DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL TRACTOR, WHEELED, WAREHOUSE: GASOLINE ENGINE DRIVEN; 4-WHEEL, PNEUMATIC TIRED, 4000 LB DRAWBAR PULL, ARMY MODEL MHE 201 (NORTHWESTERN MOTOR CO. MODEL JG 40PT4) FSN 3930-926-1066

HEADQUARTERS, DEPARTMENT OF THE ARMY

DECEMBER 1967

SAFETY PRECAUTIONS

Before Operation

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

Do not allow smoking or the use of an open flame in the immediate vicinity while servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

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

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

During Operation

Be alert for other workers to be sure they are not in the way of the moving tractor or towed load.

Do not fill fuel tank while the engine is running. Fuel spilled on a hot engine may explode and cause injury to personnel.

If the tractor is operated in an inclosed area, be sure adequate ventilation is provided. Exhaust gases contain carbon monoxide. Continued breathing of exhaust fumes is dangerous and can be fatal.

After Operation

Do not allow smoking or the use of an open flame in the immediate vicinity while servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

Use only approved cleaning solvents to prevent the possibility of fire or poisoning.

If the tractor is parked on an incline, block at least two wheels in the event of handbrake failure.

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

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

TECHNICAL MANUAL
No. 10-3980-603-35

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 19 December 1967

Direct Support, General Support and Depot Maintenance Manual TRACTOR, WHEELED, WAREHOUSE: GASOLINE ENGINE DRIVEN; 4-WHEEL, PNEUMATIC TIRED, 4000 LB DRAWBAR PULL, ARMY MODEL MHE 201 (NORTHWESTERN MOTOR CO. MODEL JG 40PT4) FSN 3930-926-1066

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

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

1-2. Forms and Records

a. DA record and report forms used for equipment maintenance will be only those pre SCRIBED IN TM 38-750.

b. 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, ATTN: AMSME-MPP, 4300 Goodfellow Blvd., St. Louis Mo., 63120.

Section II. DESCRIPTION AND DATA

1-3. Description

For a complete description of the Army Model MHE 201 Warehouse Tractor refer to TM 10-3930-603-12.

1-4. Tabulated Data

a. General. This paragraph contains maintenance data pertinent to direct support, general support, and depot maintenance personnel. A wiring diagram is included in TM 10-3930603-12.

b. Engine Classification and Rating.

(1) *Basic engine*.

Manufacturer	Chrysler Corp.
Model	IND-931-1604-
Bore	3.25 in. (inches)
Stroke	4.62 in.
Brake horsepower (continuous)	73 at 2800 rpm (revolutions per minute)
Taxable horsepower	25.35
Compression ratio	7:1
Compression pressure	130 to 145 lb (pound)
Firing order	1-5-3-6-2-4

(2) *Crankshaft*.

Type	Counterbalanced
Main bearing journal diameter	2.50 in.
Connecting rod journal diameter	2.06 in.

(3) *Connecting rods*.

Type	Drop forged
Length (center to center)	7.81 in.
Bearing diameter	2.06 in.
Piston bushing diameter	0.86 in.

(4) *Pistons*.

Type	U-slot, cam ground
Material	Cast iron
Weight	16 oz (ounces)
Length	3.5 In.
Number rings	4
Compression ring groove depth	0.169 in.
Oil ring groove depth	0.172 in.
Piston pin type	Floating
Piston pin diameter	0.86 in.
Piston pin length	2.75 in.

Number compression rings.	2
Width compression ring	0.094 in.
Number oil rings	2
Width, oil rings	0.156 in.

(5) *Camshaft*.

Type bearings	Replaceable
Number bearings	4
Bearing size	
No. 1	2.00 in. diameter X 1.09 in. long
No. 2	1.93 in. diameter X 1.84 in long
No. 3	1.94 in. diameter X 1.84 in. long
No. 4	1.25 in. diameter X 1.25 in. long
Type drive	Chain

(6) *Intake valves*.

Head diameter	1.531 in.
Lift	0.379 in.
Length	4.4845 in.
Operating clearance (hot).	0.010 in.
Seat angle	45 degrees

(7) *Exhaust valves*

Head diameter	1.407 in.
Lift	0.379 in.
Length	4.78 in.
Operating clearance (hot).	0.014 in.
Seat type	Replaceable
Seat angle	45 degrees
Tappet clearance (cold)	0.014 in.
Valve springs	
Free length	2 in.
Pressure at 1 3/4 in.	40 to 45 lbs
Pressure at 1 3/8 in.	110 to 120 lbs

(8) *Valve tappets*.

Type	Mushroom
Stem diameter	0.625 in.

(9) *Oil pump*.

Manufacturer	Chrysler Corp.
Part number	1314607
Type	Rotary
Driven by	Camshaft
Intake	Floating screen

(10) *Oil pressure relief valve*.

Setting	465-5 lbs.

c. Carburetor.

Venturi size	1 11/32 in.
Main jet meter	317 CC (centimeters) per min. (minute).
Power jet size	0.0413 in.

d. Starting Motor.

Voltage	12 Volt, DC
Rotation	Clockwise at drive end
Poles	4
Brushes	4
Brush tension	32 to 36 oz (ounces)

Free running test

Voltage	11 volts, DC
Current draw	90 amps (maximum)
Speed	1925 to 2400 rpm

Lock resistance test

Voltage	4 volts, DC
Current draw	400 to 450 amps

Solenoid switch

Pull in coil	14.4 to 16.0 amps at 6 volts, DC
Hold in coil	11.5 to 12.6 amps at 6 volts, DC

e. Distributor.

Rotation	Clockwise (viewed from top)
Control	Automatic
Cam angle	38 to 40 degrees
Capacitor	0.18 to 0.28 microfarads
Breaker arm spring tension.	17 to 20 oz

Automatic advance

350 rpm	0 degrees
400 rpm	3 degrees
620 rpm	5 degrees
940 rpm	8 degrees
1150 rpm	10 degrees

f. Generator

Voltage	12 volts, DC
Rotation	Clockwise at drive end
Rated output	30 amperes
Poles	2
Brushes	2
Brush spring tension	18 to 36 oz
Ground polarity	Negative
Field coil draw (70°F)	1.2 to 1.3 amps at 10 volts
Motorizing draw (70°F)	3.4 to 3.9 amps at 10 volts

Output test (70°F)

0 amps at 1325 rpm, maximum.	17.8 volts
30 amps at 2250 rpm,	15.0 volts maximum.

g. Voltage Regulator.

(1) *Cutout relay*.

Winding resistance	128 to 142 ohms
Contact points close	12.4 to 13.3 volts
Contacts open	3 to 56 amp discharge after 7 amp charge

(2) *Current regulator*.

Amperage (50°F)	39 amps maximum
Amperage (130^{0}F)	31 amps maximum

(3) *Voltage regulator*.

Winding resistance	52 to 58 ohms
Voltage with 7 amps charge rate	
At 50° ± 0.3^{o}F	14.7 volts
At 140° ± 0.3°F	14.1 volts

h. Transmission Classification and Rating.

Manufacturer	Chrysler Corp.
Type	Automatic, with torque converter
Model	A 727
Fluid type	AQ, AFT, Suffix "A"
Gear Ratio	
Low	2.45 to 1.00
Second	1.45 to 1.00
Drive	1.00 to 1.00
Reverse	2,20 to 1.00
Fluid capacity	19 1/2 pt (pint)

i. Repair and Replacement Standards. Table 1-1 lists manufacturer's sizes, tolerances, desired clearances, and maximum allowable wear and clearances.

Table 1-1. Repair and Replacement Standards

Component	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
ENGINE:					
Crankshaft					
End play			0.002	0.006	0.006
Taper				0.001	0.001
Out of round					0.001
Bearings					
Diameter, all		250			
Length, No. 1.	1.23				
Length, No. 2 and 3	1.03				
Length, No. 4	1.58				
CONNECTING RODS					
Bearings					
Diameter, all		2.06			
Length, all	1.00				
End play			0.006	0.011	0.011
Bearing Clearance			0.0010	0.0025	0.0025
Bushing diameter		0.86			
Bushing length		1.12			
CAMSHAFT					
Bearings					
Diameter No. 1		2.00	0.002	0.004	
Diameter No. 2		1.98	0.002	0.004	
Diameter No. 3					
Diameter No. 4		125	0.002	0.004	
End play			0.002	0.006	0.006
Clearance			0.002	0.004	0.004
Pistons					
Clearance at top land			0.018	0.026	0.026
Clearance at skirt.			0.002	0.0012	0.0012
Ring groove depth					
Compression		0.169			
Oil control		0.172			
Ring groove width					
Upper compression	0.09400	0.09415			

Table 1.1. Repair and Replacement Standards-Continued

Component	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
Lower oil	0.15625	0.15650			
Piston pin					
Diameter	0.86				
' Length	2.75				
Clearance 70°					
In piston			0.00001	0.0002	0.0002
In rod			0.0001	0:0005	0.0005
Piston rings					
Ring gap.			0.007	0.015	0.015
Compression ring width		0.094			
Oil ring width		0.156			
Ring clearance in groove					
Upper compression			0.0025	0.0040	0.0040
Lower compression			0.0020	0.0035	0.0035
Upper oil			0.0010	0.0025	0.0025
Lower oil.	-		0.001	0.003	0.008
Ring gap	-		0.007	0.0015	
Intake valves					
Head diameter	1.531				
Lift	0.379				
Length	4.4845				
Stem diameter	0.340	0.341			
Stem clearance			0.001	0.003	0.003
Operating clearance (hot)			0.010		0.010
Exhaust valves					
Head diameter	1.407				
Lift	0.379				
Length	4.78				
Stem diameter.	0.340	0.341			
Stem clearance			0.003	0.005	0.005
Operating clearance					0.014
Tappets, valve					
Clearance, cold		0.014			
Stem diameter	0.625				0.001
Valve Springs					
Free length	2.00				
Length with spring compressed with pressure 110 to 120 lbs		1.380			
Length with spring compressed with pressure 40 to 45 lbs		1.750			
Valve guides					
Ream after installation					
Exhaust	0.344	0.345			0.345
Intake	0,342	0.343	0.343		
Cylinders					
Bore	32500	3.2515			
Taper					0.020
Out of round					0.005
Reconditioning working limits					0.001
STARTING MOTOR ARMATURE					
End play		0.010			
Runout		0.003			
DISTRIBUTOR SHAFT					
End play	0.003	0.010			0.010
Side play		0.005			

Table 1.1. Repair and Replacement Standards--Continued

Component	Manufacturer's dimensions and tolerance in inches		Desired clearance		Maximum allowable wear and clearance
	Minimum	Maximum	Minimum	Maximum	
DISTRIBUTOR CONTACT GAP	0.018	0.020			0.020
GENERATOR ARMATURE END PLAY	0.003	0.010			0.010
VOLTAGE REGULATOR					
Cutout relay point gap	0.015				
Air gaps					
Cutout relay	0.025	0.027			
Current regulator	0.048	0.052			
Voltage regulator	0.048	0.052			

j. Nut and Bolt Torque Data. Table 1-2 lists tractor nut and bolt torque data.

Table 1-2. Nut and Bolt Torque Data

Item	Torque data-foot-pound
Frame	
Rear body bolts	40-46
Hood support bolts	55-60
Dash bolts	55-60
Bumper bolts	40-45
Fender bolts	55-60
Steering gear mounting bolts-	40-45
Front spring U-bolts	40-45
Front wheel nuts	50-55
Engine	
Crankshaft bearing cap bolts	70-85
Rod bearing cap nuts	4-560
Head bolts	66-70
Spark plugs	25-30
Manifolds	23-26
Water pump bolts	23-26
Oil pump bolts	30-35
Rear Axle	
Mounting bolts	80-85
Carrier mounting bolts	65
Carrier bearing cap bolt	130
Carrier cover bolt	45
Drop gear case mounting bolt	40
Drop gear cover bolt	40
Pinion nut	400
Rear wheel lug nut	65
Transmission Assembly	
Torque converter drain plug	14
Fluid filter mounting screws	2-3
Oil pan bolts	12-14
Neutral starting switch	25-35
Kickdown band adjusting screw, with adapter.	4-5
Kickdown band adjusting screw, without adapter.	6-7
Kickdown band adjusting screw locknut.	29
Low and reverse band adjusting screw, with adapter.	4-5
Low and reverse band adjusting screw, without adapter.	6-7
Low and reverse band adjusting screw locknut.	35
Rear flange nut	175
Extension housing bolts	24
Governor body to support bolts	8-10
Valve body mounting bolts	8-10
Valve stiffener plate	2-3
Governor plug end plate screws	2-3
Shuttle valve cover plate screws	2-3
Shift valve end plate screws	2-3
Regulator valve end plate screws	2-3
Valve body transfer plate screws	2-3
Control valve spring retainer screws	2-3
Output shaft support screws	12-14
Reaction shaft support screws	12-14
Control valve body mounting bolts	8-10
Converter housing bolts	25-30
Lower drive plate to converter bolts	22-24

Table 1-2. Nut and Bolt Torque Data—Continued

k. Time Standards. Tables 13 and 1-4 list the number of man hours required under normal conditions to perform the indicated maintenance and repair for the tractor. Components are listed under the appropriate functional index. The times listed are not intended to be rigid standards. Under adverse conditions, the operations will take longer, but under ideal conditions, with highly skilled mechanics, most of the operations can be accomplished in considerably less time.

Table 1-3. Time Standards-Lubrication and Service

Lubrication and service	Man-hours
01 ENGINE	
0100 Engine Assembly:	
Engine, gasoline (Includes draining, flushing, and replenishing engine lubricating oil.)	0.5

Table 1-3. Time Standards-Lubrication and Service-Continued

Lubrication and service	Man-hours
0106 Engine lubricating system:	
Filter, oil (Includes draining and cleaning filter body, and replacing element.)	0.3
Crankcase breather (Includes removal, cleaning and installation.)	0.3
03 FUEL SYSTEM	
0302 Fuel Pump:	
Pump, Fuel (Includes removal, cleaning, replacing element and installation of bowl.)	0.3
0304 Air Cleaner	
Cleaner, air (Includes removal, cleaning, replenishing of lubricating oil and installation.)	0.3
06 ELECTRICAL SYSTEM	
0601 Generator:	
Generator assembly (Includes removal of plugs, oil wicks, and replacing plugs.)	0.2
0605 Ignition Components:	
Distributor assembly (Includes removal of cap and rotor; lubricate wick and reinstall rotor and cap.)	0.5
Spark plugs (Includes removal, cleaning, adjusting and installation of spark plugs.)	0.5
07 TRANSMISSION	
0700 Transmission Assembly:	
Transmission and torque converter assembly (Includes draining and replenishing transmission fluid.)	1.0
11 REAR AXLE	
1102 Differential assembly:	
Differential assembly (Includes draining and replenishirtg lubricant.)	0.5
Drop gear case (Includes draining and replenishing lubricant.)	0.5
12-BRAKES	
1204 Hydraulic Brake System.	
Master cylinder - (Includes replenishing brake fluid.)	0.2

Table 1-3. Time Standards-Lubrication and Service-Continued

Lubrication and service	Man-hours
13 WHEELS	
1311 Wheel Assembly:;	
Bearings, front wheel (Includes removing wheels and bearings, repacking, and installation.)	25
14 STEERING	
1407 Steering Gear Assembly:	
Housing, steering gear (Includes checking level and refilling with lubricant.)	0.2

Table 1-4. Remove and Replace

Remove and replace	Man-hours
01 ENGINE	
0100 Engine Assembly:	
Engine, gasoline (To remove and install external assemblies and subassemblies.)	10.0
0101 Crankcase, Block, Cylinder Head:	
Head assembly	1.0
Block assembly (Engine removed, includes removal and installation of all assemblies and subassemblies.)	14.0
0102 Crankshaft:	
Crankshaft assembly (Engine removed, includes removal and installation of oil pan, connecting rods, timing gear cover, crankshaft timing gear, flywheel and clutch housing.)	605
Pulley crankshaft (Removal and installation.)	0.7
Bearing, main (Includes removal and installation of oil pan and crankshaft)	8.6
Seal, crankshaft, rear (Engine removed, includes removal of oil pan, disconnecting connecting rods, and removal of crankshaft.)	7.0

Table 1-4. Remove and Replace Continued

Remove and replace	Man-hours
Seal, crankshaft, front (Engine removed includes removal of oil pan and timing gear cover.)	5.0
0103 Flywheel Assembly: (Engine removed includes removal and installation of clutch housing, dust guard and oil pan)	
Flywheel ring gear (Flywheel removed.)	1.0
Housing, flywheel (Engine removed includes removal of flywheel, dust guard and oil pan.)	5.5
0104 Pistons, Connecting Rods:	
Pistons, rings, pins, and bearings (each) (Engine removed includes removal and installation of cylinder head, oil pan, connecting rod bearings and removal of carbon ridge from cylinder block.)	5.0
Rods, connecting (each) Engine removed includes removal and installation of oil pan, cylinder head and pistons.)	5.8
0105 Valves, Camshafts, and Timing System:	
Valves, intake and exhaust (Includes removal and installation of cylinder head and valve cover plate.)	5.5
Guides, springs and locks (Includes removal and installation of valves, guides, springs and locks.)	7.5
Seats, exhaust valve (Includes removal and installation of cylinder head and valves.)	6.0
Rocker arms and tappets (Includes removal and installation of cylinder head, oil pan, crankshaft pulley, timing gear cover, camshaft gear and valves)	7.5
Camshaft (Engine removed includes removal and installation of cylinder head, oil pan, valves, timing gear cover, timing gear, and oil pump.)	

Table 1-4. Remove and Replace-Continued

Remove and Replace-Continued	Man-hours
Bearings, camshaft (Includes removal of cylinder head, valves, oil pan and timing gear cover.)	8.5
Timing gears (Engine removed includes removal and installation of timing gear cover, crankshaft pulley, gear and chain.)	6.0
0106 Engine Lubrication System:	
Pump, oil (Includes removal and installation of oil pump and gasket.)	1.2
Filter, oil (Includes removal and installation of oil lines and bracket.)	0.8
Valve, oil pressure regulating (Includes removal and installation of plunger, spring, gasket, and cap.)	0.2
Breather, crankcase (Includes removal and installation of breather and gasket.)	0.3
Pan, oil (Engine removed includes removal and installation of seals and gaskets.)	2.0
Gage, oil level	0.1
Lines, oil (Includes removal and installation of lines and fittings.)	0.5
0108 Manifolds.	
Manifolds (Includes removal and installation of air cleaner, carburetor, and governor linkage.)	1.5
03 FUEL SYSTEM	
0301 Carburetor: (Includes removal and installation of air cleaner, fuel lines, fittings, gasket and linkage.)	
0302 Fuel Pump:	
Pump, fuel (Includes removal and installation of fuel lines, fitting, guard and gasket)	0.3
0304 Air Cleaner (Includes removal, installation and service.)	0.3

Table 1-4. Remove and Replace-Continued

Remove and replace	Man-hours
0306 Tanks, Lines and Fittings:	
Lines and fittings ..... (Includes removal and installation of fittings.)	1.5
Tank, fuel ..... (Includes removal and installation of strap and fuel lines.)	1.5
0308 Engine Speed Governor:	
Governor, engine speed..... (Includes removal and installation of air cleaner, fuel lines, carburetor and gasket.)	0.9
0312 Accelerator Throttle and Choke Control:	
Linkage, throttle control ..... (Includes removal and installation of throttle, choke control and foot throttle linkage.)	1.2
04 EXHAUST SYSTEM	
0401 Muffler and Pipes:	
Muffler and tail pipe ..... (Includes removal and installation of muffler, tail pipe and hangers.)	1.3
05 COOLING SYSTEM	
0501 Radiator:	
Radiator assembly..... (Includes removal and installation of hood fan, water pump, and hoses.)	1.2
0503 Water Manifolds, Headers, Thermostats and Housing Gasket:	
Thermostat..... (Includes removal and installation of upper radiator hose.)	0.5
0504 Water Pump:	
Pump assembly, water ..... (Includes removal and installation of coolant hoses.)	1.0
0505 Fan Assembly:	
Belt, fan.....	0.5
Fan..... (Includes removal and installation of fan belts.)	0.9
06 ELECTRICAL SYSTEM	
0601 Generator:	
Generator assembly ..... (Includes removal and installation of wiring and mounting brackets)	0.8

Table 1-4. Remove and Replace-Continued

Remove and replace	Man-hours
0602 Generator Regulator:	
Regulator, generator..... (Includes removal and installation of wiring and mounting bracket.)	0.5
0603 Starting Motor:	
Starter assembly ..... (Includes removal and wiring, and cable)	0.8
0605 Ignition Components:	
Distributor ..... (Includes removal, instal-lation and timing engine.)	1.5
Ignition coil..... (Includes removal and installation of coil and capacitor.)	0.5
Spark plugs..... (Includes removal and installation of wiring harness.)	1.5
Wiring ..... (Includes removal and installation of spark plug harness.)	0.5
0605 Ignition Components:	
Distributor ..... (Includes removal, instal-lation and timing engine.)	1.6
Ignition coil..... (Includes removal and installation of coil and capacitor.)	0.5
Spark plugs..... (Includes removal and installation of wiring harness.)	1.5
Wiring ..... (Includes removal and installation of spark plug harness.)	0.5
0607 Instrument Panel:	
Panel assembly, instrument..... (Includes removal and installation of all gages and controls.)	3.4
0609 Lights:	
Light, head ..... (Includes removal and installation of headlight and wiring.)	0.5
Lights, tail and blackout..... (Includes removal and installation of light and wiring.)	0.5
0611 Horn, Siren:	
Horn.....	0.3

Table 1-4. Remove and Replace-Continued

Remove and replace	Man-hours
(Includes removal and installation of horn, horn relay, and bracket.)	
0612 Batteries:	
Battery ..... (Includes removal and installation of cables.)	0.6
07 TRANSMISSION	
0708 Torque Converter ..... (Includes removal and installation of transmission assembly.)	2.5
0710 Transmission Assembly:	
Transmission assembly ..... (Transmission removed, includes removal and installation of propeller shaft, floor plate and starting motor.)	2.0
0713 Intermediate Clutch:	
Clutch, front ..... (Transmission removed, includes removal and installation of control valve and front pump.)	1.0
Clutch, rear ..... (Transmission removed, ineludes removal and installation of control valve and rear pump.)	1-3
Clutch, overrunning ..... (Transmission removed, includes removal and installation of control valve, front and rear pumps and servo units.)	2.0
0714 Servo Unit:	
Servo unit, kick down ..... (Transmission removed, includes removal and installation of control valve, front and rear clutches.)	1.4
Servo unit, low and reverse..... (Transmission removed, includes removal and installation of control valve and front and rear clutch.)	1.8
0721Coolers Pump and Motors:	
Valve assembly, control..... (Transmission removed, includes removal and installation of oil pan.)	1.3
Governor assembly ..... (Transmission removed, includes removal and installation of control valve.)	1.0

Table 1-4. Remove and Replace continued

Remove and replace	Man-hours
Pump assembly, rear ..... (Transmission removed, includes removal and installation of control valve.)	1.0
Pump assembly, front ..... (Transmission removed, includes removal and installation of control valve.)	1.0
09 PROPELLER AND PROPELLER SHAFTS	
0900 Propeller Shaft:	
Shaft assembly, propeller ..... (Includes removal and installation of universal joints.)	1.0
10 FRONT AXLE	
1000 Front Axle Assembly:	
Axle assembly, front ..... (Includes removal and installation of front wheels and springs.)	3.0
1004 Steering and Leaning Wheel Mechanism:	
Tie rod assembly ..... (Includes removal and installation of tie rod ends.)	0.6
11 REAR AXLE	
1101 Axle Assembly Rear ..... (Includes removal and installation of entire drive unit.)	2.0
1102 Differential:	
Differential assembly ..... (Includes removal and installation of rear wheels, propeller shaft, reduction gear case and drive axle.)	3.0
Reduction gear assembly ..... (Differential removed)	0.6
Ring gear and pinion assembly ..... (Differential removed, includes removal of spider gears and bearings.)	2.6
12 BRAKES	
1201 Hand Brake Assembly:	
Brake assembly, hand .....- (Includes removal and installation of propeller shaft and hand brake drum.)	2.0
1202 Service Brakes:	
Shoes, Brake ..... (Includes removal and installation of rear wheels.)	3.0

Table 1-4. Remove and Replace-Continued

Remove and replace	Man-hours
1204 Hydraulic Brake System:	
Cylinder assembly, wheel ..... (Brake lining removed, includes removal and installation of brake tubing.)	3.0
Cylinder assembly, master ..... (Includes removal of floor plate and hydraulic lines.)	1.0
13 WHEELS AND TRACKS	
1311 Wheel Assembly:	
Wheel assembly, front ..... (Includes removal and installation of wheel bearings.)	1.0
Wheel assembly, rear ..... (Includes removal and installation of brake shoes.)	3.0
1313 Tires, Tubes:	
Tire, front ..... (Includes removal, repair and installation.)	1.5
Tire, rear ..... (Includes removal, repair and installation of both tires.)	1.2
14 STEERING	
1401 Steering Assembly:	
Steering gear assembly ..... (Includes removal and installation of steering wheel and arm.)	2.0
15 FRAME, TOWING ATTACHMENTS AND DRAWBAR	
1501 Frame Assembly:	
Frame assembly ..... (Includes removal and installation of transmission and differential.)	20.0
1502 Counterweights:	
Counterweight ..... (Includes removal and installation of rear deck plate.)	1.0
1503 Pintles and towing attachments:	
Coupler, towing	05
16 SPRINGS AND SHOCK ABSORBERS	
1601 Springs:	
Spring, front ..... (Includes removal and installation of spring shackles and brackets)	1.0
18 BODY, CAB, HOOD AND HULL	
1801 Body, Cab, Hood, Hull Assemblies:	
Hood assembly	0.5
1806 Upholstery, Seat	
Seat assembly.....	0.5

Table 1-4. Remove and Replace-continued

CHAPTER 2

GENERAL MAINTENANCE INSTRUCTIONS

Section I. SPECIAL TOOLS AND EQUIPMENT

2-1. Repair Part, Special Tools and Equipment

a. No special tools and equipment is required by direct support, general support and depot maintenance personnel for performing maintenance on the warehouse tractor.

b. Repair parts for Direct Support, General Support and Depot Maintenance are listed in TM 10-3930-60335P.

2-2. Specially Designed (Fabricated) Tools and Equipment

No specially designed (fabricated) tools and equipment is required by direct support, genera; support and depot maintenance personnel for performing maintenance on the warehouse tractor
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Section II. TROUBLESHOOTING

2-3. General

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the tractor and its components. Malfunctions which may occur are listed in tables 2-1 through 2-3. Each malfunction stated is followed by a list of probable causes of the trouble. The corrective action recommended is described opposite the probable cause.

2-4. Engine Troubleshooting

Table 2-1 lists the engine troubleshooting malfunctions, probable causes and possible remedies.

Table 2-1 Engine Troubleshooting

Malfunction	Probable Cause	Corrective Action
1 .Engine fails to start.	a. Defective carburetor	a. Rebuild carburetor (pare 3-2,3 4).
	b. Defective distributor.	*b* Rebuild distributor (pare 3-15, 2-1
	c. Defective valves.	c. Grind or replace valves (pare -23, -25).
	d. Defective starting motor.	d. Rebuild starting motor (pare 3-11, 3-13).
2. Engine overheats	a. Defective water pump.	a. Replace water pump (TM 1 3930-603-12).
	b. Defective radiator.	b. Repair or replace radiator (pare 3-37).
	c. Distributor defective or out of time.	c. Rebuild distributor (pare 3-16, 3-17).
3. Engine misfires.	a. Defective carburetor.	a. Rebuild carburetor (pare 3-2,3 4).
	b. Defective distributor.	b. Rebuild distributor (pare 3-15, 3-17).
	c. Defective valves.	c. Grind or replace valves (pare -23, -25).

Table 2-1. Engine Troubleshooting-continued

Malfunction	Probable Cause	Corrective Action
4. Excessive smoke from engine exhaust	a. Defective carburetor.	a. Rebuild carburetor (para 3-2,3-4).
	b. Worn intake valve guides.	b. Replace valve guides (para 3-23, 3-25).
	c. Worn piston rings or cylinder bore.	c. Repair block (para 3-43, 8-45).
5. Engine idles poorly or rough under load.	a. Burned or stuck valves.	a. Grind or replace valves (para 3-23, 3-25).
	b. Broken valve spring.	b. Replace valve spring (para 3-23, 3-25).
	c. Defective distributor.	c. Rebuild distributor (para 3-15, 3-17).
	d. Restricted fuel supply.	d. Rebuild carburetor (para 3-2, 3-4).
6. Engine has low oil pressure	a. Excessive main bearing or connecting rod clearance.	a. Replace rod bearings (para 3-31, 3-33), or main bearings(para 3-39, 3-41).
	b. Oil pump screen clogged	b. Clean or replace oil pump screen (para 3-27, 3-29).
	c. Defective oil pump.	c. Repair or replace oil pump (para 3-19, 3-21).
7. Engine has a metallic knock, runs noisy.	a. Worn or defective main bearings.	a. Replace main bearings(para 3-29, 3-1).
	b. Worn or defective connecting rod bearings or pin bushings.	b. Replace connecting rod bearings and pin bushings (para 8-81, 8-88).
	c. Worn pistons on piston pins.	c. Replace pistons and pins (para 3-31 and 3-43).
	d. Worn timing gears	d. Replace timing gears (part 3-35, 3-37).
	c. Defective crankshaft.	e. Replace crankshaft (para 3-39, 3-41).
8. Engine lacks power.	a. Defective pistons and rings.	a. Replace pistons and rings (para 3-31, 3-33).
	b. High engine temperature caused by defective cooling system.	b. Replace water pump(TM10-3930-603-12). Repair radiator (para 3-47).
	c. Defective valves.	c. Grind or replace valves (para 3-23, 3-25).
	d. Defective carburetor.	d. Rebuild carburetor (para 3-2, 3-4).
	e. Defective distributor.	e. Rebuild distributor (para 3-15, 3-17).

2-5. Transmission Troubleshooting

Table 2-2 lists the transmission troubleshooting.

Table 2.2. Transmission Troubleshooting

Malfunction	Probable Cause	Possible Remedy
1. Transmission will not upshift.	a. Incorrect throttle linkage adjustment.	a. Adjust throttle linkage (para 2-12).
	b. Kickdown band out of adjustment.	b. Adjust kickdown band (para 2-12). Perform hydraulic pressure test (para 2-13) and adjust (para 2-14).

Table 2-1. Transmission Troubleshooting--Continued

Malfunction	Probable Cause	Possible Remedy
Transmission will not up-shift- Continued.	c. Governor sticking.	c. Remove, clean or replace governor (para 4-13, 4-15).
	d. Valve body defective or leaking	d. Perform pressure tests (para 2-13) adjust as necessary (para 2-14).
	e. Accumulator sticking	e. Repair or replace accumulator (para 4-26, 4-27).
	f. Clutches or servo unit is defective	f. Remove valve body and perform air pressure test (para 2-15), repair clutches (para 4-35, 4-42) repair servo unit (para 4-51, 4-54).
	g. Defective oil pump.	g. Perform hydraulic pressure test (para 2-13), repair or replace oil pump (para 4-29, 4-33).
	h. Defective kickdown servo or linkage adjustment.	h. Rebuild servo units (para 4-51, 4-64), adjust linkage (para 2-12).
	I. Defective front clutch.	i. Rebuild front clutch (para 4-35,4-38).
	j. Worn or broken input shaft or reaction shaft seal rings.	j. Replace input shaft (para or 4-39, 4-42). Replace reaction shaft and seals (para 4-29, 4-33).
2. Transmission will not kick down or downshift normal.	a. Defective throttle linkage adjustment.	a. Adjust throttle linkage (para 2-12).
	b. Defective gear shift control cable adjustment.	b. Adjust gear shift control cable cable (para 2-12).
	c. Kickdown band out of adjust-ment.	c. Adjust kickdown band (para 2-12).
	d. Hydraulic pressure too high low.	d. Perform hydraulic pressure or test (para 2-13). Adjust pressure (para 2-14).
	e. Governor sticking.	e. Rebuild governor (para 4-13, 4-15).
	f. Defective valve body.	f. Perform pressure test (para 2-13). Repair valve body (para 425, 4-27).
	g. Defective accumulator.	g. Repair accumulator (para 4-25, 4-27).
	h. Defective clutch or servo.	h. Remove valve body (para 4-25, perform pressure test (para 2-13). Repair clutches (para 4-35, 4-42), repair servo (para 4-51 4-54).
,	i. Defective servo band or link-age.	i. Repair servo band (para 4-51 4-54) adjust linkage (para 2-12).
	j. Defective overrunning clutch.	j. Repair overrunning clutch (para 4-51, 4-54).
3. Transmission shifts erratic.	a. Low fluid level.	a. Add fluid.
	b. Aerated fluid.	b. Inspect for air leaks in fluid suction passages (para 2-15).
	c. Incorrect gear shift control cable adjustment.	c. Adjust control cable (para 2-12).

Table 2-2. Transmission Troubleshooting--continued

Malfunction	Probable Cause	Possible Remedy
Transmission shifts erratic-Continued.	d. Hydraulic pressure too high or low.	d. Perform hydraulic pressure test (para 2-13), adjust pressure (para 2-14).
	e. Governor sticking.	e. Repair governor (para 4-13, 4-15).
	f. Clogged oil filter.	f. Replace oil filter (para 4-25, 427).
	g. Defective valve body.	g. Peform pressure test (para 2-13),repair control assembly (para 4-25, 4-27).
	h. Sticking front or rear clutch.	h. Perform pressure test (para 2-13), repair front clutch (para 4-85, 4-38), repair rear clutch (para 4-39, 442).
	i. Defective oil pump.	i. Perform pressure test (para 2-13), adjust or repair oil pump (para 4-29, 4-33).
	j. Worn or broken input shaft, or defective input shaft support seal rings.	j. Replace input shaft support seal ring and shaft (para 4-39, 4-42).
4. Harsh transmission engagement in drive, first, second or reverse ranges.	a. Engine idle speed too high.	a. Adjust engine idle speed and throttle linkage (TM 10-3930-603-12).
	b. Hydraulic pressure too low or high,	b. Check fluid level. Perform hydraulic pressure test (para 2-13). Adjust pressure as necessary (para 2-14).
	c. Low-reverse band out of adjustment.	c. Adjust low-reverse band (para 2-12).
	d. Defective valve body.	d. Perform pressure test (para 2-13). Repair valve body (para 4-25, 4-27).
	e. Accumulator sticking, broken rings or spring.	e. Inspect and repair accumulator (para 4-25, 4-27).
	f. Defective low reverse servo band or linkage.	f. Repair servo (para 4-51, 4-54), adjust low reverse band (para 2-12). Replace low reverse band (para 4-51, 4-54).
	g. Defective front or rear clutch.	g. Repair front clutch (para 4-35, 4-38). Repair rear clutch (para 4-39, 4-42).
5. Delayed engagement in drive, first, second, and reverse ranges.	a. Low fluid level.	a. Add fluid.
	b. Gear shift control cable out of adjustment	b. Adjust gear shift control cable (para 2-12).
	c. Clogged oil filter.	c. Replace oil filter (para 4-25 4-27).
	d. Hydraulic pressure too high or low.	d. Perform hydraulic pressure test (para 2-13). Adjust hydraulic pressure (para 2-14).
	e. Defective valve body.	e. Perform pressure test (para 2-13). Repair valve body (para 4-26, 4-27).
	f. Accumulator sticking, sticking rings or spring.	f. Repair accumulator (para 4-25, 4-27).

Table 2-2. Transmission Troubleshooting-Continued

Malfuntion	Probable Cause	Possible Remedy
Delayed engagement in drive, first, second, and reverse range-Continued.	g. Clutches or servo sticking or not operating.	g. Perform air pressure test (para 2-15). Repair front clutch (para 4-35, 4-38) or rear clutch (para 4-39, 4-42).
	h. Defective oil pump.	h. Perform hydraulic pressure test (para 2-13), repair oil pump (para 4-29, 4-33). Adjust hydraulic pressure (para 2-14).
	i. Defective front or rear clutch.	i. Repair front clutch (para 4-35, 4-38). Repair rear clutch (para 4-39, 4-42).
	J. Worn or broken input shaft or worn input shaft seal rings.	j. Replace input shaft, (replace seal rings (para 4-39, 4-42)).
	k. Aerated fluid.	k. Inspect for air leakage into suction passages (para 2-15).
6. Runaway or harsh upshift third to second gear kickdown.	a. Low fluid level.	a. Add fluid (LO 10-3930 and 603-12).
	b. Hydraulic pressure too high or low.	b. Perform hydraulic pressure test (para 2-13). Adjust hydraulic pressure (para 2-14).
	c. Kickdown band out of adjustment.	c. Adjust kickdown band (para 2-12).
	d. Defective control valve body.	d. Perform pressure test (para 2-13), adjust pressure (para 2-14).
	e. Defective governor.	e. Repair governor (para 4-13, 4-15).
	f. Accumulator sticking due to broken ring or spring.	f. Inspect and repair accumu lator (para 4-25, 4-27).
	g. Sticking clutch or servo unit.	g. Remove valve body and perform air pressure test (para 2-15). Repair control valve (para 4-25, 4-27).
	h. Defective kickdown servo band or linkage adjustment.	h. Inspect and repair servo unit (para 4-51, 4-54). Adjust linkage (para 2-12).
	I. Defective front clutch.	i. Repair clutches (para 4-35, 4-42).
	j. Worn or broken input shaft or reaction shaft support seal rings.	j. Inspect and replace reaction input shaft (para 4-30, 4-33). Replace reaction shaft support seal rings (para 4-29).
7. Transmission slips in forward drive positions	a. Low fluid level.	a. Add fluid (LO-10-3930 603-12).
	b. Aerated fluid.	b. Inspect for air leaks into oil pump suction.
	c. Incorrect Rearshift control cable adjustment.	c. Adjust gearshift control cable (para 2-12).
	d. Hydraulic pressure too low.	d. Perform hydraulic pressure test (para 2-13). Adjust pressure (para 2-14).

Table 2-2. Transmission Troubleshooting-Continued

Malfunctlon	Probable Cause	Possible Remedy
Transmission slips in forward drive position-Continued.	e. Leaking valve body.	e. Perform hydraulic pressure test (para 2-13). Repair control valve (para 4-25, 4-27).
	f. Accumulator sticking, caused by broken rings or spring.	i. Repair accumulator (para 4-25, 4-27).
	g. Defective clutches or servo unit.	g. Remove valve body (para 4-25), repair front clutch (para 4-35, 4-38). Repair rear clutch (para 4-39, 4-42). Repair servos (para 4-51, 4-54).
	h. Overrunning clutch not holding.	h. Repair overrunning clutch (para 4-51, 4-54).
	i. Worn or broken input shaft or reaction shaft support seal rings.	i. Inspect reaction shaft bore and replace shaft and seal rings (para 4-29, 4-33).
8. Transmission slips in reverse only.	a. Low fluid level.	a. Add fluid (LO-10-3930-603-12).
	b. Aerated fluid.	b. Inspect for leakage into oil pump suction passages (para 2-15).
	c. Incorrected gear shift control cable adjustment.	c. Adjust control cable (para 2-12).
	d. Hydraulic pressure too low.	d. Perform hydraulic pressure test (para 2-13). Adjust pressure (para 2-14).
	e. Low-reverse band out of adjustment.	e. Adjust low-reverse band (para 2-12).
	f. Defective control valve body.	f. Perform hydraulic pressure test (para 2-13), repair control valve (para 4-25, 4-27).
	g. Front clutch or servo unit is defective.	g. Perform air pressure test (para 2-15). Repair servo unit (para 4-51, 4-54). Repair front clutch (para 4-35, 4-38).
	h. Low-reverse servo band or linkage out of adjustment	h. Adjust low-reverse band (para 2-12). Adjust linkage (para 2-12).
	i. Defective oil pump.	i. Perform hydraulic pressure test (para 2-13). Adjust pressure (para 2-14). Repair oil pump (para 4-30, 4-33).
9. Transmission slips in all positions.	a. Low fluid level.	a. Add fluid (LO-10-3930-603-12).
	b. Hydraulic pressure too low.	b. Perform hydraulic pressure test (para 2-13). Adjust pressure (para 2-14).
	c. Defective control valve body.	c. Perform hydraulic pressure test (para 2-13), repair control valve (para 4-25, 4-27).

Table 2-2. Transmission Troubleshooting-Continued

Malfunction	Probable Cause	Possible Remedy
Transmission slips in all positions-Continued	d. Defective oil pump.	d. Perform hydraulic pressure test and adjust (para 2-13) Repair oil pump (para 4-30, 4-33).
	e. Clutches or servo sticking.	e. Perform air pressure test (para 2-13). Repair front clutch (para 4-35, 4-38), rear clutch (para 4-39, 4-42), servos (para 4-39, 4-42).
	f. Worn or broken input shaft or reaction shaft support seal rings.	f. Inspect and replace seal rings. Inspect bores and replace shaft and seal rings, repair input shaft (para 4-39, 4-42).
10. Transmission has no drive in any position.	a. Low fluid level.	a. Add fluid (LO-10-3930-603-12).
	b. Hydraulic pressure too low.	b. Perform hydraulic pressure test (para 2-13). Adjust as necessary (para 2-14).
	c. Oil filter clogged.	c. Replace oil filter (para 4-7).
	d. Defective control valve.	d. Perform hydraulic pressure test (para 2-13), adjust pressure (para 2-14), repair control valve (para 4-25, 4-29).
	e. Defective oil pump.	e. Perform hydraulic pressure tests (para 2-13), adjust (para 2-14), repair oil pump (para 4-29, 4-33).
	f. Clutches and servo unit sticking.	f. Perform air pressure test (para 2-15), repair front clutch (para 4-35, 4-38), rear clutch (para 4-39, 4-42) or servos (para 4-51, 4-54).
11. Transmission will not drive in forward positions.	a. Hydraulic pressure too low.	a. Perform hydraulic pressure test (para 2-13), adjust (para 2-14).
	b. Defensive control valve body.	b. Perform hydraulic pressure test (para 2-13), repair control valve (para 4-25, 4-27).
	c. Accumulator sticking, broken rings or spring.	c. Inspect and repair accumulator (para 4-25, 4-27).
	d. Defective clutches or servo.	d. Perform air pressure test (para 2-15), repair front clutch (para 4-35, 4-38), rear clutch (para 4-39, 4-42), servo unit (para 4-4-54).
51,	e. Worn or defective rear clutch.	e. Repair or replace rear clutch (para 4-39, 4-42).
	f. Overrunning clutch not holding.	f. Repair overrunning clutch (para 4-51, 4-54).
	g. Worn or broken input shaft or reaction shaft support seal rings	g. Inspect and replace seal rings, inspect ring bores (para 4-29).

Table 2-2. Transmission Troubleshooting-Continued

Malfunction	Probable Cause	Possible Remedy
12. Transmission will not drive in reverse.	a. Incorrect gearshift control cable adjustment.	a. Adjust gearshift control cable linkage (para 2-12).
	b. Hydraulic pressure is too low.	b. Perform hydraulic pressure test (para 2-13), adjust as necessary (para 2-14).
	c. Low-reverse band out of adjustment.	c. Adjust low-reverse band (para 2-12).
	d. Defective control valve body.	d. Perform hydraulic pressure test (para 2-13). Repair control valve (para 4-25, 4-27).
	e. Front clutch or servo sticking or not operating.	e. Perform air pressure test para 2-13), repair front clutch (para 4-35, 4-38), servo unit (para 4-51, 4-54).
	f. Low-reverse servo, band, or linkage defective.	f. Inspect servo for damaged seals or binding linkage (para 4-52), replace bands (para 4-54). Adjust bands (para 2-12).
	g. Defective front clutch.	g. Repair or replace front clutch (para 4-36, 4-38).
13. Transmission drives in neutral.	a. Incorrect gearshift control cable adjustment.	a. Adjust gearshift control cable (para 2-12).
	b. Defective control valve body.	b. Perform hydraulic pressure test (para 2-13). Repair control valve (para 4-25, 4-27).
	c. Defective rear clutch.	c. Repair or replace rear clutch (para 4-39, 4.42).
14. Transmission clogs or locks.	a. Kickdown band out of adjustment.	a. Adjust kickdown band (para 2-12).
	b. Low-reverse band out of adjustment.	b. Adjust low-reverse band (para 2-12).
	c. Kickdown or low-reverse servo band linkage is defective.	c. Inspect servo unit for sticking or broken seal rings, binding linkage, or faulty lining. Repair as necessary (para 4-52).
	d. Planetary gear sets broken, seized.	d. Replace planetary gear sets (para 4-45, 4-49).
	e. Defective overrunning clutch.	e. Repair or replace overrunning clutch (para 4-51, 444).
15. Transmission has grating, scraping, growling noise.	a. Kickdown band out of adjustment.	a. Adjust kickdown band (para 2-12).
	b. Low-reverse band out of adjustment.	b. Adjust low-reverse band (para 2-12).
	c. Damaged output shaft bearing or bushing.	c. Replace output shaft bearing and bushing (para 4-9).
	d. Governor support has binding or broken seal rings.	d. Replace governor support seal rings (para 4-13, 4-15).
	e. Oil pump scored or binding.	e. Repair or replace oil pump (para 4-29, 4-33).
	f. Defective front or rear clutch.	f. Replace front clutch (para 4-35, 4-38), or rear clutch (para 4-39, 4-42).

Table 2-2. Transmission Troubleshooting-Continued

Malfunction	Probable Cause	Possible Remedy
Transmission has grating, scraping, growling noise-Continued.	g. Planetary gear sets broken or seized.	g. Replace planetary gear sets (para 4-45, 4-49).
	h. Defective overrunning clutch.	h. Repair or replace overrunning clutch (para 4-51, 4-54).
16. Transmission makes a whizzing or buzzing sound.	a. Low fluid level.	a. Add fluid (LO 103930 603-12).
	b. Oil pump sucking air.	b. Inspect oil pump for nicks or burrs on mating surfaces. Rebuild oil pump (para 4-30, 4-33).
	c. Defective valve.	c. Rebuild valve body assembly (para 4-25, 4-27).
	d. Damaged overrunning clutch inner race damage.	d. Repair overrunning clutch (para -51, 4-54).
17. Transmission is hard to fill, fluid flows out filler tube.	a. High fluid level.	a. Drain to correct level (LO 10-3930-603-12).
	b. Clogged breather.	b. Service breather (LO 10 3930-603-12).
	c. Oil filter clogged.	c. Replace oil filter (para 4-7).
	d. Aerated fluid.	d. Inspect for air leakage into oil pump (para 2-15).
18. Transmission overheats.	a. Low fluid level.	a. Add fluid (LO 10-3930-603-12).
	b. Kickdown band adjustment too tight.	b. Adjust kickdown band (para 2-12).
	c. Low-reverse band adjustment too tight.	c. Adjust low-reverse band (para 2-12).
	d. Defective cooling system.	d. Clean or repair cooling system (para 3-47).
	e. Cracked or restricted oil cooler line.	e. Repair or replace line (para 2-10, 2-11).
	f. Defective oil pump.	f. Repair oil pump (para 4-30, 4-33).
	g. Insufficient clutch plate clearance in front and	g. Measure and adjust front plate clearance (para 4-38) rear clutches. and rear plate clearance (para 4-42).
19. Engine starting motor will not engage in neutral or park.	a. Defective gearshift control cable adjustment.	a. Adjust gearshift control cable (para 2-12).
	b. Defective or incorrectly adjusted neutral starting switch.	b. Test operation of switch, replace switch if necessary (para 2-12).
	c. Broken lead to neutral switch.	c. Repair or replace lead (para 2-12).

2-6. Axles and Steering Troubleshooting

Table 2-3 lists the front axle, rear axle, and steering gear troubleshooting.

Table 2-. Axles and Steering Gear Troubleshooting

Malfunction	Probable Cause	Possible Remedy
1. Front wheels shimmy.	a. Worn spindle bolts and bushings.	a. Replace spindle bolts (para 5-11, 6-13).
	b. Loose or worn steering knuckle or tie rod ends.	b. Replace tie rods and steering knuckle (para 5-2, 5-6).
2. Tractor is hard to steer. gear (para 66).	a. Defective steering.	a. Repair and adjust steering
	b. Binding spindle bolts.	b. Replace spindle bolts (para 5-11, 5-13).

Table 2-3. Axles and Steering Gear Troubleshooting-Continued

	Malfunction		Probable Cause		Possible Remedy
3.	Tractor pulls to one side.	a.	Broken spring.	a.	Replace spring (para 5-8, 5-10).
		b.	Broken spring shackle or bolt.	b.	Replace spring shackle (para 5-8, 5-10).
4.	Rumbling noise in rear axle.	a.	Defective rear axle or carrier bearing.	a.	Replace bearings (para 5-15, 5-19).
		b.	Ring gear and pinion out of adjustment.	b.	Adjust ring gear and pinion (para 5-18).
		c.	Defective pinion bearing.	c.	Replace pinion bearing (para 5-15, 5-19).
		d.	Stripped or damaged tooth in ring gear, pinion or spider gears.	d.	Rebuild differential (para 5-15, 5-19).

Section III. REMOVAL AND INSTALLATION OF MAJOR COMPONENTS

2-7. General

a. *Body and Flame Group*. The body group consists of the hood assembly, hold supports, fuel tanks, operators seat. battery carrier, deck and baffle plates, towing coupler, rear body assembly, and counterweight. Normally fenders, deck plates, rear wheel enclosure and panels can be repaired without removal.

However, when it is necessary to work on some power train components, removal is necessary.

b. Engine. The engine is a military standard industrial unit. It is a six cylinder.

four cycle, gasoline burning type, liquid cooled and pressure lubricated. It features a forged steel balanced crankshaft, forged steel connecting rods, replaceable bearings, and splash lubricated pistons each with four piston rings.

The design of certain high mortality parts conforms to military standards for interchangeability.

c. Transmission.

(1) The tractor is equipped with a Chrysler Model A727 automatic trails mission. This transmission combines a torque converter with a fully automatic three speed gear system. The torque converter housing and transmission case are an integral aluminum casting. The transmission consists of two multiple disc clutches, an overrunning clutch, two servos and bands, and two planetary gear sets to provide three forward speeds and a reverse range. The common sun gear of the planetary gear sets is connected to the front clutch by a driving shell which is splined to the sun gear and to the front clutch retainer. The hydraulic system consists of a front and rear pump and a single valve body which contains all valves except the governor valve. Venting of the transmission is accomplished by drilled passages through the upper part of front oil pump housing.

(2) The torque converter is attached to the engine crankshaft through a flexible driving plate. Engine torque is transmitted through the torque converter and then, through the input shaft to multiple disc clutches in the transmission. The power flow depends on application of clutches and bands.

(3) Cooling of the transmission converter is accomplished by circulating transmission fluid through an oil-to-water type cooler connected with engine cooling system. The torque converter assembly is a sealed unit which cannot be disassembled. Dirt or other foreign material may be removed by flushing. The transmission fluid is filtered by an internal "dacron type" filter.

(4) Shifting of the transmission is accomplished with a manual shift lever located just forward to the right of

the steering column. The lever has five detented positions: R (reverse), N (neutral), D (drive), 2 (second), and 1 (low). The gearshift control is linked to the transmission by a cable which runs through the steering column support bracket and down the engine firewall.

2-8. Body Group Removal

a. Hood Support Removal.

(1) Remove engine hood, throttle and choke controls, headlights and radiator (TM 10-3930-603-12).

(2) Tag and disconnect all electrical leads, and remove front and rear hood supports as illustrated in figure 2-1.

b. Operator's Seat Removal. Remove operator's seat assembly (TM 10-3930--603-12).

c. Battery Carrier Bracket Removal.

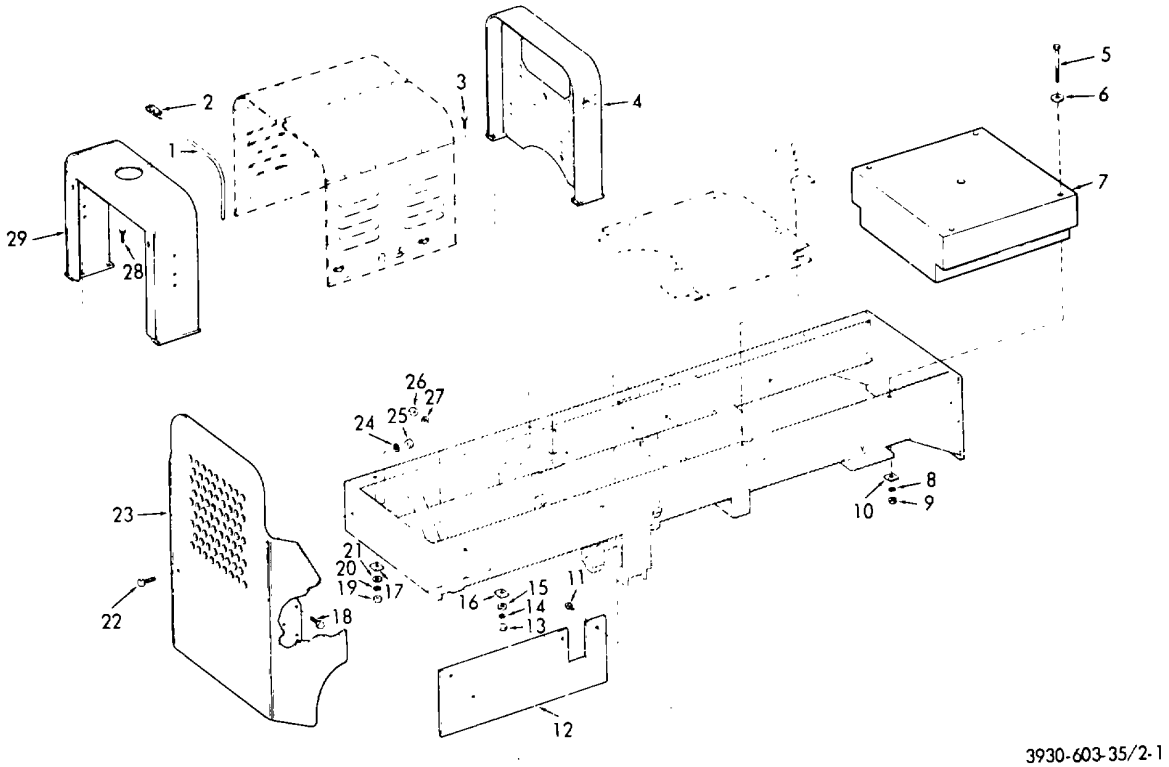
(1) Remove battery and battery cables (TM 10-3930-603-12).

(2) Remove battery carrier bracket as illustrated in figure 2-2.

d. Front Bumper Removal. Remove front bumper as illustrated in figure 2-1.

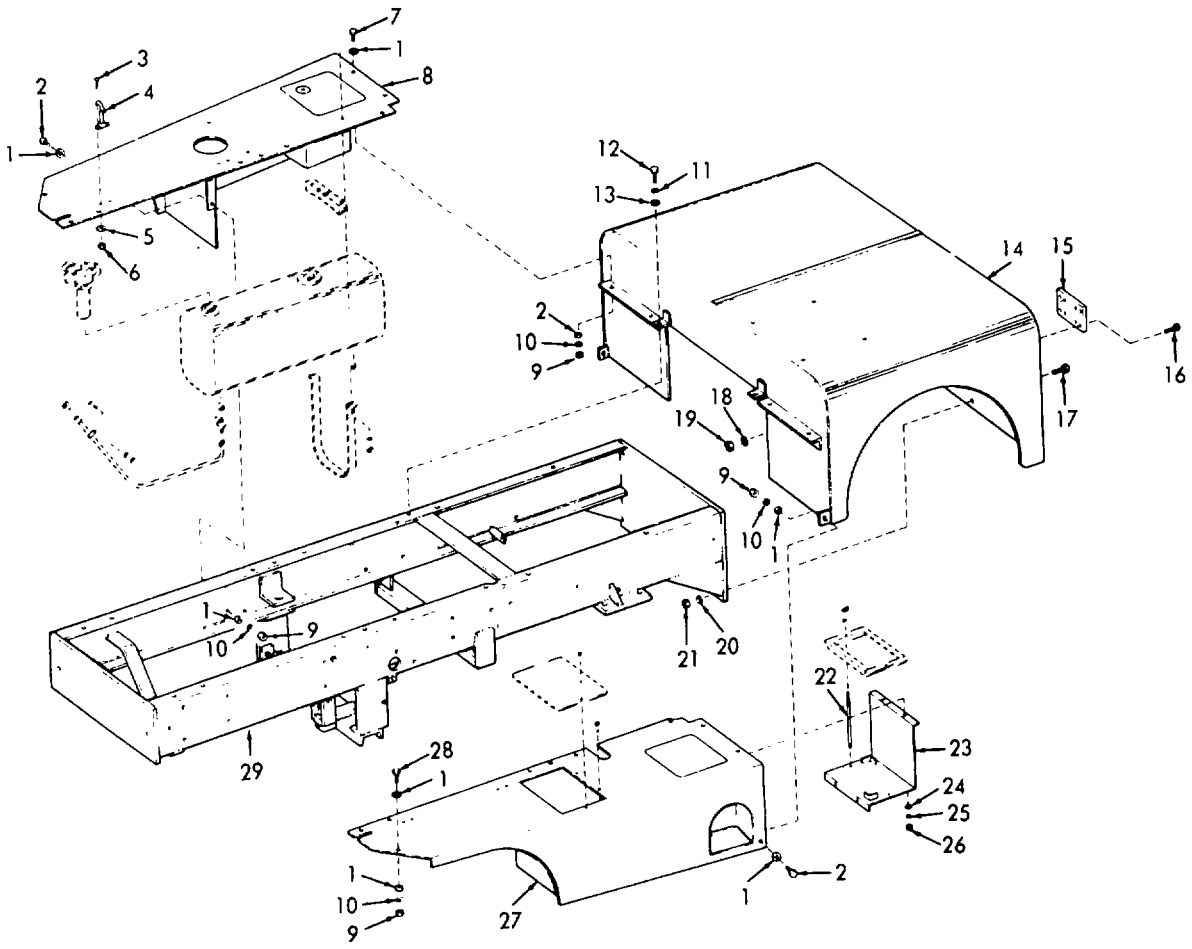
e. Front Fender Removal.

(1) Remove parking brake, deck plate hood assembly, and fuel tank assembly (TM 10-3930-603-12).



1	Rubber hose	9	Hex nut	17	Wedge washer	25	Hex nut
2	Drain trough	10	Wedge washer	18	Hex head capscrew	26	Hex nut
3	Hex head capscrew	11	Hex head capscrew	19	Hex nut	27	Lockwasher
4	Rear hood support	12	Baffle plate	20	Lockwasher	28	Hex head capscrew
5	Hex head capscrew	13	Hex nut	21	Flat washer	29	Front hood support
6	Flat washer	14	Lockwasher	22	Hex head capscrew		
7	Counterweight	15	Flat washer	23	Front bumper		
8	Lockwasher	16	Wedge washer	24	Lockwasher		

Figure 2-1. Front body group and counterweight, removal and installation.



1 Flat washer
2 Hex head capscrew
3 Round head screw
4 Hood cup
5 Lockwasher
6 Hex nut
7 Hex head capscrew
8 Right front fender
9 Self locking hex nut
10 Lockwasher
11 Lockwasher
12 Hex head capscrew
13 Flat washer
14 Rear body assembly
15 Adapter plate
16 Hex head capscrew
17 Hex head capscrew
18 Lockwasher
19 Hex nut
20 Lockwasher
21 Hex nut
22 Battery Box stud
23 Battery carrier bracker
24 Flat washer
25 Lockwasher
26 Hex nut
27 Left front fender
28 Hex head capscrew
29 Frame assembly

Figure 2-2. Rear body group and fender, removal and installation.

Note

Removal of fuel tank assembly is required only for removal of right front fender.

(2) Remove front and rear hood supports (*a*. above).

(3) Remove right and left front fenders as illustrated in figure 2-2.

f. Rear Body and Counterweight Removal.

(1) Remove towing coupler assembly and deck plate (TM 10-3930-603-12).

(2) Remove rear body assembly as illustrated in figure 2-2.

(3) Attach a suitable lifting device with at least 2,000 lb capacity and remove counterweight as illustrated in figure 2-1.

2-9. Body Group Installation

a. Rear Body and Counterweights Installation.

(1) Attacs a suitable lifting device with at least a 2,000 lb capacity and install rear counterweight as illustrated in figure 2-1.

(2) Install rear body assembly as illustrated in figure 2-2.

(3) Install rear towing coupler assembly (TM 10-3930-603-12).

b. Front Fenders Installation.

(1) Install right and left front fenders as illustrated in figure 2-2.

(2) Install fuel tank assembly (TM 10-3930-603-12).

c. Front Bumper Installation. Install front bumper as illustrated in figure 2-1.

d. Battery Carrier Bracket Installation.

(1) Install battery carrier bracket as illustrated in figure 2-2.

(2) Install battery and cables (TM 10-3930-603-12).

e. Operator's Seat Installation. Install operator's seat (TM 10-3930-603-12).

f. Hood Support Installation.

(1) Install front and rear hood supports as illustrated in figure 2-1.

(2) Connect instrument panel electrical leads and remove tags.

(3) Install throttle linkage, choke control, radiator, headlights and hood (TM 10-3930-603-12).

2-10. Transmission Removal

a. Do not remove the transmission from tractor until a careful diagnosis made, the definite cause of trouble is determined, and all possible eternal corrections performed. In diagnosing any abnormal shift conditions, always perform the hydraulic pressure tests (para 2-13) before removal or disassembly of transmission. Adjust hydraulic pressure (para 2-14).

Caution

The transmission and torque converter must be removed as an assembly; otherwise, the converter drive plate, pump bushing, and oil seal will be damaged. The drive plate will not support a load; therefore, none of the weight of transmission must be allowed to rest on drive plate during transmission removal.

b. Disconnect negative ground cable at battery.

c. Remove rear body assembly (para 2-8).

d. Place transmission range selector in neutral position, raise tractor with a suitable hoist and support with stands.

e. Remove propeller shaft, hand brake and drum assembly, and starting motor (TM 10-3930-03-12).

f. Remove transmission assembly as illustrated in figure 2-3.

Caution

Do not rotate torque converter or drive plate by prying with a screwdriver or similar tool as drive plate may become distorted. Also the starter motor should never be engaged if drive plate is not attached to torque converter with at least one bolt, or if transmission mounting capscrews have been loosened.

g. Place removed transmission on repair stand (fig. 2-4) and remove "C" clamp holding torque converter to transmission housing.

h. Remove eight screws (14, fig. 2-5), lockwashers (15), and remove drive plate (16) and adapter pilot (13) from engine crankshaft.

i. Do not remove drive adapter plate (1) from engine block unless plate is damaged and has to be replaced.

2-11. Transmission Installation

a. Attach small "C" clamp to edge of transmission housing to hold converter in place during transmission installation.

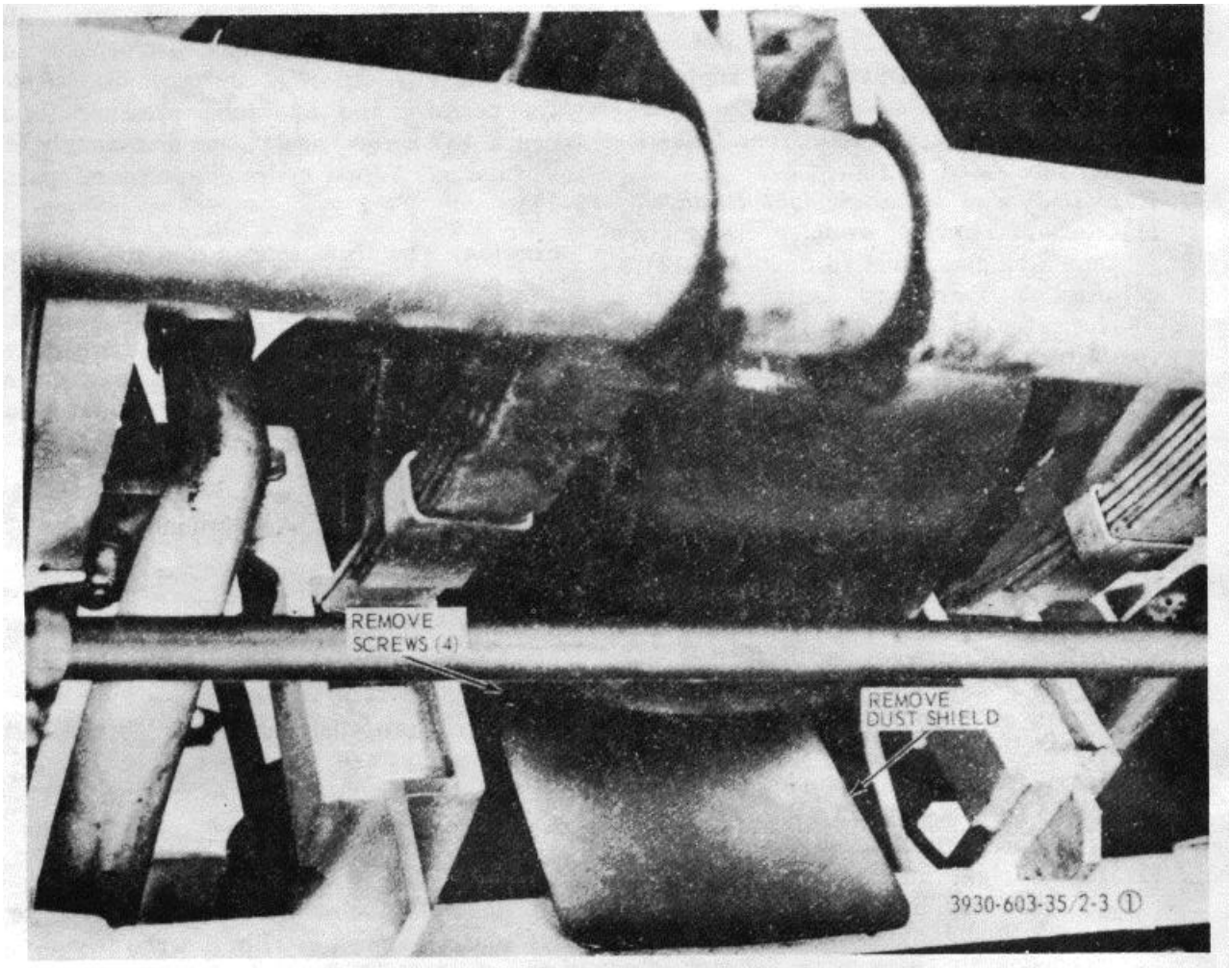


Figure 2-3 (1). Transmission removal and installation.

b. Inspect converter drive plate (16, fig. 25) for distortion or cracks and replace if necessary.

Caution

The transmission and torque converter must be installed as an assembly, otherwise the converter drive plate, front pump bushing, and oil seal will be damaged. The drive plate will not support a load; therefore, none of the weight of transmission must be allowed to rest on drive plate during installation.

c. Install transmission drive plate (16, fig. 2-5) and adapter plate (13) to end of engine crankshaft and secure with eight capscrews (14) and lockwashers (15).

d. Use a suitable hoist, lower transmission and torque converter into tractor. Rotate converter so match marks (made during removal) on converter and drive plate are in line so parts will be installed in their original position.

e. Carefully work transmission assembly forward over adapter plate dowel into position and install transmission as illustrated in figure 2-3. Tighten transmission mounting hardware to torque values shown in table 1-2.

f. Install starting motor, propeller shaft, negative ground cable and hand brake and drum assembly (TM 10-3930-603-12).

g. Fill transmission with oil (LO 10-3930-603-12).

h. Install rear body assembly (para 2-9).

i. Adjust transmission assembly (para 2-12 below).

Figure 2-3 (2). Continued.

2-12. Transmission Adjustment and Test

The lubrication, adjustments and test procedures covered below are in tractor services which must be performed by overhaul personnel every six months or after repair or overhaul of transmission assembly.

a. Gearshift Actuator Cable Adjustment.

(1) Disconnect control cable from gearshift control lever at transmission (para 2-10).

(2) Move selector lever to neutral position to see if detent assembly (fig. 2-6) is aligned with neutral "notch" in detent plate. Loosen two retaining nuts and aline detent assembly as required.

(3) Move gearshift control lever (fig. 27) on transmission all the way to rear (in neutral detent).

(4) With control lever in neutral position and detent and selector lever in

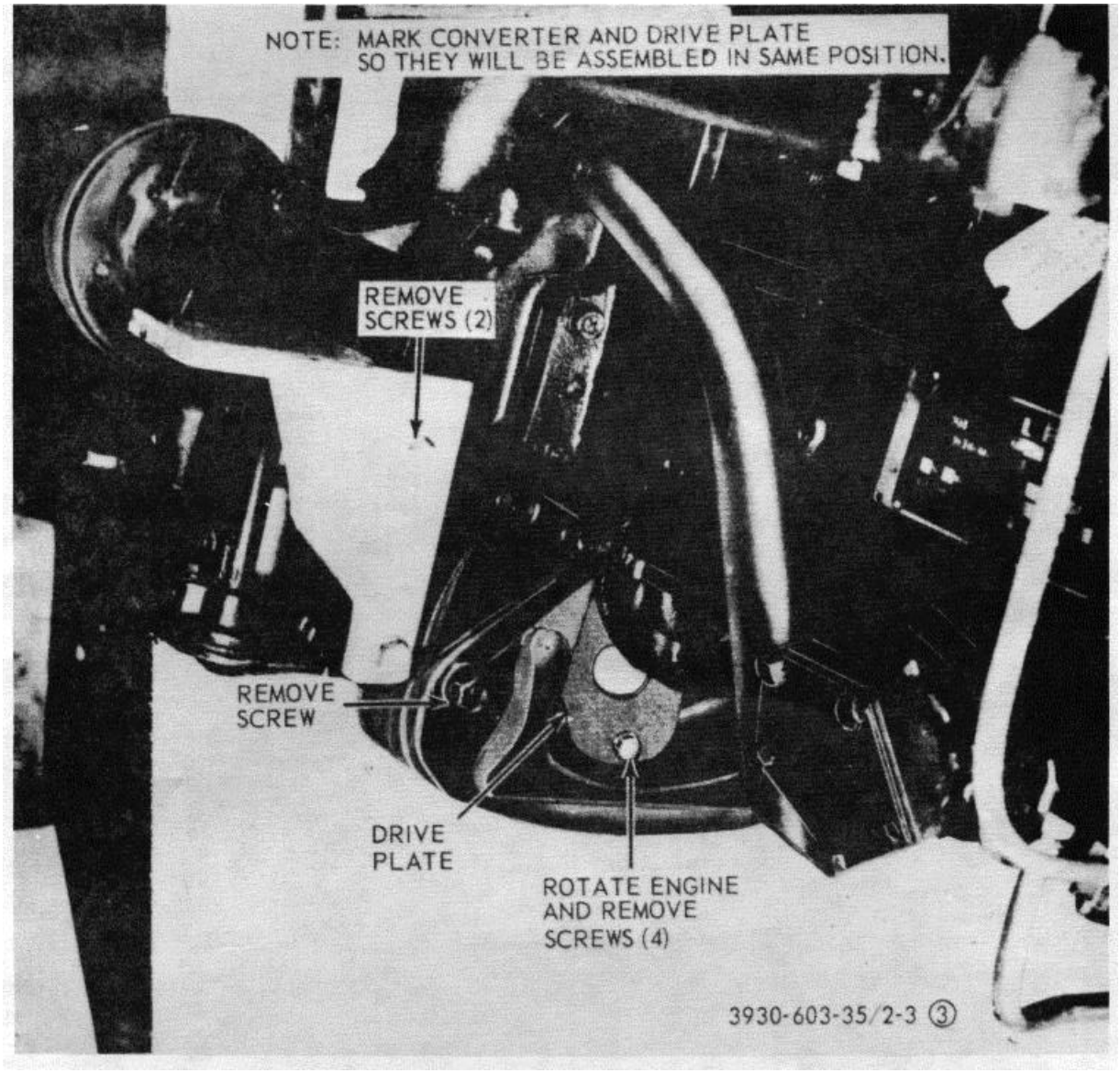


Figure 2-3 (3). Continued.

neutral position, adjust cable length with clevis and connect cable to control lever. With correct cable length, the clevis pin should be installed without any forward or rearward movement of neutral control lever.

b. Neutral Starting Switch Adjustment and Test.

(1) Disconnect wire from neutral switch (fig. 2-7). Connect one lead of test lamp to battery current and other lead to switch terminal. If test lamp does not light, the switch may be defective, out of adjustment, or gearshift control cable may be improperly adjusted.

(2) Unscrew switch from transmission case allowing fluid to drain into a container. Move range selector to neutral position and inspect to see that switch operating lever fingers are centered in switch opening in transmission case.

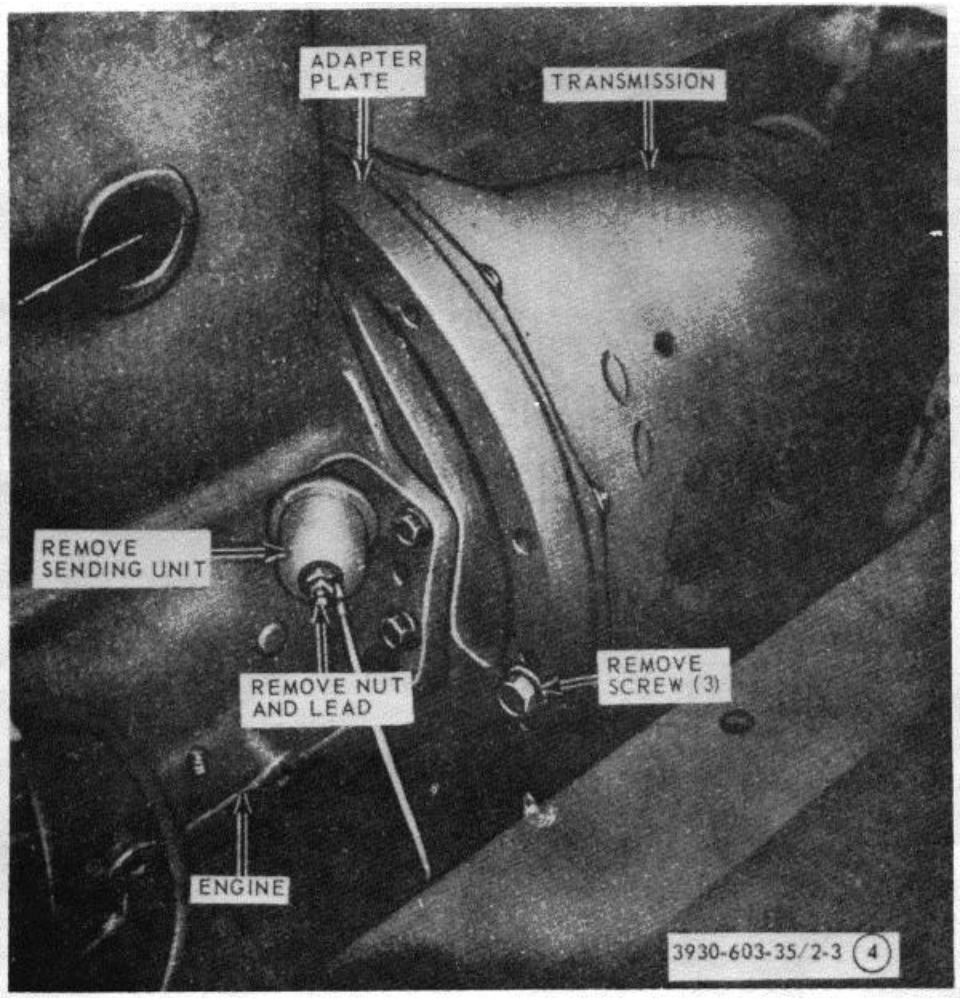


Figure 2-3 (4). Continued.

(3) Screw switch into transmission case and tighten to 25 to 35 foot-pounds torque. Reset switch with test lamp.

(4) Add fluid to transmission to bring it up to proper level (LO 10-3930-603-12).

(5) Test starter for proper operation in neutral position. Readjust gear shift cable if necessary (a. above).

c. Kickdown Band Adjustment.

(1) Loosen locknut on kickdown band adjusting screw (fig. 2-7) and back off approximately five turns. Check adjusting screw for free turning in transmission case.

(2) Use band adjustment wrench with adapter and tighten band adjusting screw 47 to 50 inch-pounds torque. If adapter is not used, tighten adjusting screw to 72 inch-pounds, which is true torque.

(3) Back off adjusting screw two turns. Hold adjusting screw in this position and tighten locknut to 29 foot-pounds torque.

d. Low and Reverse Band Adjustment.

(1) Raise tractor and drain transmission fluid (LO 10-3930-603-12).

(2) Remove transmission oil pan (fig. 2-8).

(3) Loosen adjusting lock screw nut (fig. 2-9) and back off approximately five turns. Check adjusting screw for free turning in lever.

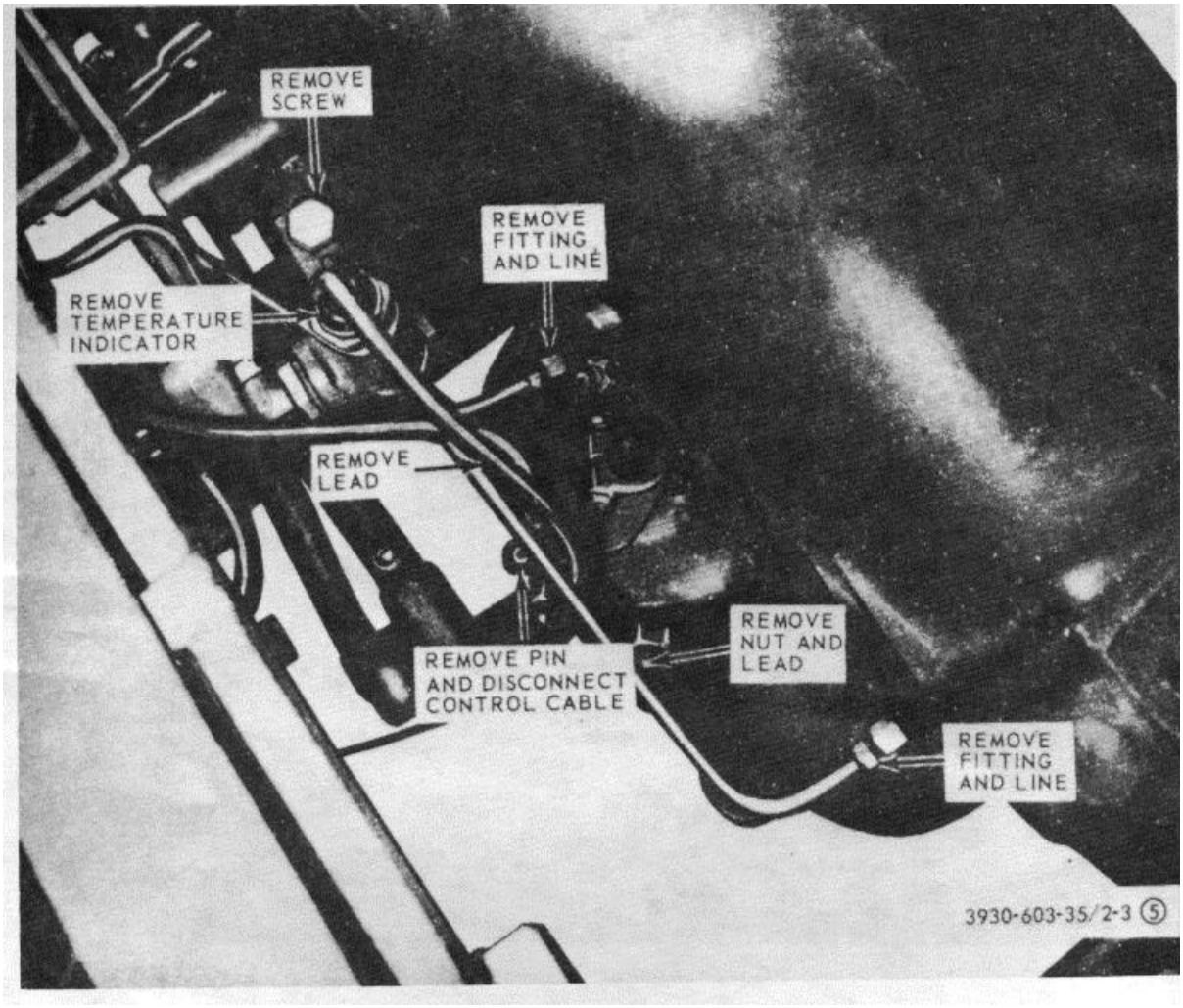


Figure 2-3 (5). Continued.

(4) Using adjusting wrench with adapter, tighten band adjusting screw to 4750 inch-pounds torque. If adapter is not used, tighten adjusting screw to 72 inch-pounds torque, which is true torque.

(5) Back off adjusting screw three turns, hold adjusting screw in this position and tighten lock nut to 35 foot-pounds torque.

(6) Use a new gasket and install transmission oil pan as illustrated in figure 2-8. Torque oil pan bolts to 150 inch-pounds.

(7) Fill transmission with fluid (LO 10-3930-603-12).

2-13. Transmission Hydraulic Control Pressure Test

a. Line Pressure and Front Servo Release Pressure. Line pressure and front servo release pressure test must be made in D (drive) position with rear wheels free to turn. Transmission fluid must be at normal operating temperature (150° to 200°F).

(1) Install an engine tachometer, raise tractor on a hoist, and position tachometer so it can be read under tractor.

(2) Connect two 0-100 psi pressure gages to pressure takeoff at side of accumulator and front servo release (fig. 210).

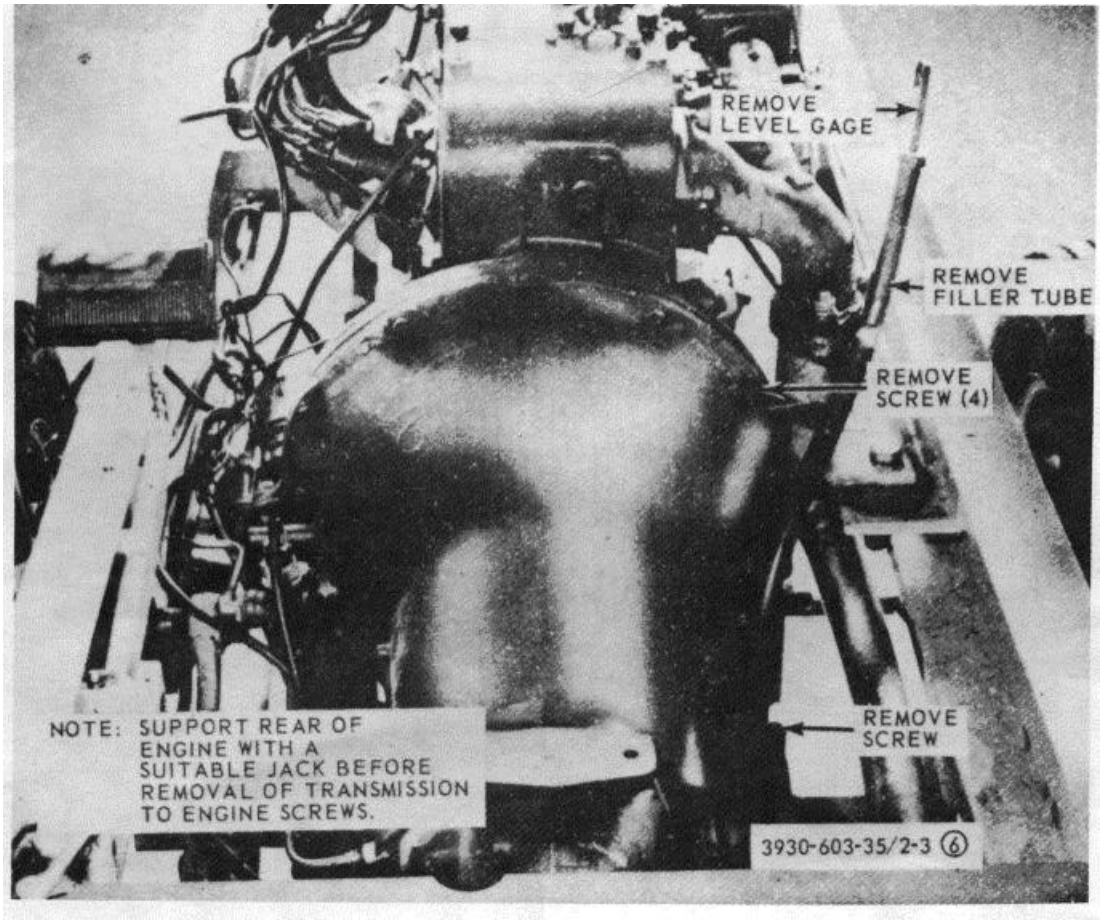


Figure 2-3 (6). Continued.

(3) With range selector in D (drive) position, speed up engine slightly until transmission shifts into direct. Front servo release will be pressurized in direct.) Reduce engine speed slowly to 1,000 rpm. Line pressure at this time (1,000 rpm) must be 54-60 psi, and front servo release pressure must not be more than 3 psi below line pressure.

(4) Move throttle lever gradually to full throttle position. Line pressure must rise to a maximum of 90-96 psi just before or at kickdown into low gear. Front servo release pressure must follow line pressure up to kickdown point and should not be more than 3 psi below line pressure. If line pressure is not 54-60 psi at 1,000 rpm, adjust the pressure (para 2-14).

(5) If front servo release pressures are less than pressures specified and line pressures are within limits, there is excessive leakage in front clutch or front servo circuits.

Note

Always inspect external transmission throttle lever for looseness on valve body shaft when making pressure test.

b. Lubrication Pressure. The lubrication pressure test must be made at same time that line pressure and front servo release pressures are tested (a. above).

(1) Install a "tee" fitting between cooler return line fitting and fitting hole in transmission case at rear of left side of transmission (fig. 2-11). Connect a 0-100 psi pressure gage to the fixture.

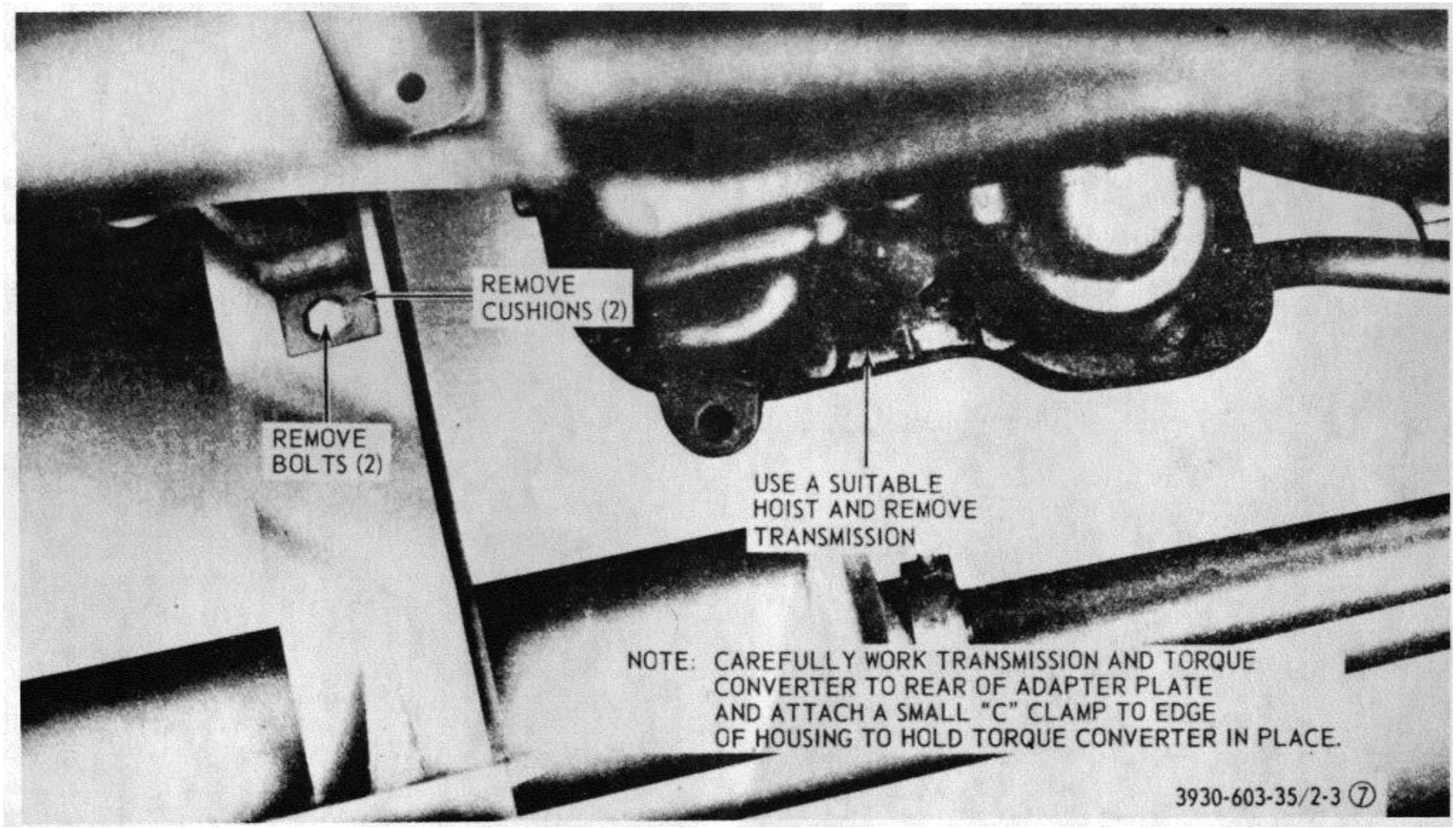


Figure 2-3 (7). Continued.

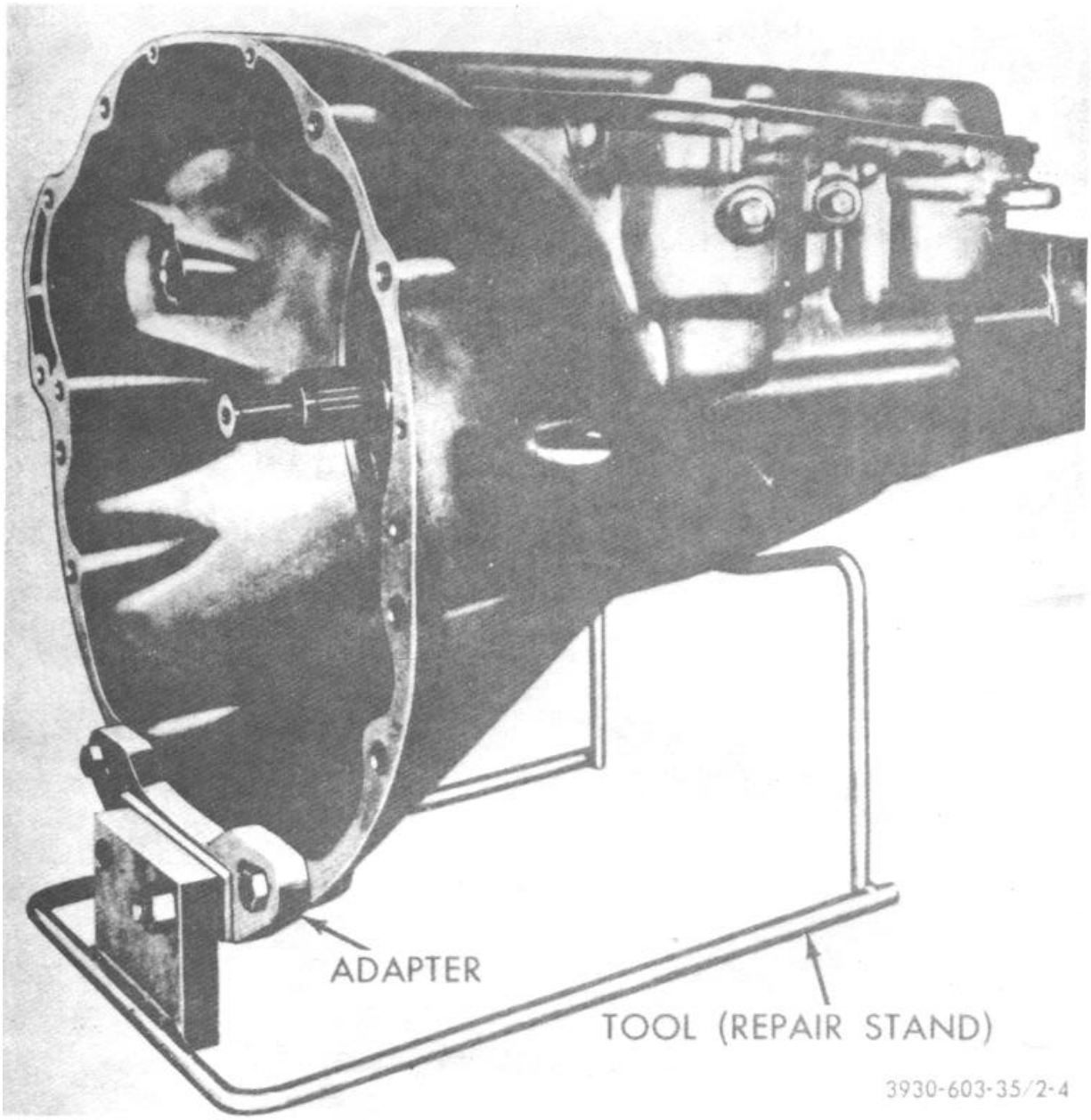


Figure 2-5. Transmission installed in repair stand.

(2) At 1,000 engine rpm, with throttle closed and transmission in direct, lubrication pressure must be 5-15 psi. Lubrication pressure will be approximately doubled as throttle is opened to maximum line pressure.

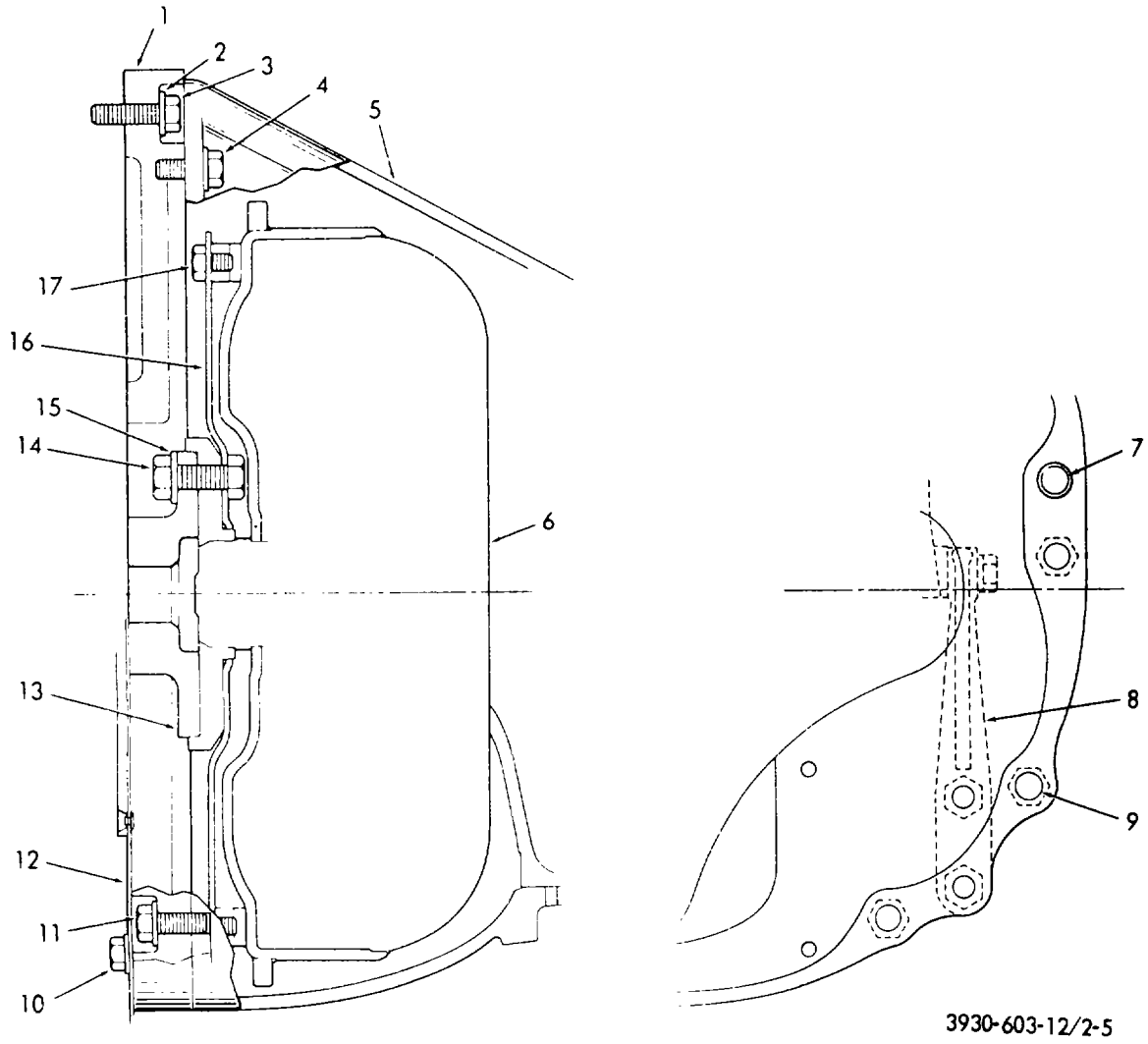
c. Rear Servo Apply Pressure.

(1) Connect a 0400 psi pressure gage, to apply pressure take-off point at rear servo (fig. 2-11).

(2) With transmission range selector in R (reverse) position and engine speed at 1,600 rpm, reverse servo apply pressure must be 240-280 psi.

d. Governor Pressure.

(1) Connect a 0-100 psi pressure gage to governor pressure take-off point, located at lower left side of transmission extension near mounting flange (fig. 2-11).



1	Adapter plate	7	Straight pin	13	Adapter pilot
2	Lockwasher	8	Strut	14	Hex head capscrew
3	Hex head capscrew	9	Screw and washer assembly	15	Lockwasher
4	Screw and washer assembly	10	Screw and washer assembly	16	Drive plate
5	Transmission assembly	11	Screw and washer assembly	17	Screw and washer assembly
6	Torque converter	12	Dust shield		

Figure 2-6. Transmission and torque converter, cutaway view.

(2) Governor pressure must fall within limits given in table 2-6. If governor pressures are incorrect at given vehicle speeds, the governor valve or weights are sticking.

Table 2-6. Governor Pressure Chart

Governor pressure (psi)	Tractor speed (mph)
16-22	5
38-47	8
65-73	12

2-14. Transmission Hydraulic Pressure Adjustments

a. Line Pressure Adjustment.

(1) An incorrect throttle pressure setting will cause incorrect line pressure readings even though line pressure adjustment is correct. Always inspect correct throttle pressure adjustments.

(2) Before adjusting line pressure,

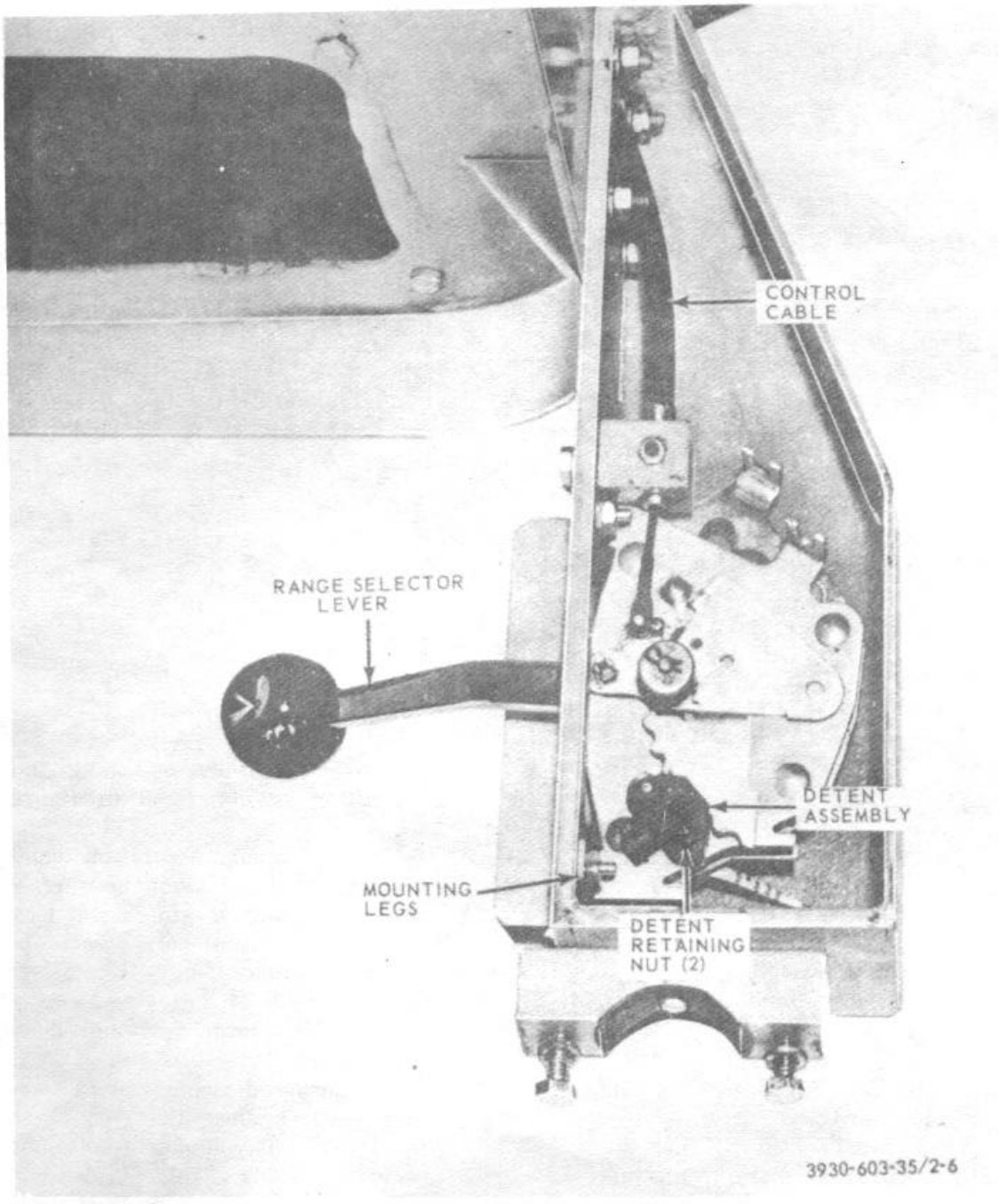


Figure 2-6. Gearshift control unit, bottom view.

measure distance between manual valve (valve in 1-low position) and line pressure adjusting screw (fig. 2-12). This measurement must be 1 7/8 inches; correct by loosening spring, retaining screws and repositioning spring retainer. The regulator valve may cock and hange up in its bore if spring retainer is out of position.

(3) If line pressure is not correct, it will be necessary to remove control valve body to perform adjustments (para 4-25).

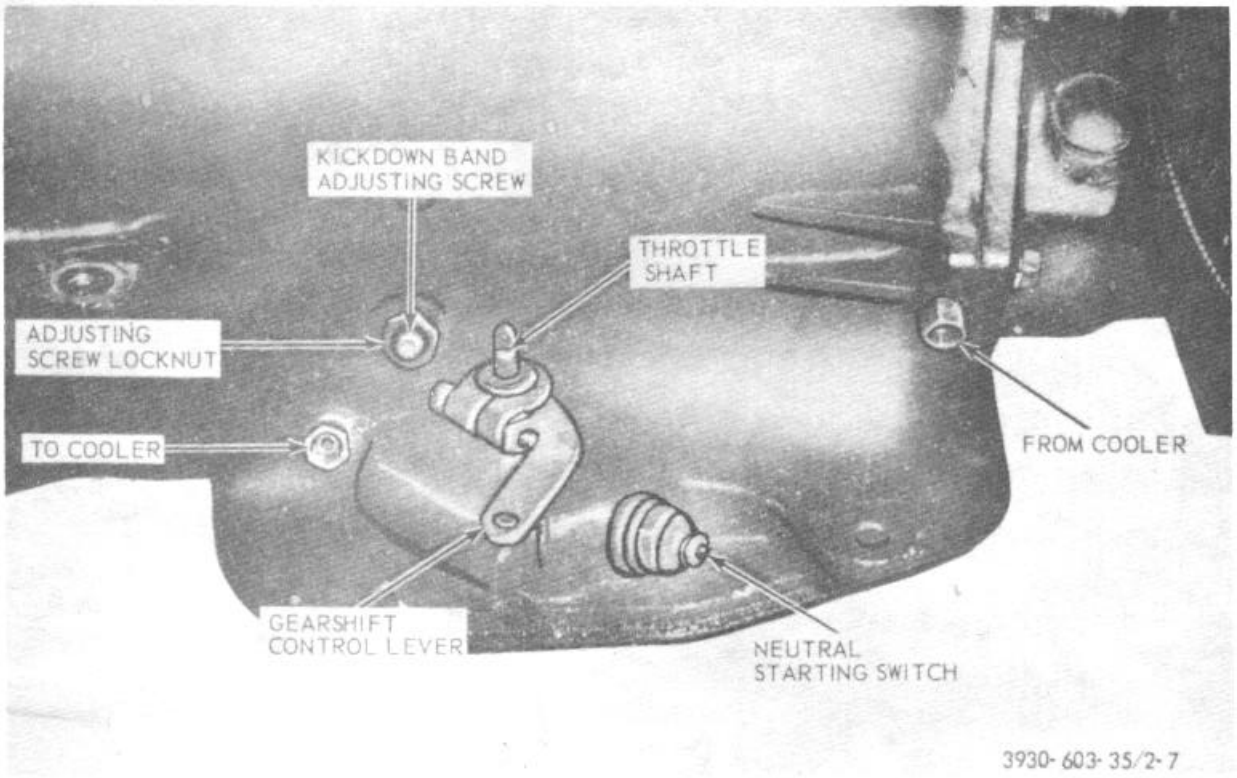


Figure 2-7. Transmission external controls, and adjustments.

(4) The approximate adjustment is 1 5/16 inches, measured from valve body to inner edge of adjusting nut (fig. 2-13). However, due to manufacturing tolerances, adjustment can be varied to obtain a specific line pressure.

(5) The adjusting screw may be turned with an allen wrench. One complete turn of screw changes closed throttle line pressure approximately 1 2/3 psi. Turning screw counterclockwise increases pressure, and clockwise decreases pressure.

b. Throttle Pressure. The throttle pressure cannot be tested accurately; therefore, adjustment must be measured if malfunction is evident.

(1) Remove tractor floor plate (TM 10-3930-603-12).

(2) Raise tractor with a suitable hoist and support with stands.

(3) Remove gearshift-control cable as illustrated in figure 2-14.

(4) Remove transmission oil pan (fig. 28).

(5) Remove control valve assembly and fluid filter as illustrated in figure 2-15.

(6) Remove accumulator piston and spring from transmission housing.

(7) Loosen throttle lever stop screw lock nut (fig. 2-16) and back it off approximately five turns.

(8) Insert gage pin of adjusting tool between throttle lever cam and kickdown valve.

(9) By pushing in on tool, compress kickdown valve against its spring so throttle valve is completely bottomed inside valve body.

(10) As force is being exerted to compress spring, tighten throttle lever stop screw finger tight against throttle lever tang with throttle lever cam touching tool and throttle valve bottomed. Make sure adjustment is made with spring fully compressed and valve bottomed in valve body.

(11) Remove adjusting tool and tighten stop screw lock nut' securely.

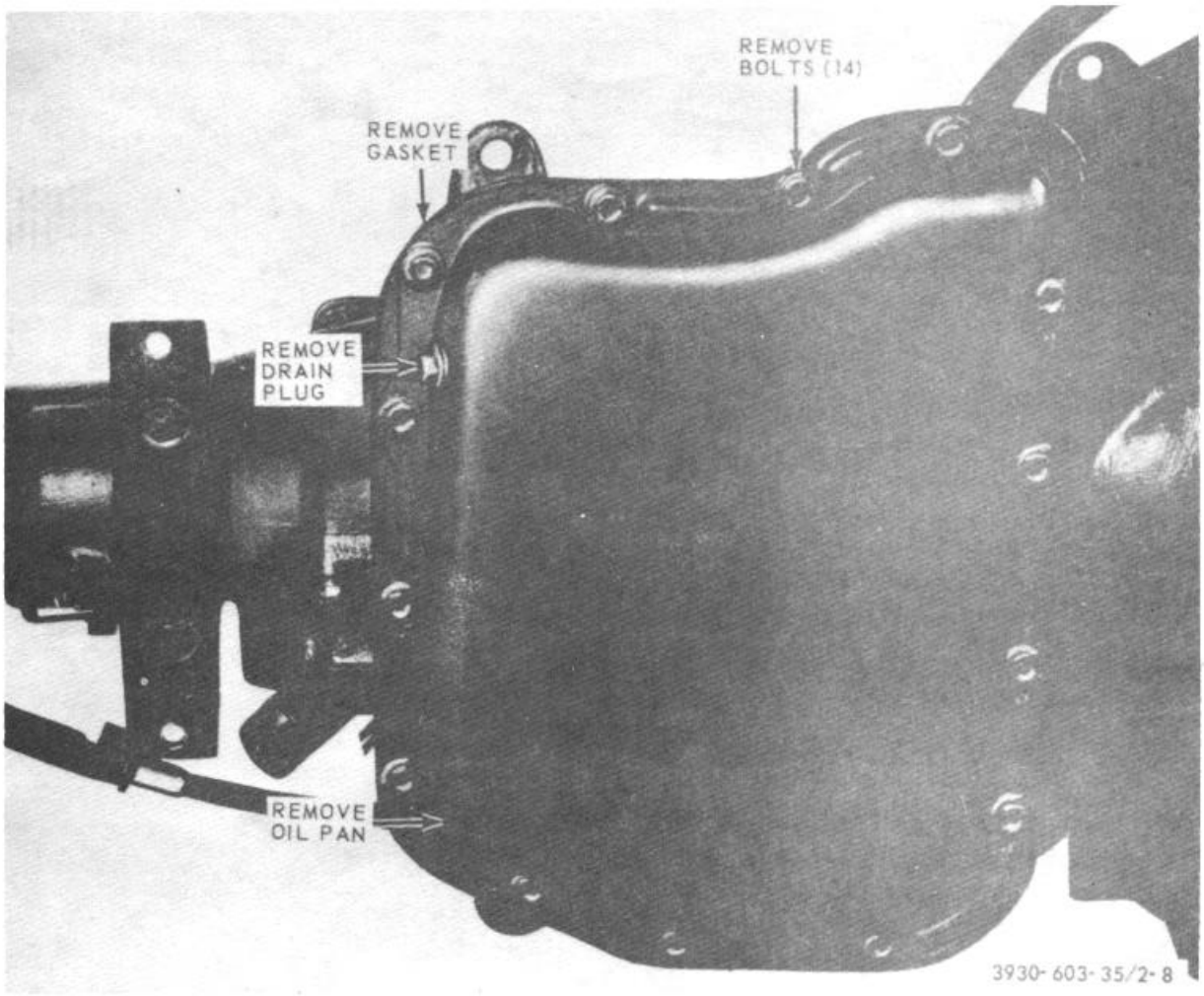


Figure 2-8. Transmission oil pan, removal and installation.

(12) Install control valve assembly and fluid filter, as illustrated in figure 2-15.

(13) Install oil pan assembly as illustrated in figure 2-8.

(14) Install gearshift control cable as illustrated in figure 2-14.

2-15. Transmission Air Pressure Test

A no drive condition may exist even with correct fluid pressure, because of inoperative clutches or bands. The inoperative units, clutches, bands and servos can be located through a series of tests by substituting air pressure for fluid pressure (fig. 2-17). The front and rear clutches, kickdown servo, and low-reverse servo may be tested by applying air pressure to their respective passages. Remove oil pan and control valve assembly (para 2-14). To make pressure test proceed as follows:

Caution

Compressed air supply must be free of all dirt or moisture. Use pressure 30 to 100 psi.

a. Front Clutch. Apply air pressure to front clutch "apply" passage and listen for a dull "thud" which indicates that front clutch is operating. Hold air pressure on for a few seconds and inspect system for excessive oil leaks.

b. Rear Clutch. Apply air pressure to rear clutch "apply" passage and listen for a dull "thud" which indicates rear clutch is operating. Also check system for excessive leaks. If a dull "thud" cannot be heard in clutches, place finger tips on clutch housing and again

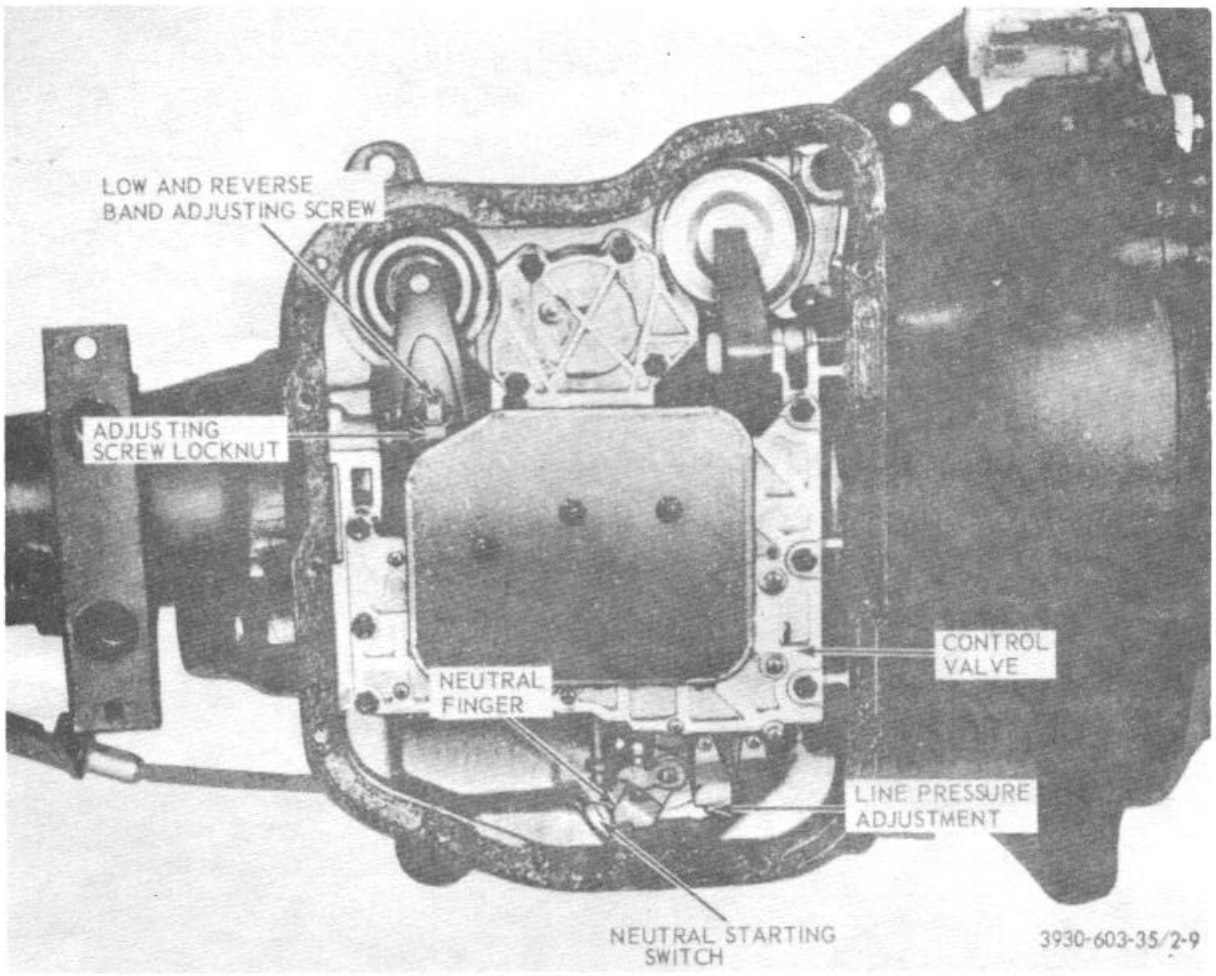


Figure 2-9. Transmission assembly, bottom view, pan removed.

apply air pressure. Movement of piston can be felt as clutch is applied.

c. Kickdown Servo. Direct air pressure into front servo "apply" passage. Operation of servo is indicated by a tightening of front band. Spring tension on servo piston will release band.

d. Low and Reverse Servo.

(1) Direct air pressure into servo "apply" passage. Operation of servo is indicated by a tightening of rear band. Spring tension on servo piston will release band.

(2) If clutches and servos operate properly, no upshift or erratic shift conditions indicate that malfunction exists in control valve.

(3) Install transmission oil pan and control valve assembly (para 2-14).

e. Governor. Governor operating failures can generally be diagnosed by a road test or hydraulic pressure test (para 2-13).

2-16. Engine Assembly Removal

a. Remove transmission and torque converter (para 2-10).

b. Remove hood assembly, carburetor fuel lines, radiator and disconnect exhaust pipe at manifold (TM 10-3930-603-12).

c. Remove front bumper and front hood support (para 2-8).

d. Tag and disconnect all electrical leads and remove rear hood support (para 2-8).

e. Remove transmission assembly (para 2-10).

f. Attach a chain hoist to engine lifting eye and remove engine assembly as illustrated in figure 2-18.

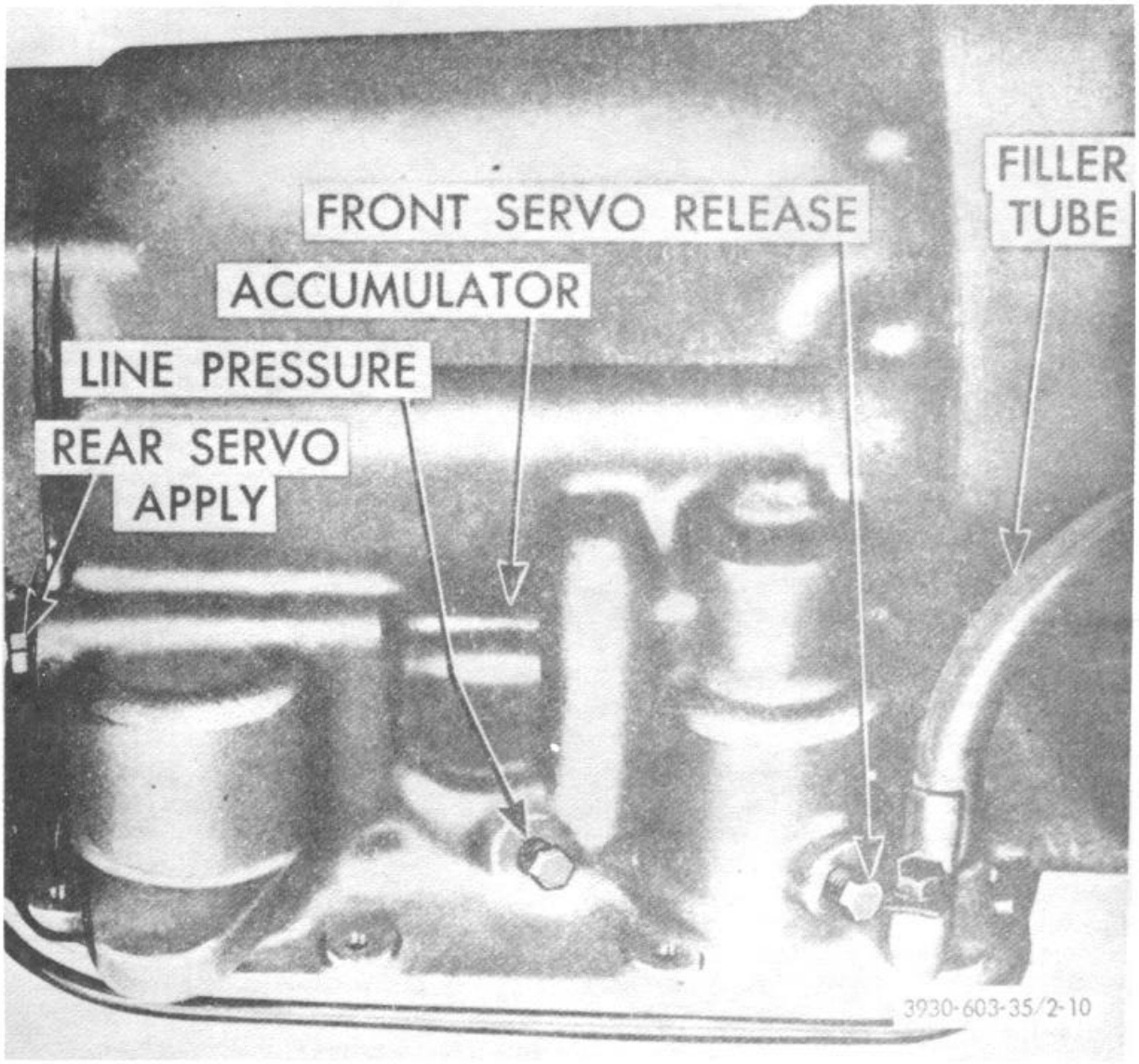


Figure 2-10. Transmission pressure test locations.

2-17. Engine Assembly, Installation

a. Attach a chain hoist to engine lifting eye. Install engine assembly as illustrated in figure 2-18.

b. Install transmission and torque converter assembly (para 2-11).

c. Install rear hood support (para 2-9).

d. Install front hood support and front bumper (para 2-9).

e. Install radiator, carburetor, fuel lines, exhaust pipe, and hood assembly (TM 10-3930-603-12).

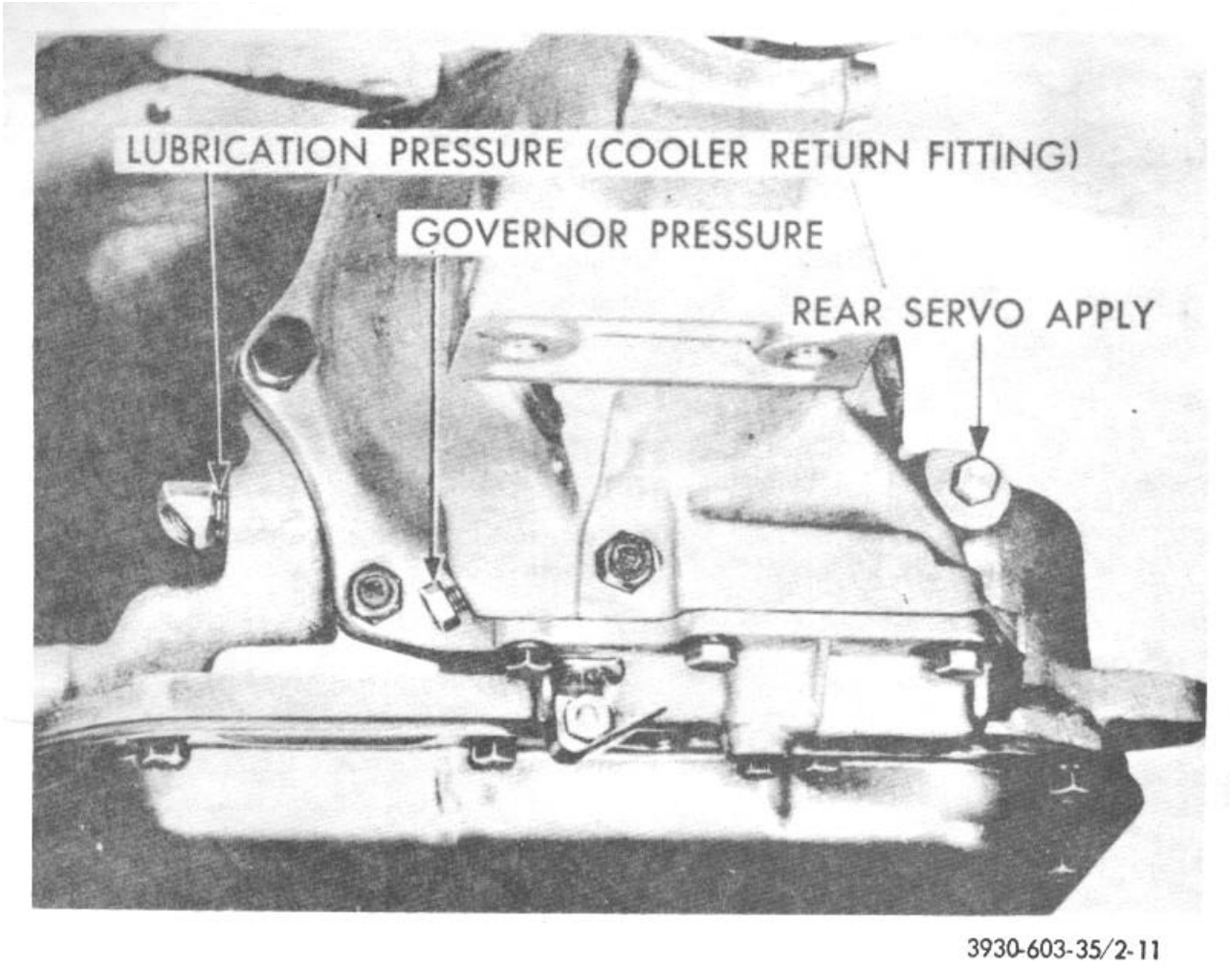


Figure 2-11. Lubrication pressure test locations, rear.

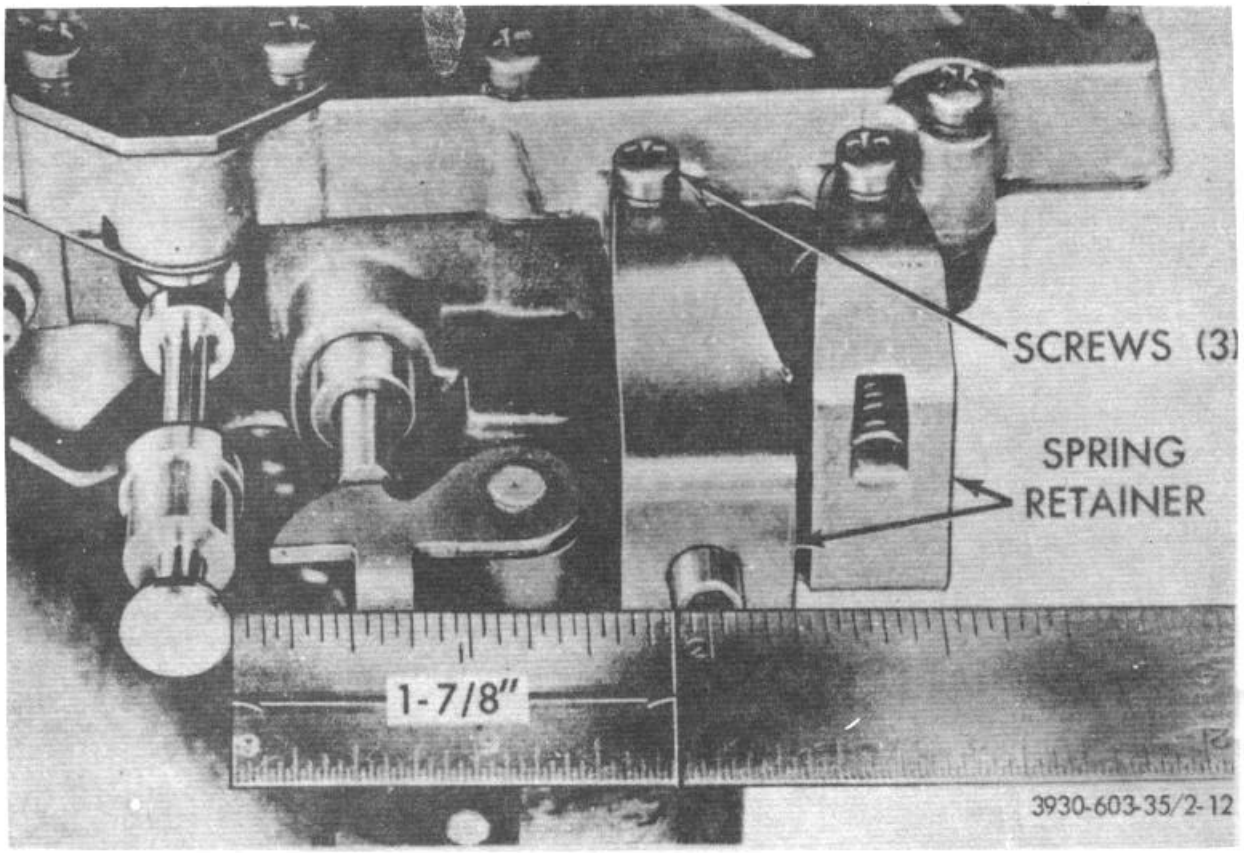


Figure 2-12. Measuring spring retainer location.

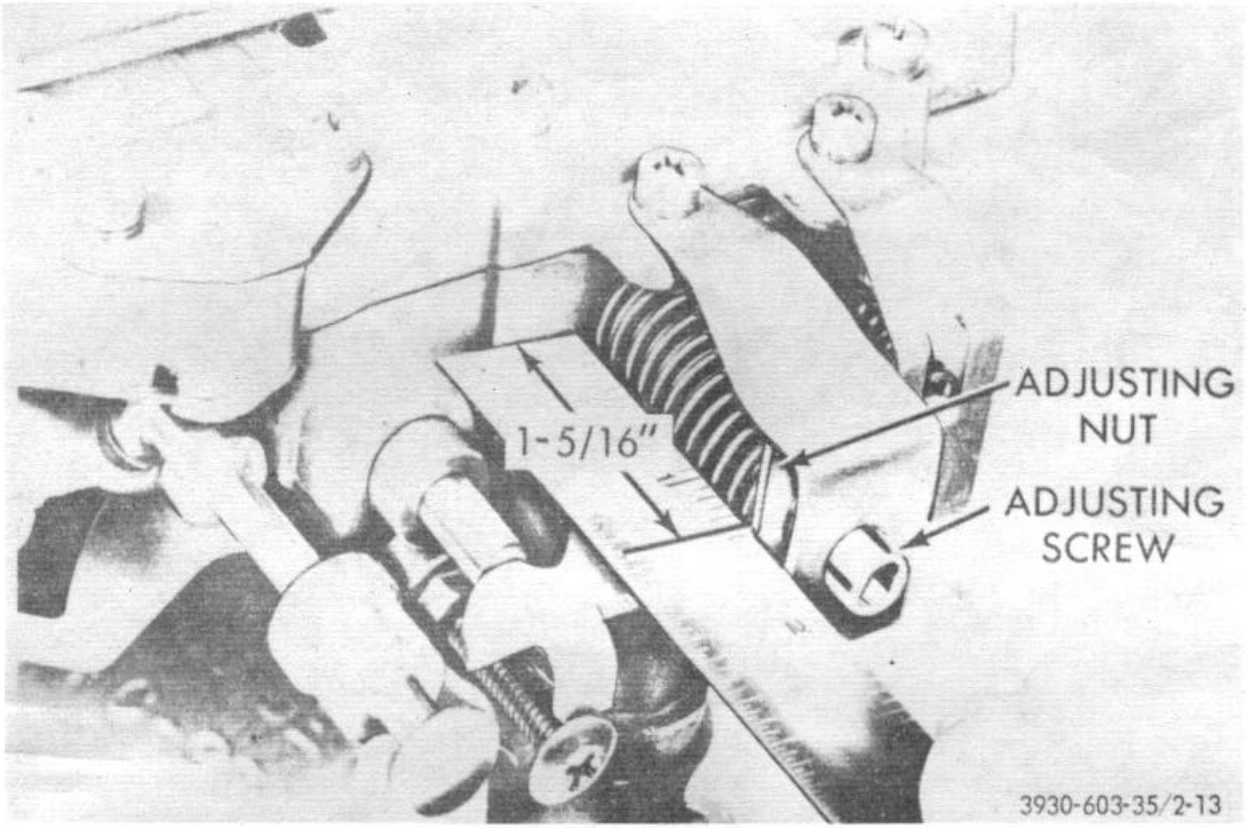


Figure 2-13. Line pressure adjustment.

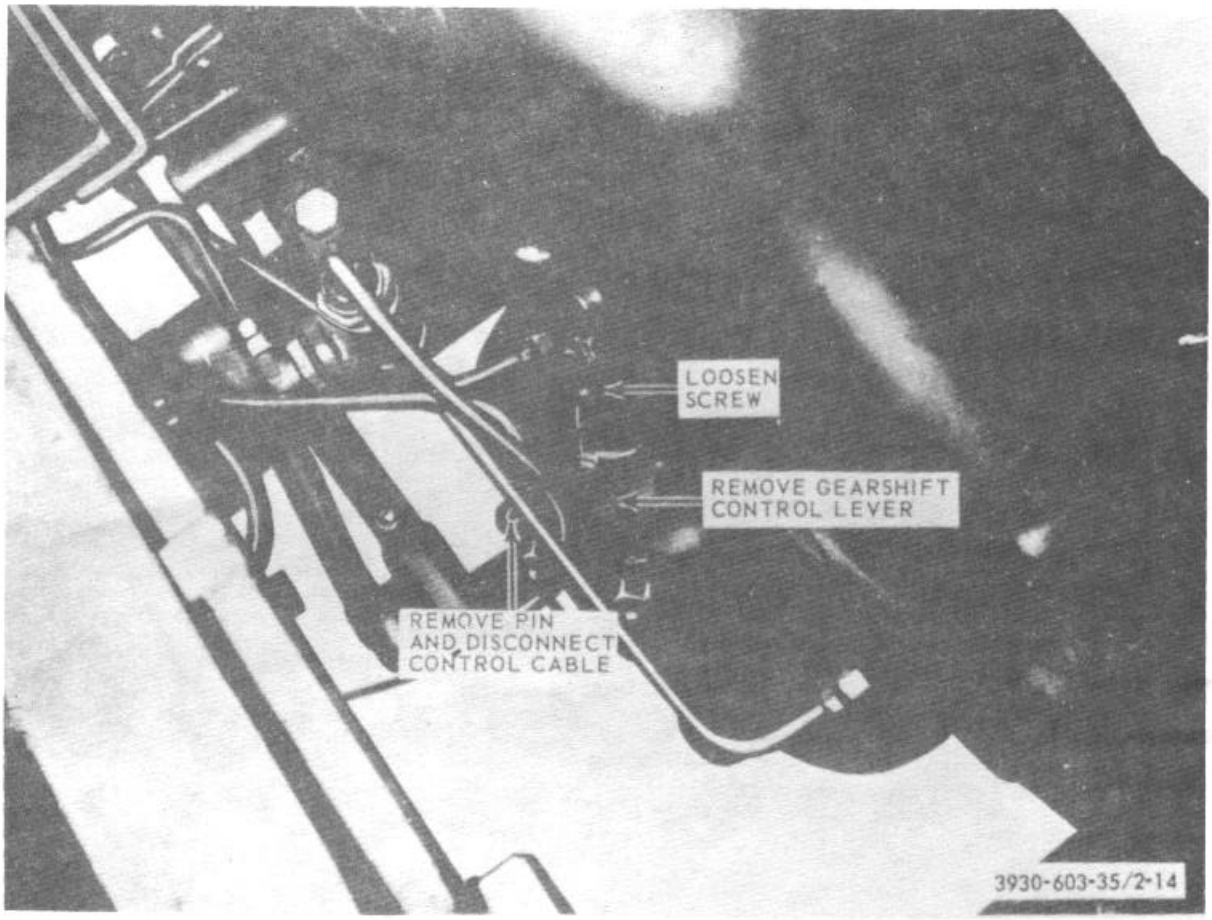


Figure 2-14. Gearshift control cable, removal and installation.

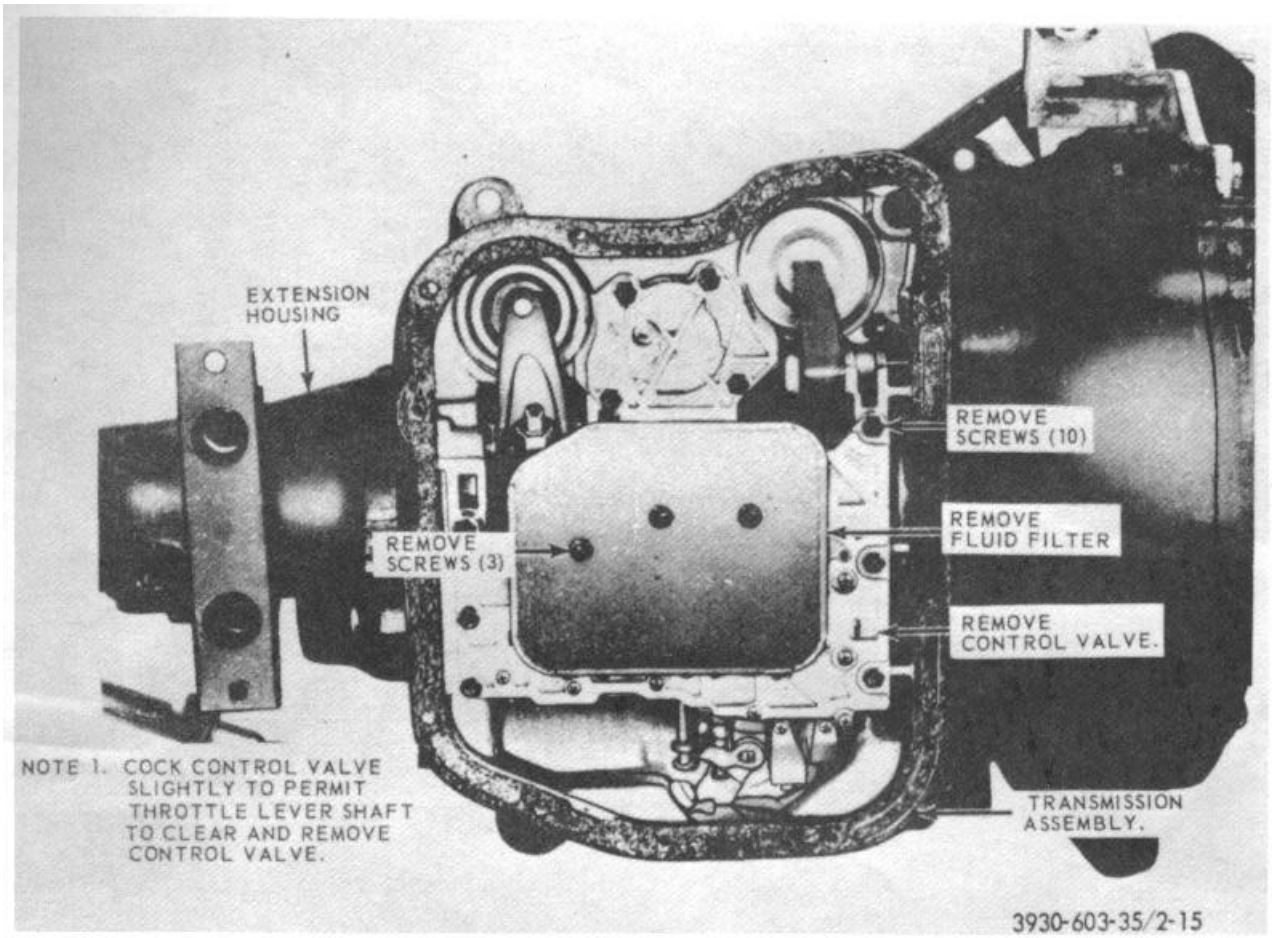


Figure 2-15. Control valve and filter, removal and installation.

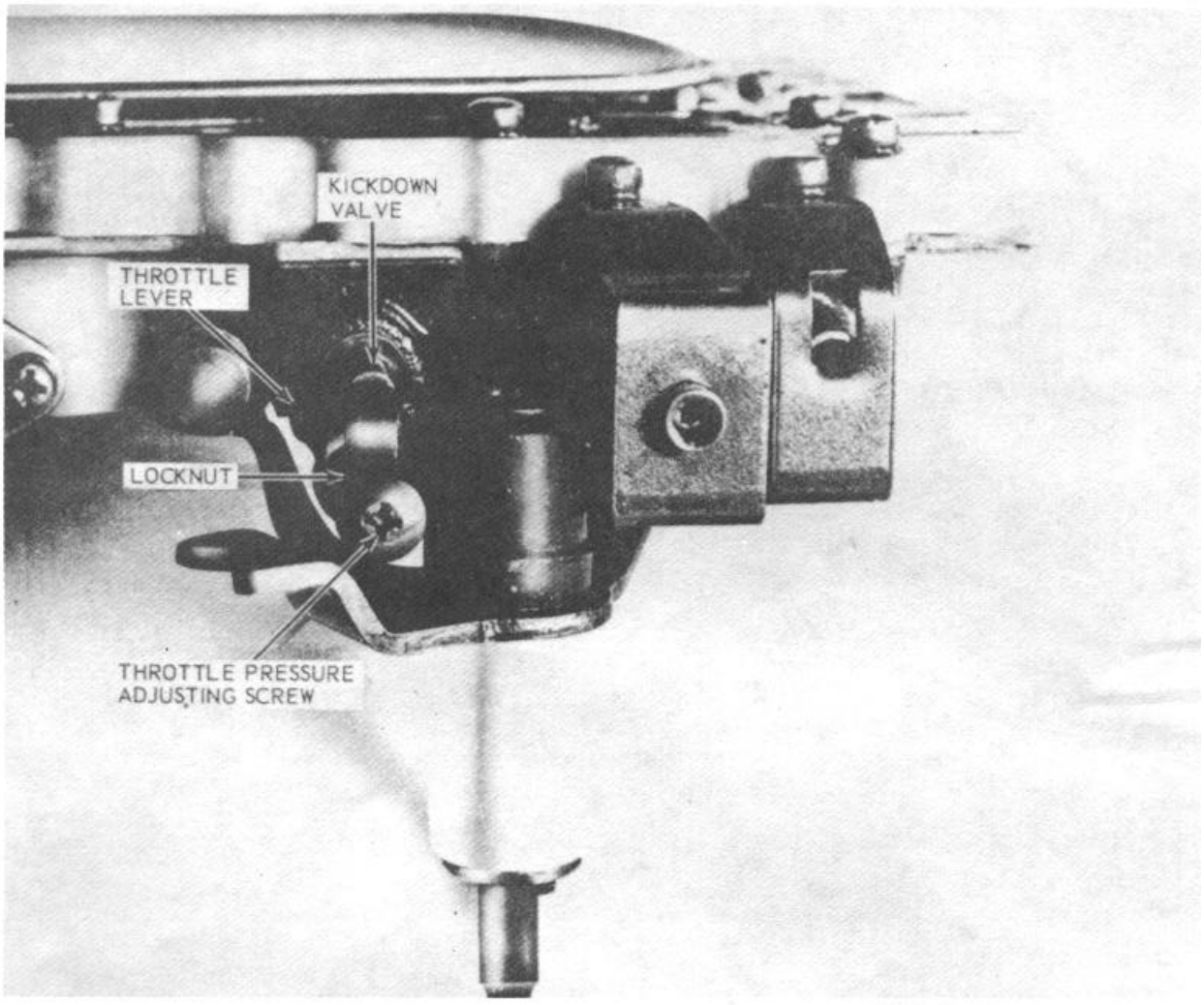


Figure 2-16. Throttle pressure adjustment.

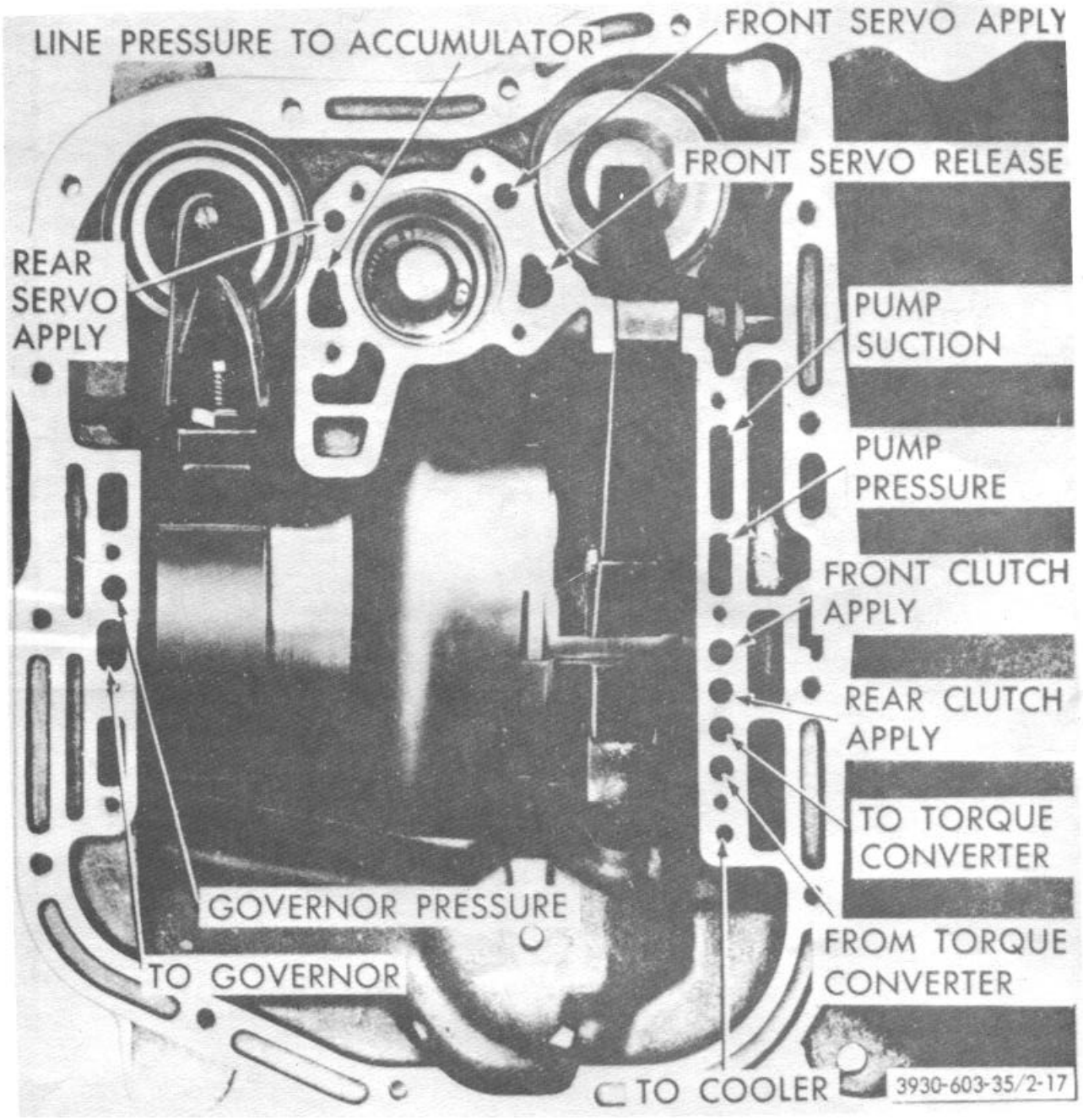


Figure 2-17. Air pressure test locations.

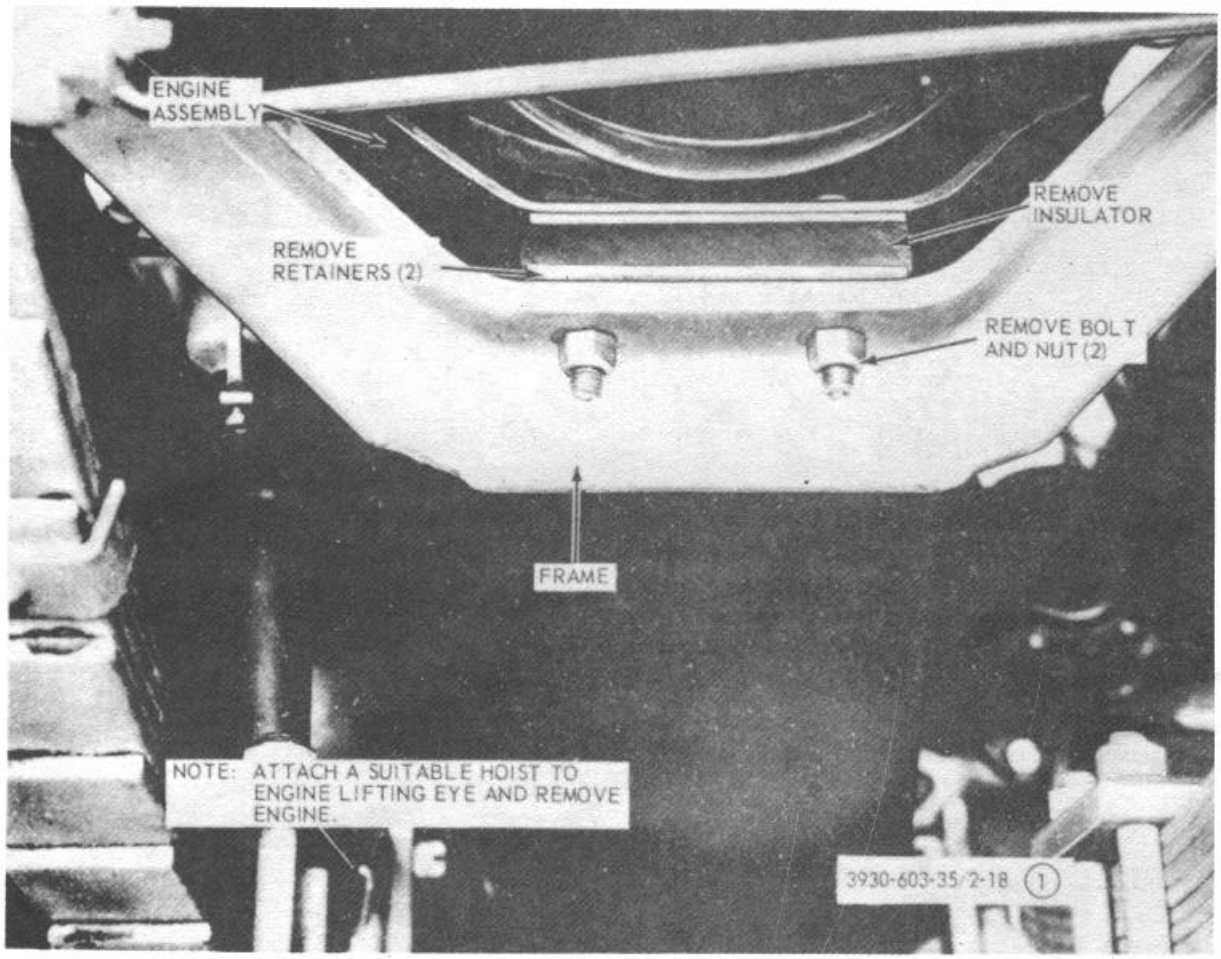


Figure 2-18 (1). Engine assembly, removal and installation.

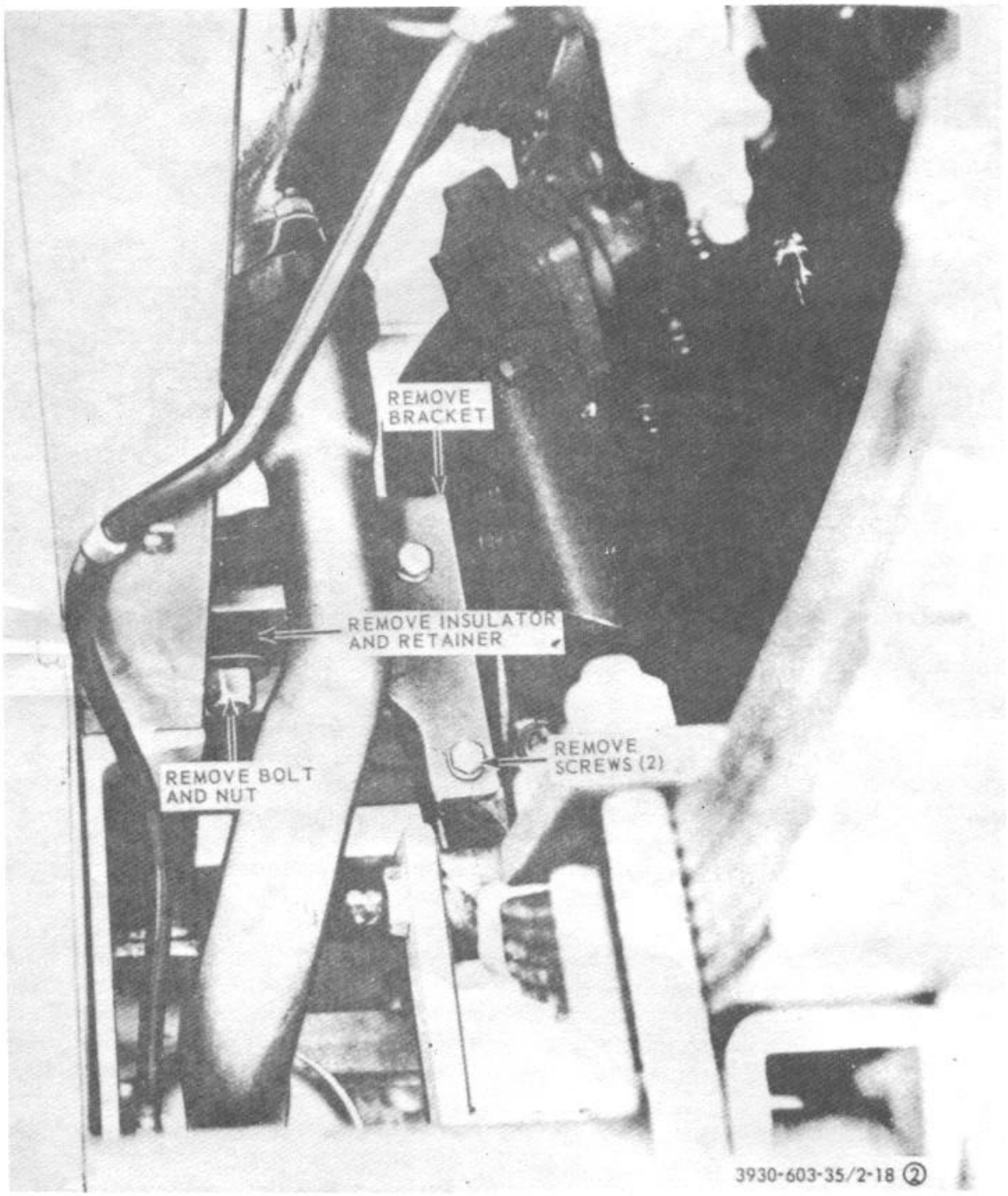


Figure 2-18 (2). Engine assembly, removal and installation (continued).

CHAPTER 3

ENGINE REPAIR INSTRUCTIONS

Section I. CARBURETOR AND FUEL TANK

3-1. General

a. The engine is equipped with a downdraft carburetor. The carburetor is connected through linkage to a pedal type accelerator at operator's position. A manual choke is also provided on instrument panel and is connected to carburetor through cable linkage.

b. The main metering system consists of a main metering jet, a main vent tube and passages for admitting air to main vent tube where fuel is mixed with air before being drawn into throat of carburetor. Fuel for all speed ranges above idle range is supplied through a main discharge nozzle.

c. An accelerator pump supplies additional fuel required when throttle valve is opened for acceleration. Fuel flows into accelerator pump cylinder through pump inlet valve. When pump is operated, inlet valve is closed and fuel is forced out pump cylinder through discharge check valve and pump jet, entering carburetor to supplement fuel supplied through main metering system. The economizer or step-up system provides extra fuel necessary for maximum power under full load operation and is actuated by manifold vacuum.

3-2. Carburetor Removal and Disassembly

a. Remove carburetor and air cleaner assembly (TM 10-3930-603-12).

b. Disassemble carburetor and air cleaner assembly as illustrated in figure 3-1.

3-3. Carburetor Cleaning and Inspection

a. Clean all reusable parts with an approved cleaning solvent and dry thoroughly.

b. Carefully clean bore of body flange of carbon accumulation by scraping. Avoid enlarging two fuel (idle) discharge holes in bore, at and above idle mixture screw.

c. Clean all jets with clean moisture-free compressed air.

d. Inspect needle and seat assembly for wear.

e. Inspect all jets and passages to make sure they are free from obstruction and clean.

f. Inspect air horn and body for warpage or cracks.

3-4. Carburetor Reassembly and Installation

a. Reassemble carburetor and air cleaner a illustrated in figure 3-1.

b. Invert carburetor and hold float pin retainer (22) against float lever pin (23) in bottom of guide slots. Bend lip on float assembly (24) to obtain 5/64 inch from bowl to float top.

c. With pump arm (9) in center hole of throttle shaft lever (34), pump plunger (12) must travel 13/32 inch from closed throttle position to wide open. Measure from top of plunger (12) to top of casting and adjust by bending pump arm (9) up or down.

d. Turn idle mixture screw in with fingers until it bottoms lightly, then back out one turn. Make final idle adjustment after carburetor installation.

e. Install and adjust carburetor (TM 103930-603-12).

3-5. Fuel Tank Repair

a. Remove fuel tank. (TM 10-3930-603-12).

b. If fuel tank is to be repaired, purge tank of all fumes by flushing with water.

c. Weld all cracks or leaks. Install drain plug, fuel supply sending unit, and filler cap.

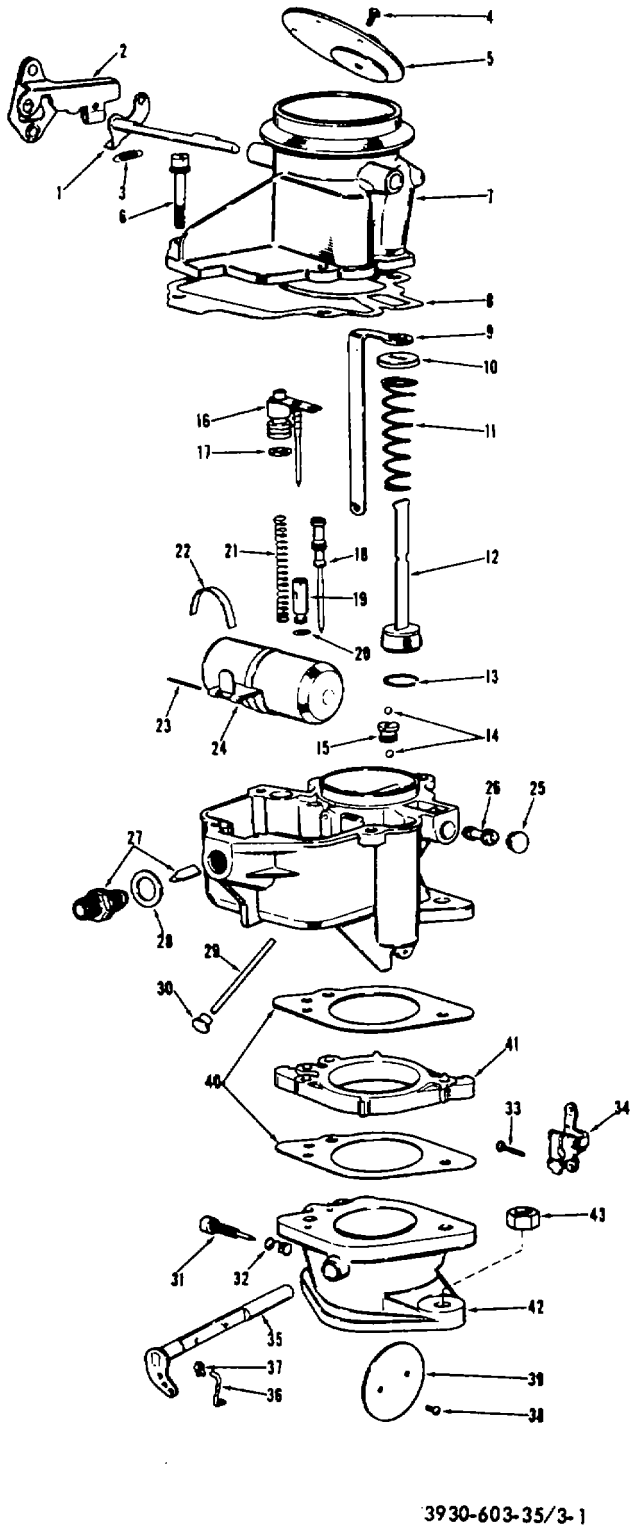


Figure 3-1. Carburetor assembly disassembly and reassembly.

1 Choke shaft
2 Choke shaft lever
3 Choke shaft spring
4 Choke shaft screw
5 Choke valve
6 Screw and washer assembly
7 Air horn
8 Gasket
9 Pump arm
10 Spring retainer
11 Pump spring
12 Pump plunger
13 Check ball ring
14 Check ball
15 Ball retainer
16 Piston and plate assembly
17 Step-up piston gasket
18 Idle orifice tube
19 Main metering jet
20 Main jet gasket
21 Step-up piston spring
22 Float lever pin retainer
23 Float lever pin
24 Float assembly
25 Pump jet rivet plug
26 Pump jet
27 Needle and seat assembly
28 Gasket
29 Gasket
30 Rivet plug
31 Idle adjustment screw
32 Idle adjustment spring
33 Lever screw
34 Throttle shaft lever
35 Throttle shaft
36 Link
37 Linkage lock
38 Throttle valve screw
39 Throttle valve
40 Gasket
41 Adapter
42 Body flange
43 Flange screw

Figure 3-1-Continued

Apply 5 psi air pressure at outlet fitting and check tank for leaks.

d. Air dry fuel tank thoroughly after repair and clean all fuel lines with compressed air.

e. Install fuel tank (TM 10-3930403-12).

Section II. GENERATOR ASSEMBLY

3-6. General

The generator assembly is mounted on left front of engine on an adjustable bracket and is driven by a belt operating from crankshaft pulley. The generator rotates counterclockwise as viewed from operator's seat.

3-7. Generator Removal and Disassembly

a. Remove generator (TM 10-3930-603-12).

b. Disassemble generator as illustrated in figure 3-2.

3-8. Generator Cleaning, Inspection and Repair

a. Blow out all dirt from inside field frame and wipe interior with a clean cloth.

Caution: Do not immerse armature or field coils in solvent.

b. Wipe armature with a clean cloth. If armature commutator is burned, scored, or worn, it must be turned down. Take very light cuts from commutator until all defective area is cleaned away. Undercut mica between commutator segments about 1/32 inch and polish with a fine crocus cloth. Clean all waste with compressed air.

c. Coat armature winding with two thin coats of moisture resistant varnish. Do not get varnish on commutator.

d. Clean brush holders with an approved cleaning solvent and dry thoroughly.

e. Inspect bearings for lubrication and noise due to wear.

f. Discard and replace brushes, gaskets, and felt washers.

g. Use a test lamp with two test probes and check field frame, field coils, terminal studs, and armature for improper ground.

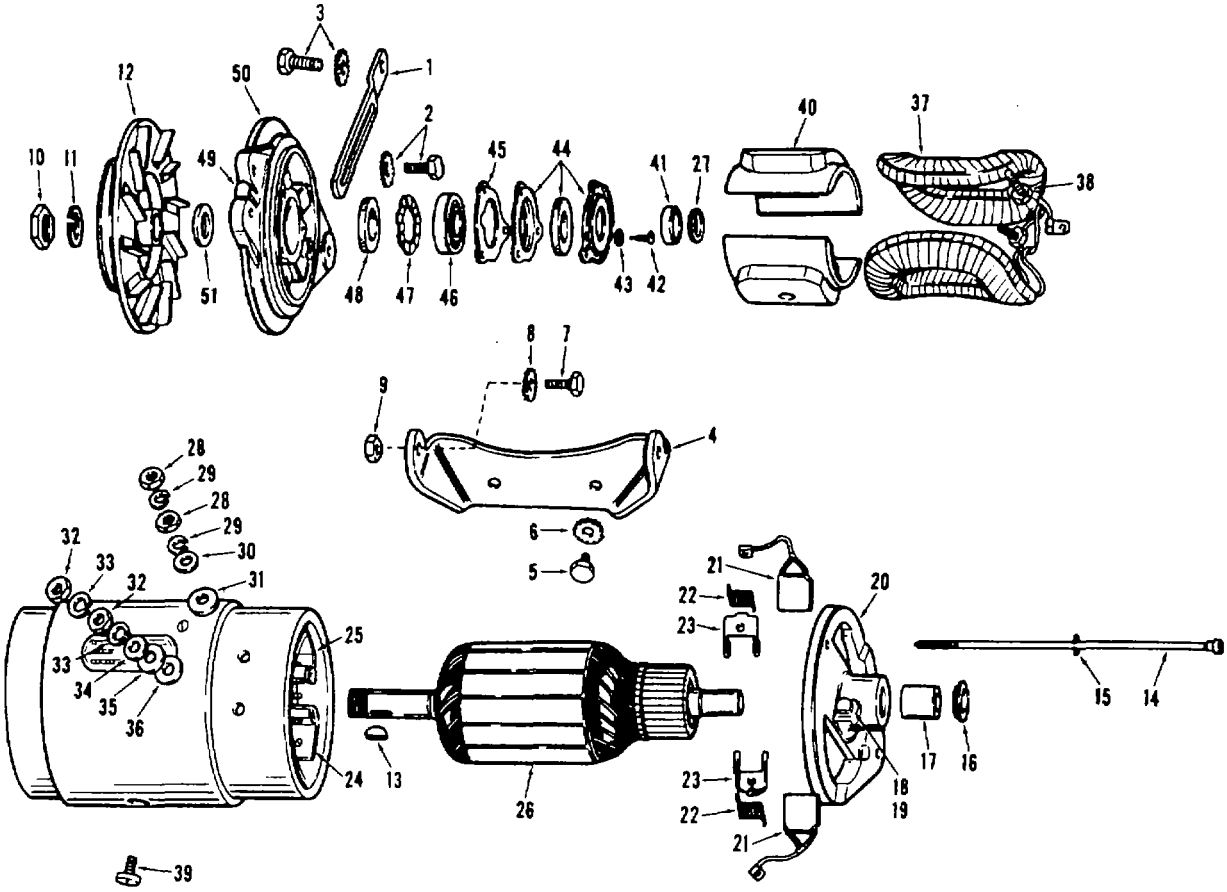
h. Replace all defective parts.

3-9. Generator Reassembly and Installation

a. Reassemble generator assembly as illustrated in figure 3-2.

b. Test generator assembly for proper output (TM 103930-603-12).

c. Install generator assembly (TM 10-3930603-12).



1	Adjusting strap	18	Oiler	35	Insulating washer
2	Screw and washer	19	Felt wick	36	Insulating bushing
3	Screw and washer	20	Commutator head	37	Field coil
4	Mounting bracket	21	Brush set	38	Field terminal stud
5	Hex head bolt	22	Brush spring	39	Pole shoe screw
6	Lockwasher	23	Brush arm	40	Pole shoe
7	Hex head capscrew	24	Insulated brush holder	41	Drive end retainer
8	Lockwasher	25	Grounded brush holder	42	Retainer screw
9	Hex nut	26	Armature assembly	43	Lockwasher
10	Armature shaft nut	27	Snap ring	44	Bearing retainer
11	Armature shaft washer	28	Armature terminal nut	45	Gasket
12	Generator pulley	29	Lockwasher	46	Ball bearing
13	Pulley key	30	Flatwasher	47	Washer retainer
14	Through bolt	31	Insulating bushing	48	Felt washer
15	Lockwasher	32	Field terminal nut	49	Oiler
16	Bearing cover	33	Lockwasher	50	Drive end head
17	Sleeve bearing	34	Washer	51	Spacer

Figure 3-2. Generator assembly, disassembly and reassembly.

Section III. STARTING MOTOR

3-10. General

The tractor is equipped with a gear reduction, clutch type starting motor. It is mounted directly on automatic transmission housing at left rear of engine. The starting motor is coupled to transmission torque converter ring gear through a clutch type drive.

3-11. Starting Motor Removal and Disassembly

a. Remove starting motor (TM 10-3930603-12).

b. Disassemble starting motor as illustrated in figure 3-3.

3-12. Starting Motor, Cleaning, Inspection and Repair

a. Blow out all dirt from inside field frame and wipe interior with a clean cloth.

Caution: Do not submerge armature, field coils, solenoid or clutch drive in solvent.

b. Wipe armature and field coils with a dry cloth; if armature commutator is burned, scored or worn it must be turned down. Take very light cuts from commutator until defective area is cleaned away. Undercut mica between commutator segments about 1/32 inch and polish with a fine crocus cloth.

c. Coat armature winding with two thin coats moisture-resistant varnish. Do not get varnish on commutator.

d. Clean brush plate with an approved cleaning solvent and dry thoroughly.

e. Wipe exterior of clutch drive with a clean dry cloth. Do not submerge clutch drive in solvent. Clutch is prelubricated at manufacturer and solvent will remove the lubricant.

f. Inspect all parts for wear or other damage. Replace defective parts.

g. Discard and replace brushes that are worn to half their original length.

h. Check brush spring tension with a spring scale hooked under spring end. Spring tension must be between 32 to 48 ounces. Replace defective spring.

i. Use a test lamp with two test probes and check field frame, field coil terminals and armature for improper ground.

j. Inspect armature shaft bearing and pinion shaft surfaces and bearings for wear.

3-13. Starting Motor Reassembly, Test, and Installation

a. Reassembly.

(1) Reassemble starting motor assembly as illustrated in figure 3-3.

(2) The shifter fork consists of two spring steel plates assembled with two rivets. There must be approximately 1/16 inch side movement at rivets to insure proper pinion gear engagement. Lubricate plates sparingly with engine oil.

(3) After installing shifting fork in drive housing, install shifting fork pivot pin. One tip of pin must be straight; the other tip must be installed at a 15 degree angle away from housing.

(4) The pinion shaft friction washer must be placed on shoulder of splines of pinion shaft before driven gear is installed.

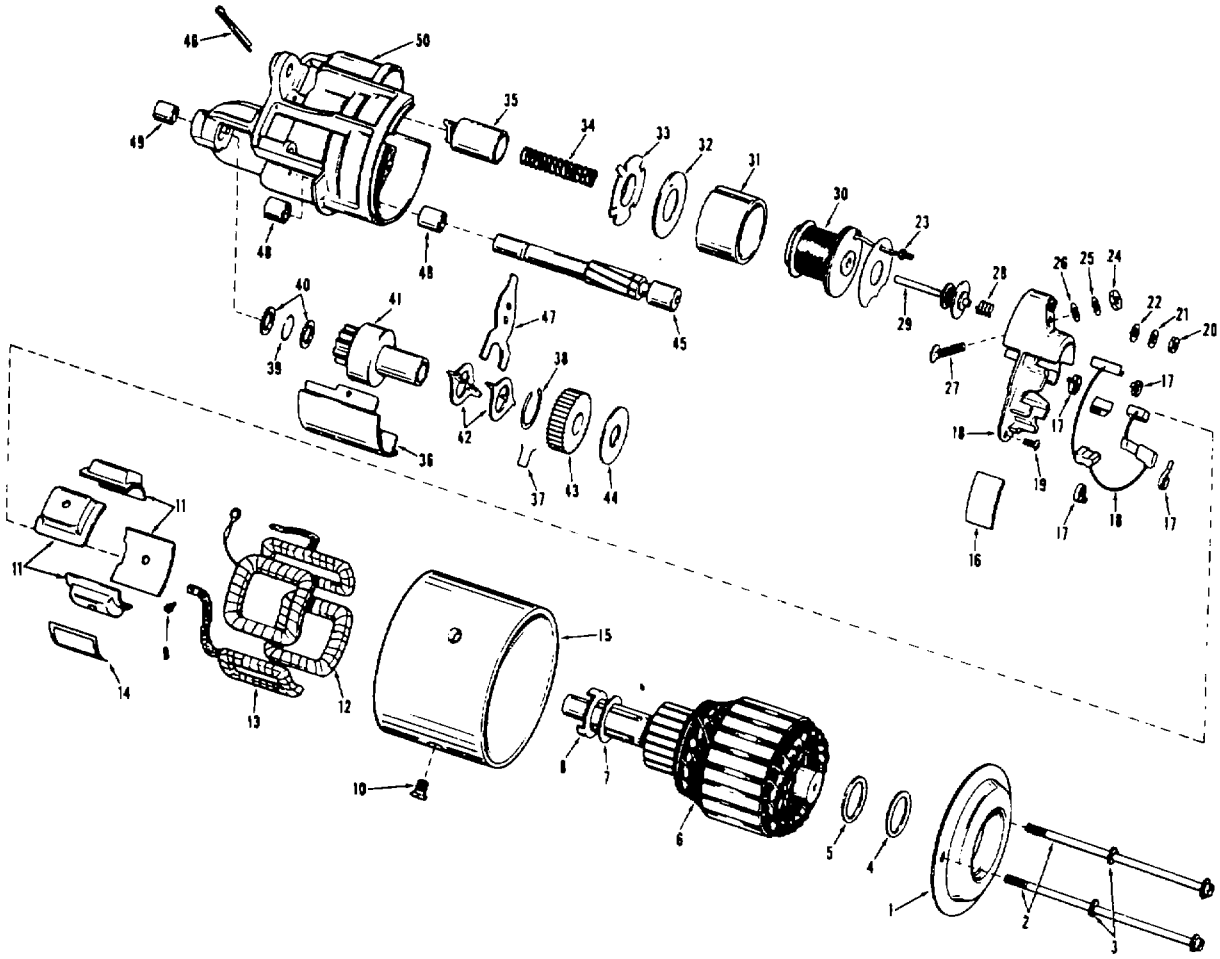
(5) Bend four tangs of solenoid retainer up to a measurement of 5/32 to 3/16 inch above surface of retainer to ensure a more positive ground. Space retainer in housing bore so four tangs rest on ridge in housing bore and not in recesses.

(6) Inspect condition of solenoid contact assembly. If top of washer is burned from arcing, disassemble contact assembly and reverse washer.

Caution: The contactor must not touch double wires when solenoid is energized, after assembly is completed.

(7) Clean area at joint between brush holder plate to field frame and gear housing mating joint. Apply a bead of brush plate sealer around four sides of joint.

Caution: Sealer must be flowed continuously to avoid gaps after head has been sealed. Use a brush or small paddle moistened with mineral spirits to press adhesive into joint.' Be sure not to get adhesive on terminal.



1	End head plate	18	Brush and plate assembly	35	Solenoid core
2	Hex head bolt	19	Screw	36	Gear housing cover
3	Lockwasher	20	Hex nut	37	Retainer
4	Flat thrust washer	21	Flat washer	38	Retainer ring
5	Fiber washer	22	Insulating washer	39	Retainer ring
6	Armature	23	Terminal stud	40	Thrust washer
7	Flat washer	24	Hex nut	41	Clutch assembly
8	Thrust washer	25	Flat washer	42	Actuator set
9	Screw and washer assembly	26	Insulating washer	43	Pinion shaft gear
10	Flat head screw	27	Terminal stud	44	Friction washer
11	Field pole	28	Solenoid switch spring	45	Pinion shaft
12	Series field coil	29	Contact assembly	46	Pivot pin
13	Shunt field coil	30	Solenoid	47	Shifting fork
14	Insulator	31	Solenoid sleeve	48	Sleeve bearing
15	Frame	32	Flat washer	49	Sleeve bearing
16	Insulator	33	Solenoid retainer	50	Gear housing
17	Brush spring set	34	Return spring		

Figure 3-3. Starting motor assembly, disassembly and reassembly.

b. Starting Motor Tests. Make following tests of assembled starter before installation:

(1) Free running test. Place starter in a vise and connect a fully charged, 12 volt battery to starter as follows:

(a) a test ammeter (100 ampere scale) and carbon pile rheostat in series with battery positive post and starter. terminal.

(b) Connect a voltmeter (15 volt scale) across starter.

(c) Rotate carbon pile to full resistance position.

(d) Connect battery cable from battery negative post to starter frame.

(e) Adjust rheostat until battery voltage shown on voltmeter reads 11 volts amperage. Draw should not exceed 78 amperes.

(2) Locked resistance test.

(a) Install starter on a test bench.

(b) Follow instructions for test equipment, test locked resistance of starter against specifications (c) below.

(c) With applied battery voltage adjusted to 4 volts, amperage draw should be 400 to 450 amperes.

c. Installation. Install starting motor assembly (TM 10-3930-03-12).

Section IV. DISTRIBUTOR ASSEMBLY

3-14. General

The engine is equipped with a conventional type distributor, driven by engine camshaft and mounted on left center of engine. The ignition coil is installed just above distributor. The primary lead to coil from ignition switch is radio suppressed by a feed through capacitor mounted on coil bracket.

3-15. Distributor Removal Disassembly

a. Remove distributor assembly (TM 103930-603-12).

b. Disassemble distributor assembly, as illustrated in figure 3-4.

3-16. Distributor Cleaning, Inspection and Repair

a. Wipe inside and outside of distributor cap, rotor, and contact point set with a cloth dampened with cleaning solvent.

b. Clean remaining metal parts with an approved cleaning solvent and dry thoroughly.

c. Inspect distributor cap and rotor for cracks and carbon runners and corroded terminals. If terminals are slightly burned, clean with a fine crocus cloth dampened in cleaning solvent. Do not use a file.

d. Inspect contact points for pitted or worn condition.

e. Clean end of drive shaft with a file and polish with an oil stone. Soak drive shaft bearings in SAE 20 engine oil prior to disassembly.

f. Replace all defective parts.

3-17. Distributor Reassembly and Installation

a. Reassemble distributor assembly as illustrated in figure 34.

b. Install distributor assembly (TM 103930-603-12).

c. Adjust contact points and time engine (TM 10-3930-603-12).

Section V. OIL PUMP ASSEMBLY

3-18. General

The oil pump assembly is a rotor type pump consisting of an inner rotor driven by oil pump drive shaft and an outer rotor that is driven by inner rotor. Clearance between inner rotor and outer rotor, and outer rotor and pump body are critical for proper oil pump operation.

3-19. Oil Pump Removal and Disassembly

a. Removal.

(1) Remove distributor (TM 10-3930603-12).

(2) Remove oil pump as illustrated in figure 35.

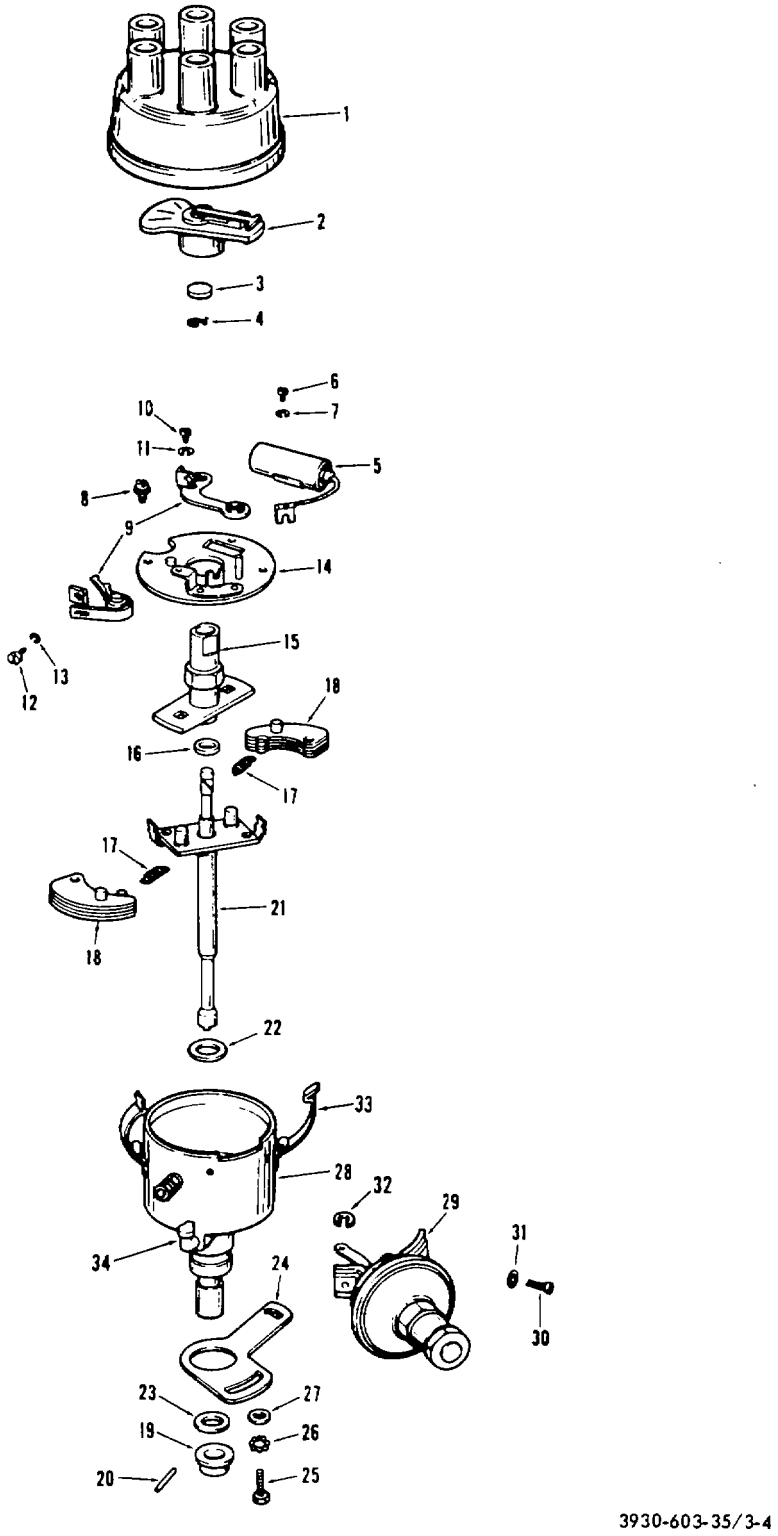


Figure 3-4. Distributor, disassembly and reassembly.

1 Distributor cap
2 Rotor
3 Cam sleeve felt wick
4 Retaining ring
5 Capacitor
6 Fillister head screw
7 Lockwasher
8 Screw and lockwasher assy
9 Breaker contact set
10 Fillister head screw
11 Flat washer
12 Spring clamp screw
13 Clamp screw washer
14 Breaker plate
15 Cam and stop plate
16 Spacer
17 Spring set
18 Governor weight
19 Shaft collar
20 Collar pin
21 Drive shaft
22 Upper thrust washer
23 Lower thrust washer
24 Advance arm
25 Hex head screw
26 Lockwasher
27 Flat washer
28 Distributor base assy
29 Vacuum chamber
30 Fillister head screw
31 Lockwasher
32 Retaining ring
33 Holddown spring
34 Oiler

Figure 3-4-Continued.

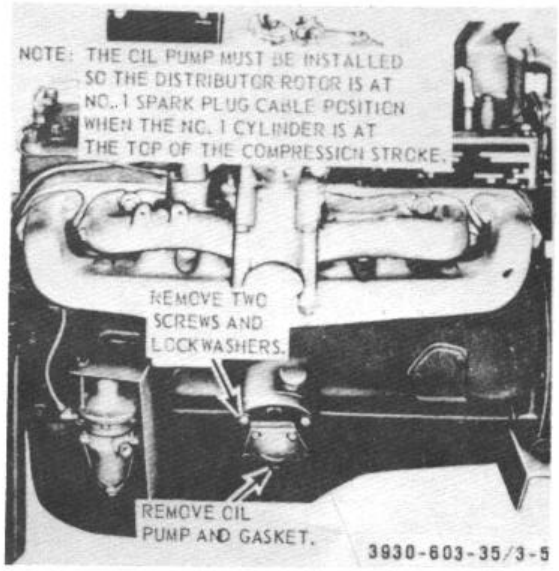


Figure 3-5. Oil pump, removal and installation.

b. Disassembly. Disassemble oil pump as illustrated in figure 3-6.

3-20. Oil Pump, Cleaning, Inspection and Repair

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Inspect all parts of pump assembly carefully, checking mating surfaces or' rotors for excessive wear, nicks, burrs, scratches or scoring.

c. To check rotors for excessive wear, slide outer rotor into pump body; then measure clearance between lobes of inner and outer rotors. If clearance is in excess of 0.010 inch, replace pump.

d. Check clearance between outer rotor and body by inserting a feeler gage; if clearance exceeds 0.008 inch replace pump.

e. The rotor diameter when measured with a micrometer calipers must not be less than 2.245 inches, and thickness of both inner and out rotors not less than 0748 inch. If rotors show excessive wear, replace pump.

f. With rotors in position, place a straightedge across pump body between bolt holes. Use a feeler gage, check clearance between rotor surface and straightedge. If clearance is more than 0.004 inch, replace pump.

g. Pump cover must be smooth, free from scratches or groove marks. Place straightedge across inner surface and check clearance with a feeler gage. If a 0.001 inch feeler gage can be inserted, replace cover.

3-21. Oil Pump Reassembly and Installation

a. Reassembly.
(1) Lubricate all parts with a light weight engine oil.
(2) Use a new cover packing and reassemble oil pump as illustrated in figure 3-6.

b. Installation.
(1) Install oil pump as illustrated in figure 345.
(2) Install distributor and time engine (TM 10-3930-603-12).

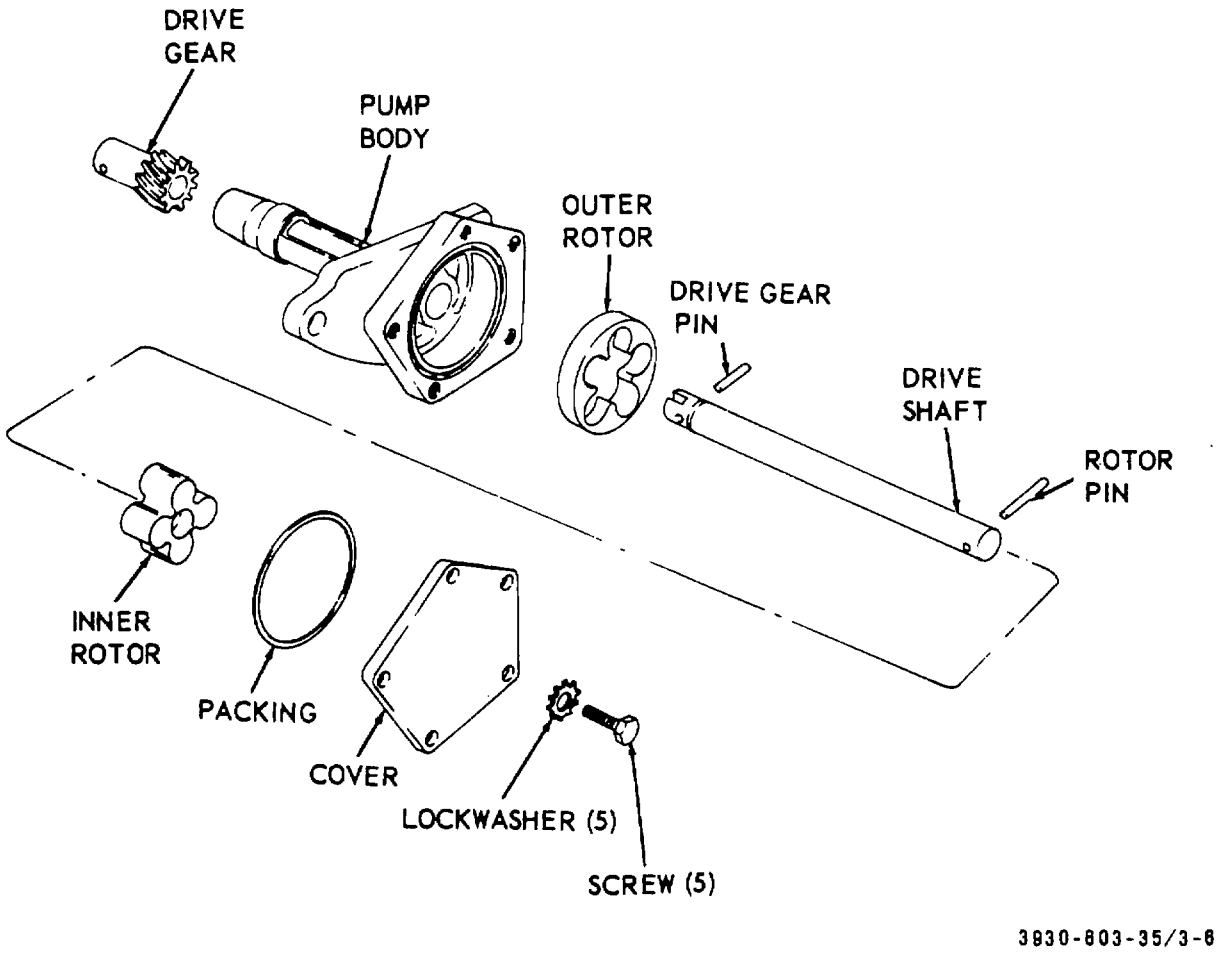


Figure 3-6. Oil pump assembly, disassembly and reassembly.

Section VI. VALVES, SPRINGS AND LIFTERS

3-22. General

The exhaust valves have replaceable seats while intake valve seats are machined into cylinder block. Both intake and exhaust valves have 45 degree seat surfaces on valve head. Valve guides are replaceable. Valve tappets are of mushroom type. The camshaft must be removed for replacement of tappets.

3-23. Valve Assemblies, Removal

a. Remove cylinder head, valve covers and manifold (TM 10-89830-603-12).

b. Rotate engine until valve to be removed is completely closed.

c. Use a cloth and plug oil return holes at bottom of valve spring chambers to prevent valve locks from dropping into engine oil pan during removal.

Note. When removing valves, place then in a rack so they can be replaced in their original position.

d. Use a valve spring compressor and remove exhaust and intake valves as illustrated in figure 37.

e. To remove valve guide, use a piloted driver and drive valve guide down into valve spring chamber. If guide does not clear lifters,

break lower section off with a hammer and drift and drive out remaining piece.

3-24. Valve Assemblies, Cleaning, Inspection and Repair

a. Cleaning, Inspection and Refacing Valves.

(1) Inspect valves for burned seats and warped stems.

(2) Use a micrometer and measure valve stems at several points. Valves with stems that are worn more than 0.0002 inch or that are burned or warped must be replaced. Refer to repair and replacement standards (table 1-1) for valve stem dimensions.

(3) Reface valves that are slightly burned and pitted. Reface valves at a 45 degree angle.

(4) After valve face has been cleaned, make sure the margin (fig. 3-8) is not less than 1/32 inch.

b. Checking Stem to Guide Clearance.

(1) If inspection indicates that clearance between valve stem and guide is excessive, or if underside of any intake valve is oily, replace valve guides. Check clearance between valve stern and guide as follows:

(a) Clean guide and valve stem and install valve in guide.

(b) a dial indicator to a convenient stud on cylinder block and adjust plunger of indicator against edge of valve head.

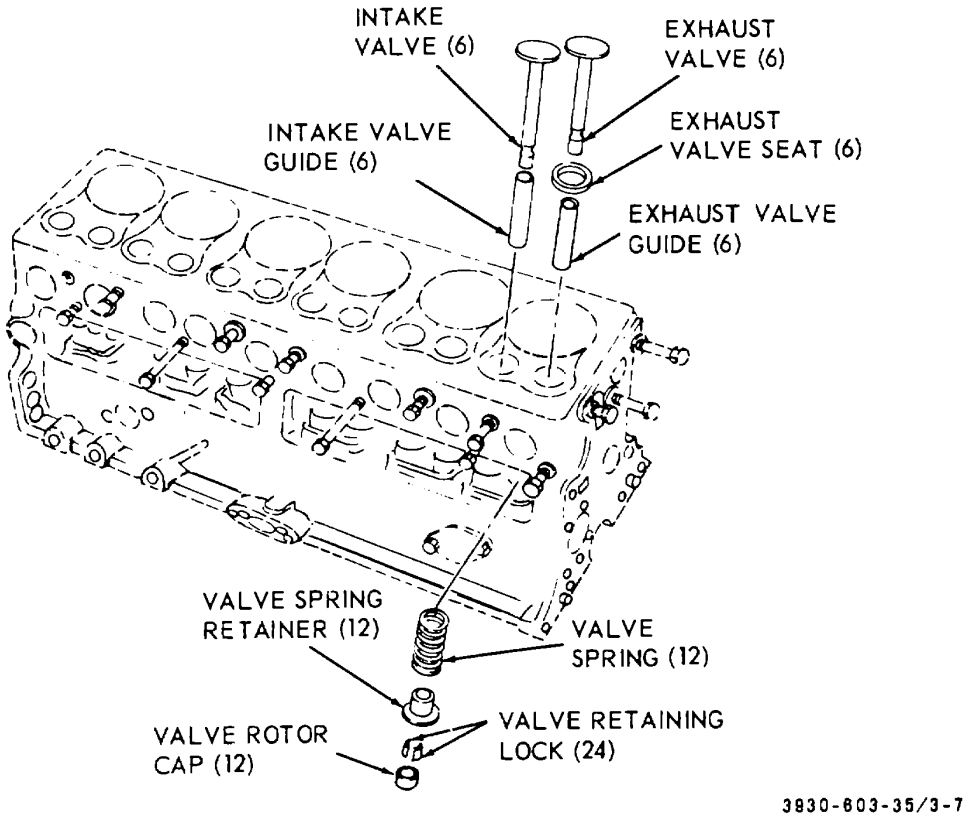


Figure 3-7. Intake and exhaust valve, removal and installation.

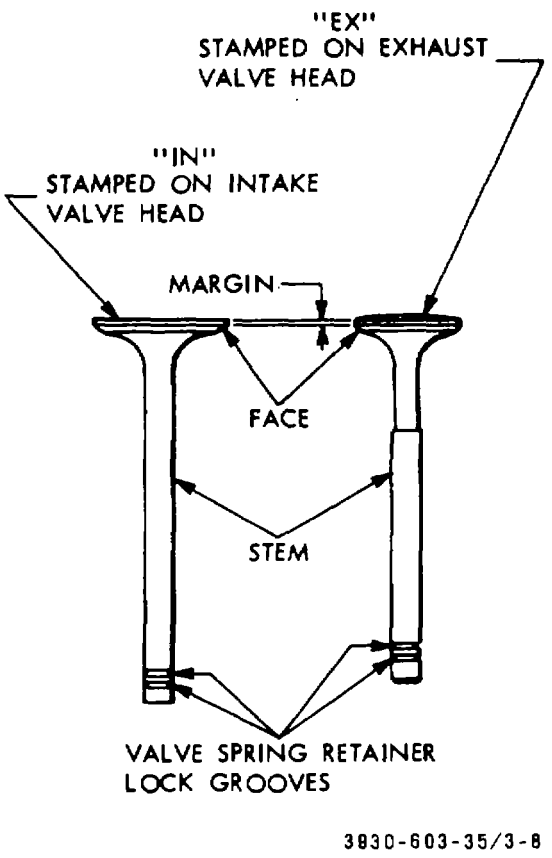


Figure 3-8. Intake and exhaust valve inspection points.

(c) Hold valve so it will not turn, then move it to and from indicator. The amount of wear in guide will be clearance above standard.. Refer to table 1-1 for correct clearance. Replace a defective valve guide.

c. Refacing Valve Seats.

(1) Grind valve seats making sure a true complete surface is obtained.

(2) Check concentricity of seat using a dial indicator. Total runout must not exceed 0.002 inch total indicator reading.

d. Testing Valve Spring Tension. Use a valve spring tester, check all valve springs for proper tension. All springs require 110 to 120 pounds pressure to compress springs to 1-3/8 inches. Replace defective springs.

3-25. Valve Assembly Installation

a. Use a valve spring compressor and install valve assemblies as illustrated in figure 3-7.

b. Lubricate valve guides with white lead, insert guides in position at top of block and drive into place. Ream new installed valve guides to dimensions in table 1-1.

c. If new valve inserts are installed, make sure cylinder block and counterbore are clean and free of dirt. Chill inserts in a container of dry ice for ten minutes, place chilled inserts in counterbore, and drive in until they firmly bottom.

d. Install cylinder head and manifold (TM 10-3930-603-12).

e. Adjust valves and install valve cover (TM 10-3930-603-12).

Section VII. OIL PAN AND OIL LINES

3-26. General

The oil pan serves as a bottom cover for engine crankcase and as a reservoir for engine lubricating oil. A float type sump strainer is located in lowest point of oil pan. Two baffle plates are welded inside oil pan to direct flow of oil back to sump in oil pan and to control oil from surging from one end of oil pan to the other.

3-27. Oil Pan and Oil Lines, Removal

a. Jack or hoist front end of tractor up and block securely.

b. Drain engine oil (LO 10-3930-603-12). Remove oil pan as illustrated in figure 3-9.

c. Remove oil strainer and oil lines as illustrated in figure 3-10.

3-28. Oil Pan and Oil Lines, Cleaning and Inspection

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Scrape pan gasket of oil pan and block.

c. Inspect oil lines and threaded fittings for damage or breaks.

d. Replace oil pan gasket and all defective parts.

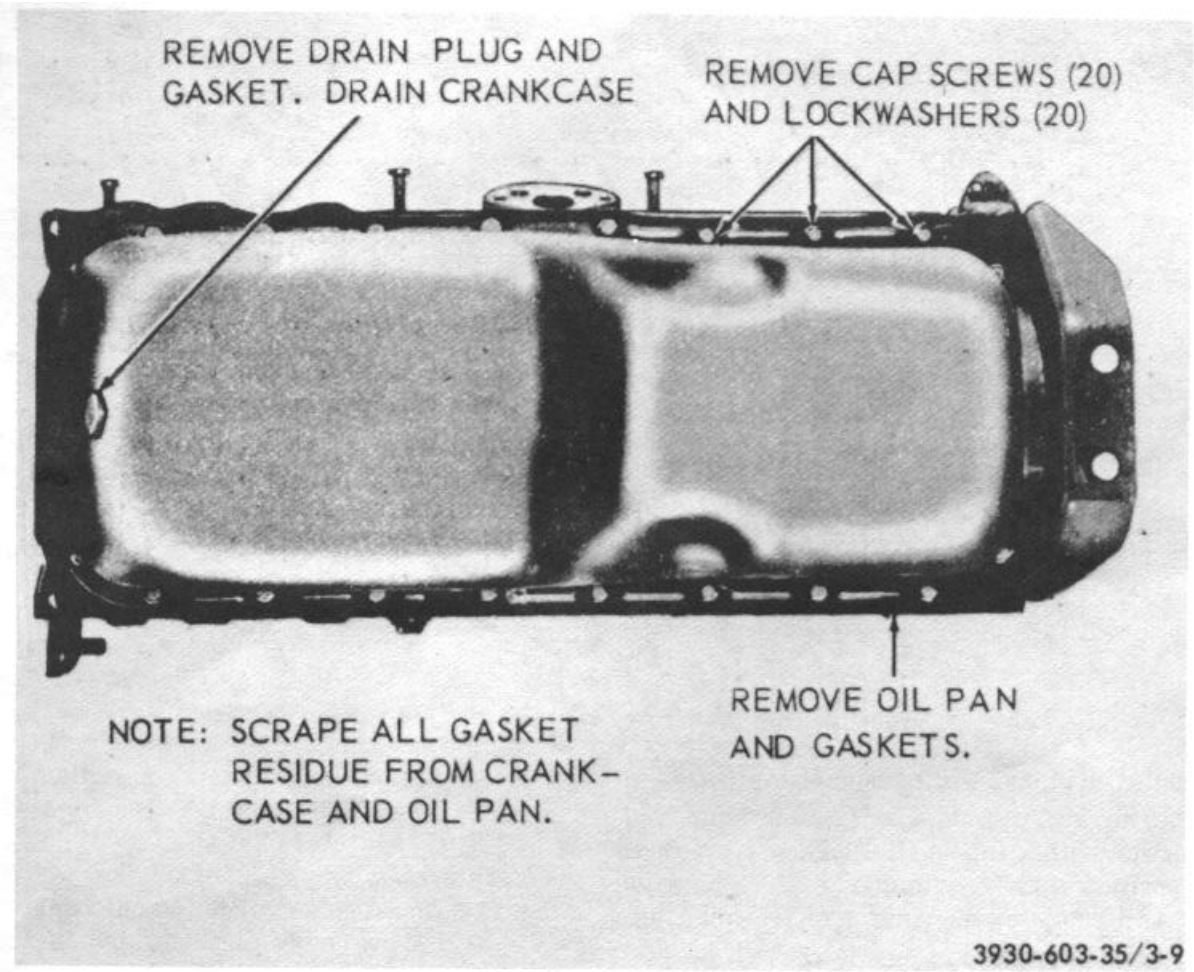


Figure 3-9. Oil pan, removal and installation.

3-29. Oil Pan and Lines, Installation

a. Install oil strainer and oil lines as illustrated in figure 3-10.

b. Install oil pan as illustrated in figure 3-9.

c. Fill engine crankcase with lubricating oil (LO 10-3930-603-12).

d. Remove blocking from front end of tractor and lower tractor to the floor.

Section VIII. PISTONS AND CONNECTING ROD ASSEMBLIES

3-30. General

a. The six connecting rods are of drop forged, I-beam construction, equipped with thin, babbit-on-steel precision type replaceable bearings. The connecting rods have metered oil passages drilled that furnishes lubrication to piston pin, bearings, pistons and cylinder walls. A sleeve type piston pin bushing is

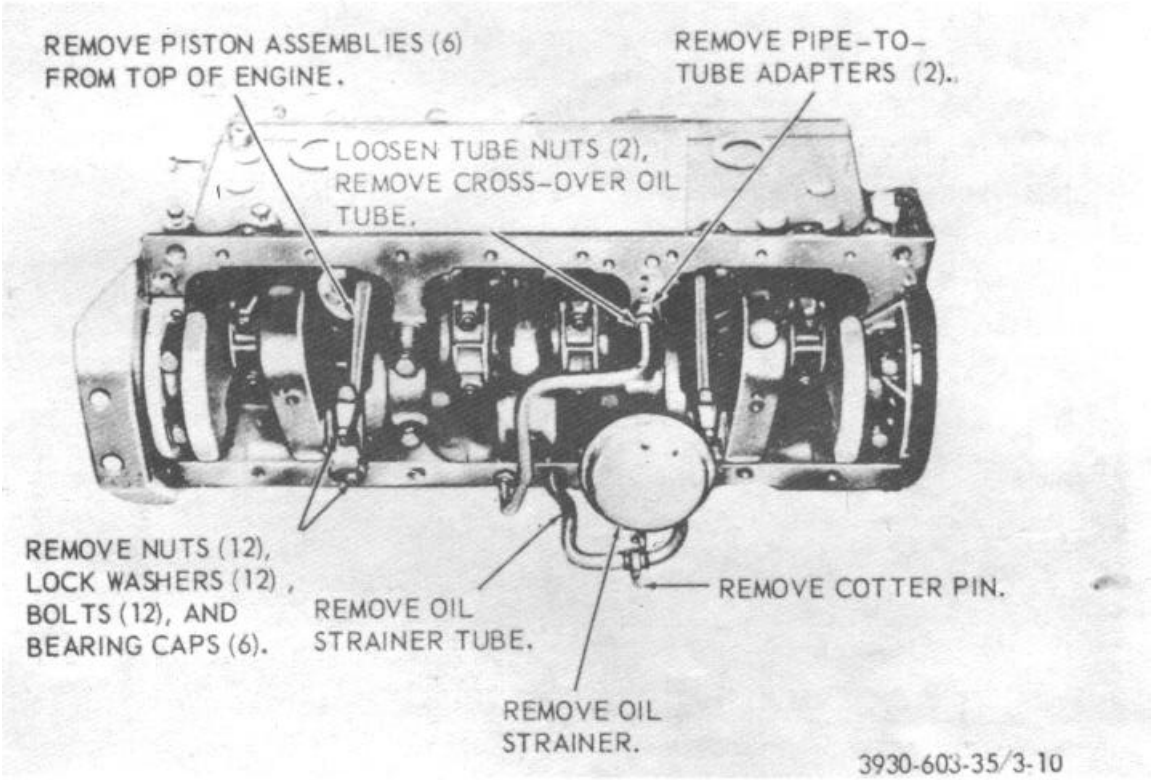


Figure 3-10. Oil strainer, oil lines, piston and connecting rod, removal and installation.

Installed in upper end of connecting rod.

b. The six pistons are of aluminum construction with a full floating piston pin secured in position with retaining rings. Each piston has two compression rings and .two oil rings.

3-31. Piston and Connecting Rod Assembly, Removal and Disassembly

a. Removal.

(1) Remove cylinder head (TM 10-3930-603-12).

(2) Remove oil pan and oil lines (para 3-27).

(3) Use a ridge reamer and remove carbon ridge from top of each cylinder bore as illustrated in figure 3-11. Use compressed air and blow all carbon from top of each piston.

(4) Remove connecting rods and piston assembly as illustrated in figure 3-10).

(5) Temporarily install connecting bearing cap on connecting rod from which they were removed.

b. Disassembly.

(1) Disassemble piston and connecting rod assembly as illustrated in figure 3-12.

(2) Use a piston ring spreader to remove rings from piston.

(3) Press piston pin bushing out of connecting rod.

3-32. Piston and Connecting Rod Assembly, Cleaning, Inspection and Repair

a. Cleaning.

(1) Wash all parts with an approved cleaning solvent and dry thoroughly.

(2) Remove carbon from top of pistons and ring grooves.

(3) Use proper size drill and remove carbon from oil return holes in ring groove.

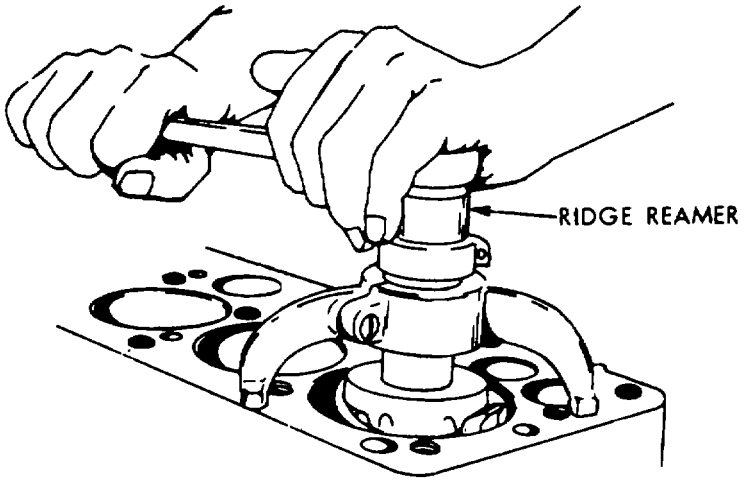


Figure 3-11. Cylinder ridge removal.

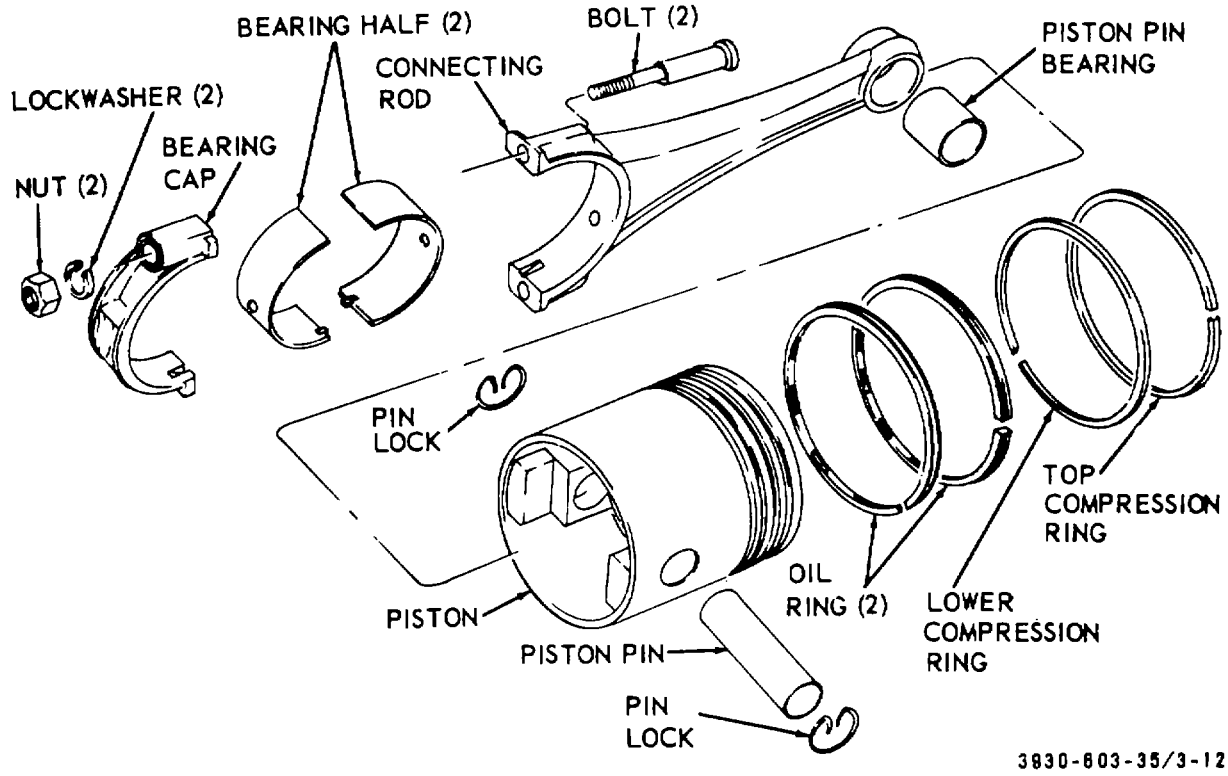


Figure 3-12. Piston and connecting rod assembly, disassembly and reassembly.

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

b. Inspection and Repair.

(1) Dry piston thoroughly and fit into cylinder bore properly, use a spring scale and feeler ribbon 0.003 inch thick by 1/2 inch wide by 10 inches long. Insert feeler ribbon full length into cylinder bore, about halfway down (fig. 3-13). Hook spring scale into end of feeler ribbon and pull ribbon from cylinder. If piston fit is correct the scale will register a 5 to 10 pound pull.

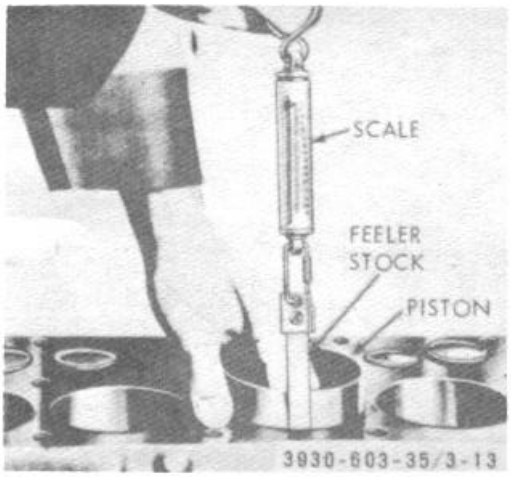


Figure 3-13. Fitting piston into cylinder block.

(2) Check fit of piston pin in piston and connecting rod. Pin must be thumb push fit in connecting rod pin bushing and a palm fit in piston bosses.

(3) Inspect piston ring gap by placing piston rings in cylinder halfway down bore as illustrated in figure 3-14. With ring square with piston bore, measure gap between ring ends. Refer to table 2-1 for clearances authorized. If gap is less than specified, remove ring and dress end with a fine cut file until correct clearance is obtained.

(4) Measure side clearance of piston rings in groove. Refer to table 2-1 for required clearances.

(5) Install piston pin in connecting rod

Figure 3-14. Measuring piston ring end gap.

and place connecting rod, with sleeve bearings, in alinement fixture. Install connecting rod cap. Pin should touch measuring bar on alinement fixture at both ends. Twist must not exceed over 0.002 inch.

(6) Replace all defective parts.

3-33. Piston and Connecting Rod Reassembly and Installation

a Reassembly.

(1) Reassemble piston and connecting rod assembly as illustrated in figure 3-12.

(2) When installing piston rings on piston, use a ring expander tool. Al-

ways start with lowest ring first, making sure that ring gaps are equally spaced about, circumference of piston, and not in vertical alinement.

(3) Make sure tapered side of compression ring is up.

b. Installation.

(1) Oil cylinders and generously coat piston and rings with engine oil. Install a piston ring compressor and compress rings into piston grooves.

(2) Install six piston and connecting rod assembly as illustrated in figure 3-10.

(3) Make sure connecting rod assembly is installed in cylinder bore from which it was removed and that oil squirt hole in rod is installed toward camshaft side of engine.

(4) Apply a light coat of engine oil to connecting rod bearing lower cap and make sure bearing lock fits into machined notch of rod and cap. Tighten connecting rod nuts to a 45 to 60 foot-pound torque.

(5) Install oil pan and lines (para 3-29).

(6) Install cylinder head (TM 10-3930603-12).

Section IX. CAMSHAFT AND TIMING GEARS

3-34. General

The camshaft is supported in crankcase by three bearings and a machined surface in rear of crankcase; timing gears are located inside timing gear housing and are lubricated by an oil tube that delivers oil under pressure directly to gear teeth.

3-35. Timing Gear Cover, Camshaft Gear, and Camshaft Removal

a. Remove engine assembly (para 2-16).

b Remove valves (para 3-23).

c. Remove oil pan (para 3-27).

d. Remove fan belt (TM 10-3930-603-12).

e. Remove distributor (para 3-15).

f. Remove oil pump (para 3-19).

g. Remove front crankshaft pulley and timing gear cover as illustrated in figure 3-15.

h. Remove timing chain and camshaft gear as illustrated in figure 3-16.

i. Disassemble camshaft and camshaft gear as illustrated in figure 3-17.

j. Carefully pull camshaft assembly out from front of engine. Do not damage bearings or lobes on camshaft.

k. If valve lifters are to be replaced, remove tappet adjusting screws (10) and drive tappets (11) from cylinder block.

l. To remove camshaft bearings (12, 13 and 14) from cylinder block, use a bearing puller and adapter. Do not remove camshaft bearings unless worn beyond permissible wear limits (table 2-1), or damaged.

3-36. Timing Gear Cover, Camshaft Gear and Camshaft, Cleaning and Inspection

a. Wash all parts in an approved cleaning solvent and dry thoroughly.

b. Discard and replace all gaskets and seals.

c. Inspect camshaft and bearings for chips, cracks, or excessive wear.

d. Inspect camshaft sprocket for broken teeth or excessive wear.

e. Use a soft bristle brush and remove all residue from crevices on camshaft and oil pump drive gear.

f. Inspect valve lifter for cracks, or excessive wear.

g. Replace all defective parts.

3-37. Timing Gear Cover, and Camshaft Sprocket Installation

a. Apply white lead to outside surface of camshaft bearings (12, 13, and 14, fig. 3-17) and install bearings in cylinder block using an arbor press with an extension ram.

b. Install twelve adjusting screws (10) into valve tappets (11) and install tappets in cylinder block.

c. Install camshaft assembly and camshaft gear as illustrated in figure 3-17. Aline timing marks on camshaft gear and crankshaft gear as illustrated in figure 3-18.

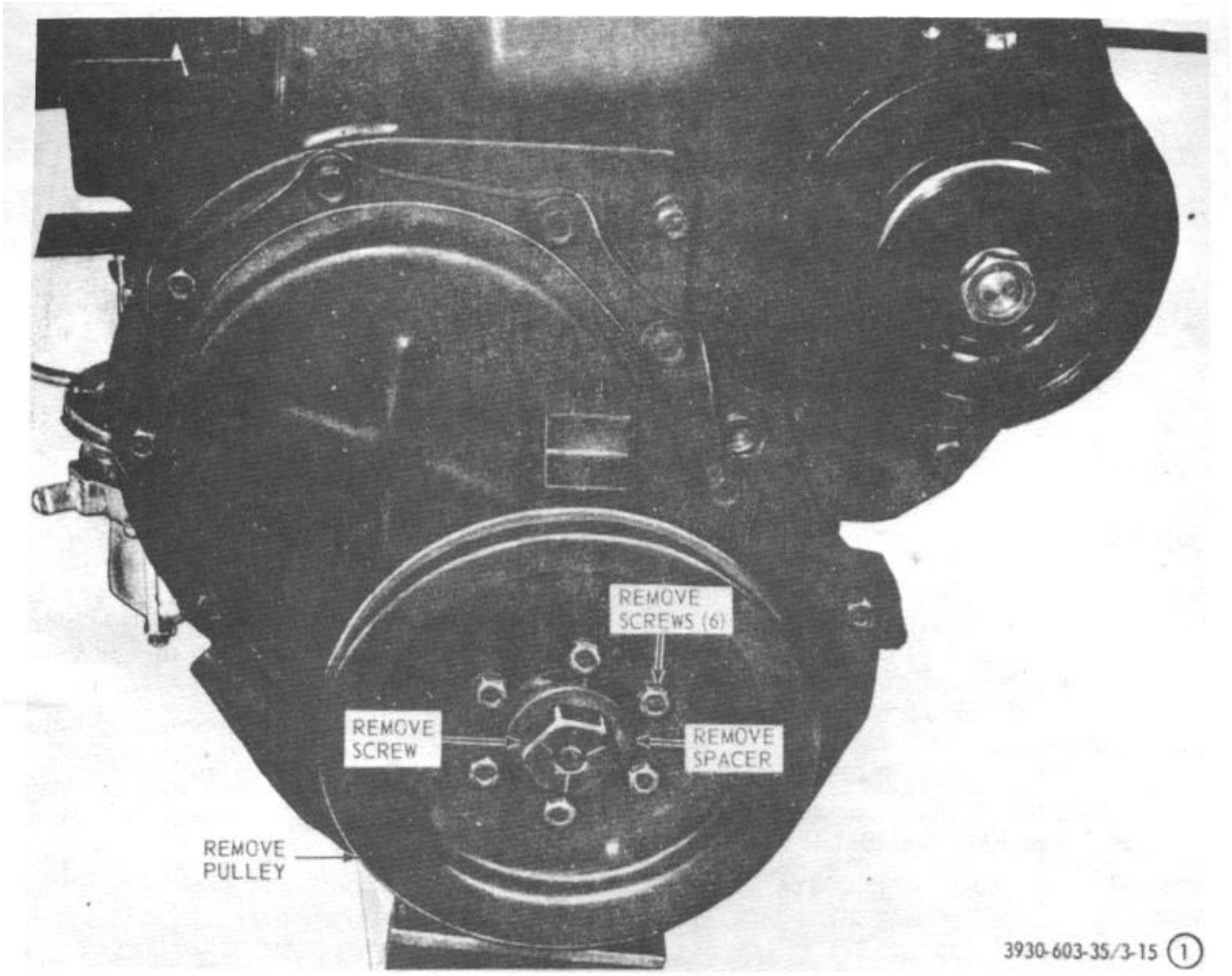


Figure 3-15 (1). Crankshaft pulley and front cover, removal and installation.

d. Install front timing gear cover as illustrated in figure 3-16.

e. Install oil pump (para 3-21).

f. Install distributor (para 3-17).

g. Install valves (para 3-25).

h. Install oil pan and oil lines (para 3-29).

i. Install engine assembly (para 2-17).

j. Install fan belt (TM 10-3930-603-12).

Section X. CRANKSHAFT

3-38. General

The engine features a forged steel counterbalanced crankshaft, mounted in four replaceable precision type main bearings of babbitt on steel type.

3-39. Crankshaft and Main Bearing Removal

a. Remove engine (para 2-16).

b. Remove oil pan and oil lines (para 827).

c. Remove pistons and connecting rods (para 3-31).

d. Remove timing gear front cover and timing chain (para 3-35).

e. Punchmark crankshaft main bearing caps and cylinder block for identification before removing caps, as illustrated in figure 3-19.

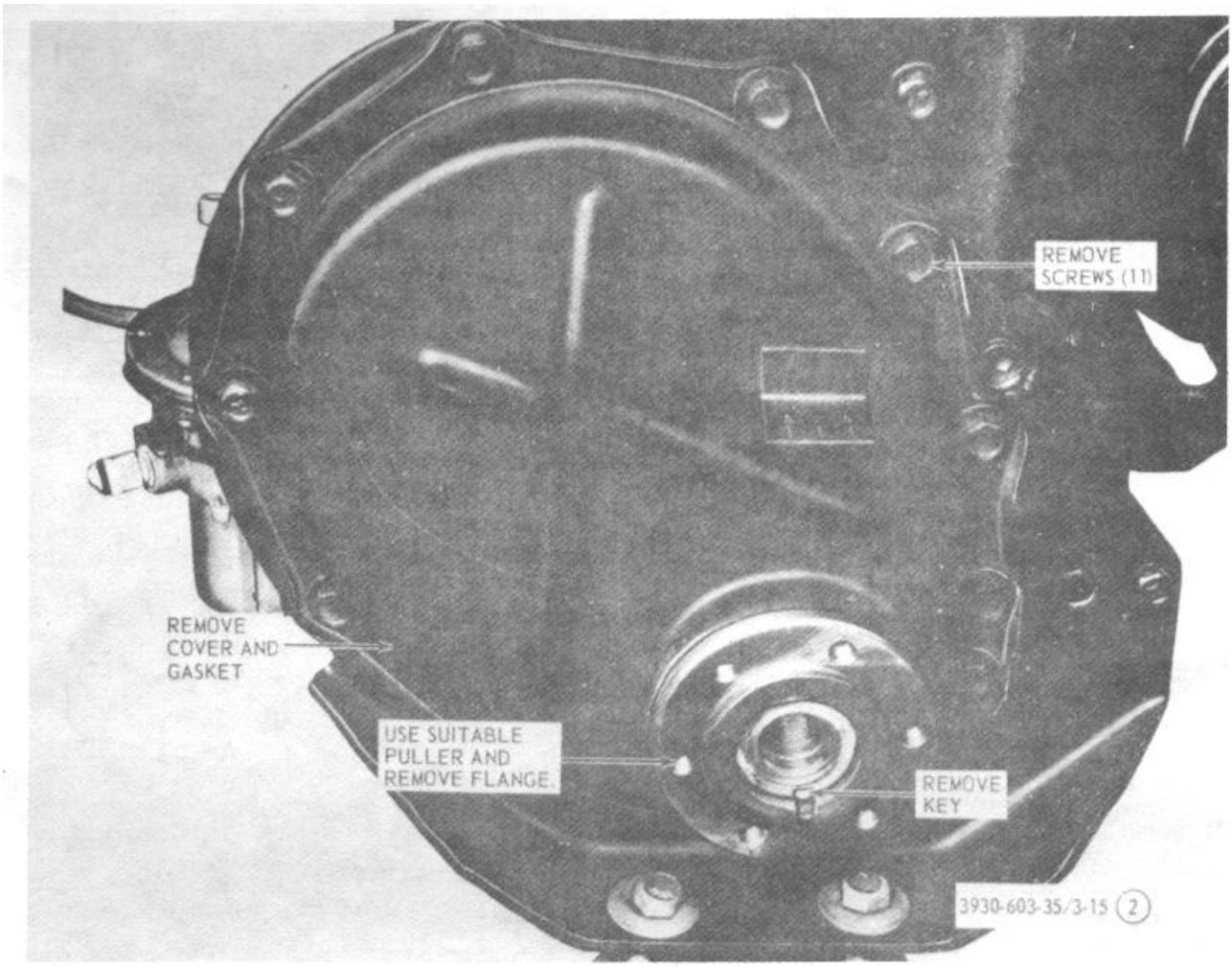


Figure 3-15 (2)-Continued.

The center caps are machined slightly offset and will cause damage if they are not reinstalled in same position.

f. Remove crankshaft and main bearings as illustrated in figure 3-20. Carefully lift crankshaft out of cylinder block and place crankshaft in a suitably blocked, clean dry location.

3-40. Crankshaft and Main Bearing, Cleaning and Inspection

a. Cleaning.

(1) Clean all parts with an approved cleaning solvent using a soft bristle brush. Wipe bearing journals and bearing halves with a lint free cloth.

(2) Clean all oil ports with a wooden stick. Make sure all oil ports in crankshaft are open to permit free flow of oil to all bearings.

b. Inspection.

(1) Use a micrometer and inspect crankshaft journals and bearing halves for excessive wear or scoring, taper, out of round, or other damage. Refer to table 1-1 for dimensions and allowable wear of bearings and crankshaft journals.

(2) Inspect crankshaft sprocket for cracks or tooth damage.

(3) Check alignment of crankshaft using V-blocks and a dial indicator. Check

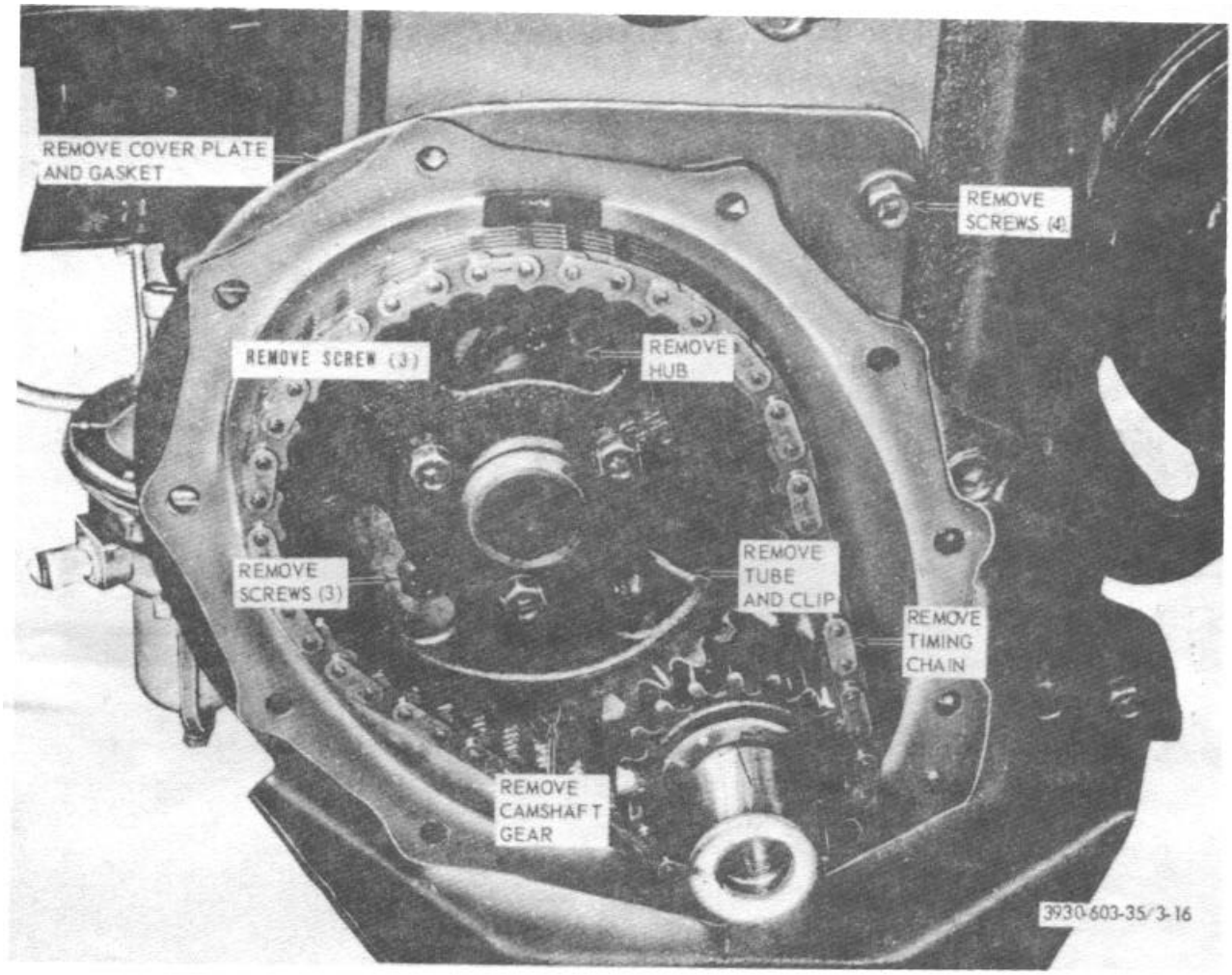


Figure 3-16. Timing chain and camshaft sprocket, removal and installation.

run out at center and intermediate points of bearing. Replace crankshaft if run out exceeds 0.003 inch.

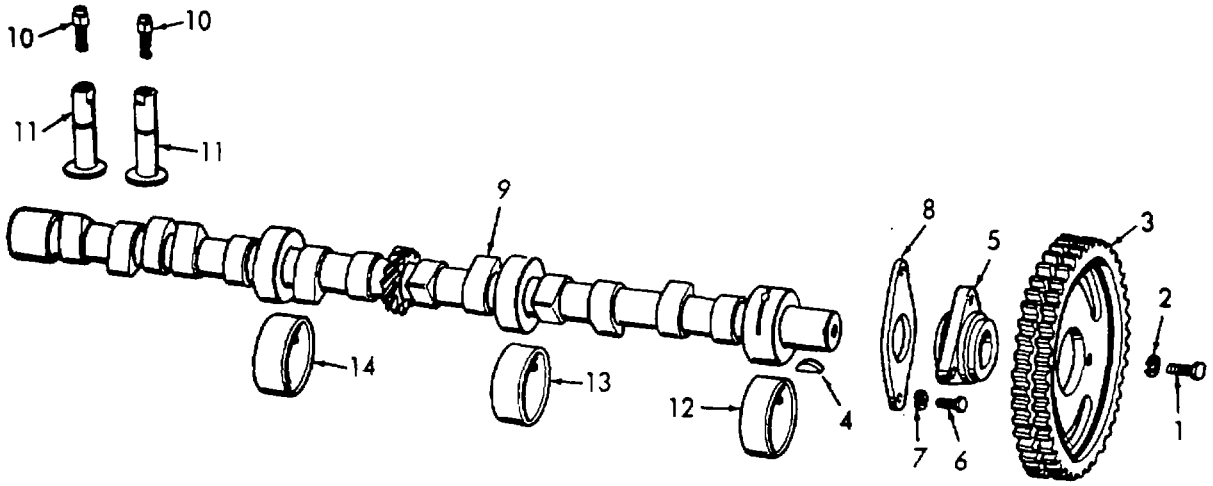
(4) Use a micrometer to take and record a reading at each end and center point of crankshaft journals. Rotate micrometer 90 degrees and repeat procedure. Take this reading on all crankshaft journals.

(5) The difference in two readings taken at same point on journal will give out of round condition. The difference between readings ,taken at ends of journal will give taper. Difference between a part dimension and average of all readings will give average wear.

(6) Examine all bearing halves for wear and scoring. The position of any apparent wear on bearings will give a good indication of crankshaft journal condition.

(7) A crankshaft with tapered or out of round journals exceeding allowable wear limits in table 1-1 must be repaired or replaced.

(8) Replace all defective parts. Discard and replace all gaskets and seals.



3930-603-35/17

1	Hex head capscrew	6	Hex head capscrew	11	Valve tappet
2	Lockwasher	7	Lockwasher	12	No. 1, camshaft bearing
3	Camshaft sprocket	8	Thrust plate	13	No. 2, camshaft bearing
4	Hub key	9	Camshaft	14	No. 3, camshaft bearing
5	Sprocket hub	10	Tappet adjusting screw		

Figure 3-17. Camshaft and camshaft sprocket, removal and installation.

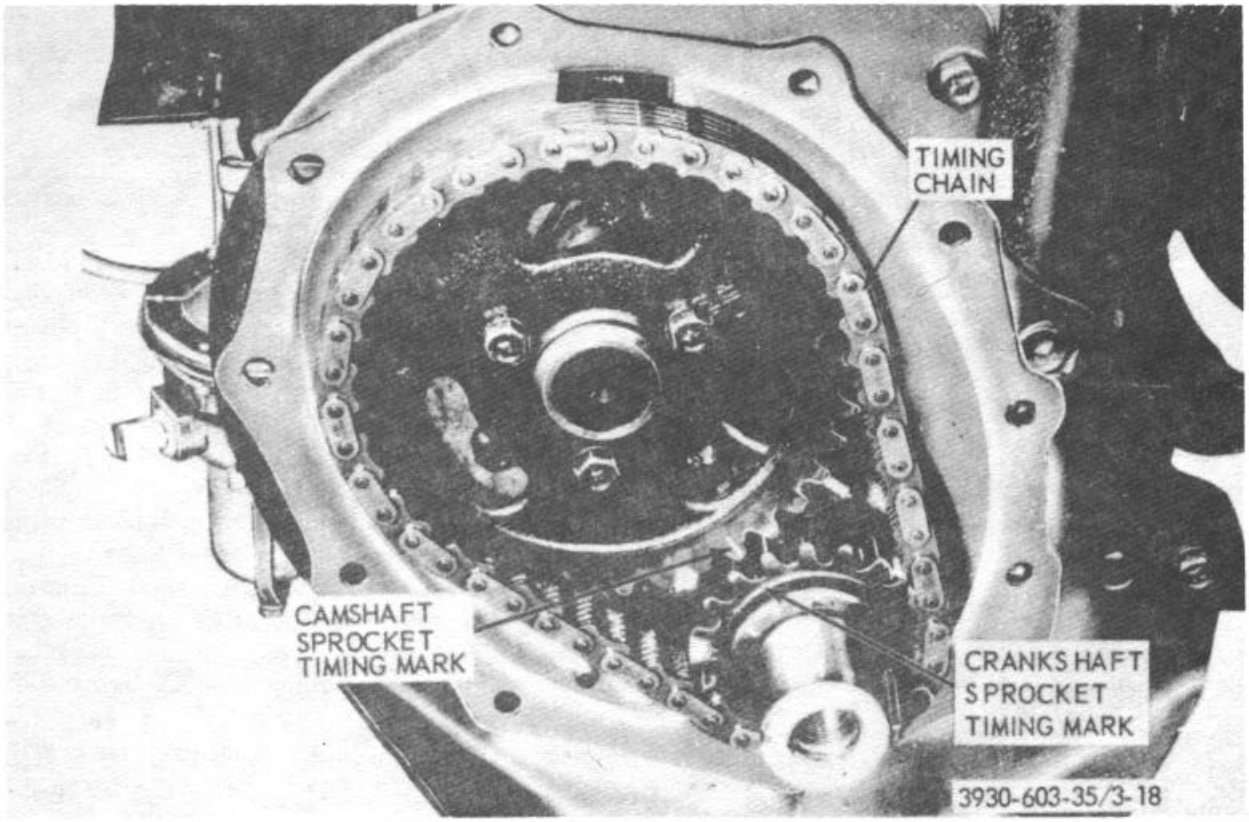


Figure 3-18. Alining timing gear marks.

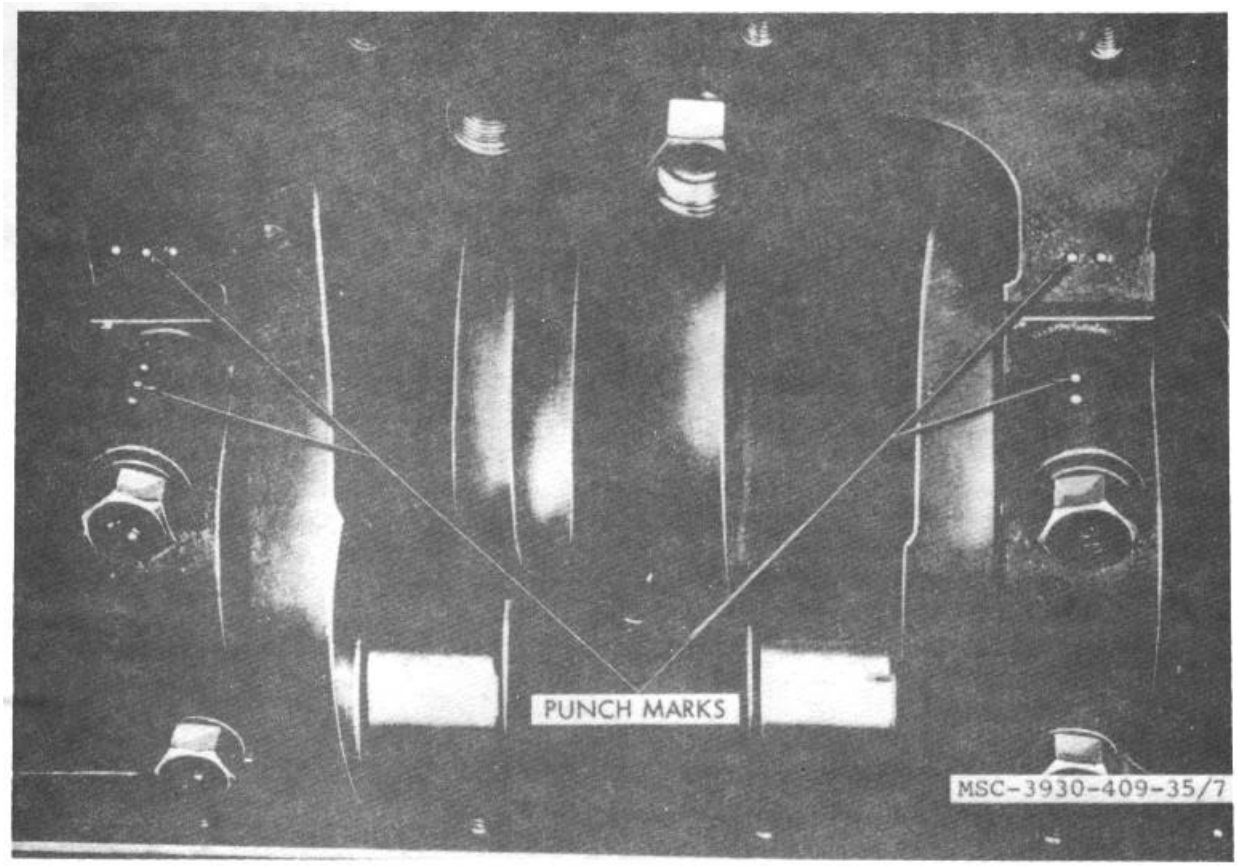


Figure 3-19. Punch marks, main bearing identification.

3-41. Crankshaft and Main Bearing Installation

a. Invert cylinder block 'and install a bearing half in each main bearing recess in cylinder block, and apply a thin coat of SAE 20 oil to each bearing.

b. Install oil seals in rear main bearing cap as illustrated in figure 3-21, and carefully guide crankshaft into position in cylinder block.

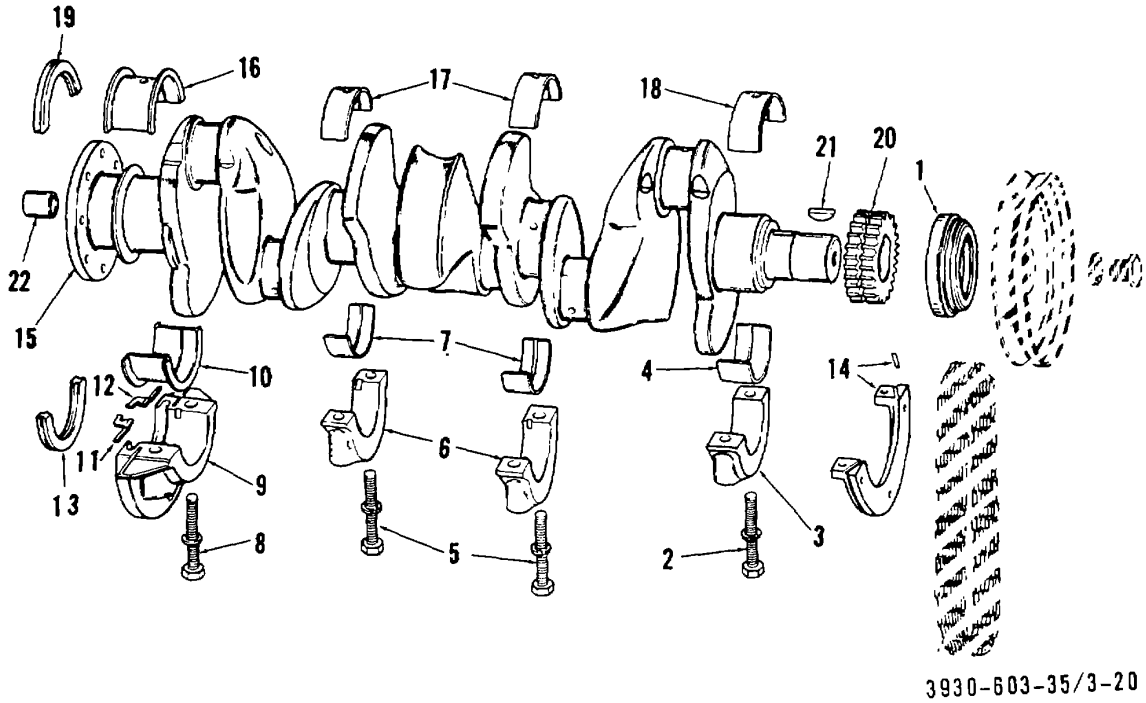
c. Apply a thin coat of SAE 20 engine oil to bearing journals and install bearing caps as illustrated in figure 3-20. Install punch marked bearing caps (fig. 3-19) on same journal from which they were removed. Make sure rear main bearing seals and gaskets are in place, and tighten bearing cap bolts finger tight.

d. Rock crankshaft slightly to seat bearings and tighten bearing capscrews to 70 to 85 pound-foot torque.

e. Refer to table 1-1 and check main bearing deep/ranges as follows:

(1) With a bearing shell in place and bearing capscrews tightened, crankshaft must be free enough to turn by hand. If crankshaft can be turned one complete revolution, clearance is at least adequate. If crankshaft cannot be turned all the way by hand, it is too tight.

(2) Take each main bearing, one at a time, and remove cap. Use a piece of 0.002 inch feeler stock, 1/2 inch wide and 1 inch long; oil stock well and place between bearing shell and crankshaft journal as illustrated in figure 3-22. Torque bearing screws (d. above). If a drag is present, the main bearing is too loose. If bearing clearance is excessive, install undersize bearings.



1 Oil slinger
2 Capscrew and lockwasher
3 Bearing cap, No. 1
4 Bearing half, No. 1
5 Capscrew and lockwasher
6 Bearing cap, No. 2 and 3
7 Bearing half, No. 2 and 3
8 Capscrew and lockwasher
9 Bearing cap, No. 4
10 Bearing half, No. 4
11 Rear bearing cap gasket R.H.
12 Rear bearing cap gasket, L.H.
13 Oil seal, rear
14 Oil seal assembly, front
15 Camshaft
16 Bearing half, No. 4
17 Bearing half, No. 2 and 3
18 Bearing half, No. 1
19 Oil seal, rear
20 Crankshaft sprocket
21 Pulley key
22 Bushing

Figure 3-20. Crankshaft and main bearings, removal and installation.

If main bearing clearance is excessive, measure crankshaft journals with a micrometer for out of round or taper (para 3-40).

f. Mount a dial indicator as illustrated in figure 3-23 so it rests against a vertical surface. Refer to table 1-1 for allowable dimensions; pry crankshaft back and forth, and measure crankshaft end play.

g. Install camshaft sprocket timing chain and timing gear cover (para 3-37).

h. Install pistons and connecting rods

(para 3-33).

i. Install oil pan and oil lines (para 3-29).

j. Install engine (para 2-17).

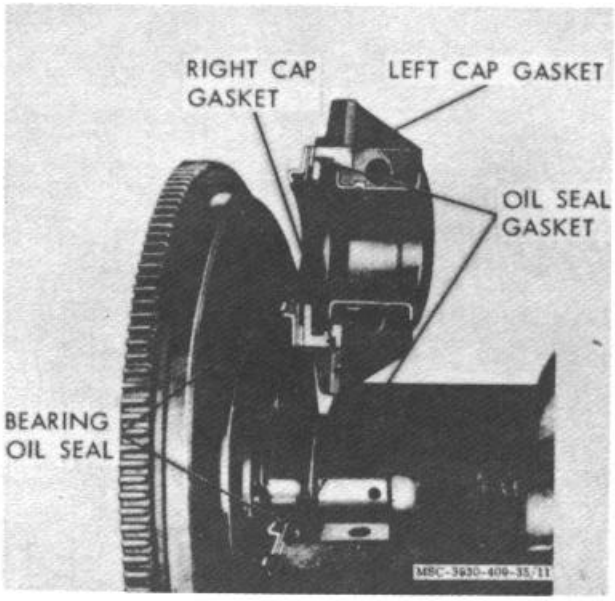


Figure 3-21. Rear bearing oil seals, installed.

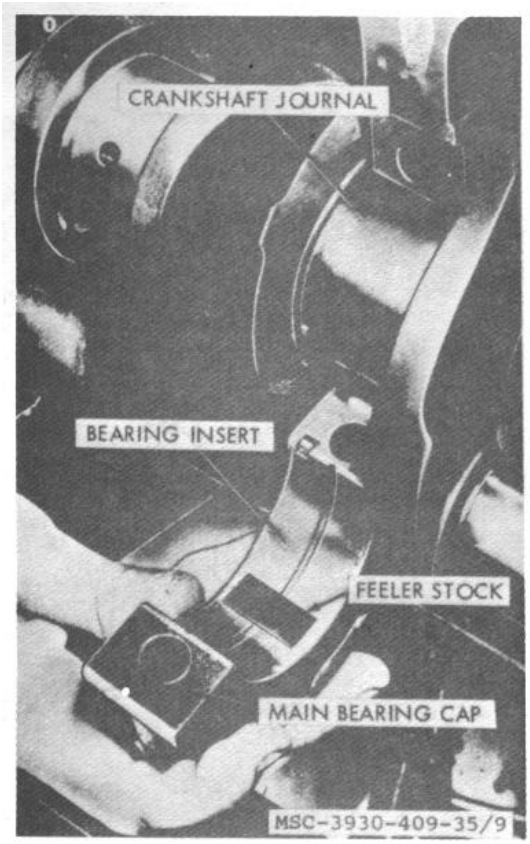


Figure 3-22. Checking main bearing clearances.

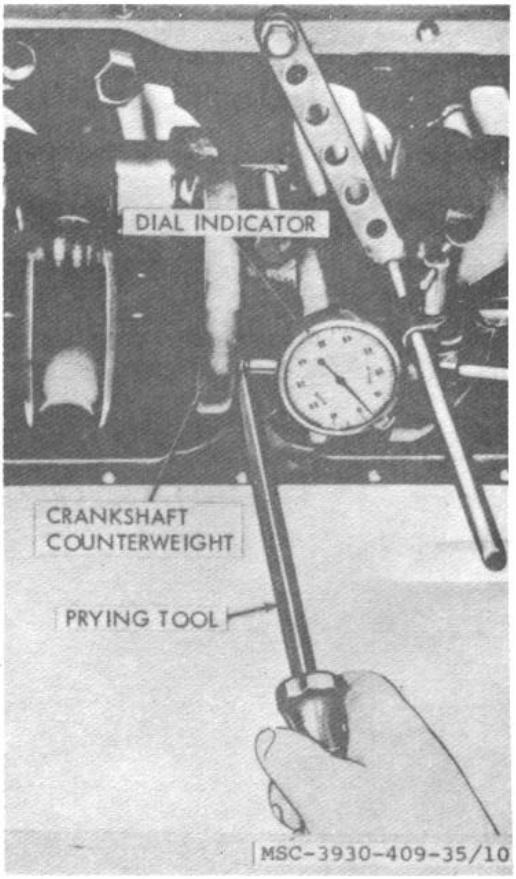


Figure 3-23. Checking crankshaft end play.

Section XI. CRANKCASE AND CYLINDER BLOCK

3-42. General

The crankcase and cylinder block assembly is constructed of cast steel. It has drilled oil passages to lubricate moving parts of engine and water passages to cool cylinders. It is the supporting base for mounting all components and accessories of engine.

3-43. Crankcase and Cylinder Block, Removal and Disassembly

a. Remove engine (para 2-16).

b. Remove generator, starter, oil filter, oil relief valve, fuel pump, water pump fan (TM 10-3930-603-12).

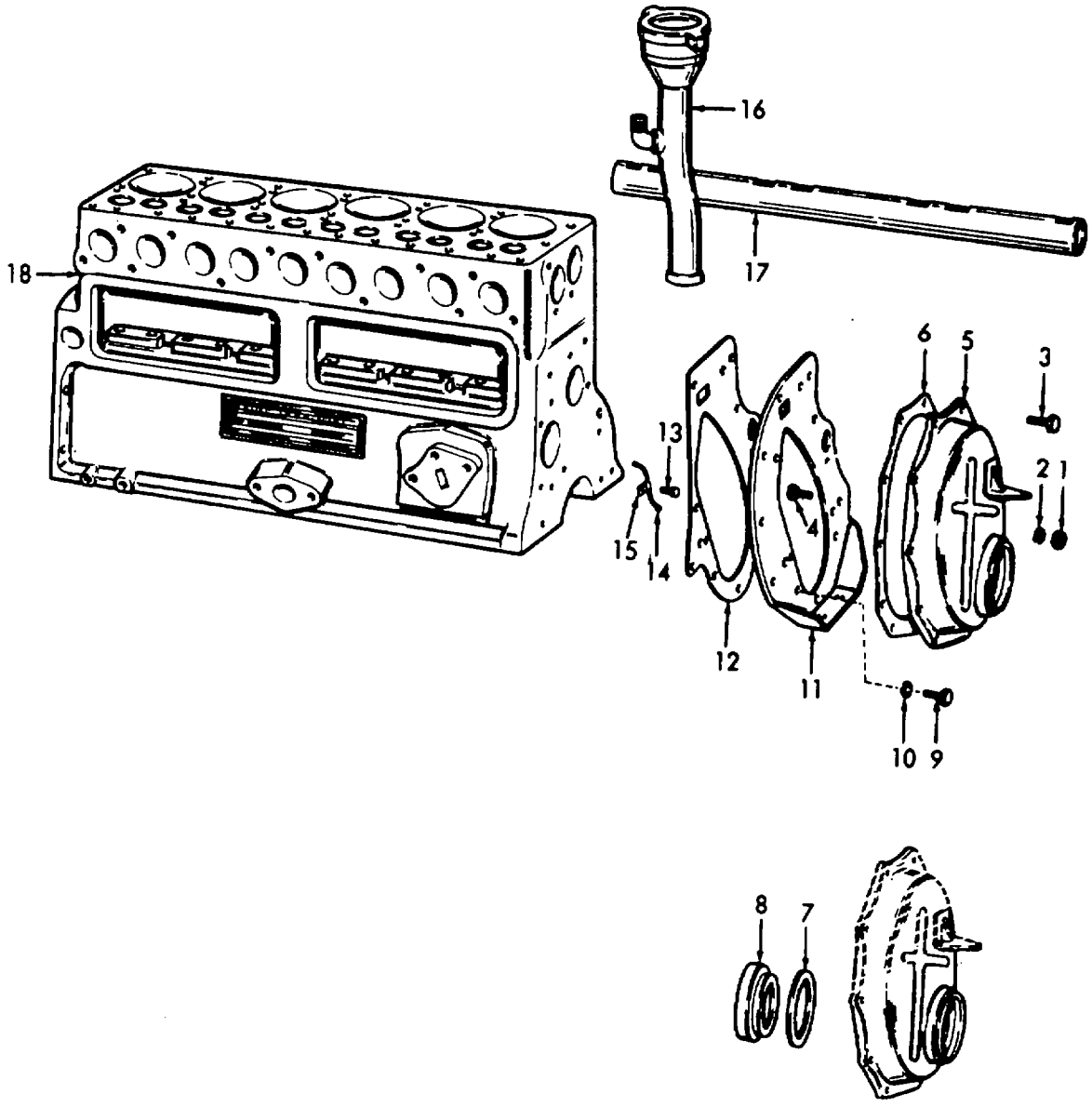
c. Remove camshaft (para 3-35).

d. Remove crankshaft and main bearings (para 3-39).

e. Disassemble cylinder block as illustrated in figure 3-24.

3-44. Crankcase and Cylinder Block Cleaning and Inspection

a. Cleaning. Wash all parts with an approved cleaning solvent and dry thoroughly.



3930-603-35/3-24

1 Hex
2 Lockwasher
3 Hex hd. bolt
4 Hex hd. bolt
5 Timing gear cover
6 Cover gasket
7 Dust seal
8 Oil slinger
9 Hex hd. screw
10 Lockwasher
11 Front plate
12 Front plate gasket
13 Hex hd. screw
14 Oil tube
15 Oil tube clamp
16 Oil filler
17 Water distributor tube
18 Cylinder block

Figure 3-24. Crankcase and cylinder block, disassembly and reassembly.

b. Inspection.

(1) Inspect water distributor tube for corrosion, clogging of openings or other damage. Replace tube showing deterioration.

(2) Measure each cylinder bore with a dial indicator or inside micrometer for taper and out of round at several points in each cylinder, in ring Level zone and below it. Compare readings with tolerances listed in table 1-1. Check cylinder walls for vertical scoring from loose piston pin retaining rings.

(3) Inspect all welch plugs for evidence of leaks.

(4) Inspect all threaded areas and plugs for damaged threads.

(5) Inspect all surfaces of block for cracks or leaks. Repair or replace a defective block.

b. Repair.

(1) Hone cylinders showing a slight taper or out of round condition within acceptable limits shown in table. 1-1.

(2) If taper or out of round exceeds acceptable limits listed in table 1-1, rebore all cylinders to next standard oversize for which pistons and rings are available (TM 10-3930-60335P). Rebore all cylinders to same oversize.

(3) If rust deposits exist in block water jacket, remove welch plugs and remove deposits. Flush water jacket and install new plugs.

3-45. Crankcase and Cylinder Block, Reassembly and Installation

a. Reassemble crankcase and cylinder block as illustrated in figure 3-24.

b. Install crankshaft and main bearings (para 3-41).

c. Install camshaft and front timing sprocket cover (para 3-37).

d. Install generator, starter, oil filter, oil relief valve, fuel pump, water pump, and fan assembly (TM 10-3930-603-12).

e. Install engine assembly (para 2-17).

Section Xll. RADIATOR ASSEMBLY

3 46. General

The tractor is equipped with a dual purpose radiator that cools the engine coolant and automatic transmission fluid. The front pump in the transmission circulates the heated transmission fluid through lower radiator tank, where heat is dissipated. The cooled fluid then circulates back into transmission and continues to circulate as long as the engine is running.

3-47. Radiator Repair

a. Remove radiator (TM 10-3930-603-12). Repair all leaks by soldering.

b. If radiator core is clogged with deposits that do not respond to cleaning outlined in TM 10-3930-603-12, unsolder upper and lower tanks and clean each water passage in core with a length of welding rod. Be careful not to puncture core, which is made of thin, soft metal.

c. Resolder upper and lower tanks to core. Test radiator for leaks (TM 10-3930-603-12).

d. Carefully straighten any bent or damaged core cooling fins.

e. Install radiator assembly. (TM 10-3930603-12).

CHAPTER 4
TRANSMISSION REPAIR INSTRUCTIONS

Section I. GENERAL INFORMATION

4-1. General Description

Refer to paragraph 2-7 for a brief description of transmission assembly and its functions. A detailed description of major assemblies will be found in sections wherein the assembly maintenance and repair instructions are furnished.

4-2. Service Diagnosis

The transmission must not be removed from tractor or disassembled until a careful diagnosis is made, the definite cause determined, and all possible external checks and adjustments made. In diagnosing any abnormal shift condition, always make Hydraulic Control Pressure Test (para 2-13), Air Pressure Test (para 2-15), before removal and disassembly of transmission assembly for repair.

4-3. Hydraulic Control System

a. The Hydraulic Control Circuits, figures 4-1 through 4-8 shows position of various valves with coded passages to indicate those under hydraulic pressure for all operations of transmission.

b. The hydraulic control system makes transmission fully automatic, and has four important functions to perform, in a general way, components of any automatic control system may be grouped into following basic groups:

(1) *Pressure supply system.* The pressure supply system consists of an oil pump driven by engine through torque converter. The single front pump furnishes pressure for all hydraulic and lubrication requirements.

(2) *Pressure regulating valves.*

(a) *Regulator valve.* The pressure regulating valves consists of a regulator valve which controls line pressure at a valve dependent on throttle opening.

(b) *Torque converter control valve.* The torque converter control valve maintains torque converter operating pressure and transmission lubricating pressure.

(c) *Governor valve.* The governor valve transmits regulated pressure to transmission, in conjunction with throttle pressure, to control upshift and downshift speeds.

(d) *Throttle valve.* The throttle valve transmits regulated pressure to transmission, in conjunction with governor pressure, to control upshift and downshift speeds.

(3) *Flow control valves.* The manual control valve obtains transmission drive ranges as selected by tractor operator.

(a) *1-2 Shift valve*. The 1-2 shift valve automatically shifts transmission from low to second or from second to low depending on tractor operation.

(b) *2-3 Shift valve.* The 23 shift valve automatically shifts transmission from second to direct or from direct to second depending on tractor operation.

(c) *Kickdown valve.* The kickdown valve makes possible a forced downshift from direct to second, second

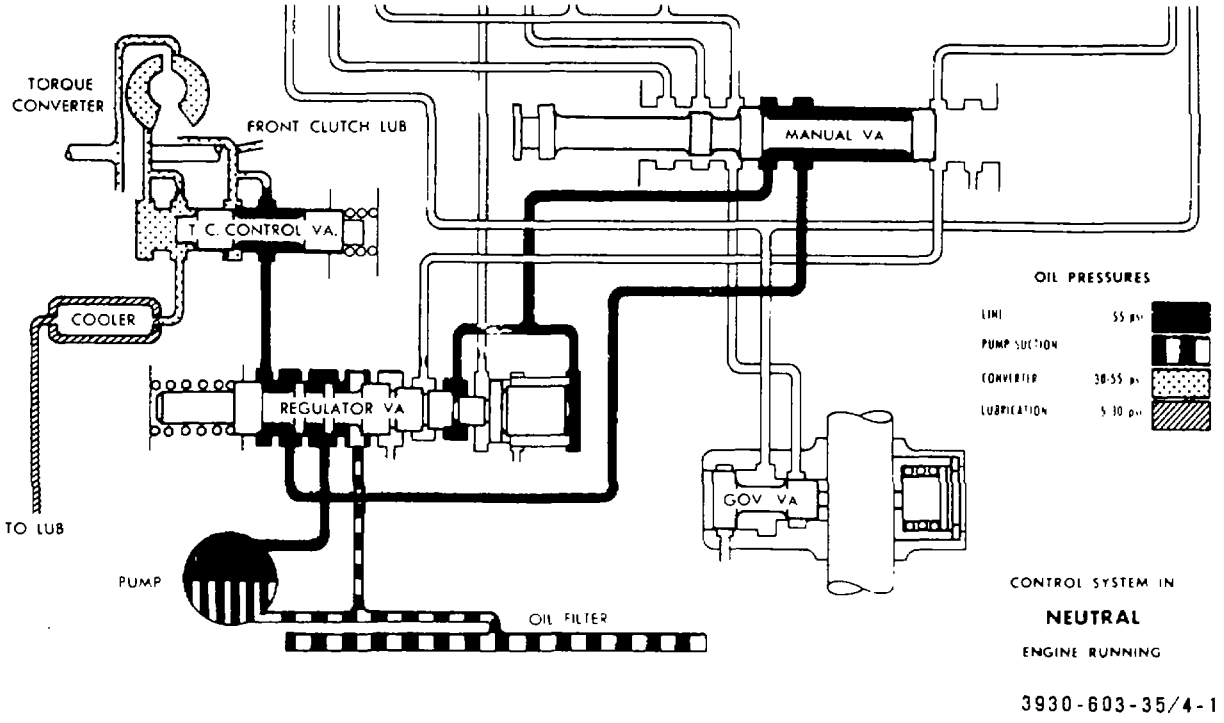


Figure 4-1. Neutral hydraulic circuits

to breakway, or direct to breakway, (depending on tractor speed), by depressing accelerator pedal past detent "feel" near wide open throttle.

(d) *Shuttle valve.* The shuttle valve has two separate functions and performs each independently of each other. The first is that of providing fast release of kickdown band, and smooth front clutch engagement when operator makes a "Lift-Foot" upshift from second to direct. The second function of shuttle valve is to regulate application of kickdown servo and band while making direct to second kickdowns.

(4) *Clutch band servo and accumulator.*

(a) The front and rear clutch pistons, and both servo pistons are moved hydraulically to engage clutches 4-2 and apply bands. The pistons are released by spring tension when hydraulic pressure is released. On 2-3 upshift, kickdown servo piston is released by spring tension on hydraulic pressure.

(b) The accumulator controls hydraulic pressure on apply side of kickdown servo during 1-2 shift; thereby cushioning kickdown band application at any throttle position.

4-4. Operation

The transmission will automatically upshift and downshift at given speeds. All shift speeds may vary somewhat due to production tolerances and rear axle ratio. This is not too important, however, the quality of the shift is very important. All shifts should be smooth, responsive, and with no noticeable engine runaway.

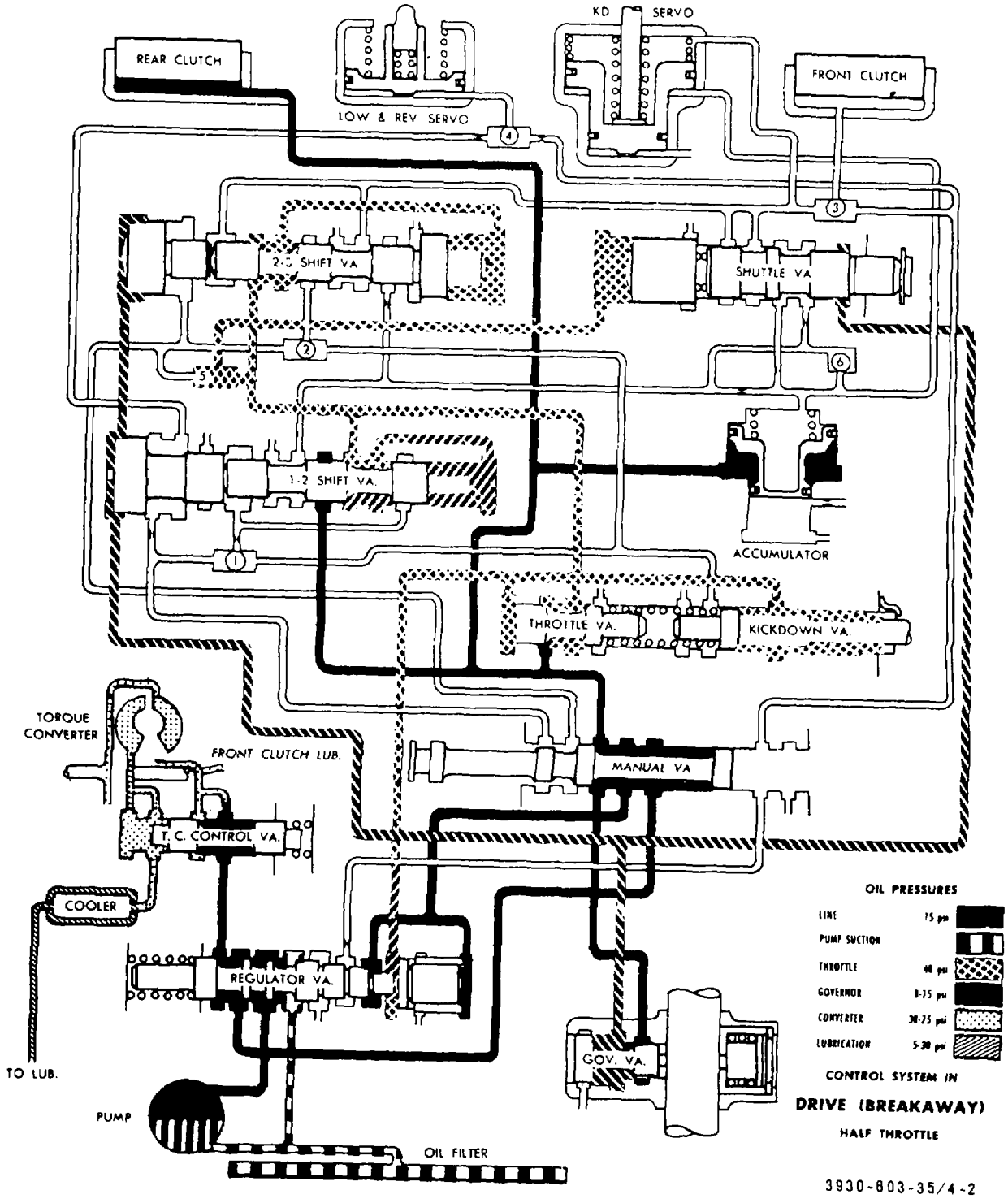


Figure 4-2. Drive-breakaway hydraulic circuits.

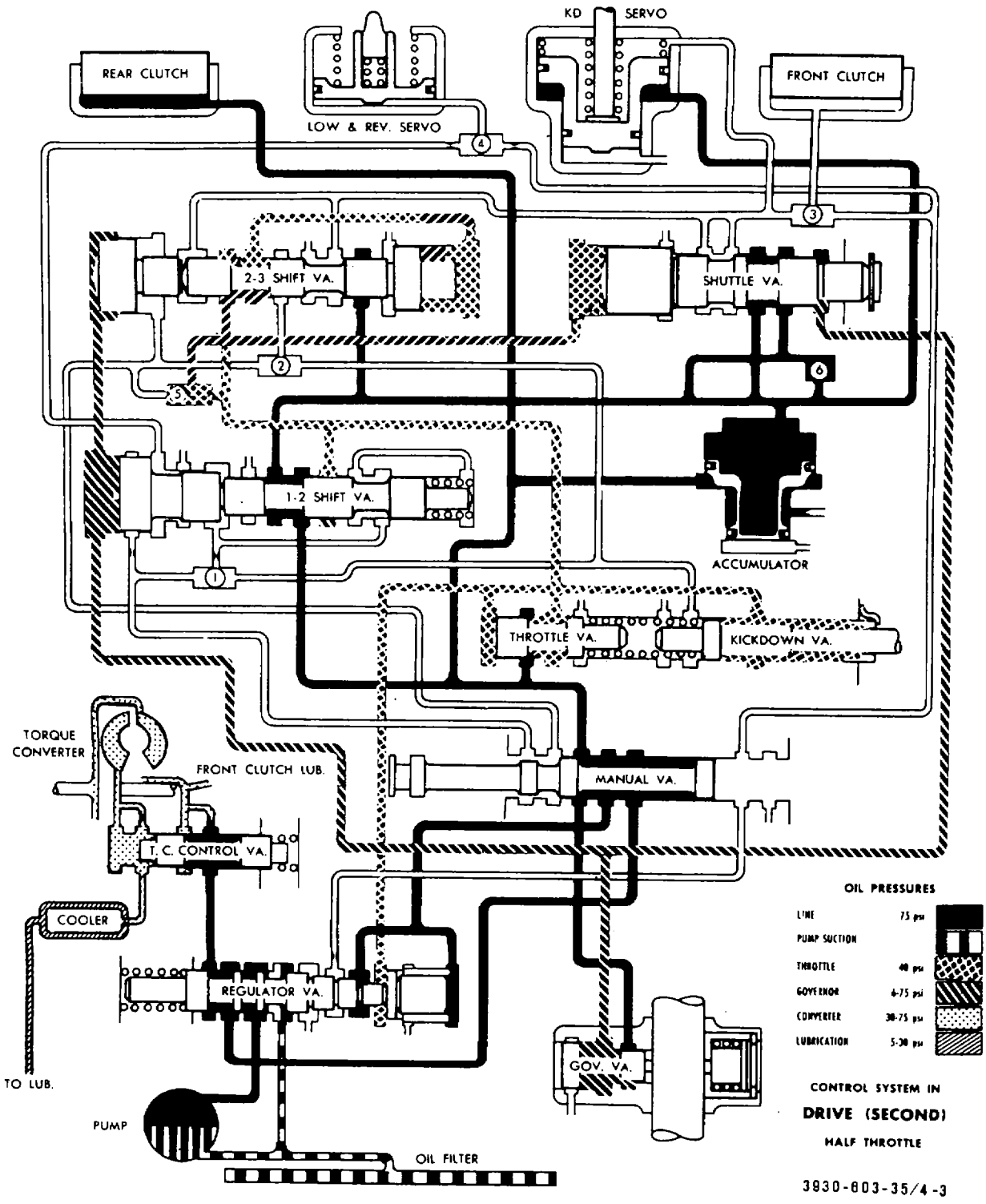


Figure 4-3. Drive-second hydraulic circuits.

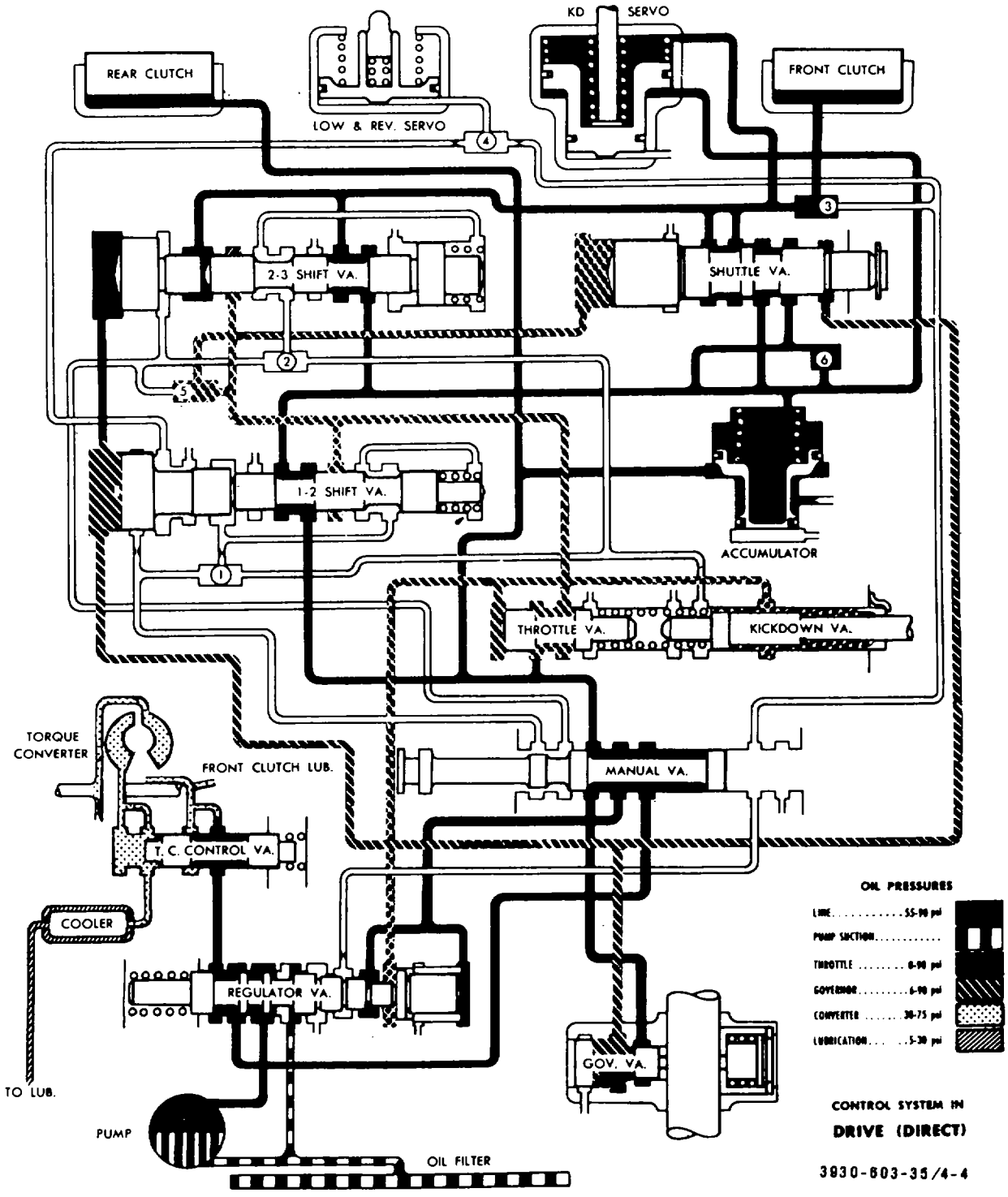


Figure 4-4. Drive-direct hydraulic circuits.

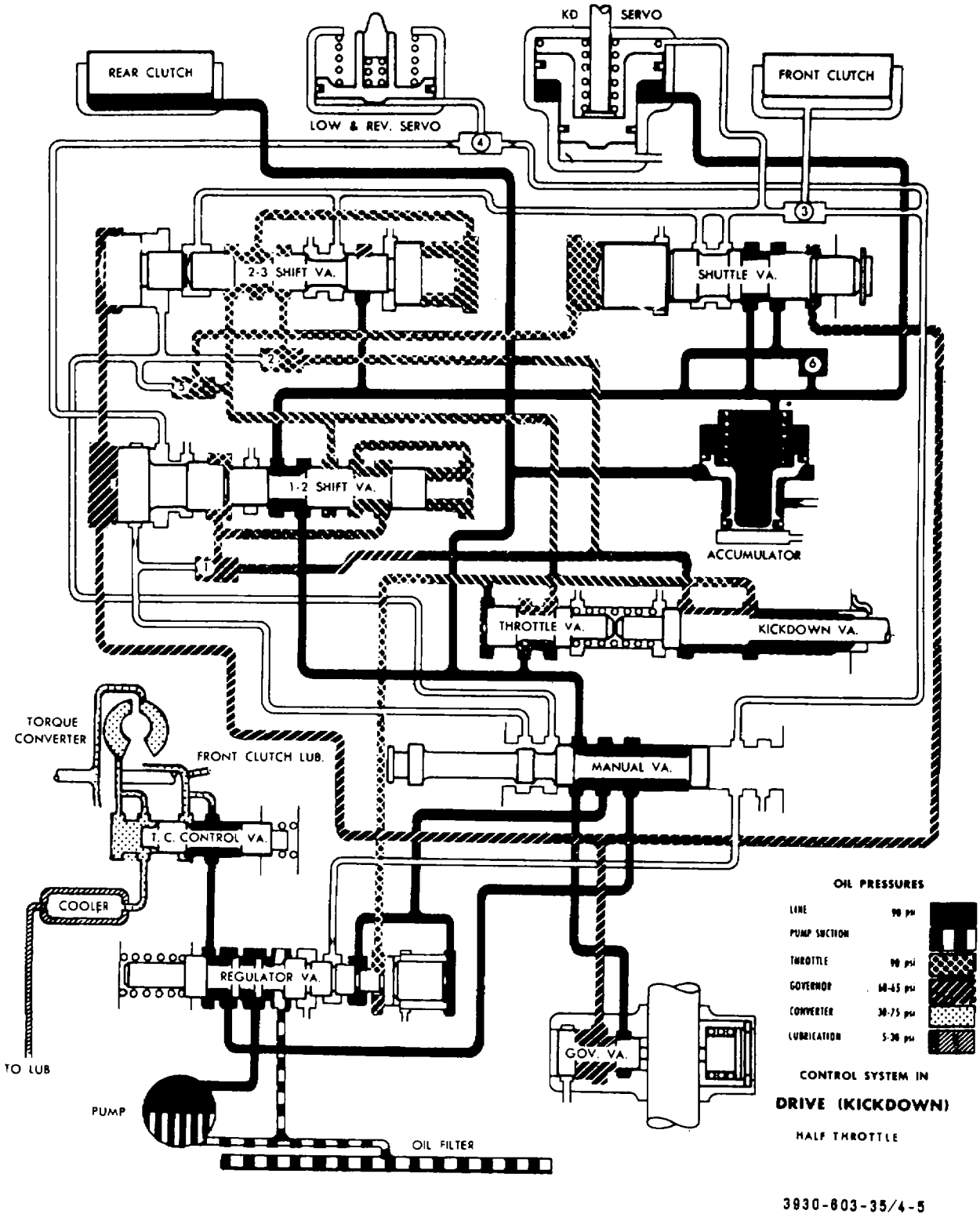


Figure 4-5. Drive-kickdown hydraulic circuits.

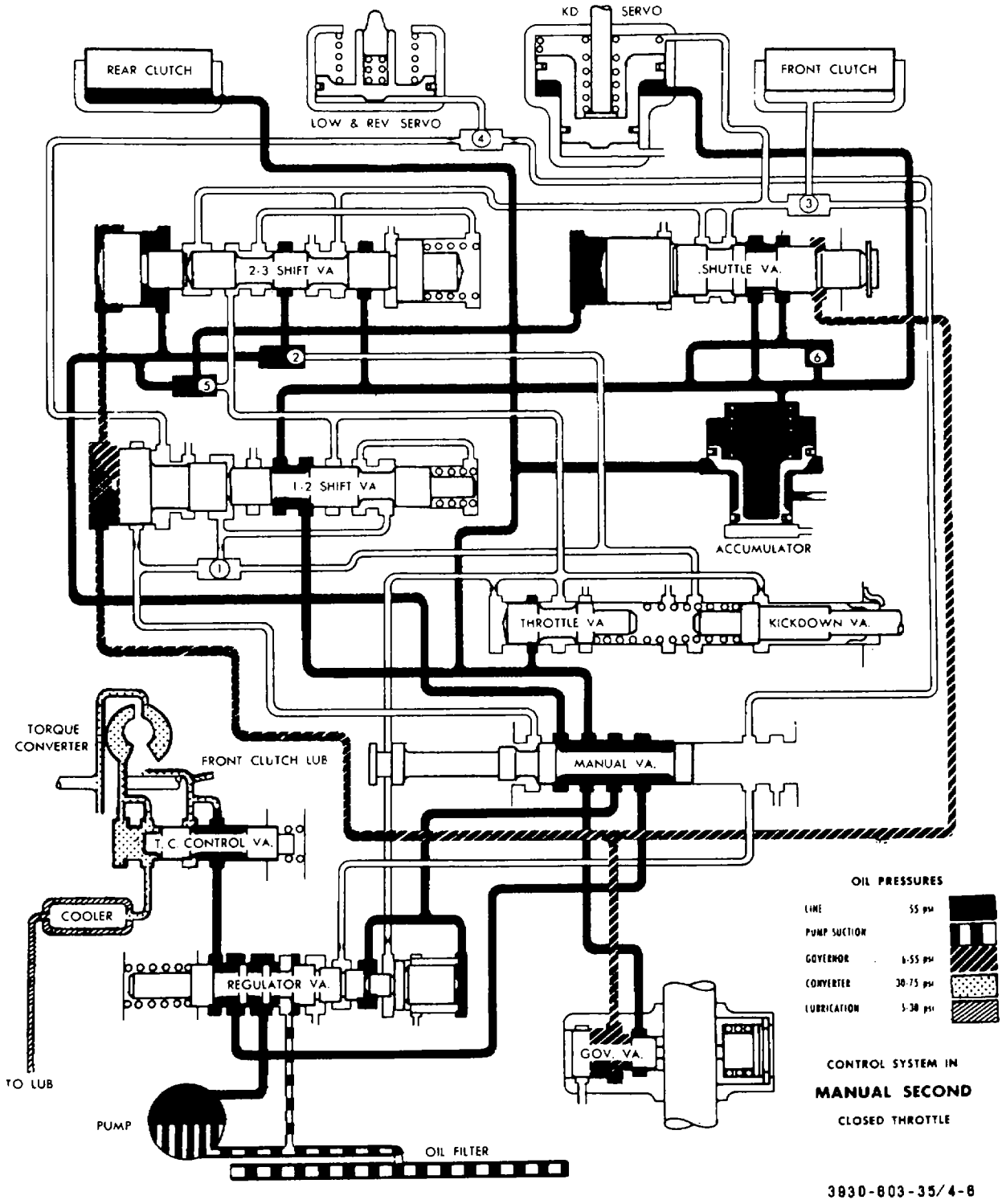


Figure 4-6. Selector lever second-hydraulic circuits.

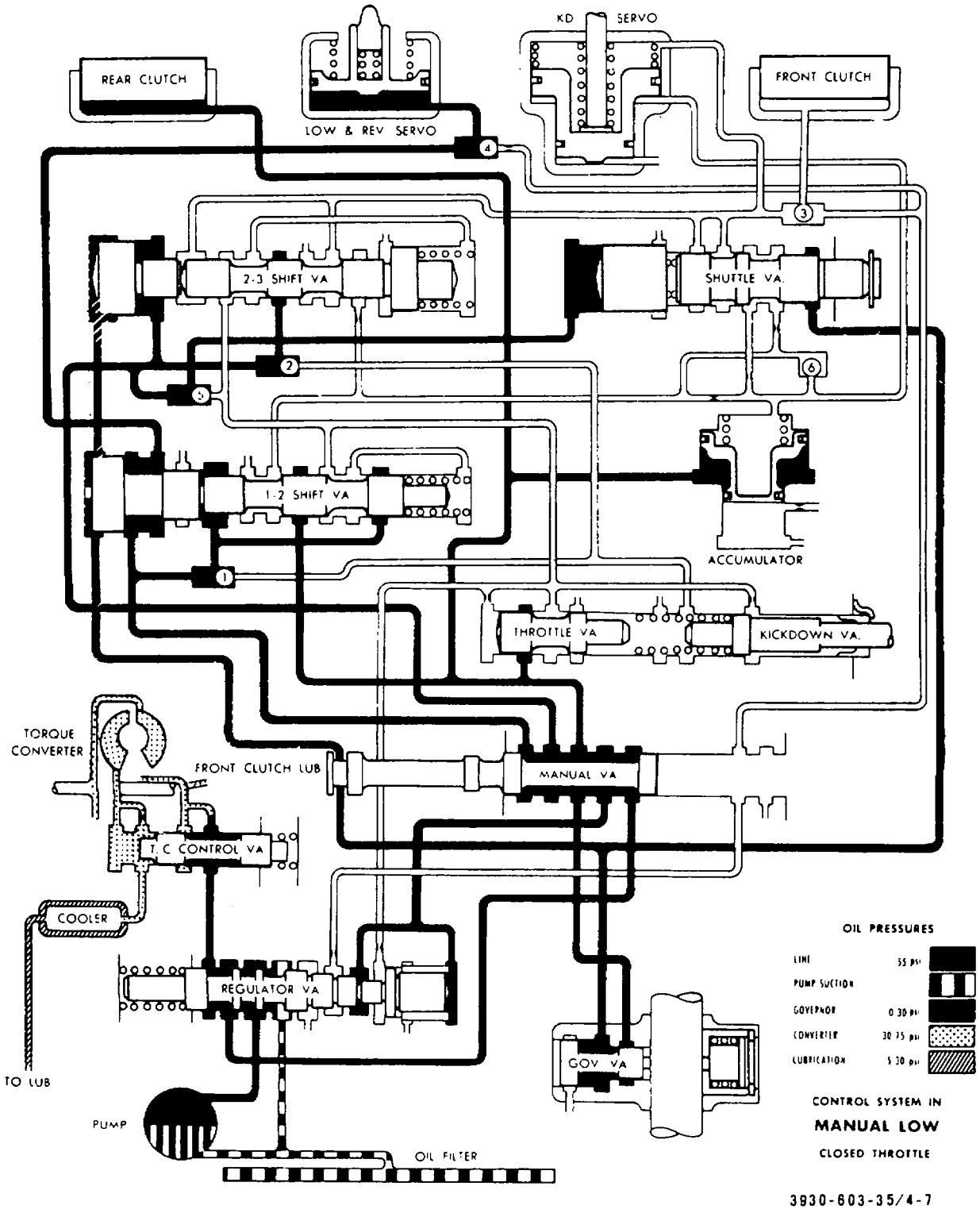


Figure 4-7. Selector lever low-hydraulic circuits.

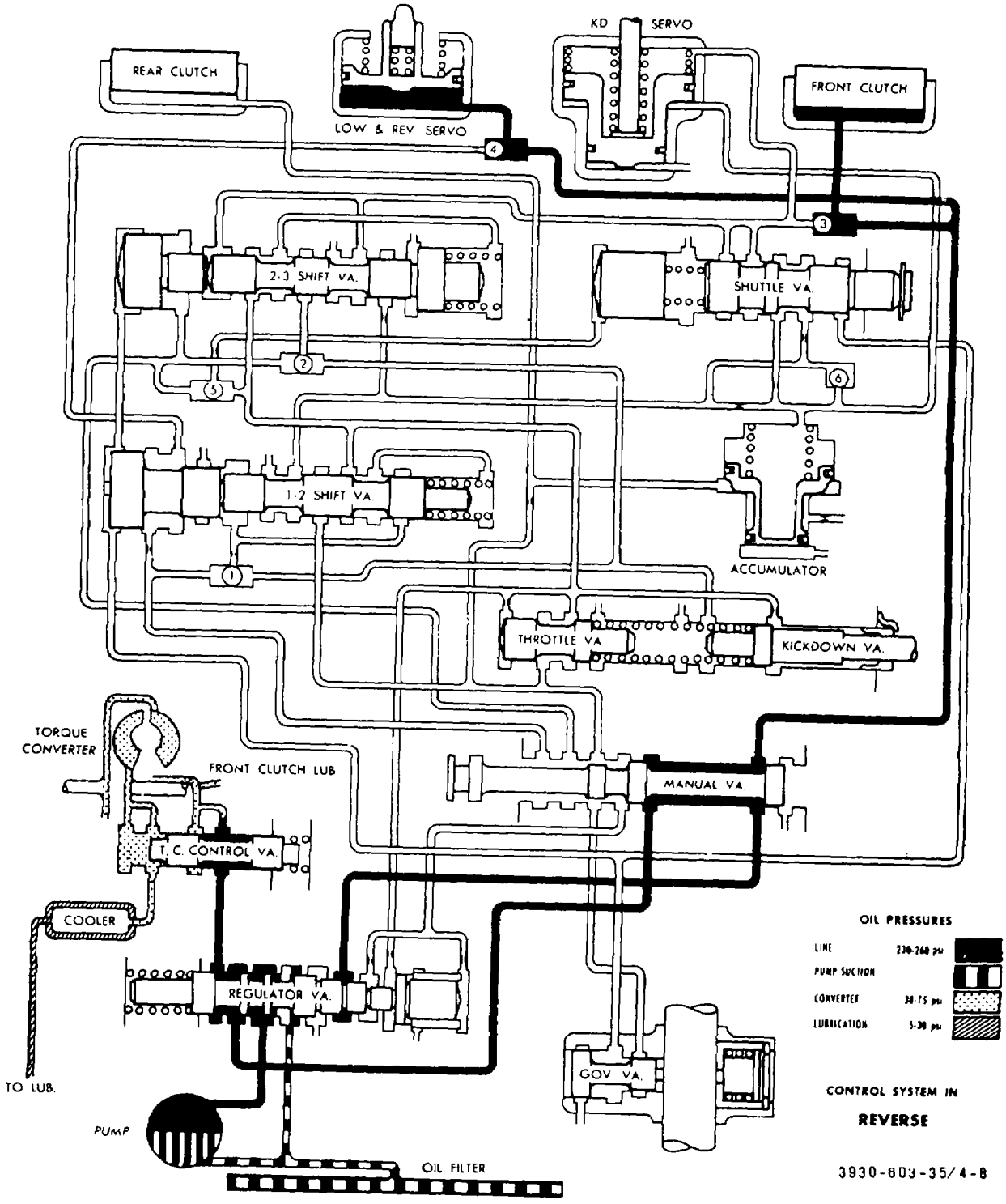


Figure 4-8. Reverse hydraulic circuit.

Section II. TRANSMISSION SERVICE AND REPAIR, IN TRACTOR

4-5. General

Various transmission components can be removed for repairs without removing transmission from tractor. The removal, reconditioning and installation procedures for these components are covered in this Section.

4-6. Aluminum Thread Repair

a. Damaged or worn threads in the aluminum transmission case and valve body can be repaired by use of heli-coils. Essentially, this repair consists of drilling out worn or damaged threads, tapping hole with a special heli-coil tap, and installing a helicoil insert into tapped hole. This brings the hole back to its original thread size.

b. Some thread drag may occur in screwing a bolt into installed heli-coil insert. Therefore, a torque reading must be taken of thread drag with an inch-pound torque wrench and added to specific bolt torque, so that all bolts securing a particular part will be tighten to same torque.

4-7. Periodic Service and Adjustment

Transmission adjustments, fluid or filter changes must be made at normal intervals (LO 10-3930-603-12). If service includes prolonged operation of unusually heavy loads, especially in dry, dusty and hot weather, periodic adjustments and changes must be made more frequently.

a. Drain transmission oil pan (LO 103930603-12).

b. Drain torque converter (para 2-10). After draining, reinstall drain plug and tighten to 14 foot-pounds torque.

c. Remove transmission oil pan as illustrated in figure 2-8.

d. Wash transmission oil pan with an approved cleaning solvent and dry thoroughly with moisture free compressed air.

e. Adjust low and reverse band (para 2-12).

f. Adjust kickdown band (para 2-12).

g. Adjust gearshift control cable (para 212).

h. Replace fluid filter element (fig. 2-9).

i. Use a new gasket and install transmission oil pan as illustrated in figure 2-8.

j. Refill transmission with fluid (LO 103930-603-12).

4-8. Gearshaft Actuator, Removal and Installation

a. Remove and install gearshift actuator as illustrated in figure 4-9.

b. Adjust gearshift actuator cable (para 212).

4-9. Output Shaft Oil Seal Removal and Installation

a. Disconnect propeller shaft at transmission and remove parking brake and drum assembly (TM 10-3930-603-12).

b. Screw tapered end of removal tool into oil-seal (8, fig. 4-10), then tighten screw of oil and remove oil seal from extension housing (5).

c. To install a new seal (8), position seal in opening of extension housing (5) with lip of seal facing in, and drive into extension housing with installation tool.

d. Install hand brake assembly and propeller shaft (TM 10-3930-603-12).

4-10. Extension Housing Removal

a. Remove output shaft oil seal from transmission extension housing (para 4-9).

b. Remove -two bolts (fig. 2-2) securing transmission extension housing to tractor frame.

c. Raise transmission slightly with a service jack. Remove six screws and washer assemblies (4, fig. 4-10) securing extension housing (5) to transmission case (24) and remove extension housing and gasket (3).

4-11. Extension Housing Bearing Replacement

a. Remove retaining ring (7, fig. 4-10) and drive ball bearing (6) out of extension housing (5).

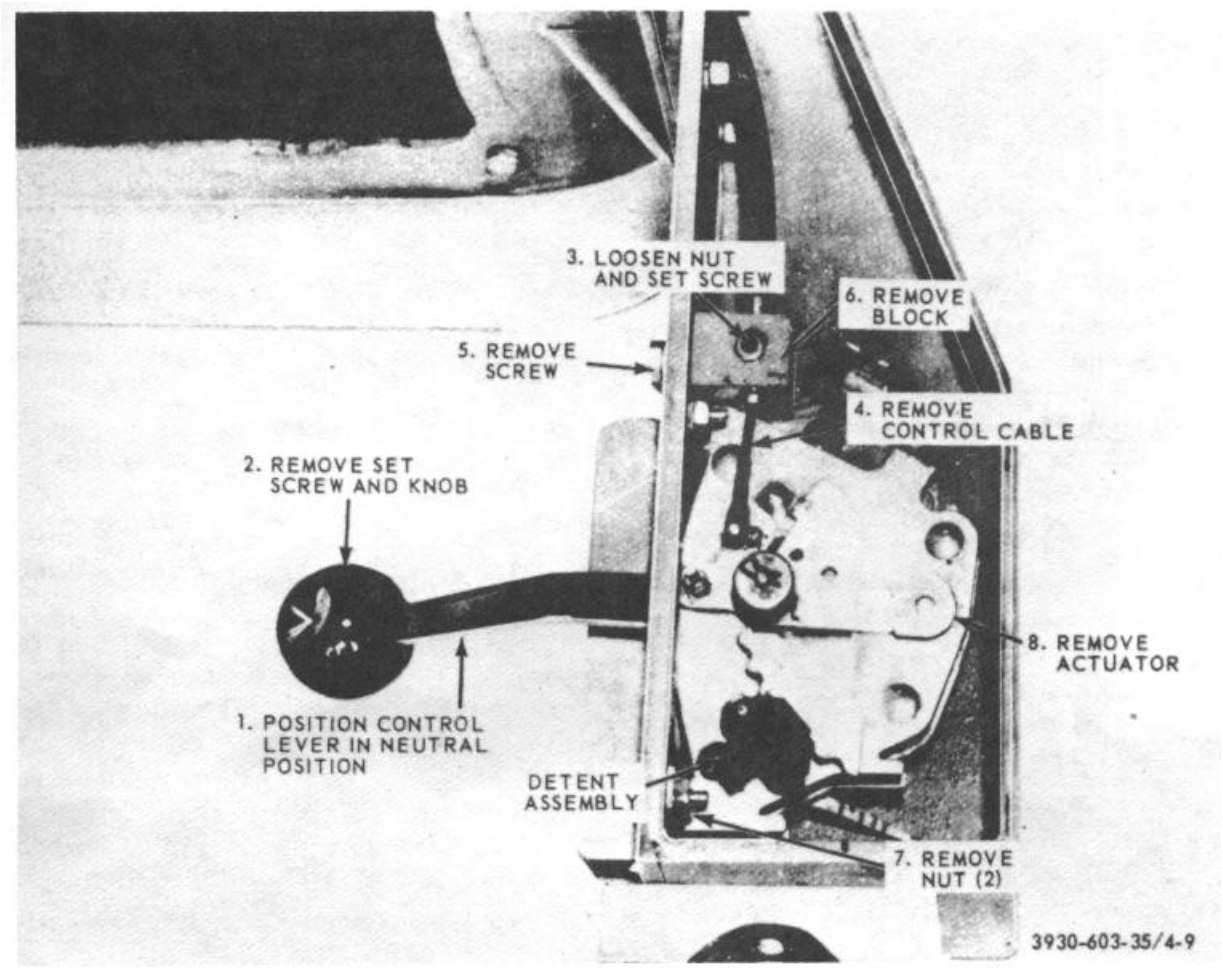


Figure 4-9. Gearshift actuator assembly, removal and installation.

b. Position a new ball bearing (6) in rear end of extension housing (5) and drive bearing into housing until it bottoms in housing.

c. Install bearing retaining ring (7) in extension housing (5).

4-12. Extension Housing Installation

a. Position a new gasket (3) and extension housing (5) on transmission case (24) and install six screw and washer assemblies (4). Tap housing into place and torque mounting bolts to 24 ft-pounds.

b. Remove service jack from under transmission and install two bolts (fig. 2-2) and secure extension housing to tractor frame.

c. Install output shaft oil seal (para 4-9).

4-13. Governor Assembly, Removal and Disassembly

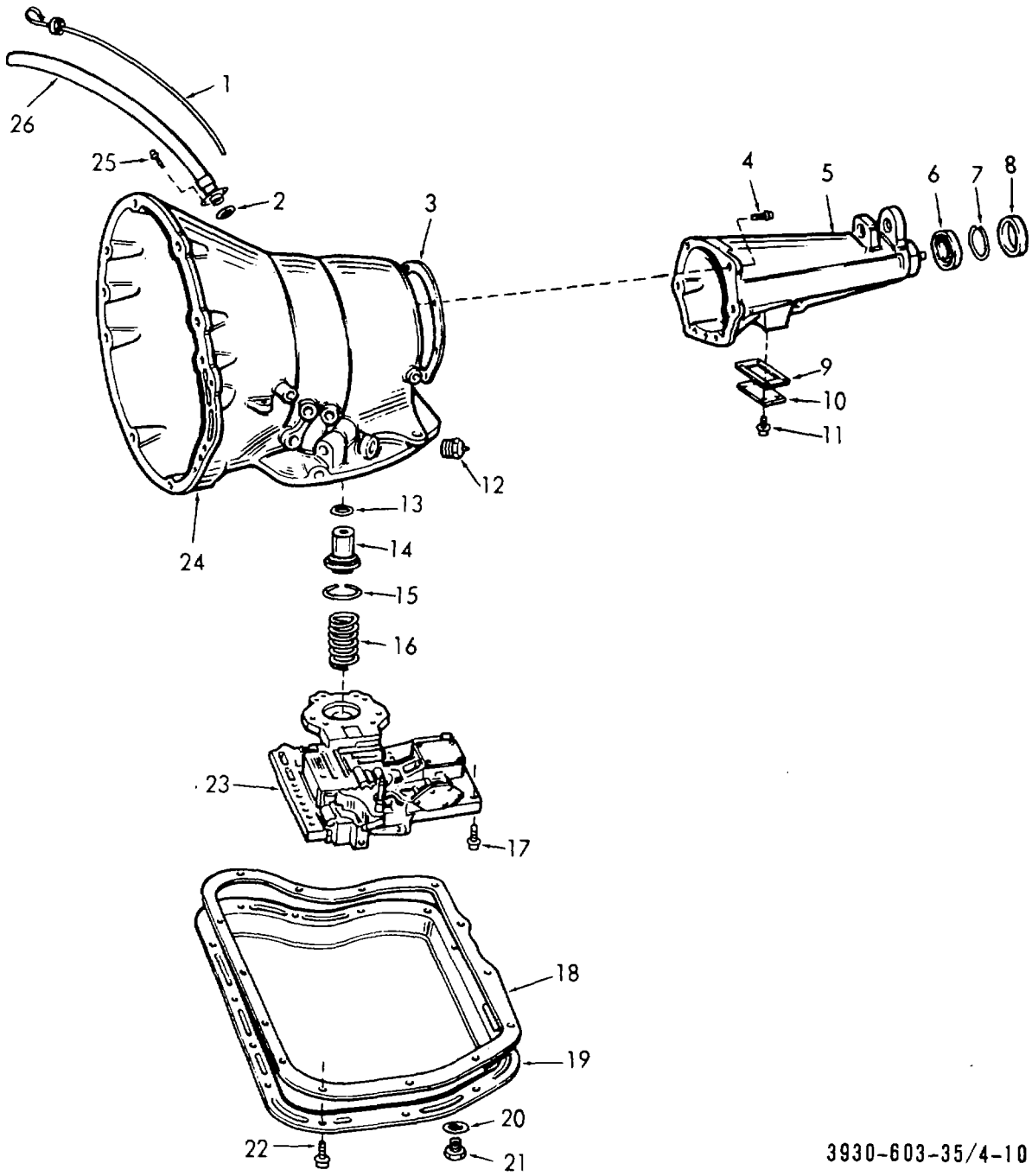
a. Remove extension housing (para 4-10).

b. Remove retaining ring (1, fig. 4-11) from weight end of governor shaft (9) and slide valve and shaft assembly out of governor body.

c. Remove and disassemble remaining parts of governor assembly as illustrated in figure 4-11.

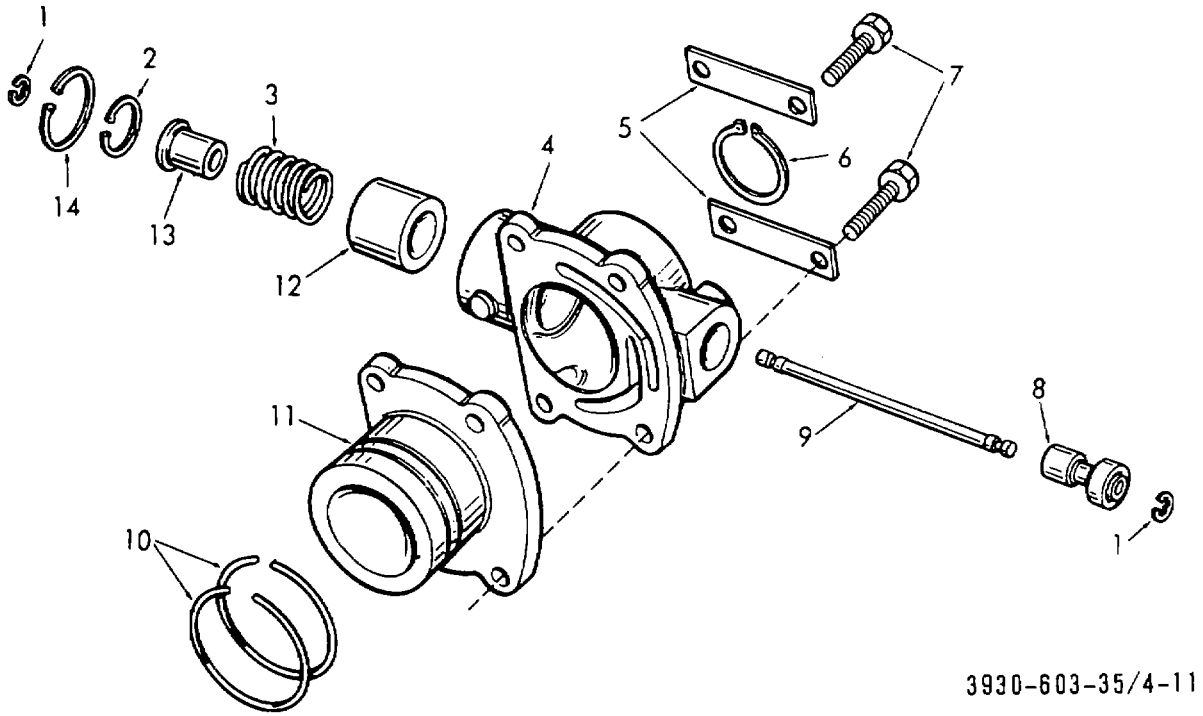
4-14. Governor Assembly, Cleaning and Inspection

a. The primary cause of governor operating failure is due to sticking governor valve or weights.



1 Oil level indicator
2 Oil filler tube seal
3 Extension housing gasket
4 Screw and washer assembly
5 Extension housing
6 Ball bearing
7 Retaining ring
8 Output shaft oil seal
9 Parking lock cover gasket
10 Parking lock cover
11 Screw and washer assembly
12 Neutral starting switch
13 Seal ring
14 Accumulator piston
15 Seal ring
16 Accumulator spring
17 Machine screw
18 Oil pan gasket
19 Oil pan
20 Drain plug gasket
21 Drain plug
22 Screw and washer assembly
23 Control valve assembly
24 Transmission case assembly
25 Screw and washer assembly
26 Oil filler tube

Figure 4-10. Transmission case, extension housing and control valve exploded views.



1 Outer retaining ring
2 Retaining ring
3 Weight spring
4 Governor body
5 Bolt lock
6 Retaining ring
7 Hex head bolt
8 Governor valve
9 Governor shaft
10 Seal ring
11 Governor support
12 Outer weight
13 Inner weight
14 Retaining ring

Figure 4-11. Governor assembly, removal, disassembly, reassembly and installation.

b. Clean all parts with an approved cleaning solvent and dry thoroughly.

c. Inspect all parts for free movement.

d. Remove rough surfaces with a fine crocus cloth.

e. Replace all defective parts.

4-15. Governor Assembly, Reassembly and Installation

a. Assemble governor body (4, fig. 4-11) to support (11) and install bolt locks (5) and bolts (7). Tighten bolts finger tight. Make sure oil passage of governor body aligns with passage in support.

b. Position body and support assembly on output shaft. Align assembly so governor valve shaft hole in governor body aligns with hole in output shaft, then slide assembly into plane.

c. Install retaining ring (6) and tighten bolts (7) ,to 100 inch-pounds torque and bend ends of bolt locks (5) over bolt heads.

d. Assemble outer weight (12), spring (3), inner weight (13) and install retaining rings (2 and 14).

e. Place governor valve (8) on shaft (9) and install one retaining ring (1).

f. Insert assembled valve and shaft into governor body, through governor weights and install second retaining ring (1). Inspect valve and weight assembly for free movement after installation.

g. Install extension housing (para 4-12).

Section III. TORQUE CONVERTER

4-16. General

The transmission torque converter (6, fig. 24) is attached to engine crankshaft through a flexible driving plate. Cooling of the torque converter is accomplished by circulating transmission fluid through an oil-to-water type cooler, located in the tractor radiator lower tank. The torque converter assembly is a sealed unit and cannot be disassembled. The starter ring gear is mounted directly on outer diameter of converter front cover.

4-17. Torque Converter Removal

a. Remove transmission and torque converter assembly (para 2-10).

b. Remove "c" clamp from edge of bell housing which was installed during transmission removal to hold torque converter in place.

c. Carefully slide torque converter out of transmission assembly.

4-18. Torque Converter Flushing

a. In the event any part has failed in transmission, the torque converter must be flushed to insure that fine metal particles are removed so they are not later transferred back into a reconditioned transmission.

b. Remove torque converter from transmission (para 4-17).

c. Place torque converter in an upright position and pour two quarts of an approved cleaning solvent into converter through impeller hub.

d. Turn and shake converter so as to swirl solvent through internal parts. Turning turbine and stator with transmission input and reaction shafts will aid in dislodging foreign material.

e. Position converter in its normal operation position with drain plug at its lowest point. Remove drain plug and drain solvent, rotate turbine and stator, and shake converter while draining to prevent dirt particles from settling.

f. Repeat flushing operation c through e above, at least once, or as many times as required until solvent drained out is clear.

g. After flushing, shake and rotate converter several times with drain plug removed to remove any residual solvent and dirt. Flush any remaining solvent from converter with two quarts of new transmission fluid, This will prevent any adverse effect solvent may have on transmission seals.

h. Install -torque converter drain plug and tighten to 14 foot-pounds torque.

4-19. Starter Ring Gear Replacement

a. Removal.

(1) Remove torque converter from transmission (para 4-17).

(2) Cut through weld material at rear side of ring gear (fig. 4-12) with a hack saw or grinding wheel. Be careful not to out or grind into front cover stamping.

(3) Scribe a heavy line on front cover next to front face of ring gear to aid in locating new ring gear on torque converter.

(4) Support converter with four lug faces resting on blocks of wood (fig. 4-12).

Caution

The converter must not rest on front cover hub during this operation.

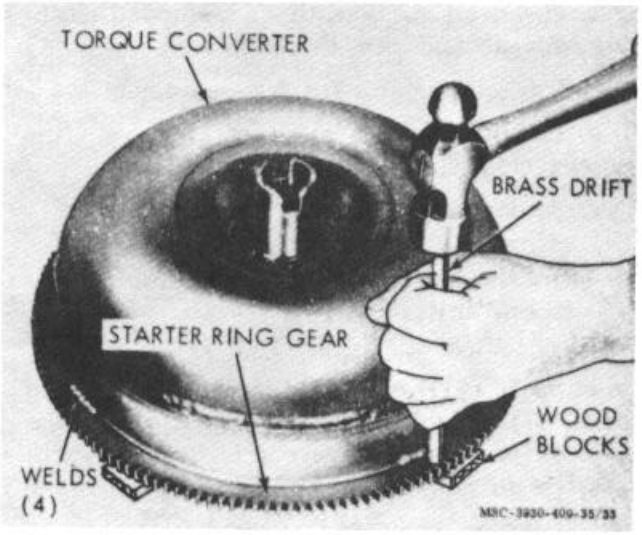


Figure 4-12. Starter ring gear removal.

(5) Use a blunt chisel or drift hammer; tap downward on ring gear near weld areas to break any remaining weld material. Tap around ring gear until it is removed from torque converter.

(6) Smooth off weld areas on cover with a file.

b. Installation.

(1) Place ring gear in an oven and set temperature at 200°F. Allow ring gear to remain in oven for 15 to 20 minutes.

(2) After ring gear is expanded by heating, place gear in position on torque converter front cover. Tap gear on cover evenly with a plastic or rawhide mallet until front face of gear is even with scribed line (made during removal) on front cover. Make sure gear is even with scribed line around full circumference of front cover.

(3) Weld ring gear to torque converter front cover, being careful to place, al nearly as possible, same amount of weld material in exactly same location as was used in original weld, this is necessary in order to maintain proper balance of unit. Place welds alternately on opposite sides of converter to minimize distortion.

(4) Use a DC Welder set at straight polarity or an AC Welder. Do not gas weld. Use a 1/8 in. diameter welding rod, and a current of 80 to 125 amps. Direct arc to intersection of gear and front cover from an angle of 45 degrees from rear face of gear.

(5) Inspect gear teeth and remove all nicks where metal is raised and weld metal splatter to ensure quiet starter operation.

4-20. Torque Converter Installation

a. Rotate pump rotors until two small holes in tool handle are vertical as illustrated in figure 4-13.

b. Carefully slide converter assembly over input shaft. Make sure converter impeller shaft slots are also vertical and fully engage front pump inner rotor lugs.

c. Inspect for full engagement by placing a straightedge on face of case as illustrated in figure 4-14. The surface of converter front cover lug should be at least 1/2 inch to rear of straightedge when converter is pushed all way- into transmission.

d. Attach a small "C" clamp to edge of converter housing to hold converter in place before and during transmission installation.

e. Install transmission and torque converter assembly (para 2-11).

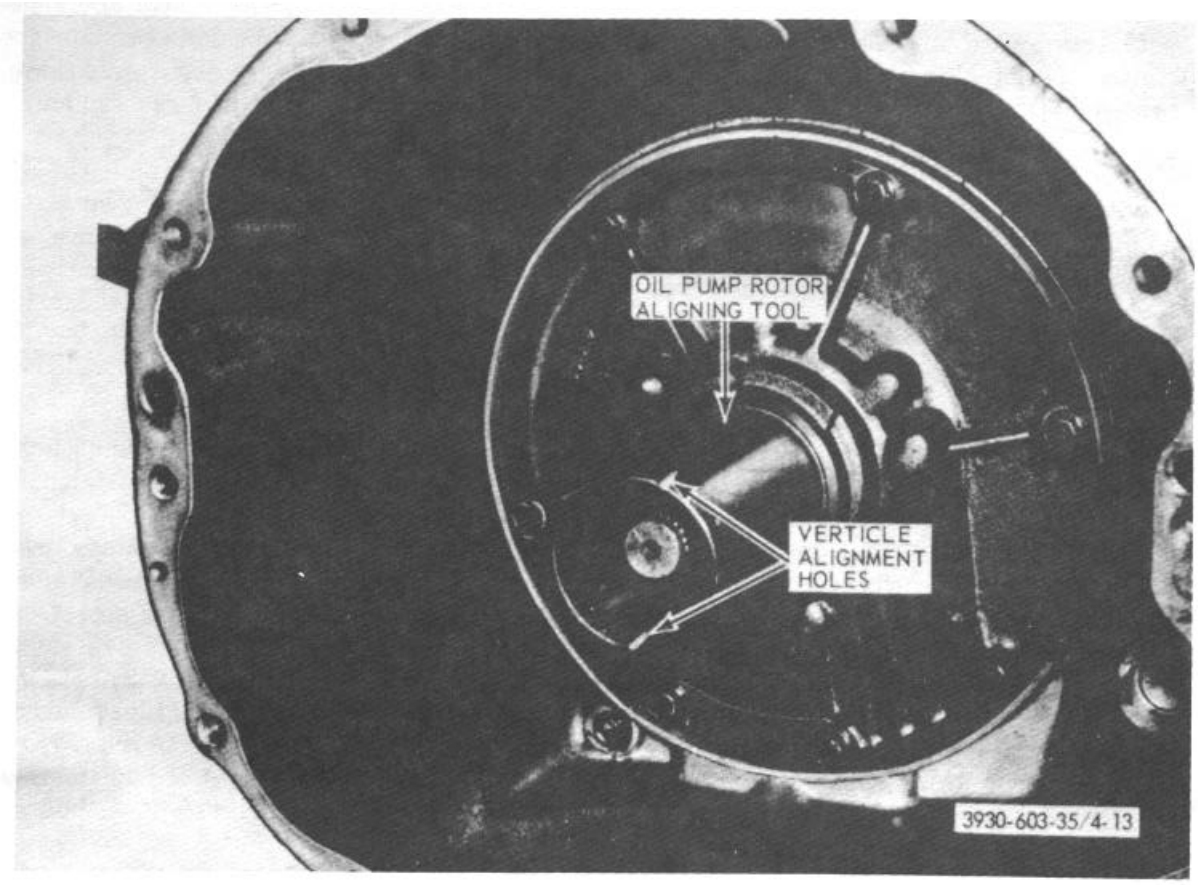


Figure 4-13. Aligning oil pump rotors.

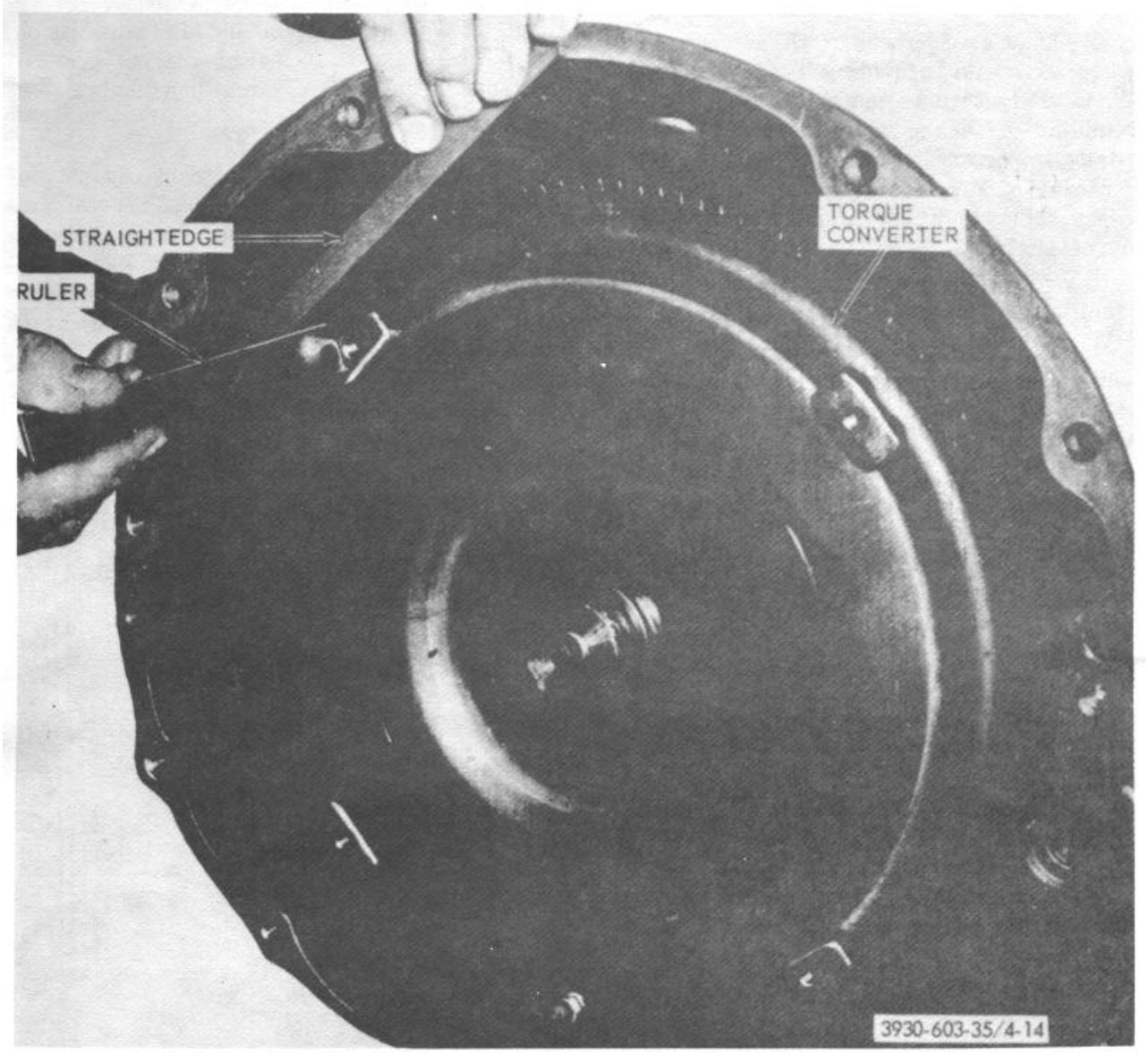


Figure 4-14. Measuring torque converter for full engagement in transmission

Section IV. PREPARATION OF TRANSMISSION FOR DISASSEMBLY

4-21. General

a. Place transmission in a repair stand as illustrated in figure 2-3. Prior to removing transmission sub-assemblies, plug all openings and thoroughly clean exterior of unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be over emphasized. When disassembling, each part must be washed in an approved cleaning solvent and dried thoroughly with moisture free compressed air. Do not wipe parts with shop towels.

b. All mating surfaces in transmission are accurately machined; therefore careful handling of parts must be exercised to avoid nicks and burrs.

4-22. Special Reconditioning Instructions

a. The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on valves, use extreme care to avoid rounding off sharp edges. The sharp edge is vitally important to valves. Sharp edges prevent dirt and foreign matter from getting between valves and body, thus reducing possibility of sticking.

b. When it becomes necessary to recondition transmission assembly always install new seals and gaskets.

c. Hell-coil inserts are recommended for repairing damaged, stripped or worn threads in aluminum parts.

d. Pre-sized bushings are available for replacement of most all bushings in transmission. Two bushings in sun gear are not serviced because of low cost of sun gear assembly.

4-23. Drive Train End Play

a. Always measure drive train end play of transmission before disassembly. This will indicate when a thrust washer change between reaction shaft support and front clutch retainer is required to properly adjust end play during reassembly (except when major parts ,are replaced).

b. Attach a dial indicator to transmission bell housing with its plunger seated against end of input shaft (fig. 4-15).

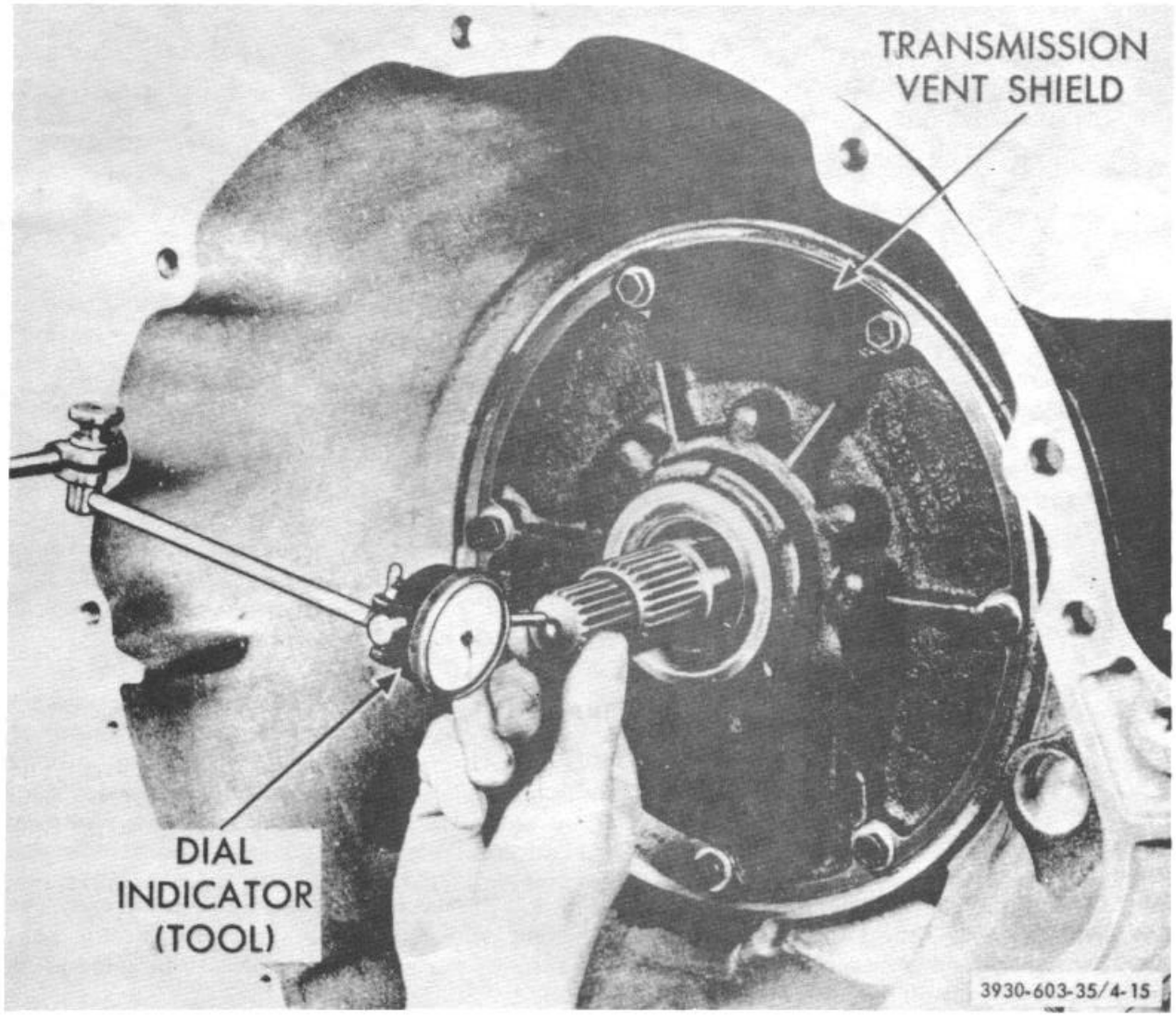


Figure 4-15. Measuring drive train end play.

c. Chuck input shaft in and out to obtain end play reading.

d. Record indicator reading for reference when reassembling transmission. End play allowances are from 0.036 to 0.084 inch.

Section V. CONTROL VALVE AND ACCUMULATOR PISTON

4-24. General

The hydraulic control valve assembly consists of manual, kickdown, torque control, throttle control, regulator, shuttle and shift valves all installed in a control valve housing.

4-25. Control Valve and Accumulator Piston Removal and Disassembly

a. Removal.

(1) Remove transmission and torque converter (para 2-10).

(2) Place transmission assembly in a repair stand (fig. 2-3) and remove oil pan as illustrated in figure 2-8.

(3) Remove fluid filter and control valve assembly as illustrated in figure 2-15.

b. Disassembly.

Caution

Never clamp any portion of valve body or transfer plate in a vise. Any slight distortion of aluminum body or transfer plate will result in sticking valves, excessive leakage or both. When removing or installing valves or plugs, slide them in or out carefully. Do not use force.

(1) Place control valve assembly in a repair stand as illustrated in figure 4-16.

(2) Hold spring retainer (2, fig. 4-17) firmly against spring force. Remove three screw and washer assemblies (1). Remove spring retainer, (2) torque converter control valve spring (39), regulator valve spring (41) with line pressure adjusting screw assembly (8).

Note

Do not alter setting of line pressure adjusting screw and nut. The nut has an interference thread and does not turn easy on screw.

(3) Carefully slide regulator valve (40) out of valve body (20).

(4) Remove seventeen screw and washer assemblies (3, fig. 4-16), and carefully lift transfer plate (2) and valve body plate (12) off valve body.

(5) Invert transfer plate (2) and remove stiffner plate (4). Remove remaining screws securing valve body plate (12) to transfer plate (2) and carefully lift off valve body plate (I2).

(6) Note location of six steel balls in valve body (fig. 4-18), and remove balls from valve body. One ball is larger than other five and is in larger chamber.

(7) Remove front pump check valve (35, Fig. 4-17) and check valve spring (36) from valve body (20).

(8) Invert valve body and lay it on clean cloth or paper. Remove E-lip and washer from throttle lever shaft (Fig 4-19). Remove any burrs from shaft, then while holding manual lever detent ball and spring in their bore, slide manual lever off throttle shaft. Remove detent ball and spring.

(9) Remove manual valve (11, fig. 4-17), carefully slide it out of valve body (20) with a rotating motion.

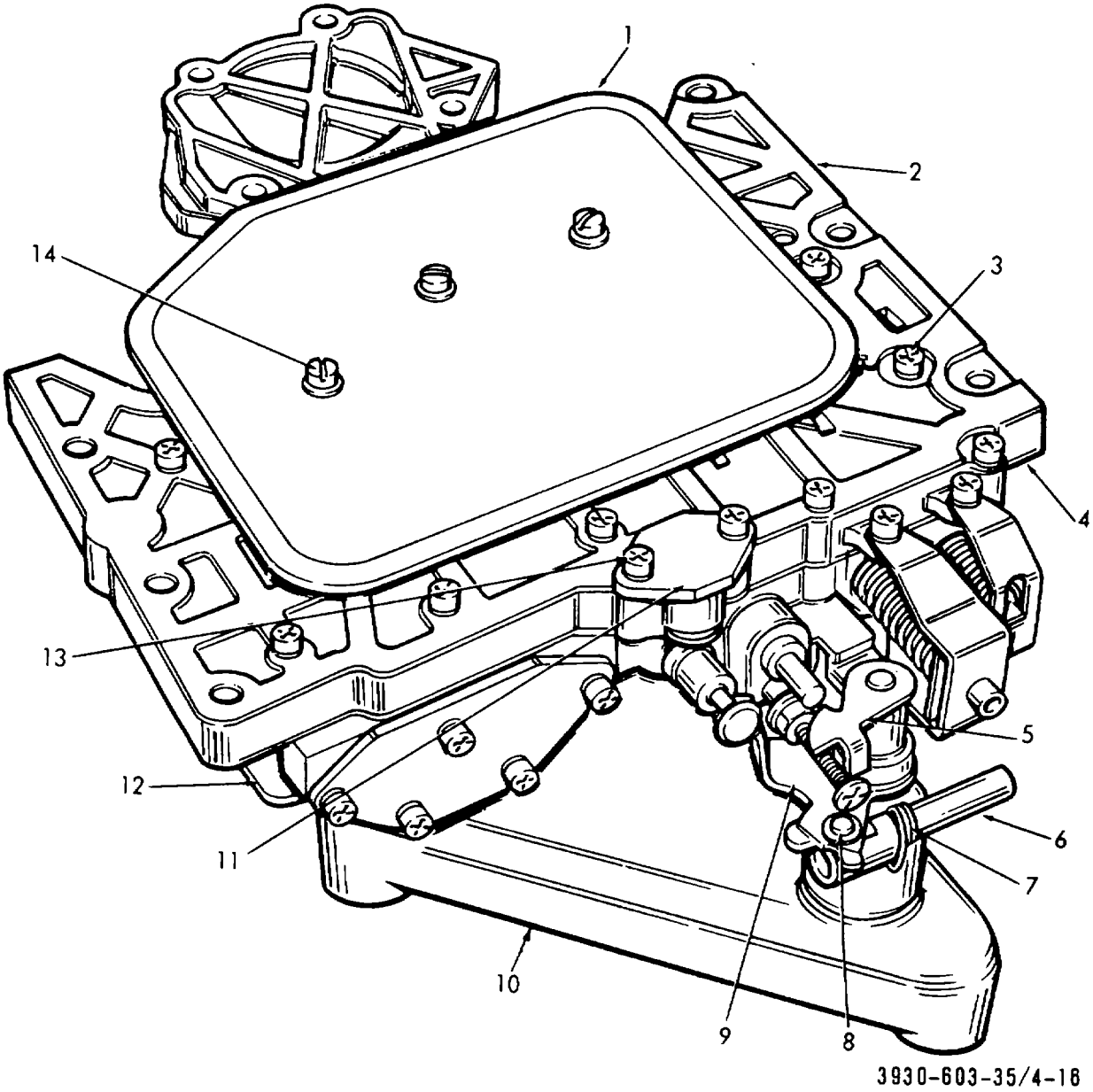
(10) Remove throttle valve lever (5, fig. 4-16) from valve body.

(11) Remove four screw and washer assemblies (22, fig. 4-17) securing shuttle cover (21) and remove cover.

(12) Remove throttle lever stop screw assembly (5) being careful not to disturb setting any more than necessary.

(13) Remove kickdown detent (7), kickdown valve (8), throttle valve spring (9) and throttle valve (10).

(14) Remove two screw and washer assembly (14) and shuttle plug cover (15) from valve body (20). Tip up valve body to allow shuttle valve plug



1 Fluid filter
2 Transfer
3 Screw and washer assembly
4 Stiffner plate
5 Throttle valve lever
6 Adapter and pin assembly
7 Adapter spring
8 Retaining ring
9 Manual valve lever
10 Repair stand
11 Block valve cover assembly
12 Valve body plate
13 Screw and washer assembly
14 Screw and washer assembly

Figure 4-16. Control valve assembly, installed in repair stand

(16) spring (17), shuttle valve (18) and valve plugs (12 and 19) to slide out into hand.

(15) Note longer stem on valve plug (12) as a means of identification.

(16) Remove two screw and washer assemblies (24), shift valve cover (25) valve springs (20 and 28), and shift valves (23 and 29) from valve body (20).

(17) Remove two screw and washer assemblies (31), regulator valve cover (30), and slide regulator valve sleeve (32) line pressure plug (33) and throttle pressure plug (34) out of valve body (20).

4-26. Control Valve and Accumulator Piston Cleaning and Inspection

a. Clean all parts in an approved cleaning solvent, allow them to soak, then dry thoroughly with moisture free compressed air.

b. Blow out all passages in valve body and make sure they are clean and free from obstruction.

c. Inspect manual and throttle valve operating levers and shafts for bends, wear or loose fits. If a lever is loose on its shaft, it may be silver soldered only, or lever and shaft assembly must be replaced.

Caution

Do not attempt to straighten bent levers.

d. Inspect all mating surfaces for burrs, nicks and scratches. Minor blemishes can be removed with a fine crocus cloth, using only a very light pressure. Use straightedge, and inspect all mating surfaces for warpage or distortion. Slight distortion can be corrected, using a surface plate. Make sure all metering holes in steel plate are open. Use a pen light, inspect bores in valve body for scores, scratches, pits and other irregularities.

e. Inspect all valve springs for distortion and collapsed coils.

f. Inspect all valves and plugs for burrs, nicks and scores. Small nicks and scores can be removed with crocus cloth, providing extreme care is taken not to round off sharp edges. The sharpness of edges is vitally important because it prevents foreign matter from lodging between valves and valve body, thus reducing possibility of sticking. Inspect valves and plugs for freedom of operation in valve body bores. When bores, valves and plugs are clean and dry, valve and plug must fall freely into bores.

g. Valve body bores do not change dimensionally with use. Therefore, a valve body that was functioning properly when unit was new, will operate correctly if it is properly and thoroughly cleaned. There is no need to replace valve body unless it is damaged during handling.

h. Inspect two accumulator seal rings (13 and 15, fig. 4-10) for wear and make sure they turn freely in piston grooves. It is not necessary to remove rings for inspection unless exterior condition warrants. Inspect accumulator piston for nicks, burrs, scores and wear. Inspect piston bore in transmission case for scores or other damage. Inspect accumulator spring (16) for distortion.

i. Replace all defective parts.

4-27. Control Valve and Accumulator Piston Reassembly and Installation

a. Reassembly.

(1) Position valve body separator plate (fig. 4-19) on transfer plate. Install stiffener plate and secure with two stiffener plate screws. Make sure all bolt holes are aligned and torque stiffener plate screws to 28 inch-pounds.

(2) Position valve plug (12, fig. 4-17) and valve plug (19) in their respective bores in valve body (20). Install shuttle valve (18), valve spring (17), shuttle valve plug cover (15) and secure with two screw and washer assemblies (14). Tighten screws to 28 inch-pounds torque.

(3) Install E-clip (fig. 4-19), on end of shuttle valve. Install shuttle valve cover plate and four cover screws, and tighten screws to 28 inch-pounds torque.

(4) Install shift valve (23, fig. 4-17), shift valve (29), valve spring (26),

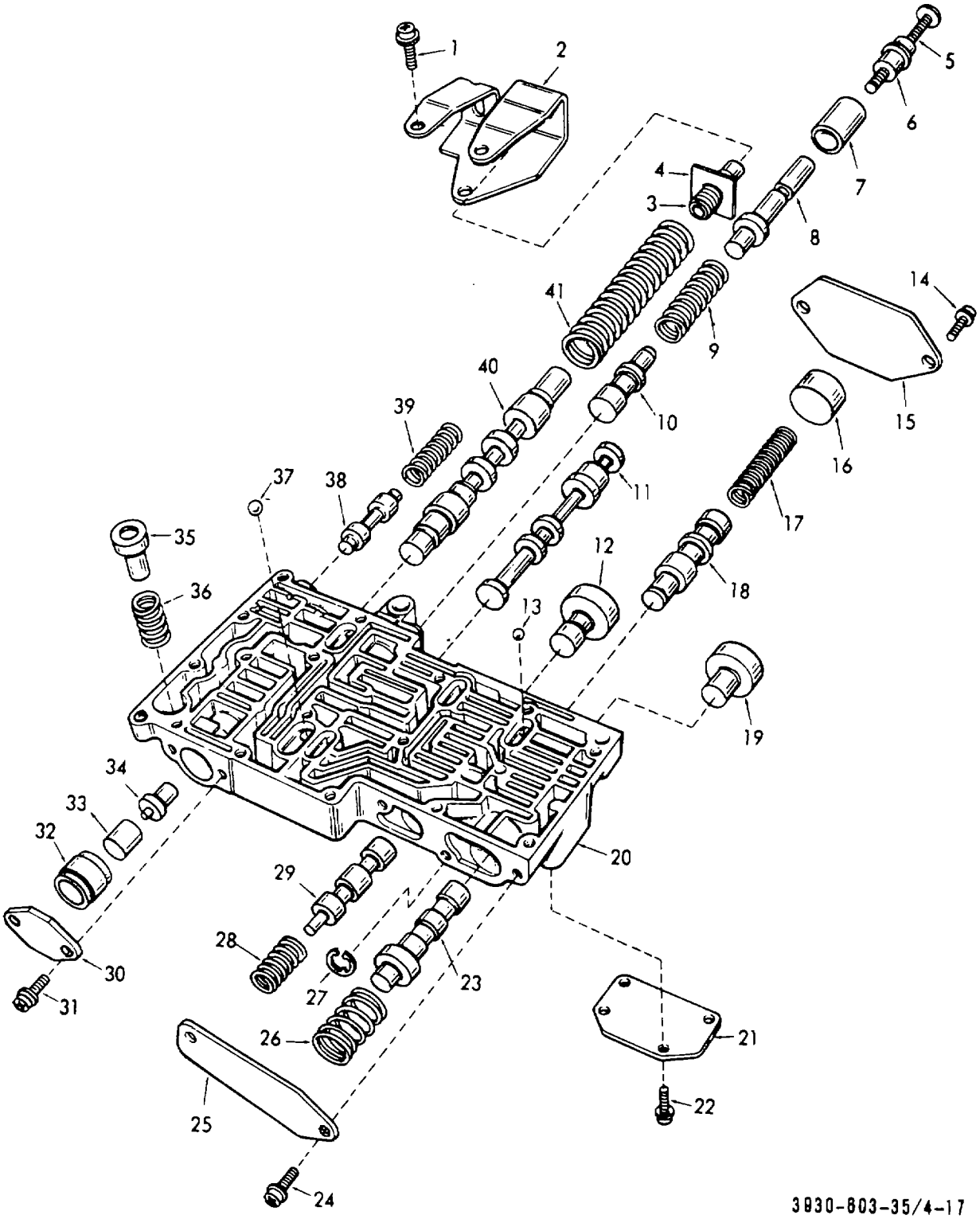


Figure 4-17. Control valve assembly, disassembly and reassembly.

1 Screw and washer assembly
2 Spring retainer
3 Adjusting screw
4 Adjusting nut
5 Throttle lever stop screw assembly
6 Lock nut
7 Kickdown detent
8 Kickdown valve
9 Throttle valve spring
10 Throttle valve
11 Manual valve
12 Valve plug, 1st. and 2nd.
13 Check valve ball, small
14 Screw and washer assembly
15 Shuttle valve plug cover
16 Shuttle valve plug
17 Valve spring
18 Shuttle valve
19 Valve plug 2nd and 3rd
20 Control valve body
21 Shuttle cover
22 Screw and washer assembly
23 Shift valve 2nd and 3nd
24 Screw and washer assy.
25 Shift valve cover
26 Valve spring 2nd & 3rd
27 Retaining ring
28 Valve spring 1st & 2nd
29 Shift valve 1st & 2nd
30 Regulator valve cover
31 Screw and washer assy
32 Regulator valve sleeve
33 Line pressure plug
34 Throttle pressure plug
35 Front pump check valve
36 Check valve spring
37 Check valve ball, large
38 Converter control valve
39 Valve spring
40 Regulator valve
41 Valve spring

Figure 4-17-Continued.

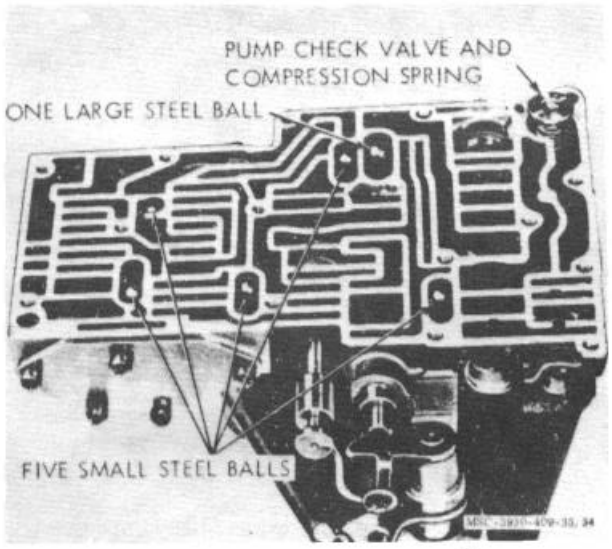


Figure 4-18. Location of Steel Balls in Valve Body.

valve spring (28), shift valve cover (25) in valve body (20) and secure with two screw and washer assemblies (24). Torque screws to 28 inch-pounds.

(5) Install throttle pressure plug (34), line pressure plug (33), regulator valve sleeve (32), regulator valve cover (30) in valve body (20) and secure with two screw and washer assemblies (31). Torque screws to 28 inch-pounds.

(6) Install throttle valve (10), throttle valve spring (9), kickdown valve (8), kickdown detent (7) (counterbore side of detent toward - valve), then assemble in valve body (20).

(7) Install throttle lever stop screw assembly (5) and tighten lock nut (6) finger tight.

(8) Install manual valve (11) in valve body (20).

(9) Install throttle lever shaft (fig. 4-19) on valve body. Insert detent spring and ball in its bole in valve body. Depress ball and spring and slide manual lever over throttle shaft so it engages manual valve and detent ball. Install retaining ring washer and E-clip on throttle shaft.

(10) Position valve body assembly on repair stand (fig. 4-16) and place six steel balls in valve body as illustrated in figure 4-18.

(11) Position transfer plate assembly (2, fig. 4-16) on valve body and install seventeen screw and washer assemblies (3), starting at center and working outward; tighten screws to 28 inch-pounds torque.

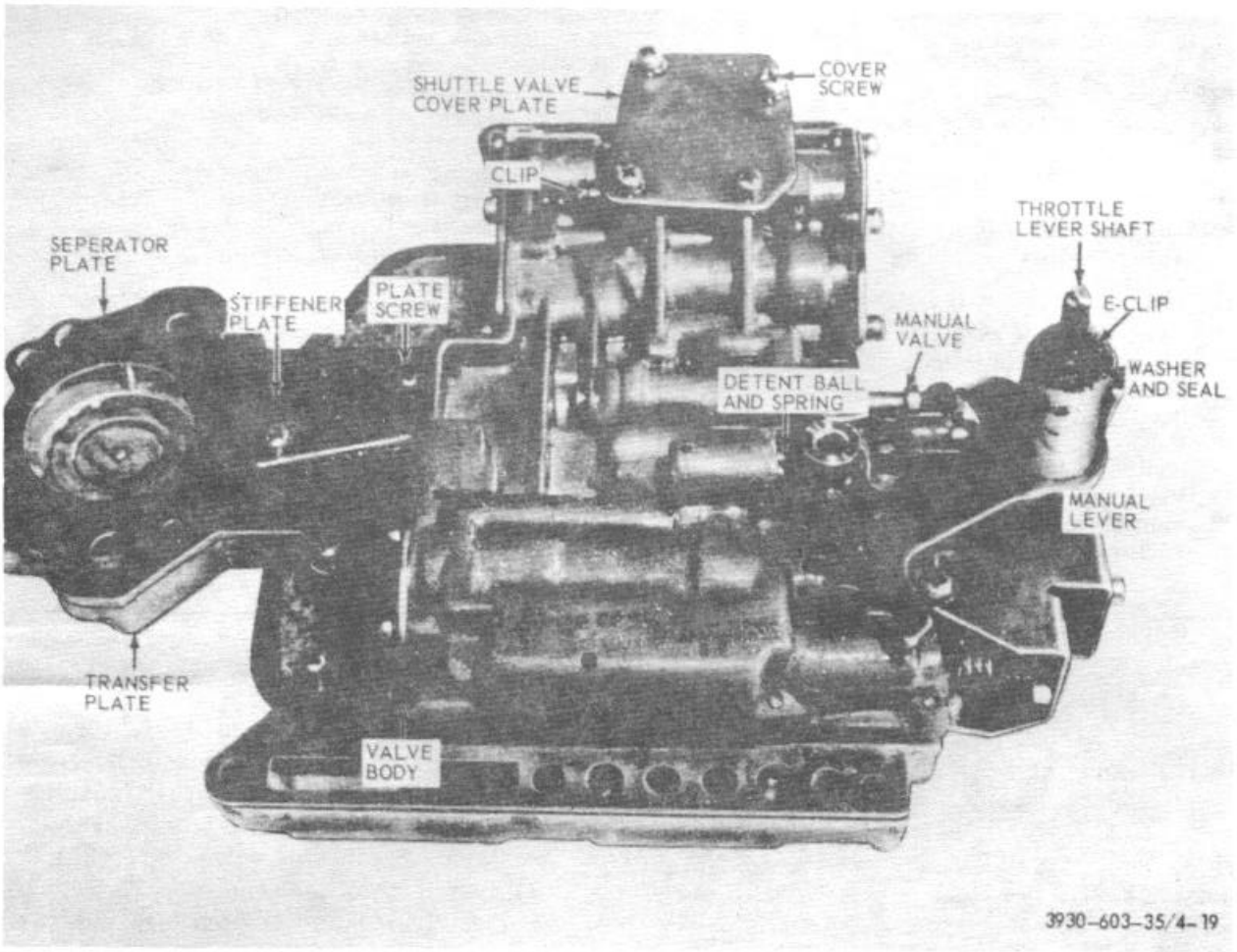


Figure 4-19. Valve body assembly, top view.

(12) Install torque converter control valve (38, fig. 4-17), regulator valve (40), valve spring (39), valve spring (41) and install adjusting screw (3) and adjusting nut (4) on end of regulator valve spring (41) with long dimension of nut at right angle to valve body.

(13) Install spring retainer (2) making sure converter valve spring (39) is engaged on tang and in position squarely on in retainer. Install three screw and washer assemblies (1) and tighten to 28 inch-pounds torque. Measure and aline spring retainer if necessary (para 2-13).

(14) Install fluid filter (1, fig. 4-16) on transfer plate (2) and secure with three screw and washer assemblies (14). Tighten screws to 28 inch-pounds torque.

(15) After control valve assembly has been serviced and completely assembled, adjust throttle and line pressure (para 2-14). However, if pressures were satisfactory prior to disassembly, use original settings.

b. Installation.

(1) Install control valve as illustrated in figure 2-15.

(2) Install transmission oil pan as illustrated in figure 2-7.

(3) Install transmission (para 2-11).

Section VI. FRONT OIL PUMP AND REACTION SHAFT

4-28. General

The front oil pump and reaction shaft is mounted in front portion of transmission case and is driven by the engine through torque converter. The single front pump furnishes pressure for all hydraulic and lubrication requirements.

4-29. Front Oil Pump and Reaction Shaft Oil Seal Replacement

a. The pump oil seal (fig. 4-20) can be replaced without removing pump and reaction shaft support assembly from transmission case.

b. Screw seal removal tool into seal, tighten screw portion of tool and remove seal.

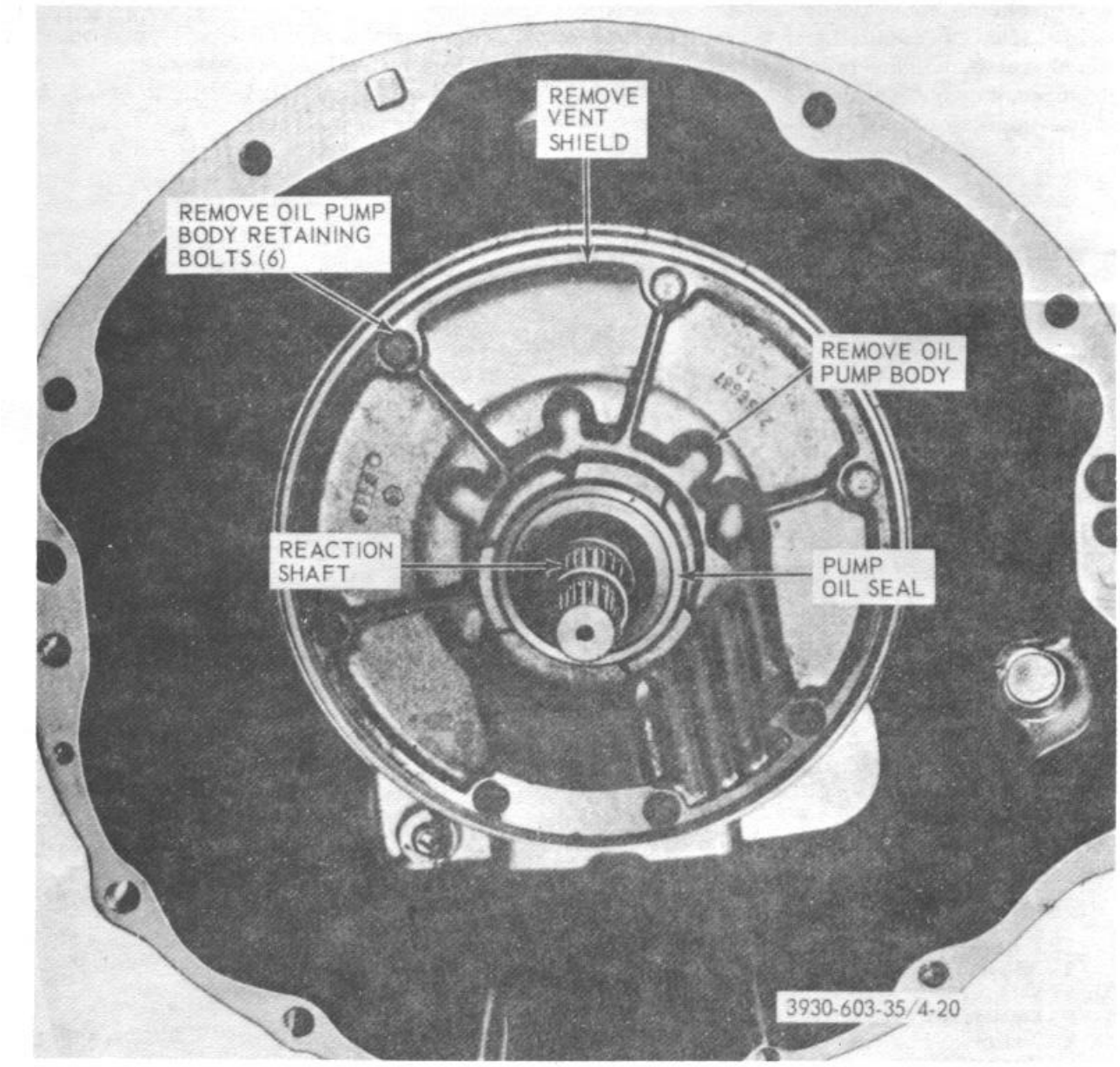


Figure 4-20. Oil pump housing and reaction shaft support removal.

c. To install a new seal, position seal in opening of pump housing with lip of seal facing inward. Use seal replacement tool, drive new seal into housing until it bottoms.

4-30. Front Oil Pump and Reaction Shaft Removal

a. Remove transmission assembly from tractor (para 2-10).

b. Remove torque converter (para 4-17).

c. Tighten front kickdown band adjusting screw (fig. 2-6) until band is tight on front clutch retainer. This prevents clutch retainer from coming out with oil pump, which could cause unnecessary damage to clutches.

d. Remove six oil pump body bolts (fig. 4-20).

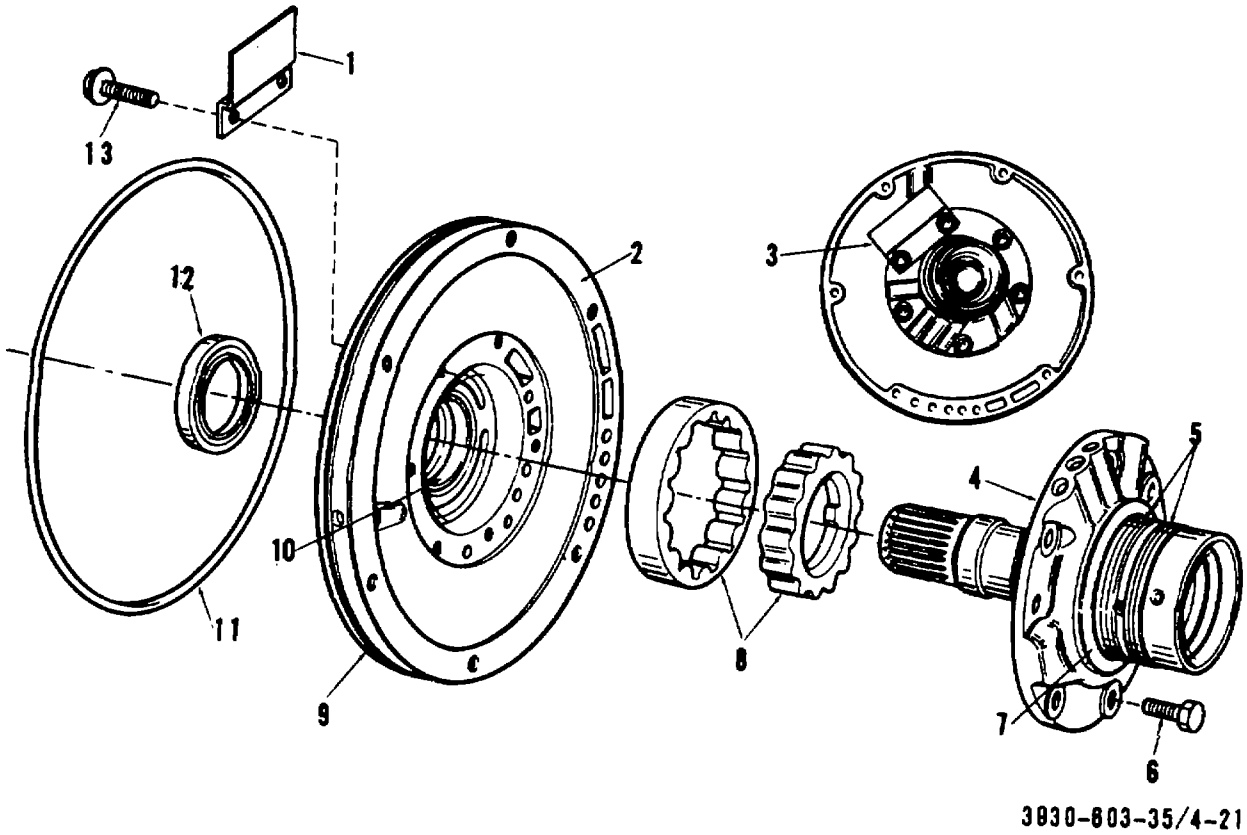
e. Attach two slide hammer pullers in two opposite holes (at 9 o'clock and 3 o'clock positions) from which pump body screws were removed.

f. Bump outward evenly on two puller weights and remove oil pump and reaction shaft support assembly from transmission case.

4-31. Front Oil Pump and Reaction Shaft Disassembly

a. Disassemble front oil pump and reaction shaft as illustrated in figure 4-21.

b. Drive oil seal (12) with a brass drift or a blunt punch.



1 Vent shield
2 Oil pump body gasket
3 Vent baffle
4 Reaction shaft and support assembly
5 Seal ring
6 Hex head bolt
7 Thrust washer
8 Pump rotor set
9 Oil pump body assembly
10 Bushing
11 Preformed packing
12 Oil seal
13 Screw and washer assembly

Figure 4-21. Oil pump housing and reaction shaft support, disassembly and reassembly.

4-32. Front Oil Pump Reaction Shaft Cleaning, Inspection and Repair

a. Cleaning. Wash all parts thoroughly with an approved cleaning solvent and dry thoroughly with moisture free compressed air.

b. Inspection.

(1) Inspect seal rings on reaction shaft support for wear or broken locks, make sure they turn freely in grooves. Do not remove seal rings unless they are to be replaced.

(2) Inspect oil pump body and reaction shaft support bushings for wear or scores. Inspect machined surface of pump body and reaction shaft support for nicks or burrs.

(3) Inspect pump rotors for scoring or pitting. With rotors cleaned and installed in pump body, place a straightedge across face of rotors and pump body. Use a feeler gage and measure clearance between straightedge and face of rotors. Clearance limits must be from 0.001 to 0.025 inch. Also, use a feeler gage, measure rotor tip clearance between inner and outer rotor tip teeth. Clearance must be 0.005 to 0;010 inch.

(4) Discard and replace all gaskets and seals.

c. Repair.

(1) *Pump bushing replacement.*

(a) Position pump housing on a clean smooth surface with rotor cavity down.

(b) Place removing head tool in bushing, and install tool handle in removing head as illustrated in figure 4-22.

(c) Drive bushing straight down and out of bore.. Be careful not to cock tool in bore.

(d) With pump housing on a smooth clean surface, hub end down, position a new bushing on installation tool head (fig. 4-22) and start bushing and installing head in bushing bore. Install tool handle and drive bushing into housing until it bottoms in pump cavity. Be careful not to cock tool during installation.

(e) Stake bushing in place with a blunt punch. A gentle tap of each stake slot location is adequate.

(f) Use a narrow blade knife or similar tool, to remove high points or burrs around staked area. Do not use a file that will remove more metal than necessary.

(g) Thoroughly clean pump housing before installation.

(2) *Reaction shaft bushing replacement.*

(a) Assemble remover tool, cup tool and hex nut as illustrated in figure 4-23.

Caution

Do not clamp any part of reaction shaft or support in a vise.

(b) With cup held firmly against shaft, thread remover into bushing as far as possible by hand.

(c) Use a wrench, and screw remover into bushing three to four additional turns to firmly engage threads in bushing (fig. 4-23).

(d) Turn hex nut down against cup to pull bushing from reaction shaft. Thoroughly clean reaction shaft to remove chips made by remover threads.

(e) Lightly grip bushing in a vise or with pliers and back tool out of bushing. Be careful not to damage threads on' remover.

(f) Slide a new bushing, chamfered end first, on installing head tool, and start in bore of reaction shaft.

(g) Support reaction shaft upright on a clean smooth surface and install handle tool in installing head. Drive bushing into shaft until it bottoms.

(h) Thoroughly clean reaction shaft support assembly before installation.

4-33. Front Oil Pump and Reaction Shaft Reassembly and Installation

a. Reassemble front oil pump and reaction shaft assembly as illustrated in figure 4-21.

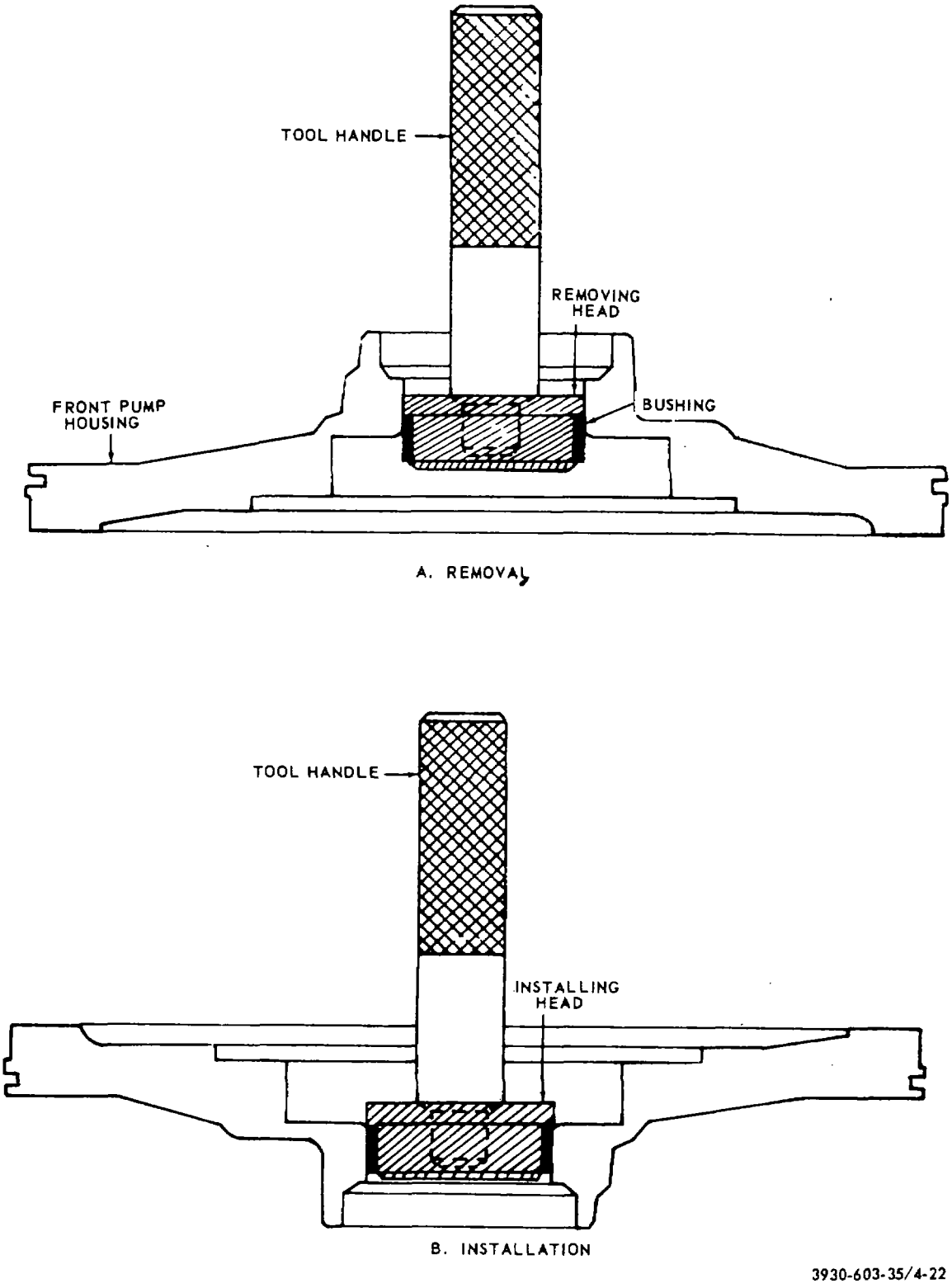


Figure 4-22. Front oil pump bushing, removal and installation.

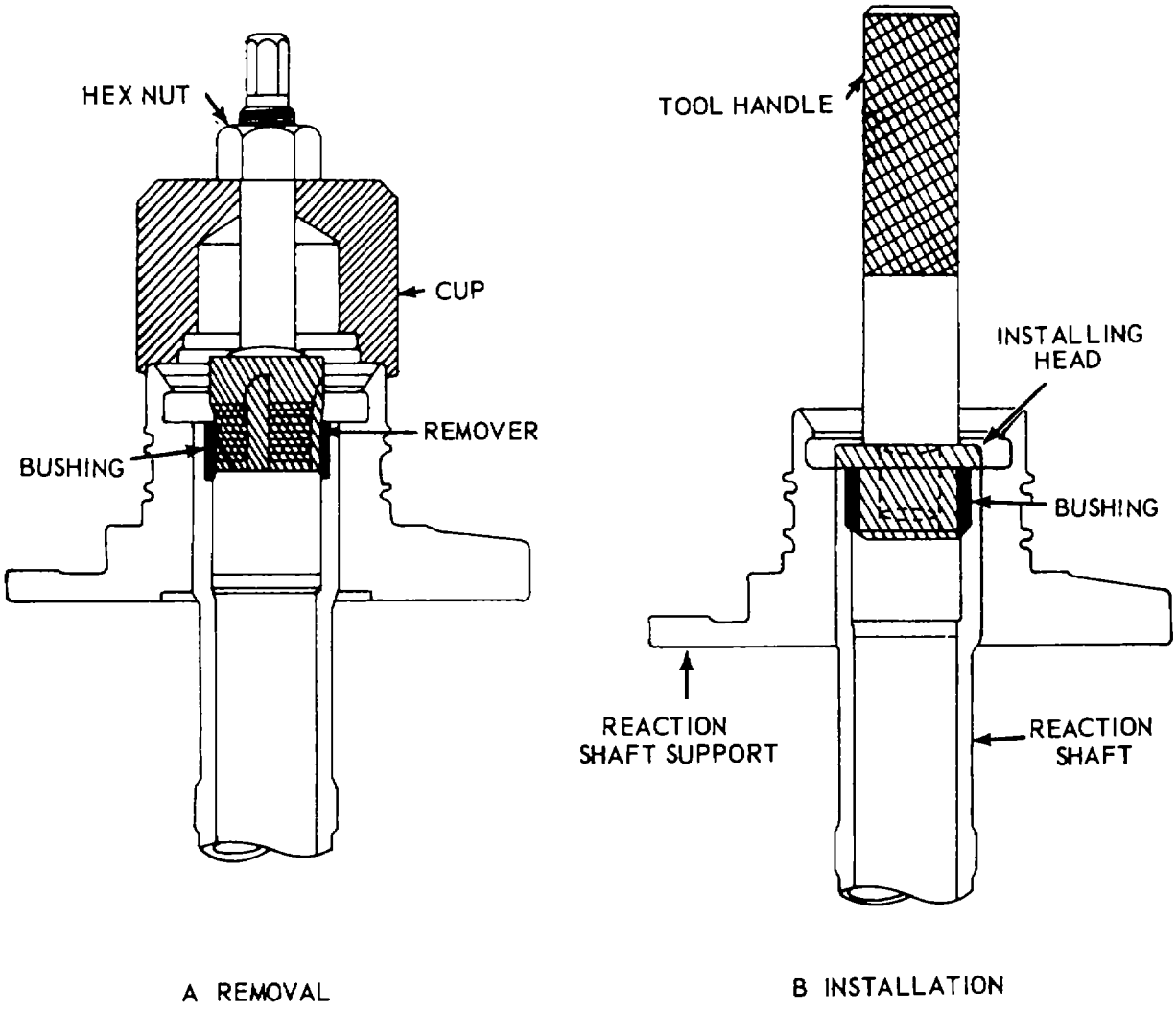


Figure 4-23. Reaction shaft bushing, removal and installation.

b. Torque six hex head housing bolts (6) to 150 inch-pounds.

c. Install oil seal (12) with lip of seal facing inward and into housing until it bottoms.

d. If difficulty was encountered during removal of front oil pump and reaction shaft assembly due to a tight fit in case, it may be necessary to expand transmission case with a heat lamp during installation. Using a suitable heat lamp, heat case in area of pump for a few minutes prior to installation of pump and reaction shaft assembly.

e. If drive train end play was not within 0.036 to 0.084 inch when measured (par 4-23), replace thrust washer (7, fig. 4-21) on

reaction shaft support hub with one of proper thickness.

Note

Thrust washers are available in three thicknesses: 0.061 to 0.063 inch, green, 0.084 to 0.086 inch, red, and 0.102 to 0.104 inch, yellow.

f. Screw two pilot studs in transmission case at the nine o'clock and three o'clock position.

g. Make sure new performed packing (11, fig. 4-21) in grove on outer flange of pump body (9) is in position and not twisted.

h. Coat performed packing in outer pump body with a light coat of grease and install pump assembly in case. Tap lightly with a soft mallet if necessary.

i. Place vent shield over vent opening and install four pump body bolts. Remove two pilot studs and install remaining two bolts and tighten bolts snug and even. Rotate input and output shafts to see if binding exists, then torque body bolts to 150 inch-pounds. Check shaft again for free rotation.

j. Install torque converter (para 4-20).

k. Install transmission (para 2-11).

Section VII. FRONT AND REAR CLUTCHES

4-34. General

The front and rear clutch pistons, and both servo pistons, are moved hydraulically to engage clutches and apply bands. The pistons are released by spring tension when hydraulic pressure is released. On 2-3 upshift, the kickdown servo piston is released by spring tension on hydraulic pressure. The accumulator controls hydraulic pressure on apply side of kickdown servo during 1-2 shift, thereby cushioning kickdown band application at any throttle position.

4-35. Kickdown Band and Front Clutch Removal

a. Remove transmission assembly (para 2-10).

b. Remove torque converter (para 4-17).

c. Remove front oil pump and reaction shaft assembly (para 4-30).

d. Remove control valve assembly (para 4-25).

e. Loosen kickdown band adjustment screw (fig. 4-24). Remove band strut and slide band out of transmission case.

f. Slide front clutch assembly out of transmission case.

4-36. Kickdown Band and Front Clutch Disassembly

a. Front Clutch Disassembly.

(1) Disassemble front clutch assembly as illustrated in figure 4-25.

(2) Use a screwdriver to remove snap ring (1) and gently lift pressure plate and clutch plates out of piston retainer assembly.

(3) Install clutch spring compressor tool over spring retainer (6) to compress clutch springs (7) and remove snap ring (5). Then, slowly release tool until spring retainer (6) is free of hub. Remove spring compressor tool, spring retainer springs.

(4) To remove piston invert piston retainer assembly and bump on a wood block and remove clutch piston (8). Remove outer and inner seal rings (9 and 10) from piston retainer.

b. Kickdown Band Disassembly. Disassemble kickdown band and linkage as illustrated in figure 4-26.

4-37. Kickdown Band and Front Clutch Cleaning, Inspection, and Repair

a. Cleaning.

(1) Wash all parts with an approved cleaning solvent and dry thoroughly.

(2) Use a soft bristle brush and clean out all bores, recesses and grooves. Dry all parts with a moisture free compressed air, place all parts on clean dry paper, and cover to prevent collection of dust.

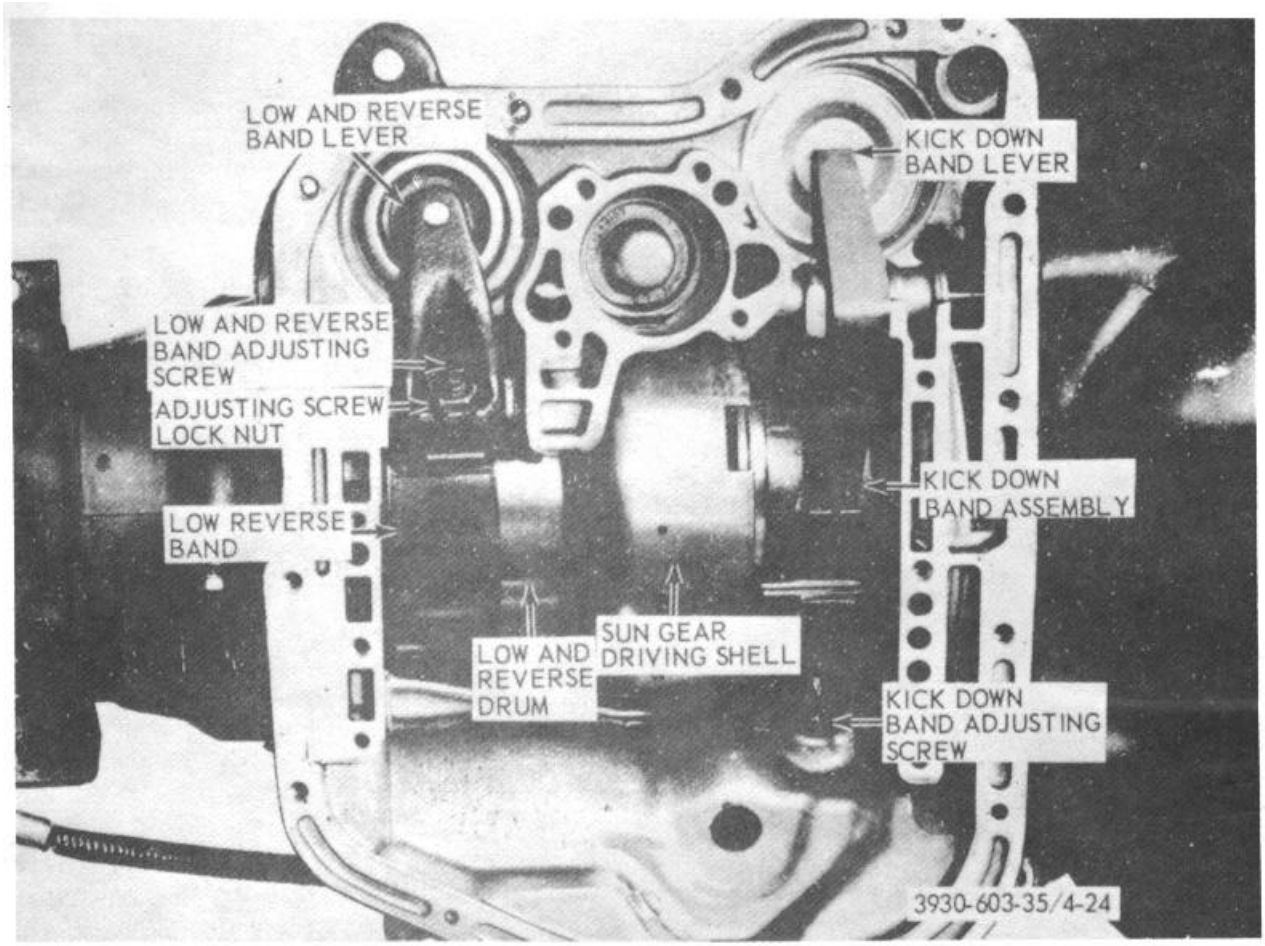


Figure 4-24. Transmission assembly, control valve removed, bottom view.

b. Inspections.

(1) Inspect clutch facings on all driving discs. Replace discs that are charred, glazed, or heavily pitted. Discs must also be replaced if they show evidence material is flaking off, or if facing material can be scraped off easily.

(2) Inspect steel plate and pressure plate surfaces for burning, scoring, or damaged driving lugs. Replace defective parts.

(3) Inspect steel plate lug grooves in clutch retainer for smooth surfaces. Plates must travel freely in grooves.

(4) Inspect band contacting surfaces on clutch retainer for scores. Note ball check in clutch retainer, make sure ball moves freely. Inspect seal surfaces in clutch retainer for nicks or deep scratches; light scratches will not interfere with sealing of neoprene rings. Inspect clutch retainer bushing for wear or scores.

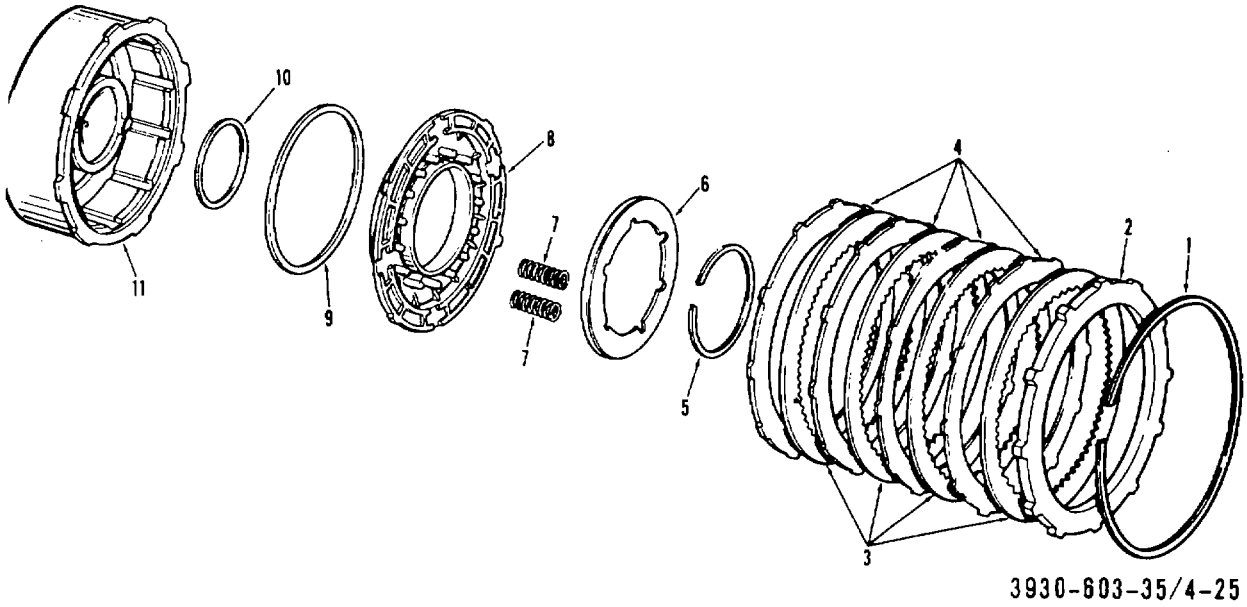
(5) Inspect inside bore of piston for score marks. If light, remove with a fine crocus cloth. Inspect neoprene seals for deterioration, wear, and hardness, and piston springs, retainer and snap ring for distortion.

(6) Inspect kickdown band, strut, band lever, and linkage for wear or damage.

(7) Replace all defective parts.

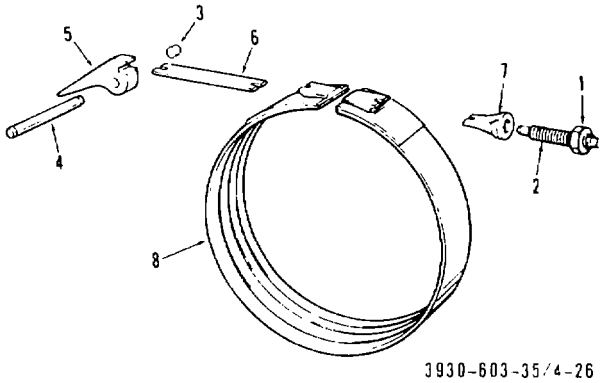
c. Front Clutch Retainer Bushing Replacement.

(1) Position clutch retainer, open end down, on a clean smooth surface, place removing tool head in bushing,



1 Snap ring (selective)
2 Pressure plate
3 Driving discs
4 Clutch plates
5 Snap ring
6 Spring retainer
7 Clutch springs
8 Clutch piston
9 Piston seal ring, outer
10 Piston seal ring, inner
11 Piston retainer assembly

Figure 4-25. Front clutch, disassembly and reassembly.



1 Adjusting nut
2 Adjusting screw
3 Shaft plug
4 Lever shaft
5 Lever
6 Strut
7 Anchor
8 Band assembly

Figure 4-26. Kickdown band and linkage, disassembly and reassembly.

and install tool handle in removing head as illustrated in figure 4-27.

(2) Drive bushing straight down and out of clutch retainer bore. Be careful not to cock tool in bore.

(3) Position clutch retainer, open end up on a clean, smooth surface. Slide a new bushing on installing head tool and start bushing in clutch retainer bore.

(4) Install handle in installation tool (fig. 4-27) and drive bushing into clutch retainer until it bottoms.

(5) Thoroughly clean clutch retainer before reassembly and installation.

4-38. Kickdown Band and Front Clutch Reassembly

a. Front Clutch Reassembly.

(1) Lubricate and install inner piston seal ring (10, fig. 4-25) on hob of piston retainer assembly (11), making sure

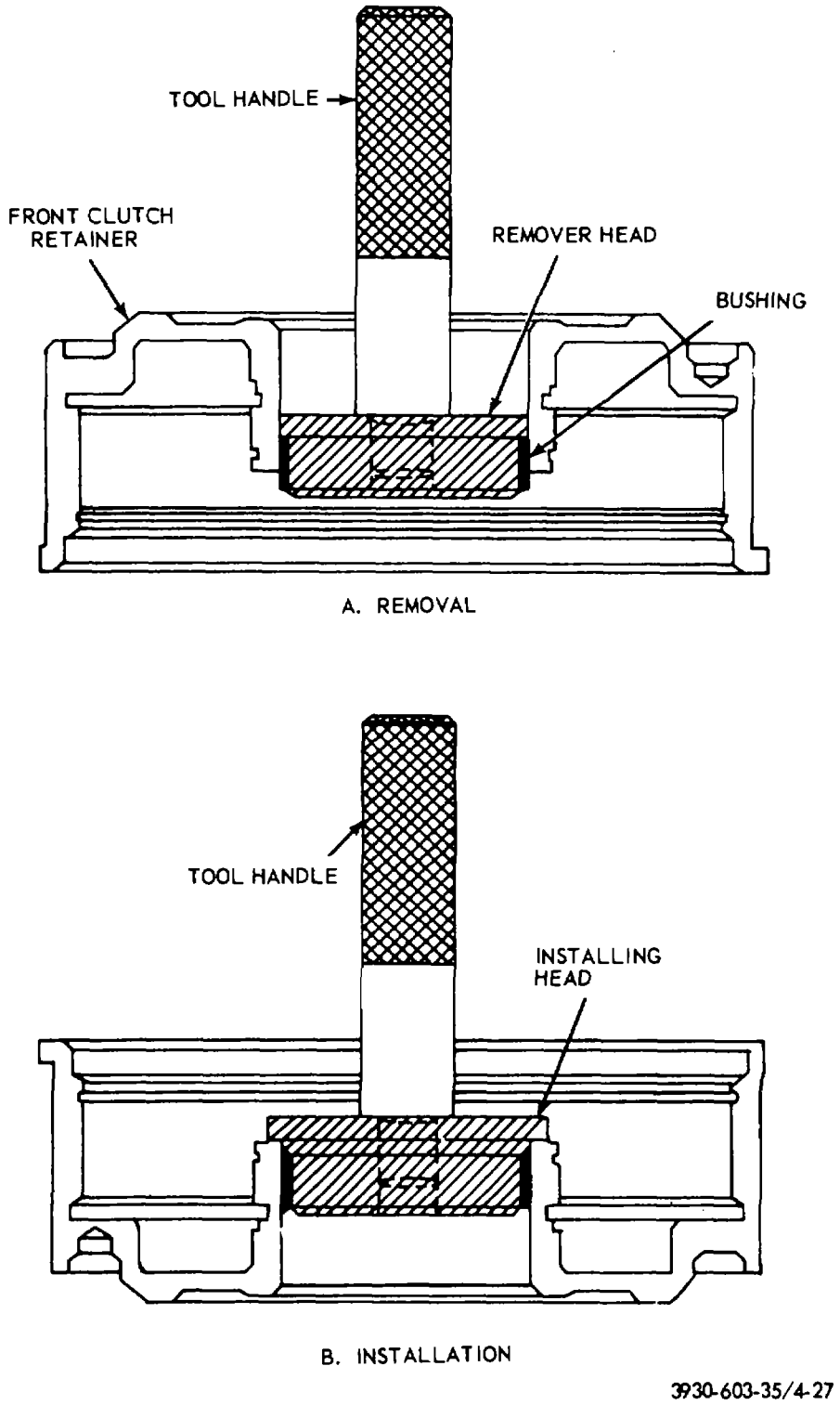


Figure 4-27. Front clutch retainer bushing, removal and installation.

lip of seal faces down and is properly seated in its groove.

(2) Install outer seal ring (9) on clutch piston (8), with lip of seal facing toward bottom of clutch piston retainer. Apply a coating of wax-type lubricant or door ease to outer edge of seal for easier installation of piston assembly. Place. piston (8) in piston retainer assembly (11) and carefully seat piston in bottom of retainer.

(3) Place ten clutch springs (7) on piston hub exactly as illustrated in figure 4-28. Position spring retainer (6, fig. 4-25) and snap ring (5) on springs. Compress springs using a spring compressor tool, seat snap ring (5) in hub groove, and remove spring compressor tool.

(4) Lubricate all clutch plates (4, fig. 425), install one clutch plate (4) followed by a driving disc (3) until all plates are installed. Install pressure plate (2) and secure clutch pack in piston retainer assembly (11) with snap ring (1). Make sure snap ring is properly seated.

(5) With front clutch completely assembled, insert a feeler gage between pressure plate and snap ring (fig. 4-29). The clearance must be 0.024 to 0.123 inch. If not, install a snap ring (1, fig. 4-25) of proper thickness to obtain specified clearance. Snap rings are available in 0.060-0.062, 0.0740.076, and 0.088-0.090 inch thickness.

b. Kickdown Band Reassembly.

(1) Slide band assembly (8, fig. 4-26) over front clutch assembly.

(2) Install adjusting nut (1) on adjusting screw (2) and install assembled adjusting screw into anchor (7) and strut (6) just enough to hold strut and anchor in place.

Figure 4-28. Front clutch piston return spring location.

4-39. Input Shaft and Rear Clutch Removal

a. With front clutch removed, grasp input shaft and slide shaft and rear clutch assembly out of transmission case.

b. Be careful not to lose thrust washer located between rear end of input shaft and forward end of output shaft.

4-40. Input. Shaft and Rear Clutch Disassembly

a. Disassemble rear clutch assembly and input shaft as illustrated in figure 4-30.

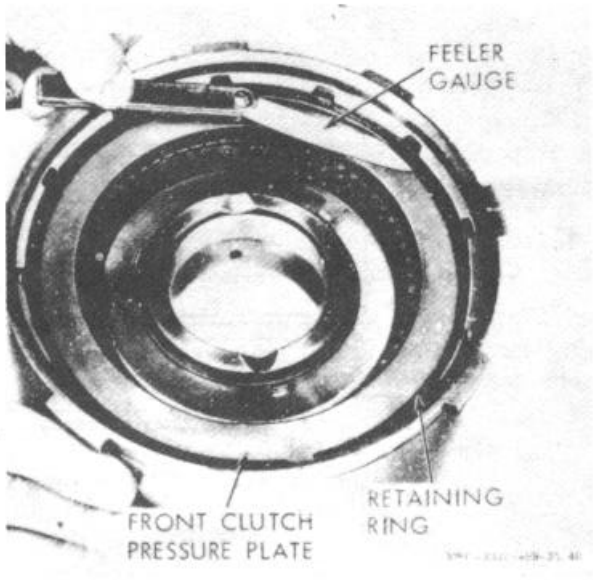
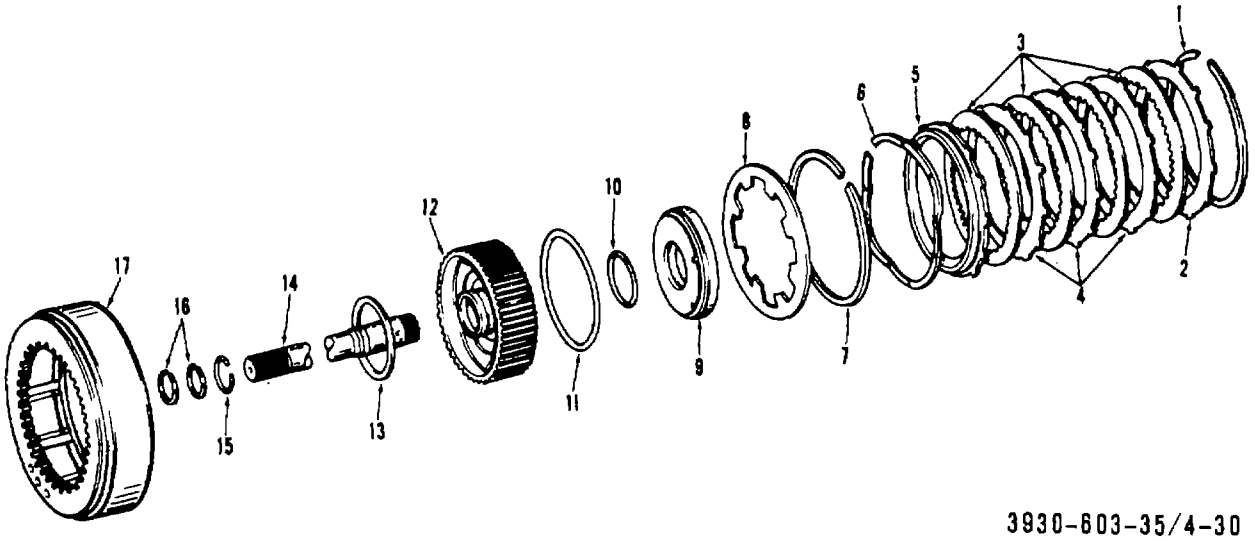


Figure 4-29. Measuring front clutch clearances.



1 Snap ring (selective)
2 Pressure plate
3 Driving discs
4 Clutch plates
5 Pressure plate
6 Wave spring
7 Spacer ring
8 Piston spring
9 Piston
10 Piston seal, inner
11 Piston seal, outer
12 Piston retainer
13 Thrust washer
14 Input shaft
15 Snap ring
16 Seal ring (2 rq)
17 Clutch retainer

Figure 4-30. Rear clutch assembly and input shaft, disassembly and reassembly.

b. Use a screwdriver to remove snap ring (I) and carefully lift pressure plate (2), clutch plates (4), driving discs (3) and pressure plate (5) out of piston retainer (12).

c. Carefully pry one end of wave spring (6) out of its groove and remove spacer ring (7) and piston spring (8).

d. Invert clutch piston retainer (12) and bump piston on a wood block to remove piston.

4-41. Input Shaft and Rear Clutch, Cleaning and Inspection and Repair

a. Cleaning. Clean rear clutch assembly using same method as that for front clutch (para 437).

b. Inspection.

(1) Inspect rear clutch assembly using same method as that of front clutch assembly (para 447).

(2) Inspect piston spring, wave spring, and spacer for distortion or breakage.

(3) Inspect seal rings on input shaft, for wear or broken locks; make sure they turn freely in their grooves. Do not remove rings unless they are defective and must be replaced.

(4) Inspect bushing in end of input shaft for wear or scores. Inspect rear to front clutch thrust washer for wear. Washer thickness must be 0.061 to 0.063 inches.

c. Input Shaft Bushing Replacement.

(1) Clamp input shaft (14, fig. 440) in a vise with soft jaws, being careful not to clamp on seal ring lands or shaft journal.

(2) Assemble remover tool, cup tool and hex nut as illustrated in figure 44-31.

(3) With cup held firmly against clutch piston retainer, thread remover into bushing as far as possible by hand.

(4) Using a wrench, screw remover into bushing three to four additional turns

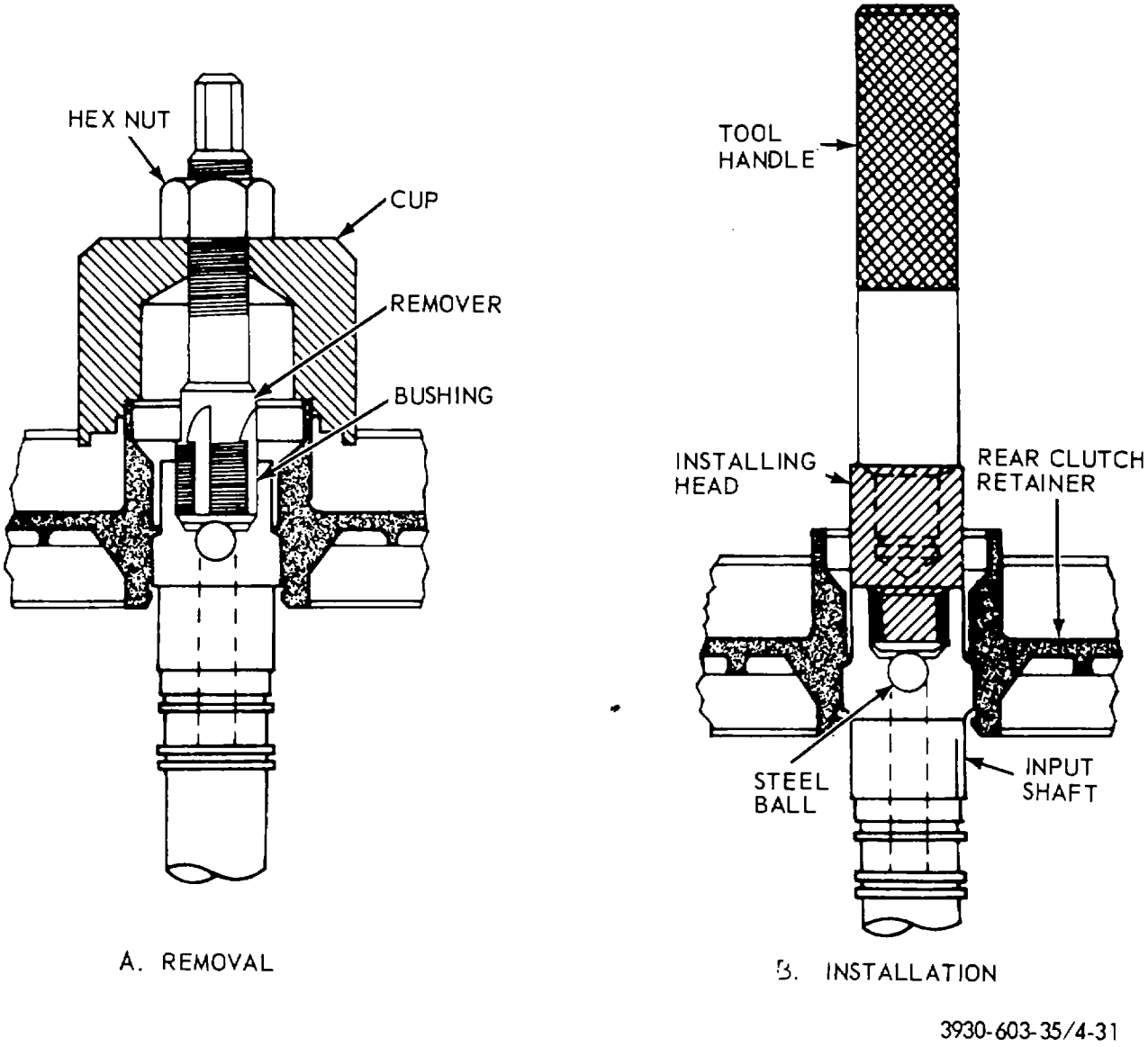


Figure 4-31. Input shaft bushing, removal and installation

to firmly engage threads in bushing. Turn hex nut down against cup and pull bushing from shaft.

(5) Thoroughly clean input shaft to remove chips made by remover threads. Make sure small lubrication hole next to ball in end of shaft is not plugged with chips and that no chips are lodged next to steel ball.

(6) Slide a new bushing on installing head tool and start them in bore of input shaft.

(7) Stand input shaft upright on a clean smooth surface and install tool handle in installing head. Drive bushing into shaft until tool bottoms.

(8) Thoroughly clean input shaft and clutch piston retainer before assembly and installation.

4-42. Input Shaft and Rear Clutch Reassembly

a. If removed, press input shaft (14, fig. 4-30) into piston retainer (12) and secure with snap ring (15).

b. Lubricate and install inner and outer seals (10 and 11) on clutch piston (9). Make sure lip of seal faces toward head of clutch retainer, and that they are properly seated in piston grooves.

c. Position assembled piston (9) in piston retainer (12), and with a twisting motion, seat piston in bottom of retainer.

d. Position clutch retainer (17) over splines on piston retainer (12) and support the assembly so clutch retainer remains in place.

e. Install clutch piston spring (8) and spacer ring (7) on top of piston in clutch retainer. Make sure spring and spacer ring are positioned properly in retainer recess. Start end of wave spring (6) in retainer groove, then progressively push or tap spring into place, making sure it is fully seated in groove.

f. Install inner pressure plate (5) in clutch retainer (17), with raised portion of plate resting on spring.

g. Lubricate all clutch plates, install one driving disc (3), followed by clutch plate (4) until all plates are installed. Install outer pressure plate (2) and secure clutchpack with snap ring (1).

h. Measure rear clutch plate clearance by having an assistant press downward firmly on outer pressure plate, then insert a feeler gage plate and snap ring as illustrated in figure 4-32. The clearance must be between 0.037 to 0.060 inch. If not, install a snap ring (1, fig. 4-30) of proper thickness to obtain specified clearance. Low limit clearance is desirable. Rear clutch plate clearance is very important in obtaining proper clutch operation. The clearance can be adjusted by use of various thickness outer snap rings. Snap rings are available in 0.060-0.062, 0.074-0.076, 0.0880.090 and 0.106-0.108 inch thickness.

4-43. Front and Rear Clutch Installation

a. The front and rear clutches, kickdown band, front oil pump and reaction shaft sup Figure 4-2. Measuring rear clutch plate clearance.

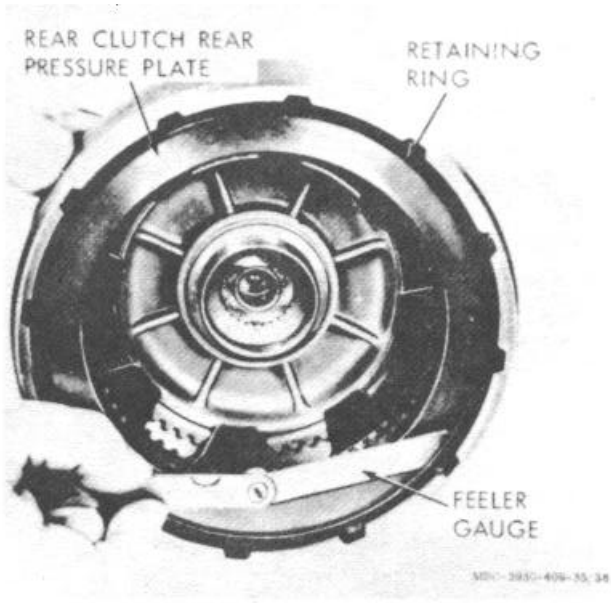


Figure 4-32. Measuring rear clutch plate clearance.

port are more easily installed together with transmission case in an upright position..

b. Support transmission case on repair stand in an upright position.

c. Carefully insert output shaft (14, fig. 430) into hole to support transmission case upright, with its weight resting on flange of output shaft support.

d. Apply a coat of grease on input to output thrust washer (1, fig. 4-33), and install on front end of output shaft (16).

e. Aline front clutch plate inner splines, and place assembly in position on rear clutch assembly. Make sure front clutch plate splines are fully engaged in rear clutch splines.

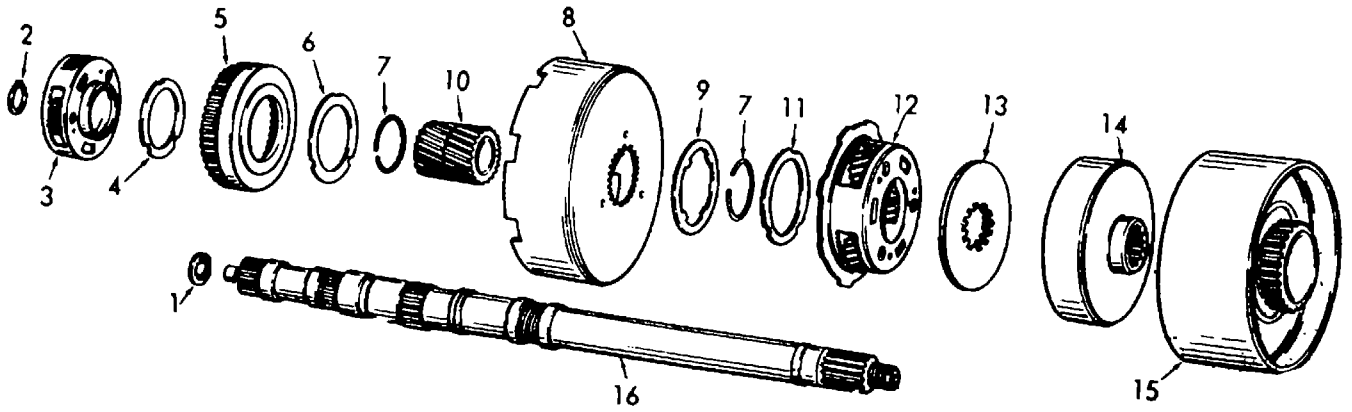
f. Aline rear clutch plate inner splines, grasp input shaft and lower front and rear clutch assemblies into transmission case.

g. Carefully work clutch assemblies in circular motion to engage rear clutch splines over splines of front annulus gear. Make sure front clutch drive lugs are fully engaged in driving shell.

h. Install front oil pump and reaction shaft housing (para 4-33).

i. Install torque converter assembly (para 4-20).

j. Install transmission assembly (para 2-11).



1	Thrust washer	7	Snap ring	13	Rear annulus thrust plate
2	Snap ring (selective)	8	Driving shell	14	Rear annulus gear assembly
3	Front planetary gear assembly	9	Steel thrust washer	15	Low and reverse drum
4	Thrust washer.	10	Sun gear	16	Output shaft
5	Front annulus gear assembly	11	Thrust washer		
6	Thrust washer	12	Rear planetary gear assembly		

Figure 4-33. Planetary gear assemblies and related parts, disassembly and reassembly.

Section VIII. PLANETARY GEAR ASSEMBLIES, SUN GEAR AND DRIVING SHELL

4-44. General

The front and rear planetary gear sets, in conjunction with two multiple disc clutches, overrunning clutch, and two servo bands provide three forward gear ratios and one reverse ratio. The common sun gear and planetary gear sets are connected to the front clutch by a driving shell which is splined to sun gear and front clutch.

4-45. Planetary Gear Assembles, Sun Gear, and Driving Shell Removal

a. Remove transmission assembly (para 210).

b. Remove front clutch (para 4-35) and rear clutch and input shaft (para 4-89).

c. Support output shaft and driving shell, and carefully slide planetary gear assembly forward and out of transmission case.

4-46. Planetary Gear Assemblies, Sun Gear and Driving Shell Disassembly

a. Measure end play of planetary gear assemblies, sun gear, and driving shell before removal from output shaft. Position assembly in an upright position, push rear annulus gear support downward on output shaft. Insert a feeler gage between rear annulus gear support hub and shoulder on output shaft as illustrated in figure 4-34. The clearance must be 0.010 to 0.039 inches. If clearance exceeds specifications, replace thrust washer and parts as necessary.

b. Disassemble planetary gear assemblies, sun gear and driving shell as illustrated in figure 4-33.

4-47. Planetary Gear Assemblies, Sun Gear and Driving Shell, Cleaning and Inspection

a. Cleaning.

(1) Wash all parts thoroughly with an approved cleaning solvent and dry thoroughly with moisture free compressed air.

(2) Use a soft bristle brush and clean all bores, recesses and grooves in shafts and gears.

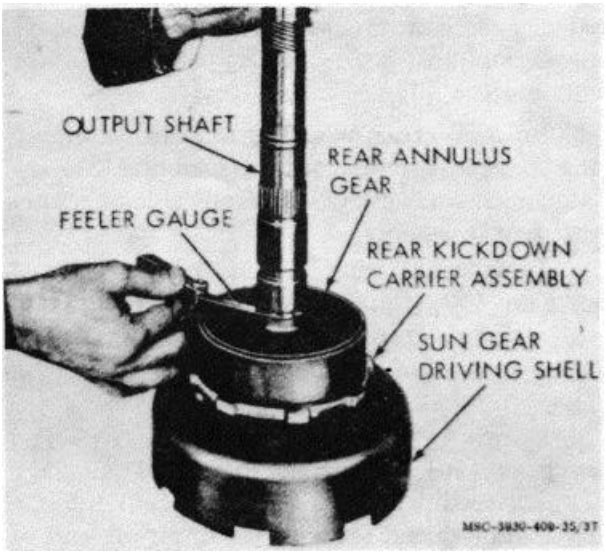


Figure 4-4. Measuring end play of planetary and sun gears, and driving shell b. Inspection.

(1) Inspect bearing surfaces on- output shaft for nicks, burrs, scores, or other damage. Remove light scratches, small nicks, or burrs with a fine crocus cloth or a fine stone.

(2) Inspect all oil passages in output shaft to make sure they are open and clean.

(3) Inspect bushings in sun gear for wear or scores. Replace sun gear assembly if bushings are worn or damaged.

(4) Inspect thrust washers for wear and scores, replace if damaged or worn.

(5) Inspect thrust faces of planetary gear carriers for wear, scores or other damage. Inspect planetary gear carrier for cracks or breaks, and the pinions for broken or worn teeth and for broken pinion shaft lock pins.

(6) Inspect annulus gears and driving gear teeth for damage or excessive wear.

(7) Replace distorted lock rings and all other defective parts.

4-48. Planetary Gear Assemblies, Sun Gear and Driving Shell Reassembly

a. Install rear annulus, gear assembly (14, fig. 4-33) on output shaft (16). Apply a thin coat of grease on thrust plate, place it on shaft and in annulus gear, making sure teeth are over shaft splines.

b. Position rear planetary gear assembly (12) in rear annulus gear assembly (13). Install thrust washer (11) on front side of planetary gear assembly.

c. Install snap ring (7) in front groove of sun gear (10) (long end of gear). Insert sun gear through front side of driving shell (8), install rear steel washer (9) and snap ring (7).

d. Carefully slide driving shell (8) and sun gear (10) on output shaft (16), engage sun gear teeth with rear planetary pinion teeth, and install thrust washer (6) in front end of driving shell.

e. Install thrust washer (4) on rear hub of front planetary gear assembly (3), then slide assembly into front of annulus gear assembly (14).

f. Carefully work front planetary gear assembly (3) and front annulus gear assembly (5) on output shaft (16), meshing planetary pinions with sun gear teeth.

g. With all components properly positioned, install selective snap ring (2) on front end of output shaft (16). Remeasure end play of assembly (fig. 4-34). Adjust clearance by use of various thickness snap rings (2). Snap rings are available in 0.048-0.052, 0.055-0.059, and 0.062-0.066 inches thickness.

4-49. Planetary Gear Assemblies, Sun Gear, and Driving Shell Installation

a. Support planetary gear assemblies, sun gear, and driving shell in transmission case, and insert output shaft (16, fig. 4-33) through rear support.

b. Carefully work assembly to rear, engaging rear planetary carrier lugs into low reverse drum slots.

Caution: Be careful not to damage ground surfaces on output shaft during installation.

c. Install input shaft and front and rear clutches (para 4 43).

Section IX. OVERRUNNING CLUTCH AND SEVRO BANDS

4-50. General

The overrunning clutch, kickdown servo, and low and reverse servo assemblies work in conjunction with planetary gear assemblies and clutches to provide the three forward gear ratios and a reverse ratio. A shuttle valve located in control valve assembly provides application and fast release for kickdown servo band to provide smooth clutch engagement.

4-51. Overrunning Clutch, Servos and Servo Band, Planetary Gear Assemblies Removal and Disassembly

Remove planetary gear assemblies, sun gear, and driving shell (para 4-45) and proceed as follows:

a. Rear Band.

(1) Slide low and reverse drum (15, fig. 4-33) over output shaft and out of transmission case.

(2) Loosen band adjusting screw, (1, fig. 4-35) and adjusting nut (2), remove band strut (6) and band (8) from transmission case.

(3) Remove lever shaft (4), seal ring (3), lever assembly (5), and link and anchor (7).

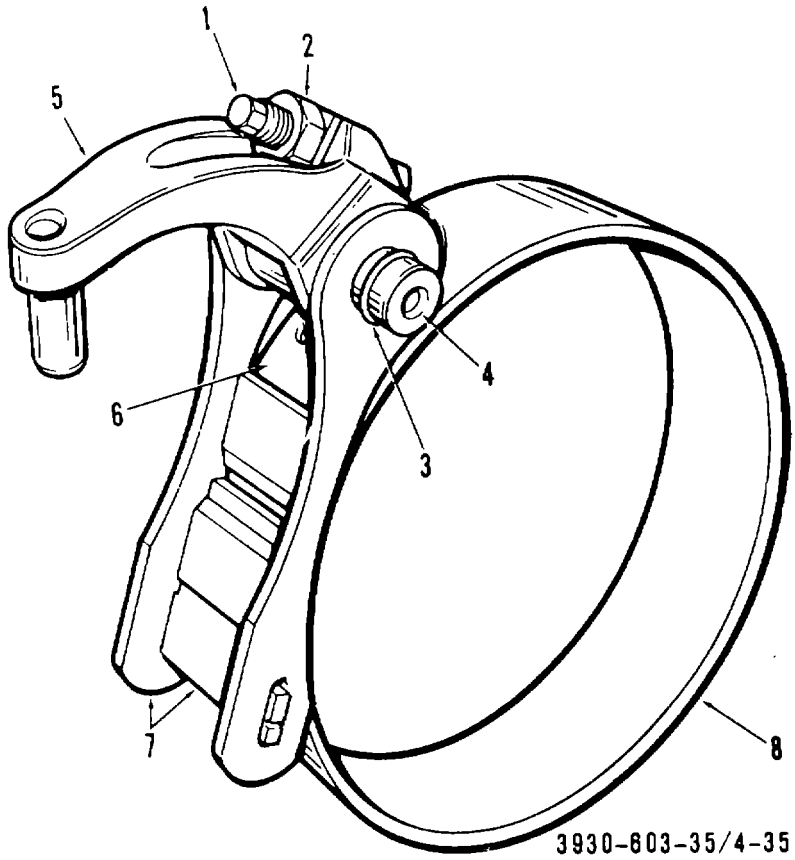
b. Overrunning Clutch.

(1) Note position of overrunning clutch rollers (3, fig. 4-36) and clutch springs (4) before disassembly, to assist in reassembly.

(2) Carefully slide out clutch race (5) and remove rollers (3) and springs (4). Remove clutch cam (1) and spring retainer (2).

c. Kickdown Servo Removal and Disassembly.

(1) Compress kickdown servo spring (4, fig. 4-37) by using engine valve spring compressor tool, then remove retaining ring (1).



1 Adjusting screw
2 Adjusting nut
3 Seal ring
4 Lever shaft
5 Lever assembly
6 Strut
7 Link and anchor
8 Band assembly

Figure 4-35. Low and reverse band assembly.

(2) Remove servo guide (3), springs (4 and 5), and piston rod (6) from transmission case. Be careful not to damage piston guide or rod during removal.

(3) Insert piston removal tool inside servo piston (8) and remove piston from transmission case. Remove seals (2) from servo guide (3) and piston (8).

d. Low and Reverse Servo.

(1) Compress low and reverse servo piston spring (3, fig. 4-38) by using engine valve spring tool, then remove snap ring (1).

(2) Remove spring retainer (2), piston spring (3), and remove servo piston and plug assembly from transmission case.

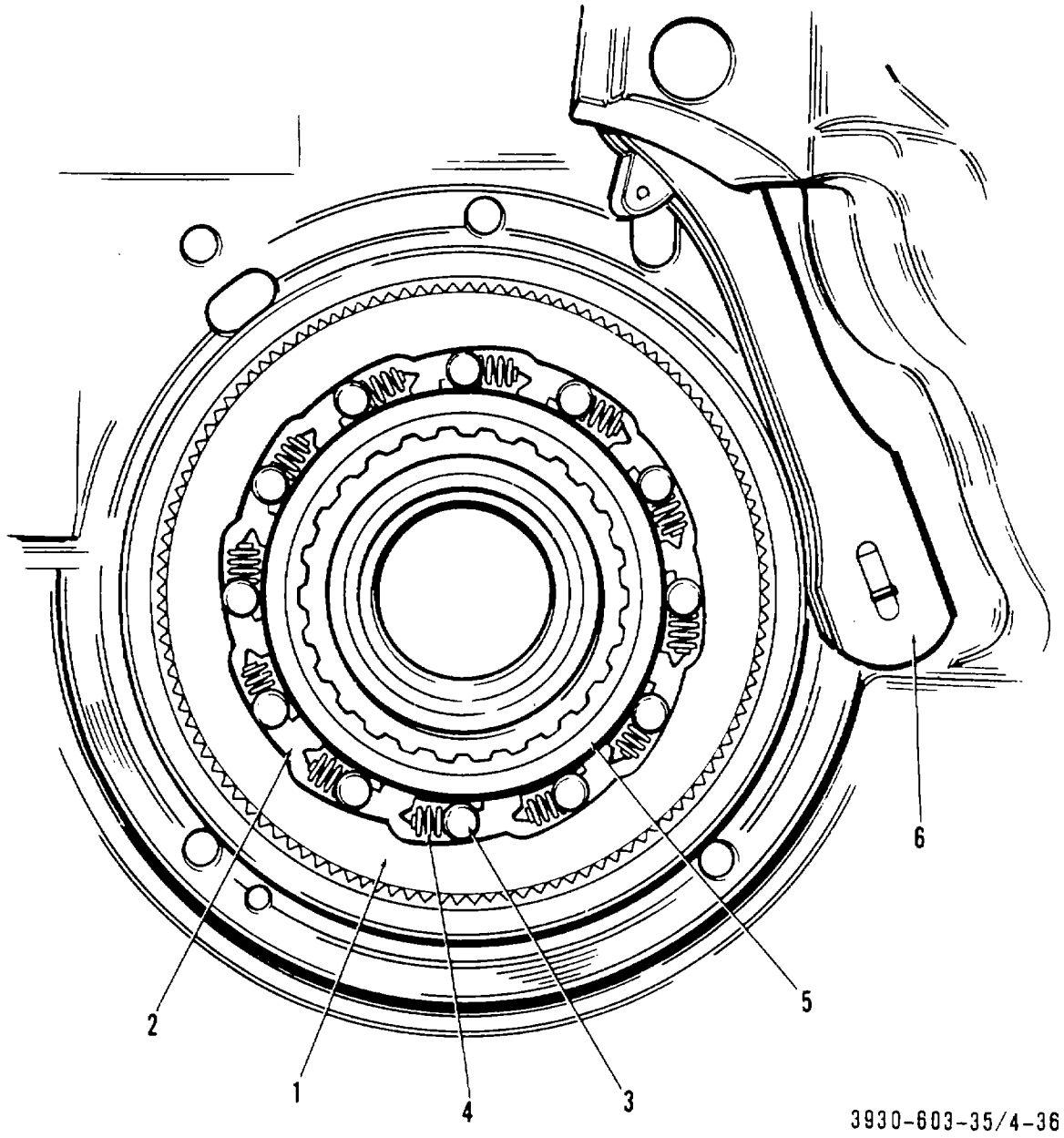
(3) Remove retaining ring (4), piston plug (5), spring (6), and seal ring (7) from piston (8).

4-52. Overrunning Clutch Servos and Servo Bands, Cleaning and Inspection

a. Cleaning.

(1) Wash all parts with an approved cleaning solvent and dry thoroughly with moisture-free compressed air.

(2) Clean all burrs and chips from overrunning clutch cam area in transmission case.



1 Overrunning clutch cam
2 Spring retainer
3 Clutch roller
4 Clutch spring
5 Clutch race
6 Low and reverse link

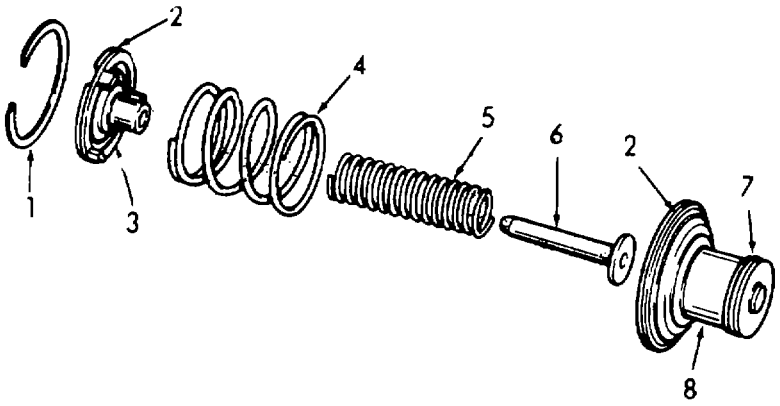
Figure 4-36. Overrunning clutch.

b. Inspection.

(1) Overrunning clutch.

(*a*) Inspect clutch rollers for smooth round surfaces. They must be free of flat spots and chipped edges.

(*b*) Inspect roller contacting surfaces in cam and race for brinelling. Inspect roller springs for distortion, wear or other damage. Inspect cam set screw for tightness. If loose,



1 Retaining ring
2 Seal ring
3 Servo guide
4 Outer spring
5 Inner spring
6 Piston rod
7 Seal ring
8 Servo piston

Figure 4-37. Kickdown servo, disassembly and reassembly.

tighten and restake case around screw.

(2) *Kickdown servo and band*.

(*a*) Inspect piston and guide seal rings for wear, and make sure they turn freely in grooves. It is not necessary to remove seal rings unless they must be replaced.

(*b*) Inspect piston for nicks, burrs, scores and wear. Inspect piston bore in case for scores or other damage. Inspect fit of guide on piston rod and piston spring for distortion.

(*c*) Inspect band lining for wear and bond of lining to band. Inspect lining for black burn marks, glazing, nonuniform wear pattern, or flaking. If lining is worn so grooves are not visible at ends or any portion of band, replace band. Inspect band for distortion or cracked ends.

(8) *Low reverse servo and band*.

(*a*) Inspect seal for distortion, wear and hardness. Inspect piston and piston plug for nicks, burrs, scores and wear; piston plug must operate freely in piston. Inspect piston bore in case for scores or other damage and springs for distortion.

(*b*) Inspect band lining for wear and bond of lining to band. If lining is worn so grooves are not visible at ends or any portion of band, replace band. Inspect band for distortion or cracked ends.

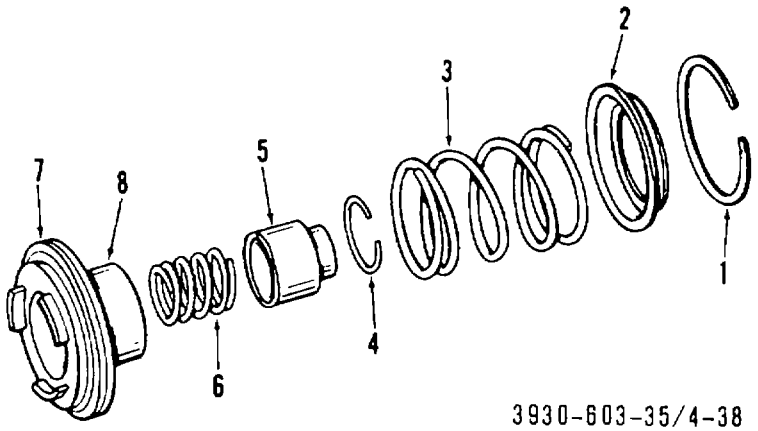
4-53. Overrunning Clutch Cam Replacement

a. Remove set screw from transmission case just below clutch cam (fig. 4-39).

b. Remove four bolts securing output shaft support to rear of transmission case. Insert a punch through bolt holes and drive cam from transmission case (fig. 4-40). Alternate punch from one bolt hole to another so cam will be driven evenly from case.

Note. The output shaft support must be in transmission owe to install overrunning clutch cam.

c. If output shaft support requires replacement, drive it to rear out of transmission case with a wood block and hammer.



1	Retainer ring	3	Piston spring	5	Piston plug	7	Seal ring
2	Spring retainer	4	Retaining ring	6	Plug spring	8	Piston

Figure 4-38. Low and reverse servo, disassembly and reassembly.

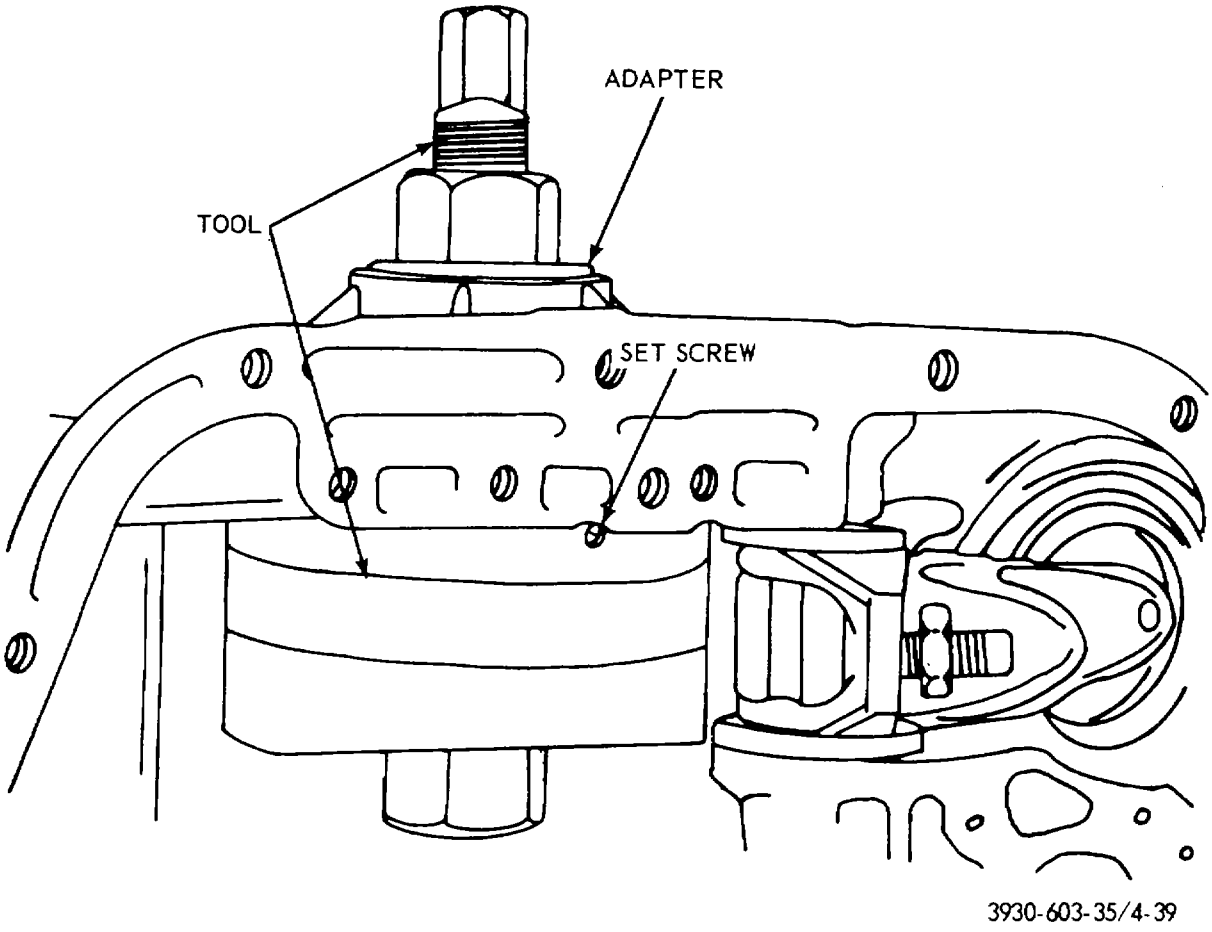


Figure 4-9. Overrunning clutch cam installation.

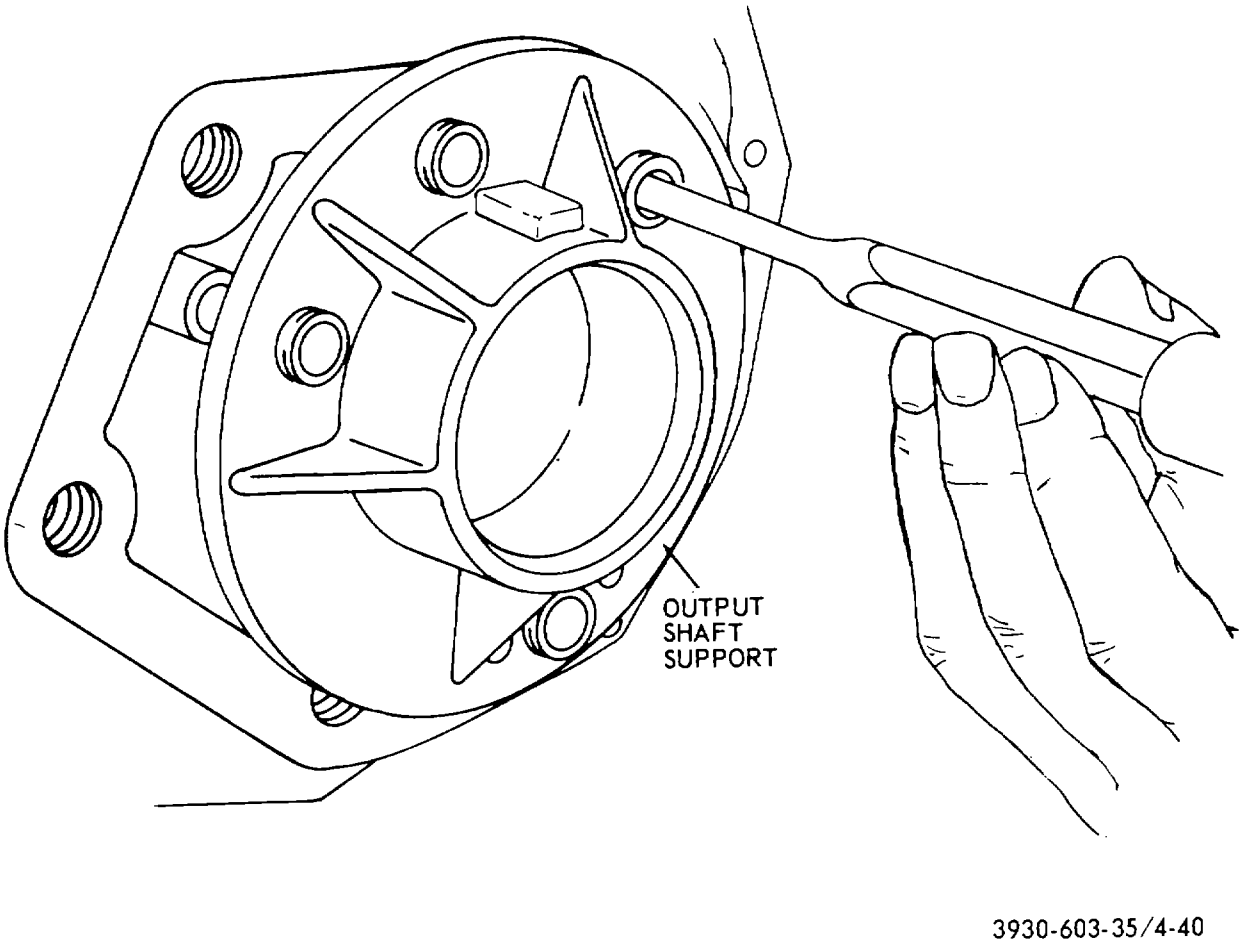


Figure 4-40. Overrunning clutch cam removal.

d. To install output shaft support, screw two pilot studs into case (fig. 4-41), then drive support firmly into transmission case with a wood block and hammer.

e. Replace spring retainer (2, fig. 4-36) on overrunning clutch cam (1), making sure retainer lugs snap firmly into notches of cam.

f. Position overrunning clutch cam (1) in transmission case with cam serrations alined with those in case. Tap cam evenly into case a far as possible with a soft mallet.

g. Install cam replacement tool and tool adapter as illustrated in figure 4-39, tighten nut on tool to seat cam into case. Make sure cam is firmly bottomed, then install cam retaining set screw. Stake case around set screw to prevent it from coming loose.

h. Remove cam installing tool, install and tighten support retaining screws to 140 inch-pounds torque. Stake case around cam six places with a blunt chisel.

4-54. Overrunning Clutch, Servos and Servo Band, Reassembly and Installation

a. Low and Reverse Servo and Band.

(1) Install seal ring (7, fig. 4-38) on piston (8). Install plug spring (6) and piston plug (5) in piston (8) and secure with retaining ring (4).

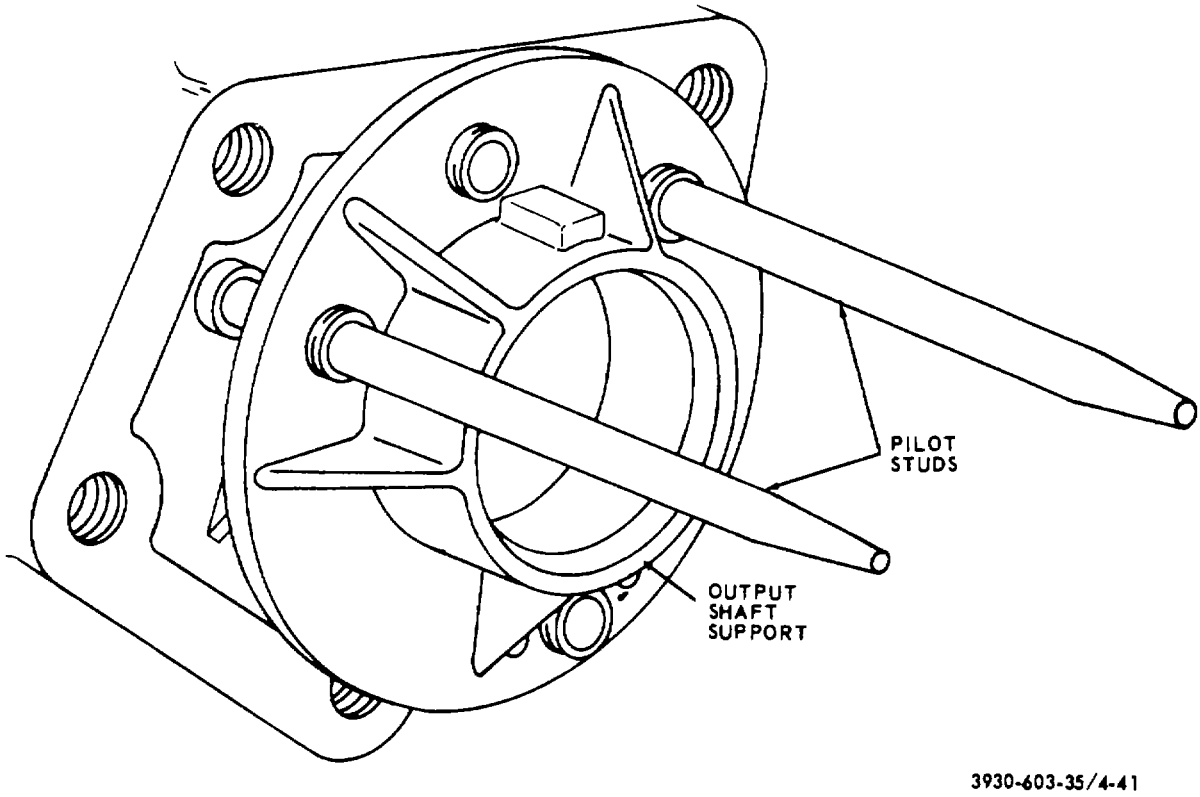


Figure 4-41. Output shaft support installation.

(2) Carefully work servo piston assembly into transmission case with a twisting motion and place piston spring (3), spring retainer (2) and snap ring (1) over piston.

(3) Compress piston spring (3) by using engine valve spring compressor and secure with retaining ring (1).

(4) Position rear band in transmission case, install strut (6, fig. 4-365), then connect link and anchor (7) to band assembly (8). Screw band adjusting screw in band just enough to hold strut in place. Be sure link and anchor assembly is installed to provide a running clearance for low and reverse drum. Install low-reverse drum (15, fig. 4-3).

b. Kickdown Servo.

(1) Install seal rings (2, fig. 4437) on servo guide (3) and servo piston (8).

(2) Carefully install servo piston (8) into bore in transmission case, install piston rod (6), (springs 4 and 5) and servo guide (3).

(3) Compress servo springs by using an engine valve spring compressor tool and secure the assembly with retaining ring (1).

c. Overrunning Clutch.

(1) Place transmission case in the upright position.

(2) Install clutch race (5, fig. 4-6) inside of clutch cam (1) and install overrunning clutch rollers (3) and clutch springs (4).

d. Planetary Gear Assemblies. Install planetary gear assemblies (para 4-49).

CHAPTER 5

AXLES AND STEERING

Section I. STEERING GEAR

5-1. General

The tractor is equipped with a manual steering gear and is of the worm and sector type. The steering wheel is attached to a steering shaft, with a worm gear at shaft base. The steering gear is connected to tie rods with a ball joint pitman arm.

5-2. Steering Gear Removal

a. Remove rear floor plate and disconnect pitman arm from drag link (TM 10-3930-603-12).

b. Remove horn button (53, fig. 5-1), contact cup (52), spring (51) and spring cap (50). Locate horn cable (48) coming out of lower end of jacket tube (18) and disconnect cable. Pull cable out through top of steering gear.

c. Remove pitman arm nut (28), lockwasher (27), securing pitman arm (29) to shaft assembly (40) and remove pitman arm.

d. Remove steering wheel nut (1), securing steering wheel (2) to steering shaft (21), and remove wheel.

e. Remove two nuts (13) and lockwashers (14), and remove clamp (43), bushing (17) and support block (16).

f. Remove screws (24 and 30) lockwashers (23) and shims (22) securing steering gear housing (32) to frame. Note number of shims (22) removed.

g. Swing steering gear assembly toward right side of tractor and work steering gear housing (32) free from tractor frame, then pull steering gear assembly down through hole in fender.

5-3. Steering Gear Disassembly

a. Remove pipe plug (33) and drain lubricant from steering gear housing (32).

b. Disassemble steering gear assembly as illustrated in figure 5-1.

c. Do not remove bushings (25) unless they are damaged and must be replaced.

5-4. Steering Gear Cleaning and Inspection

a. Cleaning.

(1) Wash all parts with an approved cleaning solvent and dry thoroughly.

(2) Use a soft bristle brush with cleaning solvent to remove all traces of oil from housing, lever shaft assembly and worm gear. Clean bearing and bushing surfaces with a lint free cloth.

(3) Use a fine crocus cloth to remove burrs, nicks, and flat spots from worm gear and studs in lever shaft assembly.

b. Inspection.

(1) Inspect lever shaft assembly bushings for scoring or other damage.

(2) Inspect lever shaft oil seal for deterioration.

(3) Inspect steering shaft and lever shaft assembly for damage and excessive wear.

(4) Discard and replace all oil seals and gaskets.

(5) Replace all defective parts.

5-5. Steering Gear Reassembly

a. If bushings (25) were replaced, ream and burnish steering gear housing (32) to

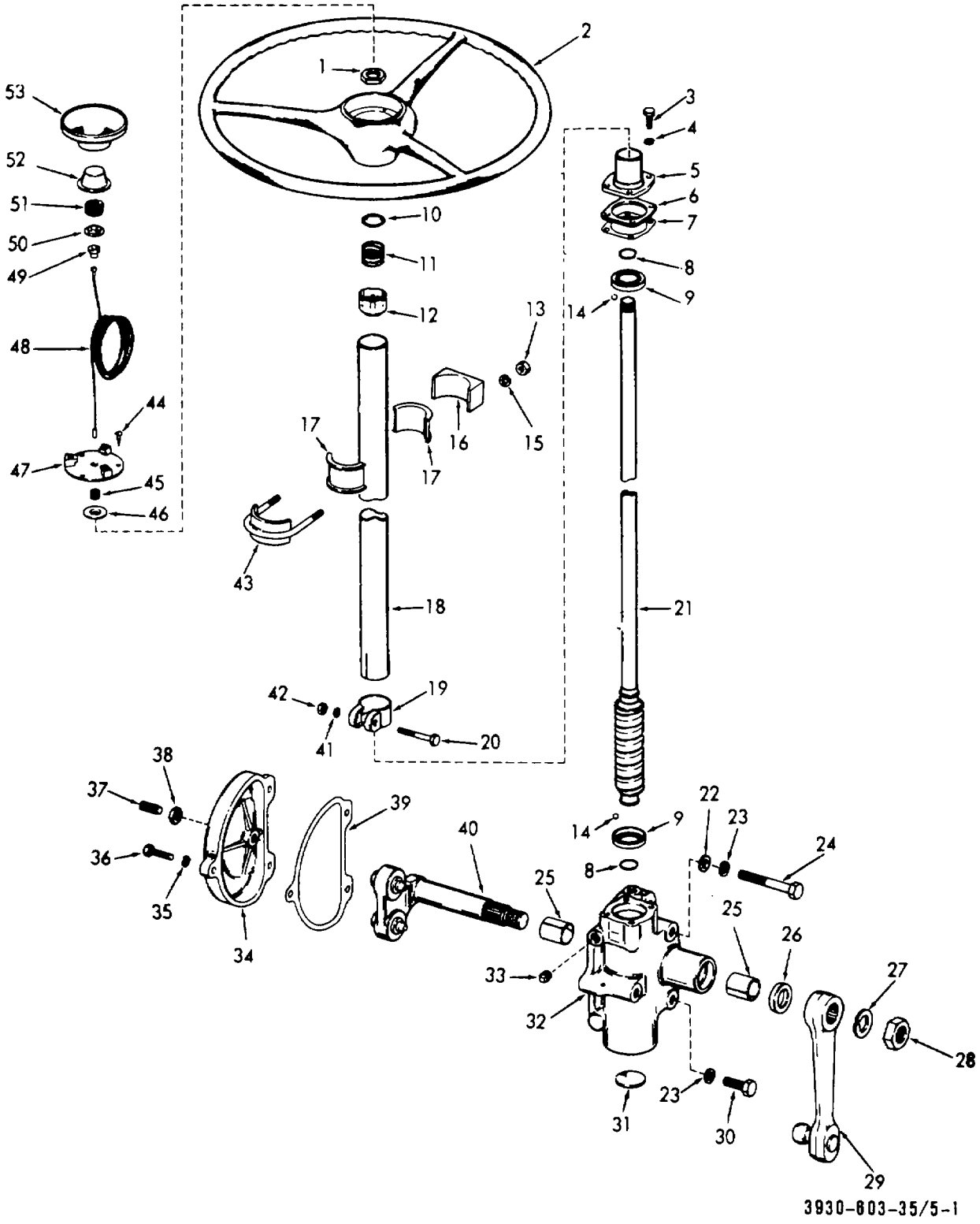


Figure 5-1. Steering gear assembly, removal, disassembly, reassembly, and installation.

1 Wheel nut
2 Steering wheel
3 Hexhead capscrew
4 Lockwasher
5 Upper housing cover
6 Upper housing spacer
7 Upper housing shim
8 Ball retainer
9 Ball cup
10 Upper bearing
11 Bearing spring
12 Spring seat
13 Hex nut
14 Steel ball
15 Lockwasher
16 Support block
17 Rubber bushing
18 Jacket tube
19 Tube clamp
20 Hex head capscrew
21 Steering shaft
22 Shim
23 Lockwasher
24 Hex head capscrew
25 Bushing
26 Oil seal
27 Lockwasher
28 Pitman arm nut
29 Pitman arm
30 Hex head capscrew
31 End cover
32 Steering gear housing
33 Pipe plug
34 Side cover
35 Lockwasher
36 Hex head capscrew
37 Adjusting screw
38 Adjusting screw locknut
39 Side cover gasket
40 Lever shaft assembly
41 Lockwasher
42 Hex nut
43 Tube clamp
44 Wood screw
45 Base plate spring
46 Contract washer
47 Base plate
48 Horn cable
49 Ferrule
50 Spring cap
51 Contact spring
52 Contact cup
53 Horn button

Figure 5-1 - Continued.

accept bushings with a 0.0015 in press fit. Use an arbor press and press bushings into housing bore.

b. Place a strong thin wire in jacket tube (18) and bring lower end out through horn cable opening before assembly of jacket tube.

c. Reassemble steering gear assembly as illustrated in figure 5-1. Do not assemble steering wheel (2), pitman arm (29) and horn components at this time.

d. Install upper housing shim (7) of same thickness as removed during disassembly to obtain correct preload on bearings. If steering gear does not turn freely with upper housing cover (5) installed, add to thickness of shim (7) to decrease bearing preload.

5-6. Steering Gear Installation

a. Position partially assembled steering gear assembly with jacket tube (18) up through tractor fender, on 'tractor frame, and secure with shims (22), three lockwashers (23) and capscrews (24 and 30). Use shims (22) as required. Torque capscrews to 40-45 pound-feet.

b. Install support block (16), rubber bushings (17), clamp (43) and secure jacket tube (18) to gearshift actuator bracket.

c. Feed wire installed during reassembly through steering wheel (2) and wheel nut (1), and install steering wheel and nut on steering shaft (21).

d. Feed wire installed during reassembly through contact washer (46), base plate spring (45) and base plate (47). Install contact washer, spring and base plate in steering wheel, and secure with three screws (44).

e. Connect horn cable (48) to wire threaded through steering gear and pull wire through shaft.

f. Install ferrule (49) over horn wire and press ferrule into base plate (47).

g. Install contact cup (52), spring cap (50), spring (51) and button (53). Turn button to catch the lips of base plate (47).

h. Position front wheels in center position, install pitman arm (29) and secure with lockwasher (27) and nut (28).

i. Adjust screw (37) for a light drag at center point of steering, then back screw off 1/2 turn and tighten locknut (38).

j. Connect pitman arm (29) to drag link and install rear floor plate (TM 10-3930-60312).

Section II. FRONT AXLE AND SPRINGS

5-7. General

The tractor is equipped with a spring mounted front axle that incorporates a single tie rod. The steering gear operates a single tie rod, to control front wheel steering.

5-8. Front Spring Removal

a. Raise front end of tractor and block securely under frame.

b. Place a jack under center of front axle tube and raise axle to take tension off front springs.

c. Remove two front wheels (TM 10-3930-603-12).

d. Remove front springs as illustrated in figure 52.

5-9. Front Spring Cleaning and Inspectio n

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Inspect all threaded areas on shackle bolts and U-bolt.

c. Inspect sleeve bearings for excessive wear or damage.

d. Inspect spring leaves for cracks or breaks.

e. Replace all defective parts.

5-10. Front Spring Installation

a. Install front spring assemblies as illustrated in figure 5-2.

b. Attach spring assembly to axle tube and rear shackle, then use suitable spring spreader and attach front shackle to tractor frame.

5-11. Front Axle Removal

a. Remove front wheels and hubs (TM 10 3930-603-12).

b. Remove drag link tube and tie rod (TM 10-3930-603-12).

c. Remove steering gear pitman arm (para 5-2).

d. Disconnect two front springs from front axle tube assembly (para 5-8).

e. Remove front axle assembly and steering knuckle as illustrated in figure 5-3.

5-12. Front Axle Cleaning and Inspection

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Inspect thrust bearing and steering knuckle pin bushings for damage or excessive wear.

c. Inspect steering arm ball and knuckle pin for nicks, burrs or excessive wear.

d. Inspect oil seal for deterioration.

e. Inspect all threaded areas for damage.

f. Replace all defective parts.

5-13. Front Axle Installation

a. Install front axle assembly as illustrated in figure 5-3.

b. Install two front springs on front axle tube assembly (para 5-10).

c. Install steering gear pitman arm (para 5-6).

d. Aline front wheels (TM 10-3930-603-12).

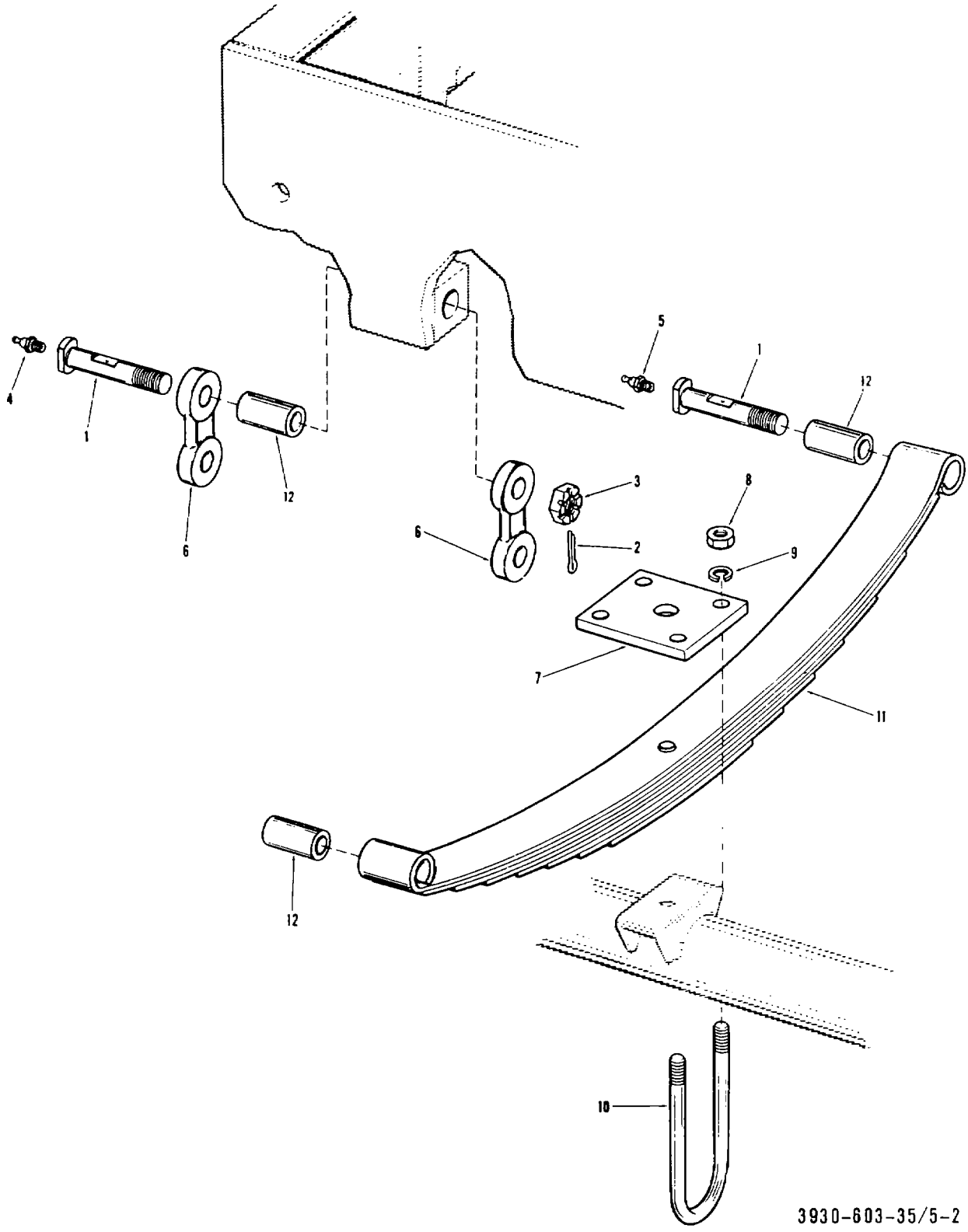
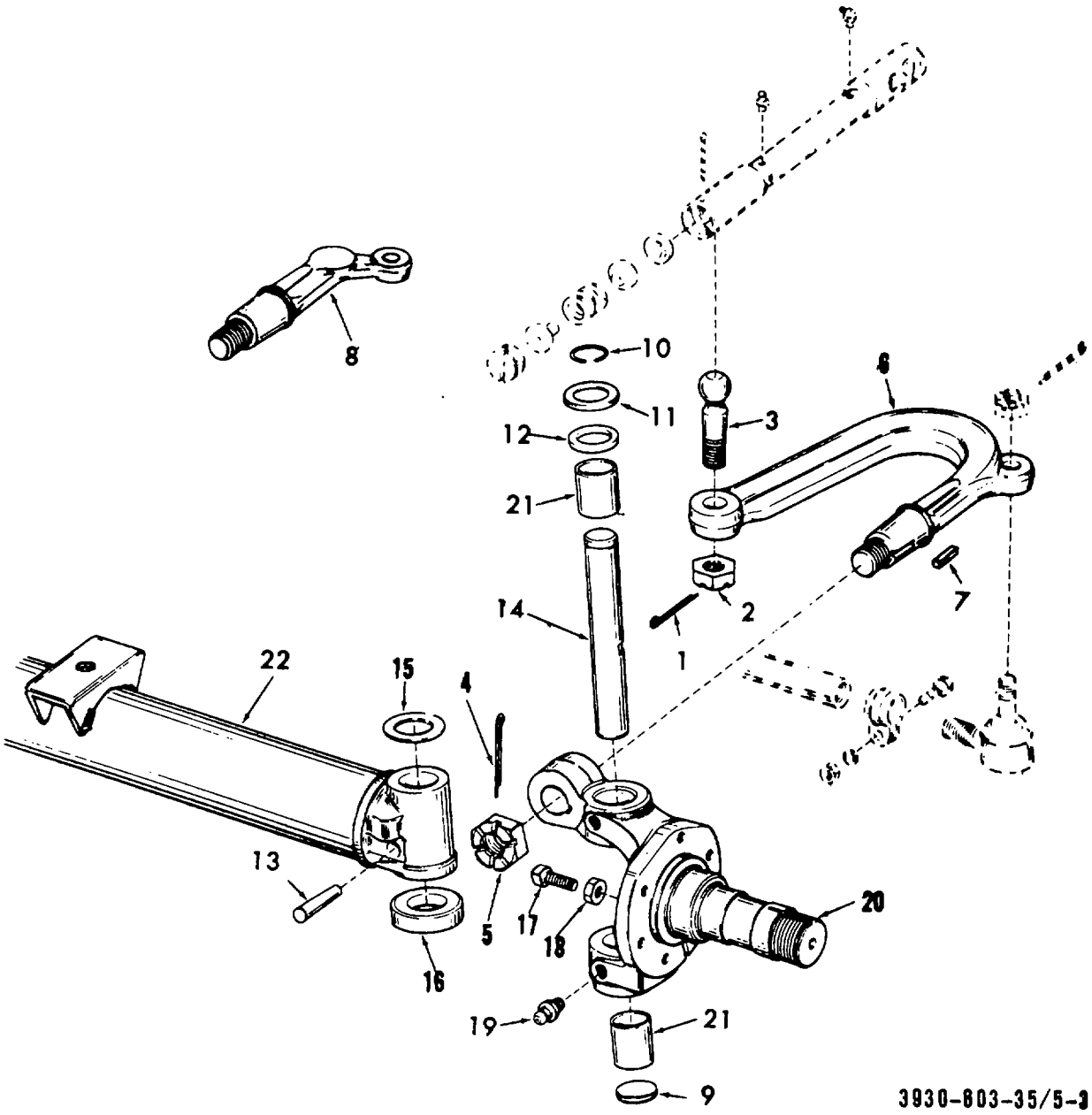


Figure 5-2. Front spring, removal and installation.

1 Shackle bolt
2 Cotter pin
3 Castellated nut
4 Lubrication fitting
5 Lubrication fitting
6 Shackle plate
7 Spring plate
8 Hex nut
9 Lockwasher
10 U-bolt
11 Front spring
12 Sleeve bearing

Figure 5-2. Continued.



1	Cotter pin	12	Oil seal
2	Castellated nut	13	Draw pin
3	Steering arm ball	14	Steering knuckle pin
4	Cotter pin	15	Shim
5	Castellated nut	16	Thrust bearing
6	Steering arm, left hand	17	Stop screw
7	Steering arm key	18	Stop screw nut
8	Steering arm, right hand	19	Lubrication fitting
9	Expansion plug	20	Steering knuckle
10	Retaining ring	21	Bushing
11	Oil seal retainer	22	Axle tube assembly

Figure 5-3. Front axle and steering knuckle, removal and installation.

Section III. REAR AXLE AND DIFFERENTIAL ASSEMBLY

5-14. General

The tractor drive components consists of rear driving axles, differential and integral drop gear case. The overall reduction gear ratio is 17 to 1. The rear axle assembly is coupled to an automatic transmission by a propeller shaft and two universal joints. The entire assembly is attached directly to the main frame; no springs are used.

5-15. Rear Axle Assembly Removal

a. Jack up rear of tractor and support with blocks placed just ahead of rear wheels.

b. Disconnect propeller shaft at drop gear case (TM 10-3930-603-12).

c. Place a jack under center of rear axle assembly to support axle weight.

d. Remove rear axle assembly as illustrated in figure 5-4. Carefully lower jack and pull axle assembly to rear.

5-16. Rear Axle Assembly, Disassembly

a. Drop Gear Case.

(1) Drain drop gear case and differential assembly (LO 10-3930-603-12).

(2) Disassemble drop gear case assembly as illustrated in figure 5-5. Use a gear puller if necessary to remove spur gear (32).

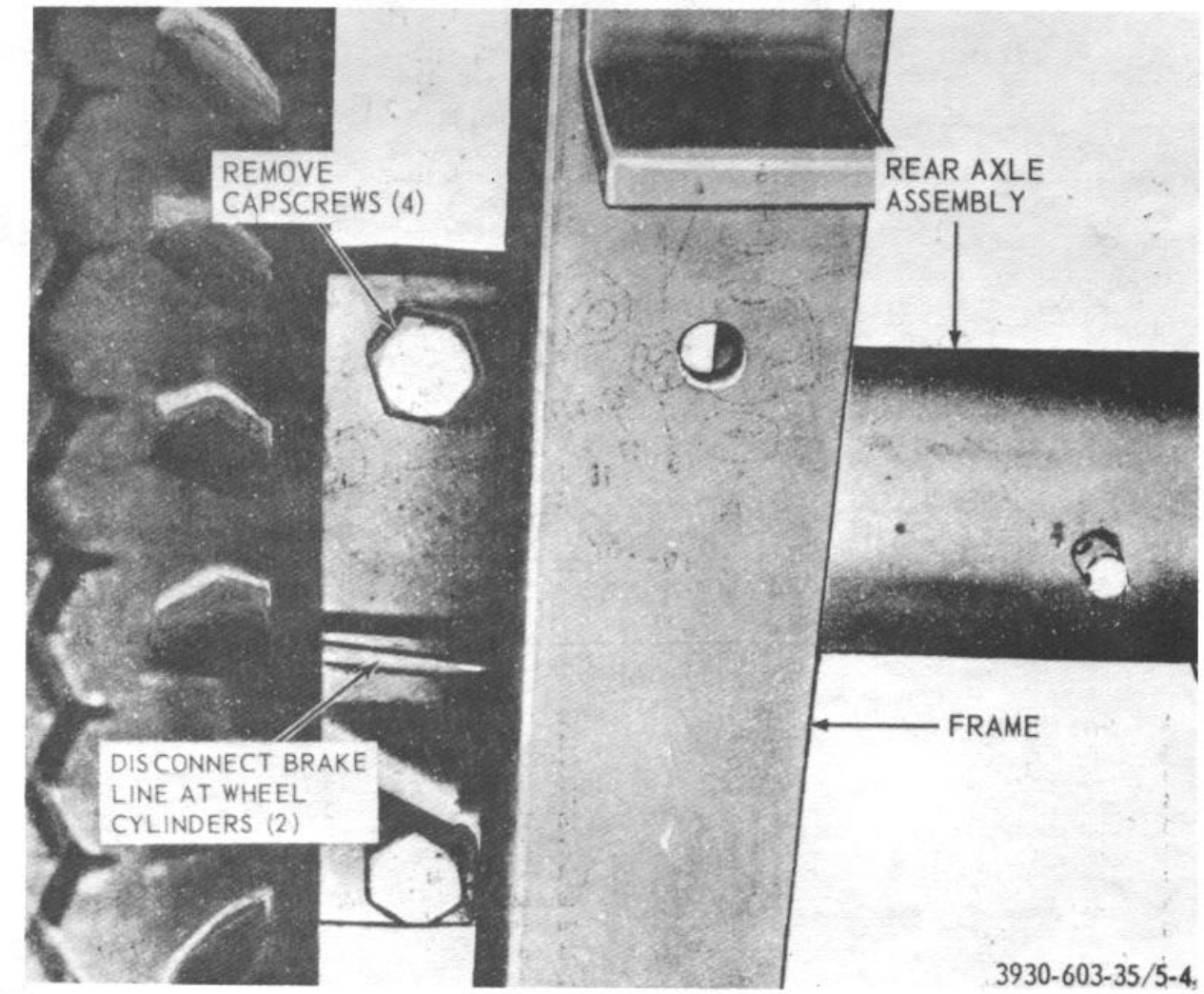


Figure 5-4. Rear axle assembly, removal and installation.

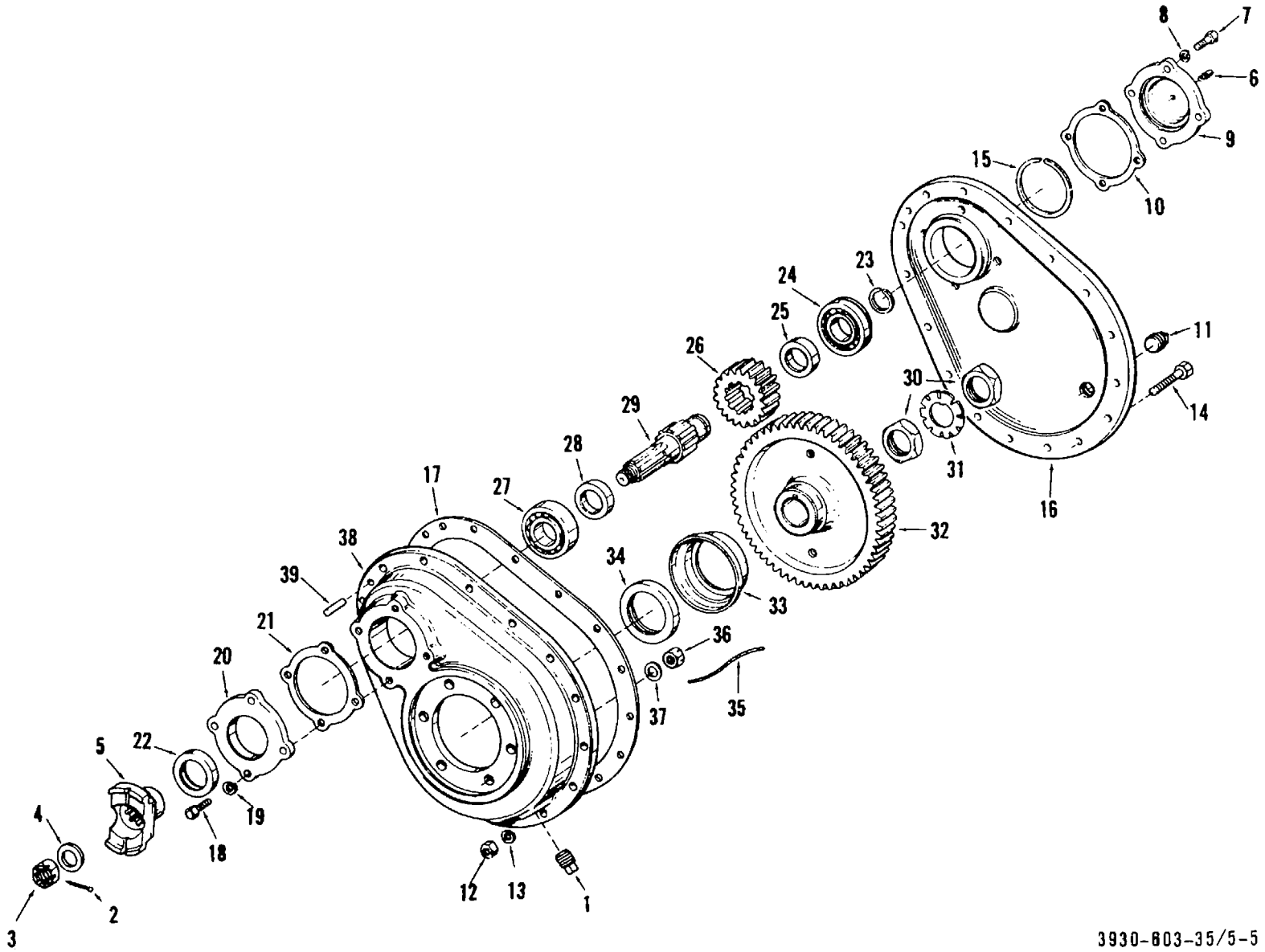


Figure 5-5. Drop gear case, disassembly and reassembly.

1 Drain plug
2 Cotter pin
3 Castellated nut
4 Flat washer
5 Input shaft yoke
6 Breather
7 Hex head capscrew
8 Lockwasher
9 Input shaft rear cap
10 Input shaft rear cap gasket
11 Filler plug
12 Hex nut
13 Lockwasher
14 Hex head bolt
15 Retaining ring
16 Gear case cover
17 Gear case gasket
18 Hex head capscrew
19 Lockwasher
20 Input shaft front cap
21 Front cap gasket
22 Oil seal
23 Retaining ring
24 Ball bearing
25 Bearing spacer
26 Spur gear
27 Ball bearing
28 Bearing spacer
29 Input shaft
30 Bearing nut
31 Bearing nut lock
32 Spur gear
33 Seal retainer
34 Oil seal
35 Lockwire
36 Castellated nut
37 Flat washer
38 Gear case
39 Straight pin

Figure 5-5. Continued.

b. Differential and Rear Axle Assembly.

(1) Remove rear wheels, brake drum, and brake assembly (TM 10-3930603-12).

(2) Disassemble rear axle housing assembly as illustrated in figure 5-6. Do not remove bearing cups (13 and 17) unless they are damaged and must be replaced.

(3) Disassemble differential carrier assembly as illustrated in figure 5-7. Do not remove bearing cups (8 and 14) or bevel gear (25) unless they are damaged and must be replaced.

5-17. Rear Axle Assembly, Cleaning and Inspection

a. Cleaning.

(1) Wash all parts with an approved cleaning solvent and dry thoroughly.

(2) Remove all grease and sludge from all bearings and dry thoroughly.

(3) Use a soft bristle brush to clean gears and pinions. Clean threaded holes, cutout sections, grooves and orifices thoroughly. Use emery cloth or a fine oil stone to remove pits from gear teeth and splines.

(4) Clean out all corners, ridges and grooves in all castings.

b. Inspection.

(1) Perform a visual inspection of all parts for excessive wear or damage.

(2) Inspect axle housing and drop gear case housing for broken welds, missing or damaged studs, and cracked housings. Make sure axle mounting pads are in good condition, that the tapped holes are not distorted or otherwise damaged.

(3) Inspect all gears, pinions, bearing cones, bearing cups and bearing recesses for evidence of wear, scoring or galling.

(4) Inspect axle shafts for damage. If equipment is available, magnaflux shafts for internal stress.

(5) Discard and replace all gaskets and seals. Replace all defective parts.

5-18. Rear Axle Assembly and Reassembly

a. Differential and Rear Axle Assembly.

(1) Reassemble differential carrier assembly as illustrated in figure 5-7.

(2) Reassemble rear axle housing assembly as illustrated in figure 5-6.

(3) Torque shaft nut (2) to 700 foot-pound and secure with cotter pin (1).

Note.
The bevel gear and drive pinion are not serviced separately and must be replaced as a set.

(4) Use same size spacer (9, fig. 5-7) as originally installed unless bevel gear and drive pinion were installed, select a spacer to provide proper bearing fit.

(5) Torque rear axle and differential bolts and nuts to valves listed in table 1-2.

b. Drop Gear Case.

(1) Reassemble drop gear case assembly as illustrated in figure 5-5.

(2) Install and torque inner bearing nut (30) so pinion bearings are 0.000 to 0.003 inch loose (5 to 15 inches-pound torque to turn shaft). Install washer (31) and outer nut (30).

(3) Torque drop gear case assembly bolts and nuts to valves listed in table 1-2.

5-19. Rear Axle Assembly Installation

a. Install rear axle assembly as illustrated in figure 5-4. Place a jack under center of rear axle assembly to support axle weight during installation.

b. Connect impeller shaft and universal joint at drop gear case assembly TM 10-3930-60312).

c. Jack up rear of tractor and remove support blocks placed under frame before removal.

d. Fill rear axle housing and drop gear case assembly with lubricant (LO 10-3930-603-12).

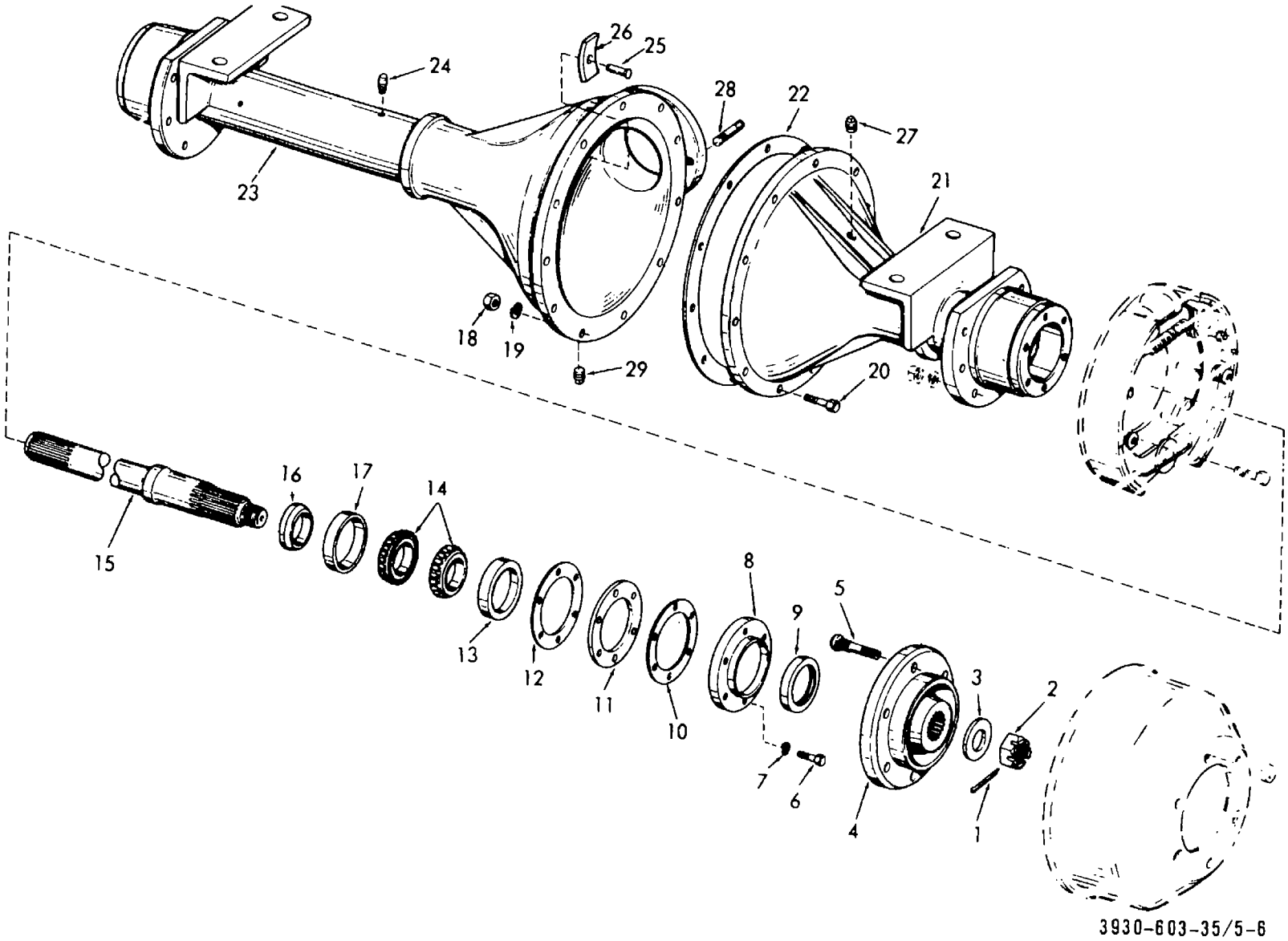


Figure 5-6. Rear axle housing disassembly and reassembly.

1 Cotter pin
2 Drive axle shaft nut
3 Flat washer
4 Wheel hub
5 Wheel stud
6 Hex head capscrew
7 Lockwasher
8 Oil seal retainer
9 Oil seal
10 Retainer gasket
11 Bearing retainer
12 Bearing retainer shim
13 Bearing cup
14 Bearing cone
15 Axle shaft
16 Spacer coller
17 Bearing cup
18 Hex nut
19 Lockwasher
20 Hex head bolt
21 Cover and tube assembly
22 Cover gasket
23 Carrier and tube assembly
24 Breather
25 Thrust block pin
26 Thrust block
27 Filler plug
28 Stud
29 Drain plug

Figure 5-6. Continued.

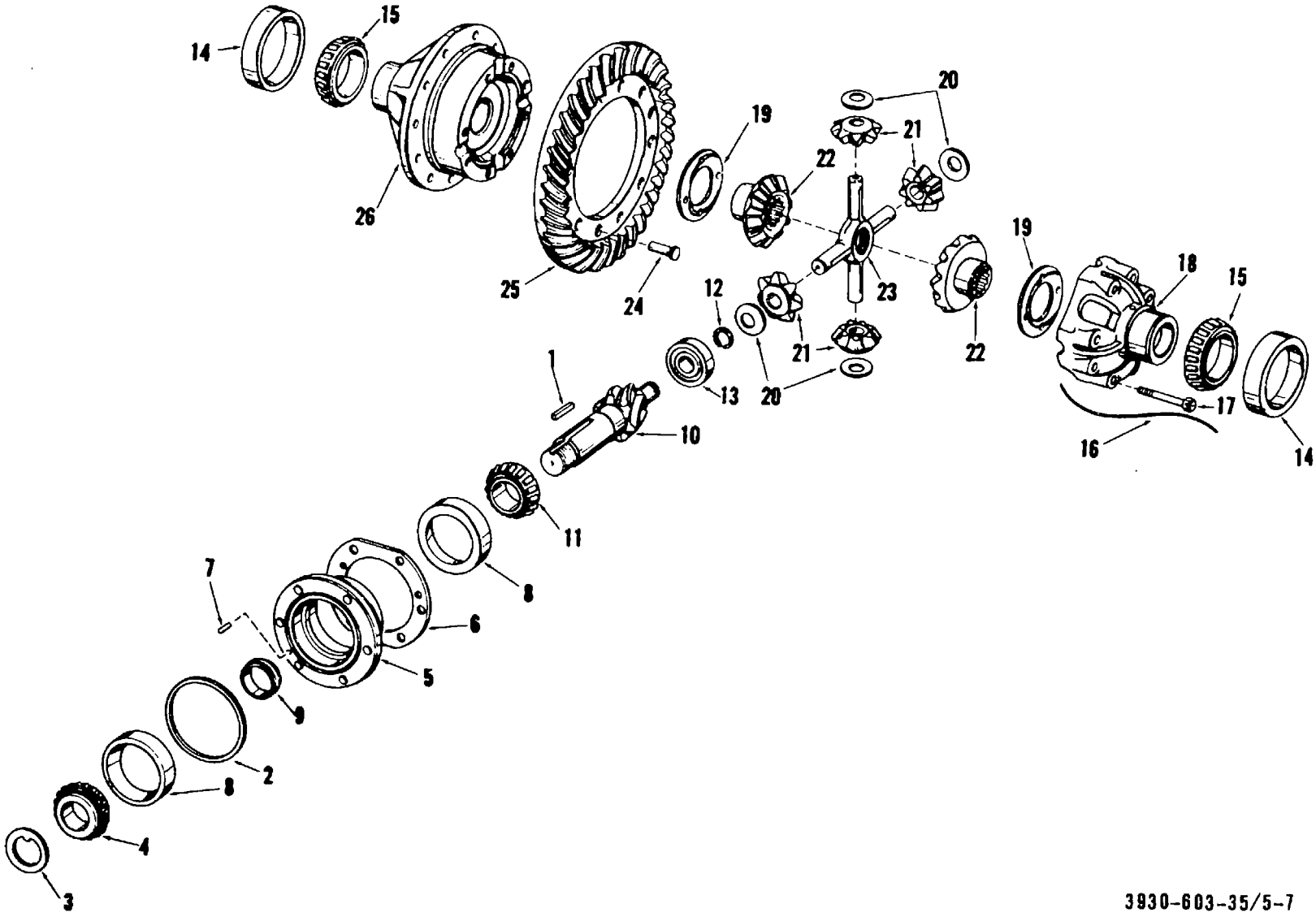


Figure 5-7. Differential carrier assembly, disassembly and reassembly.

1 Gear key
2 Pinion gasket
3 Flat washer
4 Bearing cone
5 Bearing cage
6 Bearing cage gasket
7 Straight pin
8 Bearing cup
9 Bearing shim
10 Drive pinion
11 Bearing cone
12 Bearing lock
13 Ball bearing
14 Bearing cup
15 Bearing cone
16 Lockwire
17 Hex head capscrew
18 Differential case, tongue half
19 Thrust washer
20 Thrust washer
21 Spider gear
22 Side gear
23 Spider
24 Bevel gear rivet
25 Bevel gear
26 Differential case, flange half

Figure 5-7. Continued.

Section IV. HYDRAULIC BRAKE SYSTEM

5-20. General

The tractor is equipped with a foot brake of conventional design using a brake master cylinder, a foot pedal, tubing and wheel cylinders installed at rear wheels.

5-21. Foot Brake Control, Removal and Disassembly

a. Remove master cylinder (TM 10-3930603-12).

b. Remove and disassemble hydraulic brake linkage and lines as illustrated in figure 5-8.

5-22. Foot Brake Control Group, Cleaning and Inspection

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Inspect tubing and fittings for cracks, breaks, or damaged threads.

c. Replace all defective parts.

5-23. Foot Brake Control, Reassembly and Installation

a. Reassemble and install hydraulic brake linkage and lines as illustrated in figure 5-8.

b. Install master cylinder assembly (TM 103930-603-12).

c. Fill master cylinder with brake fluid and bleed hydraulic brakes (TM 10-3930-603-12).

5-24. Master Cylinder Removal and Disassembly

a. Remove master cylinder (TM 10-3930603-12).

b. Disassemble master cylinder as illustrated in figure 5-9.

5-25. Master Cylinder Cleaning, Inspection, and Repair

a. Wash all parts thoroughly with an approved cleaning solvent and dry thoroughly.

b. Inspect all parts for corrosion, distortion, or other damage. Replace all defective parts.

c. If cylinder walls in master cylinder housing are scored or corroded, polish it smooth 5-18 with crocus cloth, or hone the cylinder. If cylinder is honed, diameter of bore must not be increased more than 0.002 inch.

d. Discard and replace all internal components of master cylinder with a repair parts kit.

5-26. Master Cylinder Reassembly and Installation

a. Reassemble master cylinder as illustrated in figure 5-9.

b. Install master cylinder (TM 10-3930603-12).

c. Bleed hydraulic brake system (TM 103930-603-12).

5-27. Wheel Cylinder Removal and Disassembly

a. Remove wheel cylinder (TM 10-3930603-12).

b. Disassemble wheel cylinder as illustrated in figure 5-10.

5-28. Wheel Cylinder Cleaning, Inspection and Repair

a. Wash all parts with an approved cleaning solvent and dry thoroughly.

b. Inspect all parts for corrosion, cistortion, or other damage. Replace defective parts.

c. If cylinder walls in wheel cylinder housing are scored or corroded, polish it smooth with a fine crocus cloth, or hone the cylinder. If cylinder is honed, diameter of bore must not be increased more than 0.004 inch.

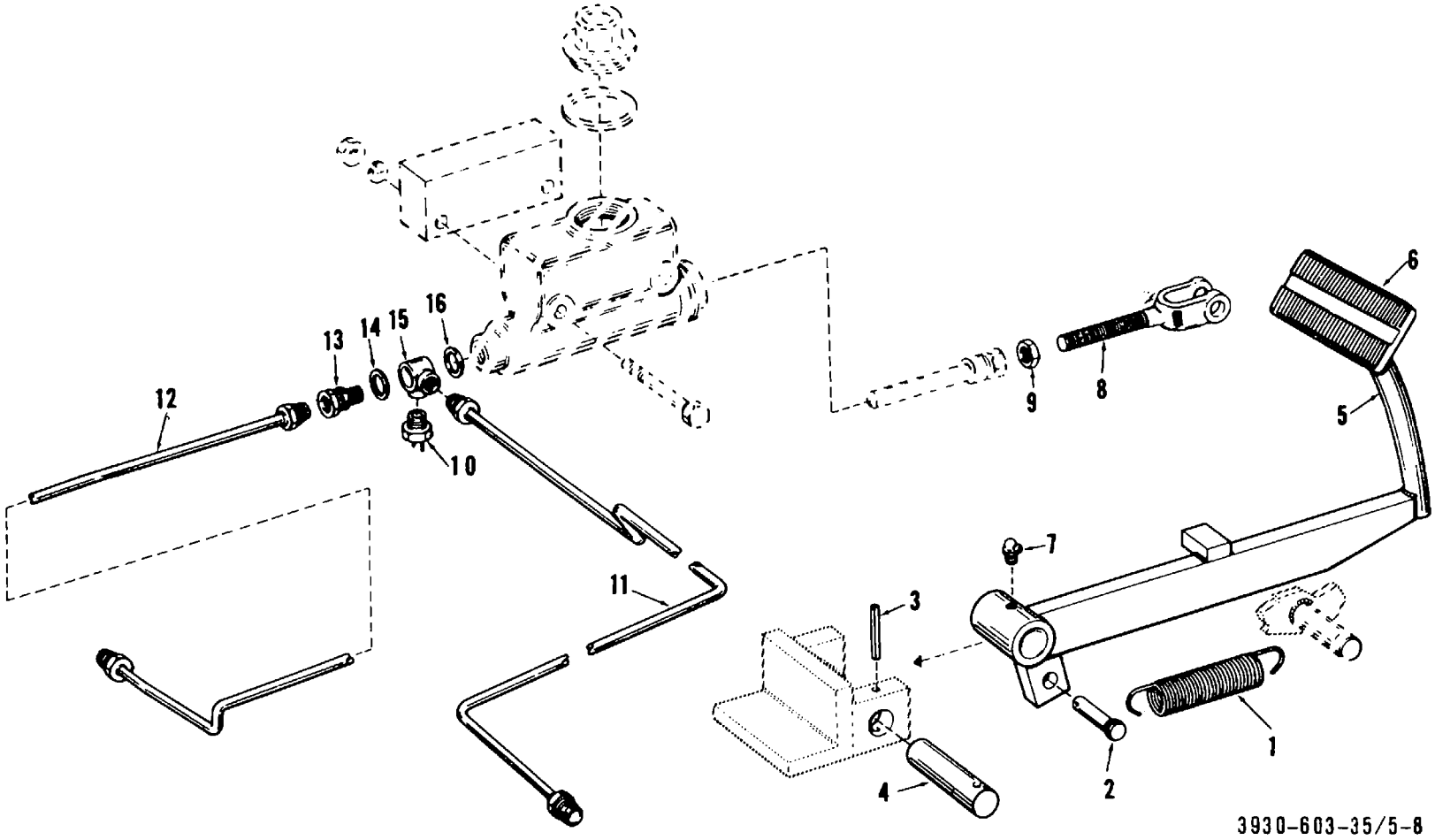
d. Discard and replace all internal components of wheel cylinder with a repair parts kit.

5-29. Wheel Cylinder, Reassembly and Installation

a. Reassemble wheel cylinder as illustrated in figure 5-10.

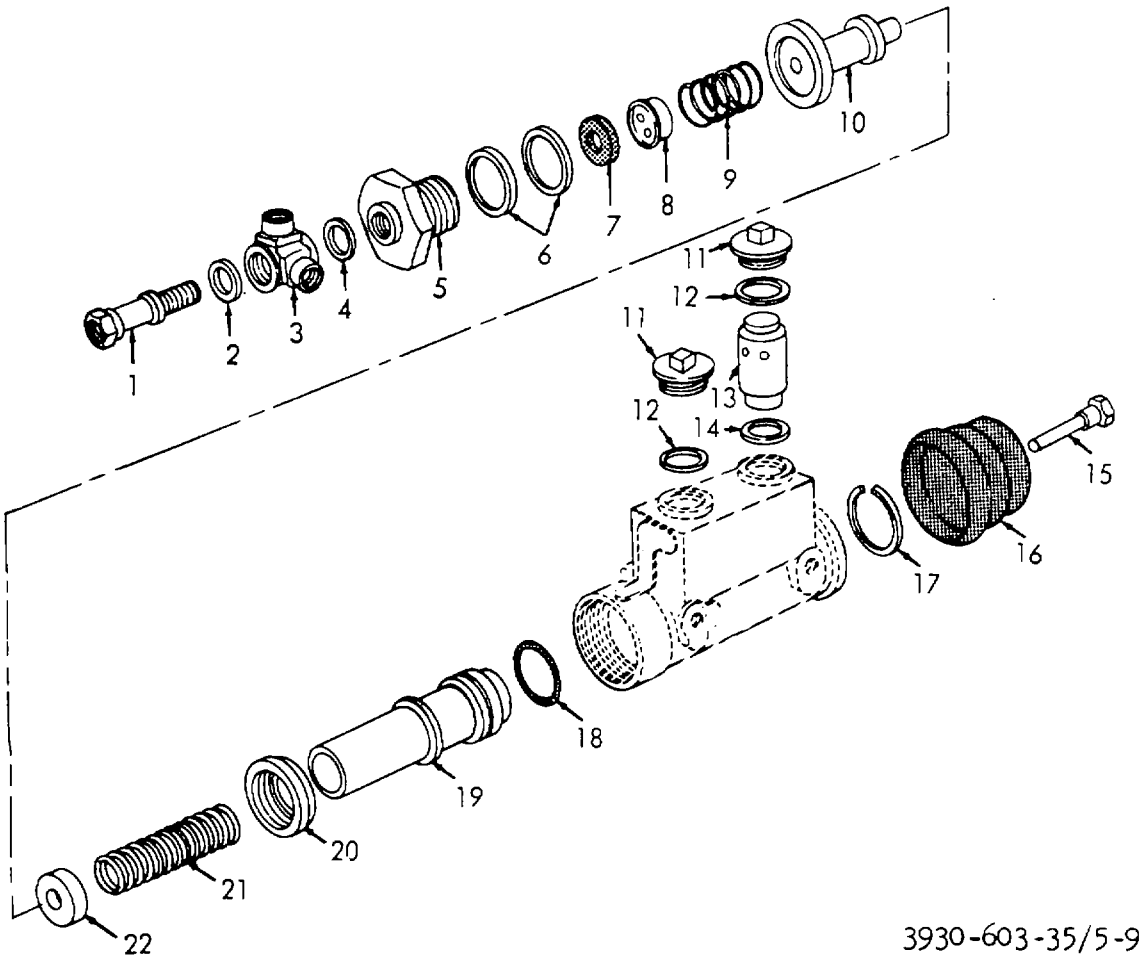
b. Install wheel cylinder (TM 1O-3930-60312).

c. Bleed hydraulic brake system and adjust ,brakes (TM 10-3930-603-12).



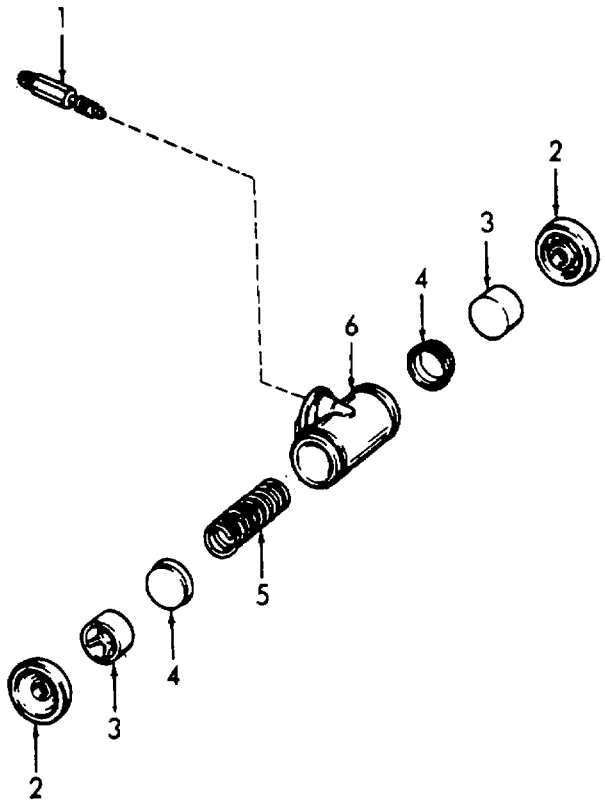
1 Brake return spring
2 Pin
3 Shaft pin
4 Brake pedal shaft
5 Brake pedal
6 Pedal pad
7 Lubrication fitting
8 Rod end
9 Hex nut
10 Stoplight switch
11 Brake line, right
12 Brake line, left
13 Tube fitting
14 Gasket
15 Outlet fitting
16 Gasket

Figure 5-8. Hydraulic brake linkage and lines.



1	Adapter bolt	12	Filler plug gasket
2	Bolt washer	13	Valve assembly
3	Line adapter	14	Valve gasket
4	Bolt gasket	15	Piston rod
5	Special plug	16	Cylinder boot
6	Gasket	17	Snap ring
7	Valve seat	18	Piston packing
8	Valve	19	Piston
9	Piston spring	20	Piston cup
10	Cup	21	Spring
11	Filler plug	22	Spring guide

Figure 5-9. Master cylinder, disassembly and reassembly.



1 Bleeder screw
2 Boot
3 Piston
4 Cup
5 Spring
6 Cylinder housing

Figure 5-10. Wheel cylinder assembly, disassembly and reassembly.

APPENDIX A

REFERENCES

A-1. Publications

TM 10-3930-603-20P	Organizational Maintenance Repair Parts List; Tractor, Wheeled, Warehouse: Gasoline Engine Driven; 4 Wheel, Pneumatic Tired, 4000 LB, DBP, Army Model MHE 201 (Northwestern Motor Co Model JG-40PT4) FSN 3930-926-1066
TM 10-3930-60335P	Direct Support, General Support, and Depot Maintenance Repair Parts List; Tractor, Wheeled, Warehouse: Gasoline Engine Driven; 4 Wheel, Pneumatic Tired, 4000 LB, DBP, Army Model MHE 201 (Northwestern Motor Co Model JG-40PT4) FSN 3930-926-1066.
TM 10-3930-603-12	Operators and Organizational Maintenance Manual, Tractor, Wheeled, Warehouse: Gasoline Engine Driven; 4 Wheel, Pneumatic Tired, 4000 LB Drawbar Pull, Army Model MHE-201, (Northwestern Motor Co Model JG40PT4) FSN 3930-926-1066.

A-2. Fire Protection

TB 5-4200-200-10	Hand and Portable Fire Extinguishers for Army Use.

A3. Painting

TM 9-213	Painting Instructions for Field Use.

A-4. Preventive Maintenance

LO 10-3930-603-12	Lubrication Order, Tractor, Wheeled, Warehouse: Gasoline Engine Driven; 4 Wheel, Pneumatic Tired, 4000 LB DBP, Army Model MHE 201 (Northwestern Motor Co Model JG-40PT4) FSN 3930-926-1066.
TM 38-750	Army Equipment Record Procedure.

INDEX

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For explanation of abbreviations used, see AR 320-50.

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 decagram = 10 grams = .35 ounce
1 hectogram = 10 decagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

TM 0-3930-603-35 TRACTOR, WHEELED, WHAREHOUSE: GASOLINE ENGINE DRIVEN-1967

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