

sary, lubricate the water pump. Inspect the thermostat; clean, if necessary, and check for proper operation.

- (6) Install the thermostat (par. 151c). Connect the hoses (par. 150c). Close both drain cocks, test for leaks (*h* below), and proceed as in *f* above.

h. Leaks. Pour water slowly into the radiator until the system is approximately half full. Start engine, run at idling speed, and fill the system completely. Stop the engine and examine the entire cooling system for leaks. Carefully check the radiator hose connections, water pump mounting bolts, gasket, water outlet elbow mounting bolts and gasket, bypass elbow mounting bolts and gasket, and the cylinder head bolts and gasket.

Note. Inspect the radiator core for leakage. This is important because the cleaning solution may uncover leaks which existed before cleaning but were plugged with rust or corrosion.

Leaks that cannot be corrected by the organizational maintenance unit must be reported immediately to ordnance maintenance personnel.

i. Coolant Service.

- (1) When servicing the engine for operation at anticipated temperatures above 32° F., fill the system nearly full with clean water. Add corrosion inhibitor compound in the proportion of one container of inhibitor to each 4 gallons of cooling system capacity. Then complete filling the system with water.
- (2) When servicing the engine for operation at anticipated temperatures below 32° F., use the procedure prescribed for reclaimed or new antifreeze compound, whichever is to be used. Inspect entire cooling system for leaks and replace any hoses not suited for extended use.

150. Hoses

a. Remove Radiator Inlet and Outlet Hoses and Radiator Outlet Tube (fig. 119).

- (1) Drain cooling system (par. 148a).
- (2) Loosen the radiator inlet hose clamps by loosening the clamp screws. Remove the hose with clamps. Remove the clamps from the hose, if hose is to be discarded or clamps must be replaced.
- (3) Loosen the radiator outlet hose upper and lower hose clamps. Remove the outlet hoses and the outlet tube. Remove the clamps from the hoses if the hoses, are to be discarded or the clamps must be replaced.

b. Inspection.

- (1) Clean rust and scale from the outlet tube. Clean all hose connections.
- (2) Inspect the inlet and outlet hose clamps for distortion, cracks,

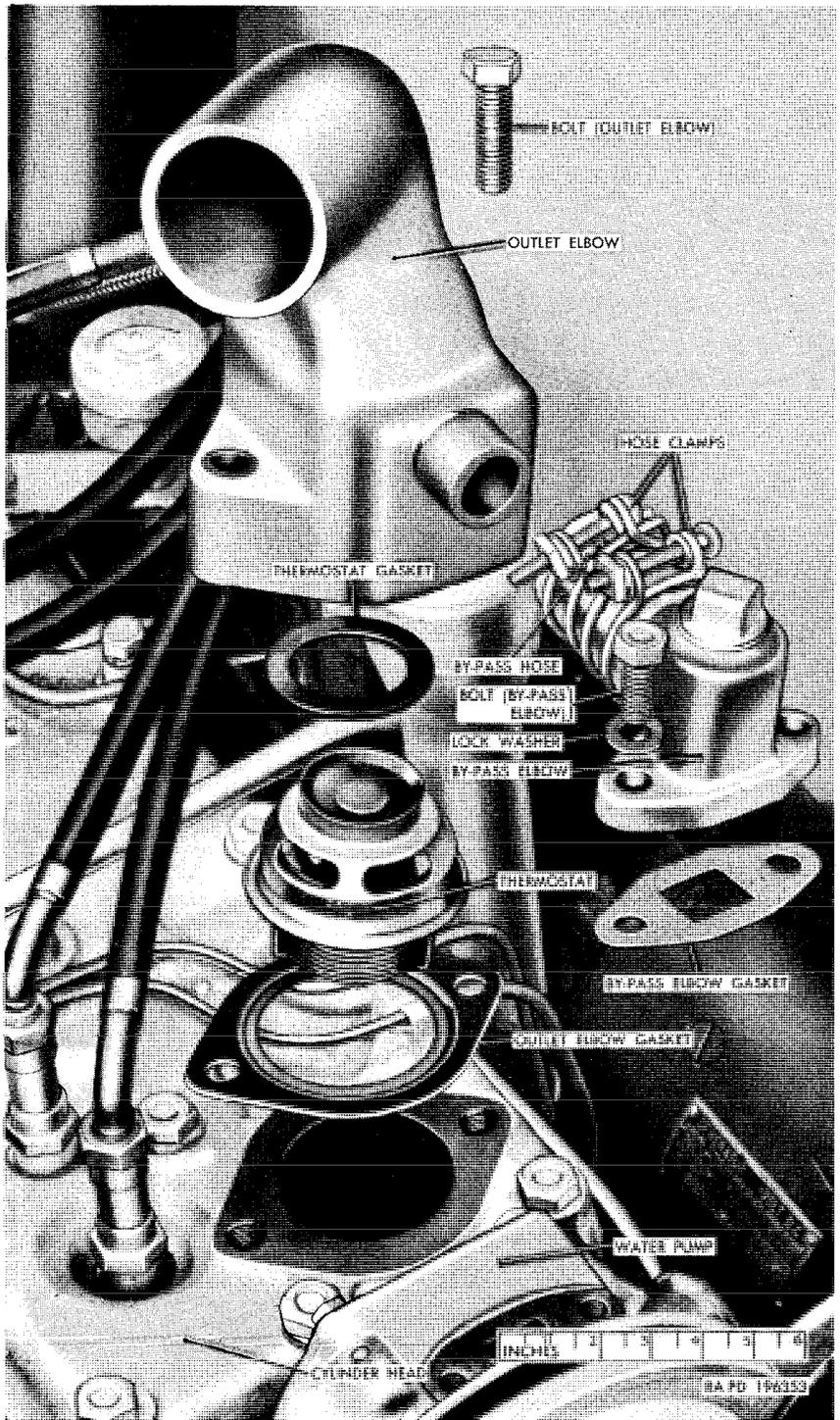


Figure 120. Water outlet elbow, thermostat, and related parts.

corrosion damage, or stripped threads. Replace clamps as necessary.

- (3) Inspect the outlet tube for corrosion damage, cracked weld around pipe plug boss (on vehicles so equipped), or other visual damage. Replace tube as necessary.

c. Install Radiator Inlet and Outlet Hoses and Radiator Outlet Tube (fig. 119).

Note. Apply a coating of liquid-type gasket cement around all hose connections and gaskets.

- (1) Install a 4-inch length of 1½-inch (ID) hose on each end of the outlet tube. Install a 1⅞-inch hose clamp on each end of each outlet hose.
- (2) Install the outlet tube with hoses attached to the radiator outlet opening and to the water pump. Position the clamps on the two hoses and tighten the clamp screws.
- (3) Install a 2⅜-inch hose clamp on each end of a 2 (ID) x 10¼ inlet hose. Position the hose on the engine water outlet elbow and on the radiator inlet opening. Position the clamps on the hose and tighten the clamp screws securely.

d. Replace Water Pump Bypass Hose.

- (1) Remove the two bolts and lockwashers attaching the water pump bypass elbow to the water pump (fig. 120).
- (2) Loosen the two hose clamps and remove the bypass elbow and hose. Remove the clamps and discard the bypass hose and bypass elbow gasket.
- (3) Install a 1 (ID) x 1⅝ hose on the water pump bypass elbow. Install a 1⅜-inch hose clamp on each end of the hose.
- (4) Clean both gasket contacting surfaces, and install a new water pump bypass elbow gasket on the water pump. Install the bypass elbow hose on the engine outlet elbow, and align the bolt holes in the elbow flange with those in the gasket and water pump. Install the two ⅝-18NC x ¾ bolts with ⅝-inch lockwashers through the bypass elbow and gasket. Tighten bolts evenly.
- (5) Position both clamps and tighten screws.
- (6) Fill the cooling system (par. 148b).

151. Thermostat

a. General. Replacement of the thermostat may be necessary if the unit is inoperative, or if it is desired to change the type of thermostat.

b. Removal.

- (1) Drain sufficient coolant from the cooling system (par. 148a) to lower the level to below the cylinder head.
- (2) Loosen the hose clamp that secures the radiator inlet hose to the engine water outlet elbow (fig. 113), and remove the hose from the elbow.

- (3) Remove the two bolts and lockwashers that attach the water pump bypass elbow to the water pump (fig. 120).
- (4) Remove the two bolts that secure the engine water outlet elbow to the cylinder head, and remove the outlet elbow and bypass elbow as a unit. Remove and discard the bypass elbow gasket.
- (5) Remove the thermostat, the thermostat gasket, and the outlet elbow gasket. Discard gaskets.

c. Installation.

- (1) Clean the gasket contacting surfaces and hose contacting surfaces thoroughly. Apply a coating of liquid-type gasket cement to both sides of a new outlet elbow gasket and a new bypass elbow gasket (fig. 120).
- (2) Install the outlet elbow gasket on the cylinder head and the bypass elbow gasket on the water pump.
- (3) Install a new thermostat gasket on top of the thermostat, and install the thermostat in the cylinder head with the word FRONT toward the radiator and coils of thermostat down into block.
- (4) Mount the assembled elbows in position and install the two $\frac{3}{8}$ -16NC x 2 bolts in the outlet elbow and the two $\frac{5}{16}$ -inch lockwashers and $\frac{5}{16}$ -18NC x $\frac{3}{4}$ bolts in the bypass elbow. Tighten all bolts evenly.
- (5) Apply liquid-type gasket cement to the outlet elbow at the hose connection. Install the radiator inlet hose on the elbow, and tighten the hose clamp.
- (6) Fill the cooling system (par. 148b).

152. Fan and Generator Drive Belt

a. Adjustment. Loosen the generator adjusting arm bolt, and move the generator toward or away from the engine to provide $\frac{1}{2}$ -inch deflection of the belt (fig. 121). Tighten the adjusting arm bolt.

b. Replacement.

- (1) Loosen the generator adjusting arm bolt (fig. 121) and push the generator toward the engine as far as possible. Disengage the belt from the generator drive pulley, the crankshaft pulley, and the fan drive pulley and remove the belt over the fan blades.
- (2) Place a new belt over the fan blades, install it in position on the crankshaft pulley, the fan drive pulley, and the generator drive pulley. Adjust the belt (*a* above).

153. Radiator

a. Removal

- (1) Drain cooling system (par. 148a).
- (2) Remove the radiator inlet and outlet hoses (par. 150a).

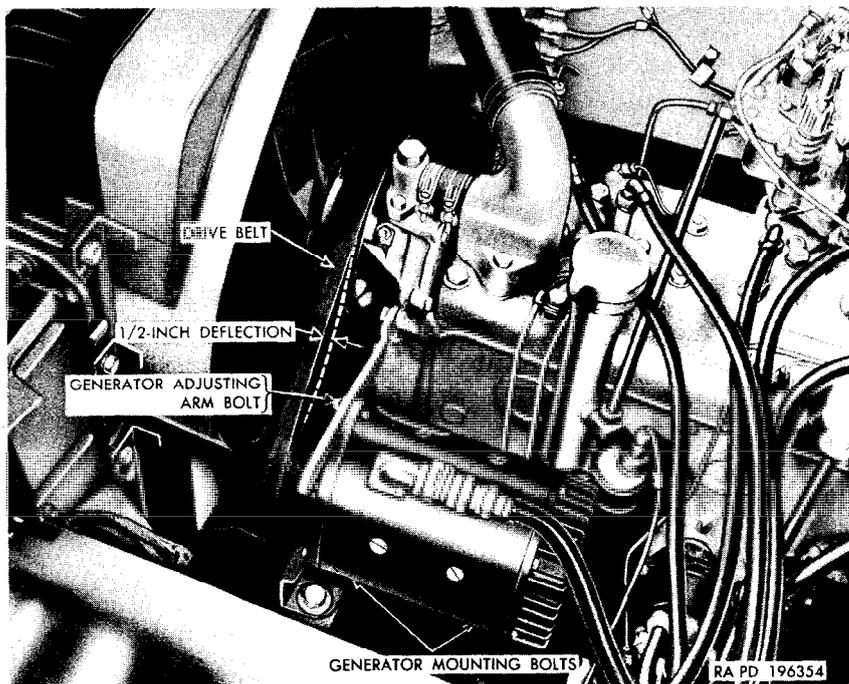


Figure 121. Adjusting fan and generator drive belt.

- (3) Remove fan and fan drive pulley.
- (4) Remove the three bolts, lockwashers, and flat washer which secure each side of the fan shroud and radiator to the radiator support (fig. 119).
- (5) Move the fan shroud back out of the way over the water pump, move the radiator back far enough to clear the upper baffle, and lift out the radiator.

Caution: Exercise care to avoid damaging the radiator core against the fan blades.

b. Installation.

- (1) Position the radiator in the radiator support.
- (2) Position the fan shroud, aligning the bolt holes in shroud and radiator with those in the radiator support.
- (3) Install a $\frac{3}{8}$ -inch lockwasher and a $\frac{3}{8}$ -inch flat washer on each of the six $\frac{3}{8}$ -24NF x 1 bolts (fig. 119). Insert bolts through the holes in fan shroud and radiator. Tighten the bolts evenly.
- (4) Install the radiator inlet and outlet hose (par. 150*b*).
- (5) Fill cooling system (par. 148*b*).

154. Fan, Fan Drive Pulley, and Water Pump

a. Remove Fan and Related Parts.

- (1) Loosen the fan belt (par. 152*b*) and disengage it from the fan drive pulley (fig. 122).
- (2) Remove the four bolts and lockwashers that secure the fan, spacer, and fan drive pulley to the pulley hub and remove the fan, spacer, and fan drive pulley.

b. Inspection. Inspect the fan for loose blade rivets, distortion, worn bolt holes, or other damage. Inspect the pulley and spacer for cracks and distortion. Replace worn or damaged parts as necessary.

c. Install Fan and Related Parts.

- (1) Install the fan drive pulley on the pulley hub with the dished side toward the water pump. Position the fan belt over the pulley and install the spacer and fan. Aline the four bolt holes in the fan, spacer, and pulley with those in the pulley hub and install the four $\frac{5}{16}$ -inch lockwashers and four $\frac{5}{16}$ -18NC x 1 bolts. Tighten bolts evenly.
- (2) Adjust the fan belt (par. 152*a*).

d. Remove Water Pump.

- (1) Drain the cooling system (par. 148*a*).
- (2) Remove fan and related parts (*a* above).
- (3) Remove the two bolts and lockwashers that secure the bypass elbow to the water pump (fig. 120).
- (4) Remove the three bolts and lockwashers that secure the water pump to the cylinder block, move the generator adjusting arm out of the way, and remove the water pump.
- (5) Remove and discard the water pump gasket and the bypass elbow gasket.
- (6) If the generator adjusting arm is to be replaced, remove the bolt and plain washer that secures the arm to the generator, and remove the arm.

e. Inspection. Clean the mating surfaces on the water pump, cylinder block, and bypass elbow. Inspect the water pump for cracks, loose body parts, or other damage. Replace the pump, if necessary.

f. Install Water Pump.

- (1) If the generator adjusting arm was removed (*d*(6) above), position the arm on the generator and install the $\frac{13}{32}$ -inch plain washer and $\frac{3}{8}$ -16NC x 1 bolt, tightening the bolt only fingertight.
- (2) Apply a coating of liquid-type gasket cement to both sides of the water pump gasket and the bypass elbow gasket and install the gaskets in position.
- (3) Position the pump on the cylinder block, alining the bolt holes in the pump, gaskets, cylinder block, and bypass elbow.

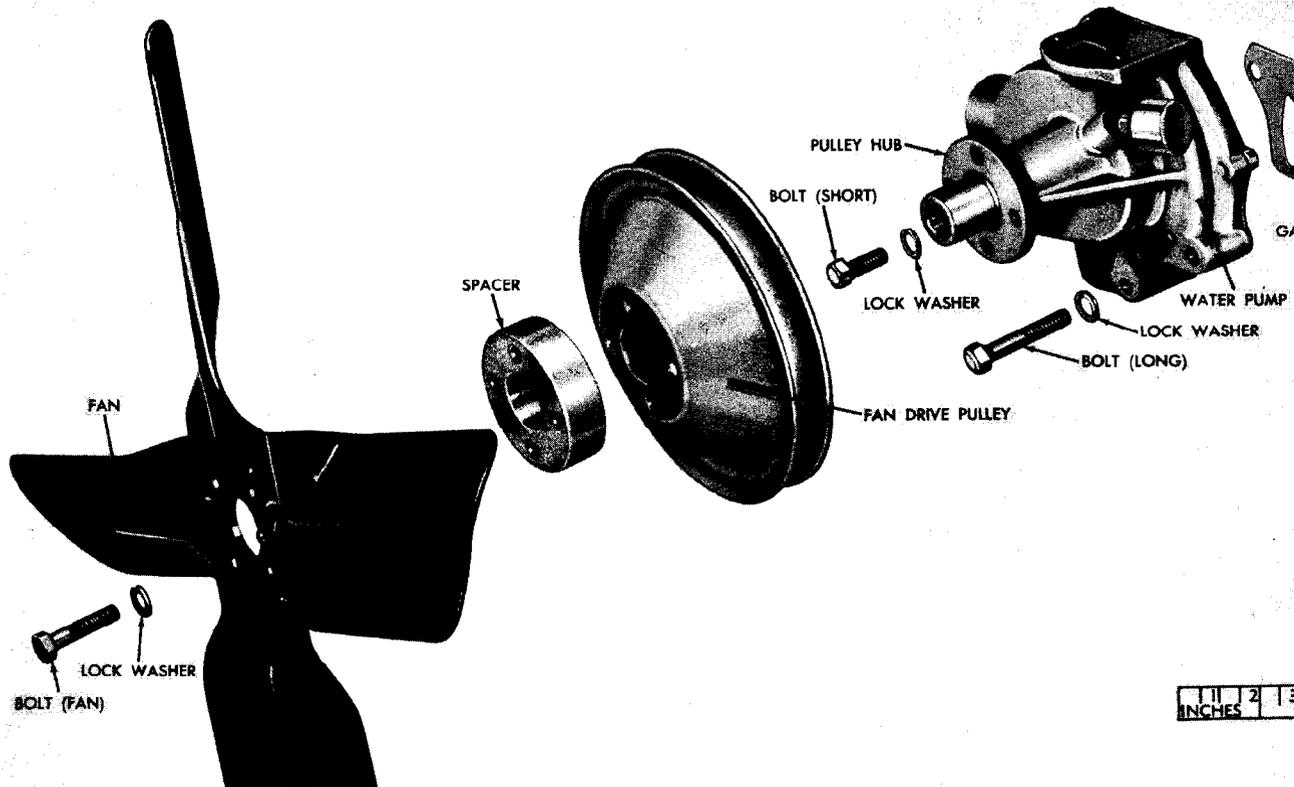


Figure 122. Fan, water pump, and related parts—exploded view.

Install a $\frac{3}{8}$ -inch lockwasher and a $\frac{3}{8}$ -16NC x 1 bolt at the right side of the pump. Install a $\frac{3}{8}$ -inch lockwasher and a $\frac{3}{8}$ -16NC x 2 bolt in the lower bolt hole. Align the hole in the generator adjusting arm with the bolt hole at the left side of the water pump, and install a $\frac{3}{8}$ -inch lockwasher and $\frac{3}{8}$ -16NC x 2 bolt. Tighten the three bolts evenly.

- (4) Install the two $\frac{5}{16}$ -inch lockwashers and $\frac{5}{16}$ -18NC x $\frac{3}{4}$ bolts to secure the bypass elbow to the water pump. Tighten the bolts.
- (5) Install the fan and related parts (*c* above).
- (6) Fill the cooling system (par. 148*b*).

155. Temperature Gage Sending Unit

a. General. When replacing the water temperature gage sending unit, be sure to install the correct type unit for the gage. The temperature gage kit includes a replacement gage and sending unit. If the gage is replaced (par. 178*c*), replace the sending unit also.

b. Removal. (fig. 123).

- (1) Drain sufficient coolant from the cooling system to lower the level to below the cylinder head.
- (2) Disconnect the sending unit cable at the cable connector on the sending unit.
- (3) Unscrew the sending unit and remove it from the cylinder head.

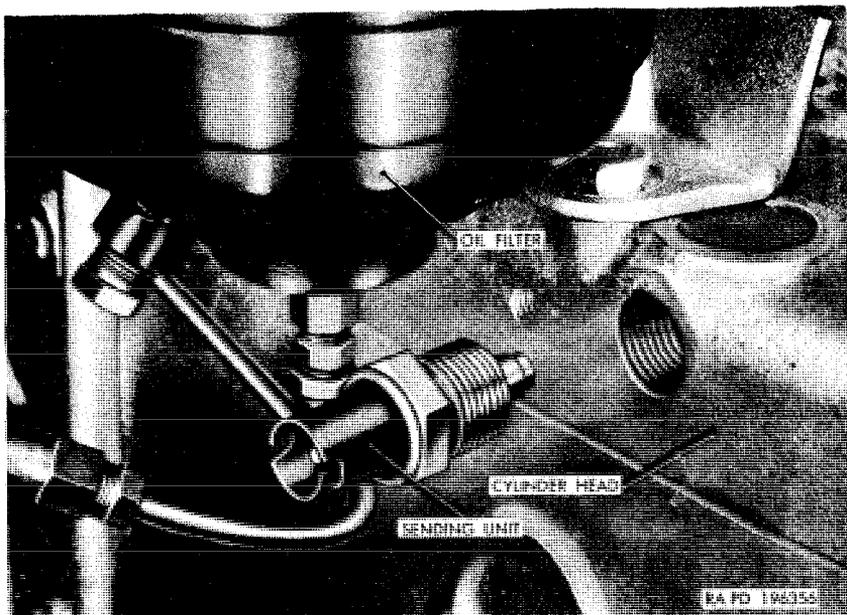


Figure 123. Water temperature gage sending unit removed.

c. Installation.

- (1) Coat the threads of the sending unit (fig. 123) with liquid-type gasket cement, install the unit in the cylinder head, and tighten.
- (2) Connect the sending unit cable at the cable connector.

156. Drain Cocks

a. Removal.

- (1) Drain the cooling system (par. 148a).
- (2) Unscrew the drain cock (fig. 152) from the front of the radiator.
- (3) Unscrew the cylinder block drain cock (fig. 81) from the cylinder block or pipe coupling (on vehicles so equipped) at the left side of the cylinder block. If the coupling or pipe nipple is damaged, unscrew the nipple and coupling from the cylinder block, and discard, as these parts are not required.

b. Installation.

- (1) Install the 1/4-inch, male pipe end drain cock in the pipe coupling or cylinder block (fig. 81) and tighten.
- (2) Install the 1/4-inch, male pipe end drain cock in the radiator.
- (3) Close both drain cocks and fill the cooling system (par. 148b).

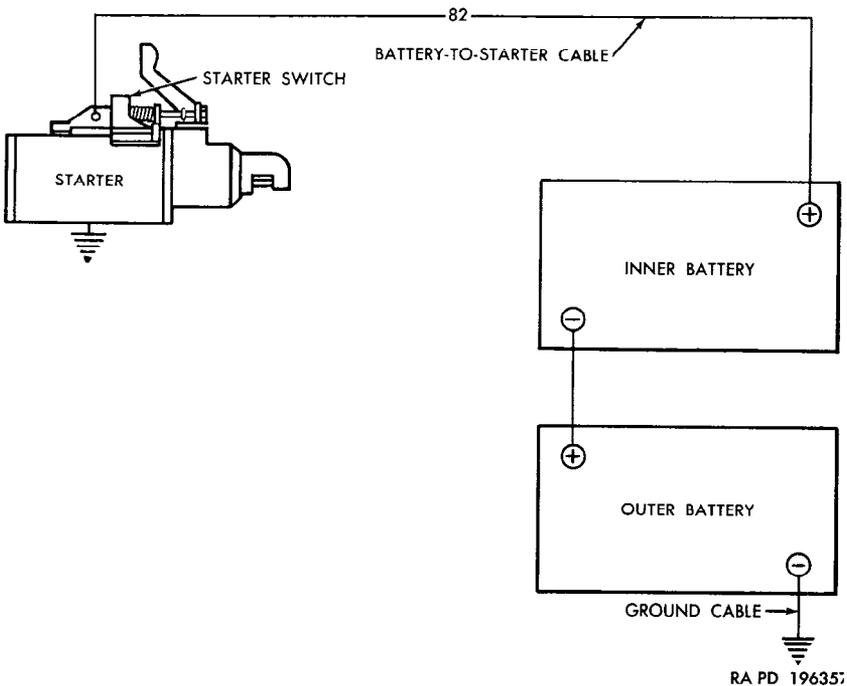


Figure 124. Starting system wiring diagram.

Section X. STARTING SYSTEM

157. Description and Data

a. Description.

- (1) The starting system (fig. 124) includes the starter, starter switch, and battery-to-starter cable. Current is supplied by two 12-volt batteries. Engagement of the starter is effected by depressing the starter switch pedal (X, fig. 12).
- (2) On vehicles of early production, a slave receptacle was provided for the introduction of additional current to start the engine (par. 6).
- (3) Two types of starters have been used (par. 6). The principal difference between the two types is in the starter switch. The starters are interchangeable only as assemblies. Early and late type starters are shown in figure 126.
- (4) Organizational maintenance of the starting system includes replacement of the starter, starter switch, starter cable, and slave receptacle and cable (on vehicles so equipped) and adjustment of the starter pinion.

b. Data.

Starter:

Clearance between pinion and thrust washer.....	$\frac{3}{32}$ to $\frac{1}{8}$
Direction of rotation.....	clockwise
Drive	mechanical shift
Make	Auto-Lite
Model.....	MCS-4301-UT, MCZ-4002-UT, or MCS-4301-4
Number of teeth in pinion.....	9
Voltage	24
Number of teeth in flywheel ring gear.....	148

158. Starter

a. Removal. Procedure for removing the starter is the same for all starter models.

- (1) Remove the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the distributor (par. 125a).
- (3) Unscrew the oil level gage pipe (fig. 125) from the cylinder block, and remove the pipe and gage.
- (4) Remove the nut from the starter switch terminal (fig. 125) and remove the battery-to-starter cable, starter-to-regulator cable, and the starter-to-slave receptacle cable (if so equipped) from the starter switch terminal.
- (5) Remove the two nuts and lockwashers that secure the starter to the studs in the clutch housing and remove the starter. Remove and discard the starter mounting seal (fig. 128).

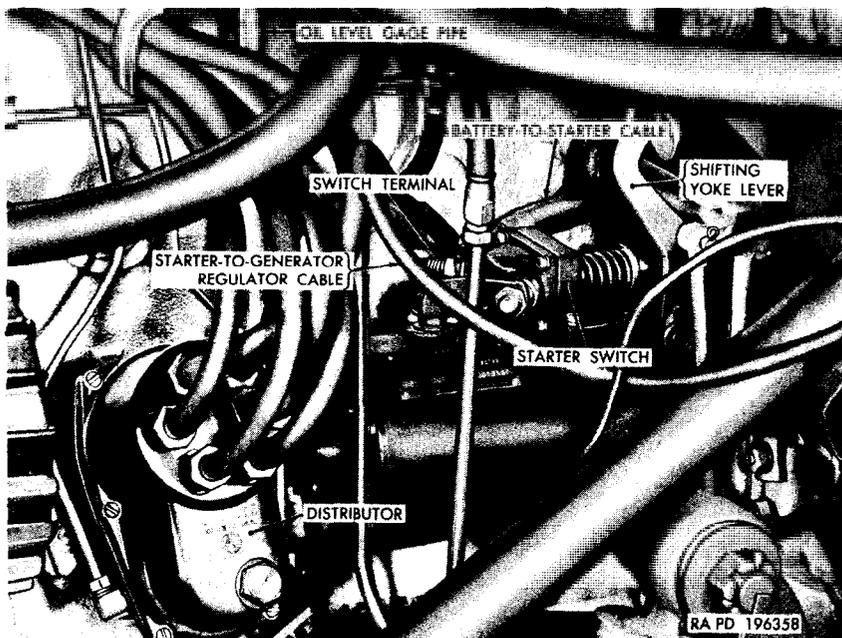


Figure 125. Starter installed.

- (6) Inspect the starter mounting studs for looseness or damage. Tighten loose studs; remove damaged studs.
- (7) Inspect the flywheel ring gear for broken or damaged teeth. Report a damaged ring gear to ordnance maintenance personnel.

b. Installation. Before installing the starter, check the starter pinion clearance and adjust if necessary (par. 160).

- (1) If the two starter mounting studs were removed (*a*(6) above) install new $\frac{7}{16}$ -14NC x $\frac{7}{16}$ -20NF x $1\frac{11}{16}$ studs in the clutch housing with the coarse thread end in the housing. Tighten the studs.
- (2) Install a new starter mounting seal (fig. 128) and place the starter (fig. 125) in position on the clutch housing. Install the two $\frac{7}{16}$ -inch lockwashers and $\frac{7}{16}$ -20NF nuts. Tighten the nuts.
- (3) Connect the battery-to-slave receptacle cable (if so equipped), the starter-to-regulator cable, and battery-to-starter cable to the front terminal of the starter switch (fig. 125) and install the terminal nut. Tighten the nut.
- (4) Install the oil level gage and gage pipe through the pipe support and screw the pipe into the opening in the cylinder block.
- (5) Install the distributor (par. 125*b*).
- (6) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).

159. Starter Switches

a. General. The early- and late-type starters are provided with distinctly different starter switches (fig. 126). When replacing the starter switch, be sure to install the same type of switch as was removed.

b. Replacement (Late-Type Switch) (fig. 128).

- (1) Remove the starter (par. 158a).

Note. Disconnect all wiring.

- (2) Remove the nut and lockwasher that secure the connector strap to the terminal in the starter frame.
- (3) Remove the four screws and lockwashers that secure the starter switch to the switch mounting bracket, and remove the switch and switch housing gasket (early-type only).
- (4) Remove the nut and lockwasher that secure the connector strap to the starter switch, and remove the strap.
- (5) Position the connector strap on the short terminal of the new starter switch, and install a $\frac{3}{8}$ -inch lockwasher and special nut.
- (6) Clean the gasket surface of the mounting bracket, and position a new switch housing gasket (early type only) and switch on the bracket with the connector strap over the terminal in the starter frame.
- (7) Install the four No. 10 lockwashers and four No. 10-32NF x $\frac{1}{2}$ machine screws to secure the switch to the bracket. Install a $\frac{3}{8}$ -inch lockwasher and special nut on the terminal in the starter frame. Tighten the four screws and the two terminal nuts.
- (8) Adjust the starter pinion clearance (par. 160b).
- (9) Install the starter (par. 158b).

c. Replacement (Early-Type Switch).

Note. The key letters noted in parentheses are in figure 127.

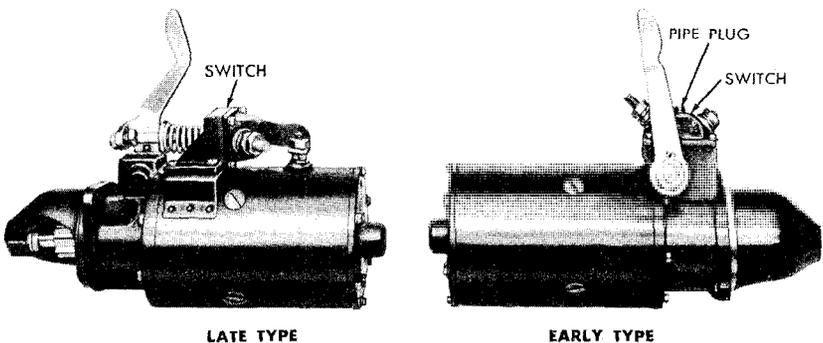
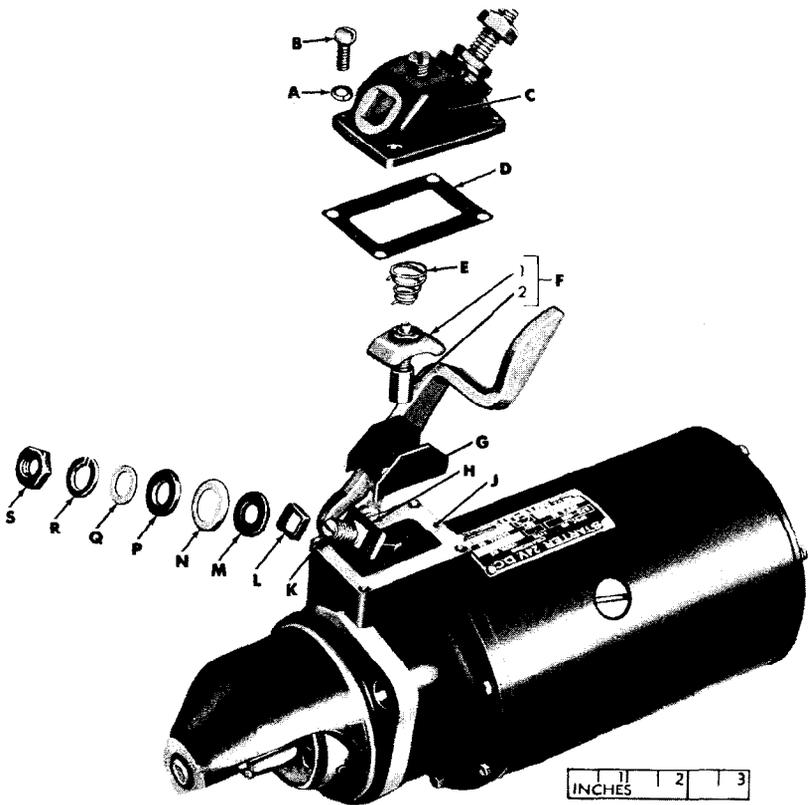


Figure 126. Starters (late- and early-types).

- (1) Remove the starter (par. 158a).
- (2) Remove the nut (S) and lockwasher (R) from the terminal (K), and remove the plain washer (Q), bushing (P), gasket retainer (N), gasket (M), and insulator (L) from the terminal (K).
- (3) Remove the four screws (B) and lockwashers (A) that secure the switch housing (C), and remove the housing and housing gasket (D).
- (4) Remove the spring (E), the switch blade assembly (F), and the cover insulator (G) from the drive housing (J).



KEY	ITEM
A	LOCK WASHER (SMALL)
B	SCREW
C	SWITCH HOUSING
D	HOUSING GASKET
E	SPRING
F	BLADE ASSEMBLY
	1 BLADE AND PLUNGER
	2 SLEEVE
G	COVER INSULATOR
H	CONNECTOR AND INSULATOR

KEY	ITEM
J	DRIVE HOUSING
K	TERMINAL
L	INSULATOR
M	GASKET
N	GASKET RETAINER
P	BUSHING
Q	PLAIN WASHER
R	LOCK WASHER
S	NUT

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Figure 127. Starter switch (early type)—exploded view.

- (5) Remove the terminal (K) from the connector and insulator (H).
- (6) Insert a new terminal (K) through the switch connector and insulator (H), positioning the terminal so that the relieved edge of the threaded end is down.

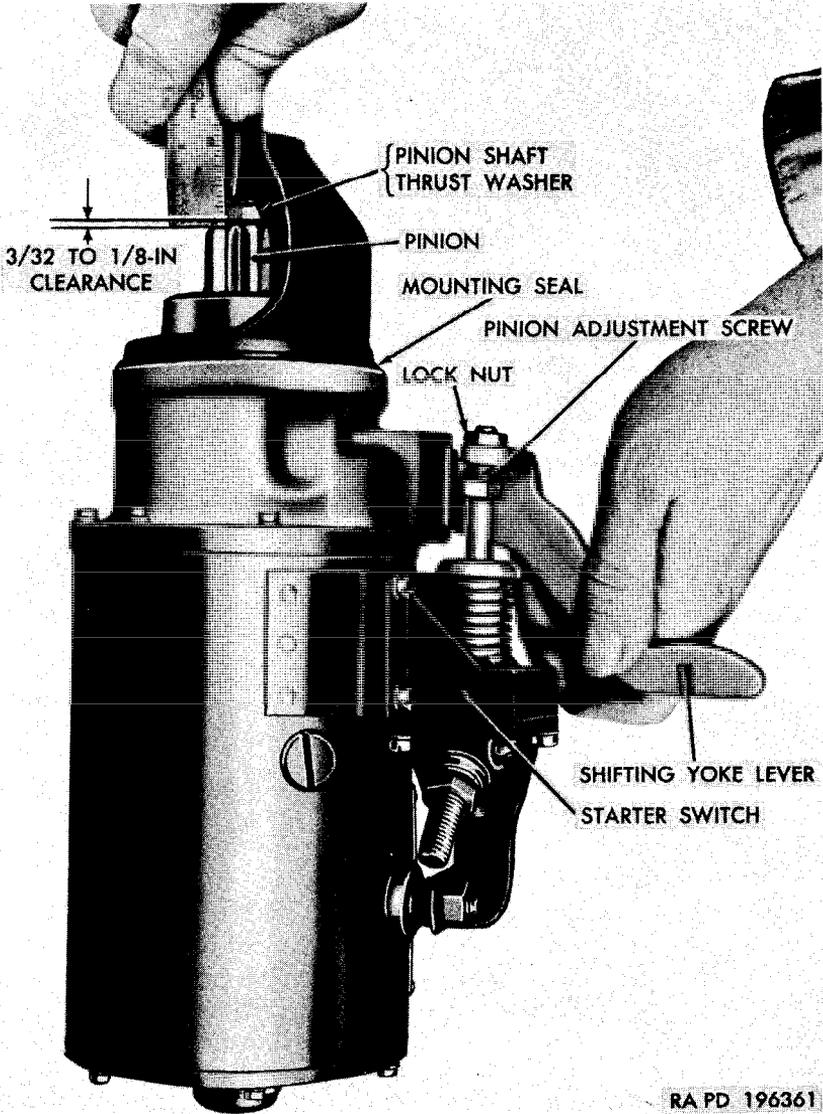


Figure 128. Pinion adjustment for late-type starter.

- (7) Make certain that the blade and plunger (F-1) is screwed into the sleeve (F-2). Fit the cover insulator (G) on the blade assembly (F) and position the parts on the starter, fitting the alining bosses of the sleeve (F-2) into the slots in the drive housing (J).
- (8) Install the spring (E) over the blade assembly (F) with the smaller diameter down.
- (9) Position the housing gasket (D) and switch housing (C) on the drive housing (J), and install the four No. 10 lockwashers (A) and No. 10-32NC x 1 $\frac{1}{4}$ fillister-head screws (B).
- (10) Install the insulator (L) over the terminal (K) and into the recess in the switch housing. Fit the gasket (M) into the gasket retainer (N) and install the bushing (P) in the opposite side of the retainer, pressing the smaller diameter of the bushing into the retainer. Install the assembled parts over the terminal (K) with the gasket next to the switch housing.
- (11) Install the $\frac{3}{8}$ -inch plain washer (Q), $\frac{3}{8}$ -inch lockwasher (R), and special nut (S) on the terminal. Tighten the nut, with the relieved side of the nut alined with the relieved edge of the terminal.
- (12) Install the starter (par. 158*b*).

160. Starter Pinion Adjustment

a. General. Proper clearance between the starter pinion and the pinion shaft thrust washer must be established before installing the starter, to insure satisfactory engagement and disengagement of the pinion and the flywheel ring gear and proper performance of the starter switch. Because of the difference in the two types of starters, the adjustment procedure for the late-type starter differs from that for the early-type starter.

b. Adjust Starter Pinion (Late-Type). Place the starter in a vertical position and push the shifting yoke lever (fig. 128) to the forward (engaged) position. While holding the lever firmly, measure the distance between the starter pinion and the pinion shaft thrust washer. This measurement should be from $\frac{3}{32}$ to $\frac{1}{8}$ inch. If the clearance at this point is not within the specified limits, loosen the locknut on the pinion adjustment screw, and turn the screw as required until correct clearance is obtained. Turning the screw clockwise decreases the clearance and turning it counterclockwise increases the clearance. Tighten the adjusting screwnut after making the adjustment.

c. Adjust Starter Pinion (Early Type). Place the starter (fig. 129) in a vertical position, resting on the commutator end. Hold the starter and push the shifting yoke lever down (toward the com-

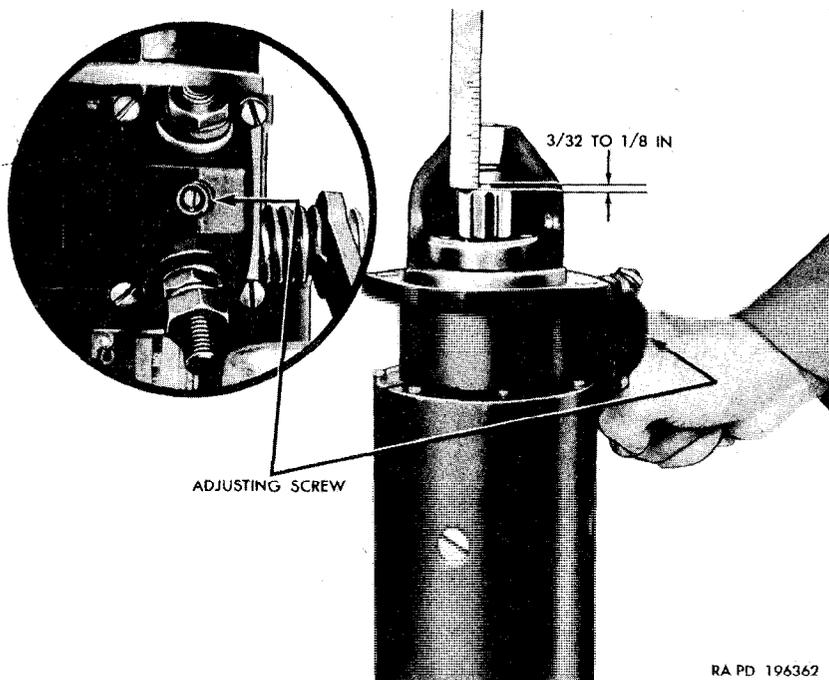


Figure 129. Pinion adjustment for early-type starter.

mutator end) as far as it will go, and measure the distance between the pinion and the pinion shaft thrust washer. This distance should be from $\frac{3}{32}$ to $\frac{1}{8}$ inch. If the clearance at this point is not within the specified limits remove the pipe plug from the top of the switch housing (C, fig. 127) and turn the switch blade plunger clockwise to decrease the clearance, or counterclockwise to increase the clearance. Install the $\frac{1}{8}$ -inch pipe plug in the switch housing after making the adjustment.

161. Auxiliary Power Receptacle (Vehicles so Equipped)

a. Removal.

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the rear splash shield from the left front fender (par. 250h).
- (3) Disconnect the slave receptacle cable (G, fig. 85) from the starter switch terminal, and disengage the cable from the cable clip on the cowl near the dimmer switch.
- (4) Remove the nut, two lockwashers, and bolt that attach the receptacle ground cable to the left running board front hanger.
- (5) Remove the two screws that secure the grommet retainer

to the inner side of the cowl panel, and slide the retainer and the grommet off the cables.

- (6) Remove the four bolts and lockwashers that secure the receptacle to the spacer on the cowl panel (fig. 130), and remove the receptacle with cables.

b. Installation.

- (1) Insert the receptacle cables through the opening in the spacer and the cowl panel with the short (ground) cable toward the rear of the vehicle. Position the receptacle on the spacer, and install the two $\frac{1}{4}$ -inch lockwashers and $\frac{1}{4}$ -28NF x $1\frac{1}{4}$ cap screws in the two rear holes, and two $\frac{1}{4}$ -inch lockwashers and $\frac{1}{4}$ -28NF x $1\frac{3}{4}$ cap screws in the two front holes (fig. 130). Tighten the screws.
- (2) Install the grommet over the cables and thread the cables through the grommet retainer with the dished side of the retainer toward the grommet. Position the grommet and retainer on the inner side of the cowl panel and install the two $\frac{1}{4}$ -20NC x $\frac{3}{8}$ cap screws. Tighten the screws.
- (3) Attach the receptacle ground cable to the left running board front hanger. Place a $\frac{3}{8}$ -inch, internal-external-teeth lockwasher at each side of the cable terminal, position the parts over the screw hole in the hanger, and install the $\frac{3}{8}$ -24NF x 1 cap screw and $\frac{3}{8}$ -24NF nut. Tighten the nut.

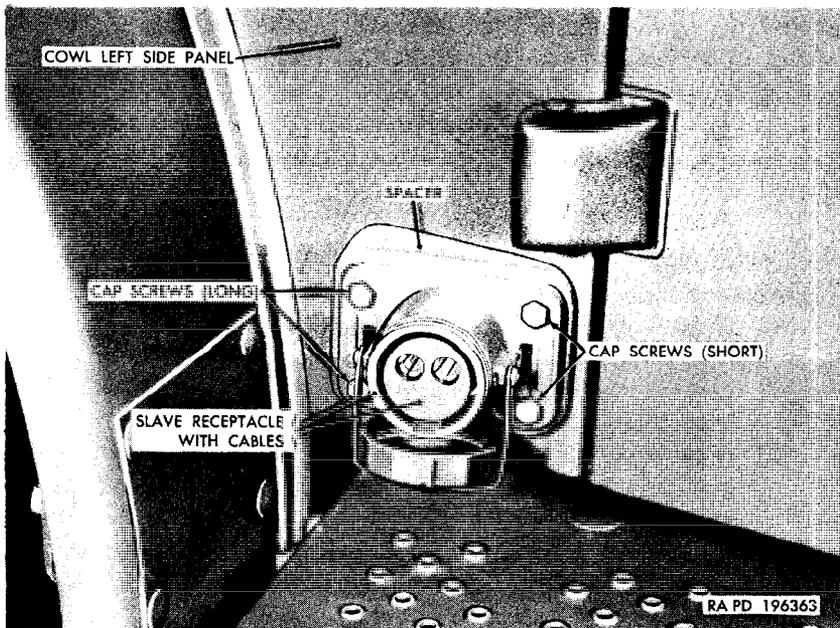


Figure 130. Auxiliary power receptacle installed.

- (4) Connect the receptacle cable to the starter switch terminal (fig. 85) and tighten the terminal nut. Engage the cable in the cable clip near the dimmer switch.
- (5) Install the left front fender rear splash shield (par. 250*i*).
- (6) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).

162. Starter Switch Pedal Alinement

a. General. On vehicles of early production, the starter pedal plunger may not be properly alined with the starter shifting yoke leveled when in the fully engaged position, causing the plunger to slip over the yoke lever when the pedal is depressed. This difficulty has been eliminated on later vehicles (par. 6). To correct the condition on early vehicles, proceed as instructed in *b* below.

b. Aline Pedal Plunger.

- (1) Remove the two screws and lockwashers that secure the lower side of the pedal bracket to the transmission cutout cover (fig. 87).
- (2) Insert spacers ($\frac{1}{4}$ -inch ID flat washers) between the bracket and the cover, alining the holes in the spacers with those in the bracket and cover. Use the same number and thickness washers for each screw hole to the pedal plunger at the shifting yoke lever.
- (3) Install the two $\frac{1}{4}$ -inch lockwashers and $\frac{1}{4}$ -28NF x $\frac{1}{2}$ screws to secure the bracket to the cover.

Note. It may be necessary to use longer screws to compensate for the spacers.

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Section XI. GENERATOR SYSTEM

163. Description and Data

a. Description.

- (1) The 24-volt generating system (fig. 131) includes the generator, generator regulator, batteries, and necessary connecting cables and wiring. The ammeter, or battery generator indicator, on the instrument panel is connected to the generator regulator. Current from the generator flows to the regulator and then to the batteries. The generator regulator controls current output to the batteries according to operation requirements, and prevents overcharging. The system is completely sealed against the entrance of water, to provide for efficient performance during fording operations.
- (2) Organizational maintenance includes replacement of the generator, generator pulley, generator mounting bracket,

generator regulator, generator regulator mounting bracket, ground straps, and generator to generator regulator cable.

b. Data.

Generator :

Charging rate :

Amperes..... 25

Watts..... 600

Drive..... belt

Location..... left side of engine

Make..... Auto-Lite or Delco-Remy

Model..... GHA-4802 UT

DR-1117495

Pulley diameter..... 3¼ in.

Generator regulator :

Make..... Auto-Lite or Delco-Remy

Model..... AL-VBC-4002 UT

DR-1118546 or

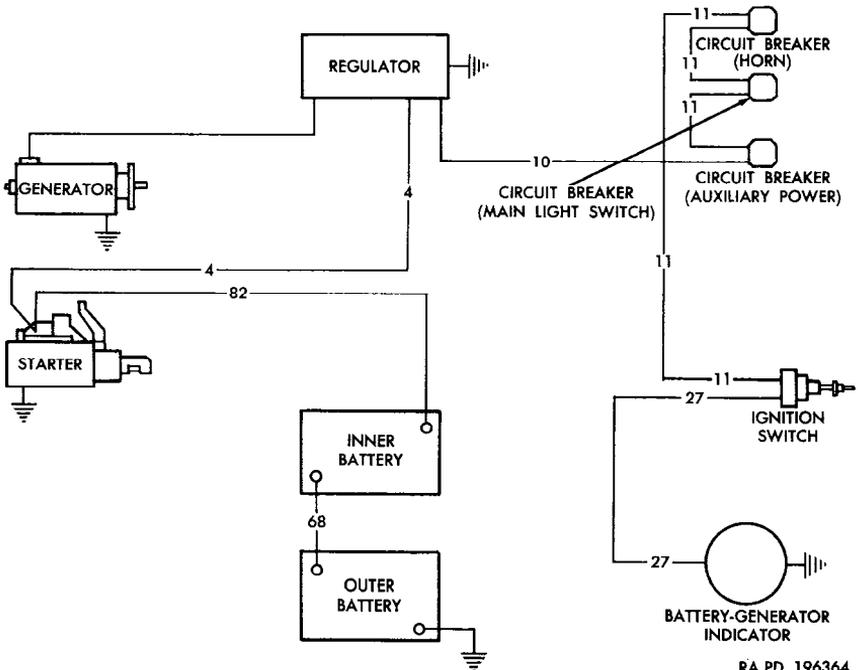
DR-1118606

164. Generator, Generator Mounting Bracket, and Cable

Note. The key letters noted in parentheses are in figure 132.

a. Remove generator.

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).



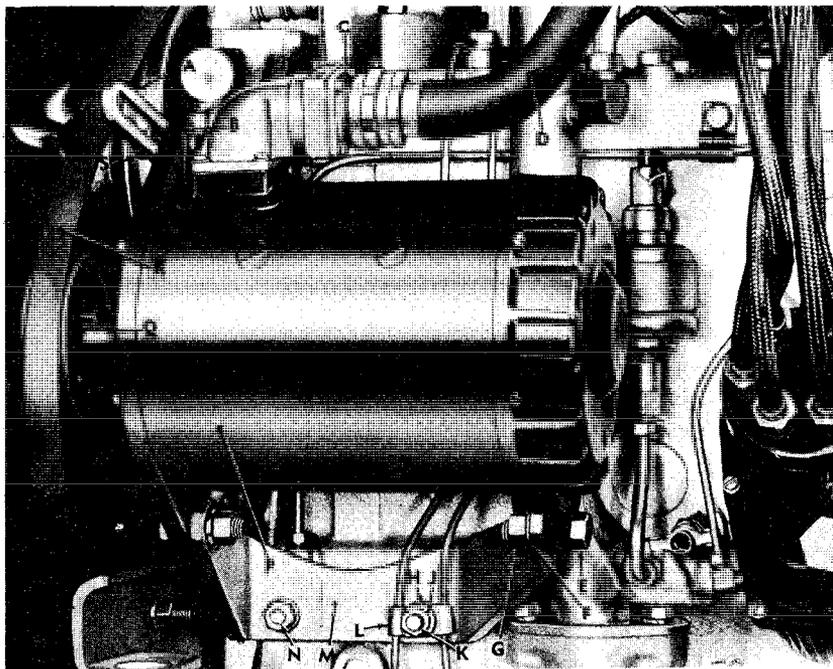
RA PD 196364

Figure 131. Generating system wiring diagram.

- (2) Disconnect the generator-to-generator regulator cable (D) from the generator nut in receptacle (C) by unscrewing the cable connector end nut with a suitable spanner wrench.
- (3) Remove the adjusting arm bolt (S) and plain washer (B) and lockwasher that secure the adjusting arm (A) to the generator (P). Push the generator toward the engine, and remove the drive belt (R) from the pulley (Q).
- (4) Remove the two nuts (G), lockwashers (F), and bolts (E) that secure the generator to the mounting bracket (M), and remove the generator.

b. Remove Generator Pulley. Remove the cotter pin, castellated nut, and lockwasher that secure the generator pulley (Q) to the armature shaft.

Note. On some generators, the pulley is attached with a safety nut and plain washer.



KEY	ITEM
A	ADJUSTING ARM
B	PLAIN WASHER
C	RECEPTACLE
D	GENERATOR-TO-GENERATOR REGULATOR CABLE
E	BOLT
F	LOCK WASHER
G	NUT
H	LOCK WASHER

KEY	ITEM
J	STUD NUT
K	STUD-TYPE SCREW
L	TENSION CLIP
M	MOUNTING BRACKET
N	BRACKET BOLT
P	GENERATOR
Q	PULLEY
R	DRIVE BELT
S	ADJUSTING ARM BOLT

RA PD 196365

Figure 132. Generator and mounting bracket.

With a suitable puller, remove the pulley from the shaft. Remove the woodruff key.

c. Remove Generator Mounting Bracket.

- (1) Remove the stud nut (J) and lockwasher (H) from the stud-type screw (K), and remove the tension clip (L) with the two vent lines from the screw. Remove the stud-type screw (K) and lockwasher.
- (2) Remove the bracket bolt (N) and lockwasher attaching the mounting bracket (M) to the cylinder block, and remove the bracket.
- (3) Removal of the generator adjusting arm (A) is described in paragraph 154d.

d. Install Generator Mounting Bracket.

- (1) Position the mounting bracket (M) on the cylinder block and install a $\frac{7}{16}$ -inch lockwasher and the special stud-type screw (K) in the rear bolt hole. Install a $\frac{7}{16}$ -inch lockwasher and $\frac{7}{16}$ -14NC x 1 bracket bolt (N) in the front bolt hole. Tighten the bolt and stud-type screw.
- (2) Position the vent line tension clip (L) with vent lines on the stud-type screw, and install the $\frac{3}{8}$ -inch lockwasher (H) and $\frac{3}{8}$ -24NF stud nut (J) to secure the clip. Be sure the two vent lines are properly engaged in the clip and tighten the nut.
- (3) If the adjusting arm (A) was removed (c(3) above), install the arm (par. 154f).

e. Install Generator Pulley. Install the $\frac{1}{8}$ x $\frac{5}{8}$ woodruff key in the armature shaft and install the pulley (Q) on the shaft (hub extension toward generator), alining the keyway in the pulley with the key. Install the $\frac{1}{2}$ -inch lockwasher, $\frac{1}{2}$ -20NF castellated nut, and $\frac{3}{32}$ x 1 cotter pin, or the special washer and safety nut. (Refer to note in b above.)

f. Install Generator.

Note. Before installing the generator, see that the generator mounting bolts and nuts are thoroughly clean and that the contacting surfaces of the bracket and generator heads are clean to insure a good ground connection.

- (1) Mount the generator in position on the mounting bracket (M) and install the two $\frac{7}{16}$ -20NF x $1\frac{3}{8}$ bolts (E), $\frac{7}{16}$ -inch lockwashers (F), and $\frac{7}{16}$ -20NF nuts (G). Do not tighten the nuts until the generator has been positioned ((3) below).
- (2) Attach the adjusting arm (A) to the generator with the $\frac{3}{8}$ -16NC x 1 adjusting arm bolt (S) and $1\frac{3}{32}$ -inch plain washer (B). Push the generator toward the engine and fit the drive belt (R) on the pulley (Q).
- (3) Position the generator to provide $\frac{1}{2}$ -inch deflection of the

drive belt, and tighten the adjusting arm bolt (S). Then tighten the two mounting bolt nuts (G).

- (4) Connect the battery-to-ground cable to the negative (-) post of the outer battery (fig. 135).
- (5) Polarize the generator (g below).
- (6) Connect the generator-to-regulator cable, turning the connector end nut securely into place with a suitable spanner wrench.

g. Polarize the Generator.

Note. If a new or rebuilt generator has been installed, the generator must be polarized before the engine is started. This is necessary in order to insure correct polarity of the generator with respect to the batteries.

- (1) Disconnect the generator-to-generator-regulator cable and insert the adapter—17-A-2987-75 of the adapter set 17-A-3150 (fig. 42) in the generator receptacle.
- (2) Connect a jumper wire to one of the FIELD terminals of the adapter (link between the adapter field terminals closed).
- (3) Touch the other end of the jumper wire *momentarily* to the terminal of the starter switch. A flash connection is sufficient to polarize the generator.
- (4) Remove the adapter from the generator receptacle and connect the generator-to-generator-regulator cable (D).

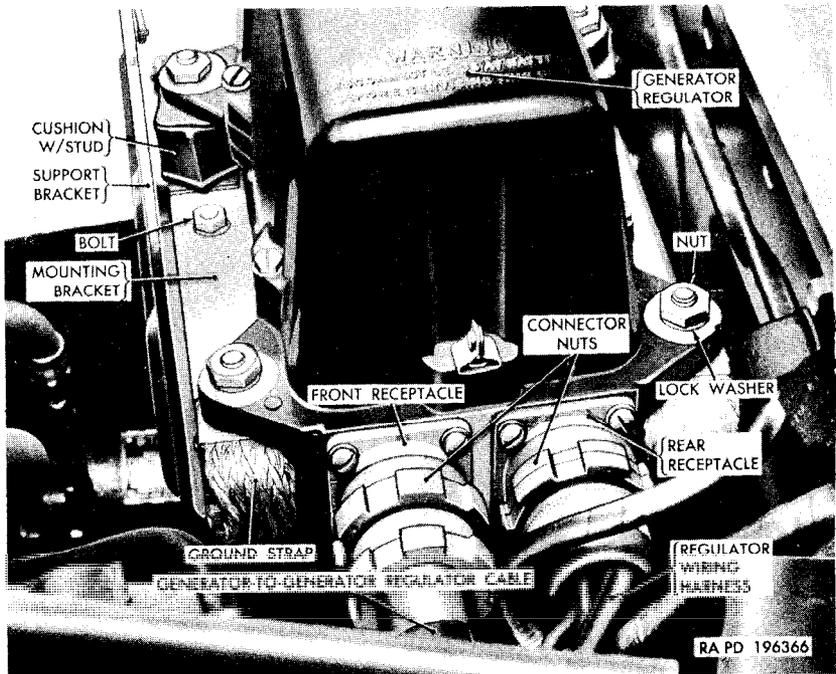


Figure 133. Generator regulator installed

h. Replace Generator-To-Generator-Regulator Cable.

- (1) Remove the four lockwasher screws which secure the left fender-to-hood panel and remove the panel.
- (2) Disengage the cable from the cable clip on the left front fender. Unscrew the generator-to-generator-regulator cable connector end nuts from the receptacle (C) and the front receptacle of the generator regulator (fig. 133), and remove the cable.
- (3) Connect the cable to the generator receptacle (C) and the front receptacle of the generator regulator (fig. 133), screwing the connector end nuts to the receptacles. Engage the cable in the cable clip on the left front fender.
- (4) Position the left fender-to-hood panel and install the four lockwasher screws. Tighten the screws.

165. Generator Regulator and Bracket

a. Remove Generator Regulator (fig. 133).

- (1) Disconnect the battery-to-ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the left fender-to-hood panel (par. 164h(1)).
- (3) Disengage the generator-to-regulator cable from the cable clip on the left front fender. Disconnect the generator-to-regulator cable and the regulator wiring harness from the generator regulator receptacles, using a suitable spanner wrench.
- (4) Remove the four nuts and lockwashers that secure the regulator, and remove the regulator.

b. Remove Cushions, Regulator Brackets, and Ground Straps (fig. 133).

- (1) Unscrew the four cushions with studs from the mounting brackets, and remove the cushions and ground straps.
- (2) Remove the four nuts, lockwashers, and bolts that secure the two mounting brackets to the regulator support bracket, and remove the two brackets.

c. Inspection.

- (1) Inspect the support bracket attaching screws for damage, looseness, or missing screws or lockwashers. Tighten loose screws and replace damaged or missing screws or lockwashers.
- (2) Inspect the four ground straps for corrosion or other damage. Replace the straps, if necessary.
- (3) Inspect the four cushions with studs for damage, deterioration, and damaged threads on the studs. Replace damaged cushions.
- (4) Inspect the two mounting brackets for cracks, distortion,

and damaged bolt or stud holes. Replace the brackets if necessary.

d. Install Regulator Brackets, Cushions, and Ground Straps (fig. 133).

- (1) Make certain that the contacting surfaces of the mounting brackets and the ground straps are thoroughly clean, to insure a good ground connection.
- (2) Position the two mounting brackets on the support bracket and install the two $\frac{1}{4}$ -28NF x 1 bolts (from the upper side of the brackets), $\frac{1}{4}$ x 0.760 internal-external-teeth lock-washers, and $\frac{1}{4}$ -28NF nuts for each bracket. Tighten the nuts.
- (3) Place one end of a ground strap over each cushion stud opening in the two mounting brackets. Install the four cushions, screwing the short end of each stud into the support bracket hole.

e. Install Generator Regulator.

- (1) Place the outer end of each ground strap on the upper end of its cushion stud, position the regulator on the four cushion studs with the two receptacles to the left side of vehicle, and install the four $\frac{5}{16}$ -inch lockwashers and $\frac{5}{16}$ -18NC nuts (fig. 133). Tighten the nuts.
- (2) Connect the regulator wiring harness to the rear receptacle and the generator-to-generator-regulator cable to the front receptacle, screwing the connector end nuts to the receptacles. Engage the generator-to-generator-regulator cable in the cable clip on the left front fender.
- (3) Install the left fender-to-hood panel (par. 164h(4)).

Section XII. BATTERY AND LIGHTING SYSTEM

166. Description and Data

a. Description.

- (1) Current for the 24-volt lighting system (fig. 134) is supplied by two 12-volt batteries. Batteries (fig. 135) for all models, except the early production models of the ambulance truck M43, are located in a box under the passenger's seat in the driver's compartment. Batteries (fig. 136) for the early production vehicles of the ambulance truck M43 (par. 6) are located in the left front compartment under the patient's seat.
- (2) Organizational maintenance of the batteries and lighting system includes cleaning, inspection, and replacement of the batteries and battery cables, replacement of lamps, lamp-units, lights, light switch, dimmer switch, and circuit breakers.

On vehicles so equipped, it also includes replacement of the trailer coupling receptacle, radio receptacle, and auxiliary power outlet receptacle.

b. Data.

Batteries :

Capacity ----- 45 amp at 20 hour rate (at 80° F.)
Cells (each battery) :
 Arrangement ----- side by side
 Number ----- 6
Make ----- Auto-Lite or Willard
Model ----- US2HN
Number required ----- 2
Plates (each battery) ----- 11
Terminal grounded ----- negative
Voltage ----- 12

Circuit breaker :

Make ----- Spencer or Wilcalator
Type ----- automatic reset
Voltage ----- 24

Dimmer switch :

Make ----- Douglas
Voltage ----- 24

Lamps and lamp units :

Make ----- Auto-Lite
Type :
 Blackout driving ----- lamp-unit (sealed beam)
 Blackout marker, parking, tail and dome lights
 ambulance truck M43) ----- lamp (G-6 bulb)
 Headlight (two) ----- lamp-unit (sealed beam)
 Spot light (ambulance truck M43, telephone
 maintenance truck V41) ----- lamp-unit (sealed beam)
 Spot light (blackout and service) ----- lamp (S-8 bulb)
 Surgical light (ambulance truck M43) ----- lamp-unit (sealed beam)

Light switch :

Make ----- Bendix
Voltage ----- 24

167. Battery Cleaning, Servicing, and Specific Gravity Test

a. Clean and Service.

- (1) Clean the batteries and battery cable terminals, removing corrosion and dirt.
- (2) Apply a light coating of petroleum jelly to the battery cable terminals to prevent corrosion accumulation. Corrosion around the battery and terminals causes battery drain and must be avoided.
- (3) Remove the six fillercaps from each battery and inspect the level of the electrolyte. The correct level should be three-eighths of an inch below the top of the cell, or well above the tops of the plates.

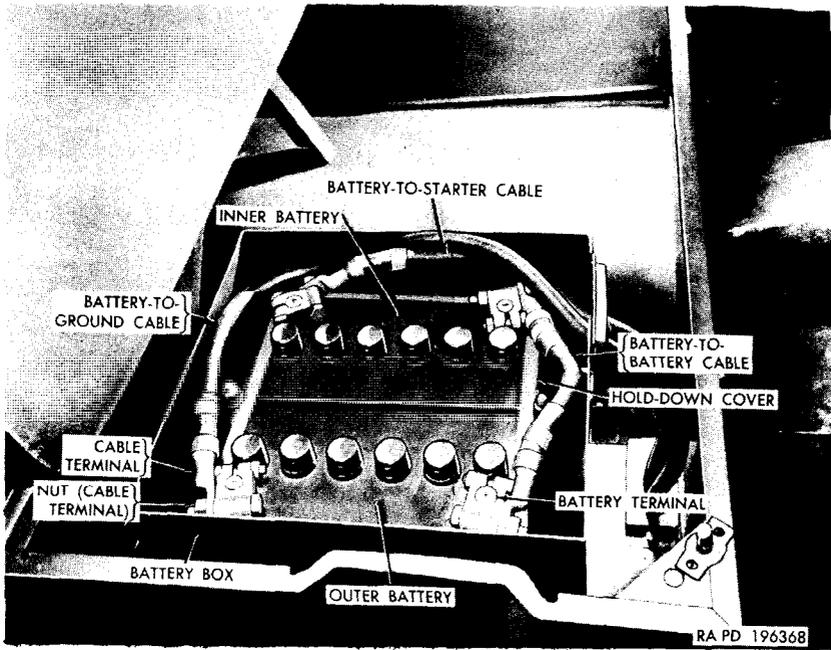


Figure 135. Battery box location (all models except early production ambulance truck M43).

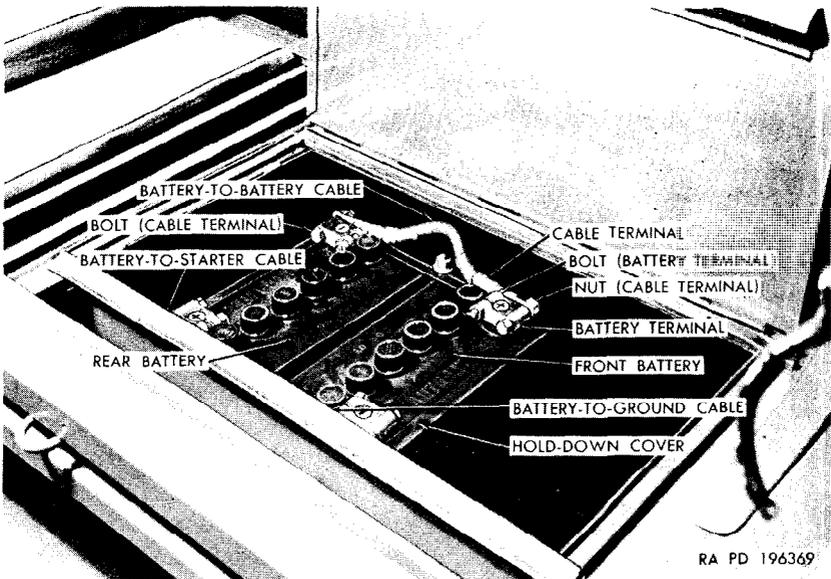


Figure 136. Battery box location (early production ambulance truck M43).

- (4) Check the specific gravity in each cell of each battery (*b* below). If the electrolyte level is too low to permit filling of the hydrometer, add clean distilled water to the proper level and run the engine for approximately 30 minutes before attempting to check the specific gravity.

Note. If distilled water is not available, use clean rain water or drinking water. The use of water with high mineral content must be avoided as it causes rapid deterioration of plates and separators.

b. Check Specific Gravity.

- (1) Remove the six fillercaps from each battery. Test and note the temperature of the electrolyte and test the specific gravity in each cell, using a hydrometer. Note the readings.
- (2) A specific gravity reading of 1.275 to 1.300 at 80° F. in each cell indicates a fully charged battery. A reading of less than 1.220 is unsatisfactory. Replace a battery if the reading is below 1.220 (par. 168).
- (3) If the temperature of the electrolyte is higher or lower than 80° F., compute the corrected specific gravity in accordance with the correction chart (fig. 137).
- (4) Compare the readings in the cells of the battery. The specific gravity in all cells of either battery should be the same, within 0.025. If variation is greater than this, an abnormal condition within the battery is indicated. Check the battery voltage drop (par. 90*e*). Replace either or both batteries, as required (par. 168).
- (5) Install the six fillercaps for each battery after completing the check.

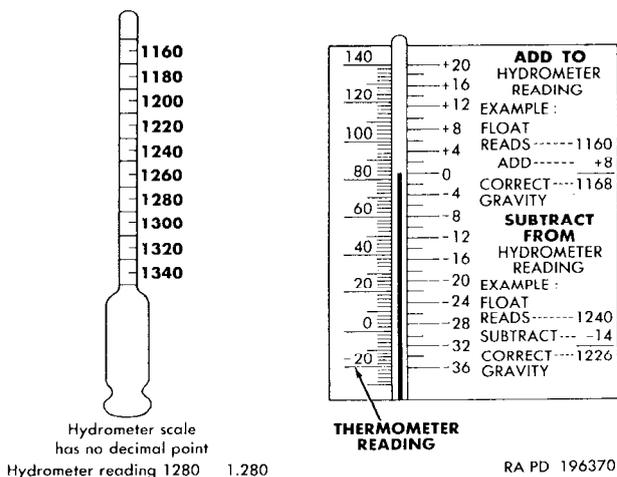


Figure 137. Hydrometer scale and temperature correction chart.

168. Battery

a. General. Batteries replaced because of a discharged condition or unsatisfactory voltage tests will be reported to ordnance maintenance personnel. Replacement procedure described in *b* and *c* below covers removal and installation of both batteries. If only one battery requires replacement, unnecessary steps may be omitted but, in any case, the battery ground cable must be removed to prevent accidental grounding of the batteries.

b. Removal.

- (1) Loosen the nut on the battery terminal bolt at the negative (−) post of the outer battery (fig. 135) or front battery (fig. 136) and remove the terminal with attached ground cable. Remove the battery-to-battery cable and the battery-to-starter cable in the same manner. Remove the insulator from the positive (+) post of the inner battery (fig. 135) or rear battery (fig. 136) if so equipped.

Note. This insulator is required on vehicles of early manufacture (par. 6). On later vehicles, the battery holddown cover eliminates the necessity for the insulator.

- (2) Remove the two holddown cover bolt nuts and flat washers, and remove the holddown cover. Lift the two batteries from the battery box.
- (3) Clean and inspect the inside of the battery box. See that it is dry and free from corrosion. Paint the box if it is rusted or has been damaged by corrosion.

c. Installation.

- (1) For vehicles with the batteries under the passenger seat, install the batteries in the battery box with the negative (−) post of the inner battery toward the front and that of the outer battery (fig. 135) toward the rear. For ambulance truck M43 with batteries in the patient compartment, install the front battery with the negative (−) post toward the center of the vehicle and that of the rear battery toward the left side of the vehicle (fig. 136).

Note. If a new battery is to be installed, check the electrolyte level. If the battery is dry, add diluted sulfuric acid to the correct level in each cell (par. 167a).

- (2) Install the holddown cover and install the $\frac{3}{8}$ -inch flat washers and $\frac{3}{8}$ -16NC nuts on the two holddown cover bolts. Tighten the nuts.
- (3) Lubricate the battery posts (par. 167a(2)). Install the battery-to-battery cable and battery terminals, being sure to install each terminal on the correct battery post (positive on positive and negative on negative (figs. 135 or 136)).
- (4) Install the rubber insulator on the positive post of the inner

battery (fig. 135), or the rear battery (fig. 136), if required. Refer to NOTE in *b*(1) above. Install the battery-to-starter cable and battery terminal on the battery post.

- (5) Install battery-to-ground cable and battery terminal on the negative (−) post of the outer battery (fig. 135) or front battery (fig. 136).
- (6) Tighten the nuts on the four battery terminal bolts.

169. Battery Terminals and Cables

a. Remove Battery Terminals (figs. 135 and 136). All battery terminals are serviced in the same manner. Positive and negative terminals are not interchangeable.

- (1) Before removing any of the battery terminals, disconnect the battery-to-ground cable (par. 168*b*(1)) to prevent accidental short circuits.
- (2) Remove the nut from the cable terminal bolt and remove the cable terminal and the bolt.
- (3) Loosen the nut on the battery terminal bolt, and remove the terminal.

b. Install Battery Terminals (figs. 135 and 136).

- (1) Clean the battery post, cable terminal, and battery terminal. Lubricate battery posts (par. 167*a*(2)).
- (2) Install a $\frac{5}{16}$ -18NC x $1\frac{1}{4}$ squarehead, lead-coated bolt in the battery terminal and install the $\frac{5}{16}$ -18NC nut loosely on the bolt. Install the terminal on the battery post.
- (3) Install the $\frac{3}{8}$ -16NC x 2 bolt through the battery terminal, install the cable terminal on the bolt, and install the $\frac{3}{8}$ -16NC nut. Position the battery terminal on the battery post and tighten both nuts.

c. Replace Battery-to-Battery Cable (figs. 135 and 136).

- (1) Remove the nut that secures each battery-to-battery cable terminal and remove the cable from the battery terminals.
- (2) Install the terminals of the new cable on the bolts in the battery terminals, and install the $\frac{3}{8}$ -16NC nut on each bolt. Tighten the nuts.

d. Remove Battery-To-Ground Cable (figs. 135 and 136).

- (1) Remove the nut that secures the battery-to-ground cable at the battery terminal, and remove the cable terminal from the bolt.
- (2) Remove the nut, bolt, and two lockwashers that secure the outer terminal of the cable to the right frame side rail.
- (3) Remove the two screws that secure each of the grommet retainers (one at the front side of the battery box and one at the floor panel). Push the grommet retainers along the two ca-

bles to provide access to the grommets, and remove the grommets.

- (4) Pull the cable from the battery box and grommet retainer up through the opening in the floor panel and the other grommet retainer.

e. Install Battery-To-Ground Cable (figs. 135 and 136).

- (1) Insert the battery terminal end of the new battery-to-ground cable through the grommet retainer at the battery box and into the box. Install the split rubber grommet on the cable at the opening in the box.
- (2) Insert the other end of the cable through the grommet retainer at the floor panel and through the opening in the floor panel. Install the other split rubber grommet on the cable at the floor panel.
- (3) Position the two grommet retainers and install the two $\frac{1}{4}$ -20NC x $\frac{3}{8}$ screws for each retainer. Tighten the screws.
- (4) Clean the frame side rail at terminal bolt hole and apply a film of lubricant. Attach the terminal of the ground cable to the right frame side rail, with a $\frac{3}{8}$ -24NF x 1 bolt, two $\frac{3}{8}$ -inch, internal-external-teeth lockwashers (one at each side of the cable terminal), and a $\frac{3}{8}$ -24NF nut. Tighten the nut.
- (5) Connect the ground cable terminal to the bolt (cable terminal) at the negative (-) post of the outer battery (fig. 135) or the front battery (fig. 136) and install the $\frac{3}{8}$ -16NC nut. Tighten the nut.

f. Remove Battery-to-Starter Cable.

- (1) Remove the nut that secures the battery-to-starter cable terminal at the battery terminal, and remove the cable terminal (fig. 135) from the bolt.
- (2) Disconnect the other end of the cable from the starter switch terminal (fig. 125).
- (3) Remove the cable grommets at the battery box and floor panel as described in *d* (3) above.
- (4) Disengage the cable from the cable clip (fig. 88) on the transmission.
- (5) Pull the front end of the cable back from the engine compartment. Remove the battery end of the cable from the battery box, two grommet retainers and the floor panel, and remove the cable from underside of vehicle.

g. Install Battery-To-Starter Cable.

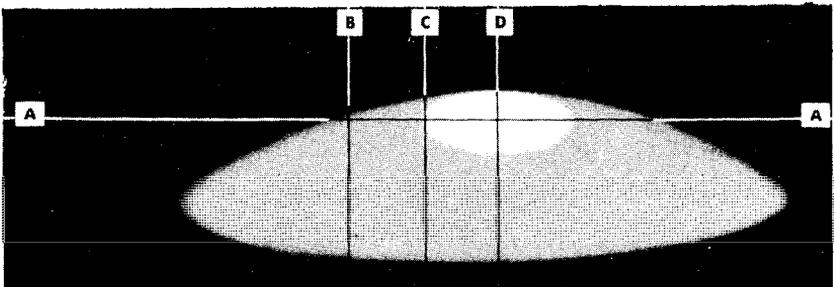
- (1) From the under side of the vehicle, place the battery-to-starter cable over the transmission and push the starter terminal end of the cable into the engine compartment below the accelerator shaft.
- (2) Insert the other end of the cable through the opening in the

floor panel, the two grommet retainers, and the opening in the battery box.

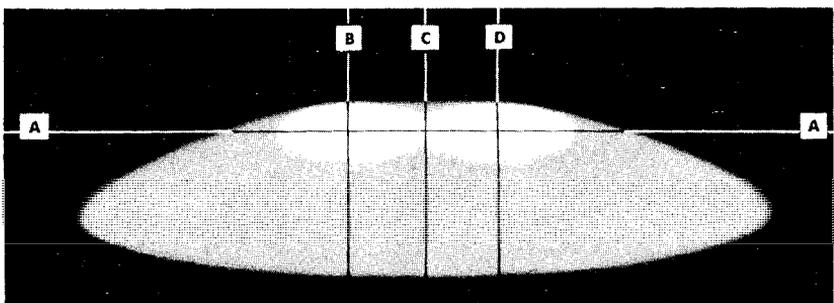
- (3) Install the two grommets and secure the grommet retainers as described in e(2) and (3) above.
- (4) Connect the cable to the starter terminal (fig. 125) and install the special terminal nut. Tighten nut. Install the other end of the cable on the bolt (cable terminal) at the positive (+) post of the inner battery (fig. 135) or the rear battery (fig. 136). Install a $\frac{3}{8}$ -16NC nut on the bolt and tighten. Engage the cable in the cable clip (fig. 88) on the transmission.

170. Service Headlight Aiming

a. General. The service headlights must be properly aimed to provide adequate visibility for night driving and to prevent glare to approaching traffic. Improperly aimed headlights may be caused by unequal inflation of the front tires or by a difference in tread of the tires, bent fenders or fender supports, or damaged front springs. Check and correct these items before attempting to adjust the headlights.



1. UPPER BEAM OF RIGHT HEADLIGHT



2. UPPER BEAM OF BOTH HEADLIGHTS

KEY **ITEM**
A—HORIZONTAL LINE 3 INCHES
BELOW HEADLIGHT CENTERS
B—VERTICAL LINE, IN LINE WITH
CENTER OF LEFT HEADLIGHT

KEY **ITEM**
C—VERTICAL LINE, IN LINE WITH
WINDSHIELD CENTER STRIP
D—VERTICAL LINE, IN LINE WITH
CENTER OF RIGHT HEADLIGHT

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Figure 138. Headlight aiming screen pattern.

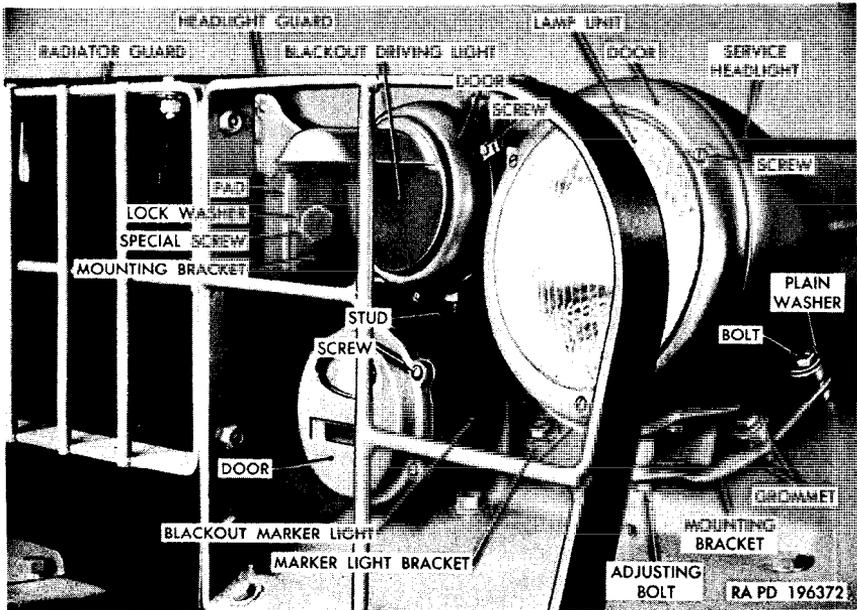


Figure 139. Service headlight, blackout driving light, and blackout marker light.

b. Procedure.

- (1) Position the vehicle on a level floor.
- (2) Locate the screen at right angles to the vehicle exactly 25 feet ahead of the headlights. Move the screen so that line (C, fig. 138) on the screen is directly in line with the center line of the vehicle.
- (3) Measure the distance from the center of the headlights to the floor. Compare this measurement with line (A, fig. 138) on the screen. Raise or lower the screen until line (A, fig. 138) is 3 inches below the measured height of the headlight centers. Lines (B and D, fig. 138) must be directly in line with the vertical center lines of the left and right headlights, respectively.
- (4) Turn the headlights on and operate the dimmer switch (EE, fig. 12) to high beam.
- (5) If either headlight pattern differs from view 2, figure 138, loosen the adjusting bolt attaching the headlight to the fender mounting bracket (fig. 139) and move the headlight as required to produce the correct pattern. Then tighten the bolt. Adjust the other headlight if necessary, in the same manner.

171. Lamps and Lamp-Units

a. Replace Service Headlight Lamp-Unit (fig. 140). Both service headlight lamp-units are serviced in the same manner.

- (1) Unscrew the three screws that secure the headlight door and

- remove the door, pulling the lower edge of the door away from the headlight body first.
- (2) Loosen the four lamp-unit retainer screws, turn the retainer clockwise to disengage it from the screws and remove the retainer.
 - (3) Pull the lamp-unit from the headlight body far enough to provide access to the three cable connectors.
 - (4) Remove the three connectors from the clips inside the headlight body, separate the connector shells, and pull the lamp-unit cable terminals from the connector sleeves. Remove the lamp-unit with attached cables.
 - (5) Connect the three lamp-unit cables to the three cables in the headlight body, matching the cable numbers. Connect the cable shells and engage the connectors in the clips inside the headlight body.
 - (6) Position the new lamp-unit in the headlight body with the three projections alined with the three recesses in the body ring. Install the lamp-unit retainer with the enlarged ends of the screw slots over the four retainer screwheads. Turn the retainer counterclockwise to engage the four screws. Tighten screws.
 - (7) Install the headlight door with the inner recess at the top,

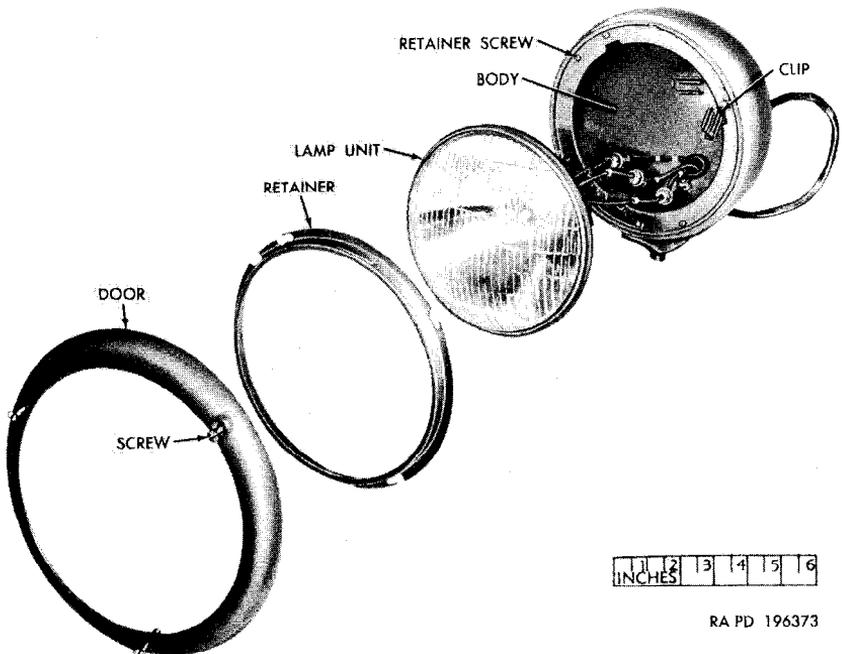


Figure 140.—Service headlight—partial exploded view.

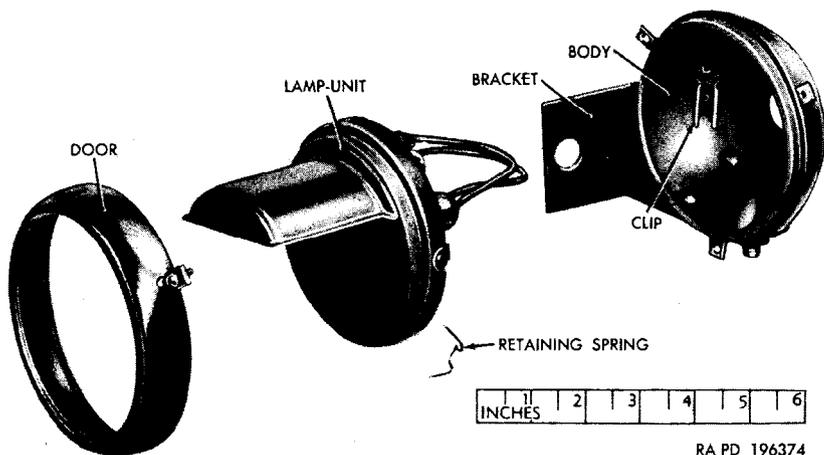


Figure 141. Blackout driving light—exploded view.

opposite the pad at the top of the body. Tighten the three screws to secure the door.

b. Replace Blackout Driving Light Lamp-unit.

- (1) Unscrew the three screws that secure the blackout driving light door to the body, and pull the door and lamp-unit (fig. 141) from the body far enough to expose the lamp-unit cable connectors.
- (2) Remove the two cable connectors from the clips inside the body. Disconnect the cable connectors and cable (a(4) above).
- (3) Remove the three lamp-unit retaining springs and remove the lamp-unit from the door.
- (4) Install the new lamp-unit in the door and install the three lamp-unit retaining springs.
- (5) Connect the two lamp-unit cables to the cables in the headlight body (a(5) above). Engage the cable connectors in the clips.
- (6) Position the door and lamp-unit on the body and tighten the three attaching screws.

c. Replace Lamps in Blackout Marker Lights or Taillights (fig. 13). The same type double tungsten filament lamps are used for the blackout marker lights (fig. 139) and the taillights. The stop light lamps are a single tungsten filament. To replace any of the lamps, unscrew the six screws that secure the door to the body (fig. 142). Remove the door and the door gasket. Remove the lamp to be replaced and install a new lamp of the same type. Install the gasket, replacing it with a new one if necessary, and install the door (fig. 142).

d. Replace Lamp-Unit in Spotlight (Ambulance Truck M43 or Telephone Maintenance Truck V-41) (fig. 143).

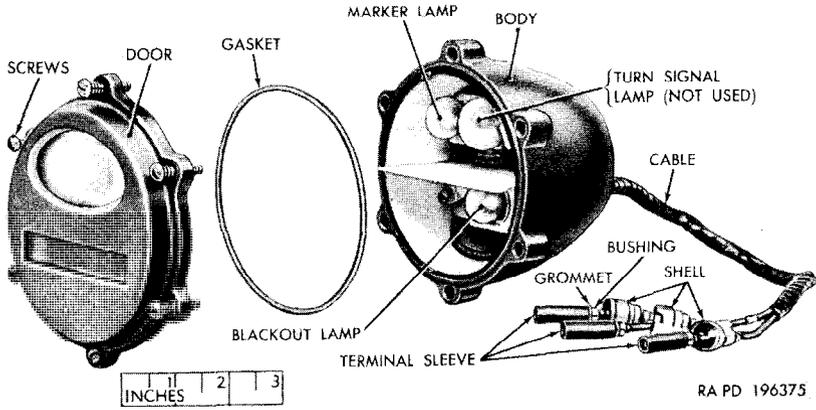


Figure 142. Blackout marker light—exploded view.

- (1) Unscrew the three screws that secure the spotlight door and pull the door and lamp-unit away from the body to provide access to the cables.
- (2) Remove the nut and lockwasher that secure the ground cable to the screw inside the body.
- (3) Remove the cable connector from the clip, separate the cable

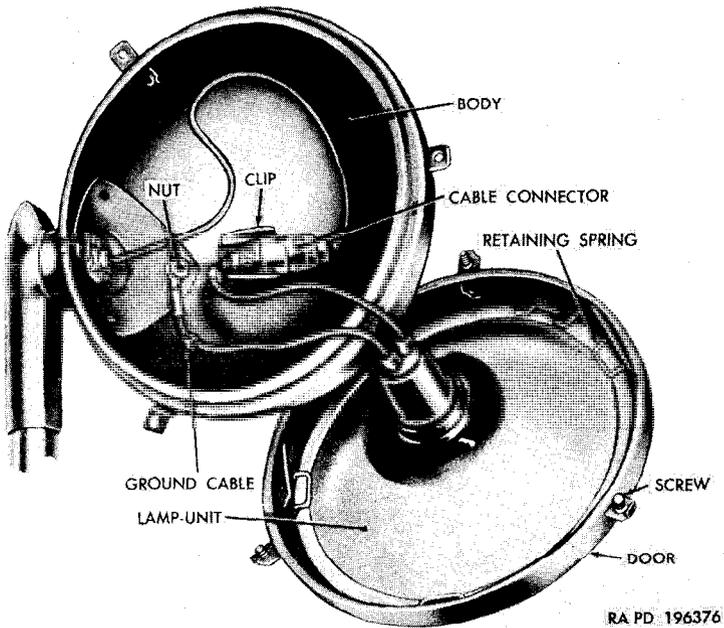


Figure 143. Spotlight lamp-unit (ambulance truck M43 and telephone maintenance truck V41).

connector shells, and remove the lamp-unit cable from the terminal sleeve.

- (4) Remove the three lamp-unit retaining springs and remove the lamp-unit from the door.
- (5) Position the new lamp-unit in the door and install the three retaining springs, spacing them evenly.
- (6) Connect the cable with the straight terminal to the cable in the spotlight body, engage the connector shells, and install the connector in the clip.
- (7) Secure the ground cable to the screw in the lamp body with a No. 8 internal-teeth lockwasher and No. 8-32NC nut.
- (8) Position the lamp-unit and door and tighten the three screws.

e. Replace Surgical Light Lamp-Unit (Ambulance Truck M43)
(C, fig. 22).

- (1) Loosen the knurled screw and lower the lamp.
- (2) Loosen the two screws which secure the lamp-unit door to the retainer ring, and pull the lamp-unit and door from the ring.
- (3) Remove the screw which secures each lamp-unit cable to the lamp-unit, and remove the lamp-unit and door.
- (4) Loosen the two screws that secure the lamp-unit to the door, and remove the lamp-unit.
- (5) Position the new lamp-unit in the door and tighten the two screws.
- (6) Connect the lamp-unit cable terminals to the lamp-unit using the two terminal screws.
- (7) Position the lamp-unit and door in the retainer ring, and tighten the two retainer ring screws.
- (8) Install the lamp in the shell, and tighten the knurled screw.

f. Replace Dome Light Lamp and/or Lens (Ambulance Truck M43)
(E, fig. 22).

- (1) Remove the two screws that secure the dome light door and remove the door lens. Remove the lamp.
- (2) Install a new lamp of the same type as the one removed. Install the lens in the door, and install the door and two No. 5 x $\frac{9}{16}$ oval-head tapping screws.

g. Replace Instrument Panel Light Lamps and/or Headlight High Beam Indicator Lamp. All lamps are replaced in the same manner.

- (1) Disconnect the speedometer shaft from the speedometer (fig. 144).
- (2) Disengage the four instrument cluster studs and lower the instrument cluster sufficiently to provide access to the headlight beam indicator and panel light socket covers.
- (3) Press the socket cover and turn it counterclockwise to disengage it from the light body. Remove the lens and the lamp.

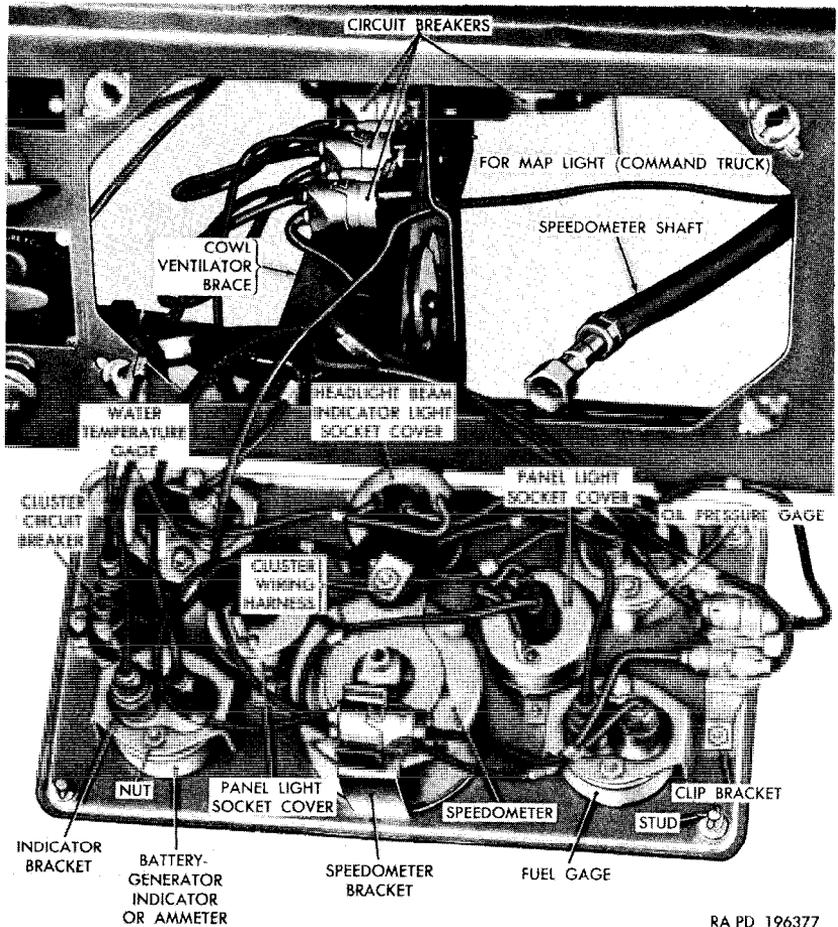


Figure 144. Instrument cluster and circuit breakers.

- (4) Install a new lamp of the same type as the one removed, and install the lens. Insert the socket cover in the body, press and turn clockwise to engage the socket with the body.
- (5) Install the instrument cluster in the instrument panel and engage the four studs.
- (6) Connect the speedometer shaft to the speedometer.

172. Driving Lights and Brackets

a. General. Both service headlights are serviced in the same manner. The left and right headlights and mounting brackets are interchangeable. The two blackout marker lights and mounting brackets are serviced in the same manner and are interchangeable. The two tail and stop lights are serviced in the same manner, but are not interchangeable.

b. Remove Service Headlight and Mounting Bracket (fig. 139).

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Disengage the headlight cable from the cable clips on the splash shield and radiator side support.
- (3) Remove the screw and lockwasher that secure the ground cable 91 to the fender front splash shield (figs. 204 and 205).
- (4) Remove the connectors for cables 17 and 18 from the clips on the fender front splash shield, separate the connector shells and remove the headlight cables from the connector sleeves.
- (5) Remove the three nuts and lockwashers that secure the headlight cable cover to the under side of the fender and remove the cover.
- (6) Remove the two remaining nuts and lockwashers from the headlight bracket bolts, and pull the headlight and mounting bracket away from the fender to provide access to the cable grommet. Remove the grommet.
- (7) Remove the headlight with attached cables and the mounting bracket, withdrawing one cable at a time through the openings in the splash shield and the fender.
- (8) Remove the adjusting bolt, lockwasher, and special washer that secure the headlight to the mounting bracket, and remove the headlight.
- (9) Remove the four mounting bracket bolts and flat washers and the four rubber grommets from the mounting bracket.

c. Inspection. Inspect the four bracket mounting bolts and the headlight adjusting bolt for cracks and damaged threads. Inspect the four mounting bracket grommets and the cable grommet for damage or deterioration. Inspect the mounting bracket for damage or distortion. Replace all parts that are unfit for further service.

d. Install Service Headlight and Mounting Bracket (fig. 139).

- (1) Install the four rubber grommets in the mounting bracket, engage the groove in each grommet with the bracket. Install a $\frac{7}{16}$ -inch plain washer on each bracket bolt and install the bolts through the grommets.
- (2) Install the $\frac{7}{16}$ -inch lockwasher and special washer on the $\frac{7}{16}$ -20NF x $1\frac{1}{4}$ bolt, with the radius side of the special washer up. Position the headlight on the bracket and install the bolt with washers. Tighten just enough to hold the parts.
- (3) Thread the three headlight cables through the openings in the fender and in the splash shield. Install the split rubber grommet on the cables and engage it in the fender opening.
- (4) Position the mounting bracket on the fender with the bracket bolts in the bolt holes, position the cable cover, and install

the five $\frac{3}{8}$ -inch internal-external-teeth lockwashers and $\frac{3}{8}$ -24NF nuts to secure the bracket and cable cover.

- (5) Connect the headlight cables 17 and 18 to their respective cables. Connect the connector shells and engage the connectors in the clips on the splash shield.
- (6) Attach the ground cable 91 to the splash shield with the $\frac{1}{4}$ -inch internal-external-teeth lockwasher and $\frac{1}{4}$ -28NF x $\frac{5}{8}$ tapping screw.

Note. When installing the left headlight, be sure that the blackout driving light ground cable is secured with the same screw.

- (7) Engage the cable in the cable clips on the splash shield and radiator guard support.
- (8) Connect the ground to the negative (-) post of the outer battery (fig. 135).
- (9) Adjust the headlight aiming (par. 170).

e. Remove Blackout Driving Light and Bracket (fig. 139).

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the headlight cable cover (b(5) above).
- (3) Disengage the blackout driving light cables from the cable clips on the left splash shield and radiator guard left side support.
- (4) Remove the screw and lockwasher that secure the ground cable terminal to the splash shield. (This screw also secures the headlight ground cable.)
- (5) Remove the connector for cable 19 from the clip on the splash shield, separate the connector shells, and pull the cable terminal from the sleeve. Remove the grommet, bushing, and connector shell from the cable.
- (6) Remove the split rubber grommet from the opening in the left front fender, and remove the blackout light cables from the openings in the splash shield and fender.
- (7) Remove the nut, lockwasher, and bearing washer from the blackout light stud, and remove the light from the bracket.
- (8) If the mounting bracket or bracket pad requires replacement, remove the two screws and lockwashers securing the bracket to the radiator guard side support and remove the bracket and pad.

f. Install Blackout Driving Light and Bracket.

- (1) Position the bracket pad and bracket (fig. 139) on the radiator guard side support, and install the two special screws and $\frac{3}{8}$ -inch internal-teeth lockwashers. Tighten the screws.
- (2) Install the blackout light on the bracket and install the bearing washer, $\frac{3}{8}$ -inch lockwasher, and $\frac{3}{8}$ -16NC nut on the stud.

- (3) Thread the cables through the openings in the fender and in the splash shield. Install the split rubber grommet on the blackout light cables and blackout marker light cables, and engage the grommet in the opening in the fender.
 - (4) Position the headlight cable cover on the under side of the fender, and install the three $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -24NF nuts. Tighten the nuts.
 - (5) Install the connector shell, bushing, and grommet on the cable 19, position the grommet next to the cable terminal and the bushing next to the grommet. Connect the cable terminal to the connector sleeve, connect the two connector shells, and engage the connector in the clip on the splash shield.
 - (6) Attach the blackout light ground cable and left headlight ground cable to the splash shield with the $\frac{1}{4}$ -inch internal-external-teeth lockwasher and $\frac{1}{4}$ -28NF x $\frac{5}{8}$ tapping screw. Engage the cables in the cable clips on the splash shield and radiator guard side support.
 - (7) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).
- g. Remove Blackout Marker Light and Bracket (fig. 139).*
- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
 - (2) Remove the headlight cable cover (b(5) above).
 - (3) Disengage the cables from the cable clips on the splash shield and radiator guard side support. Remove the connectors for cables 20, 491, 480 from the clips on the splash shield, separate the connector shells, and remove the cable terminals from the connector sleeves.
 - (4) Remove the grommet from the marker light cables and blackout driving light cable (left light only).
 - (5) Remove the nut, lockwasher, and two bolts that attach the marker light bracket to the fender (one nut and lockwasher were removed when the cover was removed). Remove the three cables, one at a time, through the openings in the splash shield and the fender.
 - (6) Remove the two screws and lockwashers that secure the marker light to the bracket, and remove the bracket.
- h. Install Blackout Marker Light and Bracket.*
- (1) Position the marker light on the bracket and install the two $\frac{3}{8}$ -inch, external-teeth lockwashers and $\frac{3}{8}$ -16NC x $\frac{3}{4}$ cap screws. Tighten the screws.
 - (2) Thread the three cables, one at a time, through the openings in the fender and the splash shield. Fit the split rubber grommet on the cables and in the fender opening.
 - (3) Position the marker light bracket on the fender and install

the two $\frac{3}{8}$ -inch, internal-external-teeth lockwashers and $\frac{3}{8}$ -24NF x $\frac{7}{8}$ machine bolts. Position the headlight cable cover, and install the four $\frac{3}{8}$ -inch, external-teeth lockwashers and $\frac{3}{8}$ -24NF nuts to secure the bracket and cover. Tighten the nuts.

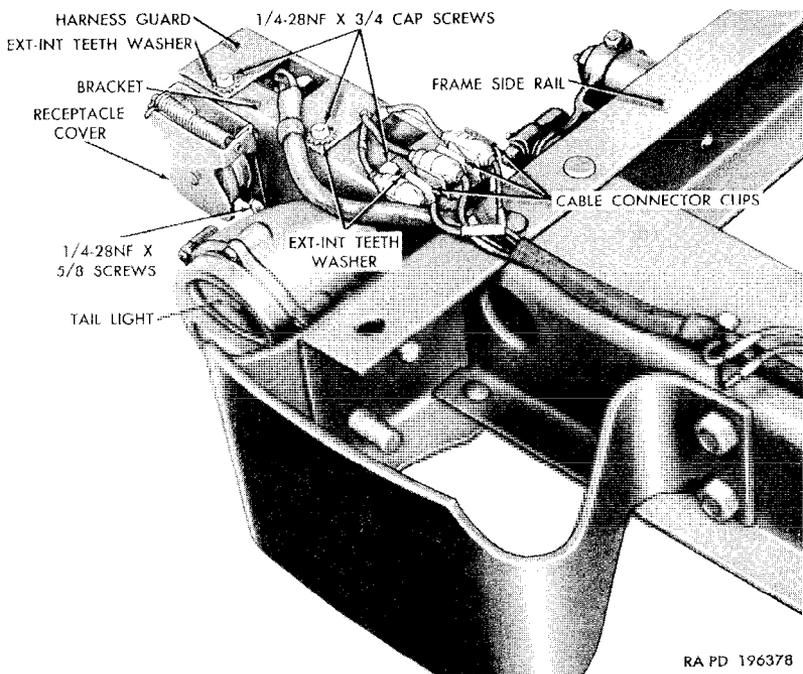
- (4) Connect the three cable terminals to their respective cable connector sleeves, connect the connector shells, and engage the connectors in the clips on the splash shield. Engage the cables in the cable clips on the splash shield and radiator guard side support.
 - (5) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).
- i. *Remove Left Taillight and Bracket* (fig. 145).

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Remove the screws and lockwashers that secure the harness guard to the taillight bracket and remove the guard.

Note. There are two screws for the guard on vehicles without a trailer coupling receptacle, three screws for vehicles with a receptacle.

- (3) Remove the three cable connectors from the cable connector clips, separate the connector shells, and disconnect the cables. The clips may be on the bracket or inside the guard.
 - (4) Remove the two screws and lockwashers that secure the taillight to the bracket, and remove the taillight with attached cables.
 - (5) If the vehicle is equipped with a trailer coupling, unscrew the grommet nut from the coupling receptacle, remove the four nuts and lockwasher bolts that secure the receptacle and receptacle cover to the frame, and pull the cover toward the rear to remove the cables from the opening in the bracket.
 - (6) Remove the two nuts, lockwashers, and bolts that secure the bracket and rear bumper to the frame side rail and remove the bracket.
- j. *Install Left Taillight and Bracket* (fig. 145).

- (1) Position the bracket on the frame side rail and install the two $\frac{5}{8}$ -18NF x 2 bolts, $\frac{5}{8}$ -inch lockwashers, and $\frac{5}{8}$ -18NF nuts. Tighten the nuts.
- (2) If the vehicle is equipped with a trailer coupling receptacle, position the receptacle and cover on the bracket and install the four $\frac{1}{4}$ -28NF x $\frac{5}{8}$ lockwasher bolts and four $\frac{1}{4}$ -28NF nuts. Tighten the bolts. Screw the grommet nut to the receptacle.
- (3) Thread the taillight cables through the opening in the bracket, position the taillight on the bracket, and install the two $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -16NC x $\frac{3}{4}$ cap screws. Tighten the screws.



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Figure 145. Left taillight and trailer coupling receptacle.

- (4) Connect the three cable terminals to their respective cables, connect the shells, and engage the connectors in the clips.
- (5) Position the harness guard on the bracket, aligning the screw holes. Place the taillight ground cable terminal over the inner screw hole and the trailer coupling cable clip over the center screw hole (on vehicles so equipped). Install the $\frac{1}{4}$ -inch, internal-external-teeth lockwasher and $\frac{1}{4}$ -28NF x $\frac{3}{8}$ cap screws (three for vehicles equipped with a trailer coupling, two for vehicles not so equipped).
- (6) Connect the ground cable to the negative (-) post of the outer battery (fig. 135).

b. Replace Right Taillight and Bracket. Procedure for replacement of the right taillight and bracket is essentially the same as that described in *i* and *j* above. The only differences are that there are two cables for the right taillight instead of three, neither of the cables is grounded, and there is no trailer coupling.

173. Light Switch and Dimmer Switch

a. Remove Light Switch.

- (1) Remove the four screws and lockwashers that attach the steering column access cover to the instrument panel and remove the cover.

- (2) Unscrew the nut that retains the waterproof grommet to the light switch receptacle (fig. 146) and remove the wiring harness cable plug from the receptacle. If the light switch is provided with the trailer coupling receptacle, disconnect the trailer coupling wiring harness in the same manner.
- (3) Remove the four screws and lockwashers that secure the light switch to the instrument panel. Remove the light switch by pushing it through the panel and removing it from beneath the panel.

b. Install Light Switch.

- (1) Install the light switch (fig. 146) from the under side of the instrument panel. Secure with four No. 10 lockwashers and No. 10-32NF x 1/2 roundhead screws.
- (2) Install the wiring harness cable plug in the light switch receptacle, and screw the grommet retaining nut to the receptacle. If the switch is provided with a trailer coupling receptacle, connect the trailer coupling wiring harness in the same manner.
- (3) Install the steering column access cover on the instrument panel with the four lockwashers and screws, being careful to position the cover in such a manner that it does not cause binding at the steering column.

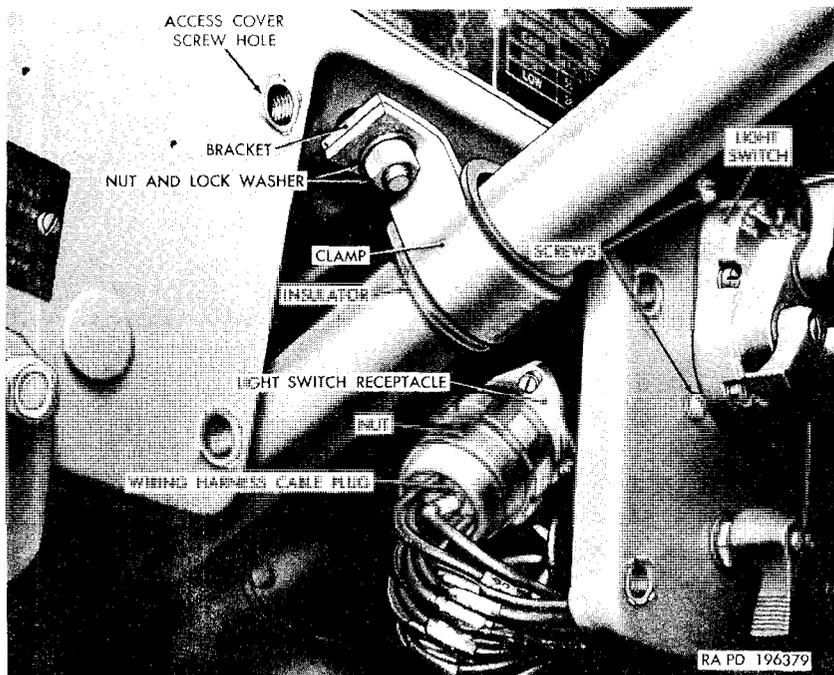


Figure 146. Steering column access cover removed.

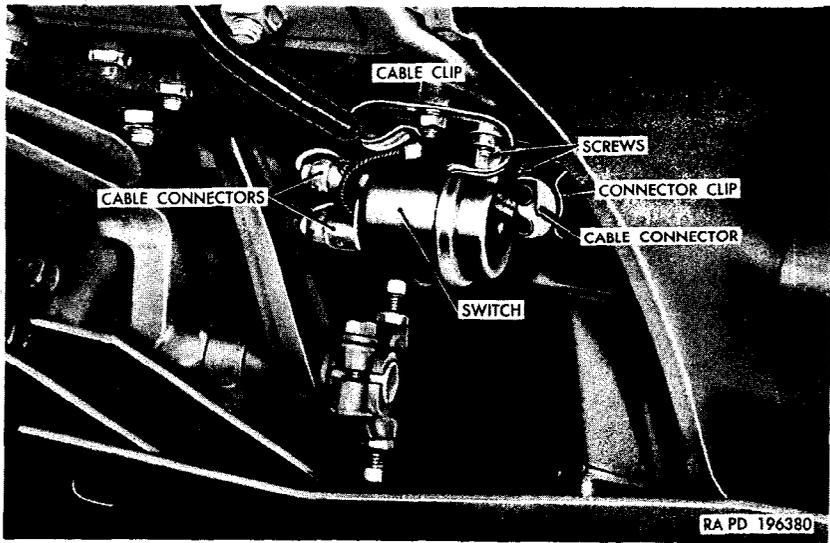


Figure 147. Dimmer switch.

c. Remove Dimmer Switch.

- (1) Remove the rear splash shield from the left front fender (par. 250*h*).
- (2) If the vehicle is equipped with a slave receptacle, disengage the receptacle cable from the cable clip near the dimmer switch.
- (3) Remove the large cable connector from the connector clip (fig. 147), separate the connector shells on the three cables, and disconnect the cable terminals.
- (4) From inside the driver's compartment, remove the two screws and lockwashers that secure the switch and remove the switch from the toeboard.

d. Install Dimmer Switch.

- (1) Position the dimmer switch (fig. 147) on the under side of the toeboard and install the two $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -16NC x $\frac{3}{4}$ cross-recess pan-head screws. Tighten the screws.
- (2) Connect the three cable terminals to their respective cables and connect the shells. Engage the large cable connector in the connector clip (fig. 147).
- (3) Engage the slave receptacle cable in the cable clip (on vehicles so equipped).
- (4) Install the left front fender rear splash shield (par. 250*i*).

174. Circuit Breakers

a. General.

- (1) Circuit breakers are of the automatic reset-type, employing

a bimetal spring which expands when the circuit is overloaded, causing a break in the circuit. As the spring cools, it contracts and again closes the circuit, causing alternate "off" and "on" conditions, informing the operator that an abnormal circuit condition exists.

- (2) With the exception of the instrument cluster circuit breaker on some vehicles, all units are mounted on the cowl ventilator brace (fig. 144). All units are accessible with the instrument cluster removed.

b. Removal. Procedure for removal of all circuit breakers is the same.

- (1) Turn the four studs that secure the instrument cluster to the instrument panel and carefully pull the cluster out. Disconnect the speedometer flexible shaft from the speedometer (fig. 144).
- (2) Detach the cables from the circuit breaker to be removed.
- (3) Remove the two screws that secure the circuit breaker to the cowl ventilator brace (fig. 144) and remove the circuit breaker. For the circuit breaker on the instrument cluster, remove the two nuts, lockwashers, and bolts that secure the circuit breaker to the instrument cluster panel and remove the circuit breaker.

c. Installation.

- (1) Position the circuit breaker on the cowl ventilator brace (fig. 144) and install the two No. 8 x $\frac{3}{4}$ sheet metal screws. For the circuit breaker on the instrument cluster (fig. 144), position the circuit breaker on the instrument cluster panel and install the two No. 8-32NC x $\frac{5}{8}$ machine bolts, No. 8 lockwashers, and No. 8-32NC nuts.
- (2) Connect the cables to the circuit breaker, following the wiring diagram (fig. 134).
- (3) Connect the speedometer flexible shaft to the speedometer, position the instrument cluster in the instrument panel, and engage the four studs by turning them clockwise.

175. Auxiliary Outlet Receptacle (on Vehicles so Equipped)

a. Removal.

- (1) Disconnect the receptacle cable at the cable connector under the instrument panel and disengage the cable from the cable clips.
- (2) Remove the four screws which attach the auxiliary outlet receptacle to the instrument panel. Remove the receptacle with cable.

b. Installation.

- (1) Thread the receptacle cable through the opening in the instrument panel and position the receptacle on the panel. Install the four No. 8 x $\frac{3}{4}$ sheet metal screws, attaching the receptacle cover chain with the lower left screw.
- (2) Connect the cable terminal at the cable connector and engage the cable in the cable clips.

176. Radio Receptacle (on Vehicles so Equipped)

a. Removal.

- (1) Disconnect the ground cable from the negative (-) post of the outer battery, and remove the radio receptacle cable from the terminal.
- (2) Disconnect the other receptacle cable terminal from the positive (+) terminal of the inner battery.
- (3) Disengage the cable from the cable clip in the driver's compartment.
- (4) Remove the four small screws that secure the radio receptacle to the wall mounting receptacle (fig. 148) and pull the receptacle and cable from the mounting receptacle. Remove the four screws that secure the mounting receptacle to the body front panel, and remove the receptacle.

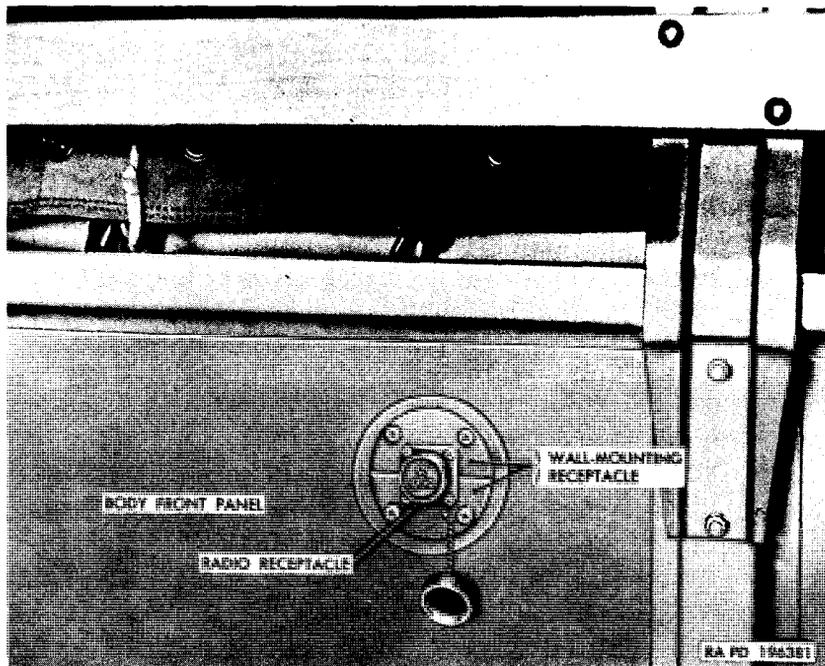


Figure 148. Radio receptacle in body front panel.

b. Installation.

- (1) Thread the receptacle cables through the receptacle opening in the body panel and through the weatherseal in the cab rear panel.
- (2) Fit the two sections of the wall mounting receptacle on the body panel and install the four $\frac{1}{4}$ -28NF x $\frac{3}{4}$ roundhead lockwasher screws. Position the radio receptacle (fig. 148) and install the four No. 8-32NC x $\frac{3}{8}$ lockwasher screws, attaching the cover chain with one of the screws.
- (3) Connect the radio receptacle positive (+) cable terminal to the positive (+) terminal of the inner battery, and the negative (-) terminal to the negative (-) terminal of the outer battery.
- (4) Connect the ground cable to the negative (-) post of the outer battery.

Section XIII. INSTRUMENTS, GAGES, AND HORN

177. Description and Data

a. Description.

- (1) The instrument cluster (figs. 8 and 144) contains the speedometer, battery-generator indicator or ammeter, water temperature gage, fuel gage, and oil pressure gage. These gages are electrically operated by means of sending units. Circuits to the gages are controlled through the ignition switch and are closed only when the ignition switch is in the ON position.
- (2) Gages supplied on vehicles of early manufacture are 6-volt gages, each one requiring a resistor when used in the 24-volt system. The 6-volt gage may be identified by the resistor case and elbow on the back side of the gage. The 24-volt gages are supplied with vehicles of later manufacture and may be installed to replace the 6-volt gage-with-resistor units.
- (3) The horn is a vibrator-type, mounted on the under side of the hood.
- (4) Organizational maintenance includes replacement of the gages, speedometer, cluster wiring harness, and the horn and related parts.

b. Data.

Ammeter :

Make..... AC
Model..... 1501244
Voltage..... 24

Battery-generator indicator :

Make..... Auto-Lite
Model..... EO-11218
Voltage..... 24

Fuel gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24
Horn :	
Make.....	Auto-Lite, Delco, or Spark-Withington
Model.....	HX-4003U, 19999881, or D2140A
Type.....	vibrator
Voltage.....	24
Oil pressure gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24
Speedometer:	
Drive.....	pinion in transfer
Make.....	Auto-Lite or AC
Water temperature gage:	
Make.....	AC
Voltage:	
With 95-ohm resistor.....	6
Without resistor.....	24

178. Instrument Cluster

(fig. 144)

a. *Remove Battery-Generator Indicator or Ammeter.* Procedure is the same for both instruments.

- (1) Turn the four studs that secure the instrument cluster to the instrument panel and pull the cluster out carefully. Disconnect the speedometer flexible shaft from the speedometer.

Note. Make certain that the ignition switch is in the OFF position before working on the instrument cluster parts.

- (2) Disconnect the cable or cables from the battery-generator indicator, or ammeter, respectively.
- (3) Remove the two nuts and lockwashers that secure the indicator bracket to the studs in the indicator, and remove the bracket. Remove the indicator from the driver's compartment side.

b. *Install Battery-Generator Indicator or Ammeter.*

- (1) Insert the battery-generator indicator or ammeter from the driver's compartment side of the cluster panel and position it in the panel.
- (2) Install the indicator bracket over the indicator and install the two No. 10-32NF nuts and lockwashers. Tighten the nuts.
- (3) Connect cable 27 (fig. 134) to the terminal of the battery-generator indicator. For the ammeter, connect cable 9 to the

left terminal and cable 8 to the right terminal (fig. 91).

- (4) Connect the speedometer shaft to the speedometer (fig. 144), position the instrument cluster in the instrument panel, and engage the four studs by turning them clockwise.

c. Replace Fuel Gage, Oil Pressure Gage, and/or Water Temperature Gage. Procedure for replacement of the fuel gage, oil pressure gage, and water temperature gage (fig. 144) is the same as that for the ammeter (*a* and *b* above). When a 6-volt gage is installed in the 24-volt system, be sure to install the resistor with the gage (par. 177a(2)). If a 24-volt water temperature gage is used to replace the 6-volt gage and resistor, replace the gage sending unit also, which is available as part of the kit.

d. Remove Speedometer (fig. 144).

- (1) Remove the instrument cluster and disconnect the speedometer shaft from the speedometer (*a*(1) above).
- (2) Remove the nut, lockwasher, and plain washer that secure the cluster wiring harness, to the speedometer bracket stud and remove the harness from the stud. It is not necessary to disconnect the cables.
- (3) Remove the cable connector from the clip on the speedometer bracket and remove the nut and lockwasher that secure the clip to the stud on the speedometer.
- (4) Remove the speedometer from the driver's compartment side of the panel. Remove the bracket. Be careful not to damage the cables as the bracket is removed.

e. Install Speedometer.

- (1) Insert the speedometer (fig. 144) from the driver's compartment side of the instrument cluster panel and position it in the panel.
- (2) Install the speedometer bracket over the speedometer with the stud holes over the two studs on the speedometer. Hold the parts in position and install the cluster wiring harness on the lower stud. Install the special plain washer, No. 10 lockwasher, and No. 10-32NF nut. Tighten the nut.
- (3) Position the connector clip on the upper stud and install the No. 10 lockwasher and No. 10-32NF nut. Tighten the nut. Engage the cable connector in the clip.
- (4) Connect the speedometer flexible shaft to the speedometer and install the instrument cluster (*b*(4) above).

f. Replace Cluster Wiring Harness.

- (1) Remove the instrument cluster (*a*(1) above).
- (2) Disconnect the wiring harness cables from the fuel gage, oil pressure gage, and water temperature gage, the instrument cluster circuit breaker or ignition switch, and the battery-generator indicator (on vehicles so equipped).

- (3) Remove the nut, lockwasher, and plain washer that secure the wiring harness to the speedometer stud and remove the wiring harness.
- (4) Install a new wiring harness on the speedometer lower stud (fig. 144), arranging the cables in proper position. Install the plain washer, No. 10 lockwasher, and No. 10-32NF nut. Tighten the nut.
- (5) Connect the wiring harness cables to the fuel gage, the oil pressure gage, the water temperature gage, the instrument cluster circuit breaker or ignition switch cable, and the battery-generator indicator (on vehicles so equipped) (fig. 134).
- (6) Install the instrument cluster (b(4) above).

179. Horn and Horn Button Cable

a. Replace Horn (fig. 149).

- (1) Disconnect the ground cable from the negative (-) post of the outer battery (fig. 135).
- (2) Disconnect the two horn cable connectors and pull the cables (Nos. 25 and 25A) and connectors from the horn.
- (3) Remove the two bolts and lockwashers that secure the horn to the bracket on the hood and remove the horn.
- (4) Position a new horn on the bracket, and install the two ¼-

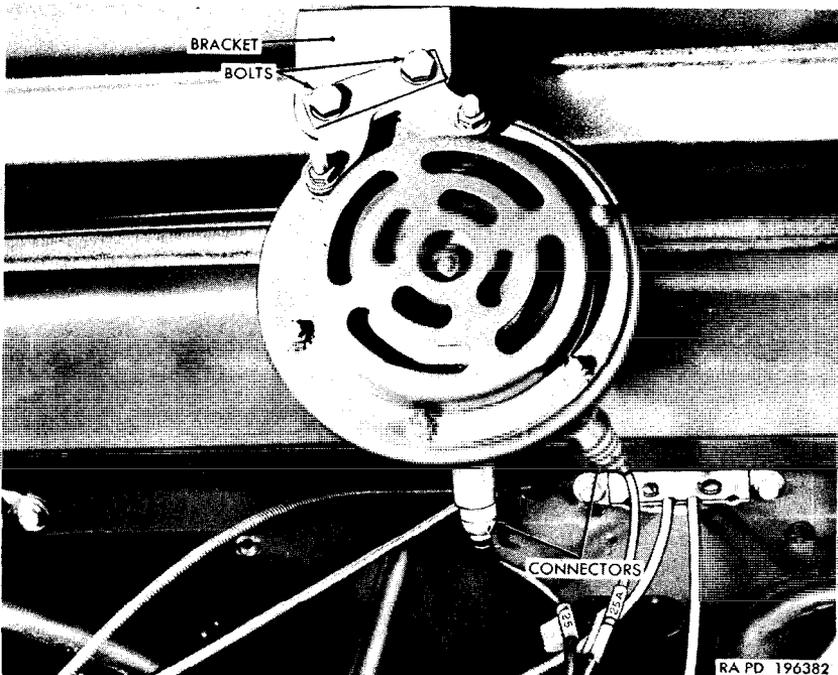


Figure 149. Horn and horn cables.

inch lockwashers and two 1/4-28NF x 1 bolts. Tighten the bolts.

(5) Attach the horn cable connectors to the horn.

b. Remove Horn Button, Horn Button Cable, and Related Parts.

Note. The key letters noted in parentheses are in figure 151.

- (1) Remove the horn button cable connector from the clip on the left front fender splash shield and disconnect the horn button cable 25A. Pull the cable and cable hose through the opening in the frame left side rail.
- (2) Remove the grommet, bushing, and cable connector shell from the lower end of the cable (A).
- (3) Unscrew the fitting nut from the lower seal plate on the steering gear housing and remove the hose (E), tube (G), and nut (F) from the cable (A). Separate the hose, tube, and nut. Remove the seal washer (H) and seal (J) from the seal plate and from the cable.
- (4) Remove the horn button seal (V). Press the horn button (U) down firmly and turn it clockwise to disengage the upper retaining plates (S) from the lower retaining plate (L). Remove the button, button spring, upper retaining plate, and snap ring as a unit. Remove the plate spring (Q).
- (5) Remove the snap ring (R) from the horn button (U), and

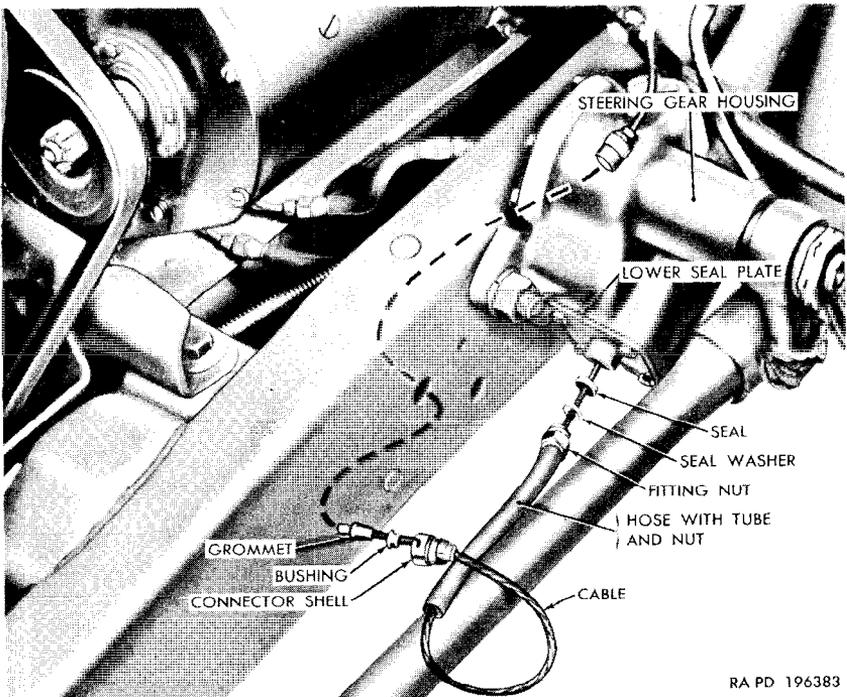


Figure 150. Horn button cable disconnect points.

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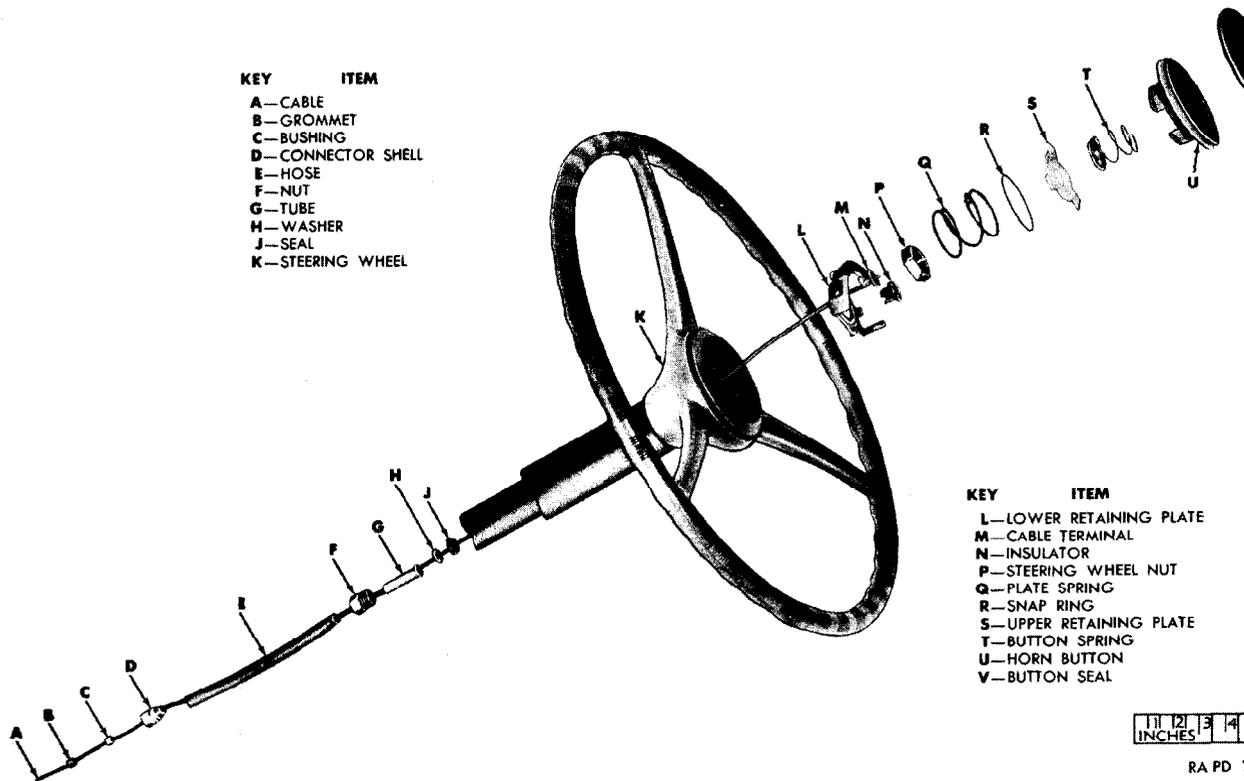


Figure 151. Horn button, cable, and related parts—exploded view.

remove the upper retaining plate (S) and the button spring (T).

- (6) Remove the insulator (N) from the upper end of the cable and pull the cable with cable terminal from the steering gear shaft.
- (7) If the lower retaining plate (L) requires replacement, remove the steering wheel nut (P) and remove the plate.

c. Inspect Horn Button, Horn Button Cable, and Related Parts.

- (1) Inspect the button seal (V), seal (J), hose (E), and grommet (B) for damage or deterioration.
- (2) Inspect the cable (A) for loose or damaged terminals, damaged insulation, or broken cable. Inspect the insulator (N) for cracks.
- (3) Inspect the horn button (U), retainer plates (L and S), and springs (Q and T) for cracks and distortion.
- (4) Inspect tube (G), nut (F), connector shell (D), and grommet bushing (C) for cracks or other visual damage.
- (5) Inspect the steering wheel nut (P) for cracks or damaged threads.
- (6) Replace all parts that are unfit for service.

d. Install Horn Button, Horn Button Cable, and Related Parts.

- (1) Install the lower retaining plate (L) over the steering gear shaft and install the steering wheel nut (P). Tighten the nut.
- (2) Insert the lower end of the horn button cable (A) in the upper end of the steering gear shaft, and push the cable down through the shaft until the lower end extends through the shaft. Install the insulator (N) on the cable just below the cable terminal.
- (3) Install the button spring (T) and the upper retaining plate (S) in the horn button (U), and install the snap ring (R).
- (4) Install the plate spring (Q) in the steering wheel and install the horn button (U), pressing the button down firmly and turning it clockwise to engage the two retaining plates (L and S). Install the button seal (V).
- (5) Install the cable seal and seal washer over the lower end of the cable and into the lower seal plate (fig. 150). Assemble the hose, tube, and $\frac{3}{8}$ -inch inverted flared tube fitting nut (fig. 150), and install the parts on the cable. Screw the nut to the lower seal plate on the steering gear housing.
- (6) Install the connector shell, bushing, and grommet on the lower end of the cable (fig. 150). Position the grommet next to the cable terminal with the bushing holding the grommet in place.

- (7) Insert the cable through the opening in the frame left-side rail, connect the cable to cable 25A, and engage the connector in the clip on the splash shield.

Section XIV. WINCH AND WINCH DRIVE SHAFT

180. Description and Data

a. Description.

- (1) The winch (fig. 152), on vehicles so equipped, is mounted at the front of the vehicle and is supported by brackets attached to the frame side rails and the front bumpers. The drive shaft has a universal joint at each end, with a shearpin in the front universal joint which prevents damage to the driving mechanism in the event the winch is overloaded. A safety brake is provided to hold a load in any desired position or in the event the shearpin breaks.
- (2) Organizational maintenance includes adjustment of the safety brake, replacement of the cable, the drive shaft universal joints and shearpin, and the winch.

b. Data.

Drive shaft:

Make..... Blood Brothers
 Model..... 4080
 Universal joints..... cross and trunnion

Winch:

Cable size..... $\frac{7}{16}$ inch x 150 feet
 Capacity..... 7,500 pounds
 Make..... Braden
 Model..... LU-4
 Weight..... 250 pounds

181. Safety Brake Adjustment

a. Disconnect Drive Shaft.

- (1) If the drive shaft is equipped with a collar, remove the locking wire from the collar setscrew at rear universal joint, loosen the setscrew, and slide the collar forward.
- (2) Remove the locking wire (fig. 153) from the drive shaft shearpin (fig. 153) and remove the shearpin.
- (3) Slide the front universal joint yoke (fig. 153) toward the rear far enough to clear the wormshaft.

b. Adjust Safety Brake.

- (1) Remove the outer jamnut (fig. 153) from the brake band end.
- (2) Insert a long punch through the shearpin hole in the wormshaft. Oscillate the shaft with the punch and at the same time tighten the inner jamnut on the brake band end until a

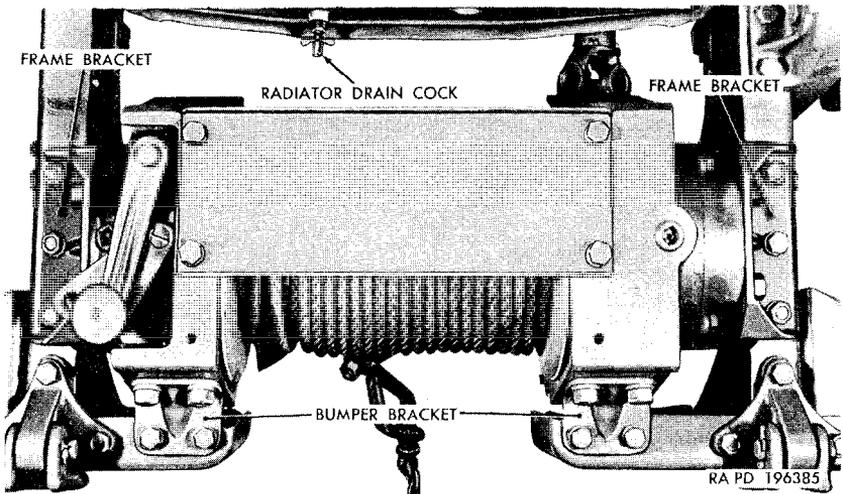


Figure 152. Winch—top view.

noticeable drag is felt when the wormshaft is rotated in one direction.

- (3) Hold the inner jamnut and install the $\frac{1}{4}$ -20NF outer jamnut. Tighten the outer nut to hold the adjustment.

c. Connect Drive Shaft.

- (1) Remove the punch from the shearpin hole in the wormshaft and position the universal joint front yoke on the wormshaft, aligning the shearpin holes. Install the shearpin and secure with locking wire (fig. 153).
- (2) If the drive shaft is equipped with a collar, position the collar to provide $\frac{5}{8}$ -inch clearance between the collar and the

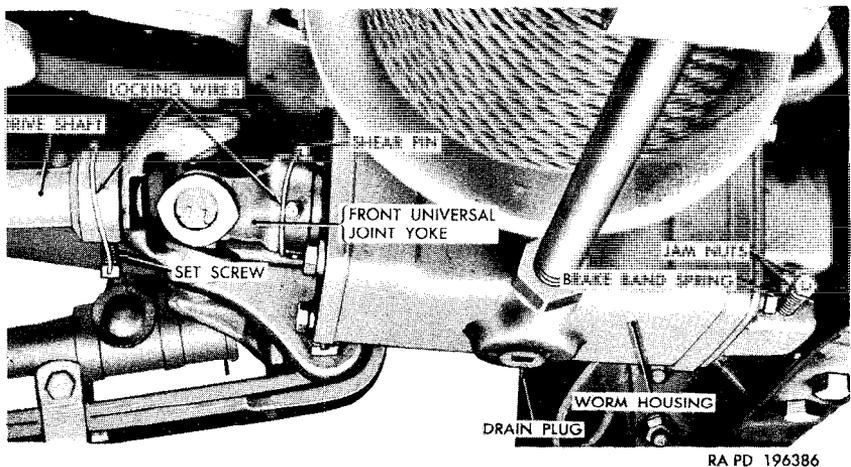


Figure 153. Winch—bottom view.

front end of the drive shaft rear universal joint yoke, tighten the collar setscrew, and secure with locking wire.

182. Drive Shaft Shearpin

a. General. Since breakage of the shearpin usually occurs as a result of overloading the winch, it is important that the winch load be lessened before attempting to move or support it after replacing the shearpin.

Caution: Support the load or make certain that the safety brake is properly adjusted (par. 181*b*) to hold the winch load while replacing the shearpin.

b. Replacement.

- (1) If the pieces of the broken shearpin cannot be removed cleanly from the universal joint yoke and the wormshaft, disconnect the yoke (par. 181*a*) and remove the pieces.
- (2) Position the universal joint yoke on the winch wormshaft and connect the drive shaft (par. 181*c*).

183. Drive Shaft and Universal Joints

a. Removal.

- (1) If the drive shaft (fig. 154) is equipped with a collar, remove the locking wire from the collar setscrew, loosen the setscrew, and slide the collar forward.
- (2) Remove the locking wire from the shearpin (fig. 153) and remove the shearpin. Push the shaft and assembled parts to the rear, and remove the front universal joint yoke (fig. 153) from the wormshaft.
- (3) Remove the 10 bolts and lockwashers that secure the winch brackets to the frame side rails and front bumpers, and raise the left side of the winch sufficiently to permit removal of the drive shaft.
- (4) Pull the shaft forward to disengage the splined end of the shaft from the front yoke of the rear universal joint, and remove the shaft. Remove the collar (if so equipped) as the shaft is removed.
- (5) Remove the locking wire from the setscrew in the rear universal joint yoke, loosen the setscrew, and remove the universal joint from the power-take-off. Remove the woodruff key from the power-take-off shaft. Remove the front universal joint from the drive shaft in the same manner.

b. Inspection.

- (1) Clean all parts.
- (2) Inspect the drive shaft for distortion, cracks, and damaged splines.

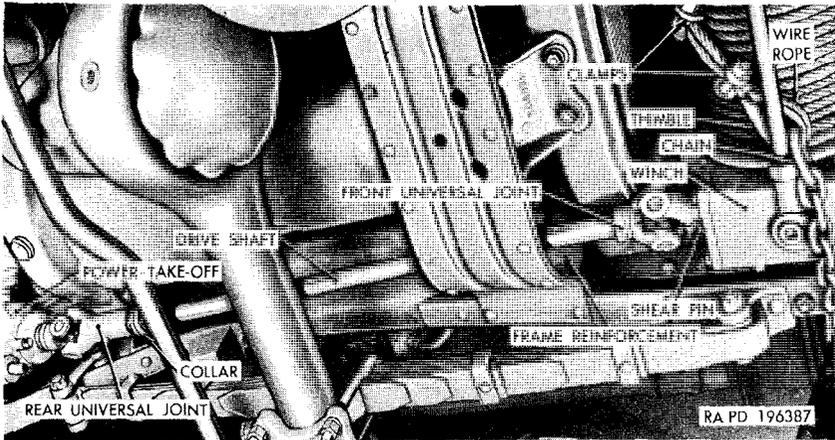


Figure 154. Winch drive shaft and universal joints.

- (3) Inspect both universal joints for wear, binding, and damaged splines (front yoke of rear joint).

Note. The front yoke should slide freely on the shaft to insure the safety feature of the shear pin.

- (4) Inspect the power-takeoff drive shaft and the switch wormshaft for corrosion damage and burs. Remove minor scratches or burs with crocus cloth.
- (5) Inspect the collar and all setscrews for cracks and damaged threads.
- (6) Replace parts that are unfit for further service.

c. Installation.

- (1) Install a No. 817 or 127 woodruff key in the keyway at the front end of the drive shaft. Install the rear yoke of the front universal joint on the shaft, aligning the keyway in the yoke with the key. Install the setscrew, tighten, and secure with locking wire (fig. 153).
- (2) Install the rear universal joint on the power-takeoff drive shaft in the manner described in *c*(1) above.
- (3) Apply a light coating of automotive and artillery grease to the splines of the drive shaft. With the winch raised as in *a*(3) above, insert the splined end of the shaft through the opening in the frame reinforcement from the front. Install the collar on the shaft (if so equipped), and insert the shaft in the front yoke of the rear universal joint, aligning the journals of both universal joints. Push the shaft and assembled parts toward the rear.
- (4) Lower the winch into position and align the front universal joint front yoke with the wormshaft. Install the yoke on the wormshaft, aligning the shearpin holes. Install the shearpin and secure with locking wire.

- (5) Install the six $\frac{1}{2}$ -inch lockwashers and $\frac{1}{2}$ -20NF x $1\frac{3}{8}$ bolts for the winch frame brackets and four $\frac{1}{2}$ -inch lockwashers and $\frac{1}{2}$ -20NF x 1 bolts for the bumper brackets. Tighten the bolts evenly.
- (6) If the drive shaft is equipped with a collar, position the collar to provide $\frac{5}{8}$ -inch clearance between the collar and the front end of the universal joint yoke, tighten the collar setscrew, and secure with locking wire.

184. Winch Cable

a. Removal. Place the winch clutch shifter handle in the DISENGAGED position (fig. 27) and unwind all the cable from the drum. Remove the setscrew that secures the cable to the drum and remove the cable.

b. Inspection. Inspect the wire rope for broken strands and rust or corrosion. Inspect the chain for damaged links or hook. Inspect the thimble and two clamps for wear or damage. Replace parts that are unfit for further service.

c. Installation.

- (1) Install the thimble on the chain, thread the wire rope through the chain link, and fit it on the thimble. Secure the rope with the two clamps and tighten the clamp nuts.
- (2) Clean the winch drum and apply a film of engine oil to the drum surface. Install the rope on the drum by passing it under the winch and around the drum at the rear, so the cable will wind correctly. Attach the end of the wire rope to the drum with the setscrew. Wind the rope under power (par. 55e), applying engine oil to the rope as it winds on the drum.

185. Winch

a. Removal.

- (1) Disconnect the winch drive shaft (par. 181a).
- (2) Remove the four bolts and lockwashers that secure the winch to bumper brackets (fig. 152) and to the front bumpers.
- (3) Remove the six bolts and lockwashers that secure the winch to frame brackets to the frame side rails, and remove the winch.
- (4) Remove the two bolts and lockwashers that secure each bumper bracket, and remove the brackets. Remove the four nuts and lockwashers that secure each frame bracket and remove the brackets.

b. Installation.

- (1) Install the two frame brackets on the studs in the winch. Install the four $\frac{3}{16}$ -inch lockwashers and $\frac{3}{16}$ -18NF nuts for each bracket. Tighten the nuts.

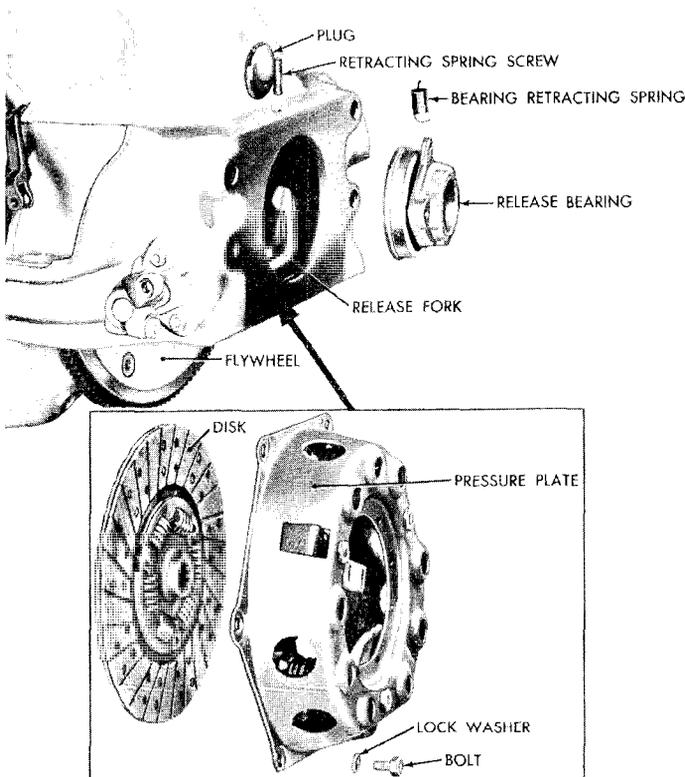
- (2) Install the two bumper brackets on the front of the winch and install two $\frac{5}{8}$ -inch lockwashers and $\frac{5}{8}$ -11NC x $1\frac{1}{2}$ bolts for each bracket. Tighten the bolts.
- (3) Position the winch on the frame side rails with the bolt holes in the frame brackets alined with those in the frame. Install three $\frac{1}{2}$ -inch lockwashers and $\frac{1}{2}$ 20NF x $1\frac{3}{8}$ bolts for each bracket. Install two $\frac{1}{2}$ -inch lockwashers and $\frac{1}{2}$ -20NF x 1 bolts for each bumper bracket. Tighten all bolts evenly.
- (4) Connect the winch drive shaft front universal joint and install the shearpin (par. 181c).
- (5) Position the collar (if so equipped) (par. 183c(6)).
- (6) Adjust the winch safety brake (par. 181b).

Section XV. CLUTCH

186. Description and Data

a. Description.

- (1) The clutch (fig. 155) consists of the disk and pressure plate, clutch release bearing, and release fork which is actuated by the clutch pedal. The disk is splined to the transmission



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Figure 155. Clutch parts—exploded view.

- shaft and the pressure plate is bolted to the engine flywheel.
- (2) Organizational maintenance of the clutch includes adjustment of the clutch pedal, replacement of the clutch pan and pan plate, and emergency replacement of the release bearing, disk, and pressure plate (par. 189).

b. Data.

Clutch pedal free travel..... 1 in
Facing :
 Dimensions..... 10 OD x 6 ID x 0.125 thick
 Material..... molded woven asbestos
 Total friction area..... 100.53 sq in
Make..... Borg and Beck
Model..... 11828
Pilot bearing :
 Size..... 0.941 OD x 0.752 ID x 7/8 long
 Type..... Oilite
Release bearing :
 Make..... Aetna
 Model..... A-893-4
 Type..... ball thrust (prelubricated)
 Size..... 10 in
Total spring pressure..... 1,504 lb

187. Clutch Pedal Adjustment

a. General. Correct clutch pedal free travel is 1 inch. Adjustment is accomplished by changing the position of the clutch pedal in relation to the clutch pedal adjusting collar. Two adjusting bolts (fig. 156) are provided for this purpose.

b. Adjustment.

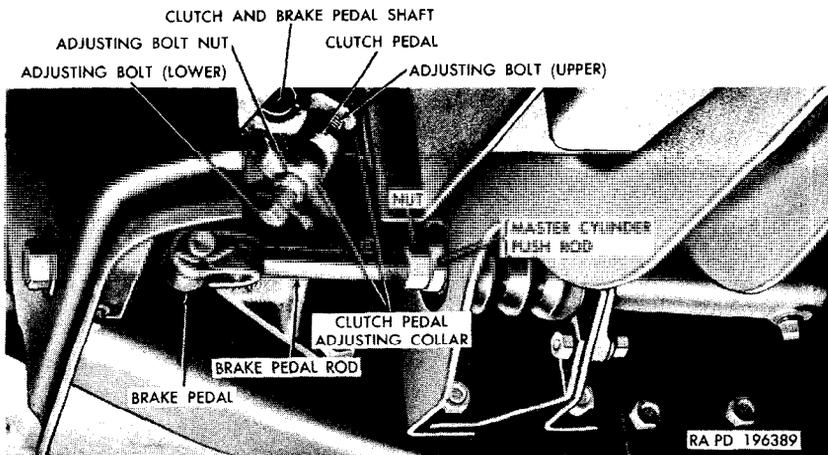


Figure 156. Clutch and brake pedals installed.

- (1) Loosen the adjusting bolt nuts on the upper and lower adjusting bolts (fig. 156).
- (2) Turn the bolts in or out of the collar to provide 1-inch free travel of the pedal. Loosen the upper bolt and tighten the lower bolt to increase free travel; loosen the lower bolt and tighten the upper bolt to decrease free travel.
- (3) Tighten the nuts on both adjusting bolts after making the adjustment.

188. Clutch Housing Pan and Pan Plate

(fig. 157)

a. General. Design changes in the clutch housing pan and pan plate provide a change in the pan drain plug and the pan plate seal (par. 6). The drain plug in the clutch pan on early vehicles is a pipe plug, while the drain plug (fig. 157) for pans on later vehicles is of a different type and is provided with a gasket. The clutch pan plate on early vehicles has two seals riveted to the plate, while the plate on later vehicles has a one-piece seal cemented to the plate. Removal and installation procedures are the same for both types of pan and plate.

b. Removal.

- (1) Remove the four bolts and lockwashers that secure the pan plate to the front side of the clutch housing and remove the plate with seal.

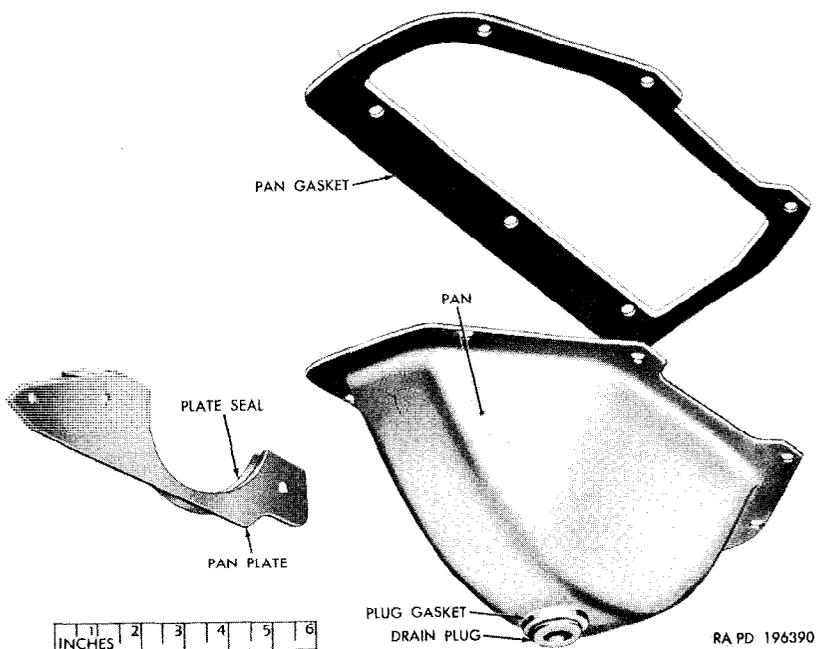


Figure 157. Clutch housing pan and pan plate (late-type).

- (2) Remove the six bolts and lockwashers that secure the pan to the clutch housing, and remove the pan and pan gasket.
- (3) Remove the drain plug from the pan. If a gasket is provided with the plug, remove the plug gasket.

c. Inspection.

- (1) Clean all parts, including the mating surfaces of the clutch housing and housing pan with dry-cleaning solvent or volatile mineral spirits.
- (2) Inspect the pan for cracks, damaged flange surfaces, distortion, or damaged threads.
- (3) Inspect the pan plate for cracks, distortion, or damaged, loose or deteriorated seals. Remove damaged seals.
- (4) Replace all parts that are unfit for further service.

d. Installation.

- (1) If the pan plate seal or seals were removed (*c*(3) above) install new seal or seals. For the late-type plate, cement the seal to the flange side of the plate with synthetic rubber cement. For the early-type plate, position the upper seal on the flange side of the plate and the lower seal on the opposite side. Install the ten $\frac{1}{8} \times \frac{1}{16}$ split rivets with the rivet heads next to the seals.
- (2) Apply a coating of liquid-type gasket cement to both sides of the pan gasket and position the gasket on the pan, aligning the bolt holes. Position the pan and gasket on the clutch housing and install the six $\frac{5}{16}$ -inch lockwashers and $\frac{5}{16}$ -18NC $\times \frac{5}{8}$ bolts. Tighten the bolts evenly. Install the pan drain plug gasket (if required) and the drain plug.
- (3) Position the pan plate at the front of the housing with the upper seal toward the front of the engine and the front portion of the pan gasket (late-type) down. Install a $\frac{3}{8}$ -inch lockwasher and $\frac{3}{8}$ -16NC $\times \frac{5}{8}$ bolt in the upper bolt hole at each side of the plate and $\frac{5}{16}$ -inch lockwasher and $\frac{5}{16}$ -18NC bolt for each lower bolt hole. Tighten the four bolts.

189. Clutch Release Bearing, Pressure Plate, and Disk

a. Co-ordination with Ordnance Maintenance Unit. Replacement of the clutch disk, pressure plate, and release bearing is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority is obtained from the responsible commander. Replacement parts, tools, and instructions may be obtained from the supporting ordnance maintenance unit.

b. Remove Clutch Release Bearing (fig. 155).

- (1) Remove the transmission (par. 194*b*).
- (2) Detach the retracting spring from the release bearing and

from the retracting spring screw, and remove the spring through the transmission shaft opening in the clutch housing.

- (3) Disengage the release bearing from the fork and remove the bearing through the transmission shaft opening.
- (4) Remove the retracting spring screw, if it must be replaced.

c. Inspection. Wipe the release bearing with a clean cloth and inspect for wear, roughness in the bearing, and damaged bearing sleeve.

Caution: Do not clean the bearing with dry-cleaning solvent or volatile mineral spirits.

Inspect the retracting spring for cracks and distortion. Inspect the retracting spring screw for damaged threads. Replace parts that are unfit for further service.

d. Install Clutch Release Bearing (fig. 155).

- (1) If the retracting spring screw was removed, install the screw in the clutch housing.
- (2) Install the release bearing in front of the bearing fork, with the larger diameter of the bearing sleeve toward the front and the retracting spring hole at the top.

Note. A new clutch release bearing is prelubricated.

- (3) Attach the retracting spring to the spring screw and to the release bearing sleeve.
- (4) Install the transmission (par. 194c).
- (5) Adjust the screw so there is slight tension on the spring when the fork is in the released position.

e. Remove Clutch Pressure Plate and Disk.

- (1) Remove the transmission (par. 194b).
- (2) Remove the clutch housing pan and pan plate (par. 188b).
- (3) Remove the clutch release bearing (*b* above).
- (4) Loosen the the six bolts that secure the pressure plate to the flywheel, rotating the flywheel to gain access to the bolts. Remove the six bolts and lockwashers, and remove the pressure plate and the clutch disk.

f. Cleaning and Inspection.

- (1) Clean the parts thoroughly with dry-cleaning solvent or volatile mineral spirits. Clean the pilot bearing (bushing-type) in the end of the crankshaft and inspect for wear or damage. Clean disk-contacting surfaces and flywheel. If the pilot bearing or flywheel is worn or scored, notify ordnance maintenance personnel.
- (2) Inspect the disk for worn, glazed, or loose facings, damaged hub splines, damaged springs, or distortion.
- (3) Inspect the pressure plate for scored disk-contacting surface, distortion, or damaged springs or fingers.

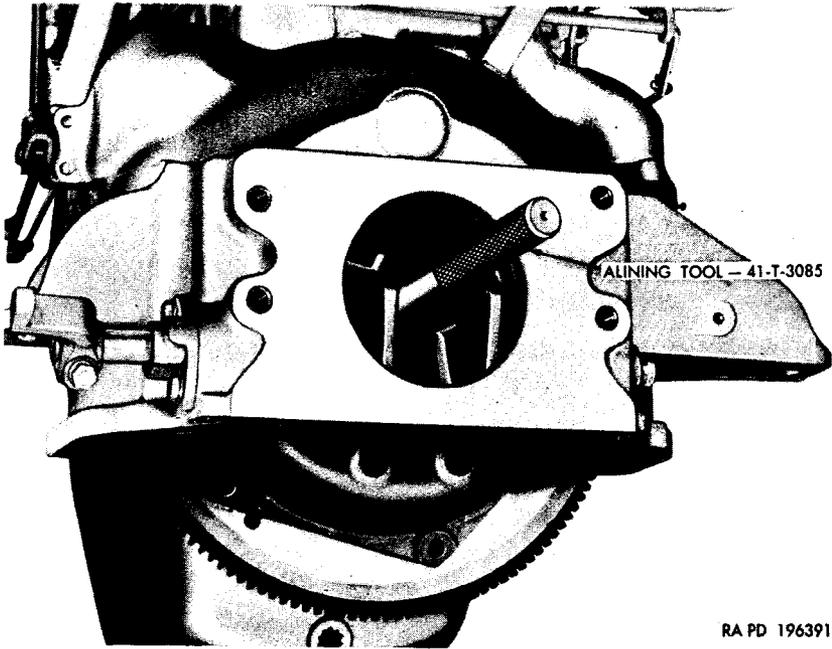


Figure 158. *Aligning clutch parts.*

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- (4) Inspect the clutch release bearing (*c* above).
- (5) Replace all parts that are unfit for further service.

g. Install Clutch Pressure Plate and Disk.

- (1) Position the disk and the pressure plate (fig. 155) on the fly-wheel. Install the six special bolts and $\frac{3}{8}$ -inch lockwashers. Do not tighten the bolts until all are installed and the clutch parts are alined ((2) below).
- (2) Insert the clutch alining tool 41-T-3085 through the pressure plate, disk, and into the pilot bearing to aline the parts (fig. 158). Tighten the six bolts evenly to 15 to 20 pound-feet torque, using a torque-indicating wrench. Remove alining tool.
- (3) Install the clutch release bearing (*d* above).
- (4) Install the clutch housing pan and pan plate (par. 188*d*).
- (5) Install the transmission (par. 194*c*).
- (6) Adjust clutch pedal (par. 187*b*), if necessary.

h. Record Replacement. Record the clutch replacement on DA Form 478.

Section XVI. TRANSMISSION AND POWER-TAKE-OFF

190. Description and Data

- (1) The transmission is a helical gear, synchro-shift unit, with four forward speeds and one reverse. On vehicle equipped

with a winch, the power-take-off is mounted at the left side of the transmission.

- (2) Organizational maintenance operations include replacement of the transmission and gear shift lever, the power-take-off cover gasket or gaskets, and the filler and drain plugs; and emergency replacement of the transmission top cover and/or gasket and the transmission with or without power-take-off.

b. Data.

Transmission :

Capacity :

Through engine T245-3955

W/o power-take-off ----- 9 pt

W/power-take-off ----- 10½ pt

After engine TT245-3955

W/power-take-off ----- 7 pt

W/o power-take-off ----- 6 pt

Make ----- New Process

Model ----- 88950

Power-take-off :

Gear speed ----- 395 rpm at 1,000 rpm engine speed

Speeds :

Forward ----- 4

Reverse ----- 1

Ratios :

First ----- 6.40 : 1

Second ----- 3.09 : 1

Third ----- 1.69 : 1

Fourth ----- 1.00 : 1

Reverse ----- 7.61 : 1

Type ----- helical gear synchro-shift

191. Gear Shift Hand Lever

a. Removal. Remove the nut, lockwasher, and bolt that clamps the gear shift hand lever to the gear shift lower lever and remove the hand lever.

b. Installation. Position the hand lever on the lower lever and install the ¼-20NF x 2 bolt, ¼-inch lockwasher, and ¼-20NF nut. Tighten the nut.

192. Power-Take-Off Cover Gasket

a. General. The transmission is provided with one or two power-take-off covers, the number depending on whether a power-take-off is used. On transmissions with power-take-off, one cover is attached to the right side of the transmission and on a transmission without power-take-off, a second cover is used at the left side. If either cover gasket is damaged or deteriorated, causing leakage of transmission lubricant, replace the gasket (*b* below).

b. Replacement. Both cover gaskets are removed and installed in the same manner.

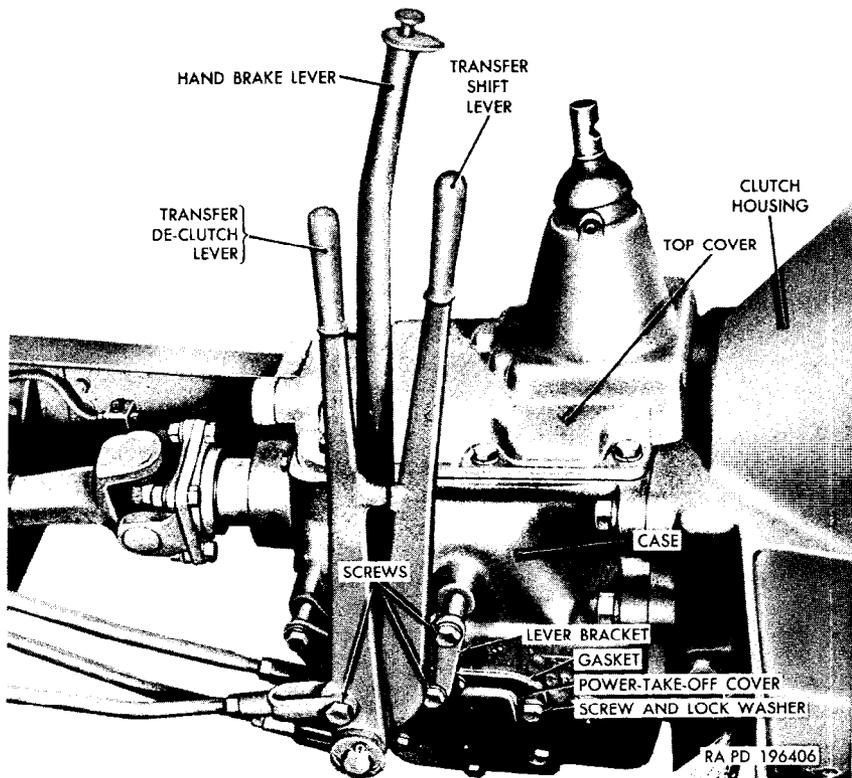


Figure 159. Transmission—right side.

- (1) Remove the drain plug (S, fig. 36) from the bottom of the transmission case and drain the lubricant into a clean container. Install the drain plug and tighten.
- (2) Remove the six cap screws and lockwashers that secure the cover to the transmission case (fig. 159) and remove the cover and cover gasket. Discard the gasket.
- (3) Clean the gasket surfaces of the case and the cover thoroughly.
- (4) Apply liquid-type gasket cement to both sides of a new gasket and position the gasket on the cover. Position the cover and gasket on the case, aligning the screw holes. Install the six $\frac{3}{8}$ -inch lockwashers and $\frac{1}{8}$ -16NC x $\frac{3}{4}$ cap screws. Tighten the screws evenly.
- (5) Fill the transmission to the proper level with the correct grade of lubricant. Refer to lubrication order (figs. 33 and 34). Use the lubricant which was drained from the transmission, if it is clean and of correct grade.

193. Transmission Case Top Cover and/or Gasket

a. *Coordination with Ordnance Maintenance Unit.* Replacement of the transmission case top cover and/or cover gasket is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement cover may be obtained from the supporting ordnance maintenance unit.

b. *Removal.*

- (1) Remove the transmission access cover (par. 121g).
- (2) Disengage the battery-to-starter cable from the cable clip (fig. 160).
- (3) Clean the top cover and remove the six bolts and lockwashers that secure the cover to the transmission case. Remove the cable clip from the right front corner and remove the cover (fig. 161). Remove and discard the cover gasket.
- (4) Clean the gasket surfaces of the transmission case and cover thoroughly, exercising care to prevent any dirt or other foreign matter from entering the case.

c. *Installation.*

- (1) Apply a coating of liquid-type gasket cement to both sides of a new cover gasket and position the gasket on the transmission case.
- (2) Install the cover carefully, engaging the rear shifter fork in

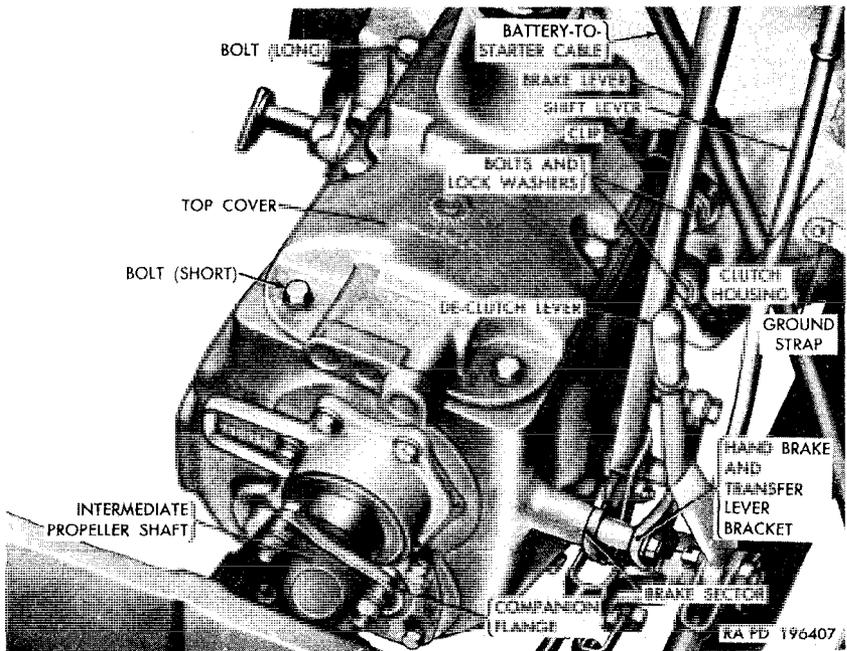


Figure 160. Transmission installed.

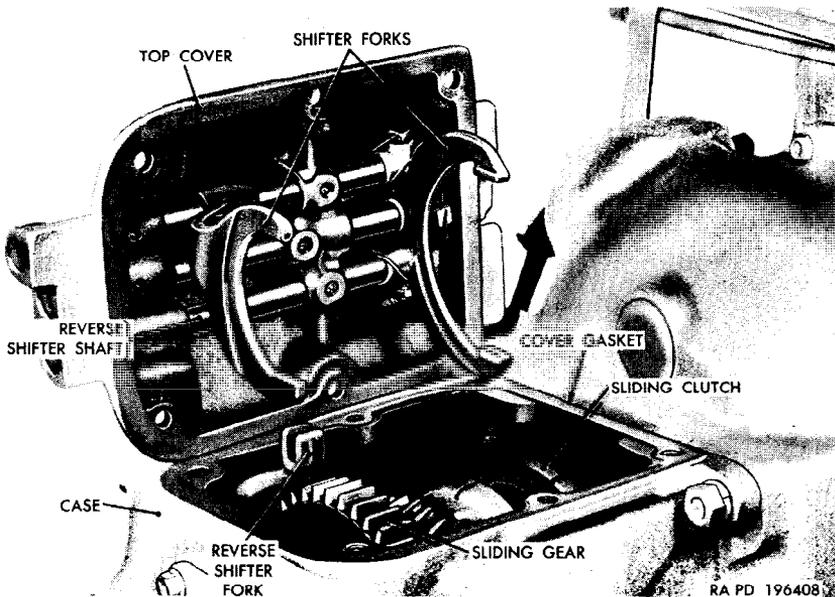


Figure 161. Transmission top cover removed.

the transmission sliding gear, the reverse shifter fork with reverse shifter shaft, and the front shifter fork in the sliding clutch (fig. 161).

- (3) Install a $\frac{3}{8}$ -inch lockwasher and $\frac{3}{8}$ -16NC x $1\frac{1}{8}$ bolt for the left front bolt opening (fig. 160) and a $\frac{3}{8}$ -inch lockwasher and $\frac{3}{8}$ -16NC x $\frac{7}{8}$ bolt for each of the other five openings, attaching the cable clip at the right front corner. Tighten the bolts evenly.
- (4) Engage the battery-to-starter cable in the cable clip.
- (5) Install the transmission access cover (par. 122f).

d. Record Replacement. Record the replacement on DA Form 478.

194. Transmission

(fig. 159)

a. Coordination with Ordnance Maintenance Unit. Replacement of the transmission is normally an ordnance maintenance operation, but may be performed by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement transmission may be obtained from the supporting ordnance maintenance unit.

b. Removal. Removal operations described below are for a transmission with power-takeoff. When replacing a transmission without power-takeoff, disregard steps pertaining to the power-takeoff and winch drive shaft.

- (1) Remove the transmission access cover (par. 121g).

- (2) Remove the three screws and lockwashers that secure the handbrake and transfer lever bracket to the right side of the transmission case.
- (3) Disengage the battery-to-starter cable from the clip on the transmission top cover (fig. 160).
- (4) Remove the four nuts, lockwashers, and bolts that secure the intermediate propeller shaft to the companion flange on the transmission (fig. 160). Secure the shaft to keep it off the floor.
- (5) Remove the four bolts and lockwashers that secure the transmission to the clutch housing. Using jacks or a dolly move the transmission straight back to disengage the main shaft from the clutch housing and the splined yoke of the winch drive shaft from the drive shaft. Lower the transmission and remove it.
- (6) If the transmission is to be replaced, remove the winch drive shaft rear universal joint from the power-takeoff drive shaft (par. 183a(4)).

c. Installation.

- (1) Clean the machined surfaces of the transmission and the clutch housing thoroughly.
- (2) Install the winch drive shaft rear universal joint on the power-takeoff drive shaft (par. 183c(1) and (2)).
- (3) Using jacks or a dolly, position the transmission and move it forward to engage the transmission shaft in the clutch; at the same time, guide the winch drive shaft into the front yoke of the rear universal joint on the power-takeoff drive shaft, alining the universal joint journals. Do not attempt to force the transmission into the clutch by hammering or other extreme methods.
- (4) Install the four $\frac{9}{16}$ -inch lockwashers and $\frac{9}{16}$ -12NC x $1\frac{3}{4}$ bolts. Tighten the bolts evenly. Remove the jacks or dolly.
- (5) Connect the intermediate propeller shaft to the transmission companion flange and install the four $\frac{7}{16}$ -20NF x $1\frac{1}{4}$ bolts, $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts. Tighten the nuts evenly.
- (6) Engage the battery-to-starter cable in the clip on the transmission cover (fig. 160).
- (7) Place the assembled handbrake lever and transfer shift levers and bracket in position at the side of the transmission and install the three $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -16NC x $2\frac{3}{4}$ screws (fig. 159). Tighten the screws evenly.
- (8) Install the transmission access cover (par. 122f).

d. Record Replacement. Record the transmission replacement on DA Form 478.

Section XVII. TRANSFER

195. Description and Data

a. Description.

- (1) The transfer (fig. 162) is of the two-range type and provides a means of transferring engine power to the front and rear axles. The handbrake band and drum are mounted at the rear of the transfer. The speedometer drive pinion is actuated by the transfer driven shaft.
- (2) Organizational maintenance operations include adjustment of the transfer control linkage, replacement of the speedometer drive pinion, air vent, and emergency replacement of the transfer. The vent is serviced in the same manner as the vent for the front axle (par. 207a).

b. Data.

Capacity----- 5 pt
Make----- New Process
Model----- 88845
Ratio:
 High range----- 1.00:1
 Low range----- 1.96:1

196. Transfer Control Linkage Adjustment

Nota. The key letters noted in parentheses are in figure 162 except where otherwise indicated.

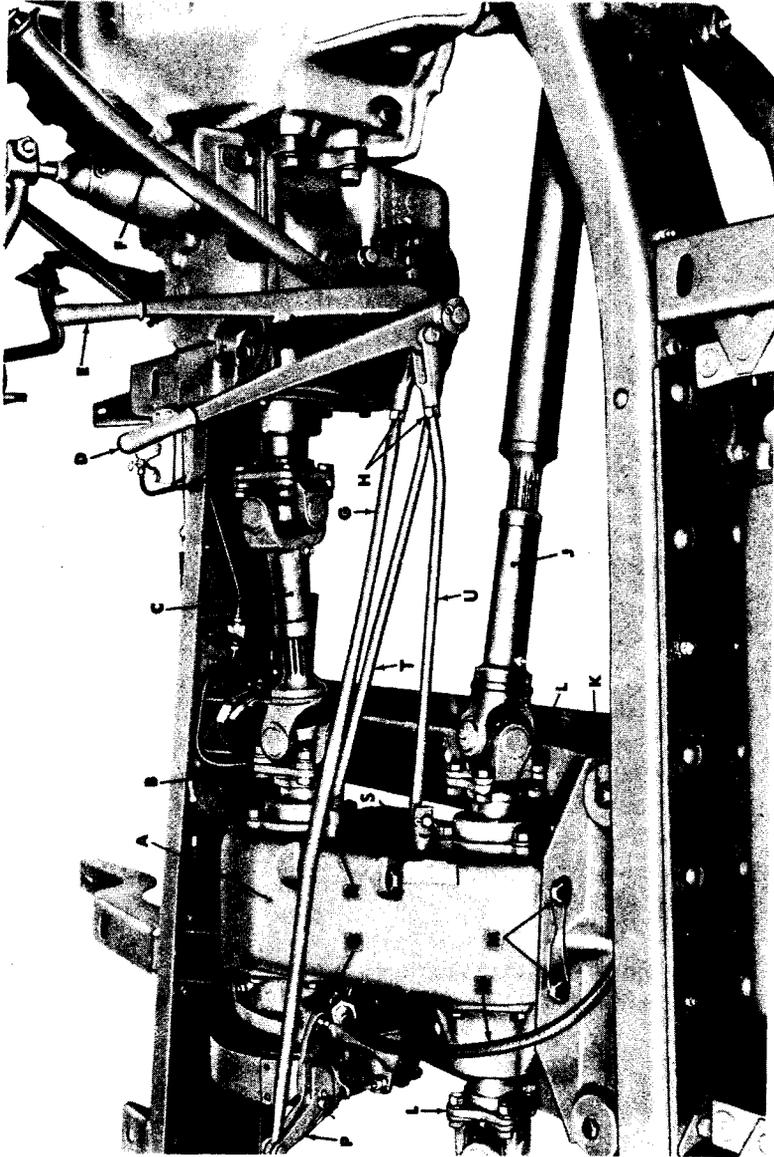
a. General. The transfer control shifter lever rod and declutch shifter lever rod must be properly adjusted to prevent disengagement of the clutch gears.

b. Check Operation of Shifter Shafts.

- (1) Remove the two cotter pins that secure the declutch shifter lever rod (U) and control shifter lever rod (T) to the shifter shafts (R) and (S) and disengage the rods from the shafts.
- (2) Jack up one rear wheel from the floor far enough to permit the wheel to be rotated. Block the other wheels and release the handbrake.
- (3) While an assistant rotates the rear wheel, move the shifter shafts "in" and "out" by hand. Make certain that the poppet ball for each shaft engages in the detent slots as the shifts are accomplished.

c. Adjust Control Shifter Lever Rod.

- (1) Push the shifter shaft (R) in until the poppet ball engages in the slot, indicating that the transfer is in high range.
- (2) Move the transfer shift control lever (Q, fig. 12) forward until approximately one-half inch exists between the lever and the front end of the lever slot in the transmission access



KEY **ITEM**

- A—TRANSFER
- B—INPUT SHAFT COMPANION FLANGE
- C—INTERMEDIATE PROPELLER SHAFT
- D—DE-CLUTCH LEVER
- E—SHIFT LEVER
- F—BRAKE LEVER
- G—BRAKE CONTROL ROD
- H—NUT
- J—FRONT PROPELLER SHAFT
- K—BOLT
- L—OUTPUT SHAFT COMPANION FLANGE
- M—MOUNTING BRACKET BOLTS
- N—SPEEDOMETER SHAFT
- P—CAM LEVER
- Q—PINION, RETAINING NUT
- R—TWO SPEED CLUTCH
- S—GEAR, SHIFTER SHAFT
- S—FRONT AXLE OUTPUT SHIFTER SHAFT
- T—CONTROL SHIFTER LEVER ROD
- U—DECLUTCH SHIFTER LEVER ROD

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Figure 162. Transfer and controls.

cover. While an assistant holds the lever in this position, check the alinement of the control shifter lever rod (T) with the hole in the shifter shaft (R). If adjustment of the rod is necessary, loosen the nut (H) on the front end of the rod and turn rod in turns of 360-degrees IN or OUT until proper alinement is obtained. Insert end of rod through shifter shaft (offset of rod down) and install a $\frac{3}{32} \times 1\frac{1}{8}$ cotter pin. Tighten nut (H) at the front end of rod.

- (3) Move the shifter lever to the rear until the poppet ball engages in the slot, indicating that the transfer is in low range.

d. Adjust Declutch Lever Rod (fig. 162).

- (1) Push the shifter shaft (S) in until the poppet ball engages in the slot, indicating that the front axle is engaged.
- (2) With the transfer shift control lever (Q, fig. 12) in the low range position as described in *c*(3) above, move the transfer declutch control lever (R, fig. 12) forward until approximately $\frac{1}{2}$ -inch clearance exists between the bosses of both levers. While an assistant holds the lever in this position, check the alinement of the declutch shifter lever rod (U) with the hole in the shifter shaft (S). If adjustment of the rod is necessary, loosen the nut on the front end of the rod and turn rod in turns of 360° "in" or "out" until proper alinement is obtained. Insert end of rod through shifter shaft (offset of rod down) and install $\frac{3}{32} \times 1\frac{1}{8}$ cotter pin. Tighten nut (H) at front end of rod.

Note. Do not change the position of the declutch shifter lever rod to establish the correct clearance, as this lever has been positioned properly if instructions in *c* above were followed.

- (3) Remove the jack and blocking.

197. Speedometer Drive Pinion and Oil Seal

a. Removal (fig. 162).

- (1) Disconnect the speedometer shaft (N) from the pinion retaining nut (Q).
- (2) Unscrew the pinion retaining nut from the bearing retainer. Remove the nut and drive pinion.
- (3) Remove the pinion and the pinion oil seal from the retaining nut. Discard the oil seal.

b. Installation (fig. 162).

- (1) Position speedometer drive pinion in the bearing retainer, making certain that the pilot at the lower end of the pinion engages in the hole of the retainer boss.
- (2) Place speedometer drive pinion oil seal in the drive pinion retaining nut (Q) and install the nut in the bearing retainer. Tighten the nut.

- (3) Connect the speedometer shaft (N) engaging the shaft core with the drive pinion, and screw the shaft nut to the pinion retaining nut.

198. Transfer

Note. The key letters noted in parentheses are in figure 162, except where otherwise indicated.

a. Coordination with Ordnance Maintenance Unit. Replacement of the transfer is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for such replacement is obtained from the responsible commander. A replacement transfer may be obtained from the supporting ordnance maintenance unit.

b. Remove Transfer.

- (1) Working from underside of the vehicle, disconnect the propeller shafts from the two output shaft companion flanges (L) and the input shaft companion flange (B) by removing the four nuts, lockwashers, and bolts that secure each propeller shaft yoke. Secure the propeller shafts to the frame to keep them off the floor.
- (2) Disconnect the transfer control shifter lever rod (T) and declutch shifter lever rod (U) at the transfer by removing the cotter pin that secures each rod to shifter shafts (R and S) and disengage the rods.
- (3) Disconnect the speedometer shaft (N) from the pinion retaining nut (Q).
- (4) Remove the cotter pin and clevis pin that secures the hand-brake control rod to the cam levers (fig. 163).
- (5) Remove the nuts, lockwashers, and plain washers from the four transfer mounting bolts (fig. 164).
- (6) Support the transfer with jacks or a dolly and remove the eight nuts, lockwashers, and bolts that secure the rear cross member (fig. 164) to the gussets on the frame side rails. Remove the rear cross member.

Caution: Exercise extreme care when removing the transfer, to support it adequately and prevent it from dropping and causing damage to the transfer or serious injury to personnel.

- (7) Remove the four transfer mounting bolts (fig. 163). Move the transfer to the rear to clear the front cross member, lower the transfer, and remove it from underneath the vehicle. Remove the four spacers and eight insulators from the left and right mounting brackets (fig. 163).

c. Remove Mounting Brackets and Speedometer Drive Pinion.

- (1) Remove the locking wire from the two mounting bracket bolts (M, fig. 162) for each mounting bracket.
- (2) Remove the two bolts and lockwashers from each bracket, and remove the two brackets.
- (3) Remove the speedometer drive pinion (par. 197a).

d. Inspection. Inspect the mounting brackets and mounting parts for cracks and distortion. Inspect the mounting bolts for damaged threads. Check the insulator spacers for damage or distortion, and the insulators for damage or deterioration. Replace parts that are unfit for further service.

e. Install Mounting Brackets and Speedometer Drive Pinion.

- (1) Install the speedometer drive pinion (par. 197b).
- (2) Position the mounting brackets on the transfer.

Note. The left (large) bracket and right (small) bracket are installed in the same manner, but are not interchangeable.

Install a ½-inch lockwasher on each mounting bracket bolt (M, fig. 162) and install the two bolts for each bracket. Tighten the bolts and secure with locking wires.

f. Install Transfer.

- (1) Install the eight insulators in the mounting brackets with the larger diameters of the insulators toward the brackets, and install an insulator spacer from the upper side through each pair of insulators (fig. 163).

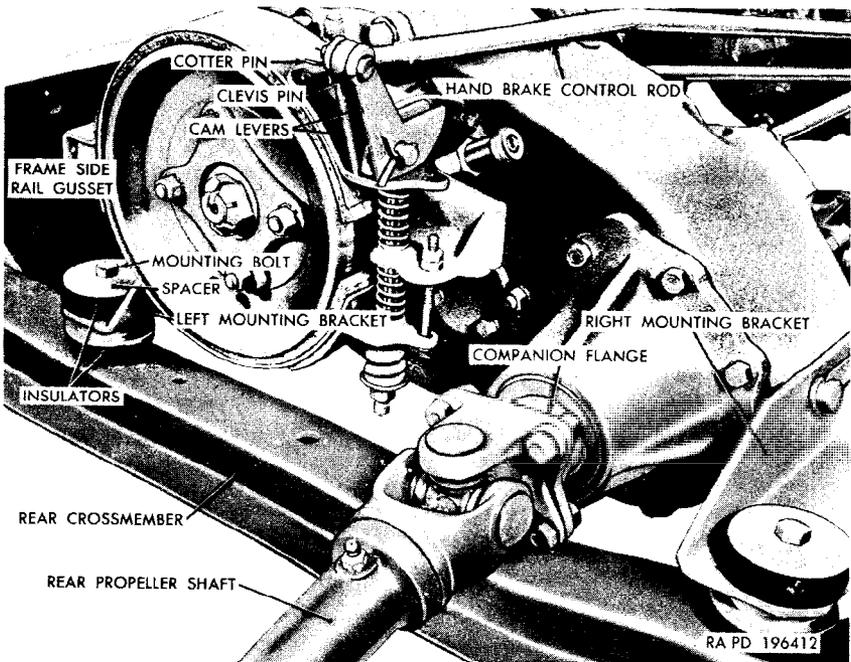
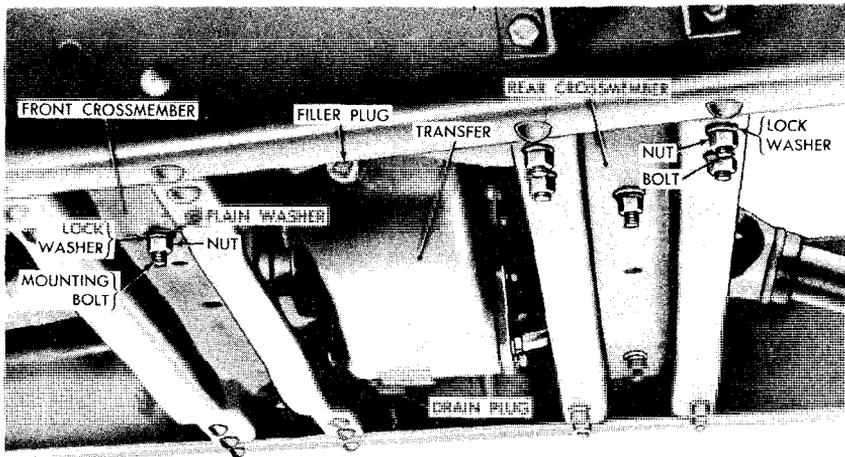


Figure 163. Transfer—rear view.



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Figure 164. Transfer—bottom view.

- (2) Position the transfer on the front cross member. Support the transfer in this position with jacks or blocking.
- (3) Position the rear cross member under the frame side rail gussets, aligning the bolt holes in the cross member with those in the gussets and mounting bolt spacers. Install the eight $\frac{7}{16}$ -20NF x 1 bolts from the upper side, $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts to secure the cross member (figs. 163 and 164). Tighten the nuts.
- (4) Install a $\frac{7}{16}$ -20NF x $3\frac{1}{2}$ transfer mounting bolt through each of the four spacers (fig. 162). Install a $1\frac{5}{32}$ -inch plain washer, $\frac{7}{16}$ -inch lockwasher, and $\frac{7}{16}$ -20NF nut on each bolt. Tighten the nuts evenly.
- (5) Remove the jacks or blocking that were used to support the transfer.
- (6) Attach the handbrake control rod to the two cam levers with the clevis pin and $\frac{5}{32}$ x 1 cotter pin.
- (7) Connect the speedometer shaft (N) to the pinion retaining nut (Q).
- (8) Align each propeller shaft with its respective companion flange and install the four $\frac{7}{16}$ -20NF x $1\frac{1}{8}$ bolts, $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts for each shaft. Tighten the nuts to 40-50 pound-feet torque.
- (9) Adjust the transfer control linkage (par. 196).
- (10) Adjust handbrake (par. 219).

g. Record Replacement. Record the transfer replacement on DA Form 478.

Section XVIII. PROPELLER SHAFTS

199. Description and Data

a. Description.

- (1) The intermediate propeller shaft (C, fig. 162) transmits power from the transmission to the transfer. The front propeller shaft (J, fig. 162) and rear propeller shaft (fig. 163) divert power from the transfer to the front and rear axles, respectively.
- (2) Complete interchangeability is provided on the roller bearings, bearing oil seals, bearing oil seal retainers, and snap rings for all universal joints; however, the journals and yokes of the intermediate propeller shaft are of greater width than those provided for the other two propeller shafts.
- (3) Organizational maintenance operations include replacement of the propeller shafts and the universal joints or related parts. When replacing the rear propeller shaft, be sure to install the correct shaft for the vehicle involved, refer to *b* below for the correct length.

b. Data.

Length :

Front (all models)----- 35½ in.

Intermediate (all models)----- 10 in.

Rear :

Cargo truck M37 or command truck M42----- 31¼ in.

Ambulance truck M43 or telephone maintenance truck V-41--- 45¼ in.

Make-----Universal Products Company

Model :

Front (all models)----- 5160-56

Intermediate (all models)----- 5360-120

Rear (M37 and M42)----- 5160-57

Rear (M43 and M41)----- 5160-58

Universal joints :

Bearings----- cageless roller

Type----- journal and roller

200. Propeller Shaft

a. *Removal.* Procedure is the same for all propeller shafts. Remove the four nuts, lockwashers, and bolts that secure each universal joint flange yoke to the companion flanges on the transfer, transmission, or differential and remove the shaft.

b. Installation.

Note. When installing the propeller shafts, be sure to install the front and rear shafts with the splined yoke toward the transmission (fig. 162).

Place the shaft in position at the companion flanges, aligning the bolt holes. Install the four ¼₁₆-20NF x 1½ bolts (front or rear shaft) or

$\frac{7}{16}$ -20NF x $1\frac{1}{4}$ bolts (intermediate shaft), $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts for each flange yoke. Tighten the nuts to 40–50 pound-feet torque.

201. Propeller Shaft

(fig. 165)

a. Disassemble Propeller Shafts. Disassembly procedure is the same for all propeller shafts.

- (1) Remove the propeller shaft (par. 200a).
- (2) Unscrew the oil seal cap from the splined yoke and remove the oil seal and two oil seal washers from the cap.
- (3) Remove the splined yoke from the shaft.
- (4) Remove the lubrication fitting from the splined yoke.

b. Disassemble Universal Joints. All universal joints are disassembled in the same manner, with the exception of the lubrication fittings for the intermediate propeller shaft journals.

- (1) Place the universal joint in a vise and compress the two bearings sufficiently to remove the two snap rings (fig. 166). Change the position of the joint in the vise and remove the other two snap rings.
- (2) Press the four bearings from the universal joint in an arbor press, or remove them in the manner shown in figure 167. For this method, place the universal joint in a vise with a $1\frac{1}{4}$ -inch heavy-duty socket over one bearing and a $\frac{1}{2}$ -inch socket against the opposite bearing. Tighten the vise to force the bearing from the yoke, being careful not to damage either oil seal retainer as the bearing is removed. Remove the other three bearings in the same manner. Separate the two yokes and remove the journal.
- (3) Remove the four bearing oil seals from each journal.

Note. Do not remove the oil seal retainers unless they are to be replaced, as the retainers must be a snug fit on the journal.

- (4) Remove the lubrication fitting from each journal.

c. Inspection.

- (1) Clean the parts in dry-cleaning solvent or volatile mineral spirits and dry with compressed air.
- (2) Inspect the splined yoke and tube for distortion, cracks, and worn or damaged splines or bearing surfaces.
- (3) Inspect the flange yokes for distortion, cracks, and worn or damaged bearing surfaces.
- (4) Inspect the journals for damaged or worn bearing surfaces, damaged oil seal retainers, and distortion.
- (5) Replace parts that are unfit for further service. The universal joint repair kits provide journals with oil seals and retainers installed, journal bearings, and bearing snap rings.

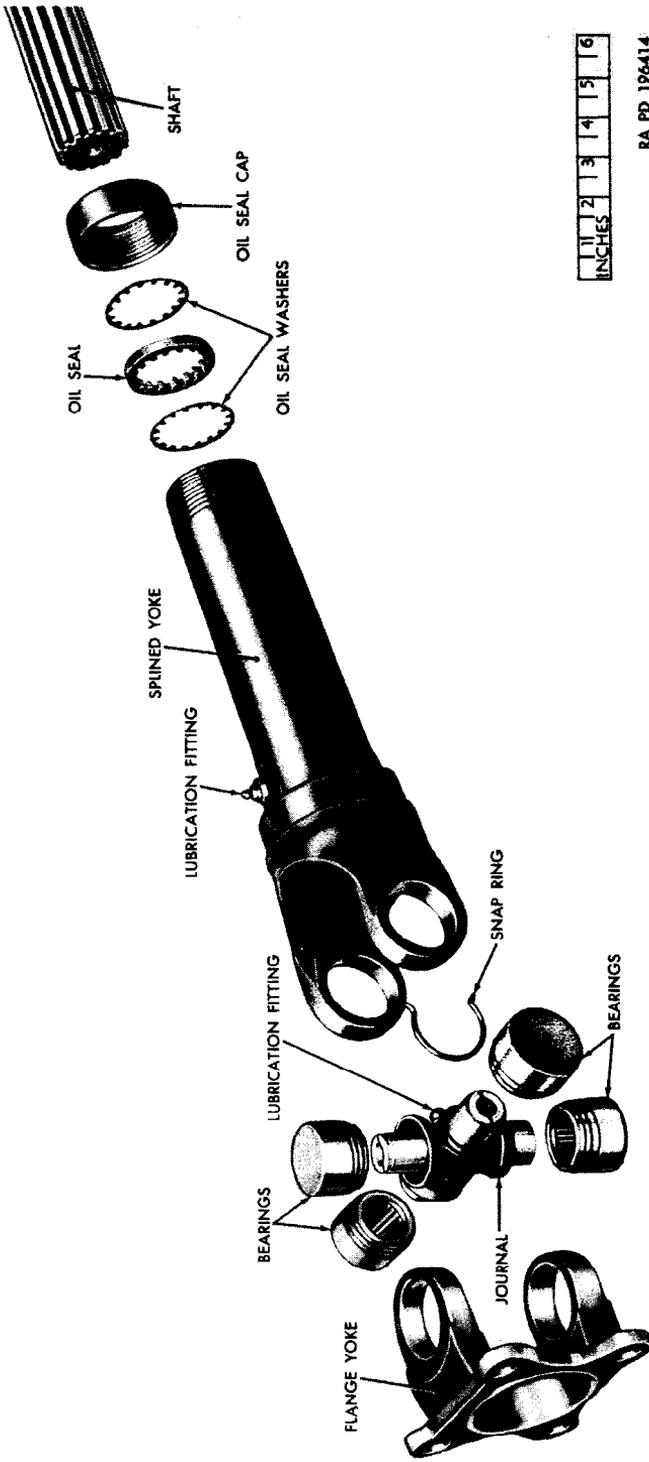


Figure 165. Propeller shaft—exploded view.

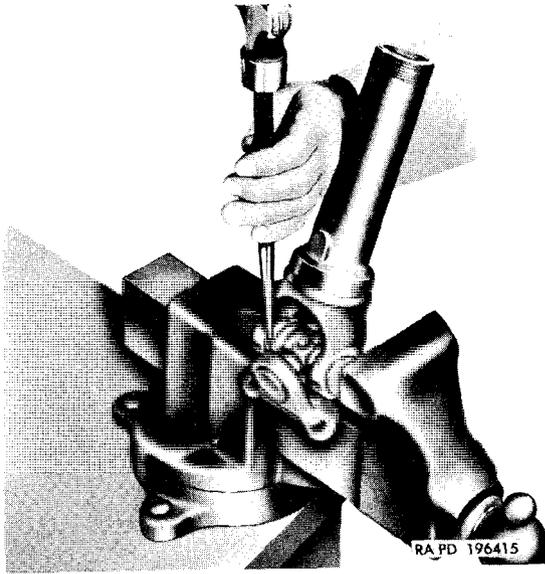


Figure 166. Removing bearing snap rings.

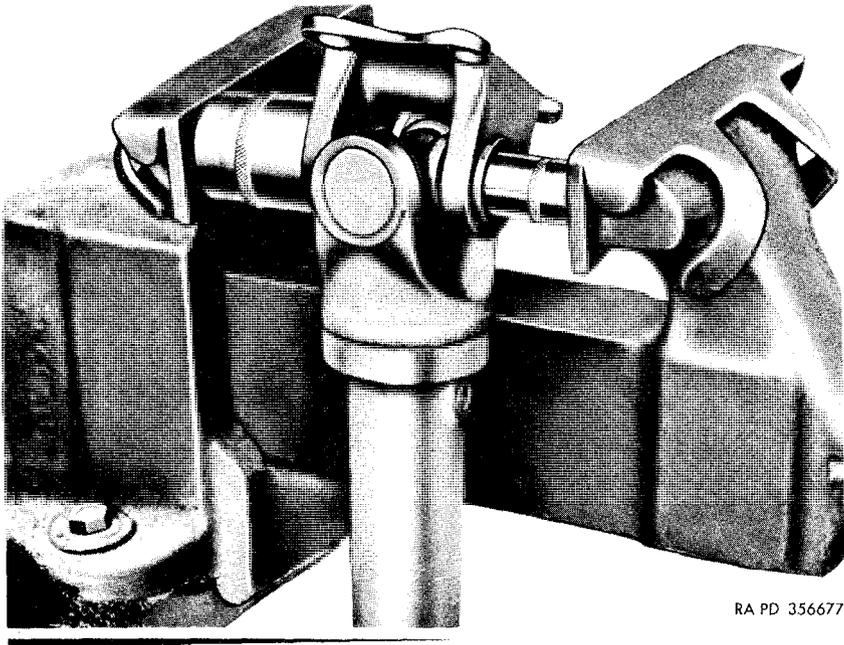


Figure 167. Removing bearings.

d. Assemble Universal Joints.

- (1) For the front or rear propeller shaft, install a $\frac{1}{8}$ NPT, $67\frac{1}{2}^\circ$ lubrication fitting in each journal, tighten the fittings so they are properly positioned for grease gun connections. For the intermediate propeller shaft journals, install a $\frac{1}{8}$ NPT lubrication fitting.
- (2) Prepare new bearing oil seals by soaking them in light engine oil for 10 minutes. If the four oil seal retainers were removed from the journal (*b*(3) above), install new retainers. Install a new oil seal in each retainer.

Note. Replace the oil seals whenever the universal joint is disassembled.

- (3) Position the journal in the splined yoke or tube, so the lubrication fitting is toward the splined yoke or tube (front or rear propeller shaft). Install a bearing at each side of the yoke, over the journal, pressing the bearings into position with an arbor press or between the jaws of a vice. Force the bearings in, until the bearing oil seals are compressed and install a new snap ring for each bearing, making certain that the rings are fully seated.

e. Assemble Propeller Shaft.

- (1) Install a $\frac{1}{8}$ NPT lubrication fitting in the splined yoke.
- (2) Place an oil seal washer on each side of the oil seal and install the parts in the cap. Position the cap on the shaft.
- (3) Install the shaft in the yoke, matching the blind splines. Screw the cap to the splined yoke.
- (4) Lubricate all fittings with automotive and artillery lubricating grease. Make certain that grease is reaching all the journal bearings and the splines.
- (5) Install the propeller shaft (par. 200*b*).

Section XIX. FRONT AXLE

202. Description and Data

a. Description.

- (1) The front axle is of the full-floating hypoid-type. The complete unit includes the housing, differential with carrier, steering knuckles, universal drives, tie rod, hubs, and service brakes.
- (2) Organizational maintenance operations include front wheel alignment toe-in, replacement of filler and drain plugs, air vent, steering knuckles, universal drives and tie rod; and emergency replacement of the front axle.

b. Data.

Alinement:

Camber angle (fixed).....	1¼° to 1¾°
Caster angle (fixed):	
No-load.....	0° to 1°
Normal load.....	1° to 2°
Pivot angle (fixed).....	8°
Toe-in (adjustable).....	0 to ½ in.
Capacity.....	6 pt
Make.....	Dodge
Ratio.....	5.83:1
Tie rod.....	ball and socket
Type.....	full floating (hypoid)
Universal drive:	
Make.....	New Process
Model.....	Tracta
Turning angle (inside wheel).....	28° to 29°

203. Front Wheel Alinement

a. *General.* Front wheel alinement affects steering of the vehicle from a standpoint of control, ease of steering, and safety and is an important factor in the life of tires. The items affecting front wheel alinement are caster, camber, pivot angle, and toe-in. Caster, camber, and pivot angle are built into the front axle housing and cannot be adjusted. Toe-in adjustment is described in *d* below. Caster may be affected by shifting of the front springs on the axle, damaged springs, or distortion of the frame. Camber may be affected by loose hub bearings or steering knuckle flange bearings, bent steering knuckles, or a damaged axle housing.

b. Check Camber, Caster, and Pivot Angle.

- (1) Check both front springs for sagged or broken leaves and loose spring clip **U**-bolts. Make certain that the springs are positioned properly on the axle. Tighten spring clip **U**-bolt nuts or replace springs, as required.
- (2) Check hub bearings for looseness. Adjust or replace the bearings, if necessary (par. 226).
- (3) Check the flange bearings for looseness. If looseness is evident, notify ordnance maintenance personnel.
- (4) Check wheel and tire runout. If runout exceeds three-eighths of an inch replace the wheel (par. 227).
- (5) Inflate all tires to 40 psi. Tread on both front tires should be approximately the same. Replace badly worn tires (par. 229).
- (6) If correction of camber, caster, and pivot angle, requires alining equipment, notify ordnance maintenance personnel.

c. *Check Toe-In* (fig. 168). Since incorrect toe-in may be caused by worn, damaged, or incorrectly adjusted wheel bearings, damaged or loose steering knuckle parts, or a bent tie rod, make certain that

these items are in good condition and correctly installed before checking toe-in.

- (1) Inflate tires to 40 psi.
- (2) Check for correct wheel bearing adjustment (par. 226).
- (3) Position the vehicle on a smooth level floor with the wheels in a straightahead position.
- (4) Place the toe-in wheel alinement gage between the wheels at the rear of the axle and as near hug height as possible, with the ends of the gage bearing against the tire side walls and at equal distances from the floor.
- (5) Set the gage at zero.
- (6) Roll the vehicle straight back far enough to bring the gage toward the front the same distance from the floor as it was at the rear.
- (7) Observe the gage pointer. The reading should be 0 to $-\frac{1}{8}$ inch.
- (8) If the gage indicates other than that specified in (7) above, adjust the toe-in (*d* below).

d. Adjust Toe-In. If toe-in is more than one-eighth of an inch or if the wheels toe out one-eighth of an inch or more, adjust both tie rod ends an equal amount. Otherwise, the adjustment may be made at the left tie rod end.

- (1) Detach the left tie rod end or both tie rod ends, if necessary, from the steering knuckle flange or flanges (par 204a).
- (2) Loosen the nut on the clamp bolt in the left tie rod end (fig. 170) or both ends, as required. Turn the end or ends counterclockwise to increase toe-in, or clockwise to decrease toe-in.

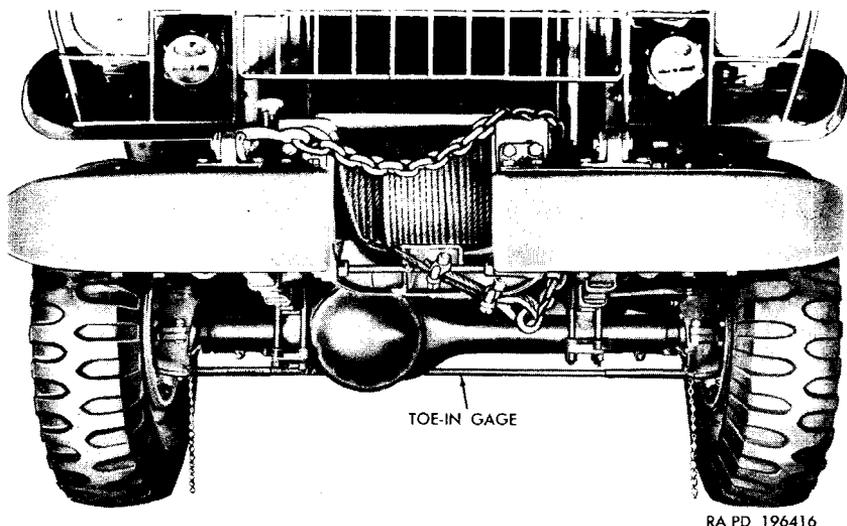


Figure 168. Measuring front wheel toe-in.

- (3) Attach the tie rod end or ends to the steering knuckle flange and again measure the toe-in (c(4) through (7) above).
- (4) Adjust the ends ((1) and (2) above) until toe-in is from 0– $\frac{1}{8}$ inch.
- (5) When the adjustment has been completed, tighten the nuts on the tie rod end clamp bolts, install the slotted stud nuts on the ball studs, tighten to 130 to 150 pound-feet torque, and install the $\frac{1}{8}$ x $1\frac{5}{8}$ cotter pins.

204. Tie Rod and Tie Rod Ends

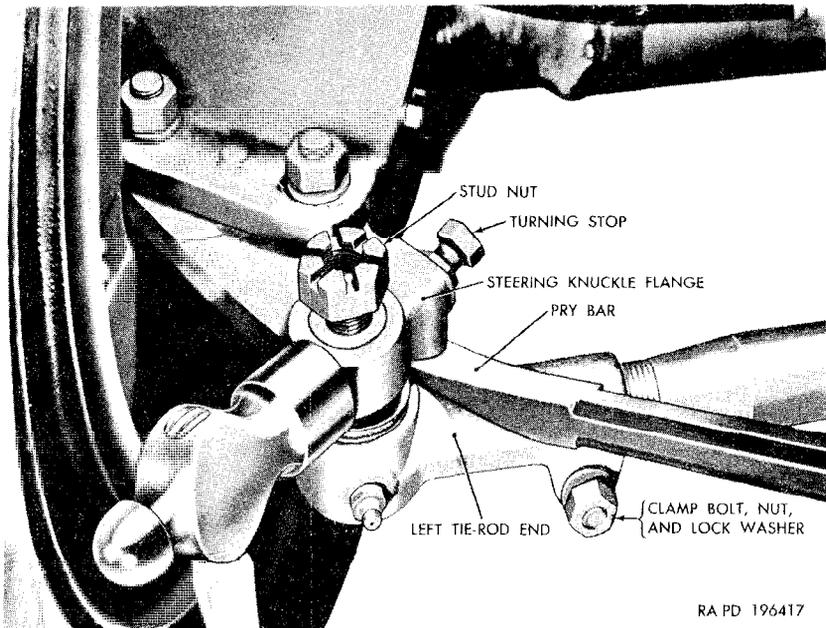
(figs. 169 and 170).

a. Removal.

- (1) Remove the cotter pin from each tie rod end ball stud. Loosen but do not remove the stud nuts.
- (2) Insert a pry bar between the left tie rod end and the steering knuckle flange. Apply pressure on the pry bar and strike the flange with a medium hammer to free the ball stud from the flange. Loosen the right tie rod end in the same manner.
- (3) Remove the two stud nuts and remove the tie rod.

b. Disassembly.

- (1) Remove the dust seal spring, the dust seal, and two seal retainers from each rod end ball stud (fig. 170). Discard the seals.



RA PD 196417

Figure 169. Removing tie rod.

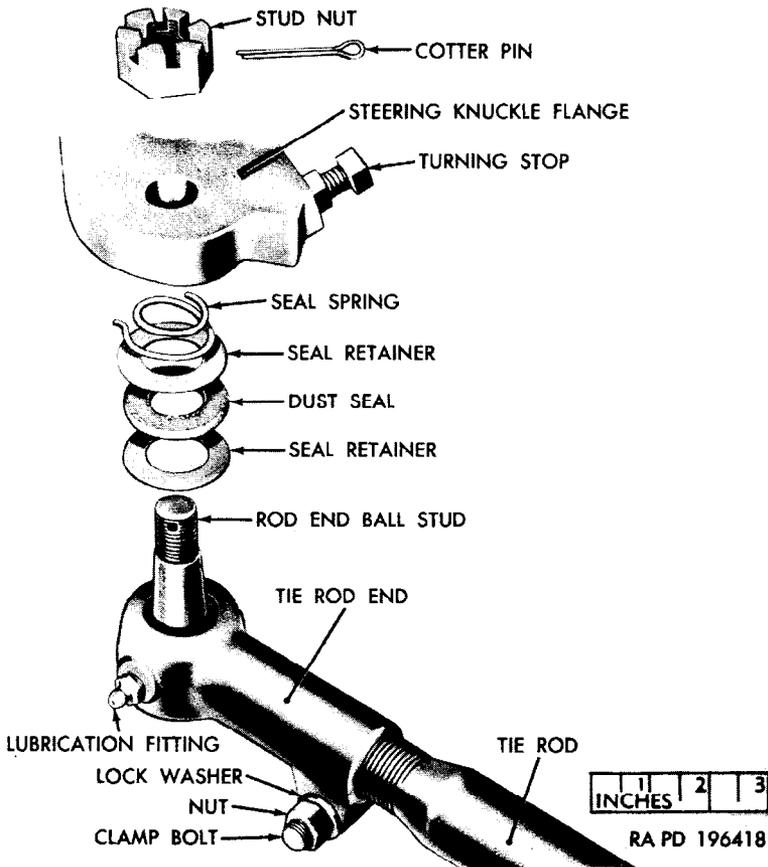


Figure 170. Tie rod—exploded view.

- (2) Remove the nut, lockwasher, and clamp bolt from each tie rod end and unscrew the ends from the tie rod.
- (3) Remove the lubrication fitting from each tie rod end.
- (4) Turning radius is governed by stop screws which are adjusted, then tack-welded to the steering knuckle arms. If inspection reveals the screws to be loose or missing, notify ordnance maintenance personnel.

c. Inspection.

- (1) Clean the tie rod and two tie rod ends in dry-cleaning solvent or volatile mineral spirits and dry with compressed air.
- (2) Inspect the tie rod for distortion or damaged threads.
- (3) Inspect both tie rod ends for cracks, damaged threads, distortion, or restricted lubricant opening. Rotate the end on the ball stud and check for freedom of operation or excessive looseness. Inspect the stud nuts for cracked or damaged threads.

- (4) Replace all parts that are unfit for further service. Dust seal parts and left and right tie rod ends are provided in kits.

d. Assembly.

- (1) Install a $\frac{1}{8}$ NPT male lubrication fitting in each tie rod end (fig. 170).
- (2) Screw the tie rod ends on the tie rod, installing the right end at the offset end of the rod. Turn the two ends an equal amount on the rod until the distance from center to center of the ball studs is $48\frac{1}{16}$ inches and the lubrication fittings in both ends are toward the rear.
- (3) Install the $\frac{7}{16}$ -20NF x $1\frac{7}{8}$ clamp bolt in each tie rod end from the front) and install a $\frac{7}{16}$ -inch lockwasher and a $\frac{7}{16}$ -20NF nut on each bolt. Do not tighten the nuts at this time.
- (4) Install the dust seal and related parts on each ball stud. Place a seal retainer on each side of the dust seal, install the parts on the ball stud, and install the dust seal spring with the larger diameter down.
- (5) Insert the ball studs up through the openings in the flanges. Install the two stud nuts but do not tighten.
- (6) Lubricate both tie rod ends with automotive and artillery lubricating grease.
- (7) Measure the toe-in (par. 203c) and adjust if necessary (par. 203d). Tighten the nuts on both tie rod end clamp bolts securely, and tighten the two stud nuts to 130-150 pound-foot torque. Install a $\frac{1}{8}$ x $1\frac{5}{8}$ cotter pin in each stud.

205. Steering Knuckle and Universal Drive Removal

a. General. Both steering knuckles and universal drives are removed in the same manner.

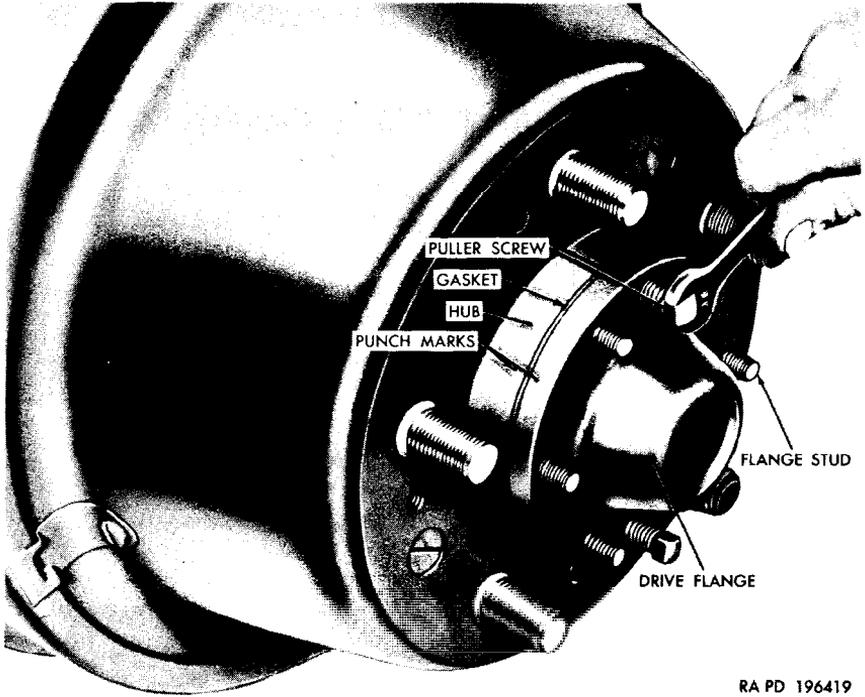
b. Remove Wheel and Tire (par. 227). Jack up the wheel and remove the five wheel stud nuts (the nuts for the left wheel have left hand threads). Remove the wheel and tire.

c. Remove Drive Flange.

- (1) Mark adjacent points of the drive flange and hub with a center punch.

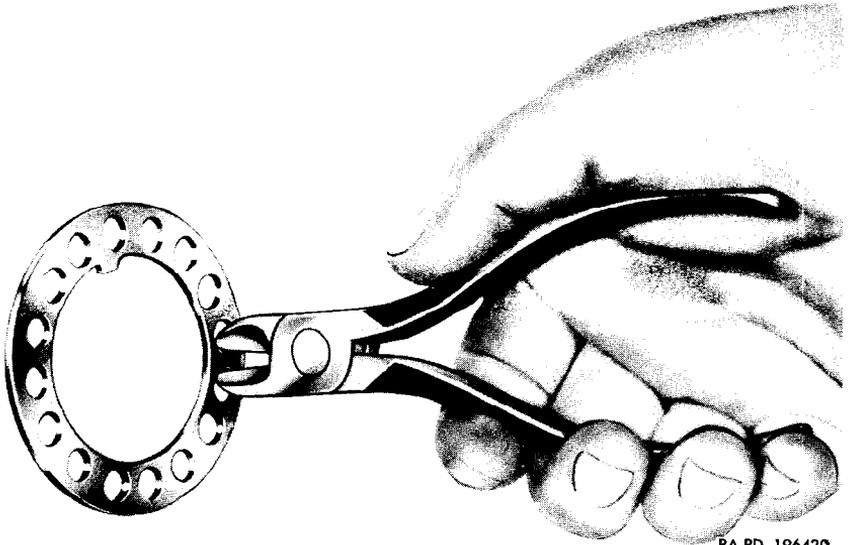
Note. This is important, as the flange must be installed in the same position on the hub to prevent peeling of the studs.

- (2) Remove the six nuts and lockwashers from the flange studs. Remove the two puller screws from the flange.
- (3) Remove the nuts from the two puller screws. Install the screws and tighten evenly to force the flange from the hub. Remove the flange and the flange gasket. Discard the gasket. Remove the two puller screws from the flange.



RA PD 196419

Figure 171. Removing drive flange.



RA PD 196420

Figure 172. Removing or installing adjusting nut lock.

d. Remove Hub and Drum.

- (1) Remove the hub bearing outer adjusting nut, using the wrench 41-W-1991-17 (fig. 189).
- (2) Remove the adjusting nut lock, using diagonal-cutting pliers (fig. 172).
- (3) Remove the hub bearing inner adjusting nut, using the wrench 41-W-1991-17 (fig. 189).
- (4) Pull the hub and brake drum part way off the steering knuckle to free the outer bearing cone, remove the cone, the hub, and brake drum (fig. 173).

e. Remove Brake Support, Steering Knuckle, and Universal Drive.

- (1) Remove the bolt and gasket that secure the brake cylinder inlet connection to the wheel cylinder, and remove the flexible line and attached connector from the wheel cylinder (fig. 181).
- (2) Remove the five bolts and lockwashers that secure the brake support and steering knuckle to the steering knuckle flange. Remove the brake support (fig. 173).
- (3) If the steering knuckle cannot be removed by pulling it from the flange, temporarily install the wheel bearing adjusting nuts on the knuckle and strike the nuts with a plastic hammer to free the steering knuckle (fig. 174). Remove the knuckle, outer shaft, and female portion of the universal joint. Separate the parts.

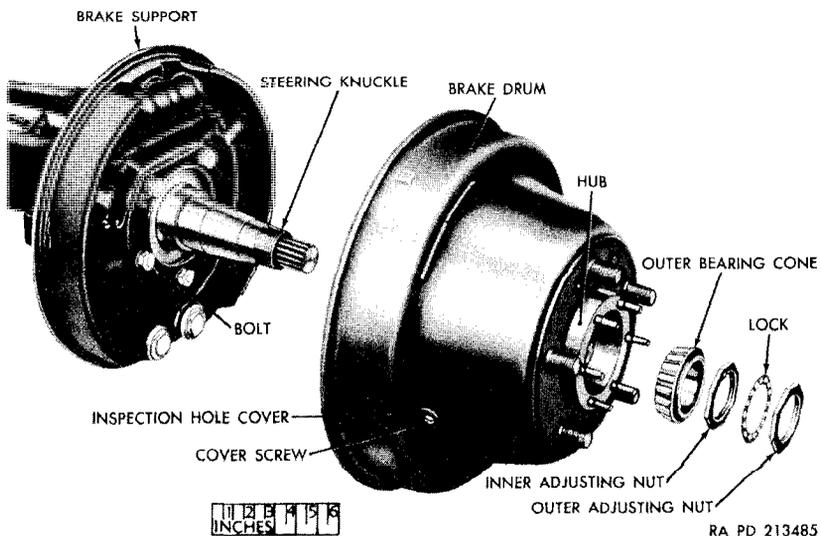


Figure 173. Front wheel hub and drum and related parts—exploded view.

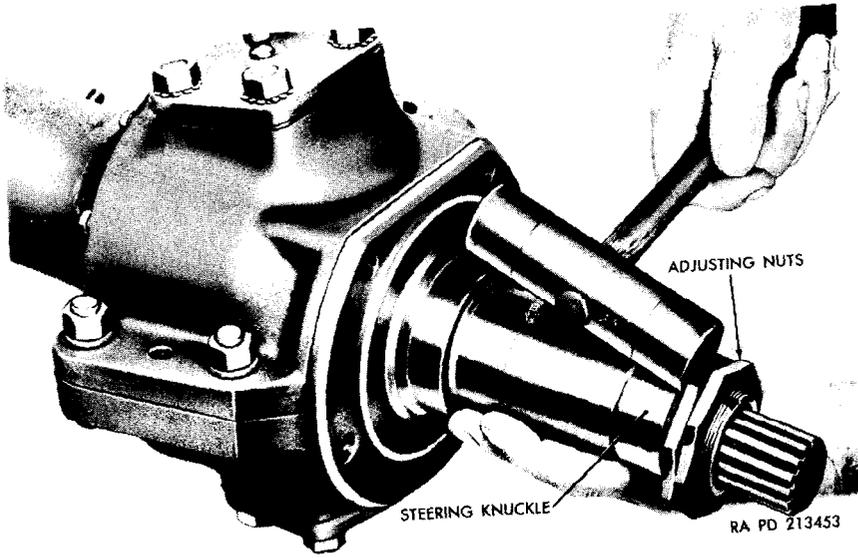


Figure 174. Removing steering knuckle.

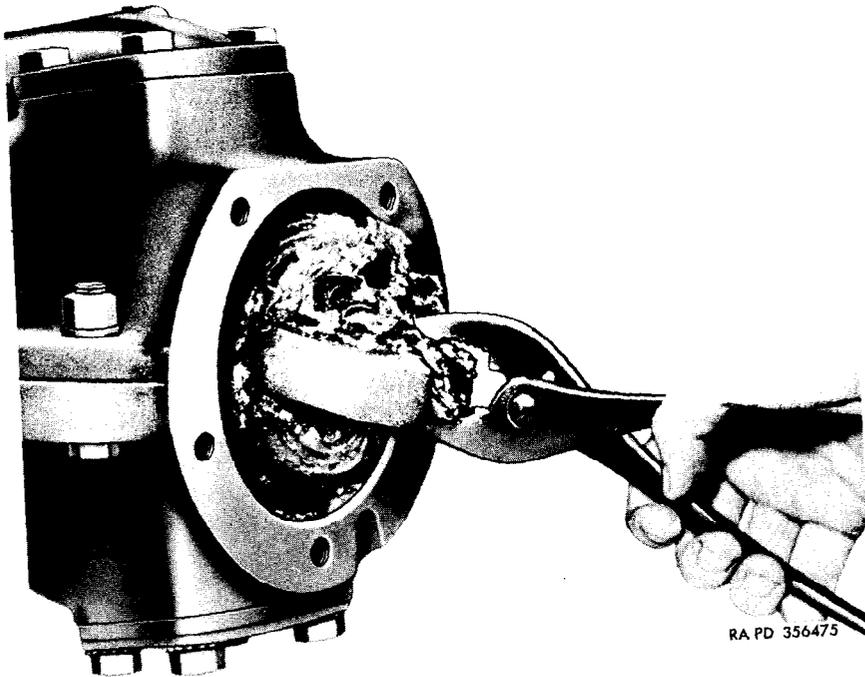
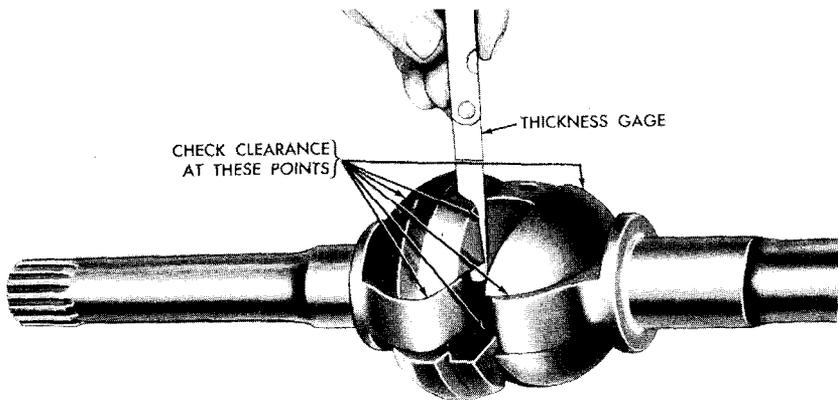


Figure 175. Removing inner shaft.



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Figure 176. Checking universal drive parts for wear.

- (4) Remove the male portion of the universal joint and the inner shaft (fig. 175). Separate the parts.

f. Cleaning and Inspection.

- (1) Inspect the lubricant in the steering knuckle flange for evidence of differential lubricant. Differential lubricant in the flange indicates leakage past the drive shaft oil seal. Notify ordnance maintenance personnel.
- (2) Clean the parts in dry-cleaning solvent or volatile mineral spirits and clean the inside of the bearing flange.
- (3) Inspect the splined surfaces of the inner and outer shafts for cracks, abrasions, or chipping. Check the shafts for distortion or damaged bearing surfaces.
- (4) Inspect the universal joint parts for cracks, chipping, or scoring.
- (5) Assemble the shafts and universal joint and check for clearance between parts as shown in figure 176. If clearance at any of the checking points exceeds 0.007 inch, replace the shaft assembly.
- (6) Inspect the steering knuckle for damaged threads, distortion, or scored or damaged bearing surfaces. Replace a damaged steering knuckle.
- (7) Inspect the brake support and brake line connection (par. 220).
- (8) Inspect the hub and bearings (par. 228*d*) and the brakedrum (par. 220*e*).

206. Steering Knuckle and Universal Drive Installation

a. Install Universal Drive, Steering Knuckle, and Brake Support (fig. 177).

- (1) Apply a coating of automotive and artillery lubricating grease to the parts and inside the bearing flange.

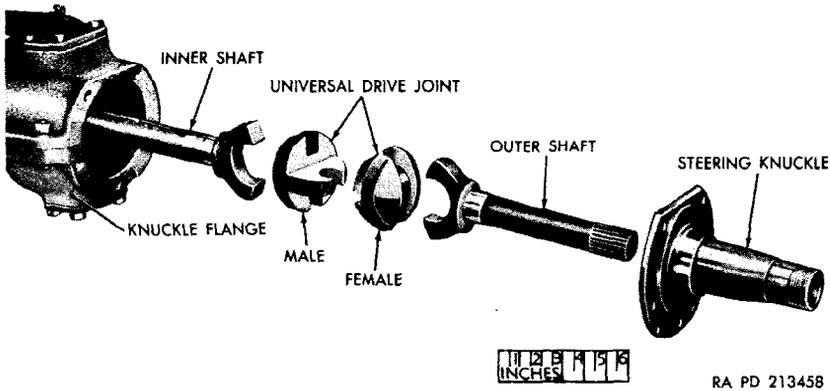


Figure 177. Steering knuckle and universal drive—exploded view.

- (2) Fit the male half of the universal drive joint on the inner shaft and insert the shaft into the axle housing, engaging the splined end of the shaft in the differential gear.
 - (3) Fit the female half of the universal drive joint on the outer shaft and insert the shaft through the steering knuckle. Engage the female half of the universal drive joint with the male half and position the steering knuckle on the knuckle flange (flat side up), aligning the bolt holes. Tap the steering knuckle into place with a plastic hammer.
 - (4) Position the brake support over the steering knuckle (fig. 173), aligning the bolt holes in the support with those in the knuckle and flange. Install the five $\frac{1}{2}$ -inch lockwashers and $\frac{1}{2}$ -13NC x $1\frac{1}{2}$ bolts. Tighten the bolts to 80–85 pound-feet torque.
 - (5) Clean the contacting surfaces of the brake line inlet connection and the wheel cylinder, and position the connection on the cylinder. Install the bolt gasket and the bolt. Tighten the bolt.
- b. *Install Hub and Drum* (fig. 173).
- (1) Apply a light film of grease to the inside of the hub and the steering knuckle to prevent rust.
 - (2) Install the assembled hub and brake drum on the steering knuckle.
 - (3) Lubricate the outer bearing cone with automotive and artillery grease, using a roller bearing lubricator or kneading the grease into the bearing with the fingers. Do not over-lubricate. Install the cone on the steering knuckle, and install the inner bearing adjusting nut with the lock pin toward the outside. Screw the nut on the steering knuckle, using the

wrench — 41-W-1991-17 (fig. 189), but do not tighten.

- (4) Install the wheel and tire (par. 227b).
 - (5) Adjust the hub bearings (par. 226).
- c. *Install Drive Flange* (fig. 171).
- (1) Coat both sides of a new drive flange gasket with liquid-type gasket cement and install the gasket over the drive flange studs.
 - (2) Position the drive flange on the hub, matching the punch marks on the flange and hub (par. 205c(1)). Install the six $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -24NF nuts. Tighten the nuts to 30–35 pound-feet torque. Install the nut on each of the two puller screws, install the screws in the flange, and tighten the nuts.
- d. *Lubricate.* Lubricate the universal drive and the steering knuckle flange bearings. Refer to lubrication order (figs. 33 and 34).
- e. *Bleed the Brakes.* Refer to paragraph 216.

207. Air Vent, and Filler and Drain Plugs

a. *Air Vent.*

- (1) The air vent (F, fig. 178) protects the axle against excessive pressure build-up and prevents water or dirt from entering the axle housing. The vent must operate properly to prevent failure of oil seals and contamination of the lubricant.
- (2) At each inspection, or as often as necessary, remove the vent from the housing and clean in dry-cleaning solvent or volatile mineral spirits. Dry with compressed air and inspect for restriction of the air passage and faulty operation.
- (3) Install the air vent, replacing it with a new one, if necessary. Screw the vent into the housing.

b. *Filler Plug.* The filler plug (EE, fig. 38) is a $\frac{3}{4}$ -inch pipe plug. Check the filler plug each time the axle is serviced, and replace if necessary. No gasket is required.

c. *Drain Plug.* The drain plug (E, fig. 35) is a special plug. A $\frac{7}{8}$ -inch annular gasket is used with the drain plug. Check the plug and gasket each time the axle is serviced, and replace if necessary.

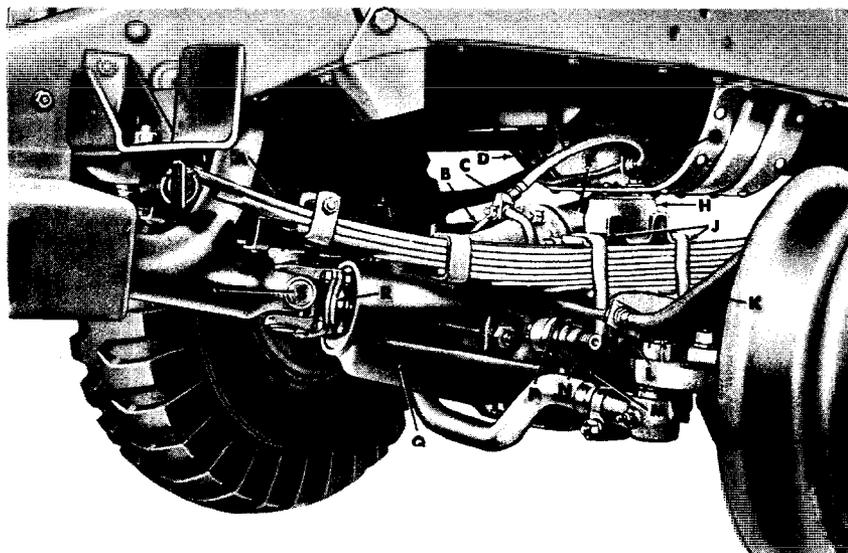
208. Front Axle

a. *Coordination with Ordnance Maintenance Unit.* Replacement of the front axle is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement axle and necessary tools may be obtained from the supporting ordnance maintenance unit.

b. *Removal.*

Note. The key letters noted in parentheses are in figure 178.

- (1) Apply the handbrake and block the rear wheels.
- (2) Place a jack under each frame side rail to the rear of the front axle, and raise the frame sufficiently to relieve the load on the front springs.
- (3) Remove the cotter pin and slotted nut that secure the lower end of the right front shock absorber, and remove the bearing retainer and shock absorber with bearings from the shock absorber stud (N) in the right spring clip U-bolt plate (M).
- (4) Remove the four nuts, lockwashers, and bolts that secure the front propeller shaft (S) to the differential carrier companion flange (R). Secure the propeller shaft to keep it off the floor.
- (5) Disconnect the brake flexible line (E) at the brake line bracket (G) on the frame front crossmember.
- (6) Disconnect the drag link from the steering knuckle arm (par. 235).
- (7) Remove the nuts and lockwashers from the four spring clips (J). Remove the clips and axle bumpers (H) from above the axle, and swing the left spring clip plate with attached shock absorber toward the rear.



KEY	ITEM
A	FRONT SPRING
B	LEFT BRAKE LINE
C	BRAKE LINE TEE
D	BRAKE LINE (FRAME TEE-TO-FRONT FLEXIBLE LINE)
E	BRAKE FLEXIBLE LINE (FRONT)
F	AIR VENT
G	BRAKE LINE BRACKET (FRAME)
H	AXLE BUMPER
J	SPRING CLIPS

KEY	ITEM
K	BRAKE FLEXIBLE LINE (TO WHEEL)
L	BRAKE LINE BRACKET (AXLE)
M	SPRING CLIP PLATE
N	SHOCK ABSORBER STUD
P	RIGHT BRAKE LINE
Q	DIFFERENTIAL CARRIER
R	COMPANION FLANGE
S	FRONT PROPELLER SHAFT

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Figure 178. Removal or installation of front axle.

- (8) Remove the axle.
- (9) Support the axle and remove the two wheels and tires (par. 227a).
- (10) Remove the brake flexible line (E) from the brake line tee (C) on the differential carrier and discard if unfit for further service.

c. Installation.

- (1) Install the brake flexible line (E) in the brake line tee (C) on the differential carrier (Q) and tighten.
- (2) Install wheels (par. 227b).
- (3) Position a front axle bumper (H) over the center bolt of each front spring (A) (offset toward center of vehicle), and install the two spring clips U-bolts (J) for the right spring on the bumper, over the spring and axle and through the spring clip U-bolt plate (M). Position the left spring clip U-bolt plate under the axle and install the clips U-bolts.

Note. The spring clips U-bolts for the right front spring are longer than those for the left front spring. Be sure to install the correct clips U-bolts for each spring.

- (4) Install the two $\frac{9}{16}$ -inch lockwashers and spring clip U-bolt nuts on each clip U-bolt. Tighten the eight nuts to 130–140 pound-feet torque.
- (5) Attach the drag link to the steering arm (par. 235).
- (6) Connect the brake flexible line (E) at the brake line bracket (G) on the frame front crossmember.
- (7) Aline the front propeller shaft flange yoke with the companion flange (R) on the differential carrier (Q) and install the four $\frac{7}{16}$ -20NF x $1\frac{1}{8}$ bolts, $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts. Tighten the nuts to 40–50 pound-feet torque.
- (8) Attach the right shock absorber with bearings to the shock absorber stud (N) in the spring clip U-bolt plate. Install the bearing retainer and $\frac{3}{4}$ -16NF triple-slotted nut. Tighten the nut and install the $\frac{5}{32}$ x $1\frac{3}{4}$ cotter pin.
- (9) Lower the frame and remove the jacks and rear wheel blocking.
- (10) Bleed the brake system (par. 216).
- (11) Adjust the toe-in (par. 203).
- (12) Check the lubricant level of the front axle and replenish, if necessary. Refer to lubrication chart (figs. 33 and 34).

d. Record Replacement. Record the replacement of the front axle on DA Form 478.

Section XX. REAR AXLE

209. Description and Data

a. Description.

- (1) The single speed rear axle is of the full floating hypoid-type. The complete axle consists of the axle housing, differential with carrier, axle drive shaft, hubs, and service brakes.
- (2) Organizational maintenance operations include replacement of the air vent, filler and drain plugs, and the axle shafts, and emergency replacement of the axle.

b. Data.

Capacity----- 6 pt
Make----- Dodge
Ratio----- 5.83:1
Type----- full floating (hypoid)

210. Drive Shaft

a. *Removal* (fig. 179). Both drive shafts are removed in the same manner. It is not necessary to raise the rear axle.

- (1) Mark adjacent spots on the shaft flange and the hub with a center punch.

Note. This is important, as the shaft flange must be installed in the same position on the hub to prevent peeling of the studs.

- (2) Remove the nuts and lockwashers from the six drive shaft flange studs. Remove the two puller screws from the flange

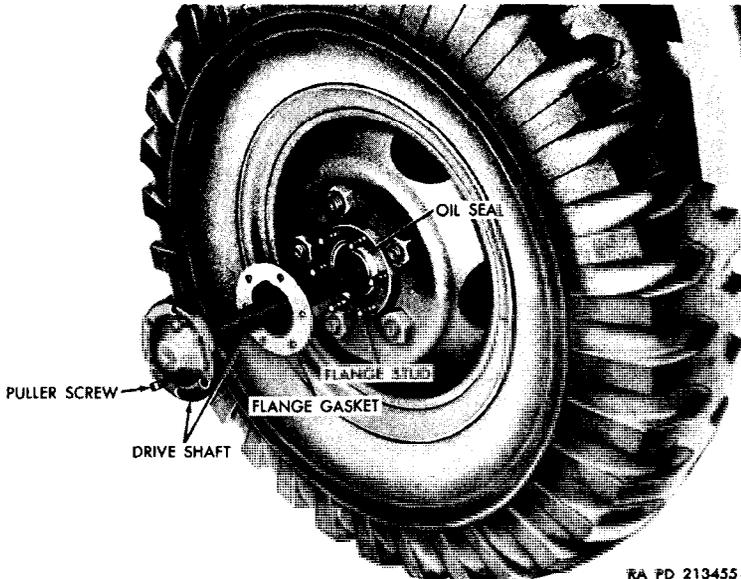


Figure 179. Rear axle drive shaft removal.

and remove the nuts. Install the screws in the flange and tighten evenly to force the flange from the hub. Pull the drive shaft from the axle housing. Remove and discard the flange gasket and remove the two puller screws from the flange.

- (3) If the drive shaft is broken and a piece of the shaft remains in the axle housing, it may be removed by snaring it with a length of wire. If the broken portion cannot be removed, replace the axle (par. 212).

b. Installation (fig. 179).

- (1) If the original shaft is to be installed, clean and inspect it for damaged splines, distortion, or damaged flange surfaces. Clean the gasket surfaces of the flange and the hub.
- (2) Apply a coating of liquid-type gasket cement to both sides of a new flange gasket, and position the gasket over the flange studs.
- (3) Install the drive shaft in the axle housing, engaging the splines in the differential gear and alining the punch marks on the flange and hub (*a*(1) above). (Disregard the punch mark on the hub when installing a new shaft.)
- (4) Install the six $\frac{3}{8}$ -inch lockwashers and $\frac{3}{8}$ -24NF nuts on the flange studs. Tighten the nuts to 30–35 pound-feet torque. Install the nuts on the two puller screws, install the screws in the flange, and tighten the nuts.

211. Air Vent and Filler and Drain Plugs

a. Replace Air Vent. The air vent (fig. 180) for the rear axle serves the same purpose as the vent in the front axle (par. 207*a*). The rear axle vent secures the brake line tee on the axle housing and is removed by unscrewing the vent nut. At each inspection, service the vent as described in paragraph 207*a*(2). When installing the vent, position the tee on the axle housing and screw the vent through the tee into the housing. Tighten the vent nut.

b. Filler and Drain Plugs. The filler plug, drain plug and gasket for the rear axle are the same as corresponding plugs for the front axle, and are serviced in the same manner (par. 207*b* and *c*).

212. Rear Axle

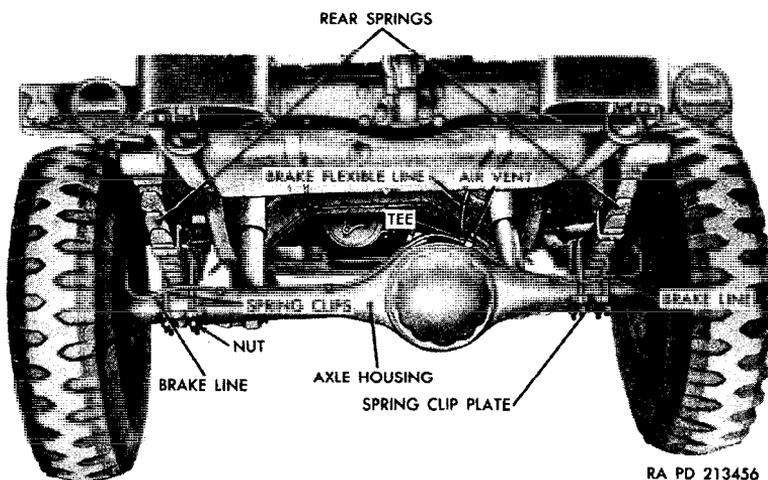
a. Coordination with Ordnance Maintenance Unit. Replacement of the rear axle is normally an ordnance maintenance operation, but may be performed in an emergency by the using organization, provided authority for performing such replacement is obtained from the responsible commander. A replacement axle may be obtained from the supporting ordnance maintenance unit.

b. Removal.

- (1) Apply the handbrake and block the front wheels of the vehicle.
- (2) Place a jack under each frame side rail ahead of the rear axle. Raise the frame sufficiently to relieve the load on the rear springs (fig. 80).
- (3) Disconnect the rear propeller shaft (R, fig. 187) at the differential carrier companion flange by removing the four nuts, lockwashers, and bolts.
- (4) Disconnect the brake flexible line at the bracket attached to the fuel tank support frame crossmember (H, fig. 187).
- (5) Remove the nuts and lockwashers from the four spring clips. Remove the clips, U-bolts, and the two clip U-bolt seats. Swing the two spring clip U-bolt plates, with attached shock absorbers, forward.
- (6) Remove the axle.
- (7) Support the axle on jacks or blocking.
- (8) Remove both wheels and tires (par. 227a).
- (9) Remove the brake flexible line (M, fig. 187) from the tee on the differential carrier and discard, if unfit for further service.

c. Installation.

- (1) Install the brake flexible line (fig. 180) in the tee on the differential carrier and tighten.
- (2) Install the two wheels and tires (par. 227).
- (3) With the frame raised (*b*(2) above), position the axle under the rear springs, with the spring center bolts in the recesses of the seats in the axle housing.



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Figure 180. Removal or installation of rear axle.

- (4) Position a spring clip U-bolt seat over each rear spring, fitting the opening over the spring center bolt.
- (5) Swing the spring clip U-bolt plates, with attached shock absorbers, toward the rear and fit each plate on the axle housing directly below the spring. Hold the parts in position and install the two spring clips U-bolt for each rear spring.

Note. Be careful not to damage the brake lines when installing the clips. Make certain that the lines are to the rear of the clips U-bolt.
- (6) Install the two $\frac{9}{16}$ -inch lockwashers and nuts for each spring clip U-bolt. Tighten all spring clip U-bolt nuts to 130–140 pound-feet torque.
- (7) Connect the brake flexible line at the bracket attached to the fuel tank support cross member.
- (8) Aline the rear propeller shaft (R, fig. 187) flange yoke with the companion flange on the differential carrier and install the four $\frac{7}{16}$ -20NF x $1\frac{1}{8}$ bolts, $\frac{7}{16}$ -inch lockwashers, and $\frac{7}{16}$ -20NF nuts. Tighten the nuts to 40–50 pound-feet torque.
- (9) Lower the frame, and remove the jacks and front wheel blocking.
- (10) Bleed the brake system (par. 216).
- (11) Check lubricant level of rear axle and replenish if necessary. Refer to lubrication chart (figs. 33 and 34).

d. Record Replacement. Record the replacement of the rear axle on DA Form 478.

Section XXI. BRAKES

213. Description and Data

a. Description.

- (1) Hydraulic service brakes with expanding brakeshoes are used at all four wheels. The brake pedal in the driver's compartment actuates the master cylinder, which operates the four wheel cylinders to apply the brakes.
- (2) Brake linings, when new, are tapered so they are thicker at the center than at the ends. This necessitates different major adjustment procedures for new and worn linings (par. 218).
- (3) Organizational maintenance operations for service brakes include replenishing brake fluid, adjustment of the brake pedal, bleeding brake systems, minor brake adjustment, major brake adjustment, replacement of the master cylinder, wheel cylinders, brakeshoes, lines, and fittings.
- (4) The handbrake lever (S, fig. 12) is connected to a control rod which operates a contracting brake band on the rear of the transfer.
- (5) Organizational maintenance operations for the handbrake

include adjustment of the brake hand and control rod and replacement of the brake lever, control rod, and brake band.

b. Data.

Hand brake:

Clearance adjustment..... 0.008 to 0.010 in.

Lever location..... right side of transmission

Lining:

Dimensions..... 2 x 24 x $\frac{1}{4}$ in.

Material..... woven asbestos

Method of attaching..... rivets

Service brakes:

Linings:

Dimensions..... $1\frac{3}{4}$ x 15 x $\frac{1}{4}$ in.

Make..... Thermoid

Method of attaching..... bonded

Type..... tapered woven and molded

Make..... Dodge

Master cylinder bore..... $1\frac{1}{4}$ in.

Pedal free travel..... $\frac{3}{4}$ to 1 in.

Type..... single cylinder

Wheel cylinder bore:

Front shoe (all)..... $1\frac{1}{4}$ in.

Rear shoe (all)..... $1\frac{3}{8}$ in.

214. Service Brake Minor Adjustment

a. General. Minor adjustment of service brakes may be necessary to compensate for normal wear of brake linings. This adjustment is made by turning the two cam adjusters on each wheel (*b* below). Before adjusting the brakes, be sure that the pedal free travel is correct (par. 217) and that wheel bearings are in good condition and properly adjusted (par. 226). Brakedrums must be cool for proper adjustment.

b. Procedure.

- (1) Place the vehicle on a level floor and release the handbrake lever (S, fig. 12). Place transmission gearshift lever (W, fig. 12) in neutral position. Disengage the front axle (fig. 26).
- (2) Jack up the wheel of the brake to be adjusted until the tire is off the floor and block the other wheels.
- (3) Turn one brakeshoe cam adjuster in the direction shown in figure 181 to decrease the clearance between the lining and the drum. Rotate the wheel and turn the cam adjuster until a noticeable drag is felt. Repeat this operation on the other cam adjuster.
- (4) Repeat operation (3) above on both brakeshoe cam adjusters of the other three wheels.

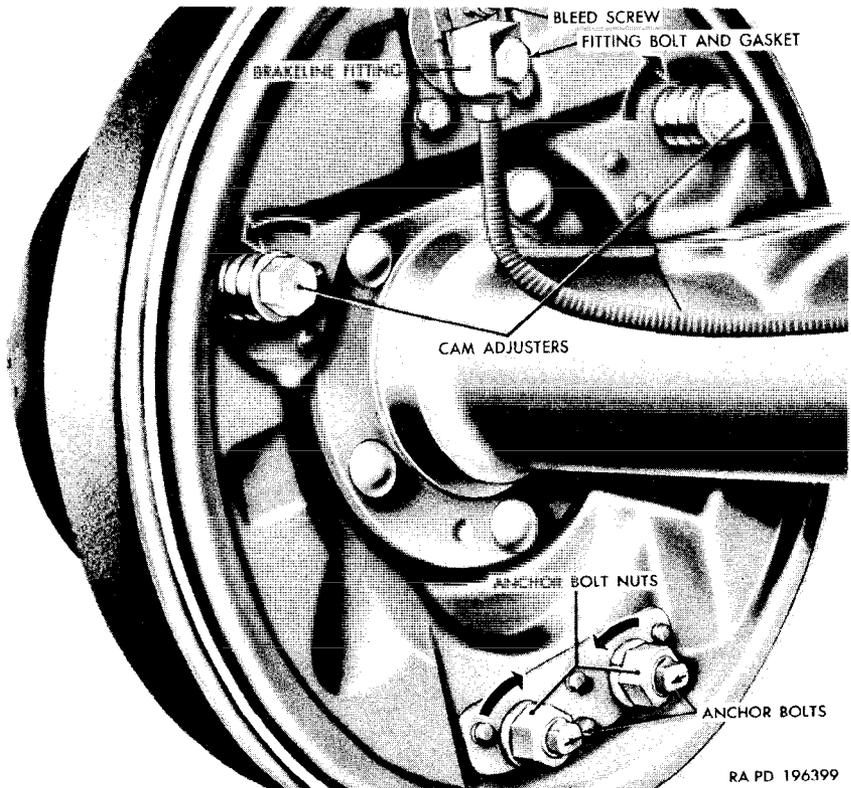


Figure 181. Brakeshoe cam adjusters and anchor bolts.

215. Replenishing Brake Fluid

a. General. If the brake fluid is low in the master cylinder, it may be an indication of an external leak in the brake system. Inspect the master cylinder, brake lines, fittings, and brake support plates (brakeshoe cam adjuster side) for evidence of brake fluid leakage. Replace parts, as required, to correct leakage.

b. Procedure.

- (1) Turn the master cylinder access cover studs 90 degrees counterclockwise and remove the cover from the floor panel in the driver's compartment (fig. 182).
- (2) Clean the top of the master cylinder and remove the master cylinder filler plug.
- (3) Fill the master cylinder with brake fluid until the fluid level is three-fourths of an inch below the top of the filler plug opening.
- (4) Install the filler plug.
- (5) Install the master cylinder access cover and turn the cover studs 90° clockwise.

216. Bleeding Brake System

a. General. Bleeding of the hydraulic brake system is necessary when wheel cylinders or brake lines have been replaced or whenever any part of the system has been disconnected. A hydraulic brake pressure filler is available for this operation (*b* below). However, the system may be bled in an emergency without use of the pressure filler (*c* below).

b. Bleed Brake System, Using Pressure Filler (fig. 182).

- (1) Remove the master cylinder access cover (par. 215*b*(1)). Close the master cylinder vent line shutoff cock. Clean top of master cylinder and remove the filler plug.

Note. Make certain the pressure filler contains an adequate amount of brake fluid.

- (2) Connect the filler hose to the top of the tank. Close the filler hose shutoff cock.
- (3) Connect a compressed air hose to the air valve in the top of the tank and charge the tank to a minimum of 25 psi as indicated on the pressure gage.
- (4) Insert the end of the filler hose in the master cylinder filler opening, and open the filler hose shutoff cock just enough to fill the master cylinder to the top. Close the filler hose shutoff cock.
- (5) Remove the filler hose from the master cylinder and install the proper adapter in the filler opening. Connect the filler hose to the adapter in the master cylinder.
- (6) Before tightening the hose connection in the adapter, open the filler hose shutoff cock slightly. When the fluid flowing from the loose connection is free from air bubbles close the filler hose shutoff cock. Tighten the connection and open the filler hose shutoff cock fully. Note the reading on the pressure gage. The gage reading should be maintained at approximately 25 psi.
- (7) Attach bleeder hose to the bleeder screw (fig. 181) of the right rear wheel cylinder. Submerge the free end of the bleeder hose in a glass receptacle containing a small amount of brake fluid. Open the bleeder screw and allow fluid to flow into the receptacle until the fluid is entirely free from air bubbles. Close the bleeder screw and remove the bleeder hose.
- (8) Bleed the left rear, right front, and left front wheel cylinders in that order, following the procedure in (7) above. When the left front wheel cylinder has been bled and while the bleeder hose is still attached to the bleeder screw (screw open), close the filler hose shutoff cock and remove the hose from the adapter in the master cylinder. Depress the brake pedal and hold it down while closing the bleeder screw at the

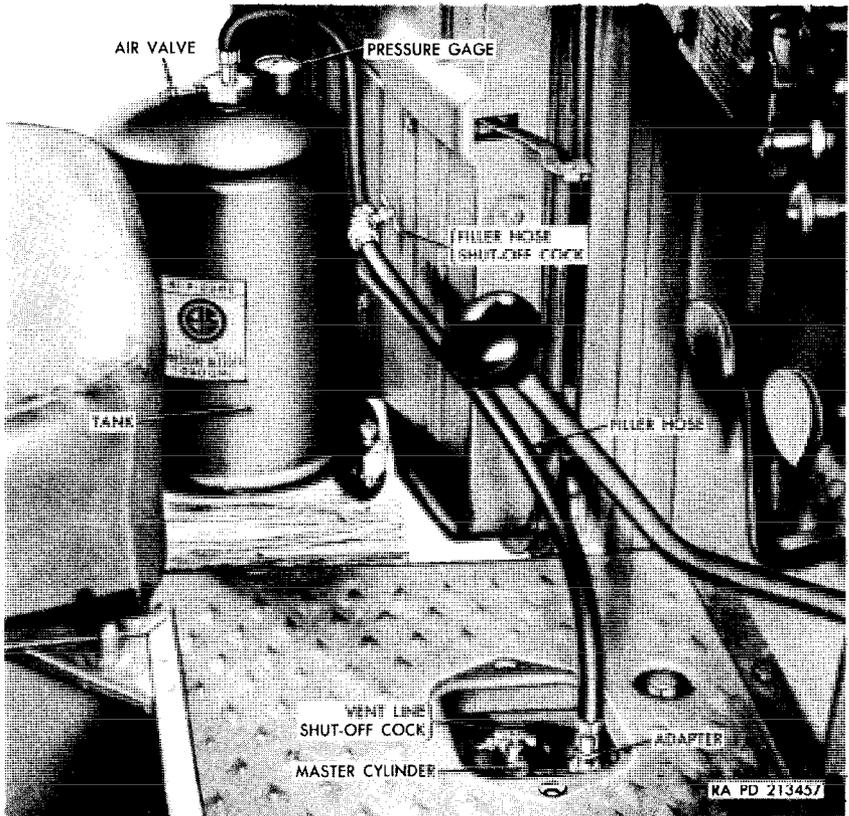


Figure 182. Pressure filler connected to master cylinder.

left front wheel cylinder. Release the brake pedal and remove the bleeder hose.

- (9) Remove the adapter from the master cylinder and install the filler plug. Open the vent line shutoff cock.
- (10) Install the master cylinder access cover and turn the two studs clockwise 90°.

c. Bleed Brake System, Without Pressure Filler.

- (1) Fill the master cylinder as in paragraph 215b(1), (2), and (3).
- (2) Connect the bleeder hose to the bleeder screw (fig. 181) at the right rear wheel cylinder. Submerge the free end of the bleeder hose in a glass receptacle containing a small amount of brake fluid. Open the bleeder screw.
- (3) Depress the brake pedal slowly about halfway and allow the pedal to return to the released position. Refill the master cylinder, as necessary, to maintain the fluid level. Repeat this procedure until the fluid flowing from the bleeder hose is clear and free from bubbles.

- (4) Close the bleeder screw and remove the bleeder hose.
- (5) Bleed the left rear, right front, and left front wheel cylinders in that order, following the procedure in (3) and (4) above for each wheel.
- (6) Fill the master cylinder, if necessary, to bring the fluid level to three-fourths of an inch below the top of the filler plug opening.
- (7) Install the filler plug.
- (8) Install the master cylinder access cover and turn the two studs 90° clockwise.

217. Brake Pedal Adjustment

a. Measure Free Travel of Pedal. Depress the brake pedal by hand until resistance is felt, release the pedal, and note the distance the pedal travels. Correct free travel is $\frac{3}{4}$ to 1 inch. If the free travel is not within these limits, adjust the pedal rod (*b* below).

b. Adjust Pedal Rod (fig. 156). Loosen the locknut on the pedal rod, detach the pedal rod from the brake pedal by removing the cotter pin and clevis pin. Turn the pedal rod in or out of the push rod as required to establish correct pedal travel (*a* above). Turning the pedal rod in increases pedal travel, and turning it out decreases the pedal travel. Turn the locknut up tight against the push rod after completing the adjustment. Aline the pedal rod with the brake pedal and install the clevis pin and $\frac{1}{8} \times \frac{7}{8}$ cotter pin.

218. Service Brake Major Adjustment

a. General.

- (1) A major brake adjustment is necessary when new brakeshoes are installed or when the linings have worn to the degree that they are no longer tapered.
- (2) For new shoes or linings, perform the major brake adjustment as in *b* below. For linings that are slightly worn, perform the major brake adjustment as in *c* below.

b. Adjust Brakes With New Linings.

Note. Check the wheel bearing adjustment for all wheels before adjusting the brakes. Adjust if necessary (par. 226).

- (1) Place the vehicle on a level floor, release the handbrake, place the transmission gearshift lever in neutral and disengage the front axle.
- (2) Jack up one of the wheels and block the other wheels to prevent the vehicle from rolling off the jack. Remove the wheel and tire.
- (3) Remove the screw that secures the drum inspection hole cover and remove the cover.

- (4) Loosen the anchor bolt nuts (fig. 181) and turn both anchor bolts to the fully released position (flats on the same horizontal plane and the arrows or punch marks toward each other).
- (5) Rotate the drum until the inspection hole is opposite the top (toe) of the front shoe and note the clearance between the lining and the drum.
- (6) Rotate the drum until the inspection hole is opposite the bottom (heel) of the front shoe and note the clearance at this point.
- (7) Adjust the cam adjuster and the anchor bolt alternately in the directions indicated in figure 181 until clearance is equalized at toe and heel and the center of the lining is in contact with the drum, resulting in a decided drag at this point.
- (8) Hold the anchor bolt and tighten the anchor bolt nuts to 90-110 pound-feet torque after completing the adjustment.
- (9) Adjust the rear shoe in the same manner ((5) through (8) above). Position the inspection hole cover and install the $\frac{1}{4}$ -20NC x $\frac{3}{8}$ tapping screw. Install the wheel and tire (par. 227b), and remove the jack and blocking.
- (10) Adjust the other three brakes in the same manner.

c. Adjust Brakes with Worn Linings (No Taper).

- (1) Perform the preliminary operations as in b(1) through (4) above.
- (2) Turn the cam adjusters so that a 0.006-inch feeler gage is a snug fit between the upper end (toe) of each brakeshoe lining and drum.
- (3) Turn the anchor bolts in the direction indicated in figure 181 to decrease the clearance between the lower and (heel) of the brakeshoe lining and the drum to 0.006 inch. This will cause the brakeshoe to move down and out, increasing the clearance at the toe of the lining to approximately 0.012 inch, resulting in proper centralization of the brakeshoe.
- (4) Hold the anchor bolts and tighten both anchor bolt nuts to 90-110 pound-feet torque after completing the adjustment.
- (5) If pedal travel is too great after the adjustments have been completed, decrease the clearance between the toe of the lining and the drum (par. 214b(3)).
- (6) Position the inspection hole cover and install the $\frac{1}{4}$ -20NC x $\frac{3}{8}$ tapping screw.
- (7) Install the wheel and tire (par. 227b) and remove the jack and blocking.
- (8) Adjust the other three brakes in the same manner.

219. Handbrake Adjustments

a. Adjust Handbrake Band (fig. 183).

- (1) Place the vehicle on a level floor and place the handbrake in the fully released position.
- (2) Remove the cotter pin and clevis pin that attach the control rod to the cam levers.
- (3) Remove the locking wire from the anchor screw.
- (4) Loosen the two jamnuts on the adjusting J-bolt and the two jamnuts on the adjusting screw.
- (5) Insert a 0.015-inch thickness gage between the brake lining and the drum at the anchor clip (point A). Turn the anchor screw as required until slight friction is felt as the gage is withdrawn.
- (6) Insert the thickness gage at point B and turn the upper nut on the adjusting J-bolt as required to establish the same clearance as at point A.
- (7) Insert the thickness gage at point C, hold the adjusting screw, and turn the lower nut on the adjusting screw as required to establish the same clearance as at points A and B.
- (8) Check the clearance between the lining and the drum at several points. Clearance should be approximately 0.015 inch at all points.
- (9) When the adjustment has been completed, tighten the jamnuts on the adjusting J-bolt and the adjusting screw. Secure the anchor screw with locking wire, attaching the wire to the

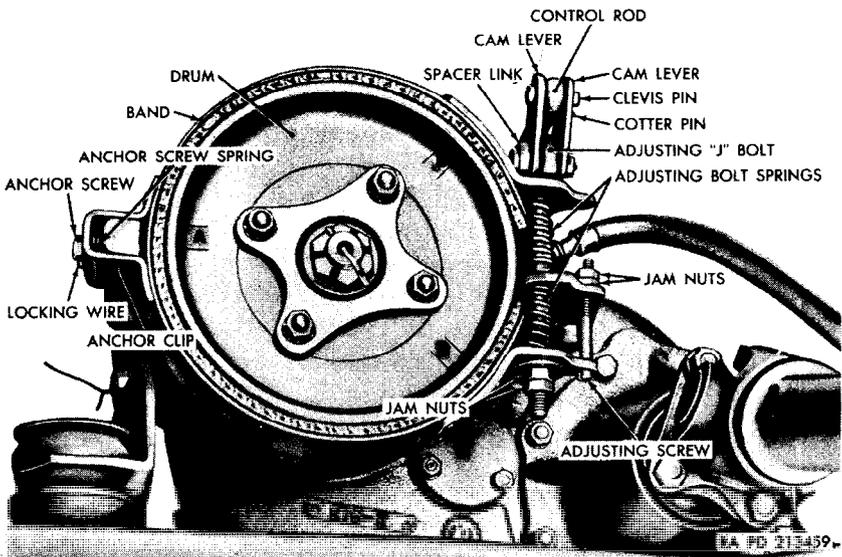


Figure 183. Handbrake band adjustment.

bracket in such a manner that it will not interfere with the anchor screw spring.

- (10) Adjust the handbrake control rod (*b* below) before connecting it to the cam levers.

b. Adjust Handbrake Control Rod.

- (1) With the brake control rod detached from the cam levers (*a*(2) above), loosen the nut at the yoke end of the brake control rod (G, fig. 162) and turn the rod in the yoke until the eye of the rod is in alinement with the clevis pin holes in the two cam levers (fig. 183).
- (2) Attach the control rod to the cam levers with the clevis pin and $\frac{5}{32} \times 1$ cotter pin.
- (3) Tighten the nut against the yoke.

Note. With the brake band and control rod properly adjusted, the pawl should be engaged in the third to fifth notch of the sector for full application of the brake.

220. Brakeshoe and Wheel Cylinder

a. General. Front and rear brakeshoes for all wheels are identical and hence interchangeable. Wheel cylinders are marked "L" or "R" for left or right wheels, respectively, and must be installed accordingly. When brakeshoes for one of the front or rear wheels require replacement, replace the brakeshoes for the other front or rear wheel

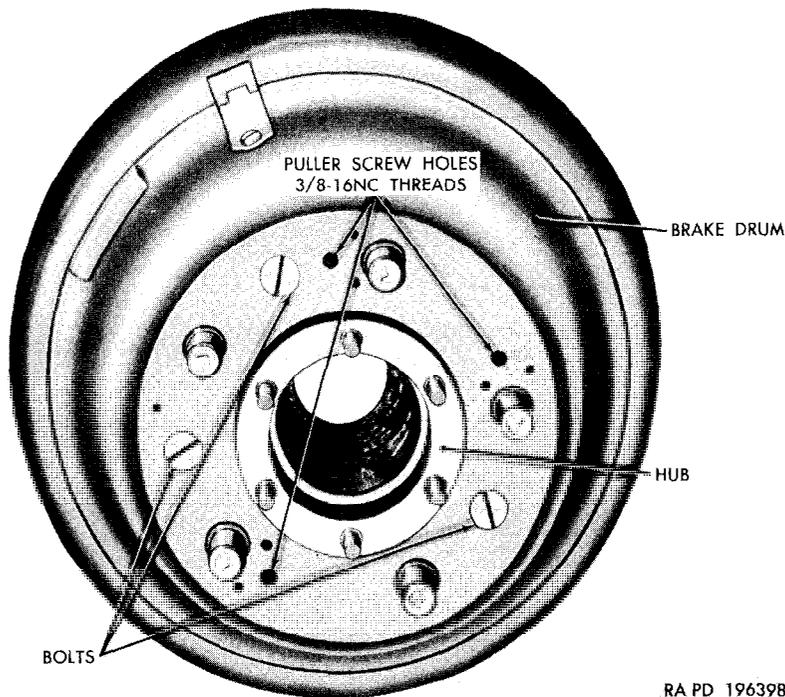


Figure 184. Brakedrum and hub.

at the same time to insure proper equalization of the brakes. Procedure is the same for all wheels.

b. Remove Brakedrum.

- (1) Remove the wheel and tire (par. 227a).
- (2) Remove the three bolts that secure the brakedrum to the hub (fig. 184), using a broad-bladed screwdriver. If the bolts are corroded, strike the screwdriver with a hammer to shock each bolt, being careful not to damage the bolt slots.
- (3) Install a $\frac{3}{8}$ -16NC x $1\frac{1}{2}$ bolt in each of the three puller screw holes in the drum and turn the three bolts in evenly to force the drum from the hub. If the drum is corroded, strike the puller bolts with a hammer as they are tightened to free the drum from the hub. Remove the drum and remove the three puller bolts.

c. Remove Brakeshoes.

- (1) Remove the brakeshoe return spring, using brake spring pliers (fig. 185).

Note. Insert a tough rubber pad between the pliers and the brake lining to prevent damaging the lining.

- (2) Place a wheel cylinder clamp over the ends of the wheel cylinder to hold the parts in place when the shoe is removed.
- (3) Remove the nut and lockwasher that secures each anchor bolt (fig. 181) and remove the two anchor bolts, with assembled C-washers, oil washers, and oil washer retainers.

Note. While the brakeshoes can be removed from the anchor bolts by removing the C-washers, it is advisable to remove the anchor bolts as described above, as they must be cleaned and lubricated each time the brakeshoes are replaced.

Release the shoes from the guide springs and wheel cylinder (fig. 185) and remove the shoes.

d. Remove Wheel Cylinder (fig. 185).

- (1) Remove the wheel cylinder inlet fitting bolt and gasket (fig. 181).
- (2) Remove the two-wheel cylinder bolts and lockwashers (fig. 181), and remove the wheel cylinder.

e. Inspection.

- (1) Inspect the brakedrum for cracks, distortion, wear, or scoring. Replace the drum, if necessary.
- (2) Inspect the brakeshoe return spring for cracks, distortion, or weakness. Replace the spring, if necessary.
- (3) Inspect the anchor bolts for wear, corrosion, damaged threads, or distortion. Inspect the C-washers and the oil washers and retainers for damage. Remove minor corrosion

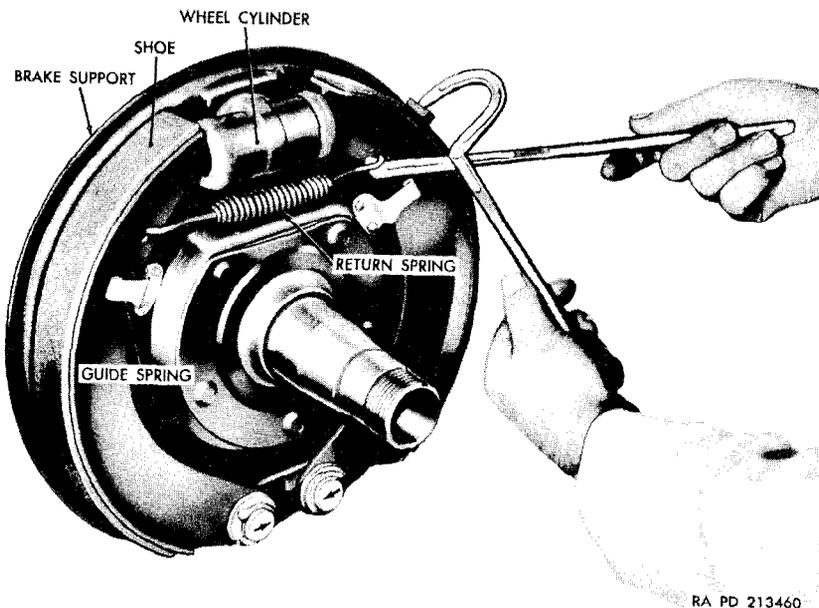


Figure 185. Removing brakeshoe return spring.

or abrasions from the anchor bolts with crocus cloth. Replace damaged anchor bolts or related parts.

- (4) Inspect the inlet fitting on the brake line. If the fitting is damaged, remove it.

f. Install Wheel Cylinder.

- (1) If the inlet fitting was removed (*e*(4) above), install a new fitting on the brake line.
- (2) Position the cylinder on the brake support (fig. 185), being sure to use the correct cylinder (*a* above). Install the two $\frac{5}{16}$ -inch lockwashers and $\frac{5}{16}$ -18NC x $\frac{5}{8}$ bolts from the rear side of the brake support (fig. 185). Tighten the two bolts.
- (3) Position the inlet fitting on the wheel cylinder and install the gasket and bolt. Tighten the bolt.

g. Install Brakeshoes.

- (1) Apply a film of lubricant on the brakeshoe cams and inner sides of the guide springs. Position the two brakeshoes on the support plate with each shoe engaged in the guide spring (fig. 185) and the upper ends of the shoes in the boots at each end of the wheel cylinder.
- (2) If the C-washers and oil washers were removed from the anchor bolts (*e*(3) above), install a new C-washer on each bolt. Apply a film of lubricant to the anchor bolts and install an oil washer retainer and oil washer on each bolt.

- (3) Install the two anchor bolts from the brakeshoe side and install a $\frac{5}{8}$ -inch lockwasher and $\frac{5}{8}$ -18NF nut on each anchor bolt. Position the anchor bolts so the arrows or punch marks are toward each other (fig. 181) and tighten the nuts fingertight.
- (4) Engage one end of the brakshoe return spring in the hole in one of the brakeshoes and engage the other end in the opposite hole, using brake spring pliers and a rubber pad (fig. 185).
- (5) Remove the wheel cylinder clamp.

h. Install Brakedrum.

- (1) Apply a coating of water pump grease to the contacting surfaces of the brakedrum and the hub to prevent corrosion and to facilitate future removal.
- (2) Position the drum on the hub, alining the bolt holes. Install the three $\frac{3}{8}$ -16NC x $\frac{7}{8}$ flathead bolts (fig. 184). Tighten the bolts evenly.

i. Perform a Major Brake Adjustment. Refer to paragraph 218b.

j. Install the Wheel and Tire. Refer to paragraph 227.

k. Bleed the brake system. Refer to paragraph 216.

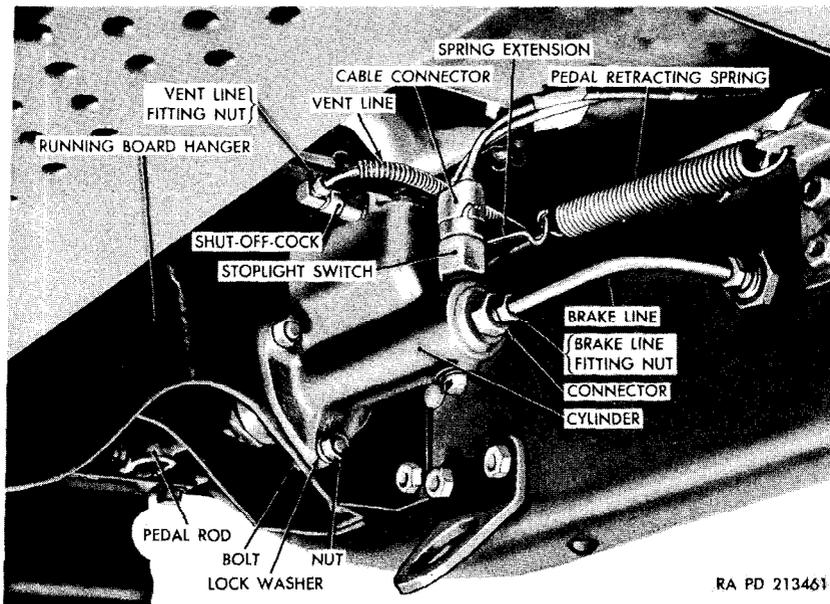
221. Brake Master Cylinder

a. Removal.

- (1) Disconnect the cable connector (fig. 186) from the stop light.
- (2) Unscrew the vent line fitting nut from the elbow in the shutoff cock.
- (3) Unscrew the brake line fitting nuts from the connector in the master cylinder and frame. Detach the brake line.
- (4) Remove the cotter pin and clevis pin that attach the pedal rod to the brake pedal (fig. 156).
- (5) Remove the three nuts, lockwashers, and bolts securing the master cylinder to the left running board hanger and pull the master cylinder out through the hanger.
- (6) Remove the stop light switch, the vent line shutoff cock and attached elbow, and the brake line connector. Unscrew the brake rod from the push rod. Remove the nut from the pedal rod if either part requires replacement.

b. Installation.

- (1) Install the inverted flared tube connector (fig. 186) in the rear of the master cylinder. Tighten the connector.
- (2) Install the vent line shutoff cock with attached elbow in the master cylinder cover. Tighten the shutoff cock.
- (3) Install the stop light switch.
- (4) Position the master cylinder on the left running board front hanger and install the three $\frac{3}{8}$ -24NF x $1\frac{1}{4}$ bolts, $\frac{3}{8}$ -inch lockwashers, and $\frac{3}{8}$ -24NF nuts. Tighten the nuts evenly.



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Figure 186. Brake master cylinder installed.

- (5) Install the $\frac{1}{2}$ -20NF nut on the pedal rod and screw the pedal rod into the master cylinder push rod (fig. 156). Connect the pedal rod to the brake pedal with the clevis pin. Do not install the $\frac{1}{8}$ x $\frac{7}{8}$ cotter pin until the brake pedal free travel has been adjusted ((10) below).
- (6) Connect the brake line to the master cylinder and frame, screwing the fitting nuts into the connectors.
- (7) Connect the vent line to the elbow in the vent line shutoff cock, screwing the fitting nut to the elbow.
- (8) Connect the cable connector to the stop light switch.
- (9) Fill the master cylinder with hydraulic brake fluid and bleed the brake system (par. 216).
- (10) Adjust the brake pedal free travel (par. 217).

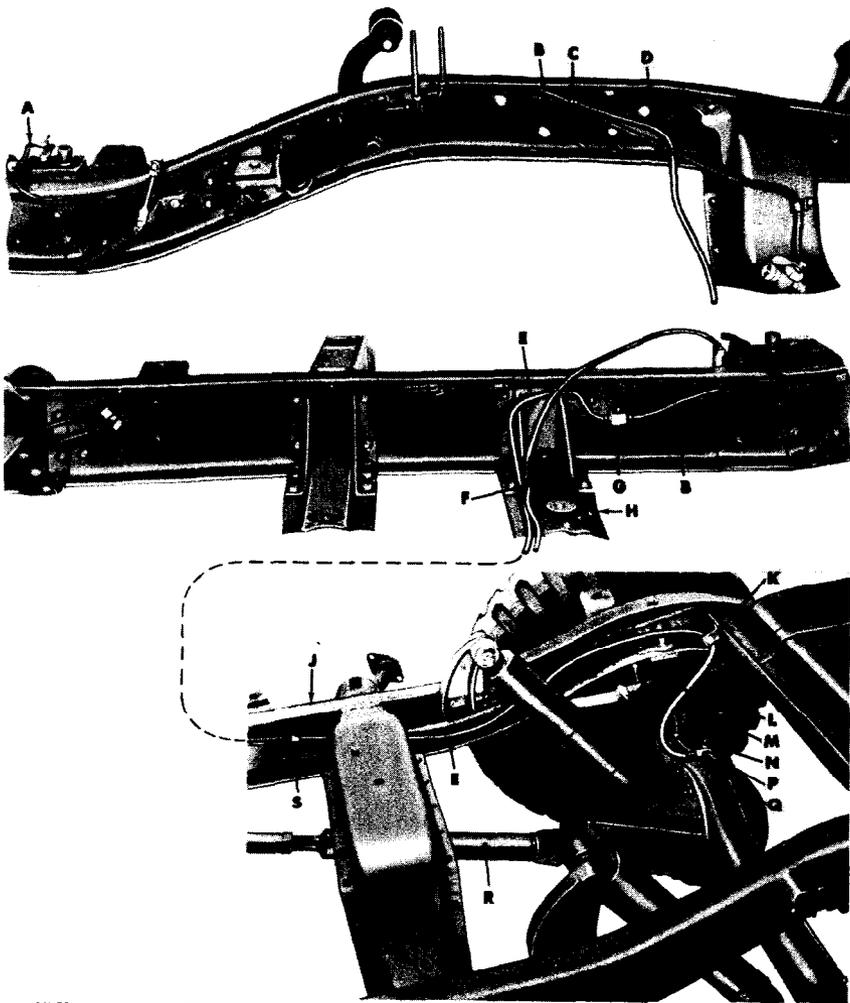
222. Brake Lines, Master Cylinder Vent Line, and Fittings

Note. The key letters noted in parentheses are figure 187, unless otherwise indicated.

a. General. If leaks develop in any of the brake lines or fittings or the master cylinder rear vent line (A), replace the affected parts as required.

b. Remove Brake Lines or Fittings.

- (1) Disconnect the affected line at both ends, disengage or remove brake line clips and remove the line. Flexible lines to the front wheel cylinders and flexible lines from the frame



KEY	ITEM
A	—MASTER CYLINDER REAR VENT LINE
B	—LINE (FRAME TEE-TO-UNION)
C	—UNION
D	—LINE (UNION-TO-FRAME BRACKET)
E	—LINE (FRAME TEE-TO-FRAME BRACKET)
F	—CLIP
G	—FRAME TEE
H	—FRAME CROSSMEMBER
J	—RIGHT FRAME SIDE RAIL
K	—FRAME BRACKET

KEY	ITEM
L	—LINE (AXLE TEE-TO-RIGHT REAR WHEEL CYLINDER)
M	—FLEXIBLE LINE
N	—CLIP
P	—LINE (AXLE TEE-TO-LEFT REAR WHEEL CYLINDER)
Q	—AXLE TEE
R	—REAR PROPELLER SHAFT
S	—CLIP

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Figure 187. Brake lines and fittings.

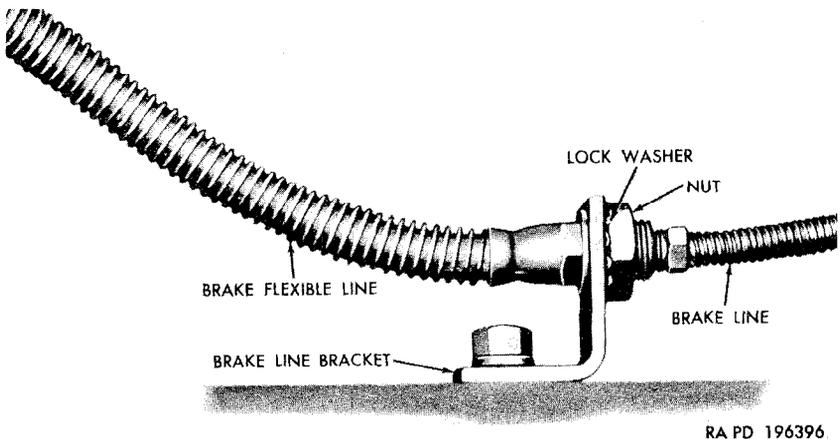
cross members to the tees on the axles are replaced as assemblies. Disconnect all flexible lines at the brake line bracket end first (fig. 188). For other lines provided with covers, remove the cover from the line before discarding the line.

- (2) Removal procedure of tees, unions, and connectors will be apparent upon examination.

c. Install Brake Line from Master Cylinder to Frame Tee. Use an 8 $\frac{1}{4}$ -inch length of $\frac{5}{16}$ -inch seamless tubing and two $\frac{5}{16}$ -inch inverted flared tube fitting nuts. Install the nuts on the tubing and double flare the tubing at both ends, using a flaring tool. Shape the tube as required and screw the fitting nuts to the connector in the master cylinder (fig. 186) and the frame tee (G).

d. Install Brake Lines from Frame Tee to Front and Rear Flexible Lines.

- (1) Use $\frac{1}{4}$ -inch seamless tubing, flexible conduit cover, and two $\frac{1}{4}$ -inch inverted flared tube fitting nuts for each line. The line (B) from the frame tee (G) to the union (C) at the left frame side rail is 40 $\frac{1}{4}$ inches long for all models. The line (E) from the tee to the frame bracket (K) is in two sections, joined by a union at the right frame side rail. The front section is 43 $\frac{3}{4}$ inches long for all models. The rear section is 68 $\frac{1}{2}$ inches long for the cargo truck M37 or command truck M42; the corresponding line for the ambulance truck M43 or telephone maintenance truck V-41 is 82 $\frac{1}{2}$ inches long. The line (D) from this union to the front flexible line is 34 $\frac{1}{4}$ inches long for all models.
- (2) Install the conduit cover and two fitting nuts on the tubing, double flare the tubing at both ends, using a flaring tool.



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Figure 188. Brake flexible line installation