DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT AND GENERAL SUPPORT

MAINTENANCE MANUAL

TRUCK, FORK LIFT, GASOLINE,

PNEUMATIC TIRES, 4,000 POUND CAPACITY

ARMY MODEL MHE 221

BAKER MODEL FJF-040

FSN 3930-151-4428

HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1971

SAFETY PRECAUTIONS

BEFORE OPERATION

Check the operating area to be sure it is clear of personnel and obstructions.

Be alert for other workers to be sure they are not in the way of the moving truck.

If the truck is operated in an enclosed area, be sure adequate ventilation is provided. Exhaust gases contain carbon monoxide.

Do not allow smoking or the use of an open flame in the immediate vicinity while servicing the batteries.

Exercise care at all times while handling electrolyte. When necessary to dilute electrolyte, always pour acid into water. Avoid breathing fumes and do not permit electrolyte to come in contact with skin. If electrolyte comes in contact with skin, wash affected area immediately with baking soda solution or with liberal quantity of water. If electrolyte splashes into eyes, wash immediately with liberal quantity of clean water and obtain medical aid as soon as possible.

When filling the fuel tank, always provide a metal-to-metal contact between the container and the fuel tank. This will prevent a static spark from being generated as fuel flows over metallic surfaces. Shut off engine while refueling.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., *24 November 1989*

Direct Support and General Support Maintenance Manual
TRUCK, FORKLIFT, GASOLINE, PNEUMATIC-TIRES,
4000 POUND CAPACITY, 144-INCH LIFT HEIGHT
(ARMY MODEL MHE-221, BAKER MODEL FJF-040)
NSN 3930-00-151-4428

TM 10-3930-627-34, 12 October 1971, is changed as follows:

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

Page ii, List of Illustrations.

Add Figure Numbers "3-0, Engine, right side view, page 3-1" and "3-0.1, Cylinder head tightening order, page 3-1".

Delete the entry for Figure Number 12-5.

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Paragraph 1-2 is superseded as follows: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Paragraph 1-3 is superseded as follows: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, ATTN: AMSTA-MB, Warren, MI 48397-5000. A reply will be furnished to you.

Paragraph 1-3.1 is added after paragraph 1-3.

1-3.1. Reporting Equipment Improvement Recommendations (EIRs)

If your forklift truck needs improvement, let us know, Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Tank-Automotive Command, ATTN: AMSTA-MP, Warren, MI 48397-5000. We'll send you a reply.

Page 3-1.

Paragraph 3-4 is superseded as follows:

3-4. Cylinder Head

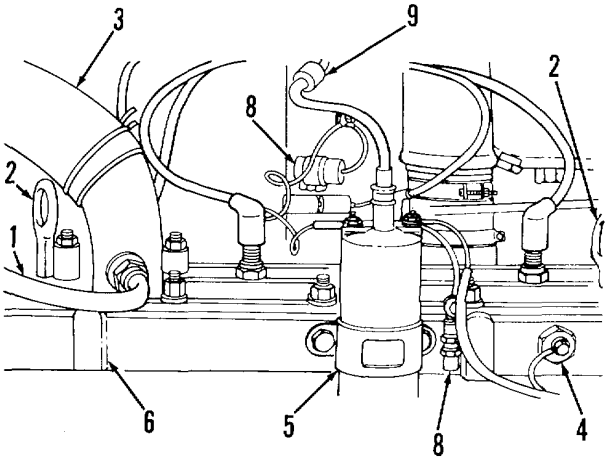
The cylinder head contains the fuel combustion chambers and the cored passages for water flow. Refer to figure 3-0 and remove the cylinder head as follows:

a. Removal.

(1) Drain cooling system.

(2) Remove bolts and lockwashers and remove coil mounting support (5, fig. 3-0) with coil from side of cylinder head. Capacitor is removed in this procedure.

(3) Remove distributor from cylinder head (TM 10-3930-627-12).



1. Tube recirculating
2. Eye, lifting
3. Hose, elbow to radiator
4. Transmitter, engine temperature
5. Support, coil mounting
6. Head, cylinder
7. Suppression resistor
8. Suppression capacitors

TA502076

Figure 3-0. Engine, right side view.

(4) Disconnect wire at engine temperature transmitter (4).

(5) Remove water pump to thermostat elbow (housing) recirculating tube (1).

(6) Loosen hose clamp and disconnect elbow to radiator hose (3) at elbow.

(7) Remove lifting eyes (2) from cylinder head studs.

(8) Remove cylinder head stud nuts and flat washers, and remove cylinder head (6) and gasket from engine block.

(9) Remove stud nuts and lockwashers, and remove elbow (housing) and thermostat from cylinder head.

(10) Remove engine temperature transmitter from the cylinder head.

(11) Remove spark plugs.

b. Cleaning and Inspection.

(1) Remove all carbon from combustion areas, using a scraper and wire brushes.

(2) Clean the cylinder head thoroughly with SD-2.

(3) Make sure that the gasket contact surfaces on the head and block are clean, smooth, and flat.

(4) Inspect the head for cracks and holes. Check flatness with a straightedge and feeler gage in three positions lengthwise and five positions crosswise. The maximum permissible is 0.004 inch low in the center lengthwise, gradually decreasing toward the ends, or 0.003 inch crosswise or in localized low spots.

c. Installation.

(1) Reverse the procedures in a above using a new gasket.

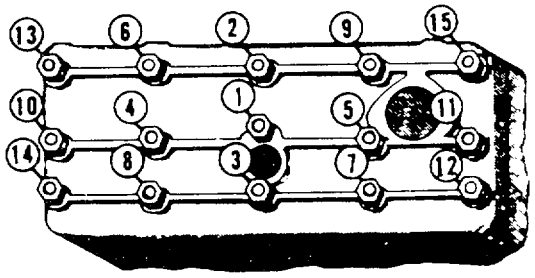
(2) Tighten each cylinder head nut to 70-75 foot-pounds torque, following the sequence in figure 3-0.1.

Paragraph 3-5*a*(1) is superseded as follows:

(1) Remove cylinder head (para 3-4). Remove manifolds and valve cover (TM 10-3930-627-12).

Page 3-10, paragraph 3-12*b*(2). Change "(TM 10-3930-627-12)" to "(para 3-4)".

Page 3-15, paragraph 3-15*b*(11). Change the last sentence to read "If out-of-round or taper exceeds 0.004 inch or if overall wear exceeds 0.008 inch, have general support maintenance rebore cylinder walls, and install oversize pistons and rings."



TA502077

Figure 3-0.1. Cylinder head tightening order.

Page 5-1. Paragraph 5-2 is superseded as follows:

5-2. Testing

See TM 10-3930-627-12.

Page 7-6. Paragraph 7-5 is rescinded.

Page 10-3. Paragraph 10-2 is rescinded.

Page 10-4. Paragraph 10-4 is rescinded.

Page 12-5. Paragraph 12-2 is superseded as follows:

12-2. Hydraulic Tank

See TM 10-3930-627-12.

Page 12-8. Paragraph 12-6*b* and figure 12-5 are rescinded.

Page 12-5. Paragraph 12-3*f* is added after paragraph 12-3*e*.

a. Test. After installation, test hydraulic pump by raising a 4000 lb. load. Operate through several cycles to be sure all air is bled from the system. After operation, inspect visually for security of mounting and for leaks.

Page A-1. Appendix A is superseded as follows:

APPENDIX A
REFERENCES

A-1. Fire Protection

TB 5-4200-200-100	Hand Portable Fire Extinguishers Approved for Army Users

A-2. Lubrication

C9100-IL	Fuels, Lubricants, Oils, and Waxes
TB 703-1	Specification List of Standard Liquid Fuels, Lubricants, Preservatives, and Related Products Authorized for Use by the U.S. Army

LO 10-3930-627-12	Truck, Forklift, Gasoline, Pneumatic-Tired Wheels, 4000 Pound Capacity, 144-Inch Lift Height (Army Model MHE-221, Baker Model FJF-040) NSN 3930-00-151-4428

A-3. Painting

TM 43-0139	Painting Instructions for Field Use

A-4. Radio Interference Suppression

FM 11-65	High Frequency Radio Communications

A-5. Maintenance

TM 9-2610-200-24	Organizational, Direct Support and General Support Care, Maintenance and Repair of Pneumatic Tires and Inner Tubes
TM 9-6140-200-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries
TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems
TB 750-1047	Elimination of Combustibles from Interiors of Metal or Plastic Gasoline and Diesel Fuel Tanks
TM 10-3930-627-12	Operator's and Organizational Maintenance Manual, Truck, Forklift, Gasoline, Pneumatic-Tired Wheels, 4000 Pound Capacity, 144-Inch Lift Height (Army Model MHE-221, Baker Model FJF-040) NSN 3930-00-151-4428
TM 10-3930-627-20P	Organizational Maintenance Repair Parts and Special Tools List for Truck, Forklift; Gasoline Engine Driven, Pneumatic-Tired; 4, 000 lb Capacity, 144-Inch Lift Height, (Baker Model FJF-040, Army Model MHE-221) (NSN 3930-00-151-4428)
TM 10-3930-627-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List for Truck, Forklift; Gasoline Engine Driven, Pneumatic-Tired, 4, 000 lbs Capacity, 144-Inch Lift Height, (Baker Model FJF-040, Army Model MHE-221) (NSN 3930-00-151-4428)
DA Pam 738-750	The Army Maintenance Management System (TAMMS)

A-6. Shipment

TB 740-97-2	Preservation of USAMECOM Mechanical Equipment and Storage and Storage
TM 740-90-1	Administrative Storage of Equipment

Page I-1, Index.

The following entries are added or superseded alphabetically:

The following entries are deleted alphabetically:

By Order of the Secretary of the Army:

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

Official :

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

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NO. 10-3930-627-34

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., *12 October 1971*

DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL
TRUCK, FORK LIFT, GASOLINE
PNEUMATIC TIRES, 4, 000 POUND CAPACITY
ARMY MODEL MHE 221
BAKER MODEL FJF-040
FSN 3930-151-4428

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope
These instructions constitute the direct and general support maintenance instructions for the gasoline engine powered fork lift truck, pneumatic tires, Baker model FJF-040.

1-2. Maintenance Forms and Records
Maintenance forms, records and reports to be used by maintenance personnel at all levels of maintenance are listed in and prescribed by TM 38-750, Army Equipment Record Procedures.

1-3. Reporting of Errors
Report of errors, omissions, and recommendations for improving this publication by the user is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded direct to Commanding General, U. S. Army Mobility Equipment Command, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120, ATTN: AMSME-MP.

Section II. DATA

1-4. Tabulated Data
The tables in this section supplement the general data given in TM 10-3930-627-12. This information covers the critical wear limits, fits and tolerances to be checked during overhaul of the fork lift truck. Table 1-1 lists standard tightening torques for screws and nuts used on the truck. Use this table as a guide unless a different tightening torque is called out in text. Table 1-1 to 1-4 list component wear limits, fits and tolerances. Some press or drag fits do not lend themselves to tabulation, but require narrative explanation. Such fits are discussed in text at the point where they are needed.

Table 1-1. Torque Values

The following table lists screw torque specifications recommended for all applications where specific torque requirements are not stated

Screw grade	Coml low-carb SAE-2	SAE-5	SAE-7	SAE-8
Head Marking	None			
Screw size	in.-lb.			
4-40	8			
6-32	12			
8-32	20			
10-24	25			
10-32	30			
12-24	35			
	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.
1/4-20	4	7	9	11
1/4-28	5	9	11	13
5/16-18	9	15	19	23
5/16-24	10	17	21	26
3/8-16	15	27	35	42
3/8-24	18	33	42	50
7/16-14	25	45	60	70
9/16-20	30	55	70	80
1/2-13	40	75	90	105
1/2-20	45	85	105	120
9/16-12	60	110	135	150
9/16-18	65	120	150	165

Table 1-1. Torque Values-Continued

Screw grade	Coml low-carb SAE-2	SAE-5	SAE-7	SAE-8
Head Marking	None			
	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.
5/8-11	80	140	170	200
5/8-18	90	155	200	230
3/4-10	125	240	300	350
3/4-16	140	275	350	400
7/8-9	175	375	500	575
7/8-14	200	400	550	625
1-8	250	575	750	850
1-12	275	650	825	950

Table 1-2. Engine Limits and Clearances

Point of measurement	Manufacturer's specifications		Wear limits
	Minimum Inches	Maximum Inches	Inches
Valve Guide			
Bore diameter, exhaust	0.3452	0.3460	0.3475
Bore diameter, intake	0.3432	0.0.3440	0.3455
Top of guide to cylinder block	1-15/32	1-15-32	
Valve Seat Angle			
Intake	30 deg.	30 deg.	
Exhaust	45 deg.	45 deg.	
Valve			
Face angle intake	30 deg.	30 deg.	
Face angle exhaust	45 deg.	45 deg.	
Stem diameter, exhaust	0.3405	0.3415	0.3385
Stem diameter, intake	0.3405	0.3415	0.3385
Valve Springs			
Note: **Effort in pounds required to compress spring length specified.**			
Valve closed, length 1-45/64	47 pounds	53 pounds	42 pounds
Valve open, length 1-27-6/	96 pounds	104 pounds	91 pounds
Camshaft			
Journal diameter			
Front	1.8715	1.8725	1.8745
Intermediate	1.7457	1.7465	1.7485
Rear	1.2465	1.2475	1.2495
Bushing Inside Diameter			
Front	1.8745	1.8755	0.004
Intermediate	1.7495	1.7502	0.004
Rear	1.2495	1.2505	0.004
Journal to Bushing Clearance			
Front, rear	0.002	0.004	0.006
Intermediate	0.003	0.0045	0.0065
End Play	0.003	0.007	0.009
Connecting Rod			
Bearing insert thickness	0.0625	0.0628	0.0618
Crank pin diameter	2.0600	2.0607	2.0590
Crank pin clearance	0.0002	0.0020	0.0030
Side play	0.006	0.010	0.0030
Crankshaft journal fillet radii	5/64	7/64	
Main Bearings			
Insert thickness	0.0950	0.0953	0.0943
Crankshaft journal diameter	2.2448	2.2457	2.2438
Journal Radii			
All except rear	5/64	7/64	
Rear (flywheel end)	7/64	9/64	

Table 1-2. Engine Limits and Clearances-continued

Point of measurement	Manufacturer's specifications		Wear limits
	Minimum Inches	Maximum Inches	Inches
Journal clearance	0.0002	0.0024	0.0034
Crankshaft end play	0.004	0.006	
Piston Pin			
Diameter	0.8591	0.8593	0.8588
Piston pin hole diameter	0.8593	0.8596	
Pin to piston fit	Light push	Light push	
Connecting rod bushing diameter	0.8593	0.8596	0.8606
Pin to bushing fit	0.0000	0.0005	
Piston Rings			
Width			
Top (chrome) & No. 2	0.0930	0.0940	0.0928
No 3 and 4	0.1545	0.1555	0.1525
Piston groove width			
Top and No. 2	0.096	0.097	0.099
No. 3 and 4	0.156	0.157	0.159
Side Clearance			
Top	0.002	0.004	
No. 2	0.001	0.003	
No. 3 and 4	0.0005	0.0025	
Thickness			
Top	0.162	0.172	
No. 2, 3 and 4	0.148	0.153	
End gap clearance	0.010	0.020	
Cylinder diameter	3.4375	3.4395	3.4493

Table 1-3. Mast Parts, Wear Limits

Point of measurement	Manufacturer's specifications		Wear limits
	Minimum Inches	Maximum Inches	Inches
Primary cylinder bore diameter	5.465	5.535	5.530 with 0.003 in. Max. eccentricity
Primary plunger outer diameter	4.9345	4.9365	4.9338. Replace if chrome is worn through.
Secondary cylinder bore diameter	2.757	2.760	2.750
Secondary cylinder outer diameter	3.184	3.187	3.183. Replace if chrome is worn through.
Secondary plunger outer diameter	2.434	2.436	2.433. Replace if chrome is worn through.
Tilt piston diameter	4.010	4.012	4.002
Tilt piston rod	1.7485	1.7500	1.7484. Replace is chrome is worn through.
Tilt cylinder bore diameter	4.017	4.020	4.024
Upright wear inserts, thickness	1/2 nominal		3/16

Table 1-4. Brakes, Wear Limits

Point of measurement	Manufacturer's specifications		Wear limits
	Minimum Inches	Maximum Inches	Inches
Brake drum inner diameter	10.495	10.505	10.565 (oversize machining limit)
Brake lining thickness	1/16		
Brake lining to drum clearance	0.010	0.020	
Brake master cylinder push rod to piston free travel.	1/8	3/16	

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

2-1. Tools and Equipment

No tools, repair parts, or equipment are issued with the fork lift truck.

2-2. Special Tools and Equipment

Figure 2-1 to 2-4 show special tools used in power steering gear repair (table 2-1). These tools are not purchased from the truck manufacturer nor are they known to be available from commercial sources. No part numbers or Federal Stock Numbers have been assigned to them. Make them locally, using figures 2-1 to 2-4 for guidance. No other special tools are required.

Note.

The type Saginaw gear used on this truck is used on many Army vehicles. Check tool sources to learn if these tools have been made for a previous job and are still available.

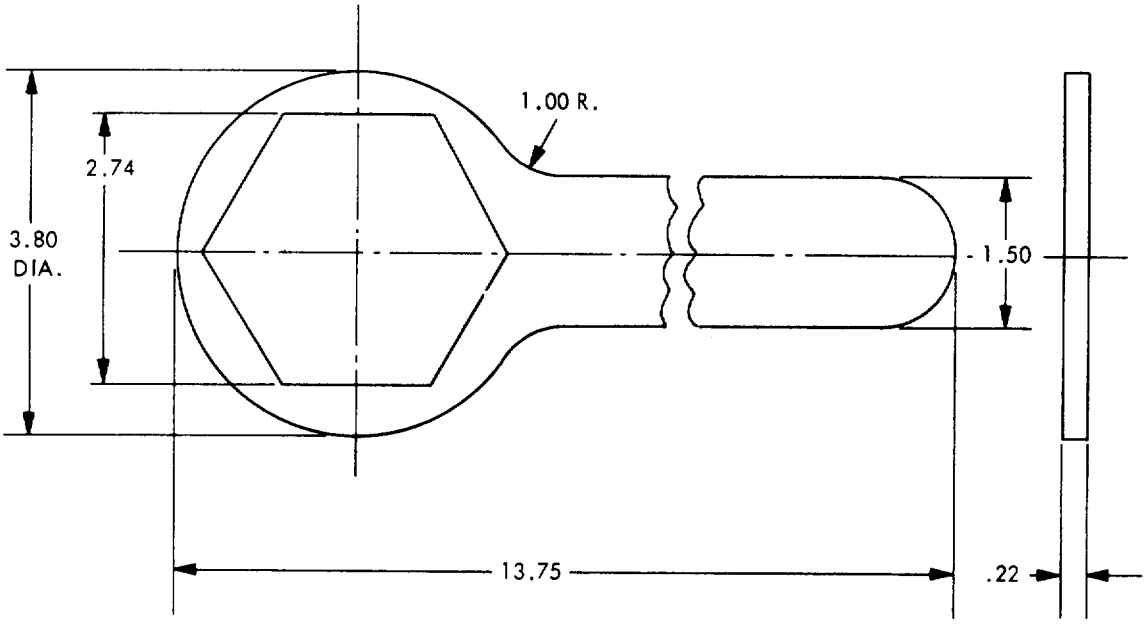


Figure 2-1. Adjuster plug lock nut wrench construction details.

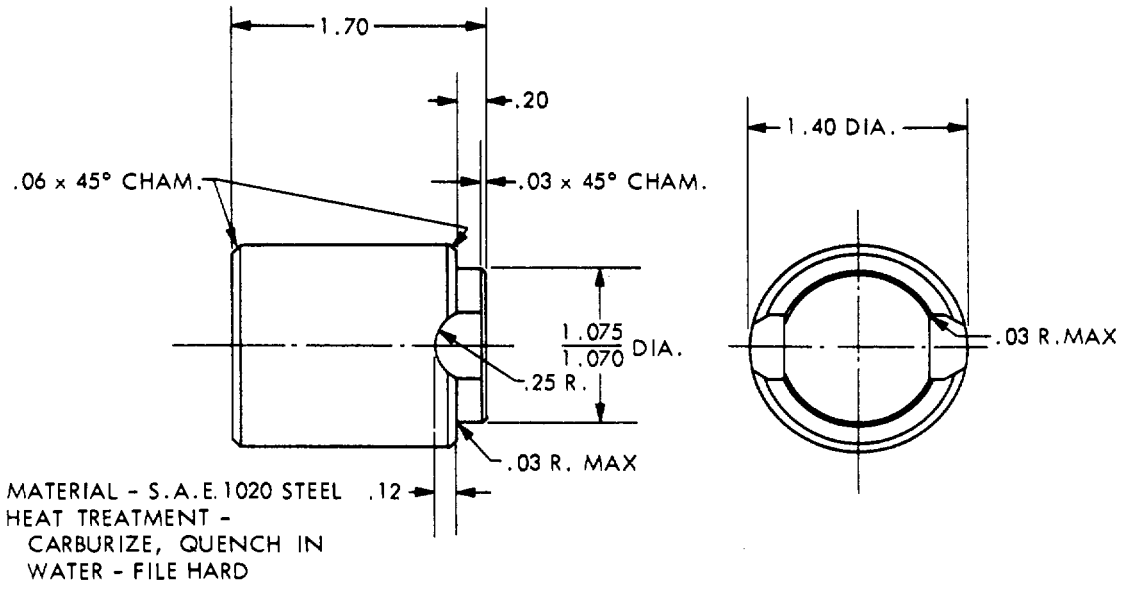


Figure 2-2. Thrust bearing retainer construction details.

Table 2-1. Special Tools (All Fabricated Locally)

Item	Figure number	Paragraph number	Use
Adjuster plug lockout wrench	2-1	11-3*a.*	To loosen and tighten adjuster plug locknut.
Thrust bearing retainer	2-2	11-3*a.* 11-3*f.*	Installing bearing retainer into bearing line.
Rack piston arbor	2-3	11-3*f.*	Retaining bearing balls in rack piston at removal and installation.
Piston ring compressor	2-4	11-3*f.*	Guiding rings on rack-piston nut into gear housing

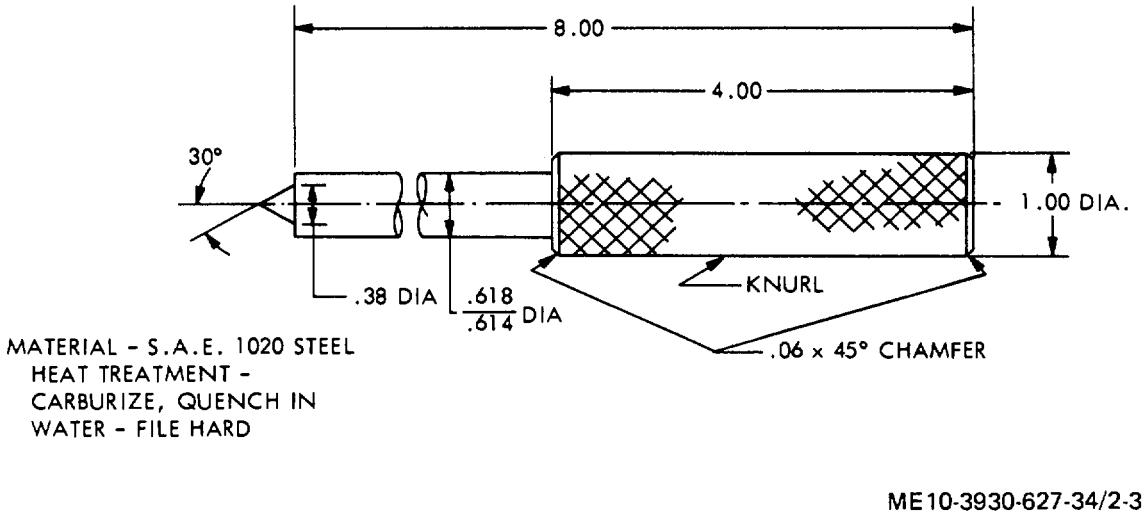


Figure 2-3. Rack-piston arbor construction details.

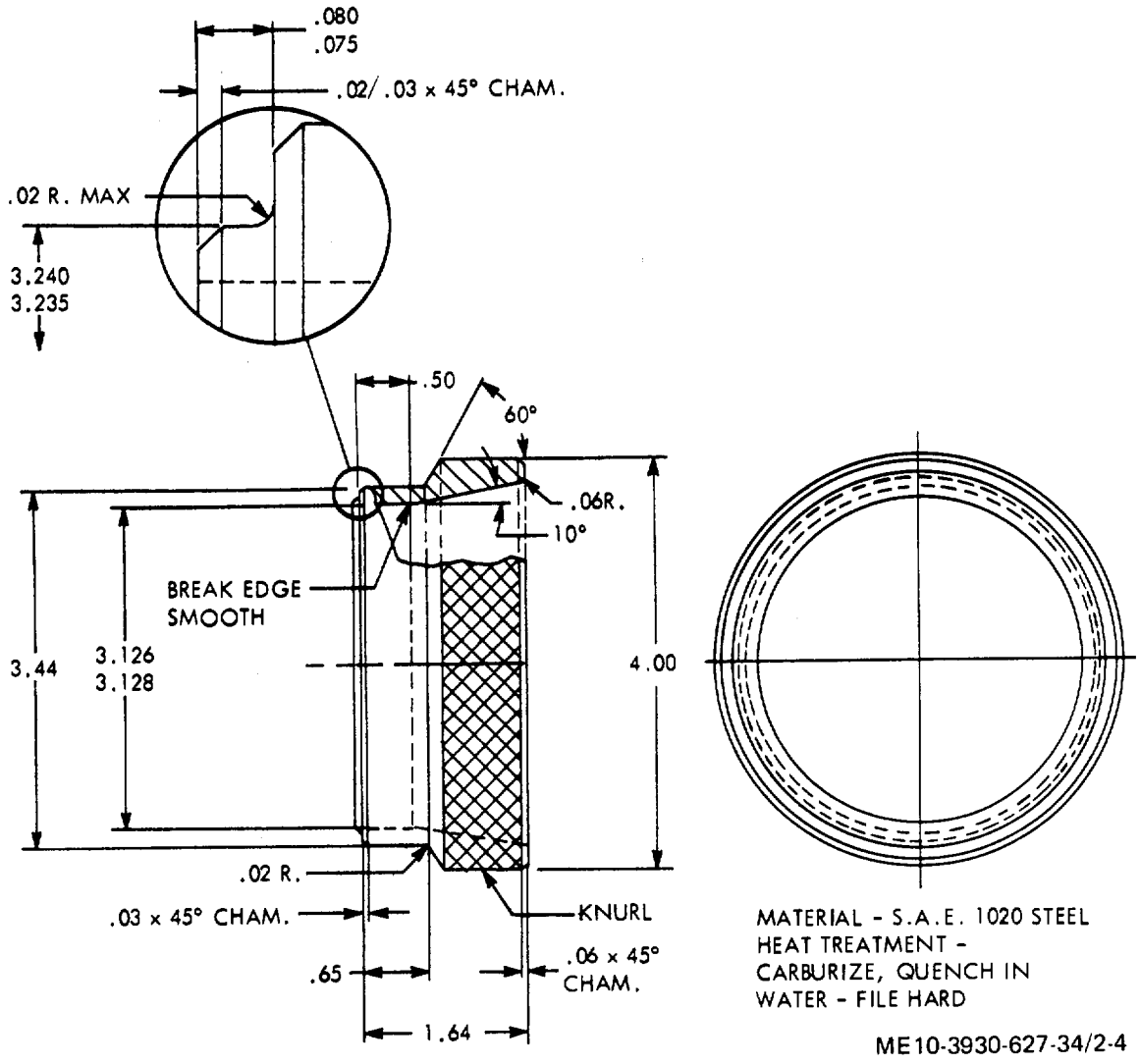


Figure 2-4. Piston ring compressor construction details.

2-3. Maintenance Repair Parts

Repair parts and equipment are listed and illustrated in the repair parts list covering direct support, general support and depot maintenance for the fork lift truck.

Section II. TROUBLESHOOTING

2-4. General

Table 2-2 contains a list of possible malfunctions of the fork lift truck, with possible causes and remedies for the malfunctions. Visual examination or previous knowledge of the truck being checked will quickly narrow down the most likely of the probable causes to a few choices, and the suggested corrective action.

2-5. Troubleshooting Chart

Table 2-2 is presented only as a guide in troubleshooting. It is not a complete list of troubles or remedies possible. Most diagnosis will rely on the skill, observations and judgment of maintenance personnel, and the use of available diagnostic equipment.

Table 2-2. Troubleshooting Chart

Malfunction	Probable Cause	Corrective Action
	ENGINE	
1. Starting motor will not crank engine when starter button is pressed.	*a*. Defective cables.	*a*. Replace cables.
	b. Incorrectly adjusted or defective neutral safety switch.	*b*. Adjust or replace switch. Paragraph 2-7*b*.
2. Engine will not turn, starting motor turns.	*a*. Stripped starting motor drive.	*a*. Replace starting motor.TM 10-3930-627-12.
	b. Stripped flywheel ring gear.	*b*. Replace flywheel ring gear, Paragraph 3-8.
3. Engine cranks but will not start.	*a*. Ignition failure.	*a*. Refer to TM 10-3930-627-12.
	b. Improper valve timing.	*b*. Retime valves, paragraph 3-7*c*.
4. Engine sluggish, misses, backfires.	*a*. Burned or stuck valves.	*a*. Repair or replace valves, paragraph 3-5.
	b. Valves out of time.	*b*. Retime valves, paragraph 3-7c.
	c. Distributor advance not operating properly.	*c*. Clean and adjust or replace as necessary.
	d. Sticky valves or valves not sealing properly.	*d*. Grind or replace valves, paragraph 3-5.
	e. Valve timing incorrect.	*e*. Time valves, paragraph 3-7*c*.
5. Engine overheats.	Improper valve timing.	Time valves, paragraph 3-7*c*.
	ENGINE NOISES	
1. Sharp ping.	Excessive carbon deposits.	Clean carbon from combustion chamber and top of piston.
2. Sharp hollow slap when starting engine.	Worn pistons.	Overhaul engine. Chapter 3.
3. Continuous knock timed with engine rpm.	*a*. Loose piston pins.	*a*. Overhaul or replace engine.
	b. Loose connecting rods.	*b*. Overhaul or replace engine.
4. Dull, heavy pounding timed with engine rpm.	Worn or burned out main bearings.	Overhaul or replace engine.
5. Continuous squeal or squeak.	Lack of lubrication at alternator, water pump or distributor.	Lubricate as appropriate.
	TRANSMISSION	
1. Oil leakage.	Defective gaskets or seals.	Replace defective items as ap-propriate.
2. Coolant leakage.	*a*. Worn or damaged hoses.	*a*. Replace hoses, TM 10-3030-627-12.
	b. Loose fittings	*b*. Tighten or replace as necessary.
3. High stall speed.	*a*. Low oil level.	*a*. Add oil to proper level.
	b. Low converter pressure.	*b*. Check converter pressure (para 7-6) and if low, check main pressure regulating valve, and cooler bypass valve (fig. 7-4), to see if they are stuck open. Overhaul transmission as needed.
	c. Slipping clutch.	*c*. Actuate other clutch to verify slipping of particular clutch being checked. Observe main pressure at clutch lines to determine if within limits (para 7-6). Overhaul if necessary, Chapter 7.
	d. Foaming oil due to:	
	1. Too low or too high oil level.	1. Adjust oil level.
	2. Water in oil.	2. Drain, flush and refill transmission.
	3. Air leak on intake side of pump.	3. Overhaul oil pump (para 7-8 and 7-11).
	4. Improper oil.	4. Change to specified oil.
4. Continuously high oil temperature.	*a*. See 3*d*. above.	
	b. Engine cooling system inoperative.	*b*. Check radiator cooling level. Eliminate restricted water or oil flow through cooler.
	c. Severe service vehicle operation.	*c*. Operate away from stall more frequently.
	d. Low oil flow through converter.	*d*. Converter pressure regulator valve stuck in near closed position. Remove and free valve (para 7-8).

Table 2-2. Troubleshooting Chart - Continued

Malfunction	Probable Cause	Corrective Action
5. Slow or erratic clutch engagement.	*a*. Improper shift linkage arrangement or adjustment.	*a*. Free linkage and adjust (para 7-5).
	b. Low main pressure.	*b*. Main pressure regulator valve stuck. Clean, check springs, free up in valve bore, (para 7-8 and 7-10).
	c. Internal oil leaks.	*c*. Check other clutches. Check shaft seal rings. Overhaul transmission (chap. 7).
6. Low clutch pressures and slow engagement at idle.	*a*. Worn pumps.	*a*. Inspect pump and overhaul if worn (para 7-8).
	b. Low oil level.	*b*. Add specified oil.
	c. Leak on intake side of main pump.	*c*. Overhaul pump paragraph 7-8.
7. Vehicle drives in one direction and creeps in that direction in neutral but stalls when shifted to opposite direction.	Directional clutch for direction vehicle will move not releasing.	
8. Inching control fails to operate.	Control linkage out of adjustment.	Adjust control linkage (para 7-5).
	HYDRAULIC SYSTEM	
1. Pump fails to start pumping.	Damaged pump.	Replace hydraulic pump (para 12-3).
2. Low pump pressure.	Worn pump.	Replace pump (para 12-3).
3. Undue pump vibration.	*a*. Pump bearings defective.	*a*. Replace pump (para 12-3).
	b. Loose mounting.	*b*. Tighten pump mounting hardware.
4. No movement of upright assembly.	Defective hydraulic pump.	Replace pump (para 12-3).
5. Hoist cylinder will not maintain raised position with load.	*a*. Hoist cylinder leakage.	*a*. Replace packings (para 12-1).
	b. Internal control valve leakage.	*b*. Repair control valve.
	c. Leakage at hydraulic lines and fittings	*c*. Inspect and correct as necessary.
6. Will not lift full rated load.	*a*. Worn pump.	*a*. Overhaul pump (para 12-3).
	b. Internal control valve leakage.	*b*. Repair or replace control valve (para 7-10).
	STEERING	
1. Difficult steering or wandering.	*a*. Steering gear out of adjustment.	*a*. Readjust steering gear.
	b. Damaged drag link.	*b*. Replace.
	c. Defective steering gear.	*c*. Replace.
	d. Excessive leakage of fluid.	*d*. Check for leaks, correct and check hydraulic tank level.
2. Fluctuating pressure.	Faulty operation of relief valves.	Flush and refill hydraulic system. If condition still exists, overhaul valve assembly.
3. Loss of system pressure.	Broken pump drive, other pump malfunction.	Repair pump and pump drive gear.
4. Chatter conditions.	*a*. Loose mounting or linkage.	*a*. Make certain all ball stud mounting and other linkage is tight. Check pitman arm stops to be certain the arm strikes the stops slightly before the steering knuckles contact the stops on the axle.
	b. Relief valve set too low.	*b*. Set relief valve at least 150 psi higher than normal steering requirements of the vehicles. Bleed air from system.
	c. Insufficient pump flow.	*c*. Insufficient pump flow at idle speeds can be corrected by increasing engine idle rpm.

Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-6. Engine

a. Removal.

(1) Drain cooling system and crankcase. Remove radiator (TM 10-3930-627-12).

(2) Disconnect these points on left side of engine (TM 10-3930-627-12).

(*a*) Air cleaner to carburetor hose.

(*b*) Fuel line from gas tank at both fuel pump and tank. Remove line.

(*c*) Hydraulic hoses at hydraulic pump.

(*d*) Choke c(able at carburetor.

(*e*) Accelerator rod at carburetor.

(*f*) Exhaust piping at manifold.

(3) Disconnect these points on right side of engine (TM 10-3930-627-12).

(*a*) Electrical connections at alternator and ignition coil.

(*b*) Battery cable and starter switch leads at starting motor switch terminal.

(*c*) Oil filter hoses at engine.

(*d*) Temperature gage electrical cable at temperature sending unit.

(*e*) Upper and lower radiator hoses.

(4) Disconnect points under engine.

(*a*) Block up engine assembly to prevent its falling.

(*b*) Remove screws and washers attaching flywheel housing on both sides of engine, and one screw and washer at rear motor support under engine timing gear cover.

(5) Engine removal.

(*a*) Attach hoist chains to engine assembly.

(*b*) Check to be certain all powerplant disconnections have been made.

(*c*) Check to see that all accessories and lines will be clear as the engine is lifted from truck.

(*d*) Disconnect engine from transmission assembly by removing screws and washers attaching transmission to flywheel housing.

(*e*) Draw engine rearward to clear transmission input shaft, then hoist it clear of truck.

b. *Installation.* Reverse procedure in *a.* above.

2-7. Transmission and Torque Converter

a. Removal.

(1) Remove entire mast assembly, (fig. 2-5) including carriage, forks; and lift cylinder as a unit, as follows:

(*a*) Attach a chain hoist to mast assembly (or use the forks of another fork lift truck), and relieve the weight of the assembly on its supporting parts. Arrange to brace the assembly against tipping as disconnections are made. The forks are to be fully lowered.

(*b*) Disconnect hydraulic hose at lift cylinder fitting, and cap hose to prevent entry of dirt.

(*c*) Disconnect both tilt cylinder assemblies at uprights (TM 10-3930-627-12).

(*d*) Disconnect wiring to spotlight.

(*e*) Remove capscrews, washers, and angle brackets which secure outer uprights to bearing bracket on frame. Lift mast assembly from truck.

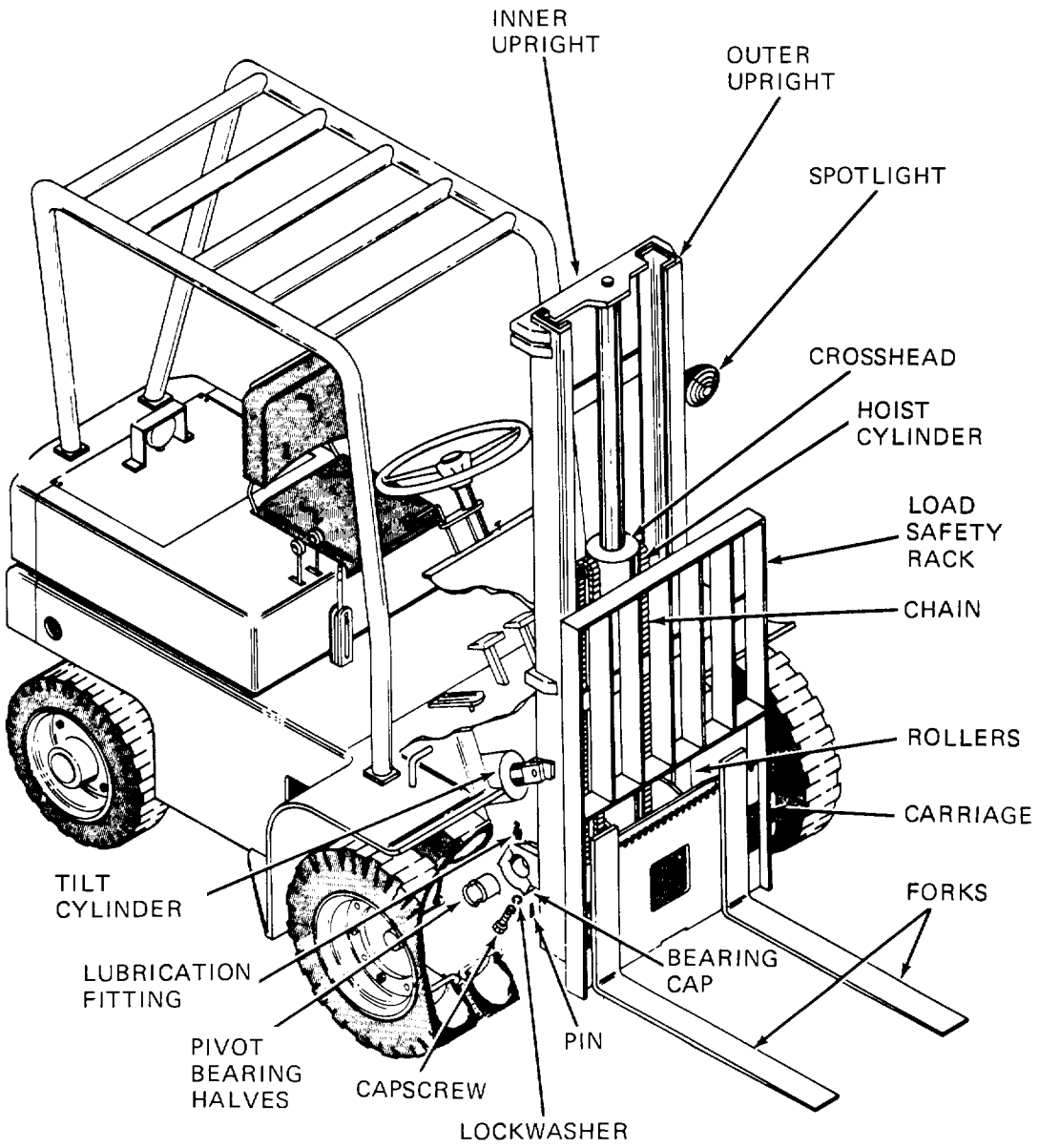


Figure 2-5. Mast removal.

(2) Drain lubricant from transmission and drive axle.

(3) Support transmission weight from below with a floor jack or equivalent wheeled support which can be adjusted for height, and remove drive axle from truck (para 2-8).

(4) Remove transmission coolant hoses and leads from transmission neutral safety switch.

(5) Remove 12 capscrews (26, fig. 2-6) and washers (27) attaching transmission to engine assembly.

(6) Disconnect all inching and shifting linkage from top of transmission assembly. Draw transmission forward from engine until splined shafts of clutch assembly (5) are free of torque converter and remove from truck. Remove six screws (3,fig. 2-7 washers (1 and 2) and remove torque converter (4) from flywheel.

Note.

Mark flywheel to indicate bolt hole nearest timing marks on drive plate so torque converter can be installed in correct position.

KEY to figure 2-6:

1. Washer
2. Screw
3. Screw
4. Seal
5. Clutch assembly
6. Gasket
7. Plug
8. Housing
9. Gasket
10. Washer
11. Screw, 1 1/8 in. long
12. Screw, 2 1/4 in. long
13. Control valve
14. Gage
15. Tube
16. Gasket
17. Gasket
18. Washer
19. Screw
20. Nut
21. Stud
22. Nut
23. Plug
24. Screw
25. Washer
26. Screw
27. Washer
28. Plug
29. Strainer
30. Gasket
31. Gasket
32. Plate
33. Washer
34. Screw
35. Plug
36. Copper washer
37. Spring
38. Ball
39. Case front half

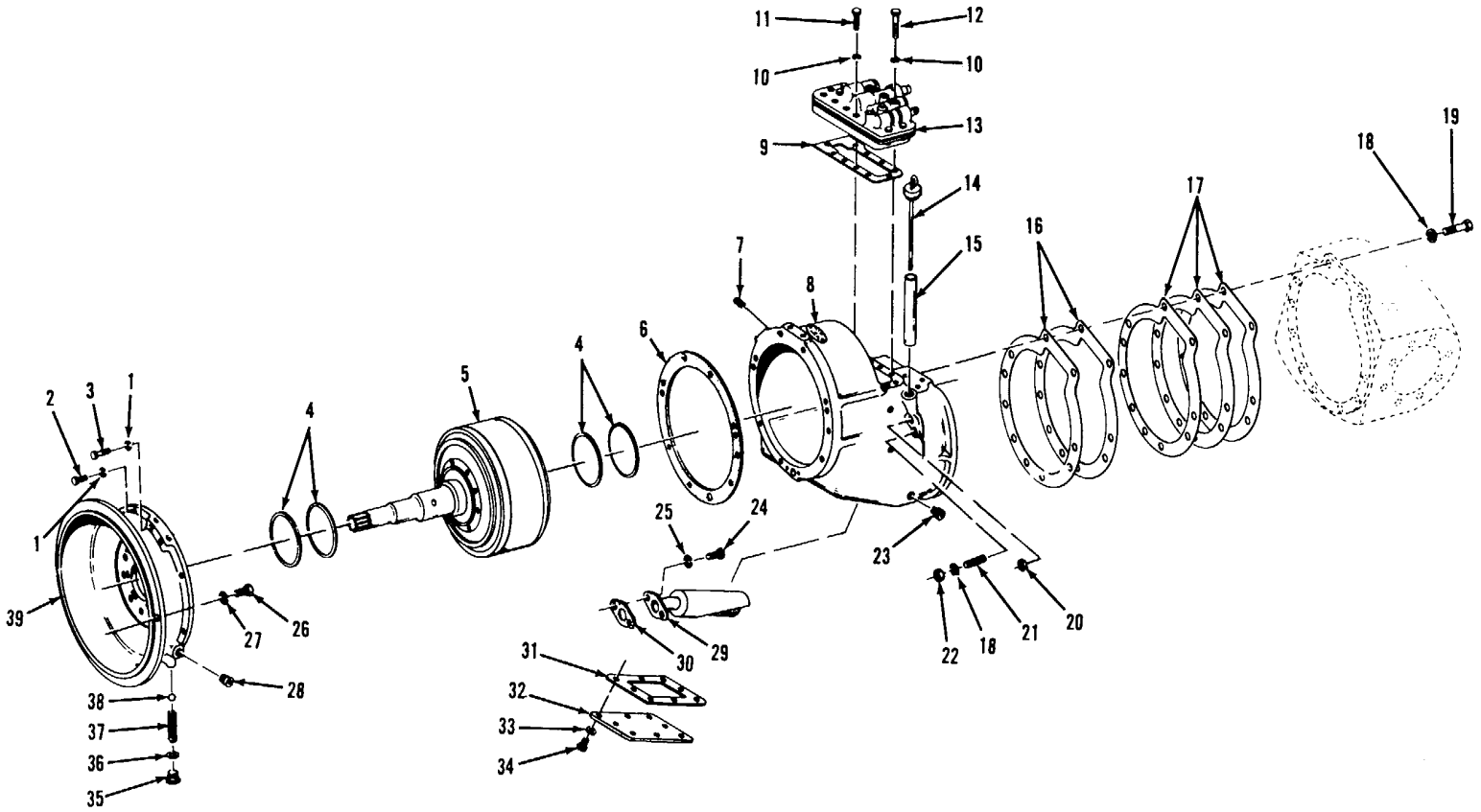
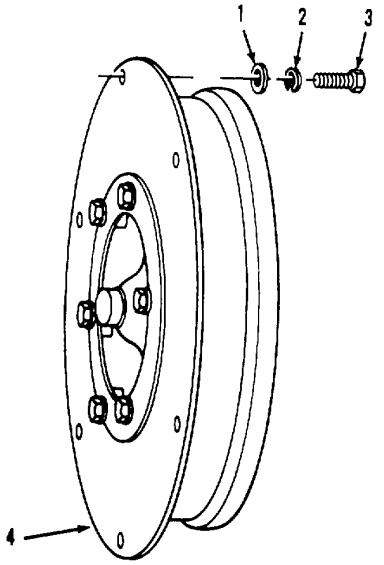


Figure 2-6. Transmission, partially exploded view.



1. Flat washer
2. Lock washer
3. Screw
4. Torque converter

Figure 2-7. Torque converter

b. Installation.

(1) Install the torque converter on the engine flywheel, with timing marks on drive plate next to hole in flywheel marked on removal. (see note, para 2-7).

(2) Reverse the removal procedure (*a.* above). Be careful to keep the clutch spline shaft aligned with the splines in the hub of the torque converter during installation, to prevent binding.

(3) After completing installation, and linkages are connected, adjust inching controls as follows:

(*a*) Attach pressure gage (0-250 psi range) to forward clutch pressure port (for location see fig. 7-4).

(*b*) Adjust the adjusting screw in the inching valve in or out as required to obtain maximum forward clutch pressure with the brake pedal in the fully released position (foot off brake).

(*c*) Disconnect pressure gage, install pipe plug in pressure port, and tighten adjusting screw lock nut.

(4) Adjust neutral safety switch as follows (fig. 2-8):

(*a*) With the switch roller just contacting the flat area of the striker plate which actuates it, adjust the switch position until the switch clicks.

(*b*) At this point measure the distance between the switch body and roller arm with a feeler gage.

(*c*) Subtract 3/32 inch from feeler gage reading, repeat (*b*) above, and tighten switch in this position.

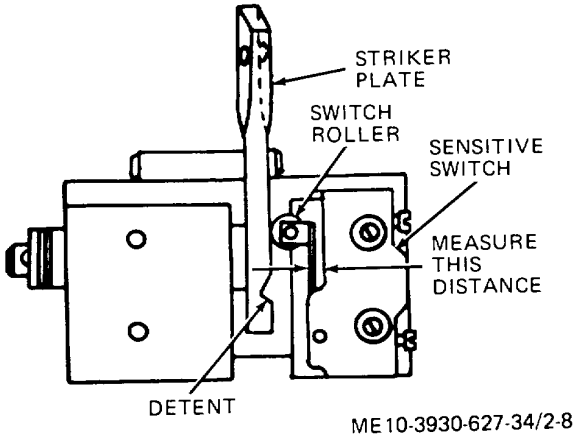


Figure 2-8. Neutral safety switch adjustment.

(5) If any quantity of fluid was lost from hoist cylinder while it was removed, after installation bleed trapped air from cylinder as follows:

(*a*) Place a heavy load on the forks to prevent rising of the carriage.

(*b*) Remove the small bleeder screw and gasket, located just below the chain anchor on the tube of the hoist cylinder.

(*c*) Station a man to observe the quality of the fluid coming from the hole from which this screw was removed, and gently pressurize the hoist cylinder by operating the lift control valve. When fluid is delivered clear and free of foam or air bubbles replace the screw and gasket, and check operation of the hoist and tilt systems.

2-8. Drive Axle

a. Removal.

(1) Remove complete mast assembly (para 2-7*a* (1)).

(2) Block up front of truck so weight is taken from front wheels. Drain oil from transmission and drive axle. Disconnect brake hoses at wheel brake fittings and linkage at parking brake outer lever.

***Warning*:**

Arrange that drive axle does not suddenly pivot as studs (21, fig. 2-6) leave transmission. Keep hands free of any area where they might be pinched by sudden shift in axle position.

(3) Remove four screws (21, fig. 2-9), washers (20), and two bearing caps (19). Support transmission and differential housing so weight does not depend on engine for support. Remove screws (19, fig. 2-6), nuts (20 and 22), and washers (18) and roll entire axle free of truck.

(4) Remove gaskets (16 and 17) and note thickness for guidance in reassembly, as the same thickness of new gaskets is to be installed at reinstallation of drive axle, if no new parts are to be installed.

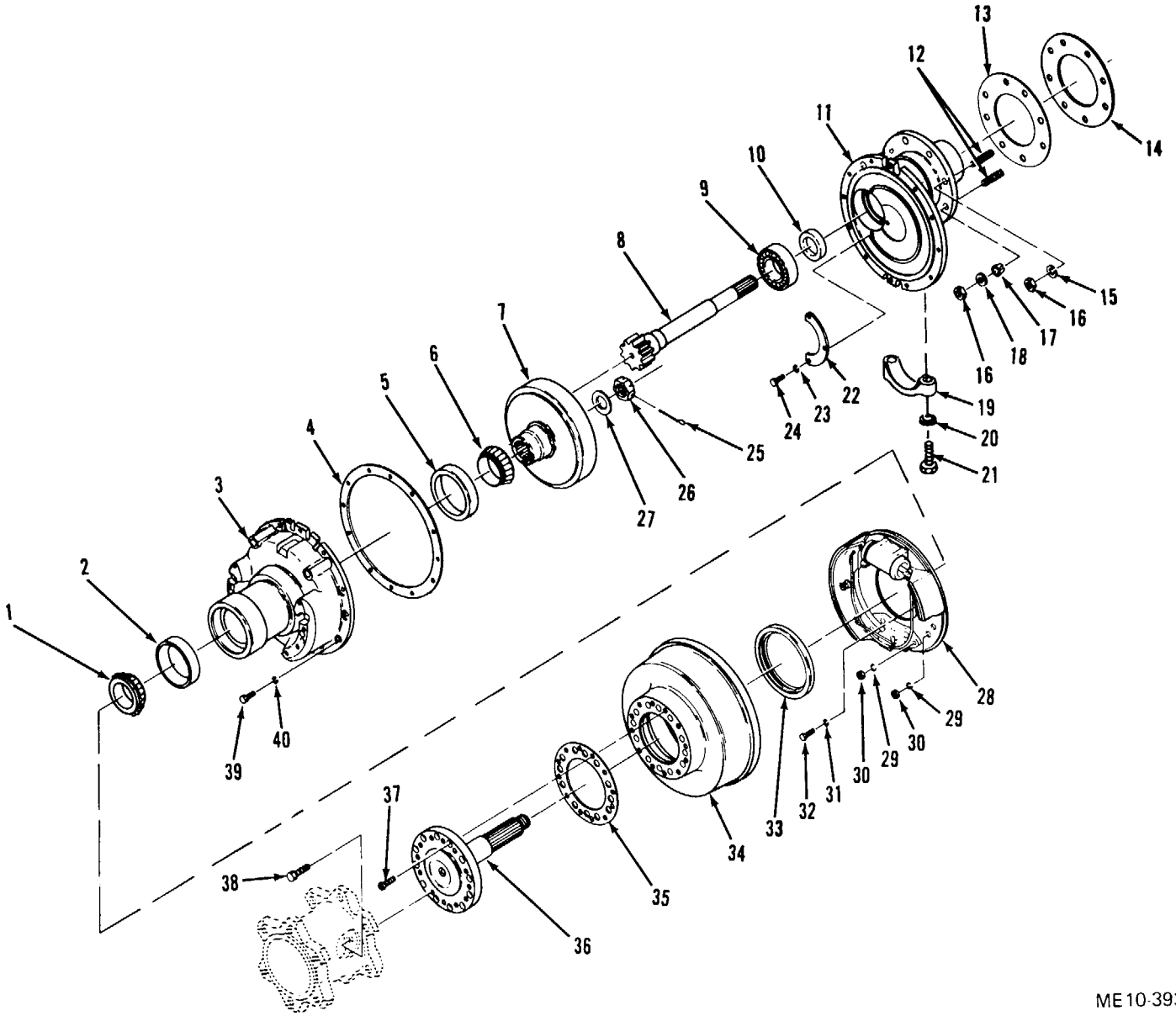


Figure 2-9. Drive axle, exploded view.

KEY to figure 2-9):

1. Outer cone and roller bearing
2. Outer bearing cup
3. Final drive gear case
4. Gasket
5. Inner bearing cup
6. Inner cone and roller bearing
7. Internal gear
8. Axle shaft
9. Ball bearing
10. Axle shaft bearing retainer
11. Axle housing
12. Stud
13. Gasket
14. Gasket
15. Washer
16. Nut
17. Tapered bushing
18. Washer
19. Bearing cap
20. Washer
21. Screw
22. Bearing retainer
23. Washer
24. Screw
25. Cotter pin
26. Nut
27. Washer
28. Brake assembly
29. Washer
30. Nut
31. Washer
32. Screw
33. Brakedrum seal
34. Brakedrum
35. Gasket
36. Final drive shaft
37. Screw
38. Screw
39. Screw
40. Washer

b. Installation.

(1) Jack or block up front of truck for convenience and safety during installation of drive axle. Support engine so its weight does not depend on the transmission for support.

(2) With wheeled floor jack under differential housing, roll assembly to mate with transmission of truck.

(3) Install gaskets (16 and 17, fig. 2-6) and secure axle to transmission. Reverse procedure in a. above.

2-9. Steering Gear

a. Removal. It is not necessary for any repair operation to remove both the steering gear and the steering column at the same time. These items can be separated at the flange shown in figure 2-10, permitting removal only of the item needing service without disturbing the other item. Refer to the following steps only as far as necessary to remove the desired assembly.

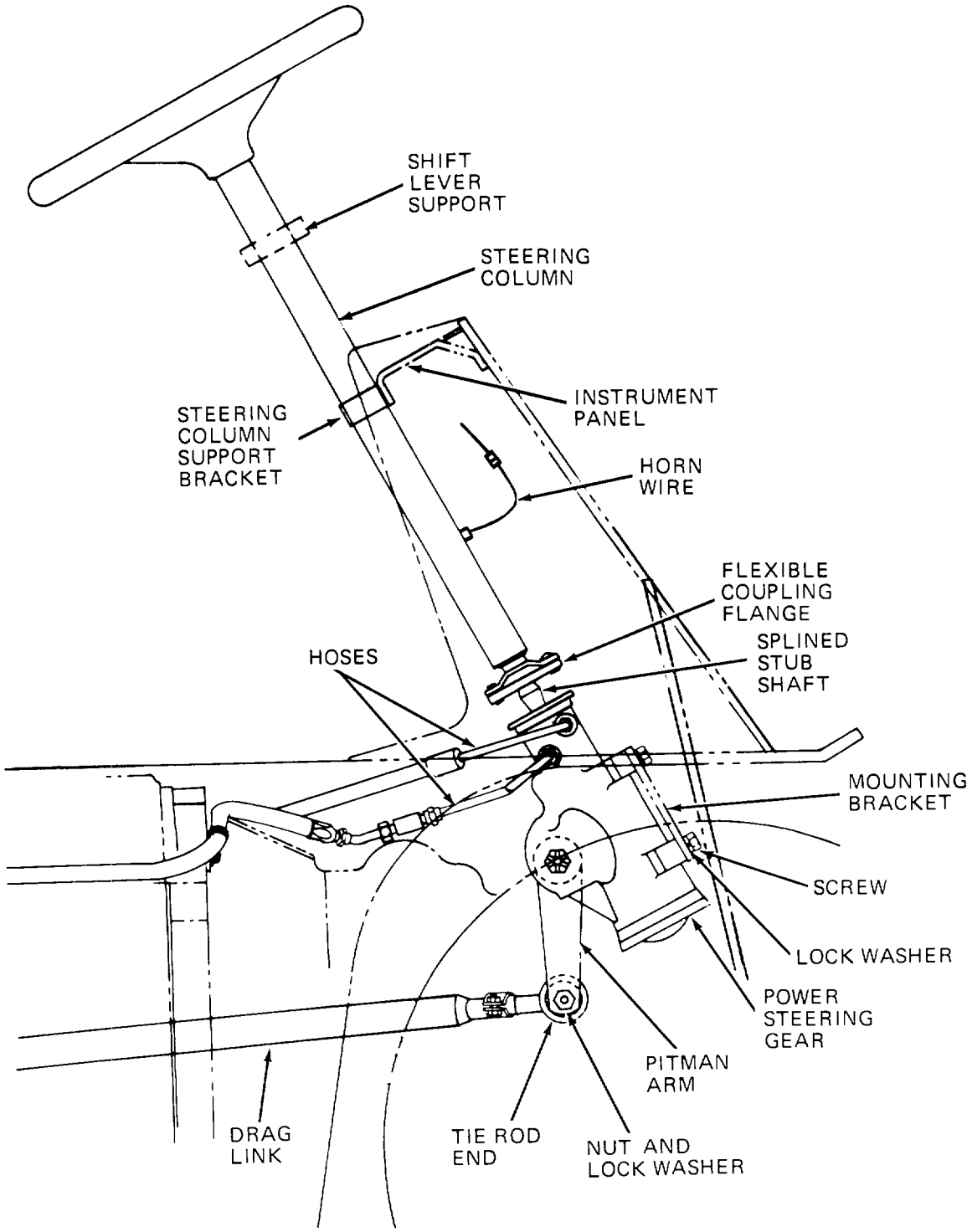


Figure 2-10. Steering gear removal.

(1) Remove the truck floor plate, and loosen the bolt which clamps the split bore of the flexible coupling to the splined stub shaft of the gear (fig. 2-10).

(2) To remove the steering column:

(*a*) Uncouple the horn wire which extends from the grommet in the lower part of the mast jacket.

(*b*) Remove two screws attaching shift lever support to steering column, and move shift lever aside.

(*c*) Remove screws, nuts and washers attaching steering column support bracket to instrument panel, and lift steering column from splined stub shaft on steering gear.

(3) To remove the steering gear:

(*a*) Remove nut and washer, and pull tie rod end on drag link from tapered hole in pitman arm.

***Note*.**

It may be necessary to use a puller to separate tie rod end and pitman arm. Do not use a hammer on tie rod end, so threads will not be damaged.

(*b*) Disconnect and tag pressure and return hoses at steering gear. Cap hoses and plug ports in gear to keep out dirt.

(*c*) Remove screws and washers at gear mounting bracket, and take gear from truck.

b. Installation.

(1) To install the steering column:

(*a*) Hold steering gear in installed position, with flexible coupling engaged with gear stub shaft, and attach steering column to instrument panel with steering column support bracket. Tighten bolt in flexible coupling.

(*b*) Reinstall shift lever support on steering column, and reconnect horn wire at connector under instrument panel.

(2) To install the steering gear:

(*a*) Place steering gear in position at mounting bracket, entering stub shaft splines into flexible coupling, and install mounting screws and lock washers through bracket into gear.

(*b*) Carefully turn steering wheel to one extreme of travel, then counting the number of turns, turn it to the opposite limit. Now turn wheel to midpoint of travel (straight ahead travel position). Pitman arm should now be pointing straight down. If it is not, pull arm from sector gear shaft and reposition arm to point straight down with gear in straight ahead position.

(*c*) Install pressure and return hoses in gear, and attach drag link tie rod end to pitman arm with lock washer and nut. Replace truck floor plate, and road test operation of steering.

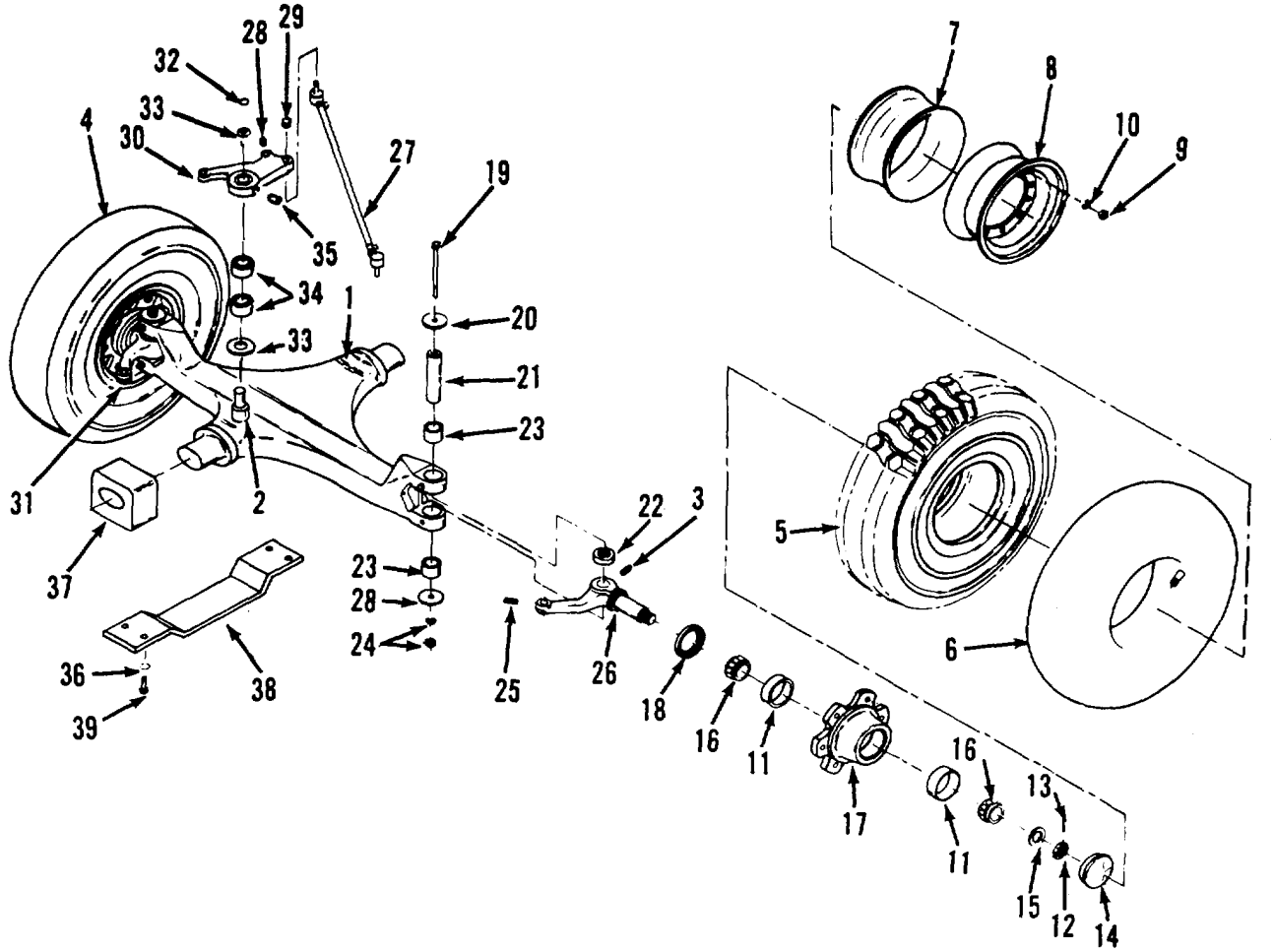
2-10. Steering Axle

a. Removal.

(1) Jack or hoist truck high enough to provide enough space in which to work. Block truck so it cannot fall after being raised.

(2) Disconnect drag link from steering axle.

(3) If rear axle is raised from ground, support it against falling when attaching parts are removed. Remove four screws (39, fig. 2-11), and washers (36), and support plate (38).



1. Steering axle
2. Shaft
3. Grease fitting
4. Tire & rim
5. Tire
6. Tube
7. Tire flap
8. Rim
9. Nut
10. Lock washer
11. Bearing cup
12. Nut
13. Cotter pin
14. Hub cap
15. Washer
16. Bearing cone
17. Hub
18. Oil seal
19. Bolt
20. Washer
21. Knuckle pill
22. Flat thrust roller bearing
23. Roller bushing
24. Nut and lock washer
25. Grease fitting
26. R. H. steering knuckle
27. Tie rod
28. Grease fitting
29. Nut and cotter pin
30. Bell crank lever
31. L. H. steering knuckle
32. Lock ring
33. Washer
34. Roller bushing
35. Grease fitting
;36. Lock washer
37. Axle block
38. Support plate
39. Capscrew

Figure 2-11. Steering axle, exploded view.

(4) Lower axle, or hoist truck to get clearance, and roll axle from beneath truck.

b. Installation. Reverse procedures in *a*. above

CHAPTER 3

REPAIR OF ENGINE

3-1. Description

The engine is a Continental FS162 engine. This is a four-cylinder L-head, water-cooled industrial unit. Since this basic engine is used in many applications by the army, direct and general support maintenance facilities can be expected to be somewhat familiar with it.

3-2. General

The following instructions cover repair of the engine through overhaul, and checks and measurements to decide if rebuild at depot level is necessary. This chapter does not give rebuilding instructions. Refer the engine to depot facilities for work beyond the general support capabilities. Minor repairs can be made with the engine in the truck; however, if major work is expected, remove the engine (para 2-6), and mount it on an engine work stand. After removing the electrical accessories steam clean the basic engine or use any method that will get it clean enough for visual inspection before disassembly.

3-3. Engine Repairs

Many of the repair jobs which follow, taken separately, can be done without removing the engine from the truck. However, should extensive maintenance be needed, it would be more practical to remove the engine before beginning repairs. The mechanic doing the work is in the best position to decide when engine removal is indicated. Procedures for specific jobs are given, as valve service, ring and bearing replacement, etc. No attempt is made to define or outline what constitutes an "overhaul" of the engine. All information required to put the engine back in good operating condition is given here. Refer to the troubleshooting chart table 2-2 to decide what repairs are needed. If any repairs needed are beyond locally available facilities or skills, refer the job to depot maintenance. In all cases observe the table of torque values to insure successful repairs.

3-4. Cylinder Head Removal, Cleaning, Inspection and Installation

Refer to TM 10-3930-627-12.

3-5. Valves and Related Components

a. Removal.

(1) Remove cylinder head, manifolds, and valve chamber cover, refer to TM 10-3930-627-12.

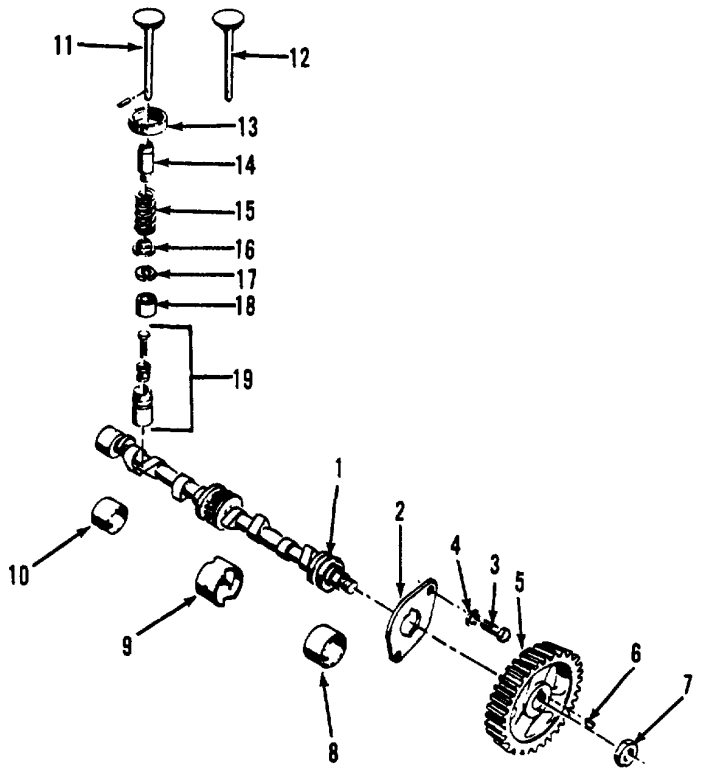
(2) Plug valve chamber oil return holes to prevent parts falling into oil pan.

(3) Rotate crankshaft until lowest point of lifter travel is reached. Using valve spring compressor, compress valve spring (15, fig. 3-1). Remove roto cap assembly (18) and valve locks (17). Release and remove valve spring compressor.

(4) Lift valves (11 and 12) out through top of cylinder block and tag them for installation in original positions.

(5) Remove valve springs and spring retainers (16) from the valve chamber.

(6) Remove tappets (19) from cylinder block. Tag tappets for replacement in holes from which they were removed.



ME10-3930-627-34/3-1

1. Camshaft
2. Thrust plate
3. Screw
4. Washer
5. Camshaft gear
6. Woodruff key
7. Nut
8. Front camshaft bushing
9. Center Camshaft bushing
10. Rear camshaft bushing
11. Intake valve
12. Exhaust valve
13. Exhaust seat insert
14. Guide
15. Spring
16. Spring retainer
17. Spring retainer lock
18. Roto cap assembly
19. Tappet assembly

Figure 3-1. Values and camshaft, exploded view.

b. Cleaning and Inspection.

(1) Clean carbon from valves with scraper or wire brush and wash in solvent. Clean valve guides (14) and ports with wire brush.

(2) Replace valves if the faces are badly cracked, scored, warped or burned. Reface valves and seats if slight evidence of these conditions exists. Intake valve seat angle is 30° and exhaust valve seat angle is 45°

(3) Test valve springs for loss of strength. A reusable valve spring will require at least 86 pounds force to compress it to 1 27/64 inch length. Inspect springs for cracks or breaks.

(4) Inspect valve stems for good condition and proper clearance in valve guides. Replace valve if stem is bent over 0.002 inch. If inside diameter of any guide is worn, to more than 0.0015 inch oversize, replace valve guide (step *c.* below).

(5) Inspect exhaust valve seat inserts (13). Replace inserts if loose or scored, or if they cannot be properly faced (step *d.* below).

(6) Inspect tappets for worn threads, scores, cracks and wear or pitting of the face.

(7) Examine adjusting screws for worn or damaged threads. Adjusting screws must be tight in tappets when turned with a wrench. Replace them if they are worn or damaged.

c. Valve Guide Replacement.

(1) Using a drift or piloted driver, drive old valve guide from the cylinder block (fig. 3-2).

(2) Using a piloted driver, drive new guide into the cylinder block. Drive guide until its top is 1 15/32 inch from the top of the block, as measured according to figure 3-3.

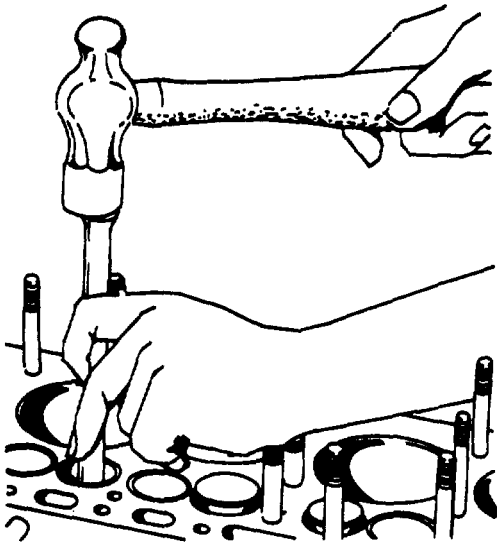


Figure 3-2. Removing valve guide.

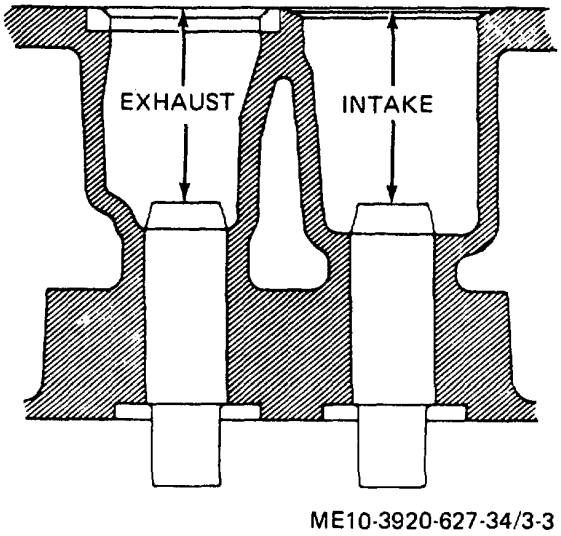


Figure 3-3. Locating valve guide depth.

d. Exhaust Valve Seat Replacement.

(1) Using a valve seat puller, remove exhaust valve seat inserts (13, fig. 3-1). Take care not to damage the seat counterbore.

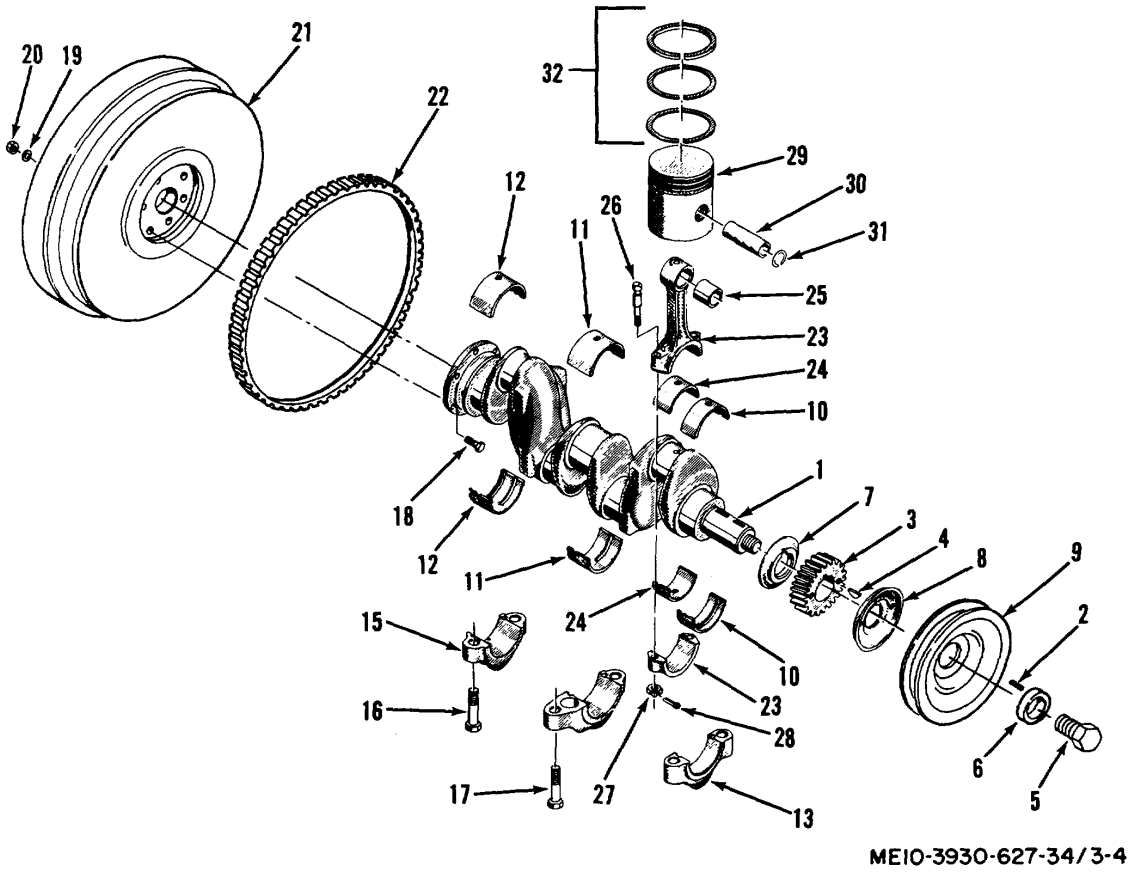
(2) Clean all carbon from the seat counterbore and valve port.

(3) Machine the counterbore to receive a seat 0.010 inch larger diameter than the seat removed, to a 0.003-0.005 inch press fit.

(4) After chilling the new seat in dry ice for not less than 20 minutes, quickly drive seat into counterbore with seat driving tool. If special tool is not available, tap seat into place.

(5) Grind exhaust valve seat to a 45° angle.

(6) All valves having less than 50 percent margin thickness at outer edge of valve seat after refacing must be replaced. Compare refaced valve with a new one to determine if thickness is less than 50 percent.



1. Crankshaft
2. Keyway plug
3. Crankshaft timing gear I
4. Key
5. Crankshaft screw
6. Crankshaft pulley washer
7. Thrust plate
8. Oil slinger
9. Pulley
10. Front main bearing
11. Center main bearing
12. Rear main bearing
13. Front main bearing cap
14. Center main bearing cap
15. Rear main bearing cap
16. Bolt
17. Bolt
18. Flywheel bolt
19. Lock washer
20. Nut
21. Flywheel assembly
22. Ring gear
23. Connecting rod assembly
24. Rod bearing
25. Piston pin bushing
26. Bolt
27. Nut
28. Cotter pin
29. Piton
30. Piston pin
31. Retaining ring
32. Piston ring set

Figure 3-4. Crankshaft and related parts, exploded view.

(7) After valves and seats have been refaced, check the width of the valve face contact with the seat. The width should be 1/16 to 3/32 inch. If the width of the contact surface exceeds 3/32 inch, the seat in the block may be narrowed by using a 15° stone to reduce the outside diameter or a 75° stone may be used to increase the inside diameter in the valve seat.

e. Installation. Reverse procedure in step *a*. above.

f. Adjust Valves. Refer to TM 10-3930-627-12.

3-6. Crankshaft Pulley

a. Removal.

(1) Remove screw (5, fig. 3-4) and washer 16).

(2) Remove pulley (9), using a puller

carefully, if it does not come off readily, and remove keyway plug (2).

b. Installation. Reverse the procedures in a. above.

3-7. Timing Gear Cover, Camshaft Gear, and Crankshaft Gear

a. Removal.

(1) Remove engine from truck (para 2-6*a*.).

(2) Remove hydraulic pump from engine, (para 12-3).

(3) Remove governor and linkage from engine, (para 4-3).

(4) Remove fan drive belt, (TM 10-3930-627-12) and crankshaft pulley, (para 3-6).

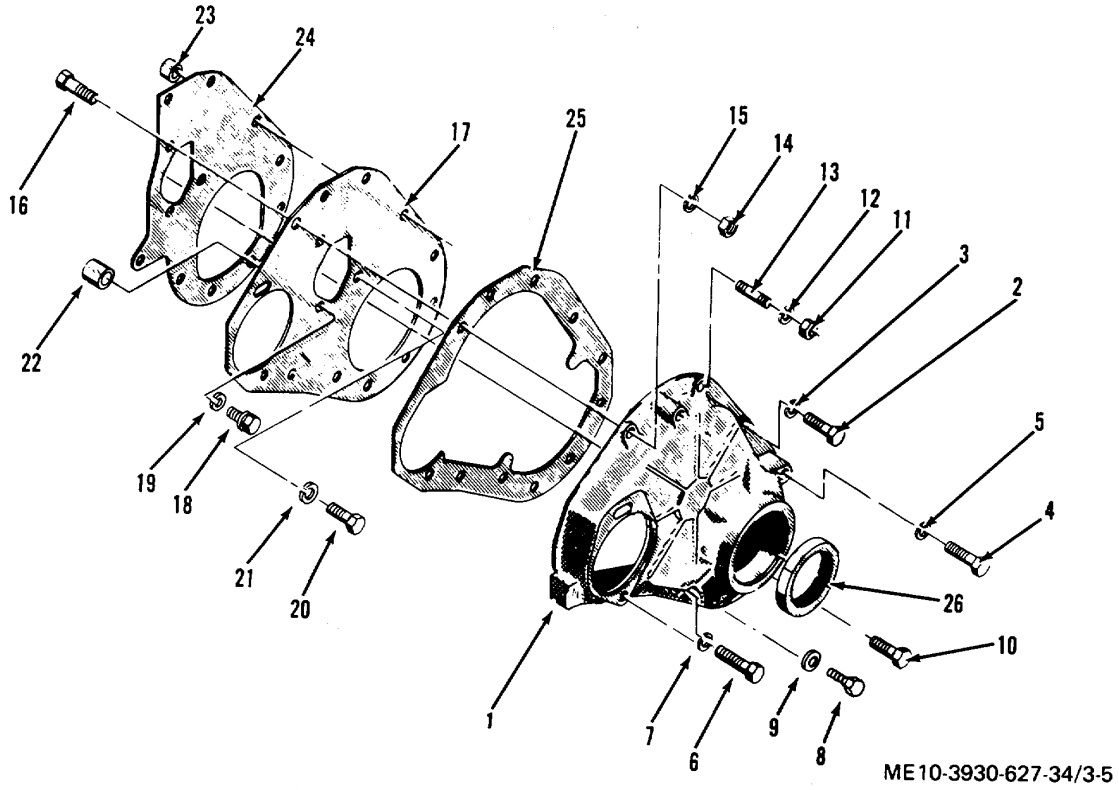
(5) Remove screws and washers from the timing gear cover (1, fig. 3-5), paying particular attention to the location of the screws as each must be replaced in the same hole.

(6) Remove the timing gear cover from the block.

(7) Remove the nut (7, fig. 3-1) from the camshaft (1).

(8) Using a suitable puller, remove timing gear (5) from the camshaft. Remove the key (6) from the camshaft. Remove two screws (3) and lock washers (4) and remove camshaft thrust plate (2) from block. Remove end plate (17, fig. 3-5) from block.

(9) Using suitable puller, remove crankshaft gear (3, fig. 3-4}, then remove gear key (41 and thrust plate (7) from crankshaft.



1. Timing gear cover
2. Screw
3. Lock washer
4. Screw
5. Lock washer
6. Screw
7. Flat washer
8. Screw, assembled washer
9. Flat washer
10. Screw, assembled washer
11. Nut
12. Lock washer
13. Stud
14. Nut
15. Lock washer
16. Screw, assembled washer
17. End plate
18. Screw
19. Lock washer
20. Screw
21. Lock washer
22. Dowel ring
23. Dowel ring
24. Gasket
25. Gasket
26. Seal

Figure 3-5. Timing gear cover.

b. Inspection and Repair.

(1) Inspect cover for dents, cracks or breaks.

(2) Examine the cover on a surface plate. If warping is evident, resurface the cover.

(3) Inspect gears for worn or damaged teeth. Replace defective gears.

(4) Repair damaged threads with a proper size tap.

(5) Inspect camshaft thrust plate for scoring and wear. Replace with new thrust plate, if either indication shows.

c. Installation. Brace camshaft and tap or press gear into place. Do not use nut to draw gear onto shaft. When installing camshaft gear, remove fuel pump and hold camshaft with a pry bar or heavy screwdriver to prevent driving expansion plug out of block.

(1) Using new gaskets and seals, install fuel pump and reverse procedure a. above and perform steps (2) through (6) below.

(2) Align timing marks on gears as shown in figure 3-6.

(3) Be sure correct (thin headed) cap screws are used on camshaft thrust plate.

(4) Be sure timing cover mounting screws are correct length for hole in which installed.

(5) Torque camshaft nut to 85 to 90 foot-pounds.

(6) Using a dial indicator, check end play of camshaft (fig. 3-7). Clearance should be 0.005 to 0.009 inch.

(7) Tune engine as necessary.

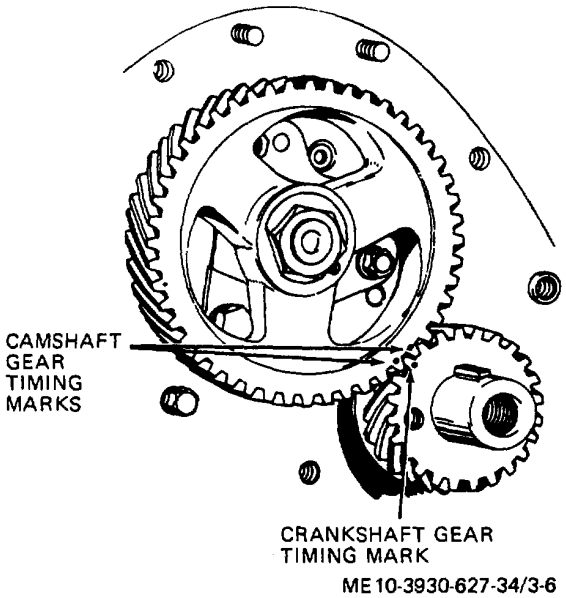


Figure 3-6. Timing valves to camshaft.

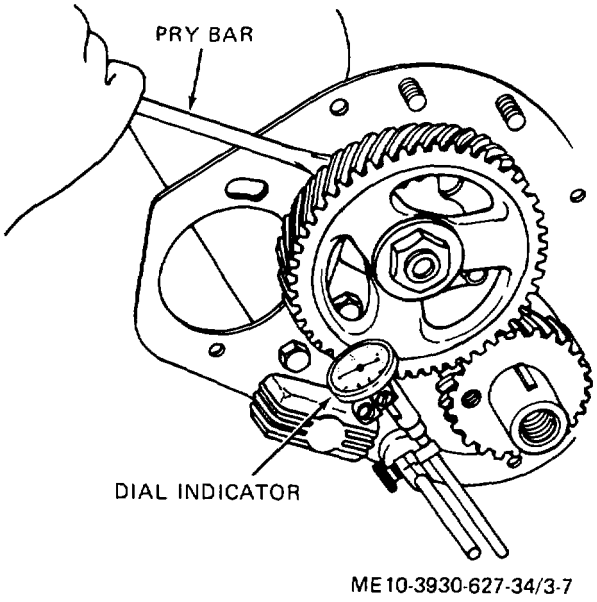


Figure 3-7. Measuring camshaft end play.

3-8. Flywheel, Ring Gear and Flywheel Housing

a. Removal and Disassembly.

(1) Remove the engine from the truck, (para 2-6 *a*.) Remove torque converter from flywheel. (para 2-7).

(2) Remove nuts (20, fig. 3-4), and lock washers (19) that secure flywheel (21) to engine crankshaft (1).

(3) Mark flywheel for reinstallation and remove flywheel from crankshaft by use of jack screw s.

(4) Drill and chisel ring gear (22) from flywheel only if necessary to replace ring gear.

(5) Support engine and remove cap screws and lock washers that secure flywheel housing to engine block.

b. Cleaning and Inspection. Ring gear can be inspected on truck by removing starting motor.

(1) Clean all parts in solvent and dry thoroughly.

(2) Inspect ring gear for cracks, broken or worn teeth.

c. Assembly and Installation.

Caution:

Be sure to heat the ring gear evenly at all points and do not allow the temperature to exceed 400° F. If the ring gear is heated unevenly, it may crack; and if the temperature exceeds 400° F, the temper in the ring gear might be destroyed.

(1) To assemble the ring gear to the flywheel, heat the ring gear evenly to a maximum temperature

of 400° F (bluish color) and install ring gear on the rim of the flywheel. Be sure beveled side of teeth is installed on correct side, so starter drive can enter.

(2) Flywheel installation. Reverse removal procedure in step a. above and torque flywheel nuts to 35 to 40 foot-pounds.

(3) To be sure that crankshaft flange has not been sprung or otherwise damaged or that counterbore in the flywheel, which locates it on crankshaft, is not damaged, mount an indicator on the flywheel housing (fig. 3-8) and check the flywheel for runout.

Note.

When checking runout, remove spark plugs to allow engine to be turned over freely.

(4) The indicator should be mounted to housing so that it contacts the face of the flywheel, then turn the flywheel at least one full revolution, at the same time holding against the crankshaft to offset the possibility of end play.

(5) Excessive runout of the flywheel (in excess of 0.008 inch) is probably caused by dirt in, or dam age to, counterbore locating the flywheel on the crankshaft flange.

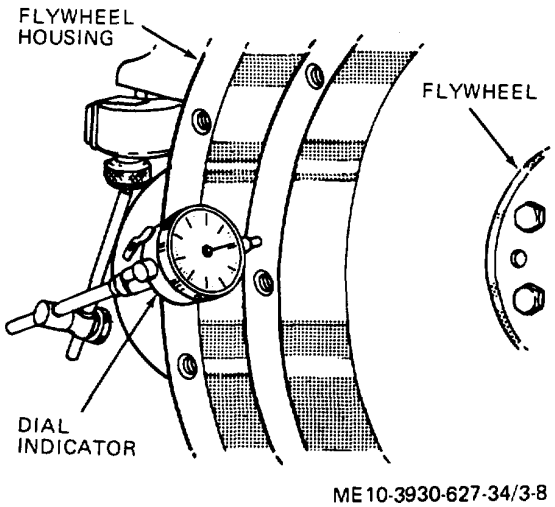


Figure 3-8. Checking flywheel runout.

3-9. Oil Pan

To properly install a complete set of pan gaskets and timing cover plate gasket, it will be necessary to remove the engine. The timing gear cover plate cannot be removed for replacement of the timing cover plate gasket unless the engine is removed from the truck. For this reason maintenance of oil pump, pistons, rods, and crankshaft bearings is normally performed with engine removed from truck.

a. Removal (oil pan).

(1) Drain oil, and remove engine from truck, (para 2-6 *a*.)

(2) Remove timing gear cover. Paragraph 3-7 *a*. (1) thru (8).

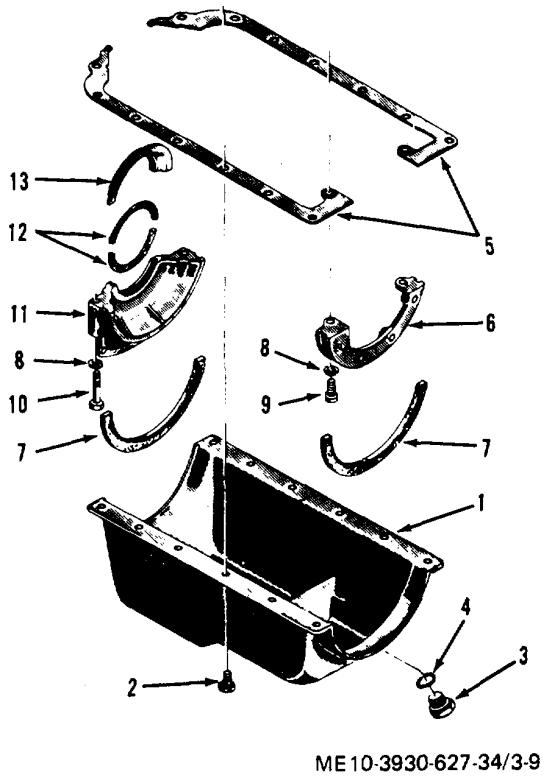
(3) Remove attaching screws (2, fig. 3-9) and remove oil pan. Scrape old gasket remains from pan and block.

(4) Remove screws (9) and front filler block (6), and filler block gasket (7).

(5) Remove screws (10) and rear filler block (11) and gasket (7). Remove half of seal (12) from filler block. Remove gaskets from engine block.

(6) Remove oil guard (13) by pushing it around crankshaft and out of engine block. Remove other half of seal (12) from oil guard. Discard all used gaskets and seals.

b. Cleaning. Clean oil pan and filler block with solvent and remove sludge and carbon from oil pan. Steam cleaning or a vapor degreaser will do a good job.



1. Oil pan
2. Scew and lock washer
3. Magnetic plug
4. Plug gasket
5. Oil pan gasket
6 Front filler block
7. Filler block gasket
8. Lock washer
9. Front block screw
10. Rear block screw
11. Rear filler block
12. Rear block seal
13. Rear block oil guard

Figure 3-9. Oil pan and seals, exploded view.

c. Inspection.

(1) Inspect oil pan and filler blocks for cracks and deep dents. Straighten or weld pan as necessary. If filler blocks are damaged they must be replaced, as they are machine fits.

(2) Inspect drain plug threads. Also check oil drain threaded insert for security. If it is loose, braze it in position.

(3) Place oil pan on a surface plate in inverted position, and inspect for warp that might cause leaks. Smooth uneven surfaces by hammering, grinding or filing.

d. Installation. (Use all new gaskets and seals).

(1) Remove any nicks and burrs from oil guard and lubricate it for ease of installation.

(2) Install seal half (12) in oil guard.

(*a*) New crankshaft seal is approximately one-third larger in diameter than width of groove in filler block and oil guard. Seal must be flattened enough to allow it to be pressed into groove.

(*b*) After installing seals in grooves, use rounded, smooth tool to iron packing into grooves so that it seats firmly.

(*c*) Use sharp knife or razor blade to trim protruding ends of packing to approximately 1/32 inch, making cuts parallel to surface of castings.

(3) Other half of seal is installed in rear filler block in same manner.

(4) Install oil guard by placing on crankshaft and pushing into groove. (Rotating crankshaft will aid in positioning seal).

(5) Install timing gear cover plate, camshaft gear, and timing gear cover.

(6) Place oil pan gaskets in position.

(7) Install front filler block. Tighten filler block to engine crankcase first, then tighten to timing gear cover. Be sure timing cover mounting screws are correct length for hole in which installed.

(8) Install rear filler block; tighten to crankcase first, then tighten to flywheel housing.

(9) Install front and rear filler block seals.

(10) Complete installation of governor and hydraulic pump.

(11) Install oil pan gasket on pan. Cement gasket in position or tie it with fine thread at several places and install pan. Torque screws evenly to 12 to 16 foot-pounds.

(12) Install engine by reversing the removal procedure.

3-10. Oil Pump and Screen

a. Removal. Clearly mark position of distributor rotor tip on housing before removing pump. Rotor must be in this position on completion of installation of the pump so ignition timing will not be disturbed.

(1) Remove the oil pan. (para 3-9).

(2) Remove nut (21, fig. 3-10) and lock washer (20) and remove the oil pump from the stud (19).

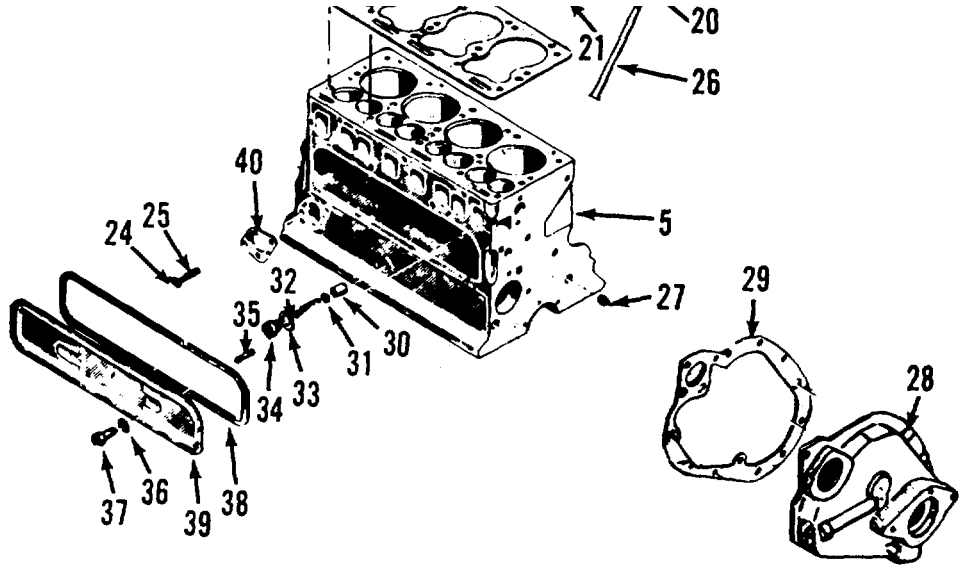
(3) Remove the screen-attaching wire and remove oil screen (18) from the pump base. When reassembling the screen to the pump base be certain that the plate in the screen is over the end of the pick-up pipe in the oil pump.

ME 10-3930-627-34/3-10

1. Body
2. Body bushing
3. Oil pump drive gear
4. Drive gear pin
5. Drive shaft
6. Key
7. Driven gear
8. Idler gear
9. Idler gear stud
10. Snap ring
11. Gasket
12. Oil pump cover
13. Screw
14. Lock washer
15. Cover to screen frame gasket
16. Screen frame
17. Spacer
18. Screen assembly
19. Body to gearing cap stud
20. Lock washer
21. Stud nut
22. Drive shaft (in crankcase) bushing

1. Body
2. Body bushing
3. Oil pump drive gear
4. Drive gear pin
5. Drive shaft
6. Key
7. Driven gear
8. Idler gear
9. Idler gear stud
10. Snap ring
11. Gasket
12. Oil pump cover
13. Screw
14. Lock washer
15. Cover to screen frame gasket
16. Screen frame
17. Spacer
18. Screen assembly
19. Body to gearing cap stud
20. Lock washer
21. Stud nut
22. Drive shaft (in crankcase) bushing

Figure 3-10. Oil pump, exploded view.



ME10-3930-627-34/3-11

1. Screw
2. Screw
3. Gasket
4. Washer
5. Cylinder block
6. Cylinder head
7. Pipe plug
8. Stud
9. Distributor drive shaft
10. Water outlet elbow
11. Nut
12. Lock washer
13. Pipe plug
14. Thermostat adapter ring
15. Thermostat
16. Gasket
17. Stud
18. Oil filler cap
19. Oil filler tube
20. Bushing
21. Drain cock
22. Oil gage rod
23. Oil gage support brace
24. Screw
25. Lock washer
26. Oil gage support
27. Ring dowel
28. Gear cover
29. Gear cover gasket
30. Oil pressure relief valve
31. Adjusting washer
32. Relief valve spring
33. Gasket
34. Relief valve plug
35. Stud
36. Gasket
37. Nut
38. Valve cover assembly
39. Gasket
40. Fuel pump gasket

1. Screw
2. Screw
3. Gasket
4. Washer
5. Cylinder block
6. Cylinder head
7. Pipe plug
8. Stud
9. Distributor drive shaft
10. Water outlet elbow
11. Nut
12. Lock washer
13. Pipe plug
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16. Gasket
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19. Oil filler tube
20. Bushing
21. Drain cock
22. Oil gage rod
23. Oil gage support brace
24. Screw
25. Lock washer
26. Oil gage support
27. Ring dowel
28. Gear cover
29. Gear cover gasket
30. Oil pressure relief valve
31. Adjusting washer
32. Relief valve spring
33. Gasket
34. Relief valve plug
35. Stud
36. Gasket
37. Nut
38. Valve cover assembly
39. Gasket
40. Fuel pump gasket

Figure 3-11. Engine block and related parts exploded view.

b. Cleaning and Inspection.

(1) Clean oil pump parts and screen with solvent and brush.

(2) Inspect pump gears and drive shaft. If pump is defective, install a new pump.

(3) Inspect screen for holes and clean mesh. If the mesh is defective, replace the screen with a serviceable one.

(4) Thoroughly wet all parts of the pump with clean engine oil prior to installation to ensure that pump will operate immediately when starting engine.

c. Installation. Reverse step *a*. above. If pump drive slot does not engage distributor without turning rotor, reengage gear teeth in different positions until oil pump is installed without changing ignition timing.

3-11. Oil Pressure Relief Valve

a. Removal.

(1) Remove muffler and manifolds with carburetor.

(2) Remove relief valve plug (34, fig. 3-11), with gasket (33), from engine block (5). Remove gasket from plug.

(3) Remove the adjusting washer (31) (if there is one) from the plug.

(4) Remove the spring (32) and valve (30) from the port in the engine block. Remove washer from valve (if there is one).

b. Cleaning. Clean all metal parts in solvent and dry with compressed air or clean lint-free cloth.

c. Inspection. Inspect the valve for scoring or pitting. Inspect the spring for distortion.

d. Installation. Reverse step a. above, adding or removing washers or installing new spring to obtain desired pressure setting. Up to four washers are permitted. The oil pressure relief valve setting is 25 to 35 psi with the engine oil at normal operation temperature at governed speed.

3-12. Pistons, Connecting Rods and Rod Bearings

a. Description. Each piston has two compression rings and two oil rings. The full floating piston pins are held in place by retaining rings. The connecting rods use babbitt lined sleeve bearing pairs. The connecting rods and the connecting rod bearing caps are matched and numbered. Numbered sides must face the camshaft when reinstalled. Never reverse or exchange bearing caps.

b. Removal. To service pistons, rod and cylinders, the engine need not be removed from the truck.

(1) Remove the oil pan. Paragraph 3-9 *a*. as applicable.

(2) Remove the cylinder head from the engine block, (TM 10-3930-627-12).

(3) Using a ridge reamer (fig. 3-12), remove the ridge from inside the top of the cylinder bore.

Note.

Ridge must be completely removed before trying to remove pistons to avoid breaking rings and the piston lands between ring grooves; however, do not cut deeper than worn part of cylinder wall.

(4) Turn crankshaft throws to lowest points, and remove cotter pins (28, fig. 3-4) and nuts (27) from the connecting rod bolts (26) and remove the lower bearing caps and bearing halves (24) from the connecting rods (23).

(5) Push the connecting rods and pistons out of the top of the cylinder bore.

(6) Temporarily install the connecting rod bearing caps on the connecting rods from which they were removed.

(7) Using a ring spreader, remove the piston rings (32) from the pistons (29), or simply break rings off, if they will not be reused.

(8) Remove the piston pin retaining rings (31) and remove the pins from the pistons, separating the connecting rods from the pistons. Press the bushings (25) from the connecting rods, using new bushings (fig. 3-13), which will result in installing new bushings in one operation.

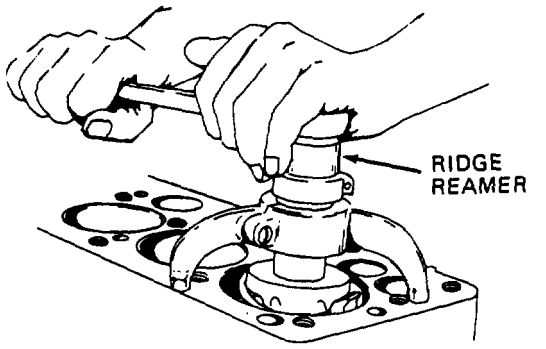


Figure 3-12. Reaming ridge from cylinder.

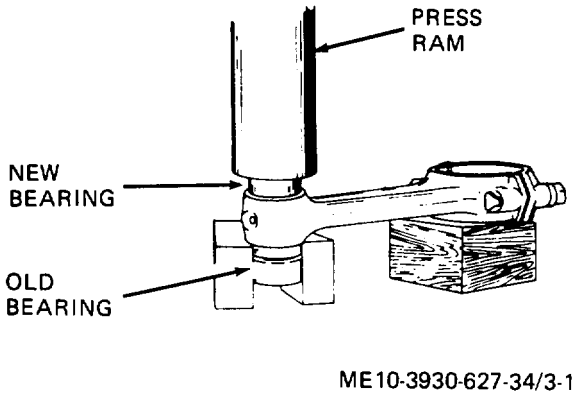


Figure 3-13. Rebushing connecting rods.

c. Cleaning.

(1) Soak pistons in solvent and remove carbon from the tops and from ring grooves of the pistons.

(2) Using a drill or probe of the proper size, clean carbon from the oil return holes in the oil ring grooves.

(3) Clean the oil groove passages in the connecting rods and caps.

d. Piston Fit. Fit the pistons clean and dry. To fit the pistons to the cylinder bore properly, use a spring scale and a feeler ribbon 1/2 inch wide, 10 inches long, and 0.003 inch thick (fig. 3-14). Insert the feeler ribbon full length into the cylinder bore, about halfway down. Hook the spring scale into the end of the feeler ribbon and pull the feeler ribbon from the cylinder. If the fit is correct, the scale should register 5 to 10 pounds pull.

e. Piston Pin Fit. Check the fit of the piston pin in the piston and the connecting rod. The piston pin should be a thumb-push fit in the piston pin bushing and a palm-push fit in the piston bosses. Heat the piston to at least 160° F in hot water to let the pin enter it readily at final assembly. Then pin can be tapped easily through rod bushing. If the piston pins or bushings are worn, they must be replaced with standard size pins and bushings. If the piston bosses are worn, the piston must be replaced.

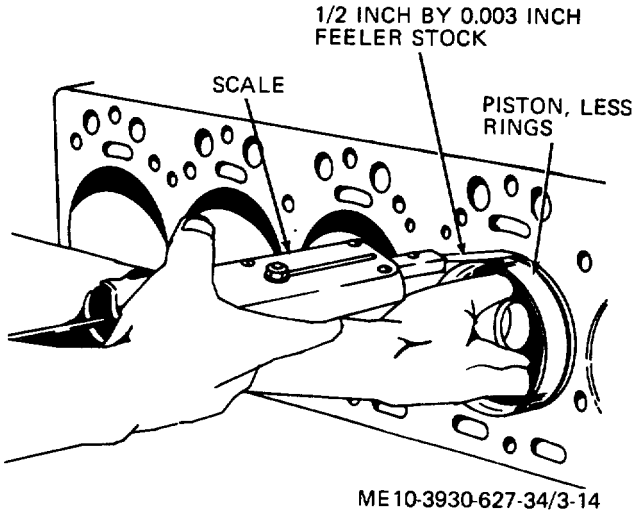


Figure 3-14. Testing piston fit in cylinder.

f. Piston Ring Installation.

(1) Always install new piston rings during an overhaul of the engine. Replacement rings are available in standard size, in 0.020 inch oversize, and in 0.040 inch oversize. Oversize ring sets are to be used only in rebored engines.

(2) To determine whether the ring has the proper end gap, place it in the cylinder, pushing it about halfway down in the cylinder bore. With the ring square with the cylinder bore (use a piston to straighten the ring in the cylinder), measure the gap between the ring ends with a feeler gage (fig. 3-15). The ring gap for all rings is 0.010 to 0.020 inch. If the gap is less than the minimum specified, remove the ring and dress ends with a fine-cut mill file until correct clearance is obtained.

(3) Measure the side clearance of the piston rings in the grooves with a feeler gage. The gap should be 0.002 to 0.004 inch for compression ring. Scraper ring gap is 0.0015 to 0.003 inch and gap for oil rings is 0.001 inch to 0.003 inch. If clearance is less than minimum specified, remove ring from piston and rub the ring lightly on piece of fine emery cloth (laid on flat surface) until proper clearance is obtained.

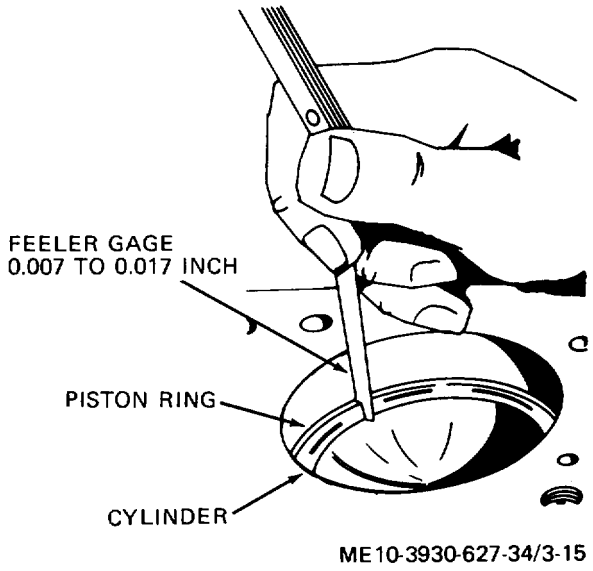


Figure 3-15. Measuring piston ring end gap.

g. Connecting Rod Alignment.

(1) Install piston pin in connecting rod and place connecting rod on aligning fixture. Install connecting rod bearing cap on connecting rod.

(2) Pin should touch measuring bar on aligning fixture at both ends. Straighten slightly bent or twisted connecting rods. Maximum bend or twist may not exceed 0.002 inch over 4 inch spread of length of the connecting rod.

h. Connecting Rod Bearing Installation.

(1) Connecting rod bearings that are scored, burned, or worn must be replaced by new ones. Replacement bearings require no reaming or fitting.

(2) Install the piston with connecting rod and with upper half of connecting rod bearing installed, but without piston rings, in the cylinder bore. Coat a piece of 0.002 inch feeler stock, approximately 1/2 inch wide and 1 inch long, with oil and place it between the lower connecting rod bearing half and crankshaft journal (fig. 3-16). Install connecting rod bearing cap and tighten nuts to 35 to 40 foot-pounds torque. Try to rotate crankshaft one full turn by hand. If slight consistent drag is felt, the clearance is correct. If the crankshaft turns freely, it will be necessary to measure crankshaft journal for taper or out-of-round. If taper or out-of-round exceeds 0.001 inch, replace crankshaft, or grind to next standard undersize, and use corresponding undersize bearings.

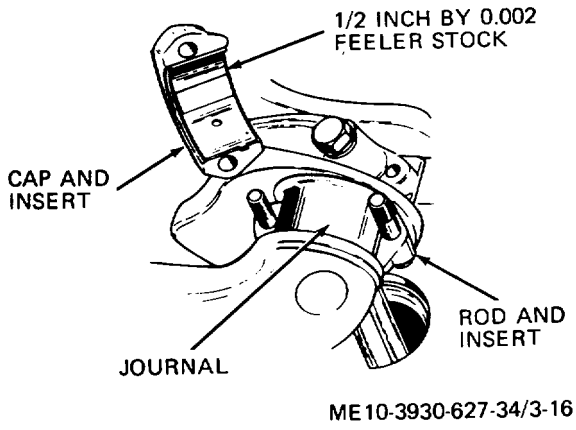


Figure 3-16. Checking connecting rod bearings.

i. Installation.

(1) It is important to remove glaze on cylinder bore to assure quick seating of piston rings.

(*a*) Cover crankshaft journals with clean cloth to prevent dirt and abrasives from getting on crankshaft.

(*b*) Surface hone cylinder bores with glaze breaker to break glaze and produce dull finish in bore. Clean glaze breaker between use in each cylinder bore to reduce amount of loose abrasives released in bore.

(*d*) Clean cylinder bores thoroughly with clean oiled rag to pick up any abrasive that might be left in bore. Follow this with clean cloth to assure that walls are clean.

(2) Install oil rings and compression rings on piston with ring expander tool. Start with lowest ring first. Make sure that tapered side of compression ring (look for work "TOP" on surface) is up. Make sure that the ring gaps are equally spaced about circumference of the piston, not in vertical alignment.

(3) Oil cylinder wall and generously coat piston and rings with engine oil to insure initial lubrication when engine is first started after repair work.

(4) Install ring compressor on piston and compress rings into grooves. Tap compressor lightly around circumference of piston to allow rings to seat evenly in grooves.

(5) Put a light coat of oil in the crankshaft end of the connecting rod and install upper half of connecting rod bearing, making certain that the bearing lock fits in the machined groove in the rod. Apply a light coat of oil to the bearing half and install the piston and connecting rod in the cylinder bore (fig. 3-17). Be very careful not to damage the cylinder bore with the connecting rod big end when installing pistons.

(6) Connecting rods are numbered according to cylinder bore in which they must be installed. Number one cylinder is at the fan end of the engine. Oil squirt hole in rod should be installed toward camshaft side of engine. Crankshaft journal should be at bottom dead center of cylinder bore in which piston and rod is being installed. Use a hammer handle to force piston through compressor into cylinder bore. While forcing piston into bore, ring compressor must be kept tight against cylinder block to prevent damage to piston rings as they enter bore.

(7) Apply a light coat of oil to connecting rod bearing cap and install lower half of the connecting rod bearing in cap, making certain that bearing lock fits in machined notch of rod. Apply a light coat of oil to bearing and install bearing cap and bearing on connecting rod. Tighten nuts to 35 to 40 foot-pounds torque. Install cotter pins in nuts.

(8) Complete installation of pistons. Before replacing the engine head, squirt a few drops of oil around edges of pistons to help lubricate rings when starting engine.

(9) Complete installation by reversing removal procedure.

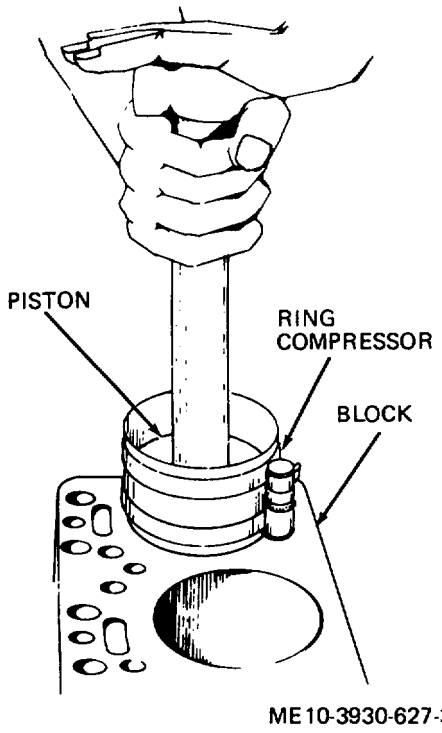


Figure 3-17. Installing pistons with ring compressor.

3-13. Crankshaft and Bearings

a. Replacement of Crankshaft Bearings. Crankshaft (main) bearings can be replaced without removing the engine, if shaft does not have to be removed. However, it is usually recommended seals and gaskets be replaced at this time (which would require engine removal) if engine has had long service without major maintenance. In this case remove engine first to make entire job easier.

(1) Remove the oil pump. (para 3-10.)

(2) Mark the bearing caps (13, 14, and 15, fig. 3-4) for correct installation. These caps are not interchangeable, nor are they to be reversed side for side at installation.

***Note*.**

To keep crankshaft supported, if engine is not removed, one pair of bearings should be replaced at a time, leaving bearing cap screws snug but not tight when installing until all bearings are replaced.

(3) Remove safety wire from main bearing cap screws and remove cap screws and caps from engine block.

(4) Remove bearing halves (10, 11 and 12) from caps.

(5) Insert bearing removing tool or flat head rivet, with head thickness less than that of bearing shell, into oil hole in the crankshaft journal. Rotate crankshaft so that tool or rivet forces upper bearing half out of engine block. Make certain to rotate crankshaft in proper direction so that bearing lock is pushed out of notch in engine block.

(6) Coat new bearing half with engine oil and insert in same manner as old bearing half was removed.

(7) Coat lower bearing half with engine oil and insert in bearing cap.

(8) Install bearing cap following procedure in step *b.* below to check clearances. After clearance is checked, leave cap screws loose so other bearings may be accurately checked.

(9) Replace remaining bearings in same manner.

***Note*.**

Be sure thrust side of center (flanged) main bearing lower half is flush with thrust side of upper half, then check crankshaft end play (fig. 3-18). End play should be 0.002 to 0.006 inch.

(10) Torque main bearing cap screws to 85 to 95 foot-pounds. Safety wire front and rear main bearing cap screws.

(11) Mount oil pump to block. (para 3-10*c*.)

(12) Safety wire center main bearing cap screws after pump installation.

(13) Install oil pan and seals (para 3-9).

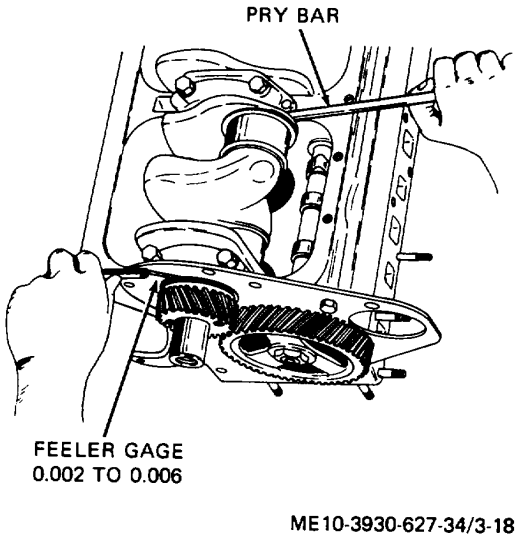


Figure 3-18. Checking crankshaft end play.

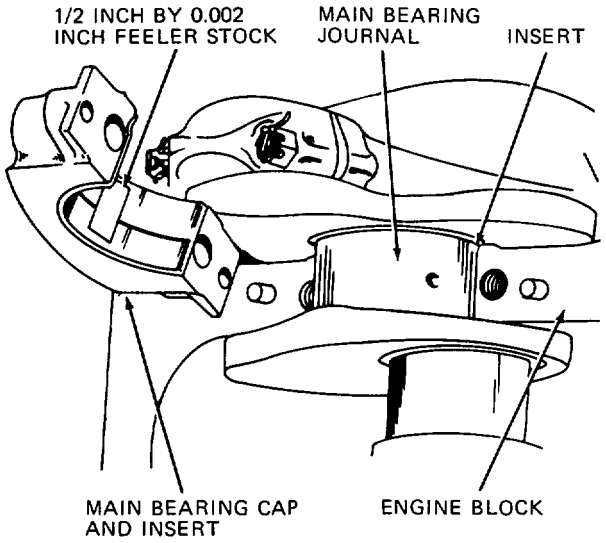


Figure 3-19. Checking main bearing fit.

b. Clearance. The crankshaft bearing clearance should be checked as follows after new bearing halves have been installed or when engine performance (crankshaft knock or low oil pressure) indicates need for such a check.

(1) Remove bearing cap and place a piece of 0.002 by 1/2 by 1 inch shim stock in bearing cap (fig. 3-19).

(2) Install bearing cap and tighten to 85 to 95 foot-pounds torque. If crankshaft rotates with noticeable drag, clearance is correct.

(3) Clearance may be checked by plastigage method if plastigage and special measuring scale are available. If this method is used, do not rotate crankshaft with plastigage in place.

Note.

Be sure center main thrust bearing lower half is flush with upper half on thrust side, then check crankshaft end play. End play should be 0.002 to 0.006 inch.

c. Removal of Crankshaft

(1) Remove the engine. (para 2-6 *a.*)

(2) Remove engine flywheel and flywheel housing. (para 3-8.) Remove the oil pump. (para 3-10.)

(3) Remove timing gear cover, cover plate and crankshaft gear. (para 3-7.)

(4) Remove the pistons from the engine block. (para 3-12 *b*.)

(5) Mark and remove crankshaft bearing caps (step *a*. (2) above) and remove bearings from caps.

(6) Remove crankshaft and remove upper bearing halves.

d. Cleaning. Clean all parts with solvent and dry them thoroughly. Use a soft wire probe to clean all oil passages.

e. Inspection and Repair of Crankshaft.

(1) Inspect crankshaft journals and bearings for excessive wear, taper, out-of-round, with a micrometer, and visually for scoring and other damage. See tabulated data for minimum allowances for bearings and journals.

(2) Inspect crankshaft gear for cracks or tooth damage. Replace gear if defective.

(3) When installing new or reconditioned crankshaft, also install new main and connecting rod bearings.

(4) Check crankshaft end play (fig. 3-18) with thrust plate, gear and pulley in place and bolt torqued.

f. Installation of Crankshaft. Reverse procedure in step *c* above, observing the following:

(1) Install oil guard before installing crankshaft.

(2) Be sure center main bearing lower half is flush with upper half on thrust side, then check end play (fig. 3-18).

(3) Install safety wire on center main bearing cap screws after pump is installed.

(4) Time crankshaft and camshaft gears (fig. 3-6).

(5) Check bearing clearance, *b*. above.

3-14. Camshaft and Bearings

a. Removal.

(1) Remove the engine from the truck (para 2-6 *a*)

(2) Remove the distributor from the engine.

(3) Remove valves and tappets. (para 3-5 *a.)*

(4) Remove oil pump. (para 3-10 *a.).*

(5) Remove timing gear cover and related parts. (para 3-7 *a)*

(6) Remove fuel pump.

(7) Using a puller, remove the cam and crank gears.

(8) Remove camshaft thrust plate (2, fig. 3-1).

(9) Use a feeler gage to check the clearance between the camshaft (1) journals and the camshaft bushings (8, 9, and 10). Correct clearance is 0.002 to 0.004 inch for all bushings. Replace all camshaft bushings if clearance of any exceeds this clearance.

(10) Remove camshaft through front of engine block, being careful not to damage lobes or camshaft bushings.

(11) Remove flywheel and flywheel housing from engine, and remove expansion plug from rear of engine in order to gain access to rear camshaft bushing if it must be replaced.

(12) Remove camshaft bushings from engine block with driver.

b. Cleaning, Inspection and Repair.

(1) Clean all metal parts in solvent and dry thoroughly.

(2) Inspect camshaft journals and lobes for wear, breaks, rough spots and other damage. Camshaft must be replaced if lobes or journals are damaged.

(3) Measure camshaft journals with a micrometer. Specified journal diameters are as follows: front, 1.8715 to 1.8725 inches; center 1.7455 to 1.7465 inches; rear, 1.2465 to 1.2475 inches. The wear limit on all journals is 0.002 inch less than minimum original size.

(4) Replace defective parts.

c. Installation.

(1) Apply a light coat of oil to bushings and install them in engine block. New bushings require no reaming, only care in installation. Line up oil holes in bushings with oil passages in block.

(2) Install thrust plate and check camshaft end play. It should be between 0.005 and 0.009 inch.

(3) Install the timing gears, being careful to line up the marks on the gears (fig. 3-6).

(4) Complete installation by reversing necessary procedure in step *a.* above.

3-15. Cylinder Block

a. Removal. Remove engine from the truck. (para 2-6 *a.*) Strip engine down to bare block by removing remaining accessories, (TM 10-3930-627-12,) crankshaft, paragraph 3-13*c*, and camshaft, paragraph 3-14 *a*.

b. Cleaning, Inspection and Repair. Follow procedure in step *a.* above and then proceed as follows:

(1) Remove gasket residue from cylinder block.

(2) Remove dirt, carbon and sludge.

(3) Remove plugs and clean oil and water passages.

(4) Clean block with steam or a vapor degreaser and dry with compressed air.

(5) Inspect block for cracks or damage.

(6) Inspect expansion plugs for good condition and tight seal, and replace plug if necessary.

(7) Examine machined surfaces for scratches, nicks, burrs or similar damage.

(8) Examine all threaded holes and retap any that are stripped or damaged.

(9) Install new studs when old ones are bent or found with damaged threads.

(10) Inspect cylinder bores while holding a light at the bottom of each bore. If rust pits are evident, or if bores are deeply scratched or scored, send block to depot for reboring.

(11) Rotate dial indicator in cylinder or measure bore with inside micrometer, and observe and record largest and smallest indications (fig. 3-20). The difference between the indications is the amount of out-of-round. Move dial indicator or micrometer up and down in cylinder and note largest and smallest indications. The difference between indications is the amount of taper of the cylinder. If out-of-round or taper exceeds 0.004 inch or if overall wear exceeds 0.008 inch, have a depot facility rebore cylinder walls and install oversize pistons and rings.

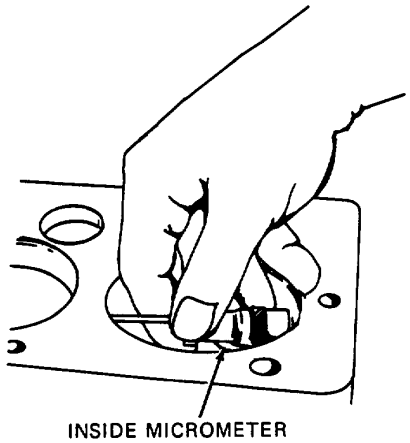


Figure 3-20. Measuring cylinder bore.

3-16. Water Pump, Removal, Inspection and Installation

3-17. Cooling System Maintenance

a. General Information. Engines are shipped with a cooling system protector pellet in the water outlet header, which should not be removed, but allowed to dissolve in the cooling system. This pellet is a film covered cartridge, all of which completely dissolves in the cooling water with proven results as a water conditioner and rust inhibitor. It can be used with all types of antifreeze during cold weather operation. The appearance of rust in the radiator or coolant is a warning that the corrosion inhibitor has lost its effectiveness and the system should be cleaned as explained below before adding fresh coolant. In some areas, the chemical content of the water is such, that even the best of rust inhibitors will not protect the cooling system from the formation of rust and scale. There are instances where this corrosive element has eaten holes through cast iron parts such as water pump impellers and bodies. This condition is caused by electrolysis taking place in the parts involved. Where these conditions exist, water filters should be incorporated in the assembly to remove these troublesome elements and offset the electrolytic action. Whenever a cooling system is badly rust clogged as indicated by overflow losses or abnormally high operating temperatures, corrective cleaning by reverse flow flushing will most effectively remove the heavy deposits of sludge, rust and scale. The reverse flow flushing should be performed immediately after draining the cleaning solution and it is advisable to flush the radiator first, allowing the engine to cool as much as possible.

b. Radiator Reverse Flushing.

(1) Disconnect the hoses at the engine.

(2) Put radiator cap on tight.

(3) Clamp the flushing gun in the lower hose with a hose clamp (fig. 3-21).

(4) Turn on the water and let it fill the radiator.

(5) Apply air pressure gradually to avoid radiator damage.

(6) Shut off the air, again fill the radiator with water and apply air pressure. Repeat until the flushing stream runs out clear.

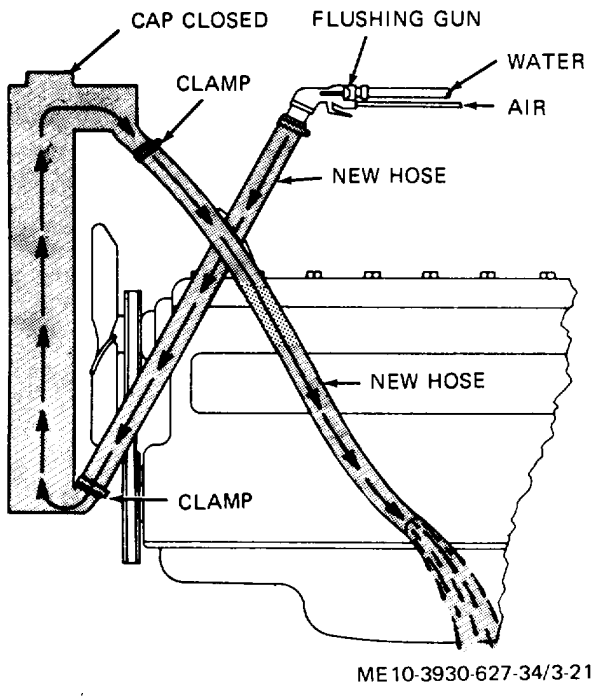


Figure 3-21. Reverse flushing radiator.

c. Engine Reverse Flushing.

(1) Remove the thermostat.

(2) Clamp the flushing gun in the upper hose (fig. 3-22).

(3) Partly close the water pump opening to fill the engine jacket with water before applying the air.

(4) Follow the same procedure outlined above for the radiator by alternately filling the water jacket with water and blowing it out with air (80 pounds pressure) until the flushing stream is clear.

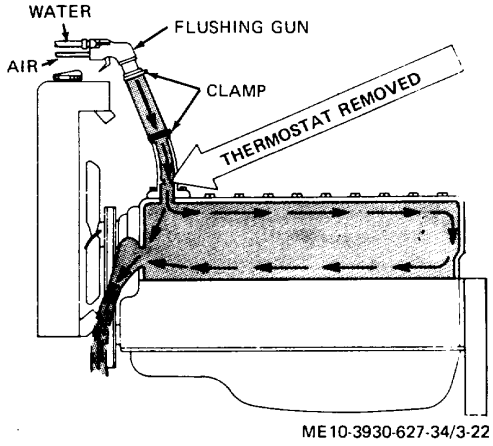


Figure 3-22. Reverse flushing engine.

CHAPTER 4

REPAIR OF FUEL SYSTEM

4-1. General

The truck uses a Zenith model 261 JX7 single venturi updraft carburetor, with a centrifugal governor.

4-2. Carburetor Repair

a. Removal, Installation and Adjustment. Refer to TM 10-3930-627-12.

b. Disassembly.

(1) Remove screws (17, fig. 4-1) that attach throttle body (5) to fuel bowl (19) and separate the two.

(2) Remove hinge pin and float and pin assembly (9) from fuel bowl..

(3) Remove needle, seat and gasket assembly (27) from throttle body.

(4) Remove bowl to body gasket (10) from body.

(5) Remove main assembly nozzle (26) and gasket (25) from bowl.

(6) Remove two screws (31) and remove throttle plate (4) from shaft.

(7) Remove throttle shaft and idle jet (28) from body.

(8) Remove idle mixture adjusting screw (8) and spring (7) from body.

(9) Remove venturi (11) from body.

(10) Remove main jet (15) and well vent jet (12) from bowl.

(11) Remove screws (14) and remove choke plate (24) from shaft (13).

(12) Remove choke shaft from body.

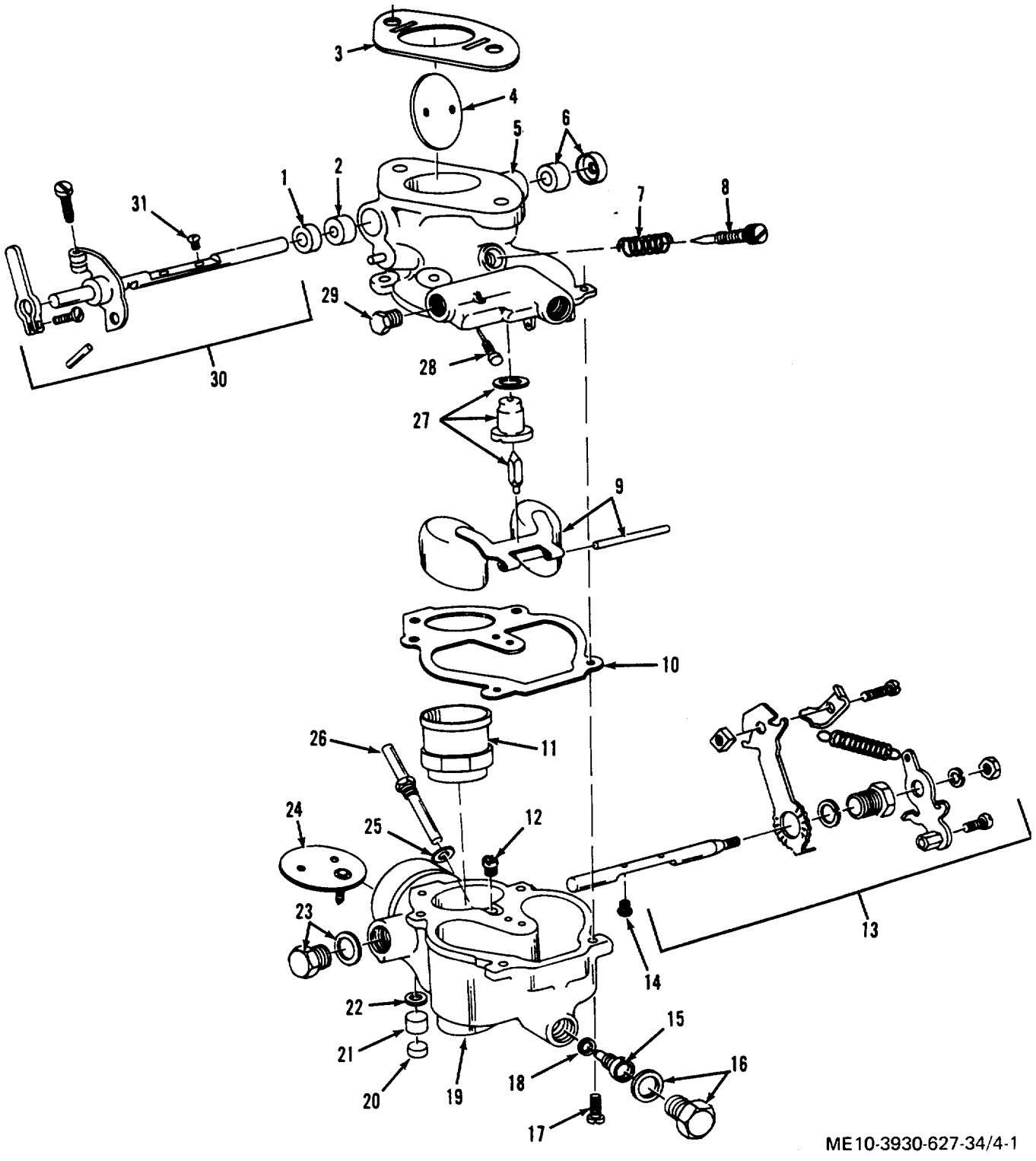


Figure 4-1. Carburetor, exploded view.

KEY to figure 4-1:

1. Retainer
2. Washer
3. Gasket
4. Throttle plate
5. Throttle body
6. Plug and bushing (idle air bleed)
7. Spring
8. Idle mixture adjusting screw
9. Float and pin assembly
10. Gasket
11. Venturi
12. Well vent jet
13. Choke shaft assembly
14. Screw
15. Main jet
16. Plug and gasket assembly
17. Screw
18. Gasket
19. Fuel bowl
20. Bowl vent bushing
21. Idle channel filler tube
22. Intake drain disk
23. Plug and washer
24. Choke plate
25. Washer
26. Discharge jet
27. Needle, seat and gasket assembly
28. Idle jet
29. Plug
30. Throttle shaft
31. Screw

c. Cleaning.

(1) Clean all metal parts in approved solvent (or a commercial carburetor cleaner) and dry thoroughly with compressed air or a clean, lint free cloth.

(2) Clean all small passages and orifices with a soft wire or some other suitable probe, being careful not to enlarge any passages while cleaning.

d. Inspection.

(1) Inspect float for cracks, dents, holes, and worn spots. Submerge float in warm water (about 140° F) and look for bubbles indicating air leaks. Discard leaky float.

(2) Inspect shafts for mutilated screw hole threads and loose fit in casting.

(3) Inspect valve and valve seat for wear. Replace with new parts if worn. Inspect mating gasketed surfaces for warpage. Replace parts showing noticeable warpage.

e. Assembly. Reverse procedures in *a.* above to assemble the carburetor. Before installing the throttle body to the fuel bowl, check the float level. The proper float setting is 1/4 inch from the float to the surface of the throttle body, with the assembly inverted so the float holds the valve closed. Before installing the carburetor on the truck, check the operation of the choke and throttle plates and shafts. The plates should close the bores without binding or sticking. Adjust the carburetor as described in TM 10-3930-627-12.

4-3. Governor Repair

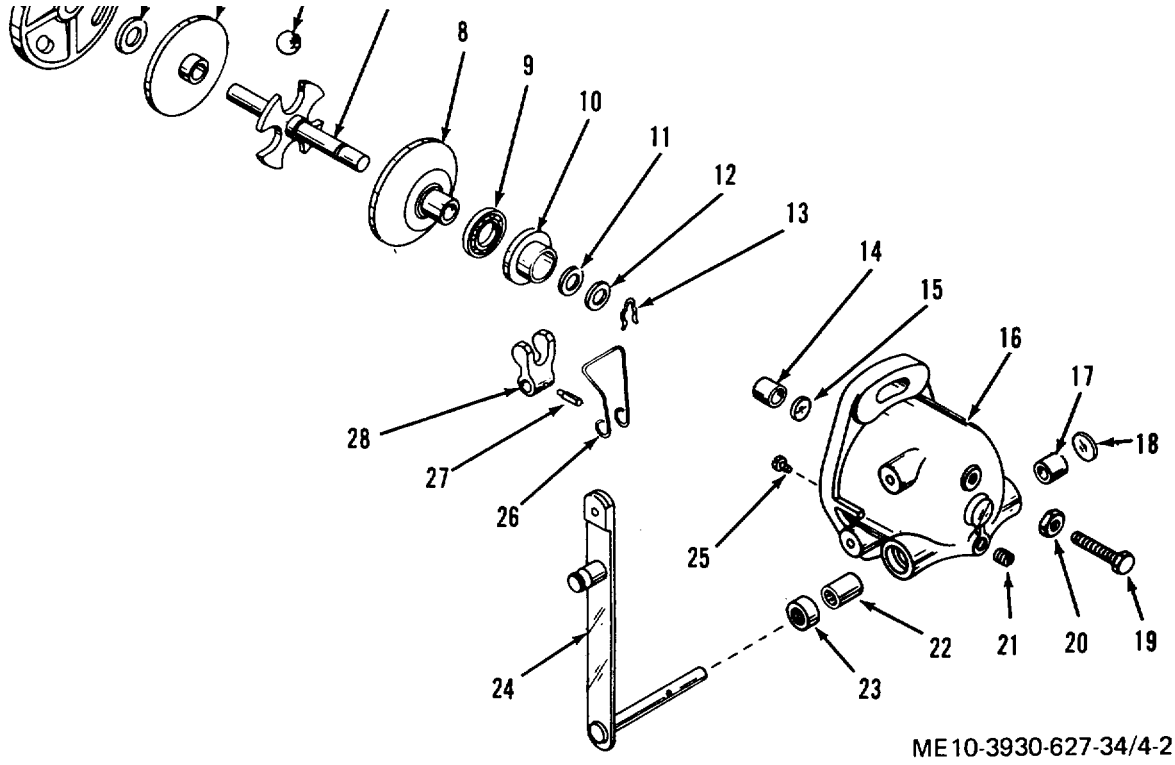
a. Removal.

(1) Remove the governor spring from the governor control lever (24, fig. 4-2).

(2) Remove the linkage between the governor and carburetor (TM 10-3930-627-12).

(3) Remove the upper capscrew, washer, and gasket plate securing the governor to the gear cover at the upper mounting hole (fig. 4-3).

(4) Remove the lower capscrew and washer attaching the governor to the gear cover, and the nut and washer shown at the side of the governor. Remove the governor and its mounting gasket from the engine.



1. Governor gear
2. Base bushing
3. Base
4. Thrust washer
5. Lower race
6. Ball
7. Drive shaft
8. Upper race
9. Thrust bearing
10. Fork base
11. Thin ball stop washer
12. Thick ball stop washer
13. Shaft clip
14. Body bushing
15. Thrust washer
16. Body
17. Body bushing
18. Plug
19. Adjusting screw
20. Nut
21. Pipe plug
22. Needle bearing
23. Oil seal
24. Governor control lever
25. Screw
26. Bumper spring
27. Groove pill
28. Fork

1. Governor gear
2. Base bushing
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4. Thrust washer
5. Lower race
6. Ball
7. Drive shaft
8. Upper race
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18. Plug
19. Adjusting screw
20. Nut
21. Pipe plug
22. Needle bearing
23. Oil seal
24. Governor control lever
25. Screw
26. Bumper spring
27. Groove pill
28. Fork

Figure 4-2. Governor, exploded view.

b. Disassembly.

(1) Remove the screw (25, fig. 4-2) holding the works assembly to the body (16), and remove the drive gear (1) with the works assembly from the body.

(2) Remove the shaft clip (13), and remove the thick and thin ball washers (12 and 11), the four balls (6), the fork base (10), assembled thrust bearing (9), and upper race (8) from the drive shaft (7). Remove thrust bearing from upper race.

(3) Press drive shaft from the drive gear (1) releasing assembled base (3) and base bushing (2), thrust' washer (4), and lower race (5).

(4) Drive out groove pin (27) securing fork (28) to shaft of governor lever (24). Remove governor lever from body, releasing fork and bumper spring (26).

(5) Remove bumper spring adjusting screw (19), nut (20), and plug (21) from body.

c. Cleaning. Wash all parts in cleaning solvent; dry thoroughly.

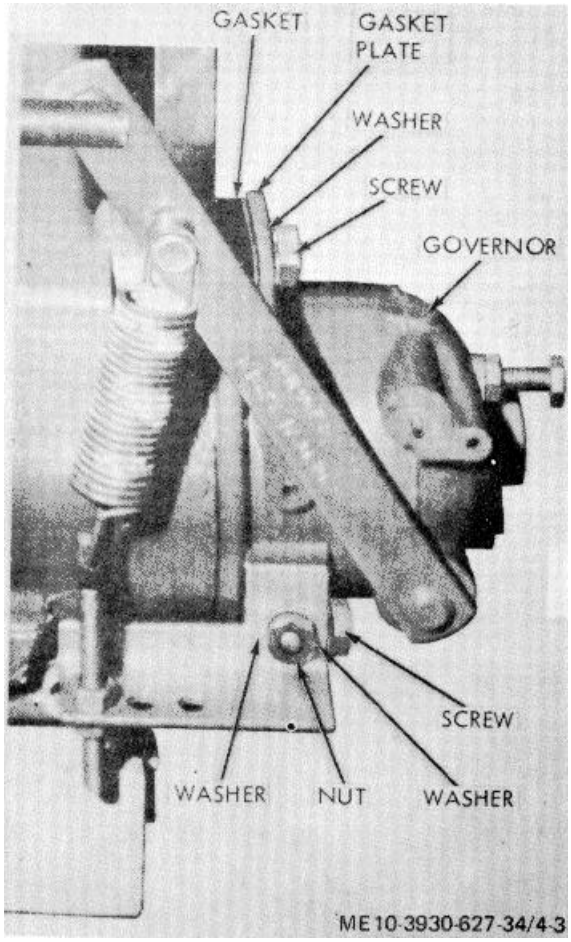


Figure 4-3. Governor, installed.

d. Inspection and Repair.

(1) Inspect fit of the drive shaft (7) in base bushing (2). Replace bushing in the base (3), if clearance exceeds 0.010 inch, as follows:

(*a)* Press old bushing from the base.

(*b)* Press in new bushing with outer flange of bushing flush with the edge of the base.

(*c)* Insert a 1/8-drill through a hole in the hub of the base and drill through wall of the bushing.

(*d)* Burnish or ream inside diameter of bushing to 0.4385/ 0.4390 inch.

(2) Inspect fit of drive shaft in body bushing (14); replace bushing if the clearance exceeds 0.005 inch, making sure there is a thrust washer (15) behind the new bushing.

(3) Inspect the thrust bearing (9) and the needle bearing (22) for pitting or scoring, and for free movement of balls and rollers; replace bearings that show signs of wear.

(4) Inspect fit of shaft of governor lever (24) in body bushing (17). Drive out plug (18) and bushing if clearance exceeds 0.005 inch. Press in new bushing and replace plug.

(5) Inspect all other parts for wear or damage; replace worn or damaged parts.

e. Reassembly.

(1) Install needle bearing (22) and new oil seal (23) in governor body (16).

(2) Position bumper spring (26) and fork (28) in body, and carefully install shaft of the governor lever (24) in body. Secure the fork to shaft with a groove pin (27).

(3) Position lower race (5) on drive shaft, with hub toward center of shaft, and follow it with thrust washer (4), assembled base (3), and base bushing (2).

(4) Press shaft in gear (1); provide endplay of 0.004 to 0.010 inch between the gear and the base.

(5) With balls (6) in position, assemble upper race (8), thrust bearing (9), fork base (10), and one thin and one thick ball stop washer (11 and 12) on drive shaft (7). Install shaft clip (13) in groove on shaft.

(6) Hold upper race in toward lower race, with balls to outer circumference of upper race, and check the clearance between thin and thick washers. Clearance should be between 0.230 and 0.240 inch; add or remove stop washers as necessary to obtain this clearance.

Note. Stop washers are available in thickness of 0.010 and 0.050 inch.

(7) assembled drive shaft in governor housing; secure with screw (25)

(8) Install governor on engine by reversing procedure in *a.* above.

(9) Adjust governor (TM 10-3930-627-12).

4-4. Fuel Tank

a. Removal and Installation. Refer to TM 10-3930-627-12.

b. Repair.

(1) Clean tank interior thoroughly with steam.

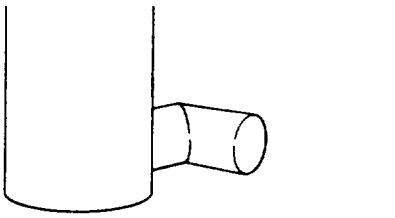
(2) Observe necessary safety precautions, and weld broken seams, holes, and other damage.

4-5. Muffler Repair

a. Removal. Remove radiator, TM 10-3930-627-12. Loosen clamp (2, fig. 4-4), and work muffler (1) free of tube (3). If the muffler is rusted to the tube use liberal quantities of penetrating oil, or heat the joint with a torch until it is free.

b. Inspection. Check muffler for internal obstructions to free flow of exhaust gas, loose baffles, (shake muffler. If it rattles, discard it) and rust holes, particularly near the lower end where condensation might collect. Discard a defective muffler.

c. Installation. Reverse *a.* above, positioning muffler so it sends exhaust gas out through the opening in the counterweight.



ME10-3930-627-34/4-4

1. Muffler
2. Clamp
3. Tube
4. Bolt
5. Lockwasher
6. Washer
7. Tube
8. Clamp
9. Flange
10. Gasket
11. Nut
12. Lock washer

1. Muffler
2. Clamp
3. Tube
4. Bolt
5. Lockwasher
6. Washer
7. Tube
8. Clamp
9. Flange
10. Gasket
11. Nut
12. Lock washer

Figure 4-4. Exhaust system, exploded view.

CHAPTER 5

REPAIR OF RADIATOR

5-1. Removal, Cleaning, and Installation

See TM 10-3930-627-12.

5-2. Testing

a. Tightly cap hose opening.

b. Submerge radiator in water.

c. With an adapter fitted to filler neck, force 3 to 5 pounds of air pressure into submerged radiator.

d. Look for escaping air by observing air bubbles in water.

e. Repeat *a.* to *d.* at connections to heat exchanger in radiator bottom tank.

5-3. Repair

a. Clean all dust, lint, and foreign matter from fins.

b. Straighten all bent fins.

c. Solder all leaks. Retest after repair.

CHAPTER 6

REPAIR OF ELECTRICAL UNITS

6-1. Alternator Description

The alternator is a 12 volt 3 phase alternating current generator with built-in rectifiers (diodes) to convert the output to direct current required by the truck electrical system.

6-2. Alternator Disassembly and Repair

a. Remove alternator from truck TM 10-3930-627-12. Clean alternator with cloth dampened with cleaning solvent. Dry thoroughly. Do not allow solvent to enter alternator.

b. Inspect alternator for cracked housing, bent shaft, or damaged drive pulley. Turn shaft by hand; it should rotate freely with no catching or binding. Replace or repair damaged alternator.

c. Test alternator if necessary to determine repairs needed, TM 10-3930-627-12.

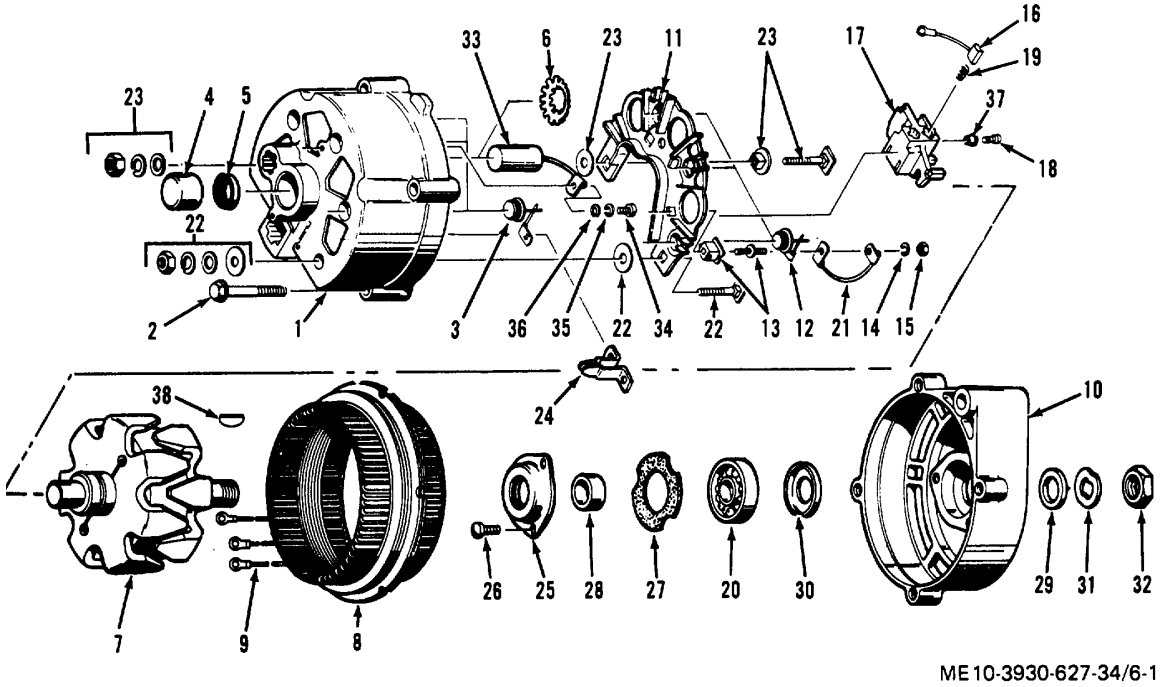
d. To disassemble, remove four screws (2, fig. 6-1), securing frame assembly (1) to frame (10). Match mark frames and use a screwdriver at stator slot to pry apart two frames.

Caution: Use pressure sensitive tape, NOT friction tape, which could leave a gummy deposit. Place piece of tape over slip ring end frame bearing (14) to prevent entry of dirt or foreign matter. Also tape shaft of rotor (7) to slip ring end.

e. Clean brushes (16) with soft, dry cloth if they are to be reused.

Caution: Do not tighten vise more than necessary as this could cause distortion of rotor. Place rotor (7) in a vise and tighten only enough to permit removal of nut (32) and lock washer 131). Remove nut, lock washer, pulley, key (38), fan outside collar (29), and rotor.

f. Check rotor for grounds by connecting a 110 volt test lamp or ohmmeter from either slip ring to rotor shaft or to rotor poles. If lamp lights or ohmmeter reading is less than 5 ohms, field winding is grounded. Replace rotor if field winding is grounded.



1. Frame assembly
2. Screw
3. Diode
4. Bearing
5. Retainer
6. Retaining spring
7. Rotor
8. Stator
9. Clip
10. Frame
11. Heat sink assembly
12. Diode
13. Terminal package
14. Washer
15. Nut
16. Brush
17. Brush holder
18. Screw
19. Spring
20. Bearing
21. Lead
22. Terminal package
23. Terminal package
24. Terminal
25. Bearing retainer
26. Screw
27. Gasket
28. Inside collar
29. Outside collar
30. Grease slinger
31. Lock washer
32. Shaft nut
33. Capacitor
34. Screw
35. Lock washer
36. Washer
37. Insulator
38. Key

Figure 6-1. Alternator, exploded view.

g. Check rotor for opens by connecting a 110 volt test lamp or ohmmeter across the two slip rings. If lamp fails to light or ohmmeter reading is infinity, field winding is open and alternator must be replaced.

h. Check rotor for short circuits by connecting a 12 volt battery and ammeter in series with the edges of the two slip rings. Note ammeter reading; it should be 1.0 to 2.3 amperes. An ammeter reading above specified value indicates shorted windings.

i. Remove three stator lead attaching nuts (fig. 6-2) and remove stator (8, figure 601) from frame.

j. Check stator winding for grounds by connecting ohmmeter between each lead and stator frame. If ohmmeter reading is less than 5 ohms, windings are grounded. Replace alternator.

k. Check stator leads for opens by connecting ohmmeter between stator leads in pairs. If ohmmeter reading is infinity, stator windings are open; replace alternator.

l. If previous electrical checks of all alternator components are normal and alternator fails to supply its rated output, it can be assumed that stator is short circuited; replace alternator.

Caution: If ohmmeter is to be used, it should have a 1 1/2 volt cell. Turn voltmeter selector to lowest range and connect ohmmeter leads to a voltmeter. Voltmeter will indicate cell voltage. Only a 12 volt test lamp should be used. A 110 volt test lamp will damage components. Check diodes with either an ohmmeter or a test lamp.

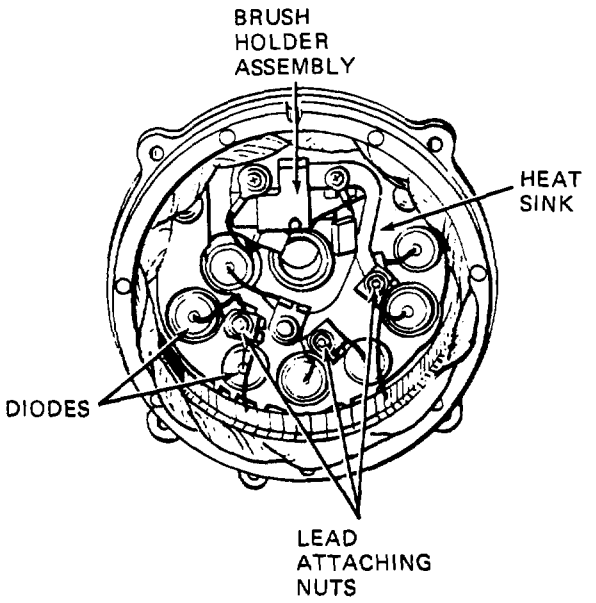


Figure 6-2. Stripping end frame.

m. With stator leads disconnected, connect one lead of ohmmeter or of 12 volt test lamp to insulated heat sink and other lead to diode lead as shown in figure 6-3. Note if lamp lights or note ohmmeter reading. Reverse leads and note readings or if lamp lights. If readings are both low or both high, or if lamp lights or fails to light in both checks, diode is defective. Check each diode in heat sink in same manner.

n. Check diodes in end frame by connecting one lead of ohmmeter or of test lamp to end frame and other lead to diode lead. Note reading on ohmmeter or note if lamp lights. Reverse lead connections and note ohmmeter readings or if lamp lights. If readings are both high or both low, or if lamp lights or fails to light in both directions, diode is defective.

Caution: Do not attempt to drive out diode as shock of impact may damage neighboring diodes. If diodes are defective, use a jig to support end frame or heat sink. Press defective diode out of heat sink or frame with arbor press and replace, using arbor press.

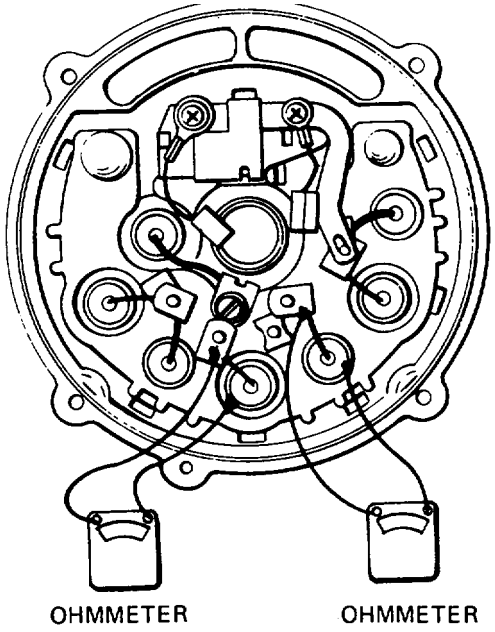


Figure 6-3. Diode Check.

Caution: Do not attempt to polish slip rings without rotating rotor as they must be polished evenly. Cleaning by hand may result in flat spots which will cause brush noise. Inspect slip rings on rotor (7, fig. 6-1). If they are dirty, clean them with a polishing cloth, 400 grain or finer. Spin rotor in lathe or equivalent, and hold polishing cloth against slip rings until they are clean.

o. Check slip rings for roughness or out-of-round. If they are rough or out-of-round, they should be trued on a lathe to 0.002 inch tolerance. Remove only enough material to make rings smooth and round. Finish by polishing with a cloth, 400 grain or finer. Blow all dust from rotor and rings after polishing.

p. Remove three screws (26, fig. 6-1) that secure bearing retainer (25) to drive frame (10); remove inside collar (28) and gasket (27). Press bearing (20) from drive frame; remove grease slinger (30).

Caution: Do not fill bearing more than one-quarter full or it may overheat. Do not use any other lubricant than lubricant specified. If bearing is in satisfactory condition, fill it one-quarter full with lubricant.

6-3. Alternator Assembly

a. Install grease slinger and press bearing in drive frame, using a tube or collar that just fits over outer race. Install new gasket (27, fig. 6-1), inside collar (28), and bearing retainer (25). Secure bearing retainer with three screws (26).

b. If bearing (4) has exhausted its lubricant, replace bearing. Press it out of frame with tube or collar that just fits inside frame bore. Press from outside of housing toward inside. Place flat plate over new bearing and press it in from outside of frame toward inside until it is just flush with outside of frame. Support inside of frame with hollow cylinder to avoid breakage. Use extreme care to avoid misalignment or placing undue stress on bearing. Saturate felt seal of retainer (5) with OE 20 and assemble it in frame.

c. Check brushes to see if they have come in contact with lubricant. If so, wipe brushes with a soft, dry cloth. Check brush springs (19) for damage or corrosion. If there is any doubt as to condition of springs, replace them. If new brushes are to be installed, remove brush holder assembly from frame by removing brush holder screws (18). Remove brushes and springs from brush holders. Install new brush springs and brushes and insert a straight wire or pin into hole at bottom of brush holder to retain brushes. Position assembled brush holder on frame and secure with two screws. Make sure parts are in correct relationship as shown in figure 6-1. Allow straight wire or pin to protrude through hole in end frame.

d. Reassemble alternator, reversing disassembly procedure. Make sure to remove tape from rotor shaft and frame bearing. When holding rotor in a vise to install rotor in frame, tighten vise only tight enough to permit torquing nut (32) to 50 to 60 foot-pounds. Withdraw wire used when assembling

brushes in holders after alternator is assembled. This will allow brushes to drop on slip rings.

6-4. Alternator Test and Installation

After installation, check and if necessary adjust regulator, TM 10-3930-627-12.

6-5. Starting Motor Removal and Installation

See TM 10-3930-627-12.

6-6. Starting Motor Test

a. Connect starting motor in series with fully-charged, 12-bolt battery, an ammeter capable of reading several hundred amperes, and a variable resistor in a setup as shown in figure 6-4. Connect negative battery lead to starting motor frame.

b. Connect a voltmeter from motor terminal to motor frame and to motor terminal as shown in figure 6-4.

c. Use a tachometer to check armature speed.

d. Adjust resistance with variable resistor until 9 volts is indicated on voltmeter.

e. Read current draw on ammeter and speed on tachometer. Current draw must be 50 to 80 am-peres. Speed must be 5500 to 10, 500 rpm.

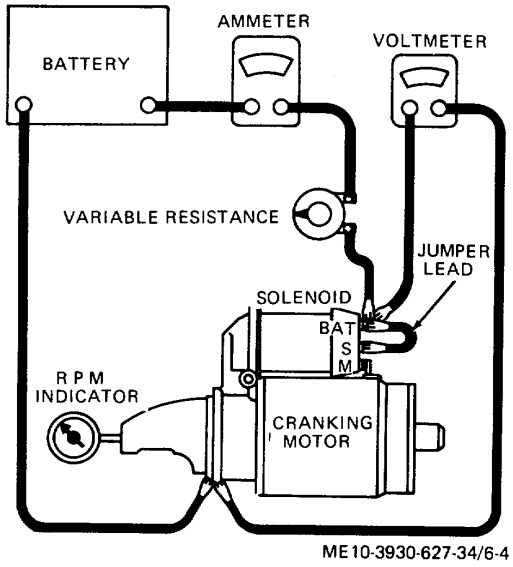


Figure 6-4. Starting motor test setup.

6-7. Starting Motor Disassembly and Inspection

a. Disassemble starting motor as shown in figure 6-5. Do not disassemble further than necessary to locate damaged parts.

b. Check for worn brushes (4). Replace if worn to half the length of a new brush from stock. Make sure brush holders (6) are clean and that brushes are not binding in holders. Check tension of brush spring (8); it must be 35 ounces minimum.

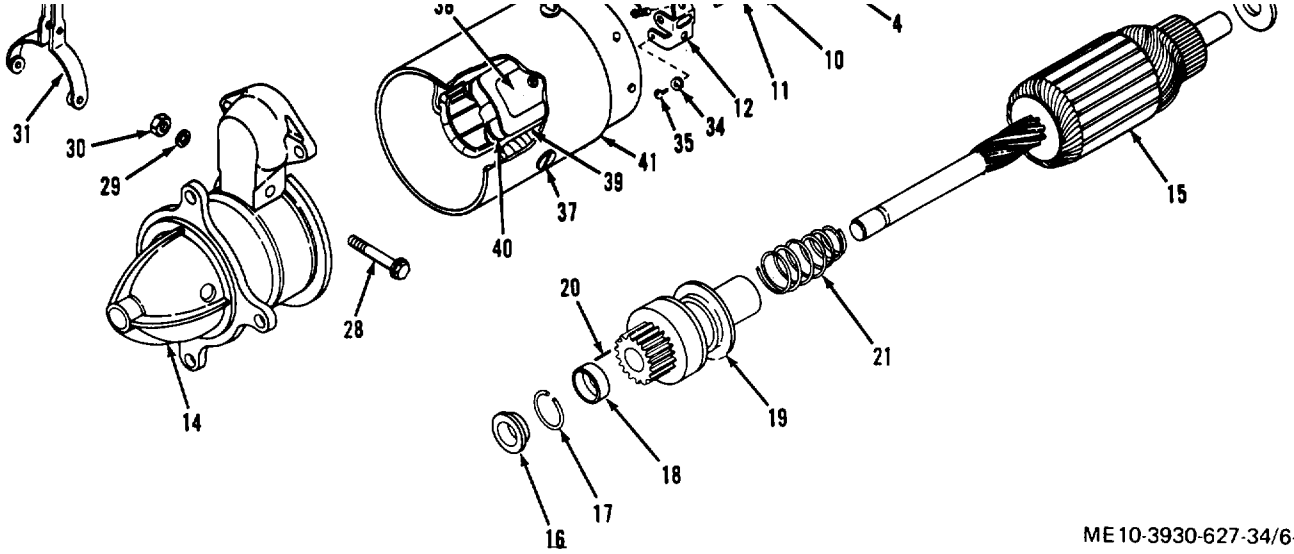
c. Check armature (15) for shorting by using a growler. Shorts are sometimes caused by brush or copper dust between copper commutator bars. Undercut commutator insulation to eliminate these shorts.

d. Check for open armature windings by checking for loose connections between commutator risers and ends of windings. Poor connections cause arcing and burning of commutator. If commutator bars are not too badly burned, resolder leads to bars and turn down commutator in lathe. Undercut commutator insulation to 1/32 inch lower than commutator bar surface.

e. Check for grounds in armature, using test lamp. If lamp lights when one probe is placed on commutator and the other is on shaft or core, armature is grounded and will need replacement.

f. Check field coils for grounds with test lamp. Connect one probe of test lamp to field frame and other to field connector. If lamp lights, field coils are grounded and must be replaced.

g. Check field coils (39 and 40) for opens with test lamp. Apply probes to ends of field coils. If lamp fails to light, field coils are open, and must be replaced.



1. Bolt
2. End bell
3. Screw
4. Brush
5. Pin
6. Brush holder
7. Lead
8. Spring
9. Screw
10. Nut
11. Lock washer
12. Brush bracket
13. Washer
14. End bell
15. Armature
16. Thrust collar
17. Retaining ring
18. Retainer
19. Drive assembly
20. Key
21. Spring
22. Screw
23. Lock washer
24. Screw
25. Lock washer
26. Solenoid assembly
27. Spring
28. Bolt
29. Lock washer
30. Nut
31. Shift lever
32. Pin
33. Plunger
34. Lock washer
35. Screw
36. Grommet
37. Screw
38. Pole shoe
39. Field coil
40. Field coil
41. Housing

1. Bolt
2. End bell
3. Screw
4. Brush
5. Pin
6. Brush holder
7. Lead
8. Spring
9. Screw
10. Nut
11. Lock washer
12. Brush bracket
13. Washer
14. End bell
15. Armature
16. Thrust collar
17. Retaining ring
18. Retainer
19. Drive assembly
20. Key
21. Spring
22. Screw
23. Lock washer
24. Screw
25. Lock washer
26. Solenoid assembly
27. Spring
28. Bolt
20. Lock washer
30. Nut
31. Shift lever
32. Pin
33. Plunger
34. Lock washer
35. Screw
36. Grommet
37. Screw
38. Pole shoe
39. Field coil
40. Field coil
41. Housing

Figure 6-5. Starting motor, exploded view.

6-8. Starting Motor Reassembly

a. Refer to figure 6-5 to reassemble starting motor.

b. When installing drive assembly (19) on armature, place spring (21) and drive assembly (19) on shaft of armature (15). Slide retainer (18) onto shaft with cupped side out. Force retaining ring (17) over end of shaft and position it in groove provided. Position thrust collar (16) on shaft against retaining ring. Use two pairs of pliers to force thrust collar over ring.

c. If brushes have been replaced, seat them using No. 00 sandpaper before assembling end bell (2). Blow brush particles off commutator so that they will not cause short circuits.

d. Before installation, disconnect motor field coil connector from solenoid terminal and INSULATE CAREFULLY.

e. Connect 12 volt battery with positive lead to S terminal of solenoid, and negative lead to motor frame. Momentarily flash a jumper from solenoid M terminal to solenoid frame. This will shift pinion of drive assembly (19) into cranking position and it will remain in this position until battery is disconnected.

f. Push drive assembly pinion back toward commutator end to eliminate slack movement and measure distance between drive assembly pinion and retainer (18). Pinion clearance must be 0.010 to 0.140 inch. Recheck assembly if clearance is not within required range. Disconnect battery and reconnect field terminal to solenoid.

CHAPTER 7

REPAIR OF TRANSMISSION

7-1. General

The transmission is a constant mesh countershaft transmission, coupled to the engine crankshaft by a torque converter, and driving the power axle by a pinion gear on its output shaft. Details of design and operation are described in the following paragraphs.

7-2. Description

a. The transmission uses self-adjusting, corkfaced clutch disks for forward-reverse shifting. Ball and roller bearings are used throughout. All gearing is precision straight spur design. The control valve is integral in this compact, self-contained unit, as is the input pump.

b. The hydraulic clutches are contained in one balanced assembly. The plates drive concentric shafts. The outer shaft drives a gear which is in direct mesh with the output gear on the output shaft. This transmits forward rotation to the output shaft. The inner shaft drives a gear which is in mesh with the output gear through an idler gear. This transmits reverse rotation to the output shaft.

c. The main case is of three piece cast construction. The rear half contains a heavy diaphragm midwall which forms one side of a rigid straddle mounted support for the output gear and shaft. Oil passages run within the walls of the case. There are no external lines except those to the cooler.

7-3. Operation

a. Oil is directed from the oil pump to the regulating valve (fig. 7-1) which regulates main pressure and bypasses excess oil to the lube circuit. Oil under main pressure then flows to the inching valve, which is controlled through linkage from the brake pedal. Depressing the brake pedal allows the inching control valve to move outward, gradually blocking main pressure feed to a dump valve located in the main valve body next to the inching valve. The end of the dump valve is also fed from an orifice directly by main pressure which positions the dump valve so that oil from the inching valve can flow through it to the selector valve.

b. Converter oil flow comes directly from the oil pump outlet but is reduced in pressure by a restriction through which oil must pass to get into the converter. Exit oil from the converter goes to a bypass valve located in the converter oil out line. This bypass valve directs oil to the sump in case of a clogged oil cooler or clogged cooler lines and provides a safety feature against extreme internal converter pressure caused by accidental restrictions. Oil from the cooler is directed to the lube circuit which delivers cooled oil under pressure to the clutch plates and bearings.

c. Suction oil flows through the filter screen before entering the oil pump.

d. Power flow through the transmission is illustrated in figure 7-2.

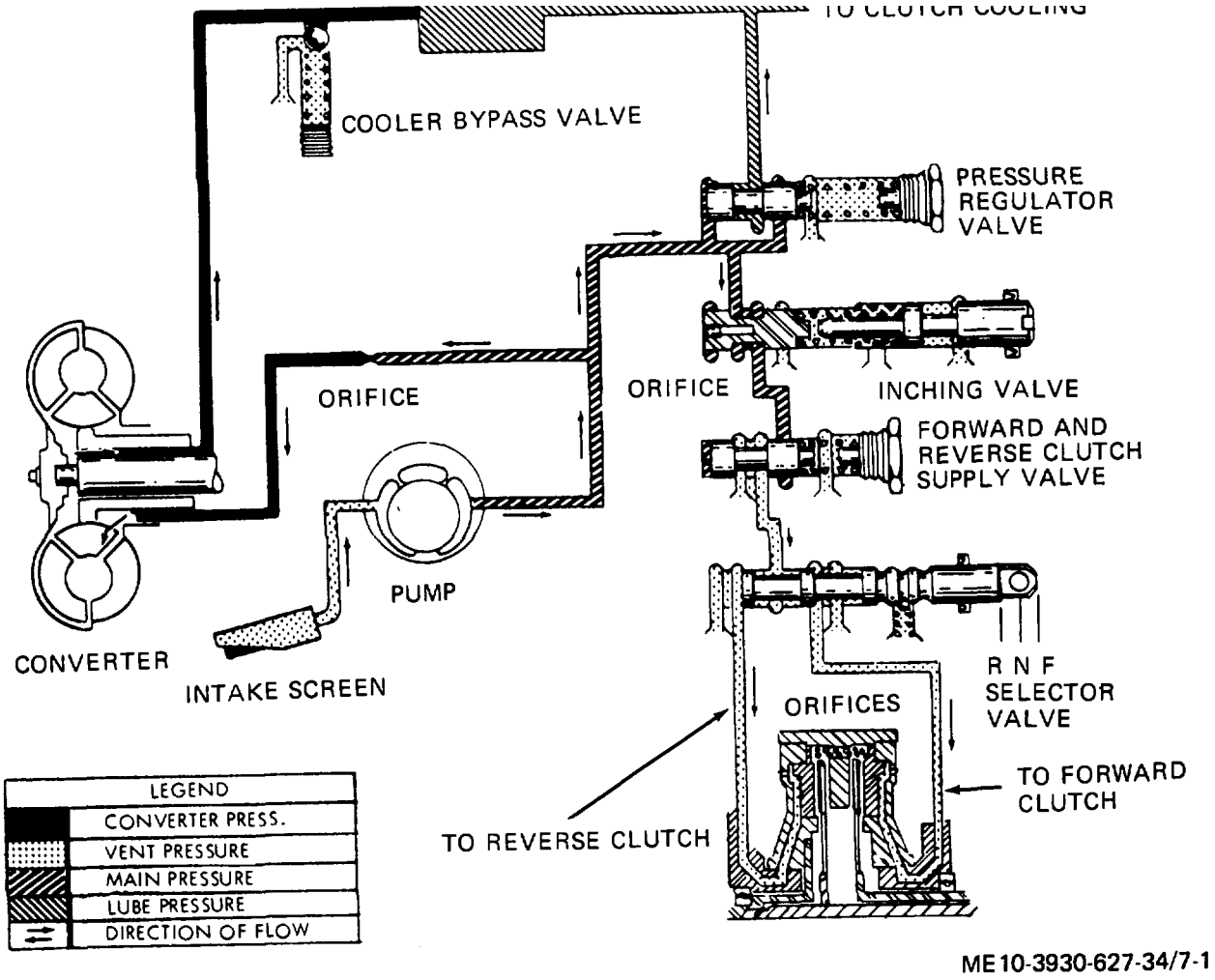


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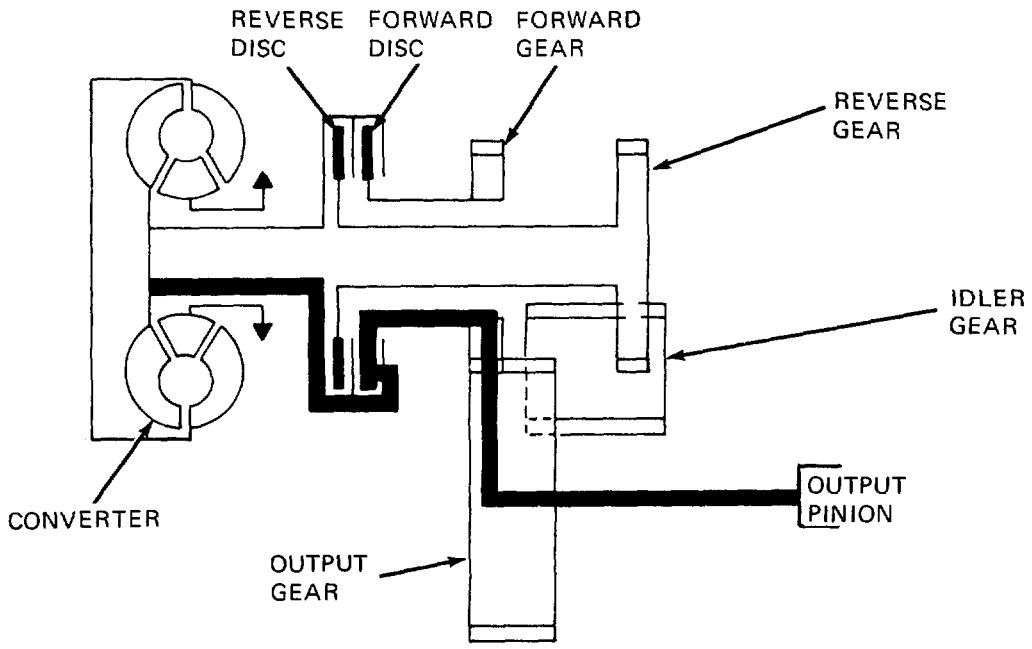
Figure 7-1. Transmission, hydraulic diagram.



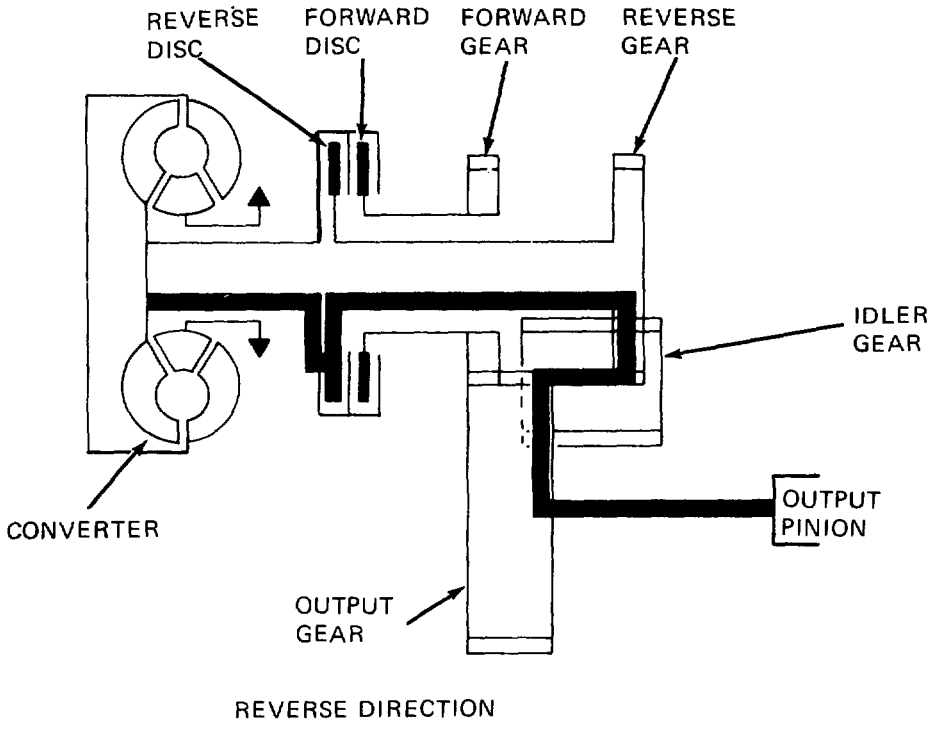


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Figure 7-2. Power flow through transmission.

7-4. Preliminary Troubleshooting Checks of Transmission

If transmission trouble is reported, first check the following to aid in isolating the reason for the failure:

a. Clean intake screen.

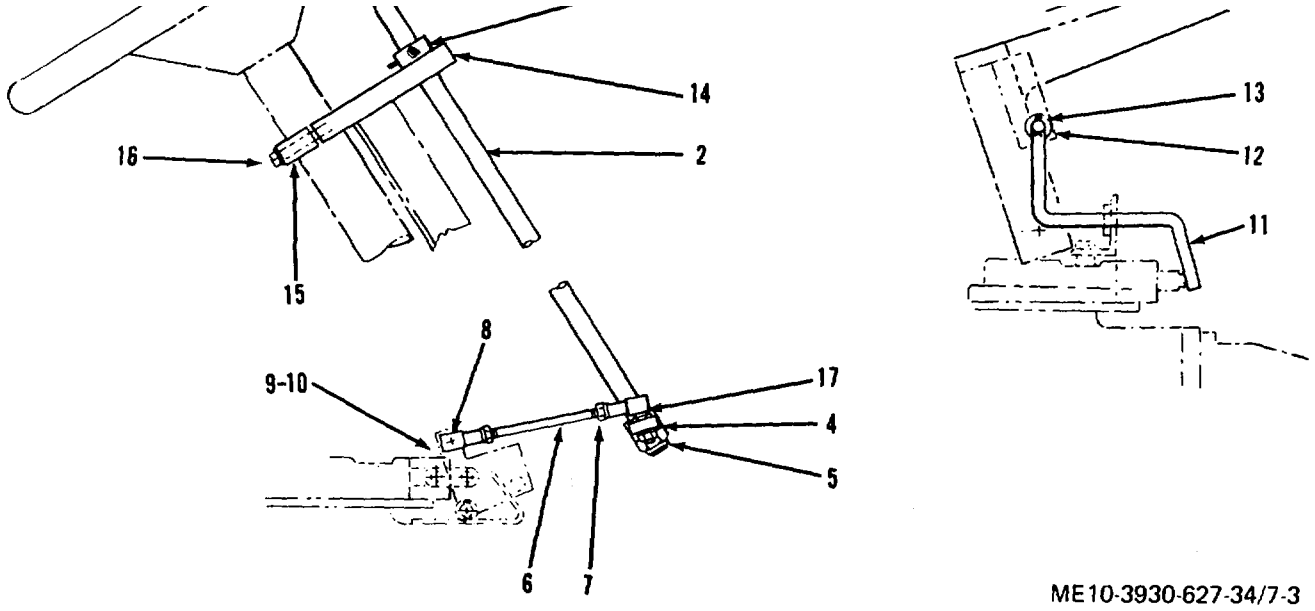
b. Be certain transmission is at proper operating temperature (180-200 deg. F).

c. Check oil level; if low, bring level up to full mark and recheck operation of truck.

d. Check linkage connections to selector valve and inching control valve (fig. 7-3).

e. Take pressure readings as shown in figure 7-4.

f. Consult table 2-2 for more help if trouble is still present.



1. Ball handle
3. Gear shift arm
3. Set screw collar
4. Serrated collar
5. Elastic stop nut
6. Rod
7. Jam nut
8. Ball joint
9. Lock washer
10. Nut
11. Inching rod
12. Plain washer
13. Cotter pin
14. Lever bearing
15. Cap
16. Screw
17. Nonmetallic washer
18. Pedal pa

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1. Ball handle
2. Gear shift arm
3. Set screw collar
4. Serrated collar
5. Elastic stop nut
6. Rod
7. Jam nut
8. Ball joint
9. Lock washer
10. Nut
11. Inching rod
12. Plain washer
13. Cotter pill
14. Lever bearing
15. Cap
16. Screw
17. Nonmetallic washer
18. Pedal pad

Figure 7-3. Transmission shift linkage.

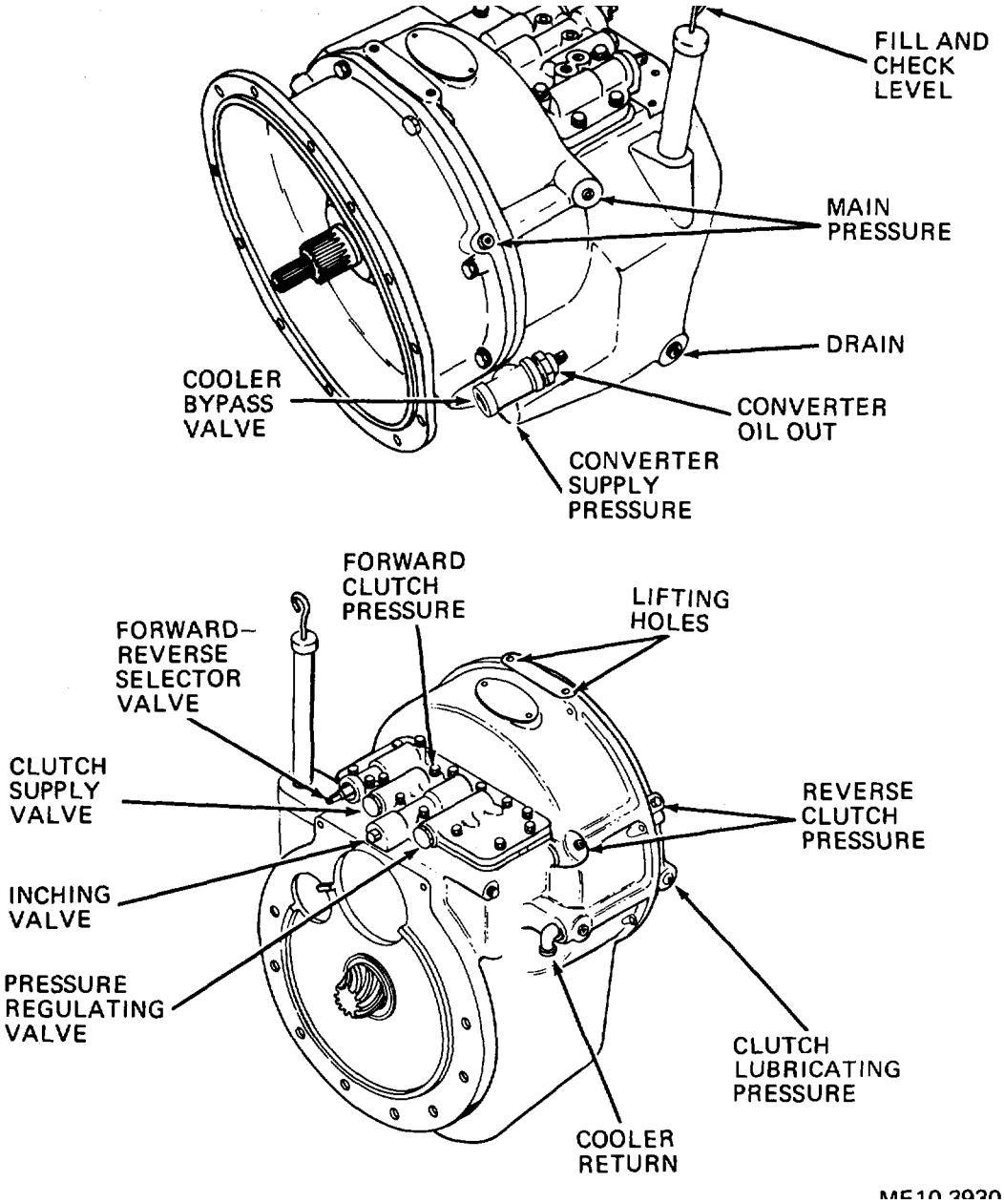

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Figure 7-4. Transmission pressure check points.

7-5. Transmission Linkage Adjustments

a. When transmission is shifted to neutral, groove pin on collar assembly (3, fig. 7-3) on shift lever (2) should align with neutral indicator. Shift transmission to neutral and check position.

b. If position needs adjustment, remove floorboards. Adjust position of lever by lengthening or shortening directional rod (6) by adjusting position of ball joints on rod. Tighten lock nuts to secure adjustment. Check positions of shift lever in relation to shift positions of the transmission.

7-6. Transmission Oil Pressure Checks

a. Checking the control pressures of the transmission is an accurate and simple method of diagnosing the causes of specific or general malfunctions.

b. Refer to figure 7-4 and check pressures at the points shown with an accurate pressure gage. Compare pressure readings obtained with situations covered in table 7-1 to isolate malfunctions to a specific area of the transmission.

Table 7-1. Transmission Pressures

Engine RPM	Main line		Converter charging pressure		Forward clutch		Reverse clutch	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
500	20	30	15	25	15	25	15	25
1000	58	68	42	50	50	58	50	58
1500	110	120	4	84	77	87	77	87
2000	120	135	84	101	80	93	80	93

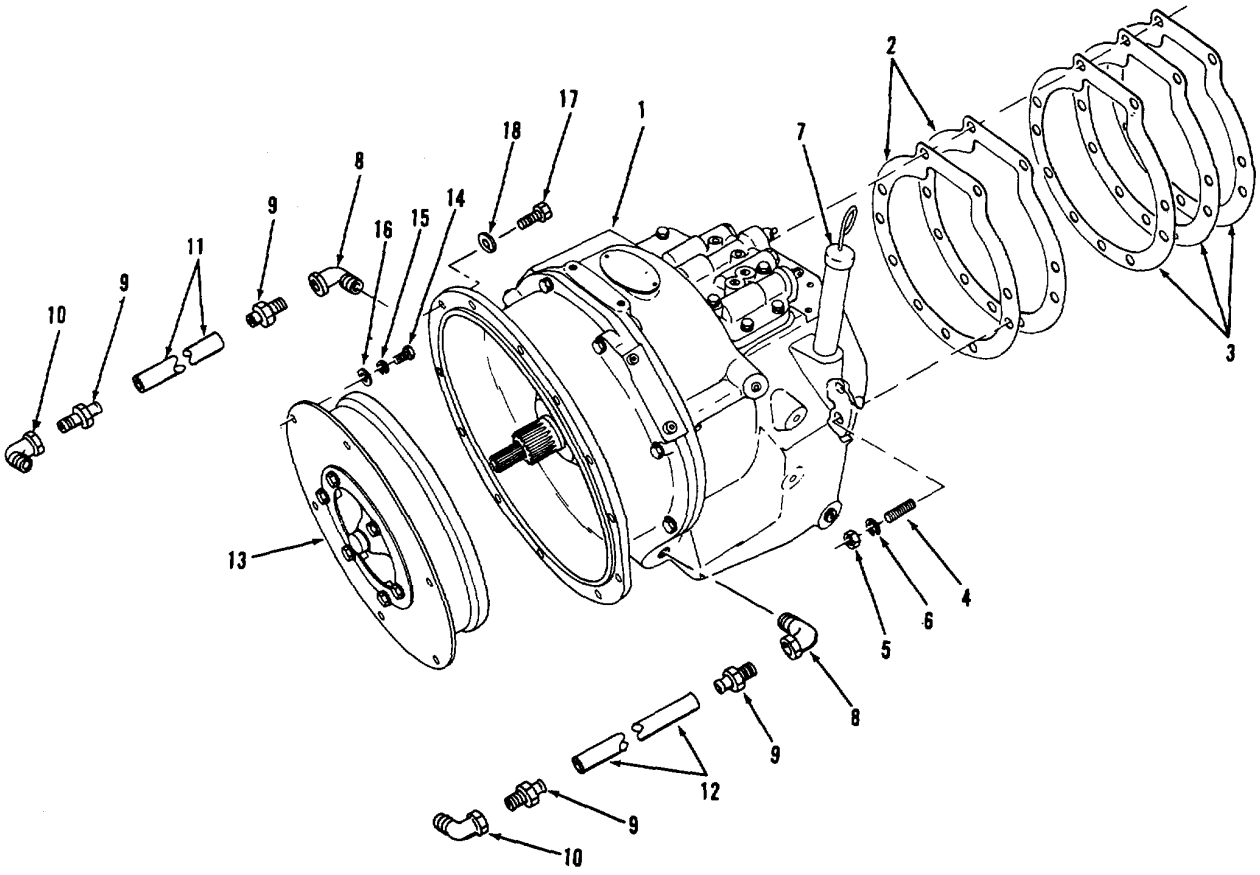
All speeds: With inching valve out to stop, pressure to clutches is "O"

7-7. Transmission Removal

a. Drain cooling system, transmission and axle. Remove power axle as explained in paragraph 2-8, supporting transmission against falling as axle is removed.

b. Disconnect cooling hoses neutral safety switch leads, and all linkage at transmission. Support front of engine by blocking and support transmission now on a wheeled dolly so it may be drawn from truck when ready.

c. Remove screws (17, fig. 7-5) and washers (18), and carefully draw transmission straight off engine until input shaft splines are free of torque converter (13) bore. Torque converter will remain on engine flywheel, and may be left there if it is not to be replaced.



1. Transmission
2. Gasket (.005)
3. Gasket (.010)
4. Stud
5. Nut
6. Lock washer
7. Dipstick
8. Street elbow
9. Fitting
10. Street elbow
11. Hose
12. Hose
13. Torque converter
14. Capscrew
15. Lock washer
16. Washer
17. Cap screw
18. Lock washer

Figure 7-5. Transmission arrangement.

7-8. Transmission Disassembly

a. Remove transmission from truck.

b. Remove cap screws and washers attaching control valve and remove valve from transmission.

c. Mark oil pump (23, fig. 7-6) case and transmission case adapter (4) to insure proper reinstallation, and remove screws (25) and washers (5) holding pump to adapter.

d. Lay transmission on case rear half and remove cap screws (17 and 18) and washers (19) holding adapter to transmission case. Lift off front case and clutch pack as a unit.

e. Separate the clutch pack assembly from the front case assembly by sliding clutch pack from front case.

f. Remove the forward and reverse gears (36, fig. 7-8) and forward drive shaft (37) in the following manner:

(1) Remove snap rings (39 and 40) holding bearing (38).

(2) Remove snap rings (33).

(3) Tap end of forward drive shaft (37) and while holding forward gear (36) and pull shaft out thru opening in housing.

g. Remove the reverse gear and shaft in the following manner:

(1) Remove snap ring (33) holding bearing (34).

(2) Scribe or punch mark the bearing retainer (41) with the gear case to insure proper reinstallation.

(3) Remove cap screw (42) and lock washer (43) holding bearing retainer.

(4) Tap end of reverse drive shaft (31) and while holding reverse gear (36) pull shaft out thru opening in housing.

h. Remove idler gear (26) and shaft (28) in the following manner:

(1) Tap small end of idler shaft and remove retainer (30).

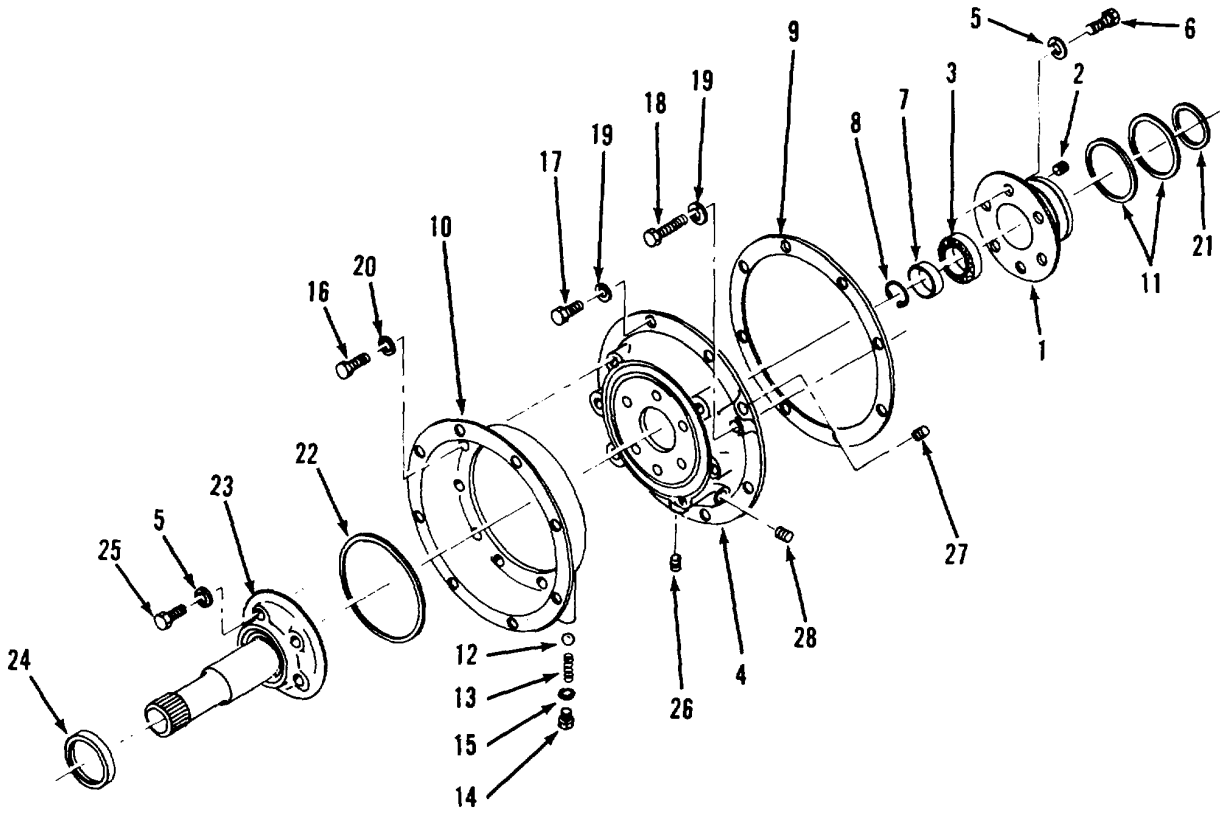
(2) Remove idler gear and bearings (27) through the valve block opening.

i. Remove counter shaft gear (25) and shaft (15) in the following manner:

(1) Remove nuts (24), lock washer (23) bearing roller (19) and cup (3). Take shims (20, 21 and 22) from shaft and remove spacer (18).

(2) Remove counter shaft gear by tapping lightly on the forward end, while holding the output gear through the valve block opening.

j. Remove the strainer element (7) by removing retaining cap screws (9) and washers (10) inside of case.



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1. Front bearing retainer
2. Plug
3. Bearing
4. Adapter
5. Lock washer
6. Screw
7. Bearing spacer
8. Drive gear snap ring
9. Case gasket
10. Converter housing
11. Sealing ring
12. 3/8 in. steel ball
13. Converter valve spring
14. Spring seat
15. Flat washer
16. Screw
17. Screw
18. Screw
19. Lock washer
20. Lock washer
21. Sealing ring
22. Pump gasket
23. Pump
24. Oil seal
25. Screw
26. 1/8 in. pipe plug
27. 1/4 in. pipe plug
28. 3/8 in pipe plug

Figure 7-6. Oil pump and front case.

7-9. Clutch Assembly

a. Disassembly.

(1) Place clutch assembly (fig. 7-7) in an arbor press and apply pressure on the front end of the input shaft, until the cylinder (3) is depressed enough to allow removal of the large snap ring (13) from the pressure plate (5).

(2) Release pressure and remove the front cylinder and input shaft (1) assembly.

(3) Remove the piston (11), clutch plate (17), and springs (15).

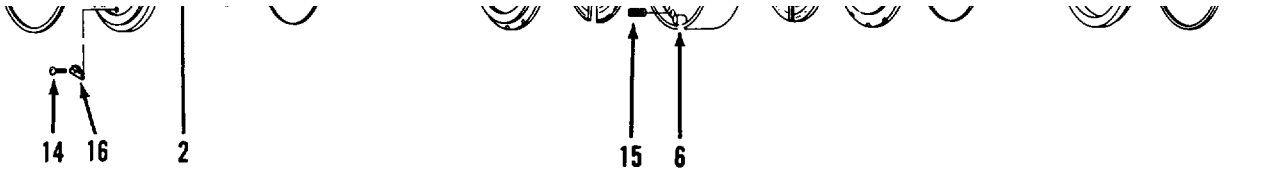
(4) Turn the drum assembly over and remove the other large snap ring (13), cylinder (8), piston (11), and clutch plate (7). Remove screws (4) and take shaft (1) from cylinder (3). Take rings (10 and 12) from piston (11).

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts in solvent. Discard all used nonmetal parts, such as seals and gaskets.

(2) Inspect parts for wear and damage. Replace defective parts with new parts. Do not attempt to repair parts by reworking.

c. Assembly. Wet all internal parts in transmission fluid and reverse procedures in a. above.



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1. Input shaft
2. Needle bearing
3. Front clutch cylinder
4. Cap screw
5. Clutch pressure plate
6. Pressure plate drive pin
7. Clutch plate (reverse)
8. Rear clutch cylinder
9. Needle bearing
10. Sealing ring
11. Clutch piston
12. Sealing ring
13. Retaining ring
14. Lock screw
15. Clutch retractor spring
16. Lock plate snap ring
17. Clutch plate (forward)

ME10-3930-627-34/7-7

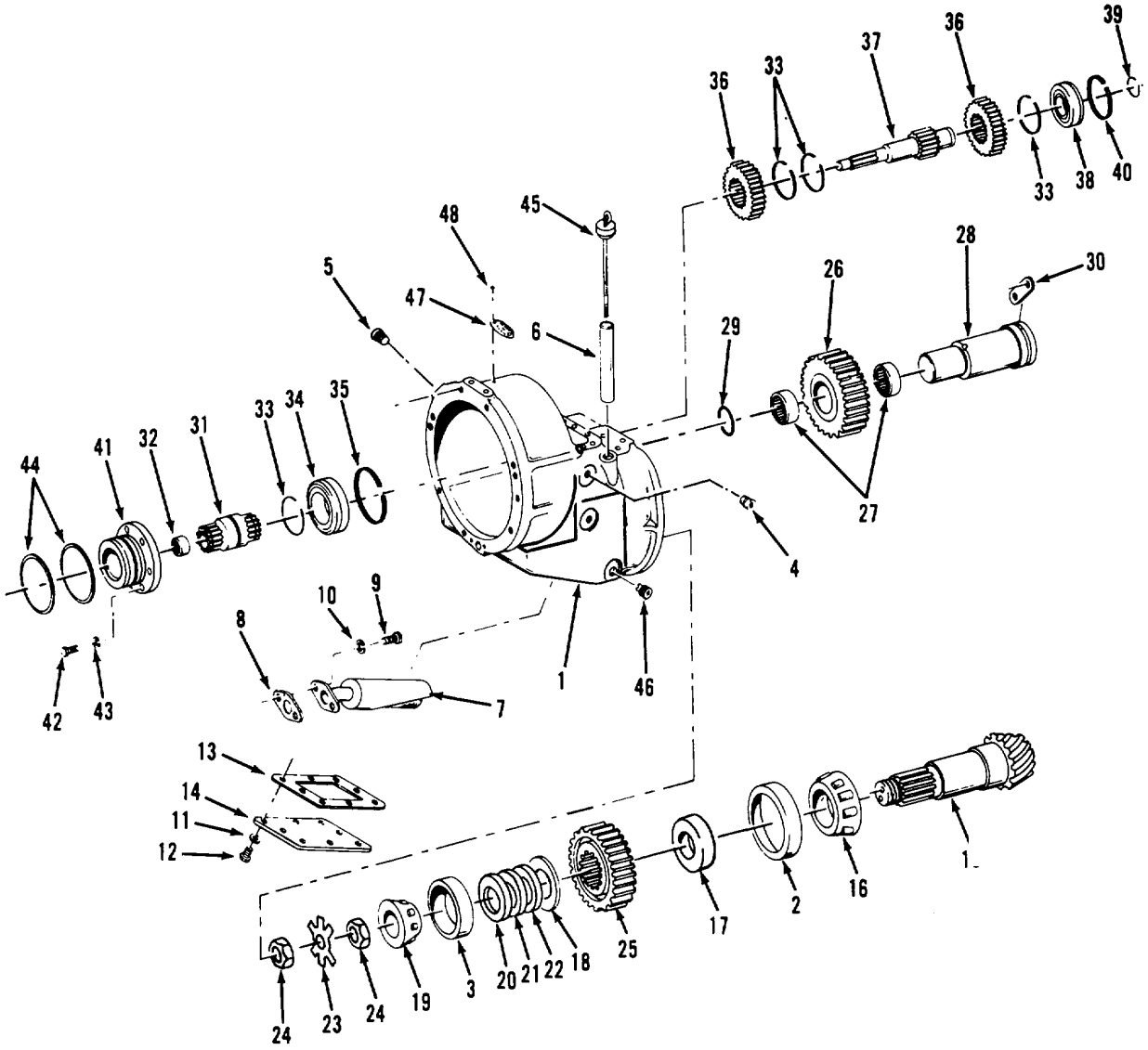
1. Input shaft
2. Needle bearing
3. Front clutch cylinder
4. Cap screw
5. Clutch pressure plate
6. Pressure plate drive pin
7. Clutch plate (reverse)
8. Rear clutch cylinder
9. Needle hearing
10. Sealing ring
11. Clutch piston
12. Sealing ring
13. Retaining ring
14. Lock screw
15. Clutch retractor spring
16. Lock plate snap ring
17. Clutch plate (forward)

Figure 7-7. Clutch park, exploded view.

7-10. Transmission Control Valve

a. Disassembly.

(1) Invert valve from position shown in figure 7-9. Remove pipe plug (1), screws (3) and lock washers (4), lower bedplate (2) and gasket (5).



ME10-3930-637-34/7-8

1. Transmission case rear half
2. Bearing cup
3. Bearing cup
4. 1/4 in. pipe plug
5. 3/8 in. pipe plug
6. Dipstick tube
7. Oil strainer
8. Oil screen gasket
9. Screw
10. Lock washer
11. Washer
12. Cap screw
13. Access cover gasket
14. Access cover plate
15. Output shaft
16. Bearing roller and cone assy
17. Spacer
18. Spacer
19. Bearing roller and cone assy
20. Shim
21. Shim
22. Shim
23. Lock washer
24. Lock nut
25. Countershaft gear
26. Idler gear
27. Needle bearing
28. Idler shaft
29. Retainer
30. Retainer
31. Reverse drive shaft
32. Needle bearing
33. Snap ring
34. Bearing
35. Snap ring
36. Reverse gear
37. Forward drive shaft
38. Bearing
39. Snap ring
40. Snap ring
41. Bearing retainer
42. Cap screw
43. Lock washer
44. Sealing ring
15. dipstick
46. 1/2 in. pipe plug
47. Name plate
48. Drive stud

Figure 7-8. Case and gear train, exploded view.

(2) Remove screws (7) and washers (8). Remove bedplate (6), and gasket (9). Spring (10), ball (11) and plunger (12), and the plunger stops (13, 22,and 27) are now uncovered. Remove them.

(3) Remove retainer plugs (16), gaskets (17), springs (18 and 20) and pistons (19 and 21).

(4) Remove seals (15 and 24), springs (25, 26 and 29) and valve pistons (23 and 28) and plunger (14).

b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts in solvent.

(2) Inspect all parts for cleanliness and damage.

(3) Discard all nonmetal parts and damaged or defective metal parts.

c. Assembly.

(1) Install inching valve locator spring (29, fig. 7-9) in valve body (30), followed by inching valve piston (28), springs (25 and 26) and plunger (23). Press seal (24) in place, and with valve body inverted from position shown. install plunger stop (22) and valve stop (27) in body to engage grooves in inching valve (28), and plunger (23).

(2) Install regulator valve piston (21), spring (20), washer (17) and retainer plug (16).

(3) Install regulator valve piston (19), spring (18), washer (17), and retainer plug (16).

(4) Install plunger (14), seal (15), valve stop (13), detent plunger (12), ball (11), and spring (10). Place gasket (9) and valve bedplate (6) on valve body and install washers (8) and screws (7). This plate retains the piston stops and detent parts in the valve body.

(5) Install gasket (5) and valve bed plate (2), using washers (4) and screws (3).

(6) Install pipe plug (1).

d. Installation. Reverse removal procedure.

7-11. Transmission Assembly

Assemble the transmission by reversing the disassembly procedures. Pay particular attention to the points listed below.

a. Make sure a gasket is in place at the suction inlet opening and not damaged when installing the oil filter screen.

b. Adjust pre-load on output shaft (15, fig. 7-8) bearings to 16 to 24 inch-pounds by adjusting the number of shims (20, 21 and 22) until that torque is reached when first lock nut (24) is torqued to 90 to 120 foot-pounds, and second lock nut is torqued to 10 to 20 foot-pounds less than the first lock nut.

c. Adjust the end play in the gears on the output shaft to 0.010 to 0.020 by interchanging spacers (17 and 18).

Note. ***This end play must exist after completing step* b. *above.***

d. All screws used for mounting components to the transmission case that have their heads exposed to view and are screwed into tapped holes that enter into the inside area of the transmission case (through-holes, not blind) are to be permatexed when mounted (a precaution against oil leakage).

e. As gears and bearings are being installed, coat them with lubricant and make certain that they rotate freely.

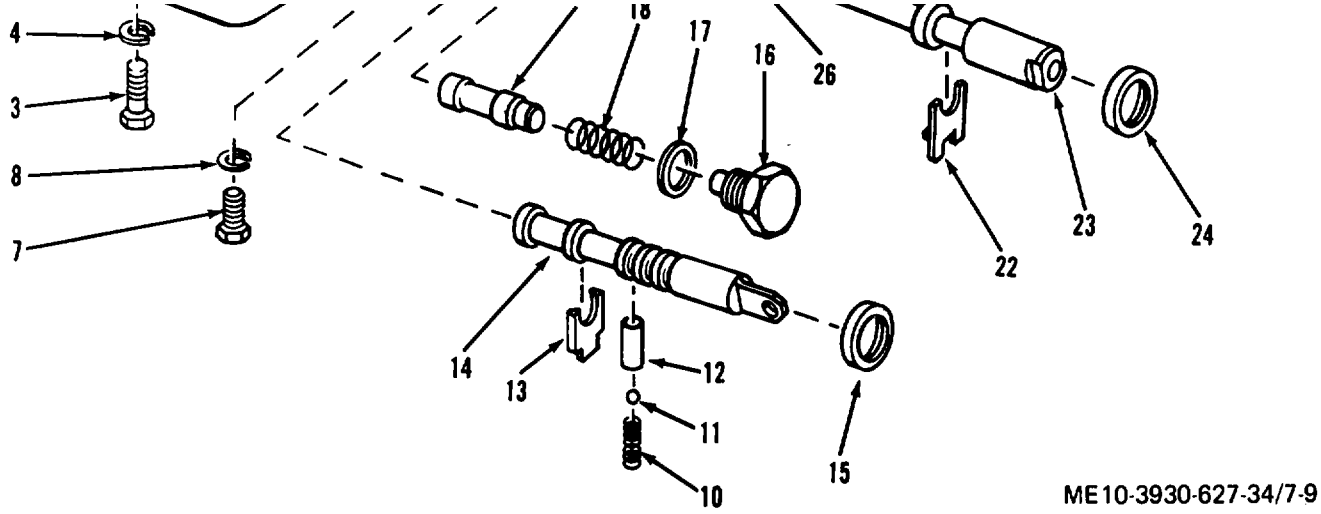
f. Be sure match marks are aligned on the oil pump assembly with the transmission case front half, and rear collector ring with the case front half, or oil passages will not be open.

g. Be sure snap rings are properly installed and thoroughly seated.

h. Use a new gasket when replacing the control valve assembly.

i. Check transmission oil level. Check that engine is at operating temperature and idling at 500 rpm. Place gear shift in neutral position. Add oil if necessary to bring level to full mark on dipstick.

j. Test transmission as given in paragraph 7-6.



1. Pipe plug
2. Lower bedplate
3. Screw
4. Lock washer
5. Gasket
6. Upper bedplate
7. Screw
8. Lock washer
9. Gasket
10. Detent spring
11. Detent ball
12. Plunger
13. Valve stop
14. Detent plunger
16. Plug
17. Washer
18. Spring
19. Regulator piston
20. Spring
21. Regulator piston
22. Plunger stop
23. Inching valve plunger
24. Seal
25. Inner spring
26. Outer spring
27. Valve stop
28. Inching
29. Locator spring

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1. Pipe plug
2. Lower bedplate
3. Screw
4. Lock washer
5. Gasket
6. Upper bedplate
7. Screw
8. Lock washer
9. Gasket
10. Detent spring
11. Detent ball
12. Plunger
13. Valve stop
14. Detent plunger
15. Seal
16. Plug
17. Washer
18. Spring
19. Regulator piston
20. Spring
21. Regulator piston
22. Plunger stop
23. Inching valve plunger
24. Seal
25. Inner spring
26. Outer spring
27. Valve stop
28. Inching valve piston
29. Locator spring
30. Valve body

Figure 7-9. Transmission valve, exploded view.

CHAPTER 8

REPAIR OF DRIVE AXLE

8-1. Description

a. The drive axle consists of a differential with its separate housing, two axle shafts which transfer power from the differential to the final drives at the wheels, and the final drive system which transfers power from the axle shafts to the wheels, which are mounted on tapered roller bearings. Each shaft has an individual housing which bolts to the differential housing and which acts to hold the differential positioned in its housing.

b. The pinion gear of the transmission engages the ring gear of the differential when the transmission is attached to the differential housing. Tooth contact and backlash are determined by selective fitting of shims at assembly. The adjustment technique is explained in this chapter.

c. Refer to table 8-1 to diagnose axle conditions before beginning disassembly.

Note. It is often difficult to determine if trouble originates in differential, axle, or transmission. Refer also to troubleshooting chart (table 2-2) for additional troubleshooting proce - dures.

8-2. Power Axle Overhaul

a. Drive Train Removal. Paragraph 2-8.

(1) Remove mast.

(2) Jack up truck frame high enough to insure crawl space under vehicle and securely install blocking under frame and under engine.

Table 8-1. Troubleshooting Chart, Power Axle

Malfunction	Probable cause	Corrective action
1. Excessive noise in drive axle	*a.* improper or insufficient lubricant.	*a.* Refer to L. O. 10-3930-627-20.
	b. Worn or damaged parts.	*b.* Overhaul axle.
	c. Improper engagement of pinion and ring gear.	*c.* Adjust shimming of axle parts.
	d. Improper engagement between transmission output shaft and ring gear.	*d.* Adjust shimming between trans- mission and differential housing.
2. Excessive backlash in axle.	*a.* Worn pinion, ring gear, or differential gears.	*a.* Overhaul axle.
	b. improper engagement of pinion and ring gear.	*b.* Adjust shimming of axle parts.
3. Axle whines at certain speeds.	*a.* Improper engagement of pinion and ring gear.	*a.* Adjust slimming of axle parts.
	b. Worn pinion, ring gear, or differential gears.	*b.* Overhaul axle.

(3) Drain transmission. Support transmission on dolly. Disconnect shift linkage from transmission; disconnect hydraulic coolant lines to radiator; drain oil from torque converter; remove flywheel access cover plate and remove screws attaching torque converter to flywheel. Disconnect leads at neutral safety switch.

(4) Disconnect parking brake linkage from brakes at wheels.

(5) Disconnect hydraulic brake lines from brake cylinders at wheels.

(6) Remove drive axle collars from frame.

(7) Remove cap screws and lock washers that secure transmission housing to engine flywheel housing.

(8) Attach sling to front lift eyes at frame and lift frame to clear axle.

(9) Remove assembled transmission and drive axle by pulling straight out from engine and rolling it out from under truck.

(10) Block up under rear end of power axle so that wheels clear ground and support transmission with hoist. Remove cap screws, nuts, and lock washers that secure transmission case to lower differential housing, and remove transmission by pulling straight away from axle.

b. Disassembly of Axle.

(1) Remove screws that secure wheels to axle and remove wheels, (TM 10-3930-627-12).

(2) Remove two spring pins (6, fig. 8-1) parking brake rods (5), cotter pins (3), nuts (4) and levers (2).

(3) Remove brake tube assemblies (8 and 9), screws, nuts and washers (15, 16, 17 and 18), fittings

(10, 11, 13, 14 and 19) and related attaching parts.

(4) Remove screws and washers (22 and 23) and separate sections of final drive gear case (47) and axle housing (61). Remove cotter pin, nut and washer (25, 26 and 27).

(5) Remove internal gear (24), bearings (28 and 29), screw (31), final drive shaft (30), gasket (32), outer bearings (33 and 34), brake drum (35) and drum seal (36).

(6) Remove screws and washers (38 and 39) and nuts and washers (40 and 41) from studs (42 and 43). Take off brake assembly (37) and pin (44).

(7) Take out parking brake lever and pin (45) and packing (46) from final drive gear case (47). Discard gasket (48).

(8) Remove six screws and washers (50 and 51) and remove both bearing retainers (49), axle shaft (52) and bearing and retainer (54 and 53).

(9) Remove nuts (55) and washers (56 and 57) to free axle housing from final drive housing (76). Separate items 61.and 76, and remove eight tapered bushings (58) from holes in axle housing. Remove and discard gaskets (62 and 63).

(10) Remove bearing (60 and 64), screws (66) and separate halves of differential case (65). Parts index numbered 67 through 71 may now be removed individually. To remove ring gear (72), drill heads off rivets (73) from ring gear side to avoid damage to case and remove rivets.

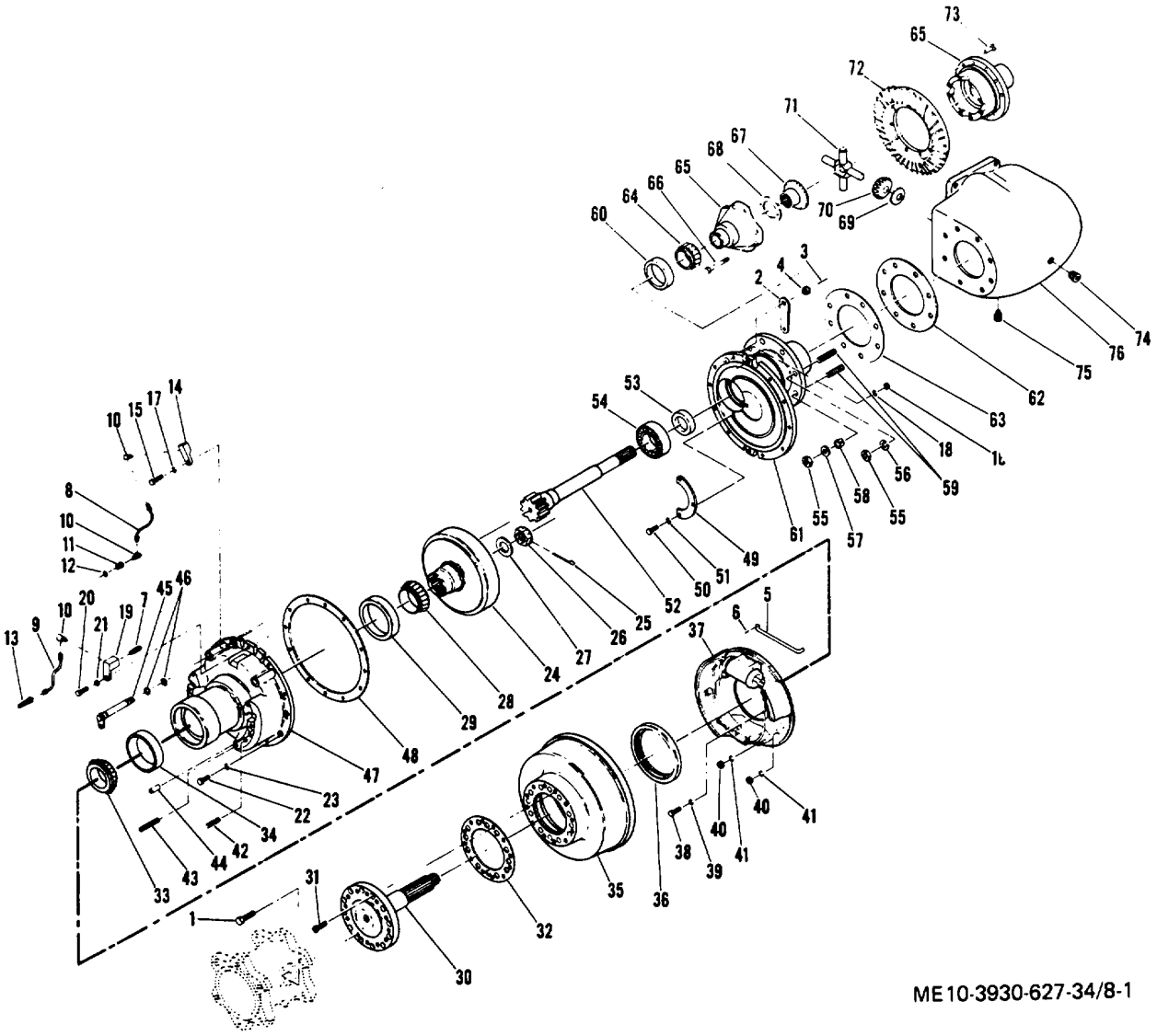


Figure 8-1. Drive axle, exploded view.

KEY to figure 8-1:

1. Wheel bolt
2. Parking brake lever
3. Cotter pin
4. Castellated nut
5. Parking brake rod, rh
6. Spring pin
7. Brake bleeder screw
8. Brake tube assembly (actuating)
9. Brake tube assembly (bleed)
10. Elbow
11. Adapter
12. Gasket
13. Bleeder tube adapter
14. Brake line fitting
15. Screw
16. Nut
17. Washer
18. Washer
19. Bleeder screw fitting
20. Screw
21. Washer
22. Screw
23. Washer
24. Internal gear final drivel
23. Cotter pin
26. Nut
27. Washer
28. Roller bearing inner cone and rollers
29. Inner bearing cup
30. Final drive shaft
31. Screw
32. Gasket
33. Bearing outer cone and rollers
34. Outer bearing cup
35. Brake drum
36. Brake drum seal
37. Brake assembly
38. Screw
39. Washer
40. Nut
41. Washer
42. Stud
43. Stud
44. Pin
45. Brake lever and pin assembly
46. Parking
47. Final drive gear case
48. Gasket
49. Bearing retainer
50. Screw
51. Washer
52. Axle shaft
53. Axle shaft bearing retainer
54. Bearing
55. Nut
56. Washer
57. Washer
58. Tapered bushing
59. Stud
60. Roller bearing cup
61. Axle housing
62. Gasket
63. Gasket
64. Bearing cone and rollers
65. Case assembly
66. Screw
67. Side bevel gear
68. Thrust washer (side gear)
69. Thrust washer (spider bevel gear)
70. Bevel gear (spider)
71. Differential spider
72. Ring gear
73. Rivet
74. Pipe plug
75. Housing oil drain plug
76. Final drive housing

c. Cleaning and Inspection. Clean all metallic parts with an approved cleaning solvent. Dry thoroughly with compressed air. Lubricate bearings with engine oil. Inspect parts as follows:

(1) Inspect all gears for cracked, worn, chipped, or broken teeth, worn bearing seats, and other damage.

(2) Inspect axle shafts for worn or broken teeth and splines, twisted shafts, and worn or scored bearing seats.

(3) Inspect bearings for worn or scored rollers and races, cracked races and seating surfaces, distortion, signs of overheating, and other damage.

(4) Inspect axle housings and differential housing for cracks, distortion, worn or damaged threads, and other damage.

(5) Replace worn and unserviceable parts.

d. Reassembly, Adjustment, and Installation. Three basic adjustments must be made when the differential has been assembled after replacement of parts. These are differential' bearing preload adjustment, ring gear and pinion backlash adjustment, and tooth contact adjustment. These adjustments require that the same transmission to be installed with the axle be used in making the adjustments. Before beginning assembly have this transmission available with one set of gaskets (2 and 3, fig. 7-5) to provide a difference between the bearing cone end and the gasket pack of 0.119 inch to 0.125 inch, (fig. 8-2). Add or remove gaskets as required to obtain required bearing exposure. Proceed as follows with assembly and adjustment.

(1) Rivet ring gear (72, fig. 8-1) to case (65) half. Press one bearing cone and roller (64) onto trunnion of each case half. Place a thrust washer (68) and side gear (67) in place in each case half.

(2) Put four spider gears (70) and thrust washers (69) on spider (71) and install in one case half. Align match marks on case halves and assemble case halves with screws (66). Install cups (60) in axle housings (61) and put a set of gaskets (62 and 63) on studs (59) of differential housing (76). Use same thickness of gaskets at each side as was removed at disassembly for initial assembly

(3) Position assembled differential in housing (76). Differential will be loose. Pass a piece of rod or

tubing about three feet long through differential center to aid manipulation during assembly. Position axle housings (61) on differential housing studs. Place tapered bushings (58) on studs and install nuts (55) and washers (56 and 57).

(4) Turn ring gear by hand, testing for noticeable drag due to preload condition of differential bearings. If no drag exists, remove gaskets (62 or 63) and repeat test until drag is noticed. Gasket (62) is 0.005 inch thick, and gasket (63) is 0.0075 inch thick. Decrease total gasket thickness in 0.0025 inch steps by removing two 0.005 inch gaskets and adding one 0.0075 inch gasket.

(5) If drag is noticeable on first trial, reverse procedure for decreasing gasket thickness in step (4) above until no drag is present, then decrease total gasket thickness until drag is felt. Preload will now be between 0. 000 inch and 0. 003 inch.

(6) Press bearings (54) and retainers (53) onto axle shafts. Positioning differential with rod (see step (3) above), enter splines of one axle shaft into side gear (67) and install bearing retainer (49). Steady differential assembly by hand and repeat installation for other axle shaft.

(7) Check pinion and ring gear backlash adjustment as follows, before assembling axle reduction ends to differential section of the axle.

(8) Temporarily assembledrive axle and gaskets (2 and 3, fig. 7-5) to transmission. Remove access plate (14, fig. 7-8), at bottom of transmission and remove pipe plug (75, fig. 8-1), from bottom of differential housing (76).

(9) Turn output gearshaft (15, fig. 7-8) so one flat on nut (2) will be horizontal.

(10) Mount a dial indicator on access hole of transmission to contact downward facing flat on the nut at a point one inch from center line of shaft.

(11) Through hole in differential housing from which pipe plug was removed, insert rod, or long pipe plug to hold ring gear locked.

(12) Turn output gearshaft in both directions through backlash freedom, noting reading on dial indicator. Reading of 0.007 inch to 0.017 inch is satisfactory.

***Note*. Several adjustments of both pinion and ring gear setting may be necessary in the following procedure before the exact thickness of gaskets to be added, removed, or exchanged at any stage. This is determined by trial and error.**

(13) Apply a thin coating of red lead to drive face of ring gear teeth, and install axle on transmission with gaskets used in step (8) above.

(14) Remove access plate (14, fig. 7-8) from bottom of transmission.

(15) Engage spur gear (25) with a pry bar, and turn it until differential has made one revolution in the forward direction.

(16) Remove transmission from axle. Examine teeth of ring gear, and compare marks in red lead from pinion gear contact with examples shown in figure 8-3.

***Note*. Ring gear is on left side of pinion when installed. References to follow will be on this basis.**

(17) If marks in red lead compare with those shown in view A, figure 8-3, indicating high, narrow tooth contact (pinion too far out), adjust by removing one or more gaskets (2 or 3, fig. 7-5) to move pinion in direction indicated in box adjacent to view A, figure 8-3. Transfer one or more gaskets (62 or 63, fig. 8-1) from left side of differential housing to right side. Repeat steps (1) through (4) above to check results of adjustment.

***Note*. Do not change total thickness of gaskets (62 and (63 used; merely change them from one side to the other as needed, so the differential bearing preload will not be changed.**

(18) If marks in red lead compare with those in view B, figure 8-3, reverse adjustment procedure given in step (17) above. Repeat steps (13) through (16) above to check results of adjustment.

(19) Reverse disassembly steps for the rest of the assembly procedures.

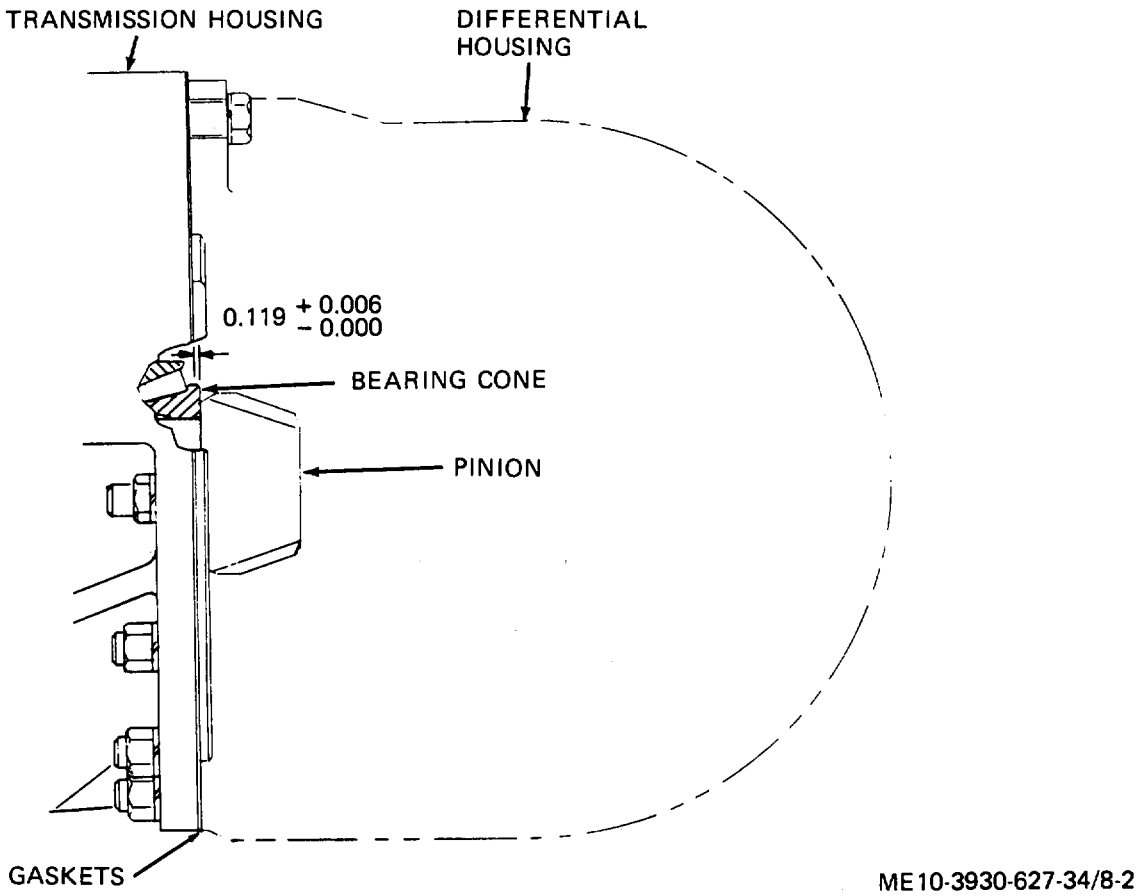
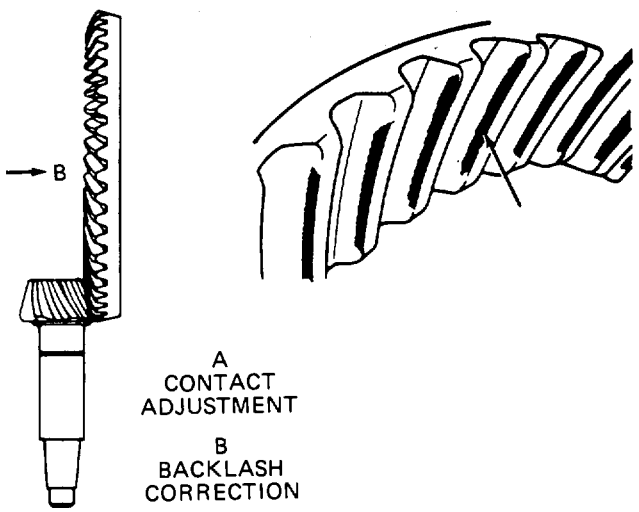
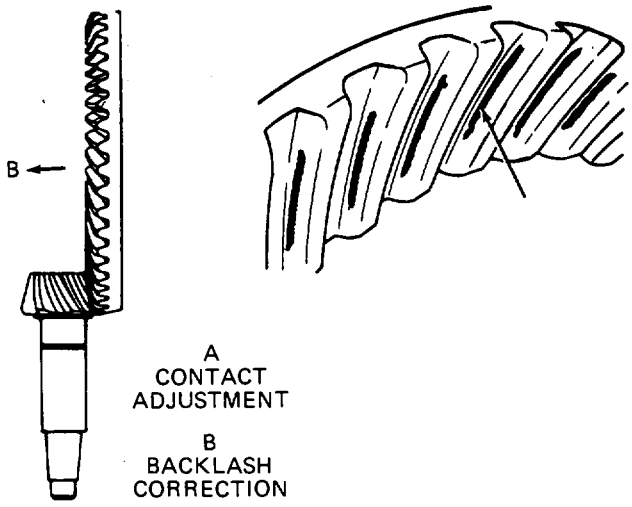


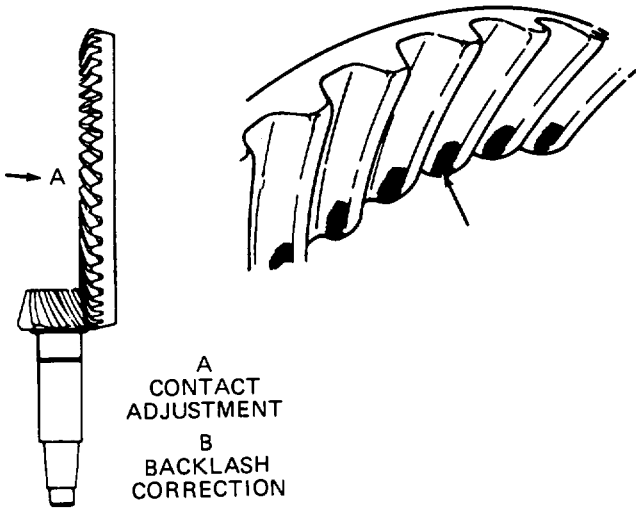
Figure 8-2. Transmission-to-differential gasket requirement.



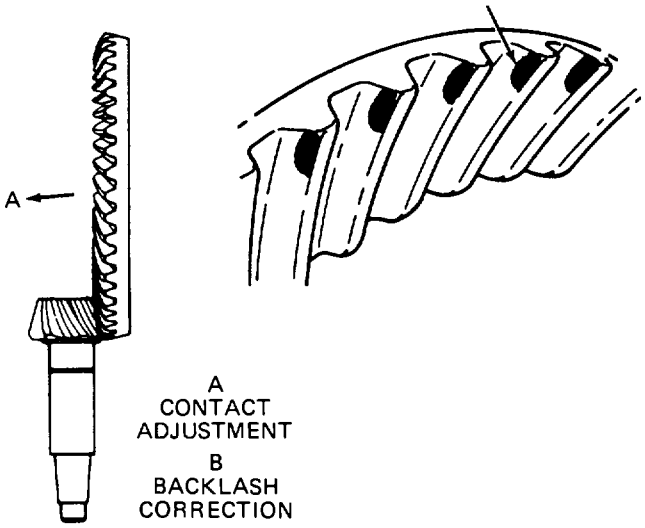
VIEW A
HIGH NARROW TOOTH CONTACT
(PINION TOO FAR OUT)



VIEW B
LOW NARROW TOOTH CONTACT
(PINION TOO DEEP)

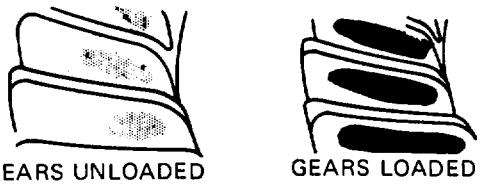


VIEW C
SHORT TOE CONTACT
(DRIVE GEAR TOO CLOSE TO PINION)



VIEW D
SHORT HEEL CONTACT
DRIVE GEAR TOO FAR FROM PINION

CORRECT TOOTH CONTACT



GEARS UNLOADED

GEARS LOADED

ME10-3930-627-34/8-3

Figure 8-3. Proper pinion-to-differential ring gear tooth contact pattern.

e. Reassembly of Power Train to Engine. Transmission torque converter must be properly engaged in transmission before attempting reassembly of power train to engine. Reassemble and install power train by reversing removal procedure. Be certain to line up timing mark of converter with timing mark on flywheel.

CHAPTER 9

REPAIR OF STEERING AXLE

9-1. Description

a. The steering axle (fig. 2-11) supports the rear of the truck through two neoprene mounting blocks (37), which fit into recesses on the truck frame. With the exception of the tie rod ends, all moving parts are fitted with antifriction bearings.

b. All wheel alignment specifications are neutral with the wheels in the straight ahead position. Adjusting the length of the tie rods adjusts toe-in, as may be necessary after new parts are installed. Adjusting the length of the drag link (if it is necessary) sets up the relationship between the steering gear and axle, as the truck will turn equally to right or left.

9-2. Alignment

a. Chalk mark each rear tire tread at hub height.

b. With rear wheels pointing straight ahead, measure the distance between the inside of the tires at this point with a straight edge, or expanding calipers, and note it to within 1/32 inch.

c. Roll truck until rear wheels make 1/2 turn (refer to the chalk marks) and measure the distance between the tires at the chalk marks. It should be the same as the previous reading within 1/16 inch.

d. To adjust the alignment, loosen the clamp screws at each end of each tie rod (27, fig. 2-11) (but not the drag link), enough to permit turning the tie rods in the threads of the tie rod ends.

e. Tie rods and ends have right hand threads at one end, left hand threads at the other. Turning the rods with the ends mounted to the axle will shorten or lengthen the tie rod assemblies enough to effect an adjustment. Turn each rod an equal amount in the same direction as needed to get both wheels pointing in the straight ahead position at the same time.

9-3. Repair and Replacement

a. Repair. Repair of the steering axle is limited to replacement of defective parts.

b. Removal.

> ***Note.*** **When raising truck to remove axle, do not lift by counterweight, but instead lift with overhead hoist hooked into holes of truck side ahead of counterweight. Without hoist, raise each side of body by placing jacks under edge or side panel just ahead of rear wheels.**

(1) Disconnect drag link from steering bellcrank (30, fig. 2-11).

(2) Remove capscrews (39, fig. 2-11), lock washers (36) and remove support plate (38).

(3) Raise truck to clear axle and roll axle from under truck.

c. Disassembly.

> ***Note.*** **Do not remove bearing cups (11, fig. 2-11) from the wheel (171 or brushings (231 from the axle (11 unless inspection indicates need for replacement.**

(1) Pry hub cap (14) from hub (17). Remove cotter pin (13), nut (12) and washer (15) from steering knuckles (26 and 31).

(2) Withdraw wheel from spindle using care not to damage seal (18).

(3) Remove four cotter pins and nuts (29) and remove tie rods (27).

(4) Remove retaining ring (32) and washer (33) from axle. Lift bellcrank (30) from pivot post.

(5) Remove double nuts (24), washers (20) and capscrew (19) from king pin (21). Press king pin from spindle.

(6) Remove spindle and thrust washer (22) from axle.

> ***Note.*** **The axle block bore is off center for multiple usage. Mark top side to insure correct reassembly.**

(7) Remove axle blocks (37) from the axle.

d. Assembly and Installation. Reverse the removal and disassembly steps, then check and adjust wheel alignment as given in paragraph 9-2.

CHAPTER 10

BRAKE REPAIR

10-1. Hand Brake

a. Replace.

(1) It is unlikely as a practical matter that all parts of the hand brake will have to be replaced at one time. Refer to figure 10-1 to identify the parts which must be replaced.

(2) Remove and replace hand brake parts as needed by reference to figure 10-1.

b. Adjustment. Refer to TM 10-3930-627-12 for adjustment procedures.

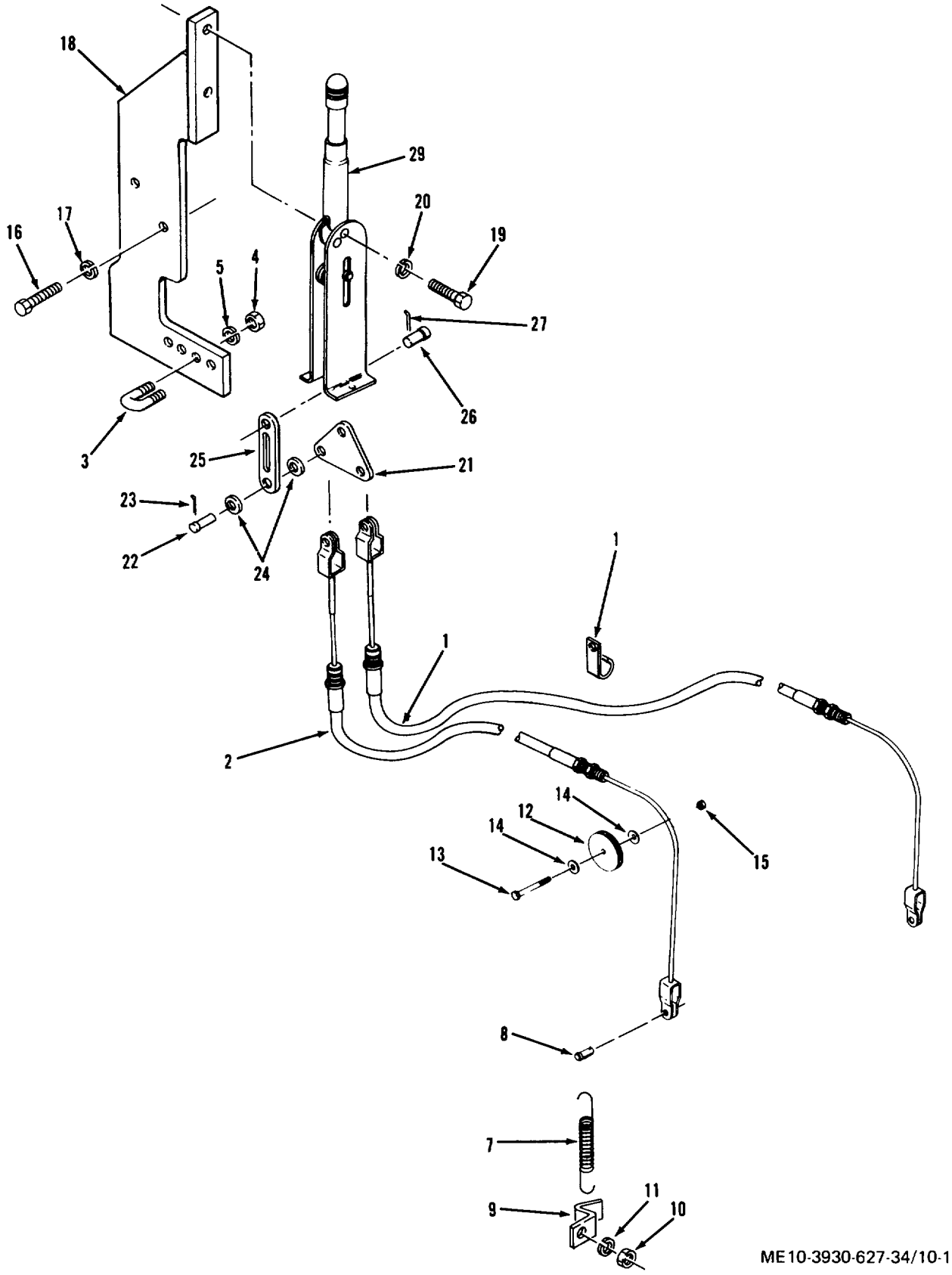


Figure 10-1. Hand brake arrangement.

KEY to figure 10-1:

1. Hand brake cable
2. Hand brake cable
3. Cable clamp
4. Nut
5. Lock washer
6. Cable clip
7. hand brake spring
8. Pin
9. Hand brake spring clip
10. Nut
11. Lock washer
12. Sheave
13. Screw
14. Washer
29. Hand brake lever
13. Self-locking nut
16. Screw
17. Lock washer
18. Brake mounting bracket
19. Screw
20. Lock washer
21. Cable equalizer plate
22. Pin
23. Cotter pin
24. Washer
25. Link
26. Pin
27. Cotter pin
28. Hand brake link

10-2. Master Cylinder Repair

a. Refer to TM 10-3930-627-12 for removal procedures.

b. Strip master cylinder of parts numbered 24 to 40 in figure 10-2. Discard all nonmetallic parts and soft metal washers.

c. Wash all parts in alcohol, dry thoroughly and inspect bore of master cylinder for rust pits or scratches.

d. If pits are found discard master cylinder. Remove slight scratches with a brake cylinder hone.

e. Dry all parts thoroughly, wet them in new brake fluid, and install all parts in reverse of disassembly order. Install a complete repair kit, using all parts furnished.

f. Install master cylinder and adjust position of push rod (33) to travel 1/32 inch to 3/32 inch, as pedal is pressed, before it contacts the piston (37).

10-3. Brake Pedal Replacement

a. Refer to figure 10-2 for details of brake pedal replacement.

b. After any linkage parts in the brake pedal components have been disturbed, recheck and adjust the push rod free travel as in paragraph 10-2, step f.

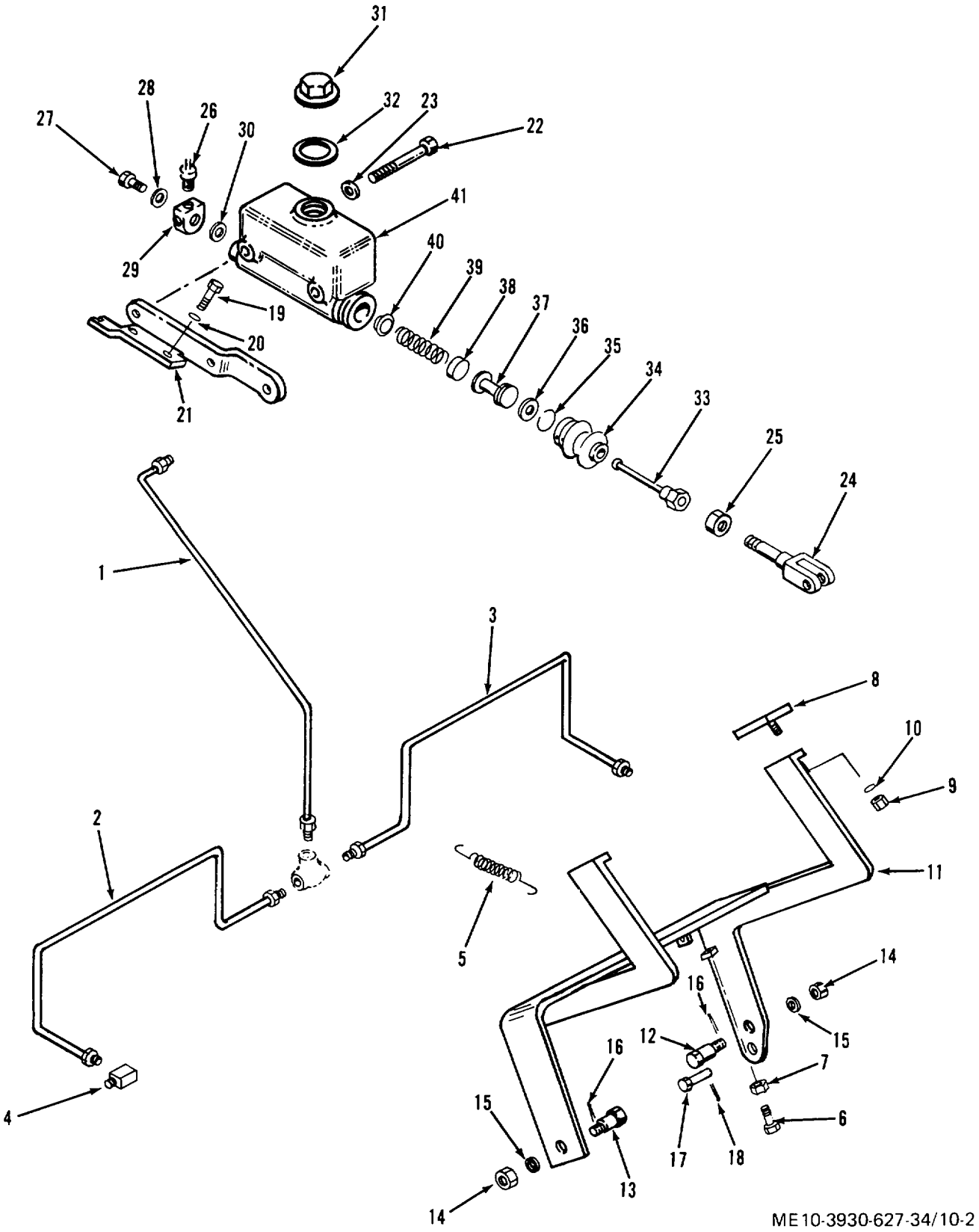


Figure 10-2. Hydraulic brake arrangement.

KEY to figure 10-2:

1. Tube
2. Tube
3. Tube
4. Elbow to wheel cylinder
5. Brake pedal return spring
6. Pedal stop screw
7. Jam nut
8. Pedal pad
9. Nut
10. Lock washer
11. Brake pedal
13. Pinion
14. Slotted nut
15. Washer
16. Cotter pin
17. Pin
18. Cotter pin
19. Screw
20. Lock washer
21. Mounting bracket
22. Screw
23. Lock washer
24. Brake cylinder clevis
25. Jam nut
26. Stop light switch
27. Connector bolt
28. Washer
29. Tube fitting
30. Washer
31. Fill cap
32. Gasket
33. Bush rod
34. Boot
35. Retaining ring
36. Piston stop plate
37. Piston
38. Cup
39. Piston return spring
40. Check salve
41. Master cylinder

10-4. Wheel Cylinder Repair

a. Removal. Refer to TM 10-3930-627-12.

b. Disassembly. Refer to figure 10-3 and take the push rod, boot, piston, cup and spring from the cylinder. These parts can be removed by hand if the brake shoes are removed or spread apart at the top.

c. Cleaning. Clean all parts with alcohol and inspect the piston and cylinder bore for scratches and pitting, and check for rust spots on the spring.

d. Repair. Clean slight scratches from the cylinder bore with a brake cylinder hone. If defects cannot be corrected by slight honing and installation of a repair kit, install a complete new wheel cylinder assembly.

e. Assembly and Installation. Soak all parts in hydraulic brake fluid and assemble and install by reversing the disassembly and removal procedures.

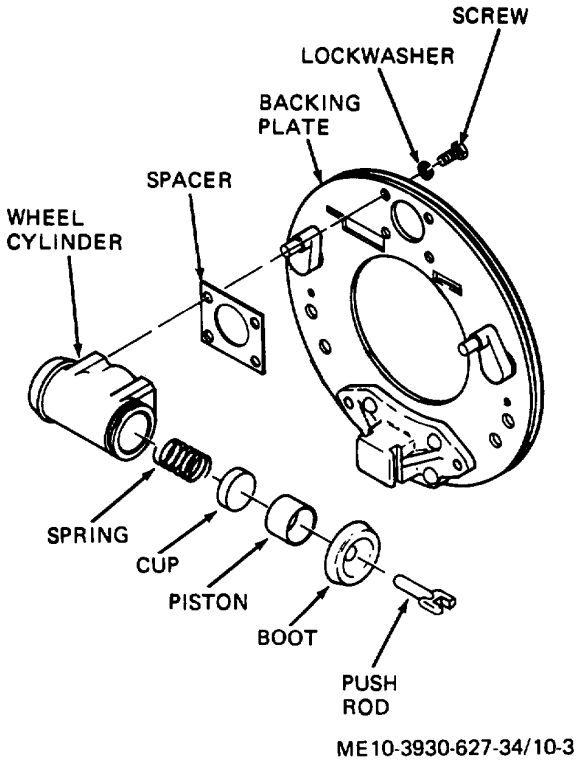


Figure 10-3. Brake wheel cylinder.

10-5. Brake Drum Repair

a. Remove brake drum, TM 10-3930-627-12, and with a shop brake drum gage, inside micrometer or dial indicator check the friction surfaces of the drum for:

(1) Taper, or bell mouthed condition over 0.010 inch TIR (total indicator reading).

(2) Out-of-round over 0.010 TIR.

(3) Oversize beyond 11.500 inches.

b. If any defect listed is found, correct the condition by truing the braking surface in a brake drum lathe. Enlarge drum bore in 0.020 inch steps as standard oversizes. If drum must be cut out beyond 0.060 oversize to remove defects, replace drum.

c. Stamp drum with actual oversize and tag it so it will be used only with oversize brake lining or shimmed brake shoes.

CHAPTER 11

STEERING GEAR

11-1. Description

The fork lift trucks are equipped with power steering. The steering gear has an integral steering valve that operates as follows:

a. The steering gear (fig. 11-1) includes a hydraulic steering valve and a combination ball nut and piston which engages the steering gear shaft through balls which mesh with the worm gear on the end of the shaft. The toothed rack on the piston engages the toothed gear segment on the pitman arm shaft. As the steering wheel and steering gear shaft are rotated, the force of the worm gear teeth against the balls causes the steering gear shaft to shift axially (up or down, depending on direction of turn) a slight amount.

b. This axial shift operates the hydraulic steering valve by shifting a spool up or down and causes oil under pressure from a section of the hydraulic pump to be ported to the top or bottom of the piston.

c. This hydraulically operated movement is transferred to the bellcrank on the steering axle to steer the vehicle. In this manner, hydraulic power assists manual power to steer the vehicle.

11-2. Steering Gear Lash Adjustment

a. Disconnect pitman arm from pitman shaft on steering gear.

b. Gently rotate steering wheel until it comes to rest against stop. Then gently rotate it in opposite direction until it rests against opposite stop, carefully counting turns required to rotate from stop to stop. Divide this number by two and rotate steering wheel in opposite direction by resulting number to center steering wheel. Mark bottom of wheel with tape.

c. Remove the horn button from the steering gear hub.

d. Turn the steering gear 1/2 turn off center. Use a 24 inch-pound torque wrench in the steering wheel nut to determine the torque required to rotate the steering shaft slowly through a 20 degree arc.

e. Turn the steering gear back to center. Loosen nut on lash adjuster opposite pitman shaft extension and rotate adjuster until torque reading is 6 inch-pounds greater than that determined in d. above. Retighten lock nut to 20 to 30 foot-pounds and recheck torque.

f. Reconnect pitman arm and replace horn button.

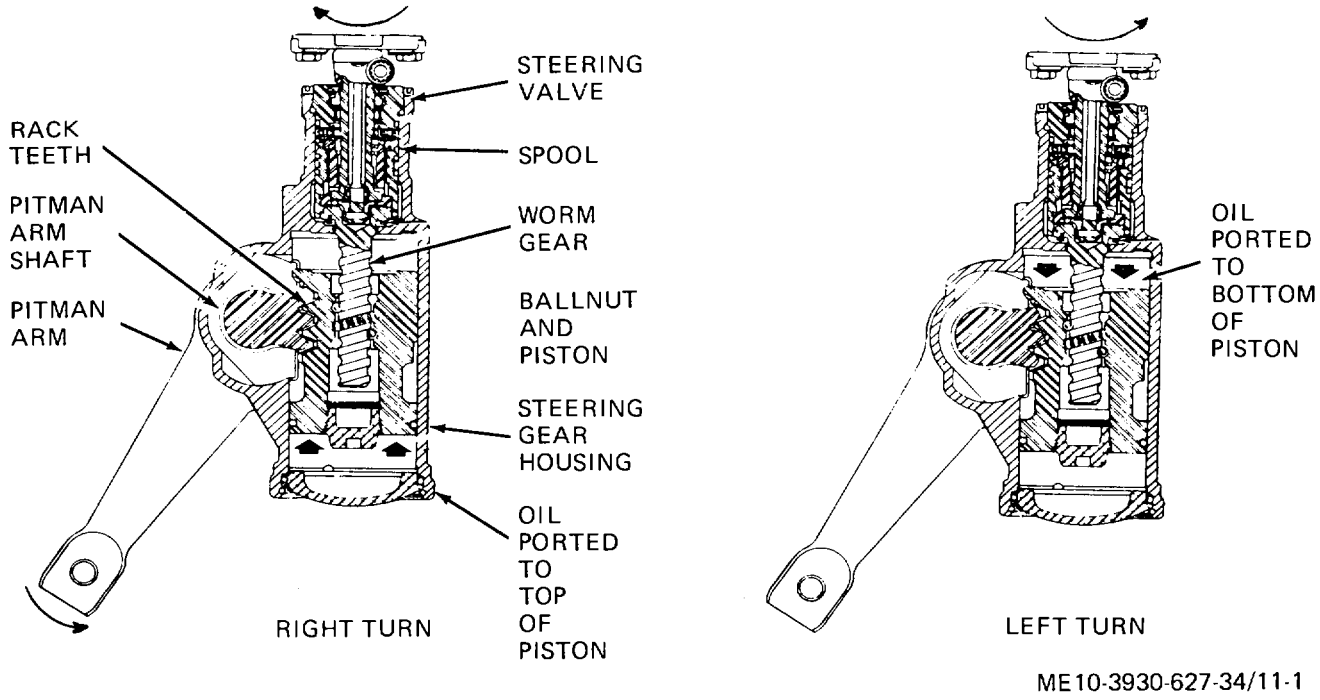


Figure 11-1. Power steering gear operation.

11-3. Steering Gear Repair

Complete disassembly of the steering gear at one time is not an overhaul operation. The instruction in following paragraphs present complete information necessary to correct any malfunction of the gear. Before beginning repairs, diagnose the probable cause of the malfunction by referring to the troubleshooting chart for the steering gear. Limit disassembly to necessary operations.

a. Adjuster Plug Assembly.

(1) Removal.

(*a*) Loosen adjuster plug lock nut (3, fig. 11-2) with adjuster plug lock nut wrench (fig. 2-11 or equal. Make wrench locally, if necessary, using data on figure 2-1.

(*b*) Remove adjuster plug assembly with spanner wrench.

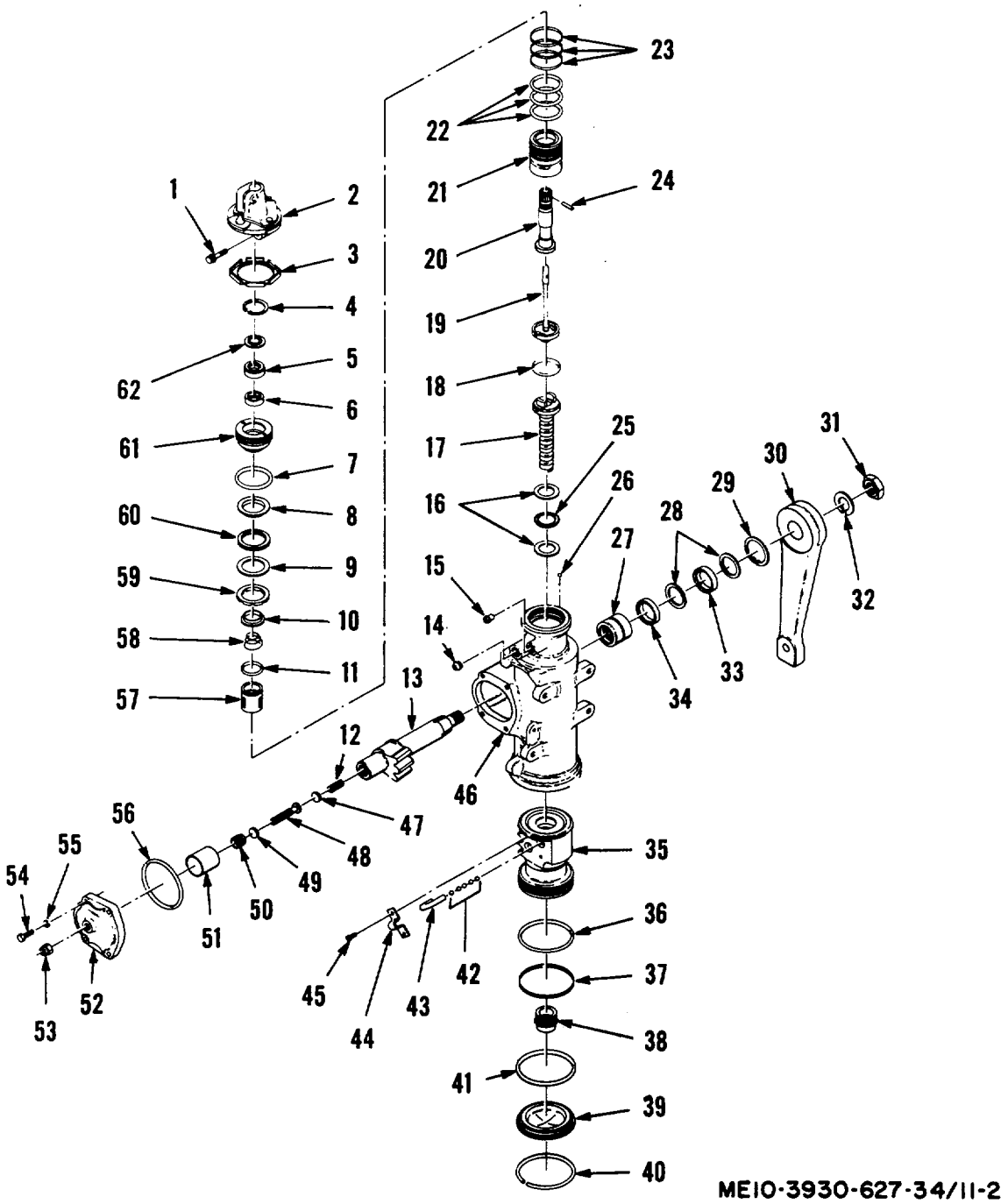


Figure 11-2. Steering gear, exploded view.

KEY to figure 11-2:

1. Screw
2. Flange
3. Nut
4. Retaining ring
5. Oil seal
6. Needle bearing
7. Packing
8. Race
9. Race
10. Bearing retainer
11. Packing
12. Spring
13. Sector gear shaft
14. Connector
15. Connector
16. Thrust bearing races
17. Worn
18. Packing
19. Torsion bar and valve cap
20. Stub shaft
21. Valve body
22. Valve body rings
23. Back-Up packing
24. Pin
25. Bearing
26. Ball
27. Bearing
28. Washers
29. Retaining ring
30. Steering arm
31. Nut
32. Washer
33. Oil seal
34. Oil seal
35. Rack-piston nut
36. Packing
37. Piston ring
38. End plug
39. Housing end plug
40. Retaining ring
41. Packing
42. Balls
43. Ball guide
44. Clamp
45. Screw
46. Housing
47. Washer
48. Lash adjuster
49. Washer
50. Retainer
51. Sleeve bearing
52. Side Cover
53. Nut
54. Screw
55. Washer
56. Packing
56. Spool
58. Spool spring
59. Spacer
60. Thrust bearing
61. Adjuster plug
62. Dust seal

(2) Disassembly.

(*a*) Remove the thrust bearing retainer (10, fig. 11-2) with a screwdriver, being careful not to score the needle bearing bore, and discard. Remove thrust bearing spacer (59), thrust bearing (60), and thrust bearing races (8 and 9).

(*b)* Remove adjuster plug packing (7) and discard.

(*c)* Remove stub shaft seal retaining ring (4), with snap ring pliers, and remove stub shaft dust seal (62).

(*d)* Remove stub shaft oil seal (5) by prying out with screwdriver and discard.

(*e)* Examine adjuster plug needle bearing (6). If rollers are broken or pitted, remove needle bearing from adjuster plug by pressing from thrust bearing end using piloted driver. Discard bearing.

(3) *Assembly*.

(*a)* Assemble needle bearing (6, fig. 11-2) by pressing from thrust bearing end of adjuster plug (61) against identification end of bearing. End of bearing is to be flush with bottom surface of stub shaft seal (5) bore.

(*b)* Lubricate new stub shaft seal with automatic transmission fluid, Type "A", and install far enough to provide clearance for dust seal (62) and retaining ring (4). Lubricate new dust seal with engine oil and install with rubber surface outward. Install retaining ring (4), making certain that the ring is properly seated.

(*c)* Lubricate packing (7) with automotive and artillery grease, MIL-G-10924, and install on adjuster plug. Assemble large thrust bearing race (8), thrust bearing (60), small thrust bearing race (9), and thrust bearing spacer (59) on adjuster plug. Press new bearing retainer (10) into needle bearing bore, using thrust bearing retainer installer, as shown in figure 2-2. If necessary, make installer locally, using figure 2-2 for guidance.

(4) *Installation*.

(*a)* Place tool to protect seal over end of stub shaft (20, fig. 11-2).

(*b)* Install adjuster plug assembly in gear housing. Adjust thrust bearing preload according to*g.* below, and tighten lock nut to 50 to 110 foot-pounds.

b. Valve.

(1) *General*. The complete valve in each steering gear is a precision unit with selective fitted parts and is hydraulically balanced at assembly. Only those parts which are service items are replaceable and interchangeable. No other valve parts are individually interchangeable. If replacement of any nonserviceable valve part is necessary, the complete rotary valve assembly must be replaced. Do not disassemble the valve unless necessary since this may result in

damaging it. If the valve spool dampener packing requires replacement, remove valve spool only, replacing packing, and reinstall spool immediately. Do not disassemble further.

***Note*. It is very uncommon to have to make any service repairs to the valve, with the exception of the valve spool dampener parking.**

(2) *Removal*.

(*a)* Remove adjuster plug as outlined under a. above.

(*b)* Remove valve from gear by grasping stub shaft (20, fig. 11-2) and pulling out valve and stub shaft.

(3) *Disassembly*.

(*a)* Remove packing (18) and discard.

(*b)* Remove spool spring (58) by prying small coil, using small screwdriver. Do not pry against the valve body (21) as this may result in a sticky valve. Work spring onto bearing diameter of the stub shaft (20). Slide the spring off the stub shaft.

(*c)* Remove valve spool (57) with extreme care.

***Caution*: The clearance between the valve body and the spool may be as low as 0.0004 inch. The slightest cocking of the spool may jam it in the valve body. To remove valve spool (57), hold valve assembly in both hands with stub shaft pointing downward. Push lightly on valve spool with a small rod by inserting rod through openings in valve cap (19) until spool is far enough out of valve that it may be grasped by the hand. Withdraw spool with a steady oscillating pull to prevent jamming. If slight sticking occurs, make a gentle attempt to reverse withdrawal procedure. If this does not free the spool, it has become cocked in the valve body bore. Do not attempt to force the spool in or out if it becomes cocked. In this case, continue to dis-assemble the valve assembly as follows and return to the spool as described in step (*d*) below.**

(*d)* Do not tap with anything metallic. If spool can be rotated it can be removed. Remove the stub shaft (20), torsion bar and valve cap assembly (19) by holding the above assembly in both hands as before, only with thumbs on valve body. Rap torsion bar lightly against the work bench. This will dislodge the cap from the valve body to cap pin. The stub shaft, torsion bar and valve cap assembly can now be removed from the valve body. If the valve spool has become cocked as described in step (*c*) above, it can now be freed. By visual inspection on a flat surface it can be determined in which direction the spool is cocked. A few very light taps with a light soft plastic or rawhide mallet should align the spool in the bore and free it.

(*e)* Remove dampener seal packing (11) from spool and discard.

(*f)* Providing the rings show evidence of excessive wear, carefully cut valve rings (22) and ring back-up packing (23), remove and discard. The valve rings are made of filled teflon and it is very unusual that replacement is required.

(4) *In-process inspection*.

(*a)* If the valve leaks externally around the torsion bar (19) replace the entire assembly.

(*b)* Check the pin in the valve body (21) which engages the cap. If it is badly damaged, replace the entire valve assembly.

(*c)* Check the worm pin groove (the smaller of the two) in the valve body. If it is damaged, replace the entire valve assembly.

(*d)* Check the spool drive pin in the stub shaft (20). If it is worn badly, cracked, or broken, replace the entire valve assembly.

(*e)* Examine the spool (57) surface for nicks and burrs. If any are found, they may be removed with a very fine hone. A slight polishing is normal on the valving surfaces.

(*f)* Examine the valve body bore for nicks or burrs. If any are found, they can be removed with light crocus cloth until the spool turns freely in the body. Be careful not to remove any stock from the surface of the body. As on the spool, a slight polishing is normal on the valving surfaces.

(5) *Assembly*.

(*a)* Lubricate three valve ring back-up packings (23) in automatic transmission fluid, Type "A". Assemble in three ring grooves on the valve body (21). Assemble the valve rings (22) in the ring grooves over the back-up packings by carefully slipping the rings over the valve body. The rings may appear loose or twisted in the grooves, but the heat of the oil after assembly will cause them to tighten.

(*b)* Install new valve spool dampener packing (11) in valve spool (57) groove.

(*c)* Assemble the stub shaft in the valve body. Align groove in valve cap (19) with pin in valve body. Make sure groove and pin are in line before tapping on cap. Hold these parts together during the rest of the assembly. Tap lightly on cap with plastic or rawhide mallet until cap is against shoulder in valve body with valve body pin in cap groove.

***Caution*: Because the clearance between the spool and the valve body is very small, extreme care must be taken when assembling these parts.**

(*d*) Lubricate valve spool with automatic transmission fluid, Type "A". Slide spool over stub shaft with notch toward valve body. Align notch with spool drive pin in stub shaft and carefully engage spool in valve body bore. Push the spool evenly and slowly with a slight oscillating motion until spool reaches drive pin. Rotate the spool slowly with pressure until the notch engages the pin. Before pushing the spool completely in, make sure the dampener packing (11) is evenly distributed in the spool groove. Slowly push the spool completely in. Take extreme care not to cut or pinch the packing.

(*e*) Place seal protecting tool over stub shaft. Slide spool spring over seal protector and work spool spring (58) down until it is seated in stub shaft groove. Take care not to mar sealing surface of stub shaft.

(*f*) Lubricate a new cap-to-worm packing (18) with automatic transmission fluid, Type "A", and install in valve assembly.

(6) *Installation*.

(*a*) Align valve body drive pin in the worm (17) with the narrow pin slot on the valve body (21). Insert the valve assembly into the gear housing (46). Do not push against stub shaft as this may cause stub shaft and cap to pull out of the valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly should be pushed in by pressing against valve body with finger tips. Be sure valve is properly seated before assembling adjuster plug assembly. Return hole in gear housing should be fully visible at this time.

(*b*) Install adjuster plug (61) assembly as outlined in a. (4) above.

c. Sector Gearshaft Assembly and Side Cover.

(1) *Removal of pitman shaft seals with gear in truck.*

(*a*) Remove the steering arm nut (31, fig. 11-2), lock washer (32), and steering arm (30). Place a basin beneath the steering gear to catch draining oil.

(*b*) Remove the sector gearshaft seal retaining ring (29), and the outer seal back-up washer (28).

(*c*) With the engine running, and the hoses attached, momentarily hold the steering wheel in the extreme left turn position. This actuates valve, allowing pressure to build up on upper side of piston, and in gearshaft chamber, thereby forcing out seals (33 and 34) and inner seal back-up washer (28). To prevent undue oil loss and pump wear, do not hold wheel for more than a second or two at a time.

(*d*) Turn off engine. Remove seals and the inner back-up washer from the shaft and discard the seals.

(2) *Removal of sector gearshaft and side cover.*

(*a*) Disconnect hoses, and remove steering gear from truck (refer to para 2-9).

(*b*) Drain out as much of remaining oil as possible.

(*c*) Rotate stub shaft (20) until sector gearshaft (13) is in center position and remove side cover retaining screws (54). Tap the end of gearshaft with soft mallet and slide gearshaft out of housing.

(*d*) Remove side cover packing (56) from side cover and discard.

(3) *Disassembly*.

(*a*) Hold lash adjuster (48) with a hex key wrench and remove the lash adjuster nut (53) and discard. Screw lash adjuster out of side cover (52).

(*b*) Remove the sector gearshaft seal retaining ring (29), and then remove the outer back-up washer (28). Tap a screwdriver between the outer seal and the inner back-up washer and pry out the seal. Tap the screwdriver between the inner seal and the shoulder in the gear housing and pry out the seal. Be careful not to damage the seal bore. Discard seals.

(*c*) Remove needle bearing (27) from gear housing bore by pressing on the stamped identification end of the bearing. Discard bearing.

(4) *In-process inspection*.

(*a*) Inspect the sleeve bearing (51) in the side cover (52) for excessive wear or scoring. If badly worn or scored, replace the side cover and bearing as an assembly.

(*b*) Check the sector gearshaft teeth and the bearing and seal surfaces. If badly worn, pitted, or scored, replace the gearshaft assembly.

(5) *Assembly*.

(*a*) Assemble new needle bearing (27, fig. 11-2) into the gear housing (46) bore from seal bore end, pressing against stamped identification end. Press in until bearing clears shoulder in gear housing 0.030 inch maximum.

(*b*) Lubricate new gearshaft seals in automatic transmission fluid, Type "A". Install the single lip seal first, then a back-up washer. Drive the seal and washer in far enough to provide clearance for the other seal, and back-up washer, and retaining ring (29). Seal must not bottom on end of counterbore. Install double lip seal and second back-up washer. Drive seal and back-up washer in only far enough to provide clearance for the retaining ring. Install sector gearshaft retaining ring, making certain that the ring is seated properly.

(*c*) Assemble side cover (52) and bearing (51) assembly on the sector gearshaft assembly. Screw the lash adjuster (48) through the side cover

until the side cover bottoms on the gearshaft, and back off 1/2 turn.

(6) *Installation*.

(*a*) Lubricate the new side cover packing (56) and install in the groove in the face of the side cover.

(*b*) Turn the stub shaft (20) as necessary until the middle rack groove is aligned with the center of the gearshaft needle bearing (27).

(*c*) Install the gear shaft so that the center tooth in the sector meshes with the center groove of the rack-piston nut (35). Make sure that the side cover packing is in place before pushing the side cover down on the gear housing.

(*d*) Install the side cover screws (54) and tighten to 30 to 35 foot pounds.

(*e*) Install lash adjuster nut (53) on lash adjuster without tightening. Adjust gearshaft (refer to f. below). Hold lash adjuster from rotating with a hex key wrench and tighten lash adjuster nut to 20 to 30 foot pounds.

d. Housing End Plug.

(1) *Removal*.

(*a*) Rotate end plug retainer ring (40, fig. 11-2) so that one end of the ring is over the hole in the housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out.

(*b*) Do not rotate further than necessary, or the balls from the rack and worm assembly will fall off the end of the worm. Rotate stub shaft (20) with 3/4 inch box end or socket wrench to full left turn position and force end plug (39) out of housing.

(*c*) Remove and discard housing end plug packing (41).

(2) *Installation*.

(*a*) Lubricate new housing end plug packing (41) with automatic transmission fluid, Type "A", and install in gear housing (46).

(*b*) Insert housing end plug (39) into gear housing and seat against packing.

(*c*) Install end plug retainer ring (40) with fingers. Install one end of ring and work ring into groove until seated. Slight tapping may be required to securely bottom retainer ring in gear housing.

e. Rack-Piston End Plug.

(1) *Removal*.

(*a*) Remove housing end plug as outlined in *d.* (1) above.

(*b*) Remove rack-piston end plug (38, fig. 11-2) by inserting a 1/2 inch drive socket extension into the square hole in the plug and turning counterclockwise.

(2) *Installation*.

(*a*) Turn plug into rack-piston and tighten to 50 to 100 foot pounds.

(*b*) Install housing end plug as outlined in *d.* (2) above.

f. Rack-Piston and Worm Assembly and Gear Housing Assembly.

(1) *Removal*.

(*a*) Remove housing end plug as outlined in *d.* (1) above.

(*b*) Remove rack-piston end plug as outlined in *e.* (1) above.

(*c*) Remove sector gearshaft as outlined in *c.* (2) above.

(*d*) Insert rack-piston arbor (see fig. 2-3 for tool details) in end of worm (17, fig. 11-2). Rotate stub shaft to left turn, which will force rack-piston nut (35) onto arbor and remove rack-piston nut from gear housing, taking care to keep arbor in place in the rack-piston nut or the balls will fall out. If rack-piston nut is being removed to replace the piston ring (37) and back-up packing (36), reassemble without further disassembly.

(*e*) Remove valve as outlined in *b.* (2) above.

(*f*) Remove worm, lower thrust bearing and races.

(2) *Disassembly*.

(*a*) Cut piston ring (37) and packing (36) back-up seal, remove from rack-piston nut (35) and discard.

(*b*) Remove screws and lock washers (45) from rack-piston nut with screwdriver.

(*c*) Remove ball return guide clamp (44).

(*d*) Place the assembly on a clean cloth and remove ball return guides (43) and arbor. Make sure all of the balls (42) are caught on the cloth.

(3) *In-process inspection*.

(*a*) Inspect housing. If bore is badly scored or worn, replace housing. If connectors (14 and 15) are badly dented or scored, replace them. To remove connectors, tap threads in connectors, using a 5/16-18 tap. Thread a screw with nut and flat washer attached into tapped hole. To pull connector, hold screw from rotating while turning nut off screw. This will pull connector from gear housing. Discard connectors.

(*b*) Inspect ball plug (26) in housing. If it is leaking or raised above housing surface, drive it in flush, to 1/16 inch below the surface. Tighten ball by staking the housing. If leakage cannot be stopped, housing must be replaced.

(*c*) Inspect all seal surfaces and retaining ring grooves for defects. If any defects are found, housing must be replaced.

(*d*) At initial assembly, the rack-piston nut, worm and balls are selected to obtain a preload of to 4 inch pounds measured on center through an angle of 90 degrees. This preload may drop during service, without having any noticeable effect on steering. Upon complaint of loose or hard steering, thrust bearing adjustment and overcenter adjustment will correct the

problem if it lies in the steering gear adjustments. If not, check the rack-piston nut and worm for excessive lash or excessive load overcenter and also for roughness at any point along the worm. If any of these conditions are found, disassemble and inspect worm and rack-piston nut grooves and all the balls for excessive wear or scoring. If either worm or rack-piston nut need replacing, both must be replaced as a matched assembly. The lash or heavy load may be corrected by replacing the standard balls with a larger or smaller size-black balls need not be replaced unless they are defective. In case the black balls cannot be distinguished from the standard balls, replace with new balls.

(*e*) Inspect ball return guides (43), making sure that the ends where the balls enter and leave the guides are not damaged.

(*f*) Inspect lower thrust bearing (25) and races (16).

(*g*) Inspect rack-piston nut (35) teeth for wear and chipping. Inspect rack-piston nut surface for scoring or burrs.

(4) *Assembly*.

(*a*) Thoroughly clean the parts and lubricate the internal parts with automatic transmission fluid, Type "A".

(*b*) Drive new connectors (14 and 15) in place with piloted driver.

(*c*) Lubricate a new back-up packing (36) with automatic transmission fluid, Type "A". Assemble in piston ring groove on rack-piston nut (35). Install new piston ring (37) in the ring groove over the packing by carefully slipping ring over the rackpiston nut. The ring may be slightly loose after assembly. This is normal. It will tighten when subjected to the hot oil in the system.

(*d*) Insert worm (17) into rack-piston nut, to bearing shoulder.

(*e*) Align the ball return guide holes with the worm groove. Load 24 balls (42) into the guide hole nearest the piston ring, while slowly rotating the worm (17) counterclockwise to feed the balls through the circuit. Alternate the black balls with the standard balls.

(*f*) Fill one of ball return guides with remaining six balls. Place other guide over balls and plug ends with grease, automotive and artillery, MIL-G-10924, to prevent balls falling out when installing guide into rack-piston nut.

(*g*) Insert guides into guide holes of rack-piston nut. Guides should fit loosely.

(*h*) Place return guide clamp over guides, install two screws and lock washers and tighten to 8 to 12 foot pounds.

(*i*) Insert rack-piston arbor tool into worm. Turn rack-piston onto the arbor. Do not allow arbor to separate from worm until rack-piston nut is fully on arbor.

(5) *Installation*.

(a) Assemble thrust bearing (25) and races (16) on worm (17). Assemble valve assembly to worm by aligning small slot in valve body (21) with pin on worm. Be sure to install packing (18) between body and worm head.

(*b*) Install valve assembly and worm in housing (46) as integral unit and continue valve assembly as outlined in *f.* (4) above. Adjust thrust bearings (see *g.* below).

(*c*) Install piston ring compressor (see fig. 2-4 for tool details) in gear housing (46, fig. 11-2). Hold it tight against shoulder in housing. Insert rack-piston nut (35) into housing until arbor engages worm. Turn stub shaft (20) clockwise, drawing rack-piston nut into the housing. When piston ring is in housing bore, withdraw arbor from rack-piston nut. Remove ring compressor.

(*d*) Install rack-piston plug as outlined in *e.* above.

(*e*) Install housing end plug as outlined in *d.* above.

(*f*) Install sector gearshaft and side cover as outlined in *c.* above.

g. Thrust Bearing Adjustment, After Assembly.

Note. **This adjustment is to be made after the worm, thurst bearings, valve assembly, adjuster plug assembly, and lock nut are assembled in the housing assembly. Proceed as follows:**

(1) Before adjusting preload, tighten adjuster plug (61) up snug, back off slightly (1/8 turn) and measure valve assembly drag.

(2) Turn adjuster plug in so that preload is 1 to 3 inch pounds more than valve assembly drag. Tighten lock nut (3). Total thrust bearing adjustment and seal drag is not to exceed 8 inch pounds.

h. Overcenter or Sector Gearshaft Adjustment After Assembly.

Note. **This adjustment is to be made after the gear is completely assembled.**

(1) With gear on center and lash adjuster backed off, measure total drag.

(2) With gear on center, adjust lash adjuster so that preload is 4 to 8 inch pounds in excess of total preload and drag. Readings are to be made through an arc not exceeding 20 degrees with gear on center.

(3) Tighten lash adjuster lock nut.

CHAPTER 12

REPAIR OF HYDRAULIC COMPONENTS

12-1. Hydraulic Hoist Cylinder

a. Removal.

(1) To remove hydraulic hoist cylinder (35, fig. 12-1) from within the uprights, remove nut (29) and washer (30) at top of inner upright. Disconnect hydraulic line and fittings at bottom of cylinder.

(2) Slide inner upright to extreme upward position and block securely with length of 4 by 4 inch wood.

(3) Release chains from cylinder by removing anchor screws (19) and nuts (20 and 21). Slide crosshead upward, freeing end of cylinder. Hoist the cylinder free of vehicle.

b. Installation.

(1) Place cylinder in position over adapter (36) in base of uprights.

(2) Slide crosshead down over top of cylinder as far as possible. Feed chains over rollers of crosshead, and secure in place with screws and nuts.

(3) Remove wood block and carefully lower inner upright, allowing it to slide in position over threaded end of cylinder. Install washer and nut on threaded end. Tighten nut, leaving a clearance of 1/32 to 1/16 inch. Make all hydraulic connections. Install lift chains so they share the load equally. Bleed air from cylinder by removing both bleeder screws, (1, fig. 12-2). When only fluid appears at bleeder holes, replace screws.

c. Disassembly.

(1) Remove hoist cylinder.

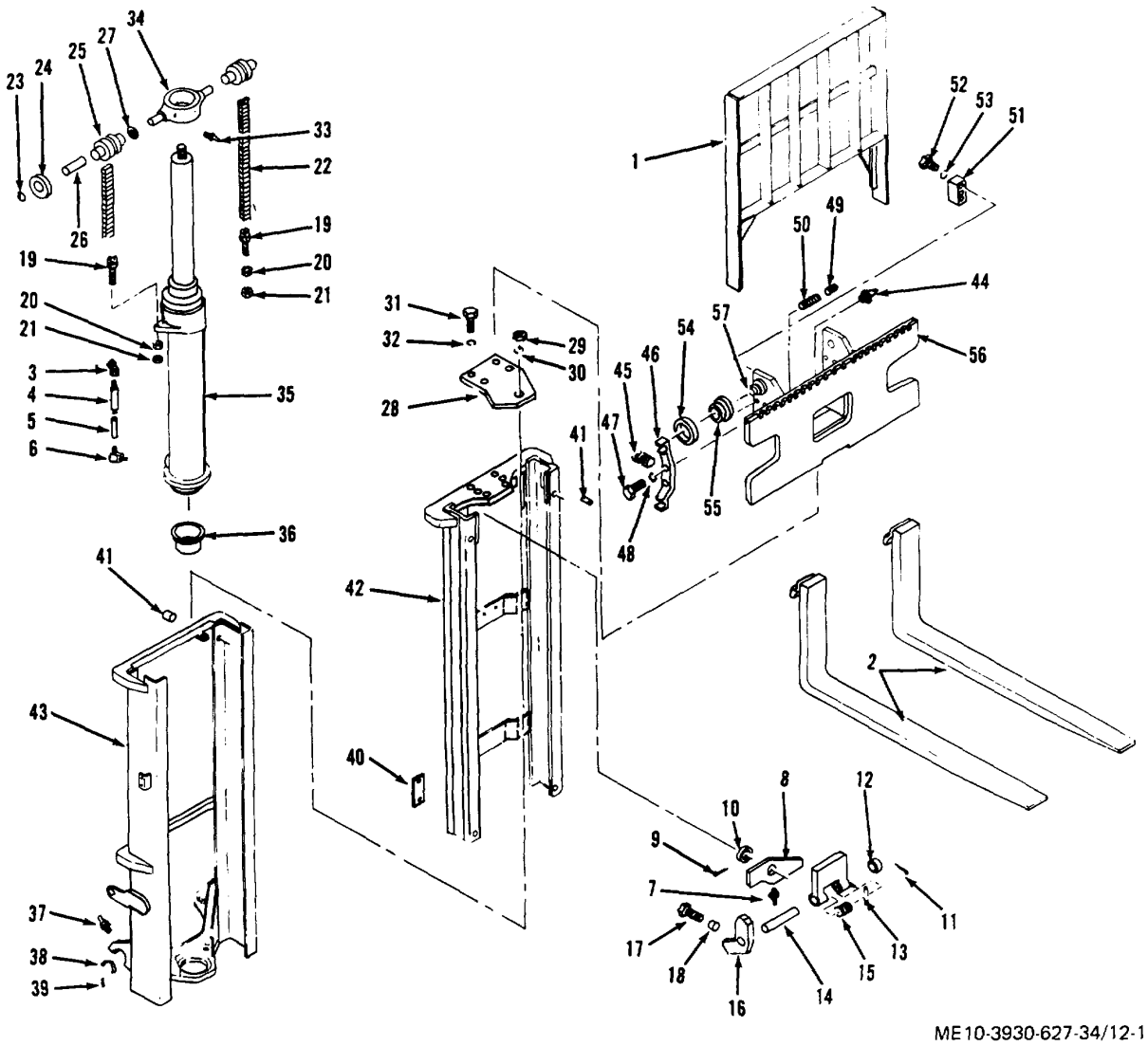
(2) Remove screws (1, fig. 12-2) and washers (2). Unscrew cylinder end (3). Remove packing (5) and washer (4) from cylinder end.

(3) Unscrew packing nut (6) from plunger (28). Remove wiper ring (7), packing retainer (8) and five packings (9).

(4) Unscrew packing nut (11) from cylinder (21). Remove wiper ring (12), retainer (13) and five packings (14).

(5) Unscrew packing nut (16) from cylinder (22). Remove wiper ring (17), packing retainer (18) and five packings (19).

(6) Unscrew and remove cylinder (21) from cylinder (22) and remove bearing (15) from inside of cylinder.

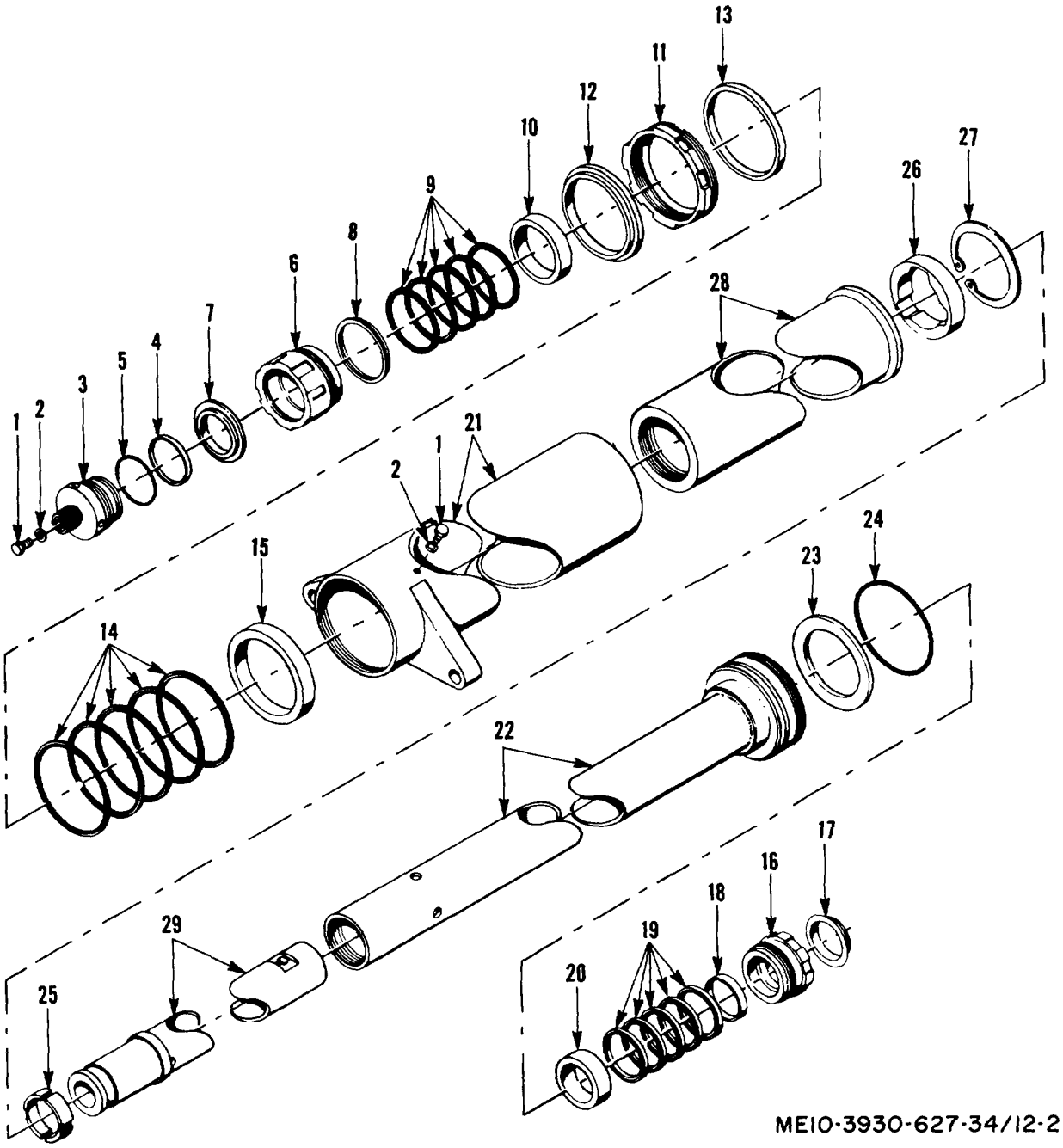


1.	Load back rest	20.	Jam nut	39.	Pin
2.	Forks	21.	Nut	40.	Upright insert
3.	Pipe to hose elbow	22.	Lift chains	41.	Upright adjusting setscrews
4.	One way restrictor valve	23.	Retaining ring	42.	Inner upright
5.	Pipe to tube nipple	24.	Washer	43.	Outer upright
6.	Pipe to tube elbow	25.	Bearing roller	44.	Lubrication fitting
7.	Lubrication fitting	26.	Inner bearing race	45.	Side thrust roller
8.	Latch Lever	27.	Washer	46.	Roller bracket
9.	Cotter pin	28.	Brace to hoist cylinder	47.	Screw
10.	Washer	29.	Self locking nut	48.	Lock washer
11.	Cotter pin	30.	Washer	49.	Setscrew
12.	Washer	31.	Screw	50.	Side thrust roller adjusting screw
13.	Spring pin	32.	Lock washer	51.	Striker bar
14.	Lever shaft	33.	Lubrication fitting	52.	Bar screw
15.	Spring	34.	Crosshead	53.	Lock washer
16.	Latch lever	35.	Hoist cylinder	54.	Carriage roller
17.	Setscrew	36.	Hoist cylinder base adapter	55.	Roller bearing
18.	Jam nut	37.	Lubrication fitting	56.	Carriage
19.	Chain adjusting screw	38.	Upright pivot bearing halves	57.	Carriage trunnion

Figure 12-1. Mast, exploded view.

(7) Remove plunger (28) and remove bearing (10) from inside plunger. Remove plunger guide (26) secured in position with retaining ring (27). Remove packing (23) and washers (24) from cylinder (22).

(8) Pull cylinder (22) from plunger (29) and remove bearing (25) from cylinder and bearing (20) from inside of plunger (29).



1.	Screw	11.	Parking nut	21.	Primary cylinder
2.	Washer	12.	Wiper ring	22.	Secondary cylinder
3.	Cylinder end	13.	Packing retainer	23.	Packing
4.	Washer	14.	Packing	24.	Washer
5.	Packing	15.	Sleeve bearing	25.	Sleeve bearing
6.	Packing nut	16.	Packing nut	26.	Plunger guide
7.	Wiper ring	17.	Wiper ring	27.	Retaining ring
8.	Packing retainer	18.	Packing retainer	28.	Primary plunger
9.	Packing	19	Packing	29.	Secondary plunger
10.	Sleeve bearing	20.	Sleeve bearing		

Figure 12-2. Hoist cylinder, exploded view.

d. Repair. Since most working surfaces of the cylinders are hard chrome plated, do not try to hone or stone away scratches. Replace all nonmetallic parts at assembly, and any parts showing wear or damage that in the judgment of the technician would cause trouble in the expected period before next scheduled overhaul.

e. Assembly.

Note. **Take special care to keep all parts of the hoist cylinder clean during reassembly. Wet interior parts with clean lubricating oil OE10. MIL-L-2104, before installing them. Reassemble as follows:**

(1) Install new bearings (25, fig. 12-2) over secondary plunger (29). Push plunger into secondary cylinder (22) from bottom and install new packing (23) and washer (24) in groove in base of secondary cylinder. Screw cylinder end (3) into secondary cylinder.

(2) Install bearing (20) in base of secondary cylinder and install packing (19) against base of bearing. Insert packing retainer (18). Insert wiper ring (17) in packing nut (16) and install packing nut in bottom of secondary cylinder.

(3) Install bearing (10) in top end of plunger (28). Install bearing (15) in primary cylinder (21). Install guide (26) and retaining ring (27).

(4) Install cylinder (22) with assembled items through bottom of primary plunger (28) and install both in primary cylinder (21).

(5) Install new packing (14) and retainer (13). Put wiper ring (12) in packing nut (11) and install packing nut on end of primary cylinder (21).

(6) Place packing (9) over plunger (29) and install packing retainer (8). Put wiper ring (7) in packing nut (6); install nut over plunger (29) and thread into plunger (28). Install two new washers (2) and replace screws (1). Do not tighten packing nut more than necessary to stop leakage, since the packing will expand when fluid pressure is applied, to form a seal. If the nut is overtightened the packing will wear out prematurely.

12-2. Hydraulic Tank

a. Removal. It will be necessary to raise the truck or park it over a service pit for certain steps of the following procedures. The truck must be spotted where removal and installation of the tank can be done without moving the truck.

(1) Lower carriage fully and tilt and tie uprights back.

(2) Remove hydraulic fluid from tank. Either remove plug from bottom of tank and drain fluid into large container, or use a suction transfer pump, with pickup hose inserted to bottom of tank through fill opening.

(3) Disconnect suction and return line hoses nearest tank. Remove four attaching nuts, lock washers and flat washers, take tank from mounting studs on frame and remove tank from underside of truck.

b. Installation.

(1) Mount the tank on the four studs provided on the frame, and install the four nuts, flat washers and lock washers which hold it in place.

(2) Connect suction and return line hoses to tank connection points.

(3) Replace plug in bottom of tank, and refill tank with specified quantity of hydraulic fluid.

c. Repair. Repair is limited to steam or solvent cleaning of the interior, removal of dents and welding or brazing of leaks. Use standard shop techniques for these repairs.

12-3. Hydraulic Pump

a. Removal.

(1) Disconnect the suction and pressure lines. Cap or plug disconnected lines immediately.

(2) Remove screws and lock washers which attach pump to engine and take off pump. If pump is not to be serviced immediately, cover all openings with masking tape, or plug them to keep dirt out of pump.

b. Installation.

(1) Position pump to mounting pad on engine, engaging pump drive gears.

(2) Install mounting screws and washers, and connect pump suction and pressure lines, and the power steering pressure line.

c. Disassembly.

(1) Remove cotter pin and nut holding pump gear (not shown) to drive gear shaft (11, fig. 12-3). Remove retaining ring (1), and eight screws (3) securing mounting flange cover (2) to housing (17). Press seal (4) out of mounting flange cover.

(2) Remove driven gearshaft (10), drive gearshaft (I1), four bushings (9 and 12) and two pins (13).

(3) Remove two packing retainers (7) and packings (5, 6, and 8). Do not remove two pins (16) from housing (17) unless necessary. Discard all nonmetallic items removed.

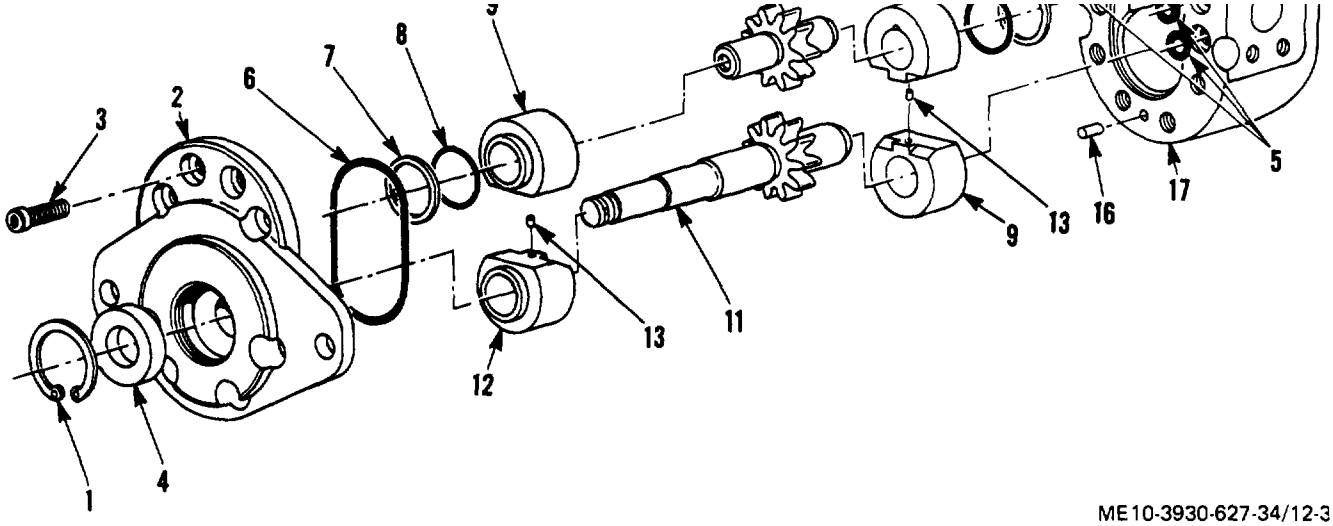
d. Repair.

(1) Check mating surfaces of cover (2) to housing (17) for irregularity.

(2) True up any warpage of these surfaces if it can be done with removal of 0. 005 inch or less of metal.

(3) Replace any other worn parts.

e. Assembly. Soak all parts in lubricating oil OE10 and assemble by reversing the disassembly procedure above.



1. Retaining ring
2. Mounting flange cover
3. Screw
4. Seal
5. Packing
6. Packing
7. Packing retainer
8. Packing
9. Bushing
10. Driven gearshaft
11. Drive gearshaft
12. Bushing
13. Pin
14. Identification plate
15. Screw
16. Pin
17. Housing

Figure 12-3. Hydraulic pump, exploded view.

12-4. Mast

a. Removal. Refer to paragraph 2-7.

b. Disassembly.

(1) Slide backrest (1, fig. 12-1) from carriage (56) and lift from truck. Remove forks (2) from truck.

(2) Unscrew four nuts (20 and 21) and remove anchor screws (19) from hoist cylinder (35) and two chains (22). Remove nut (29) and washer (30) attaching hoist cylinder to inner upright (42). Slide inner upright up and brace in position. Lift hoist cylinder from truck.

(3) Remove cylinder adapter (36) from bottom of outer upright (43). Remove the crosshead (34). To disassemble crosshead, remove two retaining rings (23) and washers (24). This releases bearings (26) and rollers (25).

(4) Slide four roller assemblies from carriage (56). Remove rollers (54) and bearings (55). Remove carriage.

(5) Remove screws (17) and nuts (18) attaching latch assembly (7 through 16) to outer upright (43); remove latch.

(6) Slide inner upright (42) up and out of outer upright (43).

c. Assembly.

(1) To assemble the mast, reverse the disassembly procedure.

(2) Adjust four inserts (40), using setscrews (41) to give 0.020 inch to 0.040 inch movement between the inner and outer uprights.

(3) Adjust carriage side thrust rollers (45) with screw (50) so clearance between roller and inner upright permits fitting of 1/8 inch metal stock

between roller and channel, but will not pass 3/16 inch stock.

(4) At installation, tighten chain nuts (20) to take slack from both chains at the same time, back off both nuts 1/16 inch and lock in place with nuts (21).

d. Repair.

(1) Replace any part which probably will not remain serviceable until next scheduled overhaul.

(2) By cold working only, align all parallel surfaces of the uprights, in three dimensions, to within 1/4 inch. Do not heat.

12-5. Tilt Cylinder Repair

a. Removal, Adjustment and Installation. Refer to (TM 10-3930-627-12).

b. Disassembly.

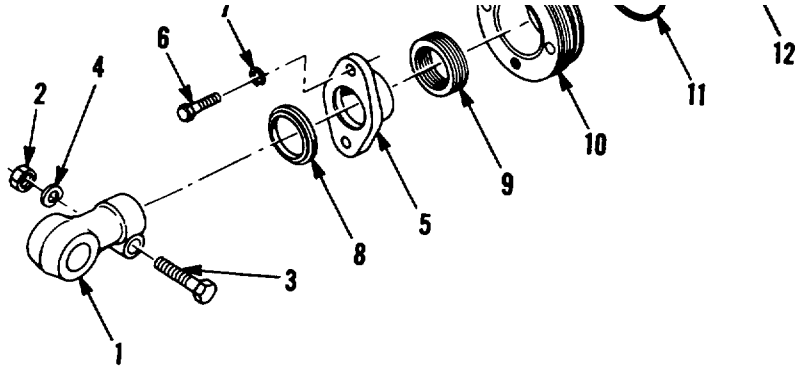
(1) Remove rod end (1, fig. 12-4) secured with nut (2), screw (3) and washer (4).

(2) Remove packing retainer (5) attached with two screws (6) and washers (7). Remove wiper ring (8) from inside packing retainer.

(3) Unscrew stuffing box (10) and remove packing set (9) and packing (11) from stuffing box.

(4) Pull piston and rod assembly (13) from cylinder (14). Packing (12) will come out with piston and rod assembly. Remove packing (12) from piston and rod assembly.

(5) Wearing parts of the tilt cylinders are hard chrome plated. Replace cylinders or piston rods showing scoring, scratches or wear through the plating. Do not hone to repair. Replace all nonmetallic parts.



ME10-3930-627-34/12-4

1. Rod end
2. Nut
3. Screw
4. Washer
5. Packing retainer
6. Screw
7. Washer
8. Wiper ring
9. Packing set
10. Stuffing box
11. Packing
12. Packing
13. Piston and rod
14. Cylinder

Figure 12-4. Tilt cylinder, exploded view.

c. Assembly.

(1) Thoroughly wet all internal parts with lubricating oil OE10 before installation. Take particular care to keep parts clean during assembly.

(2) Install piston and rod (13) in cylinder (14), to bottom. Fit packing (12) into recess in cylinder, lay packing (11) on top of it, and install stuffing box (10) in cylinder snugly with spanner wrench.

(3) Slide packing set (9) down piston rod, carefully entering it into recess of stuffing box.

(4) Lubricate and install wiper ring (8) in recess of packing retainer (5) and install packing retainer (loosely at first) with screws (6) and washers (7).

(5) Install rod end (1) on piston rod, and replace screw (3) washer (4) and nut (2), but do not tighten, as rod end final position must be adjusted when tilt cylinder is installed.

(6) Operate tilt control to test operation and check for leaks.

(7) Correct leaks around piston shaft by evenly tightening both screws (6) only enough to stop major fluid leakage past packing (9). Slight weeping of fluid onto rod is desirable for lubrication and corrosion protection. Do not tighten screws more than just enough to stop leakage. Shafts should not run dry at any time.

12-6. Control Valve Repair

a. Removal and Installation. Refer to TM 10-3930-627-12.

b. Adjustment. Adjustment procedures given here presume the valve is installed on a serviceable truck. If dismounted valve is to be adjusted for return to stock, use same procedure, getting hydraulic pressure from a hydraulic test set, and plug ports before storing valve. Proceed as follows:

(1) Install shaft through HOIST and TILT levers, spacing levers with spacers within bracket.

(2) When levers are positioned satisfactorily, install three cotter pins to secure shaft.

(3) Disconnect upper TILT hose, and insert a hydraulic pressure gage scaled to read to 2000 pounds per square inch in port.

(4) Remove cap nut (fig. 12-5) and insert screwdriver in slot of adjusting setscrew. With engine running move TILT control lever to UP position, and turn adjusting setscrew as necessary to cause pressure gage to indicate 1700 to 1900 pounds per square inch. Lock adjustment with nut and recheck setting after tightening nut.

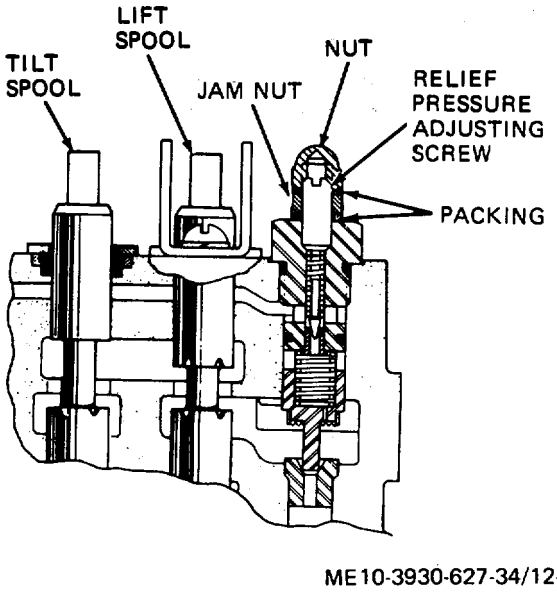


Figure 12-5. Hydraulic system relief valve adjustment.

c. Disassembly.

> ***Caution:*** **This valve contains numerous similar appearing, but not interchangeable, parts. Before disassembly, arrange separate containers for parts related to each spool to avoid problems at assembly. Equivalent parts with different index numbers on figure 12-6 are not interchangeable.**

(1) Unscrew plug and seal (1, fig. 12-6). Remove nut (2), nut (4) and seals (3). Back out setscrew (5), and remove spring (6) and plunger (7). Remove safety relief valve cap (12) and packing (9).

(2) Remove packing (10) and retainer (11), seat (8), spring (13), screen (14), plunger (15) and seat (16).

(3) Remove check valve cap (17), packing (18), spring (19) and poppet (20).

(4) Remove screws (22) and brackets (21) from both TILT and HOIST valves. Remove wipers (23), packing retainers (24) and packings (25).

(5) Take off both spool caps (26), and remove retaining rings (27 and 34), four spring retainers (28 and 35), springs (29 and 36), and washers (30 and 37).

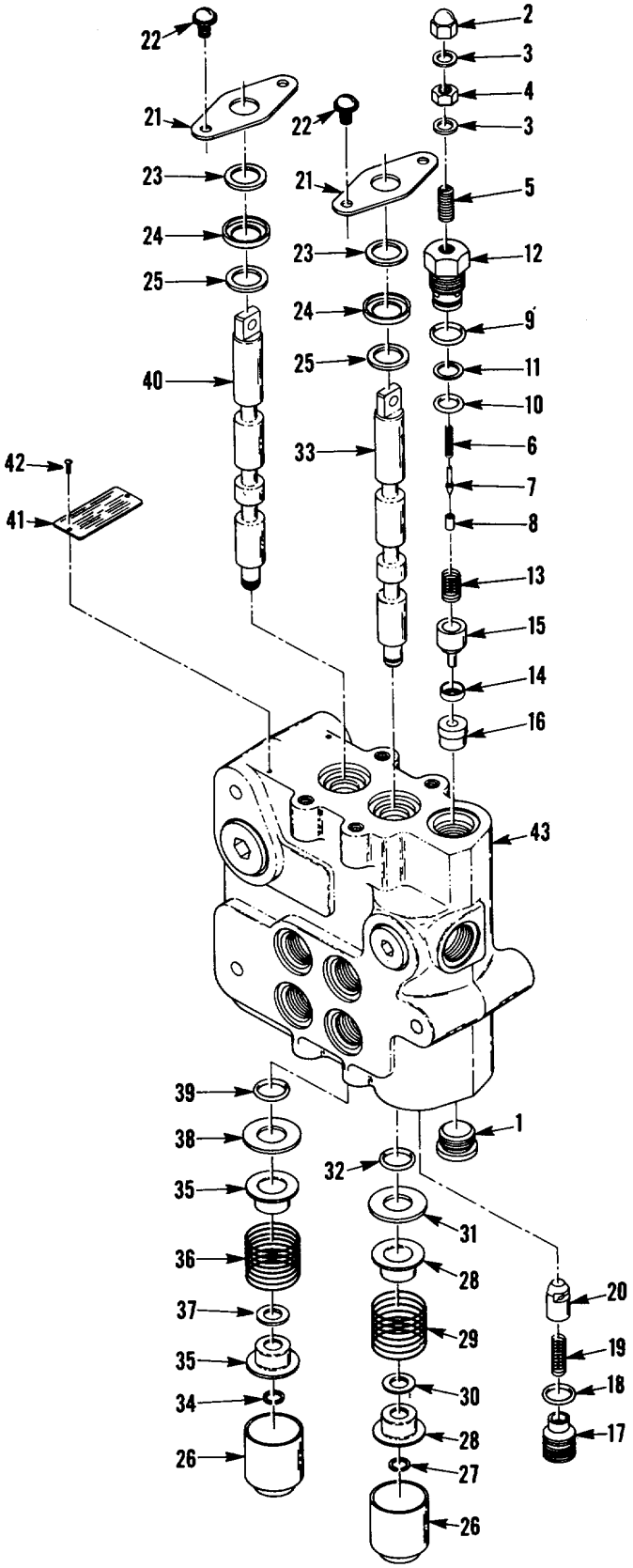
(6) Remove packing retainers (31 and 38) and packings (32 and 39).

(7) Remove spool (33) and spool (40) from body (43).

(8) If identification plate (41) must be replaced, remove drive screws (42).

(9) Discard all nonmetallic parts removed.

(10) Particularly examine spools (33 and 40) and their bores in the valve body for scratches or damage. Since these spools are a select fit in the bores, replace the entire valve if they are damaged.



ME10-3930-627-34/12-6

Figure 12-6. Control valve, exploded view.

KEY to figure 12-6:

1. Plug and seal
2. Nut
3. Seals
4. Nut
5. Setscrew
6. Spring
7. Plunger
8. Seat
9. Packing
10. Packing
11. Packing retainer
12. Safety relief valve cap
13. Spring
14. Screen
15. Plunger
16. Seat
17. Check valve cap
18. Packing
19. Spring
20. Poppet
21. Bracket
22. Screw
23. Wiper
24. Packing retainer
25. Packing
26. Spool cap
27. Retaining ring
28. Spring retainer
29. Spring
30. Washer
31. Packing retainer
32. Packing
33. Spool D1
34. Retaining ring
35. Spring retainer
36. Spring
37. Washer
38. Packing retainer
39. Packing
40. Spool P1
41. Identification plate
42. Screw
43:. Body

d. Assembly.

(1) Thoroughly wet all internal parts with lubricating oil OE 10 just before installation. Take care to keep parts clean, and assemble in a clean work area.

(2) Replace spools (33 and 40), in valve body (43).

> ***Note:*** **These spools are not interchangeable. Note shape and install as shown.**

(3) Install packing retainers (24), wipers (23) and packings (25) at upper ends of both spools, then install brackets (21) on spools.

(4) Install packings (32 and 39) and retainers (31 and 38) on lower end of spools. Install washers (30 and 37). Place a spring retainer (28 and 35) on each end of springs (29 and 36), install springs and secure with retaining rings (27 and 34). Replace spool caps (26).

(5) Install check valve cap (17) and packing (18), spring (19) and poppet (20) in valve body.

(6) Screw seat (16) in place and drop in plunger (15) and screen (14). Install pilot seat (8) with packing (10) and retainer (11).

(7) Install packing (9) and valve cap (12). Drop plunger (7) and spring (6) in place. Install jam nut (4) and seals (3) on setscrew (5) and loosely install setscrew. This screw must be adjusted after the valve is installed on the truck, or on a hydraulic test rack as given above in b.

(8) Install plug (1) and seal (3), and temporarily replace cap nut (2).

APPENDIX A

REFERENCES

A-1. Fire Protection	
TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
A-2. Lubrication	
C9100-IL	Identification List for, Fuels, Lubricants, Oils and Waxes
LO 10-3930-627-12	Lubrication Order; Truck, Lift, Fork, Gasoline, Pneumatic Tired Wheels, 4,000 pound capacity, Baker Mdl FJF-040
A-3. Painting	
TM 9-213	Painting Instructions for Field Use
A-4. Radio Suppression	
TM 11-483	Radio Interference Suppression
A-5. Maintenance	
TM 9-1870-1	Care and Maintenance of Pneumatic Tires
TB 750-651	Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling Systems
TM 38-750	The Army Maintenance Management System
TM 10-3930-627-12	Operation and Organization Maintenance Manual; Truck, Lift, Fork, Gasoline, Pneumatic Tired Wheels, 4,000 Lb. Cap, Baker Model FJF-040.
TM 10-3930-627-20P	Organization Maintenance Repair Parts and Special Tools List; Truck, Lift, Fork, Gasoline, Pneumatic Tired Wheels, 4, 000 Lb. Cap, Baker Model FJF-040
TM 10-3930-627-34P	Direct and General Support and Depot Maintenance Repair Parts and Special Tools Lists; Truck, Lift, Fork, Gasoline, Pneumatic Tired Wheels, 4, 000 Lb. Cap, Baker Model FJF-040.
A-6. Shipment and Storage	
TB 740-97-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
TM 740-90-1	Administrative Storage of Equipment

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