCH
- FF—ENGINE PRIMER KNOB

*Figure 12. Controls and instruments in driver's compartment.*

RA PD 195248



RA PD 196249

*Figure 13. Vehicle driving lights.*

## *b. Operation.*

*Note.* The light switch positions are shown in figure 14.

- (1) *Blackout marker lights.* To operate the blackout marker lights (fig. 13), move the light switch upper lever to position B. To turn off the blackout marker lights, move the upper lever to position C.
- (2) *Blackout driving light and blackout taillights.* To operate the blackout driving light and the blackout taillights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position A. To turn off the blackout driving light and the blackout taillights, move the upper lever to position C.
- (3) *Service stop light.*

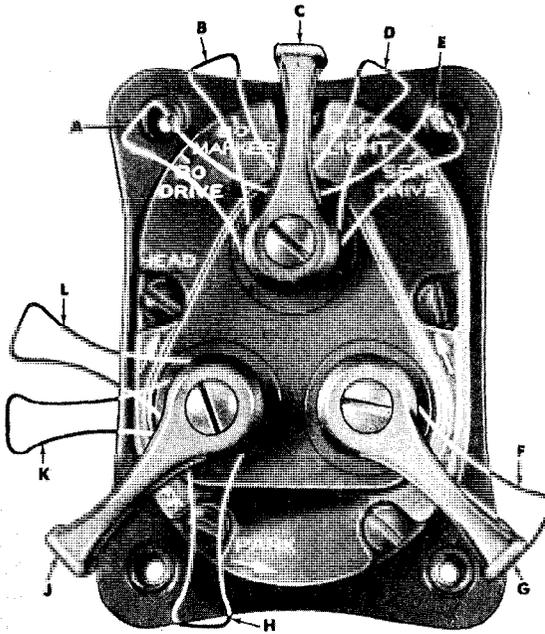
*Note.* The service stop light (fig. 13) is operative only during brake pedal application when the light switch upper lever is in position D (for daytime driving) or in position E ((4) below) (*for night driving*).

To operate the service stop light (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position D.

- (4) *Service headlights.* To operate the service headlights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position E. Move the lower left lever to position L. To turn off the headlights, move the light switch upper and lower left levers to positions C and J, respectively. To raise or lower the headlight beam, depress and release the dimmer switch.
- (5) *Instrument panel lights.* With the service headlights in use ((4) above), the instrument panel lights are automatically on bright. With the blackout driving light on ((2) above), the panel lights may be turned to dim or bright. For dim panel lights, move the light switch lower left lever to position K; for bright panel lights, move the lever to position L. To turn off the instrument panel lights, move the lower left lever to position J.
- (6) *Service parking lights.* To operate the service parking lights (fig. 13), raise the light switch lower right lever to position F and simultaneously move the upper lever to position E. Move the lower left lever to position H. To turn off the service parking lights, move the light switch upper and lower left levers to positions C and J, respectively.

## **19. Crankcase Ventilation Valve Dual Control**

The crankcase ventilation valve dual control (G, fig. 12) (on vehicles so equipped) operates the shutoff valves in the crankcase ventilat-



- KEY      ITEM**
- A—UPPER LEVER IN BLACKOUT DRIVE POSITION
  - B—UPPER LEVER IN BLACKOUT MARKER POSITION
  - C—UPPER LEVER IN OFF POSITION
  - D—UPPER LEVER IN STOPLIGHT POSITION
  - E—UPPER LEVER IN SERVICE DRIVE POSITION
  - F—LOWER RIGHT LEVER IN UNLOCKED POSITION
  - G—LOWER RIGHT LEVER IN LOCKED POSITION
  - H—LOWER LEFT LEVER IN PARK POSITION
  - J—LOWER LEFT LEVER IN OFF POSITION
  - K—LOWER LEFT LEVER IN DIM PANEL LIGHT POSITION
  - L—LOWER LEFT LEVER IN BRIGHT PANEL LIGHT POSITION

RA PD 196250

Figure 14. Light switch.

ing system. Pull the control out to close the shutoff valves before fording, and push the control in after fording to open the shutoff valves.

## 20. Throttle Control

*a. General.* The throttle control (H, fig. 12) provides hand operation of the carburetor throttle valve. Two types of controls were incorporated in production (par. 6d(7)).

*b. Control Button.* To open the throttle, pull the control button out to obtain the desired engine speed. Friction holds the throttle in the desired position. To decrease engine speed, push the control button in.

*c. Control Handle.* To open the throttle, pull the control handle out to obtain the desired engine speed. To decrease engine speed, turn the handle one-fourth turn counterclockwise, push in and turn the handle one-fourth turn clockwise.

## 21. Windshield Support Frame Clamp Handles and Windshield Holddown Catches (Except Ambulance Truck M43)

*a. General.* The windshield support frame clamp handles (N, fig. 12) draw the windshield support frame lower center weatherstrip

tight against the cowl and hold the windshield support frame in the upright position.

*b. Lowering Windshield Support Frame.*

- (1) Remove cab top cover and related parts (par. 265a).
- (2) Disengage the windshield support frame right and left clamp handles. Lower the windshield support frame and engage the windshield holddown catches (fig. 15) in the support frame brackets.

*c. Raising Windshield Support Frame.*

- (1) Disengage the windshield holddown catches from the windshield support frame brackets. Raise the support frame to the upright position and engage the windshield support frame right and left clamp handles (N, fig. 12). Engage the holddown catches in the catch rests (fig. 15).
- (2) Install cab top cover and related parts (par. 265c).

## **22. Transfer Shift Control Lever**

The transfer shift control lever (Q, fig. 12) is used to shift the transfer into high or low range. For high-range operation, place the lever in the forward position. For low-range operation, pull the lever toward the rear. Refer to paragraph 53 for operating instructions.

## **23. Transfer Declutch Control Lever**

The transfer declutch control lever (R, fig. 12) is used to engage and disengage the front axle drive. To engage the front axle drive, pull the lever back. To disengage the front axle drive, push the lever forward. Refer to paragraph 53 for operating instructions.

## **24. Handbrake Lever**

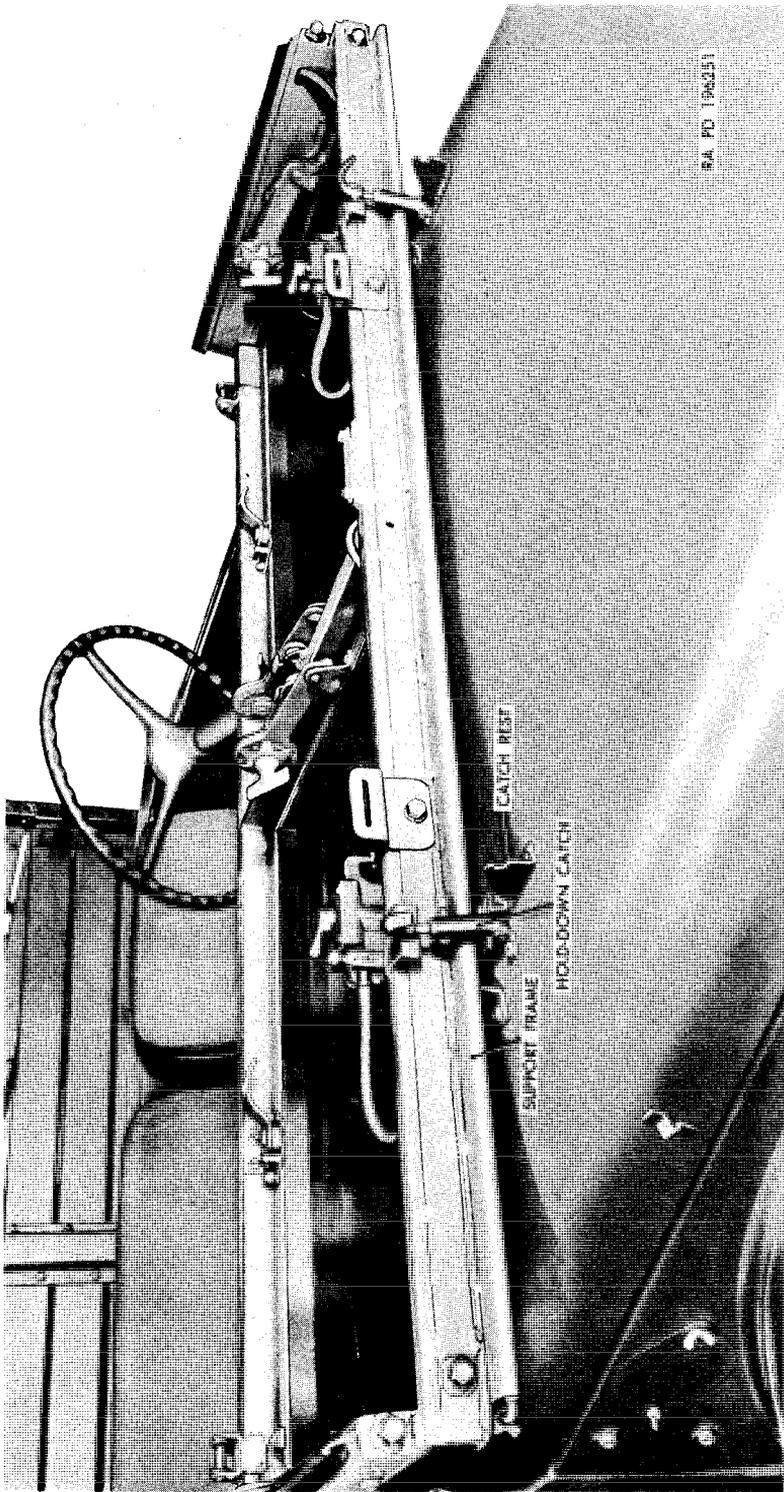
The handbrake lever (S, fig. 12) is used to hold the vehicle during parking. To apply the handbrake, pull the lever to the rear. To release the handbrake, pull the lever back slightly, depress the button at the top of the lever, and while holding it in the depressed position, push the lever all the way forward.

## **25. Cowl Ventilator Handle**

The cowl ventilator handle (U, fig. 12) admits air to the driver's compartment. To open the ventilator, push the handle forward; to close the ventilator, pull the handle back.

## **26. Transmission Gearshift Lever**

The transmission gearshift lever (W, fig. 12) selects the transmission gears for the various forward speeds or reverse. Refer to paragraph 53 for operating instructions.



*Figure 15. Windshield support frame in lowered position (except ambulance truck M43).*

## **27. Starter Switch Pedal**

The starter switch pedal (X, fig. 12) operates the starter. When the pedal is depressed, it engages the starter drive pinion with the flywheel ring gear teeth and closes the starter switch to crank the engine.

## **28. Choke Control**

The choke control (Y, fig. 12) operates the carburetor choke valve. Pull the choke control out to close the choke valve; push the control in to open the valve.

## **29. Power-Take-Off Shift Lever**

The power-take-off shift lever (Z, fig. 12) (on vehicles equipped with a winch assembly) selects gears in the power-take-off for operating the winch drive shaft. A spring-loaded hinged lock secures the lever in neutral position. Refer to paragraph 55 for operating instructions.

## **30. Accelerator Pedal**

The accelerator pedal (AA, fig. 12), connected by linkage to the carburetor throttle lever, controls engine speeds. Depress pedal to increase engine speed; release pedal to decrease engine speed.

## **31. Ignition Switch**

The ignition switch (BB, fig. 12) closes the ignition circuit for engine starting. To turn the ignition on, turn the switch clockwise. To turn the ignition off, turn the switch counterclockwise. When the ignition switch is on, the fuel gage, the ammeter or battery generator indicator, and the water temperature gage register.

## **32. Brake Pedal**

The brake pedal (CC, fig. 12) controls the service brakes. Brake pedal application stops the vehicle and actuates the stop light switch. Refer to paragraph 53 for operating instructions.

## **33. Clutch Pedal**

The clutch pedal (DD, fig. 12) engages and disengages the engine from the transmission. Refer to paragraph 53 for operating instructions.

## **34. Dimmer Switch and High Beam Indicator**

The dimmer switch (EE, fig. 12), operated by foot, controls the beam of the service headlights. Depress and release the switch to change the headlight beam. Use the high beam for open-road night driving when there is no approaching traffic. Use the low beam for

driving in heavy traffic or when approaching on-coming traffic. The service headlight high beam indicator (T, fig. 12) lights when the service lights are on high beam.

### 35. Engine Primer Knob

The engine primer knob (FF, fig. 12) (on vehicles so equipped) actuates the engine primer pump for cold-weather starting. Two full strokes of this pump should be sufficient to start the engine in subzero weather.

### 36. Hood Controls

*a. Hood Locks.* A hood lock (fig. 17), attached to each radiator side support, secures the hood in the closed position.

*b. Hood Holder.* The hood holder secures the hood in the wide open position (fig. 16). To use the holder, disengage it from the hood holder clip (fig. 16), raise the hood, and engage the holder in the hood holder socket.

**Warning:** Never leave the hood in the open position without securing it with the hood holder. A gust of wind or jar may cause an unsupported hood to fall, resulting in serious or fatal injury to personnel.

*c. Hood Supports.* A hinged hood support, mounted on each radiator tie rod, holds the hood in a partially open position. Refer to warning (b above).

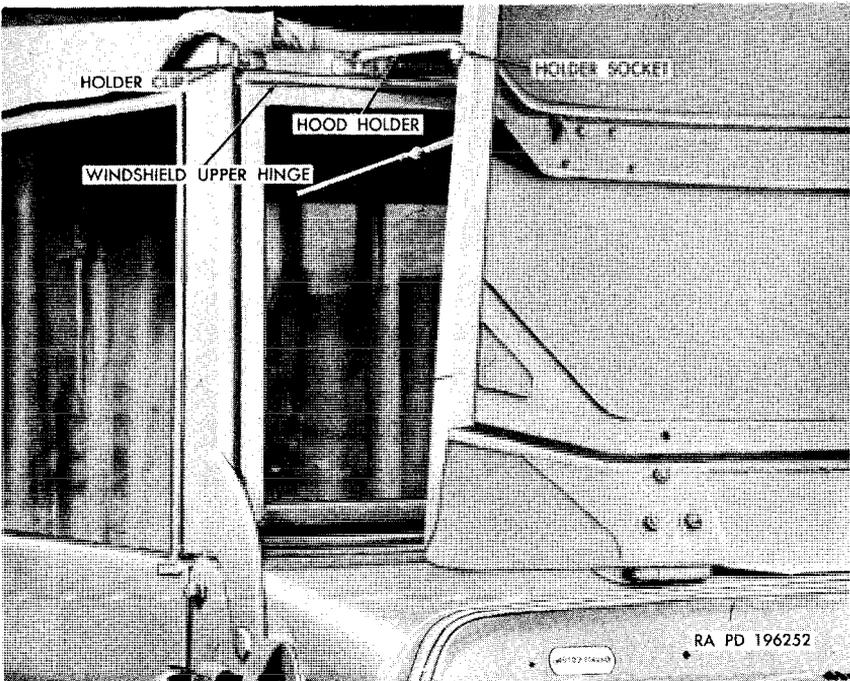


Figure 16. Hood in open position.

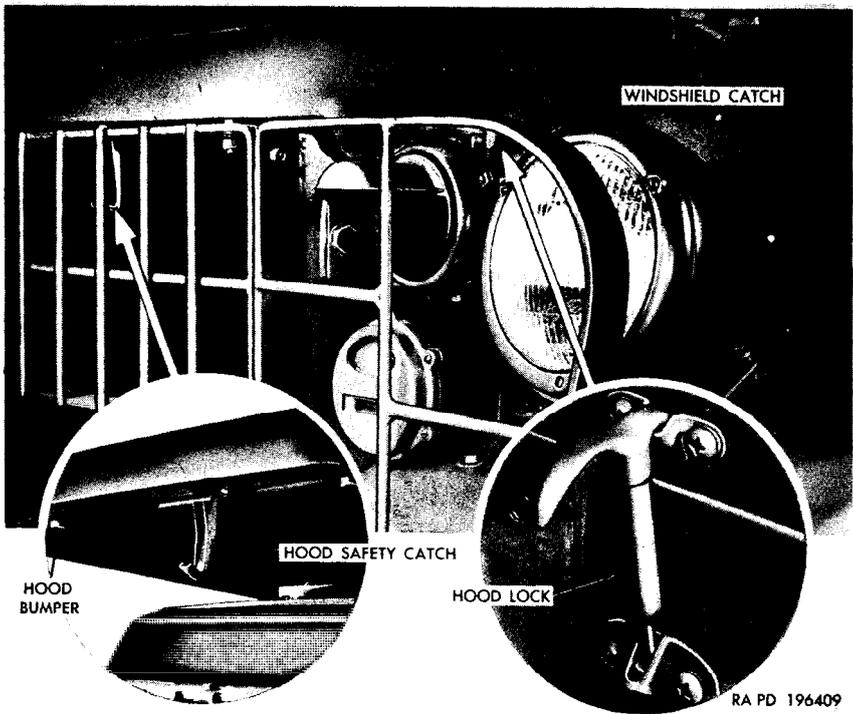


Figure 17. Hood lock and safety catch.

d. *Hood Safety Catch* (fig. 17). The spring-loaded hood safety catch (on vehicles so equipped) prevents the hood from opening in the event the hood locks become disengaged. When the safety catch is held toward the radiator, the hood is released; the catch engages automatically when the hood is closed.

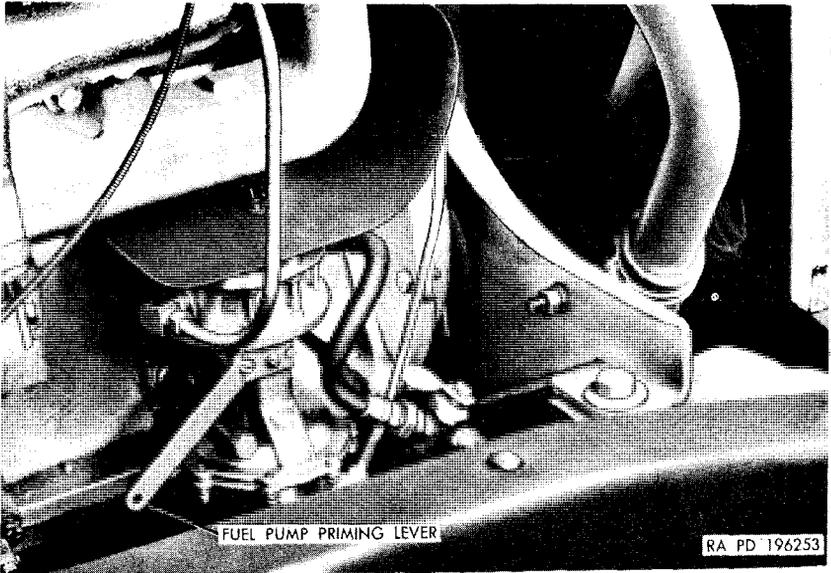
### 37. Fuel Pump Priming Lever

The fuel pump priming lever (fig. 18) fills the fuel system without unnecessary use of the starter and drain on the batteries. If the engine has been run until the fuel supply is exhausted, fill the tank and operate the fuel pump priming lever 30 or 40 strokes, or until the lever works freely, indicating that the carburetor float chamber and fuel line are full. The engine can then be started (par. 52).

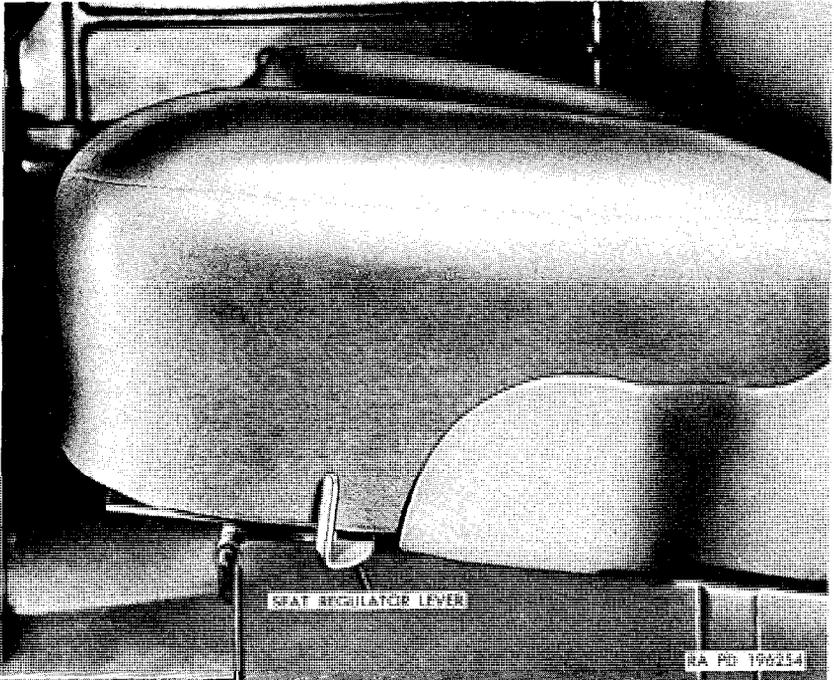
*Note.* If the priming lever moves freely without operating the diaphragm, crank the engine one revolution to move the fuel pump rocker arm from the high point of the cam on the camshaft.

### 38. Driver's Seat Regulator Lever

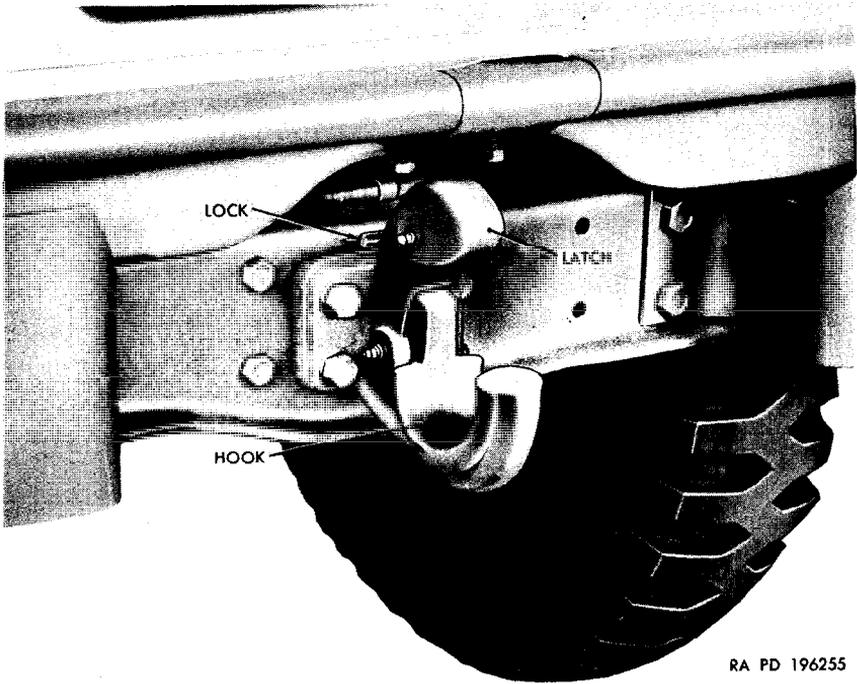
The driver's seat regulator lever (fig. 19) releases the seat regulator to permit seat adjustment. When the lever is held forward, the seat can be moved forward or back to the desired position.



*Figure 18. Fuel pump priming lever.*



*Figure 19. Driver's seat regulator lever.*



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*Figure 20. Pintle (open position).*

### **39. Pintle (Except Ambulance Truck M43)**

The pintle (fig. 20), provided for towing purposes, consists essentially of a hook and hinged latch. A spring-loaded lock secures the pintle latch in the closed position. To open the pintle, pull the lock toward the rear and raise the latch; to close the pintle, push the latch down.

### **40. Hinged-Type Spare Wheel Carrier Lock Levers (Ambulance Truck M43)**

The hinged-type spare wheel carrier (fig. 6) (on ambulances so equipped) can be unlocked from either the inside or outside, thus providing full use of the driver's compartment left door. To open the door from the outside, press the spare wheel carrier lock lever (fig. 6) down, swing the carrier out, and open door. To open the door from the inside, raise the spare wheel carrier inside lock lever to the unlocked position (fig. 21), unlatch the door, and push both the door and the spare wheel carrier open.

### **41. Partition Door Ventilator (Ambulance Truck M43)**

The partition door ventilator (R, fig. 22) is opened or closed by the ventilator knob.

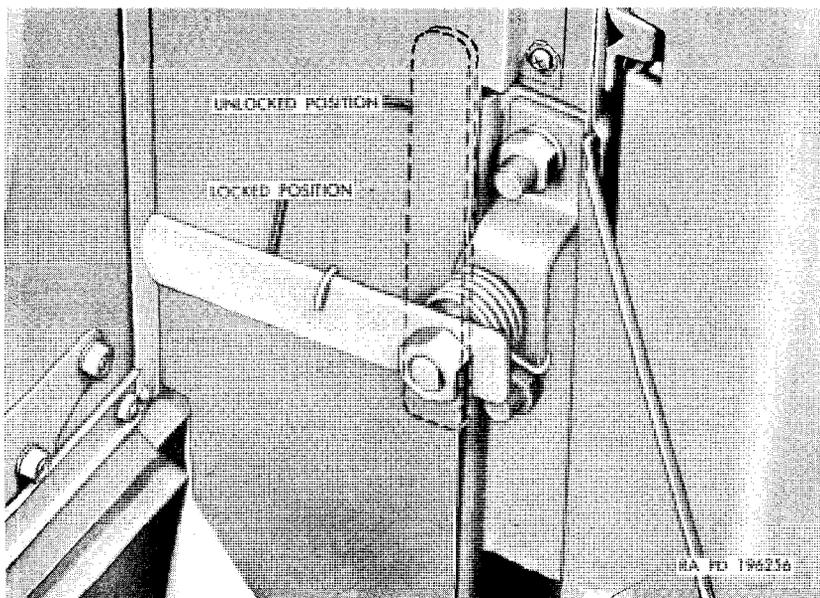


Figure 21. Hinged-type spare wheel carrier inside lock lever (ambulance truck M43).

## 42. Surgical Light and Dome Light (Ambulance Truck M43)

*a. Surgical Light.* The surgical light (C, fig. 22) is provided with a toggle switch to turn the lamp on or off. To direct the light beam, loosen the knurled thumb screw that secures the lamp in the shell and swing the lamp in the desired direction. When the lamp is not in use, position it in the shell and tighten the thumb screw.

*b. Dome Light.* The dome light (E, fig. 22), fitted with a ruby lens, is controlled by a toggle switch.

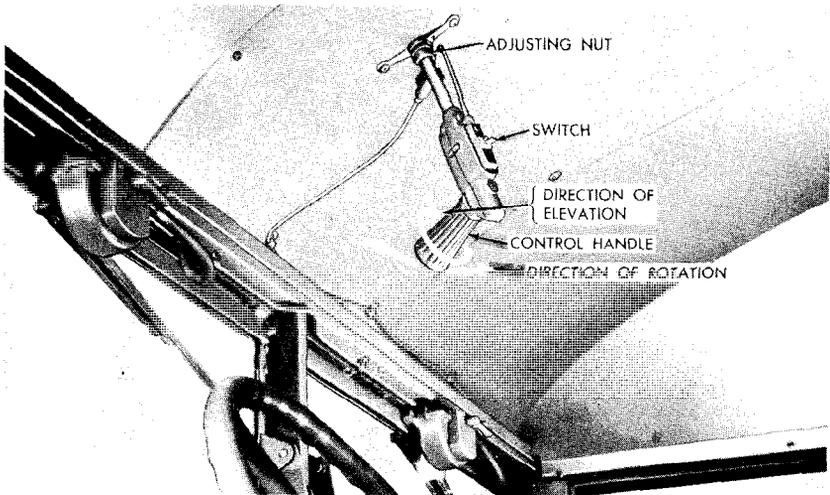
## 43. Spotlight (Ambulance Truck M43 and Telephone Maintenance Truck V-41)

*a.* The spotlight for the ambulance truck M43 (A, fig. 23) is mounted on the roof of the driver's compartment. The controls are operated by the driver or attendant.

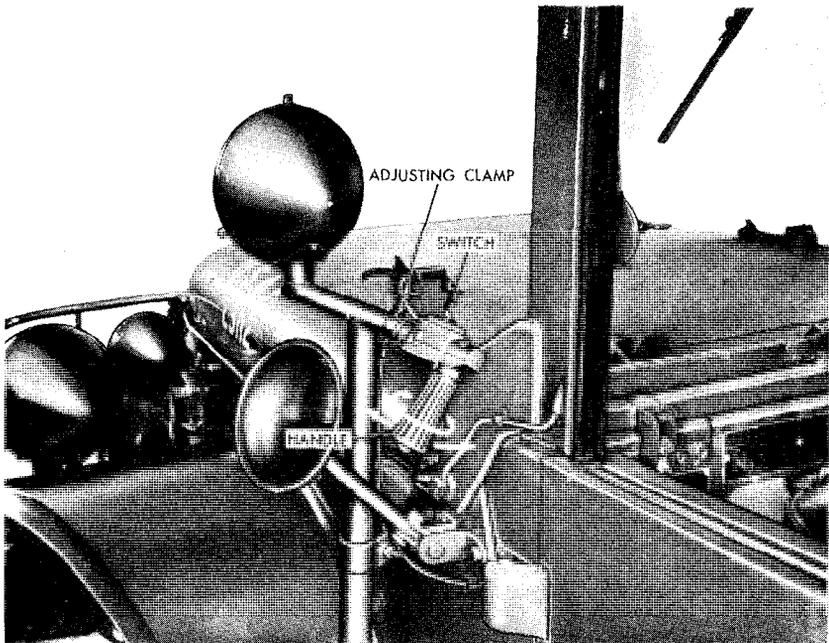
*b.* The spotlight for the telephone maintenance truck V41 is mounted on a support attached to the left front fender and cowl (B, fig. 23), and is operated by the driver.

*c.* To operate either spotlight, turn the vehicle light switch to the SERVICE DRIVE position (E, fig. 14) and push the spotlight switch forward. Either spotlight can be elevated and rotated by the control handle.





(A) AMBULANCE TRUCK M43



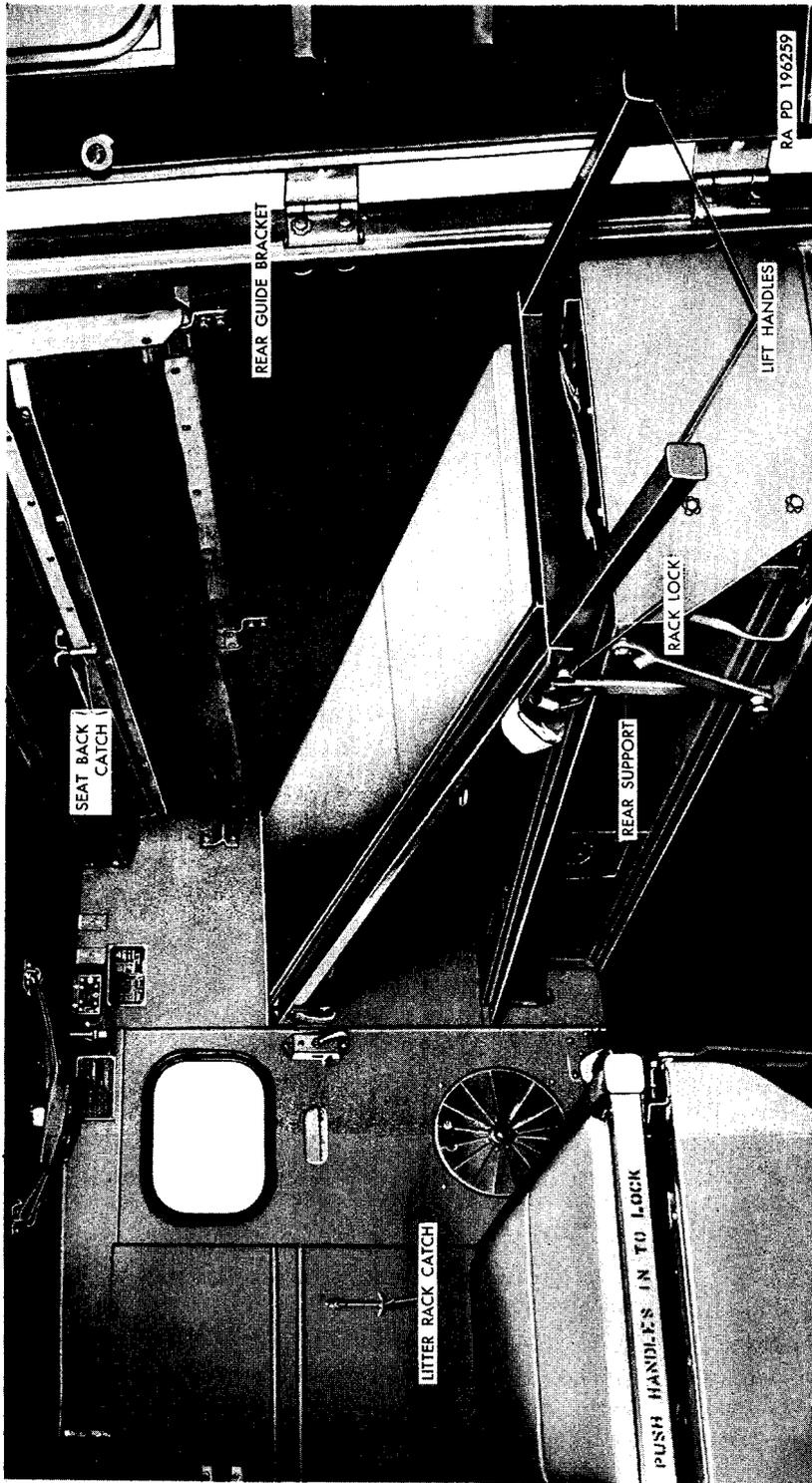
(B) TELEPHONE MAINTENANCE TRUCK V41

RA PD 196258

Figure 23. Spotlight controls.

six seated patients can be accommodated. Safety and litter holddown straps are provided.

*b. Lowering Litter Rack* (fig. 24). The litter rack catch must be disengaged from the catch bracket to provide clearance for lowering the rack. Pull out both litter rack lift handles to disengage the litter rack locks. Push both rack supports forward and lower the



*Figure 24. Raising or lowering litter rack.*

rear of the rack. Lift the front end of the rack from the partition, and lower the rack. Push the two lift handles in.

*c. Raising Litter Rack* (fig. 24). Raise the seat back cushion and engage the seat back catch. Pull out the two litter rack lift handles. Raise the front end of the litter rack and engage the rack pins in the partition openings. Raise the rear of the litter rack and engage with the litter rack rear guide bracket. Push the two lift handles in to lock the litter rack in the raised position.

*Note.* If the litter rack supports are not in the fully raised position, the lift handles cannot be pushed in.

Engage the litter rack catch.

## **45. Ammeter or Battery Generator Indicator**

(J, fig. 12)

*a. Ammeter.* The ammeter (on vehicles so equipped) registers the amperage flowing to or from the batteries. When the generator output exceeds the current drawn by electrical units, the indicator will show CHG (charge). When the current drawn by electrical units exceeds that of the generator, the ammeter will show DIS (discharge). When the batteries are fully charged, the generator regulator reduces the current to the batteries, thereby, protecting them from overcharging; at such times, the indicator may show a zero reading, or slight charge. The ammeter is operative only when the ignition switch is on.

*b. Battery Generator Indicator.* The battery generator indicator (on vehicles so equipped) indicates whether the generator is charging, regardless of the battery condition. The dial is divided into three sections, red, yellow, and green. When the ignition switch is off, the indicator pointer will be in the red section, indicating an open circuit to the batteries. When the ignition switch is on, the indicator pointer moves to the yellow section, indicating a closed circuit to the batteries. When the generator is charging, the indicator pointer moves to the green section.

## **46. Speedometer**

(K, fig. 12)

The speedometer registers the speed in miles per hour of a moving vehicle, and records the total number of miles the vehicle has been driven. A flexible shaft connects the speedometer to the speedometer drive pinion in the transfer.

## **47. Fuel Gage**

(L, fig. 12)

The fuel gage registers the fuel level in the fuel tank. It is connected electrically to the fuel gage sending unit in the fuel tank cover and is operative only when the ignition switch is on.

## 48. Oil Pressure Gage

The oil pressure gage (P. fig. 12) registers the pressure in the engine oiling system. It is connected electrically to the oil pressure gage sending unit (fig. 25). Normal pressure at idling speed is 40 psi. Slightly higher pressure should register at increased engine speeds.

**Caution:** If no pressure is registered within 30 seconds after the engine is started, stop the engine and investigate and correct the cause (par. 95*d*).

## 49. Oil Level Gage

(fig. 25)

The bayonet-type oil level gage indicates the oil level in the engine crankcase. Two marks, FULL and ADD OIL, are scribed on the gage. To remove the gage, turn the gage cap counterclockwise to disengage the cap from the gage pipe and pull the gage from the pipe. Wipe the oil from the gage, insert it in the pipe carefully and engage the cap so that an accurate reading will be obtained. Remove the gage again and note the oil level. When installing the gage, turn the cap clockwise to secure it to the gage pipe.

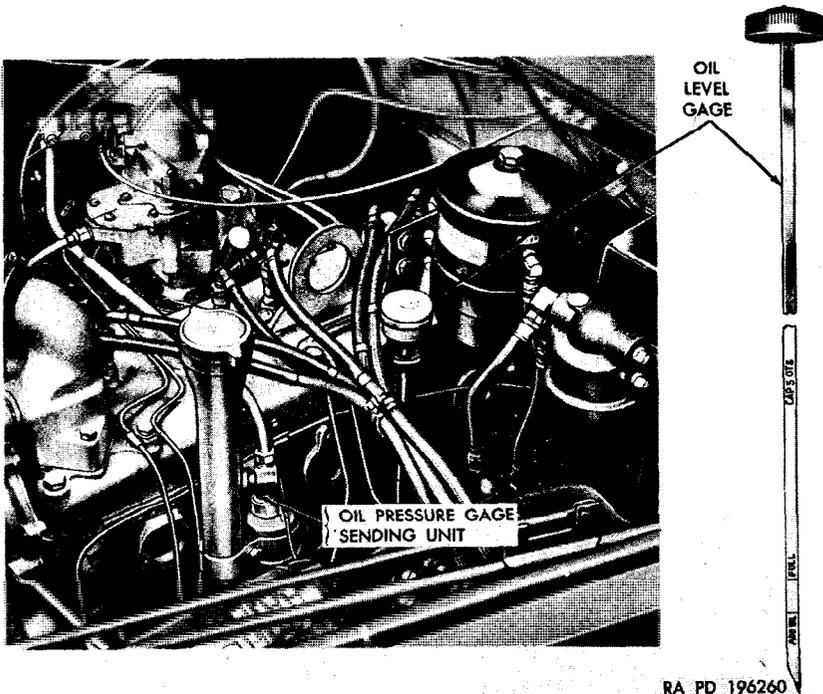


Figure 25. Oil level gage and oil pressure gage sending unit.

## 50. Water Temperature Gage

(V, fig. 12)

The water temperature gage registers the coolant temperature in the cooling system in degrees Fahrenheit. It is electrically connected to the water temperature gage sending unit in the cylinder head. Gage reading with the engine at normal operating temperature should be between 160° and 165° F. The gage is operative only when the ignition switch is on.

### Section III. OPERATION UNDER USUAL CONDITIONS

#### 51. General

This section contains instructions for the mechanical steps necessary to operate all models of the ¾-ton, 4 x 4 vehicles covered in this manual under conditions of moderate temperatures and humidity. For operation under unusual conditions, refer to paragraphs 63 through 68.

#### 52. Starting the Engine

*a. Starting.* Before starting the engine, make certain the “before-operation” services outlined in table II have been performed.

- (1) Place the transmission gearshift lever in neutral position. Make certain the power-take-off shift lever (on vehicles so equipped) is locked in neutral position.
- (2) Apply the hand brake.
- (3) Pull out the throttle control (H, fig. 12) about one-third of the travel distance.

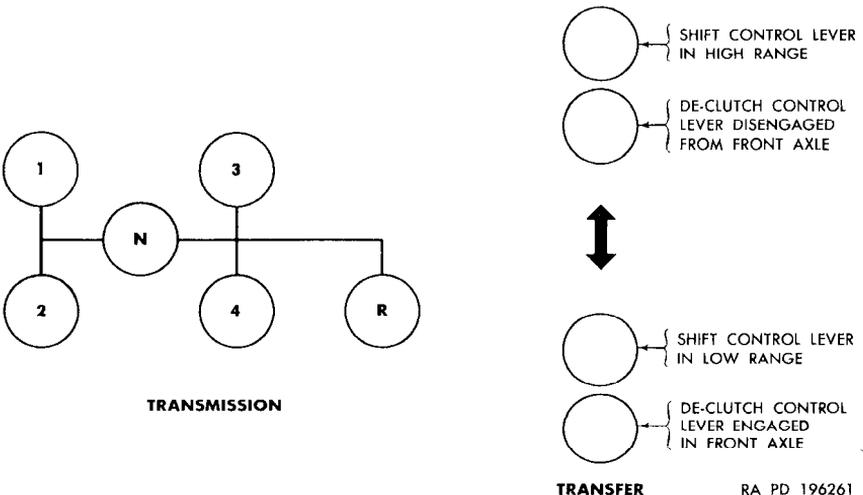


Figure 26. Transmission and transfer shift diagram.

- (4) If the engine is cold, pull out the choke control (Y, fig. 12) all the way (if engine is warm, do not use the choke).
- (5) Depress the clutch pedal (DD, fig. 12).
- (6) Turn the ignition switch (BB, fig. 12) to the ON position and depress the starter switch pedal (X, fig. 12). Release the pedal as soon as the engine starts.

*Note.* Do not operate the starter continuously for more than 30 seconds. If the engine fails to start within 30 seconds, wait 10 to 15 seconds before trying again. If the engine fails to start after a reasonable time, investigate and correct the cause (par. 85b).

- (7) After the engine has started, release the clutch pedal, push the throttle control part way in to reduce engine speed, and push the choke control in until the engine runs smoothly.

*Note.* Push the choke control all the way in, as soon as the engine will operate without stalling.

Observe the engine oil pressure gage reading.

**Caution:** If no pressure is indicated within 30 seconds after the engine is started, stop the engine and investigate and correct the cause (par. 95d).

*b. Warming Up Engine.* Run the engine at idle speed or slightly faster, until the water temperature gage indicates a rise in temperature before operating the vehicle. Avoid high engine speeds during warmup period. Observe the oil-pressure gage, the water temperature gage, and the ammeter or battery generator indicator for proper functioning.

## 53. Driving the Vehicle

*a. Use of Clutch.* To disengage the clutch, depress the clutch pedal (DD, fig. 12) all the way. To engage the clutch, release the clutch pedal.

**Caution:** Avoid "riding" the clutch pedal, as this practice causes unnecessary wear of the clutch parts.

*b. Double-Clutching.* Driving instructions referred to in *c* below are based on the double-clutching procedure while the vehicle is in motion. This procedure consists of momentarily engaging the clutch with the transmission gear shift in the neutral position while shifting gears.

*c. Driving Instructions.*

*Note.* Before driving the vehicle in the daytime, turn the light switch upper lever to STOP LIGHT position (par. 18b (3)). This step is important; otherwise the stop light is inoperative.

- (1) Depress the clutch pedal and place the transmission gearshift lever in first speed position (1, fig. 26).
- (2) Place the transfer shift control lever in high range position and the transfer declutch lever in the disengaged position (fig. 26).

- (3) Release the hand brake lever (S, fig. 12).
- (4) Depress the accelerator pedal (AA, fig. 12) and, at the same time, release the clutch pedal with a steady, gradual motion to prevent sudden engagement, thus, avoiding jerky vehicle movement. As the vehicle moves forward, accelerate the engine gradually until road speed indicated on the transmission and transfer gearshift instruction plate (B, fig. 8) is attained.
- (5) Momentarily, depress the clutch pedal and, at the same time, release the accelerator pedal, move the transmission gearshift lever to the next higher gear position (fig. 26).
- (6) Repeat (4) and (5) above until the vehicle is moving in fourth speed (direct drive).

*d. Use of Reverse.* Before attempting to drive in reverse, first bring the vehicle to a complete stop. Depress the clutch pedal, place the gearshift lever in the reverse position (R, 26), and engage the clutch slowly while depressing the accelerator pedal enough to maintain engine speed.

*e. Stopping Vehicle.* Release the accelerator pedal and apply the brake pedal (CC, fig. 12). As the vehicle slows to a stop, depress the clutch pedal and move the transmission gearshift lever to the neutral position, release the clutch pedal, apply the hand brake, and release the brake pedal.

**Caution:** When applying the brakes, avoid severe application of the brake pedal.

*f. Stopping Engine.* Allow the engine to run a few minutes at idling speed, then turn the ignition switch (BB, fig. 12) to the OFF position.

*g. Use of Transfer.*

- (1) *General.* The transfer may be operated in high range with the front axle engaged or disengaged. When the front axle is engaged, torque is divided equally between the front and rear axles. When the transfer is in low range, the front axle is also engaged, preventing excessive strain on the rear axle.

**Caution:** Front axle should be engaged only in off-the-road operation, on slippery roads, steep grades, or during hard pulling. Disengage front axle when operating on average roads under normal conditions, to prevent excessive tire wear.

- (2) *High range (front axle disengaged).* For operation on a smooth level highway, place the transfer in high range and be sure that the front axle is disengaged. With the vehicle stopped, depress the clutch pedal (DD, fig. 12) and place the transmission gearshift lever (W, fig. 12) in first gear (I, fig. 26). Move the transfer shift control lever (Q, fig. 12) and

the transfer declutch control lever (R, fig. 12) to the forward positions (fig. 26). If difficulty is encountered in shifting the shift control lever, release the clutch pedal slightly to allow the gears to mesh. With the transfer engaged, proceed with the driving operations (*c*(4) through (6) and *d* above).

**Caution:** Do not attempt to shift either of the transfer control levers with the vehicle in motion, as serious damage to the transfer gears or other internal parts will result.

- (3) *High range (front axle engaged).* To engage the front axle while operating in high range, stop the vehicle, depress the clutch pedal, move the shift control lever to the high range position, and move the declutch control lever to the engaged position (fig. 26). Proceed with driving operations (*c*(4) through (6) and *d* above).
- (4) *Low range (front axle engaged).* For transporting heavy loads over rough terrain or up steep grades, or for operating through mud, sand, snow, or ice, use low range. With the vehicle stopped, depress the clutch pedal (DD, fig. 12), place the transmission gearshift lever (W, fig. 12) in first gear (1, fig. 26), and move the transfer shift control lever (Q, fig. 12) to the low range position (fig. 26). As the shift control lever is placed in low range position, it engages the transfer declutch control lever (R, fig. 12), moving it to the engaged position. If difficulty is encountered in operating the shift control lever, release the clutch pedal slightly to permit the gears to mesh. With the transfer engaged, proceed with driving operations (*c*(4), (5), and (6) and *d* above).

*h. Driving up Steep Grades.* When driving up a steep grade, shift the transmission to the next lower gear (fig. 26) to prevent excessive engine laboring or stalling. If it becomes necessary to shift to a still lower gear with the vehicle in motion, depress the clutch pedal and move the gear shift lever to neutral position, quickly release the clutch pedal and, at the same time, accelerate the engine to governed speed, depress the clutch pedal, move the gearshift lever to the lower gear position (fig. 26) and release the clutch pedal, accelerating the engine, as necessary, to prevent loss of speed.

*Note.* The entire procedure must be accomplished quickly and smoothly to be effective.

*i. Driving Down Steep Grades.* When driving down long, steep grades, shift the transmission to a lower gear to permit the engine to assist in slowing the vehicle. The gear selected will be determined by the length and steepness of the grade. Usually the second speed gear is preferred to any other.

**Caution:** Avoid constant and severe application of the brakes to prevent burning or excessive wear of brake linings.

*j. Road Speeds.* The transmission and transfer gearshift instruction plate (B, fig. 8) shows maximum permissible road speeds in various gears. Do not exceed these speeds unless tactical conditions demand it. A new or rebuilt vehicle should be driven carefully during the first 500 miles of operation and should not be driven at sustained high speed during the first 2,000 miles of operation. Operation in fourth speed should not exceed 28 mph during the initial 500-mile breaking-in period.

**Caution:** Avoid careless operation in the lower gears, as it will result in high engine speed.

In the lower gears, the speeds comparable to 28 mph in fourth gear are third gear 17 mph; second gear 9 mph; and first gear 4 mph. After the first 500 miles, speeds may be increased slightly for brief periods until the breaking-in process (2,000 miles) is completed.

*k. Maintenance.* See table II for before operation, during operation, at-the-halt, and after-operation maintenance services to be performed by the driver or operator.

## 54. Towing the Vehicle

### *a. Towing to Start Engine.*

**Caution:** Do not attempt to tow the vehicle until the reason for not starting has been determined.

- (1) Attach a towing cable or chain from the pintle (fig. 20) of the towing vehicle to the lifting shackles (fig. 27) at the front of the stalled vehicle.
- (2) Prepare stalled vehicle for towing. Pull out the choke control (Y, fig. 12) and throttle control (H, fig. 12) about one-third of its travel. Turn the ignition switch (BB, fig. 12) on. Depress the clutch pedal (DD, fig. 12) and place the transmission gear shift lever (W, fig. 12) in fourth gear position (fig. 26). Place the transfer shift control lever (Q, fig. 12) in the high range position and the transfer declutch control lever (R, fig. 12) in the disengaged position (fig. 26). Keep the clutch pedal depressed until the vehicles are moving at a speed sufficient to start the stalled engine ((4) below).
- (3) Operate the towing vehicle in first gear, starting slowly to avoid unnecessary strain.
- (4) As both vehicles attain a speed of approximately 5 mph, carefully release the clutch pedal of the towed vehicle.

*b. Towing a Disabled Vehicle.* The method of towing a disabled vehicle must be determined by the nature of the disability. The instructions in (1) through (6) below will serve as a guide in selecting the method of towing.

- (1) If no damage exists in the power train from the wheels through the transfer, the vehicle may be towed with the four

wheels on the ground. Place the transmission gear shift lever in neutral and the transfer control levers in the forward positions (fig. 26). This method of towing requires a driver in the towed vehicle to steer and to operate the brakes. Keep the towing cable taut by applying the brakes as necessary.

- (2) If damage is within the transfer assembly, disconnect both axle propeller shafts at the differentials and secure them to the frame. The vehicle may then be towed with all four wheels on the ground ((1) above).
- (3) If the damage is within the rear axle, remove the rear axle drive shafts (par. 210*a*). Secure a piece of tin or cardboard over the flange openings to retain the grease in the axle. The vehicle may then be towed with all four wheels on the ground, ((1) above).
- (4) If the damage is within the front axle or the universal drive parts have been damaged, remove the drive flanges (par. 205*a*). The vehicle may then be towed with all four wheels on the ground, ((1) above).
- (5) If the vehicle must be towed with the front wheels off the ground, make certain that the transfer control levers are in the forward position (fig. 26).
- (6) Avoid towing the vehicle with the rear wheels off the ground, unless other methods are impossible.

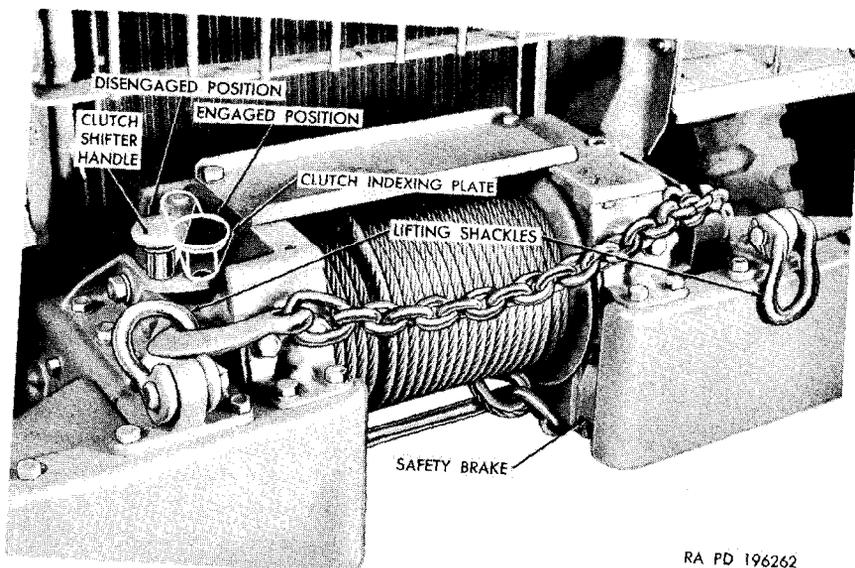
#### **Section IV. OPERATION OF MATERIEL USED IN CONJUNCTION WITH MAJOR ITEM**

##### **55. Winch and Power-Take-Off (On Vehicles So Equipped)**

*a. General.* The winch (fig. 27), mounted at the front of the vehicle, is operated by power transmitted through the transmission and power-take-off and the winch drive shaft. The winch clutch shifter handle controls engagement and disengagement of the winch clutch with the winch cable drum. The power-take-off shift lever (fig. 28) controls direction of winch drum rotation when the clutch shifter handle is in the engaged position. A safety brake operates on the winch worm shaft to hold the load.

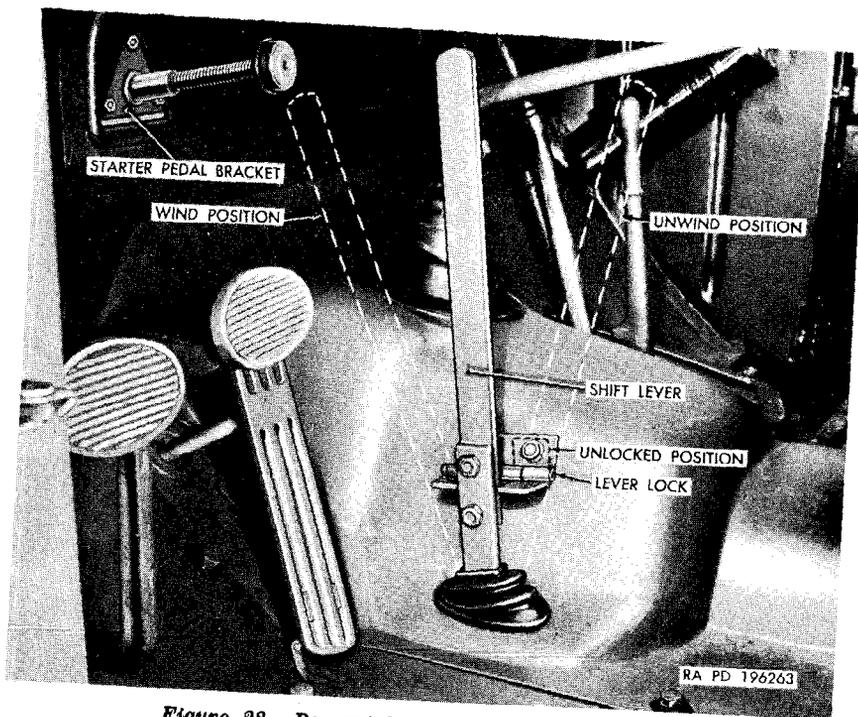
*b. Controls.*

- (1) To operate the winch clutch shifter handle (fig. 27), raise the handle knob to disengage the knob shaft from the clutch indexing plate, move the handle to the engaged or disengaged position, and release the handle knob. The knob shaft spring holds the handle in position on the indexing plate.
- (2) To operate the power-take-off shift lever (fig. 28), raise the lever lock, and move the shift lever to the desired position. The lock is spring-loaded to hold the lever in neutral position and prevent accidental winch drive shaft engagement.



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Figure 27. Winch installed.



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Figure 28. Power-take-off shift lever positions.

*c. Unwinding Cable.* To unwind winch cable, move the winch clutch shifter handle to the disengaged position, and pull cable from the drum until the required length of cable has been unreeled.

*d. Unwinding Cable Under Load.*

- (1) Start the engine and run at idle speed or slightly faster until normal operating temperature is reached.
- (2) Place the winch clutch shifter handle in the engaged position (*b*(1) above).
- (3) Apply the hand brake lever (S, fig. 12).
- (4) Depress the clutch pedal (DD, fig. 12) and move the power-take-off shift lever to the unwind (rear) position (*b*(2) above).
- (5) Release the clutch pedal and depress the accelerator pedal. Operate the engine at an even speed to wind the cable.
- (6) To stop the cable, depress the clutch pedal and release the accelerator pedal. The winch safety brake will hold the load.

*e. Winding Cable.* Procedure for winding the cable is the same as for unwinding under load, with the exception of *d*(4) above. To wind the cable, place the power-take-off shift lever in the wind (forward) position. If all the cable has been unreeled from the drum, guide the cable as it winds to keep the first layer of coils as close together as possible, thus preventing the next layer from pressing in between the coils of the preceding layer.

**Caution:** Do not wind the cable too far, as serious damage may result if it is wound beyond the thimble that attaches the chain to the cable.

Clean and lubricate the drum and cable. Refer to lubrication order (figs. 33 and 34).

## **56. Ventilator Blowers (Ambulance Truck M43)**

*a. General.* Two ventilator blowers are provided to draw hot air or odors from the patient compartment. Each blower motor is controlled by a switch (fig. 10). Openings in the blower ducts are controlled by the ventilator blower control valve handles (F, fig. 22).

*b. Operation.* To operate either blower, turn the blower switch (fig. 10) on. Turn the ventilator blower control valve handles (F, fig. 22) to the desired position to regulate the valve. When the valve handles are in the horizontal positions the valves are fully open; when the handles are in the vertical position, the valves are fully closed.

## **57. Personnel Heater (Ambulance Truck M43)**

*a. General.* Personnel heater operation in the patient compartment is controlled by the heater control. Compartment temperature is regulated by the personnel heater thermostat (fig. 10).

*b. Operation.* Specific instructions for operating the heater and thermostat are provided on the personnel heater operating instruction plate (fig. 10). To deflect the stream of warm air from the heater outlet, move the heat deflector handle (N, fig. 22).

## **58. Ladder Rack Lock Control (Telephone Maintenance Truck V-41)**

The ladder rack lock control (fig. 29) secures ladders and other equipment on the rack. To open the lock, move the control forward. To close the lock, move the control toward the rear.

## **59. Pole Rack Lock Control (Telephone Maintenance Truck V-41)**

The pole rack lock control secures pike poles during transit. To open the rack, pull the control outward as shown in figure 29. To close the rack, move the control down.

## **60. Water Cask Fasteners (Telephone Maintenance Truck V-41)**

Two spring-loaded water cask fasteners secure the water cask (fig. 29) in position. To engage or disengage the fasteners, pull against spring tension and hook or unhook from the fastener catches.

## **61. PR Reel (Telephone Maintenance Truck V-41)**

*Note.* The key letters noted in parentheses are in figure 30.

*a. General.* The PR reel (C) is supported in a frame mounted on three support brackets (A, E, and F) in the truck body. The expansion lock pin (B) secures the outer section of the reel in one of four positions on the reel shaft to accommodate different sizes of cable or varying loads on the reel. Reel braking is controlled by the brake wing nut (D). The support bracket lock lever (G) locks the reel frame in the support brackets.

*b. Removal.* Move the support bracket lock lever (G) upward to the unlocked position. Lift the PR reel (C) from the brackets.

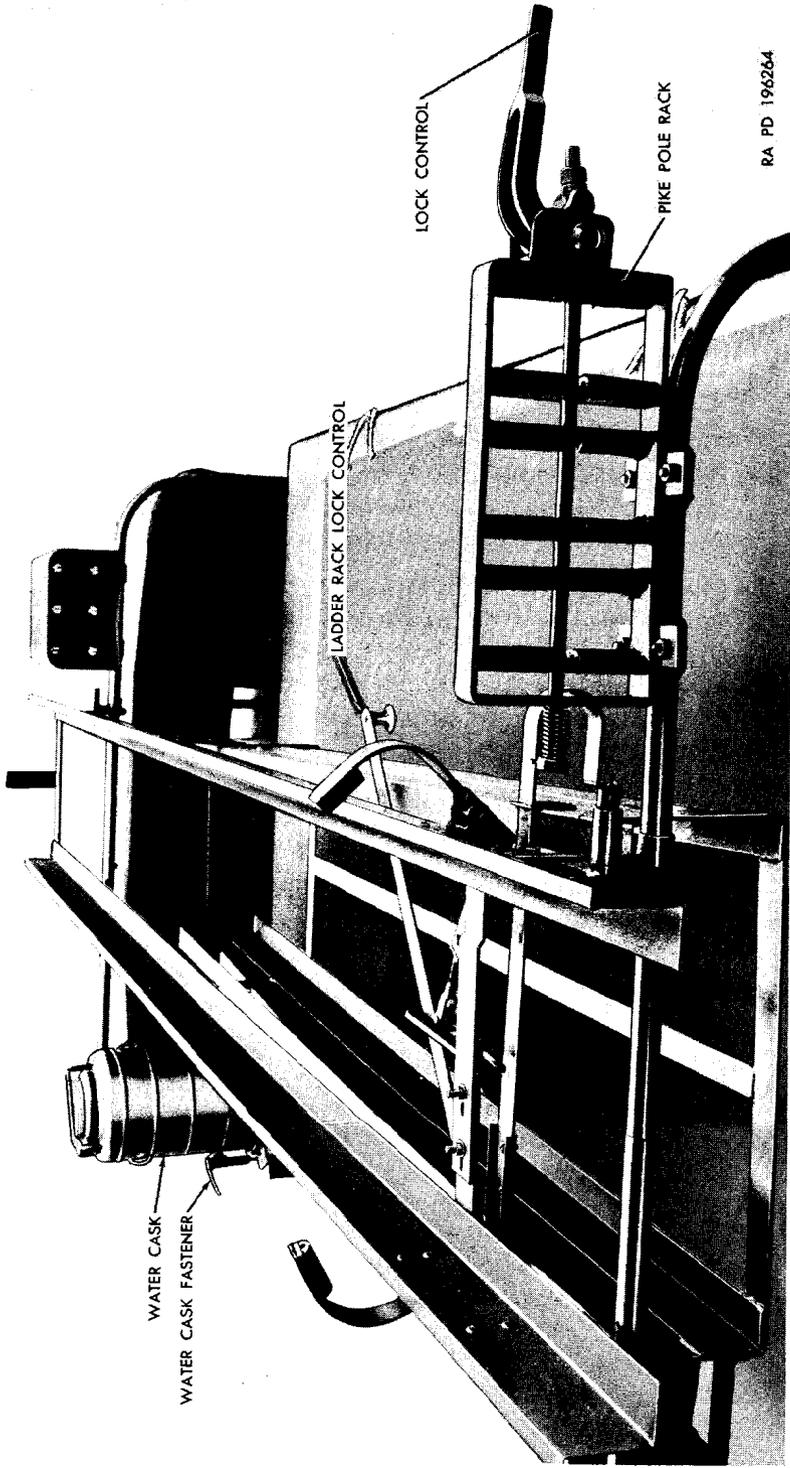
*c. Installation.* With the support bracket lock lever (G) in the unlocked position, mount the PR reel (C) in the three support brackets. Pull the lock lever down to the locked position.

## **62. Fire Extinguisher**

fig. 31

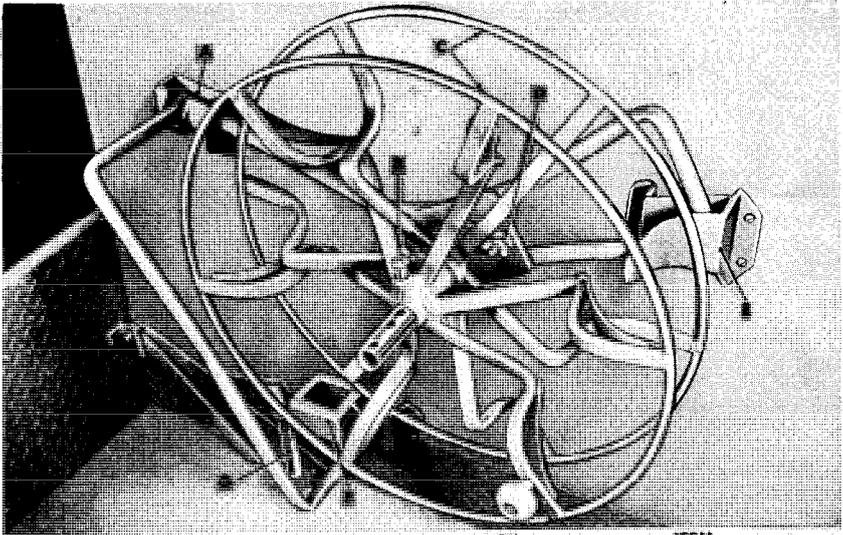
*a. Location.* The fire extinguisher is mounted in a bracket on the right cowl inside panel of the cab (cargo truck M37, command truck M42, and telephone maintenance truck V41) or to the rear of the right door inside the driver's compartment (ambulance truck M43).

*b. Operation.* Remove the extinguisher from the bracket. Turn the handle counterclockwise to the released position and work with a pumping motion. For best results, direct the discharge toward the base of the flames. To extinguish burning liquid in a container, direct the discharge against the inside of the container just above the burning liquid.



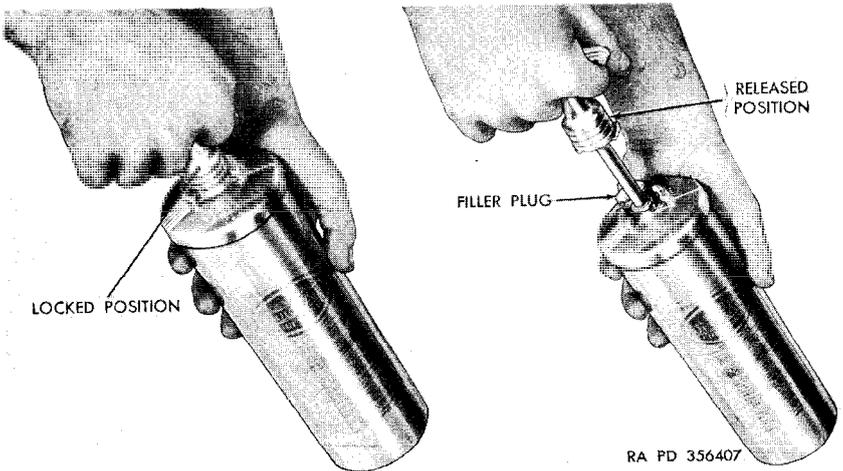
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*Figure 29. Ladder rack lock control, pole rack lock control, and water cask fastener (telephone maintenance truck V-41).*



- | KEY | ITEM                        | KEY | ITEM                         |
|-----|-----------------------------|-----|------------------------------|
| A   | —UPPER REAR SUPPORT BRACKET | E   | —UPPER FRONT SUPPORT BRACKET |
| B   | —EXPANSION LOCK PIN         | F   | —LOWER SUPPORT BRACKET       |
| C   | —PR REEL                    | G   | —LOCK LEVER                  |
| D   | —BRAKE WING NUT             |     |                              |
- RA PD 196265

*Figure 30. PR reel installed (telephone maintenance truck V-41).*



*Figure 31. Operation of fire extinguisher.*

*c. Maintenance.* Each time the extinguisher is used, refill with fire extinguisher liquid through the filler plug opening. After filling, turn the handle to the locked position. Keep the extinguisher clean, fully charged, and properly stowed.

## **Section V. OPERATION UNDER UNUSUAL CONDITIONS**

### **63. General Conditions**

*a.* In addition to the operating procedures described for usual conditions, special instructions of a technical nature for operating and servicing these vehicles under unusual conditions are contained or referred to herein. In addition to the normal preventive maintenance service, special care in cleaning and lubrication must be observed where extremes of temperature, humidity, and terrain conditions are present or anticipated. Proper cleaning, lubrication, and storage and handling of fuels and lubricants not only insure proper operation and functioning, but also guard against excessive wear of the working parts and deterioration of materials.

*b.* TM 21-300 contains very important instructions on driver selection, training, and supervision and TM 21-305 prescribes special driving instructions for operating wheeled vehicles under unusual conditions.

**Caution:** It is imperative that the approved practices and precautions be followed. A detailed study of these technical manuals is essential for use of this materiel under unusual conditions.

*c.* Refer to paragraph 75 for lubrication under unusual conditions; to table II and table III for preventive maintenance checks; and to par. 278-282 for maintenance procedures.

*d.* When recurrent failure of materiel results from subjection to extreme conditions, report the condition on DA Form 468 (par. 3*d*).

### **64. Extreme-Cold Weather Conditions**

#### *a. General Problems.*

- (1) Extensive preparation of materiel scheduled for operation in extreme-cold weather is necessary. Generally, extreme cold will cause lubricants to thicken, freeze batteries or prevent them from furnishing sufficient current for cold-weather starting, crack insulation and cause electrical shortcircuits, prevent fuel from vaporizing and properly combining with air to form a combustible mixture for starting, and will cause the various construction materials to become hard, brittle, and easily damaged or broken.
- (2) The cooling system must be prepared and protected for temperatures below +32° F. in accordance with instructions in TM 9-2855 on draining and cleaning the system and the selection, application, and checking of antifreeze compounds to suit the anticipated conditions.

- (3) TM 9-2855 also describes the method of correcting specific gravity readings for batteries exposed to extreme cold.
- (4) For description of operations in extreme cold, refer to FM 31-70 and FM 31-71 as well as to TM 9-2855.

**Caution:** It is imperative that the approved practices and precautions be followed. TM 9-2855 contains information which is specifically applicable to these vehicles as well as to all other vehicles. It must be considered an essential part of this manual, not merely an explanatory supplement to it.

*b. Winterization Equipment.* Special equipment is provided for the vehicles when protection against extreme-cold weather (0° to -65° F.) is required. This equipment is issued as specific kits. Each kit contains a technical bulletin which provides information on description, installation instructions, and methods of use. TM 9-2855 contains general information on winterization equipment and processing.

*c. Fuels, Lubricants, and Antifreeze Compounds (Storage, Handling, and Use).*

- (1) The operation of equipment at arctic temperatures will depend to a great extent upon the condition of the fuels, lubricants, and antifreeze compounds used in the equipment. Immediate effects of careless storage and handling or improper use of these materials are not always apparent, but any deviation from proper procedures may cause trouble at the least expected time.
- (2) In arctic operations, contamination with moisture is a source of many difficulties. Moisture can be the result of snow getting into the product, condensation due to "breathing" of a partially filled container, or moisture condensed from warm air in a partially filled container when a product is brought outdoors from room temperature. Other impurities will also contaminate fuels and lubricants so their usefulness is impaired.
- (3) Refer to TM 9-2855 for detailed instructions on storage, handling, and use.

## **65. Extreme-Cold Weather Operation**

### *a. General.*

- (1) The driver must always be on the alert for indications of the effect of cold weather on the vehicle.
- (2) The driver must be very cautious when placing the vehicle in motion after a shutdown. Thickened lubricants may cause failure of parts. Tires frozen to the ground or frozen to the shape of the flat spot while underinflated must be considered. One or more brake shoes may be frozen fast and require preheating to avoid damage to the clutch surfaces. After warming up the engine thoroughly, place transmission

in first gear and drive vehicle slowly about 100 yards, being careful not to stall the engine. This should heat gears and tires to a point where normal operation can be expected.

- (3) Constantly note instrument readings. If instrument reading consistently deviates from normal, stop the vehicle and investigate the cause. A special engine thermostat provided in the arctic winterization kit opens at 180° F., and at this temperature, the engine will give best results. If temperature gage reading consistently exceeds 200° F., adjust flap on radiator winterfront cover to admit more air.

*b. At Halt or Parking.*

- (1) When halted for short shutdown periods, the vehicle should be parked in a sheltered spot out of the wind. If no shelter is available, park so that the vehicle does not face into the wind. For long shutdown periods, if high ground is not available, prepare a footing of planks or brush. Chock in place if necessary.
- (2) When preparing a vehicle for shutdown periods, place control levers in the neutral position to prevent them from possible freezing in an engaged position. Freezing may occur when water is present due to condensation.
- (3) Clean all parts of the vehicle of snow, ice, and mud as soon as possible after operation. Refer to table II for detailed after-operation procedures. If the winter front and side covers are not installed, be sure to protect all parts of the engine and engine accessories against entrance of loose, drifting snow during the halt. Cover and shield the vehicle but keep the ends of the canvas paulins off the ground to prevent them from freezing to the ground.
- (4) If no power plant heater is present, the batteries should be removed (par. 168*b*) and stored in a warm place.
- (5) Refuel immediately in order to reduce condensation in the fuel tank. Prior to refueling, open fuel tank drain cock and drain off any accumulated water.
- (6) Immediately after engine "shutdown," start the power plant heater and check to be sure it operates effectively. The heater should avoid the necessity of removing the batteries to warm storage, and is designed to operate unattended during overnight stops. Instructions for operation of winterization equipment are contained in the pamphlet packed with the kit.
- (7) Correct tire inflation pressure is prescribed in paragraph 67*b*.
- (8) When drain cocks have been opened to remove liquid from the cooling system, inspect both drain cocks to be sure they are not obstructed. If the drain cocks are obstructed by foreign material, remove the two cocks. This is particularly

important before leaving a vehicle that has had the engine drained to protect the block from freezing. The draining of an engine cooling system to prevent freezing will be done only when no approved antifreeze solution is available.

## **66. Operation in Extreme-Hot Weather Conditions**

*a. General.* Continuous operation of the vehicle at high speeds or long hard pulls in low gear positions on steep grades or in soft terrain may cause the water temperature gage to register overheating. Avoid the continuous use of low gear ratios whenever possible. Continually watch the temperature and halt the vehicle for a cooling-off period whenever necessary and the tactical situation permits. Frequently inspect and service cooling unit, oil filter, and air cleaner. If the engine temperature consistently rises above 200° F., look for dust, sand, or insects in radiator fins and blow out any accumulation with compressed air or water under pressure. Flush cooling system if necessary (par. 149). Also, check that the correct type thermostat is installed. If a 180° thermostat is in use, replace it with a 160° unit (par. 151).

*b. At Halt or Parking.*

- (1) Do not park the vehicle in the sun for long periods, as the heat and sunlight will shorten the life of the tires. If possible, park vehicle under cover to protect it from sun, sand, and dust.
- (2) Cover inactive vehicles with paulins if no other suitable shelter is available. Where entire vehicle cannot be covered, protect window glass against sand etching, and protect engine compartment against entry of sand.
- (3) Correct tire inflation pressure is prescribed in paragraph 67*b*.
- (4) Vehicles inactive for long periods in hot humid weather are subject to rapid rusting and accumulation of fungi growth. Make frequent inspections and clean and lubricate to prevent excessive deterioration. Be sure that the cooling system is protected with rust inhibitor compound and that the paint is in good condition. Remove the batteries (par. 168*b*) and store in a cool place. See SB 9-4 for detailed instructions on limited storage.

## **67. Operation on Unusual Terrain**

*a. General.*

- (1) Vehicle operation on snow or ice and in deep mud requires the use of tire chains. Tire chains must be installed in pairs (front and rear) to prevent power train damage and wear. Select a gear ratio low enough to move vehicle steadily and without imposing undue driving strain on engine and power train. However, racing of the engine for extended periods must be avoided.

*Note.* Avoid excessive clutch slippage.

- (2) Operators must at all times know the position in which the front wheels are steering, as the vehicle may travel straight-ahead even though the wheels are cramped right or left. A piece of string or friction tape attached to the front portion of the steering wheel rim in "straightahead" position will indicate to the driver whether the front wheels are "ploughing." This ploughing action may cause the vehicle to stall, or suddenly veer to right or left.
- (3) If one or more wheels become mired and others spin, it may be necessary for the vehicle to be winched or towed by a companion vehicle, or to jack up the wheel which is mired and insert planking or matting beneath it. Do not jam sticks or stones under a spinning wheel, as this only forms an effective block and will wear the tire tread unnecessarily.
- (4) Operation in sand requires daily cleaning of air cleaners and fuel and oil filters. Engine vents and other exposed vents should be covered with cloth.
- (5) At high altitudes, coolant in vehicles boils at proportionately lower points than 212° F., thus, it will be necessary to keep a close watch on the engine temperature during the summer months.

*b. Recommended Tire Pressures.* Pressure in all tires is 40 psi for driving cross-country or on highways. For operation in mud, sand, or snow, reduce tire pressure to 15 psi. Be sure to increase tire pressure to 40 psi after operating in mud, sand, or snow.

*c. After-Operation Procedures.* Remove accumulations of snow, ice and mud from under the fenders and from the radiator core, engine compartment, steering knuckles and arms, brake cylinder boots and hoses, air cleaner, and electrical connections.

**Caution:** Exercise care when removing such accumulations to prevent damage to the affected areas.

## 68. Fording Operation

*a. General.* In fording, vehicles may be subjected to water varying in depth from only a few inches to a depth sufficient to completely submerge the vehicle. Factors to be considered are spray-splashing precautions, normal fording capabilities, deep-water fording using fording kits, and accidental complete submersion.

*b. Normal Fording.* Maximum vehicle fording depth is 42 inches in the standard vehicle provided with waterproofing protection provided for critical units during manufacture, but without a deep-water fording kit. Observe the precautions listed in (1) through (6) below before and during fording.

- (1) Make sure the battery cell vent caps are snug.
- (2) Verify depth of water to be forded and do not exceed the known fording limits of the vehicle.

- (3) The engine must be operated at maximum efficiency before attempting to ford.
- (4) Shift the transmission into first speed position, and engage the transfer shift lever in low range (this will engage the front axle). On vehicles so equipped, close the crankcase ventilation shutoff valves by pulling out the crankcase ventilation valve dual control (G, fig. 12). Pull out the throttle control (H, fig. 12) to overcome the possibility of a "stall" when the cold water chills the engine. Enter the water slowly. Should the engine stall while submerged, it may be started in the usual manner.
- (5) All normal fording should be at speeds of from 3 to 4 mph to avoid forming a "bow wave." Avoid using the clutch, if possible, because frequent use while submerged may cause the clutch to slip. If the ford is deep enough for the spinning fan blades to catch water, loosen the fan belt before crossing; otherwise, they may throw water over the electrical units. The brakes will usually be "lost" but in some cases may "grab" after vehicle emerges. Applying the brakes a few times after dry land has been reached will help dry the brake linings.
- (6) If accidental complete submersion occurs, the vehicle will be salvaged, temporary preservation applied as outlined in paragraph 279 and then sent to the ordnance maintenance unit as soon as possible for necessary permanent maintenance.

*c. Deep-Water Fording.* Refer to TM 9-2853 for general information, descriptions, and methods of use of deep-water fording kits, and for general procedures for the operation of vehicles so equipped.

*d. After-Fording Operations.* Immediately after vehicle emerges from the water, push in the crankcase ventilation valve dual control (G, fig. 12), mounted on the instrument panel (on vehicle so equipped), to allow the crankcase ventilating system to operate normally and relieve crankcase pressure. Push in the throttle control (H, fig. 12). Open all drain holes in body. Check the condition of all tools and equipment carried on the vehicle. Clean and dry all items and stowage compartments as soon as possible. Also, at the earliest opportunity, check the engine oil level and check for presence of water in the crankcase. Heat generated by driving will evaporate or force out most water which has entered at various points. Also, any *small* amount of water which has entered the crankcase either through leakage or due to condensation will usually be dissipated by the ventilating system. Refer to paragraph 279 for maintenance operations after fording.

## CHAPTER 3

### ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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#### Section I. PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR OPERATION AND ORGANIZATIONAL MAINTENANCE

##### 69. General

Tools, equipment, and spare parts are issued to the using organization for maintaining the materiel. Tools and equipment should not be used for purposes other than prescribed and, when not in use, should be properly stored in the compartment and/or roll provided for them.

##### 70. Parts

Spare parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise un-serviceable, providing replacement of these parts is within the scope of organizational maintenance functions. Spare parts, tools, and equipment supplied for the  $\frac{3}{4}$ -ton cargo truck M37, command truck M42, ambulance truck M43, and telephone maintenance truck V41 are listed in Department of the Army Supply Manual ORD 7 SNL G-741, which is the authority for requisitioning replacements.

##### 71. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this materiel are listed for issue to first echelon by ORD 7 SNL G-741. Common tools and equipment for second echelon are listed in ORD 6 SNL J-7, Sections 1, 2, and 3; ORD 6 SNL J-10, Section 4; and are authorized for issue by T/A and T/OE.

##### 72. Special Tools and Equipment

Certain tools and equipment (fig. 32) specially designed for operation and organizational maintenance, repair, and general use with the materiel are listed in table I for information only. This list is not to be used for requisitioning replacements.

Table I. Special Tools and Equipment for Operation and Organizational Maintenance

Item	Identifying No.	References		Use
		Fig.	Par.	
ADAPTER, puller...	41-A-18-173	32, 196	233	To remove steering wheel (used with PULLER 41-P-2954).
ADAPTER, puller...	41-A-18-241	32, 197	234, 243	To remove steering idler arm (used with PULLER 41-P-2957).
DRIFT, oil seal. . . .	41-D-1535-25	32, 191	228c	To remove hub bearing oil seals.
HANDLE, remover and replacer.	41-H-1397	32, 191	228c	Used with DRIFT 41-D-1535-25.
REPLACER, hub bearing oil seal.	41-R-2392-405	32, 193	228e	To install hub bearing oil seals.
WRENCH, bearing adjusting nut.	41-W-1991-17	32, 189	205d, 226	To remove, install, and adjust hub bearing adjusting nuts.

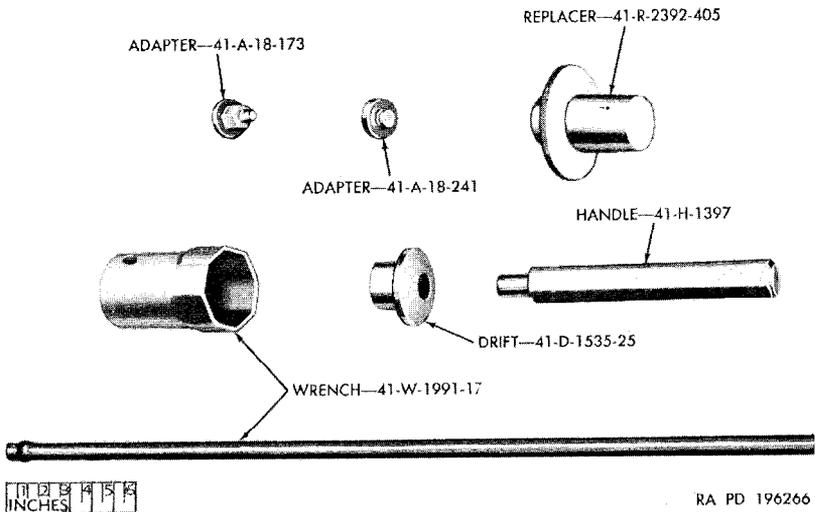


Figure 32. Special tools and equipment for operation and organizational maintenance

## Section II. LUBRICATION AND PAINTING

### 73. Lubrication Order

LO 9-8030 order (figs. 33 and 34) prescribes cleaning and lubrication procedures as to locations, intervals, and proper materials for these vehicles. This order is issued with each vehicle and is to be

# LUBRICATION ORDER

LC 19-75AA-9

# LO 9-8030

2 December 1953 (Supersedes LO 9-840, 29 May 1951)

**TRUCK, 3/4-TON, 4 x 4, M37, M42, M43, V-41 ( )/GT**

References: TM 9-840; ORD 7 5N1 G-741

Clean fittings before lubricating. Clean parts with THINNER, paint, volatile mineral spirits (TPM) or SOLVENT; dry cleaning (SD). Dry before lubricating. Lubricate dotted arrow points on both sides of the equipment.

Intervals are based on normal operation. Reduce to compensate for abnormal operation and severe conditions or contaminated lubricants. During inactive periods, intervals may be extended commensurate with adequate preservation. Lubricate after washing or fording.

LUBRICANT • INTERVAL

- C, Fig 35 → Winch Worm Case Level (Check level) W
- D, Fig 35 → Winch Worm Case Drain (Drain and refill) (Cap. 1 qt.) A
- A, Fig 35 → Winch Worm Case Fill GO
- G, Fig 35 → Winch Universal Joint and Propeller Shaft Yoke GAA M
- L, Fig 35 → Spring Bolt GAA 1
- H, Fig 35 → Steering Idler Arm GAA 1
- J, Fig 35 → Steering Drag Links GAA 1
- M, Fig 36 → Universal Joint and Steering Knuckle Bearings (See note 6) GAA 1

INTERVAL • LUBRICANT

- B, Fig 35 → Winch Cable (See note 7) OE
- C, Fig 35 → Winch Drum and Shaft Case Level (Check level) W
- D, Fig 35 → Winch Drum and Shaft Case Drain (Drain and refill) (Cap. 1 qt.) A
- A, Fig 35 → Winch Drum and Shaft Case Fill W GO
- G, Fig 35 → Winch Propeller Shaft Shear Pin GAA
- Q, Fig 39 → Water Pump 1 WP
- F, Fig 35 → Front Differential Drain (Drain and refill) (Cap. 2 1/2 qts.) (See note 5) 12

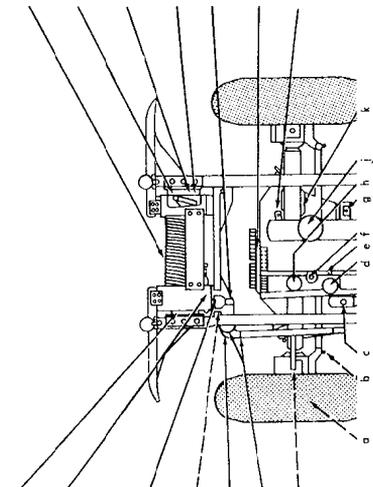
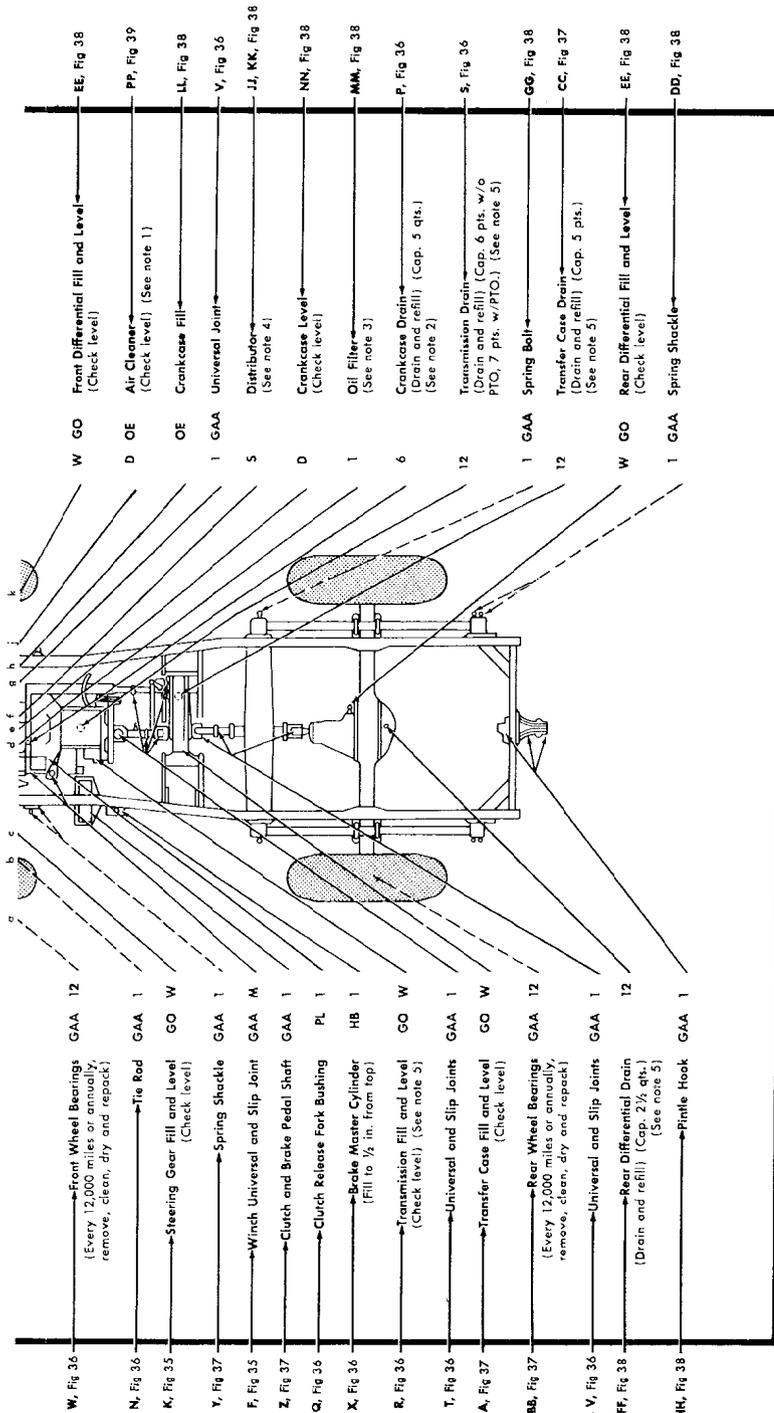


Figure 33. Lubrication order—LO 9-8030.



RA PD 196267

Figure 33—Continued.

## KEY

LUBRICANTS	EXPECTED TEMPERATURES		INTERVALS
	above +32° F	+40° F to -10° F	
OE-Oil, lubr, engine	OE 30	OE 10	O-Daily W-Weekly M-Monthly
GO-Lubricant, Gear, universal	GO 90	GO 75	S-Semi-annually A-Annually
GAA-Grease, lubr, automotive and artillery	GAA	GAA	1-1,000 Miles 6-6,000 Miles
HB-Fluid, hydraulic, brake	HB	HB	
PL-Oil, lubr, grease	PL (Med)	PL (Special)	12-12,000 Miles

## NOTES

- AIR CLEANER**—(Oil both types.) Daily, replenish to bead level with OE, crankcase grade. Every 1,000 miles, clean oil reservoir and refill with OE or above. Disassemble, clean, oil parts, refill with oil above whenever crankcase oil is changed. For desert or extremely dusty conditions, clean all parts and refill with OE once every operating day or more frequently if required.
- CRANKCASE**—Drain every 6,000 miles or semiannually. Drain only when hot after operation. Refill FULL with crankcase oil level. For operation on heavy duty engine oil, maintain engine coolant temperature at 140° F, minimum.
- OIL FILTERS**—Every 1,000 miles, remove plug in bottom of case and drain sediment. Every 6,000 miles or semiannually, when crankcase is being drained, remove element, clean inside of case and install new element.
- DISTRIBUTOR**—Every 6,000 miles, or semiannually, remove distributor, remove plug under name plate and wipe off felt wick. Soak wick in PL. Fill plug opening with GAA. Insert wick, remove excess grease and install plug. Wipe breaker cam lightly with GAA and breaker arm pivot with 1 to 2 drops of PL.
- GEAR CASES**—Drain every 12,000 miles or annually. Drain only when hot after operation. Fill to plug levels (except transmission) before operation and after draining. Clean vents weekly and after operation in mud or water. TRANSMISSION LEVEL: Check level weekly. To check level, remove cap screw located upper rear side of right hand power take-off cover. Remove fill plug and fill to level of screw hole. When replacing cap screw, discard lock washers and replace with copper or brass flat washer. (W or PIO without power-take-off; W PFD with power-take-off).
- FRONT WHEEL UNIVERSAL JOINTS AND STEERING KNUCKLE BEARINGS**—Every 1,000 miles or semiannually, remove lower plug and lubricate through fitting located on top of steering support at lower plug hole. Replace plug. Do not disassemble constant velocity universal joints.

7. **WINCH CABLE**—After each operation, clean and oil with used crankcase oil or OE. Weekly, if cable has not been used, coat outer coils. Monthly, unwind entire cable, clean and oil. After each use, coat with oil. After 12 months, coat with grease. Wipe off excess oil with PL. Coat winch drum also with CW before rewinding cable or drum.

8. **WINCH PROPELLER SHAFT SHEAR PIN**—Semiannually, disassemble front universal joint, remove shear pin and universal joint from propeller shaft. Lubricate with GAA. Clean and oil universal joint collar with GAA to prevent rusting.

9. **OIL CAN POINTS**—Every 1,000 miles or monthly, lubricate hinges and latches, clutch and brake pedal linkage, parking brake linkage, transfer controls, winch shifter shaft with PL.

10. **DO NOT LUBRICATE**—Shock absorbers, springs, clutch release bearing.

11. **LUBRICATE AT TIME OF DISASSEMBLY BY ORDINANCE PERSONNEL**—Generator, starter, clutch pilot bearing, speedometer, flexible shaft.

## BY ORDER OF THE SECRETARIES OF THE ARMY AND THE AIR FORCE:

OFFICIAL: **WM. E. BERGIN,**  
Major General, United States Army,  
The Adjutant General.

OFFICIAL: **M. B. RIDGWAY,**  
General, United States Army,  
Chief of Staff.

OFFICIAL: **K. E. THEBAUD,**  
Colonel, United States Air Force,  
Air Adjutant General.

OFFICIAL: **M. F. TWINING,**  
Chief of Staff,  
United States Air Force.

LO P-8030

RA PD 359235

Figure 34. Lubrication order notes.

carried with it at all times. In the event the vehicle is received without a copy, the using organization will immediately requisition one. See DA Pam 310-4 for lubrication order of current date. Lubrication which is to be performed by ordnance maintenance personnel is listed in the lubrication order NOTES.

## 74. General Lubrication Instructions

*a. General.* Any special lubricating instructions required for specific mechanism or parts are covered in the pertinent section.

*b. Usual Conditions.* Service intervals specified on the lubrication order are for normal operation and where moderate temperature, humidity, and atmospheric conditions prevail.

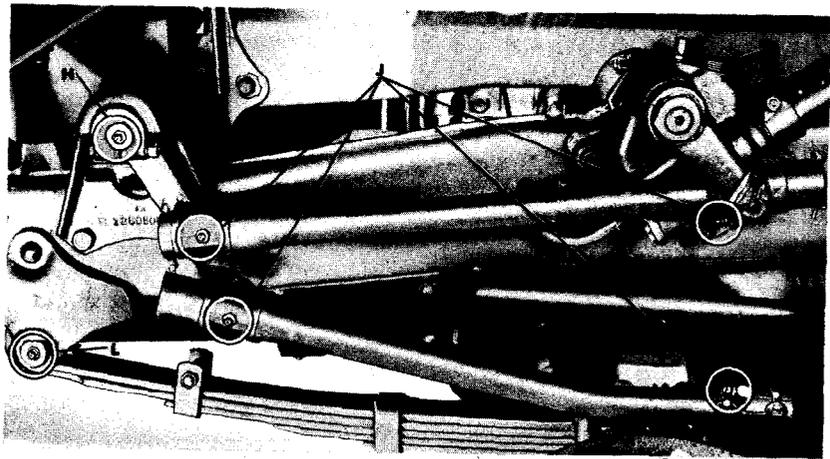
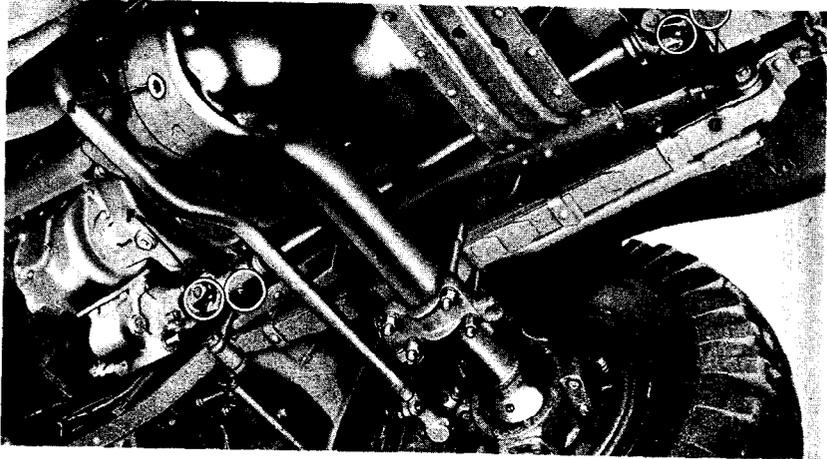
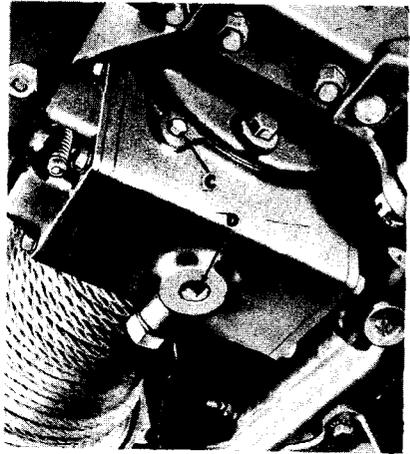
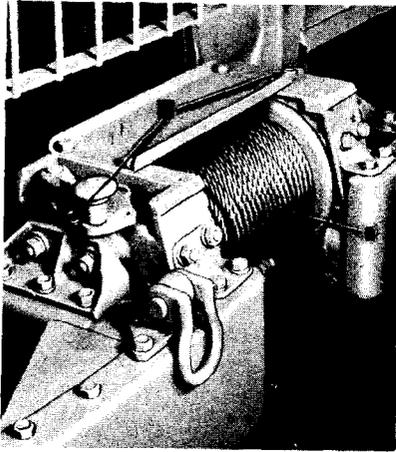
*c. Lubrication Equipment.* Each vehicle is supplied with lubrication equipment adequate for its maintenance. Clean this equipment both before and after use. Operate the lubricating guns carefully and in such a manner as to insure a proper distribution of the lubricant.

*d. Points of Application.*

- (1) Lubricating fittings, grease cups, filler and drain plugs, and oilholes are shown in figures 35 through 39 and are referenced to the lubrication order. Wipe these devices and the surrounding surfaces clean before and after lubricant is applied.
- (2) A  $\frac{3}{4}$ -inch red circle should be painted around all lubricating fittings and oilholes.
- (3) Clean and lubricate unsealed bearings ((*a*), (*b*), and (*c*) below).
  - (*a*) Wash all of the old lubricant out of the bearings and from the inside of the hubs with volatile mineral spirits or dry-cleaning solvent and dry the parts thoroughly.

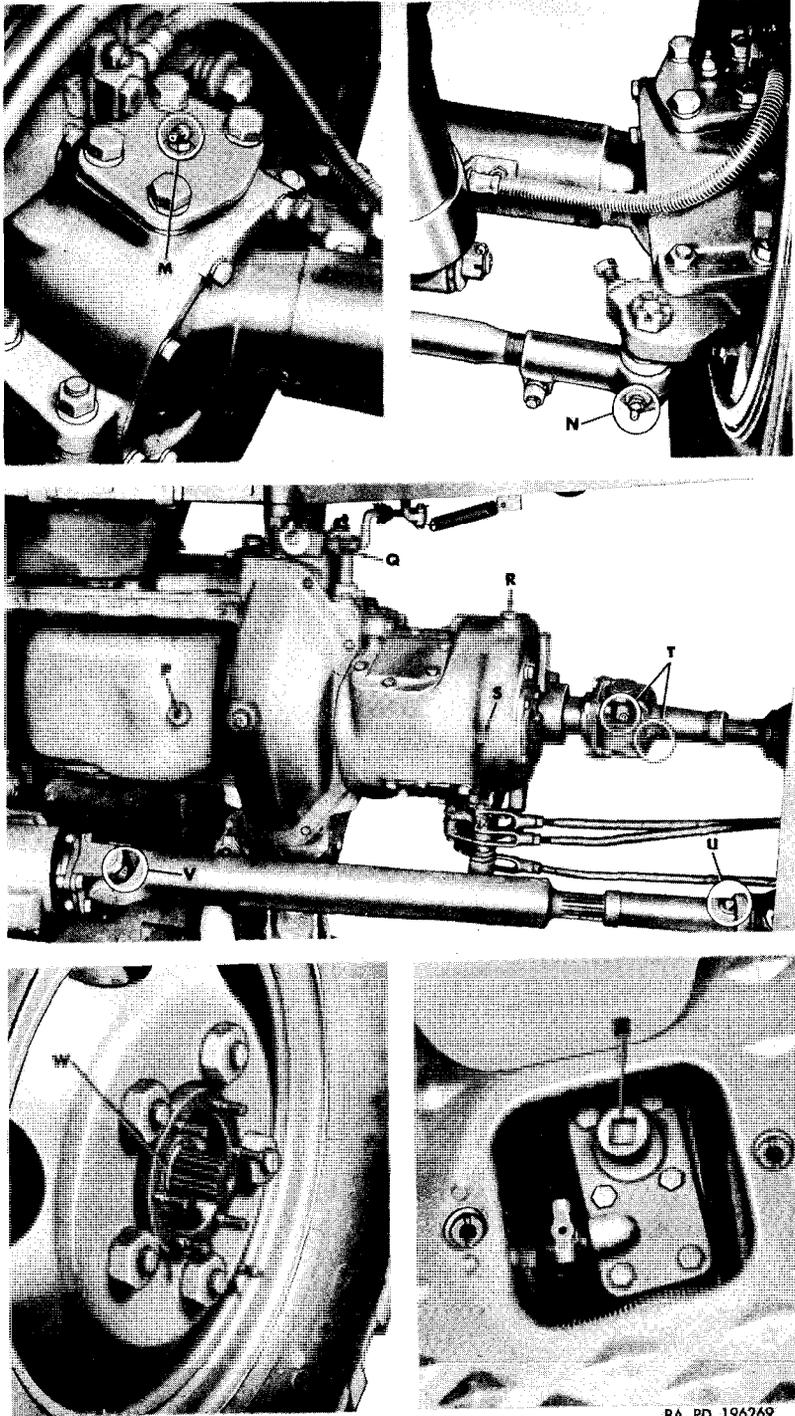
**Caution:** Bearings must not be dried or spun with compressed air. See TM 37-265 for care and maintenance of bearings.

- (*b*) Pack the bearings by hand or with a mechanical packer, introducing the lubricant carefully between the rollers. Do not smear grease only on the outside of the bearings and expect it to work in. Great care must be exercised to insure that dirt, grit, lint, or other contaminants are not introduced into the bearings. If the bearings are not to be installed immediately after repacking, wrap them in clean oilproof paper to protect them from contaminants.
- (*c*) After the bearings are properly lubricated, pack the hubs with a sufficient amount of lubricant to uniformly fill them to the inside diameters of the inner and outer bearing races. Coat the steering knuckles or spindles and drive flanges with a thin layer of lubricant (not over one-sixteenth inch) to prevent rusting. Do not fill the drive



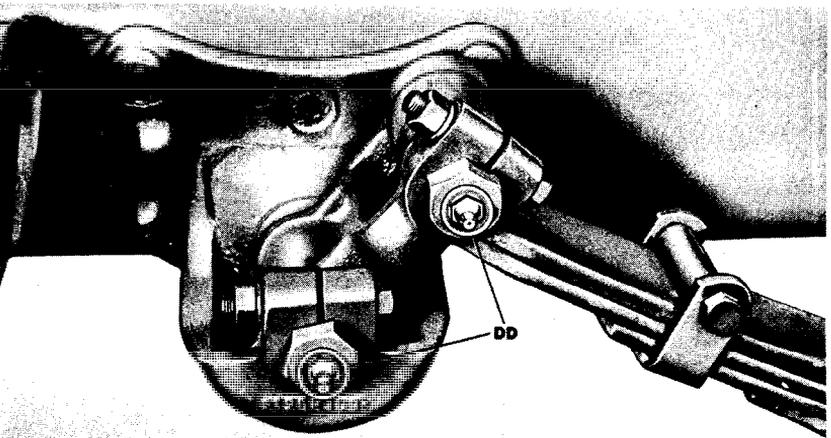
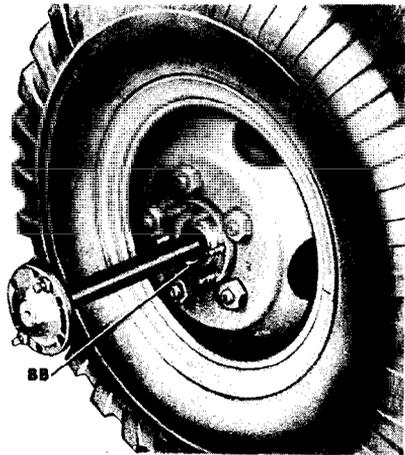
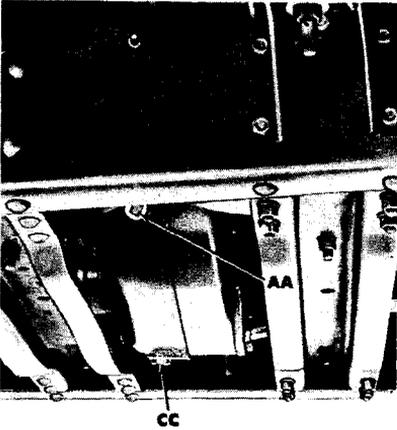
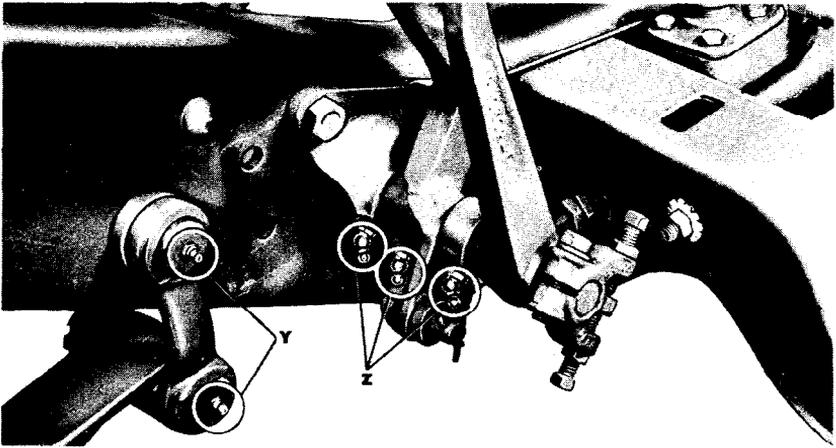
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Figure 35. Localized lubrication points (A through L).



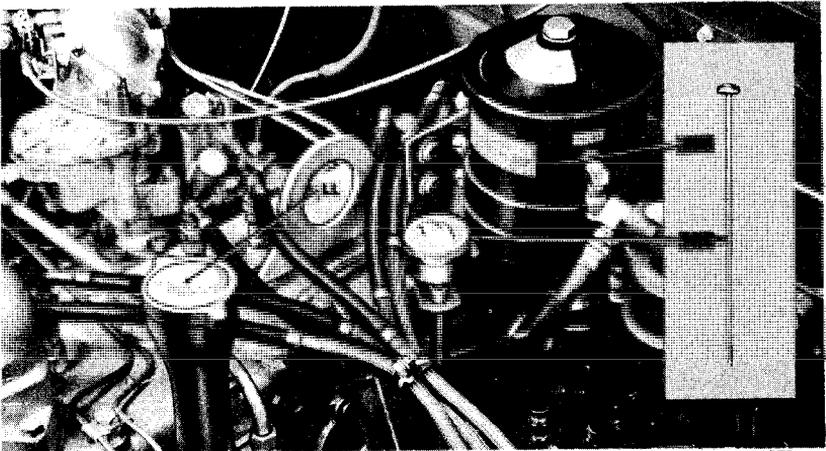
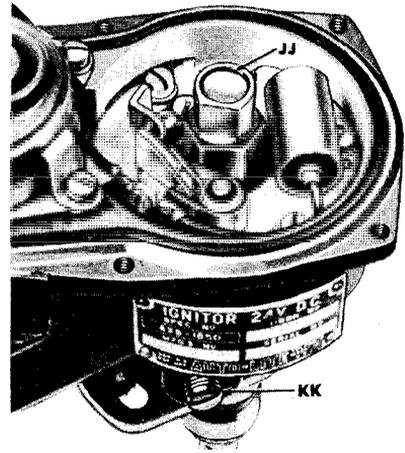
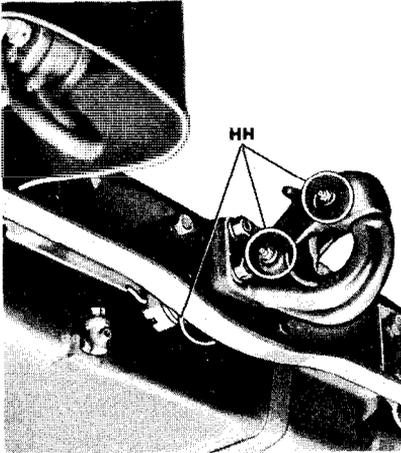
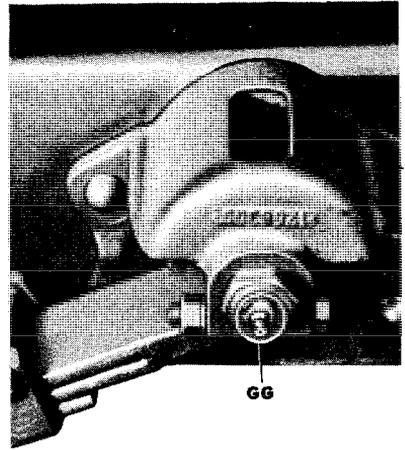
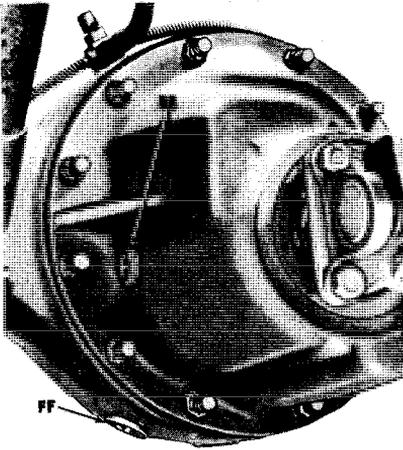
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Figure 36. Localized lubrication points (M through X).



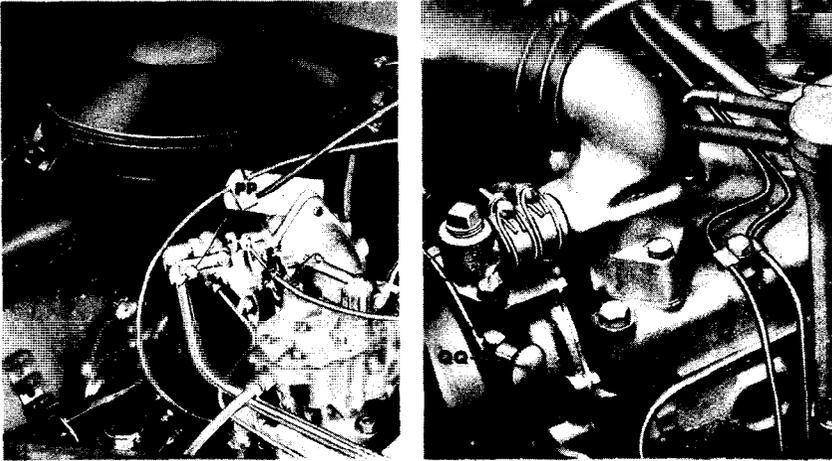
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Figure 37. Localized lubrication points (Y through DD).



RA PD 196271

Figure 38. Localized lubrication points (EE through NN).



RA PD 196272

**Figure 39. Localized lubrication points (PP and QQ).**

flanges to serve as grease cups under any circumstances. They should be lightly coated, however, to prevent rusting.

*Note.* For normal operation, lubricate wheel bearings at 12,000 miles or at annual intervals, whichever comes first.

*e. Reports and Records.*

- (1) Report unsatisfactory performance of prescribed petroleum fuels, lubricants, or preserving materials, using DA Form 468, Unsatisfactory Equipment Report.
- (2) Maintain a record of lubrication of the vehicle on DA Form 461, Preventive Maintenance Service and Inspection for Wheeled and Half-Track Vehicles.

**75. Lubrication Under Unusual Conditions**

*a. Unusual Conditions.* Reduce service intervals specified on the lubrication order, i. e., lubricate more frequently, to compensate for abnormal or extreme conditions, such as high or low temperatures, prolonged periods of high-speed operation, continued operation in sand or dust, immersion in water, or exposure to moisture. Any one of these operations or conditions may cause contamination and quickly destroy the protective qualities of the lubricants. Intervals may be extended during inactive periods commensurate with adequate preservation.

*b. Changing Grade of Lubricants.* Lubricants are prescribed in the "Key" (fig. 34) in accordance with three temperature ranges; above +32° F., +40° to -10° F., and from 0° to -65° F. Change the grade of lubricants whenever weather forecast data indicate that air temperatures will be consistently in the next higher or lower temperature range or when sluggish starting caused by lubricant thicken-

ing occurs. No change in grade will be made when a temporary rise in temperature is encountered.

*c. Maintaining Proper Lubricant Levels.* Lubricant levels must be observed closely and necessary steps taken to replenish in order to maintain proper levels at all times.

## **76. Lubrication for Continued Operation Below 0° F.**

Refer to TM 9-2855 for instructions on necessary special preliminary lubrication of the vehicle, and to TB 9-2855-5, -6 and -7 for instructions on installation of winterization kits.

## **77. Lubrication After Fording Operations**

*a.* After any fording operation, in water 12 inches or over, lubricate all chassis points to cleanse bearings of water or grit as well as any other points required in accordance with paragraph 281 for maintenance operations after fording.

*b.* If the vehicle has been in deep water for a considerable length of time or was submerged beyond its fording capabilities, precautions must be taken as soon as practicable to avoid damage to the engine and other vehicle components ((1), (2), and (3) below).

- (1) Perform a complete lubrication service (par. 74).
- (2) Inspect engine crankcase oil. If water or sludge is found, drain the oil and flush the engine with preservative engine oil PL-30. Before putting in new oil, drain the oil filter and install a new filter element (par. 116b).

*Note.* If preservative engine oil is not available, engine lubricating oil OE-30 may be used.

- (3) Operation in bodies of salt water enhances the rapid growth of rust and corrosion, especially on unpainted surfaces. It is most important to remove all traces of salt water and salt deposits from every part of the vehicle. For assemblies which have to be disassembled, dried, and relubricated, perform these operations as soon as the situation permits. Wheel bearings must be disassembled and repacked after each submersion. Regardless of the temporary measures taken, the vehicle must be delivered as soon as practicable to the ordnance maintenance unit.

## **78. Lubrication After Operation Under Dusty or Sandy Conditions**

After operation under dusty or sandy conditions, clean and inspect all points of lubrication for fouled lubricants and relubricate as necessary.

*Note.* A lubricant which is fouled by dust and sand makes an abrasive mixture that causes rapid wear of parts.

## 79. Painting

Instructions for the preparation of the materiel for painting, methods of painting, and materials to be used are contained in TM 9-2851. Instructions for camouflage painting are contained in FM 5-20B. Materials for painting are listed in ORD 7 SNL G-741.

### Section III. PREVENTIVE MAINTENANCE SERVICES

#### 80. General

*a. Responsibilities and Intervals.* Preventive maintenance services are the responsibility of the using organization. These services consist generally of daily operator's services (daily A services) performed by the operator or crew, and of biweekly services (biweekly B services) performed by the crew (under supervision of the squad, section, and platoon leaders); and of the scheduled services to be performed by organizational maintenance personnel (C and D services). Intervals are based on normal operations. Reduce intervals for abnormal operations or severe conditions. Intervals during inactive periods may be extended accordingly.

*b. Daily A Preventive-Maintenance Services.* Each tactical vehicle will be inspected by its assigned operator and crew, each day it is operated. This service is divided into four parts—

- (1) *Before-operation service.* This is a brief service to ascertain that the vehicle is ready for operation; it is mainly a check to see if conditions affecting the vehicle's readiness have changed since the last after-operation service.
- (2) *During-operation service.* This service consists of detecting unsatisfactory performance. While driving, the driver or crew should be alert for any unusual noises or odors, abnormal instrument readings, steering irregularities, or any other indication of malfunction of any part of the vehicle. Every time he applies the brakes, shifts gears, or turns the vehicle, the driver should instinctively consider it a test and note any unusual or unsatisfactory performance.
- (3) *At-the-halt service.* This service consists of investigating any deficiencies noted during operation and repeating part of the before-operation service.
- (4) *After-operation service.* This is the basic daily service for tactical vehicles. It consists of correcting, so far as possible, any operating deficiencies, so that the vehicle is prepared to roll again, upon a moment's notice, should the tactical situation so require.

*c. Biweekly B Preventive-Maintenance Services.* These services supplement the daily A preventive-maintenance service and are applied as indicated in table II. They provide for cleaning the vehicle

more thoroughly and for servicing certain items that do not require daily attention. The biweekly B service is applied to wheel vehicles once in 2 weeks by organizational maintenance personnel assisted by the operator.

*d. Round-the-Clock Operation.*

- (1) *Delegation of after-operation service.* Certain units, such as Transportation Corps truck companies, may operate almost continuously and this may require the operators to be on duty so long that it is not reasonable to expect them to perform the after-operation service. Under such circumstances, the after-operation service, usually performed by the driver, may be delegated to additional drivers or to second-echelon personnel. It may also be desirable to organize a fleet-maintenance crew.
- (2) *Fleet-maintenance crew.* When the vehicle has completed its daily run, the operator makes a report of the condition of the vehicle and is relieved. The vehicle is turned over to the fleet-maintenance crew and is readied for the next period of operation. Economy of personnel is accomplished by specialization, and several inspection stations are established to perform the after-operation service. Augmentation of drivers and/or organization-maintenance personnel may be accomplished by the employment of local civilian labor or by augmentation cells of military personnel. Normally, an operation that will justify the organization of a fleet-maintenance system to perform the after-operation service will also require the organization of a production-line maintenance system to accomplish the C and D (table I) preventive-maintenance services. Under these circumstances, the scope of each service should be integrated with the other.

*e. General Procedures for All Services and Inspections.*

- (1) The general procedures ((2), (3), and (4) below) apply to both first-and-second-echelon preventive-maintenance services and to all inspections and are just as important as the specific procedures.
- (2) Inspections to see if items are in good condition, correctly assembled or stowed, secure, not excessively worn, not leaking, and adequately lubricated apply to most items in the preventive-maintenance and inspection procedures. Any or all of these checks that are pertinent to any item (including supporting, attaching, or connecting members) will be performed automatically as general procedures, in addition to any specific procedures given.

- (a) Inspection for good condition is usually visual inspection to determine if the unit is safe or serviceable. Good condition is explained further as meaning: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.
  - (b) Inspection of a unit to see if it is correctly assembled or stowed is usually a visual inspection to see if the unit is in its normal position in the vehicle and if all its parts are present and in their correct relative positions.
  - (c) Inspection of a unit to see if it is secure is usually a visual, hand-feel, pry-bar, wrench, or screwdriver inspection for looseness in the unit. This inspection will include any brackets, lockwashers, locknuts, locking wires, and cotter pins as well as any connecting tubes, hoses, or wires.
  - (d) Excessively worn is understood to mean worn beyond serviceable limits, or likely to fail if not replaced before the next scheduled inspection. Excessive wear of mating parts or linkage connections is usually evidenced by too much play (lash or lost motion). It includes illegibility as applied to markings, data and caution plates, and printed matter.
- (3) Where the instruction "tighten" appears in the procedures, it means tighten with a wrench, even if the item appears to be secure.
  - (4) Such expressions as "adjust if necessary" or "replace if necessary" are not used in the specific procedures. It is understood that whenever inspection reveals the need of adjustments, repairs, or replacements, the necessary action will be taken.

## 81. Cleaning

*a. General.* Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as shown in (1) through (4) below.

- (1) Use dry-cleaning solvent or volatile mineral spirits to clean or wash grease or oil from all parts of the vehicle.
- (2) A solution of one part grease-cleaning compound to four parts of dry-cleaning solvent or volatile mineral spirits may be used for dissolving grease and oil from engine blocks, chassis, and other parts. Use cold water to rinse off any solution which remains after cleaning.
- (3) After the parts are cleaned, rinse and dry them thoroughly. Apply a light grade of oil to all polished metal surfaces to prevent rusting.

- (4) Before installing new parts, remove any preservative materials, such as rust-preventive compound, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in the lubrication order (fig. 33).

*b. Nameplates.* Nameplates, caution plates, and instruction plates made of steel rust very rapidly. When they are found to be in a rusty condition, they should be thoroughly cleaned and heavily coated with an application of lacquer. Refer to TM 9-2851.

*c. General Precautions in Cleaning.*

- (1) Dry-cleaning solvent and volatile mineral spirits are inflammable and should not be used near an open flame. Fire extinguishers should be provided when these materials are used. Use only in well ventilated places.
- (2) These cleaners evaporate quickly and have a drying effect on the skin. If used without gloves, they may cause cracks in the skin and, in the case of some individuals, a mild irritation or inflammation.
- (3) Avoid getting petroleum products, such as dry-cleaning solvent, volatile mineral spirits, engine fuels, or lubricants on rubber parts as they will deteriorate the rubber.
- (4) The use of diesel fuel oil, gasoline, or benzene (benzol) for cleaning is prohibited.

## **82. Preventive Maintenance by Driver or Operator(s)**

*a. Purpose.* To insure efficient operation, it is necessary that the vehicle be systematically inspected at intervals every day it is operated and also biweekly, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. Any defect or unsatisfactory operating characteristics beyond the scope of the driver or operator to correct must be reported at the earliest opportunity to the designated individual in authority.

*b. Services.* Driver's or operator's preventive maintenance services are listed in table II. Every organization must thoroughly school its personnel in performing the maintenance procedures for these vehicles as set forth in this manual.

Table II. Driver's or Operator's Preventive Maintenance Services

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
<b>USUAL CONDITIONS</b>					
X		X	X	X	<p><b>Caution:</b> Place all tags describing condition of vehicle in the driver's compartment in a conspicuous location so that they will not be overlooked.</p> <p><i>Fuel, oil, water.</i> Check fuel, oil, and water levels. Look for leaks in engine compartment. Check spare containers for contents. If water is added in cold weather, test solution with a hydrometer to determine if there is sufficient antifreeze (par. 64a(2)).</p>
X		X	X	X	<p><i>Tires.</i> Gage tires for correct pressure (par. 67b). Remove penetrating objects such as nails or glass. Note any apparent loss of air, unusual wear, or missing valve caps.</p>
X		X	X	X	<p><i>Leaks, general.</i> Look under vehicle and in engine compartment for indications of fuel, engine-oil, water, gear-oil, or brake-fluid leaks.</p>
X				X	<p><i>Vehicle equipment.</i> Visually inspect fire extinguishers (on vehicles so equipped) and vehicle publications, including Standard Form 91 and DA Form 614.</p>
X			X	X	<p>See that fire extinguishers are charged and sealed (if vehicle is so equipped).</p> <p>Operate lights, horn (if tactical situation permits), and windshield wipers. Visually inspect rear view mirror, reflectors, cab and body, pintle (on vehicle so equipped), lifting shackles, doors (including door locks, window regulators, and blackout curtains where used). Check canvas items (cab and body covers and curtains). Check the key locks and keys (ambulance truck M43 rear door and telephone maintenance truck V41 compartment doors).</p>
X				X	<p>Check tools and equipment to see that all items are in good condition and properly stowed.</p>
X				X	<p>Check the operation of the personnel heater, ventilating blowers, surgical light, spotlight, and litter racks (ambulance truck M43).</p>
X				X	<p>Check the ladder rack, pike pole front rack, pike pole clamp, PR reel and frame and support brackets, and spotlight (telephone maintenance truck V-41).</p>
X				X	<p>Check for any tampering or damage that may have occurred since last inspection.</p>

Table II. Driver's or Operator's Preventive Maintenance Services—Continued

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
USUAL CONDITIONS—Continued					
X			X	X	<i>Brakes</i> Check the service brakes for adequate pedal (par. 217) and the hand brake for proper adjustment (par. 219).
X			X	X	<i>Wheel and drive flange stud nuts.</i> Check the wheel and drive flange stud nuts for tightness.
X	X				<i>Instruments</i> (fig. 12). Observe instruments and gages for normal readings during warm-up and during operation of the vehicle.
	X				<b>Caution:</b> If it is necessary to add coolant to the radiator while the engine is overheated, run the engine at idling speed and slowly add the coolant. See paragraph 147a for precaution to be observed when removing pressure radiator cap. If no oil pressure is registered, stop the engine immediately, investigate the cause, and correct (par. 95d).
					<i>General operation.</i> Be alert for any unusual noises or improper operation of steering, clutch, brakes, or gear shifting.
		X	X	X	<i>Operating faults.</i> Investigate and correct or report any faults noted during operation.
		X	X	X	<i>Springs and shock absorbers.</i> Inspect springs, spring bolts, shackles, shock absorbers, and attaching parts for damage.
			X	X	<i>Lubricate.</i> Lubricate daily or weekly items specified on lubrication order.
			X	X	<i>Clean.</i> Clean glass, vision devices, and inside of cab and body. Wipe dust from the exterior of the body.
				X	Wash vehicle, clean the engine and engine compartment. Refer to paragraph 81.
				X	<i>Batteries.</i> Clean (par. 167a). Check water level, inspect terminals for tightness and coating of grease. On vehicles so equipped, see that the insulator is installed on the positive (+) post of the inner battery between cover and terminal.
				X	<i>Assemblies and belts.</i> Inspect assemblies such as carburetor, starter, generator, and water pump for looseness of mountings or connections. Press fan and generator drive belts to determine if tension is correct (par. 152a).

Table II. Driver's or Operator's Preventive Maintenance Services—Continued

Intervals					Procedure
Daily A				Biweekly B	
Before-operation	During-operation	At-the-halt	After-operation		
					USUAL CONDITIONS—Continued
X			X	X	<i>Electrical wiring.</i> Inspect visually electrical wiring, conduits, connectors, and shielding.
				X	<i>Steering gear and steering controls.</i> Check the steering gear, steering tie rod, and drag links for loose or damaged parts.
				X	<i>Azle and transfer vent.</i> Inspect for clogging.

### 83. Preventive Maintenance by Organizational Maintenance Mechanics

*a. Intervals.* The indicated frequency of the prescribed preventive maintenance services is considered a minimum requirement for normal operation of vehicle. Under unusual operating conditions, such as extreme temperatures, dust or sand, or extremely wet terrain, it may be necessary to perform certain maintenance services more frequently.

*b. Driver or Operator Participation.* The drivers or operators should accompany vehicles and assist the mechanics while periodic organizational preventive maintenance services are performed. Ordinarily, the driver should present the vehicle for a scheduled preventive maintenance service in a reasonably clean condition.

*c. Special Services.* These are indicated by the item numbers in the columns which show the interval at which the services are to be performed, and show that the parts or assemblies are to receive certain mandatory services. For example, an item number in one or both columns opposite a *Tighten* procedure means that the actual tightening of the object must be performed. The special services are as shown in (1) through (5) below.

- (1) *Adjust.* Make all necessary adjustments in accordance with instructions contained in the pertinent section of this manual and information contained in changes to the subject publication or technical bulletins.
- (2) *Clean.* Clean the unit as outlined in paragraph 81 to remove old lubricant, dirt, and other foreign material.

- (3) *Special lubrication.* This applies either to lubrication operations that do not appear on the vehicle lubrication order or to items that do appear but which should be performed in connection with the maintenance operation if parts have to be disassembled for inspection or service.
- (4) *Serve.* This usually consists of performing special operations, such as replenishing battery water, draining and re-filling units with oil, replacing oil filter, element and cleaning filter, cleaning fuel filter and air cleaner.
- (5) *Tighten.* All tightening operations should be performed with sufficient torque (force on the wrench handle) to tighten the unit according to good mechanical practice. Use a torque-indicating wrench where specified. Do not over-tighten, as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lockwashers, locknuts, locking wires, or cotter pins to secure the tightened parts.

*d. Special Conditions.* When conditions make it difficult to perform the complete preventive maintenance procedures at one time, they can sometimes be handled in sections. Plan to complete all operations within the week if possible. All available time at halts and in bivouac areas must be utilized, if necessary, to assure that maintenance operations are completed. When limited by the tactical situation, items with special services in the columns should be given first consideration.

*e. DA Form 461.* The numbers of the preventive maintenance procedures that follow are identical with those outlined on DA Form 461, Preventive Maintenance Service and Inspection for Wheel and Half-Track Vehicles. Certain items on the form that do not apply to these vehicles are not included in the procedures in this manual. In general, the sequence of items on the form is followed, but in some instances there is deviation for conservation of the mechanic's time and effort.

*f. Procedures.* Table III lists the services to be performed by organizational mechanic or maintenance crew at the designated intervals. Each page of the table has two columns at the left for designated intervals of every 1,000 miles (C service) and 6 months or 6,000 miles, whichever occurs first (D service). Very often it will be found that a particular procedure does not apply to both scheduled intervals. In order to determine which procedure to follow, look down the column corresponding to the maintenance procedure and whenever an item number appears, perform the operations indicated opposite the number.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>INSPECTION AND ROAD TEST</b>		
<p><i>Note.</i> When the tactical situation does not permit a full road test, perform only those items that require little or no movement of the vehicle.</p>		
<p><i>Before operation: Fuel, oil, water, antifreeze, tires, instruments, leaks, general visual inspection of vehicle and equipment. Perform the before-operation service (par. 82).</i></p>		
1	1	<p><i>Dash instruments, switches, and gages, oil pressure, fuel and temperature, ammeter or battery generator indicator, speedometer, and other controls.</i> Note generator output on the ammeter or battery generator indicator immediately after starting engine, before generator regulator has reduced the charging rate. Observe all instruments for normal readings. Note whether the ignition switch and light switch assembly operate freely and make positive contact. Check all other controls for normal operation.</p>
2	2	<p><i>Horn, rear view mirror, and windshield wipers.</i> Sound horn to determine if signal is normal (if tactical situation permits). Test windshield wipers for satisfactory operation. Examine mirror and reflectors.</p>
3	3	<p><i>Engine—idle, acceleration, power, noise, governed speed.</i> In warming up the engine, observe if it starts easily and if choke and throttle controls operate satisfactorily. Note if idling speed is correct. Listen for any unusual noises at idle and higher speeds. When operating the vehicle, note if it has normal power and acceleration in each speed. Listen for any unusual noises when the engine is under load. Speed up the vehicle, on a level stretch, to see if it will reach, but not exceed, the specified governed speed.</p>
4	4	<p><i>Steering—free-play, bind, wander, shimmy, side pull, column, and wheel.</i> With the vehicle moving straightahead, determine if the steering wheel has excessive free play and if there is any tendency to wander, shimmy, or pull to one side. Turn the steering wheel through its entire range and note any bind. Examine steering column and wheel.</p>
5	5	<p><i>Clutch—free travel, drag, noise, chatter, grab, slip.</i> Note if the clutch pedal has 1 inch of free travel and if action of the pedal return spring is satisfactory. Note whether clutch disengages completely or has a tendency to drag. Observe smoothness of engagement and tendency to chatter, grab, or slip and any unusual noise. With transmission in neutral, depress and release clutch pedal, listening for a defective release bearing.</p>

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>INSPECTION AND ROAD TEST—Continued</b>		
7	7	<i>Brakes (service and hand)—braking effect, feel, side pull, noise, chatter, pedal travel, hand control.</i> Note if the brake pedal has correct free travel (par. 217) and if action of return spring is satisfactory. Observe if pedal goes too close to floor. Make several stops, noting side pull, noise, chatter, grabbing, or any other abnormal condition. Observe if the hand brake lever ratchet holds and if the lever requires more than three-quarters travel for full application. Stop the vehicle on an incline and apply the hand brake to determine if it holds the vehicle.
8	8	<i>Generator, starter, and starter switch—action, noise, speed.</i> Note if the starter engages smoothly without unusual noise and turns the engine with adequate cranking speed. Watch the ammeter or battery generator indicator to note whether generator is charging properly.
9	9	<i>Transmission and transfer—lever action, declutching, vibration, noise.</i> Shift transmission into all speeds and transfer into high and low ranges, observing any unusual stiffness of the shift levers, tendency to slip out of gear, unusual noise, or excessive vibration. Make similar observations of the transfer declutch lever.
10	10	<i>Unusual noises—attachments, cab, body and wheels, power train.</i> At all times during the road test, be alert for unusual or excessive noises that may indicate looseness, defects or deficient lubrication at any point.
11	11	<i>Lamps—head, tail, marker, body, stop, spot, and blackout.</i> During stops in the road test, test the operation of exterior and interior lights and light switches. Note whether the headlights appear to be properly aimed. Note condition of all lights and reflectors. Test the spotlight switch and handle for proper operation (ambulance truck M43 and telephone maintenance truck V-41). Test the surgical light and dome light switches and the operation of the surgical light (ambulance truck M43).
<b>AFTER ROAD TEST</b>		
25	25	<i>Temperatures—brake drums, hubs, axles, transmission, transfer, differentials.</i> Immediately after the road test, feel these units cautiously. An overheated wheel hub and brake drum indicates an improperly adjusted, defective or dry wheel bearing or a dragging brake. An abnormally cool condition indicates an inoperative brake. An overheated gear case indicates lack of lubrication, internal maladjustment, or defective parts.  <i>Note.</i> It is normal for hypoid axles and transfer assemblies to run quite hot after the vehicle has been operated a considerable distance. If the axle housings or transfer are too hot for the hand to be placed upon them, it is not necessarily an indication of malfunctioning. If lubricant levels are correct and there were no unusual noises during the road test, assume they are all right.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>AFTER ROAD TEST—Continued</b>		
25		Inspect propeller shaft assemblies. Tighten universal joint companion flange nuts.
26	26	<i>Leaks—engine oil, fuel, water, axle housings, transmission, transfer, steering gear, brake system, exhaust.</i> Make general observations in the engine compartment and underneath the vehicle for evidence of oil, water, fuel, lubricant, or exhaust leaks. Inspect the vents in the front and rear axle, transfer, and steering gear housing for clogging. Inspect spark-plug, manifold, and cylinder-head gaskets. <b>Caution:</b> Do not tighten the cylinder head or exhaust manifold unless there is evidence of looseness or leakage. If cylinder head requires tightening, use a torque-indicating wrench and tighten in the correct sequence (fig. 78) and to proper torque (par. 115 b). <i>Lubrication.</i> Inspect vehicle for proper lubrication. See lubrication order (figs. 33 and 34).
27	27	Lubricate vehicle in accordance with lubrication order. Coordinate with inspection and disassembly operations to avoid duplication.
27	27	During lubrication, inspect tires for unusual wear, penetrating objects, and proper matching.
	27	Rotate and match tires according to tread design and degree of wear. See TM 31-200 for acceptable limits in matching tires. Tighten axle drive flange nuts.
<b>MAINTENANCE OPERATION</b>		
28	28	<i>Batteries—specific gravity.</i> Make hydrometer test of electrolyte in each cell of both batteries (par. 167), and record the readings in space provided on DA Form 461.
29	29	<i>Batteries—voltage.</i> Perform starting motor cranking voltage test (par. 90e), using test meter. Record the voltage registered in space provided on DA Form 461.
29		After battery test, clean tops of batteries, coat terminals lightly with grease, and repaint carrier if corroded. Inspect the level of water to see that it covers the tops of the plates. <i>Note.</i> If distilled or approved water is not available, clean water, preferably rain water, may be used.
30		<i>Compression.</i> Test compression in each cylinder (par. 112), with throttle and choke wide open, and record in space provided on DA Form 461. Perform the compression test with the engine at normal operating temperature.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
MAINTENANCE OPERATION—Continued		
31		<i>Crankcase ventilation.</i> Inspect carburetor air cleaner and air cleaner elbow, and the crankcase ventilation metering valve for cleanliness and good condition (par. 117). On vehicles so equipped, inspect operation of the ventilation shutoff valve dual control (par. 118c).
31		Clean and service these items in accordance with lubrication order and paragraph 133b.
32		<i>Radiator—core, shell, pressure cap, and gasket.</i> Inspect these items, noting particularly if the radiator core is clogged with foreign matter or if fins are bent. Check the gasket on the pressure cap. Observe coolant level and examine coolant for contamination. In cold weather, test coolant with a hydrometer to see if it contains sufficient antifreeze.
32		If need is indicated, drain cooling system (par. 149), clean and fill, adding corrosion inhibitor, unless antifreeze, which contains inhibitor, is used. Tighten radiator mountings and hose clamps.
33		<i>Water pump, fan, drive belt, and pulleys.</i> Inspect pulleys and fan for alinement and belt for tension (par. 152a). Inspect water pump for leaks.
34		<i>Valve mechanism—clearance, cover gaskets.</i> Gage valve tappet clearance (par. 113) and inspect for weak or broken valve springs, low compression or tappet noise. If clearance is incorrect, adjust, and recheck compression. Inspect cover gaskets.
35		<i>Spark plugs—clean and adjust, distributor, cap, rotor, points, shaft, automatic advance and wiring, ignition timing.</i> Remove and inspect spark plugs (par. 124). Remove and inspect the distributor, distributor cap, rotor, and breaker points and test operation of automatic advance mechanism by hand. Test distributor shaft for looseness by hand feel. Install distributor and check the ignition timing with timing light for correct timing and proper advance (par. 126). Test generator regulator with low-voltage circuit tester (par. 92f, i, and j).
35		Clean spark plugs and adjust gap to 0.028 to 0.033 inch (par 124e). Dress distributor breaker points and adjust gap to 0.018 to 0.022 inch (par. 129). If points are badly pitted, replace both points and capacitor (par. 128).
36		<i>Manifolds and heat control valve.</i> Inspect these items. Look particularly for leakage signs at the manifold gaskets. Check the manifold heat control valve seasonal adjustment (par. 114g).

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
<b>MAINTENANCE OPERATION—Continued</b>		
37	37	<i>Carburetor, choke, throttle, linkage, fuel filter, strainer, lines.</i> Inspect these items, noticing particularly if the shafts and linkage operate freely and are not excessively worn. Observe if the choke valve opens fully when the control is released and if the throttle valve opens fully when the accelerator is fully depressed or the hand throttle control is all the way out.
	37	Perform an engine vacuum test and adjust carburetor idle mixture (par. 111). Test that fuel pump pressure (par. 138a) is between 4 and 5½ psi at idling speed.
	37	Clean the strainer in the fuel tank filler pipe (par. 142c) and sediment bowl of the fuel filter (par. 139b). Drain water and sediment from fuel tank if there is evidence of contamination, using a container to catch the drainings.
	38	<i>Exhaust pipe and muffler.</i> Inspect; listen for excessive or unusual noises and look for exhaust leaks.
	38	Tighten mountings.
	39	<i>Brake shoes—linings, anchor pins, shoe return springs, cylinders, and lines.</i> Test the brake linkage or freedom of action. Inspect brake lines for leaks.
	39	Check operation of brake master cylinder (par. 217).
	39	Remove wheels and hubs (par. 205d) and examine brake drums, shoe assemblies, anchor pins, supports, and shoe return springs. Check brake wheel and master cylinders for leakage (pars. 220 and 221). Clean and inspect wheel bearings (par. 228d).
	39	Wheel bearings will be disassembled, cleaned and repacked at every second 6,000-mile inspection, or annually. If the wheel bearings are due for repacking, remove wheels and hubs and inspect the brake internal components as outlined in the preceding paragraph.
	40	<i>Cab and/or body—doors, hardware, glass, top and frame, curtains and fasteners, seats, upholstery, safety straps, and paint.</i> Inspect these items, paying particular attention to cab or body mountings; include springs. Test operation of doors, windows, windshield, ventilator, hood hinges and fasteners. Observe seat mountings and upholstery. Inspect the litter racks and personnel heater (ambulance truck M43). Inspect PR reel, ladder and pole racks and clamps, and all compartments (telephone maintenance truck V41). Make a general inspection of body, including glass, panels, tops, fenders, running boards, tailgate, chains, stakes, bows, paulins, curtains, and radiator and lamp guards. Examine condition of paint and legibility of markings and identification and caution plates.

Table III. Organizational Mechanic or Maintenance Crew C and D Preventive Maintenance Service—Continued

Interval		Procedure
C (Every 1,000 miles)	D (6 months or 6,000 miles, whichever occurs first)	
MAINTENANCE OPERATION—Continued		
	40	Tighten body and hold-down bolts (figs. 210 and 211).
	42	<i>Bumpers—front and rear, pintle, and lifting shackles.</i> Inspect these items. Test operation of pintle assembly and note whether it locks securely.
	44	<i>Winch—power-take-off.</i> Inspect power-take-off, winch drive shaft, and shear pin. Inspect winch cable. Test winch operation (par. 55). Inspect vent in the worm housing for clogging.
	44	Clean and oil winch cable in accordance with the lubrication order (figs. 33 and 34).

## Section IV. TROUBLESHOOTING

### 84. General

a. This section contains troubleshooting information and tests for locating and correcting some of the troubles which may develop in the vehicle. Troubleshooting is a systematic isolation of defective components by means of an analysis of vehicle trouble symptoms; testing to determine the defective component and applying the remedies. Each symptom of trouble given for an individual unit or system is followed by a list of probable causes of the trouble and suggested procedures to be followed.

b. This manual cannot cover all possible troubles that may occur under the many conditions of operation. If a specific trouble, test, and remedy therefor are not covered herein, proceed to isolate the system in which the trouble occurs and then locate the defective component. Do not neglect use of any test instruments such as the low voltage circuit tester, carbon pile resistor and rheostat, adapter set, test lamp, hydrometer, and pressure and vacuum gages that are available (par. 89). Standard automotive theories and principles of operation apply in troubleshooting the vehicle. Question vehicle driver to obtain maximum number of observed symptoms. The greater the number of symptoms of troubles that can be evaluated, the easier will be the isolation of the defect.

## 85. Engine

### a. Engine Will Not Turn.

- (1) *Starter inoperative.* Refer to paragraph 91a.
- (2) *Damaged starter pinion or flywheel ring gear.* If the starter hums but will not engage, remove the starter (par. 158a) and inspect the starter pinion and the flywheel ring gear. Replace starter (par. 158) or notify ordnance maintenance personnel.
- (3) *Mechanical seizure of parts.* Remove spark plugs (par. 124d). Place the transmission in fourth gear, jack up rear wheel, and attempt to turn the engine by turning the rear wheel. If the engine still cannot be turned, notify ordnance maintenance personnel.

### b. Engine Turns but Will Not Start or Starts Hard.

- (1) *Ignition system faulty.* Refer to paragraph 93a.
- (2) *Fuel system faulty.* Refer to paragraph 86a.
- (3) *Valves faulty.* Check compression (par. 112) to determine if valves are faulty. Adjust valve tappets (par. 113) or notify ordnance maintenance personnel.

### c. Engine Does Not Idle Properly or Misfires on Acceleration.

- (1) *Fuel system faulty.* Refer to paragraph 86d.
- (2) *Ignition system faulty.* Refer to paragraph 93d.
- (3) *Crankcase ventilation shutoff valves closed (on vehicles so equipped).* Open valves. Check operation of both shutoff valves and dual control (par. 118 c and e).
- (4) *Intake manifold or manifold gasket leaks.* Replace manifold or gaskets (par. 114).
- (5) *Compression low.* Check compression (par. 112) to determine if valves are faulty. Adjust valves (par. 113) or notify ordnance maintenance personnel.
- (6) *Exhaust system restricted.* Refer to paragraph 87b.

### d. Engine Does Not Develop Full Power.

- (1) *Ignition system faulty.* Refer to paragraph 93e.
- (2) *Fuel system faulty.* Refer to paragraph 86c.
- (3) *Compression low.* Refer to c (5) above.
- (4) *Exhaust system restricted.* Refer to paragraph 87b.

### e. Engine Misfires at High Speed.

- (1) *Ignition system faulty.* Refer to paragraph 93f.
- (2) *Valves faulty.* Refer to b(3) above.

### f. Excessive Oil Consumption.

- (1) *Leaks.* Visually inspect the engine for external oil leaks. Service as necessary. If servicing does not correct the condition, notify ordnance maintenance personnel.
- (2) *Crankcase ventilation shutoff valves closed (on vehicles so equipped).* Refer to c(3) above.

(3) *Fuel pump main body oil seal defective.* Check the fuel pump main body oil seal by disconnecting the fuel pump-to-manifold vacuum line (A, fig. 105). If oil is evident, replace the fuel pump (par. 138).

(4) *Compression low.* Refer to *c*(5) above.

*g. Excessive Fuel Consumption.*

(1) *Fuel system faulty.* Refer to paragraph 86e.

(2) *Ignition system faulty.* Refer to paragraph 93g.

(3) *Valves faulty.* Refer to *b*(3) above.

(4) *Exhaust system restricted.* Refer to paragraph 87b.

*h. Engine Overheats.*

(1) *Cooling system faulty.* Refer to paragraph 88a.

(2) *Ignition system faulty.* Refer to paragraph 93e.

(3) *Cylinder-head gasket or carburetor mounting gasket defective.* To check for damaged cylinder-head gasket, remove the thermostat (par. 151b) and fan belt (par. 152b(1)), run the engine and observe coolant in the outlet elbow opening. If air bubbles appear in the coolant, replace cylinder-head gasket (par. 115c through *g*). Replace a defective carburetor mounting gasket (par. 137).

*i. Engine Noises.*

(1) *Spark knock or ping.* (A sharp metallic knock occurring on acceleration or when operating under heavy load.)

(a) *Ignition timing too early.* Check with timing light and adjust (par. 126).

(b) *Carbon accumulation in combustion chamber.* Remove cylinder head and clean carbon (par. 115c).

(c) *Engine overheats.* Refer to *h* above.

(d) *Distributor automatic advance not functioning properly.* Check spark advance with timing light (par. 126). Replace distributor if automatic advance is faulty (par. 125).

(2) *Piston slap.* (A clear metallic knock heard when engine is under load but not always audible at high speeds or at idle.) Notify ordnance maintenance personnel.

*Note.* This condition may be considered normal if piston slap is evident when engine is cold and diminishes as engine temperature increases.

(3) *Piston pin noise.* (A metallic knock usually occurring, when idling, with engine hot.) Notify ordnance maintenance personnel.

(4) *Main or connecting rod bearing knock.* (A sharp metallic knock heard momentarily during rapid acceleration.) Notify ordnance maintenance personnel.

(5) *Fan belt noisy.* (A partially broken or loose fan belt will

- cause a rhythmic noise. A glazed fan belt will cause an intermittent squeal.) Adjust or replace fan belt (par. 152).
- (6) *Flywheel ring gear noise.* (A loud grating noise heard after servicing.) Flywheel ring gear noise may be caused by insufficient clearance between flywheel ring gear and clutch housing drain plug (on vehicles equipped with a  $\frac{3}{4}$ -inch pipe plug). Correction can be made by removing the pipe plug and cutting one-eighth inch from the thread end of plug.

## 86. Fuel System

### *a. Engine Turns but Will Not Start or Starts Hard.*

- (1) *Lack of fuel.* Fill fuel tank.
- (2) *Fuel filter to fuel pump shutoff cock closed.* Open fuel line shutoff cock (H, fig. 86).
- (3) *Fuel filter plugged.* Remove and clean filter element or replace filter as required (par. 139).
- (4) *Fuel pump faulty.* Check fuel pump pressure. Replace fuel pump if necessary (par. 138).
- (5) *Fuel lines plugged.* Check fuel lines for restriction (par. 141).
- (6) *Choke inoperative.* Check operation of choke control and lever. Adjust control if necessary (par. 134a).
- (7) *Throttle inoperative.* Check throttle control and accelerator linkage for proper operation. Service or adjust as necessary (par. 134b).
- (8) *Carburetor air cleaner oil level too high.* Service air cleaner (par. 133b).
- (9) *Carburetor floods.* Refer to *b* below.
- (10) *Carburetor and governor faulty.* If (1) through (4) above do not correct the condition, replace carburetor (par. 137).

*b. Carburetor Floods.* If carburetor flooding is evidenced, push the choke control all the way in, pull the throttle control out, and crank the engine with the starter to force excess fuel from the engine.

- (1) *Choke stuck.* Refer to *a*(6) above.
- (2) *Fuel pump pressure excessive.* Check fuel pump pressure and replace fuel pump if pressure exceeds  $5\frac{1}{4}$  psi (par. 138).
- (3) *Carburetor and governor faulty.* If (1) and (2) above do not correct the condition, replace carburetor (par. 137).

### *c. Engine Does Not Develop Full Power.*

- (1) *Throttle linkage incorrectly adjusted, worn, or damaged.* Adjust throttle control or bellcrank to carburetor rod (par. 134b). Replace worn or damaged throttle linkage parts as required (par. 144).
- (2) *Carburetor governor incorrectly adjusted.* Check governor operation by operating vehicle in second speed and observe

the speedometer reading. If a speed of 17 mph cannot be reached in second speed, replace carburetor (par. 137) or notify ordnance maintenance personnel.

- (3) *Ignition system faulty.* Refer to paragraph 93e.
- (4) *Valves faulty.* Refer to paragraph 85b(3).
- (5) *Exhaust system restricted.* Refer to paragraph 87b.
- (6) *Other causes.* If causes of trouble cannot be located by performing (1) through (5) above, notify ordnance maintenance personnel.

*d. Engines Does Not Idle Properly or Misfires on Acceleration.*

- (1) *Carburetor incorrectly adjusted.* Adjust carburetor (par. 111).
- (2) *Fuel filter restricted.* Clean or replace fuel filter as required (par. 139).
- (3) *Carburetor air cleaner restricted.* Service air cleaner (par. 133b).
- (4) *Carburetor faulty.* Replace carburetor (par. 137).
- (5) *Ignition system faulty.* Refer to paragraph 93d.
- (6) *Valves faulty.* Refer to paragraph 85b(3).
- (7) *Other causes.* If cause of trouble cannot be located by performing (1 through 6) above, notify ordnance maintenance personnel.

*e. Excessive Fuel Consumption.*

- (1) *Fuel leaks.* Check for fuel leaks and service as required.
- (2) *Carburetor air cleaner restricted.* Service air cleaner (par. 133b).
- (3) *Choke control incorrectly adjusted.* Check operation of choke control and lever. Adjust control if necessary (par. 134a). If carburetor choke valve is inoperative, replace carburetor (par. 137).
- (4) *Ignition system faulty.* Refer to paragraph 93g.
- (5) *Valves faulty.* Refer to paragraph 85b(3).
- (6) *Exhaust system restricted.* Refer to paragraph 87b.
- (7) *Other causes.* If cause of trouble cannot be located by performing (1 through 6) above, notify ordnance maintenance personnel.

## **87. Exhaust System**

*a. Exhaust Leaks.*

- (1) *Damaged muffler, tail pipe, or exhaust pipes.* Inspect muffler, tail pipe, and exhaust pipes for corrosion or other visual damage. Replace parts as necessary (par. 146).
- (2) *Exhaust manifold gasket leaks.* Inspect manifold gaskets for leaks. Replace gaskets if necessary (par. 114).
- (3) *Manifold flanges cracked.* Inspect manifold flanges for cracks. Replace manifold if necessary (par. 114).

- (4) *Leaks at exhaust pipes, muffler, or tail pipe connections.* Inspect exhaust pipes, muffler, or tail pipe attaching screws and gaskets. Service or replace as necessary (par. 146).

**Warning:** Correct exhaust leaks as soon as possible to prevent illness of driver and passengers resulting from exhaust fumes.

*b. Engine Does Not Develop Full Power.*

- (1) *Exhaust system restricted.* Remove obstruction from tail pipe, replace damaged or restricted muffler, tail pipe, or exhaust pipes (par. 146).
- (2) *Ignition system faulty.* Refer to paragraph 93e.
- (3) *Fuel system faulty.* Refer to paragraph 86c.
- (4) *Compression low.* Refer to paragraph 85c(5).
- (5) *Other causes.* If cause of trouble cannot be located by performing (1) through (4) above, notify ordnance maintenance personnel.

## 88. Cooling System

*a. Engine Overheats.*

- (1) *Insufficient cooling solution.* Replenish solution.
- (2) *External leaks.* Inspect hoses, clamps, radiator core, water pump, drain cocks, cylinder outlet elbow, engine block expansion plugs, and water temperature gage sending unit fitting for leaks. Service as necessary.
- (3) *Radiator fins clogged.* If foreign matter is lodged between radiator fins, blow out with compressed air and flush with a hose from engine side.
- (4) *Fan belt loose or broken.* Adjust loose fan belt. Replace broken fan belt (par. 152).
- (5) *Radiator core and/or engine block restricted.* Clean and flush cooling system (par. 149).
- (6) *Thermostat defective, missing, or incorrectly installed.* Install or replace thermostat (par. 151).
- (7) *Water pump faulty.* To check operation of water pump, drain cooling system to a level below the water pump bypass elbow, remove bypass elbow and hose (par. 150d); turn the fan by hand and note if water pump impeller turns. If impeller does not turn, replace water pump (par. 154d and f).
- (8) *Water temperature gage or gage sending unit faulty.* Refer to paragraph 95a.
- (9) *Ignition system faulty.* Refer to paragraph 93e.
- (10) *Exhaust system restricted.* Refer to paragraph 87b.

*b. Engine Runs Too Cold.*

- (1) *Water temperature gage or sending unit faulty.* Refer to paragraph 95a.

- (2) *Thermostat stuck in open position.* Check thermostat and replace if necessary (par. 151).
  - (3) *Thermostat missing.* Install correct thermostat (par. 151).
- c. *Loss of Coolant.*
- (1) *Hose or hose connections faulty.* Tighten hose clamps or replace hose as required (par. 150).
  - (2) *Water pump or water pump gasket faulty.* Replace water pump and/or gasket as required (par. 154).
  - (3) *Radiator leaks.* Replace radiator (par. 153).
  - (4) *Cylinder head loose or cylinder-head gasket faulty* Tighten cylinder-head cap screws or replace cylinder head or gasket as required (par. 115).
  - (5) *Radiator cap or radiator cap gasket faulty.* Replace radiator cap or gasket as required.
  - (6) *Cylinder block leaks.* Notify ordnance maintenance personnel.
  - (7) *Cylinder-head outlet elbow on gasket faulty.* Replace elbow and/or gasket.

## 89. Electrical Testing Equipment

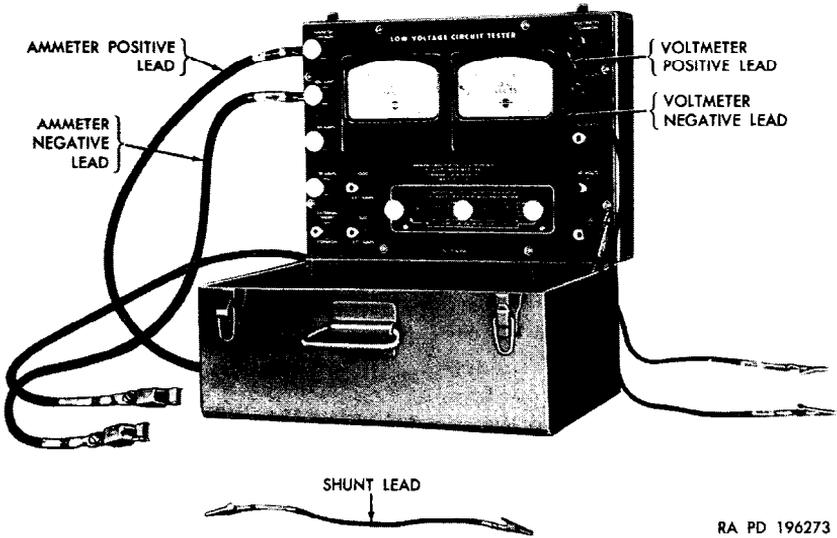
a. *General.* Troubleshooting of components of the electrical system may be accomplished with the use of testing equipment available to organizational maintenance crews. This equipment includes the low voltage circuit tester (fig. 40), the carbon pile resistor and field rheostat (fig. 41), and the adapter set (fig. 42).

### b. *Hook-up of Low Voltage Circuit Tester.*

- (1) All leads of the low voltage circuit tester affected by polarity are identified either by a red or black protector over the connecting clip or by the symbols + or - at the end of the test lead. Red indicates a positive (+) connector and black indicates a negative (-) connector.
- (2) To insure correct meter readings, the positive (+) test lead clip for either the test voltmeter or the test ammeter must always be connected at the emanating source of current flow. For example, if the current is flowing from the batteries, the positive (+) test lead must be connected to the battery side of the circuit; however, if current is flowing from the generator to the batteries, the positive (+) test lead must be connected to the generator side of the circuit.

## 90. Batteries

a. *Batteries Damaged.* Check batteries for damaged case, terminals, or cell cover plates. If any of these conditions are noted, replace batteries (par. 168).



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Figure 40. Low voltage circuit tester.



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Figure 41. Carbon pile resistor and field rheostat.

KEY	ITEM
A	ADAPTER—17-A-2967-50
B	ADAPTER—17-A-1375-50
C	ADAPTER—17-A-2975
D	ADAPTER—17-A-2987-50
E	ADAPTER—17-A-2987-75

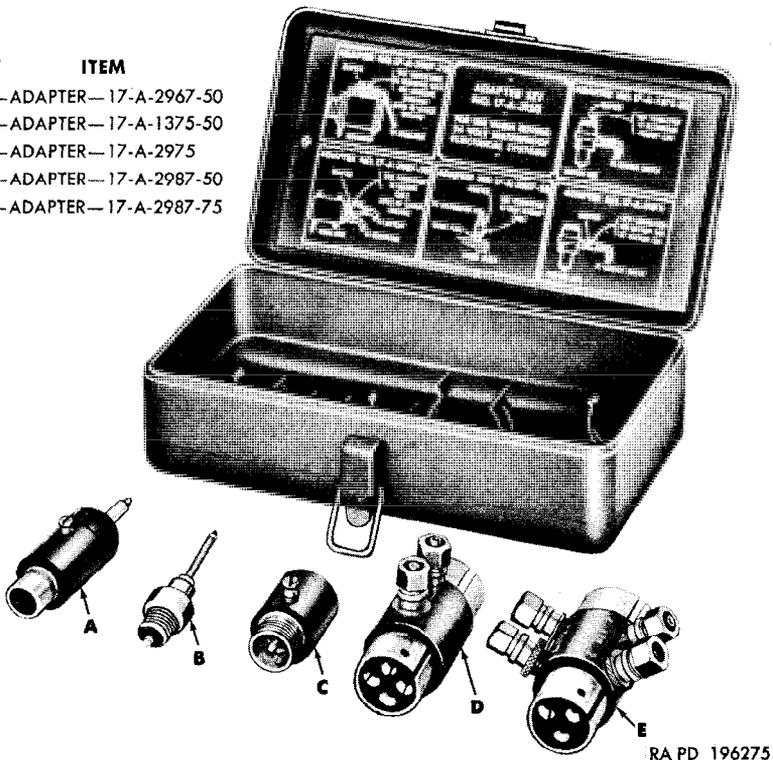


Figure 42. Adapter set 17-A-3150.

*b. Batteries Discharged.*

- (1) *Excessive use of starter.* Avoid unnecessary use of starter.
- (2) *Ignition switch or vehicle lights left on for long periods.* Turn ignition and light switches off when vehicle is not in operation.
- (3) *Battery to starter cable short circuiting on battery hold down cover.* Remove, clean, and install insulator and cover (par. 168).
- (4) *Generator voltage regulator faulty.* Check voltage regulator (par. 92*f* through *i*) and correct as necessary.
- (5) *Lack of periodic battery inspection.* Check batteries at specified intervals (refer to table III.).

*c. Check Battery Specific Gravity.* Refer to paragraph 167.

*d. Check Battery Voltage* (fig. 43). The battery voltage check is to determine the battery condition.

- (1) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the positive (+) terminal of the inner battery.

- (2) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the negative (-) post of the outer battery.
- (3) *Read voltmeter.* Observe the reading on the lower scale of the tester voltmeter. This reading should be at least 23 volts, with the batteries at a temperature of 70° F. Voltage reading will be lower at lower temperatures and higher at higher temperatures. If the combined voltage of the two batteries is less than 23 volts (at 70° F.), check each battery. Replace battery (par. 168) if voltage reading shows less than 11.5 volts.
- (4) *Remove testing equipment.* When the check has been completed, remove the testing equipment.

*e. Check Battery Voltage Drop (Starter Cranking Engine).* The check of the battery voltage drop with the starter cranking the engine is to determine the condition of the batteries and the starter. The engine must be at normal operating temperature for this check.

- (1) *Connect voltmeter test leads.* Connect the voltmeter test leads (d (1) and (2) above) and note the combined voltage reading of the batteries.
- (2) *Read voltmeter.* Crank the engine with the starter (ignition switch off) and observe the voltmeter lower scale reading. The reading should not drop below 22 volts. A reading of less than 22 volts with the starter cranking the engine indi-

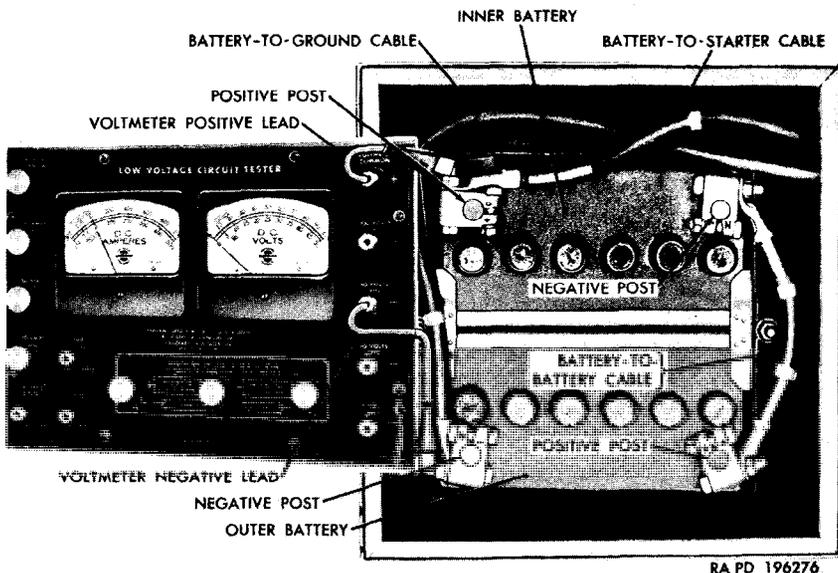
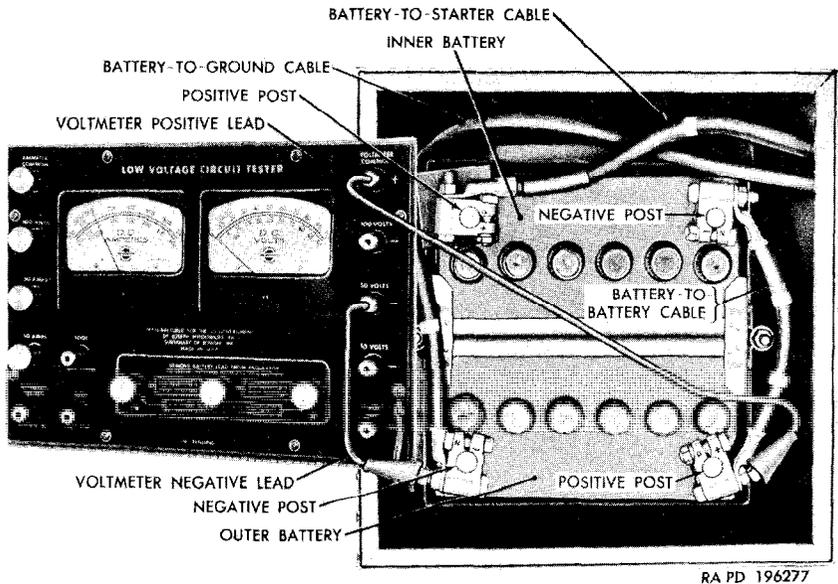


Figure 43. Testing battery voltage.

cates partially discharged or defective batteries or a faulty starter. Check each battery individually ((3) and (4) below) to determine whether one or both batteries are at fault.

- (3) *Check voltage of outer battery* (fig. 44). Connect the positive (+) test lead clip to the positive (+) post of the outer battery and the negative (-) test lead clip to the negative (-) post of the outer battery. Crank the engine with the starter (ignition switch off) and note the reading on the voltmeter lower scale.
- (4) *Check voltage of inner battery* (fig. 45). Connect the positive (+) test lead clip to the positive (+) post of the inner battery and the negative (-) test lead clip to the negative (-) post of the inner battery. Crank the engine with the starter (ignition switch off) and note the reading on the voltmeter lower scale.
- (5) *Compare voltage readings of the two batteries.* The reading for each battery should be not less than 11 volts and variation between the two batteries should not exceed 1 volt. If voltage reading of one battery is low, replace the low battery (par. 168) and repeat the check described in (1) and (2) above.

*f. Check Battery-to-Battery Cable Resistance* (fig. 46). Testing the resistance in the battery to battery cable is to isolate excessive resistance between the batteries. When making this check, the test leads



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Figure 44. Testing voltage of outer battery.

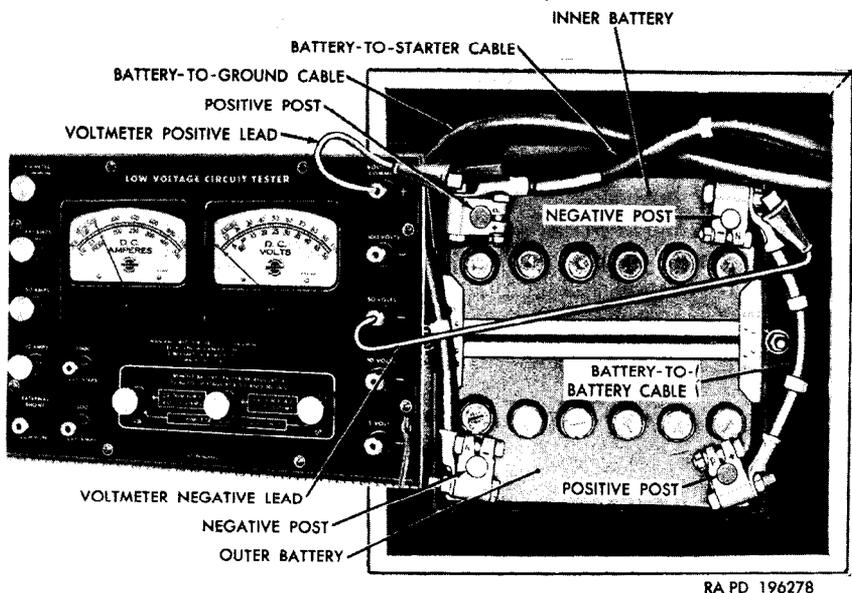


Figure 45. Testing voltage of inner battery.

must be attached to test prods in the battery posts, rather than to the battery cable terminals, to insure accurate readings.

*Note.* To make a test prod, use a short length of 1/8-inch welding rod and grind one end to a sharp, long point. Two prods will be required. Using a light hammer, drive the prods into the center of the battery posts.

- (1) *Warm up engine.* Start the engine and run at idling speed until normal operating temperature is reached. Stop the engine.
- (2) *Install test prods in battery posts.* Drive a test prod into the positive (+) post of the outer battery and the negative (-) post of the inner battery.
- (3) *Connect voltmeter positive (+) test lead.* Connect the positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the test prod in the positive (+) post of the outer battery.
- (4) *Connect voltmeter negative (-) test lead.* Connect the negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the test prod in the negative (-) post of the inner battery.
- (5) *Read voltmeter.* Crank the engine with the starter (ignition switch) and observe the upper scale of the voltmeter. The voltage reading should not exceed 0.1 volt. If the reading exceeds 0.1 volt, check for corroded battery terminals or a loose cable in the cable terminals. Clean corrosion from terminals. Replace a defective cable (par. 169c).

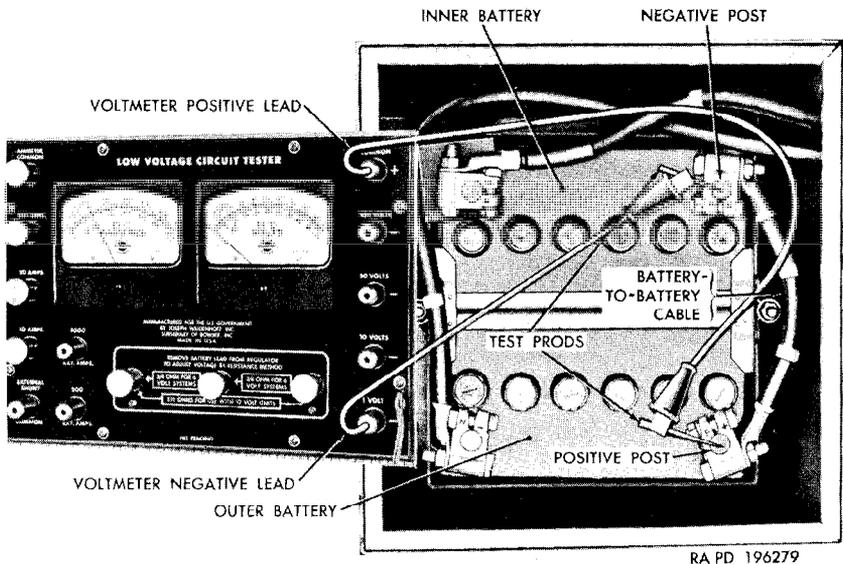


Figure 46. Testing battery-to-battery cable resistance.

- (6) *Remove testing equipment.* When the test has been completed, remove the testing equipment and the test prods.

## 91. Starting System

### a. Starter Inoperative.

- (1) *Batteries discharged.* Test batteries for specific gravity and condition (pars. 90 and 167). Replace battery if necessary (par. 168).
- (2) *Battery cables loose, corroded, or broken.* Clean and tighten all electrical connections at battery, ground, and starter. Replace broken or defective cables (par. 169).
- (3) *Starter switch faulty.* Connect a suitable jumper cable from the battery to starter cable terminal to the other starter switch terminal, to bypass the starter switch. Scrape lacquer from the switch terminal to insure a good connection. If the starter runs, it indicates that the starter switch is defective. Replace the starter switch (par. 159).
- (4) *Starter faulty.* If starter is inoperative after checking or replacing switch, replace starter (par. 158).

### b. Starter Spins But Does Not Crank Engine.

- (1) *Flywheel ring gear broken.* Remove the starter (par. 158a) and inspect flywheel ring gear teeth. If teeth are broken or damaged, report to ordnance maintenance personnel.
- (2) *Starter pinion damaged.* Replace starter (par. 158).

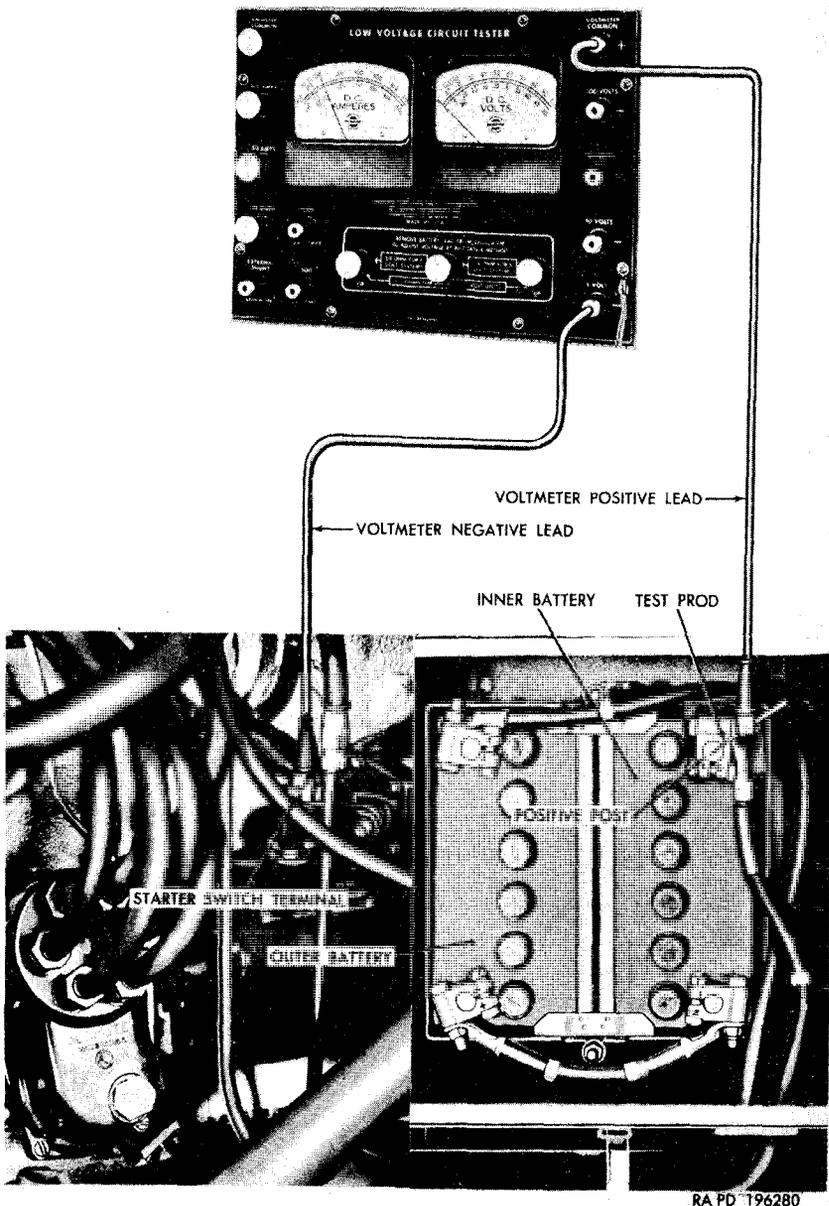
*c. Starter Cranks Engine Slowly (Batteries Satisfactory).* Check voltage drop (resistance) in circuits between starter and battery with starter cranking engine (par. 90f). If voltage drop is not excessive, replace starter (par. 158).

*d. Check Battery-to-Starter Cable Resistance* (fig. 47). Check for excessive resistance (voltage drop) in the battery-to-starter cable to determine cause of malfunction of the starting system. The engine must be at normal operating temperature.

- (1) *Install test prod in battery post.* Drive a test prod into the positive (+) post of the inner battery (par. 90f).
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the test prod.
- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the starter switch terminal.
- (4) *Crank engine and read voltmeter.* Crank the engine with the starter (ignition switch off) and observe the reading on the upper scale of the tester voltmeter. The reading should not exceed 0.2 volt.
- (5) *Clean connections or replace battery-to-starter cable.* If reading exceeds 0.2 volt, check for loose or dirty connections at the starter switch and battery, a corroded battery terminal, or a loose cable in cable terminals. Clean and tighten connections. Replace a defective battery to starter cable (par. 169f and g).
- (6) *Remove testing equipment.* After completing the check, remove the testing equipment and the prod from the battery post.

*e. Check Starting System Ground Circuit Resistance* (fig. 48). The resistance check of the starting system ground circuit is to determine cause of malfunction of the starting system. The engine must be at normal operating temperature.

- (1) *Install test prod in battery post.* Drive a test prod into the negative (-) post of the outer battery (par. 90f).
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and connect the clip end of the lead to the starter frame.
- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the prod in the negative (-) post of the outer battery.



*Figure 47. Checking battery-to-starter cable resistance.*

- (4) *Read voltmeter.* Crank the engine with the starter (ignition switch off) and observe the reading of the upper scale of the tester voltmeter. The reading should not exceed 0.1 volt. If voltage reading exceeds 0.1 volt, check for a loose starter, a loose or damaged ground strap, a loose or corroded ground cable connection at frame, loose or corroded cable terminal at battery, or loose cable in cable terminal. If all

connections are clean and tight and the cables are in good condition, it indicates that the starter is at fault. Replace defective starter (par. 158).

- (5) *Remove testing equipment.* After completing the check, remove the testing equipment and the test prod from the battery post.

## 92. Charging System

*a. General.* Troubleshooting of the charging system includes checking of the generator, generator regulator, and cables.

*b. Ammeter or Battery Generator Indicator Does Not Indicate Charge.* Check generator operating voltage (*e* below).

*c. Excessive Evaporation of Water in Batteries.* Generator voltage regulator setting too high. Check voltage at generator regulator (*i* below).

*d. Batteries Require Frequent Recharging.* Generator voltage regulator setting too low. Check voltage at generator regulator (*i* below).

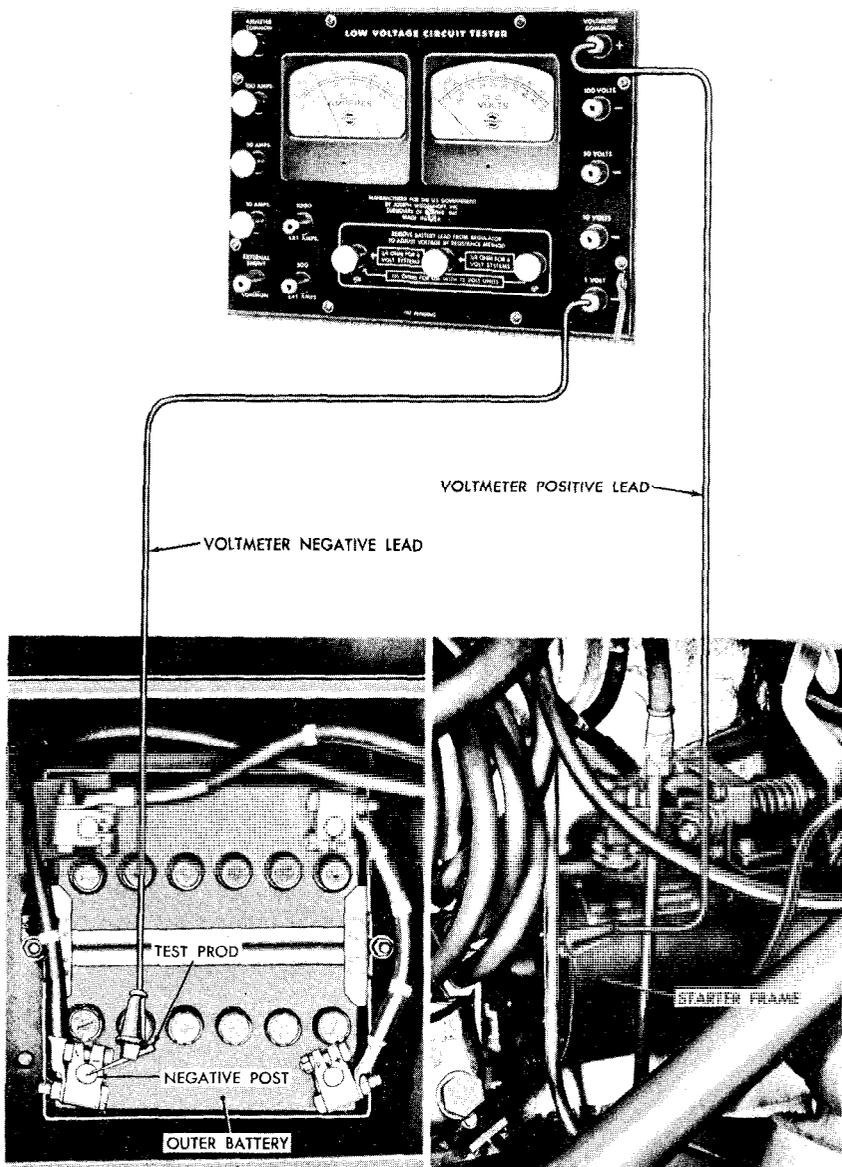
*e. Check Generator and Generator Regulator for No-Charge* (fig. 49). The generator and generator regulator check is to determine the cause of a no-charge reading of the ammeter or battery generator indicator. In order to obtain accurate readings, the engine must be at normal operating temperature to idle properly during the test.

- (1) *Warm up engine.* Start the engine and run until normal operating temperature is reached. Stop the engine.
- (2) *Disconnect generator-to-regulator cable and install adapter.* Disconnect the generator-to-regulator cable from the receptacle on the generator by unscrewing the cable connector nut with a spanner wrench. Install adapter 17-A-2987-75 (E, fig. 42) in the generator receptacle. Close both links of the adapter.

*Note.* Do not connect the cable to the adapter.

- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the adapter ARM terminals.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (5) *Connect tester shunt lead.* Connect the tester shunt lead to the other ARM terminal of the adapter and to one of the adapter FIELD terminals.

**Caution:** Do not perform any tests with the shunt lead connecting the ARM and FIELD terminals of the generator



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Figure 48. Checking starting system ground circuit resistance.

adapter when the generator is connected to the battery, as the resulting high voltage will be detrimental to the entire electrical system and cause failure of parts.

- (6) *Run engine and read voltmeter.* Start the engine and operate at idle speed. Observe the voltmeter lower scale reading.

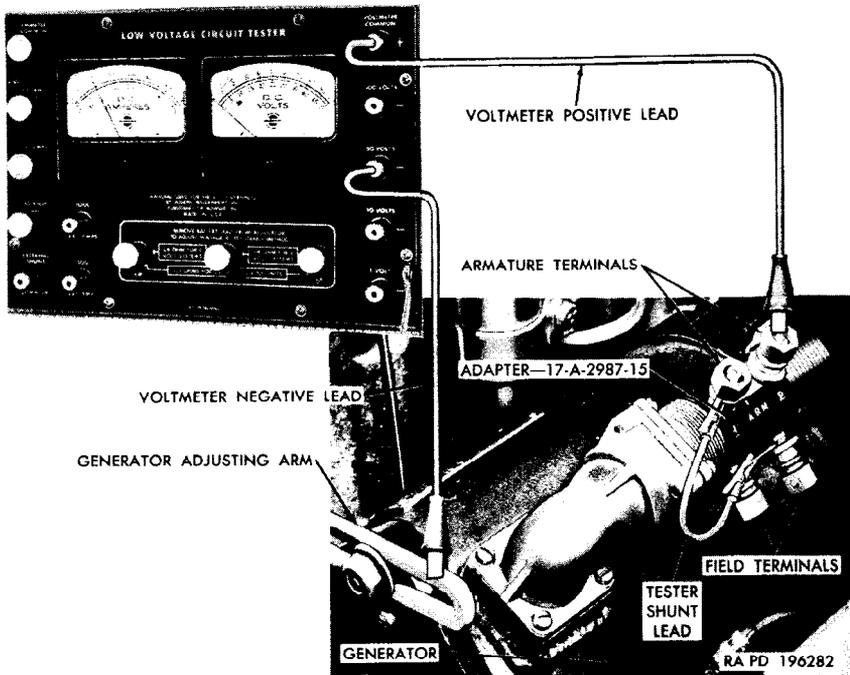


Figure 49. Troubleshooting generator.

The voltage reading should be 30 volts with the engine at idling speed or slightly faster.

- (7) *Source of trouble.* If voltage reading is low or no reading is shown on voltmeter, the generator is probably at fault. Replace the generator (par. 164). If the voltage reading is 30 volts or more, the generator is functioning properly, and a faulty generator regulator is probably the cause of the "no charge" condition. Replace the generator regulator (par. 165).

- (8) *Remove testing equipment and connect generator-to-regulator cable.* Remove testing equipment. Connect generator-to-regulator cable to receptacle on generator and tighten nut with a spanner wrench.

*f. Check Maximum Charge* (fig. 50). Checking the maximum charge is to determine whether the current regulator of the generator regulator is functioning properly.

- (1) *Disconnect battery-to-ground cable.* Disconnect the battery-to-ground cable from the negative (-) post of the outer battery to prevent an accidental ground while connecting test leads.
- (2) *Install adapter in generator terminal receptacle.* Disconnect the generator to regulator cable from the receptacle on the generator and install adapter 17-A-2987-75 (E, fig. 42) in

receptacle. Make certain that the link between adapter ARM terminals is closed. Insert the cable in the adapter.

- (3) *Connect voltmeter test leads.* Connect tester voltmeter positive (+) and negative (-) test leads as instructed in e(3) and (4) above.

*Note.* Do not connect the tester shunt lead.

- (4) *Install adapter at generator regulator.* Unscrew the cable connector nut from the generator regulator rear receptacle and remove the cable. Install adapter 17-A-2987-50 (D, fig. 42) in the receptacle and connect the cable to the adapter. Open the link on the adapter.
- (5) *Connect ammeter positive (+) test lead.* Connect the ammeter positive (+) test lead to the AMMETER COMMON terminal of the low voltage circuit tester and attach the clip end of the lead to the inner terminal of the adapter in the generator regulator.
- (6) *Connect ammeter negative (-) test lead.* Connect the ammeter negative (-) test lead to the 50 AMPS terminal of the tester and attach the clip end of the lead to the outer terminal of the adapter in the generator regulator.

**Caution:** Insert clean wiping cloth or other suitable insulation between the two ammeter lead clips and around each clip to prevent accidental grounding when the battery is connected to the circuit.

- (7) *Connect battery-to-ground cable.* Connect the battery-to-ground cable to the negative (-) post of the outer battery.
- (8) *Position carbon pile resistor and field rheostat in vehicle.* Place the carbon pile resistor and field rheostat 17-R-6249 (fig. 41) in the driver's compartment convenient to the batteries (on ambulance truck M43 with batteries under the left litter rack, place the resistor in the patient compartment).
- (9) *Connect carbon pile resistor leads to battery.* Connect one of the carbon pile resistor leads to the positive (+) terminal of the inner battery and the other lead to the negative (-) terminal of the outer battery.
- (10) *Start engine and read test meters.* Start the engine and operate at a speed equivalent to 20 mph for 15 minutes. Observe the reading on the lower scale of the tester ammeter. If the ammeter reading is less than 24 amperes, hold the carbon pile switch in the ON position and turn the carbon pile knob clockwise until the tester voltmeter lower scale shows a reading of not less than 25 volts. Observe the ammeter lower scale reading. The ammeter should indicate a charge of 24 to 27 amperes.

*Note.* Avoid turning the carbon pile knob clockwise further than is necessary to produce the full charging rate.

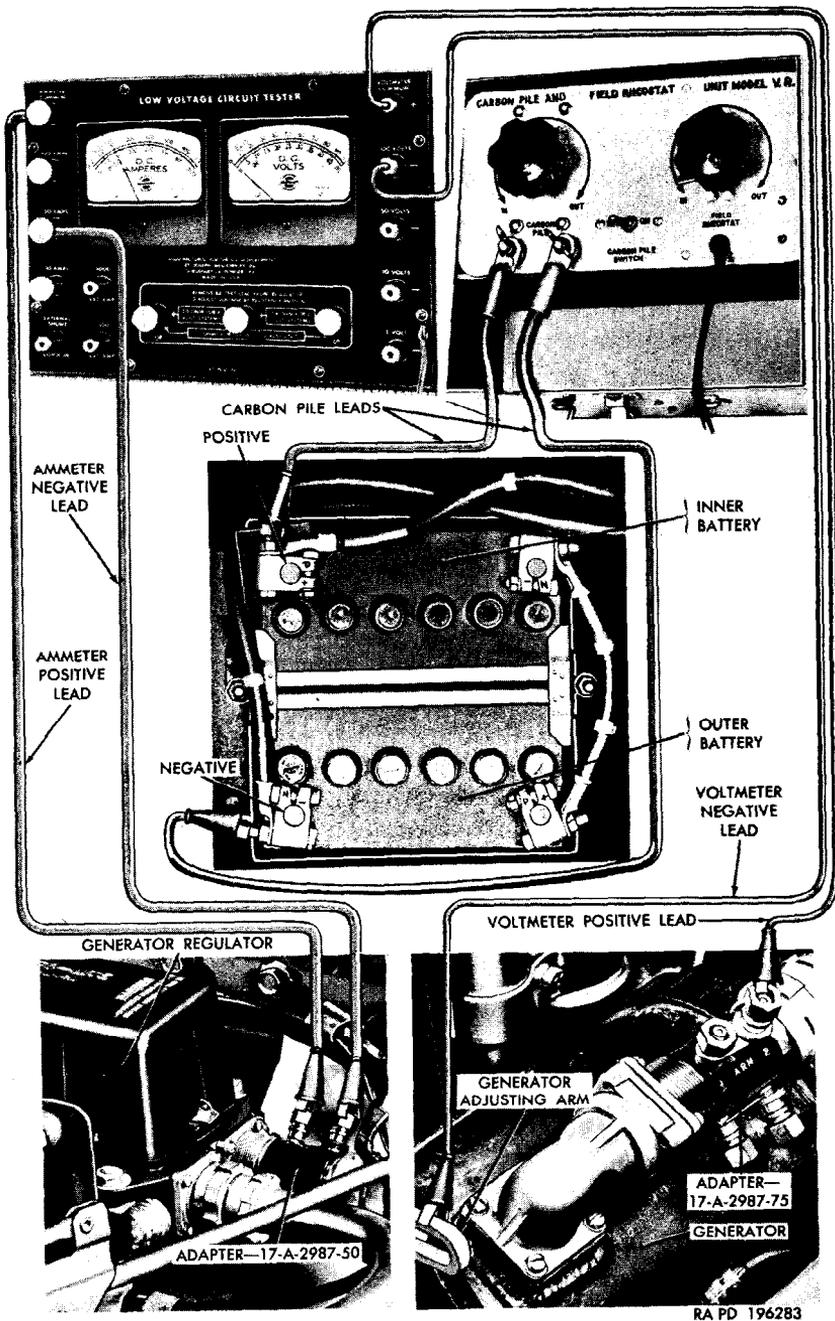


Figure 50. Checking maximum charge.

- (11) *Stop engine and perform necessary repairs.* Stop the engine. If the ammeter reading is less than 24 amperes, replace the generator regulator (par. 165), or notify ordnance maintenance personnel.
- (12) *Remove testing equipment.* When the check has been completed, disconnect battery-to-ground cable from the negative (-) post of the outer battery and remove the testing equipment. Connect battery-to-ground cable to battery. Connect generator-to-regulator cable to the generator and generator regulator.

*g. Check Charging System Insulated Cables Resistance* (fig. 51). Checking resistance in the charging system insulated cables is to determine malfunctions which affect the operation of the voltage regulator. With the exception of the voltmeter test leads, all connections are the same as those described in *f* above.

- (1) *Disconnect battery-to-ground cable.* Remove the battery-to-ground cable from the negative (-) post of the outer battery.
- (2) *Install test prod in battery post.* Drive a test prod into the positive (+) post of the inner battery.
- (3) *Connect voltmeter positive (+) lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the "ARM" terminals of the adapter in the generator receptacle.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester.

*Note.* Do not attach the clip end of the lead at this time.

- (5) *Start engine.* Start the engine and operate at a speed equivalent to 20 mph.
- (6) *Connect voltmeter negative (-) test lead to battery.* Attach the clip end of the voltmeter negative (-) lead to test prod in the positive (+) post of the inner battery.

**Caution:** Do not attach the voltmeter negative (-) test lead to the battery until the engine is running, to prevent full battery voltage from being impressed across the voltmeter of the low voltage circuit tester, causing an inaccurate scale reading or damage to the tester.

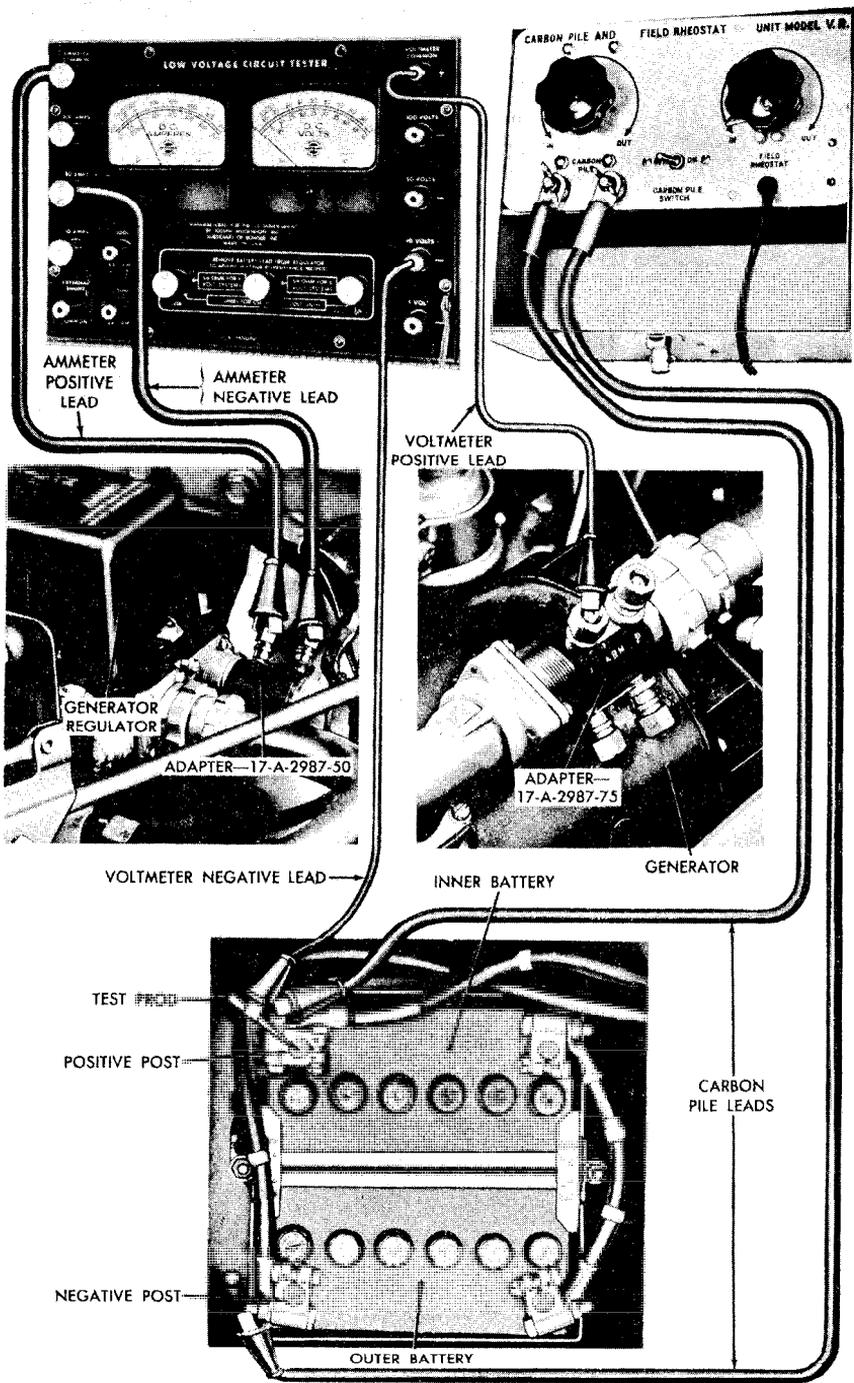
- (7) *Operate carbon pile resistor and read voltmeter.* Operate the carbon pile switch and knob (*f* (10) above) and observe the upper scale of the voltmeter. The voltage reading should not exceed 1 volt when the generator is charging 24 to 27 amperes.

- (8) *Remove testing equipment and perform necessary repairs.* If voltage reading exceeds 1 volt, check for loose or corroded connections at the starter switch and battery terminal, and check for loose or damaged terminals on the battery-to-starter cable. Clean and tighten connections. Replace a damaged cable (par. 169*f* and *g*). Repeat the test. If resistance in the cable is satisfactory, remove the testing equipment (*f*(12) above) and test prod. Connect the cable to the generator and generator regulator.

*h. Check Charging System Ground Circuit Resistance* (fig. 52). Checking the charging system ground circuit resistance is to determine malfunctions which affect the operation of the voltage regulator. The generator must be operating properly and the engine must be at normal operating temperature. With the exception of the voltmeter test lead connections, the testing equipment connections are the same as those described in *f* above.

- (1) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the negative (-) post of the outer battery.
- (2) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 1 VOLT terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (3) *Connect ammeter test leads.* Connect the ammeter test leads (*f*(5) and (6) above).
- (4) *Connect carbon pile resistor leads to battery.* Connect the carbon pile resistor leads (*f*(9) above).
- (5) *Start engine and read test meters.* Start the engine and operate at a speed equivalent to 20 mph to obtain an ammeter reading of 24 to 27 amperes. Operate the carbon pile switch and knob (*f*(10) above) and observe the reading on the upper scale of the voltmeter. The reading should not exceed 0.1 volt. Stop the engine after noting the voltage.
- (6) *Perform necessary repairs.* If voltage reading exceeds 0.1 volt, check for loose generator or generator mounting bracket, corroded battery terminal, or a loose or dirty battery ground cable connection at the frame. Tighten generator bolts and generator mounting bracket bolts. Clean and tighten connections.
- (7) *Remove testing equipment.* Remove the testing equipment (*f*(12) above) and connect the cables to the generator and generator regulator.

*i. Check Voltage Regulator Setting* (fig. 53). The purpose of checking the setting of the voltage regulator is to determine the cause



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Figure 51. Checking charging system insulated cables resistances.

of inadequate battery charge and/or excessive evaporation of water from the batteries.

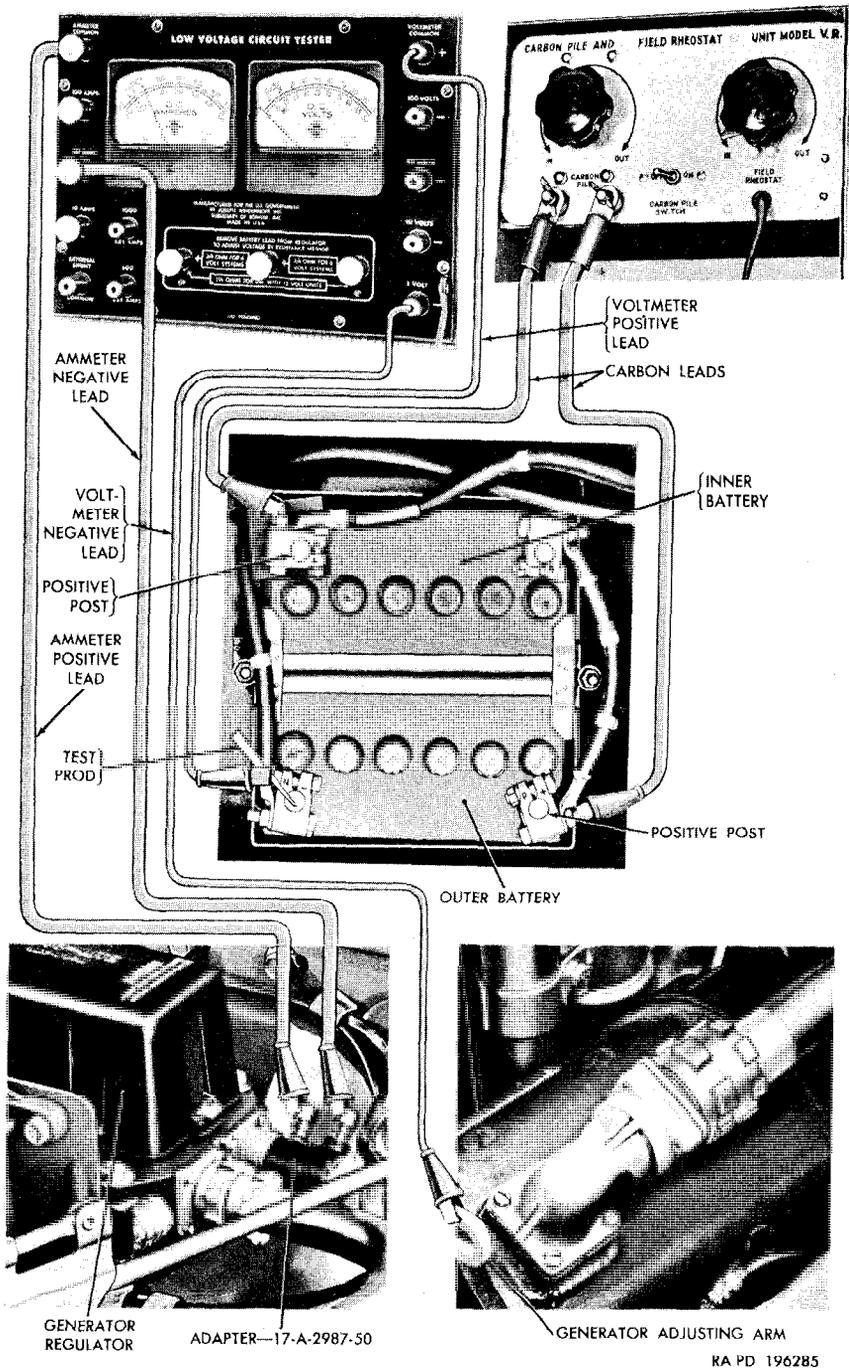
- (1) *Warm up engine and disconnect battery-to-ground cable.* Run the engine until normal operating temperature is reached, stop the engine, and disconnect the battery-to-ground cable from the negative ( - ) post of the outer battery.
- (2) *Install adapter in generator regulator.* Remove the cable from the generator regulator rear receptacle and install the adapter - 17-A-2987-50 (D, fig. 42) in the receptacle.

*Note.* Do not connect the cable to the adapter.

- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the inner terminal of the adapter.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the regulator mounting stud nut.
- (5) *Connect battery-to-ground cable.* Connect the battery-to-ground cable to the negative ( - ) post of the outer battery and start the engine.
- (6) *Cycle voltage regulator.* Operate the engine at a speed equivalent to 20 mph for several seconds; then reduce the engine speed to cycle the voltage regulator.
- (7) *Read voltmeter.* Repeat (6) above three or four times, then increase engine speed to the equivalent of 20 mph and read the voltage on the lower scale of the voltmeter. Voltage reading should be from 27 to 28 volts for hot climate or summer months, and 28 to 29 volts for cold climates or winter months.
- (8) *Perform necessary repairs.* If the voltage is not within the specified limits, replace the generator regulator (par. 165) or notify ordnance maintenance personnel.
- (9) *Remove testing equipment.* After completing the test, remove the testing equipment (*f*(12) above) and connect the cable to the generator regulator rear receptacle.

*j. Check Circuit Breaker Unit Closing Voltage* (fig. 54). The circuit breaker unit check is to determine whether the circuit breaker unit in the generator regulator functions properly. In order to obtain an accurate diagnosis of circuit break unit performance, the generator voltage regulator must be functioning properly (*i* above).

- (1) *Disconnect battery-to-ground cable.* Disconnect the battery-to-ground cable from the negative ( - ) post of the outer battery.



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Figure 52. Checking charging system ground circuit resistance.

- (2) *Install adapter in generator terminal receptacle.* Disconnect the generator-to-generator regulator cable from the generator receptacle and install adapter 17-A-2987-75 (E, fig. 42) in the generator receptacle. Connect the cable to the adapter, close the link between the adapter ARM terminals, and open the link between the adapter FIELD terminals. Tighten terminal nuts.
- (3) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to one of the ARM terminals of the adapter in the generator terminal receptacle.
- (4) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the generator adjusting arm.
- (5) *Install adapter in generator regulator.* Disconnect the generator to regulator cable from the regulator rear receptacle. Install adapter 17-A-2987-50 (D, fig. 42) in the receptacle, and connect the cable to the outer end of the adapter. Open the link between the two adapter terminals and tighten the terminal nuts.

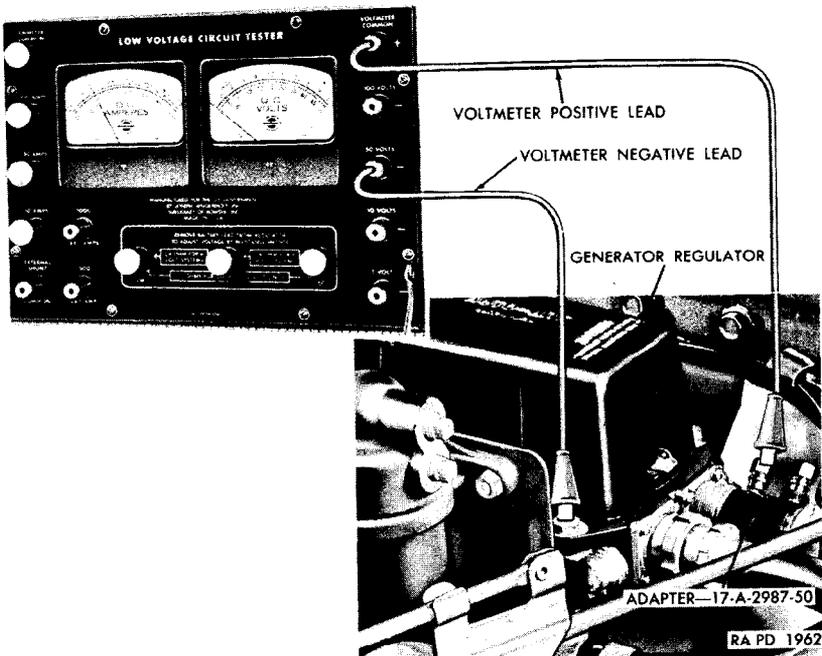


Figure 53. Checking voltage regulator setting.

- (6) *Connect ammeter test leads.* (Connect the ammeter leads (*f* (5) and (6) above).
- (7) *Connect field rheostat.* Connect the field rheostat leads of the resistor to the two "FIELD" terminals of the adapter in the generator receptacle.
- (8) *Connect battery-to-ground cable and start engine.* Connect the battery-to-ground cable to the negative (−) post of the outer battery and start the engine. Set the throttle control at fast idle.
- (9) *Cycle circuit breaker unit.* Turn the field rheostat knob clockwise until the ammeter indicates that the generator is charging. Turn the field rheostat back and forth two or three times to cycle the circuit breaker unit.

*Note.* If the circuit breaker unit points do not open (ammeter hand returns to zero) when the field rheostat knob is turned counterclockwise as far as it will go, reduce the engine speed. Adjust engine speed so that the circuit breaker points open and close when the knob is turned back and forth.

- (10) *Operate field rheostat and read test meters.* Turn the field rheostat knob clockwise slowly until the ammeter hand just flickers, indicating that the circuit breaker unit points are closing. Observe the voltage reading on the voltmeter lower scale. The voltage reading should be not less than 24.5 volts, or at least 1 volt under the voltage regulator setting (*i* (7) above).
- (11) *Perform necessary repairs.* If the voltage reading is not within the specified limits, replace the generator regulator (par. 165) or notify ordnance maintenance personnel.
- (12) *Remove testing equipment.* When the test has been completed, remove the testing equipment (*f* (12) above) and connect the cables to the generator and generator regulator.

### 93. Ignition System

#### *a. Engine Turns but Will Not Start or Starts Hard.*

- (1) *Spark plugs fouled, incorrectly adjusted, or defective.* Remove one of the spark plug cables (par. 124*a*). Crank engine with starter (ignition switch on), while holding the spark plug cable one-fourth inch from the cylinder head. If the spark jumps the gap between the cable and cylinder head, remove all plugs, clean, and inspect. Adjust the gap if necessary. Install the plugs, replacing defective plugs (par. 124). If spark does not jump the gap, proceed with check outlined in (2) through (12) below.
- (2) *Breaker points incorrectly adjusted.* Adjust breaker points (par. 129).

*Note.* Servicing the distributor requires its removal (par. 125*a*).

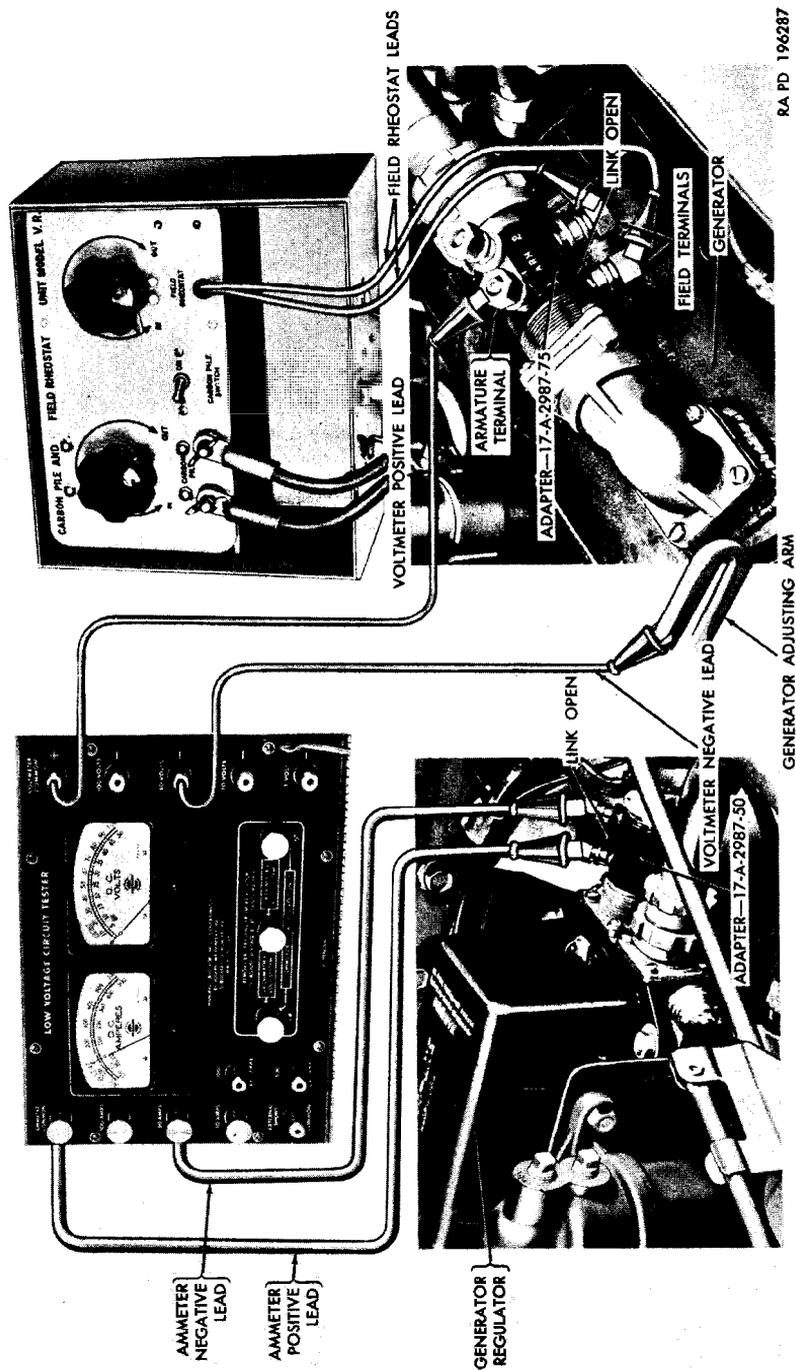


Figure 54. Checking circuit breaker unit.

- (3) *Breaker points burned, pitted, oxidized, or oily.* Clean or replace breaker points and capacitor (par. 128).

*Note.* Oxidation of breaker points is caused by high charging voltage or oil.

Refer to paragraph 92*i* for checking charging voltage. If distributor parts are oily, clean parts or replace distributor as required (par. 125).

- (4) *Ignition coil faulty.* Check the ignition coil with the distributor removed (par. 125*a*) from the engine and held in a vise. Remove the cap cover and connect a test lead from the positive (+) terminal of the coil to the positive (+) terminal of one of two 12-volt batteries connected in series. Connect a second test lead from the negative (-) post of the opposite battery to a suitable ground on the distributor base. Insert a third test lead in the high tension terminal of the coil and hold the end of the lead one-fourth inch from the distributor base while rotating the distributor shaft. If a spark jumps the  $\frac{1}{4}$ -inch gap, the coil is satisfactory. If a spark does not jump the gap, replace the coil (par. 130).
- (5) *Rotor faulty.* Check the rotor for burred or broken parts. Replace if defective (par. 128).
- (6) *Cap spring broken or missing.* Replace or install spring (par. 127*c*).
- (7) *Cap faulty.* Remove cap and check for cracks or other damage. Replace a defective cap (par. 127).
- (8) *Ignition switch faulty.* Check ignition switch (*b*(7) below). Replace defective switch (par. 131).
- (9) *Excessive resistance in primary circuit or through breaker points.* Check resistance in primary circuit (*b* below) and breaker points (*c* below) and correct as necessary.
- (10) *Fuel system faulty.* Refer to paragraph 86*a*.
- (11) *Valve faulty.* Refer to paragraph 85*b*(3).
- (12) *Other causes.* If cause of trouble cannot be located by performing (1) through (11) above, notify ordnance maintenance personnel.

*b. Check Primary Circuit Resistance* (fig. 55). Primary circuit resistance check is to determine the resistance through the ignition switch and the primary circuit.

- (1) *Install adapter 17-A-2975 in distributor receptacle.* Disconnect the primary cable from the distributor at the receptacle. Install the adapter 17-A-2975 (C, fig. 42) in the receptacle and connect the cable to the adapter.
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the

lead to the battery-to-starter cable at the starter switch terminal.

- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal of the tester and attach the clip end of the lead to the terminal of the adapter in the distributor.
- (4) *Start engine.* Start the engine and operate at idle speed.
- (5) *Change voltmeter negative (-) test lead connection.* Change the voltmeter negative (-) test lead from the 50 VOLTS terminal on the tester to the 1 VOLT terminal.
- (6) *Read voltmeter.* Observe the voltage reading on the voltmeter upper scale. This reading should not exceed 0.2 volt.
- (7) *Check ignition switch.* If voltage reading exceeds 0.2 volt, check for loose or corroded connections at the starter switch terminal, ignition switch, and the cable connector at the left splash shield or at the filter on the dash (vehicles so equipped). If the connections are clean and tight, eliminate the switch from the circuit and repeat the test. To do this, remove the instrument cluster far enough to provide access to the ignition switch. Disconnect the two cables (11 and 12) at the cable connectors and connect cable (11) to cable (12). Start the engine and observe the voltage reading on the upper scale of the voltmeter. If voltage reading is satisfactory with the ignition switch bypassed, replace the switch (par. 131).
- (8) *Remove testing equipment.* When the test has been completed, remove the testing equipment and connect the cable to the distributor.

*c. Check Breaker Points Resistance* (fig. 56). Breaker points resistance check is to determine whether excessive resistance exists through the breaker points because of oil, burning, or oxidation.

- (1) *Install adapter in cap cover.* Remove the cap cover plug and the O-ring packing and install adapter 17-A-1375-50 (B, fig. 42) in the plug opening.
- (2) *Connect voltmeter positive (+) test lead.* Connect the voltmeter positive (+) test lead to the positive (+) terminal of the low voltage circuit tester and attach the clip end of the lead to the terminal on the adapter in the cover.
- (3) *Connect voltmeter negative (-) test lead.* Connect the voltmeter negative (-) test lead to the 50 VOLTS terminal on the tester and attach the clip end of the lead to one of the cap cover screws.
- (4) *Check voltage.* Turn the ignition switch on and observe the voltmeter. If the voltmeter shows battery voltage reading (approximately 24 volts) on lower scale, engage the starter momentarily to close the breaker points (voltmeter reading practically zero).

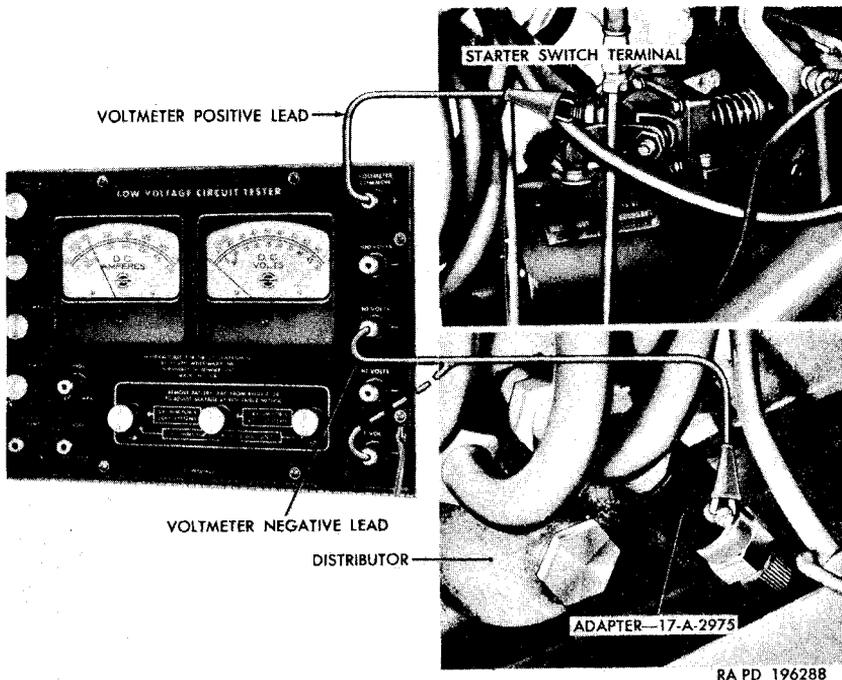
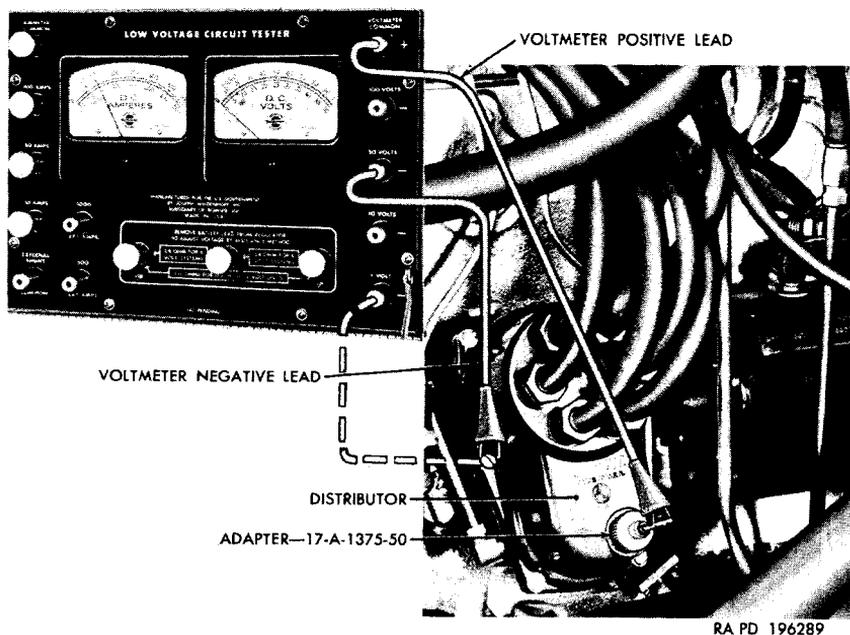


Figure 55. Checking ignition primary circuit resistance.

- (5) *Change voltmeter negative (-) test lead.* Change the voltmeter negative (-) test lead from the 50 VOLTS terminal on the tester to the 1 VOLT terminal.
  - (6) *Observe voltmeter reading and perform necessary repairs.* Observe the voltage reading on the upper scale of the voltmeter. The reading should not exceed 0.2 volt. If the voltage reading exceeds 0.2 volt, remove the distributor (par. 125a), and clean or replace breaker points, as required (par. 128).
- d. *Engine Does Not Idle Properly or Misfires on Acceleration.*
- (1) *Spark plugs faulty.* Remove spark plugs. Inspect spark plugs for incorrect gap and cracked porcelain. Clean, adjust, or replace spark plugs (par. 124).
  - (2) *Spark plug cables faulty.* Disconnect spark plug cables from spark plugs and check each cable for electrical leakage by holding each cable terminal one-fourth inch from the cylinder head. Turn on ignition switch, crank engine with starter and, if missing is evident, replace faulty cables (par. 124).
  - (3) *Distributor breaker points faulty.* Remove distributor (par. 125a) and inspect breaker points. If breaker points are faulty, replace points (par. 128).
  - (4) *Cap cracked.* Remove distributor (par. 125a) and inspect



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*Figure 56. Checking resistance through breaker points.*

the cap for cracks and burning. Replace cap if necessary (par. 127).

(5) *Coil faulty.* Refer to *a*(4) above.

(6) *Fuel system faulty.* Refer to paragraph 86*d*.

(7) *Valves faulty.* Refer to paragraph 85*b*(3).

(8) *Other causes.* If cause of trouble cannot be located by performing (1) through (7) above, notify ordinance maintenance personnel.

*e. Engine Overheats or Does Not Develop Full Power.*

(1) *Ignition timing late.* Check ignition timing with timing light and adjust if necessary (par. 126).

(2) *Automatic advance faulty.* Check automatic advance with a timing light. Accelerate engine and note if pointer at fan drive pulley indicates advance as engine speed is increased. If no advance is noted, replace distributor (par. 125).

(3) *Fuel system faulty.* Refer to paragraph 86*c*.

(4) *Valves faulty.* Refer to paragraph 85*b*(3).

(5) *Exhaust system restricted.* Refer to paragraph 87*b*.

(6) *Other causes.* If cause of trouble cannot be located by performing (1) through (5) above, notify ordinance maintenance personnel.

*f. Engine Misfires at High Speed.*

(1) *Spark plugs faulty.* Refer to *d*(1) above.