TM 9-812

WAR DEPARTMENT TECHNICA

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

(IHC MODELS H-542-9 AND H-542-11 MARMON-HERRINGTON MODEL H-542-11 KENWORTH MODEL H-542-11)

WAR DEPARTMENT *MARCH 1944*

EIGENDOM VAN
BUR. BUITENL. VOORSCHR.

№ 36623

CAT. Nr. T.A. 9-012	DAT. 3/44 WIJZ.: + C1
	AAN: Bibl 49
	ADRES:
TERUG VOOR: 15 JUNI 1954	

UITLEENREGLEMENT:

De voorschriften worden uitgeleend voor een vastgestelde tijd, die bepaald wordt door de boven aangegeven uiterste datum van teruggave. Het BBV behoudt zich het recht voor, elk voorschrift, om redenen van dienstbelang, vóór afloop van de leestijd terug te vorderen. Indien het voorschrift niet door een ander wordt verlangd kan **verlenging** van de leestijd worden toegestaan. Tenminste **4 dagen** vóór het verstrijken van de leestijd moet een dergelijke verlenging worden aangevraagd. In geval van overplaatsing, enz. moet het BBV hiervan in kennis worden gesteld. Bij demobilisatie moet het voorschrift **onverwijld** aan BBV worden geretourneerd. Bij terugzending van voorschriften per post of anderszins moet dit zodanig geschieden, dat de voorschriften in volkomen ongeschonden staat het BBV bereiken. Het door de lener ondertekend uitleenbewijs wordt hem dan teruggezonden (teruggegeven).

WAR DEPARTMENT TECHNICAL MANUAL

★ TM 9-812

5-TON 4x2 TRACTOR TRUCK (C.O.E.)

(IHC MODELS H-542-9 AND H-542-11 MARMON-HERRINGTON MODEL H-542-11 KENWORTH MODEL H-542-11)

WAR DEPARTMENT

MARCH 1944

★ This manual supersedes TB 9-812-1, 15 February 1944

WAR DEPARTMENT
Washington 25, D. C., 11 March 1944

TM 9–812, 5-ton 4 x 2 tractor truck (C.O.E.) (IHC models H–542–9 and H–542–11, Marmon-Herrington model H–542–11, Kenworth model H–542–11), is published for the information and guidance of all concerned.

[A.G. 300.7 (16 Dec. 43]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION: X

(For explanation of symbols, see FM 21–6)

CONTENTS

PART ONE—Vehicle Operating Instructions

PART TWO—Vehicle Maintenance Instructions

CONTENTS (Cont'd)

PART ONE — Vehicle Operating Instructions

Section I

INTRODUCTION

1. SCOPE.

a. This technical manual is published for the information and guidance of using arm personnel charged with the operation, maintenance, and minor repair of the materiel.

b. In addition to a description of the 5-ton 4 x 2 tractor truck with cab over engine, this manual contains technical information required for the identification, use, and care of the materiel. The manual is divided into two parts. Part One, which includes Sections I through VIII, gives vehicle operating instructions. Part Two, which includes Sections IX through XXXVI, gives vehicle maintenance instructions for using arm personnel charged with the responsibility of doing maintenance work within their jurisdiction.

c. In all cases where the nature of the repair, modifications, or adjustment is beyond the facilities of the unit, the responsible ordnance service should be informed so that trained personnel with suitable tools and equipment may be provided, or proper instructions issued.

d. The vehicle models of the tractor truck covered by this manual are International Harvester Models H-542-9 and H-542-11, Marmon-Herrington Model H-542-11, and Kenworth Model H-542-11. The official tractor truck model number is 542, to which are added a prefix letter designating the manufacturer of the engine and a suffix number relating to the tire size.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

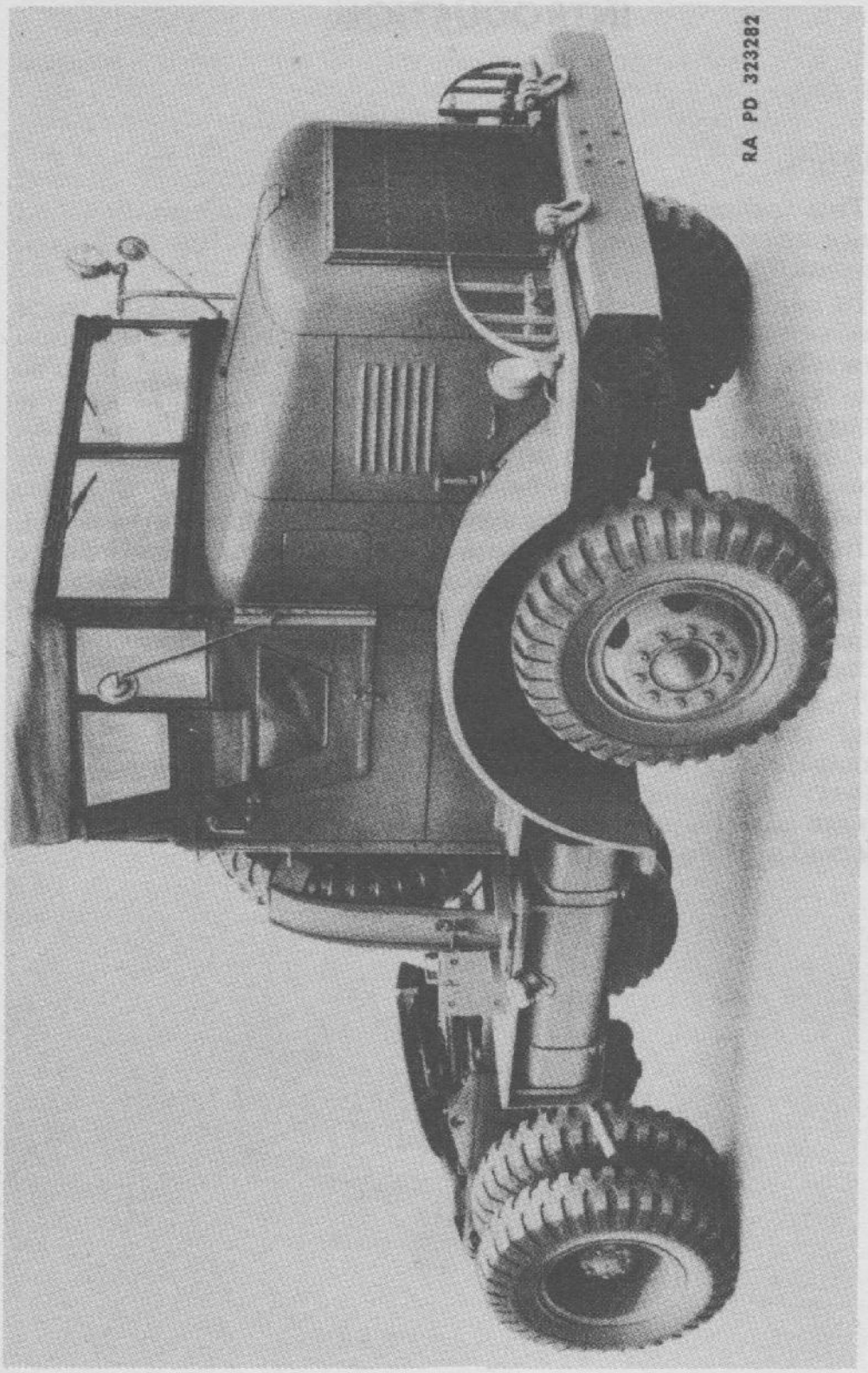
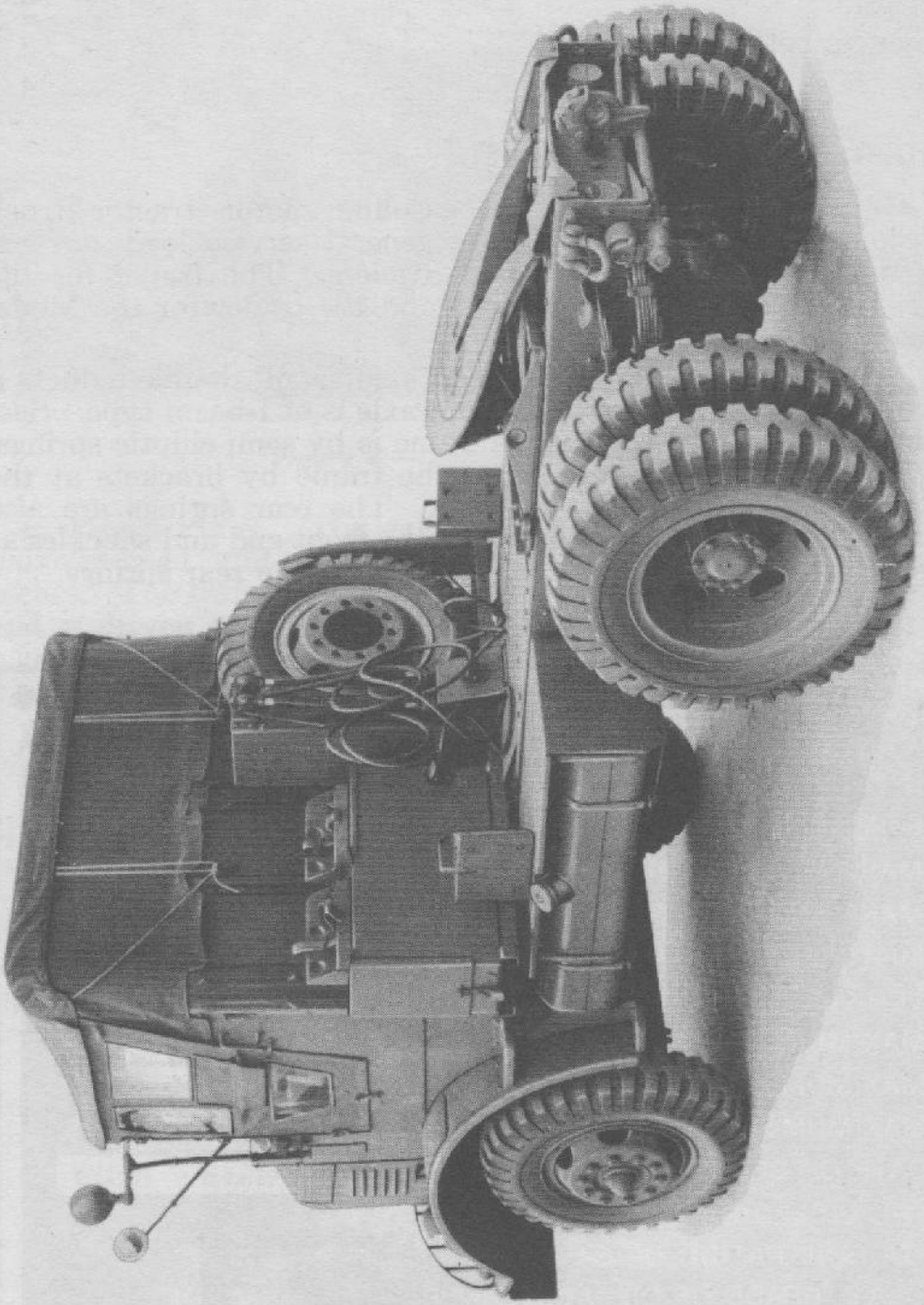


Figure 1 — 5-Ton 4 x 2 Tractor Truck (C.O.E.), Right Front

INTRODUCTION



RA PD 323283

Figure 2 — 5-Ton 4 x 2 Tractor Truck (C.O.E.), Left Rear

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

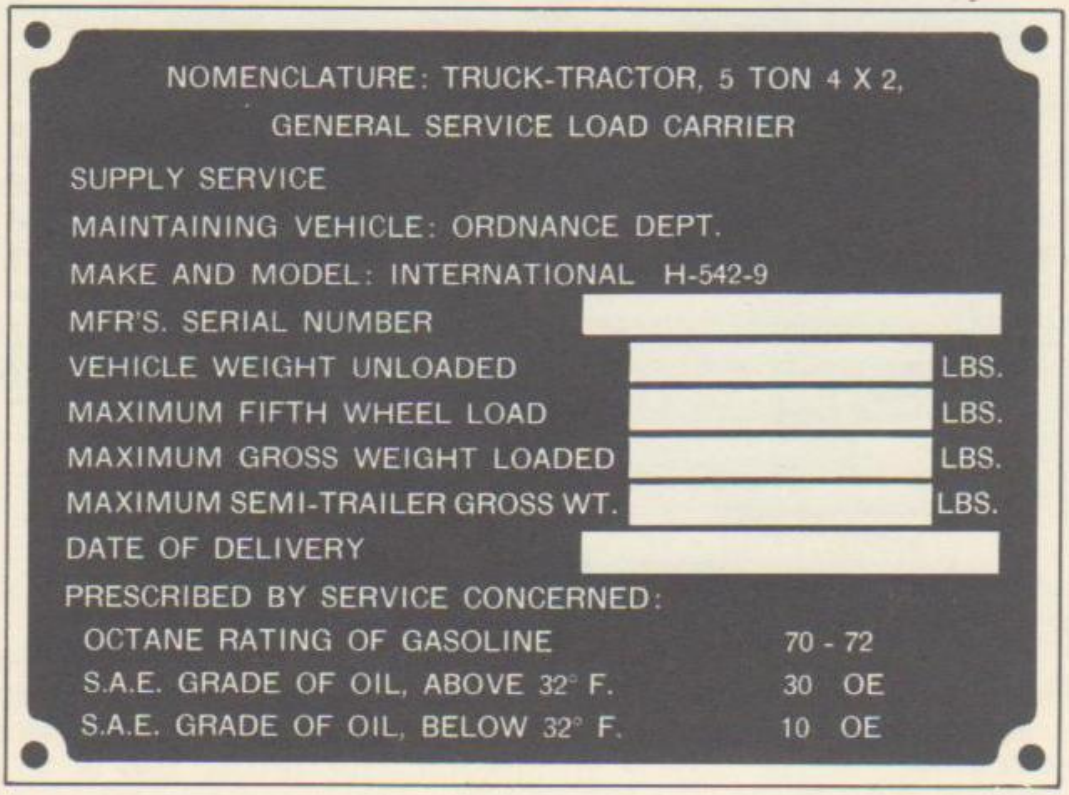
Section II

DESCRIPTION AND TABULATED DATA

2. DESCRIPTION (figs. 1 and 2).

a. General. The 5-ton 4 x 2 gasoline motor tractor truck Models H-542-9 and H-542-11 are general service load carriers. Both models are designed to haul trailers. The trailer for the Model H-542-9 is 16 feet in length, and the trailer for the Model H-542-11 is 25 feet in length.

b. Axles and Springs. The rear axle is of double-reduction type and is the drive axle. The front axle is of I-beam type. Suspension of axles from the chassis frame is by semi-elliptic springs. The front springs are attached to the frame by brackets at the front end and shackles at the rear. The rear springs are also attached to the frame by brackets at the front end and shackles at the rear. Auxiliary springs are mounted on the rear springs.



RA PD 323287

Figure 3 — Vehicle Nomenclature Plate

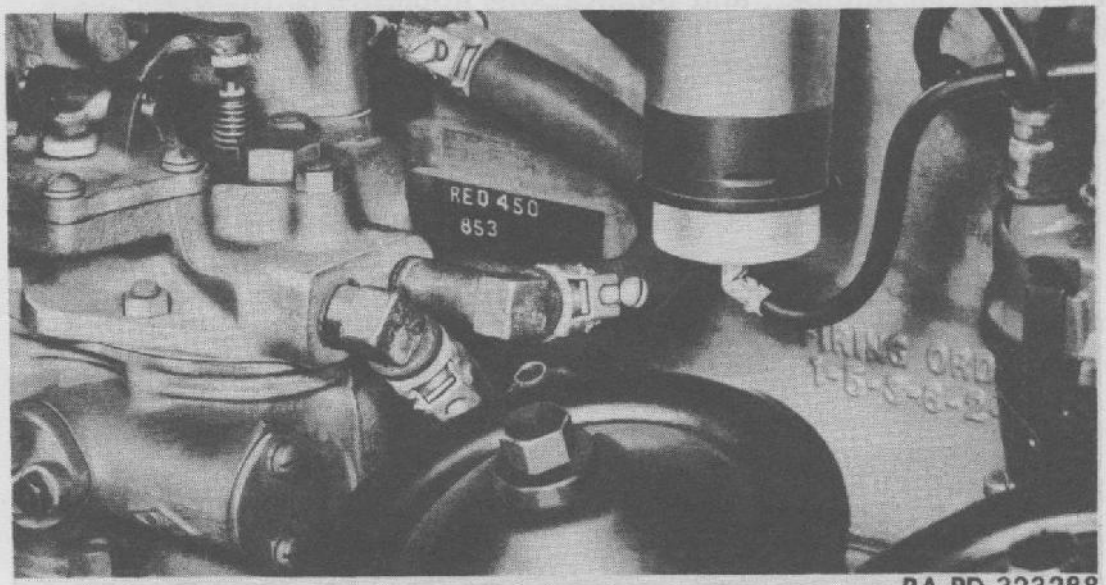


Figure 4 — Engine Serial Number

c. Power Plant. The engine in these vehicles is a 6-cylinder, valve-in-head unit with a piston displacement of 450.99 cubic inches. The transmission is mounted on the rear end of the engine and is driven by a single disk friction clutch. The transmission has five forward speeds and one reverse speed. Fifth speed is direct.

d. Brakes. There are two separate and independently controlled brake systems on each vehicle.

(1) SERVICE BRAKES. The service brakes are air-actuated, and operate two mechanical brake shoes at each wheel. An air compressor, mounted on the engine, supplies air to reservoir tanks from which it is delivered to the brake chambers at each wheel, actuating the brake shoes upon application of the brake pedal.

(2) HAND BRAKE. The hand brake, mounted on the propeller shaft, is a four-shoe, disk-type brake of Tru-Stop design. It is actuated by a brake lever in the driver's compartment.

e. Cab. The two-man cab is a metal, open-top enclosure around the driver's compartment. It is equipped with a windshield, and removable top and side curtains.

f. Fifth Wheel. As the vehicles are tractor trucks, they are equipped with a frame-mounted fifth wheel and loading ramp for trailer connection.

g. Vehicle Identification. The vehicles may be identified outwardly by the forward construction of the cab, and the fifth wheel mounting (figs. 1 and 2). Correct identification of the various components of the vehicle is important for proper use of this manual. Identification can be made by checking plates, stamps, or tags which show model number, serial number, and other information applying to any unit. This identification is attached to,

or stamped on the various components. Vehicle serial number, engine serial number, and publications applying to the vehicle are determined by checking the following plates or stampings:

(1) VEHICLE NOMENCLATURE PLATE. This plate includes vehicle nomenclature, serial number, model, pay load, and other data (fig. 3). It is located inside the cab on the cowl panel.

(2) ENGINE AND SERIAL NUMBER. This identification is stamped on a boss at the left front side of the engine just below the cylinder head (fig. 4).

(3) PUBLICATIONS PLATE. This plate includes TM number of technical manuals, and parts list to use with the vehicle (fig. 5). It is located in the driver's compartment on the dash panel.

RA PD 323289

Figure 5 — Publications Plate

3. DIFFERENCES BETWEEN MODELS.

a. All H-542-11 models are identical in construction. The principal differences between Model H-542-9 and Model H-542-11 vehicles are listed below.

	H-542-9	H-542-11
Tire size	9.00x20	11.00x20
Auxiliary horn	Yes	No
Front spring leaves	11	13
Rear spring leaves	11	16
Spotlight	Yes	No
Fifth wheel mounted ahead of rear axle	3 in.	6 in.

4. DATA.

a. Vehicle Specifications.

		H-542-9	H-542-11
Wheelbase	in.	120	120
Length over-all	in.	199 7/8	199 7/8
Width over-all	in.	94 5/8	97 1/2
Height over-all	in.	102 1/2	104 3/4
Wheel size	in.	20	20
Tire size	in.	9:00x20	11:00x20

DESCRIPTION AND TABULATED DATA

		H-542-9	H-542-11
Tread center to center:			
Front	in.	69 7/8	71 3/8
Rear	in.	72 1/4	72 1/4
Crew		Two	Two
Weight of vehicle (approximate):			
Front	lb	6,717	6,745
Rear	lb	4,883	5,218
Total	lb	11,600	11,963
Ground clearance (rear)	in.	9 1/16	10 9/16
Pintle height	in.	30 13/16	33 1/4
Octane rating of fuel		72	72
b. Performance.			
Approach angle	deg	32	35
Departure angle	deg	50	55
Minimum turning radius:			
Right		23 ft 6 in.	25 ft 1 in.
Left		23 ft 5 in.	25 ft 3 in.
Turning radius in degrees (maximum)	deg	37	33
Towing facilities:			
Front		Tow eyes	Tow eyes
Rear		Pintle	Pintle
Maximum grade ascending ability	pct	41	25
Maximum allowable engine speed	rpm	2,600	2,600
Maximum permissible road speed:			
First (low)	mph	4	5
Second	mph	8	8
Third	mph	13	14
Fourth	mph	23	25
Fifth (direct)	mph	35	38
Reverse	mph	4	5
c. Capacities.			
Transmission	pt	24 1/2	24 1/2
Rear axle	pt	17	17
Fuel tanks	gal	80	80
Cooling system	qt	36	36
Crankcase:			
Dry	qt	15	15
Refill (pan only)	qt	9	9
Refill (incl. new filters)	qt	14	14
Air cleaner	pt	4	4
Steering gear	pt	5	5

Section III

DRIVING CONTROLS AND OPERATION

5. INSTRUMENTS AND CONTROLS.

a. Control and operation information and instructions outlined in this section are specifically for the driving and operating personnel of the vehicle. All controls and instruments pertinent to the operation and driving of these vehicles are grouped in the driver's compartment or cab (fig. 6).

b. **Instruments.** The following instruments, illustrated in figure 7, are grouped on the dash. (See also figs. 73 and 74.)

(1) TEMPERATURE GAGE. The temperature gage indicates the temperature of the coolant in the cooling system, not the quantity of coolant in the system. The gage is graduated from 100°F to 220°F. It is connected by a tube to a sending unit located in the engine.

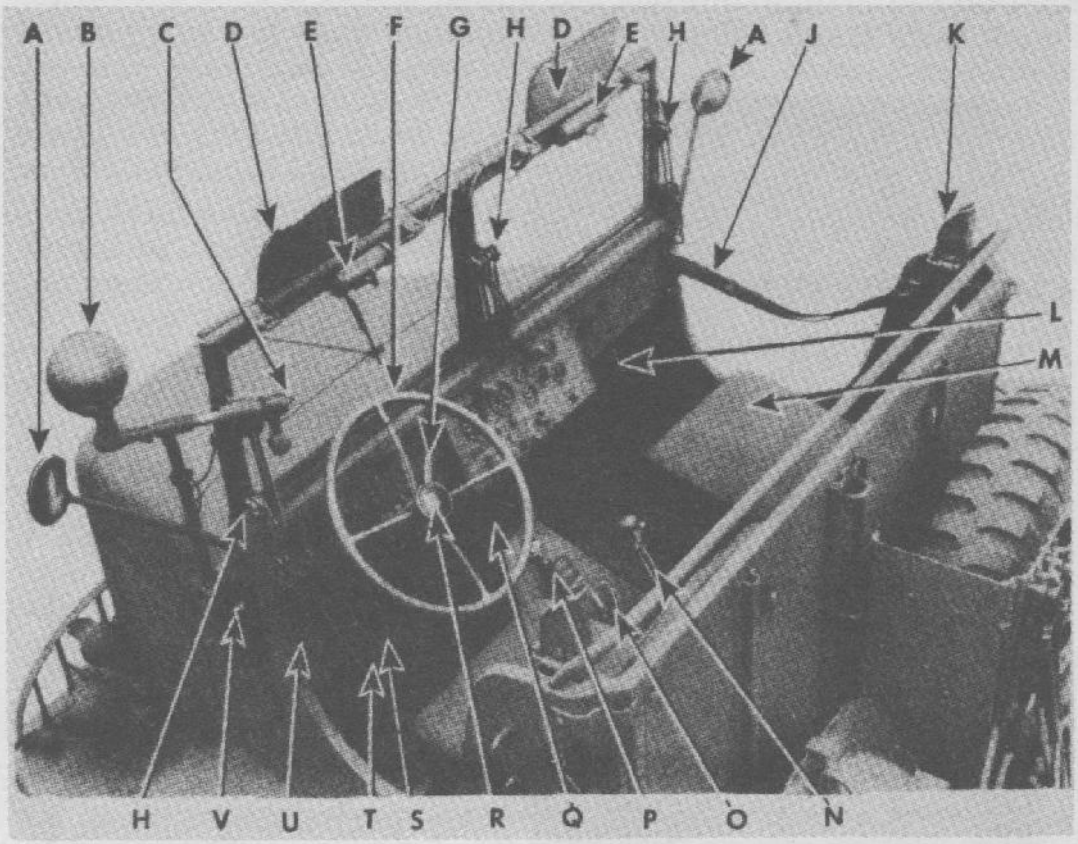
(2) FUEL GAGE. The fuel gage is electrically operated, and is interconnected with the two fuel tank sending units. The gage indicates the level of gasoline in the tanks, and will only register after the ignition switch is turned on. A fuel tank selector switch, located just below the temperature gage, permits reading the level of gasoline in either of the separate tanks.

(3) SPEEDOMETER. The speedometer indicates the road speed of the vehicle in miles per hour. The unit, operated through a flexible cable from the transmission, records total number of miles traveled and trip miles. The trip indicator can be cleared by turning the button located on the underside of the speedometer head.

(4) OIL PRESSURE GAGE. The oil pressure gage indicates the pressure of the engine lubricating oil, not the amount of oil in the crankcase. The pressure reading may vary according to operating conditions. However, if the oil pressure should fall to zero while the engine is operating, stop the engine immediately and determine the cause. The gage is connected to the engine by tubing.

(5) AMMETER. The ammeter indicates the rate of charge or flow of electric current being applied to the battery by the generator, or the rate of discharge from the battery. At low engine speeds, the needle may show a negative or discharge reading. When the battery is fully charged, a very slight charge is indicated by the needle.

(6) TACHOMETER. The tachometer or engine speed indicator is graduated in hundreds of revolutions per minute from 300 to 3,000. It is driven by a flexible drive shaft from the distributor drive housing. The instrument contains a maximum speed needle



A—REAR VIEW MIRROR
B—SPOT LIGHT
C—SPOT LIGHT SWITCH
D—SUN VISOR
E—WINDSHIELD WIPER MOTOR
F—STEERING WHEEL
G—BRAKE VALVE LEVER
H—WINDSHIELD ADJUSTING QUADRANT
J—SAFETY STRAP
K—RIFLE SCABBARD
L—COWL SIDE VENTILATOR
M—SEAT
N—TRANSMISSION SHIFT LEVER
O—EMERGENCY BRAKE LEVER
P—FIRE EXTINGUISHER
Q—FLOOR TUNNEL
R—HORN BUTTON
S—ACCELERATOR PEDAL
T—BRAKE VALVE PEDAL
U—CLUTCH PEDAL
V—SPOT LIGHT TERMINAL PLUG

RA PD 323413

Figure 6 — Driver's Compartment

which can only be reset by means of a key inserted in the tachometer lock just below the tachometer.

(7) AIR PRESSURE GAGE. The air pressure gage indicates the air pressure in the air reservoir tanks. It is graduated from 0 to 150 pounds per square inch. No attempt should be made to drive the vehicle until air pressure of at least 70 pounds is indicated on

Figure 7 — Instrument Panel and Dash

the gage. Should a sudden or abnormal loss of air pressure be noted, the vehicle should be stopped and the cause of pressure loss investigated. A buzzer unit sounds a warning signal when the air pressure is less than 60 pounds per square inch. A caution plate on the panel reads as follows: "WARNING—Buzzer operation is an indication that the truck must immediately be brought to a stop and the cause of loss of brake air pressure determined."

c. **Controls.** Vehicle controls include all switches and various operating and miscellaneous controls located in the driver's compartment. Actual operation and use of each control is explained in the respective operation paragraphs.

(1) IGNITION SWITCH (fig. 7). The ignition switch is of lever type. The handle must be turned clockwise to the "ON" position before the engine can be started.

(2) CHOKE BUTTON (fig. 7). The choke button is used to operate the carburetor choke valve when starting a cold engine. Pulling the choke button out away from panel closes the choke valve. The choke valve will be opened when the choke button is again pushed all the way in against the panel.

(3) THROTTLE BUTTON (fig. 7). The throttle button may be used to open the throttle slightly when starting the engine, or to set the throttle at any position to maintain a constant engine speed. The button can be pulled out in varying degrees, accelerating the engine from idling speed to maximum governed speed. Operation of the throttle button actuates the accelerator pedal, though operation of the accelerator pedal has no effect on the throttle button.

(4) SPARK CONTROL (fig. 7). The vehicle is equipped with a manually operated spark advance or retard control. The control button is located just above the choke button. Its neutral position is three-eighths inch out from the panel. Above the control button is a caution plate reading: "SPARK ADJUSTMENT—To reduce spark knock retard or PULL OUT. For loss of power at high altitude advance or PUSH IN."

(5) MAIN LIGHT SWITCH (fig. 7). The main light switch, located at the left of the instrument panel, is of rotary type and lever operated. It contains a safety lock plunger, designed to prevent accidental display of lights during maneuvers, which must be depressed before the switch lever can be moved to other than the blackout marker light position. The switch controls the service and blackout headlights, the service and blackout stop and taillights, and the blackout driving light. The switch is marked to indicate lever positions for light control.

(6) PANEL LIGHT SWITCH (fig. 7). The instrument panel light switch button operates the two panel illuminating lights.

(7) CRANKING MOTOR CONTROL SWITCH BUTTON (fig. 7). This push button is surrounded by a caution plate reading: "STARTING CAUTION—1. Press starter button firmly. 2. Do not repress button until engine comes to complete rest (approx. 5 seconds) if not started on first attempt. SERIOUS DAMAGE to

cranking motor may result if above rules are not followed." This warning must not be neglected.

(8) AUXILIARY HORN BUTTON (fig. 7). On the Model H-542-9, an auxiliary horn is installed. It is actuated by the auxiliary horn button located at the lower right of the instrument panel.

(9) DIMMER SWITCH (fig. 6). The foot-operated dimmer switch, accessible to the driver's left foot, is used to control the upper and lower headlight beams. The switch is not operative unless the main light switch is in service position. Use of this switch permits the driver to dim the headlights when approaching or passing oncoming vehicles, and to turn on bright lights when again needed.

(10) CLUTCH PEDAL (fig. 6). The clutch pedal, operated by the driver's left foot, engages and disengages the clutch. Depressing the clutch pedal disengages the engine from the transmission so that transmission gears may be shifted.

(11) SERVICE BRAKE PEDAL (fig. 6). The service brake pedal, operated by the driver's right foot, controls the application and release of the air brakes at the wheels. The driver applies pressure to the pedal to actuate the control valve which controls the flow of air to the brake chambers. Operating the brakes of a vehicle equipped with air brakes differs little from usual operation of brakes. Because operation of the brake pedal requires very little physical effort, proper control of the brakes is easily accomplished. It is important to remember that the distance the brake pedal is depressed determines the air pressure delivered to the brake chambers, and that the brake chamber pressure determines the braking force. The driver must always remember that he is operating a brake valve capable of giving finely graduated brake control, and should make full use of this feature. The best stop results when the first brake application is as firm as the speed, condition of the road, and passenger comfort permit, followed by a tapering off of brake pressure as the speed decreases. As the stop is completed, there must only be sufficient air pressure in the brake chambers to hold the vehicle stationary. The brakes must not be applied lightly at first and the braking pressure increased as the speed decreases, otherwise a very rough stop will result. The brake pedal must not be "fanned", as this merely wastes compressed air and has no bearing on correcting braking results. The brake pedal must not be fully depressed except in cases of emergency, as this causes full braking force, which is not necessary in ordinary service, to be delivered to the wheels. If the trailer should break away from the tractor truck, the driver must immediately apply the brakes, bring the tractor truck to a stop, and hold it with the hand brake while the cut-out cocks in the service and emergency lines are closed. The air brake system will then be recharged to normal pressure. When disconnecting the trailer from the tractor truck, the emergency feature of the brake system on the trailer is used to lock the trailer brakes. This is approved practice, but no air brake system alone should be relied on to hold a parked vehicle. The hand brake must always be applied, or the wheels blocked.

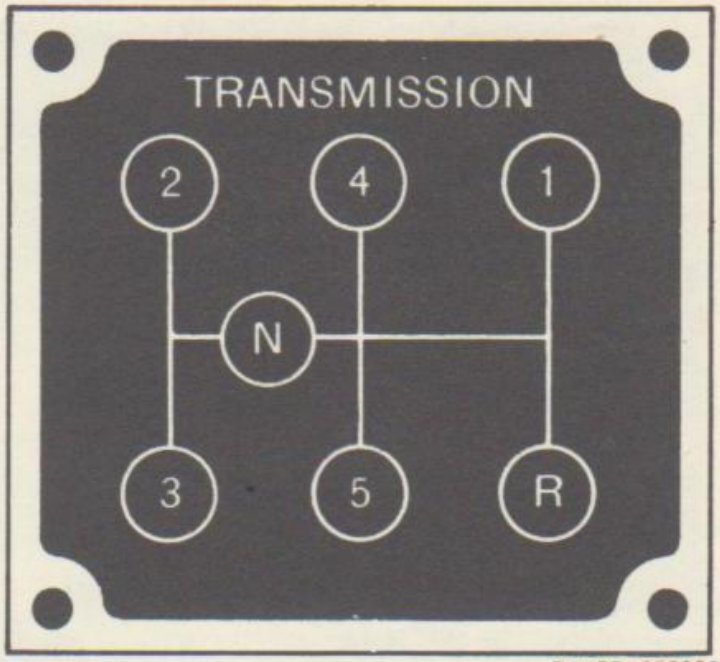


Figure 8 — Shifting Diagram

(12) ACCELERATOR PEDAL (fig. 6). The accelerator pedal, operated by the driver's right foot, controls the carburetor throttle valve. When the pedal is completely released, the engine will operate at idling speed. Acceleration from idling speed to governed speed is controlled by the amount the pedal is pressed down.

(13) HAND BRAKE LEVER (fig. 6). The hand brake lever, at the immediate right of the driver, is operated by the right hand. It controls application of the mechanical brake shoes on the propeller shaft. The hand brake should not be used to brake the vehicle during normal road operation. The primary purpose of this brake is to hold the vehicle in parked position, or to assist in bringing it to an emergency stop. When the lever is pulled back, a spring-loaded latch will lock the lever in applied position.

(14) TRANSMISSION SHIFT LEVER (fig. 6). The transmission shift lever, accessible to the driver's right hand, is used to select the various gear ratios or speeds provided in the transmission. The transmission provides five forward speeds and one reverse. The shifting pattern or diagram is shown on an instruction plate (fig. 8). Shifting instructions are detailed in paragraph 6 d.

(15) STEERING GEAR (fig. 6). The front wheels are turned or steered by means of the steering gear assembly which is connected to the front axle steering knuckles and tie rod by means of a drag link.

(16) WINDSHIELD WIPER CONTROL VALVES (fig. 7). Windshield wiper operating control valves are provided to the left of the choke, throttle, and spark controls, for the independent operation of each windshield wiper. The valve buttons must be turned to place the wipers in operation.

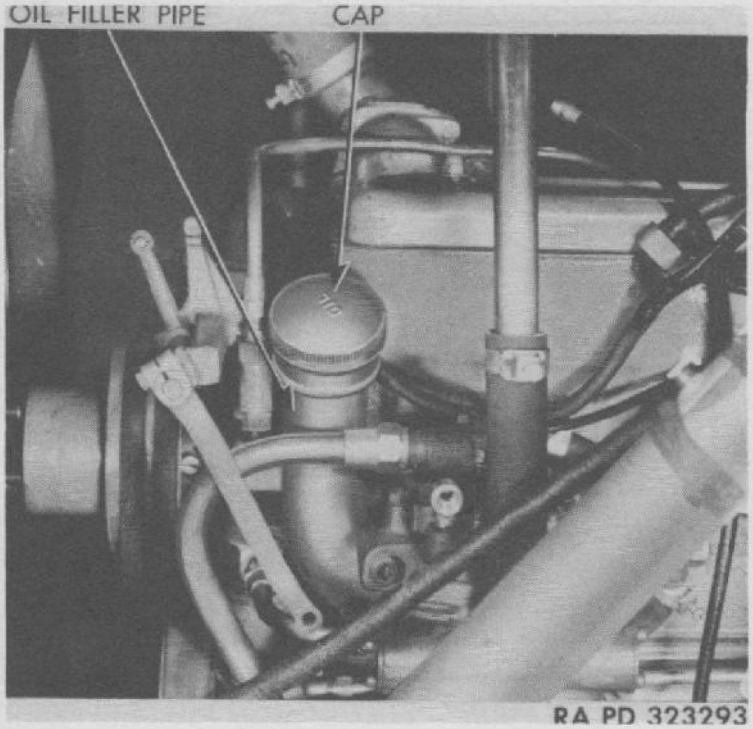


Figure 9 — Oil Filler Pipe

(17) WINDSHIELD ADJUSTING SCREWS. The windshield can be placed in two open positions, either tilted outward at the bottom, or completely lowered forward. As shown in figure 6, the upper adjusting thumb screw nuts are for the purpose of tilting the windshield outward and upward. These thumb screw nuts must be loosened in order to push the windshield out at the bottom to the desired position. After the windshield is in the desired position, tighten thumb screw nuts securely. The lower thumb screw nuts must be loosened and the windshield pushed forward to attain a completely lowered position.

(18) FIRE EXTINGUISHER (fig. 6). The fire extinguisher is of carbon tetrachloride type and is mounted in a support bracket between the two crew compartment seats. The mounting bracket includes a spring-type clamp which must be opened before the extinguisher can be removed.

6. USE OF INSTRUMENTS AND CONTROLS IN VEHICLE OPERATION.

a. Before-operation Service. The Before-operation Service described in paragraph 16 must be accomplished before the engine is started. The gasoline, oil, and water supply should be checked as described below.

(1) GASOLINE. Each fuel tank has a filler neck. When filling a fuel tank, the supply hose must be properly grounded to prevent static sparks, and care must be taken to prevent the entrance of

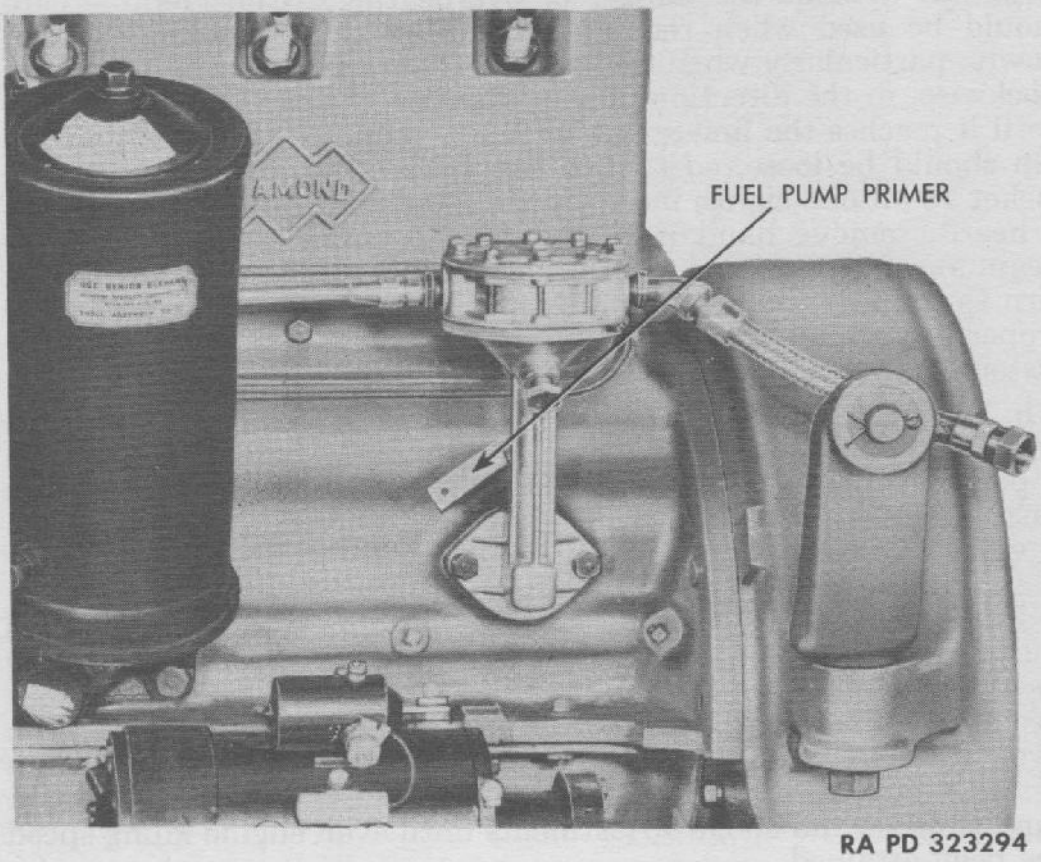


Figure 10 — Fuel Pump Primer

dirt or water into the fuel tank. The octane rating of gasoline to be used is specified on the vehicle nomenclature plate (fig. 3). Use of fuel with an octane rating less than recommended necessitates the readjustment of ignition timing.

(2) CRANKCASE OIL. The crankcase oil filler pipe (fig. 9), mounted on the left-hand side of the engine, is accessible by raising the left-hand hood side section. The lubricant capacity of the crankcase, type of lubricant recommended, and filling, draining, and flushing intervals are outlined in paragraph 21. The oil filler bayonet gage or dip stick, mounted on the left-hand side of the engine, is also accessible by raising the left side of the hood. The lower portion of the dip stick is graduated to show the relative oil level in the crankcase. The dip stick should be pulled out, lower portion wiped off with a clean cloth, reinserted to its limit, then pulled out again for correct reading. The level of oil in the crankcase will be indicated on the lower portion of the dip stick. Crankcase oil should always be kept up to the "FULL" mark.

(3) WATER SUPPLY. The radiator filler cap is accessible through an opening in the shell. This filler cap is of the sealing type which maintains a slight pressure on the cooling liquid when the engine

warms up to operating temperature. This permits a slightly higher operating temperature, resulting in improved engine performance without the danger of overheating. Considerable care should be used when removing the filler cap. Loosen the cap slowly, particularly when the engine is hot. Turn the cap counterclockwise, in the direction of the arrow on the cap. Turn the cap until it reaches the first stage, or safety stop. In this position the cap should be loose, so that it can be pressed down against the gasket about one-eighth inch. If the sound of escaping air or steam is heard, remove hand from the filler cap until it stops. After steam and air pressure has been released, press the cap downward, turn to the extreme left, then lift off. Refer to paragraph 75 c for proper procedure for adding coolant to the system or draining the system.

b. Starting the Engine. Place the transmission shift lever in neutral position. Pull the hand brake lever back, and lock in applied position. If the engine is cold, pull out the hand throttle button one-half inch, and hold choke button out about half way. If vehicle has been standing for any length of time, hand primer oil fuel pump (fig. 10) must be pumped several tines. Push clutch pedal down to disengage clutch, and hold in depressed position until engine has been started. NOTE: *If vehicle has been standing for some time in cold weather, it is recommended that engine be turned over several times before turning on ignition.* Turn ignition switch lever to "ON" position. Press cranking motor control switch button. Release the instant the engine starts. Make necessary hand throttle and choke adjustments until even engine idling speed has been attained.

c. Warming up the Engine. After the engine has been started, it should be permitted to operate through a short warm-up period whenever conditions permit. This warm-up period provides the driver with an opportunity to observe and check the performance of the engine before the vehicle is placed under way. After the engine is running smoothly, listen for any sharp knocks, clattering, or other unusual noises. Report any unusual noises immediately to the proper authority. No vehicle should be placed in service if the engine is not operating efficiently.

(1) MINIMUM AND MAXIMUM OPERATING TEMPERATURES. It is essential that engine water temperature be maintained at or above 160°F, and that this temperature be reached as soon as possible. In cold weather this is best controlled by covering the lower portion of the radiator with corrugated paper carton or similar material. Temperature should rise steadily during warm-up period until the gage shows 160°F or higher. No prescribed time can be set for the temperature to reach normal operating stage, as atmospheric conditions, length of time engine has been idle, and other factors determine the length of the warm-up period. As a general rule, engine operation equivalent to driving 5 miles should bring the temperature up to 160°F. Run the engine during the warm-up period at a fast idle speed of 800 revolutions per minute. If the temperature rises sharply to above 190°F, the engine should

immediately be stopped, and the cause of overheating determined and corrected.

(2) NORMAL OPERATING TEMPERATURES. Between 160°F and 180°F are satisfactory temperatures for efficient engine operation. Temperatures above 180°F or below 160°F after several miles of operation, indicate improper cooling system operation.

(3) OIL PRESSURE. When the engine first starts, the consistency of the oil may cause a sharp rise in oil pressure reading on the gage. After the oil warms up, oil pressure should recede slowly to normal. The pressure readings may fluctuate as engine speed increases or decreases. A sudden drop, high reading, or erratic fluctuation of oil pressure indicates trouble. The engine should be stopped immediately, and the cause of the trouble localized and corrected.

(4) AMMETER. This instrument indicates the charging activity of the generating system. The ammeter may or may not show charge by a plus (+) reading when the engine is first started. As a general rule, the ammeter will show charge after engine speed is increased, depending upon the amount starting has drained the battery, registering maximum charging rate when the battery is low. The ammeter should never show excessive discharge during the engine warm-up period.

d. Operating the Vehicle.

(1) STARTING ON LEVEL GROUND. After the engine has been thoroughly warmed up and checked for satisfactory operation, start the vehicle moving as follows: Release the hand brake. Disengage the clutch fully. Move the transmission gearshift lever to the first speed position (fig. 8). Release the clutch pedal gradually, and at the same time slowly depress the accelerator pedal to increase the speed of the engine. Do not race the engine.

(2) STARTING ON A GRADE. If the vehicle is on a grade, one method of starting is as follows: Disengage the clutch fully. Move the gearshift lever to the first speed position (fig. 8). Gradually engage the clutch, release the hand brake as the engine picks up the load, and accelerate the engine by means of the foot accelerator.

(3) SHIFTING TRANSMISSION FROM LOW TO HIGH SPEEDS. The transmission shift from first to fifth speeds can be accomplished in successive stages as follows: After first speed engagement is made, accelerate the engine until road speed is increased to approximately that indicated on the maximum permissible road speed plate (fig. 11). Then release the accelerator pedal, depress the clutch pedal, and move the gearshift lever into second speed position (fig. 8). Release the clutch pedal and accelerate to proper road speed. Repeat operations for third, fourth, and fifth speeds, in successive stages. Fifth speed is generally used for normal operation on average roads.

(4) SHIFTING TRANSMISSION FROM HIGH TO LOW SPEEDS. The transmission should always be shifted into the next lower gear before the engine starts to labor and before the vehicle speed is appreci-

Plate on H-542-9

Plate on H-542-11

RA PD 323295

Figure 11 — Maximum Speed Plates

ably decreased. The need for "down-shifting" is generally apparent when ascending a steep grade, or when power is needed to pull through rough terrain, muck, or sand. As a precautionary measure, the same speed ratio used to ascend a grade, or the next lower, should be used when descending the same grade. Double clutch procedure recommended for shift from a high to a lower transmission range is as follows:

(*a*) The metal plate, located on the dash panel, showing the maximum permissible road speeds in the various gears (fig. 11) will be helpful in determining the maximum road speed at which a shift from a higher to a lower gear ratio can be made. These maximum road speeds are as follows:

Transmission Gear Range	Maximum Permissible Road Speed (mph)	
	H-542-9	H-542-11
5th speed (direct)	35	38
4th speed	23	25
3rd speed	13	14
2nd speed	8	8
1st speed (low)	4	5
Reverse	4	5

For example, in shifting from fifth speed to fourth speed, the maximum road speed at which this change can be made is approximately 20 to 23 miles per hour, since 25 is the maximum available road speed for fourth gear in the Model H-542-11 (23 for the Model H-542-9).

(*b*) Depress the clutch pedal and release the accelerator pedal at the same time. Shift the transmission lever into neutral. Release the clutch pedal and accelerate the engine momentarily to synchronize the transmission gears. Depress the clutch pedal again,

and move the transmission shift lever into the next lower speed. Do not force the shift lever, but rather "feel" it into position. Release the clutch pedal, and accelerate the engine to the desired speed. Do not exceed the speed shown on the maximum permissible road speed plate (fig. 11). The transmission may be shifted successively into all next lower speeds in the same manner. As soon as the driver becomes accustomed to the sound of the engine at various engine speeds and has become practiced in "double-clutching", he will be able to shift from a higher to a lower gear very rapidly without clashing the gears.

(5) SHIFTING TRANSMISSION INTO REVERSE. The vehicle must first be brought to a full stop before the transmission shift lever can be placed in reverse position (fig. 8). The shift is made as follows: Depress the clutch pedal to disengage the clutch. Press down on the foot brake pedal to bring the vehicle to a full stop. Move the shift lever from neutral position to the right, depressing the lock tab to permit the lever to go fully to the right, and then move the shift lever to the reverse position. Release the clutch pedal, and accelerate the engine to the desired rate of speed. Do not, however, attempt to exceed the speed shown on the maximum permissible road speed plate (fig. 11).

(6) GOING UP GRADES. When ascending steep grades, always shift into lower transmission speeds before the vehicle begins to labor. This can be accomplished most successfully when the vehicle still has sufficient momentum to permit changing gears without bringing vehicle to a stop. It is advantageous to shift at as nearly the top road speed of the lower gear as possible, as outlined in sub-paragraph (4) above. CAUTION: *When shifting to a lower gear at any rate of vehicle speed, make sure that the engine speed is synchronized with the vehicle speed before the clutch is engaged. If the clutch is engaged when the engine is operating at less than the relative vehicle speed, the drive line may be damaged.*

(7) GOING DOWN GRADES. The importance of restraining the speed of the vehicle while descending grades cannot be over-emphasized. Attention is again directed to the maximum permissible road speed plate (fig. 11). The plate clearly states the maximum speed at which a tractor truck may be operated in various gear ratios of the transmission. In general, it is advisable to use the same transmission speed, or the next lower, going down hill as would be required to climb the same hill. The vehicle speed must not be allowed to exceed the maximum speed for that gear as shown on the caution plate (fig. 11). Keep the vehicle under control at all times. Reduce the speed of the vehicle by using the brakes as required to hold the speed below the maximum permissible road speed for the specific gear range. NOTE: *The possibility of overspeeding is greater when the truck is loaded, and, therefore, more caution is required.*

(8) USE OF VEHICLE LIGHTS.

(*a*) *Service Headlights.* The driver must depend upon the service headlights for night time visibility. These headlights, when correctly aimed and adjusted (par. 92) and maintained in

good order, will provide adequate lighting for all conditions. The high beam, as controlled by the foot dimmer switch, is generally used when there are no approaching vehicles or when operating on unlighted roadways. The low beam should be used when approaching or passing another vehicle. The low beam will not throw light far enough ahead for clear road driving. However, when another vehicle is approaching, objects between the two vehicles show up in silhouette against the road. The visibility under this condition is sometimes greater than the clear road visibility with the high beam.

(*b*) *Blackout Marker Lights.* The blackout marker lights are designed for use when a display of illumination is not permissible. Only these lights can be operated without first depressing the locking plunger of the light switch.

(*c*) *Blackout Driving Light.* The blackout driving light is used only when driving under blackout conditions.

(*d*) *Blackout Taillights.* The lens on each blackout taillight is designed to produce two beams. This design is such that when one truck is following another at a safe distance, these two beams converge into a single beam.

(*e*) *Spotlight.* A spotlight is provided for use on the Model H-542-9, but not on the Model H-542-11.

e. Stopping the Vehicle.

(1) Application or release of the service or foot brakes is accomplished in the conventional automotive manner. The driver applies pressure to the foot pedal in varying degrees to brake the vehicle as desired. A fine degree of brake application can be obtained, from a smooth, easy brake action to an abrupt stop. The driver should bear in mind that service brakes apply to all four wheels, therefore only a normal amount of pedal pressure is required to actuate the brakes, provided the power system is functioning properly.

(2) CHECKING VEHICLE SPEED. Release the accelerator pedal. Depress the brake pedal slowly and evenly until the vehicle is checked to desired speed. Do not "fan" the pedal, but apply even pressure. This will permit the engine to assist in checking speed.

(3) NORMAL VEHICLE STOP. Refer to paragraph 5 c (11).

(4) EMERGENCY STOP. Release the accelerator, step sharply and hard on the brake and clutch pedals, and at the same time pull up on the hand brake lever. NOTE: *This action should be used only in emergencies.*

(5) HAND BRAKE LEVER. This lever should not be used to brake the vehicle during normal driving. The primary purpose of the hand brake is to hold the vehicle in stationary position.

f. Stopping the Engine.

(1) PRELIMINARY. Before stopping the engine, the driver should inspect the engine to make certain that it will start again at a

moment's notice. Observe the engine idling performance, and investigate any unusual noises noticed. Check the ammeter action to see that there is no excessive charge or discharge. Check the reading of the temperature gage to see that it is at least 160°F. Report any unsatisfactory performance to designated authority.

(2) PROCEDURE. Shift the transmission into neutral position. Apply the hand brake lever. Be sure the throttle and choke buttons are pushed all the way in. Turn the ignition switch to "OFF" position.

7. TOWING THE VEHICLE.

a. Towing to Start Vehicle. The engine may be started by towing the vehicle with another vehicle. The tow chain or line should be of sufficient length to permit maneuverability of both vehicles. Pull the throttle button of the towed vehicle out about one-half inch, and hold the choke out part way if the engine is cold. Place the transmission in fourth speed (fifth if traction is difficult). Turn on the ignition switch. While being towed for the first 100 feet, press down on the clutch to hold in disengaged position. When the towed vehicle speed reaches approximately 10 miles per hour, slowly engage the clutch. Disengage the clutch immediately after the engine starts.

b. Towing Disabled Vehicle. If the transmission on the vehicle to be towed is not damaged, shift transmission to neutral. While being towed, the revolving gears of the transmission will provide lubrication to the gears and bearings. If the transmission is damaged, it will be adviseable to prevent the rotation of gears, bearings, and shafts which might otherwise suffer greater damage. Remove both rear axle drive shafts (par. 120), and cover the wheel hub openings to prevent the entrance of dirt or loss of lubricant. The same procedure should be followed if the front wheels are off the ground, to prevent rotation of the differential gears. A vehicle with rear wheels off the ground should be towed backwards only in an emergency, and it is adviseable to disconnect and remove the propeller shaft (par. 112).

Section IV

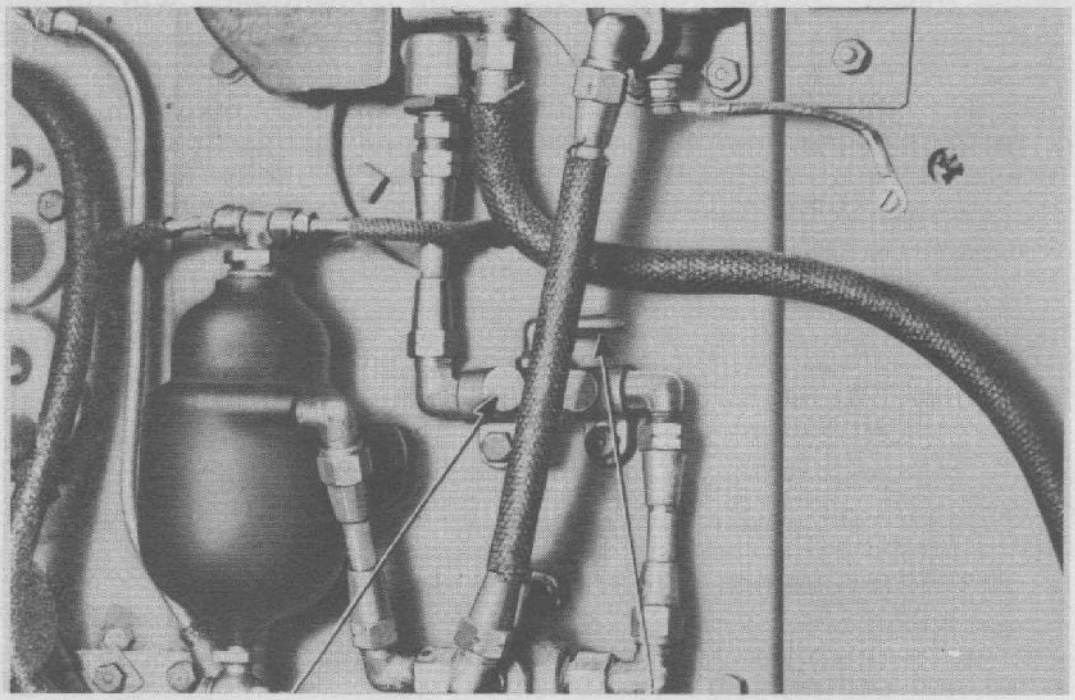
AUXILIARY EQUIPMENT CONTROLS AND OPERATION

8. FIRE EXTINGUISHER (fig. 6).

a. The fire extinguisher is operated by turning the handle to the left and working up and down like a pump. Best results will be obtained by directing the stream of liquid at the base of the flame, except in the case of burning liquid in a container, when the extinguisher stream should be directed against the inside of the container above the surface of the liquid.

9. TIRE INFLATION HOSE (fig. 12).

a. A tire inflation hose and a tire pressure gage are included in



TIRE HOSE CONNECTION (REMOVE CAP) AIR SUPPLY VALVE HANDLE

RA PD 323284

Figure 12 — Tire Inflation Hose Connection

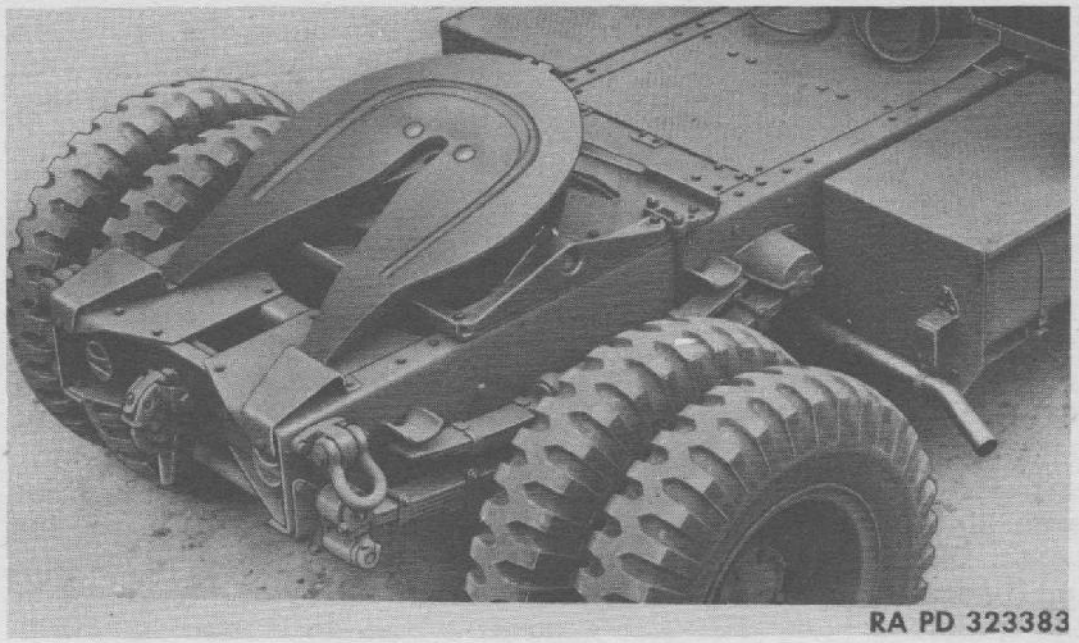


Figure 13 — Fifth Wheel Installed

the tool equipment of the vehicle. The inflation hose, when required, is to be attached to the supply valve of the air brake system. This valve is located on the air appliance panel in the engine compartment. Remove the cap from the supply valve, connect the tire inflation hose, and turn the supply valve handle to a position in line with the hose. This serves to cut out the governor from the air system and direct the air compressor output into the tire inflation hose.

10. FIFTH WHEEL (fig. 13).

a. The trailer coupler or fifth wheel requires little service other than lubrication of the several fittings and of the table. The trailer is disconnected from the tractor truck by means of the lock release lever which permits the tractor truck to be driven out from under the trailer. Keep fifth wheel mounting bolts tight.

b. Connecting Trailer to Tractor Truck. In connecting a trialer to the tractor truck air brake system, remove the dummy couplings from the hose couplings on the trailer. Connect the hose lines between the tractor truck and the trailer, being careful to see that the service line outlet on the tractor truck is connected to the service line outlet on the trailer, and that the emergency line outlet on the tractor truck is connected to the emergency line outlet on the trailer. Identification tags are mounted on all vehicles so that the connections can be easily identified. After the hose lines have been properly connected, the cut-out cocks in the outlets on the tractor truck must be opened. The cut-out cocks are open when the handle is at right angles to the line. This will permit the air brake system on the trailer to be charged and make the trailer brakes ready to operate. After connecting

the air brake system of a trailer to a tractor truck, the operation of the brakes must be checked before the vehicles are moved, by making a brake application and observing that the trailer brakes apply and release properly.

c. Disconnecting Trailer from Tractor Truck. To disconnect a trailer from a tractor truck, close the cut-out cocks on the tractor truck and disconnect the connecting hose lines. Always connect dummy couplings to all hose couplings when they are not in use. Disconnecting the trailer should automatically apply the trailer brakes, but no vehicle braked by air pressure should be parked where there is danger of moving in case the air pressure leaks off and the brakes release. The parking brake must be set or the wheels blocked to prevent the vehicle moving.

d. Releasing Trailer Brakes. If the brakes on the trailer have been automatically locked by disconnecting from the tractor truck, and it is necessary to release the brakes without reconnecting the trailer to the tractor truck, open the reservoir drain cock on the trailer.

Section V

OPERATION UNDER UNUSUAL CONDITIONS

11. COLD WEATHER OPERATION.

a. Purpose. Operation of automotive equipment at subzero temperatures presents problems that demand special precautions and extra careful servicing from both operation and maintenance personnel, if poor performance and total functional failures are to be avoided.

b. Gasoline. Winter grade of gasoline is designed to reduce cold weather starting difficulties; therefore, the winter grade fuel should be used in cold weather operation.

c. Storage and Handling of Gasoline. Due to condensation of moisture from the air, water will accumulate in tanks, drums, and containers. At low temperatures, this water will form ice crystals that will clog fuel lines and carburetor jets unless the following precautions are taken:

(1) Strain the fuel through filter paper, or any other type of strainer that will prevent the passage of water. CAUTION: *Gasoline flowing over a surface generates static electricity that will result in a spark, unless means are provided to ground the electricity. Always provide a metallic contact between the container and the tank, to assure an effective ground.*

(2) Keep tank full, if possible. The more fuel there is in the tank, the smaller the volume of air will be from which moisture can be condensed.

(3) Add one-half pint of denatured alcohol, Grade 3, to the fuel tank each time it is filled. This will reduce the hazard of ice formation in the fuel.

(4) Be sure that all containers are thoroughly clean and free from rust before storing fuel in them.

(5) If possible, after filling or moving a container, allow the fuel to settle before filling fuel tank from it.

(6) Keep all openings of containers tight to prevent snow, ice, dirt, and other foreign matter from entering.

(7) Wipe all snow or ice from dispensing equipment and from around fuel tank filler cap before removing cap to refuel vehicle.

d. Lubrication.

(1) TRANSMISSION AND DIFFERENTIAL.

(*a*) Universal gear lubricant, SAE 80, where specified on figure 14

or War Department Lubrication Guide, is suitable for temperature as low as −20°F. If consistent temperature below 0°F is anticipated, drain the gear cases while warm and refill with Grade 75 universal gear lubricant, which is suitable for operation at all temperatures below 0°F. If Grade 75 universal gear lubricant is not available, SAE 80 universal gear lubricant diluted with the fuel used by the engine, in the proportion of one part fuel to six parts universal gear lubricant, may be used. Dilute make-up oil in the same proportion before it is added to gear cases.

(*b*) After engine has been warmed up, engage clutch and maintain engine speed at fast idle for 5 minutes, or until gears can be engaged. Put transmission in low (first) gear, and drive vehicle for 100 yards, being careful not to stall the engine. This will heat gear lubricants to the point where normal operation can be expected.

(2) CHASSIS POINTS. Lubricate chassis points with general purpose grease, No. 0.

(3) STEERING GEAR HOUSING. Drain housing, if possible, or use suction gun to remove as much lubricant as possible. Refill with universal gear lubricant, Grade 75, or, if not available, SAE 80 universal gear lubricant diluted with fuel used in the engine, in the proportion of one part fuel to six parts SAE 80 universal gear lubricant. Dilute make-up oil in the same proportion before it is added to the housing.

(4) OILCAN POINTS. For oilcan points where engine oil is prescribed for above 0°F, use light lubricating preservative oil.

(5) PRECAUTIONS.

(*a*) Keep crankcase oil fluid by one of the following methods, listed in order of preference:

1. Keep vehicle in a heated enclosure when not in use.

2. After stopping engine, drain crankcase oil while still hot. Place warning tag in a conspicuous place in the cab to indicate crankcase is empty. Store oil in a warm place if possible; otherwise, heat oil before reinstalling.

3. Cover entire cab and engine section with tarpaulin. Place fire pots under tarpaulin about 3 hours before engine is to be started. A Primus, Van Prag, or other type blowtorch, and ordinary kerosene lanterns may be used. CAUTION: *Be careful in applying flame directly to oil pan.*

4. Do not move the vehicle from a warm place into subzero temperature, unless necessary.

5. Park vehicle without setting propeller shaft brake, to avoid brake freezing. Block wheels to prevent rolling of vehicle, and keep a blowtorch handy to thaw frozen propeller shaft or service brakes.

6. Inspect vehicle frequently for broken screws, bolts or other metal parts, and for loosened nuts.

OPERATION UNDER UNUSUAL CONDITIONS

7. Dilute crankcase oil with gasoline, or with Diesel fuel in an emergency. Turn engine over several times to mix oil and diluent. After 4 or more hours of operation, redilute oil if vehicle is to be left standing unprotected for 3 or more hours. Use diluent for both original dilution and redilution as follows:

Temperature	Diluent	Quantity
0°F to –20°F	gasoline	½ qt to each 4½ qt of engine oil
0°F to –20°F	Diesel fuel	½ qt to each 3½ qt of engine oil
Below – 20°F	gasoline	1 qt to each 5 qt of engine oil
Below – 20°F	Diesel fuel	1 qt to each 4 qt of engine oil

NOTE: *Presence of diluent increases engine oil consumption. Check oil level frequently.*

e. Protection of Cooling Systems.

(1) USE ANTIFREEZE COMPOUND. Protect the system with antifreeze compound (ethylene-glycol type) for operation below +32°F. The following instructions apply to use of new antifreeze compound.

(2) CLEAN COOLING SYSTEM. Before adding antifreeze compound, clean the cooling system, and completely free it from rust. If the cooling system has been cleaned recently, it may be necessary only to drain, refill with clean water, and again drain. Otherwise clean the system with cleaning compound.

(3) REPAIR LEAKS. Inspect all hose and replace if deteriorated. Inspect all hose clamps, plugs, and drain cocks, and tighten if necessary. Repair all radiator leaks before adding antifreeze compound. Correct all leakage of exhaust gas or air into the cooling system.

(4) ADD ANTIFREEZE COMPOUND. When the cooling system is clean and tight, fill the system with water to about one-third capacity. Then add antifreeze compound, using the proportion of antifreeze compound to the cooling system capacity indicated below. Protect the system to at least 10°F below the lowest temperature expected to be experienced during the winter season.

ANTIFREEZE COMPOUND CHART

(for 36-quart capacity cooling system)

Temperature	Antifreeze Compound (ethylene-glycol type)
+10°F	10 qt
0°F	11½ qt
—10°F	13½ qt
—20°F	16 qt
—30°F	18 qt
—40°F	20½ qt
—50°F	22½ qt

(5) WARM THE ENGINE. After adding antifreeze compound, fill with water to slightly below the filler neck; then start and warm the engine to normal operating temperature.

(6) TEST STRENGTH OF SOLUTION. Stop the engine and check the solution with a hydrometer, adding antifreeze compound if required.

(7) INSPECT WEEKLY. In service, inspect the coolant weekly for strength and color. If rusty, drain and clean cooling system thoroughly, and add new solution of the required strength.

(8) PRECAUTIONS.

(*a*) Antifreeze compound is the only antifreeze material authorized for ordnance material.

(*b*) It is essential that antifreeze solutions be kept clean. Use only containers and water that are free from dirt, rust, and oil.

(*c*) Use an accurate hydrometer. To test a hydrometer, use one part antifreeze compound to two parts water. This solution will produce a hydrometer reading of 0°F.

(*d*) Do not spill antifreeze compound on painted surfaces.

f. Electrical Systems.

(1) GENERATOR AND CRANKING MOTOR. Check the brushes, commutators, and bearings. See that the commutators are clean. The large surges of current which occur when starting a cold engine require good contact between brushes and commutators.

(2) WIRING. Check, clean, and tighten all connections, especially the battery terminals. Be sure that no short circuits are present.

(3) COIL. Check coil for proper functioning by noting quality of spark.

(4) DISTRIBUTOR. Clean thoroughly, and clean or replace points. Check the points frequently. In cold weather, slightly pitted points may prevent engine from starting.

(5) SPARK PLUGS. Clean and adjust spark plugs or replace, if necessary. If it is difficult to make the engine fire, reduce the gap to 0.005 inch less than that recommended for normal operation (par. 81 c). This will make ignition more effective at reduced voltages likely to prevail.

(6) TIMING. Check the timing carefully. Be sure that the spark is not unduly advanced nor retarded.

(7) BATTERY.

(*a*) The efficiency of batteries decreases sharply with decreasing temperatures, and becomes practically nil at —40°F. Do not try to start the engine with the battery when it has been chilled to temperatures below —30°F, until battery has been heated, or unless a warm slave battery is available. See that the battery is always fully charged, with the hydrometer reading between 1.275 and 1.300. A fully charged battery will not freeze at tem-

peratures likely to be encountered even in Arctic climates, but a fully discharged battery will freeze and rupture at +5°F.

(*b*) Do not add water to a battery when it has been exposed to subzero temperatures unless the battery is to be charged immediately. If water is added and the battery not put on charge, the layer of water will stay on top and freeze before it has a chance to mix with the acid.

(8) LIGHTS. Inspect the lights carefully. Check for short circuits and presence of moisture around sockets.

(9) ICE. Before every start, see that the spark plugs, wiring or other electrical equipment are free from ice.

g. Starting and Operating Engine.

(1) INSPECT CRANKING MOTOR MECHANISM. Be sure that no heavy grease or dirt has been left on the cranking motor throw-out mechanism. Heavy grease or dirt is liable to keep the gears from being meshed, or cause them to remain in mesh after the engine starts running. The latter will ruin the cranking motor and necessitate repairs.

(2) USE OF CHOKE. A full choke is necessary to secure the rich air-fuel mixture required for cold weather starting. Check the butterfly valve to see that it closes all the way and otherwise functions properly.

(3) CARBURETOR AND FUEL PUMP. The carburetor, which will give no appreciable trouble at normal temperatures, is liable not to operate satisfactorily at low temperatures. Be sure the fuel pump has no leaky valves or diaphragm, as this will prevent the fuel pump from delivering the amount of fuel required to start the engine at low temperatures when running speeds are reduced to between 30 and 60 revolutions per minute.

(4) AIR CLEANER. At temperatures below 0°F, do not use oil in air cleaner. The oil will congeal and prevent the easy flow of air. Wash filter elements in dry-cleaning solvent, dry, and replace. Ice and frost formations on the air cleaner elements can cause an abnormally high intake vacuum in the carburetor air horn hose, resulting in collapse.

(5) FUEL SYSTEM. Remove and clean sediment bowl, strainers, etc., daily. Also drain fuel tank sump daily to remove water and dirt.

h. Chassis.

(1) BRAKE BANDS. Brake bands, particularly on a new vehicle, have a tendency to bind when they are very cold. Always have a blowtorch handy to warm up these parts, if they bind prior to moving, or while attempting to move, the vehicle. Parking the vehicle with the brake released will eliminate most of the binding. Precaution must be taken, under these circumstances, to block the wheels or otherwise prevent the movement of the vehicle.

(2) EFFECT OF LOW TEMPERATURES ON METALS. Inspect the vehicle frequently. Shock resistance of metals, or resistance against breaking, is greatly reduced at extremely low temperatures. Operation of vehicles on hard, frozen ground causes strain and jolting which will result in screws breaking, or nuts jarring loose.

12. HOT WEATHER OPERATION.

a. General. Operation of these vehicles in high temperatures requires regular maintenance of cooling units, lubrication filtering devices, and air cleaners. In extremely high temperatures, water-saving devices, such as surge or overflow tanks, should be employed. Avoid the continuous use of low gear ratios whenever possible. Make frequent inspections and servicing of air cleaners, fuel filter, and oil filter, if side panels are removed during operation in dusty areas. Watch the temperature and oil gage constantly. Check and replenish oil and water frequently. CAUTION: *Inspect vehicle frequently for broken screws, bolts, or other metal parts, and for loosened nuts.*

b. Cooling System Maintenance.

(1) COOLING LIQUID. The formation of scale and rust in the cooling system is more likely to occur during operation in extremely high temperatures, so that rust preventives should always be added to the cooling liquid (par. 75). Use only clean water. Avoid the use of water that contains alkali or other substances which may cause scale and rust formations.

(2) COOLING SYSTEM. Thoroughly clean and flush the cooling system at frequent intervals when operating in extremely high temperatures.

(3) FAN BELTS AND WATER PUMP. Inspect fan belts at regular intervals and adjust if necessary (par. 76). Water pump must be kept in good operating condition.

(4) THERMOSTATS. Check the operation of the thermostats (par. 79). A thermostat must open at the calibrated temperature to prevent overheating of cooling liquid.

(5) HOSE CONNECTIONS. Check hose connections frequently for leaks.

c. Hot Dry Climates.

(1) Keep cooling system full of recommended coolant and maintain proper level of correct grade of lubricating oil in lubricating system. Check engine temperature frequently, and if temperature rises to 212°F, stop engine and inspect cooling system. Flush cooling system if necessary. Look for sand in radiator fins, and blow out with compressed air, if available.

(2) Under desert conditions, check oil filter, carburetor, air cleaner, and air compressor air filter every few hours, and service as necessary.

(3) Under sandy conditions, use lubricants sparingly, and clean all sand from fittings before lubricating.

(4) Avoid touching machined surfaces when making repairs.

(5) Do not park vehicle in sun for long periods, because this shortens life of tires. If possible, place vehicle under cover to protect it from sand and dust. Cover inactive vehicles with tarpaulins if no suitable building is available.

d. Hot Damp Climates.

(1) Keep cooling system clean and filled with clean, fresh (not salt) water. Use soft water when possible. Note engine temperature as registered by temperature gage frequently. Stop vehicle immediately if temperature of engine reaches 212°F.

(2) Protect exterior surfaces from atmosphere by renewing paint on all painted surfaces. Keep a film of light engine oil on unfinished exterior metal surfaces.

(3) Flush metal surfaces which have been exposed to salt water with fresh water, and apply a film of light engine oil to unfinished metal parts.

(4) Make frequent inspections of stored vehicles. Remove corrosion from exterior surfaces with flint paper 2/0 (from machined surfaces with crocus cloth), and apply a protective coating of paint, oil, or rust preventive compound.

e. Battery.

(1) WATER LEVEL. In torrid zones, cell water level should be checked daily. Replenish with pure distilled water if available, otherwise with any water fit to drink. However, continuous use of water with a high mineral content will eventually cause damage to the battery and should be avoided.

(2) SPECIFIC GRAVITY. Batteries operating in torrid climates should have a weaker electrolyte than for temperate climates. Instead of 1.300 gravity, the electrolyte should be adjusted to around 1.210 to 1.230 for a fully charged battery. This will prolong the life of the negative plates and separators. Under this condition the battery should be recharged at about 1.160. Where freezing conditions do not prevail, there is no danger with gravities from 1.230 to as low as 1.075.

(3) SELF-DISCHARGE. A battery will "self-discharge" at a greater rate at high temperatures if standing for long periods. This must be taken into consideration when operating in torrid zones. If necessary to park for several days, remove battery, and store in a cool place.

13. OPERATION IN MUD, SNOW, ICE, SAND, AND FLOOD.

a. Mud. Install tire chains on both rear wheels, and select low enough gear ratio to move vehicle steadily without putting undue driving strain on engine and axles.

b. Snow and Ice. Skidding is the general hazard encountered in these conditions. Install chains, and select the proper gear ratio to move the vehicle steadily, without imposing undue strain on engine and axle. When skidding occurs, turn the front wheels in the same direction that the rear end is skidding. Decelerate the engine, and apply brakes very gradullay until vehicle is under control. Proceed with caution. Remove chains as soon as their use is no longer necessary.

c. Sand. The main objective when driving in sand is to avoid the possibility of spinning the driving wheels. If possible, lay an improvised track with planks or brush in order to prevent the wheels coming in contact with the loose footing. Do not let the motor labor. Reverse and go forward several times if necessary, until a solid road bed is reached.

d. Flood. Know the fording depth of this vehicle, and do not exceed its known limits. Reduce the vehicle speed to 4 miles per hour and proceed with caution. Exercise care to avoid water damage to electrical and driving systems. Lubricated parts which have been affected by mud and water must be serviced at earliest opportunity.

e. Precautions. Do not allow mud, snow, or ice to cake on wheels, slack adjusters, steering knuckles, and steering arms, or to gather on the air system safety valve, oil filter, or air filter openings. Inspect and clean mud, snow, or ice off radiator core, fan, and fan belts. Keep mud, snow, ice, and moisture off all electrical connections.

14. DECONTAMINATION.

a. Poisonous Gas. Removing and destroying dangerous chemical agents encountered when operating in affected areas is known as decontamination and is covered by instructions contained in FM 17-59.

Section VI

FIRST ECHELON PREVENTIVE MAINTENANCE SERVICES

15. PURPOSE.

a. To insure mechanical efficiency, the vehicle must be systematically inspected at intervals each day that it is operated, and weekly, so that 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. The services set forth in this section are those performed by driver or crew before operation, during operation, at halt, after operation, and weekly.

b. Driver preventive maintenance services are listed on the back of "Drivers Trip Ticket and Preventive Maintenance Service Record," W.D. Form No. 48, to cover vehicles of all types and models. Items peculiar to specific vehicles but not listed on W.D. Form No. 48 are covered in manual procedures under the items with which they are releated. Certain items listed on the form that do not pertain to the vehicle involved are eliminated from the procedures as written into the manual. Every organization must thoroughly school each driver in performing the maintenance procedures set forth in manuals whether they are listed specifically on W.D. Form No. 48 or not.

c. The items listed on W.D. Form No. 48 that apply to this vehicle are expanded in this manual to provide specific procedures for accomplishment of the inspections and services. These services are arranged to facilitate inspection and conserve the time of the driver, and are not necessarily in the same numerical order as on W.D. Form No. 48. The item numbers, however, are identical with those shown on that form.

d. The general inspection of each item applies also to any supporting member or connection, and generally includes a check to see whether or not the item is in good condition, correctly assembled, secure, or excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether or not the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut.

(2) The inspection of a unit to see that it is "correctly assem-

bled" is usually an external visual inspection to see if it is in its correctly assembled position in the vehicle.

(3) The inspection of a unit to determine if it is "secure" is usually an external visual examination, a wrench, hand-feel, or a pry-bar check for looseness. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in assembly.

(4) "Excessively worn" will be understood to mean worn close to, or beyond serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

e. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority.

16. BEFORE-OPERATION SERVICE.

a. This inspection schedule is designed primarily as a check to see that the vehicle has not been tampered with or sabotaged since the After-operation Service was performed. Various combat conditions may have rendered the vehicle unsafe for operation, and it is the duty of the driver to determine whether or not the vehicle is in condition to carry out any mission to which it is assigned. This operation will not be entirely omitted, even in extreme tactical situations.

b. **Procedures.** Before-operation Service consists of inspecting items listed below according to the procedure described, and correcting or reporting any deficiencies. Upon completion of the service, results should be reported promptly to the designated individual in authority.

(1) ITEM 1, TAMPERING AND DAMAGE. Examine exterior of vehicle, engine, wheels, brakes, and steering control for any damage by falling debris, shell fire, sabotage, or collision.

(2) ITEM 2, FIRE EXTINGUISHER. Inspect portable fire extinguisher to see that it is present, full, securely mounted, and that nozzle is clean. Shake to determine contents.

(3) ITEM 3, FUEL, OIL, AND WATER. Add fuel, oil, or water as needed. Report unusual losses. NOTE: *During period when antifreeze is used, if it becomes necessary to replenish a considerable amount of water, have value of antifreeze tested.*

(4) ITEM 4, ACCESSORIES AND DRIVES. Examine air compressor, carburetor, generator, regulator, cranking motor, and water pump to see that they are in good condition and securely mounted. Check fan and air compressor belts for $\frac{1}{2}$- to $\frac{11}{16}$-inch deflection with finger pressure between pulleys.

(5) ITEM 5, AIR RESERVOIRS. Inspect reservoirs (tanks) and all air line connections for good condition and secure mountings. Open pet cocks and drain condensation.

(6) ITEM 6, LEAKS, GENERAL. Look on ground under vehicle, and under hood, for indications of fuel, oil, or water leaks. Examine

driving axle and transmission case for evidence of grease leaks. Trace any leaks to their source, and correct or report them to designated authority.

(7) ITEM 8, CHOKE. In cold weather pull choke about half-way out, and in freezing weather all the way out, while starting engine. Leave choke out only long enough to keep engine running smoothly until warmed up, then push to closed position.

(8) ITEM 7, ENGINE WARM-UP. Start engine, and note if cranking motor has adequate cranking speed and engages and disengages properly without unusual noise. If oil pressure does not indicate at least 30 pounds within one-half minute, stop engine and investigate trouble. Set hand throttle at 800 revolutions per minute while warming up engine. Do not move vehicle until temperature gage shows approximately 135°F.

(9) ITEM 9, INSTRUMENTS.

(*a*) *Fuel Gage.* Fuel gage must register approximate amount of fuel in each tank as selected by the fuel gage selector switch.

(*b*) *Oil Pressure Gage.* Oil pressure gage must register at least 30 pounds with engine running at approximately 800 revolutions per minute. If gage shows low or zero, stop engine and investigate or report immediately to designated authority.

(*c*) *Ammeter.* Ammeter may show high charging rate for first few minutes after starting engine until generator has restored to battery the current used, then register slight charge or zero with lights and accessories turned off. High charging rate for extended period may indicate a dangerously low battery or faulty regulator.

(*d*) *Engine Temperature Gage.* Temperature should rise slowly during warm-up. Normal operating temperature is 160°F to 180°F. If temperature continues to rise above 190°F, stop engine and investigate.

(*e*) *Tachometer.* White pointer should indicate the engine revolutions per minute. Red pointer should remain at the maximum engine revolutions per minute reached. Governed speed of the engine is 2600 revolutions per minute and should not be exceeded.

(*f*) *Air Pressure Gage.* During warm-up period gage should show a steady build-up until pressure of 105 pounds is reached. If pressure exceeds 105 pounds, stop engine and investigate. Do not move vehicle until minimum pressure of 70 pounds has been reached.

(10) ITEM 10, HORNS AND WINDSHIELD WIPERS. Sound horns for proper tone if tactical situation permits. Examine windshield wipers for proper operation and good contact through full stroke.

(11) ITEM 11, GLASS AND REAR VIEW MIRROR. Clean all glass, and inspect for cracks and discoloration. Adjust mirror for clear rear vision.

(12) ITEM 12, LAMPS AND REFLECTORS. Set light switch in each position, and inspect respective lights to see that they are securely mounted, burning, clean, and go out when switch is turned off.

(13) ITEM 13, WHEEL AND FLANGE NUTS. Inspect all wheel stud nuts and axle drive flange stud nuts to see that they are present and secure.

(14) ITEM 14, TIRES. Inspect tires for flats or low pressure (Model H-542-9, all tires should be 65 pounds; Model H-542-11, front tires 50 pounds, rear tires 70 pounds). Examine tires, wheels, rims, and valve caps for same condition as left when parking the vehicle.

(15) ITEM 15, SPRINGS. Inspect springs for evidence of tampering or sabotage since parking the vehicle.

(16) ITEM 16, STEERING LINKAGE. Examine steering gear housing for leaks or loose mounting bolts, and inspect all linkage for loose or damaged condition.

(17) ITEM 17, FENDERS AND BUMPER. Make sure that all fenders and bumper are in good condition, securely mounted, and have not been damaged since parking the vehicle.

(18) ITEM 18, TOWING CONNECTIONS. Pintle hook must be in serviceable condition, latch operate freely, and lock pin attached to chain. Lifting eyes must be present, serviceable, and secure.

(19) ITEM 19, CAB. Inspect cab for good condition and secure mounting. See that top and side curtains are not torn, and that all fasteners and attaching straps are present and secure.

(20) ITEM 20, DECONTAMINATOR. Decontaminator must be present, fully charged, and securely mounted. Shake to determine contents.

(21) ITEM 21, TOOLS AND EQUIPMENT. Inspect all tools and equipment for presence, serviceability, and proper stowage.

(22) ITEM 22, ENGINE OPERATION. After proper operating temperature of 160°F to 180°F has been reached, engine should idle smoothly. Accelerate and decelerate engine a few times, and listen for any unusual vibration or noise. Observe instruments for proper reading, and observe exhaust for excessive smoking.

(23) ITEM 23, DRIVER'S PERMIT AND FORM NO. 26. Operator must have his driver's permit. The Standard Form No. 26 Driver's Report—Accident, Motor Transportation, vehicle manual, Lubrication Guide, and W.D., A.G.O. Form No. 478 must be present, legible, and safely stowed.

(24) ITEM 25, DURING-OPERATION SERVICE. The During-operation Service should start immediately after the vehicle is put in motion, in the nature of a road test.

17. DURING-OPERATION SERVICE.

a. While vehicle is in motion, listen for such sounds as rattles, knocks, squeals, or hums that may indicate trouble. Look for indications of trouble in cooling system, and smoke from any part of the vehicle. Be on the alert to detect any odor of overheating components or units such as generator, brakes, or clutch, fuel vapor from a leak in fuel system, exhaust gas, or other signs of trouble. Each time the brakes are used, gears shifted, or vehicle

turned, consider this a test, and notice any unsatisfactory or unusual performance. Watch the instruments constantly. Notice promptly unusual instrument indications that may signify possible trouble in system to which the instrument applies.

b. Procedures. During-operation Service consists of observing items listed below according to the procedures following the instructions in each item, and investigating any indications of serious trouble. Notice minor deficiencies to be corrected or reported at earliest opportunity, usually the next scheduled halt.

(1) ITEM 27, FOOT AND HAND BRAKES. . With vehicle in motion, apply foot brake and observe for smooth and effective braking without pull to one side and without excessive drop in air pressure. Stop vehicle on grade and apply hand brake. Brake should hold vehicle with at least one-third of ratchet travel in reserve, and brake lever should remain in applied position.

(2) ITEM 28, CLUTCH. While shifting gears note any chatter, grabbing, or squealing of the clutch. Observe if clutch slips under load. Clutch pedal should have 1¾ to 2 inches of free pedal travel before clutch starts to disengage.

(3) ITEM 29, TRANSMISSION. Transmission gears should shift smoothly, and not slip out of mesh. If there is any unusual noise in transmission, stop vehicle and investigate.

(4) ITEM 31, ENGINE AND CONTROLS. Be on the alert for any deficiencies in engine operation, such as lack of power on acceleration, excessive smoke, misfiring, or overheating. Note any binding or looseness in engine control linkage.

(5) ITEM 32, INSTRUMENTS. Observe all instrument readings frequently during operation for indication of normal functioning of systems to which they apply.

(*a*) *Oil Pressure.* Normal reading is approximately 30 to 40 pounds with engine running above 800 revolutions per minute.

(*b*) *Ammeter.* Ammeter may show high charging rate for first few minutes after starting engine, until generator has restored to the battery the current used in starting, then register slight charge or zero with lights and accessories turned off. High charging rate for extended period may indicate a low battery or faulty regulator.

(*c*) *Fuel Gage.* Fuel gage should register approximate amount of fuel in each tank as selected by the fuel gage selector switch.

(*d*) *Speedometer.* Speedometer should register vehicle speed without needle fluctuation and record accumulating mileage without noise.

(*e*) *Engine Temperature Gage.* Normal temperature range is 160°F to 180°F. If temperature rises above 190°F, stop engine and investigate.

(*f*) *Tachometer.* White pointer should indicate the engine revolutions per minute. Red pointer should remain at the maximum revolutions per minute reached. Governed speed of the engine is 2,600 revolutions per minute and must not be exceeded.

(*g*) *Air Pressure Gage.* During warm-up period gage should

show a steady build-up until pressure of 105 pounds is reached. If pressure exceeds 105 pounds, stop engine and investigate. Do not move vehicle until minimum pressure of 70 pounds has been reached.

(6) ITEM 33, STEERING GEAR. Observe for wander, shimmy, binding, or pulling to either side of the road.

(7) ITEM 34, RUNNING GEAR. Listen for any unusual noise in wheels, axles, or springs that would indicate loose or damaged units.

18. AT-HALT SERVICE.

a. The At-halt Service may be regarded as minimum battle maintenance and should be performed under all tactical conditions, even though more extensive maintenance services must be slighted or omitted altogether.

b. **Procedures.** At-halt Service consists of investigating any deficiencies noted during operation, inspecting items listed below according to the procedures following the items, and correcting any deficiencies found. Deficiencies not corrected should be reported promptly to the designated individual in authority.

(1) ITEM 38, FUEL, OIL, AND WATER. Check to see that there is adequate fuel, oil, and water to operate vehicle to next scheduled stop. Replenish as supply and tactical situation permit. Loosen radiator cap cautiously, and do not fully remove until hissing has stopped.

(2) ITEM 39, TEMPERATURES OF HUBS, BRAKE DRUMS, TRANSMISSION, AND AXLE. Feel the wheel hubs and brake drums for abnormal temperatures. If any wheel hub is too hot to touch, bearings may be inadequately lubricated, damaged, or improperly adjusted. Abnormal temperatures at brake drums may be caused by dragging or improperly adjusted brakes. Examine transmission and rear axle for overheating and excessive oil leaks.

(3) ITEM 40, AXLE VENT. Inspect vent to see that it is present, secure, and not clogged.

(4) ITEM 41, PROPELLER SHAFTS. Inspect universal joints for loose bolts and any evidence of excessive lubricant leaks.

(5) ITEM 42, SPRINGS. Look for loose, broken, or shifting spring leaves, and loose mounting bolts, U-bolts, clips, and shackles.

(6) ITEM 43, STEERING LINKAGE. Inspect Pitman arm and linkage for looseness or damage. Observe steering gear housing for grease leaks.

(7) ITEM 44, WHEEL AND FLANGE NUTS. Inspect all wheel stud nuts and axle drive flange stud nuts to see that they are present and secure.

(8) ITEM 45, TIRES. Inspect for flats or low pressure (Model H-542-9, all tires should be 65 pounds; Model H-542-11, front tires 50 pounds, rear tires 70 pounds). Examine tires for missing valve caps, cuts, or bruises. Remove all foreign objects embedded in treads or wedged between dual wheels.

(9) ITEM 46, LEAKS, GENERAL. Look on ground under vehicle for evidence of fuel, oil, or water leaks, and around axles and transmission for evidence of grease leaks. Trace all leaks to their source, and correct or report them to designated authority.

(10) ITEM 47, ACCESSORIES AND BELTS. Inspect all accessories for loose mountings and incorrect alinement. Fan belts must not be frayed or broken and should have ½ to 11/16-inch deflection with finger pressure between the pulleys.

(11) ITEM 48, AIR CLEANER. If vehicle has been operated under extreme dust or sand conditions, examine sump for excessive dirt. Remove and clean if necessary.

(12) ITEM 49, FENDERS AND BUMPER. Inspect for loose mountings and damaged condition.

(13) ITEM 50, TOWING CONNECTIONS. Lifting eyes and pintle hook must be in serviceable condition. Pintle latch must operate freely, and lock pin must be securely attached to chain.

(14) ITEM 51, CAB. Inspect cab for good condition and secure mounting. See that top and side curtains are not torn, and that all fasteners and attaching straps are present and secure.

(15) ITEM 52, APPEARANCE AND GLASS. Clean all cab glass, rear vision mirror, and light lenses, and inspect for damage.

19. AFTER-OPERATION AND WEEKLY SERVICE.

a. After-operation Service is particularly important, because at this time the driver inspects his vehicle to detect any deficiencies that may have developed, and corrects those he is permitted to handle. He should report promptly, to the designated individual in authority, the results of his inspection. If this schedule is performed thoroughly, the vehicle should be ready to operate again on a moment's notice. The Before-operation Service, with a few exceptions, is then necessary only to ascertain whether the vehicle is in the same condition in which it was left upon completion of the After-operation Service. The After-operation Service should never be entirely omitted, even in extreme tactical situations, but may be reduced to the bare fundamental services outlined for the At-halt Service, if necessary.

b. Procedures. When performing the After-operation Service, the driver must remember to consider any irregularities noticed during the day in the Before-operation, During-operation, and At-halt Services. The After-operation Service consists of inspecting and servicing the following items. Those items of the After-operation Service that are marked by an asterisk (*) require additional weekly services, the procedures for which are indicated in subparagraph (*b*) of each applicable item.

(1) ITEM 55, ENGINE OPERATION. Before stopping engine, check for smooth idle. Accelerate and decelerate a few times, noting any unusual noise or excessive smoking. Investigate any deficiencies noted during operation.

(2) ITEM 56, INSTRUMENTS. Before stopping engine, inspect

all instruments for good condition, secure mounting, and proper readings.

(*a*) *Fuel Gage.* Gage should register approximate amount of fuel in either tank as selected by the fuel gage selector switch. Recheck reading after filling.

(*b*) *Oil Pressure Gage.* Gage should register between 30 and 40 pounds with engine running above 800 revolutions per minute.

(*c*) *Ammeter.* Ammeter should show zero (0) or only slight charge (+) at idling speed with all lights and accessories turned off.

(*d*) *Temperature Gage.* Gage should register between 160°F and 180°F for normal operation.

(*e*) *Tachometer.* White pointer should indicate the engine revolutions per minute. Red pointer should remain at the maximum revolutions per minute reached, and not exceed reading of 2,600.

(*f*) *Air Pressure Gage.* Air pressure should be between 80 and 105 pounds and must not drop excessively when brakes are applied.

(3) ITEM 57, HORNS AND WINDSHIELD WIPERS. Sound horns for proper tone, if tactical situation permits. Examine windshield wipers for proper operation and good blades.

(4) ITEM 54, FUEL, OIL, AND WATER. Fill the fuel tanks. Check the engine oil level with bayonet gage and, if necessary, fill to correct level. Check radiator coolant for proper level and contamination. Loosen radiator cap cautiously, do not fully remove until hissing has stopped, and add coolant as needed. In freezing weather have coolant checked with hydrometer, and add antifreeze with water as required. See that any fuel or water used from spare cans is replenished.

(5) ITEM 58, GLASS AND REAR VISION MIRROR. Inspect all cab glass for looseness and damage. Clean glass, and adjust rear vision mirror.

(6) ITEM 59, LAMPS AND REFLECTORS. Set light switch successively in each position and inspect respective lights to see that they are securely mounted, burning, clean, and go out when switch is turned off.

(7) ITEM 60, FIRE EXTINGUISHER. Examine portable fire extinguisher to see that it is full, securely mounted, and that nozzle is clean. A discharged extinguisher must be refilled or replaced.

(8) ITEM 61, DECONTAMINATOR. Decontaminator must be fully charged, securely mounted, and valve closed. Remove plug to determine contents.

(9) ITEM 62, *BATTERY.

(*a*) Inspect battery for leaks or damage, security of mountings, and connections. Battery connections and mountings should be kept clean and tight. Electrolyte should be three-eighth inch above top of plates. Add clean water if necessary.

(*b*) *Weekly.* Examine battery for cracks and leaks, tighten

all terminals and mountings, clean corroded terminals, and apply coating of grease. Add clean water to bring level three-eighth inch above cell plates. In freezing temperature, do not add water until just before vehicle is to be operated.

(10) ITEM 63, *ACCESSORIES AND BELTS.

(*a*) Inspect generator, fan, and air compressor belts to see that they are securely mounted and properly alined. Belts must have ½ to 11/16-inch deflection with finger pressure between pulleys.

(*b*) *Weekly.* Examine fuel pump, carburetor, generator, regulator, cranking motor, and fan for loose mounting bolts. Inspect belts for condition and adjustment.

(11) ITEM 64, *ELECTRICAL WIRING.

(*a*) Inspect all accessible wiring and conduits to see that they are clean, secure, and properly supported.

(*b*) *Weekly.* Wipe all oil and dirt from wiring, and inspect for deterioration. Make sure all connections are secure.

(12) ITEM 65, *AIR CLEANER AND ENGINE BREATHER CAPS.

(*a*) If vehicle has been operated under extreme dust or sand conditions, examine filter elements for clogged condition. Remove and clean if necessary.

(*b*) *Weekly.* Remove and clean air cleaner and engine breather caps, elements, and sumps. Refill to proper oil level, and reinstall.

(13) ITEM 66, *FUEL FILTER.

(*a*) Close shut-off valve, remove plug from filter bowl, and drain accumulated water and dirt.

(*b*) *Weekly.* Remove filtering element, and clean with dry-cleaning solvent. Make sure that all dirt is cleaned from filter bowl before reassembling.

(14) ITEM 67, ENGINE CONTROLS. Examine engine and accessory controls for loose, worn, or binding linkage. Lubricate as necessary.

(15) ITEM 68, *TIRES.

(*a*) Inspect tires for correct pressure (Model H-542-9, all tires 65 pounds; Model H-542-11, front tires 50 pounds, rear tires 70 pounds). Replace any missing valve caps, and inspect tires for cuts, bruises, fractures, or evidence of excessive wear.

(*b*) *Weekly.* Inspect tires for evidence of abnormal wear, and replace badly worn or otherwise unserviceable tires. Match tires according to tread and over-all circumferences.

(16) ITEM 69, *SPRINGS.

(*a*) Examine springs for evidence of broken or shifting leaves, loose or missing U-bolts, broken center bolts, shackle bolts, and rebound clips.

(*b*) *Weekly.* Tighten shackle and rebound clip bolts.

(17) ITEM 70, STEERING LINKAGE. Examine Pitman arm, drag link, and tie rod for damage and loose connections. Check for presence and security of steering stop screws.

(18) ITEM 71, PROPELLER SHAFTS, CENTER BEARING AND VENT. Examine propeller shafts for proper alinement, and universal joints for lubricant leakage and wear. Inspect center bearing for leaking seals and security of mounting. Inspect vent for clogged condition.

(19) ITEM 72, *AXLE VENT.

(*a*) Inspect axle vent for good condition, cleanliness, and secure attachment.

(*b*) *Weekly*. Remove vent, clean if necessary, and reinstall.

(20) ITEM 73, LEAKS, GENERAL. Inspect all fuel, oil, and water lines and connections for evidence of leaks. Look on ground under vehicle and around driving axle and transmission case for grease leaks.

(21) ITEM 74, GEAR OIL LEVELS. Examine transmission and driving axle for proper oil levels. Oil must not be more than one-half inch below filler hole when cold, and not above bottom edge of filler hole when hot.

(22) ITEM 75, AIR RESERVOIRS. Inspect reservoirs and all air line connections for good condition, secure mounting, and leaks. Open reservoir pet cocks and drain condensation.

(23) ITEM 76, FENDERS AND BUMPER. Examine fenders and bumper for good condition and secure mounting. Tighten all loose mounting bolts. Report any damaged condition to designated authority.

(24) ITEM 77, *TOWING CONNECTIONS.

(*a*) Lifting eyes and pintle hook must be in serviceable condition, and pintle pin attached to chain.

(*b*) *Weekly*. Lubricate and free up any binding conditions of pintle hook.

(25) ITEM 78, CAB. Inspect cab for loose mountings. See that soft top is in raised position, all fasteners present and secure, and that top is not ripped, seams torn, or glass broken.

(26) ITEM 82, *TIGHTEN WHEEL, RIM, AXLE DRIVE FLANGE, AND SPRING U-BOLT NUTS.

(*a*) See that all wheel rim and axle drive flange bolts and nuts are present and tightened securely.

(*b*) *Weekly*. Inspect all units for evidence of damaged or loose mounting bolts or nuts, and tighten as required.

(27) ITEM 83, *LUBRICATE AS NEEDED.

(*a*) Oil and lubricate all parts where inspection reveals need for lubrication. For specific intervals and lubricants to be used, refer to Lubrication Guide (par. 21).

(*b*) *Weekly*. Lubricate all points indicated on vehicle Lubrication Guide requiring attention on a weekly or mileage basis, also any points where conditions and experience indicate that additional lubrication is necessary.

(28) ITEM 84, *CLEAN ENGINE AND VEHICLE.

(*a*) Thoroughly clean inside of cab. Remove excessive dirt

and grease from exterior of vehicle, and make sure identification markings are visible.

(*b*) *Weekly*. Wash vehicle if possible, and observe for bright spots that would cause glare. Clean all excess dirt or oil from exterior of engine and, if compressed air is available, blow out all foreign objects from the radiator cooling fins.

(29) ITEM 85, *TOOLS AND EQUIPMENT.

(*a*) Inspect all tools for presence and serviceability, checking against vehicle stowage list (pars. 22 to 24).

(*b*) *Weekly*. Clean and stow all tools and equipment. Replace missing tools or equipment, or report to designated authority.

Section VII

LUBRICATION

20. LUBRICATION GUIDE.

a. War Department Lubrication Guide (fig. 14) prescribes lubrication maintenance for 5-ton 4 x 2 Tractor Truck (C.O.E.)

b. A lubrication guide is placed on or is issued with each vehicle and is to be carried with it at all times. In the event the vehicle is received without a guide, the using arm shall immediately requisition a replacement from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Mich.

c. Lubrication instructions on the guide are binding on all echelons of maintenance and there shall be no deviations from these instructions.

d. Service intervals specified on the guide are for normal operation conditions. Reduce these intervals under extreme conditions such as excessively high or low temperatures, prolonged periods of high speed, continued operation in sand or dust, immersion in water, or exposure to moisture, any one of which may quickly destroy the protective qualities of the lubricant and require servicing in order to prevent malfunctioning or damage to the materiel.

e. Lubricants are prescribed in the "Key" in accordance with three temperature ranges; above +32°F, +32°F to 0°F, and below 0°F. Determine the time to change grades of lubricants by maintaining a close check on operation of the vehicle during the approach to change-over periods. Be particularly observant when starting the engine. Sluggish starting is an indication of thickened lubricants and the signal to change to grades prescribed for the next lower temperature range. Ordinarily it will be necessary to change grades of lubricants *only when air temperatures are consistently in the next higher or lower range*, unless malfunctioning occurs sooner due to lubricants being too thin or too heavy.

21. DETAILED LUBRICATION INSTRUCTIONS.

a. Lubrication Equipment. Each piece of materiel is supplied with lubrication equipment adequate to maintain the materiel. Be sure to clean this equipment both before and after use. Operate lubricating guns carefully and in such manner as to insure a proper distribution of the lubricant.

b. Points of Application.

(1) Red circles surrounding lubrication fittings, grease cups, oilers and oil holes make them readily identifiable on the vehicle.

Wipe clean such lubricators and the surrounding surface before lubricant is applied.

(2) Where relief valves are provided, apply new lubricant until the old lubricant is forced from the vent. Exceptions are specified in notes on the Lubrication Guide.

c. Cleaning. Use SOLVENT, dry-cleaning, or OIL, fuel, Diesel, to clean or wash all parts. Use of gasoline for this purpose is prohibited. After washing, dry all parts thoroughly before applying lubricant.

d. Lubrication Notes on Individual Units and Parts. The following instructions supplement those notes on the Lubrication Guide which pertain to lubrication and service of individual units and parts.

(1) AIR CLEANER AND BREATHER. Daily, check level and refill engine air cleaner oil reservoir to bead level with used crankcase oil or OIL, engine, SAE 30 above +32°F and SAE 10 from +32°F to 0°F. From 0°F to —40°F, use OIL, hydraulic. Below —40°F remove oil and operate dry. Every 1,000 miles, daily under extreme dust conditions, remove air cleaners and wash all parts.

(2) VENTS. Gear case vents will be kept clean at all times. Axle housing vent must be cleaned and kept open. Inspect each time oil is checked and each time truck is operated under extremely dirty or muddy conditions.

(3) CRANKCASE. Daily, check level and refill to FULL mark with OIL, engine, SAE 30 above +32°F or SAE 10 from +32°F to 0°F. Below 0°F refer to OFSB 6-11. Every 1,000 miles, remove drain plug from bottom of crankcase and completely drain case. Drain only when engine is hot. After thoroughly draining, replace drain plug and refill crankcase to FULL mark on gage with correct lubricant to meet temperature requirements. Run engine a few minutes and recheck oil level. Be sure pressure gage indicates oil is circulating.

(4) OIL FILTERS. Every 1,000 miles, remove drain plug from oil filters to drain sediment. Every 6,000 miles, or more often if filter becomes clogged, remove filter element, clean inside of case and install new element. After renewing element, run engine a few minutes, recheck crankcase oil level, and fill to FULL mark with the correct grade of OIL, engine.

(5) GEAR CASES. Weekly, check level with truck on level ground, and if necessary add lubricant to within ½ inch of plug level when cold, or to plug level when hot. Every 6,000 miles, drain and refill. Drain only after operation when gear lubricant is warm. Refill with LUBRICANT, gear, universal SAE 90 above +32°F, SAE 80 from +32°F to 0°F or grade 75 below 0°F.

(6) WHEEL BEARINGS. Remove bearing cone assemblies from hub. Wash bearings, cones, spindle, and inside of hub, and dry thoroughly. Do not use compressed air. Inspect bearing races and replace if damaged. Wet the spindle and inside of hub and hub cap with GREASE, general purpose, No. 2 to a maximum thickness of 1/16 inch only to retard rust. Lubricate bearings with

TRUCK, 5 TON, 4x2, C.O.E.
(IHC)

SNL G-671.

For detailed instructions, refer to TM 9-812.

Clean fittings before lubricating. Lubricate after washing.

Clean parts with SOLVENT, dry-cleaning or OIL, fuel, Diesel. Dry before lubricating.

Requisition replacement Guide from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Michigan.

Reduce intervals under severe operating conditions.

Lubricate dotted arrow points on both sides. Opposite points are shown by short arrows.

Lubricant • Interval

Steering Gear Drain **6M**
Drain and refill

Spring Bolt **CG I**

Drag Link **CG I**

Air Compressor Sediment Drain **I**

Tachometer Cable **CG 6M**
Remove core and coat lightly with No. 0

Shock Absorber Link **CG I**

Slack Adjuster **CG I**

Brake Camshaft **CG I**

King Pin **CG I**

Front Wheel Bearings **WB 6**
Remove, clean and repack

Drag Link **CG I**

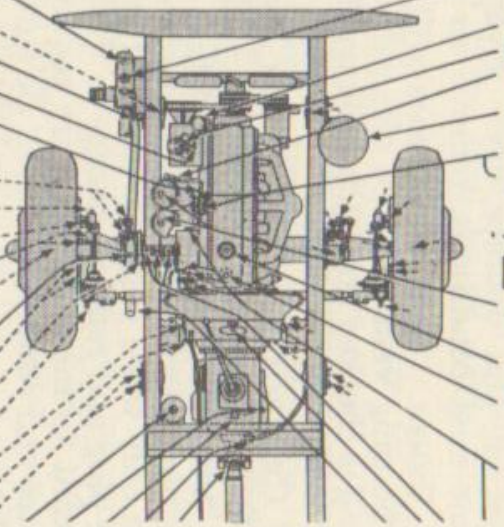
Brake Anchor Pins **CG I**

Shock Absorber **SA 6**

Tie Rod **CG I**

Clutch Cross Shaft **CG I**

Engine Rear Support **CG I**



Serviced From Under Hood

Interval • Lubricant

I GO Steering Gear Fill and Level Check level

D OE Crankcase Fill

½ OE Air Compressor Rockers

D *Crankcase Level*
Check level

D OE Air Cleaner
Check level (See Note)

6 OE Distributor (See Note)

I WB Distributor Shaft
Turn cup down 1 full turn, refill as required

Serviced From Cab

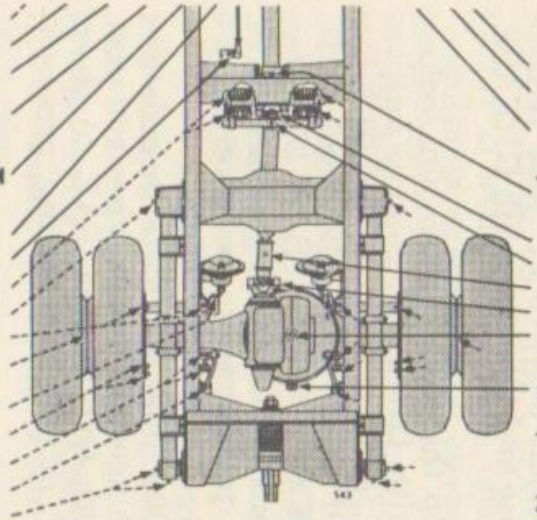
I *Oil Filters* Drain sediment
Every 6,000 miles, renew element (See Note)

D OE Engine Breather
Check level (See Note)

I *Crankcase Drain*
Drain and refill Cap. with Filters, 13½ qt.; without Filters, 8½ qt. (Reached from under truck) (See Note)

I OE Starter 6 to 8 drops
(Front bearing reached from under truck) (See Note)

RA PD 330857



Spring Shackle CG 1
Air Valve Lever CG 1
Transmission Fill and Level GO W
Check level
Transmission Drain 6
Drain and refill Cap. 12¼ qt. (See Note)
Speedometer Cable CG 6M
Remove core and coat lightly with No. 0
Universal Joint CG 6
Disc Brake Relay Lever CG 1
Disc Brake Anchor Pins CG 1
Spring Bolt CG 1
Brake Camshaft CG 1
Rear Wheel Bearings WB 6
Remove, clean and repack
Slack Adjuster CG 1
Brake Anchor Pins CG 1
Shock Absorber Link CG 1
Shock Absorber SA 6
Spring Shackle CG 1

6 WB Starter Reduction Gears

1 CG Pedal Shaft
6 WB Clutch Release Bearing
Sparingly
1 CG Steering Tube Jacket Upper Bearing

1 WB Propeller Shaft Center Bearing
6 CG Universal Joint
1 CG Disc Brake Cross Shaft
1 CG Universal Slip Joint
1 CG Universal Joint
6 *Differential Drain*
Drain and refill Cap. 8½ qt. (See Note)
W GO Differential Fill and Level
Check level

KEY

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE		
	above +32°F.	+32°F. to 0°F.	below 0°F.
OE—OIL, engine			
Crankcase	OE SAE 30	OE SAE 10	See OFSB 6-11
Other Points	OE SAE 30	OE SAE 10	PS
GO—LUBRICANT, gear, universal	GO SAE 90	GO SAE 80	GO Grade 75
CG—GREASE, general purpose	CG No. 1	CG No. 0	CG No. 0
WB—GREASE, general purpose, No. 2—All temperatures			
SA—FLUID, shock-absorber, heavy—All temperatures			
OH—OIL, hydraulic—From 0°F. to −40°F.			
PS—OIL, lubricating, preservative, special—See OE			

INTERVALS
D—Daily
W—Weekly
6M—6 months
½—500 miles
1—1,000 miles
6—6,000 miles

COLD WEATHER: For Lubrication and Service below 0°F., refer to OFSB 6-11.

No. 543 [NOT TO BE REPRODUCED in whole or in part without permission of the Office of the Chief of Ordnance.] CHEK-CHART

NOTES

AIR CLEANER AND BREATHER—Refill with used crankcase oil or OE. Every 1,000 miles, disassemble and wash all parts. From 0°F. to −40°F., use OH. Below −40°F., remove oil and operate dry.

CRANKCASE—Drain only when engine is hot.

GEAR CASES—Drain only after operation. Fill to plug level when hot or to ½ inch below plug level when cold.

OIL FILTERS—After renewing element, run engine a few minutes and refill crankcase to FULL mark.

DISTRIBUTOR—Every 6,000 miles, wipe breaker cam lightly with WB and lubricate breaker arm pivot and wick under rotor with 1 to 2 drops of OE.

STARTER—Every 6,000 miles, remove starter and lubricate Bendix drive outer bearing with OE. Also remove plug in bottom of reduction gear case and lubricate with WB.

OIL CAN POINTS—Every 1,000 miles, lubricate Throttle and Accelerator Linkage, Brake Linkage, Hinges, Latches, Clevises and Pins, Pintle and other rubbing parts with OE.

DO NOT LUBRICATE—Springs, Clutch Pilot Bearing, Generator.

LUBRICATED BY ORDNANCE PERSONNEL—Water Pump (Refer to TM 9-1812).

Copy of this guide will be carried on the material at all times. These lubrication instructions are binding on all echelons of maintenance.

By order of the Secretary of War:
G. C. Marshall, Chief of Staff.

29 Dec. 1943
Supersedes all previous issues.

Figure 14 — Lubrication Guide

RA PD 330857 B

GREASE, general purpose, No. 2 with a packer, or by hand, kneading lubricant into all spaces in the bearing. Use extreme care to protect the bearings from dirt, and immediately reassemble and replace wheel. Do not fill hub or hub cap. The lubricant in the bearing is sufficient to provide lubrication until the next service period. Any excess might result in leakage into the drum. Adjust bearings in accordance with instructions in paragraph 149.

(7) DISTRIBUTOR. Every 1,000 miles, lubricate distributor shaft with GREASE, general purpose, No. 2 by turning grease cup one full turn. Every 6,000 miles, wipe the distributor breaker cam lightly with GREASE, general purpose, No. 2. Also lubricate the breaker arm pivot and wick under rotor with 1 to 2 drops of OIL, engine, SAE 30 above +32°F, SAE 10 for +32°F to 0°F, and OIL, lubricating, preservative, special, below 0°F.

(8) CRANKING MOTOR. Every 6,000 miles, remove cranking motor (starter) and lubricate Bendix drive outer bearing with OIL, engine, SAE 30 above +32°F, SAE 10 for +32°F to 0°F, and OIL, lubricating, preservative, special, below 0°F. Also remove plug in bottom of reduction gear case and lubricate with GREASE, general purpose, No. 2.

(9) BASE (FIFTH WHEEL). Keep the base, coupler pin, locking jaws and guides well lubricated with GREASE, general purpose No. 1 above —32°F or GREASE, general purpose, No. 0 below —32°F. If covered with grit and sand, clean and relubricate. Lubricate the king pin lock with OIL, engine, SAE 30 above +32°F, SAE 10 for +32°F to 0°F, or OIL, lubricating, preservative, special below 0°F, as needed to permit easy operation of the hand lever.

(10) OILCAN POINTS. Every 1,000 miles, lubricate throttle and accelerator linkage, brake linkage, hinges, latches, clevises and pins, pintle, and other rubbing parts with OIL, engine, SAE 30 above +32°F, SAE 10 for +32°F to 0°F, or OIL, lubricating, preservative, special, below 0°F.

(11) DO NOT LUBRICATE. Springs, clutch pilot bearing, and generator.

(12) LUBRICATED BY ORDNANCE PERSONNEL ONLY.

(*a*) *Water Pump.* When disassembled for inspection or repair, repack with GREASE, general purpose, No. 2. Grease level should be ½ inch below filler plug opening.

(13) REPORTS AND RECORDS.

(*a*) *Reports.* Unsatisfactory performance of materiel will be reported to the ordnance officer responsible for maintenance.

(*b*) *Records.* A record of lubrication may be maintained in the Duty Roster (W.D., A.G.O. Form No. 6).

Section VIII

TOOLS AND EQUIPMENT STOWAGE ON THE VEHICLE

22. VEHICULAR TOOLS (fig. 15).

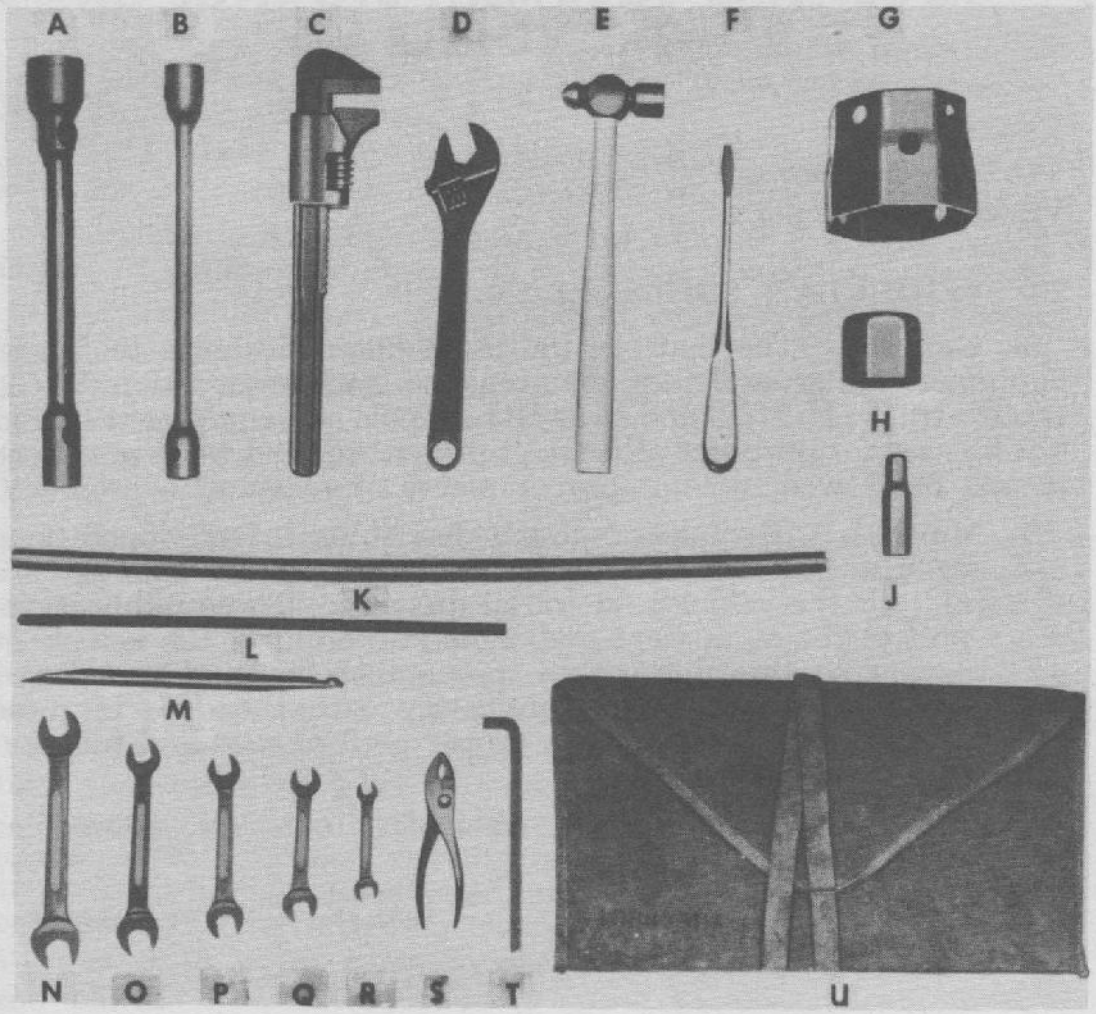
a. General. The materiel indicated herein includes tools and equipment for general care, maintenance, and preservation for the tractor trucks H-542-9 and H-542-11. Tools and equipment should not be used for purposes other than prescribed, and when not in use should be stowed in their proper places or receptacles provided.

b. Manuals. Technical manuals describing drivers' operations and organization maintenance, as well as a parts catalog, are shipped with the vehicles for initial delivery. These publications are a part of the equipment and should accompany the vehicle at all times, or be available within the organization and transferred with the vehicle. Complete familiarity with the data in these publications is necessary for the proper performance and function of drivers and mechanics.

c. Stowage. The following vehicular tools are stowed as follows:

Tool	Federal Stock No.	Location
HAMMER, machinists, ball peen, 16-oz	41-H-523	In tool box
HANDLE, wrench, driving nut	41-H-1542-25	In tool box
HANDLE, wrench, wheel bearing nut (141190H)		In tool box
HANDLE, wrench, wheel stud nut (116684H)		In tool box
PLIERS, combination slip joint, 6-in.	41-P-1650	In tool box
SCREWDRIVER, common, 6-in. blade	41-S-1076	In tool box
WRENCH, adjustable, auto type, 15-in.	41-W-450	In tool box
WRENCH, adjustable, crescent type, 12-in.	41-W-488	In tool box
WRENCH, driving flange nut (19495 HA)		In tool box
WRENCH, engineers, 15-deg angle, open-end, 3/8-in. x 7/16-in.	41-W-991	In tool box
WRENCH, engineers, 15-deg angle, open-end, 1/2-in. x 19/32-in.	41-W-1003	In tool box
WRENCH, engineers, 15-deg angle, open-end, 9/16-in. x 11/16-in.	41-W-1005-5	In tool box

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

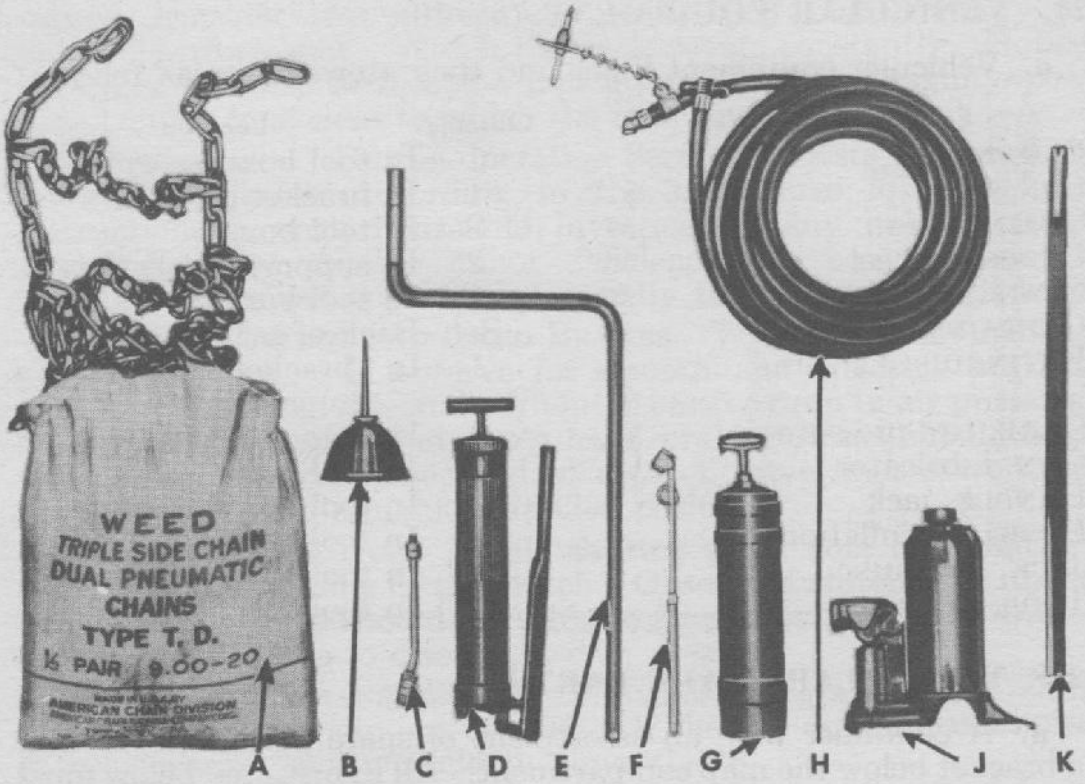


A WRENCH. WHEEL STUD NUT
B WRENCH, AXLE DRIVE FLANGE NUT
C WRENCH, AUTO TYPE
D WRENCH ADJUSTABLE
E HAMMER, PEEN
F SCREW DRIVER
G WRENCH, REAR WHEEL BEARING NUT
H WRENCH, FRONT WHEEL BEARING NUT
J WRENCH, SPARK PLUG
K HANDLE, WHEEL NUT WRENCH
L HANDLE, WHEEL BEARING NUT WRENCH
M TOOL, TIRE RIM
N WRENCH, DOUBLE END, 3/4 - 7/8 INCH
O WRENCH, DOUBLE END, 5/8 - 25/32 INCH
P WRENCH, DOUBLE END, 9/16 - 11/16 INCH
Q WRENCH, DOUBLE END, 1/2 - 9/32 INCH
R WRENCH, DOUBLE END, 3/8 - 7/16 INCH
S PLIERS
T WRENCH, DRAIN PLUG
U BAG, TOOL

RA PD 323299

Figure 15 — Vehicular Tools

TOOLS AND EQUIPMENT STOWAGE ON THE VEHICLE



A CHAINS, TIRE	F GAGE, TIRE
B CAN, OIL	G EXTINGUISHER, FIRE
C ADAPTER, LUBRICATOR	H HOSE, TIRE INFLATION
D GUN, LUBRICATOR	J JACK, HYDRAULIC
E CRANK STARTING	K HANDLE, JACK

RA PD 323398

Figure 16 — Vehicular Equipment

Tool	Federal Stock No.	Location
WRENCH, engineers, 15-deg angle, open-end, $\frac{5}{8}$-in. x $\frac{25}{32}$-in.	41–W–1008–10	In tool box
WRENCH, engineers, 15-deg angle, open-end, $\frac{3}{4}$-in. x $\frac{7}{8}$-in.	41–W–1012–5	In tool box
WRENCH, socket, drain plug, countersunk (122815 H)		In tool box
WRENCH, spark plug, 14-mm. (136386H)		In tool box
WRENCH, wheel bearing nut, front (141225)		In tool box
WRENCH, wheel bearing nut, rear (141226)		In tool box
WRENCH, wheel stud nut (52393VA)		In tool box

23. VEHICULAR EQUIPMENT (fig. 16).

a. Vehicular equipment items and their stowage are as follows:

Equipment	Quantity	Location
BAG, tool	1	In tool box
CAN, oil	1	In bracket on dash
CHAINS, tire	1 Set	In tool box
CHOCKS, wheel	2	In supports on fuel tank
CRANK, starting	1	In tool box
CURTAINS, side	Set	Back of seats
EXTINGUISHER, fire	1	In bracket in driver's compartment
GAGE, tire pressure	1	In map compartment
GUN, lubricator	1	In tool box
HANDLE, jack	1	In tool box
HOSE, tire inflation	1	In tool box
JACK, hydraulic	1	In tool box
TOOL, tire rim	1	In tool box

24. VEHICULAR SPARE PARTS.

a. A container with an assortment of spare parts is located in a bracket below the map compartment. All items listed below must be replaced immediately after use, so that spare parts may be available at all times.

Spare Parts	Quantity	Location
BELT, fan	2	In spare parts container
CAPS, tire valve	Box	In spare parts container
CORES, tire valve	Box	In spare parts container
LAMP, blackout marker light	1	In spare parts container
LAMP-UNIT, blackout stop light	1	In spare parts container
LAMP-UNIT, blackout taillight	1	In spare parts container
LAMP-UNIT, service stop light	1	In spare parts container
PINS, cotter	Box	In spare parts container
SPARK PLUG, with gasket	1	In spare parts container
TAPE, friction	Roll	In spare parts container
WIRE, 22-gage	Coil	In spare parts container

PART TWO—Vehicle Maintenance Instructions

Section IX

MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD

25. DESCRIPTION.

a. Every vehicle is supplied with a copy of A.G.O. Form No. 478 which provides a means of keeping a record of each MWO completed or major unit assembly replaced. This form includes spaces for the vehicle name and U.S.A. Registration Number, instructions for use, and information pertinent to the work accomplished. It is very important that the form be used as directed and that it remain with the vehicle until the vehicle is removed from service.

26. INSTRUCTIONS FOR USE.

a. Recording. Personnel performing modifications or major unit assembly replacement must record clearly on the form a description of the work completed and must initial the form in the columns provided. When each modification is completed, record the date, hours and/or mileage, and MWO number. When major unit assemblies, such as engines, transmissions, and transfer cases, are replaced, record the date, hours and/or mileage, and nomenclature of the unit assembly. Minor repairs and minor parts and accessory replacements need not be recorded.

b. Early Modifications. Upon receipt by a third or fourth echelon repair facility of a vehicle for modification or repair, maintenance personnel will record the MWO numbers of modifications applied prior to the date of A.G.O Form No. 478.

Section X

SECOND ECHELON PREVENTIVE MAINTENANCE

27. SECOND ECHELON PREVENTIVE MAINTENANCE SERVICES.

a. Regular scheduled maintenance inspections and services are a preventive maintenance function of the using arms, and are the responsibility of commanders of operating organizations.

(1) FREQUENCY. The frequency of the preventive maintenance services outlined herein is considered a minimum requirement for normal operation of vehicles. Under unusual operating conditions, such as extreme temperatures and dusty or sandy terrain, it may be necessary to perform certain maintenance services more frequently.

(2) FIRST ECHELON PARTICIPATION. The drivers should accompany their vehicles and assist the mechanics while periodic second echelon preventive maintenance services are performed. Ordinarily the driver should present the vehicle for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry and not caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the vehicle should not be washed or wiped thoroughly clean, since certain types of defects, such as cracks, leaks, and loose or shifted parts or assemblies are more evident if the surfaces are slightly soiled or dusty.

(3) If instructions other than those contained in steps (4) and (5) which follow are required for the correct performance of a preventive maintenance service, or for correction of a deficiency, other sections of this manual pertaining to the item involved, or a designated individual in authority, should be consulted.

(4) GENERAL PROCEDURES. These general procedures are basic instructions which are to be followed when performing the services on the items listed in the specific procedures. NOTE: *The second echelon personnel must be thoroughly trained in these procedures so that they will apply them automatically.*

(*a*) When new or overhauled subassemblies are installed to correct deficiencies, care should be taken to see that they are clean, correctly installed, properly lubricated, and adjusted.

(*b*) When installing new lubricant retainer seals, a coating of the new lubricant should be wiped over the sealing surface of the lip of the seal. When the new seal is a leather seal, it should be soaked in SAE 10 engine oil (warm if practicable) for at least 30 minutes. The leather lip should be worked carefully by hand before installing the seal, and it must not be scratched or marred.

(*c*) The general inspection of each item applies also to any supporting member or connection, and usually includes a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn. The mechanic must be thoroughly trained in the following explanations of these terms.

1. The inspection for "good condition" is usually an external visual inspection to determine if the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut.

2. The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether or not it is in its normal assembled position in the vehicle.

3. The inspection of a unit to determine if it is "secure" is usually an external visual examination, and a wrench, hand-feel, or pry-bar check for looseness. Such an inspection should include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in assembly.

4. "Excessively worn" will be understood to mean worn close to, or beyond serviceable limits, and likely to result in a failure if not replaced before the next scheduled inspection.

(*d*) *Special Services.* These services are indicated by repeating item numbers in the columns showing 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 include:

1. Adjust. Make all necessary adjustments in accordance with the pertinent section of this manual, special bulletins, or other current directives.

2. Clean. Clean units of the vehicle with dry-cleaning solvent to remove excess lubricant, dirt, and other foreign material. After the parts are cleaned, rinse them in clean fluid and dry them thoroughly. Take care to keep the parts clean until reassembled, and be certain to keep cleaning fluid away from rubber or other material that it would damage. Clean the protective grease coating from new parts since this material is not a good lubricant.

3. Special Lubrication. This applies either to lubrication operations that do not appear on the vehicle Lubrication Guide, or to items that do appear on Guide but should be performed in connection with the maintenance operations, if parts have been disassembled for inspection or service.

4. Serve. This usually consists of performing special operations, such as replenishing battery water, draining and refilling units with oil, and cleaning or changing the oil filter or cartridges.

5. Tighten. All tightening operations should be performed with sufficient wrench torque (force on the wrench handle) to

tighten the unit according to good mechanical practice. Use torque-indicating wrench where specified. Do not overtighten, as this may strip threads or cause distortion. Tightening will always be understood to include the correct installation of lock washers, lock nuts, and cotter pins provided to secure the tightening.

(*e*) When conditions make it difficult to perform the complete preventive maintenance procedures at one time, they can sometimes be handled in sections, planning 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.

(*f*) The numbers of the preventive maintenance procedures that follow are identical with those outlined on W.D. AGO Form No. 461, which is the Preventive Maintenance Service Work Sheet for Wheeled and Half-track Vehicles. Certain items on the work sheet that do not apply to this vehicle are not included in the procedures in this manual. In general, the numerical sequence of items on the work sheet is followed in the manual procedures, but in some instances there is deviation for conservation of the mechanic's time and effort.

(5) SPECIFIC PROCEDURES. The procedures for performing each item in the 1,000-mile (monthly) and 6,000-mile (6-month) maintenance procedures are described in the following chart. Each page of the chart has two columns at its left edge corresponding to the 6,000-mile and 1,000-mile maintenance respectively. Very often it will be found that a particular procedure does not apply to both scheduled maintenances. In order to determine which procedure to follow, look down the column corresponding to the maintenance due, and wherever an item number appears perform the operation indicated opposite the number.

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
	ROAD TEST
	NOTE: *When the tactical situation does not permit a full road test, perform operations which require little or no movement of the vehicle. When a road test is possible, it should be for preferably 3 miles, and not over 5 miles.*
1	1 BEFORE-OPERATION SERVICE. Perform the Before-operation Service as directed in paragraph 16.
3	3 INSTRUMENTS AND GAGES.
	Oil Pressure Gage. Oil pressure should be 30 to 40 pounds with engine above fast idle. Stop engine and investigate if gage registers zero or low pressure.
	Ammeter. High charging rate should be indicated for first few minutes, until generator restores to battery the current used in starting engine. High charging rate for

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
		extended period with all the electrical units turned off may indicate a low battery or a faulty regulator. *Temperature Gage.* Reading should increase gradually during warm-up period until normal temperature of 160°F to 180°F is reached. CAUTION: *Stop engine and investigate if temperature rises above 190°F. Do not move vehicle until engine temperature reaches 135°F.* *Fuel Gage.* Gage should register approximate amount of fuel in each tank as selected by the fuel gage selector switch. *Speedometer.* Speedometer needle should indicate vehicle speed, and odometer should record accumulating miles. *Air Pressure Gage.* Air pressure should be between 80 and 105 pounds. Pressure should not drop excessively when brakes are applied. Low pressure indicator buzzer should sound at pressures below 60 pounds. *Tachometer.* White pointer should indicate the engine revolutions per minute. Red pointer should remain at the maximum revolutions per minute reached. Governed engine speed is 2,600 revolutions per minute and should not be exceeded.
4	4	HORNS AND MIRROR. Test horns for proper operation and tone, if tactical situation permits. Adjust the rear vision mirror.
5	5	BRAKES (SERVICE AND PARKING). Apply foot brake during operation to test for smooth effective braking without side pull. Apply hand brake with vehicle on reasonable incline. Brake should hold vehicle with one-third of ratchet travel in reserve, and should remain in applied position.
6	6	CLUTCH. While shifting gears, note any drag, chatter, or squealing of the clutch. Test for slipping while under load. Pedal-free travel before meeting resistance should be 1¾ to 2 inches. See paragraph 62 for adjustment.
7	7	TRANSMISSION. Shifting levers must operate freely, and gears must not slip out of mesh. Note any unusual noises that would indicate damaged gears or bearings or inadequately lubricated parts.
8	8	STEERING. Turn steering wheel full travel in both directions, road conditions permitting, and observe any looseness or binding. Note any tendency to wander, shimmy, or pull the vehicle to one side while driving in straight-ahead position. When the vehicle is stopped, inspect the steering wheel and column for good condition and secure mountings.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
9	9	ENGINE. Engine should run smoothly at idle speed. Listen for knocks and rattles at idle and under load, while engine is accelerated and decelerated. Under load, be on the alert for heavy ping, indicating excessive carbon or early ignition. Note any misfiring or excessive smoking. Test vehicle for power and governed speed of 35 miles per hour on Model H-542-9 or 38 miles per hour on Model H-542-11.
10	10	UNUSUAL NOISES. During road test, be on the alert for any unusual noise or vibration that would indicate loose, worn, or damaged units or attachments, or lack of lubrication.
12	12	AIR BRAKE SYSTEM LEAKS. With air pressure at 105 pounds, apply the foot brake and stop the engine. There should be no noticeable drop of pressure in one minute. If pressure drops during the test, test the system for leaks by soapsuds method.
13	13	TEMPERATURES. Cautiously touch hubs, brake drums, transmission, and driving axle for evidence of overheating.
14	14	LEAKS (ENGINE OIL, WATER, AND FUEL). Look on ground under vehicle, and around engine, radiator, axles, and transmission for evidence of fuel, oil, or water leaks. Trace any leaks found to their source, and correct or report them to designated authority.
16	16	GEAR OIL LEVEL AND LEAKS. Remove filler plugs and check lubricant level in driving axle and transmission. NOTE: *Level is from the lower edge of the filler hole when hot, to ½ inch below when cold.* If gear oil change is due or condition of the lubricant indicates a change is necessary, drain and refill. Examine all units for any evidence of grease leaking at the seals.
		MAINTENANCE OPERATIONS
		Raise Vehicle — Block Safely
17	17	UNUSUAL NOISES (ENGINE, BELTS, ACCESSORIES, TRANSMISSION, PROPELLER SHAFT, AND JOINTS). Run vehicle in an intermediate gear, slightly above idle speed, and listen for any unusual noises or excessive vibrations that would indicate worn, damaged, or underlubricated units. Locate and correct or report any unusual noises heard during road test to designated authority.
22	22	BATTERY. Inspect battery case for cracks and leaks. Clean top of battery; inspect cables, terminals, bolts, posts, straps, and hold-downs for good condition. Test specific gravity and record on W.D., A.G.O. Form No. 461.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
		Specific gravity readings below 1.225 indicate battery should be recharged or replaced. Add clean water to bring electrolyte 3/8 inch above plates.
22		*Serve.* Perform high-rate discharge test according to instructions for "condition" test which accompany test instrument, and record voltage on W.D., A.G.O. Form No. 461. Cell variation should not be more than 20 percent. NOTE: *Specific gravity must be above 1.225 to make this test.*
		Clean. Clean entire battery and carrier, and repaint carrier if corroded. Clean battery cable terminals, terminal bolts, nuts, and battery posts. Inspect bolts for serviceability. Lightly grease posts before reassembling terminals. Tighten hold-down bolts carefully to avoid damage to the battery.
18	18	CYLINDER HEAD AND GASKETS. Examine cylinder head to see that it is in good condition and secure. Look for oil, water, or compression leaks around bolts or gaskets. Cylinder head will not be tightened unless there is a definite evidence of looseness or leaks. If necessary to tighten cylinder head, follow sequence in paragraph 50, tighten cylinder head bolts to a tension of 80 foot-pounds with torque-indicating wrench, and readjust valve stem to rocker arm clearance to 0.018 to 0.020 inch with engine hot and running.
	19	VALVE MECHANISM. Listen for noisy valves, indicating excessive valve stem to rocker arm clearance. Adjust clearance when need is indicated by excessive noise or faulty engine performance.
19		*Adjust.* Adjust valve stem to rocker arm clearance to 0.018 to 0.020 inch with engine hot and running. Inspect valves, rocker arms, shaft, springs, and retainers to see that they are in good condition, correctly assembled, and secure. Make sure oil is being delivered to valve mechanism. Replace valve rocker arm cover gasket if unserviceable.
	20	SPARK PLUGS. Disconnect high tension wires from spark plugs. Wipe the insulators clean. Inspect insulators for cracks or any indication of compression leaks. Connect wires.
20		*Serve.* Clean dirt from around spark plug base. Remove spark plugs, and clean thoroughly with abrasive-type cleaner, or install new or reconditioned plugs. Inspect insulators for cracks, and inspect electrodes for burning. Reset the gap, bending outer electrode only,

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly

to 0.028 to 0.032 inch. Install plugs, using new gaskets, after item 21 has been performed.

21		COMPRESSION TESTS. Test compression of each cylinder and record gage reading on W.D., A.G.O. Form No. 461. Normal compression at cranking speed is 108 to 115 pounds. Individual cylinder compressions should not vary more than 10 pounds between cylinders.
23	23	CRANKCASE. Inspect oil pan, timing gear cover, and clutch housing for evidence of oil leaks. If an oil change is due or conditions of oil indicates the necessity, remove oil pan drain plug and drain oil. Refill to the proper level with specified oil. CAUTION: *Do not start engine until item 24 has been performed.*
24	24	OIL FILTER AND LINES. Inspect oil filter and lines to see that they are in good condition, securely mounted, and not leaking. Remove filter drain plug and drain off accumulated sediment.
24		*Serve.* Remove oil filter elements. Clean and drain case. Install new filter elements, and make sure to replace cover gasket when reassembling. Check filter for leaks after starting engine.
25	25	RADIATOR (SHELL, CORE, MOUNTINGS, HOSE, CAP AND GASKET, ANTIFREEZE, AND RECORD). Inspect radiator core for leaks, loose mounting bolts, or obstructions. Inspect shell for damage and coolant for contamination. If antifreeze is used, test for temperatures anticipated, and record on W.D., A.G.O. Form No. 461. Clean dirt and insects from exterior of core, and tighten all mounting bolts and hose connections securely.
26	26	WATER PUMP, FAN, AND SHROUD. Examine water pump for evidence of leaks. See that fan blades are in good condition, and mounting bolts tight. Note if there is noticeable end play in shaft. Inspect shroud to see that it is securely mounted, not bent, and that it does not contact the fan blades.
27	27	GENERATOR, CRANKING MOTOR, AND SWITCH. Inspect generator and cranking motor for loose mounting bolts and loose wiring connections. Fully depress clutch pedal and press cranking motor control switch button to test operation of the cranking motor mechanism.
27		*Serve.* Remove generator and cranking motor inspection covers, and inspect commutators and brushes to see that they are in good condition, that brushes are free in their holders, springs not broken, and all brush wires in good condition and secure.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
		Clean. If commutators are dirty, clean with flint paper 2/0, and blow out dust and dirt with compressed air. Replace cover bands, and tighten all mounting bolts and electrical connections securely.
28	28	AIR COMPRESSOR. Inspect compressor for good condition, secure mounting, and leaks.
		Adjust. Check the clearance of the unloader valve and the discharge valve. Unloader valve and discharge valve clearance should be 0.010 to 0.015 inch.
29	29	DRIVE BELTS AND PULLEYS. Inspect fan, generator, and air compressor pulleys to see that they are in good condition and securely mounted. Examine belts for excessive wear and for deterioration.
		Adjust. Adjust belts to ½- to 11/16-inch deflection with finger pressure between the pulleys.
30	30	TACHOMETER DRIVE AND ADAPTER. Inspect to see that they are in good condition, correctly assembled, and secure. Make sure flexible casing is properly supported and not leaking.
31	31	DISTRIBUTOR. Clean distributor cap and housing. Remove cap, and examine cap and rotor arm for cracks, carbon runners, or excessively burned electrodes. Inspect points for proper gap, alinement, burned or pitted condition. If points are slightly burned, reface on fine stone, and adjust gap to 0.018 to 0.024 inch.
31	31	*Serve.* If distributor plate assembly is excessively dirty, remove and thoroughly clean, dry with compressed air, and lubricate all parts as specified in Lubrication Guide. If breaker points are pitted, burned, or worn to an unserviceable condition, install a new set of points so that they are well alined and engage squarely, and set gap to 0.018 to 0.024 inch. By finger rotation, test centrifugal advance for normal range of movement and return, when released, without binding or sticking. Make sure all wiring is clean and tight as unit is reassembled.
32	32	COIL AND WIRING. Inspect coil for cracked insulation or loose mounting bolts. Examine all wiring for good condition, cleanliness, correct assembly, tight connections, and chafing against other parts. Clean all exposed ignition wiring with a dry cloth.
33	33	MANIFOLDS. Inspect intake and exhaust manifolds for cracks, gasket leaks, or loose mounting nuts.
33		*Tighten.* Tighten all manifold and mounting nuts securely.

Maintenance		
6,000 Mile	1,000 Mile	
6-Month	Monthly	
34	34	CARBURETOR AIR CLEANER. Inspect for evidence of leaks. Remove air cleaner and disassemble. Thoroughly clean element and oil reservoir. Refill with engine oil to level mark on body. Reassemble, tightening all mounting connections securely.
35	35	ENGINE BREATHER CAP. Remove engine breather cap, and thoroughly clean the element and sump. Dip element in engine oil, drain off excess oil, and replace. Refill sump to proper level.
36	36	CARBURETOR (CHOKE, THROTTLE, LINKAGE, AND GOVERNOR). Inspect carburetor, lines, and connections for evidence of leaks. Inspect all linkage for wear, and see that it completely opens and closes choke and throttle valves when operated. Make sure that governor is properly sealed.
37	37	FUEL FILTER AND LINES. Examine filter for loose mountings and connections. Remove filter bowl and element, and clean thoroughly. Blow lightly with compressed air, and reassemble, using new gaskets.
38	38	FUEL PUMP. Inspect pump to see that it is in good condition, securely mounted, and not leaking.
38		*Test.* Attach pressure gage to fuel inlet line at carburetor, and start engine. Fuel pump pressure should be 4 to 5 pounds with engine running at idle speed.
39	39	CRANKING MOTOR. Start engine and note if action of cranking motor is satisfactory, particularly that starting drive engages and disengages properly without unusual noises and has adequate cranking speed to start engine readily. As engine starts, observe if all instruments are operating properly.
40	40	OIL, FUEL, AND WATER LEAKS. With engine running, inspect all units serviced for fuel, oil, or water leaks. Trace any leaks to their source, and correct or report them to designated authority.
41	41	IGNITION TIMING. Check ignition timing marks on crankshaft pulley and on pointer on gear case. They should line up as light flashes. Accelerate engine, and note if centrifugal advance is operating correctly.
41		*Adjust.* Adjust the ignition timing, following the instructions in paragraph 49.
42	42	ENGINE IDLE AND VACUUM TESTS. Connect vacuum gage, and adjust the carburetor idle mixture and idle speed until the highest steady vacuum reading is reached.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
43	43	REGULATOR UNIT. Inspect generator and regulator mountings and electrical connections. See that they are in good condition and secure, and that regulator is properly grounded.
43		*Test.* Make voltage, amperage, and cut-out test, using the low-voltage tester. Follow instructions on the test set cover to determine if the unit is functioning properly. Replace faulty regulator.
47	47	TIRES AND RIMS, INCLUDING SPARES. See if all valve stems are in good condition and in correct position. Replace leaky valve cores or missing caps. Examine tires for cuts, bruises, breaks, blisters, and irregular tread wear. Remove embedded glass, nails, or stones from treads. Inflate tires to correct pressure (Model H-542-9, all tires 65 pounds; Model H-542-11, front tires 50 pounds, rear tires 70 pounds). Determine and correct any mechanical deficiencies that may be causing abnormal tire wear, or report condition to designated authority. Remove tires worn thin at center of tread or unserviceable, and exchange for new or retreaded tires. Change the wheel position of tires with irregular wear, to equalize wear of all tires. When switching tire position, spare tires must be mounted on one of the road wheels. Inspect rims for damage, and tighten all wheel lug nuts.
47		*Matching Tires.* Match tires according to tread wear and over-all circumferences. With tires properly inflated, $\frac{3}{4}$-inch variation is permissible in over-all circumferences.
48		REAR BRAKES (DRUMS AND SUPPORTS). Remove rear wheels, thoroughly clean, and inspect drums for excessive wear, scores, or leaking grease seals. Inspect backing plate for loose mountings or damaged condition.
	49	REAR BRAKE SHOES (LININGS, LINKAGE, GUIDES, AND ANCHORS). Inspect linings through inspection holes in brake drums to see if they are worn so that bolt heads may score drums within next 1,000 miles of operation. If vehicle has recently been operated in deep water, mud, loose sand, or dirt that may have entered brake drums, remove rear hub and drum for inspection of brake linings to determine whether they should be replaced and whether lubricant has been contaminated. If linings on one wheel brake must be replaced, remove all wheels and service the brakes similarly.
49		With rear wheels removed, inspect linings to see if they are in good condition, secured to brake shoes, in good wearing contact with drums, free of dirt or lubricant,

Maintenance		
6,000 Mile	1,000 Mile	
6-Month	Monthly	
		and not excessively worn. Also see that brake shoes are in good condition, properly secured and guided by anchor bolts and springs, and return to brake camshaft by retracting springs. Clean all dust from linings with a wire brush, clean cloth, or compressed air. Replace linings if worn to bolt heads, or if they will not be serviceable until the next inspection.
		Adjust. If linings are slightly worn, make minor brake shoe adjustment to compensate for wear. Where new linings have been installed, adjust shoes by the major adjustment method, as outlined in paragraph 145 f (4). Brake shoes should have a clearance of 0.010 inch at cam end of brake shoe.
	52	REAR WHEEL (BEARINGS, SEALS, DRIVE FLANGES, AND NUTS). Revolve the wheels to test for run-out, and listen for any indications of damaged wheel bearings. Grip top and bottom of wheel, and push in on top while pulling out on bottom to test wheel bearing adjustment. Tighten wheels, and adjust bearings if necessary.
53	53	FRONT BRAKES (DRUMS, SUPPORTS, CAMS AND SHAFTS, HOSE, AIR CHAMBERS, PUSH RODS AND SEALS, SLACK ADJUSTERS). Examine the chambers and hose connections for air leaks. Make sure slack adjusters are securely mounted and push rod seals are in place.
53		*Serve.* Remove front wheels, and inspect and service as follows: On 6,000-mile maintenance service, the several wheel bearings and brake items up to 60 are group services and overlap. Perform in best order for economy of time and orderly reassembly.
		Drums, and Supports. Clean drums thoroughly, and inspect for excessive wear, scores, or leaking grease seals. Inspect backing plates for loose mountings or damage.
	54	FRONT BRAKE SHOES (LININGS, LINKAGE, GUIDES, AND ANCHORS). Inspect linings through inspection holes in brake drums to see whether they are worn so that bolt heads may score drums within next 1,000 miles of operation.
54		Inspect brake shoes, linings, anchor bolts and springs as outlined in item 49, 6,000-mile maintenance.
54	54	*Adjust.* If linings are slightly worn, make minor brake shoe adjustment to compensate for wear. Where new linings have been installed, adjust shoes by the major adjustment method as outlined in paragraph 145 f (4). Brake shoes should have clearance of 0.010 inch at cam end of brake shoe.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
56	56	FRONT SPRINGS. Inspect springs for sag, broken or shifted leaves, and loose or missing U-bolts, shackle bolts, center bolts, and rebound clips.
		Tighten. Tighten all mounting and assembly bolts and nuts securely.
57	57	STEERING. Examine Pitman arm, drag link, and tie rod for loose mountings and worn or damaged condition. Inspect steering gear housing for proper oil level, loose mountings, or oil leaks.
57		*Tighten.* Tighten Pitman arm nut and steering housing mounting bolts securely. CAUTION: *Steering column bracket must be loose when tightening steering case mounting nuts, to avoid distorting the column.*
58	58	SHOCK ABSORBERS. Inspect shock absorbers and mountings to see that they are not damaged, excessively worn, or leaking.
58		*Serve.* Fill reservoir with shock absorber fluid, disconnect link, and test shock absorber action. When arm is moved up and down there should be resistance in both directions.
	60	FRONT WHEEL (BEARINGS, WHEELS, DRIVE FLANGES, AND NUTS). Revolve the wheels to test for run-out, and listen for any indications of damaged wheel bearings. Grip top and bottom of wheel, and push in on top while pulling out on bottom to test wheel bearing adjustment. Tighten wheels, and adjust bearings if necessary.
60		Remove wheel and hub assembly, and inspect wheel bearings and races for cracks, pits, and fractures. Clean bearings thoroughly, and repack with specified lubricant. Reinstall bearings with new seals. Adjust bearings, and lock securely.
61	61	FRONT AXLE. Inspect to see if axle is sprung or bent, or appears to have shifted. Measure distance from front spring eye bolt to center of axle spring pad on each side. This distance should be approximately the same on each side. Tighten all mounting bolts securely.
63	63	ENGINE (MOUNTING, GROUND STRAP). Inspect all mounting bolts to see that they are present and secure. Make sure ground strap connections are clean and tight. Tighten all loose mounting and side pan bolts.
64	64	HAND BRAKE. Examine sector, pawl, and linkage for excessive wear or loose mountings. Inspect linings for excessive wear or oil-soaked condition. Inspect disk for scores. Adjust clearance between linings and disk to

Maintenance		
6,000 Mile	1,000 Mile	
6-Month	Monthly	
		0.010 inch, to compensate for wear. Replace excessively worn or oil-soaked lining.
65	65	CLUTCH PEDAL. Test pedal for free travel of 1¾ to 2 inches, and examine linkage for wear or missing cotter pins. Return spring must bring pedal to release position.
		Adjust. CAUTION: *Clutch pedal free travel must not be adjusted with the pedal linkage. Free travel is maintained by shims at the clutch pressure plate.* If necessary to make adjustment, refer to paragraph 62.
66	66	BRAKE PEDAL. Test pedal for free operation. Examine linkage for wear, missing cotter pins, and return spring tension.
69	69	AIR BRAKE APPLICATION VALVE. Inspect to see that the application valve operates freely and is securely mounted, and that the valve closes fully when the brake pedal is released.
70	70	AIR BRAKE RESERVOIRS. Examine the reservoirs to see that they are in good condition and securely mounted. Open drain cocks, and drain condensation.
71	71	TRANSMISSION. Inspect all transmission seals and gaskets for evidence of leakage. Examine all attaching bolts for looseness.
71		*Tighten.* Tighten all assembly mounting bolts and screws securely.
73	73	REAR PROPELLER SHAFT. Inspect propeller shaft for alinement, flange bolts for looseness, and universal joints for excessive wear or grease leaks.
73		*Tighten.* Tighten all mounting bolts securely.
74	74	CENTER BEARING. Inspect center bearing for excessive wear, leaking grease seals, and clogged vent.
		Serve. Clean vent, fill to proper level with specified lubricant, and tighten all mounting bolts.
75	75	REAR AXLE. Inspect axle for alinement, leaking grease seals, and clogged vent. Test pinion shaft for excessive end play.
		Serve. Clean vent, and tighten all mounting bolts and cap screws securely.
76	76	REAR AIR BRAKES. Examine the chambers and hose connections for air leaks. Make sure slack adjusters are securely mounted and push rod seals are in place. Tighten all mountings and connections as necessary.
77	77	REAR SPRINGS. Inspect springs for sag, broken or shifted leaves, and loose or missing U-bolts, shackle bolts, center bolts, and rebound clips. Tighten all mounting and assembly bolts and nuts.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance		
6,000 Mile	1,000 Mile	
6-Month	Monthly	
78	78	REAR SHOCK ABSORBERS AND LINKS. Inspect to see that bodies are secured to frame, links are in good condition, and seals not leaking.
78		*Serve.* Disconnect arm, remove filler plug, and work absorber up and down while filling. There should be resistance in both directions.
79	79	CAB MOUNTINGS. Examine cab mountings, cushions, and blocks for cracks or deterioration, and make sure that hold-down bolts and coil springs are present and secure. CAUTION: *Steering column bracket must be loose before tightening cab bolts.*
80	80	FRAME. Examine frame and crossmembers for cracks, alinement, and loose or missing bolts.
81	81	WIRE, CONDUITS, AND GROMMETS. Examine all wiring, wiring looms, conduits, and grommets under vehicle for presence and condition. Tighten all loose wiring connections, and make sure no wiring is chafing against other parts.
82	82	FUEL TANKS, FITTINGS, AND LINES. Examine fuel tanks to see that they are in good condition and securely mounted. Inspect each cap for defective gasket or blocked vent, and see that it fits securely on filler neck. Inspect all fuel lines and connections and see that they are in good condition, secure, and not leaking.
83	83	BRAKE LINES. Inspect all brake lines to see that they are in good condition and securely connected, and make sure that there is no possibility of chafing of flexible hose. Tighten all connections and hose clamps as necessary.
84	84	EXHAUST PIPE, MUFFLER, AND TAIL PIPE. Examine exhaust pipe and muffler for loose mountings, loose connections, deterioration, or evidence of leaks. Inspect tail pipe for obstruction or damage.
85	85	VEHICLE LUBRICATION. If due, lubricate all points of vehicle in accordance with instructions in paragraph 21 of this manual, and current Lubrication Guide and directives, using only clean lubricant, and omitting items that have had special lubrication during this service. Replace missing or damaged fittings, lines, plugs, or vents.
86	86	TOE-IN AND TURNING STOPS. Use gage to determine if there is toe-in of $\frac{1}{32}$ to $\frac{3}{32}$ inch. Turn steering wheel to limit in both directions, and inspect the turning stops to see that they are present and securely locked, and prevent the tires from rubbing against the vehicle.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Maintenance	
6,000 Mile	1,000 Mile
6-Month	Monthly
88	88	FIFTH WHEEL (BED PLATE AND BOLTS). Inspect the fifth wheel rocker plate and bed plate to see that they are in good condition, correctly assembled, and securely mounted. Examine the kingpin to see that it is not excessively worn. Clean the rocker plate thoroughly, and lubricate with chassis lubricant. Lubricate all fifth wheel assembly and latch mechanism if necessary. CAUTION: *When trailer is not attached to tractor, the fifth wheel should be covered to prevent accumulation of rust and dirt.*
88	88	*Tighten.* Tighten all mounting bolts securely.
89	89	TRACTOR TRUCK TO TRAILER WIRING AND CONNECTIONS. Examine all tractor truck to trailer wiring and connections to see that they are in good condition and securely fastened.
91	91	LAMPS AND REFLECTORS. Set light switch successively in each position, and inspect respective lights to see that they are securely mounted, burning, clean, and go out when switch is turned off.
93	93	FRONT (BUMPER, TOWING EYES, BRUSH GUARDS, AND GRILL). Inspect these items to see that they are present, in good condition, and securely mounted.
94	94	HOOD. Inspect hood to see that it is in good condition and properly alined with radiator and cowl, and that hood fasteners and prop are present and hold the hood securely. Lubricate hooks and hinges with engine oil.
95	95	FRONT FENDERS AND RUNNING BOARDS. Examine fenders and running boards to see that they are in good condition and securely mounted. Tighten all mounting bolts and nuts as necessary.
96	96	CAB (HARDWARE, GLASS, SEATS, UPHOLSTERY, FLOORBOARDS, VENTILATOR, AND MAP COMPARTMENT). Inspect these units to see that they are in serviceable condition and securely mounted. Operate ventilators and make sure they are in alinement, operate properly, and lock when closed.
101	101	PINTLE HOOK. Inspect the pintle hook for good condition and secure mounting. Pintle latch must operate freely, and lock pin must be attached to chain. Tighten mounting bolts, and lubricate pintle latch.
103	103	PAINT AND MARKINGS. Inspect cab for rust spots or chipping paint, and observe for any bright spots that would cause excessive glare and reflection. Make sure identification plates and markings are visible.

SECOND ECHELON PREVENTIVE MAINTENANCE

Maintenance		
6,000 Mile	1,000 Mile	
6-Month	Monthly	
104	104	RADIO BONDING (SUPPRESSORS, FILTERS, CONDENSERS, SHIELDING). Inspect all bonding and connections to see that they are clean, secure, and in serviceable condition. NOTE: *Any irregularities except cleaning and tightening should be reported through proper channels to signal corps personnel.*
131	131	TOOLS. Inspect all tools for condition, proper mounting, and serviceability, checking against the vehicle stowage list.
132	132	FIRE EXTINGUISHER. Inspect to see that the portable fire extinguisher is present, fully charged, and securely mounted, and that nozzle is clean.
133	133	DECONTAMINATOR. Inspect decontaminator to see that it is present, fully charged, and securely mounted, and that nozzle is clean.
134	134	FIRST AID KIT. Inspect first aid kit to see that it is present and securely mounted. Check contents with list on cover, and replenish as necessary.
135	135	PUBLICATIONS AND FORM NO. 26. Check to see whether vehicle manuals, Lubrication Guide, Standard Form No. 26 Driver's Report—Accident, Motor Transportation, and MWO and Major Unit Assembly Replacement Record W.D., A.G.O. Form No. 478, are present, legible, and properly stowed.
136	136	TRACTION DEVICES (CHAINS). Inspect tire chains to see if they are in good condition, not excessively worn, and properly stowed.
139	139	FUEL AND WATER CANS AND BRACKETS. Inspect to see that these items are in good condition, securely mounted, not leaking, and that caps are attached to chains.
141	141	MODIFICATIONS (WORK ORDERS COMPLETED). Inspect the vehicle to make certain that all Modification Work Orders have been properly completed, and entered on W.D., A.G.O. Form No. 478. Enter any replacement of major unit assembly made at time of this service.
142	142	FINAL ROAD TEST. Repeat items one to fourteen inclusive, paying particular attention to those units on which work has been performed to make certain that they have been restored to proper operating condition. Correct or report any deficiencies found during the final road test.

Section XI

NEW VEHICLE RUN-IN TEST

28. PURPOSE.

a. When a new or reconditioned vehicle is first received by the using organization, it is necessary for second echelon personnel to determine whether or not the vehicle will operate satisfactorily when placed in service. For this purpose, inspect all accessories, subassemblies, assemblies, tools, and equipment to see that they are in place and correctly adjusted. In addition, perform a run-in test of at least 50 miles, as directed in AR 850-15, paragraph 25, table III, according to procedures in paragraph 30 below.

29. CORRECTION OF DEFICIENCIES.

a. Deficiencies disclosed during the course of the run-in test will be treated as follows:

(1) Correct any deficiencies within the scope of the maintenance echelon of the using organization before the vehicle is placed in service.

(2) Refer deficiencies beyond the scope of the maintenance echelon of the using organization to a higher echelon for correction.

(3) Bring deficiencies of serious nature to the attention of the supplying organization.

30. PROCEDURE.

a. Preliminary Service.

(1) FIRE EXTINGUISHER. See that portable extinguisher is present and in good condition. Test it momentarily for proper operation, and mount it securely.

(2) FUEL, OIL, AND WATER. Fill fuel tank. Check crankcase oil and coolant supply, and add as necessary to bring to correct levels. Allow room for expansion in fuel tanks and radiator. During freezing weather, test value of antifreeze, and add as necessary to protect cooling system against freezing. CAUTION: *If there is a tag attached to filler cap or steering wheel concerning engine oil in crankcase, follow instructions on tag before driving the vehicle.*

(3) FUEL FILTER. Inspect fuel filter for leaks, damage, and secure mountings and connections. Drain filter sediment bowl. If any appreciable amount of water or dirt is present, remove bowl,

and clean bowl and element in dry-cleaning solvent. Also drain accumulated water or dirt from bottom of fuel tank. Drain only until fuel runs clean.

(4) BATTERY. Make hydrometer and voltage tests of battery, and add clean water to bring electrolyte three-eighths inch above plates.

(5) AIR BRAKE TANKS. Inspect tanks and all air line connections for good condition and secure mountings. Open tank pet cocks and drain condensation.

(6) AIR CLEANER AND ENGINE BREATHER CAPS. Examine carburetor air cleaner and engine breather caps to see that they are in good condition and secure. Remove the elements from these units, and wash thoroughly in dry-cleaning solvent. Apply a film of oil to cleaner and breather elements, and refill reservoirs to proper level with fresh oil.

(7) ACCESSORIES AND BELTS. See that accessories, such as air compressor, carburetor, generator, regulator, cranking motor, distributor, water pump, fan, and oil filter, are in good condition and securely mounted. See that fan and air compressor drive belts are in good condition and adjust to have $\frac{1}{2}$- to $\frac{11}{16}$-inch deflection with finger pressure between the pulleys.

(8) ELECTRICAL WIRING. Examine all accessible wiring and conduits to see if they are in good condition, securely connected, and properly supported.

(9) TIRES. See that all tires, including spare, are properly inflated (Model H-542-9, all tires 65 pounds; Model H-542-11, front tires 50 pounds and rear tires 70 pounds), stems in correct position, and all valve caps present and finger-tight. Remove objects lodged in treads and carcasses, and between dual wheels, and inspect for damage.

(10) WHEEL AND FLANGE NUTS. See that all wheel mounting nuts and axle flange nuts are present and secure.

(11) FENDERS AND BUMPER. Examine fenders and bumper for looseness and damage.

(12) TOWING CONNECTIONS. Examine all towing eyes and pintle hook for looseness and damage, and see that pintle latch operates properly and locks securely.

(13) CAB. Inspect cab for good condition and secure mounting. See that top and side curtains are properly installed, and that all fasteners and attaching straps are present and secure.

(14) LUBRICATE. Perform a complete lubrication of the vehicle covering all intervals according to the instructions on the Lubrication Guide (par. 21), omitting gear cases, wheel bearings, and other units covered in preceding procedure. Check all gear case oil levels, and add oil as necessary to bring to correct level; change only if condition of oil indicates the necessity, or if gear oil is not of proper grade for existing atmospheric temperature. NOTE: *Perform operations in steps (15) to (18) during lubrication.*

(15) SPRINGS AND SHOCK ABSORBERS. Inspect shock absorber

springs, U-bolts shackles, and clips to see that they are in good condition, correctly assembled, and secure. Examine shock absorber seals for evidence of leaks.

(16) PROPELLER SHAFTS, CENTER BEARING, AND VENTS. Inspect all shafts, universal joints, and center bearing to see if they are in good condition, correctly assembled, alined, secure, and not leaking excessively at seals or vents. Be sure vent passages are not clogged.

(17) AXLE VENT. Inspect axle vent to see that it is present, in good condition, and not clogged.

(18) CHOKE. Examine choke to be sure it opens and closes fully in response to operation of choke button.

(19) ENGINE WARM-UP. Start engine, noting cranking motor action and any tendency toward hard starting. Set hand throttle to run engine at 800 revolutions per minute during warm-up. Reset choke button so that engine will run smoothly, and to prevent overchoking and oil dilution.

(20) INSTRUMENTS.

(*a*) *Fuel Gage.* Gage should register the approximate amount of fuel in each tank as selected by the fuel gage selector switch.

(*b*) *Oil Pressure Gage.* Gage should register at least 30 pounds with engine running at approximately 800 revolutions per minute. If gage shows low or zero, stop engine, and investigate or report immediately to designated authority.

(*c*) *Ammeter.* Ammeter may show high charging rate for first few minutes after starting engine until generator has restored to battery the current used, then register slight charge or zero with lights and accessories turned off. High charging rate for extended period may indicate a dangerously low battery or faulty regulator.

(*d*) *Engine Temperature Gage.* Temperature should rise slowly during warm-up. Normal operating temperature is 160°F to 180°F. If temperature continues to rise above 190°F, stop engine and investigate.

(*e*) *Tachometer.* White pointer should indicate the engine revolutions per minute. Red pointer should remain at the maximum engine revolutions per minute reached. Governed speed of the engine is 2,600 revolutions per minute, and must not be exceeded.

(*f*) *Air Pressure Gage.* During warm-up period, gage should show a steady build-up until pressure of 105 pounds is reached. If pressure exceeds 105 pounds, stop engine and investigate. Do not move vehicle until minimum pressure of 70 pounds has been reached.

(21) ENGINE CONTROLS. Observe if engine responds properly to controls, and if controls operate without excessive looseness or binding.

(22) HORNS AND WINDSHIELD WIPERS. See that these items are in good condition and secure. If tactical situation permits, test horns for proper operation and tone. See if wiper arms will

operate through their full range and that blades contact glass evenly and firmly.

(23) GLASS AND REAR VIEW MIRRORS. Clean all cab glass and mirror, and inspect for looseness and damage. Adjust rear view mirror for correct vision.

(24) LAMPS (LIGHTS) AND REFLECTORS. Clean lenses and inspect all units for looseness and damage. If tactical situation permits, open and close all light switches to see if lights respond properly.

(25) LEAKS, GENERAL. Look on ground under vehicle for evidence of fuel, oil, or water leaks, and around axles and transmission for evidence of grease leaks. Trace all leaks to their source, and correct or report.

(26) TOOLS AND EQUIPMENT. Check tools and equipment against vehicle stowage lists (pars. 22 to 24) to be sure all items are present, and see that they are serviceable and properly mounted or stowed.

b. Run-in Test. Perform the following services during the road test of the vehicle. On vehicle which has been driven 50 miles or more in the course of delivery from the supplying to the using organization, reduce the length of the road test to the least mileage necessary to make observations listed below. CAUTION: *Avoid continuous operation of the vehicle at speeds approaching the maximums indicated on the caution plate.*

(1) INSTRUMENTS AND GAGES. Do not move vehicle until engine temperature reaches 135°F. Maximum safe operating temperature is 200°F. Observe readings of ammeter, oil, temperature, fuel, and air gages, to be sure they are indicating the proper functioning of the units to which they apply. Also see that the speedometer registers the vehicle speed, and that odometer registers total accumulating mileage.

(2) BRAKES (FOOT AND HAND). With vehicle in motion, apply foot brake and observe for smooth and effective braking. Stopping of vehicle should be accomplished within reasonable distance without side pull and without excessive drop in air pressure. Stop vehicle on grade and apply hand brake. Brake should hold vehicle securely with at least one-third of ratchet travel in reserve.

(3) CLUTCH. Observe if clutch operates smoothly without grab, chatter, or squeal on engagement, and without slippage when fully engaged and under load. See that pedal has 1¾- to 2-inch free travel before meeting resistance. CAUTION: *Do not ride clutch pedal at any time, and do not engage and disengage new clutch severely or unnecessarily before driven and driving disks have become properly worn in.*

(4) TRANSMISSION. Gearshift mechanism should operate easily and smoothly. Gears should operate without unusual noise, and should not slip out of mesh.

(5) STEERING. Observe steering action for binding or looseness, and note any excessive pull to one side, wander, shimmy, or wheel tramp. See that column bracket and wheel are secure.

(6) ENGINE. Be on the alert for any unusual noise or abnormal

engine operating characteristics, such as lack of pulling power or acceleration, backfiring, misfiring, stalling, overheating, or excessive exhaust smoke. Observe if engine responds properly to all controls.

(7) UNUSUAL NOISE. Be on the alert throughout road test for any unusual noise from cab and attachments, running gear, suspension, or wheels that might indicate looseness, damage, wear, inadequate lubrication, or underinflated tires. NOTE: *Halt vehicle at 10-mile intervals for the services which follow.*

(8) AIR BRAKE SYSTEM LEAKS. With air pressure at governed maximum of 105 pounds and the brakes applied, stop the engine. There should not be a noticeable drop in air pressure within one minute.

(9) TEMPERATURES. Cautiously touch each brake drum and wheel hub to test for abnormal temperatures. Examine transmission and differential housing for indications of overheating and excessive lubricant leaks at seals, gaskets, or vents.

(10) LEAKS. With engine running and fuel, engine oil, and cooling systems under pressure, look within engine compartment and under vehicle for indications of leaks.

c. Vehicle Publications and Reports.

(1) PUBLICATIONS. See that vehicle technical manuals, Lubrication Guide, Standard Report Form No. 26 Drivers Report—Accident, Motor Transportation, and W.D., A.G.O. Form No. 478 MWO and Major Unit Assembly Replacement Record are in the vehicle, legible, and properly stowed. NOTE: *U.S.A. registration number and vehicle nomenclature must be filled in on Form No. 478, for new vehicles.*

(2) REPORTS. Upon completion of run-in test, correct or report any deficiencies noted. Report general condition of vehicle to designated individual in authority.

Section XII

ORGANIZATION TOOLS AND EQUIPMENT

31. STANDARD TOOLS AND EQUIPMENT.

a. All standard tools and equipment available to second echelon are listed in SNL N-19.

32. SPECIAL TOOLS.

a. The special tools provided for second echelon maintenance service are listed below.

Special Tool Description	Federal Stock Number	Manufacturer's Number
Bar, sliding, 22-in., socket wrench	41–B–312–200	MTM–M3–16D
Handle, 1-in. dia. hd., 10 in. lg., for removers and replacers	41–H–1074	J–1660–1
Head, sq., 1-in., male, for sliding bar	41–H–1779–50	MTM–M3–16E
Replacer, flywheel clutch pilot bearing	41–R–2380–450	TEC–50–8
Sling, lifting, engine	41–S–3832–12	J–3741
Wrench, socket, detachable, close sweep, ¾-in. hex., ½-in. sq. drive, cylinder head	41–W–2964–710	J–3764
Wrench, socket, detachable, narrow sweep, ¾-in. open end, ½-in. sq. drive, cylinder head	41–W–2964–715	J–3763
Wrench, socket, drive shaft flange nut, 2⅜-in.	41–W–3058–450	MTM–M3–16H

Section XIII

TROUBLE SHOOTING

33. GENERAL.

a. Scope. The information contained in this section includes a compilation of symptoms of difficulties which might be encountered in the operation of the vehicle together with the possible causes, remedies, and diagnosis. Only those difficulties which can be detected by the using arms are included in this manual. Wherever practicable, the trouble shooting procedures are classified according to the sections of this manual. In some cases a symptom indicating trouble in one unit may be caused by difficulty in another unit, and cross references to the related units are made whenever this condition exists.

b. Diagnosis. Causes of trouble symptoms or faults in a vehicle may be numerous. Diagnosis of symptoms is an orderly process of eliminating causes of the symptom by checking the most probable or common cause first, and proceeding from that point.

34. ENGINE.

a. Engine Will Not Turn.

(1) CRANKING MOTOR INOPERATIVE. See paragraph 40 a.

(2) INCORRECT OIL VISCOSITY. Drain crankcase and refill with proper grade of oil (par. 21).

b. Engine Turns But Will Not Start.

(1) INOPERATIVE IGNITION SYSTEM. Remove a cable from a spark plug, hold cable terminal ¼ inch from cylinder head, and crank the engine. If the spark does not jump the gap, the ignition is inadequate. See paragraph 39.

(2) INOPERATIVE FUEL SYSTEM. Open fuel valves, remove outlet line at the fuel pump and, with the ignition turned off, turn the engine with the cranking motor. If free flow of fuel is not evident, fuel is not reaching carburetor. See paragraph 36.

c. Engine Does Not Develop Full Power.

(1) IMPROPER IGNITION. See paragraph 39.

(2) OIL TEMPERATURE TOO HIGH. Improper or insufficient engine oil. Change oil (par. 21).

(3) IMPROPER VALVE ADJUSTMENT. Check clearance, and adjust to 0.018 to 0.020 inch (par. 53).

(4) IMPROPER TYPE FUEL. Use fuel having octane rating of 70 to 72.

(5) PRE-IGNITION. If the proper octane fuel is being used and the ignition system is functioning satisfactorily, the spark plugs may be of improper heat range or defective. Replace (par. 81). If spark plug replacement does not correct complaint, notify higher authority.

(6) CLOGGED FUEL FILTER. Clean the fuel filter (par. 69 c).

(7) AIR LEAKS AT CARBURETOR OR MANIFOLD FLANGES. With engine running at 800 revolutions per minute, apply a small amount of oil at carburetor gaskets and manifold flanges. If oil is sucked in, a leak is evident. Replace carburetor gaskets (par. 66 c) or manifold gaskets (pars. 54 c and 55 b).

(8) INCORRECT GOVERNOR SETTING. If governor cuts off below the governed engine speed of 2,600 revolutions per minute, report to higher authority, or replace carburetor and governor (par. 66 c).

d. Engine Misfires at Idling Speeds.

(1) FAULTY IGNITION SYSTEM. See paragraph 39.

(2) LOW ENGINE COMPRESSION. Test compression (par. 49 a) and if difference of 10 pounds pressure per square inch between cylinders is encountered, report to higher authority.

(3) DEFECTIVE SPARK PLUGS. Short out each spark plug by touching screwdriver with wood handle to spark plug terminal and to cylinder head. If spark plug is operating satisfactorily, a noticeable difference in operation of engine will result. If no difference is noted, replace spark plug (par. 81).

(4) WEAK OR BROKEN VALVE SPRINGS. Remove valve rocker arm cover and inspect valve springs. If broken springs are noted, replace.

(5) IMPROPER VALVE STEM TO ROCKER ARM CLEARANCE. Adjust valve stem to rocker arm clearance to 0.018 to 0.020 inch (par. 53).

(6) DEFECTIVE VALVES. Use of a vacuum gage (41-G-500) will be helpful in diagnosing valve failures. Erratic action of gage is indicative of valve disorders. Apply penetrating oil or kerosene around valve stems, and note whether valves are freed up. If not, valves must be ground or replaced. Report to higher authority.

(7) INTAKE MANIFOLD LEAKS. Vacuum leaks at intake manifold or carburetor will cause a lean fuel-air mixture. Tighten manifold, or replace gaskets.

(8) LEAKING CYLINDER HEAD GASKET. Tighten cylinder head cap screws evenly to 80 foot-pounds. If leak persists, replace cylinder head gasket (pars. 50 and 52).

e. Engine Misses Fire at High Speeds. Missing at high speeds is commonly caused by a weak secondary current in the ignition circuit. See paragraph 39 g for trouble shooting and diagnosis. Other possible causes are as follows:

(1) INCORRECT VALVE STEM TO ROCKER ARM CLEARANCE. Check and adjust clearance to 0.018 to 0.020 inches (par. 53).

(2) VALVE SPRINGS WEAK OR BROKEN. Remove valve rocker arm cover and inspect valve springs. If broken, replace.

(3) LEAKING CYLINDER HEAD GASKET. Tighten cylinder head cap screws evenly to 80 foot-pounds. If leak persists, replace cylinder head gasket (pars. 50 and 52).

(4) DEFECTIVE FUEL PUMP. Worn fuel pump linkage will cause difficulty. Test fuel pump (par. 67 b). If defective, replace fuel pump (par. 67 c).

f. Engine Overheats. The most common cause of engine overheating is a faulty cooling system. Refer to trouble shooting and diagnosis of cooling system (par. 38). Other causes of engine overheating are as follows:

(1) LATE IGNITION TIMING. Check ignition timing (par. 49) and make necessary corrections.

(2) TOO LEAN FUEL-AIR MIXTURE. Check engine for vacuum leaks at intake manifold or carburetor, and correct as necessary.

g. Lack of Power. Lack of power is usually due to one of the following causes:

(1) ENGINE OVERHEATING. Follow procedure in subparagraph f above.

(2) POOR COMPRESSION. Test compression (par. 49) using a compression gage. Compression should not vary more than 10 pounds per square inch between cylinders.

(3) STICKING VALVES. Remove valve rocker arm cover, and apply penetrating oil or kerosene to valve stems. If treatment does not free up valves, they must be removed and cleaned or replaced.

(4) LATE IGNITION TIMING. Check ignition timing (par. 49) and correct if necessary.

(5) BRAKES DRAGGING. Adjust brakes (par. 145 d).

h. Excessive Oil Consumption. Aside from obvious and readily discernible leakage of oil from the oil pan, gear cover, or oil filter base gaskets, the following are possible causes of excessive engine oil consumption:

(1) ENGINE OVERHEATING. See subparagraph f above.

(2) POOR COMPRESSION. Test compression (par. 49) and correct causes.

(3) OIL LEVEL TOO HIGH. Maintain oil level at "FULL" mark on oil level bayonet gage (dip stick).

(4) IMPROPER GRADE AND VISCOSITY OF OIL. Drain and refill crankcase with new oil of recommended grade and viscosity (par. 21).

(5) OVERSPEEDING ENGINE. Correct poor driving practices (par. 6) to avoid unnecessary and excessive engine speeds.

(6) EXCESSIVE LOW GEAR DRIVING. Correct poor driving practices (par. 6).

(7) INCORRECT CARBURETOR ADJUSTMENT. Make high speed main jet adjustment (par. 66 **b**).

(8) CLOGGED FUEL TANK CAP VENTS. Open vents or replace caps.

(9) RESTRICTED FUEL FLOW. Check fuel lines for restriction (par. 36).

(10) WATER IN FUEL. Remove drain plug from base of carburetor and note for presence of water. If found, drain and clean fuel filter (par. 69), and if necessary drain and refill fuel tanks (par. 68).

i. Tachometer Inoperative.

(1) BROKEN OR KINKED CABLE. Replace cable.

(2) FAULTY TACHOMETER HEAD. Replace head.

(3) TACHOMETER ADAPTER DRIVE GEAR BROKEN. Replace gear.

35. CLUTCH.

a. Clutch Drag. Idle the engine at 800 revolutions per minute. Push clutch pedal to fully released position, and allow time for clutch to stop. Shift transmission into first or reverse gear. If the shift cannot be made without a severe clashing of the gears or if, after engagement of the gears, there is a jumping or creeping movement of the vehicle with the clutch fully released, the clutch is at fault. Check the following:

(1) EXCESSIVE PEDAL CLEARANCE. Adjust clutch linkage (par. 62).

(2) WARPED OR CRACKED DRIVING OR DRIVEN PLATES. Replace clutch (pars. 63 and 64).

(3) DEFECTIVE CLUTCH. Replace clutch (pars. 63 and 64).

b. Clutch Slips. Slippage of the clutch is generally caused by one or more of the following imperfections.

(1) IMPROPER ADJUSTMENT OF CLUTCH. Adjust clutch (par. 62).

(2) LACK OF PEDAL FREE TRAVEL. Adjust linkage (par. 62).

(3) DEFECTIVE CLUTCH. Replace clutch (pars. 63 and 64).

(4) WORN CLUTCH FACINGS. Replace clutch driven member (pars. 63 and 64).

(5) GREASE ON CLUTCH FACINGS. Clean or replace clutch driven member (pars. 63 and 64).

c. Clutch Chatters. In general, clutch chattering is most pronounced when starting vehicle in low or reverse gear under vehicle load and results from the clutch disk failing to adhere to the flywheel surface.

(1) GREASE ON CLUTCH FACINGS. Replace or clean driven member (pars. 63 and 64).

(2) EXCESSIVE LOOSENESS. Inspect transmission mounting, propeller shaft universal joints, and engine mountings for looseness, and correct.

36. FUEL SYSTEM.

a. Fuel Does Not Reach Carburetor.

(1) LACK OF FUEL. Check gage on instrument panel, and replenish fuel.

(2) FUEL VALVES NOT TURNED ON. Turn on fuel valves.

(3) CLOGGED GAS TANK VENTS. Open vents in gas tank caps.

(4) INOPERATIVE FUEL PUMP OR CLOGGED FUEL FILTER OR LINES. Disconnect fuel line from inlet side of fuel filter, and check flow from the tanks. If fuel does not flow freely at the filter, clean lines back to fuel tanks. Service fuel filter. If fuel flows freely through fuel filter but does not reach carburetor, the fuel pump is inoperative. Replace fuel pump (par. 67).

b. Fuel Does Not Reach Cylinders.

(1) THROTTLE NOT OPENING. Adjust throttle linkage (par. 66).

(2) CARBURETOR JETS CLOGGED. Replace carburetor (par. 66).

(3) LOW FUEL PUMP PRESSURE. Install fuel pump pressure gage (41–G–500) in the outlet side of the fuel pump. Pressure should read between 4 and 5 pounds. If less than 4 pounds, replace fuel pump (par. 67).

c. Excessive Fuel Consumption. The most common cause of excessive fuel consumption is leaks in the system, and the logical remedy is to tighten the connections, replace defective gaskets, or replace units.

(1) LEAKY FUEL LINES. Tighten connections.

(2) FUEL LEAK AT CARBURETOR. Tighten cover to body screws.

(3) FUEL LEAK AT FUEL PUMP. Tighten fuel pump cover, or replace fuel pump (par. 67).

(4) FUEL LEAKS AT FUEL FILTER. Tighten bowl retainer nut, or replace gasket (par. 69).

(5) FUEL LEAKS IN FUEL TANK. Replace fuel tank (par. 68).

(6) WORN CARBURETOR PARTS. Replace carburetor (par. 66).

(7) IMPROPER CARBURETOR ADJUSTMENT. Adjust carburetor (par. 66).

d. Engine Idles Too Fast.

(1) IMPROPER THROTTLE LINKAGE ADJUSTMENT. Adjust idling speed stop screw and air-fuel idle screw (par. 66).

(2) CARBURETOR THROTTLE STICKING. Free up and lubricate linkage.

(3) CONTROL LINKAGE RETURN SPRINGS BROKEN OR MISSING. Check linkage for weak, broken, or missing return springs. Replace as necessary.

e. Low Fuel Pressure.

(1) AIR LEAKS AT FUEL LINES, FUEL PUMP, FILTER, OR CARBURETOR. Isolate and correct leaks.

(2) FUEL PUMP DIAPHRAGM BROKEN. Test fuel pump (subpar. b (3) above), and replace if defective (par. 67).

(3) FUEL PUMP VALVES LEAKING. Test fuel pump (subpar. b (3) above), and replace if defective (par. 67).

(4) FUEL LINES PLUGGED. Disconnect fuel line at carburetor. With ignition switch turned off, crank engine and note fuel flow. If restricted flow is evident, repeat procedure at fuel filter, fuel pump, and finally at fuel tanks to locate clogged fuel lines. Clean or replace lines.

f. Engine Falters on Accelerating. Dirt in carburetor will clog jets and cause trouble. Replace carburetor (par. 66).

37. EXHAUST SYSTEM.

a. General. The operator can generally detect any troubles in the exhaust system by unusually loud noises or by the odor of exhaust fumes. Exhaust system deficiencies should be corrected with least possible delay.

b. Odor of Exhaust Fumes in Driver's Compartment. CAUTION: *Exhaust gases contain deadly poisonous carbon monoxide gas which is odorless, colorless, and tasteless.*

(1) MUFFLER BLOWN OUT OR LEAKING. Replace muffler (par. 73).

(2) EXHAUST PIPE CONNECTIONS LEAKING. Tighten connections at exhaust manifold and at muffler.

(3) EXHAUST MANIFOLD CRACKED OR GASKETS LEAKING. Replace manifold or gaskets (pars. 54 and 55).

c. Excessive Combustion Noises.

(1) MUFFLER BLOWN OUT. Replace muffler (par. 73).

(2) MANIFOLD GASKET DEFECTIVE. Replace gasket (pars. 54 and 55).

d. Excessive Rattling.

(1) MUFFLER MOUNTINGS LOOSE. Tighten mountings.
(2) TAIL PIPE MOUNTINGS LOOSE. Tighten mountings.

38. COOLING SYSTEM.

a. General. The following causes and remedies pertain only to cooling system units. Since overheating or overcooling are the most common engine complaints, reference should be made to paragraph 34 for other causes of these troubles.

b. Overheating. Overheating is generally traceable to one of the following causes:

(1) LACK OF COOLANT IN SYSTEM. If system lacks coolant, replenish. Check for leaks at hose connections, water pump, and radiator.

(2) FAN BELTS LOOSE. Loose fan belts cause loss of cooling efficiency from the fan. Adjust fan belts (par. 76).

(3) THERMOSTAT FAILURE. Rapid increase in engine temperature and overheating may be caused by failure of thermostats to open. Remove and test thermostats (par. 79), or replace.

(4) LOSS OF COOLANT. Check system for leaks. If hose leaks, tighten or replace. If water pump leaks, replace (par. 77). If radiator is leaking, replace (par. 78).

(5) COOLING SYSTEM CLOGGED. See paragraph 75 for cooling system tests and cooling system cleaning.

c. Overcooling.

(1) THERMOSTAT FAILURE. If the engine outlet thermostat remains open, the system will operate at too low a temperature. Test thermostats (par. 79), and replace if defective.

39. IGNITION SYSTEM.

a. No Spark—Ammeter Shows Zero Reading.

(1) IGNITION SWITCH NOT FULLY ON. Turn on switch.
(2) DEFECTIVE IGNITION SWITCH. Replace switch (pars. 102 and 103).

(3) BROKEN PRIMARY WIRE FROM IGNITION SWITCH TO COIL OR FROM COIL TO DISTRIBUTOR. A zero reading on ammeter, while ignition is turned on and engine is being cranked, indicates that no current is flowing in the ignition primary circuit. The following checks should be made on the units of the primary circuit.

(*a*) Disconnect wire at battery side of ammeter, and make flash test to determine if current is flowing to ammeter.

(*b*) Check continuity of circuit from ammeter to ignition switch and then through ignition switch with switch turned on.

(*c*) Check continuity of circuit through primary wire from ignition switch to coil and then from coil to distributor. If current

flows through primary wire from switch to coil but not from coil to distributor, replace the ignition coil. If current flows through the primary wire and coil to the distributor, the trouble is within the distributor.

(*d*) Remove distributor cap and check the condition of the breaker points and point opening.

(4) DISTRIBUTOR POINTS NOT CLOSING OR EXCESSIVELY BURNED OR PITTED. If points are not opening but are not burned or pitted, adjust opening. If points are excessively burned or pitted, replace breaker points (par. 82).

(5) DEFECTIVE COIL. Check coil (step (3) (*c*) above), and if defective, replace with new coil (par. 83).

(6) LOOSE CONNECTION FROM CRANKING MOTOR TO IGNITION SWITCH. Check connections, clean, and tighten.

b. No Spark—Ammeter Reading Normal. If ammeter shows normal discharge of 2 to 4 amperes with ignition switch on, the primary circuit is functioning correctly and the trouble must be traced to the secondary circuit as follows:

(1) HIGH TENSION WIRE FROM COIL TO DISTRIBUTOR BROKEN OR GROUNDED. Remove coil to distributor high tension wire from distributor cap. Hold end of wire about $\frac{3}{8}$ inch from a ground (metal). While cranking engine with cranking motor, or "rocking" the points, note spark. If a hot, snappy spark results, reconnect wire to distributor. If weak spark results, replace the condenser. If a weak spark persists, replace the coil. If no spark results, check high tension wire from coil to distributor for continuity of circuit. Replace wire with one known to be good.

(2) DEFECTIVE DISTRIBUTOR CAP. With high tension wire from coil to distributor inserted in socket in distributor cap, remove cap. Crank engine, and observe inside of cap for visible current leaks. If found defective, replace cap. Check condition of cap center electrode by holding one end of a high tension wire on electrode and other end about $\frac{3}{8}$ inch from a ground. Crank engine. Spark should jump to ground. If no spark is produced, replace cap.

(3) DEFECTIVE DISTRIBUTOR ROTOR. Remove high tension wire from coil to distributor from distributor cap. Remove cap. Hold end of high tension wire from coil about $\frac{3}{8}$ inch away from rotor. Crank engine. If spark is noted, replace rotor.

(4) DEFECTIVE SPARK PLUG WIRES. Test each spark plug wire by disconnecting from spark plug and holding about $\frac{3}{8}$ inch from spark plug terminal. Crank engine and note spark. Wires not producing a good spark should be replaced with wires known to be good, and the test repeated.

c. No Spark—Ammeter Indicates Abnormal Discharge. If ammeter shows an abnormal discharge of over 4 amperes with ignition switch turned on, but zero with switch turned off, the trouble lies beyond the ignition switch and before the primary exit at the coil. Check as follows:

(1) DEFECTIVE SWITCH. With ignition switch turned on, disconnect wire at dead side of switch. If ammeter returns to zero, the switch is correct. If ammeter does not return to zero, replace switch with one known to be good, and reconnect wire.

(2) COIL TERMINAL NOT GROUNDED. With switch turned on, wire at dead side disconnected, and ammeter at zero, disconnect wire at primary entrance to coil. If ammeter returns to zero, check terminal of coil for grounded condition. If not grounded, replace coil.

(3) DEFECTIVE WIRE FROM SWITCH TO COIL. If ammeter still shows an abnormal discharge after disconnecting the primary wire at the coil, replace wire from switch to coil.

d. Weak Spark.

(1) DEFECTIVE DISTRIBUTOR POINTS. Remove distributor cap and check condition of points. Adjust opening, or replace points if badly burned or pitted.

(2) DEFECTIVE DISTRIBUTOR CAP. Refer to subparagraph **b** (2) above.

(3) DEFECTIVE CONDENSER. Replace condenser with one known to be good.

(4) LOOSE CONNECTIONS FROM STARTER THROUGH DISTRIBUTOR. Clean and tighten all connections.

(5) DEFECTIVE HIGH TENSION WIRES. If wires are wet or swollen, replace with new wires.

(6) DEFECTIVE IGNITION COIL. Replace coil with one known to be good.

e. Engine Overheats and Lacks Power. The main cause of engine overheating due to the ignition system is late ignition timing. Check and correct timing (par. 49).

f. Engine Backfires.

(1) CROSSED SPARK PLUG CABLES. Check spark plug cables to assure their being attached in 1-5-3-6-2-4 order.

(2) CRACKED DISTRIBUTOR CAP. Refer to subparagraph **b** (2) above.

g. Engine Misses at High Speed Under Load.

(1) INCORRECT SPARK PLUG GAP. Test and adjust spark plug gap to 0.028 to 0.032 inch (par. 81). Replace defective spark plugs.

(2) DISTRIBUTOR POINT GAP INCORRECT. Check distributor point gap (par. 82) and adjust to 0.018 to 0.024 inch.

(3) DEFECTIVE COIL. Test for coil failure by replacing coil with one known to be good.

(4) DEFECTIVE CONDENSER. Replace condenser with one known to be good.

h. Pre-ignition.

(1) DEFECTIVE SPARK PLUGS. Install new spark plugs of correct type (par. 81).

i. Excessive "Ping" Under Load or High Speed.

(1) INCORRECT MANUAL SPARK ADVANCE. Adjust control. Excessive "ping" under load or at high speed can be caused by incorrect manual advance or by using an inferior grade of fuel. The manual advance can usually be adjusted to give satisfactory performance with common grades of fuel.

40. STARTING AND CHARGING SYSTEM.

a. Cranking Motor Will Not Operate.

(1) DISCHARGED BATTERY. Check battery level and specific gravity (par. 96) and clean and tighten battery terminals.

(2) LOOSE BATTERY GROUND CABLE. Clean and tighten battery ground terminal connection.

(3) DEFECTIVE MAGNETIC SWITCH. Connect a jumper lead from the battery terminal of the magnetic switch to the small terminal on the top of the magnetic switch. This by-passes the magnetic switch control circuit. If the cranking motor now operates, replace the magnetic switch (par. 90).

(4) DEFECTIVE IGNITION SWITCH. If cranking motor still does not operate, connect a heavy jumper lead between the two main terminals, connecting the lead to nuts (not studs) to avoid burning threads. This connects the cranking motor to the battery. If cranking motor is in normal condition it will operate, and the trouble will be isolated in the ignition switch. Replace ignition switch (pars. 102 and 103).

(5) DEFECTIVE CRANKING MOTOR. If cranking motor still does not operate after above tests, cranking motor must be replaced (par. 89).

b. Noisy Cranking Motor.

(1) LOOSE CRANKING MOTOR MOUNTING. Tighten mounting cap screws.

(2) DEFECTIVE DRIVE ASSEMBLY. Replace cranking motor (par. 89).

(3) WORN COMMUTATOR OR BUSHINGS. Replace cranking motor (par. 89).

(4) LACK OF LUBRICATION. Lubricate cranking motor (par. 21).

c. Excessive Strain on Battery.

(1) LOOSE TERMINALS. Clean and tighten terminals.

(2) STICKING BRUSHES, WORN COMMUTATOR, OR ARMATURE RUBBING FIELD COILS. Replace cranking motor (par. 89).

d. Discharged Battery.

(1) LOOSE OR DIRTY TERMINALS. Clean and tighten battery terminals (par. 96).

(2) EXCESSIVE RESISTANCE IN CABLES. Test cables for resistance (par. 96) or replace cables.

(3) GENERATOR REGULATOR NOT OPERATING.

(*a*) *A Low Battery and a Low or No Charging Rate.* Check the circuit for defective wiring and loose connections. If these are in order, momentarily connect a jumper lead between the armature and field terminals of the regulator, and operate the generator at about 2,000 revolutions per minute. If the output increases substantially, the regulator may be considered at fault and should be replaced (par. 86). If the output remains low with the terminals bridged, then the generator may be considered at fault.

(4) GENERATOR NOT CHARGING. After having isolated trouble in generator, proceed as follows:

(*a*) *No Generator Output.* If no generator output can be obtained from the generator, remove the cover band and check for sticking or worn out brushes, gummed or burned commutator, or other causes of poor contact between the commutator and the brushes. If trouble is due to gummed or dirty commutator, operation may be temporarily restored by holding a strip of flint paper, Class B, No. 00, against the commutator with a piece of wood while the generator is operated. This will clean the commutator.

(*b*) *Unsteady or Low Output.* Check for loose drive belts and adjust (par. 76). Check for sticking brushes, out-of-round or rough commutator, and for high mica on the commutator. If encountered, replace generator (par. 85).

41. TRANSMISSION.

a. Excessive Noise.

(1) INSUFFICIENT LUBRICANT. Add lubricant of proper viscosity (par. 21) to ½ inch below level of plug.

(2) LUBRICANT OF INCORRECT VISCOSITY. Drain and refill with lubricant of correct viscosity (par. 21).

(3) GEARS OR BEARINGS BROKEN, WORN, OR LOOSE ON SHAFTS. If problem is not one of lubrication, and excessive noise is heard with vehicle standing still, engine running, and transmission in neutral, the transmission must be replaced (pars. 107 and 108).

b. Hard Shifting.

(1) CLUTCH FAILS TO RELEASE. If clashing of gears is encountered when attempting to shift from neutral into low gear, the clutch is not fully releasing. Adjust clutch pedal free travel and clutch (par. 62), or replace clutch (pars. 63 and 64).

(2) BINDING IN CONTROL COVER ASSEMBLY. Replace control cover assembly.

c. Gears Slipping.

(1) WEAK OR BROKEN SHIFT POPPET SPRINGS. Replace control cover assembly.

(2) EXCESSIVELY WORN GEARS. Replace transmission assembly (pars. 107 and 108).

(3) BENT SHIFTING FORK. Replace control cover assembly.

d. Lubricant Leakage.

(1) LOOSE DRAIN PLUGS. Tighten.

(2) DEFECTIVE GASKETS. Notify higher authority.

42. FRONT AXLE.

a. Hard Steering.

(1) FRONT AXLE SHIFTED. Check distance from front spring eye to some point on axle beam. Compare this measurement with like measurement on opposite side. If measurements do not agree, loosen spring U-bolts, relocate axle, and retighten spring U-bolts.

(2) LACK OF LUBRICATION. Lubricate front axle kingpins, tie rod ends, and drag link ends (par. 21).

(3) BIND IN STEERING KNUCKLE. Raise front wheels from ground, and disconnect drag link at front axle. Turn wheels and tie rod from side to side. If bind is found, disconnect one end of tie rod from steering knuckle. Test each wheel, turning from side to side. If bind persists and lubrication does not free up, replace axle assembly (pars. 116 and 117).

(4) TIGHT STEERING GEAR. With drag link disconnected at front axle, revolve steering gear from one extreme to the other. If bind or rough spots are encountered, replace steering gear assembly (pars. 158 and 159).

(5) EXCESSIVE CASTER. Checking of front axle caster requires special equipment. Report to higher authority.

(6) TIRES UNDERINFLATED. Check air pressure, using an accurate gage, and inflate tires to proper pressure (on Model H-542-9, all tires 65 pounds; on Model H-542-11, front tires 50 pounds, rear tires, 70 pounds).

(7) IMPROPER TOE-IN. Check toe-in of front wheels, and correct to $^{1}/_{32}$ to $^{3}/_{32}$ inch (par. 115).

b. Shimmy.

(1) EXCESSIVE LOOSENESS IN FRONT AXLE. Raise front wheels from ground, move wheels from side to side and up and down, and note any looseness. If excessive, replace axle (pars. 116 and 117).

(2) FRONT AXLE SHIFTED. Refer to subparagraph a (1) above.

(3) EXCESSIVE AXLE CASTER. Refer to subparagraph a (5) above.

(4) INSUFFICIENT FRONT WHEEL TOE-IN. Check toe-in of front wheels, and correct to $^{1}/_{32}$ to $^{3}/_{32}$ inch (par. 115).

c. Wandering.

(1) AXLE SHIFTED. Refer to subparagraph a (1) above.

(2) TIRES UNEQUALLY INFLATED. Test tires with accurate pressure gage, and inflate to proper pressure (on Model H-542-9, all tires 65 pounds; on Model H-542-11, front tires 50 pounds, rear tires 70 pounds).

(3) TIGHT STEERING GEAR. Localize trouble to steering gear by disconnecting drag link (subpar. a (3) above). Adjust (par. 157) or replace steering gear (pars. 158 and 159).

(4) FRONT WHEEL BEARINGS OUT OF ADJUSTMENT. Adjust front wheel bearings (par. 149).

43. REAR AXLE.

a. Continuous Axle Noise.

(1) TIRES IMPROPERLY INFLATED OR TREAD WORN UNEVENLY. If axle noise is caused by tires, the noise will disappear when the vehicle is driven over soft, unfinished road surface. Inflate tires equally and properly.

(2) WHEEL BEARINGS WORN, OUT OF ADJUSTMENT, OR IN NEED OF LUBRICATION. If noise persists, check wheel bearings for wear and adjustment (par. 149). Repack wheel bearings.

(3) INSUFFICIENT LUBRICANT. Add lubricant (par. 21).

b. Axle Noise on Drive Only or on Coast Only.

(1) PINION AND RING GEAR OUT OF ADJUSTMENT OR WORN EXCESSIVELY. Replace rear axle assembly (pars. 120 and 121).

c. Excessive Backlash in Axle Driving Parts.

(1) AXLE FLANGE CAP SCREWS OR NUTS LOOSE, OR WORN HOLES IN AXLE SHAFT FLANGES. Tighten nuts. If holes in axle flanges are worn, replace axle shafts (pars. 120 and 121).

(2) RING GEAR AND PINION OUT OF ADJUSTMENT OR WORN EXCESSIVELY. Replace axle assembly (pars. 120 and 121).

44. BRAKES.

a. Insufficient Braking Action.

(1) BRAKES NEED ADJUSTING. Adjust brakes (par. 145).

(2) BRAKES NEED RELINING. Replace brake shoes (par. 145).

(3) LOW AIR PRESSURE IN AIR BRAKE SYSTEM. See subparagraph h below.

(4) BRAKE VALVE DELIVERY PRESSURE LOW. Check brake valve delivery pressure. If below normal, adjust brake valve linkage, or replace brake valve (par. 125).

b. Brakes Apply Too Slowly.

(1) BRAKES NEED ADJUSTING. Adjust brakes (par. 145).

(2) LOW AIR PRESSURE IN BRAKE SYSTEM. See subparagraph h below.

(3) BRAKE VALVE DELIVERY PRESSURE LOW. Check brake valve delivery pressure. If below normal, adjust brake valve linkage, or replace brake valve (par. 125).

(4) EXCESSIVE LEAKAGE WITH BRAKES APPLIED. See subparagraph l below.

(5) RESTRICTION IN TUBING OR HOSE LINES. Service or replace lines (pars. 134 and 135).

c. Brakes Release Too Slowly.

(1) BRAKES NEED ADJUSTING. Adjust brakes (par. 145).

(2) BRAKE VALVE NOT RETURNING TO FULL RELEASED POSITION. Adjust brake valve or linkage (par. 125).

(3) RESTRICTION IN TUBING OR HOSE LINES. Service or replace tubing or hose (pars. 134 and 135).

(4) EXHAUST PORT OF BRAKE VALVE RESTRICTED OR PLUGGED. Remove restriction or plug, or replace brake valve (par. 125).

(5) EXHAUST PORT OF QUICK RELEASE VALVE RESTRICTED OR PLUGGED. Remove restriction, or replace quick release valve (par. 127).

(6) EXHAUST PORT OF RELAY VALVE RESTRICTED OR PLUGGED. Remove restriction, or replace relay valve (par. 128).

(7) DEFECTIVE QUICK RELEASE VALVE. Replace quick release valve (par. 127).

(8) DEFECTIVE RELAY VALVE. Service or replace relay valve (par. 128).

d. Brakes Do Not Apply.

(1) NO AIR PRESSURE IN AIR BRAKE SYSTEM. Start engine and charge brake system.

(2) RESTRICTED OR BROKEN TUBING LINE. Replace line (par. 134).

(3) DEFECTIVE BRAKE VALVE. Service or replace brake valve (par. 125).

e. Brakes Do Not Release.

(1) BRAKE RIGGING BINDING. Free-up all linkage and parts, and lubricate.

(2) BRAKE VALVE NOT RETURNING TO FULL RELEASED POSITION. Service or replace brake valve (par. 125).

(3) DEFECTIVE BRAKE VALVE. Service or replace brake valve (par. 125).

(4) RESTRICTION IN TUBES OR HOSE. Service or replace tubes or hose (pars. 134 and 135).

(5) AIR TRAPPED IN FRONT SERVICE LINE BEYOND DOUBLE CHECK VALVE. Trouble is due to plugged vent hole in dummy coupling, or because dummy coupling does not have a vent hole.

Clear vent hole in dummy coupling, or replace with a dummy coupling having a vent hole.

f. Brakes Grab.

(1) GREASE ON BRAKE LINING. Report to higher authority, or change brake shoes (par. 145).

(2) BRAKE DRUM OUT-OF-ROUND. Replace brake drum (par. 146).

(3) DEFECTIVE BRAKE VALVE. Service or replace brake valve (par. 125).

g. Uneven Brakes.

(1) BRAKES NEED ADJUSTING, LUBRICATING, OR RELINING. Adjust (par. 145) or lubricate brakes, or report to higher authority.

(2) GREASE ON BRAKE LINING. Report to higher authority, or replace brake shoes (par. 145).

(3) BRAKE SHOE RELEASE SPRING OR BRAKE CHAMBER RELEASE SPRING BROKEN. Replace spring.

(4) BRAKE DRUM OUT-OF-ROUND. Replace brake drum (par. 146).

(5) LEAKING BRAKE CHAMBER DIAPHRAGM. Replace brake chamber diaphragm.

h. Air Pressure Will Not Rise to Normal (80 to 105 Pounds).

(1) DEFECTIVE AIR GAGE. Replace air gage (par. 140).

(2) EXCESSIVE AIR LEAKAGE. Check for leakage, and service or replace defective units.

(3) RESERVOIR DRAIN COCK OPEN. Close drain cock.

(4) CUT-OUT COCK IMPROPERLY LEFT OPEN. Close cut-out cock.

(5) GOVERNOR OUT OF ADJUSTMENT. Adjust governor (par. 124).

(6) NO CLEARANCE AT COMPRESSOR UNLOADING VALVES. Adjust clearance to 0.010 inch minimum to 0.015 inch maximum (par. 123).

(7) SLIPPING COMPRESSOR DRIVE BELT. Adjust belt tension (par. 123).

(8) DEFECTIVE AIR COMPRESSOR. Replace air compressor (par. 123).

i. Air Pressure Rises to Normal (80 to 105 Pounds) Too Slowly.

(1) EXCESSIVE LEAKAGE. Check for leakage, and service or replace defective units.

(2) CLOGGED COMPRESSOR AIR STRAINER. Clean air compressor strainer.

(3) NO CLEARANCE AT COMPRESSOR UNLOADING VALVES. Adjust clearance to 0.010 inch minimum to 0.015 inch maximum (par. 123).

(4) ENGINE SPEED TOO SLOW. Increase engine speed.

(5) COMPRESSOR DISCHARGE VALVES LEAKING. Replace air compressor (par. 123).

(6) WORN COMPRESSOR. Replace compressor (par. 123).

(7) EXCESSIVE CARBON IN COMPRESSOR CYLINDER HEAD OR DISCHARGE LINE. Replace compressor or discharge line (par. 123).

(8) COMPRESSOR DRIVE BELT SLIPPING Adjust belt tension (par. 123).

j. Air Pressure Rises Above Normal (105 Pounds).

(1) DEFECTIVE AIR PRESSURE GAGE. Replace gage (par. 140).

(2) DEFECTIVE COMPRESSOR GOVERNOR. Replace governor (par. 124).

(3) COMPRESSOR GOVERNOR OUT OF ADJUSTMENT. Adjust governor (par. 124).

(4) RESTRICTION IN LINE BETWEEN GOVERNOR AND COMPRESSOR UNLOADING MECHANISM. Service or replace line.

(5) TOO MUCH CLEARANCE AT COMPRESSOR UNLOADING VALVES. Adjust clearance to 0.010 inch minimum to 0.015 inch maximum (par. 123).

(6) UNLOADING VALVE CAVITIES OR UNLOADING PASSAGE IN COMPRESSOR CYLINDER HEAD BLOCKED WITH CARBON. Replace compressor (par. 123).

(7) COMPRESSOR UNLOADING VALVES STUCK CLOSED. Replace compressor (par. 123).

k. Air Pressure Drops Quickly With Motor Stopped and Brakes Released.

(1) LEAKING BRAKE VALVE. Replace brake valve (par. 125).

(2) LEAKING RELAY VALVE. Replace relay valve (par. 128).

(3) LEAKS IN TUBING. Service or replace tubing (par. 136).

(4) COMPRESSOR DISCHARGE VALVES LEAKING. Replace compressor (par. 123).

(5) COMPRESSOR GOVERNOR LEAKING. Service or replace governor (par. 124).

(6) EXCESSIVE LEAKAGE ELSEWHERE IN AIR BRAKE SYSTEM. Make leakage tests, locate leakage, and service or replace defective units.

l. Air Pressure Drops Quickly With Motor Stopped and Brakes Fully Applied.

(1) LEAKING BRAKE CHAMBER DIAPHRAGM. Replace brake chamber or diaphragm (par. 129).

(2) LEAKING BRAKE VALVE. Replace brake valve (par. 125).

(3) LEAKING RELAY VALVE. Service or replace relay valve (par. 128).

(4) CUT-OUT COCK IMPROPERLY LEFT OPEN. Close cut-out cock.

(5) LEAKING TUBE LINE. Service or replace line (par. 136).
(6) LEAKING HOSE LINE. Service or replace hose (par. 136).

m. Compressor Knocks Continuously or Intermittently.

(1) LOOSE DRIVE PULLEY. Tighten pulley.
(2) BACKLASH IN DRIVE GEARS OR DRIVE COUPLING. Service or report to higher authority.
(3) WORN OR BURNED-OUT BEARINGS. Replace compressor (par. 123).
(4) EXCESSIVE CARBON DEPOSITS IN COMPRESSOR CYLINDER HEAD. Replace compressor (par. 123).

n. Type B4B Brake Valve "Groans" When Brakes Are Applied.

(1) DEFECTIVE BRAKE VALVE. Replace brake valve (par. 125).

o. Relay Valve "Groans" or "Chatters" when Brakes are Applied.

(1) DEFECTIVE RELAY VALVE. Replace relay valve (par. 128).

p. Quick Release Valve "Blats" When Brakes Are Released.

(1) DEFECTIVE QUICK RELEASE VALVE. Replace quick release valve (par. 127).

q. Safety Valve "Blows Off."

(1) SAFETY VALVE OUT OF ADJUSTMENT. Adjust safety valve (par. 137).
(2) AIR PRESSURE IN AIR BRAKE SYSTEM ABOVE NORMAL. Refer to subparagraph j above.

r. Exhaust Check Valve in Relay Valve "Whistles" When Brakes Are Released.

(1) DEFECTIVE EXHAUST CHECK VALVE. Replace check valve (par. 131).

s. Excessive Oil and Water in Air Brake System.

(1) RESERVOIRS NOT BEING DRAINED DAILY. Drain all reservoirs daily. Clean system if necessary.
(2) COMPRESSOR PASSING EXCESSIVE OIL. Replace compressor (par. 123).

45. SPRINGS AND SHOCK ABSORBERS.

a. Hard Riding.

(1) INSUFFICIENT SPRING PIN LUBRICATION. Lubricate spring pins and shackle pins (par. 21), making sure grease goes all the way around pins.
(2) FROZEN SPRING SHACKLES. Free-up, lubricate, and adjust spring shackles.

(3) SHOCK ABSORBERS INOPERATIVE. Disconnect shock absorber links, and test shock absorber action. If inoperative, replace unit (par. 155).

b. Excessively Flexible.

(1) OVERLUBRICATION. Refer to paragraph 21. Clean excess grease from sides of springs.

(2) LACK OF FLUID IN SHOCK ABSORBERS. Refill shock absorbers (par. 155).

(3) SHOCK ABSORBERS INOPERATIVE. Disconnect shock absorber links, and test unit operation. If little or no resistance is felt, replace unit (par. 155).

(4) BROKEN SPRING LEAVES. Examine springs for broken leaves and, if found, replace spring (pars. 153 and 154).

c. Excessive Noise.

(1) WORN SPRING PINS OR SHACKLE BOLTS. Use pry bar to test for wear of pins or bolts. Replace as necessary.

(2) WORN OR BROKEN SHOCK ABSORBER LINKS. Inspect shock absorber links for wear, damage, or looseness. Replace links if defective (par. 155).

d. Spring Leaf Failures.

(1) SPRING LEAF FAILURES AT SPRING EYE. Failures at this point are generally caused by tight spring shackles or frozen spring pins. Free up, lubricate, and adjust shackles, and replace spring (par. 153).

(2) SPRING LEAF FAILURES AT CENTER SECTION OF SPRING. Breakage of spring leaves at the center bolt section are generally caused by loose spring U-bolts. Replace spring, and tighten U-bolts securely (par. 153).

(3) GRABBING BRAKES. Grabbing brakes result in extreme twist or strain on springs. Adjust brakes (par. 145).

46. STEERING GEAR.

a. General. Many complaints of steering difficulty are falsely charged to the steering gear assembly. Therefore, in order to isolate the steering gear from the balance of the front axle and connections, the drag link should be disconnected from the steering arm at the gear housing assembly (par. 157). This will permit unobstructed diagnosis of the unit. In general, steering complaints rightfully traceable to the steering gear are as follows:

b. Hard Steering.

(1) LACK OF LUBRICANT. Lubricate as instructed in paragraph 21.

(2) TIGHT STEERING GEAR. Revolve steering wheel from one extreme to the other. If tightness is felt, adjust steering gear (par. 157).

(3) DAMAGED BEARINGS, CAM, OR LEVER. If rough spots, bumps, or noise are encountered while revolving steering gear, internal damage is indicated. Replace steering gear assembly (pars. 158 and 159).

(4) STEERING COLUMN MISALINED. Loosen steering tube jacket clamp at top of steering gear housing, and loosen bracket at dash panel. Aline column, and retighten.

c. Wander or Weaving.

(1) TIGHT ADJUSTMENT IN STRAIGHT-AHEAD POSITION. If gear is tight in mid-position or straight ahead, adjust steering gear (par. 157).

d. Oil Leaks.

(1) DEFECTIVE OIL SEAL IN HOUSING. Replace steering gear (pars. 158 and 159).

(2) LOOSE COVER OR GASKET. Tighten cover or replace gasket.

47. BATTERY AND LIGHTING SYSTEM.

a. Discharged Battery. If a battery repeatedly discharges, it may be caused either by generator or regulator malfunction (par. 40). Other possible causes of battery discharge are as follows:

(1) LOOSE OR DIRTY TERMINALS. Clean and tighten terminals (par. 96).

(2) EXCESSIVE RESISTANCE IN CABLES. Check line voltage (par. 88).

(3) ELECTROLYTE LEVEL LOW. Replenish water (par. 96).

(4) BATTERY CELLS SHORTED. With ignition switch off, or high tension lead removed from ignition coil, operate cranking motor and check each cell of battery with a low reading voltmeter (par. 96). If voltage falls below 1.7 volts at 80°F, or if there is a difference between cell readings of more than $\frac{1}{10}$ volt, the battery should be replaced (par. 96).

b. Lights Do Not Light.

(1) BURNED OUT LAMPS. Replace sealed beam unit (par. 92).

(2) BROKEN WIRE. Locate broken wire and repair or replace.

(3) DEFECTIVE LIGHT SWITCH. Replace switch (pars. 102 and 103).

(4) DEFECTIVE CIRCUIT BREAKERS. Replace circuit breakers (pars. 102 and 103).

c. Frequent Lamp Failures.

(1) GENERATOR REGULATOR OUT OF ADJUSTMENT. Replace regulator assembly (par. 86).

(2) POOR BATTERY GROUND CONNECTION. Clean and tighten ground connections.

d. Insufficient Light.

(1) Poor Ground. Clean and tighten ground connections.

(2) Loose Terminals. Isolate and tighten terminals.

(3) Discharged Battery. Recharge or replace battery (par. 96).

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

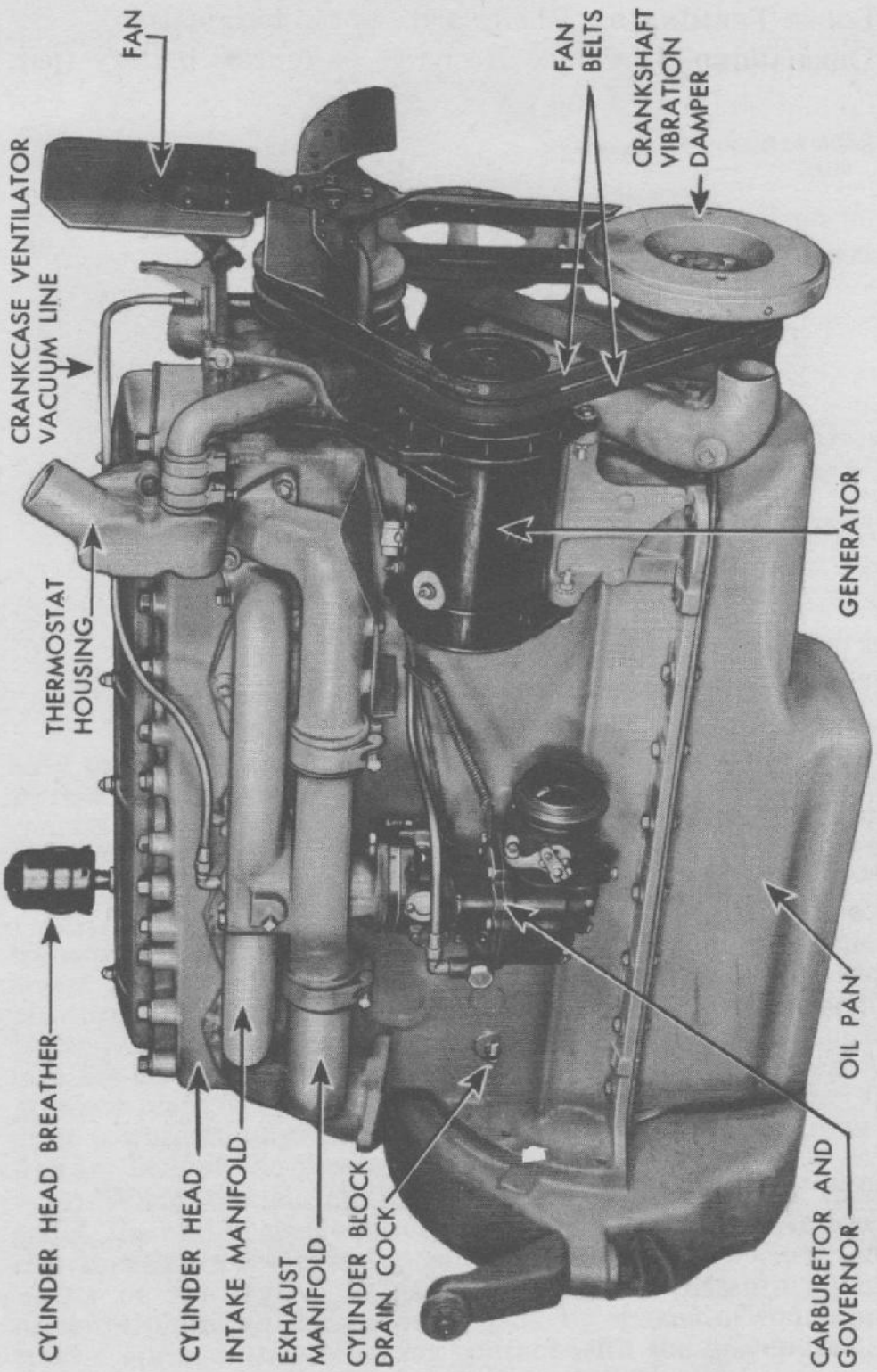


Figure 17 — Engine Right Front

Section XIV

ENGINE DESCRIPTION, MAINTENANCE, AND ADJUSTMENT

48. DESCRIPTION AND DATA (figs. 17 and 18).

a. Description. The gasoline engine in these vehicles is a 4-cycle, 6-cylinder-in-line, overhead-valve type. The engine serial number is stamped on a pad at the left front side of the engine crankcase just below the cylinder head (fig. 4). Cylinders are numbered from front to rear. Crankshaft rotation is clockwise as viewed from the front end. This section covers the maintenance operations allocated to using arm maintenance personnel on the basic engine assembly, engine oiling system, and crankcase ventilation system.

b. Data.

Make	International
Model	Red-450-D
Type	Overhead valve
Number of cylinders	6
Bore	4⅜ in.
Stroke	5 in.
Displacement	450.99 cu in.
Torque (max. at 900 rpm)	354 ft-lb
Horsepower (max. at 2,700 rpm)	143
Governed speed	2,600 rpm
Compression ratio	6.3 to 1
Firing order	1-5-3-6-2-4
Crankcase oil capacity (dry)	15 qt
Crankcase oil capacity (refill—pan only)	9 qt
Crankcase oil capacity (refill—pan and oil filters)	14 qt
Oil filter location	Left side
Oil level bayonet gage location	Left side

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

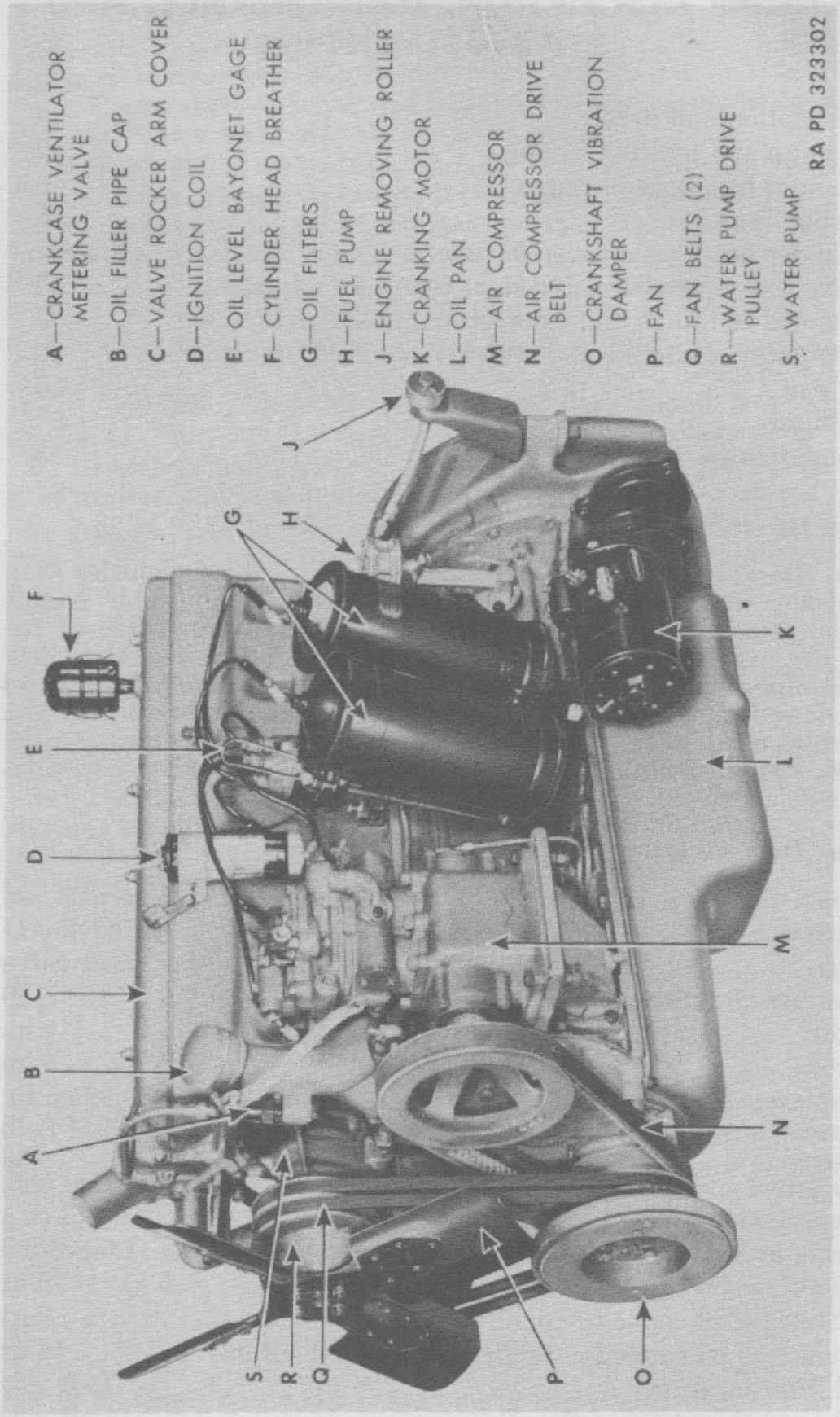


Figure 18 — Engine Left Front

Oil drain location ..... Bottom of pan
Cooling system capacity ..... 36 qt
Cooling system drains—number 2
Cooling system drains—location:
  Engine block ..... Right side—rear
  Radiator ..... Lower right corner
Weight of engine w/accessories ..... 1,315 lb

49. TUNE-UP AND IGNITION TIMING.

a. General Tune-up. Engine tune-up is an orderly process of checking engine and accessory equipment to determine that it is within specifications. In addition, preventive maintenance corrective operations should be accomplished so that new engine performance is restored. A compression gage, a vacuum gage, and a neon timing light (synchroscope) are necessary for proper engine tune-up. Use of the equipment is as follows:

(1) COMPRESSION TESTS.

(*a*) Shut off fuel supply and run engine until carburetor and fuel pump are dry.

(*b*) Remove floor tunnel from driver's compartment. Loosen spark plugs, blow loose dirt from around base of plugs, and remove plugs.

(*c*) With ignition key turned off, open throttle fully.

(*d*) Place compression tester tightly in spark plug hole. Turn engine over at cranking motor speed to allow three compression strokes on gage. Note reading. Follow the same procedure for each cylinder.

(*e*) Compression readings between cylinders should not vary more than 10 pounds. Normal compression on pressure gage at cranking speed is 108 to 115 pounds per square inch.

(*f*) Recheck any low reading cylinders after inserting about two tablespoons of SAE 50 engine oil on top of pistons. An increase in reading will indicate faulty pistons or piston rings. Failure to increase reading will indicate faulty valves. Two adjacent low reading cylinders indicate a probable defective cylinder head gasket.

(2) VACUUM TESTS. Before using a vacuum gage, be certain that engine is thoroughly warmed up and normalized to engine operating temperature of 160°F to 180°F. The vacuum gage should then be attached to the engine at the center of the intake manifold. Vacuum gage readings indicate the vacuum condition throughout the engine, and readings should be taken at approximately 350 revolutions per minute. Analysis of the gage readings is as follows:

(*a*) *Normal Engine.* A normal engine pulls a vacuum of between 18 and 21 inches. The vacuum reading will drop to about 2 inches when the throttle is opened, and will rebound to about 25 inches when the throttle is closed.

(*b*) *Steady Needle—Slightly Low Vacuum.* If the engine pulls a vacuum of 15 to 16 inches with a steady needle, the piston rings, pistons, or oil are probably in poor condition. Slight needle motion indicates late ignition timing.

(*c*) *Steady Needle—Low Vacuum.* If the needle is between 8 and 12 inches, it is an indication of worn valve guides, worn piston rings, poor oil, or an intake manifold leak.

(*d*) *Steady Needle—Very Low Vacuum.* If the vacuum drops below 5 inches with a steady needle, it indicates an intake manifold leak.

(*e*) *Gradual Drop.* If a normal reading is obtained when the engine starts but the needle gradually drops, check the exhaust system. Probably the muffler is choked so that a back-pressure is being created.

(*f*) *Irregular Drop—Normal Vacuum.* If the engine pulls a normal vacuum of 18 to 21 inches but the needle drops at irregular intervals, check for gummy valve stems, rich mixture, lean mixture, or defective spark plugs.

(*g*) *Regular Drop—Normal Vacuum.* A periodic regular drop with a normal vacuum indicates a faulty valve, or a head gasket leak.

(*h*) *Slow Movement—Low Vacuum.* A low vacuum with a slow moving needle indicates late valve timing, poor carburetor adjustment, defective spark plugs, poor ignition, or gummy valve stems.

(*i*) *Wide Variation.* An oscillating needle over a wide range, with the variations increasing with increased engine speed, indicates weak or broken valve springs.

(3) NEON TIMING LIGHT (SYNCHROSCOPE). Operation instructions for neon timing lights vary as to manufacture. In principle, however, the instrument is designed to be connected into the high tension circuit, and its operation permits accurate synchronization or timing of the ignition and valves. Follow instructions of equipment manufacturer.

b. Tune-up Procedure. Before performing the operations listed below, the engine crankcase should be drained and refilled with fresh engine oil (par. 21), the oil filter serviced, and the crankcase air cleaner serviced (par. 71). The following operations should then be performed in the order given:

(1) SPARK PLUGS. Service and adjust (par. 81).

(2) BATTERY AND IGNITION CABLES. Clean and tighten.

(3) BATTERY. Test and service (par. 96).

(4) DISTRIBUTOR CAP. Clean and inspect (par. 82).

(5) DISTRIBUTOR ROTOR. Remove and clean (par. 82).

(6) DISTRIBUTOR POINTS. Inspect, clean, and adjust (par. 82).

(7) CONDENSER. Inspect and tighten connections (par. 82).

(8) IGNITION TIMING. Check and adjust (subpar. c below).

(9) CYLINDER HEAD. Tighten cap screws with a torque wrench to a tension of 80 foot-pounds.

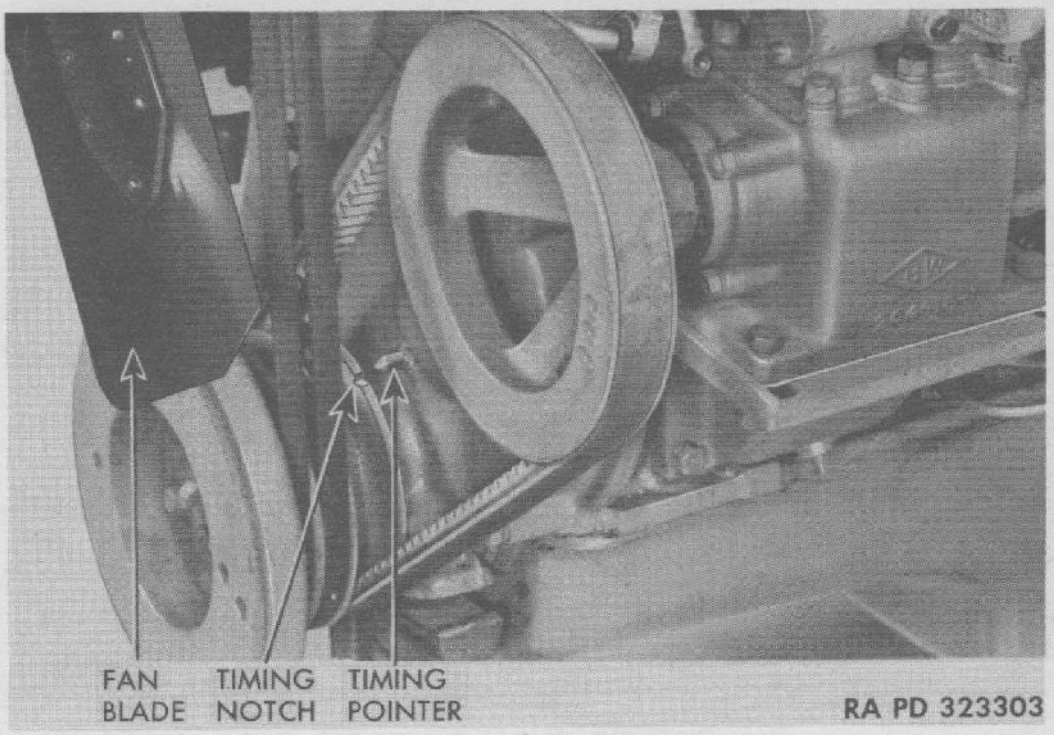


Figure 19 — Pulley Timing Notch and Pointer

(10) VALVE ROCKER ARM TO VALVE STEM CLEARANCE. Check and adjust (par. 53).

(11) CARBURETOR. Check and adjust idling speed and mixture (par. 66).

(12) FUEL FILTER. Service (par. 69).

(13) AIR CLEANER. Service (par. 71).

(14) FUEL PUMP. Check and service (par. 67).

(15) FUEL LINES. Check for leaks.

c. Ignition Timing Procedure.

(1) Remove floor tunnel from driver's compartment.

(2) Adjust manual spark control knob $\frac{3}{8}$ inch out from instrument panel.

(3) Loosen swivel clamp screw at distributor hold-down plate, and set pointer of plate to index with point on distributor mounting bracket. Tighten swivel clamp screw.

(4) Remove the No. 1 spark plug wire from the spark plug, by pulling out with a slight twisting motion. This will prevent damage to the spring-type connections.

(5) Remove the No. 1 spark plug and gasket from the cylinder head, using a properly fitting socket wrench to avoid damage to spark plug.

(6) Turn the engine over with a hand crank until the No. 1 cylinder is coming up on compression stroke. Hold thumb over spark plug hole until pressure is felt. Continue turning until notch

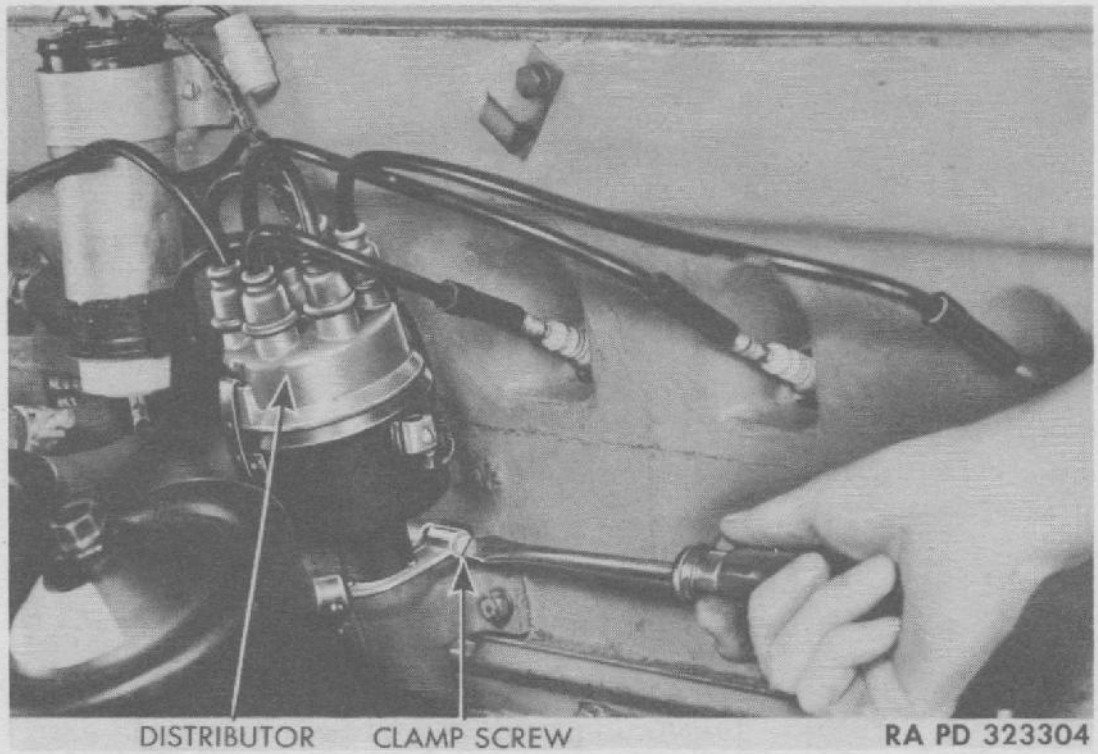


Figure 20 — Loosening Distributor Clamp Screw

in crankshaft drive pulley flange indexes with pointer on timing gear case cover. Replace spark plug and gasket.

(7) Note position of the No. 1 spark plug wire terminal in the distributor cap, and place mark on distributor housing.

(8) Remove distributor cap, and check position of rotor. Rotor arm should point to number one spark plug wire terminal position or mark made on housing.

(9) Remove rotor and dust shield from distributor. Adjust breaker point gap clearance to 0.018 to 0.024 inch (par. 82 **b**).

(10) With control knob $\frac{3}{8}$ inch from instrument panel, timing notch in crankshaft drive pulley flange and pointer indexing (fig. 19), and rotor turned toward the No. 1 cylinder, loosen the distributor clamp screw (fig. 20) and rotate distributor housing until contact points just separate. Tighten clamp screw.

(11) Install dust seal, rotor, and distributor cap, and install and connect spark plug.

(12) Install floor tunnel in driver compartment.

50. CYLINDER HEAD GASKET REMOVAL.

a. Because of the cab-forward design of this vehicle, the removal of the cylinder head gasket can best be accomplished as follows:

(1) Drain cooling system.

(2) WORK FROM BENEATH LEFT SIDE OF HOOD.

(*a*) Disconnect crankcase breather vacuum line at top of valve.

(*b*) Remove two cap screws and lock washers holding accelerator control cross-shaft bracket to cylinder head.

(*c*) Remove ignition coil from cylinder head, removing two nuts and lock washers from mounting studs.

(*d*) Disconnect spark plug wires from spark plugs Nos. 1, 2, and 3, using a twisting motion when disconnecting.

(*e*) Remove spark plugs Nos. 1, 2, and 3.

(*f*) Disconnect air compressor to cylinder head water hose at the cylinder head hose clamp, by loosening the clamp and sliding off the hose.

(3) WORK FROM BENEATH RIGHT SIDE OF HOOD.

(*a*) Remove two cap screws from thermostat housing.

(*b*) Remove one cap screw and lock washer connecting water pump to generator adjusting strap at cylinder head.

(*c*) Remove three front nuts and washers holding intake and exhaust manifolds to the cylinder head.

(4) Remove floor tunnel from driver's compartment.

(5) Remove screws from left-hand toeboard and from floorboard section, and remove boards.

(6) WORK FROM DRIVER'S COMPARTMENT.

(*a*) Disconnect spark plug wires, and remove spark plugs Nos. 4, 5, and 6.

(*b*) Remove wiring harness loom clip retainer bolt at cylinder head.

(7) Remove screws from right-hand toeboard and from floorboard section, and remove boards.

(8) WORK FROM DRIVER'S COMPARTMENT.

(*a*) Disconnect temperature gage unit from cylinder head.

(*b*) Remove remaining nine nuts and washers from intake and exhaust manifold to cylinder head studs.

(*c*) Block up manifolds and pry away from cylinder head and off from studs.

(9) Remove cylinder head breather, being careful not to spill oil.

(10) Remove four rocker arm cover retaining nuts, and lift off cover and gasket.

(11) REMOVE VALVE ROCKER ARM ASSEMBLY.

(*a*) Remove six rocker arm to cylinder head cap screws from rocker arm assembly.

(*b*) Remove six nuts from rocker arm to cylinder head studs.

(*c*) Remove cap screw holding rocker arm oil connection bracket to the cylinder head. NOTE: *This is the third cap screw from the rear on the left side.*

(*d*) Lift rocker arm assembly from studs. Be careful not to lose the two locating washers in the second and fifth brackets.

(12) Lift out all 12 valve push rods.

(13) Working from inside the cab, lift off the cylinder head.

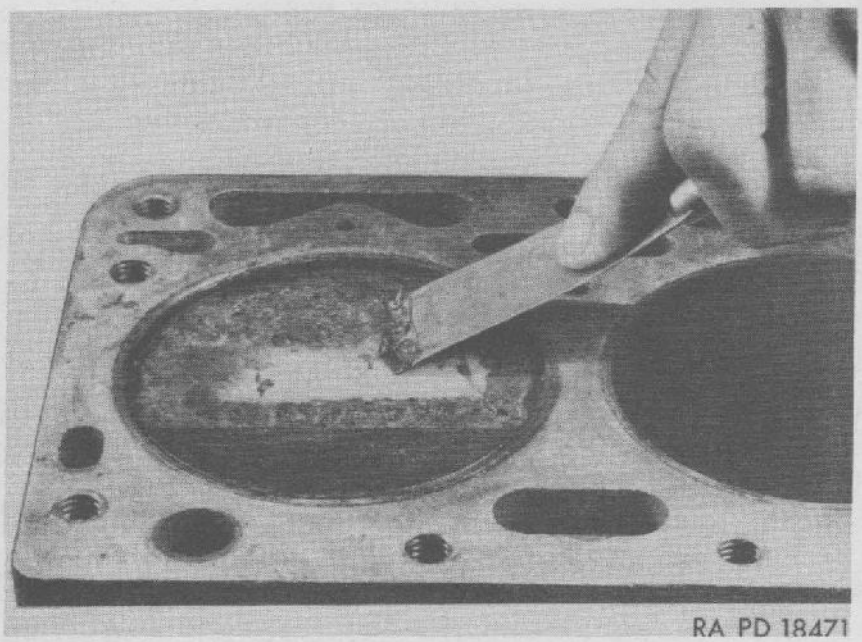


Figure 21 — Removing Carbon from Piston

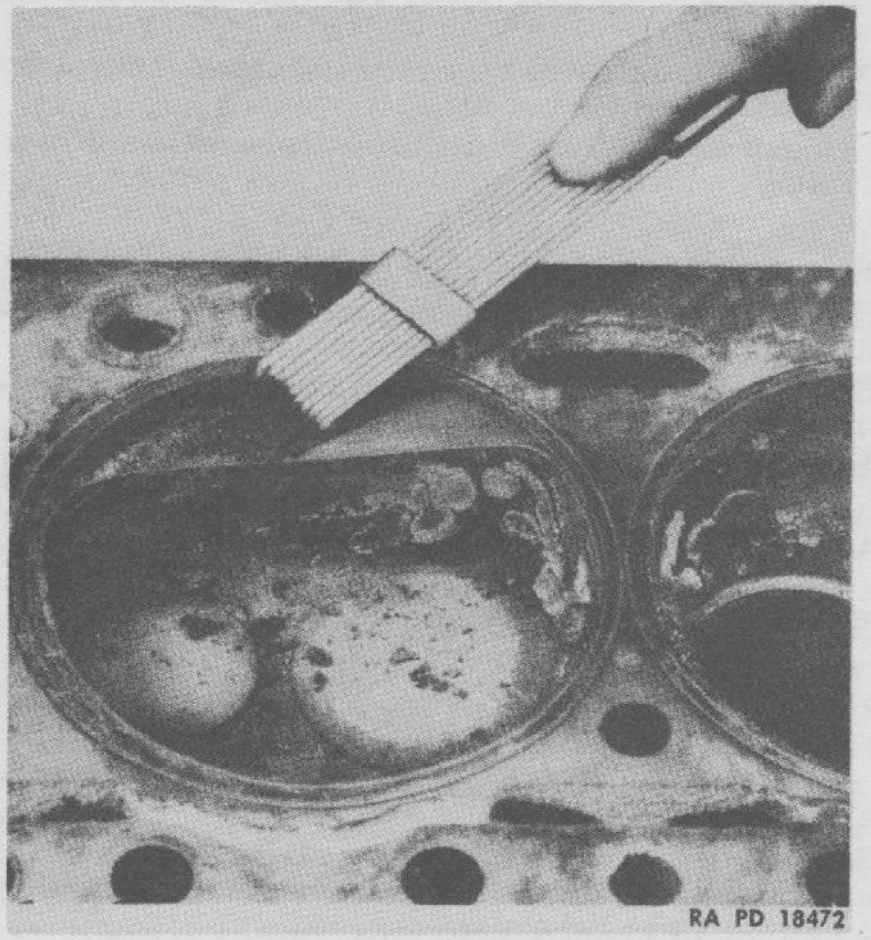


Figure 22 — Removing Carbon from Cylinder Head

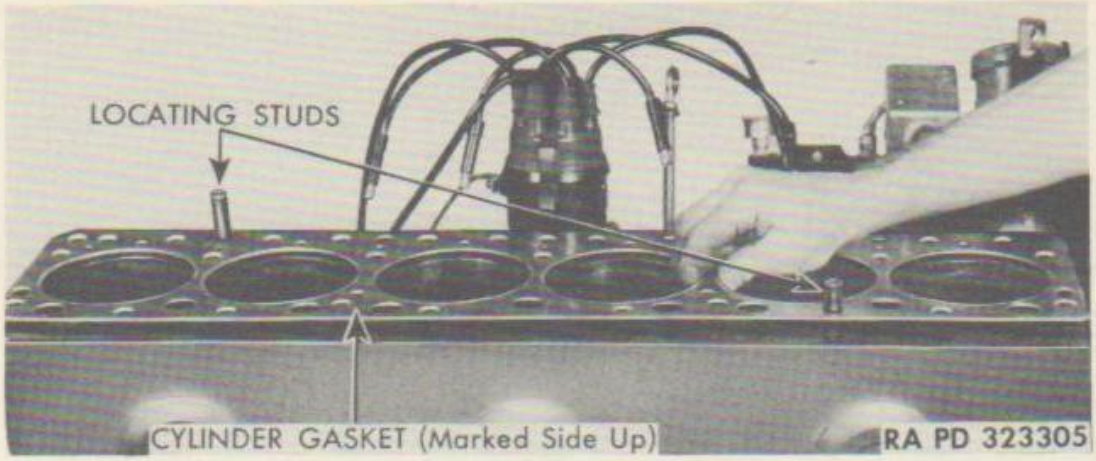


Figure 23 — Installing Cylinder Head Gasket

(14) Remove old cylinder head gasket from the cylinder block. and clean the block surface.

(15) Scrape carbon from heads of pistons (par. 51).

(16) Clean cylinder head intake and exhaust manifold gasket surfaces.

51. CARBON REMOVAL.

a. Remove cylinder head gasket (par. 50).

b. Scrape carbon from heads of pistons with scraper (fig. 21).

c. Using scraper or carbon brush, remove carbon from cylinder head combustion chambers (fig. 22).

d. Install cylinder head gasket as outlined in following paragraph.

52. CYLINDER HEAD GASKET INSTALLATION.

a. Because of the cab-forward design of the vehicle, the installation of the cylinder head gasket is best performed as follows:

(1) Make sure that all gasket surfaces are absolutely clean and smooth.

(2) Install cylinder head locating studs in block, placing one at each end of block.

(3) Place gasket, marked side up as stamped, over locating studs (fig. 23).

(4) Place cylinder head in position on top of gasket over locating studs.

(5) Start three or four cylinder head cap screws into holes, and remove the two head-locating studs. Install balance of cylinder head cap screws except the rocker arm oil connection bracket cap screw, third from the rear at left side. Tighten cylinder head

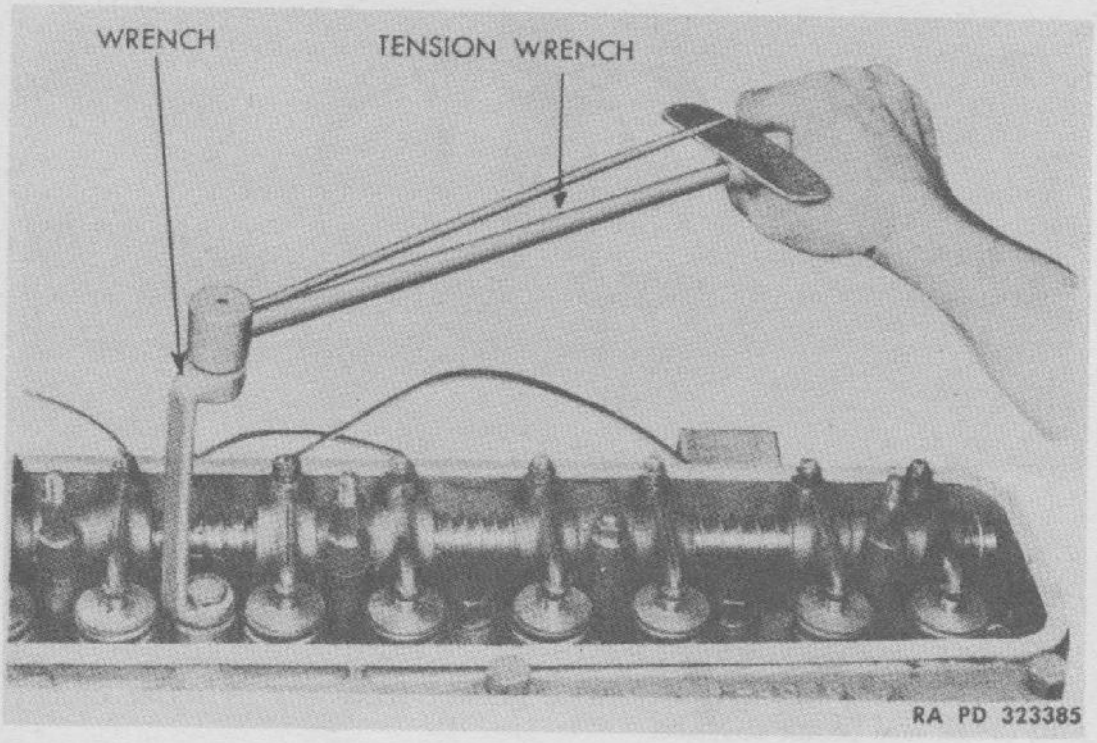


Figure 24 — Tightening Cylinder Head Cap Screws Using Wrench (41-W-2964-710) and Tension Wrench (41-W-3630)

cap screws alternately and evenly (fig. 24) to 80 foot-pounds with a wrench (41-W-2964-710) and tension wrench (41-W-3630).

(6) Insert all 12 valve push rods in place, making sure that lower end of each enters socket in valve tappet.

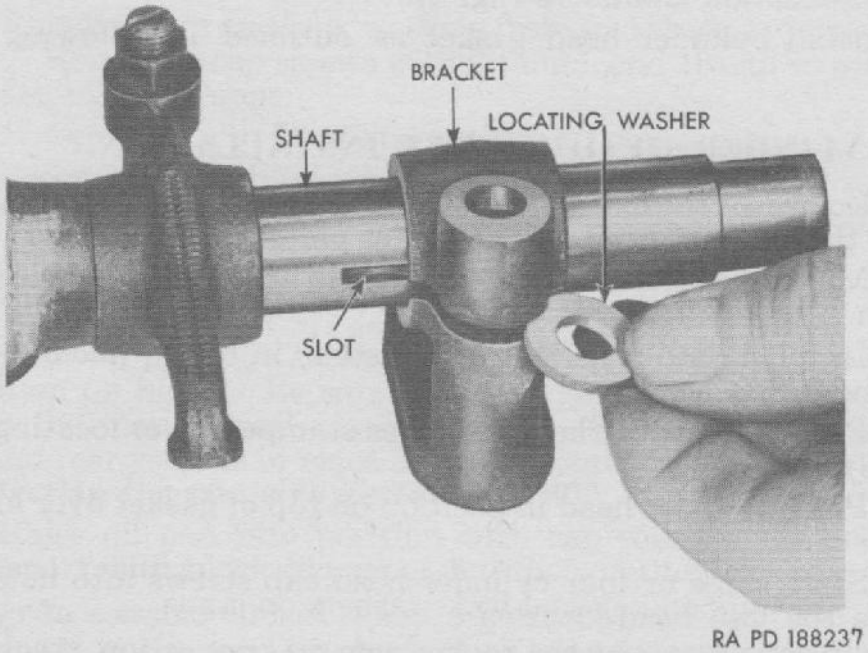


Figure 25 — Installing Rocker Arm Shaft Locating Washer

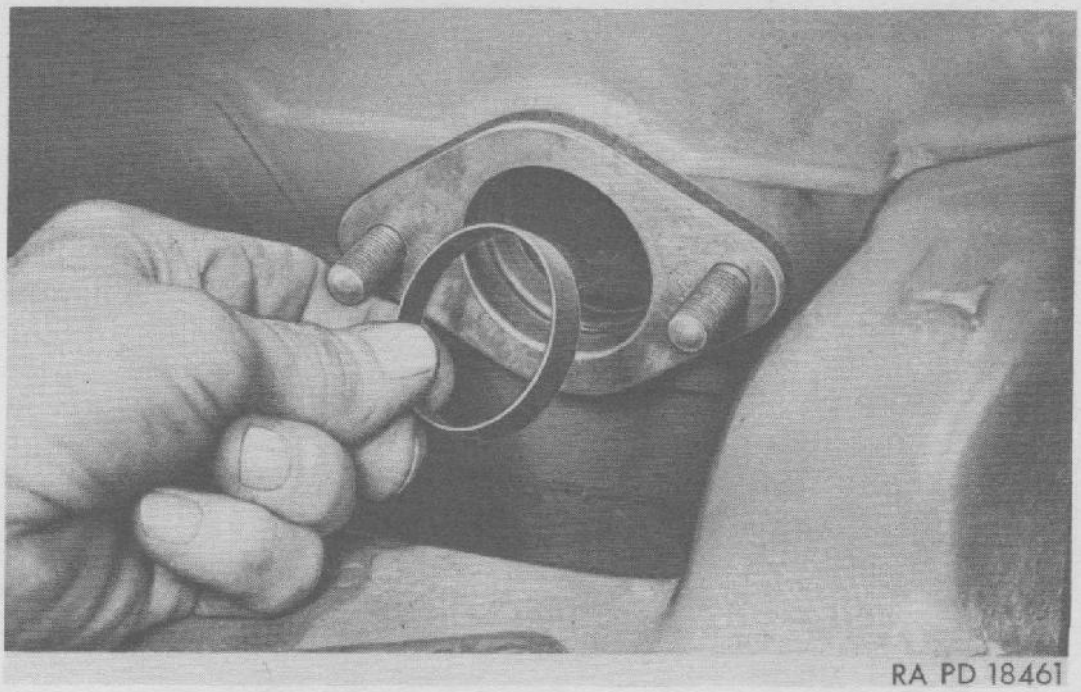


Figure 26 — Installing Intake Manifold Pilot Ring

(7) Place valve rocker arm assembly in position on cylinder head, making sure that shaft locating washers (fig. 25) are in place. Loosen valve rocker arm adjusting screw nuts, and back adjusting screws out as far as possible.

(8) Locate rocker arm adjusting screws in sockets of valve push rods. Install six cap screws, and install six nuts and washers on studs. Tighten cap screws and nuts.

(9) Install oil connection bracket cap screw, and tighten.

(10) Install intake manifold pilots (fig. 26) in place in cylinder head ports. Install intake and exhaust manifold gaskets in place, and place manifolds over studs. Install and tighten nuts and washers on studs.

(11) Connect temperature gage at cylinder head.

(12) Install cap screws and lock washers in accelerator control cross-shaft bracket at cylinder head.

(13) Install thermostat housing and new gasket at cylinder head. Install two cap screws and lock washers, and tighten securely.

(14) Connect air compressor to cylinder head water hose at cylinder head, and tighten hose clamp screw.

(15) Install ignition coil and loom clip at cylinder head, and install two nuts and special lock washers on studs.

(16) Connect crankcase breather vacuum line at top of ventilator valve.

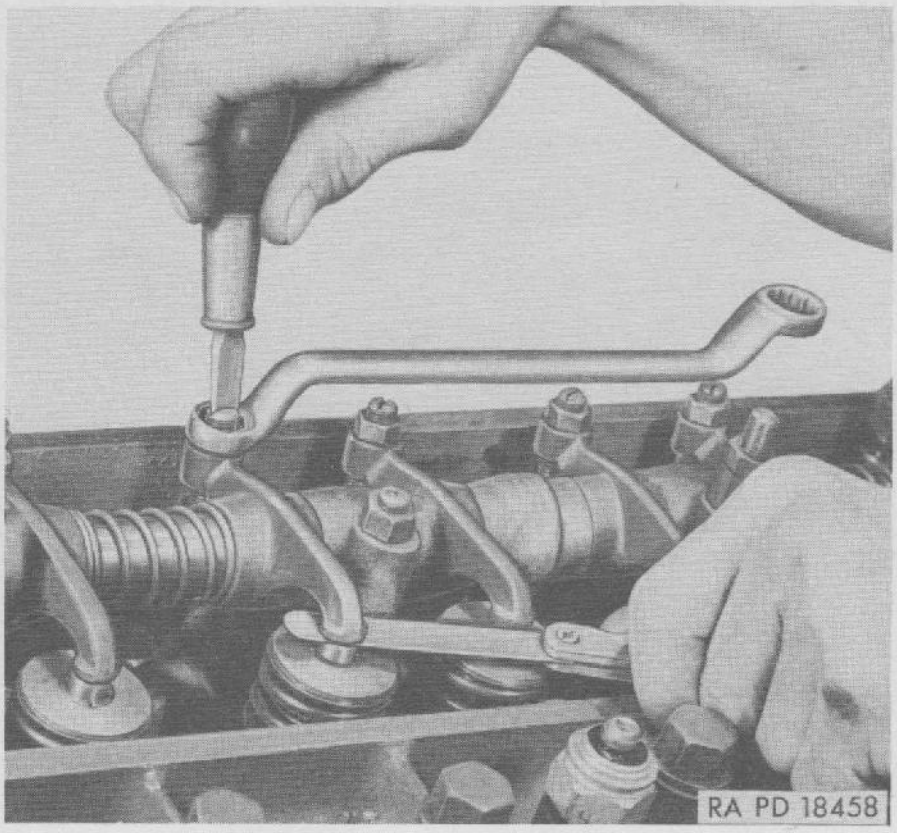


Figure 27 — Adjusting Valve Rocker Arm to Valve Stem Clearance

(17) Adjust valve rocker arm to valve stem clearance. NOTE: *This is not final adjustment.*

(*a*) Place piston No. 1 on top dead center on the firing stroke.

(*b*) Adjust clearance between rocker arm and valve stems of intake and exhaust valves of cylinder No. 1 to a clearance of 0.018 to 0.020 inch, by tightening adjusting screw until clearance is obtained, then tightening lock nut.

(*c*) Revolve engine crankshaft ⅓ turn, and adjust valve clearance at cylinder No. 5. Continue process by adjusting valve clearance for cylinders Nos. 3, 6, 2, and 4, in the order named.

(18) Install spark plugs; and connect spark plug wires.

(19) Fill cooling system, start engine, and allow to warm to normal temperature of 160°F to 180°F.

(20) Retighten cylinder head cap screws to a tension of 80 foot-pounds.

(21) Readjust valve stem to valve rocker arm clearance as follows:

(*a*) With engine at operating temperature of 160°F to 180°F, after having operated at least 30 minutes, allow engine to idle at lowest steady speed.

(*b*) Loosen valve adjusting screw lock nuts, and turn adjusting

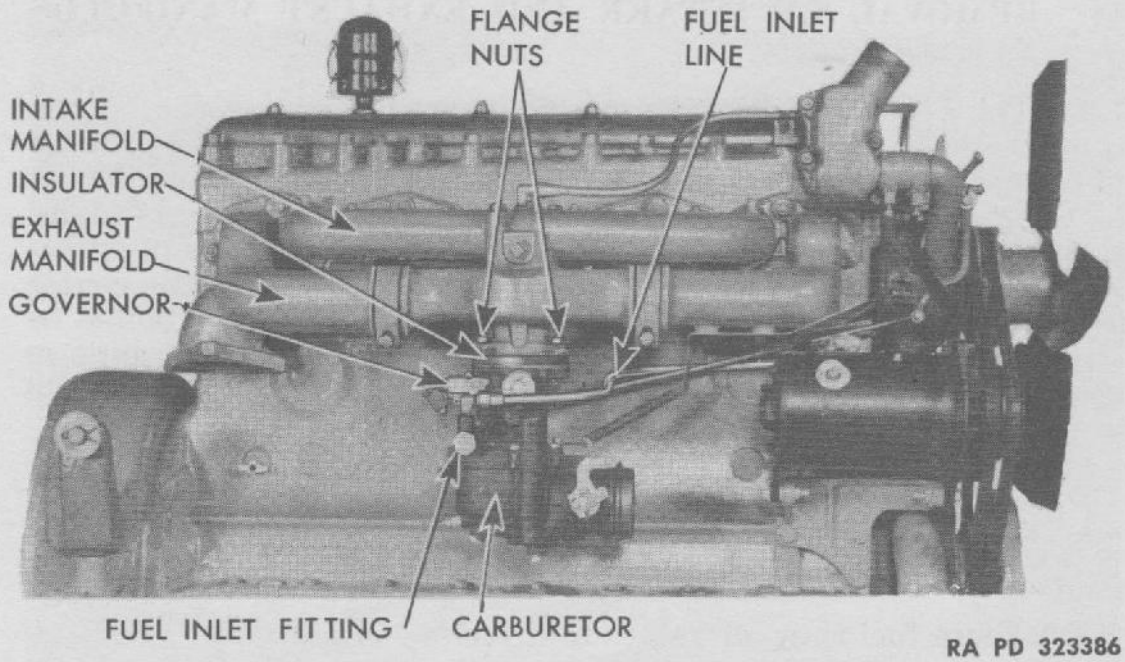


Figure 28 — Carburetor and Manifolds Installed

screws in or out to provide 0.018- to 0.020-inch clearance measured with a feeler gage. Adjust all valve clearances in this manner, then tighten lock nuts securely.

(22) Install new valve rocker arm cover gasket, and install rocker arm cover. Install four retaining nuts.

(23) Install cylinder head breather in position.

(24) Install toeboards and retaining screws.

(25) Install floorboards and retaining screws.

(26) Install floor tunnel in driver's compartment.

53. VALVE ROCKER ARM TO VALVE STEM CLEARANCE ADJUSTMENT.

a. Remove engine tunnel from driver's compartment.

b. Remove four nuts from valve rocker arm cover, and lift off rocker arm cover and gasket.

c. With engine at operating temperature of 160°F to 180°F and idling at lowest steady speed, adjust clearance between valve stems and rocker arms as follows:

(1) Loosen valve adjusting screw lock nut on first rocker arm, and adjust screw as necessary to provide 0.018- to 0.020-inch clearance measured with a feeler gage (fig. 27).

(2) Repeat operation at the adjusting screw for each valve.

(3) Tighten lock nuts securely, rechecking clearance at each valve before proceeding to the next valve.

d. Install new rocker arm cover gasket, and install cover. Install four retaining nuts.

e. Install engine tunnel in driver's compartment.

54. REMOVAL OF INTAKE AND EXHAUST MANIFOLDS AND GASKETS.

a. The exhaust and intake manifolds are bolted together at the center. Both manifolds are held against the cylinder head by means of nuts and washers on the retaining studs. The intake manifold is of one-piece construction and is piloted to the cylinder head by pilot rings in the intake ports. The exhaust manifold is of three-section construction, the two end sections being held to the center section by expansion clamps and seals. The carburetor is bolted to the underside of the intake manifold, while the exhaust pipe is attached to the exhaust manifold outlet flange (fig. 28). Gaskets are used between the manifolds and the cylinder head.

b. Removal of Intake and Exhaust Manifolds (fig. 28).

(1) Remove retaining cap screws and splash shield at right front fender.

(2) Close fuel shut-off valves in driver's compartment.

(3) Disconnect fuel line at carburetor, and disconnect choke control wire. Disconnect throttle control rod at carburetor.

(4) Loosen carburetor to air cleaner elbow clamp screw, and disconnect elbow from carburetor.

(5) Remove two nuts from carburetor flange studs. Remove carburetor and insulator from intake manifold.

(6) Remove three nuts from three exhaust pipe flange bolts, and remove bolts.

(7) Raise right-hand side of hood, remove floor tunnel from driver's compartment, and remove screws from right-hand toeboard and floorboard. Remove towboard and floorboard.

(8) Disconnect crankcase ventilator vacuum line at top of intake manifold.

(9) Remove 12 manifold to cylinder head stud nuts and washers.

(10) Pry intake and exhaust manifolds from studs.

(11) Separate intake and exhaust manifolds by removing attaching cap screws.

(12) Separate exhaust manifold sections by loosening expansion clamp screws.

c. Removal of Gaskets Only. The intake and exhaust manifold gaskets may be removed with but little disassembly of parts as follows:

(1) Raise right-hand side of hood.

(2) Remove three front manifold to cylinder head stud nuts and washers.

(3) Remove floor tunnel from driver's compartment.

(4) Remove screws from right-hand toeboard and right-hand floorboard. Remove toeboard and floorboard.

(5) Remove remaining nine manifold to cylinder head stud nuts and washers.

(6) Disconnect crankcase ventilator vacuum line at top of intake manifold.

(7) Support manifolds and pry manifolds from studs.

(8) Remove old gaskets, and clean gasket surfaces of both manifolds and of cylinder head.

55. INSTALLATION OF INTAKE AND EXHAUST MANIFOLDS AND GASKETS.

a. Installation of Intake and Exhaust Manifolds.

(1) Assemble exhaust manifold sections, and install expansion clamp seals and expansion clamps. Do not tighten clamp screws securely at this time.

(2) Place new gasket between intake manifold and exhaust manifold center section. Install retaining cap screws, but do not tighten.

(3) Place intake manifold pilots in intake ports of cylinder head. Place new gaskets in position over studs.

(4) Place intake and exhaust manifolds in position on studs, and install 12 nuts and washers on studs. Tighten evenly and securely.

(5) Tighten exhaust manifold expansion clamp screws, and tighten exhaust manifold to intake manifold retaining cap screws.

(6) Connect crankcase ventilator vacuum tube at top of intake manifold.

(7) Connect exhaust pipe flange at exhaust manifold, being sure that seal ring is in place. Install three flange bolts and nuts, and tighten securely.

(8) Install carburetor and insulator at intake manifold, and install two carburetor flange stud nuts.

(9) Connect air cleaner pipe elbow at carburetor, and tighten clamp screw.

(10) Connect throttle control rod, fuel line, and choke wire at carburetor. Open fuel shut-off valves in driver's compartment.

(11) Install right-hand floorboard, toeboard, and attaching screws.

(12) Install floor tunnel in driver's compartment.

b. Installation of Gaskets Only.

(1) Install new intake and exhaust manifold gaskets in place over studs at cylinder head.

(2) Be sure intake manifold pilot rings are in place in the intake ports of cylinder head.

(3) Place manifolds against cylinder head over studs. Install twelve nuts and washers, and tighten evenly and securely.

(4) Connect crankcase ventilator tube at top of intake manifold.

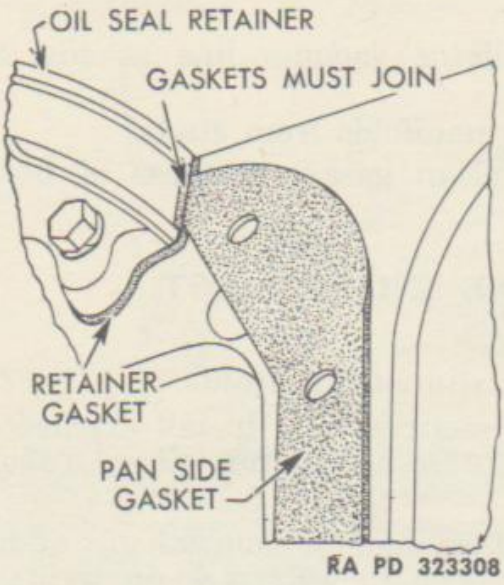


Figure 29 — Oil Pan Side Gasket Installation

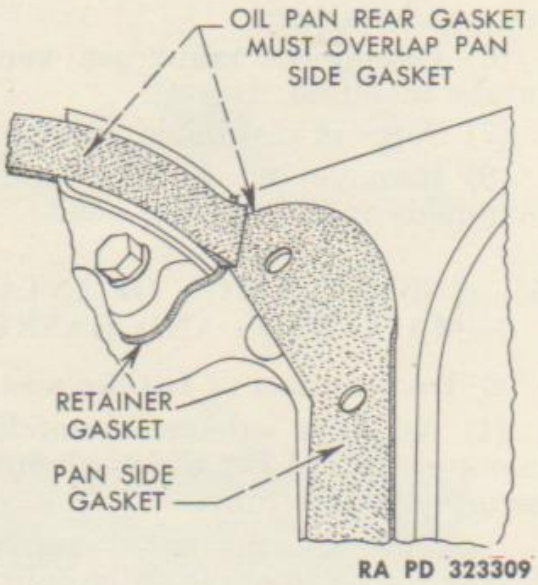


Figure 30 — Oil Pan Side Gasket Overlapped by Rear Gasket

(5) Install right-hand toeboard, right-hand floorboard, and retaining screws.

(6) Install floor tunnel in driver's compartment.

56. OIL PAN.

a. Removal.

(1) Remove drain plug from base of oil pan, and drain oil into receptacle.

(2) Remove nuts and lock washers from two studs at front end of oil pan. Remove 8 cap screws without nuts, and 10 cap screws with nuts from oil pan flange.

(3) Lower oil pan to floor, and remove oil pan gasket.

b. Cleaning. Wash oil pan externally and internally with dry-cleaning solvent. Wash drain plug, and clean off any accumulated metal particles.

c. Installation.

(1) Coat oil pan side gaskets with sealing compound, and place in position on block. Be sure that side gasket joins but does not overlap the rear oil seal retainer gasket (fig. 29). Place oil pan front and rear gaskets in place over seal retainers. The rear gasket must overlap the pan side gaskets (fig. 30).

(2) Raise oil pan into position with cap screw holes lined up, and support with block or jack.

(3) Install cap screws, nuts, and lock washers, but do not tighten until all are in place. Then tighten all nuts and cap screws snugly and evenly.

Figure 31 — Oil Filter Installed

(4) Install oil pan drain plug securely. Refill crankcase with oil of proper grade (par. 21) to full mark on bayonet gage (dip stick).

57. **OIL FILTER** (fig. 31).

a. Description. The oil filter on this engine is of dual-cartridge type, and is mounted on the left-hand side of the engine. All of the oil does not pass through the filter since a portion of it by-passes the filter at the control valve in the base of the filter. The filtering elements are of replaceable-cartridge type.

b. Removal.

(1) CARTRIDGES. Unscrew nut fitting at top of filter cover, and lift off cover. Lift out filter cartridge.

(2) OIL FILTER ASSEMBLY. Loosen clamp screw from clamp band around front oil filter unit. This band attaches to the oil level bayonet gage (dip stick) tube. Remove three nuts and lock washers and three cap screws and lock washers from oil filter case (fig. 32). Remove oil filter assembly by lowering from engine.

c. Installation.

(1) CARTRIDGES. Insert new cartridge in oil filter case. Use new gasket at oil filter cover, and install cover. Tighten nut fitting at top of cover. Start engine and allow to run for at least 10 minutes to charge the oil filter cartridges fully. Shut off

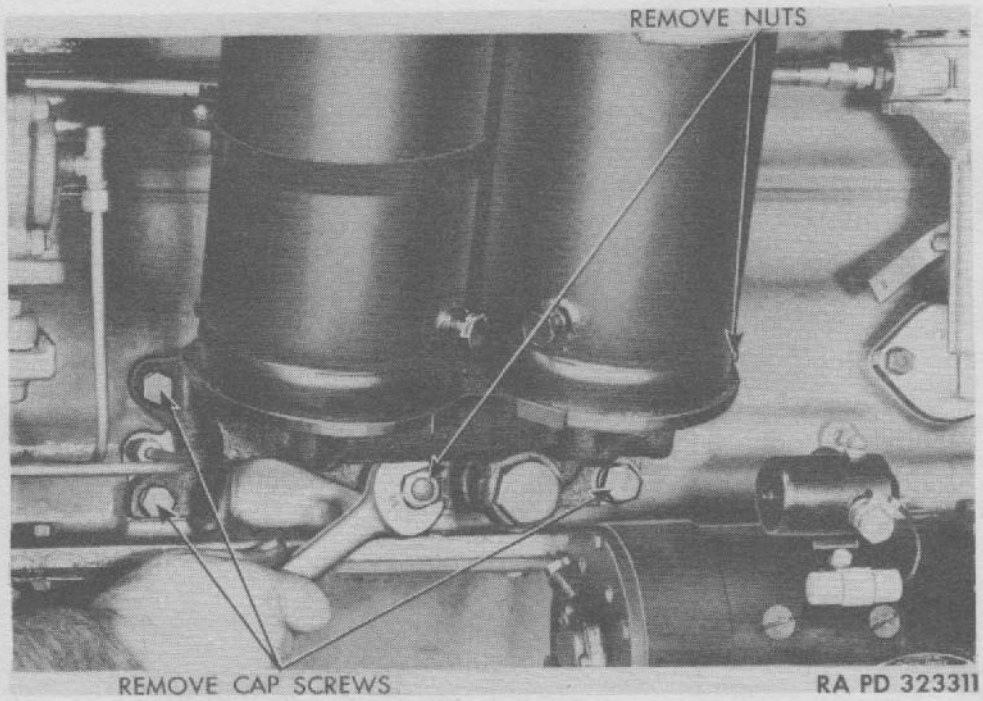


Figure 32 — Removing Oil Filter

engine, and add oil to crankcase to bring level to "FULL" mark on oil level bayonet gage (dip stick). Inspect filter for oil leaks.

(2) OIL FILTER ASSEMBLY. Coat new oil filter base gasket with joint and thread compound, and place in position on block. Place oil filter on engine. Install three cap screws and lock washers, and three nuts and lock washers, and tighten securely. Start engine and allow to run at least 10 minutes to charge filter cartridges fully. Shut off engine, and add oil to crankcase to bring level to "FULL" mark on bayonet gage (dip stick). Check filter for leaks.

58. CRANKCASE VENTILATION.

a. Description. This vehicle has a crankcase ventilator valve installed at the oil filler pipe (fig. 33), and the engine is also equipped with a cylinder head breather (fig. 34). The purpose of the crankcase ventilator valve, which is connected to the intake manifold by a vacuum line, is to control the amount of fumes and vapors drawn from the crankcase by the intake manifold vacuum. The purpose of the cylinder head breather is to filter the air being drawn into the engine through the valve rocker arm compartment.

b. Removal.

(1) CYLINDER HEAD BREATHER. To service the cylinder head breather, disconnect the two clips from the oil cup and lift off the assembly. The oil cup can then be lifted from the unit for cleaning and refilling.

(2) CRANKCASE VENTILATOR VALVE. To remove the ventilator valve, disconnect the vacuum line leading to the intake manifold.

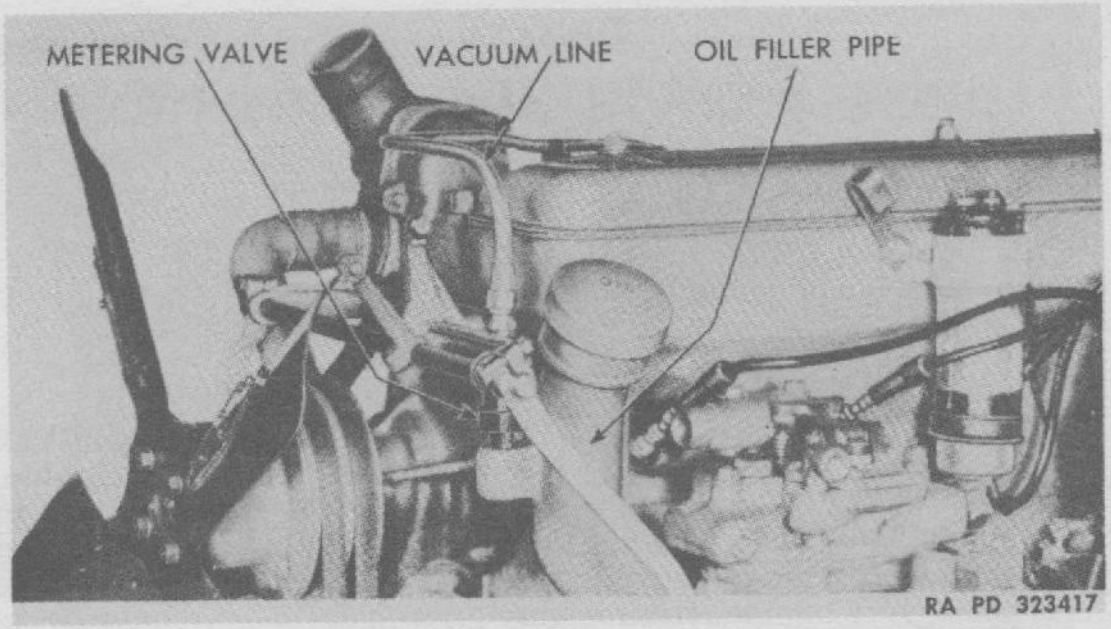


Figure 33 — Crankcase Ventilator Metering Valve Installed

Unscrew the ventilator valve unit from the oil filler pipe. To service, separate the two halves of the valve unit and remove the plunger. Clean the parts in paint and varnish remover, and reassemble.

c. Installation.

(1) CYLINDER HEAD BREATHER. Place unit in position over tube on valve rocker arm compartment, and fasten clips below oil cup.

(2) CRANKCASE VENTILATOR VALVE. Install ventilator valve in position on oil filler pipe with arrow pointing upward. Screw unit into filler pipe. Connect vacuum line leading to the intake manifold.

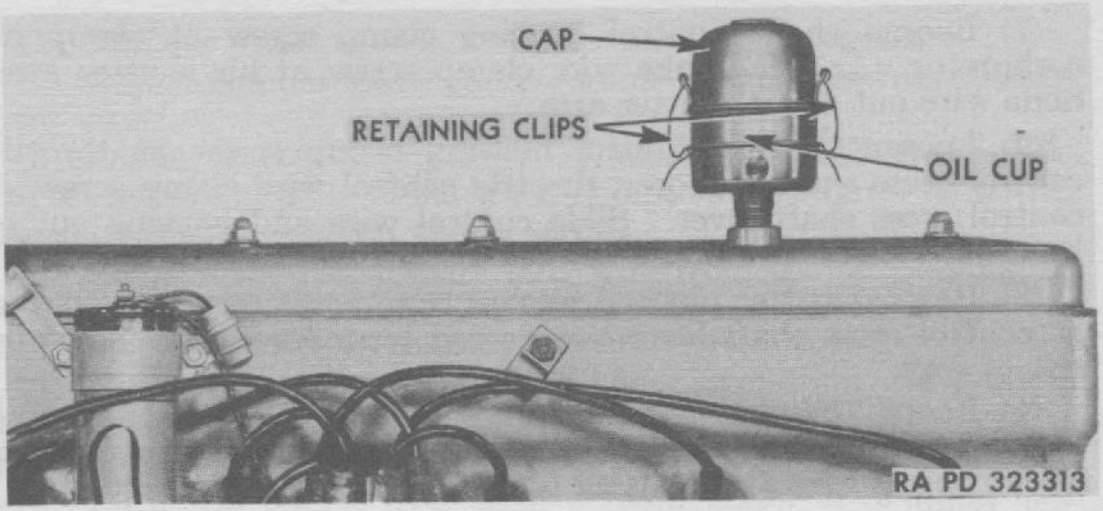


Figure 34 — Cylinder Head Breather Installed

Section XV

ENGINE REMOVAL AND INSTALLATION

59. REMOVAL.

a. Remove Radiator. Refer to paragraph 78 b.

b. Remove Front Bumper. Remove two bolts, nuts, and lock washers from bumper to lower frame flanges, one on each side. Remove two long bolts, nuts, and lock washers from bumper to frame side rails, one on each side. Remove two bolts, nuts, and lock washers from each of two front lifting eye brackets, and remove brackets. Lift bumper from frame.

c. Remove Frame Upper Flange to Bumper Brackets. Remove nuts, lock washers, and bolts, one each side, from frame flange to frame brackets, and remove brackets.

d. Remove Floor Tunnel. Unhook latches from floor tunnel, and remove tunnel from driver's compartment.

e. Remove Floorboards. Remove screws from left floorboard section and from right floorboard section, and remove floorboards from cab.

f. Remove Splash Shields. Remove screws from left splash shield beneath fenders and screws from right splash shield, and lift out shields.

g. Remove Exhaust Pipe. Remove three nuts and bolts from exhaust pipe flange at exhaust manifold at right rear of engine. Loosen nut and clamp bolt at muffler to free exhaust pipe, and remove exhaust pipe from chassis.

h. Disconnect Choke, Throttle, and Spark Controls.

(1) Loosen choke control housing clamp screw at clamp on carburetor. Loosen choke wire clamp screw at air shutter arm. Slide wire out of air shutter arm.

(2) Loosen throttle control housing clamp screw at throttle control cross shaft. Loosen throttle control wire clamp screw at control cross shaft lever. Slide control wire and housing out of bracket.

(3) Remove cotter pin and washer from accelerator control rod at control cross shaft lever. Slide rod from lever, and fasten up out of way.

(4) Loosen manual spark control housing clamp screw, and loosen spark control wire clamp screw at distributor control arm. Slide control wire and housing out of control arm bracket.

i. Disconnect tachometer drive housing and drive shaft at distributor and tachometer drive mounting bracket.

j. Free all controls for spark, choke, and tachometer drive housing from engine parts.

k. **Disconnect Air Cleaner.** Loosen clamp screws at carburetor to air cleaner elbow. Disconnect carburetor to air cleaner pipe at air cleaner. Loosen clamp screw in hose clamp at air compressor end of air cleaner to air compressor hose. Lift off air cleaner pipe.

l. **Disconnect Fuel Line.** Close fuel valves in driver's compartment. Disconnect fuel pump fuel inlet line at rear end of flexible line.

m. **Disconnect Wiring.** Disconnect positive battery cable at battery. Loosen clamp screw collars at two amphenol plugs at the rear of instrument panel, and disconnect amphenol plugs. Feed each harness through dash out of cowl.

n. **Disconnect Temperature Gage.** Remove engine unit of temperature gage from cylinder head.

o. **Disconnect Air Compressor.** Release air from air brake system by applying and releasing brakes several times. Disconnect air compressor to air brake system governor flexible air line at air compressor. Disconnect air compressor to reservoir air line at air compressor, and disconnect union in air line from compressor to reservoir at frame left rail above engine mounting. Remove this disconnected section of air line from the chassis. Also disconnect flexible oil pressure line to gage at the fitting at air compressor.

p. **Remove Right Front Wheel Air Brake Line.** Disconnect air line at right frame side rail fitting, and remove pipe support clip from front engine support clip bolt at right side. Disconnect air line at quick release valve at left front corner of frame. Lift air line out of frame.

q. **Remove Front Brake Quick Release Valve.** Disconnect left front brake air line at quick release valve. Disconnect air supply line at front brake shut-off cock. Remove two nuts and lock washers from two cap screws holding quick release valve to bracket, remove cap screws, and remove quick release valve and front brake shut-off cock.

r. **Disconnect Hand Control Valve Air Line.** Loosen compression fitting nuts at hand control valve air line at steering column just above steering gear, and at union located inside frame side rail. Remove curved section of air line thus disconnected.

s. **Disconnect Air Line to Right Reservoir.** Loosen union nuts at compression fittings in air line from air appliance panel to right-hand air reservoir at dash, and at inside of right frame side rail. Remove curved section of air line from vehicle.

t. **Disconnect Transmission and Clutch Housing at Engine.** Place jack beneath transmission at rear, and support engine below engine flywheel housing with a jack. Remove 12 cap screws and lock washers from clutch housing flange at engine bell housing. Lower rear of engine until rollers rest on frame side rail flanges, and remove jack.

u. **Disconnect Front of Engine Crossmember from Frame.** Remove two nuts, lock washers, and bolts from engine front support

crossmember to frame lower flange at each side. Remove two cap screws, nuts, and lock washers from engine to crossmember ground strap, and remove ground strap. Remove nuts and lock washers from four cap screws at end of engine front crossmember.

v. **Lower Engine to Rollers.** Raise front end of engine, and remove crossmember to frame flange spacer plates. Lower engine until engine rests upon rollers on frame side rail lower flanges.

w. Remove nut and lock washer from lower steering gear to frame bolt. Slide bolt far enough out of frame to permit engine crossmember to pass by.

x. **Remove Engine From Frame.** Install engine lifting eye bolts in cylinder head at right front corner and at left rear corner, and attach chain and hoist at front eye bolt. Roll engine far enough forward to permit attachment to rear eye bolt. Use hoist to lift engine out of frame.

y. **Remove Engine Front Crossmember.** Cut engine mounting cap screw lock wire, and remove lock wire. Remove two cap screws, flat washers, and springs from engine front mounting. Remove engine front crossmember from beneath engine gear case cover.

60. INSTALLATION.

a. **Install Engine Front Crossmember.** Place engine front crossmember in position beneath engine gear case at engine mounting. Install two springs, flat washers, and engine front mounting cap screws. Tighten cap screws to compress springs to length of $3\frac{1}{8}$ inches. Install lock wire in cap screws.

b. **Install Engine in Frame.** Install engine lifting eye bolts in engine cylinder head at right front corner and at left rear corner. Attach chain and hoist, and raise engine to position in front of frame. Lower engine until rear rollers rest upon top of frame side rail flanges. Push engine toward rear as far as engine sling will permit. Disconnect at rear eye bolt, and continue pushing engine toward rear until front engine crossmember and rollers enter frame. Lower engine upon rollers, and disconnect hoist. Remove engine lifting eye bolts.

c. **Connect Engine and Transmission Main Gear Shaft.** Push engine toward rear, guiding transmission main gear drive shaft into clutch driven member and being careful not to spring shaft or clutch driven member hub. Push engine completely toward transmission.

d. **Connect Engine Flywheel Housing at Clutch Housing.** Place jack underneath engine flywheel housing, and raise as required to permit installation of 12 cap screws and lock washers in clutch housing flange at bell housing, raising jack at rear of transmission as necessary to assure alinement. Remove jacks from below transmission and engine flywheel bell housing.

e. **Connect Engine Front Crossmember at Frame.** Place jack beneath front of engine, and raise to permit installation of

spacer plates at each side rail flange. Install one spacer plate at each end. Install two cap screws, nuts, and lock washers in each end through frame flange and spacer plate. Remove jack from beneath engine.

f. Connect Engine Ground Strap. Clean connecting location at engine and at frame, and install engine ground strap. Install cap screws, nuts, and lock washers.

g. Install two bolts, nuts, and lock washers through frame and engine crossmember at each end.

h. Install lower steering gear to frame with bolt, nut, and lock washer, and tighten securely.

i. Connect Air Line to Right Reservoir. Place curved section of air line from air appliance panel to right-hand reservoir in position, and tighten compression couplings at dash and at union inside right frame channel.

j. Connect Air Line for Hand Control Valve. Place curved section of hand valve air line in position, and tighten compression fittings at couplings at steering column and at inside of frame channel.

k. Install Quick Release Valve and Shut-off Cock. Place quick release valve and shut-off cock in position at left front corner of frame. Install two cap screws, nuts, and lock washers. Connect air supply line at front brake shut-off valve, and connect left front brake air line at the quick release valve.

l. Install Right Front Wheel Air Brake Line. Install front wheel air brake line in position in front engine support clip, and connect air line at quick release valve. Connect air line at right frame side rail.

m. Connect Air Compressor. Place curved section of air line in position in chassis, and connect compression fittings at coupling in line from reservoir and at air compressor. Connect flexible air supply line from governor to air compressor at air compressor. Connect flexible oil pressure line to gage at air compressor.

n. Connect Wiring. Feed harness for two amphenol plugs through cowl dash. Connect amphenol plugs at rear of instrument panel, and tighten clamp collars. Connect positive battery cable at battery.

o. Connect Fuel Line. Connect fuel line at rear of fuel pump flexible inlet fuel line. Open fuel valve in driver's compartment, and check fuel line for leaks.

p. Connect Air Cleaner. Place air cleaner pipe in position, connect in hose at air compressor, and connect at air cleaner and at carburetor elbow. Tighten all clamp screws.

q. Connect Tachometer. Connect tachometer drive shaft and housing at distributor mounting bracket, and tighten coupling.

r. Connect Spark, Throttle, and Choke Controls.

(1) Slide spark control wire and housing into control arm bracket. Adjust distributor housing to center, and pull spark

control button 3/8 inch from instrument panel. Tighten clamp screws in bracket at spark control wire and housing.

(2) Slide foot accelerator control rod into bracket cross shaft lever, and install cotter pin and washer in control rod.

(3) Slide control wire and housing into bracket, and tighten housing clamp screw and control wire clamp screw.

(4) Insert choke control wire housing in air shutter arm bracket, and tighten clamp screw. With air shutter in fully open position, and choke control button in against the instrument panel, tighten the choke control wire clamp screw.

s. Connect Temperature Gage. Connect temperature gage engine unit at cylinder head.

t. Install Exhaust Pipe. Insert lower end of exhaust pipe in front end of muffler. Connect exhaust pipe at exhaust manifold flange, being sure that seal ring is in position. Install three bolts and nuts. Tighten exhaust pipe clamp screw at muffler.

u. Install Splash Shields. Place splash shields in place beneath front fenders, and install retaining cap screws and lock washers.

v. Install Floorboards. Install right and left floorboard sections in driver's compartment, and install floor retaining screws.

w. Install Engine Tunnel. Install engine tunnel in driver's compartment, and hook latches.

x. Install Frame to Bumper Upper Flange Brackets. Install frame to bumper bracket at frame upper flange at each side, and install one bolt, nut, and lock washer in each.

y. Install Front Bumper. Lift front bumper into position on front of frame. Install two lifting eye brackets on bumper, and install two bolts, nuts, and lock washers in each bracket. Install two long bolts, nuts, and lock washers into frame and bumper, one at each end. Install two bolts, nuts, and lock washers into bumper and lower frame flanges, one on each side.

z. Install Radiator. Refer to paragraph 78.

aa. Check Operation. Start engine, charge air brake system, and check connections for air leaks. Check controls for smoothness and responsive action.

Section XVI

CLUTCH

61. DESCRIPTION AND DATA.

a. Description.

(1) The clutch in this vehicle is a single-plate, dry-disk type. It is attached to the engine flywheel by cap screws, as shown in figure 35. The clutch engages by clamping a driven disk between the flywheel face and clutch pressure plate, thereby transmitting engine power through the transmission to the driving units of the truck. The driven disk is splined to the transmission main drive gear shaft, and has a friction-type facing on each side. To obtain smooth clutch engagement, the pressure plate moves perpendicu-

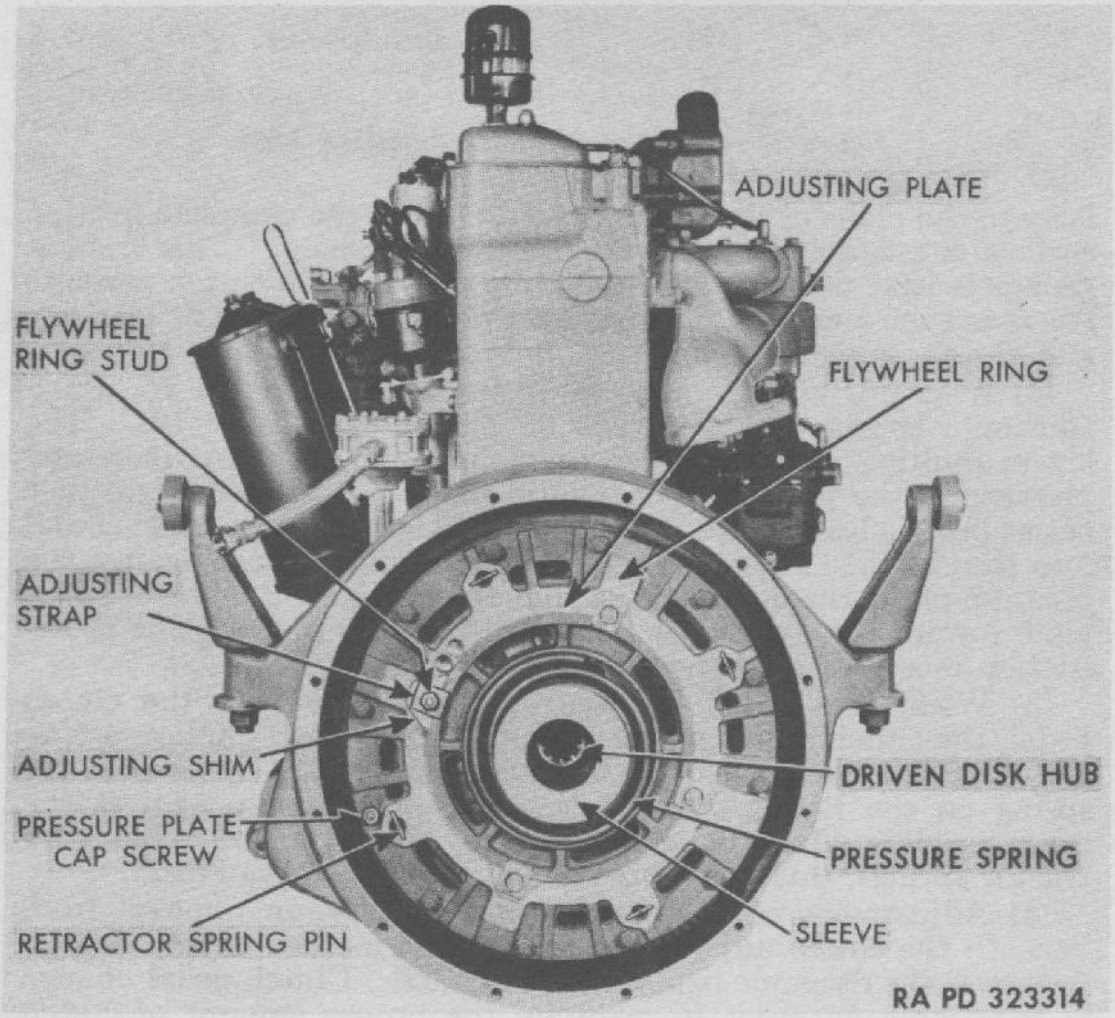


Figure 35 — Clutch Installed

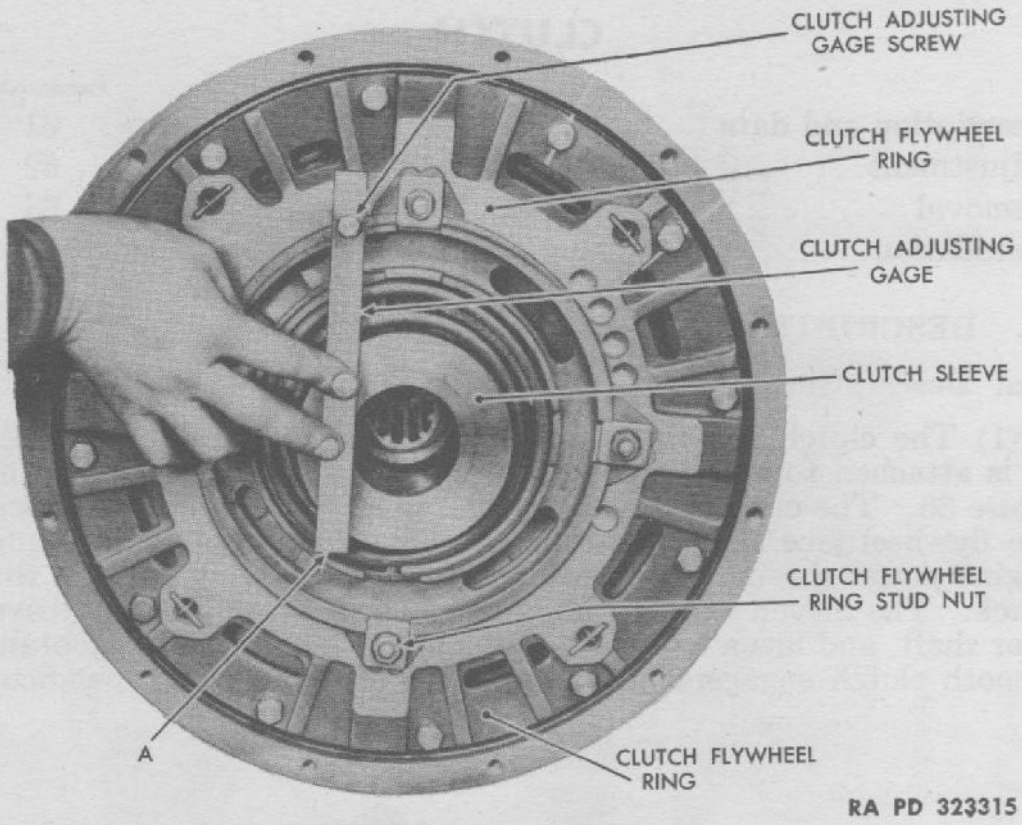


Figure 36 — Position of Clutch Adjusting Gage

larly to the plane of the flywheel face, so that the complete friction surface is contacted at exactly the same moment. This friction generates heat which is distributed by means of 20 clutch pressure levers in such a way as to prevent burning of the clutch driven disk and clutch pressure plate.

(2) A heavy clutch pressure spring acts on a sleeve which transmits spring energy to the 20 clutch pressure levers. The levers multiply the spring pressure and transmit this increased pressure to the pressure plate. The levers have raised edges that act as fan blades to force cooling air through the clutch spring and into the clutch. They also provide a uniform pressure against the pressure plate, thereby assuring that the movement of the pressure plate toward the flywheel will be perpendicular to the plane of the friction face of the flywheel.

(3) When the clutch is disengaged by depressing the clutch pedal, the clutch sleeve moves toward the flywheel. Action on the clutch pressure levers is opposite to the force of the clutch pressure spring on the levers. This action relieves pressure against the pressure plate which is moved back by means of four clutch retractor springs, thus breaking contact with the driven disk.

(4) Adjustment of the clutch is made by shim removal from beneath the clutch adjusting straps. This method of adjustment preserves the dynamic balance of the clutch. Clutch pedal linkage is adjustable, in order to maintain the proper amount of clutch pedal free travel.

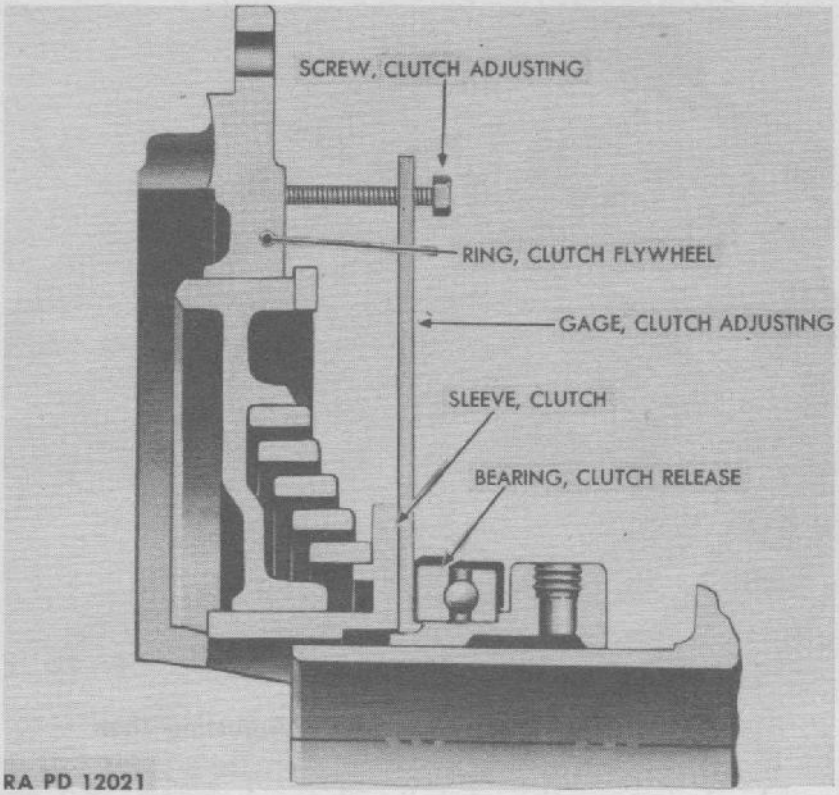


Figure 37 — Measurement of Clutch Adjustment

b. Data.

Make	W. C. Lipe
Model	Z-31-S
Size	14 in.
Weight	60 lb

62. ADJUSTMENT.

a. Clutch adjustment is made by removal of adjusting shims from under four clutch adjusting straps. These adjusting straps are reached through the clutch housing top hand-hole cover. Do not wait for the clutch to slip before making adjustment. Adjust the clutch as soon as the free travel of the clutch pedal, before the clutch disengages, becomes ½ inch or less.

b. Procedure.

(1) REMOVE CLUTCH HOUSING COVER. Remove clutch housing top handhole cover.

(2) CHECK CLUTCH ADJUSTMENT.

(*a*) Place an improvised clutch adjusting gage or a straightedge across the face of the clutch sleeve (fig. 36). The clutch adjusting gage screw must be in a position to touch the machined face of the clutch flywheel ring. The end of the gage or straight edge (A, fig.

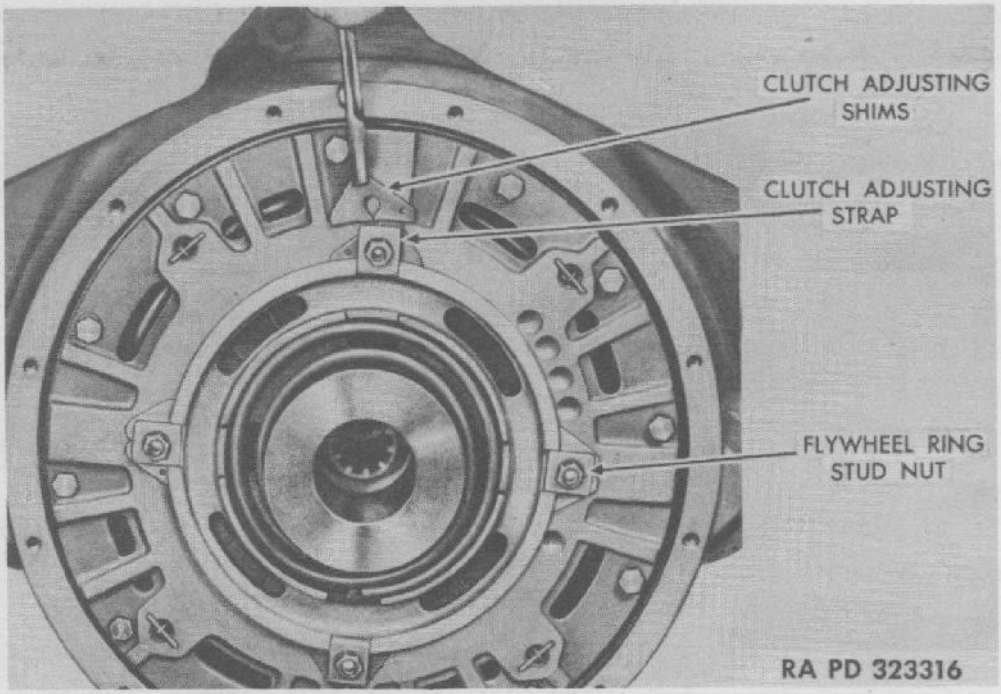


Figure 38 — Removing Clutch Adjusting Shim

36) must be between the clutch release bearing and the clutch sleeve thrust surface. Push the clutch release bearing forward until in contact with the gage end by depressing the clutch pedal, and hold in position with a clutch pedal depressor.

(*b*) Turn the clutch adjusting gage screw down until screw touches clutch flywheel ring. Gage must be flat against clutch sleeve face while screw is being turned down (fig. 37).

(*c*) Remove clutch adjusting gage without turning screw. Measure length of screw from end to inside of gage. When straightedge is used, measure distance with 6-inch scale. The measurement should be 1¼ inches, with an allowable plus variation of 1/16 inch, but no minus variation.

(3) ADJUST CLUTCH.

(*a*) To obtain correct measurement given above, it is necessary to remove one or more clutch adjusting shims from under each of the four clutch adjusting straps. The same number of shims must be removed from under each strap. One set of four shims removed reduces the 1¼-inch distance (step (2) (*c*) above) by 7/64 inch.

(*b*) Working through the clutch housing cover handhole, it will be necessary to turn the engine to reach each of the flywheel ring studs in turn.

(*c*) Loosen each of four clutch flywheel ring stud nuts five complete turns (fig. 36).

(*d*) Engage clutch by removing clutch pedal depressor. This permits clutch adjusting plate to move out of contact with clutch adjusting shims.

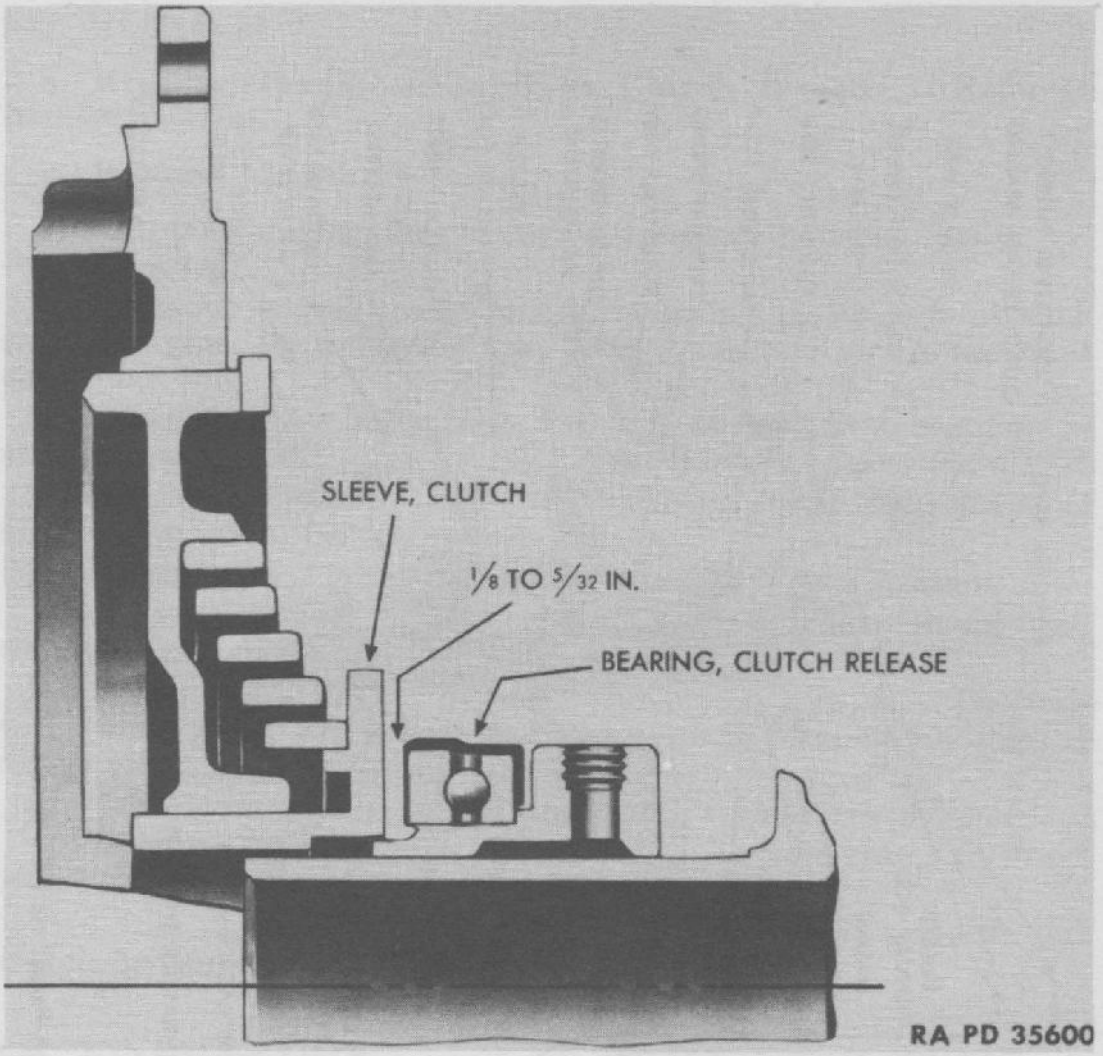


Figure 39 — Clutch Release Bearing Clearance

(*e*) Remove one shim from under each of four clutch adjusting straps (fig. 38). Make certain entire shim is removed each time, as no portion must be left between clutch adjusting plate and clutch flywheel ring. Mark each clutch adjusting strap with a piece of chalk as soon as shim has been removed. This will prevent removing more than one shim from each strap, an error easily made if straps are not marked.

(*f*) Check measurement. Continue removing clutch adjusting shims one at a time from each of four straps, until measurement given in step (2) (*c*) above, is obtained.

(4) Remove clutch pedal depressor, and tighten all four clutch adjusting strap nuts.

(5) CHECK CLUTCH RELEASE BEARING CLEARANCE. Measure distance from face of clutch release bearing to thrust surface of clutch sleeve (fig. 39). Measurement must be from 1/8 to 5/32 inch. Adjust the clutch pedal linkage at the clutch lever throw-out adjustable yoke (fig. 40) until the measurement is within these limits.

(6) Install clutch housing top cover.

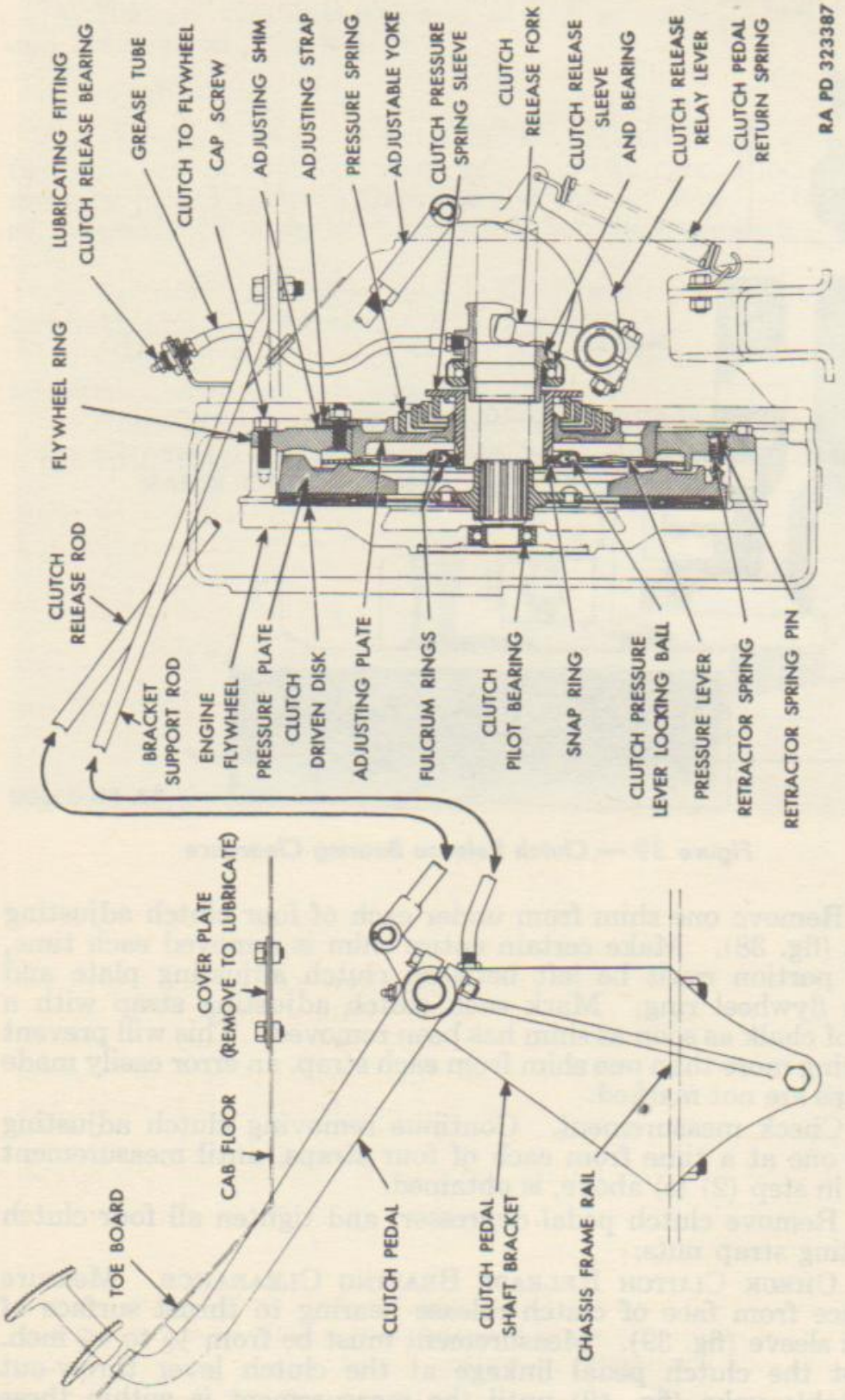


Figure 40 — Clutch Pedal and Control Linkage Diagram

63. REMOVAL.

a. Remove Transmission from Clutch Housing. Refer to paragraph 107.

b. Remove Clutch Housing.

(1) Support engine below engine flywheel housing, using hydraulic jack.

(2) Remove engine rear support mounting plates, one at each side of engine, by removing two bolts, nuts, and lock washers at each mounting.

(3) Remove three bolts, nuts, and lock washers from each end of engine rear support crossmember lower flange at frame side rails.

(4) Remove two bolts, nuts, and lock washers from each end of engine support to frame bracket.

(5) Remove rear engine frame crossmember from position.

(6) Disconnect clutch pedal control rod at clutch release arm, removing cotter pin and yoke pin.

(7) Chalk-mark engine flywheel and clutch flywheel ring position. Remove 12 cap screws and lock washers from clutch housing flange at engine flywheel housing.

(8) Lift down clutch housing and clutch release mechanism.

(9) Remove 12 cap screws and lock washers from clutch flywheel ring.

(10) Lift clutch assembly from engine flywheel, and lift out clutch driven disk.

64. INSTALLATION.

a. Install Clutch in Flywheel.

(1) Place clutch driven member in position in engine flywheel, placing long hub of disk toward rear.

(2) Lift clutch into position in engine flywheel. Aline cap screw mounting holes, or if replacing same clutch, aline chalk marks. Install 12 cap screws and lock washers loosely in position in holes.

(3) Use clutch pilot tool to aline clutch disk and engine flywheel pilot bearing. Hold disk in alinement and tighten all 12 mounting cap screws and lock washers securely.

b. Adjust Clutch. Follow procedure outlined in paragraph 62 b.

c. Install Clutch Housing.

(1) Place clutch housing, clutch release shaft, and release bearing in position at engine flywheel housing, and install 12 mounting cap screws and lock washers in mounting flange.

(2) Connect clutch control rod at clutch release arm, installing yoke pin and cotter pin.

(3) Install engine rear crossmember and brackets in position

below clutch housing, and install two bolts, nuts, and lock washers at each bracket.

(4) Install three bolts, nuts, and lock washers at each end of engine rear support crossmember lower flange.

(5) Install engine rear support mounting plates, installing two bolts, nuts, and lock washers at each plate.

(6) Remove jack or support from below engine flywheel housing.

d. Install Transmission. Refer to paragraph 108.

e. Adjust Clutch Pedal Free Travel. Refer to paragraph 62 b.

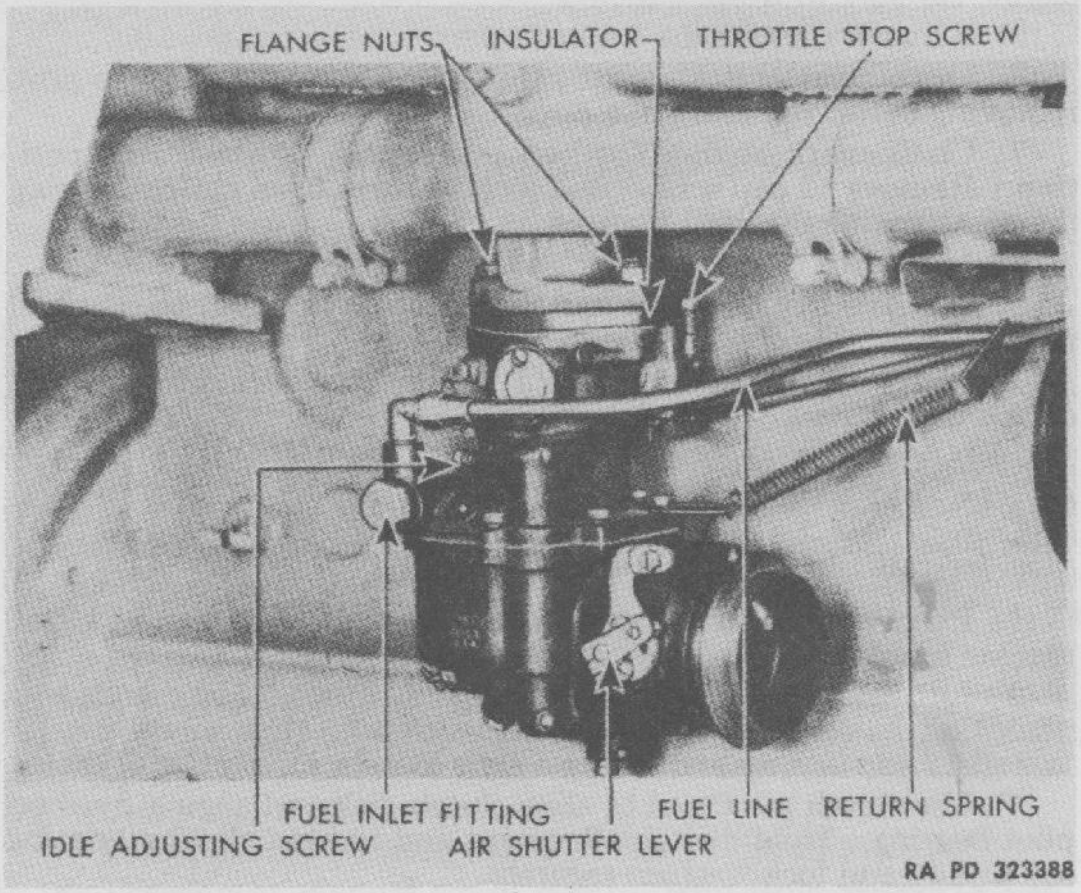


Figure 41 — Carburetor

Section XVII

FUEL SYSTEM

65. DESCRIPTION (fig. 42).

a. Description. The air-fuel system of this vehicle consists of two frame-mounted fuel tanks of 40-gallon capacity each, fuel lines, fuel tank control valves, fuel pump, auxiliary fuel filter, carburetor, and suitable throttle and choke controls. The fuel control valves are located in the driver's compartment at the right and to the rear of the driver.

b. Operation. The fuel pump is actuated by the engine camshaft. Operation of the fuel pump forces gasoline, which has been filtered through the frame-mounted auxiliary fuel filter, into the carburetor. The fuel in the carburetor is then mixed with cleaned air from the air cleaner and drawn into the engine cylinders by the suction stroke of the pistons.

66. CARBURETOR (fig. 41).

a. Description and Data.

(1) DESCRIPTION. The carburetor is an updraft unit of double-venturi design. It is a balanced carburetor which maintains proper depression ratio between the air intake and the fuel bowl. Air cleaner restrictions have only a minimum influence on mixture ratio. This construction protects bowl vent, well vent, and idling air opening from admitting dirt, because all air must enter through the air cleaner. A governor of velocity type is incorporated as an integral part of the carburetor.

(2) DATA.

Make ..... Zenith
Model 63-AW-14R

b. Adjustment. Only the idle speed jet and main jet are adjustable on this carburetor.

(1) IDLE SPEED. After engine is warmed to normal operating temperature, adjustment for idle mixture can be made with a vacuum gage. Connect vacuum gage at intake manifold and, with engine operating at 350 to 400 revolutions per minute, adjust idle screw (fig. 43) to obtain the highest possible steady vacuum reading on the gage.

(2) MAIN JET. The main jet adjusting needle (fig. 43) is generally properly adjusted at about $1\frac{1}{2}$ turns open. NOTE:

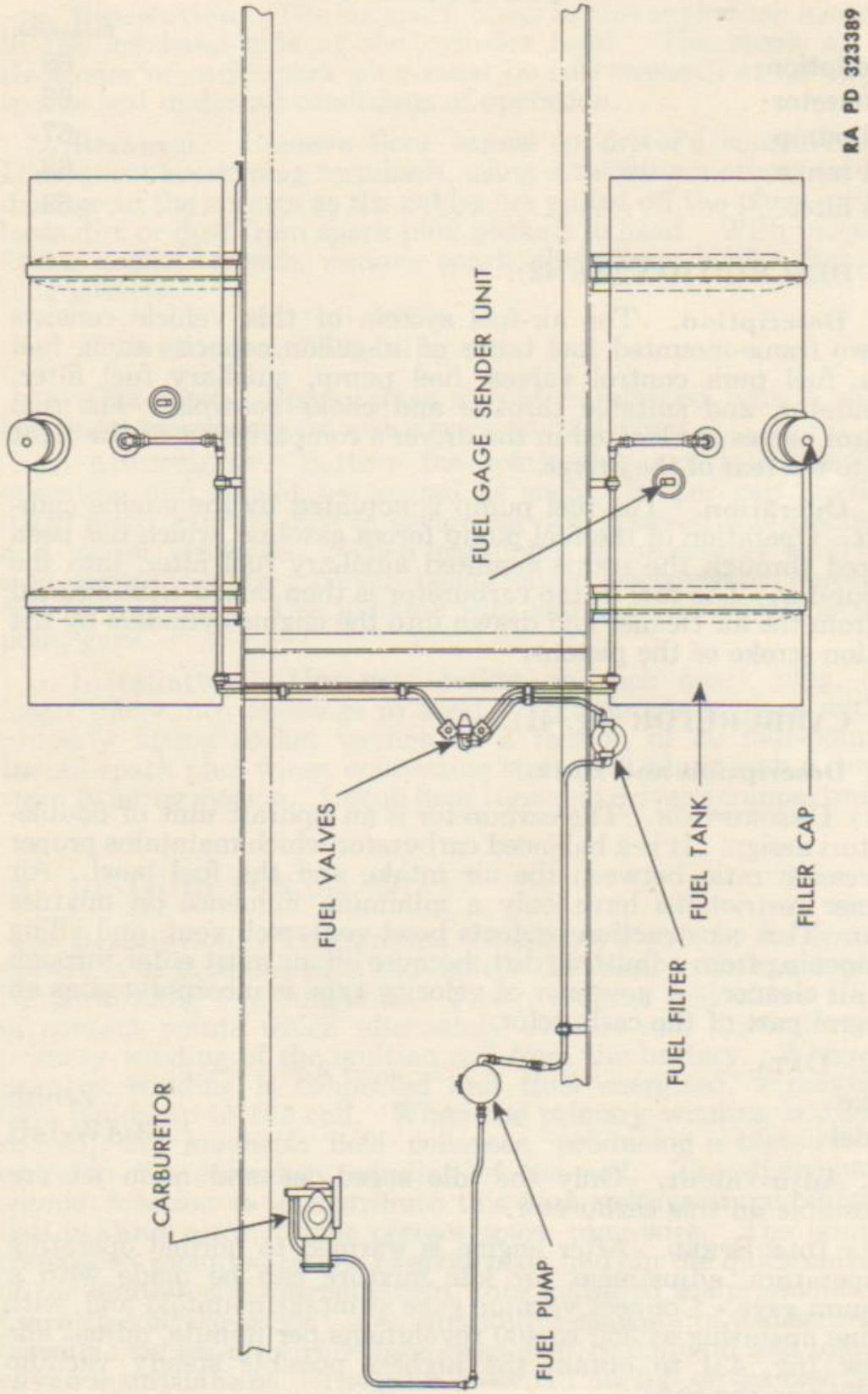


Figure 42 — Fuel System Diagram

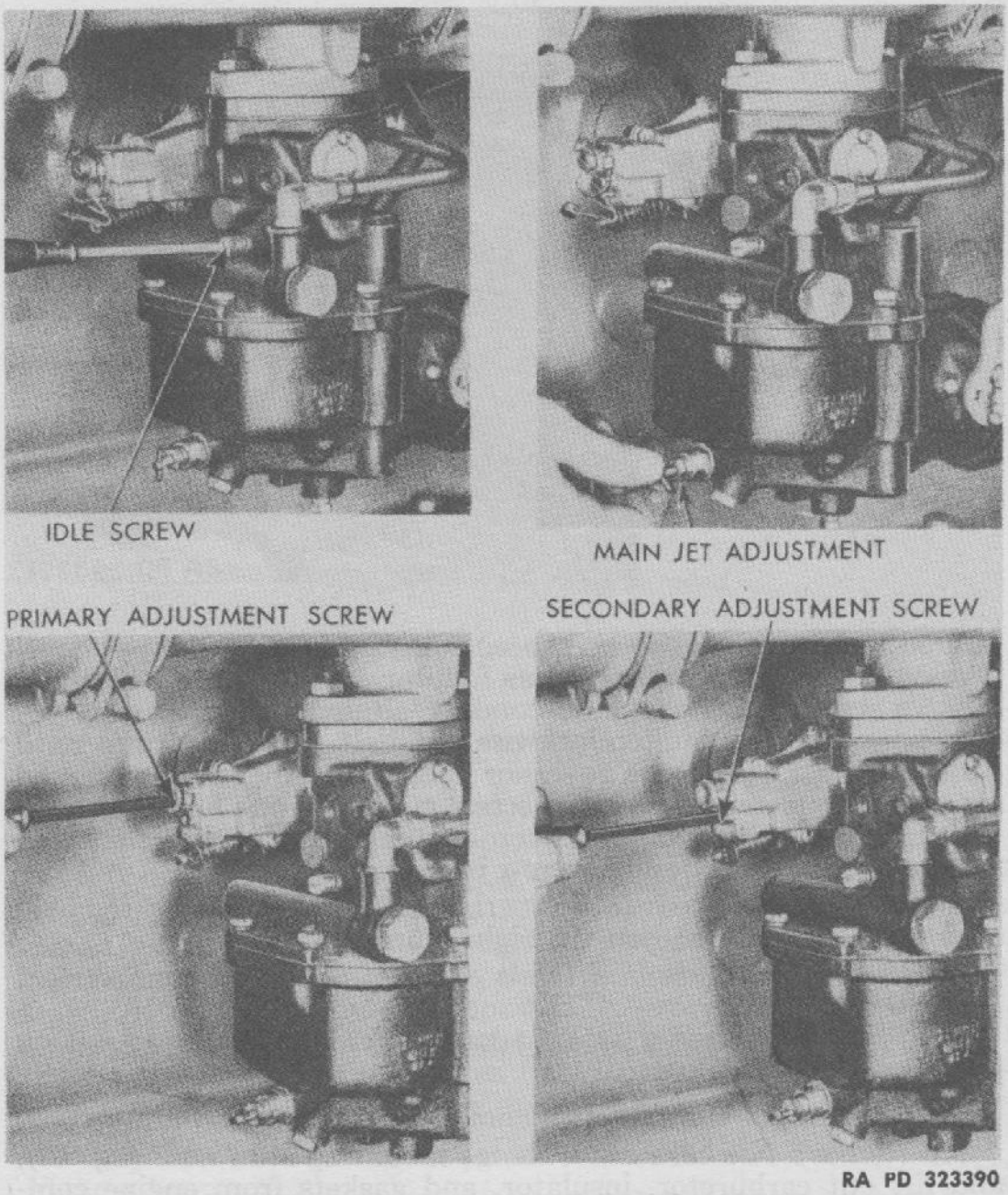


Figure 43 — Carburetor and Governor Adjustment Points

This adjustment needle must be off its seat or possible starving of the engine will result.

(3) GOVERNOR ADJUSTMENT. Following installation of a rebuilt carburetor, it may be necessary to make minor adjustments of the governor. There are two adjustment screws, the primary above, and the secondary below. Adjustments are made as follows:

(*a*) *Primary Adjustment.* Remove governor seal and seal wire. Remove screw plug. To increase speed, turn primary adjustment screw (fig. 43) clockwise. To decrease speed, turn adjustment screw counterclockwise. Replace screw plug. Install new seal wire and seal.

(*b*) *Secondary Adjustment.* If surge is encountered, or it is

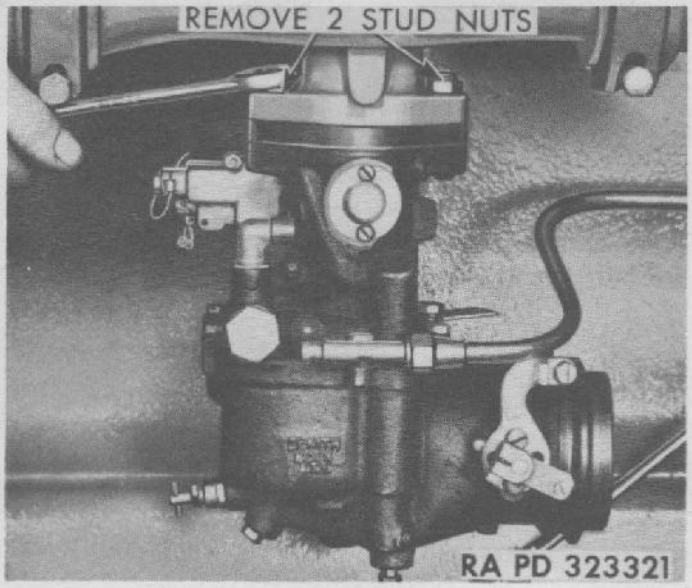


Figure 44 — Removing Carburetor Mounting Stud Nuts

desired to lower the governed speed to less than 25 miles per hour, it may be necessary to proceed as follows: Remove seal wire, and remove screw plug. Adjust secondary adjustment screw (fig. 43) inside by turning counterclockwise one-half turn at a time until surge is remedied. If the governor does not regulate the governed speed closely enough, turn the screw clockwise one-half turn at a time until surge results, and then one-half turn counterclockwise to eliminate surge. Replace screw plug and seal wire.

c. Removal. Access to the carburetor is attained by removal of the dust shield beneath the right front fender.

(1) Close fuel valves in driver's compartment. Disconnect fuel line at carburetor.

(2) Loosen carburetor elbow clamp screws, and disconnect elbow from carburetor.

(3) Disconnect throttle and choke controls at carburetor.

(4) Remove two carburetor flange mounting stud nuts (fig. 44), and lift out carburetor, insulator, and gaskets from engine compartment.

d. Installation.

(1) Place new gaskets and insulator in position on carburetor flange, and install carburetor at flange of manifold. Install two mounting nuts and tighten securely.

(2) Connect fuel line at carburetor.

(3) Connect throttle and choke control wires at carburetor, making sure that control buttons are in against panel.

(4) Connect carburetor inlet elbow from air cleaner to carburetor, and install and tighten clamp.

(5) Turn on fuel control valves, and check for leaks. Start engine and warm to normal operating temperature, then adjust carburetor idle speed as outlined in subparagraph b above.

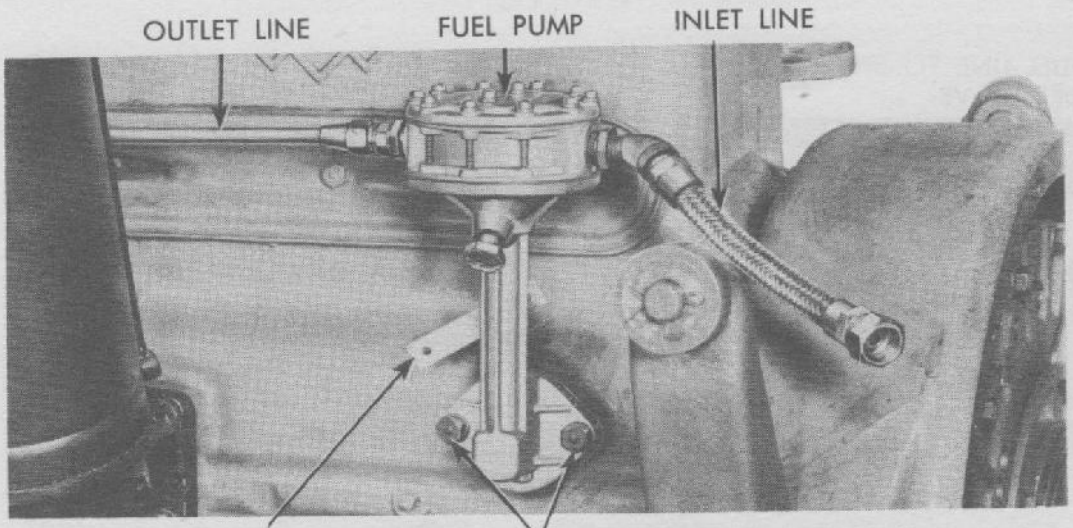


Figure 45 — Fuel Pump Installed

67. FUEL PUMP (fig. 45).

a. Description and Data.

(1) DESCRIPTION. The fuel is drawn from the fuel tanks and pumped to the carburetor by a mechanical diaphragm-type fuel pump which is attached to the left-hand side of the crankcase toward the rear. It is operated by an eccentric on the engine camshaft. The fuel pump requires no adjustment or maintenance within the scope of this text. Working parts are lubricated by engine oil which comes through an opening in the crankcase. Connector line fittings should, however, be checked regularly for leaks. Body screws must be kept tight to prevent air and fuel leaks, and mounting nuts must be tight. This pump is equipped with a manually-operated primer lever (fig. 10) to assist in priming the pump when necessary.

(2) DATA.

Make ..... AC
Model 1538412

b. Testing. If fuel pump is believed to be defective, unit should be checked prior to removal from engine. Disconnect fuel outlet line at carburetor end, and connect a fuel pump pressure gage. Start engine. There will be sufficient fuel in the carburetor to operate engine during test. Normal operating pressure should be from 4 to 5 pounds on the gage. Higher, lower, or fluctuating pressure indicates fuel pump trouble. Stop engine, disconnect gage, and replace defective fuel pump as outlined immediately below.

c. Removal. Close fuel tank shut-off valves. Disconnect fuel lines at inlet and outlet sides of fuel pump. Remove two cap screws and lock washers from fuel pump mounting flange (fig. 45). Lift off fuel pump and gasket.

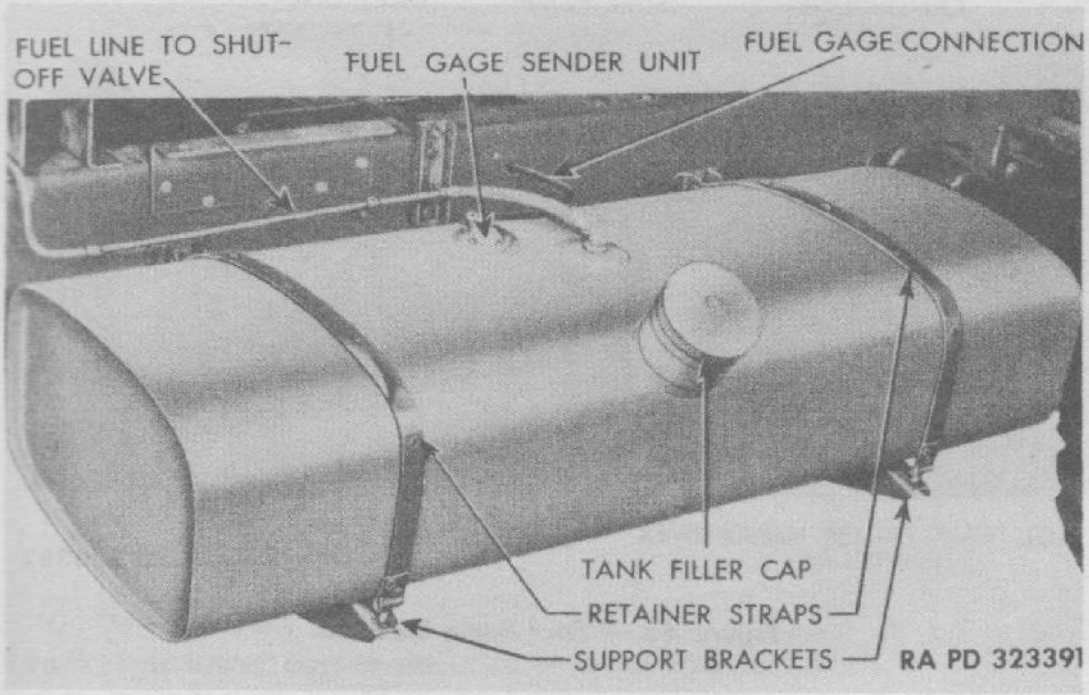


Figure 46 — Fuel Tank Installed

d. Installation. Place fuel pump in position on crankcase, using a new flange gasket. Install two cap screws and lock washers, and tighten securely. Connect fuel lines, open shut-off valves, operate fuel pump primer lever to charge pump, and check for fuel leaks.

68. FUEL TANKS (fig. 46).

a. Description. Two fuel tanks of 40-gallon capacity each are mounted on the frame side rails of the vehicle. Each tank contains a level gage, fuel strainer, and flame arrester screen. The fuel tank caps are vented. The tanks are grounded electrically as a precaution against static electricity sparks. Both tanks are connected to the fuel shut-off valves in the driver's compartment by tubing and flexible lines. A fuel level gage and switch, mounted on the instrument panel, permit the checking of each fuel tank individually.

b. Removal. Either fuel tank may be removed as follows: Disconnect fuel line at fuel tank outlet. Disconnect fuel gage wire and ground wire at fuel gage tank unit. Remove nuts and lock washers from two fuel tank retainer straps, and disconnect straps from around tank. Lift fuel tank from mounting brackets.

c. Installation. Install fuel tank in position on mounting brackets, and connect retainer straps. Install and tighten nuts and lock washers on two strap screws. Connect fuel line at fuel tank outlet. Connect wiring for gage and ground at fuel gage tank unit.

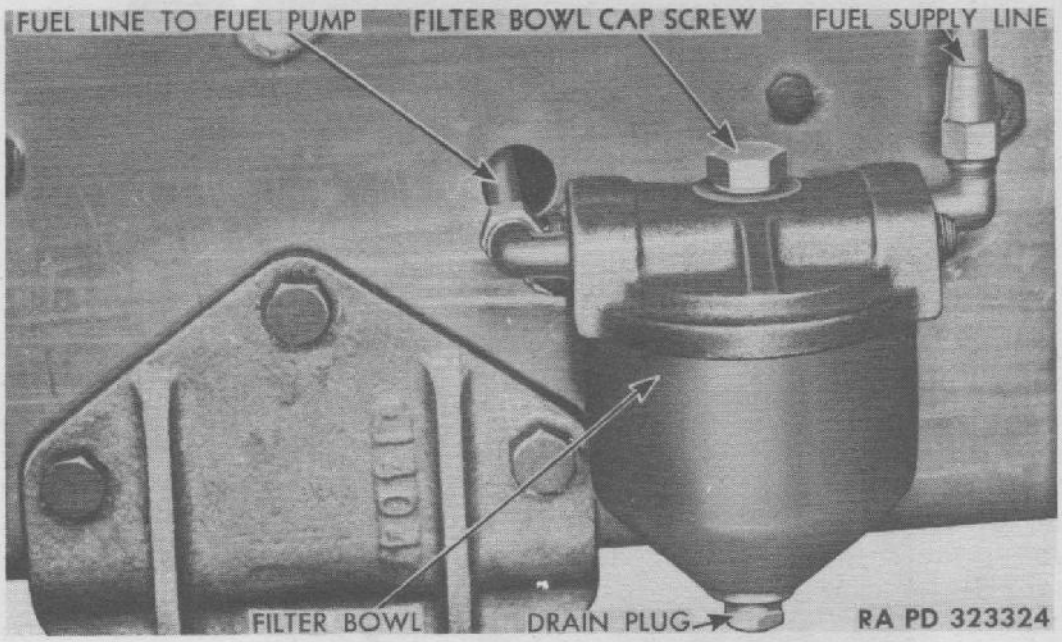


Figure 47 — Fuel Filter Installed

69. **FUEL FILTER** (fig. 47).

a. Description and Data.

(1) DESCRIPTION. An auxiliary fuel filter of multiple-disk type is mounted on the left-hand frame side rail just ahead of the fuel tank. It serves to remove any dirt and water from the fuel before it goes to the fuel pump.

(2) DATA.

Make . . . . . AC
Type T-2
Model 1595839

b. Removal. To remove the auxiliary fuel filter assembly from the vehicle, close the fuel shut-off valves in the driver's compartment, and disconnect the fuel lines at the filter. Remove two cap screws, nuts, and lock washers from filter bracket, and remove unit from frame.

c. Servicing. It is not necessary to remove the entire unit from the vehicle for servicing. Proceed as follows:

(1) To drain dirt and water from the filter bowl, close the fuel shut-off valves in the driver's compartment. Remove drain plug from bottom of filter bowl, and drain off any water or dirt in the bowl. Open one shut-off valve for a second or two to flush out the bowl. Close shut-off valve, and replace drain plug. Open the fuel shut-off valves.

(2) To clean the filter element, first close the shut-off valves.

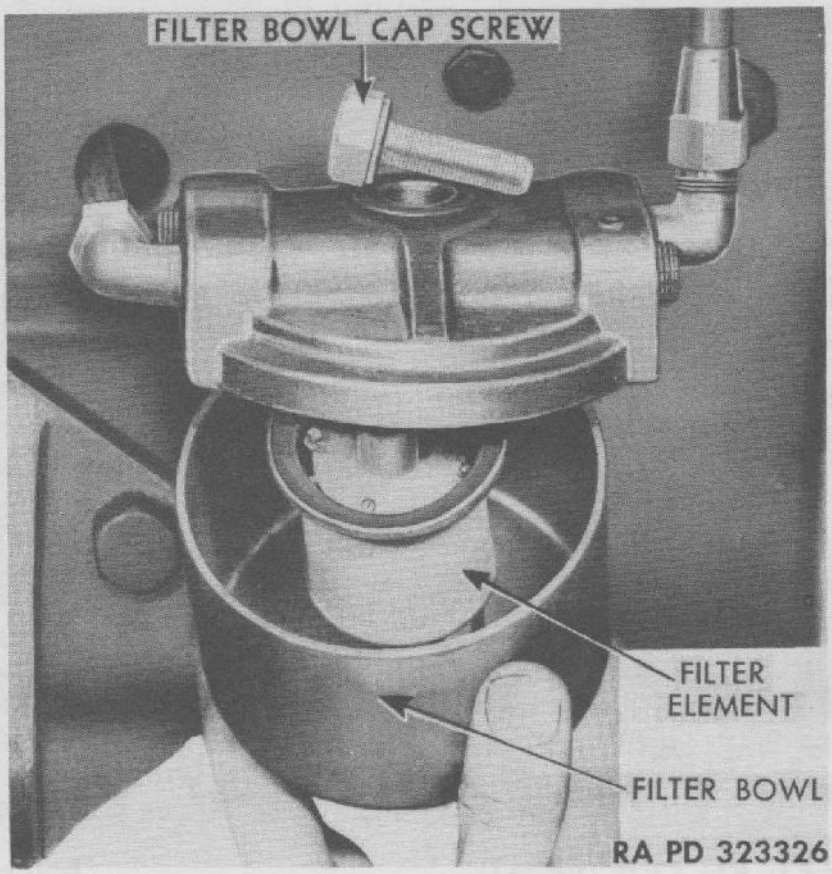


Figure 48 — Removing Fuel Filter Bowl

Remove filter bowl cap screw, and remove bowl and filter element (fig. 48). Wash all parts of the filter in dry-cleaning solvent or clean gasoline, slushing the element back and forth in the solvent to remove any particles of dirt that might be lodged between the plates of the element. Reassemble the filter, making sure the gaskets are in good condition. Reopen shut-off valves in driver's compartment.

d. Installation. Install filter assembly in position on frame and install two cap screws, nuts, and lock washers. Tighten securely. Connect fuel lines from supply valves and to fuel pump. Open shut-off valves in driver's compartment.

Section XVIII

AIR INTAKE AND EXHAUST SYSTEM

70. DESCRIPTION.

a. The air intake and exhaust system consists of the air cleaner, the carburetor (par. 66), the intake and exhaust manifolds, an exhaust pipe which attaches to the exhaust manifold, a frame-mounted muffler, and a tail pipe which carries the exhaust into the wheel airstream on the right-hand side of the vehicle. The function of the exhaust system is to carry the exhaust gases away from the engine and driver's compartment, and to muffle the combustion noises of the engine. All exhaust pipe, muffler, and tail pipe connections must be inspected regularly for leakage of exhaust gases and for looseness. After-operation inspection should be made for damage, and replacement made with new parts as necessary.

71. AIR CLEANER.

a. Description and Data.

(1) DESCRIPTION. The oil-bath type carburetor air cleaner (fig. 49) is mounted to the dash panel on the engine compartment side, and is readily accessible by lifting the right-hand hood side. The construction is such that uncleaned air is drawn into the cleaner inlet openings and down through the center tube of the cleaner at high velocity. The direction of travel of the air is reversed above the oil level in the oil cup, and this reversal of flow causes the larger particles of dirt to fall into the oil. The partially cleaned air then travels upward through the oil-moistened filtering element where any remaining dirt and dust particles are removed. The cleaned and purified air then leaves the air cleaner and enters the carburetor.

(2) DATA.

Make	United
Model	T-195-1200
Type	Oil bath
Mounting	Dash
Oil cup capacity	2 qt

b. Removal.

(1) AIR CLEANER. To remove air cleaner assembly from

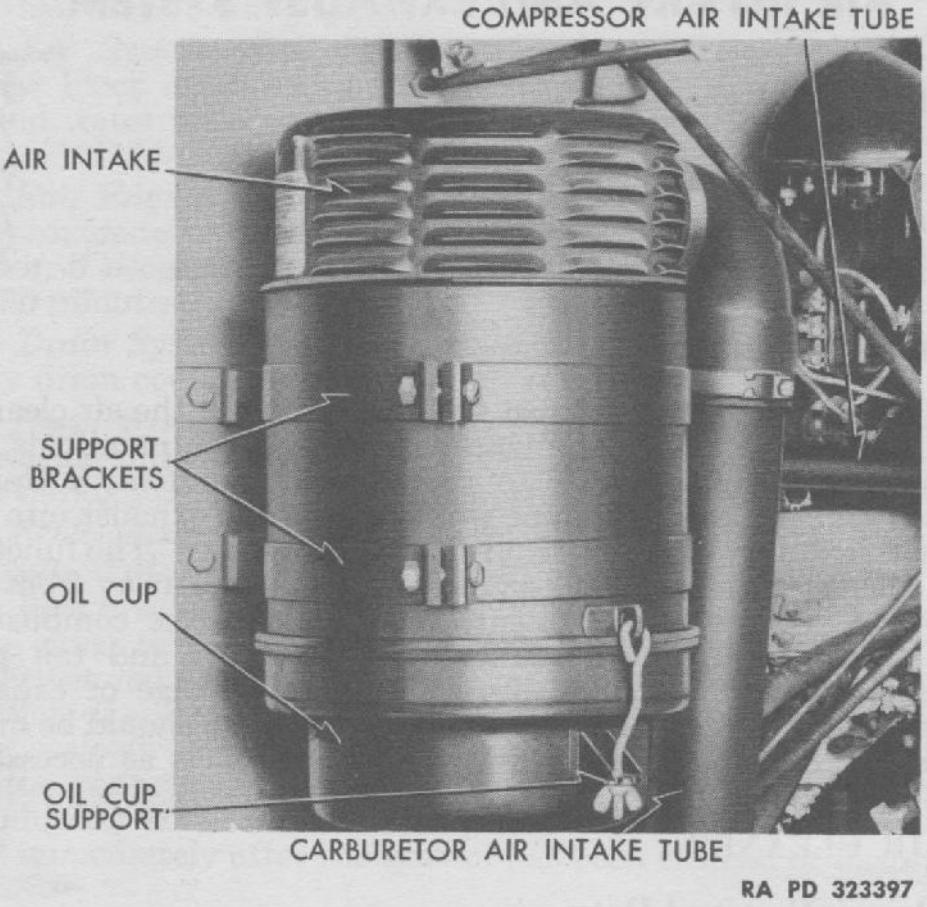


Figure 49 — Air Cleaner Installed

vehicle, loosen carburetor air intake tube clamp screw, and disconnect elbow at air cleaner. Remove four nuts and lock washers from air cleaner mounting bracket, and remove assembly from dash.

(2) FILTERING ELEMENT. Loosen two wing nuts from oil cup hooks, and lower oil cup. Loosen wing nut at base of filtering element, unscrewing it from shell cover. Lower filtering element from shell.

c. Servicing. Loosen two wing nuts from oil cup hooks, and lower oil cup. Empty oil from cup. Clean oil cup externally and internally in dry-cleaning solvent. Refill oil cup to level mark (capacity 2 qt). Unscrew wing nut at base of filtering element, and remove element. Wash element by slushing in dry-cleaning solvent, and allow to drip dry.

d. Installation.

(1) ASSEMBLY. Place assembly in position on bracket, and install four cap screws, nuts, and lock washers. Connect air cleaner outlet elbow at air cleaner, and tighten clamp screw.

(2) FILTERING ELEMENT. Place filtering element in position in case, and tighten wing nut at base. Place oil cup in position, and tighten two wing nuts on oil cup hooks.

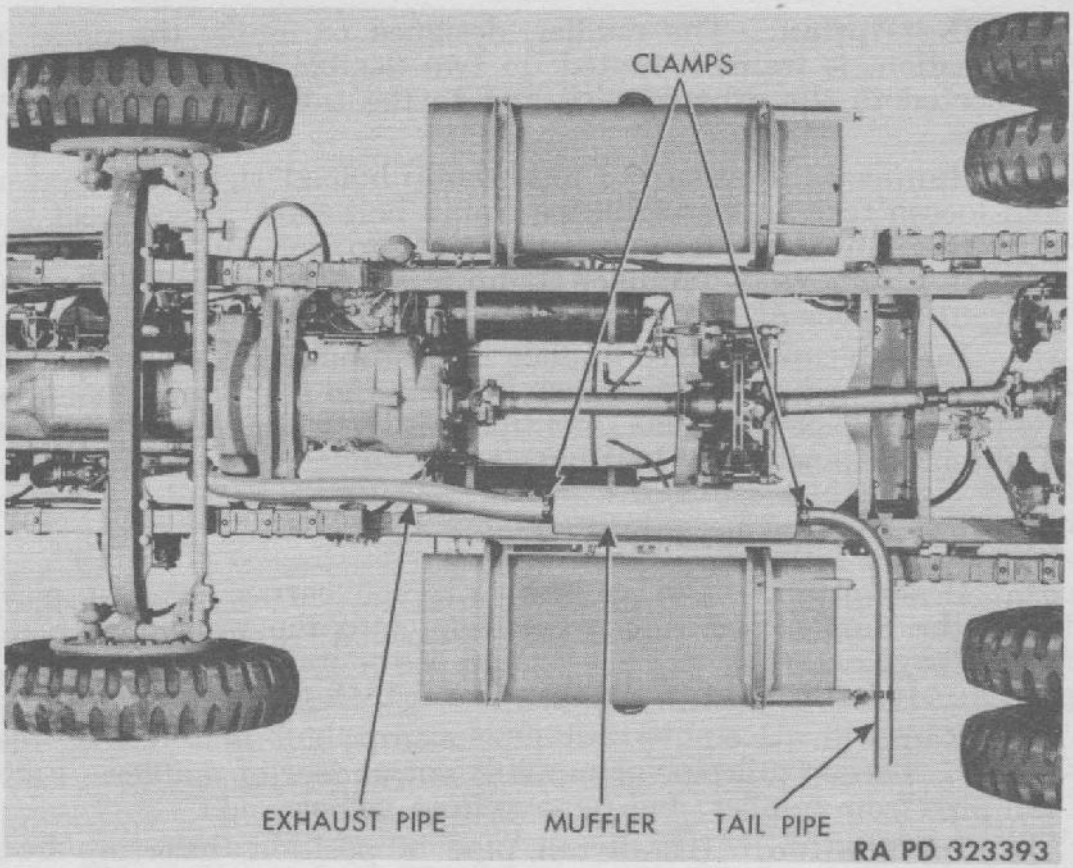


Figure 50 — Exhaust Pipe Installed Bottom View

72. EXHAUST PIPE (fig. 50).

a. Description. The exhaust pipe is a metal pipe extending from the exhaust manifold on the right side of the engine to the muffler. It is attached to the manifold by the exhaust pipe flange, three bolts, and three nuts. The connection is sealed by a seal ring located between the exhaust pipe flange and the exhaust manifold. The pipe attaches to the muffler, where it is held in place by a clamp.

b. Removal. Access to the exhaust pipe flange bolts is attained through removal of the engine tunnel from the driver's compartment. Loosen clamp bolt nut at front of muffler. Remove nuts from three bolts at exhaust pipe flange, and remove bolts. Slide exhaust pipe forward to disconnect from muffler, and lower from vehicle.

c. Installation. Place exhaust pipe in position, inserting end into muffler. Place exhaust flange seal ring in flange, insert three bolts from bottom of flange, and install three nuts on bolts. Tighten nuts evenly and securely, making sure that exhaust pipe has clearance at bottom of engine. Tighten exhaust pipe clamp bolt nut at muffler. Install floor tunnel.

73. MUFFLER (fig. 50).

a. Description. The muffler, designed to muffle the noise of combustion, is frame-mounted on two flexible mountings. It is connected to the exhaust pipe and to the tail pipe by means of clamps.

b. Removal. Loosen tail pipe clamp bolt at right rear fender, and loosen rear muffler tail pipe clamp bolt nut. Disconnect tail pipe from muffler. Loosen muffler clamp bolt nut at front of muffler. Remove two muffler clamp to support bracket bolts, one at front and one at rear of muffler. Remove muffler.

c. Installation. Place muffler in position in support bracket, and install one bolt and nut each in front and rear support clamps. Connect tail pipe to muffler, and tighten all muffler clamp bolt nuts. Tighten tail pipe clamp bolt nut at rear fender.

74. TAIL PIPE (fig. 50).

a. Description. The muffler tail pipe carries exhaust gases from the muffler and discharges them into the wheel airstream. The pipe is attached to the rear end of the muffler by means of a clamp. It is attached to the rear fender by a flexible support.

b. Removal. Remove tail pipe clamp bolt and nut at rear fender. Loosen tail pipe clamp bolt nut at rear of muffler. Force tail pipe from muffler, and remove from vehicle.

c. Installation. Install tail pipe in position, inserting front end in muffler. Install tail pipe clamp bolt and nut at rear fender, but do not tighten. Tighten tail pipe clamp bolt at rear of muffler, then tighten clamp bolt nut at rear fender.

Section XIX

COOLING SYSTEM

75. DESCRIPTION AND DATA.

a. Description. The cooling system of this vehicle consists of a radiator, fan, water pump, and two thermostats. One thermostat starts to open at 145°F to 150°F and is fully open at 180°F, and the other starts to close at 140°F to 150°F and is fully closed at 165°F to 170°F. This combination provides a recirculation system. When the engine is cool, the engine outlet thermostat is closed and the by-pass thermostat is open. This permits the pump to circulate the coolant in the engine without passing it through the radiator. As the engine warms, the engine outlet thermostat opens and the by-pass thermostat closes, permitting the coolant to circulate through the radiator in the normal manner. The radiator unit contains a surge tank or expansion chamber (par. 78). The cooling system is under pressure of 3½ to 4½ pounds, which increases the cooling efficiency of the system, since the boiling point of water is raised about 3 degrees for each pound of pressure. The surge tank cap is of pressure type, having a pressure release valve which releases at 3½ to 4½ pounds pressure, and a vacuum vent valve which operates at 1-inch vacuum. Coolant in the system expands as it warms, so that a small portion is displaced from the radiator proper into the expansion chamber or surge tank. As the coolant cools, the liquid in the surge tank is permitted to drain back into the radiator.

b. Data.

(1) RADIATOR.

Make	Modine
Type	Tubular
Model	AD-4806

(2) WATER PUMP.

Make	IHC
Type	Mechanical seal

(3) FAN.

Size	22 in.
Number of blades	4
Angle of blades	30 deg

786109 O - 48 - 10

(4) FAN BELTS.

Number used	2
Type	VEE
Width	5/8 in.

(5) THERMOSTATS.

(a) *Engine Outlet.*

Make	Dole
Model	PT-5-6
Starts to open	145°F to 150°F
Fully open	180°F

(b) *Engine By-pass.*

Make	Dole
Model	J-1780
Starts to close	140°F to 150°F
Fully closed	165°F to 170°F

(6) SYSTEM CAPACITY ..... 36 qt

c. Servicing.

(1) GENERAL MAINTENANCE. Cooling system maintenance involves the following procedures which must be accomplished.

(a) Keep sufficient cooling liquid in system. Basic coolant is fresh, clean water, to which must be added inhibitors (rust preventives) and, at temperatures below 32°F, antifreeze solutions (par. 11).

(b) Drain, flush, and refill system whenever inspection reveals any accumulations of rust or scale. Always clean system seasonally, as well as before and after using antifreeze solution (par. 11).

(c) If engine overheats from lack of water, do not add cold water immediately. Radiator should only be filled after boiling has ceased and engine has cooled, when water must be added slowly, preferably with engine running. Cold water should not be poured into system when engine is hot, as sudden change of temperature may damage cylinder head and block.

(d) Keep cylinder head bolts, water pump mounting bolts, hose clamps, and fitting connections tight. Examine all hose lines carefully, and replace if cracked, swollen, or deteriorated in any way.

(e) Test periodically for air suction and for exhaust gas leaking into the system (step (4) below).

(f) Inspect and adjust fan belts frequently, and replace as necessary (par. 76).

(2) DRAINING. Remove radiator filler cap, and open radiator drain cock. Open drain cock at right rear side of cylinder block. If cooling liquid is to be saved, catch in suitable container. Be sure both the radiator and cylinder block are empty. NOTE:

If system is not refilled immediately, attach a tag marked "NO WATER IN COOLING SYSTEM" *to the steering wheel.*

(3) REFILLING PROCEDURE. Use clean, soft water. Avoid use of water that contains alkali or other substances that promote the accumulation of scale and rust. Close radiator drain cock and cylinder block drain cock tightly. Fill system through radiator filler neck until cooling liquid can be seen through filler neck. Install radiator filler cap. Check water level again after engine is warmed up, and add coolant if needed to keep proper level.

(4) AIR SUCTION AND EXHAUST GAS LEAKAGE TESTS. Air circulating through the cooling system, as well as exhaust gas leaking into the system, cause rapid corrosion and rust formation which will eventually clog the system and cause overheating and loss of cooling liquid. Air may be drawn into the system due to low liquid level in the radiator, leaky water pump, or loose fitting connections. Exhaust gas may be blown into the cooling system past the cylinder head gasket or through cracks in the cylinder head and block.

(*a*) *Air Suction Test.* Adjust level of cooling liquid in radiator, allowing room for expansion to avoid any loss from overflow during test. Replace pressure cap with a plain cap, and tighten on radiator until airtight. Attach length of rubber tube to lower end of overflow tube, making connection airtight. Run engine with transmission in neutral gear at a safe high speed until temperature gage stops rising and remains stationary. Without changing engine speed, put end of rubber tube in a bottle of water, avoiding kinks and sharp bends that might block flow of air. Watch for bubbles in bottle of water. The continuous appearance of bubbles indicates that air is being sucked into the cooling system.

(*b*) *Exhaust Gas Leakage Test.* Start test with engine cold. Remove fan belts (par. 76) to prevent pump operation. Drain cooling system until cooling liquid level is at top of thermostat housing, but no lower. This can be determined by loosening cylinder head outlet to thermostat housing to check level of liquid. If liquid leaks from this connection, continue to drain system until liquid no longer leaks. Remove thermostats (par. 79 **b**). Make sure thermostat housing is full of liquid, adding liquid if necessary. With transmission in neutral gear, start engine. Accelerate and decelerate it several times, watching for bubbles in water in thermostat housing both while accelerating and after engine speed drops back to idle. The appearance of bubbles, or a sudden rise of cooling liquid, indicates exhaust gas leakage into cooling system. Make test quickly before boiling can start, as steam bubbles will give misleading results. If exhaust gas leakage is evident, replace cylinder head gasket and report to higher authority.

(5) PREVENTIVE CLEANING AND FLUSHING. Use an effective cleaning solution, which may be made by using one pound of sal soda or one-half pound of soda ash to one gallon of water. Make up approximately sufficient solution to fill system.

(*a*) *Drain System.* Run engine at idling speed to stir up loose rust, then drain cooling system.

(*b*) *Fill System With Cleaning Solution.* Close radiator and cylinder block drain cocks. Pour cleaning solution into radiator, and add water if necessary to fill cooling sytem. Install radiator cap.

(*c*) *Run Engine to Heat Solution.* Run engine to heat solution to approximately 180°F. NOTE: *Do not allow to boil.* Cover radiator, if necessary, to attain 180°F. Continue to run engine at least 30 minutes.

(*d*) *Drain System.* Stop engine, wait a few minutes, then completely drain cooling system.

(*e*) *Flush System.* Fill cooling system with clean, soft water. Run engine until warmed up to flush system by circulating clean water throughout system, then completely drain system again.

(*f*) *Refill System.* Refill system, using clean, soft water or antifreeze solution as operating conditions require (par. 11).

(*g*) *Rust Preventives (Inhibitors).* To maintain efficiency, cooling system must be free of rust and scale. Use of inhibitors or rust preventives reduces or prevents corrosion of metals and prevents formation of scale. Inhibitors are not cleaners and do not remove rust or scale already formed. Treating the cooling system with an inhibitor consists of adding an inhibitor to the cooling liquid. The inhibitor should be renewed periodically, and must always be added immediately after the system has been cleaned or flushed.

76. FAN AND FAN BELTS (fig. 17).

a. Description.

(1) FAN. The four-bladed fan assembly is attached to the fan and water pump pulley which is driven by the fan belts.

(2) FAN BELTS. Two endless V-belts are used to drive the fan, water pump, and generator.

b. Adjustment.

(1) FAN. No adjustment is required for the fan other than proper fan belt tension. A defective fan must be replaced.

(2) FAN BELTS.

(*a*) The tension of the two fan belts is important, since too loose a tension will contribute to slipping, while excessive tension will cause premature belt failure. When replacing a fan belt, two new fan belts should be installed. This will assure both belts having the same tension.

(*b*) Adjustment of fan belts is accomplished by loosening the generator adjusting strap bolt nut and moving the generator toward or away from the engine to provide $\frac{1}{2}$- to $\frac{11}{16}$-inch deflection or sag of the belts from a straight line measured at a point midway between the fan pulley and generator pulley. Tighten the generator adjusting strap bolt nut securely.

c. Removal.

(1) FAN. Remove four cap screws and lock washers attaching fan to the fan and water pump pulley, and remove fan.

(2) FAN BELTS. Loosen the generator adjusting strap bolt nut, and move generator toward engine. Lift fan belts from generator pulley, then from fan and water pump pulley, and finally from crankshaft fan drive pulley.

d. Installation.

(1) FAN. Place fan assembly in position on the fan pulley face, and install four cap screws and lock washers.

(2) FAN BELTS. Place two fan belts over crankshaft fan drive pulley, then over fan and water pump pulley, and finally over generator pulley. Move generator away from engine to provide ½- to 11/16-inch deflection (subpar. *b* above), and tighten generator adjusting strap bolt nut.

77. WATER PUMP (fig. 18).

a. Description. The water pump is of packless design, and is mounted at the front of the engine. No adjustments are necessary. The only service required is lubrication at time of assembly (par. 21). The water pump, driven by the fan belts, serves to draw coolant from the radiator and to circulate this coolant through the engine.

b. Removal. Water pump removal from the engine is accomplished as follows:

(1) Drain cooling system, saving solution if it contains antifreeze compound.

(2) Remove fan assembly by taking out four cap screws and lock washers from fan hub.

(3) Remove fan belts (par. 76 c).

(4) Disconnect throttle and spark control linkage from bracket. Disconnect tachometer drive cable at distributor drive housing, and remove cable from inside linkage bracket.

(5) Remove two cap screws holding accelerator control crossshaft bracket to water pump. Remove bracket.

(6) Loosen hose clamp screws at upper and lower hose connections at water pump, and loosen connection at thermostat housing.

(7) Disconnect water line to air compressor at water pump.

(8) Remove remaining cap screw and lock washer holding water pump to engine cylinder head. Lift water pump from engine, and remove gasket.

c. Installation.

(1) Clean gasket surface of cylinder head of old gasket and sealing compound. Coat new gasket with joint and thread compound, and place in position on cylinder head.

(2) Place water pump in position, and install cap screw and lock washer at lower side.

(3) Install accelerator control cross-shaft bracket in position, and install two cap screws and lock washers. Tighten all three retaining cap screws securely.

(4) Connect hose connections, and tighten hose clamp screws.

(5) Install fan with four cap screws and lock washers.

(6) Install fan belts (par. 76 d).

(7) Insert tachometer drive cable through linkage bracket, and connect at distributor drive housing.

(8) Connect spark and throttle controls to control bracket.

(9) Connect air compressor water line at water pump.

(10) Refill cooling system, and check for leaks.

78. RADIATOR.

a. Description. The radiator of this vehicle is of tubular design and incorporates a surge tank or expansion chamber in its upper portion. The purpose of the pressure system is to increase cooling efficiency of the system, and the surge tank allows for expansion of coolant as outlined in paragraph 75 a. The radiator assembly is mounted at the front of the frame on spring-type mountings and is supported at the cowl by two truss rods.

b. Removal.

(1) Drain cooling system, opening drain cock at lower right corner of radiator core.

(2) Remove Radiator Shell and Grill.

(*a*) Remove three nuts, lock washers, and cap screws from radiator grill and brush guard at fenders on each side. Remove two slotted-head screws, nuts, and lock washers attaching radiator shell to brackets at lower corner of shell on each side.

(*b*) Disconnect light wiring for blackout driving light at left-hand junction blocks, and for headlights at left- and right-hand junction blocks.

(*c*) Disconnect generator regulator harness at amphenol plug.

(*d*) Remove one nut and lock washer from each radiator shell stay rod at shell end. Pull slightly forward to clear hood hinge rod.

(*e*) Remove hood by removing two cap screws, nuts, and lock washers from hood support arms at hood side panels.

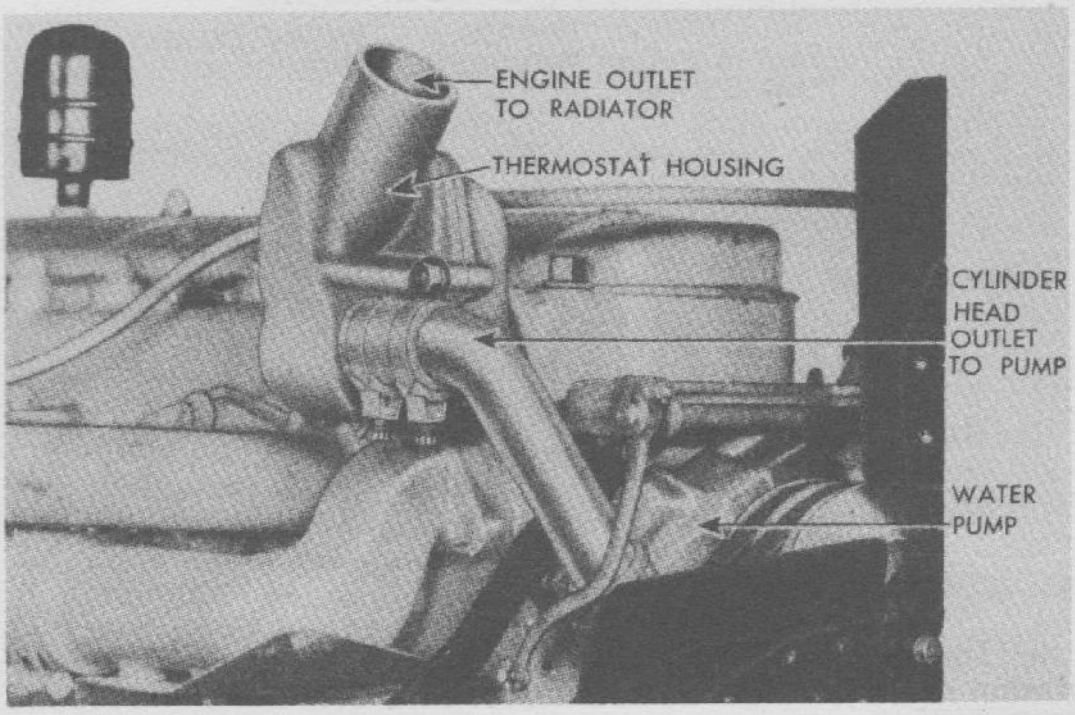
(*f*) Lift radiator shell and grill from chassis.

(3) Remove Radiator Core.

(*a*) Remove nut and lock washer from each of two radiator core stay rods.

(*b*) Loosen radiator hose clamp screws in upper and lower radiator hose at radiator inlet and outlet.

(*c*) Remove cotter pin, nut, flat washer, and spring from each of two radiator mounting screws at bottom.



RA PD 323349

Figure 51 — Thermostat Housing Installed

(*d*) Lift radiator core from mounting, pulling core forward at top to free from hose and from stay rods. NOTE: *Do not lose the radiator mounting pads, one at each side underneath radiator mounting bracket.*

c. Installation.

(1) INSTALL CORE.

(*a*) Place one radiator mounting pad in position over each mounting screw.

(*b*) Lift radiator core into position on frame, and insert radiator inlet and outlet connections into upper and lower hose. Insert radiator core stay rods into brackets at core as core is moved rearward at top.

(*c*) Install one spring, flat washer, and nut on each of two radiator core mounting screws. Tighten nuts and compress springs until cotter pins can be inserted, and install cotter pins in screws.

(*d*) Install nuts and lock washers on radiator core stay rods at radiator core.

(*e*) Tighten hose clamp screws in upper and lower hose connections.

(*f*) Install hood in position, and attach hood support arms at hood side panels with cap screws, lock washers, and nuts.

(2) INSTALL RADIATOR SHELL AND GRILL.

(*a*) Lift radiator shell and grill into position on frame, and aline mounting holes.

(*b*) Install three cap screws, nuts, and lock washers in brush guard at each front fender.

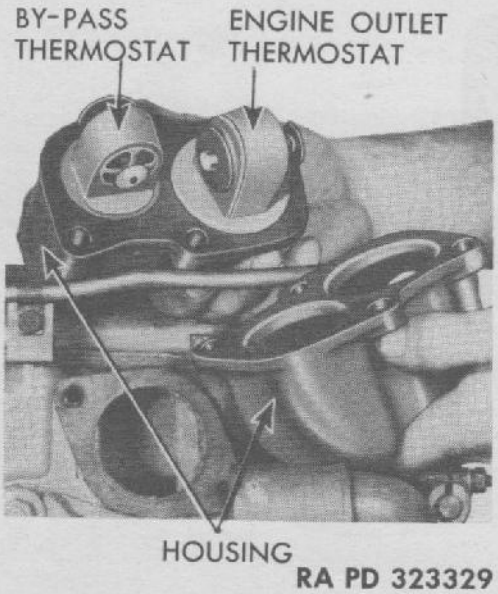


Figure 52 — Thermostat Housing Disassembled

(*c*) Install two screws, nuts, and lock washers in shell and bracket at lower corner on both sides of radiator shell.

(*d*) Install nuts and lock washers on radiator shell to cowl stay rods at each side.

(3) CONNECT WIRING. Connect headlight wires at left- and right-hand junction blocks, and connect blackout driving light wires at left-hand junction block.

(4) Connect generator regulator harness at amphenol plug.

(5) Refill cooling system, and check all connections for leaks.

79. THERMOSTATS.

a. Description. Two thermostats are used in the cooling system of this vehicle (par. 75 a). Both thermostats are located in a housing at the upper right front corner of the engine (fig. 51). The lower thermostat is the engine outlet thermostat, and the upper one is the by-pass thermostat (fig. 52).

b. Removal. Removal of either thermostat requires removal of the thermostat housing.

(1) Drain cooling system below the level of the cylinder head, saving the solution if it contains antifreeze compound.

(2) Loosen upper hose connection clamp screws, and loosen hose at thermostat housing.

(3) Remove four cap screws and lock washers attaching housing to cylinder head, lift off housing, and remove gasket.

(4) Separate two halves of thermostat housing (fig. 52). Remove thermostats, and remove gaskets from housing.

(5) TESTING THERMOSTATS. To determine if thermostats are operative and fit for further service, test in water. Warm the water gradually and note the points of opening and closing of the thermostats, using a reliable thermometer. The engine outlet thermostat

should start to open at approximately 145°F and be fully open at approximately 180°F. The by-pass thermostat should start to close at approximately 140°F and be fully closed at approximately 170°F. If in doubt as to satisfactory performance of a thermostat, discard and install a new one.

c. Installation. Each thermostat must be placed in its respective location, with the valves toward the outside of the engine. The proper mounted position of the lower engine outlet thermostat is with the small valve plate rearward. For the upper by-pass thermostat, the small valve plate must point upward.

(1) Coat new gaskets with sealing compound and place in position. Place thermostats in recesses as outlined above. Place two halves of thermostat housing together.

(2) Place thermostat housing in position on cylinder head, install four cap screws and lock washers, and tighten securely.

(3) Connect hose connection at thermostat housing, and tighten hose clamp screws.

(4) Refill cooling system, and check for leaks.

No.	SIZE	CIRCUIT LABEL No.	TRACERS
2	14	12	2
3	8	5	1
4	14	14	2
20	00	7	0
21	14	11	2
22	12	15	3
23	14	13	2
24	00	6	0

PART DESCRIPTION
G—DISTRIBUTOR
H—IGNITION COIL
I—CRANKING MOTOR
J—AMMETER
K—CONDENSER
L—IGNITION SWITCH
M—BATTERY
N—CONDENSER
O—CRANKING MOTOR CONTROL SWITCH BUTTON
S—B.O. LIGHT SWITCH

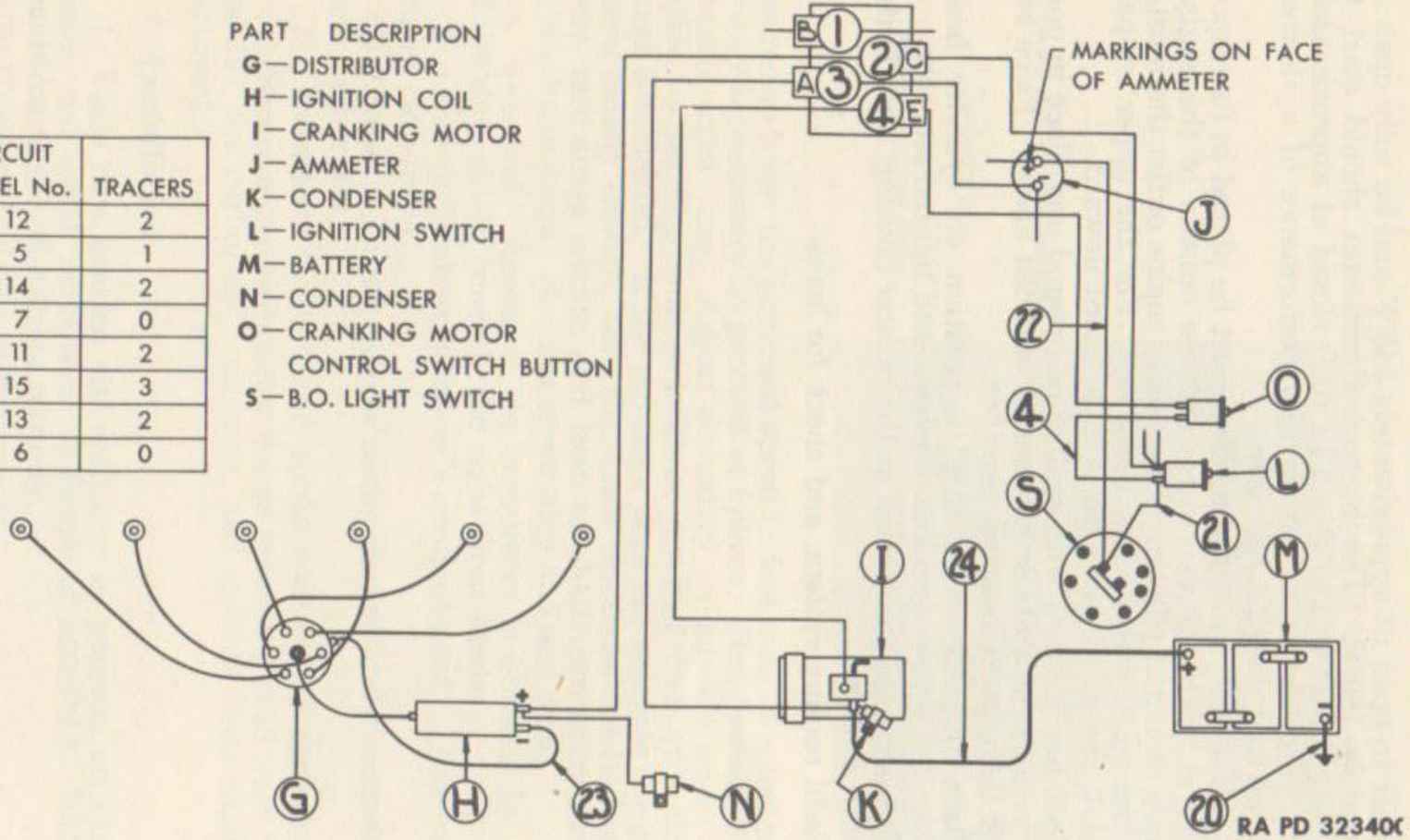


Figure 53 — Ignition Circuit Diagram

Section XX

IGNITION SYSTEM

80. DESCRIPTION AND DATA.

a. Description. The ignition system includes an ignition switch (fig. 7), the source of electrical energy, either the battery (par. 96) or generator (par. 85), an ignition coil, a distributor assembly, six spark plugs, and the necessary high and low tension wires to connect the units (fig. 53). There are two distinct electrical circuits in the ignition system, the primary circuit and the secondary circuit. Briefly, these circuits function in the following manner. With the ignition switch turned on and the distributor contact points closed, current flows through the primary winding of the ignition coil and builds up a strong magnetic field in the coil. This magnetic field collapses and induces a high voltage in the secondary winding of the coil every time the distributor contact points open. This induced high voltage is distributed to the spark plugs at correct firing intervals by the distributor cap and rotor and the high tension wires between the distributor cap and spark plugs.

b. Data.

(1) DISTRIBUTOR.

Make . . . . . Delco-Remy
Model 1110161
Breaker point gap . . . . . 0.018 to 0.024 in.
Firing order 1-5-3-6-2-4
Cam angle . . . . . 35 deg
Initial setting . . . . . Top dead center
Contact point spring pressure . . . . . 17 to 21 oz

(2) IGNITION COIL.

Make . . . . . Delco-Remy
Model 1115149

(3) SPARK PLUGS.

Make . . . . . Champion
Type J-9-64
Size . . . . . 14 mm
Point gap . . . . . 0.028 to 0.032 in.

81. SPARK PLUGS.

a. Description. The six spark plugs in this engine are installed in the left-hand side of the cylinder head. The spark at the electrodes of each spark plug must be full strength at all engine speeds and under all conditions of operation.

b. Removal. Remove floor tunnel in driver's compartment. Disconnect spark plug terminals, using a twisting motion to avoid damage to the springs as the cables are pulled off the plugs. Blow loose dirt or dust from spark plug pockets in head. With properly fitting socket wrench, remove spark plugs from head. Remove plug gaskets.

c. Adjustment and Cleaning.

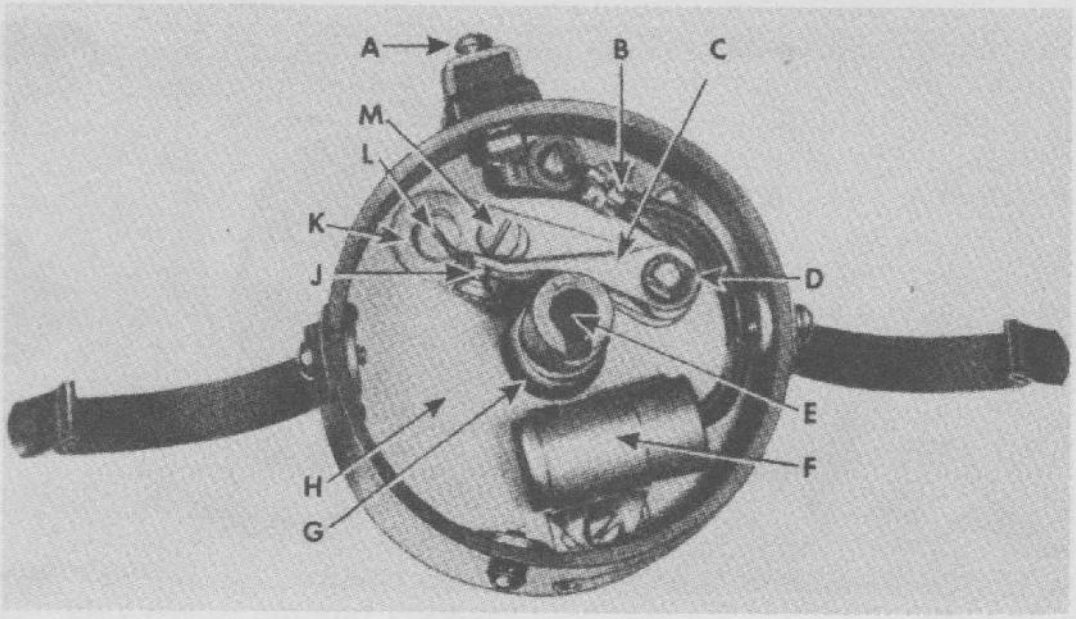
(1) CLEANING. Spark plugs should be cleaned with a sand-blasting type cleaner or with dry-cleaning solvent.

(2) ADJUSTMENT. Setting the spark plug gap is a precision operation and should be treated as such. Proper gap provides 0.028 inch, or 0.032 inch in severe service, between side electrode and center electrode. When regapping is necessary, bend the side electrode only. Never bend center electrode or porcelain will be fractured. Use a round wire gap gage for checking plug point gaps.

d. Installation. Use new gasket on each spark plug, and insert plugs into openings in head. Tighten spark plugs with a properly fitting socket wrench to a tension of 30 foot-pounds. Install spark plug wires, connecting springs at plugs with a downward twisting motion. Install floor tunnel in driver's compartment.

82. DISTRIBUTOR (fig. 18).

a. Description. The ignition distributor's part in the ignition system is to produce, time and deliver the spark to the spark plugs by performing two functions. First, it opens and closes a pair of contact points which alternately connect and disconnect the primary winding of the ignition coil from the battery. When the primary winding is connected and thus energized, a magnetic field builds up in the coil. When the primary winding is disconnected, the magnetic field collapses, producing a high voltage surge in the secondary winding of the coil. The distributor's second function is to distribute this high voltage surge, through the cap and rotor, to the correct spark plug wire. The ignition condenser, mounted on the breaker plate, aids in the quick collapse of the ignition coil magnetic field, thus aiding in the production of the high voltage surge. The distributor consists of a distributor housing, mainshaft and weight base, and centrifugal and manual advance mechanism. A rotor is mounted on top of the cam, and the assembly is covered by the distributor cap, held in place by spring clips. A bakelite plate containing dust seals is located inside the distributor below the rotor to keep out dust. The



A—PRIMARY WIRE TERMINAL	G—CAM
B—CONDENSER PIG-TAIL TERMINAL	H—BREAKER PLATE
C—BREAKER LEVER	J—BREAKER POINTS
D—BREAKER LEVER RETAINING CLIP	K—BREAKER POINT SUPPORT
E—OIL WICK	L—CLAMP SCREW
F—CONDENSER	M—ECCENTRIC SCREW

RA PD 323396

Figure 54 — Distributor, with Cap, Rotor, and Dust Shield Removed

distributor has both automatic and manually controlled advance mechanism. The manual advance is controlled from the driver's compartment (par. 5 c (4)).

b. Adjustment of Breaker Points.

(1) Remove floor tunnel from driver's compartment.

(2) Remove distributor cap from distributor by unhooking clips. Lift off rotor and seal cap, and reinstall rotor on shaft.

(3) Crank engine slowly with hand crank until breaker lever pad rests on the high point of distributor cam.

(4) Adjust opening of points by loosening clamp screw and turning eccentric screw until a gap or opening of 0.018 to 0.024 inch is obtained (fig. 54). Use a feeler gage. Tighten clamp screw after adjustment is made.

(5) Remove rotor, reinstall seal cap and rotor, and install distributor cap.

(6) Install floor tunnel in driver's compartment.

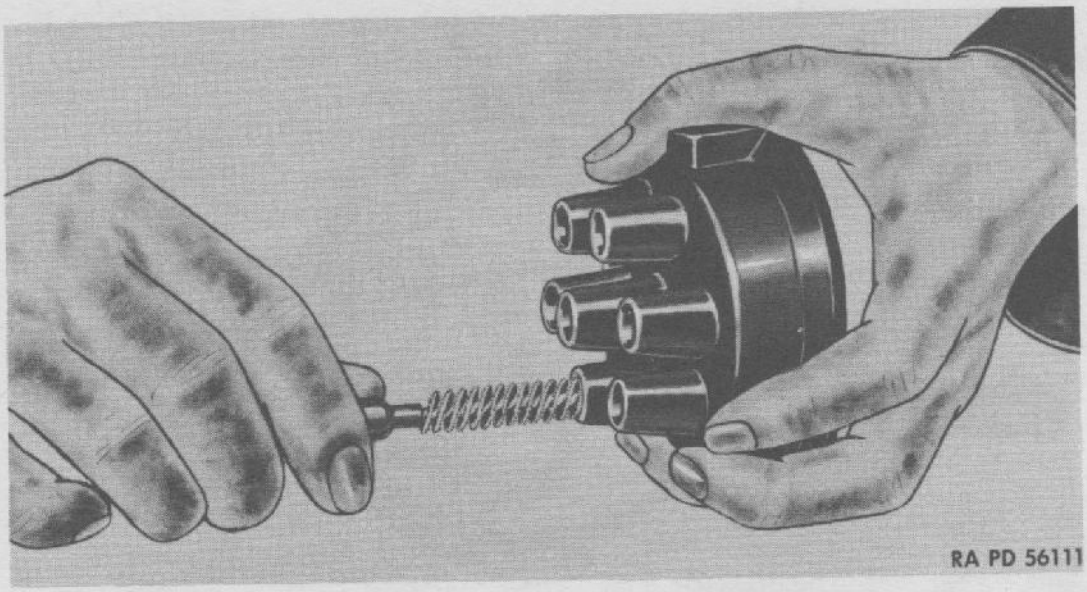


Figure 55 — Cleaning Distributor Cap Wire Sockets

c. Removal.

(1) BREAKER POINTS (fig. 54). Attain access to distributor breaker points (subpar. b (1) and (2) above). Pry clip from top of breaker arm pivot, and remove screw from terminal support. Lift breaker lever arm and spring from pivot. Remove contact point support retaining screw, and lift out support.

(2) DISTRIBUTOR CONDENSER. Attain access to inside of distributor (subpar. b (1) and (2) above). Remove terminal screw from terminal support. Remove condenser retaining screw, and lift condenser from distributor.

(3) DISTRIBUTOR ASSEMBLY.

(*a*) Attain access to distributor by removal of floor tunnel in driver's compartment.

(*b*) Lift off distributor cap and rotate engine with hand crank until distributor is in No. 1 firing position. NOTE: *Do not crank engine while distributor is removed.*

(*c*) Disconnect low tension wire at side of distributor.

(*d*) Disconnect manual spark control wire from swivel at base plate.

(*e*) Loosen distributor clamp screw, and lift distributor from distributor drive housing.

(*f*) Disconnect spark plug wires and high tension cable from distributor cap, and install cap on distributor.

(4) DISTRIBUTOR CAP.

(*a*) Remove floor tunnel from driver's compartment.

(*b*) Disconnect spark plug wires from cap, noting position in which they are installed as to 1-5-3-6-2-4 firing order. Unhook two spring clips, and lift cap from distributor.

d. Inspection and Cleaning. At regular intervals, the cap and rotor should be inspected for cracks. Clean and examine the inside and outside of the cap. Clean the cap wire sockets with a small round brush (fig. 55).

e. Installation.

(1) BREAKER POINTS.

(*a*) Place contact point support in position in housing, and install retaining screw but do not tighten.

(*b*) Install breaker lever over pivot, placing end of spring to inside of terminal support. Install screw in terminal support. Insert breaker arm retaining clip on top of pivot.

(*c*) Adjust breaker points. Refer to subparagraph **b** (3) and (4) above.

(*d*) Check ignition timing. Refer to paragraph 49 **c**.

(2) DISTRIBUTOR ASSEMBLY.

(*a*) Place engine in No. 1 cylinder firing position.

(*b*) Remove distributor cap and seal, and rotate distributor shaft to place rotor in No. 1 firing position.

(*c*) Insert distributor drive end into drive housing. Rotate distributor cam only as necessary to permit drive shaft tang to index with the slot in the driving shaft.

(*d*) Check ignition timing (par. 49 **c**), and tighten clamp screw.

(*e*) Pulling spark control knob away from instrument panel a distance of $\frac{3}{8}$ inch, and having advance plate pointer of distributor centered, connect manual spark control wire to swivel at distributor.

(*f*) Install distributor seal plate, rotor, and cap, and connect spark plug wires in 1-5-3-6-2-4 order.

(*g*) Connect low tension wire at distributor housing, and connect high tension cable to center of cap.

(*h*) Install floor tunnel in driver's compartment.

83. IGNITION COIL (fig. 18).

a. Description. The ignition coil is an oil-filled unit encasing the primary and secondary coil windings. The high tension lead to the distributor connects to the center terminal. The filter lead and switch lead are attached to the positive terminal, and the low tension lead to the distributor housing is attached to the negative terminal. The purpose of the coil is to step up or multiply the voltage of the primary coil to the high value required for the electric discharge at the gaps of the spark plugs.

b. Removal.

(1) Remove floor tunnel from driver's compartment.

(2) Disconnect high tension wire (to center of distributor) at coil.

(3) Remove nut from positive terminal, and disconnect radio filter wire and lead to ignition switch terminal.

(4) Remove nut and lock washer, and disconnect low tension lead to distributor at negative terminal of coil.

(5) Remove two nuts and special lock washers from coil band, and remove coil from engine.

c. Installation.

(1) Place coil and coil band in position on studs, and install two nuts and special lock washers. The two special lock washers must be placed between the nuts and the coil band. Rotate coil as necessary to position the positive terminal upward. Tighten nuts.

(2) Connect radio filter and ignition switch leads at positive terminal, and install nut and lock washer.

(3) Connect low tension lead from distributor to negative terminal, and install nut and lock washer.

(4) Connect high tension lead to terminal of coil.

(5) Install floor tunnel in driver's compartment.

Section XXI

CHARGING SYSTEM

84. DESCRIPTION AND DATA (fig. 56).

a. Description. The charging system of the vehicle includes the engine-mounted generator (fig. 17), the bracket-mounted generator regulator or control (fig. 57), and connecting wires. The purpose of the system is to keep the battery charged and to furnish current for ignition, lighting, and electrical accessories. Only the generator and generator regulator are covered in this section. Refer to other electrical sections for information covering other electrical units.

b. Data.

(1) GENERATOR.

Make ..... Delco-Remy
Model 1105863
Voltage 6
Rotation ..... Clockwise viewed from front
Brush tension ..... 25 oz
Drive ..... Dual V-belts

(2) GENERATOR REGULATOR

Make ..... Delco-Remy
Model 1118468
Ground ..... Negative
Voltage 6

85. GENERATOR (fig. 17).

a. Description. The generator is a shunt-wound, two-brush type mounted on a bracket at the right-hand front of the engine and is driven by dual V-belts from the crankshaft pulley in conjunction with the water pump and fan. The generator is cooled by air drawn in through openings in the rear of the generator by a fan mounted behind the drive pulley.

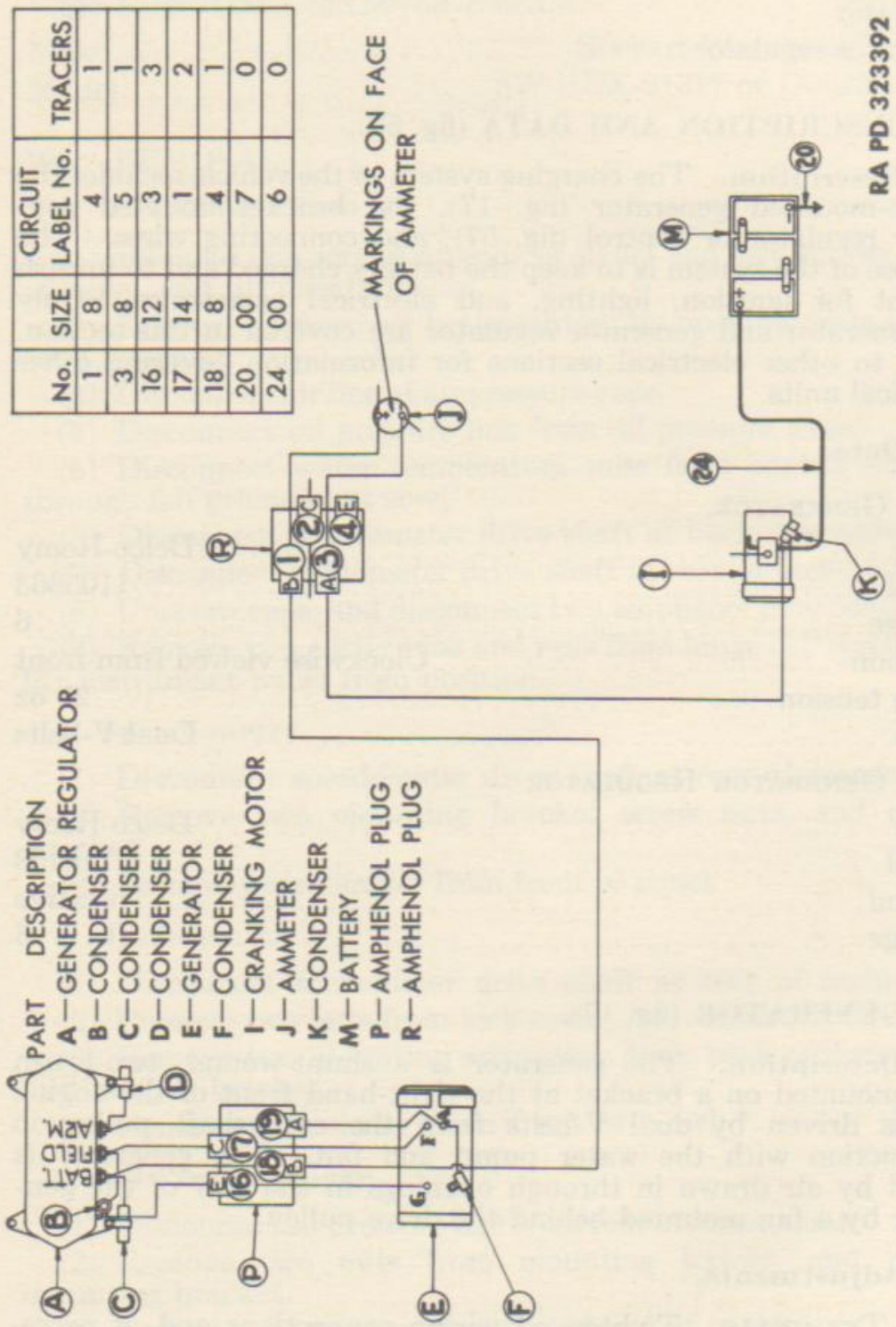
b. Adjustments.

(1) TERMINALS. Tighten all wiring connections and, if necessary, remove and clean terminals. Check wiring for evidence of insulation cracks and other failure.

(2) BRUSHES. Remove cover band, and inspect brushes for worn condition. If brushes are excessively worn, replace the

786109 O - 48 - 11

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)



No.	SIZE	CIRCUIT LABEL No.	TRACERS
1	8	4	1
3	8	5	1
16	12	3	3
17	14	1	2
18	8	4	1
20	00	7	0
24	00	6	0

Figure 56 — Charging Circuit Diagram

generator. Check pig-tail lead connections to be sure they are tight. Install cover band.

(3) COMMUTATOR. Remove cover band, and inspect commutator. If dirty, clean with a strip of flint paper. (Do not use emery cloth.) Blow out all dust with compressed air. Report to higher authority if commutator is excessively rough. Replace cover band.

(4) MOUNTING. Check and tighten mounting bracket to engine cap screws. Also tighten adjusting arm to generator cap screw.

(5) DRIVE BELTS. Check generator drive belt tension. A slight pressure on belts at a point midway between the generator pulley and fan drive pulley should result in ½- to 11/16-inch deflection. Low belt tension will cause a reduced and unsteady generator output. Excessive tension will cause rapid wear on belts and on generator bearings. Adjust drive belts if necessary, or replace both drive belts if either is frayed or worn (par. 76).

c. Removal.

(1) DISCONNECT WIRING. Remove terminal nuts from field and armature terminals of generator, and disconnect wires.

(2) REMOVE FAN BELTS. Remove nut from generator adjusting ator and fan. Install generator adjusting strap bolt, nut, and lock washer. Adjust drive belt tension (par. 76).

(3) REMOVE GENERATOR. Remove two cotter pins, nuts, and special lock washers from generator to mounting bracket bolts. Remove bolts and two special lock washers, and lift generator from bracket.

d. Installation.

(1) INSTALL GENERATOR. Place generator in position on engine bracket, and install two bolts and special lock washers in bracket. Bolts enter from front and rear with special lock washers between bolt head and bracket. Install two nuts and special lock washers on mounting bolts, and install cotter pins.

(2) INSTALL FAN BELTS. Place fan belts in grooves of generator and fan pulleys. Install generator adjusting strap bolt, nut, and lock washer. Adjust drive belt tension (par. 76).

(3) CONNECT WIRING. Connect wires to field and armature terminals of generator, and install terminal nuts.

(4) POLARIZE GENERATOR. When generator or regulator wires have been disconnected or the battery changed, the generator should be polarized after the units are reconnected and before the engine is started. Reversed polarity will cause regulator points to vibrate excessively and burn. Make certain that generator is correctly polarized by momentarily causing a short-circuit across the field and armature terminals on the regulator with a screwdriver or jumper wire. NOTE: *This must be done before starting engine.* This allows a momentary surge of battery current to the generator which automatically gives the generator the correct polarity with respect to the battery it is to charge.

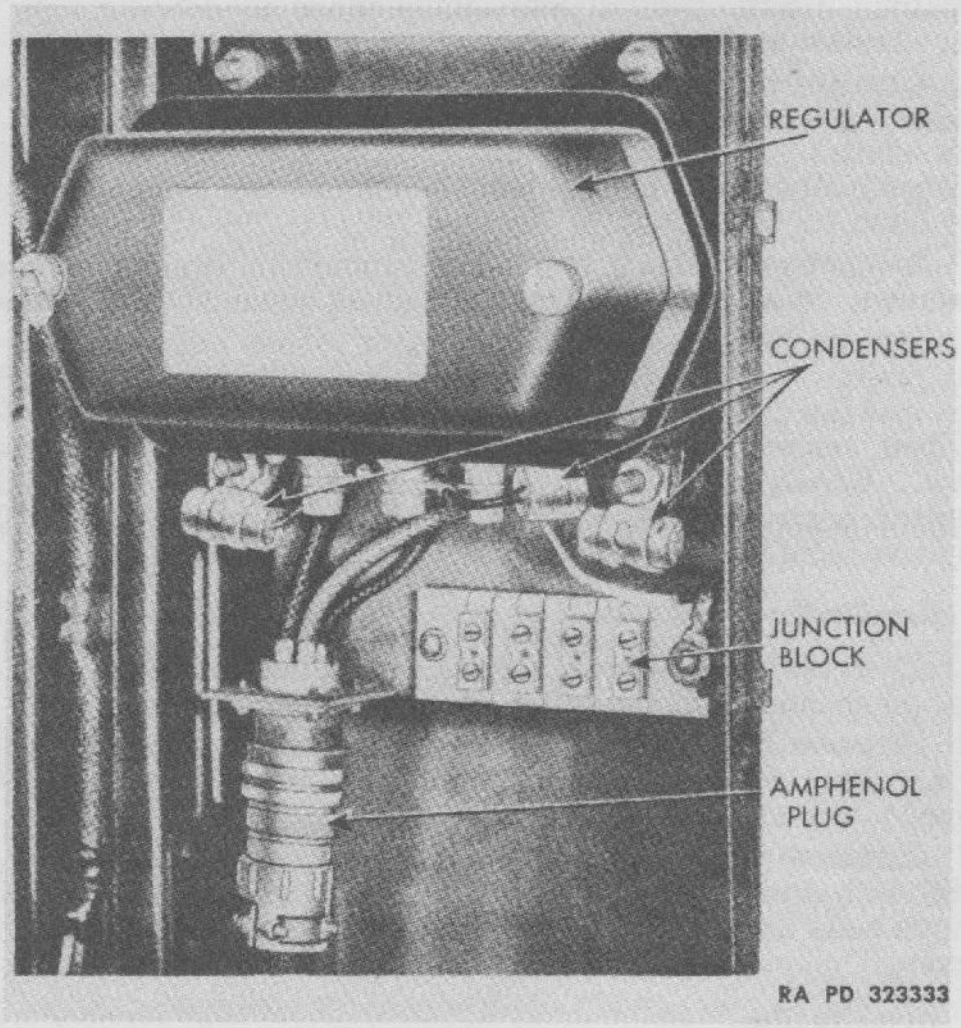


Figure 57 — Generator Regulator Installed

86. GENERATOR REGULATOR (fig. 57).

a. Description. The generator regulator is a three-unit type containing a cut-out relay, a voltage regulator, and a current regulator. It is mounted on a bracket affixed to the radiator shell at the right-hand front of the engine, and is accessible by lifting the hood. Regulator units automatically open and close the circuit between the generator and battery as needs require, and control the maximum generator amperage and voltage output. The three units perform the following functions:

(1) CUT-OUT RELAY. The cut-out relay automatically closes the circuit between the generator and battery when the generator voltage rises above that of the battery, and automatically opens the circuit between the generator and battery when the generator voltage falls below that of the battery.

(2) VOLTAGE REGULATOR. The voltage regulator controls the generator voltage by not allowing it to rise above a value determined by the voltage regulator setting.

(3) CURRENT REGULATOR. The current regulator controls the

maximum generator output (amperage) by not allowing the output to exceed the value of the current regulator setting.

b. Removal.

(1) DISCONNECT WIRES. Remove nuts and lock washers from narked "BATTERY," "FIELD," and "ARMATURE" terminals on regulator, and remove wires from terminal screws. Tape the end of the wire removed from the "BATTERY" terminal. Remove the screw and lock washer attaching the ground wire to the regulator base. After removing wires from terminal screws, reinstall nuts and lock washers, and reinstall ground screw and lock washer.

(2) REMOVE REGULATOR. Remove four nuts and lock washers from bolts attaching regulator to bracket, lift off one condenser at each end, and lift generator regulator from bracket.

c. Installation.

(1) INSTALL REGULATOR. Place generator regulator in position on bracket over mounting bolts. Place condenser on bolt at each end of regulator. Install four lock washers and nuts on mounting bolts.

(2) CONNECT WIRING. After removing nuts and lock washers from terminals, connect wiring to "ARMATURE," "FIELD," and "BATTERY" terminals as follows:

(*a*) *Armature Terminal.* Connect 1-MFD condenser lead, and connect red cable.

(*b*) *Field Terminal.* Connect .01-MFD condenser lead, and connect black cable having red tracer threads.

(*c*) *Battery Terminal.* Connect 5-MFD condenser lead, and connect black cable.

(*d*) Install nuts and lock washers. Connect ground wire to regulator base with screw and lock washer.

(3) CORRECT POLARITY. When generator or regulator wires have been disconnected or the battery changed, the generator must be polarized after the units are reconnected, and before the engine is started. Reversed polarity will cause regulator points to vibrate excessively and burn. Make certain that generator is correctly polarized by momentarily causing a short-circuit across the "FIELD" and "ARMATURE" terminals of the regulator with a screwdriver or jumper wire. NOTE: *This must be done before starting the engine.* This allows a momentary surge of battery current to the generator which automatically gives the generator the correct polarity with respect to the battery it is to charge.

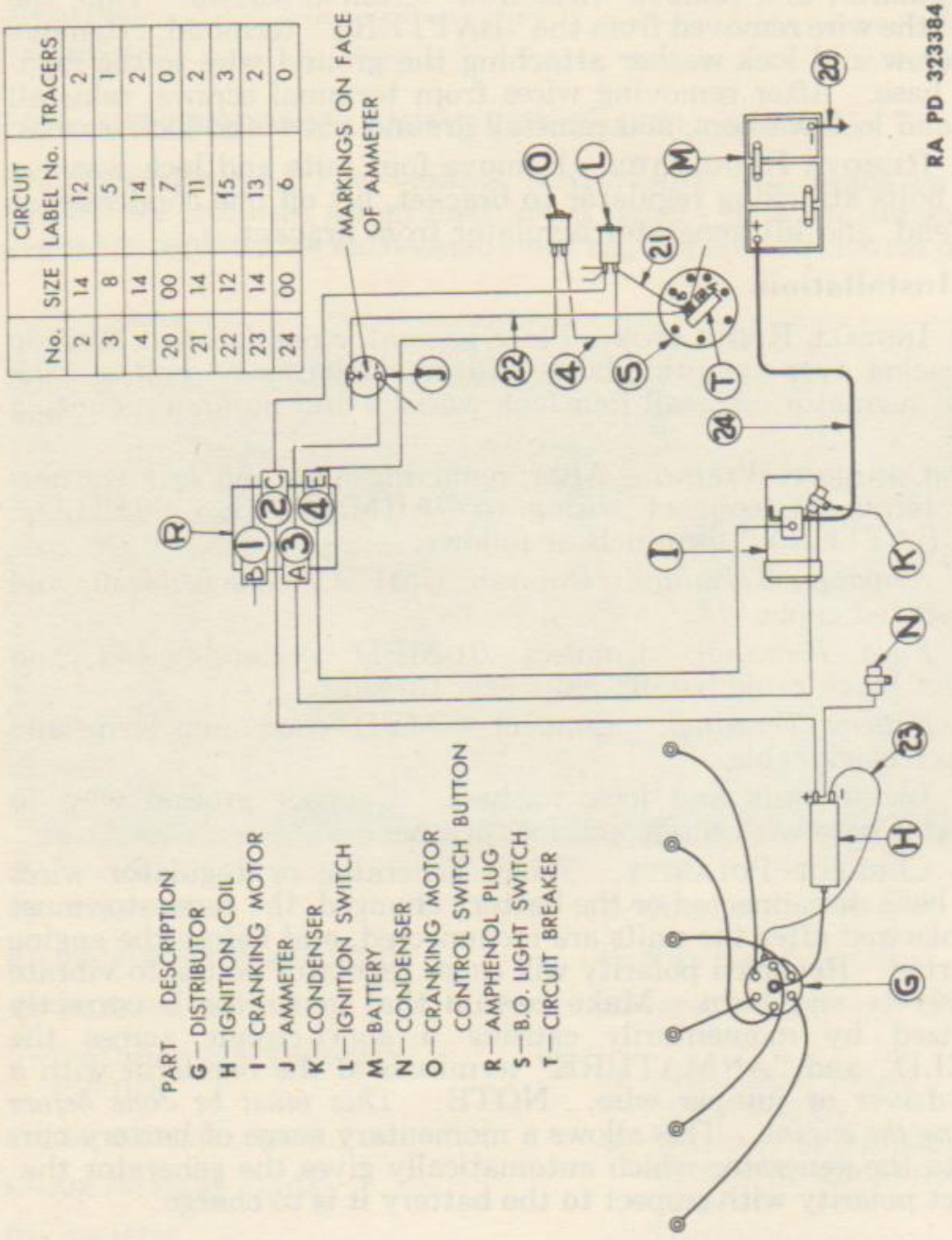


Figure 58 — Starting Circuit Diagram

Section XXII

STARTING SYSTEM

87. DESCRIPTION AND DATA (fig. 58).

a. Description. The starting system of this vehicle consists of the battery (par. 96), cranking motor magnetic switch, and cranking motor. The cranking motor cranks the engine when the circuit from the battery is completed at the cranking motor control switch. The starting and continued running of the engine after cranking is dependent upon the proper functioning of carburetion and ignition, as well as upon other engine conditions. The cranking motor merely cranks the engine electrically, thus eliminating hand cranking. When the driver presses the cranking motor control switch button on the instrument panel, the circuit from the battery to the magnetic switch on the cranking motor is closed, supplying the heavy current needed to rotate the cranking motor armature. This rotation causes the cranking mechanism to engage or mesh with teeth on the engine flywheel.

b. Cranking Motor Data.

Make	Delco-Remy
Model	1109000
Voltage	6
Brush tension	36 to 40 oz

88. LINE VOLTAGE TESTS.

a. Check cable leads and connections to determine if they are in good condition and tight. Excessive resistance produces an abnormal voltage drop which may lower voltage at cranking motor to such a low value that normal operation of the motor will not be obtained. Abnormal voltage drop can be detected with a low-reading voltmeter.

b. Testing Procedure.

(1) Check voltage drop between grounded battery terminal (negative) and vehicle frame. Place one prod of voltmeter (17-T-5575) on grounded terminal of battery and other prod on vehicle frame. With cranking motor turning over engine while ignition switch is off, the voltage reading must be less than $^1/_{10}$ volt. If more than this, there is an excessive resistance in this circuit.

(2) Check voltage drop between ungrounded (positive) battery terminal and magnetic switch with voltmeter (17-T-5575) while cranking motor is operated. If reading is more than $^1/_{10}$ volt, there is excessive resistance in circuit.

(3) Check voltage drop between cranking motor housing and vehicle frame with the voltmeter. Reading must be less than $^1/_{10}$ volt.

(4) If excessive resistance is found in any of the three circuits, disconnect cables, and clean the connections. If cables appear frayed, replace with new cables of correct size. Check condition of ground strap, and replace if necessary. Check condition of magnetic switch, and replace if necessary (par. 90).

89. CRANKING MOTOR (fig. 18).

a. Description. The cranking motor is attached to the engine flywheel housing at the left-hand side, and is held in place by three cap screws and lock washers. It is a six-brush, six-pole unit, with Eclipse drive, operated by a magnetic switch and using internal reduction gears. The Eclipse drive provides automatic and positive meshing of the driving pinion when the cranking motor control switch button is pressed and the magnetic switch is energized. When the engine starts, the drive pinion is automatically disengaged.

b. Adjustments.

(1) MOUNTING. Check cranking motor mounting cap screws to assure their being tight.

(2) BRUSHES. Remove cover band, and inspect condition of brushes and pigtail connections. If pig-tail connections are loose, they should be tightened. If appreciable brush wear is evident, or brushes are sticking in holds, the cranking motor should be replaced.

(3) COMMUTATOR. Remove cover band, and inspect commutator for dirty condition, roughness, burned spots, and high mica. If commutator is dirty, it can sometimes be cleaned with a strip of flint paper. (Never use emery cloth to clean commutator.) All dust must be blown from the cranking motor after the commutator has been cleaned. If the commutator is rough, burned, or has high mica, the cranking motor should be replaced.

c. Removal.

(1) Disconnect battery ground (negative) cable to prevent accidental discharge of the battery.

(2) DISCONNECT WIRING. Disconnect battery and ammeter cables at cranking motor. Disconnect cranking motor control switch to magnetic switch wires at magnetic switch.

(3) REMOVE CRANKING MOTOR. Remove three mounting cap screws and lock washers from cranking motor flange (fig. 18), and lift cranking motor from engine flywheel housing.

d. Installation.

(1) Place cranking motor in position in opening in engine flywheel housing, and install three mounting cap screws and lock washers.

(2) CONNECT WIRING. Connect battery and ammeter cables to cranking motor. Connect cranking motor control switch to magnetic switch wires at magnetic switch.

(3) Connect battery ground cable (negative) at battery.

90. MAGNETIC SWITCH.

a. Description. The magnetic switch, mounted on the cranking motor (fig. 18), consists of a winding, solenoid plunger, contact terminals, and contact disk. When the winding is energized by connection to the battery, the resulting magnetic field pulls in the solenoid plunger, forcing the contact terminals against the contact disk and connecting the cranking motor to the battery. Release of the cranking motor control switch button disconnects the magnetic switch winding from the battery, so that the magnetic switch spring can separate the contact disk from the terminals, opening the circuit between the cranking motor and the battery.

b. Removal.

(1) Disconnect battery ground cable (negative) at battery.

(2) Disconnect wires at magnetic switch on cranking motor.

(3) Remove one nut and lock washer connecting strap terminal at switch.

(4) Remove two cap screws and lock washers from magnetic switch bracket to cranking motor. Lift switch from connecting strap and cranking motor.

c. Installation.

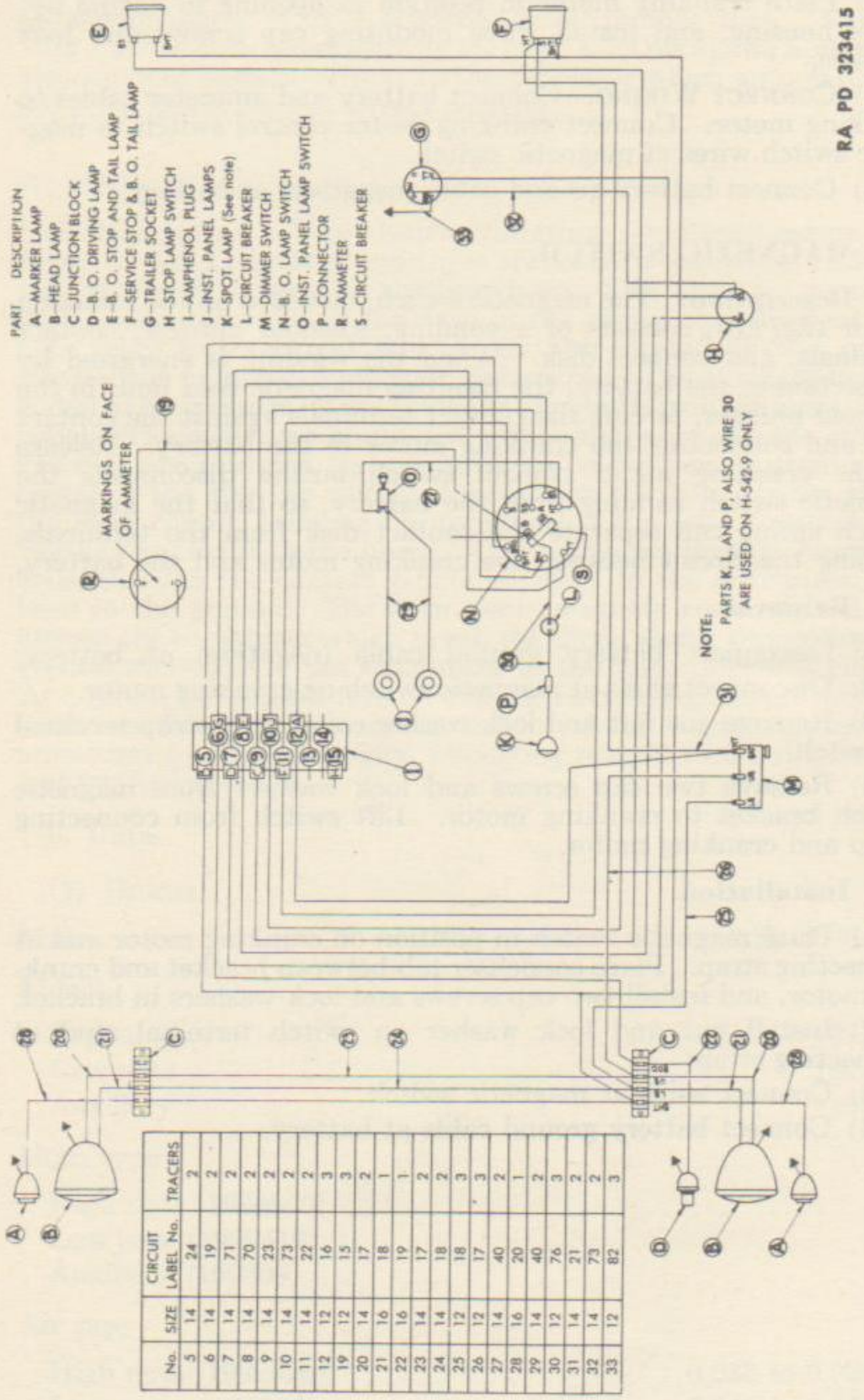
(1) Place magnetic switch in position on cranking motor and at connecting strap. Place condenser tab between bracket and cranking motor, and install two cap screws and lock washers in bracket.

(2) Install nut and lock washer on switch terminal stud at connecting strap.

(3) Connect wires at magnetic switch.

(4) Connect battery ground cable at battery.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)



No.	SIZE	CIRCUIT LABEL No.	TRACERS
5	14	24	2
6	14	19	2
7	14	71	2
8	14	70	2
9	14	23	2
10	14	73	2
11	14	22	2
12	12	16	3
19	12	15	3
20	14	17	2
21	16	18	1
22	16	19	1
23	14	17	2
24	14	18	2
25	12	18	3
26	12	17	3
27	14	40	2
28	16	20	1
29	14	40	2
30	12	76	3
31	14	21	2
32	14	73	2
33	12	82	3

Figure 59 — Lighting Circuit Diagram

Section XXIII

LIGHTING SYSTEM, BATTERY, AND HORNS

91. LIGHTING SYSTEM (fig. 59).

a. Description. The six-volt lighting system includes the service headlights, blackout driving light, blackout marker lights, service and blackout stop and taillights, instrument panel lights, and actuating switches. The entire system is protected by circuit breakers.

92. HEADLIGHTS.

a. Description. Service headlights (fig. 60) are mounted at the right and left of the radiator on the fenders. They are of double-filament sealed beam lamp-unit type. These lights are

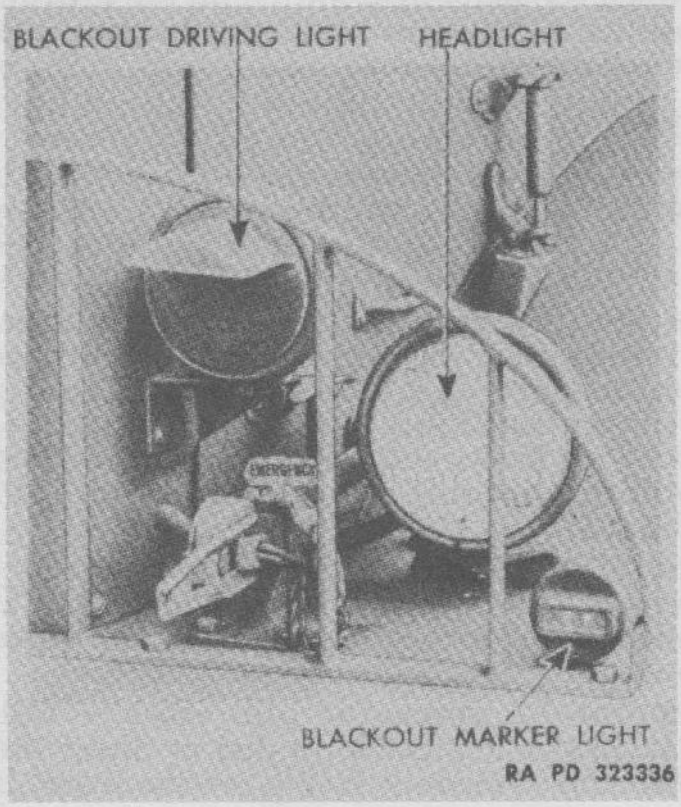


Figure 60 — Headlight Installed

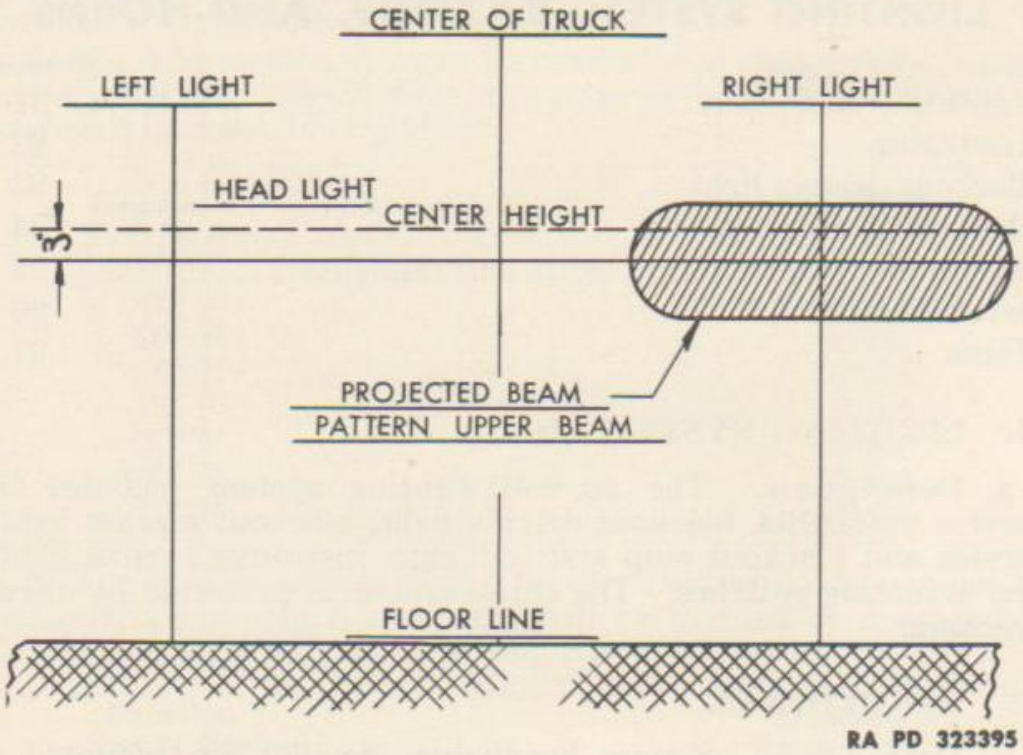


Figure 61 — Headlight Adjustment Pattern

illuminated when the main light switch on the instrument panel is in service position. The upper and lower beams are controlled by the foot-operated dimmer switch.

b. Servicing.

(1) LIGHT BEAM. The difference of a few degrees in the aiming adjustment of the headlights will determine the effectiveness of the light beam. The aiming adjustment of the headlights should be checked periodically, or whenever the light beam is effective.

(2) LAMPS AND WIRING. Lamps must never be blackened, and proper voltage must be maintained. Low battery, loose or dirty electrical contacts in the wiring system, and poor ground connections all contribute to a decrease in voltage. Check wiring and connections regularly, and keep the battery properly charged. Make certain that the wiring between the battery and generator is in good condition.

(3) LENSES. Dirty lenses absorb a large amount of light and therefore decrease light output. Lenses are easily cleaned with water. The inside of sealed beam lamp-unit lenses cannot be cleaned because the lens is sealed to the reflector.

(4) REFLECTORS. A sprung or bent reflector will distort the light beam, making it impossible to dim or direct the light beam correctly. The only remedy is to replace the sealed beam unit.

c. Aiming Adjustment Procedure. Aiming adjustment operations must be done accurately to assure effective lighting. When

Figure 62 — Loosening Door Retaining Screw

Figure 63 — Removing Sealed Beam Unit

aiming the headlights the light beam may seem distorted. This condition is usually caused by a sprung reflector which requires replacement. Headlights can be adjusted quickly and accurately with a headlight tester. However, if this equipment is not available, a satisfactory adjustment can be made as follows:

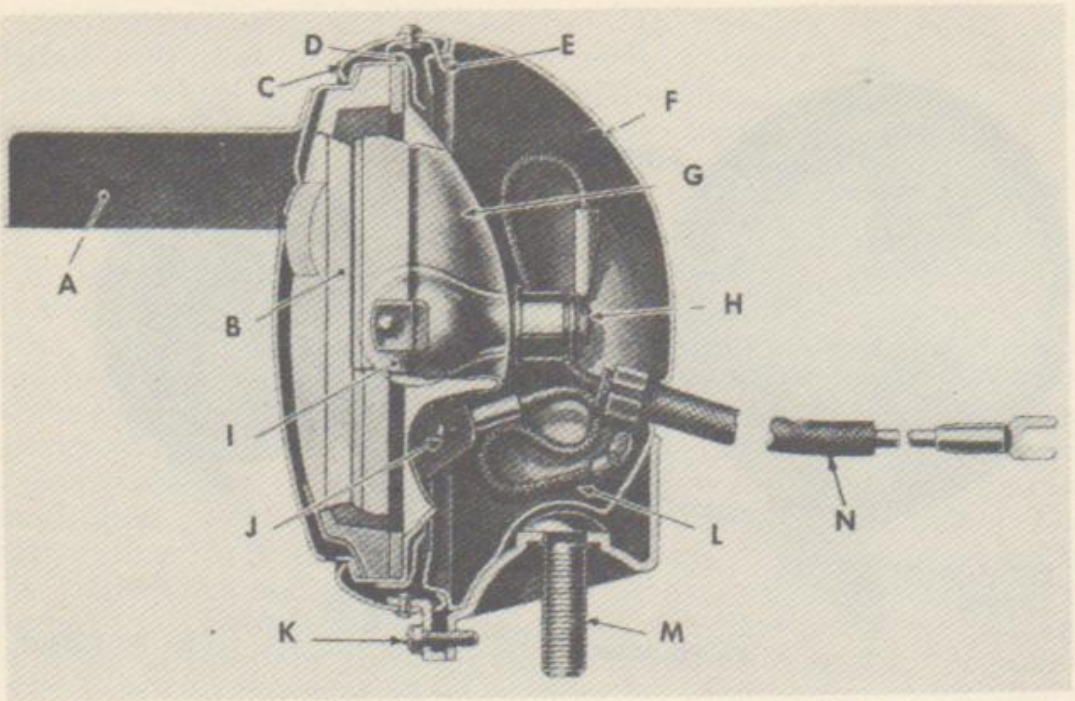
(1) POSITION VEHICLE. Place vehicle on level floor so that headlights are 25 feet from s screen or chart. A horizontal line on the chart shall be placed at a level 3 inches below the height of the light centers above the floor. Vertical lines on the chart mark the distance between the center lines of the headlights, and are equally spaced from the center line of the chart.

(2) ADJUSTMENT. Each light must be adjusted by loosening the mounting stud nut and shifting the light body so that the hot spot of the beam will be centered over the point of intersection of the vertical and horizontal lines. Covering one light while adjusting the other will facilitate adjustment. Figure 61 illustrates the beam pattern to be attained. Tighten headlight mounting nuts securely.

d. Removal.

(1) SEALED BEAM LAMP-UNIT. Loosen the door retaining screw of headlight body (fig. 62). Lift off door from light. Lift sealed beam lamp-unit from light body, and disconnect three-way connector (fig. 63).

(2) HEADLIGHT ASSEMBLY. Disconnect wiring at junction block. Remove nut and lock washer from headlight mounting stud. Lift assembly from bracket.



A BEAM VISOR
B LENS
C MOULDING RING
D RETAINING RING
E MOULDING RING TOP CLIP
F DRIVING LIGHT BODY
G REFLECTOR
H TERMINAL SCREW
I LAMP
J GROUND WIRE SCREW
K MOULDING RING RETAINING SCREW
L GROUND WIRE
M LAMP MOUNTING STUD
N WIRE HARNESS

RA PD 64649

Figure 64 — Blackout Driving Light Sectional View

e. Installation.

(1) SEALED BEAM LAMP-UNIT. Connect sealed beam lamp-unit to three-way connector in light body. Place sealed beam lamp-unit in position in body. Place door in position over unit, and tighten retaining screw.

(2) HEADLIGHT ASSEMBLY. Place headlight in position on mounting bracket, and install nut and lock washer. Connect wiring at junction block. Adjust headlight (subpar. e above).

93. BLACKOUT DRIVING LIGHT (fig. 64).

a. Description. The blackout driving light is mounted on the fender to the left of the radiator. This light is controlled by the main light switch on the instrument panel. The blackout driving light furnishes a diffused light beam to permit limited illumination when driving under blackout conditions.

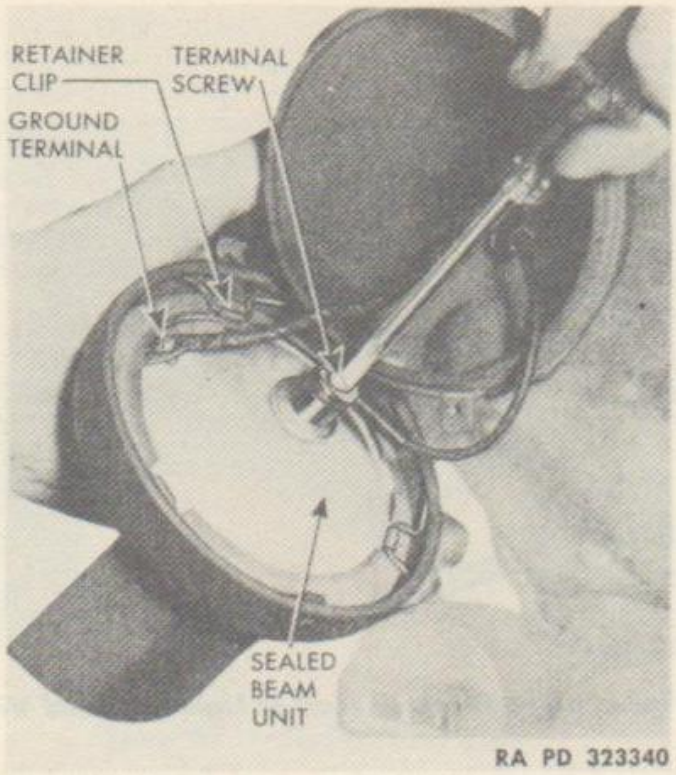


Figure 65 — Disconnecting Blackout Driving Light Sealed Beam Unit

b. Removal.

(1) SEALED BEAM LAMP-UNIT. The sealed beam lamp-unit includes a lens, reflector, bulb element, and beam visor sealed together as a unit.

(*a*) Remove moulding screw at bottom of moulding.

(*b*) Pull moulding out at bottom, and raise sealed beam lamp-unit upward to free clip at top of light body.

(*c*) Disconnect wires from rear of sealed beam lamp-unit by loosening screws at bulb and at retaining ring (fig. 65).

(*d*) Use screw driver to loosen three spring clips attaching retaining ring and sealed beam lamp-unit to moulding.

(2) BLACKOUT DRIVING LIGHT ASSEMBLY.

(*a*) *Disconnect Wiring.* Remove screws from driving light wiring at junction block, and feed harness through opening.

(*b*) *Remove Light.* Remove mounting stud nut and lock washer from stud at bracket, and lift unit from bracket.

c. Installation.

(1) SEALED BEAM LAMP-UNIT.

(*a*) Place moulding around front side of sealed beam lamp-unit, with split in moulding at bottom. Locate retaining ring with clips

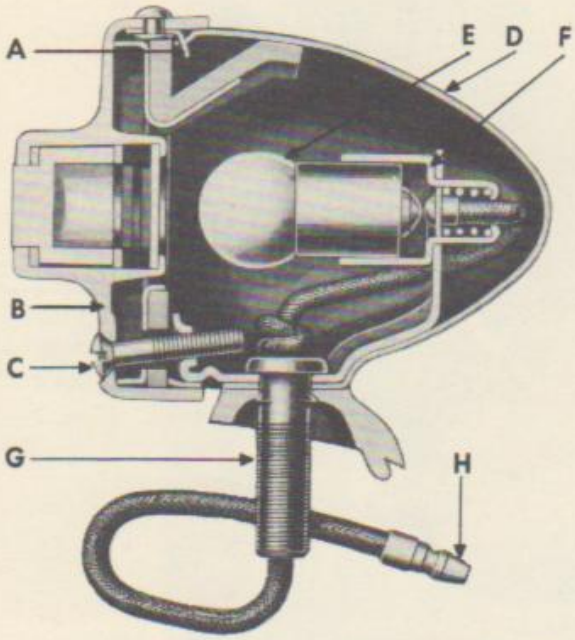


Figure 66 — Blackout Marker Light Sectional View

at back of sealed beam lamp-unit, and force retaining ring springs under flange of moulding.

(*b*) Install light wire under screw head at rear of sealed beam lamp-unit, and tighten screw securely. Attach ground wire to retaining ring in the same manner.

(*c*) Install sealed beam lamp-unit assembly in light body with moulding clip engaged in slot at top of body. Install retaining screw at bottom of moulding.

(2) BLACKOUT DRIVING LIGHT ASSEMBLY.

(*a*) Place driving light in position on bracket, and install nut and lock washer thumb-tight on stud.

(*b*) Feed harness through opening, and connect wires at junction block screws.

(*c*) *Aim Adjustment.* Use a projection screen for adjustment of the blackout driving light (fig. 61). The vehicle should be loaded and on a level surface at the time of adjustment.

1. Loosen light mounting stud nut at mounting bracket.

2. Shift the light as required so that the visual cut-off of the top of the beam on the vertical screen 10 feet in front of the light is at least 2 inches and not more than 3 inches below the bottom of the horizontal slot in the light shield.

3. Tighten mounting stud nut, being careful not to alter aim adjustment.

94. BLACKOUT MARKER LIGHTS (fig. 66).

a. Description. Blackout marker lights are mounted at the front of each front fender and are illuminated only when the main light switch is in blackout driving position. The blackout marker

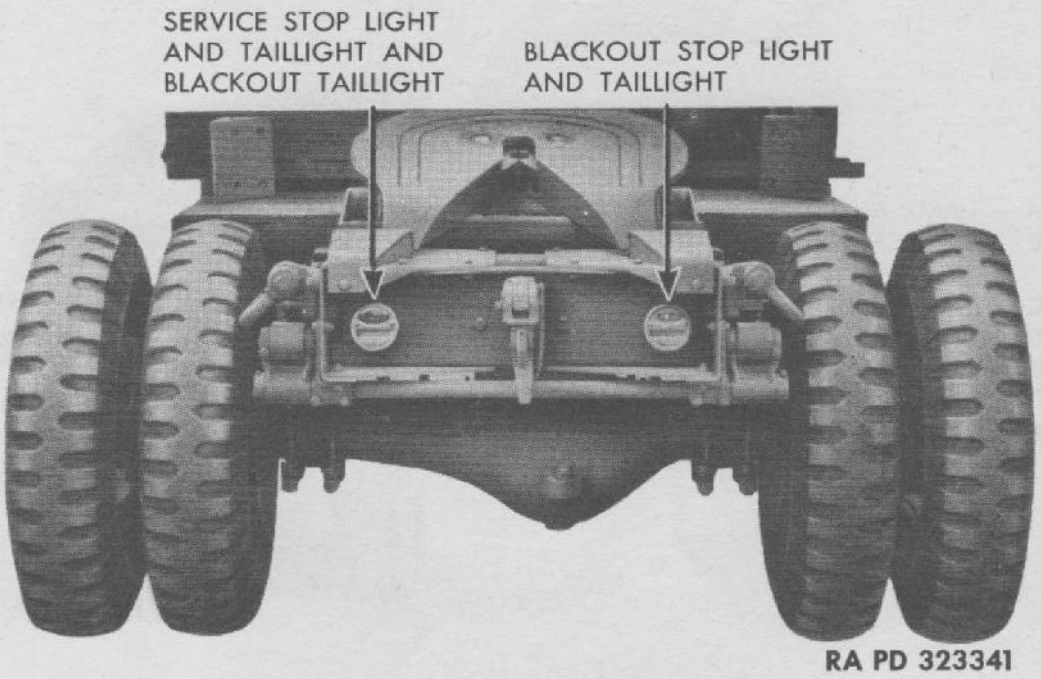


Figure 67 — Taillights Installed

lights incorporate a specially designed lens and color filter which diffuses the light beam.

b. Removal.

(1) LAMP ONLY. The lamp of the marker light is replaceable in the conventional manner. Remove retaining screw from light door, and lift door from bottom and away from light body. Turn lamp and remove from socket.

(2) MARKER LIGHT ASSEMBLY. Disconnect wire at junction block, and feed wire through opening. Remove nut and lock washer from mounting stud at base of light, and lift light from bracket.

c. Installation.

(1) LAMP ONLY. Insert lamp into socket, and turn into position. Place light door in position, connecting clip at top of door into slot in body. Install door retaining screw.

(2) MARKER LIGHT ASSEMBLY. Place marker light assembly in position on mounting bracket, and install nut and lock washer on mounting stud, having marker light in a straight ahead position before tightening nut. Feed wire through opening, and attach at terminal screw on junction block.

95. SERVICE AND BLACKOUT STOP LIGHTS AND TAILLIGHTS.

a. Description. The two combined stop light and taillight units are mounted at the rear of the vehicle (fig. 67). The left-hand

A — LAMP AND LENS UNIT COVER
B — SERVICE STOP AND TAIL LIGHT LAMP-UNIT
C — LAMP SOCKET IN BODY
D — MOUNTING STUD
E — BLACKOUT TAIL LIGHT LAMP-UNIT
F — COVER SCREW

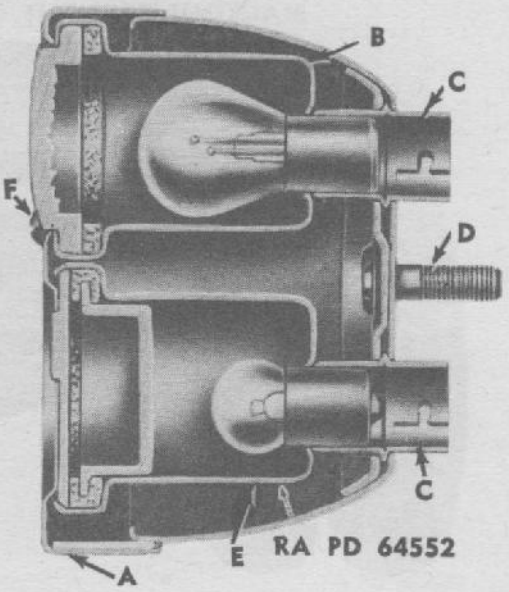


Figure 68 — Service Stop Light and Taillight Sectional View

light incorporates a combination service stop light and taillight unit in the upper portion, and blackout taillight unit in the lower portion (fig. 68). The right-hand light incorporates a blackout stop light in the upper portion, and a blackout taillight in the lower portion (fig. 69). The lens on each blackout taillight unit is designed to produce two beams. These two beams are directed so that they

A — LAMP AND LENS UNIT COVER
B — BLACKOUT STOP LIGHT LAMP-UNIT
C — LAMP SOCKET IN BODY
D — MOUNTING STUD
E — BLACKOUT TAIL LIGHT LAMP-UNIT
F — COVER SCREW

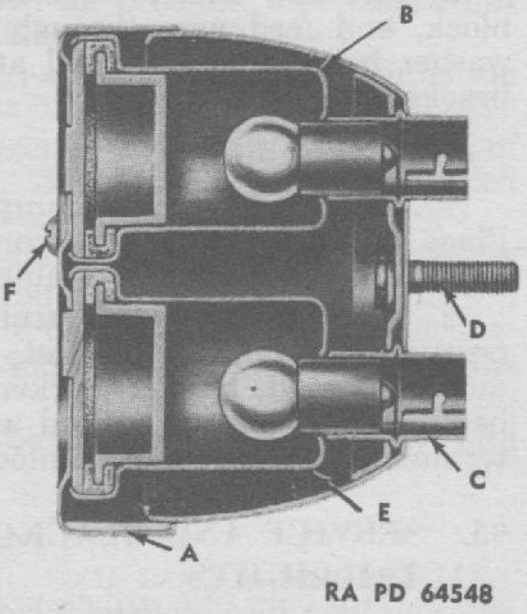


Figure 69 — Blackout Stop Light and Taillight Sectional View

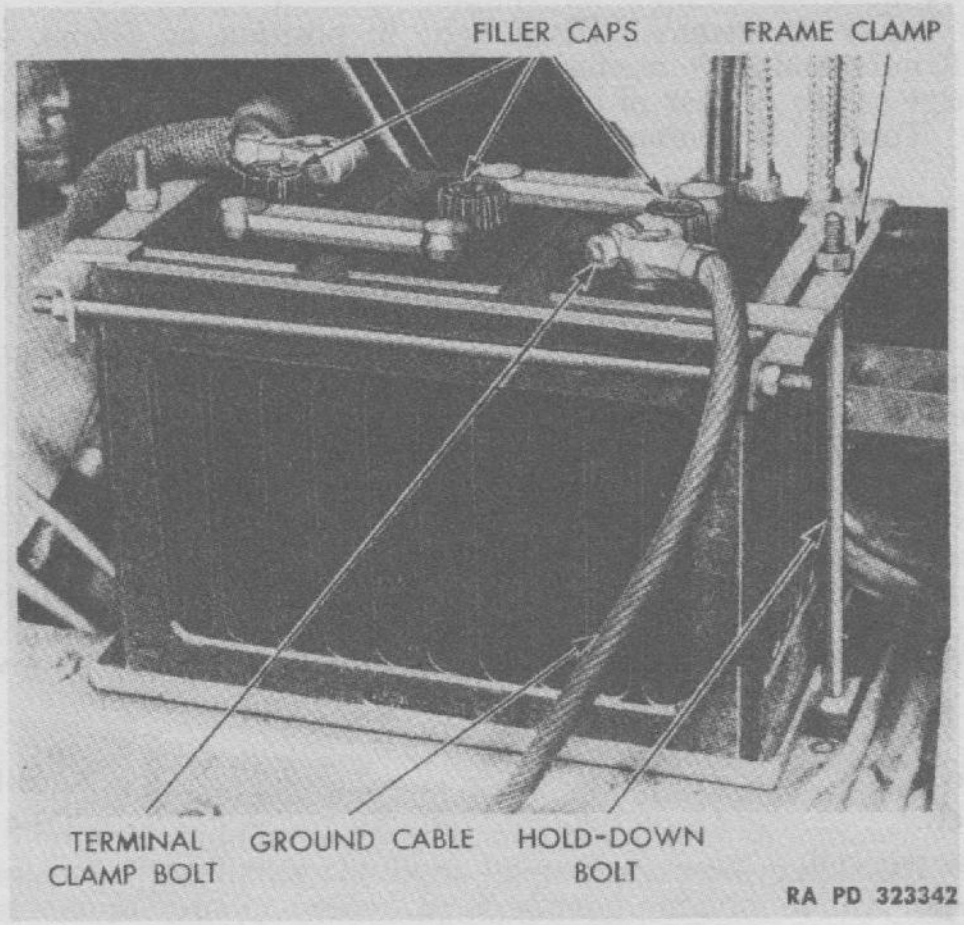


Figure 70 — Battery Installed in Carrier

merge into a single beam at a specified distance. Thus, when one vehicle is following another under blackout conditions, the driver of the rear vehicle can maintain a safe distance between vehicles by staying far enough behind the forward vehicle so that the two beams appear as one. The beams of the blackout stop light and taillights are diffused so that they are not visible from above. The lights are composed of individual sealed beam lamp-units.

b. Removal.

(1) INDIVIDUAL LAMP-UNITS. Disconnect cable at rear of lamp-unit in conventional manner, turning counterclockwise and then pulling plug from socket. Remove two screws from light door, and lift door from body. Pull defective lamp-unit from light body.

(2) LIGHT ASSEMBLY. Disconnect cables at rear of light by turning plugs counterclockwise and pulling out. Remove nuts and lock washers from two mounting screws in rear of light. Lift light from frame.

c. Installation.

(1) INDIVIDUAL LAMP-UNIT. Push new lamp-unit into light body, entering plug into socket. Place light door in position, and install two screws and lock washers. Connect wiring at rear of light, inserting plug and turning clockwise.

(2) LIGHT ASSEMBLY. Place light in position on frame, and install nuts and lock washers on each of two mounting screws. Connect cables at rear of light, inserting plugs and turning clockwise. Test lights to assure proper connection.

96. BATTERY (fig. 70).

a. Description. The battery is a six-volt type, and is mounted in a carrier at the left-hand frame rail at the left rear corner of the cab. It is an electrochemical device for storing electrical energy, and has two functions. The first function is to govern the voltage of the electrical system. The second function is to provide electrical energy to the cranking motor and ignition circuit while the engine is being started. The battery also supplies energy, under limited conditions, to the lights and other electrical accessories. The battery has its negative terminal grounded. Place is provided in the right-hand end of the tool box for carrying a spare battery. Remove the right-hand fluid container and fluid container bracket in order to raise the tool box lid sufficiently for battery removal.

b. Data

Make	Auto-lite
Model	TS-4-19
Plates per cell	19
Voltage	6
Ampere hours (20-hour rate)	152
Ampere hours (20-minute rate)	180

c. Servicing.

(1) WATER LEVEL. Remove three filler caps, and check level of water (electrolyte) in each cell. Water level should be approximately $\frac{3}{8}$ inch above plates. Do not overfill. During cold weather, water should be added only immediately before operation. Use pure distilled water. If this is not available, use drinking water which is colorless, tasteless, and odorless.

(2) BATTERY TERMINALS. Inspect condition of battery terminals. If found corroded, remove terminal and clean with a solution of ammonia and water. Coat cable terminal and battery post with grease. Install terminal on post and tighten clamp nut securely.

(3) TESTING AND CHARGING.

(*a*) *Specific Gravity in Cells.* With an accurate hydrometer. check each cell of battery for specific gravity of battery solution, A fully charged battery should test between 1.260 and 1.300. If the reading is below 1.225 under normal operating conditions, the battery should be replaced with a fully charged battery. To determine the actual specific gravity of the electrolyte, it is necessary to check the temperature of the solution with a thermometer. If the temperature is normal, 80°F, the specific gravity reading

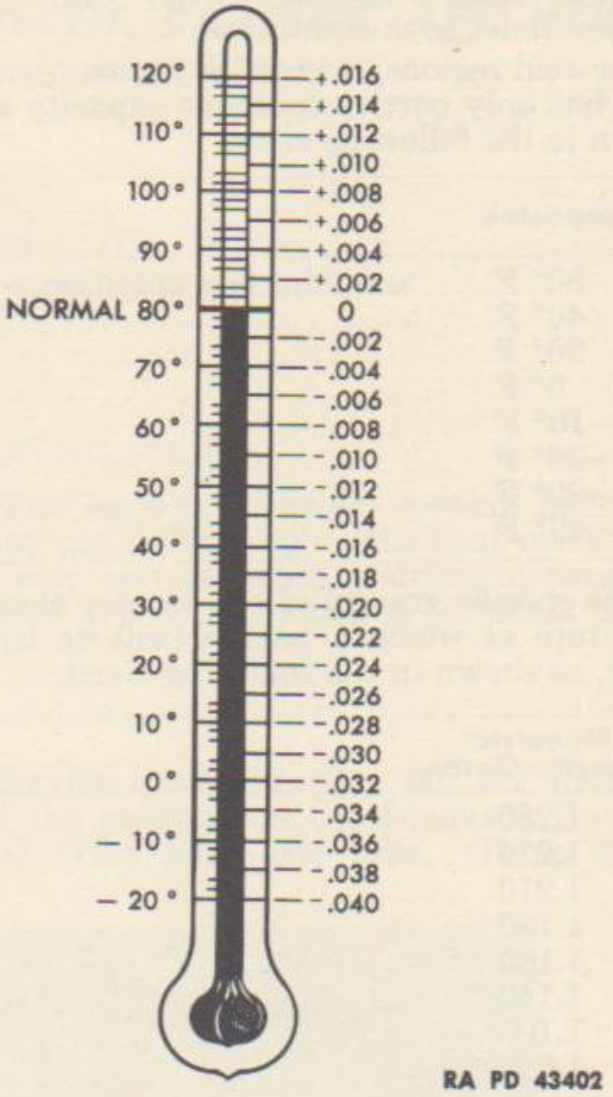


Figure 71 — Hydrometer Correction Chart

will be correct. However, if the temperature is above or below 80°F, it will be necessary to determine the actual specific gravity. This is due to the fact that the liquid expands when warm, so that the same volume weighs less than it weighs at 80°F. The reverse is also true, so that when the temperature is below normal the liquid contracts and the same volume weighs more than it weighs at 80°F. The correction chart (fig. 71) shows the figures to be used to make these corrections. For example, when the specific gravity as shown by the hydrometer reading is 1.290 and the temperature of the electrolyte is 60°F, it will be necessary to subtract 8 points or 0.008 from the 1.290 reading, which gives 1.282 as the actual specific gravity. If the hydrometer reading shows 1.270 at a temperature of 110°F, it will be necessary to add 12 points or 0.012 to the reading, which gives 1.282 as the actual specific gravity.

(*b*) *Temperature Effects.*

1. In tropical or hot regions, danger of overheating of battery is much greater than in cooler climates. The battery should be

adjusted to have a specific gravity when fully charged of 1.225 maximum under such conditions.

2. For cold regions, it must be remembered that a fully charged battery has only partial discharge capacity at lower temperatures, as shown in the following chart:

Temperature	Discharge Capacity
80° F	100 pct
40° F	76 pct
20° F	61 pct
0° F	43 pct
—10° F	35 pct
—20° F	25 pct
—30° F	15 pct
—40° F	10 pct

3. The specific gravity of the battery electrolyte determines the temperature at which a battery will be harmed or damaged by freezing, as shown in the following chart.

Electrolyte Specific Gravity	Electrolyte Freezing Point
1.280	—90° F
1.220	—30° F
1.210	—20° F
1.180	—10° F
1.160	— 0° F
1.140	+10° F
1.100	+19° F
1.000	+32° F

(c) *Charging.* When battery requires charging, it should be supplied with a charging rate of one ampere per positive plate per cell, or 9.0 ampere rate. Charging should continue for 2 hours after the specific gravity and terminal voltage show no further rise. The electrolyte temperature should not be permitted to rise above 110°F.

(4) CELL VOLTAGE TEST. With the ignition switch off, or the high tension lead removed from the ignition coil, operate cranking motor and quickly check each cell of battery with a low-reading voltmeter (17-T-5575). If voltage falls below 1.7 volts at 80°F, or if there is a difference between cell readings of more than $^1/_{10}$ volt, the battery is defective and must be replaced.

(5) LINE VOLTAGE TESTS. Before it can be definitely determined that battery cables are satisfactory, tests should be made as directed in paragraph 88.

d. Removal. The battery is accessible at the right-hand side of the driver's seat below the floor plate.

(1) Lift seat hook at front of seat, and slide seat toward right. Lift out seat.

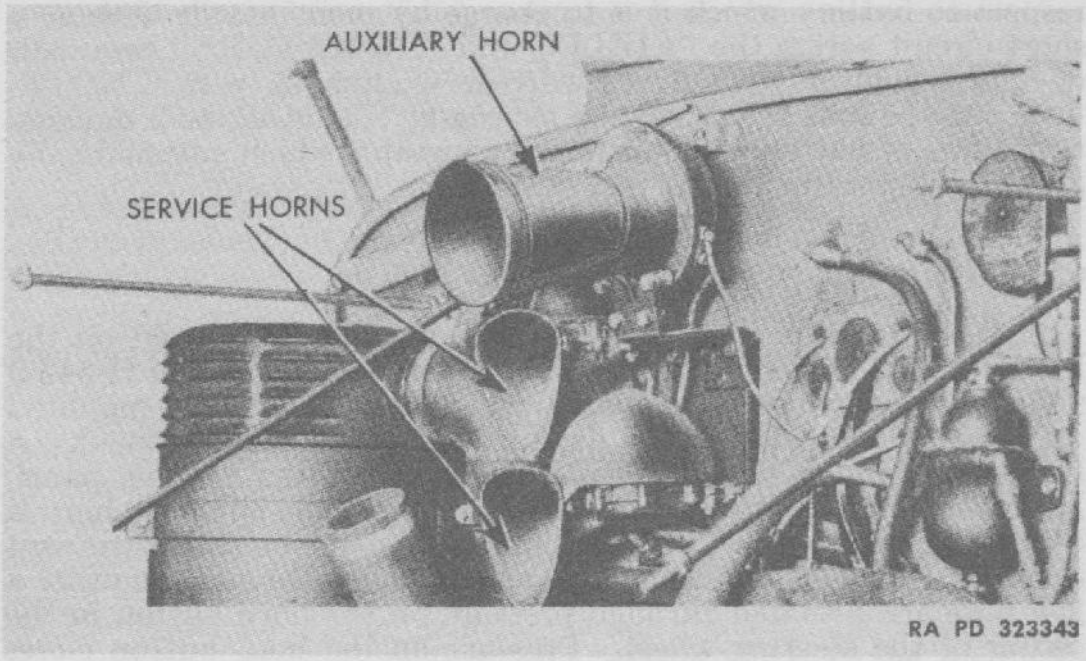


Figure 72 — Horns Installed

(2) Remove 10 cap screws from floor plate, and remove floor plate.

(3) Remove nut and lock washer from each of two battery hold-down bolts.

(4) Loosen battery terminal bolt nuts, and disconnect terminals.

(5) Lift battery from bracket, using frame clamp as handle or a battery lifter strap. Do not tip battery during removal as electrolyte might be spilled.

(6) Loosen nut and lock washer at one end of each of two frame clamp bolts, and lift frame clamp from battery.

e. Installation.

(1) Place battery frame clamp in position on top of battery, and install and tighten nut and lock washer on each bolt.

(2) Place battery in position in bracket, using clamp frame as handle or a battery lifter strap. Be careful not to tilt battery during installation.

(3) Install and tighten two nuts and lock washers on battery hold-down bolts.

(4) Connect battery terminals at battery posts, and tighten terminal bolt nuts.

(5) Install floor plate, and install 10 retaining cap screws.

(6) Place seat in position on support, slide toward left, and connect seat retaining hook at front of seat.

(7) CORRECT POLARITY. When generator or regulator wires have been disconnected, or battery has been disconnected, generator should be polarized after units are reconnected and before the engine is started. Make sure generator is correctly polarized with

respect to battery which it is to charge by momentarily causing a short-circuit across the "FIELD" and "ARMATURE" terminals on the regulator with a screwdriver or jumper wire. NOTE: *This must be done before starting the engine.* This allows a momentary surge of battery current to the generator which automatically gives the generator the correct polarity.

97. HORNS (fig. 72).

a. Description. Two electric vibrating horns are used on the Model H-542-11 vehicle, and three are used on the Model H-542-9 vehicle, one of which is an auxiliary horn. The horns are mounted on a removable panel of the dash in the engine compartment. A horn relay and a circuit breaker are also located on this panel. Each of the units is individually replaceable. The auxiliary horn is operated by pressure on the auxiliary horn button on the instrument panel. The other two horns, one with a high note and the other a low note are actuated through pressure on the horn button in the center of the steering wheel. Pressure on the horn button closes the relay circuit, bringing the terminals of the relay together and closing the circuit to the horns. Current passes through magnetic coils, through the contact points adjacent to the armatures, and then to the ground. The horn electromagnets are energized and attract the armatures which break the direct shunt connections to ground and include the resistances in the horn electrical circuit. As a result, the current falls off and the electromagnets are momentarily weakened. This make and break of circuit causes the armatures to vibrate rapidly, imparting motion to the diaphragm and producing sound.

b. Data.

(1) HORNS.

Make ..... Delco-Remy

Model:

High note 1999520
Low note 1999519
Auxiliary 199809

Horn type:

High note (1999520) 520
Low note (1999519) 519
Auxiliary (199809) 809

Air gap:

High note (1999520) ..... 0.035 to 0.039 in.
Low note (1999519) ..... 0.045 to 0.049 in.
Auxiliary (199809) ..... 0.027 to 0.033 in.

Current draw:

High note (1999520)	18 to 20
Low note (1999519)	19 to 21
Auxiliary (199809)	7 to 9

(2) HORN RELAY.

Make	Delco-Remy
Model	1116775
Air gap with points closed	0.015 in.
Air gap with points open	0.025 in.

c. Adjustments. If tone of horn is not satisfactory, after ascertaining that cause is not a low battery, poor connections, or broken or loose parts, the horns may be adjusted as follows:

(1) Remove screw from back of horn shell, and lift shell from horn.

(2) To adjust current draw, connect a voltmeter (17-T-5575) into the circuit at horn terminals, and adjust current draw by varying the position of the adjusting nut. Loosen lock nut and turn adjusting nut to left (counterclockwise) to increase current draw, or to right (clockwise) to decrease current draw. Too much current will cause horn to have a sputtering sound. The adjustment is very sensitive. Move adjusting nut $^1/_{10}$ turn at a time, and lock in position each time before trying. NOTE: *If voltmeter is not available, adjust according to sound.*

(3) Install back of horn shell, and install screw.

d. Removal. The horns may be removed either individually or as a group. If the entire group is to be removed, the mounting panel can be removed by taking out four cap screws, nuts, and lock washers from corners of panel after disconnecting horn wires and relay wires. Individual horn is removed by disconnecting wiring at horn terminal screw, removing two cap screws from horn bracket at horn panel, and lifting off horn.

e. Installation. Place horn in position, install two cap screws on mounting bracket, and tighten securely. Connect wiring at horn terminal. When installing the horns and panel as a group, place panel in position on dash, install cap screw, nut, and lock washer at each corner, and connect horn wiring at horns and at relay.

Section XXIV

RADIO NOISE SUPPRESSION

98. DESCRIPTION.

a. General. When the engine of any motor vehicle is running, the electrical system of that vehicle is a source of radio interference. It actually broadcasts radio waves or signals that will interfere with any receiving apparatus that may be operating in the vehicle or in its vicinity. This interference also enables the enemy to determine the exact location of the vehicle through the use of detecting instruments. In view of the foregoing, this vehicle has been suppressed to eliminate radiated disturbances at their source. Radio noise suppression is accomplished through the use of the following devices:

(1) FILTERS. A filter is an assembly consisting of a winding and one or more condensers connected internally in a metal case and mounted at the desired location in such a manner that the case is well grounded to the vehicle.

(2) RESISTOR SUPPRESSORS. A resistor suppressor is a high resistance unit or element mounted securely in an insulated housing having electrical connections in both ends and so constructed as to have electrical contacts at each end.

(3) BONDS. A bond is an electrical contact, of extremely low resistance, between two or more metal parts. Flexible braided metal bonding straps are used for this purpose.

(4) WASHER "PILE-UP", Special toothed lock washers having both internal and external teeth are often used at points of bonding where they are securely fastened by bolts and nuts. They may be used in varied quantities at each location. When occasion arises to remove for servicing a part having these special lock washers incorporated in the mounting, the washers must always be re-installed exactly as installed by the manufacturer.

(5) CONDENSERS. A condenser is an electrical element consisting of two conductors separated by a dielectric whose purpose is to control electrical surge.

b. Servicing or Testing.

(1) Location and manner of installation of all radio noise suppression items is a function of the Signal Corps, therefore no changes should be made except at their direction.

(2) If trouble is believed existent in one of the items, a new unit must be substituted for the old. No attempt must be made to repair defective suppression items.

RADIO NOISE SUPPRESSION

99. ELECTRICAL SYSTEM CONDITION.

a. It is necessary that the electrical system be in proper operating condition to insure successful radio noise supression. At such times as it is believed that the supression system is not functioning properly, a systematic and thorough check-up of the electrical system must be given to insure that all is functioning properly. The following deficiencies vitally affect the radio noise suppression system.

(1) Dirty distributor caps.
(2) Incorrect spark plug gaps.
(3) Burned or pitted breaker contact points.
(4) Broken or oil-soaked wires.
(5) Loose electrical connections.
(6) Poor battery connections.

100. POINTS OF NOISE SUPPRESSION.

a. This vehicle is suppressed through use of condensers, bond straps, and special lock washers located as follows:

(1) CONDENSERS.

(*a*) Three at generator regulator, one of 0.01 MF at "FIELD" terminal, and one each of 0.10 MF at "AMMETER" and "BATTERY" terminals.

(*b*) One of 0.10 MF at ignition coil.
(*c*) One of 0.10 MF at cranking motor.
(*d*) One of 0.10 MF at generator.

(2) BONDS.

(*a*) One at generator regulator to radiator shell.

(*b*) One at each front wheel housing splash shield to frame side rail.

(3) SPECIAL LOCK WASHERS.

(*a*) At front and rear sections of wheel housing splash shields, three combination cap screws and lock washers.

(*b*) At ignition coil to head mounting.
(*c*) At generator regulator mounting.
(*d*) At generator mounting.
(*e*) At each bond strap.
(*f*) At each condenser.

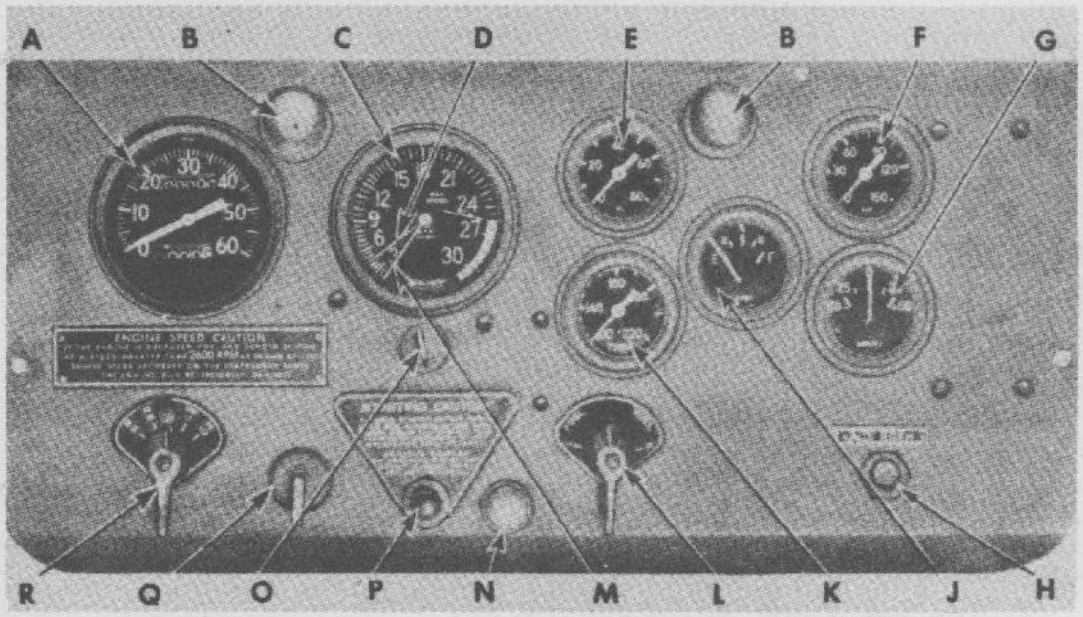
5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Section XXV

INSTRUMENTS

101. DESCRIPTION AND DATA (figs. 73 and 74).

a. Description The various instruments and gages on this vehicle are mounted on an instrument panel. The instruments or gages are replaceable individually but require either removal of the

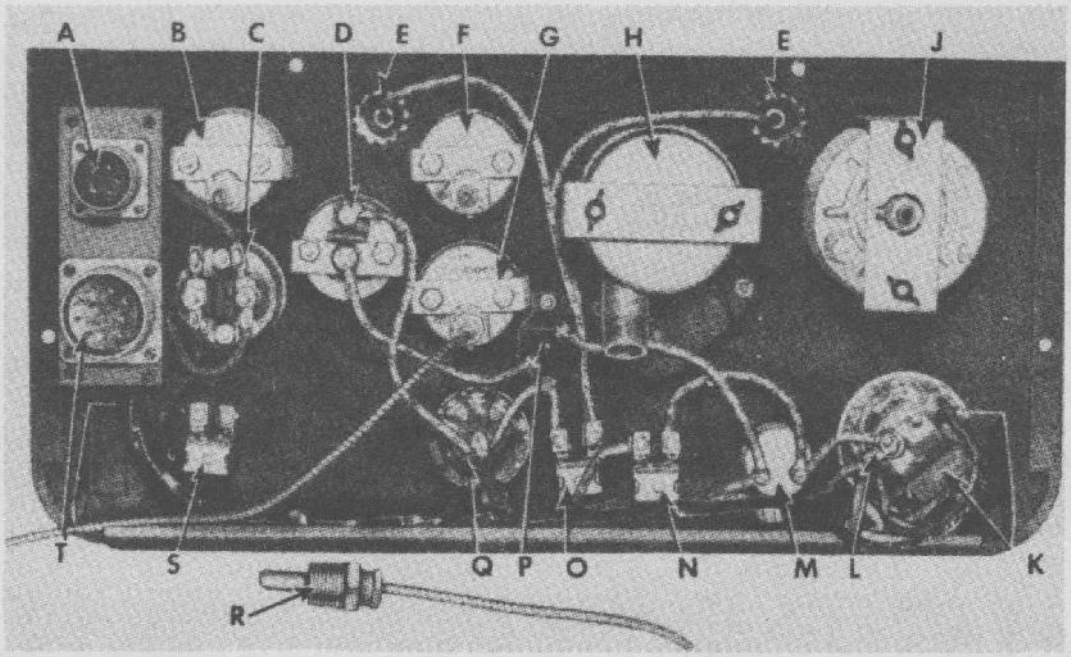


A—SPEEDOMETER
B—INSTRUMENT PANEL LIGHT
C—TACHOMETER
D—MAXIMUM REVOLUTIONS POINTER
E—OIL PRESSURE GAGE
F—AIR PRESSURE GAGE
G—AMMETER
H—AUXILIARY HORN BUTTON
J—FUEL GAGE
K—TEMPERATURE GAGE
L—FUEL GAGE SWITCH
M—REVOLUTIONS PER MINUTE POINTER
N—INSTRUMENT PANEL LIGHT SWITCH
O—TACHOMETER MAXIMUM REVOLUTIONS POINTER LOCK
P—CRANKING MOTOR CONTROL SWITCH BUTTON
Q—IGNITION SWITCH
R—LIGHT SWITCH

RA PD 323418

Figure 73 — Instrument Panel Front View

INSTRUMENTS



A—AMPHENOL PLUG, CHARGING AND STARTING

B—AIR PRESSURE GAGE

C—AMMETER

D—FUEL GAGE

E—INSTRUMENT PANEL LIGHT

F—OIL PRESSURE GAGE

G—TEMPERATURE GAGE

H—TACHOMETER

J—SPEEDOMETER

K—CIRCUIT BREAKER, LIGHT SWITCH

L—LIGHT SWITCH

M—IGNITION SWITCH

N—CRANKING MOTOR CONTROL SWITCH BUTTON

O—INSTRUMENT PANEL LIGHT SWITCH

P—CIRCUIT BREAKER, FUEL GAGE

Q—FUEL GAGE SWITCH

R—TEMPERATURE GAGE BULB

S—AUXILIARY HORN BUTTON

T—AMPHENOL PLUG, CHASSIS WIRING

RA PD 323419

Figure 74 — Instrument Panel Rear View

panel from the case or tilting the panel forward to afford access to the backs of the various items. The various items on this panel are as follows:

(1) SPEEDOMETER. The speedometer is of dial type graduated 0 to 60 miles per hour. Total mileage up to 99,999 miles and trip mileage up to 999 miles are recorded on totalizers. The speedometer is driven by a flexible drive shaft. A trip mileage totalizer reset button is located in back and at the bottom of the instrument.

(2) TACHOMETER. The tachometer is graduated in hundreds of engine revolutions from 0 to 3,100 revolutions per minute. It incorporates a maximum speed needle which automatically records the maximum engine speed attained during operation. This needle

can only be reset to zero by inserting and turning a key in the tachometer.

(3) OIL PRESSURE GAGE. The oil pressure gage is graduated from 0 to 80-pound pressure. It is of pressure type and is connected to the engine by a tube and flexible line.

(4) AIR PRESSURE GAGE. The air pressure gage registers the amount of air pressure in the air brake system and is connected to the air appliance panel by tubing. It is graduated from 0 to 150-pound pressure per square inch.

(5) AMMETER. The ammeter is designed to indicate a charging or discharging condition of the electrical system. It is graduated —50, —25, 0, +25, +50. Readings toward the left hand or minus side indicate total current discharge of the battery. Readings toward the right or plus side indicate net current charge to the battery. The total output of the generator is not indicated by the ammeter readings.

(6) FUEL GAGE. The fuel gage is graduated E (empty), ¼, ½, ¾, F (full), and is designed to indicate the amount of gasoline in the fuel tank being checked as controlled by the fuel gage indicator switch on the panel. Either the right-hand or left-hand tank can be read as selected.

(7) TEMPERATURE GAGE. The engine temperature gage or heat indicator registers the temperature of the engine coolant. The gage is graduated from 100°F to 220°F with the figures 100, 140, 180, 200, and 220. It is attached to the engine by a tube which is a part of the gage.

(8) LIGHT SWITCH. The light switch which controls the service and blackout lights is of rotary type. When the switch is turned counterclockwise, the blackout lighting equipment becomes operative. When turned clockwise, the service lights become operative. To permit turning the switch toward the service light position, or from BO-MK to BO-DR, it is necessary to depress the lock button above the switch. This design prevents accidental showing of lights during blackout driving conditions. Lights operative in the various positions marked on the switch are as follows:

(*a*) *BO-DR.* This is the blackout driving light position. Only the blackout driving light and blackout stop lights and blackout taillights are operative.

(*b*) *BO-MK.* This position permits operation of the blackout marker lights, blackout stop lights, and blackout taillights.

(*c*) *OFF.* In this position, no lights are operative.

(*d*) *STOP-LT.* In this position of the switch, attainable only after depressing the stop button while turning the switch, only the service stop lights are operative.

(*e*) *HD-LTS.* In this position at the extreme right of the switch, the service head lights, service stop lights, and service taillights are operative.

(9) IGNITION SWITCH. No ignition switch key is required as the ignition switch is of lever type. In the vertical position, the

ignition is "OFF". When turned clockwise, the ignition is "ON".

(10) CRANKING MOTOR CONTROL SWITCH BUTTON. The magnetic switch on the cranking motor is operated by pushing in on the control button on the instrument panel. NOTE: *Release the button the instant the engine starts.*

(11) INSTRUMENT PANEL LIGHTS. The instrument panel illumination is provided by two instrument panel lamps which are shielded. These lamps are controlled by a panel light switch. When in position in against the panel, the lights are inoperative. When the switch is pulled out, the lights go on.

(12) AUXILIARY HORN BUTTON. On the Model H-542-9 vehicles equipped with an auxiliary horn, a separate horn button is provided on the instrument panel, located at the right-hand side below a plate reading "AUX HORN".

b. The instrument panel with gages and instruments is held in position on the dash by one screw at each end of the panel and two screws at the top of the panel. Removal of these four screws will permit the panel to be tilted out of the case for inspection or service. Complete removal also requires disconnecting wiring plugs, air line, etc., and removal of two hinge cap screws (par. 102).

c. Data.

(1) SPEEDOMETER.

Make.....Stewart-Warner
Model.....590-AB

(2) TACHOMETER.

Make.....Stewart-Warner
Model.....424-CV

(3) TACHOMETER LOCK.

Make.....Stewart-Warner
Model.....400290

(4) TEMPERATURE GAGE.

Make.....Stewart-Warner
Model.....442080-45

(5) OIL PRESSURE GAGE.

Make.....Stewart-Warner
Model.....444063

(6) FUEL GAGE.

Make.....Stewart-Warner
Model.....441023

(7) AIR PRESSURE GAGE.

Make.....Stewart-Warner
Model.....44068

(8) AMMETER.

Make.....Stewart-Warner
Model.....440047

(9) FUEL GAGE SELECTOR SWITCH.

Make.....Stewart-Warner or Douglass
Model.....SW-BEX-91317 or Douglass-6331

102. REMOVAL.

a. Instrument Panel.

(1) Remove two screws at ends of panel and two screws at top of panel, and tilt panel forward.

(2) Exhaust air from air brake system by opening drain cock at each reservoir.

(3) Disconnect air line at air pressure gage.

(4) Disconnect oil pressure line from oil pressure gage.

(5) Disconnect water temperature tube from engine, and pull through felt grommet at cowl.

(6) Disconnect speedometer drive shaft at back of speedometer.

(7) Disconnect tachometer drive shaft at rear of tachometer.

(8) Unscrew caps, and disconnect two amphenol plug connectors.

(9) Remove two cotter pins and nuts from hinge cap screws, and lift instrument panel from position.

b. Speedometer.

(1) Disconnect speedometer drive shaft at rear of speedometer.

(2) Remove two mounting bracket screw nuts, and remove bracket.

(3) Remove speedometer from front of panel.

c. Tachometer.

(1) Disconnect tachometer drive shaft at rear of tachometer.

(2) Remove two nuts from lock cover, and remove cover.

(3) Remove two mounting screw nuts from back of instrument, and remove bracket.

(4) Remove tachometer from front of panel.

d. Oil Pressure Gage.

(1) Disconnect oil pressure line from rear of instrument.

(2) Remove two nuts from mounting screws, and remove mounting bracket.

(3) Remove oil pressure gage from front of panel.

e. Air Pressure Gage.

(1) Exhaust air from air brake system by opening drain cock at each reservoir.

(2) Disconnect air line at back of pressure gage.

(3) Remove two nuts from mounting screws, and remove bracket.

(4) Remove air gage from front of panel.

f. Ammeter.

(1) Disconnect wiring from ammeter, removing two terminal screw nuts.

(2) Remove mounting bracket.

(3) Remove ammeter from front of panel.

g. Fuel Gage.

(1) Disconnect ignition switch to fuel gage wire and disconnect fuel tank to gage wire at gage terminals by removing terminal nuts.

(2) Remove two mounting screw nuts from screws, and lift off bracket.

(3) Remove fuel gage from front of panel.

h. Temperature Gage.

(1) Disconnect temperature gage tube from engine, and pull through felt grommet at cowl.

(2) Remove two nuts from gage mounting screws, and remove bracket.

(3) Remove gage and tube from front of panel.

i. Fuel Gage Selector Switch.

(1) Disconnect wiring at switch terminal screws.

(2) Remove screw from switch handle lever, and remove switch lever from post.

(3) Remove lock nut and lock washer from switch at front of panel.

(4) Remove switch through rear of panel.

j. Instrument Panel Light Switch.

(1) Disconnect wires at panel light switch terminals.

(2) Remove screw from switch knob, and remove knob.

(3) Remove lock nut and lock washer from front of panel.

(4) Remove panel light switch from rear of panel.

k. Cranking Motor Control Switch Button.

(1) Disconnect wiring at switch terminals.

(2) Remove lock nut from switch control at front of panel.

(3) Remove button from rear of panel.

l. Ignition Switch.

(1) Disconnect wires from ignition switch terminals.

786109 O - 48 - 13

(2) Remove spanner nut from ignition switch.
(3) Remove ignition switch from rear of panel.

m. Light Switch.

(1) Disconnect wiring at switch terminals.
(2) Remove screw from switch lever at front oi panel.
(3) Remove switch lever from switch.
(4) Remove lock nut and lock washer from switch at front of panel.
(5) Remove switch from rear of panel.

103. INSTALLATION.

a. Instrument Panel.

(1) Place instrument panel in position in dash, and install two hinge cap screws, nuts, and cotter pins.
(2) Connect two amphenol plugs to mating plugs.
(3) Connect tachometer drive shaft to back of tachometer.
(4) Connect speedometer drive shaft to back of speedometer.
(5) Connect water temperature gage tube engine unit at cylinder head.
(6) Connect oil pressure line to back of pressure gage.
(7) Connect air pressure line to back of air pressure gage.
(8) Start engine and charge air brake system. Check air pressure gage connection and oil pressure gage connection for leaks. Check operation of all instruments.
(9) Lay panel in against dash, install one screw in each end of panel, and two screws at top of panel.

b. Speedometer.

(1) Insert speedometer through panel from front.
(2) Install mounting bracket and two mounting screw nuts.
(3) Connect speedometer drive shaft to rear of speedometer

c. Tachometer.

(1) Insert tachometer in panel from front of panel.
(2) Install mounting bracket, and install two nuts on mounting screws.
(3) Connect tachometer drive shaft at tachometer.

d. Oil Pressure Gage

(1) Insert oil pressure gage in panel from front.
(2) Install mounting bracket, and install two nuts on mounting screws.
(3) Connect oil pressure line at rear of oil pressure gage.
(4) Start engine and check for oil leaks.

e. Air Pressure Gage.

(1) Insert air pressure gage in panel from front.
(2) Install bracket, and install two nuts on mounting screws.
(3) Connect air line at rear of air gage.
(4) Start engine, charge air brake system, and check for air leaks.

f. Ammeter.

(1) Insert ammeter in panel from front.
(2) Install bracket, and install two nuts on mounting screws.
(3) Connect wiring at ammeter, and install terminal nuts.

g. Fuel Gage.

(1) Insert fuel gage in panel from front.
(2) Install mounting bracket, and install two nuts on mounting screws.
(3) Connect wires leading to ignition switch and to fuel tank to terminals.

h. Temperature Gage.

(1) Insert temperature gage in panel from front.
(2) Install mounting bracket, and install two nuts on mounting screws.
(3) Connect temperature gage tube engine unit at cylinder head.

i. Fuel Gage Selector Switch.

(1) Insert selector switch through panel from rear.
(2) Install lock washer and lock nut on switch at front of panel.
(3) Install switch lever, and install lever retaining screw.
(4) Connect wiring at switch terminal screws.

j. Panel Light Switch.

(1) Insert panel light switch in panel from rear.
(2) Install lock nut and lock washer on switch at front of panel.
(3) Install switch knob, and install knob set screw.
(4) Connect wires at switch terminals.

k. Cranking Motor Control Switch Button.

(1) Insert button in panel from rear.
(2) Install lock nut on switch control at front of panel.
(3) Connect wiring at terminals of switch.

l. Ignition Switch.

(1) Insert ignition switch in panel from rear.
(2) Install spanner nut on switch at front of panel.
(3) Connect wires to terminals of switch.

m. Light Switch.

(1) Insert light switch in panel from rear.

(2) Install lock nut and lock washer on switch at front of panel.

(3) Install switch lever on switch, and install lever retaining screw.

(4) Connect wiring at terminals of switch.

Section XXVI

WIRING HARNESS

104. WIRING AND CIRCUIT DIAGRAMS.

a. Wiring. The electrical wiring of this vehicle consists of six wiring harness sections, comprising four complete harnesses. Two of the harnesses, the chassis harness and the engine harness, are in two sections, one section being inside the instrument panel and the other section outside. The connection at the instrument panel is by means of quickly detachable connectors known as amphenol plugs. The other two harnesses are the generator regulator harness and the headlight harness.

b. Circuit Diagrams. To facilitate servicing of the vehicle, the circuit diagram for this tractor truck has been broken down into three main divisions shown in figures 75, 76, and 77. These circuit diagrams illustrate not only the instruments and electrical accessories, but also illustrate the wiring diagram of the particular circuit. The small letters at the amphenol plugs in the diagrams indicate the letter stamping to be found on the amphenol plugs themselves to facilitate proper wiring connection for service repair should such be necessitated. The three main subdivisions into which the electrical system is subdivided in this manual are outlined below:

(1) STARTING AND CHARGING CIRCUIT (fig. 75). This diagram illustrates the connections from the cranking motor switch button and ignition switch through the instrument panel inner harness to the amphenol plug, then through the outer harness to the battery, cranking motor, ignition coil, distributor, and spark plugs. It also illustrates the generator regulator harness from regulator to generator and to instrument panel.

(2) LIGHTING AND HORN CIRCUIT (fig. 76). This diagram illustrates the wiring from the lighting switches through the inner harness to the amphenol plug, then through the outer harness to the lighting and horn accessories.

(3) INSTRUMENT CIRCUIT (fig. 77). This diagram traces the wiring from the instrument panel through the amphenol plug, then through the outer harness section to the instrument accessories.

c. Circuit Breakers.

(1) DESCRIPTION. The electrical system of this vehicle is protected by circuit breakers which are of the automatic-reset type. These circuit breakers are located in the spot light circuit (on Model H-542-9), in the horn circuit, in the fuel gage circuit, and on the back of the headlight switch. There are no cartridge-type fuses on this vehicle.

No.	SIZE	CIRCUIT LABEL No.	TRACERS
1	8	4	1
2	14	12	2
3	8	5	1
4	14	14	2
16	12	3	3
17	14	1	3
18	8	4	1
19	8	2	1
20	00	7	0
21	14	11	2
22	12	15	3
23	14	13	2
24	00	6	0

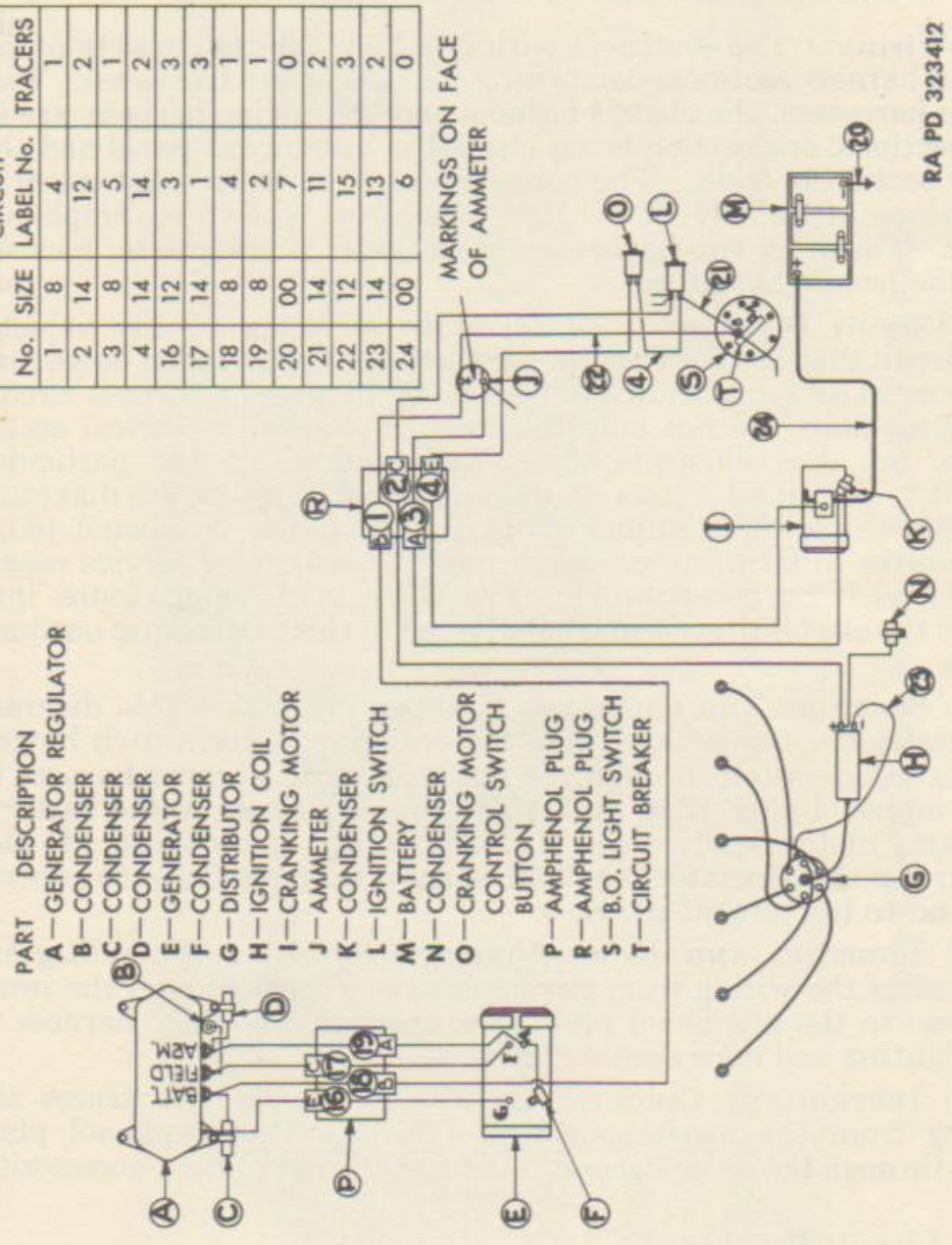
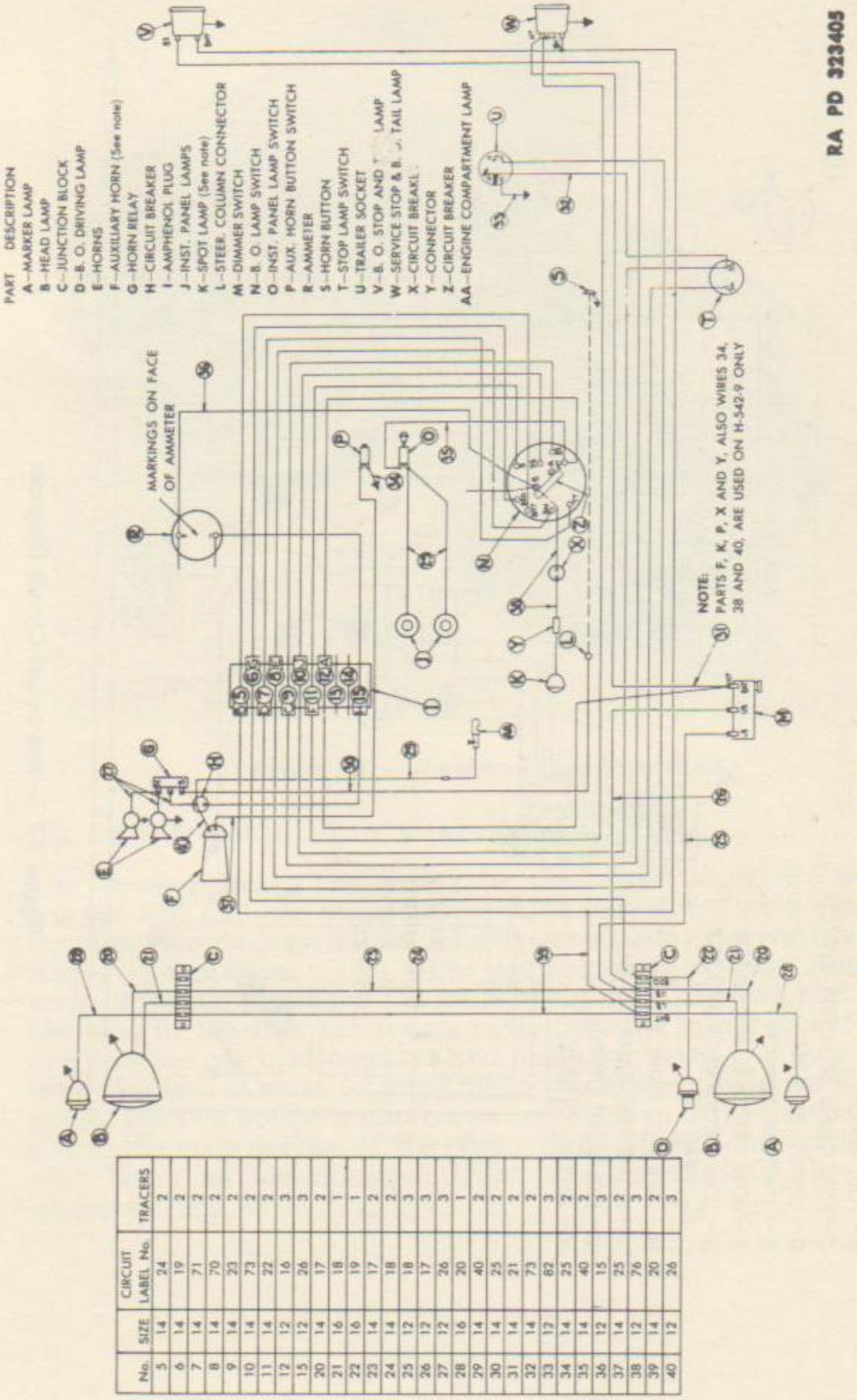


Figure 75 — Starting and Charging Circuit Diagram

WIRING HARNESS



No.	SIZE	CIRCUIT LABEL No.	TRACERS
5	14	24	2
6	14	19	2
7	14	71	2
8	14	70	2
9	14	23	2
10	14	73	2
11	14	22	2
12	12	16	3
15	12	26	3
20	14	17	2
21	16	18	1
22	16	19	1
23	14	17	2
24	14	18	2
25	12	18	3
26	12	17	3
27	12	26	3
28	16	20	1
29	14	40	2
30	14	25	2
31	14	21	2
32	14	73	2
33	12	82	3
34	14	25	2
35	14	40	2
36	12	15	3
37	14	25	2
38	12	76	3
39	14	20	2
40	12	26	3

Figure 76 — Lighting and Horn Circuit Diagram

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

No.	SIZE	CIRCUIT LABEL No.	TRACERS
13	14	28	2
14	14	29	2
16	14	74	2
17	16	79	BRAID
18	14	27	2

Figure 77 — Instrument Circuit Diagram

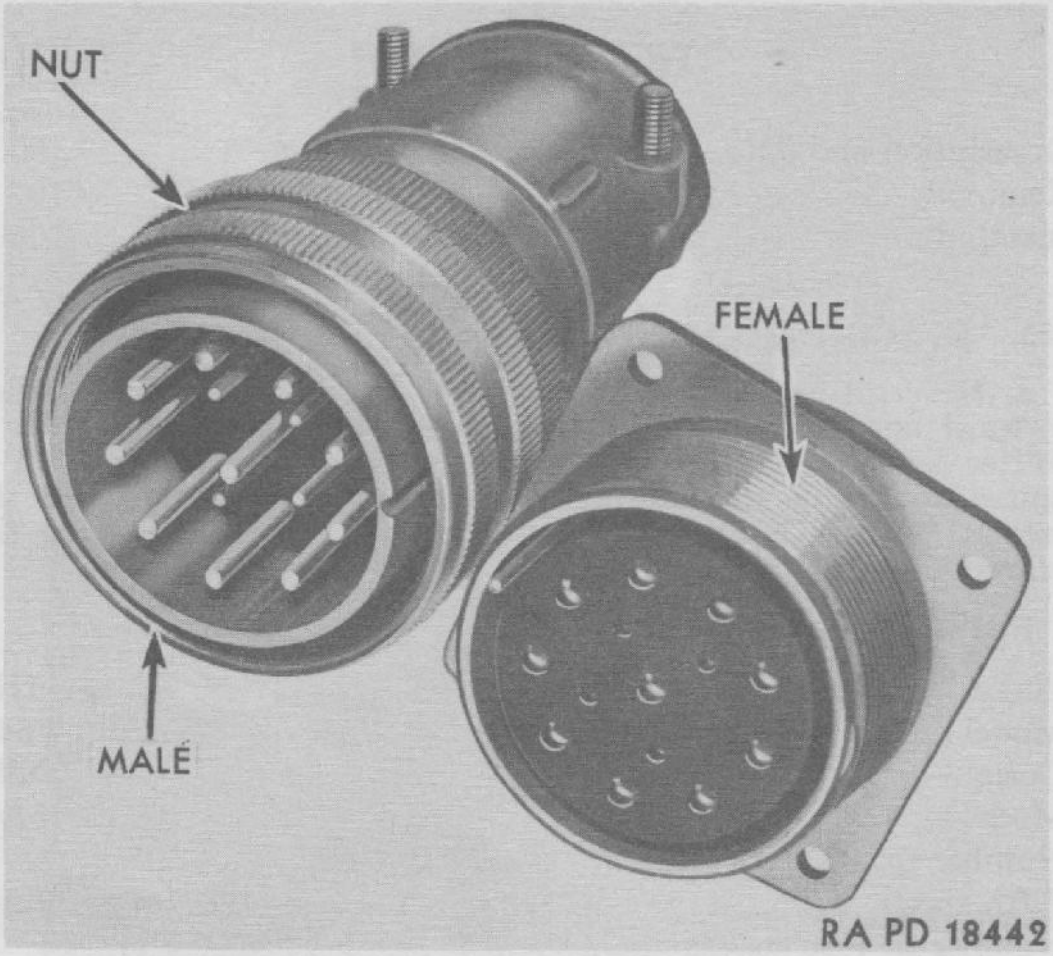


Figure 78 — Amphenol Plug Separated

105. AMPHENOL PLUGS (fig. 78).

a. Description. The wiring harness which is in two sections has the two sections connected by a quickly detachable connector coupling known as an amphenol plug, which provides corrosion-free wiring connections. The wires are soldered to their respective male or female portion of the amphenol plug. The two portions of the plug fit together much as a radio tube fits into a socket. The two sections are held together and made corrosion-free by a screw-type coupler. A small locating lug in the female portion of the plug guides the two portions into correct connection through means of a slot in the male portion of the plug. Each wiring connection in the plug bears an identification letter as illustrated in the circuit diagrams (figs. 75 to 77).

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Section XXVII

TRANSMISSION

106. DESCRIPTION AND DATA (fig. 79).

a. Description. The transmission in this vehicle has five forward speeds and one reverse speed, and is controlled by a shifter lever in the driver's compartment. The transmission is bolted to the clutch housing, which in turn is attached to the engine flywheel housing. The transmission is connected to the rear axle by the propeller shaft.

b. Data.

Make	IHC
Model	F54D
Design	Fuller
Model	5A62
Number forward speeds	5
Fifth speed	Direct
Number reverse speeds	1
Reduction ratios:	
First (low)	8.08 to 1
Second	4.67 to 1
Third	2.62 to 1
Fourth	1.5 to 1
Fifth (direct)	1.00 to 1
Reverse	8.12 to 1

107. REMOVAL.

a. Transmission Assembly. The transmission can be removed from the vehicle without disturbance of the clutch.

(1) DISCONNECT REAR PROPELLER SHAFT. Bend lock plates, and remove four cap screws from rear propeller shaft front universal joint at companion flange. Lower end of propeller shaft, and wire or tie trunnion yoke bearings to spider to prevent loss or damage.

(2) DISCONNECT FRONT PROPELLER SHAFT. Remove four cap screws from front propeller shaft universal joint trunnion yoke bearings at transmission companion flange. Lower end of propeller shaft, and tie or wire bearings to spider to prevent loss or damage.

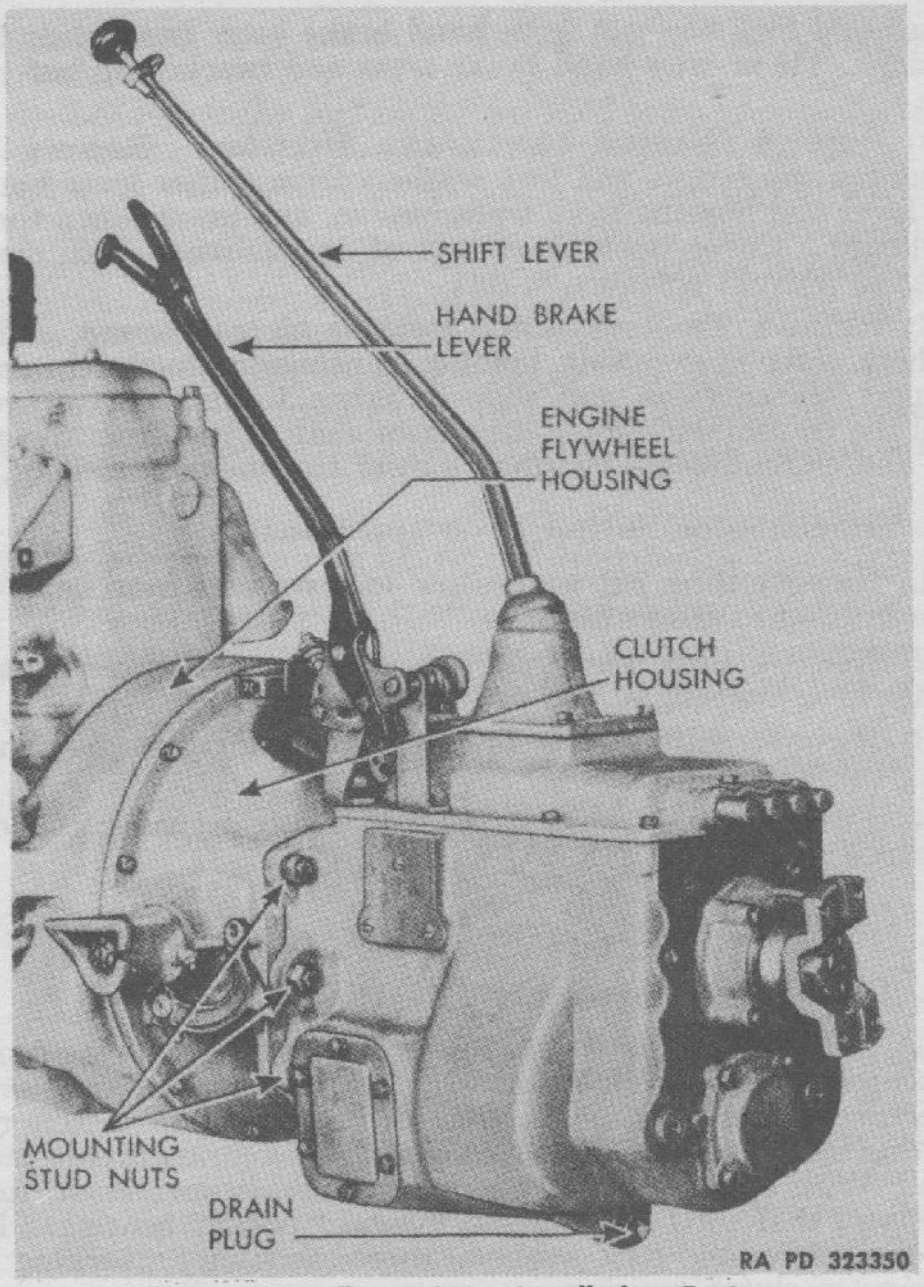


Figure 79 — Transmission Installed on Engine

(3) REMOVE FRONT PROPELLER SHAFT AND HAND BRAKE DISK.

(*a*) Unhook and remove two small tension springs from bottom of hand brake shoes.

(*b*) Remove four nuts, two each side, from four propeller shaft center bearing housing bracket bolts at frame cross member, and remove bolts.

(*c*) Lower propeller shaft, center bearing assembly, and brake disk straight down out of brake shoes.

(4) DISCONNECT SPEEDOMETER DRIVE SHAFT. Unscrew drive shaft housing coupling at rear of transmission, and disconnect speedometer drive shaft.

(5) DISCONNECT HAND BRAKE LEVER. Remove three cap

screws and lock washers from hand brake lever bracket at transmission. Tie or wire hand brake lever and bracket up out of the way.

(6) REMOVE SHIFTER LEVER AND HOUSING. Remove three remaining cap screws and lock washers from shifter lever housing. Lift lever and housing from transmission, and lower down through floorboard. Cover opening at top of transmission with cloth or paper to prevent entrance of dirt.

(7) REMOVE TRANSMISSION. Remove six cap screws and lock washers, three at each side, holding transmission to clutch housing. Support transmission and slide or move toward rear of vehicle until the transmission main drive gear shaft is free from the clutch hub and clutch release bearing. Lower transmission to floor.

b. Transmission Shifter Lever and Housing.

(1) Remove three cap screws and lock washers from hand brake lever bracket at transmission.

(2) Remove three remaining cap screws and lock washers from shifter lever housing at top of transmission.

(3) Remove shifter lever and housing from transmission, and lower through floorboard.

(4) Cover top of transmission with cloth or paper to prevent entrance of dirt.

108. INSTALLATION.

a. Transmission Assembly.

(1) INSTALL TRANSMISSION IN POSITION. Raise transmission into position behind clutch housing. Move transmission forward, inserting transmission main gear drive shaft into clutch release bearing and guiding it into the splines of the clutch driven member hub. With splines properly indexed, move transmission forward to insert shaft end into engine flywheel pocket bearing. Install six cap screws and lock washers, three each side, attaching transmission to clutch housing.

(2) INSTALL SHIFTER LEVER AND HOUSING. Raise shifter lever and housing up through floorboard. After installing new gasket, place housing on transmission, being careful that end of lever enters shifter fork opening. Install three cap screws and lock washers in transmission shifter housing cover. Do not install in left front hole.

(3) INSTALL HAND BRAKE LEVER. Connect hand brake lever bracket at transmission, installing three cap screws and lock washers.

(4) Connect speedometer drive shaft at rear of transmission, and connect drive shaft housing, tightening nut.

(5) INSTALL FRONT PROPELLER SHAFT IN POSITION.

(*a*) Raise front propeller shaft, center bearing assembly, and

hand brake disk into position, sliding brake disk up between brake shoes.

(*b*) Install four bolts and nuts, two each side, in propeller shaft housing trunnion bearing brackets at frame cross member.

(*c*) Connect two small tension springs at bottom of brake shoes.

(6) CONNECT FRONT PROPELLER SHAFT. Remove retaining wire from bearings. Raise front propeller shaft front universal joint into position in transmission companion flange. Install four cap screws in trunnion bearing flanges.

(7) CONNECT REAR PROPELLER SHAFT. Remove retaining wire from bearings. Raise front end of rear propeller shaft into position in companion flange. Install four cap screws in trunnion bearing flanges.

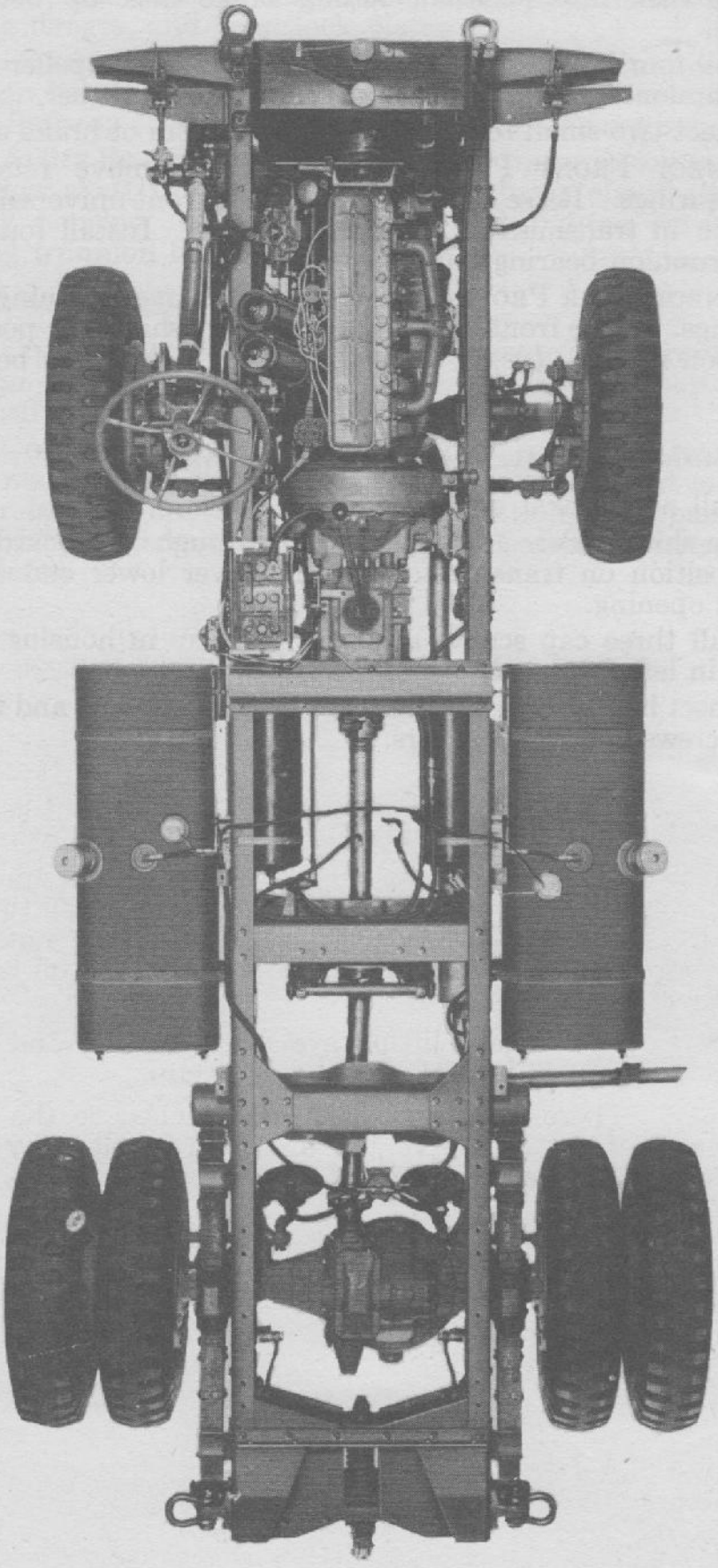
b. Transmission Shifter Lever and Housing.

(1) Install new gasket on transmission housing.

(2) Raise shifter lever and housing up through floorboard, and place in position on transmission so that lever lower end enters shifter fork opening.

(3) Install three cap screws and lock washers in housing. Do not install in left front hole.

(4) Connect hand brake lever bracket to transmission, and install three cap screws and lock washers.



RA PD 323406

Figure 80 — Chassis Frame Installed Top View

Section XXVIII

FRAME

109. DESCRIPTION (figs. 80 and 81).

a. General. The frame of this vehicle consists of two frame side rails adequately braced by front, rear, and intermediate crossmembers. The crossmembers are attached to the side rails by gusset plates. No rivets are used in the frame either for crossmember or bracket attachment. Body fit bolts with nuts and lock washers are used.

b. Pintle Hook. A pintle hook is installed in rear crossmember of the frame for the purpose of attaching towed loads.

(1) REMOVAL. Remove cotter pin from large pintle hook nut. Remove nut and flat washer. Withdraw pintle hook from bracket and spring.

(2) INSTALLATION. Insert pintle hook through bracket and spring. Install large flat washer and nut. Tighten nut enough to permit installation of cotter pin.

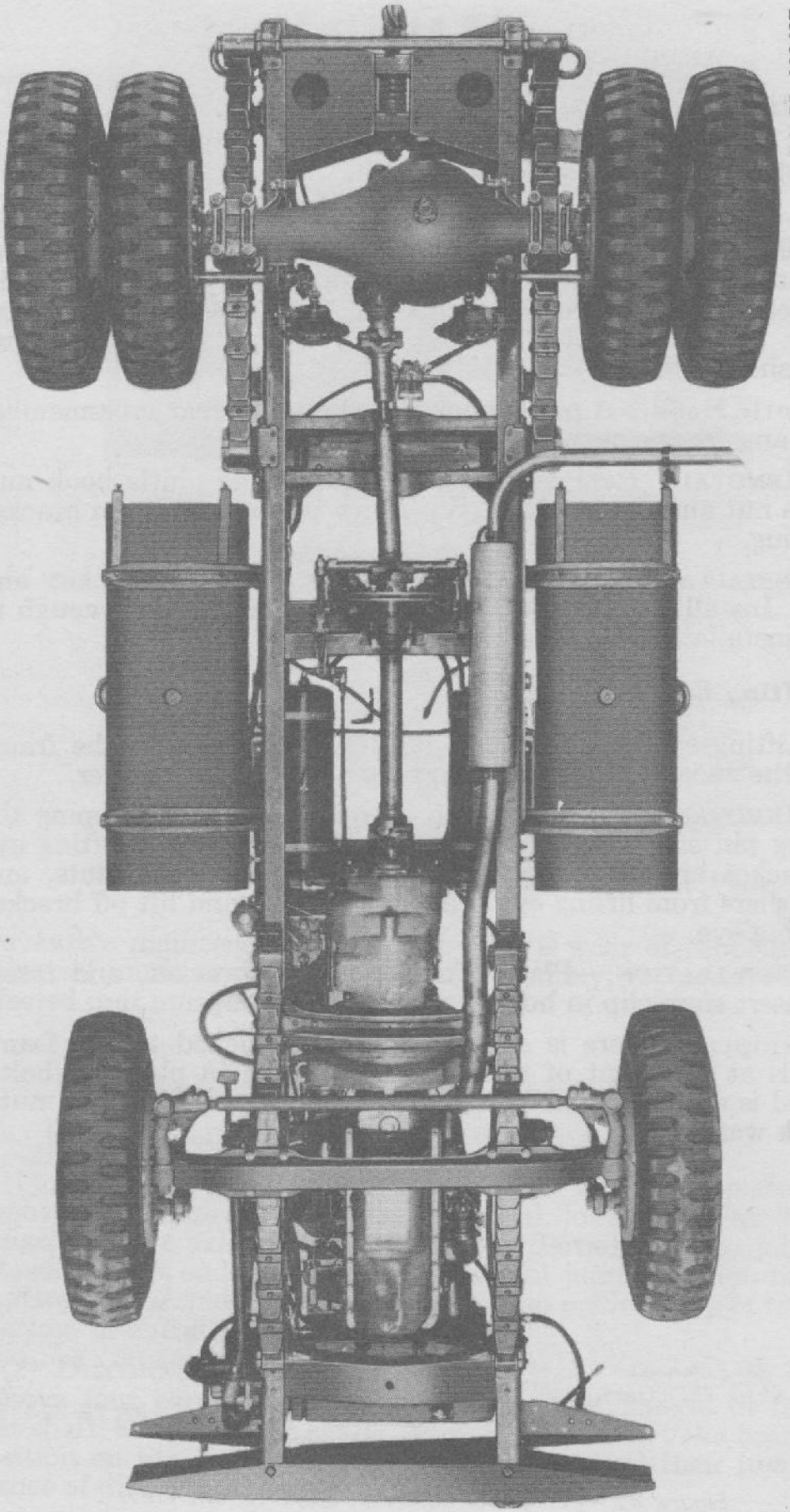
c. Lifting Eyes (Loops).

(1) Lifting eyes are installed at each rear corner of the frame and at the ends of the frame side rails at the front bumper.

(2) REMOVAL. Lifting eye can be removed by unsnapping the retaining pin snap clip and removing the pin. If the lifting eye and bracket are to be removed, remove three bolts, nuts, and lock washers from lifting eye bracket at frame, and lift off bracket and lifting eye.

(3) INSTALLATION. Place lifting eye over bracket, and insert pin. Insert snap clip in hole of pin, and close clip.

d. Bumper. There is a front bumper attached to the frame side rails at the front of the vehicle and held in place by bolts. Removal is accomplished by removal of the attaching bolts, nuts, and lock washers.



RA PD 323407

Figure 81 — Chassis Frame Installed Bottom View

Section XXIX

PROPELLER SHAFTS

110. DESCRIPTION AND DATA (fig. 82).

a. Description.

(1) Two propeller shafts are used on this vehicle, one extending from the transmission to the frame center crossmember and through the brake disk, and the other extending from the hand brake disk to the rear axle. Universal joints are used at the transmission end, at the hand brake disk, and at the rear axle. A propeller shaft slip joint is incorporated in the rear propeller shaft at the rear axle end. The propeller shafts are of tubular construction with splined slip yoke, and the universal joints have steel roller bearings.

(2) The front propeller shaft section is supported at the frame center crossmember in a propeller shaft bearing which is self-alining. This support bearing permits the use of shorter propeller shaft sections. The center bearing (fig. 83) consists of an opposed tapered roller bearing assembly, effective seals and dirt collectors, and a housing. The assembly is supported at the frame crossmember by two trunnion yokes mounted in abric insulators.

111. ADJUSTMENTS.

a. No adjustments are necessary in the propeller shaft assembly other than to keep the mounting cap screws and bolts tight. If

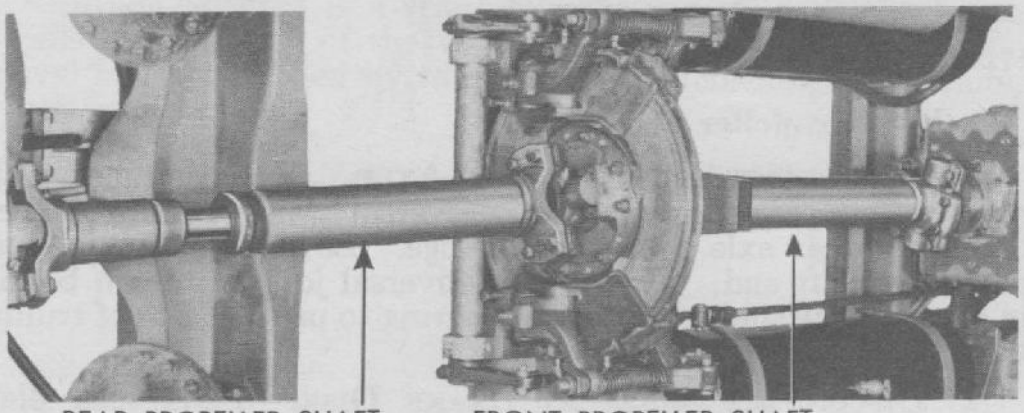


Figure 82 — Propeller Shafts Installed Bottom View

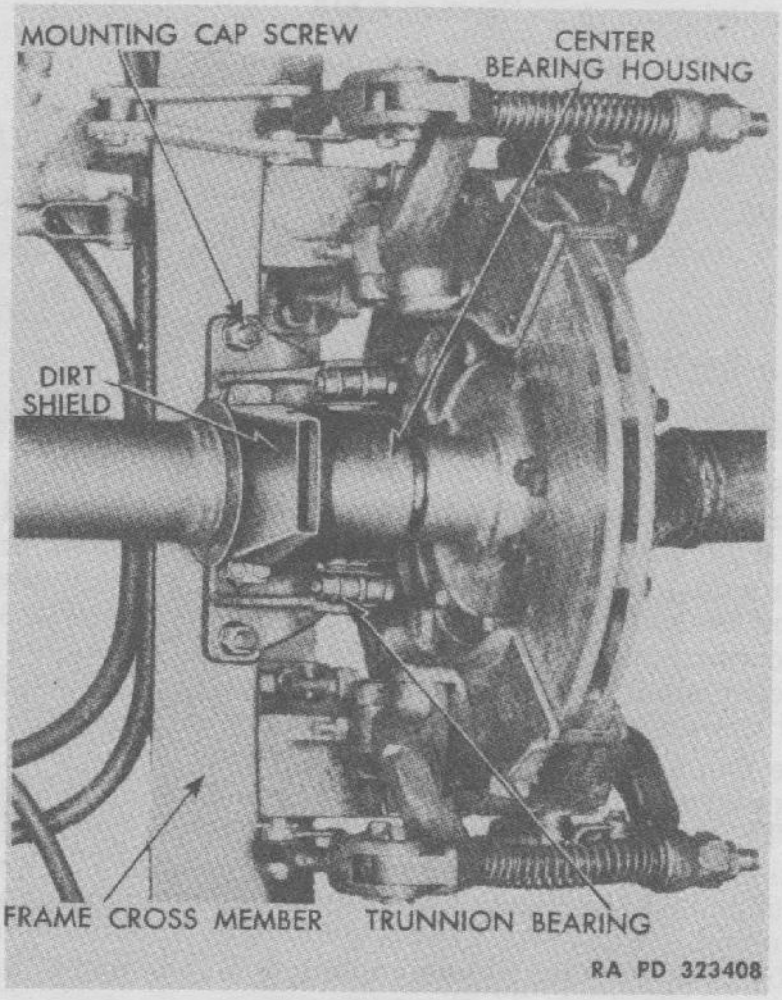


Figure 83 — Propeller Shaft Center Bearing Bottom View

preventive maintenance inspection reveals wear of propeller shaft universal joints or of center bearing assembly, replacement of the affected unit must be made.

112. REMOVAL.

a. Rear Propeller Shaft.

(1) DISCONNECT SHAFT AT REAR AXLE. Bend lock plates, then remove four cap screws from universal joint trunnion bearing flanges at rear axle companion flange. Lower the slip joint and propeller shaft end. Fasten the universal joint trunnion bearings in place on the spider with wire or string to prevent loss of trunnion bearings or entrance of dirt.

(2) DISCONNECT SHAFT AT BRAKE DISK. Bend lock plates, remove four cap screws from universal joint flanges at front of rear shaft, and lower the shaft. Wire the trunnion yoke bearings in position on the universal joint spider to prevent their loss or entrance of dirt.

b. Front Propeller Shaft.

(1) DISCONNECT AT TRANSMISSION. Bend lock plates, then remove four cap screws from universal joint trunnion bearing flanges at transmission companion flange. Fasten universal joint trunnion bearings in place on spider with wire or string to prevent loss of trunnion bearings or entrance of dirt.

(2) DISCONNECT REAR PROPELLER SHAFT. NOTE: *Omit this operation if rear shaft has been removed.* Bend lock plates, and remove four cap screws from rear propeller shaft front universal joint trunnion bearing flanges. Lower front end of propeller shaft. Wire or tie trunnion bearings to spider.

(3) REMOVE BRAKE SHOE SPRINGS. Unhook springs, one on each side, from brake shoes.

(4) REMOVE FRONT PROPELLER SHAFT AND HAND BRAKE DISK ASSEMBLY. Remove four nuts, two on each side, from propeller shaft center bearing housing bracket to frame crossmember bolts. Lower propeller shaft and brake disk assembly straight down out of brake shoes.

(5) REMOVE SPIDER AND TRUNNIONS. Remove four trunnion bearing cap screws and special lock washers from rear end of front shaft.

(6) REMOVE COMPANION FLANGE AND BRAKE DISK. Remove cotter pin, nut, and washer. Remove flange and disk from splined shaft.

(7) REMOVE CENTER BEARING AND HOUSING ASSEMBLY. Slide bearing and housing assembly off shaft.

113. INSTALLATION.

a. Front Propeller Shaft and Center Bearing Assembly. Installation of the front propeller shaft, center bearing, companion flange, and brake disk can best be accomplished together.

(1) INSTALL CENTER BEARING END HOUSING ASSEMBLY. Slide bearing and housing onto splined shaft.

(2) INSTALL COMPANION FLANGE AND BRAKE DISK. Slide companion flange and brake disk assembly onto splined shaft. Install washer, nut, and cotter pin.

(3) INSTALL SPIDER AND TRUNNIONS. Place trunnion bearing on companion flange, and install four bolts with special lock washers.

(4) INSTALL PROPELLER SHAFT AND HAND BRAKE DISK ASSEMBLY. Raise shaft and center bearing to position, and install four bolts in frame crossmember. Install lock washers and nuts on bolts, but do not tighten. Have them merely flush.

(5) CONNECT REAR PROPELLER SHAFT. NOTE: *Omit this operation if rear propeller shaft has also been removed and must be reinstalled.* Place rear shaft front universal joint in place in brake

disk companion flange, install four cap screws in universal joint bearing flanges, and bend lock plates.

(6) CONNECT AT TRANSMISSION. Place front universal joint trunnion bearings in place in transmission companion flange, and install four cap screws and lock plates. Tighten securely, and lock.

(7) ALINE SHAFT. Start engine, place transmission in first gear, and allow shaft to run at idle speed to bring about alinement of bearing housing. Shut off engine, and tighten center bearing housing trunnion bearing nuts securely.

b. Rear Propeller Shaft.

(1) CONNECT AT BRAKE DISK. Place rear shaft front universal joint in place in companion flange, install four cap screws in universal joint bearing flanges, and bend lock plates.

(2) CONNECT AT REAR AXLE. With slip joint on rear propeller shaft, making sure that arrows on shaft and on joint are in alinement, raise slip joint universal joint to position in companion flange. Install four cap screws in universal joint bearing flanges, and bend lock plates.

Section XXX

FRONT AXLE

114. DESCRIPTION AND DATA (fig. 84).

a. Description. The front axle of this vehicle is of I-beam type with steering knuckles mounted at the ends. The axle is attached to the chassis by means of the front springs, and to the steering gear by a drag link from the steering gear arm to the front axle steering arm. The two steering knuckles are connected by a tie rod.

b. Data.

Make ..... Timken

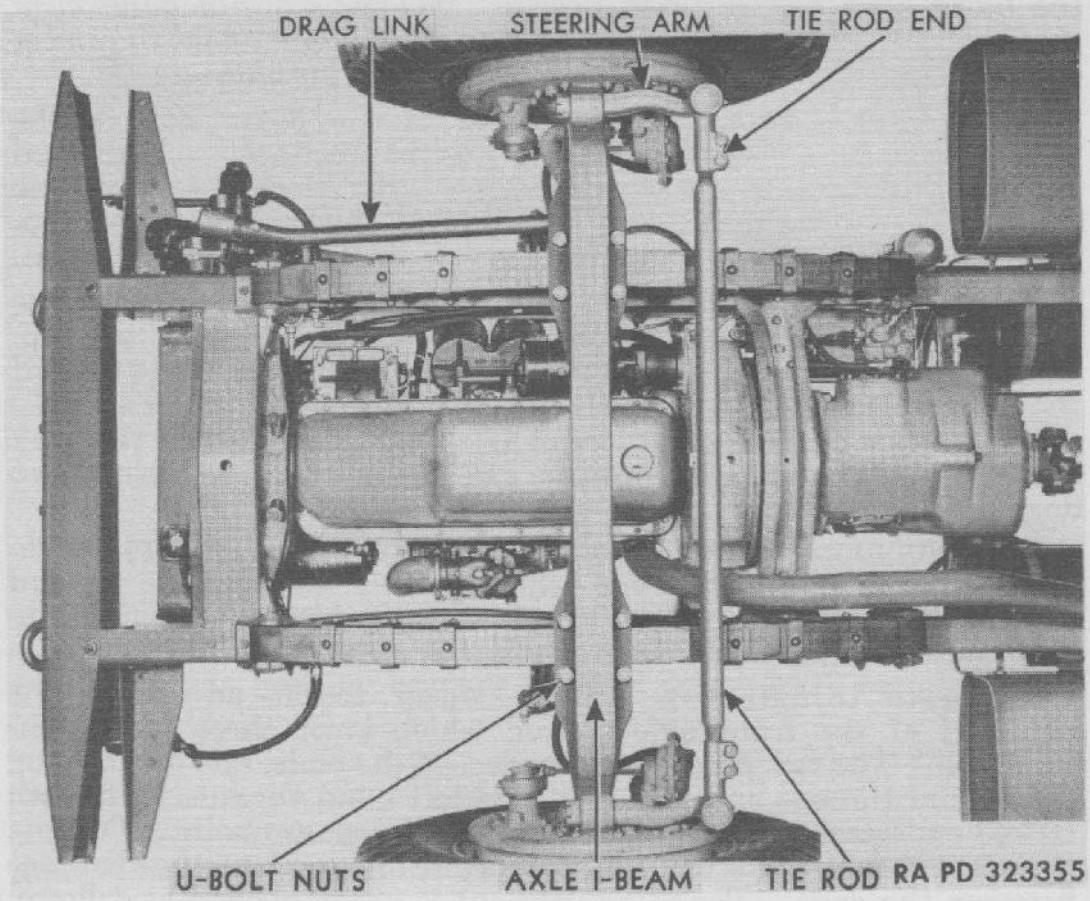


Figure 84 — Front Axle Installed Bottom View

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Model (Timken)	26450WX3
Model (IHC)	F-770
Alinement angles:	
Toe-in	1/32 to 3/32 in.
Caster	2 deg
Camber	1 deg
Kingpin inclination	8 deg

115. ADJUSTMENTS.

a. Alinement Angles. Correction of front wheel toe-in is the only adjustment which comes within the scope of this manual. The alinement angles and their purpose in the axle are, however, described below.

(1) TOE-IN. The toe-in adjustment is a setting of the front wheels so that they are closer together at the front of the axle than at the rear. The specified toe-in of the front wheels as controlled by the tie rod adjustment is 1/32 to 3/32 inch, or the measurement which will produce the least side-slip per mile. Incorrect toe-in of the front wheels will result in rapid tire wear. Excessive toe-in will produce a scuffing or "feather-edge" at the inside of the tire tread design. Toe-out will produce like wear at the outer edge of tire tread design. NOTE: *Toe-in adjustment should always be checked and corrected following any change in camber or caster angles, or after any adjustment or servicing of the tie rod.*

(2) CAMBER. Front wheel camber is the inclination of the front wheels from a vertical plane. Positive camber is an outward tilt or inclination of the wheels at the top. Negative or reverse camber is an inward tilt or inclination of the wheels at the top. The specified positive camber of these front wheels is one degree.

(3) CASTER. Axle caster is the amount of tilt of the axle knuckle pin or king pin toward the front or rear of the vehicle at the top. There is positive caster when the top of the knuckle pin tilts toward the rear. Negative caster is the result of a forward tilt of the top of the knuckle pin. The purpose of axle caster is to provide stability of steering. The specified positive axle caster of this vehicle is two degrees.

(4) KNUCKLE PIN INCLINATION. The top of the steering knuckle pin inclines inward toward the vehicle at an angle from the vertical plane. This angle is called knuckle pin or king pin inclination. The knuckle pin inclination of this axle is eight degrees.

b. Toe-in Adjustment. Front wheel toe-in adjustment is obtained at the front axle tie rod which is of three piece construction. The rod proper is threaded at the ends, one end having right-hand threads and the other end left-hand threads. The two tie rod end assemblies are locked in place by clamp bolts. Turning the tie rod will therefore either shorten or lengthen the distance between the ends. Toe-in adjustment is accomplished as follows:

(1) Inflate tires to proper and equal pressures.

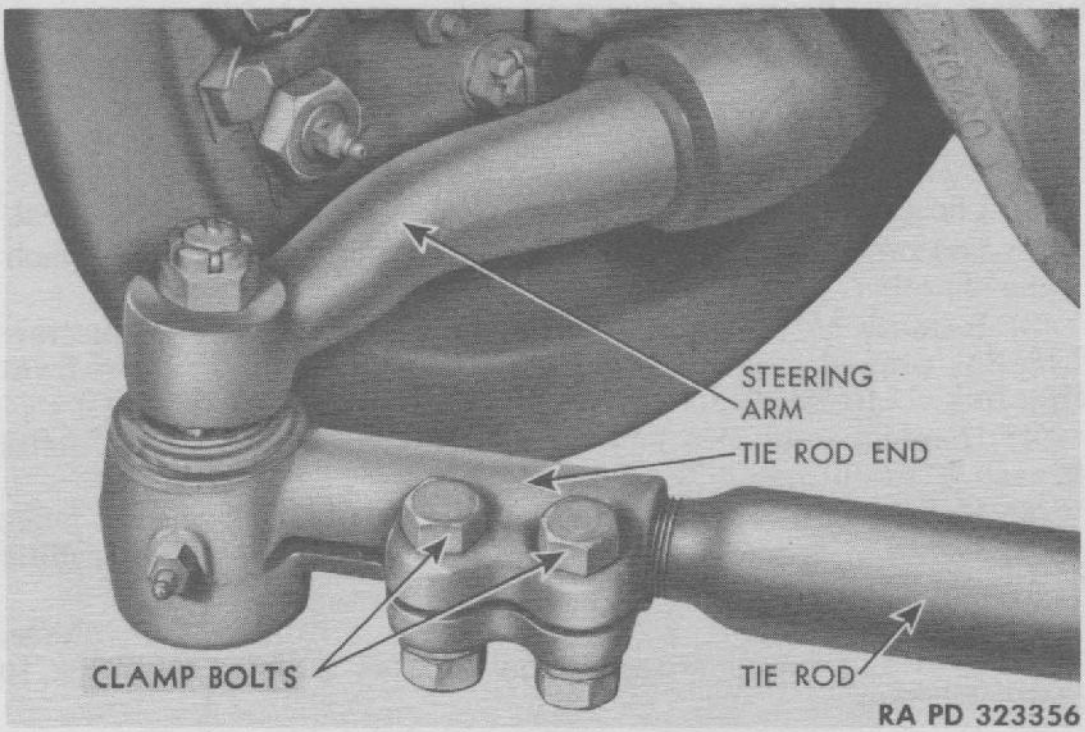


Figure 85 — Tie Rod End Installed

(2) Raise front wheels from floor so that wheels may be rotated freely.

(3) Spin wheels, and chalk the center of the tire tread of each front tire.

(4) Scribe a line on the chalked portion of the tread. This line will be continuous around the circumference of the tire if made by holding a sharp-pointed instrument in front of the tire while revolving the wheel.

(5) Lower the wheels to the floor, in a straight-ahead position. Roll vehicle forward about one foot.

(6) Measure the distance between the scribed lines at the front and rear of the tires, measuring at as near hub height as possible. NOTE: *Do not measure between tire side walls or between tire rims.* The difference between the two measurements denotes the amount of toe-in or toe-out present. The measurement at the front of the tires should be $\frac{1}{32}$ to $\frac{3}{32}$ inch less than that at the rear.

(7) Loosen the tie rod end clamp bolt nuts at each end of the tie rod (fig. 85).

(8) Turn tie rod a small amount to alter toe-in.

(9) Raise front wheels to remove vehicle weight momentarily, then lower and roll vehicle forward one foot. Recheck measurements.

(10) When adjustment of the tie rod results in a toe-in of $\frac{1}{32}$ to $\frac{3}{32}$ inch (closer at front than at rear), tighten tie rod end clamp bolts securely.

c. **Front Wheel Bearing Adjustment.** For instructions covering front wheel bearing adjustment, see paragraph 149.

116. REMOVAL.

a. Front Axle Assembly.

(1) Loosen front wheel stud nuts about ½ turn at each wheel.

(2) Disconnect front wheel brake chamber air lines at each brake chamber, one on each side.

(3) Remove cotter pin from axle end of drag link, and unscrew drag link plug at axle end. Remove dust shield and felt seal from drag link. Lift drag link end from steering arm at axle.

(4) Remove nuts and lock washers from front spring U-bolts at each front spring.

(5) Raise front end of vehicle, either with hoist or with jacks under frame at rear of front springs, sufficiently to permit rolling front axle assembly from beneath the vehicle.

(6) Roll front axle toward front and out from under vehicle. Place axle and wheel assembly on support stands, clamping to prevent rolling.

(7) Remove wheel stud nuts from each wheel, and remove tire and disk assemblies from hubs.

b. Tie Rod Assembly.

(1) Remove cotter pin and nut from tie rod end ball stud at each end of tie rod.

(2) Use puller to remove tie rod end and ball stud from steering arm at each end.

(3) Lower tie rod from axle.

117. INSTALLATION.

a. Front Axle Assembly.

(1) With front axle placed on support stands, install front tire and rim assemblies, then remove axle and wheel assembly from stand.

(2) Roll axle and wheel assembly under vehicle, and place in position below the front springs.

(3) Lower vehicle onto axle, making sure that front spring center bolt heads enter their sockets in the axle.

(4) Install U-bolts in position, and install nuts and lock washers on U-bolts at each spring. Before finally tightening the nuts, measure from the front spring front pin lubricator to the axle spring seat on each side. The measurements must be identical. Shift the axle forward or backward as necessary to accomplish this alinement. Tighten U-bolt nuts securely.

(5) Connect steering drag link at front axle steering arm, and install drag link end plug. Draw plug up snugly, then back off to

first hole, and install cotter pin. Place dust seal and dust shield around end of drag link, and lock in place.

(6) Connect air brake chamber air line at each air brake chamber. Apply brakes, and test connections for air leaks. Test with soap suds. No leak is permissible.

(7) Tighten front wheel stud nuts securely.

(8) Check front wheel toe-in adjustment, and correct if necessary (par. 115 **b**).

b. Front Axle Tie Rod.

(1) Loosen tie rod end clamp bolt nuts at each end of tie rod. This will permit ends to aline themselves.

(2) Place tie rod in position with lubricator fittings toward rear of chassis. Insert tie rod end ball studs in steering arms, install nuts securely, and install cotter pins.

(3) Adjust front wheel toe-in (par. 115 **b**).

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Section XXXI

REAR AXLE

118. DESCRIPTION AND DATA (fig. 86).

a. Description. The rear axle in this vehicle is of double-reduction, full-floating type. The differential is of inverted-bowl type mounted on top of the rear axle housing. The full-floating design permits easier servicing since axle drive shafts may be removed or installed without disturbing the wheels. The axle drive shafts carry none of the vehicle weight and are concerned only with transmitting the driving force to the wheels. The rear wheels are carried on axle tubes pressed into the axle housing. The rear axle assembly is attached to the vehicle by the rear springs and rear spring U-bolts. It is connected to the transmission and power plant by propeller shafts (par. 110).

b. Data.

Make	Timken
Model (Timken)	R-3100WX5
Model (IHC)	R-1690
Type	Double-reduction, full floating
Gear ratio	8.14 to 1.00

119. ADJUSTMENTS.

a. Alinement. There is neither camber, caster, or toe-in of wheels at the rear axle. The only phase of alinement within the scope of this manual is the alinement of the axle with the chassis. This is accomplished by measuring from the rear spring front pin lubricator to the axle spring seat at each side of the vehicle. Both measurements must be identical. If not, loosen the rear spring U-bolt nuts, and force axle forward or rearward to aline the axle, then retighten the spring U-bolt nuts.

120. REMOVAL.

a. Rear Axle Assembly. The only replacements allowable within the scope of this manual concern the axle drive shafts, wheels or wheel bearings (par. 150), brake shoes (par. 145), or brake

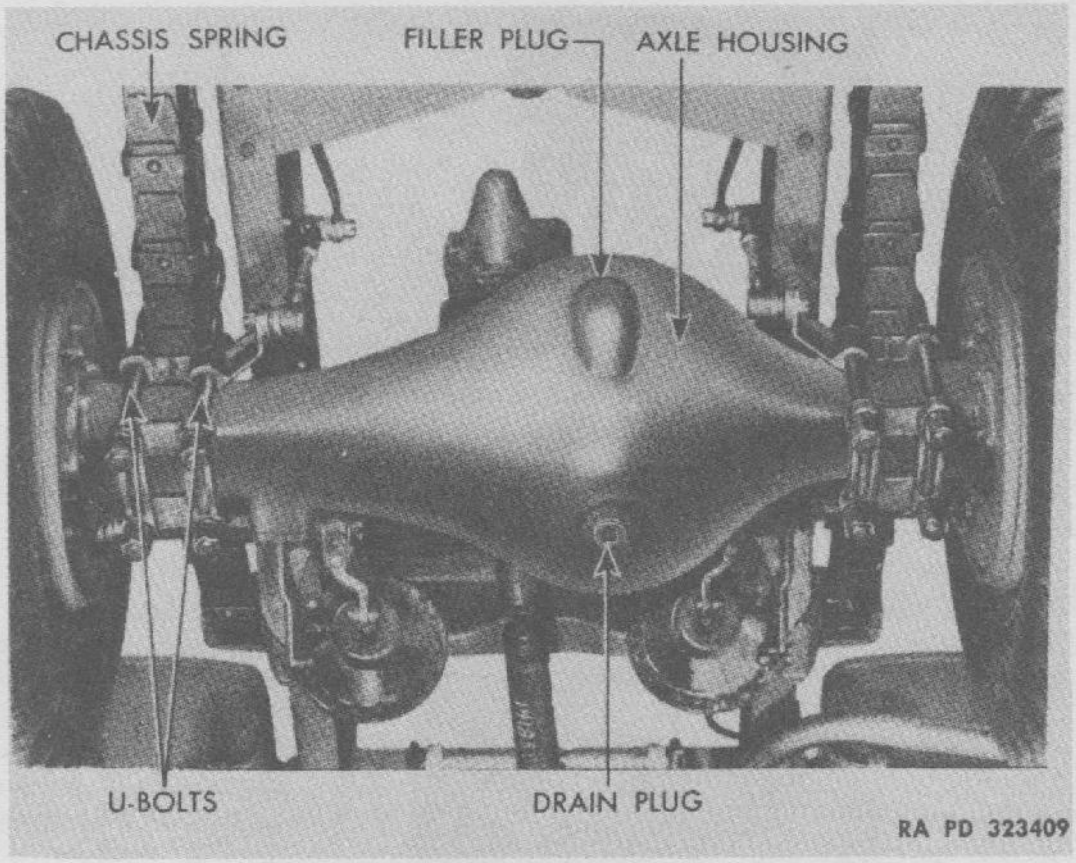


Figure 86 — Rear Axle Installed Bottom View

drums (par. 146). Any other services or replacements require complete axle assembly replacement.

(1) Loosen wheel stud nuts at each rear wheel.

(2) Loosen and remove nuts and lock washers from rear spring U-bolts.

(3) Disconnect air brake chamber air supply line at each rear axle brake chamber.

(4) Bend lock plates, and remove four cap screws from rear propeller shaft universal joint flanges at rear axle. Lower propeller shaft end to floor.

(5) Raise vehicle frame and springs from the rear axle, either with a chain hoist or with jacks beneath the frame side rails ahead of the rear spring front pins.

(6) Roll rear axle and wheels out from under the chassis, and place assembly on support stands while removing tire and disk assemblies from hubs.

b. Axle Drive Shaft (fig. 87).

(1) Remove seven nuts and lock washers from axle drive studs.

(2) Loosen lock nuts on each of two axle drive shaft flange cap screws, and screw cap screws in to force axle shaft from position.

(3) Lift axle shaft from tube.

Figure 87 — Removing Rear Axle Drive Shaft with Flange

121. INSTALLATION.

a. Rear Axle Assembly.

(1) With rear axle assembly on support stands, install tire and disk assemblies onto hubs.

(2) Roll axle assembly under vehicle, and place in position beneath the rear springs.

(3) Lower vehicle onto rear axle, making sure that rear spring center bolts rest properly in their recesses.

(4) Install U-bolts in place in rear axle, and install nuts and lock washers on U-bolts. Before tightening U-bolt nuts, check axle alinement by measuring from the rear spring front pin lubricators to the axle spring seats, and shift the axle as necessary to aline. The measurements must be identical. Tighten U-bolt nuts securely.

(5) Raise propeller shaft end, connect at rear universal joint, install four cap screws, and bend lock plates on universal joint flanges.

(6) Connect air supply line at each air brake chamber. Apply brakes, and check for leaks with soap suds. No leak is permissible.

b. Axle Drive Shaft (fig. 87).

(1) Unscrew two cap screws used for drive shaft removal until flush with inner flange surface. Insert rear axle drive shaft in axle tube, insert axle shaft splines in differential side gear splines, and push axle shaft into axle over wheel hub studs.

(2) Place hub stud cones over hub studs, and install seven nuts and lock washers on studs. Tighten nuts securely. Tighten two cap screws, and tighten lock nuts.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

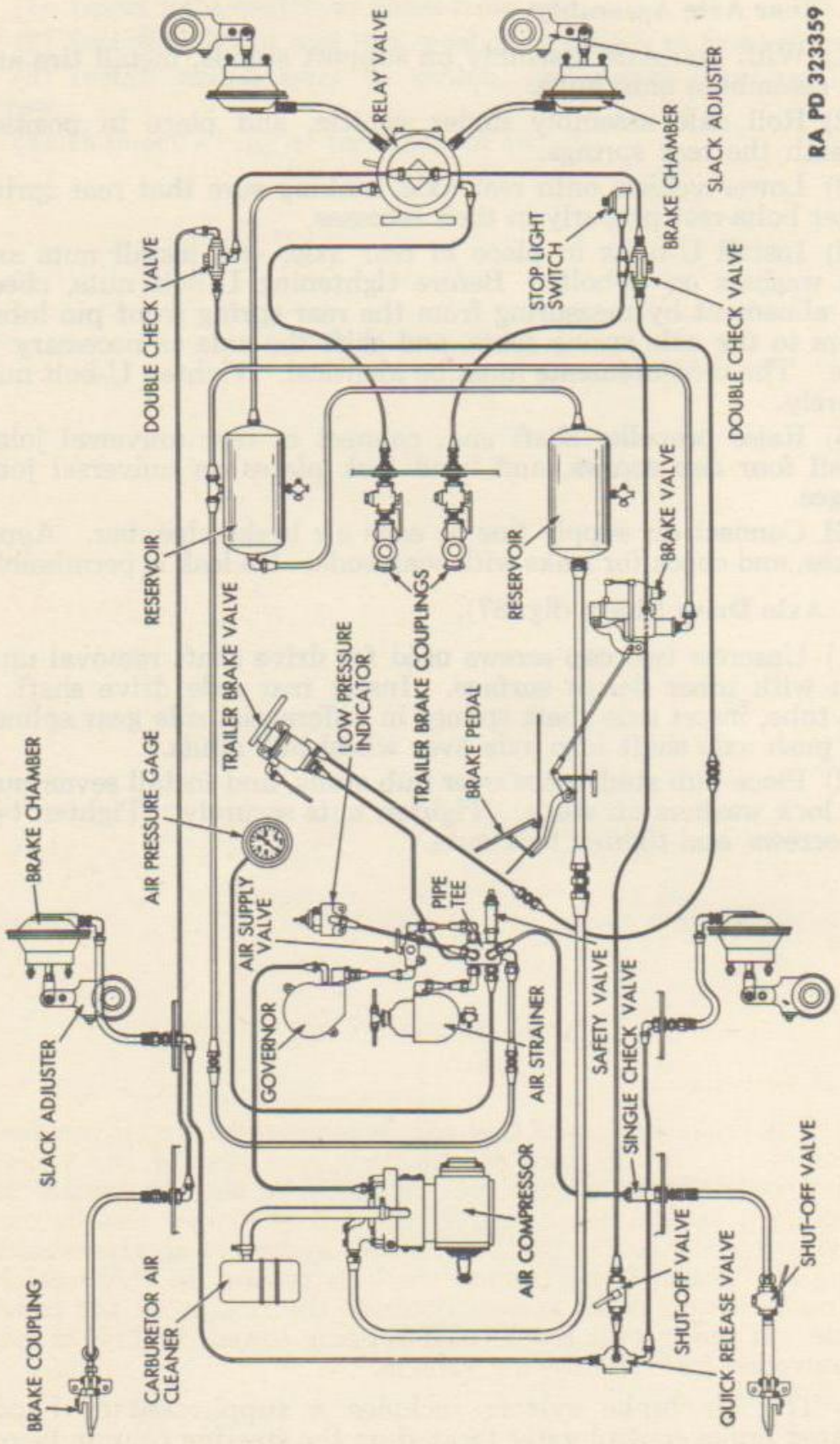


Figure 88 — Brake System Diagram

Section XXXII

BRAKE SYSTEM

122. DESCRIPTION AND DATA (fig. 88).

a. Description.

(1) The brake system of this vehicle is operated by air pressure. It includes air connections at the front and rear of the vehicle so that the air brake system may not only be used to control the brakes on a vehicle being towed but so that it may also be connected to and controlled by the air brake system of another vehicle towing it. Thus, if the tractor truck is towing another vehicle, the tractor truck brake system controls the brakes on the towed vehicle. If the tractor truck itself is being towed, its brakes may be controlled from the towing vehicle.

(2) The air brake system includes a supplementary hand-operated brake control valve located on the steering column below the steering wheel. This hand brake valve controls only the brakes

on the vehicle being towed, supplementing the foot-operated brakes on both vehicles. This independent control of the brakes on a towed load is useful under adverse road conditions when it is sometimes adviseable to apply the brakes on the towed load without applying the brakes on the towing vehicle.

b. Hand Brake. The hand brake or parking brake is a four-shoe, disk-type brake mounted on the propeller shaft and actuated by a hand lever in the driver's compartment. For additional information, see paragraph 147.

c. Data.

(1) GENERAL.

Brake type ..... Air
Make ..... Bendix-Westinghouse

(2) COMPRESSOR.

Model 2-UE-7¼-VW

(3) GOVERNOR.

Type ..... O-I
Model 215039

(4) BRAKE VALVE.

Type B-4-B
Model 220720

(5) HAND BRAKE VALVE.

Type ..... HP
Model 215304

(6) QUICK RELEASE VALVE.

Model 205000

(7) RELAY VALVE.

Model 216035

(8) SLACK ADJUSTERS.

Type:
Front ..... K
Rear ..... RB

(9) AIR SUPPLY VALVE.

Model 220282

(10) STOP LIGHT SWITCH.

Model 215537

(11) SINGLE CHECK VALVE.

Model 220306

(12) DOUBLE CHECK VALVE.

Model 217698

BRAKE SYSTEM

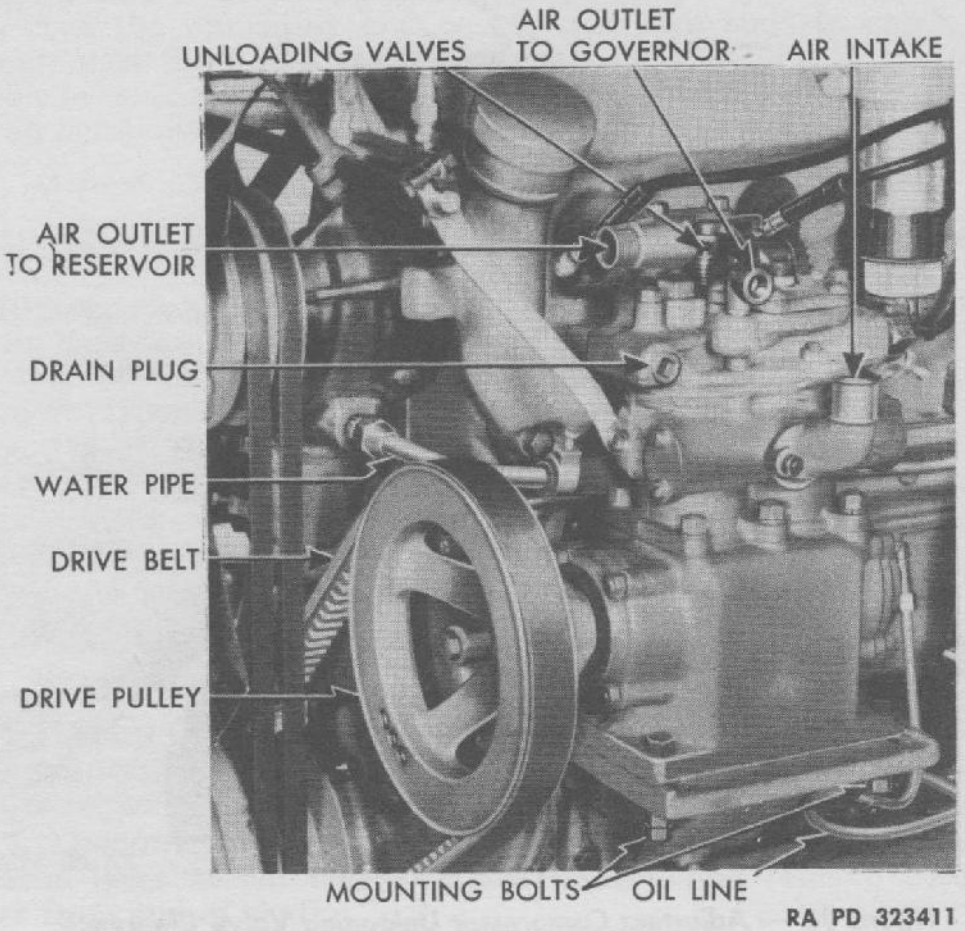


Figure 89 — Air Compressor Installed

(13) RESERVOIRS.

Number used 2
Size . . . . . 8x26 in.
Model 217321

(14) AIR PRESSURE GAGE.

Make . . . . . Stewart-Warner
Model 444068
Capacity . . . . . 150 lb

(15) LOW PRESSURE INDICATOR.

Model 215186
Cut-out pressure . . . . . 60 lb

(16) BRAKE SHOES.

Front:
  Size . . . . . 17¼x4x¾ in.
Rear:
  Size . . . . . 17¼x5½x¾ in.

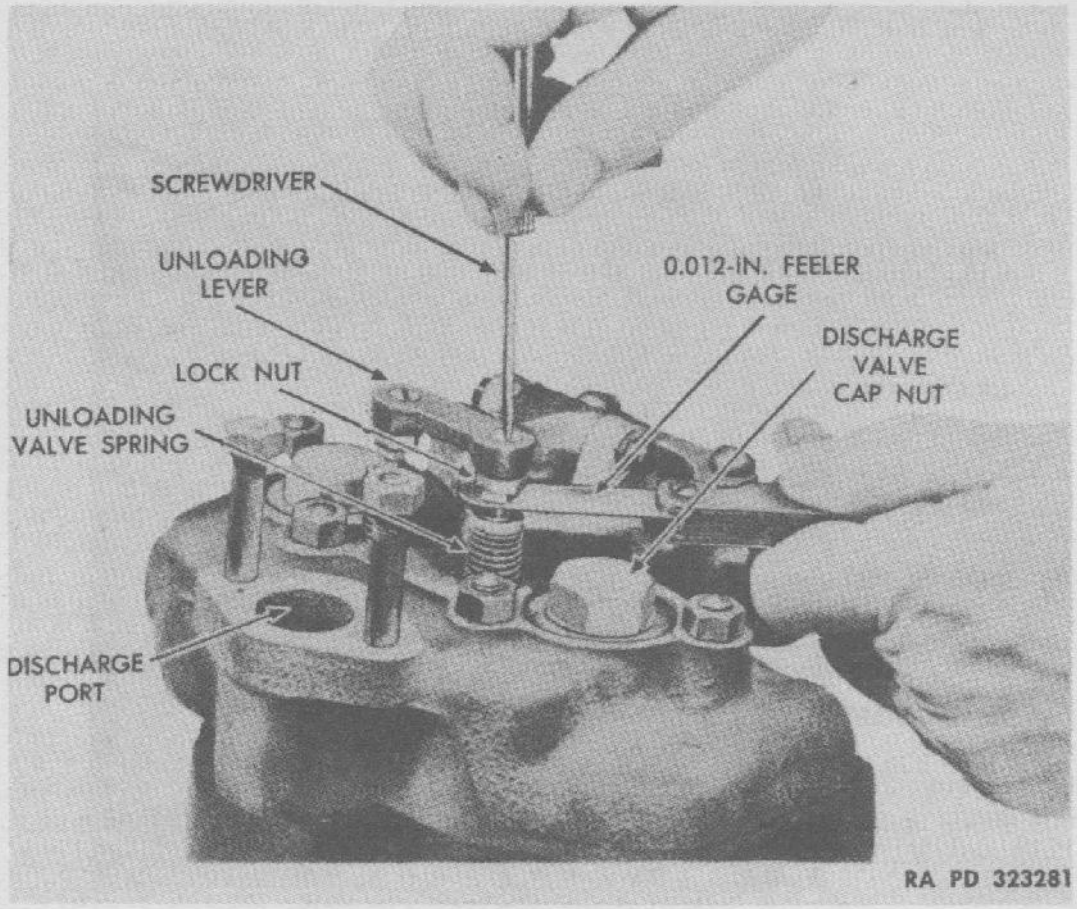


Figure 90 — Adjusting Compressor Unloading Valve Clearance

123. **COMPRESSOR** (fig. 89).

a. Description. The Bendix-Westinghouse air compressor is mounted on the left-hand side of the engine toward the front. It is a single-acting reciprocating type designed to receive its lubrication from the engine. It is water-cooled from the engine. The compressor is driven by a V-belt from the engine crankshaft pulley, and operates continuously while the engine is running. The actual compression of air is controlled by the governor.

b. Failure of the compressor to maintain normal air pressure in the air brake system of the vehicle usually denotes loss in efficiency due to wear, provided leakage in the system is not excessive. Another sign of wear is oil passing. If either of these conditions develop and inspection shows the remainder of the brake system to be in good condition, the air compressor must be replaced.

c. Leakage Tests.

(1) Excessive leakage past the discharge valves can be detected by fully charging the air brake system, then stopping the engine and carefully listening at the compressor for the sound of escaping air. This must be done in a quiet place. If air can be heard escaping inside the air compressor, the discharge valve leakage is excessive, and air compressor must be replaced.

(2) With the air brake system fully charged and governor cut out, coat the unloading box cover with soap suds to check for leakage past the unloader diaphragms. Leakage of a 3-inch soap bubble in three seconds is permissible. If excessive leakage is found, the air compressor must be replaced.

d. Adjustment.

(1) UNLOADING VALVES. Check compressor unloading valve clearance, and adjust if necessary (fig. 90). Clearance must be 0.010 inch minimum to 0.015 inch maximum. To adjust clearance, loosen lock nuts and turn adjusting screws until proper clearance is obtained. Tighten lock nuts. Clearance can only be checked when governor is cut in (compressor not unloaded).

(2) DRIVE BELT. Compressor drive belt tension must be such that ½- to 11/16-inch deflection is possible under pressure at a point midway between the compressor pulley and the crankshaft drive pulley. To adjust tension, loosen four nuts from mounting cap screws at base of compressor, and slide compressor as required to provide proper tension on belt. Tighten lock nuts securely.

e. Removal.

(1) DRAIN COOLING SYSTEM. Open radiator drain cock at lower right corner, and remove radiator cap. NOTE: *If system contains antifreeze, save solution.*

(2) DISCONNECT THROTTLE LEVER. Loosen clamp screw nut at throttle lever at left end of throttle shaft, and remove throttle lever from end of shaft.

(3) Loosen hose clamp at air brake elbow on compressor head. Remove hose from compressor.

(4) Disconnect air line from compressor to governor, and remove line from compressor.

(5) DISCONNECT AIR SUPPLY LINE. Unscrew air supply line connection at compressor, and at fitting on left-hand frame side rail. Remove clip retaining bolt and nut from line at frame, and remove air supply line from compressor.

(6) DISCONNECT WATER HOSE AT COMPRESSOR. Loosen water inlet hose clamp at compressor elbow, and remove hose from compressor. Loosen air compressor water outlet hose clamp screw at compressor.

(7) DISCONNECT OIL PRESSURE LINES. Disconnect oil pressure gage line and air compressor oil feed line at compressor tee fitting.

(8) REMOVE COMPRESSOR. Remove double nuts and lock washers from each of four compressor to compressor bracket bolts, and remove bolts. Remove drive belt from pulley, and lift air compressor from engine.

f. Installation.

(1) INSTALL COMPRESSOR. Place air compressor in position on compressor to engine mounting bracket. Install four mounting bolts, and loosely install one nut and lock washer on each bolt.

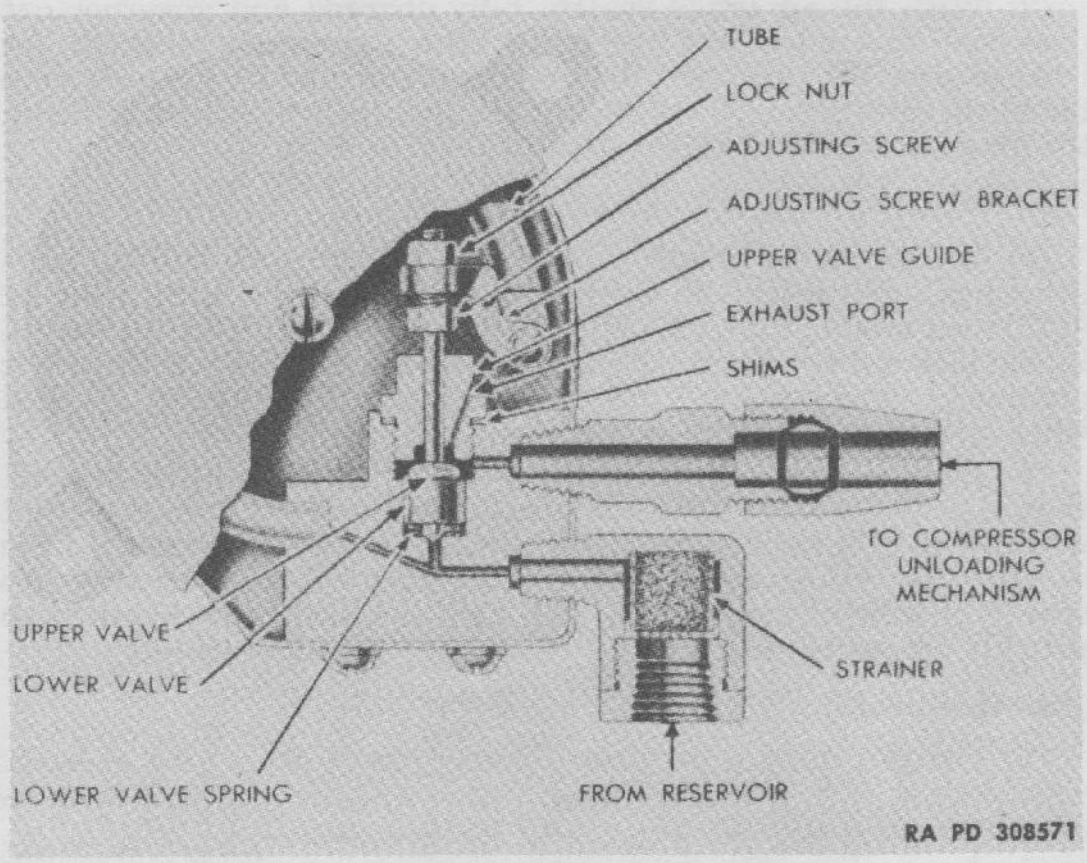


Figure 91 — Governor Sectional View

(2) INSTALL DRIVE BELT. Place drive belt in pulley groove. Move compressor away from engine to provide a tension to belt such that a ½-inch depression can be made in the belt at a point midway between the compressor and crankshaft drive pulleys. Tighten nuts securely, then install and tighten four lock nuts.

(3) CONNECT OIL PRESSURE LINES. Connect oil pressure gage line and air compressor oil feed line at compressor tee fitting.

(4) CONNECT WATER HOSE AT COMPRESSOR. Connect water inlet hose to compressor elbow, and tighten clamp screws. Connect water outlet hose to air compressor, and tighten hose clamp screw.

(5) CONNECT AIR SUPPLY LINE. Connect air supply line at air compressor and at frame fitting at left-hand side rail. Install clip retaining bolt, and tighten connections.

(6) Connect air line from compressor to governor at compressor.

(7) CONNECT THROTTLE LEVER. Place throttle lever in position on end of throttle shaft. Install bolt, nut, and lock washer.

(8) Connect air intake hose at elbow of compressor, and tighten hose clamp screw.

(9) FILL COOLING SYSTEM. Close radiator drain cock, and refill cooling system.

(10) Start engine, charge brake system, and check all air, water, and oil connections at compressor for leaks.

124. GOVERNOR (fig. 91).

a. Description. The governor is mounted on the air appliance panel on the dash. The purpose of the governor is to control automatically the air pressure being maintained in the reservoirs of the air brake system by the compressor. Although the compressor runs continuously, actual compression of air is controlled by the governor which, acting in conjunction with the compressor unloading mechanism, stops or starts compression when the maximum pressure in the reservoirs of 100 to 105 pounds or minimum pressure of 80 to 85 pounds is reached.

b. Operating Tests.

(1) With the engine running, build up air pressure in the air brake system and observe at what pressure registered by the dash gage the governor cuts out, stopping further compression. The governor must cut out when the dash gage registers between 100 and 105 pounds.

(2) With the engine running, slowly reduce the air pressure in the system by applying and releasing the brakes and observe at what pressure, registered by the gage, the governor cuts in and compression is resumed. The governor must cut in between 80 and 85 pounds.

(3) Before condemning or adjusting the pressure settings of the governor, be sure that the dash gage is registering accurately. This may be checked by connecting an accurate test gage to the rear emergency line and comparing the pressure registered by the dash gage with the pressure registered by the test gage.

c. Adjustment. When necessary, the pressure settings (cut-in and cut-out pressures) may be adjusted after removing the governor cover. The pressure setting is raised by loosening the adjusting screw lock nut and turning the adjusting screw clockwise (fig. 91). Pressure setting may be lowered by turning the adjusting screw counterclockwise. The lock nut must be tightened after every adjustment. Reinstall governor cover. If the governor can not be adjusted to proper cut-in and cut-out pressures, it must be replaced.

d. Leakage Tests.

(1) Remove cover. With governor in its cut-out position, test for leakage by applying soap suds to the exhaust port. Leakage in excess of a one-inch soap bubble in three seconds is not permissible.

(2) With the governor in its cut-in position, test for leakage by applying soap suds to the exhaust port. Leakage in excess of a one-inch soap bubble in three seconds is not permissible.

(3) If leakage in excess of a one-inch soap bubble in either of the above tests is found, the governor must be replaced.

(4) Install cover after making tests.

e. Removal.

(1) Drain air brake system.

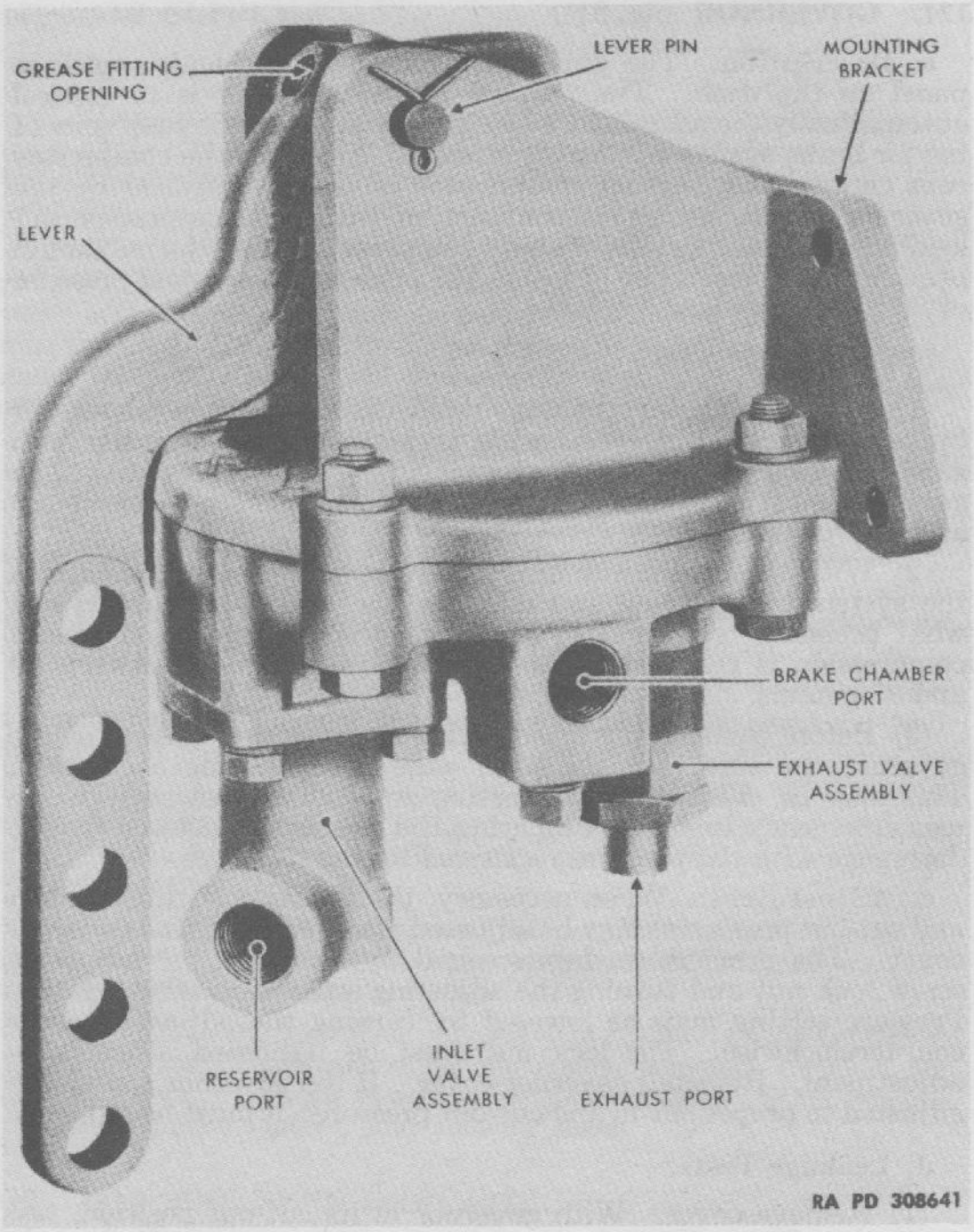


Figure 92 — Brake Valve

(2) Disconnect air line from compressor at governor, and disconnect air line from governor to supply valve.

(3) Remove two cap screws from governor base, and remove governor from panel.

f. Installation.

(1) Install governor in place on air appliance panel, and loosely install two cap screws in governor base.

(2) Connect air line to air supply valve, and connect air line to air compressor at governor.

(3) Tighten governor mounting cap screws at base.

125. FOOT BRAKE VALVE (fig. 92).

a. Description. The B-4-B-type brake valve on this vehicle is bracket-mounted and connected by pedal linkage to the brake pedal. The brake valve controls the air pressure delivered to or released from the brake chambers of the vehicle. The further the driver depresses the brake pedal, the more severe the brake application will be. After the brakes have been applied, they may be partially released by partially releasing the brake pedal, or entirely released by permitting the brake pedal to return to full released position.

b. Operating Tests.

(1) Check the delivery pressure of the brake valve with an accurate test gage connected to the service line outlet at the rear of the vehicle. The first movement of the brake pedal towards the applied position, after the slack is taken up, should cause the brake valve to deliver approximately five pounds of air pressure. Approximately full reservoir pressure should be delivered by the brake valve when the pedal is fully depressed. If the brake valve does not deliver approximately full reservoir pressure when the brake pedal is fully depressed, adjust the pedal stop or linkage so as to increase the travel of the brake valve lever. This should increase the delivered pressure. When making this adjustment, be sure no strain is placed on the valve lever due to the edge of the lever cap striking the cover when the brake pedal is fully depressed. Also be sure the brake valve lever returns to full released position when the brake pedal is released.

(2) Hold the brake pedal at several different positions between released position and fully applied position, and observe that intermediate pressures between 5 and 70 pounds are definitely determined by the position in which the brake pedal is held.

c. Leakage Tests.

(1) First with the brakes released, then with the brakes fully applied, coat the exhaust port with soap suds. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible in either test. If excessive leakage is found, the brake valve must be replaced.

(2) With brakes applied, check for leakage out of the top of the brake valve. No leakage is permissible. If leakage is found, the brake valve must be replaced.

d. Removal.

(1) Drain air brake system.

(2) Disconnect brake pedal rod at brake valve, removing clevis pin.

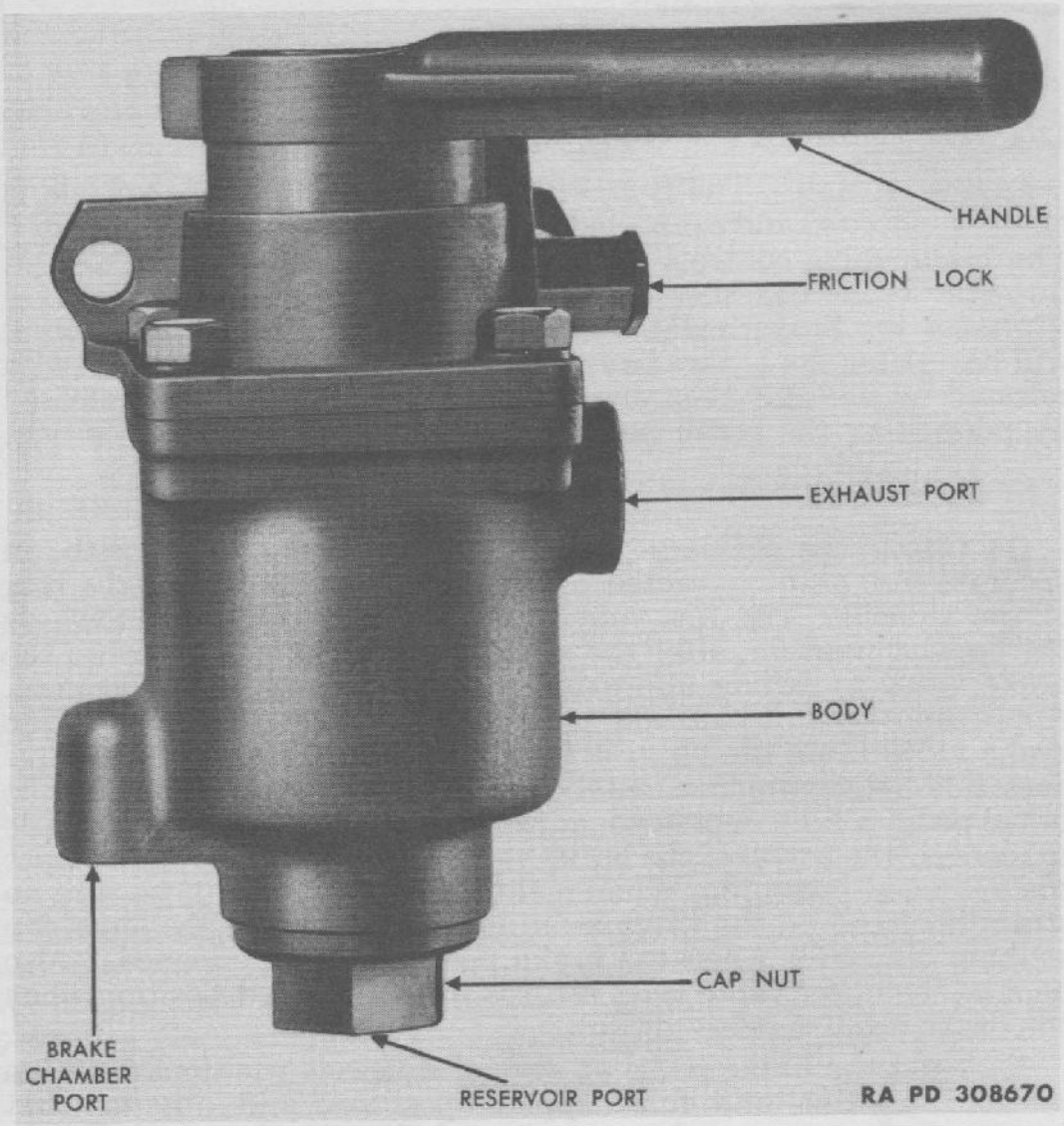


Figure 93 — Hand-Operated Brake Valve

(3) Disconnect air lines leading to reservoirs and to front and rear brakes at brake valve.

(4) Remove four brake valve mounting bolts, nuts, and lock washers at mounting bracket, and remove brake valve from bracket.

e. Installation.

(1) Install brake valve in position on mounting bracket, and install four bolts, nuts, and lock washers loosely in bracket.

(2) Connect air lines to reservoirs and to front and rear brakes at brake valve.

(3) Tighten air line connections.

(4) Connect brake pedal rod at brake valve, and install clevis pin.

(5) Start engine, charge brake system, and test brake valve.

126. HAND BRAKE VALVE (fig. 93).

a. Description. The HP-type brake valve is mounted on the steering column below the steering wheel. Its purpose is to control the brakes on the trailer independently of the brakes on the tractor truck. It is so designed that the driver can set the ratchet-type handle in any one of several positions between released and fully applied brakes. The brakes on the towed vehicle are thus kept applied on the towed vehicle until the brake valve handle is moved to released position. The distance the brake valve handle is moved in a clockwise direction toward applied position determines the severity of the brake application. The driver may, therefore, control the brakes on the trailer as the speed, load, and road conditions require.

b. Operating Tests.

(1) Check the delivery pressure of the brake valve with an accurate test gage connected to the service line outlet at the rear of the vehicle. With the brake handle moved to its fully applied position, the brake valve must deliver at least 60-pound pressure.

(2) Move the brake valve handle to several positions between fully applied and fully released positions, and observe that the air pressure registered by the test gage varies in accordance with the position to which the handle is moved.

c. Leakage Tests. First with the brake valve handle in released position, then with the brake valve handle in fully applied position, coat the exhaust port with soap suds to check for leakage. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible in either of these tests. If excessive leakage is found, the inlet and exhaust valve assembly or the complete hand brake valve must be replaced.

d. Correcting Excessive Leakage. If excessive leakage is found, it will usually be caused by dirty or worn valves or valve seats. Leakage due to dirty valves or valve seats may be corrected by removing the inlet and exhaust valve assembly and cleaning the valves and valve seats. Leakage due to worn valves may be corrected by installing new inlet and exhaust valve assembly. If the valve seats are pitted or worn excessively, or if the installation of a new inlet and exhaust valve assembly does not correct the leakage, the brake valve must be replaced.

e. Removal.

(1) Drain the air brake system.

(2) Disconnect air lines at inlet and outlet connections of brake valve and exhaust port.

(3) Remove two mounting bolts, nuts, and lock washers from valve retaining clamp. Remove brake valve from steering column.

f. Installation.

(1) Place brake valve in position on steering column, install clamp, and install clamp bolts, nuts, and lock washers loosely.

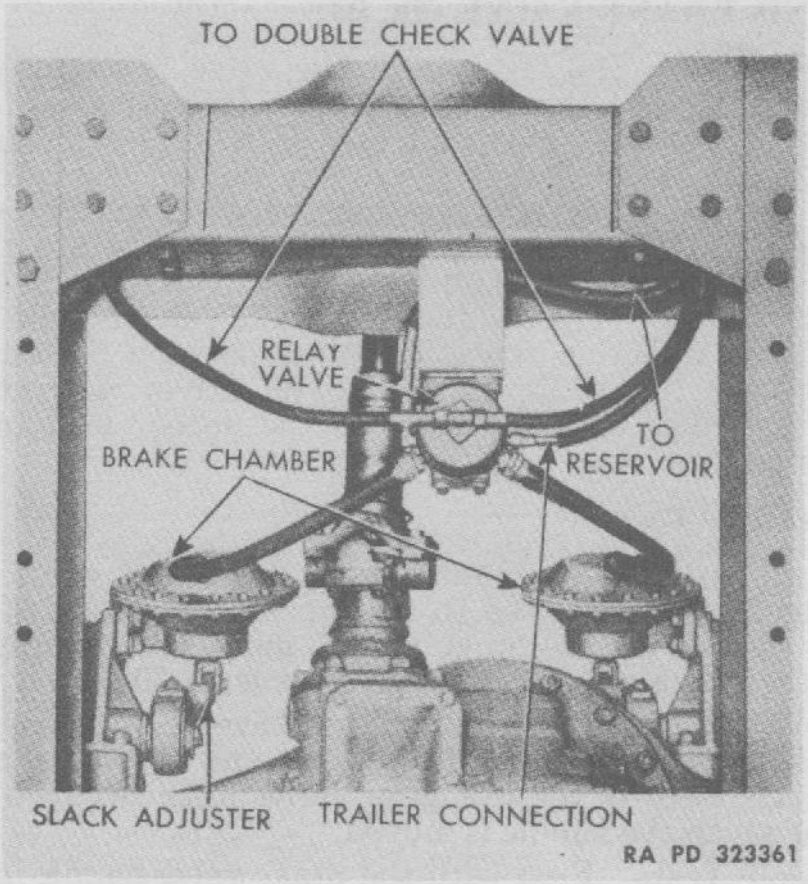


Figure 94 — Relay Valve Installed

(2) Connect air lines at inlet and outlet connections of brake valve, and at exhaust port, and tighten securely.

(3) Tighten clamp bolts and nuts securely.

(4) Start engine, charge air brake system, and test brake valve.

127. QUICK RELEASE VALVE.

a. Description. The purpose of the quick release valve is to reduce the time required to release the brakes by hastening the exhaust of air pressure from the brake chambers. It is used for the front wheel brake chambers. The valve consists of a body containing a spring-loaded diaphragm so arranged as to permit air under pressure to flow through the valve only in the direction of the brake chambers, but when the pressure is reduced, the air which has passed through the valve is permitted to escape through the exhaust port.

b. Testing.

(1) OPERATING TEST. Apply the brakes and make sure that when the brakes are released, air pressure is quickly exhausted through the exhaust port of the valve. Be sure the exhaust port is not restricted in any way.

(2) LEAKAGE TESTS. With brakes applied, coat the exhaust port

with soap suds to detect leakage. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible.

c. Removal. Disconnect air lines from brake chambers at quick release valve. Remove two nuts, lock washers, and cap screws from quick release valve mounting, and remove valve from frame.

d. Installation. Mount valve in position at frame, and install two cap screws, nuts, and lock washers loosely. Connect air lines from brake chambers at quick release valve. Tighten mounting cap screw nuts securely.

128. RELAY VALVE (fig. 94).

a. Description. The relay valve speeds up the application and release of the rear wheel brakes. It is controlled by the brake valve and keeps the air pressure in the rear brake chambers the same as the pressure being delivered to it by the brake valve. It reacts to very slight changes in pressure and quickly raises, lowers, or completely exhausts pressure from its brake chambers as the brake valve raises, lowers, or completely exhausts air pressure in it.

b. Operating Tests.

(1) With the air brake system charged, apply brakes and check to be sure the rear wheel brakes controlled by the relay valve apply promptly.

(2) Release brakes, and check to be sure air pressure is exhausted from the exhaust port of the relay valve promptly.

c. Leakage Tests. First with brakes released, then with brakes fully applied, coat the exhaust port with soap suds to determine leakage. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible in either of the tests. If excessive leakage is found, the relay valve must be replaced.

d. Removal.

(1) Drain air brake system.

(2) DISCONNECT AIR LINES. Disconnect both air lines from double-check valves at relay valve. Disconnect air supply line from reservoir at relay valve. Disconnect both air lines to the rear brake chambers at relay valve. Disconnect air line to emergency line at relay valve.

(3) Remove two mounting bolts, nuts, and lock washers from relay valve mounting. Remove valve from mounting bracket.

e. Installation.

(1) Install relay valve in position on mounting bracket, and loosely install two bolts, nuts, and lock washers.

(2) CONNECT AIR LINES. Connect two air lines from double-check valves at relay valve. Connect air supply line from reservoir to valve. Connect both air lines from rear brake chambers at valve. Connect air line from emergency line at valve.

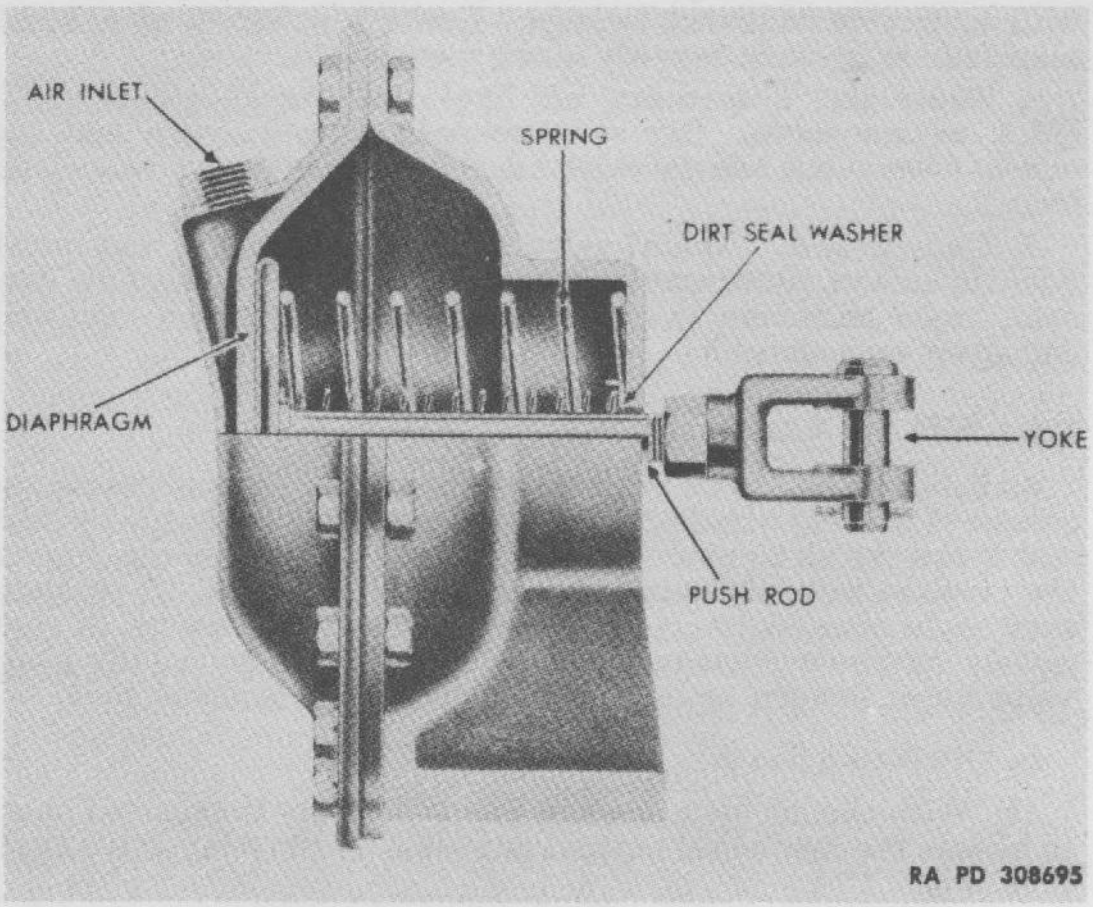


Figure 95 — Rear Brake Chamber Sectional View

(3) Tighten relay valve mounting bolt nuts securely.

(4) Start engine, charge brake system, and test relay valve.

129. BRAKE CHAMBERS.

a. Description. Four brake chambers are installed on this vehicle, one at each wheel. The purpose of a brake chamber is to convert the energy of compressed air into mechanical force and motion necessary to operate the brakes. A brake chamber consists of a body, diaphragm, spring, and push rod with connecting yoke (fig. 95).

b. Operating Tests.

(1) Apply brakes, and observe that each brake chamber push rod moves out promptly without binding.

(2) Release brakes, and observe that each brake chamber push rod returns to released position promptly without binding.

c. Leakage Tests.

(1) With brakes fully applied, coat the bolt flanges holding the diaphragm in place with soap suds to check for leakage. No leakage is permissible. If leakage is found, tighten flange bolts. All flange bolts must be tightened evenly and sufficiently to prevent

leakage. Otherwise the diaphragm will be distorted, and premature failure will result.

(2) With brakes fully applied, check for leakage through the diaphragm by coating the clearance hole around the push rod, and the drain holes in the non-pressure plate with soap suds. No leakage is permissible. If leakage is found, the diaphragm must be replaced.

(3) Excessive push rod travel will cause premature failure of brake chamber diaphragm. When diaphragms are replaced, brake chamber release springs must also be checked, and replaced if necessary. When replacing brake chamber springs, be sure to install the same type spring as the one removed, otherwise uneven braking will result.

d. Removal.

(1) Disconnect air line at brake chamber.

(2) Remove cotter pin from yoke pin, and remove yoke pin from yoke. Disconnect yoke from slack adjuster.

(3) Remove mounting bolts from brake chamber, and remove chamber from bracket.

e. Installation.

(1) Install brake chamber in position on bracket, and install mounting bolts.

(2) Connect air line at brake chamber.

(3) Connect push rod to slack adjuster, and install yoke pin and cotter pin.

(4) Adjust brakes and be sure push rod is correct length. Turn slack adjuster adjusting screw until the brakes drag, then back off until free. With brakes applied, after proper adjustment, the slack adjuster arm and the push rod must form an angle slightly less than 90 degrees, and all slack adjusters on the vehicle must be at this same angle.

130. SLACK ADJUSTERS.

a. Description. One slack adjuster is used at each brake chamber. Slack adjusters consist of a worm and gear enclosed in a body which also serves as an adjustable lever. They provide a quick and easy means of adjusting the brakes to compensate for brake lining wear. During brake operation, the entire slack adjuster rotates bodily with the brake camshaft. During brake adjustment, the worm moves the gear so as to change the position of the lever arm in relation to the brake camshaft.

b. Testing. Adjust brakes (par. 145 **d**), and note brake chamber push rod travel when brakes are applied. Make several brake applications and again check push rod travel. Push rod travel must remain the same as it was after adjustment. If the push rod travel increases, or if difficulty is experienced in keeping the brakes adjusted in service, the slack adjuster must be replaced.

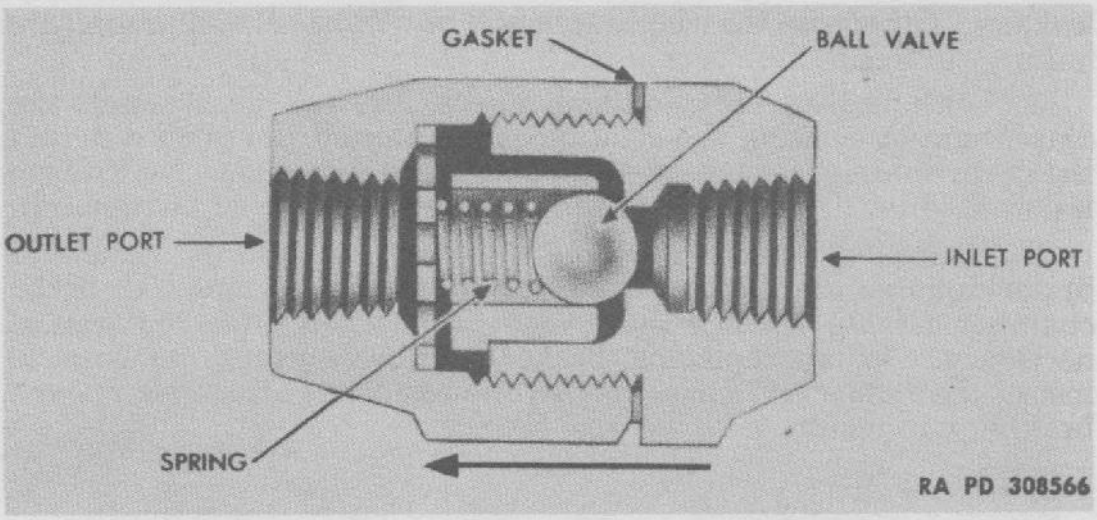


Figure 96 — Single Check Valve Sectional View

c. Removal. Slack adjusters are a sliding fit on the brake camshafts and are held in place by a washer and cap screw. The slack adjuster may be pulled off the brake camshaft after disconnecting the brake chamber push rod and removing the cap screw and flat washer.

d. Installation. Install slack adjuster on brake camshaft, and install flat washer and cap screw. Connect air chamber push rod to slack adjuster. Adjust brakes (par. 145 d).

131. CHECK VALVES.

a. Description.

(1) SINGLE CHECK VALVE (fig. 96). The single check valve is a small device containing a spring-loaded ball valve so arranged as to

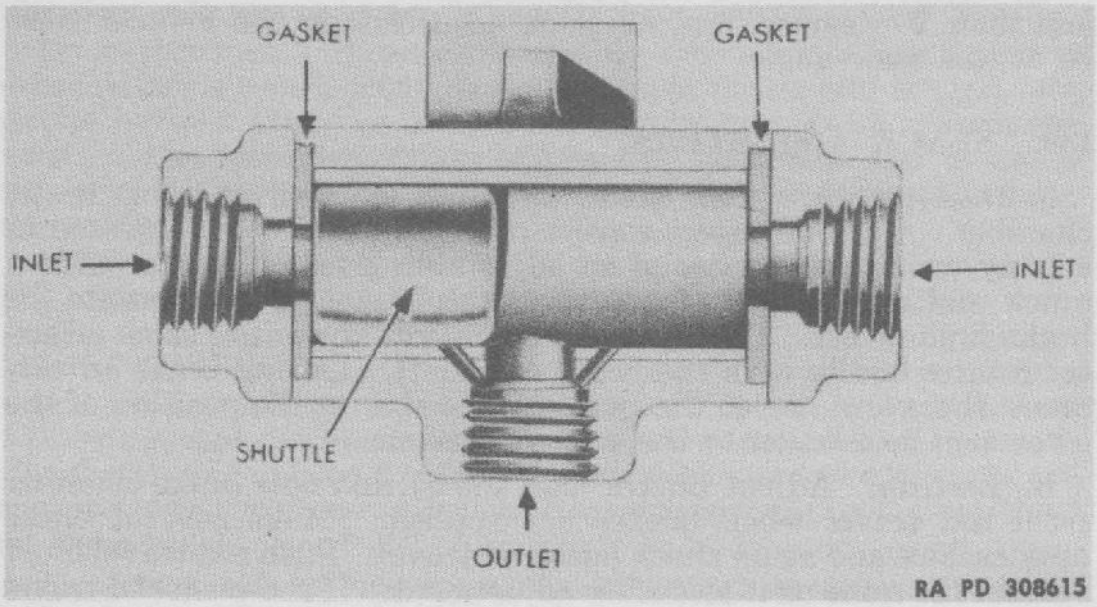


Figure 97 — Double Check Valve Sectional View

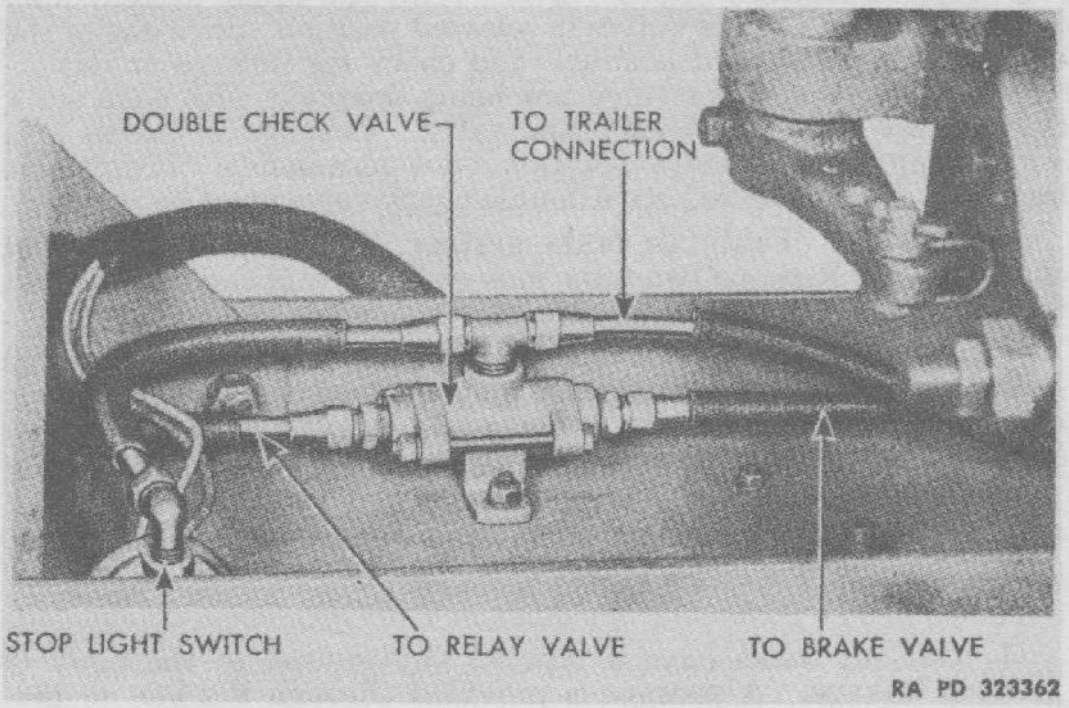


Figure 98 — Double Check Valve Installed

permit air to flow through the check valve in only one direction. It is installed in the line leading to the front emergency line outlet. Its purpose is to prevent the loss of reservoir air pressure in the event the cut-out cock in this line is left open.

(2) DOUBLE CHECK VALVES (fig. 97). Two double check valves are used on the vehicle, one at each frame side rail. They are connected into the air lines from the relay valve to the trailer lines (fig. 98). The purpose of the double check valves is to control the brakes on the trailer or towed load. If the double check valve was not used, when one of the brake valves was moved to its applied position, air pressure from the reservoir would escape through the exhaust port of the other brake valve whose exhaust valve would be open. When the double-check valve is used and one of the brake valves is moved to the applied position, the double check valve blocks off the line leading to the other brake valve and in this manner prevents any loss of air pressure through the open exhaust valve of the brake valve not being operated.

b. Testing Single Check Valve. With the air brake system fully charged, open the cut-out cock in the emergency line at the front of the vehicle, and check for leakage with soap suds. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible. Leakage may be caused by a dirty or worn ball valve or seat. Leakage due to dirt may be corrected by cleaning. If leakage is due to worn ball valve or valve seat, the check valve must be replaced. Very excessive leakage is caused by the single check valve being incorrectly installed. If this is the case, remove the check valve, turn end for end, and reconnect in the line.

c. Testing Double Check Valve. With the brake system fully charged and both brake valves in released position, move one of the brake valves to applied position, and check for leakage at the exhaust port of the brake valve not being operated with soap suds. Repeat test with the other brake valve. Leakage in excess of a 3-inch soap bubble in three seconds is not permissible. If excessive leakage is found, the defective double check valve must be replaced.

d. Removal. Drain air brake system. Disconnect air lines at check valve. Remove two nuts, lock washers, and cap screws from frame mounting, and remove valve.

e. Installation. Install valve in position on frame, and install but do not tighten two cap screws, nuts, and lock washers. Connect air lines at valve securely. Tighten mounting cap screw nuts securely. Start engine, charge brake system, and test for leaks.

132. CUT-OUT COCKS.

a. Description.

(1) Cut-out cocks have a tapered key ground to the body to prevent leakage. A passage is provided through the key so that when the key is turned to its open position air is permitted to flow through the cock, but when the key is turned to the closed position air is prevented from flowing through the cock. Cut-out cocks are used in the service and emergency lines of the tractor truck to provide a means of closing off these lines when they are not being used.

(2) The cut-out cock is open when the handle is at a 90-degree angle with the body of the cock, and closed when the handle is parallel with the body of the cock. Stops are provided so the handle cannot be turned beyond its normal open or closed positions.

(3) Always open and close cut-out cocks by hand. Never strike the handle with a hammer or similar instrument as the cock will be damaged and leakage will develop.

b. Testing.

(1) With brakes applied and cut-out cock closed (hose line disconnected), test with soap suds for leakage past the key. Also check for leakage through the body by coating the outside of the cut-out cock with soap suds.

(2) With brakes applied and cut-out cock open (hose line connected), check for leakage through the body by coating the outside of the cut-out cock with soap suds.

(3) Leakage in excess of a 3-inch soap bubble in three seconds in either of these tests is not permissible.

(4) Leakage is caused by a dirty or scored key or body. Leakage due to dirt is corrected by cleaning and applying a light coating of cup grease to the key before assembly. Leakage due to a scored key or body cannot be repaired, and the cut-out cock must be replaced.

c. Removal and Installation. Drain air brake system. Remove and install cut-out cock with a wrench applied at the end being loosened or tightened. Any severe strain put on the cut-out cock body due to using the wrench on the wrong end will distort the body and cause leakage. Test cut-out cock for serviceability after replacement.

133. DRAIN COCKS.

a. Description.

(1) Drain cocks have a brass body fitted with a tapered brass key. The drain cock is open when the handle is parallel to the body, and closed when the handle is at right angles to the body. Drain cocks are installed in the bottom of each reservoir in the air brake system to provide a convenient means of draining the condensation which normally collects in the reservoirs.

(2) Always open a drain cock by hand. Never strike the handle with a hammer or any other instrument or the cock will be damaged and leakage will develop.

b. Testing.

(1) With the air brake system charged, test with soap suds for leakage past the key. Also check for leakage through the body by coating the outside of the drain cock with soap suds.

(2) Leakage in excess of a 3-inch soap bubble in three seconds is not permissible.

(3) Leakage is caused by a dirty or scored key or body. Leakage due to dirt is corrected by cleaning and applying a thin coating of cup grease on the key before assembly. Leakage due to a scored key or body cannot be repaired, and the drain cock must be replaced.

c. Replacement. Drain air brake system, unscrew drain cock from reservoir, and install new drain cock. Start engine, charge air brake system, and test drain cock for leakage.

134. HOSE, HOSE ASSEMBLIES, AND HOSE CONNECTORS.

a. Description. Hose and hose fittings provide a means of making flexible air connections between points on a vehicle which normally change their position in relation to each other, also of making flexible connections between two vehicles. All hose assemblies include detachable-type hose connectors with spring guards. Hose assemblies used to connect the air brake system of another vehicle are fitted with hose couplings. The special rubber hose used has an outside diameter of $\frac{3}{4}$ inch and an inside diameter of $\frac{3}{8}$ inch. The hose is identified as BWE-BW-101-M. The two hose lines or hose couplings at the front and rear of the tractor truck are marked by tags identifying them as "SERVICE" or "EMERGENCY".

766109 O - 48 - 16

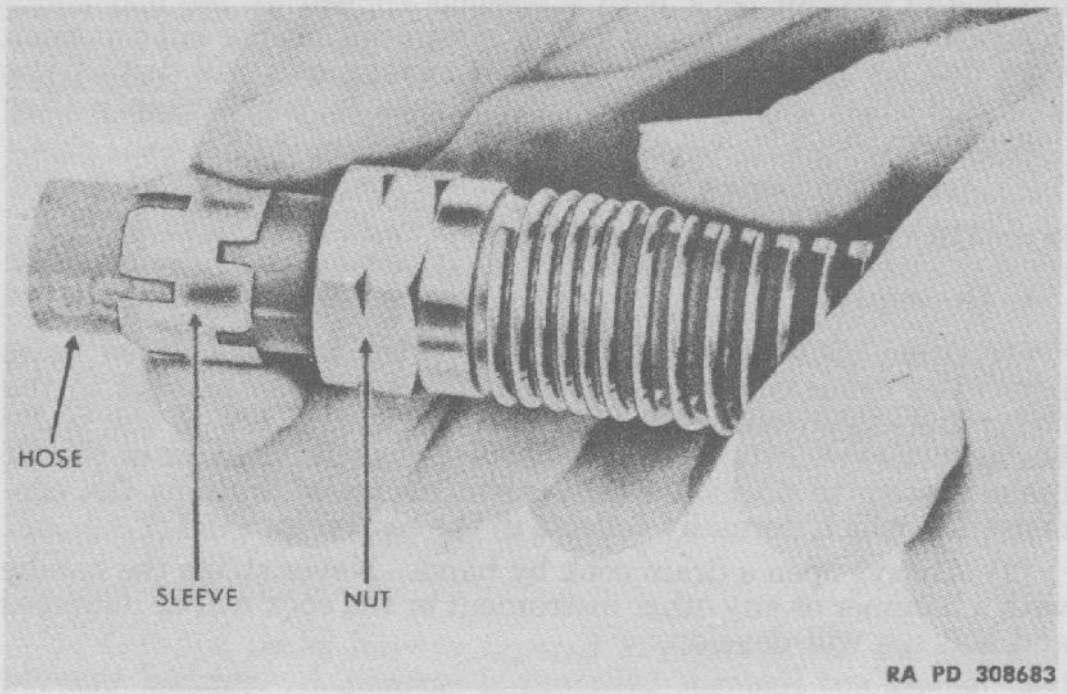


Figure 99 — Connection Nut and Sleeve in Position on Hose

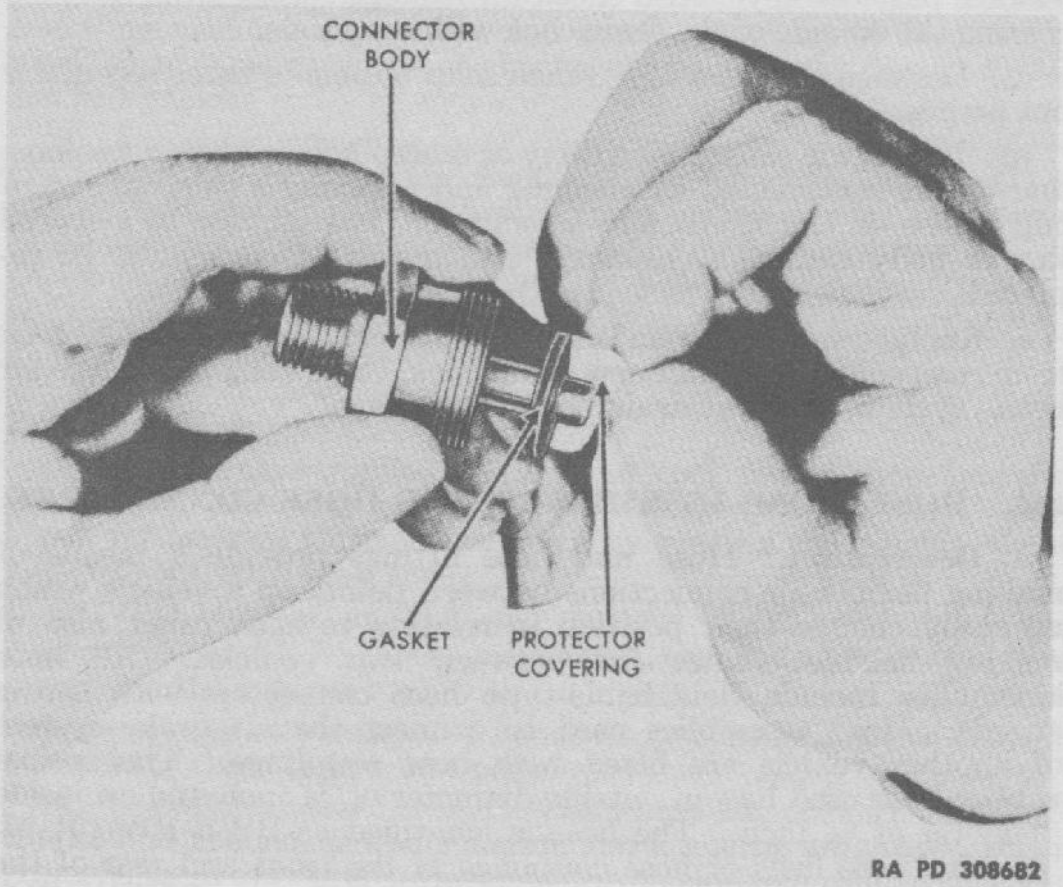


Figure 100 — Removing Protector Cover from Gasket

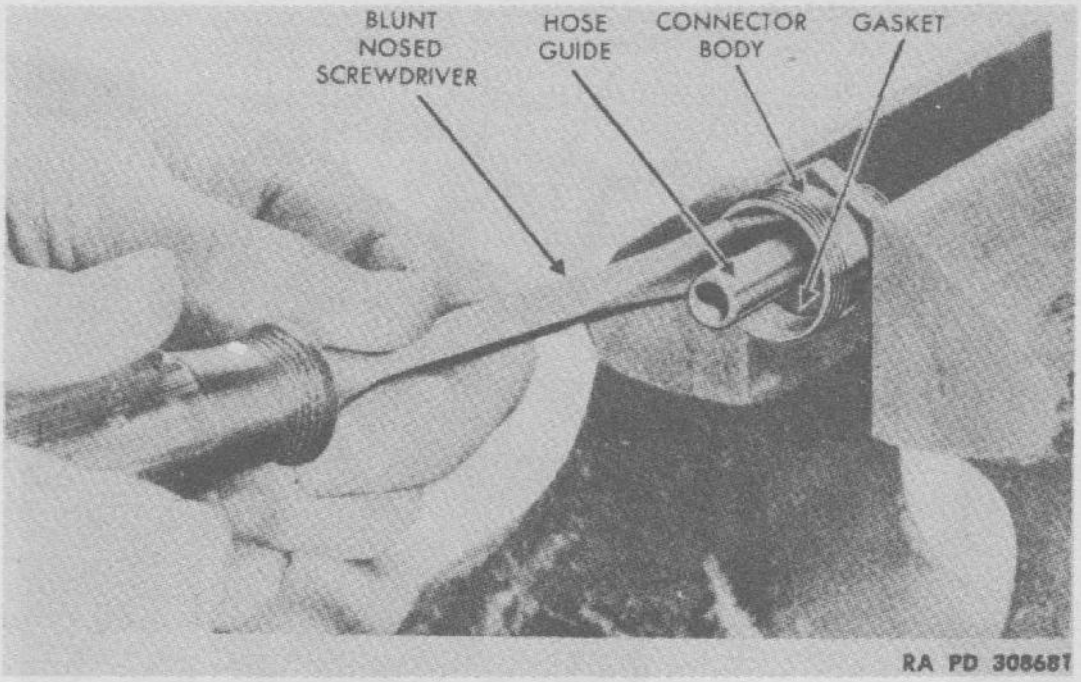


Figure 101 — Pushing Gasket into Bottom of Recess of Connector Body

b. Testing.

(1) OPERATING TEST. If any evidence is found indicating that a hose line is restricted, remove and blow air through it in both directions to be sure the passage through the hose is clear and not obstructed in any way.

(2) LEAKAGE TEST. With the brakes applied to be sure that the hose line being tested is under pressure, coat the outside of the hose and connections with soap suds to check for leakage. No leakage is permissible. Leakage at the connectors is sometimes corrected by tightening the connector nut. If this fails to correct the leakage, replace the connectors, hose, or both.

c. Replacement. Hose assemblies are easily replaceable by removing the detachable connectors and installing a new piece of hose.

(1) Remove connector nuts, and pull hose out of connector body.

(2) Do not attempt to remove used sleeve from hose.

(3) Cut a piece of new hose to required length, being sure that cut is made at right angles to outside wall of hose and that end of hose is smooth.

(4) Blow out hose with an air line to remove all cuttings.

(5) Place connector nut and sleeve on hose (fig. 99), being sure that barbs on inside of sleeve point toward end of hose that is being connected.

(6) Place new gasket over end of guide in connector body so that side with removable protector covering is next to hose. Remove protector covering from gasket (fig. 100), and push gasket into bottom of recess in connector body (fig. 101).

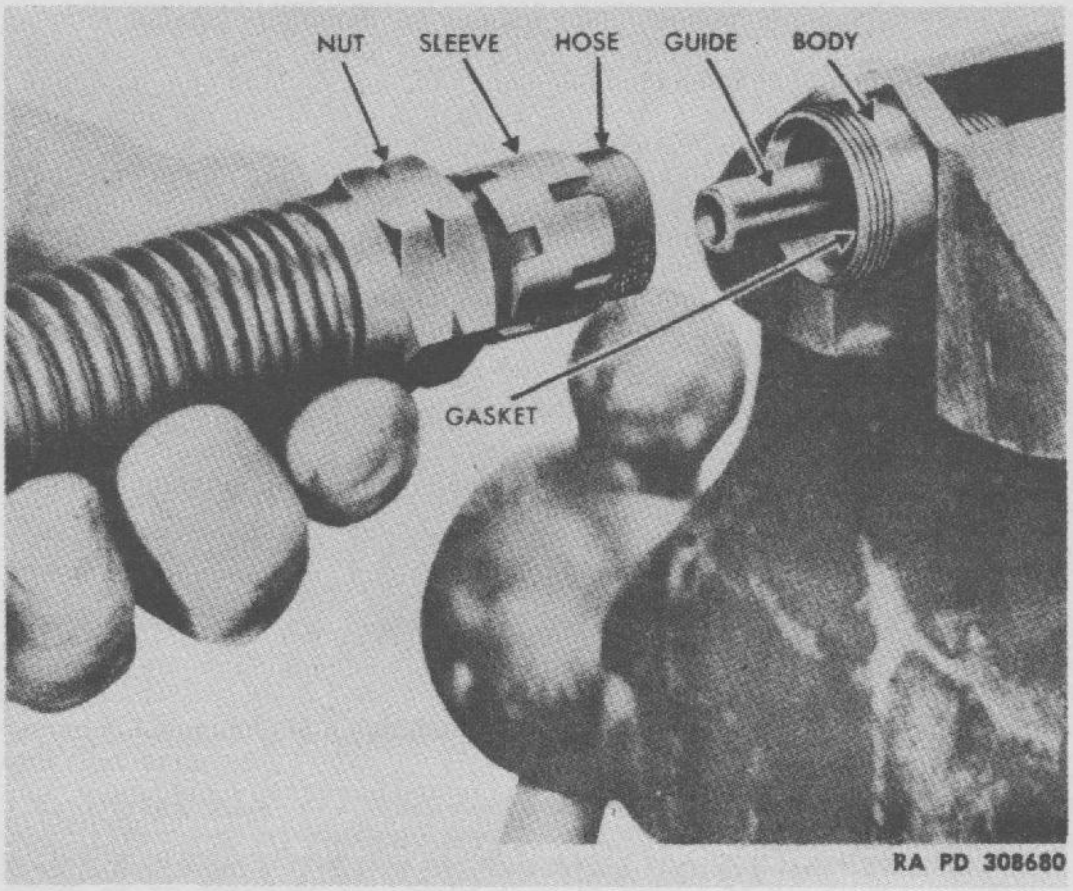


Figure 102 — Placing Hose in Connector Body

(7) Put end of hose in connector body, making sure that end of hose is against gasket at bottom of the recess (fig. 102).

(8) Move sleeve if necessary until it is against edge of connector body. Tighten connecting nut. It is only necessary to tighten nut sufficiently to insure an air-tight joint.

(9) When installing a hose assembly where both ends are permanently connected, the hose connector at either end is used as a swivel by loosening the nut on one of the connectors. Turn the hose in the loose connector before the connector nut is again tightened. This permits the installation of the hose without kinking or twisting.

135. HOSE COUPLINGS AND DUMMY COUPLINGS.

a. Description.

(1) Hose couplings provide an easy and convenient method of connecting and disconnecting air lines between vehicles by hand. The design of the hose coupling is such that when two of them are coupled together pressure is put on two rubber gaskets, making an air-tight seal.

(2) Dummy couplings are made in two general designs, some being fitted with brackets to permit them to be rigidly mounted on the vehicle, while others are fitted with a chain attaching them to

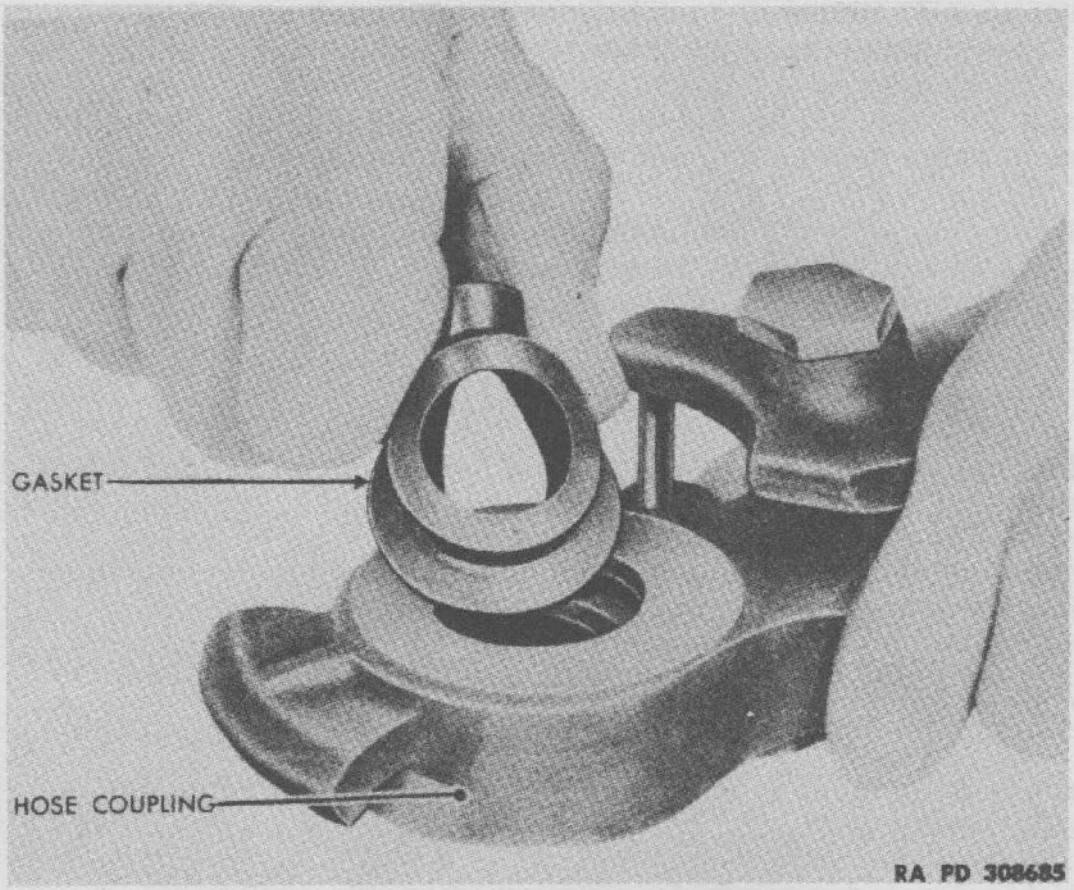


Figure 103 — Installing Hose Coupling Gasket, First Operation

the vehicle. The bracket type is used where the dummy coupling is to serve as a fastening for holding hose lines when not in use, whereas the chain type is used for blocking off hose couplings rigidly mounted on the vehicle as used on this tractor truck. The purpose of the dummy coupling is to prevent the entrance of dirt or other foreign matter into the air brake lines when the lines are not being used. Dummy couplings used to protect the service line coupling at the front of the tractor truck are drilled with a small vent hole to prevent air from being trapped in this line and keeping the brakes applied.

b. Testing.

(1) With the hose couplings connected and brakes applied, coat the hose couplings all over with soap suds to check for leakage. There must be no leakage.

(2) Leakage is usually caused by worn, damaged, or improperly installed gaskets. To correct leakage, install new gaskets.

(3) Remove old gaskets by prying out with a screwdriver. Before attempting to install a new gasket, be sure the groove in the coupling in which the gasket fits is thoroughly cleaned. Otherwise, it will be impossible to install a new gasket properly.

(4) To install a new gasket, partially collapse it with the fingers (fig. 103), and enter one side of the gasket flange in the groove in

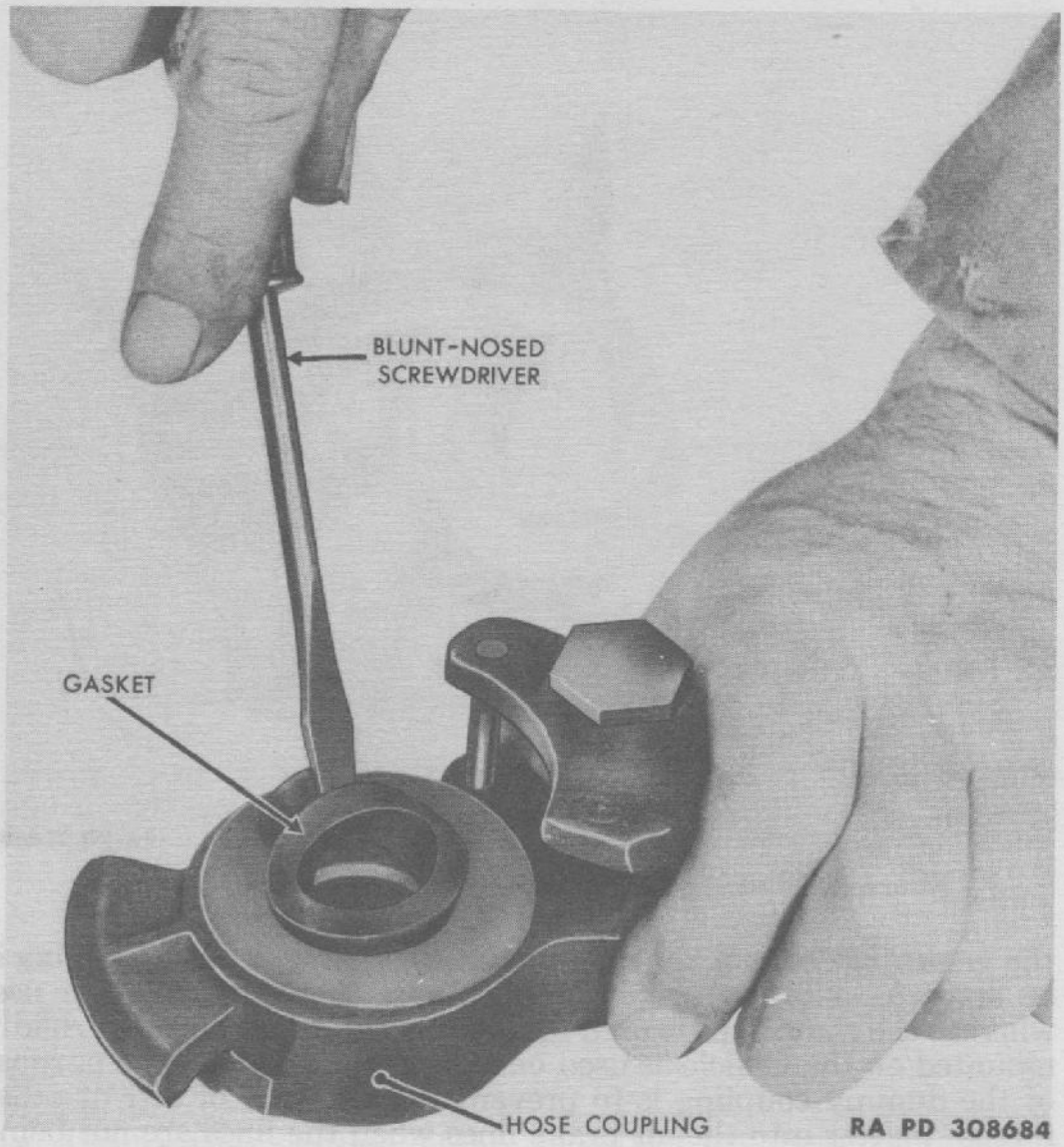


Figure 104 — Installing Hose Coupling Gasket, Final Operation

the coupling. Then use a blunt nosed screwdriver or similar instrument to push gasket into place (fig. 104). When properly installed, the exposed face of the gasket will be flat, not twisted or bulged at any point.

136. TUBING AND TUBING FITTINGS.

a. Description. Tubing and fittings are used to connect the various devices in the air brake system where it is not necessary to use flexible hose.

b. Tubing Sizes. Three sizes of copper tubing are used in the brake system. The largest, with an outside diameter of ¾ inch, is used in the compressor discharge line. Tubing used to carry the air supply to the brake valves and relay valve has an outside diameter of ½ inch. Tubing which carries a relatively small

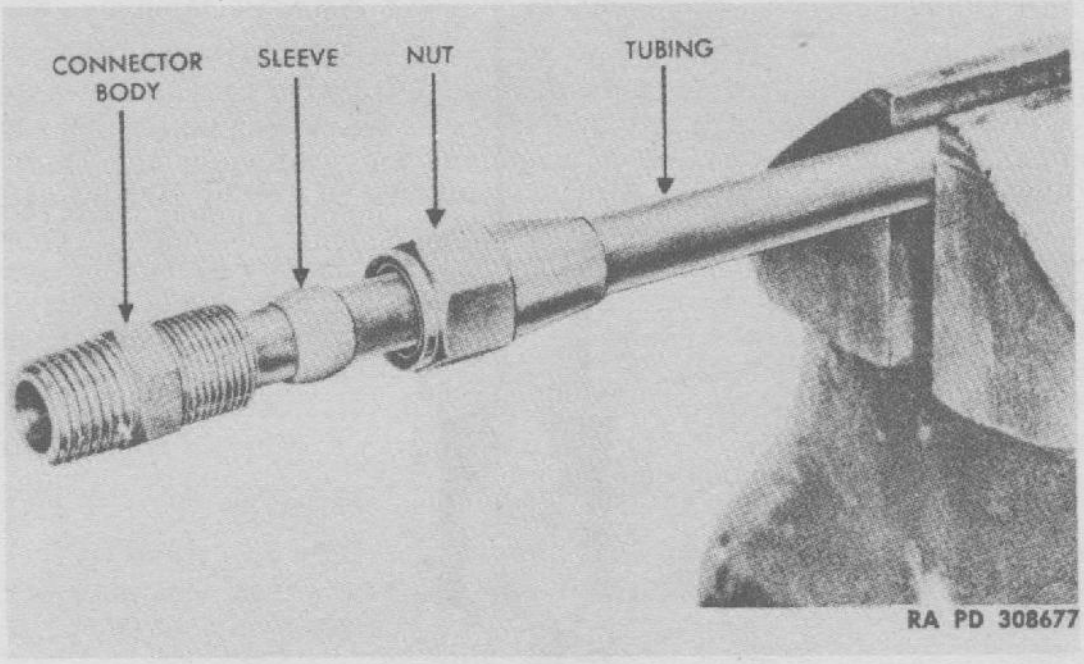


Figure 105 — Tubing and Fitting Ready for Assembly

quantity of air, or located where the rate of flow is not important, has an outside diameter of $\frac{3}{8}$ inch. The inside diameters are not the same as for commercial tubing, and it is important that tubing of the correct outer and inner diameter be used.

c. Fittings. Tubing fittings used in the air brake system are three-piece compression-type. Flared-type fittings such as are used in gasoline lines must not be used in the air brake system.

d. Operating Tests. If any evidence is found indicating that a tubing line is restricted, remove and blow air through it in both directions to be sure the passage through the tubing is clear and not obstructed in any way. Inspect tubing for partial restrictions such as may be caused by dents or kinks. Damaged tubing must be replaced.

e. Leakage Tests. With the air brake system fully charged, governor cut out, and brakes applied, coat all tubing lines and fittings with soap suds to check for leakage. No leakage is permissible. Leakage at a tubing fitting is sometimes corrected by tightening the tubing fitting nut. If this fails to correct the leakage, replace the tubing fitting, the tubing, or both.

f. Cutting Tubing.

(1) Cut tubing to required length with a hack saw or tubing cutter. Cut square with the outside wall. Make sure the ends of the tubing are smooth, not crimped or partially closed. Ream or file the ends if necessary.

(2) Blow out tubing with air line to remove all cuttings and filings. This is very important.

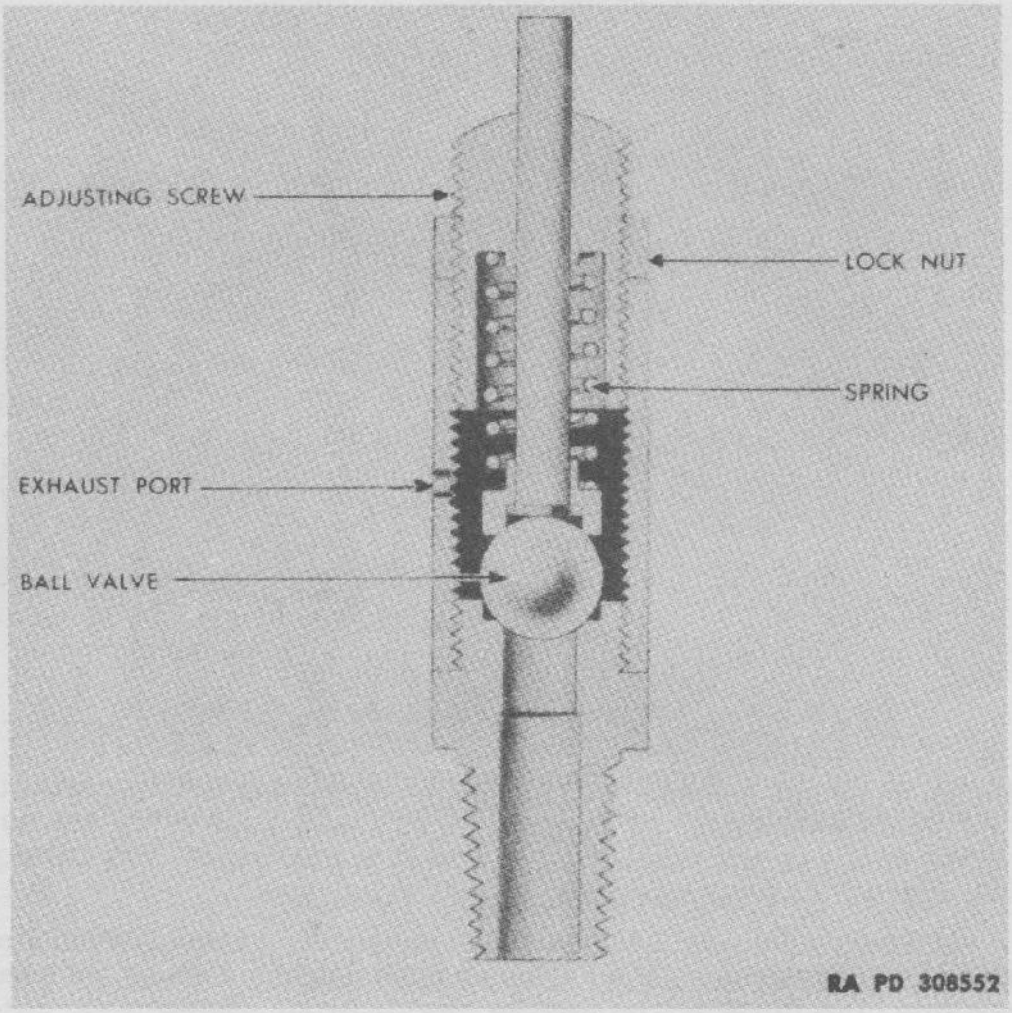


Figure 106 — Safety Valve Sectional View

(3) Always use a new sleeve when replacing tubing lines. Tubing fitting nuts and bodies may be used again provided they are in serviceable conditions. Place nut and new sleeve on tubing, and put end of tubing in recess in tubing fitting or connector body (fig. 105).

(4) Hold tubing at bottom of recess, and tighten nut to seal the joint to prevent leakage.

137. SAFETY VALVE (fig. 106).

a. Description.

(1) The purpose of the safety valve is to protect the air brake system against excessive air pressure. Should the air pressure in the air brake system rise above the setting of the safety valve at 150 pounds, the valve opens and permits excessive pressure above 150 pounds to be exhausted. It is located on the air appliance panel on the dash (par. 144).

(2) The safety valve consists of a spring-loaded ball check valve which is set to "blow off" at 150-pound air pressure.

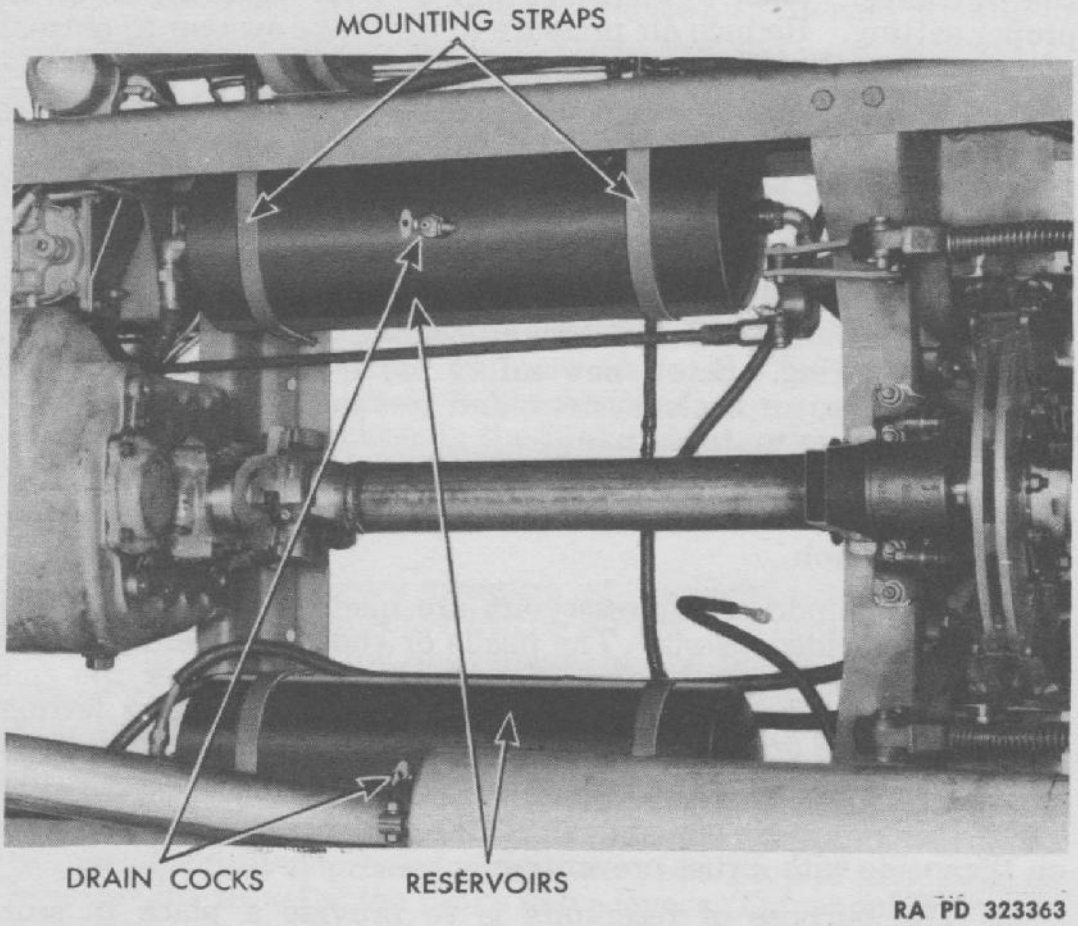


Figure 107 — Air Reservoirs Installed Bottom View

b. Testing.

(1) PRESSURE SETTING TESTS.

(*a*) Connect a test gage known to be accurate into the air brake system so as to register reservoir pressure. A simple way to do this is to connect the air gage to the emergency line at the rear of the tractor truck and open the emergency line cut-out cock. With the motor running, temporarily stop governor operation by turning the air supply valve on the air appliance panel to its air supply position, and permit the air pressure in the air brake system to rise until the test gage registers 150 pounds. When the test gage reaches 150 pounds, the safety valve must release, or "blow off". If the safety valve does not release, stop the engine immediately and adjust pressure setting of the safety valve. Do not permit air pressure in the air brake system to build up higher than 150 pounds, otherwise the compressor may become damaged.

(*b*) To adjust the pressure setting of the safety valve, loosen lock nut and turn adjusting screw. Turning adjusting screw counterclockwise lowers the pressure setting. Turning screw clockwise raises the pressure setting. Turn the adjusting screw as required until the safety valve releases at 150 pounds registered by

the test gage. Then tighten lock nut to hold adjusting screw at proper setting. Reduce air pressure in air brake system to normal of approximately 100 pounds by applying and releasing the brakes.

(2) LEAKAGE TESTS. With the air brake system fully charged to approximately 100 pounds, coat the safety valve all over with soap suds to check for leakage. Leakage of a 1-inch soap bubble in five seconds is not permissible. Slight leakage may sometimes be corrected by lightly tapping the end of the release pin. If this fails to correct the leakage, replace the safety valve.

c. Replacement. Drain brake system, and unscrew safety valve from fitting. Screw new safety valve into position. Start engine, recharge air brake system, and test safety valve.

138. RESERVOIRS (fig. 107).

a. Description.

(1) The cylindrical air reservoirs are made of sheet steel with electrically welded seams. The heads or ends are steel stampings securely held in place by the sides which are spun over the ends before the end seams are welded in place. Pipe-tapped ferrules welded in place are used at the openings. Two reservoirs 8 by 26 inches are used on this vehicle, one at each side of the chassis.

(2) Reservoirs are tested against 200-pound pressure and treated on the inside with a rust preventive.

(3) The purpose of reservoirs is to provide a place to store compressed air so that there will be an ample supply available for immediate use in brake operation. They also provide storage for sufficient compressed air to permit several brake applications after the engine has stopped. Another function of a reservoir is to provide a place where the air, heated during compression, may cool and the oil and water vapors condense.

b. Testing.

(1) LEAKAGE TESTS. With the air brake system charged, coat the outside of the reservoir with soap suds to check for leakage. If any leakage is found, replace the reservoir.

(2) INSPECTION. Inspect inside and outside surfaces for damage or corrosion. A small flashlight is helpful when inspecting the interior. If damage or corrosion is found that would weaken the reservoir, replace the reservoir.

c. Removal. Drain air brake system. Disconnect air outlet and inlet lines at reservoir. Remove nuts from lower end of reservoir straps, and pull straps from bracket. Lower air reservoir from chassis.

d. Installation. Install air reservoir in position, and install mounting straps in brackets. Connect inlet and outlet air lines at reservoir. Start engine, charge air brake system, and test connections for leaks.

139. AIR STRAINER.

a. Description. An air strainer or filter mounted on the air appliance panel (fig. 108) traps any dirt or foreign matter which might otherwise go into the windshield wipers. It also serves as a condensing chamber to cool the compressed air, and to remove any oil or water from the air.

b. Removal. Drain air brake system. Disconnect two outlet lines to windshield wipers at top. Disconnect air inlet line at strainer. Remove two cap screws from strainer base, and lift off strainer.

c. Installation. Place strainer in position on air appliance panel, and install two cap screws loosely. Connect air inlet line and two windshield wiper outlet lines. Tighten mounting cap screws. Start engine, charge air brake system, and test connections for leaks.

140. DASH AIR PRESSURE GAGE.

a. Description.

(1) The purpose of the dash-mounted air pressure gage is to register the amount of air pressure in the air brake system. While air pressure gages of this type are commercially accurate, they must never be confused with or substituted for test air gages which are intended primarily for accurately checking air pressures in an air brake system.

(2) Only test gages known to be accurate are to be used for checking brake valve delivery pressures, governor pressure settings, and other tests. Test gages differ from ordinary dash gages in respect to material and workmanship much as an expensive watch differs from a cheaper one and due to these differences they are more accurate over their entire range and maintain their accuracy over longer periods.

b. Testing.

(1) Check dash air gage for accuracy. The simplest way to do this is to compare the pressures registered by the gage over its normal pressure range with the pressures registered by a test gage known to be accurate.

(2) Dash gage which loses its accuracy must be replaced. The continued use of a dash gage showing an error of more than five pounds is not recommended.

c. Removal. Drain air brake system. Remove two screws from instrument panel, and tilt panel forward. Disconnect air line at back of pressure gage. Remove two nuts from mounting screws on gage. Remove gage from panel.

d. Installation. Place gage in position on panel, and install two nuts on mounting screws. Connect air line to back of pressure gage. Tilt instrument panel back to position, and install screws. Start engine, and recharge air brake system.

141. AIR SUPPLY VALVE.

a. Description.

(1) The air supply valve is mounted on the air appliance panel (par. 144). Its purpose is to provide a convenient means of using the air pressure in the air brake system for such purposes as tire inflation.

(2) The air supply valve is installed in the line between the governor and the reservoir. When the handle of the air supply valve is turned to its air supply position, the governor is connected into the air brake system. The compressor operates continuously under these conditions, and pressures as high as the setting of the safety valve, 150 pounds, may be obtained.

(3) Turn the handle of the air supply valve under normal conditions so as to be parallel with the body of the valve.

(4) When air supply is desired, connect an air hose to the side connection of the valve by removing the cap nut. Turn the handle of the air supply valve to its air supply position, forming an angle of 90 degrees with the body of the valve, to permit air pressure up to 150 pounds to be delivered through side connection.

(5) Turn the valve handle only by hand. Never strike it with a hammer or other heavy tool, or the valve will be damaged and leakage will result.

b. Testing. With brake system charged, coat the entire valve with soap suds to check for leakage. Leakage in excess of a 1-inch soap bubble in three seconds is not permissible. If leakage is excessive, replace the valve.

c. Removal. Drain air brake system. Disconnect air lines at supply valve. Remove two cap screws from valve base, and remove valve from panel.

d. Installation. Install supply valve in position on air appliance panel, and install two mounting cap screws loosely. Connect air lines at valve. Tighten two mounting cap screws. Start engine, charge air brake system, and test for leaks.

142. LOW PRESSURE INDICATOR.

a. Description. The low air pressure indicator is a safety device designed to give an automatic warning whenever the air pressure in the air brake system is below approximately 60 pounds. Operating as an air-controlled switch of an electrical circuit, the low pressure indicator automatically sounds a buzzer when the air pressure drops too low.

b. Testing.

(1) OPERATING TESTS.

(*a*) Drain air brake system, turn on ignition key, and start motor. The low pressure indicator buzzer must sound until the

air pressure in the air brake system reaches a point between 54 and 66 pounds, at which point the buzzer must stop sounding.

(*b*) Continue to build up air pressure in the air brake system until the pressure reaches at least 75 pounds, then stop engine. Reduce the air pressure in the air brake system by making brake applications, and check to see at what pressure the buzzer again sounds. The buzzer must sound when the pressure in the air brake system reaches a point between 66 and 54 pounds.

(2) LEAKAGE TEST. With the air brake system fully charged, coat the outside of the low pressure indicator with soap suds to check for leakage. No leakage is permissible. Leakage at the lower diaphragm screw can sometimes be corrected by removing the electrical connection and carefully tightening the terminal screw nut. Leakage through the small vent hole in the cover signifies a leaking diaphragm, and the low pressure indicator must be replaced.

c. Removal. Drain air brake system. Disconnect wiring at low pressure indicator. Disconnect air line at indicator. Remove two cap screws from indicator mounting at air appliance panel, and lift indicator from panel.

d. Installation. Install low pressure indicator in position on air appliance panel, and install two cap screws loosely. Connect air line to indicator. Connect wiring at indicator. Tighten mounting cap screws securely. Start engine, charge air brake system, and test for leakage.

143. STOP LIGHT SWITCH.

a. Description. The stop light switch is mounted on the left-hand frame side rail to the rear of the double check valve. Stop light switches are electro-pneumatic switches which close the stop light electrical circuit when the brakes are applied.

b. Testing.

(1) OPERATING TEST. With all air pressure exhausted from the air brake system, move the brake valve to applied position and start motor. Observe at what pressure registered by the dash gage the stop lights light. Stop lights must light before the dash gage registers 10-pound pressure.

(2) LEAKAGE TEST. With brakes applied, coat the stop light switch with soap suds to check for leakage. No leakage is permissible. If leakage is found, the stop light switch must be replaced.

c. Removal. Drain air brake system. Disconnect wiring at stop light switch. Disconnect air line at stop light switch. Remove two mounting cap screws, nuts, and lock washers. Remove stop light switch from frame side rail.

d. Installation. Install stop light in position on frame side rail, and install two mounting cap screws, nuts, and lock washers loosely. Connect air line, and tighten mounting cap screw nuts. Connect wiring at stop light switch. Start engine, charge air brake system, and test stop light switch.

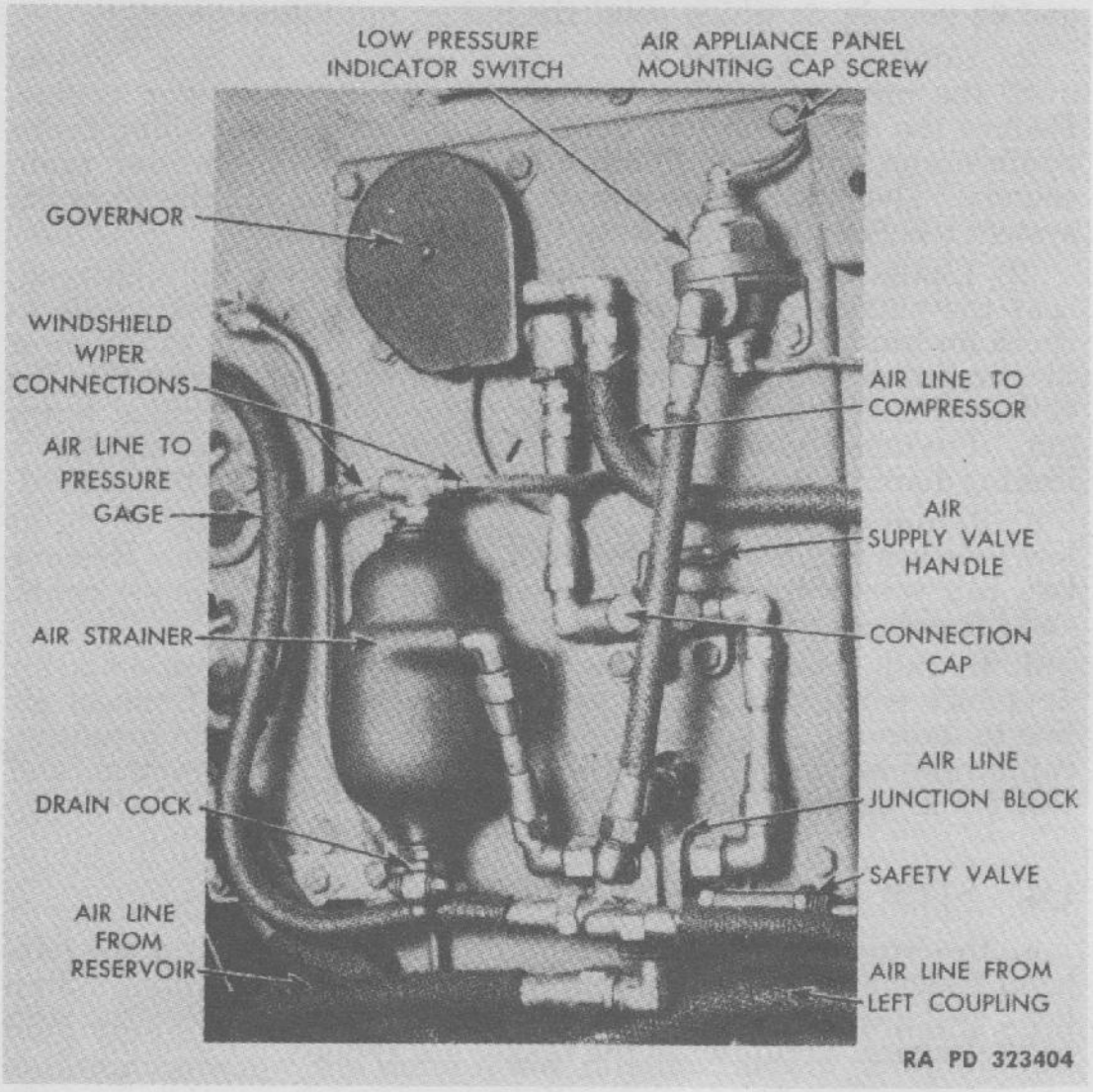


Figure 108 — Air Appliance Panel Installed

144. AIR APPLIANCE PANEL (fig. 108).

a. Description. The air appliance panel is mounted on the front of the dash in the engine compartment. On the panel are mounted the governor, low pressure indicator, air strainer, supply valve, safety valve, air line junction block, and connecting tubing. The panel is removable as a unit, but the back of the panel has cage-type nuts behind each of the instruments to permit replacement of individual items without panel removal.

b. Removal.

(1) Drain air brake system.

(2) Disconnect wiring at low pressure indicator.

(3) Disconnect two air lines to windshield wipers at air strainer, air line to air compressor at governor, and air lines to air pressure gage and single check valve at junction block.

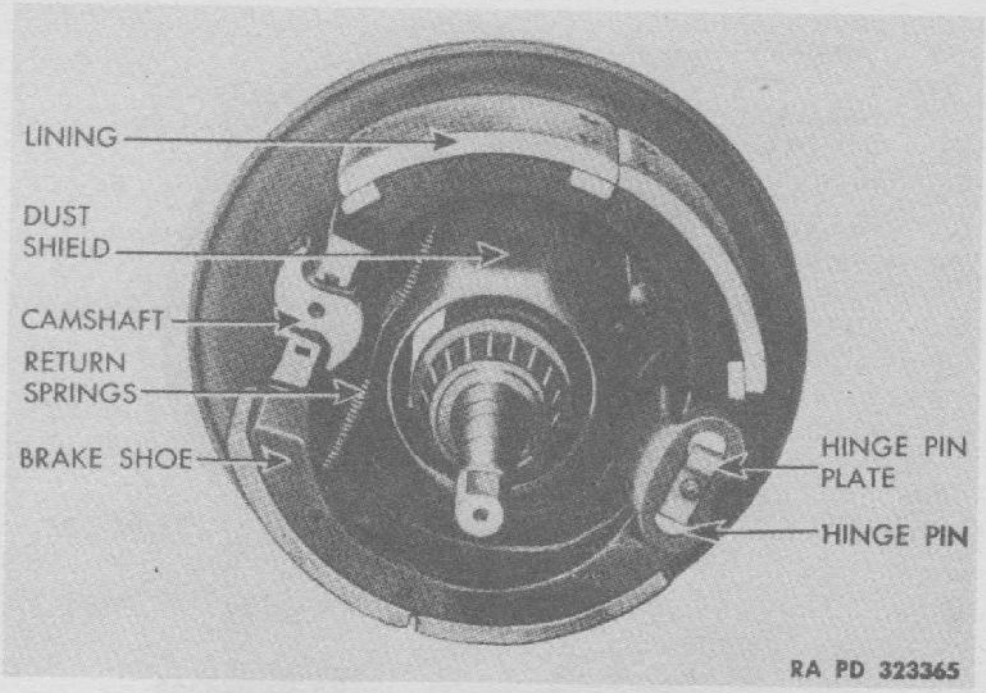


Figure 109 — Front Axle Brake Installed

(4) Remove four cap screws, nuts, and lock washers from corners of air appliance panel. Lift air appliance panel from dash.

c. Installation.

(1) Place air appliance panel in position on dash, and loosely install four cap screws, nuts, and lock washers.

(2) Connect air lines from reservoir, pressure gage, and check valve at junction block, from compressor at governor, and both lines from windshield wipers at air strainer.

(3) Connect wiring at low pressure indicator, and tighten four air appliance panel cap screw nuts securely.

(4) Start engine, charge brake system, and test all connections for leakage.

145. BRAKE SHOES (figs. 109 and 110).

a. Description. The brake shoes on the front and rear axles of the vehicle are anchored at the rear end and actuated by brake operating cams at the front end. Brake shoe retracting springs are used to assure proper return of the brake shoes to the released position. The brake shoe linings are bolted to the brake shoes.

b. Operation.

(1) When air pressure is delivered to the brake chambers, the brake chamber push rods, acting through the slack adjusters, rotate the brake camshafts. The rotation of the brake cams, on the opposite end of the brake camshaft, spreads the shoes and forces the brake shoe linings against the brake drums, applying the brakes.

(2) Increasing the air pressure delivered to the brake chambers

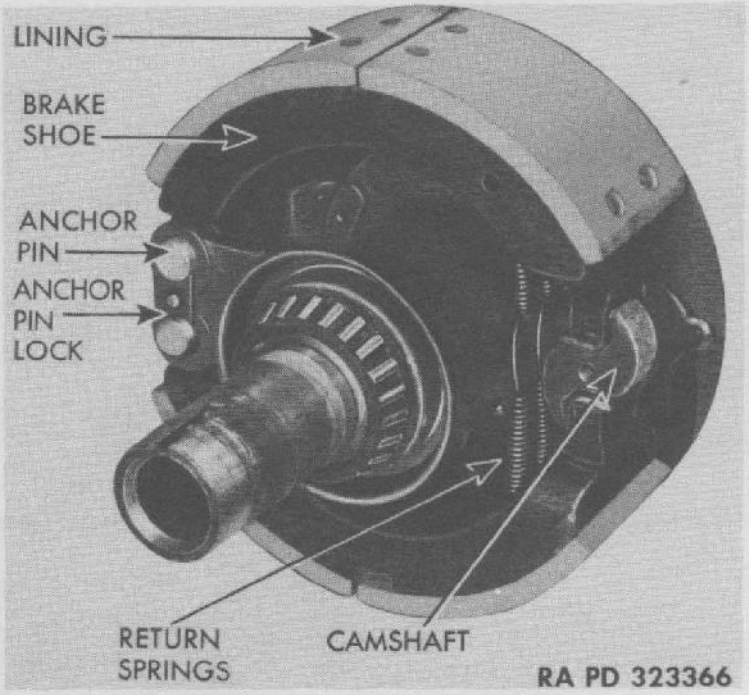


Figure 110 — Rear Axle Brake Installed

increases the force pressing the linings against the drums. The harder the linings are pressed against the drums, the greater the friction developed, and the more severe the brake application.

(3) When air pressure is released from the air brake chambers, the brake chamber release springs and the brake shoe release springs return the brake mechanism to the released position.

c. Inspection.

(1) The wheels and brake drums must be removed periodically as operating conditions demand, and the brake shoes, hinge pins, camshafts, and camshaft bearing brackets inspected for wear.

(2) Inspect brake shoe linings. If worn unevenly, or worn down to the bolt heads, the shoes must be replaced.

(3) Before removing brake shoes from the brake backing plates, inspect the fit of the hinge pin bushings for looseness or binding. Excessively worn hinge pin bushings must be replaced, and binding must be corrected either by refitting or by proper lubrication. If necessary, report to higher authority for axle replacement.

(4) Inspect the cam follower plates for wear or looseness, and replace if necessary.

d. Adjustment for Wear. All adjustments of the brakes must be made with wheels jacked up.

(1) Raise vehicle wheel clear of the ground.

(2) Turn slack adjuster screw on end of slack adjuster worm shaft until brakes drag, then back off screw until wheel is free. Revolve wheel by hand while making adjustment.

(3) After proper adjustment of the slack adjuster and with the brakes applied, the slack adjuster arm and the brake chamber push

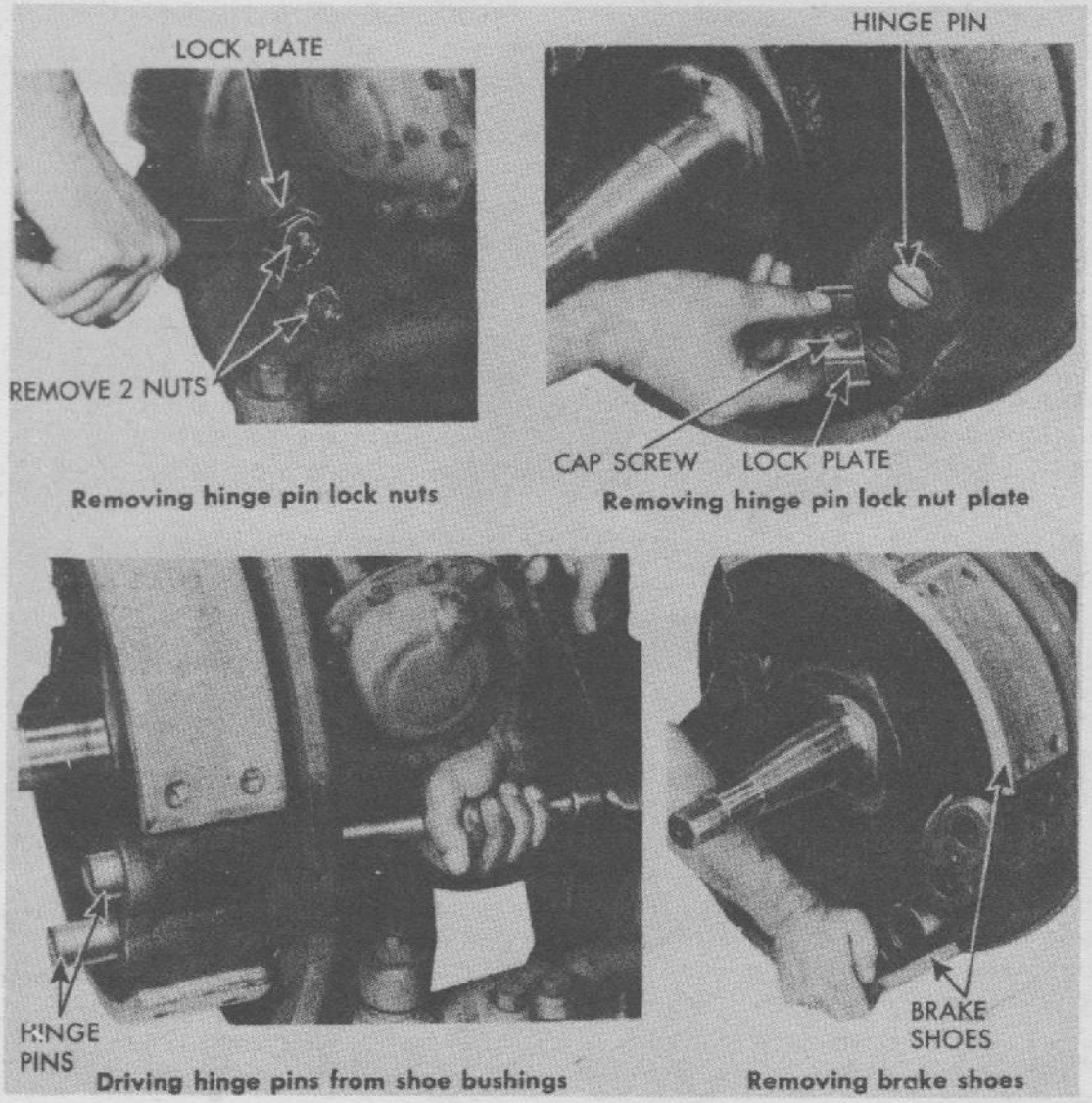


Figure 111 — Removing Front Brake Shoes

rod must form an angle slightly less than 90 degrees, and all slack adjusters on the vehicle must be at the same angle.

(4) The recommended minimum push rod stroke after brakes have been adjusted is $\frac{5}{8}$ inch for front brakes and $\frac{3}{4}$ inch for rear brakes. The maximum stroke before brakes must be readjusted is $1\frac{3}{8}$ inches for front brakes and $1\frac{3}{4}$ inches for rear brakes.

e. Front Brake Shoe Removal.

(1) REMOVE WHEEL. Refer to paragraph 150 a.

(2) REMOVE BRAKE SHOE HINGE PINS (fig. 111). Bend down hinge pin lock nut lock plate at rear of backing plate, and remove lock nuts from hinge pins. Remove retaining cap screw and hinge pin lock plate from opposite end of hinge pins. Drive hinge pins from bushings with a drift.

Figure 112 — Removing Rear Brake Shoes

(3) REMOVE BRAKE SHOES. The brake shoes can now be lifted from position on the brake backing plate. After the two shoes are removed, the brake shoe return springs can easily be removed.

f. Front Brake Shoe Installation.

(1) INSTALL BRAKE SHOES. Connect two brake shoe return springs to each brake shoe. Place both brake shoes in position at backing plate, seating the shoes on the cam wear plates. Place hinge pin ends of shoes in position in bracket.

(2) INSTALL HINGE PINS. Place hinge pins in position in bracket bushings, having slots in ends of pins at inside and lengthwise with the axle. Drive pins into place. Line up slots in pins, and install hinge pin lock plate and cap screw. Install hinge pin lock nuts, and tighten securely. Bend tabs of lock plate at lock nuts.

(3) INSTALL WHEEL. Refer to paragraph 151 a. Omit last operation of lowering wheel to floor.

(4) ADJUST BRAKES.

(*a*) *Centralize Shoes.* Centralize the brake cam so that both brake shoes will contact the brake drum at the same time. This adjustment is made by applying the brakes, and loosening the cam bearing mounting bolts while holding the brakes in the applied position. Tap the camshaft into position. Tighten the cam bearing bracket bolts.

(*b*) *Adjust Slack Adjuster.* Rotate the wheel by hand while turning the slack adjusting screw on the end of the slack adjuster worm shaft until there is 0.010-inch clearance between brake shoe lining and brake drum. NOTE: *If feeler gage of 0.010-inch thickness is not available, adjust slack adjuster screw until drag is felt in wheel, then back off until wheel is just free from drag.*

(5) Remove blocks, and lower wheel to floor.

g. Rear Brake Shoe Removal.

(1) REMOVE WHEEL. Refer to paragraph 150 b.

(2) REMOVE BRAKE SHOE HINGE PINS (fig. 112). Remove cap screw and lock washer from hinge pin retainer plate at inner end, and remove retainer plate from grooves in hinge pins. Drive hinge pins out of hinge pin bracket bushings toward rear face of backing plate, and remove pins.

(3) REMOVE BRAKE SHOES. The two brake shoes can now be lifted off from brake backing plate and brake cam (fig. 112). Disconnect brake shoe return springs from brake shoes.

h. Rear Brake Shoe Installation.

(1) INSTALL BRAKE SHOES. Connect the two brake shoe return springs to the brake shoes. Place the two brake shoes in position on backing plate, seating the shoes on the cam wear plates. Place hinge pin ends of shoes in position in bracket.

(2) INSTALL HINGE PINS. Insert hinge pins in bracket bushings from rear face of backing plate, slotted ends first. Have slots in

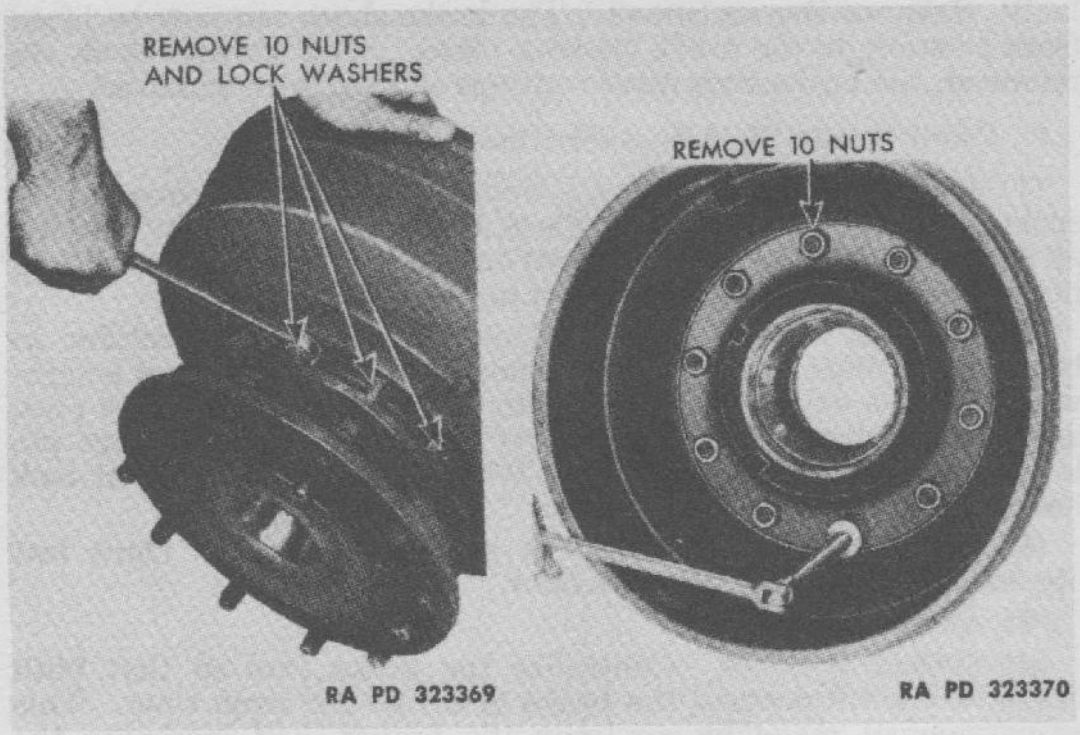


Figure 113 — Removing Nuts from Drum to Hub Cap Screws

Figure 114 — Removing Nuts from Hub Studs

pins located opposite each other, that is, upper pin slot downward and lower pin slot upward. Drive hinge pins into place. Aline slots in hinge pins, place pin retainer plate in place in slots, and install cap screw and lock washer.

(3) INSTALL WHEEL. Refer to paragraph 151 b. Omit last operation of lowering wheel to floor.

(4) ADJUST BRAKES. Adjust rear wheel brakes as outlined in subparagraph f (4) above.

(5) Remove blocks, and lower wheels to floor.

146. BRAKE DRUMS.

a. When brake drums and wheels are removed, the drums must be inspected for grooving, scoring, heat-checking, cracking, or excessive wear. Service and replace as necessary. If a drum is replaced, it must be checked for out-of-round after being bolted to the wheel. It should be concentric with the wheel bearings within 0.010 inch.

b. Removal.

(1) FRONT BRAKE DRUM.

(*a*) Raise vehicle, and block wheel. Remove tire and rim.

(*b*) Remove wheel hub and drum from axle, following procedure outlined in paragraph 150 a (3) to (5).

(*c*) Remove ten nuts and lock washers from drum to hub retaining cap screws (fig. 113).

(*d*) Remove drum from hub, and remove 10 cap screws from holes.

(2) REAR BRAKE DRUM.

(*a*) Raise vehicle, and block wheel. Remove tires and rims from hub.

(*b*) Remove wheel hub and drum from axle, following procedure outlined in paragraph 150 **b** (2) to (7).

(*c*) Remove 10 nuts and lock washers from hub studs (fig. 114), and remove drum from hub.

c. Installation.

(1) FRONT BRAKE DRUM.

(*a*) Be sure that drum and hub mounting surfaces are smooth and clean.

(*b*) Place drum in position on hub, and install 10 cap screws from brake drum side. Install nuts and lock washers, and tighten securely.

(*c*) Install hub and drum on axle, following procedure outlined in paragraph 151 **a** (3) to (5).

(*d*) Install tire and rim.

(*e*) Adjust brakes. Refer to paragraph 145 **f** (4).

(*f*) Remove blocks, and lower wheel to floor.

(2) REAR BRAKE DRUM.

(*a*) Be sure that hub and drum mounting surfaces are smooth and clean.

(*b*) Place brake drum in position on hub over studs, install nuts and lock washers, and tighten securely.

(*c*) Install hub and drum, following procedure outlined in paragraph 151 **b** (3) to (6).

(*d*) Install tires and rims.

(*e*) Adjust brakes (par. 145 **f** (4)).

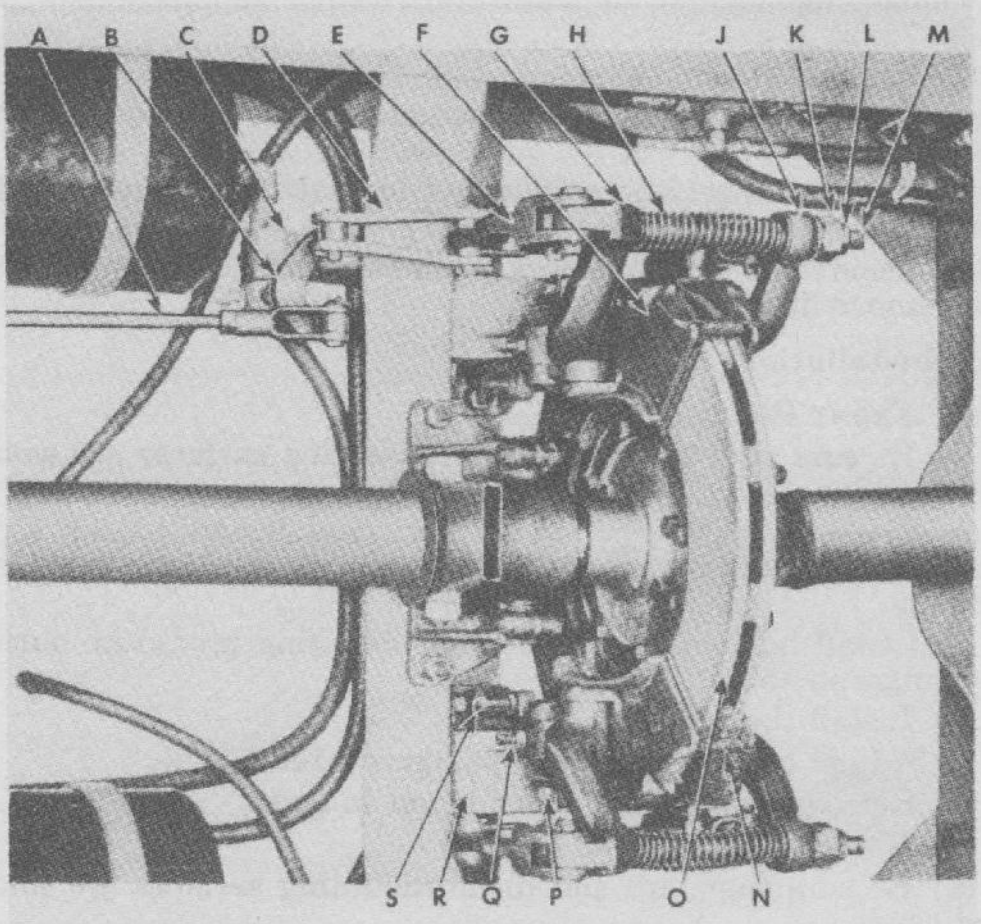
(*f*) Remove blocks, and lower wheel to floor.

147. HAND BRAKE.

a. Description (fig. 115).

(1) The hand brake, variously referred to as the parking brake, drive shaft brake, or emergency brake, is of four-shoe, disk type, and is mounted on a bracket on the frame center crossmember. The disk is attached to the propeller shaft companion flange at the rear of the front propeller shaft. The brake shoes are mounted on pins in brackets attached to the crossmember. The brake is operated by a hand lever mounted at the left-hand side of the transmission in the driver's compartment. The hand lever is connected to the brake assembly by a control rod.

(2) This disk brake must not be used to decelerate or stop the vehicle in normal operation. It is to be used as a parking brake only, except in case of emergency.



A—BRAKE PULL ROD
B—RELAY LEVER
C—RELAY LEVER BRACKET
D—RELAY LINKS
E—OPERATING LEVER
F—BRAKE SHOE
G—BRAKE SHOE FRONT LEVER ARM
H—LEVER ARM RELEASE SPRING
J—BRAKE SHOE REAR LEVER ARM
K—TIE ROD SPHERICAL NUT
L—TIE ROD LOCK NUT
M—TIE ROD
N—BRAKE SHOE SPRING
O—BRAKE DISK ASSEMBLY
P—BRAKE SHOE PIN RETAINER SCREW
Q—LEVER ARM ANCHOR PIN LOCK SCREW
R—BRAKE ANCHOR BRACKET
S—BRAKE SHOE ADJUSTING SET SCREW

RA PD 323371

Figure 115 — Hand Brake Installed Bottom View

b. Data.

Make . . . . . American Chain
Type . . . . . 4-shoe, disk

c. Adjustment (fig. 115).

(1) Place hand brake lever in fully released position.
(2) TIGHTEN SPHERICAL NUT. Loosen tie rod lock nut, and

tighten spherical nut so that lever arm spring exerts enough pressure to bring operating lever to stop solidly against lever arm.

(3) ADJUST BRAKE YOKE END PULL ROD. Insert a 0.010-inch feeler gage between front shoe lining and disk, and adjust brake lever pull rod to maintain this clearance.

(4) ADJUST REAR BRAKE SHOE. Insert a 0.010-inch feeler gage between rear shoe lining and disk. Tighten spherical nut to maintain this clearance. Tighten lock nut.

(5) ADJUST BRAKE SHOE ADJUSTING SET SCREWS. Be sure that tension springs are in position at bottom of brake shoes. Loosen lock nuts on adjusting set screws. Adjust set screws so that linings are parallel to brake disk.

(6) Make same adjustments at brakes shoes on opposite side of brake.

d. Removal. Brake shoes or brake disk may be replaced through partial disassembly of the brake.

(1) BRAKE SHOES. To remove brake shoes, follow procedure exactly.

(*a*) Place hand lever in full released position.

(*b*) Remove lock nut from spherical nut, and remove spherical nut from tie rod.

(*c*) Remove small tension spring from bottom of brake shoes.

(*d*) Apply hand brake lever so that rear shoe arm will be cleared of the tie rod and spring.

(*e*) Remove brake shoe lock screws, and remove brake shoe pins.

(*f*) Remove brake shoes from assembly.

(2) BRAKE DISK.

(*a*) Disconnect rear propeller shaft universal joint at the brake disk companion flange, removing four trunnion bearing cap screws from flanges. Lower shaft.

(*b*) Remove brake shoes, following procedure outlined in step (1), above.

(*c*) Remove cotter pin and nut from front propeller shaft rear companion flange. Remove nuts and lock washers from eight disk to companion flange cap screws, and remove cap screws. Pull companion flange from propeller shaft.

(*d*) Lower disk from brake.

e. Installation.

(1) BRAKE SHOES.

(*a*) Place brake shoes in position in brackets, install brake shoe pins, and install brake shoe set screws.

(*b*) Release hand lever, and insert tie rod and spring in brake shoe arm.

(*c*) Install spherical nut and lock nut, but do not tighten.

(*d*) Install tension spring on bottom of shoes.

(*e*) Adjust brakes, following procedure outlined in subparagraph c above.

(2) BRAKE DISK.

(*a*) *Install Disk in Brake Assembly.* Place brake disk in position over end of propeller shaft. Install propeller shaft companion flange on shaft, and install eight retaining cap screws, nuts, and lock washers.

(*b*) *Install Brake Shoes.* Follow procedure outlined in step (1), above.

(*c*) *Connect Propeller Shaft.* Raise front end of rear propeller shaft to position, and install four cap screws in trunnion bearing flanges at universal joint.

(*d*) *Adjust Brakes.* Follow procedure outlined in subparagraph c above.

Section XXXIII

WHEELS AND BEARINGS

148. DESCRIPTION.

a. Disk-type wheels are used on this vehicle. The disks are attached to the wheel hubs by wheel hub stud nuts. The front wheels carry single tires, while the rear wheels mount dual tires.

b. Data.

(1) WHEELS.

Make	Budd
Size	20 in.

(2) TIRES.

Tread type	Non-directional
Size:	
On Model H-542-9	9.00 x 20
On Model H-542-11	11.00 x 20
Tire pressure:	
On Model H-542-9 front and rear	65 lb
On Model H-542-11—Front	50 lb
Rear	70 lb

(3) WHEEL BEARINGS.

Make	Timken
Front bearing model numbers:	
Inner cup	5521
Inner cone	5582
Outer cup	4320
Outer cone	4367
Rear bearing model numbers:	
Inner and outer cups	592-A
Inner and outer cones	596

c. Tires and Tubes. Tires should be repaired in accordance with conventional methods. Punctures and tears causing exposure of the cord or fabric must be vulcanized (TM 31-200). Tires must be inflated equally, and not operated underinflated. Bal-

anced correct tire pressures facilitate steering, improve riding comfort, and contribute to safe driving and maximum tire mileage. Before pumping air into a tube, depress valve momentarily to blow out any dirt in the valve. Keep valve caps in place to prevent entrance of dirt and foreign matter.

149. ADJUSTMENTS.

a. Wheel Stud Nuts. Check and tighten wheel stud nuts daily for the first 500 to 1,000 miles of service. Use special wrench provided for purpose in vehicle, but do not use extension on the handle or apply pressure other than direct hand effort. Successively tighten opposite nuts to prevent cocking wheel on studs. Never use oil on wheel stud nuts. Wheel studs and nuts are marked "R" and "L" to indicate side of vehicle on which they must be installed in the wheel hubs. Those marked "R" are right-hand threaded and must be used on the right side of the chassis. Those marked "L" are left-hand threaded and must be installed on the left-hand side of the vehicle.

b. Front Wheel Bearings.

(1) Raise wheel from floor, and block.

(2) Remove three hub cap retaining cap screws, hub cap, and cap gasket.

(3) Straighten locking tab of lock washers, and remove bearing lock nut from steering knuckle.

(4) Remove bearing adjusting nut lock washer from steering knuckle.

(5) Using slotted side of special wrench with slot located over the adjusting nut lug pin, adjust wheel bearings. Revolve wheel by hand while tightening bearing lock nut until a definite drag is felt. Back off adjustment about $\frac{1}{6}$ turn.

(6) Reinstall adjusting nut lock washer over nut, locating so that lug pin enters one of the holes in the lock washer.

(7) Install outer lock nut lock washer and lock nut. Tighten securely, and bend tab of washer against side of nut.

(8) Install hub cap gasket and hub cap at hub, and install three retaining cap screws.

(9) Lower wheel to floor.

c. Rear Wheel Bearings.

(1) Raise wheel from floor, and block.

(2) Remove seven stud nuts and lock washers from rear axle flange studs.

(3) Loosen lock nuts on two screws in axle shaft flange, and screw both screws into flange to force axle drive shaft from studs.

(4) Remove axle drive shaft from housing.

(5) Using special wrench, remove lock nut from axle.

(6) Lift lock nut from position over adjusting nut.

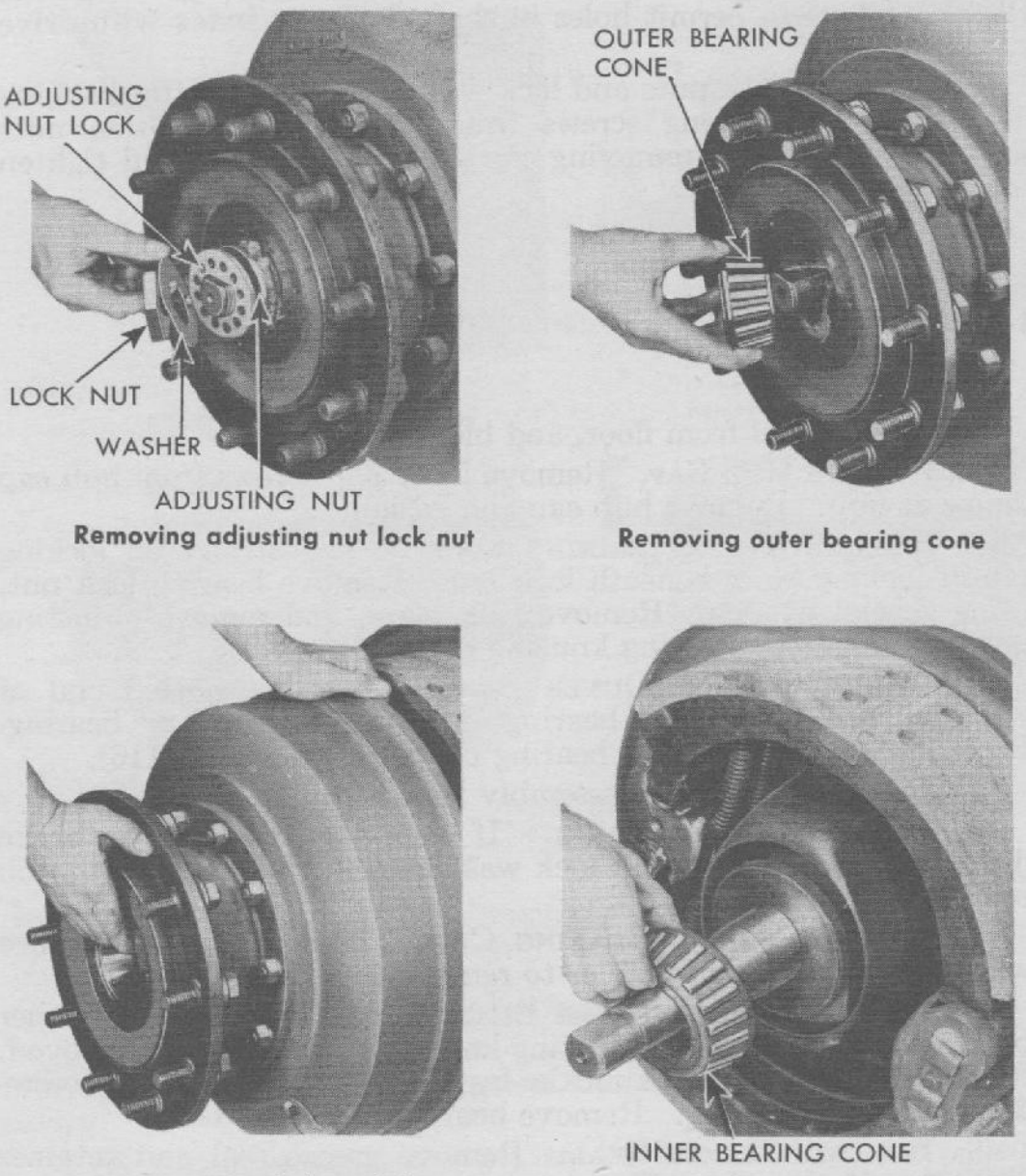


Figure 116 — Removing Front Wheel Bearings

(7) Using slotted end of special wrench with slot over pilot lug of adjusting nut, adjust wheel bearings. Rotate wheel by hand while tightening adjusting nut until a definite drag is felt. Back off adjustment about $\frac{1}{6}$ turn.

(8) Place adjusting nut lock in position over adjusting nut, having pilot lug entered in one of the holes in the nut lock.

(9) Install outer lock nut, and tighten securely.

(10) Install axle drive shaft in position in axle housing, indexing the drive shaft splines with the differential side gear splines. Revolve wheel to permit holes in shaft flange to index with drive studs.

(11) Install seven nuts and lock washers on studs, after backing out the two removing screws from the flange. Tighten nuts securely. Screw two removing cap screws into flange, and tighten lock nuts.

(12) Lower wheel to floor.

150. REMOVAL.

a. Front Wheels.

(1) Raise wheel from floor, and block.

(2) REMOVE HUB CAP. Remove three cap screws from hub cap flange at hub. Remove hub cap and gasket.

(3) REMOVE WHEEL BEARING LOCK NUTS. Straighten locking tab of locking plate beneath lock nut. Remove bearing lock nut, using special wrench. Remove lock plate, and remove adjusting nut lock nut from steering knuckle (fig. 116).

(4) REMOVE WHEEL OUTER BEARING. Using slotted end of special wrench, remove bearing adjusting nut from bearing. Remove front wheel outer bearing cone from hub (fig. 116).

(5) Lift hub and drum assembly from axle (fig. 116).

(6) REMOVE BRAKE DRUM. If necessary to remove brake drum, remove 10 nuts and lock washers from brake drum to hub retaining cap screws.

(7) REMOVE WHEEL BEARING CUPS. If necessary to replace wheel bearing cups, use puller to remove cups from hub.

(8) REMOVE WHEEL INNER BEARING. The front wheel inner bearing will adhere to the steering knuckle as the wheel is removed. Remove from steering knuckle by placing two opposed screwdrivers behind bearing. Remove bearing cone (fig. 116).

(9) REMOVE GREASE SEAL. Remove grease seal and retainer from steering knuckle pilot pin.

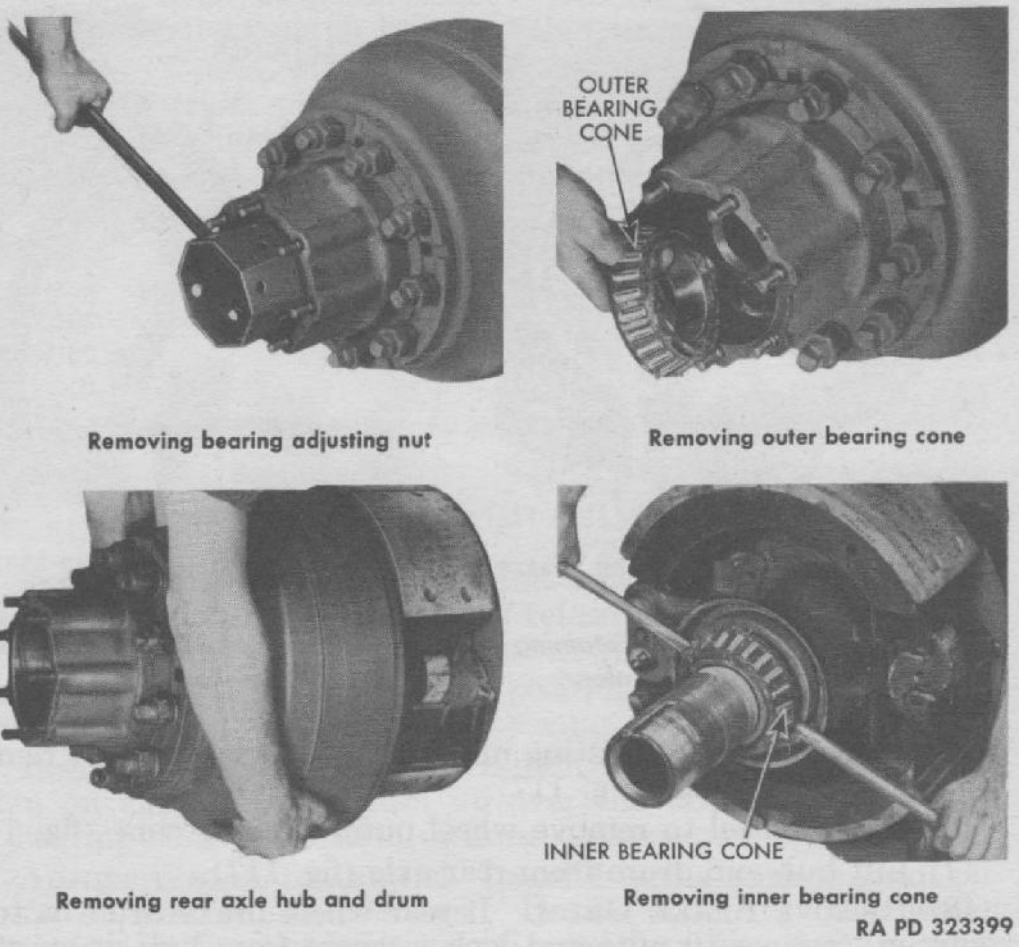
(10) CLEAN HUB. Following removal of hub and bearings, clean all grease from hub.

(11) CLEAN, INSPECT, AND LUBRICATE BEARINGS.

(*a*) Place bearings in fresh dry-cleaning solvent and allow to soak larger particles of grease. Slush bearings up and down in solvent and revolve bearings on races. Repeat process of cleaning until bearings are absolutely clean.

(*b*) When bearings are clean and dry, inspect for pits, cracks, or rust spots. Inspect each roller carefully. If any imperfections are found, do not reinstall bearing. Replace with a new bearing.

(*c*) Use bearing packing equipment if available to repack wheel bearing cone. If packing equipment is not available, pack grease (WB 2) by hand into rollers and retainer until well filled. Coat



Removing bearing adjusting nut

Removing outer bearing cone

Removing rear axle hub and drum

Removing inner bearing cone

RA PD 323399

Figure 117 — Removing Rear Wheel Bearings

bearing cone in hub with grease, but do not pack wheel hub cavity.

(*d*) If wheel bearings are not to be immediately reinstalled, wrap carefully to prevent entrance of dirt or moisture. NOTE: *Do not use engine oil on bearings or the oil will prevent wheel bearing grease from adhering to rollers.*

b. Rear Wheels.

(1) Raise wheel from floor, and block.

(2) Remove nuts and lock washers from seven rear axle flange studs (fig. 87).

(3) Loosen lock nuts on two cap screws in flange, and screw cap screws into flange to force shaft from housing (fig. 87). Remove shaft.

(4) REMOVE BEARING OUTER LOCK NUT. Using special wrench, remove outer lock nut from axle. Remove lock washer.

(5) REMOVE BEARING ADJUSTING NUT. Remove adjusting nut

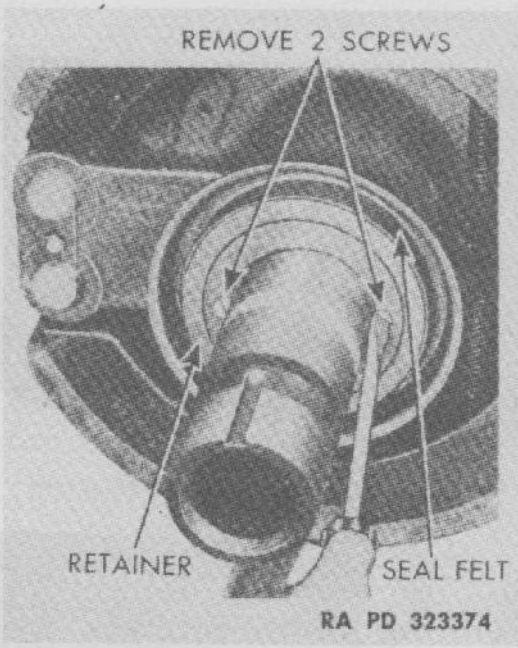


Figure 118 — Removing Retaining Screws from Seal Retainer

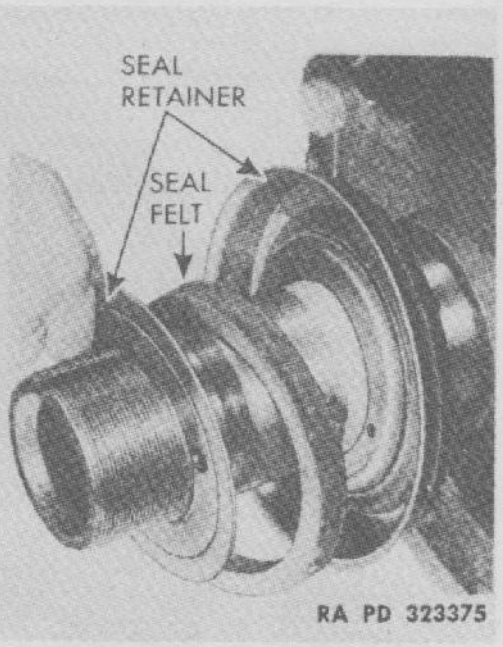


Figure 119 — Removing Grease Seal and Retainer from Axle

lock nut from above adjusting nut. Using special wrench, remove bearing adjusting nut (fig. 117).

(6) Shake wheel to remove wheel outer bearing cone (fig. 117).

(7) Lift hub and drum from rear axle (fig. 117).

(8) REMOVE BRAKE DRUM. If rear wheel brake drum is to be replaced, remove 10 nuts and lock washers from hub drum studs at inside drum. Remove brake drum from hub.

(9) REMOVE WHEEL BEARING CUPS. If necessary to replace bearing cups, remove bearing cups from hub with puller.

(10) REMOVE WHEEL INNER BEARING CONE. With two opposed screwdrivers or a puller, slide inner bearing cone from rear axle tube (fig. 117).

(11) REMOVE GREASE SEAL. Remove two retaining screws from grease seal retainer (fig. 118), and remove retainer and grease seal from axle (fig. 119).

(12) CLEAN, INSPECT, AND LUBRICATE BEARINGS. Follow procedure outlined in subparagraph a (11) above.

151. INSTALLATION.

a. Front Wheel.

(1) INSTALL GREASE SEAL. Install new grease seal in seal retainer, and place retainer on steering knuckle pilot pin.

(2) INSTALL INNER BEARING CONE. Place inner bearing cone in position on steering knuckle.

(3) INSTALL WHEEL HUB AND DRUM. With bearing cups well seated in recesses in wheel hub, and brake drum attached to

hub with retaining cap screws, lock washers, and nuts, place wheel hub in position on steering knuckle and up over brake shoes. Place outer bearing cone in hub.

(4) ADJUST WHEEL BEARINGS. Install bearing adjusting nut on steering knuckle, and tighten with special wrench. Rotate wheel by hand while tightening nut until a definite drag is felt. Then back off about $\frac{1}{6}$ turn.

(5) INSTALL BEARING LOCK NUTS. Install adjusting nut lock nut, indexing the pilot lug in one of the holes of the lock nut. Place outer lock nut flat washer in position, install outer lock nut, and tighten securely. Bend flange of lock washer around side of outer lock nut.

(6) INSTALL HUB CAP. Install new gasket on hub surface, and install hub cap and three retainer cap screws.

(7) Lower wheel to floor.

b. Rear Wheel.

(1) INSTALL GREASE SEAL. Install new grease seal and seal retainer on rear axle, and install two retainer screws.

(2) INSTALL INNER BEARING CONE. With bearing cone properly packed with grease, place cone in position on axle next to seal retainer.

(3) INSTALL WHEEL HUB AND DRUM. Lift hub and drum into position on axle, placing drum up over the brake shoes. Place outer bearing cone in position in hub.

(4) ADJUST WHEEL BEARINGS. Install bearing adjusting nut on axle, and adjust wheel bearings. Rotate hub by hand while tightening adjusting nut with special wrench until a definite drag is felt. Back off adjustment about $\frac{1}{6}$ turn.

(5) INSTALL BEARING LOCK NUTS. Install adjusting nut lock nut on axle so that pilot lug indexes with one of the holes in the lock nut. Install outer lock nut, and tighten securely.

(6) INSTALL AXLE DRIVE SHAFT. Install new drive shaft gasket. Insert axle drive shaft in axle housing, and index the drive shaft splines in the differential side gear splines. Rotate hub as necessary to permit axle shaft flange holes to engage with the driving studs, and push axle drive shaft into axle. Install seven nuts and lock washers on studs, and tighten securely.

(7) Lower wheel to floor.

Section XXXIV

SPRINGS AND SHOCK ABSORBERS

152. SPRING SUSPENSION.

a. The front springs (fig. 120) of semi-elliptic type are shackled at the rear and pivoted to a bracket at the front. The springs are attached to the front axle I-beam with U-bolts.

b. On the rear springs (figs. 121 and 122) of semi-elliptic type are mounted auxiliary or over-load springs. The rear springs are shackled at the rear and are pivoted at the front ends in brackets. The springs are attached on top of the axle housing by means of U-bolts.

c. Spring shackle bolts, pivot end bolts, rebound clips, U-bolts, and spring center bolts must be kept tight at all times to avoid spring leaf failures. Spring leaf failures near the center bolt are indicative of loose U-bolts. Spring breakage at the ends is indicative of tight shackle bolts or pivot bolts. With the vehicle under load, spring U-bolt nuts should be retightened at the end of each 50 miles of operation until the U-bolt nuts show no further signs of loose..ess. Use a wrench having at least 18-inch leverage.

153. FRONT SPRINGS (fig. 120).

a. Description. The front springs are mounted on top of the front axle and support the weight of the front of the vehicle. They are attached to the front axle by U-bolts. The spring leaves are held in alinement by rebound clips, and are held together at the center by a center bolt. The top or main leaf of the front springs has an eye at each end into which bushings are pressed. The second leaf is wrapped around the eyes.

b. Removal. Breakage of a spring leaf or leaves requires that repairs be made immediately. Spring repair requires removal of the spring for sending to higher echelon.

(1) REMOVE U-BOLTS. Remove two nuts and lock washers from each of two front spring U-bolts. Lift U-bolts from spring, and remove one spacer plate from each side of spring. NOTE: *The shock absorber connecting link is attached to the spring bumper or rebound plate which can be laid aside without necessity of disconnecting link.*

(2) RAISE VEHICLE. Raise front end of vehicle high enough to remove weight of vehicle from spring but allow weight of spring to rest on axle. Place jacks or blocks beneath the vehicle frame at each side for safety.

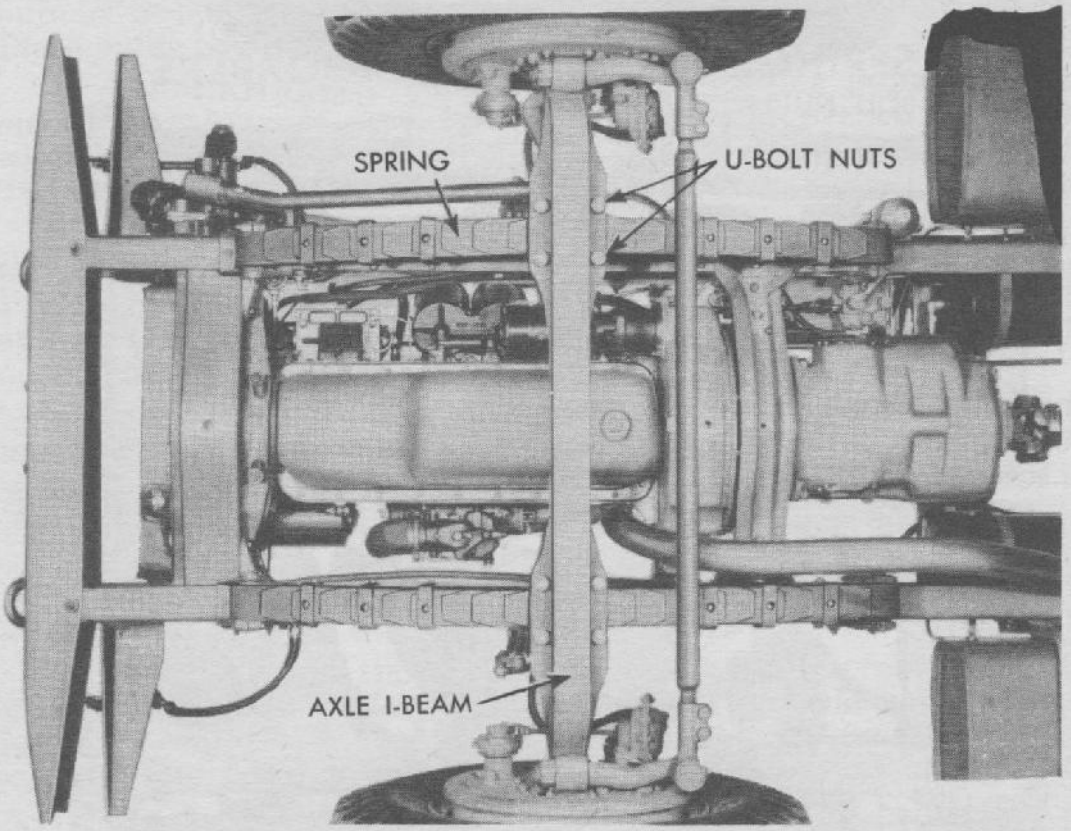


Figure 120 — Front Springs Installed Bottom View

(3) REMOVE SPRING REAR SHACKLE PIN. Remove nuts and lock washers from two spring pin clamp bolts at front spring rear shackle at each side. Drive spring pin from spring eye, driving pin from inner side.

(4) REMOVE SPRING FRONT PIVOT PIN. Remove nut and lock washer from front spring pivot pin clamp bolt, and remove bolt from bracket. Drive pivot pin from spring eye and bracket, driving pin toward inside.

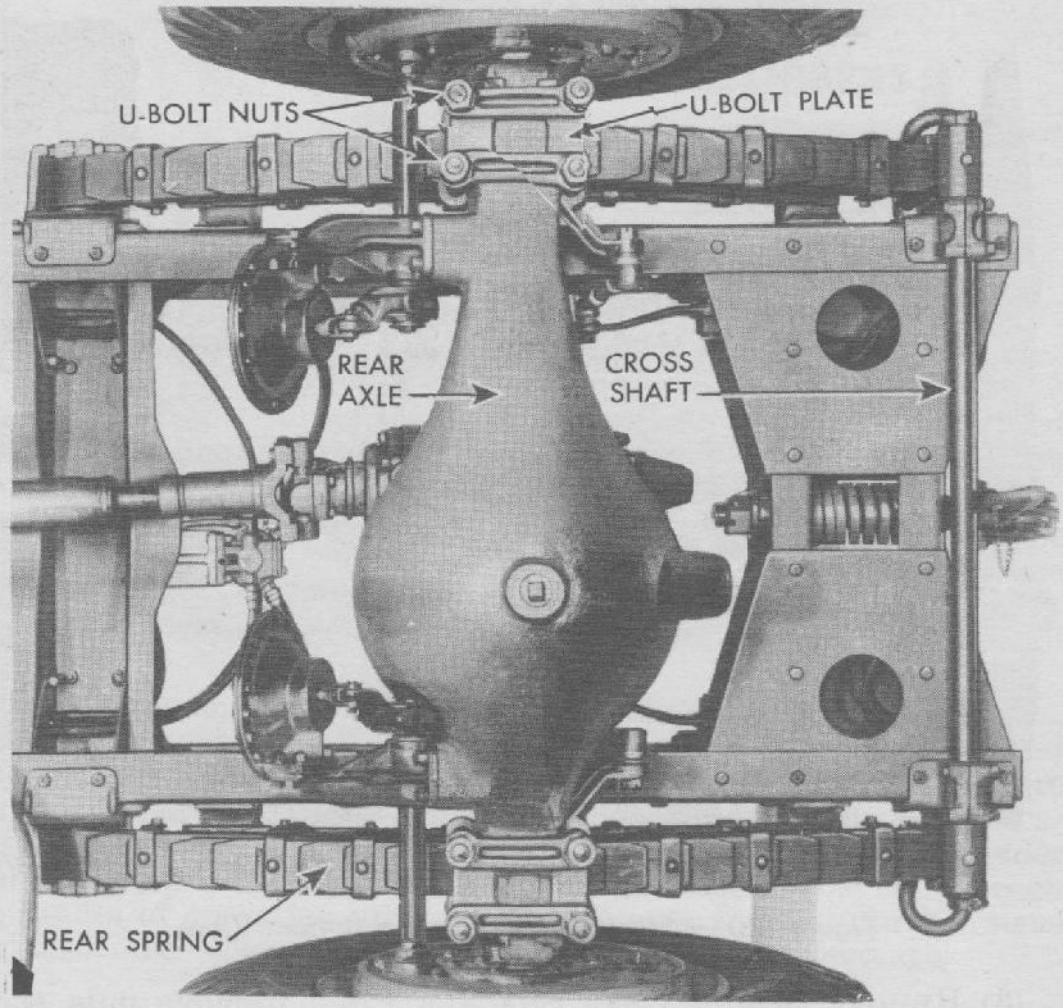
(5) REMOVE SPRING. Raise vehicle enough to facilitate lifting spring down from axle.

c. Installation.

(1) INSTALL SPRING. Lift front spring into position on front axle, being sure that spring center bolt head rests in socket in axle.

(2) INSTALL SPRING PIVOT PIN. Raise front end of spring to position in front spring bracket. Drive spring pivot pin into bracket and spring eye, having slot in pin on bottom to assure alinement with clamp bolt. Line up slot and bolt hole with punch, install clamp bolt, and install nut and lock washer.

(3) INSTALL SPRING SHACKLE PIN. Raise rear end of spring to position in shackle. Drive spring pin into spring eye and shackle, having slots in pin in alinement with clamp bolt holes.



RA PD 323377

Figure 121 — Rear Springs Installed Bottom View

Install clamp bolts, nuts, and lock washers, and tighten securely.

(4) INSTALL U-BOLTS. Lower vehicle weight onto spring. Place spring spacer plates in place at each side of spring. Place spring bumper on spring, and install U-bolts. Install two nuts and lock washers on each U-bolt. Tighten securely.

154. REAR SPRINGS (figs. 121 and 122).

a. Description. The top or main leaf of each rear spring has an eye formed at each end into which a bushing is pressed. The second leaf has its ends wrapped around the eyes. The auxiliary spring is mounted on a shroud or seat on top of the main spring. The entire assembly is attached to the rear axle housing by U-bolts. The front of the rear spring is attached to the vehicle by a bracket, and the rear by a shackle. The spring leaves are held in position by clips and center bolts.

b. Removal. To replace broken spring leaves it is necessary to remove the spring, but to remove an auxiliary spring it is not

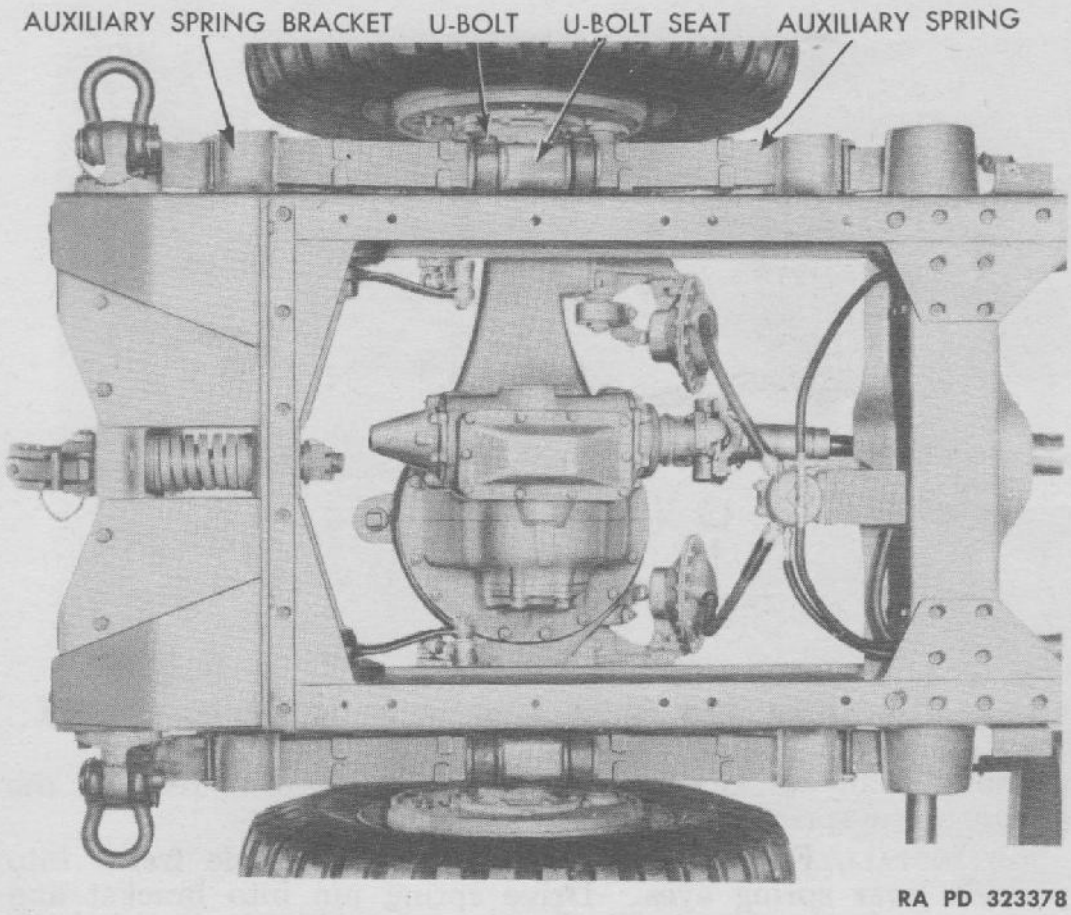


Figure 122 — Rear Springs Installed Top View

necessary to remove the main spring. Removal is accomplished as follows.

(1) REMOVE AUXILIARY SPRING. Remove two nuts and lock washers from each of two rear spring U-bolts. Remove U-bolt seat plate and U-bolts. Lift off auxiliary spring. Lift off spring shroud from main spring.

(2) RAISE VEHICLE. Raise rear of vehicle frame high enough to remove vehicle weight from spring but still allow spring to rest on rear axle housing.

(3) REMOVE FRONT SPRING PIN. Remove nut and lock washer from spring pin clamp bolt, and drive out clamp bolt. Remove lubricator fitting from end of spring pin, attach puller, and remove spring pin.

(4) REMOVE REAR SHACKLE PIN. Remove nut and lock washer from shackle pin clamp bolt, and drive out clamp bolt. Remove lubricator fitting from spring pin, attach puller, and remove pin.

(5) REMOVE SPRING. Raise vehicle rear end sufficiently to facilitate lifting spring assembly from axle, and lift off spring.

c. Installation.

(1) INSTALL SPRING. Lift rear spring into place on rear axle

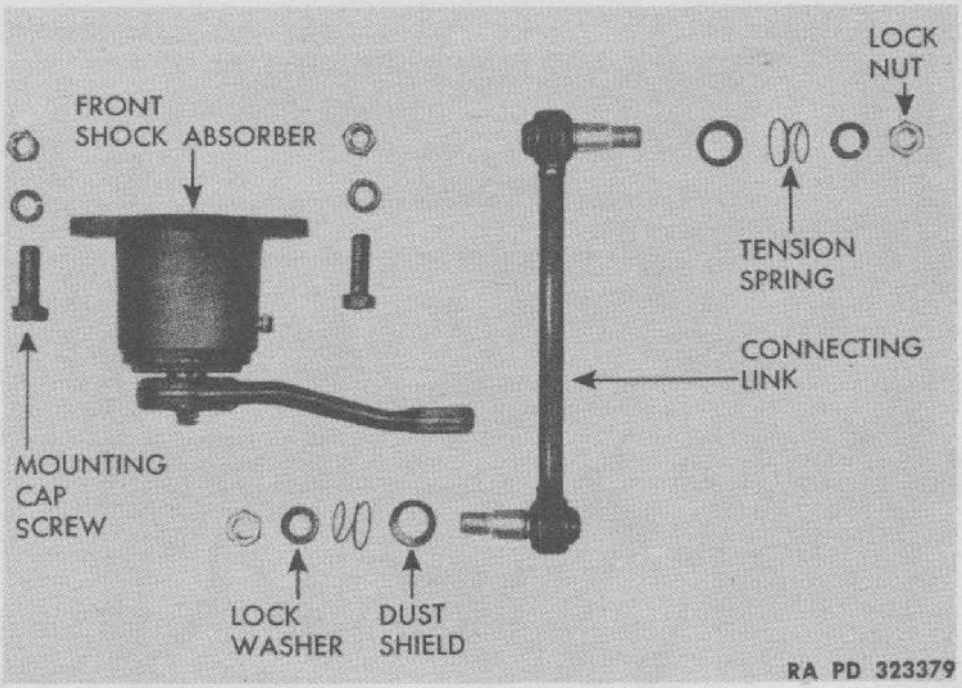


Figure 123 — Front Shock Absorber and Connecting Link, Disassembled

housing, being certain that the spring center bolt rests in the socket in the spring seat.

(2) INSTALL FRONT SPRING PIN. Lower vehicle frame into position over spring eyes. Drive spring pin into bracket and spring eye, having slot in pin in alinement with clamp bolt hole. Use punch to line up pin and bolt hole. Install clamp bolt, nut, and lock washer.

(3) INSTALL REAR SHACKLE PIN. Drive shackle pin into shackle, having slot in pin in alinement with clamp bolt hole. Use punch to line up pin and bolt hole. Install clamp bolt, lock washer, and nut.

(4) INSTALL AUXILIARY SPRING AND U-BOLTS. Place spring shroud over main spring. Place auxiliary spring on top of shroud, and install U-bolt plate on top of auxiliary spring. Install U-bolts in position, install two nuts and lock washers on each U-bolt, and tighten securely.

(5) Install lubricators in spring pins, and lubricate (par. 21).

155. SHOCK ABSORBERS (figs. 123 and 124).

a. Description. Shock absorbers at both front and rear springs control the rebound action of the springs. The shock absorber mechanisms are bolted to the frame, and the connecting links are attached to the spring plates at the front and rear of the vehicle. The links have lubricators at each end.

b. Data.

(1) FRONT SHOCK ABSORBERS.

Make.....Houdaille

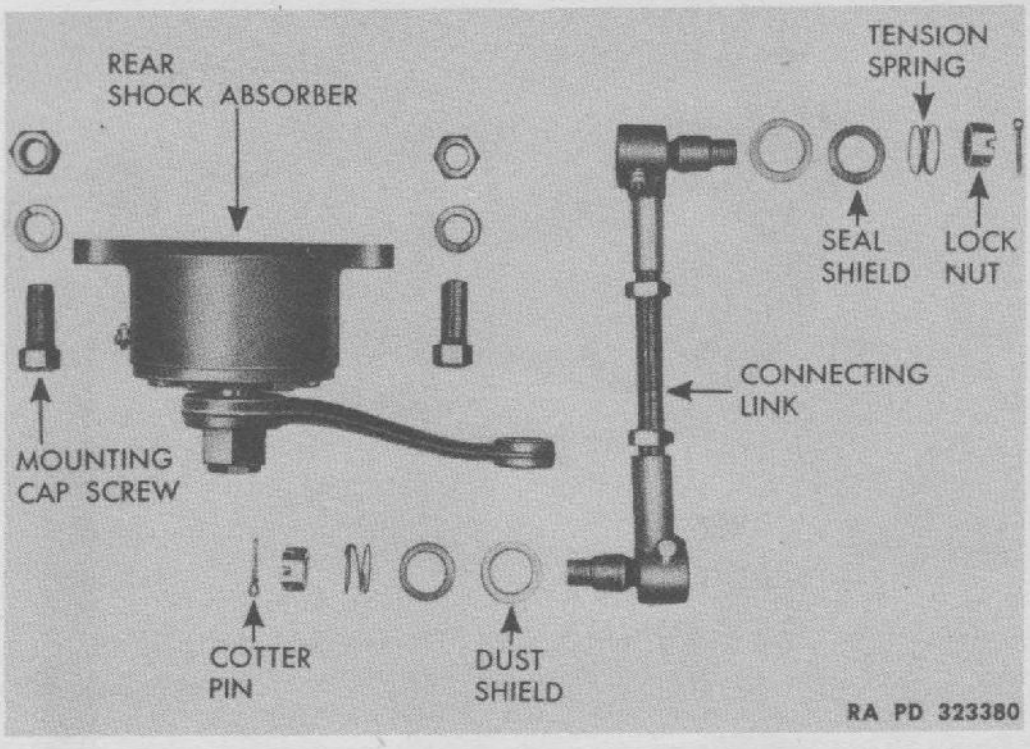


Figure 124 — Rear Shock Absorber and Connecting Link, Disassembled

Model . . . . . BBCLT

(2) REAR SHOCK ABSORBERS.

Make . . . . . Houdaille
Model . . . . . BBLB

c. Adjustment. The shock absorbers are adjusted at the factory to meet average riding conditions, and it is recommended that the factory setting be maintained. Adjustments can be made, however, to meet special operating conditions. To adjust the unit, the valve indicator on the outside of the instrument is rotated (fig. 125). NOTE: *The adjustment screw of the rear unit is located underneath the outer nut of the shaft at the side of the housing.* To increase the resistance of the shock absorber, the indicator is rotated clockwise. The indicator should not be turned more than ⅛ inch at a time until satisfactory control is obtained. NOTE: *Do not adjust past shoulder stops.*

d. Refilling. To prevent particles of dirt entering the shock absorber when refilling, clean all dirt from unit and from frame surrounding unit. Remove filler plug, and inspect fluid level which should be at level of plug. Refill if necessary.

(1) Disconnect shock absorber link at axle end.

(2) Pump shock absorber arm up and down several times to dispel air trapped in the unit. Add fluid (par. 21) and repeat pumping. When the working chamber is properly filled, there will be uniform resistance and no "rubbery" feeling or lost motion. Refill chamber to level of filler plug, and install filler plug.

(3) Connect shock absorber link at axle end.

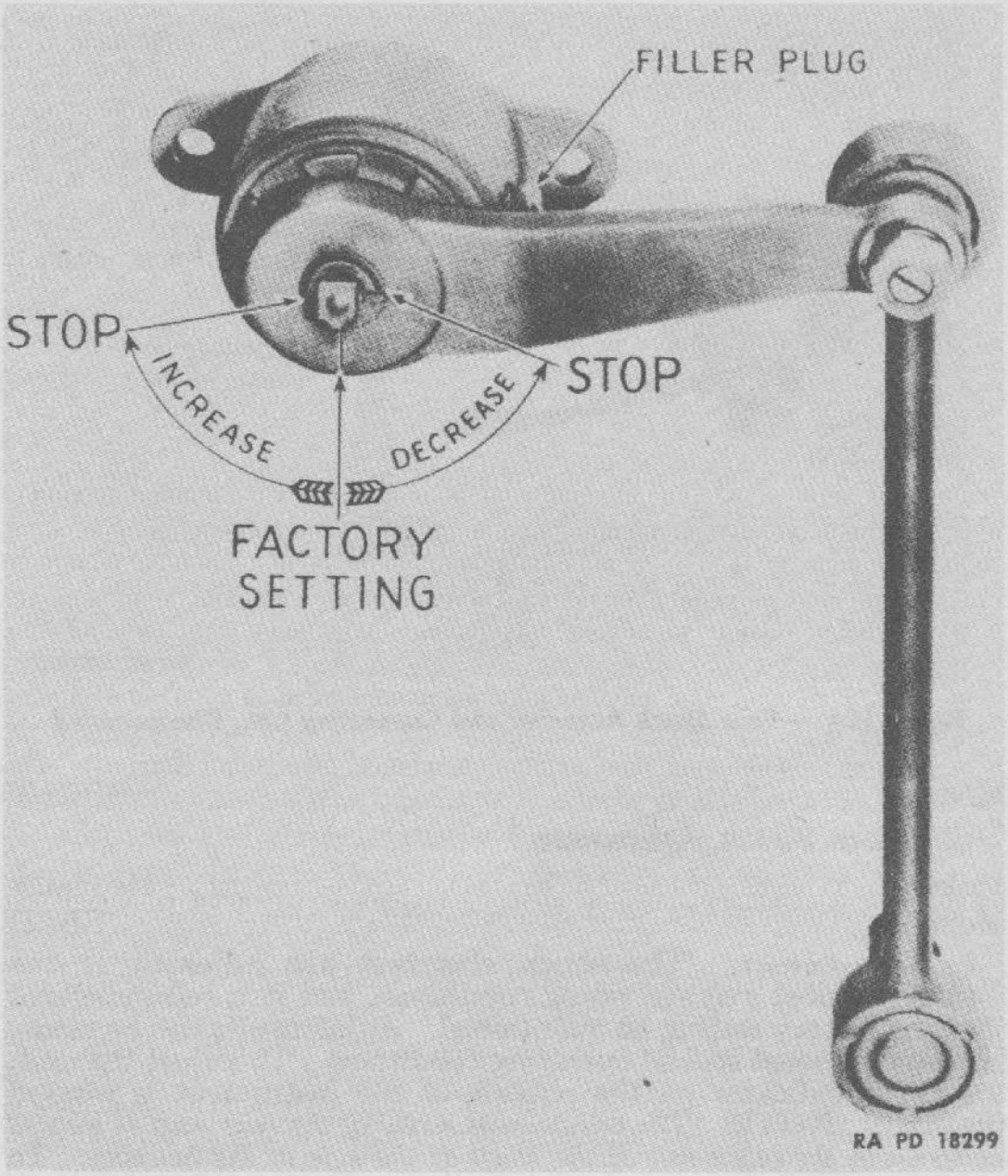


Figure 125 — Shock Absorber Adjustment Points

e. Removal.

(1) FRONT. Remove nut and lock washer from lower end of shock absorber link. Using soft hammer, drive tapered ball stud from U-bolt seat arm. Remove seal washer and spring from tapered ball stud. Remove two nuts and lock washers from shock absorber mounting bolts at frame, remove bolts, and lift unit from frame.

(2) REAR. Remove cotter pin and nut from shock absorber link at lower end. Using soft hammer, drive tapered ball stud from U-bolt seat arm. Remove seal washer and spring from tapered ball stud. Remove two nuts and lock washers from two

unit mounting bolts at frame, remove bolts, and lift unit from frame.

f. Installation.

(1) FRONT. Place shock absorber in position on frame, and install two bolts, nuts, and lock washers. Place spring and seal washer on ball stud of link. Drill ball stud into U-bolt seat arm. Install nut and lock washer.

(2) REAR. Place shock absorber in position on frame, and install two bolts, nuts, and lock washers. Place spring and seal washer on connecting link ball stud. Drive ball stud into position in U-bolt seat arm. Install nut and cotter pin.

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

Section XXXV

STEERING GEAR AND DRAG LINK

156. DESCRIPTION AND DATA.

a. Description.

(1) The steering gear in this vehicle is mounted at the front of the left-hand frame side rail (fig. 126). The steering column tube is designed so that it can be separated from the steering gear to facilitate service. This is accomplished by having the tube joined by a splined section just above the steering cam. The

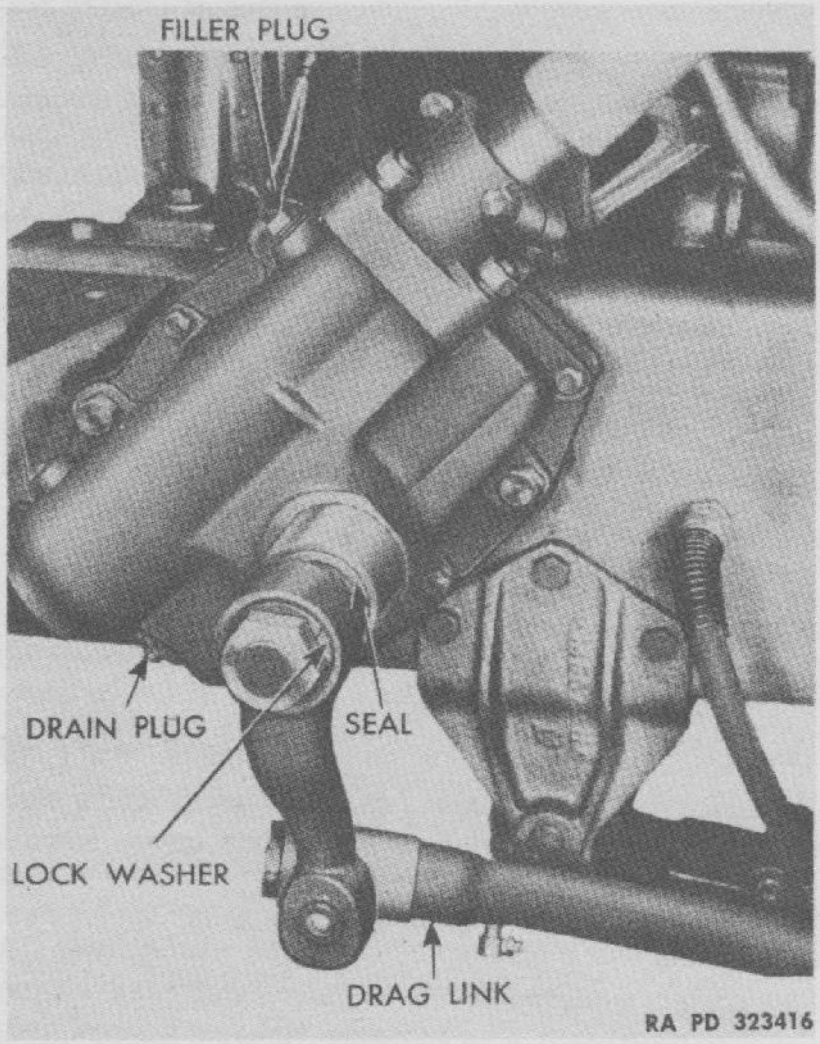


Figure 126 — Steering Gear Installed

STEERING GEAR AND DRAG LINK

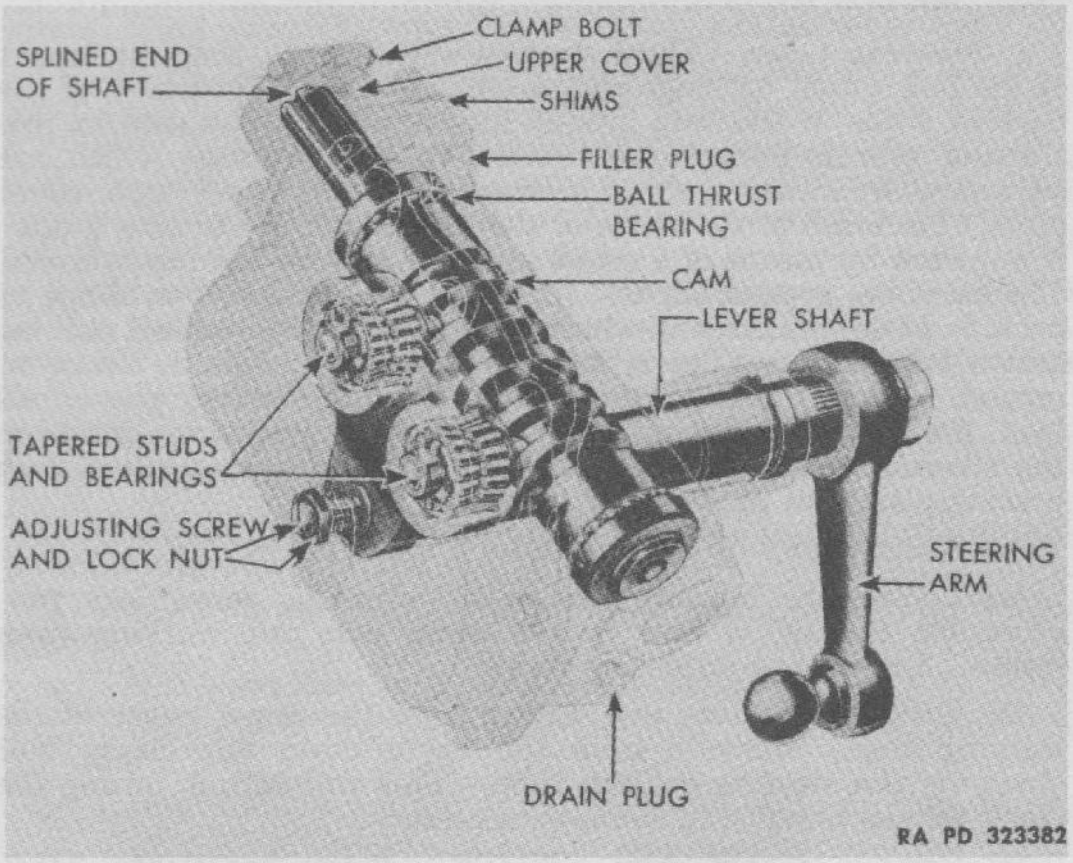


Figure 127 — Steering Gear Sectional View

steering column and post is attached to the steering gear housing by a clamp bolt.

(2) The steering gear is of cam and twin-lever design. The cam has twin tapered studs which are mounted in tapered roller bearings (fig. 127). The cam and lever design of the steering gear embodies a variable ratio worm which engages an internal lever on the side of the worm. This provides long internal leverage in combination with variable ratio. Higher gear reduction in the normal or straight-ahead driving position results in road shock reduction, easier steering, and more freedom from wandering, while lower gear reduction at the turning range provides quicker and easier steering on the turns.

(3) The drag link serves to connect the steering gear arm (Pitman) with the front axle steering arm. It consists of a tube, with ends containing thrust plugs and springs which serve to form ball and socket joints at the steering arms.

b. Steering Gear Data.

Make	Ross
Model	T-71
Type	Twin-lever, bearing stud
Ratio	22-18-22

157. ADJUSTMENTS.

a. Steering Gear. There are two adjustments, the adjustment of the ball thrust bearings on the cam, and the adjustment of the tapered studs in the cam groove for backlash. The cam in this steering gear is mounted between two ball bearings which are adjustable by means of shims between the housing and upper cover plate. Backlash of the studs of the lever shaft in the cam groove is adjusted by means of a screw and lock nut on the inside cover. The cams are ground slightly higher in the mid-position range to provide close adjustment where the usual straight-ahead driving action takes place. The adjustments must be made in the order named. When making adjustments, free the steering gear of all load, preferably by disconnecting the steering gear drag link from the steering gear arm, and loosening the instrument panel dash bracket clamp on the steering column.

(1) ADJUSTMENT OF BALL THRUST BEARINGS ON CAM.

(*a*) Loosen the housing side cover adjusting screw lock nut, accessible through a hole in the frame side rail, working from inside. Loosen the adjusting screw.

(*b*) Unscrew the four cap screws from the upper cover of the steering gear. Remove from the upper cover the clamp bolt clamping the steering column tube. This will permit raising the cover for the removal of shims as necessary.

(*c*) Remove a thin shim. NOTE: *Shims are 0.002, 0.003, and 0.010 inch thick.* Clip shim for removal.

(*d*) Reassemble cover, and tighten four cap screws. NOTE: *The cover should always be drawn down tight against the shims to provide a tight assembly. Be careful, however, in the event that too much shim thickness has been removed, not to draw so tight as to break the ball races.*

(*e*) Adjust in the above manner through the addition or removal of shims until there is a barely perceptible drag but the steering wheel turns freely with the thumb and forefinger lightly gripping the wheel rim.

(*f*) When adjustment of ball thrust bearings is completed, install steering column upper cover clamp bolt, nut, and lock washer.

(2) ADJUSTMENT FOR MINIMUM BACKLASH OF TAPERED STUDS IN CAM GROOVE. Backlash of the studs in the cam groove appears as end play of the lever shaft, and backlash at the steering wheel and at the ball on the steering gear arm. Proper adjustment requires that a very slight drag be felt through the mid-position when turning the steering wheel slowly from one extreme position to the other.

(*a*) Count the number of revolutions of the steering wheel while turning from one extreme to the other. One-half this number denotes the mid-position (or straight-ahead position) of the gear. Always make adjustment in this mid-position. Do not

adjust in positions off mid-position as backlash at these positions is normal and not objectionable.

(*b*) Tighten side cover adjusting screw until the adjustment is correct, a very slight drag being felt through the mid-position when turning the steering wheel slowly from one extreme to the other. Tighten lock nut to hold this adjustment, and recheck.

(*c*) Tighten steering column clamp bolt at instrument panel.

(*d*) Place front wheels in straight-ahead position. With steering gear in mid-position, raise end of drag link and note whether ball of steering arm will connect at the drag link without excess movement to one side or the other. If not, remove nut and lock washer from steering gear lever shaft, remove the steering arm with a puller, and reset arm on the lever shaft splines. Install and tighten lock washer and lock nut.

(*e*) Connect steering arm and drag link, and install drag link plug. Tighten plug until snug, then back off just enough to permit inserting cotter pin. Install dust seal and seal shield on drag link.

b. Drag Link Adjustment. Remove cotter pin at each end of drag link. Tighten each drag link end plug until snug, then back off adjustment about one-sixth turn or enough to permit inserting new cotter pins. It should be possible to move drag link on steering arm balls using full hand pressure.

158. REMOVAL.

a. The design of the steering gear in this vehicle permits the removal of the steering gear assembly from the frame without removing the steering wheel and steering column. This is made possible by the splined design of the steering post and steering gear connection.

(1) DISCONNECT STEERING DRAG LINK. Remove screw from drag link dust shield at front of steering drag link, and remove shield and felt seal. Remove cotter pin and drag link adjusting plug. Disconnect drag link from steering gear arm ball.

(2) Loosen steering column clamp bolt nuts at instrument panel extension.

(3) Remove nut, clamp bolt, and lock washer from top of steering housing upper cover.

(4) REMOVE STEERING GEAR FROM FRAME. Remove nuts and lock washers from three bolts holding steering gear assembly to frame side rail. Lower steering gear assembly straight down from frame and from steering column.

159. INSTALLATION.

a. Install Steering Gear Assembly on Frame. Raise steering gear straight upward along frame side rail and connect at steering column post, indexing splines of steering post and steering gear. Aline bolt holes in steering gear housing and in frame. Install three bolts, nuts, and lock washers in steering gear and frame.

b. Install clamp bolt, nut, and lock washer in steering gear upper housing cover.

c. Tighten nuts on steering column to instrument panel extension clamp bolt.

d. **Connect Steering Gear Drag Link.** Connect steering gear drag link to steering gear arm ball. Install drag link end plug. Tighten until snug, then back off plug until cotter pin can be inserted. Install drag link seal felt and seal shield over end of drag link.

Section XXXVI

SHIPMENT AND TEMPORARY STORAGE

160. GENERAL INSTRUCTIONS.

a. Preparation for domestic shipment of the vehicle is the same as preparation for temporary storage or bivouac. Preparation for shipment by rail includes instructions for loading and unloading the vehicle, blocking necessary to secure the vehicle on freight cars, number of vehicles per freight car, clearance, weight and other information necessary to prepare the vehicle properly for rail shipment. For more detailed information and for preparation for indefinite storage refer to AR 850–18.

161. PREPARATION FOR TEMPORARY STORAGE OR DOMESTIC SHIPMENT.

a. Vehicles to be prepared for temporary storage or domestic shipment are those ready for immediate service but not used for less than thirty days. If vehicles are to be indefinitely stored after shipment by rail, they will be prepared for such storage at their destination.

b. If the vehicles are to be temporarily stored or bivouaced, take the following precautions.

(1) LUBRICATION. Lubricate the vehicle completely (par, 21).

(2) COOLING SYSTEM. If freezing temperature may normally be expected during the limited storage or shipment period, test the coolant with a hydrometer and add the proper quantity of antifreeze to afford protection from freezing at the lowest temperature anticipated during the storage or shipping period. Completely inspect the cooling system for leaks.

(3) BATTERY. Check battery and terminals for corrosion and, if necessary, clean and thoroughly service battery (par. 96).

(4) TIRES. Clean, inspect, and properly inflate all tires. Replace with serviceable tires, tires requiring retreading or repairing. Do not store vehicles on floors, cinders, or other surfaces which are soaked with oil or grease. Wash off immediately any oil, grease, gasoline, or kerosene which comes in contact with the tires under any circumstances.

(5) ROAD TEST. The preparation for limited storage will include a road test of at least 5 miles, after the battery, cooling system, lubrication, and tire service, to check on general condition of the vehicle. Correct any defects noted in the vehicle operation, before the vehicle is stored, or place a note on a tag attached

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

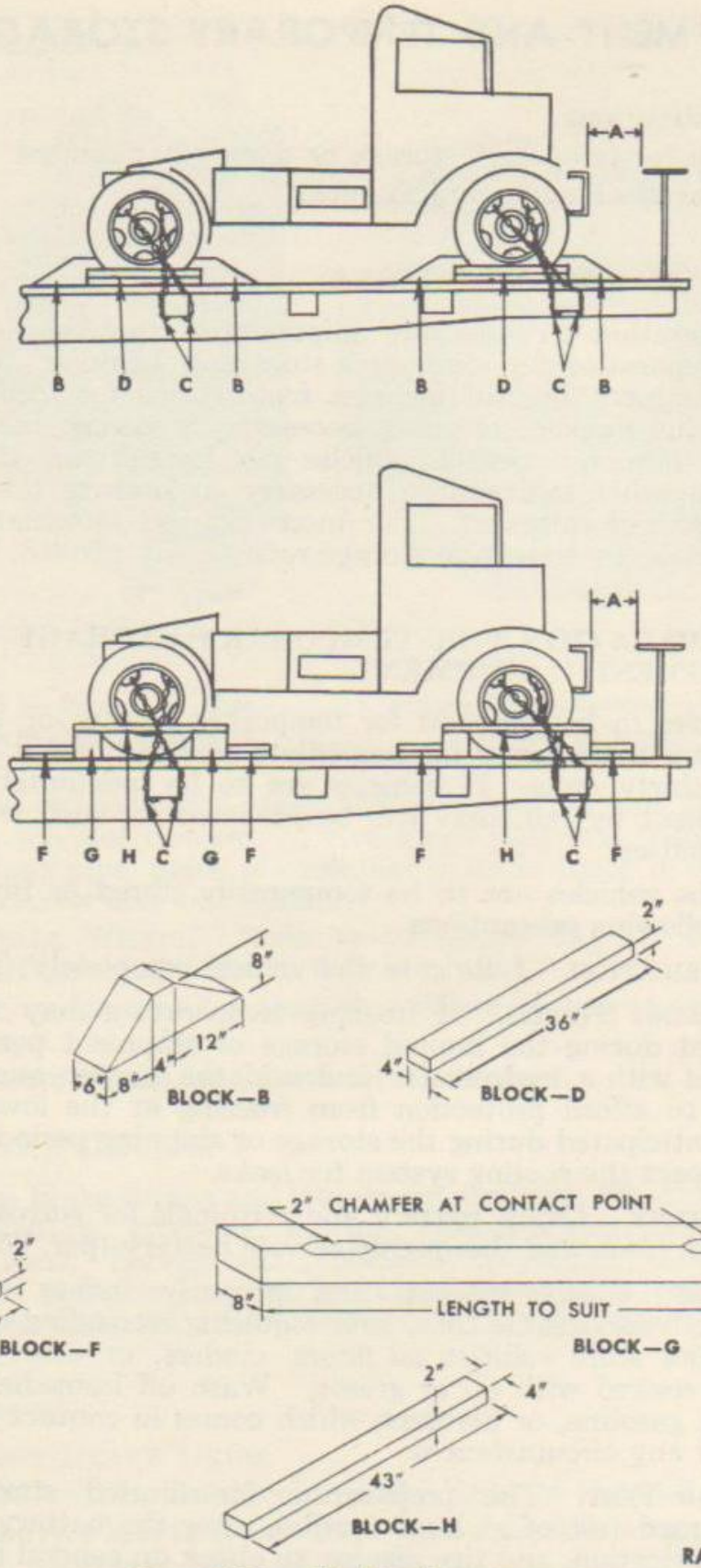


Figure 128 — Blocking Requirements for Securing Wheeled Vehicles on Railroad Cars

to the steering wheel, stating the repairs needed or describing the condition present. A written report of these items will then be made to the officer in charge.

(6) FUEL IN TANKS. It is not necessary to remove the fuel from the tanks for shipment within the United States, nor to lable the tanks under Interstate commerce commission regulations. Leave fuel in the tanks except when storing in locations where fire ordinances or other local regulations require removal of all gasoline before storage.

(7) EXTERIOR OF VEHICLES. Remove rust appearing on any part of the vehicle with flint paper. Repaint painted surfaces whenever necessary to protect wood or metal. Coat exposed polished metal surfaces susceptible to rust, such as winch cables or chains, with medium grade preventive lubricating oil. Close firmly all cab doors, windows, and windshields. Vehicles equipped with open-type cabs with collapsible tops will have the tops raised, all curtains in place, and the windshield closed. Make sure tarpaulins and window curtains are in place and firmly secured. Leave rubber mats, such as floor mats, where provided, in an unrolled position on the floor, and not rolled or curled up. Equipment such as pioneer and truck tools, tire chains, and fire extinguishers will remain in place in the vehicle.

(8) INSPECTION. Make a systematic inspection just before shipment or temporary storage to insure all above steps have been covered and that the vehicle is ready for operation on call. Make a list of all missing or damaged items and attach it to the steering wheel. Refer to "Before-operation Service" (par. 16).

(9) ENGINE. To prepare the engine for storage, remove the air cleaner from the carburetor. Start the engine and set the throttle to run the engine at a fast idle, pour 1 pint of medium grade preservative lubricating oil, Ordnance Department Specification AXS-674, of the latest issue in effect, into the carburetor throat, being careful not to choke the engine. Turn off the ignition switch as quickly as possible after the oil has been poured into the carburetor. With the engine switch off, open the throttle wide and turn the engine five complete revolutions by means of the cranking motor. If the engine cannot be turned by the cranking motor with the switch off, turn it by hand or disconnect the high-tension lead and ground it before turning the engine by means of the cranking motor. Then reinstall the air cleaner.

(10) BRAKES. Release brakes and check the wheels.

c. Inspections in Limited Storage. Vehicles in limited storage will be inspected weekly for conditions of tires and battery. If water is added when freezing weather is anticipated, recharge the battery with a portable charger or remove the battery for charging. Do not attempt to charge the battery by running the engine.

162. LOADING AND BLOCKING FOR RAIL SHIPMENT.

a. Preparation. In addition to the preparation described in paragraph 161, when Ordnance vehicles are prepared for domestic

shipment, the following preparations and precautions will be taken.

(1) EXTERIOR. Cover the body of the vehicle with a canvas cover supplied as an accessory.

(2) TIRES. Inflate pneumatic tires from 5 to 10 pounds above normal pressure.

(3) BATTERY. Disconnect the battery to prevent its discharge by vandalism or accident. This may be accomplished by disconnecting the positive lead, taping the end of the lead, and tying it back away from the battery.

(4) BRAKES. The brakes must be applied and the transmission placed in low gear after the vehicle has been placed in position with a brake wheel clearance of at least 6 inches (fig. 128 "A"). The vehicles will be located on the car in such a manner as to prevent the car from carrying an unbalanced load.

(5) All cars containing Ordnance vehicles must be placarded "DO NOT HUMP."

(6) Ordnance vehicles may be shipped on flat cars, end door box cars, side door box cars, or drop end gondala cars, whichever type car is the most convenient.

b. Facilities for Loading. Whenever possible, load and unload vehicles from open cars under their own power, using permanent end ramps and spanning platforms. Movement from one flat car to another along the length of the train is made possible by cross-over plates or spanning platforms. If no permanent end ramp is available, an improvised ramp can be made from railroad ties. Vehicles may be loaded in gondala cars without drop ends by using a crane. In case of shipment in side-door cars, use a dolly-type jack to warp the vehicles into position within the car.

c. Securing Vehicles. In securing or blocking a vehicle, three motions, lengthwise, sidewise, and bouncing, must be prevented. There are two approved methods of blocking the vehicles on freight cars, as described below. When blocking dual wheels, all blocking will be located against the outside wheel of the dual.

(1) METHOD 1 (fig. 128). Locate eight blocks "B," one to the front and one to the rear of each wheel. Nail the heel of each block to the car floor using five 40-penny nails to each block. That portion of the block under the tread will be toenailed to the car floor with two 40-penny nails to each block. Locate two blocks "D" against the outside face of each wheel. Nail the lower block to the car floor with three 40-penny nails and the top block to the lower block with three 40-penny nails. Pass four strands, two wrappings, of No. 8 gage, black annealed wire "C" through clevis on bumper at the front of the vehicle and then through a stake pocket on the railroad car. Perform the same operation at the rear of the vehicle passing the wire through the clevis at rear on frame. Duplicate these two operations on the opposite side of the vehicle. Tighten the wires enough to remove slack. When a box car is used, this strapping must be applied in a similar fashion

and attached to the floor by the use of blocking or anchor plates. This strapping is not required when gondala cars are used.

(2) METHOD 2 (fig. 128). Place four blocks "G," one to the front and one to the rear of each set of wheels. These blocks are to be at least 8 inches wider than the over-all width of the vehicle at the car floor. Using sixteen blocks "F," locate two against blocks "G" to the front of each wheel and two against blocks "G" to the rear of each wheel. Nail the lower cleat to the floor with three 40-penny nails and the top cleat to the cleat below with three 40-penny nails. Locate four cleats "H" on the outside of each wheel to the top of each block "G" with two 40-penny nails. Pass four strands, two wrappings, of No. 8 gage, black annealed wire "C" through clevis on bumper (front) and also clevis at rear on frame as described in Method 1 above.

d. Shipping Data.

	H-542-9	H-542-11
Length over-all	199 7/8 in.	199 7/8 in.
Width over-all	94 5/8 in.	97 1/2 in.
Height over-all	102 1/2 in.	104 3/4 in.
Shipping weight	11,600 lb	11,963 lb
Approximate floor area	132 sq ft	136 sq ft
Approximate volume	1,122 cu ft	1,182 sq ft
Bearing pressure (lb per sq ft)	88	88

REFERENCES

PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes to or revisions of the publications given in this list of references and for new publications relating to materiel covered in this manual:

Introduction to Ordnance Catalog (explains SNL system)	ASF Cat ORD-1 IOC
Ordnance publications for supply index (index to SNL's)	ASF Cat ORD-2 OPSI
Index to ordnance publications (lists FM's, TM's, TC's and TB's of interest to Ordnance personnel, MWO's, OPSR's, BSD, S of SR's, OSSC's and OFSB's. Includes alphabetical listing of Ordnance major items with publications pertaining thereto)	OFSB 1-1
List of publications for training (lists MR's, MTP's, T/BA's, T/A's, and FM's, TM's, and TR's concerning training)	FM 21-6
List of training films, film strips and film bulletins (lists TF's, FS's, and FB's by serial number and subject)	FM 21-7
Military training aids (lists graphic training aids, models, devices, and displays)	FM 21-8

STANDARD NOMENCLATURE LISTS.

5-Ton 4 x 2 Tractor Truck (C.O.E.) (IHC Models H-542-9 and H-542-11, Marmon-Herrington Model H-542-11, Kenworth Model H-542-11)	SNL G-671
Cleaning, preserving and lubrication materials, recoil fluids, special oils, and miscellaneous related items	SNL K-1
Soldering, brazing and welding materials, gases and related items	SNL K-2
Tool sets—motor transport	SNL N-19

EXPLANATORY PUBLICATIONS.

Fundamental Principles.

Automotive electricity	TM 10-580
Automotive lubrication	TM 10-540
Basic maintenance manual	TM 38-250
Driver's manual	TM 10-460
Driver selection and training	TM 21-300

REFERENCES

Electricity fundamentals	TM 1-455
Military motor vehicles	AR 850-15
Motor vehicle inspections and preventive maintenance service	TM 9-2810
Precautions in handling gasoline	AR 850-20
Standard military motor vehicles	TM 9-2800
The internal combustion engine	TM 10-570

Maintenance and Repair.

Cleaning, preserving, lubricating and welding materials and similar items issued by the Ordnance Department	TM 9-850
Cold weather lubrication and service of combat vehicles and automotive materiel	OFSB 6-11
Maintenance and care of pneumatic tires and rubber treads	TM 31-200
Ordnance Maintenance: 5-ton 4 x 2 tractor truck (C.O.E.) (International Harvester)	TM 9-1812
Ordnance Maintenance: Electrical equipment (Delco-Remy)	TM 9-1825A
Ordnance Maintenance: Power brake systems (Bendix-Westinghouse)	TM 9-1827A
Ordnance Maintenance: Carburetors (Zenith)	TM 9-1826C
Ordnance Maintenance: Fuel pumps	TM 9-1828A
Ordnance Maintenance: Speedometers and tachometers (Stewart-Warner)	TM 9-1829A
Tune-up and adjustment	TM 10-530

Protection of Materiel.

Camouflage	FM 5-20
Chemical decontamination, materials and equipment	TM 3-220
Decontamination of armored force vehicles	FM 17-59
Defense against chemical attack	FM 21-40
Explosives and demolitions	FM 5-25

Storage and Shipment.

Ordnance storage and shipment chart, group G —Major items	OSSC-G
Registration of motor vehicles	AR 850-10
Rules governing the loading of mechanized and motorized army equipment also major caliber guns, for the United States Army and Navy, on open top equipment published by Operations and Maintenance Department of Association of American Railroads.	
Storage of motor vehicle equipment	AR 850-18

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)

INDEX

A

B

C

INDEX

C — Cont'd

D

D — Cont'd

E

INDEX

I — Cont'd

L

INDEX

L — Cont'd

M

O

P

Q

R

R — Cont'd

S

INDEX

S — Cont'd

T

T — Cont'd

V

W

U. S. GOVERNMENT PRINTING OFFICE : O—1948

TM 9-812

5-TON 4 x 2 TRACTOR TRUCK (C.O.E.)
MODELS H-542-9 AND H-542-11

TECHNICAL MANUAL

TM 9-812
C 1

5-TON 4X2 TRACTOR TRUCK (COE) M425 AND M426 (IHC MODELS H-542-9 AND H-542-11, MARMON-HERRINGTON MODEL H-542-11, AND KENWORTH MODEL H-542-11)

CHANGES No. 1

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *3 April 1951*

TM 9-812, 11 March 1944, is changed as follows:

The title of this manual is changed to 5-TON 4X2 TRACTOR TRUCK (COE) M425 AND M426 (IHC MODELS H-542-9 AND H-542-11, MARMON-HERRINGTON MODEL H-542-11, AND KENWORTH MODEL H-542-11).

1. Scope

* * * * * * *

b. In addition to * * * of the matériel. The manual is divided into **three** parts. Part One, which includes sections I through **VII,** gives vehicle operating instructions. Part Two, which includes section **X through XXXV.1,** gives vehicle maintenance instructions for using arm personnel charged with the responsibility of doing maintenance work within their jurisdiction. **Part Three, which includes sections XXXVII and XXXVIII, gives instructions for shipment and limited storage and destruction to prevent enemy use. The appendix at the end of the manual contains a list of references including standard nomenclature lists, forms, technical manuals, and other publications applicable to the matériel.**

c. In all cases * * * proper instructions issued.

Note. (Added) The replacement of certain assemblies, that is, front axle, rear axle, clutch, engine, and transmission is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing these replacements is obtained from the responsible commander. A replacement assembly, any tools needed for the operation which are not carried by the using organization, and any necessary special instructions may be obtained from the supporting ordnance maintenance unit.

d. The vehicle models * * * the tire size. **The tractor truck M425 (light-weight) is the standard designation for International Harvester Model H-542-9 vehicle. The M426 (heavy) is the standard designation for the H-542-11 Model vehicle.**

---

*Supersedes TB 9-812-2, 27 June 1944; and those portions of TB ORD 196, 2 January 1943; TB ORD 205, 29 September 1944; TB ORD 247, 29 January 1945; TB ORD 279, 4 April 1945; TB ORD 341, 13 July 1946; and TB ORD 342, 8 July 1946, pertaining to the matériel contained herein.

1.1. Forms, Records, and Reports

(Added)

a. GENERAL. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all units operating and maintaining vehicles. It is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. AUTHORIZED FORMS. The forms generally applicable to units operating and maintaining these vehicles are listed in the appendix. No forms other than those approved for the Department of the Army will be used. Pending availability of forms listed, old forms may be used. For a current and complete listing of all forms, refer to current SR 310–20–6.

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 matériel occur.

d. REPORT OF UNSATISFACTORY EQUIPMENT OR MATERIALS. Any suggestions for improvement in design and maintenance of equipment, safety and efficiency of operation, or pertaining to the application of prescribed petroleum fuels, lubricants, and/or preserving materials 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 AGO Form 468, Unsatisfactory Equipment Report. Such suggestions are encouraged in order that other organizations may benefit.

5. Instruments and Controls

* * * * * * *

c. CONTROLS. Vehicle controls include * * * respective operation paragraphs.

* * * * * * *

(16) *Windshield wiper control valves* (fig. 7). Windshield wiper operating * * * wipers in operation. **A maximum wiper speed of not more than 60 cycles per minute or 120 strokes per minute should be maintained at all times. If the wiper speed is not correct, it may be adjusted by removing the wiper blade, wiper arm, and control knob and setting the valve shaft to obtain a speed of 80 cycles per**

minute of wiper motor operation. After adjustment, install the control knob, wiper blade, and wiper arm.

* * * * * * *

6. Use of Instruments and Controls in Vehicle Operation

a. BEFORE-OPERATION SERVICE. The before-operation * * * as described below.

* * * * * * *

(2) *Crankcase oil.* The crankcase oil * * * hood side section. The lubricant capacity of the crankcase, type of lubricant recommended, and filling **and** draining intervals are outlined in **section VII.** The oil filler * * * the "FULL" mark.

* * * * * * *

c. WARMING UP THE ENGINE. After the engine * * * not operating efficiently.

* * * * * * *

(3) *Oil pressure.* When the engine * * * slowly to normal. **Oil pressure gage must register at least 30 psi with engine running at approximately 800 rpm.** The pressure readings * * * localized and corrected.

* * * * * * *

(5) (Added) *Air pressure.* During warm-up period, air pressure gage should show a steady build-up until pressure of 105 psi is reached. If pressure exceeds 105 psi, stop engine and investigate. Do not move vehicle until minimum pressure of 70 psi has been reached.

(6) (Added) *Engine speed.* Engine speed is governed at a maximum of 2,600 rpm and should never be exceeded.

* * * * * * *

10. Fifth Wheel

(fig. 13)

* * * * * * *

b. CONNECTING TRAILER TO TRACTOR TRUCK. In connecting a * * * and release properly. **The trailer light connection is attached to front center of deck platform. The socket is of the female type with four metal contact blades. A spring metal cover keeps socket closed when not in use. Wires from socket are attached to the stop light and lighting circuits.**

* * * * * * *

Section V

OPERATION UNDER UNUSUAL CONDITIONS

(Superseded)

11. General Conditions

a. In addition to the operating procedures described for usual conditions, special instructions of a technical nature for operating and servicing this vehicle 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 the matériels.

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 matériel under unusual conditions.

c. Refer to the lubrication order for lubrication, to tables I and II for preventive maintenance checks, and to section XXXV.1 for maintenance procedures under unusual conditions.

d. When chronic failure of matériel results from subjection to extreme conditions, report of the condition should be made on DA AGO Form 468 (par. 1.1).

12. Extreme-cold Weather Conditions

a. General Problems.

(1) Extensive preparation of matériel scheduled for operation in extreme-cold weather is necessary. Generally, extreme cold will cause lubricants to thicken or congeal, freeze batteries or prevent them from furnishing sufficient current for cold-weather starting, crack insulation and cause electrical short circuits, 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) For description of operations in extreme cold, refer to FM 70–15 and 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 this vehicle 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. Information on winterization equipment, used for operation in extreme-cold weather (0° to –65° F.), is contained in TM 9–2855.

c. FUELS, LUBRICANTS, AND ANTIFREEZE COMPOUNDS (STORAGE, HANDLING, AND USE). 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. Refer to TM 9–2855 for detailed instructions.

Note. If the cooling system is filled with arctic antifreeze compound, make up a warning tag and place it on or near the radiator cap. The tag will read "This cooling system is filled with compound, antifreeze, arctic. CAUTION: Do not add water or any other type of antifreeze."

13. 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. Congealed 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 temperature gage reading consistently exceeds normal temperature, stop the vehicle and investigate the cause.

(4) Refer to TM 21–305 for special instructions on driving

hazards in snow, ice, and unusual terrain encountered under extreme-cold weather conditions.

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, effort should be made to prepare a footing of planks or brush. Chock in place if necessary.

(2) When preparing a vehicle for shutdown periods, place transmission lever in the neutral position to prevent it 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 I for detailed after-operation procedure. If the winter front and side covers are not available or installed, be sure to protect all parts of the engine and engine accessories against entrance of loose, drifting snow during the halt. Snow flurries penetrating the engine compartment may enter the crankcase filler vent, etc. 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 heating device is present, the battery should be removed and stored in a warm place.

(5) Refuel immediately in order to prevent condensation in the fuel tanks.

(6) Check tire pressure (par. 148).

14. Operation in Extreme-hot Weather Conditions

a. GENERAL. Continuous operation of the vehicle at high speed or long hard pulls in low gear positions on steep grades or in soft terrain may cause the vehicle to register overheating. Avoid the continuous use of low gear ratios whenever possible. Continuously 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.

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, place 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) Vehicles inactive for long periods in hot humid weather are subjected to rapid rusting and accumulation of fungi growth. Make frequent inspections and clean and lubricate to prevent excessive deterioration.

(4) Check tire pressure (par. 148).

14.1. 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 tied to the front portion of the steering wheel rim in straight-ahead 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 temperatures during the summer months.

(6) Check tire pressure (par. 148).

b. AFTER-OPERATION PROCEDURES. Clean all parts of the vehicle of snow, ice, mud, dust, and sand as soon as possible after operation. Particular care should be taken to remove collections of ice, snow, and mud from the radiator core, engine compartments, steering knuckles and arms, brake chambers and hoses, crankcase breather oil filters, air cleaners, and electrical connections.

Caution: Carefully remove accumulations of ice, caked mud, etc., from under fenders.

14.2. Fording Operations

a. GENERAL. In fording, vehicles may be subjected to water varying in depth from only a few inches to an amount 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. Fording of bodies of water up to maximum vehicle fording depth of 32⅞ inches is based on the standard vehicle with special protection provided for critical units, but without deep-water fording kit. Observe the following precautions:

(1) Do not exceed the known fording limits of the vehicle.

(2) The engine must be operated at maximum efficiency before attempting to ford.

(3) Shift gears into low range. Speed up engine to overcome the possibility of a "stall" when the cold water chills the engine. Enter the water slowly. If engine stalls while fording, it may be started in the usual manner.

(4) 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, to prevent the blades from throwing water over the electrical units. The brakes will usually be "lost" but in some cases may "grab" after emergence. Applying the brakes a few times will help dry out the brake linings after dry land has been reached.

(5) If accidental complete submersion occurs, the vehicle will be salvaged, temporary preservation applied by performing a complete lubrication service (par. 21) and item

b(5) in paragraph 159.3, 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.

d. AFTER-FORDING OPERATIONS. Immediately after vehicle emerges from the water, if tactical situation permits, remove water from compartments, check engine oil level, and check for presence of water in 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 159.3 for maintenance operations after fording.

Section VI

PREVENTIVE MAINTENANCE BY DRIVER OR OPERATOR

(Superseded)

15. General

a. RESPONSIBILITY AND INTERVALS. Preventive maintenance services are the responsibility of the using organization. These services consist generally of before-operation, during-operation, at-the-halt, after-operation, and weekly services performed by the driver or operator; and of the scheduled services performed at designated intervals by organization mechanic or maintenance crews. Intervals are based on normal operations. Reduce intervals for abnormal operations or severe conditions. Intervals during inactive periods may be extended accordingly.

b. DEFINITION OF TERMS. The general inspection of each item applies also to any supporting member or connection and is generally a check to see whether the item is in good condition, correctly assembled, secure, and not excessively worn.

(1) The inspection for good condition is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term good condition is explained further by the following: not bent or twisted, not chafed or burred, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, and not deteriorated.

(2) The inspection of a unit to see that it is correctly assembled is usually an external visual inspection to see if it is in its normal assembled position in the vehicle.

(3) Inspection of a unit to determine if it is secure is usually an external visual examination or a check by hand, wrench, or pry-bar for looseness. Such an inspection must include any brackets, lock washers, lock nuts, locking wires, or cotter pins used.

(4) By excessively worn is meant worn beyond serviceable limits or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection.

16. Cleaning

a. GENERAL. Any special cleaning instructions required for specific mechanisms or parts are contained in the pertinent section. General cleaning instructions are as follows:

(1) Use dry-cleaning solvent or volatile mineral spirits paint thinner 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 paint thinner 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 compounds, protective grease, etc.; prepare parts as required (oil seals, etc.); and for those parts requiring lubrication, apply the lubricant prescribed in the lubrication order.

b. GENERAL PRECAUTIONS IN CLEANING.

(1) Dry-cleaning solvent and volatile mineral spirits paint thinner 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 paint thinner, engine fuels, or lubricants on rubber parts, as they will deteriorate the rubber.

(4) The use of Diesel fuel oil, benzene (benzol), or gasoline, for cleaning is prohibited.

17. Preventive Maintenance by Driver or Operator

a. PURPOSE. To insure mechanical efficiency, it is necessary that the vehicle be systematically inspected at intervals every day it is operated, and also weekly, so that 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 defects 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 I. Every organization must thoroughly school its personnel in performing the maintenance procedures for this vehicle as set forth in this manual.

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

Intervals					Procedure
Before-Operation	During-Operation	At-the-Halt	After-Operation	Weekly	
					Caution: Place all tags describing condition of vehicle in the driver's compartment in a conspicuous location so that they will not be overlooked.
X		X	X	X	*Fuel, oil, water.* Check fuel, oil, and water levels. Look for leaks in engine compartment. Check spare containers for contents.
X				X	*Tires.* Gage tires for correct pressure.
		X	X	X	Remove penetrating objects such as nails or glass. Remove stones from between duals. Note any apparent loss of air, unusual wear, or missing valve caps.
X		X	X	X	*Leaks, general.* Look under vehicle for indication of fuel, engine oil, gear oil, or water.
X					*Vehicle equipment.* Visually inspect fire extinguishers and vehicle publications, including necessary forms.

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

Intervals					Procedure
Before-Operation	During-Operation	At-the-Halt	After-Operation	Weekly	
				X	See that fire extinguishers are charged.
X			X	X	Operate lights, horn or siren (if tactical situation permits), and windshield wipers. Visually inspect mirrors, reflectors, etc.
X			X	X	Visually inspect body, towing connections, doors, paulins, tools, etc.
				X	Check for any tampering or damage that may have occurred since last inspection.
X	X				*Instruments.* Observe for normal readings during warmup and during operation of vehicle (par. 5).
					Caution: If oil gage registers zero or excessively low, shut off engine immediately and investigate cause.
	X				*General operations.* Be alert for any unusual noises or improper operation of steering, clutch, brakes, or gear shifting.
		X	X	X	*Operating faults.* Investigate and correct or report any faults noted during operation.
		X	X	X	*Springs and suspensions.* Look at springs, suspensions, shock absorbers, and torque rods to see if they have been damaged.
			X		*Fuel filters.* Check all fuel filters for leaks.
				X	Remove the drain plug or sediment bowl and remove all water and sediment from the filter (par. 69).
			X	X	*Air-brake reservoirs.* Drain condensation.
			X	X	*Lubricate.* Lubricate daily and weekly items specified on lubrication order.
			X	X	*Clean.* Clean glass and inside of vehicle. Wipe off exterior of vehicle.
				X	Wash vehicle, clean engine, and engine compartment.
				X	*Battery.* Clean, check water level and inspect terminals for tightness and coating of grease.
				X	*Assemblies and belts.* Inspect assemblies such as carburetor, generator, compressor, starter and water pump for looseness of mountings or connections. Press drive belts to determine if tension is correct (pars. 76 and 123*d*(2)).

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

Intervals					Procedure
Before-Operation	During-Operation	At-the-Halt	After-Operation	Weekly	
				X	*Electrical wiring.* Inspect, visually, electrical wiring, harnesses, and shielding.
				X	*Axle and transfer vents.* Inspect for clogging.
					UNUSUAL CONDITIONS
					Preventive maintenance services for usual conditions will apply, with emphasis on servicing by the operator, to combat the effect of unusual conditions of extreme cold, extreme heat, unusual terrain, and fording. The special services described below are required to assure optimum results under unusual conditions.
					EXTREME COLD
					(pars. 12, 13, and 159.1 and TM 9–2855)
			X		*Cooling and fuel systems.* Refuel and add denatured alcohol as required.
				X	Drain fuel tank and fuel tank sump to remove condensation; refuel tank.
X					Check level and specific gravity of radiator coolant. Add ethylene glycol and/or water if needed.
					Note. If system carries arctic antifreeze, replenish with same but do not add water or any other type of antifreeze.
		X	X		*Transmission lever.* Position lever in neutral position.
X		X			*Tires.* Check for tires frozen to ground or for frozen flat spots.
X				X	Check for availability and serviceability of tire chains.
X					Check for proper pressure (par. 148).
				X	*Battery.* Check for proper charge.
			X		Remove battery and store in warm place, if vehicle is not equipped with power plant heater.
X			X	X	*Clean.* Clean snow, ice, and mud from all parts of vehicle.
X					*Brakes.* Check for frozen brake shoes.
					Winterization equipment (if available).
X					Check personnel heater and windshield defrosters for proper operation.
			X		Fill power plant heater fuel tank and check unit for proper functioning.
				X	Check all winterization equipment for secure installation and proper functioning.

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

Intervals					Procedure
Before-Operation	During-Operation	At-the-Halt	After-Operation	Weekly	
					UNUSUAL CONDITIONS—Continued
					EXTREME COLD—Continued
X			X		Check winterfront cover, hood blankets, under chassis blankets, hard top enclosure, etc. for security and proper adjustment.
					EXTREME HEAT (pars. 14 and 159.2)
X				X	*Cooling and fuel systems.* Check air cleaner, fuel and oil filters, and radiator fins and clean as often as necessary to keep them in good condition.
X					*Battery.* Check electrolyte level.
				X	Check for proper charge.
			X		If necessary to park for extended periods, remove battery and store in cool place.
		X	X		*Tires.* Shield tires, if possible, from direct rays of the sun.
X				X	Check for proper pressure (par. 148).
					UNUSUAL TERRAIN (pars. 14.1 and 159.4)
			X		*Lubrication.* Check for fouled lubricants and lubricate as necessary.
X				X	*Tires.* Check for proper pressure (par. 148).
X				X	Check for availability and serviceability of tire chains.
X				X	*Cooling and fuel systems.* Check air cleaner, fuel and oil filters, and radiator fins and clean as often as necessary to keep them in good condition.
X			X	X	*Clean.* Clean all parts of vehicle of snow, ice, mud, dust, and sand.
				X	Check for any sand-blasted surfaces and touch-up paint as required.
X			X		*Vents.* Check engine vents and other exposed vents and keep them covered with cloth.
					FORDING OPERATIONS (pars. 14.2 and 159.3)
X					*Fording limits.* Check vehicle fording limits. Loosen fan belt if required. See paragraph 14.2 for operating precautions.

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

Intervals					Procedure
Before-Operation	During-Operation	At-the-Halt	After-Operation	Weekly	
					UNUSUAL CONDITIONS—Continued
					FORDING OPERATIONS—Continued
X			X		*Tires.* Check for proper pressure (par. 148).
X				X	Check for availability and serviceability of tire chains. Install if necessary.
			X		*Clean.* Remove water and sludge from all parts of vehicle and wash with fresh water.
			X		*Battery.* Check electrolyte for contamination.
X					Check vent caps for tightness.
			X		*Cooling and fuel systems.* Check air cleaner, oil and fuel filters, and clean or replace if necessary.
			X		*Lubrication.* Lubricate as specified in lubrication order.

Section VIII
TOOLS AND EQUIPMENT STOWAGE ON THE VEHICLE
(Rescinded)

Note. For information on parts, special tools and equipment for organizational maintenance, refer to section XII.

Section IX
MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD
(Rescinded)

27. Second Echelon Preventive Maintenance

a. Regular scheduled maintenance * * * of operating organizations.

* * * * * * *

(5) *Specific procedures.* The procedures for performing each item in the 1,000 **miles or 60 days** and 6,000 **miles or 6 months** maintenance procedures are described in **table II.** Each page of the **table** has two columns at its left edge corresponding to the 6,000 **miles or 6 months** and 1,000 **miles or 60 days** maintenance respectively. Very often it * * * opposite the number.

Table II. Organizational Mechanic or Maintenance Crew Preventive Maintenance Services

6,000 miles or 6 months[1 2]	1,000 miles or 60 days[1 2]	Procedure
		ROAD TEST **The driver of a vehicle is often unaware of defects in his vehicle which have developed gradually and to which he has become accustomed. The fact that many drivers lack the ability to detect the developing causes of vehicle failures makes it desirable for the mechanic to road test the vehicle as part of the periodic preventive maintenance services. Before and during this road test, any repairs or adjustments necessary to insure safe operation should be made. The appropriate paragraph in the following service procedures should be consulted. If a defect found on the road test does not require immediate correction, note it on the check sheet. The defect can be corrected later during the service. Make provisions for securing necessary replacement parts or units.** *Note.* When the tactical situation does not permit a full road test, perform operations 2, 3, 4, 5, 6, 9, 10, 12, and 14 which require little or no movement of the vehicle. When a road * * * over 5 miles.
1	1	*Before-operation service.* (Superseded) Perform the before-operation service as outlined in table I, paragraph 17, as a check to determine whether the vehicle is in a satisfactory condition to make the road test safely and that it is adequately supplied with fuel, engine oil, and coolant.
2	2	*Air pressure build-up (governor cut-off and low pressure indicator).* (Added) During the warm-up period, operate the engine at fast idle speed and observe whether the brake air pressure builds up at a normal rate to the specified maximum limits and whether the governor then cuts off to stop compressing action. Observe whether the indicator signal stops as pressure is built up above the danger point.
*	*	* * * * *
4	4	*Horns, mirrors, and windshield wipers.* (Superseded) If the tactical situation permits, test the horn. The signal should be normal. Examine the rear view mirrors and the windshield wiper blades and arms to see that they are in good condition and secure.

Table II. Organizational Mechanic or Maintenance Crew Preventive Maintenance Services—Continued

6,000 miles or 6 months[1] [2]	1,000 miles or 60 days[1] [2]	Procedure
		ROAD TEST—Continued
		Observe whether the blades make good contact with the glass and that they operate properly through their complete stroke without indication of loose motor mountings.
*	*	* * * * *
		MAINTENANCE OPERATIONS (Raise Vehicle, Block Safely)
		Caution: (Added) Use necessary precautions to block the vehicle so that it may be operated safely in gear at reasonable speeds. If facilities are not available for adequately and safely jacking up and blocking vehicle, omit the services which follow that require running the engine in gear.
17	17	*Unusual noises (Superseded) (engine, belts, accessories, transmission, shaft and joints, axle, and wheel bearings).* With the engine running, observe as follows: *Engine, belts, and accessories.* Accelerate and decelerate the engine momentarily and listen for any unusual noise in these units that might indicate damaged, loose, or excessively worn engine parts, drive belts, or accessories.
		Transmission, propeller shafts and joints, axles, and bearings. With the transmission in an intermediate gear, operate at a constant moderate speed by use of the hand throttle and listen for any unusual noise that might indicate damaged, loose, or excessively worn unit parts. Also observe propeller shafts and wheels for vibrations or runout and check for vibrations in the other units. These vibrations may indicate looseness or unbalance. All of the drive wheels should rotate at approximately the same speed. Slow running wheels may indicate tight brakes or wheel bearings. In such a case, move the gear shift lever to neutral, spin the wheel by hand, and check for drag.
*	*	* * * * *

Table II. Organizational Mechanic or Maintenance Crew Preventive Maintenance Services—Continued

6,000 miles or 6 months[1 2]	1,000 miles or 60 days[1 2]	Procedure
		MAINTENANCE OPERATIONS—Continued
28	28	*Air compressor.* Inspect compressor for * * * mounting, and leaks. *Adjust.* Check the clearance * * * to 0.015 inch.
28	28	*Clean.* (Added) Clean the governor air strainer in dry-cleaning solvent or volatile mineral spirits paint thinner; dry and install.
28	28	*Special lubrication.* (Added) Refer to lubrication order for instructions.
*	*	* * * * *
37	37	*Fuel filter and lines.* Examine filter for * * *, using new gaskets. *Note.* If filter element or screen is damaged or clogged beyond cleaning, replace it.
*	*	* * * * *
47		*Matching tires.* Match tires according * * * in over-all circumferences. ***Caution:*** After performing the tire-matching service, do not install the wheels until the wheel bearing services are completed.
*	*	* * * * *
55		*Steering knuckles.* (Added) Clean and examine knuckles to see that they are in good condition and not excessively worn. Pay particular attention for wear of bearings and for loose or damaged steering arms. Inspect machined surfaces that carry wheel bearings for excessive wear or damage.
*	*	* * * * *
60		*Front wheel (bearings, wheels, drive flanges, and nuts).* Revolve the wheels * * * and lock securely. *Note.* (Added) Proper adjustment of the wheel bearings is vital to the life of the bearings and the lubricant retainer seals. If the bearings are adjusted too loosely, the lubricant retainer seals cannot seal properly for any extended period. If the bearings are adjusted too tightly, they are likely to become damaged.
*	*	* * * * *
82	82	*Fuel tanks, fittings, and lines.* Examine fuel tanks * * *, and not leaking.
82		(Added) Remove the fuel tank drain plugs and drain off the accumulated water and sediment. Drain only until the fuel starts tc run clear.

Table II. Organizational Mechanic or Maintenance Crew Preventive Maintenance Services—Continued

6,000 miles or 6 months[1 2]	1,000 miles or 60 days[1 2]	Procedure
		MAINTENANCE OPERATIONS—Continued
*	*	* * * * *
86	86	*Toe-in and turning stops.* Use gage to * * * against the vehicle. ***Caution:*** (Added) If toe-in adjustment is necessary, be sure the tie rod is in correct position and well secured after the adjustment is made. Toe-in must be kept within specified limits to avoid unnecessarily rapid tire wear.
*	*	* * * * *
96	96	*Cab (hardware, glass, seats, upholstery, floorboards, ventilator, and map compartment).* Inspect these units * * * lock when closed. *Note.* (Added) Glass, even if cracked or if laminated layers are separated, need not be replaced as unserviceable unless its condition constitutes a safety hazard or obstructs the vision of driver or crew.
*	*	* * * * *
103	103	*Paint and markings.* Inspect cab for * * * markings are visible. *Note.* (Added) Steel identification plates rust very rapidly. When plates are found to be in a rusty condition, they should be cleaned thoroughly and heavily coated with applications of clear lacquer.
*	*	* * * * *
131	131	*Tools.* (Superseded) Check Department of the Army Supply Catalog ORD 7 SNL G–508 to see that all tools and equipment issued with and carried on the vehicle are present, in good condition, clean, and properly stowed or securely mounted. Any tools having bright or polished surfaces, mounted on outside of vehicle, should be dulled by application of dust or mud to prevent glare or reflections. Tools with cutting edges should be sharp and with edges protected.
*	*	* * * * *
135	135	*Publications and Standard Form 91.* (Superseded) The vehicle and equipment manuals, lubrication order, and Standard Form 91 (Operator's Report of Motor Vehicle Accident) should be present, legible, and properly stowed.
*	*	* * * * *

Table II. Organizational Mechanic or Maintenance Crew Preventive Maintenance Services—Continued

6,000 miles or 6 months[1] [2]	1,000 miles or 60 days[1] [2]	Procedure
		MAINTENANCE OPERATIONS—Continued
141	141	*Modifications (work orders completed)* (Superseded). Check DA AGO Form 478 to determine whether all Modification Work Orders have been completd. A list of current Modification Work Orders is contained in SR 310–20–4. Enter any modifications or major unit assembly replacements made during this service on DA AGO Form 478.
*	*	* * * * *
		UNUSUAL CONDITIONS (Added)
		Maintenance operations and road tests as prescribed under usual conditions will apply equally under unusual conditions for operation under all conditions except in extreme-cold weather. Intervals are necessarily shortened in extreme-cold weather servicing and maintenance. Vehicles subjected to salt-water immersion or complete submersion should be evacuated to an ordnance maintenance unit as soon as possible after the exposure.

[1] The chart which appears in TM 9–812, dated 11 March 1944, (pp. 60-73, incl.) will be changed so that "6,000 Mile" and "1,000 Mile" columns will read "6,000 Miles or 6 Months" and "1,000 Miles or 60 Days", as above.

[2] Whichever occurs first.

28. Purpose

a. When a new * * * placed in service. For this purpose, inspect all accessories, subassemblies, assemblies, tools, and equipment to see that they are in place and correctly adjusted.

b. (Added) In addition, perform a run-in test of at least 50 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 30.

c. (Added) Whenever practicable, the vehicle driver will assist in the performance of these services.

30. Procedure

a. PRELIMINARY SERVICE.

* * * * * * *

(12) *Towing connections.* Examine **lifting** eyes, **fifth wheel,** and pintle hook for looseness and damage, and see that pintle latch operates properly and locks securely.

* * * * * * *

(26) *Tools and equipment.* Check **that all** tools and equipment are present, serviceable, and properly mounted or stowed.

(27) *Steering linkage.* (Added) Inspect steering linkage for loose or damaged parts.

b. RUN-IN TEST. **Operating instructions for the vehicle are found in paragraph 6.** Perform the following * * * *the caution plate.*

* * * * * * *

(11) *Air pressure.* (Added) Observe whether the brake air pressure builds up at a normal rate to the specified maximum limits (par. 124) and then cuts off.

(12) *Horns and windshield wipers.* (Added) See that they operate properly.

c. VEHICLE PUBLICATIONS AND REPORTS.

(1) *Publications.* See that vehicle technical manuals, lubrication **order,** and Standard Form **91 (Operator's Report of Motor Vehicle Accident)** are **present,** legible, and properly stowed.

Note. USA registration number * * * for new vehicles.

* * * * * * *

Section XII

PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR ORGANIZATIONAL MAINTENANCE

(Superseded)

31. General

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

32. Parts

Spare parts are supplied to the using organization for replacement of those parts most likely to become worn, broken, or otherwise unserviceable, provided such operations are within the scope

of organizational maintenance functions. Spare parts, tools, and equipment supplied for the 5-ton 4x2 tractor truck M425 and M426 are listed in Department of the Army Supply Catalog ORD 7 SNL G–671 which is the authority for requisitioning replacements.

32.1. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this matériel are authorized for issue by the ORD 7 catalog and by T/A and T/O&E.

32.2. Special Tools and Equipment

Certain tools and equipment specially designed for organizational maintenance, repair, and general use with the matériel are listed in table III for information only. This list is not to be used for requisitioning replacements.

Table III. Special Tools and Equipment for Organizational Maintenance

Item	Identifying Number	References		Use
		Fig.	Par.	
ADAPTER, puller, shackle bolt.	41–A–18–241	15	153 154	Removal of spring bracket and shackle pins
WRENCH, cyl hd bolt, close sweep, dble hex box, ½ in sq-drive, size of opng ¾ in, lgh 5 7/16 in.	41–W–2964–710	15 24	52	Installation of cylinder-head cap screws
WRENCH, wheel brg nut, dble oct, 4 7/16 and 4 15/16 in.	41–W–3825–72	15	149 150 151	Removal and installation of rear-wheel-bearing nuts
WRENCH, wheel brg nut, sgle-end, tubular, hex, size of opng 2⅜ in, lgh 2⅜ in.	41–W–3825–105	15	149 150 151	Removal and installation of front-wheel-bearing nuts

52. Cylinder Head Gasket Installation

a. Because of the * * * performed as follows:

* * * * * * *

(5) Start three or * * * at left side. Tighten cylinder head cap screws alternately and evenly (fig. 24) to 80 foot-pounds with **cylinder head bolt** wrench (41–W–2964–710) and **a torque** wrench.

* * * * * * *

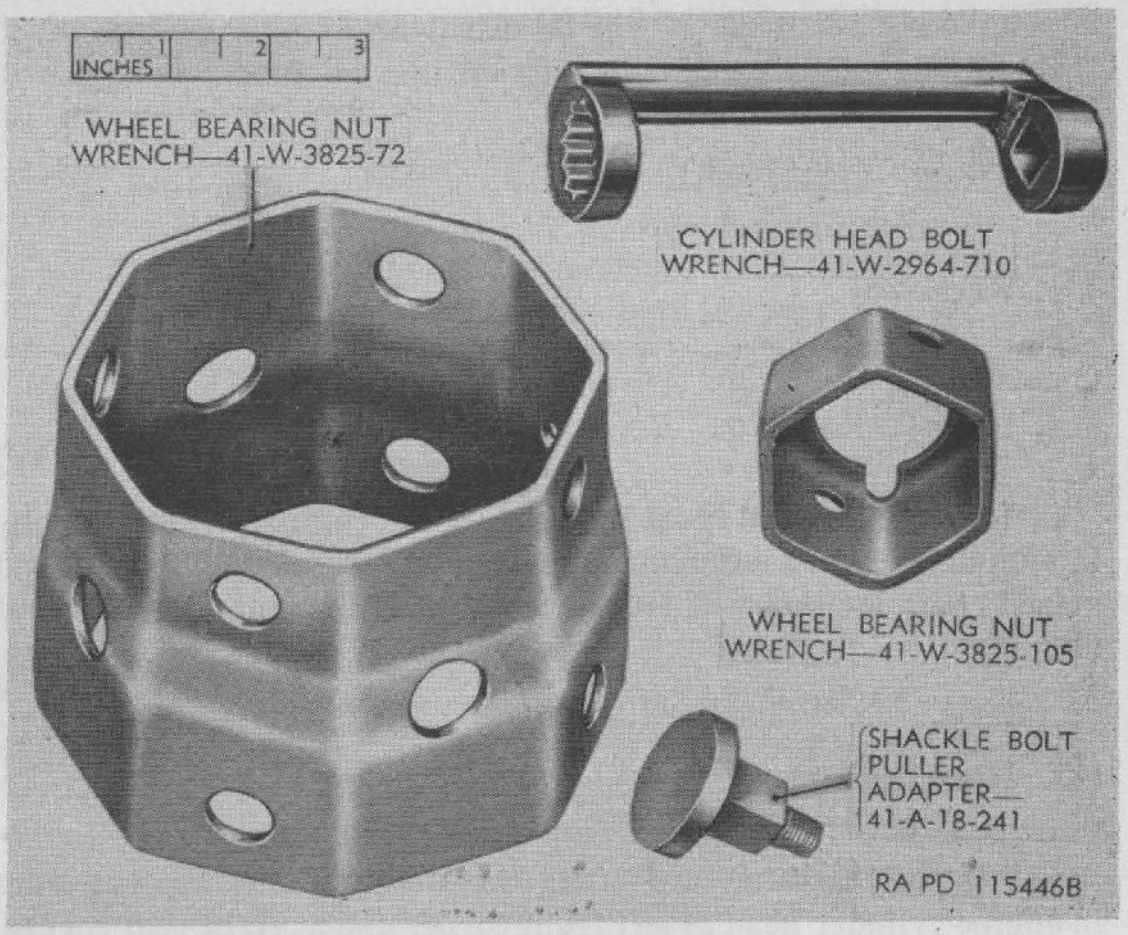


Figure 15. Special Tools.

(20) (Superseded) Retighten cylinder-head cap screws using cylinder head-bolt wrench (41–W–2964–710 (fig. 24)) and a torque wrench, until the torque wrench indicates 80 foot-pounds.

* * * * * * *

Figure 24. Tightening Cylinder Head Cap Screws Using **Cylinder Head Bolt** *Wrench (41–W–2964–710) and* **a Torque** *Wrench.*

The nomenclature on figure 24 is changed as follows: "Wrench" and "Tension Wrench" to "Cylinder Head Bolt Wrench (41–W–2964–710)" and "Torque Wrench," respectively.

57. Oil Filter

(fig. 31)

* * * * * * *

c. INSTALLATION. **After removing wrappers from the filter cartridges and before installing cartridges in vehicle, thoroughly remove any wax coating with a clean cloth and dry-cleaning solvent or volatile mineral spirits paint thinner. Unless the wax coating**

is completely removed, it will be dissolved by the passage of oil through the cartridge and be carried into oil lines where it will cause clogging.

(1) *Cartridges.* Insert new cartridge * * * for oil leaks.

* * * * * * *

59. Removal

Note. (Added) Before removal of engine, refer to paragraph 1*c* for information on coordination with an ordnance maintenance unit.

a. REMOVE RADIATOR. Refer to paragraph 78*b*.

* * * * * * *

x. REMOVE ENGINE FROM FRAME. Install engine lifting eye bolts in cylinder head at **left** front corner and at **right** rear corner, and attach chain and hoist at front eye bolt. Roll engine far * * * out of frame.

* * * * * * *

60. Installation

* * * * * * *

b. INSTALL ENGINE IN FRAME. Install engine lifting eye bolts in engine cylinder head at **left** front corner and at **right** rear corner. Attach chain and * * * lifting eye bolts.

* * * * * * *

ab. Record of replacement. (Added) Make a record of an accomplished replacement on DA AGO Form 478 (MWO and Major Unit Assembly Replacement Record and Organizational Equipment File).

63. Removal

Note. (Added) Before removal of clutch, refer to paragraph 1*c* for information on coordination with an ordnance maintenance unit.

a. Remove transmission from Clutch Housing. Refer to paragraph 107.

* * * * * * *

81. Spark Plugs

* * * * * * *

c. ADJUSTMENT AND CLEANING.

* * * * * * *

(3) *Visual inspection.* (Added) Before adjustment, inspect the spark plug for broken or cracked insulator and core. Look for a point, or mound, on the core under the side electrode which may accumulate heat and act as a hot

spot in service. Ascertain if plugs require too much cleaning to remove encrustment or were previously cleaned too often. Such plugs should be discarded. The spark plug gap will gradually widen after several thousand miles or many hours of service. This condition is normal, and plugs should be regapped. A gap may widen or wear quickly at low mileage. This indicates that the engine temperature is too high for the plug or that a wrong type of plug has been used. If electrode is too badly eroded, the plug should be discarded.

* * * * * * *

82. Distributor

(fig. 18)

* * * * * * *

f. Low octane fuel adjustment. (Added) When heavy detonation occurs due to the use of a lower octane motor fuel than is prescribed, the distributor must be adjusted to remedy this condition. After checking the distributor points (*b* above), retard the manual initial spark setting (par. 5*c*(4)) until a slight pinging is apparent under full-throttle and full load conditions. When the proper octane number gasoline motor fuel is again available, reset the spark setting.

Note. In no case will a fuel of less than 68 octane number be used.

92. Head Lights

* * * * * * *

c. AIMING ADJUSTMENT PROCEDURE (Superseded) (fig. 61).

(1) Place unloaded truck on a smooth horizontal surface so that head lights are 25 feet away from a vertical wall or other vertical surface. The center line of the truck must be at right angles to the vertical surface.

(2) Measure the height of the head light center from the floor, and mark a horizontal line at this height on the vertical surface (line X—X, fig. 61).

(3) Mark line A—A, below X—X, at one-twelfth the distance between line X—X and the floor.

(4) Draw vertical lines B—B and C—C directly in front of each head light.

(5) Turn on head lights at main light switch and select high beam with dimmer switch. It is not necessary to make adjustment on low beam.

(6) Loosen head light mounting bolt nut on each head light. Cover one head light and aim the other so that the center of the zone of greatest intensity (hot spot) is centered at the intersection of lines A—A and B—B or A—A and C—C, depending on which head light is being aimed. Tighten the head light mounting bolt nut securely, making sure adjustment is not disturbed. Aim the other head light in the same manner.

(7) After each head light is aimed separately, check both head lights simultaneously for conformity to line A—A.

* * * * * * *

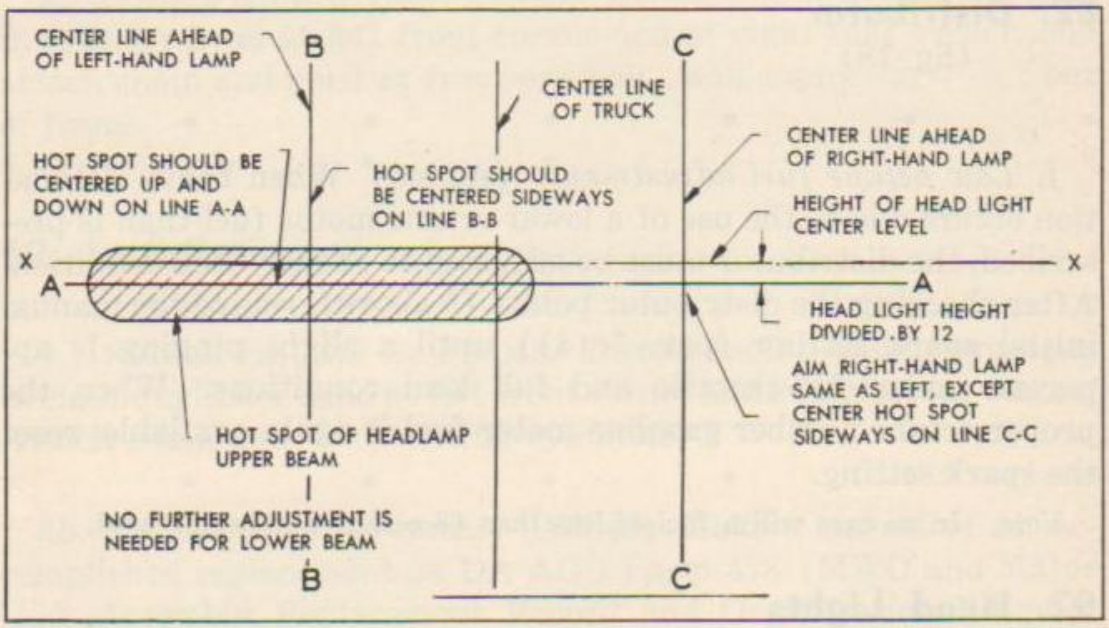


Figure 61. (Superseded) *Head light aiming.*

96. Battery

(fig. 70)

* * * * * * *

c. SERVICING.

* * * * * * *

(3) *Testing and charging.*

(*a*) *Testing.* (Superseded) With an accurate hydrometer, check each cell of battery for specific gravity of battery solution. A fully charged battery should test between 1.260 and 1.300. If the reading is below 1.225 under normal operating conditions, the battery should be replaced with a fully charged battery. Correct all specific gravity readings to 80° F.

(*b*) RESCINDED.

* * * * * * *

Figure 71, Hydrometer Correction Chart, is rescinded.

107. Removal

Note. (Added) Before removal of transmission, refer to paragraph 1*c* for information on coordination with an ordnance maintenance unit.

a. TRANSMISSION ASSEMBLY. The transmission can * * * of the clutch.

* * * * * * *

116. Removal

Note. (Added) Before removal of front axle, refer to paragraph 1*c* for information on coordination with an ordnance maintenance unit.

a. FRONT AXLE ASSEMBLY.

* * * * * * *

120. Removal

Note. (Added) Before removal of rear axle, refer to paragraph 1*c* for information on coordination with an ordnance maintenance unit.

a. REAR AXLE ASSEMBLY. The only replacements * * * axle assembly replacement.

* * * * * * *

149. Adjustments

a. WHEEL STUD NUTS. Check and tighten * * * miles of service. Use wrench provided for purpose in vehicle, but do not use extension on the handle or apply pressure other than direct hand effort. Successively tighten opposite * * * of the vehicle.

b. FRONT-WHEEL BEARINGS.

* * * * * * *

(3) Straighten locking tab of **jam nut lock** and remove bearing lock nut from steering knuckle.

(4) Remove bearing nut lock **ring** from steering knuckle.

(5) Using **wheel bearing nut wrench (41–W–3825–105)**, adjust wheel bearings. Revolve wheel by hand while tightening bearing lock nut until a definite drag is felt. Back off adjustment about one-sixth turn.

(6) Reinstall **bearing** nut lock **ring** over nut, locating so that **dowel** enters one of the holes in the **ring.**

(7) Install **jam** nut lock and lock nut. Tighten securely **using wrench (41–W–3825–105)**, and bend tab of **lock** against side of nut.

* * * * * * *

c. REAR-WHEEL BEARINGS.

* * * * * * *

(5) Using **wheel bearing nut wrench (41–W–3825–72)**, remove **outer adjusting** nut from axle.

(6) Lift **adjusting nut washer** from position over **inner** adjusting nut.

(7) Using **wrench (41–W–3825–72)**, adjust wheel bearings. Rotate wheel by hand while tightening adjusting nut until a definite drag is felt. Back off adjustment about one-sixth turn.

(8) Place adjusting nut **washer** in position over adjusting nut, having **dowel** entered in one of the holes in the lock **washer.**

(9) Install outer **adjusting** nut **using wrench (41–W–3825–72)** and tighten securely.

* * * * * * *

150. Removal

The nomenclature on figure 116, Removing Front Wheel Bearings, is changed as follows: "Adjusting Nut Lock" and "Washer" to "Bearing Nut Lock Ring" and "Lock," respectively.

a. FRONT WHEELS.

* * * * * * *

(3) *Remove wheel bearing lock nuts.* Straighten locking tab of **jam nut lock** beneath lock nut. Remove bearing lock nut, using **wheel bearing nut** wrench **(41–W–3825–105)**. Remove lock and remove **bearing** nut lock **ring** from steering knuckle (fig. 116).

(4) *Remove wheel outer bearing.* Using **wrench (41–W–3825–105)** remove bearing adjusting nut from bearing. Remove front wheel outer bearing cone from hub (fig. 116).

* * * * * * *

(9) (Superseded) *Remove hub oil seal.* Remove oil seal retainer from steering knuckle.

* * * * * * *

(11) *Clean, inspect, and lubricate bearings.*

(*a*) Place bearings in fresh dry-cleaning solvent **or volatile mineral spirits paint thinner** and allow to soak larger particles of grease. Slush bearings up * * * are absolutely clean.

* * * * * * *

b. REAR WHEELS.

* * * * * * *

(4) *Remove bearing outer adjusting nut.* Using **wheel bearing nut** wrench **(41–W–3825–72)**, remove outer **adjusting** nut from axle. Remove lock washer.

(5) (Superseded) *Remove bearing inner adjusting nut.* Using wrench (41–W–3825–72), remove bearing inner adjusting nut (fig. 117).

* * * * * * *

(11) *Remove hub oil seal.* Remove two retaining screws from **oil** seal retainer (fig. 118), and remove retainer and **oil** seal **felt** from axle (fig. 119).

* * * * * * *

Figure 119. "Removing **Hub Oil** *Seal and Retainer from Axle."*

151. Installation

a. FRONT WHEEL.

(1) (Superseded) *Install hub oil seal.* Install new oil seal retainer on steering knuckle.

* * * * * * *

(4) *Adjust wheel bearings.* Install bearing adjusting nut on steering knuckle, and tighten with **wheel bearing nut** wrench **(41–W–3825–105)**. Rotate wheel by * * * about one-sixth turn.

(5) *Install bearing lock nuts.* (Superseded) Install bearing nut lock ring indexing the dowel in one of the holes of the ring. Place jam nut lock in position, install *bearing* lock nut, and tighten securely with wrench (41–W–3825–105). Bend flange of lock around side of bearing lock nut.

* * * * * * *

b. REAR WHEEL.

(1) *Install hub oil seal.* Install **inner retainer, oil** seal **felt,** and **outer** retainer on rear axle, and install two retainer screws.

* * * * * * *

(4) *Adjust wheel bearings.* Install bearing **inner** adjusting nut on axle, and adjust wheel bearings. Rotate hub by hand while tightening **inner** adjusting nut with **wheel bearing nut** wrench **(41–W–3825–72)** until a definite drag is felt. Back off adjustment about one-sixth turn.

(5) *Install bearing nuts.* Install adjusting nut **washer** on axle so that **dowel** indexes with one of the holes in the **washer.** Install outer **adjusting** nut, and tighten securely **using wrench (41–W–3825–72).**

* * * * * * *

153. Front Springs

(fig. 120)

* * * * * * *

b. REMOVAL.

* * * * * * *

(3) *Remove spring rear shackle pin.* (Superseded) Remove nuts and lock washers from spring-shackle-pin clamp screws. Remove screws from shackle. Remove lubricating fitting from shackle pin and insert shackle bolt puller adapter, 41–A–18–241. Pull spring shackle pin from spring eye, using puller.

(4) *Remove spring front pivot pin.* Remove nut and * * * bolt from bracket. **Remove lubricating fitting from pivot pin and insert adapter, 41–A–18–241. Pull** pivot pin from spring eye and bracket, **using puller.**

* * * * * * *

154. Rear Springs

(figs. 121 and 122)

* * * * * * *

b. REMOVAL. To replace broken * * * accomplished as follows:

* * * * * * *

(3) *Remove front spring pin.* Remove nut and * * * out clamp bolt. Remove **lubricating** fitting from end of spring pin. **Insert adapter (41–A–18–241), into fitting hole and remove spring pin, using puller.**

(4) *Remove rear shackle pin.* Remove nut and * * * out clamp bolt. Remove **lubricating** fitting from spring pin. **Insert adapter (41–A–18–241) into fitting hole and remove spring pin, using puller.**

* * * * * * *

Section XXXV.1

MAINTENANCE UNDER UNUSUAL CONDITIONS

(Added)

159.1. Extreme-cold Weather Maintenance

a. Refer to TM 9–2855 for a general discussion of maintenance problems, the application of antifreeze compounds and arctic-type lubrication, handling of storage batteries in extreme cold, and dewinterization procedure.

b. Refer to the pertinent technical bulletin for information on winterization kit if utilized by vehicle under consideration.

159.2. Extreme-hot Weather Maintenance

a. COOLING SYSTEM. Thoroughly clean and flush the cooling system (par. 75) at frequent intervals and keep system filled to within a few inches of the overflow pipe with clean water when operating in extremely high temperatures. Formation of scale and rust in the cooling system occurs more often during operation in extremely high temperatures; therefore, corrosion-inhibitor compound should always be added to the cooling liquid. Avoid the use of water that contains alkali or other substances which may cause scale and rust formations. Use soft water whenever possible.

b. BATTERY.

(1) *Electrolyte level.* In torrid zones, check level of electrolyte in cells daily and replenish, if necessary, with pure distilled water. If this is not available, rain or drinking water may be used. However, continuous use of water with high mineral content will eventually cause damage to battery and should be avoided.

(2) *Specific gravity.* Batteries operating in torrid climates should have a weaker electrolyte than for temperate climates. Instead of 1.280 specific gravity, as issued, the electrolyte (sulphuric acid, sp gr 1.280) should be diluted with pure distilled water, as specified in TM 9–2857, to 1.200 to 1.240 specific gravity. This is the correct reading for a fully-charged battery. This procedure will prolong the life of the negative plates and separators. Under this condition a discharged battery should be recharged at about 1.160 specific gravity.

(3) *Self-discharge.* A battery will self-discharge if left standing for long periods at high temperatures. This must be taken into consideration when operating in torrid zones.

If necessary to park for several days, remove battery and store in a cool place.

Note. Do not store acid-type storage battery near stacks of tires, as the acid fumes have a deleterious effect on rubber.

c. CHASSIS AND BODY.

(1) In hot, dry climates a careful watch must be kept for evidence of the presence of moths and termites.

(2) In hot, damp climates corrosive action on all parts of the vehicle will occur and will be accelerated in areas of high humidity and during the rainy season. Evidences will appear in the form of rust and paint blisters on metal surfaces, and mildew or fungi mold on fabrics, leather, and unpainted surfaces.

(3) Protect all exposed exterior painted surfaces from the atmosphere by touch-up painting and protect unfinished exposed metal surfaces by a film of engine lubricating oil (OE–10). Cables and terminals will be protected by ignition insulation compound.

(4) Make frequent inspections of idle, inactive vehicles. Remove corrosion from exterior surfaces with abrasive paper or cloth and apply a protective coating of paint, oil, or suitable rust preventive.

159.3. Maintenance After Fording

a. GENERAL. Although all of the vehicle unit housings are vented to atmospheric pressure with the exception of the steering gear and front axle spindles and seals are provided which prevent the free flow of water into the housings, it must be realized that, due to the necessary design of these assemblies, some water may enter, especially during submersion. It is advisable, therefore, that the following service be accomplished on all vehicles which have been exposed to some depth of water or completely submerged, especially in salt water, and precautions taken as soon as practicable to halt deterioration and avoid damage before the vehicle is driven extensively in regular road service.

b. CLEANING AND LUBRICATION.

(1) *Body and chassis.* Drain and clean out body, engine, and tool compartment; clean all exposed unpainted parts and coat with a film of engine lubricating oil (OE–10). Cables and terminals will be protected by ignition insulation compound. In the case of assemblies which have to be disassembled for cleaning, perform these operations as soon as the situation permits, or refer to ordnance main-

tenance unit. Lubricate the chassis thoroughly as directed in the lubrication order. Do more than the *usual* lubrication job, making sure that lubricant is generously forced into each bearing to force out any water present. Wheels will be removed for bearing cleaning and repacking in every case.

(2) *Transmission and axles.* Check the lubricant in the transmission and both axle housings. Should there be evidence that water has entered, drain the housings and flush them thoroughly with a half-and-half mixture of oil (OE–10) and dry-cleaning solvent or volatile mineral spirits paint thinner. Locate and remedy the cause of the leak. Refill to filler plug level with the correct grade of lubricant.

(3) *Wheels and brakes.*

(*a*) Remove the front wheels and flush out the knuckle housings with a half-and-half mixture of oil (OE–10) and dry-cleaning solvent or volatile mineral spirits paint thinner. Refill to filler plug level with the correct lubricant. Remove rear wheels. Wash all wheel bearings thoroughly with dry-cleaning solvent or volatile mineral spirits paint thinner after which repack, assemble, and adjust them as outlined in paragraph 149.

(*b*) With wheels removed, dry out brake linings and clean rust and scum from brake drum face.

(4) *Steering gear.* Remove and disassemble steering gear. If the lubricant is contaminated, clean the housing thoroughly with a half-and-half mixture of oil (OE–10) and dry-cleaning solvent or volatile mineral spirits paint thinner. Assemble, refill with correct grade of lubricant, and adjust (par. 157).

(5) *Engine crankcase oil and oil filter.* Inspect crankcase oil for presence of water. If water or sludge is found, drain, flush, and refill with the correct lubricant. Drain and clean oil filter if necessary.

(6) *Engine valve chamber.* Clean out engine valve chamber.

c. BATTERY. Check the battery for quantity and specific gravity of electrolyte to be sure no water entered through the vent caps. This is of special importance should the vehicle have been submerged in salt water. Add electrolyte and charge if necessary.

d. DISTRIBUTOR. Remove the distributor cap and check to determine if any water has entered the distributor. If any water is present, remove the distributor for cleaning.

e. ELECTRICAL CONNECTIONS. Check all electrical connections for corrosion, particularly the bayonet-type connectors used in the various circuits.

f. CARBURETOR BOWL, FUEL STRAINER, ETC. Clean carburetor bowl, fuel strainer, pump, filter, tank, and lines as found necessary after inspection. If water is found in the air cleaner, clean and change the oil.

g. ALUMINUM OR MAGNESIUM PARTS. If vehicle remains in salt water for any appreciable length of time, aluminum or magnesium parts which were exposed to the water will probably be unfit for further use and must be replaced.

h. CONDENSATION. Although most units are sealed and vented, the sudden cooling of the warm interior air upon submersion may cause condensation, with resultant collection of moisture within the cases or instruments. A period of exposure to warm air after fording should eliminate this fault. Cases which can be opened may be uncovered and dried.

159.4. Maintenance After Operation on Unusual Terrain

a. MUD. Thorough cleaning and lubrication of all parts affected must be accomplished as soon as possible after operation in mud, particularly when a sea of liquid mud has been traversed. Clean out radiator fins and interior of engine compartment. Repack wheel bearings if necessary. Clean, oil, and stow chains in vehicle.

b. SAND OR DUST. Replace badly frosted windshield and door glasses. Repaint surfaces blasted by sand. Clean engine compartment. Lubricate vehicle completely to force out lubricants contaminated by sand, salt, or dust. Air cleaners and fuel and oil filters must be cleaned at least daily. Engine and other exposed vents should be covered with cloth.

Section XXXVI

SHIPMENT AND TEMPORARY STORAGE

(Rescinded)

PART THREE

(Added)

SHIPMENT AND LIMITED STORAGE AND DESTRUCTION TO PREVENT ENEMY USE

Section XXXVII. SHIPMENT AND LIMITED STORAGE

163. Domestic Shipping Instructions

a. PREPARATION FOR SHIPMENT IN CONTINENTAL UNITED STATES. When shipping the 5-ton 4x2 tractor truck (COE) interstate or within the continental United States, except directly to port of embarkation, the officer in charge of preparing the shipment will be responsible for furnishing vehicles to the carriers for transport in a serviceable condition, properly cleaned, preserved, painted, lubricated, etc., as prescribed in SB 9–4.

Note. For loading and blocking instructions of vehicles on freight cars, refer to paragraphs 165 and 166.

b. PREPARATION FOR SHIPMENT TO PORTS.

(1) *Inspection.* All used vehicles destined for oversea use will be inspected prior to shipment in accordance with TB ORD 385.

(2) *Processing for shipment to ports.* All vehicles destined to ports of embarkation for oversea shipment will be further processed in accordance with SB 9–4.

Note. Ports of embarkation will supplement any necessary or previously omitted processing upon receipt of vehicle.

c. REMOVAL OF PRESERVATIVES FOR SHIPMENT. Personnel withdrawing vehicles from a limited storage status for domestic shipment *must not remove preservatives,* other than to insure that the matériel is complete and serviceable. If it has been determined that preservatives have been removed, they must be restored prior to domestic shipment. The removal of preservatives is the responsibility of depots, ports, or field installations (posts, camps, and stations) receiving the shipments.

d. ARMY SHIPPING DOCUMENTS. Prepare all Army shipping documents accompanying freight in accordance with TM 38–705.

164. Limited Storage Instructions

a. GENERAL.

(1) Vehicles received for storage already processed for domestic shipment, as indicated on the vehicle processing

record tag (WD AGO Form 9–3), must not be reprocessed unless the inspection performed on receipt of vehicles reveals corrosion, deterioration, etc.

(2) Completely process vehicle upon receipt directly from manufacturing facilities or if the processing data recorded on the tag indicates that vehicle has been rendered ineffective by operation or freight shipping damage.

(3) Vehicle to be prepared for limited storage must be given a limited technical inspection and be processed as prescribed in SB 9–63. The results and classification of vehicle will be entered on DA AGO Form 461–5.

b. RECEIVING INSPECTIONS.

(1) Report of vehicles received for storage in a damaged condition or improperly prepared for shipment will be reported on DD Form 6 in accordance with SR 745–45–5.

(2) When vehicles are inactivated, they are to be placed in a limited storage status for periods not to exceed 90 days. Stand-by storage for periods in excess of 90 days will normally be handled by ordnance maintenance personnel only.

(3) Immediately upon receipt of vehicles for storage, they must be inspected and serviced as prescribed in paragraph 27. Perform a systematic inspection and replace or repair all missing or broken parts. If repairs are beyond the scope of the unit and the vehicles will be inactivated for an appreciable length of time, place vehicles in a limited storage status and attach tags to the vehicles specifying the repairs needed. The reports of these conditions will be submitted by the unit commander for action by an ordnance maintenance unit.

c. INSPECTIONS DURING STORAGE. Perform a visual inspection periodically to determine general condition. If corrosion is found on any part, remove the rust spots, clean, paint, and treat with the prescribed preservatives.

Note. Touch-up painting will be in accordance with TM 9–2851.

d. REMOVAL FROM LIMITED STORAGE.

(1) If the vehicles are not shipped or issued upon expiration of the limited storage period, vehicles may either be processed for another limited storage period or be further treated for stand-by storage (vehicles inactivated for periods in excess of 90 days up to 3 years) by ordnance maintenance personnel.

(2) If vehicles to be shipped will reach their destination within the scope of the limited storage period, they need not be reprocessed upon removal from storage unless inspection reveals it to be necessary according to anticipated in-transit weather conditions.

Note. All used vehicles that are to be reissued to troops within the continental limits of the United States will be inspected prior to shipment in accordance with TB ORD 385.

(3) Deprocess vehicles when it has been ascertained that they are to be placed into immediate service. Remove all rust-preventive compounds as prescribed in section VI and thoroughly lubricate as prescribed in section VII. Inspect and service vehicles as prescribed in section X.

(4) Repair and/or replace all items tagged in accordance with *b*(3) above.

e. STORAGE SITE. The preferred type of storage for vehicles is under cover in open sheds or warehouses whenever possible. Where it is found necessary to store vehicles outdoors, the storage site must be selected in accordance with AR 700–105 and protected against the elements as prescribed in TB ORD 379.

165. Loading the 5-Ton 4x2 Tractor Truck (C.O.E.) for Rail Shipment

a. PREPARATION.

(1) When vehicles are shipped by rail, every precaution must be taken to see that they are properly loaded and securely fastened and blocked to the floor of car. All on vehicle matériel (OVM) will be thoroughly cleaned, preserved, packed, and securely stowed in or on the vehicle for transit.

(2) Prepare all vehicles for rail shipment in accordance with paragraph 163*a*. In addition, take the following precautions:

(*a*) Disconnect the truck battery to prevent its discharge by vandalism or accident. This is accomplished by disconnecting the positive lead, taping the end, and tying it back away from the battery.

(*b*) Apply the truck hand brake and place the transmission in neutral position after the vehicle has been finally spotted on the freight car. The vehicles must be loaded on the car in such a manner as to prevent the car from carrying an unbalanced load.

(*c*) Increase tire pressure slightly higher than normal except where shipment is to be exposed to extremely hot weather conditions.

b. TYPES OF CARS. Instructions contained herein pertain to the loading of vehicles in boxcars (cars equipped with side or side and end doors); gondola cars (open top cars having fixed sides, fixed or drop ends and solid bottom), and flatcars (cars with wooden floors laid over sills and without sides or ends but equipped with stake pockets).

c. METHOD OF LOADING VEHICLES ON FREIGHT CARS.

(1) *Flatcar loading.*

(*a*) When suitable hoisting equipment is not available for loading vehicles on or for subsequent unloading from a flatcar, an end ramp must be used in cases where the vehicle is not on a level with the flatcar deck. Vehicles on a warehouse platform or loading dock can be pivoted over spanning platforms aboard a flatcar adjacent to the platform, then again pivoted into lateral position on the flatcar.

(*b*) When unboxed vehicles must be loaded from ground level, a ramp may be improvised ((4) below) by borrowing railroad ties normally found stacked in railroad yards and by procuring necessary planking. An end ramp is shown in place in figure 129.

Note. Railroad ties alone, stacked without deck planking and not securely anchored, provide a very unstable ramp and must be rearranged upon each successive use. The torque action of the wheels of self-propelled vehicles will tend to collect and collapse a simple stack of railroad ties and should, therefore, not be attempted except under conditions of extreme emergency.

(*c*) To accomplish loading, the vehicle is towed onto the improvised apron at base of ramp and unhitched. Using a cable laid along the center line of the flatcar, attached to vehicle, the vehicle is pivoted to point towards the ramp. A chock behind one wheel of the vehicle will prevent undesirable rearward travel and assist pivoting.

Caution: Personnel used to assist in pivoting the vehicle into position must be careful to avoid injury by the violent side-whipping likely to occur when strain is applied to the cable. Follow up forward movement of the vehicle by chocking behind one wheel on the ramp.

(*d*) For powering the towing cable, a vehicle with winch is spotted at *right angles* to the train. It is located at about the third or fourth flatcar to facilitate signaling and because of cable length limits. A single-sheave snatch block located between cars on the train center line will provide the necessary *lateral* pull. A vehicle passing this point can be towed by a vehicle on the ground with personnel guiding its passage. A long tow cable from the towing vehicle will lessen the tendency of the towed vehicle to stray from the center line of the train.

Note. The snatch block fastening chain must be lashed to an adjacent solidly fixed object or stake to offset the cross pull of the powered winch (fig. 131).

(*e*) After the first vehicle is loaded on the flatcar, additional vehicles may be similarly hauled aboard by passing the towing cable beneath the loaded vehicle. When a train of flatcars is being loaded, steel or wooden spanning platforms or bridges are used to cover the gap between cars. Flatcar brake wheels must first be lowered to floor level to permit passage. A pair of improvised spanning platforms are shown in place in figure 129. These spanning platforms are moved along the train by hand as the vehicle advances.

(*f*) The above method of train loading requires careful advance planning as to the order of loading, so that vehicles are arranged on each flatcar under prescribed methods and combinations.

(2) *Gondola car loading.*

(*a*) Fixed-end gondola cars may only be loaded when hoisting facilities are available for initial loading and for unloading at destination. Hopper- or drop-bottom gondola cars without false flooring and hoisting facilities are not to be used for shipments of unboxed vehicles.

(*b*) Drop-end gondola cars may be loaded exactly as described for flatcars ((1) above). Height of fixed sides is immaterial. Vehicles may progress through a gondola car by passing over the two inwardly-dropped ends and over spanning platforms. Vehicles selected to remain in a gondola car are first moved to the *closed* end of the car, then spread out for blocking after the remaining end is closed and latched.

Note. Do not block vehicle flush against ends of gondola car. When ordering gondola cars, specify inside width required as some may be received with gussets along the inner sides which affect clearance.

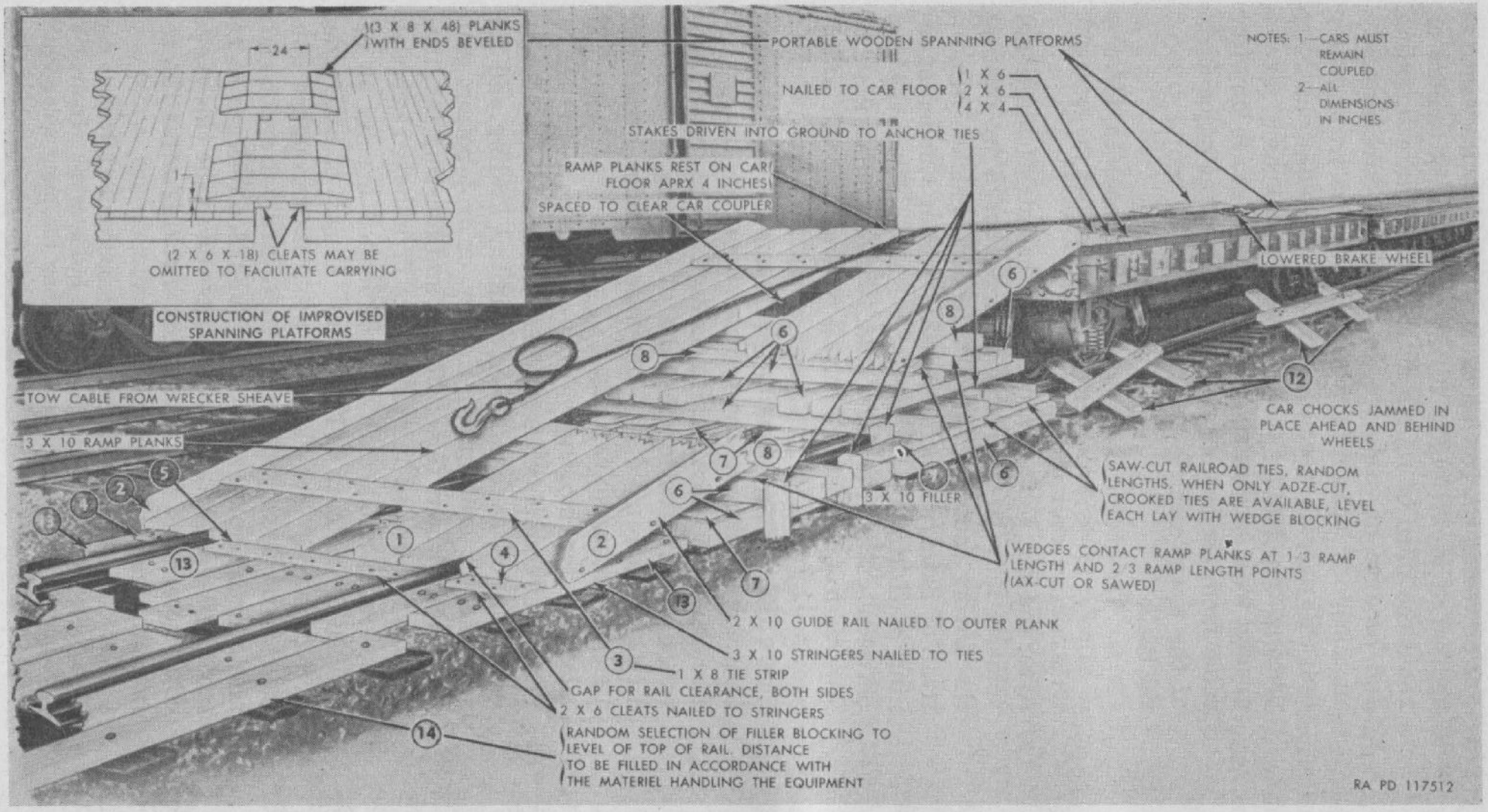


Figure 129. Construction of improvised loading ramp and spanning platforms.

BILL OF MATERIALS FOR RAMP AS ILLUSTRATED					
PART NO	QUANT REQ'D	PART NAME	LENGTH	WIDTH	THICKNESS
1	8	RAMP PLANKS	20 ft	10 in	3 in
2	2	GUIDE RAILS	20 ft	8 in	2 in
3	2	TIE STRIPS	8 ft	8 in	1 in
4	2	CLEATS	18 in	6 in	2 in
5	1	CLEAT	56 in	6 in	2 in
6	31	RAILROAD TIES	8 ft	8 in	8 in
7	AS REQD	FILLERS	AS REQD	10 in	3 in
8	AS REQD	WEDGES (CUT TO FIT)	8 ft	—	—
9	1	STEPDOWN PIECE	8 ft	4 in	4 in
10	1	STEPDOWN PIECE	8 ft	6 in	2 in
11	1	STEPDOWN PIECE	8 ft	6 in	1 in
12	4	CHOCK BLOCKS	AS REQD	4 in	4 in
13	AS REQD	STRINGERS	AS REQD	10 in	3 in
14	AS REQD	GROUND DUNNAGE	AS REQD		

NOTES:

1. RAMP SHOWN IS OF CAPACITY OF LARGEST END-LOADING FREIGHT CAR. FOR LESSER LOADS, REDUCE NUMBER OF RAMP PLANKS.
2. WIDTH DETERMINED BY TREAD OF MATERIEL BEING LOADED.
3. FOR LOADING TWO WHEELED ARTILLERY TRAILERS, OR SHORT WHEELBASE MATERIEL, RAMP PLANKS MAY BE SHORTER.

CAUTION: WHEN RAMP IS TOO SHORT, UNDERPINNING OP MATERIEL WILL STRIKE END OF RAMP (EX: 90 MM AA GUN).

4. OPENING AT CENTER MAY BE FILLED UP TO THE CAR COUPLER TO AVOID INJURY TO MANEUVERING PERSONNEL.
5. FOR LOADS OVER 40-TONS, APPROACH END OF FLATCAR MUST BE BLOCKED UP TO AVOID TIPPING OF FLATCAR.
6. THIS TYPE RAMP IS ADAPTABLE TO DROP-END GONDOLA AND AUTO END-DOOR BOX CAR LOADING.
7. WHEN LOADING AN AUTO END-DOOR BOX CAR, IT MAY BE NECESSARY TO LOAD A FLATCAR COUPLED TO THE BOX CAR, TO GAIN OVERHEAD LOADING CLEARANCE.
8. WHEN LOADING BY WRECKER CABLE, WITH PULL AT 90-DEGREES TO TRAIN, USING A SHEAVE, FLATCAR AT POINT OF PULL MUST BE LASHED TO ADJACENT RAILS, CARS, OR OTHER FIXED OBJECT.

RA PD 117513

Figure 130. Details for construction of improvised loading ramp.

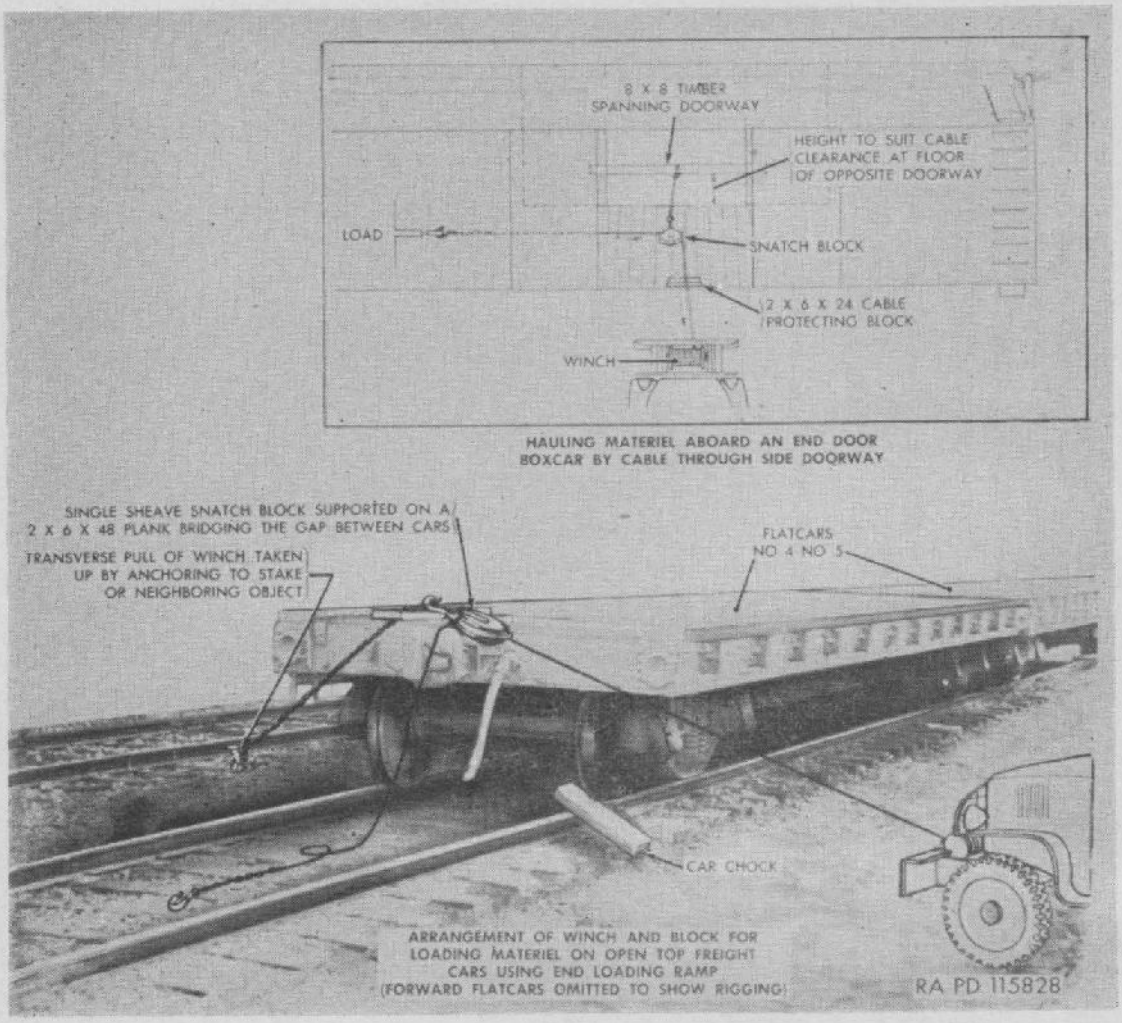


Figure 131. Method of powering the towing cable.

(3) *Boxcar loading.*

(*a*) End-door boxcars are spotted with the door end toward the ramp and loaded as described for flatcars ((1) above) except that loading must be accomplished by pushing the vehicle or towing by cable and block through the side door (fig. 131). When the height of the vehicle to be loaded is close to the inside height limits of the boxcar, it will be necessary to first load the vehicle on an adjacent flatcar. The two end doors must be opened *before* the flatcar is coupled to the door end of the boxcar.

Note. When ordering end-door boxcars, it must be remembered that some automobile boxcars may be received with an overhead built-in rack which affects inside height calculations. Specify inside height required. Keep open end doors clear of traffic on adjacent tracks.

(*b*) Side-door boxcars are provided with either single or double rolling doors at each side and must be loaded from a platform of about the same level as the boxcar

floor or from an adjacent flatcar. Automobile cars of this type have large side door openings and present less difficulty in loading. However, ordinary boxcars may require the use of roller automobile jacks to maneuver the vehicle into place. Steel plates or spanning platforms must be used to bridge the gap between platform and car.

Note. In emergencies when no roller jack is available, the vehicles may be moved sideways by means of an ordinary jack canted against the axle from the floor. Wetting both floor of the car and bridging will reduce the friction of the tires.

(4) *Loading ramp.*

(*a*) A ramp for end-loading of vehicles on open top freight cars may be improvised when no permanent ramps or hoisting facilities are available. A ramp suitable for the loading of most ordnance items is shown in figure 129. For loading the 5-ton 4x2 tractor truck (COE), the width of the ramp may be reduced to two double-plank runways, each cleated together. Length of planking must be determined with consideration to under chassis clearance, in order to clear the hump at upper end of ramp.

Caution: Personnel guiding the vehicle up the ramp must exercise care when working close to the edges of the ramp planking.

(*b*) The car bearing the ramp must be securely blocked against rolling, particularly when the car brakes are not applied as in train loading. Successive cars must remain coupled and be additionally chocked at several points along the train when ground towing of vehicles aboard the train is being effected.

(*c*) Whenever the freight cars are not on an isolated track or blocked siding, each end approach to the train must be posted with a blue flag or light to advise that men are at work and that the siding may not be entered beyond those points.

(*d*) Upon completion of the loading operation, the ramp planks and bridging devices should be loaded on the train for use in unloading operations. Random sizes of timbers used in building the approach apron up to rail level should be included. All materials should be securely fastened to the car floors, after vehicles are blocked in place, and entered upon the bill of lading (B/L). Railroad ties borrowed for the operation

should not be forwarded to the unloading point unless specifically required and only with the consent of the owner.

d. LOADING RULES. For general loading rules pertaining to rail shipment of ordnance vehicles, refer to TB 9–OSSC–G.

Warning: The height and width of vehicles when prepared for rail transportation must not exceed the limitations indicated by the loading table as prescribed in section II, AR 700–105. Whenever possible, local transportation officers must be consulted about the limitations of the particular railroad lines to be used for the movement to avoid delays, danger, or damage to equipment.

166. Blocking the 5-Ton 4x2 Tractor Truck (C.O.E.) for Rail Shipment

a. GENERAL. All blocking instructions specified herein are minimum and are in accordance with the Association of American Railroads "Rules Governing the Loading of Commodities on Open Top Cars." Additional blocking may be added as required at the discretion of the officer in charge. Double-headed nails may be used if available, except in the lower piece of two-piece cleats. All item reference letters given below refer to the details and locations as shown in figure 132.

Note. Any loading methods or instructions developed by any source which appear in conflict with this publication or existing loading rules of the carriers, must be submitted to the Chief of Ordnance, Washington 25, D. C., for approval.

b. BRAKE WHEEL CLEARANCE "A." Load trucks on flatcars with a minimum clearance of at least 4 inches below and 6 inches above, behind, and to each side of the brake wheel (fig. 132). Increase clearance as much as is consistent with proper location of load.

Note. Vehicles should be laterally spotted on flatcar so that wheels are centrally positioned between stake pockets in order that wheel strapping "G" (*h* below) provides uniform cross-wiring.

c. CHOCK BLOCKS "B" (6 X 8 X 24 INCHES, 12 REQUIRED PER TRUCK). Locate the 45-degree face of blocks against the front and rear of each wheel. Blocks are to be positioned in such a manner as to allow flush application of wheel side cleats "D" (*e* below) when nailed to chock blocks. Nail heel of blocks to car floor with three fortypenny nails and toenail both sides of blocks to car floor with two fortypenny nails each.

Note. Chock blocks may be cut from timbers (or railroad ties, when available) as shown in figure 133.

d. CUSHIONING MATERIAL "C." Locate suitable cushioning material, such as waterproof paper, burlap, etc., between tires and

cleats "D." The cushioning material should protrude beyond cleats "E" at floor and above cleats "D."

e. WHEEL SIDE CLEATS "D" (1 X 8 X 50 INCHES, FOUR REQUIRED PER TRUCK). Locate and nail cleats "D" to chock blocks "B" with four tenpenny nails at each end.

f. FLOOR SIDE CLEATS "E" (2 X 4 X 42 INCHES, EIGHT REQUIRED PER TRUCK).

Locate two floor side cleats against each wheel side cleat "D" with cushioning material protruding underneath cleats. Nail lower cleats to car floor with four thirtypenny nails and upper cleats to lower cleats and car floor with four fortypenny nails.

g. CROSS CLEATS "F" (2 X 4 INCHES, LENGTH TO SUIT, FOUR REQUIRED PER TRUCK). Locate two cleats across the top of the front chock blocks and two cleats across the rear chock blocks. Nail lower cleats to the top of chock blocks with two thirtypenny nails at each end. Nail upper cleats to the lower cleats and top of chock blocks with two fortypenny nails, staggered at each end.

h. WHEEL STRAPPING "G" (NO. 8 GAGE BLACK ANNEALED WIRE, LENGTH TO SUIT).

Note. For gondola or boxcar loading, wheel strapping will not be required.

(1) *Front wheels.* Form a cable by twist-tying four strands of wire together. Pass cable through ventilating hole in upper part of front wheel slightly *forward* of center and out through adjacent ventilating hole. Pass the other end of the cable through a stake pocket *rearward* of front wheel. Form a 6-inch loop in the end by winding each of the four wires tightly around the cable a few turns. Position the loop midway between the wheel and stake pocket. Pass the free end of the cable through the loop, hand tighten, and again wind the ends of the wires around their cable tightly to form another loop. Place a random length 2 x 2-inch cleat between cables. Insert a tightening tool at center of cable and twist just taut enough to remove all slack. Withdraw tightening tools, leaving cleat in cable to maintain an aperture for tightening cable during transit. Form another cable and pass through ventilating hole at upper part of front wheel slightly *rearward* of center and out through adjacent ventilating hole, crossing initial cable. Pass other end of cable through a stake pocket *forward* of front wheel. Complete and twist-tie as described above. Repeat above operations for the other front wheel.

(2) *Rear wheels.* Each outside rear wheel will be cross-cabled to stake pocket as prescribed for the front wheel ((1) above) (fig. 132).

Note. Cables are passed through stake pockets in such a manner that the cable loop lays against the car frame. A short stake driven into the stake pocket will protect the cable loop from chafing and loosening. (This stake is omitted in fig. 132.) When flatcars which are provided with well-type stake pockets are received, a loop of the strapping cable is passed through the stake pocket and a short piece of wood, about 2 x 4 x 18 inches, is inserted in the loop below the stake pocket. Subsequent tightening of the strapping will cause the cable to draw the wooden block securely against the bottom of the stake pocket.

i. AXLE STRAPPING "H." Locate two pieces of 1¼ x 0.035-inch hot-rolled steel strapping over each axle close to brakes. Coil strapping around steel anchor plates as shown in figure 132. Secure by nailing anchor plates to car floor with not less than six twentypenny nails (double-headed nails preferred). As an alternate method of securing axles, form and substitute a cable "J," consisting of four strands of No. 8 gage black annealed wire or wires of equivalent strength, at each location for steel strapping "H." Pass cables over axle and around wooden cleats "K" (2 x 4 x 18 inches). Locate cleats lengthwise of car and nail to car floor with four thirtypenny nails in each cleat. As in *h*(1) above, join both ends of cable together, twist, and tighten with rod or bolt just taut enough to take up slack (fig. 132 inset).

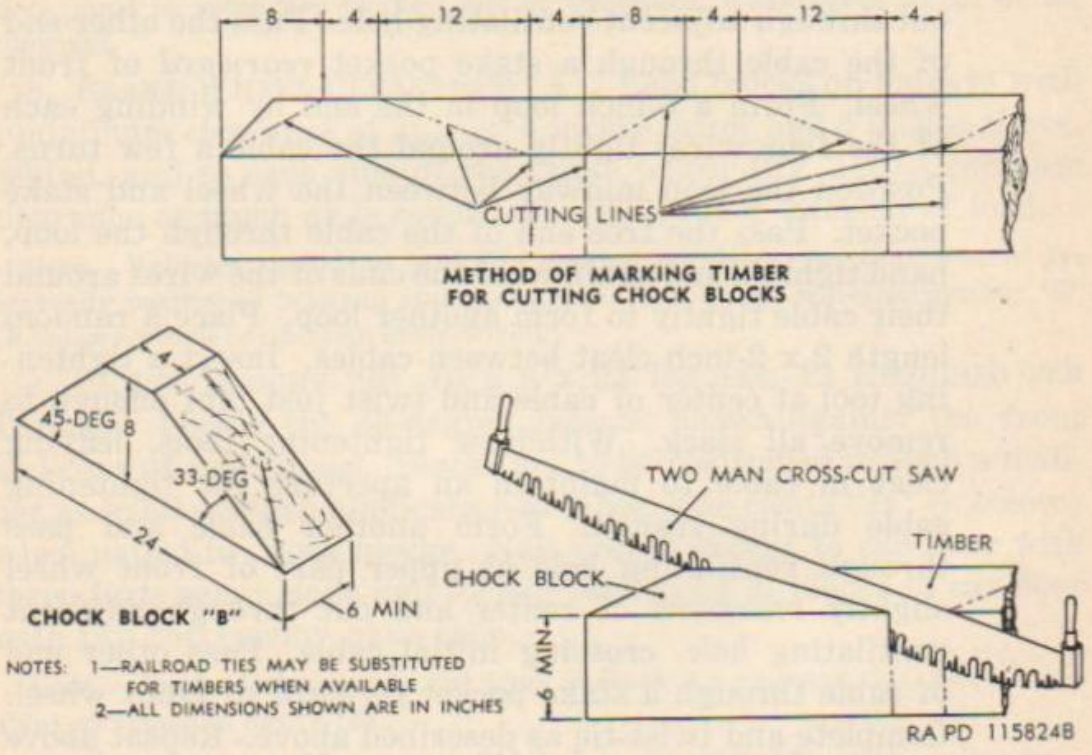


Figure 133. Cutting chock blocks from timber.

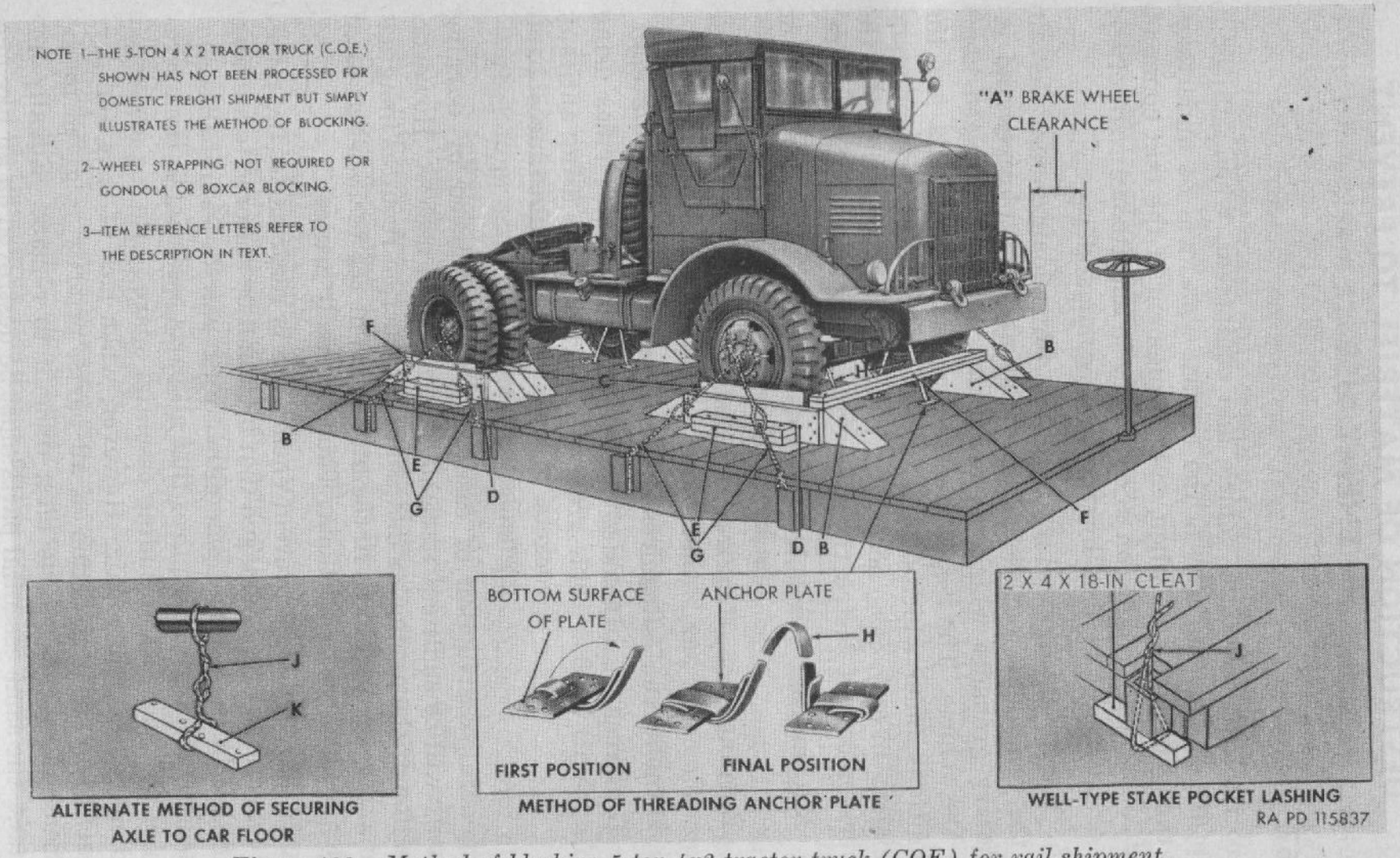


Figure 132. Method of blocking 5-ton 4x2 tractor truck (COE) for rail shipment.

Section XXXVIII

DESTRUCTION OF MATÉRIEL TO PREVENT ENEMY USE

167. General

a. Destruction of the vehicle and equipment, when subject to capture or abandonment in the combat zone, will be undertaken by the using arm only when, in the judgment of the unit commander concerned, such action is necessary in accordance with orders of, or policy established by, the army commander.

b. The information which follows is for guidance only. Certain of the procedures outlined require the use of explosives and incendiary grenades which normally may not be authorized items for the vehicle. The issue of these and related materials, and the conditions under which destruction will be effected, are command decisions in each case, according to the tactical situation. Of the several means of destruction, those most generally applicable are:

Mechanical—Requires ax, pick mattock, sledge, crowbar, or similar implement.

Burning—Requires gasoline, oil, incendiary grenades, or other inflammables.

Demolition—Requires suitable explosives or ammunition.

Gunfire—Includes artillery, machine guns, rifles using rifle grenades, and launchers using antitank rockets. Under some circumstances hand grenades may be used.

In general, destruction of essential parts, followed by burning usually will be sufficient to render the matériel useless. However, selection of the particular method of destruction requires imagination and resourcefulness in the utilization of the facilities at hand under the existing conditions. Time is usually critical.

c. If destruction to prevent enemy use is resorted to, the matériel must be so badly damaged that it cannot be restored to a usable condition in the combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of the matériel, including essential spare parts, be destroyed or damaged beyond repair. However, when lack of time and personnel prevents destruction of all parts, priority is given to the destruction of those parts most difficult to replace. Equally important, the same essential parts must be destroyed on all like matériel so that the enemy cannot construct one complete unit from several damaged ones.

d. If destruction is directed, due consideration should be given to—

(1) Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments or ricocheting projectiles which may occur incidental to the destruction.

(2) Observance of appropriate safety precautions.

168. Destruction of the 5-Ton 4x2 Tractor Truck (C.O.E.)

a. METHOD NO. 1—BY BURNING.

(1) Remove and empty portable fire extinguishers.

(2) Puncture fuel tanks as near the bottom as possible, collecting gasoline for use as outlined in (5) below.

(3) Using an ax, pick mattock, sledge, or other heavy implement, smash all vital elements such as radiator, distributor, carburetor, generator, battery, air compressor, ignition coil, fuel pump, spark plugs, air cleaner, lights, trailer sockets, trailer brake couplings, brake valves, instruments, and controls. If time permits and if a sufficiently heavy implement is available, smash the engine cylinder block and head, crankcase, and transmission.

(4) Slash tires. Exercise care to prevent injury from inflated tires blowing out while being slashed. Whenever practicable, it is usually preferable to deflate tires before slashing.

(5) Pour gasoline and oil over the wheels, brakes, and electrical wiring and then ignite. If gasoline and oil are not available, use incendiary grenades. If gasoline, oil, and incendiary grenades are available, a combination of them may be used. Elapsed time: about 6 minutes.

Caution: Due consideration should be given to the highly inflammable nature of gasoline and its vapor. Carelessness may result in painful burns.

b. METHOD NO. 2—WITH DEMOLITION MATERIALS.

(1) Remove and empty portable fire extinguishers.

(2) Puncture fuel tanks.

(3) Prepare two 2-pound charges of explosive (two 1-lb. blocks of TNT or equivalent per charge). Set one charge on top of the clutch housing and the other on the right side of the engine, as low as possible. Connect the two charges for simultaneous detonation with detonating cord. Provide for dual priming to minimize the possibility of a mis-

fire. For priming, either a non-electric blasting cap crimped to at least 5 feet of safety fuse (safety fuse burns at the rate of 1 foot in 30 to 45 seconds; test before using) or an electric blasting cap and firing wire may be used. The safety fuse, which contains black powder, and blasting caps must be protected from moisture at all times. This safety fuse may be ignited by a fuse lighter or a match; the electric blasting cap requires a blasting machine or equivalent source of electricity.

Caution: Keep the blasting caps, detonating cord, and safety fuse separated from the charges until required for use.

Note. For the successful execution of methods of destruction involving the use of demolition materials, all personnel concerned will be thoroughly familiar with the pertinent provisions of FM 5–25. Training and careful planning are essential.

(4) Destroy the tires by placing an incendiary grenade under each tire. The detonation of the explosive charges should be delayed until the incendiary fires are well started. This will prevent the fires from being extinguished by the blast when the charges are detonated.

(5) Detonate the charges. If primed with nonelectric blasting cap and safety fuse, ignite and take cover. If primed with electric blasting cap, take cover before firing. Elapsed time: about 6 minutes.

c. METHOD NO. 3—BY GUNFIRE.

(1) Remove and empty portable fire extinguishers.

(2) Puncture fuel tanks.

(3) Destroy the tires as in method No. 1 or 2 above.

(4) Destroy the vehicle by gunfire, using artillery and machine guns; by rifles, using rifle grenades; or by launchers, using antitank rockets. Fire on the vehicle aiming at the engine, axles, wheels, and body. Although one well placed direct hit may destroy the vehicle, several hits are usually required for complete destruction unless an intense fire is started, in which case the vehicle may be considered destroyed. Elapsed time: about 6 minutes.

Caution: Firing at ranges of 500 yards or less should be from cover.

REFERENCES
(Rescinded)

APPENDIX
(Added)

REFERENCES

1. Publication Indexes

The following publication indexes and lists of current issue should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to matériel covered in this manual:

Index of Administrative Publications (Army Regulations, Special Regulations, Readjustment Regulations, Joint Army-Air Force Adjustment Regulations, General Orders, Bulletins, Circulars, Commercial Traffic Bulletins, Joint Procurement Circulars, Department of the Army, and ASF Manuals).	SR 310–20–5
Index of Army Motion Pictures and Film Strips	SR 110–1–1
Index of Army Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).	SR 310–20–3
Index of Blank Forms and Army Personnel Classification Tests.	SR 310–20–6
Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.	SR 310–20–4
Introduction and Index (supply catalogs)	ORD 1
Military Training Aids	FM 21–8

2. Supply Catalogs

The following Department of the Army Supply Catalogs pertain to this matériel:

a. AMMUNITION.

Ammunition, Rifle, Carbine, and Automatic Gun.	ORD 11 SNL T–1

b. ARMAMENT.

Gun, Machine, Cal. .30, Browning, M1919A4, Fixed and Flexible; M1919A5, Fixed; and M1919A6; and Ground Mounts.	ORD (*) SNL A–6
Gun, Machine, Cal. .50, Browning, M2, Heavy Barrel, Fixed and Flexible; and Ground Mounts.	ORD (*) SNL A–39
Mount, Truck, M32, M36, M37, M37A1, M37A2, M37A3, and M50; Mount, Ring, M49, M49A1, M49A1C, and M49C.	ORD (*) SNL A–55, Sec 19

c. DESTRUCTION TO PREVENT ENEMY USE.

Land Mines and Fuzes, Demolition Material, and Ammunition for Simulated Artillery and Grenade Fire.	ORD 11 SNL R–7

d. MAINTENANCE AND REPAIR.

Cleaners, Preservatives, Lubricants, Recoil Fluids, Special Oils, and Related Maintenance Materials.	ORD 3 SNL K–1
Items of Soldering, Metallizing, Brazing, and Welding Materials: Gases and Related Items.	ORD 3 SNL K–2
Lubricating Equipment, Accessories, and Related Dispensers.	ORD (*) SNL K–3
Tool-Sets (Common), Specialists' and Organizational.	ORD 6 SNL G–27, Sec 2

e. VEHICLE.

Truck, 5-Ton, 4x2, Tractor, M425 and M426	ORD (*) SNL G–671

3. Forms

The following forms pertain to this matériel:

Standard Form 91, Operator's Report of Motor Vehicle Accident

Standard Form 91A, Transcript of Operator's Report of Motor Vehicle Accident

Standard Form 93, Report of Investigating Officer

Standard Form 94, Statement of Witness

DA Form 30b, Report of Claims Officer

WD AGO Form 9–3, Processing Record for Storage and Shipment

---

* See ORD 1, Introduction and Index, for published catalogs of the Ordnance section of the Department of the Army Supply Catalog.

DA AGO Form 9–68, Spot Check Inspection Report for Wheeled and Half-Track Vehicles
DA AGO Form 9–74, Motor Vehicle Operator's Permit
DA AGO Form 9–75, Daily Dispatching Record of Motor Vehicles
DA AGO Form 348, Driver Qualification Record
WD AGO Form 460, Preventive Maintenance Roster
WD AGO Form 461, Work Sheet for Wheeled and Half-Track Vehicles—Preventive Maintenance Service and Technical Inspection
DA AGO Form 461–5, Limited Technical Inspection
DA AGO Form 468, Unsatisfactory Equipment Report
WD AGO Form 478, MWO and Major Unit Assembly Replacement Record and Organizational Equipment File.
WD AGO Form 811, Work Request and Job Order
WD AGO Form 811–1, Work Request and Hand Receipt
DD Form 6, Report of Damaged or Improper Shipment
DD Form 317, Preventive Maintenance Service Due (Sticker)

4. Other Publications

The following explanatory publications contain information pertinent to this matériel and associated equipment:

a. AMMUNITION.

Regulation for Firing Ammunition for Training, Target Practice and Combat.	SR 385–310–1
Report of Accident Experience	SR 385–10–40

b. ARMAMENT.

Browning Machine Guns, Cal. .30, M1917A1, M1919A4, and M1919A6.	FM 23–55
Browning Machine Gun, Cal. .50, HB, M2	FM 23–65
Machine Gun Mounts for Trucks	TM 9–224

c. CAMOUFLAGE.

Camouflage	TM 5–267
Camouflage, Basic Principles	FM 5–20
Camouflage of Vehicles	FM 5–20B

d. DECONTAMINATION.

Decontamination	TM 3–220
Decontamination of Armored Force Vehicles	FM 17–59
Defense Against Chemical Attack	FM 21–40

e. DESTRUCTION TO PREVENT ENEMY USE.

Explosives and Demolitions	FM 5–25

f. GENERAL.

Cooling Systems: Vehicles and Powered Ground Equipment.	TM 9–2858

Driver Selection, Training, and Supervision, Wheeled Vehicles.	TM 21–300
Driver's Manual	TM 21–305
Instruction Guide: Operation and Maintenance of Ordnance Matériel in Extreme Cold (0° to –65° F.).	TM 9–2855
Motor Transport	FM 25–10
Motor Vehicles	AR 700–105
Mountain Operations	FM 70–10
Operations in Snow and Extreme Cold	FM 70–15
Precautions in Handling Gasoline	AR 850–20
Principles of Automotive Vehicles	TM 9–2700
Spark Plugs	TB ORD 313
Storage Batteries—Lead-Acid Type	TM 9–2857
Supplies and Equipment—General: Unsatisfactory Equipment Report.	SR 700–45–5

g. MAINTENANCE AND REPAIR.

Basic Maintenance Manual	TM 38–650
Cleaning, Preserving, Sealing, and Related Materials Issued for Ordnance Matériel.	TM 9–850
Hand, Measuring, and Power Tools	TM 10–590
Lubrication Order	LO 9–812
Maintenance and Care of Hand Tools	TM 9–867
Maintenance and Care of Pneumatic Tires and Rubber Treads.	TM 31–200
Motor Vehicle Inspection and Preventive Maintenance Services.	TM 37–2810
Painting Instructions for Field Use	TM 9–2851
Preparation of Ordnance Matériel for Deep Water Fording.	TM 9–2853

h. SHIPMENT AND LIMITED STORAGE.

Army Marking Directive	TM 38–414
Army Shipping Document	TM 38–705
Instruction Guide: Ordnance Packaging and Shipping (Posts, Camps, and Stations).	TM 9–2854
Ordnance Storage and Shipment Chart—Group G	TB 9–OSSC–G
Preparation of Unboxed Ordnance Matériel for Shipment.	SB 9–4
Protection of Ordnance General Supplies in Open Storage.	TB ORD 379
Shipment of Supplies and Equipment: Report of Damaged or Improper Shipment.	SR 745–45–5

Standards for Oversea Shipment and Domestic Issue of Ordnance Matériel Other Than Ammunition and Army Aircraft.	TB ORD 385
Storage, Inspection, and Issue of Unboxed Serviceable Motor Vehicles; Preparation of Unserviceable Vehicles for Storage; and Deprocessing of Matériel Prior to Operation.	SB 9–63

[AG 300.7 (28 Feb 51)]

BY ORDER OF THE SECRETARY OF THE ARMY:

OFFICIAL:
EDWARD F. WITSELL
Major General, USA
The Adjutant General

J. LAWTON COLLINS
Chief of Staff
United States Army

DISTRIBUTION:

Tech Svc (2) except 9 (25); Arm & Svc Bd (2); AFF (2); AA Comd (2); Log Comd (5); OS Maj Comd (10); Base Comd (2); MDW (3); A (20); CHQ (2); D (2); R 9 (2); Bn 9 (2); C 9 (2); FC (2); Sch (5) except 9 (50); Gen Dep (2); Dep 9 (10); PE (Ord O) (5), OSD (2); PG 9 (10); Ars 9 (10); Dist 9 (10); T/O&E's: 20–210–1S (1); 20–211S (1); 55–18 (1); SPECIAL DISTRIBUTION.

For explanation of distribution formula, see SR 310–90–1.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1951—914946