TM 10-3930-237-35

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DS, GS, AND DEPOT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, GASOLINE

SOLID RUBBER TIRED WHEELS

2000 POUND CAPACITY

ARMY MODEL MHE-192

CLARK MODEL C20B-1632032-100

FSN 3930-781-3857

CLARK MODEL C20B-1632033-127

FSN 3930-781-3858

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

SEPTMEBER 1964

Changes in force: C1

CHANGE
NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC *25 March 1985*

DIRECT SUPPORT, GENERAL SUPPORT AND

DEPOT MAINTENANCE MANUAL

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(NSN 3930-00-781-3857)

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(NSN 3930-00-781-3858)

TM 10-3930-237-35, September, 1964 is changed as follows:

Title appearing on front cover and page 1 changed as shown above:

Inside front cover add the following:

WARNING

Operation of this equipment presents a noise hazard to personnel in the area. The noise level exceeds the allowable limits for unprotected personnel. Wear ear muffs or ear plugs which were fitted by a trained professional.

WARNING

Compressed air, used for cleaning purposes will not exceed 30 psi (207 kPa). Wear face shield and protective clothing to prevent injury when using compressed air.

WARNING

Drycleaning solvent P-D-680 is toxic and flammable. Wear protective goggles and gloves and use only in a well ventilated area. Avoid contact with skin, eyes, and clothes and don't breath vapors. Do not use near open flame or excessive heat. The flash point is 100°F - 138°F (38°C - 59°C). If you become dizzy while using cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately.

WARNING

Cooling system is pressurized. Remove cap slowly and only when engine is cool or painful burns could result.

Page 12:

Paragraph 11, immediately following the title add the following:

WARNING

Compressed air, used for cleaning purposes will not exceed 30 psi (207 kPa). Wear face shield and protective clothing to prevent injury when using compressed air.

Paragraph 11.*c.* is superseded as follows:

c. **Cylinder Head**

Removal.

(1) Drain coolant from the radiator and engine.
(2) Remove hydraulic tank filler pipe and air cleaner (fig. 4.1). Cover sump elbow to keep dirt or part from falling in.
(3) Tag and remove high-tension and primary distributor wire from coil (fig. 4.1).
(4) Remove nuts and lockwashers that secure transmission oil filter and coil bracket to head and block. Position bracket to provide clearance to remove cylinder head.
(5) Loosen generator adjusting strap bolt (fig. 4.1). Push generator toward engine. Remove belts from generator pulley.
(6) Remove generator adjusting strap bolt, washer, and lockwasher. Remove nuts and washers securing generator to cylinder head.
(7) Remove nuts and washer securing thermostat housing to cylinder head.
(8) Remove the bypass elbow (fig. 4.1) from the water pump and thermostat elbow; remove the thermostat housing.
(9) Remove nuts and washers (fig. 4.1) securing engine oil filter to cylinder head studs.
(10) Remove distributor (see TM 10-3930-237-20).
(11) Tag and disconnect the lead from the water temperature sending unit (fig. 4.1). Remove the sender.

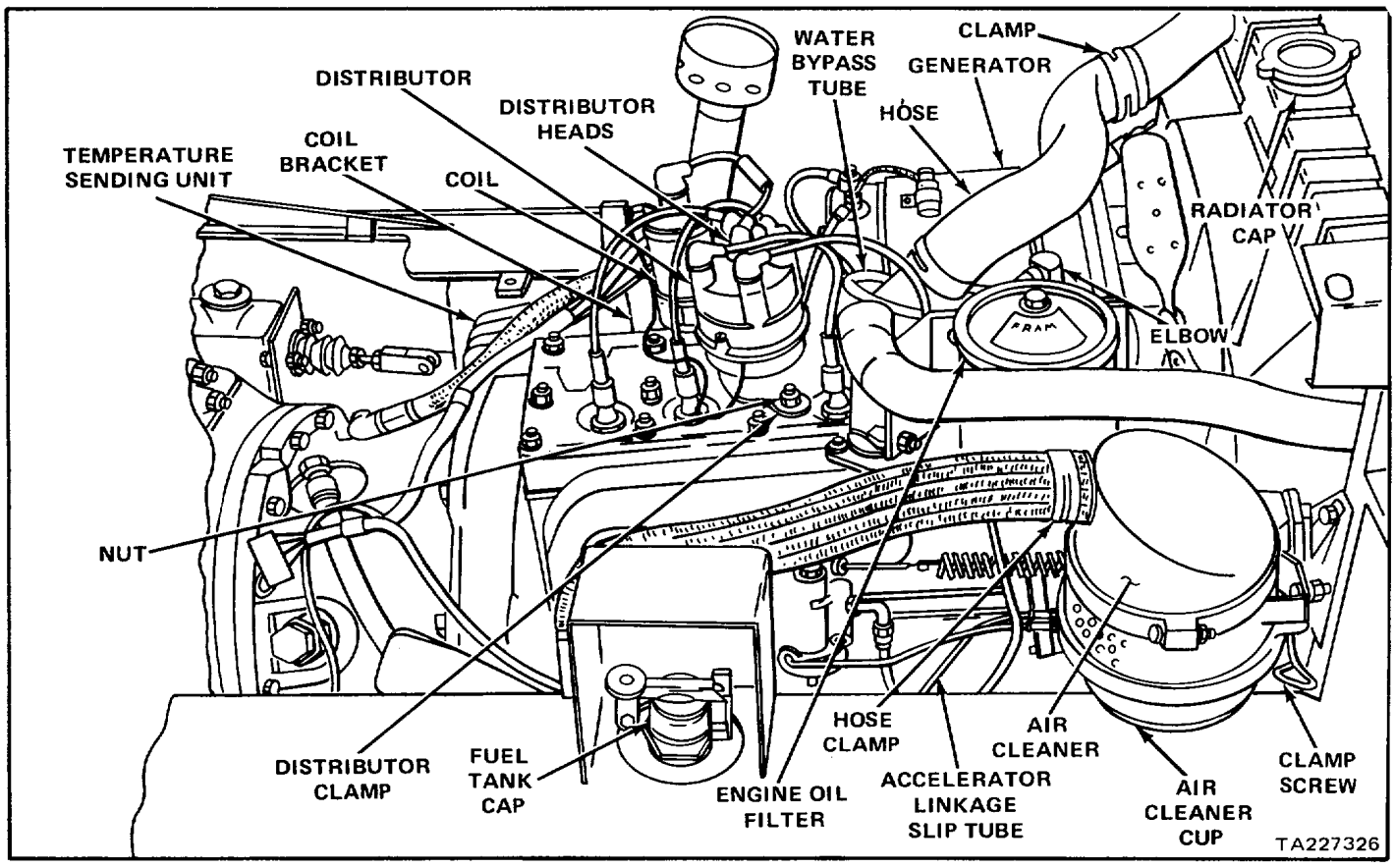

Figure 4.1. Engine compartment, left view.

(12) Remove the nuts and washers securing the cylinder head (fig. 4.4). Remove the cylinder head and gasket.

c.1 Cleaning and Inspection.

(1) Remove all carbon from combustion areas with a scraper and wire brush. Clean all remaining residue from the cylinder head with an approved cleaning solvent. Dry with clean, dry compressed air.
(2) Clean the top of the cylinder block with a scraper and a cloth dampened in an approved cleaning solvent. Be very careful not to get dirt in the cylinders or water jacket.
(3) Inspect the cylinder head for cracks, corrosion, damaged threads, plugged water ports, or other defects.
(4) Check flatness lengthwise with a straightedge and feeler gage (fig. 4.2). The maximum permissible low spot is 0.004 inch in the center, gradually decreasing toward the ends. Check flatness lengthwise at each edge and in the middle of the head.
(5) Check flatness crosswise with a straightedge and a filler gage (fig. 4.3). The maximum permissible low spot is 0.003 inch in localized areas. Check flatness crosswise at each end and between each combustion chamber.
(6) Inspect cylinder head studs for looseness or damaged threads.
(7) Replace the gasket hoses and defective parts.

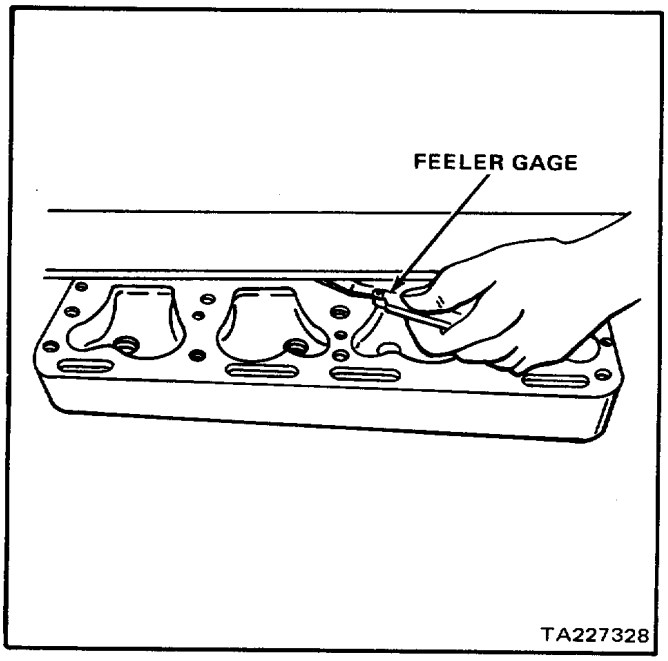

Figure 4.2. Checking cylinder head flatness lengthwise.

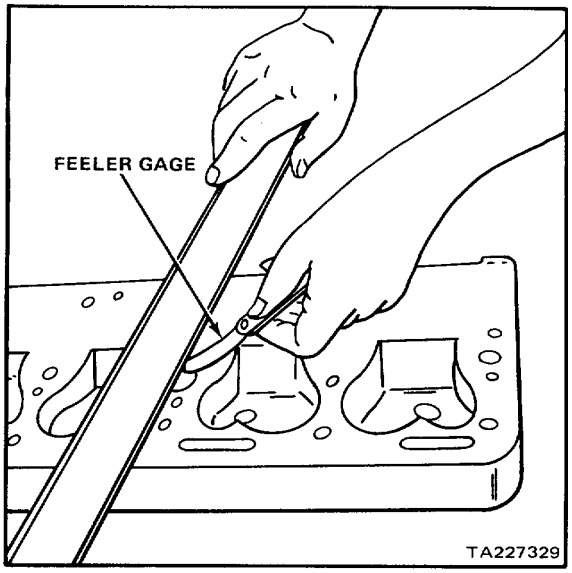

Figure 4.3. Checking cylinder head flatness crosswise.

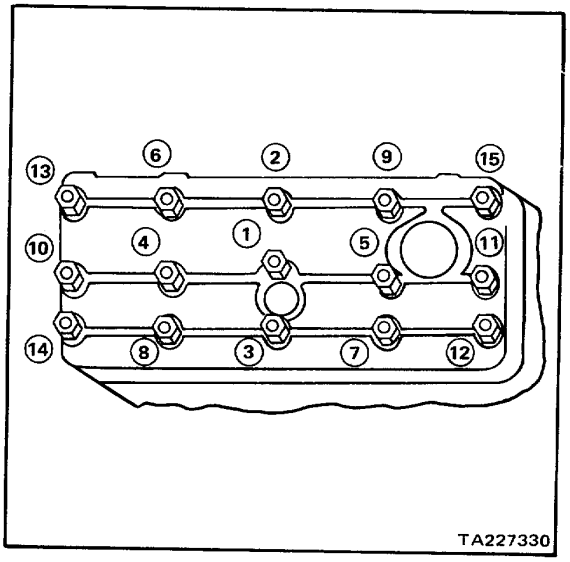

Figure 4.4. Cylinder head nut tightening sequence.

Page 22, paragraph 11.*o.* is superseded as follows:

o. Installation. Install head and other parts in reverse order of removal and retime engine if necessary. (see TM 10-3930-237-20).

Page 24:

Paragraph 13.*a.*(1), change (TM 10-3930-237-20) to paragraph 11.*c.*

Paragraph 13.*a.*(2), change (TM 10-3930-237-20) to paragraph 13.*c.* below.

Page 27, after paragraph 13.*b.*(11) add the following new section:

c. With the engine at operating temperature and running at idle speed, set the valves for 0.012-inch clearance as follows:

(1) Check for proper 0.012-inch clearance by alternately passing a 0.01-inch and a 0.013inch flat feeler gage between the head of the adjusting screw and valve stem (fig. 28.1).
(2) If a 0.011-inch feeler gage moves freely back and forth in the gap when the valve is not being lifted and 0.013-inch feeler gage binds at all times, the clearance requires no adjustment.
(3) If a 0.011-inch feeler gage is gripped at all times, the clearance is insufficient.
(4) Hold valve lifter with an open end wrench while using a second wrench to turn adjusting screw one-quarter to one-half turn clockwise. Repeat clearance check and adjustment until proper clearance is obtained. The adjustable-type valve lifters have self-locking adjusting screws that require no locknuts.
(5) If 0.013-inch feeler moves freely when valve is not being lifted, the clearance is too great. Hold valve lifter with an open end wrench while using a second wrench to turn valve lifter adjusting screw counterclockwise one-quarter to one-half turn. Repeat the clearance check and adjustment until proper clearance is obtained.
(6) Repeat clearance check and adjustment for remaining intake valves.
(7) Check exhaust valve clearance for proper 0.012-inch clearance by alternately passing a 0.011- and 0.013-inch flat feeler gage between the head of the adjusting screw and the valve stem cap.
(8) If necessary, adjust the exhaust valve clearance in the same manner as the intake valves described in (1) through (5) above.
(9) Install the valve chamber cover using a new gasket. Secure with two cover nuts and gaskets.

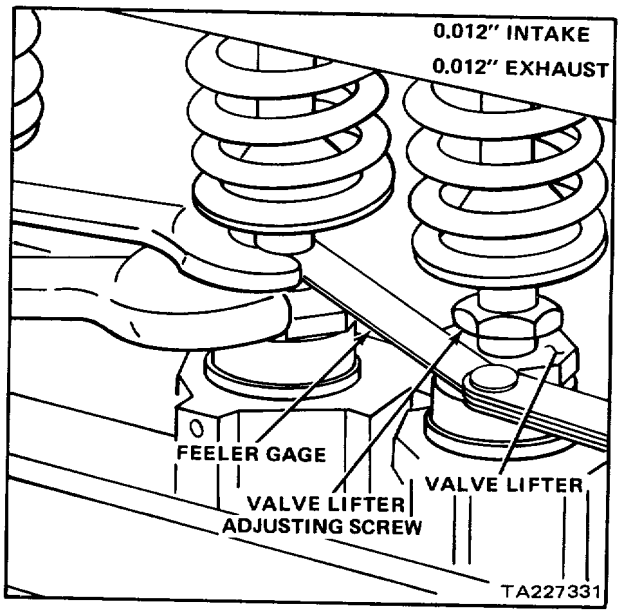

Figure 28.1. Value adjustment.

Page 27:

Paragraph 13.*c.* is changed to 13.d.

Paragraph 13.*d.*(3), change (TM 10-3930-237-20) to paragraph 13.*c.*

Paragraph 13.*d.*(4), change (TM 10-3930-237-20) to paragraph 11.*o.*

Page 28, paragraph 13.d.(5) and (6) change (TM 10-3930-237-20) to paragraph 13.*c.*

WARNING

Compressed air, used for cleaning purposes will not exceed 30 psi (207 kPa). Wear face shield and protective clothing to prevent injury when using compressed air.

Insert the above WARNING where indicated below:

Page 29, paragraph 15.*b.*, after title and before (1).

Page 34, paragraph 16.*b.*, after title and before (1).

Page 37, paragraph 20.*c.*, after title and before (1).

Page 41, paragraph 21.*c.*, after title and before (1).

Page 44, paragraph 23.b., after title and before (1).

WARNING insertion continued:

Page 49, paragraph 27, after title and before a.

Page 47, paragraph 24.*c.*(8), first sentence, change of cracks to for cracks.

Page 68, Figure 50, change callouts as follows:

21 Lockwasher	26 Cotter pin
22 Screw	27 Flat washer
23 Roller bearing	28 Shim
24 Steering knuckle	29 Setscrew
25 Nut	30 Nut

Page 72, paragraph 35.*c.*(2). Following the word arm add (22), following nut (23) add torque to 40 - 50 inch-pounds.

Page 77:

Paragraph 42.*c.*, change title Cleaning and Inspection to Cleaning, Inspection and Repair.

Paragraph 42.*d* (4), line 4, change on to an.

Page 94:

APPENDIX I REFERENCES is changed as follows:

Paragraph 1.

Line 2, change 320-5 to 310-25; following word Terms add (Short Title)

Line 3 is superseded by:
310-50 Catalog of Abbreviations and Brevity Codes

Line 5 is deleted

Paragraph 2.

Line 7, change title to read:

Index of Army Motion Pictures and Related Audio Visual Aids

Line 8, change title to read:

Index of Army Publications and Blank Forms

Lines 9, 10, 11 and 12 are deleted

After line 8 above add:

DA PAM 738-750, The Army Maintenance Management System (TAMMS)

Paragraph 3.

Lines 14, 15 and 16 are deleted

Line 17, title is changed to read:

Military Symbols (Reprinted With Basic Incl C1)

After line 17 above add the following:

21-305, Manual For The Wheeled Vehicle Driver

Paragraph 4. Technical Manuals is deleted

Page 96, APPENDIX III

Line 2, change TM 10-3930-237-35P to TM 10-3930-237-34P.

By Order of the Secretary of the Army

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

DONALD J. DELANDRO
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25A, Direct and General Support Maintenance requirements for Warehouse Equipment.

TECHNICAL MANUAL
No. TM 10-3930-237-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *24 September 1964*

DS, GS, AND DEPOT MAINTENANCE MANUAL

TRUCK, LIFT, FORK, GASOLINE
SOLID RUBBER TIRED WHEELS
2000 POUND CAPACITY
ARMY MODEL MHE-192
CLARK MODEL C20B-1632032-100
FSN 3930-781-3857
CLARK MODEL C20B-1632033-127
FSN 3930-781-3858

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CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for use by personnel responsible for direct and general support and depot maintenance of the Fork Lift Truck, Models C26B-1632032-100 and C20B1632033-127, manufactured by Clark Equipment Company, Battle Creek, Michigan.

b. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA Publications) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen or typewriter. The original and one copy will be forwarded direct to the Commanding Officer, U. S. Army Mobility Equipment Center, ATTN: SMOME-MM, 4300 Goodfellow Blvd., St. Louis, Mo., 63120. One information copy will be provided to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).

2. Appendixes

Appendix I is a list of current references applicable to this manual. Appendix II, containing the Maintenance Allocation Chart, is published in the Organizational Maintenance Manual, TM 10-3930-237-20. Appendix III, repair parts and special tools lists authorized for field and depot maintenance, is published in the Field and Depot Maintenance Repair Parts and Special Tools Lists Manual, TM 10-3930-23735P.

3. Forms, Records, and Reports

The maintenance forms, records, and reports to be used in the direct support, general support and depot maintenance of this equipment are listed and described in TM 38-750.

4. Orientation

Throughout this manual, the terms right, left, front and rear, with respect to the engine or truck, indicate directions from the viewpoint of the operator sitting in the seat of the truck.

Section II. DESCRIPTION AND DATA

5. Description

a. Engine. The four-cylinder, four-stroke cycle, L-head, water-cooled engine has a 3¼ inch bore and a 3½ inch stroke for a displacement of 116 cubic inches. It develops a brake horsepower of 34.2 at 2800 rpm and has a compression ratio of 6.72 to 1. The crankshaft has three main bearings, and the engine is pressure lubricated by positive-displacement gear pump.

b. Drive System. The unitized drive system consists of a single-speed, forward and reverse transmission; a differential with a pinion shaft directly driven by transmission output; and pinion shafts which engage the differential and transfer power to the front wheels to propel the vehicle. Final reduction is in the wheels.

c. Hydraulic System. The hydraulic system is powered by a vane-type hydraulic pump mounted on and driven by the engine. The pump capacity is 6 gpm at 1200 rpm. The working pressure of the hydraulic system is 2000 psi maximum.

d. Steering System. The fork lift truck is steered by the rear wheels through the use of a mechanical steering

system. The steering system consists of a steering handwheel, steering gear, drag link assembly, steering axle and tie rods.

e. Electrical System. The negatively grounded, 12-volt electrical system employs a DC generator with a conventional three-unit voltage regulator. The starting circuit is actuated by the starter and ignition switch. The starting circuit is routed through the transmission neutral position switch to prevent cranking of the engine when the transmission is in either drive position. By closing the circuit through the ignition switch and neutral position switch, the starting relay is energized which completes the circuit to the starter motor solenoid switch. As the solenoid energizes, it engages the overrunning clutch with the flywheel ring gear and completes the circuit from the battery to crank the engine.

f. Differences in Models. The two models covered in this manual differ in the height of the mast assembly and the addition of overhead protection for the driver in model with the higher mast assembly. Model C20B-1632032-100 has a 100 inch lifting capability while Model C20B-1632033-127 has a 127 inch lifting capability and is provided with a drivers overhead guard. General configuration of mast assembly parts is the same; only dimensions are different.

6. Tabulated Data

a. Engine.

Make	Continental
Model	YS 116
Number of cylinders-	Four
Bore	3¼ inches
Stroke	3½ inches
Displacement	116 cubic inches
Compression ratio	6.72 to 1
Brake horsepower	34.2 at 2800 rpm
Torque	89 ft lb at 1200 rpm
Firing order	1-3-4-2
Weight, bare engine	279 lb.
Number of main bearings	Three
Crankshaft:	
Main bearing journal diameter.	1.7482 in. min.
Connecting rod journal diameter.	1.4338 in. min.
Clearance-main bearing journals to bearings.	0.002 in. to 0.0032 in.
End play	0.002 in. to 0.006 in.
Clearance -crank pin bearing journals to connecting rod bearings.	0.0007 in. to 0.0031 in.
Flywheel:	
Runout	0.008 in. max.
Eccentricity	0.008 in. max.
Flywheel housing:	
Face runout	0.008 in. max.
Bore eccentricity	0.008 in. max.
Camshaft:	
Fan end bearing journal diameter.	1.8075 in. min.
Middle bearing journal diameter.	1.7445 in. min.
Drive end bearing journal diameter.	1.2455 in. min.
Clearance-camshaft journals to fan end and drive end bearings.	0.002 in. to 0.004 in.
Clearance-camshaft journal to center bearing.	0.003 in. to 0.0047 in.
End play	0.003 in. to 0.007 in.
Clearance-camshaft gear to crankshaft gear.	0.0015 in. max.
Valves:	
Intake valve stem diameter.	0.3128 in. max.
Exhaust valve stem diameter.	0.3128 in. max.
Valve guide bore diameter-intake.	0.3133 in. max.
Valve guide bore diameter -exhaust.	0.3150 in. max.
Valve spring tension:	
Compressed to $1\frac{3}{6}\frac{3}{4}$ in.	42 pounds min.
Compressed to $1\frac{1}{6}\frac{5}{4}$ in.	86 pounds min.
Clearance-valve lifter to bore.	0.005 in. max.
Valve seat angle	45°
Pistons:	
Piston pin hole diameter.	0.8796 in. max.
Piston ring gap	0.010 in. min. to 0.020 in. max.
Piston pin diameter	0.8588 in. min.
Piston ring groove width:	
Top groove	0.099 in. max.
Middle grooves	0.0985 in. max.
Bottom groove	0.191 in. max.
Piston ring width:	
Top ring	0.0910 in. min.
Middle ring	0.0910 in. min.
Bottom ring-	0.1840 in. min.

Connecting rod:
Piston pin bearing diameter ..... 0.8606 in. max.

b. Starting Motor.

Make ..... Delco-Remy
Model 1107244
Type of drive ..... Overrunning clutch

c. Generator.

Make ..... Delco-Remy
Mode 1102342

d. Main Hydraulic Pump.

Make ..... Vickers
Model- V-200-6-3C-12-S82
Type ..... Vane
Capacity ..... 6 gpm

e. Transmission.

Make ..... Clark
Part number 282158
Type ..... Single-speed, forward and reverse, torque converter-coupled.
Ratios:
Forward ..... 7.46 to 1
Reverse ..... 7.33 to 1

f. Hydraulic Control Valve.

Make ..... Vickers
Model CM11N01-R20WDL20

g. Tilt-Lock Valve.

Make ..... Clark
Part number 134370

h. Wheel Brakes.

Make ..... Clark
Part number 07804
Type ..... Self-adjusting, external, expanding, hydraulic cylinder-actuated.

i. Carburetor.

Make ..... Zenith
Model 68-8
Type ..... Single-barrel, updraft. float-type.

CHAPTER 2

MAINTENANCE INSTRUCTIONS

Section I. TROUBLESHOOTING

7. Purpose

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the fork lift truck or any of its components.

8. Troubleshooting Procedure

Possible troubles that may be encountered are listed in table I. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy is described opposite the probable cause.

Table I. Troubleshooting Chart

Trouble	Probable cause	Remedy
Starting motor operates, but fails to crank engine when switch is engaged.	Defective starting motor or drive gear	Overhaul starting motor. (par. 21).
Engine will not start	Sticking carburetor float	Disassemble and clean carburetor. (par. 15).
	Low engine compression	Set tappet clearance (TM 10-3930-237-20). Replace cylinder head gasket (TM 10-3930-237-20). Replace valve springs (par. 13). Replace valves (par. 13). Replace piston rings (par. 11).
Engine operates but backfires and Spits	Low carburetor float level	Adjust carburetor float (par. 15).
	Valve sticking, not seating properly, burned, or pitted.	Repair or replace defective parts (par. 13).
	Excessive carbon in cylinders	Remove carbon from cylinders (par. 11 and par. 12).
	Weak valve springs	Replace defective parts (par. 13).
Engine misfires on one or more cylinders.	Valve tappet holding valve open	Repair or replace tappets (par. 13).
	Low engine compression	See "Engine will not start" above.
	Cracked cylinder block or broken Valve tappet or tappet screw.	Replace defective parts (par. 12 and par. 13).
Engine does not idle properly	Uneven cylinder compression	See "Engine will not start" above.
	Defective carburetor accelerating pump system, dirt in metering jets, or incorrect float level.	Clean and overhaul carburetor (par. 15).
Engine backfires	Valve holding open	Repair or replace valve (par. 13).
Engine stalls on idle	Carburetor choke valve sticking in closed position.	Free and lubricate valve (par. 15). Overhaul and clean carburetor (par. 15).
	Low engine compression	See "Engine will not start" above.
Engine misses at high speeds	Sticking valves or weak or broken valve springs.	Replace defective parts (par. 13).
	Uneven cylinder compression	See "Engine will not start" above.
	Dirty or defective carburetor	Overhaul and clean carburetor (par. 15).

Table I. Troubleshooting Chart-Continued

Trouble	Probable cause	Remedy
Engine lacks power	Low compression, broken valve springs, or sticking valves.	See "Engine will not start" above.
Engine overheats	Low engine compression	See "Engine will not start" above.
	Leaking cylinder block or head	Replace defective parts (par. 12 and TM 10-3930-237-20).
Fuel consumption is high	Worn or broken carburetor parts	Overhaul carburetor (par. 15).
	Carburetor float level too high; accelerating pump not properly adjusted.	Adjust carburetor float (par. 15).
	Low engine compression	See "Engine will not start" above.
	Loose engine mounts, permitting engine to shake and raising fuel level in carburetor.	Replace defective mounts (par. 10).
Engine oil consumption is high	Defective piston or rings, excessive side clearance of intake valves in guides, cylinder bores worn (scored, out-of-round, tapered), excessive bearing clearance, or misalined connecting rods.	Repair or replace defective parts (pars. 11, 12, and 13).
Engine oil pressure is low	Clogged oil pump screen	Remove oil pan and clean pump screen (par. 11).
	Oil leaks	Repair or replace defective parts (par. 11).
	Faulty oil pump, sticking or improperly adjusted pressure regulator, or broken spring.	Repair or replace defective parts (par. 11).
A heavy dull knock sounds in engine when accelerating under load.	Worn or damaged main bearings	Replace main bearings (par. 11).
Engine knocks when loaded or unloaded.	Excessive end play in crankshaft	Adjust crankshaft end play (par. 11).
A light metallic knock occurs when engine is at about two-thirds maximum speed.	Worn or damaged connecting rod bearings.	Replace connecting rod bearings (par. 11).
A persistent sharp clicking noise occurs at any engine speed.	Broken piston ring or pin	Replace defective parts (par. 11).
Engine vibrates at any speed	Engine loose on mountings	Tighten engine mounts (par. 10).
	Flywheel or torque converter out of balance.	Repair or replace defective parts (par. 11).
Fuel reaches carburetor, but does not reach cylinders. 15).	Clogged fuel passage in carburetor	Overhaul and clean carburetor (par.
	Carburetor float valve stuck in closed position. 15).	Overhaul and clean carburetor (par.
Cooling solution is low	Leaking radiator	Repair radiator (par. 18).
Starting motor cranks engine slowly	Dirty commutator	Clean commutator (par. 21).
	Insufficient brush surface contact	Free or replace brush (par. 21).
	Defective starting motor	Overhaul starting motor (par. 21).
Starting motor does not crank engine.	Faulty drive mechanism	Overhaul drive mechanism (par. 21).
	Faulty solenoid switch	Replace switch (par. 21).
	Faulty neutral starting switch	Replace switch (par. 24).
Low or fluctuating generator output	Insufficient brush surface contact	Free or replace brush (par. 20).
	Weak brush springs	Replace spring (par. 20).
	Worn commutator	Overhaul generator (par. 20).
	Dirty commutator	Clean commutator (par. 20).
Generator is noisy	Defective bearings or armature rubbing on field poles.	Repair or replace defective parts (par. 20).
	Improperly seated brushes	Seat brushes (par. 20).
Continuous drive axle noise	Badly worn parts	Replace worn parts (par. 27).

Table I. Troubleshooting Chart-Continued

Trouble	Probable cause	Remedy
Complete failure of drive axle to function.	Broken axle shaft	Replace axle shaft (par. 25).
	Broken teeth on ring gear or pinion gear.	Replace ring gear, pinion, and other parts of differential as necessary (par. 27). Adjust ring gear and pinion gear correctly (par. 27).
Drive axle noise occurs on drive or on coast only	Differential, pinion gear and ring gear out of adjustment or worn.	Adjust, repair, or replace entire unit if condition warrants (par. 27).
Excessive backlash in drive axle	Loose axle shaft drive flange cap screws.	Tighten cap screws (par. 25).
	Loose flange on axle shaft	Reweld flange to shaft (par. 25).
	Worn splines on axle shaft at differential end.	Replace drive flange and shaft assembly (par. 25).
	Differential drive pinion gear and ring gear out of adjustment or worn.	Adjust or replace as condition warrants (par. 27).
Steering is difficult	Tight steering system connections	Adjust linkage (par. 31).
	Tight steering gear; misalined wheels	Aline and adjust steering gear and axle (par. 30 and par. 31).
	Bent pitman arm	Replace pitman arm (par. 30).
	Misalined steering gear mounting	Adjust mounting silent blocks. (par. 31).
Truck wandering or weaving	Improper toe-in, camber, or caster (axle twisted).	Repair and adjust axle (par. 31).
	Worn or maladjusted steering gear	Repair, replace, or adjust steering gear (par. 30).
	Loose steering gear mountings	Tighten loose mounting silent blocks (par. 31).
Shimmy or wobble occurs in low speed.	Loose steering connections	Adjust and tighten linkage (par. 31).
	Steering gear worn or adjustment too loose	Repair, replace, or adjust steering gear (par. 30).
Vehicle pulls to one side	Bent steering arm or connection	Straighten or replace bent linkage (par. 31).
Brakes drag	Broken or weak brake pedal return spring.	Replace spring (par. 38).
	Brake shoe anchor pin tight in shoe	Free pin and lubricate lightly (par. 35).
	Broken or weak brake shoe return spring.	Replace spring (par. 35).
	Scored or rough drums	Repair or replace drum and brake shoe and lining assemblies (par. 25 and par. 35).
Brake pedal travel is excessive	Scored brake drums	Repair or replace drums (par. 25).
	Scored or distorted brake drum	Repair or replace drums (par. 25).
Main hydraulic pump does not deliver oil.	Broken pump shaft	Overhaul pump (par. 42).
Main hydraulic pump does not develop pressure.	Relief valve sticking open	Overhaul and clean pump (par. 42).
Hydraulic cylinders work slowly at rated engine rpm.	Defective main control valve	Overhaul control valve (par. 43).
	Defective cylinder	Overhaul defective cylinder (par. 46 and par. 47).
	Defective hydraulic pump	Overhaul hydraulic pump (par. 42).
Hydraulic cylinders chatter when operating.	Defective cylinder	Overhaul defective cylinder (par. 46 and par. 47).
	Defective hydraulic pump	Overhaul hydraulic pump (par. 42).
Main hydraulic pump makes noise	Air leak at pump shaft packing	Replace shaft packing (par. 42).
	Worn shaft packing	Replace shaft packing (par. 42).
Lift and tilt actions fails	Low oil pressure	Overhaul main hydraulic pump (par. 42).

Table I. Troubleshooting Chart-Continued

Trouble	Probable cause	Remedy
Oil leak at top of lift cylinder assembly.	Worn or damaged lift piston seal	Replace cylinder seal (par. 47).
	Scored cylinder wall.....	Overhaul cylinder (par. 47).
Oil leak around piston rod at tilt cylinder. ..	Worn seal	Replace cylinder seal (par. 46).
	Scored piston rod	Overhaul piston (par. 46).
Truck will not move in either direction.	No oil pressure in transmission	Clean transmission intake lines. Overhaul transmission oil pump (par. 28).
Truck will move in one direction only.	No oil pressure to directional selector ..... (seals and preformed packings in directional selector possibly defective).	Overhaul transmission (par. 28).
	Directional selectors disks not releasing, .. disks defective, or relief hole in drum clogged.	Overhaul transmission (par. 28).
Truck moves slowly in both directions ..... at wide open throttle.	Low oil pressure (faulty inching ..... valve, faulty relief valve, or faulty..... pump).	Repair or replace defective parts (pars. 24 and 28).
	Clogged sump screen	Clean screen (TM 10-3930-237-20).
Transmission overheats.....	Low directional selector pressure ..... (check with gage) inching valve not functioning properly.	Overhaul transmission (par. 28).
	Defective selector seals	Overhaul transmission (par. 28).
	Regulator valve sticking open.....	Overhaul transmission control valve (par. 24).
	Clogged sump screen	Clean screen (TM 10-3930-237-20).
	Insufficient oil to torque converter and ..... cooler.	Clean transmission cooling lines (TM 10-3930-237-20).
	Cooler clogged internally stopping ..... flow of oil.	Clean transmission oil cooler (TM 10-3930-237-20).
	Worn bushing in torque converter ..... impeller hub, allowing oil to leak out.	Replace torque converter (par. 10).
	Slipping stator.....	Replace torque converter (par. 10).
Machine has full power, but transmission . overheats.	Pressure regulator valve sticking, giving low pressure	Overhaul transmission control valve (par. 24).

Section II. ENGINE

9. General

The engine is a four-cylinder, water-cooled, valve-in-block, pressure-lubricated gasoline engine. It is mounted in the truck with the cooling fan facing the rear of the truck. The fan end of the engine is mounted on a single point support. The flywheel housing at the opposite end is secured to the transmission housing. The engine is shrouded by lift-off side panels and by a hood assembly under the operator's seat.

10. Engine Removal and Replacement

a. Removal.

(1) Disconnect parking brake lever from stub shaft (TM 10-3930-237-20).

(2) Tag and disconnect electrical leads at voltage regulator (TM 10-3930-23720).

(3) Remove overhead guard, lift-off side panels, floor plate, and hood parts (TM 10-3930-237-20).

(4) Tag and disconnect electrical leads at ignition coil, generator, starter solenoid, and starter relay (fig. 1).

(5) Remove air cleaner and mounting bracket (TM 10-3930-237-20).

(6) Disconnect fuel lines from fuel pump (TM 10-3930-237-20).

(7) Disconnect accelerator linkage from

governor control lever (TM 10-3930-237-20).

(8) Disconnect choke linkage from carburetor (TM 10-3930-237-20).

(9) Remove battery cables (TM 10-3930-237-20).

(10) Drain engine oil, transmission oil, and engine coolant (TM 10-3930-23720).

(11) Remove engine oil filter and mounting bracket (TM 10-3930-237-20).

(12) Tag and disconnect electrical leads from engine oil pressure sender, engine temperature sender, and engine hourmeter switch.

(13) Disconnect hydraulic lines from transmission oil filter and drain lines into suitable container (TM 10-3930-23720).

(14) Disconnect hydraulic lines from main hydraulic pump (fig. 1) and drain lines into suitable container.

(15) Remove counterweight, muffler, and radiator (TM 10-3930-237-20).

(16) Block up securely underside of transmission. Support weight of engine with hoist.

(17) Remove cotter pin (8, fig. 2), Nut (7), two washers (5), and support pad (6) that secure support assembly (3) to truck frame.

Note. Remaining support pad (6) and washer (5), mounted on stud of support assembly, can be removed after engine is removed from truck.

(18) Remove 12 capscrews and lockwashers that secure engine flywheel housing to transmission housing. Remove engine and assembled torque converter by pulling out toward rear of truck.

(19) Remove six bolts (6, fig. 3) and lockwashers (5) that secure flywheel drive plate (2) to flywheel; remove plate and torque converter (1).

(20) Remove six bolts (4) that secure torque converter (1) and converter drive and reinforcing plate (3) to flywheel drive plate; remove torque converter and reinforcing plate.

(21) Remove main hydraulic pump from engine (par. 42a).

(22) Remove distributor from engine (TM 10-3930-237-20).

(23) Remove generator and starter from engine (TM 10-3930-237-20).

(24) Remove ignition coil, transmission oil filter and starter relay by removing two nut (fig. 1) and lockwashers that attach mounting bracket to engine cylinder head.

(25) Remove carburetor, water pump, and fuel pump from engine (TM 10-3930237-20).

(26) Remove engine oil pressure sender, engine temperature sender, and engine hourmeter switch (TM 10-3930237-20).

(27) Remove nut (1, fig. 2), bolt (4) and lockwashers (2) that attach support assembly (3) to engine; remove support assembly. Inspect support pads (5) and discard if damaged.

b. Replacement.

(1) Position support assembly (3, fig. 2) over mounting stud on fan end of engine; secure support assembly to engine with nut (1), two lockwashers (2) and bolt (4). Install washer (5) and support pad (6) on stud of support assembly.

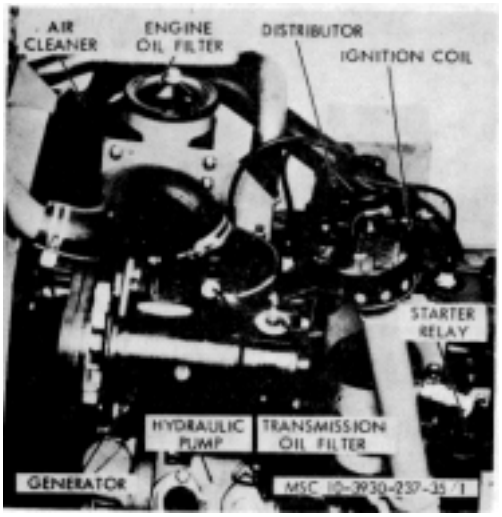


Figure 1. Engine compartment, right side view.

(2) Install engine oil pressure sender, engine temperature sender, and engine hourmeter switch (TM 10-3930-237-20).

(3) Install carburetor, water pump and fuel pump on engine (TM 10-3930-237-20).

(4) Install ignition coil, transmission oil filter, and starter relay by locating mounting bracket on two studs on engine cylinder head; secure bracket with two nuts and lockwashers (fig. 1).

(5) Install generator and starter on engine (TM 10-3930-237-20).

(6) Install distributor on engine (TM 10-3930-237-20).

(7) Install main hydraulic pump on engine (par. 42e).

(8) Position converter drive and reinforcing plate (3, fig. 3) and flywheel drive plate (2) on the torque converter (1); secure with six bolts (4).

(9) Position the assembled torque converter and flywheel drive on the engine flywheel; secure with six bolts (6) and lockwashers (5).

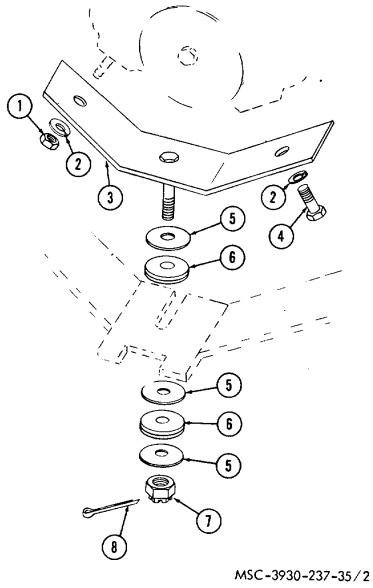
(10) Position assembled engine and torque converter on truck so that splined shaft of transmission engages splined hole of converter. Aline engine flywheel housing with torque converter housing and secure with 12 capscrews and lockwashers.

(11) Install two washers (5, fig. 2) and support pad (6) on stud of engine support assembly (3); secure support assembly to truck frame with nut (7) and cotter pin (8).

(12) Install counterweight, muffler and radiator (TM 10-3930-237-20).

(13) Connect hydraulic lines to main hydraulic pump (fig. 1).

(14) Connect hydraulic lines to transmission oil filter (TM 10-3930-23720).



1 Nut	5 Washer
2 Lockwasher	6 Support pad
3 Support assembly	7 Nut
4 Bolt	8 Cotter Pin

Figure 2. Engine mount, exploded view.

(15) Connect electrical leads to engine oil pressure sender, engine temperature sender, and engine hourmeter switch.

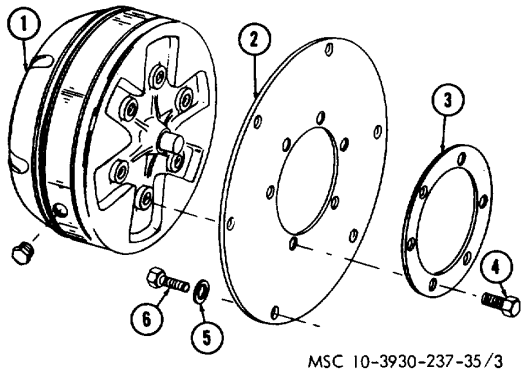
(16) Install engine oil filter and mounting bracket (TM 10-3930-237-20).

(17) Fill engine crankcase, transmission, and radiator to proper levels (TM 10-3930-237-20).

(18) Install battery cables (TM 10-3930-237-20).

(19) Connect and adjust choke linkage to carburetor (TM 10-3930-237-20).

(20) Connect and adjust accelerator linkage to governor control lever (TM 10-3930-237-20).



1 Torque converter
2 Flywheel drive plate
3 Converter drive and reinforcing plate
4 Bolt
5 Lockwasher
6 Bolt

Figure 3. Torque converter and drive plates, exploded view.

(21) Connect fuel lines to fuel pump and hoses to water pump (TM 10-3930-237-20).

(22) Install air cleaner and mounting bracket (TM 10-3930-237-20).

(23) Connect electrical leads to ignition coil, generator, starter solenoid, and starter relay.

(24) Install overhead guard, lift-off side panels, floor plate, and hood parts (TM 10-3930-237-20).

(25) Connect electrical leads to voltage regulator (TM 10-3930-237-20).

(26) Connect parking brake lever to stub shaft (TM 10-3930-237-20).

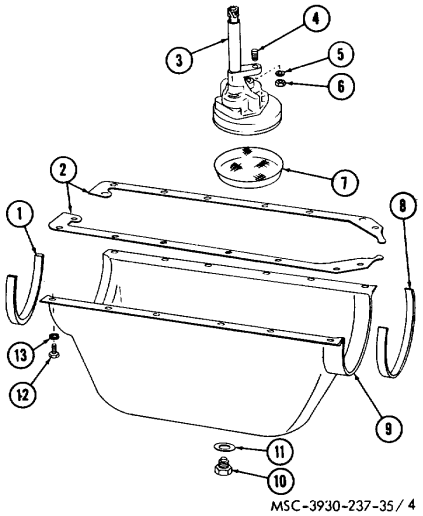
11. Engine Overhaul

a. Engine Removal. Remove the engine (par. 10).

b. Oil Pan, Oil Pump, and Filler Block Removal.

(1) Remove the 12 screws (12, fig. 4) and lockwashers (13) that secure the oil pan (9) to the block; remove the oil pan and gaskets (1, 2 and 8).

(2) Remove the nut (6) and lockwasher (5) that secure the oil pump assembly.



1 Gasket
2 Gasket
3 Oil pump assembly
4 Stud
5 Lockwasher
6 Nut
7 Oil strainer
8 Gasket
9 Oil pan
10 Plug
11 Gasket
12 Screw
13 Lockwasher

Figure 4. Oil pan and oil pump parts group, exploded view.

Remove the oil strainer (7) from the oil pump assembly.

(3) Remove the two screws (25, fig. 5) and lockwashers (26) that secure the filler block (24) to the block (7); remove the filler block and seal (23).

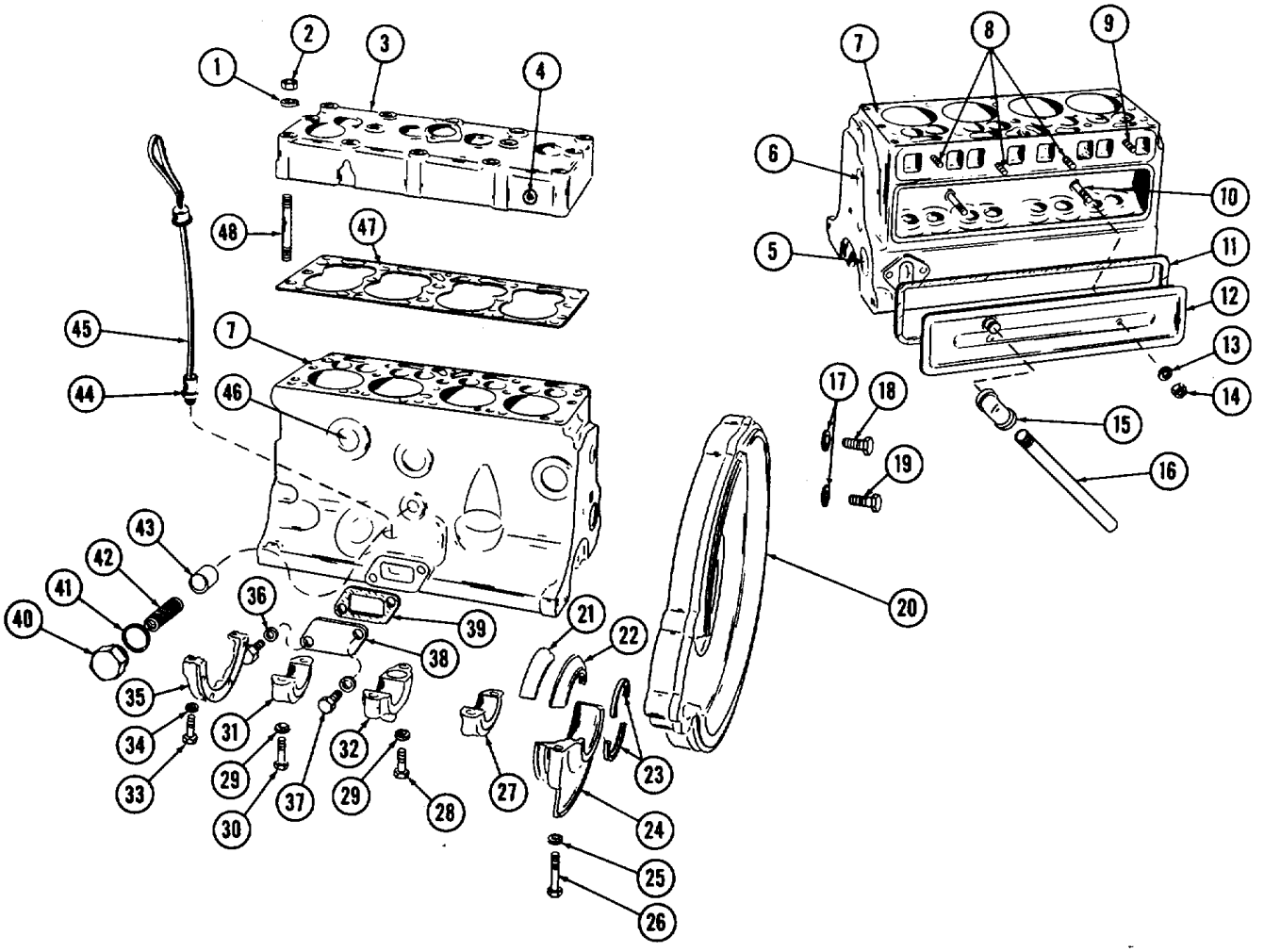
(4) Remove the two screws (33) and lockwashers (34) that secure the filter block (35) to the block; remove the filler block.

c. Cylinder Head Removal. Removal the cylinder head (TM 10-3930-237-20).

d. Gear Cover and Idler Gear Removal.

(1) Remove the gear cover (par. 16).

(2) Remove the idler gear and shaft (21, fig. 31) from the bearing (32). Remove the thrust plunger (35) and spring (34) from the gear.



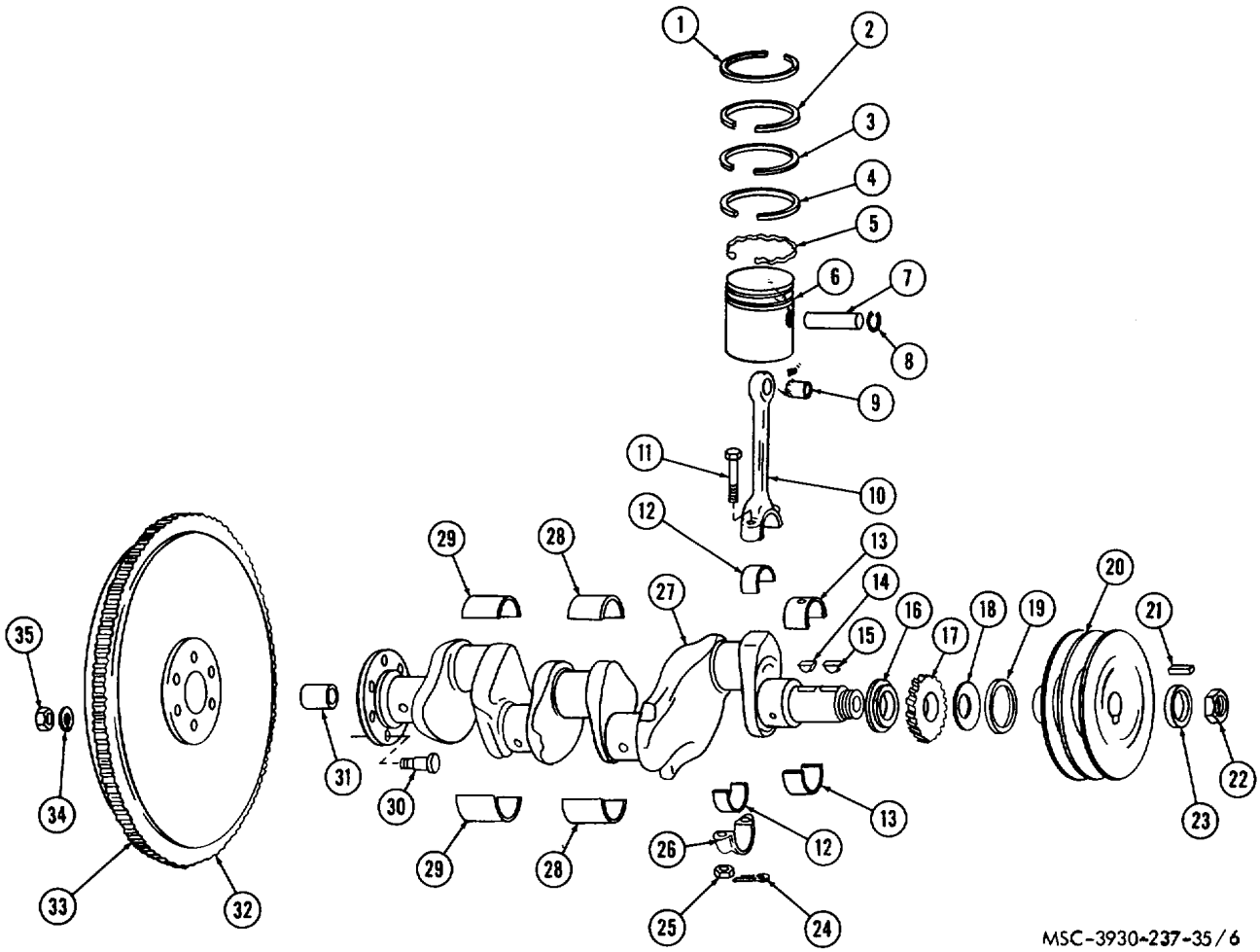
1 Washer	13 Washer	25 Screw	37 Screw
2 Nut	14 Nut	26 Washer	38 Cover
3 Cylinder head	15 Elbow	27 Cap	39 Gasket
4 Plug	16 Tube	28 Screw	40 Plug
5 Plug	17 Lockwasher	29 Washer	41 Gasket
6 Plug	18 Bolt	30 Capscrew	42 Spring
7 Block	19 Screw	31 Cap	43 Valve
8 Stud	20 Flywheel housing	32 Cap	44 Support
9 Stud	21 Felt	33 Screw	45 Rod assembly
10 Stud	22 Guard	34 Washer	46 Plug
11 Gasket	23 Seal	35 Filler block	47 Gasket
12 Cover	24 Filler Block	36 Washer	48 Stud

Figure 5. Engine, exploded view.

(3) Remove the three nuts (8) and lockwashers (9) that secure the bearing support (40) to the gear cover; remove the bearing support and gasket (39).
(4) Press the seal (38) from the gear cover.
(5) Remove the bearing (33) from the shaft of the idler gear.

e. Flywheel and Flywheel Housing Removal.

(1) Remove the six nuts (35, fig. 6) and lockwashers (34) that secure the flywheel (32) to the crankshaft (27); remove the flywheel. Remove the bolts (30) from the crankshaft.
(2) Remove the bolts (18, fig. 5), washers (17) and three capscrews (19), that secure the flywheel housing (20) to the block (7);



1 Piston ring	10 Connecting rod	19 Seal	28 Sleeve bearing
2 Piston ring	11 Bolt	20 Pulley	29 Sleeve bearing
3 Piston ring	12 Sleeve bearing	21 Plug	30 Bolt
4 Piston ring	13 Sleeve bearing	22 Nut	31 Sleeve bearing
5 Piston ring expander	14 Key	23 Washer	32 Flywheel
6 Piston	15 Key	24 Cotter pin	33 Ring gear
7 Piston pin	16 Plate	25 Nut	34 Lockwasher
8 Retaining ring	17 Gear	26 Connecting rod cap	35 Nut
9 Sleeve bearing	18 Slinger	27 Crankshaft	

Figure 6. Crankshaft and piston parts group, exploded view.

remove the flywheel housing.

f. Piston and Connecting Rod Removal and Disassembly.

(1) Ream the ridge of the top of each cylinder bore with a standard ridge reamer. Blow metal fragments from the cylinder with compressed air.

(2) Remove the two cotter pins (24, fig. 6) and nuts (25) that secure a connecting rod cap (26) to a connecting rod (10); remove the cap and sleeve bearing (12).

(3) Push assembled piston (6) and connecting rod up through the top of the block.

Caution

While pushing the piston and rod from the block, be very careful the connecting rod does not scratch the cylinder wall.

(4) Remove the two retaining rings (8) from the piston; push the piston pin (7) from the piston and rod.

Note

Disassemble the pistons and piston rods in sets, and keep the sets together. Also, be sure each piston and piston rod set is installed in the cylinder from which it was removed.

(5) Remove the piston rings (1-4) and piston ring expander (5) from the piston.
(6) Remove and disassemble the three remaining piston and connecting rod assemblies.

g. Crankshaft Removal.

Note

Paragraph j(6) below contains instructions for main bearing replacement without removing the crankshaft.

(1) Remove the two screws (30, fig. 5) and washers (29) that secure the cap (31) to the block; remove the cap.
(2) Remove the two screws (28) and washers (29) that secure the cap (32) to the block; remove the cap.
(3) Remove the two screws (30) and washers (29) that secure the cap (27) to the block; remove the cap.
(4) Remove the sleeve bearings (13, 28, and 29, fig. 6) from the bearing caps.
(5) Lift the crankshaft (27) from the block.
(6) Remove the sleeve bearings (13, 28, and 29) from the block.
(7) Remove the guard (22, fig. 5) and felt (21) from the block. Remove the seal (23) from the guard.

h. Valve and Camshaft Removal.

(1) Remove the valves (par. 13a).
(2) Remove the valve lifters (8, fig. 22). Note the location of each valve lifter so it may be reinstalled in the guide hole from which it was removed.
(3) Remove the nut (19) that secures the gear (18) to the camshaft (11), pull the gear from the camshaft.
(4) Remove the two bolts (17) and lockwashers (16) that secure the thrust washer (15) to the block; remove the thrust washer.
(5) Pull the camshaft from the block.

i. Cleaning and Inspection.

(1) Clean all metal parts in an approved cleaning solvent. Dry with clean, dry, compressed air. Make sure that the crankshaft, connecting rod, and cylinder block oil ports are open by blowing compressed air through each port.
(2) Inspect the oil pan for dents, distorted sealing surfaces, cracks, damaged drain hole threads, or other defects.
(3) Inspect the filter blocks for cracks, distortion, damaged sealing surfaces, or other damage.
(4) Inspect the oil pump assembly for a damaged drive gear, drive shaft play, body cracks, strainer distortion, or other defects.
(5) Inspect the cylinder head (TM 103930-237-20).
(6) Inspect the flywheel housing for cracks, damaged sealing surfaces, or other defects.
(7) Inspect the flywheel for damaged teeth, cracks, distortion, or other defects.
(8) Inspect the pistons for cracks, scoring, pitting, damaged ringlands, or other defects.
(9) Inspect the piston rods for cracks, distortion, scoring, or other defects.
(10) Inspect the crankshaft for cracks, scored or grooved bearing journals, damaged key slots and bolt holes, or other defects.
(11) Inspect the valves and other pertinent parts (par. 13b).
(12) Inspect the tappets for scoring, pitting, cracks, or other defects.
(13) Inspect the camshaft for cracks, pitting, worn or scored lobes or bearing journals, damaged threads or key slots, or other defects.
(14) Inspect the engine block (par. 12d).
(15) Inspect the parts listed in table II to be certain the parts are not worn beyond the limits given.
(16) Replace the gaskets, seals, and repair or replace damaged or defective parts.

Table II. Wear Limits

Part	Point of measurement	Wear limits
Valve guides	Bore diameter	Intake-0.3133 in. max. Exhaust-0.3150 in. max.
Intake valve stems	Stem diameter	0.3128 in. max.
Exhaust valve stems	Stem diameter	0.3128 in. max.
Valve springs	Tension when compressed to 1 33/64 in.	42 pounds min.
	Tension when compressed to 1 15/64 in.	86 pounds min.
Camshaft	Fan end bearing journal diameter	1.8075 in. min.
	Middle bearing journal diameter	1.7445 in. min.
	Drive end bearing journal diameter	1.2455 in. min.
Crankshaft	Connecting rod bearing journal diameter.	1.4338 in. min.
	Main bearing journal diameter	1.7482 in. min.
Piston pins	Pin diameter	0.8588 in. min.
Connecting rods	Piston pin bearing diameter	0.8606 in. max.
Piston	Piston pin hole diameter	0.8796 in. max.
	Piston ring groove width top groove	0.099 in. max.
	Piston ring groove width-two middle grooves.	0.0985 in. max.
	Piston ring groove width-bottom groove.	0.191 in. max.
Piston rings	Piston ring width-Top ring	0.0910 in. min.
	Piston ring width-two middle rings	0.0910 in. min.
	Piston ring width-bottom ring	0.1840 in. min.

j. Crankshaft Repair and Installation.

(1) If the gear (17, fig. 6) is damaged or defective, press the gear from the crankshaft (27). Position the key (14) in the keyway and press a replacement gear onto the crankshaft. When the gear is replaced, the camshaft gear (18, fig. 22) must also be replaced.

(2) Flatten the seal (23, fig. 5) with a hammer or vise; install in the rear guard (fig. 7). Trim the seal flush with the guard. Install the felt (21, fig. 5) and the assembled seal and guard in the block (7). Lubricate the seal with engine oil.

(3) Position the upper half of the sleeve bearings (13, 2 and 29, fig. 6) in the block. Install the crankshaft (27) in the block. Install the lower half of the sleeve bearings (13, 28 and 29) in the bearing caps (27, 31 and 32, fig. 5).

(4) Check the clearance between the crankshaft bearing journals and bearings as follows:

(a) Place a piece of plastigage near the oil hole of the bearing cap.

(b) Position the cap on the block and secure with the two screws and lockwashers. Tighten the screws to 8595 foot-pounds torque.

(c) Remove the bearing and bearing cap. Check the bearing journal-to-

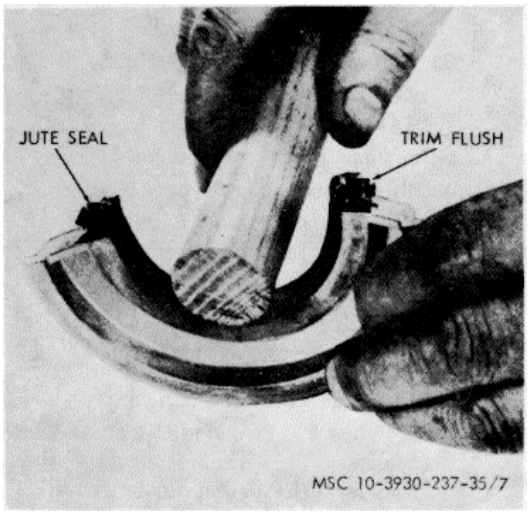


Figure 7. Installing top half of rear seal in guard.

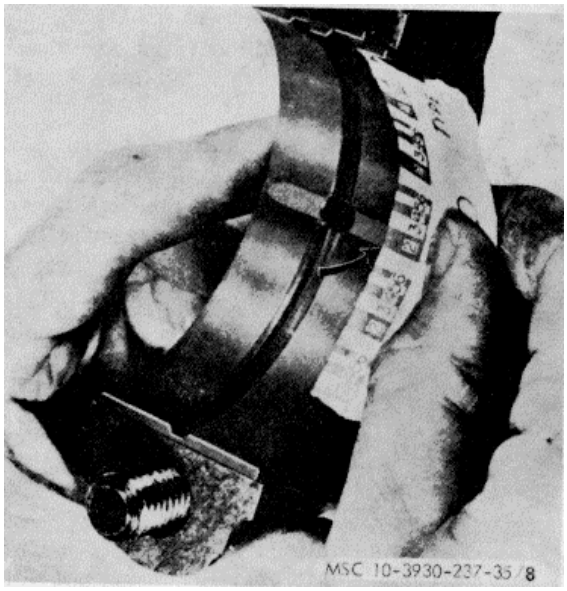


Figure 8. Checking bearing clearance with plastigage.

bearing clearance using plastigage (fig. 8).

(5) Clearance must be between 0.0006 and 0.0032 inch. If the clearance is not within these limits, replace the bearings and recheck the clearance.

(6) Remove and replace the bearings as follows:

(a) Remove the bearing cap; remove the bearing from the cap.

(b) Install a pin with an angular head in the oil hole in the crankshaft bearing journal (fig. 9).

(c) Rotate the crankshaft by hand. The pin will force the top bearing half out of its seat.

(d) Position the replacement bearing on the crankshaft bearing journal. Rotate the crankshaft by hand. The pin will force the bearing half into position.

(e) Install the replacement bearing half in the cap. Install the cap.

(7) Check the remaining bearing-to-bearing journal clearances and replace bearings as necessary.

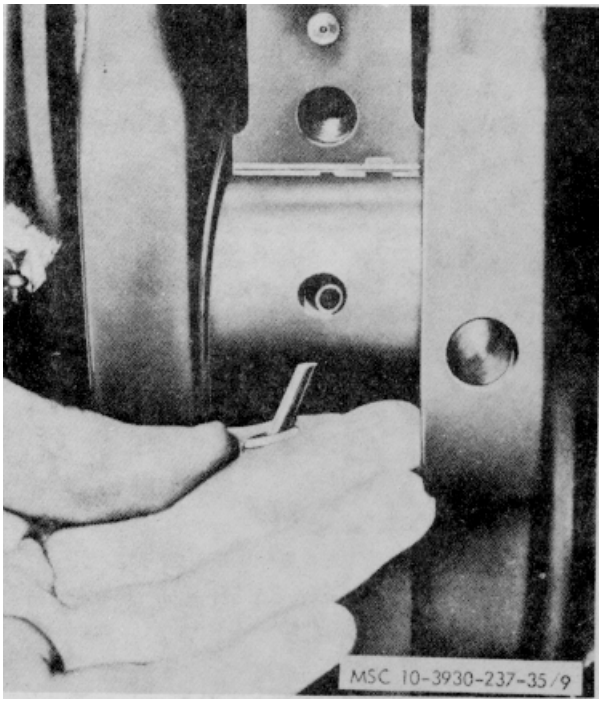


Figure 9. Removing bearing with angular-headed pin.

(8) An alternate method of checking bearing clearance is as follows:

(a) Oil the bearing and bearing journal with engine oil.

(b) Position a strip of 0.0032-inch feeler gage, 1/2 inch long, on the bearing cap (fig. 10).

(c) Install the cap on the block; secure with the screws and lockwashers. Tighten the screws to 85-95 foot-pounds torque.

(d) Try to turn the crankshaft by hand. If the crankshaft will not turn or a definite drag is felt, bearing-to-bearing journal clearance is within tolerance.

(9) After all main bearings have been installed, check crankshaft end play using a dial indicator. If end play is not between 0.002 and 0.006 inch, replace the thrust plate (16, fig. 6) as follows:

(a) Pull the gear (17) from the crankshaft. Remove the thrust plate from the crankshaft.

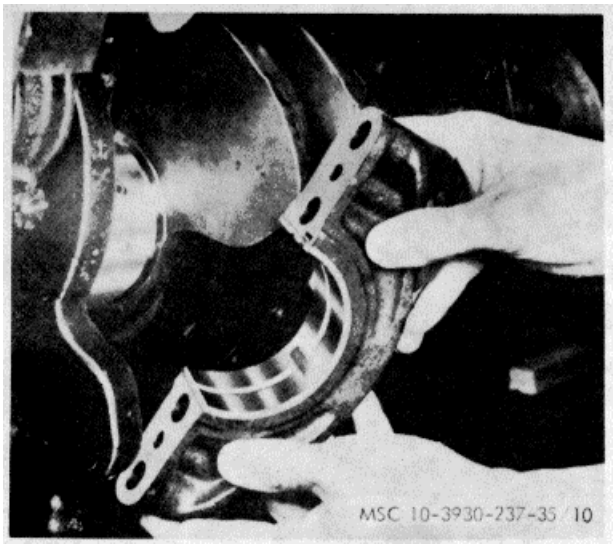


Figure 10. Checking bearing clearance with feeler stock.

(b) Position a new thrust plate and the key (14) on the crankshaft; drive the gear onto the shaft.

(c) Press the gear into final position by installing the oil slinger (18), seal (19), pulley (20), washer (23), and nut (22).

(d) Remove the nut, washer, pulley, seal and slinger.

k. Camshaft and Valve Repair and Reassembly.

(1) Install the camshaft (11, fig. 22) in the block. Check the clearance between the camshaft bearing journals and camshaft bearings (14, 12 and 10) with feeler stock cut in strips 1/4 inch wide. Dress the feeler stock with a stone to eliminate the burs or feathered edges. Clearance between the fan end and drive end bearings and journals must be between 0.002 and 0.004 inch and the center journal must be between 0.003 and 0.0047.

Caution

Do not insert the camshaft too far into the block. If the camshaft bumps the expansion plug on the drive end of the engine, an oil leak could result.

(2) If clearance exceeds tolerances, re move the camshaft from the block and install new camshaft bearings. The camshaft bearings are presized and do not have to be honed after installation.

(3) Lubricate the camshaft bearings with engine oil and install the camshaft in the block. Position the thrust washer (15) on the camshaft; secure with the two bolts (17) and lockwashers (16).

(4) Position the backing plate (23, fig. 31) and gasket (25) on the block; secure with the five screws (29, 30 and 31) and two lockwashers (4).

(5) Position the key (13, fig. 22) on the camshaft. Hold the camshaft toward the front of the engine with a bar inserted into the fuel pump hole. Aline the timing marks on the camshaft and crankshaft gears (fig. 11) and drive the gear (18, fig. 22) onto the camshaft. Position the governor drive assembly (21, fig. 32) against the camshaft gear and secure with nut (19, fig. 22). Tighten the nut to 85 to 90 foot pounds torque.

(6) Check camshaft end play with a dial indicator. If end play is not between 0.003

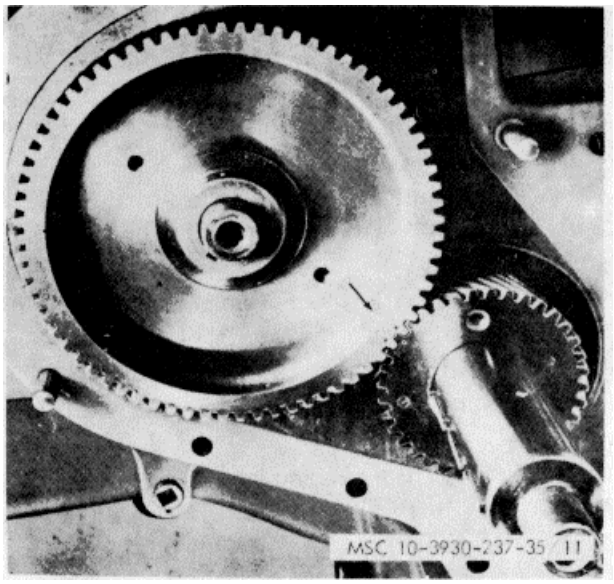


Figure 11. Timing gears installed with timing marks alined.

and 0.007 inch, remove the camshaft timing gear and replace the thrust washer (15, fig. 22) by removing the camshaft timing gear.

(7) Check the clearance between the camshaft and crankshaft gears as follows:

(a) Force the teeth of the gears apart with a screwdriver. Attempt to insert a 0.0015-inch feeler gage into the gap between the gears. If the gage will enter, the clearance is excessive.

(b) If the gage will not enter, place a finger at the junction of the two gears and tap the camshaft gear with a hammer (fig. 12). If vibrations can be felt in the large gear, the clearance is sufficient.

(8) If gear clearance is too great or too small, the gears must be replaced. Replace the gears only in sets. Gear sets are available in standard size (marked S), 0.002 and 0.004 inch undersize (marked U), and 0.002 and 0.004 inch oversize (marked O). Install a gear set marked the same as the set removed. Check the clearance as directed in (7) above. If clearance is too great, install the next smaller size gear set. If clearance is

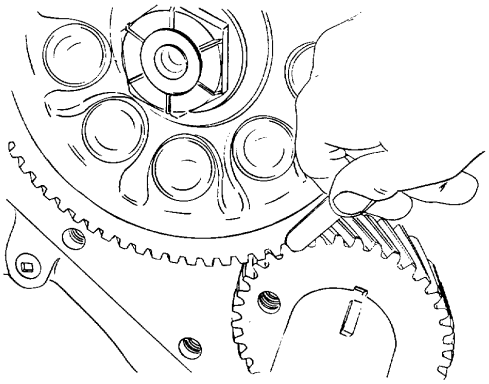


Figure 12. Checking gear clearance.

insufficient, install the next larger size set., (9) Install each valve lifter (8, fig. 22) in its hole. Check the clearance between the lifter and the bore. If clearance exceeds 0.005 inch, replace the lifter.

(10) Install the valves (par. 13c).

l. Piston and Connecting Rod Repair and Installation.

(1) Check piston fit (fig. 13) using a piece of 0.0015-inch feeler stock cut 1/2 inch wide. Dress the edges of the feeler stock with a stone to remove burs and feathered edges. The block and pistons must be at room temperature when piston fit is tested. Position the feeler stock midway between the piston pin bosses. With the piston inserted about 2 inches into the block, the feeler stock must pull from the block with 5 to 10 pounds pull. If the feeler stock does not offer enough resistance, perform the same test with a new standard size piston. If sufficient resistance is still not obtained, rebore the cylinders (par. 12e) and install oversize pistons.

(2) If new pistons (6, fig. 6) and piston pins (7) are being used, press a new sleeve bearing (9) into each connecting rod (10). Ream and hone the sleeve bearings to 0.8596 to 0.8593inch diameter.

(3) If the pistons and pins are not being r

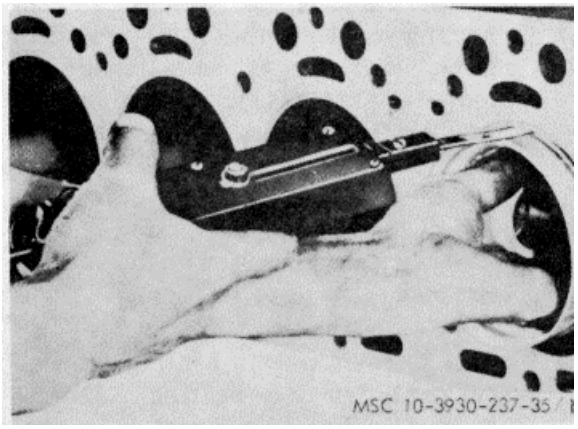


Figure 13. Checking piston fit in cylinder bore.

replaced, check the clearance between the piston pins and the sleeve bearings. Clearance must be between 0.0000 and 0.0005 inch. If clearance is not within this tolerance, press new sleeve bearings into the connecting rods and ream and hone to provide the proper clearance. After honing, 75 percent of the sleeve bearing surface must contact the piston pin.

(4) When pins, bushings, and pistons of the proper size have been found, assemble the pistons to the connecting rods as follows:

(a) Heat the pistons and connecting rods in an oven or in water to a minimum of 160° F.

(b) Position a connecting rod in its piston. Install the piston pin; secure with the retaining rings (8).

(5) Slide the piston rings (1 through 4) squarely into the cylinders in which they will be used. Check the ring gap with feeler gap. If the ring gap is not at least 0.010 inch, file the rings to provide a larger gap. If the ring gap exceeds 0.020 inch, rebore the cylinders (par. 12e) and install oversize pistons and rings.

(6) Install a piston ring expander (5) on the bottom ring groove of a piston. Install the piston rings on the piston with a standard ring expander tool.

(7) Assemble the remaining pistons, connecting rods, and piston rings.

(8) Install the assembled pistons and connecting rods in the same cylinders from which they were originally removed (par. 11f(4)). Use a ring compressor to compress the piston rings. Lubricate the pistons and cylinder walls with engine oil before installing the pistons. Wrap the bottom end of the connecting rods with a cloth to prevent damage to the cylinder walls during installation.

(9) Check the crank pin bearing journal-to-connecting rod bearing clearance with plastigage as directed in j(4) above. Tighten the connecting rod cap bolts to 35-40 foot-pounds torque. If clearance is not between 0.0007 and 0.0031 inch, replace the connecting rod bearings and recheck the clearance. If clearance is still not within tolerance, replace the crankshaft.

(10) As an alternate method of checking crank pin bearing journal-to-connecting rod bearing clearance, install a piece of 0.0031-inch thick feeler stock between the bearing and journal and check the clearance as directed in j(8) above. Tighten the connecting rod cap bolts to 3540 foot-pounds torque. Instead of rotating the crankshaft to detect drag, try to slide the connecting rod alternately toward the front and rear of the engine. If clearance is within tolerance, a definite drag will be felt. If clearance is not within tolerance, replace the connecting rod bearings and recheck the clearance. If clearance is still not within tolerance, replace the crankshaft.

(11) Lubricate the crank pin bearing journals and the sleeve bearings with engine oil. Install a cap (26) on its connecting rod and crank pin bearing journal; secure with the two bolts (11) and nuts (25). Tighten the nuts to 35-40 foot-pounds torque. Install the cotter pins (24).

(12) Secure the remaining connecting rods to the crank pin bearing journals.

m. Flywheel and Flywheel Housing Installation.

(1) Position the flywheel housing (20, fig. 5) on the block (7); secure with the bolts (18), washers (17) and three cap screws (19).

(2) If the teeth on the flywheel ring gear (33, fig. 6) are damaged, replace the ring gear as follows:

(a) Cut the ring gear with a torch or hack saw and remove the ring gear from the flywheel (32).

Caution

When cutting the ring gear, be extremely careful not to damage the flywheel.

(b) Heat the replacement ring gear in an oven and cool the flywheel in water or a refrigerator.

(c) Position the replacement ring gear on the flywheel. As the ring gear and flywheel approach the same temperature, the ring gear will contract to a very tight fit on the flywheel.

(3) Position the assembled flywheel and ring gear on the crankshaft (27); secure with six bolts (30), lockwashers (34), and nuts (35). Tighten the nuts to 35-40 foot-pounds torque.

(4) Check flywheel runout by mounting a dial indicator (fig. 14) and rotating the crankshaft through one full revolution. Hold pressure against the flywheel to eliminate crankshaft end play. If flywheel runout exceeds 0.008 inch, remove the flywheel and clean the crankshaft flange and flywheel seat. Install the flywheel and recheck runout. If runout still exceeds 0.008 inch, replace the flywheel.

(5) Check flywheel eccentricity by mounting a dial indicator (fig. 15) and rotating the crankshaft through one revolution. If the flywheel is eccentric more than 0.008 inch, loosen and retighten the flywheel mounting bolts and recheck eccentricity.

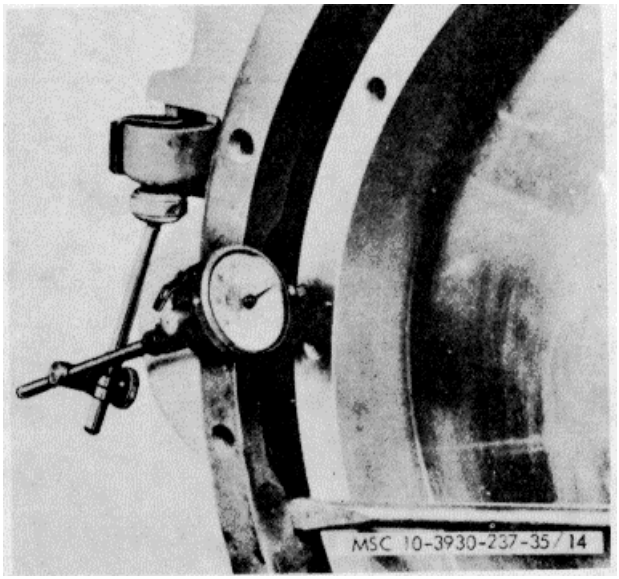


Figure 14. Checking flywheel runout.

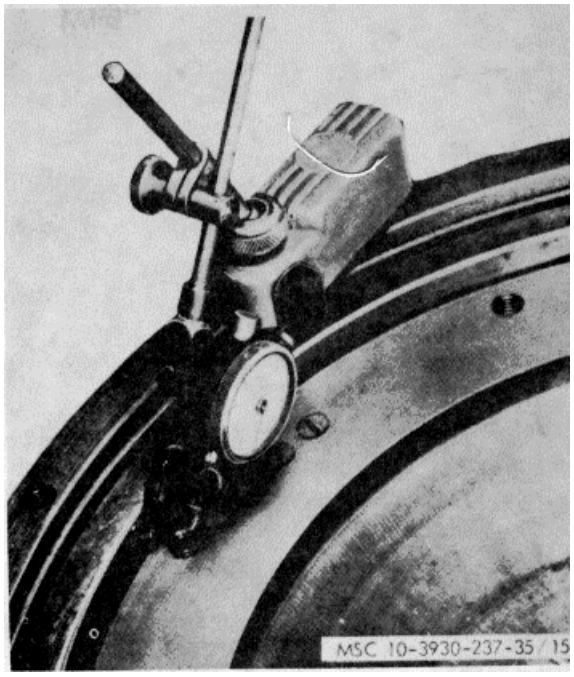


Figure 15. Checking flywheel eccentricity.

If eccentricity still exceeds 0.008 inch, replace the flywheel.

(6) Check runout of the flywheel housing face by mounting a dial indicator (fig. 16) and rotating the crankshaft through one revolution. Hold pressure against the flywheel to eliminate end play. If runout exceeds 0.008 inch, clean the mounting surfaces of the flywheel housing and the block. Recheck flywheel housing runout. If the runout is still not within limits, replace the flywheel housing.

(7) Check eccentricity of the flywheel housing bore by mounting a dial indicator (fig. 17) and rotating the engine through one revolution. If the housing bore is eccentric more than 0.008 inch, loosen the flywheel housing mounting bolts and tap the housing into its proper position with a soft hammer. Tighten the bolts and recheck eccentricity of the housing bore. If the housing can not be brought into true position, replace the housing.

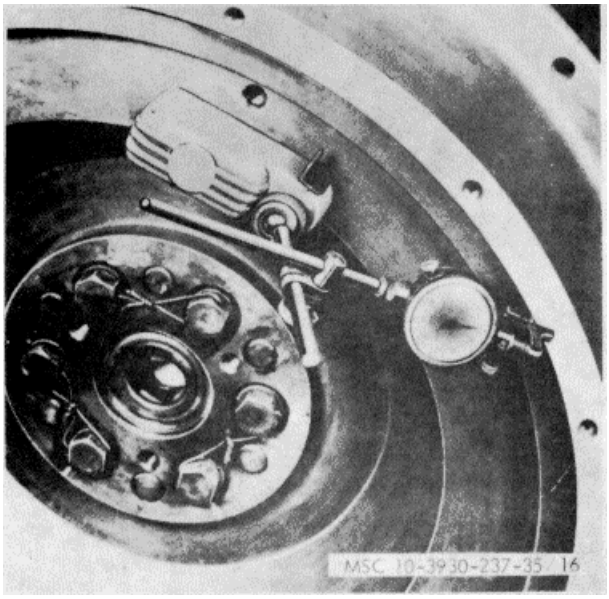


Figure 16. Checking flywheel housing runout.

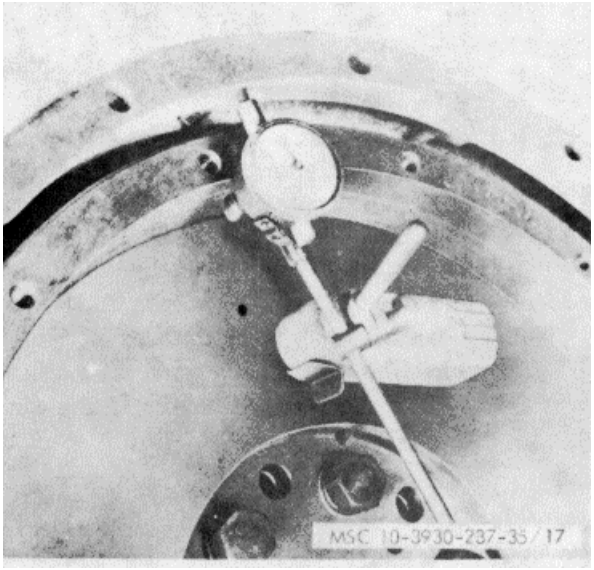


Figure 17. Checking of flywheel housing eccentricity.

n. Front Cover Reassembly and Installation.

(1) Install the idler gear and shaft (21, fig. 31) in the bearing (32). There should be no perceptible side play of the shaft in the bearing. If the shaft is loose, remove the bearing and install a new bearing in the block. Check the clearance again. If the shaft is still loose, replace the idler gear and shaft.

(2) Install the bearing (33) into the bearing support (40)

(3) Lubricate the idler gear and shaft with engine oil. Install the thrust washer (22) on the idler gear and shaft, and install the idler gear and shaft in the bearing (32).

(4) Press a new seal (38) into the gear cover (37).

(5) Lubricate the seal with engine oil. Install the gear cover (par. 16c).

(6) Hold the spring (34) and thrust plunger (35) on the idler gear; position the gasket (39) and the assembled bearing support and bearing on the gear cover; secure with the three nuts (8) and lockwashers (9).

o. Cylinder Head Installation. Install the cylinder head (TM 10-3930-237-20).

p. Filler Block, Oil Pump and Oil Pan Installation.

(1) Install the gasket (8, fig. 4) on the rear filler block (24, fig. 5) by placing a drop of nonhardening cement in the middle of the gasket and pressing the gasket into the groove in the filler block (fig. 18).

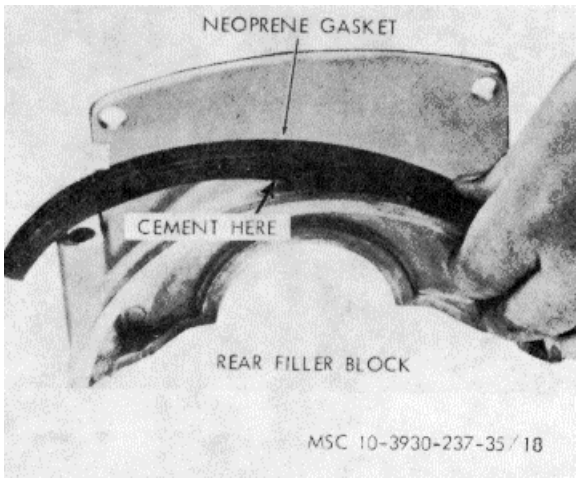


Figure 18. Installing neoprene gasket in rear filler block.

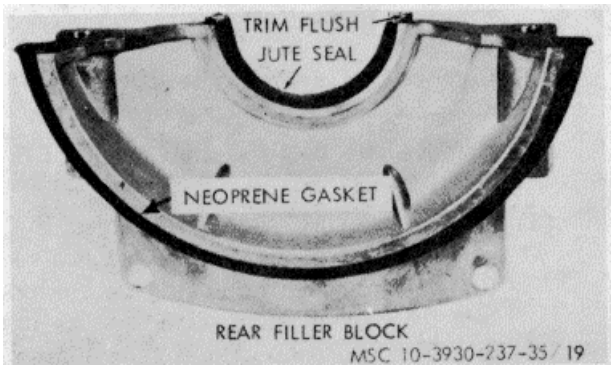


Figure 19. Lower half of ring seal installed in filler block.

(2) Install the seal in the rear filler block as follows:

(a) Flatten the seal in a vise or with a hammer until the seal fits into the groove in the filler block.

(b) Roll the seal into the filler block groove with a round object (fig. 7).

(c) Trim the seal flush with the filler block (fig. 19).

(3) Lubricate the seal with engine oil. Install the assembled filler block, gasket and seal on the engine block (fig. 20); secure with the two screws (25, fig. 5) and lockwashers (26). Tighten the screws to 15-20 foot-pounds torque.

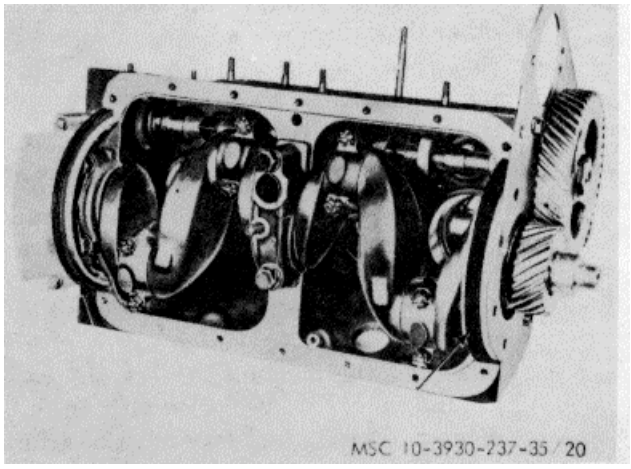


Figure 20. Filler block installed in engine block.

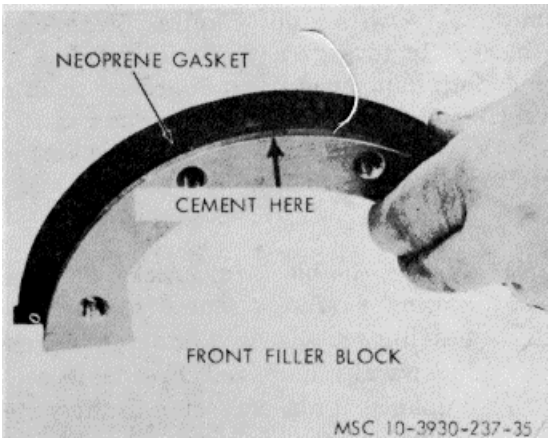


Figure 21. Installing neoprene gasket in front filler block.

(4) Install the gasket (1, fig. 4) on the front filler block (35, fig. 5) by placing a drop of nonhardening cement on the middle of the gasket and pressing the gasket into the groove in the filler block (fig. 21).

(5) Install the assembled gasket and filler block on the engine block (fig. 20); secure with the two screws (33, fig. 5) and lockwashers (34). Tighten the screws to 15-20 foot-pounds torque.

(6) Position the oil pump assembly (3, fig. 4) on the engine block; secure with the nut (6) and lockwasher (5). Install the oil strainer (7) on the oil pump assembly.

(7) Flatten oil pan gasket surfaces with a block of wood and a hammer. Position the gaskets (2) on the oil pan (9). Install the oil pan and gaskets on the engine block; secure with the 12 screws (12) and lockwashers (13). Tighten the screws to 15 to 20 footpounds torque.

q. Installation. Install the engine according to the replacement procedures in paragraph 10b.

12. Engine Block

a. Removal. Remove the engine (par. 10a).

b. Disassembly. Disassemble the engine (par. 11b-h).

c. Cleaning. Remove dirt and grease deposits from the block with a putty knife. Steam-clean the block. Remove greasy or gummy deposits with a cloth dampened in an approved cleaning solvent. Clean the oil and water passages in the block with compressed air. Remove varnish deposits with a wire brush.

d. Inspection.

(1) Inspect the block for cracks, damaged sealing surfaces, scored or damaged bearing seats, scored or scratched cylinder walls, damaged threads, loose or damaged studs, corrosion in the water jacket, or other defects.

(2) Check piston fit in the cylinder bores (par. 11l(1)).

(3) Check cylinder bore wear with an inside micrometer. Measure the cylinder bore at 45° intervals below the travel of the lowest piston ring where the cylinder is not worn. Compare this measurement with a measurement taken about 1/4 inch below the top of the cylinder. The maximum allowable cylinder wear (the difference between these two measurements) is 0.008 inch.

(4) Replace the block if it is cracked, or defects cannot be repaired. Replace loose or damaged studs. Retap damaged threads. If a proper piston fit cannot be attained (par. 11(1)), the cylinders are scratched or scored, or cylinder wear exceeds 0.008 inch, rebore the cylinders as directed in e below.

e. Reboring. Rebore the cylinders to 3.2700 to 3.2720-inch diameter (0.020 inch oversize). If this is not sufficient to eliminate cylinder wear or damage, rebore the cylinders to 3.2900 to 3.2920-inch diameter (0.040 inch oversize). Maximum allowable overbore is 0.040 inch.

f. Reassembly. Reassemble the engine (par. 11k-p).

g. Installation. Install the engine according to the replacement procedures in paragraph 10b.

13. Valves

a. Removal.

(1) Remove the cylinder head (TM 10-3930-237-20).

(2) Remove the valve tappet cover (TM 10-3930-237-20).

(3) Using a spring lifter, compress the valve spring (4, fig. 22) at each valve (1) and remove the spring retaining lock (6) from each valve that is in the closed position. Rotate the engine crankshaft to close the remaining valves and remove the remaining locks.

(4) Lift each valve from the top of the block. Place them in order in a rack to assure that each will be reassembled in the same valve guide from which it was removed.

(5) Remove the valve stem caps (7). Remove the valve lifters (8).

(6) Do not remove the valve guides (3) or valve seats (2) unless inspection indicates that they are faulty.

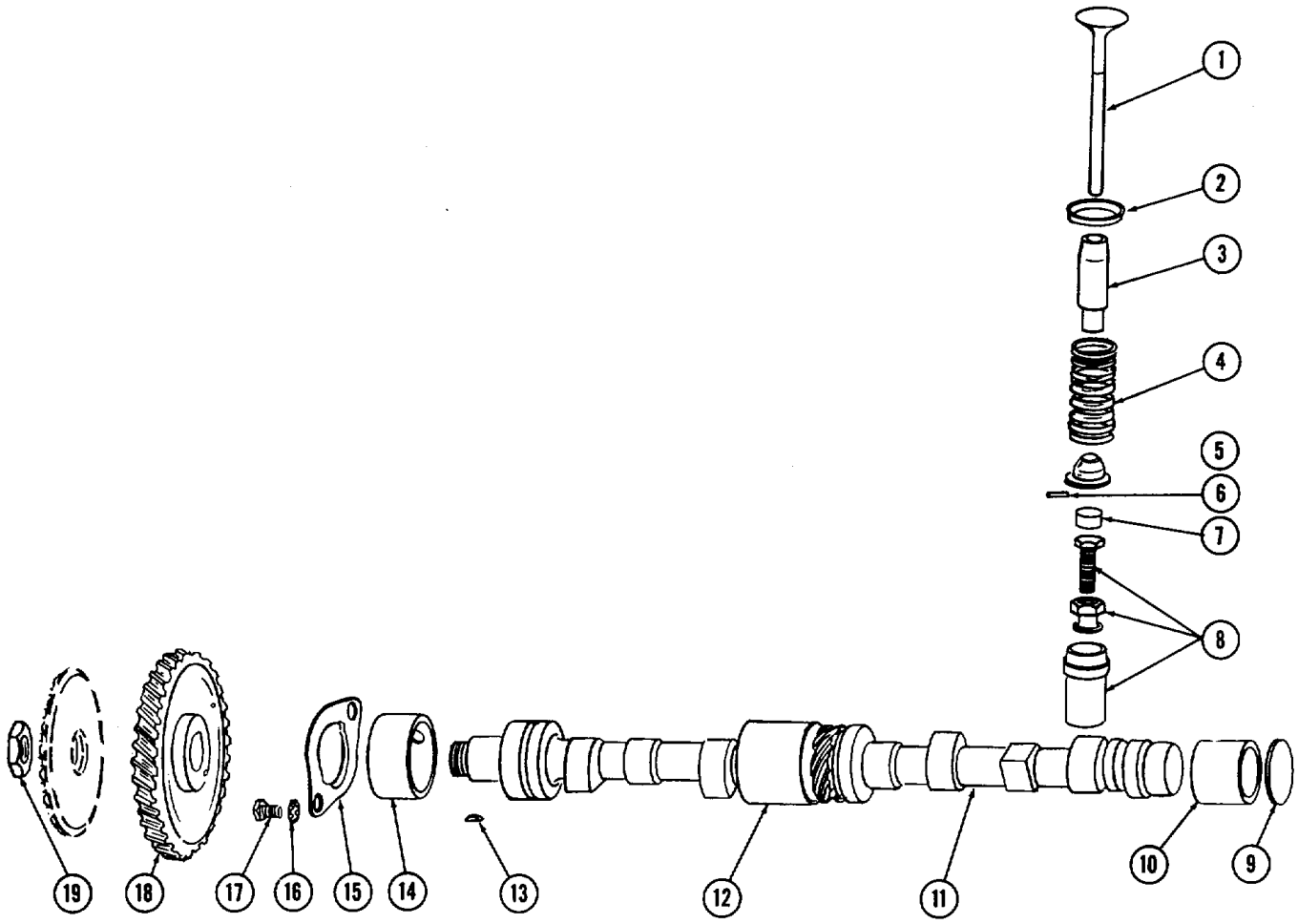
b. Cleaning, Inspection, and Repair.

(1) Clean the valves, valve springs, valve lifters, and valve stem caps (7, fig. 22) with an approved cleaning solvent; dry thoroughly. Remove carbon deposits with a wire brush.

(2) Clean the valve guides installed in the block with a valve guide cleaner or wire brush. Remove all lacquer and other deposits.

(3) Clean the valve seats with a wire brush.

(4) Inspect the valves for cracks, bent stems, distortion, and wear. If the valves are not seriously damaged, regrind them. After grinding, the valve head thickness must be at least 50 percent the thickness of a new valve. Replace the valves if they are ground to less than this amount. Check the reground valves on V-blocks with an indicator. The contact face must be true with the stem to within 0.002 inch. E Repeat refacing operation if necessary.



1	Valve	6	Spring retaining lock	11	Camshaft	16	Lockwasher
2	Valve seat	7	Valve stem cap	12	Center bearing	17	Bolt
3	Valve guide	8	Valve lifter assembly	13	Key	18	Gear
4	Valve spring	9	Plug	14	Front bearing	19	Nut
5	Spring retainer seat	10	Rear bearing	15	Thrust washer		

Figure 22. Valve and camshaft group parts, exploded view.

(5) Check for loose or worn valve guides. Check the internal diameter of the valve guide with a telescope gage and a micrometer. Replace guides that are worn to a bell-mouthed shape or guides that have a maximum diameter of more than 0.3133 (intake) and 0.3150 (exhaust).

(6) If the valve guides are worn or damaged, drive out the guides from the combustion side, using a driver that is slightly smaller than the external diameter of the guide (fig. 23). With the driver, drive in new guides from the combustion side. When properly seated, valve guide tops will be 7/8 inches from the top of the block (fig. 24).

Caution: **Do not attempt to ream the valve guides after seating them. Guides are pre-reamed and coated. Further reaming will remove the coating.**

(7) Check the exhaust valve seat inserts for cracks or loose mounting. Pull out faulty valve seats (fig. 25). Replace valve seats with new 0.010 inch oversized valve seats. Counterbore the valve seats to a diameter of

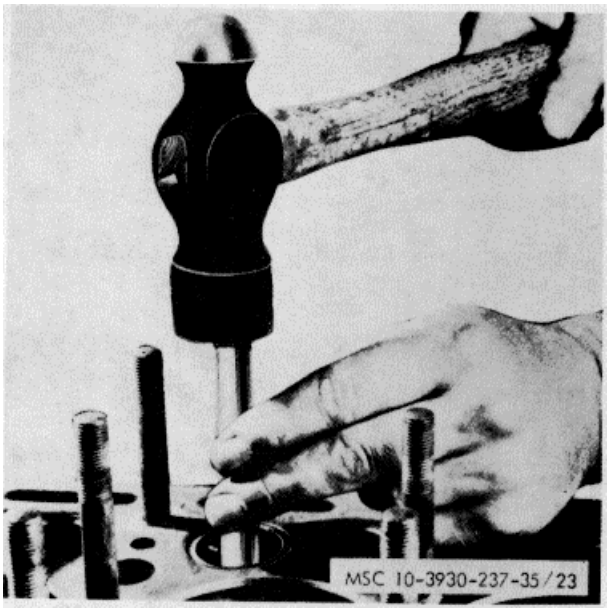


Figure 23. Removing valve guides.

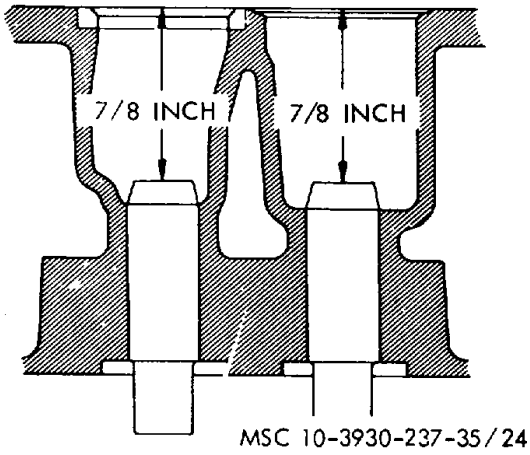


Figure 24. Valve guide location.

1.1255 to 1.1245 inches. This will provide a 0.003 to 0.005-inch press fit. Counterbore deeply enough so that the boring tool will clean up the bottom of the bore to assure proper heat conduction from the valve insert. Chill the valve seats in dry ice for 20 minutes. Install the valve seat in place with a piloted driver using an arbor press or by applying light blows with a hammer until the valve seat is

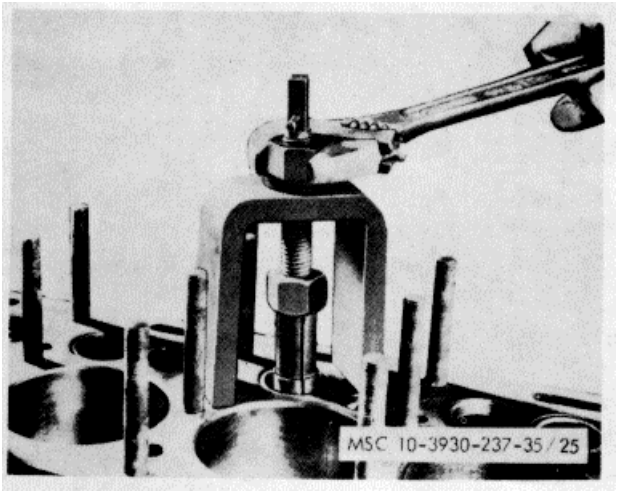


Figure 25. Pulling valve seat insert.

resting against the bottom of the bore. Roll or peen the valve seat in place.

(8) Check the valve springs for cracks and distortion. Test compression strength with a spring tester. Compression strength must be as follows:

Length	*Load (minimum)*
$1\frac{3}{6}\frac{3}{4}$ in. (closed)	42 pounds
$1\frac{1}{6}\frac{5}{4}$ in. (open)	86 pounds

(9) Grind the valve seats (fig. 26). The seat angle of the intake valves is 45°. The seat angle of the exhaust valve is 45°. Use a dial indicator (fig. 27) to check the valve seat for runout. The total indicator reading must not exceed 0.002 inch. Clean the valve seat and surrounding area thoroughly after grinding.

(10) After the valves and seats have been refaced and reground, coat the seat lightly with Prussian blue and drop the valve into place oscillating it slightly to transfer the blue pattern to the valve face. This should show a contact width of /16 to %2 inch, and should fall well within the width of the valve face, leaving at least /64 inch on either side of the contact area. If the contact area is greater than 31/2 inch, narrow the contact area by grinding the outside diameter of the seat with a 15° stone

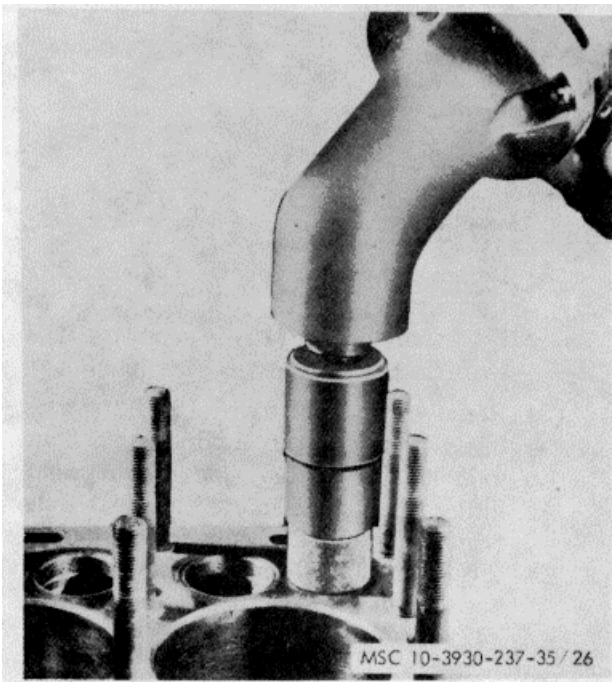


Figure 26. Grinding valve seat.

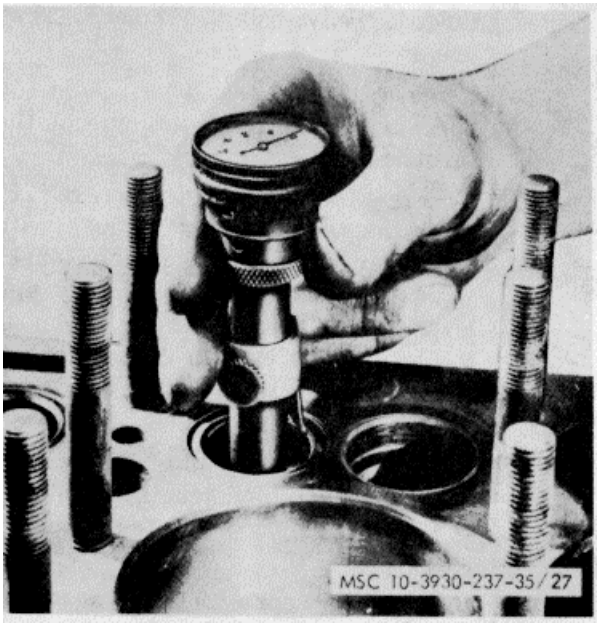


Figure 27. Checking valve seat for runout.

or by grinding the inside diameter of the seat with a 60° or 75° stone (fig. 28). After the seat area is corrected, touch the seat lightly with the original grinding stone to remove the burred or feathered edge.

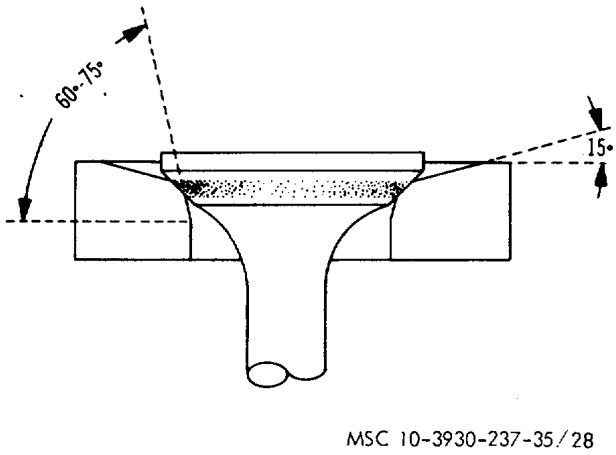


Figure 28. Narrowing valve seat.

(11) Inspect the spring retainer seats, spring retaining locks, valve stem caps, and valve lifters for cracks, scoring, overheating, and wear. Replace damaged parts.

c. Installation.

(1) Position the valve lifters (8, fig. 22) in the engine block.

(2) Assemble the valves (1), valve springs (4), spring retainer seats (5), spring retaining locks (6), and valves stem caps (7). Compress the valve springs with a spring compressor to install the spring retaining locks. Turn the engine over as necessary to allow each valve to move to the closed position before attempting to install the valve parts. Make sure each valve is installed in the guide from which it was removed.

(3) Temporarily set valve tappet clearance (TM 10-3930-237-20).

(4) Install the cylinder head (TM 103930-237-20).

(5) Operate the engine until it reaches operating temperature. Adjust valve tappet clearance (TM 10-3930-237-20).

(6) Install the valve tappet cover (TM 10-3930-237-20).

Section III. FUEL SYSTEM

14. General

a. The fuel system consists of a fuel tank, fuel pump, supply line, carburetor, and a governor. All components of the fuel system are covered in TM 10-3930-237-20 with the exception of the carburetor and governor.

b. The fuel is drawn from the fuel tank, through the supply line, by the fuel pump. The pump then delivers the fuel to the carburetor where it is mixed with the proper amount of air and vaporized. The fuel-air mixture leaves the carburetor and enters the intake manifold of the engine where it is drawn into the engine cylinders.

c. The carburetor is of updraft, single-barrel design with a manual choke. The level of the fuel in the fuel chamber is regulated by a float which controls the fuel valve. The fuel valve does not close and open alternately, but assumes an opening regulated by the. float, sufficient to maintain a proper fuel level in the fuel chamber that is equal to the demand of the engine according to its speed and load.

d. The governor is a built-in, camshaft timing gear-driven, sealed, engine-lubricated, centrifugal, variable speed, flyball type that controls speed by adjusting the amount of travel of the control rod to the carburetor. As the camshaft timing gear rotates, the drive assembly balls are pressed against the outer slant of the race assembly to push the race outward. The race assembly in turn presses against the lever and shaft assembly which is connected to the carburetor throttle control through a direct linkage. The throttle plate is closed by this action, slowing the engine to governed speed. As the engine slows, less pressure is exerted by the balls, and the race assembly moves inward. This movement is transferred through the linkage to the carburetor throttle control to increase fuel flow to the engine and increase engine speed. In this manner, the engine speed is regulated.

15. Carburetor

a. Disassembly.

(1) Remove the carburetor (TM 10-3930237-20).

(2) Remove the four screws (24, fig. 29) that attach the throttle body (6) to the fuel bowl (19); separate the throttle body from the fuel bowl.

(3) Remove the float axle (13) by pressing a screwdriver against the float axle at the slotted side of the float hinge bracket. Remove the float axle from the opposite side and remove the float (14). Remove the fuel valve needle (17), gasket (18) and venturi (42) from the throttle body.

(4) Remove the seat (16) and washer (15) from the throttle body (6) using the special tool, Zenith Part No. C16182. Remove the idle jet (12) from the throttle body using a small screwdriver.

(5) Remove the idle adjusting needle (5) and spring (4) from the side of the throttle body.

(6) Unscrew the throttle stop screw (11) until the threaded end is flush with the lever (9). Make match marks with a file on the throttle body and lever (9) to aid reassembly. Remove the screws (2) and throttle plate (3). Remove the throttle shaft and lever (9).

(7) Drive the plug (45) and bushing (44) out, using a 6-inch length of 1/4-inch rod inserted through the opposite shaft hole.

(8) Remove the opposite bushing (44), throttle shaft seal (7), and retainer (8) using 6-inch length of 1/4-inch rod inserted through the opposite shaft hole.

(9) Remove the plug (20) and washer (21) from the fuel bowl body. Remove the

drain plug (25) from the bottom of the fuel bowl body (19) using special tool, Zenith Part No. C16110. Remove main jet (22) and washer (23) with special tool, Zenith Part No. C161-83.

(10) Remove main discharge jet (40) and washer (39) from center of large opening in machined surface of fuel bowl body (19) with special tool, Zenith Part No. C161-9. Remove well vent (41) from inside of fuel bowl using a screwdriver.

(11) Make match marks with a file on choke bracket (27), fuel bowl body (19) and lever (29) to aid in reassembly.

(12) Remove lever spring (31) from the choke lever (29) and choke bracket (27). Remove choke bracket screws (28) choke bracket (27) and shaft plug (38).

(13) Remove the choke plate screws (37), choke plate (36) and choke lever and shaft (29).

Note. **If necessary, insert a screwdriver in the tube and bend the bowl vent tube up slightly to give the choke clearance.**

(14) Remove retainer (26) and packing (35) as described in (7) and (8) above.

b. Cleaning, Inspection, and Repair.

(1) Discard all washers, gaskets, the main jet, well vent jet, idle jet, fuel valve, and seat. Replace these parts with new ones from the repair kit.

(2) Clean all parts in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Blow out all passages in the air intake, fuel bowl, and throttle body with compressed air.

Caution. **Do not clean by inserting a wire or drill into any openings or passages as this will destroy their fine calibration.**

(4) Inspect all parts of the carburetor for wear, distortion, cracks, breaks, or other damage; replace any worn or damaged parts.

c. Reassembly.

(1) Assemble the packing (35, fig. 29) and retainer (26) and place the completed assembly on the special tool, Zenith Part No. C161-72-1, with the packing facing the small end of the tool. Insert the small end of the special tool into the choke shaft hole, start the retainer into the counterbore in the body, and lightly drive the retainer into the body until it is flush with the machined surface. Tap the shaft plug (38) into position with a hammer.

(2) Install the choke bracket (27) and screws (28) in position using the match marks. Start the choke plate (36) into the air intake with the poppet valve inserted first and pointing down toward the fuel bowl. Hold the choke plate up and insert the choke shaft (29) into place with the cutout section facing up. Rotate the shaft to the closed position, place the choke plate in the cutout section, and install the screws (37) to secure the choke plate. Install the spring (31) to return the choke to the wide open position.

Note. **Be sure the choke plate and shaft are properly centered before tightening the screws.**

(3) Install the main discharge jet (40) and washer (39) in the fuel bowl (19) using special tool, Zenith Part No. C161-9. Install the well vent (41) into the fuel bowl using a small screwdriver. Install main jet (22) and washer (23) using special tool, Zenith Part No. C161-83.

(4) Install drain plug (25) into the bottom of the fuel bowl using special tool, Zenith Part No. C161-10. Install plug (20) and washer (21) into fuel bowl body (19).

(5) Install bushing (44) and plug (45) into the throttle body opposite the stop pin; use a light hammer to drive the plug flush with the boss. Install opposite bushing (44) in throttle body using fingers.

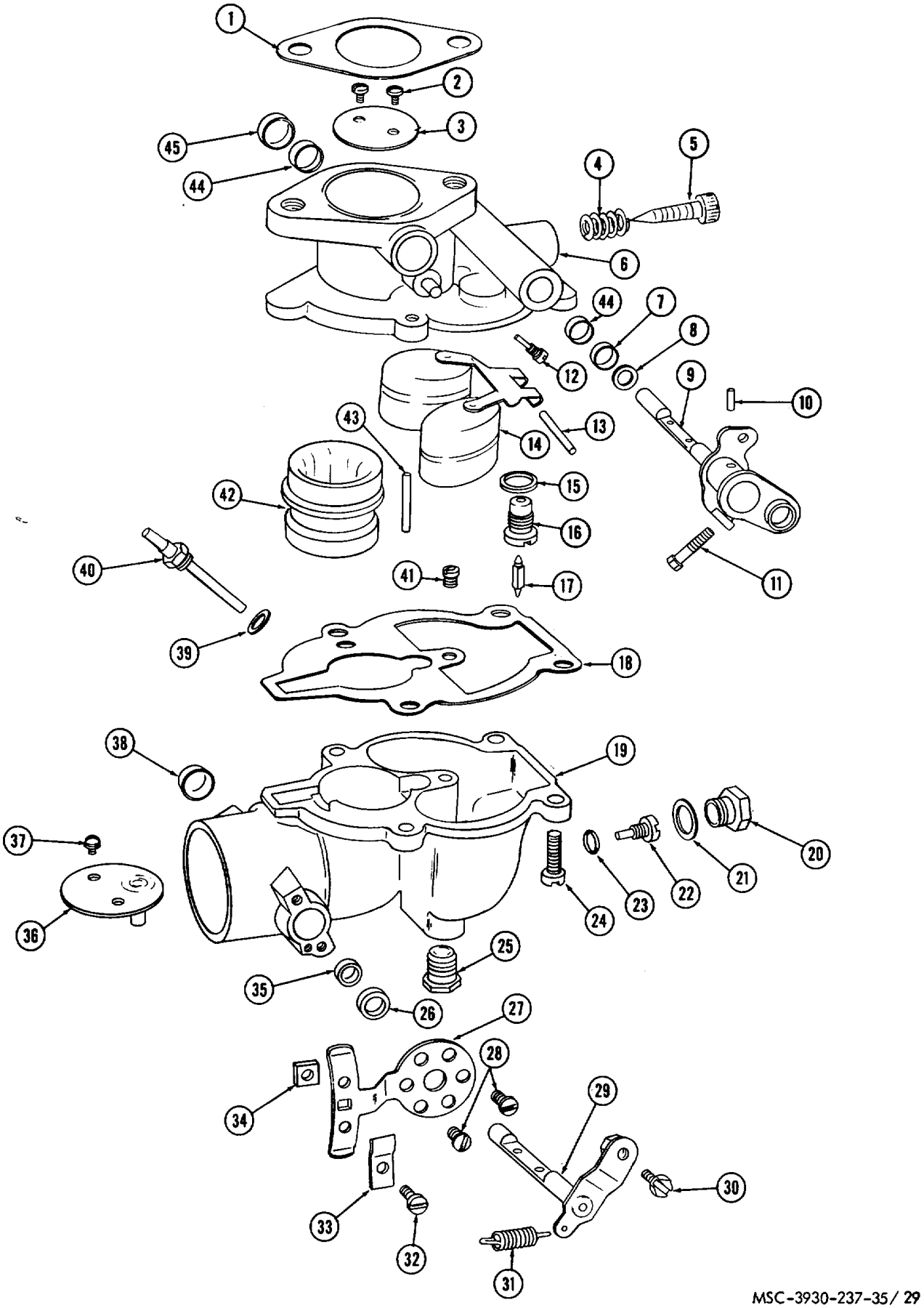


Figure 29. Carburetor, exploded view.

1 Gasket
2 Screw
3 Throttle plate
4 Spring
5 Idle adjusting needle
6 Throttle body
7 Seal
8 Retainer
9 Throttle shaft and lever
10 Pin
11 Screw
12 Idle jet
13 Float axle
14 Float
15 Washer
16 Seat
17 Fuel valve
18 Gasket
19 Fuel bowl
20 Plug
21 Washer
22 Main jet
23 Washer
24 Screw
25 Drain plug
26 Retainer
27 Bracket
28 Screw
29 Choke lever and shaft
30 Screw
31 Spring
32 Screw
33 Clamp
34 Nut
35 Packing
36 Choke plate
37 Screw
38 Plug
39 Washer
40 Discharge jet
41 Well vent
42 Venturi
43 Idle filler tube
44 Bushing
45 Plug

Figure 29. -- Continued.

(6) Assemble seal (7) and retainer (8) on special tool, Zenith Part No. C16172-1; insert small end of tool into the throttle shaft opening and start retainer into counterbore in body. Light drive seal and retainer into body (6) until retainer is flush with machined surface.

Note. **Retainer (8) must be flush with machined surface or slightly below to avoid striking throttle lever (9).**

(7) Insert throttle shaft and lever (9) into the throttle body (6). Turn the stop screw (11) into the throttle shaft and lever and turn it out far enough to permit complete closing of the throttle.

(8) Rotate the throttle shaft and lever (9) to the closed position, insert the throttle plate (3) into the cutout section of the throttle shaft, and hold the plate in position. Start the throttle plate screws (2) and tighten with a small screwdriver, being sure that the throttle plate is properly centered in the throttle body bore.

Note. **The screw holes in the throttle plate are off center. Start the side of the throttle plate with the shortest distance between the screw holes and beveled edge into place first. The plates are made with two opposite edges beveled to fit the throttle body bore when the plate is closed. The throttle plate will not close tightly if installed upside down. Pressure on the plate must be maintained with the finger until the screws are tightened. When properly installed, the side of the throttle plate farthest away from the mounting flange will be alined with the idle discharge holes when the plate is closed.**

(9) Install the idle adjusting needle (5) and spring (4) in the threaded passage in the side of the throttle body. Seat lightly with a screwdriver and back out one and one-quarter turns as a preliminary adjustment. Install the idle jet (12) in the counterbored passage in the machined surface of the throttle body. Install the seat (16) and washer (15) using special tool, Zenith Part No. C161-82.

(10) Place a new throttle body-to-fuel bowl gasket (18) on the machined surface of the fuel bowl cover. Install the fuel valve (17) in the seat followed by the float (14) and float axle (13).

(11) With the throttle body (6) in an inverted position and viewed from the free end of the float, the float bodies (14) must be centered and at right angles to the machined surface (fig. 30). The distance from the machined surface of the cover to the top side of the highest point of the float bodies must be 17/64 to 11%4 inches.

(12) To increase or decrease the distance between the float body and machined surface, use long-nosed pliers and bend the lever close to the float body.

Note. **Replace with a new float if position is off more than A inch.**

(13) Insert venturi (42) in the fuel bowl bore with the small opening down and the flat side of the venturi toward the well vent (41).

(14) Position the two completed bodies together and secure with the four screws (24); tighten

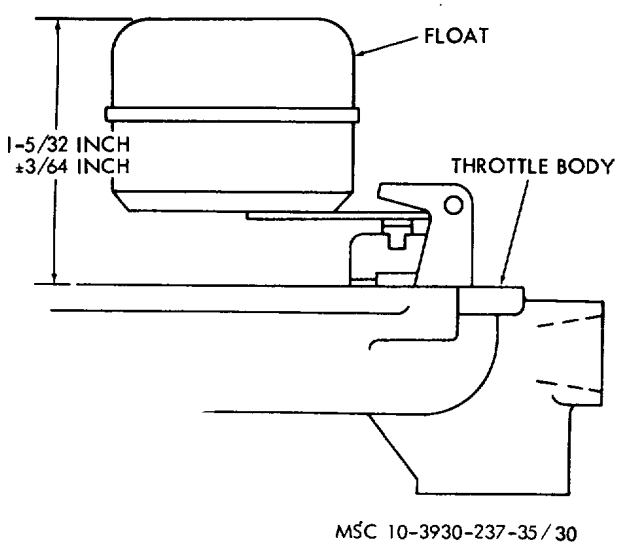


Figure 30. Checking installation of carburetor float.

the screws evenly. Hold the throttle lever in the closed position and turn the throttle stop screw (11) in until it just contacts the stop pin; then turn the screw in one and one-half turns as a preliminary adjustment of the idle speed.

(15) Install and adjust the carburetor (TM 10-3930-237-20).

16. Governor

a. Removal and Disassembly.

(1) Remove the counterweight, muffler, and radiator (TM 10-3930-237-20).

(2) Remove the fan and generator, drive belts (TM 10-3930-237-20).

(3) Remove the nut (22, fig. 6) and washer (23) that secure the pulley (20) remove the pulley.

(4) Disconnect the linkage from the governor lever (TM 10-3930-237-20).

(5) Disconnect the hose to the engine oil filter from the gear cover. Drain the oil from the filter and crankcase.

(6) Remove the cotter pin (8, fig. 2), nut (7), two washers (5), and lower support pad (6) from the stud of the support assembly (3). Hoist the engine just enough to raise the upper support pad (6) off the frame. Block the engine in this position.

(7) Remove the hydraulic pump and mounting plate (par. 42a).

(8) Remove the bolts (1, 7, 11, 14, 16, and 18, fig. 31), nuts (3, 8, 13, and 17). lockwashers (2, 4, 9, and 12) and washers (15) that secure the gear cover to the engine block; remove the gear cover from the engine block.

(9) Remove the race assembly (19, fig. 32) from the end of the camshaft. Remove the nut (20) to remove the drive " assembly (21) from the camshaft timing gear (1). Loosen the nut (18) and remove the adjusting screw (17) and the nut.

Note. **Do not remove the drive screws (15) and spring (16) unless obviously damaged.**

(10) Remove the spring (7) from the eyebolt (6) and lever (8). Remove the nuts (3), lockwashers (4) and remove the eyebolt (6) from the bracket (5). Remove the nut (2) that secures the bracket (5) to the engine block; remove the bracket.

1	Bolt	12	Lockwasher	23	Backing plate	34	Spring
2	Lockwasher	13	Nut	24	Dowel ring	35	Thrust plunger
3	Nut	14	Bolt	25	Gasket	36	Gasket
4	Lockwasher	15	Washer	26	Gasket	37	Gear cover
6	Stud	16	Bolt	27	Pin	38	Seal
6	Stud	17	Nut	28	Mounting plate	39	Gasket
7	Bolt	18	Bolt	29	Screw	40	Bearing support
8	Nut	19	Fill tube	30	Screw	41	Washer
9	Lockwasher	20	Cap	31	Screw	42	Thrust screw
10	Lockwasher	21	Idler gear	32	Bearing	43	Plug
11	Bolt	22	Thrust washer	33	Bearing	44	Pin

Figure 31. Gear cover, exploded view.

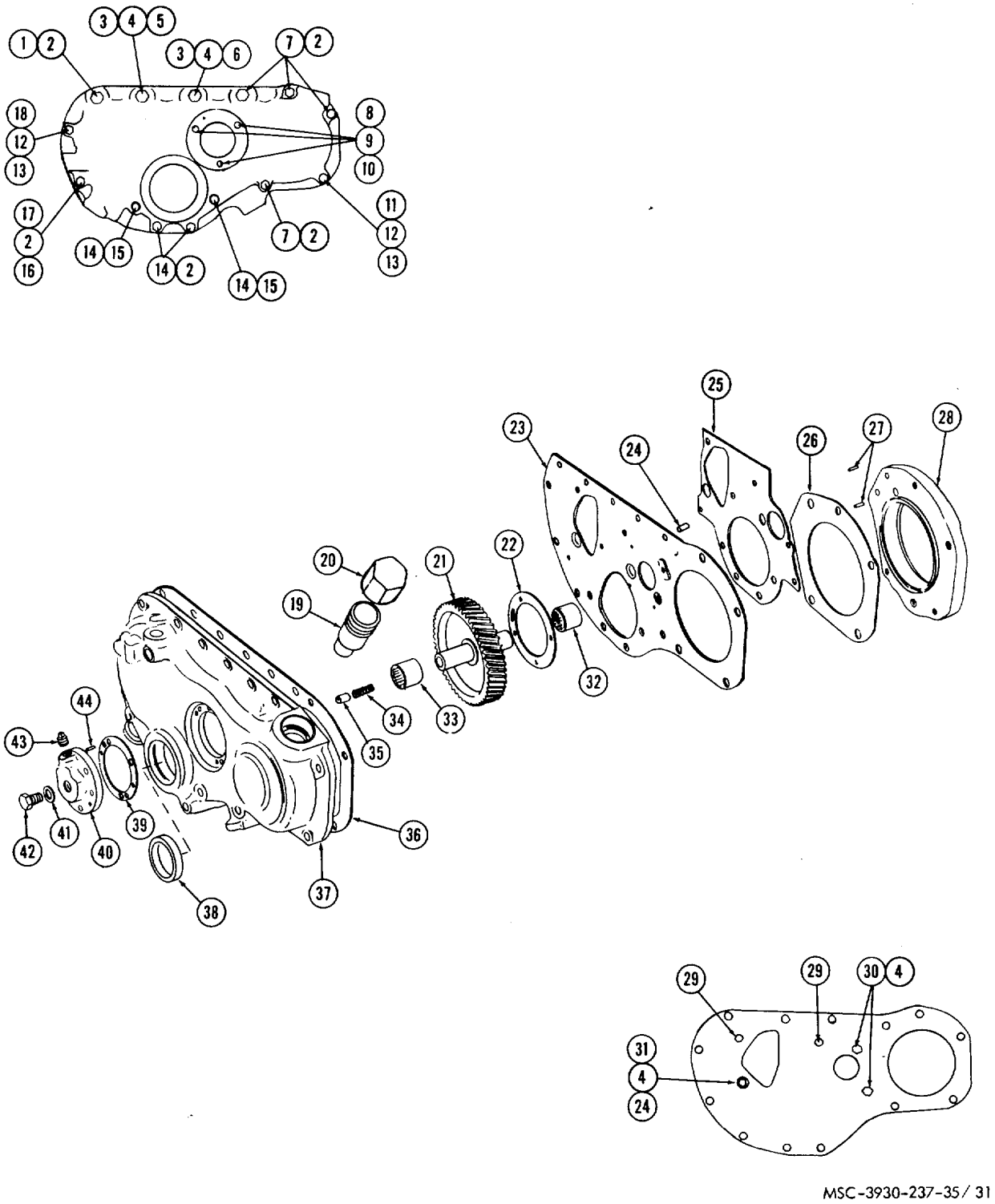


Figure 31. --Continued.

(11) Remove the plug (14) and the pin (13) that secures the lever (8) to the lever (12); remove lever (8) and lever (12).

(12) If the needle bearings (11) are damaged, use a pin of a slightly smaller diameter than the gear housing hole and drive the dust seal (9), oil seal (10), and needle bearings (11) out of the gear cover.

b. Cleaning, Inspection, and Repair.

(1) Discard the seals.

(2) Clean all parts of the governor in an approved cleaning solvent; dry with compressed air. Dip the needle bearings and drive assembly in engine oil.

(3) Inspect the race assembly for wear, scoring, distortion, cracks, breaks, or other damage; replace damaged parts. Remove burs and scoring by lapping with crocus cloth. If the burs or scores are too deep to remove in this manner, replace the part.

(4) Inspect the drive assembly for a cracked ball retainer; worn, pitted, or scored balls; distortion; or other damage. Replace a damaged drive assembly.

(5) Check the needle bearings for smooth operation; replace sticking or rough operating bearings.

(6) Inspect the shaft for wear, scoring, and distortion; replace if damaged.

(7) Inspect all other governor parts for cracks, scoring, wear, or distortion; replace damaged parts.

c. Reassembly and Installation.

(1) Position the needle bearings (11, fig. 32) in the gear cover; tap them into the cover with a driver and a light hammer until there is clearance for the oil seal (10) and dust seal (9).

(2) Install the oil seal and dust seal.

(3) Tap the lever (8) into the dust seal (9), oil seal (10), bearings (11) and into lever (12). Secure lever (8) to lever (12) with pin (13). Install plug (14).

(4) Position the bracket (5) on the stud at the engine block and secure with nut (2). Turn one nut (3) on the eyebolt (6), position the eyebolt through the bracket, and secure with other nut (3) and lockwasher (4). Allow equal threads to show on either side of the nuts as a preliminary adjustment.

(5) If removed, position the spring (16) in the gear cover and secure with screws (15); turn the nut (18) onto the adjusting screw (17). Turn the adjusting screw into the gear cover about one-quarter of the way as a preliminary adjustment. Position the drive assembly (21) on the shaft of the camshaft timing gear and secure with nut (20). Position shaft of race assembly (19) into camshaft and press race assembly flush against drive assembly (21).

(6) Position a new gasket (36, fig. 31) on the gear cover. Position the gear cover on the backing plate (23) and secure with bolts (1, 7, 11, 14, 16, and 18), nuts (3, 8, 13 and 17), lockwashers (2, 4, 9 and 12) and washers (15).

Note. **Be sure the gasket seat on the gear cover and backing plate is clean before installing gear cover.**

(7) Install the main hydraulic pump and mounting plate (par 42c).

(8) Lower the engine so that the upper support pad (6, fig. 2) is resting on the truck frame; install the bottom support pad (6), washers (5), nut (7) and cotter pin (8).

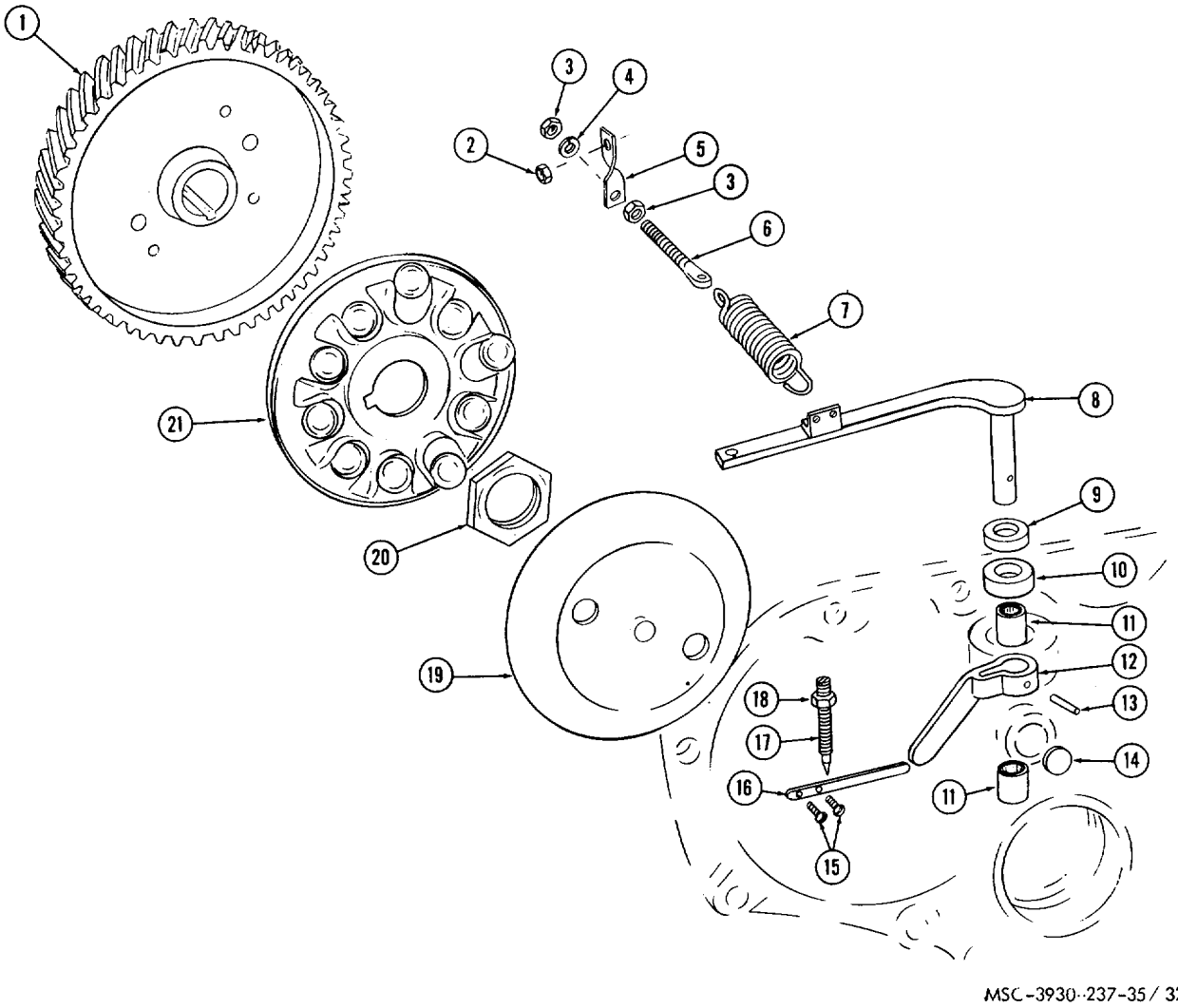
(9) Connect the hose from the engine oil filter to the gear cover; fill the crankcase. (See Lubrication Order, TM 103930-237-20).

(10) Secure the crankshaft pulley to the crankshaft using the nut (22, fig. 6) and washer (23).

(11) Position the fan and generator drive V-belts on the pulleys (TM 10-3930237-20). Connect the governor linkage clevises to the lever.

(12) Install the muffler, radiator, and counterweight (TM 10-3930-237-20).

d. Adjustment. Adjust the governor linkage (TM 10-3930-237-20).



1	Camshaft timing gear	7	Spring	13	Pin	19	Race assembly
2	Nut	8	Lever	14	Plug	20	Nut
3	Nut	9	Dust seal	15	Screw	21	Drive assembly
4	Lockwasher	10	Oil seal	16	Spring		
5	Bracket	11	Needle bearing	17	Adjusting screw		
6	Eyebolt	12	Lever	18	Nut		

Figure 32. Governor, exploded view.

Section IV. COOLING SYSTEM

17. General

a. All components of the cooling system, except the radiator, are covered in TM 10-3930237-20.

b. The radiator consists of a series of tubes through which the coolant is circulated. Fins are attached to the tubes to give a more extended surface through which heat can be dissipated. For most effective use, these fins must be kept clean and free from accumulated dirt.

18. Radiator

a. Testing.

(1) Remove the radiator (TM 10-3930237-20).

(2) Place the cap tightly on the radiator and close the drain cock. Block off the upper hose connection; connect an air line to the lower hose connection with an air pressure gage in the line.

(3) Submerge the radiator in a tank of water. Open the air line to the radiator and apply a pressure of not more than 8 to 10 psi.

(4) Watch the radiator for signs of bubbles coming from the core during this pressure test. The pressure cap should rise at approximately this pressure. Shut off the air to the radiator and allow the air to escape until the safety cap seats. Hold the pressure for 5 minutes. If no bubbles appear from the core, the radiator is good. If bubbles appear, mark the origins of the bubbles and remove the radiator from the tank.

b. Repair.

(1) Replace a defective drain cock.

(2) Solder any holes found in the radiator.

(3) Solder all tubing connections that leak under pressure.

(4) Repair a badly damaged radiator. If radiator is still defective, replace it with a new radiator.

(5) Install the radiator (TM 10-3930237-20).

Section V. ELECTRICAL SYSTEM

19. General

A 12-volt battery provides the power necessary to operate the starting motor. When the starting switch is turned to the start position, and the transmission is in neutral, the circuit to the starting relay closes. The relay closes a circuit through the solenoid switch which, when energized, engages the pinion on the starter drive with the engine ring gear and then closes the circuit to the starting motor to crank the engine. The ignition system, simultaneously energized through another circuit, fires the fuel mixture in the engine cylinders. When the engine is running, it drives the generator to recharge the batteries; the rate of charge is controlled by a voltage regulator which also provides reverse current protection.

20. Generator

a. Testing.

(1) Connect a voltmeter, ammeter, load rheostat, and battery in the circuit (fig. 33).

(2) Drive the generator at 1970 rpm. Adjust the load rheostat until the ammeter reads 25 amperes and the voltmeter reads 14 volts. If these specifications cannot be obtained, disassemble the generator for further testing.

b. Disassembly.

(1) Remove the generator (TM 10-3930237-20).

(2) Remove the nut (1, fig. 34) and lockwasher (2) that secure the pulley (3) and fan (4) to the armature shaft; remove the pulley, fan, key (13) and collar (5).

(3) Remove the two thru bolts (26) and lockwashers (27). Remove the plug (21) from the commutator end frame (22). Using suitable puller, carefully remove commutator end frame from commutator end armature shaft bearing (24).

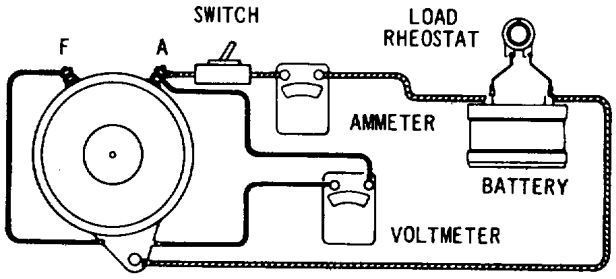


Figure 33. Circuit for testing generator output.

(4) Tap the drive end frame (6) from the body (41); remove the assembled end frame and armature (14).

(5) Remove the ring (12) from the retainer (11). Remove the three screws (37) that attach the retainer (11) to the drive end frame; remove the retainer, gasket (10), bearing (9), retainer (8) and felt (7) from the drive end frame (6).

(6) Position a scale on the brush arm (28) and check the brush tension. If the brush tension is less than 28 ounces, remove the brushes (30) by lifting the arm off the brush, sliding the brush out the side of the holder and removing the screws (19) and washers (20) that attach the brushes to the body (41) and armature terminal stud (18).

(7) Remove the arms (28) and springs (29) from the brush holders; remove the springs from the arms and discard the springs.

(8) Remove the nuts (31), washers (32, 33 and 34) and bushings (35 and 36) at the field and armature terminals; remove the screws (40) that secure the insulators (15), pole shoes (16), and field coil (17) to the body (41).

Note. **Do not remove components at the field and armature terminals unless obviously damaged or as may be necessary to replace missing parts. Do not remove the field coil (17) before performing tests described in c(10) and c(11) below.**

c. Cleaning, Inspection and Repair.

(1) Wipe all parts of the generator, except the brushes, with a cloth lightly dampened in an approved cleaning solvent; dry thoroughly with low pressure, compressed air. Wipe the brushes with a clean, dry cloth.

(2) Inspect armature bearing (24, fig. 34) for worn surfaces, looseness, cracked ring or race, and a rough or catchy feeling. If it is necessary to remove the bearing from the armature shaft, use a suitable bearing puller and pull against the inner race. If it is necessary to pull against the outer race, use extreme care to avoid loading and damaging the balls. When remounting bearing, use an arbor press and press firmly and evenly against the inner race only.

(3) Check the size of the brushes; replace them if they are less than one-half the length of a new brush.

(4) Inspect the armature commutator for roughness, out-of-round or high mica. If any of these conditions exist, turn the commutator down on a lathe and undercut the mica 1/32 inch. Remove only enough stock to make the commutator smooth and round. After undercutting, finish the commutator with No. 00 sandpaper. Clean all particles from the commutator and armature using low pressure, dry, compressed air. Check the armature for short circuits as described in (7) below.

Caution: **Always blow particles off the commutator in the direction away from the armature windings.**

(5) Check the brush holders for distortion, cracks, breaks, or other damage; replace damaged brush holders.

(6) Replace the brush springs if tension is less than 28 ounces.

(7) Check for short circuits in the armature by rotating the armature on a growler with a steel strip such as a hacksaw blade held firmly on the armature. The steel strip will vibrate on the area of the short circuit. Short circuits are usually caused by particles between the commutator bars. If short circuits are found, clean spaces between the commutator bars using an undercutting tool and cleaning thoroughly with compressed air. If a short circuit cannot be removed, replace the generator.

(8) Check for open circuits by inspecting for loose connections at the points where the conductors are connected to the commutator risers. Open circuits can be checked electrically by determining if continuity exists between adjacent commutator bars. Continuity must exist. Open circuits cause

arcing and burning of the commutator. If the bars are not badly burned, resolder the leads and turn the commutator down on a lathe. Undercut the mica and test for short circuits as described in (7) above. If the open circuit cannot be cleared, replace the generator.

(9) Check for grounds by checking the armature with a test lamp. Place one probe of the test lamp on the armature core and the other on each comrmutator bar in turn. If the test lamp lights, the armature is grounded. If grounded, clean armature thoroughly and recheck for grounds. If ground cannot be repaired, replace the generator.

(10) Check the field coils for grounds by checking the coils with a test lamp. Place one probe of the test lamp on the field body assembly and the other on the field coil leads. If the test lamp lights, the field coils are grounded. Replace the generator if the field coils are grounded.

(11) Check the field coils for open circuits by checking with a test lamp. Connect the probes of the test lamp to the two leads from the coils. If the lamp does not light, the coil is open. Replace the generator if the field coils are open.

d. Reassembly.

(1) Position the felt (7, fig. 34),. retainer (8), bearing (9), gasket (10) and retainer (11) on the drive end frame (6). Secure with the three screws (37). If removed, install the bearing (24) on the commutator end of the armature shaft (14) using the procedure described in c(2) above.

(2) Position the springs (29) and arms (28) on the brush holders.

(3) Install the armature (14) in the body assembly (41). Install the brushes (30) into the brush holders and secure the brush leads to the body (41) and armature terminal stud (18), using screws (19) and washers (20). Seat the brushes using No. 00 sandpaper. Take care to blow brush particles from the generator.

(4) Install the ring (12) into the retainer (11) of the assembled drive end frame (6). Slide the assembled drive end frame onto the drive end of the armature (14). Aline the pin hole of the drive end frame with the pin (23) at the drive end of the body (41).

(5) Position the commutator end frame (22) over the bearing (24) of the commutator end of the armature (14). Aline the pin hole of the frame with the pin (23) at body (41). Carefully tap the commutator end frame flush to the body. Install the plug (21) in the end frame.

(6) Secure the drive end frame assembly (6) and the commutator end frame assembly (22) to the body (41) using two thru bolts (26) and lockwashers (27).

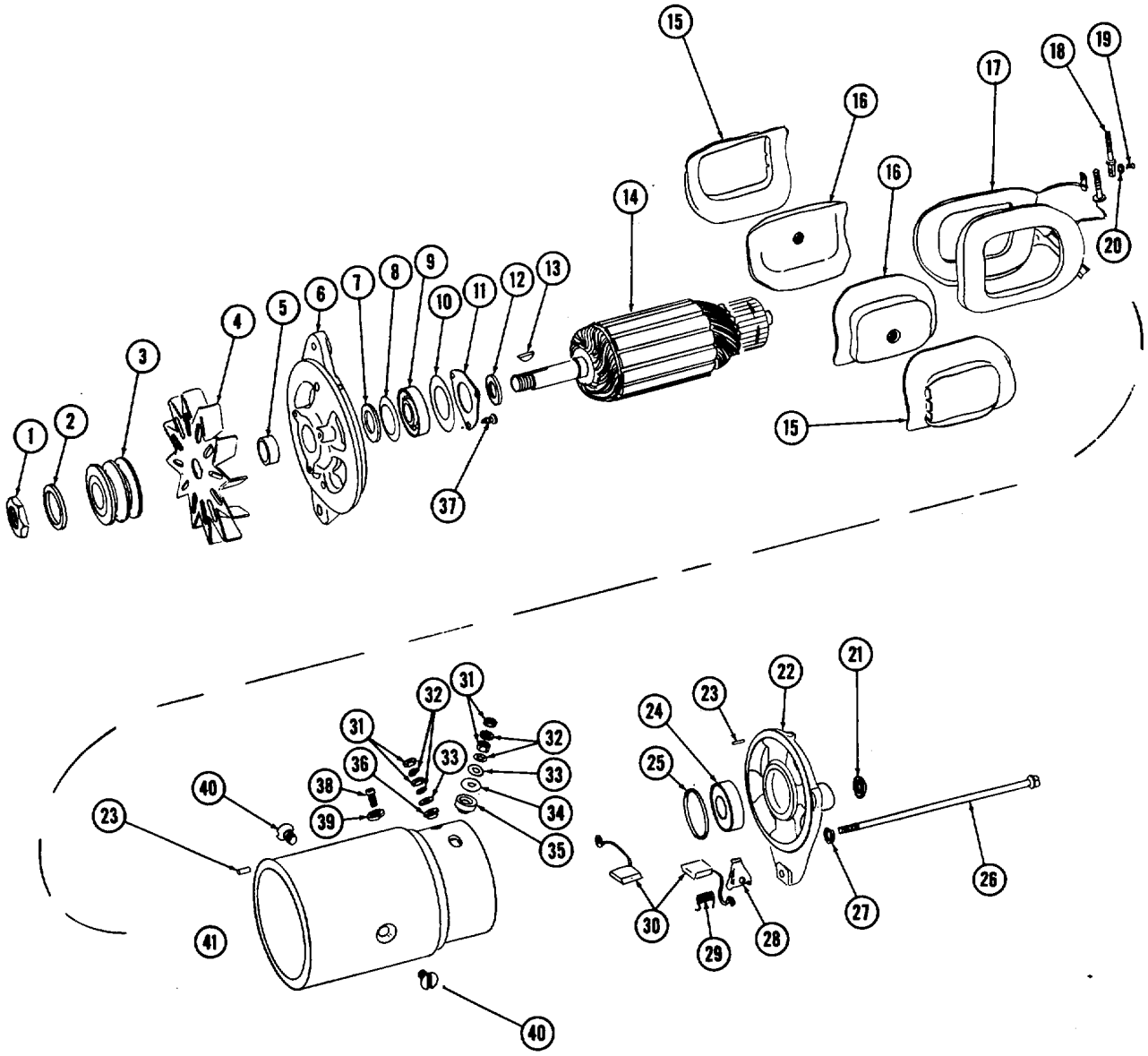
(7) Install the collar (5) into the drive end frame (6). Install the key (13) into the key slot in the armature shaft. Position the fan (4) and pulley (3) on the armature shaft over the key and secure with the nut (1) and lockwasher (2).

21. Starting Motor

a. Testing. Before the starting motor is disassembled, perform the following test to determine if the starting motor is operating properly.

(1) *No-load test.* Connect the starting motor, a 12-volt battery, an ammeter, a variable resistor, and a voltmeter in a circuit (fig. 35). Close the switch to drive the starter. Vary the resistance until the voltmeter reads 10.6 volts. The ammeter must read between 49 and 76 amperes and the armature speed must be between 6200 and 9400 rpm as indicated on a tachometer held against the shaft. Disassemble the starting motor for further tests (par. 20c) if it does not perform to specifications.

(2) *Resistance test.* Connect the starting motor, a 12-volt battery, an ammeter, a voltmeter, and a



1	Nut	12	Ring	23	Pin	34	Washer
2	Lockwasher	13	Key	24	Bearing	35	Field terminal bushing
3	Pulley	14	Armature	25	Seal		
4	Fan	15	Insulator	26	Thru bolt	36	Armature terminal bushing
5	Collar	16	Pole shoe	27	Lockwasher		
6	Drive end frame	17	Coil	28	Brush arm	37	Screw
7	Felt	18	Armature terminal stud	29	Brush spring	38	Screw
8	Retainer	19	Screw	30	Brush	39	Lockwasher
9	Bearing	20	Lockwasher	31	Nut	40	Screw
10	Gasket	21	Plug	32	Lockwasher	41	Body
11	Retainer	22	Commutator end frame	33	Washer		

Figure 34. Generator, exploded view.

variable resistor in the circuit (fig. 36). Lock the pinion gear of the drive assembly with a brake arm. Close the switch and adjust the voltage to read 4.3 volts using the variable resistor. The ammeter must read between 270 and 310 amperes. Disassemble the starting motor for further tests (par. 20c) if it does not perform to specifications.

Caution. **Do not operate the starting motor for more than 30 seconds at a time without pausing for 2 minutes to allow it to cool.**

b. Disassembly.

(1) Remove the starting motor (TM 103930-237-20).

(2) Remove the nut that connects the field connection to the stud on the solenoid switch assembly (3, fig. 37).

(3) Match-mark the end frame (14), drive housing (23), and field frame assembly (6) to aid reassembly. Remove the thru bolts (16) and lockwashers (15); remove the end frame and field frame assembly using a plastic hammer if necessary.

(4) Remove the assembled drive housing (23), drive assembly (25), armature (21) and

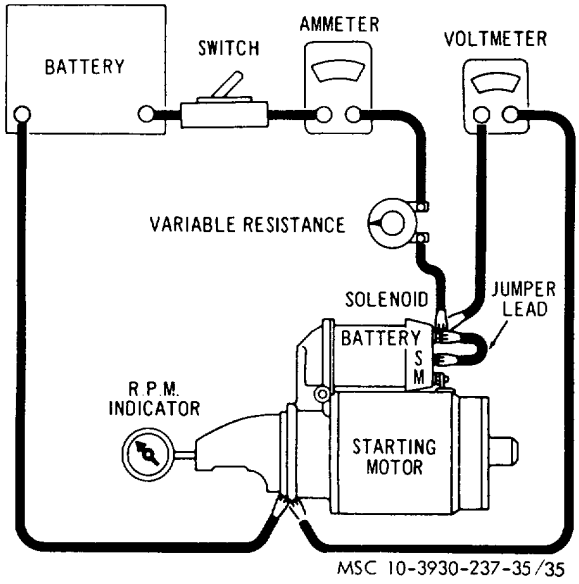


Figure 35. No-load test circuit.

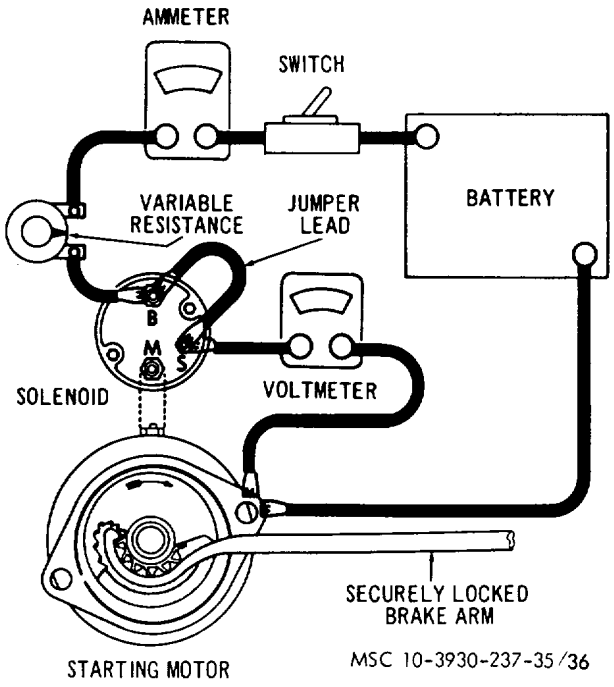


Figure 36. Resistance test circuit.

solenoid switch assembly (3).

(5) Remove the solenoid switch lever pivot bolt (22), nut (1), and lockwasher (2) and lockwashers (4) that secure the solenoid switch assembly (3) to the drive assembly; remove the solenoid switch assembly. Slide the armature (21) out of the drive housing.

(6) Slide the thrust collar (28) off the armature shaft. Place a cylinder over the shaft and on the collar (26); drive it off the retaining ring (27); remove the retaining ring and collar, and remove the drive assembly (25) and spring (24).

(7) If the bushing (29) is worn or damaged, press it from the drive housing (23).

(8) Position a scale on the brush arm and check brush tension. If brush tension is not 35 ounces, remove the screws (10) that secure the brushes (9) to the brush holders (11 and 17); remove the brushes. Remove the screw

(7) lockwasher (19), nut (18), and brush lead (8). Remove the pin (13) and remove the brush holders and springs (12). Remove the supports (20).

c. Cleaning, Inspection, and Repair.

(1) Clean the armature, field frame assembly, and solenoid switch assembly with a cloth lightly dampened in an approved cleaning solvent.

(2) Clean all other parts of the starting motor, except the brushes, in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Check the size of the brushes; replace them if they are less than one-half the length of a new brush.

(4) Inspect the armature commutator for roughness, out-of-round, or high mica. If any of these conditions exist, turn the commutator down on a lathe and undercut the mica 1/32 inch. Remove only enough stock to make the commutator smooth and round. After undercutting, finish the commutator with No. 00 sandpaper. Clean all particles off the commutator using compressed air. Check the armature for short circuits (par. 20c).

Caution. **Always blow particles off the commutator in the direction away from the armature windings.**

(5) Check the brush holders for distortion, cracks, breaks, or other damage; replace damaged brush holders.

(6) Inspect the drive assembly for cracks, breaks, clutching action, or other damage; replace the drive assembly if any parts are damaged.

(7) Check the armature and field windings for short circuits, grounds, and open circuits using the same method described for the generator parts (par. 20c). Replace the starting motor if the armature of the field windings is shorted, grounded, or open.

(8) If removed, replace the bushing in the drive housing. Replace the springs if brush tension is not to specification.

d. Reassembly.

(1) Position the supports (20, fig. 37) and brush lead (8) in the field frame assembly (6); secure with the screw (7), lockwasher (19), and nut (18). Position the brush holders (11 and 17) on the supports and secure with the pin (13). Position the springs (12) over the brush holders. Place the brushes (9) in the brush holders; secure with the screws (10).

(2) Place the spring (24) and drive assembly (25) on the shaft of the armature (21). Slide the collar (26) on the shaft with the cupped side out. Force the retaining ring over the end of the shaft and position it into the grove provided. Position the thrust collar (28) on the shaft and against the retaining ring. Use two pairs of pliers to force the thrust collar over the ring.

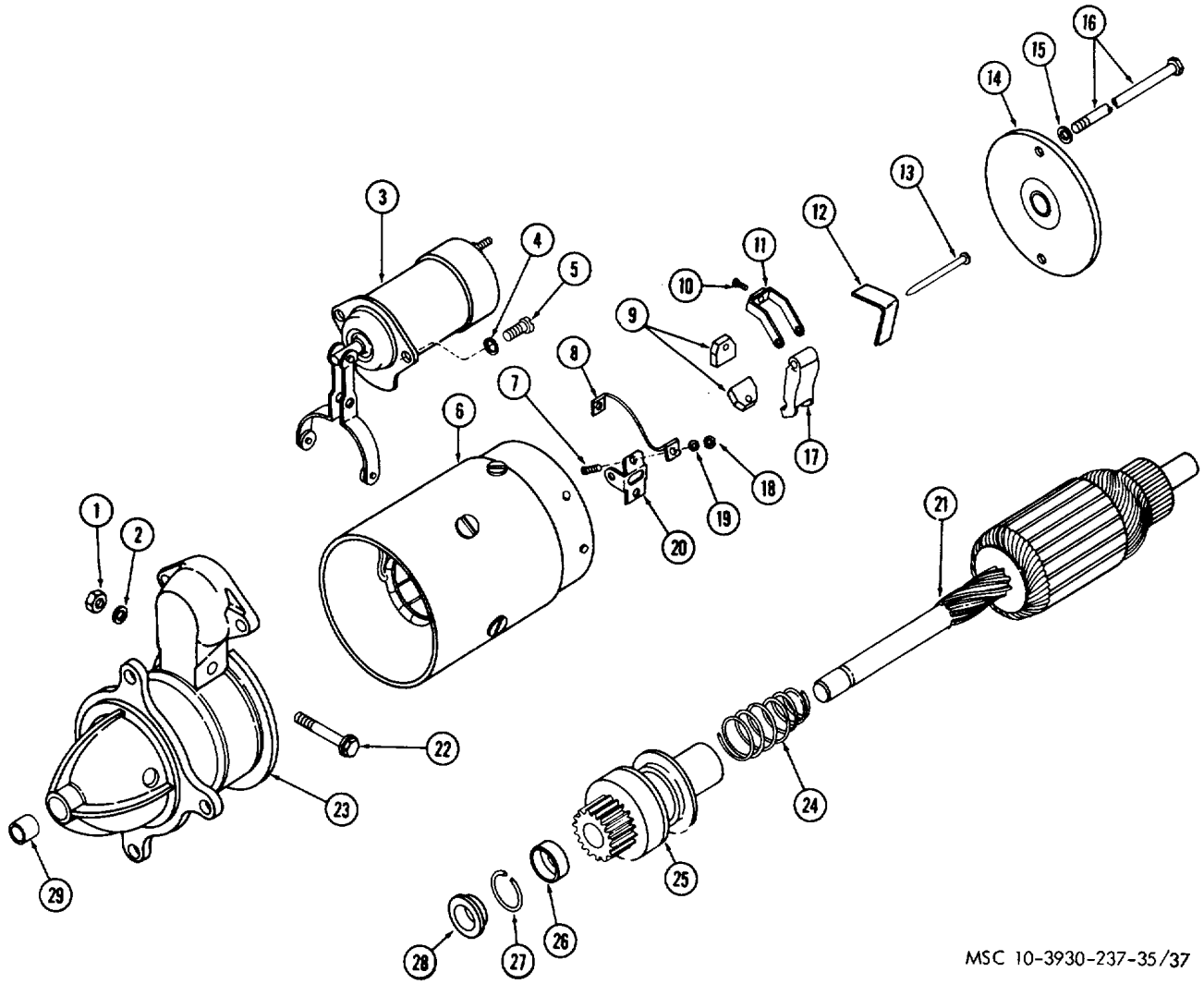
(3) If the bushing (29) was removed from the drive housing (23), press in a new bushing.

(4) Slide the armature (21) and the assembled drive mechanism into the drive housing bushing (29). Position the solenoid switch assembly (3) on the drive housing with the lever engaging the drive collar. Install the pivot bolt (22), nut (1), and lockwasher (2). Secure the solenoid switch assembly with the two screws (5) and lockwashers (4). Slide the field frame assembly (6) over the armature so that the match marks on the drive housing line up with the marks on the field frame assembly.

Caution. **Lift the brushes when inserting the armature into the field frame assembly.**

(5) Connect the electrical connector from the field frame to the stud on the solenoid switch.

(6) Position the end frame (14) on the field frame assembly so that the match marks line up on the end frame and the field frame assembly; secure the end frame with the two thru bolts (16) and lockwashers (15).



1	Nut	9	Brush	17	Brush holder	25	Drive assembly
2	Lockwasher	10	Screw	18	Nut	26	Collar
3	Solenoid switch assembly	11	Brush holder	19	Lockwasher	27	Retaining ring
4	Lockwasher	12	Spring	20	Support	28	Thrust collar
5	Screw	13	Pin	21	Armature	29	Bushing
6	Field frame assembly	14	End frame	22	Bolt		
7	Screw	15	Lockwasher	23	Drive housing		
8	Brush lead	16	Thru bolt	24	Spring		

Figure 37. Starting motor, exploded view.

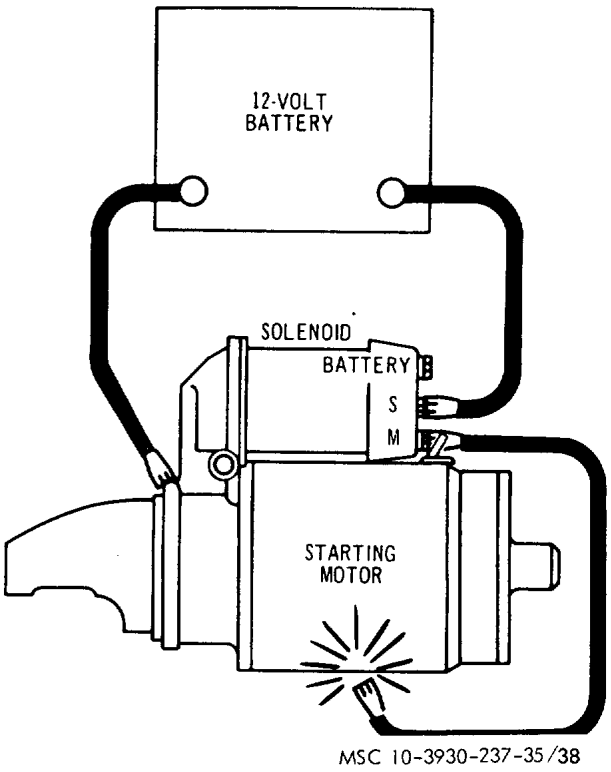


Figure 38. Circuit for checking pinion clearance.

Note. **If brushes have been replaced, seat them using No. 00 sandpaper before assembling the end frame. Blow the brush particles off the commutator so that they will not cause a short circuit during operation.**

(7) Check the pinion clearance after reassembly by connecting the starting motor and a battery in the circuit (fig. 38). Disconnect the motor field lead from the solenoid motor terminal.

Caution. **Insulate the motor field lead carefully to avoid arcing during the checking procedure.**

(8) Momentarily touch the jumper lead from the solenoid motor terminal to the motor frame. This will shift the pinion into cranking position. It will stay in this position until the battery is disconnected.

(9) Push the pinion back toward the commutator end to eliminate all slack movement. Measure the distance between the pinion gear of the drive assembly (25, fig. 37) and the collar (26). If clearance is not between 0.010 and 0.140 inch, disassemble the starting motor as described in b above and check alinement of the collar (26) on the retaining ring (27).

(10) Test the starting motor as directed in a above.

(11) Install the starting motor (TM 103930-237-20).

Section VI. TRANSMISSION AND DRIVE SYSTEM

22. General

a. The torque converter, mounted on the flywheel of the engine, is directly coupled to the transmission main drive gear. Power flows through the transmission directional selectors and gears to provide the power to the front drive wheels. Transmission ratios are 7.46 to 1, forward, and 7.33 to 1, reverse.

b. A constant drive, positive displacement pump is mounted within the transmission case. The pump supplies pressurized hydraulic oil to the directional selectors under control of the control valve.

c. The axle adapter and differential are directly mounted to the transmission case; the pinion shaft, driven by transmission output, drives the ring gear of the differential directly. The wheel and axle assembly is directly mounted to the axle adapter and has a drive ratio of 4.375 to 1.

d. The unitized construction of the drive system makes it very compact. There are no propeller shafts or universal joints required between the various components.

23. Transmission Control Lever and Linkage

a. Removal and Disassembly.

(1) Remove the cotter pin (13, fig. 39) that secures the pin (11) in the clevis (12); remove the pin. Remove the clevis from the transmission control arm. Remove the nut (9) and lockwasher (10) that secure the ball joint

(16) to the rod (21); remove assembled rod (15).

(2) Loosen the nuts (14) and turn the clevis (12) and ball joint (16) off the rod (15). Remove the nuts.

(3) Remove the two bolts (19) and lockwashers (20) that hold the pillow block (8) to the steering gear support.

(4) Drive the roll pin (1) out of the lever (2) and rod (21); remove the lever and discard the roll pin. Remove the washer (23) from the rod. Remove the four cap screws (7) that secure the cap (6) to the upper bracket (5); remove the cap.

(5) Slide the upper bracket up off of the rod. Pull the rod, pillow block, and collar (18) up out of the dash panel and between the spokes of the steering wheel.

(6) Remove the setscrew (17) that secures the collar to the rod; slide the pillow block and collar off the rod.

(7) Inspect the bushing (22) for cracks, scoring, wear, burs, or other damage. If damaged, drive the bushing out of the upper bracket using a drift pin and hammer.

b. Cleaning, Inspection, and Repair.

(1) Clean all parts of the lever and linkage in an approved cleaning solvent; dry with compressed air or by wiping with a clean cloth.

(2) Inspect all parts of the lever and linkage for cracks, breaks, distortion, wear, or other damage; replace damaged parts.

c. Reassembly and Installation.

(1) Slide the collar (18, fig. 39) down over the rod (21); turn the setscrew (17) into the collar, but do not tighten. Slide the pillow block (8) onto the rod. If the bushing (22) was removed, press a new bushing into the upper bracket (5) and slide the upper bracket onto the rod.

(2) Position the washer (23), and lever (2) on the rod.

(3) Position the assembled rod on the steering column of the fork lift truck and secure it in place using the upper bracket, cap (6) and cap screw (7). Secure the lever to the rod with the roll pin (1).

(4) Aline the pillow block (8) with the holes provided on the steering gear support and secure it in place using the bolts (19) and lockwashers (20). Place a 1/16-inch spacer between the lever (2) and washer (23). Slide the collar (18) up until it touches the pillow block and secure in this position with the setscrew (17). Remove the spacer.

(5) Turn the nuts (14) onto the rod (15). Turn the ball joint (16) and clevis (12) onto the rod. Position the ball joint up through the hole provided in the rod (21) and secure in place with the nut (9) and lockwasher (10). Position the clevis on the transmission control arm and secure in place with the pin (11) and cotter pin (13).

(6) Adjust the transmission control lever and linkage as described in TM 10-3930-237-20.

24. Transmission Control Valve

a. Removal.

(1) Remove the steering gear (par. 30a).

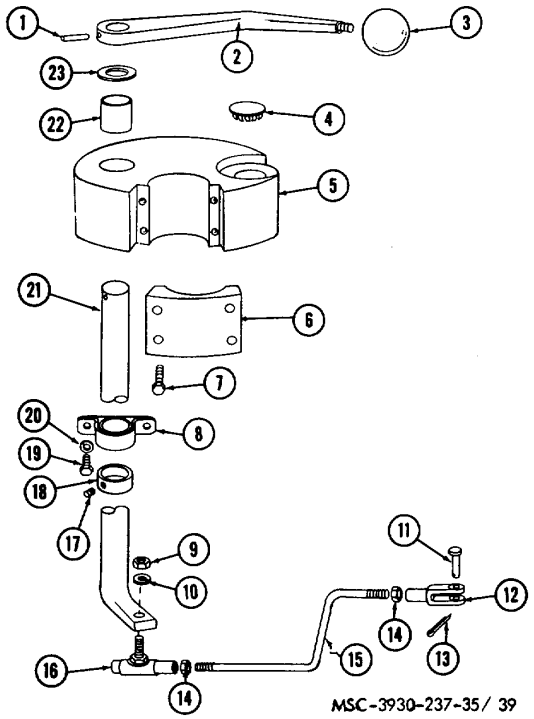
(2) Remove the tubes from the reducers (18 and 20, fig. 40). Disconnect the electrical wires from the switch (58), and the transmission linkage from the outer selector arm (1).

(3) Clean the area around the control valve to prevent the entry of dirt into the transmission.

(4) Remove the five bolts (111 and 109, fig. 46) and lockwashers (108 and 110) that secure the transmission control valve (107) to the transmission case (91); remove the control valve assembly from the fork lift truck. Remove and discard the gasket (106).

b. Disassembly.

(1) Remove the cotter pin (7, fig. 40) and pin (6) that secure the outer inching arm (5) to the piston (16). Remove the bolt (4), nut (9), and



1	Pin	13	Cotter pin
2	Lever	14	Nut
3	Knob	15	Rod
4	Plug	16	Ball joint
5	Upper bracket	17	Setscrew
6	Cap	18	Collar
7	Capscrew	19	Bolt
8	Pillow block	20	Lockwasher
9	Nut	21	Rod
10	Lockwasher	22	Bushing
11	Pin	23	Washer
12	Clevis		

Figure 39. Transmission control lever and linkage, exploded view.

(8) that secure the outer inching arm to the shaft of the inner inching arm (27); remove the outer inching arm.

(2) Remove the retaining ring (55) and washer (54), and tap the shaft of the lower arm down out of the cover (25). Remove the spacer (26) from the inner arm. Remove the seal (53) from the cover.

(3) Remove the bolt (3) and lockwasher (2) that secure the outer selector arm (1) to the inner selector arm (49); remove the outer selector arm.

(4) Remove the cotter pin (45) and pin (48) that secure the inner selector arm (49) to the selector valve link (46). Remove the retaining ring (61) that secures the inner selector arm to the cover (25); remove the washer (60) and tap out the inner selector arm. Remove the seat (59) from the cover. Do not remove the bushings (51 and 52) unless they are damaged and require replacement.

(5) Pull the selector valve (47) out of the body. Remove pin (44) that attaches link (46) to selector valve (47). Remove the pins (31 and 43) and remove the rod (30), spring (29), inching valve (28), and sleeve (42). Remove the plug (40), preformed packing (39), ball (38), and spring (41). Remove the plugs (33 and 37).

(6) Remove the reducers (18 and 20) from the cover and remove the seal (19), cup (17), piston (16), spring (15), washer (14), retaining ring (13), washer (21), spring (22), and ball (23). Remove the plug (24) from the cover.

(7) Remove the plug (10), washer (11), and ball (12). Remove the switch (58), pin (56), and washer (57).

(8) Remove seal (50) from cover (25).

(9) Remove bolt (34), bolt (36), and washers (35) attaching body (32) to cover (25).

c. Cleaning, Inspection and Repair.

(1) Discard all seals, bushing, if removed, the gasket, and the preformed packing.

(2) Clean all other parts of the control valve assembly in an approved cleaning solvent; dry with compressed air.

(3) Check the bores in the body and cover for wear and scoring; replace the part if the bores are scored.

(4) Inspect the piston and selector valve for scoring, burs, wear, or other damage. Check the fit of the parts in their bores.

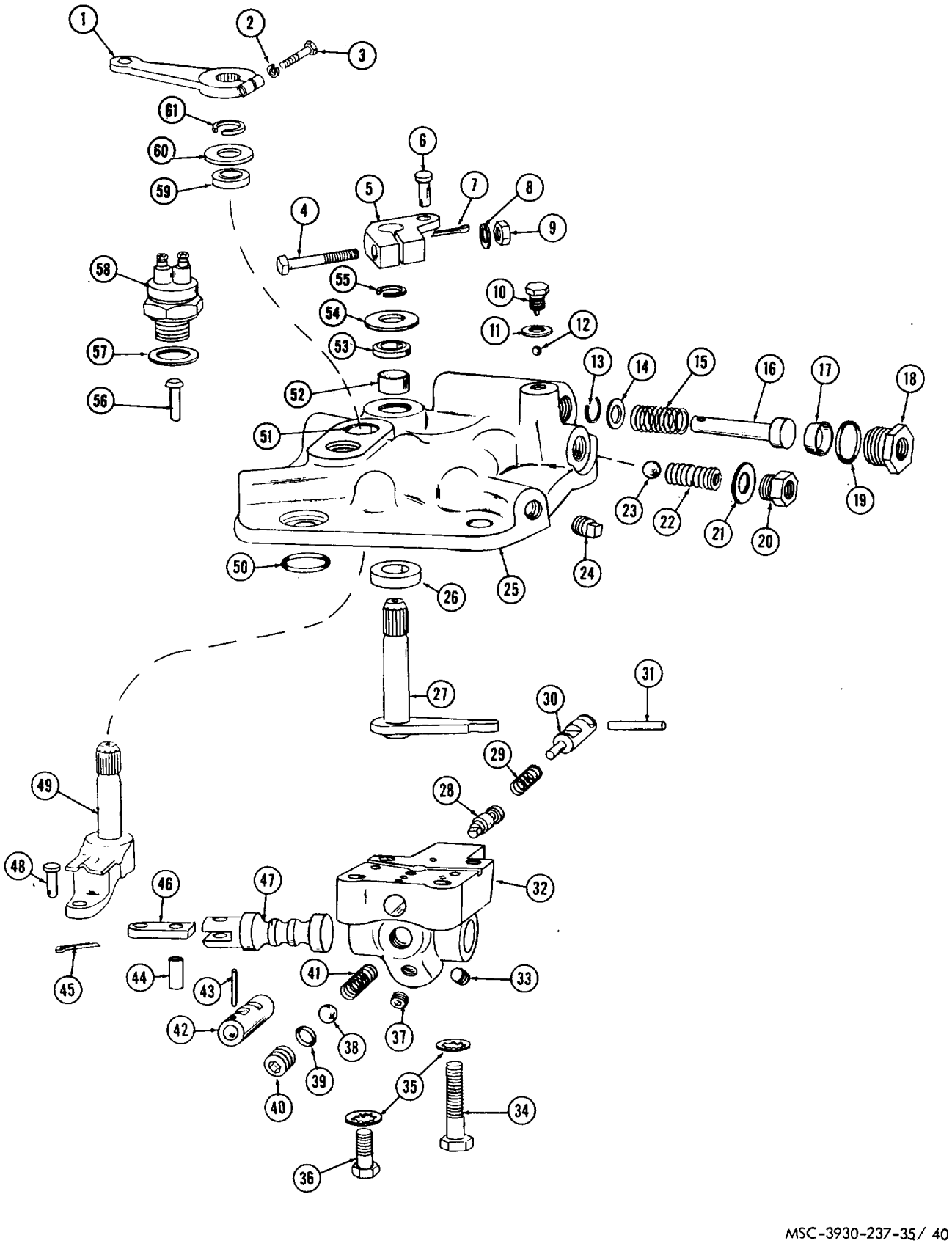


Figure 40. Transmission control valve, exploded view.

1 Outer selector arm
2 Lockwasher
3 Bolt
4 Bolt
5 Outer inching arm
6 Cotter pin
7 Cotter pin
8 Lockwasher
9 Nut
10 Plug
11 Washer
12 Ball
13 Retaining ring
14 Washer
15 Spring
16 Piston
17 Cup
18 Reducer
19 Seal
20 Reducer
21 Washer
22 Spring
23 Ball
24 Plug
25 Cover
26 Spacer
27 Inner inching arm
28 Inching valve
29 Spring
30 Rod
31 Pin
32 Body
33 Plug
34 Bolt
35 Lockwasher
36 Bolt
37 Plug
38 Ball
39 Preformed packing
40 Plug
41 Spring
42 Sleeve
43 Pin
44 Pin
45 Cotter pin
46 Link
47 Selector valve
48 Pin
49 Inner selector arm
50 Seal
51 Bushing
52 Bushing
53 Seal
54 Washer
55 Retaining ring
56 Pin
57 Washer
58 Switch
59 Seal
60 Washer
61 Retaining ring

Figure 40-Continued.

They must provide a close tolerance fit. Replace any damaged parts.

(5) Inspect all shafts, pistons, and valves for distortion, or other damage; replace damaged parts.

(6) Check the operation of the switch; replace if defective.

(7) Inspect the springs for distortion, cracks, and loss of tension. Replace damaged springs.

(8) Inspect the cover and body of cracks, breaks, burs, distortion, or other damage; remove burs using a fine stone. Replace a damaged cover or body.

(9) Replace all cotter pins and weak or distorted retaining rings.

d. Reassembly.

(1) If removed, press the bushings (51 and 52, fig. 40) into the cover (25). Install the seal (53) in the cover. Position the spacer (26) on the inner inching arm (27) and insert the inner arm into the cover through the bushing and seal. Place the washer (54) on the shaft and secure in place using the retaining ring (55).

(2) Install the seal (59) in the cover. Insert the inner selector arm (49) through the bushing (51) and seal, install the washer (60) on the shaft of the inner selector arm, and secure with the retaining ring (61).

(3) Place the ball (12) in the cover; position the washer (11) on the plug (10) and turn the plug into the cover.

(4) Place the retaining ring (13) in the cover. Insert the washer (14), spring (15), piston (16), cup (17), and seal (19) into the cover and secure them in place using the reducer (18). Install the plug (24) in the cover.

(5) Position the outer inching arm (5) on the shaft of the inner inching arm (27) so that the pin (6) can be placed into the holes provided in the piston and arm to secure them together. Insert the pin and secure with the cotter pin (7). Secure the outer arm with the bolt (4), nut (9), and lockwasher (8).

(6) Position the outer selector arm (1) on the shaft of the inner selector arm (49); secure with a bolt (3) and lockwasher (2).

(7) Position the ball (23) and spring (22) into the cover; place the washer (21) on the reducer (20). Install the reducer into the cover to secure the ball and spring. Position the washer (57) on the switch (58); install the pin (56) and turn the switch into the cover.

(8) Position the sleeve (42) in the body (32) and secure it with the pin (43). Insert the inching valve (28), spring (29), and rod (30) into the body and secure with the pin (31). Insert the

spring (41), ball (38), and preformed packing (39) into the body and secure them with the plug (40). Turn the two plugs (33 and 37) into the body. Position link (46) into selector valve (47) and secure with pin (44). Slide the selector valve assembly (47) into the body.

(9) Position the assembled body on the cover and secure in place using the bolts (34 and 36) and lockwashers (35).

(10) Position the inner selector arm (49) on the selector valve link (46) so that the pin (48) can be inserted to secure them together; insert the pin and secure with the cotter pin (45).

(11) Insert seal (50) into cover (25).

e. Installation.

(1) Position a new gasket (106, fig. 46) on the transmission case (91); position the control valve assembly (107) on the housing and secure with the five bolts (109 and 111) and lockwashers (108 and 110).

(2) Connect the tubes to the reducers (18 and 20, fig. 40). Connect the electrical wires to the switch (58). Connect the transmission linkage to the outer selector arm (1). If necessary, reposition the outer selector arm on the shaft of the inner selector arm (49).

(3) Install the steering gear (par. 30e).

f. Adjustment. Transmission control valve adjustment includes neutral starting switch adjustment and transmission oil pressure adjustment (par. 28a). Adjust the neutral starting switch as follows:

(1) Block the fork lift truck so that it cannot move.

(2) Hold the starting switch in the starting position with the transmission control lever in either the forward or reverse position. Slowly move the control lever toward the neutral position. If the engine fails to crank, repeat the procedure moving the lever toward neutral from the opposite direction.

(3) If the engine starts before the lever reaches the neutral position, place shims between the switch and the transmission control valve cover so that the engine cranks with the transmission in dead neutral.

(4) Check the above procedure for the other direction.

(5) If shimming the switch will not correct the difficulty, replace the switch. Adjust the new switch as directed in (1) through (4) above.

25. Wheel and Axle Shaft

a. Removal and Disassembly. Remove and disassemble the wheel and axle shaft (TM 10-3930-237-20).

b. Cleaning, Inspection, and Repair.

(1) Discard the seals.

(2) Thoroughly clean all metal parts of the wheel and axle shaft in an approved cleaning solvent; dry with compressed air. Coat all bearings lightly with clean lubricating oil.

(3) Inspect the bearings (21, fig. 41), bearing cups (5 and 24), and bearing cones (4 and 25) for cracks, nicks, signs of overheating, looseness, rough or binding operation, or other damage; replace both cup and cone if one mating part is damaged.

(4) Inspect the ring gear (7) and pinion and shaft (22) for cracks, burs, chipped or worn teeth, or other damage. Remove burs with a fine stone. Replace any damaged parts.

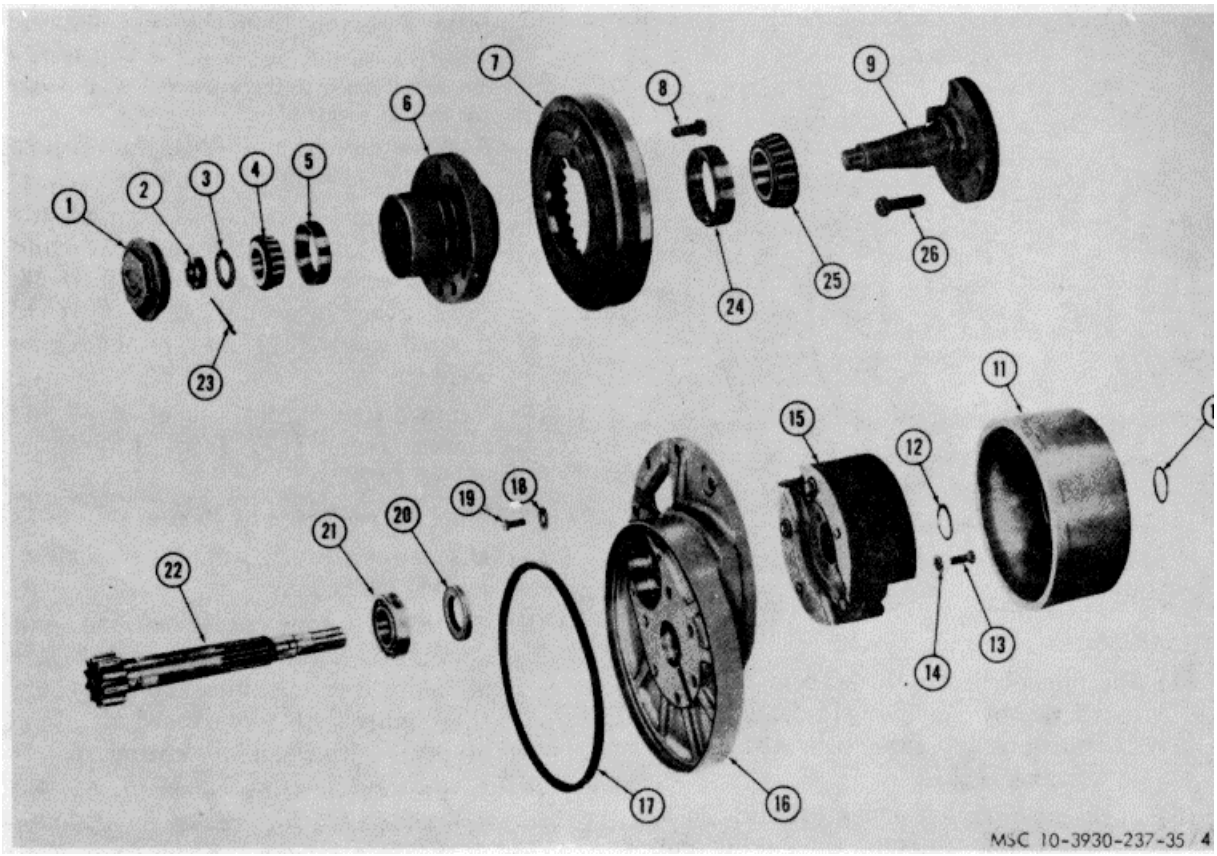
(5) Inspect the wheel hub and spindle for cracks, breaks, signs of overheating, or other damage; replace damaged parts.

(6) Inspect the brake drums (11) for cracks, signs of overheating, or scoring of the inner diameter. Turn down a slightly scored drum on a lathe. Replace the brake drum if it cannot be repaired.

c. Reassembly and Installation.

(1) Replace all seals and unserviceable parts.

(2) Reassemble and install the wheel and axle shaft (TM 10-3930-237-20).



1	Hub cap	8	Screw	15	Brake assembly	22	Pinion and shaft
2	Nut	9	Spindle	16	Spindle support	23	Cotter pin
3	Washer	10	Retaining ring	17	Seal	24	Bearing cup
4	Bearing cone	11	Drum	18	Washer	25	Bearing cone
5	Bearing cup	12	Retaining ring	19	Screw	26	Screw
6	Hub	13	Screw	20	Seal		
7	Ring gear	14	Lockwasher	21	Bearing		

Figure 41. Wheel and axle shaft, exploded view.

26. Drive Wheel Assembly

a. Disassembly. Press drive wheel tires (1, fig. 42) from drive wheels (2).

b. Cleaning, Inspection, and Repair.

(1) Clean drive wheel and metal base of tire assembly with an approved cleaning solvent and dry with compressed air.

(2) Inspect drive wheel tires for wear, cracks and separation from metal base.

(3) Inspect drive wheels for cracks, breaks, and elongated mounting holes.

(4) Discard damaged parts and reassemble as in (c).

c. Reassembly. Press drive wheel tires (1, fig. 42) onto drive wheels (2) until metal base of tire assembly is flush with outer edge of drive wheel.

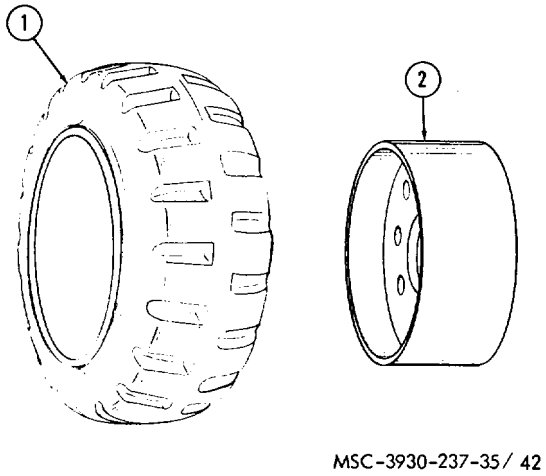
27. Axle Adapter and Differential

a. Removal.

(1) Remove the carriage assembly and mast assembly (pars. 49a and 48a).

(2) Drain the axle adapter and differential into a suitable container by opening the plug (34, fig. 43).

(3) Disconnect the electrical wires from the transmission control valve. Disconnect the brake tubes from the transmission control valve.



1 Tire assembly 2 Drive wheel

Figure 42. Drive wheel assembly, exploded view.

(4) Disconnect brake lines from tee, remove tee by removing axle adapter to-transmission case bolt (37) and lockwasher (36).

(5) Jack the fork lift truck up and block it in position. Support the engine and transmission with blocks.

(6) Remove the bolts (1) that secure the rings (2) to the chassis of the truck.

(7) Remove the bolts (37), lockwashers (36), nuts (24), and lockwashers (25) the secure the axle adapter to the transmission case; remove the axle adapter and differential assembly from the fork lift truck. Remove the shims (13).

(8) Remove the wheel and axle shaft (TM 10-3930-237-20).

b. Disassembly.

(1) Slide the two rings (2, fig. 43) off the axle adapter (11). Remove the oil level gage (9), tube (10) and plug (8). Remove screw (3) that positions bushing (4) on axle adapter (11); remove bushing (4).

(2) Remove the nuts (29) and washers (30) that secure the carriers (5) to the axle adapter; remove the carriers, seals (6 and 31), bearing cups (32), and shims (33). Remove the differential assembly from the axle adapter.

Note. **Keep shim sets together so that they can be returned to the same side of the axle adapter at reassembly.**

(3) Remove eight bolts (20) that secure flanged case (21) to plain case (14).

(4) Remove thrust washers (18) and side gears (15) from plain case (14) and flanged case (21); remove eight bolts (22) attaching ring gear (19) to flanged case (21) and remove ring gear.

(5) Remove four thrust washers (16) and pinion gears (17) from differential spider (23).

c. Cleaning, Inspection, and Repair.

(1) Discard all seals, and other unserviceable parts.

(2) Clean all other parts of the axle adapter and differential assembly in an approved cleaning solvent; dry thoroughly with compressed air. Coat all parts with clean lubricating oil.

(3) Inspect the bearing cones (7, fig. 43) . and cups (32) for cracks, nicks, looseness, or rough or binding operation; replace the complete bearing assembly if either part is damaged.

(4) Inspect the gears for cracked, chipped, or worn teeth or scored or worn bore holes; replace all differential gears (four pinion and two side gears), differential spider, and thrust washers (four pinion and two side washers) if any gear is damaged.

(5) Inspect the differential housings for cracks, breaks, scoring, or other damage; replace a damaged differential housing.

Note. **The ring gear and pinion drive shaft of the transmission are replaced as a matched set only. To replace the pinion driveshaft, refer to paragraph 28.**

(6) Inspect the axle adapter, bushings, and rings for cracks or damage; replace damaged parts.

d. Reassembly and Installation.

(1) Install pinion gears (17, fig. 43) and thrust washers (16) on differential spider (23).

(2) Position ring gear (19) on flanged case (21) and secure with bolts (22); torque bolts to 20-25 foot pounds. Position thrust washers (18) and side gears (15) in plain case (14) and flanged case (21).

(3) Install assembled pinion (spider, thrust washers and pinion gears) into notches provided in plain case (14) and roll pinion gears between side gears to insure proper tooth alinement. Position assembled flange case (case, pinion gear and mounting bolts) over assembled pinion and plain case; roll side gears to insure proper alinement with pinion gears and secure flanged case (21) to plain case (14) with bolts (20); torque bolts (20) to 20 to 25 foot pounds.

(4) Press the bearing cones (7) onto the differential housing if they were replaced. Press the bearing cups (32) into the carrier (5) if replaced.

(5) Position the assembled differential into the axle adapter (11). Place the same thickness of shims (33) as were removed during disassembly on the carrier mounting studs (28). Position the seals (6 and 31) in the carrier (5). Place the carrier on the axle adapter over the differential housing bearing cones (7) and secure in place with the nuts (29) and washers (30); torque the nuts evenly to 24-28 foot-pounds.

(6) Position bushing (4) on axle adapter. (11) and secure with the screw (3). Slide the rings (2) onto the axle adapter (11). Position the axle adapter and differential assembly on the transmission using the same thickness of shims (13) as were removed at disassembly. Make sure the transmission pinion shaft engages the ring gear (19). Secure the adapter to the transmission case with the nuts (24), lockwashers (25), bolts (37), and lockwashers (36).

(7) Secure the axle adapter to the frame using the bolts (1).

(8) Paint three or four teeth of the gear of the pinion drive shaft (96, fig. 46) with red lead or mechanic's blue. Rotate the pinion drive gear until the ring gear makes one complete revolution. Remove the axle adapter, note the area of tooth contact on the ring gear and compare it with that shown in figure 44. Make adjustments as indicated in the illustration to correct for incorrect gear wear patterns.

(9) Install the wheel and axle shaft (TM 10-3930-237-20).

(10) Remove the engine and transmission supports; lower the fork lift truck to the floor.

(11) Replace electrical wires, brake line tee and brake lines removed during disassembly.

(12) Fill the differential and transmission (TM 10-3930-237-20).

(13) Install the mast assembly and carriage assembly (par. 48e and 49e).

28. Transmission

a. Testing.

(1) Steam-clean the entire fork lift truck before testing the transmission. Clean the radiator (TM 10-3930-237-20).

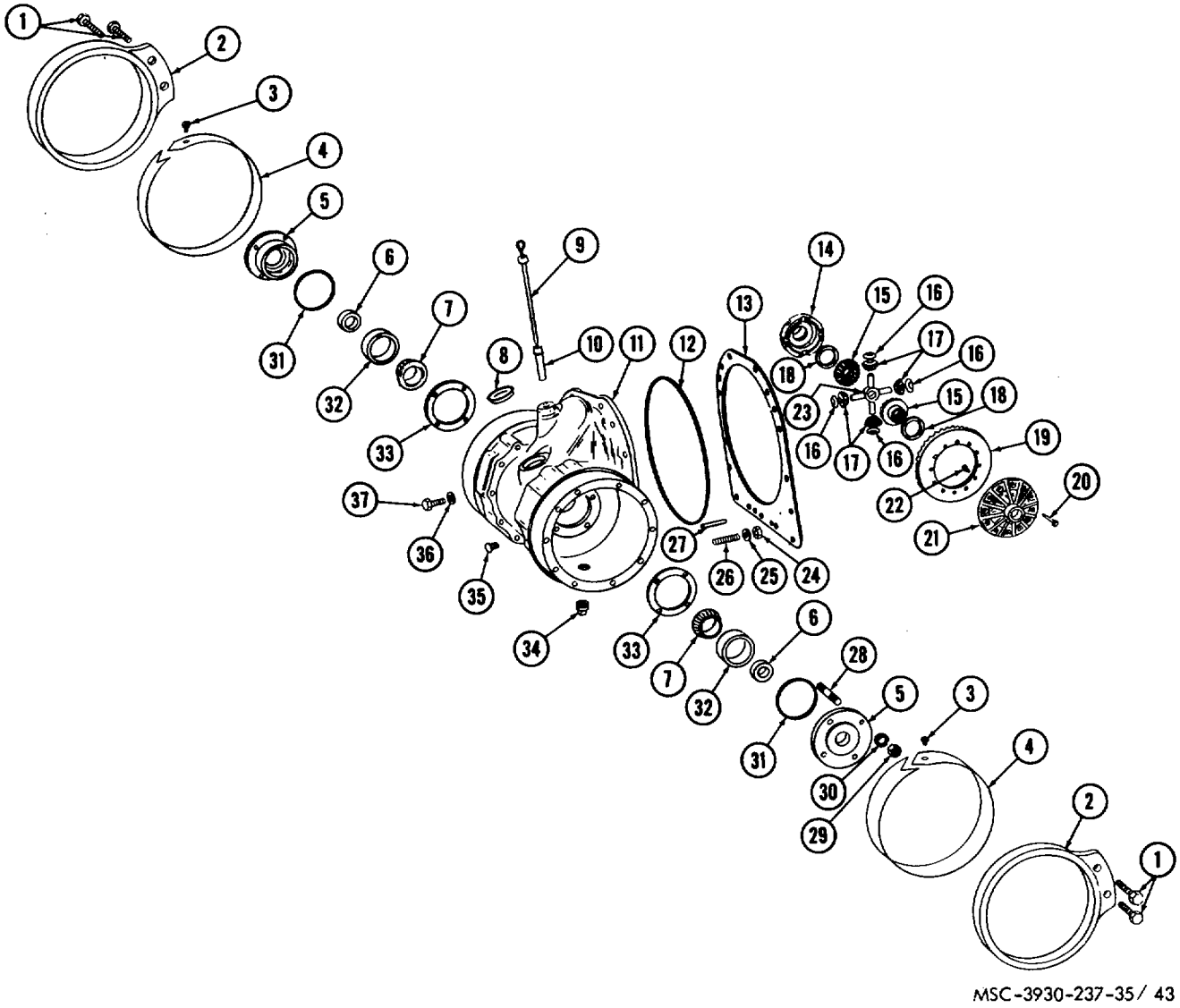
(2) Run the fork lift truck in forward and reverse for a total of 3 minutes. Stop the engine and check the fluid level with the dipstick. Add transmission fluid until the level reaches the full mark on the dipstick.

(3) Check, and adjust if necessary, the brake pedal free travel (TM 103930-237-20).

(4) Adjust the engine speed for prescribed no-load rpm (TM 10-3930-237-20).

(5) Check the engine for normal engine stall by positioning the truck against an immovable object and with the engine in gear, accelerating to full throttle position. Normal engine stall is between 1210 and 1300 rpm. If the engine stalls between 1000 and 1210 rpm, the engine is losing power.

(6) If the engine stalls between 650 and 900 rpm, the torque converter stator is slipping and the



1	Bolt	11	Axle adapter	21	Flanged case	31	Seal
2	Ring	12	Seal	22	Bolt	32	Bearing cup
3	Screw	13	Shim	23	Differential spider	33	Shim
4	Bushing	14	Plain case	24	Nut	34	Plug
5	Carrier	15	Side gear	25	Lockwasher	35	Plug
6	Seal	16	Thrust washer	26	Stud	36	Lockwasher
7	Bearing cone	17	Pinion gear	27	Dowel pin	37	Bolt
8	Plug	18	Thrust washer	28	Stud		
9	Oil level gage	19	Ring gear	29	Nut		
10	Tube	20	Bolt	30	Lockwasher		

Figure 43. Axle adapter and differential, exploded view.

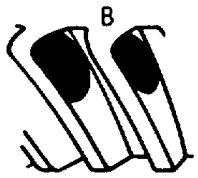
is slipping and the torque converter must be replaced (par. 10).

(7) Check the transmission oil pump pressure as follows:

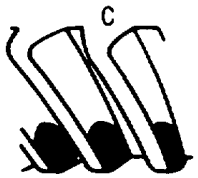
(a) Remove the pipe plug and install a pressure gage that will indicate between 0 and 200 psi at the converter housing outlet (fig. 45).

(b) Run the engine at 2000 rpm with the transmission in neutral. The pressure gage should indicate between 110 and 125 psi. If

A. Correct gear tooth contact.

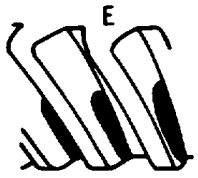


B. Short heel contact. Add shims at point 2 and remove shims from point 3 of drawing below. Remove shims at point 1.



C. Short toe contact. Add shims at point 1 of drawing below. Remove shims at point 2 and add shims at point 3.

D. Contact too close to tooth edge. Add shims at point 1 of drawing below. Remove shims at point 2 and add shims at point 3.



E. Contact too deep in gear groove. Add shims at point 2 and remove shims at point 3 in drawing below. Remove shims at point 1.

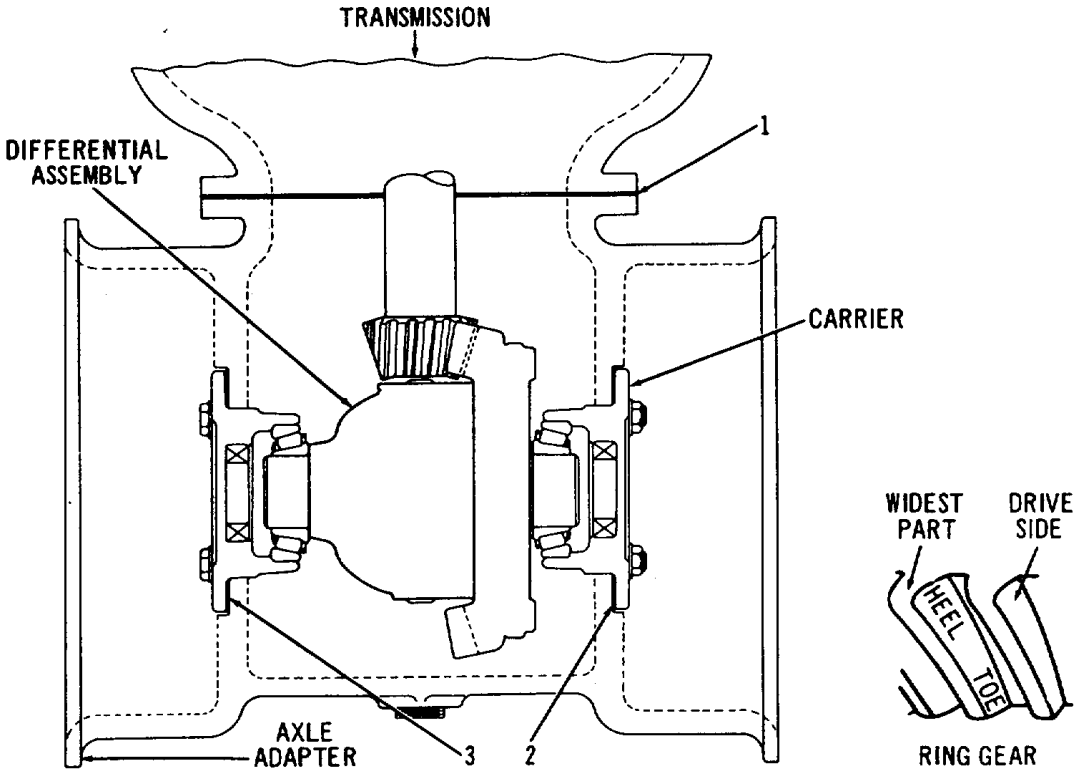


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Figure 44. Ring gear adjustment.

the pressure sure is low, loosen the control valve mounting screws and place shim stock (0.001 inch to 0.002 inch thick by 11/2 inches wide) between the inlet pressure hole of the control valve cover and the transmission case (fig. 45). Tighten the mounting screws.

(c) Recheck the pressure as described in (a) and (b) above. If the pressure is still low, overhaul the control valve pressure regulating valve or transmission oil pump. Determine which is defective as described in (8) below.

(d) Remove gage from the converter housing outlet and replace the plug.

(8) Check the transmission control valve and transmission directional assemblies as follows:

(a) Securely block the fork lift truck so that it cannot move.

(b) Install a pressure gage that indicates between 0 and 200 psi at either the forward or reverse outlet plugs (fig. 45).

(c) Run the engine at 2000 rpm and place the transmission control lever in the position that corresponds to the outlet at which the pressure gage has been placed (forward or reverse). The pressure gage should indicate between 110 and 125 psi.

(d) If the pressure is low, loosen the control valve mounting screws and insert shim stock (0.001 inch to 0.002 inch thick by 11/2 inches wide) between the outlet hole of the control valve cover used for the pressure check and the transmission case. Tighten the mounting screws.

(e) Recheck the pressure. If the pressure is still low, the trouble is in the transmission control valve. Overhaul the transmission control valve (par. 24).

(f) If shimming brings the pressure up to the prescribed limits, the transmission is defective. Remove the shim and overhaul the transmission as described in b through f below. Remove the gage and insert the plug.

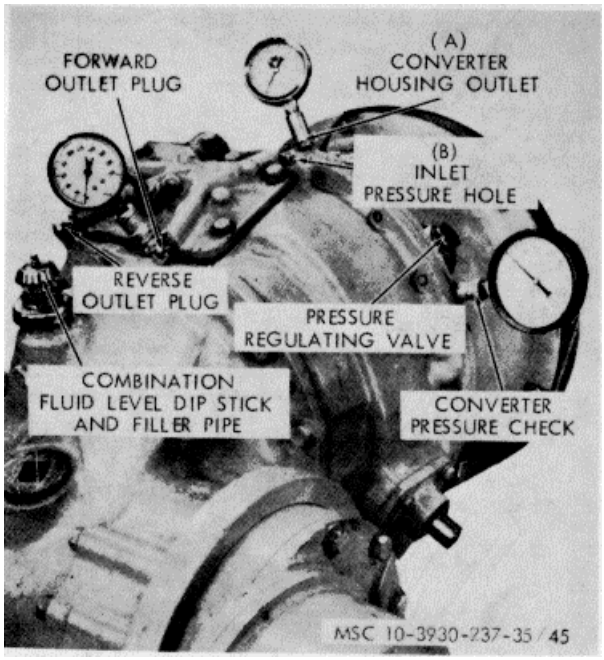


Figure 45. Transmission pressure checks.

(9) Check the torque converter pressure as follows:

(a) Install a pressure gage that indicates between 0 and 200 psi in the converter pressure check hole (fig. 45) in the torque converter housing.

(b) Run the engine at 2000 rpm with the transmission in neutral. The pressure gage should indicate between 65 and 75 psi.

(c) If the pressure is not between the prescribed limits, overhaul the pressure regulating valve (fig. 45) as described in c below.

b. Removal.

(1) Remove the drain plug (34, fig. 43) from the axle adapter and remove the drain plug (86, fig. 46) to drain the transmission and axle.

(2) Remove the' steering gear (par. 30a). Remove the instrument panels (TM 10-3930-237-20).

Remove the dash panel.

(3) Remove the tilt cylinders (TM 10-3930-237-20).

(4) Remove the brake pedal (par. 38a). Remove the brake hydraulic lines.

(5) Remove the overhead guard (TM 10-3930-237-20).

(6) Remove the carriage assembly and mast assembly (pars. 49a and 48a).

(7) Disconnect the oil cooler hoses from the transmission. Disconnect and tag all electrical leads. Disconnect all piping and tubing.

(8) Disconnect the parking brake linkage from the transmission.

(9) Jack up the fork lift truck and block securely under the frame. Block up under the flywheel housing of the engine.

(10) Wrap a sling around the transmission housing (68, fig. 46). Make sure the position of the cable will not interfere with the removal of the bolts that secure the axle adapter to the transmission. Support the weight of the transmission with a hoist. Remove the wheels and axle shafts (TM 10-3930-237-20). Remove the axle adapter and differential (par. 27a).

(11) Remove the bolts (69) and lockwashers (70) that secure the transmission assembly to the engine. Maintain support of the transmission with the hoist. Pry the transmission from the engine. Pull straight back to disengage the shaft of the input gear from the torque converter (44). When the shaft is disengaged, lower the transmission onto a dolly and roll it from the front of the truck.

(12) Remove the torque converter from the engine (par. 10a).

c. Disassembly.

(1) Remove the transmission control valve (par. 24a).

(2) Remove the hand brake mechanism (par. 34a).

(3) Remove the bolts (88, fig. 46) and lockwashers (87) that secure the cover (89) to the case (91); remove the cover, gaskets (85), and screen (90).

(4) Remove the eight bolts (45) and lockwashers (46) that secure the cover (42) to the housing (68); remove the cover and gasket (40) from the housing. Remove the seal (43), preformed packings (38, and 52), and the gear (53) from the stator (54).

(5) Remove the body (25) from the cover (42). Remove the roll pin (26), plug (20), washer (21), spring (22), pressure regulator (23), stop (24), washer (27), and seal ring (28) from the body. Remove the plug (50) that secures the relief in the cover; remove the spring (48) and ball (51) from the cover, and the seal (49) from the plug. Remove the plug (41) from the cover.

(6) Remove the cotter pin (78) and nut (77) that secure the brake drum (76) to the pinion drive shaft (96); remove the brake drum, key (97), and preformed packing (74)'from the pinion drive shaft.

(7) Remove the 15 bolts (60 and 61) and lockwashers (62) that secure the housing (68) to the case (91); remove the housing from the case. Mark the location of the odd-sized bolt to aid reassembly. Remove the seals (64 and 65), preformed packings (63), bearing cone (73), retaining ring (71), and bearing cup (72) from the housing.

(8) Remove the five bolts (55) that secure the stator (54) to the housing; remove the stator and shims (57). Remove the seal rings (56) from the shaft of the gear (66). Retain the shims for reassembly.

(9) Remove the retaining ring (58) and remove the shaft from the bearing (59). Tap the bearing from the housing.

(10) Remove the two bolts (33) and .lockwashers (32) that secure the transmission oil pump (30)

to the plate (31); remove the pump from the plate and remove the bolt (34) and lockwasher (35) that secure the plate to the housing; remove the plate from the housing.

(11) Disassemble the transmission oil pump (fig. 47) as follows:

(a) Remove the retaining ring (39, fig. 46) that secures the gear (29) to the drive shaft; remove the washer (37), gear, and key (36) from the pump.

(b) Remove the four cap screws (15, fig. 47) that secure the cover (3) to the body (9), remove the cover. Remove the assembled driven gear (7) and idler shaft (2) from the cover or body.

(c) Lay the body on its machined surface and use a drift pin to tap the needle bearings (10) out of their seats.

(d) Remove the retaining ring (11), drive gear (12), key (13), and retaining ring (14) from the drive shaft (17). Press the drive shaft out of the cover; remove the washer (16).

(e) If they are damaged, pull the pins (5) from the cover. Press the needle bearings (4) from the cover, being careful to press squarely against the outer race of the bearing.

(12) Remove the shim (81, fig. 46), spacer (82), gear (83), and spacer (84) from the pinion shaft; remove the pinion shaft; and the cone of the bearing (95) from the transmission case (91). Press the bearing cone from the shaft. Remove the retaining ring (93) and cup of the bearing (94) from the case.

(13) Remove the four bolts (98) and lockwashers (99) that secure the cap (100) to the case; remove the cap, gasket (102), and preformed packing (103). Remove the nut (104) that secures the shaft to the case; hold the directional assembly (1 through 18) by the drum and hub (3) and pull the assembly out of the case. Remove the other directional assembly in a similar manner.

(14) Remove the retaining ring (1) and remove the spacer (2) from the shaft (15). Slide the assembled selector pack (3 through 11) from the shaft. Remove the gear assembly (14) from the shaft (15).

(15) Remove the retaining ring (11) from the drum and hub (3) and remove the end plate (10), disks (7 and 9), and springs (8) from the drum and hub. Remove the piston (6) from the drum and hub; remove the outer seal (5) from the piston and remove the inner seal (4) from the drum and hub.

(16) Remove the retaining ring (18) and press the bearing (17) from the shaft (15). Remove the spacer (16).

(17) Repeat steps (14 through 16) above to disassemble the other selector pack.

(18) Remove the oil seals (19) from the housing (68). Press the bearings (105) from the case (91), taking care to press against the outer race of the bearing.

d. Cleaning, Inspection, and Repair.

(1) Discard the seals and preformed packing.

(2) Clean the bearings by placing them in a wire basket and immersing them in a container of an approved cleaning solvent. Agitate the basket in the solvent to thoroughly clean the bearings. Dry with clean, dry, compressed air, taking care not to spin the bearings. Lubricate with light oil after cleaning.

(3) Clean all other parts of the transmission assembly and transmission oil pump in an approved cleaning solvent; dry with compressed air.

(4) Lubricate all metal parts of the assembly with transmission fluid.

(5) Inspect all bearings for cracks, nicks, wear, scoring, overheating, or other damage; replace damaged bearings.

(6) Inspect the gears for chips, cracks, breaks, worn teeth, worn splines, or other damage; replace damaged gears.

(7) Inspect the case, housing, and all covers for cracks, breaks, distortion, knicked seal seats, or other damage; replace parts if damage makes them unserviceable.

(8) Inspect the disks for cracks, nicks, distortion, wear, scoring, overheating, or other damage; replace the complete disk assembly if any disks are defective.

(9) Inspect the gears of the transmission oil pump for cracks, burs, wear, or other damage. Replace damaged gears. To replace the driven gear, drive the shear pin (1, fig. 47) out of the gear and idler shaft (2); remove the retaining rings (6 and 8) and slide the gear off the shaft. Replace the gear and secure with a new shear pin, and retaining rings.

Caution: **Be sure the shear pin is clear of the faces of the gear.**

(10) Check the oil pump shafts, cover, and body for scoring, wear, distortion, or other damage; replace damaged parts. If the idler shaft is damaged, remove the driven gear as described in (9) above and replace the shaft.

(11) Check the bearings for flat spots, distortion, sticking action, or other damage; replace damaged bearings.

e. Reassembly.

(1) Place the spacer (16, fig. 46) and bearing (17) on the shaft (15); secure with the retaining ring (18). Slide the gear assembly (14) on the shaft, and the disks (7 and 9) onto the gear assembly. Place the thrust washer (13) on the shaft.

(2) Install the inner seal (4) on the hub of the drum and hub. Install the outer seal (5) on the piston (6). Install the piston in the drum and hub.

(3) Install the disks (7 and 9) and springs (8) in the drum and hub, making sure that the first disk inserted has splines which engage the drum and hub and the second disk has splines which engage the gear assembly. Alternate disks until all eight are installed. Install the end plate (10) in the drum and hub and secure the assembly with the retaining ring (11).

(4) Aline the disks that engage the gear assembly and install the selector pack on the assembled shaft (15) and gear (14). Install the spacer on the shaft and secure with the retaining ring (1).

(5) Assemble the second selector group as directed in (1) through (4) above.

(6) Press the bearings (105) into the case (91) so that the retaining ring on the bearing is firmly seated against the case. Install the selector groups in the case so that the threaded ends of the shafts enter the bearings (105); secure with the nuts (104).

(7) Install the retaining ring (93) in the case (91). Press the cup of the bearing (94) into the case so that it is firmly seated against the retaining ring (93). Install the retaining ring (71) and press the bearing cup (72) firmly against the ring in the housing.

(8) Press the bearing (59) into the housing until it rests firmly against its integral retaining ring. Install the shaft of the gear (66) in the bearing and secure with the retaining ring (58). Make sure the two seal rings (56) are installed on the shaft and install the stator (54), using shims (57) to take up play of the gear (66). Secure the support with bolts (55) and lockwire.

(9) Reassemble the transmission oil pump (30) as follows:

(a) Immerse all parts of the pump in clean engine oil before reassembly.

(b) Press the needle bearings (4, fig. 47) into the cover (3). Slide the washer (16) over the drive shaft (17); position the drive shaft into the cover. Place the retaining ring (14), key (13), drive gear (12), and retaining ring (11) on the drive shaft.

(c) Position the assembled driven gear (7) into the cover. Press the needle bearings (10) into the holes provided in the body.

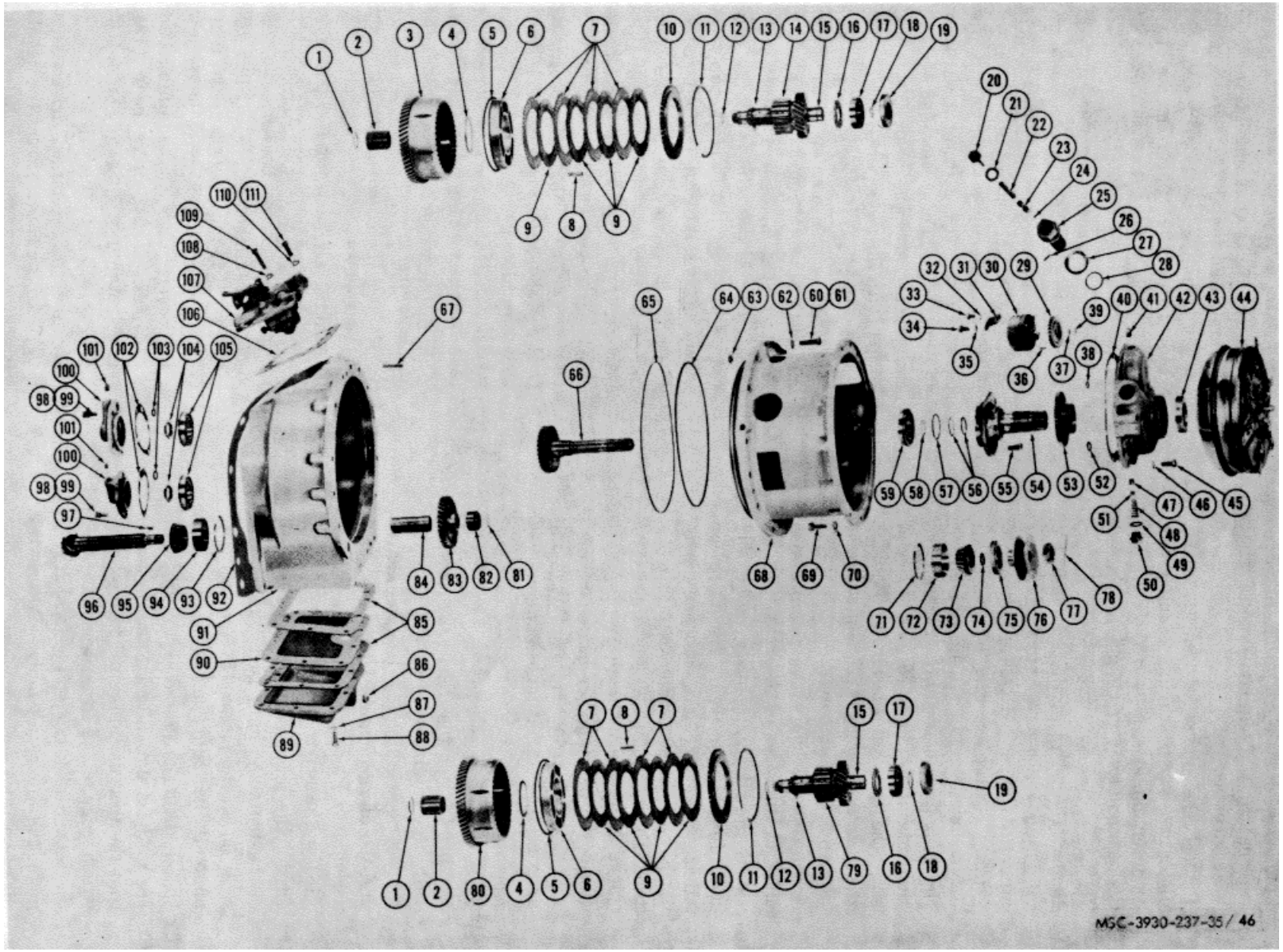


Figure 46. Transmission, exploded view.

1	Retaining ring	29	Gear	57	Shim	85	Gasket
2	Spacer	30	Oil pump	58	Retaining ring	86	Plug
3	Drum and hub	31	Plate	59	Bearing	87	Lockwasher
4	Inner seal	32	Lockwasher	60	Bolt	88	Bolt
5	Outer seal	33	Bolt	61	Bolt	89	Cover
6	Piston	34	Bolt	62	Lockwasher	90	Screen
7	Disk	35	Lockwasher	63	Preformed packing	91	Case
8	Spring	36	Key	64	Seal	92	Shim
9	Disk	37	Washer	65	Seal	93	Retaining ring
10	End plate	38	Preformed packing	66	Gear	94	Bearing cup
11	Retaining ring	39	Retaining ring	67	Pin	95	Bearing cone
12	Preformed packing	40	Gasket	68	Housing	96	Pinion drive shaft
13	Thrust washer	41	Plug	69	Bolt	97	Key
14	Gear assembly	42	Cover	70	Lockwasher	98	Bolt
15	Shaft	43	Seal	71	Retaining ring	99	Lockwasher
16	Spacer	44	Torque converter	72	Bearing cup	100	Cap
17	Bearing	45	Bolt	73	Bearing cone	101	Plug
18	Retaining ring	46	Lockwasher	74	Preformed packing	102	Gasket
19	Oil seal	47	Seat	75	Seal	103	Preformed packing
20	Plug	48	Spring	76	Brake drum	104	Nut
21	Washer	49	Seal	77	Nut	105	Bearing
22	Spring	50	Plug	78	Cotter pin	106	Gasket
23	Pressure regulator	51	Ball	79	Gear assembly	107	Transmission control valve
24	Stop	52	Preformed packing	80	Drum and hub		
25	Body	53	Gear	81	Shim	108	Lockwasher
26	Roll pin	54	Stator	82	Spacer	109	Bolt
27	Washer	55	Bolt	83	Gear	110	Lockwasher
28	Seal ring	56	Seal ring	84	Spacer	111	Bolt

Figure 46. --Continued.

Position the body over the shafts and shaft ends into the needle bearings. Secure the cover to the body with the four cap screws (15).

(d) Position the key (36, fig. 46) on the drive shaft and press the gear (29) over the shaft and key. Place the washer (37) on the shaft and secure in place using the retaining ring (39).

(10) Position the transmission oil pump on the plate (31) and secure them together using the bolts (33) and lockwashers (32). Insert the pump into the housing and secure the plate in position using the bolt (34) and lockwasher (35).

(11) Position new seals (64 and 65) and preformed packing (63) on the housing. Position the housing on the case (91) using the pin (67) as a guide. Aline the gears so that they mesh by turning the main drive gear shaft. Secure the housing to the case using the bolts (60 and 61) and lockwashers (62). Position the two oil seals (19) in the housing.

(12) Position the cone of the bearing (95) on the pinion drive shaft (96) and insert the pinion drive shaft part of the way into the case (91). Install the spacer (84), gear (83), and spacer (82) on the pinion drive shaft. Seat the shaft and install the bearing cone (73), preformed packing (74), and brake drum (76); secure with the nut (77). When the nut is tightened, check the rotation of the pinion drive shaft. If the shaft binds, add shims (81). If the shaft has any end play, remove shims (81). When the proper shim thickness is obtained, install the seal (75) in the housing and reinstall the brake drum (76) and nut (77). Secure the nut with the cotter pin (78).

(13) Position the gear (53) on the stator so that the teeth of the gear mesh with those of the

transmission oil pump drive gear (29). Insert the ball (51), spring (48), and seal (49) into the cover (42) and secure in place with the plug (50). Insert the stop (24), pressure regulator (23), roll pin (26), and spring (22) into the body (25); position the washer (21) on the plug (20) and turn the plug into the body.

(14) Position the washer (27) and seal ring (28) on the body; turn the body into the cover.

(15) Position the seal (43) and preformed packings (38 and 52) in the cover. Place the gasket (40) on the cover and position the cover on the housing. Secure the cover with the bolts (45) and lockwashers (46).

(16) Position the gaskets (102) and preformed packings (103) on the caps (100); secure with bolts (98) and lockwashers (99).

(17) Position two new gaskets (85) and a screen (90) on the cover (89); position the cover on the transmission case and secure with the bolts (88) and lockwashers (87). Insert the plug (86) into the cover.

(18) Position the transmission control valve (107) on the case using a new gasket (106); secure with the bolts (109 and 111) and lockwashers (108 and 110).

f. Installation.

(1) Install the torque converter on the engine flywheel (par. 10b).

(2) Position the transmission assembly on the engine bell housing with a hoise; secure using the bolts (69, fig. 46) and lockwashers (70).

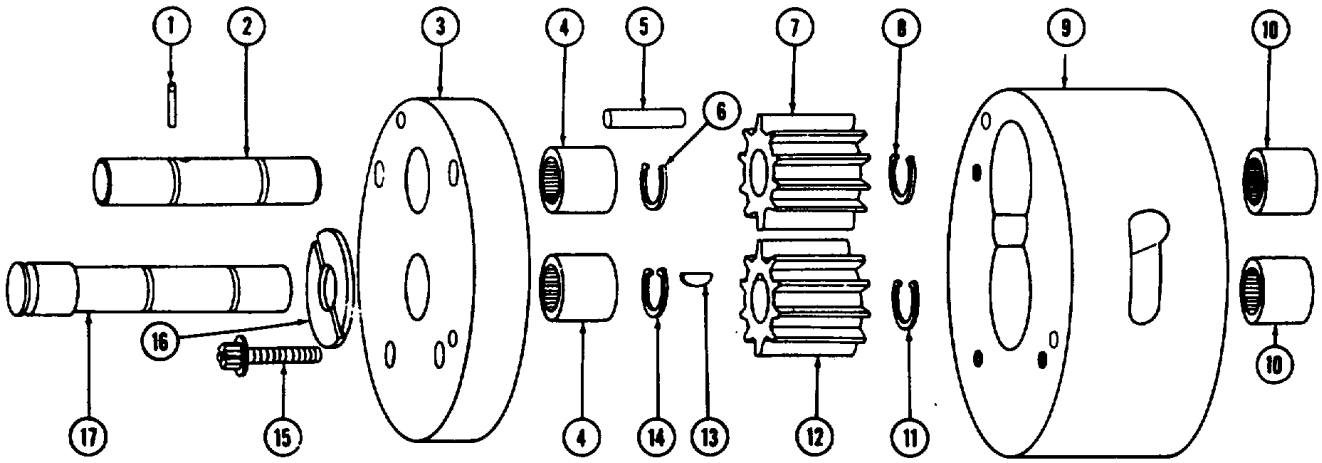
(3) Install the axle adapter and differential (par. 27d).

(4) Install the wheel and axle shafts (TM 10-3930-237-20).

(5) Remove the engine blocks and lower the fork lift truck to the ground.

(6) Install the mast assembly and carriage assembly (pars. 48e and 49e).

(7) Connect the hand brake linkage and the transmission control linkage (pars. 34c and 23c).



1	Shear pin	6	Retaining ring	11	Retaining ring	16	Washer
2	Idler shaft	7	Driven gear	12	Drive gear	17	Drive shaft
3	Cover	8	Retaining ring	13	Key		
4	Needle bearing	9	Body	14	Retaining ring		
5	Pin	10	Needle bearing	15	Capscrew		

Figure 47. Transmission oil pump, exploded view.

(8) Position, reclamp, and reconnect all hoses, wires, and tubes to the transmission assembly and wheel and axle shafts.

(9) Replace the tilt cylinders (TM 10-3930-237-20).

(10) Install the dash panel and install the instrument panels (TM 10-3930-237 20). Install the steering gear (par. 30e).

(11) Fill the transmission and axle adapter and differential with an approved lubricant.

(12) Test the transmission as described in a above.

Section VII. STEERING SYSTEM

29. General

a. The fork lift truck is steered by the rear wheels through the use of a mechanical steering system. The steering system consists of a steering gear, steering axle, drag link, tie rods, and steering wheels.

b. The steering handwheel acts to turn the truck through the steering gear Pitman arm, which is mechanically connected by the drag link to the steering arm of the rear-mounted steering axle. The steering axle arm is connected to the steering wheels by tie rods.

30. Steering Gear

a. Removal.

(1) Remove the instrument panel (TM 10-3930-237-20).

(2) Remove the transmission control lever from the steering column (par. 23a). Remove all wiring from the steering column.

(3) Remove the cotter pin from the end of the drag link and turn the plug out until the drag link is free of the pitman arm (29, fig. 48); swing the drag link clear of the pitman arm.

(4) Remove the nut (31) and lockwasher (30) from the shaft and gear assembly (49). Position a pry bar behind the pitman arm through the slot provided in the support (36); pry the pitman arm off the gear and shaft assembly.

(5) Remove the nuts (18), lockwashers (17), and U-bolt (15) that secure the steering column to the dash panel. Loosen the knurled bolt (38) to unclamp the steering gear from the support.

(6) Support the steering gear and remove the nut (26), lockwasher (25), and bolt (24) that secure the steering gear to the support. Remove the steering gear from the fork lift truck.

b. Disassembly.

(1) Remove the bolts (56, fig. 48) and lockwashers (57) that secure the cover (54) to the housing assembly (47) ; remove the cover, nut (55), lash adjuster (52), adjusting shim (53), and shaft and gear assembly from the housing assembly. Tap on the threaded end of the shaft and gear assembly if necessary to dislodge the parts. Remove the gasket (50) from the cover.

(2) Remove the nut (55) from the lash adjuster and remove the shaft and gear assembly from the cover; remove the lash adjuster from the shaft and gear assembly. Remove the shims and note their thickness and quantity.

(3) Remove the cover (1) from the horn button by pulling up on the cover. Remove the horn button (2) by pressing down and turning it out of the retainer (6). Remove the cup (3), spring (4), and cap (5). Remove the three screws (63) that hold the retainer to the steering wheel (7); remove the retainer. Remove the nut (8) that secures the steering wheel to the shaft assembly (13); pull the steering wheel off the shaft assembly.

(4) Remove the four bolts (43) and lockwashers (42) that secure the cover (41) to the housing, remove the cover, gasket (46), and bearing cone (40).

Slide the shaft assembly out of the housing.

Note. **If the shaft will not slide out freely, tap the upper end with a light soft-faced hammer. Do not damage the shaft threads.**

(5) Remove the nut (44) from the adjuster (45) and the adjuster from the cover. Remove the plug (48) from the housing.

(6) Remove the spring (62) retainer (61), bearing assembly (60), retaining washers (59) and adapter (58) from the upper end of the housing. Unsolder the connection of the cable assembly (9) from the shaft assembly; remove the cable assembly. Remove the ferrule (10) from the shaft assembly. Pull the bearing cup (14) out of the housing assembly.

(7) Remove the retainer (28) from the housing. Inspect the bushing (27) for scoring, wear, or other damage; remove the bushing if damaged.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts of the steering gear in an approved cleaning solvent; dry with compressed air.

(2) Inspect all bearings for cracks, binding, rough operation, flat spots, wear, or other damage; replace damaged bearings.

(3) Inspect the housing for cracks, breaks, distortion, stripped threads, or other defects; retap threads as necessary; replace housing if damaged.

(4) Inspect the bushing (51) in the cover (54, fig. 48) for wear, burs, or scoring; replace as an assembly if the bushing is damaged.

(5) Turn the ball nut slowly up and down the full length of the worm gear on the shaft assembly and check for flat spots, rough operation, binding, wear, or other damage; replace a damaged shaft assembly.

(6) Inspect the shaft and gear assembly for scoring, nicks, or worn teeth; replace the shaft and gear assembly if damaged.

(7) Inspect the springs for distortion, loss of tension, or other damage; replace the springs if damaged.

(8) Discard all gaskets, preformed packings, and unserviceable parts.

d. Reassembly.

(1) If the bushing (27, fig. 48) was removed, position the new bushing on the housing and tap into place using a light hammer and a soft wooden block. Install the retainer (28).

(2) Insert the ferrule (12) into the shaft assembly (13); pass the cable assembly (9) down through the ferrule and out the opening provided in the side of the shaft assembly. Solder the cable assembly end to the collar on the shaft. Press the bearing cup (14) into the housing assembly (47). Insert the shaft assembly into the housing assembly. Make sure the nut on the threads of the shaft is centered before installing the shaft.

(3) Turn the adjuster (45) loosely into the cover (41); turn the nut (44) loosely onto the adjuster. Lubricate the bearing cone (40) with light oil. Position the bearing cone (40) in the adjuster. Position the new gasket (46) and assembled cover on the housing; secure in place using the bolts (43) and lockwashers (42).

(4) Insert the lash adjuster (52) into the end of the shaft and gear assembly (49) using a shim (53) that allows it to turn, but does not allow any end play. Position the cover (54), with bushing (51) installed, on the lash adjuster; with a screwdriver inserted through the threaded hole in the cover, turn the lash adjuster into the cover as far as possible.

(5) Lightly oil the gear teeth on the shaft and gear assembly (49). Place a new gasket (50) on the cover and position the cover on the housing being careful to engage the teeth on the shaft and gear assembly (49) with those on the shaft assembly (13). Secure with three bolts (56) and

lockwashers (57) Turn the nut (55) onto the lash adjuster.

(6) Position the adapter (58), bearing assembly (60), retaining washer (59), spring retainer (61) and spring (62) over the shaft assembly and into the housing assembly. Position the steering wheel (7) on the shaft assembly and secure with the nut (8).

(7) Position the retainer (6) in the steering wheel and under the horn contact; secure with the three screws (63). Place the cap (5) over the horn contact, and position the spring (4) and cup (3) on the retainer over the cap. Place the horn button (2) into the steering wheel so that its locking devices are alongside the retainer locking devices. Insert two small screwdrivers into opposite slots in the horn button; press down and turn the horn button clockwise until it is engaged. Press lip of cover (1) into hole in horn button (2) until cover is seated on button.

(8) Lubricate the steering gear. (See Lubrication Order, TM 10-3930-237-20).

e. Installation.

(1) Position the assembled steering gear into the support (36, fig. 48); aline the steering gear so that the bolt (24) can be inserted. Insert the bolt and secure the steering gear to the support with the nut (26) and lockwasher (25). Insert spacer (39) in slot in support. Clamp the support to the boss on the steering gear with the knurled bolt (38) and lockwasher (37).

(2) Position the pitman arm (29) on the shaft and gear assembly (49); secure with the lockwasher (30) and nut (31).

(3) Position the cushion (16) on the steering column. Secure the steering gear to the dash panel using the U-bolt (15), nuts (18), and lockwashers (17).

(4) Adjust the steering system as directed in f below. Swing the drag link into position and insert the ball on the pitman arm into the drag link socket. Tighten the plug in the drag link until there is no movement of the ball in the socket. Then back the plug off until the cotter pin can be positioned to secure the plug.

(5) Install the transmission control lever to the steering column (par. 23c).

(6) Replace the instrument panel (TM 10-3930-237-20).

f. Adjustment.

(1) *Centering the Steering Wheel.*

(a) Disconnect the drag link from the pitman arm. Note the relative position of drag link parts when disconnecting the link so the parts may be reassembled correctly.

(b) Check the lubricant level in the steering gear housing. If low, add enough lubricant to bring the level up to the plug (48, fig. 48).

(c) Tighten the housing assembly to the bolts.

(d) Determine the straight-ahead position of the steering mechanism by turning the steering wheel to the extreme right. Then turn to the extreme left, counting the exact number of turns from the right to the left end. Turn the steering wheel back one-half the number of wheel turns. Mark the steering wheel with respect to the steering column so the center position may readily be found during adjustment procedures.

Caution: **Approach the extreme ends cautiously; the ball nut must not strike the ends with any degree of force.**

(2) *Thrust adjustment.*

(a) Check the tightness of all cover bolts. If necessary, loosen the nut and turn the lash adjuster counterclockwise a few turns to provide the clearance between the shaft and gear assembly and the ball nut.

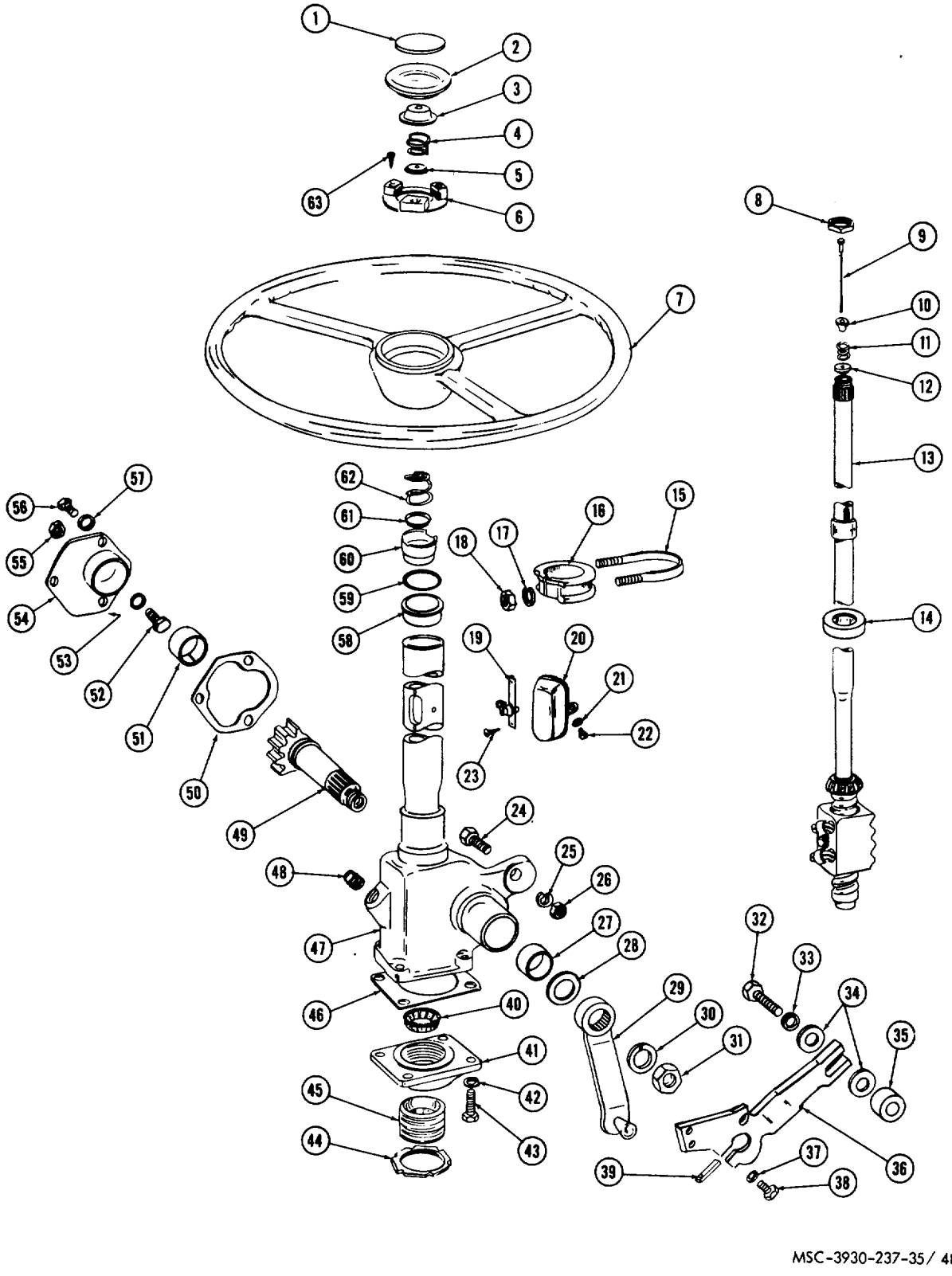


Figure 48. Steering gear, exploded view.

1	Cover	22	Screw	43	Bolts
2	Horn button	23	Screw	44	Nut
3	Cup	24	Bolt	45	Adjuster
4	Spring	25	Lockwasher	46	Gasket
5	Cap	26	Nut	47	Housing assembly
6	Retainer	27	Bushing	48	Plug
7	Steering wheel	28	Retainer	49	Shaft and gear assembly
8	Nut	29	Pitman arm	50	Gasket
9	Cable assembly	30	Lockwasher	51	Bushing
10	Ferrule	31	Nut	52	Lash adjuster
11	Spring	32	Bolt	53	Shim
12	Washer	33	Lockwasher	54	Cover
13	Shaft assembly	34	Washer	55	Nut
14	Bearing cup	35	Spacer	56	Bolt
15	U-bolt	36	Support	57	Lockwasher
16	Cushion	37	Lockwasher	58	Adapter
17	Lockwasher	38	Screw	59	Retaining washer
18	Nut	39	Spacer	60	Bearing assembly
19	Connector assembly	40	Bearing cone	61	Retainer
20	Cover	41	Cover	62	Spring
21	Lockwasher	42	Lockwasher	63	Screw

Figure 48. --Continued.

(b) Turn the steering wheel gently to one extreme end. Turn the steering wheel back one full turn. With the spring scale on a spoke of the steering wheel, measure the pull required to keep the steering wheel moving. The pull on the scale should be made at right angles to the spoke. If the pull is within 1½ to 2 pounds, proceed to the lash adjustment in (3) below. If the pull is not within 1½ to 2 pounds, loosen the nut (fig. 49) and then turn the adjuster (fig. 49) clockwise until all end play is removed. Using a spring scale as directed above, check the pull and readjust as necessary; then tighten the nut securely.

(3) *Lash adjustment.*

Note. **Always make the thrust adjustment as directed in (2) above before making the lash adjustment.**

(a) Position the steering gear mechanism in straight-ahead position as described in (1) above.

(b) Turn the lash adjuster (fig. 49) clockwise to remove all lash between the gear teeth. Tighten the nut. Position the spring scale on the steering wheel so that pull may be made at right angles to a wheel spoke.

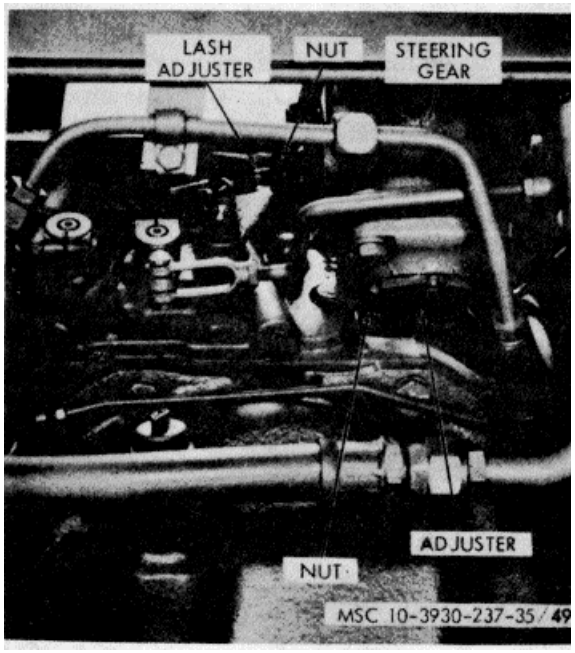


Figure 49. Steering gear adjustment.

(c) Measure the pull while the steering wheel is turned through the center position. Readjust the lash adjuster if the reading is not within 2½ to 3 pounds.

(d) Tighten the nut (fig. 49); recheck pull and readjust if necessary.

(e) After adjustments are made, install the drag link on the pitman arm.

Note. **If steering axle and linkage adjustment is necessary, do not install the drag link to the pitman arm. Adjust the axle and linkage (par. 31*f*).**

31. Steering Axle

a. Removal.

(1) Remove the counterweight (TM 10-3930-237-20).

(2) Block the drive wheels of the fork lift truck and jack the steering wheels clear of the floor. Remove the hub caps. Remove the two cotter pins (26, fig. 50) and nuts (25) that secure the wheel assemblies to the axle shaft; remove the wheel and bearings from the fork lift truck.

(3) Disconnect the rear drag link from the ball stud (7) by removing the cotter pin and turning the plug free of the ball stud. Swing the rear drag link clear of the steering axle assembly.

(4) Support the steering axle assembly with a jack and remove the four bolts (22) and lockwashers (21) that secure the steering axle assembly to the axle mounting blocks (17). Lower the steering axle assembly to the floor. Remove the two cotter pins (20), washers (16) and nuts (15) that secure the axle mounting blocks to the frame; remove the blocks.

b. Disassembly.

(1) Remove the cotter pins (2, fig. 50) and nuts (1) that secure the assembled tie rods to the steering knuckles (24) and to the spider (3); remove the tie rod assemblies.

(2) Loosen the nuts (11), that secure the rod ends (12) to the tie rod (10); remove the tie rod ends (12), nuts (11) and covers (13). Disassemble the other tie rod assembly in the same manner.

(3) Remove the retaining ring (4) that secures the spider (3) to the pin (19). Remove the thrust washers (5), bearing seals (6) and spider (3) from the pin. Press the bearing (9) from the spider.

(4) Drive the draw key (31) out of the steering knuckle assembly (36) using a drift pin. Puncture and pry out the expansion plugs (18).

(5) Drive the pin (32) out of the center assembly (35) to release the steering knuckle (24), thrust bearing (23), shim (27), and washer (28) from the center assembly.

(6) If the bearings (33) are damaged, drive them from the center assembly, (35) with a soft drift.

(7) Remove the stop screws (29) and nuts (30) from the steering knuckles (24). Remove grease fittings (8, 14 and 34).

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts of the steering axle assembly; except the bearings, in an approved cleaning solvent; dry thoroughly with compressed air.

(2) Clean the bearings by placing them in a wire basket and agitating them in an approved cleaning solvent. Dry thoroughly with compressed air, taking care that the air pressure does not spin the dry bearings.

(3) Inspect all parts for cracks, breaks, distortion, or other damage; replace damaged parts.

(4) Inspect the bearings for scoring or wear; replace damaged bearings.

(5) Inspect the pins (32, fig. 50) for wear, scoring, or distortion; replace damaged pins.

(6) Inspect the axle mounting blocks for cracks, distortion, worn pivot shafts, and damaged threads, replace damaged blocks.

(7) Clean the grease fittings with a fine wire to dislodge any hardened grease accumulations.

d. Reassembly.

(1) Press the bearings (33, fig. 50) into the steering knuckle supports on the center assembly (35).

(2) Position the thrust bearing (23), steering knuckle (24), and washer (28) on the center assembly bracket. If the steering knuckle-to-bracket end play exceeds 0.015 inch, add one shim (27) between the washer (28) and steering knuckle. Tap the pin (32) down through the steering knuckle so that the draw key (31) will pass through the slot in the pin. Drive in the draw key and stake it in place.

(3) Position the expansion plugs (18) on the center assembly bracket. Tap the expansion plugs flush with the side of the center assembly bracket and stake in place.

(4) If removed, press the bearing (9) into the spider (3). Slide the lower thrust washer (5) and seal (6) onto the pin (19). Position the spider (3), upper thrust washer (5), seal (6) and retaining ring (4) onto the pin.

(5) Install the two nuts (11) on the two tie rod ends (12). Turn the tie rod ends into the tie rod (10). Position the tie rod assembly into the steering knuckle and spider with covers (13) over the tie rod end and secure nuts (11); secure with nuts (1) and cotter pins (2). Reassemble the other tie rod in the same manner.

(6) Replace grease fittings (8, 14 and 34) and the two stop screws (29) and nuts (30).

e. Installation.

(1) Position the axle mounting blocks (17, fig. 50) into the holes provided in the fork lift truck frame and secure with the nut (15), washer (16), and cotter pin (20). Raise the steering axle assembly so that the brackets provided on it are in line with the axle mounting blocks. Secure the steering axle assembly to the axle mounting blocks with the four bolts (22) and lockwashers (21).

(2) Connect the rear drag link to the ball stud (7) and secure with the drag link plug and cotter pin.

(3) Replace the wheel assemblies and bearings and secure with nuts (25) and cotter pins (26).

f. Steering Axle and Linkage Adjustment.

(1) Raise the steering wheels from the floor.

(2) Remove the rear drag link from the steering axle spider ball stud.

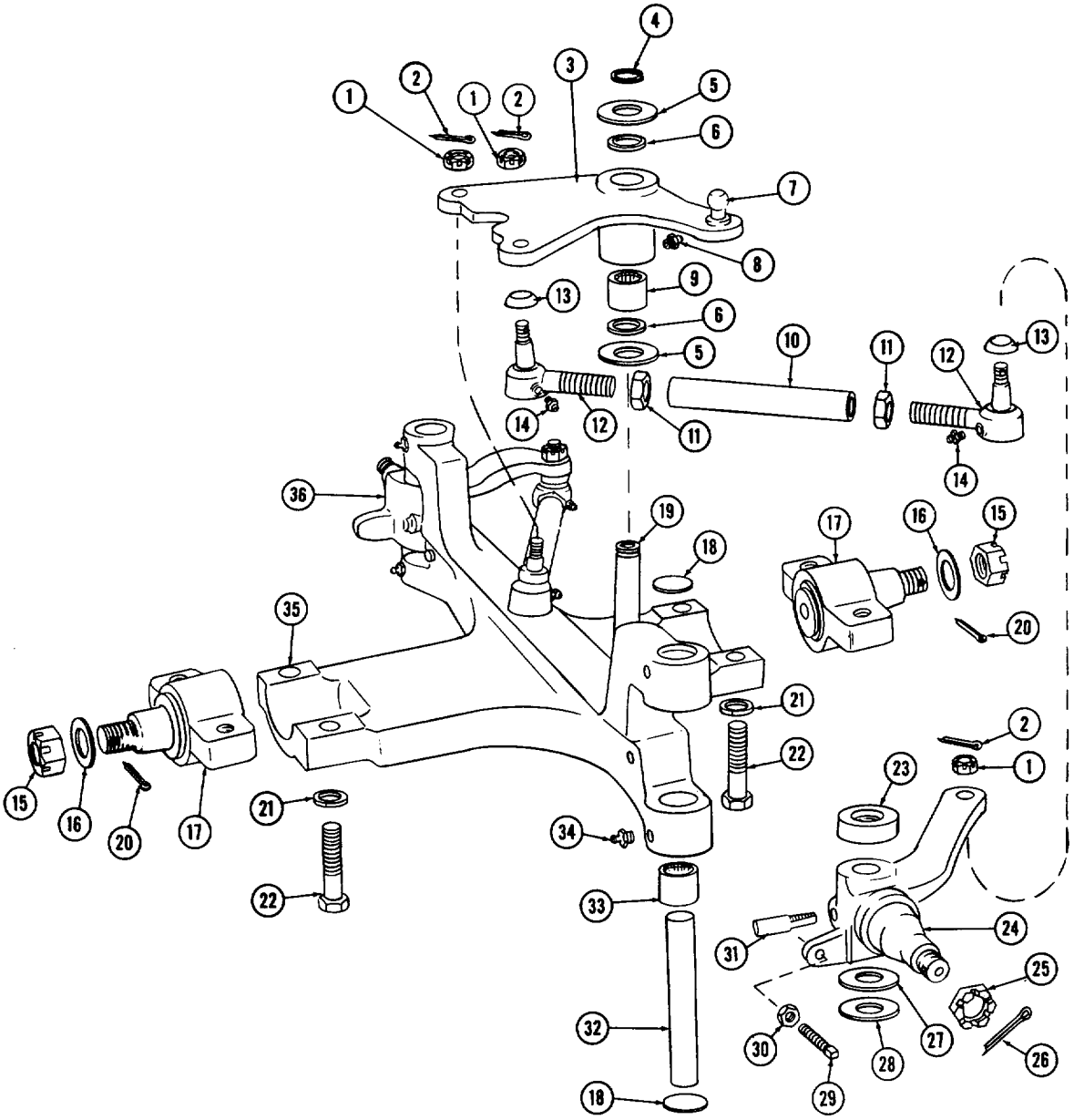
(3) Check the steering wheels for correct turning geometry, by turning the wheels all the way to the left. This should allow the righthand steering wheel to attain an angle of 750 to the frame. If adjustment is necessary, the axle stop screw (fig. 51) on the front side of the steering knuckle is turned in or out, whichever is necessary to achieve the correct angle. Repeat this procedure with the left wheel.

(4) After adjusting the stop screws, check steering wheel alinement. Place the steering wheels in the straight-ahead position. The steering wheels should track squarely with the drive wheels with no toe-in or toe-out. If adjustment is necessary, adjust the alinement of the steering wheels by running one tie rod end from the spider, loosening the locknuts (11, fig. 50) and turning the tie rods until the wheels are in alinement.

Note. **Tie rods should be adjusted the same length. Adjust both tie rods until the wheels are in alinement; then tighten the lock nuts to secure adjustment.**

(5) With the steering wheels in full leftturn position, attach the rod end of the drag link to the spider ball stud and tighten.

(6) Turn the steering wheel all the way to the left. Turn the steering wheel one-quarter turn clockwise, loosen the nut on the adjustable end of the drag link, and turn the rod end until the grease fitting on the rod end lines up with the



1 Nut
2 Cotter pin
3 Spider
4 Retaining ring
5 Thrust washer
6 Seal
7 Ball stud
8 Grease fitting
9 Bearing
10 Tie rod
11 Nut
12 Tie rod end
13 Cover
14 Grease fitting
15 Nut
16 Washer
17 Axle mounting block
18 Expansion plug
19 Pin
20 Cotter pin
21 Stop screw
22 Nut
23 Lockwasher
24 Bolt
25 Thrust bearing
26 Steering knuckle
27 Nut
28 Cotter pin
29 Shim
30 Washer
31 Draw key
32 Pin
33 Bearing
34 Grease fitting
35 Center assembly
36 Steering knuckle assembly

Figure 50. Steering axle, exploded view.

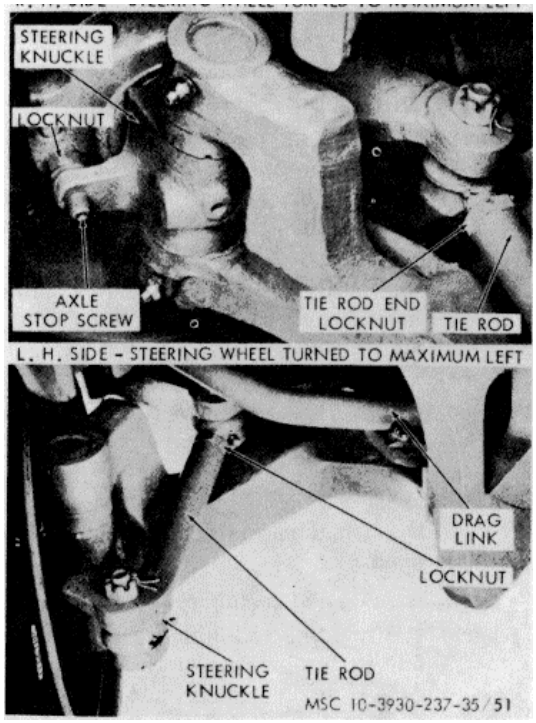


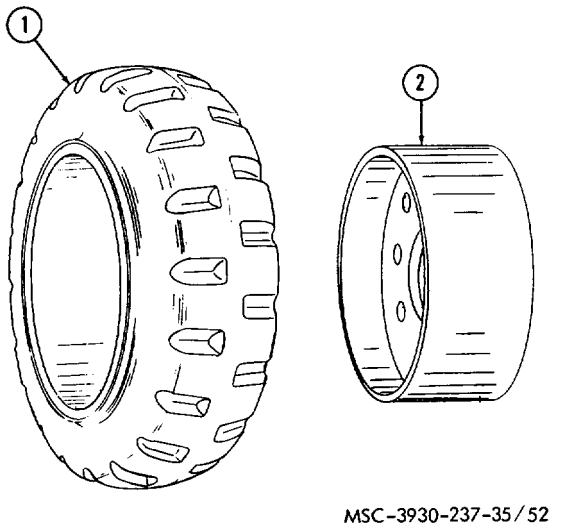
Figure 51. Steering axle and linkage adjustment.

ball on the pitman arm. Install and tighten the nuts on the clamp bolts.

(7) Turn the steering wheel until the steering wheels are in a straight-ahead position. Remove the steering wheel and replace on the steering column with the center spoke alined, plus or minus 10°, with the center line of the truck (par. 30).

32. Steering Wheel

a. Disassembly. Press steer wheel tires (1, fig. 52) from steer wheels (2).



1 Tire assembly **2 Steer wheel**

Figure 52. Steer wheel assembly, exploded view.

b. Cleaning, Inspection and Repair.

(1) Clean steer wheel and metal base of tire assembly with an approved cleaning solvent and dry with compressed air.

(2) Inspect steer wheels for cracks, breaks, and elongated mounting holes.

(3) Inspect steer wheel tires for wear, cracks and separation from metal base.

(4) Discard damaged parts and reassemble as in c below.

c. Reassembly. Press steer wheel tires (1, fig. 52) onto drive wheels (2) until metal base of tire assembly is flush with outer edge of steer wheel.

Section VIII. BRAKE SYSTEM

33. General

a. The fork lift truck uses a hydraulically operated, externally expanding, two wheeled, self-adjusting, service brake system that consists of the brake pedal and linkage, master cylinder, and a wheel cylinder and service brake assembly mounted at each end of the drive axle.

b. The hand brake mechanism is a hand-operated mechanical system that consists of the handle mounted to the right of the operators

seat, the linkage, a V-type drum mounted on the end of the transmission pinion shaft, and an inverted V-type brake shoe mounted on the transmission cover with the necessary linkage to press the shoe into the drum to hold the vehicle.

c. There are no adjustment required on the service brake assemblies except on the length of the brake master cylinder stroke. The required adjustments on the hand brake mechanism are made through an access opening in the transmission housing. All adjustments of the brake system are covered in TM 10-3930-237-20.

34. Hand Brake Mechanism

a. Removal and Disassembly.

(1) Remove the engine (par. 10a).

(2) Remove right side tilt cylinder (TM 10-3930-237-20).

(3) Disconnect the hand brake linkage from the arm and shaft assembly (TM 10-3930-237-20).

(4) Remove the spring (4, fig. 53) from the lever (14) and spring screw (6).

(5) Remove the retaining ring (11) and washer (10) from the arm and shaft assembly (9). Remove the cotter pin (7) and washer (8) from the draw rod (12); slide the arm and shaft assembly out of the transmission housing and off the draw rod.

(6) Remove the two cap screws (17) and lockwashers (18) that secure the assembled housing to the transmission cover; remove the housing assembly. Remove the spring screw (6) and lockwasher (5).

(7) Turn the draw rod (12) out of the sleeve (13) and the nut (15) off of the sleeve; remove the sleeve from the lever (14). Using a drift pin, drive the pin (16) out of the housing (3) and lever; remove the lever, brake shoe (1), and retaining spring (2) from the housing. Position the brake shoe and lever assembly so that the cam on the lever is up; tap the cam down and out of the brake shoe bracket and remove the retaining spring (2).

b. Cleaning, Inspection, and Repair.

(1) Discard the preformed packing.

(2) Clean all parts of the hand brake mechanism in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Inspect the brake shoe for overheating, scoring, wear, incorrect alinement, or other damage; replace a damaged brake shoe.

(4) Inspect all metal parts for burs, cracks, breaks, distortion, or other damage; replace damaged parts.

(5) Inspect the splines on the arm and shaft assembly for damage; replace the arm and shaft assembly if damaged.

c. Reassembly and Installation.

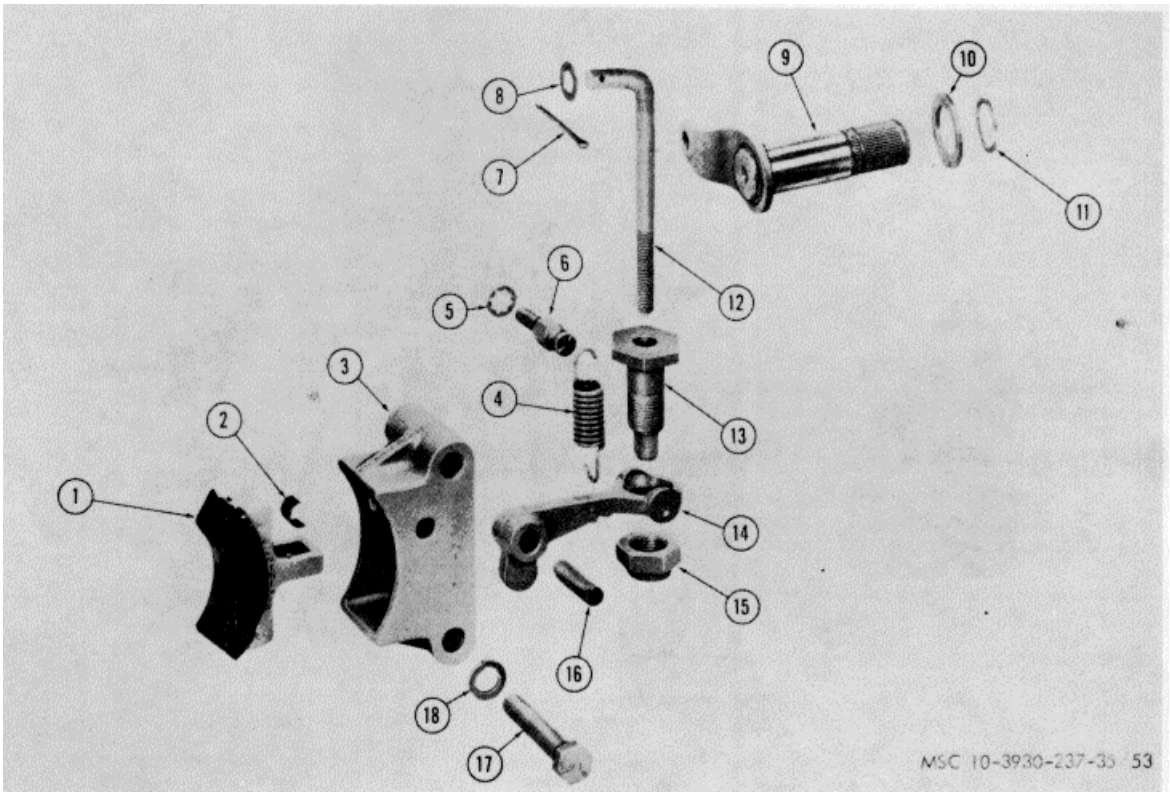
(1) Position the retaining spring (2, fig. 53) in the bracket of the brake shoe (1). Position the cam of the lever (14) on the bracket and force it down into the bracket. Place the assembled brake shoe and lever into the housing (3) and drive the pin (16) through the hole in the housing and lever to secure the brake shoe and lever assembly.

(2) Place the assembled housing on the transmission cover and secure it with the cap screw (17) and lock washer (18). Install the spring screw (6) and lockwasher (5) on the transmission cover.

(3) Turn the draw rod (12) into the sleeve (13); place the sleeve through the hole provided in the lever and turn the nut (15) onto the sleeve.

Note. **Allow some free movement in the lever sleeve hole when placing the nut on the sleeve.**

(4) Slide the arm and shaft assembly (9) through the transmission housing; position the draw rod into the hole provided on the arm and secure the draw rod with the washer (8) and cotter pin (7). Secure the arm and shaft assembly to the transmission cover by placing the washer (10)



1	Brake shoe	7	Cotter Din	13	Sleeve
2	Retaining spring	8	Washer	14	Lever
3	Housing	9	Arm and shaft assembly	15	Nut
4	Spring	10	Washer	16	Pin
5	Lockwasher	11	Retaining ring	17	Capscrew
6	Spring screw	12	Draw rod	18	Lockwasher

Figure 53. Hand brake mechanism, exploded view.

on the shaft and securing with the retaining ring (11). Position the spring (4) over the spring screw and lever.

(5) Install the engine (par. 10b).

(6) Install right side tilt cylinder (TM 10-3930-237-20).

(7) Connect and adjust the hand brake handle assembly and linkage (TM 10-3930-237-20).

35. Service Brakes

a. Disassembly.

(1) Remove the brake assembles (TM 10-3930-237-20).

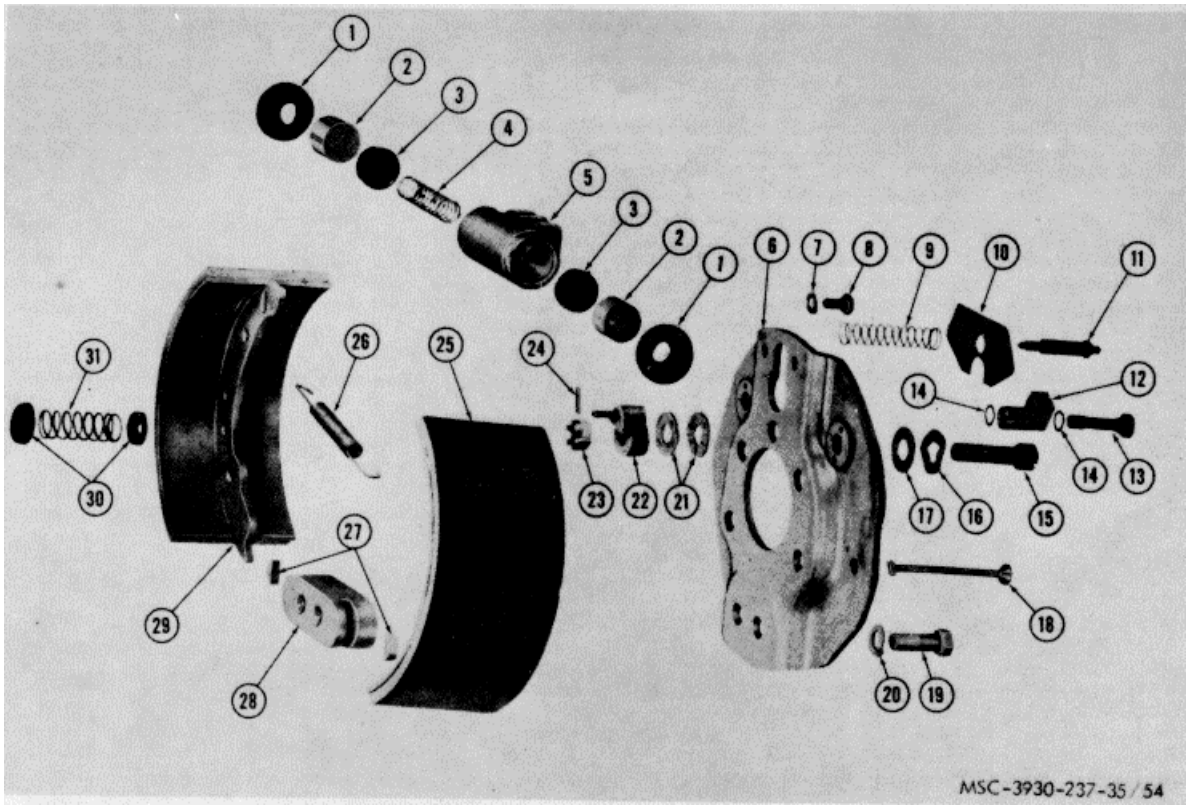
(2) Remove the two cap screws (8, fig. 54) and lockwashers (7) that secure the wheel cylinder to the disk (6); remove the wheel cylinder.

(3) Remove the retainer cups (30) and springs (31) from the guide pins (18). Remove the guide pins. Remove the two springs (26), brake shoes (29), and lining (25). Remove the keys (27) from the anchor block (28).

(4) Remove the bolt (19) and lockwasher (20) that secure the anchor block to the disk (6); remove the anchor block. Remove the pin (24) from the adjusting bolt (15); remove the nut (23), reaction arm (22), index washer (21), washer (17), wave washer (16), and adjusting bolt.

b. Cleaning, Inspection, and Repair.

(1) Wire-brush the brake shoes. Remove oil or grease with an approved cleaning solvent.



1	Boot	8	Cap screw	14	Gasket	20	Lockwasher	26	Spring
2	Piston	9	Spring	15	Adjusting bolt	21	Index washer	27	Key
3	Piston cup	10	Dust shield	16	Wave washer	22	Reaction arm	28	Anchor block
4	Spring	11	Bleeder screw	17	Washer	23	Nut	29	Brake shoe
5	Cylinder	12	Fitting	18	Guide pin	24	Pin	30	Retainer cup
6	Disk	13	Bolt	19	Bolt	25	Lining	31	Spring
7	Lockwasher								

Figure 54. Service brake assembly, exploded view.

(2) Clean all other parts of the service brake in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Inspect all metal parts of the service brake for cracks, breaks, distortion, or other damage; replace damaged parts.

(4) Inspect the brake lining for wear, scoring, distortion, or other damage; replace and rebond worn or damaged brake lining.

(5) Inspect the brake drum for scoring, overheating, out-of-round, wear, or other damage; replace a badly worn or scored brake drum. Turn down a drum to repair other damage.

(6) Remove any glazed spots from the brake lining by rubbing with a hard wire brush.

c. Reassembly.

(1) If the brake shoes were relined or the drums turned down, replace the reaction arm (22, fig. 54).

(2) Position the adjusting bolt (15), wave washer (16), washer (17), index washer (21), and reaction arm on the disk (6); secure with the nut (23) and a new pin (24).

(3) Position the wheel cylinder on the disk and secure with the capscrews (8) and lock washers (7). Position the anchor block (28) on the disk and secure with the bolts (19) and lock washers (20).

(4) Position the brake shoes (29) in the anchor block with the keys (27) and

over the reaction arms; secure with the two springs (26)

(5) Insert the guide pin (18) through the disk and brake shoe; position the retainer cups (30) and springs (31) on the guide pin to secure the brake shoes against the disk.

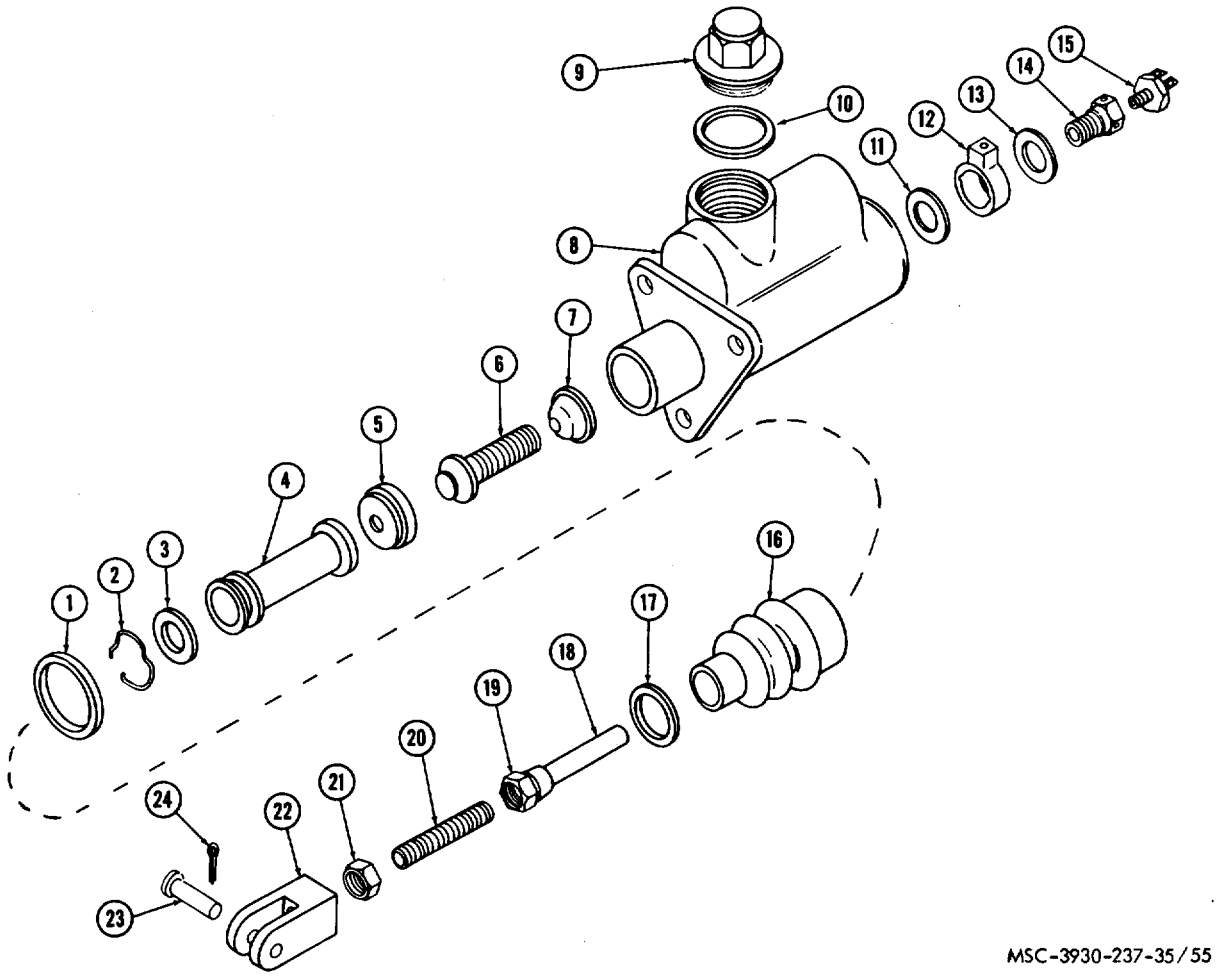
36. Brake Master Cylinder

a. Disassembly.

(1) Remove the brake master cylinder (TM 10-3930-237-20).

(2) Remove the cotter pin (24, fig. 55), clevis pin (23), clevis (22), and nut (21) from the stud (20). Remove the stud from the push rod (18) and remove the nut (19) from the stud. Slide the retaining ring (17) off the bellows (16); pull the push rod (18) out of the piston (4) through the bellows. Spread open the other retaining ring (1) and slide it off the bellows. Remove the bellows and retaining ring from the tank (8).

(3) Using a small screwdriver, pry the lock wire (2) and the stop plate (3) from the tank. Remove the switch (15) bolt (14), gasket (11 and 13),



1	Retaining ring	7	Check valve assembly	13	Gasket	19	Nut
2	Lock wire	8	Tank	14	Bolt	20	Stud
3	Stop plate	9	Cap	15	Switch	21	Nut
4	Piston	10	Gasket	16	Bellows	22	Clevis
5	Cup	11	Gasket	17	Retaining ring	23	Clevis pin
6	Spring	12	Outlet fitting	18	Push rod	24	Cotter pin

Figure 55. Brake master cylinder, exploded view.

and outlet fitting (12) from the other end of the tank.

(4) Insert a rod into the opening from which the plug and outlet fitting were removed; push the piston (4), primary cup (5), spring (6), and check valve assembly (7) out of the tank. Remove the cap (9) and gasket (10) from the tank filling opening.

b Cleaning, Inspection, and Repair.

(1) Discard the piston, cup, check valve, and bellows.

(2) Clean all other metal parts of the brake master cylinder in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Inspect the tank for cracks, distortion, and damaged threads. Check the bore of the tank for pitting or scoring. Replace if damaged.

(4) Inspect the piston for cracks, wear, or scoring; replace if damaged.

c. Reassembly.

(1) Position the check valve assembly (7, fig. 55) on the spring (6); slide the check valve cup (5), and piston (4) into the tank (8). Place the stop plate (3) on the piston and secure with the lock wire (2).

(2) Place the retaining ring (1) on the tank (8), slide the bellows (16), with the vent hole down, onto the boss until it fits down into the groove provided. Position the retaining ring over the end of the bellows to secure it to the tank.

(3) Turn the nut (19) onto the stud (20), and the stud into the push rod (18); lock in position with the nut (19). Slide the assembled push rod into the piston through the bellows. Position the bellows over the push rod boss and secure it with the retaining ring (17).

(4) Position the gasket (11), outlet fitting (12), and gasket (13) on the bolt (14); turn the assembled bolt and fitting into the tank (8), and secure it tightly. Install switch (15) into bolt (14) and secure.

(5) Position the gasket (10) on the cap (9) and turn the cap into the tank.

(6) Turn the nut (21) and clevis (22) onto the stud; lock the clevis in position with the nut. Insert the clevis pin (23) into the clevis and secure with the cotter pin (24).

(7) Cover the opening in the plug to keep dirt out.

(8) Install and adjust the brake linkage (TM 10-3930-237-20).

37. Wheel Cylinder

a. Removal and Disassembly.

(1) Remove the brake assemblies (TM 10-3930-237-20).

(2) Disconnect the spring (26, fig. 54) from the brake shoes (29); spread the brake shoes apart so that the wheel cylinder is clear. Remove the two cap screws (8) and lockwashers (7) that secure the wheel cylinder to the disk (6); remove the wheel cylinder.

(3) Pull the boots (1) from the cylinder (5) and push the pistons (2), piston cups (3), and spring (4) out of the cylinder. Turn the bleeder screw (11) and bolt (13) out of the cylinder; remove the fitting (12) and gaskets (14).

b. Cleaning, Inspection, and Repair.

(1) Discard the boots and pistons.

(2) Clean all parts of the wheel cylinder with hydraulic brake fluid; dry thoroughly.

(3) Inspect the cylinder for scoring, pits, burs, or wear by holding the cylinder up to a strong light and looking through it; replace the cylinder if damaged.

(4) Inspect all other parts of the wheel cylinder for cracks, breaks, distortion, burs, scoring, or other damage; replace damaged parts.

(5) Remove any cleaning residue with crocus cloth or jeweler's rouge.

(6) Check for proper clearance between the piston and cylinder by sliding the piston into the

cylinder and checking with a wire feeler gage. Replace the cylinder and piston if clearance is greater than 0.005 inch.

c. Reassembly and Installation.

(1) Insert the spring (4, fig. 54), two piston cups (3), and pistons (2) into the cylinder (5). Position the boots (1) on the cylinder and pistons.

(2) Place the assembled cylinder on the disk (6); secure with the two cap screws (8) and lockwashers (7).

(3) Insert the bleeder screw (11) into the cylinder. Position two new gaskets (14) in the fitting (12) and cylinder, and secure the fitting to the cylinder using the bolt (13).

(4) Position the springs (26) on the brake shoes.

(5) Install the brakes (TM 10-3930-237-20).

38. Brake Pedal and Linkage

a. Removal.

(1) Remove the right tilt cylinder (TM 10-3930-237-20).

(2) Remove the cotter pin (24, fig. 55) and clevis pin (23) that secure the brake master cylinder push rod clevis to the brake pedal.

(3) Remove the spring (2, fig. 56) from the brake pedal and bracket on the fork lift truck chassis. Turn the grease fitting out of the pin (4).

(4) Using a drift pin, drive the pin out of the pedel and bracket.

(5) Using a drift pin, drive the pin (3) through the bracket in the truck frame and into the pin (4). Remove the pedal from the truck, remove pin (3) from pin (4).

b. Cleaning and Inspection.

(1) Clean all parts of the brake pedal in an approved cleaning solvent. Dry thoroughly with compressed air.

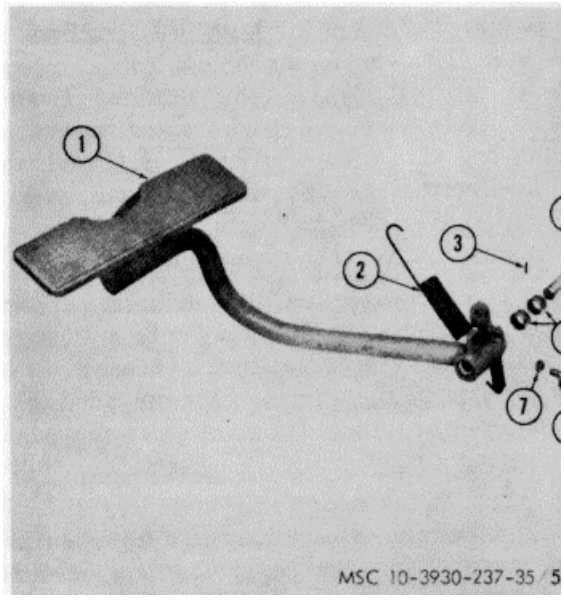
(2) Inspect all parts of the brake pedal for cracks, breaks, distortion, or other damage; replace damaged parts.

c. Installation.

(1) Position the brake pedal (1, fig. 56) into the bracket provided; drive the pin (4) into the bracket and pedal to secure them together.

Note. **Be sure the pin hole in the pin (4) is alined with the pin hole in the frame bracket. Turn the grease fitting into the pin. Drive pin (3) into bracket on truck frame far enough to engage pin hole in pin (4).**

(2) Attach the clevis (22, fig. 55) on the brake master cylinder push rod to the bracket provided on the pedal; secure with the clevis pin (23) and cotter pin (24). Connect the spring (2, fig. 56) to the bracket provided on the pedal and connect to the truck frame.



1	Brake pedal	4	Pin	6	Stop bolt
2	Spring	5	Bearings	7	Nut 3 Pin

Figure 56. Brake pedal, exploded view.

Section IX. SEAT

39. General

The fork lift truck is equipped with an adjustable (front to rear) seat comprised of a frame, seat cushion and backrest cushion. The seat and backrest cushions are removable (TM 10-3930-237-20).

40. Seat and Backrest Cushions

a. Removal. Remove the seat and backrest cushions (TM 10-3930-237-20).

b. Inspection. Inspect the seat and backrest cushions for cracks, tears, loose or missing staples and damaged mounting boards.

c. Repair. Patch small tears with a suitable tape and replace loose or missing staples. Reupholster if excessive amount of cushion filler is missing.

Section X. HYDRAULIC SYSTEM

41. General

a. The hydraulic system consists of an oil reservoir, hydraulic pump, control valve, tiltlock valve, one single-action lift cylinder, two double-action tilt cylinders, and various lines and connections. The hydraulic oil is drawn from the reservoir by a pump mounted on the engine at the right side of the gear cover. The oil is forced through the high pressure lines to the control valve. When the control levers are in the neutral position, the oil flows though the control valve and back to the reservoir. When one of the control levers is moved, the oil is diverted through the various lines and connections to the corresponding cylinder or cylinders to perform the desired motion.

b. The single-action lift cylinder applies force in an upward direction only and is returned to its lowered position by the weight of the carriage or the weight of the unloaded mast assembly when the control lever is moved to the lowering position.

c. The double-action tilt cylinders tilt the upright forward or backward to aid in spotting and transporting the load. The upright and load are held in position by a tilt-lock valve that prevents cylinder movement when the engine is stopped, thereby preventing the tilting forward and dropping of a load through accidental movement of the tilt control lever.

42. Hydraulic Pump Assembly

a. Removal.

(1) Remove the two bolts and lockwashers that hold the hose flange to the main hydraulic pump (fig. 1). Cover the flange opening to prevent dirt from entering the hydraulic system.

(2) Remove the hose from the tee; remove the connector from the pump cover. Plug the hose to prevent dirt from entering the hydraulic system.

(3) Remove the five bolts (7 and 11, fig. 31) and lockwashers (2 and 12) and the nut (13) that secure the pump mounting plate (28) to the engine; remove the assembled pump, pump mounting plate and gasket (26).

(4) Remove the nut (9, fig. 57) that secures the pump drive gear to the shaft (11); pull the drive gear from the shaft and remove the key (7).

(5) Remove the two nuts and lockwashers that secure the pump to the pump mounting plate; remove the pump.

b. Disassembly.

(1) Match-mark the cover (1, fig. 57), ring (14), and body (13) with a prick punch to assure proper reassembly of the pump.

(2) Remove the four bolts (17) that hold the cover and ring to the body; remove the cover (1), spring (2), pressure plate (16), pins (3), ring (14), and preformed packings (5). Remove the vanes (4) from the rotor (15) and remove the rotor from the shaft (11).

(3) Remove the retaining ring (8) and press on the splined end of the shaft to remove the assembled shaft and bearing (10), being careful

to protect the shaft with a soft board.

(4) Press the bearing (10) from the shaft, being careful to support the inner races of the bearing.

(5) Pry the seal (12) from the body with a thin, hooked tool. Tap the bearing (6) out of the body with a drift inserted through the shaft hole in the body.

c. Cleaning and Inspection.

(1) Discard the seal and preformed packings.

(2) Thoroughly clean all parts of the pump assembly, except the bearings, in an approved cleaning solvent; shake excess solvent from the parts and dry with compressed air.

(3) Clean the bearings by placing them in a wire basket and agitating them in clean solvent. Dry with compressed air taking care not to spin the dry bearings. Dip in engine oil to lubricate the bearings.

Caution: **Do not use a cloth to wipe the pump parts because lint trapped in the parts can enter the hydraulic system at reassembly.**

(4) Inspect the ring, rotor, and vanes for wear, scoring, distortion, or other damage. Replace the ring, rotor, and vanes in complete sets only, if damaged.

Note. **No side play is allowable in vane movement in the rotor slots.**

(5) Inspect the face of the pressure plate that rides on the vanes for scoring. Lap out scores with crocus cloth. Replace the pressure plate if scores cannot be removed.

(6) Inspect the bearings for wear, pitting, and looseness; replace damaged bearings.

d. Reassembly.

(1) Replace the seal and preformed packings.

(2) Immerse all pump parts in clean hydraulic oil to lubricate them before assembly.

(3) Stand the shaft (11, fig. 57) on a soft wood board and press on the bearing (10) using an arbor press with a driver that only touches the inner race. Lay the body (13) on a clean cloth with the bearing housing up. Position the bearing (6) and press it into the housing using an arbor press with a driver that contacts only the outer race of the bearing.

Caution: **Do not damage the splines or threads on the shaft while positioning the bearing.**

(4) Position the seal (12), with the sealing lip inward on the seal housing of the body. Seal the seal firmly using on arbor press with a driver that touches on the outer diameter of the seal only.

(5) Tape the shaft splines with a thin, smoother layer of cellophane tape. Carefully slide the shaft and bearing into the seal side of the body, splined end first. Tap the threaded end of the shaft lightly with a lead mallet to be sure the shaft is firmly seated. Remove the tape from the shaft. Position the retaining ring (8) in the body.

Caution: **Take care not to damage the sealing lip of the seal when inserting the shaft.**

(6) Install the preformed packing (5) on the cover and the body. Position the ring (14), correctly orienting the punch marks on the body. Insert the two pins (3) through the ring and into the body to hold the ring in place. Slide the rotor (15) onto the splines of the shaft so that the slots face out. Insert the 12 vanes (4) into the slots of the rotor with their curved edges out.

(7) Stand the pump on the body end and position the pressure plate (16) on the pins. Slide the pressure plate down until it firmly contacts the ring. Place the spring (2) into the hole provided in the pressure plate. Position the cover (1), correctly orienting it to the punch marks on the

ring; slide it down on the pins until it firmly contacts the ring. Insert the four bolts (17) and torque them evenly to 65 to 75 foot-pounds.

e. Installation.

(1) Position the gasket (26, fig. 31) and pump on the pump mounting plate (28) of the engine; secure to the studs on the plate with two nuts and lockwashers.

(2) Position the key (7, fig. 57) and the pump drive gear on the end of the pump drive shaft; secure with the nut (9).

(3) Position the assembled pump and pump mounting plate on the backing plate (23, fig. 31) of the engine; make sure the pump drive gear properly engages the driving gear. Secure with the five bolts (7 and 11) and lockwashers (2 and 12) and the nut (13).

(4) Turn the connector with the tee into the pump assembly cover. Connect the hose to the tee.

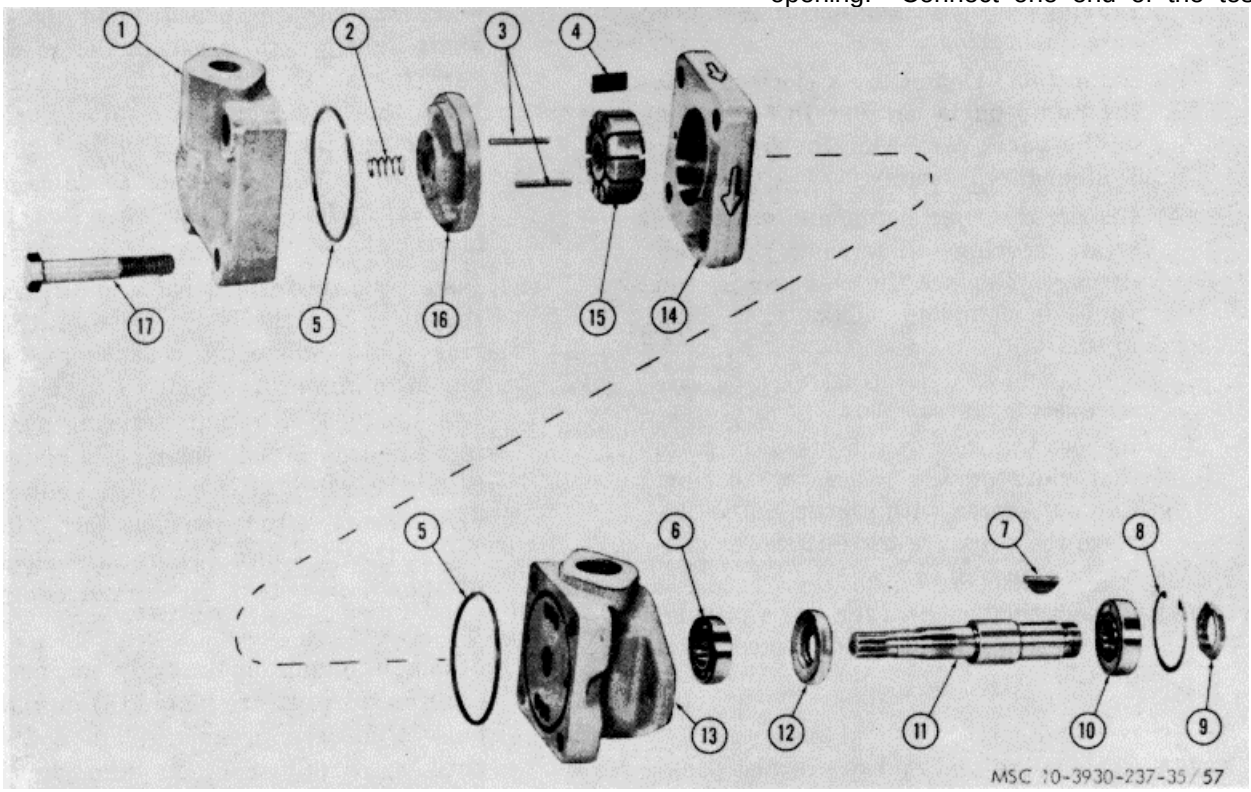
(5) Position the flange on the port of the pump assembly body; secure the flange with two nuts and lockwashers.

f. Testing.

(1) Connect tachometer (fig. 58). Set lobe switch to 4-lobe position.

(2) Disconnect pressure hose from hydraulic pump and plug hose end. Connect one end of test hydraulic pressure hose to hydraulic pump and other end to inlet side of flow tester, Clark Part No. 1800060 (fig. 58). Be sure all connections are tight.

(3) Disconnect reservoir return line hose at the hydraulic control valve and plug the valve opening. Connect one end of the test return



1	Cover	5	Preformed packing	9	Nut	12	Seal	15	Rotor
2	Spring	6	Bearing	10	Bearing	13	Body	16	Pressure plate
3	Pin	7	Key	11	Shaft	14	Ring	17	Bolt
4	Vane	8	Retaining ring						

Figure 57. Hydraulic pump assembly, exploded view.

hose to the reservoir return hose and the other end to the outlet side of the flow tester. Be sure all connections are tight.

(4) Set flow tester orfice selector handle (fig. 58) on 0-30 gpm position (maximum clockwise).

(5) Turn tester load valve (fig. 58) to fully open position by turning all the way to the left (maximum counterclockwise).

Caution: **Load valve is capable of extremely high pressure and must be in the**

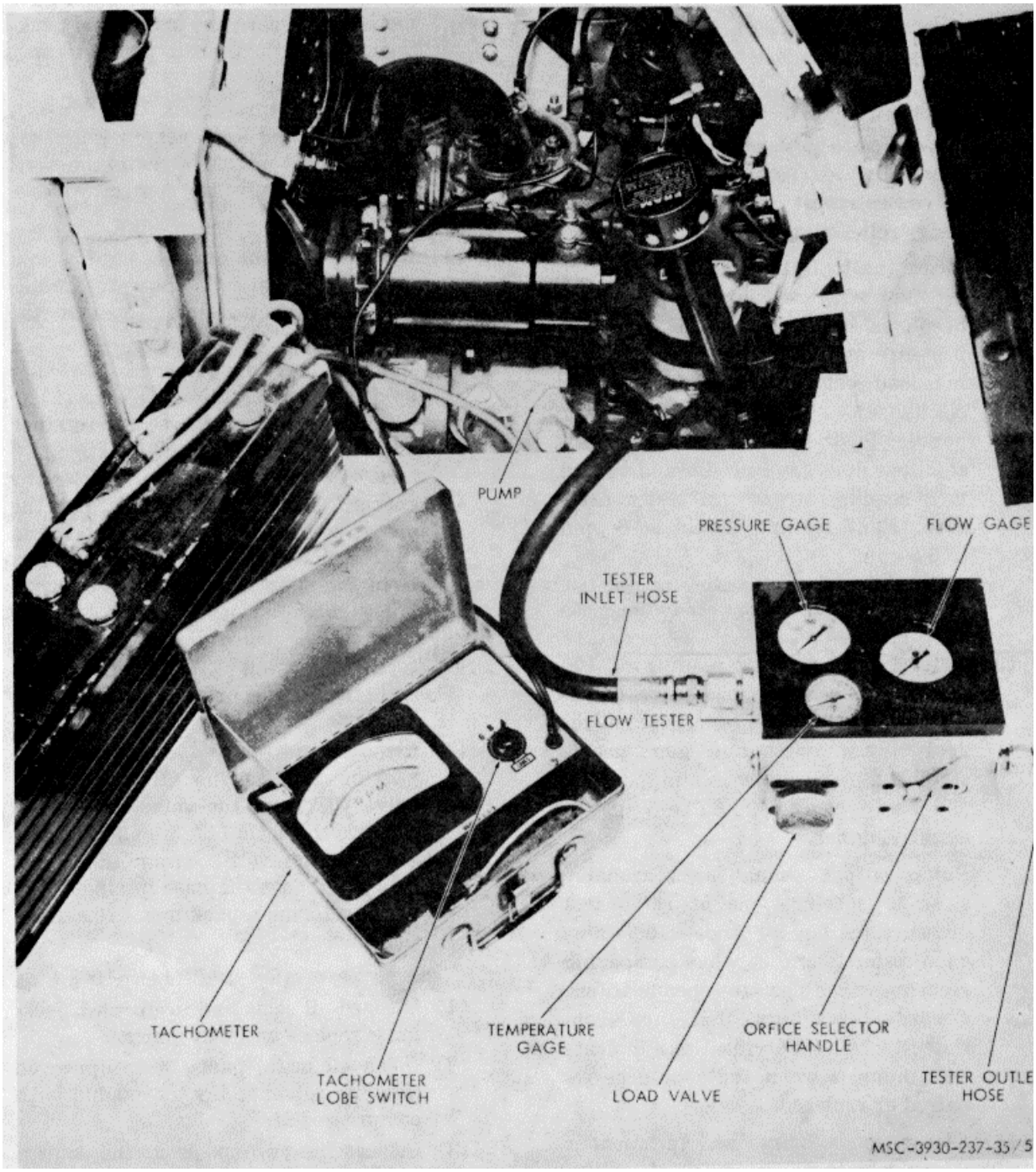


Figure 58. Testing hydraulic pump.

fully open position before starting test. Do not exceed prescribed test pressures when conducting test.

(6) Start the vehicle engine and set the engine speed at 1450 RPM.

(7) Bring the hydraulic oil to the test temperature of 130° F. by gradually applying the load valve (turning clockwise) until the fluid pressure reaches 1000 psi.

Caution: **Apply load valve pressure gradually as rapid application of valve can result in "blowing out" the tester relief plug.**

(8) After the hydraulic oil is brought to test temperature and the flow gage needle is stabilized, gradually reduce pressure at tester to 100 psi by turning load valve to the left (counter clockwise). Turn orfice selector handle to the left (10 gal scale), stabilize flow gage needle and record flow reading at 100 psi tester pressure. Flow reading should be 6 gpm to 6.5 gpm.

Note. **It will be necessary to maintain engine speed of 1450 rpm when testing pump under load.**

(9) After recording flow reading at 100 psi, gradually apply load valve (turning clockwise) until pressure stabilizes at 1000 psi. With flow gage needle stabilized, record flow reading at 1000 psi. Flow reading should be 5 gpm or slightly higher.

(10) Pump output should be reasonably close to specifications at rated test pressure. Allow + or 10 % flow gage tester tolerance when comparing recorded readings to specifications. Recorded readings that are consistently below specifications indicate that pump is worn and should be repaired or replaced.

(11) Disconnect test lines and tachometer. Connect hydraulic pump pressure line to pump and reservoir return line to hydraulic control valve.

43. Hydraulic Control Valve

a. Removal.

(1) Remove the hydraulic control levers and linkage (par. 45a).

(2) Remove the five hydraulic line connections from the control valve; remove and discard the preformed packings. Cover the lines to prevent entry of dirt.

(3) Remove the three bolts (23, fig. 59), nuts (19), and lockwashers (20) that secure the control valve to the fork lift truck; remove the control valve.

b. Disassembly.

(1) Remove the four nuts (8, fig. 59) and studs (22) that hold the valve bodies (14 and 21) together; separate the valves.

(2) Remove the four screws (32) that hold the retainer (1) and sleeve (2) to the valve bodies; remove the retainer and sleeve, preformed packings (3 and 4), and spring (5). Slide the spools (7) out of the valves. Tag the spools so that they can be replaced in the same valve body at reassembly. Grip the stem of the plug (29) with pliers and pull it out of the valve. Remove the backup ring (28), preformed packing (27), spring (26), ball (25), and plug (24) from the valve.

(3) Remove the plug (11), preformed packing (12), spring (10), and relief valve (9) from the valve body (14). Remove the seals (17, 30, and 31) and the retainer (18) from the valve bodies; remove the backup rings (15) and preformed packings (16) from the spools.

c. Cleaning, Inspection, and Repair.

(1) Discard all seals and preformed packings; replace with new parts.

(2) Clean all metal parts in an approved cleaning solvent; dry thoroughly with compressed air.

(3) Inspect the two spools of the control valve for distortion, cracks, wear, or scoring; replace the entire valve assembly if the spool is damaged.

(4) Inspect all parts of the hydraulic control valve for burs; remove burs by lapping with crocus cloth.

(5) Inspect the valve bores for burs and scoring; if scores and burs are not deep, remove them with crocus cloth. If burs and scores are deep, replace valve assembly.

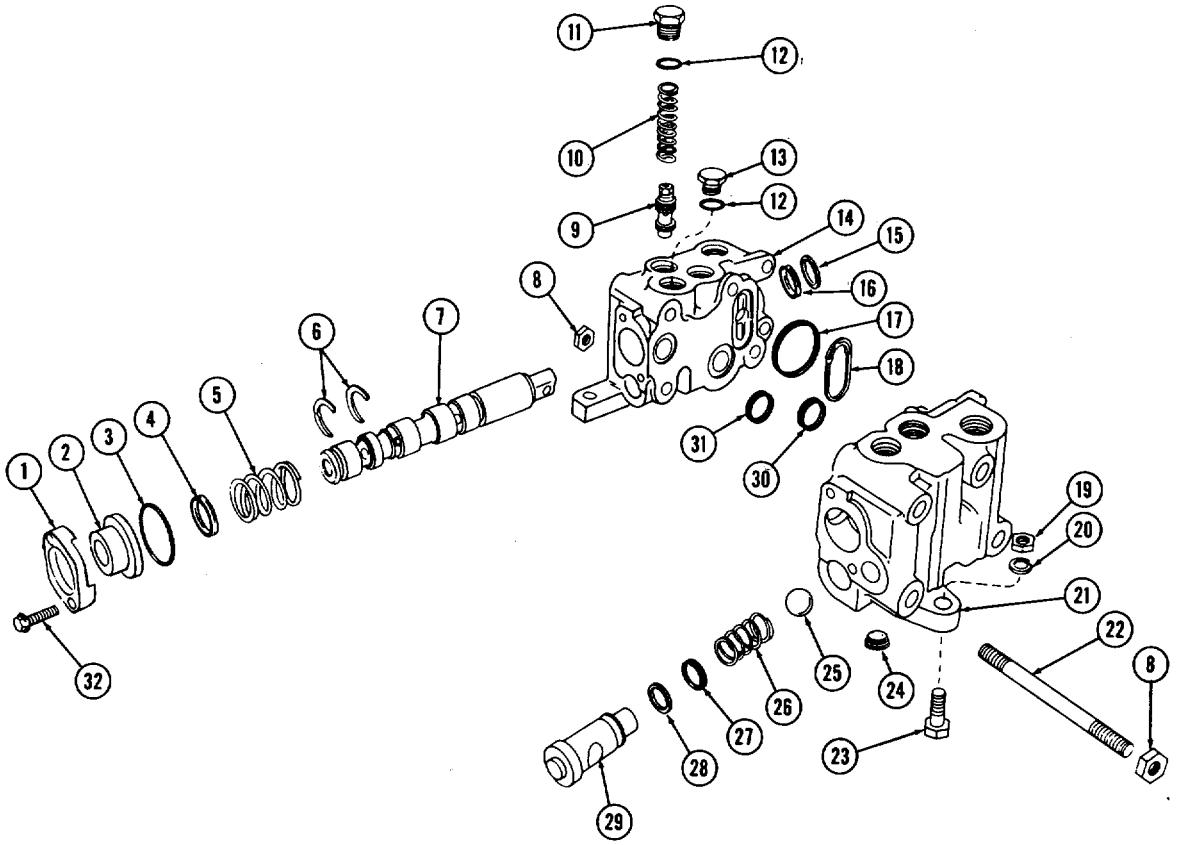
(6) Inspect the retainers (6, fig. 59) and spring (5) for distortion, cracks, breaks, or other damage; if parts are damaged, remove the retainers from the spool and replace with four new retainers.

(7) Coat parts lightly with hydraulic oil. Check the spools, relief valve, and ball for freedom of movement in their bores. If spool is not free to move, replace the entire valve assembly. If the relief valve or ball is not free to move, replace the relief valve and ball.

d. Reassembly.

(1) Immerse all parts of the hydraulic control valve in clean hydraulic oil before reassembly.

(2) If the retainers (6, fig. 59) were removed, position one retainer on the spool (7) so that it



1	Retainer	9	Relief valve	17	Seal	25	Ball
2	Sleeve	10	Spring	18	Retainer	26	Spring
3	Preformed packing	11	Plug	19	Nut	27	Preformed packing
4	Preformed packing	12	Preformed packing	20	Lockwasher	28	Backup ring
5	Spring	13	Plug	21	Valve body	29	Plug
6	Retainer	14	Valve body	22	Stud	30	Seal
7	Spool	15	Backup ring	23	Bolt	31	Seal
8	Nut	16	Preformed packing	24	Plug	32	Screw

Figure 59. Hydraulic control valve, exploded view.

overlaps on both prongs. Slide the spring (5) over the spool and position the other retainer in a similar manner on the spool to retain the spring. Position the preformed packing (16) on the spool and position backup ring (15) against packing. Assemble the other spool in a similar manner.

(3) Slide the assembled spools into the valve bodies (14 and 21). Install the plug (24), balls (25), springs (26), preformed packings (27), backup rings (28), and plugs (29) in the valve bodies.

(4) Position the preformed packing (3) on the sleeve (2), and packing (4) on spool (7); position the sleeve (2) and retainer (1) on the valve bodies; secure the spools and plugs in the valve bodies by securing the retainers with the four screws (32).

Caution: **Replace the spools in the same valve body from which they were removed.**

(5) Slide the relief valve (9) and spring (10) into the valve body (14); position the preformed packing (12) on the plug (11) and secure the spring and relief valve in the valve body with the plug.

Caution: **Do not over-tighten the plugs as they are easily stripped.**

(6) Position the seals (17, 30, and 31) and the retainer (18) on the valve bodies; secure the two valve bodies together with the four studs (22) and nuts (8). Torque the nuts evenly to 15 footpounds. Install the other blank plug (13) onto the open port using a preformed packing.

e. Installation.

(1) Position the hydraulic control valve on the fork lift truck and secure with three bolts (23, fig. 59), nuts (19), and lockwashers (20).

(2) Connect the five hydraulic lines to the hydraulic control valve using new preformed packings.

(3) Install the control levers and linkage (par. 45c).

(4) Start the fork lift truck engine and operate both control -levers in both positions. Inspect the connections, plugs, and mating surfaces of the hydraulic control valve for leaks. Tighten the nuts and plugs as required to stop leaks.

44. Tilt-Lock Valve

a. Disassembly.

(1) Remove the tilt-lock valve (TM 10-3930-237-20).

(2) Remove the cap (8, fig. 60) from the body (2). Slide the spring (6) and the stop (7) out of the body. Remove the cap (9) from the body.

(3) Set the body on the end from which the spring was removed and remove the plug (13). Place a rod into the opening and press the spool (4) out of the body. Remove the seals (3 and 5) from the spool.

b. Cleaning, Inspection, and Repair.

(1) Discard the seals. Clean all other parts of the tilt-lock valve in an approved cleaning solvent. Dry thoroughly with compressed air.

Caution: **Protect parts from dirt after cleaning.**

(2) Inspect all parts of the tilt-lock valve for cracks, wear, scoring, or other damage. Replace damaged parts.

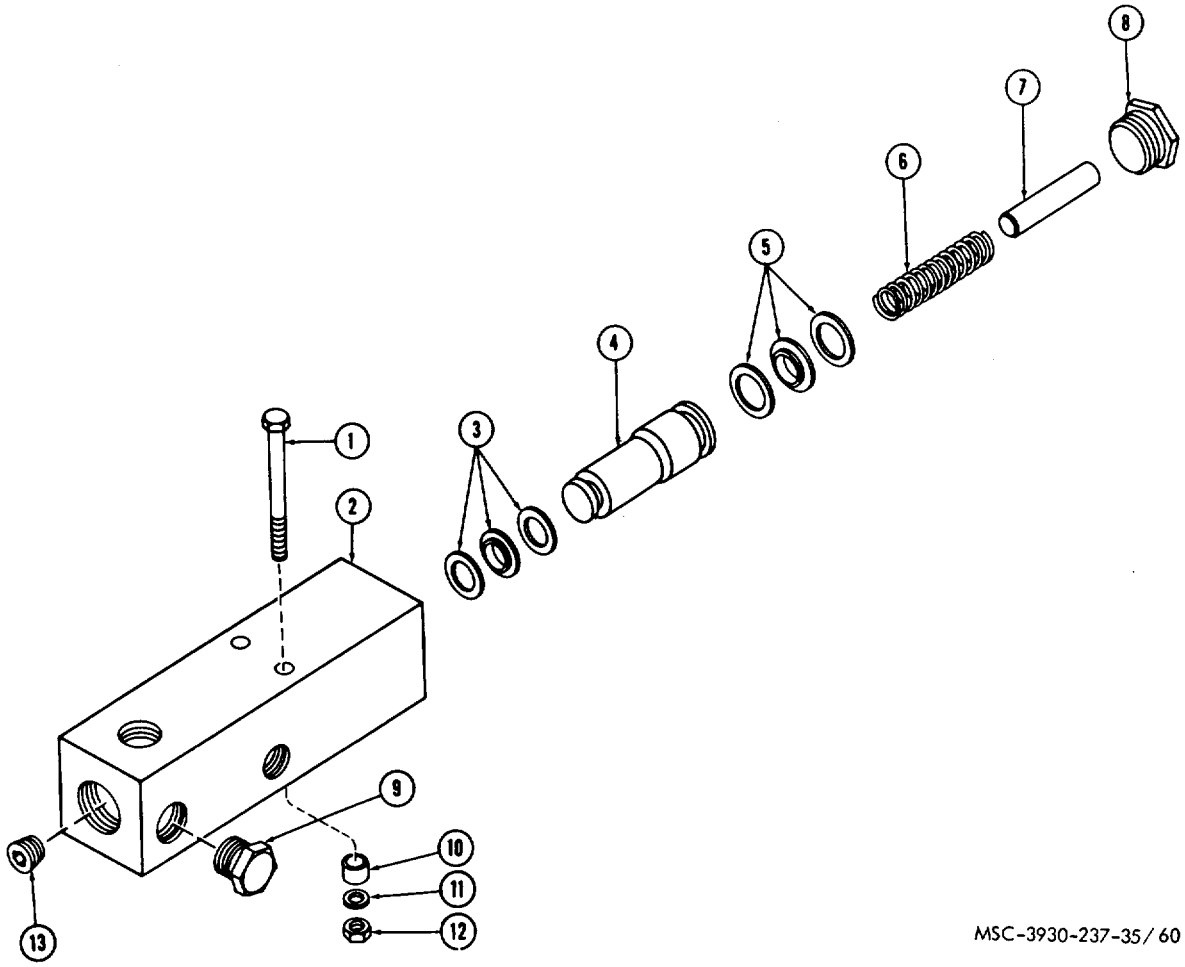
(3) Inspect the spring for distortion and for loss of tension.

c. Reassembly.

(1) Replace the seals (3 and 5, fig. 60) and immerse all parts of the valve in clean hydraulic oil before reassembly.

(2) Position the T-rings of the seals (3 and 5) on the spool (4); install the backup rings on the sides of the T-rings. Slide the spool, stop (7) and spring (6) into the body (2) and secure with the cap (8).

(3) Turn the plug (13) and cap (9) into the body. Cover all openings to protect the tilt-lock valve from dirt.



1	Bolt	4	Spool	7	Stop	10	Spacer	12	Nut
2	Body	5	Seal	8	Cap	11	Lockwasher	13	Plug
3	Seal	6	Spring	9	Cap				

Figure 60. Tilt-lock valve, exploded view.

45. Control Levers and Linkage

a. Removal and Disassembly.

(1) Remove the seven bolts, nuts, and lockwashers that secure the lower instrument panel to the fork lift truck; lower it down out of the way. Remove the two screws that hold the blank plate in place; remove the plate.

(2) Turn the two knobs (1, fig. 61) from the levers (2 and 9). Remove the cotter pins (3) and clevis pins (4) that secure the levers to the valve spools and to the control lever bases (6); remove the levers and washers (5).

(3) Remove the two retaining rings (8) from the base pin (7) and remove the pin. Remove the two control lever bases (6) from the control valve.

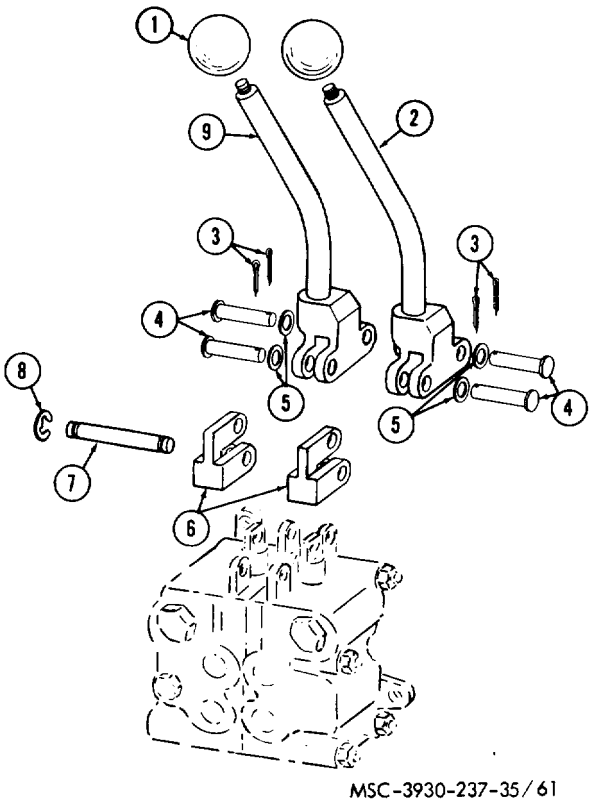
b. Cleaning, Inspection, and Repair.

(1) Clean all metal parts in approved cleaning solvent; dry thoroughly.

(2) Inspect all parts for cracks, breaks, wear, distortion, or other damage; replace damaged parts.

c. Reassembly and Installation.

(1) Position the two control lever bases (6, fig. 61) on the valve; secure with the base pin (7).



1	Knob	6	Control lever base
2	Control lever	7	Pin
3	Cotter pin	8	Retaining ring
4	Clevis pin	9	Control lever
5	Washer		

Figure 61. Control levers and linkage, exploded view.

Secure the pin with two retaining rings (8).

(2) Position the control levers (2 and 9) on the control lever bases and on the control valve spools; secure with the clevis pins (1), washers (5), and cotter pins (3). Turn the knobs (1) on the control levers.

46. Hydraulic Tilt Cylinder

a. Disassembly.

(1) Remove the hydraulic tilt cylinder (TM 10-3930-237-20).

(2) Remove the bolt (26, fig. 62), nut (2), and lockwasher (3) that secure the rod end (27) to the piston and rod assembly (24); turn the rod end from the piston and rod assembly. If it is damaged, use a drift pin to drive the alinement bushing (19) from the base eye by tapping against the outer race only.

(3) Remove the three bolts (4) and lockwashers (5) that secure the retainer cover (6) to the gland (14); remove the retainer cover, retainer assembly (8), shim (9), seal assembly (7), and cover (10).

(4) Turn in the three bolts (18) and press the gland into the tube assembly (20) until the segmented ring set (13) can be removed; remove the segmented ring set. Remove the gland (14).

(5) Remove the retaining ring (15) from the gland. Remove the bushings (11) by tapping out with a drift pin; remove the packing set (12) using a sharp thin-edged tool.

(6) Remove the backup ring (16) and preformed packing (17) from the gland. Slide the piston and rod assembly out of the tube assembly and remove the two piston seals (21), wear ring (22), and spacers (23 and 25) from the piston and rod assembly. Remove grease fittings (1).

b. Cleaning, Inspection, and Repair.

(1) Discard all unserviceable parts.

(2) Clean all metal parts thoroughly in an approved cleaning solvent; dry thoroughly with clean, dry compressed air.

(3) Check all metal parts for corrosion, cracks, burs, breaks, distortion, or other damage. Check the contact areas for scoring or wear. Remove burs with a fine stone. Replace all damaged parts.

(4) Replace all seals, packings, and other unserviceable parts.

c. Reassembly.

(1) Immerse all parts in clean hydraulic oil for lubrication before reassembly.

(2) Position the wear ring (22, fig. 62) and two piston seals (21) on the piston and rod assembly. Position spacer (23) in tube assembly (20). Slide the piston and rod

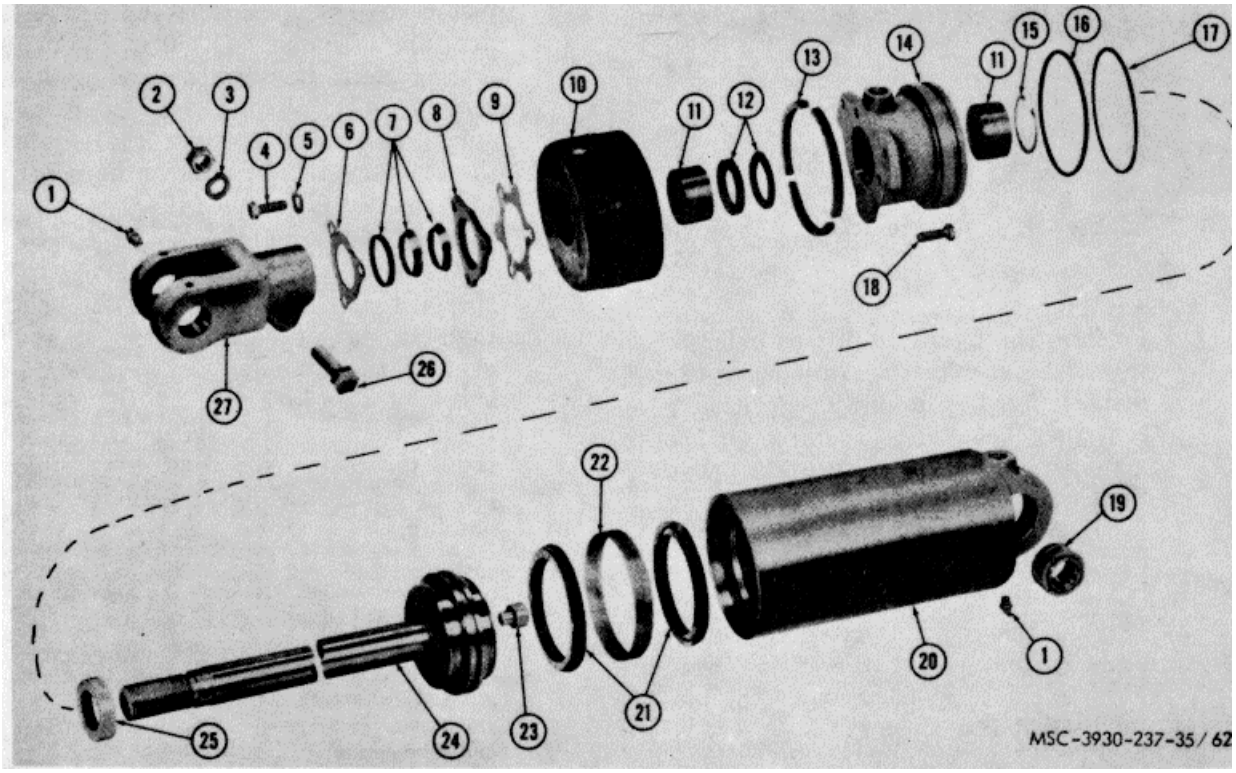
assembly into the tube assembly. Slide the spacer (25) on the piston and rod assembly. Position the preformed packing (17) and backup ring (16) on the gland (14).

(3) Install a new packing set (12) and bushings (11) in the gland (14). Position the retaining ring (15) to secure the rear bushing. Set the gland on a clean cloth with the retaining ring end down and position the seal assembly (7), cover (10), three shims (9), retainer assembly (8), and retainer cover (6) on the gland. Secure the parts with the three bolts (4) and lockwashers (5). Install the bolts finger tight only. Install the bolts (18) on the gland and turn them fully in.

(4) Install the gland assembly in the tube assembly (20). Install the three ring segments of the ring set. Turn out on the bolts (18) to tighten the gland securely against the segmented ring set.

(5) Tighten the bolts (4) to provide a firm seal between the rod and gland. If a firm seal is not made when the bolts are tightened, remove one or more shims as required and retighten the bolts.

(6) Turn the rod end (27) on the piston and rod assembly (24); secure the rod end with the bolt (26), lockwasher (3), and nut (2). Install grease fittings (1).



1	Grease fitting	10	Cover	19	Alinement bushing
2	Nut	11	Bushing	20	Tube assembly
3	Lockwasher	12	Packing set	21	Piston seal
4	Bolt	13	Segmented Ring set	22	Wear ring
5	Lockwasher	14	Gland	23	Spacer
6	Retainer cover	15	Retaining ring	24	Piston and Rod assembly
7	Seal assembly	16	Backup ring	25	Spacer
8	Retainer assembly	17	Preformed packing	26	Bolt
9	Shim	18	Bolt	27	Rod end

Figure 62. Hydraulic tilt cylinder, exploded view.

47. Hydraulic Lift Cylinder

a. Removal.

(1) Remove the carriage assembly (par. 49a).

(2) Provide a container to catch the hydraulic oil as the hydraulic connection to the cylinder is broken. Disconnect the cylinder hose assembly (21, fig. 63) from the elbow (22).

(3) Support the hydraulic lift cylinder with a hoist, using a sling wrapped around the cylinder under the chain bracket. Remove the two bolts (22, fig. 64), nuts (21), and lockwashers (20) that hold the adapter (24) into the bracket on the mast.

(4) Remove the six bolts (1) and lock-washers (2) that secure the bracket at the top of the cylinder to the mast. Hoist the assembled cylinder, bracket, and adapter (24) from the mast. Remove the retaining ring (3) that secures the bracket (4) to the top of the cylinder. Remove the retaining ring (23) that secures the adapter (24) to the base of the cylinder.

b. Disassembly.

(1) Position the hydraulic lift cylinder so that the end with the two elbows (22 and 24, fig. 63) is down. Position a container below the opening on the piston rod assembly (20) and remove the elbows and the preformed packing (23). Allow the hydraulic oil to drain completely. After the oil has drained, lay the cylinder flat.

(2) Remove the two setscrews (8 and 9, fig. 65) that secure the piston head (10) to the cylinder; remove the piston head and bearings (7).

(3) Clean the exterior parts of the cyl-inder thoroughly so that dirt and grime will not enter when it is disassembled.

(4) Using special tool, Clark No. 394469, unscrew gland nut (42, fig. 63); slide the nut off over the primary piston (36) and remove the wiper (43) from the gland nut. Use special tool, Clark No. 394717, to hold the stationary tube assembly (4) and loosen the cylinder head (29) with special tool, Clark No. 394162 (980-AT); slide the body (38) off the assembled primary piston, piston rod assembly (20) and stationary tube assembly (4). Remove the packing assembly (41), retainer (40) and bushing (39) from the body; re-move the backup ring (26) and pre-formed packing (25) from the cylinder head. Remove the retaining ring (37) from the body (38).

(5). Using special tool, Clark No. 394968, unscrew the gland nut (34) from the cylinder head and slide it off the piston rod assembly (20). Using special tool, Clark No. 394470, unscrew the gland nut (48) and slide the assembled piston rod assembly (20) and stationary tube assembly (4) out of the primary piston. Remove the packing assembly (47), adapter (46), packing spring (45), and retainer (44) from the primary piston; remove the wiper (1) from the gland nut (48).

(6) Remove lockscrew (28) and setscrew (27) from cylinder head (29). Use special tool, Clark No. 394717 to hold the stationary tube assembly (4) and remove the cylinder head with the special tool, Clark No. 394162 (980-AT). Remove the stationary tube from the piston rod assembly. Slide the cylinder head off the piston rod assembly.

Note. **Do not remove the plug (18) unless obviously damaged. Remove the packing assembly (33), adapter (32), packing springs (31), and retainer (30) from the cylinder head. Remove the wiper (35) from the gland nut (34). Remove the two needle valves (2) and bleeders (3) from the body and stationary tube assembly.**

(7). Remove the retaining ring (5) that secures the flow regulator assembly (6 through 17) to the piston rod assembly (2); slide the flow regulator assembly out of the piston rod assembly and remove bushing (19) from rod assembly.

(8) Remove the retaining ring (17) from the regulator body (7); remove the seating ring (16), spring

(15), and regulator piston (11) from the regulator body. Remove the retaining ring (14) from the regulator piston and remove the spacer (13) and plate (12). Remove the regulator spring (9) and spring seat (10) from the regulator piston. Remove the pre-formed packings (8 and 6) from the regulator body.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts thoroughly in an approved cleaning solvent. Dry thoroughly with compressed air.

Caution: **Do not allow dirt to get on disassembled parts after cleaning.**

(2) Check all metal parts for cracks, burs, rust, distortion, scores, or other dam-age. Remove burs with a fine stone. Replace damaged parts.

(3) Replace all seals, wipers and other unserviceable parts.

d. Reassembly.

(1) Immerse all parts of the hydraulic lift cylinder in clean hydraulic oil to lubricate them before reassembly.

(2) Position the regulator spring (9, fig. 63), spring seat (10), plate (12), and spacer (13) in the regulator piston (11) and secure with the retaining ring (14). Slide the assembled regulator piston, spring (15), and seating ring (16) into the regulator body (7); secure them with the retaining ring (17). Position the preformed packings (6 and 8) on the regulator body; slide the assembled regulator body into the piston rod assembly (20) and secure it with the retaining ring (5). Install bushing (19) on piston rod assembly.

(3) Slide the piston rod assembly (20) into the stationary tube assembly (4). Install retaining ring (37) into body (38). Position the cylinder head (29) on the piston rod assembly and turn the cylinder head onto the stationary tube assembly. Install setscrew (27) and lockscrew (28) in cylinder head (29) and secure. Using special tools, Clark Nos. 394717 and 394162 (980-AT), torque the cylinder head to a minimum of 300 foot-pounds. Position the packing springs (31) in the retainer (30) and slide the assembled retainer and adapter (32) into the cylinder head over the end of the piston rod assembly.

(4) Position packing assembly (33) into cylinder head (29) and tap into place using special tool, Clark No. 394162 (934-AT). Position wiper (35) into the gland nut (34); slide the assembled gland nut over the piston rod assembly and into the cylinder head. Using special tool, Clark No. 394468, tighten the gland nut into the cylinder head.

(5) Slide the primary piston (36) over the assembled stationary tube and piston rod assembly. Position the packing springs (45) in the retainer (44); slide the assembled retainer and adapter (46) into the primary piston over the stationary tube assembly. Insert small diameter of special tool, Clark No. 393625, into primary piston (36); slide packing assembly (47) through large diameter of special tool and into primary piston. Using special tool, Clark No. 394716, tap packing assembly (47) into primary piston. Position wiper (1) in the gland nut (48). Slide the gland nut over the stationary tube assembly and tighten the gland nut in the primary piston using special tool, Clark No. 394470.

(6) Position the backup ring (26) and preformed packing (25) on the cyl-inder head. Slide the body (38) over the assembled primary piston, stationary tube assembly and piston rod as-sembly; turn the body onto the cyl-inder head and torque to a minimum of 300 foot-pounds. Slide the bushing (39) and retainer (40) over the primary piston. Insert small diameter of special tool, Clark No. 397969 (920-AT) over the primary piston and into the body (38); insert packing assembly (41) into the large diameter of

the special tool, over the primary piston and into the body. Using special tool, Clark No. 397969 (936-AT), tap packing assembly (41) into position in body (38). Position wiper (43) in gland nut (42); slide gland nut over primary piston assembly and tighten in body using special tool, Clark No. 394469. Turn the needle valves (2) into the bleeders (3); turn the two assembled bleeder valves .into the hydraulic lift cylinder.

(7) Position the assembled bearings (7, fig. 65) and piston head (10) on the lift cylinder; secure with the two set-screws (8 and 9).

c. Installation.

(1) Position the adapter (24, fig. 64) on the base of the lift cylinder; secure with a retaining ring (23). Position the bracket (4) on the top of the cylinder; secure with a retaining ring (3).

(2) Wrap a sling around the cylinder as-sembly under the chain brackets and raise the cylinder with a hoist. Insert the adapter at the base into the bracket on the mast. Position the bracket at the top of the cylinder on the mast; secure with six bolts (1) and lockwashers (2). Install the two bolts (22), nuts (20), and lockwashers (21) in the bracket to retain the adapter (24).

(3) Position the preformed packing (23, fig. 63) on the elbow (24) ; connect the elbow into the piston rod assembly and tighten securely. Connect the elbow (22) on the cylinder hose as-sembly (21); turn the assembled elbow and hose onto the elbow (24).

(4) Fill the hydraulic tank with hydraulic oil. Start the engine of the fork lift truck, open the needle valves (2) in the bleeders (3), and raise the mast assembly. Close the bleeder valves when the hydraulic oil flows out. the gland nuts until a thin film of hydraulic oil is left on the piston rods. Operate the hydraulic lift cylinder until all air is removed from the system.

(5) Install the carriage assembly (par. 49e).

48. Mast Assembly

a. Removal.

(1) Remove the carriage assembly and the hydraulic lift cylinder (pars. 49a and 47a). Remove headlight (TM 10-3930-237-20).

(2) Block the rear wheels of the fork lift truck so that it will not roll when the front end is jacked up. Jack up the front end of the truck and install blocks under it. Wrap a sling around one of the cross bars of the outer rail and support the weight the mast with a hoist.

1	Wiper	17	Retaining ring	33	Packing assembly
2	Needle valve	18	Plug	34	Gland nut
3	Bleeder	19	Bushing	35	Wiper
4	Stationary tube assembly	20	Piston rod assembly	36	Primary piston
5	Retaining ring	21	Cylinder hose assembly	37	Retaining ring
6	Preformed packing	22	Elbow	38	Body
7	Regulator body	23	Preformed packing	39	Bushing
8	Preformed packing	24	Elbow	40	Retainer
9	Regulator spring	25	Preformed packing	41	Packing assembly
10	Spring seat	26	Backup ring	42	Gland nut
11	Regulator piston	27	Setscrew	43	Wiper
12	Plate	28	Lockscrew	44	Retainer
13	Spacer	29	Cylinder head	45	Packing spring
14	Retaining ring	30	Retainer	46	Adapter
15	Spring	31	Packing spring	47	Packing assembly
16	Seating ring	32	Adapter	48	Gland nut

Figure 63. Hydraulic lift cylinder, exploded view.

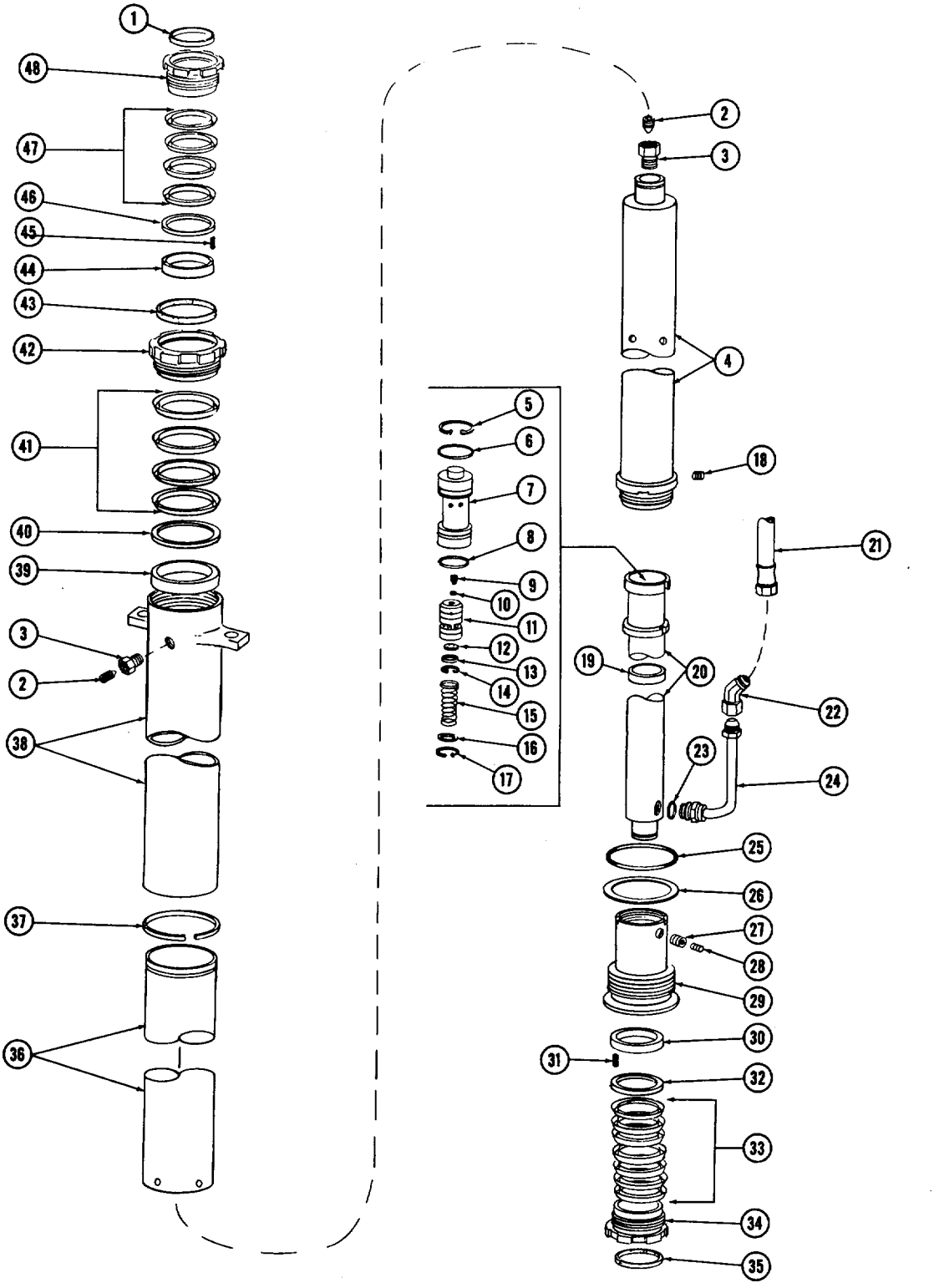


Figure 63. --Continued.

(3) Remove the two cotter pins (13, fig. 6) that hold the tilt cylinder rod pins (14) in the outer rail assembly; re-move the pins. Swing the tilt cylinders clear of the outer rail brackets and tie them back for safety.

(4) Remove the four bolts (18) and lock-washers (19) that secure the trunnion caps (17) to the outer rail trunnion brackets; remove the caps. Lift the mast off the fork lift truck. Lower the tilt cylinders until they rest on the drive axle housing.

b. Disassembly.

(1) Lay the mast assembly flat so that it rests on the inner rail (28, fig. 64). Roll the outer rail (25) along the inner rail until the rollers (27) stop its movement. Wrap a sling around the outer rail cross bars and lift it up off the inner rail with a hoist.

(2) Remove the bolts (5) and lock-washers (6) that secure the stop pad (7) and shim (8) to the outer rail; re-move the pad and shim. Remove the bolts (10) and lockwashers (11) that hold the safety catches (12 and 9) to the outer rail; remove the safety catches. Remove the four rollers (27) and shims (26) from the inner and outer rails.

c. Cleaning, Inspection, and Repair.

(1) Clean all metal parts of the mast as-sembly, except the rollers, with an ap-proved cleaning solvent. Wipe off dirt, dust, and grease and oil deposits.

(2) Clean the rollers by wiping with a cloth dampened in an approved cleaning solvent.

(3) Inspect all metal parts for wear, distortion, or other damage; replace defective parts.

(4) Inspect the trunnion bushings for wear, scoring, distortion, or other damage; replace bushings if damaged.

(5) Inspect stop pads for wear, cracks, distortion, or other damage; replace damaged stop pads.

(6) Inspect inner and outer rail assemblies for cracks, breaks, or distortion; repair inner and outer rails by welding or straightening. Replace rails if they cannot be repaired.

d. Reassembly.

(1) Position the two stop pads (7, fig. 64) and shims (8) on the outer rail (25); secure with bolts (5) and lockwashers (6). Position the two safety catches (9 and 12) on the outer rail and secure each with two bolts (10) and lock-washers (11).

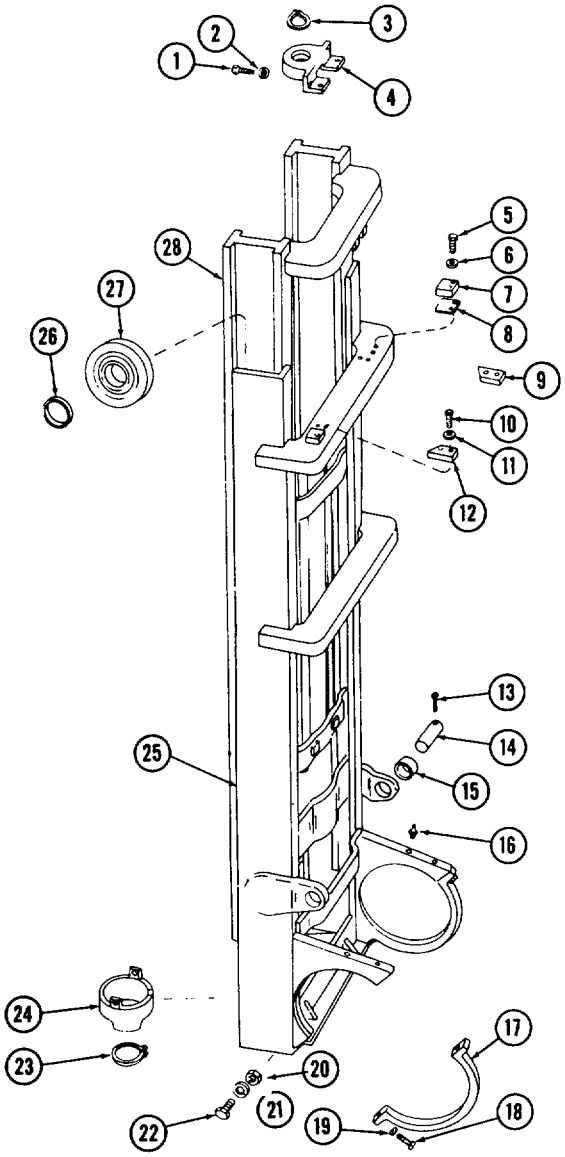
(2) Place the shims (26) and two rollers (27) on the inner rail (28) and outer rail (25). Position the outer rail on the inner rail so that the inner rail rollers slide in the outer rail track. Move the outer rail along until it contacts the stop pads. It must move freely, without binding or drag. If binding or dragging is present, check welds or bends made during repair; correct the cause of drag or bind.

(3) Turn the inner and outer rail assembly over and block the outer rail so that it is level and the trunnion brackets are clear of the ground. Slide the outer rail down until the rollers stop it; support the outer rail so that it is level. Use a pry bar to move the inner rail fully to one side. Maximum clearance between rails and rollers on the side forced apart is /32 inch. Check for this clearance on the full length of the inner rail for the outer rail roller, and down to 20 inches below the outer rail rollers for the inner rail rollers. Add or remove shims behind the rollers to maintain this maximum clearance. Check again for clearance; readjust if necessary.

Note. **The inner rail is made with a slight taper so that the bottom is wider than the top. Make the outer rail roller adjustments with the inner rail in the fully extended position or the rail will bind when reassembled.**

e. Installation.

(1) Raise the tilt cylinders and tie them back for safety. Wrap a sling around the upper cross bar of the outer rail and use a hoist to lift the mast



1	Bolt	15	Bushing
2	Lockwasher	16	Grease fitting
3	Retaining ring	17	Trunnion cap
4	Bracket	18	Bolt
5	Bolt	19	Lockwasher
6	Lockwasher	20	Nut
7	Stop pad	21	Lockwasher
8	Shim	22	Bolt
9	Safety catch	23	Retaining ring
10	Bolt	24	Adapter
11	Lockwasher	25	Outer rail
12	Safety catch	26	Shim
13	Cotter pin	27	Roller
14	Pin	28	Inner rail

Figure 64. Mast assembly, exploded view.

assembly into position on the fork lift truck. Position the mast assembly on the fork lift truck; attach the trunnion caps with bolts (18) and lockwashers (19).

(2) Swing the tilt cylinders down and position the rod eye in the bracket provided on the outer rail; secure the tilt cylinder to the mast assembly with the pins (14). Secure the pins with the cotter pins (13).

(3) Install the hydraulic lift cylinder and the carriage assembly (par. 49a and 47a). Install headlight (TM 10-3930-237-20).

(4) Raise the mast assembly to full height and lower slowly. No binding or dragging is allowable when the mast is raised or lowered.

(5) Position the fork lift truck on level ground and, with the mast vertical, lower the mast assembly completely. The upper cross bar of the inner rail must contact both stop pads (7). If not, add or remove shims (8) under the pads as necessary.

49. Carriage Assembly

a. Removal.

(1) Position blocks under the carriage as-sembly so that the forks are clear. Lower the carriage assembly until it rests firmly on the blocks.

(2) Remove the two nuts (13 and 14, fig. 65) and cotter pin (15) that secure the anchors (12) to the hydraulic lift cylinder; remove the anchors and chain assemblies (18) from the hydraulic lift cylinder and lay them over the carriage assembly.

(3) Start the engine; using the hydraulic control valve, raise the mast assembly until the carriage assembly is clear of the mast assembly. Remove the carriage assembly from the fork lift truck.

b. Disassembly.

(1) Remove the cotter pin (26, fig. 65) that secures the pin (25) to the carriage (27); remove the pin,

anchor (20), and chain assembly (18) from the carriage.

(2) Pry the connecting link (11) apart and remove the link from the chain and anchor. Remove the cotter pin (16) that secures the pin (17) to the anchor (20); remove the pin and anchor from the chain.

(3) Pull the rollers (24) off the pins on the carriage and remove the shims (23). Note the number of shims re-moved. Raise the levers (4) so that 'the forks (1) are free to slide on the carriage; aline the fork bases with the notch at the base of the carriage and lift the forks off the carriage. Re-move the screw (21) that secures the roller (22) to the carriage; remove the roller.

(4) Drive the pin (5) out of the pin (2) and remove the lever (4), spring (3), and the pin from the forks.

c. Cleaning, Inspection, and Repair.

(1) Clean all parts of the carriage assembly in an approved cleaning solvent; dry thoroughly.

(2) Inspect all parts of the carriage as-sembly for distortion, cracks, breaks, or other damage. Weld cracks or broken weldments. Replace damaged parts.

(3) Inspect all parts of the carriage as-sembly for rust, chipped paint, or other damage; remove any rust and paint the entire assembly.

(4) Check the rollers for binding operation, cracks in the seals, or other dam-age; replace damaged rollers.

(5) Discard any damaged cotter pins or other pins.

d. Reassembly.

(1) Position the offset link (19, fig. 65) on the chain assembly (18), press the two parts of the link together, and stake the link pins in place. Position the anchor (20) in the offset link and secure it in place with the pin (17) and cotter pin (16). Position the anchor (12) on the connecting link (11); place the connecting link on the chain assembly and press the ,two parts of, the link together. Stake the link pins in place.

(2) Insert the assembled anchor (20) into the bracket on the carriage (27) and secure it with the pin (25) and cotter pin (26). Position the rollers (22) on the carriage and secure with the screws (21). Position the rollers (24) on the carriage using the same number of shims (23) removed at disassembly.

(3) Insert the springs (3) and pins (2) into the forks (1); position the levers

(4) on the pins and secure in place with the pins (5). Lift the levers to the up position. Position the forks in line with the notch at the carriage base and slide the forks onto the carriage.

e. Installation.

(1) Position the assembled carriage on the ground directly in front of the fork lift truck. Start the engine and raise the mast assembly until the carriage assembly rollers (24, fig. 65) clear the inner rail of the mast assembly. Slide the carriage assembly under the mast assembly and lower the mast to engage the rollers of the carriage.

(2) Pass the chains over the bearings (7) and pass the anchor (12) through the brackets provided on the hydraulic lift cylinder. Secure the chain with the nut (13). Turn the nut up until there is no slack in the chain. Turn the other nut (14) onto the anchor, but allow it to remain loose. Insert the cotter pin (15) into the anchor.

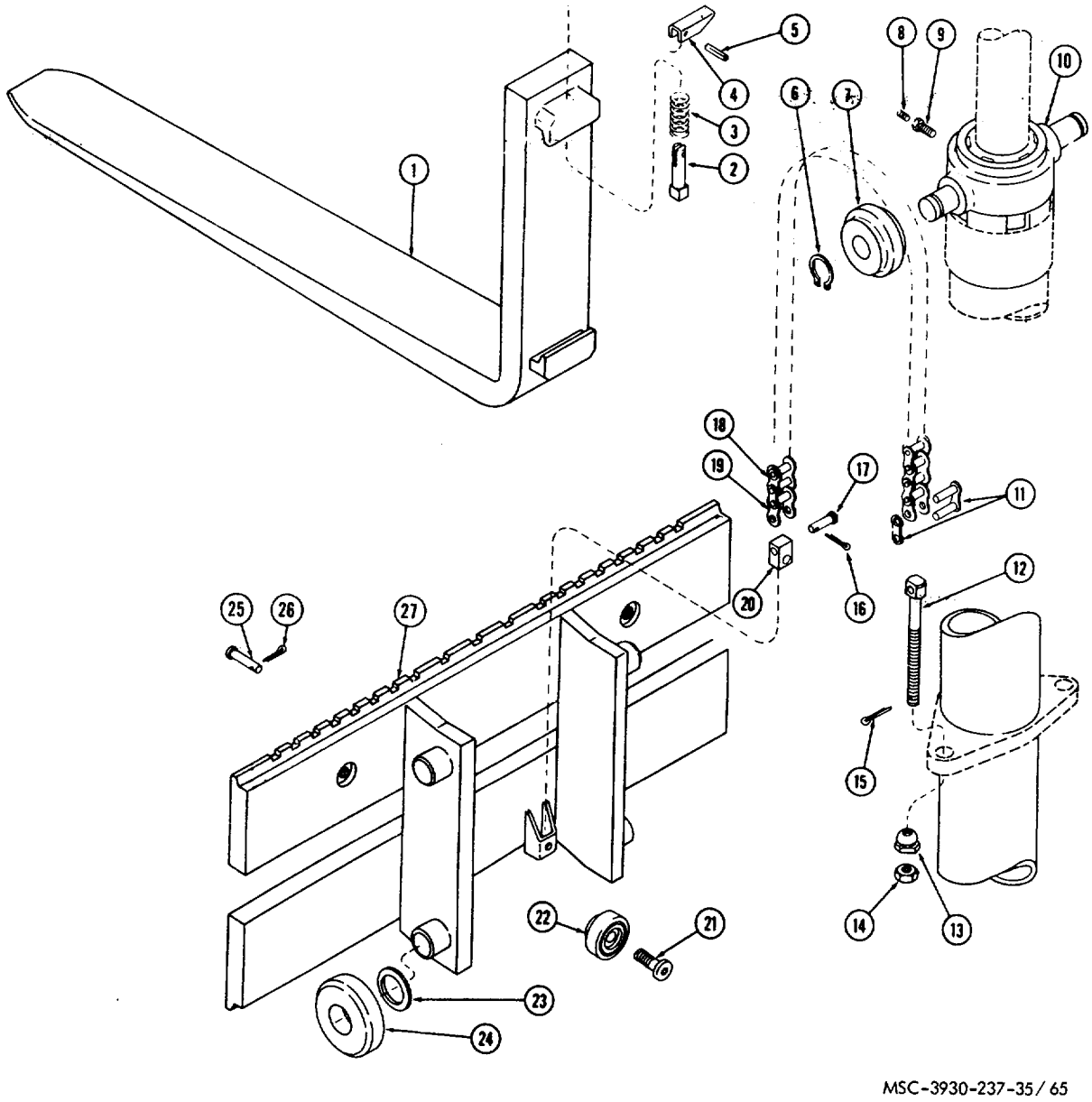
f. Adjustment.

(1) Adjust the carriage assembly chain as described in TM 10-3930-237-20.

(2) There is no adjustment on the rollers (22, fig. 65). Check for clearance of 1/32 inch on each side. If clearance is greater than this, replace the rollers.

(3) Check the rollers (24) for clearance of not more than /32 inch between the roller side and the inner rail of the mast assembly on each side. If

clearance is greater than 1/32 inch, remove the carriage assembly and place shims (23) under the roller until the prescribed clearance is attained.



1	Fork	10	Piston head	19	Offset link
2	Pin	11	Connecting link	20	Anchor
3	Spring	12	Anchor	21	Screw
4	Lever	13	Nut	22	Roller
5	Pin	14	Nut	23	Shim
6	Retaining ring	15	Cotter pin	24	Roller
7	Bearing	16	Cotter pin	25	Pin
8	Setscrew	17	Pin	26	Cotter pin
9	Setscrew	18	Chain assembly	27	Carriage

Figure 65. Carriage assembly, exploded view.

APPENDIX I
REFERENCES

1. Army Regulations and Special Regulations

320-5	Dictionary of United States Army Terms
320-50	Authorized Abbreviations and Brevity Codes
600-55	Motor Vehicle Driver Selection, Testing, and Licensing
750-5	Organization, Policies, and Responsibilities for Maintenance Operation

2. Department of the Army Pamphlets

108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings
310-1	Index of Administrative Publications
310-2	Index of Blank Forms
310-3	Index of Training Publications
310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
310-5	Index of Graphic Training Aids and Devices

3. Field Manuals

5-25	Explosives and Demolition
21-5	Military Training
21-6	Techniques of Military Instruction
21-30	Military Symbols

4. Technical Manuals

21-300	Driver Selection and Training (Wheeled Vehicles)
38-750	Army Equipment Record Procedures

APPENDIX II
MAINTENANCE ALLOCATION CHART

Refer to appendix II of the Organizational Maintenance Manual, TM 10-3930-237-20.

APPENDIX III
REPAIR PARTS AND SPECIAL TOOLS LISTS

Refer to Direct and General Support and Depot Maintenance Repair Parts and Special Tools Lists Manual, TM 10-3930-23735P.

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USAMOCOM (2)
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USAMUCOM (5)
USAECOM (5)
USATECOM (5)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
LOGCOMD (1)
MDW (1)
Armies (5)
NG: State AG (3).
USAR: None.

USA Mbl Equip Cen (36)
Svc Colleges (2)
Br Svc Sch (2) except
USAQMS (10)
USA QM Cen (4)
USMA (1)
Army Dep (4)
POE (2)
USA Tm1Comd (2)
USA Tm1(2)
Arsenals (2)
PG (2)
USAOSA (2)
Instl (2)
QM Fld Maint Shops (2)
Units org under fol TOE: (2 each)
10-105
10-106
10-107
10-349
10-445
10-448

For explanation of abbreviations used, see AR 320-50.

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