TM 10-3930-624-34

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, POWER SHIFT G.E.D., 6,000 LB CAPACITY, 180 IN. LIFT

(ALLIS CHALMERS MODEL F-60-24PS-180)

(ARMY MODEL MHE 212)

FSN 3930-489-0263

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1971

WARNING PAGE

When servicing battery, do not smoke or use flame in the vicinity. Batteries generate hydrogen, a highly explosive gas.

Do not fill fuel tank while engine is running. Provide metallic contact between the fuel container and fuel tank to prevent a static spark from igniting fuel. Wipe or flush any spillage before starting the engine.

Wear safety glasses and protective clothing when prescribed by the job.

Do not remove the radiator cap from an overheated radiator; stop engine and allow radiator to cool.

Make sure forks are lowered to the ground and hand brake is engaged firmly before leaving the truck unattended.

If the truck is parked on an incline, set brakes and block at least two wheels.

Store flammable liquids in safe containers.

Disconnect battery cables before servicing electrical components.

Use proper tools. Keep tools clean and in good condition.

Install warning tags on the steering wheel if the vehicle is in unsafe operating condition or if any component has been drained.

TM 10-3930-624-34
C 2

CHANGE

No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington D.C., 9 November 1989

Direct Support and General Support Maintenance Manual

TRUCK, LIFT, FORK: POWER SHIFT G.E.D., 6,000 LB CAPACITY, SRT, 180 IN. LIFT (ALLIS CHALMERS MODEL F60-24PS-180) (ARMY MODEL MHE-212) NSN 3930-00-489-0263

TM 10-3930-624-34, 11 May 1971, is changed as follows:

Cover and *page i.* The manual title is changed to read as shown above.

Page ii, List of Illustrations. Delete entries for numbers 4-21 and 4-22.

Page 1-1.

Paragraph 1-2 is superseded as follows:

1-2. Maintenance Forms, Records, and Reports

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by DA Pam 738-750.

Paragraph 1-3 is superseded as follows:

1-3. Reporting Errors and Recommending Improvements

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

Page 2-1, paragraph 2-3. Change "TM 10-3930-624-35P" to "TM 10-3930-624-20P".

Page 4-20.

Paragraph 4-11 *b* is rescinded.

Paragraph 4-11 *c* is superseded as follows:

c. Cleaning and Inspection.

(1) Clean master cylinder assembly with denatured alcohol or clean hydraulic brake fluid.

***Caution:* Any solvents other than alcohol or brake fluid will deteriorate rubber parts, causing them to become soft, tacky, and swollen.**

(2) Replace master cylinder if any evidence of wear, damage, malfunction, or leakage is identified.

Paragraph 4-11 *d* and figure 4-19 are rescinded.

Page 4-22.

Paragraph 4-12 *b* is rescinded.

Paragraph 4-12 *c* is superseded as follows:

c. Cleaning and Inspection.

(1) Clean wheel cylinder with denatured alcohol or clean hydraulic brake fluid.

***Caution:* Any solvents other than alcohol or brake fluid will deteriorate rubber parts, causing them to become soft, tacky, and swollen.**

(2) .Replace wheel cylinder if any evidence of wear, damage, malfunction, or leakage is identified.

Paragraph 4-12 *d* is rescinded..

Page 4-23. Paragraph 4-13 is superseded as follows:

4-13. Pedal, Brake and Inching

Refer to TM 10-3930-624-12.

Page 4-24. Figure 4-21 is rescinded.

Page 4-25. Figure 4-22 is rescinded.

Page 5-12. Paragraph 5-8 *a* is superseded as follows:

a. Removal. Refer to TM 10-3930-624-12.

Page 5-14. Paragraph 5-8 *e* is superseded as follows:

e. *Installation.* Refer to TM 10-3930-624-12.

Page A-1.

Paragraph A-2. Change "TM 9-213" to "TM 43-0139".

Paragraph A-3.

Change "TM 38-750" and its title to "DA Pam 738-750, The Army Maintenance Management System (TAMMS)".

Add “TM 10-3930-624-12, Operator and Organizational Maintenance Manual, Truck, Lift, Fork: Power Shift G.E.D., 6,000 LB Capacity, SRT, 180 In. Lift (Allis-Chalmers Model F60-24PS-180) (Army Model MHE-212) NSN 3930-00-489-0263”.

Add “TM lo-3930-624-2OP, Organizational Maintenance Repair Parts and Special Tools Lists, Truck, Lift, Fork: Power Shift G.E.D., 6,000 LB Capacity, SRT, 180 In. Lift (Allis-Chalmers Model F60-24PS-180) (Army Model MHE-212) NSN 3930-00-489-0263”.

Change “TM 10-3930-624-35P” and its title to “TM 10-3930-624-34P, Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools Lists), Truck, Lift, Fork: Power Shift G.E.D., 6,000 LB Capacity, SRT, 180 In. Lift (Allis-Chalmers Model F60-24PS- 180) (Army Model MHE-212) NSN 3930-00-489-0263”.

By Order of the Secretary of the Army:

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

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WILLIAM J. MEEHAN II
Brigadier General, United States Army
The Adjutant General

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HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON. D.C., *11 May 1971*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, POWER SHIFT G.E.D., 6,000 LB CAPACITY, 180 IN. LIFT (ALLIS CHALMERS MODEL F-60-24PS-180) (ARMY MODEL MHE 212)

F SN 3930-489-0263

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

The instructions in this manual are for the use of personnel to whom the F60-24PS-180 Forklift Truck is issued. This manual contains procedures for Direct Support and General Support levels of maintenance for the equipment and its accessories.

1-2. Forms and Records

Maintenance forms. records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in, and prescribed by, TM 38-750.

1-3. Reporting of Errors

Reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA form 2028, Recommended Changes to Publications, and forwarded to Commanding General, U.S. Army Mobility Equipment Command, ATTN: AMSME-MPP. 4300 Goodfellow Blvd., St. Louis. Mo. 63120.

Section II. DESCRIPTION AND DATA

1-4. Description

A general description of the forklift truck and information pertaining to the identification plates are contained in TM 10-3930-624-12. A -more detailed description of specific components and assesmblies is contained in the applicable sections of this manual.

1-5. Tabulated Data

a. Engine

Manufacturer	Allis-Chalmers
Manufacturer part number	4515261
Model	6MB-230
Type	Gasoline
Displacement	230 cubic inches
Power	55 horsepower at 220 rpm
Torque	153 ft lbs at 1200 rpm
Number of cylinders	6-in line
Bore	3 7/16 inches
Stroke	4 1/3 inches
Firing order	1-5-3-6-2-4
Compression ratio	7.3 to 1

b. Carburetor.

Manufacturer	Zenith Carburetor Division
Manufacturer part number	0-13151
Model	267-J8
Type	Up-draft, single barrel

c. Alternator, Electrical.

Manufacter	Delco-Remy
Manufacturer part number	1100877
Model	10-DN
Type	12 volt, negative ground
Voltage output	12 volts
Current output	22 amps
Rotation	Clockwise

d. Starter, Electrical.

Manufacturer	Delco-Remy
Manufacturer part number	1107325
Type	12 volt, negative ground
Amperage draw	75 amps/10.3 volts at 6900 rpm
Rotation	Clockwise

c. Transmission.

Manufacturer	Warner Gear
Manufacturer part number	10-01-000-001
Model	T12
Type	Single range
Gear ratio:	
Forward	1.19:1
Reverse	1.19:1
Maximum input torque	350 ft lbs
Maximum input speed	2200 rpm
Pressure :	
Main	100-140 psi
Converter	55-80 psi
Lube	12-30 psi

f. Drive *Axle.*

Manufacturer	Allis-Chalmers
Manufacturer part number	4797277

g. Cylinder. Master, Brake.

Manufacturer	Wagner Electric
Manufacturer part number	FE24728
Type	Combination reservoir and cylinder

h. Wheel Cylinder.

Manufacturer	Wagner Electric
Manufacturer part number	FD20945A
Type	Standard straight bore, double end

i. Power Steering Cylinder.

Manufacturer	Bruning Co.
Manufacturer part number	6802-061
Type	Single plunger
Stroke	8 inches

j. Steering Gear.

Manufacturer	Char-Lynn
Manufacturer part number.	UC3-01SCK
Type	Hydraulic

k. Hydraulic Pump.

Manufacturer	Tyrone Hydraulics
Manufacturer part number	GPA2 / 115
Model	D D
Type	Positive gear
Primary flow	2-3 gpm
Secondary flow	18-10 gpm
Speed (max)	2200 rpm
Pressure (max)	2000 psi
Primary flow relief valve setting	1600 ±100 psi
Rotation	Counterclockwise
Drive ratio, engine to pump	1:1

l. Distributor.

Manufacturer	Delco-Remy
Manufacturer part number	1112461

m. Tilt Cylinder.

Manufacturer	Allis-Chalmers
Manufacturer part number	4825960
Type	Single stage
Forward tilt	3 degrees
Backward tilt	8 degrees

n. Lift Cylinder.

Manufacturer	Allis-Chalmers
Manufacturer part number	4824430 (primary) 4824437 (secondary)
Type	Tri-free lift

o. Torque Data.

General Torques

Bolt size (inches)	Grade 5 Minimum	Grade 5 Maximum	Grade 8 Minimum	Grade 8 Maximum
1/4	9	11	12	15
5/16	17	20.5	24	29
3/8	35	42	45	54
7/16	54	64	70	84
1/2	80	96	110	132
9/16	110	132	160	192
5/8	150	180	220	264
3/4	270	324	380	456
7/8	400	480	600	720
1	580	696	900	1080
1 1/8	800	880	1280	1440
1 1/4	1120	1240	1820	2000
1 3/8	1460	1680	2380	2720
1 1/2	1940	2200	3160	3560

Note. These values apply to fasteners as received from supplier. dry. or when lubricated with normal engine oil. They do not apply if special graphite or moly-disulfide greases or other extreme pressure lubricants are used. This applies to both UNF and UNC threads.

p. Electrical Schematic Diagram. See figure 1-1.

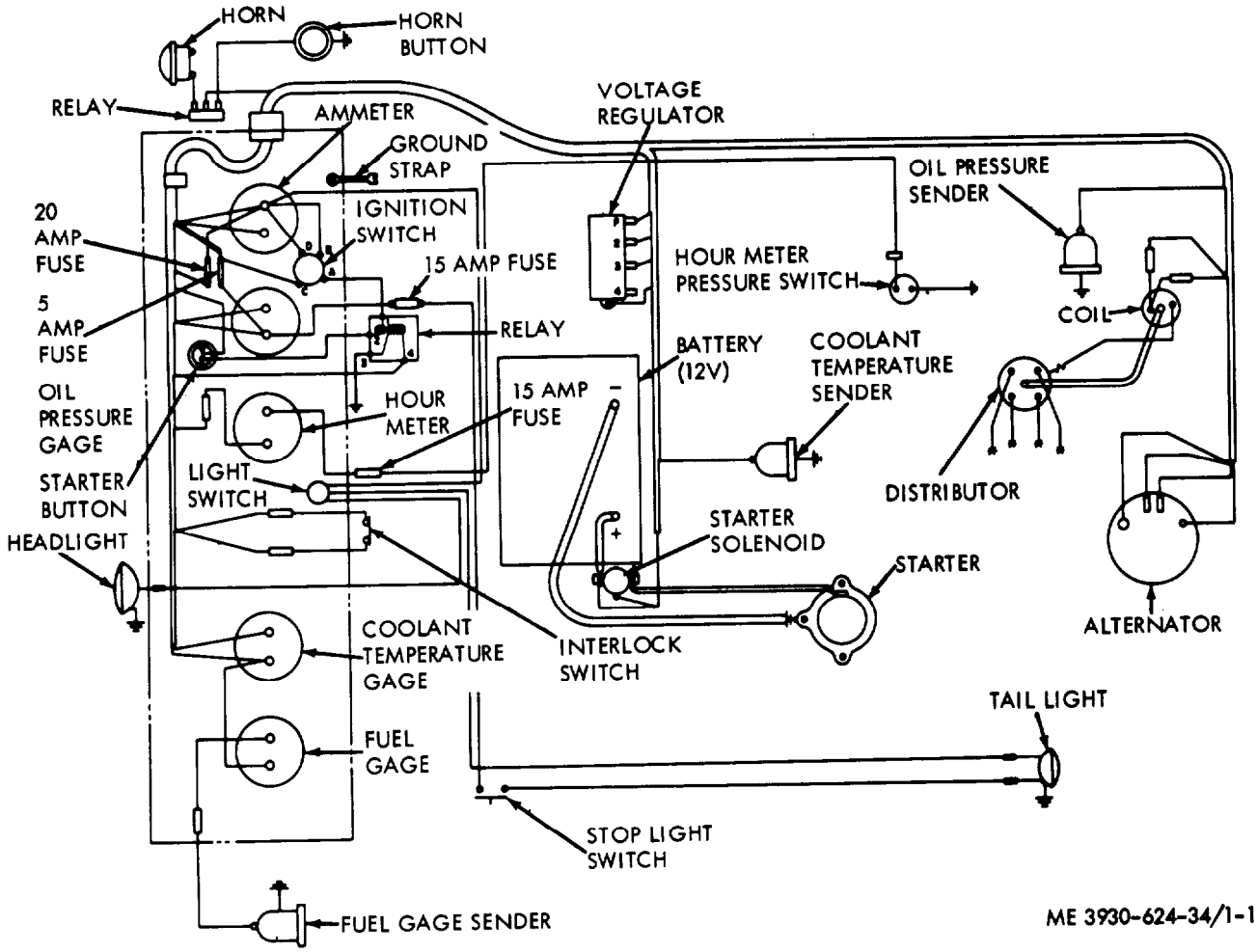


Figure 1-1. Electrical schematic diagram.

q. Hydraulic Diagram. See figure 1-2.

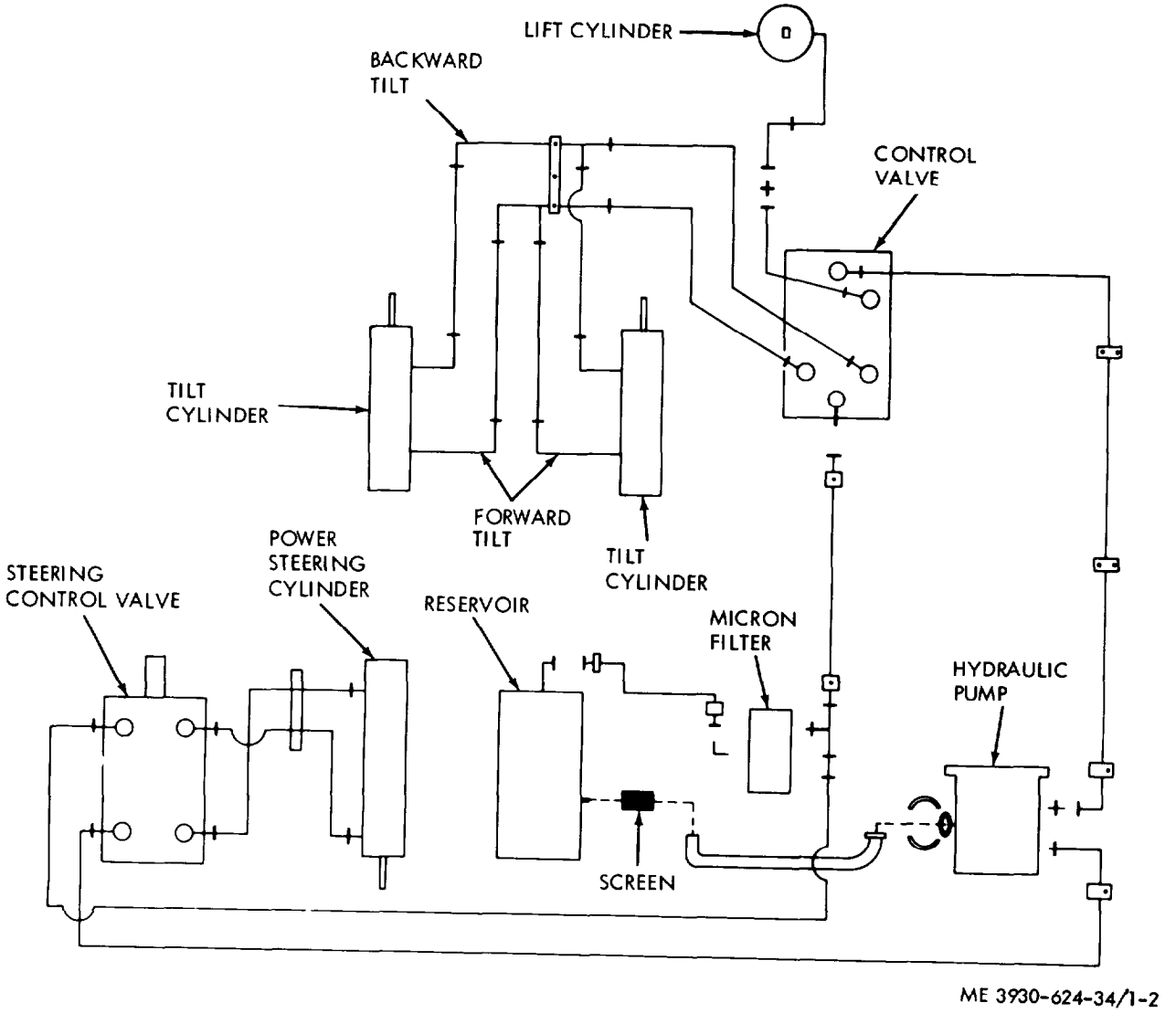


Figure 1-2. Hydraulic diagram,

r. Transmission and Torque Converter Hydraulic System Diagram. See figure 1-3.

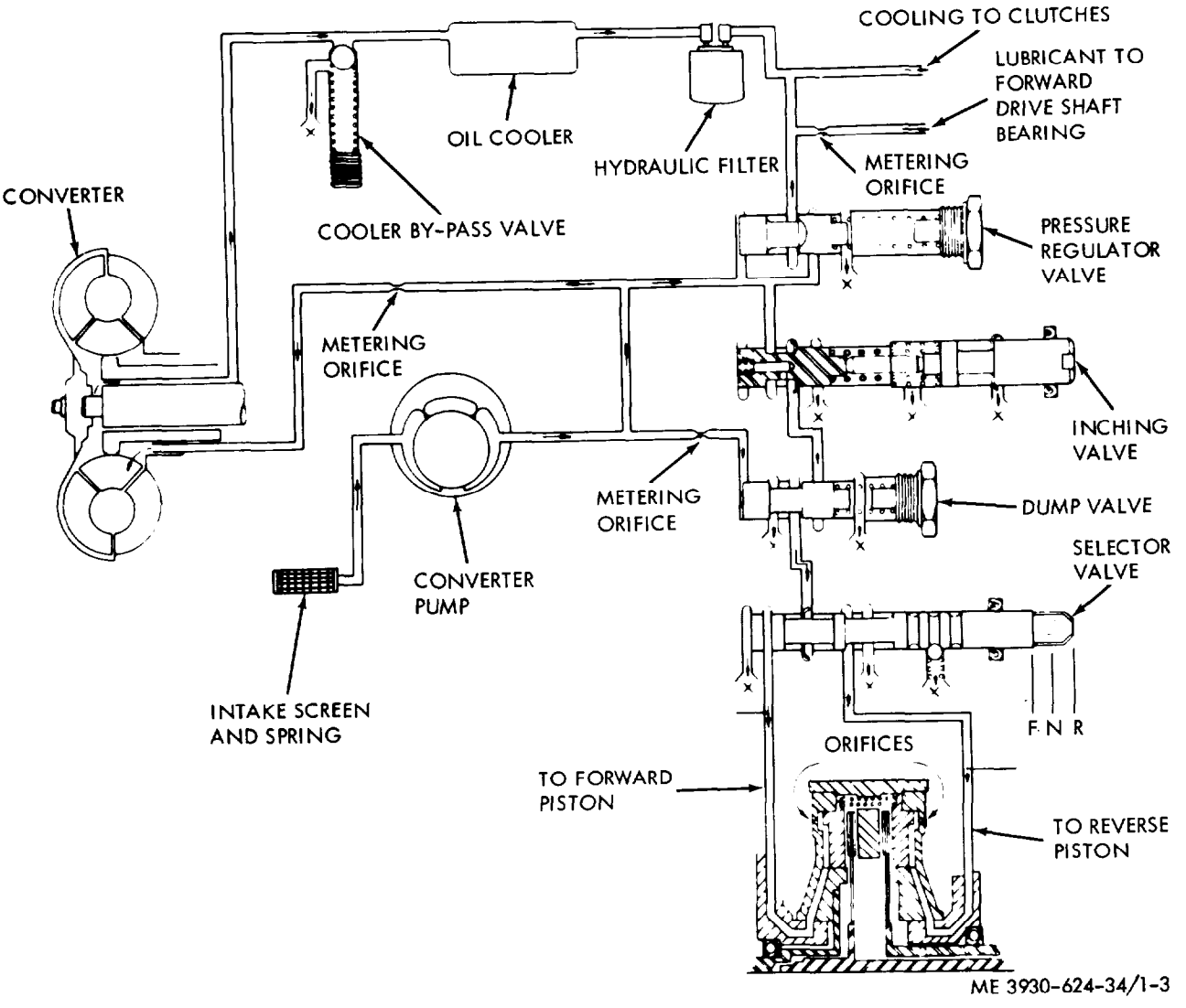


Figure 1-3. Transmission and torque converter hydraulic system diagram.

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

2-1. Tools and Equipment

There are no tools and equipment issued with or authorized for the F 60-24PS-180 Forklift Truck.

2-2. Special Tools and Equipment

There are no special tools and equipment issued with or authorized for the F 60-24PS-180 Forklift Truck.

2-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts and special tools manual, TM 10-3930-624-35P.

Section II. TROUBLESHOOTING

2-4. General

Table 2-1 provides information for diagnosing and correcting improper operation or failure of the forklift truck components. Each symptom is followed by a list of probable causes and possible remedies.

2-5. Troubleshooting

Malfunctions shall be limited to the scope of maintenance allocated to direct support and general support maintenance by the Maintenance Allocation Chart.

Table 2-1. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1. Engine hard to start or will not start.	*a.* Water in the fuel.	*a.* Let truck stand. When the water has settled to the bottom. drain from carburetor (para 3-2), fuel pump sediment bowl. and fuel tank (para 3-4).
	b. Gasoline flow obstructed.	*b.* Check fuel lines. carburetor screen, fuel valves in fuel pump. and fuel pump sediment howl. Locate and remove obstructions.
	c. Defective wires.	*c.* Replace with new wires.
	d. No compression.	*d.* Valves not seating properly (Grind valves (para 3-12).
2. Engine stops suddenly.	*a.* Dirt in fuel.	*a.* Drain tank. Refill with fresh fuel only after sediment bowl. carburetor (para 3-21. and fuel tank (para 3-4) have been cleaned.
	b. Dirt in filter.	*b.* Clean carburetor (para 3-2) and air filter.
	c. Plugged fuel line.	*e.* Disconnect fuel lines. Blow out or remove obstruction.
	d. Air leak in fuel line.	*d.* Tighten connections or replace faulty tubing.
3. Engine misses.	*a.* Chafed wiring, broken cable, or loose connections.	a. Replace or tighten the connections.
	b. Leaks at cylinder head gasket.	*b.* Tighten head or replace gasket (para 3-12).
	c. Engine overheats, causing valves to stick.	*c.* Check cooling system. Do not add cold water immediately. Allow engine to cool to avoid cracking

Malfunction	Probable Cause	Corrective Action
		the cylinder head. Free the values by cleaning the valve stems. Replace valves if burned (para 3-12).
	d. Warped valves.	*d.* Replace (para 3-12).
	e. Stuck valve.	*e.* Remove valve cover, and with screwdriver, free the sticking valve. Valve stem and guide will have to be cleaned to restore proper clearance. If condition continues, valves need regrinding.
4. Engine knocks.	*a.* Carbon in combustion chamber (pinging knock in cylinder).	*a.* Remove cylinder head. Clean out carbon (para 3-12).
	b. Loose connecting rod bearings. (Sharp knock, low oil pressure.1	*b.* Replace bearings (para 3-16).
	c. Loose main bearings. (Heavy knock-low oil pressure.)	*c.* Replace main bearings (para 3-17).
	d. Loose piston pins. (Sharp double knock.)	*d.* Replace pins or bushings (para 3-16).
	e. Piston and cylinder wear.	*e.* Replace sleeve (para 3-18). pistons. and rings lpara 3-16).
5. Engine overheats.	*a.* Scale in water jacket.	*a.* Use solvent solution and thoroughly flush the cooling system.
		Caution: **Never mix coolant compounds or inhibitors with any cleaning, neutralizing, or flushing compounds.**
	b. Particles of rubber hose or other foreign substances inside the cooling system.	*b.* Remove by thoroughly flushing out radiator and cooling system.
	c. Intake hose at pump collapses.	*c.* Replace hose.
	d. Loose timing coupling bolts.	*d.* Tighten bolts.
	e. Radiator core clogged.	*e.* Remove by use of air hose or brush.
	f. Leaky radiator.	*f.* Repair (para 3-10). Do not use quick-stop leak solders. because these tend to clog the circulation. Lead scolder must be used.
6. Loss of power.	*a.* Low oil pressure. due to external oil leaks. thin oil, or sticking of oil pressure relief valve.	*a.* Repair leaks by tightening the connection replacing the line. Drain and fill with fresh oil. Remove oil pressure relief valve and clean. Do not switch spring.
	b. Air leak at fuel line.	*b.* Tighten connections.
	c. Leaky valves.	*c.* Grind valve (para 3-12).
	d. Worn piston rings.	*d.* Replace rings (para 3-16).
	e. Blown cylinder head gasket.	*e.* Replace cylinder head gasket (para 3-12).
	f. Air cleaner obstructions.	*f.* Clean air cleaner and tubing.
	g. obstruction in exhaust line.	*g.* Remove obstruction.
	h. Choke valve out of adjustment.	*h.* Adjust.
7. Explosion in exhaust	*a.* Weak spark.	*a.* Check battery. distributor. cables ignition coil.
	b. Partially open exhaust valve.	*b.* Replace weak or broken spring (para 3-12).
8. Engine runs irregularly (sputters).	*a.* Warped exhaust valve.	*a.* Replace valve (para 3-12).
	b. Leaky valves.	*b.* Regrind or replace valves (para 3-12).
	c. Leaky intake manifold.	*c.* Tighten capscrews or replace gaskets.

Malfunction	Probable Cause	Corrective Action
	d. Air leaks in carburetor gaskets.	*d.* Tighten cover capscrews or replace gaskets in carburetor (para 3-2).
	e. Partially closed fuel shutoff valve.	*e.* open.
	f. Water and sediment in carburetor.	*f.* Let water settle to, bottom and drain. Drain out sediment. and clean screens. Check source of supply,
	g. Fuel lines partially blocked.	*g.* (Check line: remove obstruction and any kinks in tubing.
	h. Loose ground cable.	*h.* Tighten.
	i. Loose jets in the carburetor.	*i.* Remove the carburetor and tighten (para 3-2).
9. Smoky exhaust.	*a.* Carburetor float sticking. (Black smoke.)	*a.* Tap carburetor lightly with hammer handle. If this does not correct the situation. carburetor must be cleaned.
	b. Worn piston rings, and out-of-round and tapered cylinders. (Blue smoke.)	*b.* Replace rings and cylinder liners (para 3-10 and 3-18).
	c. Thin lubrication oil. (Blue smoke.)	*c.* Use oil of correct viscosity. Refer to the lubrication order LO 10-3930-624-12.
	d. Oil level too high.	*d.* Drain surplus oil from crankcase.
10. Ammeter does not register.	*a.* Commutator dirty.	*a.* Clean rommutator (para 5-2).
	b. Worn brushes.	*b.* fireplace (para 5-2).
11. Alternator does not generate current.	*a.* Broken external connection.	*a.* Repair.
	b. Shorted armature.	*b.* Replace (or repair (para 5-2).
	c. Shorted field.	*c.* Replace or repair (para 5-2).
		Caution: **Do not attempt to polarize alternator.**
12. Starting motor failure.	*a.* Broken connection.	*a.* Reconnect or replace cable (para 5-3).
	b. Commutator dirty.	*b.* Clean with 00 sandpaper: do not use emery cloth (para 5-3).
	c. Worn brushes.	*c.* Replace (para 5-3).
	d. Bad teeth on flywheel.	*d.* Replace ring gear (para 3-14).
13. No gasoline at the carburetor.	*a.* Clogged fuel suction line.	*a.* Check the fuel lines between the tank and the fuel pump and the carburetor.
	b. Float stuck (dirty needle valve).	*b.* Tap the carburetor bowl gently. Or remove the carburetor, and clean the needle valve and float chamber (para 3-2).
	c. Air leak.	**c.** (Check all connections and fuel lines between the carburetor. fuel pump and tank.
14. Engine surges.	Surge screw out of adjustment (governor).	Adjust (para 3-3).
15. Carburetor leaks gasoline when idling.	*a.* Float stuck (dirty needle valve).	*a.* Tap carburetor gently to dislodge the dirt in the fuel valve. if this does not correct the condition. remove the carburetor and clean the valve (para 3-2).
	b. Drain plug not tight.	*b.* Tighten.
16. Radiator boils.	*a.* Leaky radiator.	*a.* Repair radiator. Do not use liquid solder. because it tends to clog the system.
	b. Faulty hose connections.	*b.* Tighten clamp or replace hose.
	c. internal collapse of suction hose at water pump.	*c.* Replace hose.
	d. Dirt. rust. scales. and sediment in the water jacket.	*d.* Use a solvent to remove: flush and drain entire system.

Malfunction	Probable Cause	Corrective Action
	e. Pieces of broken hose in system.	*e.* Remove by draining and flushing out the system.
Unable to lift or tilt load.	*a.* Load too heavy.	*a.* Do not lift more than 6000 pound load.
	c. Insufficient or no oil in hydraulic system.	*b.* Check tank for proper oil level and plugged suction line.
	c. Air leak at suction line.	*c.* Tighten connections.
	d. Damaged or worn hydraulic pump.	*d.* Replace or repair (para 5-5).
	e. Relief valve binding open.	*e.* Replace or repair (para 5-6).
	f. Broken lift chain.	*f.* Repair.
	g. Obstruction in hydraulic lines.	*g.* Check flow of oil from pump through hydraulic system.
	h. Damaged lift cylinder.	*h.* Check for binding or inoperative plunger (para 5-9 or 5-10).
	i. Control valve inoperative.	*i.* Inspect for internal leakage or damaged parts and repair (para 5-6).
	j. Incorrect relief valve setting.	*j.* Adjust setting to 1700 psi (para 5-6).
18. Lift and tilt too slow.	*a.* Engine speed governed too low.	*a.* Inspect governor controls and adjustment (para 3-3).
	b. Internal leakage at pump.	*b.* Inspect for worn or damaged parts (para 5-5).
	c. Leakage at cylinder packing.	*c.* Replace packing (para 5-8, 5-9 and 3-10).
	d. Air leaks in system.	*d.* Tighten all connections.
	e. Misalignment.	*e.* Check masts. carriage or tilt linkage for cause of binding.
	f. Faulty relief Valve.	*f.* Check for worn or damaged parts. Repair or replace. Check relief valve setting (para 5-6).
19. Mast tilts or carriage slips downward while load is elevated.	*a.* Internal leakage in cylinders.	*a.* Replace parking (para 5-8, 5-9 and 5-10).
	b. Oil leak at packing glands.	*b.* Replace packing (para 5-8, .5-9 and 5-10).
	c. Leak in control valve.	*c.* Check for worn or damaged plungers (para 5-6).
	d. Leaks in oil lines.	*d.* Tighten all connections or replace damaged lines.
20. Noisy hydraulic pump.	*a.* Insufficient or no oil.	*e.* (Check tank for proper oil level or restricted suction line.
	b. Air leaks.	*b.* Tighten intake connections.
	c. Oil bubbles in intake oil.	*c.* Use hydraulic oil with antifoaming characteristics.
	d. Coupling misalignment.	*d.* Realine.
	e. Pump head loose.	*e.* Tighten.
21. Hydraulic oil overheating.	*a.* Relief valve set too low.	*a.* Check setting for 1500 to 1700 psi (para 5-6).
	b. Internal oil leakage in hydraulic pump.	*b.* Repair or replace pump (para 5-5).
	c. Pump too tight after overhaul.	*c.* Remove and repair (para 5-5).
	d. Restricted lines.	*d.* Check and clean lines.
22. Wheels will not turn.	*a.* Broken axle shaft.	*a.* Replace axle shaft (para 4-6).
	b. Teeth broken from axle shaft or bull gear.	*b.* Replace axle shaft or bull gear (para 4-6 and 4-15).
	c. Broken teeth on ring pear or pinion.	*c.* Replace ring gear and pinion (para 4-6).
23. Axle noise on drive or coast.	*a.* Excessive wear at ring gear and pinion.	*a.* Adjust, if possible, or replace (para 4-6).
	b. Worn pinion gears or side gears in differential case.	*b.* Replace worn gears (para 4-6).
24. Continous axle noise.	*a.* Excessive wear in gears.	*a.* Replace worn parts (para 4-6).
	b. Uneven tire wear.	*b.* Replace tires (4-16).
	c. Worn or damaged bearing.	*c.* Replace bearings (para 4-6).
25. Excessive backlash on drive unit.	*d.* Worn splines on axle shaft.	*a.* Replace axle shaft (para 4-6).

Malfunction	Probable cause	corrective Action
	b. Worn ring gear or pinion.	*b.* Replace gear and pinion (para 4-6).
26. Pedal goes to toe plate.	*a.* External leak in brake system or leak part master cylinder piston cup.	*a.* Check system for leaks and repair (para 4-111.
27. Both brakes drag.	*a.* Mineral oil in brake system.	*a.* Clean system, replace cups in brake cylinders. and refill system with brake fluid (para 4-12).
	b. Breather port in master cylinder clogged.	*b.* Clean out breather port (para 4-11.
28. One wheel drags.	*a.* Obrtruction in brake line.	*a.* Remove obstruction or replace line.
	b. Swollen wheel cylinder piston cups or piston binding.	*b.* Replace defective or damaged parts (para 4-12).
29. Truck pulls to one ride.	*a.* Uneven tread wear.	*a.* Replace tires (para 4-16).
	b. Drum scored.	*b.* Repair or replace drum (para 4.15).
30. Loss of coolant.	*a.* Cracked engine block or head.	*a.* Replace damaged part (para 3-12 and 3-18).
	b. Defective herd gasket.	*b.* Replace (para 3.12).
	c. Leaking radiator.	*c.* Repair or replace (para 3-10).
	d. Drain cocks loose or open.	*d.* Close or tighten drain cocks.
31. Temperature gage indicates excessive operating temperature.	*a.* Defective instrument panel gage or sending unit.	*a.* Replace inoperative unit.
	b. Surface or radiator core clogged.	*b.* Clean the radiator.
	c. Obstruction in cooling system.	*c.* Clean out cooling system.
	d. Leak in cooling system.	*d.* Repair.
32. Rapid wear or breakage of fan belt.	*a.* Fan blades striking belt.	*a.* Adjust or replace fan.
	b. Exceenive drag from alternator.	*b.* Check alternator bearings (para. 5-2).
	c. Broken or rough pulleys.	*c.* Replace pulleys.
33. Fan or pump noisy.	*a.* Loose fan blades.	*a.* Repair or replace fan.
	b. Loose fan hub.	*b.* Tighten.
34. Ammeter reading Zero with ignition switch ON and engine turning.	*a.* Broken or loose wiring at ignition switch.	*a.* Repair or replace wiring.
35. Ammeter does not show charge.	*a.* Defective stator.	*a.* Repair or replace windings (para 3-2).
	b. Worn alternator brushes.	*b.* Replace brushes (para 3-2).
	c. Shorted alternator *armature.*	*c.* Repair or replace armature (para 5-2).
	d. Defective rectifying diodes in alternator.	*d.* Replace (para 5-2).
	e. Shorted alternator fields.	*e.* Repair or replace field coils (para 5.2).
36. Ammeter shows heavy discharge with engine stopped.	*a.* Shorted circuits.	*a.* Trace wiring for aborts.
37. Ammeter show, rapid fluctuation.	*a.* Shorted *or* loose) connections.	*a.* Trace wiring for breaks or looseness.
	b. Dirty, loose, or worn alternator brushes.	*b.* Clean and tighten brushes. Replace if worn (para 5-2).
	c. Defective alternator.	*c.* Repair or replace (para 5-2).
38. Starting motor failure.	*a.* Broken connections.	*a.* Reconnect or replace wires.
	b. Commutator dirty.	*b.* Clean (para 5-3).
	c. Worn brushes.	*c.* Replace (para 5-3).
	d. Broken drive.	*d.* Replace (para 5-3).
	e. Bad teeth on flywheel.	*c.* Replace ring gear (para 3-14).
39. Horn does not blow.	*a.* Faulty horn button.	*a.* Check for faulty ground or replace horn button (para 4.18).
40. Horn blows continuously.	*a.* Grounded horn wire.	*a.* Eliminate ground. Check for frayed wire.
	b. Defective horn button.	*b.* Replace (para 4-18).
41. Hard steering.	*a.* Defective hydraulic pump.	*a.* Replace or recondition (para 5-5).
	b. Broken or weak relief valve opting.	*b.* Replace spring.
	c. Binding relief valve.	*c.* Free valve.

Malfunction	Probable cause	Corrective Action
	d. Line leakage.	*d.* Tighten connections.
	e. Bent steering linkage.	*e.* Replace damaged parts (para 4-8).
	f. Improper wheel alinement.	*f.* Aline wheels lpara 4-8).
	g. Leakage in steer cylinder.	*g.* Repair (para 4-19).
	h. Faulty control valve.	*h.* Repair or replace (para 4-18).
42. Steering too sensitive.	*a.* Hydraulic pressure too high.	*a.* Check for binding relief valve (para 5-5).
	b. Faulty flow control valve.	*b.* Recondition - free any binding parts (para 5-6).
43. Loose steering.	*a.* Wheels out of alinement.	*a.* Aline wheels (para 4-8).
	b. Loose linkage.	*b.* Tighten linkage or replace (para 4-8).
	c. Worn king pins.	*c.* Replace (para 4-8).
	d. Wheel bearings loose or worn.	*d.* Adjust bearings or replace (para 4-15).
44. Low hydraulic oil pressure.	*a.* Worn pump.	*a.* Recondition or replace (para 5-5).
	b. Weak relief valve spring.	*b.* Replace spring.
	c. Relief valve stuck open.	*c.* Remove and free valve.
	d. Flow control valve stuck open.	*d.* Free flow control valve.
	c. External leakage.	*e.* Tighten or replace fittings, hoses or seals.
	f. Internal leakage.	*f.* Replace seals in valves or cylinders (para 4-18 and 4-19).
45. Transmission does not operate in any speed or slips in all speeds.	*a.* Defective oil pump.	*a.* Replace pump (para 4-2).
	b. Leakage within transmission.	*b.* Repair transmission (para 4-3).
46. Transmission does not shift.	*a.* Low clutch pressure.	*a.* Check and adjust pressure (para 4-3).
	b. Defective oil pump.	*b.* Replace pump (para 4-2).
47. Loss of power during or after shifting.	Gears not correctly engaged.	Disassemble transmission and correct (para 4-3).

Section III. GENERAL MAINTENANCE

2-6. General

This section contains general maintenance information that would otherwise have to be repeated throughout this manual.

2-7. Maintenance Requirements

a. Hardware and Threaded Parts. Inspect hardware for damaged threads. rounded corners, and damaged slots. Threaded holes and parts should accept their mating parts without requiring excessive torque. Threads may be chased with a tap or die. Replace any threaded parts which cannot be repaired.

b. Gaskets. Replace all gaskets which are disturbed during repair operations or which show evidence of leakage. When installing gaskets. use grease or gasket cement to retain gasket in position during reassembly procedures.

c. Oil Seals and Packings. Thoroughly lubricate the sealing lip of spring loaded seals with grease or other suitable lubricant when installing. Apply non-hardening sealer to the outer circumference of encased seals or to the mating bores to prevent possible leakage. Immerse preformed packings in the liquid or lubricant with which they will be in contact.

d. Ball and Roller Bearings. After removing an antifriction bearings, cover them immediately to keep out dirt and abrasives. Flush thoroughly with solvent, tap them against a wooden block to remove packed lubricant, and air-dry. Coat cleaned bearings with oil, and wrap in clean paper. Replace any bearings that are scored, pitted, discolored from overheating, or otherwise damaged. When installing bearings against shoulders, be sure the chamfered side faces the shoulder. Lubricate the bearing and its mating surface when pressing a bearing into place. Press bearings only on the race adjacent to the mating part. Use drivers which contact as much of the race as possible.

e. Repair of Damaged Machined and Polished Surfaces. Remove rough spots, scores, burrs, galling. gouges, and other surface damage from machined and polished surfaces. Use a suitable honing stone. crocus or emery cloth, file, or any other method that will permit the part to function efficiently. The finish of the part must approximate that of the original finish. Do not alter critical dimensions beyond acceptable limits. Build up shafts. rods, and other worn parts by metallizing, chrome plating, or welding. Grind built up parts to original size.

f. Welding Repair. Welding must be performed by a qualified welder. Welds must provide complete fusion and penetration and comply with governing specifications. Inspect all welds using a radiographic or magnetic particle process. Grind all new welds flat and smooth whenever possible.

g. Part Replacement. Replace authorized parts which are worn or defective with new parts. Consider such factors as age, mileage, operating hours, usage, and parts availability to determine the necessity of part replacement.

Section IV. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-8. Engine

a. Removal.

Note. It is recommended that the engine and transmission be removed as a unit. Clean the engine and transmission before removing from the truck.

(1) Remove the counterweight. Refer to TM 10-3930-624-12.

Note. Tag all hydraulic lines, coolant lines, electrical wiring, fuel lines, and mechanical linkages which are disconnected for engine removal. This will ensure proper reinstallation of the engine.

(2) Drain the engine cooling system and disconnect the coolant hoses from the radiator.

(3) Refer to TM 10-3930-624-12 and drain the oil from the transmission. Disconnect the transmission oil cooler lines at the radiator. Cap or plug openings.

(4) Refer to TM 10-3930-624-12 and remove the radiator from the truck.

(5) Drain the hydraulic reservoir (fig. 2-1). Disconnect the hydraulic hoses at the pump (fig. 2-2). Cap the ends of the hoses and the pump inlet and outlet ports to prevent the entry of foreign material. Remove the hose clamps on each side of the oil pan. Tie the lines out of the way.

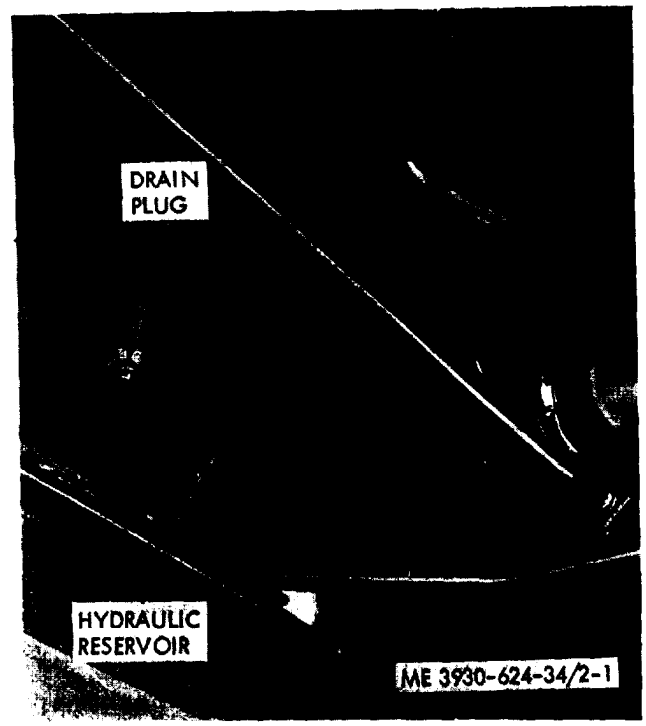


Figure 2-l. Hydraulic reservoir drain.

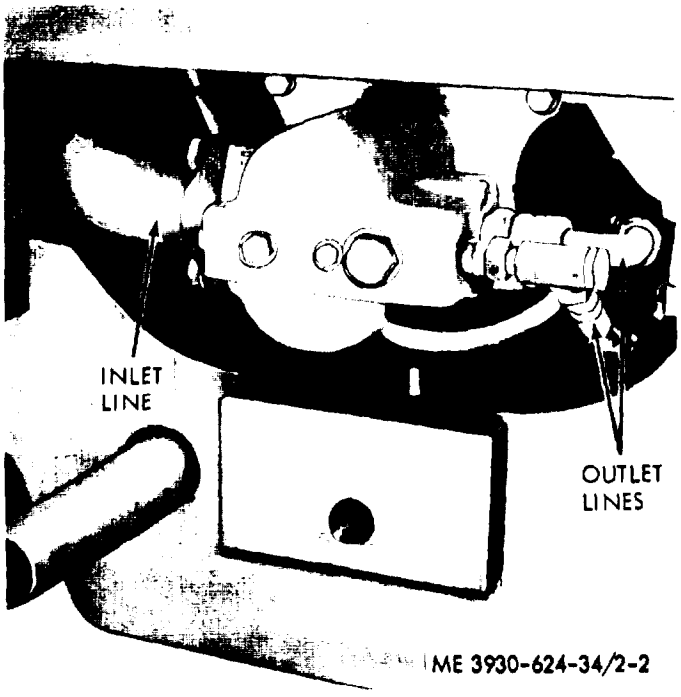


Figure 2-2. Hydraulic liner.

(6) Remove the toe plate and floor plate.

(7) Remove the hood assembly, hood support and side panels.

(8) Remove the seat and seat support.

(9) Remove the front grille.

(10) Disconnect the battery leads at the battery. Remove the battery and battery case. Remove the wiring harness.

(11) Close the fuel shutoff valve. Disconnect the fuel line at the inlet side of the fuel pump. Cap openings.

(12) Disconnect the shift linkage at the transmission control valve. Refer to figure 2-3.

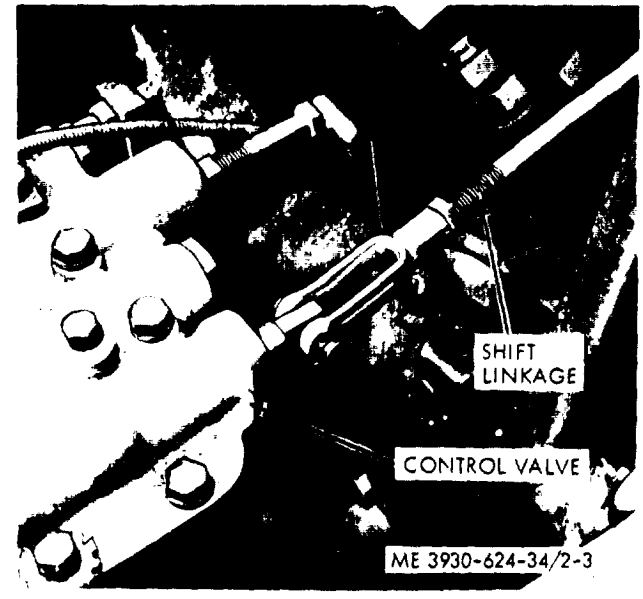


Figure 2-3. Shift linkage.

(13) Disconnect the throttle linkage. Refer to figure 2-4.

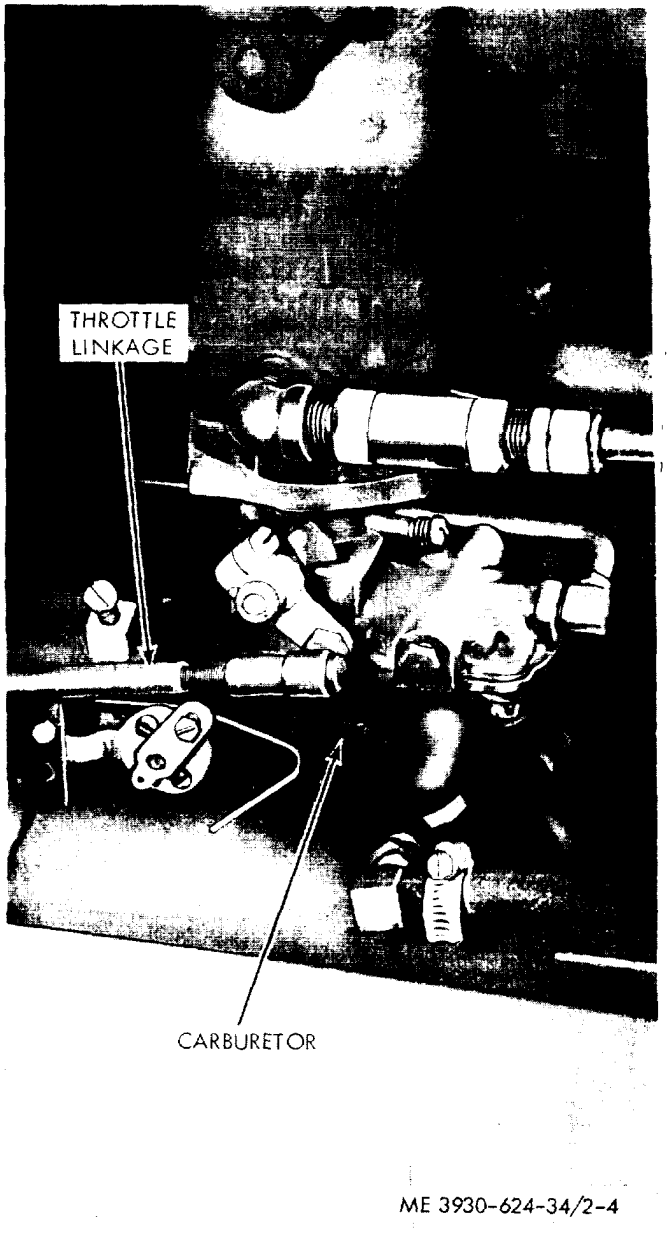


Figure 2-4. Throttle linkage.

(14) Disconnect the exhaust pipe from the manifold.

(15). Removed the nuts, washers, and capscrews securing the front and rear engine mounts to the truck frame.

(16) Remove the rocker arm cover. Install internally threaded eyebolts on the lifting studs (fig. 2-5) and attach the lifting sling to the eyebolts.

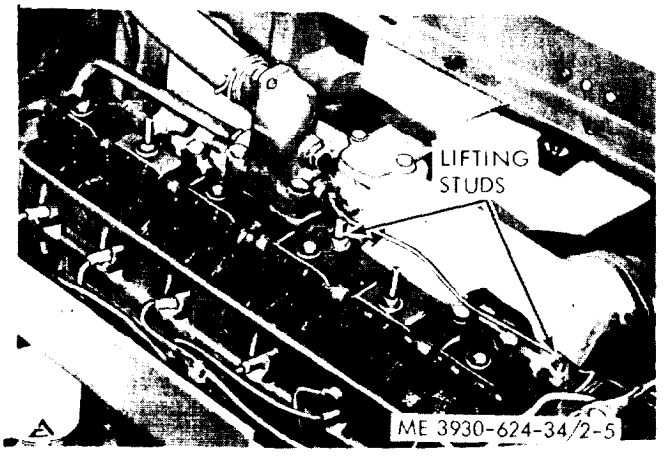


Figure 2-5. Lifting studs.

Caution: Be sure all hydraulic lines. electrical wiring, fuel lines, and mechanical linkages are disconnected and tagged before trying to remove the engine.

(17) Using a suitable hoist. raise the engine high enough to clear the engine supports. Move the engine toward the war **to** free the transmission from the drive shaft slip joint. Raise and remove the engine and transmission from the truck.

b. Installation.

(1) Attach a lifting sling to the lifting studs on the cylinder head. Using a suitable sling. slowly lower the engine and transmission onto the truck frame .

(2) Have an assistant line up the drive shaft slip joint so that it will enter the output shaft of the transmission without damage during installation.

(3) With the, engine correctly alined in the truck frame and positioned on the rubber mounts. install the mounting capscrews, Washers. and nuts. Tighten the nuts to a torque of 60 ft lbs and removed the hoist and sling.

(4) Connect the exhaust pipe, using a new gasket.

(5) Connect the throttle linkage (fig. 2-4) and shift linkage (fig. 2-3), and make the initial adjustments at this time. Final adjustment can be made after installation is complete.

(6) Conncted the fuel supply lines and open the shutoff valve.

(7) Install the wiring harness.

(8) Clamp the hydraulic hose along the oil pan and connect the lines to the hydraulic pump.

Service the hydraulic system as instructed in LO 10-3930-624-12 in TM 10-3930-624-12. Install the radiator (TM 10-3930-624-121 and pour coolant into the engine cooling system and check for leaks.

(10) Install the counterweight.

(11) Fill the crankcase to the proper level with lubricant specified in LO 10-3930-624-12. However. if the engine has been rebuilt, or a new engine was installed, fill the crankcase with six quarts of the specified lubricant. Pour an additional quart of lubricant over the rocker arm assemblies and cylinder head components to ensure initial lubrication of valves and push rod mechanism.

(12) Adjust the valve clearance. Refer to TM 10-3030-024-12.

(13) Install the battery case and battery. Comment the battery cables.

(14) Check to make certain that all control linkage, lines. and hoses are properly installed, and that all capscrews and bolts are tightened.

(15) Install the floor plate and toe plate. Install the front grille seat and seat support.

(16) If the engine has been rebuilt, or if a new engine has been installed, operate the engine on the following run-in schedule.

(a) Inspect the air cleaner to determine if it has been properly serviced. Refer to TM 10-3930-024-12 for service information.

(b) Lubricate all points where lubrication is required. Refer to the current LO 10-3930-624-12.

Warning: **If the engine is run indoors, pipe the exhaust gases to the outside.**

(c) Start the engine and allow to run at approximately 600-700 rpm. Check the oil pressure gage. If the gage does not register during the first 30 seconds after starting. stop the engine at once and refer to table 2-1, Troubleshooting.

(d) Check for oil. fuel, and coolant leaks. Shut down the engine and repair any leaks.

(e) Check the ammeter. If a normal reading is not indicated, check the electrical system for grounds. shorts. or loose connections.

(f) Check the engine timing. Refer to TM 10-3930-624-12.

(g) Check the carburetor setting. Refer to TM10-3930-624-12.

(h) After the engine has reached normal operating temperature (165° - 185°F), check the valve clearances.

(i) A run-in period of six to eight hours is recommended. Start with no load and gradually inerease the engine load to full load for the last two hours.

(j) At the end of the run-in gradually slow down the engine and allow it to idle at 500 rpm for a few minutes, allowing the engine to cool gradually. Shut down the engine.

(k) Tighten the cylinder head capscrews to a torque of 110 ft lbs. Refer to paragraph 3-12 for the proper tightening sequence.

(l) Recheck the crankcase oil level and all points of adjustment, making the necessary corrections.

(17) Install the rocker arm cover.

(18) Install the side panels and hood.

2-9. Transmission

a. Removal.

(1) Remove the floor plate, toe plate, seat and support, battery and battery case, and one corner post.

(2) Refer to TM 10-3930-624-12 and drain the oil from the transmission.

(3) Disconnect the cooler lines at the bottom and right side of the sump.

(4) Label and disconnect the shift linkage (fig. 2-3).

(5) Disconnect the universal joint at the transmission.

(6) Remove the capscrews and lockwashers which secure the converter housing to the flywheel housing. Use a suitable tool to rotate the flywheel.

(7) Attach a lifting chain and chain hoist to the transmission as shown in figure 2-6, and remove from the truck.

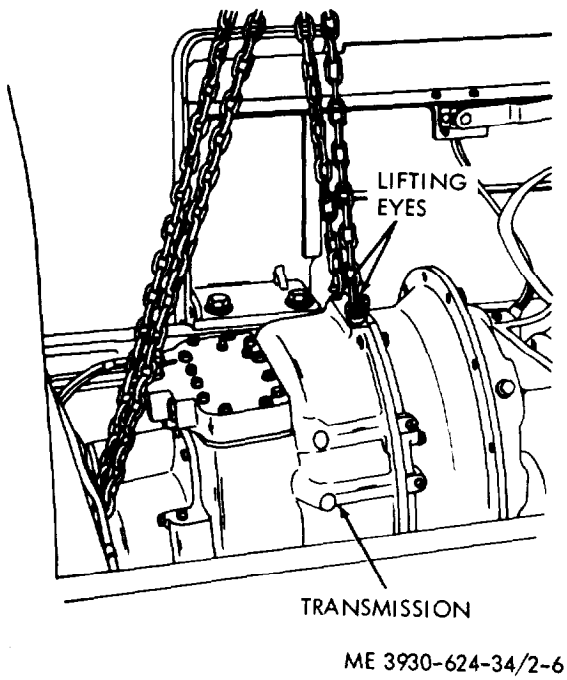


Figure ***2-6.*** *Transmission removal.*

(8) Remove the mounting hardware which secures the torque converter to the flywheel. Note the number of shims on the converter pilot and flywheel.

b. Installation.

(1) When installing the converter, use the following procedure to ensure that the tangs of the converter extend the proper depth into the pump.

(a) Without the shims on the pilot, install the converter on the flywheel and tighten the capscrews.

(b) Place a scale or rule across the tangs of the converter and another scale from the face of the flywheel housing to the scale across the tangs. Refer to figure 2-7.

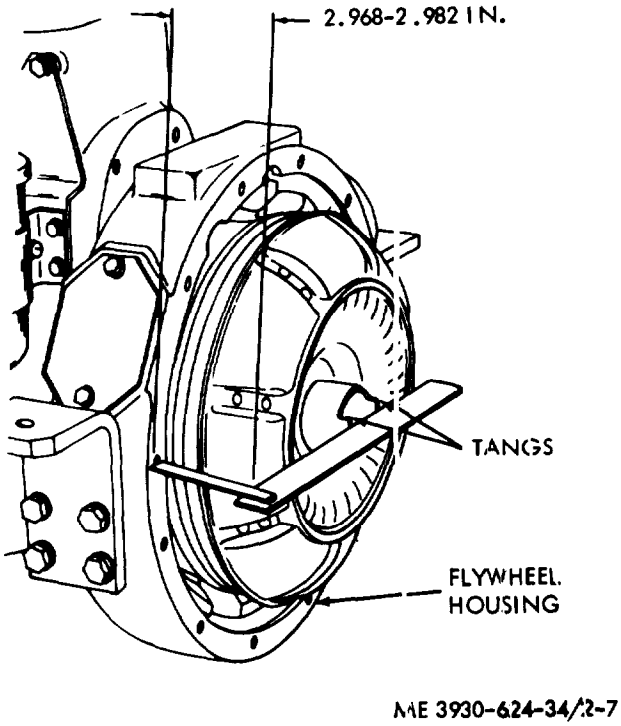


Figure 2-7. Checking tang depth

(c) Record the measurement from the face of the tangs to the face of the housing.

(d) If the measurement is less than 2.968 inches. remove the converter and add shims at the converter pilot to obtain the specified dimension.

(e) If the measurement is more than 2.982 inches. insert a gasket between the converter housing and flywheel housing. Make the gasket the thickness required to obtain the specified dimension.

(2) Use the following procedure to align the torque converter.

(a) Mount the dial indicator as shown in figure 2-8.

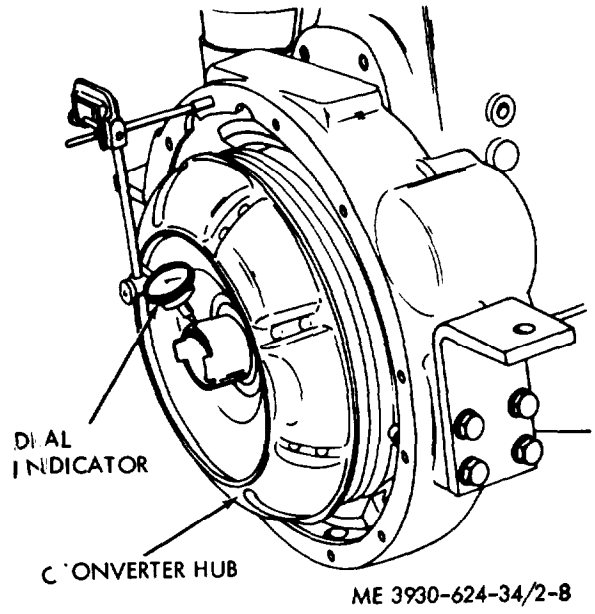


Figure 2-8. Checking converter ***alinement.***

(b) Rotate the converter and note the dial indicator reading. The hub runout should not exceed 0.005 inch or 0.010 inch total indicator readout.

(c) Rend the converter plate to adjust to the correct reading. Do not use shims between the plate and the flywheel.

(d) After correct alignment is obtained, recheck the tang depth as described in (1), above.

(3) Use the for lowing procedure for installing the transmission and torque converter in the forklift truck.

(a) Mount the converter to the flywheel by installing the capscrew s and lockwashers through the inspection plate in the flywheel bell housing.

(b) After the converter has been securely installed, rotate the converter hub until the filler hole appears an d add one quart of oil. Refer to the current LO 10-3930-624-12 for the proper oil-

(c) After the assembly has been installed in the truck add 10 quarts of oil to the transmission.

(d) Install the floor plate, toe plate, seat and support, battery and battery case and corner post.

2-10. Front Axle Assembly (Drive)

a. Removal.

(1) Remove the mast. Refer to paragraph 6-2.

(2) Disconnect the main hydraulic brake line at the junction block located on the differential housing. Disconnect the hydraulic lines or any other lines which are attached to the front axle housing. Cap or plug openings.

(3) Disconnect the parking brake cable by removing the clevis pin from the parking brake actuating lever.

(4) Disconnect the universal joint. leaving the slip joint in the transmission.

(5) Attach hoist hooks in the tilt cylinder. holes in the front plate. Pull them snug to take the weight of the truck off the front axle. Refer to figure 2-9.

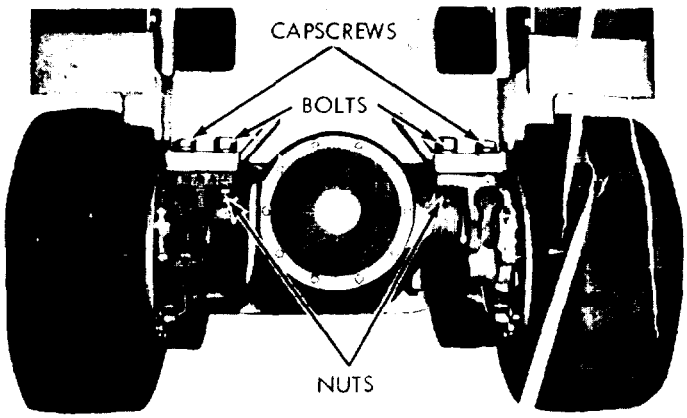


Figure 2-9. Front axle assembly removal.

(6) Remove all mounting bolts and capscrews from the mounting pads. Raise the truck away from the front axle assembly, and remove the front axle assembly from under the truck frame. It may be necessary to apply pressure at t he mounting pads to free the unit from the truck; the dowel pins fit tightly in the mounting pads. Refer to figure 2-10.

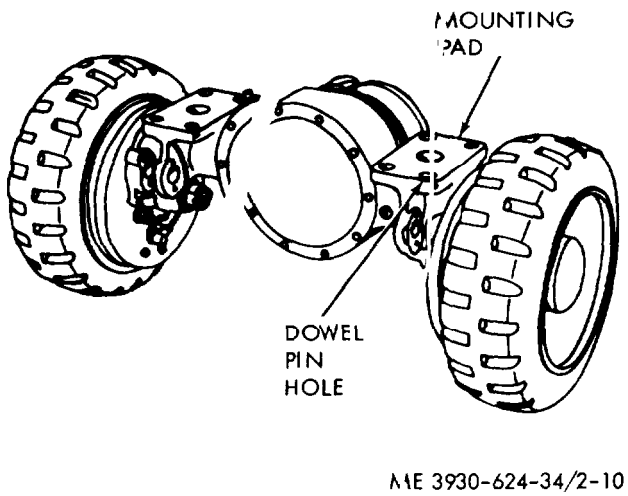


Figure 2-10. Mounting pad

b. Installation. Install the front axle assembly by reversing the removal procedure. Tighten all mounting hard ware and hose connections securely. Tighten capscrews (fig. 2-91 to a torque of 350 to 450 ft lb. Be sure the front axle assembly is properly alined with the transmission. Bleed the hydraulic brake system. Refer to TM 10-3930-624. 12.

2-11. Rear Axle Assembly (Steering)

a. Removal.

Warning: **Block the front wheels (drive) and raise the forks several feet off the ground before removing the rear axle.**

(1) Raise the rear end of the truck with a chain hoist to a height which makes all parts accessible, Block the truck in this position.

(2) Remove the rear wheels.

(3) Place a suitable jack under the rear axle and raise the jack slightly to remove stress from the axle mounting housings and to support the axle during removal.

(4) Disconnect the tie rods and power steering cylinder.

(5) Remove the capscrews and locknuts securing the axle mounting housing to the truck frame. Refer to figure 2-11.

(6) Lower the jack and remove the rear axle assembly **from** the truck.

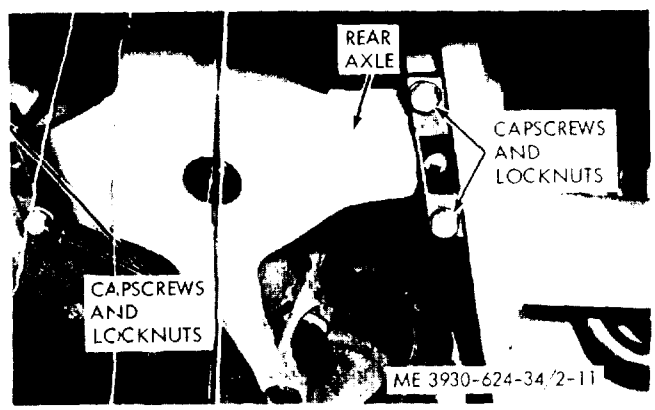


Figure 2-11. Rear axle mounting.

b. Installation.

(1) With the rear axle assembly on the jack, raise the axle assembly into position. Secure the axle mounting housings to the truck frame with capscrews and locknuts.

(2) Install all equal amount of shims between the frame and spacers on each end of the rear axle trunnion fore and aft to eliminate play. Secure the shims the the axle mounting housings with capscrews. 'lighten the housing mounting capscrews to 125-135 ft-lbs.

(3) Connect the tie rods and power steering cylinder.

(4) Install the rear wheels.

CHAPTER 3

REPAIR OF THE ENGINE

Section I. REPAIR OF THE FUEL SYSTEM

3-1. General

The fuel system consists of a gasoline tank, fuel filter, fuel pump, carburetor, air cleaner, and the necessary lines to complete the system. One end of the fuel line is connected to the shutoff valve at the base of the fuel tank. The other end of the fuel line is connected to the fuel strainer and sediment bowl. The sediment bowl is directly connected to the fuel pump.

3-2. Carburetor

a. Removal. Refer to TM 10-3930-624-12 for the removal procedure.

b. Disassembly.

(1) To separate the carburetor body, remove the four screws and lockwashers (1, fig. 3-1) which attach the throttle body (2) to the fuel bowl (52). Discard gaskets (3 and 4).

(2) Remove the float needle and valve seat (5) and the washer (6) from the body (2). Remove the jet (7), the needle (8), the spring (9) and the plug (10).

(3) Remove the plate (12), the retainers (14), the spring (15), the levers (17 and 19), and one each of the bushings (21), the washers (22 and 23), and the seals (24). Remove the shaft (26) and the other bushing, washers, and seal (21-24).

(4) Remove the venturi (28).

(5) Remove the float axle (29) by pressing a screwdriver against the float axle at the slotted side of the float hinge bracket. Pull the float axle out from the opposite side and remove the float (30).

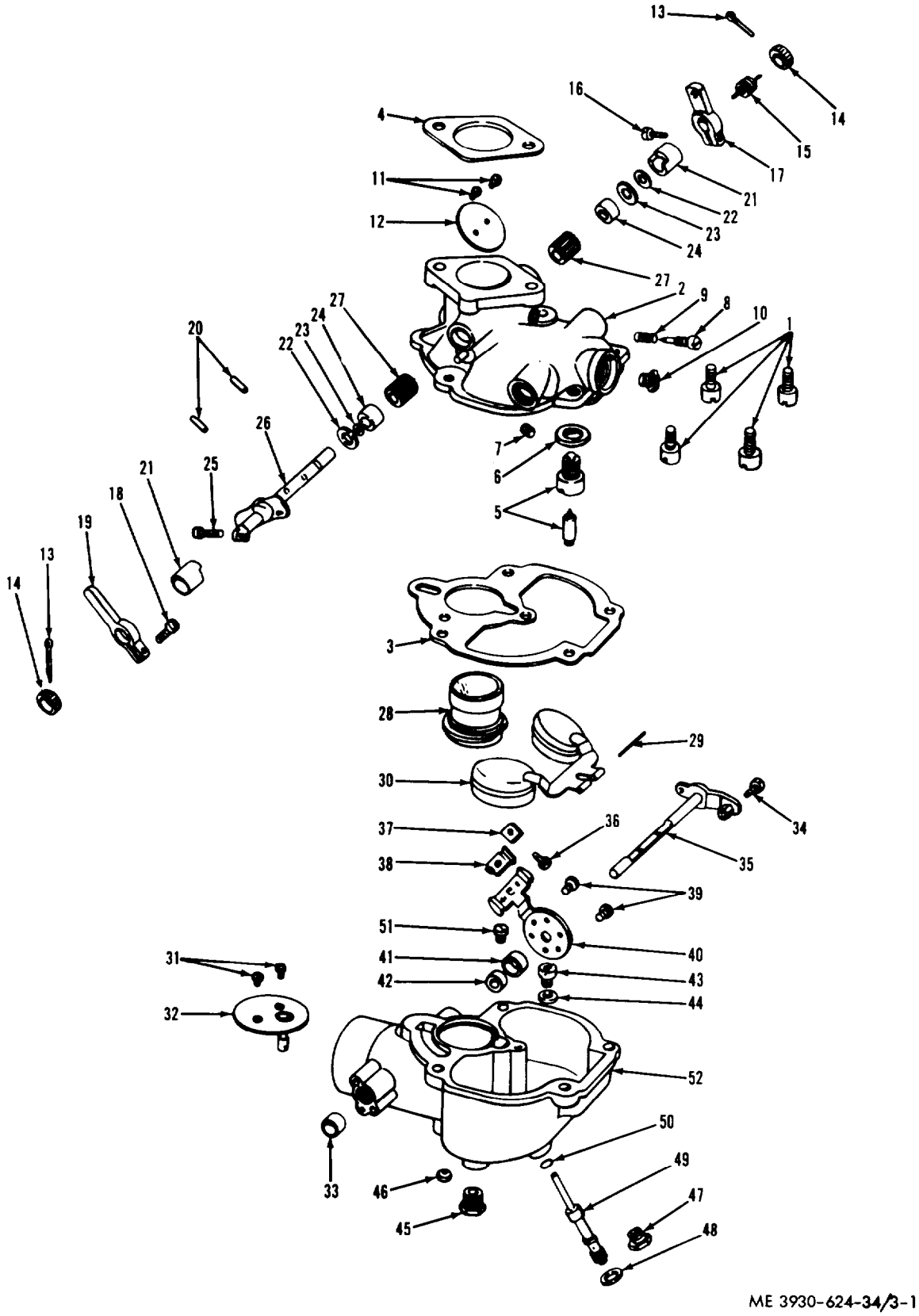


Figure 3-1. Carburetor assembly.

KEY to fig 3-1:

1. Capscrew and lockwasher
2. Body
3. Gasket
4. Gasket
5. Valve and seat
6. Washer
7. Jet
8. Needle
9. Spring
10. Plug
11. Capscrew
12. Plate
13. Cotter pin
14. Retainer
15. Spring
10. Capscrew
17. Lever
18. Capscrew
19. Lever
20. Roll pin
21. Bushing
22. Washer
23. Washer
24. Seal
25. Screw
26. Shaft
27. Needle bearing
28. Venturi
29. Float axle
30. Float
31. Screw
32. Plate
33. Plug
34. Screw
35. Shaft and lever
36. Screw
37. Nut
38. Clip
39. Screw
40. Bracket
41. Retainer
42. Washer
43. Jet
44. Washt=r
45. Plug
46. Jet
47. Plug
48. Washer
49. Jet
50. Washer
51. Jet
52. Body (fuel bowl)

(6) Remove the plate (32) and the plug (33) so the shaft and lever (35) may be withdrawn from the fuel bowl (52).

(7) Remove the clip (38) the bracket (40) and the retainer(41).

(8) Remove jets (43, 46, 49 and 51).

c. Cleaning. Clean all metal parts in solvent. Blow out all passages with compressed air. Make certain that all carbon deposits have been removed from the throttle bore and the ports.

d. Repair. Repair is limited to replacing parts contained in a repair kit. The parts are as follows: gasket (4,fig. 3-1), valve and seat (5), needle (8), seal (24), float axle (29), plug (33), retainer (41) and washers (6, 22, 42. 44, 48 and 50).

e. Reassembly. Assemble in reverse order of disassembly. observing the following :

(1) When installing the idle adjustment needle (8, fig. 3-) and friction spring (9) into the front of the body, do not overtighten. The seat may be damaged. Seat needle lightly, then back **the** adjustment needle out 1 ¼ turns for preliminary adjustment.

(2) Check for the correct float level. Invert the throttle body. Measure from the machined surface of the body to the top side of the float bodies at the highest point. This dimension should be 1 5 /32± **1 /** 32 in. To increase or decrease the distance between the float body and the machined surface, use a long-nosed pliers and bend the lever close to the float body.

(3) After fuel bowl and throttle body have been assembled, perform preliminary adjustment of the idle speed. Turn the throttle stop screw (25) in until it Just contacts the stop pin. Then turn the screw in an additional 1 1/2 turns.

f. Installation. Install and adjust the carburetor as directed in TM 10-3930-624-12.

3-3. Governor

a. Removal. (fig. 3-2.1

(1) Clean the governor housing and surrounding area to keep dirt out of the governor assembly.

(2) Remove the ignition coil from the governor assembly.

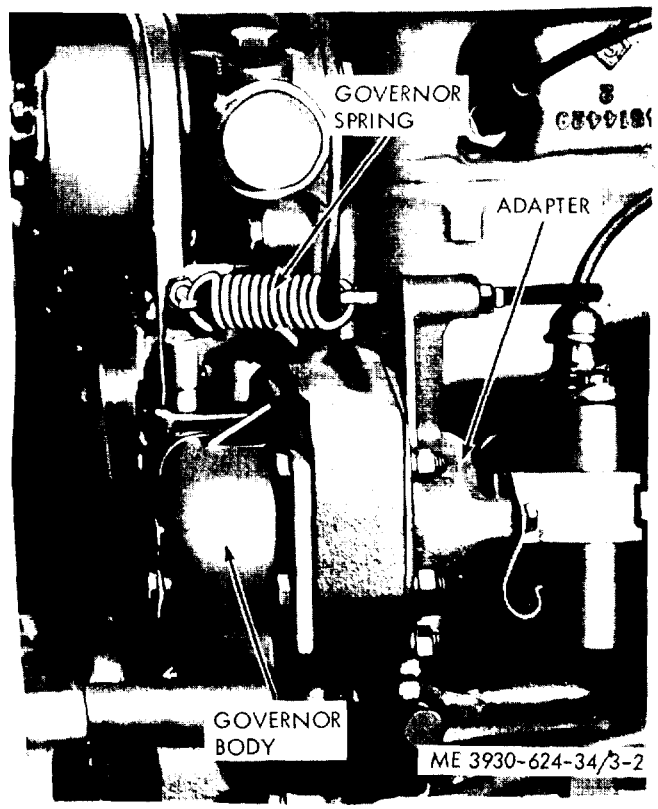


Figure 3-2. Governor.

(3) Remove the governor spring from the adjusting screws and disconnect the governor lever from the governor control rod.

(4) Remove the stud nut and the two capscrews from the flywheel housing. Lift the governor body away from the gear housing. In some instances the governor weights, shaft and drive gear will remain in the gear housing.

(5) Slide the thrust bearing and sleeve off the weight assembly shaft and work the drive gear free from the adapter.

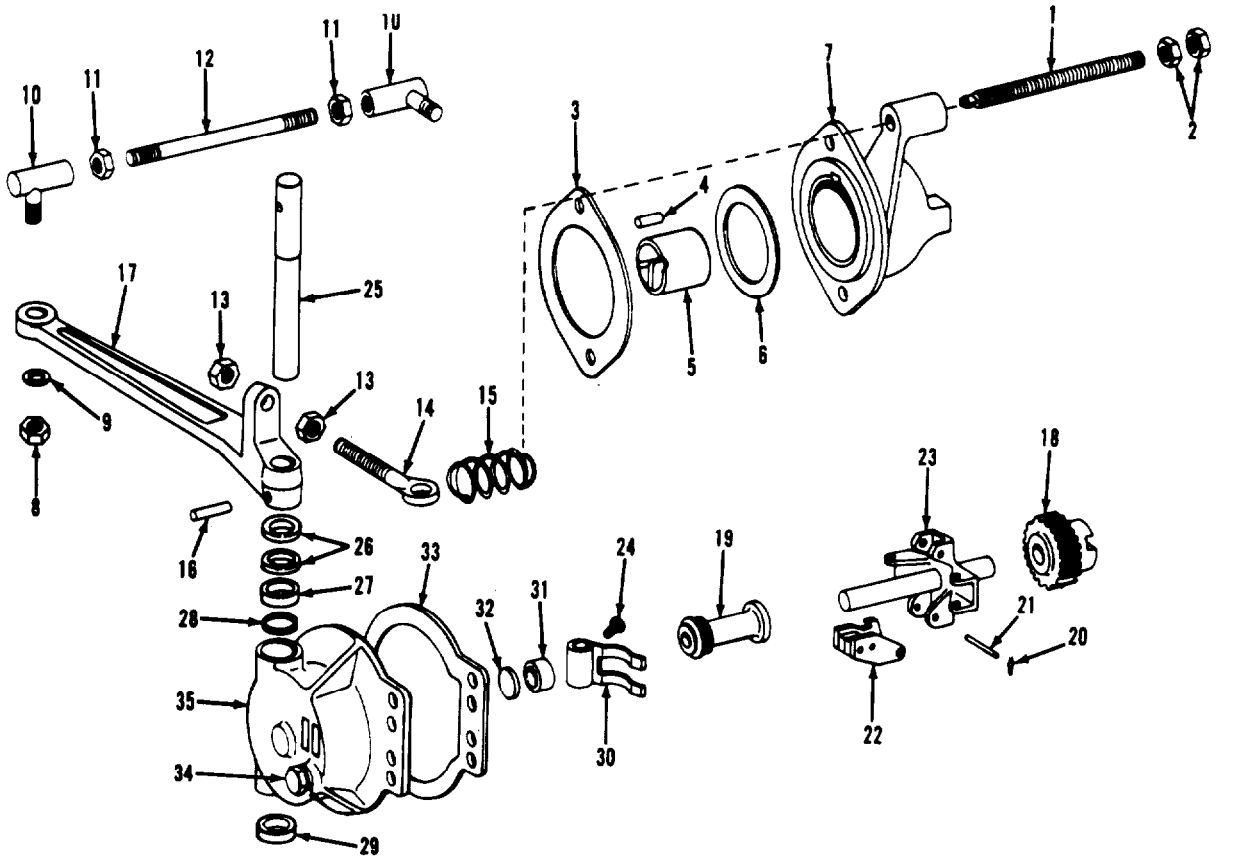
(6) Remove the two capscrews and lockwashers which attach the adapter to the front plate and gear housing. Remove the adapter and thrust vvasher. Remove the governor assembly.

b. Disassembly. (fig. 3-3.)

(1) Disassemble the adapter by removing the

bearing (5) and thrust washer (6) from the adapter housing (7).

(2) Disassemble the governor body as follows:



1. Control shaft
2. Nut
3. Gasket
4. Dowel
5. Bearing
6. Thrust washer
7. Adapter housing
8. Nut
9. Washer
10. Joint
11. Nut
12. Governor control rod
13. Nut
14. Eye screw
15. Spring
16. Pin
17. Governor
18. Gear
19. Sleeve and bearing assembly
20. Clip
21. Pin
22. Weight
23. Spider and shaft assembly
24. Capscrew
25. Rocker shaft
26. Oil seal
27. Bearing
28. Snap ring
29. Bushing
30. Yoke
31. Bushing
32. Thrust disc
33. Gasket
34. Capscrew
35. Body

Figure 3-3. Governor, exploded view.

(a) Remove the governor control rod (12), eye screw (14) and governor lever (17).

(b) Remove the spider and shaft assembly (23), drive gear (18) and sleeve and bearing assembly (19) as a unit from the body (35).

(c) Pull the governor drive gear (18) from the shaft. Remove the sleeve and bearing assembly (19) and weights (22).

(d) Remove the capscrews (24) which secure the yoke (30) to the rocker shaft (25). Remove the rocker shaft and seals and bushings. Remove the yoke (30).

c. Cleaning, Inspection and Repair.

(1) Clean all components with a cleaning solvent and thoroughly dry with compressed air.

(2) Inspect the rocker shaft (25. fig. 3-3) and bearing (27) for scoring and wear. Replace if the lever shaft does not rotate freely in the governor body.

(3) Slide the thrust disc (32) and bushing

onto the spider shaft. Replace if they do not slide easily.

(4) Inspect the drive gear (18) for worn or chipped teeth. Inspect machined surfaces for scoring. Replace the gear if necessary.

(5) Replace the weights (22) if they fit loosely or bind on the pivot pins (21).

(6) Inspect the bearing (5) and thrust washer (6) for worn spots or score marks. Replace the bearing if it fits loosely in the adapter housing (7).

(7) Replace the spring (1.5) if it is cracked or weak.

d. Reassembly.

(1) Install the bearing (5,fig. 3-3) so that the oil holes is up. Press into the housing (7).

(2) Assemble the remaining components in the reverse order of disassembly.

e. Installation. Install the governor by reversing the removal procedure. Refer to TM 10-3930-624-12 for the adjustment procedure.

3-4. Fuel Tank

a. Removal. Refer to TM 10-3930-624-12.

b. Disassembly.

(1) Remove the fittings and allow the remaining fuel to flow from the tank.

(2) Remove the filler assembly by un screwing it from the top of the tank.

(3) Remove the fuel gage sending unit. Be careful not to bend the float arm when removing the unit from the tank.

c. Cleaning. Inspection and Repair.

(1) Drain sediment from the fuel tank by opening the shutoff valve at the bottom of the fuel tank.

(2) Clean the tank with a solvent.

(3) Inspect the tank for leaks, cracks, dents, rust or corrosion.

Warning: **Before repairing the fuel tank, be sure the interior of the tank has been properly cleaned of gasoline and vapor to prevent hazard to personnel.**

(4) Repair the tank if it is damaged. Replace the tank if it is damaged beyond repair.

(5) Inspect the copper fuel line and hose for damaged connectors, crimping, cracks or oil soaked hose. Replace damaged lines.

d. Reassembly. Reassemble in the reverse order of diassembly.

e. Installation. Refer to TM 10-3930-624-34-12. After the fuel tank is installed and filled with gasoline. open the shutoff valve and start the engine and check for fuel leaks.

Section II. REPAIR OF THE ENGINE LUBRICATION SYSTEM

3-5. General

The purpose of the lubrication system is to reduce friction between moving parts such as gears, bushings. shafts. bearings, and pistons. The lubrication system consists primarily of the oil pump. oil pressure valve. oil pan, and oil filter. The oil pressure in the system is pre-set to 35 to 40 psi at full governed speed with the engine oil hot. After the engine has been run-in, the oil pressure operating range is 25 to 35 psi at rated engine operating speed arld normal operating temperature. The pressure at idle is approximately 15 psi. A relief valve in the oil pump returns the oil to the oil pan when the discharge pressure exceeds 70- 90 **psi.**

3-6. Oil Pump

a. Removal.

(1) Position the distributor rotor to fire on the No. 1 cylinder before removing the oil pump. This is done by positioning the No. 1 piston on the compression stroke with "IGN"in the center of the timing hole in the flywheel housing. In this position the piston is before top dead center. Mark the side of the distributor housing to indicate the position of the rotor.

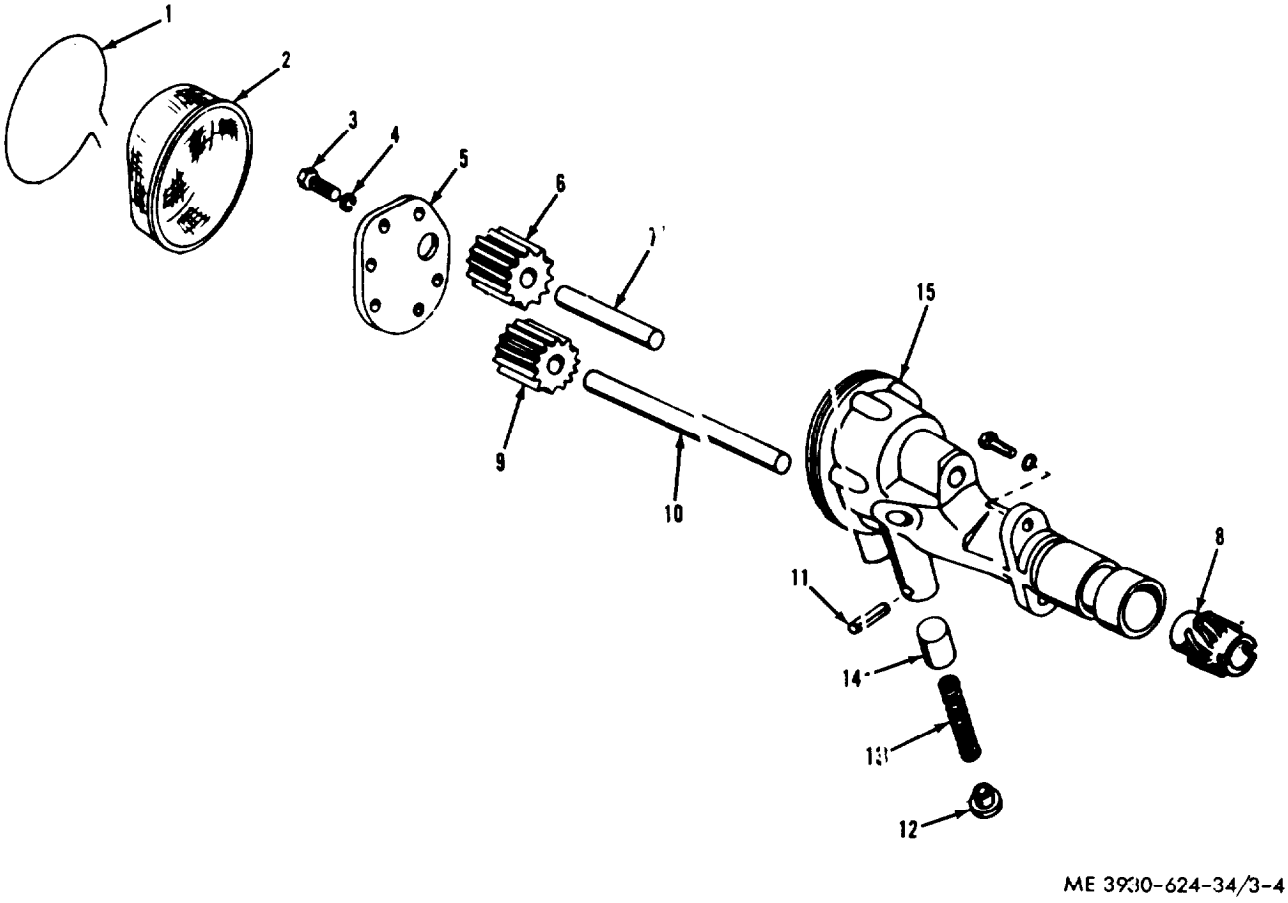
(2) Remove the oil pan. Refer to paragraph 3-8.

(3) Remove the capscrews and lockwashers which secure the oil pump to the cylinder block.

(4) Loosen the nut at the oil pump end of the oil tube assembly. Remove the pump from the cylinder block.

b. Disassembly. (fig. 3-4).

(1) Remove the screen retaining wire (1) and the oil screen (2). Remove the pump cover (5).



1. Wire
2. Screen
3. Capscrew
4. Lockwasher
5. Cover
6. Idler gear
7. Idler shaft
8. Gear
9. Drive gear
10. Drive shaft
11. Pin
12. Retainer
13. Spring
14. Piston
15. Body

Figure 3-4. Oil pump, exploded view.

(2) Remove the idler gear (6) and the idler shaft (7).

(3) Place the pump in a press and remove the gear (8). Place a drift on the drive shaft and remove the drive gear (9) and drive shaft (10).

(4) Remove the pin (11). retainer (12), spring (13) and piston (14).

c. Cleaning and Inspection.

(1) Clean in a suitable solvent and dry with compressed air.

(2) Inspect the gear teeth, inside of pump housing and inner face of the cover for scratches, cracks. nicks, burrs. scoring and other surface damage. Smooth surfaces with a soft hone or crocus cloth or replace as required.

(3) Inspect the pump shafts and shaft bores for scoring and wear.

(4) Install the gears and shafts in the pump body. Radial clearance between the gears and pump body should be 0.001 to 0.002 inch. End clearance between the gears and pump cover should be 0.002 to 0.004 inch and must not exceed 0.006 inch. Backlash between the pump gears should not exceed 0.020 inch. Replace parts as required. Replace the pump if clearances are not maintained.

d. Reassembly. Assemble the oil pump in the reverse order of disassembly. Observe the following :

(1) Press the gears (6 and 9, fig. 3-4) onto the shafts (7 and 10) so that the gears are flush with the ends of **the** shafts.

(2) Lubricate the shafts (7 and 10) before installing in the body.

(3) After assembling the pump, rotate the gear (8) to make sure it turns freely.

e. Installation.

(1) Use the following procedure to install the oil pump. If the distributor and the oil pump were both removed from the engine, refer to (2), below.

(a) Make certain the distributor rotor is aligned with the reference mark made on the side of the distributor housing as instructed in a, above.

(b) Position the offset of the oil pump in the cylinder block. Use a dial indicator to position the offset of the pump drive gear to the right, towards the rear of the cylinder block, so the slot will be at the specified angle (fig. 3-5).

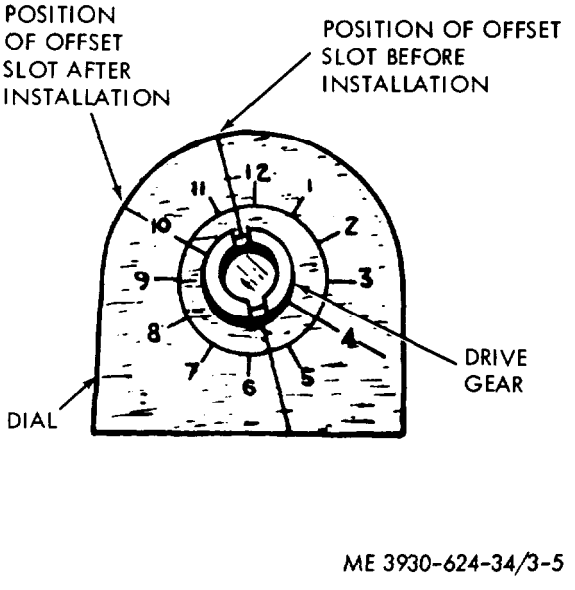


Figure 3-5. Positioning drive gear *offset slot.*

(c) Insert the oil pump in the cylinder block, engaging the oil pump drive gear with the gear on the camshaft. Install one retaining capscrew and lockwasher and tighten only enough to hold the pump in place.

Caution: Do not tighten the capscrews unless the pump drive gear has properly engaged with the gear on the camshaft and the tang on the distributor drive engages with the drive slot in the pump gear.

(d) After the oil pump is in mesh with the gear on the camshaft, check to make certain that the distributor drive has engaged the slot in the pump drive gear. Make certain the rotor is pointing to the reference mark made on the side of the housing.

(e) Install the cap on the distributor.

(f) Install a second retaining capscrew and lockwasher and tighten both capscrews to a torque of 18 to 21 ft lbs. Do not overtighten the capscrews.

(g) After the pump is secured in position, check the gear backlash between the drive gear and the gear on the camshaft. Correct gear backlash is 0.004-0.010 inch and can be checked through the opening at the fuel pump mounting pad.

(h) Install the oil tube from the block to the pump and tighten the nuts securely.

(i) Install the oil pan. Refer to paragraph *3-8.*

(2) If the engine was overhauled, or if the oil pump and the distributor were both removed, use the following procedures to install the oil pump.

(a) Rotate the crankshaft in the direction of engine rotation until the No. 1 cylinder exhaust valve lobe on the camshaft points horizontally to the side of the cylinder block. When the No. 1 cylinder exhaust valve camshaft lobe is in this position, the piston is on the compression stroke near or at top dead center. The timing mark stamped on the flywheel should be in the timing hole in the flywheel housing.

(b) Position the offset of the oil pump in the cylinder block. Use a dial indicator to position the offset of the pump drive gear to the right towards the rear of the cylinder block, so the slot will be at the specified angle. Refer to figure 3-5.

(c) Insert the oil pump in the cylinder block, engaging the oil pump drive gear with the gear on the camshaft. As the pump drive gear meshes with the camshaft gear, it will rotate slightly. When the pump gear is fully engaged with the camshaft gear. the slot will be positioned at a specified angle. Refer to figure 3-5. Install the capscrews finger-tight to hold the pump in position.

(d) Insert the distributor into the cylinder block and rotate the rotor until the offset tang on the distributor drive engages the slot in the pump drive gear. In this position the rotor will be pointing to the No. 1 cylinder spark plug wire in the distributor cap.

(e) Install the cap on the distributor.

(f) Install the second retaining capscrew and lockwasher and tighten both capscrews to a torque of 18 to 21 ft-lbs. Do not overtighten.

(g) After the pump is secured in position, check the gear backlash between the drive gear and the gear on the camshaft. Gear backlash is 0.004-0.010 inch and can be checked through the opening at the fuel pump mounting pad.

(h) Install the oil tube and tighten the front and rear tube nuts securely.

(i) Install the oil pan. Refer to paragraph 3-8.

3-7. Oil Pressure Valve Adjustment

a. Start the engine and operate at half throttle. Observe the engine oil pressure gage.

b. Turn the adjusting screw (fig. 3-6) to obtain a gage reading of approximately 10 psi.

c. Allow the engine to reach operating temperature and operate at high idle. Turn the adjusting screw if necessary to obtain a gage reading of 25 to 30 psi.

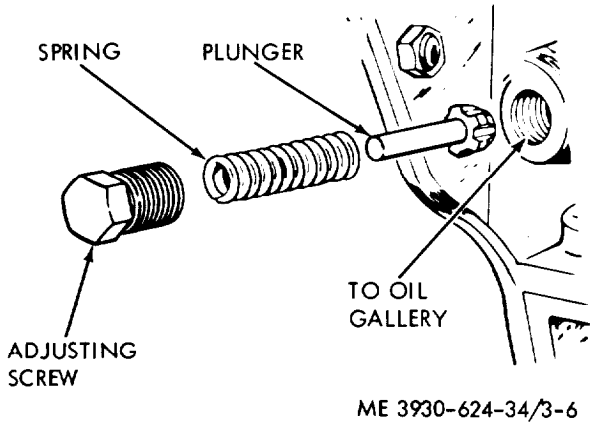


Figure 3-6. Oil pressure valve.

3-8. Oil Pan

a. Removal.

(1) Refer to TM 10-3930-624-12 and drain the engine oil.

(2) Remove the grille from the counterweight.

(3) Remove the steer axle assembly. Refer to paragraph 2-1 I.

Note. It will be necessary to work through the counterweight in order to remove the front oil pan capscrews.

(4) Remove the rapscrews from the front and side of the oil pan, and remove the oil pan.

b. Installation.

(1) Cement a new gasket to the oil pan side rails.

(2) The oil seal at the rear of the engine should be replaced when the engine is overhauled. If the engine has not been overhauled. inspect the lower portion of the seal to make certain it is in good condition. If the seal has to be replaced, it will be necessary to remove the flywheel housing.

(3) When the engine is overhauled. the oil pan front gasket should be cemented to the rear of the front plate before it is secured to the front of the cylinder block. If the engine has not been overhauled and the oil pan portion of the gasket is dam aged, scrape away the gasket as far as the cylinder block rails. Cut the lower portion from the new gasket and cement it in position on the front plate assembly.

(4) Before installing the oil pan, place a small quantity of a nonhardening sealing compound in the corners formed by the flywheel housing and cylinder block rails, and front plate assembly and cylinder block rails. This will prevent oil leaks at these points.

(5) Position the oil pan on the cylinder block rails and secure with capscrews and lockwashers. Tighten the capscrews to a torque of 18 to 21 ft lbs.

(6) Service the engine with oil. Refer to LO 10-3930-624-12.

Section III. REPAIR OF THE COOLING SYSTEM

3-9. General

The cooling system cools the engine, torque converter. and transmission. The system consists of the radiator. thermostat. fan. water pump, and hoses. The water pump circulates the coolant through the engine and returns it to the radiator. The coolant is then cooled by a flow of air drawn across the radiator by the fan. When the engine coolant is below operating temperature, the thermostat closes, preventing the circulation of coolant until it reaches the proper temperature. Torque converter and transmission oil is transferred through hoses to the lower part of the radiator where it is cooled.

3-10. Radiator

a. Removal. Refer to TM 10-3930-624-12.

b. Testing.

(1) Completely drain the coolant from the radiator before testing.

(2) Plug all radiator outlets except the top outlet. Immerse the radiator in water and apply 10 psi air pressure through the top outlet.

(3) Carefully check for air bubbles which indicate a leak.

c. Repair. Solder all leaks. Wash off excess acid after soldering to prevent corrosion of the metal tubes.

d. Installation. Refer to TM 10-3930-624-12.

Section IV. REPAIR OF THE ENGINE COMPONENTS

3-11. General

The removable valve-in-head cylinder head is attached to the cylinder block by special capscrews. It contains the intake valves, exhaust valves, inserts, and spark plugs and supports the rocker arm assembly, The one piece cylinder block employs replaceable cylinder sleeves which are sealed in the block base by seal rings. The top of the cylinder sleeves are flanged to fit a machined recess in the cylinder block. A one piece head gasket prevents leakage between the block, cylinder sleeves, and cylinder head. The crankshaft is a heat-treated alloy steel forging, supported by seven main bearings. The crankshaft has an oil seal at each end. The aluminum pistons are attached to the forged steel connecting rods by full-floating piston pins. The pins are secured in the piston by snap rings in the piston bosses. The connecting rods utilize bronze bushings in the upper end and replaceable, steel-backed aluminum lined bearings in the lower end. The camshaft, supported by four camshaft bearings, is driven from the crankshaft gear through the timing gear and operates the valves through the push rods and rocker arm assembly. The camshaft also drives the oil pump, fuel pump, and distributor. The rocker arms are installed on a hollow shaft which provides lubrication for the rocker arms. Excess oil flows out through an overflow line and lubricates the valve lifters and the camshaft. The intake and exhaust manifold is a one piece casting with separate porting for the exhaust gases and incoming fuel-air mixture. An updraft carburetor is mounted on the intake manifold.

3-12. Cylinder Head, Valves and Valve Mechanism

a. Removal.

(1) Remove the hood, side panels, seat and seat support, and air cleaner. Refer to TM 10. 3930-624-12.

(2) Remove the rocker arm cover (4, fig. 3-7). Remove the vent hose.

(3) Remove the oil tube from the cylinder head to the rocker arm shaft.

(4) Remove the capscrews (6) and washers (7) which secure the rocker arm shaft supports (9) and clips (8) to the cylinder head. Lift the rocker arm assembly from the head.

(5) Drain the radiator and engine block. Refer to TM 10-3930-624-12.

(6) Remove the intake and exhaust manifold. Refer to TM 10-3930-624-12.

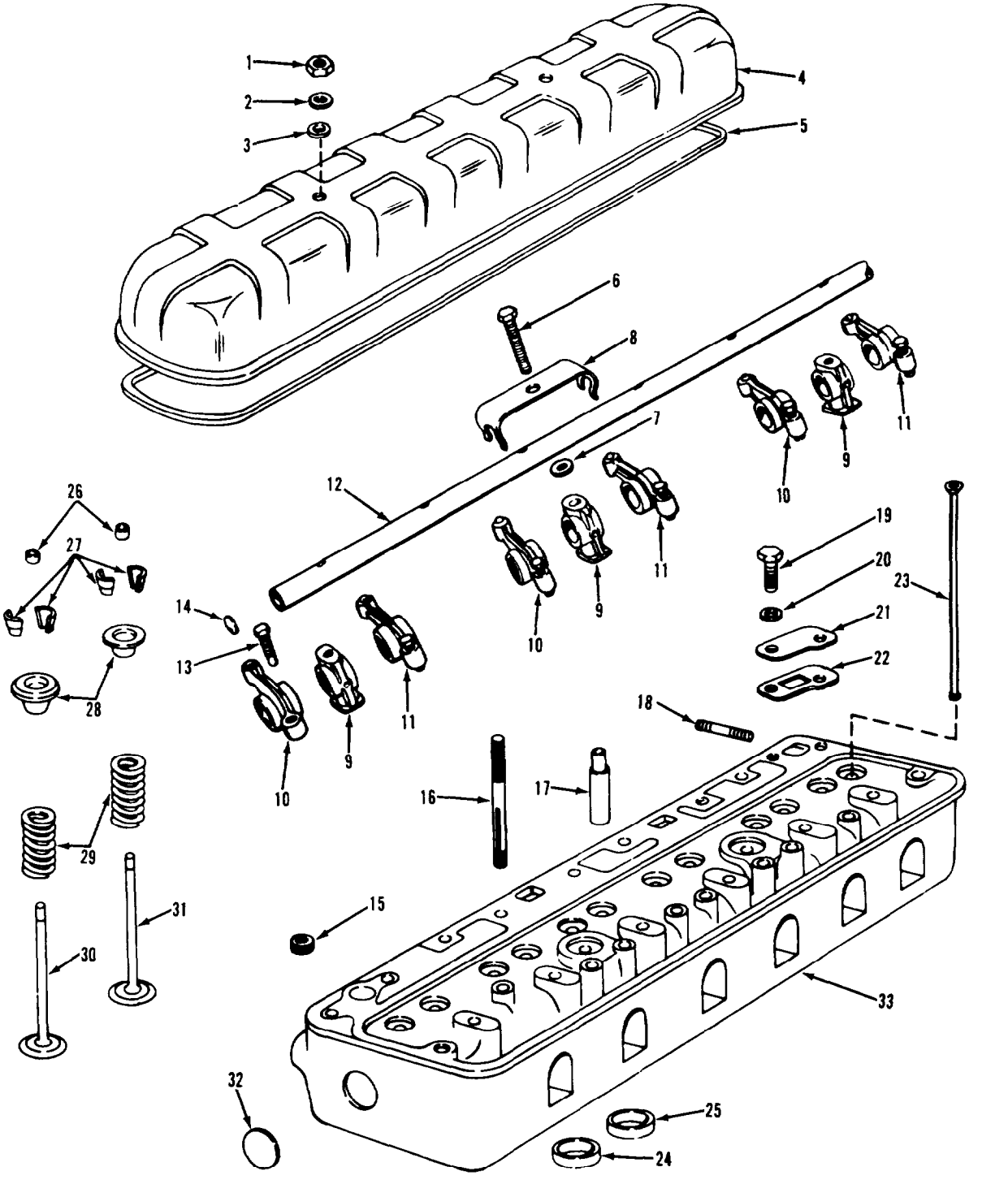
(7) Disconnect the lead from the coolant temperature sending unit. Remove the coolant tubes and the thermostat housing. Refer to TM 10-3930-624-12.

(8) Disconnect the rocker arm oil feed line from the cylinder head and move it out of the way.

(9) Remove the cylinder head capscrews and washers. Attach a hoist to the cylinder head and remove from the truck. Discard the head gasket.

b. Disassembly. (fig. 3-7.)

(1) Slide the rocker arms (10 and 11) off the rocker arm shaft (12). Remove the adjusting screws (13) and plug (14).



ME 3930-624-34/3-7

1. Nut
2. Washer
3. Washer
4. Rocker arm cover
5. Gasket
6. Capscrew
7. Washer
8. Clip
9. Support
10. Rocker arm
11. Rocker arm
12. Shaft
13. Screw
14. Plug
13. Plug
16. Stud
17. Guide
18. Stud
19. Capscrew
20. Washer
21. Cover
22. Gasket
23. Push rod
24. Insert
25. Insert
26. Cap
27. Lock
28. Retainers
29. Spring
30. Valve
31. Valve
32. Plug
33. Cylinder head

Figure 3-7. Cylinder head and valve.

(2) Remove the plug (15) from the cylinder head. Remove the studs (16) from the head. Using a guide removal tool, extract the valve guides (17).

(3) Remove the studs (18). capscrews (19). washers (20), cover (21) and gasket (22).

(4) Remove the push rods (23) from the cylinder head.

(5) Inspect the valve seat inserts (24 and 25). If loose, cracked or pitted, remove by welding a bead around the inside of the beveled edge. Allow to cool and lift out the inserts.

(6) Place the cylinder head on end and depress the springs (29) with a spring compressor. Remove the caps (26), locks (27) and retainers (28). Release the spring compressor and remove the springs (29) and valves (30 and 31). Mark the valves as they are removed to ensure installation in original positions.

c. *Cleaning, Inspection and Repair.*

(1) Inspect the rocker arm bore for wear. The specified clearance between the shaft and the bore is 0.001 to 0.0035 inch and must not exceed 0.005 inch. If the clearance is greater than the allowable limit, the rocker arm should be replaced. Inspect the machined end (valve stem end) of the rocker arms for signs of wear. If they are not excessively worn, the contact surface can be refaced on a lathe.

(2) Inspect the rocker arm shaft for wear and replace if necessary. Remove the end plugs, and clean the oil holes with a solvent and compressed air.

(3) Clean the cylinder head with a cleaning solvent, removing all carbon deposits. If the cylinder head is to be replaced. the parts removed from the old head must be thoroughly inspected before installing them in a new head. Be sure the water passages in the cylinder head are clean.

(4) Inspect both ends of the push rods for signs of wear. Polish.out any nicks or score marks. If the push rods are bent, twisted, or damaged. they must be replaced.

(5) Inspect the flat surface of the valve lifters for wear. Replace any worn lifters. Check the lifter bore in the cylinder block and the OD of the valve lifter stem. If there is more than 0.0025 inch clearance, the lifter should be replaced.

(6) Inspect the valve springs for cracks. Both intake and exhaust valve springs when compressed to a length of 1 27 / 32 inches should exert a resistance force of 42-47 pounds. When the spring is compressed to 1 13 / 32 inches, it should have a resistive force of 122- 131 pounds. Spring free length is 2 3 / 32 inches. Replace any springs that are cracked or weak.

(7) Clean the carbon from the valves and valve seats. Replace the valves if they are cracked, bent, or worn beyond the allowable limits. The specified limits of the valve stems is 0.3405-0.3415 inch. Before installing new valves or valves used previously, the valve seats in the cylinder head should be inspected for proper valve seating. If previously used valves are to be reinstalled, the valve stems should be cleaned and the valve faces ground to an angle of 45° When refacing the valves. remove just enough to clean up the face, removing all evidence of pitting and grooving.

(8) Clean the carbon from the valve guides using a valve guide cleaning tool. The specified clearance of the intake valve stem in the valve guide is 0.0015 to 0.0033 inch, and should not exceed 0.006 inch. If clearances exceed the specified limits. the valve, valve guide, or both should be rfxplaced.

(9) Inspect the valve seat inserts. If loose, cracked, or pitted. new inserts must be installed. When new valve seat inserts are installed, or previously used inserts refaced, refinishing must be done with a valve grinder set. Use the following procedure to grind the valve seat inserts.

(a) Install the valve seat grinding tool in position with the tool pilot in the valve guide.

(b) Use a 45° grinding wheel for refacing the valve seat. Use the 30° grinding wheel for narrowing the intake valve seat to the specified 1/16 inch and use the 60° grinding wheel to narrow the exhaust valve seat to 3 / 32 inch.

(c) After the seats have been ground, use a dial indicator gage to check concentricity of the valve seats relative to the valve guides. Total run out of the valve should not exceed 0.002 inch.

(d) Insert the valves in position in the cylinder head and lap in place, using a fine grain valve lapping compound. After lapping, contact between the valves and seats may be checked by wiping a thin film of Prussian Blue on each valve scat and setting the valves in place. Bounce each valve once on its seat but do not rotate the valve. If the valve seats were properly ground, a continuous thin blue line will be evident around the face of the valve.

d. Reassembly. (fig. 3-7.)

(1) If new valve guides (17) are installed, insert the upper (chamfered) end of the guide on a guide installing tool. Press the guide into the cylinder head until the top of the guide protrudes 7 / 32 inch above the the top surface of the cylinder head. Position all guides to the same depth in the head.

(2) Insert the valves (30 and 31) into the guides to check for proper clearance between the valve stems and valve guides. Specified clearance is 0.0015 to 0.0035 inch. If clearance is less than 0.0015 inch. ream the guides to obtain proper clearance. Inside diameter of the valve guide is 0.343 to 0.344 inch.

(3) If new seat inserts (24 and 25) are to be

installed, chill the inserts in dry ice. Start the inserts into the counterbore (valve seat side up). Using a valve seat installation tool, drive the insert down tightly into the counterbore. Stake the valve seats in position using a center punch. Stake at two or three points around the edge of the seat. Refinish the valve seat inserts.

(4) Install the valves (30 and 31) in their original positions. Install the springs (29), retainers (28) and locks (27). Using a spring compressor, compress the springs and install the caps (26).

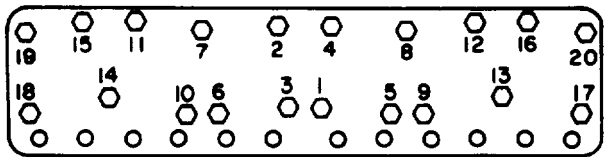
(5) Assemble remaining components in the reverse order of disassembly.

e. Installation.

(1) Clean the top of the cylinder block.

Caution: **Inspect top of the pistons for foreign objects before installing the head.**

(2) Install guide studs in holes 11 and 12. Refer to figure 3-8.



ME 3930-624-34/3-8

Figure 3-8. Guide stud location *and torquing sequence.*

(3) Be sure the new cylinder head gasket is installed with the proper side up. The gasket is marked to indicate which side is to be installed on the cylinder block. Do not use any sealer or gasket dope on any part of the cylinder head gasket assembly. A thin coat of light grease may be used on the top deck of the cylinder block around the cylinder bores.

(4) Position the fire rings inside the cylinder bores of the gasket and ensure that the gasket does not overlap the fire rings.

(5) Lower the cylinder head to the block with the aid of a sling. The head should be properly located by the guide studs.

(6) Install the capscrews in all locations except those occupied by guide studs.

(7) Remove the guide studs and install the remaining capscrews. Tighten the capscrews in the specified numerical sequence (fig.3-8) to 55 ft lbs.

(8) Retighten the capscrews, in numerical sequence, to a final torque of 110 ft lbs.

(9) Install the push rods and make sure they seat properly in the lifters.

(10) install the rocker arm assembly on the cylinder head, making certain that the shaft supports are positioned with the longer section down. Refer to figure 3-9.

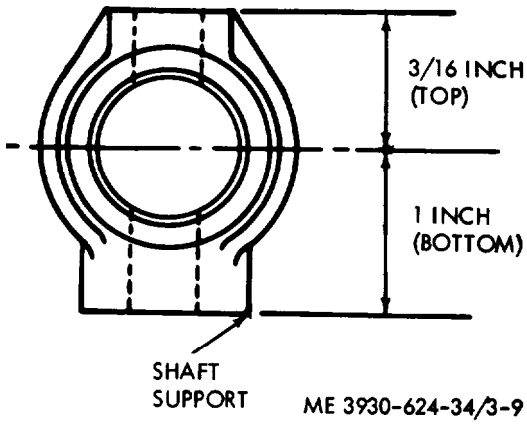


Figure 3-9. Rocker arm shaft support installation.

Caution: **The rocker arms are not designed to contact the valve stems at the center, but 1/16 inch off center. Do not bend the rocker arms to make them line up center to center with the valve stems.**

(11) With the valve lash adjusting screws (13, fig. 3-7) correctly seated in the push rods (23), tighten the shaft support stud nuts and capscrews to a torque of 18 to 22 ft lbs.

(12) Install the oil tube between the rocker arm shaft and cylinder head.

(13) Connect the rocker arm oil feed line from the head.

(14) Install the thermostat housing. Connect the coolant outlet tube from the thermostat housing to the radiator. Install the coolant bypass tube and connect the lead at the coolant temperature sending unit.

(15) Install the manifold. Refer to TM 10-3930-624-12.

(16) Close the drain cocks and refill the cooling system with the proper coolant.

(17) Adjust the valve clearance. Refer to TM 10-3930-624-12.

(18) Install a new rocker arm cover gasket. Install the rocker arm cover and vent hose.

(19) Install the seat and seat deck, air cleaner, and side panels.

3-13. Timing Gear Assembly

a. Removal.

(1) Remove the radiator and fan belt. Refer to TM 10-3930-624-12.

(2) Remove the hydraulic pump and crankshaft pulley.

(3) Remove the governor. Refer to paragraph 3-3.

(4) Remove the front support capscrews and raise the front end of the engine approximately 2 inches. Block the engine in this position.

(5) Remove the capscrews, lockwashers, stud nut, and lockwasher attaching the timing gear cover to the front plate and oil pan.

(6) Tap the cover lightly to remove the cover. Do not attempt to pry the cover off.

(7) Remove the retaining clip and remove the camshaft gear. Refer to paragraph 3-1.5.

(8) Remove the fuel pump from the side of the engine. Refer to TM 10-3930-624-12. Place a bar through the opening against the side of the cam to hold the camshaft in a forward positinn.

(9) Use a gear puller to remove the crankshaft gear from the crankshaft. Refer to paragraph 3-17.

(10) Remove the governor drive gear. Refer to paragraph 3-3.

b. Cleaning and Inspection.

(1) Clean the timing gear cover. timing gears, and mounting hardware with a cleaning solvent.

(2) Inspect the timing gear cover for dents, cracks, corrosion.

(3) Inspect the gears for nicked, scored, or broken teeth. Replace any worn or damaged parts. Refer to paragraph 3-15 for camshaft gear inspection and paragraph 3-17 for crankshaft gear inspection.

c. Installation.

(1) Use the following procedure to install the camshaft gear:

(a) Line up the camshaft gear on the key. Drive the gear onto the camshaft using a block of hardwood and a hammer. Drive the gear on far enough so the thrust plate rests against the camshaft journal.

(b) Check the clearance between the thrust plate and the bearing journal. Refer to paragraph 3-15. The specified clearance is 0.003-0.008 inch.

(c) Install the retaining clip.

(d) Remove the bar which was used to hold the camshaft in position.

(2) Use the following procedure to install the crankshaft gear:

(a) Install the key in position on the crankshaft.

(b) Heat the crankshaft gear in boiling oil for approximately 15 minutes. Pick up the gear with a tongs or pliers and slide the gear onto the crankshaft. Make sure the gear timing mark is aligned with the camshaft gear timing mark. It may be necessary to tap the gear with a wood block and a hammer to seat it against the crankshaft shoulder.

(c) Allow the gear to cool gradually; do not immerse in water or oil.

(3) Install the fuel pump. Refer to TM 10-3930-624-12. Install the governor assembly. Refer to paragraph 3-3.

(4) Check the backlash of the gears with a dial indicator. Refer to figure 3-10. One or more of the mating gears should be replaced if the backlash exceeds 0.008 inch.

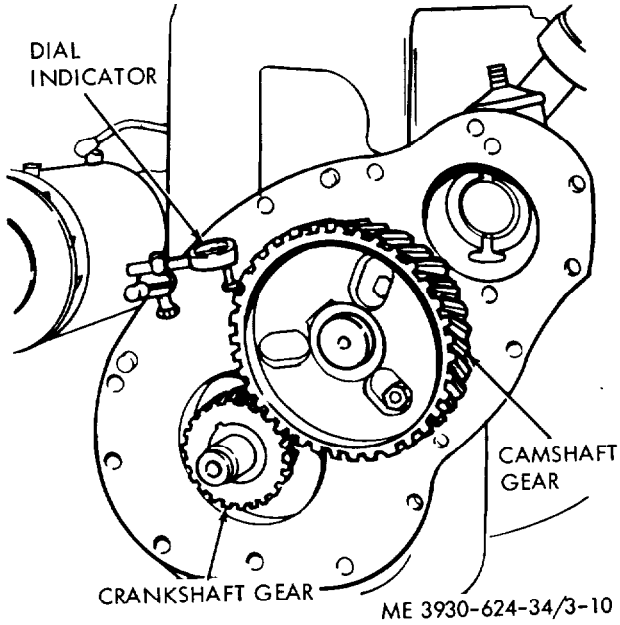


Figure 3-10. Checking gear backlash.

(5) Install a new gasket and install the timing gear cover.

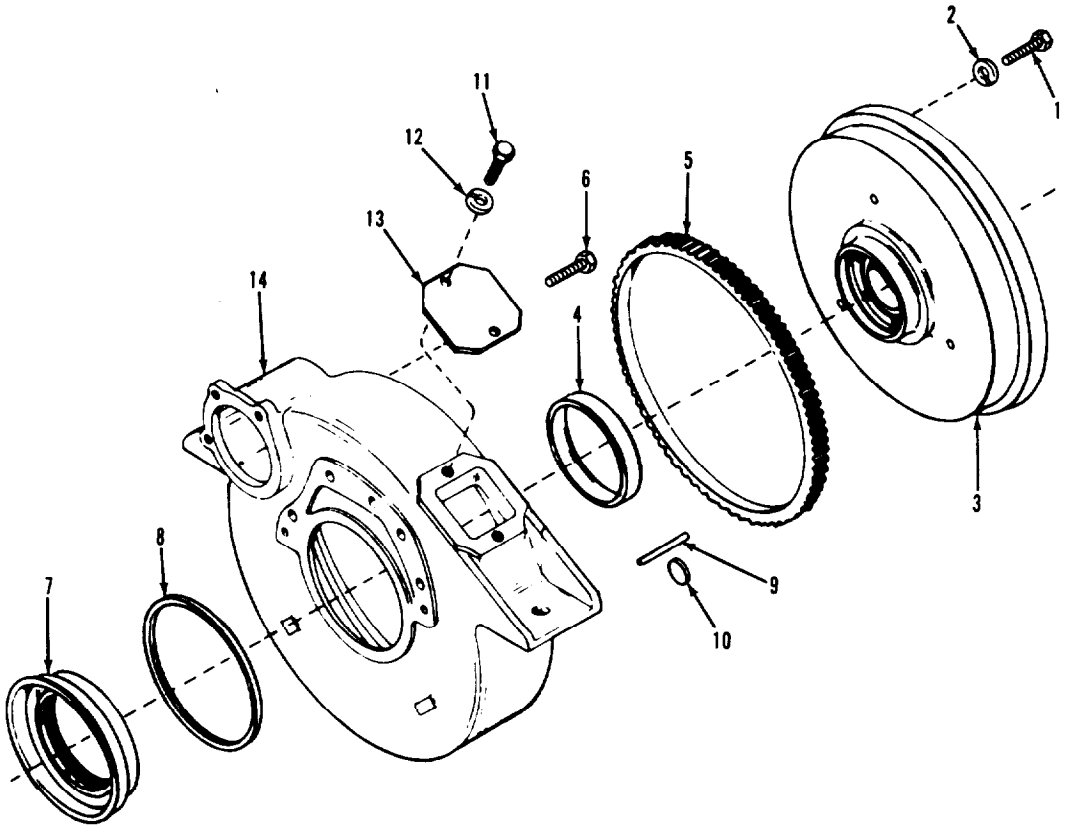
(6) Install the crankshaft pulley and hydraulic pump (para 5-5).

3-14. Flywheel Assembly

a. Removal and Disassembly.

(1) Remove the transmission. Refer to paragraph 2-8.

(2) Remove two capscrews (1, fig. 3-11) and lockwashers (2) which are horizontally opposite and install two guide studs. Attach a sling to the flywheel (3) and remove the remaining capscrews (1). Slide the flywheel off the guide studs.



ME 3930-624-34/3-11

1. Capscrew
2. Lockwasher
3. Flywheel
4. Wear sleeve
5.
6. Capscrew
7. Oil seal
8. Oil seal
9. Dowel pin
10. Plug
11. Capscrew
12. Lockwasher
13. Cover
14. Flywheel housing

Figure 3-11. Flywheel and flywheel housing. exploded view.

(3) Inspect the wear sleeve (4) on the front side of the flywheel for scoring and damage. Use a pry bar or a three jaw external puller to remove the wear sleeve if it must be replaced.

Caution: **Be careful not to score or damage the flywheel while removing the wear sleeve.**

(4) Inspect the ring gear (5) for damage and wear. Replace if necessary.

Caution: **Do not attempt to remove the ring gear without first expanding it.**

(5) Grind a notch through the ring gear (5). Expand the ring and drive it off the flywheel.

(6) Remove the starter motor. Refer to TM 10-3930-624-12.

(7) Loosen the capscrews on the oil pan to relieve pressure at the pan section of the oil seal in the flywheel housing.

(8) Remove two horizontally opposite capscrews (6) and install guide studs.

(9) Attach a sling to the flywheel housing and remove the flywheel housing

(10) Press out the rear oil seal (7) and remove the outer oil seal (8).

(11) Remove the dowel pins (9), plugs (10) and inspection cover (13) from the flywheel housing (14).

b. Cleaning, Inspection and Repair.

(1) Clean all parts with a cleaning solvent.

(2) Inspect the flywheel for cracks or other damage. Replace if. cracked or extensively damaged.

(3) Inspect the remaining parts for damage and wear and replace as necessary.

(4) Remove all burrs and nicks from the surface of the flywheel that fits against the flange of

the crankshaft. If the surface is not smooth and true they flywheel may wobble. This will result in improper torque converter operation and engine vibration.

c. Reassembly and Installation. (fig. 3-11.)

(1) If the ring gear (5) was removed, install as follows:

(Caution: Do not heat the ring gear to a bright red as heat-treatment will be destroyed.

(a) Heat the ring gear uniformly to approximately) 400°F (red heat visible in the dark). Keep the flywheel at room temperature.

(b) Start the ring gear on the flywheel (3) so the chamfered ends of the teeth are facing the cylinder block. These ends of the teeth engage with the drive pinion of the starter motor.

(c) Drive the ring gear down tight against the shoulder of the flywheel. Allow the ring gear to cool slowly. do not cool with water.

(2) Install the wear sleeve (4) as follows:

(a) Position the wear sleeve so its beveled edge is in the same direction as the beveled edge of the flywheel.

(b) Do not use any lubricant or sealer between the wear sleeve and flywheel flange. Metal to metal contact between the sleeve and flywheel flange is required for adequate heat flow to prevent overheating and burning of the oil seal.

(c) Do not heat the wear sleeve before installing. Press on when the wear sleeve and flywheel are at approximately the same temperature.

(3) Install a new outer oil seat (8) and a new rear oil seal (7) on the flywheel housing.

(4) Reassemble the remaining flywheel assembly components.

(5) Ensure that the mating surfaces of the flywheel housing and the cylinder block are clean and smooth

(6) Install the flywheel housing in the reverse order of removal.

(7) Using a dial indicator. check the housing runout. Refer to figure 3-12. Total runout must not exceed 0.010 inch.

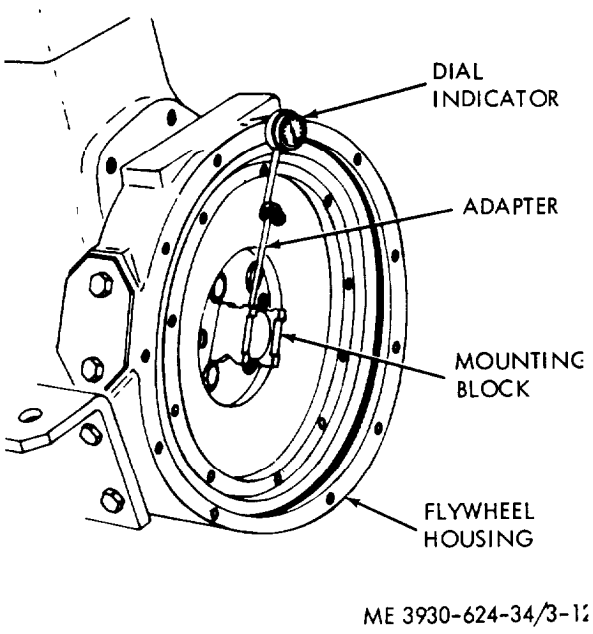
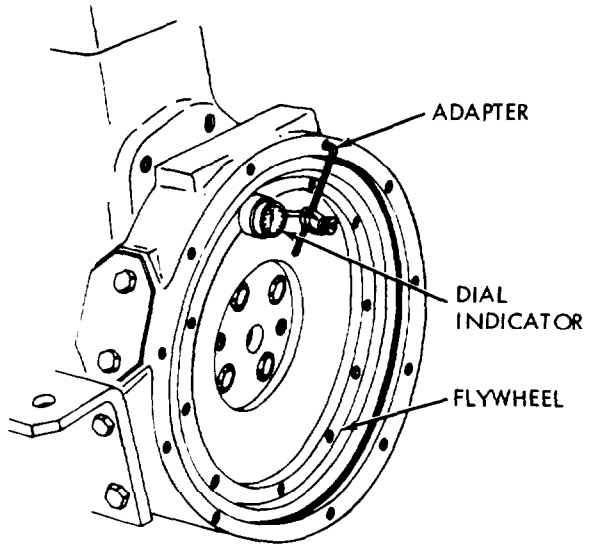


Figure 3-12. Checking flywheel housing runout.

(8) If a new flywheel (3) is to be installed, compare the timing marks of the old and new flywheels.

(9) Install the flywheel by reversing the removal procedure. The flywheel can be installed in only one position because of the offset capscrew hole.

(10) Attach a dial indicator and check the flywheel runout. Refer to figure 3-13. Runout must not exceed 0.005 inch.



ME 3930-624-34/3-13

Figure 3-13. *Checking flywheel runout.*

(11) Install the transmission (para 2-9).

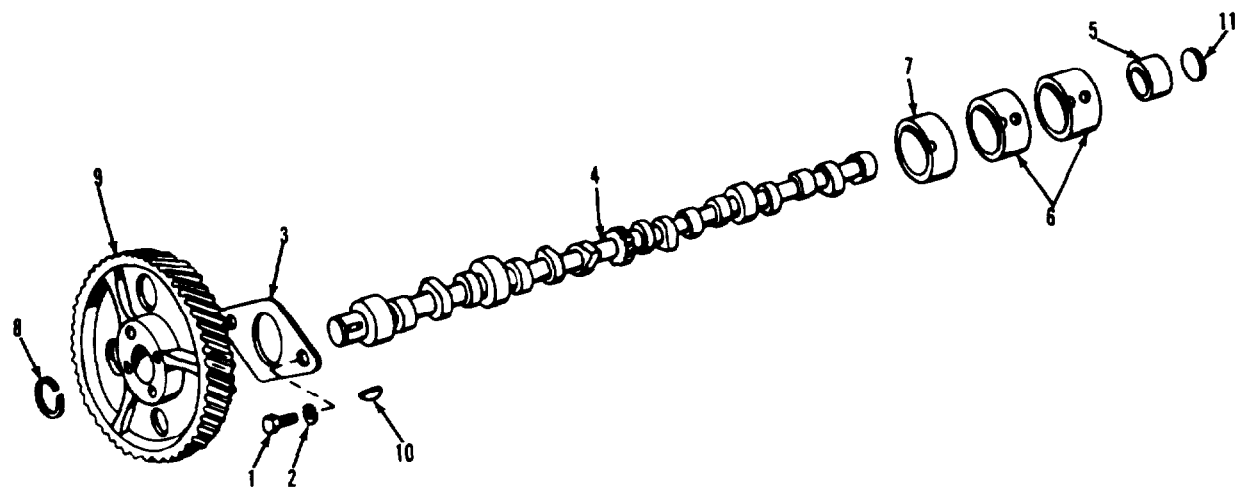
33-15. Camshaft and Camshaft Bearings

a. Removal.

(1) Remove the timing gear housing cover (para 3-13).

(2) Drain and remove the oil pan (para 3-8) and oil pump (para 3-6).

(3) Rotate the crankshaft until openings in the camshaft gear align with the thrust plate capscrews (1, fig. 3-14).



ME 3930-624-34/3-14

1. Capscrew
2. Lockwasher
3. Thrust plate
4. Camshaft
5. Bearing
6. Bearing
7. Bearing
8. Retaining ring
9. Gear
10. Key
11. Plug

Figure 3-14. Camshaft assembly.

Caution: **Be sure to note the location of the hollow capscrew since it must be reinstalled in the same location.**

(4) Remove the capscrews (1) and lockwashers (2) which secure the thrust plate (3) to the cylinder block.

(5) `Push the valve lifters upward in the cylinder block. In most cases they fit tight enough in the lifter bore to stay out of the way of the cam lobes. If not they may be lifted separately by rotating the camshaft as it is removed.

(6) Remove the camshaft (4). Be careful to keep it aligned with the engine so the camshaft bearings do not bind on the journals.

(7) Remove the flywheel housing (para 3-14).

(8) Remove the expansion plug (11) from the camshaft rear bearing bore.

(9) Use a camshaft bearing removal and installation tool to remove the camshaft bearings (5, 6 and 7).

b. Disassembly.

(1) Remove the camshaft gear retaining ring (8, fig. 3-14).

(2) Use a gear puller to remove the camshaft gear (9) from the camshaft.

(3) Remove the key (10) from the camshaft.

c. Cleaning, Inspection, and Repair.

(1) Clean the camshaft and camshaft bearings with a cleaning solvent.

(2) Inspect the camshaft gear for worn, nicked, or broken teeth.

(3) Use a telescopic gage, micrometer, or other suitable measuring device to obtain the following measurements. If the measurements do not fall within the specified limits the parts must be replaced.

(a) ID of front and intermediate camshaft bearings (when installed is 2.00 10-2.0040 inches. The ID of the rear camshaft bearing when installed is 1.2510-1.2540 inches.

(b) OD of front and intermedite camshaft journals in 1.998-1.999 inches. The OD of the rear camshaft journal is 1.2480-1.2490 inches.

(c) The camshaft bearing-to-journal running clearance is 0.0020-0.0060 inch.

(d) OD of front and intermediate camshaft bearings is 2.1285-2.1305 inches. The OD of the rear camshaft bearing is 1.3790-13805 inches.

(e) The bore in the block for the front and intermediate camshaft bearings is 2.1240-2.1250 inches. The bore for the rear camshaft bearings is 1.3740-1.3750 inches.

(f) The fit for the front and intermediate camshaft bearings in the bore of the cylinder block is 0.0020-0.0060 inch tight. The fit for the rear camshaft bearing is 0.0040-0.0065 inch tight.

(g) The overall width of the camshaft bearings are: front-1 1/8 inches, intermediate-7/8 inch, and rear-l inch.

(h) The camshaft end clearance is 0.0030-0.0080 inch.

(i) The camshaft gear width is 1 inch.

(j) The specified thickness of the thrust plate is 0.1650-0.1670 inch.

(k) The fit of the camshaft gear on the camshaft is 0.0010-0.0030 inch tight.

d. Reassembly. Reassemble the camshaft in reverse order of disassembly.

e. Installation.

(1) Install the camshaft bearings (5, 6 and 7, fig. 3-14), alining the oil holes in the bearings with the oil holes in the block. Use a camshaft bearing removal and installation tool to properly position the bearings. Insert a wire through the oil hole to make sure the holes line up.

(2) Install a new camshaft hole plug (11) in the bore in the cylinder block at the camshaft rear bearing location.

(3) Check the thrust clearance by inserting a feeler gage between the thrust plate (3) and the cam shaft bearing surface. The specified clearance is 0.003-0.008 inch. If the end clearance exceeds the maximum wear limit of 0.014 inch, remove the gear (9) from the camshaft (4). File the back side of the gear hub. This permits pressing the gear further on the shaft and reduces the thrust plate clearance.

(4) Install the camshaft (4), making sure the timing marks on the camshaft and crankshaft gears are aligned to ensure proper engine timing.

(5) Reinstall the remaining engine components by reversing the removal procedures.

(6) Install the drain plug in the oil pan and service the lubrication system. Refer to the current LO 10-3930-624-12.

3-16. Pistons and Connecting Rods

a. Removal and Disassembly.

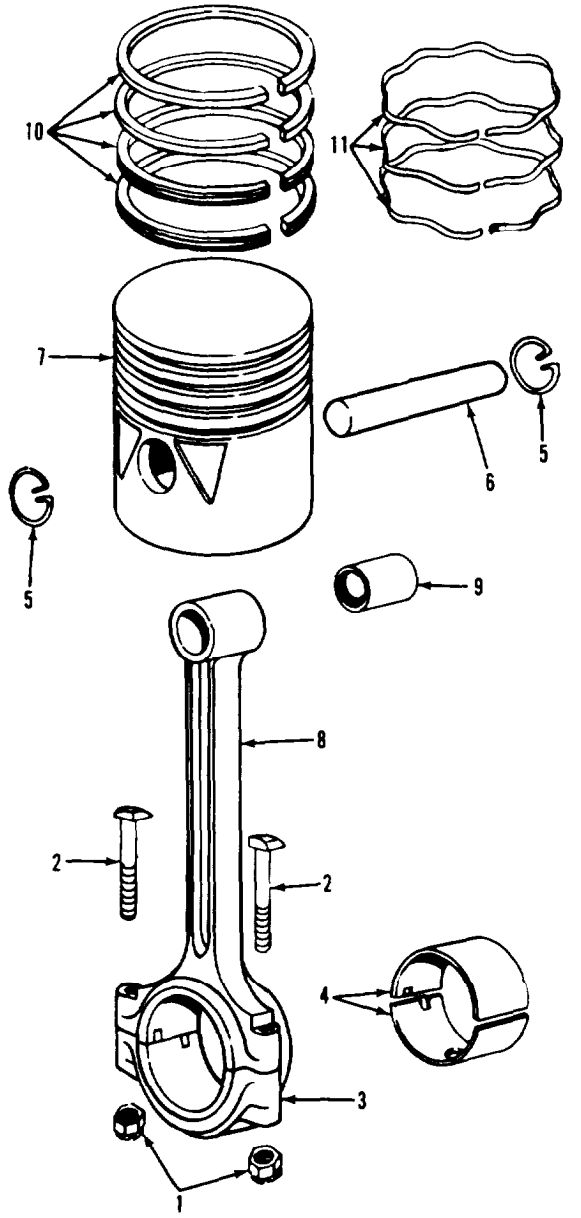
(1) Remove the cylinder head. Refer to paragraph 3-12. Cover the cylinder head and top of the engine to prevent dust from entering into the exposed parts.

(2) Remove the steer axle assembly. Refer to paragraph 2-10.

(3) Drain the oil from the crankcase. Remove the oil pan (para 3-8) and oil pump (para 3-6).

(4) If the cylinder sleeves are worn so there is a ridge at the upper end of the ring travel, remove the ridge with a ridge reamer before the piston is removed. This prevents damage to the rings during removal and installation.

(5) Remove the nuts (1, fig. 3-15), and bearing caps (3) from each connecting rod (8) in turn and push the piston (7) and connecting rod assembly out through the top of the cylinder block.



1. Nut
2. Capscrew
3. Bearing cap
4. Liner
5. Retaining ring
6. Pin
7. Piston
8. Connecting rod
9. Bushing
10. Ring
11. Ring

Figure 3-15. Piston and connecting rod.

(6) Remove the liners (4) if they are to be replaced.

(7) Remove the piston pin retaining rings (5). Drive out the pin (6) using a wood block or brass drift.

(8) Remove the bushing (9) if it is excessively or unevenly worn.

(9) Remove the rings (10 and 11) if they must be replaced.

b. Cleaning, Inspection and Repair.

Caution: **Do not use cleaning solvents containing chemicals which will react with aluminum alloy.**

(1) Clean all parts with a cleaning solvent and dry with compressed air.

(2) Use the following procedure to check for piston wear.

(a) Inspect the piston skirt for score marks or other indications of improper piston clearance. Inspect the inside of the piston for cracks. Replace any piston that is scored or cracked.

(b) Check the piston for wear by inserting it into its respective cylinder sleeve and measuring the clearance between the piston and the sleeve. Make sure that the piston is inserted into the sleeve far enough so the measurement is taken in the area of the piston ring travel. The specified clearance is from 0.0023-0.0048 inch, measured at the bottom of the piston skirt and at right angles to the piston pin. The piston skirt diameter of a new piston is 3.4365-3.4385 inches. measured at the right angles to the piston pin. The inside diameter of a new cylinder sleeve is 3.4379-3.4385 inches. The piston or cylinder sleeve, or both, must be replaced if the clearance exceeds 0.008 inch.

(c) If the piston is to be replaced, new rings must be used.

(3) Use the following procedure to inspect the piston rings.

(a) Select the rings to be installed on each piston and insert them one at a time into the cylinder sleeve in which they are to operate. Use a piston to push the ring squarely into the cylinder sleeve so that it is parallel with the top of the cylinder block. Push the ring far enough down into the bore of the cylinder sleeve to be on the ring travel area.

(b) Measure the ring gap with a feeler gage. The ring gap specification for all rings is 0.011 inch minimum. If necessary, file the ring ends with a fine cut file to obtain the correct clearance.

(c) Measure the ring to groove clearance (top of the ring to top of the groove in the piston). Refer to figure 3-16. Specified clearances are as follows: top-compression 0.002-0.004 inch, second-compression 0.0015-0.0035 inch. third-oil control 0.0015-0.0035 inch, and fourth-oil control 0.001-0.003 inch.

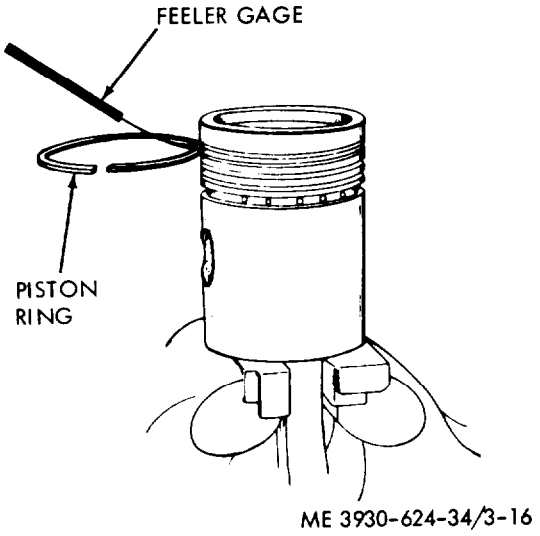


Figure 3-16. Checking ring-to-groove clearance.

(4) Perform the following measurements and inspections on the connecting rod.

(a) Measure the outside diameter of the piston pin to determine the wear. The specified diameter of a new piston pin is 0.8591-0.8593 inch.

(b) The specified inside diameter of the connecting rod bushing is 0.8593-0.8596 inch. pin to bushing clearance is 0.0000-0.0005 inch. Clearance up to 0.0020 inch is permissible. If the clearance is close to or beyond this limit, replace the connecting rod bushing.

(c) Inspect the connecting rod bearing shells for scoring, chipping, corrosion, cracking, or signs of over-heating. Discard the bearing shells if any of these conditions are apparent. The back of the bearing shells should be inspected for bright spots and discarded if any are found. This condition indicates they have been moving in their supports.

(d) Inspect the bearing shells for wear. The specified inside diameter of the bearing shells when installed is 2.1239-2.1254 inches. This provides a running clearance of 0.0015-0.0040 inch. New bearing shells must be installed when this clearance exceeds 0.000 inch.

(e) Measure the connecting rod bearings for vvear and clearance. Refer to paragraph 3-17.

(5) If wear on the rod bushings or bearings indicates that the rod is bent, replace the rod.

d. Reassembly and Installation.

(1) If the rings have been removed from the piston. new rings must be installed. Refer to the ring inspection procedure above to ensure that the rings meet with specifications. Install the rings (10. fig. 3-15) on the pistons (7) with the ring removal and installation tool. Take care not to spread the rings more than necessary. Stagger the ring gaps evenly around the piston so that no two are in line.

(2) Use the following procedure to install the oil control rings (11).

(a) Place the stainless steel expander spacer of the three piece ring in the nil groove with the ends butted.

(b) Install the steel segment on top of the expander spacer with the gap of the segment approximately 90° beyond the gap of the stainless steel expander. Make certain the expander remains butted.

(c) Install the second segment on the bottom side of the expander spacer. Position the segment gap approximately 90° from the expander spacer gap in the opposite direction from which the top segment has been positioned.

(d) Recheck the installation. The nil control ring should be free to move in the groove. A slight drag will be noticed due to the side sealing action of the steel segments. Make sure the expander spacer remains butted.

(3) If the connecting rod bushing (9) is worn, the old bushing may be pressed nut and a new bushing pressed in. Refer to the inspection procedure above to determine if the bushings are to be replaced.

(4) If there is no wear between the piston (7) and the pin (6), but wear exists between the bushing (9) and the pin, install a new bushing and ream to fit a standard size pin.

(5) Use the following procedure to assemble the connnecting rod (8) and piston.

(a) Install one of the piston pin retaining rings (5) in one end of the hole in the piston.

(b) Immerse the piston in boiling water for approximately five minutes. Then insert the upper end of the connecting rod into the piston and insert the piston pin (6).

(c) Install the other piston pin retaining ring (5) at the opposite end of the piston pin.

(6) When installing the pistons and connecting rods, be sure to place them in their respective cylinders. The number on the bearing cap (3) should be opposite the camshaft side of the engine.

(7) Place a ring compressor over the piston rings. Make certain that the rings are wholly in their grooves before tightening the compressor. Tighten the compressor gradually. Pause to move the compressor sideways to be sure the rings are free. Compress the rings as much as possible.

(8) Place the piston and connecting rod in its respective cylinder sleeve. The lower end of the connecting rod should be aligned with the

crankshaft.Tap the top of the piston with the wood handle of a hammer to push the piston out of the ring compressor and into the sleeve.

(9) Place the upper bearing liner (4) in position on the connecting rod. Install the bearing cap and liner, making certain the identifying marks are alined.

(10) Install the connecting rod nuts (11 and tighten to a torque of 40 to 45 ft lbs.

(11) Check the connecting rod side play at the bearing journal. Refer to figure 3-17. The specified clearance is 0.003-0.009 inch.

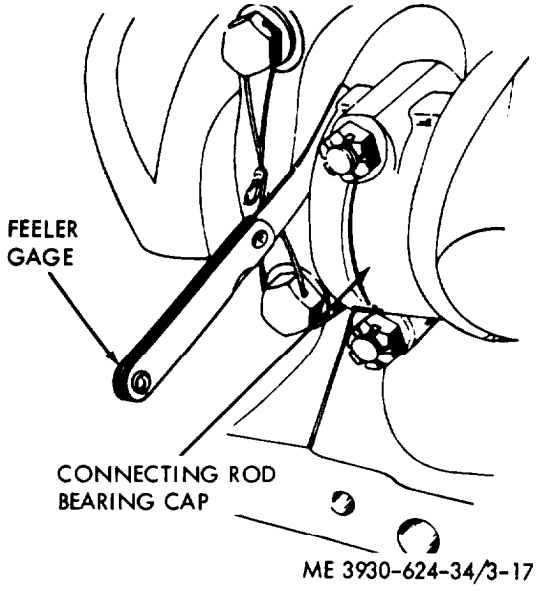


Figure 3-17. Checking rod side play.

(12) Replace all items which were removed in order to remove the pistons and connecting rods.

3-17. Crankshaft and Main Bearings

a. Removal and Disassembly.

(1) Drain the engine lubricating oil.

(2) Remove the engine. Refer to paragraph 2-8.

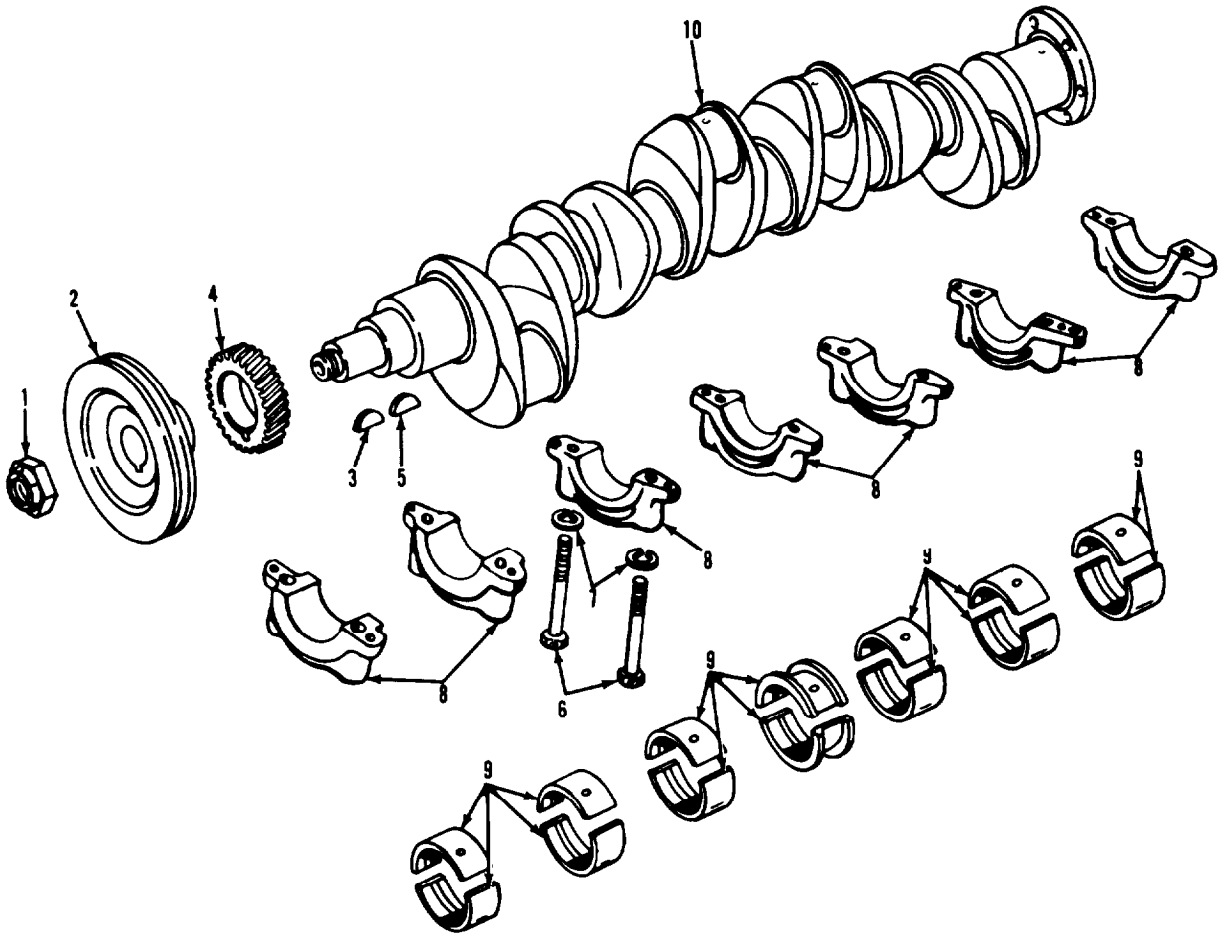
(3) Remove the transmission. Refer to paragraph 2-9.

(4) Remove the starter motor. Refer to TM 10-3930-624-12.

(5) Remove the flywheel and flywheel housing. Refer to paragraph 3-14.

(6) Remove the crankshaft pulley nut (1, fig. 3-18) and install a puller. Remove the pulley (2) from the crankshaft and remove the key (3). Remove the crankshaft gear (4) and key (5).

(7) Remove the capscrews which secure the oil pan to the engine and remove the oil pan.



1. Nut
2. pulley
3. Key
4. Gear
5. key
6. Capscrew
7. Lockwasher
8. Bearing cap
9. Bearing shell
10. Crankshaft

Figure 3-18. Crankshaft assembly.

(8) Remove the capscrews (6) and lockwashers (7), and remove the bearing caps (8) and bearing shells (9). Remove the crankshaft (10).

b. Cleaning, Inspection and Repair.

(11) Clean ail parts with a cleaning solvent.

(2) Clean the crankshaft oil passages with a solvent and blow out with compressed air.

(3) inspect the crankshaft journals for scoring. chipping, cracking, or signs of overheating. if the crankshaft has overheated (usually indicated by discolored or blue bearing journal surfaces), or is scored or excessively worn. recondition or replace as required. Examine the bearing journals for crarks if overheating has occured.

(4) Measure the crankshaft main bearing and connecting rod journals at several places on their diameter to check for roundness. The specified diameter of the main bearing journals is 2.4984-2.4994 inches. The specified diameter of the connecting rod journal is 2.1214-2.1224 inches.

(5) Inspect the main bearings as follows:

(a) Replace any bearing shells that are scored, chipped, pitted, or worn beyond the specified limits. Bright spots on the backs of the shells indicates bearings have shifted in their supports and must be replaced.

(b) Insert a 1 / 32 inch diameter soft lead wire or a plastic strip manufactured for this purpose across the center of each lower bearing shell by removing and replacing one bearing cap at a time. Tighten the bearing capscrews to 110 to 120 ft lbs, crushing the wire or strip to a shim thickness between the shells and the crankshaft journals. Remove the bearing caps and measure the

thickness of the compressed lead or plastic strip. The clearance between the shells and the journals should be 0.0013 to 0.0040 inch at all main bearings. Install new bearing shells if this clearance exceeds 0.007 inch.

(c) Measure the inside diameter of the bearing cap installed and tightened to a torque of 110 to 120 ft lbs. The specified inside diameter of new bearings is 2.5007-2.5024 inches. Any deviation below 2.5007 inches indicates the amount of bearing wear.

(d) Measure the diameter of the crankshaft journal at corresponding bearing locations and subtract this dimension from the inside diameter measurement of the bearing. The difference between these two measurements is the crankshaft to bearing clearance. The bearing shells do not form a true circle when they are not installed. When measuring for inside diameter, install the bearings in the cylinder block and tighten the capscrews to 110 to 120 ft lbs. The two halves of the shell have a squeeze fit in the seat and bearing cap, and must be tight when the cap is drawn down.

(e) Check the end play of the crankshaft, which is taken up by the thrust flanges of the center main bearing shell. Refer to figure 3-22. The specified end play is 0.003-0.009 inch and should not exceed 0.015 inch. If worn beyond the specified limit, the bearing shell should be replaced.

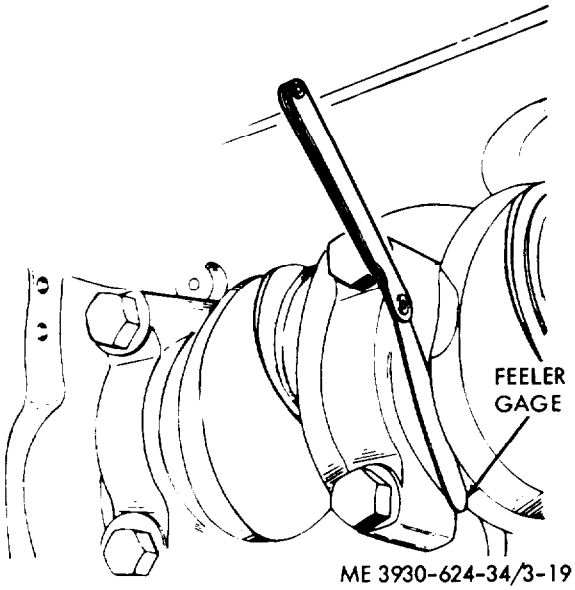


Figure 3-19. Checking crankshaft end play.

c. Reassembly and Installation.

(1) Proceed as follows if the old main bearing caps are to be installed:

(a) Install the upper halves of the main bearing shells (9, fig 3-18) in the main bearing seats of the cylinder block. Make sure that the bearing shell tangs are properly located in corresponding slots in the bearing seats of the cylinder block. The flanged bearing shell is always installed at the center main bearing location.

(b) Lubricate all crankshaft main bearing journals. Lower the crankshaft (10) into the cylinder block with the flywheel flange end of the shaft toward the rear.

(c) Place the lower halves of the main bearing shells (9) in the main bearing caps (8). inserting tangs of the shells into the slots in the caps. The bearing caps are numbered one through six, indicating their respective positions. Insert the flanged shell in the center main bearing cap.

(d) Install the bearing caps (8) with the numbers corresponding to the numbers stamped on the lower left side of the cylinder block, and secure with lockwashers (7) and capscrews (6).

Caution: Do not overtighten the main hearing capscrews. Bearing caps may distort causing bearings to be drawn tight against the crankshaft resulting in prermature failure.

(e) Tighten the capscrews to a torque of 110 to 120 ft lbs.

(f) Install the flywheel and flywheel housing (para 3-14).

(g) Install the starter motor as instructed in TM 10-3930-624-12.

(h) Install the transmission to the engine (para 2-9).

(i) Install the engine in the truck (para 2-10).

(j) Service the engine with lubricating oil and coolant.

(2) Proceed as follows if new main bearing caps are to be installed:

(a) Loosely install two 1/4 x 2 inch long temporary locating dowels in the two ¼ inch dowel holes in the cylinder block. Place the dowels where the replacement cap is to be installed. Refer to figure 3-20.

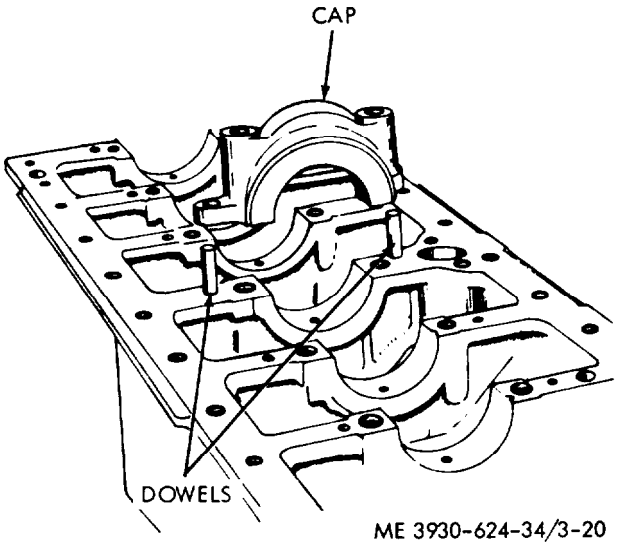


Figure 3-20. Temporary locating *dowel.*

(b) Install the replacement cap (8, fig.3-18) on the temporary dowels. Make certain the bearing tang slot is on the same side as the bearing tang slot in the cylinder block. The cap has 17/64 inch drilled dowel holes.

(c) Install the lockwashers (7) and main bearing capscrews (6) and tighten to a torque of 110 to 120 ft lbs. After the capscrews are correctly tightened. remove the two temporary dowels.

(d) Use the two 17 / 64 inch holes in the bearing cap as a drill locating jig. Enlarge the 1/4 inch holes in the cylinder block to 17 / 64 inch using a drill. Hand ream these holes to 0.2808-0.2816 inch to a minimum depth of ½ inch.

(e) Install oversize dowels (0.2801-0.280h inch diameter) with knurled ends fitting tight in the rap.

(f) The cylinder block is now ready for machining of the bearing caps. This is a machine shop job. Correct size of the main bearing bore is 2.6913-2.6820 inches. It is necessary to strictly adhere to this dimension to obtain a correct fit of the main bearings.

(g) Complete the installation as instructed in (1), above.

3-18. Cylinder Block and Cylinder Sleeves

a. Removal and Disassembly.

(1) Remove the engine from the truck. Refer to paragraph 2-7.

(2) Remove the cylinder head assembly. Refer to paragraph 3-12.

(3) Remove the pistons and connecting rods. Refer paragraph 3-16.

(4) Rotate the crankshaft to gain access for the installation of a cylinder sleeve puller.

(5) Install the puller tool to remove the sleeve from the top of the cylinder block.

(6) Remove the oil gallery plugs at the front and rear of the engine.

(7) Remove the oil pressure regulating valve. Refer to paragraph 3-7.

b. Cleaning and Inspection.

(1) Clean the oil passages in the cylinder block throughly, Effective cleaning of these passages can be accomplished only with the use of high steam pressure. Mix a solvent in the water to dissolve sludge and foreign material that has collected.

(2) To clean the cylinder block water jackets, apply high pressure steam and water through all block openings. Turn the block in various positions while this is being done so that loose scale will be washed nut. After oil and water passages have been cleaned, flush the passages with clean water under pressure. This will remove all traces of solvent and foreign material.

(3) Remove all carbon, dirt, and oil from the cylinder sleeves and the machined recess in the bore in the cylinder block. Replace the cylinder sleeves if they are scored or worn beyond the allowable limits. Slightly scuffed cylinder sleeves, if not worn, may sometimes be made usable by polishing or lapping to remove surface irregularities.

Note. When measuring the cylinder sleeves with an inside micrometer, first measure in a position parallel to the crankshaft and then at right angles to the crankshaft. These measurements should be taken at several locations within the area of piston ring travel.

(4) Check the cylinder sleeves for roundness by means of a cylinder diameter checking gage. Allovvable out-of-round when installed is 0.001 inch. Using an inside micrometer, measure the cylinder sleeve for taper and wear. The specified inside diameter of a new cylinder sleeve is 3.4379-3.4385 inches. The cylinder sleeve should be round to 0.00 10 inch and have no more than 0.007 inch taper. Cylinder sleeves that do not meet these requirements must be replaced.

(5) If the cylinder sleeves are within the allowable wear limits and are to be used again, there may he a slight ring travel ridge near the top of the sleeve which should be removed with a ridge reamer.

c. Reassembly and Installation.

(1) Install the oil gallery plugs at the front and rear of the engine.

(2) Install the oil pressure regulating valve. Refer to paragraph 3-7.

(3) Thoroughly clean the cylinder sleeve and the bore in the cylinder block. Be sure the bottom surface of the flange on the cylinder sleeve and

counterbore in the cylinder block are clean and free from nicks or burrs.

(4) Before installing the rubber seal rings, insert the sleeve into the bore to make certain the sleeve can be pushed down into place by hand pressure. Withdraw the sleeve from the block. If the sleeve cannot be inserted in the above manner, more cleaning is necessary.

(3) With the rubber seal rings installed and lubricated with liquid soap. hydraulic brake fluid, or soluble oil, install the sleeve in the cylinder block. Be careful not to cut or scratch the seal rings. When the sleeve is nearly in place, apply pressure to the opposite sides of the sleeve with both hands. Press into place with a sudden quick application of pressure. Be careful not to get dirt under the flange of the sleeve, which would prevent it from properly seating.

(6) With the flange of the cylinder sleeve firmly seated in the counterbore of the cylinder block. the top surface of the cylinder sleeve must be 0.002 inch above the top flat surface of the cylinder block. Hold a straight edge across the cylinder sleeve flange and use a feeler gage to measure the standout of the sleeve flange above the block.

CHAPTER 4

REPAIR OF TRANSMISSION, STEERING AND DRIVE COMPONENTS

Section I. REPAIR OF TRANSMISSION

4-1. General

The powershift transmission consists of three major components - a torque converter, a hydraulically actuated clutch pack and a single speed constant mesh transmission. See figure 4-1. Power from the engine is delivered to the torque converter which in turn drives a pump and a clutch pack. Housed in the clutch drum are two double-faced clutch plates which, when activated, move the truck forward or backward through splined hubs transmitting power to the gear train. The torque converter furnishes torque multiplication under load and serves as a fluid coupling. The gear type oil pump, in the rear of the converter, furnishes oil pressure to activate the clutches. The pump also furnishes oil to the torque converter, the clutch plates and the front bearing of the forward drive shaft. The control valve directs oil to the forward and reverse clutch pistons, discs in the clutch pack. When the reverse clutch is activated, power is delivered to the transmission through a hollow shaft which connects the reverse gear and reverse clutch. If the forward clutch is actuated, power is delivered to the transmission through a solid shaft, which rotates inside the hollow reverse shaft, connecting the forward gear and forward clutch.

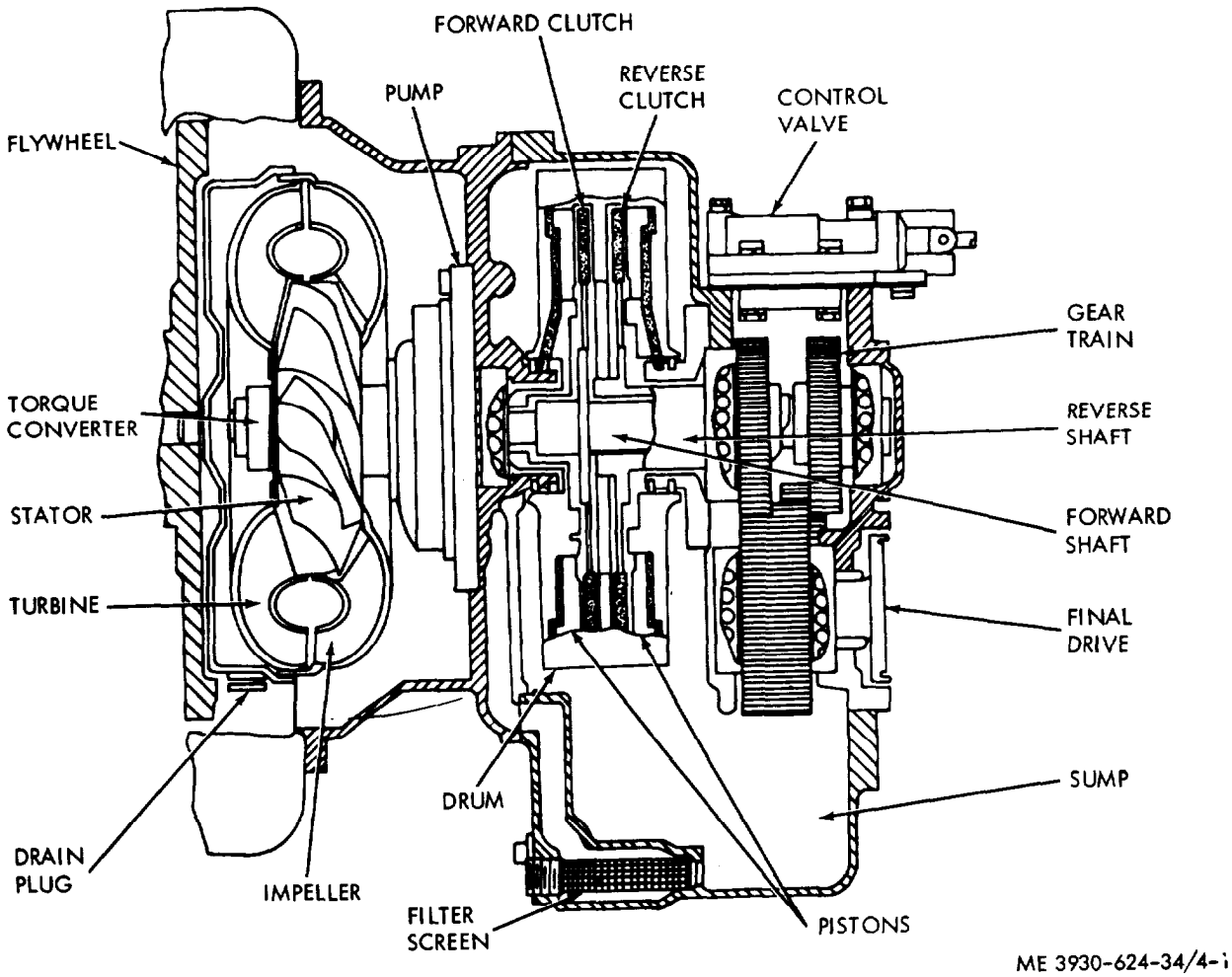


Figure 4-1. Torque converter and transmission.

4-2. Torque Converter

a. Removal.

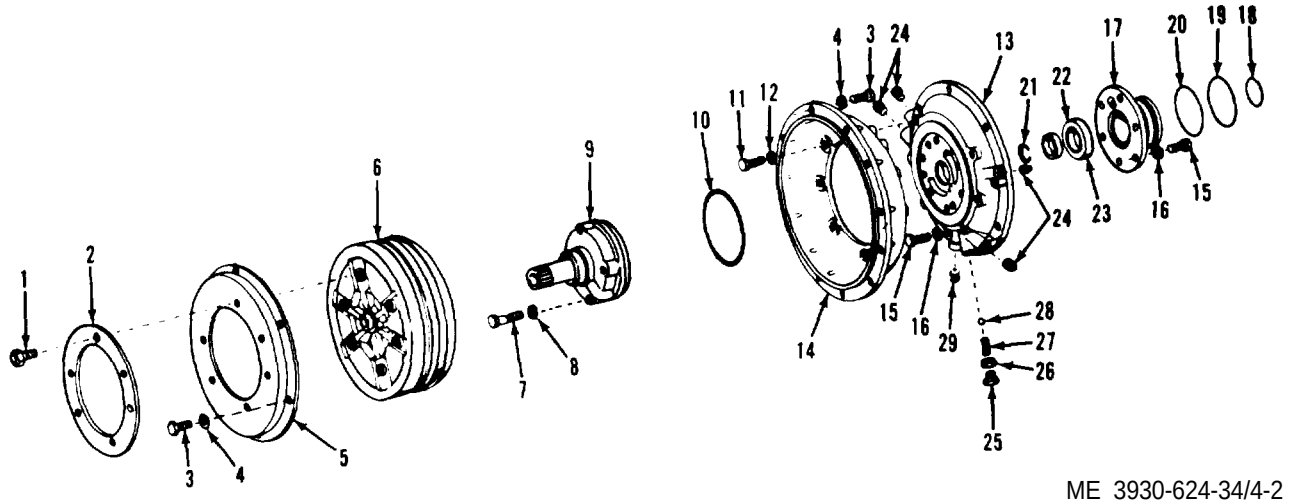
(1) Remove the torque converter and transmission from the truck. Refer to paragraph 2-9.

(2) Remove the attaching hardware and remove the torque converter housing from the drum and disc assembly.

h. Disassembly.

(1) Torque converter. (fig. 4-2.)

(a) Remove the bolts (1) and the reinforcing plate (2). Remove the capscrews (3), lockwashers (4) and the drive plate (5). Remove the converter (6).



ME 3930-624-34/4-2

1. Bolt
2. Plate
3. Capscrew
4. Lockwasher
5. Plate
6. Converter
7. Bolt
8. Lockwasher
9. Pump
10. Preformed packing
11. Bolt
12. Lockwasher
13. Plate
14. Housing
15. Bolt
16. Lockwasher
17. Support
18. Preformed packing
19. Preformed packing
20. Preformed packing
21. Snap ring
22. Seal
23. Seal
24. Plug
25. Plug
26. Washer
27. Spring
28. Ball
29. Elbow

Figure 4-2. Torque converter and pump assembly, exploded view.

(b) Remove the bolts (7) and lockwashers (8) and remove the pump (9) and preformed packing (10).

(c) Remove the bolts (11) and lockwashers (12) and remove the plate (13) from the converter housing (14).

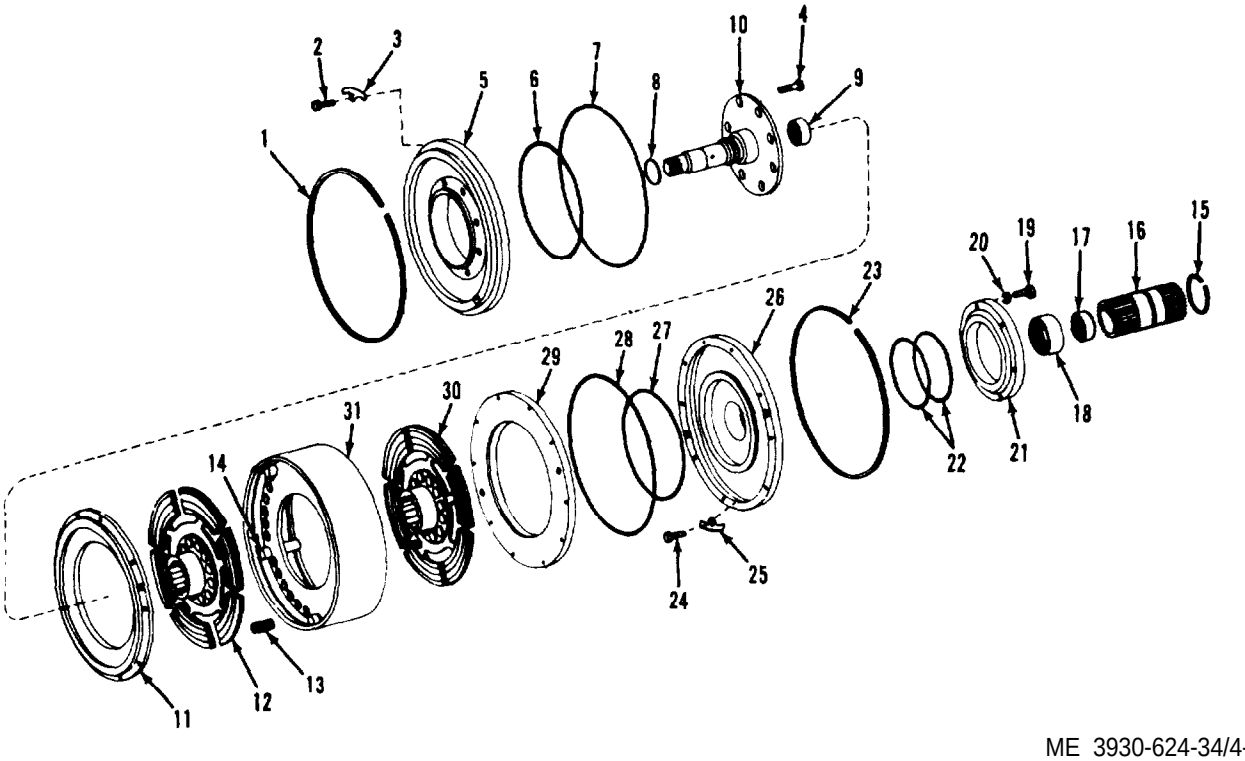
(d) Remove the bolts (15) and lockwashers (16) and remove the support (17). Remove the preformed packings (18, 19 and 20), snap ring (21) and seals (22 and 23).

(e) Remove the plugs (24) from the plate. Remove the plug (25). washer (26), spring (27), ball (28) and elbow (29).

(2) Drum and disc assembly. (fig. 4-3).

(a) Place the drum and disc assembly in an arbor press. Gradually apply sufficient pressure on the turbine shaft (10) until the cylinder (5) is depressed enough to remove the retaining ring (1).

(b) Slowly release the pressure on the press and remove the capscrews (2) and locks 13). Remove the cylinder and turbine shaft as an assembly. Tap the cylinder (5) with a soft mallet if necessary to aid in removal. Remove the capscrews (4) and remove the cylinder from the turbine shaft.



1. Retaining ring
2. Capscrew
3. Lock
4. Capscrew
5. Cylinder
6. Seal ring
7. Seal ring
8. Seal ring
9. Bearing
10. Turbine shaft
11. Piston
12. Disc
13. Spring
14. Pin
15. Retaining ring
16. Shaft
17. Bearing
18. Bearing
19. Capscrew
20. Lockwasher
21. Plate
22. Seal ring
23. Retaining ring
24. Capscrew
25. Lock
26. Cylinder
27. Seal ring
28. Seal ring
29. Piston
30. Disc
31. Drum

Figure 4-3. Drum and disc assembly, exploded view.

(c) Remove the seal rings (6, 7 and 8) and pull the bearing (9) from the turbine shaft (10).

(d) Remove the piston (11), forward drive disc (12). springs (13) and pins (14) from the drum.

(e) Remove the retaining ring (15), shaft (16) and bearings (17 and 18).

(f) Remove the plate (21) seals (22) and retaining ring (231. Remove the cylinder (26), seal rings (27 and 28), piston (29) and reverse drive disc (30).

c. Cleaning, Inspection and Repair.

(1) Clean all components in a suitable solvent. Dry with compressed air.

(2) Perform general inspection procedures (para 2-7).

(3) Inspect the plates for cracks, breaks and other damage. Replace as required.

(4) Inspect the converter for chips, cracks, scoring, deformation and other damage. Replace as required.

(5) Inspect the pump for damage and wear. If damage or wear is excessive, replace the complete pump assembly.

(6) Replace damaged or deteriorated seals.

(7) Inspect the housing for cracks, chips, nicks, scratches and other damage. Repair or replace as required.

(8) Inspect the spring for cracked or weak condition. Replace if necessary.

(9) Inspect the support for cracks and other damage. Replace if necessary.

(10) Inspect pistons for flat spots, scoring and wear. Smooth minor surface damage with a soft hone or crocus cloth. Replace pistons if damage or wear is excessive.

(11) Inspect the cylinders for nicks, chips, scratches, scoring and other damage and wear. Repair cylinders if possible or replace as required.

(12) Inspect the turbine shaft for cracks and distortion and for damage to the splined end. Replace the turbine shaft if damaged.

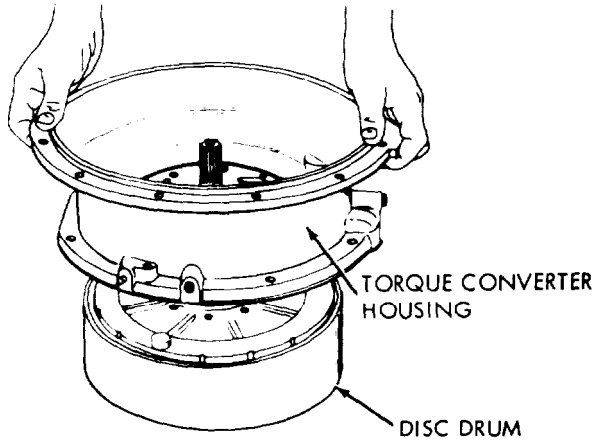
(13) Inspect bearings for nicks, chips, flat spots. scoring, wear, and out-of-round condition. Replace bearings if any damage is evident.

(14) Inspect the discs for wear, scoring, dents, cracks, chips and other damage. Replace if damage is evident or if grooves are worn out of clutch facing.

(15) Inspect piston rings for free fit in their grooves.

(16) Inspect the drum for cracks, chips, nicks, scratches and other damage. Repair or replace as required.

d. Reassembly. Lubricate all parts with transmission lubricant. Assemble the drum and disc assembly in reverse order of disassembly. Install torque converter by reversing removal procedure. Mount drum and disc assembly to torque converter housing (fig. 4-4 I.



ME 3930-624-34/4-4

Figure 4-4. Installing torque converter to drum and disc assembly.

e. Installation. Install in reverse order of removal. Refer to paragraph 2-9.

4-3. Transmission Gear Case Assembly

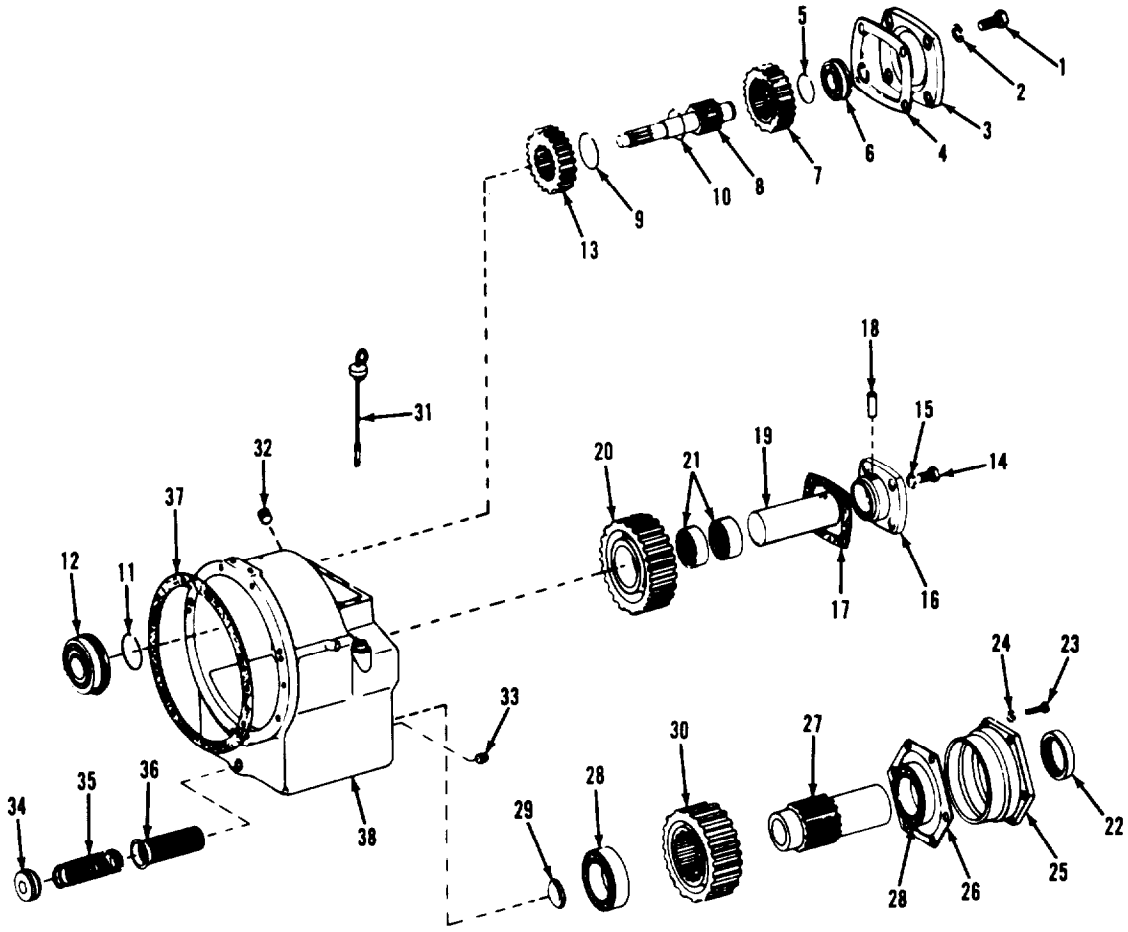
a. Removal. Remove the transmission from the truck. Refer to paragraph 2-9.

b. Disassembly.

(1) Remove the control valve from the transmission housing. Refer to paragraph 4-4.

(2) Lay the transmission on the gear case. Remove the capscrews which secure the torque converter housing to the gear case. Attach a hoist to the housing and remove the housing and the disc drum assembly as a unit. Be careful not to damage seal rings in the collector ring on the gear case.

(3) Refer to figure 4-5. Remove the capscrews (1) and lockwashers (2) which secure the retainer (3) to the housing. Remove the retainer (3) and gasket (4).



ME 3930-624-34/4-5

1. Capscrew
2. Lockwasher
3. Retainer
4. Gasket
5. Snap ring
6. Bearing
7. Gear
8. Shaft
9. Snap ring
10. Snap ring
11. Snap ring
12. Bearing
13. Gear
14. Capscrew
15. Lockwasher
16. Retainer
17. Gasket
18. Pin
19. Shaft
20. Gear
21. Bearing
22. Seal
23. Capscrew
24. Lockwasher
25. Retainer
26. Gasket
27. Shaft
28. Bearing
29. Plug
30. Gear
31. Dipstick
32. Plug
33. Plug
34. Plug
35. Spring
36. Screen
37. Gasket
38. Housing

Figure 4-5. Transmission gear case assembly, exploded view.

(4) Remove the snap ring (5) from the splined section of the forward shaft (8). Tap the forward shaft at the clutch end and remove from the housing. Remove the bearing (6) and forward gear (7) from the forward shaft (8).

(5) Remove the snap rings (9, 10 and 11), bearing (12) and reverse gear (13).

(6) Remove the capscrews (14), lockwashers (15). retainer (16) and gasket (17). Note the position of the pin (18). Remove the pin and idler shaft (19). Remove the idler gear (20) and the bearings (21).

(7) Remove the seal (22), capscrews (23), lockwashers (24). retainer (25) and gasket (26). Remove the output shaft (27). tapping with a soft hammer if necessary. Remove the bearings (28), plug (29) and output gear (30).

(8) Remove the dipstick (31), plugs (32, 33 and 34), spring (35) and filter screen (36). Scrape the gasket (37) from the face of the housing (38).

c. Cleaning. Inspection and Repair.

(1) Clean ail components in suitable solvent. Dry with compressed air.

(2) Follow general inspection procedures (para 2-7).

(3) Inspect gears for broken, cracked, worn or chipped teeth. Replace damaged or worn gear.

(4) Inspect the output flange for cracks, breaks and other damage. Check the spline for damage and wear. Repair or replace the flange if damaged.

(5) Inspect the forward, reverse and idler shafts for cracks, breaks, worn splines, and other damage. Repair or replace if damaged.

(6) Inspect the idler shaft for cracks, breaks and other damage. Replace if damaged.

(7) Inspect bearings for burrs and rough spots. Light scratching will not impair operation. Smooth minor roughness with a soft hone or crocus cloth. Replace abrasive bearings.

(8) Inspect the filter screen and spring for corrosion and damage. Blow out clogged passages with compressed air. Replace if necessary.

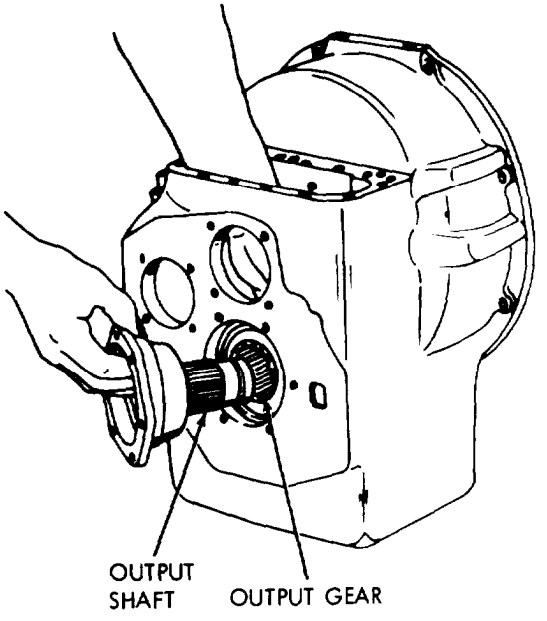
(9) Inspect the housing and retainers for chips, cracks and other damage. Repair by welding if feasible or replace as required.

d. Reassembly. Reassemble the transmission in the reverse order of disassembly. Observe the following:

(1) Ensure that the spring (35, fig. 4-5) is in place when installing the filter screen (36).

(2) When installing gears and bearings, coat them with transmission lubricant and make sure they rotate.

(3) Install the output shaft (27) so that the internally splined end extends outside the gear case. Refer to figure 4-6.



ME 3930-6247-34/4-6

Figure 4-6. Installing output gear and shaft.

(4) Install the idler shaft (19, fig.4-5) and gear (20). Refer to figure 4-7. Ensure that the machined reliefs on the idler shaft retainer (16, fig. 4-5) are positioned down so that oil in the retainer can drain into the transmission case.

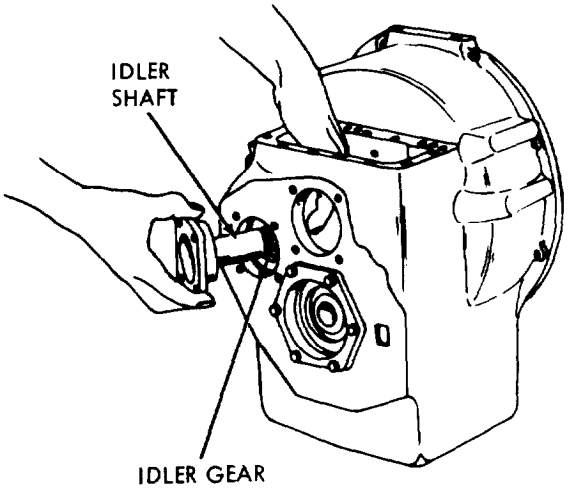


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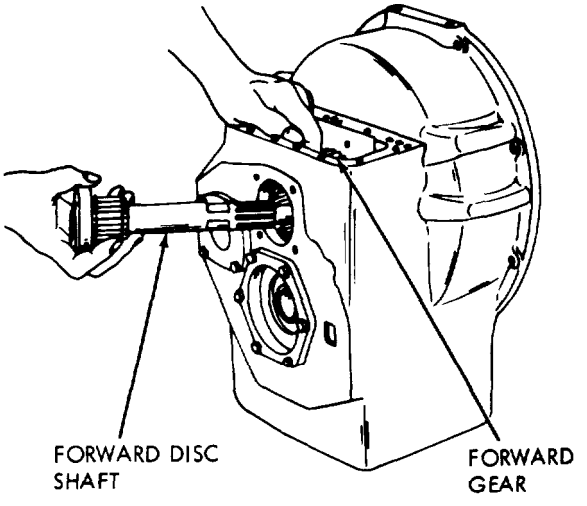
Figure 4-7. Installing idler gear and shaft.

(5) When installing the forward shaft (8), forward gear (7) and reverse gear (13), ensure that the snap rings (5, 9, 10 and 11) are properly installed and completely seated. Refer to figure 4-8 for forward gear and shaft installation.



ME 3930-624-34/4-8

Figure 3-8. Installing forward gear and shaft.

(6) When installing the converter housing and disc drum to the transmission, be careful not to damage the seal rings on the disc drum assembly.

e. Installation. Install the transmission in the truck. Refer to paragraph 2-9.

f. Testing. The transmission depends on correct operating pressures for efficient operation. The pressures to be checked are: pump pressure, converter pressure, forward and reverse clutch pressures (stalled and free running), inching pressure, and clutch cooling oil pressure. The oil temperature should be 80° to 100°F, except where otherwise specified.

(1) Check the pump pressure. See figure 4-9.

(a) Install a pressure gage calibrated to 300 psi. in the pump port on the converter pump adapter.

(b) Leave the transmission in neutral and start the engine. Accelerate the engine to its full governed speed. Note the pressure indicated on the pressure gage.

(c) If the pump pressure is between 100 psi and 140 psi the pump is in normal operating condition.

(d) If the pump pressure is over 150 psi, check the regulator valve spring and spool for free operation or damage and check for restricted lines and passages. If the pump pressure is below 100 psi, check for low oil level, a faulty pump, excessive line leakage, a faulty regulator valve, faulty directional valve, or a clogged filter screen.

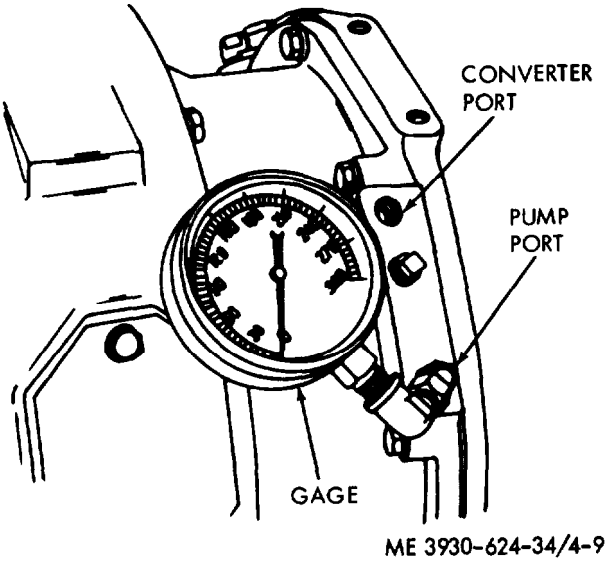


Figure 4-9. Checking pump and converter pressure.

(2) Check the converter pressure. See figure 4-9.

(a) Install a pressure gage, calibrated to 300 psi, in the converter supply pressure port on the pump adapter.

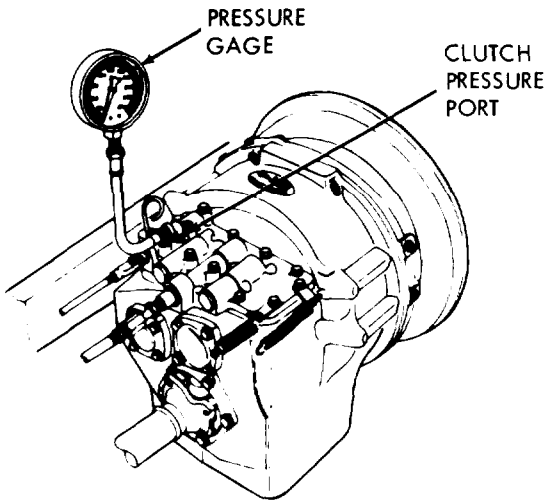
(b) Leave the transmission in neutral and start the engine. Accelerate the engine to its full governed speed (2200 rpm). Note the pressure indicated on the pressure gage.

(c) If the converter pressure is 65 psi to 100 psi maximum, the converter is in normal operating condition. With the engine idling at 500 rpm, the converter pressure should be between 10 psi and 30 psi.

(d) If the converter pressure is above 100 psi at 2200 rpm, check for excessive pump pressure, enlarged metering orifice, or restricted converter return passages. If the pressure is below 65 psi, check for low oil level, clogged filter screen, faulty pump, or clogged converter orifice in pump collector ring.

(3) Check the forward and reverse clutch pressures at stall.

(a) Install a pressure gage, calibrated to 300 psi, in the clutch pressure port. See figure 4-10.



ME 3930-624-34/4-10

Figure 4-10. Checking clutch pressure.

(b) Start the engine and position the truck against the wall. Apply both the parking brake and the foot brake-the drive wheels must be locked. With the truck in this stalled condition, place the selector lever in the forward position and accelerate the engine momentarily to wide open throttle. DO not allow engine rpm to exceed 1500 rpm. Note the pressure indicated on the gage. Place the selector lever in the reverse position and repeat the procedure. Note the pressure indicated on the gage.

(c) If the pressures indicated are above 65 psi, and do not exceed normal pump pressure noted in (1) above, the pressure in the clutch circuit is normal.

(d) If the pressure is below 65 psi, check for low oil level. restricted lines or passages, damaged seal rings, defective or incorrectly adjusted selector valve, defective pump. or excessive leaks in the disc and drum assembly.

(e) When the engine is idling. and either clutch is engaged. the clutch circuit pressure should be 15 to 25 psi.

(4) Check the forward and reverse clutch pressures with the wheels free running.

(a) Install pressure gages, calibrated to 300 psi, in the pump pressure port and the converter pressure port (fig. 4-9) and clutch pressure port (fig. 4-10).

(b) Raise the truck so that both drive wheels are off the floor. Block the truck securely with both wheels free to rotate. Secure the inching pedal up so the inching valve plunger cannot move. Bring oil temperature to 200°F.

(c) Run the engine at full governed speed and check the pressures with the selector lever in both forward and reverse positions. The following cable indicates the normal pressures (in psi) at the specified engine speeds:

Table 4-1. Hydraulic Pressures.

Engine rpm	Main line (pump press)		Converter		Forward clutch		Reverse clutch	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
500	18	30	15	25	15	27	15	27
2000	105	125	65	80	80	100	80	100

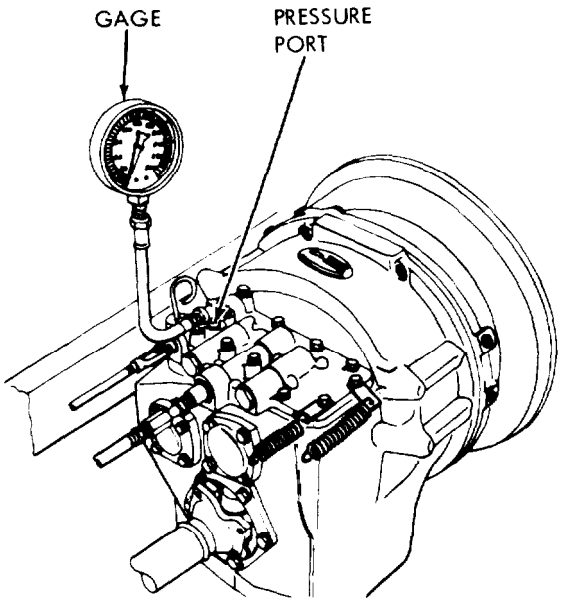
(d) At a speed of 2000 rpm, release the inching pedal. Clutch pressure should drop to zero in both forward and reverse positions.

(e) Disconnect the cooler return hose at the return port on the left side of the adapter. Plug the port. Install a 200 psi pressure gage in the hose. With the clutch engaged and the oil sump temperature at 120° to 170°F, run the engine at governed speed. The relief valve which protects the cooling oil circuit must open at 65 psi to 100 psi. It should open near 100 psi, and never under 6.5 psi, Increase the pressure, if necessary. by adding a spacer between the spring and the hex head plug on the lower right of the adapter. Cut off a small portion of the spring (or remove washers. if any) to reduce pressure.

f. Regulating Valve Adjustment.

(1) Remove the floor plate.

(2) Install a 0 to 160 psi pressure gage at the pressure part on the top right of the control cover. Refer to figure 4-11.



ME 3930-624-34/4-11

Figure 4-11. Regulating valve adjustment.

(3) Engage the parking brake.

(4) Start the engine and allow the oil to warm up to 80° to 100°F. Operate at idle.

(5) Place the transmission in forward or reverse.

(6) The pressure gage should indicate 18 to 23 psi. If necessary, slowly turn the adjusting screw on the regulating valve to correct the gage reading.

(7) Shut down the engine. remove the pressure gage and close the pressure port. Install the floor plate.

4-4. Transmission Control Valve

a. Removal. The control valve may be removed from the truck with the transmission (para 2-91 or alone. Proceed to step 5 if the transmission has been removed from the truck.

(1) Remove toe and floor plate.

(2) Clean exterior of valve and surrounding area so dirt cannot enter the valve.

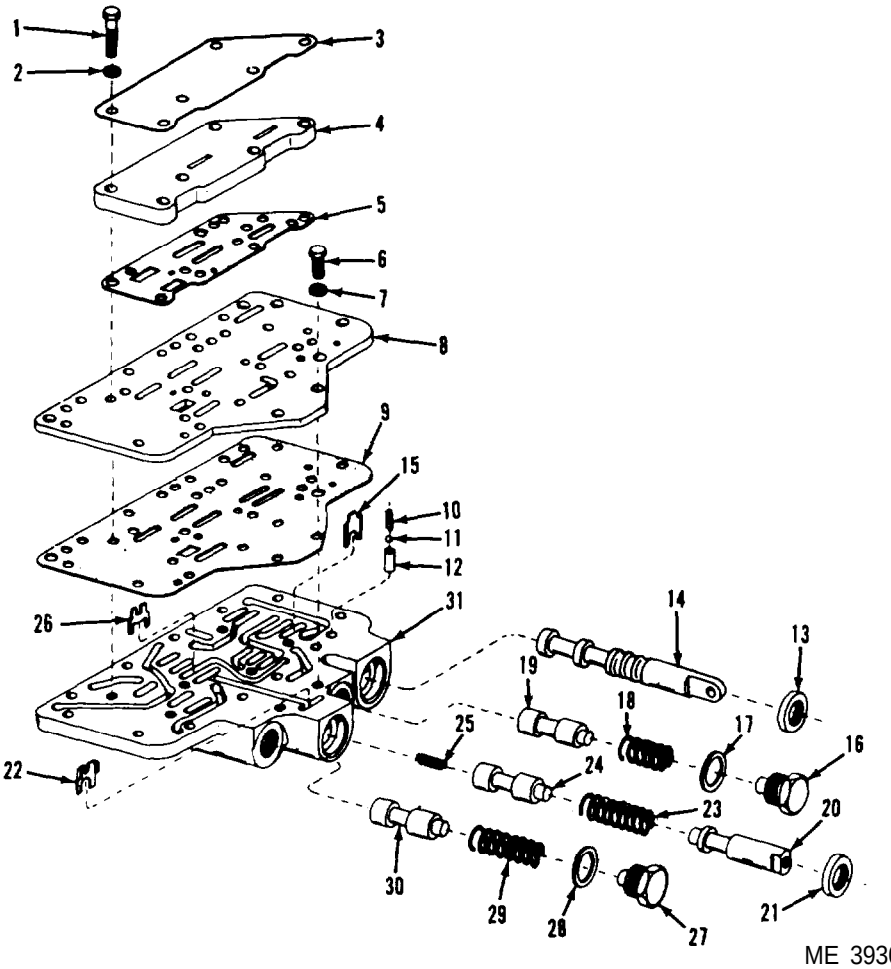
(3) Disconnect the mechanical linkage (fig. 2-4).

(4) Disconnect hydraulic lines (fig. 2-3) and cap or plug openings.

(5) Remove attaching hardware and lift the valve from the transmission.

b. Disassembly. (fig. 4-12.)

(1) Remove the bolts (1) and lockwashers (2) and remove the cover (3), plate (4) and gasket (5).



ME 3930-624-34/4-12

1. Bolt
2. Lockwasher
3. Cover
4. Plate
5. Gasket
6. Capscrew
7. Lockwasher
8. Plate
9. Gasket
10. Spring
11. Ball
12. Sleeve
13. Oil seal
14. Selector valve
15. Stop
16. Screw
17. Gasket
18. Spring
19. Dump valve
20. Plunger
21. Oil seal
22. Stop
23. Spring
24. Inching valve
25. Spring
26. stop
27. Screw
28. Gasket
29. Spring
30. Regulator valve
51. Body

Figure 1-12. Control valve. exploded view.

(2) Remove the capscrews (6). lockwasher (7), plate (8) and gasket (9).

(3) Remove the spring (10). detent ball (11) and sleeve (12).

(4) Remove the oil seal (13) and selector valve (14). Remove the selector valve stop (15).

(5) Remove the spring retaining screw (16). gasket (17). spring (18) and dump valve (19).

(6) Remove the inching valve plunger (20), on seal (21). plunger stop (22). spring (23), inching valve (24), spring (25) and inching valve stop (26).

(7) Remove the spring retaining screw (27). gasket (28). spring (29) and regulator valve (30) from the valve body (31).

c. Cleaning. Inspection and Repair.

(1) Clean valve and components using suitable

solvent. Dry with compressed air. Blow out all the passages in the valve body.

(2) Perform general inspection procedures.

(3) Inspect the valve plungers and spools for scoring and wear, Remove surface blemishes with a soft hone or crocus cloth. Replace if wear is excessive.

(4) Inspect springs for cracks or weakness. Replace if necessary.

(5) Inspect spring retainers for damage. Replace as required.

(6) Inspect the detent ball for flatspots. Smooth surfaces or replace.

(7) Inspect the separator plate, valve body and valve cover for cracks, chips, nicks, dents and other damage. Repair or replace as required.

d. Reassembly. Assemble the valve in the reverse order of disassembly. Lubricate parts lightly with transmission oil before assembling. Ensure that plungers and spools operate freely. Install the stops at the selector valve plunger and the inching valve plunger so that the angled edges face the back of the valve body.

e. Installation. Install the valve by reversing the removal procedure.

Section II. REPAIR OF FRONT AXLE ASSEMBLY

4-5. General

The front (drivel axle assembly is a double reduction, spiral bevel and internal gear drive. The drive wheels, bevel drive pinion, and differential assembly are supported by tapered roller bearings. The axle drive shafts (jack shafts), which are used only for torque transfer and carry no weight, are supported by double thrust bearings. The differential carrier is mounted at the center of the drive unit housing. Final reduction is obtained through an internal tooth ring gear (bull gear) inside the drive wheel, in addition to the usual reduction at the differential pinion and ring gear. Figure 4-13 shows a cutaway view of the front axle assembly.

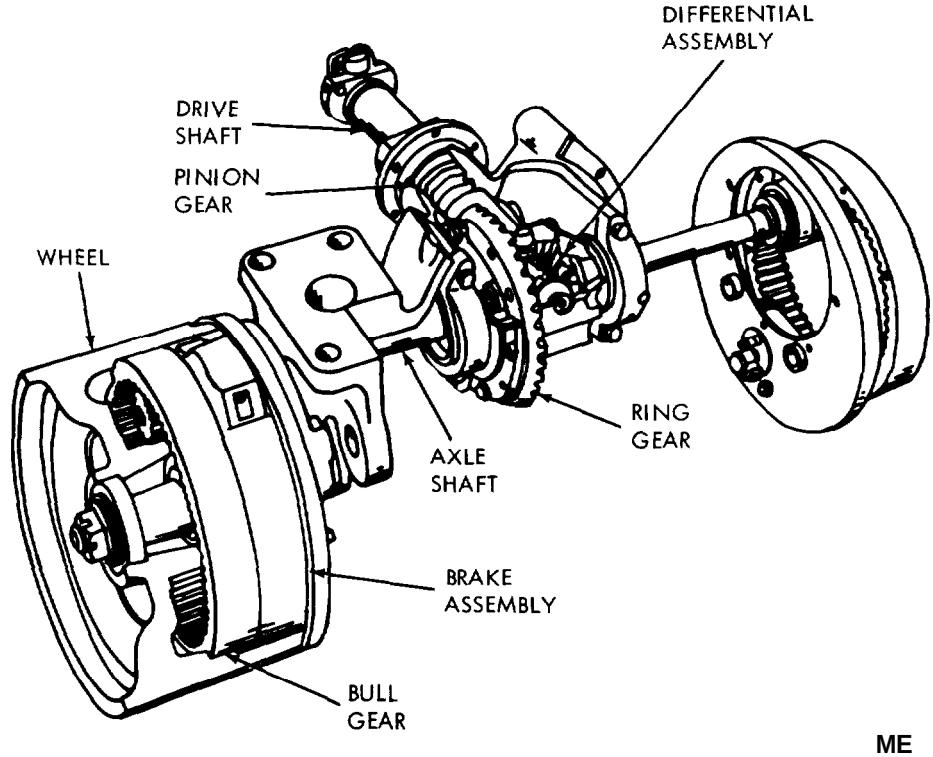


Figure 4-13. Front axle assembly, cutaway view.

4-6. Front Axle Assembly (Drive)

a. Removal. For removal of the front- axle assembly, refer to paragraph 2-10.

b. Disassembly.

(1) Remove the drive wheels. Refer to TM 10-3930-024-12. For repair, refer to paragraph 4-15.

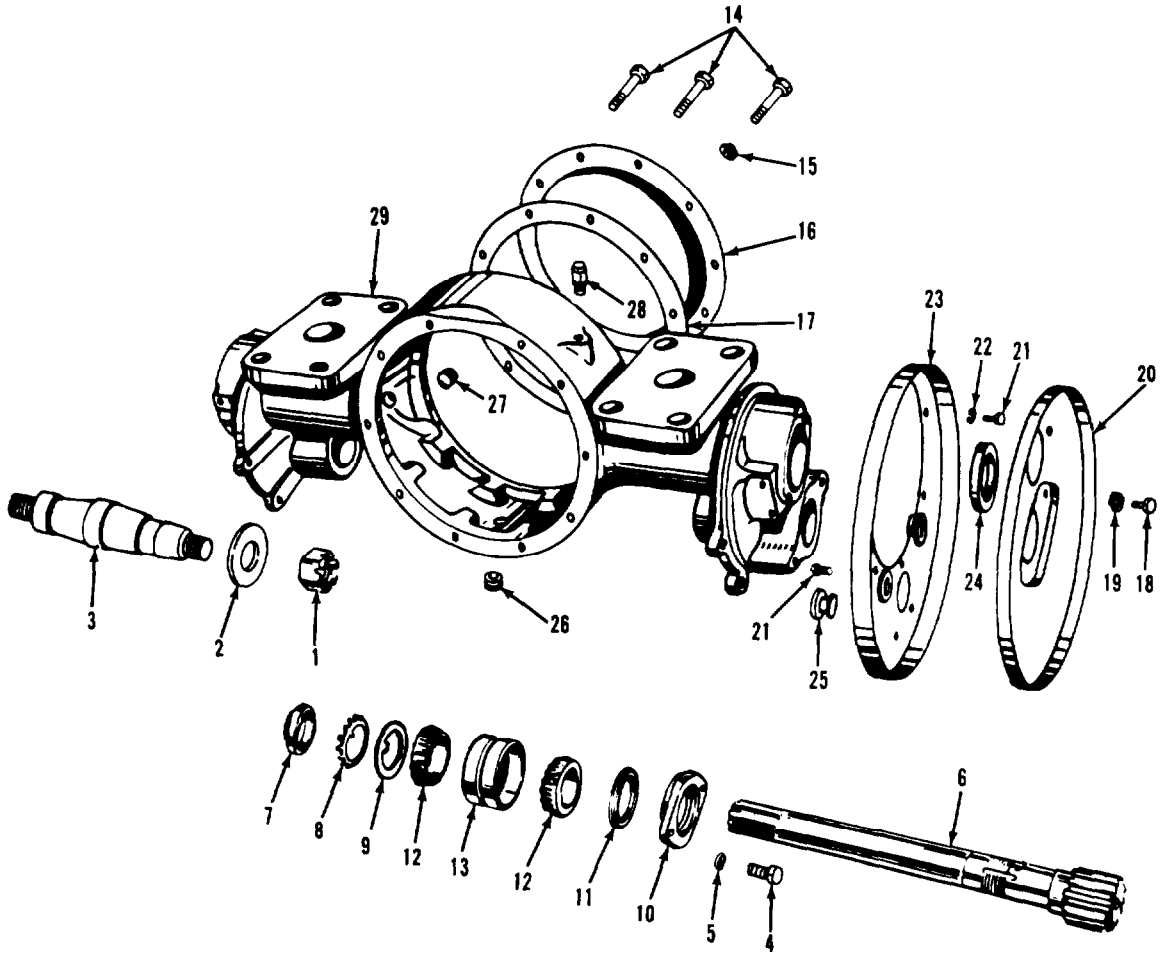
(2) Loosen the locknut (1, fig. 4-14) at the backside of the axle housing two or three turns.

(3) Place a pipe 23/4 in. I.D. and 5 in. long over the spindle (3).

Caution: **Ensure that the pipe is flush against the drive axle housing.**

(4) Install a washer and nut on the spindle and tighten the nut until the spindle is loose on the housing.

(5) Remove the nut. washer and pipe. Remove the locknut (1), washer (2) and spindle (3).



ME 3930-624-34/4-14

1. Locknut
2. Washer
3. Spindle
4. Capscrew
5. Lockwasher
6. Axle shaft
7. Locknut
8. Lockwasher
9. Tongued washer
10. Cap
11. Seal
12. Bearing
13. Bearing cup
14. Bolt
13. Lockwasher
16. Cover
17. Gasket
18. Capscrew
19. Lockwasher
20. Dust cover
21. Capscrew
22. Lockwasher
23. Backing plate
24. Seal
25. Plug
26. Plug
27. Plug
28. Breather
29. Housing

Figure 4-14. Front axle and axle housing, exploded view.

(6) Remove the capscrews (4) and lock-washers (5). Install a weight puller in the threaded end of the axle shaft (6). and carefully remove the axle shaft.

(7) Straighten the prongs on the lockwasher (8), and remove the locknut (7), lockwasher (8) and tongued washer (9).

18) Place the axle shaft assembly in a suitable press, and remove the bearing assembly from the shaft (6). Be careful not to damage the cap (10). Slide the cap from the shaft.

(9) Remove the oil seal (11) from cap (10) and separate the bearings (12) from the bearing cups (13).

(10) Remove the parking brake. Refer to TM 10-3930-624-12.

(11) Remove the bolts (14) and lockwashers (15). Remove the front cover (16) and gasket (17).

(12) Remove the capscrews which secure the differential carrier to the axle housing and remove the carrier. Refer to paragraph 4-7 for differential repair instructions.

(13) Remove the capscrews (18), lockwashers (19). dust cover (20), rapscrews (21). lockwashers (22). brake backing plate (23). seal (24), and plug (25). Refer to TM 10-3930-024-12 for brake repair. Remove the plugs (26 and 27) and breather (28).

c. Cleaning. Inspection and Repair.

(1) Clean all components in suitable solvent. Dry with compressed air.

(2) Follow general inspection procedures.

(3) Inspect bearings for nicks, scratches, scoring and pitting of the hearing surfaces. Replace damaged bearings.

(4) Inspect the spindle for cracks, breaks, scoring, other damage, and wear. Replace as required.

(5) Inspect the axle shaft for nicked or broken splines and for bends, cracks, burrs, scoring, pitting and wear. Repair by welding and remachining if possible. Remove burrs and minor surface damage with a soft hone or crocus cloth. Replace axle shaft as required.

(6) Inspect the axle shaft housing for cracks, fatigue lines, burrs and damage to the machined surfaces. Replace if cracked or badly damaged.

d. Reassembly. Assemble the front axle and axle housing in the reverse order of disassembly. Pack axle bearings with lubricant prescribed in LO 10-3930-624-12. Tighten the locknuts (7, fig. 4-14) until the bearing cup (13) binds slightly when rotated and secure with washers (8).

4-7. Differential and Carrier Assembly

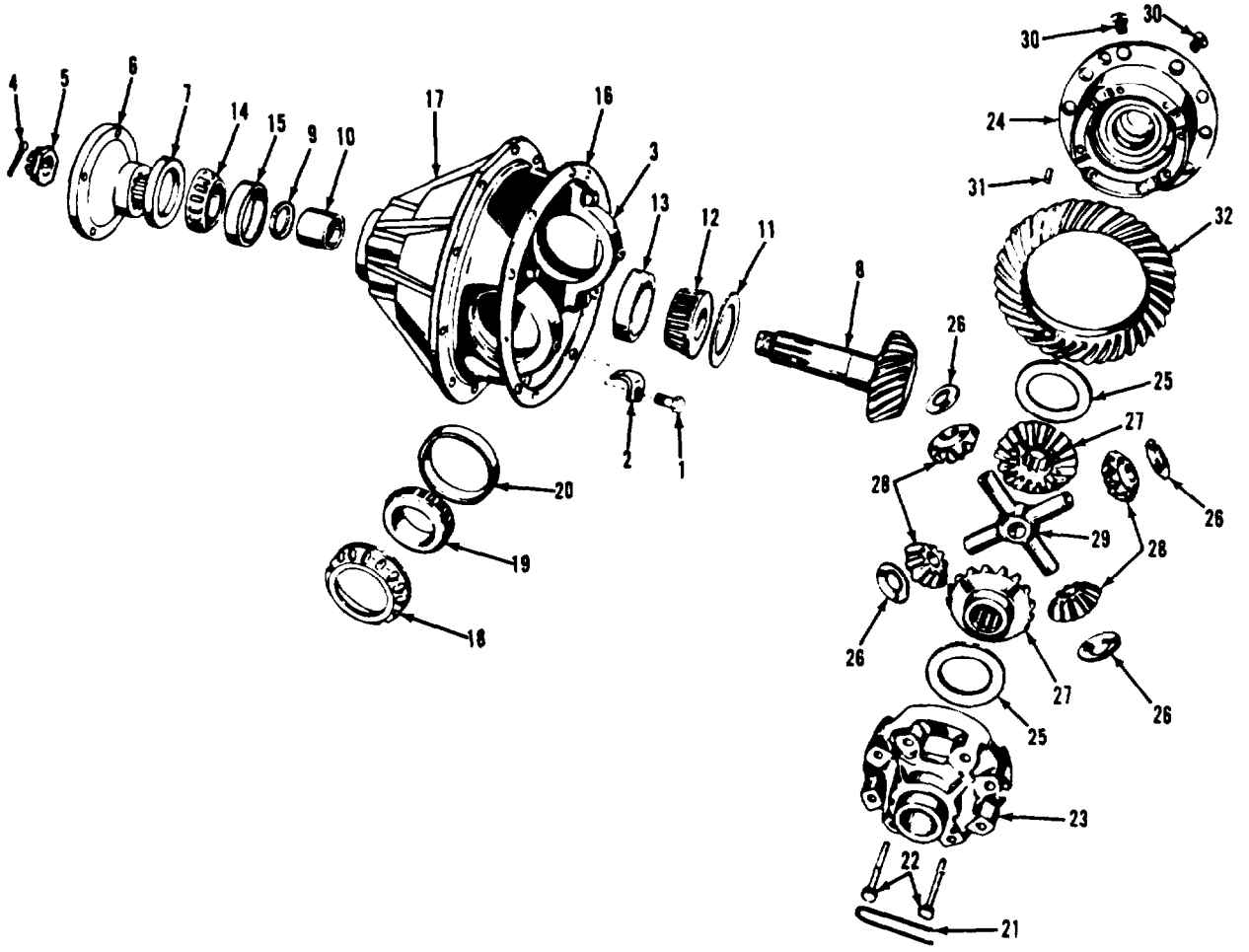
a. Removal.

(1) If the front axle housing has not been removed from the truck, disconnect the universal joint from the parking brake drum.

(2) Remove the front cover (10, fig. 4-14). Remove the capscrews which secure the carrier to the axle housing. Remove the carrier from the truck.

b. Disassembly. (fig. 4-15).

(1) Mark the caps (31 and the carrier (17) for proper installation. Cut the lockwire and remove the capscrews (1). locks (2) and bearing caps (3).



1. Capscrew
2. Lock
3. Cap
4. Cotter pin
5. Nut
6. Flange
7. Seal
8. Pinion
9. Shim
10. Spacer
11. Shim
12. Bearing cone
13. Cup
14. Bearing cone
15. Cup
16. Gasket
17. Carrier
18. Nut
19. Bearing
20. Cup
21. Lockwire
22. Capscrew
23. Case
24. Case
25. Thrust washer
26. Thrust washer
27. Gear
28. Spider gear
29. Spider
30. Capscrew
31. Dowel
32. Ring gear

Figure 4-15. Differential and carrier assembly, exploded view.

(2) Remove the differential assembly and adjusting nut (18).

(3) Remove the cotter pin (4) and pinion flange nut (51. Remove the pinion flange (6) and the parking brake drum. Remove the seal (7).

(4) Place the carrier (17) in a press and remove the pinion (8) from the carrier. Remove the shims (9 and 11) and the spacer (10).

(5) Remove the front bearing (12), bearing cup (13), rear bearing (14) and bearing cup (15) using suitable pullers.

(6) Remove the gasket (16) from the face of the carrier (17).

(7) Remove the adjusting nut (18). Pull the bearing (19) and drive off the bearing cup (20).

(8) Remove the lockwire (21) and capscrews (22). Separate the plain case half (23) from the flange case half (24). Note aligning marks on the case halves.

(9) Remove the thrust washers (25 and 26), side gears (27), spider gears (28) and spider (29).

(10) Cut the lockwire and remove the capscrews (30). Using a brass drift, drive out the dowels (31) and remove the ring gear (32).

c. Cleaning, Inspection and Repair.

(1) Clean all components except bearings in solvent and dry with compressed air. Clean bearings as instructed in paragraph 2-7.

(2) Inspect gears for chipped, cracked, broken or worn teeth. Check machined surfaces for nicks, scratches, scoring, pitting and other surface damage. Remove burrs and minor surface blemishes with a soft hone or crocus cloth. Inspect the bores for worn or out-of-round condition. Replace gears if excessively worn.

Note. The ring gear and pinion must be replaced as a set.

(3) Inspect the bearings for nicks, scratches, scoring and pitting of the bearing surfaces. Replace damaged bearings.

(4) Inspect the pinion for chipped or broken teeth. Inspect the splines and all machined surfaces for nicks, scratches, scoring, pitting and other damage. Smooth surfaces with a soft hone or crocus cloth. Replace pinion and ring gear if damage or wear is excessive.

(5) Inspect cases and carrier for cracks, breaks, fatigue lines, and damage to machined surfaces. Remove minor surface blemishes with a soft hone or crocus cloth. Repair damage if possible or replace as required.

(6) Inspect bearing cups and cones for nicks, scratches, burrs, scoring, pitting and wear. Replace cups and cones as assemblies as required.

(7) Inspect all other components for damage and wear. Replace parts as necessary.

d. Reassembly. (fig. 4-15.)

(1) Position two dowels (31) in the ring gear (32) and align the ring gear with dowel holes in the flange case (24). Install the capscrews (30) and tighten to draw the ring gear into place. Tighten the capscrews and secure with lockwire.

(2) Place the thrust washer (25) in the bottom of the flanged case 124). Install the side gear (27), spider (29), spider gears (28), thrust washers (26), side gear (27) and thrust washer (25).

(3) Install the plain case half (23) and secure with capscrews (22) and lockwire (21).

(4) Press the front bearing cup (11) and the rear bearing cup (15) into the carrier (17). Ensure that the cups are fully seated.

(5) Place the carrier housing in a preload fixture to determine the necessary preload shims. Set the shims and spacer aside for use in final assembly.

(6) Press the front bearing (12) onto the pinion (8) and place in the carrier. Install the rear bearing (14), pinion flange (6) and flange nut (5). Do not install shims or spacer at this time. Tighten the nut to a torque of 15 to 25 in. lbs. Spin the pinion to the right and left at least six times and check the torque.

(7) Place the carrier housing so that the open end is up, and install a side bearing bore arbor tool. Do not install the caps.

(8) Insert a feeler gage between the top of the pinion and the bottom of the arbor. The gage reading, plus or minus the value etched on the pinion head is the shim pack dimension. For example, if the pinion is etched +0.003, subtract 0.003 from the feeler gage reading. If the pinion is etched -0.003, add 0.003 to the reading. Thus, if the feeler gage reading is 0.020 and the pinion is etched + 0.003, the shim pack would be 0.017.

(9) Remove the flange nut (5), pinion flange (6), rear bearing (14), pinion (8) and front bearing (12).

(10) Install the shim pack under the head of the pinion (8) and press on the bearing (12). Install the spacer and shims determined in step (5) above. Install the cup (13) and seal (7) and install the pinion in the carrier. Install the rear bearing (14), pinion flange (6) and flange nut (5). Tighten the nut to a torque of 15 to 25 in. lbs. and secure with the cotter pin (4).

(11) Install a new gasket (16).

(12) Install the differential assembly, engaging the ring gear with the pinion. Coat the ring gear (32) with white lead or Prussian blue to obtain a tooth pattern. Install the bearing caps (3) but do not tighten the capscrews (1).

(13) Using a dial indicator, adjust the ring gear laterally for a backlash of 0.005 to 0.010. To increase backlash, loosen the adjusting nut (18) nearest the ring gear and tighten the opposite nut. To decrease backlash, reverse the operation.

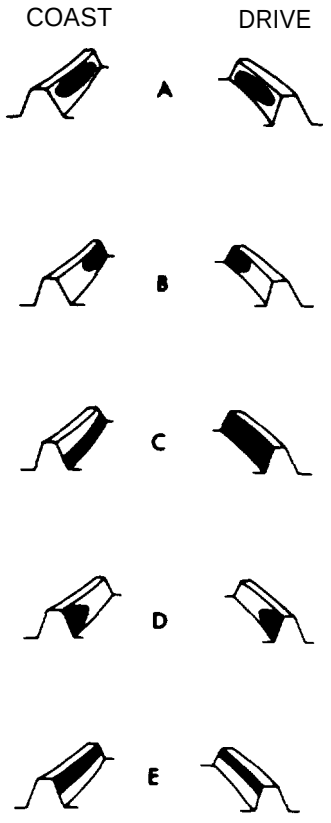
(14) When backlash is properly adjusted, rotate the pinion and hold back on the ring gear to simulate a load. Rotate the pinion several turns and inspect the teeth of the pinion for the ring gear contact pattern. The contact should start at a point 1/32 to 1/16 inch from the top of the tooth and continue downward to a point 1/32 to 1/16 inch from the bottom of the tooth. Refer to pattern A in figure 4-16. Patterns B through E show improper wear as follows:

(a) Pattern B indicates excessive contact on the toe of the tooth. To correct this, move the ring gear away from the pinion. Then add shims to bring the pinion toward the ring gear to correct the backlash.

(b) Pattern C indicates excessive contact at the flank of the tooth. To correct this, remove shims to move the pinion away from the ring gear until the contact comes to the full working depth of the gear tooth, without breaking contact at the flank. Then move the ring gear toward the pinion to correct the backlash.

(c) Pattern D indicates excessive contact at the heel of the tooth. To correct this, move the ring gear toward the pinion. Then remove shims to move the pinion away from the ring gear for correct backlash.

(d) Pattern E indicates excessive contact at the face of the tooth. To correct this, add shims to bring the pinion toward the ring gear until the contact covers the flank of the tooth without breaking contact at the face. Move the ring gear away from the pinion to correct the backlash.



ME 3930-624-34/4-16

Figure 4-16. Differential tooth pattern.

(15) Move the pinion or ring gear as necessary to obtain the correct tooth contact pattern. Readjust backlash.

(16) Tighten the capscrews to secure the bearing caps (3, fig. 4-15) and install lockwire. Install the adjusting nut locks (2) and capscrews (1).

e. Installation.

(1) Install the differential and carrier assembly in the front axle housing.

(2) Place a new gasket on the mounting flange of the carrier and coat it with a gasket adhesive.

(3) Secure the carrier with mounting hardware. Install copper washers at all holes below the differential oil level. Install a new gasket (17, fig. 4-14, and the cover (16).

(4) If the front axle housing is installed in the truck, connect the universal joint to the parking brake drum.

Section III. REPAIR OF REAR AXLE

4-8. General

The rear axle is a trunnion mounted steer axle. The rear wheels are mounted on the spindles on tapered roller bearings, and the spindles pivot in the axle on needle bearings. The rear axle and rear wheels serve only for steering and load carrying. They have no driving or braking function.

4-9. Rear Axle Assembly (Steer)

a. Removal.

(1) Raise the rear of the truck until the steer axle is accessible and block the truck securely in this position. The blocks must not interfere with the removal of the steer axle.

(2) Remove the steer wheels. Refer to TM 10-3930-624-12.

(3) Disconnect the tie rods and power steering cylinder.

(4) Place a suitable jack under the steer axle assembly and raise the jack enough to remove the stress from the axle mounting housings.

(5) Remove the capscrews and locknuts which secure the axle mounting housings to the frame.

(6) Lower the jack and steer axle assembly and remove them from under the truck.

b. Disassembly.

(1) Remove the capscrew (1, fig. 4-17), washer (2), and locknut (3) securing the axle mounting housings.

(2) Remove the axle mounting housings (4) and spacers (5) from the steer axle (40).

(3) Remove the capscrews (6), washers (7), shims (8). and self-aligning ball bushings (9) from the axle mounting housings (4). Note the number of shims on each axle mounting housing for reassembly.

(4) Remove the cotter pins (10) from the ends of the tie rods (21). Remove the adjusting plugs (11) and the ball seat (12). Detach the tie rods (21) from the pivot arm assembly (25). Remove the ball seat (13), the spring (14), and the safety plug (15) from the tie rod end.

(5) Remove the grease fittings (16).

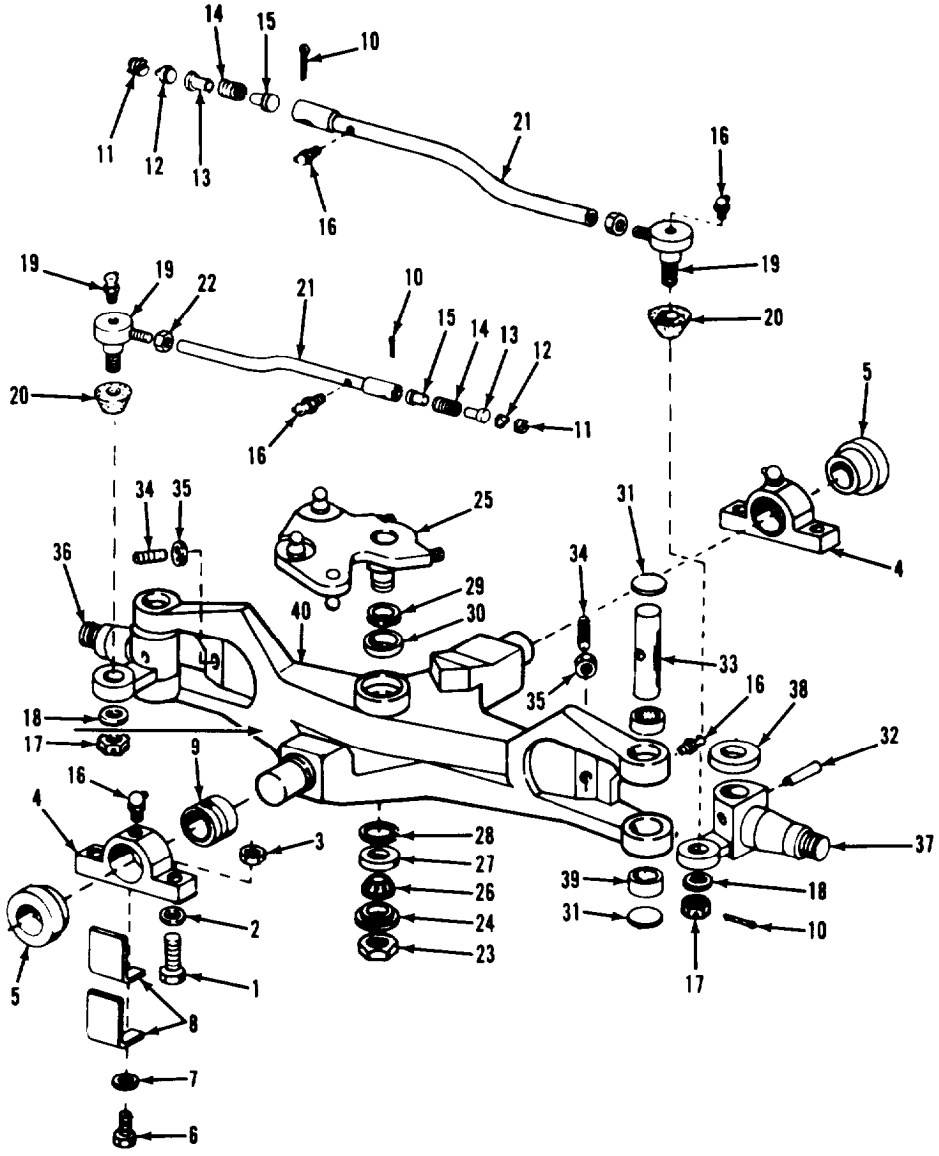
(6) Remove the nut (17) and washer (18) securing the ball socket (10). Remove the ball socket (19) and cover (20) from the spindles (36 and 37). Remove tie rod (21) and nut (22) from ball socket (10).

(7) Remove the pivot arm retaining nut (23) and washer (24). Remove the pivot arm assembly (25). Use a bearing puller to remove the pivot arm bearings (26 and 29), and cups (27 and 30). Remove the lock ring (28).

(8) Remove the expansion plugs (31) at each end of the king pins (33). Remove the roll pins (32) from the spindles (36 and 37). Tap the king pins 133) out of the steer axle (40).

(9) Remove the limit stop setscrews (34). nuts (35), spindles (36 and 37), and thrust washer (38).

(10) King pin needle bearings (39) can be replaced by forcing them out with the replacement bearings using a bearing replacement tool, or an arbor press.



ME 3930-624-34/4-17

1. Capscrew
2. Washer
3. Locknut
4. Axle mounting housing
5. Spacer
6. Capscrew
7. Washer
8. Shim
9. Self-alining ball bushing
10. Cotter pin
11. Adjusting plug
12. Ball seat
13. Ball seat
14. Spring
16. Grease fitting
17. Nut
18. Washer
19. Ball socket
20. Cover
21. Tie rod
22. Nut
23. Pivot arm retaining nut
24. Washer
25. Pivot arm assembly
26. Pivot arm bearing
27. Bearing cup
28. Lock ring
29. Pivot arm bearing
30. Bearing cup
31. Expansion plug
32. Roll pin
33. King pin
34. Limit stop setscrew
35. Nut
36. Spindle
37. Spindle
38. Thrust washer
39. King pin needle bearing
40. Steer axle

Figure 4-17. Rear axle assembly, exploded view.

c. Cleaning. Inspection and Repair.

(1) Wash all parts with a suitable solvent. Dry them with compressed air.

(2) Inspect the king pins (33, fig. 4-17), spindles (36 and 37), and the pin of the pivot arm (25) for scoring or excessive wear. Check weld and

tightness of ball studs and pins in pivot arms. Inspect all the bearings, tie rods parts, ball studs, and ail other parts for damage or excessive wear.

(3) Replace any parts which show excessive wear or damage.

d. Reassembly. Reassemble the components in reverse order of disassembly observing the following :

(1) Hand pack the king pin needle bearings (39, fig. 4-17) with wheel bearing grease, and grease the thrust washers (38). Position each spindle (36 and 37) and thrust washer in the steer axle (40). Position the king pin (33) with the slot toward the top. Make sure the roll pin hole in the spindle will lineup with the roll pin hole in the king pin.

(2) Hand pack the pivot arm bearings (27 and 30) with wheel bearing grease, and press them into the steer axle. See figure 4-18. Position the pivot arm (25, fig. 4-171, pivot arm bearings and bearing cups (27 and 30), lock ring (28), washer (24), and retaining nut (23) in the steer axle. Pre-load the pivot arm bearings to 15-20 in. lbs. Crimp the edge of the retaining nut (23) into the slot in the pivot arm pin.

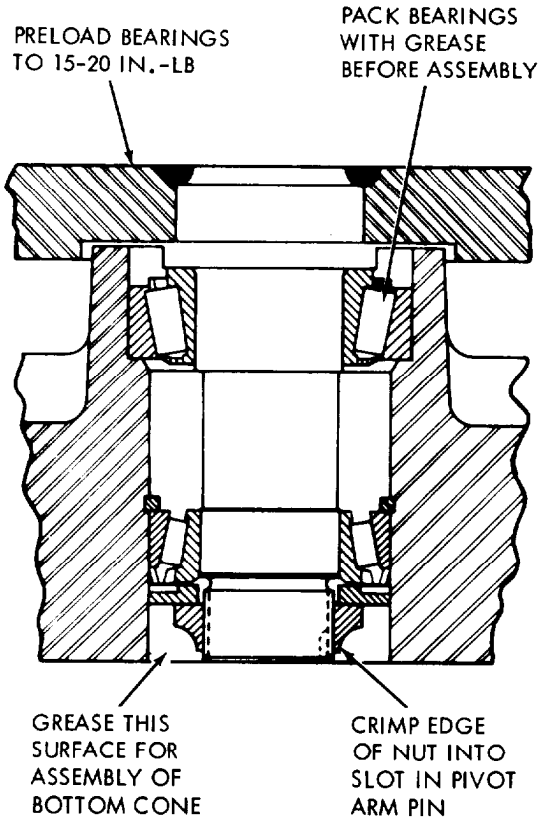


Figure 4-18. Pivot arm bearings.

e. Installation. Install the rear axle assembly by reversing the removal procedure. Tighten the axle mounting housing capscrews to a torque of 125 to 135 ft lbs.

f. Adjustment.

(1) Raise the rear of the truck so the steer wheels clear the floor and block the truck securely in position.

(2) Position the steer wheels straight ahead, parallel with the side of the truck frame. Measure the distance between the centers of the steer wheel treads, at the rear of the tires and at the front of the tires. The measurements should be equal. If they are not. adjust the tie rods to obtain equal measurements (zero toe-in).

(3) Turn the steering wheel full right and measure the angle of travel of the wheels. The right wheel must have rotated 54° to 56° and the left wheel, 75° to 80°. Adjust the left stop bolt of the pivot arm to obtain correct rotation. Turn the steering wheel full left and repeat the adjustment using the right stop bolt.

(4) Start the engine and check the operation of the steering system. When all adjustments are correct, the stop bolts on the pivot arm should contact the axle before the piston bottoms at either end of the power steering cylinder.

(5) Stop the engine and lower the truck to the floor.

Section IV. REPAIR OF SERVICE BRAKES

4-10. General

The hydraulic brake system consists of a master cylinder, lines, two wheel cylinders, shoes, and related parts. The brake components at the wheels arc located between dust shields at each drive wheel. The wheel cylinders are double-end type. They transfer movement through links to the bottom of the brake shoes. The top of the brake shoes move freely against wear plates, held there only by the tension springs. The brakes are self adjusting, with a friction slide assembly in each wheel. The friction in the slide assembly is great enough to prevent the springs from collapsing it, but not great enough to prevent wheel cylinder pressure from expanding it.

4-11. Master Cylinder

a. Removal. Refer to TM 10-3930-624-12.

b. Disassembly.

(1) Secure the master cylinder in a vise. Be careful not to tighten the vise excessively, which could distort the cylinder or crack the casting.

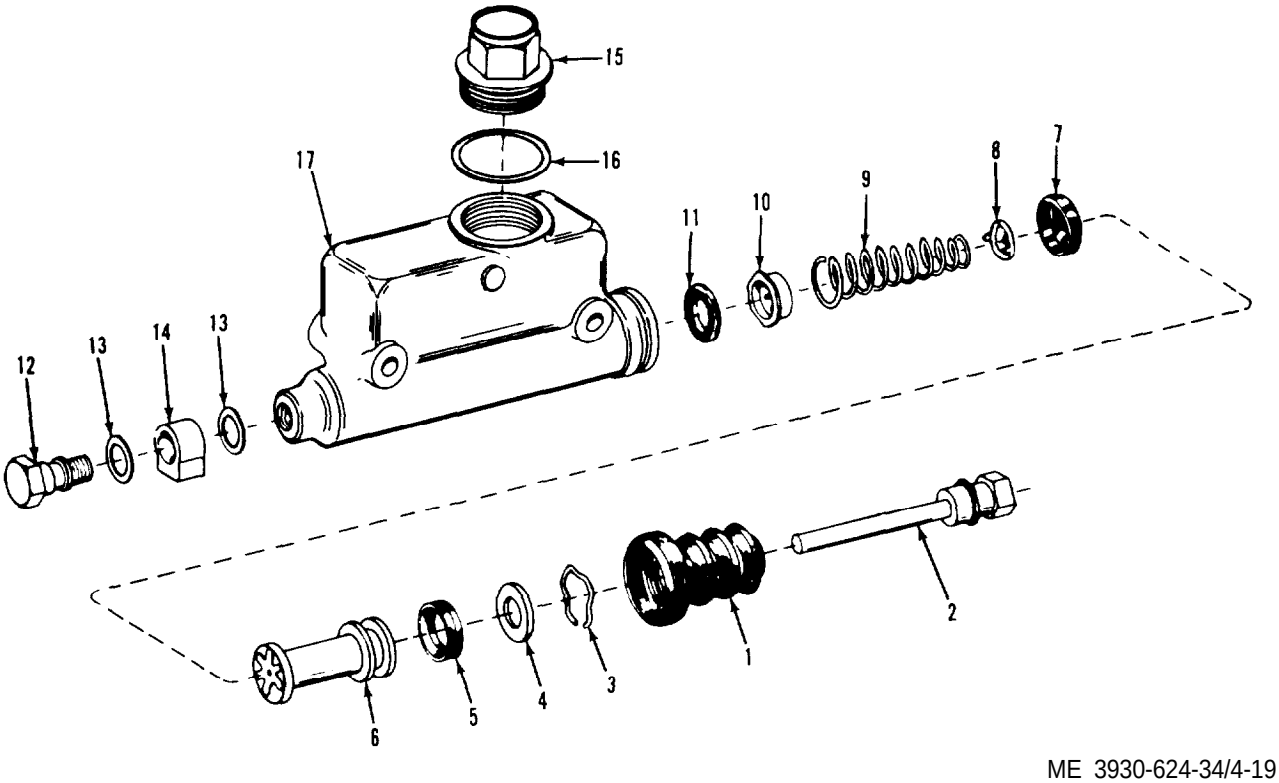
(2) Remove the boot (1, fig. 4-19) and the push rod (2).

(3) Pry out the lock ring (3) holding the piston assembly (6) in position.

(4) Carefully remove the plate (4), seal (5), piston assembly (6), cup (7), retainer (8), spring (9), valve (10), and the seal (11).

(5) Working from the other end of the cylinder. remove the bolt (12). copper gaskets (13), and fitting (14).

(6) Remove the filler cap (15) and gasket (16) from the body (17).



ME 3930-624-34/4-19

1. Boot
2. Push Rod
3. Lock ring
4. Plate
5. Seal
6. Piston
7. Cup
8. Retainer
9. Spring
10. Valve
11. Seal
12. Bolt
13. Copper gasket
14. Fitting
15. Filler cap
16. Gasket
17. Body

Figure 4-19. Master cylinder, exploded view.

c. Cleaning, Inspection and Repair.

(1) Use a lint-free cloth and clean the parts in denatured alcohol or clean brake fluid.

Caution: **Any solvents other than alcohol or brake fluid will deteriorate rubber parts, causing them to become soft, tacky and swollen.**

Cylinder castings may be cleaned with the usual cleaning methods. but must be finish cleaned with alcohol or brake fluid to remove all traces of other solvents. Parts must be kept clean for reassembly.

(2) Inspect the cylinder bore. Deep blemishes will require honing to resurface the cylinder wall. Pressure marks and discoloration may he polished out with crocus cloth. (Do not use sandpaper or emery cloth.) Make certain all the ports are open. The intake and bypass ports (inside the reservoir) may be probed with a soft iron wire.

(3) If honing is necessary, coat the cylinder bore with hydraulic brake fluid. Follow the honing equipment manufacturer's instructions. Remove material in single passes. After each pass, remove the hone and inspect the bore to see if all blemishes have been removed. Remove only enough material to eliminate blemishes. If the cylinder bore is honed beyond the allowable tolerance. replace the master cylinder. Original cylinder bore is 1.000 to 1.007 inches.

(4) After honing, remove the cylinder from the vise and clean the cylinder thoroughly. Check to be certain the ports are open and free of burrs which might cause damage to moving parts.

(5) Replace the parts which are contained in a repair kit. Replace all other parts which are worn. damaged, or corroded.

d. Reassembly. (fig. 4-19).

(1) Lubricate the ports and the cylinder bore with clean hydraulic brake fluid.

(2) Install the valve (10), seal (11), spring (9) and retainer (8) in the bore. The large end of the

spring must be toward the outlet port end of the cylinder bore.

(3) Place the cup (7) in the cylinder bore and install the piston (6) and seal (5).

(4) Place the plate (4) and lock ring (3) over the push rod (2). Use the push rod (2) to push against the piston (6). Install the plate (4) and secure the parts with the lock ring (3). Make sure the lock ring seats securely in the groove provided in the end of the cylinder.

(5) Install the copper gaskets (13), the fitting (14), and the bolt (12) in the outlet of the master cylinder (17).

(6) Position the boot (1) over the push rod end of the master cylinder and insert the push rod (2) into the seat provided on the piston (6).

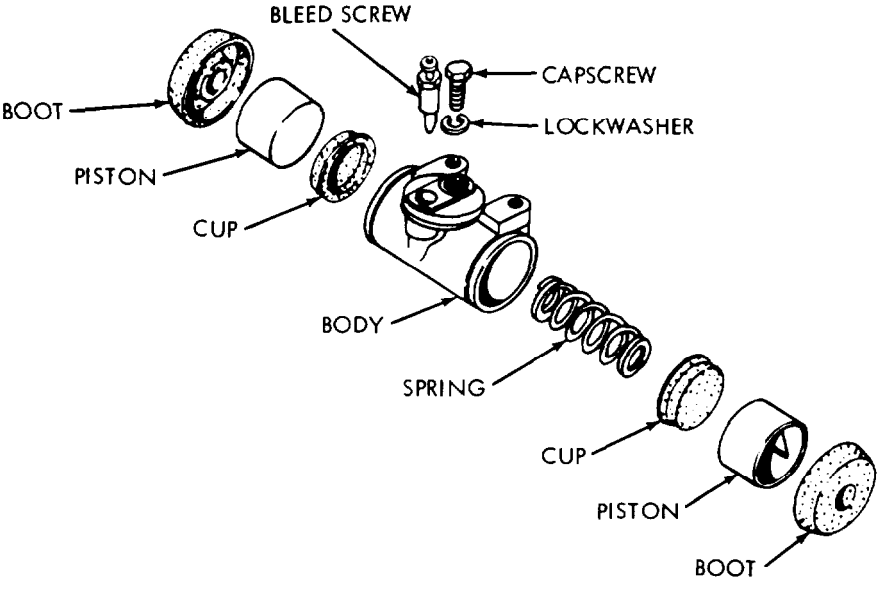
(7) Install the gasket (16) and the filler cap (15).

e. Installation. Refer to TM 10-3930-624-12.

4-12. Wheel Cylinder

a. Removal. Refer to TM 10-3930-624-12.

6. Disassembly. Remove the boots (fig. 4-201 from the cylinder and push out the internal parts. Low pressure air can be used at the inlet port to assist in removal.



ME 3930-624-34/4-20

Figure 4-20. Wheel cylinder. exploded view.

c. Cleaning, Inspection and Repair.

(1) Use a lint-free cloth and clean the parts thoroughly in denatured alcohol or clean brake fluid. Parts must be kept clean for reassembly.

Caution: **Any solvents other than alcohol or brake fluid will deteriorate rubber parts, causing them to become soft, tacky and swollen.**

(2) Inspect all parts for wear, corrosion, or damage. Inspect the cylinder bore. Pressure marks and discoloration may be polished out with crocus cloth. (Do not use sandpaper or emery cloth.) Deep blemishes will require honing to resurface the cylinder wall.

(3) Make certain the ports are open. They may be probed with a soft iron wire.

(4) If honing is necessary, secure the cylinder in a vise. BP careful not to tighten the vise excessively. This could distort the cylinder or crack the casting. Coat the cylinder bore with clean hydraulic brake fluid. Follow the honing equipment manufacturer's instructions. Remove material in single passes. After each pass, remove the hone and inspect the bore to see if all blemishes have been removed. Remove only enough material to eliminate blemishes. If the cylinder bore is honed beyond the allowable tolerance, replace the cylinder. Original cylinder bow is 1.500 to 1.5070 inches.

(5) After honing, remove the cylinder from the vise and clean the cylinder thoroughly. Check to be certain the ports are open and free of burrs which might cause damage to moving parts.

(6) Replace the parts which are contained in a repair kit. Replace all other parts which are worn, damaged, or corroded.

d. Reassembly.

(1) Lubricate the parts and the cylinder bore with clean hydraulic brake fluid.

(2) Refer to figure 4-20. Insert a cup and piston in one end of the cylinder. Never try to push a piston through the length of the cylinder.

(3) Insert the spring, the cup, and the piston in the other end of the cylinder.

(4) Install the cylinder boots. Make certain they are properly seated in the grooves provided in the casting.

e. Installation. Refer to TM 10-3930-624-12.

4-13. Pedal. Brake and Inching

a. Removal.

(1) Remove the floor plate and toe plate.

(2) Disconnect the master cylinder clevis pin. Remove the pedal springs and the brake pedal stop.

(3) Remove the setscrews holding the shaft in position. Install a 2 inch long capscrew in the end of the pedal shaft.

(4) Pressing against the capscrew, press the shaft out of the steering column mounting bracket into the opposite bracket and remove the capscrew.

(5) Loosen the bracket capscrews and lower the assembly until the shaft can be removed from the pedals. Remove the pedals from the truck.

b. Installation.

(1) Position the pedals on the shaft. Raise the shaft and pedal assembly into alignment with the hole in the steering column mounting bracket and push the shaft into the hole.

(2) Insert the 2 in. long capscrew into the end of the shaft and pull the shaft out far enough to locate the setscrew holes. Align them with the setscrew holes in the mounting brackets, push the shaft in, and install the setscrews. Remove the capscrew and tighten the mounting bracket.

(3) Install the brake pedal stop and the pedal springs. Connect the master cylinder clevis pin.

(4) Make any necessary adjustments (subpara c).

(5) Install the toe plate and floor plate.

c. Adjustment.

(1) Mechanical adjustment. (fig. 4-21.)

Caution: **Ensure that the inching plunger is completely bottomed before making any adjustments. Be sure that the inching pedal stop prevents the inching plunger from piercing the back of the control valve.**

(a) With the brake pedal in the normal position, set the inching pedal stop to allow a 1/16- 1/4 in. gap between the pickup lug and brake pedal.

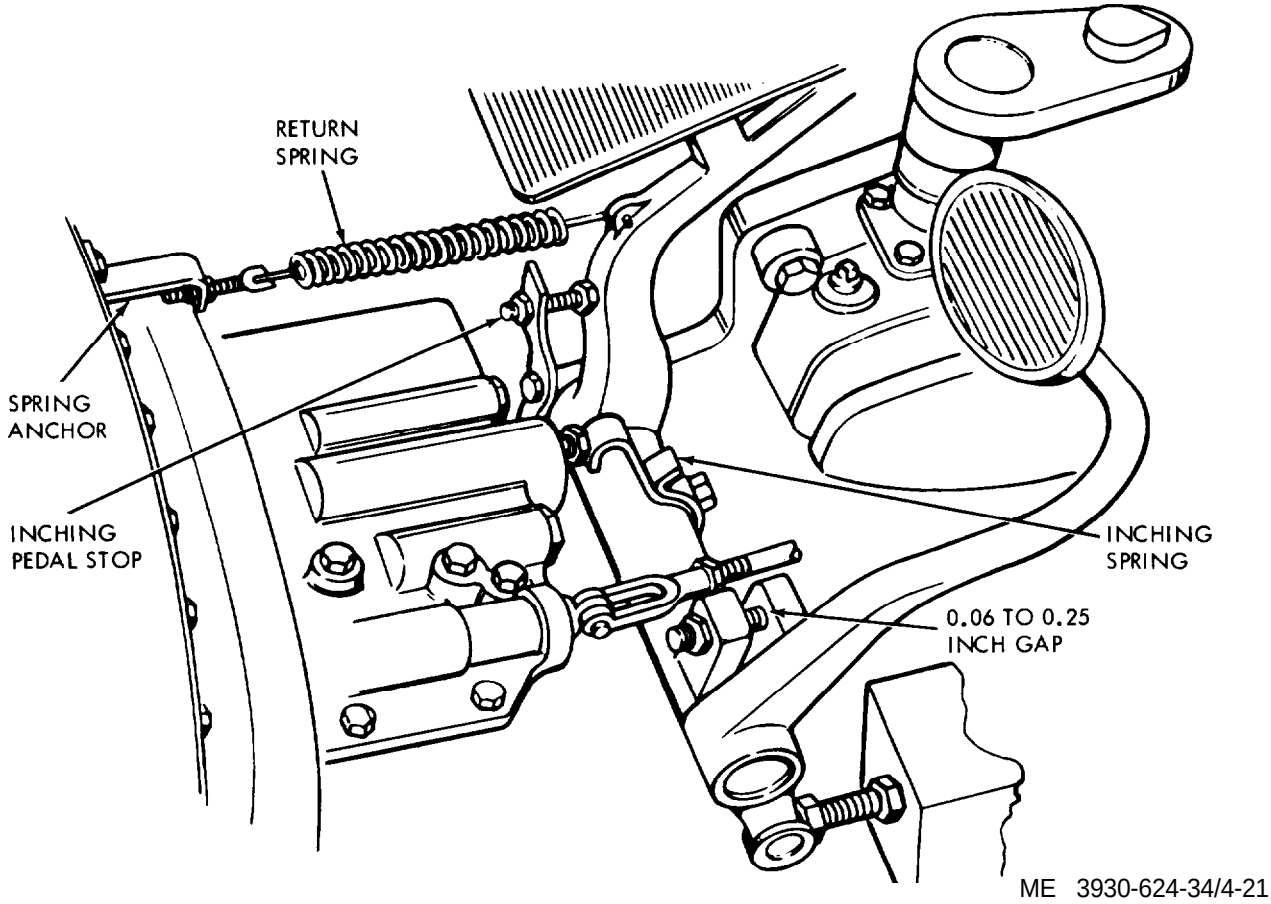


Figure 4-21. Inching pedal mechanical adjustment.

(b) Install the return spring (normal length 10 in.). Tighten the spring until it is 11-11¼ in. long.

(c) Position the inching spring against the plunger so that the deflection is 3/32-1/8 in.

(d) Raise the drive wheels off the floor, start the engine and operate at high idle, and shift the transmission into forward or reverse gear. The inching valve plunger must not move forward.

(e) Lower the wheels to the ground. engage the brakes, and place the transmission in gear. The engine should approach a stall. Shut down the engine.

(2) Hydraulic adjustment. (fig. 4-22.)

Note. Do not perform hydraulic adjustments until the mechanical adjustments are correct.

(a) Install a 160 or 300 psi pressure gage at the pressure port of the powershift control cover.

(b) Depress the brake pedal until the brake shoes engage the drum. A slight resistance will be felt in pedal movement.

(c) Place a wedge between the brake return stop and the pedal lug to fix the position of engagement.

(d) Engage the parking brake.

(e) Start the engine and operate at low idle (500 to 600 rpm). Place the transmission in neutral and keep the seat deck down. Depress the inching pedal until the pressure gage reads 6 to 10 psi.

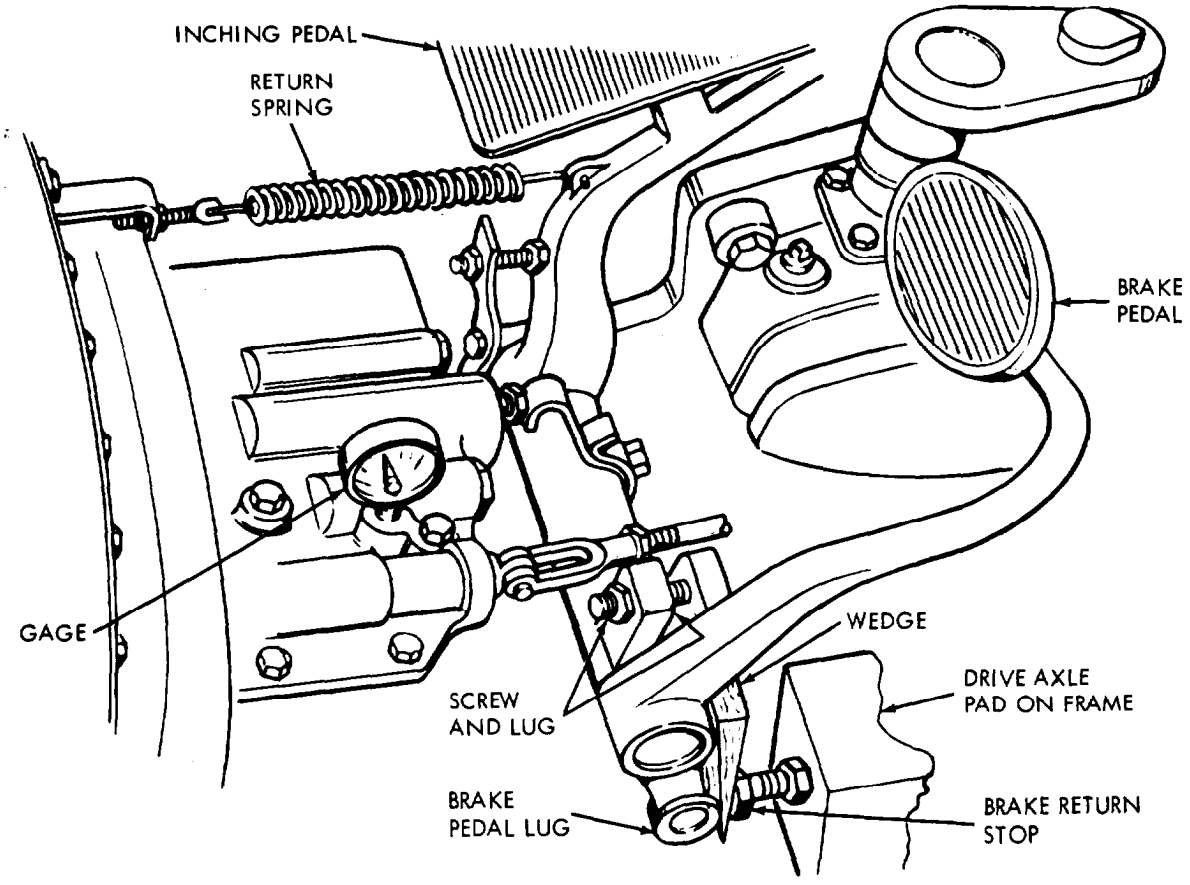


Figure 4-22. Inching pedal hydraulic adjustment.

(f) Set the adjusting screw to contact the brake pedal lug and lock.

(g) Operate the engine at high idle speed. Remove the wedge and compress the inching pedal spring to 3/32- 1/8 in. Pressure gage should indicate 100-160 psi. Pull the inching pedal forward and ensure that the pressure reading does not increase. Shut down the engine.

(h) Loosen the inching spring mounting capscrew and readjust the spring to a 3/32-1/8 in. deflection. Tighten the capscrew. Check for free oscillation of the inching spring.

Section V. REPAIR OF WHEEL ASSEMBLIES

4-14. General

The drive wheel assembly consists of a wheel, a tire, a bull gear and bearings. The bull gear is bolted inside the wheel. Part of the space on the inside surface of the wheel serves as a brake drum. The steer wheel assembly consists of a wheel, a tire and bearings.

4-15. Wheel Repair

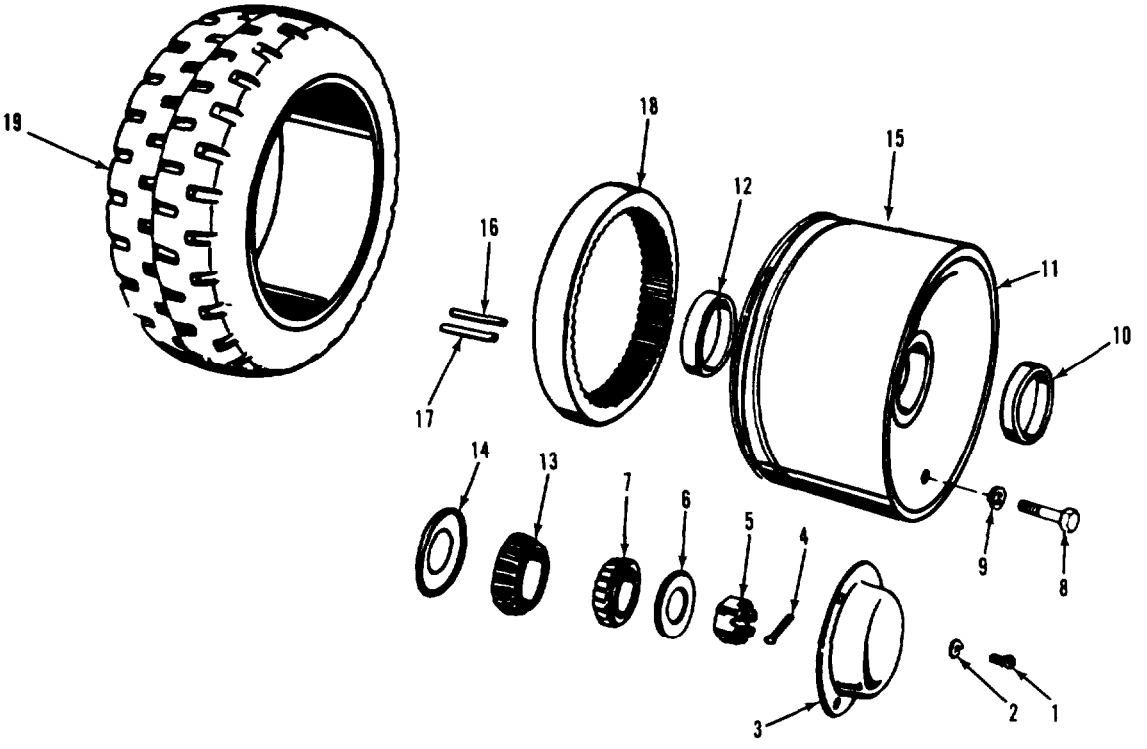
a. Removal. Refer to TM 10-3930-624-12 for the wheel removal procedure.

b. Dissembly. (fig. 4-23)

Note. Figure 4-23 is an illustration of the drive wheel. The steer wheel is similar, with differences noted.

(1) Remove capscrew (1), lockwasher (2), and hub cap (3).

(2) Remove cotter pin (4), bearing adjusting nut (5), washer (6), and outer bearing (7).



ME 3930-624-34/4-23

1. Capscrew
2. Lockwasher
3. Hubcap
4. Cotter pin
5. Bearing adjusting nut
6. Washer
7. Outer bearing
8. Capscrew (drive wheel only)
9. Lockwasher (drive wheel only)
10. Outer cup
11. Wheel
12. Inner cup
13. Inner bearing
14. Grease shield
15. Felt strip (drive wheel only)
16. Roll pin (drive wheel only)
17. Roll pin (drive wheel only)
18. Bull gear (drive wheel only)
19. Tire

Figure 4-23. Wheel assembly. exploded view.

(3) Remove outer cup (10), wheel (11), inner cup (12) inner bearing (13) and grease shield (14).

(4) For drive wheels only, remove felt strip (15) roll pins (16 and 17), and bull gear (18).

c. Repair. Repair wheels as follows:

(1) *Bearing cups.*

(a) Insert a brass drift pin in the recesses on the inner hub of the wheel, and tap the drift with a hammer to remove the bearing cups.

(b) When installing each bearing cup, position it in the wheel carefully. Press in with an arbor press or use a brass drift. Tap evenly around the edge of the cup. so that it will not bind.

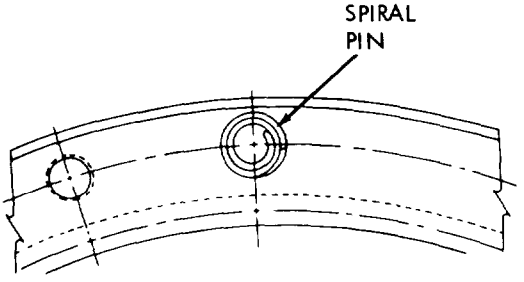
(2) *Bull gear.*

(a) Remove the three capscrews which secure the bull gear to the inner side of the wheel.

(b) Turn the wheel over. Insert standard hardened capscrews with three inches of thread into the holes provided in the bull gear.

(c) Tighten the capscrews evenly until the bull gear is removed from the wheel bore.

(d) To install the bull gear, first install the spiral pins in the bull gear. Aline each spiral pin as shown in figure 4-24, with the edge of the outer coil on the bolt circle. Drive the pins into the bull gear from the bottom side until the pins are flush with the top side.



ME 3930-324-34/4-24

Figure 4-24. Spiral pin installation.

(e) Position the bull gear, bottom side down, in the drive wheel. Aline the spiral pins with the holes in the drive wheel and tap the bull gear evenly to start it into the drive wheel.

(f) Install the capscrews which were originally removed and alternately tighten the capscrews and tap the bull gear until the gear is seated. Try to insert a 0.003 inch feeler gage between the gear and the shoulder. When the gear is properly seated, the gage will not enter at any point. Tighten the capscrews to a torque of 28 to 32 ft lbs.

(3) *Brake drum.*

(a) When resurfacing the brake drums, follow the resurfacing equipment manufacturer's instructions. Always resurface both drums of the truck to an equal diameter.

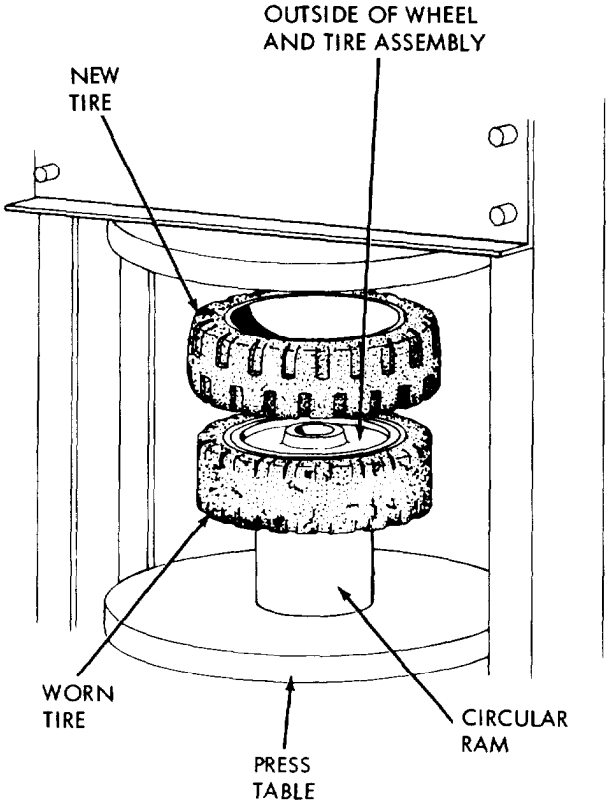
(b) Finish grind or hone the drums to remove cutting tool marks. Otherwise, linings will wear rapidly. If a brake drum surface requires machining to a diameter greater than 0.030 inch beyond original diameter, the wheel must be discarded. Thin drums may break under strain. Original brake drum surface diameter is 13.135 to 13.143 inches.

d. Reassembly. Assemble the wheel in the reverse order of disassembly.

e. Installation. Refer to TM 10-3930-624-12.

4-16. Tire Replacement

Place the old wheel, with the chamfered side up, on a circular ram having a smaller outside diameter than the tire inside diameter and place in a 100 ton or larger hydraulic press. See figure 4-25. Position the new tire on top of the old tire. Run the press slowly for the first few inches of travel. If the tire begins to cock, stop and realign it. A sharp tap with a soft headed mallet will usually do this. Continue pressing until the old tire is off and the new tire is correctly positioned on the wheel. Make sure the rim of the new tire is pressed onto the wheel to the same location as the original.



ME 3930-624-34/4-25

Figure 4-25. Tire replacement.

Section VI. REPAIR OF STEERING SYSTEM

4-17. General

The steering system consists of the steering wheel, column and valve assembly, the power steering cylinder and the steer axle assembly. Oil for the power steering system is supplied by the hydraulic pump. which also serves the truck hydraulic system. The power steering system is fully hydraulic, with no mechanical connection between the column assembly and the cylinder. The base of the cylinder is anchored to the frame. The pivot arm is connected to the steer wheel spindles by two tie rods.

4-18. Steering Gear Assembly

a. Adjustment. Release the upper steering column support and notice whether the column moves to a different position. If it moves, it should be clamped in its new position or the position should be corrected at the mounting bracket on the vehicle. If the column has been bent due to misalignment, it must be replaced.

b. Removal.

(1) Remove the floor plate and the toe plate.

(2) Disconnect the shift linkage at the transmission. Refer to figure 4-26.

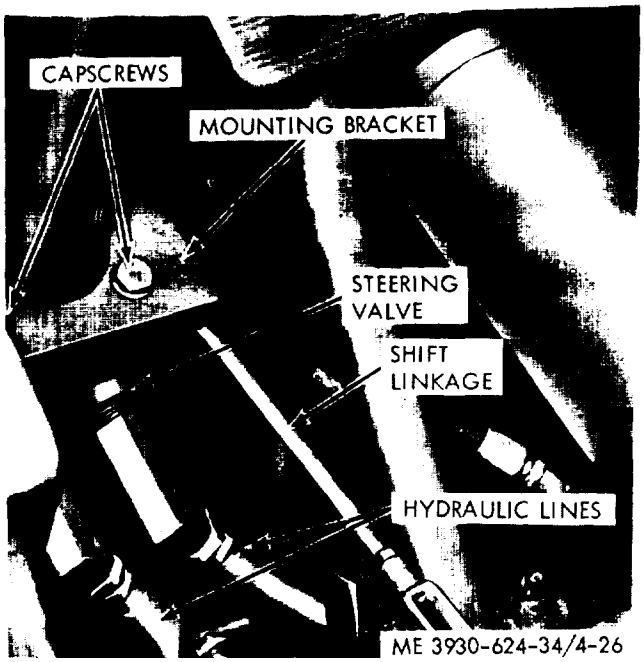


Figure 4-26. Steering valve.

(3) Disconnect the hydraulic lines at the steering control valve, plug the lines and ports to keep out dirt, and tag the lines for identification.

(4) Disconnect the horn button wire at the horn.

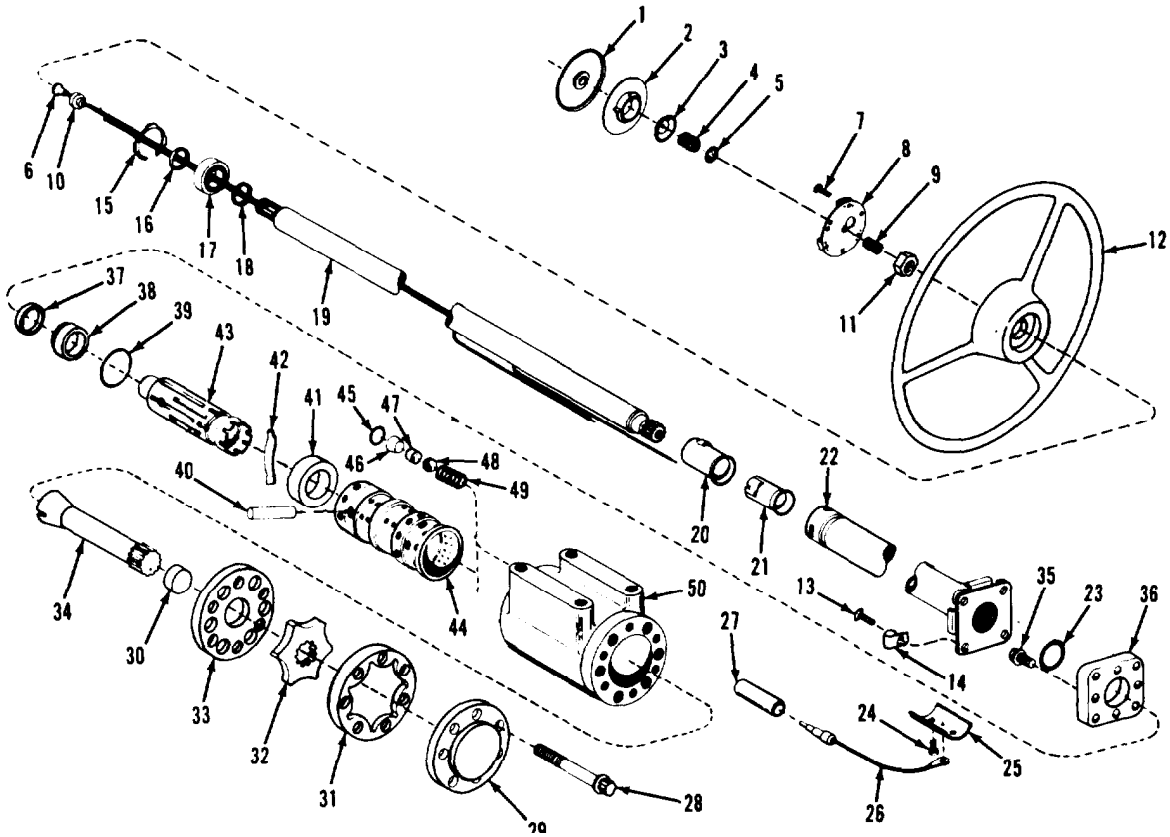
(5) Remove the capscrews which secure the steering column and valve assembly to the mounting bracket. Remove the upper column support and remove the steering column and valve assembly from the truck. Place it in a clean work area for disassembly.

c. Disassembly.

(1) Remove the horn button (2, fig. 4-27) and rubber cover (1) by pushing down and turning it counterclockwise.

(2) Remove the born button contact cup (3), spring (4), and cap (5). Remove the terminal from the lower end of the horn wire and pull the wire and ferrule (6) from the column. Remove the capscrews (7), plate (8), spring (9), and washer (10).

(3) Remove the nut (11) which secures the steering wheel (12) to the shaft. Using a suitable puller, pull the wheel from the shaft.



ME 3930-624-34/4-27

1. Cover
2. Horn but ton
3. Contact cup
4. Horn button spring
5. Cap
6. Ferrule and wire
7. Capscrew
8. Plate
9. Spring
10. Washer
11. Nut
12. Steering wheel
13. Capscrew
14. Clip
13. Retaining ring
16. Snap ring
17. Rearing
18. Snap ring
19. Shaft
20. Contact ring
21. Insulator
22. Tube and flange
23. Oil seal
24. Capscrew
23. Horn brush assembly
26. Wire lead
27. Connector
28. Capscrew
29. End cap
30. Spacer
31. Ring gear (rotor)
32. Rotor
33. Plate
34. Drive
35. Capscrew
36. Mounting plate
37. Seal
38. Bushing
39. Seal
40. Centering pin
41. Centering disc
42. Centering spring
43. Spool
44. Sleeve
45. Seal ring
46. Check valve seal plug
47. Check valve seat
48. Check ball
49. Check valve spring
50. Valve housing

Figure 4-27. Steering wheel. column and valve, exploded view.

(4) Make alinement marks on the mounting plate (36) and the column flange (22) to ensure correct reassembly. Remove the capscrews (13) and clips (14) securing the column (22) to the mounting plate (36) and separate the two assemblies.

(5) If service of the column is necessary, disassemble.

(a) Remove the retaining ring (15) and the first snap ring (16). Push the shaft (19) free of the tube (22) with thumb pressure.

(b) Remove the bearing (17) and remaining snap ring (18).

(6) Remove the contact ring (20) and the insulator (21) from the tube and flange (22). Remove the seal (23).

(7) Remove the capscrews (24), horn brush assembly (25). lead (26). and connector (27).

(8) With plugs in the ports of the valve unit, clean the exterior with a wire brush to eliminate the possibility of paint or dirt particles getting inside the unit.

(9) Remove the plugs and clamp the valve unit in a vise with the meterity end up. Use a smooth jawed wise or use sheets of soft metal on the jaws to protect the valve unit surfaces. Remove the cap-screws (28) which secure the cap (29) and the gear plate and drive assembly.

(10) Remove the cap (29) and the spacer (30). Remove the gear plate and drive assembly from the valve housing (50). Remove the rotor ring gear (31). the rotor (32). and the plate (33) from the drive (34).

(11) Remove the control unit from the vise and check for free rotation of the control spool and sleeve parts with the steering column shaft.

(12) Place a clean wooden block across the vise throat to support spool parts and clamp unit across port face with control end up. Remove the capscrews (3.5) which secure mounting plate.

(13) Hold the spool assembly down against the wooden block and lift off mounting plate (36).

(14) Remove the seal (37) and the mounting plate locator bushing (38). Remove seal (39).

(15) Place the port surface of the housing securely on a solid surface and remove the spool-sleeve assembly (40-44) from the 14-hole end of the housing.

Caution: **Use extreme care when removing these parts, because they are very closely fitted and must be rotated slightly as they are withdrawn.**

(16) Remove the centering pin (40) from the sleeve (44). Push inside the lower edge of the spool (43) to move it toward the splined end and remove the spool carefully from the sleeve. Remove the centering disc (41). Push the centering spring (42) out of the spot in the spool (43).

(17) With a small bent tool or wire, remove the seal ring (45) and seal plug (46) from the housing. Do not pry against the edge of the hole in the housing bore.

(18) Clamp the housing in the vise, control end up. Unscrew the check valve seal (47) with a 3/16 in. hex wrench. Remove the housing from the vise.

(19) Turn the housing over and with the check valve hole toward the lowest corner, tap it lightly with the palm to remove the check valve seat (47), ball (48). and spring (49) from the housing (50).

d. Cleaning, Inspection and Repair.

(1) Carefully clean the parts with a suitable solvent and allow them to air dry. Place the parts on clean paper towels. Be careful not to use any rags which have loose lint or threads,

(2) Inspect the surfaces of all moving parts for scoring, excessive wear, or damage. Smooth burnished surfaces are normal in many areas. Do not mistake this condition for excessive wear.

(3) Slightly scored surfaces can be cleaned up by hand rubbing with 600-grit abrasive paper. Replace any defective or excessively worn parts. Replace all seals with new seals.

(4) Polish the flat surfaces of the metering section of the control valve.

(a) Place a piece of 600-grit abrasive paper face up on a piece of plate glass or a similar smooth, flat surface.

(b) Clean the ends of the rotor by stroking it across the abrasive. This will also remove any sharp grit which could scratch other components.

(c) Lightly clean up both sides of the ring gear, both sides of the plate, the 14-hole end of the housing, and the flat side of the end cap. Stroke each surface across the abrasive several times and check the results. Any small bright area indicates a burr, which must be removed. When polishing the parts, hold them as fiat as possible against the abrasive. After 6 to 10 strokes across the abrasive, check the part to see if it is polished.

(d) After each part is polished. rinse it clean in solvent, dry it with compressed air, and place it where it will remain absolutely clean for reassembly.

e. Reassembly.

(1) Lubricate all of the parts lightly with clean hydraulic oil.

(2) Install the housing (50, fig. 4-27) in a vise with the control end up and the 14-hole end resting on a clean wooden block. Clamp it lightly across the port surface and install the check valve spring (49) into the bore with the large end of the spring down.

Install the ball (48) and make sure it rests on the top of the spring.

(3) Place the check valve seat (47) on a hex wrench and install it in the check valve bore so that the machined counterbore of the seat is properly seated with the ball. Tighten check seat to 150 in. Ibs. Check the ball action by pushing the ball against the spring force with a small pin.

Note. The hall does not have to be snug against the seat to function properly.

(4) Carefully install the spool (43) within the sleeve (44). Make sure that the spring slots of both parts are at the same end. Rotate the spool carefully while sliding the parts together. Test for free rotation. The spool must rotate smoothly within the sleeve with fingertip force applied at the splined end.

(5) With the spring slots of the spool and the sleeve aligned, stand the part on end and insert the spring installation tool through the slots in both parts. Position 3 pairs of centering springs (42) (or 2 sets of 3 each) on the bench so that the extended edges are down and the arched center sections are together. In this position, insert one end of the entire spring set into the spring installation tool.

(6) Compress the extended end of the centering spring set and push it into the spool-sleeve assembly. while withdrawing the installation tool. Make sure the springs are centered in the assembly, so they can be pushed down evenly and flush with the upper edges of the spool and sleeve.

(7) Install the centering pin (40) through the sleeve-spool assembly and push it into place until the centering pin is flush or slightly below the sleeve diameter at both ends.

(8) Place the housing (50) on a solid surface with the port face down. Install the sleeve-spool assembly with the splined end entering the 14-hole end of the housing first. Push the parts gently into place. flush with the 14-hole end of the housing, with a slight rotating motion. Do not push the assembly beyond the flush point, because the centering pin may drop into the discharge groove of the housing.

Caution: **Be extremely careful not to cock the spool-sleeve assembly out of position as it enters the housing. It must enter straight to avoid scoring.**

(9) Check the assembly for free rotation within the housing by turning the assembly with light finger force at the splined end. Hold the parts in position and place the 14-hole end of the assembly down against a wooden block or flat surface.

(10) Install the seal ring (45) on the check valve seal plug (46) and install the plug in the housing (50). Exert a steady pressure on the plug, rocking it slightly so the seal ring enters smoothly without being cut.

(11) Insert the mounting plate locator bushing (38) with the large OD chamfer up, partially into the housing. Rotate the hushing to seat it smoothly against the sleeve-spool assembly.

(12) Install new mounting plate seal (37) and shaft seal (23) into the mounting plate (36). Push each seal carefully into the seal groove with the fingers. The seal grooves are slightly smaller than the seals to provide adequate sealing. Then thin oil seal (39) at the outside of the mounting plate must he pressed into the counterbore with the lip facing out.

(13) Place the mounting plate, with seals installed, over the spool shaft and slide it down over the locator bushing, carefully, so the seals will not he disturbed.

(14) Aline the bolt holes in the mounting plate (36) with the tapped holes in the housing (501. Make sure the mounting plate is flush against the end of the housing assembly so the locator bushing is not cocked. Install the four mounting plate capscrews and tighten them gradually and evenly to a torque value of 250 in. Ibs.

(15) Reposition the housing assembly in the vise with the 14-hole surface facing up, and clamp across the edges of the mounting plate. Make sure the spool and sleeve are flush or slightly below the surface of the housing.

(16) Wipe the end surfaces of the housing clean with the palm. Clean each flat mating surface in a similar way for reassembly.

(17) PIace the plate (33) on the housing assembly. aligning the bolt holes in the plate with the tapped holes in the housing.

(18) Place the metering ring gear (31) on the assembly. aligning the bolt holes.

(19) Install the splined end of the drive (34) into the rotor (32), with the slot at the control end of the drive aligned with the valleys between the rotor teeth.

(20) Push the splined end of the drive through the rotor until the spline extends one-half its length beyond the rotor. Hold it in this position while installing it in the valve unit. Note the position of the centering pin (40) within the valve unit. This pin engages the slot in the drive. Hold the plate and ring gear so they do not move out of position. Install the drive and rotor assembly into the valve unit and carefully position the parts so the drive does not become disengaged from the rotor. Rotate the drive and rotor (34 and 32) slightly, to align the slot in the drive with the centering pin.

Caution: **Alinement of the cross slot in the drive with the valleys between the teeth of the rotor determines the proper valve timing of the control valve unit. There are 12 teeth on the**

spline, and 6 on the rotor. Alinement will he correct in 6 positions and incorrect in 6 positions. If the drive and the rotor slip out of position during assembly into the control valve unit. make sure to realine them correctly.

(21) Place the spacer (30) in position in the rotor. If the spacer does not fit flush with the surface of the rotor. the drive has not properly engaged the warning pin. If the spacer fits flush. place the end cap (29) in position on the assembly and install two capscrews (28). Tighten them only finger-tight to maintain alignment of the parts.

(22) Install the remaining capscrews (28) and tighten them gradually and evenly to a torque valve of 150 in. lbs.

(23) Reassemble the steering column (13-27), the steering wheel (12) and the horn button assembly, (1-10) by reversing the disassembly procedure.

(24) Assemble the steering column to the control valve unit. Rotate the shaft to aline the splines while bringing the mounting surfaces together. Use the guide marks made during disassembly to align the column flange correctly with the mounting plate. Tighten the capscrews to a torque of 280 in. Ibs.

f. Installation. Install the steering column and control valve unit by reversing the removal procvedure. Tighten the bottom mounting hardware first. to prevent stress on the column tube.

4-19. Steering Cylinder

a. Removal.

(1) Raise the rear of the truck until the cylnder is accessible. Block the truck securely in position.

(2) Place a pan under the cylinder ports and disconnect the hoses from the cylinder. Plug the cylinder ports and the hoses and tag the hoses for identification.

(3) Disconnect the power steering cylinder from the mounting bracket and remove the cylinder front the truck.

b. Disassembly.

(1) Remove the lot-k ring (1. fig. 4-28) securing the spacer (2) in position and remove the spacer.

(2) Remove the lock ring (3) securing the head (8) in the tube (8) and remove the head (8) from the tube (18) by pulling out the rod and piston assembly.

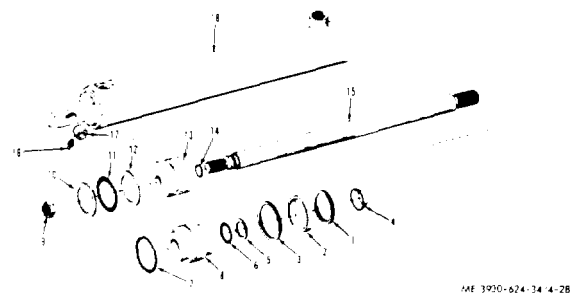
(3) Carefully slide the head (8) off the rod (15). Remove the rod wiper (4), washer (5). and seal (6) from the head (8).

(4) Remove the nut (9) securing the piston (13) to the rod (15). Slide, the piston (13) off the rod (15).

(5) Remove the washers (10 and 12) and the seal ring (11) from the piston (13). Remove the rod seal (14) from the rod (15).

(6) If the grease fitting (16) is damaged, replace it.

(7) If the bushing (17) requires replacement, press it out with a suitable tool or arbor press.



1. Lock ring
2. Spacer
3. Lock ring
4. Wiper
5. Washer
6. Seal
7. Head seal
8. Head
9. Lock nut
10. Lock ring
11. Seal ring
12. Washer
13. Piston
14. Rod seal
15. Rod
16. Grease fitting
17. Bushing
18. Tube

Figure 4-28. Steering cylinder. exploded view.

c. Cleaning. Inspection and Repair.

(1) Clean the metal parts in a suitable solvent and dry them with compressed air. Wipe the seals clean. using hydraulic oil as a solvent.

(2) Inspect the tube bore, rod. head and piston for cracks. scratches. scoring or other damage, and excessive wear. Inspect the seals for damage or excessive wear.

(3) Slight imperfections can he cleaned up with a polishing stone. Replace any damaged or excessively worn parts.

d. Reassembly. Reassemble the cylinder by reversing the disassembly procedure. Lubricate the cylinder parts with a light coating of hydraulic oil. Be careful not to damage seals against threads or sharp edges during reassembly. When installing the head assembly, compress the lock ring. Keep it

compressed while sliding the head into the tube until the lock ring can snap into place.

e. Installation. Install the cylinder by reversing the removal procedure. Make any necessary steering system adjustments (para 4-9).

CHAPTER 5

REPAIR OF ELECTRICAL AND HYDRAULIC COMPONENTS

Section I. REPAIR OF ELECTRICAL COMPONENTS

5-1. General

The electrical system of the truck is used to supply power for starting and turning the engine. It also supplies power for the lights and instruments on the truck.

5-2. Alternator

a. Removal. Refer to TM 10-3930-024-12 for the alternator removal procedure.

b. Disassembly. (fig. 5-1.)

(1) Remove the four thru-bolts (1) from the alternator assembly.

Note. Place a scribe mark on the stator (15) and end frames (14 and 46) to aid in locating the parts in the same position during reassembly.

(2) Separate the drive end frame (14) and the rotor assembly (8) from the stator assembly (15). Pry them apart at the stator slot with a screwdriver.

(3) Place the rotor (8) in a vise and tighten just enough to permit removal of the shaft nut (2). Remove the shaft nut (2), washer (3), pulley (4). fan (5) and collar (6).

(4) Separate the rotor (8) from the drive end. removing key (7).

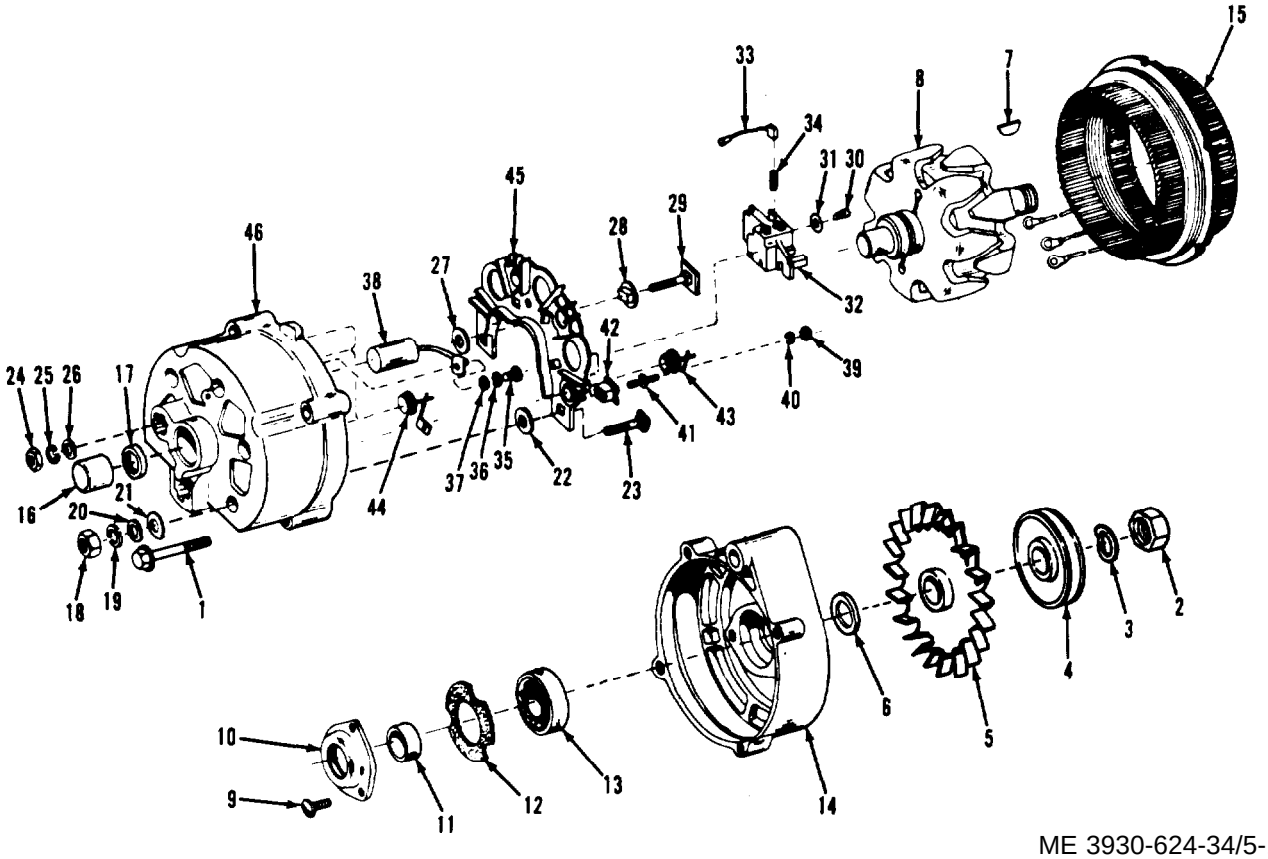
(5) Remove retainer (10). collar (11), gasket (12), and bearing (13) from end frame (14).

(6) Remove stator (15) from end frame (46).

(7) Remove end frame bearing (16) and retainer (17) from end frame (46). Place a piece of tape over the bearing and over the slip ring assembly on the rotor shaft.

(8) Remove brush holder (32). brushes (33), and springs (34).

(9) Remove capacitor (38) diodes (43 and 44) and heat sink (45) from end frame (46). If diode replacement is necessary, refer to sub-paragraph c.



1. Thru bolts
2. Shaft nut
3. Washer
4. Pulley
5. Fan
6. Collar
7. Key
8. Rotor
9. Capscrew
10. Retainer
11. Collar
12. Gasket
13. Bearing
14. End frame
15. Stator
16. End frame bearing
17. Retainer
18. Nut
19. Lockwasher
20. Washer
21. Insulating washer
22. Insulating washer
23. Terminal stud
24. Nut
25. Lockwasher
26. Washer
27. Insulating washer
28. Insulator
29. Terminal stud
30. Capscrew
31. Washer
32. Brush holder
33. Brush
34. Brush spring
35. Capscrew
36. Lockwasher
37. Washer
38. Capacitor
39. Nut
40. Lockwasher
41. Terminal stud
42. Insulator
43. Diode (positive)
44. Diode (negative)
45. Heat sink
46. Frame

Figure 5-1. Alternator.

c. Cleaning, Inspection and Repair.

(1) Cleaning. Clean all parts of the alternator with cleaning solvent, except for the stator (15, fig. 5-1), rotor (8), and heat sink 145). Dry thoroughly with compressed air.

(2) Rotor checking procedure.

(a) Check the rotor circuit for grounds. Connect a test lamp or an ohmmeter to each of the slip rings in turn and to the rotor shaft. Refer to fig. 5-2. If the lamp lights or the ohmmeter produces a low reading, it indicates that the rotor is grounded and the alternator must be replaced.

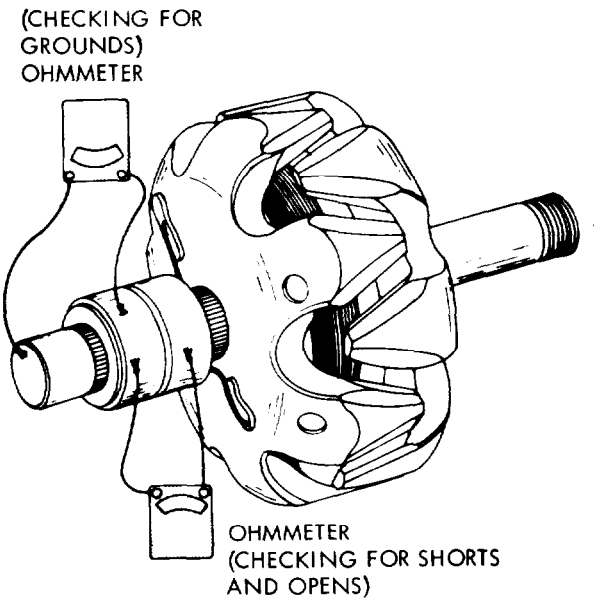


Figure 5-2. Checking rotor for grounds, shorts and opens.

(b) To check the rotor for an open field, connect a test tight or an ohmmeter to each of the slip rings. as shown in figure .5-2. If the lamp fails to light or the ohmmeter reading is high (infinite), the winding is open.

(c) Connect a voltmeter and battery in series with the slip rings. If the reading on the ammeter is above 2.9-2.3 amps. a shorted winding is indicated. The alternator must be replaced. Refer to figure 5-2.

(3) Stator checking procedure.

Note. When checking the statorwindings, remove the three stator lead attaching nuts and separate the stator assembly from the end frame.

(a) Check the stator for grounded windings, Connect the probes of a test tamp or an ohmmeter from each of the three stator leads in turn to the stator frame as shown in figure 5-3. If the test tamp lights or the meter reading is low, the stator is grounded. The alternator must be replaced if the ground cannot be located and repaired.

(b) Connect the test tamp or ohmmeter between the stator leads successively as illustrated in figure .5-3. If the lamp fails to light or the meter reading is high. the windings are open. If the open condition in stator cannot be remedied, the alternator must be replaced.

(c) Shorted windings in the stator are indicated if all other electrical checks are normal, but the alternator does not supply rated output. For alternator specifications refer to table 5-1.

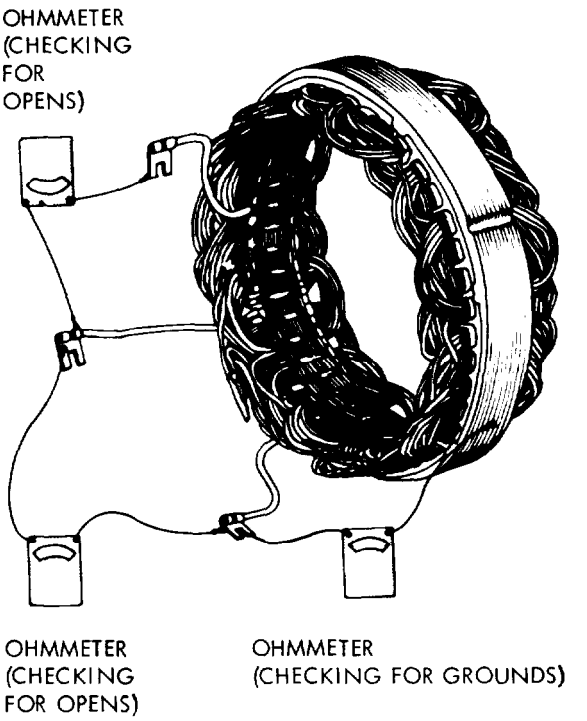


Figure 5-3. Checking stator windings.

(4) *Checking the diodes.*

Note. When checking the diode, disconnect the stator.

(a) Connect one ohmmeter lead or 12 volt test tamp lead to the heat sink frame and the other test lead to the diode lead (fig. 5-4). Note meter reading or condition of test lamp. Reverse the test leads and note new meter reading or condition of test tamp.

(b) A good diode will have a high reading in one direction and a low reading in the other direction. If the meter reading or the condition of the test lamp is similar in both readings, the diode is defective and must be replaced.

(c) Repeat the above outlined procedure for ail six diodes.

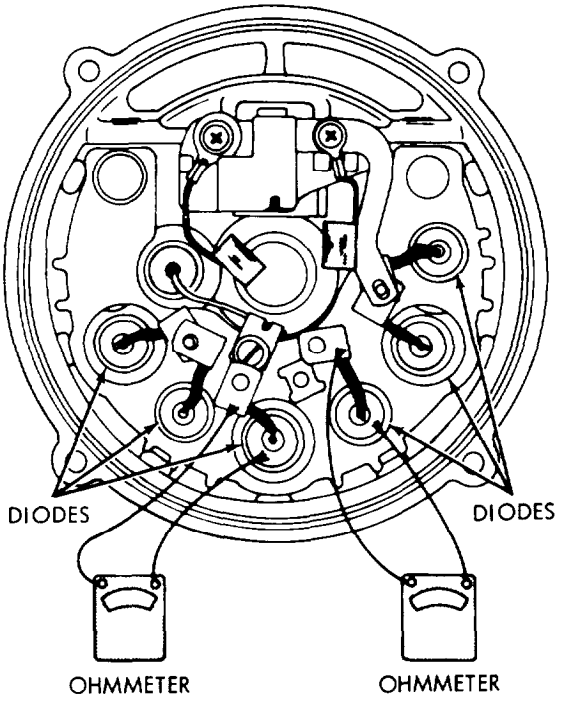


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Figure 5-4. Checking the diodes.

(5) Diode replacement.

(a) Support the end frame or heat sink in a suitable toot.

(b) Remove the old diode with an arbor press.

(c) Press in the new diode. Apply the pressure to the outer edge of the diode.

Caution: Do not try to hammer the new diodes into the heat sink or end frame. The shock will damage them.

(6) Slip ring service.

Note. To clean dirty slip rings, use a 400 grain or finer polishing cloth.

(a) Secure the rotor in a lathe.

(b) Hold polishing cloth against the slip rings white the rotor is rotating until they are clean.

Caution: **The rotor must be rotated so that the slip rings will be cleaned evenly. Trying to clean the slip rings by hand without spinning the rotor will cause flat spots on the slip rings, resulting in brush noise.**

(c) If the slip rings are rough or out of round, they must be trued to a maximum indicator reading of 0.002 in.

(d) Polish the trued slip rings with 400 grain or finer polishing cloth and blow away ail dust with compressed air.

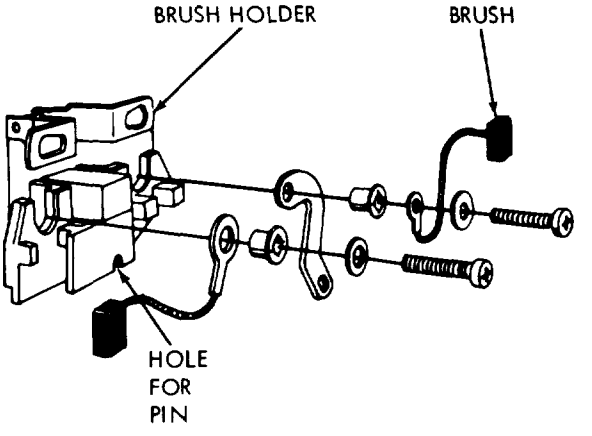
(7) *Bearing service.*

(a) Inspect the drive end bearing for excessive lash between the inner and outer races, scoring. and excessive wear. Replace if necessary.

(b) If the felt seal is worn or hardened, it should also be replaced.

(c) Check the grease supply in the slip ring end frame bearing. If it is exhausted, the bearing should be replaced.

(8) *Brush replacement.* (fig. 5-5.)



ME 3930-624-34/5-5

Figure 5-5. Alternator brush replacement.

(a) Remove the two brush holder screws.

(b) Remove the brush holder assembly from the end frame. Remove brushes and springs. The length of a new brush is ½ in. and should be replaced when they reach a length of 3/8 in. Check the spring tension of the brush springs. It should be between 8 and 12 ozs.

(c) Install new springs and brushes in the brush holder.

(d) Insert a piece of straight wire or a pin into the holes at the bottom of the brush holder to retain the brushes in their proper position.

(e) Install the brush holder assembly onto the end frame, noting carefully the proper alignment of parts.

Note. Be sure to allow the straight wire to protrude through the hole in the end frame.

d. Reassembly. (fig. 5-1.)

(1) Install the stator (15) in the drive end frame (14).

(2) Install the pulley assembly on the rotor and tighten the shaft nut to a torque of 50-60 ft. tbs.

(3) Before installing the slip ring end frame assembly (14) to the rotor (8), remove the tape from the bearing and shaft.

(4) Install the remaining parts in the reverse order of disassembly.

(5) When the alternator is assembled, withdraw the brush retaining wire through the hole in the end frame. This will allow the brushes to contact the slip rings.

e. Installation. For the installation of the alternator refer to TM 10-3930-624-12.

5-3. Starting Motor

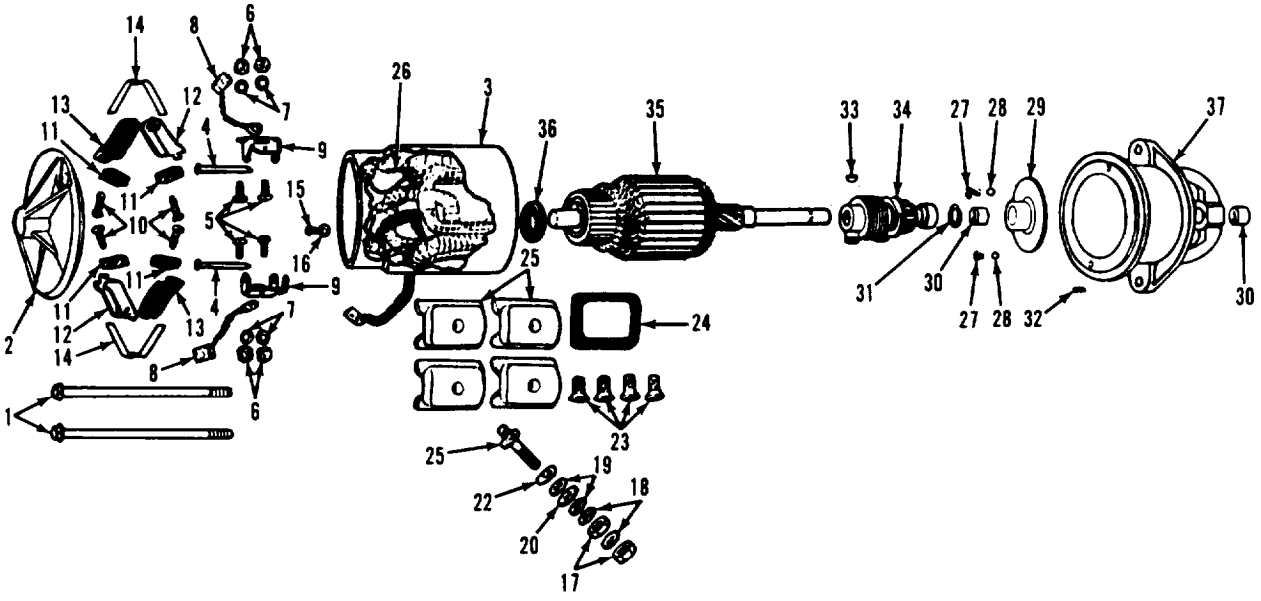
a. Removal. Refer to TM 10-3930-624-12 for the removal procedure of the starter motor.

b. Disassembly.

(1) Secure the starter motor in a bench vise at the drive end of the unit. Be careful not to damage the drive end housing.

(2) Remove the two thru-bolts (1, fig. 5-6) and slide the commutator end frame (2) and the field frame (3) from the armature (35).

(3) Remove the commutator end frame (2) from the field frame (3). Remove the pin (4), the capscrew (5), nut (6), washer (7) and lead (8) from the lead support (9).



1. Thru bolt
2. Find frame (commutator)
3. Field frame
4. Pin
5. Capscrew
6. Nut
7. Washer
8. Lead
9. Lead support
10. Capscrew
11. Brush
12. Brush holder
13. Brush holder
14. Brush spring
15. Capscrew
16. Washer
17. Nut
18. Washer
19. Washer
20. Washer
21. Grommet
22. Stud
23. Capscrew
24. Insulator
25. Pole shoe
26. Field coil
27. Capscrew
28. Washer
29. Plate
30. Bushing
31. Thrust washer
32. Pin
33. Key
34. Drive mechanism
35. Armature
36. Spacer
37. End frame (drive housing)

Figure 5-6. Starting motor, exploded view.

(4) Remove the capscrews (10), brushes (11), brush holders (12 and 13). and brush spring (14).

(5) Remove the capscrews (15) and washers (10) from the field coil (26). Do not remove the field coils. If tests indicate that the coils are defective, replace the starter motor.

(6) Remove the nuts (17), washers (18, 19 and 20), and grommet (21) which secure the terminal stud (22). Remove the stud.

(7) Remove the capscrews (23), insulators (24). and shoe poles (25) from inside the field frame (3).

(8) Remove the capscrew (27). washer (28), and center bearing plate (29) from the drive end housing (37). Remove the bushing (30).

(9) Remove pin (32) and key (33). Use a puller or press the drive mechanism (34) from the armature (35).

(10) Remove the spacer (36) from the armature (35) .

c. Cleaning, Inspection and Repair.

(1) Clean the starter motor parts with suitable solvent, but do not use cleaning solvents on the drive mechanism, armature and field coils. Dry the parts thoroughly with compressed air.

(2) Check the bushings for roughness, scoring, or , excessive clearance. The bushing running clearances are as follows: commutator end frame 0.0090-0.00 13 in., center bushing and drive housing bushing 0.0015-0.0050 in.

(3) Check the brush holders to be sure that they will properly hold the brushes against the commutator. Check the spring for a tension of 35 ounces. Check the condition of the brushes; if pitted or worn to less than 1/2 their original length, replace. Compare old brushes with a new one to determine extent of wear.

(4) Carefully inspect the armature commutator. If it is burned. rough, or out-of-round, turn down and undercut the mica as follows:

(a) Place the armature in a lathe and turn down the commutator until true. Make sure that the cut is not made on the commutator riser bars. Do not cut closer than 3/16 in. from the riser bars. The solder would be removed, thus weakening the coil connections.

(b) Undercut the mica between the bars to a depth not exceeding 0.030 in. The undercut must be the full width of the mica separation and flat at the bottom. After the undercutting, the slots should be cleaned out to remove any dirt or copper dust.

(c) The commutator should be sanded lightly with No. 00 sandpaper to remove any burrs left from undercutting.

(5) Check the starter motor as follows:

(a) Check the armature for shorts by placing it on a growler.

(b) Test the armature for grounds by placing one probe of a test lamp on the armature shaft and place the other probe on each commutator bar in turn. If the test lamp lights, the armature is grounded and the starter motor must be replaced.

(c) Using a test lamp, place the probes on each of the field leads of the starter motor. If the lamp does not light, the coils are open and must be replaced.

(d) Place one probe of the test lamp on the field frame and the other probe on a field coil lead. If the test lamp lights, the starter motor terminal or one of the field coils forming a pair are grounded. If the ground cannot be located or repaired, replace the starter.

(e) Using the test lamp, place one of the probes on each of the brush holders in turn and the other probe on the commutator end frame. If the lamp lights, the brush holder is grounded due to defective insulation. Replace the insulation and recheck.

d. Reassembly. Reassemble in reverse order of disassembly observing the following :

(1) Apply a thin coating of grease before pressing on the drive mechanism (34, fig. 5-6).

Note. If the drive mechanism is rotated to the full extended lock position on the screw shaft during replacement or overhaul of starter motor. do not attempt to force it in the reverse direction. Install the drive even though it is fully extended. After the motor is installed on the engine and the engine starts, centrifugal force will unmesh the drive pinion from the flywheel ring gear in the usual manner.

(2) Place a few drops of oil on the bushings (30) before installing.

e. Installation. Refer to TM 10-3930-624-12 for the installation instructions for the starting motor.

Section II. REPAIR OF HYDRAULIC COMPONENTS

5-4. General

The hydraulic system supplies fluid to operate the lift, tilt, and steering system. The hydraulic system consists basically of an oil reservoir, hydraulic pump, control valve, tilt cylinders, and primary and secondary lift cylinders.

5.5. Hydraulic Pump

a. Removal.

(1) Remove the radiator grille TM 10-3930-624-12).

(2) Disconnect the hoses from the pump. Refer to figure 5-7. Tag the lines and cap or plug openings.

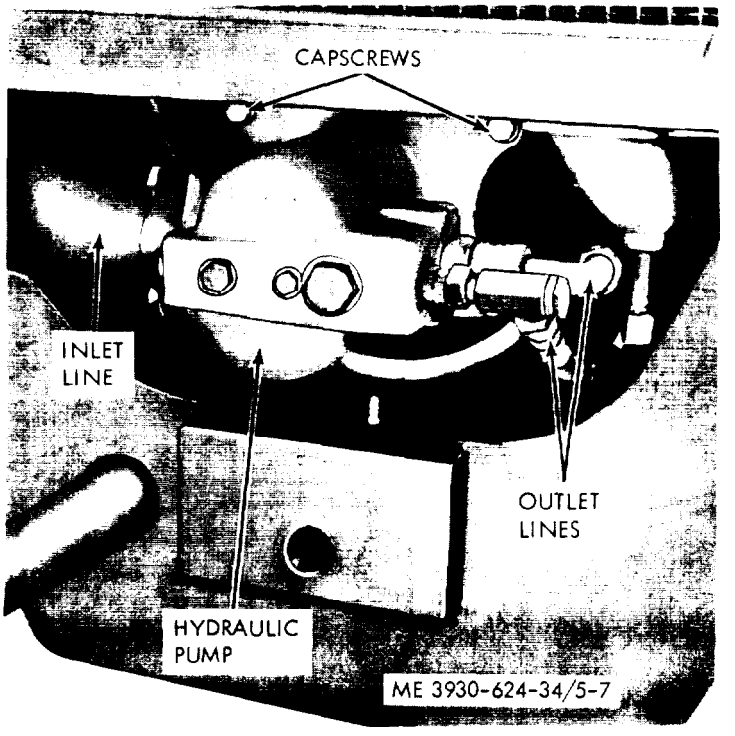


Figure 5-7. Hydraulic pump lines.

Table 5-1. Alternator Specifications

Rotation viewing D.E	Field current (80° F)			Cold output at specified voltage					Rated hot output lamps)
	Grd	Amps	Volts	Spec. volts	Amps	Approx rpm	Amps	Approx rpm	
CW	Neg	1.9-2.3	12	14.0	12	1100	42	6500	42

(3) Remove the capscrews and lockwashers attaching the pump flange to the engine and remove the pump.

b. Disassembly. (fig. 5-8.)

(1) Thoroughly clean the outside of the pump to prevent the entry of foreign material upon disassembly.

(2) Remove the countersunk hexagon head capscrews (1) and mounting flange (2). Set pump aside, keeping drive shaft pointed up. Using a soft metal drift, tap the seals from the bore. Take care not to mar the surface of the bore.

(3) Remove the preformed packings (4 and 6) and backup rings (5).

(4) Invert the pump while holding one hand over the front bushings (7). Let the bushings slide out. Tap the pump body lightly with a piece of wood or a soft mallet if the bushings stick.

(5) Remove the drive shaft (9) and the idler gear (10).

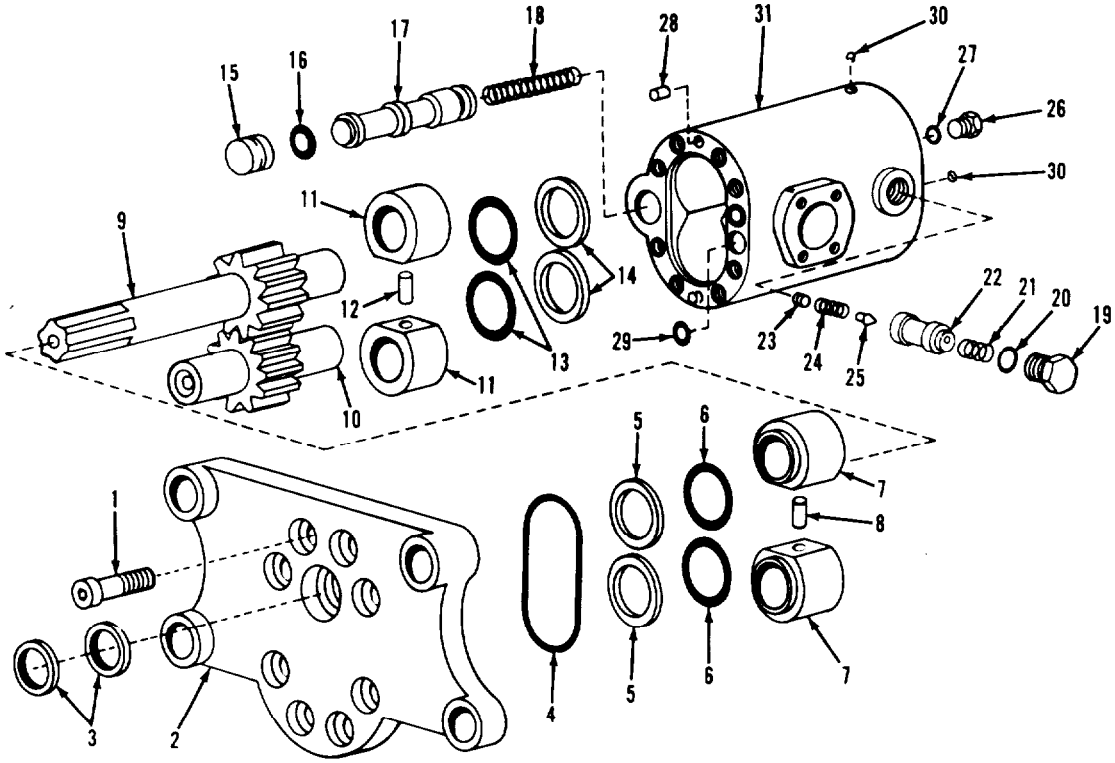
(6) Remove the rear bushings (11) and packing rings (13 and 14).

(7) If the valve plug (15) has not been expelled by the spring, turn a 1/4 in. screw into it and extract it. Remove the preformed packing (16), spool (17), and spring (18).

(8) Remove the relief valve port plug (19), preformed packing (20), and spool assembly (22 through 25).

(9) Taking note of the number of turns required, remove the setscrew (23), the spring (24), and cone (25) from the spool (22).

(10) Remove remaining plugs (26 and 30), dowel (28), and preformed packings (27 and 29) from pump body (31).



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1. Countersunk capscrew
2. Mounting flange
3. Seals
4. Preformed packing
5. Backup rings
6. Preformed packing
7. Front bushings
8. Dowel
9. Drive shaft (gear)
10. Idler gear
11. Rear bushings
12. Dowel
13. Preformed packing
14. Backup ring
15. Plug
16. Preformed packing
17. Spool
18. Spring
19. Plug
20. Preformed packing
21. Spring
22. Spool
23. Setscrew
24. Spring
25. Cone
26. Plug
27. Preformed packing
28. Dowel
29. Preformed parking
30. Plug
31. Plump body

Figure 5-8. Hydraulic pump, exploded view.

c. Cleaning, Inspection and Repair.

(1) Clean all parts with a solvent and dry with compressed air. Flush the hydraulic system before reinstalling the pump.

(2) Check the bushing bores near the front of the housing. using a 2 in. inside micrometer. If the bores measure over 1.770 in.. discard the pump body. This indicates the pump has been subjected to excessive pressures. Check the system to determine the cause.

(3) Measure the depth of the grooves cut by the gears. If deeper than 0.005 in., a reduced flow of hydraulic oil results. The gear track should have a smooth texture radially and should be a darker color than the rest of the body. If it has a sand-paper-like texture, and a light gray, or silvery color (when dry), the oil is probably dirty or foamy. Check the suction line for leaks. If the pump body is to be reused, hone the face flat with a fine stone and clean thoroughly.

(4) Inspect the shaft seals in the end plate. If they are not damaged or have not been leaking they can be reused. Place a straight-edge across the machined surface that faces the pump body. If the flange is bowed. replace.

(5) Looking at the plate from the pump side, measure the top left and lower right mounting holes. If the holes are larger than 0.441 in. diameter. replace the flange. This indicates the pump has been running with the mounting bolts

loose. If the flange is to be reused, hone in the same manner as the body fare.

(6) Handle the pump gears carefully when inspecting. The pump must be replaced if following measurements are less than that specified. The journal diameter is 0.872 in.. the length of the gear is 1.319 in., and the gear OD is 1.754 in. Check the gear teeth ends and remove any burrs with a small, fine hone. If the journal surfaces are blackened and can be scratched with a penknife, they have lost their casehardening and the pump must be replaced.

(7) Handle bushings carefully. The bore of the bushing. which will be worn slightly oval, must not measure over 0.882 in. at the largest reading. The length of the bushing must not measure under 1.055 in. Remove minor cuts or scratches by honing in a circular motion with an extra fine stone. Be sure the sharp edge between the face of the bushing and the OD is not broken. Erosion on the face of the bushing near the rectangular land and in the lube oil slot indicates air in the system. Check for air leaks on the suction side of the pump.

(8) Check the diameter of the valve spool lands (22, fig. 5-8) and replace the spool if the diameter is less than 0.748 in. at any point. Check the balance and flow orifices and clear with a fine wire if necessary.

(9) Check the valve spool spring (21) to see that it is not bent or deformed. Replace the spring if the length is less than 3 1/2 in.

(10) Inspect the cone (25) for wear and erosion and replace if damaged.

(11) Inspect the cone valve spring (24). Replace if bent or deformed.

d. Reassembly. (fig. 5-8.)

(1) Place the pump face up and install the two body dowels (28). tapping them in place with a plastic hammer. Coat the body bores with light oil.

(2) Place the bushings (11), preformed packing (13), and backup ring (14) on the shoulder at the rear of the pump. Hold in place with grease, if necessary. Place the bushing dowel (12) in the holes in the flat side of the bushings.

Caution **: Do not tap or force the bushings into the bores. They should drop to the bottom by their own weight.**

(3) Holding the bushings together, carefully align them and slide them, with the packing side down. into the bores. Coat the faces and bores of the bushing with light oil. Be sure the bushings bottom in the housing and the backup rings do not fall off.

(4) Turn the pump body so that the priority valve (15 through 18) is to the left. Place the drive gear (9) in the top bore and the idler gear (10) in the lower bore. Coat the journals and the gear faces with a light coat of oil.

(5) Place the bushing dowel (8) between the two front bushings. Hold the bushings together, and insert them face down into the pump bores. Do not force the bushings into position. They will slide in smoothly if properly aligned. Place the preformed packing (6) and backup rings (5) on the bushing shoulders.

Place the two preformed packings (29) in the two small recesses in the face of the body on the inlet side of the pump and place the body preformed packing (4) in its recess around the bushings.

(7) Place the priority valve spring (18) in the valve spool (17), coat the spool with nil, and install it spring first, into the valve bore.

(8) Install the preformed packing (16) on the valve plug (15), coat with oil and insert the plug into the valve bore with the threaded hole outward. Push in until it is flush with the face of the body.

(9) To replace the seals (3) in the mounting flange (2), first press in the nil seal with the lip pointed in, then press in the oil seal with the lip pointed out. Install the mounting flange (2) on the pump, taking care not to damage the seals on the shaft. Before sliding the end plate all the way down, check to see that all seals and backup rings are still in place.

(10) Tighten the countersunk capscrews (1) to secure the flange to the pump body. To insure proper gear meshing, rotate the drive shaft using a maximum torque of eight ft. lbs.

(11) Install the cone (25) and spring (24) into the spool (22). Secure the parts in position with one setscrew (23). Turn the setscrew in the same number of turns required for removal. Lock in place with the remaining setscrew (23).

(12) Install the spool assembly in the relief port of the pump. Place the preformed packing (20) on the plug (19). Install the relief valve spring (18) and plug (19).

e. Installation.

Caution: **Do not force the pump into position. This will damage the bushing faces and result in poor operation and short pump life.**

(1) Install the pump carefully, sliding the pump shaft into the engine coupling. If it binds, remove the pump and inspect the coupling and the shaft for burrs or other damage.

(2) When the pump is in place, install the two close-fitting capscrews which help align the pump with the engine. Install the remaining capscrews and tighten.

(3) Install the pump inlet line and tighten just enough so the backup washer is flat against the side of the pump. Do not over-tighen as this will damage the pump housing threads.

(4) Install the pump outlet lines and tighten.

(5) Install the radiator grille (TM 10-3930-624-12).

(6) Check the oil reservoir to be sure the oil level is correct. Run the pump for one minute with no load to allow the system to fill. Check the inlet and outlet ports for leaks. Tighten the connections to eliminate any leaks. If the pump is cavitating, tighten the inlet line at the pump. After one minute of running, shut down the engine and recheck the oil level in the reservoir. If it is low, fill to the proper level. If severe foaming is noted, check for a leak in the inlet line or for improper oil. Refer to the current LO 10-3930-624-12 for the proper oil.

5-6. Control Valve

a. Removal.

Note. Before removing the valve make sure that the lift cylinders are collapsed. Tilt the mast backward and forward to relieve the pressure in the control valve.

(1) Disconnect the control linkages at the valve spool connections as shown in figure 5-9.

(2) Tag and disconnect all hydraulic lines to the control valve. Cap or plug openings.

(3) Remove the mounting hardware and the control valve.

b. Disassembly.

(1) Clean the exterior of the control valve and dry with compressed air. Clamp the valve in a vise. Be careful not to damage the housing.

(2) Remove the cap nut (1, fig. 5-10), washer (2). locknut (3). washer (4), plug (5) and plug (6). Remove the preformed packing (7) from the plug.

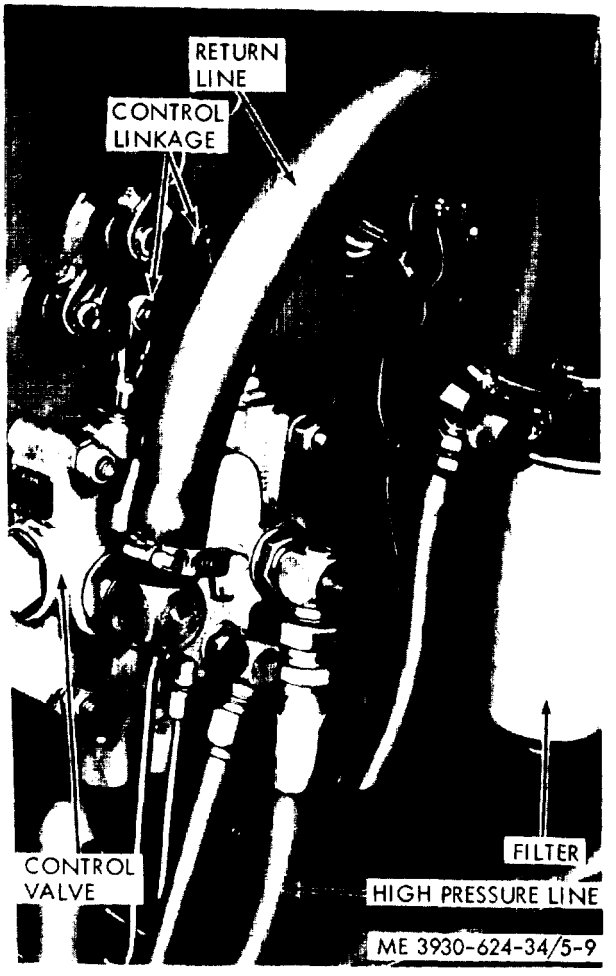
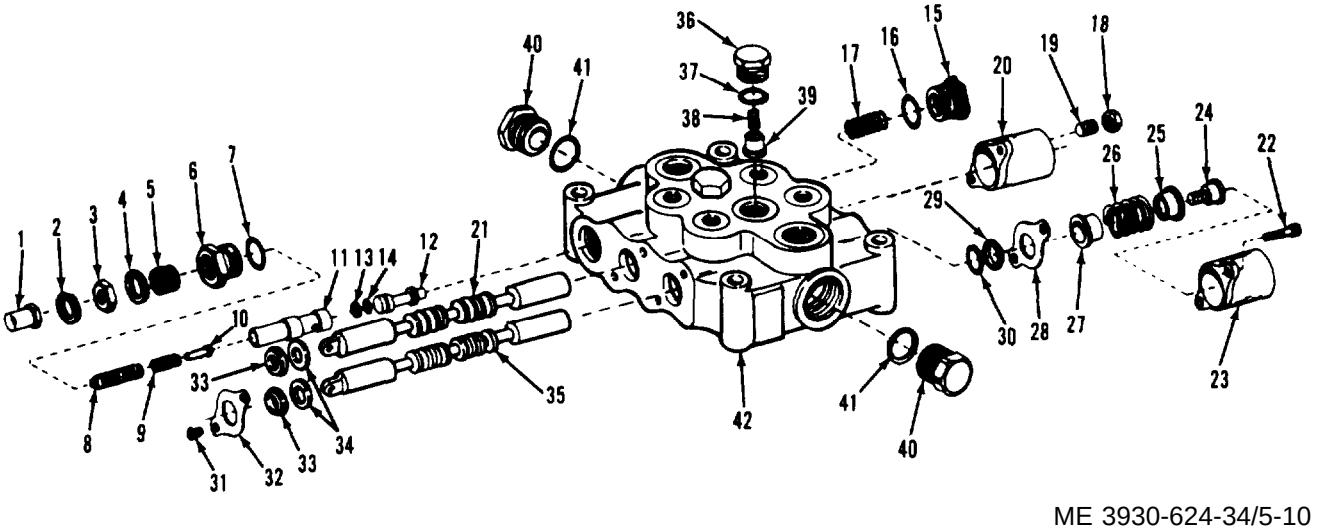


Figure 5-9. Control valve.



ME 3930-624-34/5-10

Figure 5-10. Control valve, exploded view.

KEY to fig 5-10:

1. Nut
2. Washer
3. Locknut
4. Washer
5. Plug
6. Plug
7. Preformed packing
8. Adjusting screw
9. Spring
10. Guide
11. Sleeve
12. Poppet
13. Backup ring
14. Preformed parking
15. Plug
16. Preformed packing
17. Spring
18. Nut
19. Stud
20. Cap
21. Plunger
22. Screw
23. Cap
24. Capscrew
25. Seat
26. Spring
27. Seat
28. Plate
29. Seat
30. Ring
31. Capscrew
32. Plate
33. Seat
34. Ring
35. Plunger
36. Plug
37. Preformed packing
38. Spring
39. Poppet
40. Plug
41. Preformed packing
42. Housing

(3) Remove the sleeve assembly (8 through (1) from the valve housing. Remove the adjusting screw (8), spring (9) and guide (10) from the sleeve (11). Remove the poppet (12), backup ring (13) and preformed packing (14).

(4) Remove the plug (15), preformed packing (16) and spring (17).

(5) Remove the nut (18), stud (19) and cap (20). Remove the lift plunger (21).

(6) Remove the screws (22), cap (23), capscrew (24), spring seat (25), spring (26), spring seat (27), plate (28), seat (29) and ring (30). Remove the capscrews (31), plate (32), seat (33), ring (34) and tilt plunger (35).

(7) Remove the check valve plug (36), preformed packing (37), spring (38) and poppet (39).

(8) Remove the plugs (40) and preformed packings (41) from the valve housing (42).

c. Cleaning and Inspection.

(1) Clean all parts with cleaning solvent and dry thoroughly.

(2) Inspect the springs for cracks, wear, deformation or signs of weakness.

(3) Discard all seals.

(4) Inspect all machined surfaces for cracks, nicks, scratches, gouges or other damage which could cause internal or external leakage.

(5) Inspect all housings for cracks, stripped threads or other damage which could affect operation.

(6) Inspect the plungers and plunger bores for scoring, chips, nicks, cracks or other damage which could result in internal or external leaks.

(7) Replace all seals and any defective parts.

d. Reassembly. (fig. 5-10.)

(1) Place a new backup ring (13) and preformed packing (14) on the poppet (12). Place into lower end of sleeve (11).

(2) Place poppet (12), spring (9) and guide (10) in the upper end of the sleeve (11).

(3) Install the spring (17) in the valve housing (42), install a new preformed packing (16) on the plug (15), and screw the plug into the valve body.

(4) Install the sleeve (11) and adjusting screw (8), add a new preformed packing (7) on the relief plug (5). Turn the plug until it is seated and sealed. Tighten the lower plug (6).

(5) Install the locknut (3) and washer (4), add the cap nut (1) and washer (2).

(6) Place new seals (29) and rings (34) into the valve housing (42). Install the plungers (2) and 35) into the proper bores.

(7) Install the seal plates (32) and screws (31).

(8) Install the seal plates (28), seats (27), and springs (26) and reinstall the special capscrew (24).

(9) Install the caps (20 and 23) and screws (22).

(10) Place new preformed packing (37) on plug (36).

(11) Install poppet (39), spring (38) and plug (36) into the valve body (42). Make sure that the plug is tight.

(12) Place new preformed packings (41) on plugs (40) and install into the valve body.

e. Installation.

(1) Install the control valve on the truck with the mounting hardware.

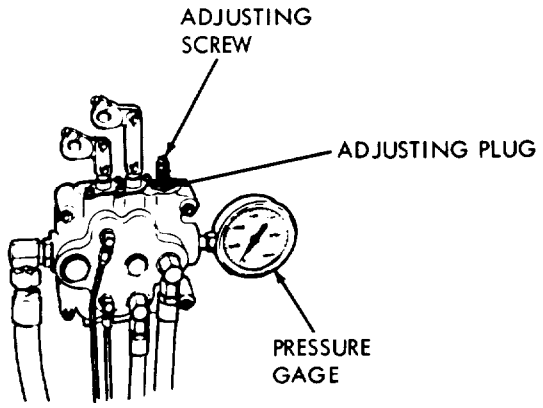
(2) Reconnect the control linkages to the control valve plungers. (fig. 5-9.) Connect hydraulic lines.

f. Relief Valve Adjustment.

(1) Remove cap nut (1, fig. 5-10), washer (2) and locknut (3) from the relief valve.

(2) Using a screwdriver, turn down the pilot poppet adjusting screw (8) until it is snug against the pilot poppet.

(3) Remove the plug from the front end of the valve body adjacent to the high pressure inlet port. Connect an oil pressure gage to the port as shown in figure 5-11. The gage should be calibrated to approximately 3000 psi.



ME 3500-624-34/5-11

Figure 5-11. Adjusting relief valves.

(4) Start the engine and run at 600 rpm.

(5) Remove the washer from the body nut. Place a nut driver over the poppet adjusting screw and engage the slots in the adjusting plug as shown in figure 5-11.

(6) Run the tilt cylinder to the end of its stroke and hold it in this position long enough for pressure to show on the gage. Turn the adjusting plug in or nut until a pressure reading of 150 to 250 psi above the required relief valve setting of 1950 psi is reached.

(7) Taking care not to disturb the position of the adjusting plug, loosen the pilot valve adjusting screw several turns (fig. 5-11).

(8) Install the larger of the two washers and the locknut. Do not tighten the locknut.

(9) With a screwdriver in the slot of the adjusting screw, accelerate the engine to a high rpm and actuate the tilt cylinder to the end of its stroke. Turn the adjusting screw in or out until a pressure reading of 1950 psi ± 50 psi is obtained on the gage.

(10) While holding the adjusting screw in position. install and tighten the locknut. Install the second washer and cap nut.

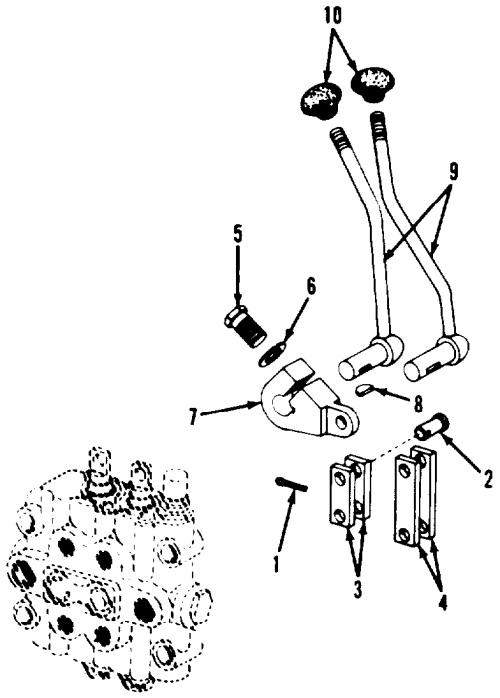
5-7. Control Levers and Linkage

a. Removal. (fig. 5-12.)

(1) Remove four capscrews, washers, and nuts securing the cowl to the truck frame. Remove the cowl to obtain access to the control valve and linkage.

(2) Remove cotter pin (1) and pin (2) securing links (3 and 4) and remove the links.

(3) Remove capscrew (5) and washer (6). Remove lever (7) which is keyed to the control handles (9). and remove the control handles.



ME 3930-624-34/5-12

1. Cotter pin
2. Pin
3. Link
4. Link
5. Capscrew
6. Washer
7. Lever
8. Key
9. Handle
10. Knob

Figure 5-12. Control levers.

b. Cleaning and Inspection.

(1) Clean all metallic parts in cleaning solvent.

(2) Inspect all parts for cracks, distortion and excessive wear. Replace as necessary.

c. Installation. (fig. 5-12.)

(1) Slide control handles (9) through truck frame. Install key (8) in keyway on control handle shaft.

(2) Install control lever (7). washer (6) and capscrew (5) on control handle shaft. Tighten capscrew securely.

(3) Install links (3 and 4) to the plungers of valve and to control lever (7). Secure links with pin (2) and cotter pin (1).

5-8. Tilt Cylinder

a. Removal.

(1) Place the mast in forward position. Hold the mast in position with a chain hoist.

(2) Remove the cotter key and pin from the tilt cylinder.

(3) Remove the toe plate and floor plate (TM 10-3930-624-12).

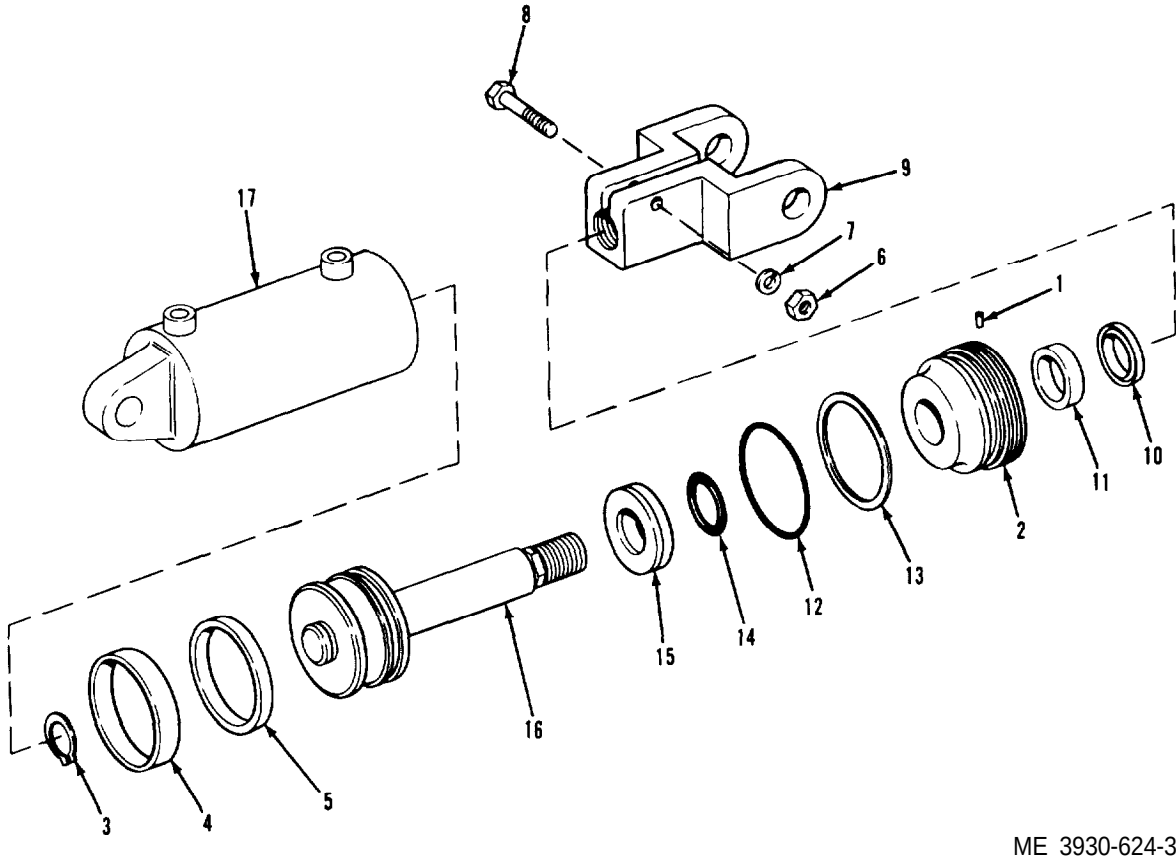
(4) Disconnect hydraulic lines at the tilt cylinder. Cap or plug openings.

(5) Remove the capscrew and pin retainer from the tilt cylinder mounting bracket in the frame. Insert a drift into the tilt cylinder mounting pin and remove the pin. Remove the tilt cylinder.

b. Disassembly. (fig. 5-13.)

(1) Place the tilt cylinder in a vise. Extend the rod to its fully extended position.

(2) Remove the pin (1) from the packing gland (2). Using a spanner wrench, unscrew the gland from the cylinder tube (17). Remove the rod and yoke assembly from the tube.



ME 3930-624-34/5-13

1. Pin
2. Gland
3. Lock ring
4. Bearing
5. Tee ring
6. Nut
7. Lockwasher
8. Capscrew
9. Yoke
10. Wiper ring
11. Packing
12. Preformed packing
13. Backup ring
14. Preformed parking
15. Spacer
16. Hod
17. Cylinder tube

Figure 5-13. Tilt cylinder, exploded view.

(3) Secure the yoke (9) in a vise. Remove the hearing (4) and tee ring (5).

(4) Remove the nut (6). lockwasher (7) and capscrew (8), and remove the yoke (9) from the rod.

(5) Remove the packing gland (2) from the rod (16). Remove the wiper ring (10), packing (11), preformed packing (12) and backup ring (13) from the gland.

(6) Remove the preformed packing (14) and spacer (13) from the rod (16).

c. Cleaning, Inspection and Repair.

(1) Clean all parts with a cleaning solvent. Thoroughly flush the inside of the cylinder tube.

(2) Inspect the cylinder tube for dents, cracks, and other damage. Inspect the cylinder for score marks or nicks. Hone the cylinder tube to remove slight score marks. If the cylinder tube is badly scored the cylinder assembly must be replaced.

(3) Inspect the piston packing and rod assembly for nicks, scratches, burrs, wear, and other damage. Inspect the piston groove for rough

spots. Remove any rough spots in the grooves. Repair or replace the piston and rod assembly as necessary.

(4) Inspect all metal surfaces where packings or seals are located. If the surfaces are scored or nicked, replace the parts or resurface them.

d. Reassembly. (fig. 5-13.)

(1) Install all new seals and packings in the cylinder. Soak the packings in hydraulic oil before installing.

Caution: **Do not use sharp tools or instruments when installing packings. When installing seal rings, do not stretch them more than absolutely necessary.**

(2) Install the packing (11) and wiper ring (10) into the packing gland (2).

(3) Install the backup ring (13), performed packing (12), spacer (15), and preformed packing (14).

(4) Install the tee ring (5) and bearing (4) on the piston.

(5) Install the packing gland (2) on the rod (10). Screw the yoke (9) on the rod and secure in place with the capscrew (8), lockwasher (7). and nut (6).

(6) Lightly lubricate the piston seals with hydraulic fluid and install the rod and yoke assembly into the cylinder tube.

(7) Tighten the packing gland with a spanner wrench and reinstall the pin (1).

e. Installation. Install the tilt cylinder in the reverse order of removal. Start the engine and operate the mast through several complete cycles and check for hydraulic leaks. Make sure the tilt cylinders bottom simultaneously.

5-9. Primary Lift Cylinder

a. Removal.

(1) Lower the fork carriage and remove the carriage backrest (para 6-3).

(2) Free the cylinder end of its lift chains (TM 10-3930-624-12).

(3) Remove the bleed screw (1. fig. 5-14) from the outer cylinder and insert a high pressure air hose. With the lift control lever held in the DOWN position, blow the oil out of the cylinder back into the reservoir.

(4) Disconnect the high pressure hose.

(5) Disconnect hydraulic lines to the cylinder. Cap or plug openings.

(6) Remove the mounting hardware securing the cylinder to the mast assembly.

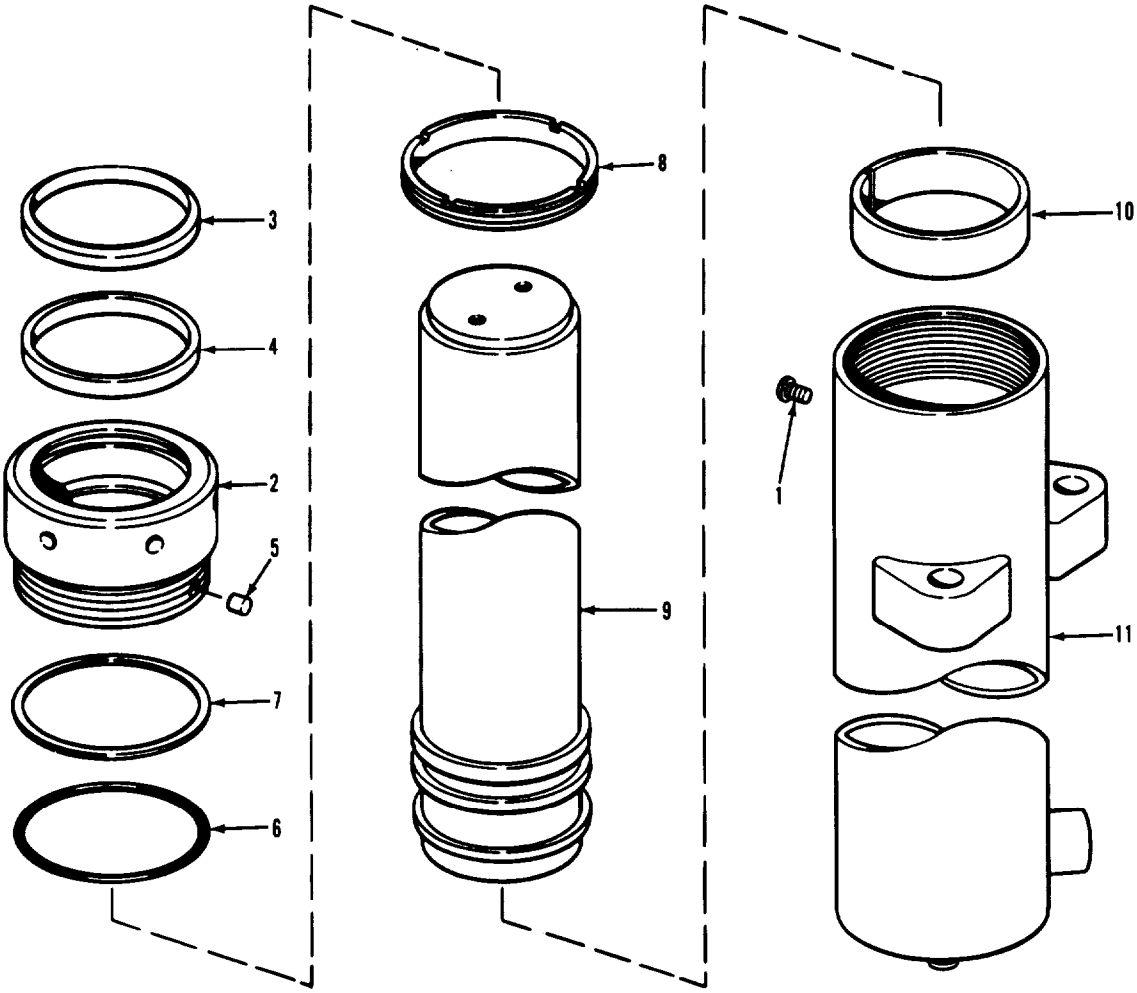
Caution: **Be careful not to damage the cylinder assembly when removing it from the mast assembly.**

(7) Attach a chain securely around the outer case of the cylinder assembly below the chain bolt flanges and remove the cylinder assembly.

b. Disassembly.

(1) Place the cylinder assembly in a bench vise and drain any remaining oil.

(2) Remove the gland (2, fig. 5-14) from the cylinder tube. Remove the wiper ring (3). packing (4), preformed packing (6) and ring (7) from the gland.



ME 3930-624-34/5-14

1. Bleed screw
2. Gland
3. Wiper ring
4. Packing
5. Pin
6. Preformed packing
7. Ring
8. Nut
9. Rod
10. Split ring
11. Tube

Figure 5-14. Primary lift cylinder, exploded view.

(3) Remove the gland nut (8). Remove the rod (9) and split ring (10) from the cylinder tube (11).

c. Cleaning, Inspection and Repair.

(1) Clean all metallic parts with cleaning solvent.

(2) Discard all packings and the wiper ring packings.

(3) Inspect the rod, packing gland, split ring and cylinder tube for cracks, nicks, scores, dents, wear on the sliding surfaces, stripped threads and other damage which may cause internal or external leakage.

(4) Replace all defective parts.

d. Reassembly. (fig. 5-14.)

(1) Place outer cylinder case in a vise. Be careful not to tighten excessively, as this will deform the cylinder case.

(2) Install the split ring (10) on the lower end of the rod (9).

(3) Carefully install the rod (9) into the cylinder tube (11).

(4) Install the gland nut (8).

(5) Place the backup ring (7) and a new preformed packing (6) on the gland (2).

(6) Install the wiper ring (3) and the packing (4) in the gland (2). Install the pin (5).

(7) Install the gland assembly into the cylinder tube (11).

e. Installation.

(1) Attach a chain securely around the cylinder assembly. Install the cylinder in the mast assembly.

(2) Secure the cylinder assembly to the mast with its mounting hardware.

(3) Attach lift chains to the cylinder end (TM 10-3930-624-12).

(4) Install the carriage backrest (para 6-3).

(5) Reconnect all hydraulic lines to the cylinder.

(1) When the cylinder assembly has been installed, run the lift to the extreme upper limit. then open the bleeder screw (1, fig. 5-14) one or two turns. Allow the trapped air and foamy oil to run out. When a clear stream of oil appears, tighten the bleeder screw.

5-10. Secondary Lift Cylinder

a. Removal.

(1) Remove the primary lift cylinder (para 5-9).

(2) Remove the bleed screw (1, fig. 5-15). Insert a high pressure air hose into bleeder screw hole. With the lift control lever held in the DOWN position, blow the oil out of the cylinder back into the reservoir.

(3) Disconnect the high pressure hose.

(4) Disconnect hydraulic lines to the cylinder. Cap or plug openings.

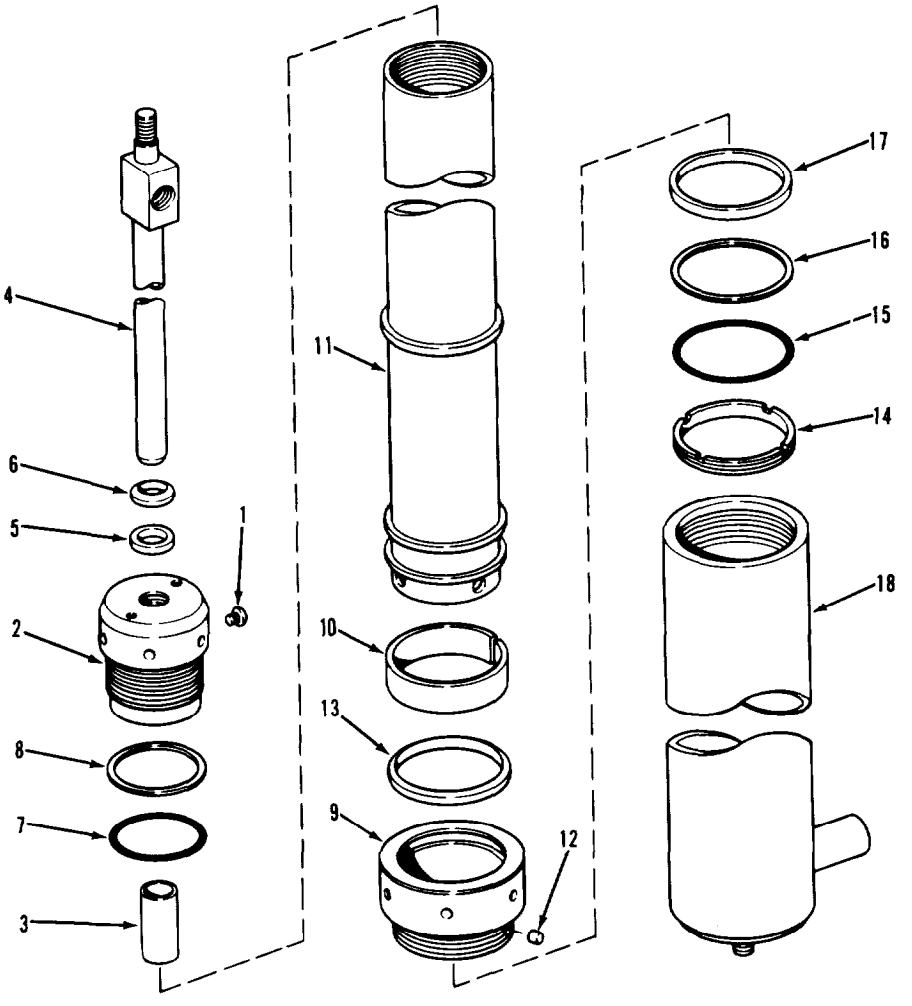
(5) Remove the mounting hardware securing the upper and lower ends of the cylinder to the mast assembly.

(6) Use a chain hoist to lift the intermediate mast assembly approximately six inches, and block in place.

(7) Carefully remove the cylinder assembly.

b. Disassembly. (fig. 5-15).

(1) Place the cylinder in a vise. Remove the end head (2). Remove the bearing (3) and the ram (4) from the end head. Remove the seal (5) and wiper ring (6) from the ram. Remove the preformed packing (7) and ring (8) from the end head.



ME 3930-624-34/5-15

1. Bleed screw
2. End head
3. Hearing
4. Ram
5. Seal
6. Wiper ring
7. Preformed parking
8. Ring
9. Gland
10. Split ring
11. Rod
12. Pin
13. Ring
14. Gland nut
15. Preformed packing
16. Ring
17. Packing
18. Cylinder tube

Figure 5-15. Secondary lift cylinder, exploded view.

(2) Unscrew the gland (9) and remove the gland and rod (11) as an assembly from the cylinder tube (18). Remove the split ring (10) and remove the gland from the rod (11). Remove. the pin (12) and ring (13) from the gland.

(3) Remove the gland nut (14), preformed parking (15). ring (16) and packing (17).

c. Cleaning. Inspection and Repair.

(1) Clean all metallic parts with solvent.

(2) Inspect the ram, rod. cylinder tube, gland nut, gland, split ring and bearing for cracks, nicks, scores, dents, excessive wear on sliding surfaces, stripped threads or other damage.

(3) Replace damaged parts as necessary.

d. Reassembly. (fig. 5-15.)

Caution: Be certain that all parts are clean and that there is no foreign matter in the cylinder case.

(1) Place the outer cylinder tube in a bench vise, be careful not to apply excessive pressure which might deform the cylinder tube.

(2) Install the gland nut (14) in the cylinder tube. Tighten securely.

(3) Install the preformed packing (15) and backup ring (16) on the outside of the gland (9).

(4) Install the bearing (3) and the wiper ring (6) in the gland (9).

(5) Carefully place the rod (11) into the cylinder tube (18).

(16) Install the gland (9) into the cylinder tube (18). Be careful not to tighten too tight, as leakage will result.

(7) Place the backup ring (8) and the preformed packing (7) on the outside of the end head (2). Slide the ram (4) through the gland (2).

(8) Place the seal (5), wiper ring (6) and the bearing (3) on the ram (4).

(9) Secure the end head (2) into the rod (11) and tighten snugly. Do not over-tighten as this will result in leakage.

e. Installation.

(1) Place the cylinder assembly into the mast assembly.

(2) Use a chain hoist on the intermediate mast assembly to remove the block. Lower the mast into place on the lift cylinder assembly.

(3) Secure the cylinder assembly to the mast assembly.

(4) Connect the high pressure hose and leakage return line to the cylinder assembly.

(5) Install the primary cylinder assembly (para 5-9).

(6) When both cylinders have been installed, run the lift assembly to the extreme upper limit. Open the bleeder screws (1, fig. 5-14 and 1, fig. 5-15) one or two turns. Allow the trapped air and foamy oil to run out. When a clear stream of oil appears, tighten the bleed screws.

CHAPTER 6

REPAIR OF THE BODY

Section I. REPAIR OF THE LIFT STRUCTURES

6-1. General

The lift structure of the vehicle consists of a mast assembly, carriage and backrest assembly, and forks. The hydraulic lift mast consists of an inner mast, an intermediate mast, and an outer mast. The intermediate and inner masts ride on adjustable roller bearings, enabling them to telescope up and down smoothly and with a minimum of drag. The carriage assembly is a welded structure having horizontal upper and lower fork support bars and a pair of vertical carriage support bars.

6-2. Mast Assembly

a. Removal.

(1) Remove the lifting forks (TM 10-3930-624-12).

(2) Disconnect hydraulic lines to the primary and secondary lift cylinders. Cap or plug openings.

(3) Detach the tilt cylinder from the mast brackets and remove the lift chains.

(4) Remove the carriage and backrest assembly (para 6-3).

(5) Attach a chain hoist to the lifting eyes on the back of the outer mast and raise the mast assembly enough to take the weight off the pivot pins.

(6) Remove the capecrews and pivot pins.

(7) Lift the mast assembly free from the truck.

b. Disassembly. (fig. 6-1.)

(1) Remove the chains (4 and 10), bolts (6 and 12), hydraulic tube (19) and bracket (20). Remove the elbows (21 and 23), fitting (25) and flow regulator (26).

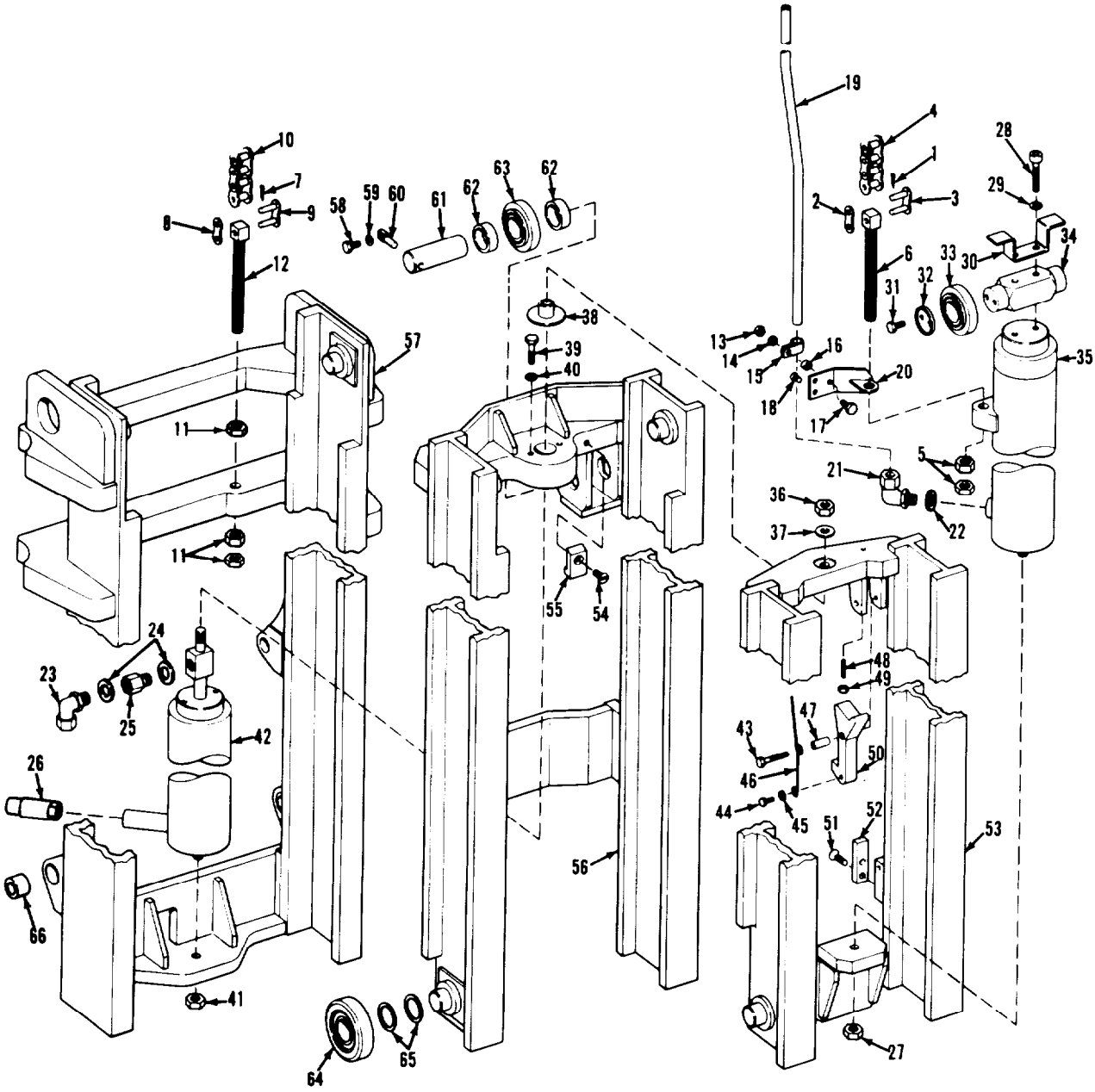


Figure 6-1. Mast assembly, exploded view.

KEY to fig. 6-1:

1. Cotter pin
2. Link
3. Link
4. Chain
5. Nut
6. Bolt
7. Cotter pin
8. Link
9. Link
10. Chain
11. Nut
12. Bolt
13. Nut
14. Lockwasher
15. Clip
16. Spacer
17. Capscrew
18. Capscrew
19. Tube
20. Bracket
21. Elbow
22. Packing
23. Elbow
24. Packing
25. Fitting
26. Regulator
27. Nut
28. Capscrew
29. Lockwasher
30. Chain guard
31. Capscrew
32. Washer
33. Bearing
34. Crosshead
35. Primary lift cylinder
36. Nut
37. Washer
38. Spacer
39. Capscrew
40. Washer
41. Nut
42. Secondary lift cylinder
43. Capscrew
44. Capscrew
45. Lockwasher
46. Spring
47. Sleeve
48. Stud
49. Nut
50. Latch
51. Capscrew
52. Plate
53. Inner mast
54. Capscrew
55. Latch
56. Intermediate mast
57. Outer mast
58. Capscrew
59. Lockwasher
60. Pin
61. Pin
62. Spacer
63. Bearing
64. Bearing
65. Shim
66. Bushing

(2) Remove the primary lift cylinder (35) and remove the chain guard (30), bearing (33) and crosshead (34). Refer to paragraph 5-9 for primary lift cylinder repair.

(3) Remove the spacer (38) and the secondary lift cylinder (42). Refer to paragraph 5-10 for secondary lift cylinder repair.

(4) Remove the spring (46), latch (50) and plate (52). Slide the inner mast assembly (53) out the bottom of the intermediate mast (56).

(5) Remove the latch (55) and slide the intermediate mast (56) out the top of the outer mast (57).

(6) Remove the pin (61), bearing (63), bearing (64) and bushing (66).

c. Cleaning. Inspection and Repair.

(1) Clean structural components with a soap solution and rinse with clean water. Soak chains for four hours in a solution of 50% engine oil with 50% solvent. Wipe dry. Clean remaining parts with solvent.

(2) Inspect the mast structures for cracks, fatigue lines, distorted or misaligned channels, broken welds and other damage. Repair cracks and minor breaks in the mast by welding. Avoid heat distortion. Replace the mast if damage is excessive.

(3) Inspect bushings and rollers for wear, scoring, pitting, discoloration, and other damage. Replace if damaged.

(4) Inspect chains for worn or damaged links. Replace as required.

(5) Inspect all other components for damage, distortion and wear. Repair or replace parts as necessary.

d. Reassembly. Reassemble the mast in the reverse order of disassembly. Adjust the mast bearings (subpara g) as required.

e. Installation.

(1) Hoist the mast assembly into position on the truck.

(2) Install the pivot pins and capscrews which secure the mast to the frame.

(3) Install the carriage and backrest assembly (para 6-3).

(4) Connect the tilt cylinder to the mast bracket. Install the lift chains. Adjust the tilt cylinder as instructed in TM 10-3930-624-12.

(5) Connect hydraulic lines to the primary and secondary lift cylinders.

(6) Install the forks (TM 10-3930-624-12).

(7) Lubricate grease fittings as instructed in the current LO 10-3930-624-12.

(8) Start the engine and operate the mast through several cycles. Remove the bleed screws on the cylinders and bleed the system until air-free oil flows out the openings.

(9) Shut down the engine and check for hydraulic oil leaks.

(10) Check the oil level in the hydraulic tank and add oil as necessary.

(11) Adjust the lift chains (subpara f).

f. Lift Chain Adjustment.

(1) Lower the carriage to its lowest point of travel. The bottom of the carriage lower bar should be 3.0 to 3.5 inches from the floor. Adjust the chain adjustment bolts (6 and 12, fig. 6-1) as necessary.

(2) Extend the mast until the primary cylinder reaches maxim urn extension. Measure the clearance between the stop on the inner mast and the carriage stop screws. Clearance should be ¼ in. to 3/8 in. Adjust bolts as required.

Note. Ensure that chains are adjusted to equal tension.

g. Mast Bearing Adjustment.

(1) Using an adjustable spanning tool, locate the narrowest point on the rear inside of the outer mast channel. Lock the tool in this position. Set an adjustable outside spanning tool to match the inside spanning tool and lock in position.

(2) Install bearings on studs at the bottom of the intermediate mast assembly. Using the outside spanning tool. span bearings at the maximum camber point. Add shims as required to obtain a maximum clearance of 0.015 inch between the bearings and the outside spanning tool. Divide shims as equally as possible between bearings.

Note. If an odd number of shims is required, place the extra shim on the same side of all mast sections and carriage so that the mast will be balanced.

(3) Using the outside spanning tool, find the widest point in the outside width on the web on the intermediate mast assembly. Install bearings on the studs at the top inside of the outer mast. Use the inside spanning tool to span bearings at the maximum camber point. Check the clearance between the spanning tools. Add shims as necessary to obtain a maximum clearance of 0.015 inch.

(4) Repeat (2) and (3) to adjust the upper bearings on the inside of the intermediate mast and the lower bearings on the inner mast.

(5) Raise and lower the mast and carriage several times to check for free movement throughout the entire range of travel. Readjust hearings if necessary.

6-3. Carriage and Backrest Assembly

a. Removal.

(1) Remove the forks. Refer to TM 10-3930-624-12.

(2) Remove the carriage lifting chains.

(3) Attach a hoist to the carriage and lift up out of the mast assembly.

b. Disassembly. (fig. 6-2.)

(1) Remove the backrest from the carriage.

(2) Remove the bearings and shims from the carriage.

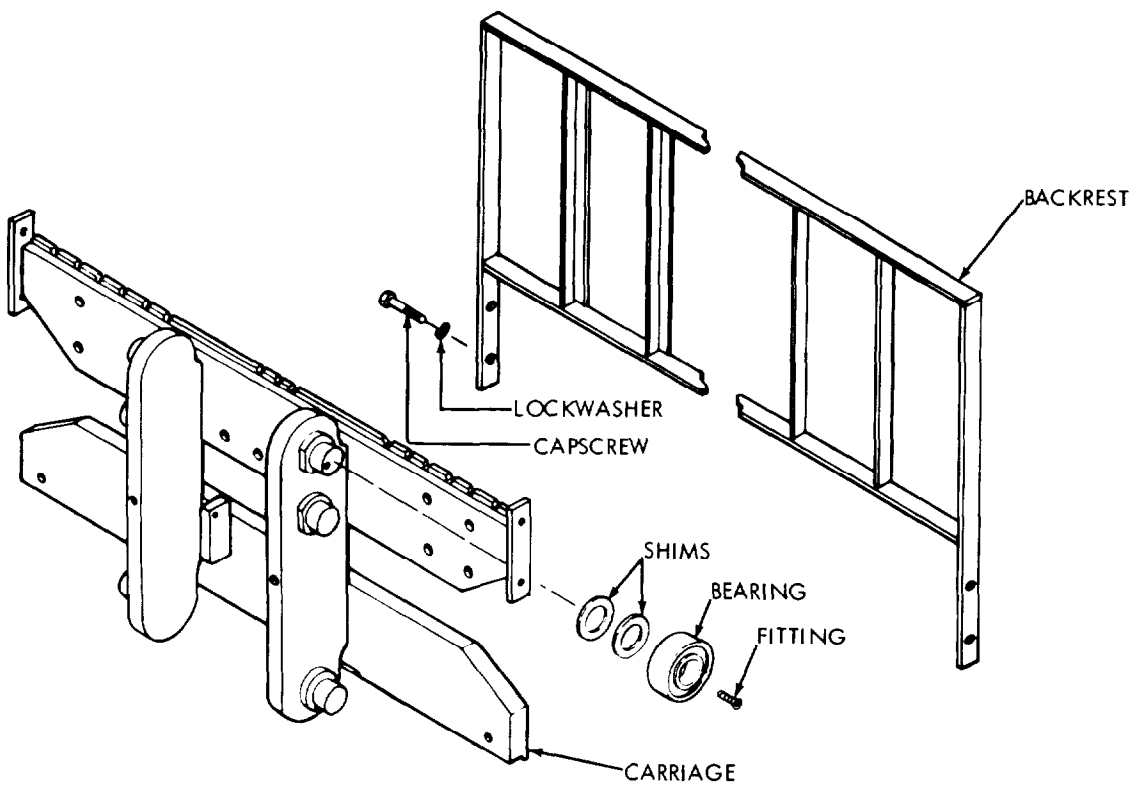


Figure 6-2. Carriage and backrest.

c. Cleaning, Inspection and Repair.

(1) Clean the carriage and backrest components with soap and water and rinse with clean wafer. Clean bearings as instructed in paragraph 2-7.

(2) Inspect the carriage and backrest for cracked or broken welds, dents, bends, distortion and other damage. Repair by welding if possible or replace as required.

(3) Inspect the rollers for distortion and damage. They must turn freely on the carriage posts. Replace rollers as necessary.

d. Reassembly. Reassemble the carriage and backrest in the reverse order of disassembly. Adjust the bearings (subpara f).

e. Installation. Install the carriage and backrest in the reverse order of removal.

f. Bearing Adjustment.

(1) Using an inside spanning tool, locate the narrowest point in the web of the inner mast assembly. Set an outside spanning tool to match the inside spanning tool. Lock tools in position.

(2) Using the outside spanning tool, span the carriage bearings at their maximum camber points. Add shims as necessary to produce a maximum clearance of 0.015 inch.

(3) Place a straightedge against the stud centerline to all three bearings on both sides of the carriage. No gap should appear between the bearings and the straightedge.

6-4. Forks

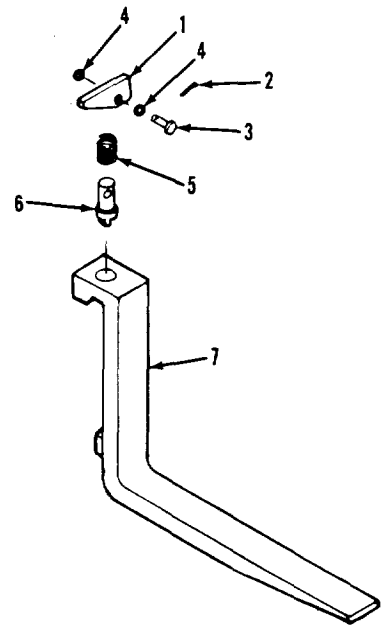
a. Removal. Refer to TM 10-3930-624-12 for the removal procedure.

h. Inspection and Repair. (fig. 6-3.)

(1) Inspect the latch (1), clevis pin (3), spring (5), and lock pin (6) for signs of wear or damage. If any of these parts are worn or damaged they must be replaced as a unit.

(2) If the fork (7) is damaged, replace as authorized.

c. Installation. Refer to TM 10-3930-624-12 for the installation procedure.



ME 3930-624-34/6-3

1. Latch
2. Cotter pin
3. Clevis pin
4. Washer
5. Spring
6. Lock pin
7. Fork

Figure 6-3. Fork and locking mechanism.

Section II. REPAIR OF THE FRAME

6-5. General

The frame of the truck is of the heavy duty, industrial type, designed for long service life with minimum maintenance.

6-6. Repair

a. CIean all parts using any applicable method.

b. Inspect the frame for cracks, cracked or broken welds, distortion or other damage. Repair cracks in the frame by welding. Replace a badly dam aged frame.

c. Inspect all frame hardware and threaded holes for thread damage. Use an appropriate tap or die to chase the threads if necessary. If hardware cannot be repaired, replace the part.

APPENDIX A

REFERENCES

A-1. Lubrication

LO 10-3930-624-12	Fuels, Lubricants, Oils and Waxes, Lubrication Order for Truck, Lift, Pork, Allis-Chalmers Model F60-24PS-180

A-2. Painting

TM 9-213	Painting Instructions for Field Use

A-3. Maintenance

TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems
TM 38-750	Army Equipment Procedures
TM 10-3930-624-35P	DS, GS and Depot Maintenance Repair Parts List for Truck, Lift, Fork, Allis-Chalmers Model F60-24PS-180

A-4. Shipment and Storage

TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage

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