

**TECHNICAL MANUAL**

**DS AND GS MAINTENANCE MANUAL**

**TRUCK, FORK LIFT, 4000 LB CAPACITY,  
144 IN. LIFT, GASOLINE ENGINE DRIVEN**

**(BAKER MODEL FJF-040)**

**(ARMY MODEL MHE211)**

**FSN 3930-935-7963**

---

**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**FEBRUARY 1971**

**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.

If the solution comes in contact with the skin, rinse the area immediately with clear water to avoid skin burns.

Do not smoke or use an open flame in the vicinity when servicing batteries as hydrogen gas, an explosive is generated. Use only distilled water to maintain battery electrolyte level.

---

**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 the fuel container and fuel tank to prevent a static spark from igniting fuel.

Wipe or flush any spillage.

---

**WARNING**

**ASPHYXIATION DANGER**

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

**DEATH**

or nausea may result if personnel fail to observe safety precautions.

Do not operate the forklift truck in a closed building without providing adequate ventilation.

**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 forklift truck.

Use extreme care when high tiering.

Position elevated load with slight back tilt of mast directly over loading spot, then tilt mast forward to stack. Use caution when approaching doorways, aisles, intersections or other workers.

Always travel with mast tilted back and fork raised just high enough to clear any uneven floor conditions.

Avoid sudden starting and stopping.

Reduce speed on turns.

Know the rated capacity of the fork lift truck and do not overload it.

Never pick up a load until certain it can be carried safely.

Make sure the load is steady before lifting and keep the load against the carriage rest.

When transporting bulky loads, travel in reverse.

Always descend ramps in reverse when carrying load.

Do not butt loads with the forks or with the rear of the truck.

---

**WARNING**

**MAINTENANCE HAZARD  
SERIOUS INJURY OR DEATH**

to personnel may result if the fork lift is not blocked securely before crawling under the fork lift truck.

---

The format of this manual is not in accordance with established Department of Army specifications because of the short leadtime involved. The technical content has been furnished by the equipment manufacturer.

Technical Manual }  
No. 10-3930-623-34 }

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
Washington, D. C., 19 February 1971

**DS and GS Maintenance Manual**  
**TRUCK, FORK LIFT, 4000 LB CAPACITY, 144 IN. LIFT,**  
**GASOLINE ENGINE DRIVEN**  
**(BAKER MODEL FJF-040) (ARMY MODEL MHE211)**  
**FSN 3930-935-7963**

## TABLE OF CONTENTS

Section	Page	Section	Page
I	INTRODUCTION AND GENERAL DESCRIPTION .....1-1	4-70.	Engine Mounted Accessories, Disassembly .....4-20
1-1.	Introduction .....1-1	4-71.	Hydraulic Pump .....4-20
1-3.	General Description.....1-1	4-72.	Ignition Distributor .....4-20
1-7.	Detailed Description .....1-3	4-75.	Carburetor.....4-20
1-37.	Electrical System Components .....1-9	4-77.	Disassembly of Throttle Body .....4-25
II	TABLE OF SPECIFICATIONS .....2-1	4-78.	Disassembly of Fuel Bowl Body .....4-25
2-1.	General .....2-1	4-79.	Starter.....4-25
2-2.	Deleted	4-80.	Alternator .....4-25.1
2-3.	Engine .....2-3	4-85.	Cylinder Head.....4-26
2-4.	Fuel System.....2-5	4-88.	Valves and Related Components Removal .....4-26
2-5.	Transmission .....2-5	4-89.	Timing Gear Cover Assembly .....4-28
2-6.	Drive Axle .....2-6	4-92.	Oil Pan Removal .....4-29
2-7.	Steering Axle .....2-6	4-93.	Oil Pump .....4-29
2-8.	Power Steering.....2-6	4-96.	Pistons and Connecting Rods .....4-30
2-9.	Hydraulic System .....2-6	4-99.	Camshaft Removal .....4-31
2-10.	Electric System .....2-6	4-100.	Flywheel Ring Gear and Flywheel Housing .....4-31
III	SPECIAL OVERHAUL TOOLS AND EQUIPMENT .....3-1	4-103.	Crankshaft Removal .....4-31
3-1.	Special Tools .....3-1	4-104.	Exhaust System Removal .....4-33
3-3.	Test Equipment .....3-1	4-105.	Deleted
IV	REMOVAL AND DISASSEMBLY .....4-1	4-108.	Steering Control System.....4-33
4-1.	General .....4-1	4-109.	Steering Column .....4-33
4-4.	Deleted	4-112.	Power Steering Gear .....4-33
4-7.	Deleted	4-115.	Drag Link.....4-39
4-10.	Deleted	4-118.	Steering Axle.....4-39
4-13.	Sheet Metal .....4-2	V	CLEANING .....5-1
4-21.	Uprights, Carriage, and Fork Assembly 4-2	5-1.	Cleaning Materials .....5-1
4-24.	Hydraulic System .....4-4	5-4.	Cleaning Precautions .....5-1
4-26.	Hoist Cylinder Assembly .....4-4	5-7.	General Instructions .....5-1
4-29.	Tilt Cylinder Assembly .....4-4	VI	REPAIR AND REASSEMBLY .....6-1
4-32.	Control Valve .....4-4	6-1.	Scope of Section .....6-1
4-35.	Hydraulic Oil Pump.....4-9	6-3.	General Instructions .....6-2
4-38.	Hydraulic Tank .....4-10	6-8.	Painting .....6-2
4-41.	Deleted	6-14.	Engine Repair and Assembly .....6-3
4-44.	Chassis Mounted Electrical Units .....4-10	6-15.	Crankshaft Repair .....6-3
4-47.	Chassis Mounted Hydraulic Brake System .....4-12	6-16.	Crankshaft Installation.....6-3
4-50.	Drive Axle .....4-12	6-22.	Piston Ring Installation .....6-4
4-53.	Wheel Brake Removal and Disassembly .....4-12	6-31.	Valve Installation.....6-7
4-55.	Transmission and Torque Converter ..4-16	6-34.	Oil Pump Assembly .....6-7
4-58.	Transmission Direction Clutch Assembly .....4-17	6-37.	Crank shaft Oil Seal Installation.....6-8
4-61.	Transmission Control Valve .....4-17	6-38.	Cylinder Head Installation.....6-9
4-64.	Engine With Accessories .....4-20	6-45.	Ignition Distributor Assembly .....6-11
4-66.	Engine Removal .....4-20	6-46.	Ignition Installation .....6-11
4-67.	Engine Mounted Accessories, Removal .....4-20	6-47.	Starter Assembly .....6-11
		6-50.	Assembly of Carburetor Fuel Bowl Body .....6-12

## TABLE OF CONTENTS (Cont'd)

Section	Page	Section	Page
6-51. Assembly of Carburetor Throttle Body .....	6-12	6-87. Rack-Piston, Worm Assembly and Gear Housing Disassembly .....	6-21
6-52. Transmission Repair and Assembly .....	6-13	6-88. Rack-Piston, Worm Assembly and Gear Housing Inspection .....	6-21
6-53. Control Valve Assembly .....	6-13	6-89. Rack-Piston, Worm Assembly and Gear Housing Assembly .....	6-22
6-56. Forward and Reverse Clutch Assembly .....	6-13	6-90. Rack-Piston, Worm Assembly and Gear Housing Installation .....	6-23
6-58. Transmission Assembly .....	6-13	6-93. Master Cylinder Assembly .....	6-23
6-59. Transmission Installation .....	6-14	6-96. Wheel Brake Assembly .....	6-24
6-60. Drive Axle Repair and Assembly .....	6-14	6-99. Deleted	
6-62. Differential Adjustments .....	6-15	6-102. Hydraulic System Assembly .....	6-25
6-64. Reduction Gear Axle End Assembly .....	6-17	6-104. Uprights, Carriage and Fork Assembly .....	6-26
6-65. Steering Gear Repair and Assembly .....	6-17	6-107. Tilt Cylinder Assembly .....	6-26
6-67. Adjuster Plug Assembly Removal .....	6-17	6-109. Hydraulic Control Valve Assembly .....	6-27
6-68. Adjuster Plug Disassembly .....	6-18	6-111. Hydraulic Oil Pump Assembly .....	6-28
6-69. Adjuster Plug Assembly .....	6-18	6-114. Deleted	
6-70. Adjuster Plug Installation .....	6-18	6-115. Hydraulic Tank Assembly .....	6-29
6-72. Steering Gear Valve Removal .....	6-19	6-117. Exhaust System .....	6-29
6-73. Steering Gear Valve Disassembly .....	6-19		
6-74. Steering Gear Valve Inspection .....	6-19		
6-75. Steering Gear Valve Assembly .....	6-19		
6-76. Steering Gear Valve - Installation .....	6-20		
6-77. Sector Gearshaft and Side Cover Removal .....	6-20		
6-78. Sector Gearshaft and Side Cover Disassembly .....	6-20		
6-79. Sector Gearshaft and Side Cover Inspection .....	6-20		
6-80. Sector Gearshaft and Side Cover Assembly .....	6-20		
6-81. Sector Gearshaft and Side Cover Installation .....	6-21		
6-82. Housing End Plug Removal .....	6-21		
6-83. Housing End Plug Installation .....	6-21		
6-84. Rack-Piston End Plug Removal .....	6-21		
6-85. Rack-Piston End Plug Installation .....	6-21		
6-86. Rack-Piston, Worm Assembly and Gear Housing Assembly Removal .....	6-21		
		VII INSPECTION, TESTING, AND TABLE OF LIMITS .....	7-1
		7-1. Scope of Section .....	7-1
		7-4. General Inspection Procedures .....	7-1
		7-17. Engine Component Inspections and Tests .....	7-1
		7-36. Distributor Timing .....	7-13
		7-37. Engine Assembly Inspections .....	7-13
		7-45. Drive Line and Control Component Inspections and Tests .....	7-14
		7-54. Hydraulic System Components .....	7-16
		7-65. Reassembly of Major Components .....	7-17
		7-79. Start Up and Breaking in Newly Overhauled Engine .....	7-20
		7-85. Operational Tests and Adjustments .....	7-20

## LIST OF ILLUSTRATIONS

Number	Page	Number	Page
i. FJF-040 Fork Lift Truck .....	iv	1-7. Transmission, Showing Pressure Passages .....	1-8
1-1. Deleted		1-8. Transmission Hydraulic Diagram .....	1-9
1-2. Fs-24e Engine, Front and Rear Views .....	1-2	1-9. Drive Axle, Exploded View .....	1-10
1-3. Charging System Basic Schematic .....	1-3	1-10. Uprights, Carriage and Fork .....	1-11
1-4. Hydraulic System Diagram .....	1-4	1-11. Electrical Schematic .....	1-12
1-5. Steering System Arrangement .....	1-5	1-12. Instrument Panel .....	1-13
1-6. Power Steering Gear Operating .....	1-7		

## LIST OF ILLUSTRATIONS (Cont'd)

Number	Page	Number	Page
3-1. Test Equipment .....	3-2	4-30. DELETED	
4-1. Fork Lift Truck Components .....	4-1	4-31. Power Steering Arrangement .....	4-36
4-2. Hydraulic System Including Tilt Cylinders .....	4-3	4-32. Power Steering Gear Assembly, Exploded View .....	4-37
4-3. Upright, Carriage and Fork Assembly, Exploded View .....	4-5	4-33. Rear Steering Axle Assembly, Exploded View....	4-38
4-4. Mast Lift Hydraulic Cylinder Assembly, Exploded View .....	4-6	5-1. Cleaning Agents .....	5-1
4-5. Mast Tilt Hydraulic Cylinder Assembly, Exploded View .....	4-7	6-1. Table of Inspection and Repair Data .....	6-1
4-6. Hydraulic Hoist and Tilt Control Valve, Exploded View .....	4-8	6-2. Checking Piston to Cylinder Fit .....	6-4
4-7. Hydraulic Pump Assembly, Exploded View .....	4-9	6-3. Pressing Out Old Piston Pin Bearing With New Bearing .....	6-4
4-8. DELETED		6-4. Driving Out Valve Guides .....	6-5
4-9. Electrical System Complete, Exploded View .....	4-11	6-5. Removing Valve Seat Insert With Puller .....	6-6
4-10. Hydraulic Brake Master Cylinder and Pedal Assembly, Exploded View .....	4-13	6-6. Using Dial Indicator To Check Flywheel Runout .....	6-8
4-11. Drive Train Less Engine, Partially Exploded View .....	4-14	6-7. Six Cylinder Head Screw Tightening Sequence ...	6-9
4-12. Front Drive Axle Complete, Exploded View. ....	4-15	6-8. Fan Drive Pulley Assembly .....	6-10
4-13. Axle Portion Hydraulic Brake Assembly, Exploded View .....	4-16	6-9. Drive Axle Ring and Pinion Gear Tooth Contact Patterns .....	6-16
4-14. Mechanical Transmission Complete, Exploded View .....	4-18	6-10. Steering Gear Adjuster Plug Locknut Wrench Details .....	6-17
4-15. Transmission Direction Drive Clutch Assembly, Exploded View .....	4-19	6-11. Steering Gear Thrust Bearing Retainer Installer Tool Details .....	6-18
4-16. Transmission Control Valve Assembly, Exploded View .....	4-19	6-12. Steering Gear Rack-Piston Arbor Tool Details .....	6-22
4-17. Engine Assembly Removal Disconnect Points .....	4-21	6-13. Steering Gear Piston Ring Compressor Tool Details .....	6-24
4-18. Gasoline Engine Assembly Complete With Accessories .....	4-22	7-1. Table of Limits and Fits and Points of Measurements (Sheet 1 of 4).....	7-2
4-19. Ignition Distributor and Spark Plugs, Exploded View .....	4-23	7-1. Table of Limits and Fits and Points of Measurements (Sheet 2 of 4) .....	7-3
4-20. Carburetor Assembly, Exploded View .....	4-24	7-1. Table of Limits and Fits and Points of Measurements (Sheet 3 of 4) .....	7-4
4-20.1 Alternator Exploded View .....	4-25.1	7-1. Table of Limits and Fits and Points of Measurements (Sheet 4 of 4) .....	7-5
4-21. Engine Electrical Starting Motor.....	4-26	7-2. Table of Torque Values .....	7-6
4-22. Engine Cylinder Block, Head and Oil Pan Group, Exploded View .....	4-27	7-3. Nondestructive Inspection Data (Sheet 1 of 2) .....	7-7
4-23. Engine Valve Train and Camshaft Group, Exploded View .....	4-28	7-3. Nondestructive Inspection Data (Sheet 2 of 2) .....	7-8
4-24. Removing and Replacing Valve Retainer Locks .....	4-28	7-4. Engine Water Pump, Exploded View .....	7-10
4-25. Timing Gear Cover and Governor Shaft Group, Exploded View .....	4-29	7-5. Starter No-Load Current and Speed Test Setup .....	7-11
4-26. Engine Oil Pump Assembly, Exploded View .....	4-30	7-6. Starter Stall Current and Torque Test Setup .....	7-12
4-27. Removing Cylinder Top Ridge With a Ridge Reamer .....	4-31	7-7. Typical Hydraulic Tilt Cylinder Test Setup.....	7-16
4-28. Engine Crankshaft and Piston Group, Exploded View .....	4-32	7-8. Transmission Directional Control Lever, Exploded View .....	7-19
4-29. Fuel, Exhaust and Engine Coolant Systems, Exploded View .....	4-34	7-9. Table of Engine Dynamometer Run-In Procedures .....	7-21
		7-10. Table of Transmission Test Pressures .....	7-21
		7-11. Table of Steering System Operational Tests (Sheet 1 of 2) .....	7-22
		7-11. Table of Steering System Operational Tests (Sheet 2 of 2) .....	7-23

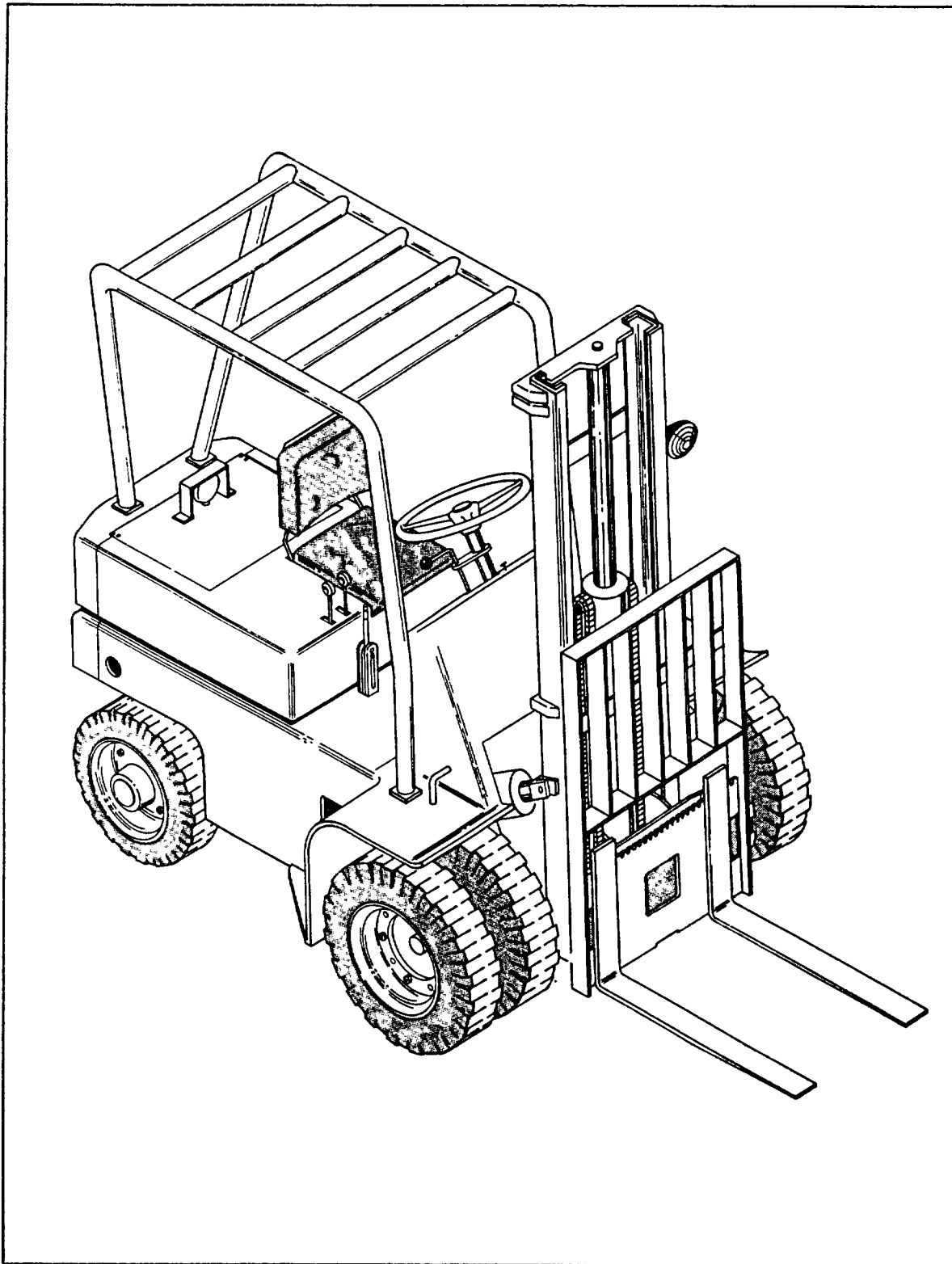


Figure i. FJF-040 Fork Lift Truck



## SECTION I

### INTRODUCTION AND GENERAL DESCRIPTION

#### 1-1. INTRODUCTION.

1. Scope. This manual contains instructions for the use of direct support and general support personnel maintaining the forklift truck as allocated by the Maintenance Allocation Chart. It provides information on the maintenance of the equipment which is beyond the scope of the tools, equipment, personnel, or supplies normally available at organizational maintenance.

2. Demolition and Administrative Storage.

a. For information on the administrative storage of this equipment, refer to TM 70-90-1.

b. For information on the demolition of this equipment, refer to TM 750-244-3.

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

#### 1-2. 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 DA Publications) and forwarded direct to: Commanding General, U. S. Army Mobility Equipment Command, ATTX: AMSME-MPP, 4300 Goodfellow Blvd., St. Louis, Missouri 63120

#### 1-3. GENERAL DESCRIPTION.

1-4. The Model FJF-040 fork lift truck is a front loading unit rated to handle loads to 4000 pounds at 24 inch load centers. Pneumatic tires permit satisfactory operation of the truck off paved surfaces.

1-5. Handling of loads is accomplished by engaging the two 40 inch fork prongs with the load. The forks are mounted on a hydraulically operated mast assembly which can raise the load to a height of twelve feet for stacking of commodities handled. The mast is tillable ten degrees rearward to cradle the load when traveling, to three degrees forward to facilitate disengaging the load when depositing it. Travel speed of the trucks is limited to about 12 miles per hour loaded, or 14 miles per hour empty, by an engine speed governor. Steering is power assisted. Arrangement of the controls conforms to general industrial truck standards, permitting ready use by operators with previous fork lift experience.

*Figure 1-1. Deleted.*

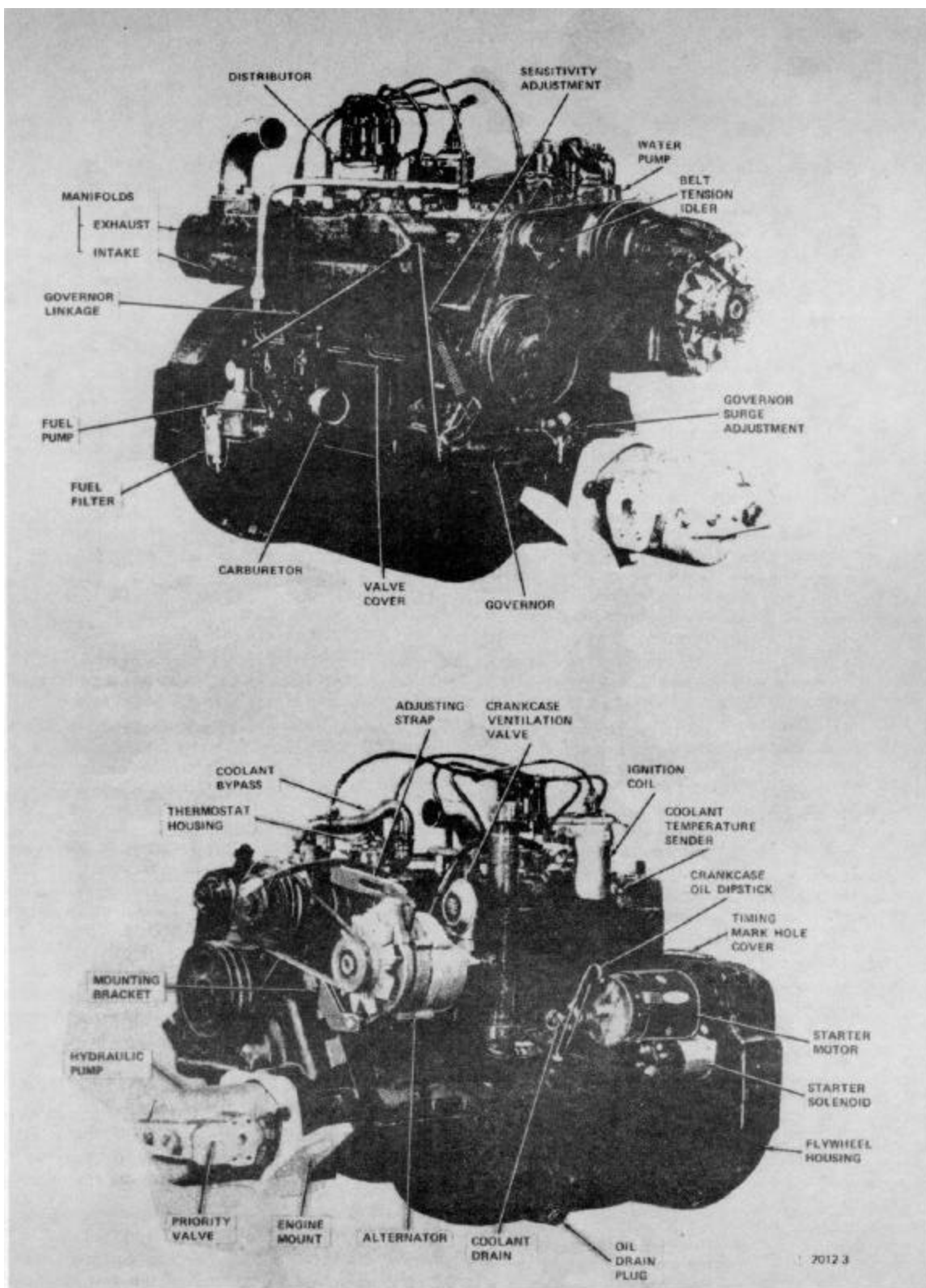


Figure 1-2. FS-244 Engine, Front and Rear Views

**1-6.** The fork lift trucks are powered by a Continental FS-244 Military Standard engine.

## 1-7. DETAILED DESCRIPTION.

### 1-8. ENGINES (See figure 1-2).

The Continental FS-244 Military Standard engine is rated at 82.3 horsepower when operating at 2800 revolutions per minute.

**1-9.** The full pressure lubrication system includes a gear-type oil pump with adjustable bypass valve to maintain suitable pressure through all speeds, and a replaceable element oil filter.

**1-10.** The fuel system includes a mechanical diaphragm fuel pump, driven by the engine camshaft, a single venturi updraft carburetor, and a mechanical governor which limits the maximum speed of the engine by closing the carburetor throttle valve when the engine reaches the governed speed. The carburetor air cleaner uses a disposable paper filter element.

**1-11. ALTERNATOR.** The alternator is an ac generator designed and constructed to give long service with a minimum of maintenance. The rotor is mounted on a ball bearing at the drive end, and a roller bearing at the slip ring end, and each bearing has a grease supply which eliminates the need for periodic lubrication. Two brushes are used to carry current through the two slip rings to the field coil which is mounted on the rotor. The brushes are extra long and under normal operating conditions will provide long periods of service. The stator windings are assembled on the inside of a laminated core that forms part of the frame. Six rectifier diodes, mounted in the slip ring end frame, are connected to the stator windings. The six diodes change the ac voltage to dc voltage which appears at the BAT terminal on the alternator. A capacitor, or condenser, mounted in the end frame protects the diodes from high voltages. Current output of the alternator is self-limiting by design to its rated maximum, regardless of speed or external circuit conditions. An externally mounted voltage regulator limits the operating voltage to a specified value through the full speed range of the alternator. Figure 1-3 shows a schematic view of the alternator and regulator.

**1-12. VOLTAGE REGULATOR.** The transistor is an electrical device made of semiconductor materials which is used as a switch to control the alternator field current in order that alternator voltage can be limited to a proper value. Figure 1-3 is a greatly simplified diagram of the alternator and regulator circuit. A brief description of the operation follows:

1. When the ignition switch is closed, battery voltage supplies current through the emitter (E) and collector (C) of the transistor to the field coil of the alternator. This emitter-collector circuit is complete since the transistor is turned "on" by a higher voltage on the emitter than on the base (B), which permits emitter-base current to flow.

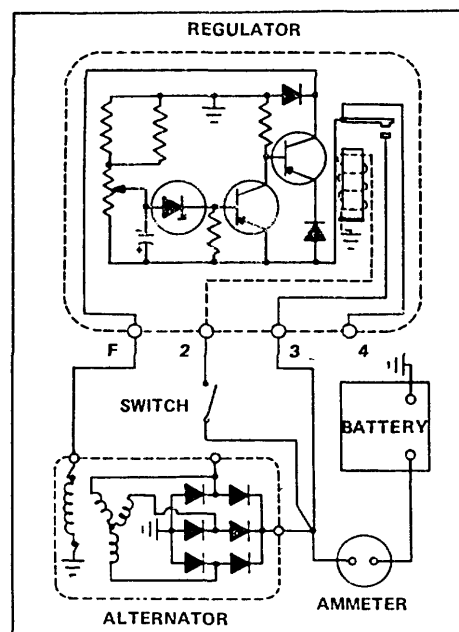


Figure 1-3. Charging System Basic Schematic

The flow of current to the field circuit of the alternator provides the magnetic field for the alternator. When the engine is started, the alternator builds up voltage. This causes current to flow to charge the battery and/or power accessories.

2. As alternator speed increases or the accessory load decreases, alternator voltage builds up to a predetermined value at which the regulator is set or adjusted. The electrical control portion of the regulator then places a higher voltage on the base of the transistor than is impressed upon the emitter, and the transistor is turned "off". With no current flow in the emitter-collector circuit, there is no current flow in the field coil of the alternator. As a result, alternator voltage drops below the setting or adjustment of the regulator.

3. Then the electrical control portion of the regulator places a lower voltage on the base of the transistor than that on the emitter, and the transistor is again turned "on". With current flow again in the emitter-collector and field coil circuit, the magnetic field is reestablished in the alternator, and alternator voltage can again build up to the setting of the regulator.

4. Thus, the switching "on" and "off" of the transistor regulates the amount of field current supplied to the alternator. The frequency of this switching is dependent primarily upon the accessory load and alternator speed. Under certain conditions the "on" and "off" cycle is repeated as much as 7,000 times per second.

5. A zener diode, driver transistor, capacitor, and resistors act together as the electrical control portion of the regulator to electrically switch the output transistor "on" and "off". A thermistor provides a temperature-compensated voltage setting which is matched to the charging requirement characteristics of the battery.

**1-13. STARTING SYSTEM.** The trucks are fitted with a Delco-Remy enclosed shift starter motor using a solenoid shifted overrunning clutch drive. The starter is operated from the instrument panel by a push button switch. A neutral safety switch operated by the transmission shift linkage is installed in the starter control circuit. This switch is closed only when the transmission is in neutral, to permit starting only at that time. These trucks also have a starter lockout solenoid in the control circuit to prevent accidental operation of the starter while the engine is running.

**1-14. IGNITION SYSTEM.** The ignition system is a conventional high tension battery powered system modified to meet radio interference suppressed requirements.

The system includes an ON-OFF switch on the instrument panel; a high tension coil, which transforms the low voltage of the battery to voltage high

enough to jump the spark plug gap, providing ignition; a distributor which times the occurrence of the spark at the cylinder and directs each high voltage pulse to the proper cylinder in firing order of the engine; a set of spark plugs and all connecting leads.

#### 1-15. DELETED

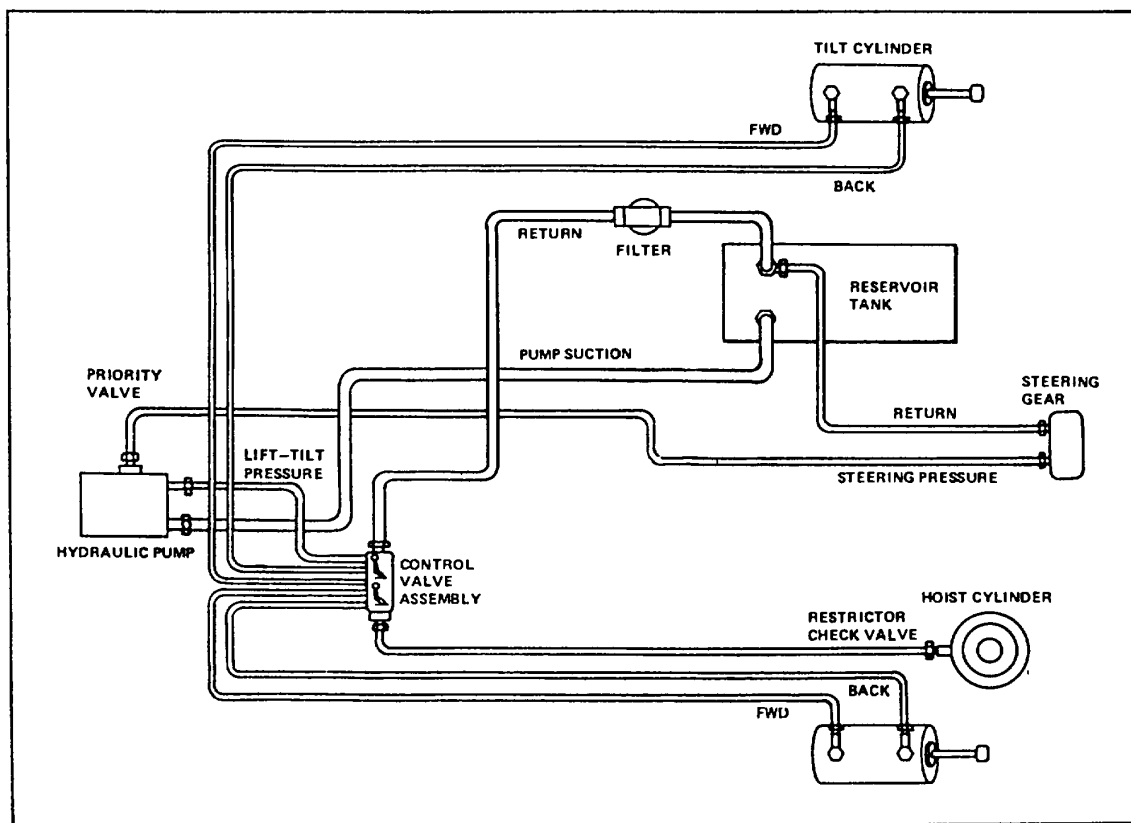


Figure 1-4. Hydraulic System Diagram

**1-16.** The distributor times the occurrence of the ignition spark in relation to the engine by means of a set of breaker points operated by an engine-driven cam. Variations in timing under changing speed are accomplished through a centrifugally operated spark advance mechanism in the distributor. The timed high voltage impulses are fed through the center terminal of the distributor cap to the rotor inside. The rotor then directs the high voltage to each spark plug wire (arranged from cap to spark plugs in proper engine firing order) in sequence, to spark each spark plug at the proper time.

**1-17. HYDRAULIC PUMP.** Hydraulic pressure for steering, hoisting, and tilting of the uprights is supplied by an engine-driven hydraulic pump. This pump is mounted at the left rear side of the engine, driven by a gear which engages the camshaft timing gear. The pump is a gear type positive displacement pump.

**1-18. UPRIGHT CARRIAGE AND FORK ASSEMBLY HYDRAULIC SYSTEM (See figure 1-4).** Using pressure from the engine-driven hydraulic pump, this system controls raising of the forks and fore and aft tilting of the uprights. The control valve assembly permits the operator to direct pressure to the hoist cylinder for raising the forks, or to the tilt cylinders to adjust the angle of the uprights and forks.

**1-19.** The flow divider (priority) valve directs the pump output to both the power steering system and the control valve assembly inlet port. A relief valve in the flow divider valve limits hydraulic pressure in the power steering system. This relief valve cracks open at 700 psi and is fully open at 1050 psi.

**1-20.** The control valve assembly is a two-spool fluid control valve with a control handle for each spool. The inboard control handle and spool control the raising and lowering of the forks by applying or releasing hydraulic pressure to the hoist cylinder. The outboard control handle and spool control tilting of the upright carriage. Each control handle has two actuating positions with a center neutral position. A pilot operated relief valve limits system pressure to 1500 psi. The hoist cylinder is a two-stage single-acting unit, raised by applying fluid pressure, and lowered by releasing pressure to permit gravity return of the elevated parts. The tilt cylinders are double-acting cylinders.

**1-21. POWER STEERING GEAR.** The power steering gear unit is basically a Saginaw recirculating ball steering gear to which has been added a torque sensitive valving arrangement, and in which the ball nut has been redesigned to act as a hydraulic piston. The valve (see figure 1-6) is an open-center rotary three-way valve, with a grooved spool to

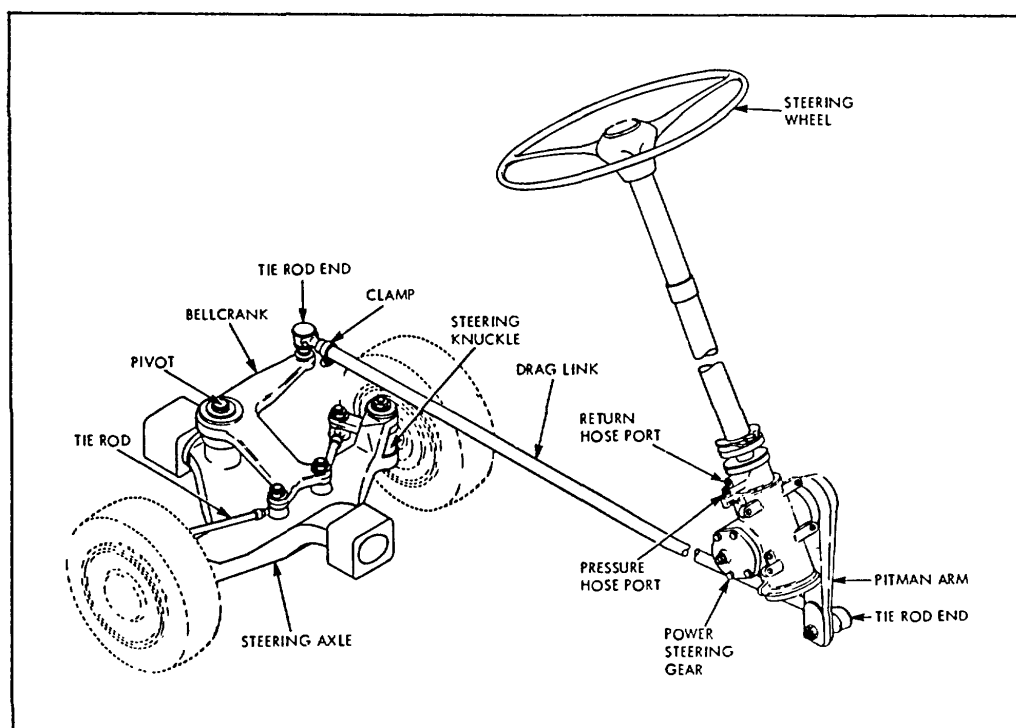


Figure 1-5. Steering System Arrangement

direct hydraulic pressure as required for either right or left turn assist. The spool is attached to the valve body at one end, and through a torsion bar to the steering gear stub shaft at the other end. Turning the steering wheel will steer the wheels without power assistance, through the torsion bar, spool and valve body, until more than about three pounds pull at the rim of the steering wheel is required. At this amount of resistance the torsion bar twists, shifting the spool in the valve body, to valve hydraulic fluid as required to supplement steering effort in the direction in which the wheel is turned, as diagramed in figure 1-6. Note that the rack-piston nut is geared directly to the pitman shaft. Power assistance is proportional to demand, and ceases when reduction in torsional load permits the torsion bar to return the valve spool to neutral. Hydraulic power is taken from the truck main hydraulic pump via a pressure reducing priority valve on the main hydraulic pump, connected by tubing directly to the steering gear housing.

#### **1-22. STEERING AXLE ASSEMBLY (See figure 1-5).**

The steering axle assembly is mounted on two neoprene blocks located to permit a degree of movement to the axle necessary to pass over irregular surfaces. The steering axle layout, and its relationship to the power steering system is shown in figure 1-5.

**1-23.** Two equal length tie rods connect a center-mounted bellcrank to each of the steering knuckles. Steering axle king pins are mounted in true vertical position to provide similar steering characteristics in either forward or reverse travel. The pneumatic tired wheels of the steering axle are not fitted with brakes.

**1-24. TRANSMISSION (See figures 1-7 and 1-8).** The transmission is a power-shifted single ratio forward and reverse unit. A torque converter transmits engine output to the transmission input shaft. The transmission is mounted directly to the engine and drive axle. No intervening drive shaft is used. Shifting between forward and reverse is accomplished by engagement of either a forward or reverse wet clutch in the unit. These clutches are engaged by hydraulic pressure selected by a control valve.

**1-25.** The clutches are contained in one large balanced drum assembly, and the plates drive concentric shafts. The outer shaft has a gear mounted on it which is in direct mesh with the output gear on the output shaft. This transmits forward rotation to the output shaft. A gear on the inner shaft drives the output shaft through an idler gear to give reverse drive. The main case is of two piece construction and the rear half contains a heavy diaphragm midwall which forms one side of a straddle mounting for the output gear and shaft. Oil passages are internal except for the lines to the transmission oil cooler. The oil supply is common for the torque converter, transmission, and drive axle, including the drive wheel bearings.

**1-26.** An internal gear pump driven by the torque converter hub supplies oil to the torque converter through a metering orifice and to a control valve assembly in the transmission housing. Oil delivered to the torque converter maintains circulation through the converter to the oil cooler, or heat exchanger in the engine radiator.

**1-27.** Additional oil from the pump is used by the control valve to provide forward or reverse directional control to the vehicle. The control valve includes a pressure regulator valve, a brake pedal operated inching valve, a forward and reverse clutch supply valve, and a forward and reverse selector valve, with neutral position. These four valves are essentially in series in the control circuit. Regulated pump pressure is delivered to the inching valve, which can either deliver it through, or partially or completely shut off this pressure as the operator requires, for inching operations while maintaining high engine speed for hoisting. Pressure on the brake pedal controls the degree of clutch slippage for inching, while the position of the selector valve determines which clutch will be engaged.

**1-28. DRIVE AXLE (See figure 1-9).** This assembly is a double-reduction drive axle, bolted directly to the front of the transmission. The output shaft of the transmission includes the drive pinion gear which mates with the ring gear of the differential assembly to provide the first reduction. Internal gears at the outer end of the first drive axles drive sun gears to give the second stage reduction to the final drive axles and the wheels.

**1-29.** The hydraulic brake assemblies at each wheel are pedal actuated as service brakes and handle operated by mechanical linkage as parking brakes. A self-adjusting feature eliminates periodic adjustment to compensate for lining wear. The brake master cylinder is a conventional automotive type, connected to a wheel cylinder at each front wheel by hydraulic lines. The service brake shoes serve also as parking brakes, being actuated by linkage from the hand brake lever next to the operator's seat. The operator can adjust any slack from the parking brake linkage by turning a knurled knob at the top of the parking brake lever.

**1-30. UPRIGHT CARRIAGE AND FORK ASSEMBLY. (See figure 1-10).** The upright carriage and fork assembly consists of four main items which are described in the following paragraphs.

**1-31. OUTER UPRIGHT.** This item is a welded one-piece assembly attached to the frame of the vehicle. It encloses the hydraulic hoist cylinder and inner upright assembly. The outer upright is pivot mounted on the frame to permit tilting by the tilt cylinder of the entire carriage and fork assembly as necessary.

**1-32. INNER UPRIGHT.** This item is a one-piece welded assembly mounted within the outer upright. The hydraulic hoist cylinder, mounted in the base of the outer upright, is attached at the top to the inner upright crossmember. The inner upright is raised by the hydraulic cylinder.

**1-33. CROSSHEAD ASSEMBLY.** The crosshead assembly is mounted on the top end of the hoist cylinder primary plunger. Chains, secured at one end to the hoist primary cylinder, pass over rollers on the crosshead assembly and are secured to the lift carriage assembly. Raising the hoist cylinder primary plunger raises the crosshead assembly to hoist the lift carriage and forks by the chain

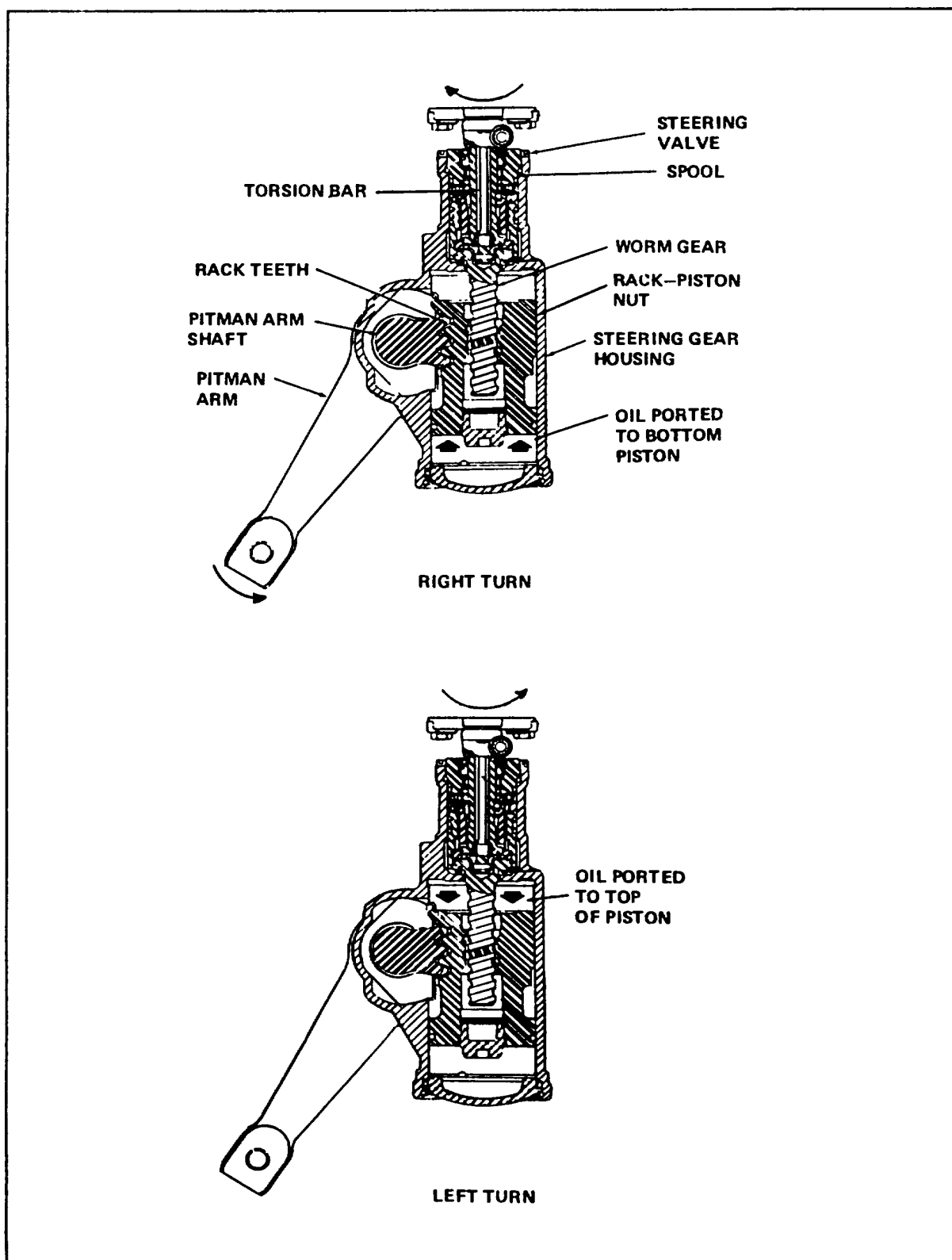


Figure 1-6. Power Steering Gear Operation

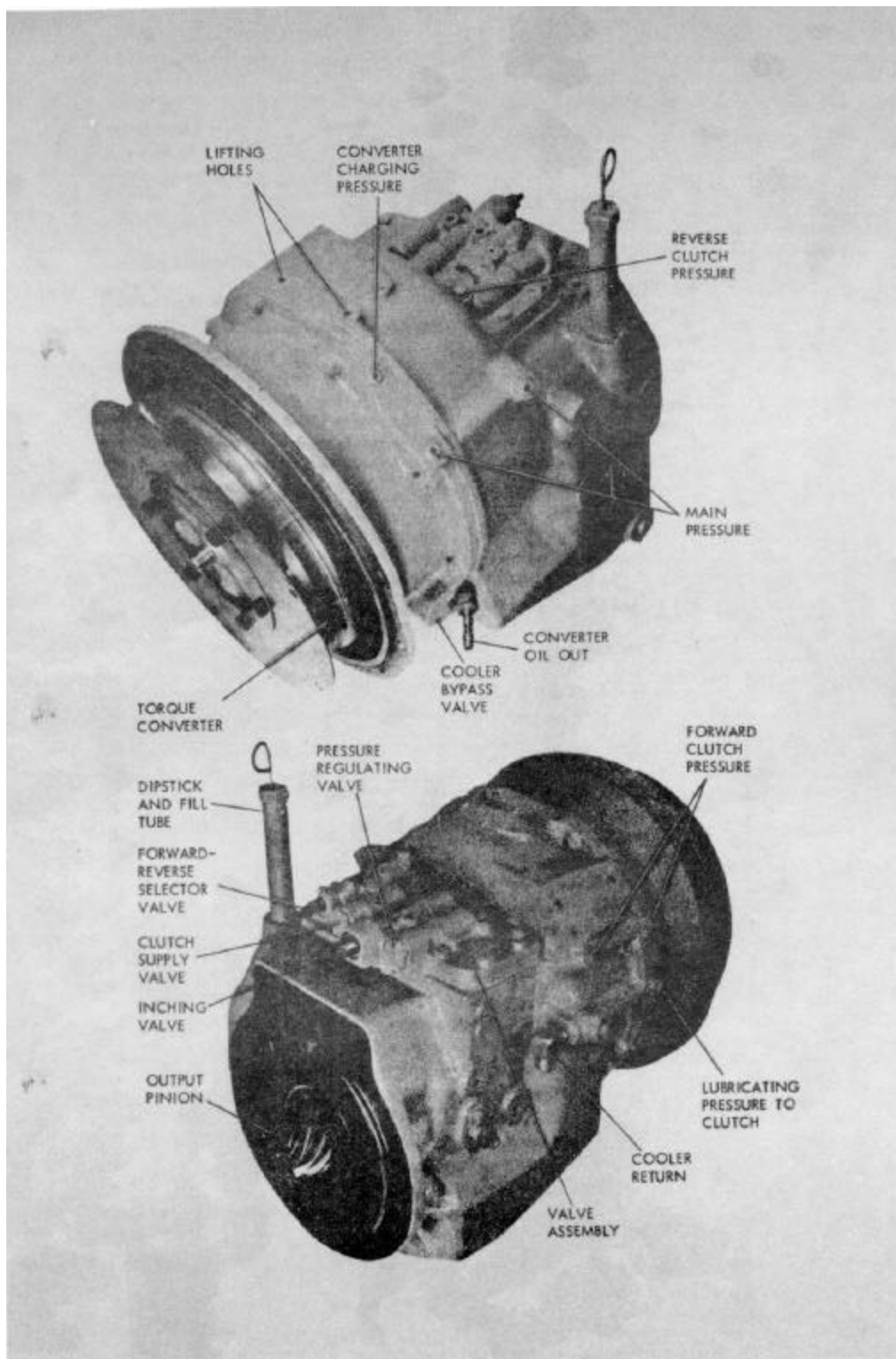


Figure 1-7. Transmission, Showing Pressure Passages



**1-34. LIFT CARRIAGE ASSEMBLY.** The lift carriage assembly is mounted on rollers between the outer and inner uprights, which serve as guide tracks for it. The forks are mounted on the lift carriage, traveling up and down with it.

**1-35. FRAME.** The basic structure of the fork lift truck is the one-piece welded frame, to which all components and major assemblies of the truck are attached. The running gear is attached to the underside of the frame, the hoisting mechanism is mounted at the frame front end, and a one-ton counterweight is fastened to the back of the frame. Since the frame houses much of the mechanism for the truck, access openings for service and maintenance are provided at appropriate locations.

**1-36. SHEET METAL.** The operator's seat is mounted on top of a hinged compartment cover. A manually operated latch at the front of this cover permits raising

the cover for access to the engine compartment from above. A radiator cover plate is bolted to the counterweight. The operator's pedal controls, the steering column, and electrical leads to the instruments and switches are mounted on or through a floor plate. For minor service of components beneath the floor plate, a small cover is located above the brake system master cylinder.

The floor plate can be removed for more extensive maintenance.

### 1-37. ELECTRICAL SYSTEM COMPONENTS.

**1-38.** The following paragraphs contain descriptions of electrical system components for the truck, excepting those units previously described in connection with the engine assembly. (See figure 1-11).

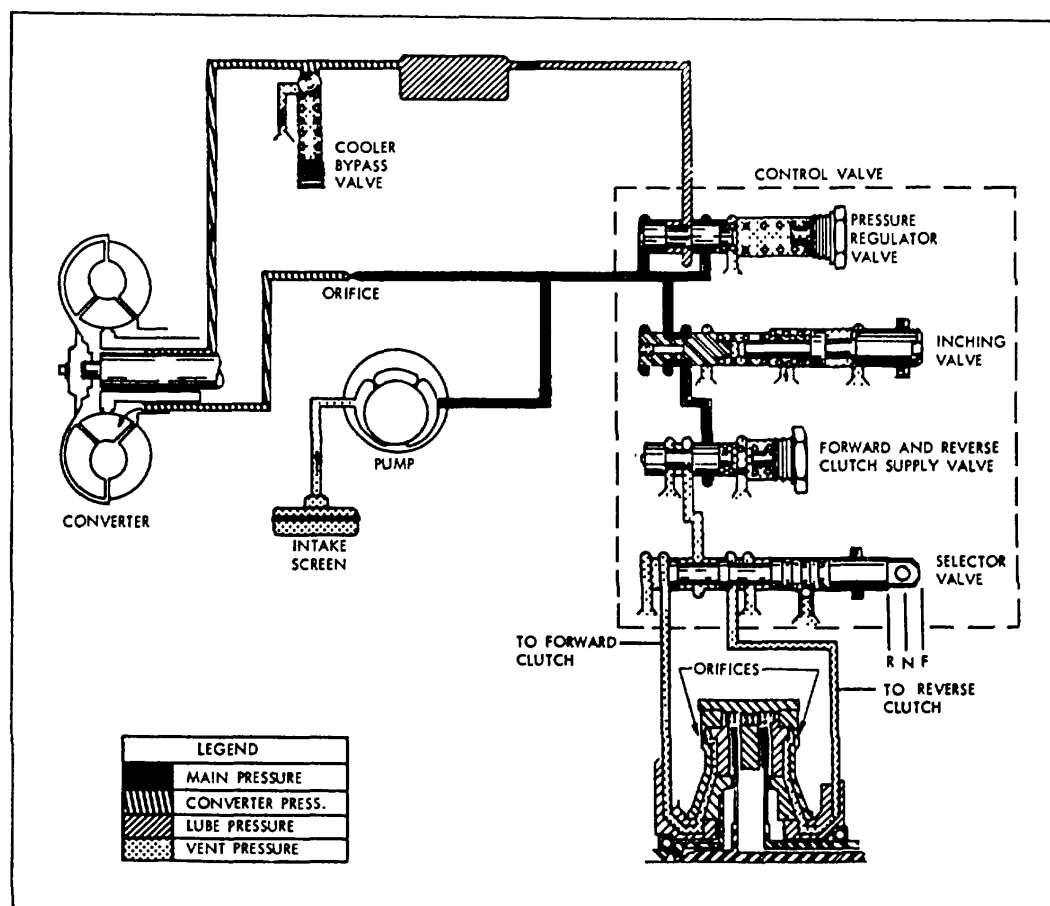


Figure 1-8. Transmission Hydraulic Diagram

**1-39. SPOTLIGHT ASSEMBLY.** The sealed-beam spotlight is mounted on the left hand hoist upright. This light is operated by a toggle switch mounted on the instrument housing.

**1-40. COMBINATION TAIL AND STOP LIGHT ASSEMBLY.** The tail and stop light assembly is mounted within a steel guard on the upper rear of the engine compartment. The taillight operates when the spotlight is turned on. The stop light is operated by the brake light switch when the foot brakes are used.

**1-41. IGNITION SWITCH.** The ignition switch is mounted on the instrument panel. Setting the ignition switch to ON position energizes the ignition system and instrument panel gages.

**1-42. SENDING UNITS.** Three sending units on the truck actuate instruments on the instrument panel. The fuel gage sending unit is mounted atop the fuel tank. This unit consists of a float mounted on an arm attached to a sliding contact. The position of the arm is proportional to the quantity of fuel. The slider shorts out turns of a resistance winding to change the current in the gauge circuit proportional to the fuel level, which is registered on the instrument.

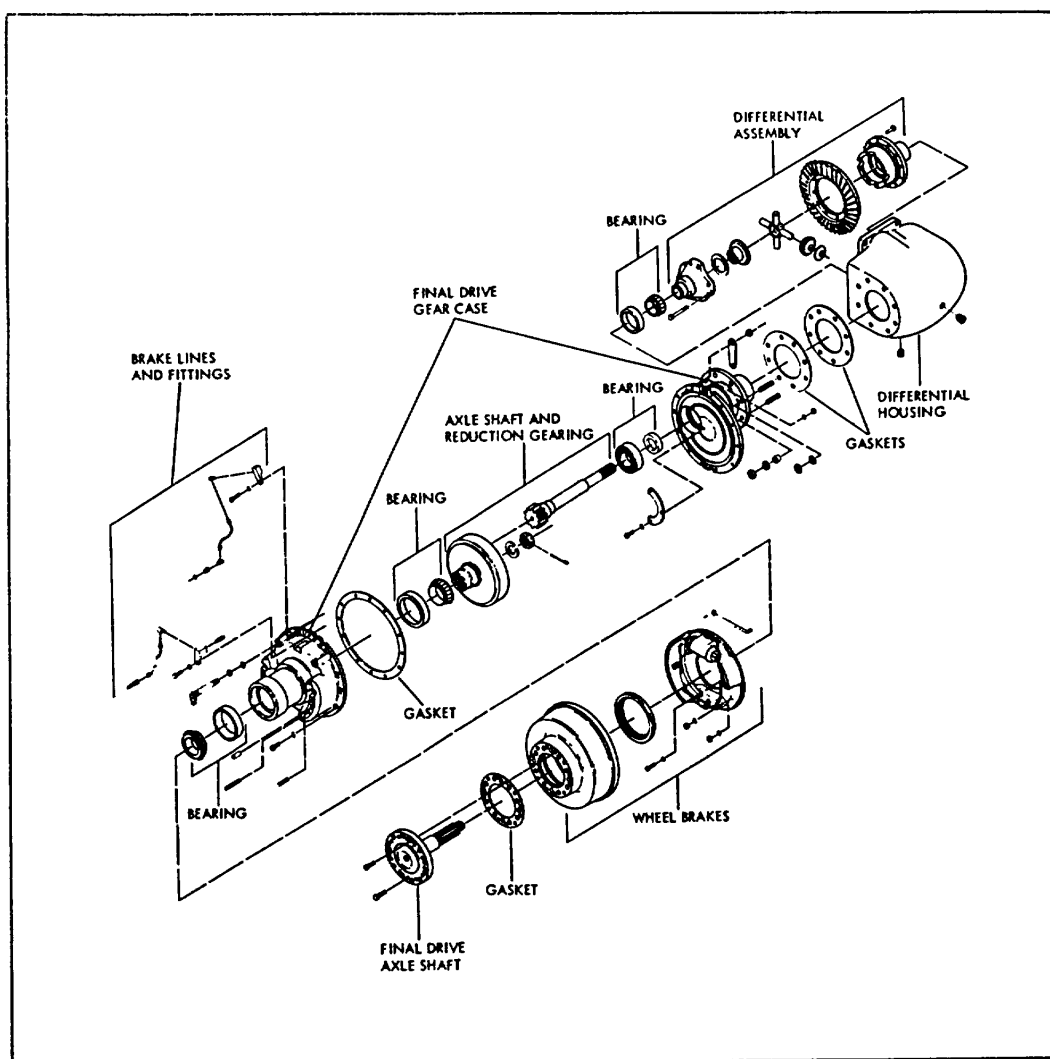


Figure 1-9. Drive Axle, Exploded View

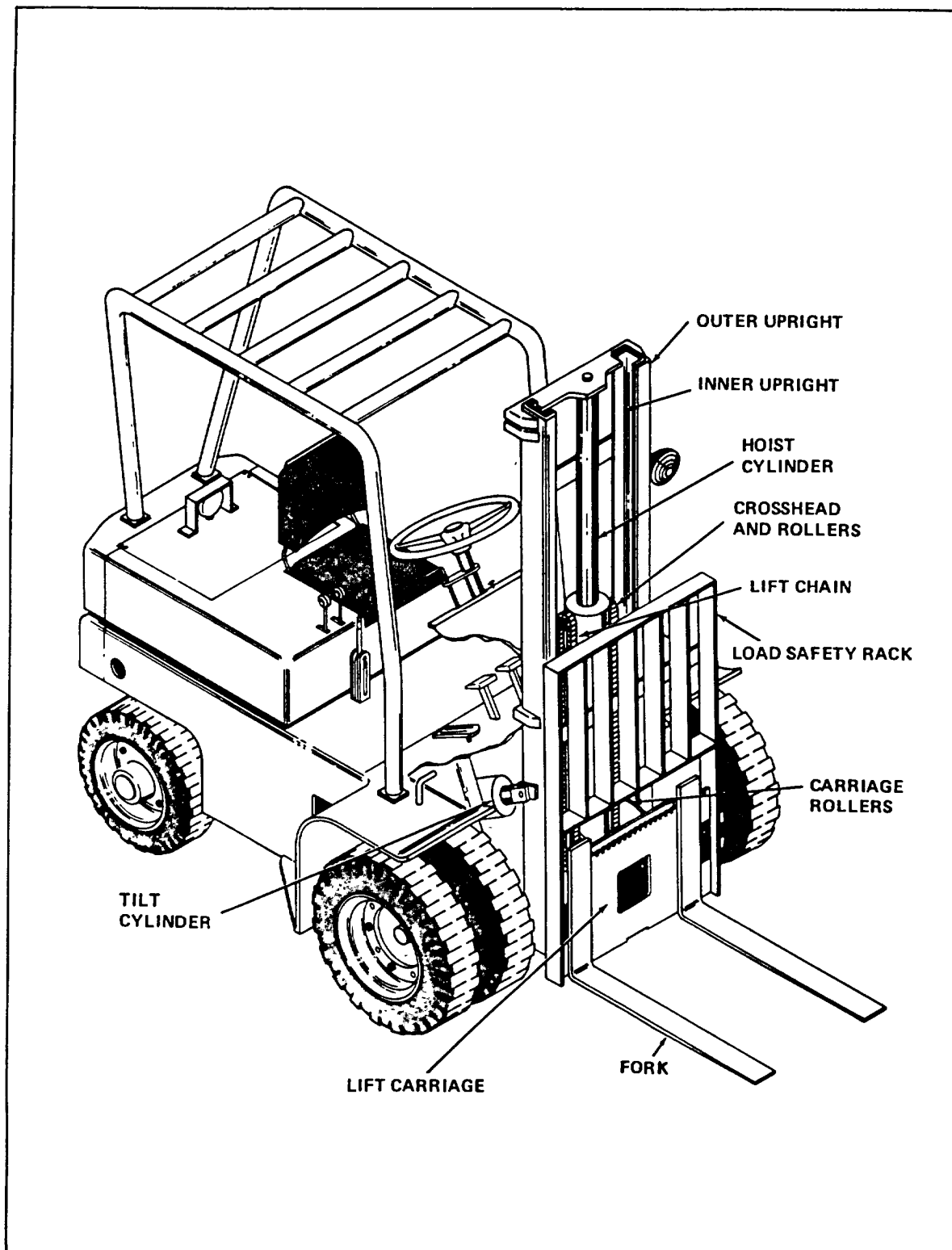


Figure 1-10. Uprights, Carriage and Fork

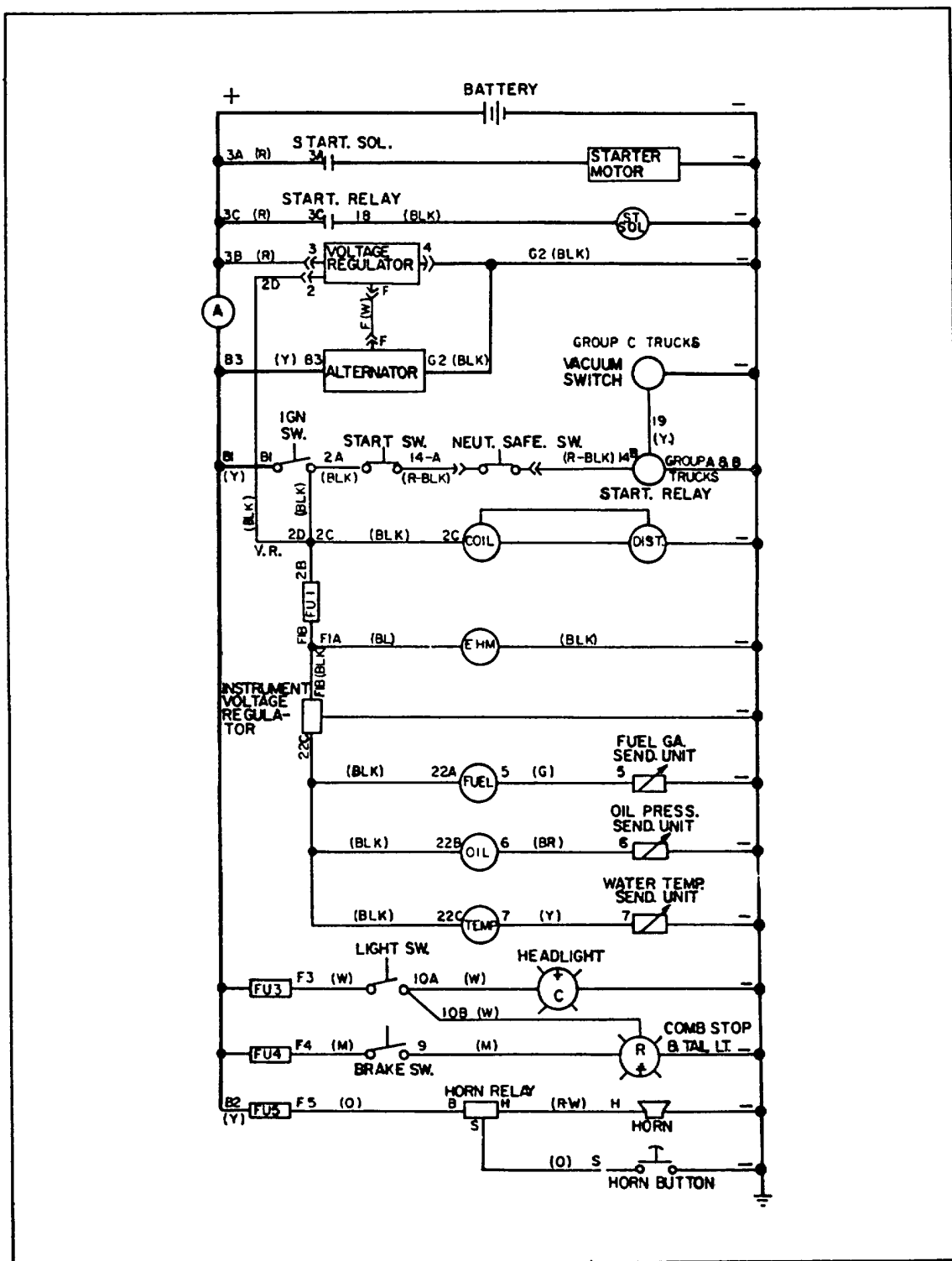


Figure 1-11. Electrical Schematic

**1-43.** The oil pressure sending unit is connected into the pressure side of the lubricating oil system. This unit contains a coil, the resistance of which varies with pressure. Actuating current to the instrument passes through this resistance coil which varies the current, and thus the indication, in proportion to the pressure on the sending unit.

**1-44.** The water temperature sending unit is threaded into the engine cylinder head to sense and respond to engine coolant temperature. This unit contains a temperature sensitive resistance coil which regulates the flow of actuating current to the engine temperature gage in proportion to engine coolant temperature (see figure 1-2).

**1-45. INSTRUMENT PANEL (See figure 1-12).** The instrument panel assembly incorporates the usual standard instruments in a compact group. The engine operation hourmeter is used to determine when periodic service operations are due. In addition to controlling the ignition system, the ignition switch energizes the instruments, and the starter circuit up to the starter button. The light switch operates the spot light and taillight.

**1-46.** The fuses in the fuse holder protect the various electrical circuits of the truck. Refer to the wiring diagram (figure 1-11) for identification of each fuse.

**1-47.** The instrument voltage regulator is a small voltage divider which reduces system voltage to six volts for instrument power.

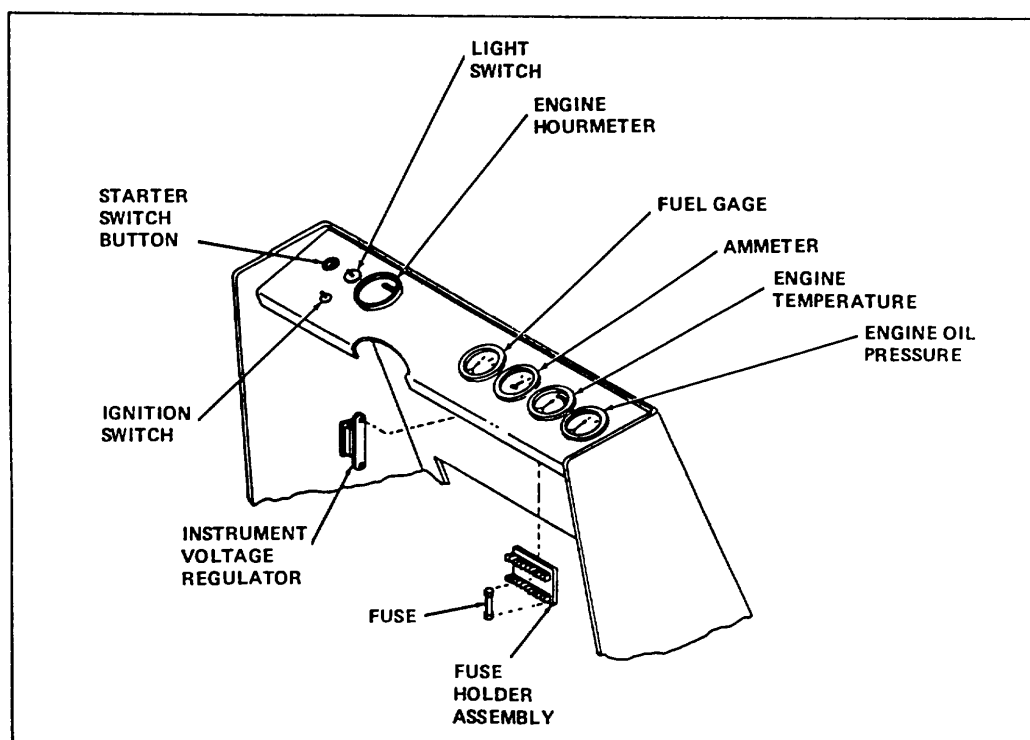


Figure 1-12. Instrument Panel

## SECTION II

## TABLE OF SPECIFICATIONS

## 2-1. GENERAL.

## 2-2. DELETED.

Type of Vehicle ..... Fork Lift Truck  
gasoline engine powered

Rated Capacity .....4000 lb at 24 in. from  
heel of fork

Lift Type .....telescopic upright boom,  
tiltable 3 deg forward, 10 deg  
backward from upright

Lift Elevation (Max.) ..... 144 in.

Fork Data ..... 4 in. wide prongs, 40 in. long  
Adjustable from 9 to 38 in.

Wheels..... 4 drive wheels and  
2 steerable wheels

Tires .....pneumatic, size 7.00 x 12  
(drive axle), and 6.90/6.00  
x 9 (steering axle)

Vehicle Turning Radius .....90 in. min. outside  
turning radius

Vehicle Top Speed ..... 12 mph

## Overall Dimensions

Height (Forks Fully Lowered) .....91 in.

Height (Forks Fully Raised) ..... 192 in.

Width.....63 in.

Length (Less Forks) .....91 in.

Vehicle Weight ..... 8165 lb

Ground Clearance (Min.) ..... 3 in.

Attachments .....overhead guard and  
load safety rack

THIS PAGE HAS BEEN DELETED.

Displacement ..... 244 cu in.  
 Compression Ratio..... 6.9:1  
 Brake Horsepower .....82.3 at 2800 rpm  
 Torque (Ft Lb) .....192 at 1200 rpm  
 Max. Oil Pressure  
     Hot at 1800 rpm .....30 to 40 psi  
 Min. Oil Pressure .....7 psi at idle  
 Firing Order ..... 1-5-3-6-24  
 Oil Capacity  
     Crankcase ..... 4 qt  
     Filter ..... 1 qt  
     Total ..... 5 qt  
 Valve Clearance  
     Intake ..... 0.014 in.  
     Exhaust ..... 0.014 in.  
 Water Capacity  
     Engine ..... 6-1/2qt  
     Engine and Radiator ..... 13 qt  
 Weight (Bare Engine) .....516 lb

#### ENGINE OVERHAUL TOLERANCES AND WEAR LIMITS IN INCHES EXCEPT AS NOTED

Cylinder Block  
     Cylinder Out-of-Round .....0.0005  
     Cylinder Taper .....0.0005  
 Crankshaft and Bearings  
     Main Bearing Journal Dia .....2.2442/2.2451  
     Additional Wear .....0.001  
     Connecting Rod Journal Dia .....2.0594/2.0601  
     Additional Wear .....0.001  
     Main Bearing Clearance .....0.0008/0.0028  
     Bearing Thickness .....0.0948/0.0953  
     Additional Wear .....0.0005

### 2-3. ENGINE

Type ..... Continental Model No. FS244  
 Number of Cylinders .....6  
 Bore and Stroke .....3-7/16 x 4-3/8 in



Crankshaft End Thrust .....	0.002/0.006
Main Bearing Size (Case Hole) .....	2.4365/2.4372
Out-of-Round.....	0.0005
Taper.....	0.0005
Runout .....	0.002

#### Connecting Rods and Bearings

Bearing Thickness .....	0.0623/0.0628
Bearing Length .....	1.057/1.067
Side Play .....	0.006/0.010
Connecting Rod Bend .....	0.000/0.002
Crankshaft Journal to Connecting Rod Bearing Clearance .....	0.0008/0.003

Connecting Rod Twist.....	0.000/0.002
Pin Bushing Inside Dia .....	0.8593/0.8596
Pin Bushing Outside Dia .....	0.9165/0.9185
Bearing Outside Dia .....	2.1865/2.1870
Pin Bushing Length .....	1.17/1.19
Pin Bushing Thickness .....	0.0345/0.0365
Bearing Inside Dia .....	2.0609/2.0624

#### Pistons

Ring Land Clearance .....	0.028/0.035
Skirt Clearance .....	0.0015
Taper of Skirt .....	0.0005/0.0015
Pin Hole Dia .....	0.8593/0.8596
Piston Pins	
Pin Dia .....	0.8591/0.8593
Additional Wear .....	0.001
Desired Fit in Bushing .....	0.000010.0005
Desired Fit in Piston at 70 Deg F .....	0.0001/0.0003
Pin Length .....	2.738/2.753

#### Piston Rings

Cylinder Dia.....	3.4375/3.4395
Width-Top Chrome & 2nd Groove Rings.....	0.0930/0.0940
Width-3rd & 4th Groove Rings .....	0.1545/0.1555
Thickness-Top Chrome Ring .....	0.162/0.172
Thickness-2nd,3rd & 4th Groove Rings ....	0.143/0.153
Gap Clearance-Al Rings .....	0.010/0.020
Side Clearance-Top Ring .....	0.002/0.004
Side Clearance-2nd Ring .....	0.0015/0.0035
Side Clearance-3rd & 4th Rings .....	0.001/0.003
Weight Compressed-Top, 3rd & 4th Rings .....	7-1/2 lb
Weight Compressed-2nd Ring .....	6-1/2 lb

#### Camshaft

Front Journal Size .....	1.8715/1.8725
Additional Wear (All Journals) .....	0.002
Intermediate Front Journal Size .....	1.8085/1.8095
Intermediate Rear Journal Size .....	1.7457/1.7465
Rear Journal Size .....	1.2465/1.2475
Valve Lift, All Valves .....	0.248
End Thrust .....	0.005/0.009

#### Camshaft Bushings

Clearance (AU) .....	0.002/0.004
Additional Wear (AU) .....	0.002
Inside Dia (Front) .....	1.8745/1.8755
Inside Dia (intermediate Front) .....	1.8115/1.8125
Inside Dia (Intermediate Rear) .....	1.7495/1.7502
Inside Dia (Rear) .....	1.2495/1.2505

#### Valves and Springs (Intake)

Stem Dia .....	0.3405/0.3415
Additional Wear .....	0.002
Head Dia .....	1.495/1.505
Overall Length .....	5.1745/5.2895
Valve Face Desired .....	0.124
Tappet Clearance (Hot) .....	0.014

Stem to Guide Clearance .....0.0017/0.0037  
 Additional Wear .....0.002  
 Valve Seat Angle .....45 deg  
 Valve Seat Width Desired .....0.066  
 Valve Spring Free Length ..... 2-1/16  
 Valve Spring Outside Dia .....31/32  
 Valve Spring Wire Size .....0.142  
 Spring Length (Valve Closed) .....145/64  
 Valve Spring Load at Closed Length ..... 47/53 lb

#### Valves and Springs (Exhaust)

Stem Dia ..... 0.3405/0.3415  
 Additional Wear .....0.002  
 Head Dia ..... 1.307/1.317  
 Overall Length .....5.1745/5.2895  
 Valve Face .....0.124  
 Tappet Clearance (Hot) .....0.014  
 Stem in Guide Clearance .....0.0037/0.0057  
 Valve Seat Angle .....45 deg  
 Valve Seat Width .....0.085  
 Valve Spring Free Length ..... 2-1/16  
 Valve Spring Outside Dia .....31/32  
 Valve Spring Wire Size .....0.142  
 Spring Length (Valve Closed) .....1-45/64  
 Valve Spring Load at Closed Length ..... 50/53 lb

#### Valve Tappets

Tappet Dia ..... 0.999/0.9995  
 Tappet Clearance in Guide ..... 0.0015/0.005

#### Valve Guides

Distance From Top of Block to  
 Top of Guide .....1-15/32  
 Stem Hole Dia (Intake) ..... 0.3432/0.3442  
 Stem Hole Dia (Exhaust) ..... 0.3452/0.3462

Additional Wear (All) .....0.0015  
 Length ..... 2-5/16

Outside Dia .....0.6565/0.6575

#### Valve Timing

Intake Valves Open Before

Top Dead Center ..... 4-1/2 deg

Crankshaft Rotation Piston Travel,

Top of Block to Top of Piston at

4-1/2 Deg Before Top Dead Center .....0.0134

#### Timing Gears

Backlash ..... 0.001/0.003

#### Cylinder Head

Max. Warpage Crosswise.....0.003

Max. Warpage Lengthwise .....0.004

#### Oil Pump

Clearance Between End of Gear

Teeth and Body ..... 0.002/0.004

Backlash to Camshaft Gear .....0.003

Lash Between Gears ..... 0.001/0.003

## 2-4. FUEL SYSTEM

#### Carburetor

Make .....Zenith

Type ..... updraft, single bore

#### Adjustments

Idle Mixture Screw ..... 1 to 1.5 turns open

Idle Speed Screw .....450 to 500 engine rpm

Fuel Pump

Pressure (Static) ..... 1.5 to 2.25 psi

Capacity (Minimum) ..... 1 pt per min.

Fuel Tank Capacity .....12.7 gal.

Governor Setting .....2500 engine rpm

## 2-5. TRANSMISSION

Make .....Baker

Type .....single-speed with forward and  
reverse constant mesh, power-shifted by  
selective engagement of clutches in oil  
Ratio ..... 1.19 to 1 reduction  
Input .....from torque converter  
Output .....direct to drive axle ring gear  
Clutches .....2 self-adjusting single  
cork-faced disks

Fluid..... OE 10  
Capacity..... 16 qt  
(Includes Drive Axle and Torque Converters)

## 2-6. DRIVE AXLE

Make.....Rockwell-Standard  
Reduction Gearing ..... double-reduction, ring and  
pinion plus internal-to-sun gears  
Reduction Overall ..... 17.27 to 1

Number of Wheels .....6  
Tire Size ..... 7.00 x 12  
Pressure ..... 100 psi  
Brake (Service) .....hydraulic drum type, internal  
expanding shoes, self-adjusting  
Brake (Parking) ..... uses service brakes, lever  
operated through linkage  
to wheels  
Brake Drum Size ..... 11.5 in. x 2.5 in.  
Wheels ..... individually demountable  
disk type

## 2-7. STEERING AXLE

Manufacturer ..... Baker  
King Pin Geometry .....neutral  
Tire Size ..... 6.90/6.00 x 9  
Pressure ..... 100 psi

## 2-8. POWER STEERING

Make..... Saginaw  
Type .....rotary valve  
Power Source ..... main hydraulic pump  
priority valve

## 2-9. HYDRAULIC SYSTEM

Fluid Capacity of Reservoir ..... 12-1/2 gal.

Fluid..... OE 10  
System Relief Valve Setting ..... 1800 psi  
Pump

Make ..... Tyrone PVP2-150AND  
Drive .....from engine timing gear  
Type ..... gear

Tilt Cylinders

Make ..... Baker  
Type .....double-acting

Hoist Cylinder

Make ..... Baker  
Type ..... single-acting 2-stage, pressure  
hoist, gravity return

## 2-10. ELECTRIC SYSTEM

Voltage .....12 volts dc  
Engine Ignition System..... Delco-Remy battery-coil-  
distributor type; radio  
interference suppressed

Alternator

Make and Model .....Delco-Remy 1100858  
Ground Polarity ..... negative  
Test Specifications  
Field Current at 80 Deg F .....2.2 to 2.6 amp  
and 12 Volts  
Cold Output at 14 Volts ..... 21 amp at 2000 rpm  
30 amp at 5000 rpm

Rated Hot Output ..... 32 amp

## Voltage Regulator

Make and Model ..... Delco-Remy 1116381

Ground Polarity ..... negative

## Test Specifications

Field Relay Closing Voltage ..... 2 to 4 volts

Voltage Setting ..... 14.1 to 14.8 at 65 deg F

13.9 to 14.7 at 85 deg F

13.7 to 14.5 at 105 deg F

13.6 to 14.3 at 125 deg F

13.4 to 14.2 at 145 deg F

13.2 to 14.0 at 165 deg F

13.1 to 13.8 at 185 deg F

Spark Plugs ..... Champion XD 16

Thread Size ..... 14 mm

Gap ..... 0.025 in.

## Distributor

**Make and Model**..... Delco-Remy 1112672

Rotation (Top View) ..... counterclockwise  
(All Trucks)

## Test Specifications

Point Opening ..... 0.021 in.

Cam Angle ..... 22 to 26 deg

Centrifugal Advance in  
Distributor Deg and Rpm..... 0.3 deg to 2.3 deg  
at 300 rpm (start)

3 deg to 5 deg  
at 400 rpm

5.5 deg to 7.5 deg  
at 800 rpm

7.5 deg to 9.5 deg  
at 1100 rpm

## Starter Motor

**Make and Model** ..... Delco-Remy 1107244

## No-Load Test Specifications (Test Values Include Solenoid)

Current Draw at 9 Volts ..... 53 amp min.

69 amp max.

Speed ..... 6400 rpm min.

8600 rpm max.

## Starter Lockout Relay

Make and Model ..... Delco-Remy 1115885

## SECTION III

## SPECIAL OVERHAUL TOOLS AND EQUIPMENT

**3-1. SPECIAL TOOLS.**

**3-2.** No special tools are required to perform the overhaul procedures given in this manual. All work can be performed with equipment commonly available to an overhaul facility.

given in this manual. All necessary accessories and adapters are furnished with test sets, together with complete operating instructions and detailed procedures for performing the tests specified in this manual. Listing of these test sets does not exclude use of other suitable equipment in the Federal Supply System as available, if it will do the required job.

**3-3. TEST EQUIPMENT.**

**3-4.** The test equipment listed in Table 3-1 and illustrated in figure 3-1 will support all test procedures

TABLE 3-1. TEST EQUIPMENT LIST

Type designation*	Alternate type designation	Fig. no.	Nomenclature	Use
PDT FSN IY4910-272-7970	PDT-5 FSN 4910-392-2939	5-14	Portable Distributor Tester	Para. 5-31
VAT-25 No FSN	LVR-3A FSN 4910-092-9136	5-14	Volt Ampere Tester	Para. 5-35
X-45A FSN 4910-839-9749	X-47 FSN 4910-500-2135	5-14	Power Timing Light	Para. 5-29
*Type designations assigned by Sun Electric Corp., Chicago, Ill. Manufacturer's Federal Supply Code No. 82386.				

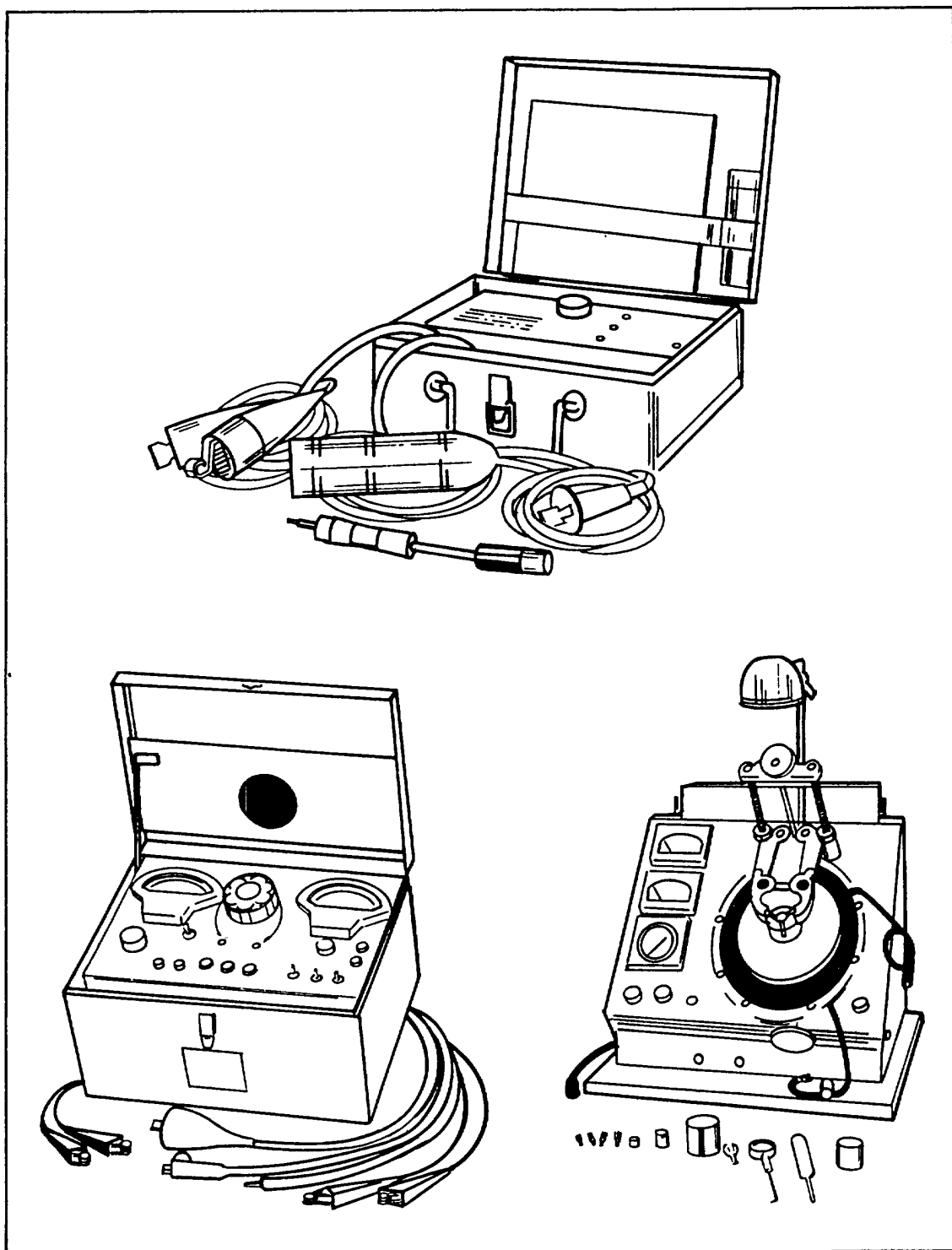


Figure 3-1. Test Equipment

## SECTION IV

## REMOVAL AND DISASSEMBLY

**4-1. GENERAL.**

**4-2.** This section contains instructions for the removal and disassembly of major assemblies of the fork lift truck (see figure 4-1). Minor repair and adjustment instructions related to removal and replacement are also given to the extent such work could be performed with the tools and equipment normally available to the using facility.

**4-3.** In general the instructions are arranged for removal of exterior parts and assemblies first thus giving access to interior assemblies. Instructions for removal of interior assemblies will assume that interfering external parts have been removed as far as necessary to proceed with the next job to be done

**4-4. DELETED.**

**4-5. DELETED.**

**4-6. DELETED.**

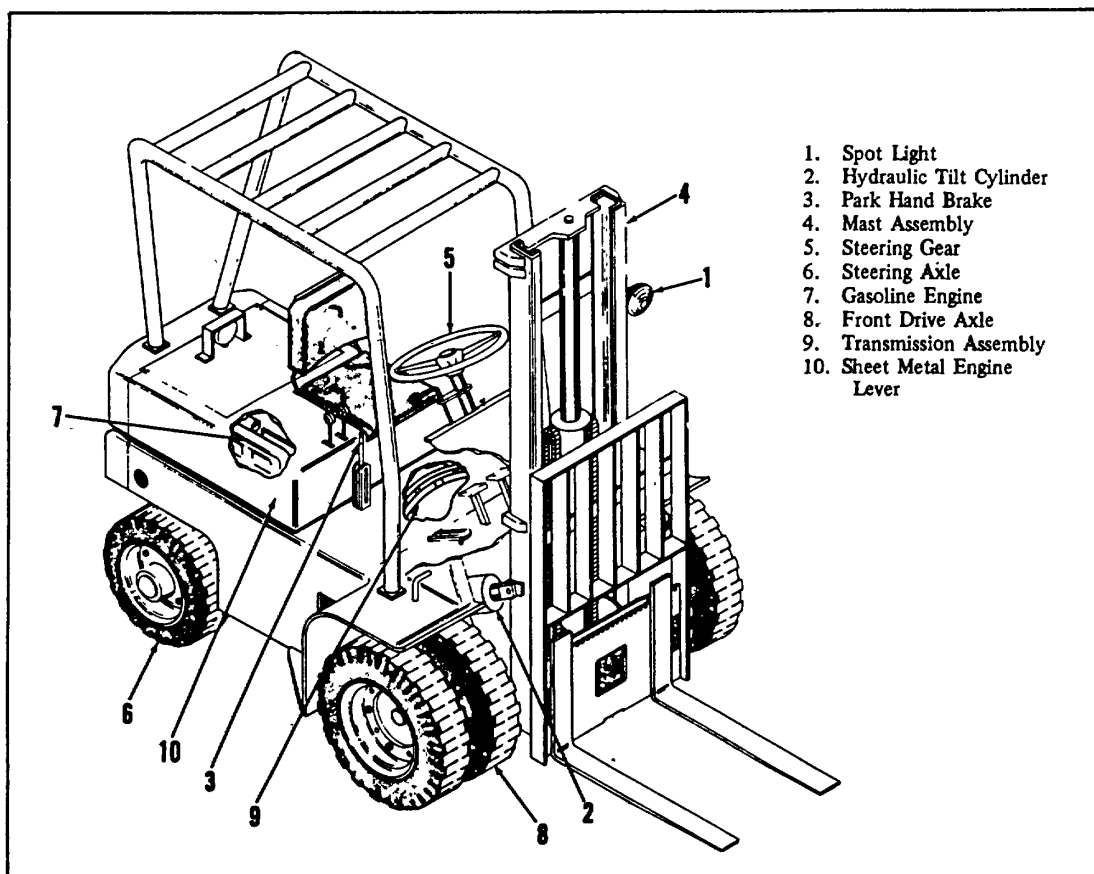


Figure 4-1. Fork Lift Truck Components

**4-7. DELETED**

**4-8. DELETED**

**4-9. DELETED**

**4-10. DELETED**

**4-11. DELETED**

**4-12. DELETED**

**4-13. SHEET METAL.**

**4-14.** The sheet metal used on the truck is subject to minor repair to the extent of removing dents or deformations, and replacing defective latches. Follow conventional sheet metal repair practice in straightening and refinishing. Replace items damaged, beyond practical repair.

**4-15. DELETED**

**4-16. DELETED**

**4-17. DELETED**

**4-18. DELETED**

**4-19. DELETED**

**4-20. DELETED**

**4-21. UPRIGHTS, CARRIAGE, AND FORK ASSEMBLY.**

**4-22. REMOVAL.** Removal of the complete assembly (see figure 1-10) is necessary before the drive axle or other power train components can be removed. In most cases the assembly itself can be maintained by removal and replacement of its components without removing the entire assembly. Remove the complete assembly as follows:

1. Attach a hoist to the assembly (or use the hoist of another fork lift truck) to relieve the weight of the unit on its attaching parts. Brace the assembly against tipping as attaching parts are disconnected.

2. Disconnect the hydraulic hose at the bottom rear of the hoist hydraulic cylinder (see figure 1-4). Cap or plug hose and cylinder fitting to prevent spilling of hydraulic fluid.

3. Remove lock screws from pins, and drive out pins (see figure 4-2) which attach tilt cylinders to outer uprights. Lift load backrest and forks off carriage.

4. Trace wiring down from spotlight to connector and disconnect wiring at this point by unplugging connector.



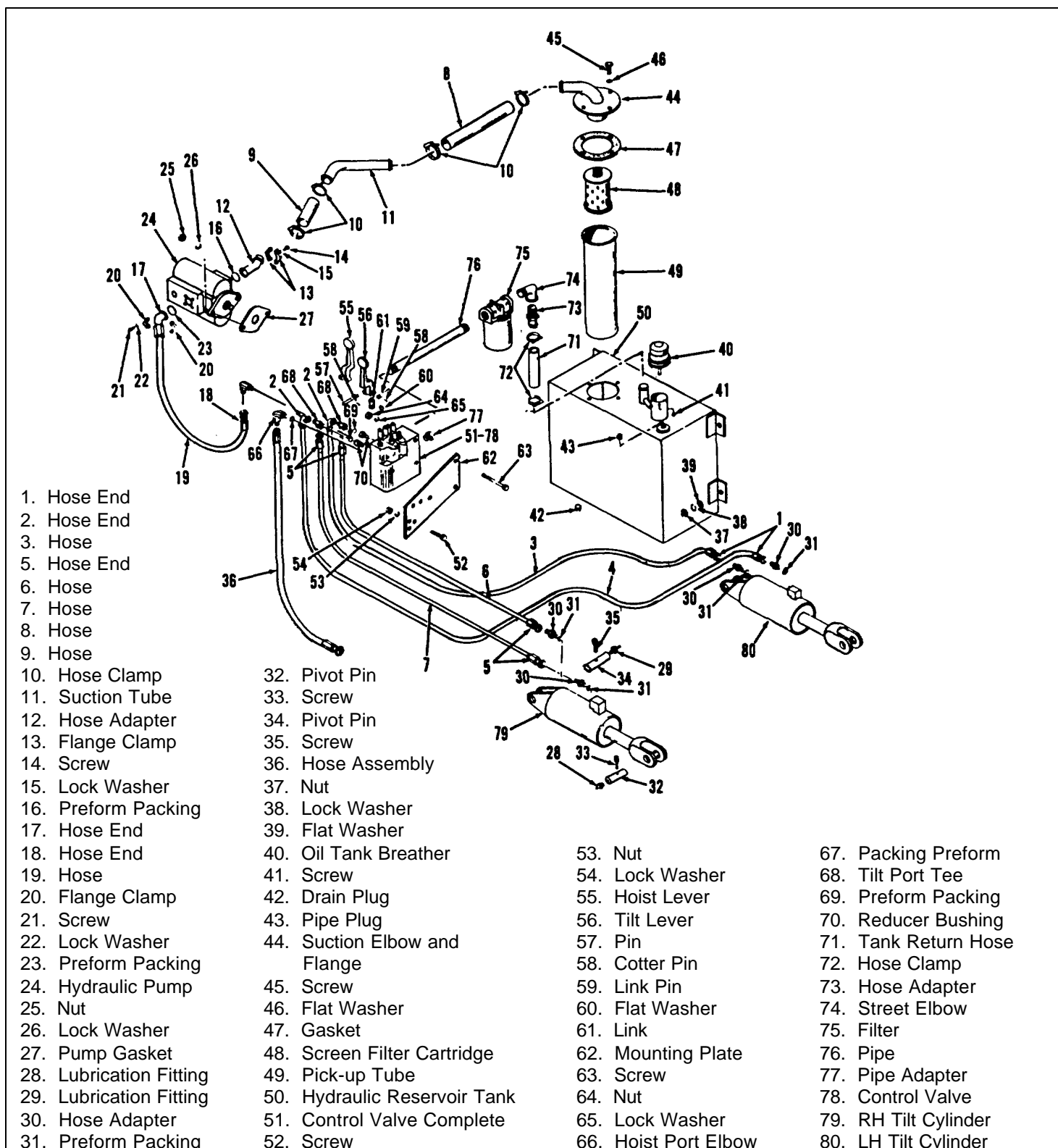


Figure 4-2. Hydraulic System Including Tilt Cylinders

5. With front wheels removed, or truck front blocked up for access, remove the two capscrews and lock washers at each bearing cap (see figure 4-1) and remove caps and bearing inserts. Remove assembly from truck.

#### **WARNING**

**If front of truck is to be raised, support it at both sides. The truck is not stable when resting on only the rear axle, and could fall from a single supporting point at the front, with resulting danger to personnel and equipment. Do not jack up truck by using upright assembly as a supporting point.**

#### **4-23. DISASSEMBLY.**

1. Slide backrest (1, figure 4-3) from carriage (56) and lift from truck. Remove forks (2) from truck.
2. Unscrew four nuts (20 and 21) and remove anchor screws (19) from hoist cylinder (35) and two chains (22). Remove nut (29) and washer (30) attaching hoist cylinder to inner upright (42). Slide inner upright up and brace in position. Lift hoist cylinder from truck.
3. Remove cylinder adapter (36) from bottom of outer upright (43). Remove the crosshead (34). To disassemble crosshead, remove two retaining rings (23) and washers (24). This releases bearings (26) and rollers (25).
4. Slide four roller assemblies from carriage (56). Remove rollers (54) and bearings (55). Remove carriage.
5. Remove screws (17) and nuts (18) attaching latch assembly (7 through 16) to outer upright (43) ; remove latch.
6. Slide inner upright (42) up and out of outer upright (43).

#### **4-24. HYDRAULIC SYSTEM.**

**4-25.** The hydraulic system is not subject to complete periodic overhaul. Rather, components are to be serviced as necessary. Disassemble hydraulic units only in a clean area maintained for that purpose. Save all serviceable fittings and attaching parts for reuse at assembly. Discard all nonmetallic parts, such as packings and gaskets, removed at disassembly. However, do not take a unit apart further than necessary for the sole purpose of removing such parts.

#### **4-26. HOIST CYLINDER ASSEMBLY.**

**4-27. REMOVAL.** Remove hoist cylinder in accordance with paragraph 4-23 step 2.

#### **4-28. DISASSEMBLY.**

1. Clamp hoist cylinder in vise equipped with V-shaped jaws. Remove screws (1, figure 4-4) and washers (2). Unscrew packing nut (6) from plunger (28). Remove wiper ring (7), packing retainer (8) and five packings (9).
2. Unscrew packing nut (11) from cylinder (21). Remove ring (12) and retainer (13) and five packings (14).
3. Slide plunger (28) from cylinder and remove guide (26), retaining ring (27) and bearings (10 and 15).
4. Unscrew packing nut (16) from cylinder (22). Remove ring (17) and retainer (18) and five packings (19). Remove bearing (20) from cylinder. Slide cylinder from plunger (29).
5. Remove packing (23) and washer (24) from cylinder. Unscrew cylinder end (3) and remove packing (4) and ring (5) and plunger (29). Remove two bearings (25).

#### **4-29. TILT CYLINDER ASSEMBLY.**

**4-30. REMOVAL.** Refer to TM 10-3930-623-12.

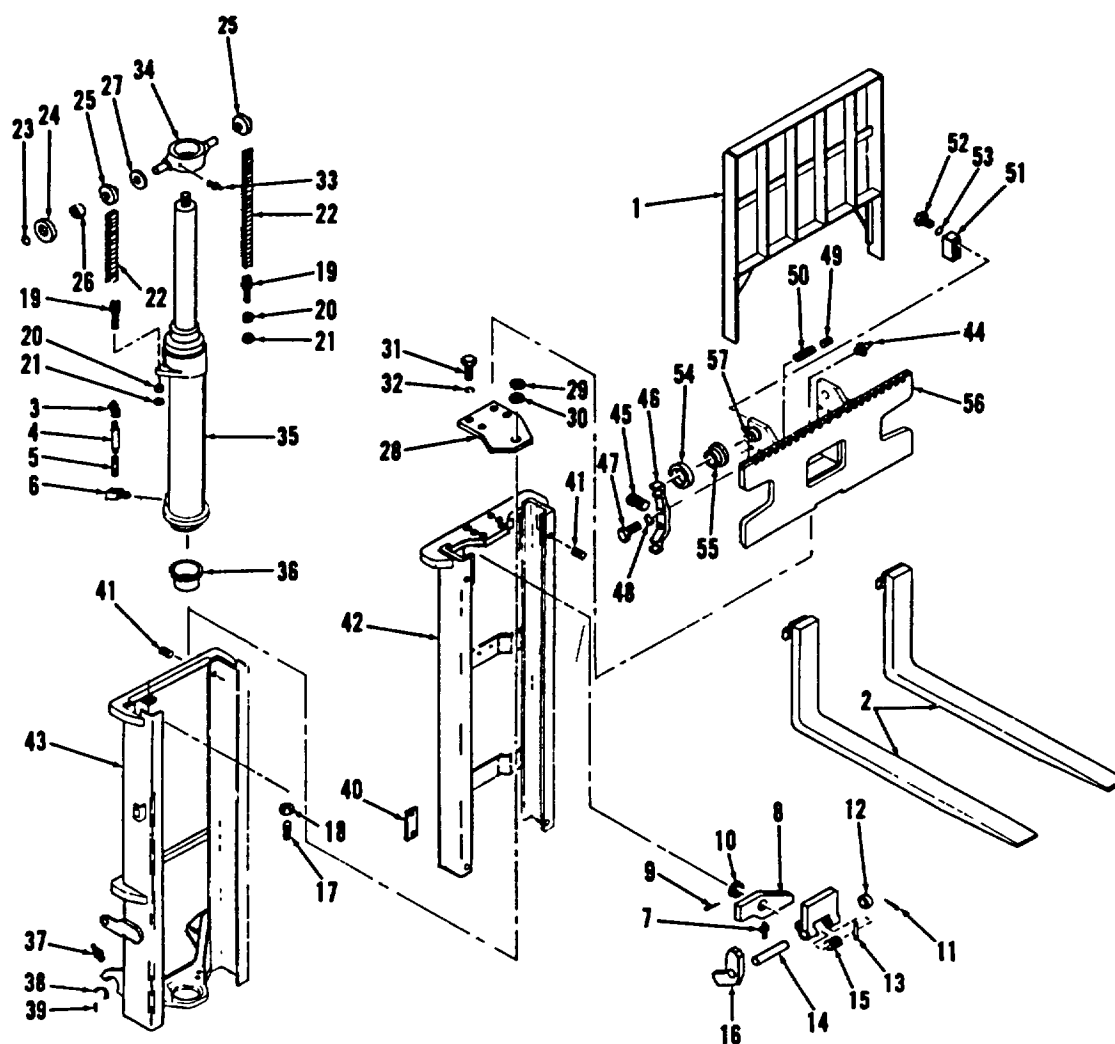
#### **4-31. DISASSEMBLY.**

1. Remove nut (3, figure 4-5), lock washer (4) and screw (2) clamping rod end (1) to piston and rod (16). Unscrew rod end.
2. Remove screw, washer and packing gland (6, 7 and 5). Remove wiper ring (8) and packing (9). Discard all packing. Unscrew stuffing box (10) from cylinder (17).
3. Remove packings (13) and backup ring (12).
4. Remove piston and rod (16), and packings (14 and 15).

#### **4-32. CONTROL VALVE.**

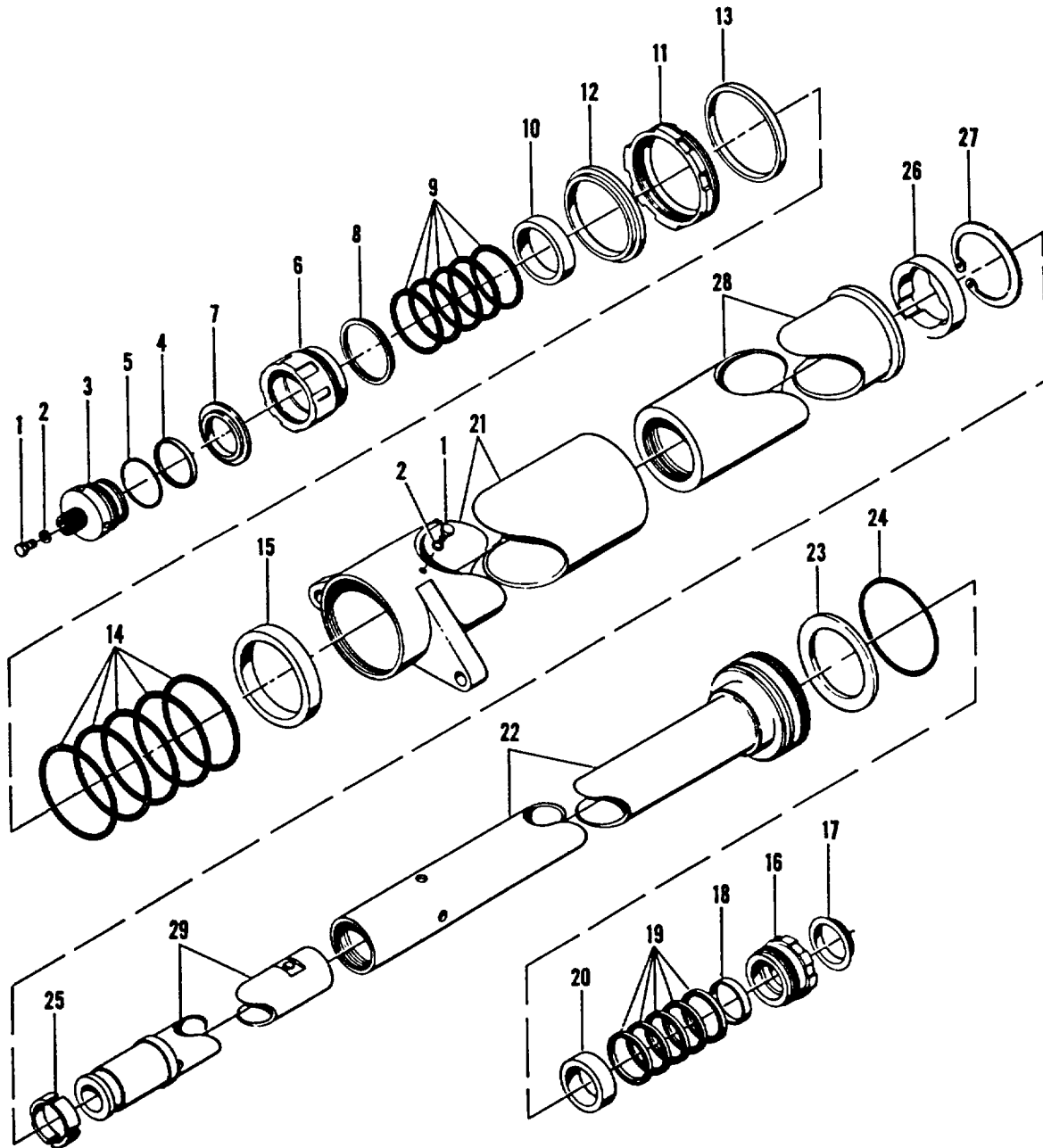
#### **4-33. REMOVAL.**

Refer to TM 10-3930-623-12.



- |                        |                          |                            |  |
|------------------------|--------------------------|----------------------------|--|
| 1. Backrest            | 16. Upright Lever        | 31. Screw                  | 46. Thrust Roller Bracket                  |
| 2. Fork Assembly       | 17. Setscrew             | 32. Lock Washer            | 47. Screw                                  |
| 3. Elbow               | 18. Nut                  | 33. Lubrication Fitting    | 48. Lock Washer                            |
| 4. Regulator Valve     | 19. Chain Anchor Screw   | 34. Cylinder Crosshead     | 49. Thrust Roller Adjustment Lock Setscrew |
| 5. Pipe Nipple         | 20. Nut                  | 35. Hoist Cylinder         | 50. Thrust Roller Adjustment Setscrew      |
| 6. Adapter Elbow       | 21. Jam Nut              | 36. Cylinder Base Adapter  | 51. Striker Bar                            |
| 7. Lubrication Fitting | 22. Chain                | 37. Lubrication Fitting    | 52. Screw                                  |
| 8. Release Lever       | 23. Retaining Ring       | 38. Bearing Half           | 53. Lock Washer                            |
| 9. Cotter Pin          | 24. Flat Washer          | 39. Straight Pin           | 54. Carriage Roller                        |
| 10. Flat Washer        | 25. Chain Bearing Roller | 40. Upright Insert         | 55. Roller Bearing                         |
| 11. Cotter Pin         | 26. Bearing Inner Race   | 41. Adjusting Setscrew     | 56. Carriage                               |
| 12. Flat Washer        | 27. Flat Washer          | 42. Inner Upright          | 57. Carriage Roller Trunnion               |
| 13. Roll Pin           | 28. Brace                | 43. Outer Upright          |  |
| 14. Lever Shaft        | 29. Lock Nut             | 44. Lubrication Fitting    |  |
| 15. Helical Spring     | 30. Flat Washer          | 45. Carriage Thrust Roller |  |

Figure 4-3. Upright, Carriage and Fork Assembly, Exploded View



- |                     |                      |                        |                      |
|---------------------|----------------------|------------------------|----------------------|
| 1. Screw            | 9. Packing           | 17. Wiper Ring         | 25. Sleeve Bearing   |
| 2. Washer           | 10. Sleeve Bearing   | 18. Packing Retainer   | 26. Plunger Guide    |
| 3. Cylinder End     | 11. Packing Nut      | 19. Packing            | 27. Retaining Ring   |
| 4. Packing          | 12. Wiper Ring       | 20. Sleeve Bearing     | 28. Primary Plunger  |
| 5. Ring             | 13. Packing Retainer | 21. Primary Cylinder   | 29. Secondary Plunge |
| 6. Packing Nut      | 14. Packing          | 22. Secondary Cylinder |                      |
| 7. Wiper Ring       | 15. Sleeve Bearing   | 23. Packing            |                      |
| 8. Packing Retainer | 16. Packing Nut      | 24. Washer             |                      |

Figure 4-4. Mast Lift Hydraulic Cylinder Assembly, Exploded View

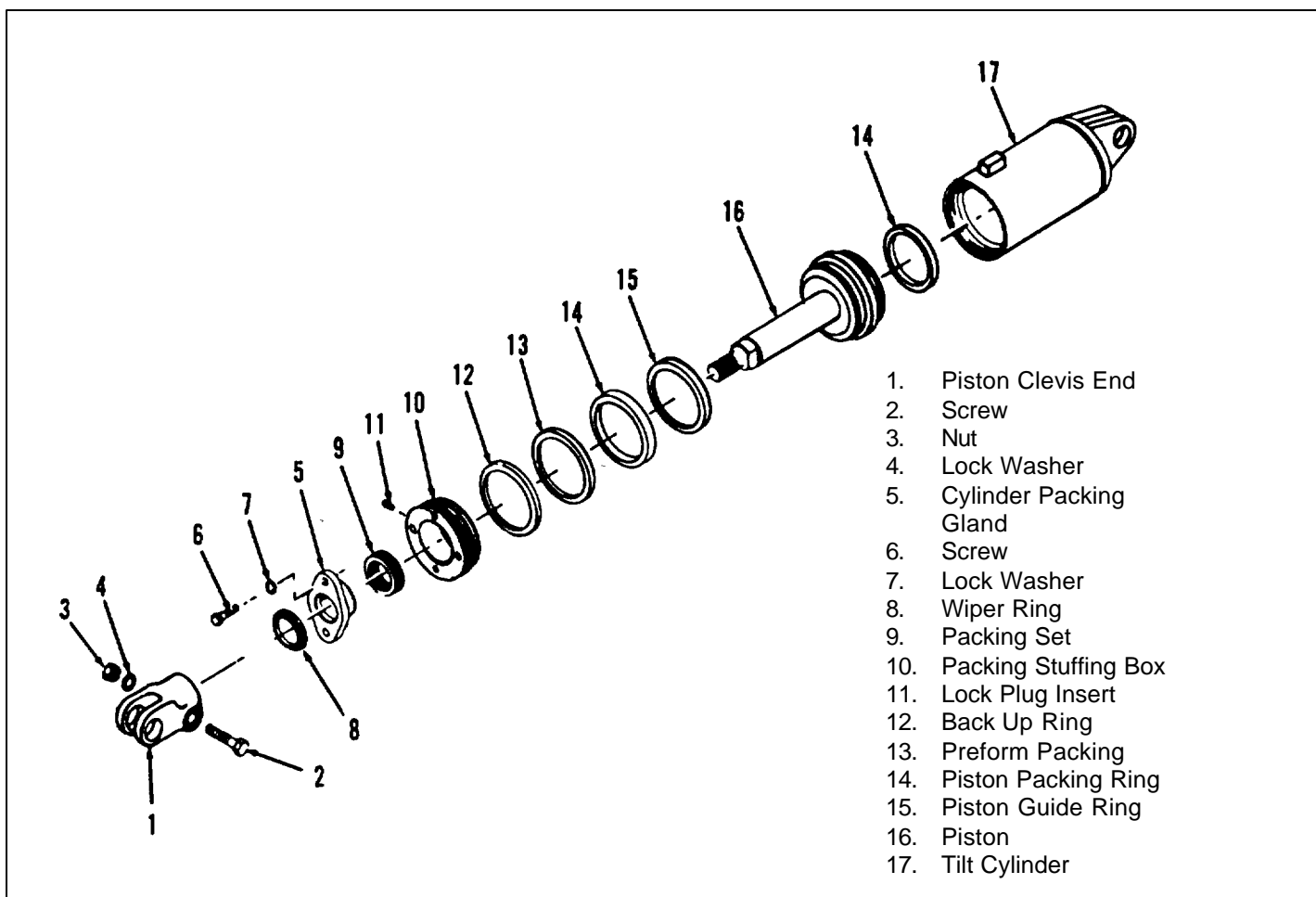


Figure 4-5. Mast Tilt Hydraulic Cylinder Assembly. Exploded View

#### **CAUTION**

The linear valve spools are selectively fitted to the valve body (43) during manufacture. Do not mix spools with other bodies. Do not scrape, nick or otherwise mar spool or body bore surfaces.

#### **4-34. DISASSEMBLY.**

1. Remove cotter pins (58, figure 4-2) and remove pins (57 and 59), links (61) and operating levers (55 and 56).

2. Unscrew plug and seal (35, figure 4-6). Remove nut (1), nut (3) and packings (2). Back out setscrew (4), and remove spring (9) and pilot plunger (10). Remove relief valve cap (5) and packing (8).

3. Remove packing and backup ring (6 and 7), pilot seat (11), spring (12), poppet screen (13), plunger (14) and seat (15).

4. Remove check valve cap and packing (16 and 17), spring (18) and poppet (19).

5. Remove screws (23) and brackets (21) from both TILT and HOIST valves. Remove wipers (25), packing retainers and packing (26 and 27).

6. Take off both spool caps (20), and remove retaining rings (28), four spring retainers (29), and springs (30).

7. Remove packing retainers (31) and packings (27).

8. If identification plate (32) must be replaced, remove drive screws (33).

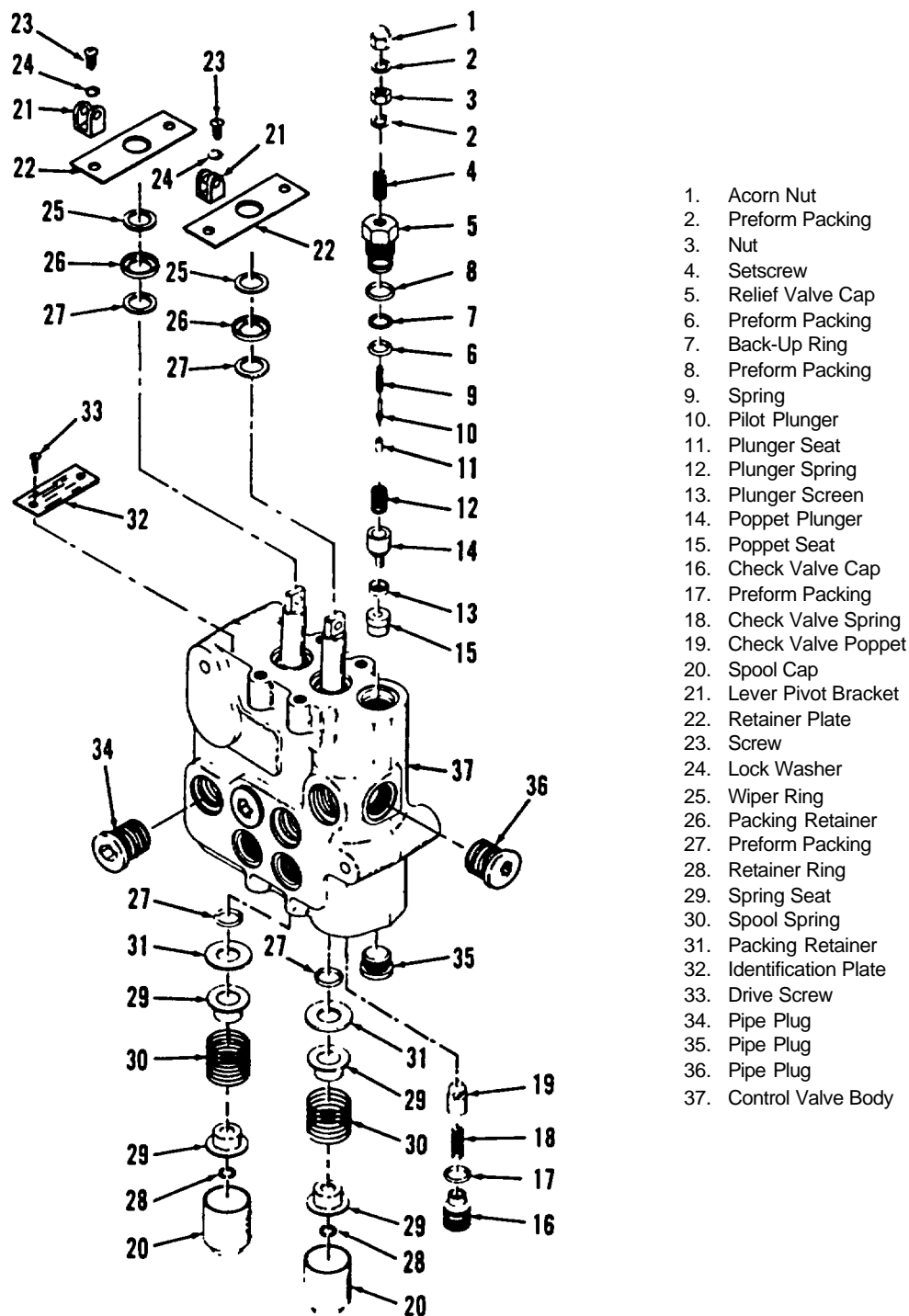


Figure 4-6. Hydraulic Hoist and Tilt Control Valve, Exploded View

**4-35. HYDRAULIC OIL PUMP.**

**4-36. REMOVAL.** If pump (24, figure 4-2) is to be removed from above, drain cooling system and remove radiator first, for access to pump. Then remove pump as follows:

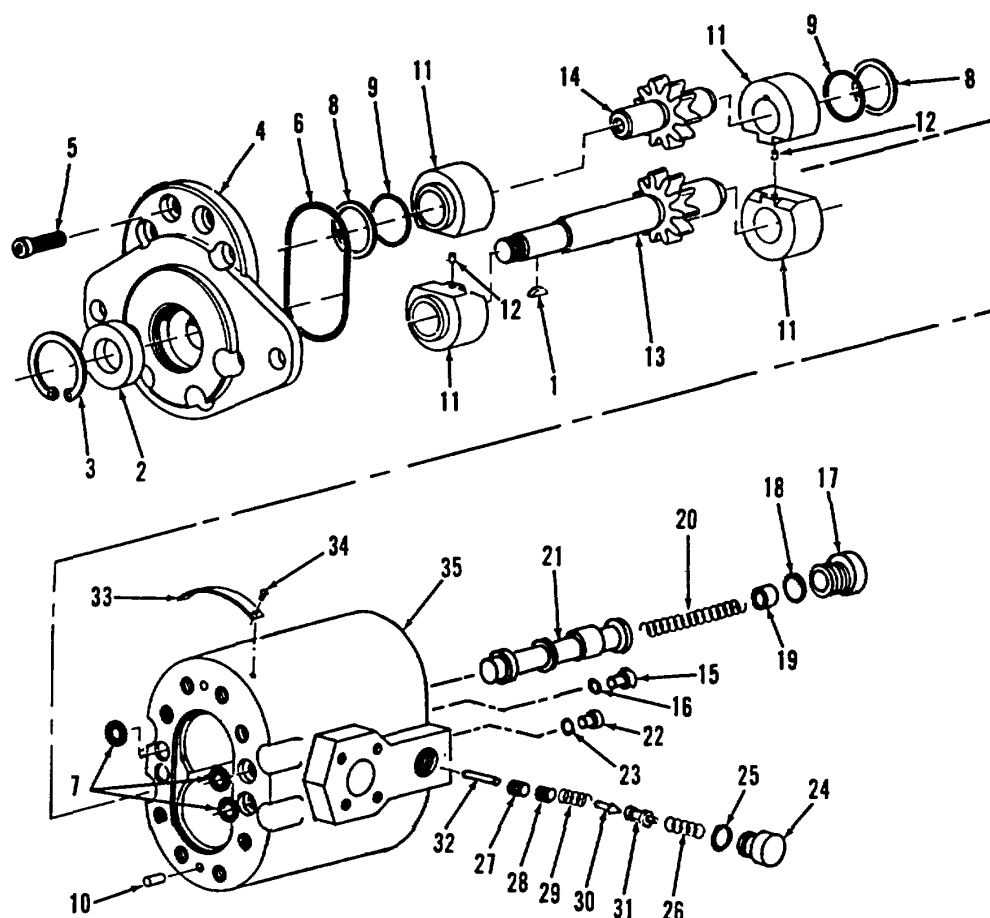
1. Remove the flange halves (13 and 20), disconnecting the pump pressure and suction lines at the pump. If fluid continues to flow from either line, raise the end of that line above the level of the top of the hydraulic tank.

2. Disconnect the power steering hose at the pump, remove nuts (25), washers (26) and take pump and gasket (27) from engine. Discard gasket.

**4-37. DISASSEMBLY.**

1. Remove woodruff key (1, figure 4-7) from slot in pump drive gearshaft (13).

2. Remove retaining ring (3), cap screw (5), seal (2) and mounting flange cover (4).



- |                         |                         |                          |                          |
|-------------------------|-------------------------|--------------------------|--------------------------|
| 1. Woodruff Key         | 10. Pin                 | 19. Spring Seat          | 27. Lock Screw           |
| 2. Oil Seal             | 11. Shaft Bushing       | 20. Spring               | 28. Adjusting Screw      |
| 3. Retainer Ring        | 12. Pin                 | 21. Priority Valve Spool | 29. Spring               |
| 4. Pump Mounting Flange | 13. Drive Gear          | 22. Passage Plug         | 30. Plunger Cone         |
| 5. Screw                | 14. Idler Gear          | 23. Preform Packing      | 31. Relief Valve Spool   |
| 6. Preform Packing      | 15. Passage Plug        | 24. Steering Pressure    | 32. Roll Pin             |
| 7. Preform Packing      | 16. Preform Packing     | Valve Plug               | 33. Identification Plate |
| 8. Back-Up Ring         | 17. Priority Valve Plug | 25. Preform Packing      | 34. Drive Screw          |
| 9. Preform Packing      | 18. Preform Packing     | 26. Spring               | 35. Pump Body            |

Figure 4-7. Hydraulic Pump Assembly, Exploded View

3. Remove driven and drive gearshafts (13 and 14), four bushings (11) and two pins (12).

4. Remove two back-up rings (8) and packings (6, 7 and 9).

5. Remove two pins (10) from pump housing (35) and drive screw (34) and identification plate (33) only if replacement is necessary.

6. Remove plug (17), packing (18), and steering gear priority valve parts (19, 20 and 21).

7. Remove plug (24), packing (25) and pressure relief valve parts (26 through 32).

#### **4-38. HYDRAULIC TANK.**

**4-39. REMOVAL.** The tank must be removed from below the truck, therefore spot the truck over a pit or raise it on a hoist. Since there will be no hydraulic fluid to lubricate the pump, tag the ignition switch with a note that the engine is not to be started. Remove the tank as follows:

1. Lower carriage fully and tilt and tie uprights back.

2. Remove hydraulic fluid from tank. Either remove plug (42, figure 4-2) from bottom of tank and drain fluid into large container, or use a suction transfer pump, with pickup hose inserted to bottom of tank through fill opening.

3. Disconnect suction and return line hoses nearest tank (see figure 4-2). Remove four attaching nuts, lock washers and flat washers, take tank from mounting studs on frame and remove tank from underside of truck.

#### **4-40. DISASSEMBLY.**

1. Remove screws (45, figure 4-2), washers (46) and take filter flange (44) and gasket (47) from tank. Unscrew filter element (48) from flange, and lift out tube (49).

2. Remove combination fill cap dipstick (40).

#### **4-41. DELETED**

#### **4-42. DELETED**

#### **4-43. DELETED**

*Figure 4-8. DELETED*

#### **4-44. CHASSIS MOUNTED ELECTRICAL UNITS.**

**4-45. REMOVAL.** All chassis mounted electrical units are shown in figure 4-9 and identified in the key to the illustration. Remove any unit using the following procedure:

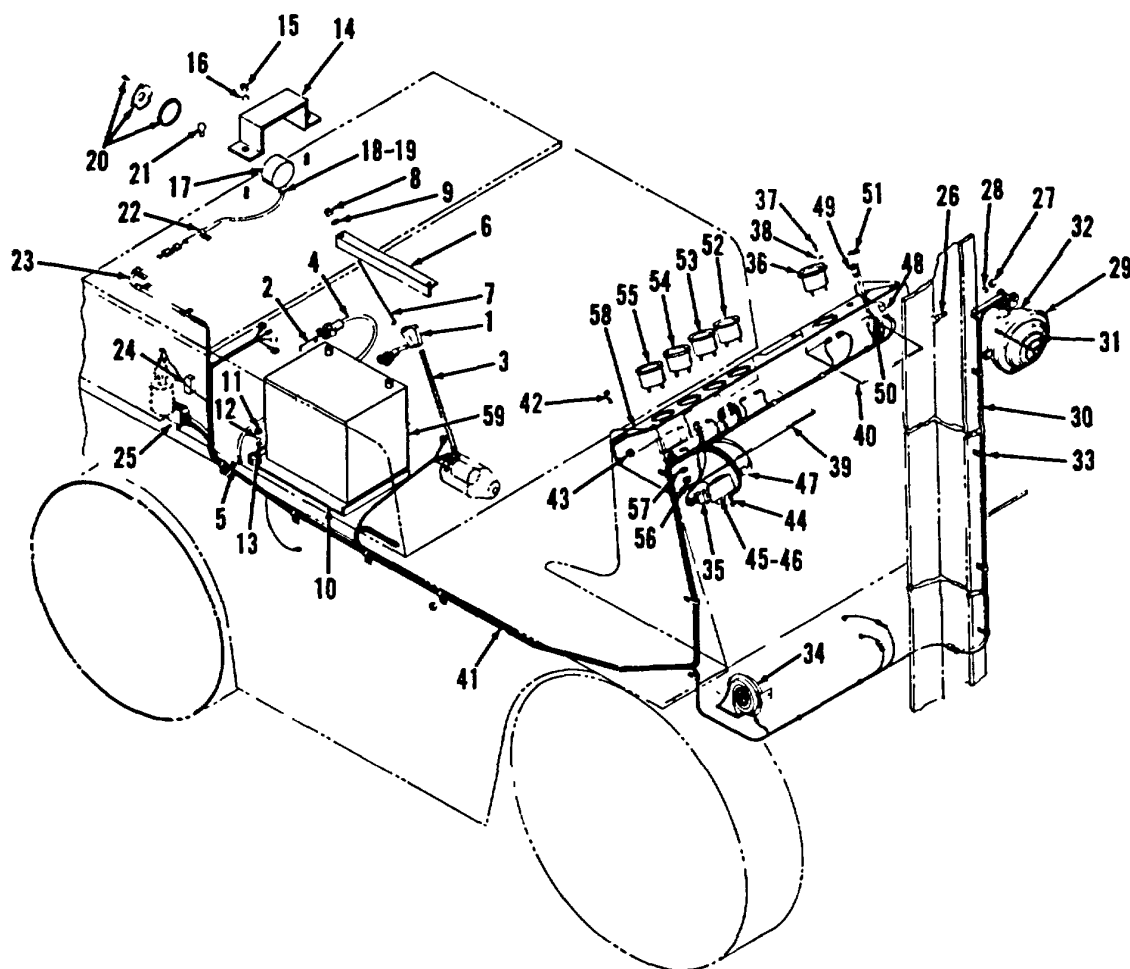
1. Disconnect either battery cable (3 or 4, figure 4-9) at battery before starting to remove unit.

2. Remove any sheet metal restricting access to the unit to be removed.

3. Disconnect wiring at nearest point to unit to be removed. Both the stop and taillight (17) and the spot light (32) have attached wiring harnesses which must be detached from the chassis. All wiring connections have either eyelet terminals or push type connectors.

4. Remove attaching parts and lift from truck.





- |                              |                       |                               |                       |
|------------------------------|-----------------------|-------------------------------|-----------------------|
| 1. Terminal Boot             | 16. Lock Washer       | 32. Lamp Housing              | 45. Fuse Holder       |
| 2. Instruction Plate         | 17. Stop-Tailight     | 33. Harness Clip              | 46. Insulator         |
| 3. Positive Lead             | 18. Nut               | 34. Horn                      | 47. Voltage Regulator |
| 4. Negative Lead             | 19. Lock Washer       | 35. Horn Relay                | 48. Starter Switch    |
| 5. Lock Washer               | 20. Taillight Lens    | 36. Hour Meter                | 49. Washer            |
| 6. Battery Holddown<br>Angle | 21. Lamp Bulb         | 37. Screw                     | 50. Toggle Switch     |
| 7. Holddown Bolt             | 22. Harness Clamp     | 38. Lock Washer               | 51. Indicator Plate   |
| 8. Nut                       | 23. Wiring Harness    | 39. Instrument Panel<br>Cover | 52. Fuel Gage         |
| 9. Washer                    | 24. Starter Relay     | 40. Instrument Panel<br>Cover | 53. Ammeter           |
| 10. Battery Tray             | 25. Voltage Regulator | 41. Chassis Wiring<br>Harness | 54. Temperature Gage  |
| 11. Nut                      | 26. Screw             | 42. Screw                     | 55. Oil Pressure Gage |
| 12. Lock Washer              | 27. Nut               | 43. Nut                       | 56. Nut               |
| 13. Washer                   | 28. Lock Washer       | 44. Fuse                      | 57. Washer            |
| 14. Light Guard              | 29. Light Guard       |                               | 58. Instrument Panel  |
| 15. Nut                      | 30. Wiring Harness    |                               | 59. Storage Battery   |
|                              | 31. Lamp Bulb         |                               |                       |

Figure 4-9. Electrical System Complete, Exploded View

**4-46. DISASSEMBLY.** The only units subject to disassembly are the spot light (32, figure 4-9) and the stop-tailight (17). Refer to figure 4-9, where all details of disassembly are shown.

#### **4-47. CHASSIS MOUNTED HYDRAULIC BRAKE SYSTEM.**

##### **NOTE**

The wheel portion of the brake system is covered in the drive axle (see paragraph 4-53).

#### **4-48. MASTER CYLINDER REMOVAL.**

Refer to TM 10-3930-623-12.

#### **4-49. MASTER CYLINDER DISASSEMBLY.**

1. Remove bolt (27, figure 4-10), gaskets (28 and 30) and fitting (29). Remove fill cap (31) and gasket (32) and discard old brake fluid.

2. Pull push rod (33) from boot (34), and pull off boot.

3. Remove retaining ring (35) and take items 36 through 40 from bore of cylinder.

#### **4-50. DRIVE AXLE.**

#### **4-51. REMOVAL.**

1. Remove the complete upright, back rest, fork and carriage assembly as instructed in paragraph 4-22 to obtain access to drive axle assembly.

2. Block up front of truck so weight is taken from front wheels. Drain oil from transmission and power axle. Disconnect brake hoses at brake line tubes (1, 2, and 3, figure 4-10) and parking brake linkage at wheels.

3. Support transmission so its weight does not depend on engine for support.

4. Remove two cap screws and lock washers (44 and 48, figure 4-11), seven nuts (46), washers (48) and jam nut and washer (47 and 48). Remove and discard gaskets (14 and 18) after noting total thickness for guidance in selecting new, gaskets when replacing drive axle.

5. Carefully draw power axle forward, clear of vehicle.

##### **WARNING**

Arrange that power axle does not suddenly pivot as studs (45) leave transmission. Keep hands free of any area where they might be pinched by sudden shift in axle position.

#### **4-52. DISASSEMBLY.**

1. Remove two spring pins (6, figure 4-12), parking brake rods (5), cotter pins (3), nuts (4) and levers (2).

2. Remove brake tube assemblies (8 and 9), screws, nuts and washers (15, 16, 17 and 18), fittings (10, 11, 13, 14 and 19) and related attaching parts.

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

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

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

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

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

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

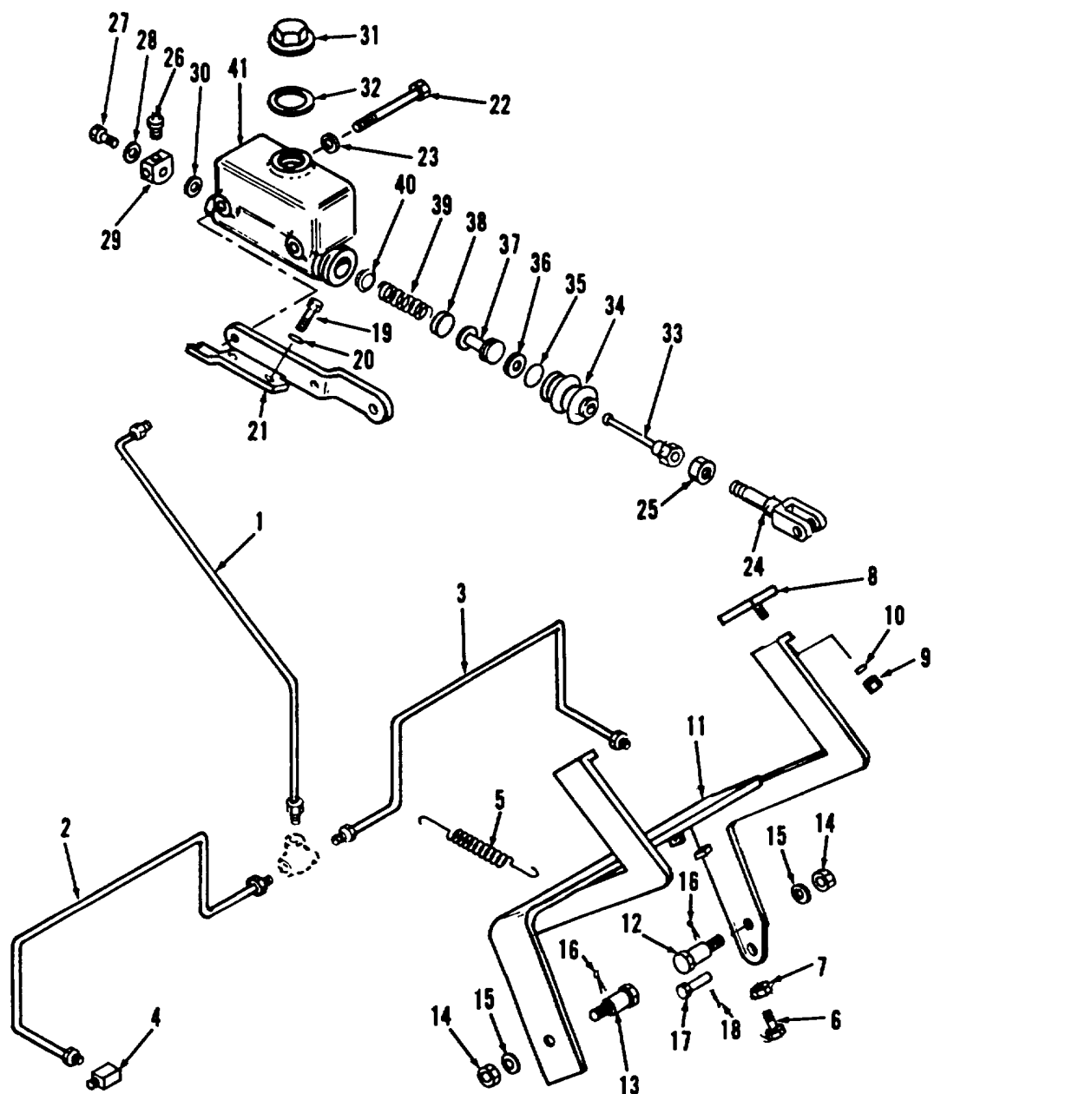
9. Remove bearing (60 and 64), screws (66) and separate halves of differential case (65). Parts index numbered 67 through 71 may now be removed individually. To move ring gear (72), drill heads off of rivets (73) from ring gear side to avoid damage to case, and remove rivets.

##### **CAUTION**

Be careful not to drill further than necessary to remove rivet heads.

#### **4-53. WHEEL BRAKE REMOVAL AND DISASSEMBLY.**

**4-54.** Routine overhaul of the brake assembly (see figure 4-13) does not usually require complete disassembly of the brakes. Disassemble the brakes to the extent necessary according to the following instructions:



- |                     |                                |                       |                               |
|---------------------|--------------------------------|-----------------------|-------------------------------|
| 1. Brake Tube       | 12. Trunnion Bolt              | 22. Screw             | 33. Push Rod                  |
| 2. Brake Tube       | 13. Trunnion Bolt              | 23. Lock Washer       | 34. Push Rod Boot             |
| 3. Brake Tube       | 14. Nut                        | 24. Push Rod Clevis   | 35. Retaining Ring            |
| 4. Elbow            | 15. Washer                     | 25. Nut               | 36. Stop Plate                |
| 5. Retractor Spring | 16. Cotter Pin                 | 26. Stop Light Switch | 37. Master Cylinder<br>Piston |
| 6. Screw            | 17. Headed Pin                 | 27. Connector Bolt    | 38. Piston Cup                |
| 7. Nut              | 18. Cotter Pin                 | 28. Washer            | 39. Spring                    |
| 8. Pedal Pad        | 19. Screw                      | 29. Brake Fitting     | 40. Check Valve               |
| 9. Nut              | 20. Lock Washer                | 30. Washer            | 41. Master Cylinder Body      |
| 10. Lock Washer     | 21. Master Cylinder<br>Bracket | 31. Filler Cap        |                               |
| 11. Brake Pedal     |                                | 32. Gasket            |                               |

Figure 4-10. Hydraulic Brake Master Cylinder and Pedal Assembly, Exploded View

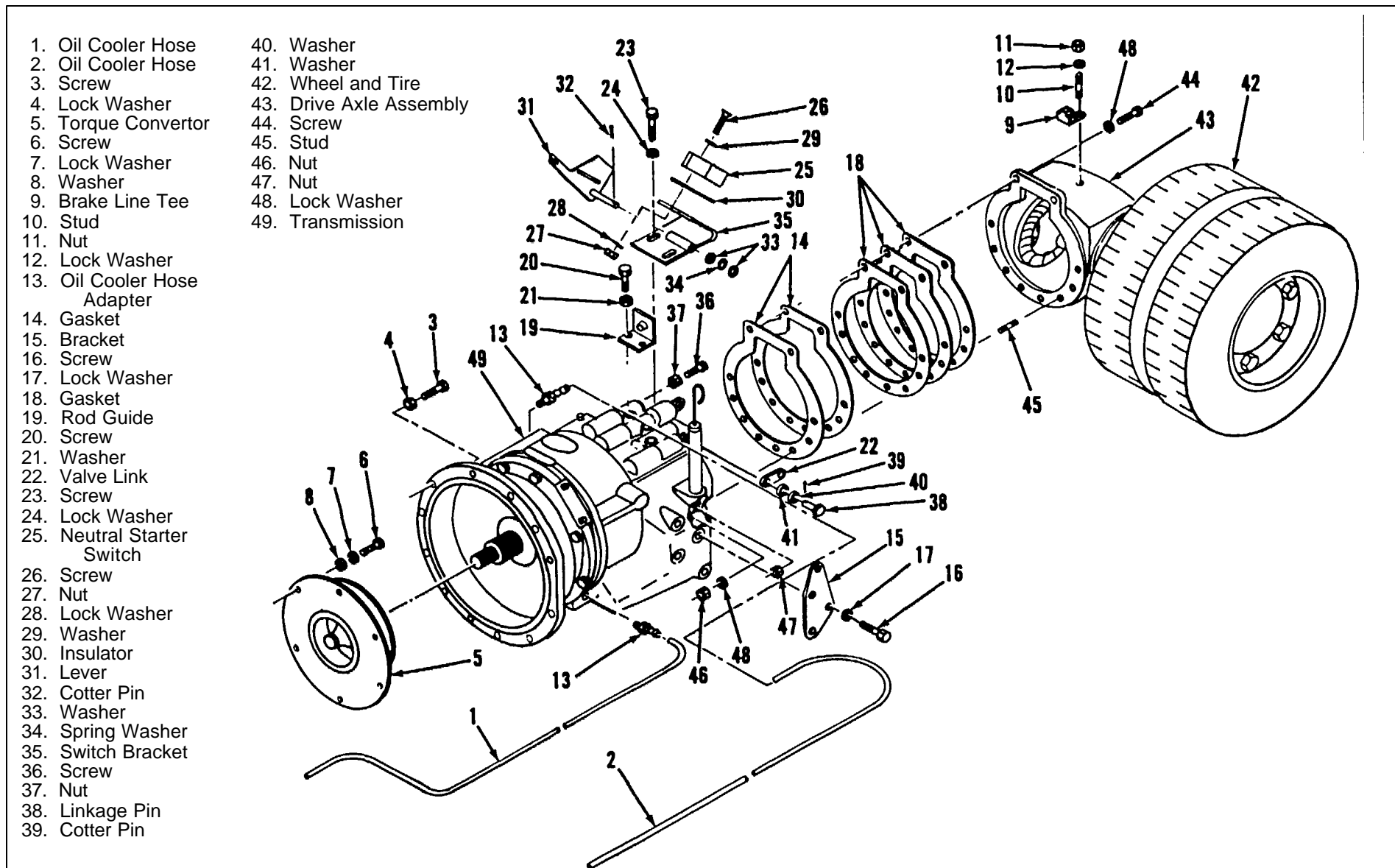


Figure 4-11. Drive Train Less Engine, Partially Exploded View

1. Wheel Bolt
2. Parking Brake Lever
3. Cotter Pin
4. Castellated Nut
5. Parking Brake Rod, RH
6. Spring Pin
7. Brake Bleeder Screw
8. Brake Tube Assembly (Actuating)
9. Brake Tube Assembly (Bleed)
10. Elbow
11. Adapter
12. Gasket
13. Bleeder Tube Adapter
14. Brake Line Fitting
15. Screw
16. Nut
17. Washer
18. Washer
19. Bleeder Screw Fitting
20. Screw
21. Washer
22. Screw
23. Washer
24. Internal Gear (Final Drive)
25. Cotter Pin
26. Nut
27. Washer
28. Roller Bearing Inner Cone and Rollers
29. Inner Bearing Cup
30. Final Drive Shaft
31. Screw
32. Gasket
33. Bearing Outer Cone and Rollers
34. Outer Bearing Cup
35. Brake Drum
36. Brake Drum Seal
37. Brake Assembly
38. Screw
39. Washer
40. Nut
41. Washer

42. Stud
43. Stud
44. Pin
45. Brake Lever and Pin Assembly
46. Packing
47. Final Drive Gear Case
48. Gasket
49. Bearing Retainer
50. Screw
51. Washer
52. Axle Shaft
53. Axle Shaft Bearing Retainer
54. Bearing
55. Nut
56. Washer
57. Washer
58. Tapered Bushing
59. Stud
60. Roller Bearing Cup
61. Axle Housing
62. Gasket
63. Gasket
64. Bearing Cone and Rollers
65. Case Assembly
66. Screw
67. Side Bevel Gear
68. Thrust Washer (Side Gear)
69. Thrust Washer (Spider Bevel Gear)
70. Bevel Gear (Spider)
71. Differential Spider

72. Ring Gear
73. Rivet
74. Pipe Plug
75. Housing Oil Drain Plug
76. Final Drive Housing

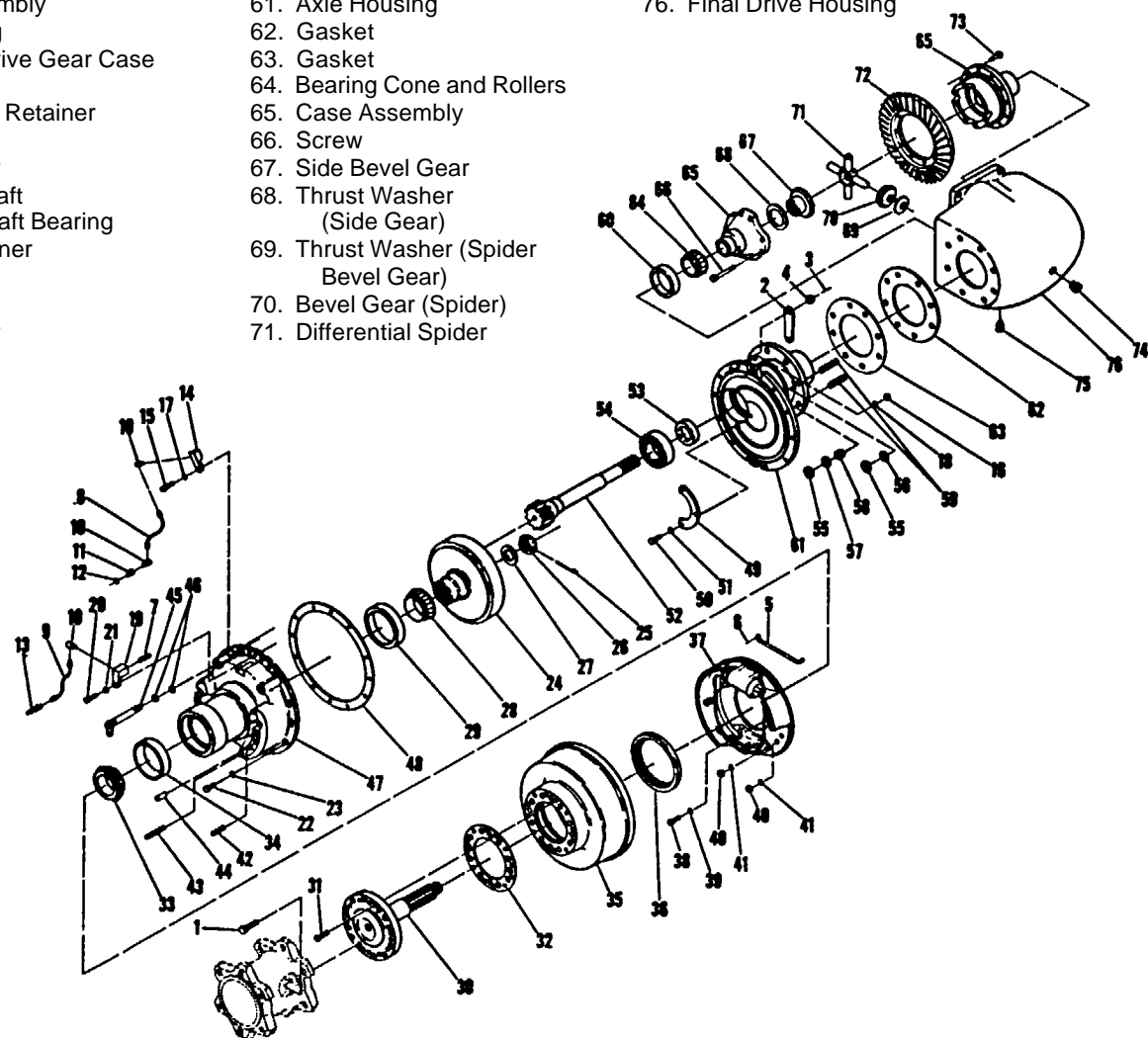


Figure 4-12. Front Drive Axle Complete, Exploded View

*Figure 4-13. DELETED*

1. Perform steps 1 through 6 of paragraph 4-52.
2. DISASSEMBLE WHEEL BRAKE AS DIRECTED IN TM 10-3930-623-12.

#### **4-55. TRANSMISSION AND TORQUE CONVERTER.**

##### **4-56. REMOVAL.**

1. Remove upright carriage and fork assembly (see paragraph 4-22) and floor plate (see paragraph 4-19).
2. Remove drive axle as outlined in paragraph 4-51.

##### **NOTE**

**Be sure to drain lubricant from axle and transmission. Remove flywheel housing bottom plate for access to torque converter drain plug. Drain torque converter to reduce weight on drive disks.**

3. Support transmission on a floor jack or dolly to relieve weight on its attaching parts and make removal easier.

4. Free hoses (1 and 2, figure 4-11) by loosening and sliding clamps up hoses. Leave clamps on hoses for reuse and pull hoses from adapters (13).

5. Remove flywheel housing top access plate. Rotate flywheel as required to remove the six screws (6), lock washers (7) and flat washers (8) attaching the torque converter (5) flexible drive disk to the flywheel.

6. Disconnect all inching and shifting linkage from top of transmission assembly.

7. Remove 12 cap screws and washers (3 and 4) attaching transmission to engine assembly.

8. Draw transmission forward from engine and remove from under truck.

**4-57. DISASSEMBLY.** Disassemble the transmission only in a clean area where dirt or dust will not contaminate the unit. Mounting the assembly in a holding stand will make working on the transmission easier, but this is not essential to the job. The torque converter cannot be disassembled. To disassemble the transmission for overhaul proceed as follows:

1. Remove eight screws and washers (6 and 7, figure 4-14), access plate (5) and gasket (8). Remove two screws (10), washers (11) and remove strainer element (9) and gasket (12).

2. Remove relief valve components (items 13, 14, 15, and 16), gage (17) and tube (18).

3. Remove and disassemble transmission pump (items 19 through 34).

4. Remove five screws (36), three screws (37) and eight washers (38), and take transmission case front half (35) and gasket (41) from case rear half (85). Remove bearing (39) from case front half.

5. Remove clutch (44) and seals (42 and 43) from case. Remove screws (47 and 48), washers (49), transmission valve assembly (46) and gasket (50) from case rear half.

#### NOTE

**Eight screws (47), 1-1/8 inches long, and four screws (48), 2-1/4 inches long, are used. Note which holes receive the long screws so they may be replaced in the proper holes.**

6. Remove two screws (52), keeper (51), shim (53), bearing (54 and 55) and spacers (56 and 57).

7. Remove six screws and washers (59 and 60), bearing retainer (58), retaining rings (64) in front of

bearing (61) and behind forward (front) cluster gear (63). Draw forward gearshaft (65) out through front of case with needle bearing (45).

8. Remove screws and washers (72 and 73), keeper (71), retaining ring (75) and retaining ring (64) in front of reverse (rear) cluster gear (63). Slide reverse gearshaft (77) forward and remove last retaining ring (64).

9. Remove reverse drive gearshaft (77) through front of case, and take gears (63) out through top of case. Remove bearings (61 and 74).

10. Draw output gearshaft (66). Remove bearing (69 and 70) from case. Remove retaining ring (67) and spur gear (68).

11. Remove screws, washers and idler shaft keeper (79, 80 and 81) and withdraw shaft (58), bearings (83), retaining ring (84) and gear (82).

#### **4-58. TRANSMISSION DIRECTION CLUTCH ASSEMBLY.**

**4-59. REMOVAL.** The clutch assembly has been removed from the transmission during transmission disassembly (refer to paragraph 4-57).

#### **4-60. DISASSEMBLY.**

1. Remove both retaining rings (1, figure 4-15), clutch cylinders (4 and 11), all screws (2 and 8) and washers (9).

2. Remove bearings (6 and 10), rings (12 and 14), piston (15) and springs (16). Remove clutch plates (17 and 18) from pressure plate (19).

#### **4-61. TRANSMISSION CONTROL VALVE.**

**4-62. REMOVAL.** The transmission control valve removal instructions are given in paragraph 4-57, step 5.

#### **4-63. DISASSEMBLY.**

1. Invert valve from position shown. Remove pipe plug (1, figure 4-16), screws and washers (3 and 4), valve bedplate and gasket (2 and 5).

2. Remove screw and washer (7 and 8), bedplate (6) and gasket (9). Spring, ball and bushing (10, 11 and 12), and the piston stops (13, 22 and 27) are now uncovered. Remove them.

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

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

- |                            |                                    |                       |                    |                            |
|----------------------------|------------------------------------|-----------------------|--------------------|----------------------------|
| 1. Pipe Plug               | 43. Ring Seal                      | 59. Screw             | 72. Screw          | 81. Shaft Retainer         |
| 2. Pipe Plug               | 44. Direction Control Drive Clutch | 60. Lock Washer       | 73. Lock Washer    | 82. Idler                  |
| 3. Pipe Plug               | 45. Roller Bearing                 | 61. Ball Bearing      | 74. Ball Bearing   | 83. Roller Bearing         |
| 4. Pipe Plug               | 46. Control Valve                  | 62. Retaining Ring    | 75. Retaining Ring | 84. Gear Retainer          |
| 5. Access Plate            | 47. Screw                          | 63. Spur Gear         | 76. Retaining Ring | 85. Transmission Case Half |
| 6. Screw                   | 48. Screw                          | 64. Retaining Ring    | 77. Gearshaft      |                            |
| 7. Lock Washer             | 49. Lock Washer                    | 65. Gearshaft         | 78. Idler Shaft    |                            |
| 8. Gasket                  | 50. Gasket                         | 66. Gearshaft         | 79. Screw          |                            |
| 9. Strainer Element        | 51. Shaft Keeper                   | 67. Retaining Ring    | 80. Lock Washer    |                            |
| 10. Screw                  | 52. Screw                          | 68. Countershaft Gear |                    |                            |
| 11. Lock Washer            | 53. Shim                           | 69. Cone and Roller   |                    |                            |
| 12. Gasket                 | 54. Cone and Roller                | 70. Bearing Cup       |                    |                            |
| 13. Plug                   | 55. Bearing Cup                    | 71. Bearing Keeper    |                    |                            |
| 14. Washer                 | 56. Spacer                         |                       |                    |                            |
| 15. Spring                 | 57. Spacer                         |                       |                    |                            |
| 16. Relief Valve Ball      | 58. Retaining Ring                 |                       |                    |                            |
| 17. Gage Rod               |                                    |                       |                    |                            |
| 18. Gage Tube              |                                    |                       |                    |                            |
| 19. Screw                  |                                    |                       |                    |                            |
| 20. Screw                  |                                    |                       |                    |                            |
| 21. Lock Washer            |                                    |                       |                    |                            |
| 22. Pump Housing           |                                    |                       |                    |                            |
| 23. Screw                  |                                    |                       |                    |                            |
| 24. Lock Washer            |                                    |                       |                    |                            |
| 25. Screw                  |                                    |                       |                    |                            |
| 26. Lock Washer            |                                    |                       |                    |                            |
| 27. Preform Packing        |                                    |                       |                    |                            |
| 28. Preform Packing        |                                    |                       |                    |                            |
| 29. Pump Inner Gear        |                                    |                       |                    |                            |
| 30. Pump Outer Gear        |                                    |                       |                    |                            |
| 31. Pump Base              |                                    |                       |                    |                            |
| 32. Gasket                 |                                    |                       |                    |                            |
| 33. Ring Seal              |                                    |                       |                    |                            |
| 34. Retaining Ring         |                                    |                       |                    |                            |
| 35. Transmission Case Half |                                    |                       |                    |                            |
| 36. Screw                  |                                    |                       |                    |                            |
| 37. Screw                  |                                    |                       |                    |                            |
| 38. Lock Washer            |                                    |                       |                    |                            |
| 39. Ball Bearing           |                                    |                       |                    |                            |
| 40. Pipe Plug              |                                    |                       |                    |                            |
| 41. Gasket                 |                                    |                       |                    |                            |
| 42. Ring Seal              |                                    |                       |                    |                            |

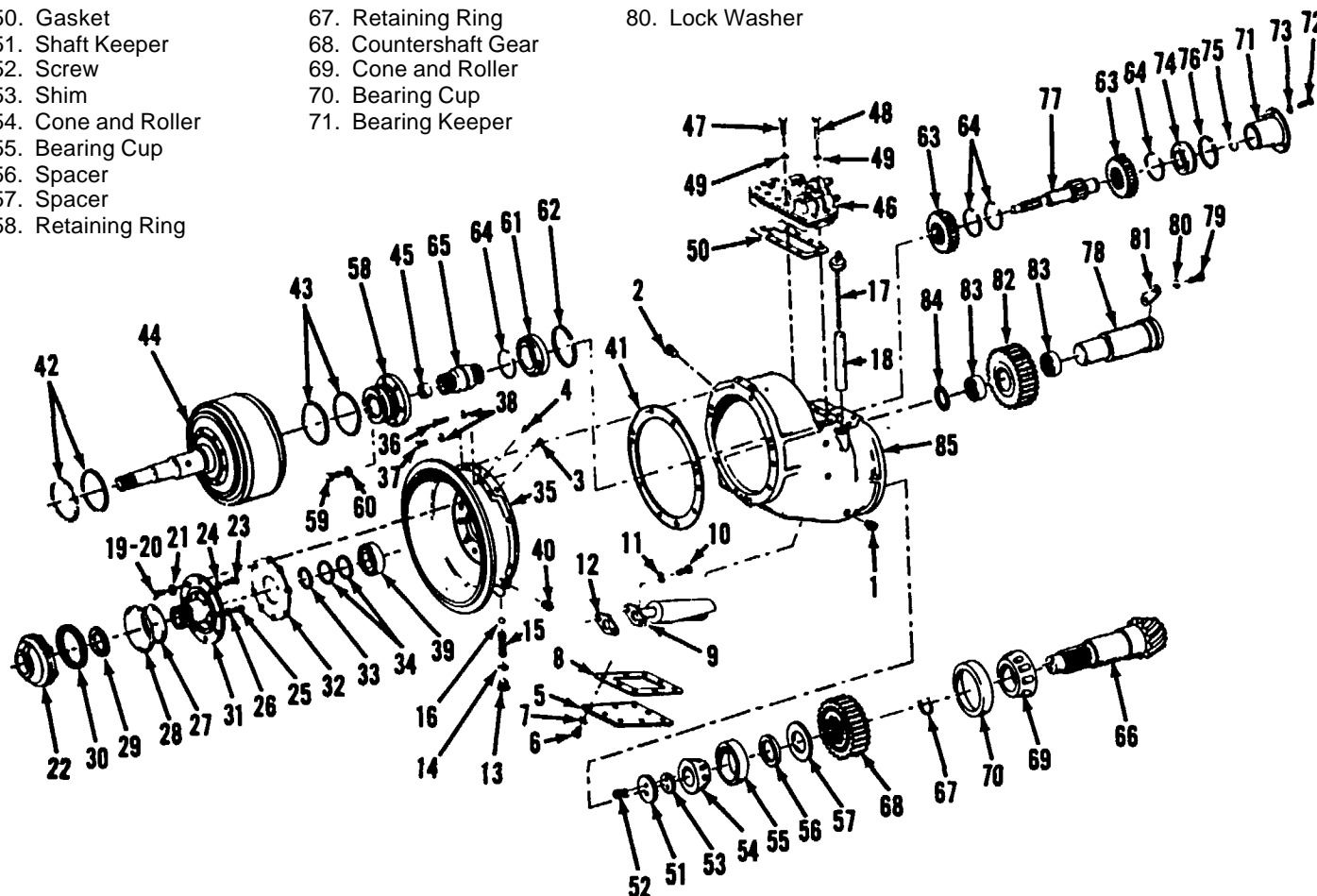


Figure 4-14. Mechanical Transmission Complete, Exploded View



- |                                    |                                   |                    |
|------------------------------------|-----------------------------------|--------------------|
| 1. Retaining Ring                  | 7. Shaft and Bearing              | 13. Straight Pin   |
| 2. Screw                           | 8. Screw                          | 14. Piston Ring    |
| 3. Lock Plate                      | 9. Lock Washer                    | 15. Piston         |
| 4. Clutch Cylinder,<br>Output End. | 10. Roller Bearing                | 16. Spring         |
| 5. Passage Plug                    | 11. Clutch Cylinder,<br>Input End | 17. Clutch Plate   |
| 6. Roller Bearing                  | 12. Piston Ring                   | 18. Clutch Plate   |
|                                    |                                   | 19. Pressure Plate |

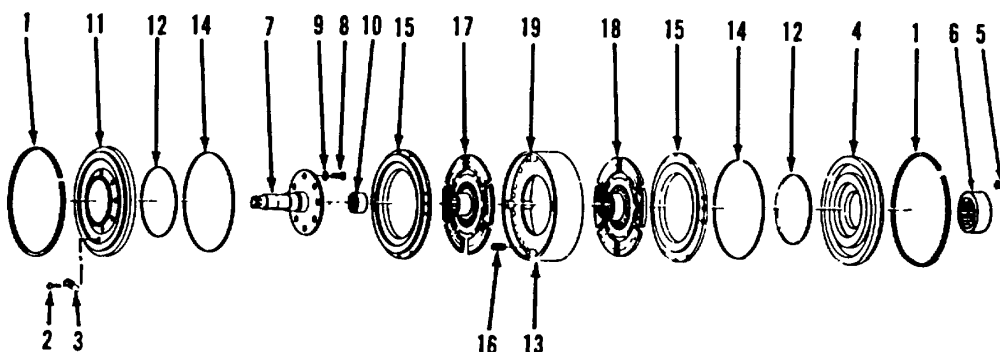
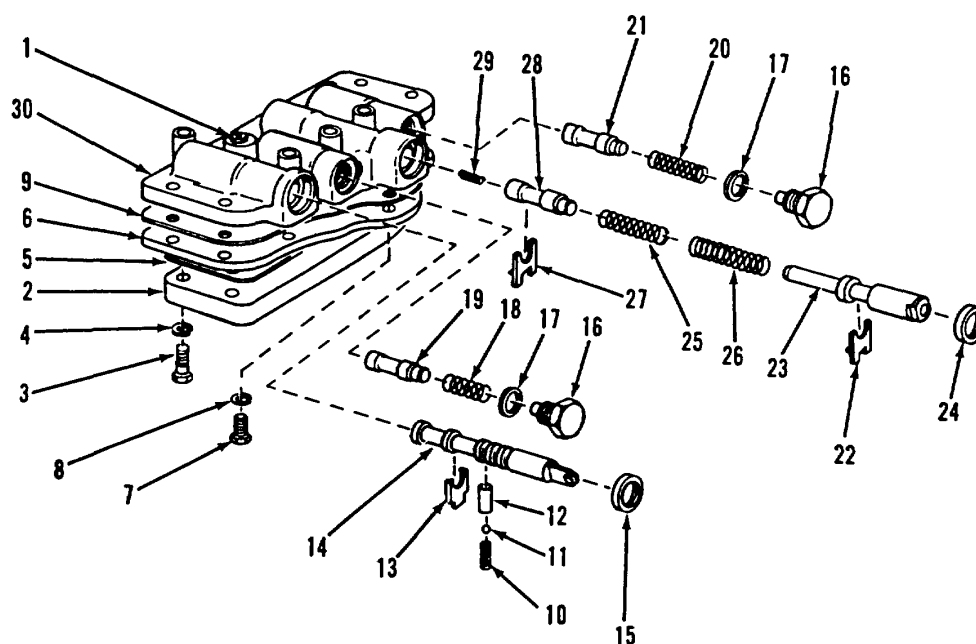


Figure 4-15. Transmission Direction Drive Clutch Assembly, Exploded View



- |                   |                    |                      |                             |
|-------------------|--------------------|----------------------|-----------------------------|
| 1. Pipe Plug      | 12. Bushing        | 16. Screw            | 20. Spring                  |
| 2. Lower Bedplate | 13. Valve Stop     | 17. Washer           | 21. Regulator Piston        |
| 3. Screw          | 14. Detent Plunger | 18. Spring           | 22. Piston Stop             |
| 4. Lock Washer    | 15. Seal           | 19. Regulator Piston | 23. Inching Valve<br>Piston |
| 5. Gasket         |                    |                      | 24. Seal                    |
| 6. Upper Bedplate |                    |                      | 25. Inner Spring            |
| 7. Screw          |                    |                      | 26. Outer Spring            |
| 8. Lock Washer    |                    |                      | 27. Valve Stop              |
| 9. Gasket         |                    |                      | 28. Inching Piston          |
| 10. Detent Spring |                    |                      | 29. Spring                  |
| 11. Detent Ball   |                    |                      | 30. Valve Body              |

Figure 4-16. Transmission Control Valve Assembly, Exploded View

#### 4-64. ENGINE WITH ACCESSORIES.

**4-65. REMOVAL PREPARATIONS.** The engine will be hoisted out of engine compartment from above. The procedure which follows permits removal without removing the mast or transmission and drive axle. Refer to TM 10-3 930-623-12, for removal instructions for chassis parts referred to below, and proceed as follows:

1. Tilt mast back, and with carriage fully lowered, place a block under the carriage so mast cannot tilt forward.
2. Remove overhead guard.
3. Remove engine compartment cover and counterweight.
4. Drain cooling system and remove radiator.
5. Drain hydraulic tank. Remove lift and tilt control valve return line to the tank.
6. Remove battery and battery tray.

#### 4-66. ENGINE REMOVAL.

1. Drain engine crankcase, replace drain plug and arrange a chain hoist sling to lifting eye.
2. Make all disconnections indicated on figure 4-17.
3. Remove 12 cap screws and washers (20 and 21, figure 4-11) which attach engine to transmission.
4. Draw engine straight rearward until torque converter hub is free of transmission input shaft splines and lift engine free of truck. Mount engine in a work stand for subsequent procedures.

#### 4-67. ENGINE MOUNTED ACCESSORIES, REMOVAL.

**4-68.** Before removing accessories and other external engine parts (see figure 4-18) remove accumulated loose dirt from the assembly by careful use of a steam cleaner, or solvent with rags, brushes and a scraper as required.

**4-69.** Removal instructions are given in TM10-3930-623 12 for engine mounted accessories listed below.

1. Hydraulic pump.
2. Fuel filter, fuel pump and carburetor (6 and 9, figure 4-18).
3. Water pump (54)

4. Alternator (22).

5. Starter (23).

6. Engine mounted electrical components. Additionally, all service procedures for the alternator are covered in the referenced publication.

#### 4-70. ENGINE MOUNTED ACCESSORIES, DISASSEMBLY.

**4-71. HYDRAULIC PUMP.** Refer to paragraph 4-35.

#### 4-72. IGNITION DISTRIBUTOR.

#### 4-73. REMOVAL.

##### NOTE

Turn crankshaft until timing lines up with indicator. Remove distributor cap and check if rotor points to the no. 1 spark plug wire position, if not rotate crankshaft one full revolution and check rotor. Scribe alignment mark on distributor and cylinder head and opposite rotor tip to insure correct reassembly.

1. Remove spark plug and coil high tension wiring and shielding (2 through 8, figure 4-19) and low voltage primary cable (1) from distributor cap and shield (10).
2. Remove nut (15) and washer (14) holding clamp (13) to cylinder head and withdraw the distributor assembly from engine.

#### 4-74. DISASSEMBLY.

1. Clamp distributor (16, figure 4-19) in soft jaw vise to disassemble.
2. Remove shield adapter ring (11) and distributor cap (10) from distributor. Pull rotor (17) from shaft cam (32).
3. Remove capacitor (20), bracket (21), point contact set (18) and breaker plate (26).
4. Remove distributor advance parts; holddown plate (28), cam (32), springs (30), weights (31) and washer (38).
5. Drive out pin (34) attaching drive coupling (33) to shaft (35). Pull shaft from housing (39). Remove oil seal (40).

#### 4-75. CARBURETOR.

#### 4-76. REMOVAL.

Refer to TM 10-3930-623-12.

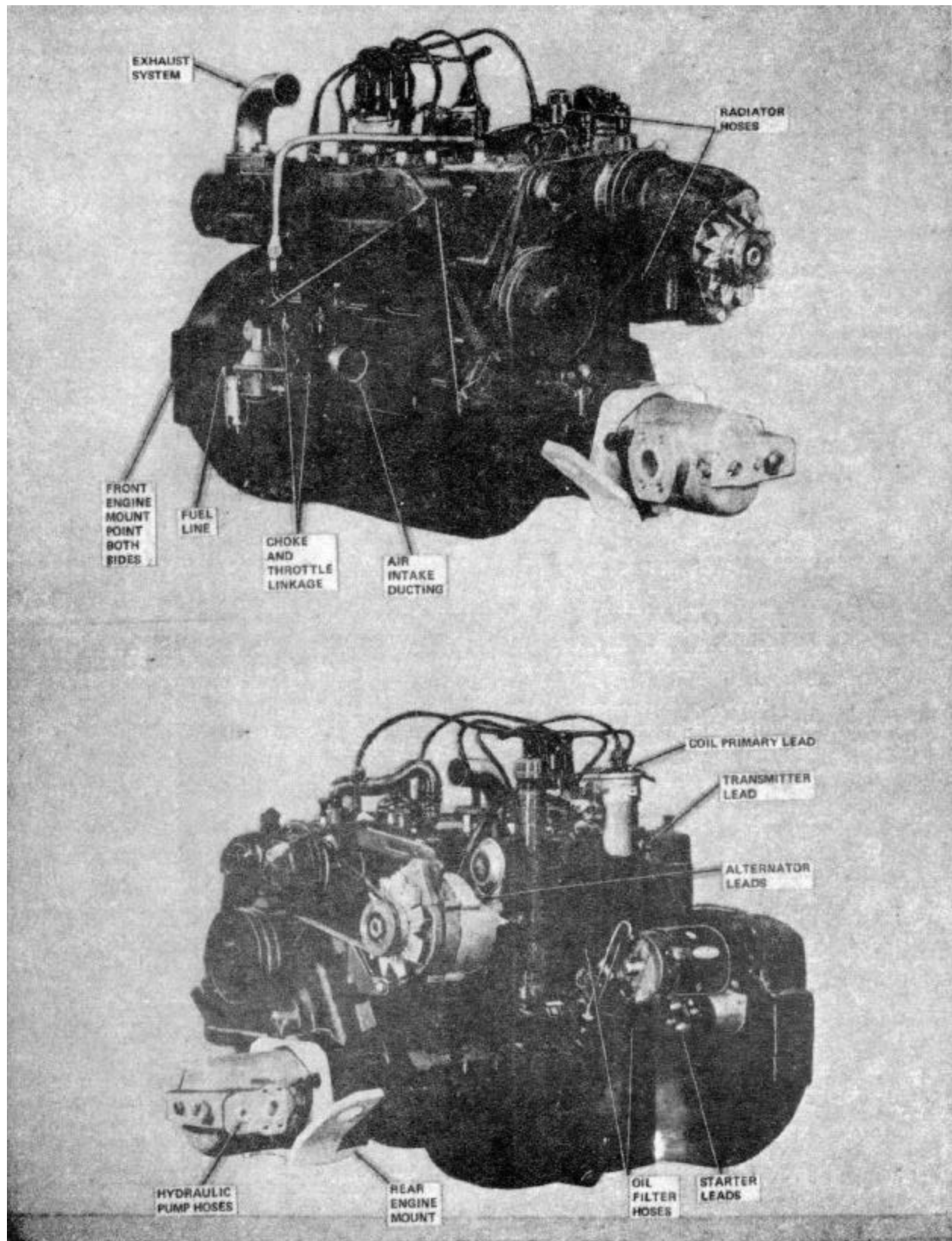


Figure 4-17. Engine Assembly Removal Disconnect Points

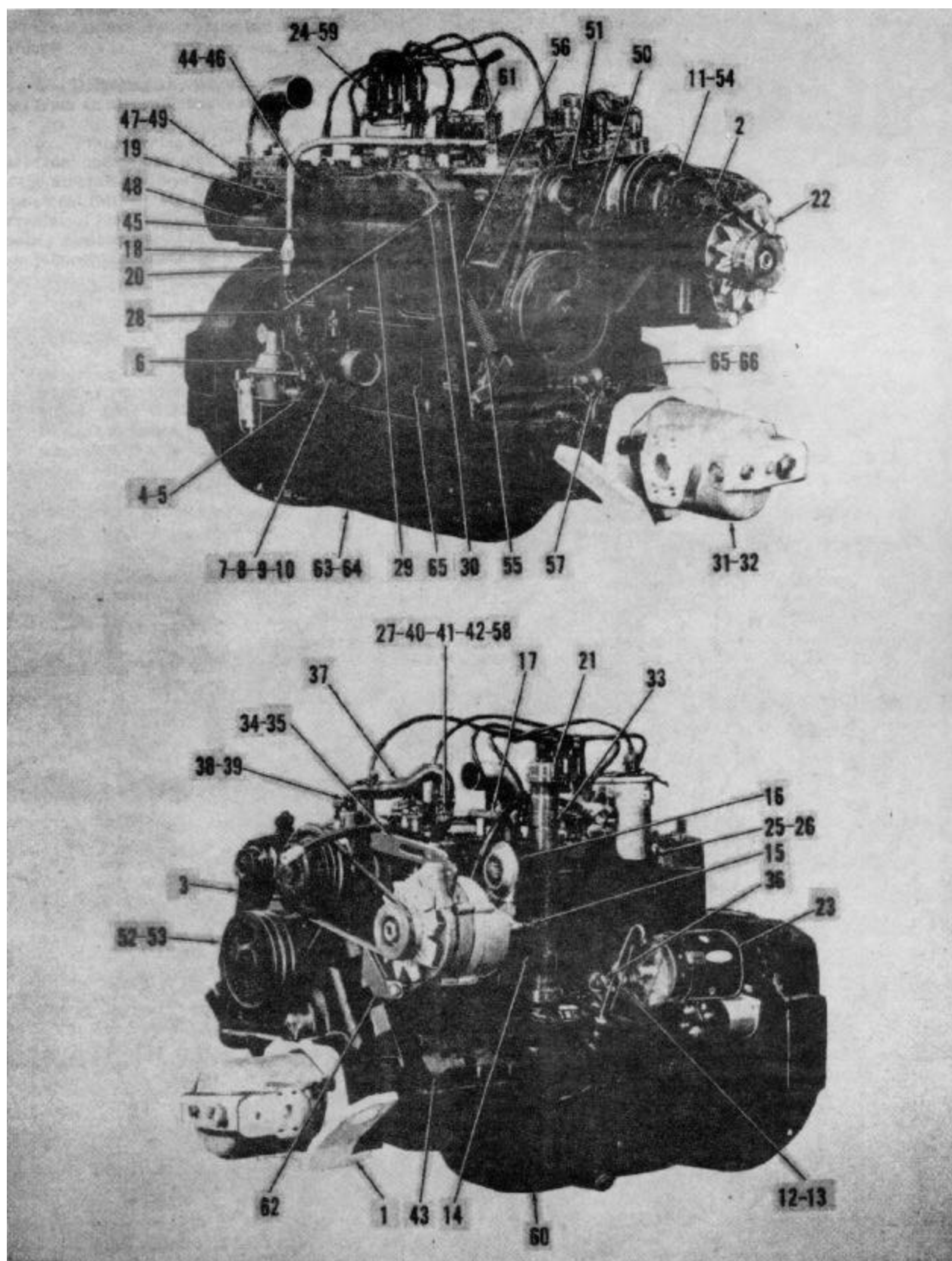
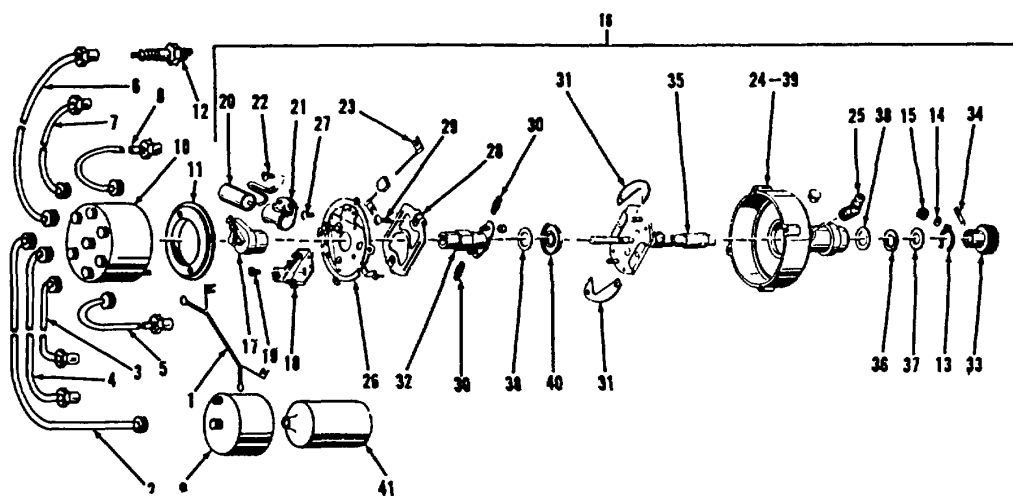


Figure 4-18. Gasoline Engine Assembly Complete With Accessories

## Key to Figure 4-18

- |                          |                          |                             |                             |
|--------------------------|--------------------------|-----------------------------|-----------------------------|
| 1. Mounting Bracket      | 18. Nut                  | 34. Adjusting Strap         | 51. Fan Idler Pulley        |
| 2. Alternator Drive Belt | 19. Vent Tube            | 35. Strap Clip              | 52. Fan Drive Pulley        |
| 3. Fan Drive Belt        | 20. Manifold Elbow       | 36. Drain Cock              | Assembly                    |
| 4. Fuel Line Tube        | 21. Oil Filler Cap       | 37. By-Pass Hose            | 53. Gasket                  |
| 5. Fuel Pump Elbow       | 22. Alternator           | 38. By-Pass Elbow           | 54. Water Pump              |
| 6. Fuel Pump             | 23. Starter              | 39. Hose Nipple             | 55. Governor Spring         |
| 7. Fuel Line Elbow       | 24. Distributor          | 40. Thermostat Ring         | 56. Spring Anchor           |
| 8. Stud                  | 25. Water Temperature    | 41. Thermostat              | 57. Governor                |
| 9. Carburetor            | Transmitter              | 42. Thermostat Housing      | 58. Stud                    |
| 10. Carburetor Gasket    | 26. Pipe Bushing         | Gasket                      | 59. Distributor Drive Shaft |
| 11. Engine Fan           | 27. Thermostat Housing   | 43. Engine Less Accessories | 60. Oil Pan                 |
| 12. Oil Filter Elbow     | 28. Rod Clip             | 44. Pipe Plug               | 61. Coil Bracket            |
| 13. Pipe Bushing         | 29. Governor Control Rod | 45. Pipe Plug               | 62. Alternator Bracket      |
| 14. Oil Filler Tube      | 30. Ball Joint           | 46. Pipe Plug               | 63. Not Used                |
| 15. Valve Elbow          | 31. Hydraulic Pump Drive | 47. Exhaust Manifold        | 64. Not Used                |
| 16. Positive Crankcase   | Gear                     | 48. Intake Manifold         | 65. Not Used                |
| Ventilation Valve        | 32. Drive Sleeve         | 49. Manifold Gasket         | 66. Not Used                |
| 17. Vent Hose            | 33. Clamp                | 50. Idler Pulley Strap      |                             |



- |                              |                          |                         |                   |
|------------------------------|--------------------------|-------------------------|-------------------|
| 1. Low Voltage Primary Cable | 12. Spark Plug           | 24. Grommet             | 36. Shim          |
| 2. High Tension Cable        | 13. Distributor Clamp    | 25. Lubrication Fitting | 37. Shim          |
| 3. Spark Plug Cable          | 14. Washer               | 26. Breaker Plate       | 38. Washer        |
| 4. Spark Plug Cable          | 15. Nut                  | 27. Screw               | 39. Housing       |
| 5. Spark Plug Cable          | 16. Distributor Assembly | 28. Holddown Plate      | 40. Oil Seal      |
| 6. Spark Plug Cable          | 17. Rotor                | 29. Screw               | 41. Ignition Coil |
| 7. Spark Plug Cable          | 18. Point Contact Set    | 30. Weight Spring       |                   |
| 8. Spark Plug Cable          | 19. Screw                | 31. Advance Weight      |                   |
| 9. Coil Shield               | 20. Capacitor            | 32. Cam                 |                   |
| 10. Distributor Shield       | 21. Bracket              | 33. Drive Collar        |                   |
| 11. Shield Ring              | 22. Screw                | 34. Pin                 |                   |
|                              | 23. Primary Lead         | 35. Shaft and Plate     |                   |

Figure 4-19. Ignition Distributor and Spark Plugs, Exploded View

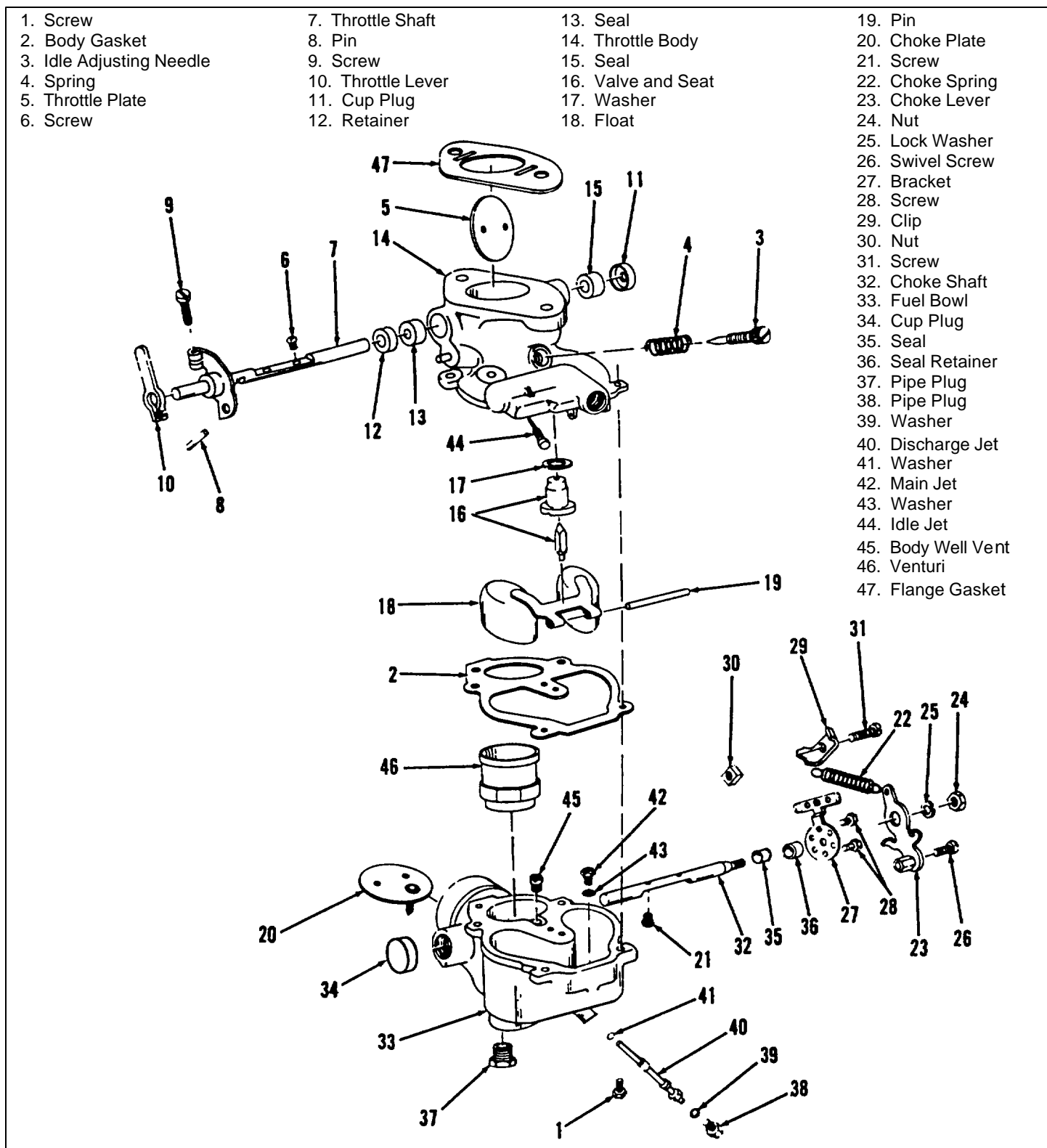


Figure 4-20. Carburetor Assembly, Exploded View

**4-77. DISASSEMBLY OF THROTTLE BODY.**

1. Remove four bowl to body screw and lockwasher assemblies (1, figure 4-20) which attach throttle body (14) to bowl (33).

2. Raise throttle body (14) slightly and separate bowl to body gasket from fuel bowl and then remove throttle body assembly being careful not to damage floats.

3. Invert throttle body assembly and remove float pin (19) from slotted end of hinge bracket, using screwdriver to force pin through slotted end of hinge bracket. Complete removal of pin from opposite side, then remove float assembly (18) and fuel valve needle (part of 16).

4. Remove bowl to body gasket (2) from machined surface of throttle body, and remove venturi (46).

5. Remove fuel valve seat (part of 16) and fiber washer (17) from throttle body.

6. Remove idle jet (44) from passage in machined surface of throttle body near fuel valve seat, using small screwdriver.

7. Remove idle adjusting needle (3) and friction spring (4) from side of throttle body.

8. Back out throttle stop screw (9) until threaded end is flush with throttle lever. Close throttle and mark across throttle body and throttle lever as a guide to correct re-assembly of parts.

9. File off riveted or peened end of throttle plate screws (6) flush with throttle shaft (7), being careful not to damage throttle plate (5) or throttle body bore. Remove throttle plate screws and throttle plate.

10. Remove throttle shaft and stop lever assembly from throttle body and drive out shaft hole plug (11), using a 6 inch length of 1/4 inch rod inserted through opposite shaft hole.

11. To remove shaft hole seal (13 and 15) and retainer (12), screw a 5/16 inch fine thread taper tap into seal retainer until firmly seated, then insert long punch or rod through opposite shaft hole and drive punch against end of tap until retainer is free of throttle body.

**4-78. DISASSEMBLY OF FUEL BOWL BODY.**

1. Remove main passage plug (38, figure 4-20) and fiber washer (39) from bottom of fuel bowl.

2. Remove drain plug (37) from outside bottom of fuel bowl.

3. Remove discharge jet (40) and fiber washer (41).

4. Remove main jet (42) and fiber washer (43) from bottom of fuel bowl.

5. Remove well vent (45) from center of large opening in machined surface of the fuel bowl.

6. Close choke and scribe across choke lever (23), choke bracket (27) and across air intake adjacent to lever as a guide to correct re-assembly.

7. Remove choke lever spring (22).

8. Remove choke plate screw and lockwasher assemblies (21) and choke plate (20).

9. Remove choke bracket screws, lockwashers and choke bracket (23 through 32).

10. Drive out shaft hole plug (34), using a 6 inch length of 1/4 inch rod inserted through opposite shaft hole.

11. To remove choke shaft seal (35) and retainer (36), screw a 5/16 inch fine thread tap into packing retainer until firmly seated, then insert long punch or rod through opposite shaft hole and drive punch against end of tap until retainer is free of air intake body. Remove retainer and packing from tap and repeat at opposite shaft hole.

**4-79. STARTER.** Determine, by performing applicable tests in Section VII, degree of disassembly necessary to restore the starter to operating condition, then disassemble only as far as necessary according to the following steps.

1. Disconnect field coils (47, figure 4-21) from solenoid (15) terminal.

2. Remove through bolts (2); then separate commutator end bell (1) from starter housing (49).

3. Remove solenoid (15) and shift lever (27); then, remove screw (32) and washer (33) to free center bearing plate (41). Take armature (34) with attached parts from drive end bell (24).

4. Remove drive thrust collar (36), retaining ring (37), and take drive assembly (39), stop collar (38) and remaining parts shown from armature shaft. Drive assemblies are serviced as a unit. Do not disassemble.

**4-80. ALTERNATOR****4-81. REMOVAL**

Refer to TM 10-3930-623-12.

**4-82. DISASSEMBLY**

a. To disassemble, remove four thru bolts (2, figure 4-20.1). securing frame assembly (1) to frame (10). Match mark frames and use a screwdriver at stator slot to pry apart two frames. Place piece of tape over slip ring end frame bearing (4) to prevent entry of dirt or foreign matter. Also tape shaft of rotor (7) to slip ring end.

b. Place rotor (7) in a vise and tighten only enough to permit removal of nut (32) and lock washer (31). Remove nut, lock washer, pulley, key (38), fan outside collar (29), and rotor.

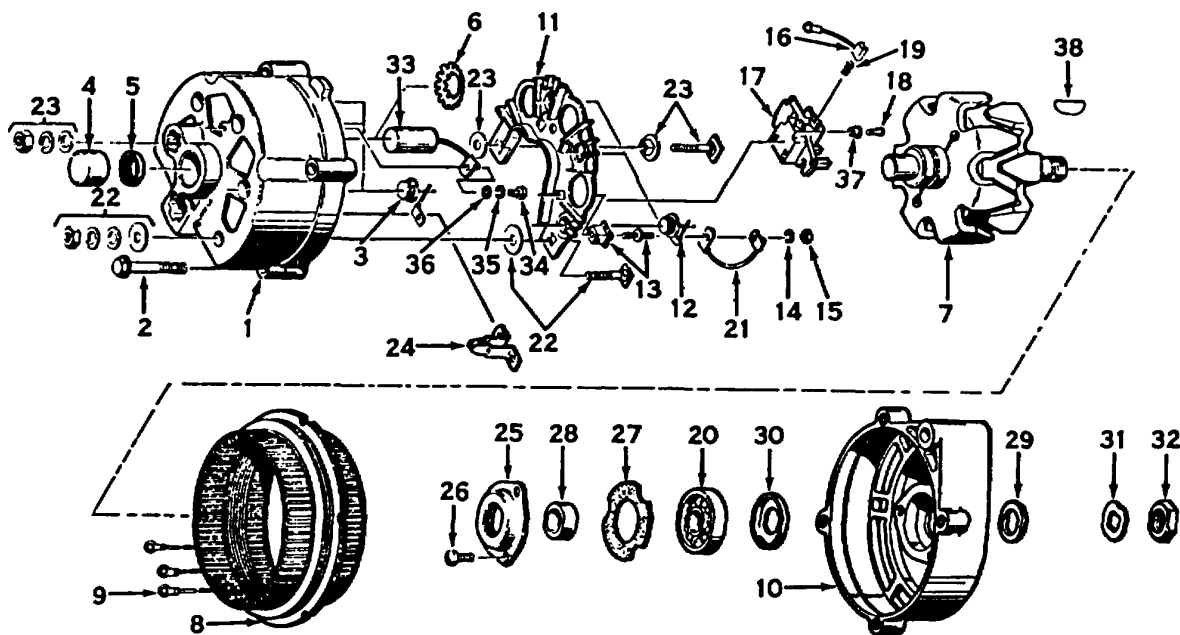
c. Remove three stator lead attaching nuts and stator (8) from frame.

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

**4-83. Deleted.**

**CAUTION**

Use pressure sensitive tape, NOT friction tape, which could leave a gummy deposit.



1. Frame Assembly
2. Thru Bolt
3. Diode
4. Bearing
5. Retainer
6. Retaining Spring
7. Rotor
8. Stator
9. Clip
10. Frame
11. Heat Sink Assembly
12. Diode
13. Terminal Package

14. Washer
15. Nut
16. Brush
17. Brush Holder
18. Screw
19. Spring
20. Bearing
21. Lead
22. Terminal Package
23. Terminal Package
24. Terminal
25. Bearing Retainer
26. Screw

27. Gasket
28. Inside Collar
29. Outside Collar
30. Grease Slinger
31. Lock Washer
32. Shaft Nut
33. Capacitor
34. Screw
35. Lock Washer
36. Washer
37. Insulator
38. Key

Figure 4-20.1 Alternator, Exploded View



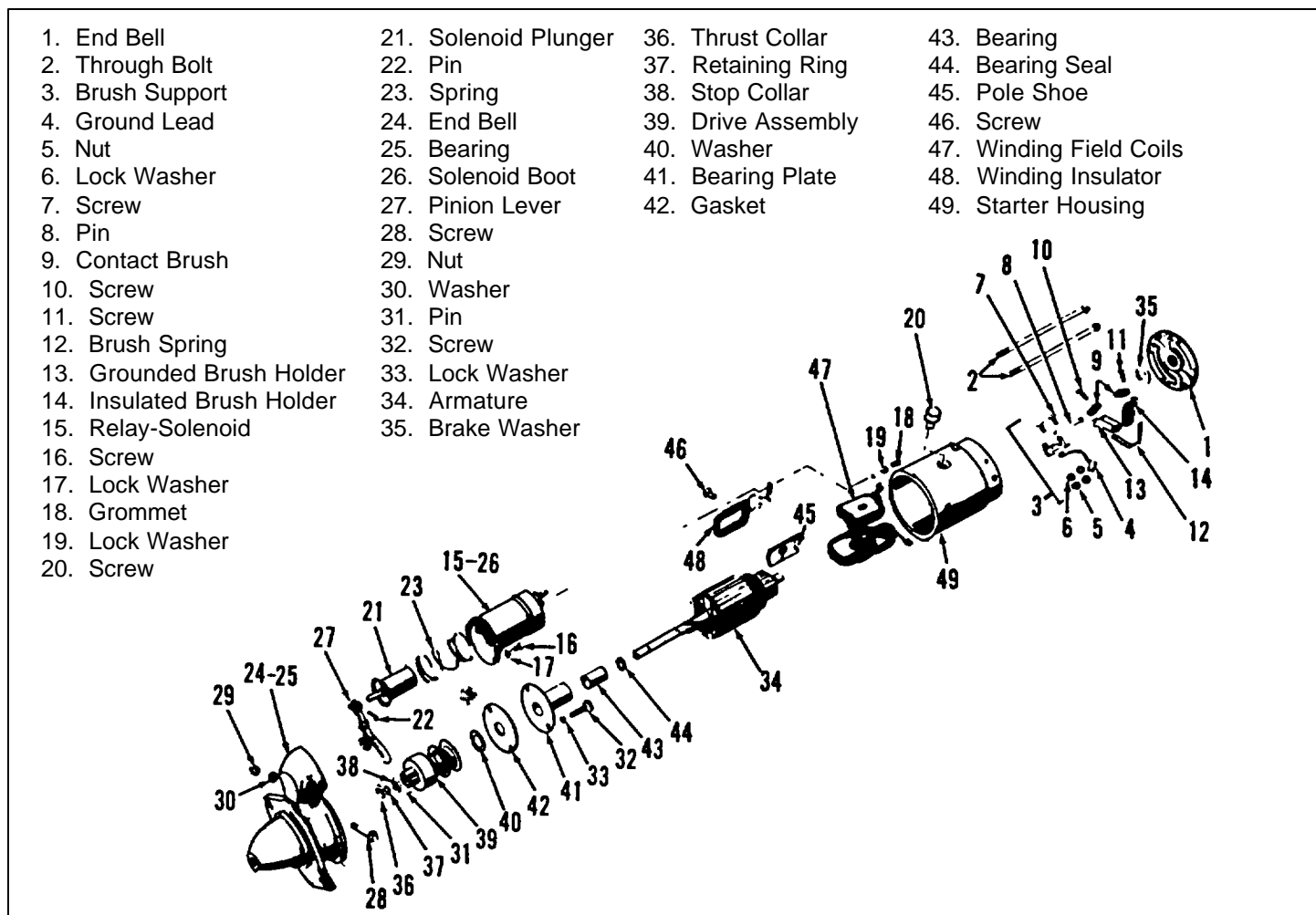


Figure 4-21. Engine Electrical Starting Motor. Exploded View

**4-84. ENGINE DISASSEMBLY,****4-85. CYLINDER HEAD.****4-86. REMOVAL**

1. Remove cylinder head screws (4, 53, and 54, figure 4-22) and washers (8 and 55), and remove cylinder head (52) and gasket (59) from engine cylinder block (62).

**4-87. DISASSEMBLY.**

1. Remove stud nuts and lock washers and remove elbow (housing) (27 figure 4-22) and thermostat from cylinder head (52).

2. Remove engine temperature transmitter from the cylinder head.

3. Remove spark plugs.

**4-88. VALVES AND RELATED COMPONENTS REMOVAL.**

1. Remove valve chamber cover (15, figure 4-22).

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

3. Rotate crankshaft until lowest point of any lifter travel is reached. Using valve spring compressor, compress valve spring (5, figure 4-23). Remove valve locks (7). Release and remove valve spring compressor. See figure 4-24. Remove remaining locks in a similar manner.

4. Lift exhaust valves (2) and intake valves (1) out through top of cylinder block and tag them for installation in original positions.

1. Pipe Plug
2. Oil Level Gage Rod
3. Brace
4. Screw
5. Screw
6. Screw
7. Nut
8. Lock Washer
9. Lock Washer
10. Expansion Plug
11. Expansion Plug
12. Pipe Plug
13. Screw
14. Flat Washer
15. Cover
16. Stud
17. Stud
18. Nut
19. Baffle
20. Baffle
21. Baffle
22. Plug
23. Gasket
24. Spring
25. Shim Washer
26. Relief Valve
27. Drain Plug
28. Oil Pan
29. Screw
30. Gasket Set
31. Filler Block Seal
32. Oil Pan Gasket
33. Rear Seal
34. Fuel Pump Stud Gasket
35. Drain Plug Washer
36. Fuel Pump
37. Front Oil Pan Filler Block
38. Rear Oil Pan Filler Block
39. Screw
40. Screw
41. Lock Washer
42. Oil Guard
43. Timing Hole Cover
44. Screw
45. Lock Washer
46. Drive Screw
47. Flywheel Housing
48. Ring Dowel
49. Screw
50. Screw
51. Lock Washer
52. Cylinder Head
53. Screw
54. Screw
55. Flat Washer

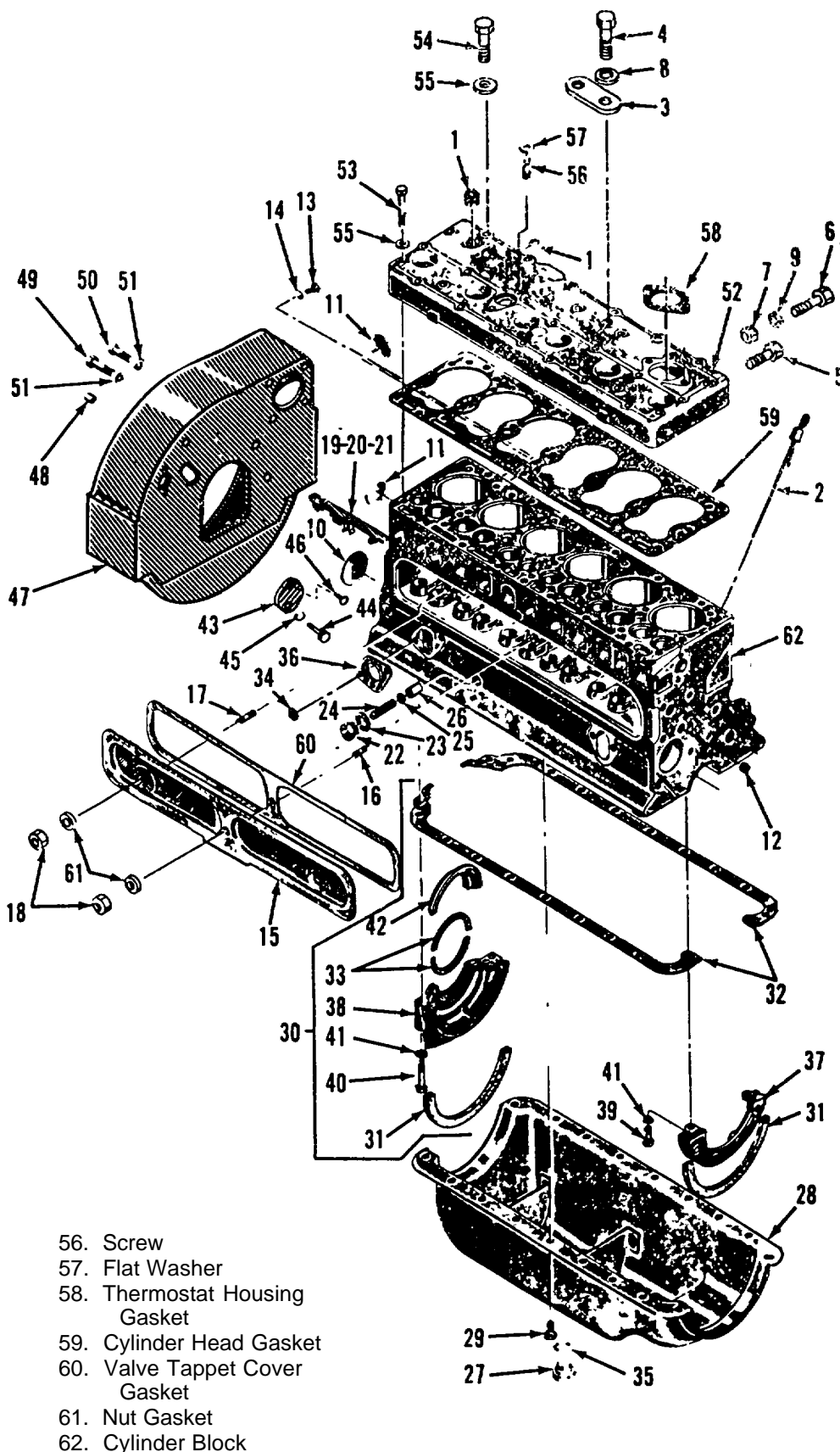


Figure 4-22. Engine Cylinder Block, Head and Oil Pan Group, Exploded View

1. Intake Valve
2. Exhaust Valve
3. Exhaust Valve Seat Insert
4. Valve Guide
5. Valve Spring
6. Retainer
7. Retainer Lock
8. Valve Tappet
9. Camshaft Gear
10. Nut
11. Woodruff Key
12. Thrust Plate
13. Screw
14. Lock Washer
15. Camshaft Front Bushing
16. Camshaft Intermediate Front Bushing
17. Camshaft Intermediate Rear Bushing
18. Camshaft Rear Bushing
19. Camshaft

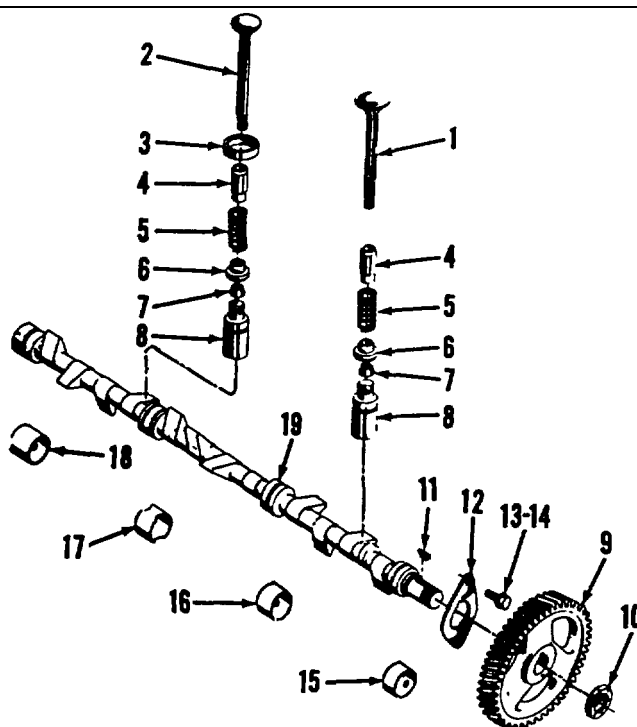


Figure 4-23. Engine Valve Train and Camshaft Group, Exploded View

5. Remove valve springs (5) and spring retainers (6) from valve chamber.

6. Remove tappets (8) from cylinder block. Tag tappets for replacement in holes from which they were removed.

#### 4-89. TIMING GEAR COVER ASSEMBLY.

**4-90. REMOVAL.** Remove screws and hollow dowels securing the timing gear cover (2, figure 4-25) to the cylinder block and remove cover assembly.

#### 4-91. DISASSEMBLY.

##### NOTE

Examine both fan drive assembly and governor control lever and shaft assembly to determine if disassembly is required.

1. Remove three screws attaching fan drive assembly (52 figure 4-18) to timing gear cover.

2. Remove drive assembly (52) and roll pin.

3. Using suitable pullers remove drive gear and pulley with keys. Remove shaft bearings.

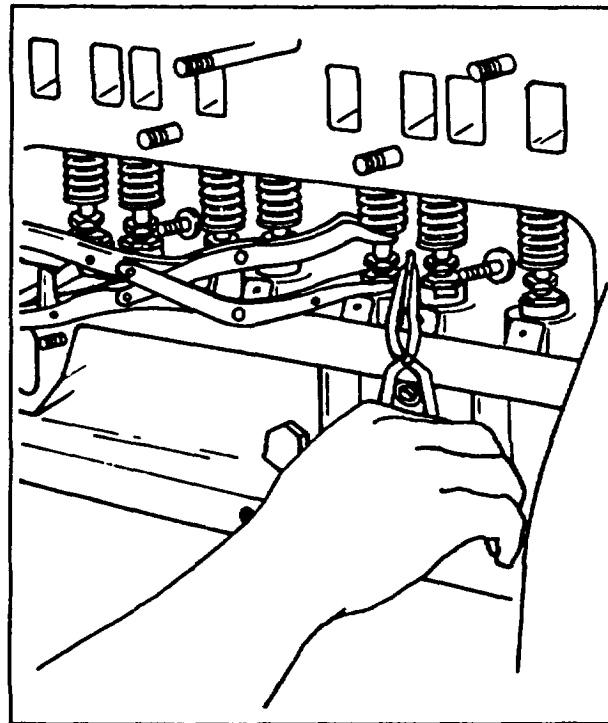
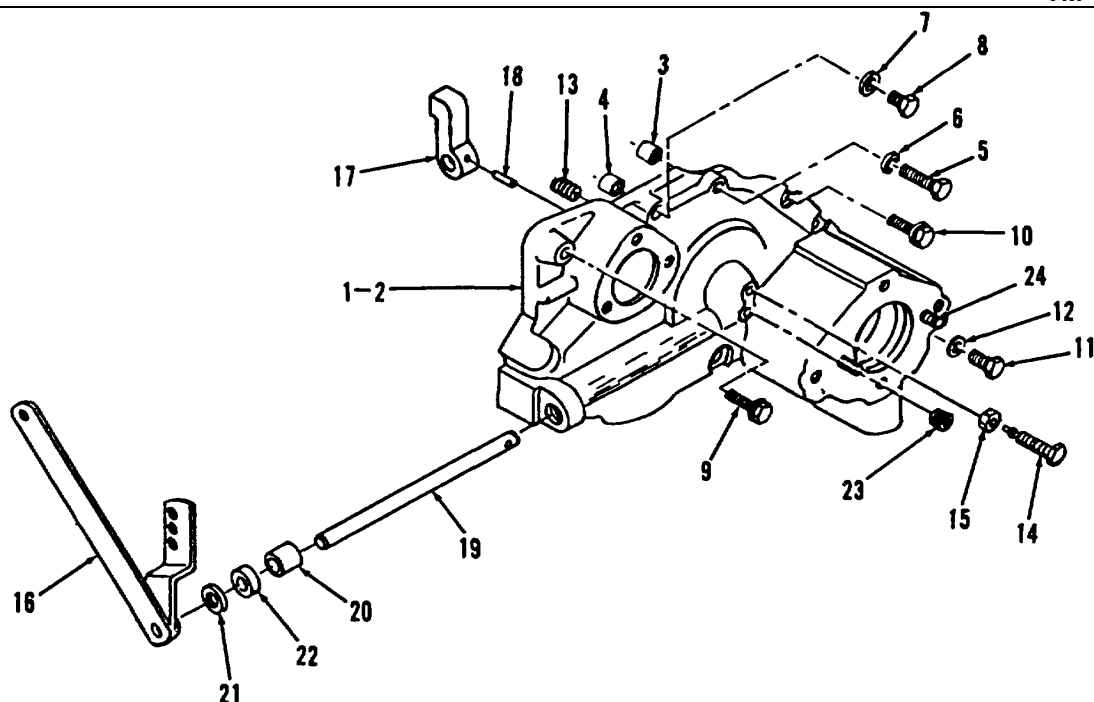


Figure 4-24. Removing and Replacing Valve Retainer Locks



- |                           |                            |                         |
|---------------------------|----------------------------|-------------------------|
| 1. Camshaft Gear Governor | 9. Screw                   | 17. Governor Rocker Arm |
| 2. Timing Gear Cover      | 10. Screw                  | 18. Pin                 |
| 3. Ring Dowel             | 11. Screw                  | 19. Governor Shaft      |
| 4. Ring Dowel             | 12. Washer                 | 20. Sleeve Bearing      |
| 5. Screw                  | 13. Surge Spring           | 21. Dust Seal           |
| 6. Lock Washer            | 14. Surge Adjustment Screw | 22. Oil Seal            |
| 7. Washer                 | 15. Nut                    | 23. Pipe Plug           |
| 8. Screw                  | 16. Governor Lever         | 24. Stud                |

Figure 4-25. Timing Gear Cover and Governor Shaft Group, Exploded View

#### NOTE

**Do not pull pulley or gear unless shaft bearing indicate excessive wear or gear is badly damaged.**

4. Remove pin (18, figure 4-25) and arm (17) from governor control shaft (19).

5. Remove shaft and dust seal (21). Remove oil seal (22) and bearings (20).

6. Remove surge screw (14) and lock nut (15)

#### 4-92. OIL PAN REMOVAL.

1. Remove attaching screws (29, figure 4-22), and remove oil pan (28). Scrape old gasket (32) and seal remains from pan and block.

2. Remove screws (39) and remove front filler block (37) and seal (31).

3. Remove screws (40) and remove rear filler block (38) and seal (31). Remove half of seal (33) from filler block. Remove gaskets from engine block.

4. Remove oil guard (42) by pushing it around crankshaft and out of engine block. Remove second half of seal (33) from oil guard.

#### 4-93. OIL PUMP.

**4-94. REMOVAL.** Remove nut (2, figure 4-26) and washer (3). Remove oil pump body (19) and assembled parts from crankcase of engine block (62, figure 4-22).

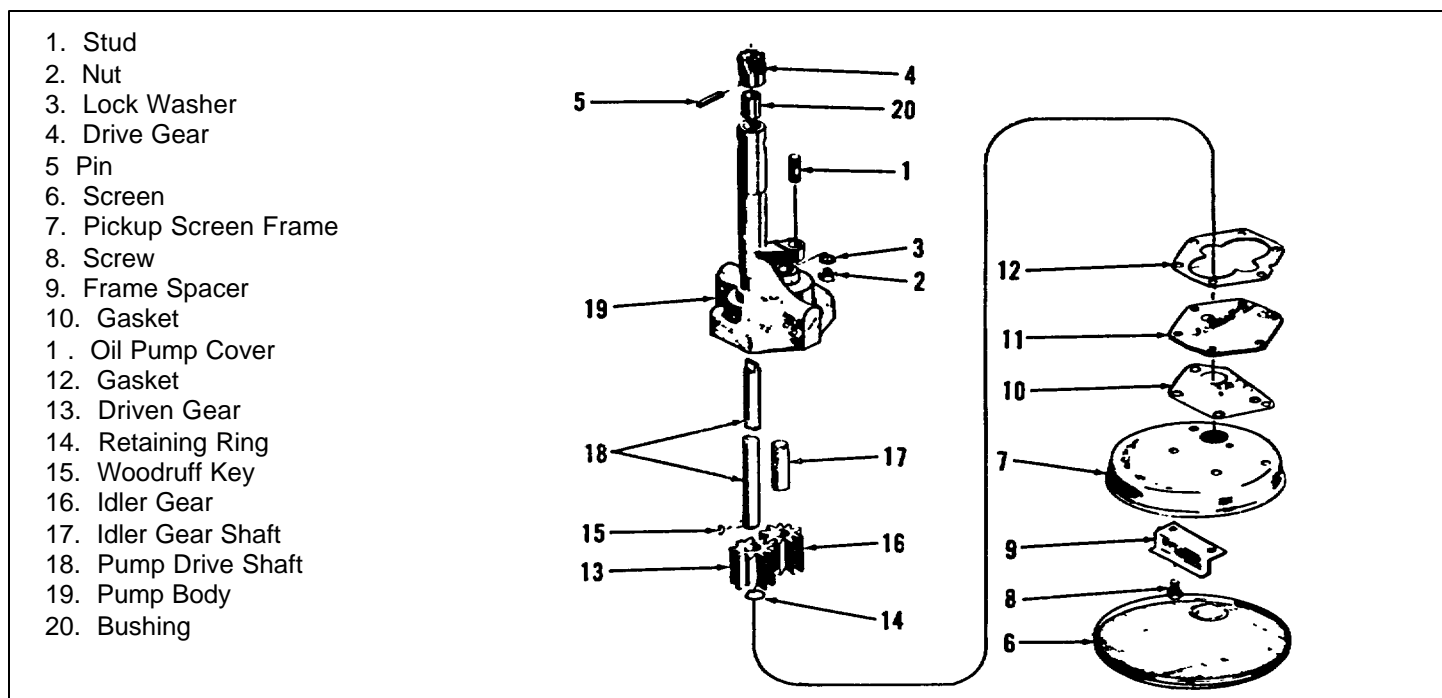


Figure 4-26. Engine Oil Pump Assembly, Exploded View

#### 4-95. DISASSEMBLY.

1. Remove screen (6, figure 4-26), screw (8), frame (7), spacer (9), pump cover (11), gaskets (10 and 12), retaining ring (14), gears (13 and 16), key (15) and stub shaft (17).

2. Drive out pin (5) and remove gear (4), bushing (20) and drive shaft (18).

#### 4-96. PISTONS AND CONNECTING RODS.

#### 4-97. REMOVAL

1. Ream top ridge from cylinder bores as shown in figure 4-27 if pistons are to be removed.

2. Remove cotter pins (19, figure 4-28) and nuts (22) from connecting rod. Remove connecting rod cap (20) and bearing inserts (24). Push connecting rod and piston assembly out through top of cylinder and

temporarily reinstall bearing cap in original position on rod. Repeat this procedure for each connecting rod.

#### NOTE

Tag piston with cylinder number to insure returning piston to correct cylinder.

#### 4-98. DISASSEMBLY.

1. If piston rings (12, 13, 14 and 15, figure 4-28) are not to be reused, remove them from the piston (16) by breaking them off. Remove retaining rings (17) from each piston, push out pin (18) and separate piston from rod (20).

2. If piston pin bearings (23) are to be replaced, press out old bearing with new one, thus installing new bearing at the same time, see paragraph 6-22.

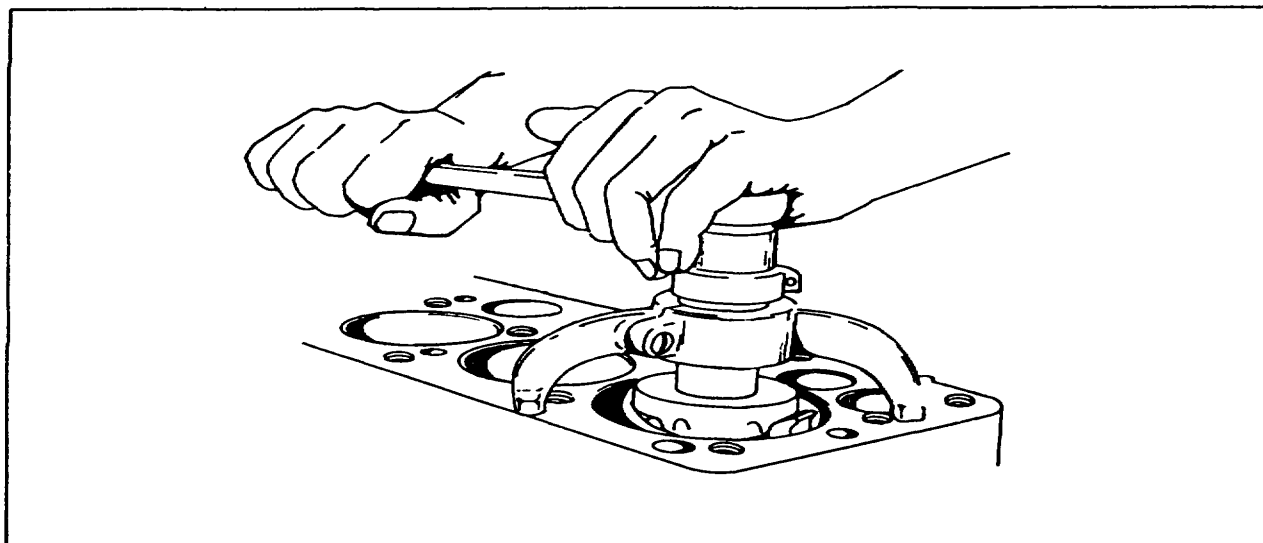


Figure 4-27. Removing Cylinder Top Ridge With a Ridge Reamer

#### 4-99. CAMSHAFT REMOVAL.

##### NOTE

Before removing camshaft, check camshaft to camshaft bearing clearance. Use 1/4 inch wide strips of feeler gauge stock. Hone feeler stock edges to remove burrs which would give a false reading. See Section VII for wear limits.

1. Remove nut (10, figure 4-23) and governor race. Remove gear (9) with a gear puller; then remove key (11).
2. Remove two screws (13), washers (14), and thrust plate (12); then withdraw camshaft (19) from block.
3. If camshaft bearings (15, 16, 17 and 18) are to be replaced, drive them out of bores in the block with a suitable driver.

#### 4-100. FLYWHEEL RING GEAR AND FLYWHEEL HOUSING.

##### 4-101. REMOVAL

1. Remove nuts (9, figure 4-28) and lock washers (10) that secure flywheel (7) to engine crankshaft (37).
2. Mark flywheel (7) to crankshaft (37) relationship for reinstallation, and remove flywheel from crankshaft by use of jackscrews.

3. Remove cap screws (49 and 50, figure 4-22) and lock washers (51) that secure flywheel housing (47) to engine block (62).

##### NOTE

Unless suitable rebuild stand is used, do not remove flywheel housing unless the block is properly supported.

#### 4-102. DISASSEMBLY.

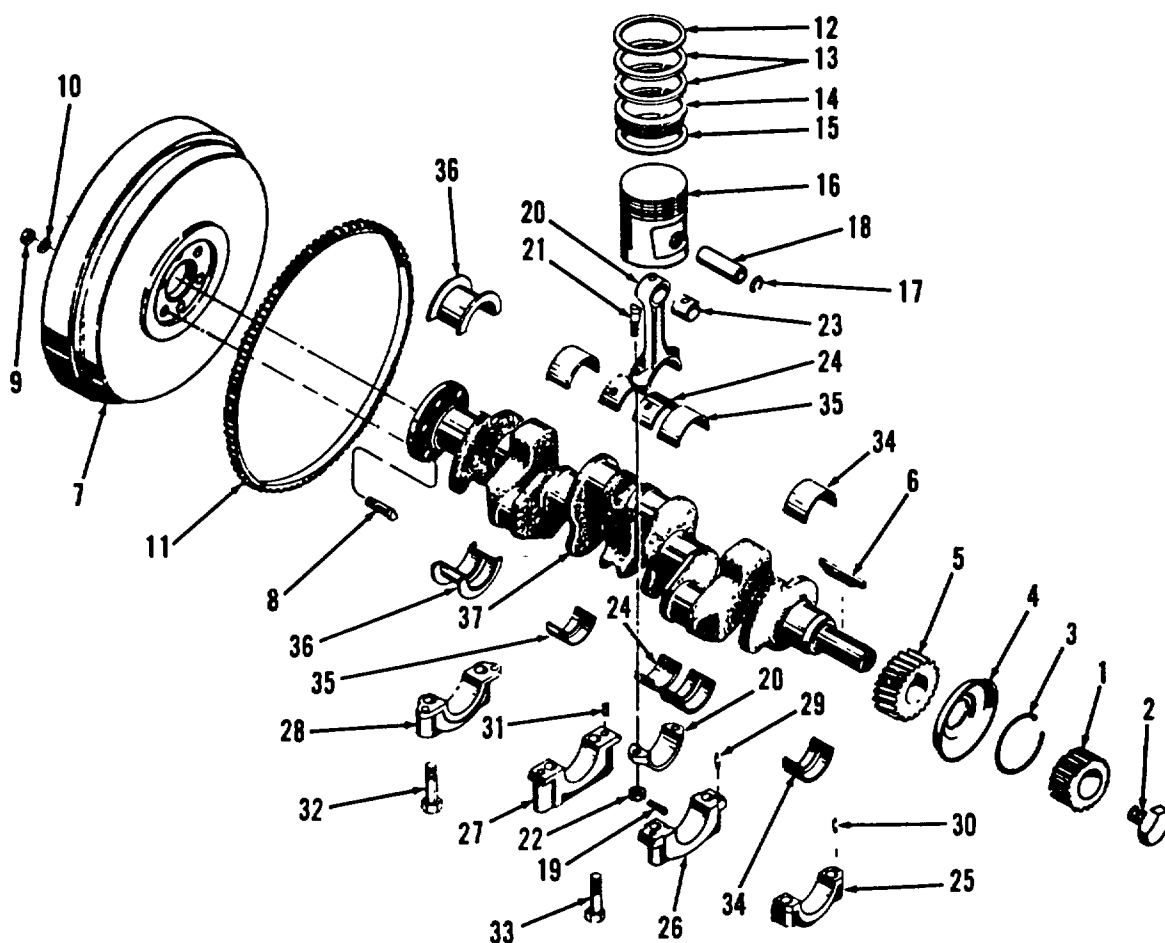
##### NOTE

Do not remove flywheel ring gear (11, figure 4-28) unless teeth are badly chipped or missing.

1. Remove flywheel ring gear (11) by drilling through ring only and chisel only as necessary to crack gear.

#### 4-103. CRANKSHAFT REMOVAL.

1. Remove retaining ring (3, figure 4-28) retaining hydraulic pump drive coupling gear (1). Pull gear from drive sleeve.
2. Remove screw (2) retaining crankshaft drive coupling gear (1) and drive sleeve. Remove gear and oil slinger (4).
3. With gear puller, remove gear (5) and key (6).



1. Hydraulic Pump Coupling Gear
2. Screw
3. Retaining Ring
4. Oil Slinger
5. Crankshaft Gear
6. Woodruff Key
7. Flywheel
8. Screw
9. Nut
10. Lock Washer
11. Flywheel Ring Gear
12. Top Compression Piston Ring
13. Second and Third Compression Piston Ring

14. Expander Piston Ring
15. Piston Ring
16. Piston
17. Retaining Ring
18. Piston Pin
19. Cotter Pin
20. Connecting Rod
21. Bolt
22. Nut
23. Connecting Rod Bearing
24. Connecting Rod Cap Bearing
25. Crankshaft Front Bearing Cap
26. Crankshaft Intermediate Front Bearing Cap

27. Crankshaft Intermediate Rear Bearing Cap
28. Crankshaft Rear Bearing Cap
29. Dowel
30. Dowel
31. Ring Dowel
32. Screw
33. Screw
34. Crankshaft Front Bearing
35. Crankshaft Intermediate Bearings
36. Crankshaft Rear Bearing
37. Crankshaft

Figure 4-28. Engine Crankshaft and Piston Group, Exploded View

4. With block upside down on a clean surface, remove screws (32 and 33) and remove main bearing caps (25, 26, 27 and 28). Remove main bearing inserts (34, 35 and 36) from caps, lift out shaft (37) and remove upper halves of main bearing inserts.

**NOTE**

**Tag main bearing inserts to insure returning to proper position if bearing inserts are to be reused.**

**4-104. EXHAUST SYSTEM REMOVAL.**

**NOTE**

**The muffler is nested within counterweight. See TM 10-3930-623-12 for removal and installation of overhead guard and counterweight.**

1. Remove clamp (8, figure 4-29) and flexible pipe (7) located between manifold elbow (9) and exhaust pipe (3).
2. Remove nut (10), washer (11), exhaust manifold elbow (9) and gasket (12) from exhaust manifold.
3. Remove screws (4), lockwasher (5), and flat washer (6) attaching the exhaust pipe (3) to truck frame.
4. Remove muffler (1) and pipe (3). Remove clamp (2) and tube from muffler.

**4-105. Deleted.**

**4-106. Deleted.**

**4-107. Deleted.**

**4-108. STEERING CONTROL SYSTEM.**

The steering control system shown in figure 4-30 is not subject to complete periodic overhaul. The following instructions are for removal of component units as necessary.

**4-109. STEERING COLUMN.**

**4-110. REMOVAL**

1. Remove floor plate, see paragraph 4-19.

2. Loosen capscrew (2, figure 4-32) securing steering column flexible coupling (6).

3. Disconnect horn button lead at suitable point.

4. Support direction control lever by wiring to overhead guard. Remove capscrews and lockwashers securing lever bracket and remove from steering column.

5. Remove steering column bracket clamp (17, figure 4-31) and remove steering column (22).

**4-111. INSTALLATION.**

1. Assemble steering column flexible coupling (6, figure 4-32) to splined end of the steering gear. Tighten clamp capscrew (2).

2. Holding steering column (22, figure 4-31) in place, assemble bracket clamp (17) with previously removed attaching parts.

3. Assemble direction control lever to steering column. Reconnect horn wire lead.

4. Replace floor plate, see paragraph 4-20.

**4-112. POWER STEERING GEAR.**

**4-113. REMOVAL**

1. Remove steering column, see paragraph 4-113.

2. Carefully remove power steering system pressure and return lines at steering gear. Plug or otherwise cover ends of lines and ports of steering gear to prevent entrance of dirt.

3. Remove nut securing drag link ball joint to steering lever (26, figure 4-32); and, with suitable tool, press ball stud from lever. The ball stud is tapered, thereby requiring a tool to facilitate separation.

4. Remove capscrews (23 and 24, figure 4-31) and lockwashers (25) attaching steering gear to chassis. Remove gear to clean area.

**4-114. DISASSEMBLY.** Complete disassembly of steering gear at one time is not an overhaul operation. The following instructions present complete information necessary to correct any malfunction of the gear. Before beginning repairs, diagnose the probable cause of malfunction by referring to the troubleshooting chart for the steering gear (figure 7-11) at the end of the steering gear repair instructions. Limit disassembly to necessary operations.



1. Muffler
2. Exhaust Pipe Clamp
3. Exhaust Pipe
4. Screw
5. Lock Washer
6. Flat Washer
7. Exhaust Hose
8. Exhaust Pipe Clamp
9. Exhaust Elbow
10. Nut
11. Lock Washer
12. Exhaust Pipe Gasket
13. Radiator Hose
14. Radiator Hose
15. Hose Clamp
16. Screw
17. Lock Washer
18. Flat Washer
19. Drain Cock
20. Cooler Hose Adapter
21. Pipe Plug
22. Radiator
23. Radiator Cap
24. Wing Nut
25. Rod
26. Dirt Shield
27. Air Cleaner Element
28. Bracket
29. Nut
30. Lock Washer
31. Flat Washer
32. Air Cleaner Hose
33. Hose Clamp
34. 011 Filter Hose
35. Screw
36. Lock Washer
37. 011 Filter Elbow
38. Nut
39. Oil Pressure Transmitter
40. Tee
41. Tee Adapter
42. Filter Bracket
43. Old Filter Base
44. 011 Filter Element
45. Fuel Tank Cap and Strainer
46. Lock Nut
47. Washer
48. Gas Line
49. Filter Bail
50. Filter Nut
51. Fuel Filter Bowl
52. Bowl Gasket
53. Fuel Filter Element Disks
54. Element Stem
55. Washer
56. Fuel Filter Head
57. Pipe Nipple
58. Nut
59. Lock Washer
60. Flat Washer
61. Shutoff Cock
62. Pipe Plug
63. Fuel Tank Sending Unit
64. Screw
65. Lock Washer
66. Gasket
67. Fuel Tank
68. Gasoline Engine

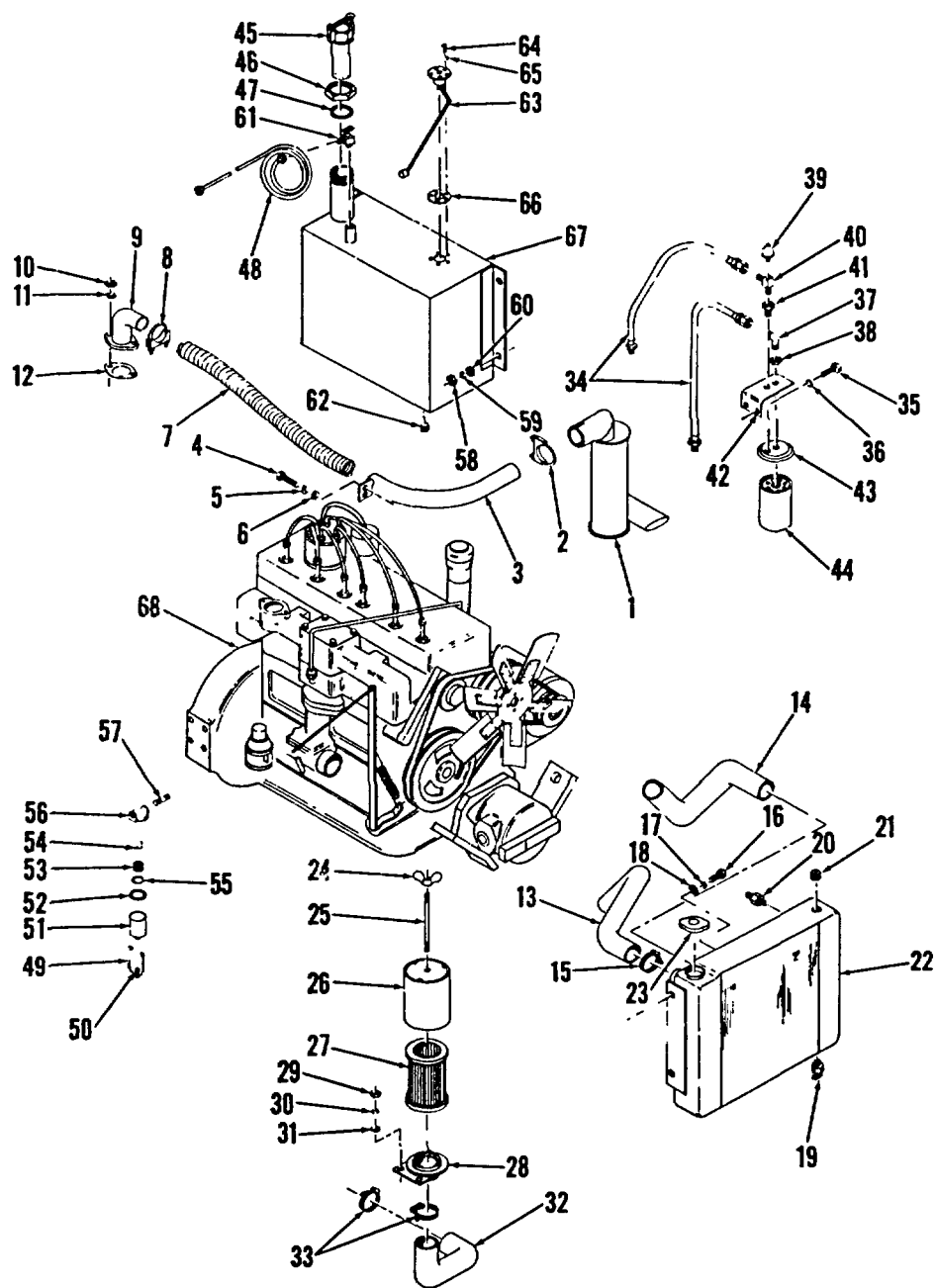


Figure 4-29. Fuel, Exhaust and Engine Coolant Systems, Exploded View

This page has been deleted.

- |                           |                            |
|---------------------------|----------------------------|
| 1. Hose Clamp             | 14. Tie Rod End            |
| 2. Screw                  | 15. Tie Rod Clamp          |
| 3. Lock Washer            | 16. Drag Link              |
| 4. Return Hose Assembly   | 17. Steering Column Clamp  |
| 5. Hose Clamp             | 18. Screw                  |
| 6. Pressure Tube Assembly | 19. Nut                    |
| 7. Pipe Plug              | 20. Lock Washer            |
| 8. PipeTee                | 21. Flat Washer            |
| 9. Hose End               | 22. Steering Gear Assembly |
| 10. Pressure Hose         | 23. Screw                  |
| 11. Hose Adapter          | 24. Screw                  |
| 12. Cotter Pin            | 25. Lock Washer            |
| 13. Lubrication Fitting   |                            |

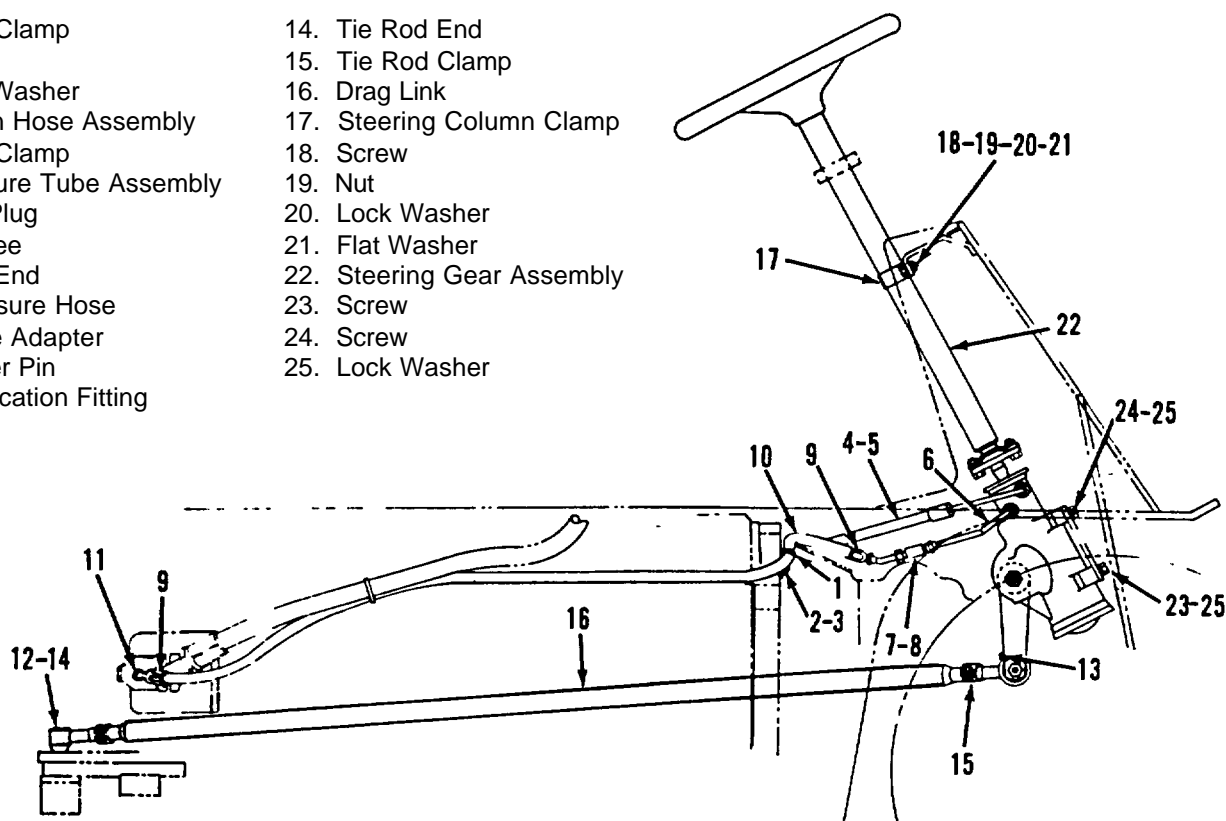


Figure 4-31. Power Steering Arrangement

## Key to Figure 4-32

- |                               |                      |                      |                               |
|-------------------------------|----------------------|----------------------|-------------------------------|
| 1. Column Grommet             | 23. Horn Brush       | 46. End Plug         | 69. Pin                       |
| 2. Screw                      | 24. Brush Spring     | 47. Dust Seal        | 70. Spring                    |
| 3. Lock Washer                | 25. Plate            | 48. Oil Seal         | 71. Perform Packing           |
| 4. Spring                     | 26. Steering Lever   | 49. Nut              | 72. Valve Spool               |
| 5. Spring Seat                | 27. Nut              | 50. Retaining Ring   | 73. Back-up Ring              |
| 6. Steering Gear Flange       | 28. Screw            | 51. Needle Bearing   | 74. Perform Packing           |
| 7. Steering Column and Flange | 29. Sleeve Bearing   | 52. Adjuster Plug    | 75. Valve Body                |
| 8. Seal Retainer              | 30. Side Cover       | 53. Thrust Race      | 76. Stub Shaft                |
| 9. Seal                       | 31. Perform Packing  | 54. Thrust Bearing   | 77. Perform Packing           |
| 10. Wire Grommet              | 32. Thrust Washer    | 55. Thrust Race      | 78. Sleeve                    |
| 11. Lower Bearing Assembly    | 33. Lash Adjuster    | 56. Spacer           | 79. Torsion Bar and Valve Cap |
| 12. Upper Bearing Assembly    | 34. Nut              | 57. Bearing Retainer | 80. Perform Packing           |
| 13. Column Jacket             | 35. Thrust Washer    | 58. Perform Packing  | 81. Ball Bearing              |
| 14. Nut                       | 36. Spring           | 59. Worm Assembly    | 82. Needle Bearing            |
| 15. Lock Washer               | 37. Sector Gearshaft | 60. Piston Ring      | 83. Check Valve Poppet        |
| 16. Steering Wheel            | 38. Retainer         | 61. Perform Packing  | 84. Spring                    |
| 17. Cover                     | 39. Retaining Ring   | 62. Clamp            | 85. Fitting Connector         |
| 18. Horn Button               | 40. Back-up Washer   | 63. Screw            | 86. Fitting Connector         |
| 19. Horn Contact              | 41. Oil Seal         | 64. Ball Guide       | 87. Gear Housing              |
| 20. Spring                    | 42. Oil Seal         | 65. Ball Nut         |                               |
| 21. Cap Contact               | 43. Housing End Plug | 66. Ball Set         |                               |
| 22. Brush Sleeve              | 44. Retaining Ring   | 67. Thrust Race      |                               |
|                               | 45. Perform Packing  | 68. Thrust Bearing   |                               |

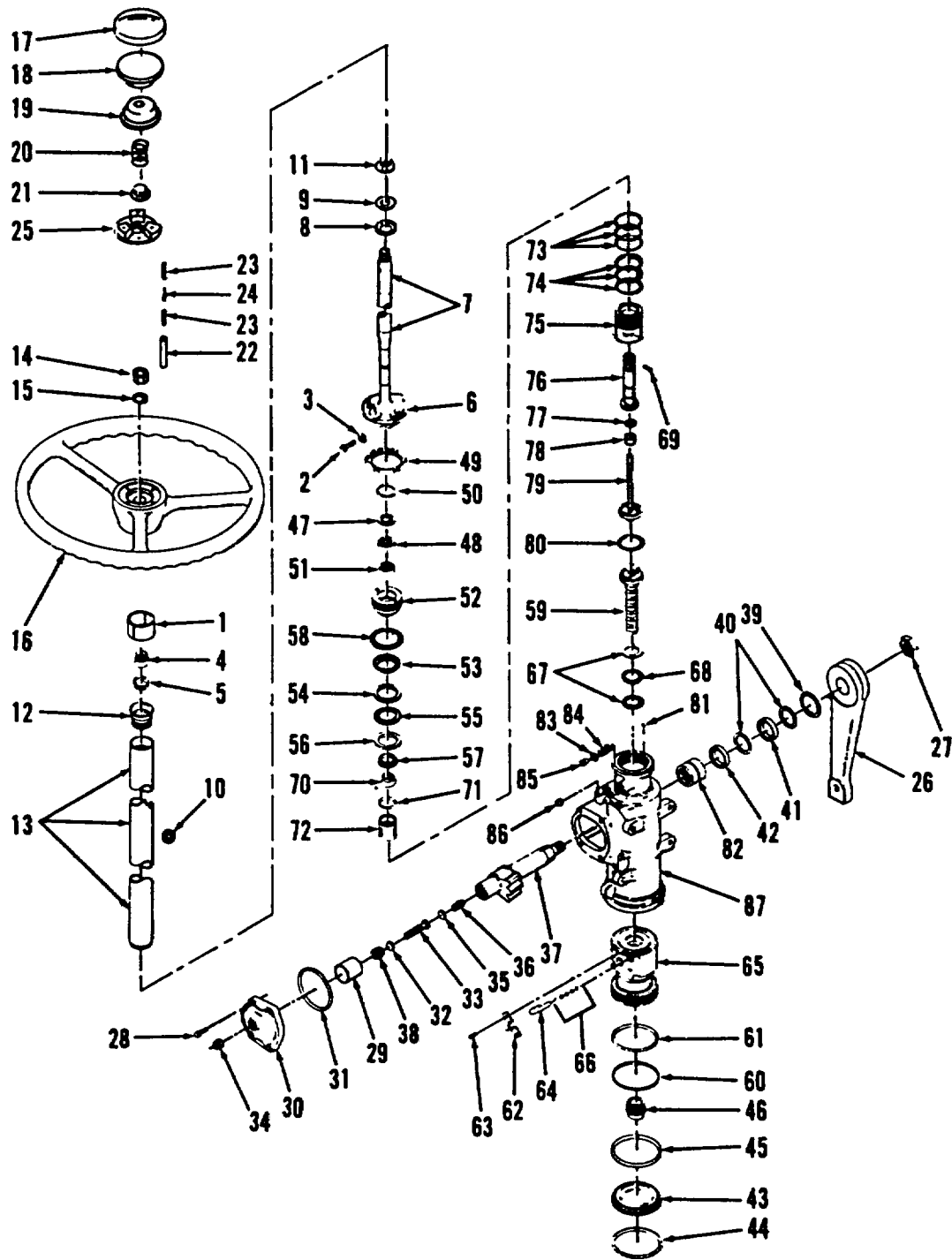


Figure 4-32. Power Steering Gear Assembly, Exploded View

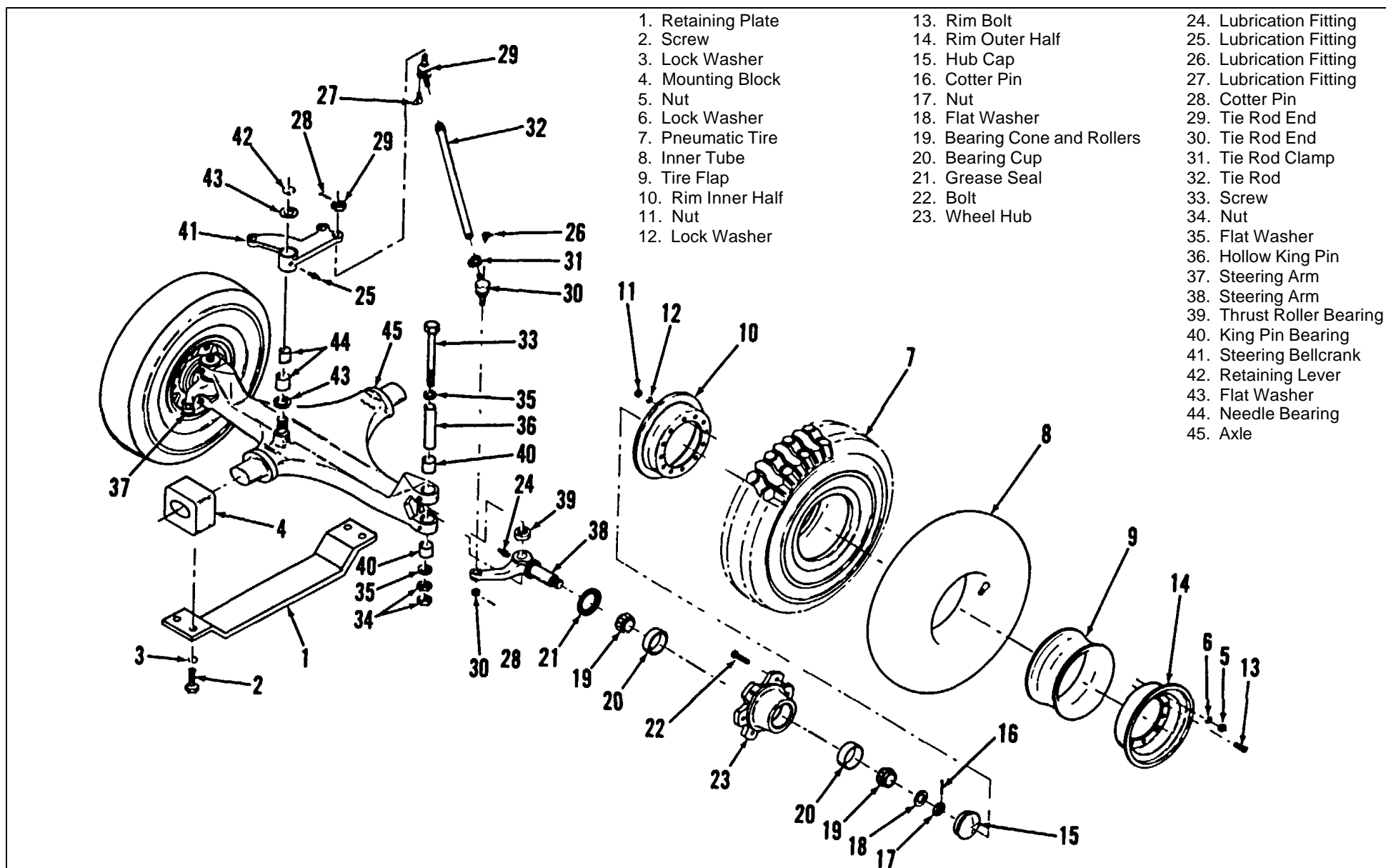


Figure 4-33. Rear Steering Axle Assembly, Exploded View

**4-115. DRAG LINK.**

**4-116. REMOVAL.** Remove floor plate (paragraph 4-19) and remove nut securing drag link (16, figure 4-31) to the steering lever (26, figure 4-32). Remove nut securing drag link (16, figure 4-31) to steering axle bellcrank (41, figure 4-33). Press ball joint studs from respective lever and bellcrank and remove drag link.

**4-117. DISASSEMBLY.****NOTE**

Measure and record distance between ball joints so, when reassembled, steering will not be affected when reinstalled.

1. Loosen clamp (15, figure 4-31) at each end of drag link (16).

**NOTE**

One ball joint will have right hand threads and the other left hand threads to provide necessary adjustment when installed.

2. Remove tie rod end ball joint (14) from drag link (16).

**4-118. STEERING AXLE.****4-119. REMOVAL NOTE****NOTE**

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

1. Disconnect drag link from steering bellcrank (paragraph 4-116).
2. Remove capscrews (2, figure 4-33) lockwashers (3) and remove axle insulator block bracket (1).

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

**4-120. DISASSEMBLY.****NOTE**

Do not remove bearing cups (20, figure 4-33) from the wheel (23) or bushing (40) from the axle (45) unless inspection indicates need for replacement.

1. Pry hub cap (15) from wheel (23). Remove cotter pin (16), nut (17) and washer (18) from axle spindle (37 and 38).
2. Withdraw wheel (23) from spindle using care not to damage seal (21).
3. Remove four cotter pins and nuts securing tie rod ends (29-30). Using suitable tool, separate taper ball studs from axle spindles and steering bellcrank (41).
4. Remove retaining ring (42) and washer (43) from axle beam (45). Lift bellcrank (41) front pivot post.
5. Remove double nuts (34), washers (35) and capscrew (33) from king pin (36). Press king pin from spindle (37 and 38).
6. Remove spindle (37 and 38) and thrust washer (39) from axle beam (45).
7. Disassemble tie rods (32) in a similar manner as the drag link. See paragraph 4-117.
8. Remove insulating mounting blocks (4) from the axle beam (45).

**NOTE**

The insulating block bore is off center for multiple usage. Mark top side to insure correct reassembly.

## SECTION V

## CLEANING

## 5-1. CLEANING MATERIALS.

**5-2.** A list of materials used during cleaning is presented in figure 5-1. Some of the cleaning materials listed in figure 5-1 are related only to the painting procedures given in Section VI.

**5-3.** In addition to the materials listed in figure 5-1, standard cleaning agents such as clean, lint-free cloths, hot and cold fresh water, dry compressed air, soap chips, ammonia, bicarbonate of soda, scrapers, wire brushes and spoon files are also required.

Cleaning Agent or Protective Coating	Specification or Description
Alcohol	MIL-A-6091
Ammonia, household grade	Commercial
Automotive and artillery grease	MIL-G-10924
Carbon removal compound	MIL-C-25107
Cleaning compound	USAF Specification 20015-E
Corrosion preventive oil	MIL-C-4339
Dry cleaning solvent	Fed. Spec P-S-661
Engine cleaning compound	MIL-C-5546
Paint thinner	Fed. Spec TT-T-291
Paint and varnish remover	MIL-R-7751
Sandpaper, 000 grade	Commercial
Sodium bicarbonate (baking soda)	Commercial
Steel wool, grade 00 or 100 or 000	Fed. Spec FF-W-556
Abrasive cloth, aluminum oxide, grade 3/0	Commercial

Figure 5-1. Cleaning Agents

## 5-4. CLEANING PRECAUTIONS

**5-5.** Most cleaning materials are inflammable, volatile, or, in some cases, toxic. Make certain that areas where cleaning is being conducted are clean and well ventilated and that proper type fire extinguishers are conveniently located.

## WARNING

**Do not use cleaning materials in a confined area or near a fire or open flame.**

**5-6.** Do not permit petroleum products to come into contact with rubber components.

## WARNING

**Always wear safety glasses when using compressed air for cleaning. Do not direct compressed air stream in direction of other personnel. Do not permit compressed air to be directed at any part of the body; serious injury may result.**

## 5-7. GENERAL INSTRUCTIONS.

**5-8.** Clean all parts before attempting to inspect them for wear or damage. Any dirt, grease, corrosion or foreign material may affect tolerance or clearances. Inspect parts for wear or damage simultaneously with the cleaning operation or as soon thereafter as possible.

**5-9.** Coat all unpainted metal parts which are subject to rust with corrosion preventive oil, Military Specification MIL-C-4339 (USAF) immediately after cleaning and drying. Avoid handling machined or polished surfaces of clean metal parts with bare hands. Keep cleaned parts in a covered container until needed for inspection or reassembly.

**5-10. TRUCK EXTERIOR.** Steam clean truck frame, front and rear axles, uprights assembly, wheels and tires to remove road dirt and old lubricant.

**5-11. GASKET RESIDUE.** Remove gasket residue by scraping. After surfaces have been scraped, saturate with dry cleaning solvent, Federal Specification P-S-661. When remaining residue has softened sufficiently, wipe clean with a clean, lint-free cloth.

**5-12. BEARINGS, CUPS, AND CONES.** Clean all unsealed bearings, cups, and cones by immersing in dry cleaning solvent, Federal Specification P-S-661. While bearing is

immersed, rotate and agitate slowly until all grease and dirt has been removed. Dry bearings with clean, dry compressed air and lubricate.

#### **CAUTION**

**Do not spin unlubricated bearings with compressed air. Avoid touching cleaned bearings with bare hands.**

**5-18. Deleted.**

**5-19. Deleted.**

**5-13.** Do not immerse sealed bearings in solvent. Sealed bearings are factory lubricated and cannot be relubricated. Wipe sealed bearings clean with a clean, dry, lint-free cloth.

**5-20. Deleted.**

**5-14. UNPAINTED METAL PARTS.** Clean all unpainted mechanical parts made of metal by immersing in dry cleaning solvent, Federal Specification P-S-661. Use a wire brush or scraper to remove caked deposits of grease and dirt. Blow out drilled passages such as oil holes in connecting rods, crankshaft, and camshaft with clean, dry compressed air. Unless specifically prohibited, ream drilled passages carefully with a stiff wire. Rinse cleaned parts with hot, fresh water and dry thoroughly.

**5-21. Deleted.**

**5-22. Deleted.**

**5-15. ELECTRICAL COMPONENTS.** Clean electrical terminals and contacts (except ignition components and starting motor commutator) with a cloth moistened in alcohol, Military Specification MIL-A-6091 (ASG). If terminals are corroded, burned, or covered with insulating material, dress carefully with a wire brush or fine cut file until metal is bright. Wipe filings away with cloth.

**5-23. Deleted.**

**5-24. Deleted.**

#### **NOTE**

**Do not use solvents, sandpaper, emery cloth or other materials to clean contacts and terminals unless recommended in the detailed instructions for the specific equipment.**

**5-25. Deleted.**

**5-16.** Clean lamps, lens and reflectors by washing in a mild soap and water solution. Rinse thoroughly with clean, fresh water and dry with a clean, lint-free cloth.

**5-17. CARBON DEPOSITS.** Remove carbon deposits by applying carbon removal compound, Military Specification MIL-C-25107, to affected parts. Wipe or scrape carbon deposits from part after carbon has softened. Wash part in a mild soap and water solution and rinse with clean, fresh water. Wipe dry with a clean, lint-free cloth.



5-26. Deleted.

5-29. Deleted.

5-27. Deleted.

5-28. Deleted.

## SECTION VI

## REPAIR AND REASSEMBLY

**6-1. SCOPE OF SECTION.**

**6-2.** This section contains instructions for repairing and reassembling major components and accessories of the truck. Installation instructions for engine accessories are included in the engine assembly instructions. Installation of major components will be found in Section VII. The need for repair or replacement of parts is determined by performing the inspections and checking the dimensions as specified in Section VII. If the serviceability of a worn or damaged part cannot be restored by the repair procedures specified in the following test, install a new

part. The general instructions are applicable to each assembly being repaired and/or reassembled unless otherwise specified in the text. Where repair instructions for a part or unit are not covered in this section, the part or unit is not subject to rework and defective parts must be replaced with new ones. Where related to reassembly, checks for clearances, backlash and lubrication are included in the text in this section. Refer to figure 6-1 to locate repair, reassembly or inspection data.

ITEM	INSPECTION DATA	REPAIR OR REASSEMBLY
Carburetor	7-18	6-49 50 52
Fuel Pump	7-20	
Water Pump	7-23	
Starter Motor	7-24 to 27	6-47 to 49
Distributor	7-29 and 30	6-45 to 46
Gasoline Engine	7-37 to 45	6-14 to 45
Transmission	7-46	6-52 to 60
Drive Axle	7-47	6-60 to 65
Master Cylinder	7-48	6-93 to 95
Wheel Cylinder	7-49	6-96 to 98
Brake Pedal	7-50	
Hand Brake	7-51	6-99 to 100
Steering Axle	7-52	
Steering Gear	7-53	6-65 to 115
Hydraulic Pump	7-56 and 57	6-111 to 113
Hoist Cylinder	7-58 and 59	6- 102 to 104
Tilt Cylinder	7-58 and 59	6-107 to 109
Control Valve	7-60 and 91	6-109 to 111
Uprights, Carriage and Fork Assembly	7-61 to 65	6-104 to 107

Figure 6-1. Table of Inspection and Repair Data

### 6-3. GENERAL INSTRUCTIONS.

**6-4. LUBRICATION.** Before installing or assembling internal metal parts, coat each part with a thin film of OE-10 engine oil, except where such application would impair operation of the assembled unit. Such lubrication provides easier installation, reduces the possibility of damage during installation, and assures immediate lubrication of the assembly when the equipment is first started.

#### CAUTION

**Never apply engine oil to rubber parts, electrical contacts, or internal parts of the hydraulic brake system.**

**6-5. GASKET REPLACEMENT.** Use new gaskets throughout when reassembling. Soak cork gaskets in OE-10 engine oil fifteen minutes before installing. Apply approved gasket cement to one side of paper gaskets, when required.

**6-6. INSTALLATION OF BEARINGS.** Exercise extreme care when installing or removing ball, roller or needle bearings. Failure to comply with installation and removal procedures listed below could result in damaged bearings and consequent malfunctioning of an assembled unit.

1. Make sure bearings, bearing seats, and tools are thoroughly cleaned before attempting to install bearings.

2. Apply a thin film of lubricating oil OE-10, engine oil, to contact surfaces of bearing and bearing seats before installation.

3. Carefully align bearing with bearing seat before installing to avoid cocked or distorted bearings.

4. Carefully press bearings into seats with an arbor press or appropriate removing and replacing tool. Always apply pressure to the race which determines the fit when installing bearings.

5. If bearing must be tapped into its seat, use a rawhide hammer or cushion the bearing with a block of wood to prevent damage.

**6-7. REPAIRING DAMAGED THREADS.** If slight thread damage is found on any threaded part, repair the threads with a tap or die of the correct size, as follows:

1. Correct internal or tapped thread damage by carefully turning the correct size tap into existing threads. Carefully remove tap and inspect threads again to see if thread damage is still obvious. If so, the damage is too extensive to repair; discard the part.

2. For damage to external threads, select a die of correct size and carefully turn die onto existing threads. Remove die and inspect threads. If damage is still obvious; discard part.

### 6-8. PAINTING.

**6-9.** Overhaul procedures include painting as a necessary step in the completion of the procedure. Before the paint is applied, prepare the surface to be painted in accordance with paragraph 6-12. Synthetic paint primer, Federal Specification TT-P-636, and Class B, yellow color paint, number 1310, Federal Specification TT-C-595, are used on the sheetmetal and uprights.

**6-10. CLEANING MATERIALS.** Use the appropriate cleaning materials listed in figure 5-1 prior to applying paint.

**6-11. SOLVENT HANDLING.** Solvents used for removing paint are generally toxic and volatile. Avoid inhaling the vapor and take precautions to keep such compounds from coming in contact with unprotected areas of the face or body. Confine the use of such compounds to a well-ventilated room, or apply out-of-doors to prevent headaches or nausea.

#### NOTE

**Never use paint removing solvents from damaged or leaking containers or solvents that have been exposed to the air for long periods of time. Do not permit paint removing solvent to come in contact with bearings, rubber, insulated wires, or plastic materials as the solvent will quickly deteriorate such materials.**

**6-12. SURFACE PREPARATION.** Painting previously painted surfaces necessitates the partial or complete removal of the old paint before a satisfactory covering can be achieved.

1. Use paint removing solvents, abrasives, scrapers or wire brushes, as necessary, to remove old paint, dirt, and rust from the area to be painted. Wash the cleaned area with a paint thinner to remove wax deposits or abrasive particles.

2. If paint removal is not necessary, a thorough washing and degreasing job must be accomplished before paint can be applied. Wash surfaces with soap and water, rinse with paint thinner, and dry with compressed air.

3. In the case of new metal surfaces, wash with paint thinner and use abrasive blasting to remove remaining dirt, oil, casting sand, mill scale, slag, or other foreign material. Wash with paint thinner again after blasting.

4. Apply paint and varnish remover with a good bristle brush, stroking in one direction only. Brushing out causes rapid evaporation of the volatile solvents, thus decreasing the effectiveness of the remover.

5. Allow the remover to remain on the painted surface until the old paint begins to wrinkle and soften. After paint softens scrape or brush off.

6. Wash all traces of paint remover wax deposits from surface with paint thinner.

7. Sandblast, wire brush, or sandpaper remaining paint or rust from the surface being worked. Rinse with paint thinner.

**6-13. PAINT APPLICATION.** Apply paint in conformance with good commercial practices and the applicable requirements of Military Specification MIL-T-704.

#### 6-14. ENGINE REPAIR AND ASSEMBLY.

#### 6-15. CRANKSHAFT REPAIR.

1. If crankshaft journals do not conform to the specifications in figure 7-1, or are badly scored, grind journal to next standard undersize; and, use undersize bearings.

##### NOTE

**Check the crankshaft for straightness within 0.002 inch TIR before grinding. Maximum grinding is limited to 0.020 inch less than diameter shown in figure 7-1 for standard crankshaft.**

2. After grinding crankshaft, check crankshaft for required fillet radii as follows:

- a. Connecting rod and all except main rear journal 5/64 to 7/64 inch.
- b. Main rear journal 7/64 to 9/64 inch.

3. Grind new fillet radii if required.

#### 6-16. CRANKSHAFT INSTALLATION.

1. Install one-half of each main bearing insert (34, 35 and 36, figure 4-28) in correct place in block. Oil each insert with OE-30 motor oil.

##### NOTE

**Machined surface in block, into which insert fits, must be wiped thoroughly clean of foreign particles so that bearing heat will be transferred directly to block web.**

2. Lay crankshaft (37) in place in block, install remaining insert halves in correct main bearing caps (25, 26, 27 and 28) and reinstall caps, loosely.

3. Check bearing clearance, see paragraph 6-18.

4. After clearance has been checked, torque main bearing cap screws (32 and 33) to 84-95 foot-pounds.

5. Install crankshaft gear (5) and key (6) on crankshaft.

6. Assemble hydraulic pump drive coupling and gear (1) with retaining ring (3).

7. Install oil slinger (4) and drive coupling on crankshaft with screw (2).

8. Check crankshaft end play for 0.002 to 0.006 inch clearance. See figure 7-1. If clearance is not within specification, replace front main bearing. Flanges on this bearing determine endplay.

**6-17. CRANKSHAFT CLEARANCE.** Check crankshaft clearance as follows after new bearings have been installed.

1. Remove bearing cap and place a piece of 0.002 by 1/2 by 1 inch shim stock in bearing cap (see 20, figure 7-1).

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

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

##### NOTE

**Install and check one bearing cap at a time.**

**6-18. PISTON FIT.** Check each piston without rings for clearance in respective cylinder bores. Check as follows:

##### NOTE

**Piston and cylinder walls must be perfectly clean and dry when fitting pistons. Pistons and block should be at room temperature (68 deg - 70 deg F) when checking.**

1. Insert inverted piston in cylinder with long strip of 1/2 inch wide 0.002 inch feeler stock between the piston and cylinder wall, midway between the piston and cylinder wall, midway between piston pin bosses. Piston pin bosses align with crankshaft.

2. Slide piston into cylinder until skirt is 2 inches below deck.

3. Attach spring scale to feeler stock and pull scale and feeler stock evenly from cylinder. Proper fit requires 5-to-10-pound pull. (See figure 6-2).

**6-19. PISTON RING FIT.** Check piston ring for side clearance in piston groove and end gap in cylinder as shown in figure 7-1. If not within specifications, increase end gap with a piston ring file. If groove clearance is below specifications, rub ring on a flat piece of fine emery cloth until clearance is obtained.

##### NOTE

**Check piston for unremoved carbon buildup in grooves before reducing ring thickness.**

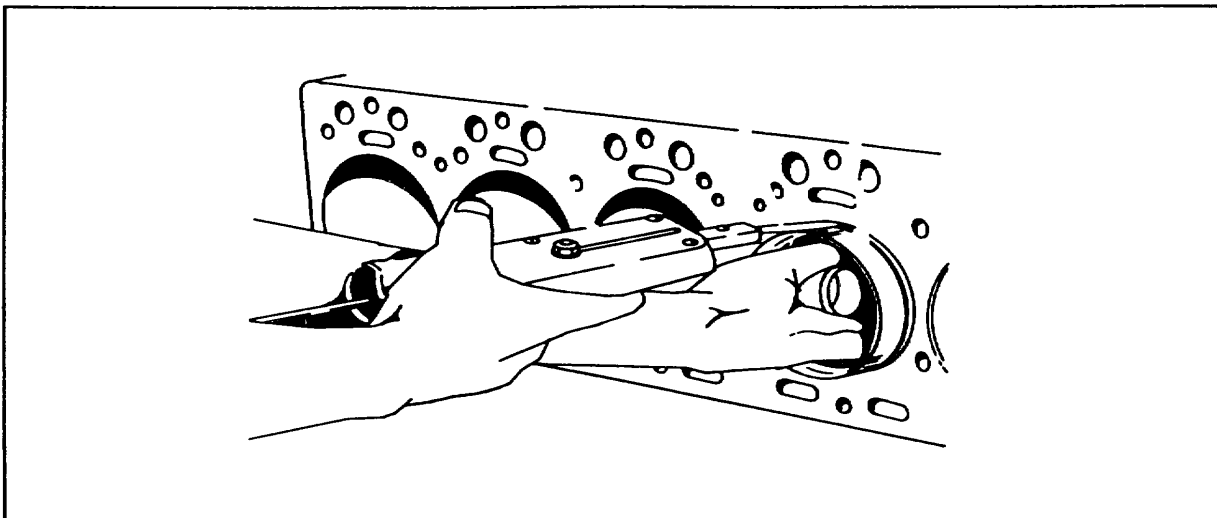


Figure 6-2. Checking Piston to Cylinder Fit

**6-20. CONNECTING ROD BEARING.** Check fit of piston pin (18, figure 4-28) in connecting rod bearing (23). See figure 7-1 for specifications. If clearance is excessive, using an arbor press and suitable support press out worn bearing and press in new one in one operation using the new bearing as a driver (figure 6-3). Bearing must be honed on a honing machine to obtain proper fit.

**NOTE**

**The piston pin must be a tight fit to the piston and have clearance in the connecting rod.**

**6-21. CONNECTING ROD REASSEMBLY.** To facilitate assembly of piston and piston pin, piston must be heated and assembled as follows:

1. Using an oven or hot oil bath (160 deg F) heat piston (16, figure 4-28) for 20 minutes.
2. Quickly assemble piston and mating connecting rod (20).

**NOTE**

**Each piston and connecting rod must be returned to the cylinder from which it was removed. In addition both must face in same direction as indicated by the word "front" on pieces or as marked when removed.**

3. Piston pin (18) can be lightly tapped to pass it through piston and rod.

4. Connecting rod piston pin to crankshaft bore must be parallel. Check for maximum of 0.002 inch twist or out of squareness spread over 4.0 inches. Connecting rod may be bent or twisted to meet specifications.

**6-22. PISTON RING INSTALLATION.**

1. Using piston ring expander tool, install three piece oil control ring (14 and 15, figure 4-28) in lower groove of piston (16). End gaps of steel segment ring should be 90 deg. in each direction from the expander spacer end gap.
2. Install third and second groove compression rings (13) and top compression ring (12).

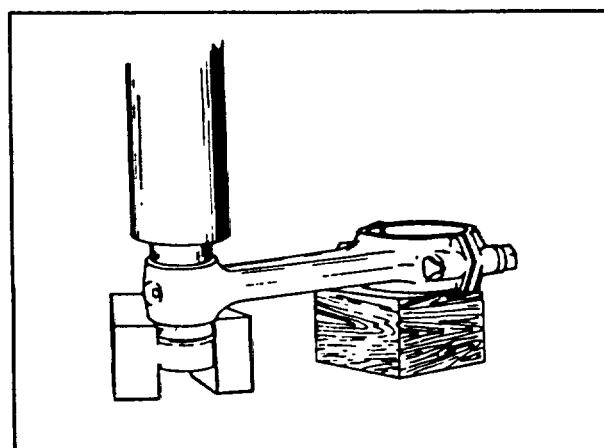


Figure 6-3. Pressing Out Old Piston Pin Bearing With New Bearing

**NOTE**

Some piston rings have a taper face. These rings are clearly marked **TOP** on upper side. Install with this side up.

**6-23. INSTALLING PISTON AND ROD-ASSEMBLIES.**

Soak piston assembly with rings in OE-30 engine oil, drain excess oil, and install assembly in cylinder as follows:

1. Compress rings into ring grooves with a ring compressor. Do not overtighten.

2. Place big end of rod into correct cylinder as indicated by number stamped on rod big end and cap. Cylinders are numbered from 1 to 6, beginning at the timing gear end of the engine. Orient rod big end to crankshaft journal so it will meet properly. Rods are properly oriented when offset side of each rod faces away from the adjacent main bearing, and the numbers stamped on the rod (1 through 6) face the camshaft. Press piston into cylinder with end of hammer handle.

**CAUTION**

**If a rod is installed reversed, the engine will lock and the rod will probably bend on the first attempt to crank the engine.**

3. Lightly oil, then install connecting rod bearing inserts (24, figure 4-28) in connecting rod, position rod on crankshaft secure bearing cap in place. Torque nuts (22) to 40-45 foot pounds, then tighten nuts as necessary to align slots with cotter pin hole in bolts (21) and install new cotter pin (19).

4. Turn crankshaft one revolution to be sure bearings and pistons are not seized before proceeding with reassembly.

**6-24. CAMSHAFT AND CAMSHAFT BEARINGS.**

Install camshaft bearings (15, 16, 17 and 18, figure 4-23), if required, beginning with the flywheel end bearing as follows:

1. Align the oil hole in the bearing with the oil passage in the block which supplies it with lubrication.

2. With a piloted driver, tap each bearing into place.

**6-25. CAMSHAFT INSTALLATION.****NOTE**

When installing camshaft use special care to prevent camshaft bumping against and loosening expansion plug to cause an oil leak.

1. Insert camshaft (19, figure 4-23) into position in block, and install thrust plate (12), washers (14) and screws (13).

**NOTE**

Mate indicator dimple on camshaft gear with those on crankshaft gear to insure correct timing of valves to piston operation.

2. Install key (11) in camshaft keyway. Assemble cam gear (9) to camshaft by driving or pressing it on. At the same time hold the camshaft forward with a suitable bar through the fuel pump opening in the block so there is no possibility of the camshaft bumping the expansion plug at the rear end. This could force it out of position, thus causing an oil leak. Check camshaft end play as shown in figure 7-1, item 11.

3. Install camshaft gear governor drive assembly with balls on camshaft.

**CAUTION**

**Never use camshaft nut to pull gear onto camshaft. This will break threaded end off of a cast iron camshaft and damage threads on a steel camshaft.**

4. Install camshaft nut (10). Torque nut to 85-90 foot pounds.

5. Assemble governor upper race shaft to end of camshaft. Lubricate governor with OE-30 engine oil.

**6-26. VALVE GUIDE REPAIRS.** Press out excessively worn or damaged valve guides with arbor press or suitable driver from cylinder head side (see figure 64). Press new valve guides (4, figure 4-23) into block from top of block. Press until guide is 1-15/32 inch below cylinder block deck.

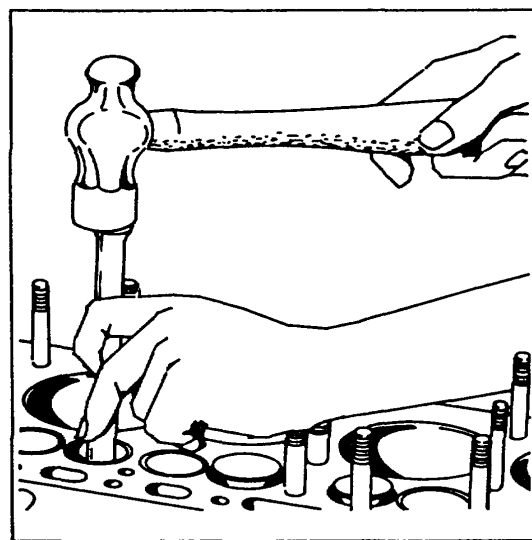


Figure 6-4. Driving Out Valve Guides

**6-27. EXHAUST VALVE INSERT SEATS.** The exhaust valve is mated to a valve seat insert (3, figure 4-23) fitted with an 0.003 to 0.005 inch interference fit to the cylinder block. Replace exhaust valve seats as follows:

1. Use suitable valve seat puller to remove any loose or defective valve seat, (see figure 6-5). Replacement seats are available in 0.010 inch oversize.

**NOTE**

**Always replace valve seat with one 0.010 inch more oversize than that removed.**

2. Use a suitable valve seat counterbore tool to enlarge valve seat bore sufficient to obtain 0.003 to 0.005 inch tight fit (bore less than valve seat outside diameter). Counterbore to full depth.

**NOTE**

**Complete counterbore drilling before starting to reassemble engine to prevent chips from falling into engine. If the engine is not completely disassembled, pack valve chambers with rags to prevent chips from falling into oil pan.**

3. Chill valve seat insert in a container of dry ice for 20 minutes. After chilling, position guide in cleaned counterbore and with suitable driver, tap in position with light hammer. Excessive force may shear sidewall of counterbore. Make sure seat is bottomed before it warms.

**CAUTION**

**Do not touch dry ice with bare hands. It will cause frost-bite due to its extreme low temperature.**

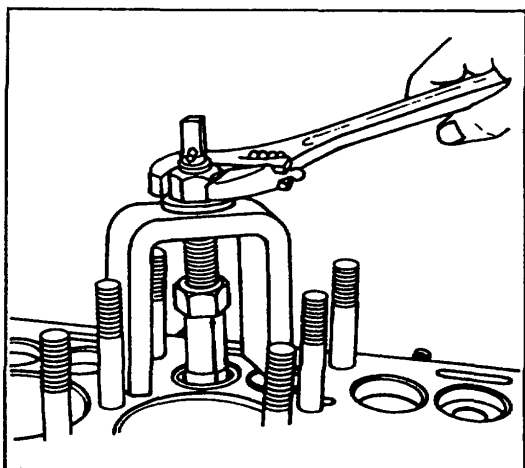


Figure 6-5. Removing Valve Seat Insert With Puller

4. Grind valve seat angle with suitable valve seat grinding tool having a long taper pilot to insure accurate seat to bore. After grinding with pilot still in position, use a dial indicator to check concentricity of valve seat. Runout must not be more than 0.002 inch.

**6-28. INTAKE VALVE SEATS.** Grind intake valve seat in cylinder block the same as the exhaust valve insert seat. See step 4 above.

**NOTE**

**The seat angle for the Continental Model F244, Standardized Military engine is 45 deg for both intake and exhaust valves.**

**6-29. VALVE REPAIRS.** Repairs to valves consists only of refacing the valve face with a suitable valve grinder tool.

1. Grind Continental Model F244, Standardized Military Engine intake and exhaust valves to a 45 deg seat angle.

2. Check that new contact face concentricity is within 0.002 inch with valve stem when checked with a dial indicator and "V" blocks. If not, reface.

**NOTE**

**If the parallel sides of valve head (area above seat angle) is reduced to less than one-half the original height, replace valve.**

**6-30. VALVE FACE TO VALVE SEAT CONTACT.**

Valves will fail prematurely due to burning, warpage or other damage, if the valve to valve seat contact is incorrect. Check contact as follows:

1. Lightly coat valve seat with Prussian blue. Assemble valve to cylinder block and rotate slightly to obtain "pattern". Remove valve.

2. Transferred blue line on valve shall be between 1/16 and 3/32 inch wide and positioned so at least 1/64 inch is clear on both sides. If blue runs off either or both sides correct as follows:

- a. Head side. Regrind valve seat with a 15 deg stone to reduce seat face diameter.
- b. Stem side. Regrind valve seat with a 60 deg to 75 deg stone to increase inner seat diameter.

**NOTE**

After seat is properly narrowed, dress with original seat angle stones to remove burrs or feather edges

**6-31. VALVE INSTALLATION.**

1. Replace tappets (8, figure 4-23) into cylinder block in order from which they were removed.
2. Set valve springs (5) and retainers (6) in valve chamber.
3. Coat valve stems with light coating of OE-30 engine oil. Insert intake valves (1) and exhaust valves (2) in position from which they were removed.
4. Use a valve spring compressor tool to lift springs and retainers. Assemble retainer locks (7) to valve stem and release spring compressor.

**NOTE**

Rotate crankshaft until camshaft lobe is at its lowest position under tappet and valve being assembled.

5. With camshaft lobe and tappet in lowest position, initially set valve clearance. Hold tappet with one wrench while adjusting self-locking adjustment screw with second wrench. Adjust intake valve for 0.014 inch clearance and exhaust valve for 0.017 inch.

**NOTE**

Final valve adjustment is made with a hot static engine. Adjust exhaust valve clearance to 0.020 inch clearance and adjust intake valve clearance to 0.012 inch.

6. Loosely assemble valve cover (15, figure 4-22) and gasket (60) to prevent entrance of foreign matter.

**6-32. FLYWHEEL REASSEMBLY.** Replace ring gear (11, figure 4-28) if inspection showed need for removal. Replace gear as follows:

1. Heat ring gear in suitable oven, to insure uniform heating, to a maximum temperature of 400 deg F (bluish color).

**CAUTION**

Heat ring gear evenly at all points and do not allow Heat ring gear evenly at all points and do not allow the temperature to exceed 400 deg F. If ring gear is heated unevenly, it may crack. If temperature exceeds 400 deg F, the temper in the ring gear might be destroyed.

2. Assemble ring gear to flywheel (7) with beveled side of teeth to engine side of flywheel. Make sure ring gear seat is clean and ring gear is fully seated before gear chills.

**6-33. FLYWHEEL AND FLYWHEEL HOUSING INSTALLATION.** Install flywheel housing (47, figure 4-22) and flywheel as follows:

1. Assemble flywheel housing to cylinder block (62) with ring dowels (48), screws (49 and 50) and lockwashers (51). Mating surfaces must be clean to reduce flywheel housing runout. Torque to 50-55 foot-pounds.
2. Assemble dial indicator to end of crankshaft to check flywheel housing face and bore runout. Maximum indicator reading is 0.008 inch for both face and bore. Rotate crankshaft to check.

**NOTE**

If runout exceeds 0.008 inch, remove housing and check for dirt or burrs between housing and cylinder block. Reassemble. Excessive runout affects life of transmission bearings.

3. Install flywheel on crankshaft. Secure with nuts (9) and lock washers (10, figure 4-28). Torque nuts to 35 to 40 foot-pounds.

**NOTE**

Flywheel screws (8) are pressed into crankshaft (37) prior to installing crankshaft.

4. Assemble dial indicator to flywheel housing to measure flywheel runout. Check torque converter bolt surface and counterbore (inner side wall). Maximum runout must not exceed 0.008 inch. (see figure 6-6).

**6-34. OIL PUMP ASSEMBLY.**

1. Press oil shaft bushing (20, figure 4-26) into pump body (19) if inspection indicates replacement.
2. Assemble drive gear (4) to shaft (18) with pin (5).

**NOTE**

Replacement gear (4) is supplied with only one pin hole. Align gear with shaft hole and drill through second side of gear.

3. Assemble driven gear (13) to drive shaft with woodruff key (15) and idler gear (16) and shaft (17) to pump body.
4. Check clearance between pump body and gears. Clearance to be 0.001 to 0.003 inch.
5. With straight edge across pump cover bolt surface, check for 0.0015 to 0.006 inch clearance between gear sides and straight edge.
6. Assemble cover (11) and gasket (12) to body with two screws (8) in idler gear end.



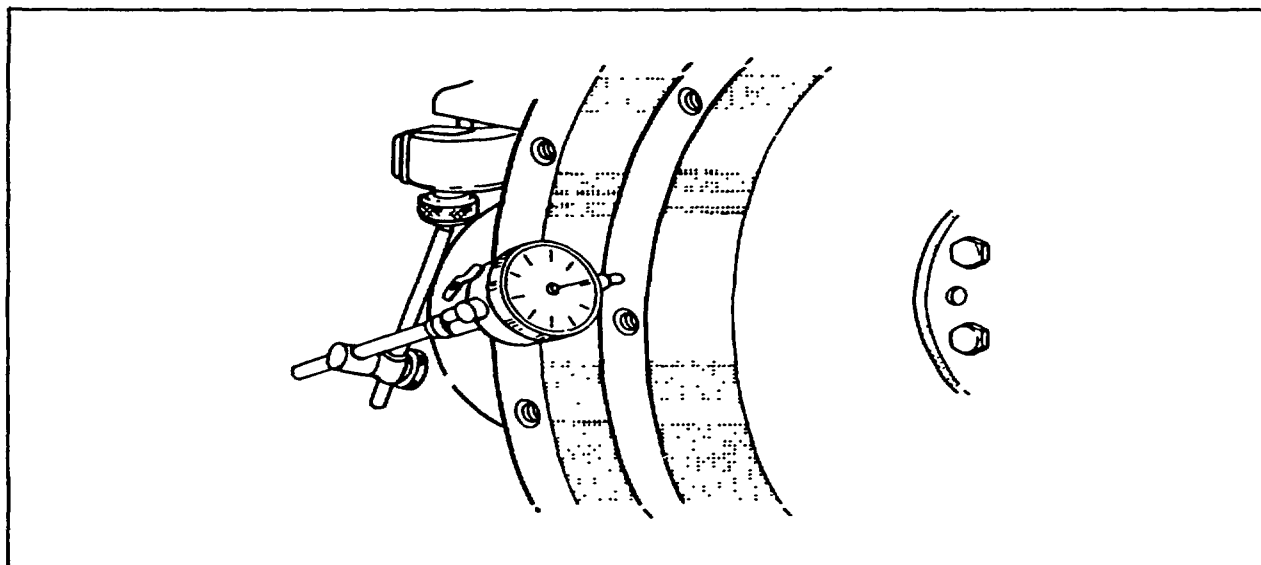


Figure 6-6. Using Dial Indicator To Check Flywheel Runout

7. Assemble gasket (10), pickup screen frame (7) and .pacer (9) to pump body and cover with four screws (8).

8. Snap screen (6) into pickup frame.

**6-35. OIL PUMP INSTALLATION.** Slide oil pump into bore of center main bearing cap. Engage gear (4, figure 4-26) with camshaft oil pump drive gear. Secure with stud (1), nut (2) and lock washer (3).

**6-36. CRANKSHAFT OIL SEAL ASSEMBLY.** The crankshaft rear oil seal consists of an upper oil guard and a lower filler block each having a jute packing. This jute packing is assembled as follows:

1. Flatten piece of rear seal (33, figure 4-22) jute packing in vise or by hammering until it will fit into groove of oil guard (42).

2. Press flattened seal into groove and with smooth hammer handle press seal to fully pack groove.

#### NOTE

**Use sufficient pressure to expand seal so it seizes sides of groove.**

3. Packing shall be installed so ends protrude from each side of oil guard. Using a sharp knife, cut ends of seal 0.020 to 0.030 inch above oil guard

#### NOTE

**Unless seal is cut with the 0.020 to 0.030 inch excess, when installed, leakage will occur between the oil guard and filler block.**

4. Install seal (33) in rear oil filler block (38) in a similar manner, see steps 1 through 3 above.

5. Assemble neoprene seal (31) to outer groove of rear filler block. Use small spot of non-hardening cement at center of groove to hold seal while assembling oil pan.

6. Assemble front oil pan filler block (37) and neoprene seal (31) in a similar manner. See step 5 above.

#### 6-37. CRANKSHAFT OIL SEAL INSTALLATION.

1. Slide oil guard (42, figure 4-22) into position around crankshaft.

2. Assemble rear oil pan filler block (38) to cylinder block (62). Install screws (40) and lock washers (41).

3. Install front oil pan filler block (37) with screws (39) and lock washers (41).

4. Lubricate oil pan to seal face of filler block seals (31) with OE 30 engine oil to prevent distortion to the seals as the oil pan is assembled to the cylinder block.

5. Install oil pan (28) using new gaskets (32). Install screws (29).

6. Torque oil pan screws (29) to 12-16 foot-pounds.

**NOTE**

**Excessive tightening of oil pan screws will cause a wavy condition of the oil pan flange permitting leakage.**

**6-38. CYLINDER HEAD INSTALLATION.**

1. Wipe cylinder block deck clean and dry. Lay cylinder head gasket (59, figure 4-22) in position.

2. Wipe mating surface of cylinder head (52) and position on cylinder block.

3. Loosely screw into position the six threaded high head screws (53) and washers (55) at oil dip stick bracket, coil bracket and lifting eye positions.

4. Loosely assemble high head screw (56) and washer (57) in cylinder head at position 18 of Cylinder Head Tightening Sequence, figure 6-7. This screw provides tapped boss for distributor holddown screw.

**NOTE**

**To facilitate location of special screws, mark cylinder head with one light center punch dimple for locations of screws (53) and two dimples for screw (56) before removal.**

5. Loosely install remaining cylinder head capscrews (54) and washers (55) in cylinder head.

6. Install spark plugs to prevent foreign materials from falling into cylinders.

7. Tighten cylinder head screws, following sequence shown in figure 6-7. With an accurate torque wrench, torque each screw to 35 to 40 foot-pounds.

**CAUTION**

**Failure to torque cylinder head capscrews in the prescribed sequence may be cause for a blown head gasket or compression leakage.**

8. Install thermostat, water outlet elbow and any plugs which will prevent foreign matter from entering cooling jacket.

**6-39. Deleted.**

**6-40. Deleted.**

**6-41. TIMING GEAR COVER ASSEMBLY.** The timing gear cover (2, figure 4-25) carries the fan drive assembly and the cam gear governor control assembly. The fan drive assembly gear is mated to the camshaft gear and must be adjusted for backlash after installation of the timing gear cover.

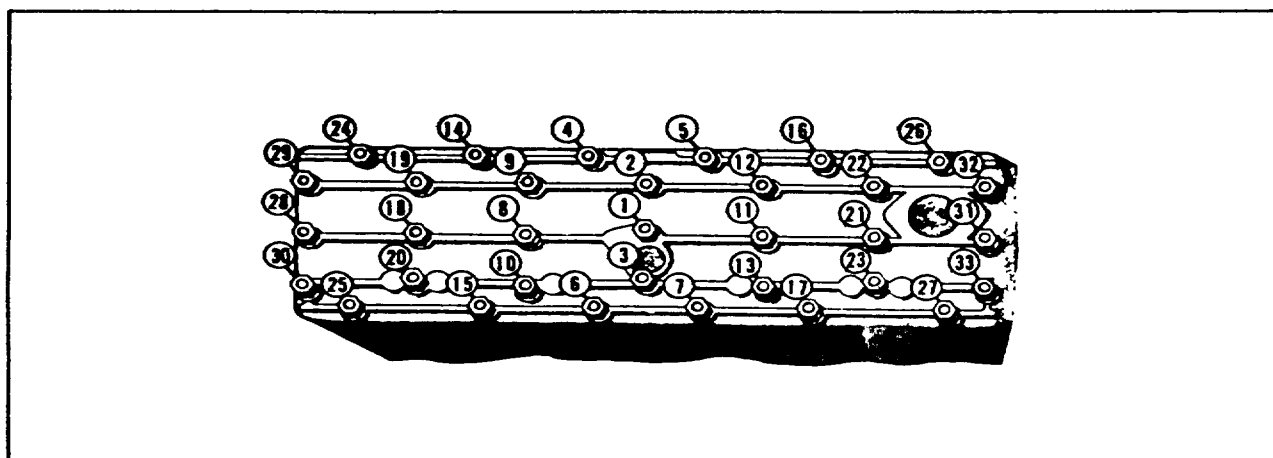


Figure 6-7. Six Cylinder Head Screw Tightening Sequence

**6-42. FAN DRIVE ASSEMBLY.** The fan drive is assembled and installed as follows (figure 6-8) :

1. Assemble shaft and bearing assembly to adapter and lock in place with setscrew and nut.
2. Heat the pulley and gear in boiling water for 20 minutes and chill and keep shaft in dry ice for 20 minutes.
3. Quickly press gear and pulley onto shaft. Pulley is to be flush with shaft end and the gear pressed on 3/64 inch more than end of shaft.
4. Assemble fan drive assembly (52, figure 4-18) to timing gear cover with gasket and three screws and washers. Do not snug tight.

**6-43. GOVERNOR CONTROL ASSEMBLY.**

1. Press bearing (20, figure 4-25) into timing gear cover (2) with oil seal (22).
2. Assemble shaft (19), dust seal (21) and lever (16) to cover. Assemble rocker arm (17) to shaft with pin (18).
3. Assemble idle surge screw (14) and lock nut (5) in cover and fit bumper spring (13) between lever (17) and surge screw.

**6-44. GOVERNOR CONTROL INSTALLATION.** The assembled timing gear cover is installed as follows:

1. Install timing gear cover assembly using new gaskets.

**NOTE**

**Camshaft gear governor upper race must be installed in camshaft before installing cover.**

2. Install 7/16 inch ring dowel (3, figure 4-25) and 3/8 inch ring dowel (4) to align cover.
3. Install two 3/8 x 2-1/2 inch screws (11) and one assembled washer 3/8 x 2-1/2 inch screw (9) and three washers (12) holding cover to front filler block.
4. Install 7/16 x 1-1/2 inch screw (5) with washer (6) in one dowel and 3/8 x 2-3/4 inch screw (8) and washer (7) in other dowel.
5. Install 3/8 x 2-1/2 inch screw (11) to lower right of crankcase, one 3/8 x 2-1/2 inch assembled washer screw (9) to upper left of crankcase and 3/8 x 1 inch screw (10) in remaining hole.
6. Install dial indicator to record far drive gear backlash at points "B", figure 6-8.

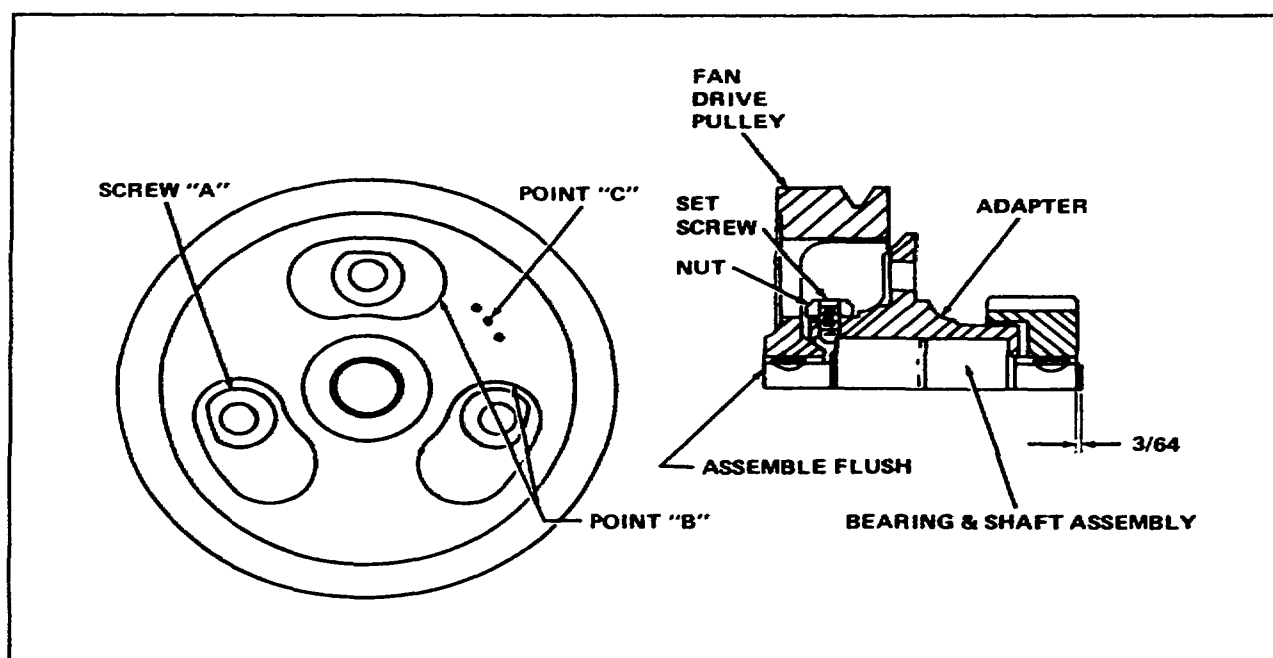


Figure 6-8. Fan Drive Pulley Assembly

7. Pivot fan drive assembly around screw "A" in a clockwise direction by tapping adapter at the top until a dial indicator reading of 0.0013 to 0.0020 inch is obtained at point "B".

**NOTE**

**Check gear backlash in both directions.**

8. Tighten three screws and recheck backlash.

9. Check that roll pin will enter timing gear cover and insert pin. If adapter does not line up with previous hole, drill a new hole at the dimples of point "C".

10. Drill 0.129/0.125 inch hole, 9/16 inch deep and install roll pin.

**CAUTION**

**Do not drill deeper than 9/16 inch as hole will break through cover and roll pin will allow leakage.**

**6-45. IGNITION DISTRIBUTOR ASSEMBLY.**

1. Assemble shaft and weight plate (35, figure 4-19) to housing (39) with seal (40). Use shims (36 and 37) as required. Assemble drive collar (33) to shaft with pin (34).

2. Assemble advance weights (31) washer (38), cam (32), and springs (30) to the shaft. Assemble holddown plate (28) and screws (29).

3. Assemble breaker plate (26), screws (27), capacitor (20), bracket (21), screw (22) and point contact set (18).

**NOTE**

**Lubricate shaft wick with a few drops of OE oil and wipe cam block with light coating of grease.**

4. Assemble rotor (20) and cap (10).

5. Assemble holddown clamp (13) to distributor body.

**6-46. IGNITION INSTALLATION.**

**NOTE**

**Align timing mark of engine with No. 1 cylinder compression stroke. Check by holding thumb over spark plug hole to determine compression stroke.**

1. Remove distributor cap and rotate rotor to alignment marks scribed during removal. Install distributor (16, figure 4-19) into cylinder head and mate the end of shaft (35) and coupling (33) with the upper end of the oil pump shaft.

**NOTE**

**Rotor will not turn when fully seated. Check alignment marks. If marks do not line up, pull distributor and move as required.**

2. Install clamp holddown nut (15) and washer (14).

3. Install cap (10) and cables (1 through 8).

**6-47. STARTER ASSEMBLY.**

1. Position field winding (47, figure 4-21) so heavy lead is aligned with grommet (18) in housing (49). Install insulators (48) on pole shoes (45) and install pole shoes to retain field winding in place. Install grommet (18) in field frame.

2. Assemble brush holders, brushes and related parts (items 3 through 14) to field frame. Connect two light field winding leads to insulated brush holders. Connect two ground leads (4) between grounded brushes and ground.

3. Install washer (35) on armature (34), then place drive assembly (39) on drive end of armature shaft. Install two collars (37 and 38) and retaining ring (36) to hold drive on shaft.

4. Assemble armature shaft into drive end bell bearing (25) install shift lever (27) in drive end bell so yoke of shift lever engages collar of drive assembly. Secure with screw (28), washer (30) and nut (29).

5. Install brush end bell (1) with through bolts (2) to keep assembly together. Pin plunger (21) to shift lever with pin (22).

6. Install spring (23) in solenoid relay (15) bore, and attach relay to drive end frame with screw (16) and washer (17).

7. Connect field winding terminal protruding from grommet (18) to terminal of solenoid relay.

**6-48. STARTER INSTALLATION.** Attach starter to flywheel housing with three screws, and reconnect the electrical leads to the solenoid relay.

#### 6-48.1. ALTERNATOR ASSEMBLY.

1. Insure that bearing (20, figure 4-20.1) is one-quarter full with lubricant. In the event lubricant is required, add as directed in LO 10-3930-623-12.

#### CAUTION

**Do not fill bearing more than one-quarter full or it may overheat.  
Do not use any other lubricant than lubricant specified.**

2. Install grease slinger (30) and press bearing (20) in frame (10), using a tube or collar that Just fits over race. Install new gasket (27), inside collar (28), and a new bearing retainer (25). Secure bearing retainer with three screws (26).

3. Replace bearing (4) if it has exhausted its lubricant.

4. Saturate felt seal of retainer (5) as directed in LO 10-3930-623-12 and assemble it in frame.

5. Reassemble alternator, reversing disassembly procedure. Make sure to remove tape from rotor shaft and frame bearing. Torque shaft nut (32) 50 to 60 foot-pounds.

#### 6-48.2 ALTERNATOR INSTALLATION.

Refer to TM 10-3930-623-12.

**6-49. CARBURETOR REPAIR.** Repairs consist of replacing shaft seals and packings, gaskets and replacement of enlarge jets. Removal and replacement of the shaft bushings is not recommended without correct counterboring tools and reamers.

#### CAUTION

**Never use a wire or drill to clean out Jets.**

## 6-50. ASSEMBLY OF CARBURETOR FUEL BOWL BODY.

1. Install packing (35, figure 4-20) in open side of retainer (36). Place completed assembly on suitable driver with packing facing small end of driver. Insert small end of driver into choke shaft hole; start retainer into counterbore of body. Lightly drive retainer into body until flush with machined surface.

2. Install shaft hole plug (34), using light hammer.

3. Refer to match marks made at time of disassembly and install choke bracket, bracket attaching screws and lock washers (23 through 31).

4. Install choke shaft and lever assembly (32). Rotate shaft so that cut out section faces out.

5. Start choke plate (20) into place (poppet valve stem and spring facing into air intake). Press choke lever against shaft boss to compress ratchet pin spring; center choke plate in closed position and start choke plate screws (21) into place. When plate is properly centered, tighten screws securely.

6. Install choke lever spring (22) to return choke to wide open position.

7. Install main jet (42) and fiber washer (43) in threaded hole at bottom of fuel bowl.

8. Install well vent jet (45) in fuel bowl and tighten, using small screwdriver.

9. Install discharge jet (40) and fiber washer (41) in large threaded passage below fuel bowl.

10. Install drain plug (37) in threaded passage at bottom of fuel bowl.

11. Install main passage plug (38) with fiber washer (39).

## 6-51. ASSEMBLY OF CARBURETOR THROTTLE BODY.

1. Insert throttle shaft packing (13, figure 4-20) in open end of retainer (12). Place completed assembly on suitable driver with packing facing small end of driver.

2. Insert small end of driver into throttle shaft hole.

Start retainer into counter-bore of throttle body. Lightly drive retainer into body until flush with machined surface or slightly below surface to avoid interference with throttle lever.

3. Insert throttle lever and stop and shaft assembly (7) in throttle body. Rotate throttle shaft to wide open position and insert throttle plate (5) into shaft. Then rotate to closed position and hold plate closed with fingers.

4. Start throttle plate screws (6) and leave screws loose. Center throttle plate in throttle bore and tighten throttle plate screws.

5. Install throttle shaft hole plug (11) in side opposite throttle lever. Use a light hammer to drive plug in flush with face of boss.

6. Install idle adjusting needle (3) and friction spring (4) in threaded passage at side of throttle body. Turn idle needle in lightly against seat, then back out needle 1-1/4 turns as a preliminary setting.

7. Install idle jet (44) in counter-bored passage of machined surface.

8. Install fuel valve seat (part of 16) and fiber washer (17).

9. Place new throttle body to bowl gasket (2) on machined surface of throttle body. Install fuel valve needle (part of 16) in seat and position float assembly (18) in hinge bracket.

10. Insert float pin (19) through hinge bracket at side opposite slot and guide axle through float bushing. Press pin through slotted end of bracket, using handle of screwdriver.

11. For correct float chamber fuel level, check distance from top of floats to machined surface of throttle body (no gasket) with throttle body inverted. Top referred to is actually lower surface of float when carburetor is in installed position. Distance should be 1-5/32 inch plus or minus 1/32 inch. To increase or decrease distance, use long nose pliers and bend lever close to float body.

### NOTE

**Do not bend, twist or apply pressure on the float bodies. The float bodies when viewed from the free end of the float bodies must be centered and at right angles to the machined surface and must move freely on the float axle.**

12. Insert venturi (46) in throttle body bore, large opening first. Position with flat side toward well vent jet when carburetor is assembled.

13. Carefully place fuel bowl assembly on throttle body assembly, being careful not to damage floats. Align screw holes in fuel bowl with holes in gasket and throttle body.

14. Start all four bowl to body screw and lockwasher assemblies (1). Tighten screws uniformly and securely.

15. Replace hex plug in side of throttle body (if removed).

16. Hold throttle lever in closed position and turn throttle stop screw (9) in until it just contacts the stop pin; then turn screw in 1-1/2 additional turns as a preliminary idle speed adjustment.

## 6-52. TRANSMISSION REPAIR AND ASSEMBLY.

### 6-53. CONTROL VALVE ASSEMBLY.

1. Clamp valve body (30, figure 4-16) in a soft jaw vise with bore ends up.

2. Carefully assemble pressure regulator pistons (19 and 21), and springs (18 and 20), retainer screws (16), and gaskets (17).

3. Assemble inching valve piston (28) and spring (29) to body. Insert stop (27). Assemble inching control springs (25 and 26) and inching spring piston (23). Insert stop (22). Press seal (24) into body.

4. Assemble direction control plunger (14) in valve body. Insert stop (13). Press seal (15) into body.

5. Assemble direction control plunger detent ball (11), spring (10) and sleeve (12).

6. Assemble bedplate (6) and lower bedplate (2) to the valve body with gaskets (5 and 9), screws (3 and 7) and lock washers (4 and 8).

### 6-54. CONTROL VALVE INSTALLATION.

Refer to TM 10-3930-623-12.

### 6-55. FORWARD AND REVERSE CLUTCH REPAIRS.

The repair of the clutch assembly consists of replacing the clutch drive plate or replacement of bearings.

#### **CAUTION**

**When parts other than the clutch plates or bearings are replaced, the assembled clutch should be checked for 0.25 oz inch balance maximum.**

### 6-56. FORWARD AND REVERSE CLUTCH ASSEMBLY.

1. Assemble forward clutch cylinder (11, figure 4-15) to input shaft (7) with screws (8) and washers (9).

2. Press forward gear shaft spigot needle bearing (10) into input shaft.

3. Press rear gear shaft needle bearing (6) into rear clutch cylinder (4). Press bearing into bore, 3/32 inch below the smaller end. Check oil passage plug (5) for tightness. If loose, stake in place.

4. Assemble sealing rings (12) to both forward and rear clutch cylinders (4 and 11).

5. Assemble sealing ring (14) into groove of each clutch piston

6. Press two straight drive pins (13) into clutch pressure plate (19).

#### **NOTE**

**Ends of pin should be 0.41 below edge of pressure plate.**

7. Assemble forward clutch plate (17) and clutch piston (11) into clutch pressure plate (19).

#### **NOTE**

**Forward clutch cylinder and mating side of clutch pressure plate are marked with one identification mark and the rear parts with two lines. Lines are etched during manufacture after assembled clutch has been balanced. Therefore, the lines must match during assembly to maintain balance.**

8. Install forward retaining ring (1), lock plate (3) and screw (2).

9. Assemble clutch piston return springs (16) in clutch plate.

10. Assemble rear clutch plate (18), hub forward, and rear clutch cylinder (15) to the pressure plate. See note in step 7.

11. Install rear retaining ring (1), lock plate (3) and screw (2).

**6-57. TRANSMISSION REPAIRS.** The repair of the transmission is limited to replacement of bearings or gears where required.

### 6-58. TRANSMISSION ASSEMBLY.

#### **NOTE**

**Lubricate all bearings, gears and packings with Type A automatic transmission fluid during assembly.**

1. Install pick-up strainer (9, figure 4-14) in rear half of transmission case (85).

2. Press bearing cups (55 and 70) into case. Press bearing cone and roller (69) onto output bevel pinion shaft (66). Assemble retaining ring (67) to shaft.

3. Assemble spur gear (68) and gear spacer (57) on output shaft.

4. Assemble required spacers (56) and bearing cone and roller (54) to shaft.

5. Assemble required number of shims (53) and bearing keeper (51) to output shaft.

**NOTE**

Quantity of shims is determined by a rolling: resistance of the output shaft (66) due to bearing preload. Preload is determined by first torquing screws (52) to 23 to 28 foot-pounds and then wrapping several turns of strong cord around the gear (68) which is then pulled with a 10 pound spring scale. Pull scale with a steady even pull. Correct preload will require 6-1/2 to 9-1/2 pounds pull. If pull is not correct add or remove shims (53) as required. Always torque keeper screws (52) to 23 to 28 foot-pounds when adjusting preload. Check for 0.010 to 0.020 inch end play of gear (68) on shaft. Adjust with shim (57).

6. After bearing preload has been obtained, lockwire screws.

7. Assemble one retaining ring (64) to rear clutch gear shaft (65) and retaining ring (62) to ball bearing (61).

8. Install bearing (61) in transmission case with retainer (58).

9. Press needle bearing (45) into gear shaft (65). Slide shaft through bearing and assemble forward spur gear (63)

and second retaining ring (64), through the case top opening, to gear shaft.

**NOTE**

**Offset gears (63) face each other when installed.**

10. Assemble idler spur gear (82) and needle bearing (83).

11. Through top opening, assemble idler gear and gear retainer (84) to idler gear shaft (78) passed through rear of the case. Assemble retainer (81).

12. Assemble retaining ring (64) to the rear groove of the reverse gear shaft (77). Press roller bearing (74) on shaft and assemble retaining ring (75).

13. Hold spur gear (63) and retaining ring (64) through the top opening and install gear shaft through case rear opening, through the gear and forward gear shaft (65). Assemble retaining ring into its groove.

14. Assemble reverse gear shaft bearing keeper (71) to case.

15. Assemble sealing rings (43) to rear of clutch assembly (44). Slide clutch assembly onto inner (77) and outer (65) gear shafts, aligning splines.

**NOTE**

**Assembly of forward and reverse clutch assembly is fully covered in paragraph 6-56.**

16. Assemble sealing ring (42) to front case half (35). Assemble case halves with gasket (41), screws (36 and 37) and lockwashers (38).

17. Assemble ball bearing (39) and two retaining rings (34) to clutch input shaft. Assemble pump seal ring (33) to shaft.

18. Assemble oil pump drive gear (29) and driven gear (30) to oil pump housing (22). Assemble housing with housing preform packing (28) and oil passage preform packing (27) to pump base (31).

19. Assemble oil pump assembly to transmission front case (35) with gasket (32) screws (20). Press oil seal into pump housing.

20. Assemble relief valve components (13, 14, 15 and 16), gage (17) and tube (18).

21. Assemble control valve assembly (46) to transmission with gasket (50), screws (47 and 48) and lock washer (49).

22. Make sure there are no foreign materials in transmission. Assemble bottom access cover plate (5) to transmission with gasket (8), screws (6) and lock washer (7)

**NOTE**

**Tapered edge of plate is installed to output shaft end of transmission.**

23. Install plugs (1,2,3 and 4).

**6-59. TRANSMISSION INSTALLATION.**

1. Assemble torque converter (5, figure 4-11) to the transmission.

**NOTE**

**The rear clutch, front clutch and pump drive splines must be aligned during assembly.**

2. Install transmission on flywheel housing of the engine with screws (3) and lockwashers (4).

3. Through top access hole of flywheel housing, install six screws (6), lockwashers (7) and flat washers (8) attaching torque converter drive disk to flywheel. Replace hole cover.

4. Connect transmission fluid cooler lines (1 and 2).

**6-60. DRIVE AXLE REPAIR AND ASSEMBLY.**

**6-61. DIFFERENTIAL ASSEMBLY.** Three basic adjustments must be made when the differential has been assembled after replacement of parts. These are differential bearing preload adjustment, ring gear and pinion backlash adjustment, and tooth contact adjustment. These



adjustments require that the same transmission to be installed with the axle be used in making the adjustments. Before beginning assembly have this transmission available with one set of gaskets (14 and 18, figure 4-11) to provide a difference between the bearing cone end and the gasket pack of 0.119 inch to 0.125 inch. Add or remove gaskets as required to obtain required bearing exposure. Proceed as follows with assembly and adjustment.

1. Rivet ring gear (72, figure 4-12) to case (65) half. Press one bearing cone and roller (64) onto trunnion of each case half. Place a thrust washer (68) and side gear (67) in place in each case half.

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

3. Position assembled differential in housing (76). Differential will be loose. Pass a piece of rod or tubing about three feet long through differential center to aid manipulation during assembly. Position axle housings (61) on differential housing studs. Place tapered bushings (58) on studs and install nuts (55) and washers (56 and 57).

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

5. If drag is noticeable on first trial, reverse procedure for decreasing gasket thickness in step 4 above until no drag is present, then decrease total gasket thickness until drag is felt. Preload will now be between 0.000 inch and 0.003 inch.

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

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

#### 6-62. DIFFERENTIAL ADJUSTMENTS.

1. Temporarily assemble drive axle and gaskets (14 and 18, figure 4-1) to transmission. Remove access plate (5 figure 4-14) at bottom of transmission and remove pip4 plug (75, figure 4-12) from bottom of differential housing (76).

2. Turn output gearshaft (66, figure 4-14) so screws (52) are in vertical alignment, and offset flats on circumference of output shaft keeper (51) will be horizontal.

3. Mount a dial indicator on access hole of transmission to contact downward facing flat on the keeper, at a point one inch from center line of shaft.

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

5. Turn output gearshaft in both directions through backlash freedom, noting reading on dial indicator. Reading of 0.007 inch to 0.017 inch is satisfactory. Adjustments to correct backlash are given in paragraph 6-61.

6. Reverse steps (1) through (4) if no adjustment is to be made.

**6-63. DIFFERENTIAL TOOTH CONTACT ADJUSTMENT.** Adjust ring gear and pinion tooth contact, after adjusting backlash, as follows:

#### NOTE

**Several adjustments of both pinion and ring gear setting may be necessary in the following procedure before the correct adjustment is achieved. It is not possible to specify the exact thickness of gaskets to be added, removed, or exchanged at any stage. This is determined by trial and error.**

1. Apply a thin coating of red lead to drive face of ring gear teeth, and install axle on transmission with gaskets used in paragraph 6-62, step 1.

2. Remove access plate (5, figure 4-14) from bottom of transmission.

3. Engage spur gear (68) with a pry bar, and turn it until differential has made one revolution in the forward direction.

4. Remove transmission from axle. Examine teeth of ring gear, and compare marks in red lead from pinion gear contact with examples shown in figure 6-9.

#### NOTE

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

5. If marks in red lead compare with those shown in view A, figure 6-9, indicating high, narrow tooth contact (pinion too far out), adjust by removing one or more gaskets (14 or 18, figure 4-11) to move pinion in direction indicated in box adjacent to view A, figure 6-9. Transfer one or more gaskets (62 or 63, figure 4-12) from left side of differential housing to right side. Repeat steps (1) through (4) above to check results of adjustment.

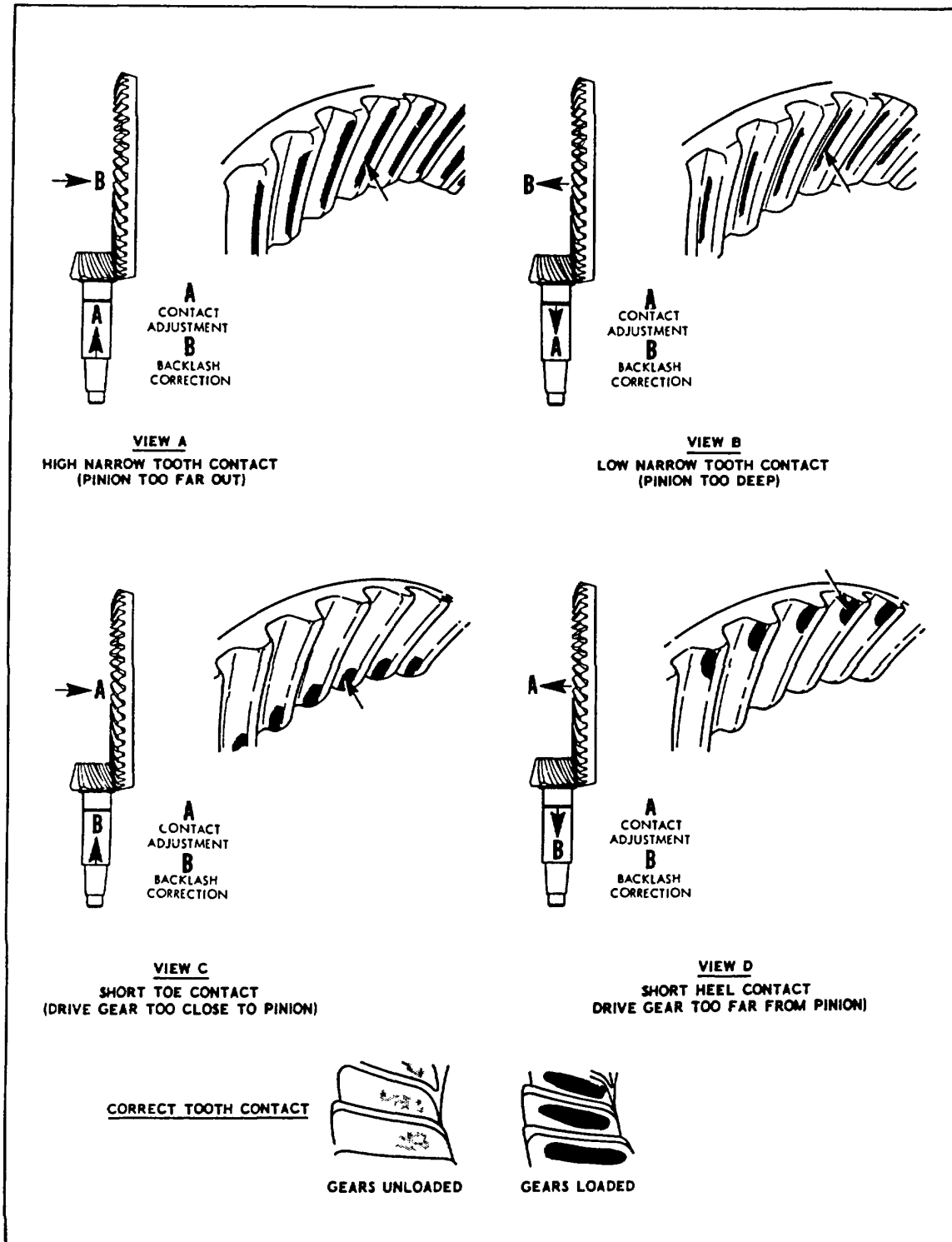


Figure 6-9. Drive Axle Ring and Pinion Gear Tooth Contact Patterns

**NOTE**

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

6. If marks in red lead compare with those in view B, figure 6-9, reverse adjustment procedure given in step 5 above. Repeat steps 1 through 4 above to check results of adjustment.

**6-64. REDUCTION GEAR AXLE END ASSEMBLY.**

1. Press bearing cups (29 and 34, figure 4-12) into reduction gear case (47).

2. Assemble brake drum (35) to final axle shaft (30)

with screw (31) and gasket (32). Press seal (36) into brake drum. Assemble bearing cone and roller (33) to axle shaft.

3. Assemble brake back plate and shoe assembly (37) to gear case with nuts (40) and washers (41). (See paragraph 6-98.)

4. Assemble preform packing (46) to parking brake lever (45) and gear case. Connect brake rod (5) to parking brake lever.

5. Assemble axle shaft and brake drum to gear case (47). Press bearing cone and roller (28) on axle shaft along with internal

gear (24). Assemble washer (27) and nut (26). Torque nut until preload on bearings is 0.000 to 0.003 inch tight. Insert new cotter pin (25).

6. Assemble reduction gear axle end to differential section of the axle with gasket (48) screws (22) and washers (23).

7. Assemble brake lines and fittings, guard and parking brake lever (2).

**6-65. STEERING GEAR REPAIR AND ASSEMBLY.**

**6-66. GENERAL.** Complete disassembly of the steering gear at one time is not an overhaul operation. The instructions in following paragraphs present complete information necessary to correct any malfunction of the gear. Before beginning repairs, diagnose the probable cause of the malfunction by referring to the troubleshooting chart for the steering gear (figure 7-11). Limit disassembly to necessary operations.

**6-67. ADJUSTER PLUG ASSEMBLY REMOVAL.**

1. Loosen adjuster plug locknut (49, figure 4-32) with adjuster plug locknut wrench (figure 6-10) or equal. Make wrench locally, if necessary, using data on figure 6-10.

2. Remove adjuster plug assembly (47, 48, 50 through 57) with spanner wrench.

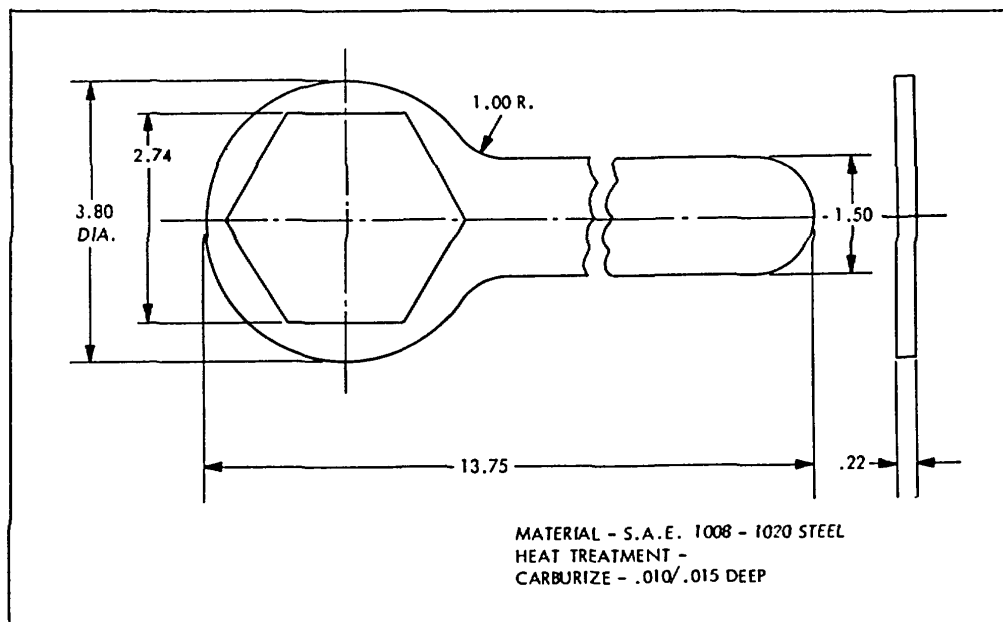


Figure 6-10. Steering Gear Adjuster Plug Locknut Wrench Details

**6-68. ADJUSTER PLUG DISASSEMBLY.**

1. Remove thrust bearing retainer (57, figure 4-32) with a screwdriver, being careful not to score the needle bearing bore, and discard. Remove thrust bearing spacer (56), thrust bearing (54) and thrust bearing races (53 and 55).
2. Remove adjuster plug packing (58) and discard.
3. Remove stub shaft seal retaining ring (50), with snap ring pliers, and remove stub shaft dust seal (47).
4. Remove stub shaft oil seal (48) by prying out with screwdriver and discard.
5. Inspect adjuster plug needle bearing (51), and if rollers are broken or pitted, remove needle bearing from adjuster plug by pressing from thrust bearing end using piloted driver. Discard bearing.

**6-69. ADJUSTER PLUG ASSEMBLY.**

1. Assemble needle bearing (51, figure 4-32) by pressing from thrust bearing end of adjuster plug (52) against identification end of bearing. End of bearing is to be flush with bottom surface of stub shaft seal (48) bore.
2. Lubricate new stub shaft seal with OE-10 engine oil and install far enough to provide clearance for dust seal (47) and retaining ring (50). Lubricate new dust seal with engine oil and install with rubber surface outward. Install retaining ring (50), making certain that the ring is properly seated.

3. Lubricate packing (58) with automotive and artillery grease, MIL-G-10924, and install on adjuster plug. Assemble large thrust bearing race (53), thrust bearing (54), small thrust bearing race (55), and thrust bearing spacer (56) on adjuster plug. Press new bearing retainer (57) into needle bearing bore, using thrust bearing retainer installer, as shown in figure 6-11. If necessary, make installer locally, using figure 6-11 for guidance.

**6-70. ADJUSTER PLUG INSTALLATION.**

1. Place tool to protect seal over end of stub shaft (76, figure 4-32).
2. Install adjuster plug assembly in gear housing. Adjust thrust bearing preload according to paragraph 6-91, and tighten locknut to 50 to 110 foot-pounds.,

**6-71. STEERING GEAR VALVE.** The complete valve in each steering gear is a precision unit with selective fitted parts and is hydraulically balanced at assembly. Only those parts which are service items are replaceable and interchangeable. No other valve parts are individually interchangeable. Replacement of any nonserviceable valve part requires that complete rotary valve assembly be replaced. Do not disassemble the valve unless necessary since this may result in damaging the assembly. If valve spool dampener packing requires replacement, remove valve spool only, replacing packing, and reinstall spool immediately. Do not disassemble further. Proceed as follows:

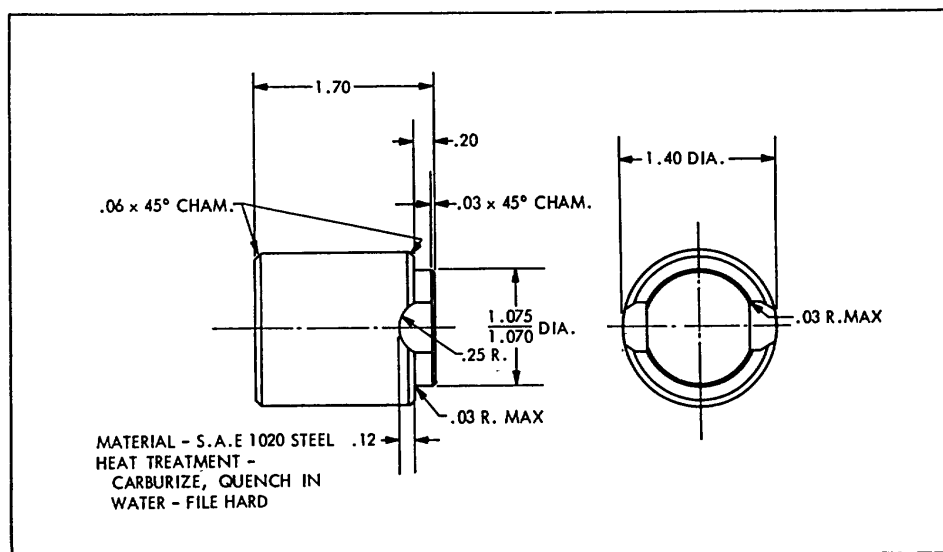


Figure 6-11. Steering Gear Thrust Bearing Retainer Installer Tool Details

**NOTE**

**It is uncommon to make service repairs to the valve assembly, with the exception of the valve spool dampener packing.**

**6-72. STEERING GEAR VALVE REMOVAL.**

1. Remove adjuster plug assembly as outlined under paragraph 6-70.

2. Remove valve assembly from gear by grasping stub shaft (76, figure 4-32) and pulling out valve assembly and stub shaft.

**6-73. STEERING GEAR VALVE DISASSEMBLY.**

1. Remove packing (80, figure 4-32) and discard.

2. Remove spool spring (70) by prying small coil, using small screwdriver. Do not pry against valve body (75) as this may result in a sticky valve. Work spring onto bearing diameter of stub shaft (76). Slide spring off the stub shaft.

3. Remove valve spool (72) with extreme care. To remove valve spool, hold valve assembly in both hands with stub shaft pointing downward. Push lightly on valve spool with a small rod inserted through openings in valve cap (79) until spool is far enough out of valve that it may be jaspered by hand. Withdraw spool with a steady oscillating pull to prevent jamming. If slight sticking occurs, make a gentle attempt to reverse withdrawal procedure. If this does not free the spool, it has become cocked in the valve body bore. Do not attempt to force spool in or out if it becomes cocked. In this case, continue to disassemble valve assembly as follows and return to the spool as described below.

**CAUTION**

**The maximum clearance between the valve body and the spool may be as low as 0.0004 inch. The slightest cocking of the spool may jam it in the valve body.**

4. Remove stub shaft (76), torsion bar and valve cap (79) assembly by holding the valve assembly in both hands as before, only with thumbs on valve body. Rap torsion bar lightly against the work bench. This will dislodge the cap from the valve body. The valve spool has become cocked as described above, it can now be freed. By visual inspection on a flat surface it can be determined in which direction the spool is cocked. A few very light taps with a light soft plastic or rawhide mallet should align the spool in the bore and free it.

**CAUTION**

**Do not tap with anything metallic. If spool can be rotated, it can be removed.**

5. Remove dampener seal packing (71) from spool and discard.

6. Where the valve PACKINGS (74) show evidence of excessive wear cut them, and rings (73), remove and discard. The valve rings are made of filled teflon and it is very unusual that replacement is required.

**6-74. STEERING GEAR VALVE INSPECTION.**

1. If the valve assembly leaks externally around the torsion bar (79, figure 4-32) replace the entire assembly.

2. Check the pin in the valve body (75) which engages the cap. If it is badly damaged, replace the entire valve assembly.

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

4. Check the spool drive pin in the stub shaft (76). If it is worn badly, cracked, or broken, replace the entire valve assembly.

5. Examine the spool (72) surface for nicks and burrs. If any are found, they may be removed with a very fine hone. A slight polishing is normal on the valving surfaces.

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

**6-75. STEERING GEAR VALVE ASSEMBLY.**

1. Lubricate three valve packings (74, figure 4-32) in OE-10 engine oil. Assemble in grooves of valve body (75). Assemble valve packings (74) in ring grooves over back-up rings (73) by carefully slipping the rings over valve body. The rings may appear loose or twisted in grooves, but the heat of the oil after assembly will cause them to tighten.

2. Install new valve spool dampener packing (71) in valve spool (72) groove.

3. Assemble the stub shaft (76) in the valve body (75). Align groove in valve cap (79) with pin in valve body. Tap lightly on cap with plastic or rawhide mallet until cap is against shoulder in valve body with valve body pin in cap groove.

**CAUTION**

**Make sure groove and pin are in line before tapping on cap. Hold these parts together during the rest of the assembly.**

4. Lubricate valve spool (72) with OE-10 engine oil. Slide spool over stub shaft (76) with notch toward valve body. Align notch with spool drive pin (69) in stub shaft and carefully engage spool in valve body bore. Push spool evenly and slowly with a slight oscillating motion until spool reaches drive pin. Rotate spool slowly with pressure until notch engages pin. Before pushing spool completely in, make sure dampener packing is evenly distributed in the spool groove. Slowly push spool completely in. Take extreme care not to cut or pinch packing.

#### **CAUTION**

**Because of close tolerance between the spool and valve body, extreme care must be taken when assembling these parts.**

5. Place seal protecting tool over stub shaft. Slide spool spring (70) over seal protector and work spool spring down until it is seated in stub shaft groove. Take care not to mar sealing surface of stub shaft (76).

6. Lubricate a new cap-to-worm packing (80) with OE-10 engine oil, and install in valve assembly.

7. If during assembly of valve, the stub shaft and cap assembly is allowed to slip out of engagement with the valve body pin, the spool may enter the valve body too far. The dampener packing will expand into the valve body oil grooves, preventing withdrawal of spool. Attempt to withdraw the spool with slight pulling and much rotary motion. If this does not free the spool after several tries, make sure spool is free to rotate; place valve body on flat surface with notched end up, and tap spool with wooden or plastic rod until packing is cut and spool can be removed. Replace packing and proceed with assembly as before.

#### **6-76. STEERING GEAR VALVE INSTALLATION.**

1. Align valve body drive pin in worm (59), figure 4-32) with narrow pin slot on valve body (75). Insert valve assembly into gear housing (87). Do not push against stub shaft as this may cause stub shaft and cap to pull out of the valve body, allowing spool seal to slip into valve body oil grooves. Valve assembly should be pushed in by pressing against valve body with finger tips. Be sure valve is properly seated before assembling adjuster plug assembly. Return hole in gear housing (87) should be fully visible at this time.

2. Install adjuster plug (52) assembly as outlined in paragraph 6-70.

#### **6-77. SECTOR GEARSHAFT AND SIDE COVER REMOVAL.**

1. Remove nut (27, figure 4-32) securing steering lever (26). Using puller, remove lever.

2. Rotate stub shaft (76) until sector gearshaft (37) is in center position and remove side cover retaining screws (28). Tap end of gearshaft with soft mallet and slide gearshaft out of housing.

3. Remove side cover packing (31) from side cover and discard.

#### **6-78. SECTOR GEARSHAFT AND SIDE COVER DISASSEMBLY.**

1. Hold lash adjuster (33, figure 4-32) with a hex key wrench and remove lash adjuster nut (34). Screw lash adjuster out of side cover (30).

2. Remove sector gearshaft seal retaining ring (39), and then remove outer back-up washer (40). Tap a screwdriver between the outer seal (41) and inner back-up washer and pry out seal. Tap screwdriver between inner seal (42) and shoulder of gear housing (87) and pry out seal. Be careful not to damage seal bore. Discard seals.

3. Remove needle bearing (82) from gear housing bore by pressing on stamped identification end of bearing. Discard bearing.

#### **6-79 SECTOR GEARSHAFT AND SIDE COVER INSPECTION.**

1. Inspect sleeve bearing (29, figure 4-32) in side cover (30) for excessive wear or scoring. If badly worn or scored, replace the side cover and bearing as an assembly.

2. Check sector gearshaft teeth and bearing and seal surfaces. If badly worn, pitted, or scored, replace the gearshaft assembly.

3. Check needle bearing (82) in housing (87).

#### **6-80. SECTOR GEARSHAFT AND SIDE COVER ASSEMBLY.**

1. Press needle bearing (82, figure 4-32) into the gear housing (87) from steering arm end, pressing against stamped identification end of bearing. Press in until bearing clears shoulder in gear housing 0.030 inch maximum.

2. Lubricate new gearshaft seals in OE-10 engine oil. Install single lip seal (42) first, then a back-up washer (40). Drive seal and washer in far enough to provide clearance for the other seal, and back-up washer, and retaining ring. Seal must not bottom on end of counterbore. Install double lip seal (41) and second back-up washer. Drive seal and back-up washer in only far enough to provide clearance for the retaining ring. Install sector gearshaft retaining ring (39), making certain that ring is seated properly.

3. Assemble side cover (30) and bearing (29) assembly to sector gearshaft assembly. Screw lash adjuster (33) through side cover until side cover bottoms on the gearshaft, and back off 1/2 turn.

**6-81. SECTOR GEARSHAFT AND SIDE COVER INSTALLATION.**

1. Lubricate new side cover packing (31), figure 4-32) and install in groove in face of side cover (30).
2. Turn stub shaft (76) as necessary until the middle rack groove is aligned with center of gearshaft needle bearing (82).
3. Install gearshaft (37) so that center tooth in the sector meshes with the center groove of rack on ball nut (65). Make sure that side cover packing is in place before pushing side cover down on gear housing.
4. Install side cover screws (28) and tighten to 30 to 35 foot-pounds.
5. Install lash adjuster nut (34) on lash adjuster without tightening. Adjust gearshaft (refer to paragraph 6H) lash adjuster from rotating with a hex key wrench and tighten lash adjuster nut to 20 to 30 foot-pounds.

**6-82. HOUSING END PLUG REMOVAL.**

1. Rotate end plug retainer ring (44, figure 4-32) so that one end of the ring is over the hole in the housing. Spring one end of ring with punch to allow screwdriver to be inserted to lift ring out.
2. Rotate stub shaft (76) with 3/4 inch box end or socket wrench to left turn corner position and force end plug (43) out of housing.

**CAUTION**

**Do not rotate further than necessary, or balls from rack and worm assembly will fall off the end of the worm.**

3. Remove and discard housing end plug packing (45).

**6-83. HOUSING END PLUG INSTALLATION.**

1. Lubricate new housing end plug packing (45) with OE-10 engine oil, and install in gear housing (87).
2. Insert housing end plug (43) into gear housing and at against packing.
3. Install end plug retainer ring (44) with fingers. Install one end of ring and work ring into groove until seated. Slight tapping may be required to securely bottom retainer ring in gear housing (87).

**6-84. RACK PISTON END PLUG REMOVAL.**

1. Remove housing end plug as outlined in paragraph 6-82.

2. Remove rack-piston end plug (46, figure 4-32) by inserting a 1/2 inch drive socket extension into the square hole in the plug and turning counterclockwise.

**6-85. RACK-PISTON END PLUG INSTALLATION.**

1. Turn plug into rack-piston and tighten to 50 to 100 foot-pounds.
2. Install housing end plug as outlined in paragraph 6-83.

**6-86. RACK-PISTON, WORM ASSEMBLY AND GEAR HOUSING ASSEMBLY REMOVAL.**

1. Remove rack-piston end plug (46, figure 4-32) as outlined in paragraph 6-84.
2. Remove sector gearshaft assembly as outlined in paragraph 6-77.
3. Insert rack-piston arbor (see figure 6-12 for tool details) through ball nut (65, figure 4-32.) in end of worm (59). Rotate stub shaft (76) to left turn, which will force rack-piston ball nut onto arbor, and remove rack-piston ball nut from gear housing (87). Take care to keep arbor in place in ball nut or balls will fall out. If rack-piston ball nut is being removed to replace the piston ring (60) and back-up packing (61), reassemble without further disassembly.
4. Remove valve assembly as outlined in paragraph 6-72.
5. Remove worm (59), lower thrust bearing (68) and races (67).

**6-87. RACK-PISTON, WORM ASSEMBLY AND GEAR HOUSING DISASSEMBLY.**

1. Cut piston ring (60, figure 4-32) and back-up packing (61), remove from rack-piston ball nut (65) and discard.
2. Remove screws and lock washers (63) from rack-piston ball nut with screwdriver.
3. Remove ball return guide clamp (62).
4. Place the assembly on a clean cloth and remove ball return guides (64) and arbor. Make sure all of the balls (66) are caught on the cloth.

**6-88. RACK-PISTON, WORM ASSEMBLY AND GEAR HOUSING INSPECTION.**

1. Inspect housing assembly (87, figure 4-32). If bore is badly scored or worn, replace housing. If flare fitting connectors (85 and 86) are badly brinelled or scored, replace them. To remove connectors, tap threads in connectors with a 5/16-18 tap. Thread a bolt with nut and flat washer attached (washer between nut and gear housing) into tapped hole. Hold bolt while turning nut off bolt. This will pull connector from gear housing. Discard connectors.

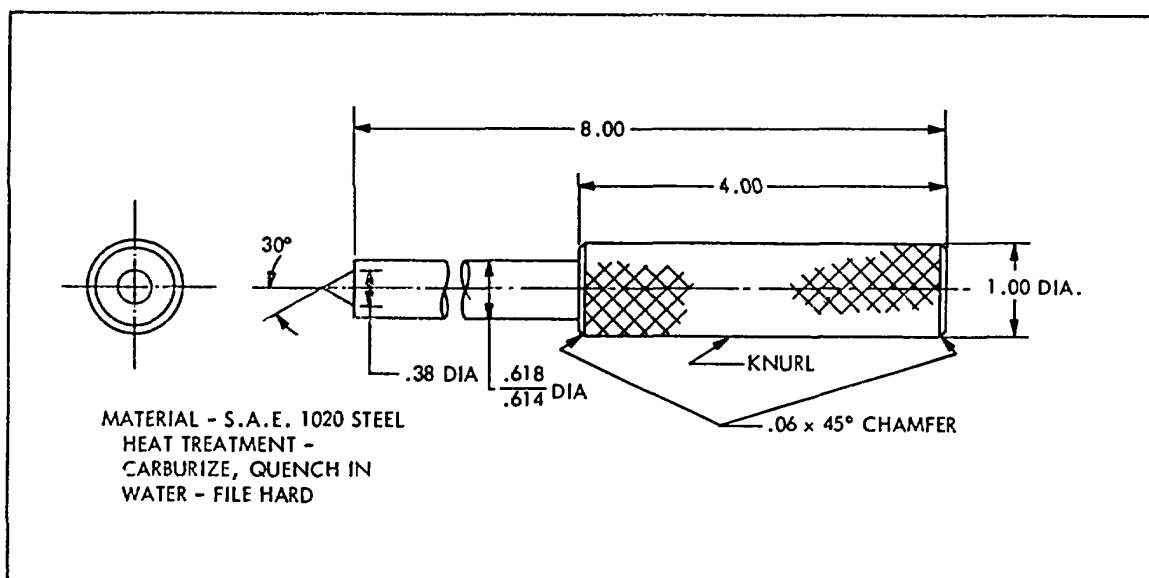


Figure 6-12. Steering Gear Rack-Piston Arbor Tool Details

2. Inspect ball plug (81) in housing (87). If it is leaking or raised above housing surface, drive it in flush, to 1/16 inch below the surface. Tighten ball by staking the housing. If leakage cannot be stopped, housing must be replaced.

3. Inspect all seal surface and retaining ring grooves for defects. If any defects are found, housing must be replaced.

4. At initial assembly, the rack-piston nut, worm and balls are selected to obtain a preload drag of 1 to 4 inch pounds measured on center through an angle of 90 degrees. This preload may drop during service, without having any noticeable effect on steering. Upon complaint of loose or hard steering, thrust bearing adjustment and overcenter adjustment will correct the problem if it lies within the steering gear adjustments. If not, check the rack-piston nut and worm assembly for excessive clearance, lack of drag, and also for roughness at any point along the worm. If any of these conditions is found, disassemble the assembly and inspect worm and rack-piston nut grooves and all the balls for excessive wear or scoring. If either worm or rack-piston nut need replacing, both must be replaced as a matched assembly. Drag may be corrected by replacing the silver balls with a larger or smaller size. Black balls need not be replaced unless they are defective. In event the black balls cannot be distinguished from the silver balls, replace with all new balls.

#### NOTE

The black balls are 0.0005 inch smaller than the silver balls. The black and silver balls must be installed alternately into the rack-piston nut and return guide.

#### NOTE

The silver ball size is stamped on the rack-piston. If no size is shown it is standard ball size number 7. Change to next larger size silver ball will increase drag 1 inch-pound or next size smaller will reduce drag by 1 inch-pound.

5. Inspect ball return guides (64), making sure that the ends where the balls enter and leave the guides are not damaged.

6. Inspect lower thrust bearing (68) and races (67).

7. Inspect rack-piston ball nut (65) teeth for wear and chipping. Inspect rack-piston nut surface for scoring or burrs.

#### 6-89. RACK-PISTON, WORM ASSEMBLY AND GEAR HOUSING ASSEMBLY.

1. Thoroughly clean the parts and lubricate the internal parts with OE-10 engine oil.

2. Drive new connectors (85 and 86, figure 4-32) in place with piloted driver.

3. Lubricate a new back-up packing (61) with OE-10 engine oil. Assemble in piston ring groove on rack-piston nut (65). Install new piston ring (60) in ring groove over packing by carefully slipping ring over rack-piston nut. The ring may be slightly loose after assembly. This is normal. It will tighten when subjected to the hot oil in the system.



4. Insert worm (59), without thrust bearing, fully into rack-piston ball nut (65).

5. Align ball return guide holes with the worm groove. Load all except seven balls (66) lubricated with OE-10 engine oil into the lower guide hole nearest the piston ring, while slowly rotating the worm (71) counterclockwise to feed the balls through the circuit. Alternate black balls with silver balls.

6. Fill one of ball return guides (64) with remaining seven balls. Place other guide over balls and plug ends with automotive grease to prevent balls falling out when installing guide into rack-piston nut.

7. Insert guides (64) into guide holes of rack-piston nut. Guides should fit loosely.

8. Place return guide clamp (62) over guides, install two screw and lock washer assemblies and tighten to 8 to 12 foot-pounds.

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

#### **6-90. RACK-PISTON, WORM ASSEMBLY AND GEAR HOUSING INSTALLATION.**

##### **NOTE**

**Lubricate all parts during assembly with OE-10 engine oil.**

1. Assemble thrust bearing (68, figure 4-32) and races (67) on worm (59). Assemble valve assembly to worm by aligning small slot in valve body (75) with pin on worm. Be sure to install packing (80) between body and worm head.

2. Install valve assembly and worm in housing (87) as integral unit. Adjust thrust bearings as outlined in paragraph 6-91.

3. Position ring compressor (see figure 6-13 for tool details) in gear housing (87) tight against shoulder of housing. Insert rack-piston ball nut (65) into housing until arbor engages worm. Turn stub shaft (76) clockwise, drawing rack-piston nut into housing. When piston ring is in housing bore, withdraw arbor from rack-piston nut. Remove ring compressor.

4. Install rack-piston plug as outlined in paragraph 6-85.

5. Install housing end plug as outlined in paragraph 6-83.

6. Install sector gearshaft and side cover as outlined in paragraph 6-81.

**6-91. THRUST BEARING ADJUSTMENT.** This adjustment is to be made after the worm, thrust bearings, valve assembly, adjuster plug assembly, and locknut are assembled in the housing assembly. Proceed as follows:

1. Tighten adjuster plug (52, figure 4-32) up snug, back off 1/8 turn and measure valve assembly drag with

inch-pound torque wrench and 12 point 3/4 inch socket on lower shaft (76).

2. Tighten adjuster plug to add preload of 1 to 3 inch-pounds in excess of valve assembly drag. Tighten locknut (49). Total thrust bearing adjustment and seal drag is not to exceed 8 inch-pounds.

**6-92. LASH ADJUSTMENT.** This adjustment is to be made after the gear is completely assembled.

1. Back off lash adjuster screw (33, figure 4-32) fully.

2. Using an inch-pound torque wrench and 12 point 3/4 inch socket on the stub shaft (76), rotate fully counting turn between each end. Turn to center position which is half the total turns from one end.

3. Rotate stub shaft through a 20 deg. arc noting torque reading. Verify with several readings.

4. Tighten lash adjuster screw (33) until torque wrench reading is 4 to 8 inch-pounds higher than that obtained in step 3. Reading should not exceed 14 inch-pounds.

5. Using a crowfoot adapter and foot-pound torque wrench, tighten locknut (34) to 25 foot-pounds while holding the adjuster screw with a hex socket wrench.

#### **6-93. MASTER CYLINDER ASSEMBLY.**

#### **6-94. ASSEMBLY.**

##### **NOTE**

**Wet master cylinder interior parts with hydraulic brake fluid, Fed Spec FV-H-910 during assembly.**

1. Assemble in brake master cylinder in order the following: check valve (40, figure 4-10), spring (39), cup (38), piston assembly (37), stop plate (36) and retaining ring (35).

2. Assemble clevis end (24) and locknut (25) to push rod (33). Adjust clevis distance between the eye center and the outer end of the push rod hex to 2-3/8 inches. Hold push rod and tighten locknut. Assemble boot (34) and push rod to master cylinder.

3. Assemble gasket (30), brake line swivel fitting (29), gasket (28) and hollow swivel bolt (27) to master cylinder.

##### **NOTE**

**Fitting is installed with 1/8 NPT port at top and the 1/4 inch OD tubing port to center of truck.**

4. Assemble reservoir cap (31) and gasket to master cylinder.

5. Assemble stop light switch to swivel fitting.

**6-95. INSTALLATION.**

Refer to TM 10-3930-623-12.

**6-96. WHEEL BRAKE ASSEMBLY.****6-97. REPAIR**

Refer to TM 10-3930-623-12.

**6-98. ASSEMBLY AND INSTALLATION.**

1. Assemble and install wheel brake in reverse of disassembly and removal procedures.
2. Refer to LO 10-3930-623-12 for lubrication requirements for the power axle assembly.
3. Bleed service brake system as directed in TM 10-3930-623-12.
4. Adjust brakes as directed in TM 10-3930-623-12.

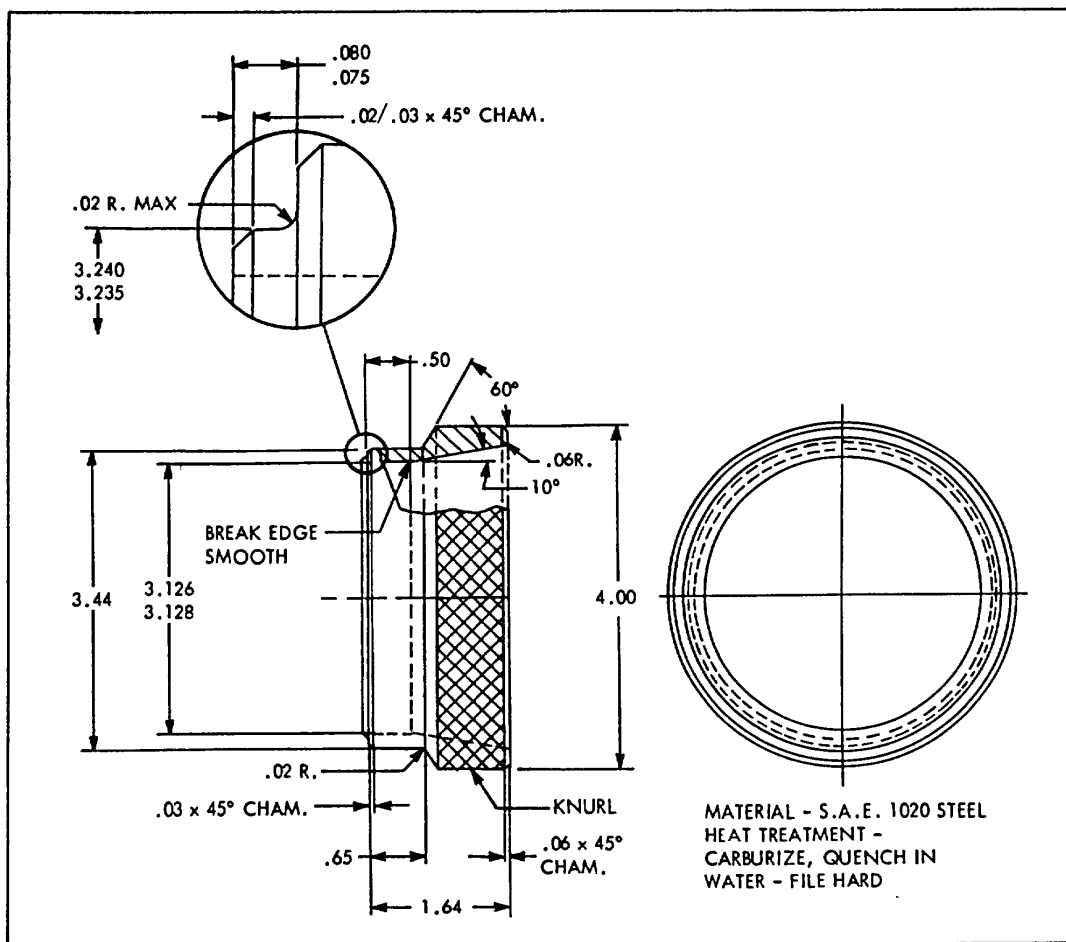


Figure 6-13. Steering Gear Piston Ring Compressor Tool Details

## 6-102. HYDRAULIC SYSTEM ASSEMBLY.

**6-103. HOIST CYLINDER ASSEMBLY.** Reassemble the hoist cylinder as follows:

### NOTE

**Use suitable strap wrench or soft jaw vise when assembling plungers and cylinders. Avoid scarring chrome plate wear surfaces of hoist cylinder parts.**

1. Install two new secondary plunger bearings (25, figure 4-4) in recess of secondary plunger (29). Carefully slide plunger into the secondary cylinder (22) from the top.

2. Install new backup ring (5) and preform packing (4) on secondary cylinder end (3) in order listed. Lubricate packing with OE-10 engine oil and install end into cylinder (22).

3. Loosely assemble air vent screw (1) and washer (2) to end (3) to prevent entry of foreign matter.

### NOTE

**Screw (1) is used to bleed air from hydraulic system after complete assembly of hydraulic system. At that time screw will be securely tightened.**

4. Install bearing (20), preform packing rings (19), and retainer (18) in bottom recess of secondary cylinder. Install packing nut (16). Clean end of secondary plunger and press wiper ring (17) into packing nut. Plug port opening of secondary plunger.

### NOTE

**Lubricate packing rings and wiper with OE-10 engine oil before assembling.**

5. Install secondary cylinder guide (26) and retaining ring (27) in lower end of the primary plunger (28).

6-99. Deleted.

6-100. Deleted.

6-101. Deleted.

6. Carefully slide secondary plunger and cylinder assembly into primary plunger from bottom.

7. Install bearing (10), preform packing rings (9) and retainer (8) in upper recess of primary plunger (28). See note in step 4. Press wiper ring (7) into packing nut (6). Clean end of secondary cylinder and install packing nut into primary plunger.

8. Assemble preform packing (23) and backup ring (24) to lower end of secondary cylinder (22). See note step 4.

9. Slide secondary cylinder assembly into lower end of the primary cylinder (21). Use spanner wrench and thread built up assembly into primary cylinder.

10. Install bearing (15), preform packing rings (14) and retainer (13) into upper end recess of the primary cylinder (21). See step 4 note. Install packing nut (11).

11. Clean upper end of primary plunger (28) and press wiper ring (12) into nut (11).

12. Loosely install air vent screw (1) and washer (2) in the primary cylinder (21). See note in step 3.

#### **6-104. UPRIGHTS, CARRIAGE AND FORK ASSEMBLY.**

1. Slide inner upright (42, figure 4-3) into outer upright (43).

2. Assemble four carriage rollers (54) and bearings (55) to carriage (56). Assemble carriage side thrust bracket (46) and rollers (45) to carriage with screws (47) and washers (48).

3. Assemble carriage striker block (51) to carriage with screws (52) and washers (53).

4. Loosely install carriage slide thrust roller adjustment screw (49).

5. Assemble carriage assembly to inner and outer uprights. Stand mast in upright position.

6. Assemble roller crosshead (34) to hoist cylinder (35).

7. Install hoist cylinder (35) and adapter ring (36) in outer upright. Attach cylinder brace (28) to inner upright and to mast cylinder with nut (29) and washer (30).

8. Assemble washer (27), roller (25) and roller bearing (24) to crosshead. Install retaining washer (24) and retaining rings (23).

9. Assemble roller chain adjusting screws (19) to mast cylinder with nuts (20) and jam nuts (21).

#### **NOTE**

**Leave full length of adjustment until chain is installed.**

10. Assemble roller chain (22) to carriage and to adjusting screws (19) passing over rollers (25).

11. Assemble latch assembly (7 through 16) to upright.

12. Install all lubrication fittings. Adjust chains, carriage and uprights for clearance.

**6-105. UPRIGHT, CARRIAGE AND FORK ADJUSTMENTS.** The uprights are provided with several adjusting setscrews (41, figure 4-3) and the carriage with setscrews (49) to insure free movement of the inner and outer uprights and carriage. Adjust as follows:

1. Adjust carriage roller thrust screw (50) to level carriage (56) with mast and upright assembly. Tighten screws until all side play is removed. Install lock setscrew (49).

2. Adjust chain tension by tightening nuts (20) on hoist cylinder chain anchor screws (19). Tighten until all slack is removed from both chains (22) without lifting carriage. Hold nut (20) and tighten jam nut (21).

3. Mast setscrews (41) are adjusted after installation and with hydraulic system in operation. Raise carriage and forks to full height and tilted fully forward. Adjust setscrews in inner and outer uprights (42 and 43) to zero clearance.

#### **6-106. UPRIGHT, CARRIAGE AND FORK INSTALLATION.**

1. Install bearing half (38, figure 4-3) in upright bracket. Press pins (39) through bearings and into bracket. Peen end of pin below surface of bearing.

2. Install bearings in bearing caps. See step 1 above.

3. Install regulator valve (4) and related fittings in hoist cylinder (35).

4. Using hoist, lift upright assembly onto truck front axle. Install bearing caps.

5. Connect tilt cylinder to upright by pins and retaining plates.

6. Install forks (2) and backrest (1).

#### **6-107. TILT CYLINDER ASSEMBLY.**

#### **NOTE**

**Wipe clean inner cylinder walls and wet all interior parts with OE-10 engine oil during assembly.**

1. Assemble nylon piston guide ring (15, figure 4-5) and two packing rings (14) on tilt cylinder piston (16). Carefully compress packing rings and slide piston into cylinder (17).

2. Assemble back-up ring (12) and preform packing (13) on cylinder stuffing box (10).

3. Check insert plug (11) and insert new plug if badly cut by cylinder threads.

4. Assemble packing set (9) in the stuffing box and compress with packing gland (5). Assemble screws (6) and lock washers (7).

#### NOTE

**Packing set consists of five molded rings which must be stacked as follows: bottom, flat side with white stripe; second and fourth from top, no color stripe; first and third from top, red stripe. Stack packing rings to nest on bottom ring. Insert ring one first into stuffing box (10).**

5. Press piston wiper ring (8) in packing gland.

6. Screw piston clevis end (1) on piston shaft and assemble clamp screw (2), nut (3) and lock washer (4).

7. Adjust tilt cylinder clevis to cylinder anchor pin holes center to center distance to 15-5/16 inch with cylinder in fully retracted condition. Torque nut (3) to 75-80 foot-pounds.

8. Plug ports to prevent entrance of foreign materials.

### 6-108. TILT CYLINDER INSTALLATION.

Refer to TM 10-3930-623-12.

### 6-109. HYDRAULIC CONTROL VALVE ASSEMBLY.

#### CAUTION

**The linear valve spools are mated to the valve body during manufacture. Do not interchange spools between valve bodies. Replacement of either spool requires complete replacement of the body with two mated spools.**

1. Oil valve spools with OE-10 engine oil. Carefully slide spool into valve body from the top.

#### NOTE

**Complete installation of one spool before installing second one.**

2. Assemble new preform packing (27, figure 4-6) into body recess with packing retainer (31).

3. Assemble in order to spool lower end, spring seat (29) spring (30), second spring seat (29) and retaining ring (28).

4. Assemble cap (20) to valve body.

5. Assemble new packing (27) to valve body upper spool bore.

6. Assemble packing retainer (26), wiper ring (25), retainer plate (22), control handle bracket (21) and screws (23).

7. Assemble regulator valve plunger seat (15), plunger (14), poppet assembly (13), spring (12), pilot seat (11), in order listed in pressure regulator bore of valve body.

8. Assemble preform packings (6 and 8) and ring (7) to relief valve cap (5).

9. Lubricate packings with OE-10 engine oil and assemble cap (5) to valve body. Carefully drop pilot plunger (10) and its spring (9) in cap bore.

10. Assemble adjustment screw (4) in cap until it meets spring (9). Assemble gaskets (2), nut (3), and acorn nut (1) loosely on setscrew.

#### NOTE

**Pressure in hydraulic systems is regulated by adjustment of setscrew (4) with system filled and pump operating. See paragraph 7-(91) for instructions. After setting pressure, nut (3) will be locked. Parts are loosely installed to prevent loss.**

11. Assemble plug and seal (35) to lower end of pressure regulator bore.

12. Assemble check valve poppet (19), spring (18) in check valve bore. Assemble preform packing (17) to plug (16) and assemble to body.

13. Plug all openings to prevent entrance of dirt until valve is to be installed.

14. Assemble operating handles (55 and 56, figure 4-2) to valve handle bracket (21, figure 4-6) with pin (57, figure 4-2) and cotter pin (58).

15. Connect handle to valve spool with links (61), pins (59) and cotter pins (58).

## 6-110. HYDRAULIC CONTROL VALVE INSTALLATION,

Refer to TM 10-3930-623-12.

## 6-111. HYDRAULIC OIL PUMP ASSEMBLY.

### NOTE

**Lubricate all parts with OE-10 engine oil before assembly. Oil all preform packings and seals before installing.**

1. Assemble new preform packing (16, figure 4-7) to priority valve passage plug (15) and packing (23) to relief valve passage plug (22). Assemble plugs to pump body.

2. Assemble priority valve spool (21), spring (20), spring seat (19) and plug (17) with new preform packing (18) to pump body.

3. Press relief valve roll pin into body oil passage.

4. Assemble relief valve spool assembly (31). Carefully drop plunger cone (30) point first into spool. Drop spring (29) into spool and screw in adjusting setscrew (28) and lock screw (27).

### NOTE

**Initially set screws (27 and 28) flush with end of valve spool (31). Final setting is adjusted with system filled and the engine driving the pump. See paragraph 7-89 for instructions.**

5. Insert spool assembly, spring (26) and plug (24) with new preform packing (25) in pump body.

6. Assemble preform packing (9) and back-up ring (8) to each bushing (11). Assemble bushing pairs with pin (12).

7. Assemble idler gear (14) and drive gear (13) and bushings. Slide assembly into pump body (35).

8. Assemble preform packings (6 and 7) in pump body. Assemble pump flange (4) over gear shaft. Secure with eight screws (5).

9. Carefully press oil seal (2) into flange recess and assemble retaining ring (3).

10. Fill pump cavity with clean OE-10 engine oil to provide initial lubrication when pump is first operated. Plug ports to prevent entrance of foreign matter.

## 6-112. HYDRAULIC OIL PUMP INSTALLATION.

### NOTE

**Drive coupling drive half is assembled to engine crankshaft during engine assembly.**

1. Assemble drive coupling gear retaining ring and gear to pump shaft (13, figure 4-7) with woodruff key (1).

2. Assemble drive coupling gear to splines of coupling on engine.

3. Install lock washers and nuts on pump mounting studs. Install retaining ring in drive coupling.

4. Assemble pump inlet and pressure lines using new preform packings (16 and 23, figure 4-2). Install flange clamps (13 and 20) with screws (14 and 21) and lock washers (15 and 22).

5. Assemble steering gear pressure hose (9, figure 4-31) to pump.

## 6-113. Deleted.

## 6-114. Deleted

#### 6-115. HYDRAULIC TANK ASSEMBLY.

1. Apply gasket sealer to both sides of the pick-up tube (49, figure 4-2) flange. Assemble tube to hydraulic reservoir tank (50).

2. Assemble screen filter element (48) to outlet elbow flange (44).

3. Assemble flange elbow and gasket (47) to tank with screws (45) and washers (46).

Torque screws to 15-18 foot-pounds maximum.

#### NOTE

**Excessive tightening will cause flange to ripple permitting leakage.**

4. Assemble plugs (42 and 43) to tank.

5. Assemble combination breather and filler assembly (40) to tank.

**6-116. HYDRAULIC TANK INSTALLATION.** Install hydraulic tank (50, figure 4-2) from underside of truck.

Hang tank on studs and install flat washers, lock washers and nuts. Connect hydraulic pump pick-up and control valve return hoses. Connect power steering return hose.

#### 6-117. EXHAUST SYSTEM.

**6-118. REPAIRS.** Repairs are not to be made to any portion of the exhaust system. Defective items must be replaced.

#### 6-119. INSTALLATION.

1. Assemble exhaust pipe (3, figure 4-29) to the muffler (1) with clamp (2).

2. Install muffler and pipe into chassis with screws (4), lock washers (5) and flat washers (6).

3. Install exhaust elbow (9) on exhaust manifold with gaskets (12).

4. Install exhaust hose (7) between the elbow and the pipe with clamp (8).

5. Install counterweight, overhead guard, seat and sheet metal. See TM 10-3930-623-12.

## SECTION VII

## INSPECTION, TESTING, AND TABLE OF LIMITS

**7-1. SCOPE OF SECTION.**

**7-2.** This section contains instructions for inspection, adjusting, and testing of various components and assemblies of the truck. Figure 7-1, Table of Limits, supports engine inspection procedures; Figure 7-2, Torque Values for Threaded Items, gives tightening data to be used on installation of components; Figure 7-3, Table of Nondestructive Inspection Data, lists required nondestructive inspection and related information. Installation procedures are given for major assemblies normally removed at overhaul. Completing these installation procedures will result in final assembly of the truck.

**7-3.** Inspection procedures generally consist of visually noting obvious damage, wear or deterioration, or using standard shop measuring tools such as micrometers. Test and adjustment procedures apply primarily to assembled components. Inspection procedures used need not be limited to those given in this section, as long as procedure is appropriate and conforms to good general shop practice. No magnetic particle or fluorescent penetrant inspections are specified by the truck manufacturer.

**7-4. GENERAL INSPECTION PROCEDURES**

**7-5. BALL NEEDLE AND ROLLER BEARING ASSEMBLIES.** Clean all bearings before inspection in accordance with paragraph 5-12. Inspect in the following manner:

1. Inspect bearing surfaces for rust deposits, deep scratches, deformation and improper number of balls or needles. If any obvious deficiency is noticed, discard bearing assembly.
2. Hold inner race between fingers and rotate outer race slowly. Note any binding or noise indicating internal damage. Discard worn bearing assemblies.
3. Radial and thrust play on an unmounted bearing must be very slight. Press inner and outer races toward one another with light finger pressure. If movement is obvious, discard bearing assembly.

**7-6. BEARING COUNTERBORES AND SEATS.** Inspect each bearing counterbore or seat for burrs, raised metal, scratches and corrosion. Remove minor defects with a fine grit hone. Replace parts having excessively damaged bearing counterbores or seats.

**7-7. SLEEVE BEARINGS.** Inspect for wear and damage. Refer to figure 7-1 for allowable wear limits.

**7-8. GEARS.** Inspect gear bodies, teeth, bores, keyways, and splines for burrs, scratches, raised metal, cracks, and excessive wear. Remove minor defects with a fine grit hone. Replace worn or defective gears.

**7-9. SHAFTS.** Inspect bearing, gear, and bushing surfaces of each shaft for wear or pitting. Inspect keyways, splines, and threads of shafts for damage and wear. Repair or replace shafts according to condition.

**7-10. THREADS.** Inspect all internal and external threaded surfaces for stripped or crossed threads and other damage. Repair or discard defective items as required. Repair threads in accordance with paragraph 6-7. Tighten threads in accordance with figure 7-2.

**7-11. SPRINGS.** Inspect all coil springs for deformation, loss of tension, wear, and other damage.

**7-12. GASKETED SURFACES ON HOUSINGS AND CASTINGS.** Inspect all gasketed surfaces for burrs, raised metal, nicks, and scratches. Remove minor defects with a fine mill file. Discard any item which does not permit a leak-proof seal.

**7-13. HOUSINGS, FORGINGS, AND CASTINGS.** Inspect housings, forgings, and castings for cracks, thread damage, and deformation. Repair or discard items as necessary.

**7-14. SHEET METAL.** Inspect all sheet metal for obvious damage such as dents, torn material, surfaces weakened by excessive oxidation, and other types of deterioration. Determine by inspection whether or not damage is beyond serviceable or repairable limits and if each item is to be repaired or discarded.

**7-15. TRUCK EXTERIOR VISUAL INSPECTION.** Inspect truck exterior for signs of fluid leaks, damage of any type to the structure, and security of attachment of all external parts, such as wheels. Frequently inspect tires for imbedded nails or glass, deep cuts, uneven or excessive wear, and underinflation.

**7-16. NONDESTRUCTIVE INSPECTION DATA.** Refer to figure 7-3 for specific nondestructive inspection data on components and assemblies. Information in this figure is supplemented in the following paragraphs.

**7-17. ENGINE COMPONENT INSPECTIONS AND TESTS.**

**7-18. CARBURETOR INSPECTION.**

1. Inspect carburetor body for cracks, damaged flanges, stripped threads, and other damage. Discard defective body.



Ref No.	Point of Measurement	See Sheet or Figure	Manufacturers' Specifications		Wear Limits Inches
			Min-Inches	Max-Inches	
	Valve Guide				
1	Bore diameter, Exhaust		0.3452	0.3462	0.3477
1	Bore diameter, Intake		0.3432	0.3442	0.3457
2	Top of guide to cylinder deck		1-15/32	1-15/32	
	Valve Seat				
3	Angle		45 deg.	45 deg.	
	Valve				
4	Seat Angle		45 deg.	45 deg.	
5	Stern diameter, Exhaust		0.3405	0.3415	0.3385
5	Stem diameter, Intake		0.3405	0.3415	0.3385
	Valve Springs				
	<b>NOTE: Effort in pounds required to compress spring to length specified</b>				
6	Valve closed, length 1-45/64		47	53	42
	Camshaft				
	Journal diameter				
7	Front		1.8715	1.8725	1.8745
8	Intermediate, Front		1.8085	1.8095	1.8115
9	Intermediate, Rear		1.7457	1.7465	1.748S
10	Rear		1.2465	1.2475	1.2495
	Bushing inside diameter				
	Front		1.8745	1.8755	1.8725
	Intermediate, Front		1.8115	1.8125	1.8095
	Interermdiate, Rear		1.7495	1.7502	1.7475
	Rear		1.2495	1.2505	1.2475
	Journal to bushing clearance				
	Front, Intermediate front, rear		0.002	0.004	
	Intermediate Rear		0.003	0.0045	
11	End play		0.005	0.009	
	Connecting Rod				
12	Bearing insert thickness		0.0623	0.0628	0.0618
13	Crank pin diameter		2.0694	2.0601	2.0584
14	Crank pin clearance		0.0008	0.0020	0.0030
15	Side play		0.006	0.010	
16	Journal Radii		0.0781	0.01094	

Figure 7-1. Table of Limits and Fits and Points of Measurements (Sheet 1 of 4)

Ref No.	Point of Measurement	See Sheet or Figure	Manufacturers' Specifications		Wear Limits Inches
			Min-Inches	Max-Inches	
17	Main bearings				
	Insert thickness		0.0948	0.0953	0.0943
	Rear flange insert thickness		0.0948	0.0953	0.0943
18	Crankshaft journal diameter		2.2442	2.2451	2.2432
19	Journal Radii				
	All except Rear		0.0781	0.1094	
	Rear (Flywheel End)		0.1094	0.1406	
20	Journal clearance		0.0008	0.0028	
21	Crankshaft end play		0.002	0.006	
22	Piston pin				
	Diameter		0.8591	0.8593	0.8588
	Piston pin hole diameter		0.8593	0.8596	
	Pin to piston fit		0.0001	0.0003	
	Connecting rod bushing diameter		0.8593	0.8596	
	Pin to bushing fit		0.0000	0.0005	
	Piston Rings				
23	Width				
	Top (chrome) and No. 2		0.0930	0.0940	0.0928
	No. 3 and 4		0.1545	0.1555	0.1525
25	Side clearance				
	Top		0.002	0.004	
	No. 2		0.0015	0.0035	
	No. 3 and 4		0.001	0.003	
26	Thickness				
	Top		0.162	0.172	
	No. 2,3 and 4		0.148	0.153	
27	End gap clearance		0.010	0.020	
28	Cylinder diameter		3.4375	3.4395	

Figure 7-1. Table of Limits and Fits and Points of Measurements (Sheet 2 of 4)

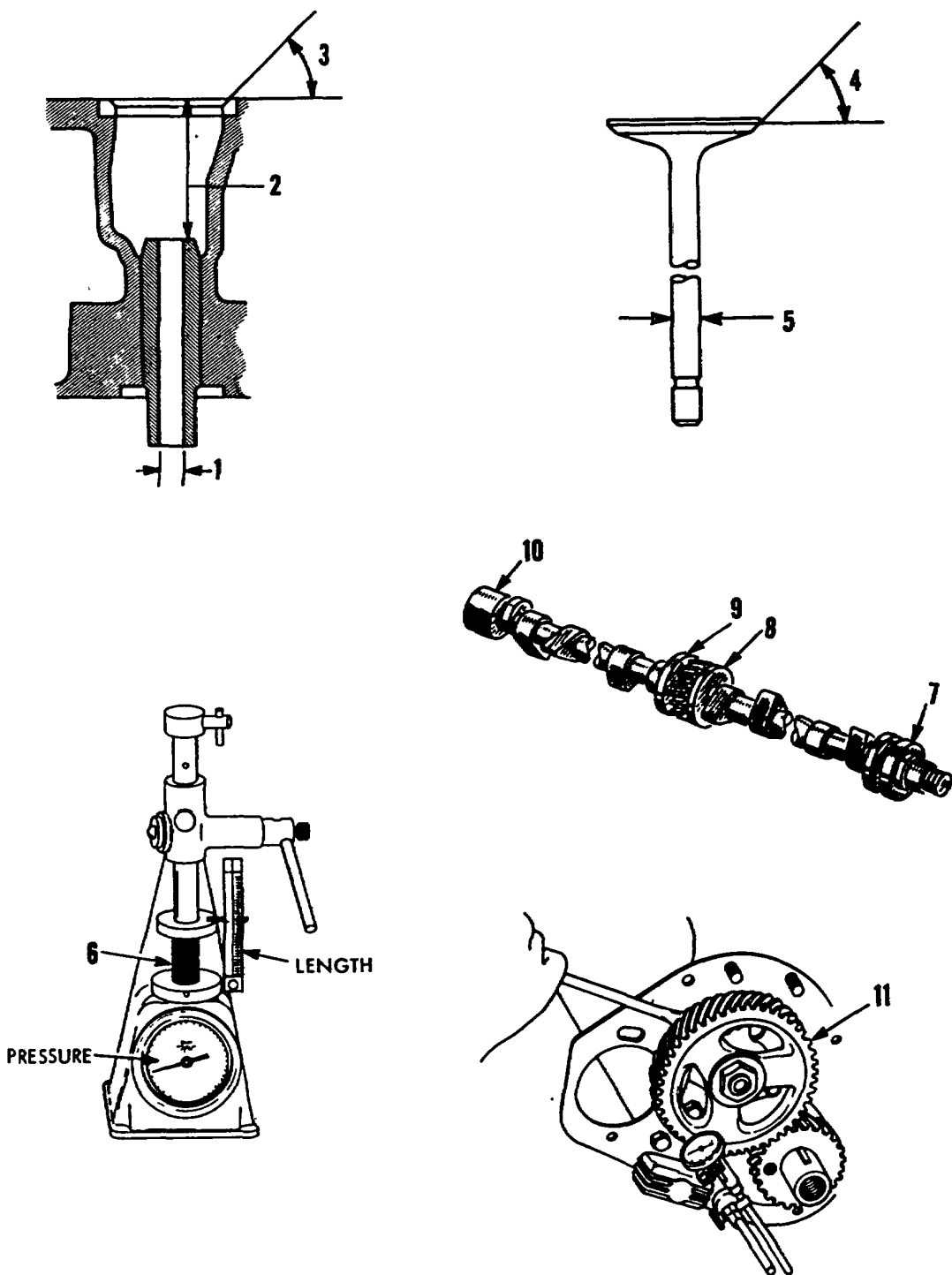


Figure 7-1. Table of Limits and Fits and Points of Measurements (Sheet 3 of 4)

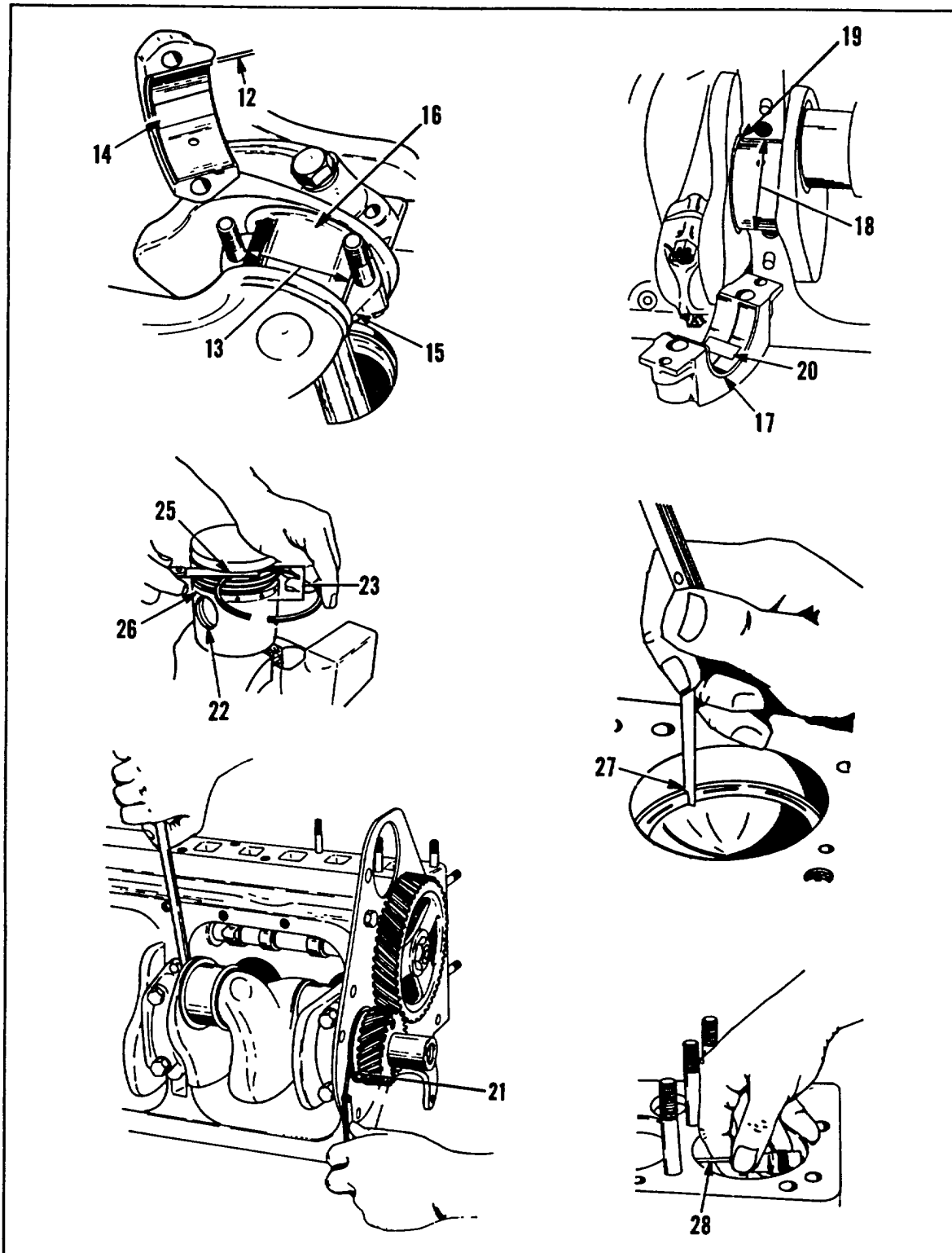


Figure 7-1. Table of Limits and Fits and Points of Measurements (Sheet 4 of 4)




The following table lists bolt torque specifications recommended for all applications where specific torque requirements are not stated.				
Bolt Grade	Coml Low-Carb SAE-2	SAE-5	SAE-7	SAE-8
Head Marking	None			
Bolt Size	In. Lb			
4-40	8			
6-32	12			
8-32	20			
10-24	25			
10-32	30			
12-24	35			
	Ft Lb	Ft Lb	Ft Lb	Ft Lb
1/4-20	4	7	9	11
1/4-28	5	9	11	13
5/16-18	9	15	19	23
5/16-24	10	17	21	26
3/8-16	15	27	35	42
3/8-24	18	33	42	50
7/16-14	25	45	60	70
7/16-20	30	55	70	80
1/2-13	40	75	90	105
1/2-20	45	85	105	120
9/16-12	60	110	135	150
9/16-18	65	120	150	165
5/8-11	80	140	170	200
5/8-18	90	155	200	230
3/4-10	125	240	300	350
3/4-16	140	275	350	400
7/8-9	175	375	500	575
7/8-14	200	400	550	625
1-8	250	575	750	850
1-12	275	650	825	950

Figure 7-2. Table of Torque Values

Part Name and No.	Type of Test	Test Procedure	Acceptable Defects
Carburetor	1. Visual inspection of parts. 2. Inspection of unit in operation.	1. Refer to para 7-18. 2. Look for fuel leaks.	None.
Fuel pump	1. Visual inspection of parts. 2. Before installation test. 3. After installation test.	1. Refer to para 7-20. 2. Refer to para 7-21. 3. Refer to para 7-22.	None.
Water pump	1. Visual inspection. 2. Operational inspection.	1. Refer to para 7-23. 2. Inspect for leaks at engine governed speed.	None.
Starting motor	1. Visual inspection of components. 2. Electrical test of components. 3. Operational tests of assembly.	1. Refer to para 7-24 to 7-31. 2. Refer to para 7-24, 7-26 and 7-27. 3. Refer to para 7-30 and 7-32.	1. Brushes may be worn to half of original length. 2. None. 3. None.
Distributor	1. Visual inspection and test of components. 2. Operational tests.	1. Refer to para 7-32 to 7-34. 2. Refer to para 7-35 and 7-36.	None. None.
Cylinder head	Visual inspection for cracks and surface warpage.	Refer to para 7-38.	0.004 inch low lengthwise, 0.003 inch low crosswise.
Cylinder block	1. Visual inspection for cracks and top surface irregularities. 2. Micrometer inspection of cylinder bores.	1. Check machined top surface with straight edge for warpage. 2. Refer to para 7-38.	1. 0.004 inch low lengthwise, 0.003 inch low crosswise. 2. Taper less than 0.008 inch, out-of-round less than 0.003 inch. Scratches less than 0.001 deep.
Camshaft	Visual inspection.	Refer to para 7-39.	Refer to para 7-39.
Valves (engine) Intake Exhaust	Visual inspection.	Refer to para 7-40.	See figure 7-1.

Figure 7-3. Nondestructive Inspection Data (Sheet 1 of 2)

Part Name and No.	Type of Test	Test Procedure	Acceptable Defects
Tappets	Visual inspection.	Examination.	Two minor pits per tappet face.
Valve springs	Use shop valve spring tester.	Refer to para 7-40.	Refer to figure 7-1.
Engine oil pump	Measurement.	Measure gear to housing clearance with feeler gage. Refer to para 7-41.	Clearance less than 0.003 inch.
Crankshaft	Visual, with micrometer and dial indicator.	Refer to para 7-42.	Refer to para 7-42.
Connecting rods	Visual, with shop rod alignment tester.	Refer to para 7-44.	Refer to para 7-44.
Transmission	1. Visual inspection of parts. 2. Road test.	1. Refer to para 7-46. 2. Refer to para 7-86.	None.
Drive axle	Visual inspection of parts.	Refer to para 7-47.	None.
Brake master cylinder	Visual inspection and test for leakage.	Refer to para 7-48.	None
Steering axle	Visual inspection.	Refer to para 7-52.	None.
Steering gear	Visual inspection and road test.	Refer to para 7-53 and figure 7-11.	None.
Hoist hydraulic system	Visual inspection for leaks.	Operate system fully loaded, then inspect for leaks.	None.
Hydraulic pump	Visual and functional inspection.	Refer to para 7-56 and 7-57.	None.
Hoist and tilt cylinders	Visual and functional inspection.	Refer to para 7-58 and 7-59.	Slight weeping of hydraulic fluid at exposed parts of cylinder plungers.
Hydraulic control valve	Visual inspection.	Refer to para 7-60.	None.

Figure 7-3. Nondestructive Inspection Data (Sheet 2 of 2)

2. Apply low pressure (25 psi maximum) compressed air to all passages to check for obstructions. Check venturi for damage and distortion. Discard damaged or defective venturi.

3. Check springs, retainers, washers, and all attaching parts for wear, stripped threads, distortion, and other damage. Discard defective parts.

#### **7-19. CARBURETOR ADJUSTMENT.**

Refer to TM 10-3930-623-12.

#### **7-20. FUEL PUMP INSPECTION.**

Refer to TM 10-3930-623-12.

#### **7-21. FUEL PUMP BEFORE INSTALLATION TESTS.**

Refer to TM 10-3930-623-12.

#### **7-22. FUEL PUMP AFTER INSTALLATION TESTS.**

Refer to TM 10-3930-623-12.

**7-23. WATER PUMP, INSPECTION.** (See figure 7-4). Complete inspection requires checking the pump both assembled and disassembled. Proceed as follows:

1. With pump disassembled, inspect all metal parts for corrosion.
2. Check shaft seals (11, figure 7-4) for deterioration.
3. Check mating surfaces of cover (5) and body (13) for cleanliness and freedom from warpage.
4. Check shaft and bearing (8) for smoothness of machined surfaces and free operation of bearing without looseness. Check hub and pulley (1) for alignment of pulley groove.
5. Check for leaks after assembly while operating.

#### **7-24. STARTING MOTOR FIELD WINDINGS INSPECTION AND TEST.**

1. Examine field windings (47, figure 4-21) for worn, burned, or frayed insulation. Replace defective windings. Check for secure connections.
2. Check terminal screw for burning and crossed or stripped threads. Discard damaged bushing and insulation washers. Discard bent dowel pin. Check housing (49) for cracks and damage. Discard defective housing.
3. Use a conventional test light to check field windings for grounds to frame and open circuits in coils.

#### **7-25. STARTING MOTOR COMMUTATOR END BELL INSPECTION.**

1. Discard oil soaked brushes or excessively worn brushes.



2. Check all lead wires for fraying, broken strands, or corrosion. Discard defective lead wires.

3. Discard broken or bent springs and brush holders. Measure spring tension with a spring gage. Discard springs if pressure of brushes to commutator is less than 35 ounces, or if springs are discolored or distorted.

4. Examine commutator end bell for cracks, distortion, or excessive side plan. Discard if damaged or worn.

#### 7-26. STARTING MOTOR ARMATURE INSPECTION AND TEST.

1. Check bearing surface at ends of shaft for pitting and scoring. Examine shaft for straightness. Discard armature (34, figure 4-21) if pits or scratches cannot be repaired with a fine grade hone, or if shaft is bent.

2. Examine commutator for roughness, high mica, and burning. If commutator is dirty or discolored, clean with 00 sandpaper. Check commutator with a dial indicator for out-of-round. If out-of-round exceeds 0.003 inch, turn down commutator on lathe, and undercut mica 1/16 inch between segments.

3. Examine all windings for properly soldered connections.

4. Check armature assembly for open coils and shorts and grounds using conventional test light and growler tests.

#### **CAUTION**

**Do not touch test lamp probes to shaft bearing surfaces. Arcing will damage smooth surfaces.**

#### 7-27. STARTING MOTOR SOLENOID RELAY INSPECTION.

1. Check starting switch terminals and terminal nuts for stripped or crossed threads. Discard parts, which cannot be repaired.

2. Use a conventional test light and a 12 volt battery to check circuit continuity of switch and relay. If the test lamp does not light when switch is closed, discard switch.

#### 7-28. STARTING MOTOR DRIVE ASSEMBLY INSPECTION.

1. Examine drive pinion and shaft assembly for worn or broken teeth. Check movement by rotating drive pinion. Discard defective or damaged assembly.

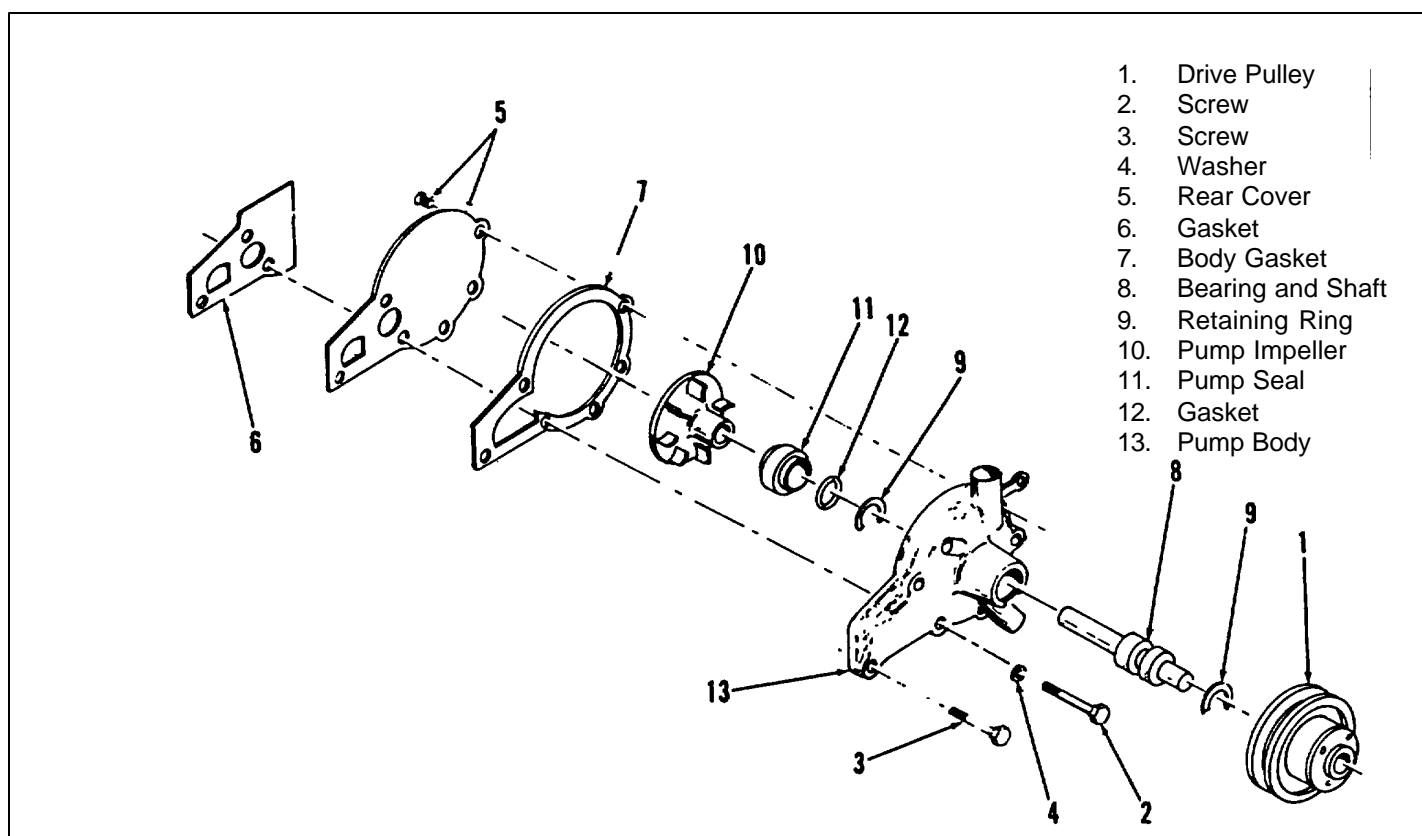


Figure 7-4. Engine Water Pump, Exploded View

2. Inspect drive spring for distortion and damage. Discard damaged drive spring.

### 7-29. STARTING MOTOR ARMATURE END PLAY ADJUSTMENTS.

1. Align drive end of armature shaft with plunger of a dial indicator. Pull shaft out toward drive end to outer limit and set dial indicator.

2. Push armature shaft in toward commutator end of starting motor assembly to inner limit. Note dial indicator reading. End play must be between 0.005 and 0.062 inch.

3. If end play exceed these limits, add or remove thrust washers at drive end of armature shaft to obtain proper end play.

### 7-30. STARTING MOTOR NO-LOAD CURRENT AND SPEED TEST.

1. Connect starting motor assembly to test circuits (figure 7-5). Be sure equipment used has sufficient capacity to handle test, anticipating possible electrical overloads if the starting motor is defective.

2. Close test switch and adjust variable resistance to obtain a voltmeter reading of 9.0 volts. The ammeter reading must be between 53 and 69 amperes.

3. Place a mechanical tachometer on drive end of armature shaft and check for speed. Correct speed at current and voltage specified in step 2 is 6400 to 8600 rpm.

4. If test indicates low speed and high current, recheck armature for shorts or grounds. If armature appears to be satisfactory, check for loose pole shoes and defective bearings.

5. If test indicates low speed and low current, examine commutator, brushes, and brush leads. Check brush spring tension.

### 7-31. STARTING MOTOR STALL CURRENT AND TORQUE TEST.

1. Connect starting motor assembly to test circuit (figure 7-6).

2. Close test switch and adjust variable resistance to obtain a voltmeter reading of 5.8 volts. Ammeter reading shall not exceed 435 amperes. Record torque value as

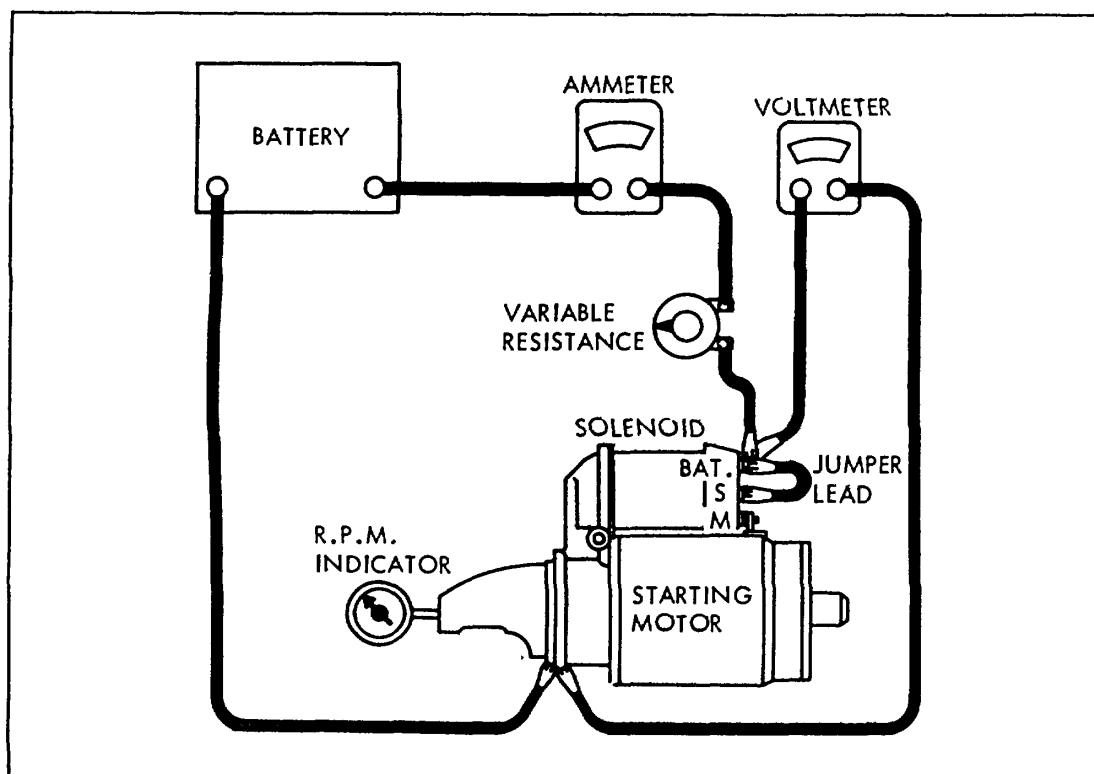


Figure 7-5. Starter No-Load Current and Speed Test Setup

indicated on the scale and compensate for length of the brake arm. Corrected torque value shall be 10.5 foot-pounds.

#### NOTE

The true torque value is obtained by multiplying the scale reading by the length of the brake arm in inches and dividing by 12.

$$\frac{\text{brake arm} \times \text{scale reading}}{12} = \text{torque in foot-pounds}$$

3. If low torque and high current are obtained in test, repeat paragraph 7-30, step 4.

4. If low torque and low current are obtained in test, repeat paragraph 7-30, step 5.

5. If severe arcing is noticed during test, check tension of brush spring. Examine brushes for wear and contact with commutator, and check soldered connections of armature windings at commutator.

#### 7-32. DISTRIBUTOR INSPECTION.

1. Examine cap and shield (10, figure 4-19) for cracks and chipped spots. Check inside of cap assembly for

carbonized (burnt) paths caused by current leakage. Discard defective cap assembly.

2. Examine metal inserts in cap terminals for burning or pitting. Discard cap assembly if severe burning or pitting is noticed.

3. Examine rotor (17) for cracked or chipped spots or burned tip.

4. Check rotor segment for excessive burning. If only end of rotor segment is burned, operation of rotor is not impaired. Discard rotor and cap assembly if burning is found on top portion of rotor segment or on plastic.

5. Examine breaker plate (26) for damage.

6. Examine capacitor (20) for broken leads, frayed insulators, or loose and corroded terminal clips. Be sure capacitor has secure ground connections.

7. Check condition of capacitor with a suitable tester. Replace capacitor if test indicates grounds or if capacity of capacitor exceeds 0.20 microfarads, plus or minus 10%.

8. Examine contact point set (18) for excessive pitting. Discard set if buildup on stationary contact is greater than 0.020 inch.

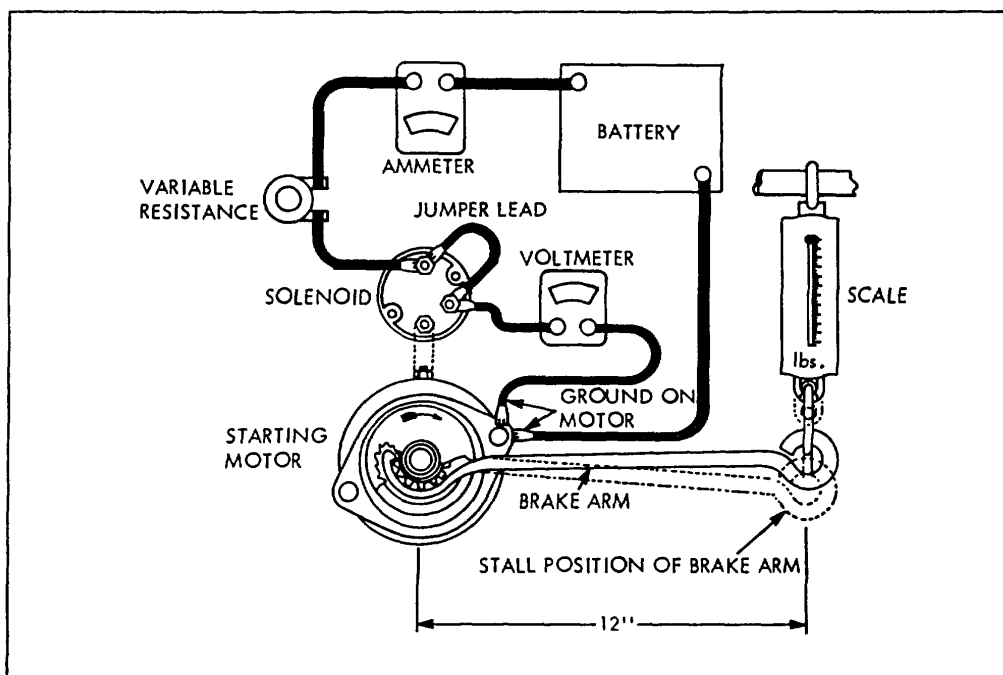


Figure 7-6. Starter Stall Current and Torque Test Setup

**NOTE**

During operation the point contact will develop a rough surface or transfer of material from the movable contact to the stationary contact. This is normal and replacement is not necessary until buildup exceeds 0.020 inch. Do not remove buildup with point file as this reduces contact area.

9. Examine cam (32) lobes for excessive wear and grooving. Replace cam if lobes are damaged.
10. Inspect housing (39) for cracks or distortion. Discard defective or damaged housing.

**7-33. DISTRIBUTOR CONTACT POINT GAP ADJUSTMENT.**

Refer to TM 10-3930-623-12.

**7-34. DISTRIBUTOR CONTACT SPRING TENSION TEST.**

Refer to TM 10-3930-623-12.

**7-35. DISTRIBUTOR ADVANCE MECHANISM TEST.**

Install assembled distributor in standard shop distributor tester and test that automatic advance mechanism meets specifications in Section II.

**NOTE**

The rpm's listed in the specifications refer to the distributor speed and not the engine crankshaft speed. The distributor driven by the camshaft rotates at half the engine speed.

**7-36. DISTRIBUTOR TIMING.**

Refer to TM 10-3930-623-12.

**7-37. ENGINE ASSEMBLY INSPECTIONS.**

**7-38. CYLINDER BLOCK INSPECTION.** Inspect as follows:

1. Check cylinder head (52, figure 4-22) machined surface with a straight edge and feeler gage for flatness in three positions lengthwise and five crosswise. Maximum deviation permitted is 0.004 inch low in center lengthwise and 0.003 inch crosswise. Minor variations up to 0.010 inch can be repaired by surface grinding or milling (but not hand filing). Discard heads showing greater warpage.

2. Check top surface of cylinder block (62) to same standards, disregarding possible raised areas around screw holes.

3. Inspect block casting for cracks, loose or defective plugs.

4. Inspect cylinder bores in block for taper from top to bottom, out-of-round using an inside micrometer or cylinder gage, (28, figure 7-1), or for any scores or scratches in the walls. Taper exceeding 0.008 inch, out-of-round exceeding 0.003 inch or scratches that cannot be removed by honing require reboring of all cylinders (even if only one is defective) to the next standard oversize bore that will correct the condition. Reboring requires installation of correct oversized pistons and rings regardless of the serviceability of the removed units.

5. Check that all drilled oil passages in the block are unplugged, by blowing through them with shop compressed air. (Since all passages are drilled straight, they can be probed with wire or welding rod to unplug them).

6. Check oil pan (28, figure 4-22) for leaks, dents, or deformations that might cause leakage of oil or interference with crankshaft travel.

7. Inspect front and rear filler blocks (37 and 38) for damage.

8. Check expansion plugs (10 and 11) for condition and security of installation. Discard any plugs in doubtful or bad condition.

### **7-39. CAMSHAFT AND BEARINGS INSPECTION.**

1. With camshaft (19, figure 4-23) installed in block, use a piece of narrow (about 1/4 inch wide or less) feeler stock to measure the bearing clearance. Clearance greater than 0.004 inch requires checking diameter of shaft journals against 7, 8, 9 and 10, figure 7-1, to determine if bearings or shaft require replacement.

2. Check rubbing surface of camshaft lobes for wear, scuffing or scratches. Discard shaft showing imperfections on the working surfaces.

3. Check camshaft lobe wear by use of dial indicator and a 5/16 inch diameter rod. Remove valve and replace with rod resting on tappet. Set dial indicator to measure lift of rod as camshaft is rotated. Minimum lift is 0.281 inch.

**7-40. VALVES AND TAPPETS INSPECTION.** Since these items are so closely related, inspect them considering their relationship with each other, as follows:

1. Inspect exhaust valve seat inserts (3, figure 4-23) and replace any that are loose, cracked or damaged.

2. Inspect valves (1 and 2) for burning, cracking, or carbon formation. Measure stem diameter for wear (5, figure 7-1).

3. Inspect tappet face for wear or pitting. More than two small pits per tappet face calls for tappet replacement.

4. Inspect valve springs (5, figure 4-23) for pressure necessary to compress them to 1-45/64 inches (6, figure 7-1). Replace weak springs.

5. Check valve guides (4, figure 4-23). Replace all guides that are worn bell-mouthed, or exceed 1, figure 7-1.

**7-41. OIL PUMP INSPECTION.** Inspect as follows:

1. Examine screen strainer (6, figure 4-26) for clogging or damage.

2. Examine gears (13 and 16) and pump body (19) for wear indicating lack of clearance. Check gear-to-body clearances for 0.003 inch maximum clearance.

3. Inspect cover (11) and gear faces for wear or scoring. Check gear to cover side of gasket (12) for 0.0015 to 0.006 inch maximum clearance.

**7-42. CRANKSHAFT INSPECTION.** Inspect crankshaft (37, figure 4-28) as follows:

1. Measure main and connecting rod bearing journals for any scoring, or wear in excess of 0.002 inch, out-of-round in excess of 0.001 inch, or taper of the journal in excess of 0.002 inch. If shaft exceeds given limits (13 and 18, figure 7-1) regrinding of the journals to the next standard undersize to fit available bearing inserts is required. Do not regrind any journal more than 0.040 inch undersize.

2. With crankshaft mounted in centers of V-blocks, check run-out at center main bearing journal. Straighten shaft if run-out exceeds 0.002 inch.

**7-43. PISTON INSPECTION.** Inspect pistons (16, figure 4-28) as follows:

1. Check piston visually for damage, carbon coating or scores or scratches.

2. Check piston dimensions against values given in 22 through 27, figure 7-1.

**7-44. CONNECTING ROD, CONNECTING ROD AND MAIN BEARING INSPECTION.** Inspect as follows:

1. Check axial alignment of both bores of each connecting rod. Bores must be parallel to within 0.002 inch at 4 inches from rod. Any bend or twist greater than this must be corrected by bending or replacing connecting rod.

2. Check thickness of rod bearing inserts (24, figure 4-28) against dimensions given in 12, figure 7-1.

### **NOTE**

**If crankshaft journal has been ground to standard undersize, add one-half the nominal crankshaft undersize to this dimension to get thickness.**

3. Repeat step 2 for main bearing inserts (34, 35 and 36, figure 4-28).

**7-45. DRIVE LINE AND CONTROL COMPONENT INSPECTIONS AND TESTS.**

**7-46. TRANSMISSION AND TORQUE CONVERTOR INSPECTION.** Perform the following inspection or disassembled transmission assembly.

1. Perform general inspection steps listed in paragraph 7-5 through 7-13 as applicable to transmission parts.

2. Inspect strainer element (9, figure 4-14) and all fluid passages for freedom from obstructions to fluid flow.

3. Inspect friction surfaces of pressure plate (19, figure 4-15) and of pistons (15) for wear, scoring, or other damage.

4. Inspect clutch plate assemblies (17 and 28) for wear or other deterioration.

5. Inspect transmission control valve according to appropriate general instructions steps; also, inspect valve body (30, figure 4-16) bores and passages for scratches, wear or obstructions. Inspect plunger (14) and pistons (19, 21, 23 and 28) for burrs, scoring or wear.

**7-47. DRIVE AXLE INSPECTION.** Inspect drive axle as follows:

1. Perform inspections listed in paragraphs 7-5 through 7-10, and paragraphs 7-12 and 7-13.

2. Inspect brake linkage, lines and fittings for wear, deformation, or any condition which would make them unserviceable.

3. Inspect service brake assembly according to paragraph 7-49.

**7-48. MASTER CYLINDER INSPECTION.**

1. Check casting assembly for cracks. Inspect plugs for damage, corrosion and leakage. Discard defective plugs. Examine bore of body (41, figure 4-10) for pits, scratches and roughness. Discard damaged castings assembly.

2. Check piston assembly (37) for cracks, breaks, burrs, wear and out-of-round. Discard defective piston assembly.

3. Examine all threaded parts for crossed or stripped threads. Discard defective parts.

4. Check piston return spring (39) and retainer (35) for bent, stretched, or broken condition. Discard damaged parts.

5. Check rubber boot (34) for cuts or rips. Discard damaged part.

**7-49. WHEEL CYLINDER AND BRAKE INSPECTION.**

Refer to TM 10-3930-623-12.

**7-50. BRAKE PEDAL INSPECTION.**

Refer to TM 10-3930-623-12.

**7-51. HAND BRAKE INSPECTION.**

Refer to TM 10-3930-623-12.

**7-52. STEERING AXLE, WITH WHEELS AND TIRES INSPECTION.** Inspect the steering axle as follows:

1. Inspect bearings (19 and 20, figure 4-33) for damage and adequate lubrication. Inspect hub (23) for damage.

2. Inspect tires (7) for cuts, wear, sidewall breaks, and inbedded glass or metal in treads. Check inflation pressure.

3. Inspect tie rod ends (29 and 30) for wear, plugged lubrication fittings or damage.

4. Inspect axle blocks (4) for deterioration, splitting or wear.

5. Examine tie rods (32) for damage, dents, kinks or bends.

6. Check king pins (36) and bearings (39 and 44) for looseness due to wear. Check all lubrication fittings for clear passages.

**7-53. STEERING GEAR ASSEMBLY INSPECTION.**

1. Inspect operation of steering gear assembly with drag link (16, figure 4-31) disconnected from steering gear arm. There should be no noticeable binding at any point in travel.

2. Reconnect drag link. With engine running, check operation of steering gear assembly. Check for leaks, and unusual noises from gear box.

3. While weight is on wheels, and steering wheel is being turned slowly left and right, check for security of mounting gear, and operation of horn button in all wheel positions.

**7-54. HYDRAULIC SYSTEM COMPONENTS.****7-55. GENERAL INSPECTION.**

1. Examine hydraulic hoses and fittings for wear, damage, looseness, or any form of deterioration. Discard defective parts.

2. Inspect oil reservoir for leaks, damage, or looseness of mounting. Inspect drain cock for corrosion and damaged threads.

3. Examine all bolts, screws, nuts, and hose clamps for crossed, stripped, or damaged threads. Make sure bolts or screws are not bent. Discard defective parts.

**7-56. HYDRAULIC PUMP INSPECTION.**

1. Inspect end cover flange (4, figure 4-7) and pump body (35) for cracks and damage. Inspect bearing counterbores and shaft bearing surfaces in body and covers for excessive wear and damage. Inspect all machined surfaces for scoring, wear and damage.

2. Inspect gears (13 and 14) for excessive wear and chipped or damaged teeth. Replace gears in matched sets.

3. Inspect shafts for loose key, worn bearing surfaces, and damage.

4. Inspect bushings (11) for wear, scoring, and damage.

**7-57. HYDRAULIC PUMP TEST.** After installation, test hydraulic pump by raising a four thousand pound load. Operate through several cycles to be sure all air is bled from the system. After operation inspect visually for security of mounting and for leaks.

**CAUTION**

**Never operate engine without full hydraulic reservoir. Hydraulic pump is connected directly to engine and requires a full hydraulic system for lubrication.**

**7-58. HOIST AND TILT CYLINDERS INSPECTION.**

Inspect all parts of hydraulic cylinders for cracks, fractures, wear, distortion, and other damage. Carefully inspect welded seams of cylinder tubes for cracks and defects. Examine cylinder head for damage. Inspect piston and inside diameter of tube for wear and out-of-round. Discard defective parts.

**7-59. HOIST AND TILT CYLINDERS EXTERNAL LEAKAGE TEST.**

1. Connect hydraulic tilt cylinder to test arrangement (figure 7-7). Use approximately 1200 psi in testing.

2. Actuate control valve to move piston to one extreme end of tube. Observe exterior of cylinder assembly for evidence of oil leakage.

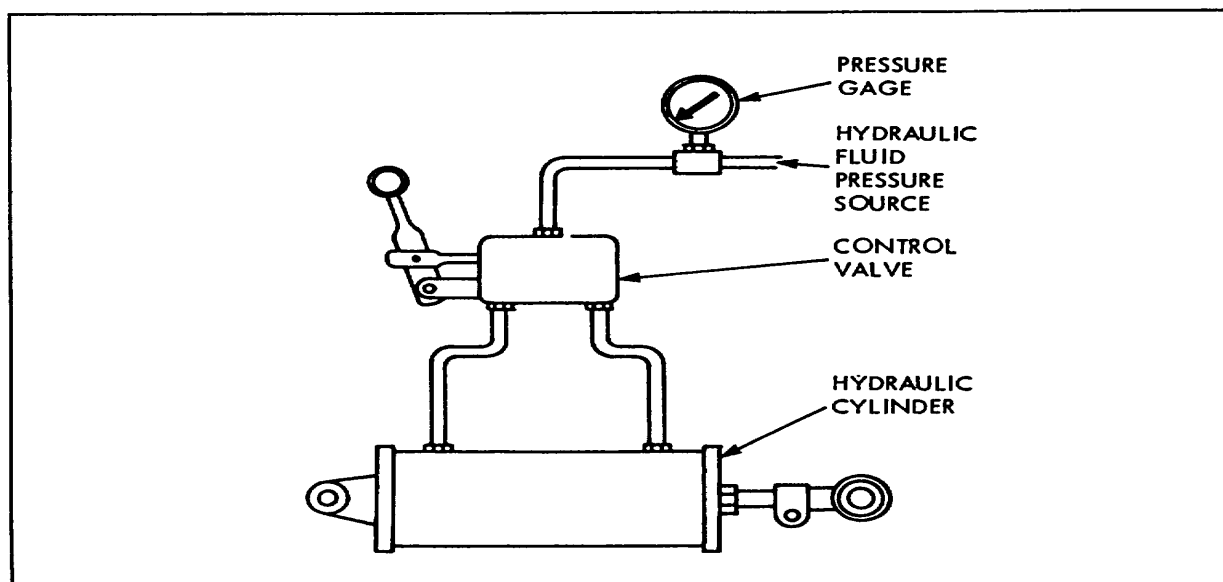


Figure 7-7. Typical Hydraulic Tilt Cylinder Test Setup

3. Actuate control valve and displace cylinder to opposite end of tube assembly.

4. If any leakage is noticed around seams, joints, or glands, repair or replace parts as required to correct leaking.

#### 7-60. HYDRAULIC CONTROL VALVE INSPECTION.

1. Inspect control valve body (37, figure 4-6) for cracks and damage. Inspect all threaded surfaces for damage and crossed threads. Discard damaged parts..

2. Inspect handles and control linkage for wear, distortion, and damage. Repair or replace parts as necessary.

3. Inspect valve spools for scoring, wear and damage. Check valve body bore in same manner. Check spring for loss of tension and damage. If spools or body are damaged, replace entire valve assembly.

#### 7-61. UPRIGHT ASSEMBLIES INSPECTION.

Thoroughly inspect and examine all parts prior to assembling the disassembled uprights. Replace any component which shows evidence of excessive wear, cracks, fractures or damage. Replace any part when in doubt as to its serviceability.

#### 7-62. LIFT CHAINS INSPECTION.

Refer to TM 10-3930-623-12.

#### 7-63. CROSSHEAD ASSEMBLY INSPECTION.

Inspect rollers (25, figure 4-3) and bearings (26) for wear and damage. Check bearings for free rotation. Inspect crosshead (34) for evidence of excessive damage. Replace if in doubt of parts serviceability.

**7-64. CARRIAGE ASSEMBLY INSPECTION.** Inspect rollers (45 and 55, figure 4-3) for wear and damage. Roller bearings (55) must be smooth without pitting, scoring or other defects. Examine carriage (56) for evidence of excessive wear.

#### 7-65. REASSEMBLY OF MAJOR COMPONENTS.

##### NOTE

**The truck is assembled from reassembled components in a logical sequence from a completely disassembled truck to a completed truck. Where the truck has not been completely disassembled, omit those paragraphs which do not apply.**

#### 7-66. ENGINE INSTALLATION.

1. Assemble engine mounting bracket (1, figure 4-18) to timing gear cover with two 1/2 X 1-1/4 inch and one 5/8 X 1-1/2 inch screws.

2. Using screw eye bolts in the special cylinder head screws at each end of cylinder head and chain hoist, position engine in truck chassis.

3. Install 5/8 X 3-1/2 inch screws, flat spacer washers, mounting insulatory and tubular spacer holding fan end of engine to chassis.

##### NOTE

**Flywheel end of engine is supported through the transmission and drive axle.**

#### 7-67. TRANSMISSION AND TORQUE CONVERTOR INSTALLATION.

1. Assemble torque converter (5, figure 4-11) to input shaft of transmission (49).

##### NOTE

**Assembly requires the careful alignment and mating of three pairs of splined shafts.**

2. Install a suitable eyebolt in top of transmission case (85, figure 4-14) and lift transmission to mate with engine flywheel housing. Pilot of torque converter must enter crankshaft recess.

3. Install twelve screws (3, figure 4-11) and washers (4) attaching transmission to flywheel housing.

##### NOTE

**Mating surfaces must be perfectly clean to prevent misalignment or runout of the power train, effecting the life of the bearings.**

4. Through flywheel housing top hand hole, install six screws (6) and washers (7 and 8) attaching torque converter drive disk to flywheel. Replace hand hole cover.

5. Remove support holding engine but support engine-transmission assembly as a unit.

**7-68. DRIVE AXLE INSTALLATION.** The truck chassis sits upon the axle housing. This requires chassis to be raised sufficient to clear axle. Install axle as follows:

1. Raise forward end of truck chassis at least 4 inches.

2. Supporting differential section of the axle (43, figure 4-11), roll axle into position.

3. Using gasket shim pack (14 and 18) previously selected to provide correct gear tooth contact pattern and backlash, assemble axle to the transmission (49).

##### NOTE

**It is recommended that outer gaskets of shim pack be the thinner ones to provide the best sealing combination.**



4. Install two screws (44) at top of axle and nuts (46 and 47) on studs (45).

**NOTE**

**One stud requires a jam or thinner nut due to closeness of flange to case.**

5. Lower truck and center trunnion brackets on axle. Install axle trunnion axle caps.

**7-69. Deleted.**

**7-70. MUFFLER INSTALLATION.** Refer to paragraph 6-147.

**7-71. Deleted.**

**7-72. Deleted.**

**7-73. STEERING AXLE INSTALLATION.**

**NOTE**

**The axle mounting block (4, figure 4-33) has an offset hole. Pneumatic tired trucks require thicker side of block to be installed at upper side.**

1. Assemble mounting blocks to axle (45) trunnions.

2. Lift rear of truck and roll axle under truck with steering bellcrank (41) to left.

3. Install axle plate (1) with screws (2) and washers (3).

**7-74. STEERING GEAR ASSEMBLY INSTALLATION.**

1. Install steering gear (22, figure 4-31) with screws (23 and 24) and washers (25).

2. Install steering column clamp (17) holding the column to the instrument panel.

3. Install drag link (16).

**NOTE**

**Adjust drag link length to position rear wheels straight ahead with steering lever (26, figure 4-32) in a vertical position. Loosen clamp (15, figure 4-31) and turn drag link to adjust. Tighten clamp.**

4. Install pressure hose assembly (10) between hydraulic pump and inlet port of steering gear.

5. Install low pressure hose assembly (4) between steering gear outlet port and hydraulic reservoir.

**7-75. TRANSMISSION NEUTRAL SAFETY SWITCH INSTALLATION.** The switch (25, figure 4-11) is installed during assembly and installation of the direction control system. Install and adjust as follows:

1. Assemble bellcrank lever (31) to bracket (35) with a flat washer (33) on either side of spring washer (34).

2. Assemble neutral safety switch (25) and insulator (30) to bracket.

3. Adjust switch toward bellcrank lever flat side until switch just clicks. Measure distance between switch roller arm and switch body.

4. Reduce measured distance by 3/32 inch and move switch into lever until distance is new reduced dimension. Tighten switch screws (26) and nuts (27). Rock lever and check for switch click when roller is in bellcrank detent.

5. Connect leads as required.

**7-76. TRANSMISSION CONTROL VALVE INSTALLATION.** Install valve linkage as follows:

1. Assemble two links (22, figure 4-11) to the control valve directional control slide with headed pin (38), washers (40) and cotter pin.

2. Assemble neutral safety switch and bracket (35) to transmission with screws (23). Hook pin of bellcrank into control valve links.

3. Assemble inching adjustment screw (36) and nut (37) to inching valve slide.

### 7-77. DIRECTION AND INCHING CONTROL INSTALLATION.

1. Assemble and install inching rod (16, figure 7-8) and rod guide (19, figure 4-11) on transmission control valve.
2. Connect inching rod to the brake pedal with cotter pin (17, figure 7-8) and washer (18).
3. Assemble pointer collar (8), bearing bracket (5) and shift lever (6). Install bracket under one steering column clamp screw and clamp to steering column with cap (2).
4. Slide lever (6) through lower weldment and assemble collar (10) and splined collar (9). Assemble locknut (7).

#### NOTE

Lever arm on collar (9) must align with knob end of shifter shaft (6). If not remove and remate splines to correct.

5. Assemble ball joints (11), and rod (15). Install between shift lever collar (9) and bellcrank lever (31, figure 4-11).

6. Position control valve slide in neutral detent position. Adjust rod (15, figure 7-8) so knob end of lever (6) points directly to side of truck. Rotate shift lever and check operation of linkage in forward and reverse positions.

7. Install knob (1).

### 7-78. UPRIGHTS, CARRIAGE AND FORK ASSEMBLY INSTALLATION.

1. Raise assembly with a hoist, and align mounts on outer upright; with journals of drive axle. Install bearing caps.
2. Reconnect wiring to spotlight (1, figure 4-1).
3. Connect tilt cylinder (79 and 80, figure 4-2) to uprights by installing pins (32) and screws (33).
4. Connect hydraulic hose at hoist cylinder fitting.

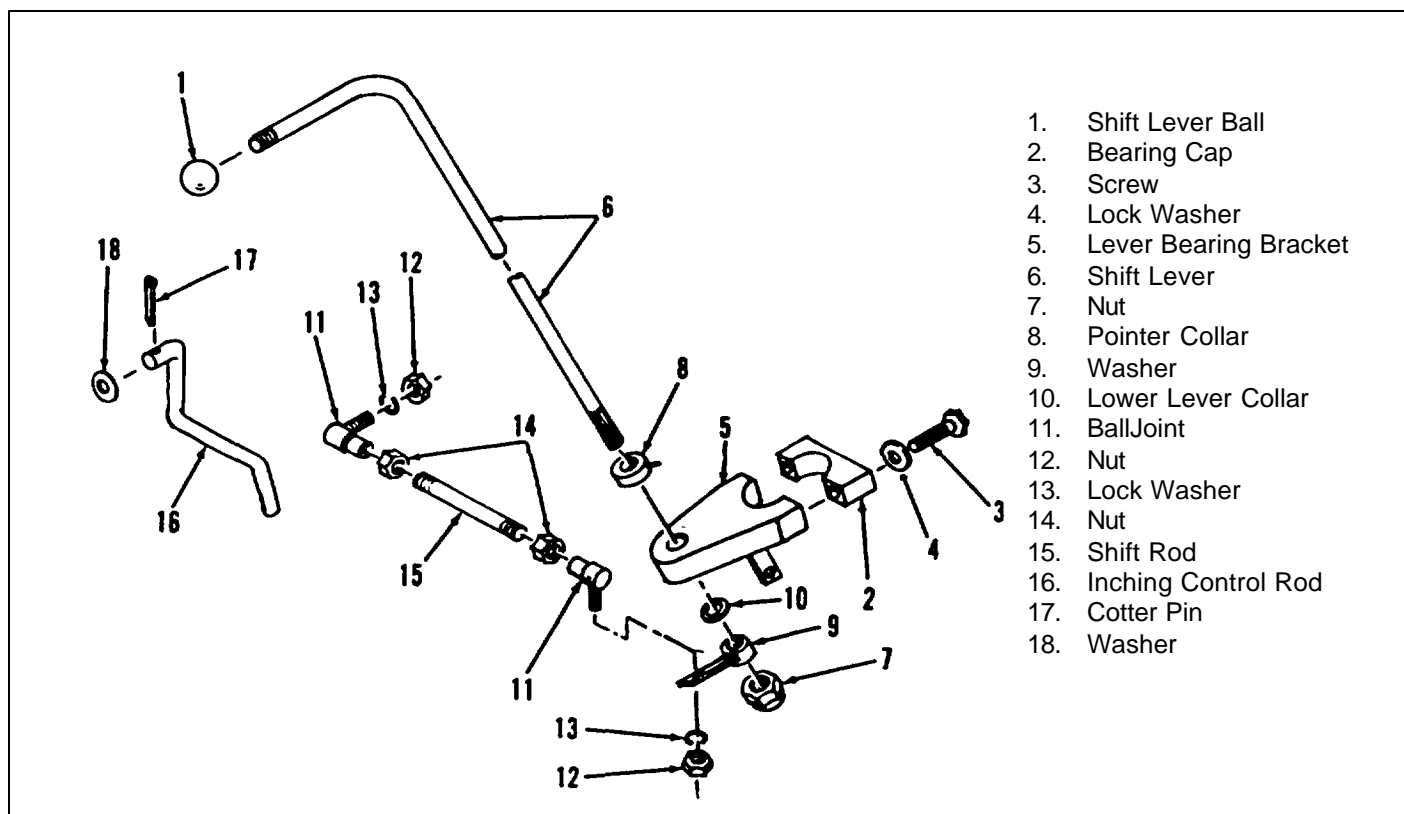


Figure 7-8. Transmission Directional Control Lever, Exploded View

## 7-79. START UP AND BREAKING IN NEWLY OVERHAULED ENGINE.

### CAUTION

The hydraulic reservoir, transmission, master brake cylinder and radiator must be filled as well as the engine oil level checked before starting engine. The hydraulic reservoir provides the required hydraulic pump lubrication.

## 7-80. PREPARATION FOR STARTING.

1. Fill engine oil galleries with pressure oiler to insure full supply of oil in system.
2. Remove hydraulic pump intake hose at the reservoir end and fill hose with correct hydraulic oil. Connect hose to reservoir.
3. Connect battery (59, figure 4-9) to electrical system.
4. Fill fuel tank.

## 7-81. STARTING ENGINE.

1. Place directional control lever in neutral position. Apply parking brake.
2. Depress accelerator pedal approximately 1/3.
3. Pull choke control out fully.

### NOTE

Usage of full choke will assist priming fuel pump and filling carburetor float chamber.

4. Turn on ignition switch and press starter button.

### NOTE

If starter does not turn, check neutral safety switch adjustment to insure it closes in neutral position. See paragraph 7-75.

5. If engine does not immediately fire, hold starter button at least 15 seconds. If engine still has not started release starter and wait at least two minutes before retrying to start engine.

6. As engine fires, open choke as necessary to prevent flooding.

7. Idle engine at approximately 700 rpm for a few minutes to warm and circulate the oil.

### NOTE

Observe oil pressure gage. Shut down engine if gage fails to show required pressure. Warm idle speed pressure is 7 psi minimum while at operating speeds it is 20-30 psi.

8. After five minutes of running at fast idle, shut down engine. Recheck oil level in crankcase and bring oil level up to full mark.

### NOTE

During shut down check all systems for leaks and refill as necessary to bring levels to full mark.

9. Restart engine and run at 800 rpm until engine reaches normal operating temperature.

10. With warm engine, operate at 450 rpm and adjust carburetor idle mixture for smoothest running of engine and check ignition timing with timing light.

**7-82. BREAK-IN PROCEDURES.** Engine must be operated in a prescribed manner during the first few hours after an overhaul or rebuild to insure proper seating of piston rings, to provide required oil control and compression. Break-in may be accomplished either with engine installed in truck or where available, on an engine dynamometer.

## 7-83. BREAK-IN OF INSTALLED ENGINE.

1. Drive truck as in normal use, but do not exceed one-half load for first two hours operation.
2. At no time cause engine to lug during run-in. Engine is lugging when it does not respond to further opening of throttle.

### CAUTION

Observe that oil pressure remains in the normal range, and that engine does not overheat. Shut down engine immediately if any malfunction develops, and correct trouble before continuing this procedure.

**7-84. BREAK-IN OF ENGINE ON DYNAMOMETER.** Install engine on dynamometer and connect hydraulic system to hydraulic pump according to dynamometer manufactures instructions. Operational steps are listed in figure 7-9.

## 7-85. OPERATIONAL TESTS AND ADJUSTMENTS.

## 7-86. TRANSMISSION.

### NOTE

Check transmission fluid level with engine operating at idle and transmission in neutral. Add fluid as necessary.

Step	Time	Manifold Vacuum In Inches of Mercury	RPM
1	Warm-up period 10 minutes	No load	600 to 800
2	10 minutes	15 inches	1500
3	15 minutes	10 inches	2000
4	15 minutes	10 inches	Governed speed
5	30 minutes	6 inches	Governed speed
6	10 minutes	Open throttle (full load)	Governed speed

Figure 7-9. Table of Engine Dynamometer Run-In Procedures

1. Road test transmission for satisfactory operation in forward and reverse operation, and for unusual noises.

2. With brakes applied, and transmission engaged, first in forward, then in reverse, check stall speed, or maximum speed at which engine will operate loaded by the torque converter. With oil temperature at 200 deg F, engine speed should be between 1615 rpm and 1785 rpm. Higher stall speed indicates slippage in the transmission clutches, defective control valve, linkage maladjustments, or low fluid level in the transmission. Lower stall speed indicates engine lacks normal power, and must be repaired before results of this test are valid.

3. If stall speed is high, test pressures for values indicated in figure 7-9. Points at which pressure measurements are made are shown in figure 1-7. Remove plug in passage to be tested, install pressure gage, and operate engine at speed specified in figure 7-10, for pressure to be tested.

**NOTE**

**If more than one gage is available, all pressure points may be tested at one time.**

**7-87. INCHING VALVE ADJUSTMENT.** The inching control valve spool is limited to a travel of 0.50 inches.

During this travel, controlled by the brake pedal, the master cylinder push rod must be free to insure complete release of the brakes. Adjust as follows:

1. Check brake pedal to insure pedal arm will be parallel to the underside of the floor plate with 1/8 inch clearance. Adjust pedal stop bolt as required.

2. Adjust inching control valve piston (23, figure 4-16) adjustment screw (36, figure 4-11) until spool is fully in when screw is against the brake pedal inching rod (16, figure 7-8).

Engine RPM	Main Line Pressure (PSI)		Converter Charging Pressure (PSI)		Forward Clutch Pressure (PSI)		Reverse Clutch Pressure (PSI)	
	Min	Max	Min	Max	Min	Max	Min	Max
500	20	30	15	25	15	25	15	25
1000	58	68	42	50	50	58	50	58
1500	110	120	74	84	77	87	77	87
2000	120	135	84	101	80	93	80	93
200	With inching valve fully actuated					0		0

Figure 7-10. Table of Transmission Test Pressures

Test For	Probable Cause	Remedy
Hard steering while driving	Frozen steering shaft bearings.	Replace bearings.
	Steering wheel rubbing against jacket.	Adjust jacket endwise.
	Steering adjustment tight.	Check adjustment by dropping pitman arm from gear or disconnecting linkage from pitman arm ball. Readjust lash adjuster if necessary.
Poor return of steering	Frozen steering shaft bearings.	Replace bearings.
	Tight steering linkage.	Lubricate.
	Steering adjustment tight.	Check adjustment by dropping steering gear arm from gear or disconnecting linkage from steering gear arm ball. Readjust if necessary.
	Tight sector to ball nut.	Adjust lash adjuster in truck to specification.
	Thrust bearing adjustment too tight.	Remove gear and adjust.
	Sticky valve spool.	Remove and clean valve or replace valve
	Tires not properly inflated	Inflate to specifications
Truck leads to one side or the other (not due to road crown)	Due to rear wheel misalignment.	Adjust to zero toe-in.
	Unbalanced or badly worn valve.  <b>NOTE: If this is cause, steering effort will be very light in direction of lead and heavy in opposite direction.</b>	Replace valve.
Momentary increase in effort when turning wheel fast	Low oil level in pump.	Check oil level in pump reservoir.
	High internal leakage.	Replace valve and/or cylinder.
External oil leaks (wipe gear thoroughly and make sure source of leakage is determined)	Loose hose connections.	Tighten.
	Damaged hose.	Replace.
	Adjuster plug seals.	Replace seals.
	Torsion bar seal.	Replace valve.
	Side cover preform packing	Replace packing.
	Steering arm shaft seal.	Replace seal.
Gear noise (rattle or chuckle)	Loose over-center adjustment.	Adjust to specification.
	Gear loose on frame.  <b>NOTE: A slight rattle may occur on turns because of the increased lash off the high point. This is normal.</b>	Check gear to frame mounting bolts. Tighten bolts to specification.

Figure 7-11. Table of Steering System Operational Tests (Sheet 1 of 2)

Test For	Probable Cause	Remedy
Gear noise (hissing sound)	There is some noise in all power steering systems. One of the most common is a hissing sound most evident at standstill parking. There is no relationship between this noise and performance of the steering. "Hiss" may be expected when steering wheel is at end of travel or when slowly turning at standstill.	Do not replace valve unless "hiss" is extremely objectionable. Slight hiss is satisfactory and in no way affects steering. A replacement valve may also exhibit slight noise and is not always a cure for the objection.
Excessive wheel kickback or loose steering	Lash in steering linkage.	Adjust parts affected.
	Excessive lash between steering arm shaft sector and ball nut.	Adjust to specification.
	Loose thrust bearing adjustment.	Remove gear and adjust.
	Ball nut and worm preload	Remove rack-piston and worm and change balls to obtain specified preload.
Hard steering when parking	Low oil level in reservoir.	Fill to proper level. If excessively low, check all lines and joints for evidence of external leakage.
	Lack of lubrication in linkage.	Add lubricant where needed.
	Tires not properly inflated.	Inflate to recommended pressure.
	Insufficient oil pressure.	If all of the above checks do not reveal the cause of hard steering, check oil pressure:
	Low oil pressure due to restriction in hoses:	
	a. Check for kinks in hoses.	a. Remove kink.
	b. Foreign object stuck in hose.	b. Remove hoses and remove restricting object or replace hose.
	Low oil pressure due to steering gear or cylinder:	
	a. Pressure loss in cylinder due to worn piston ring and rod seal.	a. Remove cylinder from truck for disassembly and inspection of ring and rod seal.
	b. Leakage at valve rings, valve body to worn seal.	b. Remove gear from truck for disassembly and replace seals.
	c. Loose fit of spool in valve body or leaky valve body.	c. Replace valve.
Valve squawks when turning or when recovering from a turn	Cut or worn dampener ring on spool.	Replace dampener ring, being careful not to cut the new ring at installation.
	Loose or worn valve.	Replace valve.
No effort required to turn	Broken valve torsion bar.	Replace valve.

Figure 7-11. Table of Steering System Operational Tests (Sheet 2 of 2)

**NOTE**

**Remove all play or looseness from brake pedal and inching rod. Inspect that pedal stop is actually stopping the pedal and not the inching valve.**

3. Depress brake pedal until inching valve piston is fully out. Note point of pedal and determine free play of master cylinder push rod.

4. If push rod does not have clearance adjust push rod end as required.

**7-88. INCHING VALVE TEST.** Assemble necessary pressure gages to operational tests. See paragraph 7-86. With brake pedal fully released, pressures should be as indicated in figure 7-9. Depress pedal until inching valve is fully out. Pressure in front and rear clutch line must show zero pressure.

**7-89. POWER STEERING SYSTEM PRESSURE TEST.** After disassembly and assembly of hydraulic pump, the system must be bled to remove entrapped air and priority valve must be adjusted to provide 1000 psi pressure minimum to the steering system. Test pressure as follows:

1. Rotate steering wheel through full range several times to remove entrapped air.

2. Remove plug (7, figure 4-31) in pressure line tee (8) and install pressure gage.

3. Operate engine at fast idle and observe steering system pressure. If pressure is 1000 and 1200 psi, shut down engine, remove gage and replace plug.

4. If pressure is not within range adjustment of priority valve (27 through 31, figure 4-7) is required.

5. Remove plug (24) and valve assembly from hydraulic pump.

6. Remove lock screw (27) and adjust screw (28). Turn in to raise pressure output and backout to reduce pressure.

7. Replace lock screw and assemble valve to pump. Check pressure.

8. If still not within range, repeat steps 5, 6 and 7.

**7-90. POWER STEERING SYSTEM TEST.** Road test the operation of the steering system. The steering wheel should turn an equal number of turns right or left from wheels straight ahead position, with a resistance at the rim of the steering wheel between three and seven pounds with the truck stationary and the engine running. Refer to figure 7-11 for more road test data.

**7-91. HYDRAULIC CYLINDER CONTROL VALVE ADJUSTMENT.** Sluggish operation of tilt and lift cylinders may result from improper adjustment of the control valve relief valve. Disassembly of control will also require adjustment of the relief valve. Adjust as follows:

1. Remove pipe plug from adapter (36, figure 4-6) and install suitable 9-3000 psi gage having 1/4 NPT male threads.

2. Start engine and operate TILT control lever until mast reaches limit of travel. Hold lever in operating position and note line pressure. Pressure should be 1650 psi.

3. If pressure is not correct, remove cap nut (1) and loosen locknut (3).

4. To raise pressure turn setscrew (4) clockwise and to reduce line pressure turn setscrew counterclockwise.

5. Recheck pressure as in step 2 and readjust if necessary.

6. Holding setscrew, tighten locknut and install cap nut.

7. Shut off engine and remove gage. Replace plug.

## APPENDIX A

## REFERENCES

## A-1. FIRE PROTECTION

TB 5-4200-200-10

Hand Portable Fire Extinguishers Approved for Army Users

## A-2. LUBRICATION

C9100IL

Fuels, Lubricants, Oils, and Waxes

LO 10-3930-623-12

Lubrication Order for Truck, Fork Lift, 4000 Lb. Capacity, 144 In. Lift, Gasoline Engine Driven, (Baker Model FJF-040) (Army Model MHE211) FSN 3930-935-7963.

## A-3. PAINTING

TM 9-213

Painting Instructions for Field Use

## A-4. CLEANING

SB 725-7930-1

Issue of Supplies and Equipment: Engineering Practices Study of CONUS and Overseas Installation Requirements for Hard and Soft Water Cleaning Compounds.

## A-5. MAINTENANCE

TM 5-331B

Utilization of Engineer Construction Equipment: Volume B, Lifting, Loading and Handling Equipment.

TM 9-1870-1

Care and Maintenance of Pneumatic Tires

TM 38-750

The Army Maintenance Management System

TM 10-3930-623-12

Operator and Organizational Maintenance Manual for Truck, Fork Lift, 4000 Lb Capacity, 144 In. Lift, Gasoline Engine Driven (Baker Model FJF-040) (Army Model MHE211) FSN 3930-935-7963



**A-5. MAINTENANCE (CONTINUED)**

TM 10-3930-623-20P      Organizational Maintenance Repair Parts and Special Tools List for Truck, Fork Lift, 4000 Lb Capacity, 144 In. Lift, Gasoline Engine Driven (Baker Model FJF-040) (Army Model MHE211) FSN 3930-935-7963.

TM 10-3930-623-35P      Direct Support, General Support and Depot Maintenance Repair Parts and Special Tools List for Truck, Fork Lift, 4000 Lb Capacity, 144 In. Lift, Gasoline Engine Driven (Baker Model FJF-04) (Army Model MHE211) FSN 3930-935-7963.

**A-6. DEMOLITION AND ADMINISTRATIVE STORAGE**

TM 740-90-1      Administrative Storage of Equipment.

TM 750-244-3      Demolition of Equipment.

By Order of the Secretary of the Army:

Official:

W. C. WESTMORELAND,  
General, United States Army,  
*Chief of Staff.*

KENNETH G. WICKHAM,  
*Major General, United States Army,  
The Adjutant General.*

Distribution:

To be distributed in accordance with DA Form 12-25, Section I,(qty rqr block no. 195) Direct and General Support maintenance requirements for Truck, Fork Lift: Gasoline.

☆U.S. GOVERNMENT PRINTING OFFICE : 1996 O - 406-421 (53121)



This fine document...

Was brought to you by me:



### [Liberated Manuals -- free army and government manuals](#)

Why do I do it? I am tired of sleazy CD-ROM sellers, who take publicly available information, slap “watermarks” and other junk on it, and sell it. Those masters of search engine manipulation make sure that their sites that sell free information, come up first in search engines. They did not create it... They did not even scan it... Why should they get your money? Why are not letting you give those free manuals to your friends?

I am setting this document FREE. This document was made by the US Government and is NOT protected by Copyright. Feel free to share, republish, sell and so on.

I am not asking you for donations, fees or handouts. If you can, please provide a link to [liberatedmanuals.com](http://liberatedmanuals.com), so that free manuals come up first in search engines:

<A HREF=<http://www.liberatedmanuals.com/>>Free Military and Government Manuals</A>

- Sincerely  
Igor Chudov  
<http://igor.chudov.com/>
- [Chicago Machinery Movers](#)