DEPARTMENT OF THE ARMY TECHNICAL MANUAL

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT

MAINTENANCE MANUAL

CRANE, TRUCK; WAREHOUSE; SLEWING BOOM;

GASOLINE ENGINE DRIVEN; FRONT WHEEL DRIVE;

PNEUMATIC TIRES; 10,000 LB CAPACITY;

HUGHES-KEENAN MODEL VSH-10

(ARMY MODEL MHE 194)

FSN 3950-723-3294

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1971

WARNING
OPERATING HAZARD
SERIOUS INJURY OR DEATH
to the operator or personnel may result if operator does not
observe these safety precautions and is not alert at all times.
While operating the crane be sure that there
is sufficient clearance-overhead and each side of crane
Be alert for other workers to insure that they are not in the way.
Avoid sudden starting and stopping
Reduce speed when making a turn-
Do not shift directional shift lever while crane sin
Know rated capacity of crane and-do not overload it.
Never pick up a load until certain it can be lifted safely.

WARNING
MAINTENANCE HAZARD
SERIOUS INJURY OR DEATH
to personnel may result if the crane is not blocked securely before
crawling under it.

CAUTION
To avoid damage to frame when raising crane, be sure that jack is placed
only at designated jack points.

CAUTION
This vehicle does not have manual steering capabilities.
It cannot be steered until engine is operating and
power steering system is functioning satisfactorily.

WARNING
DANGEROUS CHEMICALS
are used in this equipment.

SERIOUS INJURY OR DEATH
may result if personnel fail to observe these safety precautions.
Avoid contact with the battery electrolyte.
Do not smoke or use flame in the vicinity when servicing batteries,
as hydrogen gas, an explosive gas is generated.
Do not remove radiator cap from an overheated radiator.

WARNING
FIRE OR EXPLOSION HAZARD
SERIOUS INJURY OR DEATH
may result if personnel fail to observe these safety precautions.
Do not fill fuel tank while engine is running.
Provide metallic contact between fuel container and fuel tank
to prevent a static spark from igniting fuel.

WARNING
ASPHYXIATION DANGER
The engine exhaust gases contain carbon monoxide,
a poisonous gas which is colorless and odorless.

DEATH
or nausea may result
if personnel fail to observe safety precautions.
Do not operate crane without providing adequate ventilation.

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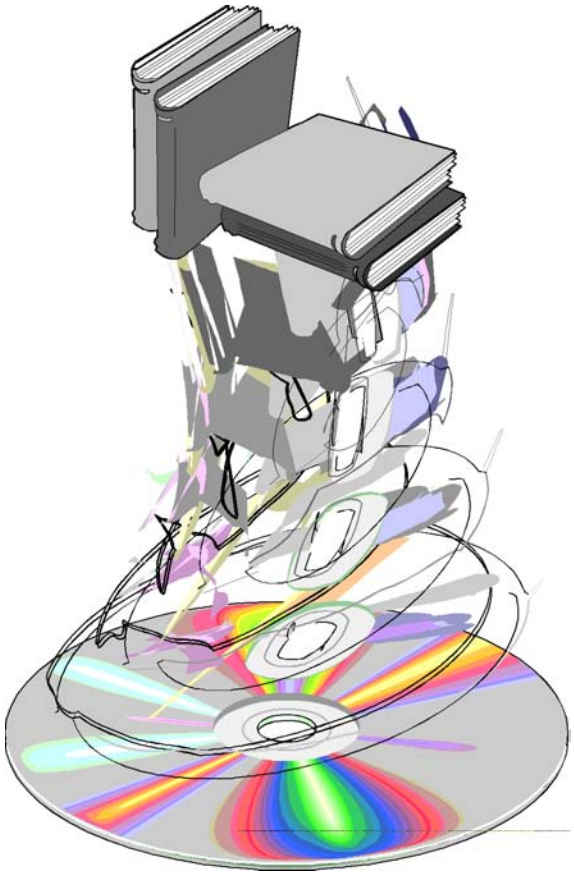

TECHNICAL MANUAL
No. 10-3950-203-34

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

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

CRANE, TRUCK; WAREHOUSE; SLEWING BOOM;

GASOLINE DRIVEN ENGINE; FRONT WHEEL DRIVE;

PNEUMATIC TIRES; 10,000 LB CAPACITY;

HUGHES-KEENAN MODEL VSH-10 (ARMY MODEL MHE 194)

FSN 3950-723-3294

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual contains instructions for the use of direct and general support personnel maintaining the Hughes-Keenan Model VSH-10(Army Model MHE-194) warehouse crane truck as allocated by the Maintenance Allocation Chart.

1-2. Forms and Records

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

1-3. Reporting of Errors

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

Section II. DESCRIPTION AND DATA

1-4. Description

A general description of the warehouse crane truck, Hughes-Keenan Model VSH-10 (Army Model MHE 194) is contained in TM 10-3950-203-10.

1-5. Identification, and Tabulated Data

a. Identification Plate. Located on right side of cab below instrument panel, contains the boom lift capacity, serial number, Federal stock number, and **service** weight.

b. Tabulated Data. Refer to TM 10-3950-203-20 for the tabulated data for the warehouse crane truck.

c. Torque Data.

(1) Engine.

	Torque (ft-lbs
Cylinder head nuts	70-75
Main bearing caps	70-75
Connecting rods	35-40
Flywheel	70-75
Intake manifold nuts	40-50
Exhaust manifold nuts	40-50
Water pump connecting nuts	50-55
Front-and rear-end plates	50-55
Gear covers	50-55
Flywheel housing bolts	50-55

(2) *Transmission.*

Case assembly gage hole plug	7-15
Oil pan drain plug	20-25
Rear band adjusting screw locknut	35-40
Front band adjusting screw locknut	20-25
Converter cover-to-converter pump nuts	15-28
Converter pump hub-to-converter pump housing bolts	8-10
Front pump-to-transmission case bolts	17-22
Front servo-to-transmission case bolts	30-35
Rear servo-to-transmission case bolts	40-45
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Upper valve body-to-lower valve body bolts	4-6
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Detent lever attaching nut	35-40
Converter cover drain plug	7-10
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Control valve body plug	10-14
Control valve lower body plug	7-15

(3) Differential.

,Cover-to-case bolt nuts	47-52
Pinion cage capscrews-and stud nuts	47-52
Differential case bolt, nuts, and capscrews	82-91
Pinion shaft nuts	175-200
Gear-to-case capscrews	38-42

d. Engine limits and clearances.

(1) Valve guide.

Length	2-5 / 16 in.
Outside diameter	.6575 / .6565 in.
Stem hole diameter	.3432 /.3422 in.
Wear limits, maximum diameter	1 447 in.
Distance, cylinder block	1-15/32 in.

(2) *Valves, intake.*

Stem diameter	.3414/.3406 in

.

Wear limits, minimum diameter .....3386 in.
Seat angle.....30
Stem clearance limits.....002/ .0008 in.
Wear limits, maximum clearance . .....0046 in.
Desired stem clearance . .....0015 in.

(3) Valves, exhaust.

Stem diameter .....3385/.3357 in.
Wear limits, minimum diameter . .....3357 in.
Seat angle 450
Stem clearance . . ..0055/.0037 in.
Wear limits, maximum clearance. .....0075 in.
Desired stem clearance . .....0045 in.

(4) Connecting rods.

Bushing hole diameter .....915/.913 in.
Bearing hole diameter.....2.1870/2.1865 in.
Bearing thickness .....06130/.06155 in.
Wear limit, minimum thickness. .....0608 in.
Diameter, crank pin . .....2.0619/2.0627 in.
Wear limit, minimum diameter . .....2.0609 in.
Clearance limit .....0007/ .0025 in.
Desired clearance :. .....0015 in.
Wear limit, maximum clearance . .....0035 in.
Side play .....010/.006 in.
Desired side play . .....006 in.

(5) Main bearings.

Diameter of bearing . ..... 2 x 1 /2 in.
Bore in block . ..... 2.5715/2.5622 in.
Bearing shell thickness . .....09250/.09275 in.
Wear limits, minimum thickness .....0920 in.
Diameter main bearing journal.... 2.3744/ 2,37'52 in.
Wear limit, minimum diameter .....3734 in.
Clearance Limits. .....0028/ .0008 in.
Desired clearance. .....0015 in.
Crankshaft end play . ..... 003/ .008 in.

(6) *Valve springs.*

Outside diameter . .....1.150/ 1.130 in.
Length, valve closed .....1-21/ 32 in.
Load, valve closed .....47-53 lb.
Wear limits, minimum weight .....42 lb.
Load, valve open . .....103-110 lb.
Wear limits, minimum weight .....93 lb.

(7) *Camshaft.*

Bearing journal diameter#l .....1.8725/ 1.8715 in
Bearing journal diameter#2 .....1.80()95/1.8085 in
Bearing journal diameter#3 .....1.74651/.745 in.
Bearing journal diameter#4 .1.2475/ 1.2465 in.
Wear limits, minimum diameter ... 001 in. under new shaft diameter
Bushing, inside diameter #l.....1.8755;/ 1.8745 in.
Bushing, inside diameter #2.....1.812/ 1.811. in.
Bushing, inside diameter #3.1. 502/ 1.7495 in.
Bushing, inside diameter #4.....1.250.5/ 1.2495 in.
Bushing, clearance limits .....004/ .0)2 in.
End play . .....00(1 / .005 in.

(8) Piston pin.

Length ..... 2.8 8 / 2.868 in.
Diameter .....3 / .891 in
Wear limit, minimum diameter .....8588 in.
Desired fit..... Light push
Bushing hole diameter ..... .859/ .8595 il.
Wear limit, maximum diameter .....8607 in.
Pin clearance in bushing.....0006/.0002 in.
Desired pin fit. ..... . .0004 in.

(9) Piston.

Cylinder diameter. ..... . 3.4395./ 3.43.,5 in.
Wear limits, cylinder bore ..... . .008 .
Piston pin hole diameter..... .8594/ .8592 in.
Ring groove width, ,#1-2-3 ..... .1285 / .125 in
Maximum wear limit.....305 in.
Ring groove width, 4..... . .253/.252 in.
Maximum wear limit.....2550 in.
Piston fit, feeler gage pounds pull.....5-10

(10) Piston rings.

Ring width, #1-2-3 ..... .124/.1'3 in.
Wear limit, minimum width .....121 in.
Ring width, #4 ..... .249/ .2485 in.
Wear limit, minimum width .....2465 in.
Ring gap clearance.....017/ .0(17 in.
Ring side clearance #1 .....()05/ .0035 in.
Ring side clearance#2-3..... .0055/ .0035 in.
Ring side clearance#4. .....1)04/ .003 in.

e. Valve Clearance.

Intake.....0.114 in.
Exhaust.....0.014 in.

f. Tire Pressure.

Front wheels.....90 psi
Rear wheels..... .85 psi

g. Capacities.

Cooling system.....21 (lt.
Fuel tank.....17 gal.
Hydraulic tank.....50 gal.
Transmission ..... 12 qt.
Differential ..... 4 (ft.
Air cleaner .....1 ft.
Crankcase (witll oil filter change).....5qt.
Oil filter.....qt.
Winch gear case.....4 (ft.

h. Overall Dimensions and Weights.

Overall length (boom lowered and extended)..... 420 in.
Overall length (boom lowered and retracted) .....372 in.
Overall width .....96 in.
Overall height (boom raised and extended).....32in.
Overall height (boom lowered.....13in.
Wheelbase..... . 1(16 in.
Under clearance . .....11 in.
Shipping weight..... . 21,700 lb
Shipping tonnage .....11 tons

i. Wiring Diagram. See figure 1-1.

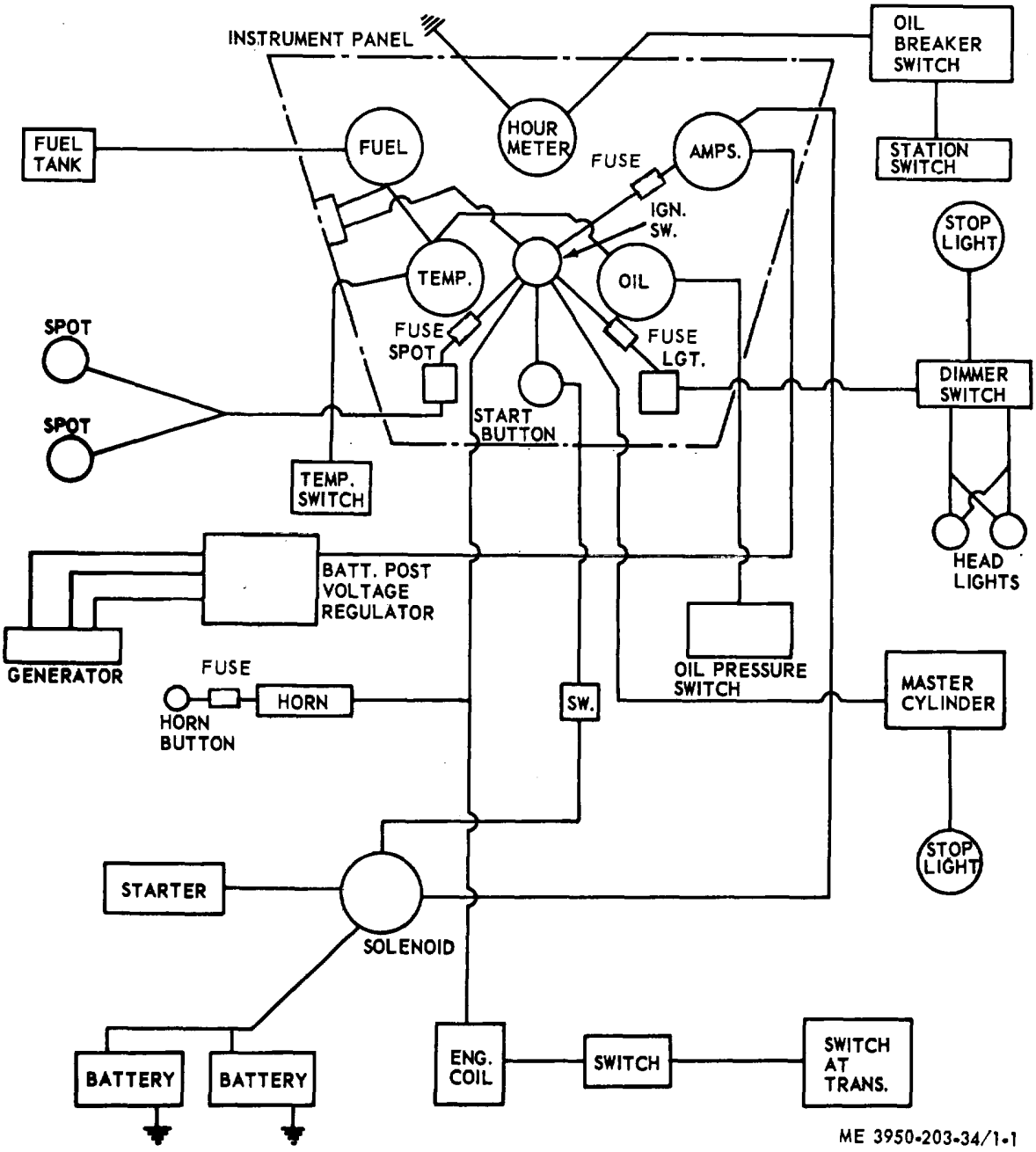


Figure 1-1. Practical wiring diagram.

Figure 1-1 Practical wiring diagram

CHAPTER 2

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. REPAIR PARTS, SPECIAL TOOLS AND EQUIPMENT

2-1. Tools and Equipment
Tools, equipment, and repair parts issued with or authorized for the warehouse crane truck are listed in the basic issue items list in Appendix II of TM 10-3950-203-10.

2-2. Special Tools and Equipment
There are no special tools or equipment required for direct support and general support maintenance to maintain the warehouse crane truck.

2-3. Maintenance Repair Parts
Repair parts are listed and illustrated in the repair parts and special tool list TM 10-3950-203-34P.

Section II. TROUBLESHOOTING

Table 2-1 provides information to diagnose and correct unsatisfactory operation or failure of the warehouse crane truck.

Table 2-1. Troubleshooting

Malfunction	Probable Cause	Corrective Action
1.Starter will not crank engine	Defective starter	Repair starter para 3-8)
2.Engine will not start	a. Defective carburetor	a. Repair carburetor (pars 3-11)
	b. Defective crankshaft or camshaft	b. Repair or replace crankshaft (pars 5-9) or camshaft (pars 5-10)
3.Engine operates but backfires and spits	a. Low carburetor float level	a. Adjust carburetor float level (pars 3-11)
	b. Defective valves, springs and seats.	b. Replace defective parts (APRs 5-7)
4.Engine misfires on one or more cylinders	Cracked cylinder block or broken valve tappet or tappet screw	Replace defective cylinder block (APRs 5-12) . Replace defective valve tappet or tappet screw (para 5-7)
5.Engine does not idle properly	Defective carburetor	Repair carburetor (para 3-11)
6.Engine backfires	a. Valve holding open	Repair or replace valves and springs (para 5-71
	b. Weak or broken valve springs	
7.Engine lacks power	Defective valves	Repair or replace valves spars 5-7)
8.Engine overheats	a. Defective block	a. Clean, repair or replace block as required (para 5-12)
	b. Leaky radiator	b. Repair radiator (para 3-10)
9.Engine oil pressure is low	a. Clogged oil pump screen	a. Clean oil pump screen (para 5-61
	b. Defective oil pump	b. Replace defective oil pump (pars 5-6)
10.Engine exhaust is excessive	Defective pistons or rings	Replace defective parts para 5-8)
11.Engine knocks	a. Worn or damaged main bearings	a. Replace main bearings (para 5-9)
	b. Excessive end play in crankshaft	b. Adjust crankshaft end play (para 5-9)
	Worn or damaged connecting rod.	Replace connecting rod bearings (para 5-8)
12.Generator output fluctuates or is low.	a. Weak brush springs	a. Replace brush springs (para 3-7)
	b defective or dirty parts	b. Clean and replace defective parts (para 3-7)
13.Generator is noisy	Defective bearings or armature	Replace defective parts (para 3-7)

Malfunction	Probable Cause	Corrective Action
14. Continuous axle noise	Badly worn parts	Replace defective parts (para 3-20 or pars 3-21)
15. Complete failure of drive axle to function	a. Broken axle shaft	a. Replace axle shaft (para 3-21)
	-b. Broken teeth on drive gear or pinion gear	b. Replace defective parts as necessary (para 3-21)
16. Excessive backlash in drive axle	a. Loose axle shaft drive flange cap screws	a. Tighten cap screws (para 3-21)
	b. Worn splines on axle shaft at differential end	b. Replace defective parts as, required (para 3-21)
	c. Differential drive pinion gear and drive gear defective	c. Replace defective parts as required (para 3-24)
17. Steering wheel does not center	Binding in linkage valve or broken centering spring	Replace defective parts as required (para 3-19)
18. Steering is difficult	Defective steering gear or related part	Replace defective parts as required (para 3-19)
19. Brakes drag	Scored or defective brake drums	Repair or replace brake drums (para 3-21)
20. Hydraulic cylinders chatter during operation	Cylinders are defective	Replace or repair defective cylinders as required (para 3-1 and 3-2)
21. Hydraulic pump makes unusual noises	a. Pump intake partially blocked.	a. Clean pump intakes (para 3-13)
	b. Air leaks at the intake or shaft seal	b. Inspect for loose connections and damaged seals. Tighten connections and replace defective seals as required (para 3-13)
	c. Defective parts	c. Repair pump (para 3-13)
22. Initial transmission engagement too rough	Control pressure too high	Clean control valve (para 3-14) and pressure regulator (pars 3-16).
23. Initial transmission engagement delayed	a. Rear band loose	a. Adjust rear band (para 4-6)
	b. Control pressure too low	,b. Clean control valve (pars 4-5) and pressure regulator (para 4-3)
24. Transmission inoperative in all ranges	Defective pump	Replace pump (para 4-8)
25. Transmission slips	it. Low control pressure	a. Clean control valve (para 4-5) and pressure regulator (para 4-3)
	b. Rear servo travel limited	b. Repair or replace rear servo (para 4-6)
	c. Front clutch slipping	c. Repair or replace front clutch (para 4-8)
	d. Rear pump check valve stuck open	d. Clean or replace rear pump check valve (para 4-8)
	Bands require adjustment.	c. Adjust bands (para 4-6)
26. Transmission will not downshift	Vacuum control solenoid is defective, requires adjustment or is disconnected electrically.	Replace, adjust, or connect electrical lead as applicable (para 4-4)

Section III. GENERAL MAINTENANCE

2-4. General

This section contains those repair instructions or references thereto that are general in nature to the crane and which would otherwise have to be repeated several times.

them clean. Leave new parts in their containers until ready for assembly. Be sure parts are clean

2-5. General Maintenance Instructions

a. Cleanliness. Whenever hydraulic, fuel, or lubricating oil lines are disconnected,clean the point of disconnect and the adjacent area. As soon as the disconnection is made, cap, plug 'r tape the opening to prevent entry of foreign material. The same recommendations for cleaning and covering apply when access covers or inspection plates are removed. Clean and inspect all parts. Be sure all passages and holes are open. Cover all parts to keep when installed. Clean the rust preventive compound from all machined surfaces of new parts before installing them.

b. Removals and Installations. Unless otherwise specified, all removals should be accomplished using an adjustable lifting beam. All supporting members (chains

and cables) should be parallel to each other and as near perpendicular as possible to the top of the object being lifted. When it is necessary to remove a component on an angle, the capacity of an eyebolt diminishes as the angle between the supporting member and the object becomes less than 900. Eyebolts and brackets should never be bent and should only have stress in tension. If a part resists removal, check to be certain all nuts and bolts have been removed and that an adjacent part is not interfering.

c. Disassembly and Reassembly. When assembling an assembly, complete each step in turn. Do not partially assemble one part and start assembling another part. Make all adjustments as recommended. Always check the job after it is completed to see that nothing is overlooked.

d. Service Tools. Two and three arm puller assemblies can be used to remove gears, bearings, hubs, bearing cages, shafts, etc. Bearing pulling attachments can be used with forcing bolts in combinations with arm pullers. When pressing one part into another, use anti-size compound or a molybdenum disulfide-base compound to lubricate the mating surfaces. Assemble tapered parts dry. Before assembling parts with tapered splines, be sure the splines are clean, dry, and free from burrs. Position the parts together by hand to mesh the splines before applying pressure. If parts which are fitted together with tapered splines are not tight, inspect the tapered splines and discard the parts if worn.

e. Bolts and Bolt Torque.A bolt which is too long may "bottom" before the head is tight against the part it is to hold. The threads can be damaged when a "long" bolt is removed. If a bolt is too short, there may not be enough threads engaged to hold the part securely. Apply proper torque values to all bolts and nuts when assembling equipment. When a specific torque value is required, it is listed in paragraph 1-5 c.

f. Locks. Flat metal locks must be installed properly to be effective. Bend one end of lock around the edge of the part. Bend the other end against a flat surface of the nut or bolt head. Always install new locks in compartments which house moving parts. When installing lockwashers on housings made of aluminum, use a flat washer between the lockwasher and the housing.

g. Lines and Wires. When removing or disconnecting a group of lines or wires', tag each one to assure proper reassembly.

h. Lubrication. Where applicable, fill the compartments of the component serviced with the amount, type, and grade of lubricant recommended in the lubrication order.

i. Shims. When shims are removed, tie them together and identify them as to location. Keep shims clean and flat until they are reinstalled.

j. Bearings. (1) Anti-friction Bearings. When an anti-friction bearing is removed, cover to keep out dirt and abrasives. Wash bearings in non-flammable cleaning solution and allow to drain dry. The bearing may be dried with compressed air but **DO NOT SPIN THE BEARING**. Discard the bearings if the races and balls or rollers are pitted, scored, or burned. If the bearing is servicable, coat it with oil and wrap it in clean paper. Do not un- wrap new bearings until time of installation. The life of an anti-friction bearing will be shortened if not properly lubricated.

(2) Double row, tapered bearings. Double row, tapered roller bearings are precision fit during manufacture and the components are not in- terchangeable. The cups, cones, and spacers are usually etched with the same serial number and letter designator. If no letter designators are found, wire the components together to assure correct installation. Reusable bearing components should be reinstalled in their original positions.

(3) Sleeve bearings. **DO NOT INSTALL SLEEVE BEARINGS WITH A HAMMER**. Use a press if possible and apply the pressure directly in line with the bore. If it is necessary to drive on a bearing, use a driver or bar with a smooth flat end. If a sleeve bearing has an oil hole, aline it with the oil hole in the mating part. (4) Bearing installation. Bearings which require expansion for installation should be heated in oil not to exceed 2500F. (1216C). When more than one part is heated to aid in assembly, they must be allowed to cool and then pressed together again. Parts often separate as they cool and shrink. Lubricate new or used bearings before installation. Bearings that are to be preloaded must have a film of oil over the entire assembly to obtain accurate preloading. When installing a bearing, spacer, or washer against a shoulder on a shaft, be sure the cham fered side is toward the shoulder. When pressing bearings into a retainer or bore, apply pressure to the outer race. If a bearing is pressed on a shaft, apply pressure to the inner race.

(5) Preloading bearings. Preload is an initial force placed on the bearings at the time of assembly. Determine preload or end clearance from the tabulated data. Care should be exercised in applying preload. Misapplication of preload to bearings requiring end clearance can result in bearing failure.

k. Gaskets. Be sure the holes in gaskets correspond with the lubricant passages in the mating parts. If it is necessary to make gaskets, select stock of the proper type and thickness. Be

sure to cut holes properly. Blank gaskets can cause serious damage.

1. Seals.

(1) Duo-cone floating seals. Floating ring seals have highly finished surfaces and are held together by toric sealing rings. The flexibility of the toric sealing rings makes the floating sealing rings self- alining and compensates for wear on the metal surfaces. During disassembly, tape the metal floating seal rings together so they will be kept in matched sets. Always install the metal floating ring seals in pairs; that is, two new seals together, or two seals that have previously run together. Never reinstall used toric sealing ring. Handle all parts with care to avoid nicks. File smooth any part, other than the sealing faces, that have nicks that may make reassembly difficult or questionable. Wash used parts. Use a wire brush to clean dirt or rust from the bore of the seal retainers to assure they are clean and smooth. Remove all oil or protective coating from floating seals and retainers with a non-flammable cleaning solvent. Check the ramps for tool marks and nicks. On used parts, remove dirt or rust deposits from the ramps. Smooth the surface with emery cloth. Be sure the ramp on the retainers and the floating seals are dry. Before assembling floating ring seals together, wipe faces of seals with lint-free tissue to remove any foreign material or fingerprints. Place one drop of oil on the cleaning surface and coat the sealing surfaces of the seals. Be careful to prevent any oil from contacting the toric sealing ring or its mating surface. Install new toric sealing rings or floating ring seals. Seat the toric sealing ring uniformly in the relief of the ring seal. Be sure the toric sealing ring is not twisted. It must set straight against the lip which keeps it from falling off the floating ring seal. If an installer tool is not used, install the toric sealing ring and floating ring seal as an assembly by pressing on the toric sealing ring. Use finger pressure only. Be sure the toric sealing ring is seated uniformly in the recess of both the floating ring and the retainer. Make sure it sets in the bore straight and against the lip that keeps it from falling out of the retainer. **DO NOT USE A SCREWDRIVER OR STICK TO ASSEMBLE TORIC SEALING RING IN THE RETAINER.**

(2) Lip-type seals.Generally, the toe or spring-loaded lip on an OIL SEAL FACES the oil being sealed or the oil having the higher pressure. The toe or lip of a **GREASE SEAL FACES AWAY** from the lubricant being sealed. Lubricate the lips of lip- type seals before installation with the same type of lubricant in which the seal will be operating. If during installation, the seal lips must pass over a shaft that has splines, a keyway, rough surface, or a sharp edge, the lip can be easily damaged. Shim stock or other material can be formed to provide a smooth surface over which to slide the seal.

m. Hydraulic Systems.

(1) Cleanliness. When removing components of a hydraulic system, cover all openings in both the component and the machine. If evidence of metal or rubber particles are 'found in the hydraulic system, flush the entire system. Disassemble and reassemble hydraulic components on a clean surface. Clean all parts in a non-flammable cleaning fluid. Then lubricate all components to aid in reassembly. Inspect all sealing components (o - rings, gaskets, etc.) when disassembling and reassembling hydraulic components. Install new components if necessary. Use only components listed in the repair parts list, one seal may resemble another but will not necessarily be compatible in a given installation.

(2) Hydraulic lines. When installing metal tubes, tighten all bolts finger-tight. Then, in this order, tighten the bolts at the rigid end, the adjustable end, and the mounting brackets. After the tubes are mounted, install the hoses. Connect both ends of hoses with all bolts finger-tight. Due to manufacturing methods there is a natural curvature to a hydraulic hose. Install the hose so any bend is in this curvature. In case of replacement hoses with angled-stem and reusable fittings, the hose curvature must be taken into consideration when assembling and positioning angled stems. Position the hose so it does not rub the machine or another hose and has a minimum of bending and twisting. Tighten hoses in place. After hoses are installed, follow this procedure, with engine running, move the appropriate levers to move the hydraulic operated components to every possible position. Observe the hoses during the cycle. Stop the engine, relieve the pressures, and eliminate any twisting, rubbing, or excessive drooping of hoses by rotating the stem of the hose.

n. Painting. Refer to TM 9-213 for painting instructions for the crane.

o. Tire Maintenance. Refer to TM 9-1870-1 for instructions for care and maintenance of pneumatic tires.

Section IV-REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-6. Boom

a *Removal* Refer to figure 2-1 for removal procedures for the boom.

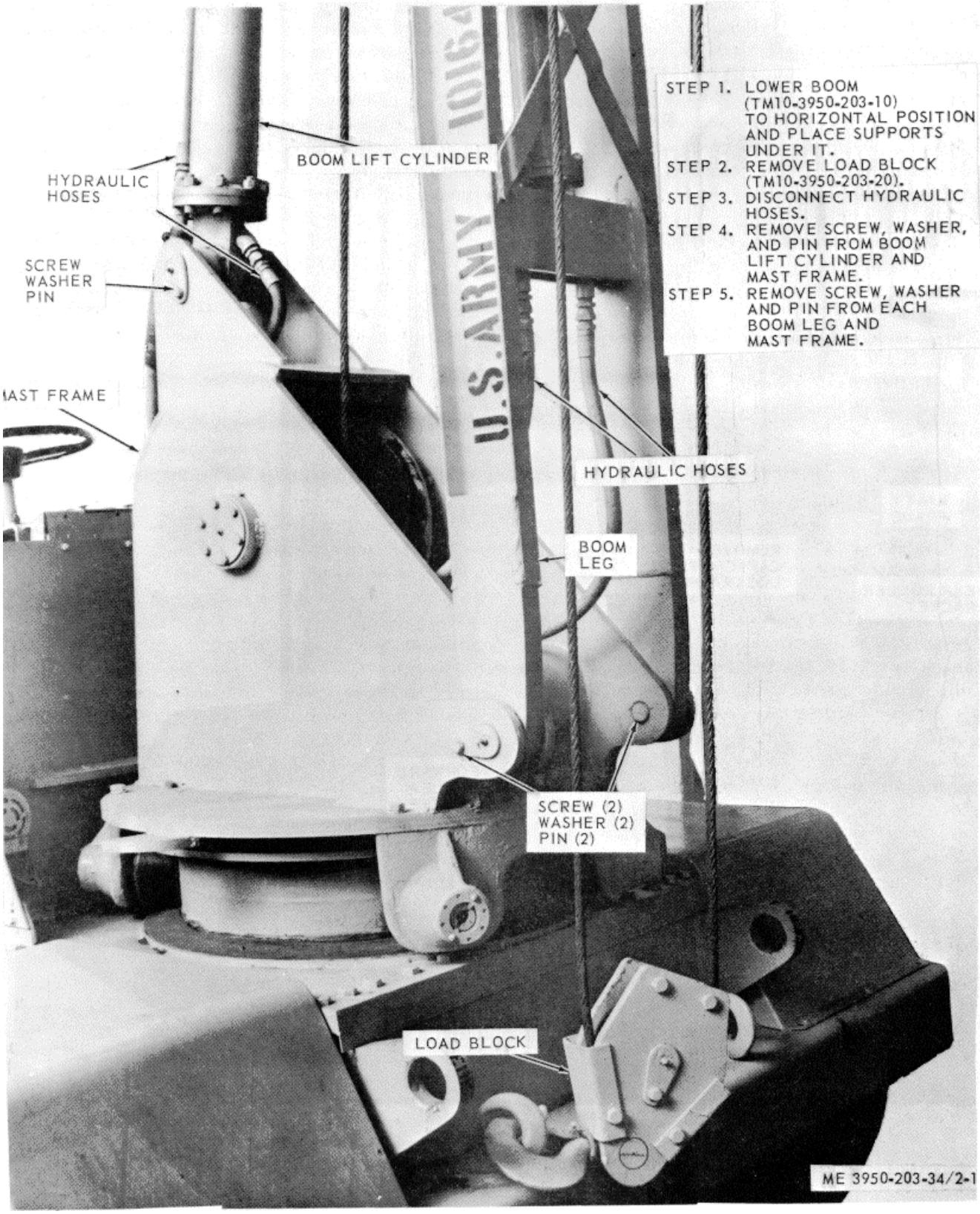


Figure 2-1. Boom removal proceudres.

b. Installation. Install the boom by reversing procedures shown on figure 2-1.

2-7 Mast Frame

a. Removal. Refer to figure 2-2 for removal procedures for the mast frame.

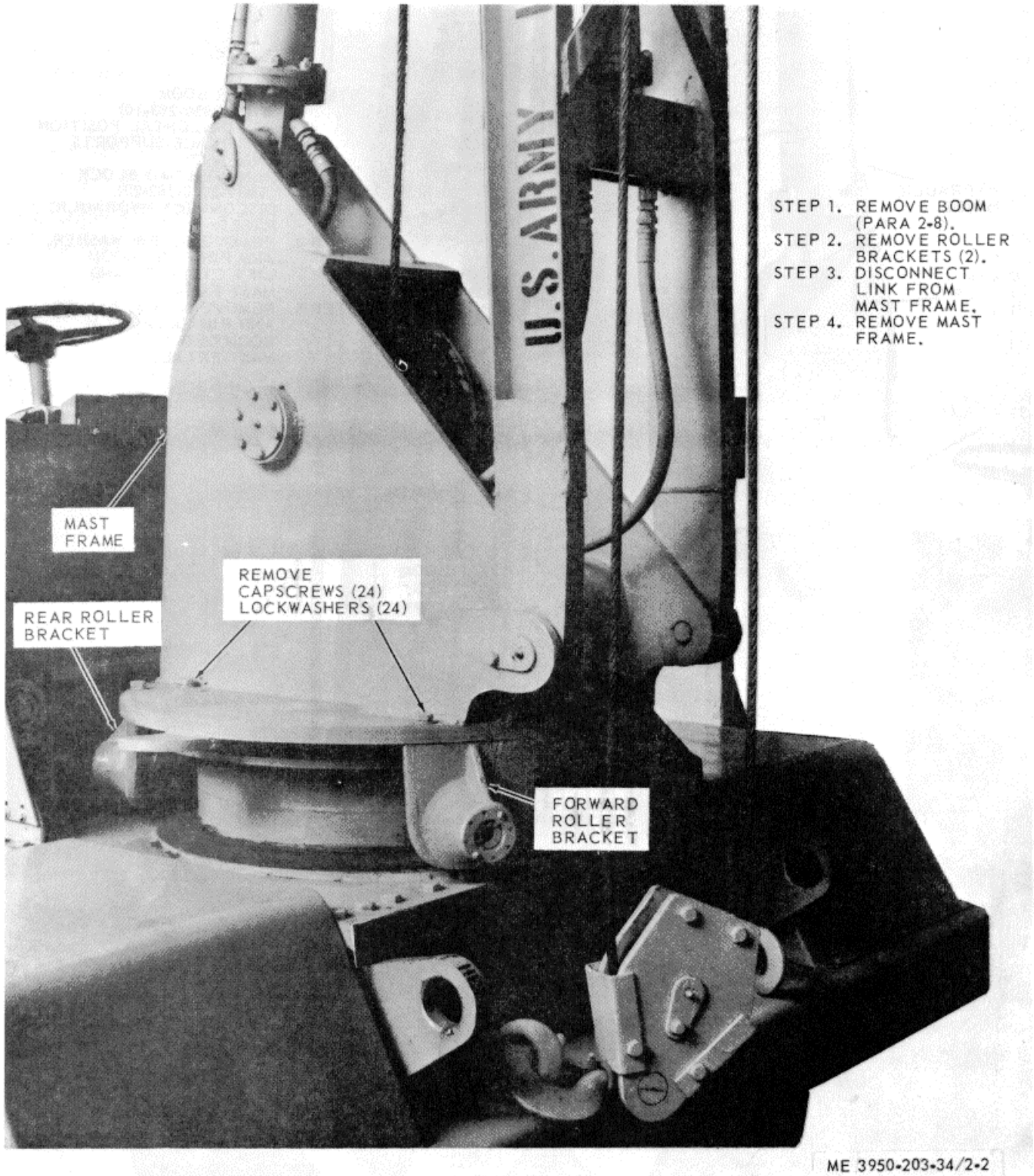


Figure 2-2. Mast frame removal procedures.

Figure 2-2. Mast frame removal procedures.

b. Installation. Install the mast frame by reversing procedures shown on figure 2-2.

2-8. Engine

To facilitate removal of the engine, the transmission and reversing gearbox should be removed with the engine (fig. 2-3).

a. Removal.

(1) Remove seat and seat support and floor plates.

(2) Drain coolant from radiator and engine and remove radiator support with radiator and battery box as an assembly.

(3) Close fuel tank shut-off valve and disconnect and remove fuel line from tank and fuel pump.

(4) Disconnect choke cable at carburetor.

(5) Disconnect exhaust flange at manifold and remove exhaust piping.

(6) Disconnect and tag wires at sending units.

(7) Disconnect and cap hydraulic lines and hoses.

(8) Disconnect control linkages. Insure all linkages and lines are disconnected and tagged and nothing will interfere with engine removal.

(9) Disconnect hydraulic pump flange at,front of engine.

(10) Disconnect drive shaft at universal joint.

(11) Remove bolts from engine mounts.

(12) Using a spreader bar, attach lifting device to engine lifting eyes.

(13) Carefully lift and remove engine and transmission assembly. Block engine on work surface to prevent tipping.

(14) Remove capscrews securing converter housing to flywheel housing and remove transmission and gear box.

(15) Remove capscrews securing torque converter to flywheel and remove torque converter.

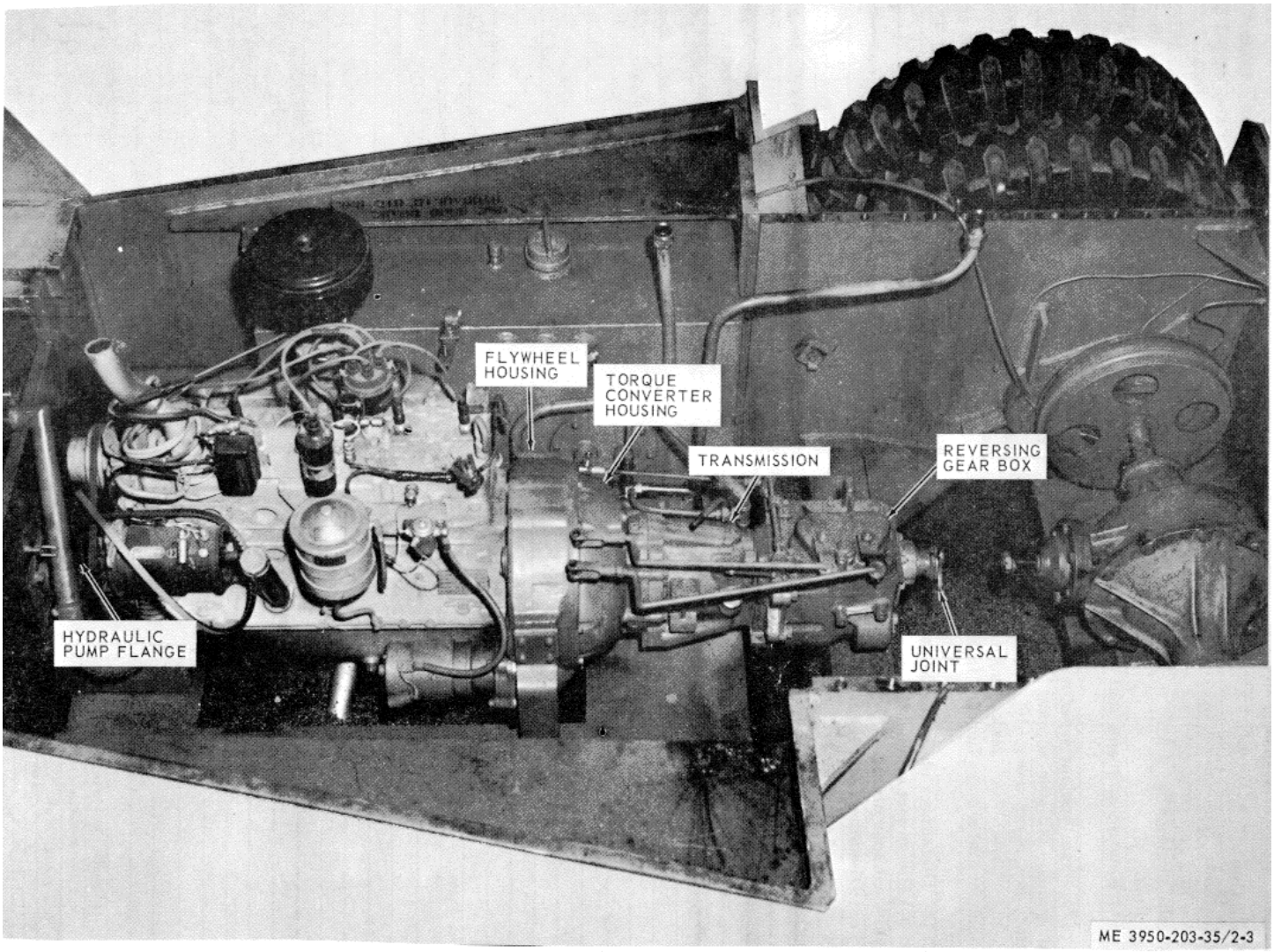


Figure 2-3. Engine and transmission prepared for removal

b. *Installation.* Install engine in reverse order of removal. Service transmission and engine as described on lubrication order. Fill cooling system with mixture of 50% water and 50% ethylene-glycol base anti-freeze. Start engine and bring to operating temperature. Check oil and coolant levels. Check for leaks. Adjust engine for proper operation as described in TM 10-3950-203-20.

CHAPTER 3

REPAIR OF CRANE

Section I. BOOM.

3-1. Boom Topping Cylinder

a. Removal.

(1) Lower boom (TM 10-3950-203-10) and provide a suitable support for it.

(2) Disconnect hydraulic hoses from topping cylinder.

(3) Refer to figure 3-1 and remove capscrews and washers securing pins (4) and (8).

(4) Support the cylinder and remove the pins. Remove the cylinder.

b. Disassembly. Refer to figure 3-1 and starting it the cylinder base end (13), disassemble the cylinder to the extent required to repair the cylinder.

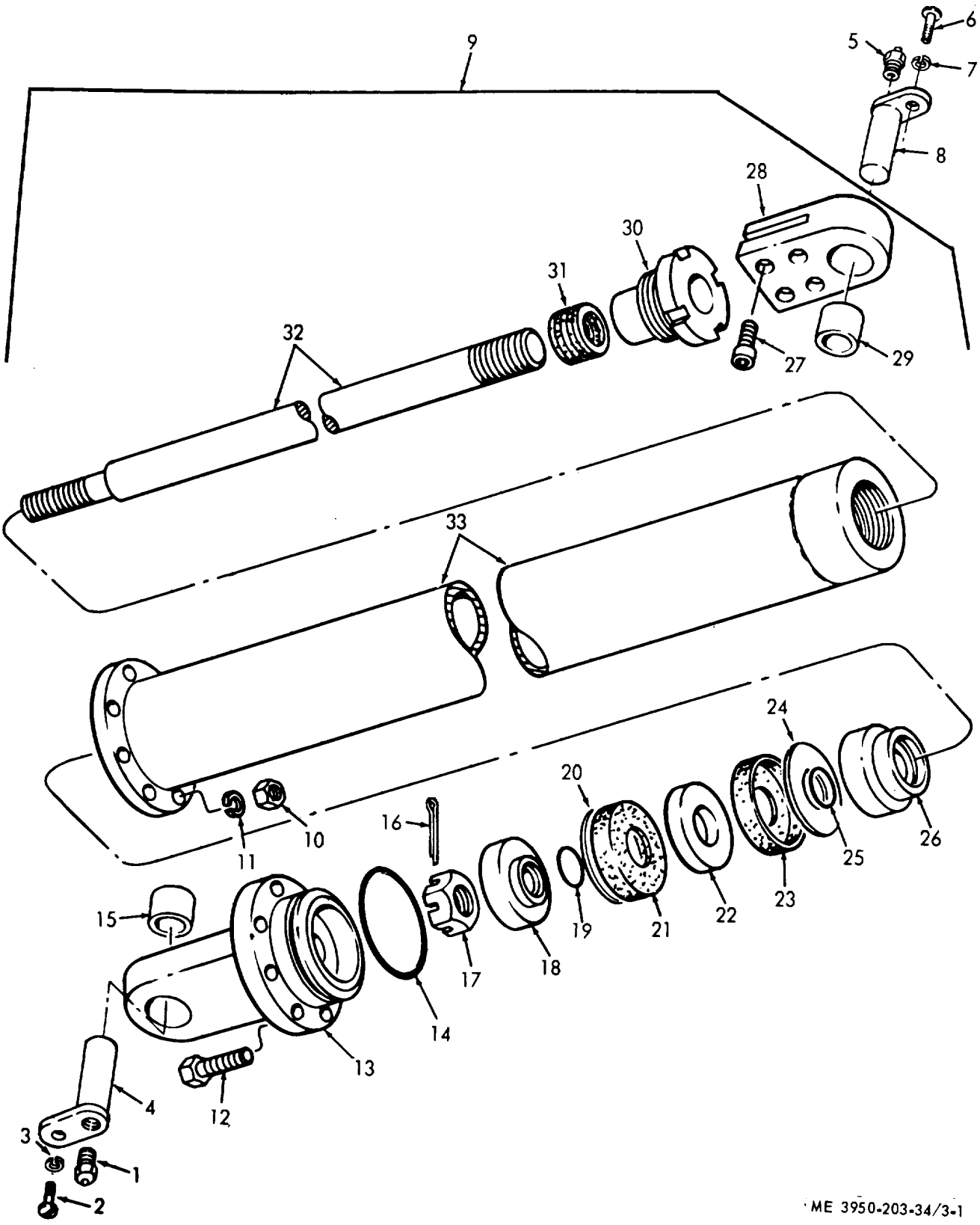


Figure 3-1. Boom topping cylinder, explode view

Key to figure 3-1.

I Fitting lubrication
2 Screw
3 Washer
4 Pin
5 Fitting, lubrication
6 Screw
7 Washer
8 Pin
9 Cylinder assembly
10 Nut (6)
11 Washer (6)
12 Screw (6)
13 End
14 Packing
15 Bushing
16 Pin, cotter
17 Nut
18 Plate
19 Packing
20 Cup
21 Cup
22 Piston
23 Cup
24 Cup
25 Packing
26 Plate
27 Screw
28 Eye
29 Bushing
30 Nut
31 Packing
32 Shaft
33 Cylinder

c. Cleaning, Inspection and Repair.

(1) Clean all parts

(2) Inspect all parts for corrosion, cracks distortion, or other defects. Check contact areas fo scoring. Remove burs with a fine stone.

(3) Replace all seals, packings, and un serviceable parts.

d. Reassembly.

(1) Immerse all parts in clean hydraulic oil for lubrication before assembly.

(2) Refer to figure 3-1 for reassembly of boom topping cylinder.

e. Installation.

(1) Support cylinder in position and insert pins. Secure pins with capscrews and lockwashers.

(2) Connect hydraulic hoses.

(3) Start engine and operate boom thru several cycles to check for proper performance.

3-2. Room Extension Cylinder

a. Removal.

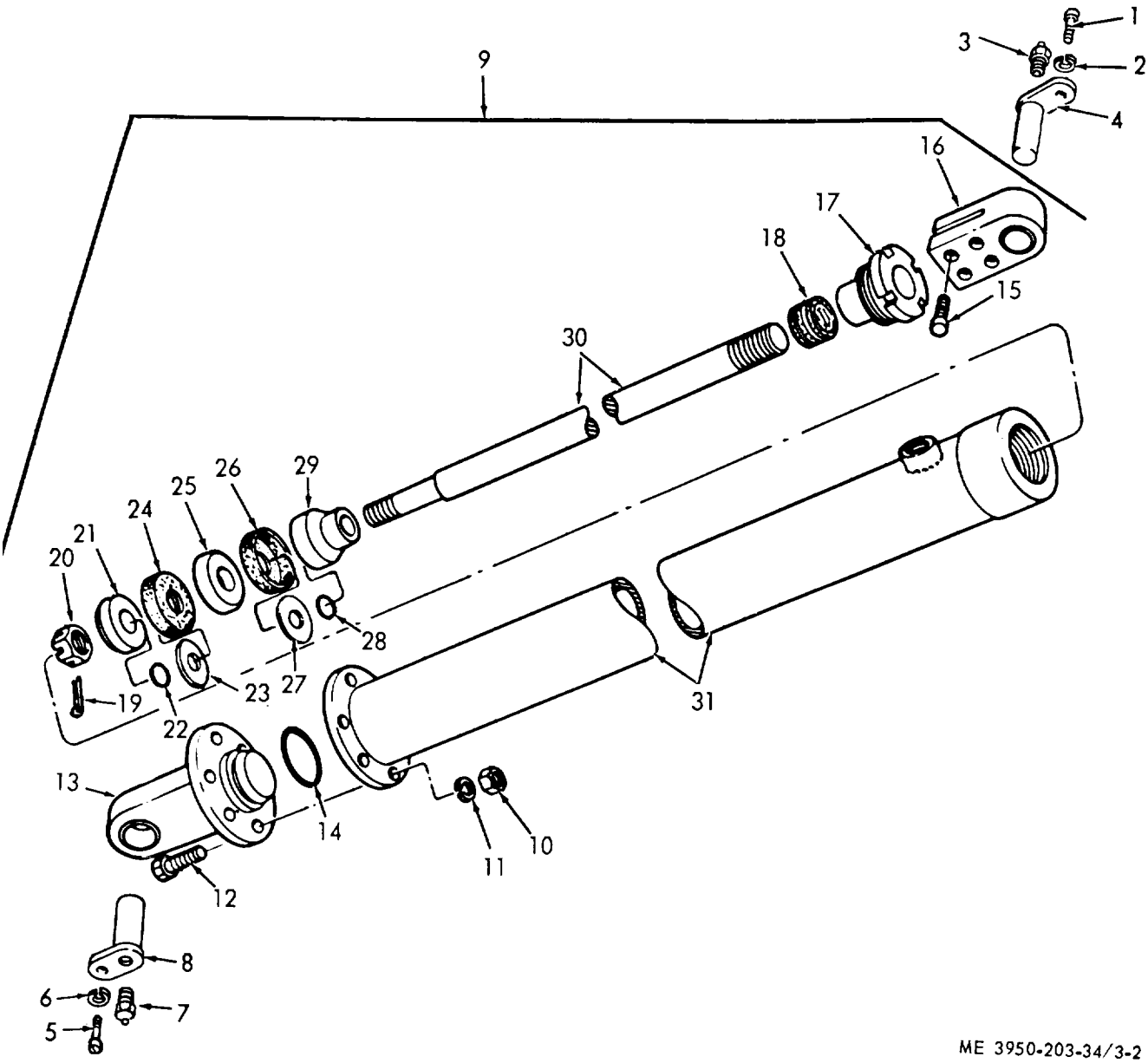
(1) Lower boom (TM 10-3950-203-10) and provide a suitable support for it.

(2) Disconnect hydraulic hoses from extension cylinder.

(3) Refer to figure 3-2 and remove capscrews and washers securing pins (4) and (8).

(4) Support cylinder and remove pins. Remove cylinder.

b. Disassembly. Refer to figure 3-2 and starting: at the cylinder base end (13), disassemble the cylinder to the extent required to repair the cylinder.



ME 3950-203-34/3-2

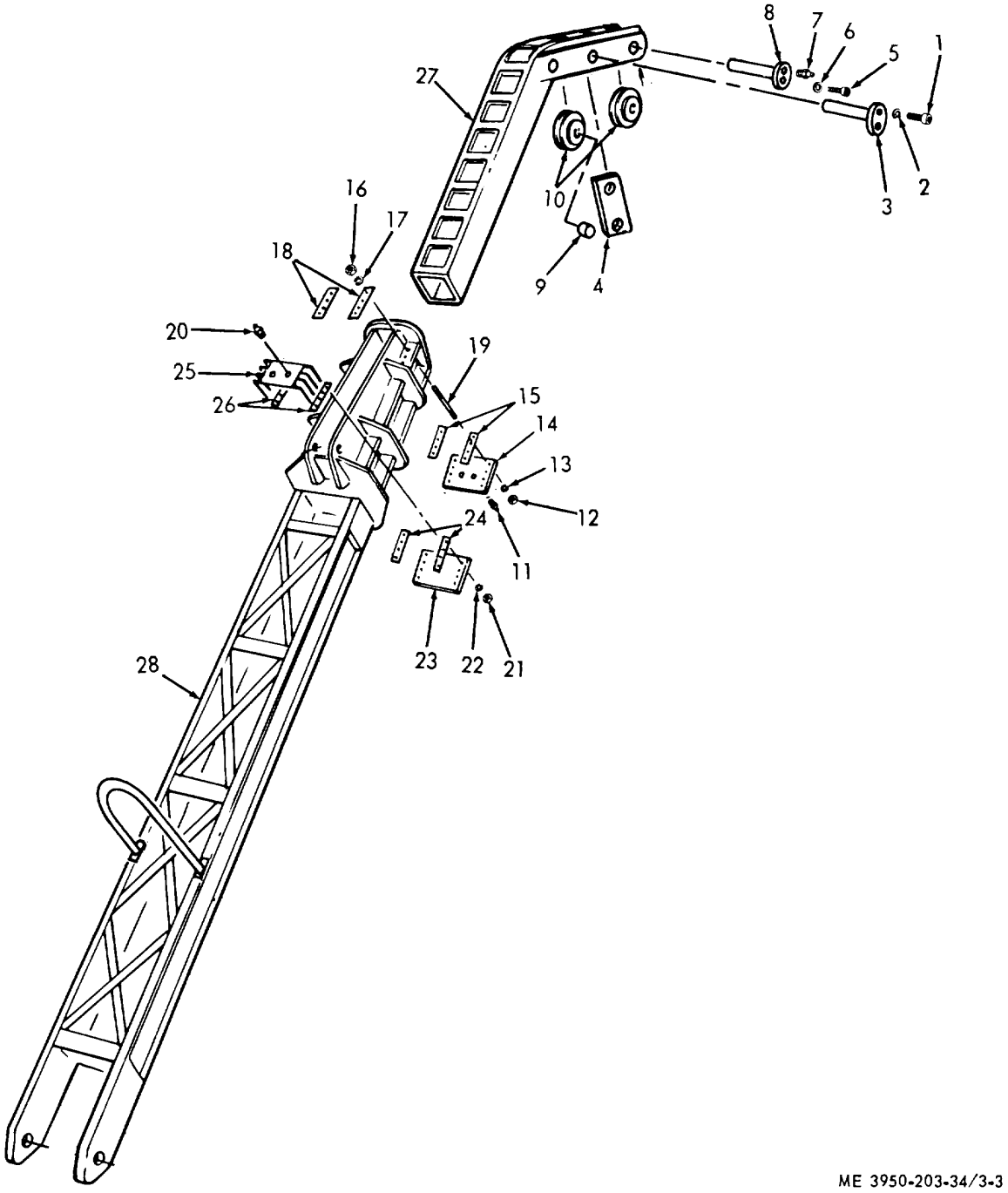
1. screw
2. Washer
3.Fitting, lubrication
4 Pin
5 Screw
6(Washer
7 Fitting, lubrication
8 Pin
9 Cylinder assy
I0 Nut (6)
11 Washer(6)
12 Screw (6)
13 End
I4 Packing
15 Screw (4)
16 Eye
17 Nut
18 Packing
Pin, cotter
20 Nut
21 Plate
22 Packing
23 Cup
24 Cup
25 Piston
26 Cup
27 Plate
28 Packing
29 Plate
30 Shaft
31 Cylinder

Figure 3-2. Boom extension cylinder, exploded view.

c. Cleaning, Inspection and Repair.
(1) Clean all parts.
(2) Inspect all parts for corrosion, cracks distortion or other defects. Check contact areas for scoring. Remove burs with a fine stone.
(3) Replace all seals, packings, and unservicable parts.
d. Reassembly.
(1) Immerse all parts in clean hydraulic oil for lubrication before reassembly.
(2) Refer to figure 3-2 for reassembly of ex tension cylinder.
e. Installation.
(1) Support cylinder in position and insert pins. Secure pins with capscrews and lockwashers
(2) Connect hydraulic lines.
(3) Start engine and operate boom thru several cycles to check for proper performance.

3-3. Boom

a. Removal.
(1) Remove boom (para 2-6).
(2) Remove boom topping cylinder (para 3-1).
(3) Remove boom extension cylinder (para 3-2).
(4) Withdraw boom male section.
b. Disassembly. Refer to figure 3-3 and disassemble boom to extent required for repair.



1 Screw	8 in 121	15 Slide (2)	22 Washer (8)
2 Washer	9 Bearing 2)	16 Nut (8)	23 Support
3 Pin	I0 Pulley 121	17 Washer 18)	24 Slide 121
4 Bar	11 Fitting (21	18 Slide 12)	25 Support
5 Screw (2)	12 Nut (8)	19 Stud 181	26 Slide
6 Washer (2)	13 Washer 8)	20 Fitting 121	27 Boom
7 Fitting (21	14 Support	21 Nut (8)	28 Boom

Figure 3-3. Boom exploded view.

c. Cleaning, Inspection and Repair.
(1) Clean all parts. reassemble boom.
(2) Inspect for cracks or other obvious damage.
(3) Weld cracks and broken welds as necessary.
(4) Replace defective parts as required.

d. Reassembly. Refer to figure 3-3 and
e. Installation.
1) Install male boom section.
(2) Install boom extension cylinder (para 3-2).
(3) Install boom topping cylinder (para 3-1).
(4) Install boom (para 2-6).
(.

Section II. MAST ASSEMBLY

3-4. Winch Assembly
a. Removal
1) Remove load block (TM 10-3950-203-20).
(2) Drain winch case
3) Disconnect hydraulic lines.
b Disassembly. Refer to figure 3-4 to disassemble winch assembly to extent required to effect repairs

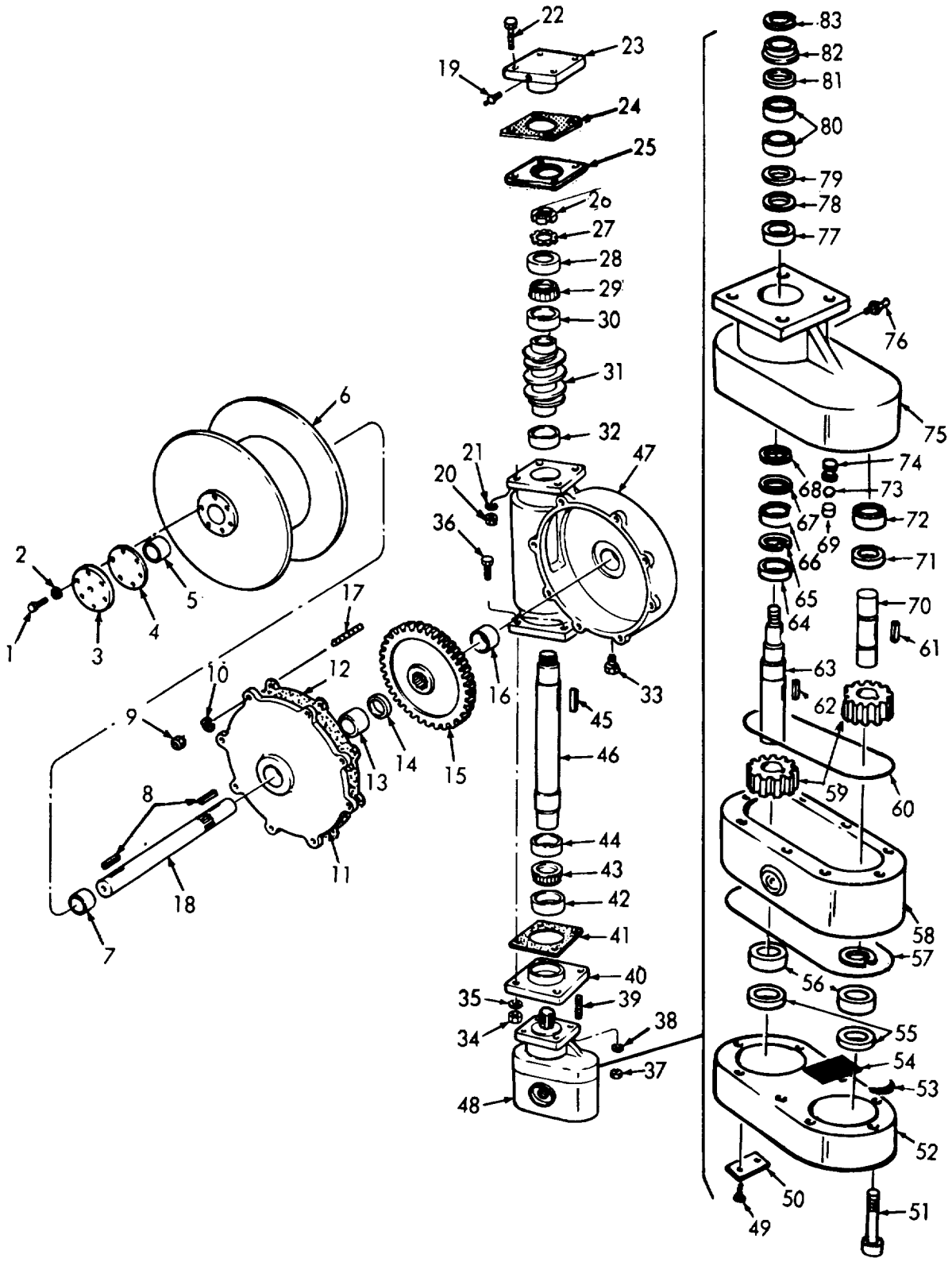


Figure 3-4. W'inch assembly, exploded view.

Key to figure 3-4

I Screw -61	18 Shafts	35 Washer (3)	52 Cover	69 Retainer
2 Washer 16	It) Fitting, lubrication	3(6 Screw (3)	53 Seal (8)	70 Shaft
3 Plate	20) Nut (4)	37 Nut (41	54 Seal (2)	71 Plate
4 Gasket	21 Washer (4)	38 Washer 141	55 Bearing 42)	2 Bearing
5 Bushing	22 Screw 141	30 Stud 14)	56 Plate (2)	73 Bearing
6 Drum	23 End cap	40 Adapter	57 Gasket	74 Seat 12)
-7 Bushing	24 Gasket	41 Gasket	58 Housing	75 Cover
8 Key (2	25 Shim	42 Cup	59 Gear(2)	76 Fitting. lubrication
92 Nut (8)	2, Nut	43 Cone and roller	60 Key	77 Seal
10 Washer (8)	27 Washer	44 Spacer	61 Key	78 Spacer
11 Cover	28 Cup	45 Key	62 Key	79 Washer
12 Gasket	20 Cone and roller	46 Shaft	63 Shaft	80 Bearing
13 Bushing	30 Cup	47 Case	64 Plate	81 Seal
14 Seal	31 Gear	48 Motor	65 Ring (3)	82 Retainer
15 Gear	32 Spacer	49 Screw (2)	66 Bearing	83 Retainer
16 Bushing	33 Plug 14)	50 Plate	67 Packing	
17 Stud 18)	34 Nut (3)	51 Screw (8)	68 Ring	

Figure 3-4. Winch assembly exploded view.

c. Cleaning and Inspection.

(1) Wipe all parts clean.

(2) Inspect all bearings for smooth operatic and housing for nicks and scoring.

(3) Inspect gears for wear, burs, and crack

(4) Inspect all parts for obvious damage.

(5) Replace all seals and gaskets.

(6) Replace defective parts as required.

d. Reassembly.

(1) Apply a light coat of oil to all parts.

(2) Refer to figure 3-4 to reassemble winc assembly.

e. Installation.

(1) Connect hydraulic lines.

(2) Fill gear case in accordance with LO 1I 3950-203-12.

(3) Install load block (TM 10-3950-203-20

(4) Attach 10,000 pound load.

(5) Operate crane (TM 10-3950-203-10) an raise 10,000 pound load.

NOTE

If crane fails to lift load, back off worm gear end cap bolts (22, fig. 3-4) in 1/2 turn increments, exercising caution, until crane lifts load.

WARNING

The worm gear is self-locking. If the end cap bolts are loosened too much, the load will free-fall when the winch control lever is shifted to lower the load.

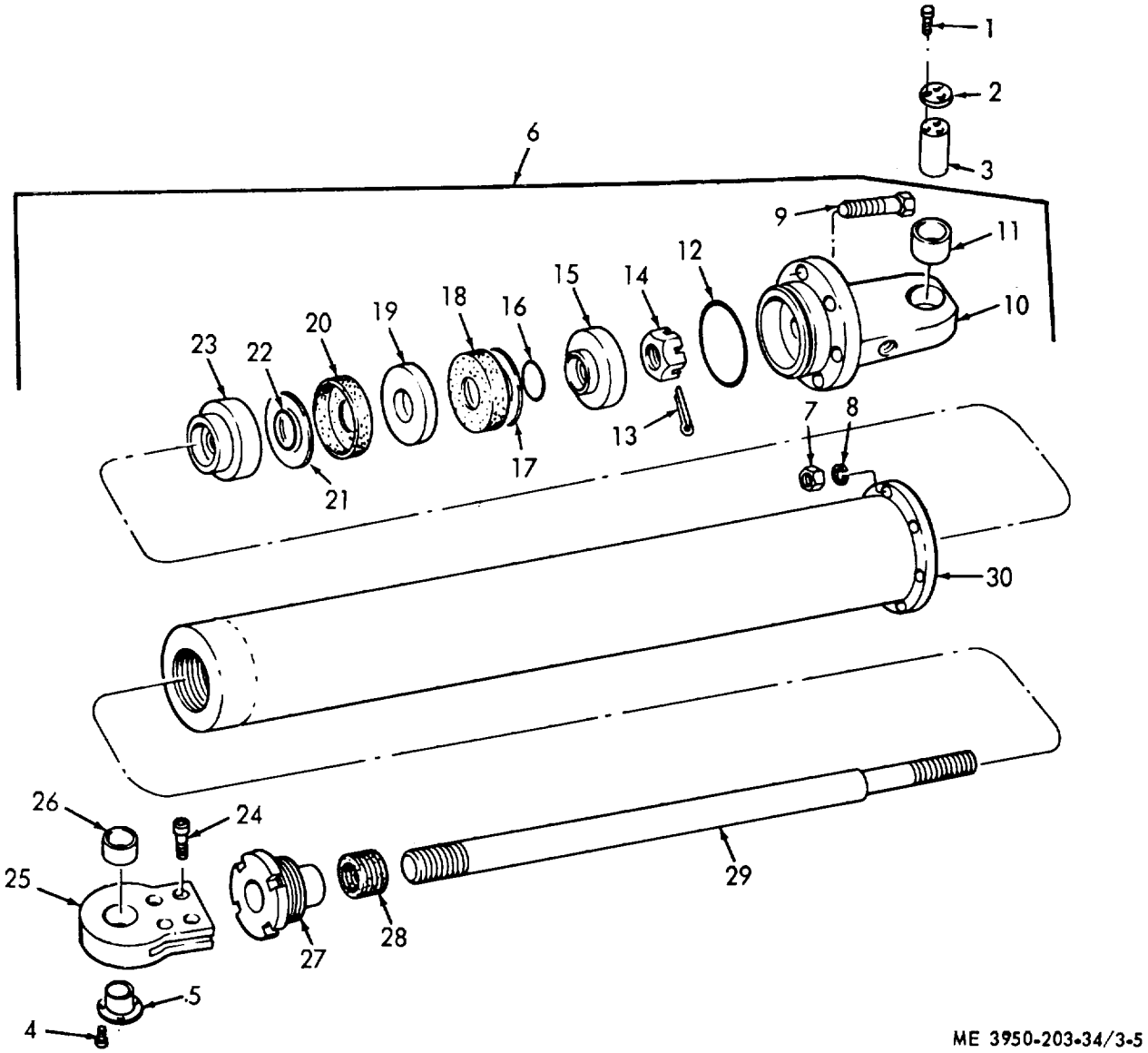
3-5. Slewing Cylinder

a. Removal.

(1) Disconnect hydraulic hoses.

(2) Refer to figure 3-5 and remove capscrews that secure retainer (2) and pin (5) and remove pins (3).and (5). Remove cylinder.

b. Disassembly.Refer to figure 3-5 and starting with cylinder base end (10), disassemble the cylinder to the extent necessary to repair the cylinder.



3 Pin	13 Pin, cotter	23 Plate
4 Screw (2)	14 Nut	24 Screw
5 Pin	15 Plate	25 Eye
6 Cylinder assy	16 Packing	26 Bushing
7 Nut (6)	17 Cup	27 Nut
8 Washer (6)	18 Cup	28 Packing
9 Screw (6)	19 Piston	29 Shaft
0 End	20 Cup	30 Cylinder

Figure 3-5. Stewing cylinder, exploded view.

c. Cleaning and Inspection.
(1) Wipe all parts clean.
(2) Inspect cylinder barrel for scoring. Replace if deeply scored.
(3) Inspect all parts for cracks or obvious damage. Replace defective parts as required.
(4) Replace packings and piston cups
d. Reassembly.
(1) Coat all parts with oil.
(2) Refer to figure 3-5 to reassemble slewing cylinder.
e. Installation.
(1) Support cylinder in position and insert pins. Secure with capscrews

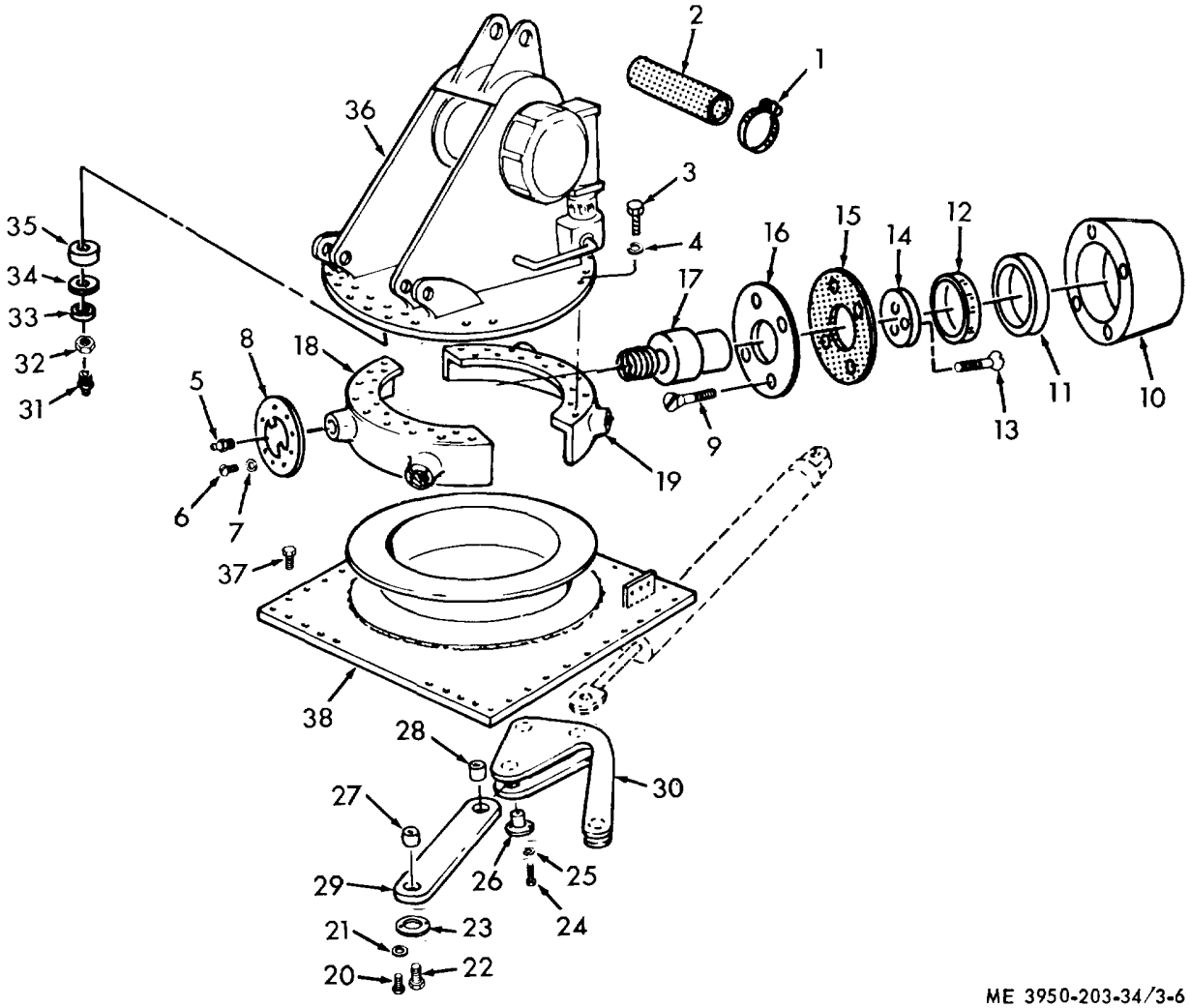
2) Connect hydraulic lines.
3) Start engine and operate cylinder thru several 1800 cycles to check for proper performance.

3-6. Turntable and Slewing Linkage

a. Removal.

(1) Remove mast frame (fig. 2-2).
((2) Disconnect slewing cylinder from linkage arm.

Disassembly. Refer to figure 3-6 to disassemble turntable and slewing linkage components-



1 Clamp (2)
2 Hose (2)
3 Screw (281
4 Washer (28)
5 Fitting, lubrication (4)
6 Screw (8)
7 Washer (8)
8 Plate (41
9 Screw (161
10 Roller (4)
11 Cup (81
12 Cone and rollers (8)
13 Screw (121
14 Retainer (4)
15 Shim
16 Plate(41
17 Shaft (4)
18 Bracket
19) Bracket
20 Bolt
21 Washer (3)
22 Bolt (3)
23 Washer
24 Screw (4)
25 Washer (4)
26 Pin
27 Bushing
28 Bushing
29 Link
30 Arm
31 Fitting 13)
32 Nut (3)
33 Washer (3)
34 Shim
35 Roller 3)
36 Mast frame
37 Screw
38 Plate

Figure 3-6. Turntable and slewing linkage, exploded view.

c. Cleaning and Inspection.
(1) Clean all parts.
(2) Inspect for obvious damage.
(3) Replace defective parts as necessary.
d. Reassembly. Refer to figure 3-6 to reassemble turntable and slewing linkage components.

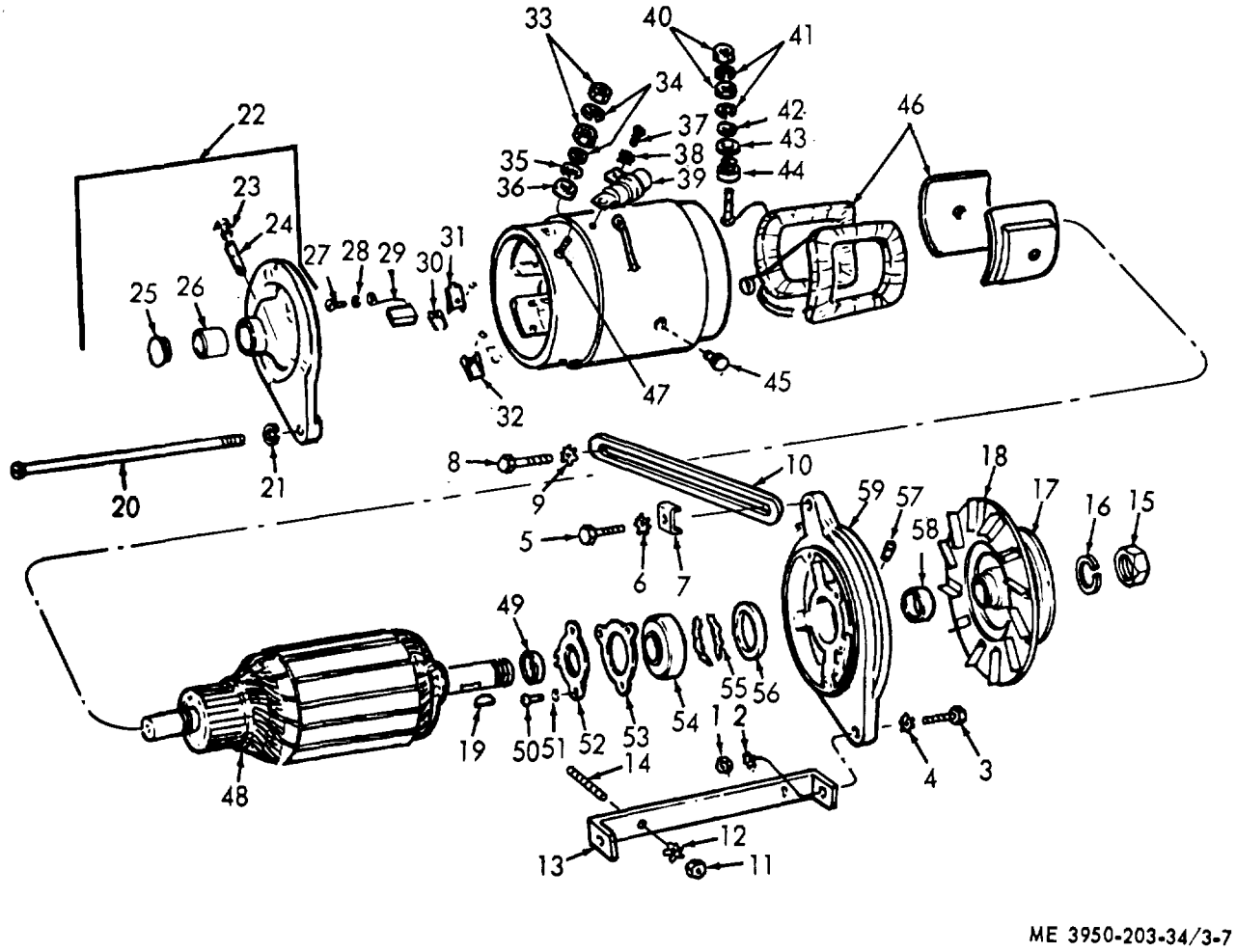
e. Installation.
(1) Connect slewing cylinder to linkage arm.
(2) Install mast frame (fig. 2-2).
(3) Inspect and adjust turntable rollers (TM 10-3950-203-20).

Section III. ELECTRICAL SYSTEM

3-7. Generator

a. Removal. Remove generator (TM 10-3950-20-20).

b. Disassembly. Refer to figure 3-7 and disassemble generator to extent necessary to effect repair



ME 3950-203-34/3-7

Figure 3-7. Generator, exploded view.

Key to figure 3-7.

1 Nut (2)
2 Washer (2)
3 Bolt (2)
4 Washer(2)
5 Bolt
6 Washer
7 Clamp
8 Screw
9 Washer
10 Brace
11 Nut (2)
12 Washer(2)
13 Bracket
14 Stud (2)
15 Nut
16 Washer
17 Pulley
18 Fan
- 19 Key
20 Bolt (2)
21 Washer {(2)
22 Head assy
23 Oil cup
24 Wick
25 Cover
26 Bearing
27 Screw
28 Washer
29 Brush set
30 Spring (2)
31 Holder
32 Holder
33 Nut (2)
34 Washer (2)
35 Washer
36 Washer
37 Screw
38 Washer
39 Capacitor
40 Nut (2)
41 Washer (2)
42 Washer
43 Washer
44 Bushing
45 Screw(2)
46 Coil
47 Screw
48 Armature
49 Spacer
30 Screw (3)
51 Washer (3)
52 Retainer
53 Gasket
54 Bearing
55 Washer
56 Packing
57 Wick
58 Retainer
59 Head assy

b. Cleaning, Inspection, and Repair.

(1) Wipe all parts, except brushes, with a cloth A,N lightly dampened in an approved cleaning solvent.

(2) Wipe brushes with a clean dry cloth.

(3) Inspect armature bearing for worn surfaces, looseness, cracked ring or race. Replace defected bearing.

(4) Check size of brushes. Replace them if they are less than one-half length of a new brush, or if worn within 1/8" of brush holder.

CAUTION

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

(5) Inspect armature commutator for roughness, out-of-round or high mica. If any of these conditions exist turn commutator down on a lathe and undercut mica 1/32 inch. Finish commutator with No. 00 sandpaper. Use compressed air to clean all dust particles from commutator and armature.

(6) Inspect brush holders for defects. Replace defective brush holders.

(7) Measure brush spring tension. Replace springs if tension is less than 28 ounces.

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

(9) Check for open circuits by inspecting for loose connections at points where conductors are connected to the commutator risers. Check continuity between adjacent commutator bars. If open circuit cannot be cleared, replace generator.

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

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

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

d. Reassembly.

(1) Refer to figure 3-7 and reassemble generator.

(2) Perform generator output test (TM 10- 3950-203-20).

e. Installation. Install generator (TM 10-3950- 203-20).

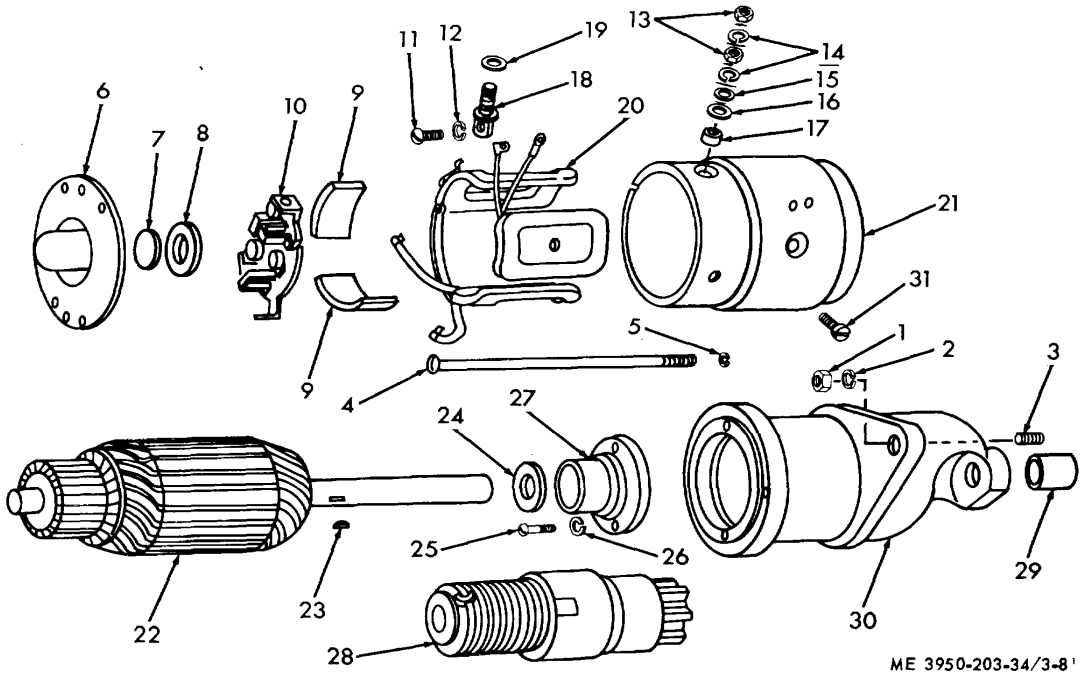
3-8. Starter

a. Removal. Remove starter (TM 10-3950-203-20).

b. Disassembly.

(1) Match-mark end frame, pinion housing, and field frame.

(2) Refer to figure 3-8 and disassemble starter.



1 Nut (3)
2Washer (3)
3 Stud (3)
4 Bolt 2)
5 Washer 12)
6 Head
7 Wick
8 Washer
9 Brush set
10 Plate
11 Screw
12 Washer
13 Nut (2)
14 Washer
15 Washer
16 Washer
17 Bushing
18 Stud
19 Washer
20 Field coil
21 Frame
22 Armature
23 Key
24 Washer
25 Screw
26 Washer
27 Bearing
28 Drive
29 Bearing
30 Housing

Figure 3-8. Starter, exploded view.

c. Cleaning, Inspection, and Repair.

(1) Use cloth lightly dampened in an approved cleaning solvent to clean armature and field frame.

(2) Clean all other parts except brushes in an approved cleaning solvent.

(3) Check size of brushes, if they are less than one-half length of new ones or if worn to within I / 8-inch of the brush holder, replace them.

CAUTION

Always blow dust particles off commutator in the direction away from armature windings

(4) Inspect armature commutator for roughness, out-of-round, or high mica. If any of these conditions exist, turn commutator down on a lathe and undercut mica 1 / 32 inch. Finish with

No. 00 sandpaper. Clean all dust particles off commutator using compressed air.

(5) Check for short circuits in armature by rotating armature on a growler with a steel strip, such as a hacksaw, blade held firmly on armature. The hacksaw blade will vibrate on the area of the short circuit. If short circuits are found, repeat above paragraph (4). If short circuit cannot be corrected, replace starter.

(6) Check for open circuits by inspecting for loose connections at points where conductors are connected to the commutator risers. Continuity must exist between adjacent commutator bars. Resolder if applicable. If open circuit cannot be cleared, replace starter.

(7) Check armature for grounds using a test lamp. Place one probe of test lamp on armature core and the other on each commutator bar in turn. If test lamp lights, armature is grounded. If ground cannot be repaired, replace starter.

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

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

(10) Check brush holders for defects and replace them if defective.

(11)Inspect drive assembly for cracks, breaks, clutching action, or other damage. Replace drive assembly if required.

(12) Inspect bearings for defects. Replace defective bearings.

d. Reassembly.

(1) Refer to figure 3-8 and reassemble starter.

(2) Perform the no-load and resistance tests (TM 10-3950-203-20).

e. Installation. Install starter (TM 10-3950-203-20).

Section IV. Cooling System

3-9. General

This section consists of testing and repairing the radiator.

3-10. Radiator

a. Removal. Remove radiator (TM 10-3950-203-20).

b. Testing and Repairing.

(1) Place cap tightly on radiator and close drain cock. Block off upper hose connection. Connect a line to lower hose connection with an air pressure gage in line.

(2) Submerge radiator in a tank of water. Open compressed air line to radiator and apply a pressure of 8-to 10-psi, then shut-off air supply.

(3) Observe water tank for bubbles escaping from radiator. If no bubbles appear, radiator does not leak. In the event bubbles appear, mark origin of bubbles and repair leak by soldering.

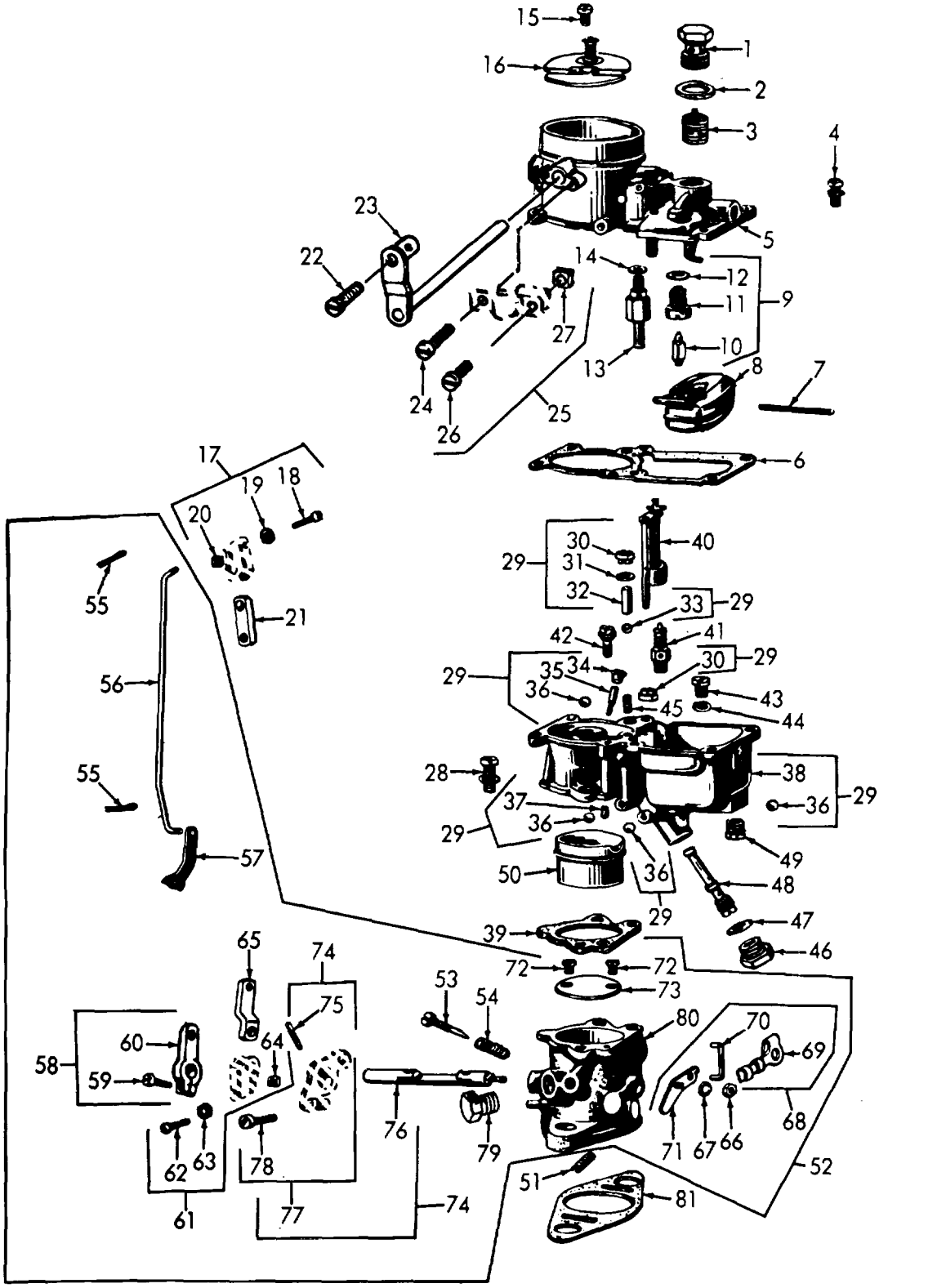
c. Installation. Install radiator (TM 10-3950-203-20).

Section V. Fuel System

3-11. Carburetor

a. Removal .Remove carburetor (TM 10-3950-

b. Disassembly. Refer to figure 3-9 and disassemble carburetor:



ME 3950-203-34/3-9

Figure 3-9. Carburetor, exploded view.

Key to figure 3-9.

1 Plug
2 Washer
3 Filter element
4 Screw
5 Air intake assy
6 Gasket
7 Axle
8 Float
9 Valve assy
10 Valve
11 Seat
12 Washer
13 Piston
14 Washer
15 Screw
16 Plate
17 Stop
18 Screw
19 Washer
20 Nut
21 Lever
22 Screw
23 Shaft and lever
24 Screw
25 Bracket
26 Screw
27 Nut (2)
28 Screw (2)
29 Bowl
30 Check valve 1(2)
31 Washer
32 Weight
33 Ball
34 Plug (4)
35 Jet
36 Plug (4)
37 Bushing
38 Bowl
39 Gasket
40 Pump
41 Valve
42 Jet, idle
43 Jet, main
44 Washer
45 Vent
46 Plug
47 Washer
48 Jet, discharge
49 Plug
50 Venturi
51 Screw
52 Throttle be
53 Needle
54 Spring
55 Cotter pin
56 Rod
57 Lever
58 Clamp
59 Screw
60 Lever
61 Stop assy
62 Screw
63 Washer
64 Nut
65 Lever
66 Nut
67 Washer
68 Lever assy
69 Clip
70 Rod
71 Lever
72 Screw (2)
73 Plate
74 Shaft and l
75 Pin
76 Shaft
77 Stop lever
78 Screw
79 Plug
80 Body
81 Gasket

c. *Cleaning and Inspection.*

(1) Clean all parts with solvent.

(2) Use compressed air to blow out all passages in air intake assembly, fuel assembly, and throttle body.

(3) Refer to figure 3-9 and inspect the following parts for excessive wear, cracks or other defects: spring (10), screw (19), washer (23), spring (25), pin (29), float (30), seat assembly (31), valve (32), seat (33**),** washer (34), cylinder (35), washer (36), washer (43), weight (44), ball (45), valve (47), washer (49), ball (53), washer (56), and jet (62). Replace any of the above parts that have been found defective.

(4) Discard and replace all gaskets.

(5) Inspect all other carburetor parts if any of them are defective. Replace carburetor.

d. Reassembly. Refer to figure 3-9 and reassemble carburetor.

NOTE

Measure float setting with a depth gage from the machined surface of the body to the top side of the float body at the highest point. Correct setting should measure 1 inches -l / 32 inch. Increase or decrease float setting as necessary.

e. Installation. Install and adjust carburetor **(**TM 10-3950-203-20).

3-12. Governor

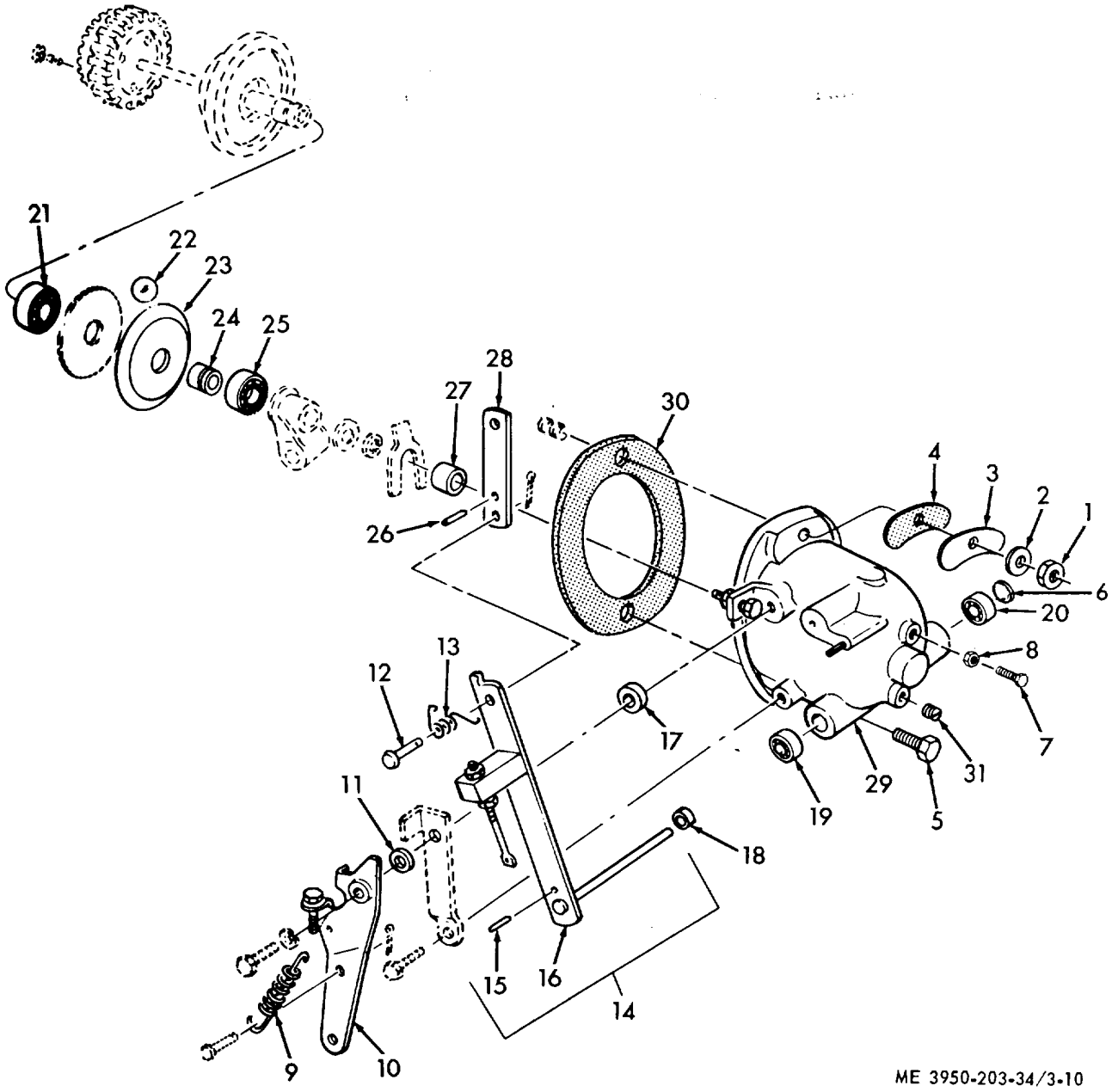
a. Removal and Disassembly.

(1) Remove seat support and left side floorplate.

(2) Disconnect carburetor linkage at governor lever.

(3) Remove mounting hardware (1, 2, 3, and 4) figure 3-10 and remove governor.

b. Disassembly. Refer to figure 3-10 and disassemble governor to extent required to effect repair.



1 Nut
2 Washer
3 Plate
4 Gasket
5 Screw
6 Plug. expansion
7 Screw
8 Nut
9 Spring
10 Lever
11 Seal
12 Pin
13 Spring
14 Lever assy
15 Pin
10 Lever
17 Bearing, sleeve
18 Bearing, sleeve
19 Bearing, needle
20 Bearing, needle
21 Bearing, ball
22 Bearing, ball
23 Bearing
24 Bearing, sleeve
25 Bearing, ball
26 Pin
27 Bearing, sleeve
28 Lever
29 Body
30 Gasket
31 Pipe plug

Figure 3-10. Governor, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for cracks, scoring, or distortion Replace defective parts as necessary.

d. Reassembly.

(1) Dip needle bearings in engine oil.

(2) Refer to figure 3-10 to reassemble governor.

e. Installation.

(1)Aline governor shaft key and install governor. Secure with mounting hardware.

(2) Install carburetor linkage.

(3) Adjust governor (TM 10-3950-203-20).

(4) Install seat support and floor plate.

Section VI. Hydraulic System

3-13. Hydraulic Pump

a. Removal.

(1) Disconnect hydraulic hoses from pump

(2) Remove coupling screws and pump mounting hardware. Remove pump.

b. Disassembly. Refer to figure 3-11 to disassemble hydraulic pump.

CAUTION

Do not pry pump apart because this could damage sealing surfaces.

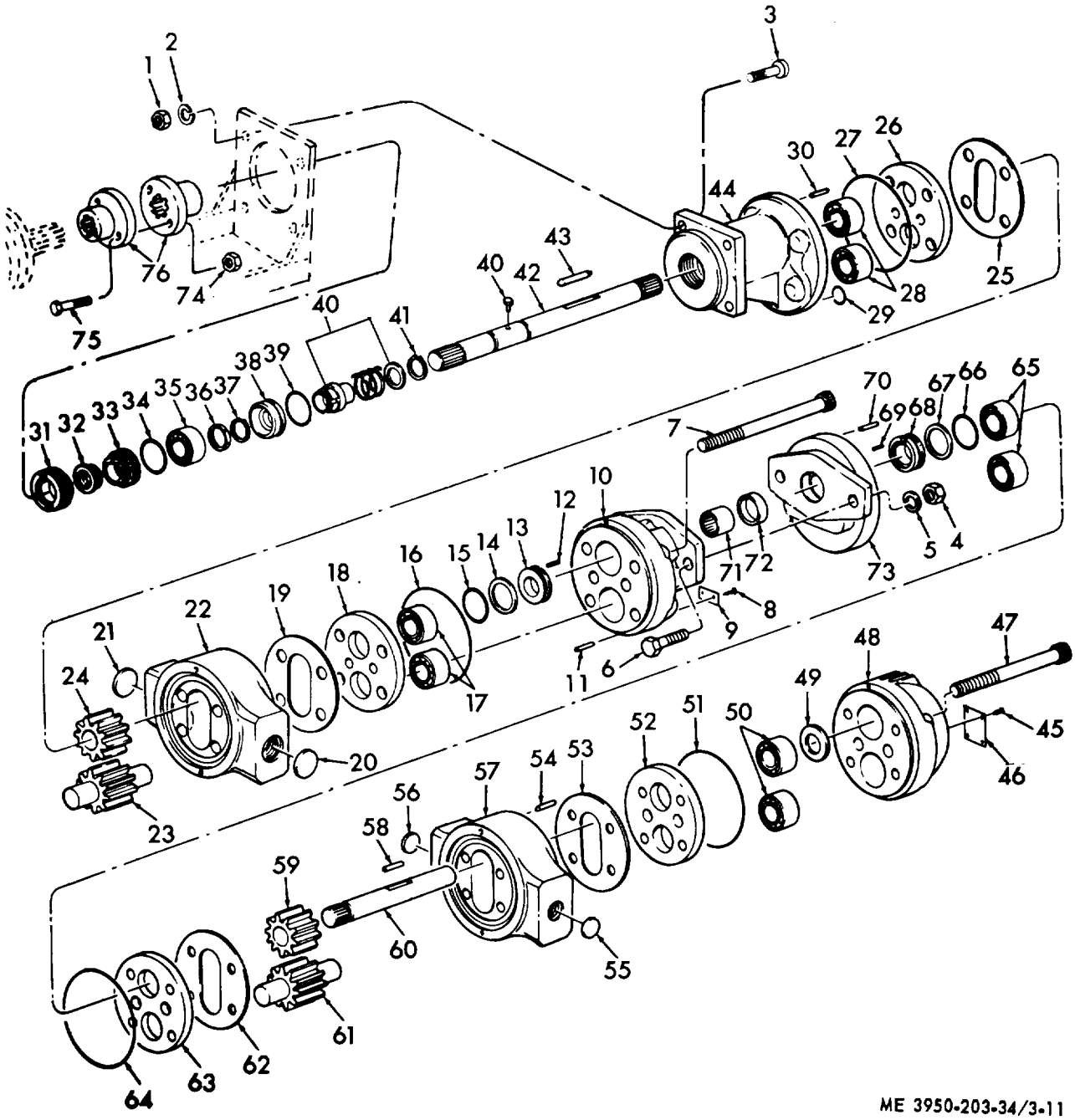


Figure 3-11. Hydraulic pump, exploded view.

Key to figure 3-11.

I Nut (4)
2 Washer (4)
3 Screw (4)
4 Nut (2)
5 Washer (2)
6 Screw (2)
7 Screw (4)
8 Screw (2)
9 Nameplate
10 Plate
11 Pin (4)
12 Pin
13 Bushing
14 Ring
15 Packing
16 Packing
17 Bearing (2
18 Wearplate
19 Shim
20 Plug
21 Plug
22 Housing
23 Gear
24 Gear
25 Shim
26 Wearplate
27 Packing
28 Bearing (2)
29 Packing (2)
30 Pin (2)
31 Retainer
32 Seal
33 Bearing
34 Packing
35 Bearing
36 Retainer
37 Ring
38 Retainer
39 Packing (2)
40 Seal
41 Ring
42 Shaft
43 Pin
44 Adapter
45 Screw
46 Nameplate
47 Screw
48 Cover
49 Thrust wash
50 Bearing (2)
51 Packing
52 Wearplate
53 Shim
54 Pin (2)
55 Plug
56 Plug
57 Housing
58 Dowel
59 Gear
60 Shaft
61 Gear
62 Shim
63 Wearplate
64 Packing
65 Bearing (2)
66 Packing
67 Ring
68 Bushing
69 Pin
70 Pin (2)
71 Coupling
72 Dowel
73 Plate
74 Nut
75 Screw
76 Coupling

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect bearing plate and gear housing for scoring and burs. Remove with mill file or stone.

(3) Inspect gears for wear, cracks, or other defects. Inspect gears width. Replace gears if width is 0.0045 inch less than gear housing.

(4) Discard and replace all "O" rings.

(5) Replace all defective parts as required.

d. Reassembly.

(1) Refer to figure 3-11 and reassemble hydraulic pump.

NOTE

Thrust washer (49) goes in bearing bore on drive shaft side only, with bronze side facing shaft end.

(2) Check rotation by turning pump with an 8 in. wrench. Only a slight drag is acceptable. If drag is too great, use additional shims (53), but do not exceed 0.0045 inch total running clearance.

e. Installation.

(1) Install hydraulic pump and secure with mounting hardware.

(2) Connect hydraulic hoses.

(3) Start engine and check for proper pump performance by operating control levers.

3-14. Control Valve

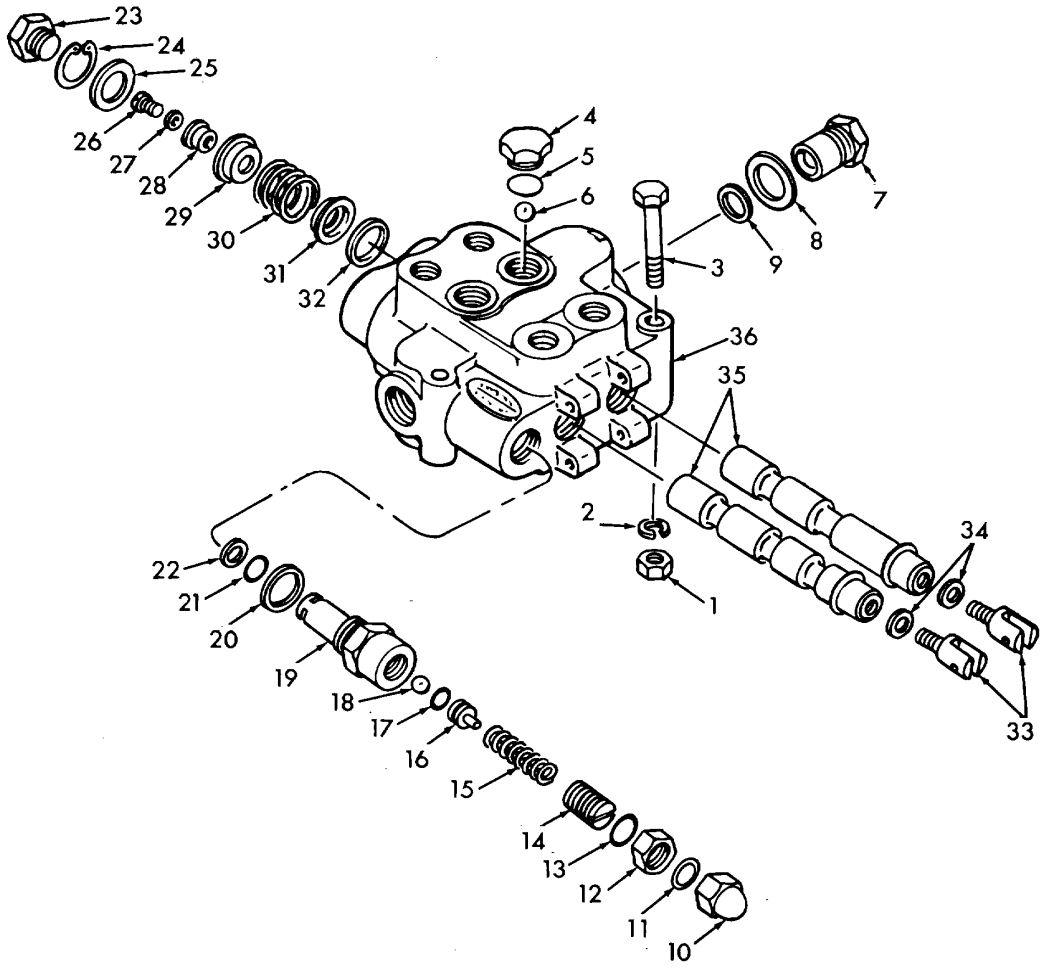
a. Removal.

(1) Disconnect hydraulic hoses.

(2) Remove control levers.

(3) Remove attaching hardware and remove control valve.

b. Disassembly. Refer to figure 3-12 and disassemble control valve.



ME 3950-203-34/3-12

1 Nut (3)
2 Washer (3)
3 Screw (31
4 Plug (2)
5 Packing (21
6 Ball (2)
7 Sleeve
8 Gasket
9 Seal
10 Nut
11 Washer
12 Nut
13 Washer
14 Screw
15 Spring
16 Guide
17 Seal
18 Ball
19 Body
20 Gasket
21 Washer
22 Packing
23 Cap (2)
24 Ring (2)
25 Washer (2)
26 Screw (2)
27 Washer 42)
28 Collar (2)
29 Seal (2)
30 Spring{2}
31 Collar (2)
32 Seal (2)
33 Adapter (2)
34 Washer (2)
35 Spool 121
36 Housing

Figure 3-12. Control Valve, exploded view

c. *Cleaning*, Inspection and Repair.

(1) Clean all parts.

(2) Inspect all parts for scoring and burs. Replace deeply scored parts.

(3) Inspect spools for freedom of motion valve body.

(4) Inspect springs for tension and cracks

(5) Inspect all threads for damage or ot defects.

(6) Replace all defective parts as requires

(7) Replace all gaskets and packing.

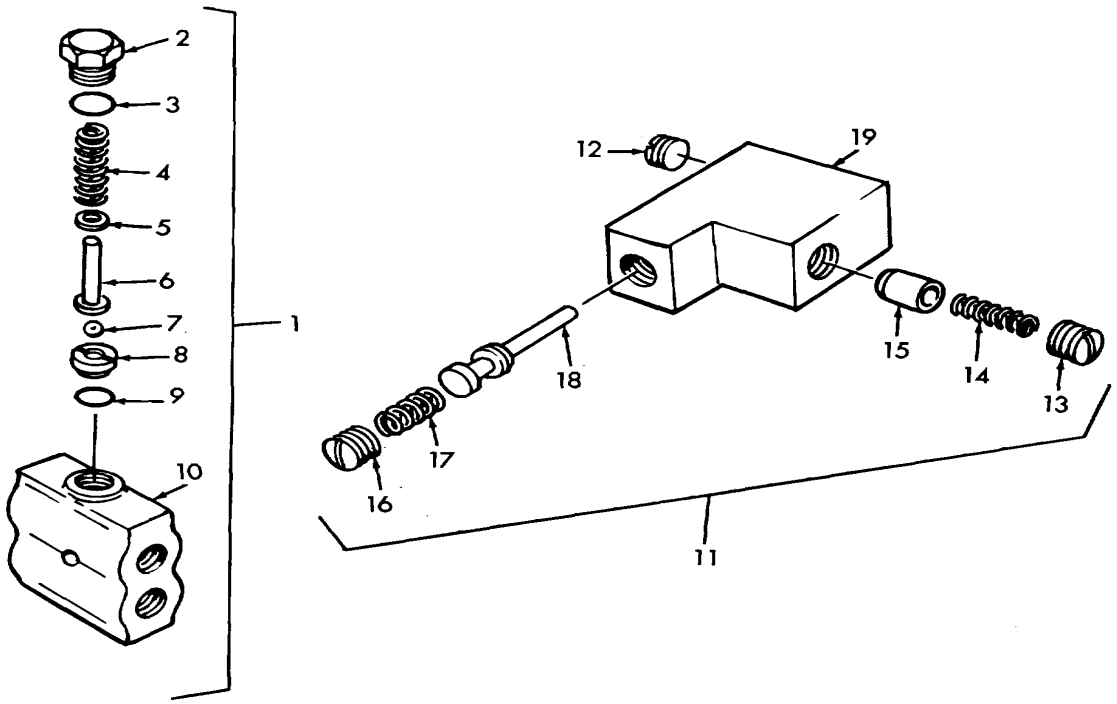
d. Reassembly. Refer to figure 3-12 and reassemble control valve.

e. Installation. Reverse removal procedures a above. With engine running, adjust relief valve adjusting screw (14) to open valve at a pressure of 1500 psi.

3-15. Cushion Valve

a. *Removal.* Disconnect hydraulic lines and remove mounting hardware from cushion valve. Remove valve.

b., *Disassembly.* Refer to figure 3-13 and disassemble cushion valve.



ME 3950-203-34/3-13

1 Valve assy
2 Cap
3 Seal
4 Spring
5 Washer
6 Guide
7 Bearing
8 Seat
9 Seal
10 Housing
11 Regular assy
12 Plug
13 Plug
14 Spring
15 Piston
16 Plug
17 Spring
18 Spool
19 Housing

Figure 3-13. Cushion valve and pressure regulator, exploded view

c. Cleaning and Inspection.
(1) Clean all parts.
(2) Inspect all parts for defects.
(3) Replace seals and defective parts.

d. Reassembly. Refer to figure 3-13 reassemble cushion valve.

e. Installation
(1) Install mounting hardware.
(2) Connect hydraulic lines.

3-16. Pressure Regulator

a. Removal. Disconnect hydraulic lines and mounting hardware from pressure regulator.

b. Disassembly. Refer to figure 3-13 to disassemble pressure regulator.

c. Cleaning and Inspection.
(1) Clean all parts.
(2) Inspect all parts for obvious defects.
(3) Replace defective parts as necessary.

d. Reassembly. Refer to figure 3-13 reassemble pressure regulator.

e. Installation.
(1) Install mounting hardware.
(2) Connect hydraulic lines.

3-17. Hydraulic Reservoir

a. Removal.
(1) Remove engine (para 2-8).
(2) Drain hydraulic reservoir.
(3) Disconnect hydraulic lines from hydraulic reservoir.
(4) Remove hydraulic reservoir.

b. Cleaning and Inspection.
(1) Clean reservoir.
(2) Inspect for defects. Repair or replace hydraulic tank as necessary.

c. Installation.
(1) Install hydraulic reservoir.
(2) Install hydraulic lines.
(3) Install engine (para 2-8).
(4) Fill hydraulic tank (LO 5-3950-203-12).

Section VII. STEERING SYSTEM

3-18. Steering Cylinder

a. Removal. Remove steering cylinder (TM 10-3950-203-20).

b. Disassembly. Disassemble steering cylinder as shown in figure 3-14, starting with cylinder base end (11), to extent necessary to repair the cylinder.

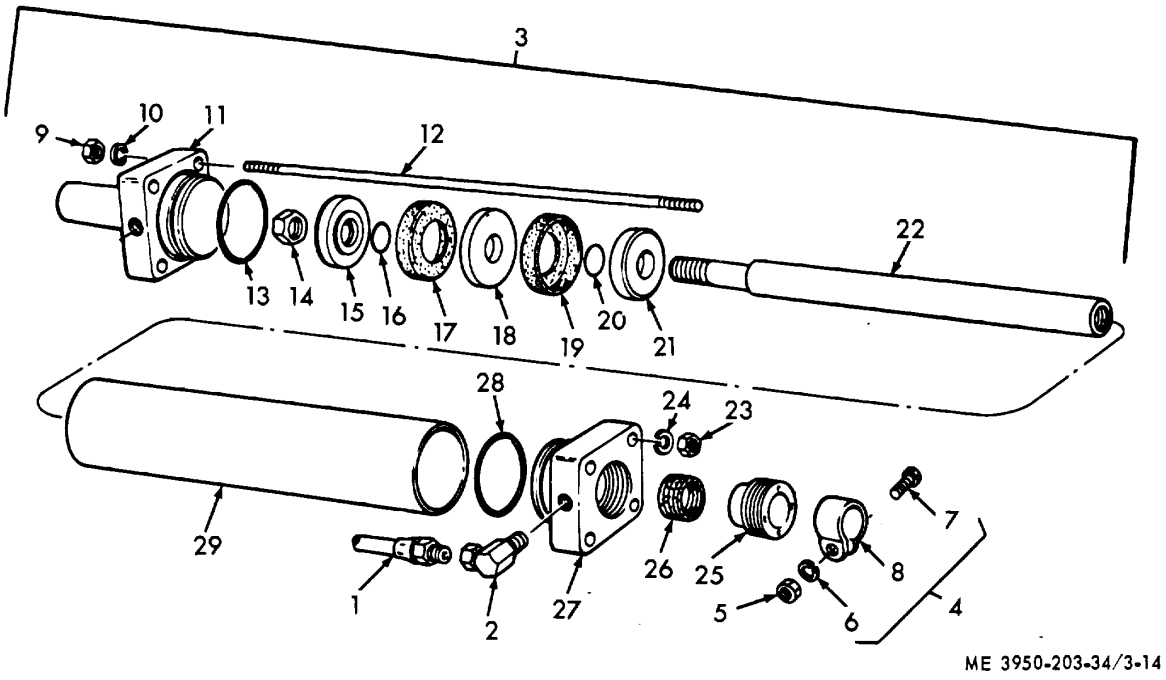


Figure 3-14. Steering cylinder, exploded view.

Key to figure 3-14,

1 Hose assy
2 Elbow (2)
3 Cylinder assy
4 Clamp (2)
5 Nut (2)
6 Washer (2)
7 Bolt (2)
8 Clamp (2)
9 Nut (4)
10 Washer (4)
11 End
12 Bolt (4)
13 Packing (2)
14 Nut
15 Plate
16 Packing
17 Cup
18 Piston
19 Cup
20 Packing
21 Plate
22 Shaft
23 Nut (4)
24 Washer (4)
25 Nut
26 Packing
27 End
28 Packing
29 Barrel

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect all parts for corrosion, cracks distortion, or other defects. Check contact areas foi scoring. Remove burs with a fine stone.

(3) Replace all seals, packings, and un serviceable parts.

d. Reassembly and Installation.

(1) Immerse all parts in clean hydraulic oil for lubrication before reassembly.

(2) Reassemble steering cylinder as shown in figure 3-14.

e. Installation.

(1) Install steering cylinder (TM 10-3950-’ 203-20).

(2) Start engine and operate cylinder thru several cycles to check for proper operation.

3-19. Steering Gear and Related Parts

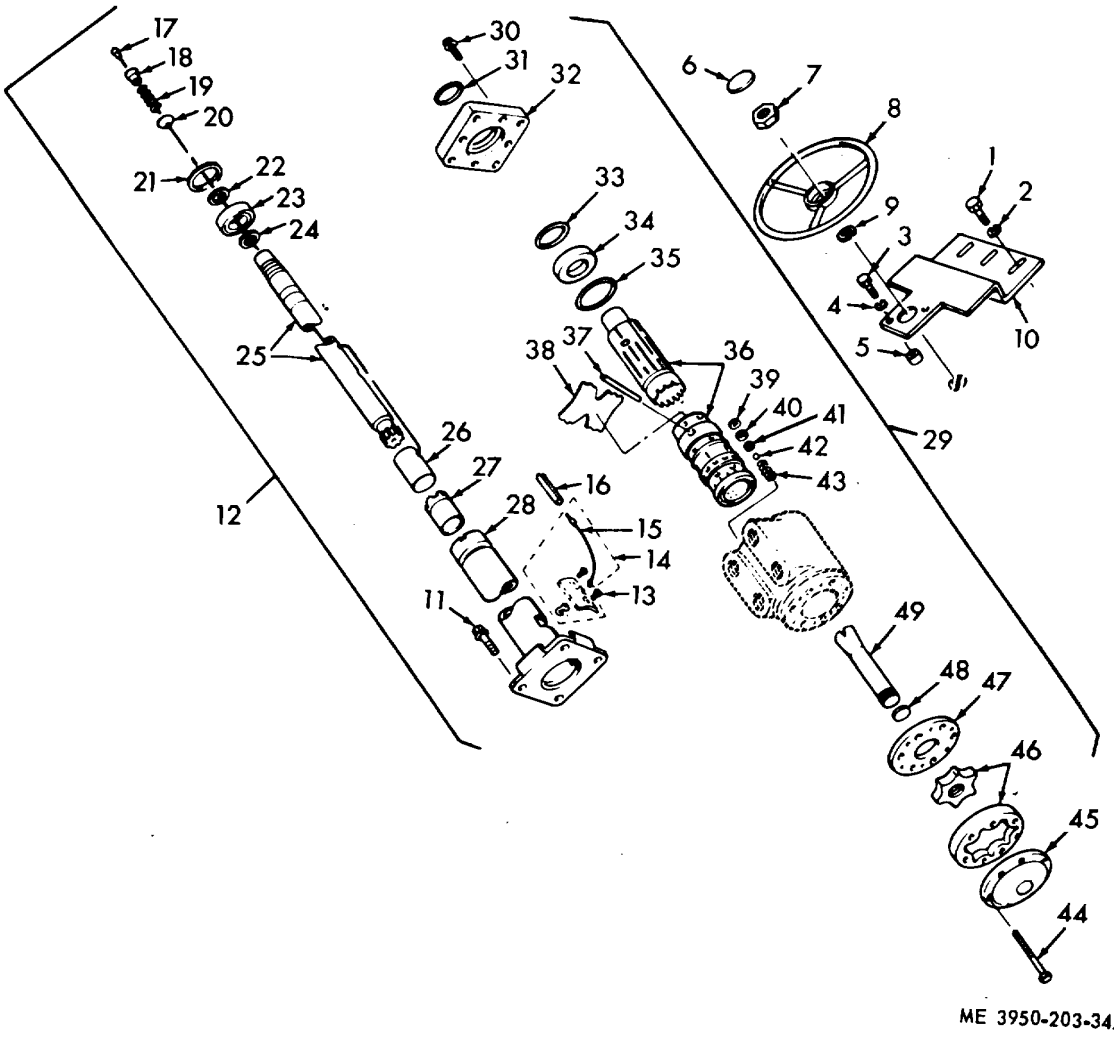
a. Removal.

(1) Remove horn button (6, fig. 3-15) and unscrew nut (7) from shaft (25). Remove wheel (8).

(2) Remove screws (3) and washers that secure assembly to bracket.

(3) Disconnect and tag hydraulic lines and fittings for proper reassembly. Remove steering assembly from bracket.

b. Disassembly. Refer to figure 3-15 to disassemble steering gear and related parts.



1.Screw (3)
2 Washer (3)
3 Screw (2)
4 Washer (2)
5 Bushing(2)
6 Button
7 Nut
8 Wheel
9 Gasket
10 Plate
11 Screw (4)
12 Column
13 Screw (2)
14 Brush
15 Terminal
16 Connector
49 Drive

17 Wire assy
18 Insulator
19 Spring
20 Washer
21 Ring
22 Ring
23 Bearing
24 Ring
25 Shaft
26 Ring
27 Insulator
28 Tube and flange
29 Valve assy
30 Screw (4)
31 Seal
32 Plate

33 Seal
34 Bushing
35’ Packing
36 Control assy
37 Pin
38 Spring (6)
39 Packing
40 Plug
41 Seat
42 Ball
43 Spring
44 Screw (7)
45 Cap (2)
46 Gear set
47 Plate
48 Spacer

Figure 3-15. Steering gear and related parts, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for obvious damage and defects. Replace defective parts as necessary.

d. Reassembly. Refer to figure 3-15 to reassemble steering gear and related parts.

e. Installation. Reverse removal procedure in a above. Start engine and operate steering thru several cycles to check for proper steering control.

Section VIII. AXLES BRAKES, AND DIFFERENTIAL

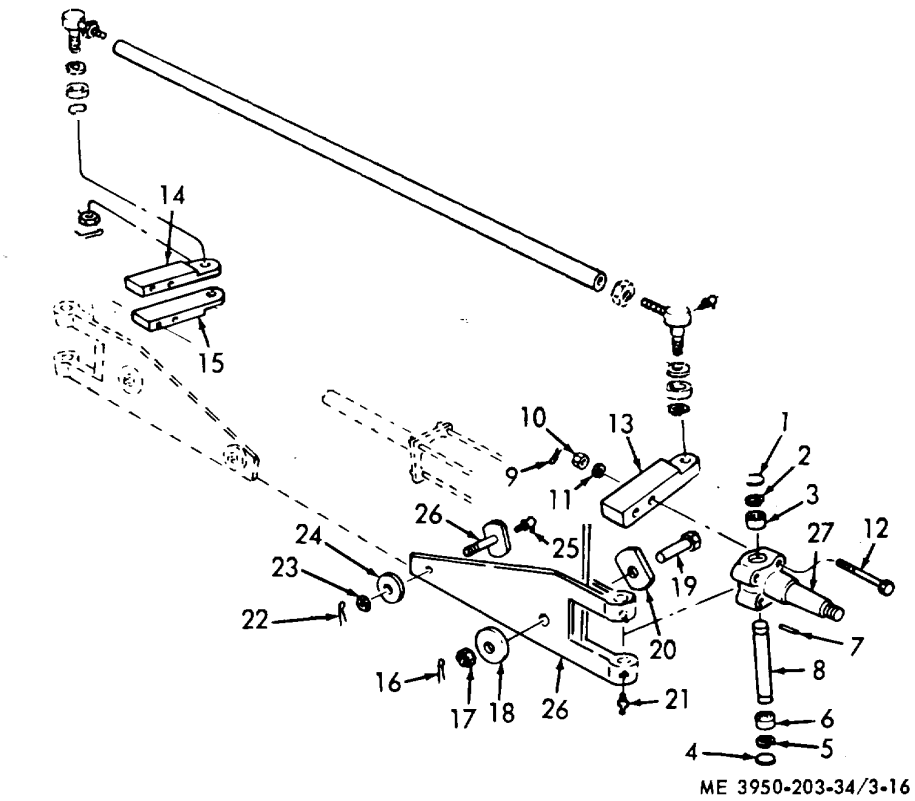
3-20. Rear Axle Spindles and Related Parts

a. Removal.

(1) Remove rear wheels (TM 10-3950 20).

(2) Remove steering cylinder (TM 10-3950- 203-20).

(3) Refer to figure 3-16 to remove rear axle spindles and related parts as shown.



1Plug
2 Ring
3 Bearing
4 Plug
5 Ring
6 Bearing
7 Pin
8 Kingpin
9 Cotter pin (6)
10 Nut (6)
11 Washer (6)
12 Screw
13 Arm
14 Arm
15 Arm
16 Cotter pin (2)
17 Nut 12)
18 Washer (2)
19 Pin (2)
20 Sleeve (2)
21 Fitting (2)
22 Cotter pin
23 Nut
24 Washer
25 Fitting
26 Arm
27 Spindle

Figure 3-16. Rear axle spindle and related parts, exploded view

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for cracks and other defects. Replace defective parts as necessary.

c. Reassembly and Installation.

(1) Refer to figure 3-16 to reassemble and) install rear axle spindle and related parts.

(2) Install steering cylinder (TM 10-3950-203-20).

(3) Install rear wheels (TM 10-3950-203-20).

3-21. Front Wheel Drive Shaft and Brake Drum

a. Removal.

(1) Remove front wheel (TM 10-3950-203-20

(2) Remove front wheel drive shaft and brake drum as shown in figure 3-17.

STEP 1. REMOVE DRIVE AXLE BEARING RETAINER BOLTS (4).

STEP 2. REMOVE RETAINING RING FROM DRIVE AXLE AT PINION DRIVE GEAR.

STEP 3. RE,MOVE RETAINING RING ON I DRIVE AXLE SHAFT BEHIND BRAKE DRUM.

STEP 4. HAVE SOME ONE HOLD BRAKE DRUM WHILE ANOTHER MECHANIC WITH A SUITABLE GEAR PULLER REMOVES THE PINION DRIVE GEAR, BEARING RETAINER, BEARING AND DRIVE AXLE SHAFT.

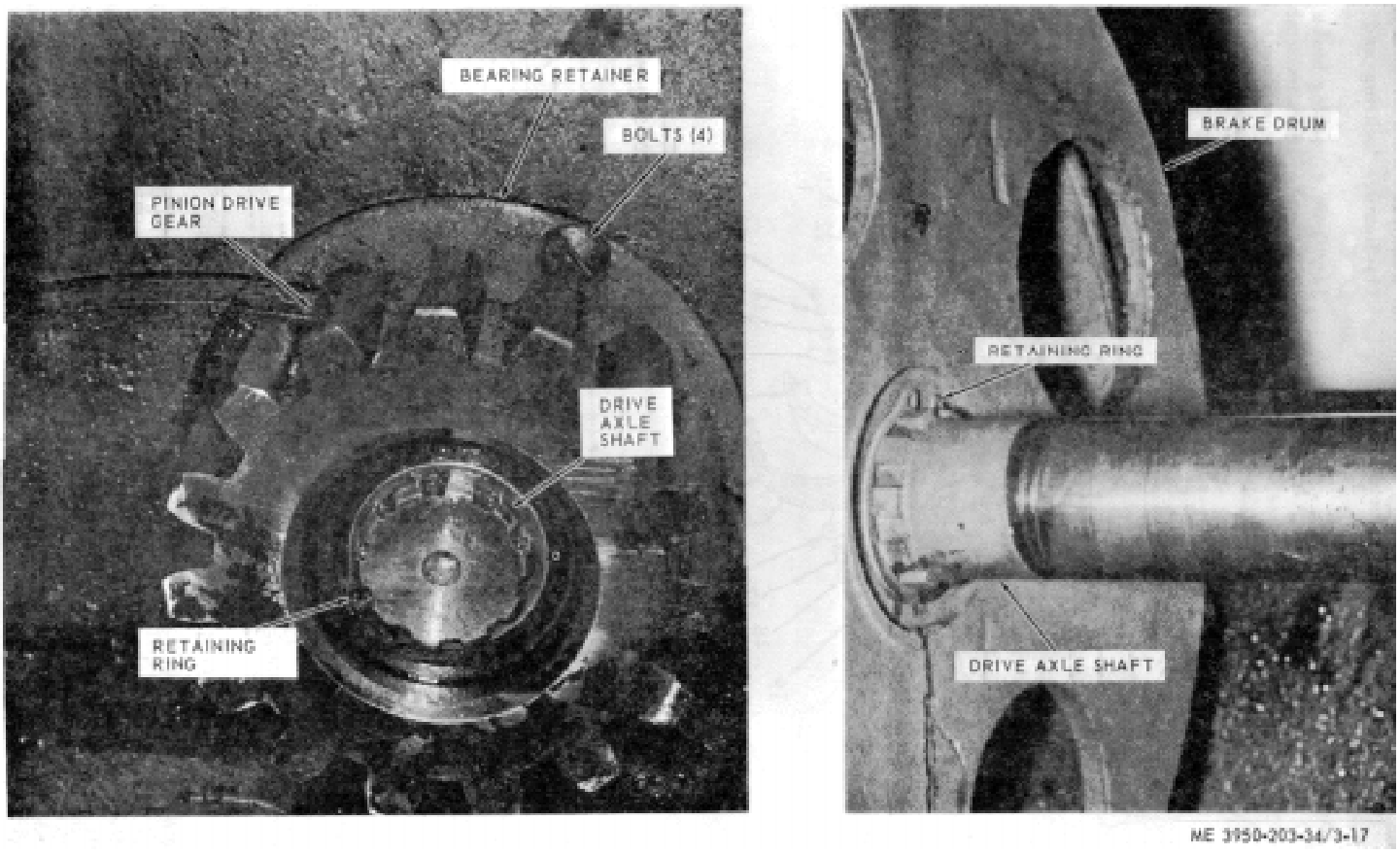


Figure 3-17. Front wheel, drive shaft, and brake drum removal.

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for cracks or other defects. Replace defective parts as necessary.

c. Installation.

(1) Install front wheel drive shaft and brake drum by reversing removal procedures a above

(2) Install front wheel (TM 10-3950-203-20

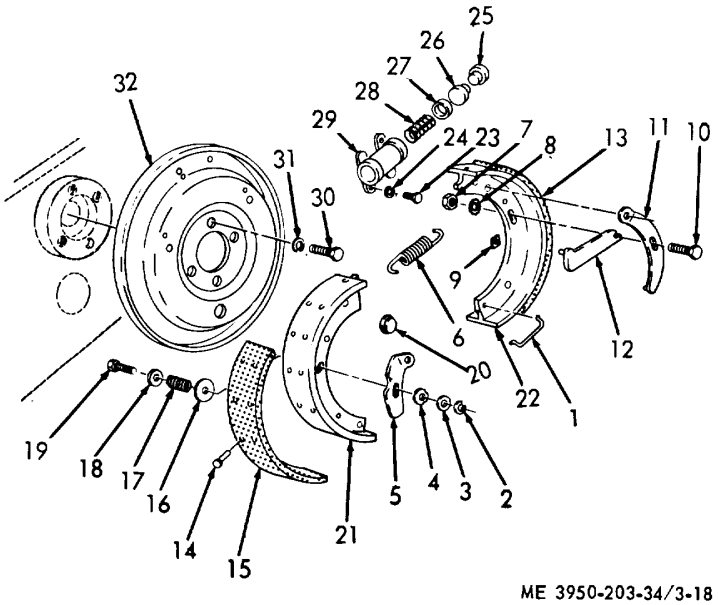
3-22. Service Brake and Wheel Cylinder

a. Removal.

(1) Remove lockring and slide back brake drum.

(2) Remove parking brake cable.

(3) Remove and disassemble service brakes and wheel cylinder components as shown in figure 3-18 to extent necessary to effect repair.



ME 3950-203-34/3-18

1 Spring
2 Lock (2)
3 Washer (2)
4 Lock (2)
5 Lever
6 Spring
7 Nut
8 Lockwasher
9 Washer
10 Bolt
11 Lever
12 Link
13 Lining
14 Rivet (24)
15 Lining
16 Cam (2)
17 Spring
18 Washer (2)
19 Stud (2)
20 Cover
21 Shoe
22 Shoe
23 Screw (4)
24 Washer (4)
25 Boot (2)
26 Piston (2)
27 Cup (2)
28 Spring
29 Cylinder
30 Screw (4)
31 Washer (4)
32 Backing plate

b. Cleaning and Inspection.

(1) Wire-brush brake shoes to remove glazed area. Remove oil or grease.

(2) Inspect brake lining for excess scoring, or other defects. Replace worn or brake shoes.

(3) Inspect wheel cylinder for leaks defective parts.

(4) Inspect all parts for cracks, distortion or other defects. Replace defective parts as necessary.

c. Reassembly.

(1) Reassemble wheel cylinder and service brake in reverse order of removal.

(2) Connect parking brake cables.

(3) Install brake drum and secure with lockring.

(4) Adjust brakes as described in TM 10-3950-203-20

Figure 3-18 Service Brake, exploded view.

3-23. Master Brake Cylinder

a. Removal. Remove master brake cylinder (TM 10-3950-203-20).

b. Disassembly. Disassemble master brake cylinder as shown in figure 3-19.

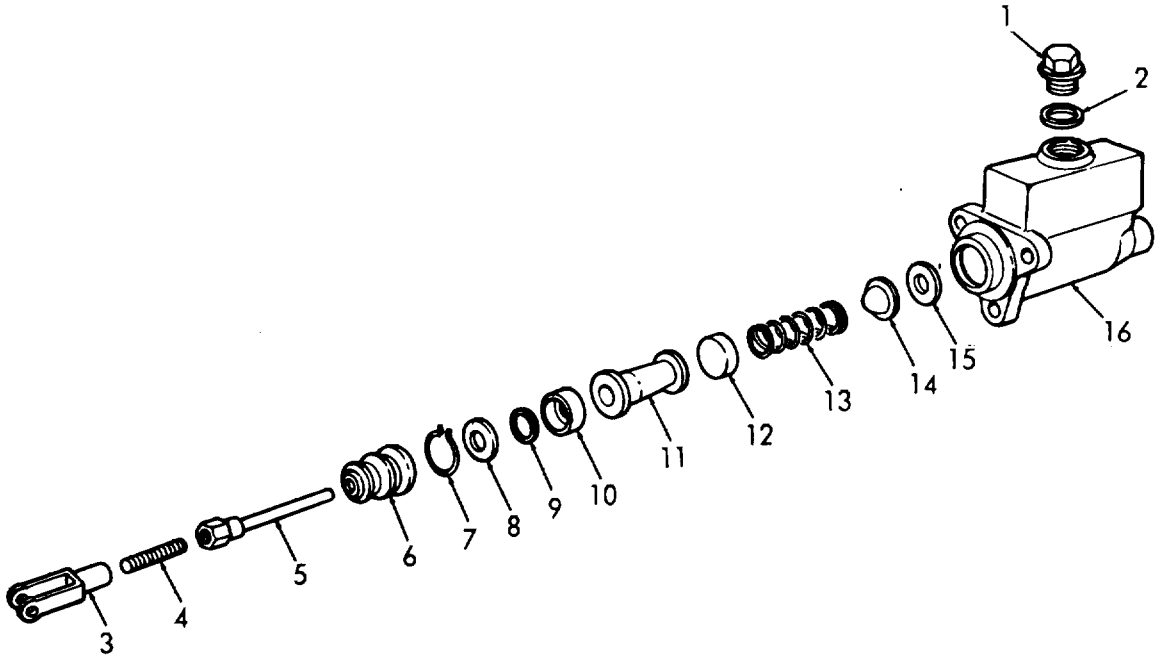


Figure 3-19. Master brake cylinder, exploded view.

1 Plug
2 Gasket
3 Yoke
4 Stud
5 Rod
6 Boot
7 Lockwire
8 Plate
9 Ring
10 Cup
11 Protector
12 Cup
13 Spring
14 Seat
15 Check valve
16 Cylinder

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect piston-fit in cylinder bore. Replace piston and / or cylinder if clearance exceeds 0.005 in.

(3) Replace piston cups.

(4) Hone cylinder as required to remove rough spots.

(5) Inspect all parts for cracks or other defects. Replace defective parts as necessary.

NOTE

Lubricate rubber parts with brake fluid before reassembly.

d. Reassembly. Reassemble master brake cylinder by reversing disassembly procedure.

e. Installation. Install master brake cylinder (TM 10-3950-203-20).

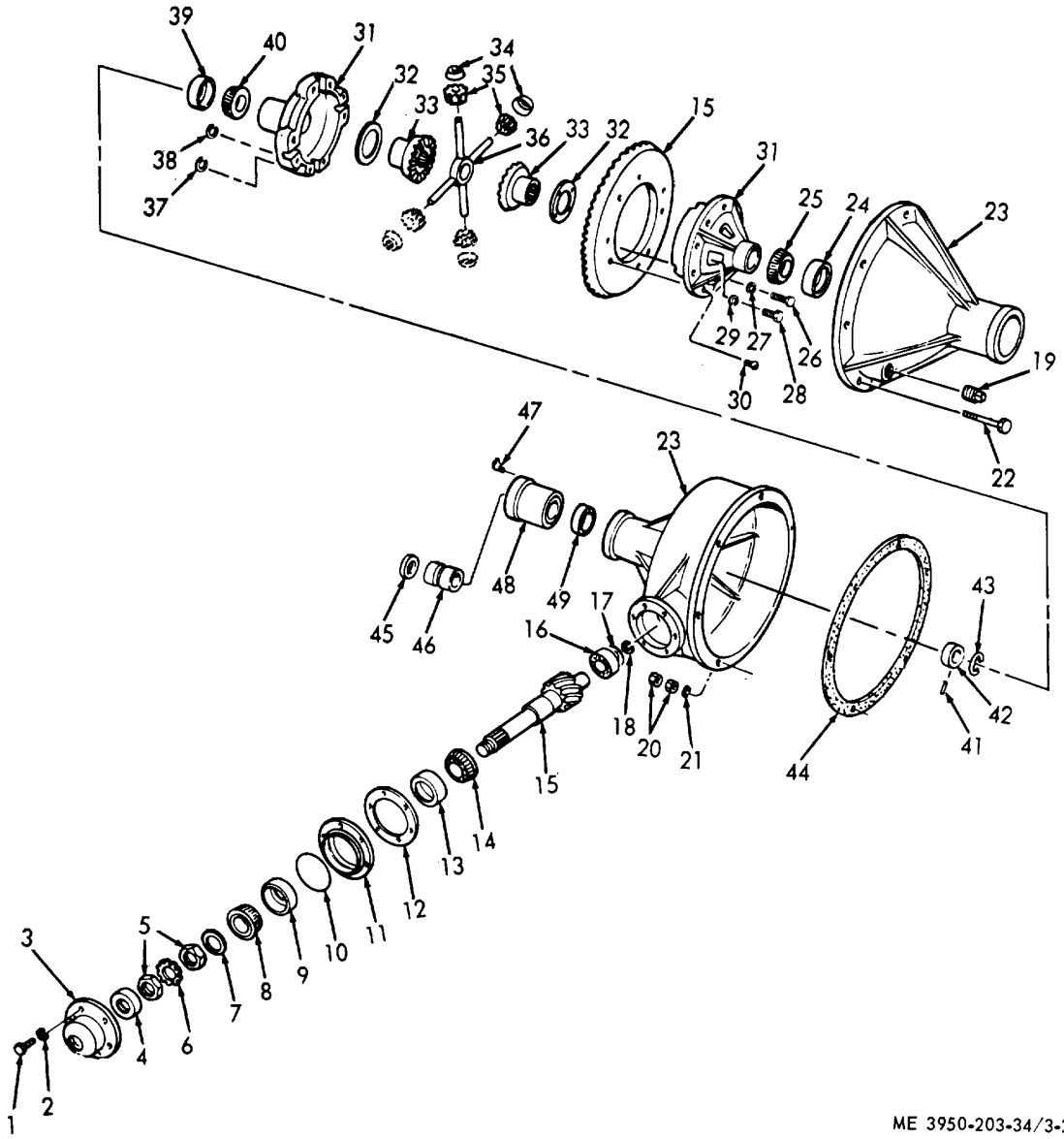
3-24. Differential

a. RemovaL. Remove front wheel drive gears and shafts (para 3-21).

WARNING

Take precautions to prevent dropping and damaging differential when handling-

b. Disassembly. Disassemble differential as shown in figure 3-20 to extent necessary to effect repair. Do not disassemble spider gear case and ring gear unless necessary.



1.Nut (6)
2 Washer (6)
3 Cover
4 Seal
5 Nut (2)
6 Washer
7 Washer
8 Cone and roller
9 Cup
10 Gasket
11 Cage assembly
12 Shim
49 Race
13 Cup
14 Cone and roller
15 Gear set
16 Bearing
17 Retainer
18 Ring, retaining
19) Plug 12)
20 Nut (I 1
21 Nut (11)
22 Bolt 11)
23 Housing
24 Cup
25 Cone and roller
26 Screw (2)
27 Washer (2)
28 Bolt (2)
29 Washer (2)
30 Rivet(12)
31 Case
32 Thrust washer
33 Gear
34 Thrust washer (4)
35 Gear
36 Spider
37 Washer
38 Washer
39 Cup
40 Cone and roller
41 Pin
42 Block
43 Retainer
44 Gasket
45 Seal
46 Seal
47 Fitting
48 Sleeve

Figure 3-20. Differential, exploded View.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect bearings, cups, and cones scoring and wear. Replace defective parts.

(3) Inspect first reduction bevel and sec reduction spur gear for wear and damage. Rep defective gears as a set.

(4) Inspect case halves, thrust washers, spider trunnions, and differential pinion and side gear excessive wear and other defects. Replace an these defective parts in sets.

(5) Discard and replace all lockwashers, oil seals, and gaskets.

(6) Remove burs and nicks from machined and ground surfaces.

(7) Replace pinion bushings as required.

d. Reassembly. Reassemble differential in reverse order of disassembly.

e. Installation. Install front wheel drive shafts and gears (para 3-21).

CHAPTER 4

REPAIR OF TRANSMISSION AND TORQUE CONVERTE

4-1. General

The model MHE 194 Crane Truck uses a 3-speedpower shifted transmission. This transmission combines a hydraulic torque converter with a fully automatic gear system which consists of two multiple disc clutches, primary sun gear, primary and secondary pinions held in a common carrier, and an internal gear to which the output shaft is attached. A reversing gearbox is joined to the extension housing and coupled by a drive shaft to the differential.

4-2. Reversing Gearbox

a. Removal.

(1) Place transmission control in neutral position (TM 10-3950-203-20).

(2) Remove final drive shaft (TM 10-3950- 203-20).

(3) Disconnect transmission fluid hose from bottom of gearbox and drain gearbox.

(4) Remove screws attaching extension housing to gearbox and gently slide gearbox off shaft.

b. Disassembly. Disassemble reversing gearbox as shown in figure 4-1.

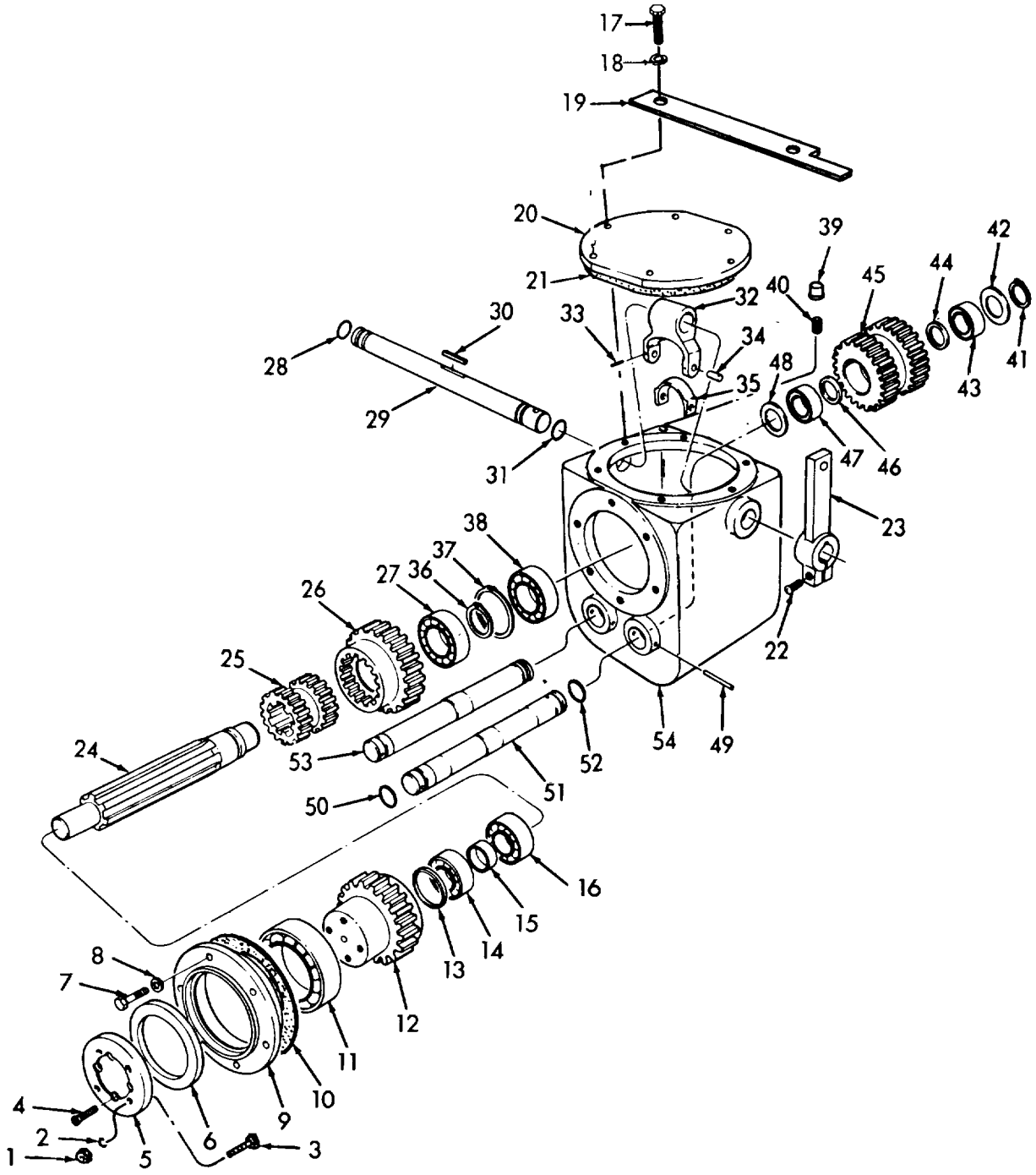


Figure 4-1. Reversing gearbox, exploded view.

Key to figure 4-1.

1 Nut (41
2 Washer (4)
3 Screw (3)
4 Screw (4)
5 Flange
6 Seal
7 Screw (6)
8 Washer (6)
9 Cap
10 Gasket
11 Bearing
12 Gear assy
13 Ring
14 Bearing
15 Spacer
16 Bearing
17 Screw (6)
18 Washer (6)
19 Lever
20 Cover
21 Gasket
22 Screw
23 Lever
24 Shaft
25 Gear
26 Gear
27 Bearing
28 Packing
29 Shaft
30 Key
31 Packing
32 Fork
33 Setscrew(
34 Pin (2)
35 Yoke
36 Ring
37 Ring .
38 Bearing
39 Gage
40 Nipple
41 Ring (2)
42 Spacer (4)
43 Bearing 12
44 Insert (2)
45 Gear (2)
46 Insert (2)
47 Race (4)
48 Ring
49 Pin (2)
50 Packing
51 Shaft
52 Packing
53 Shaft
54 Housing

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for cracks or other defects. Replace defective parts as required.

(3) Inspect bearings to insure that they turn freely. Replace bearings that grab or are noisy.

(4) Inspect shafts for excessive wear and scoring. Replace shafts as necessary.

(5) Discard and replace all gaskets, seals and "0" rings.

d. Reassembly. Reassemble reversing gearbox as shown in figure 4-1

e. Installation.

(1) Install reversing gearbox in reverse of removal procedure.

(2) Refer to LO 10-3950-203-12 and add transmission fluid as required.

4-3. Transmission Oil Pan and Regulator Valve

a. Disassembly. Disassemble oil pan and regulator valve as shown in figure 4-2.

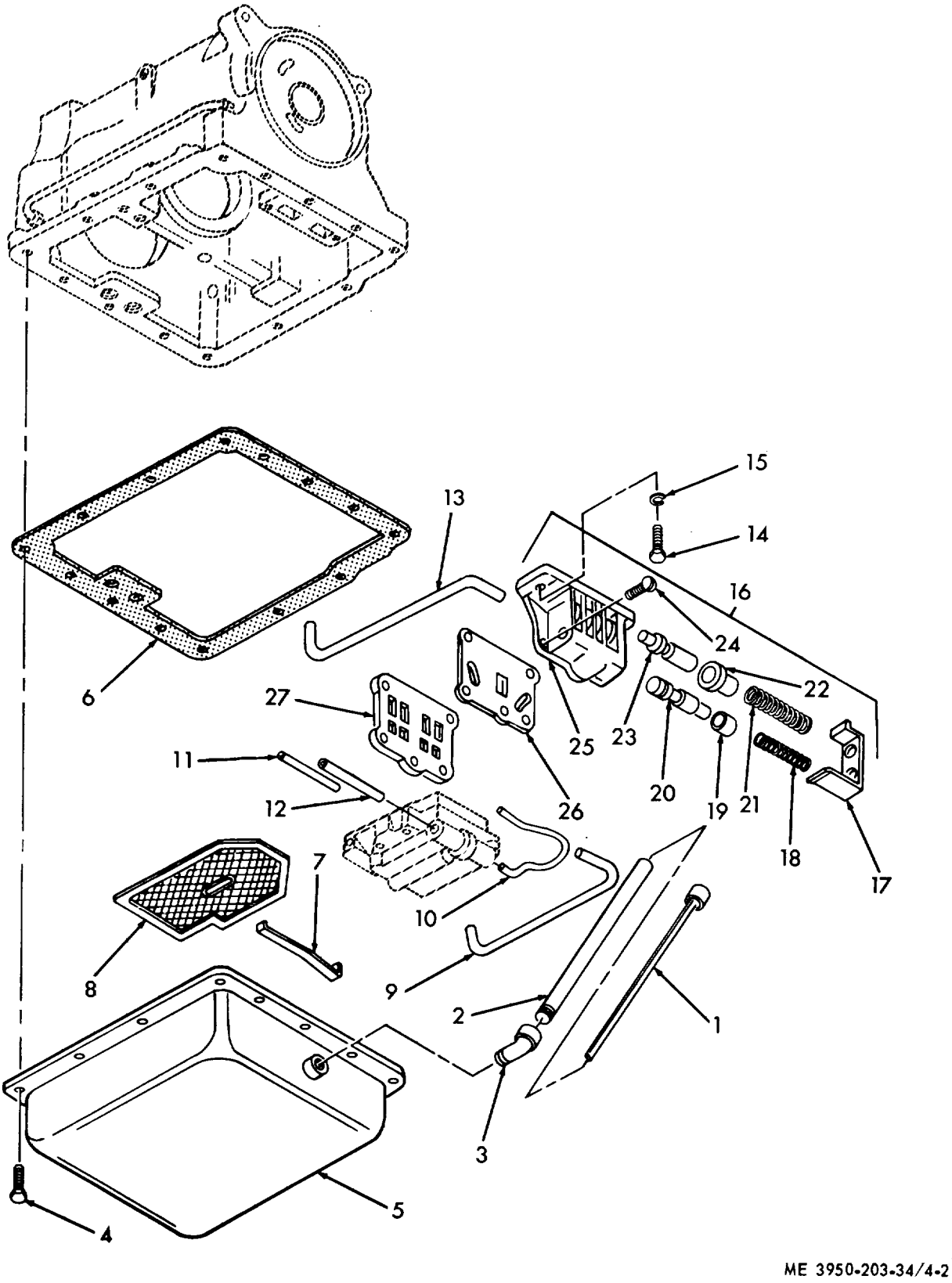


Figure 4-2. Transmission oil pan and regulator valve, exploded view.

Key to figure 4-2.

1 Dipstick
2 Pipe
3 Elbow
4 Bolt 14
5 Pan
6 Gasket
7 Clip
8 Strainer
9 Tube
10 Tube
11 Strut
12 Strut
15 Washer (2)
16 RegulatorI
17 Retainer
18 Spring
19 Spacer
20 Valve
21 Spring
22 Seat
23 Valve
24 Screw (8)
25 Body
26 Plate

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for cracks or other defects. The strainer should not have dents or holes in it. Inspect valve springs for fatigue and distortion. Insure that valves move freely in bore. Inspect mating surfaces for burrs. Remove all burrs. Replace defective parts as necessary.

(3) Discard and replace pan gasket.

c. Reassembly. Reassemble regulator valve and transmission oil pan in reverse of disassembly. Fill transmission with oil specified in LO 10-3950-203-12.

4-4. Vacuum Control Valve

a. Removal. Remove vacuum control valve as shown in figure 4-3.

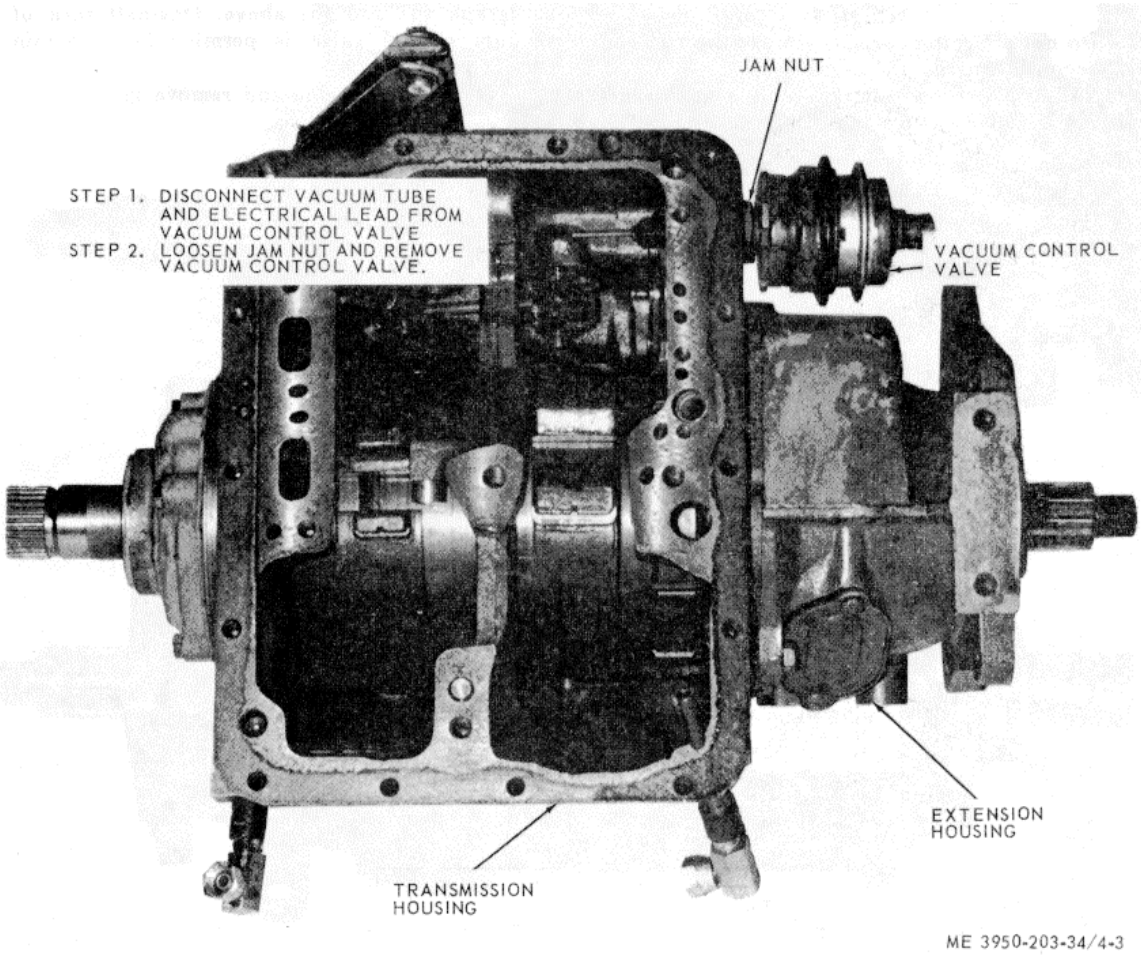


Figure 4-3. Vacuum control valve removal.

b. Cleaning and Inspection.

(1) Clean vacuum control valve.

(2) Inspect for defects. Replace defective vacuum control valve.

c. Installation.

(1) Install vacuum control valve as shown in figure 4-3.

(2) Adjust jam nut to obtain 3/8 inch distance from face of transmission case to face of vacuum control valve.

d. Test.

(1) Attach tachometer to engine.

(2) Remove pipe plug at rear of transmission shown in figure 4-4, and connect a 0-300 psi gage to it.

(3) Set hand brake and operate engine at 1,000 r.p.m.

CAUTION

Do not operate engine for more than 10 seconds during this next step.

(4) Apply service brakes and place transmission selector control to "D" position. The pressure gage should read 80-to 100-pounds per square inch. If this pressure is not indicated, proceed to the next step after repositioning transmission selector control to "N" position.

(5) Connect a vacuum gage in the carburetor-to-vacuum control valve line and repeat step (4).The vacuum gage should read 5.8-to 6.8-inches of mercury at 1,000 revolutions per minute. A low vacuum gage reading indicates a leak at the carburetor gasket, or at the carburetor-to-vacuum control valve, or in the vacuum control valve. Tighten connections or replace vacuum control valve if necessary. A high vacuum gage reading indicates the carburetor vent is plugged or the line has restrictions. Remove restrictions as applicable.

(6) Check installation of vacuum control valve to obtain correct pressure readings as indicated in paragraph (4) and (5) above. One-half turn of vacuum control valve is permissible to obtain correct pressures.

(7) Shut off engine and remove gages.

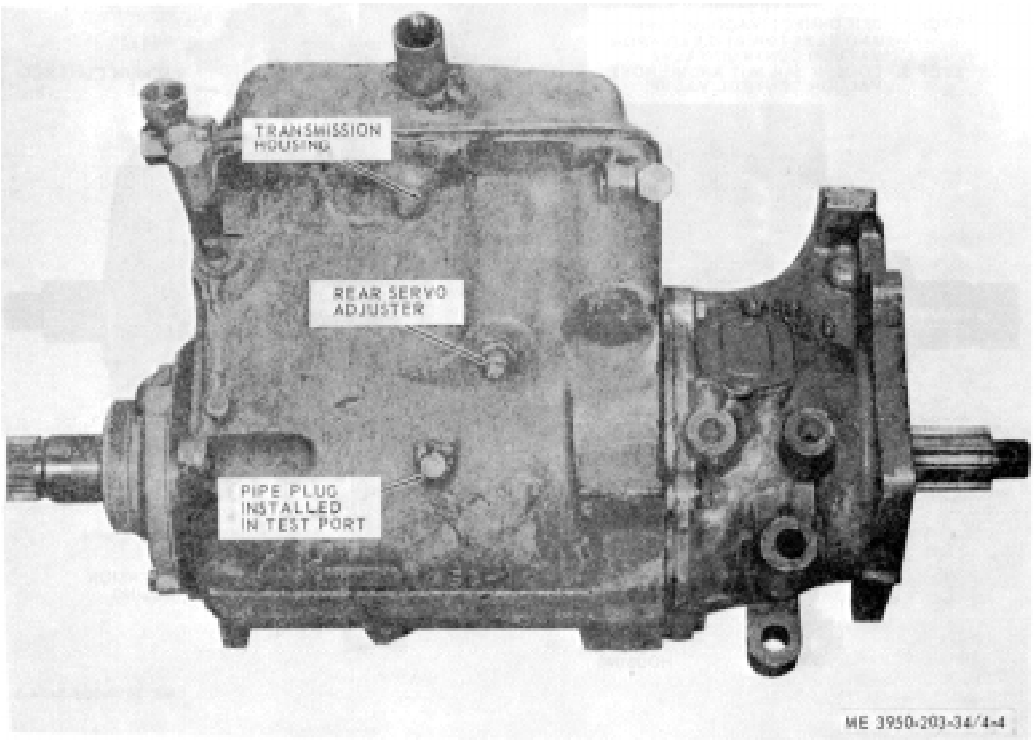


Figure 4-4. Transmission rear servo adjuster and test port

4-5. Control Valve

a. Removal.

(1) Remove transmission oil pan (para

(2) Remove oil regulator and compensator tubes from control valve shown in figure 4-c

(3) Loosen front servo mounting screw.

(4) Loosen control valve mounting screws and slightly raise valve.

(5) Remove servo tubes.

(6) Remove control valve.

b. Disassembly. Disassemble control valve as shown in figure 4-6.

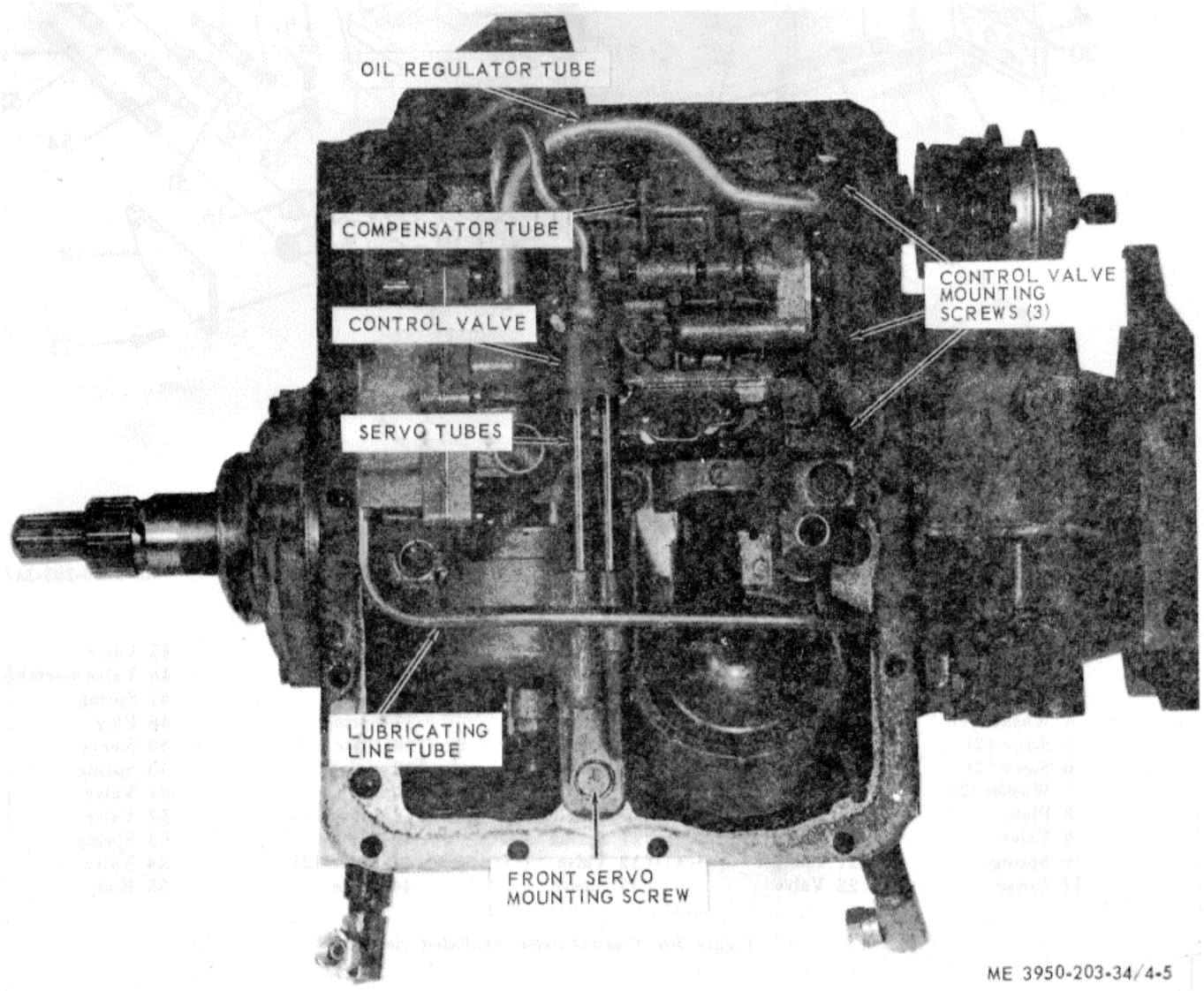
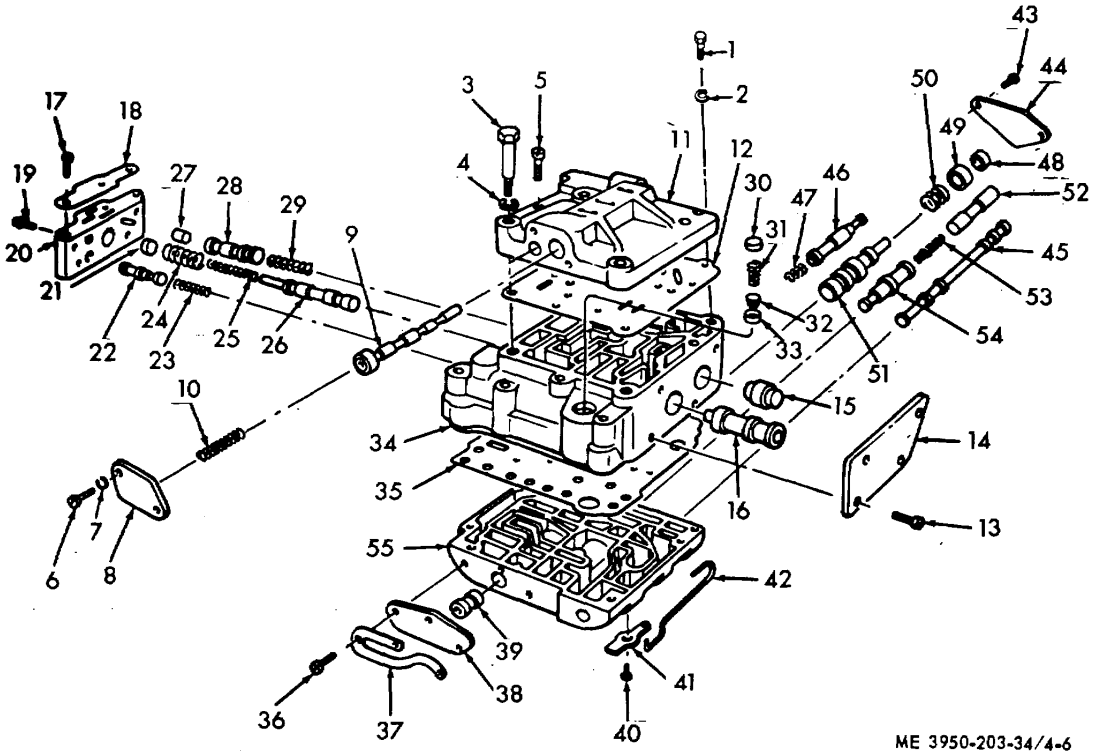


Figure 4-5. Control valve, installed view



1 Bolt (3)	12 Plate	23 Spring	34 Body	45 Valve
2 Washer (3)	13 Screw (2)	24 Spring	35 Plate	46 Valve assembly
3 Bolt (4)	14 Plate	25 Spring	36 Screw	47 Spring
4 Washer {4)	15 Plug	26 Valve	37 Spring	48 Plug
5 Screw 12)	16 Plug	27 Valve	38 Plate	49 Sleeve
6 Screw (2)	17 Screw (3)	28 Valve	39 Valve	50 Spring
7 Washer (2)	18 Plate	29 Spring	40 Pin	51 Valve
8 Plate	19 Screw 4)	30 Plug	41 Lever	52 Valve
9 Valve	20 End ,body	31 Spring	42 Hook	53 Spring
10 Spring	21 Plunger	32 Valve	43 Screw (2)	54 Valve
11 Cover	22 Valve	33 Sleeve	44 Plate	55 Body

Figure 4-6. Control valve, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2} Inspect for cracks or other defects.

(3) Inspect springs for fatigue and distortion

(4) Inspect mating surfaces for burs. Remove' all burs.

(5) Insure that valves move free in bores.

(6) Replace defective parts as necessary.

d. Reassembly. Reassemble control valve shown in figure 4-6.

e. Installation.

(1) Install control valve as shown in figure 4-5.

(2) Install servo, compensator, and regulator tubes.

(3) Install transmission oil pan (para 4-3).

4-6. Servos, Front and Rear

a. Removal. Remove front and rear servos as illustrated in figure 4-7.

b. Disassembly. Disassemble servos as shown in figure 4-8.

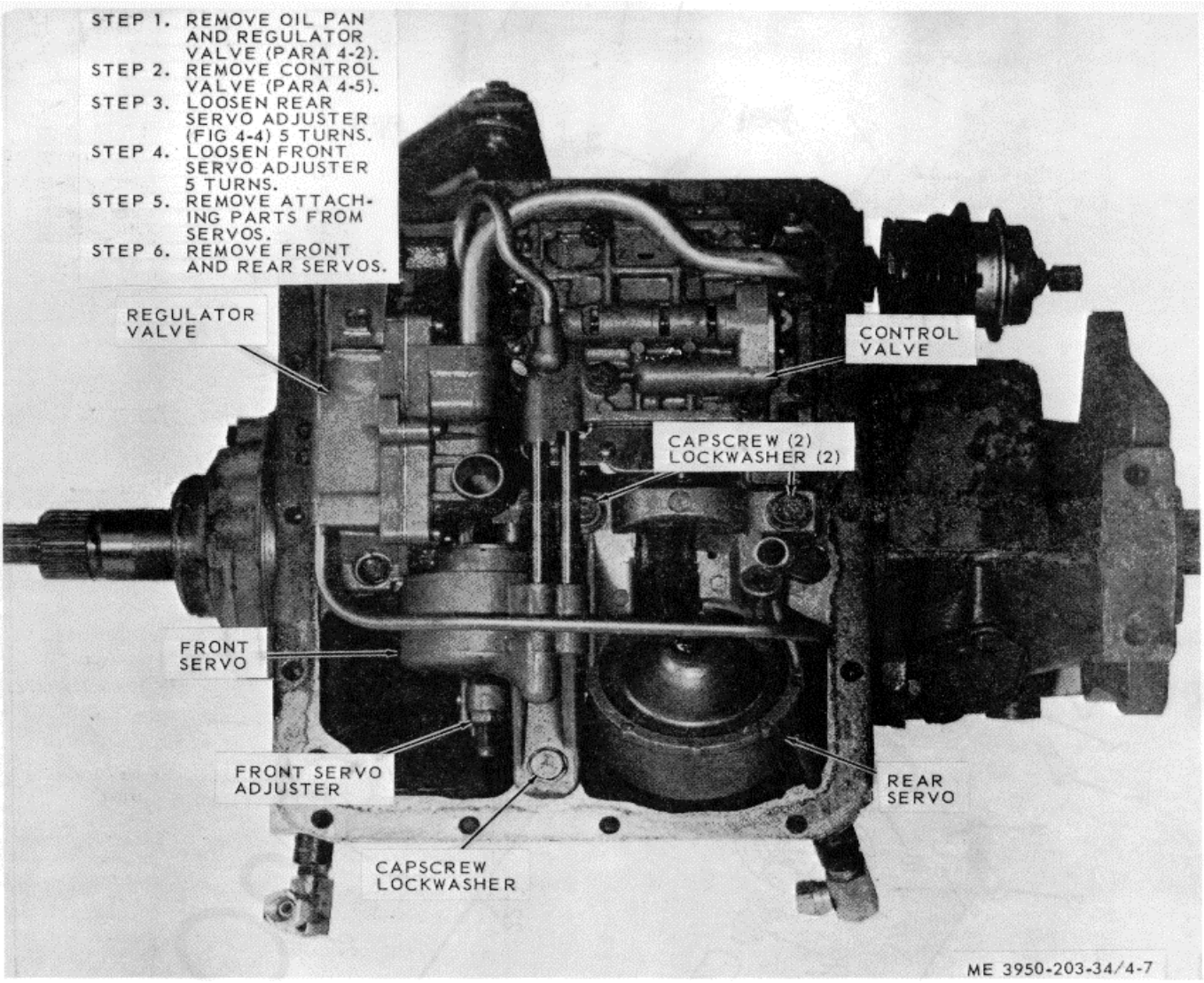


Figure 4-7. Front and rear servos removal.

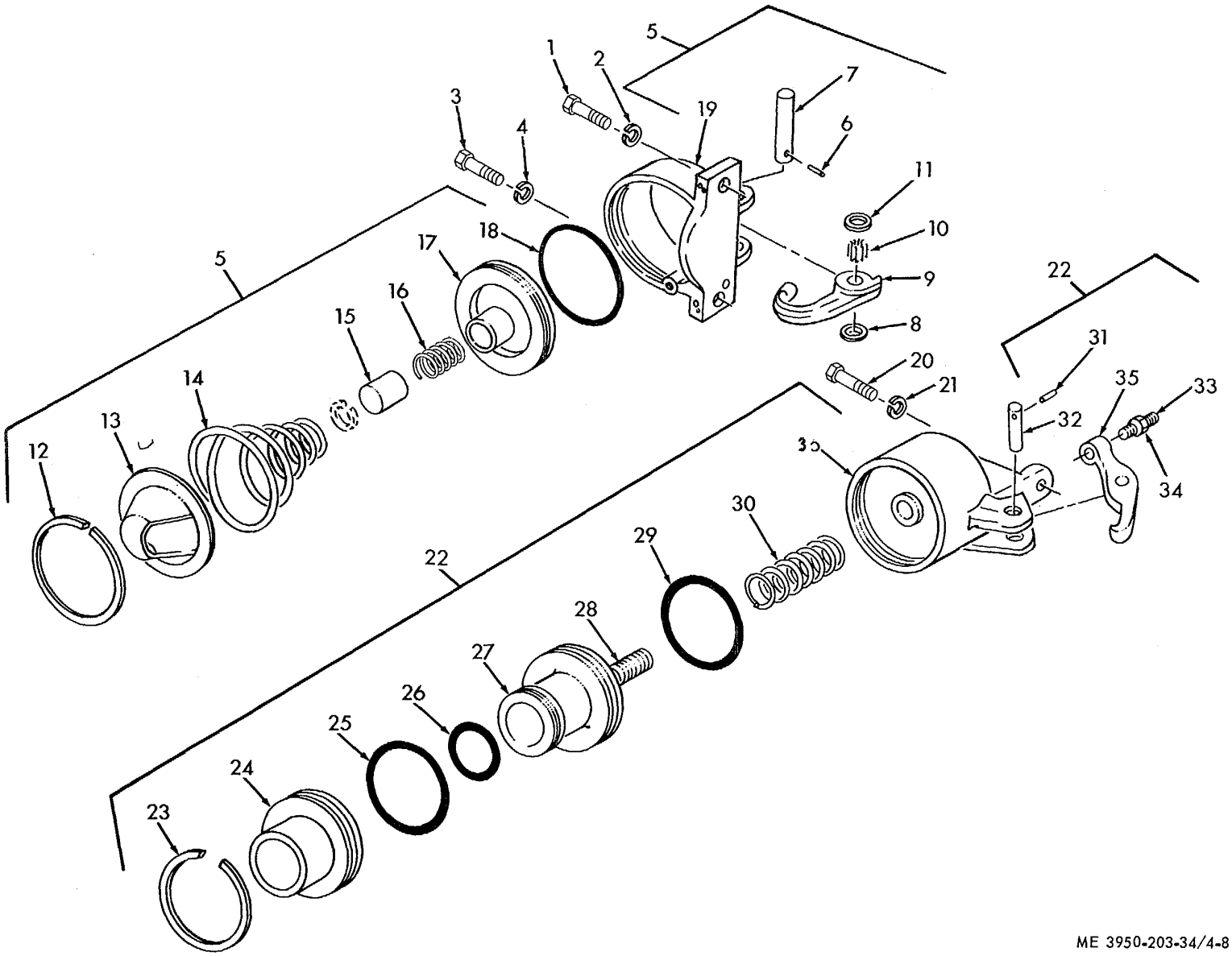


Figure 4-8. Front and rear servos, exploded view.

Key to figure 4-8.

1 Screw	19 Body
2 Washer	20 Bolt
3 Screw	21 Washer
4 Washer	22 Servo assy, front
5 Servo assy, rear	23 Ring
6 Pin	24 Sleeve
7 Shaft	25 Ring
8 Plug	26 Ring
9 Lever	27 Piston
10 Bearing	28 Pin
11 Plug	29 Ring
12 Retainer	30 Spring
13 Retainer	31 Pin
14 Spring	32 Pin
15 Plug	33 Screw
16 Spring	34 Nut
17 Piston	35 Lever
18 Ring	36 Body

c. Cleaning and Inspection.

(1) Inspect bodies for dents and cracks.

(2) Inspect screws and nuts for stripped threads.

(3) Inspect mating surfaces for burrs, and remove all burrs.

(4) Inspect shafts and levers for excessive wear or other defects.

(5) Inspect springs for fatigue and distortion

(6) Replace defective parts as necessary.

(7) Discard and replace rings.

d Reassembly and Installation. Reassembly front and rear servos as shown in figure 4-8.

e. *Installation*.

(1) Position front servo with band forward and ends up.

(2) Position servo strut with slotted end aline with servo actuating lever and small end alined with band end.

(3) Rotate band, strut, and servo into position engaging anchor end of band with anchor pin in transmission case.

(4) Locate servo on dowel in case, install front servo mounting lockwasher and capscrew, but only turn capscrew two or three threads.

(5) Install servo tubes.

(6) Install control valve (para 4-5).

(7) Tighten front servo mounting capscrew.

(8) Position rear servo anchor strut and rotate rear band to engage strut.

(9) Position servo actuating lever strut and install mounting lockwashers, setscrew, and cap screw.

(10) Refer to figure 4-7 to insure that the servos have been installed as shown.

f. Front Servo Adjustment.

(1) Loosen front servo adjusting screw locknut.

(2) Back off nut three turns.

(3) Loosen adjusting screw five complete turns.

(4) Using front band adjusting wrench, insert 1/4" spacer between lever end stem.

(5) Tighten screw until ratchet overruns.

(6) Back off adjusting screw one complete turn and tighten locknut to 20-25 ft-lbs. torque.

g. Rear Servo Adjustment.

(1) Loosen adjusting screw locknut three turns with 3/4" socket.

(2) Back off adjusting screw until free travel is obtained.

(3) Tighten adjusting screw until ratchet overruns.

(4) Back off adjusting screw 1½2 turns.

(5) Hold adjusting screw stationary and tighten locknut to 40 ft-lbs torque.

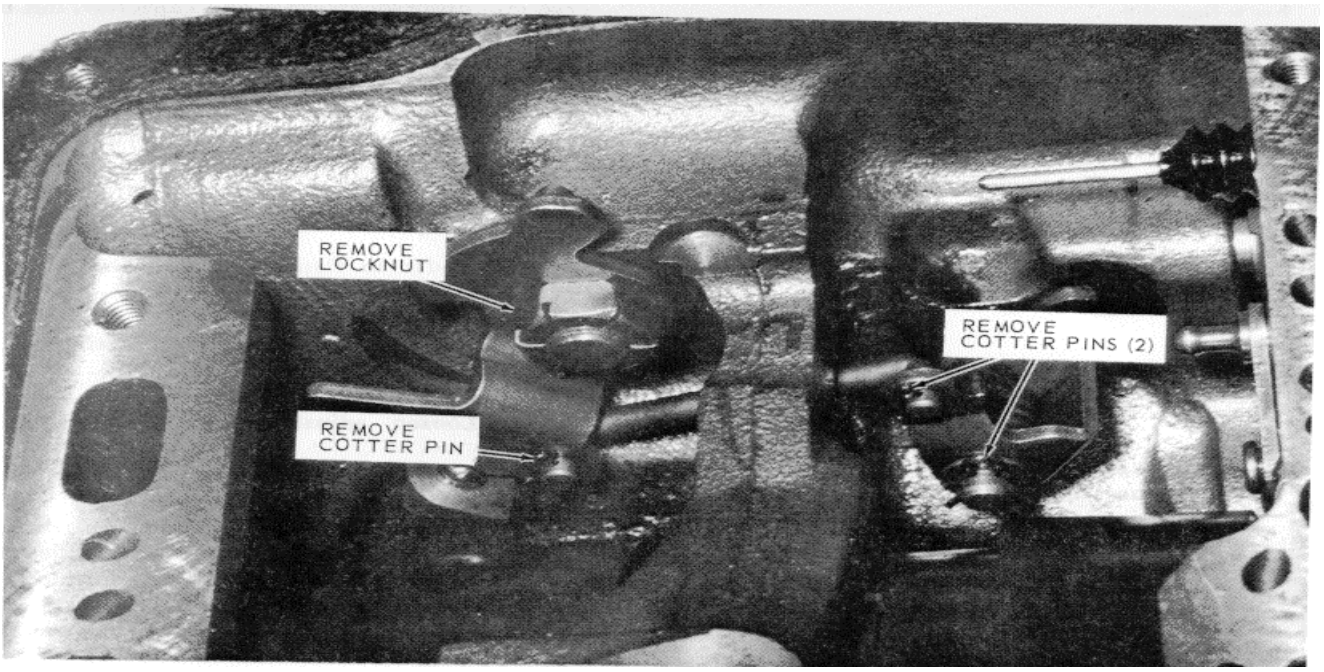
4-7. Transmission Lever Linkage

a. Removal.

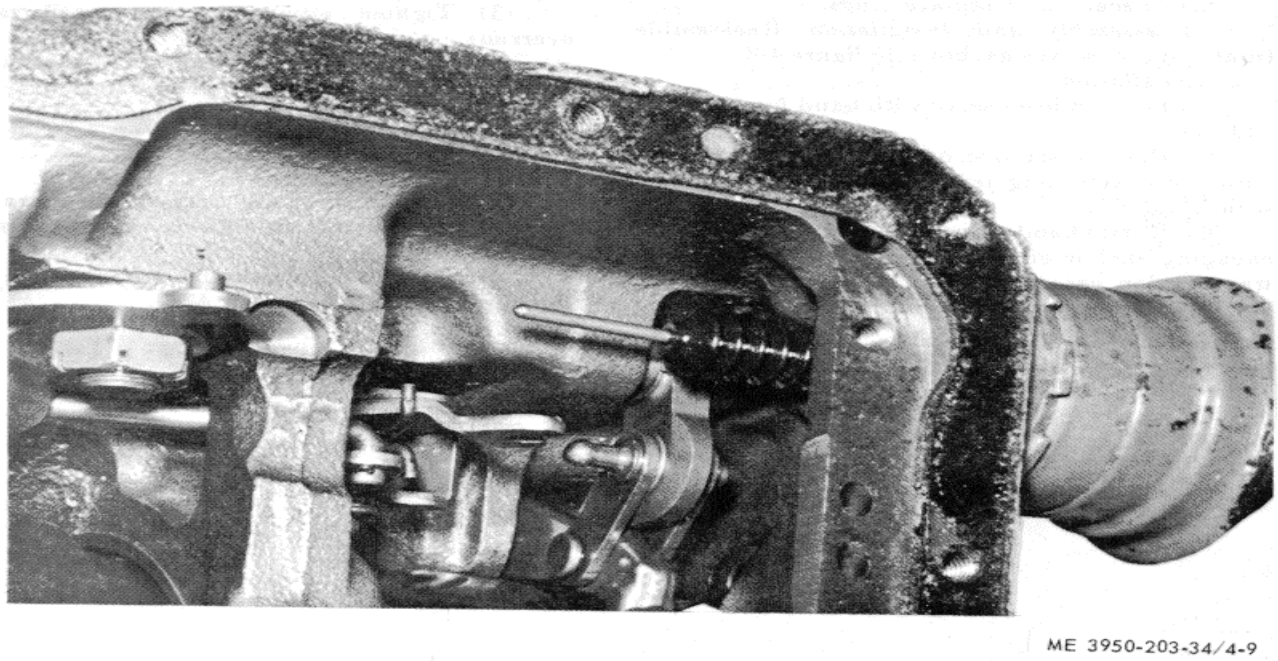
(1) Remove front and rear servos (para 4-6).

(2) Remove transmission lever linkage shown in figure 4-9.

b. Disassembly. Disassemble transmission lever linkage as shown in figure 4-10.



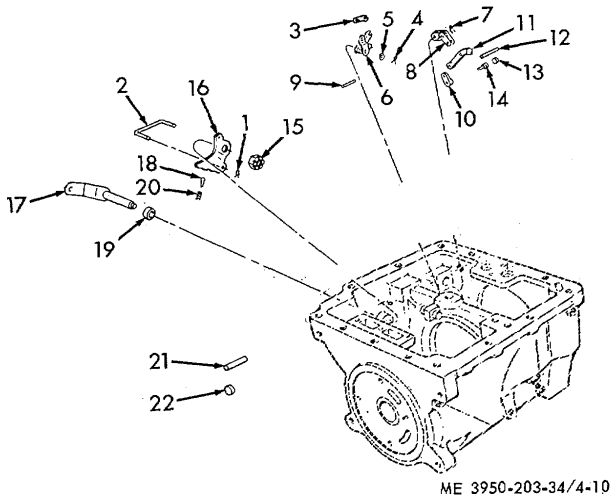
A. LEVER LINKAGE FRONT VIEW.



ME 3950-203-34/4-9

B. LEVER LINKAGE SIDE VIEW.

Figure 4-9. Transmission lever linkage removal



1 Pin (2)	12 Pin
2 Rod	13 Plug(2)
3 Pawl	14 Pin
4 Spring	15 Locknut
5 Washer	16 Lever assy
6 Lever	17 Lever assy
7 Pin	18 Ball
8 Lever	19 Bearing
9 Pin	20 Spring
10 Link	21 Pin
11 Lever assy	22 Plug (3)

Figure 4-10. Transmission lever linkage, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect all parts for cracks, distortion excessive wear, or other defects. Replace defective parts as necessary.

d. Reassembly. Reassemble lever linkage show in figure 4-10.

e. Installation.

(1) Install lever linkage as shown in figure 4-'

(2) Install front and rear servos (para 4-6 4-8. Transmission

a. Removal.

(1) Remove reversing gearbox (para 4-2).

(2) Disconnect vacuum line and wires from vacuum control switch.

(3) Remove neutral start switch (TM 10-3950-203-20).

(4) Disconnect transmission control linkage

(5) Drain transmission by removing filler pipe.

(6) Place suitable lift cradle under transmission oil pan to support weight of transmission.

(7) Remove upper capscrews that secure transmission to converter housing and insert pilot studs in their place.

(8) Remove lower capscrews that secure transmission to converter housing.

(9) Insure that cradle alines transmission with converter housing then pull transmission away from converter housing.

b. Disassembly.

(1) Remove transmission lever linkage (para 4-7).

(2) Remove transmission shafts and related parts shown in figure 4-11.

(3) Disassemble transmission shafts and related parts shown in figure 4-12.

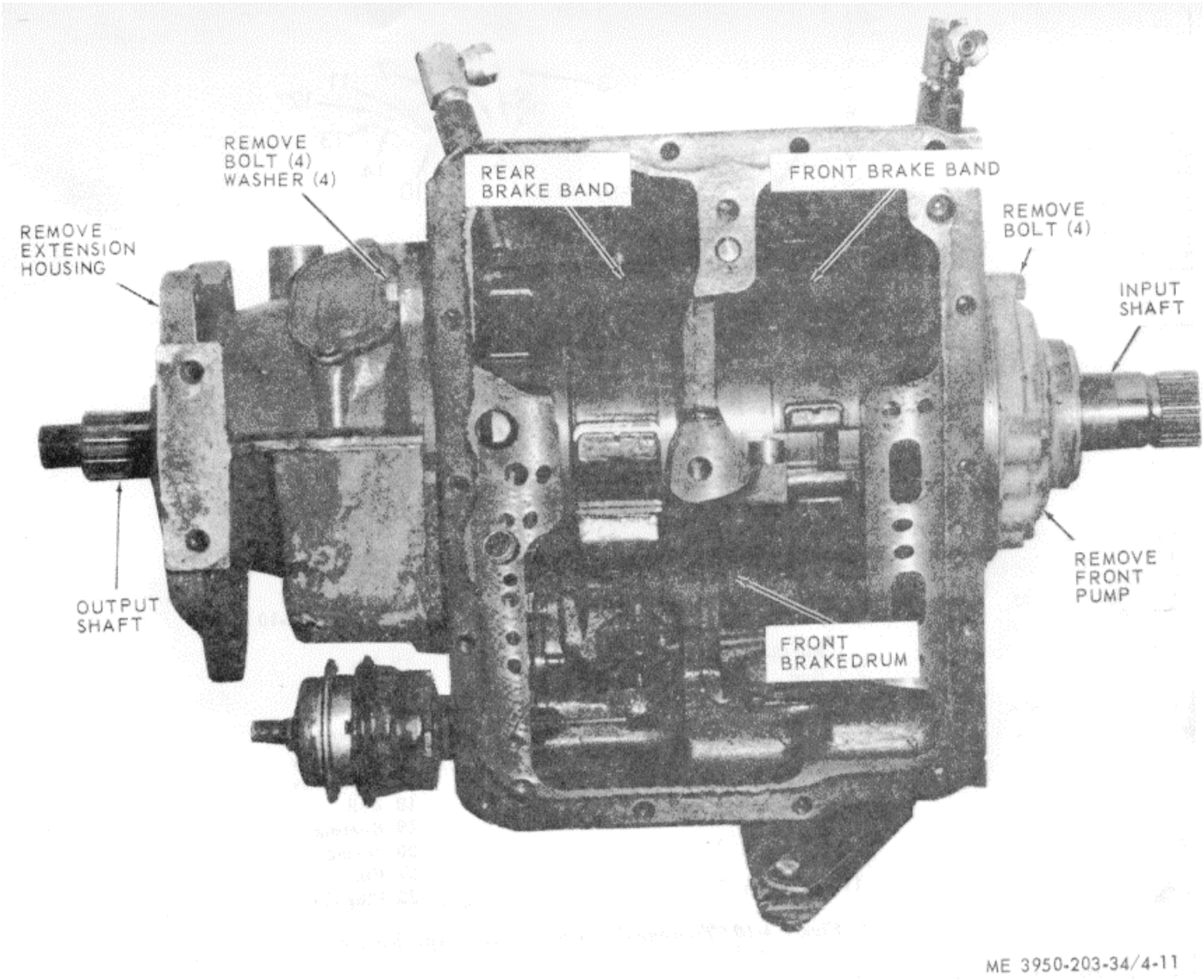


Figure 4-11. Transmission assembly

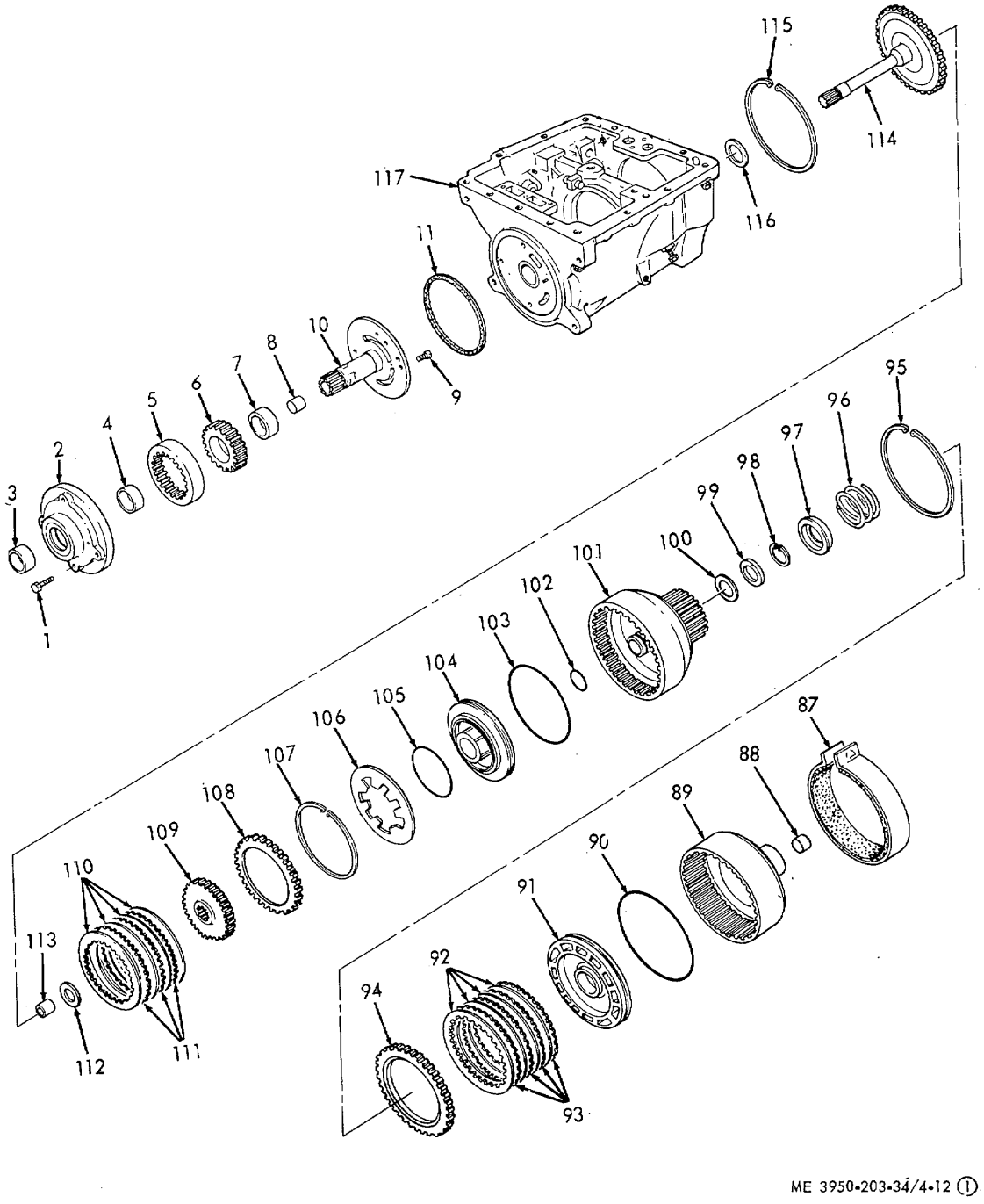


Figure 4-12 (1). Transmission, exploded view.

Key to figure 4-12.

1 Bolt (4)
2 Body, front pump
3 Seal
4 Bushing
5 Gear
6 Gear
7 Bushing
8 Bushing
9 Screw
10 Support
11 Gasket
12 Screw (2)
13 Washer (2)
14 Cover
15 Gasket
16 Bolt (4)
17 Washer (4)
18 Extension housing
19 Tube
20 Tube
21 Tube
22 Sleeve
23 Ring (4)
24 Ring
25 Screw (2)
26 Washer (2)
27 Weight
28 Screw
29 Cover
30 Body, governor
31 Valve
32 Spring
33 Retainer
34 Counterweight
35 Screw
36 Washer
37 Screw
38 Washer
39 Cover
40 Gear
41 Gear
42 Screws
43 Screw (5)
44 Body
45 Gasket
46 Bushing
47 Gasket
48 Bearing
4(" Key
50 Bushing
51 Shaft
52 Sleeve
53 Retainer
54 Gear
55 Spacer
56 Bushing
57 Cover
58 Spacer
59 Washer (12)
60 Pinion (3)
61 Pinion (3)
62 Washer
63 Roller (42j
64 Pin (3) '
65 Ring (2)
66 Bushing
67 Spacer (3)
68 Roller (84)
69 Pin (3)
70 Washer (12)
71 Rivet (3)
72 Drum
73 Band assy
74 Bushing
75 Support
76 Seat
77 Spring
78 Ring (2)
79 Ring (2)
80 Gear assy
81 Gear
82 Washer
83 Bushing
84 Key
85 Gear
86 Ring
87 Band assy
88 Bearing
89 Drum
90 Ring
91 Piston
92 Plate assy (4)
93 Plate (4)
94 Plate
95 Retainer
96 Spring
97 Seat
98 Retainer
99 Washer
100 Washer
101 Drum
102 Ring
103 Ring
104 Piston
105 Ring
106 Spring
107 Ring
108 Gear
109 Gear
110 Plate assy (4)
111 Plate (4)
112 Washer
113 Bushing
114 Shaft
115 Retainer
116 Washer
117 Case

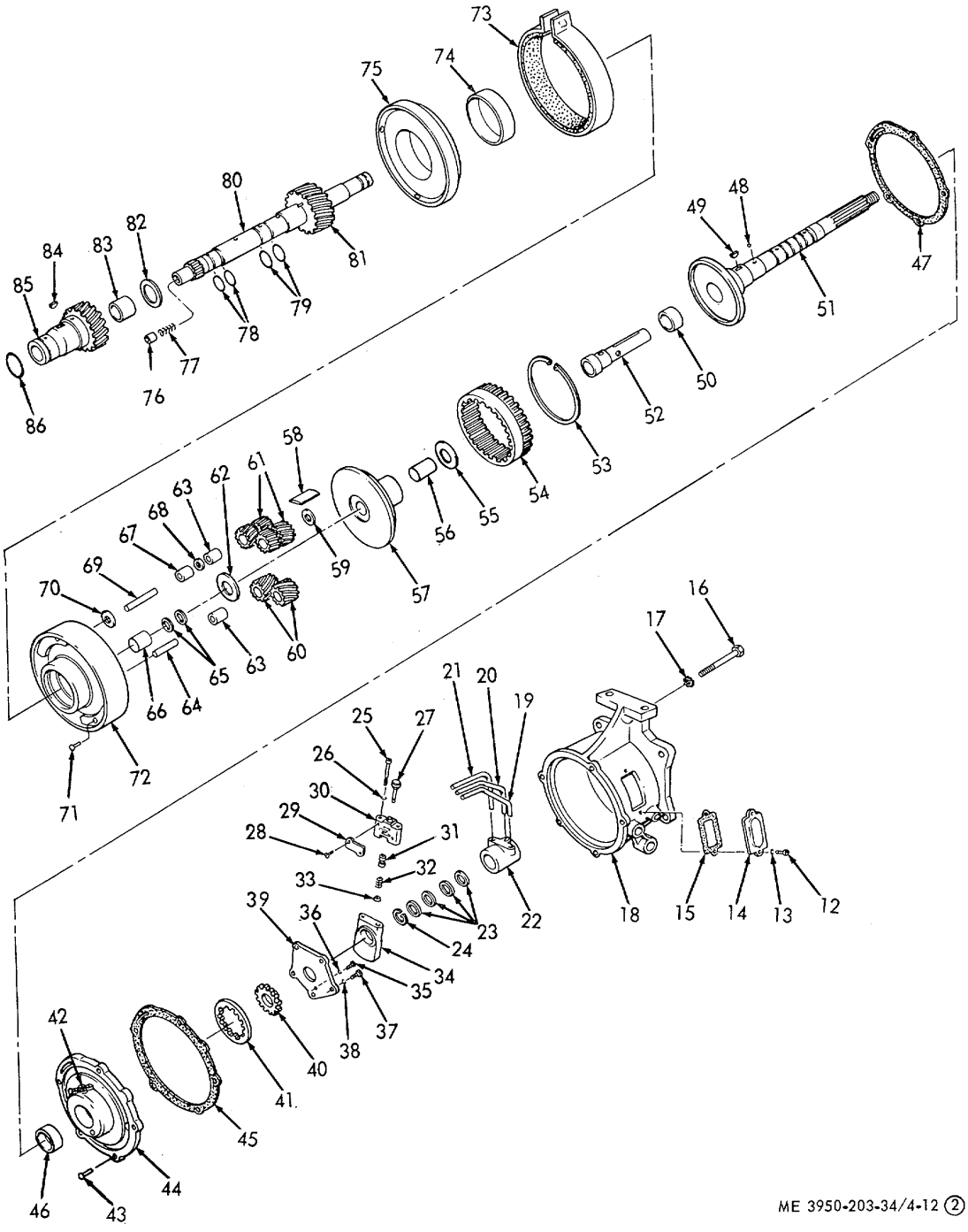


Figure 4-12 (2). Transmission, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect extension housing for cracks other defects and replace extension housing if foul defective.

(3) Inspect drum band surface, bushing, and thrust surfaces for scoring. Remove scoring with crocus cloth or replace part.

(4) Inspect bearings for excessive wear other defects. Replace as necessary.

(5) Inspect fluid passages for obstruction. Remove all obstructions.

(6) Inspect gear teeth for cracks, excessive wear, or other defects. Replace defective gears necessary.

(7) Inspect plates for fit on clutch hi serrations. Replace all plates badly scored, or which do not fit freely in hub serrations.

(8) Use a feeler gage to measure coning of steel plates. Replace plates with cone not between 0.01 to-0.015 inch.

(9) Inspect clutch pressure plates for scoring on clutch plate bearing surfaces. Replace if deeply scored.

(10) Inspect clutch release spring for distortion. Replace if badly bent.

(11) Inspect clutch hub thrust surfaces for scoring. Replace as necessary.

(12) Inspect turbine shaft splines for wear. Replace shaft if splines are excessively worn. Replace shaft and bushing assembly if bushing deeply scored.

(13) Inspect governor weight valve and bore for scoring. Replace if crocus cloth does not remove scoring.

(14) Inspect transmission case for cracks a other defects.

(15) Inspects bushings for scoring and excessive wear. Replace bushings as necessary crocus cloth does not remove scoring or if worn excessively.

(16) Inspect torsion lever pin for wear.

(17) Inspect all levers for excessive wear.

(18) Discard and replace all seals and gaskets.

d. Reassembly. Refer to figure 4-12 and 4-11 reassemble and install transmission shafts a related parts and using the following instruction:

(1) Lubricate all parts with engine oil OE-1

(2) Install clutch assemblies as follows:

(a) Install front band in transmission case so that anchor end is alined with anchor in case

(b) Lift clutch assemblies, holding parts together, installing from rear, while positioning servo band on the drum.

(c) Position center support in case, aligning hole in center support with hole in side of case.

(d) Install right and left center supports bolts and external tooth lockwashers.

(3) Install pinion carrier and output shaft as follows:

(a) Position rear servo band in transmission case with struts ends up.

(b) Place anchor end with depression toward adjusting screw.

(c) Install bronze thrust washer on thrust face inside pinion carrier.

(d) Install pinion carrier assembly by positioning rear band over drum while meshing planet pinions.

(e) Install seal rings on primary sun gear shaft and check for free movement in grooves.

(f) Install selective thrust washer on rear of pinion carrier.

(g) Measure pinion end play with feeler gage. End play should be 0.010-to 0.020-inch. If the end play exceeds 0.020 in. replace thrust washer.

(h) Install output shaft, carefully meshing internal gear with pinions.

(4) Install rear pump as follows:

(a) Position rear pump drive key in keyway on output shaft.

(b) Position new front and rear gaskets on pump body.

(c) Insure drive key is alined with keyway in pump drive gear.

(5) Install governor as follows:

(a) Position governor drive ball in output shaft pocket. Retain ball with OE-10 engine oil.

(b) Install governor assembly, alining groove with ball in output shaft.

(6) Install oil collector sleeve and tubes.

(7) Install extension housing.

(8) Install front pump, except leave one capscrew out.

(9) Check transmission end play as follows:

(a) Mount dial indicator support rod in capscrew hole.

(b) Mount dial indicator so that contact rests on end of turbine shaft.

(c) Pry front clutch cylinder to rear of transmission with large screwdriver.

(d) Remove screwdriver and pry units toward front of transmission by inserting screwdriver between large internal gear and pinion carrier.

(e) Indicator reading between steps (d) and *(e)* should be 0.008" to 0.044". In the event this requirement has not been satisfied, repair or replace parts as necessary until it is.

(f) Remove indicator and support and install front pump mounting capscrew.

(10) Install lever linkage (para 4-7).

e. Installation.

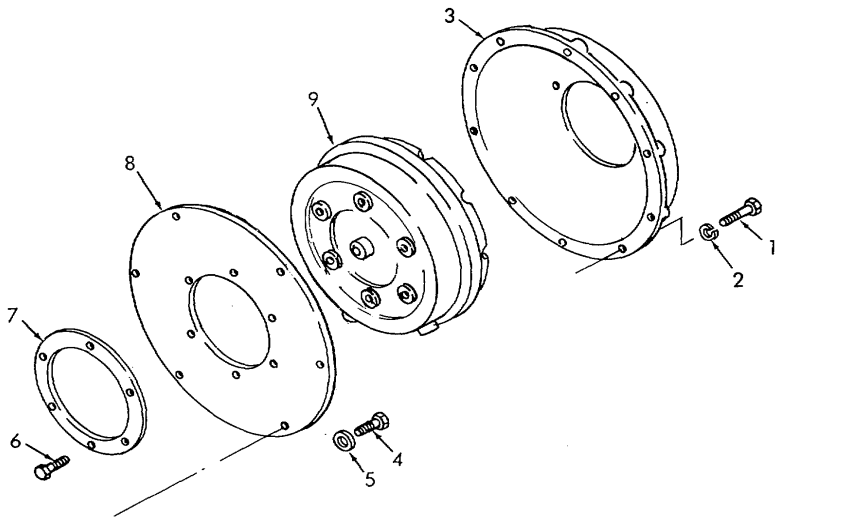
(1) Install transmission in reverse of removal procedure.

(2) Refer to LO 10-3950-203-12 and add transmission fluid as required.

4-9. Torque Converter

a. Removal. Remove transmission (para 4-8).

b. Disassembly. Disassemble torque converter as shown in figure 4-13.



1 Bolt (6)
2 Washer (6)
3 Housing
4 Bolt (6)
5 Washer (6)
6 Bolt
7 Disk
8 Disk
8 Disk
9 Converter

Figure 4-13. Torque converter, exploded view.

c. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect parts for cracks, excessive wear, or other defects. Replace defective parts as necessary.

d. Reassembly and Installation.

(1) Reassemble torque converter in reverse procedure of removal.

(2) Service torque converter (LO 10-3950-203-12).

e. Installation. Install transmission (para 4-8).

f. Testing.

(1) Connect a tachometer on the engine.

(2) Apply hand and service brakes and start engine.

(3) Place transmission selector in drive and accelerate engine to wide open throttle.

(4) Monitor tachometer for a period of 5-to 10-seconds. A steady reading at stall speed indicates the converter is operating normally. In the event that it is not operating normally, repair or replace as necessary.

CHAPTER 5

REPAIR OF ENGINE

Section I. FLYWHEEL AND HOUSING

5-1. Flywheel

(1) Remove torque converter (para 4-9).

(2) Remove starter (TM 10-3950-203-20).

(3) Remove flywheel (fig. 5-1).

(4) Heat ring gear before removing it from fly wheel, but do not remove it unless a new one is to be installed.

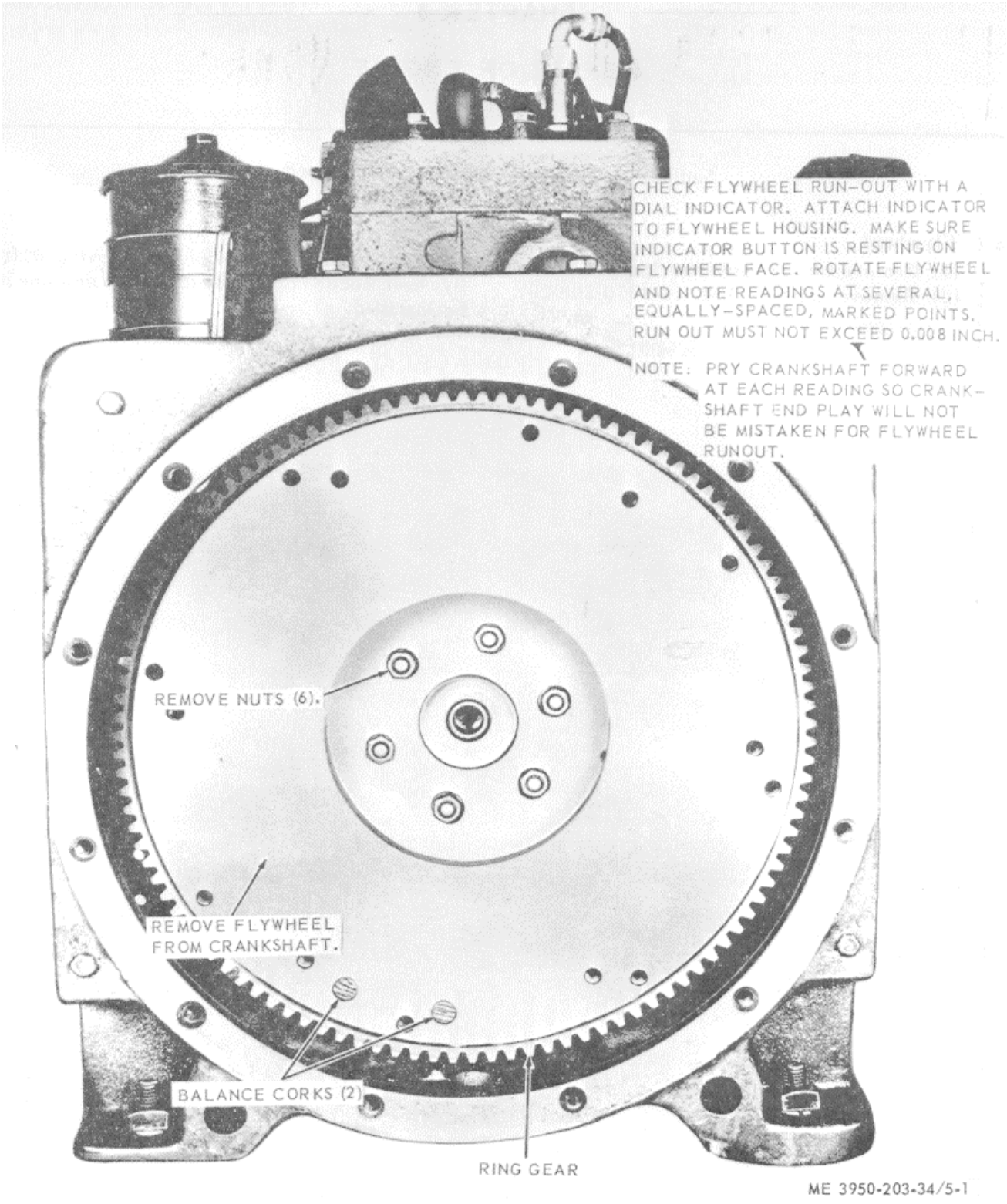


Figure 5-1. Flywheel, removal and installation.

b. Cleaning and Inspection.

(1) Clean flywheel.

(2) Inspect for cracks, broken ring gear teeth and other defects. Replace defective parts a necessary.

c. Installation.

(1) Heat ring gear and install if applicable.

(2) Install flywheel and check run-out a shown in figure 5-1. In the event run-out exceed 0.008 inch, replace flywheel.

(3) Install starter (TM 10-3950-203-20).

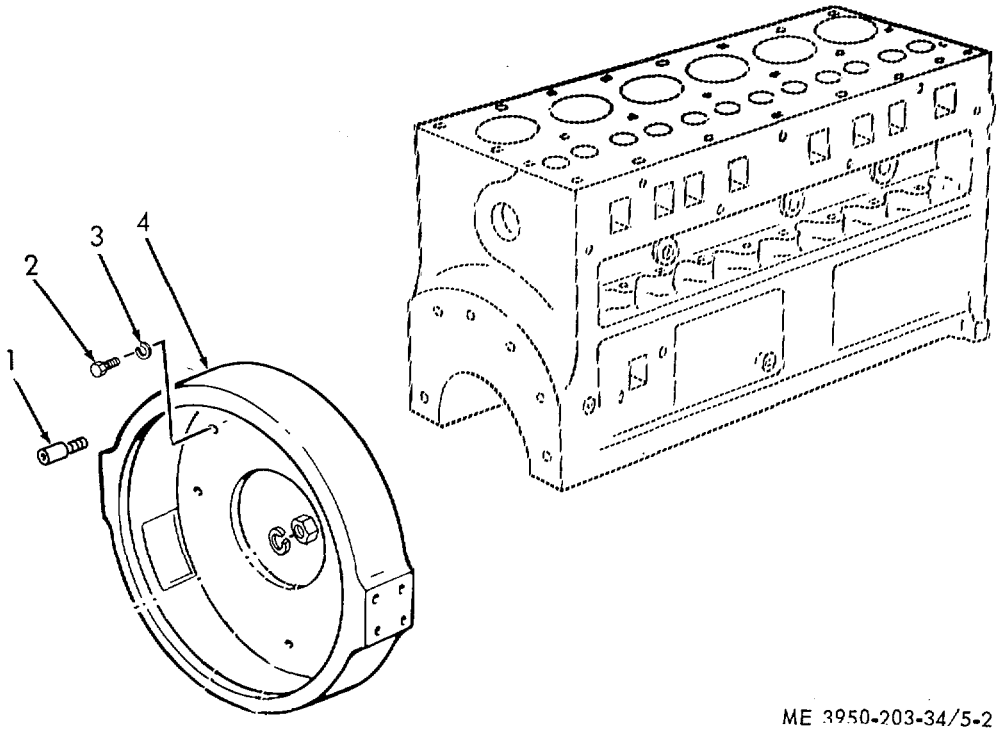
(4) Install torque converter (para 4-9).

5-2. Flywheel Housing

a. Removal

(1) Remove flywheel (para 5-1).

(2) Remove flywheel housing as illustrated in figure 5-2.



1 Screw (2)
2 Screw (3)
3 Washer (5)
4 Housing

Figure 5-2. Flywheel housing exploded view.

b. Cleaning and Inspection.

(1) Clean flywheel housing.

(2) Inspect for cracks or other defects. Replace defective flywheel housing.

c. Installation

(1) Refer to figure 5-2 and install flywheel housing in reverse of removal procedure.

(2) Install flywheel (para 5-1).

Section II. TIMING GEAR COVER AND GEARS

5-3. Timing Gear Cover

a. Removal.

(1) Remove governor (para 3-12)

(2) Remove crankshaft pulley using gear puller.

3) Refer to figure 5-3 and remove timing gear cover.

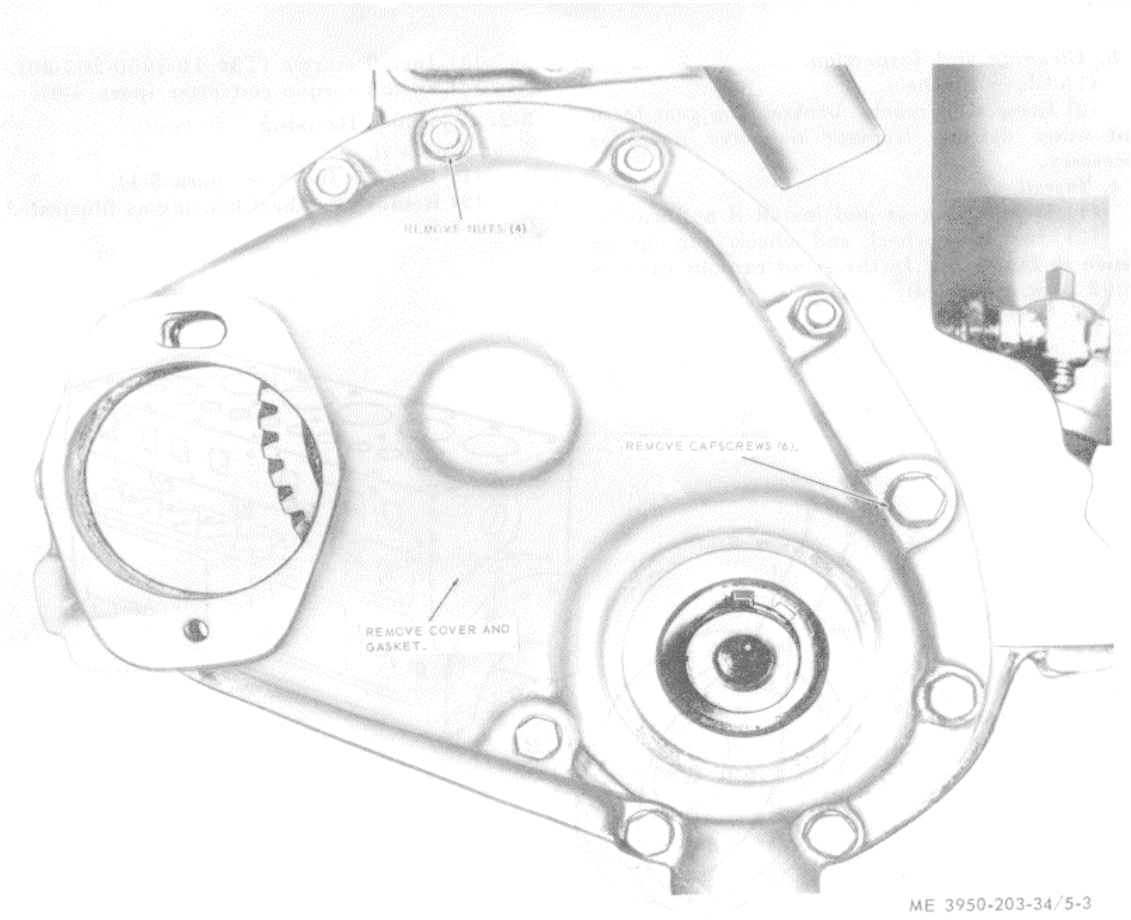


Figure 5-3. Timing gear cover removal.

b. Cleaning and Inspection.

(1) Clean cover.

(2) Inspect for cracks or other defects. Replace defective cover.

c. Installation

(1) Refer to figure 5-3 and install timing gear cover in reverse of removal procedure.

(2) Install crankshaft pulley.

(3) Install governor (para 3-12).

5-4. Timing Gears

a. Removal

(1) Remove timing gear cover (para 5-3).

(2) Refer to figure 5-4 and remove timing gears

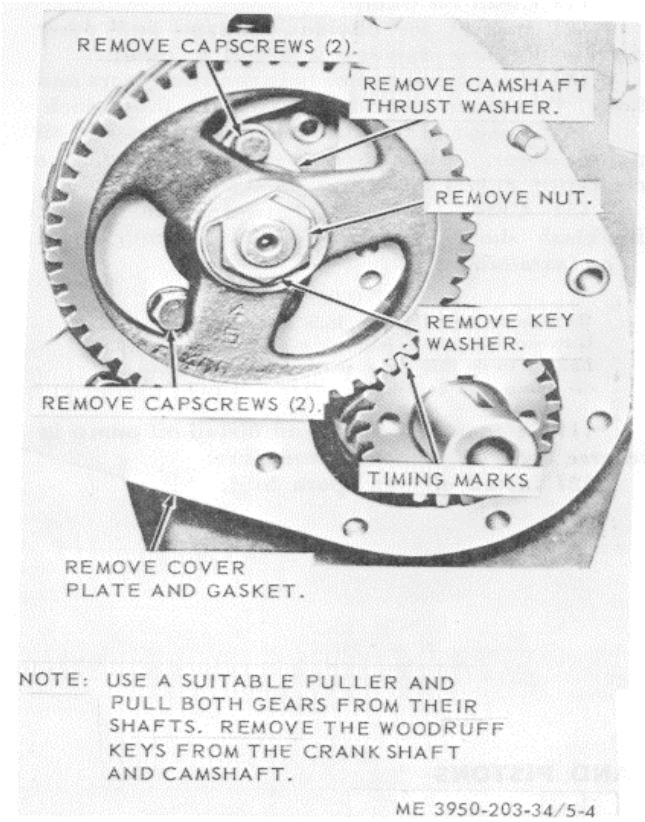


Figure 5-4. Timing gears removal

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect gears for excessive wear and damage. Replace defective gears.

c. Installation.

(1) Refer to figure 5-4 and install timing gears with timing marks positioned as shown.

(2) Check backlash of timing gears with a screwdriver forcing mating teeth as far apart as possible. Measure this clearance with a feeler gage. If clearance is 0.002 inch or greater, replace gears as a set.

(3) Install timing gear cover (para 5-3).

Section III. PAN AND PUMP

5-5. Oil Pan

a. Removal

(1) Drain oil.

(2) Refer to figure 5-5 and remove oil pan.

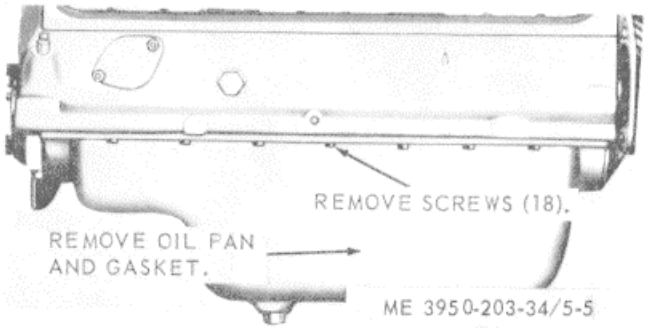


Figure 5-5. Oil pan removal

b. Cleaning and Inspection.

(1) Clean oil pan.

(2) Inspect oil pan for cracks and other defects. Replace a defective oil pan.

(3) Discard gasket.

c. Installation.

(1) Using new gasket, install oil pan in reverse of removal procedure.

(2) Fill crankcase with oil (LO 10-3950-203-12).

5-6. Oil Pump

a. Removal.

(1) Remove oil pan (para 5-5).

(2) Refer to figure 7-7 and remove oil pump.

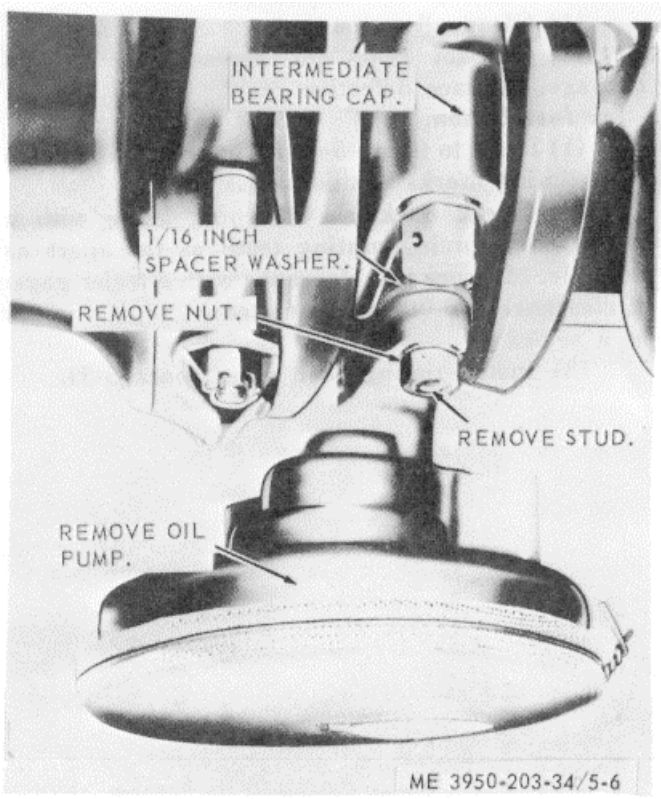


Figure 5-6. Oil pump removal

b. Cleaning and Inspection.

(1) Clean oil pump.

(2) Inspect for obvious damage and other defects. Replace damage or defective pump.

(3) Measure clearance between spur gears and body. Clearance should be 0.001-to 0.003-inch.

(4) Check end play between spur gears and oil pump cover. With cover gasket installed, the clearance should be 0.0015-to 0.006-inch.

(5)Check backlash between spur gears. Backlash should measure 0.003-to 0.0065-inch.

c. Installation.

NOTE

Be sure to install I/16 inch flat spacer washer between oil pump mounting and bearing cap. Failure to do this will cause interference between oil pump and camshaft.

(1) Refer to figure 5-6 and install oil pump in reverse order of removal procedure.

(2) Install oil pan (para 5-5).

Section IV. VALVES AND PISTONS

5-7. Valves, Guides, and Lifters

a. Removal

(1) Remove valve lifter cover (TM 10-3950 203-20).

(2) Remove cylinder head (TM 10-3950-203-20).

(3) Remove valves, guides, and lifters as shown in figure 5-7.

(4) Disassemble valves, guides, and lifters as shown in figure 5-8.

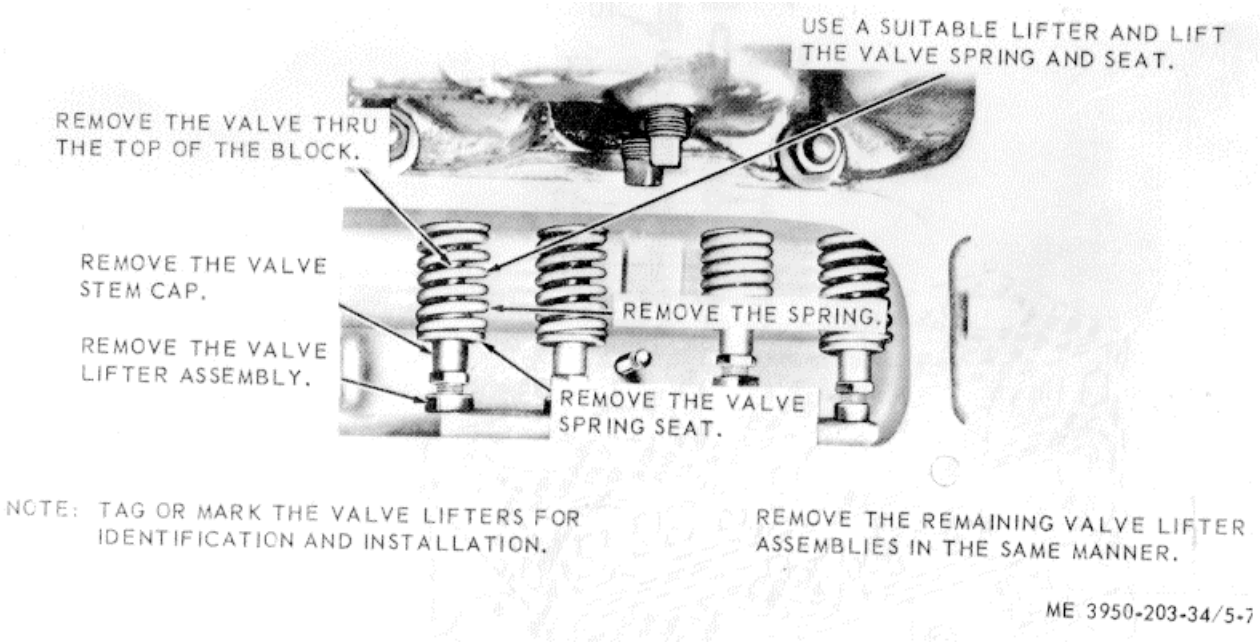
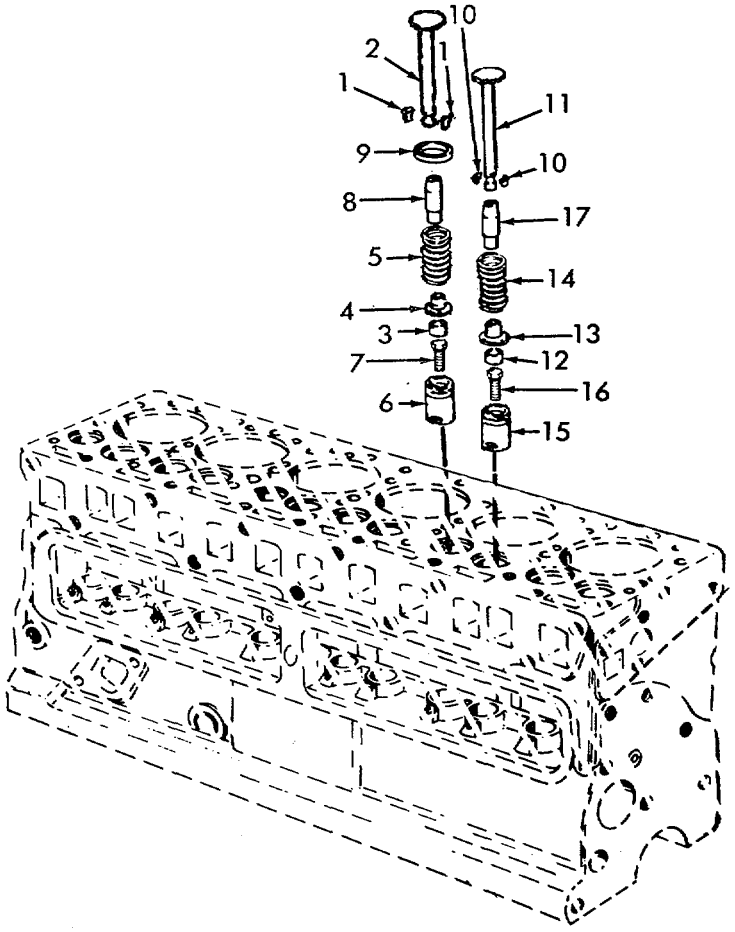


Figure 5-7. Valves, guides, and lifters removal.



1 Retainer(12)
2 Exhaust valve (6)
3 Cap(6)
4 Seat (6
5 Spring 6)
6 Lifter (6)
7 Capscrew (6)
8 Valve guide (6)
9 Insert (6)
10 Retainer (12)
11 Intake valve (6)
12 Cap (6)
13 Seat (6)
14 Spring (6)
15 Lifter (6)
16 Capscrew (6)
17 Valve guide (6)

Figure 5-8. Valves, guides, and lifters, exploded view.

b. Cleaning, Inspection and Repair.

(1) Clean all parts.

(2) Inspect for cracks or other defects. Rep defective parts.

(3) Measure valve guides for excessive wear Inside diameter should be 0.3422-to 0.3432-inch]. Replace a guide that is worn to 0.3447 inch.

(4) Measure valve spring length in valve closed position which should be 1 21 / 32 inches and] 47-to 53-pounds. Measure valve spring length in the valve-open position which should be 13/8 inches and the load 103-to 110-pounds. Replace springs that do not conform to the above requirement

(5) Measure the intake valve stem diameter should be 0.3406-to 0.3414-inch. If valve stem is worn to 0.3386 inch or less, replace valve.

(6) Measure the exhaust valve stem diameter It should be 0.3357-to 0.3385-inch. If valve stem is worn to 0.3357 inch or less, replace valve.

(7) Grind both valve seats and faces required. The intake valve seat angle and intake valve face angle are 30°. Exhaust valve seat angle is 45°. Measure angles with a line at right angles to the stem. Check face with center line of stem using a dial indicator. Runout on the valve faces must not exceed 0.002 inch. If the runout exceeds this amount, repeat grinding or replace valves necessary. Measure distance from outside of valve faces to the top of the valve. If this distance one-half or less than that of a new valve, replace valve.

(8) Reface the exhaust valve seat inserts with suitable refacing tool according to directions furnished. Correct seat insert angle is 45°. Grind new face to a width of 1 / 16-to 3 / 32-inch. Check valve seat faces with a dial indicator. If runout exceeds 0.002 inch, repeat the grinding operation or replace inserts. Grind each valve in its respective seat and insert to assure a gastight fit.

c. Installation.

NOTE

Chill the exhaust valve seat inserts for several minutes to shrink their diameters and permit them to be more easily driven into their respective counterbores. Be sure the valve seat insert is properly seated against bottom of counterbore. Drive valve guides from top of block to a depth of 1-15/32 inches, measured from top of guide to top of cylinder block. When replacing ferox-coated guides, do not ream; the guides are prereamed before coating. Further reaming removes the coating.

(1) Reassemble and install valves, guides, and lifters as shown in figures 5-8 and 5-7.

(2) Adjust valves (TM 10-3950-203-20).

(3) Install cylinder head (TM 10-3950-203-20).

(4) Install valve cover (TM 10-3950-203-20).

5-8. Pistons and Connecting Rods

a. Removal.

(1) Remove cylinder head (TM 10-3950-203-20).

(2) Remove oil pump (para 5-6).

(3) Refer to figure 5-9 and remove cotter pin (2), nut (3), lower connecting rod cap (5) and lower bearing sleeve (6).

(4) Push connecting rods (5) up and remove upper bearing sleeve (6).

(5) Wrap bottom of rods (5), to prevent damage to cylinder walls, and then push the connecting rods, with pistons attached, up and out of cylinders.

(6) Remove rings (8) and complete disassembly as shown.

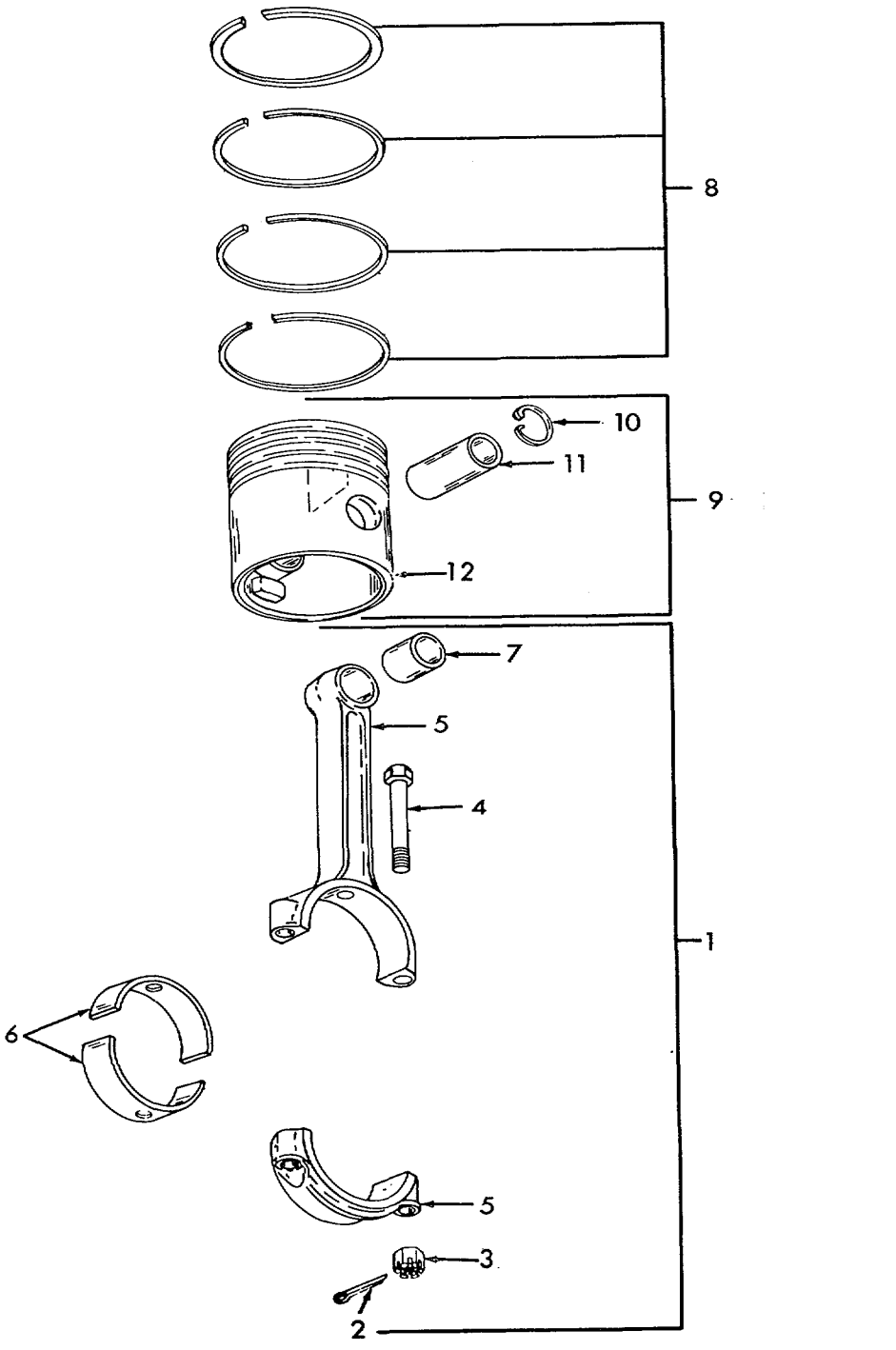


Figure 5-9. Piston and connecting rod, exploded view.

Key to figure 5-9.

1 Connecting rod assy (6)	7 Bearing (6)
2 Cotter pin (12)	8 Ring set (6)
3 Nut (12)	9 Piston and pin assy
4 Capscrew (12)	10 Retainer (6)
5 Connecting rod and cap (6)	11 Pin (6)
6 Bearing sleeve set (6)	12 Piston (6)

b. Cleaning, Inspection and Repair.

(1) Clean all parts.

(2) Inspect all parts for cracks or other defects Replace defective parts.

(3) Check fit of piston pin the boss of piston and in piston pin bushing. The piston pin should 0.8591-to 0.8593-inch in diameter with an out-,of round and taper allowance of only 0.0003 inch. The proper piston pin fit in piston pin bushing with a 0.0004 inch clearance. The piston pin 0.0001 inch larger than piston pin boss a requires a force fit.

(4) Check piston ring gap by installing a piston, ring in cylinder. Position a piston in the cylinder and push it against the ring until the ring is square with cylinder walls. Gap should measure 0.007-0.017-inch. If gap exceeds 0.017 inch, replace ring If gap is less than 0.007 inch, file end with a flat file until proper gap is obtained.

(5) Check piston ring groove clearance. Install; a piston ring on piston and measure with a feeler gage between ring and piston land. Clearance should be 0.0035-to 0.005-inch on first ring, 0.0035- to 0.0055-inch on the second and third rings, and 0.003- to 0.0045-inch on the fourth. If rings do not meet these specifications, replace them.

(6) Check piston-to-cylinder clearance. Select two strips of feeler stock 10 inches long, ½/2-inch wide, and 0.002 inch thick. Attach feeler stock to a spring scale. Invert piston and place feeler stock and piston in the cylinder. Withdraw feeler stock, observe scale reading. The required spring scale readings is from 5-to 10-pounds. Test in several places. Replace piston that does not meet requirements.

c. Installation.

NOTE

Coat rings, pistons, pins, and bearings with a thin film of lubricating oil.

(1) Refer to figure 5-9 to reassemble and install rings, piston, connecting rods, sleeves, and bearing.

(2) Check clearance between sleeve bearing and crankshaft. Place a plastic gage between bearing and connecting rod journal on crankshaft. Torque, nuts 35-to 40-foot pounds. The required clearance is 0.0015 inch. Replace bearing set if necessary to obtain required clearance.

(3) Install oil pump (para 5-6).

(4) Install cylinder head (TM 10-3950-203-20).

Section V. CRANKSHAFT AND CAMSHAFT

5-9.Cranshaft, Bearings and Seals

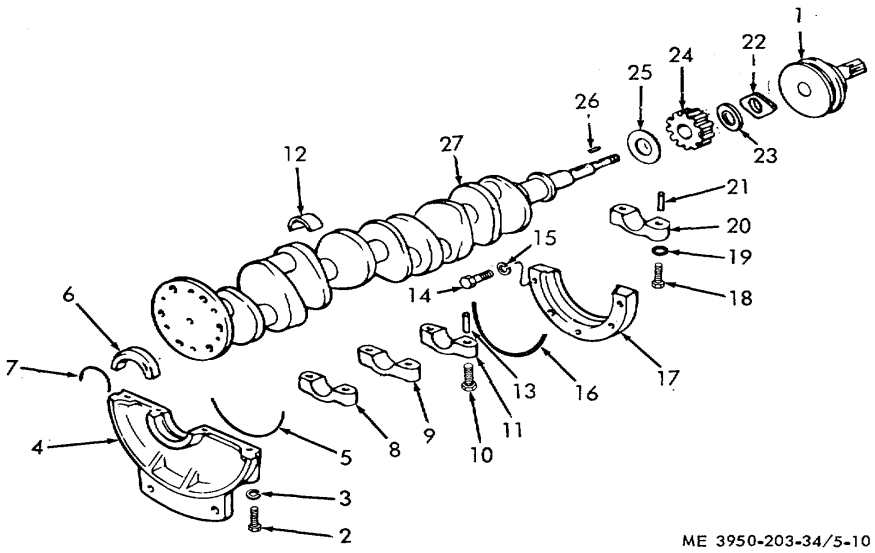
a. Removal.

(1) Remove timing gears (para 5-4)

(2) remove pistons and connecting rod (para 5-8)

(3) Remove flywheel (para 5-1).

(4) Remove the crankshaft, bearings and seals as illustrated in figure 5-10.



1 Pulley
2 Screw (2)
3 Washer (2)
4 Block
5 Gasket
6 Guard
7 Felt
8 Cap
9 Cap
10 Screw (6)
11 Cap
12 Bearing (6)
13 Dowel
14 Screw (2)
15 washer
16 Gasket
17 Block
18 Bolt (2)
19 Washer (2)
20 cap
21 Pin
22 Jaw
23 Deflector
24 Gear
25 Thrust plate
26 Key
27 Crankshaft

Figure 5-10. Crankshaft and related parts, exploded view.

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect parts for defects. Replace defective parts.

(3) Use micrometer to measure diameter of the main bearing journals. This diameter should measure 2.3744-to 2.3752-inches. If any of the main journals is less than 2.3734 inches, replace crankshaft. Clearance between main bearing journals and inserts is 0.0028 inch maximum and 0.0008 inch minimum.

(4) Use micrometer to measure diameter of connecting rod journals. They should measure 2.0619-to 2.0627-inches. If any rod journals diameter is less than 2.0609 inches, replace crankshaft.

c. Installation.

(1) Refer to figure 5-10 and install crankshaft, bearings and seals.

(2) Check fit of the bearing inserts by placing a piece of feeler stock, 1/2 inch wide between insert and journal. Torque bolts 85 - 95 foot-pounds. Check movement of crankshaft when turned. A positive drag should be felt. If crankshaft fails to turn, or turns without a drag, the inserts are defective and must be replaced.

(3) Install flywheel (para 5-1).

(4) Install pistons and connecting rods (para 5-8).

(5) Install timing gears (para 5-4).

5-10. Camshaft and Bearings

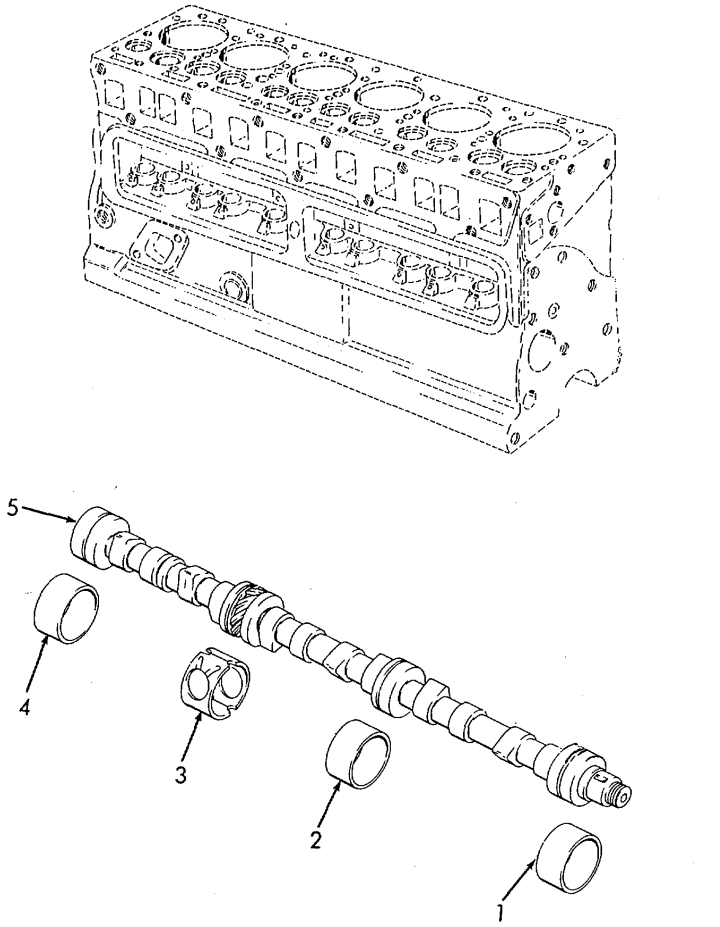
a. Removal.

(1) Remove valves (para 5-7).

(2) Remove timing gears (para 5-4).

(3) Remove oil pump (para 5-6).

(4) Remove camshaft and bearings illustrated in figure 5-11.



1. Front bearing
2 Front intermediate bearing
3 Rear intermediate bearing
4 Rear bearing
5 Camshaft

Figure 5-11. Camshaft and bearings, exploded view.

b. Cleaning and Inspection.

(1) Clean all parts.

(2) Inspect for obvious damage and other defects. Replace defective parts as necessary.

(3) Measure diameter of camshaft bearing journals at several places on the journals. The front journal should be 1.8715-to 1.8725-inches. The front intermediate journal should be 1.8085-to1.8095-inches. The rear intermediate journal should be 1.7457-to 1.7465-inches. The rear

journal should be 1.2465-to 1.2475-inches. Replace camshaft whose journals are worn 0.001 inch more than the minimum diameter.

(4) Measure inside diameters of the camshaft bearings. The inside diameter of the front bearing should be 1.8745-to 1.8755-inches. The front intermediate should be 1.8115-to 1.8125-inches. The rear intermediate should be 1.7495-to 1.7502-inches. The rear bearing should be 1.2495-to 1.2505-inches.

c. Installation.

(1) Install bearings and camshaft as illustrated in figure 5-11.

(2) Check clearance between camshaft journal and camshaft bearing which should be 0.002-to 0.004-inch. If clearance exceeds 0.004 inch, replace bearings.

(3) Check camshaft end play. Mount a dial indicator on the engine with indicator pointer resting against camshaft gear. Move gear and shaft to their limits of travel and observe dial indications. End play should be 0.005-to 0.009-inch. If end play exceeds 0.009 inch, replace thrust washer (fig. 5-4).

(4) Install oil pump (para 5-6).

(5) Install timing gears (para 5-4).

(6) Install valves (para 5-7).

Section VI. BLOCK

5-11. General

The engine block is a solid, one-piece, iron alloy casting. It houses the crankshaft, camshaft, connecting rods, pistons, and valves. The block has full length water jackets around the cylinders and has water passages around the valves for cooling. Drilled oil passages carry oil under pressure to all bearings and moving parts requiring lubrication.

5-12. Block

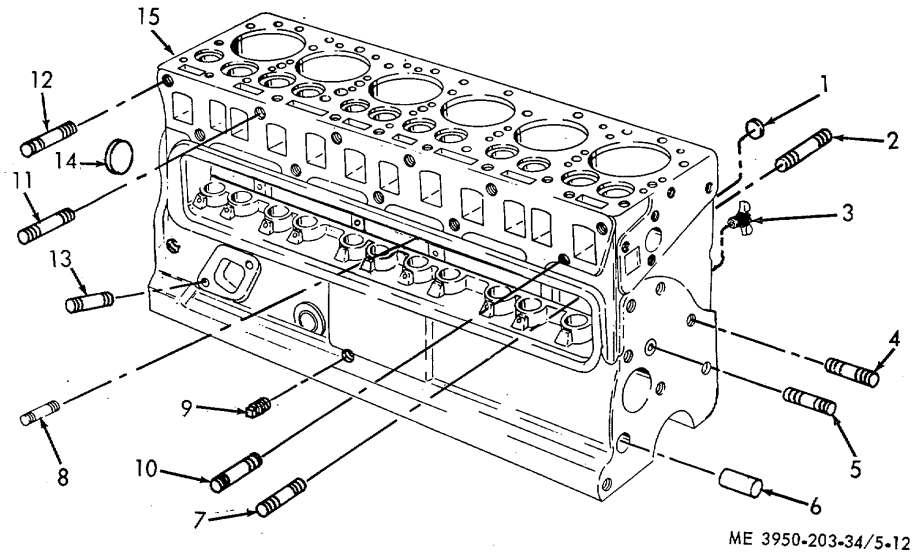
a. Disassembly.

(1) Remove crankshaft (para 5-9).

(2) Remove camshaft (para 5-10).

(3) Remove flywheel housing (para 5-2).

(4) Remove and disassemble parts from engine block as shown in figure 5-12.



1.Plug, expansion (9)
2 Stud (3)
3 Draincock
4 Stud (3)
5 Stud
6 Bushing
7 Stud (2)
8 Stud
9 Plug (3)
10 Stud
11 Stud (8)
12 Stud (2)
13 Stud (2)
14 Plug
15 Engine block

Figure 5-12. Engine block. exploded view.

b. Cleaning, Inspection and Repair.

(1) Soak engine block in strong caustic solvent for at least two hours, then remove and clean with steam.

(2) Inspect for cracks, excessive wear, or other defects.

(3) Use a straight edge and feeler gage to check the machined surfaces of the block. If the surface are worn or warped more than 0.010 inch, the block must be replaced.

c. Reassembly.

(1) Reassemble and install parts on engine block as shown in figure 5-12.

(2) Install flywheel housing (para 5-2).

(3) Install camshaft (para 5-10).

(4) Install crankshaft (para 5-9).

APPENDIX A

REFERENCES

A-1. Fire Protection	
TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users.
A-2. Lubrication	
LO 10-3950-203-12	Lubrication order
A-3. Painting	
TM 9-213	Painting Instructions for Field Use.
A-4. Cleaning	
C6800IL	Chemicals and Chemical Products.
SB725-7930-1	Hard and Soft Water Cleaning Compounds.
A-5. Maintenance	
TM 38-750	The Army Maintenance Management System.
TM 5-764	Electric Motor and Generator Repair.
TM 9-6140-200-15	Operation and Organizational, Field and Depot Maintenance; Storage Batteries, Lead-acid Type.
TM 10-3950-203-10	Operator's Manual
TM 10-3950-203-20	Organizational Maintenance Manual
P	Direct Support and General Support Maintenance
(When Printed)	Repair Parts and Special Tools List
A-6. Shipment and Storage	
TB 740-93-2	Preservation of USAMEC Mechanical Equipment for Shipment and Storage
TM 38-230-1	Preservation and Packing of Military Equipment.
TM 740-90-1	Administrative Storage of Equipment.
A-7. Demolition	
TM 750-244-3	Destruction of Material to Prevent Enemy Use.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States

Army,
Official:

Chief of Staff.

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-25, Section II, (qty rqr block No. 335) direct and general support maintenance requirements for Cranes, Truck Mounted.

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C1

CHANGE

NO. 1

HEADQUARTERS

DEPARTMENT OF THE ARMY

Washington, D.C., *30 September 1991*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

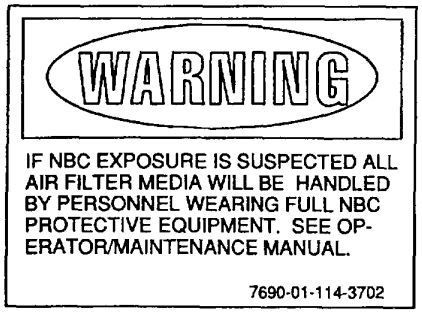
**CRANE, TRUCK; WAREHOUSE; SLEWING BOOM;
GASOLINE ENGINE DRIVEN; FRONT WHEEL DRIVE;
PNEUMATIC TIRES; 10,000 LB CAPACITY
(HUGHES-KEENAN MODEL VSH-10, ARMY MODEL MHE-194)
NSN 3950-00-723-3294**

TM 10-3950-203-34, 12 October 1971,is changed as follows:

Cover and *title* page is changed as shown above.

Page 1-1, the following paragraph is added after **Section II, "DESCRIPTION AND DATA."**

A decal has been developed that warns of NBC exposure. It is to be positioned in a noticeable place on or near the air cleaner or air filter housing. You may order the decal using part number 12296626, CAGEC 19207. Refer to air cleaner (page 2-33, figure 2-26).



Add the following WARNING to the following pages;

Inside front cover, after the list of WARNINGS and CAUTIONS;

page 1-2, item g. *Capacities* preceding, "*Air cleaner;*"

page 2-2, after **Section III, "GENERAL MAINTENANCE":**

WARNING

If NBC exposure Is suspected, all air filter media should be handled by personnel wearing protective equipment. Consult your unit NBC Officer or NBC NCO for appropriate handling or disposal instructions.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with DA Form 12-25-E (Block 2103) Direct Support and General Support maintenance requirements for TM10-3950-203-34.

∗U.S. GOVERNMENT PRINTING OFFICE: 1991 543-016140140

TM 10-3950-203-34 CRANE, TRUNK; WAREHOUSE; SLEWING BOOM- 1971

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