

MF500 SERIES TRACTOR WORKSHOP SERVICE MANUAL

Publication No. 1856 072 M1

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SPECIAL TOOLS

Tool No.	Description	Tool No.	Description
MF.266B	Planetary Carrier Bush Inner Coil Seal Bearing Cone and Unit Replacer	MF.333	Draft Control Rod Gauge (Increased Tension Range)
MF.267A	Epicyclic Hub Pre-load Gauge	MF.349	Valve Seal Forming Tool
MF.295B	Wheel Guide Pilots	MF.350	Valve Circlip Replacer
MF.555-2A	Differential Coupling Bearing Cone Remover	MF.351	Valve Plug Remover and Replacer
MF.1105-2A	Differential Bearing Cup Remover/Replacer	MF.352	Control Valve Spring Retainer
MF.1105-7A	Differential Bearing Cup Remover/Replacer Adaptor	MF.353	Control Valve Body 'O' Ring Guide
MF.1105-8	Epicyclic Hub Inner Bearing Cup Remover/Replacer Adaptor	MF.354	Control Valve Body Replacer
MF.1105-11	Rear Axle Shaft Oil Seal Remover and Replacer	MF.356	Position and Draft Control Setting Gauge
CLUTCH & TRANSMISSION		MF.357A	Dummy Bolt and Screwdriver Adjuster
MF.159A	Single and Dual Clutch Centraliser	MF.357	Screwdriver Adjuster
MF.177	Transmission Main Drive Shaft Oil Seal Pilot	MF.359	Pressure Control Bleed Pipe
MF.178	P.t.o. Main Drive Shaft Pilot	MF.360	Hydraulic Pump Adjusting Kit
MF.200-25	Multi-Purpose Bearing Remover	MF.363	Quadrant Lever Retainer Tool
MF.215	Secondary Clutch Setting Gauge	MF.364	Oil Seal Replacer (P.t.o.)
MF.218A	Front P.t.o. Housing Replacer (Main Tool)	810	Hydraulic Pressure and Flow Test Fixture (Main Tool)
MF.218A-2	Front P.t.o. Housing Replacer Adaptor	MF.810-1	Adaptor
MF.255B	Multi-Power Pinion Oil Seal Replacer and Assembly Sleeve	MF.810-4	Multi-Power Pump Flow Adaptor
MF.256A	Multi-Power Pinion Assembly Inner Oil Seal Replacer	MF.810-6	I.p.t.o. Pressure Gauge Adaptor
MF.314	Lever Fulcrum Height Setting Gauge	MULTI-PURPOSE & MISCELLANEOUS TOOLS	
MF.315	Main Drive Shaft Retainer Needle Bearing and Seal Remover/Replacer	13	Tension Wrench
MF.331	Transmission Input Shaft Oil Seal Replacer	MF.148A	Hydraulic Pressure Test Equipment (Main Tool)
MF.347	Transmission Case Drill and Ream Jig	MF.195	Bearing Cups Remover/Replacer (Main Tool)
MF.1105-6	Differential Carrier Plate Oil Seal Remover/Replacer Adaptor	MF.200	Hand Press (Main Tool)
7600B	Flywheel Spigot Bearing Remover (Main Tool)	MF.260	Low Pressure Hydraulic Test Set (Main Tool)
MF.7600-1	Flywheel Spigot Bearing Remover Adaptor	270	Tractor Splitting Kit
P.T.O. & HYDRAULICS		MF.365-1	Plates
MF.163	Spring Retainer Nut Wrench	MF.356-3	Short Support Bars
MF.166	Hydraulic Adaptor for Life Cover	MF.356-4	Long Support Bars
MF.167	P.t.o. Oil Seal Pilot	MF.365-6	Bar Pins
MF.195-6	Two Speed P.t.o. Shaft Needle Bearing Remover/Replacer	MF.365-7	Tommy Bar
MF.226A	Hydraulic Life Cover Remover/Replacer	MF.365-8	Stands
MF.226A-3	Lift Cover Cradle Adaptor Set	550	Driver Handle (Main Tool)
		555	Three Leg Adjustable Puller (Main Tool)
		MF.1105	Bearing Remover (Main Tool)
		7065M	Heavy Duty Circlip Pliers
		7066	Circlip Pliers
		HD.3	Circlip Plier Points
		964 - Gun page 9-12 Special Tools	
		** CAB	
		PT.468	Locking Strip replacer
		18G.468A	Adaptor
		** 600.358	Wheel part

SPECIFICATION

Part 1 — Section A

Page Number

**

MF550 MF560 MF565 MF575 MF590

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SPECIFICATION

MF550 TRACTOR

ENGINE

Make: Perkins, to MF specification
Type and Model: Four-stroke, direct injection diesel AD3.152
Number of Cylinders: Three
Bore: 91,44 mm (3.6 in)
Stroke: 127 mm (5 in)
Capacity: 2,5 litre (152.7 in³)
Compression Ratio: 16.5:1
Firing Order: 1, 2, 3
Horsepower: 47 PS (34.5 kW) at 2250 rev/min (DIN 70020). 49 hp at 2250 rev/min (B.S. AU 141: 1967 Ambient Conditions)
Maximum Torque (at 1400 rev/min): 169 Nm (125 lbf ft) (DIN 70020). 177 Nm (131 lbf ft) (B.S. AU 141: 1967 Ambient Conditions)
Lubrication: Throwaway, cannister type full flow external filter
Valves: Overhead, pushrod operated
Valve tip Clearance (Inlet and Exhaust): 0,30 mm (0.012 in) cold. 0,25 mm (0.010 in) hot

FUEL SYSTEM AND AIR CLEANER

Fuel Lift Pump: A.C. Delco with hand primer
Fuel Filter: C.A.V. filter with transparent sediment bowl
Injection Pump: C.A.V. Distributor type, with mechanical governor
Engine Speeds (no load): Idling—700 to 750 rev/min. Maximum—2390 rev/min
Injection Timing: 16° B.T.D.C.
Injectors: C.A.V. type nozzles and nozzle holders
 Initial setting pressure 19,25 N/mm² (190 Atmosphere). Working pressure 17,27 N/mm² (170 Atmosphere)
Easy Starting Aid: C.A.V. Thermostart Mark III C
Air Cleaner: Two stage, dry element, removable for cleaning with warning light and buzzer

ELECTRICAL SYSTEM

Voltage: 12 volt NEGATIVE EARTH
Battery: 17 plate, 96 Ah. Lucas Mono Lid. Exide Mono Lid. Lucas Aqualok. Exide Auto-Fil
Starter Motor: Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector
Alternator: Lucas 23ACR or Motorola 9AR 2501K
Light Bulb Sizes:
 Headlights UK 36/36W, Others 45/40W
 Side Lights 5W
 Rear Lights 5W
 Indicator Lights 21W
 Brake Lights 21W
 Number Plate Lights 5W
 Plough Light 36W
 Panel Lights 2.2W
 Interior Light 5W

Fuses:

Dipped Headlights 15A
 Side Lights 10A
 Brake Lights 10A
 Warning Light 15A
 Main Beam Headlights 15A
 Flashing Indicators 10A
 Plough Light 10A
 Blower Motor 17A
 Wiper Motor 10A
 Interior Light 2A
 Horn 35A
 Cigar Lighter 35A
Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)

COOLING SYSTEM

Type: Thermostat controlled with centrifugal pump to assist circulation. Four bladed fan driven by a belt from the crankshaft.
Fan Belt Deflection (Total): 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley

TRANSMISSION

Clutch Live P.t.o. Tractors: Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated.
I.p.t.o. Tractors: Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories.
Eight Speed Gearbox: The eight speed gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, compounded by an epicyclic unit.
Eight Speed Synchromesh Gearbox (Certain Territories): The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh as third and fourth gears, compounded by an epicyclic unit.
Multi-Power Gearbox: The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears actuated by a hydraulic clutch
Epicyclic Reduction: 4:1
Final Drive Ratio: 6.17:1

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GENERAL

The cab is a welded all steel fabrication with an integral safety frame of square section steel tube. It is lined throughout with anticoustic vinyl faced foam which reduces the interior noise level to meet new legislation.

A laminated rubber and foam floor mat is also fitted. The cab is glazed with toughened safety glass. The right hand side window and rear screen are both hinged to permit opening. A hinged lower window is fitted below the rear view screen to give convenient access to the implement controls.

The door (a two-door version is supplied for certain market requirements) is lockable and a latch is fitted to retain the door in the open position.

The cab is fitted with a comprehensive manually

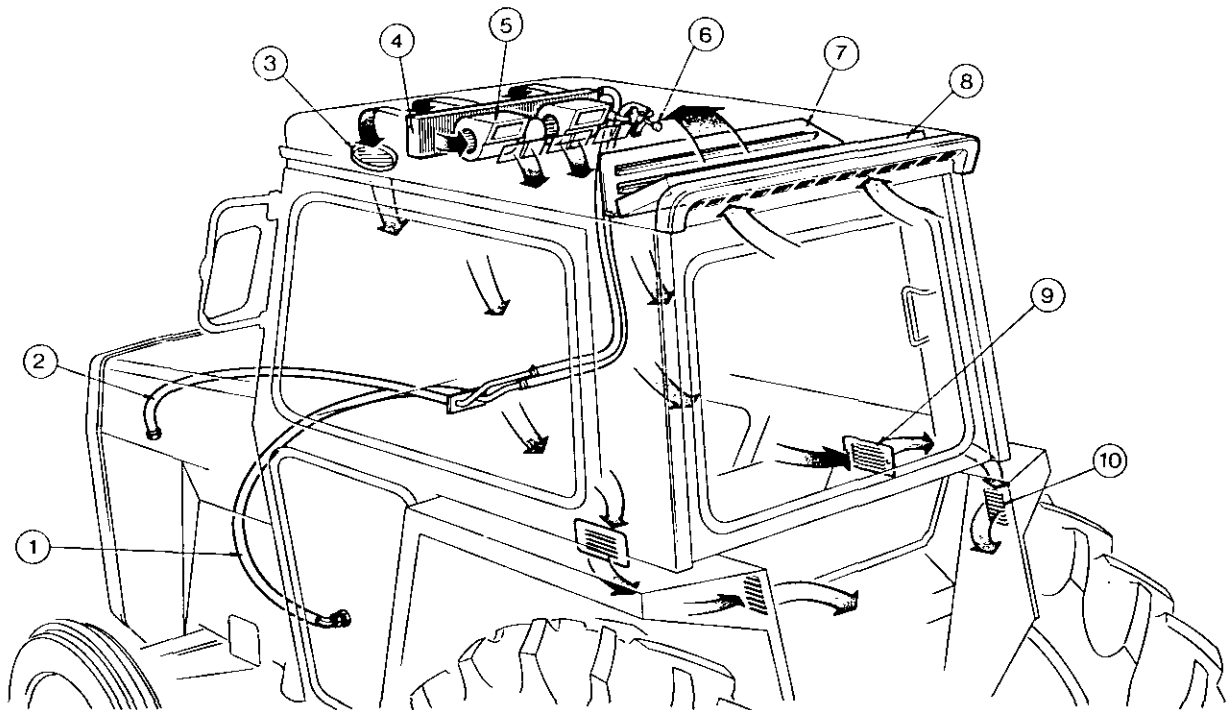
controlled air ventilation/heating system. Filtered air entering the cab roof from the rear passes to twin blowers in the roof mounted plenum chamber assembly.

Here the air is either heated or fed at ambient air temperature to the windscreen or cab interior by means of adjustable vents.

Air recirculation is obtainable by sealing off the rear air intake, whereby the cab interior air is re-cycled using the twin blowers.

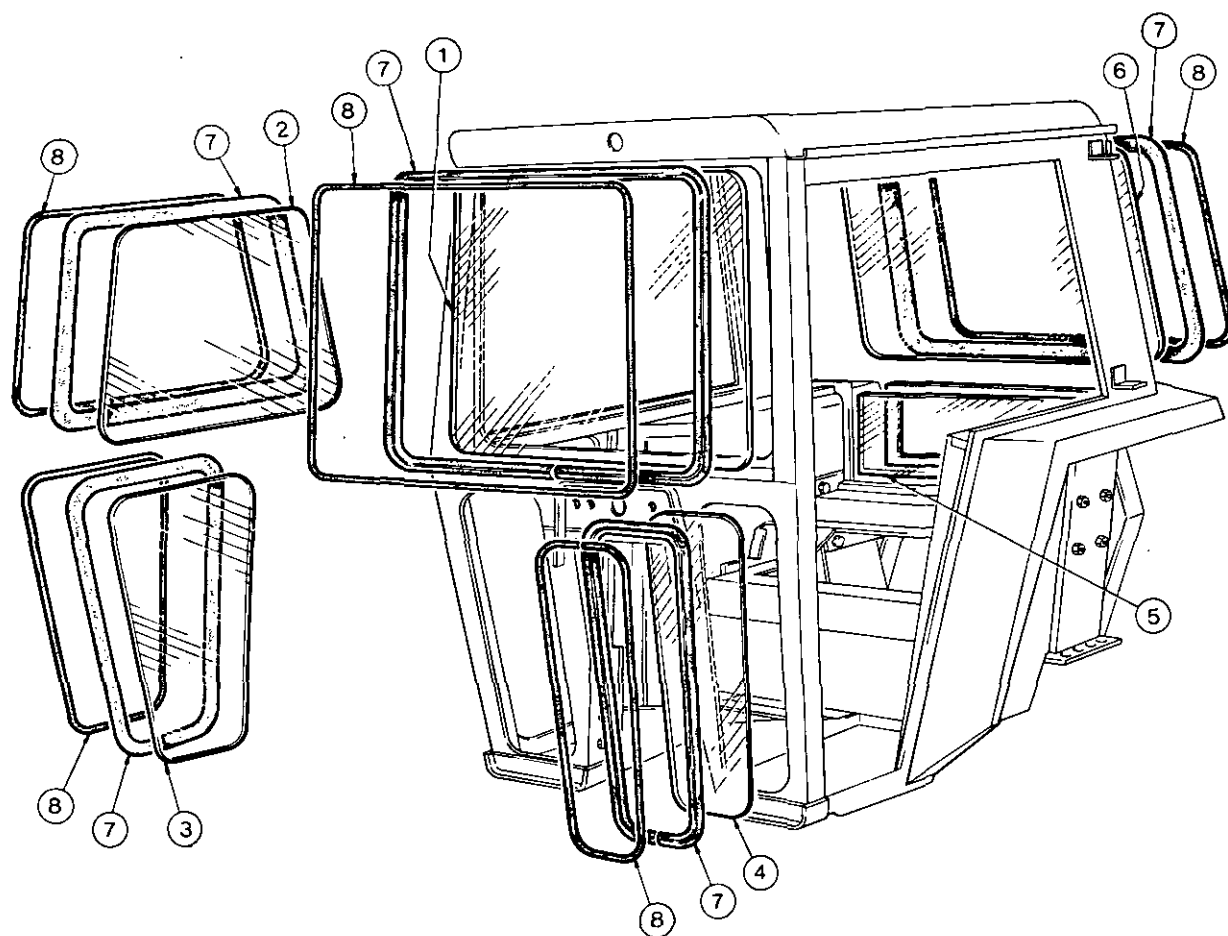
A heat exchanger is fitted adjacent to the air blowers and fed by hot water from the engine water pump. The temperature is controlled by a flow valve mounted in the plenum chamber which is operated from within the cab.

CAB AND FITTINGS



KEY TO FIGURE 1

- ** 1. Hose—water feed
- 2. Hose—water return
- 3. Windscreen demister duct
- 4. Heat exchanger
- 5. Blower unit
- 6. Water flow control valve
- 7. Recirculation flap
- 8. Air filter
- 9. Air outlet grille—cab interior
- 10. Air outlet grille—cab exterior

**KEY TO FIGURE 2**

- 1 Windscreen glass
- 2 Side window and door glass
- 3 Lower side window and lower door glass
- 4 Bulkhead glass
- 5 Rear lower window glass
- 6 Rear window glass
- 7 Rubber moulding
- 8 Locking strip

CAB AND FITTINGS**REAR LOWER WINDOW GLASS****Removal and Replacement** 2B-25-16**Removal**

1. Remove all broken glass from the window frame.
2. Scrape off all the sealer and clean the frame.

Replacement

3. Using sealant F, place it in position onto the window frame as close to the inner edge of the aperture as possible.
4. Place the new glass into position, laying it onto the sealing strip. Place the 'TRIPLEX' legend in the top R.H. corner facing the outside of the cab.
5. Apply a firm even pressure onto the glass until the sealant strip is compressed and has spread to a rectangular section approximately half the original thickness.

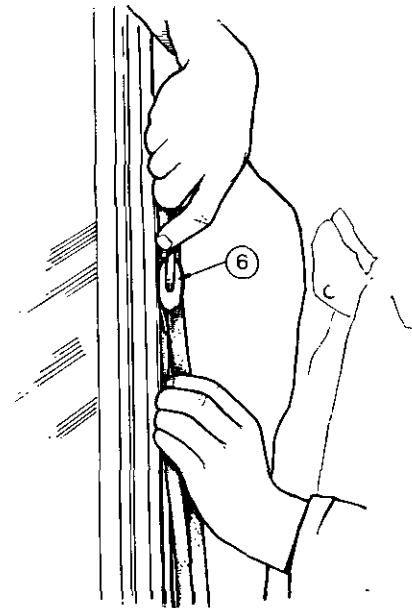
DOOR, SIDE WINDOW AND REAR WINDOW SEALS**Removal and Replacement** 2B-26-16

Special Tools: Wheel Part No. 600-358.

1. Remove the rear window, operation 2B-19-12.
2. Remove the side window, operation 2B-22-12.
3. Remove the rubber seal moulding from the windows and door.

Replacement

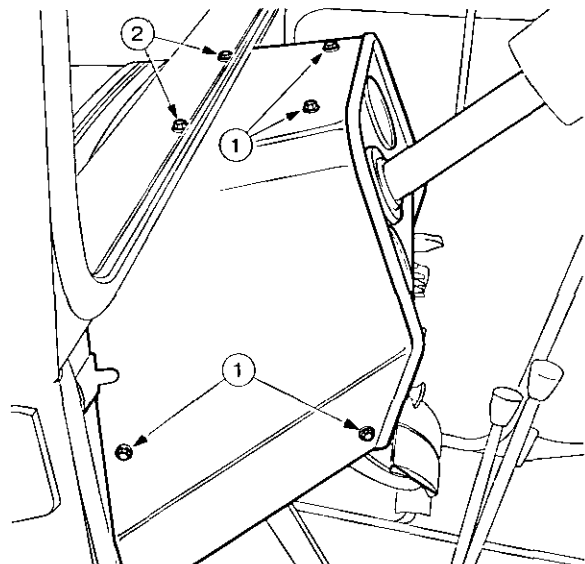
4. Ensure the retaining channel is clean and undamaged.
5. Lubricate the channel and the new seal with a soft soap solution, petroleum jelly or silicone base grease.
6. Using Special Tool Pt. No. 600-358 press the seal rubber into position. Position the wheel onto the inner edge of the moulding and using a firm pressure roll the moulding into the channel.
7. Work around the frame in one direction only ensuring a good fit at each corner.
8. Trim the seal approximately 13 mm (0.5 in) beyond the joint.
9. Force in the overlap to obtain a tight butt joint.
10. Reverse procedures 1-2.

**INSTRUMENT PANEL COWL****Removal and Refitment** 2B-27-16**Removal**

1. Remove the six bolts securing the cowl inside the cab.
2. From outside the cab remove the two bolts securing the cowl to the front cross member.
3. Withdraw and remove the cowl from the cab.

Refitment

4. Reverse procedures 1-3.



ENGINE SUMP**Removal and Refitment**

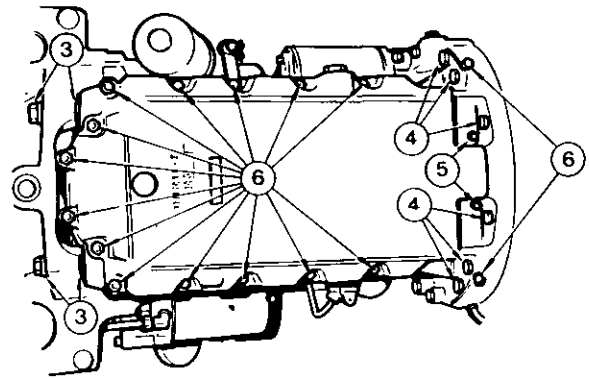
4A-58-57

Removal

1. Drain the engine oil.
2. Lightly support the centre of the sump with a trolley jack.
3. Remove the bolts, washers and shims.
4. Remove the bolts and washers.
5. Remove the nuts and washers.
6. Remove the bolts and washers.
7. Lower the jack and remove the sump.
8. Remove the old gasket.

Refitment

9. Reverse procedures 1 to 8 except:
 - (a) Use a new gasket lightly coated with recommended sealant 'A'.
 - (b) Ensure that the two shims are correctly located between the front axle casting and the engine sump casting.
 - (c) Tighten the sump to transmission casing bolts to a torque of 75 Nm (55 lbf ft).
 - (d) Tighten the front axle to sump bolts to a torque of 270 Nm (200 lbf ft).

**OIL PUMP****Removal and Refitment**

4A-59-57

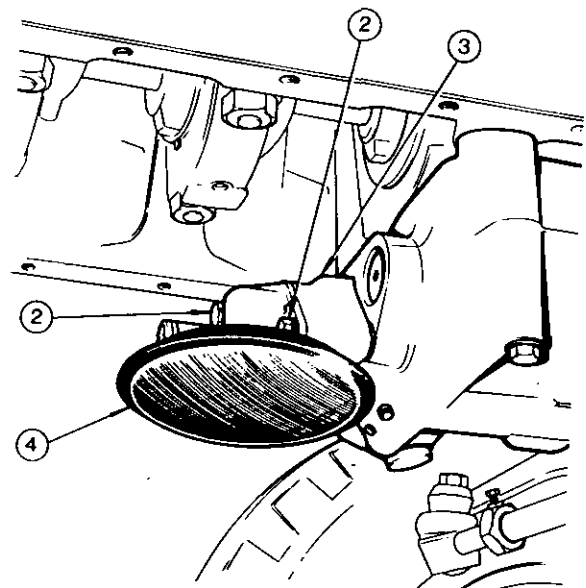
Removal

1. Remove the sump operation 4A-58-57.
2. Remove the seven bolts.
3. Remove the pump.
4. Remove the strainer.

Refitment

5. Reverse procedures 1 to 4, except:

Tighten the oil pump securing bolts to a torque of 28 Nm (21 lbf ft).



ENGINE

OIL PUMP

Servicing

4A-60-58

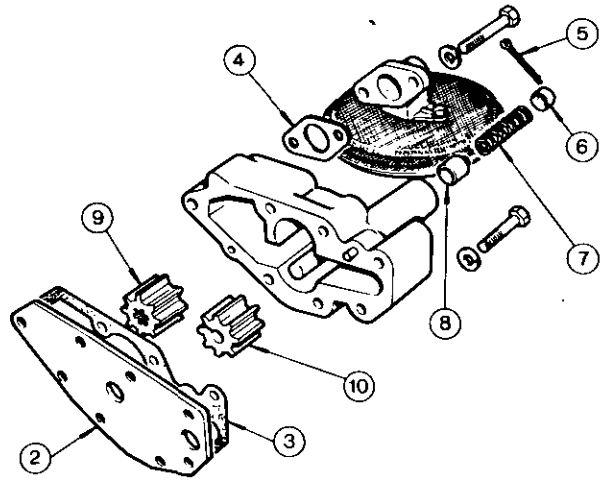
Disassembly

NOTE: The balancer unit drive and driven shafts, needle roller bearings, keys and oil pump gears must be changed after 5 000 hours work.

1. Remove the oil pump operation 4A-59-57.
 2. Remove the back plate.
 3. Remove the gasket.
 4. Remove the gasket.
 5. Remove the split pin.
 6. Remove the cap.
 7. Remove the relief valve spring.
 8. Remove the relief valve plunger.
 9. Remove the driving gear.
 10. Remove the driven gear.
- Examine all parts for wear, replace any parts whose condition is suspect.
New drive and driven gears must only be replaced in pairs.

Reassembly

11. Reverse procedures 1 to 10.



ENGINE BALANCER UNIT

Removal and Refitment

4A-61-58

Removal

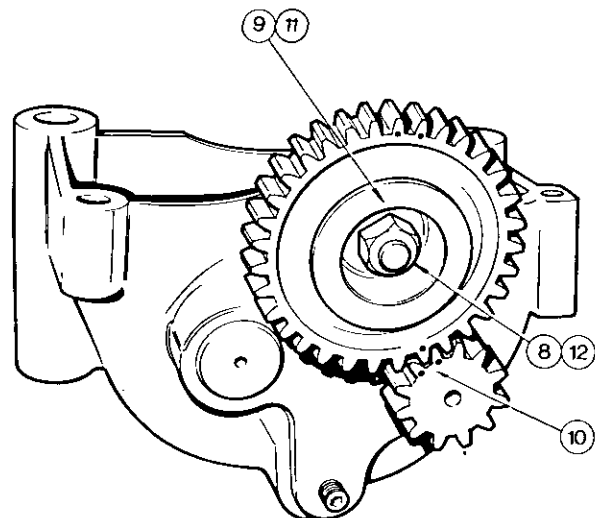
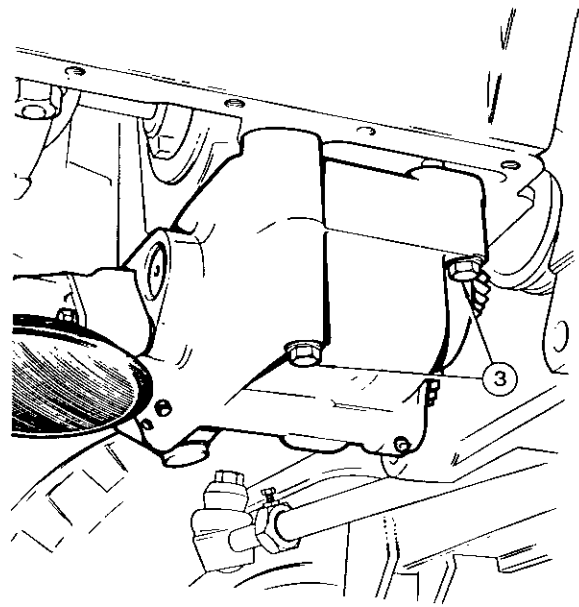
1. Remove the sump, operation 4A-58-57.
2. Support the balancer unit.
3. Remove the four bolts and washers, and remove the balancer unit.
4. Remove the oil pump, operation 4A-59-57, procedures 2 and 3.

Refitment

5. Refit the oil pump, operation 4A-59-57, except do not refit the sump.
6. Remove the timing case cover, operation 4A-49-49.
7. Turn the crankshaft to T.D.C. Nos. 1 and 4 cylinders, (i.e. with the crankshaft gear keyway at the top of its periphery).
8. Remove the nut.
9. Remove the idler gear hub.
10. Align the single mark on the idler gear between the double marks on the driven gear.
11. Refit the idler gear hub.

NOTE: Ensure that the dowel on the idler gear hub, locates through the thrust plate and into the corresponding hole in the balancer casing.

- ** 12. Refit the nut and tighten it to a torque of 55 Nm (40 lbf ft).
13. Ensure that the two thimbles on the rear upper face of the balancer casing are correctly located. Refit the balancer unit ensuring that the timing marks on the balancer unit driven gear, and idler gear, and idler gear and crankshaft gear are all aligned.
14. Refit the timing case cover, operation 4A-49-49.



ENGINE BALANCER UNIT**Servicing**

4A-62-59

Special Tool: 50 ton Hydraulic Press

Disassembly

NOTE: The balancer drive and driven shafts, needle roller bearings, keys and oil pump gears must be changed after 5 000 hours work.

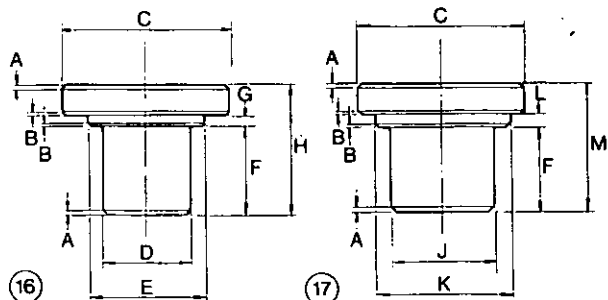
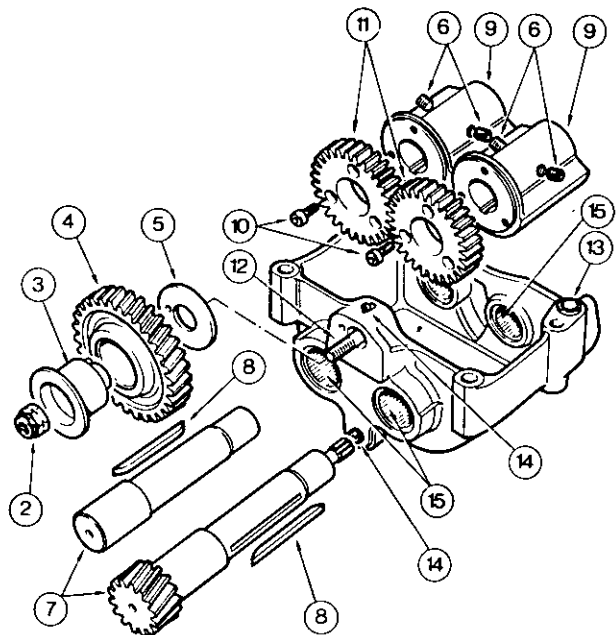
- **
1. Remove the balancer unit, operation 4A-61-58.
 2. Remove the nut.
 3. Remove the idler gear hub.
 4. Remove the idler gear.
 5. Remove the idler gear thrust plate.
 6. Remove the grub screws.
 7. Using the 50 ton hydraulic press, press the shafts forwards out of the housing taking care that the keys do not damage the needle roller bearings.
 8. Remove the keys.
 9. Remove the balance weights complete with the drive gears.
 10. If necessary, remove the Allen screws from each weight.
 11. Remove the drive gears.
 12. Remove the idler gear hub stud.
 13. Remove the oilway thimbles.
 14. Remove the seven oilway blanking plugs and flush the oilways clean.
 15. If necessary, press out the needle roller bearings.

Reassembly

16. Press new small needle roller bearings into the rear end of the balancer unit, (ensuring that the writing on the rim of the bearing faces away from the balancer frame) using a tool made to the given dimensions and the 50 ton Hydraulic Press.
 17. Press new large needle roller bearings into the front end of the balancer unit (ensuring that the writing on the rim of the bearing faces away from the balancer frame) using a tool made to the given dimensions, and the 50 ton Hydraulic Press.
 18. Reverse procedures 1 to 14, except:
 - (a) Thoroughly degrease all male and female threads and apply a few drops of recommended sealant 'C' to the threads prior to reassembly.
 - (b) Tighten the six Allen screws, securing the gears to the balance weights, to a torque of 15 Nm (11 lbf ft).
 - (c) When refitting the two shafts, ensure that the balancer drive gears are enmeshed so that both keyways are at either T.D.C. or B.D.C.
 - (d) Extreme care must be taken when pressing in the shafts to ensure fouling of the keys and needle roller bearings does not occur.
 - (e) Tighten the two balance weight grub screws to a torque of 10 Nm (7lbf ft).
 - (f) Ensure that the dowel on the idler gear hub locates in the corresponding hole in the balancer frame.
 - (g) Tighten the idler gear hub securing nut to a torque of 55 Nm (40 lbf ft).
- **

Key to Figs 16 and 17

- A. 1,6 mm (0.63 in) \times 45° CHAMFER
 B. 0,8 mm (0.31 in) \times 45° CHAMFER
 C. 51 mm (2 in) dia.
 D. 25,298 mm (0.996 in) dia.
 E. 32,944 mm (1.297 in) dia.
 F. 25,4 mm (1 in)
 G. 2,769 mm (0.109 in)
 H. 37,719 mm (1.485 in)
 J. 31,648 mm (1.246 in) dia.
 K. 40,869 mm (1.609 in) dia.
 L. 3,572 mm (0.141 in)
 M. 38,506 mm (1.516 in)



ENGINE**CONNECTING ROD BIG END BEARING****Removal and Refitment** 4A—63—60**Removal**

1. Remove the balancer unit, operation 4A—61—58, procedures 1 to 3.
2. Rotate the crankshaft until the required bearing is at B.D.C.
3. Remove the two nuts from the big end bolts.
4. Remove the big end cap complete with the shell bearing, and then remove the bearing from the big end cap.
5. Remove the big end bolts.
6. Rotate the crankshaft until the shell bearing can be removed from the connecting rod.
7. Repeat procedures 2 to 6 for the remaining big end bearings.

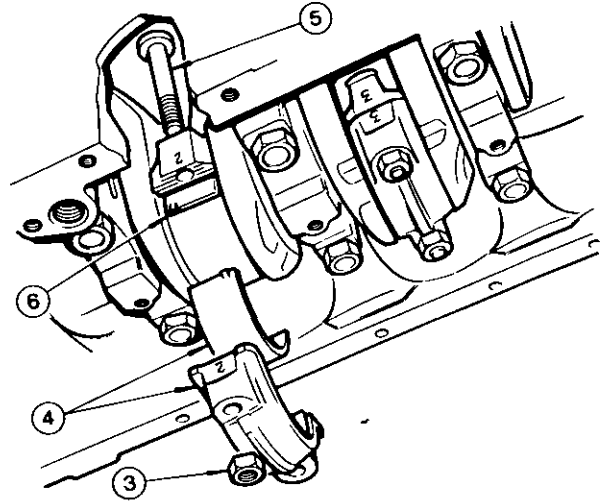
Examine the shell bearings for wear and scoring. If any bearing is found to be suspect, replace the complete set.

Check the crankpins for wear and ovality using a micrometer. Check the diameter of the crankpins in the horizontal plane and the vertical plane at each end of the crankpin.

Crankpin wear and ovality should not exceed 0,0381 mm (0,0015 in). The crankshaft should be re-ground or replaced if these limits are exceeded.

Refitment

8. Reverse procedures 1 to 7, except:
 - (a) Ensure that all components are scrupulously clean and lubricated with clean engine oil.
 - (b) Ensure that the steps on the shell bearing halves fit into the slots on the connecting rods and that the bearings are re-fitted in their original positions and are properly seated.
 - (c) Ensure that the flats on the connecting rod bolts are located against the shoulders on the connecting rods.
 - (d) Ensure that the connecting rod and the end cap are refitted with the identification marks together and are on the left hand side of the engine.
 - (e) Tighten the big end nuts to a torque of 95 Nm (70 lbf ft).
 - (f) The connecting rod big end cap attachment bolts are special bolts and should they require replacement, only bolts supplied by the manufacturer should be used.

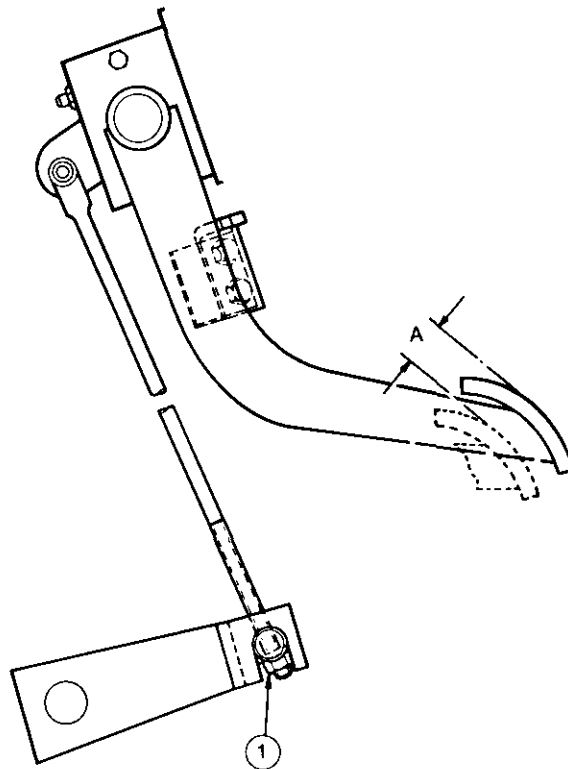


CLUTCH PEDAL

Adjustment (MF 550 Tractor)

5A-02-05

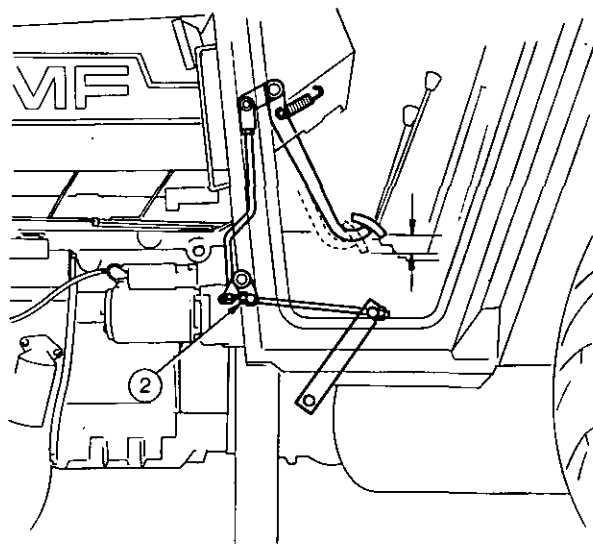
1. Adjust the nut on the linkage to give 22 to 28 mm ($\frac{7}{8}$ to $1\frac{1}{4}$ in) free pedal travel 'A'.

*** * CLUTCH PEDAL**

Adjustment (MF 565 Tractor)

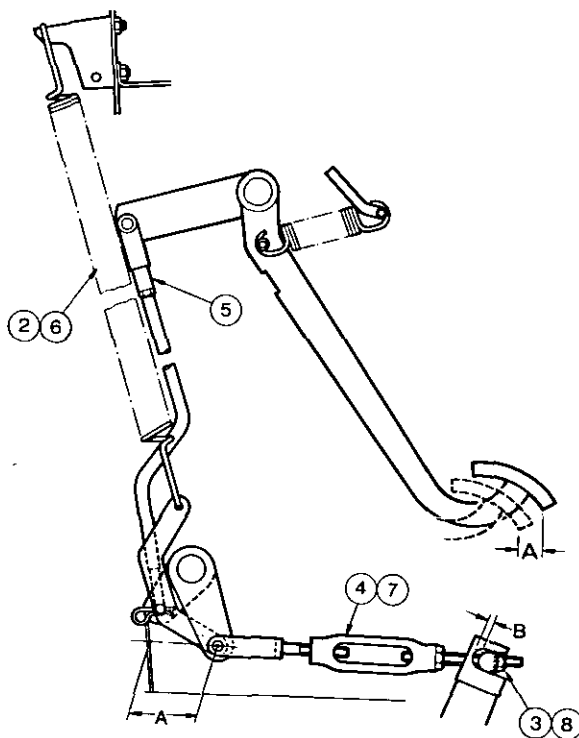
5A-03-05

1. Measure the clutch pedal free travel at the pedal pad. This measurement should be 25 mm (1 in), if this is incorrect proceed as follows:
2. Turn the bolt clockwise (looking straight at the bolt head) to decrease and anti-clockwise to increase pedal free travel.



DUAL CLUTCH**CLUTCH PEDAL****Adjustment (MF575 and 590 Tractors) 5A-04-06**

1. Remove the hood, Part 3B.
2. Release the spring from its top attachment.
3. Slacken the locknut.
4. Slacken the turnbuckle as much as possible.
5. Adjust the clevis until 'A' is 56 to 60 mm ($2\frac{1}{8}$ to $2\frac{3}{8}$ in).
6. Reconnect the spring.
7. Adjust the turnbuckle until 'B' is 5 to 9 mm ($\frac{1}{4}$ to $\frac{3}{8}$ in) which should give a clutch pedal free travel of 13 to 25 mm ($\frac{1}{2}$ to 1 in).
8. Retighten the turnbuckle locknut.
9. Operate the clutch pedal through its full travel a minimum of five times and recheck the clutch pedal free travel.
10. Refit the hood, Part 3B.



PINION ASSEMBLY**Servicing**

6A-22-19

Special Tools: MF 200 Hand Press
MF 200-23 Adapter
MF 200-25 Adapter
Pre-load Gauge

Disassembly

1. Remove the pinion assembly, 6A-20-21 (Standard Flow Pump) 6A-21-21 (High Flow Pump).
2. Remove the locking ring as follows:
 - a. Place the pinion in a soft faced vice with the jaws of the vice holding the flats, adjacent to the locking rollers of the collar.
 - b. Using a cold chisel, cut one half to two thirds into the locking collar at points B and C.
 - c. Reposition the pinion in the vice and chisel down the splines into the cuts made at points B and C. A few hefty blows will fracture the locking collar enabling it to be removed.

NOTE: Great care should be taken to avoid damaging the threads of the pinion.

3. Remove the sleeve and the splined hub (Standard Flow Pump) or the bearing sleeve, sleeve keeper and thrust washer (High Flow Pump).
4. Remove the housing, complete with the front bearing cone.
5. Fit the pinion to MF 200 with MF 200-23 and MF 200-25—Press off the bearing.
6. Remove the snap ring securing the pilot bearing to the pinion.
7. Fit the pinion to MF 200, using MF 200-23, then press off the pilot bearing.

Examination

Examine all components for signs of wear, scoring or pitting. Any faulty or worn parts must be replaced.

NOTES:

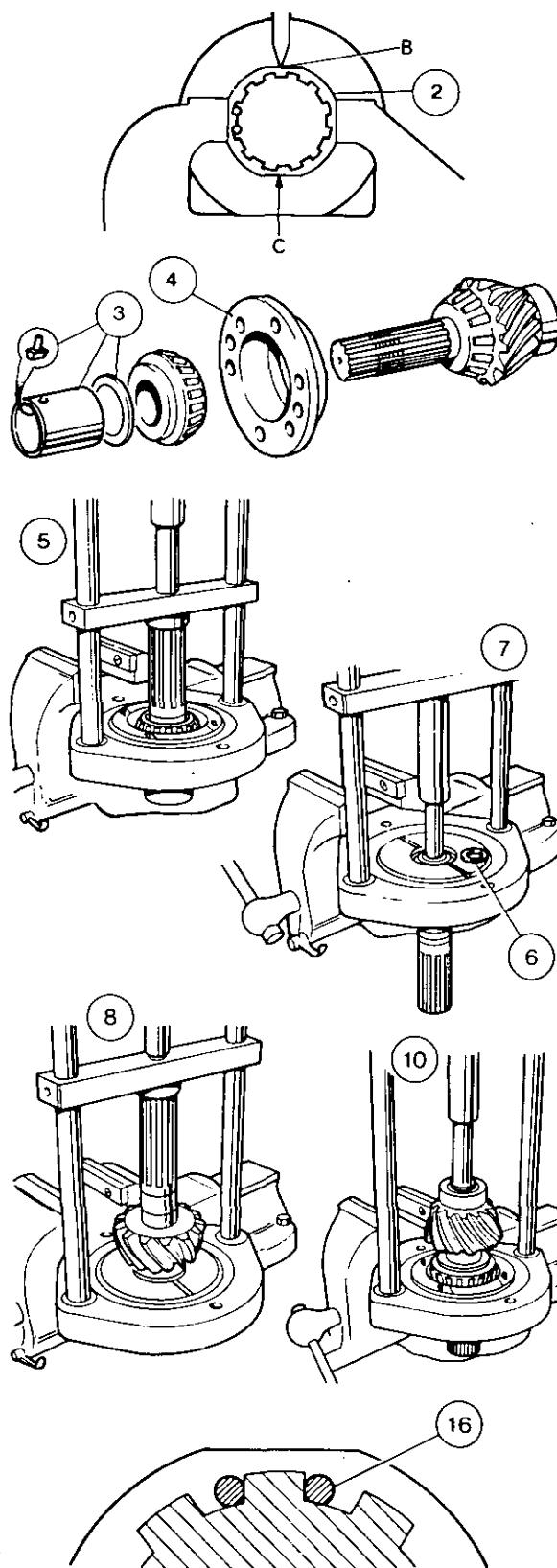
1. If the pinion is damaged the crownwheel must also be replaced as these are only supplied in matched sets.
2. The taper roller bearings are serviced as a pair, assembled with the housing.

Reassembly

8. Using MF 200 and MF 200-23, press the pilot bearing on to the pinion.
9. Secure the pilot bearing with a new snap ring.
10. Using MF 200, MF 200-23 and MF 200-25 press the bearing onto the pinion.
11. Locate the pinion in its housing and fit the front bearing cone.
12. Refit the splined hub (Standard Flow Pump) or the thrust washer, sleeve keeper and bearing sleeve (High Flow Pump) and a new locking ring, hand tightened.
13. Hold the housing in a soft faced vice.
- ** 14. Fit a suitable pre-load gauge to the pinion and tighten the locking ring to give a pre-load reading of 24 kg cm (20 lbf in).
15. Remove the gauge, tap the pinion firmly to centralise the bearings, then re-check the pre-load.
16. Secure the locking ring by tapping a locking roller down either side of one of the pinion splines.

NOTE: The needle rollers must be driven flush with the locking collar.

17. Refit the pinion assembly, operation 6A-20-18, or 6A-21-18.



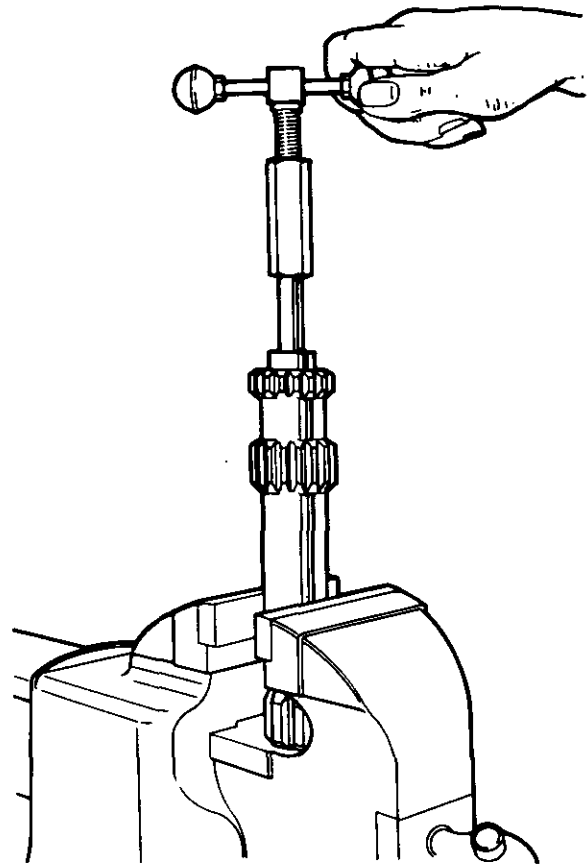
REAR AXLE AND BRAKES**REAR DRIVE SHAFT****Servicing**

6A-23-20

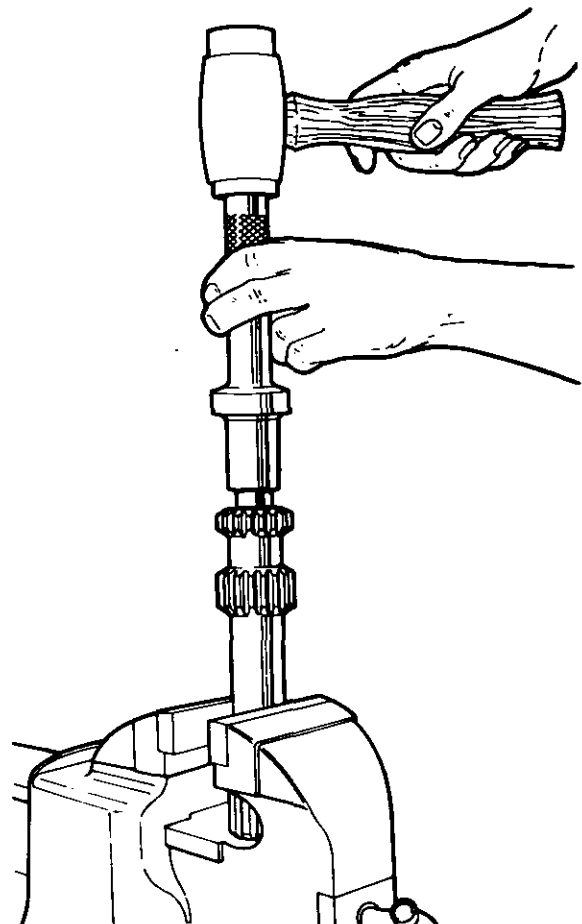
Special Tools: MF 202A Needle Roller Bearing Puller
 MF 203A Needle Roller Bearing Driver
 550 Universal Handle

Disassembly

1. Remove the lift cover, Part 8A.
2. Remove the split pin from the shear tube.
3. Remove the shear tube.
4. Remove the rear drive shaft.
5. Locate the end of MF 202A underneath the bearing cage.
6. Extract the bearing.
7. Remove the plunger and spring.

**Reassembly**

8. Reverse procedures 1 to 7 except:
 - a. Place the bearing depth control collar (part of MF203A) on the end of the driveshaft over the new bearing. Drive the bearing into the drive shaft using MF203A and the 550 handle until the tool contacts the depth control collar.
 - b. Fit a new split pin to give an end float of 0,40 to 2,50 mm (0.015 to 0.100 in).



PINION ASSEMBLY (STANDARD FLOW PUMP)

Removal and Refitment

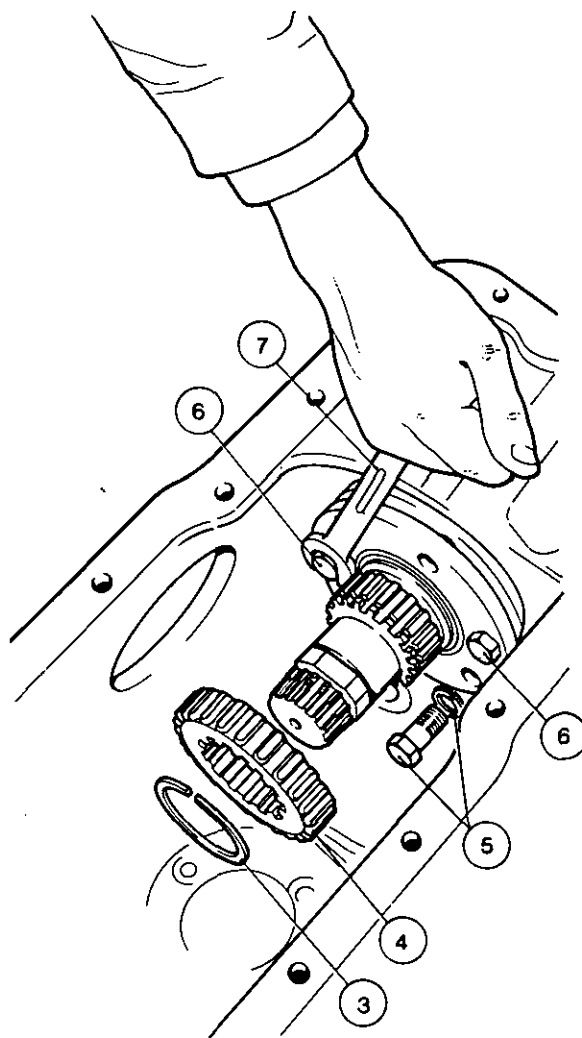
6A-53-55

Removal

1. Remove the lift cover and the hydraulic pump(s) as stated in Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted), Part 6B.
3. Release the snap ring.
4. Slide off the gear.
5. Remove the six bolts and spring washers.
6. Screw one of the bolts into each of the two tapped holes.
7. Tighten the bolts, thus withdrawing the pinion assembly.

Refitment

8. Reverse procedures 1 to 7 except:
 - (a) Ensure that the locating pin is aligned before pressing the housing into place.
 - (b) Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - (c) Fit a new snap ring.



PINION ASSEMBLY (HIGH FLOW PUMP)

Removal and Refitment

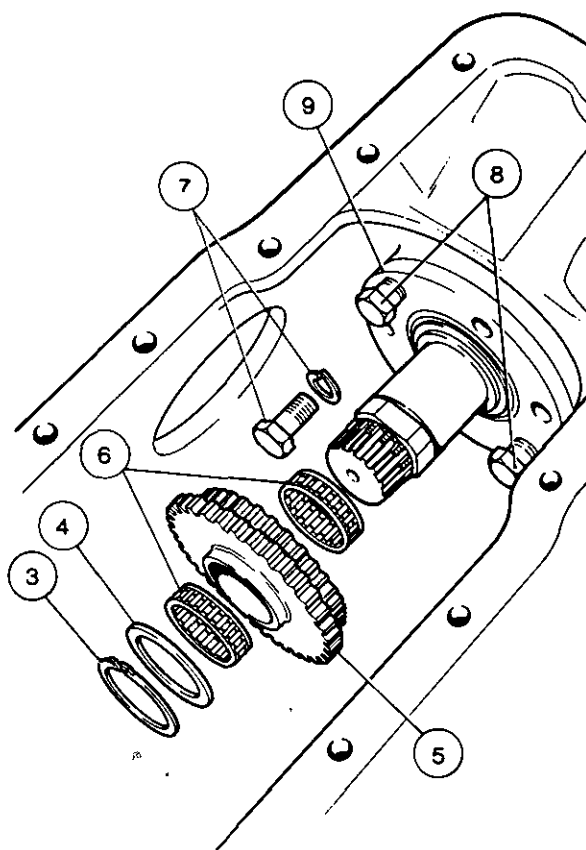
6A-54-55

Removal

1. Remove the lift cover and the hydraulic pump(s) as stated in Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted), Part 6B.
3. Release the circlip.
4. Remove the thrust washer.
5. Remove the gear cluster.
6. Slide the needle roller bearings off the bearing sleeve.
7. Remove the six bolts and spring washers.
8. Screw one of the bolts into each of the two tapped holes.
9. Tighten the bolts thus withdrawing the pinion assembly.

Refitment

10. Reverse procedures 1 to 9 except:
 - (a) Ensure that the locating pin is aligned before pressing the housing into place.
 - (b) Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - (c) When the thrust washer shows signs of wear it should be renewed.
 - (d) Fit a new circlip.



REAR AXLE AND BRAKES

PINION ASSEMBLY

Servicing

6A-55-56

Special Tools: MF 200 Hand Press
MF 200-23 Adaptor
MF 200-25 Adaptor
Pre-load Gauge

Disassembly

1. Remove the pinion assembly, operation 6A-53-55 (Standard Flow Pump), 6A-54-55 (High Flow Pump).
2. Remove the locking ring as follows:
 - (a) Place the pinion in a soft faced vice with the jaws of the vice holding the flats, adjacent to the collar locking rollers.
 - (b) Using a cold chisel, cut one half to two thirds into the locking collar at points b and c.
 - (c) Reposition the pinion in the vice and chisel down the splines into the cuts made at points b and c. A few hefty blows will fracture the locking collar enabling it to be removed.

NOTE: Great care should be taken to avoid damaging the threads of the pinion.

3. Remove the sleeve and the splined hub (Standard Flow Pump) or the bearing sleeve, sleeve keeper and thrust washer (High Flow Pump).
4. Remove the housing, complete with the front bearing cone.
5. Fit the pinion to MF 200 with MF 200-23 and MF 200-25. Press off the bearing.
6. Remove the snap ring securing the pilot bearing to the pinion.
7. Fit the pinion to MF 200, using adaptor MF 200-23, then press off the pilot bearing.

Examination

Examine all components for signs of wear, scoring or pitting. Any faulty or worn parts must be replaced.

NOTES:

- (a) If the pinion is damaged the crownwheel must also be replaced as these are only supplied in matched sets.
- (b) The taper roller bearings are serviced as a pair, assembled with the housing.
- (c) New snap rings should always be fitted.

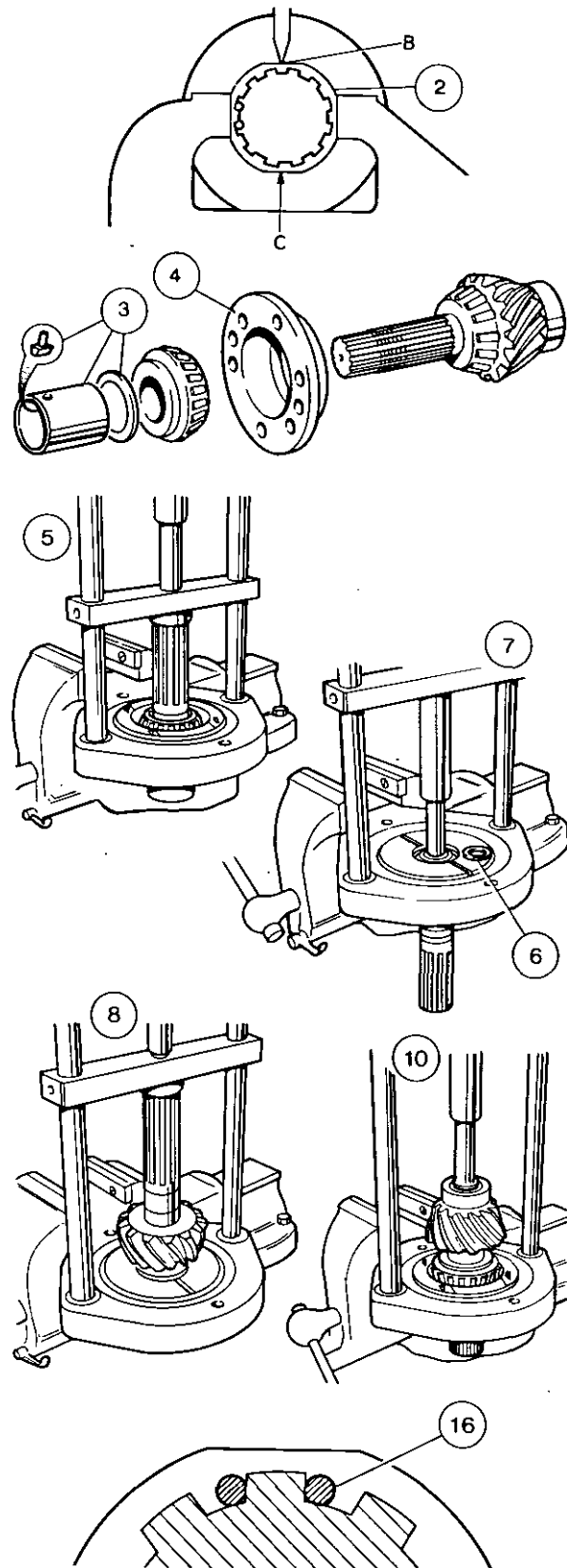
Reassembly

8. Using MF 200 and MF 200-23, press the pilot bearing on the pinion.
9. Secure the pilot bearing with a new snap ring.
10. Using MF 200 and MF 200-23 and MF 200-25 press the bearing onto the pinion.
11. Locate the pinion in its housing and fit the front bearing cone.
12. Refit the sleeve and the splined hub (Standard Flow Pump) or the thrust washer and bearing sleeve with the sleeve keeper (High Flow Pump) and a new locking ring, hand tightened.
13. Hold the housing in a soft faced vice.
- ** 14. Fit a suitable pre-load gauge to the pinion and tighten the locking ring to give a pre-load reading of 24 kg cm (20 lbf in).
15. Remove the gauge, tap the pinion firmly to centralise the bearings, then re-check the pre-load.
16. Secure the locking ring by tapping a locking roller down either side of one of the pinion splines.

NOTE: The needle rollers must be driven flush with the locking collar.

Before refitment, the pinion assembly should be freely lubricated with clean transmission oil.

17. Refit the pinion assembly, operation 6A-53-55 (Standard Flow Pump), 6A-55-55 (High Flow Pump).

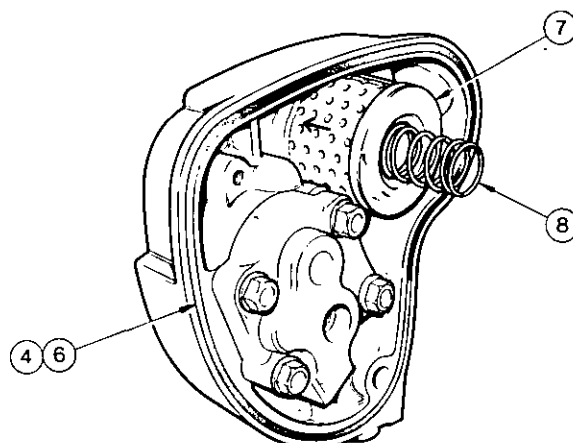
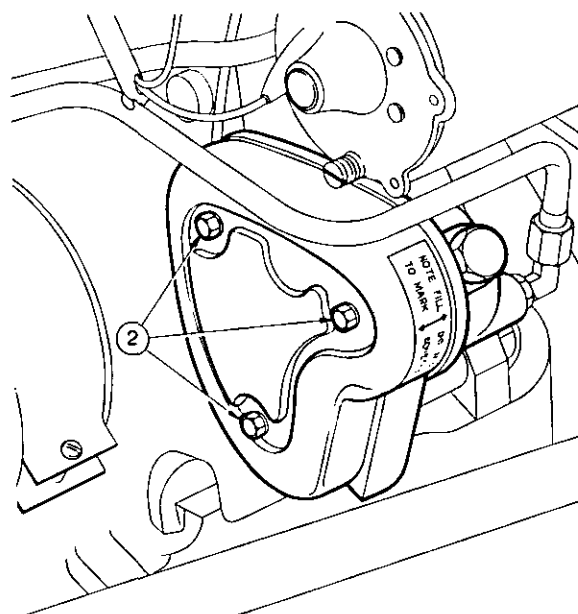


STEERING PUMP (MF 550 TRACTOR)**Element Removal and Replacement 7B-04-03****Removal**

1. Place a container beneath the pump body.
2. Remove the bolts and washers.
3. Remove the reservoir cover complete with the filter element and spring.
4. Remove the seating ring.

Replacement

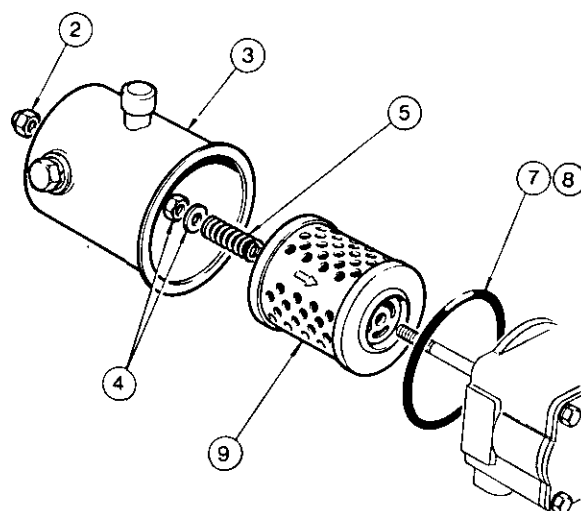
5. Coat the outside edge of the new seating with petroleum jelly.
6. Fit sealing ring into recess.
7. Fit new filter element with the arrow pointing towards the pump body.
8. Locate spring in element recess.
9. Fit reservoir cover.
10. Compress the spring and tighten the securing bolts until the cover is in contact with the sealing ring, then tighten the bolts a further turn.
11. Refill the reservoir, operation 7B-03-02.

**STEERING PUMP (Plessey) (MF 565, 575 & 590 TRACTORS)****Element Removal and Replacement 7B-05-03****Removal**

1. Place a suitable drain tray below the filter.
2. Remove the nut and sealing washer.
3. Remove the canister.
4. Remove the nut and washer.
5. Remove the spring.
6. Remove and discard the filter element then wash all components in clean paraffin and dry them with fluff free cloth.
7. Remove the sealing ring.

Replacement

8. Fit a new sealing ring.
9. Fit a new filter element with the arrows pointing towards the pump body.
10. Reverse procedures 1 to 5 except:
 - (a) Tighten the canister retaining nut to a torque of 27 Nm (20 lbf ft).
11. Check the steering system oil level, operation 7B-03-02.



STEERING**** STEERING PUMP (Aero-quip) (MF 565, 575 & 590 TRACTORS)****Element Removal and Replacement****Removal**

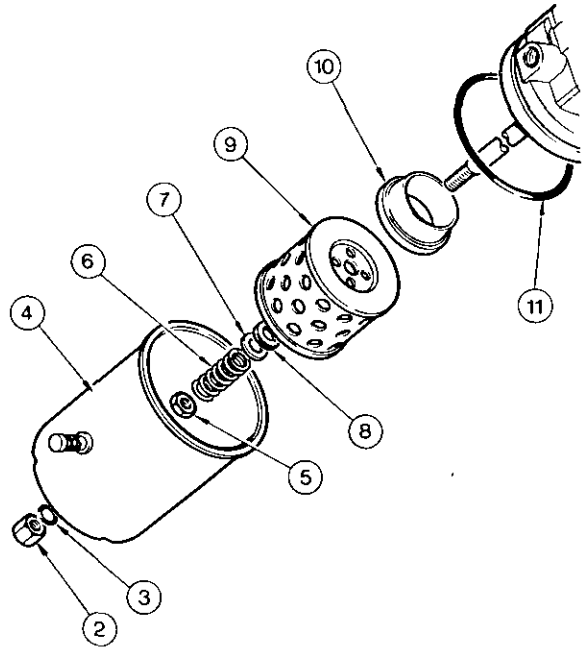
7B-06-04

1. Place a suitable drain tray below the filter.
2. Remove the nut.
3. Remove the seal.
4. Remove the canister.
5. Remove the nut.
6. Remove the spring.
7. Remove the washer.
8. Remove the seal.
9. Remove and discard the filter element, wash all components in clean paraffin and dry them with a fluff free cloth.
10. Remove the spacer.
11. Remove the sealing ring.

Replacement

12. Fit a new sealing ring if necessary.
13. Fit a new filter element with the arrows pointing towards the pump body.
14. Reverse procedures 1 to 8 except:
 - (a) Tighten the canister retaining nut to a torque of 27 Nm (20 lbf ft).
15. Check the steering system oil level, operation

** 7B-03-02.

**STEERING PUMP (MF 550 TRACTORS)****Removal and Refitment**

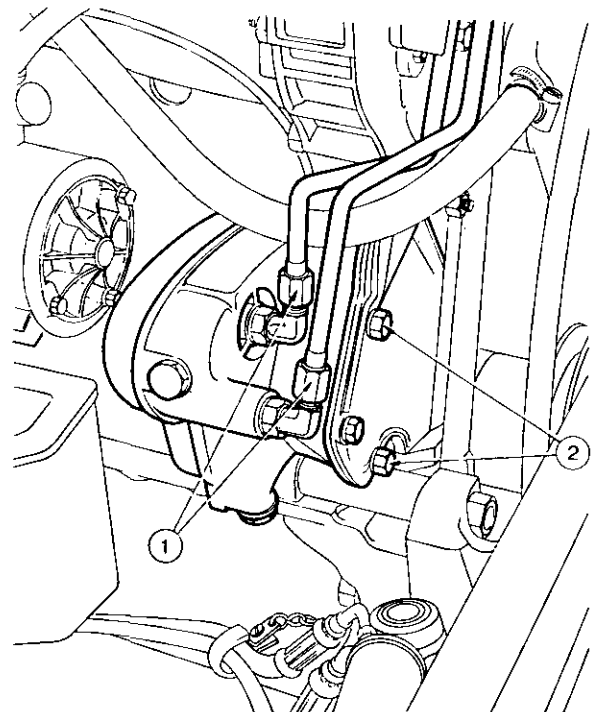
7B-07-04

1. Disconnect the pipes from the pump.
2. Remove the two bolts and washers.
3. Remove the pump.

Refitment

4. Reverse procedures 1 to 3 except:
 - (a) Tighten the two bolts to a torque of 27Nm (20 lbf ft).
5. Check the steering pump oil level, operation

7B-02-02.



ACCESSORIES

Part 10 — Section A

Operation Number	Table of Contents	Page Number
	AUTOMATIC HITCH	
	GENERAL	02
** 10A—01—02	Kit Fitment	02
	Latch Adjustment	03
10A—02—04	Removal and Refitment	04
	SWINGING DRAWBAR	
	GENERAL	06
10A—03—06	Kit Fitment	
	STABILISERS	07
10A—04—07	Kit Fitment (MF 550 Tractor)	
10A—05—07	Kit Fitment (MF 565, 575, 590 Tractor)	07
	STABILISER EXTENSION KIT	08
10A—06—08	Kit Fitment	
	HYDRAULIC ASSISTER RAM	08
10A—07—08	Fitment	

ACCESSORIES

GENERAL

The auto hitch is a supplementary lifting mechanism fitted to the swinging drawbar frame which enables ring type drawbar implements to be hitched to the tractor, without the operator leaving his seat, by actuating a release lever and operating the hydraulic quadrant levers.

If required, the hitch hook can be replaced by the swinging drawbar by lowering the hitch, removing the pivot pin and sliding out the hitch hook, then replacing it by the drawbar.

Operation

WARNING: Always operate the Auto Hitch from the tractor seat.

To Lower the Hitch

1. Place the Draft Control lever in the fully UP position.
2. Select CONSTANT PUMPING with the Position Control lever.
3. Push the release lever rearwards.
4. Whilst holding the release lever in the rearward position, move the Position Control lever to DOWN. The hitch will then lower.

To Raise the Hitch

Move the Position Control lever to TRANSPORT; the hitch will then raise and latch automatically.

The maximum lift capacity with the hitch hook fitted is 2268 kg (5000 lb).

AUTO HITCH

Kit Fitment

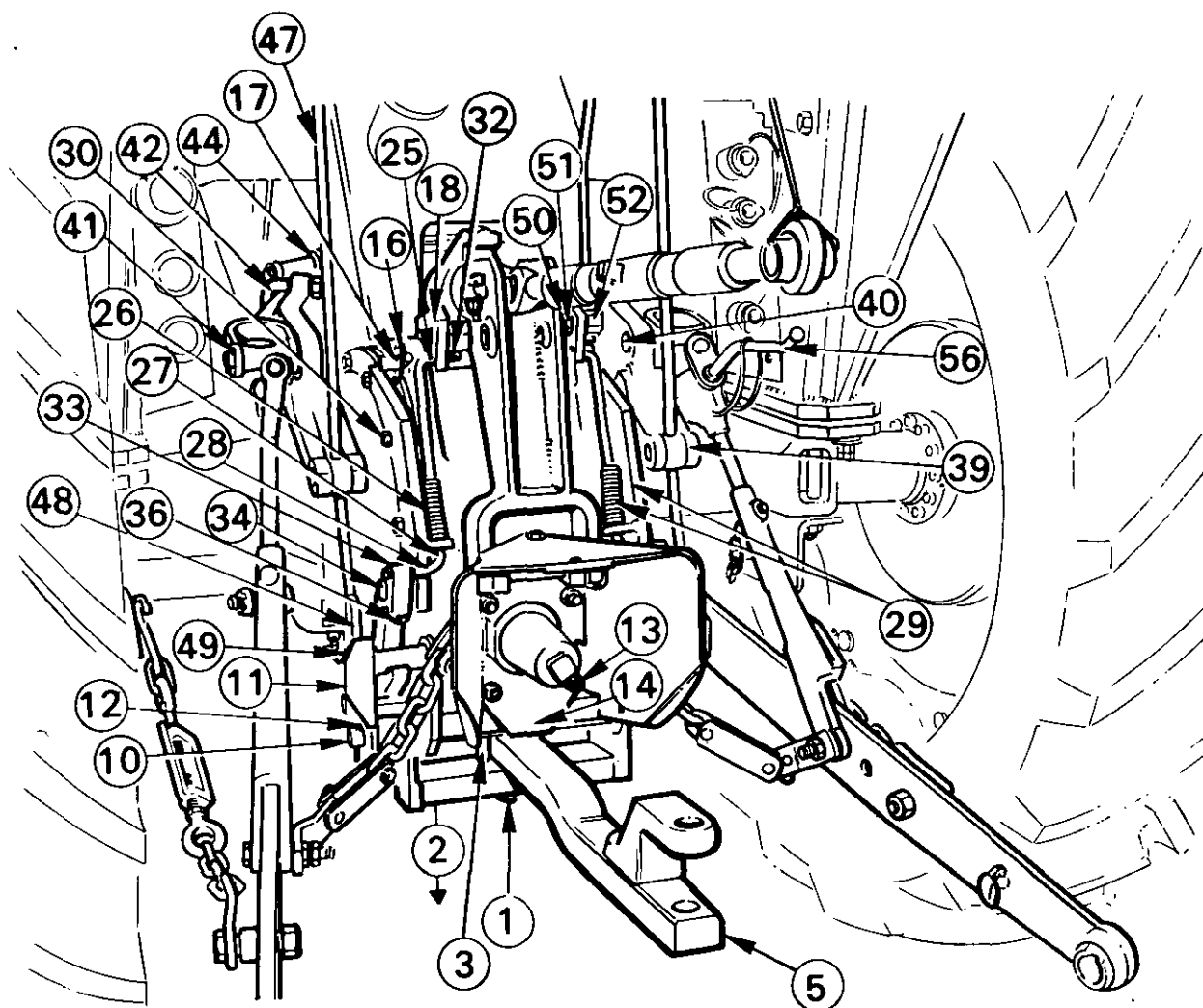
10A—01—02

These instructions assume that the tractor is already equipped with a swinging drawbar to which certain additions and modifications must be made.

To obtain the maximum downward travel of the lift arms, it may be necessary on certain tractors to grind off the two location pads on the top rear section of both trumpet housings.

The long and shallow rear number plate must be exchanged for the shorter deeper type.

1. Remove the two locating pin hair pins.
2. Lower the drawbar mounting frame onto a jack.
3. Remove the two locating pins.
4. Remove the pivot pin.
5. Remove the swinging drawbar.
6. Feed in the hitch hook.
7. Fit the pivot pin.
8. Fit the two locating pins.
9. Fit the two locating pin hair pins.
10. Feed in the mounting frame lift shaft.
11. Fit the two catches, guide plates rearwards.
12. Fit the two lift shaft split pins.
13. Remove the two bottom control beam bracket nuts and washers.
14. Fit the hook stop, outer cranked face rearwards.
15. Refit the two bottom control beam bracket washers and nuts.
16. Remove the linch pin.
17. Remove the long hitch pin.
18. Locate the pivot assembly, welded bar upwards and forwards between the two long hitch pin lugs.
19. Refit the long hitch pin.
20. Refit the linch pin.
21. Heavy duty swinging drawbar only, remove the six support bracket bolts.
22. Heavy duty swinging drawbar only, remove the two support brackets.
23. Heavy duty swinging drawbar only, remove the two trumpet/centre housing bolts above the six removed in procedure 21.
24. Normal duty swinging drawbar only, remove the eight rear trumpet/centre housing bolts, similar to procedures 21 and 23.
25. Fit the two outer push rod split pins. MF 550 only, other tractors use the centre hole.
26. Feed the two push rod springs onto the bottom ends.
27. Feed the bottom ends of the two push rods downward through the spring abutments on the lower ends of the support bracket.
28. Compress the two springs and trap the bottom ends of the push rods under the support brackets.
29. With the two springs innermost, locate the push rods in the pivot assembly plates and the two support brackets on the trumpet housing flanges.
30. Fit the eight trumpet/centre housing bolts.
31. Tighten the eight trumpet/centre housing bolts to a torque of 130 Nm (95 lbf ft).
32. Fit the two push rod split pins.
33. Locate each latch opening to the rear on each support bracket spigot and push rod end simultaneously.
34. Fit the two snap rings.
35. Check the two latches for freedom of movement.
36. Lubricate the two latches.
37. Support the two lower links and discard the lift arm split pins.
38. Discard the two lift arm clevis pins.
39. Locate the two extensions against the inner faces of the lift arms.
40. Fit the two clevis pins through the extensions, lift arms and lift rod knuckles. Remove the lower link supports.
41. Fit the two split pins.
42. Normal duty auto-hitch only. Screw the four adjuster buttons into the two extension arms.
43. Normal duty Auto-hitch only. Fit the two 'U' bolts and the four locking nuts.
44. Normal duty Auto-hitch only. Close any gaps between the two lift arms and the 'U' bolts by rotating the protruding threaded shanks of the four adjuster buttons before tightening the four locking nuts.
45. Heavy duty Auto-hitch only, fit the two front extension bolts and washers, heads outwards.
46. Jack up the mounting frame and locate the two catches in the latches; remove the jack.
47. Feed the two lift rods through the lift arm extensions and run the tube nuts, unslotted ends first, half on.
48. Fit the two lift rods, offsets to the right hand side, to the catch spigots.
49. Fit the two split pins.
50. Fit the handle trunnion to the pivot assembly plate, normally the right hand.
51. Half run the trunnion nut.
52. Feed on the trunnion sleeve, long end first and align the holes.
53. Feed in the control handle, set in position.
54. Tighten the trunnion nut.
55. Adjust the auto-hitch as detailed later, the two roll pins are fitted to the slotted nuts during this procedure.
56. Reduce the "throw" of the levelling box handle to 70 mm (3½ in) to avoid a foul condition occurring with the lift arm extension or rod.

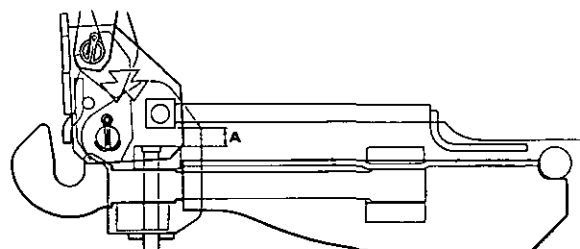


** AUTO HITCH

Latch Adjustment

1. Move the Draft Control lever to 'up'.
2. With the tractor engine running move the Position Control lever to TRANSPORT.
3. Screw down the slotted adjusting nut to take up all clearance at 'A' between the squared rear end of the mounting bracket end locating pin bar at the drawbar frame.
4. Move Position Control lever to CONSTANT PUMPING.
5. When necessary, slacken off the slotted nuts an equal amount each to eliminate any interferences at 'A' between the squared rear end of the mounting bracket and the locating pin bar at the drawbar frame.
6. Fit a roll pin to each adjusting nut.
7. During use the gap at 'A' between the squared rear end of the mounting bracket and the locating pin bar of the drawbar frame must not exceed 9.5 mm ($\frac{3}{8}$ in) and should be checked every 500 hours.

**



ACCESSORIES**AUTO-HITCH****Removal and Refitment**

10A—02—04

Removal

1. Remove the two hair pins.
2. Lower the auto-hitch onto a trolley jack.
3. Discard the two lift rod split pins.
4. Detach the two lift rods.
5. Remove the two locating pins.
6. Remove the pivot pin.
7. Remove the hitch hook.
8. Remove the front linch pin.
9. Remove the support pin.
10. Remove the mounting frame on a trolley jack.
11. Discard the two split pins.
12. Match mark and remove the two catches.
13. Remove the lift shaft.
14. Support the attachment bracket on a trolley jack.
15. Remove the four locking nuts.
16. Remove the attachment bracket with the trolley jack.
17. Remove the two bottom control beam nuts and washers.
18. Match mark and remove the hook stop.
19. Remove the four locking nuts or two bolts and lockwashers.
20. Normal duty auto-hitch only, remove the two 'U' bolts.
21. Discard the two split pins.
22. Remove the two clevis pins.
23. Remove the two lift arm extensions or lift arm extensions four adjuster buttons and lift rod assemblies.
24. Remove the two roll pins.
25. Remove the two nuts.
26. Remove the two lift rods.
27. Slacken off the handle trunnion nut.
28. Withdraw the handle.
29. Remove the trunnion tube.
30. Remove the trunnion nut and trunnion.
31. Remove the two snap rings.
32. Match mark and remove the two latches.
33. Discard the two inner push rod split pins (MF 550 Tractor shown, all other Tractors use end hole).
34. Remove the eight support bracket bolts.
35. Remove the two support brackets.
36. Remove the two push rods.
37. Discard the two outer push rod split pins (MF 550 Tractor shown, all other Tractors use the centre hole).
38. Remove the two springs.
39. Remove the linch pin.
40. Remove the long pin.
41. Match mark and remove the pivot bracket.

Refitment

42. Reverse procedures 1 to 41 except:
 - (a) The pivot assembly is fitted welded bar upwards and forwards.
 - (b) The bottom ends of the two push rod and spring assemblies are trapped under the cut outs in the support brackets.
 - (c) Tighten the eight support bracket bolts to a torque of 130 Nm (85 lbf ft).
 - (d) Fit new split pins.
 - (e) The two latches are fitted open face rearwards.
 - (f) Ensure that the two snap rings locate correctly in their grooves.
 - (g) The handle is normally fitted to the right hand plate of the pivot assembly.
 - (h) The lift rod nuts are fitted unslotted end first.
 - (i) The fitting of the lift rod roll pins is delayed until after the auto-hitch has been adjusted.
 - (j) The heads of the two extension arm clevis pins are positioned on the extension arm side.
 - (k) Normal duty auto-hitch only, after the two 'U' bolts have been fitted to the lift arms and extensions, size the four adjuster buttons by rotating the two flats in each protruding threaded shank to touch the lift arm before finally tightening the four locking nuts.

MF560 TRACTOR**ENGINE****Make:** Perkins, to MF specification**Type and Model:** Four-stroke, direct injection diesel AD4.203**Number of Cylinders:** Four**Bore:** 91,4 mm (3.6 in)**Stroke:** 127 mm (5 in)**Capacity:** 3,35 litre (203 in³)**Compression Ratio:** 16:1**Firing Order:** 1, 3, 4, 2**Horsepower:** 56 PS (41 kW) at 2 000 rev/min (DIN 70020)**Maximum Torque (at 1 200 rev/min):** 218 Nm (161 lbf ft) (DIN 70020)**Lubrication:** Throwaway, cannister type full flow external filter**Valves:** Overhead, pushrod operated**Valve Tip Clearance (Inlet and Exhaust):** 0,30 mm (0.012 in) cold. 0,25 mm (0.010 in) hot**FUEL SYSTEM AND AIR CLEANER****Fuel Lift Pump:** A.C. Delco, with hand primer**Fuel Filter:** C.A.V. filter, with transparent sediment bowl**Injection Pump:** C.A.V. Distributor type, with mechanical governor**Engine Speeds (no load):** Idling—700 to 750 rev/min. Maximum—2140 rev/min**Injection Timing:** 23° B.T.D.C.**Injectors:** C.A.V. type nozzles and nozzle holders
Initial setting pressure 17,73 N/mm² (175 Atmosphere). Working pressure 17,23 N/mm² (170 Atmosphere)**Easy Starting Aid:** C.A.V. Thermostart Mark III C**Air Cleaner:** Two stage, dry element, removable for cleaning with warning light and buzzer**ELECTRICAL SYSTEM****Voltage:** 12 volt NEGATIVE EARTH**Battery:** 96 Ah. Fulmen**Starter Motor:** France—Paris Rhone D11E-137 or DHE-84

Others—Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector

Alternator: Motorola 9AR 2501K**Light Bulb Sizes:**

Headlights 45/40W

Side Lights 5W

Rear Lights 5W

Indicator Lights 21W

Brake Lights 21W

Number Plate Lights 5W

Plough Light 36W

Panel Lights 2.2W

Interior Light 5W

Fuses:

Dipped Headlights 15A

Side Lights 10A

Brake Lights 10A

Warning Lights 15A

Main Beam Headlights 15A

Flashing Indicators 10A

Plough Light 10A

Blower Motor 17A

Wiper Motor 10A

Interior Light 2A

Horn 35A

Cigar Lighter 35A

Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)**COOLING SYSTEM****Type:** Thermostat controlled with centrifugal pump to assist circulation. Four bladed fan driven by a belt from the crankshaft**Fan Belt Deflection (Total):** 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley**TRANSMISSION****Clutch Live P.t.o. Tractors:** Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated

I.p.t.o. Tractors: Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories

Eight Speed Synchromesh Gearbox: The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh on third and fourth gears, compounded by an epicyclic unit**Multi-Power Gearbox:** The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears, actuated by a hydraulic clutch**Gearbox Epicyclic Reduction:** 4:1**Final Drive:** Bevel drive with epicyclic final hub reduction giving an overall ratio of 10.83:1

SPECIFICATION

POWER TAKE-OFF

Live Power Take-off: Engine speed drive is engaged by a lever to the left of the operator's seat.

Independent Power Take-off: Engine speed i.p.t.o. is engaged by a lever to the left of the operator's seat. The i.p.t.o. clutch is a multi-plate, wet clutch

Reduction Ratio (Standard Pump): 3:12:1. (High Flow Pump)—3:12:1 at 540 rev/min. 1:69:1 at 1 000 rev/min)

Speeds (Standard Pump): 540 rev/min at 1 684 engine rev/min. (High Flow Pump)—540 rev/min at 1 686 engine rev/min. 1 000 rev/min at 1 690 engine rev/min

Power Take-off Shaft: Six spline (540 rev/min), 21 spline (1 000 rev/min), 35 mm (1.38 in) diameter, with an annular groove for securing p.t.o. couplings

HYDRAULIC SYSTEM

Ferguson Pump: Four cylinder, scotch yoke type pump driven from the forward end of the p.t.o. shaft, supplies oil, under pressure to the ram cylinder and four external take-off points

Tapping Point Thread Sizes: Top— $\frac{3}{8}$ N.P.S.M. Side— $\frac{3}{8}$ N.P.T.F.

Pressure Control System: The Pressure Control System operates from 0,69 to 20,7 N/mm² (100 to 3 000 lbf/in²)

Pump Maximum Output (Standard Pump): 15 litre/min (3.4 Imp. gal/min) at 2 000 engine rev/min
(High Flow Pump) 26,5 litre/min (5.9 Imp. gal/min) at 2 000 engine rev/min

Pump Maximum Pressure: 20,7 N/mm² (3 000 lbf/in²)

Linkage: Three point linkage, with Category 1 or 2 interchangeable ball ends. A barrel turnbuckle type, adjustable top link is fitted, plus check chains adjustable for Category 1 and 2

Maximum Lift Capacity: 1 542 kg (3 400 lb)

AUXILIARY HYDRAULICS

Auxiliary Pump: Gear type pump with separate gear train and output for Multi-Power and i.p.t.o. supply

Pump Output: To auxiliaries—36 litre/min (7.9 Imp. gal/min). To Multi-Power/i.p.t.o.—19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: Auxiliaries—17,3 to 19,3 N/mm² (2 500 to 2 800 lbf/in²). Multi-Power/i.p.t.o.—4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o. Pump: Gear type pump

Pump Output: 19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: 4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o./Auxiliary Filtration: Externally mounted 25 micron filter with replaceable cartridge type element

Standard Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (640 p.t.o. rev/min)			
	litre/ min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	15,0	3.4	6,5	6.4
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	51,0	11.3	16,0	15.8

High Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (1 185 p.t.o. rev/min)			
	litre/ min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	26,5	5.9	11,2	11.0
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	62,5	13.8	19,5	19.3

BRAKES

Type: Girling, oil immersed 222,4 mm (8.75 in) mechanical five plate disc brakes, operated together or independently to assist steering

Parking Brake: Operates on both rear wheels simultaneously.

Trailer Brakes: Hydraulically operated by brake pedals

STEERING

Type: Hydrostatic, with a gear pump and integral reservoir

Toe-in: 3 mm ($\frac{1}{8}$ in)

Turns Lock to Lock: 3:3

FRONT AXLE

Type: Three section, adjustable for track width

Wheel Camber: 3° 30'

Wheel Castor: 4° 56'

TRACK ADJUSTMENTS

Front Track: 1 321 to 1 828 mm (52 to 72 in) in 102 mm (4 in) increments

Rear Track: 1 321 to 2 235 mm (52 to 88 in) in 102 mm (4 in) increments

WHEELS AND TYRES**Front:**

- W4-00 x 16 wheels fitted with 6-00-16, 4 ply tyres
- W4-00 x 19 wheels fitted with 6-00-19, 6 ply tyres
- 5-50F x 16 wheels fitted with 7-50-16, 6 ply tyres

Rear:

- W10 x 32 wheels fitted with 11-32, 6 ply tyres
- W10 x 36 Double disc wheels fitted with 11-36, 6 ply tyres
- W12-28 Double disc wheels fitted with 14-28, 12-28 or 13-28, 6 ply tyres

Water Ballasting: Additional weight for each rear tyre:-

- 11-32 tyres: 143 kg (316 lb)
- 11-36 tyres: 159 kg (349 lb)
- 14-28 tyres: 254 kg (559 lb)
- 12-28 tyres: 169 kg (362 lb)
- 13-28 tyres: 200 kg (440 lb)

CAPACITIES

Fuel Tank: 67 litre (15 Imp. gal)

Engine Sump (including filter): 7,1 litre (12.5 Imp. pt)

Cooling System: 11,4 litre (20 Imp. pt)

Transmission:

Eight Speed—33 litre (57 Imp. pt)

Multi-Power—32 litre (56 Imp. pt)

Epicyclic Hubs: 1,7 litre (3 Imp. pt)

Power Steering Reservoir: 1,1 litre (2 Imp. pt)

GENERAL DIMENSIONS (Fig. 1)

A. Overall Height: 2 337 mm (92 in)

B. Overall Width: 1 829 mm (72 in)

C. Overall Length: 3 708 mm (146 in)

D. Wheelbase: 2 172 mm (85.5 in)

Ground Clearance:

E. Under Weight Frame: 343 mm (13.5 in)

F. Under Engine Sump: 381 mm (15 in)

Turning Circle: 8,5 m (28 ft) Without Brakes

Weight (with fuel, oil and water: 2 762 kg (6 090 lb)

Note: The above dimensions are for a tractor fitted with 7.50-16 front tyres and 14-28 rear tyres at 1 524 mm (60 in) track setting.

MOUNTING POINTS (Fig. 2)

1. 184 mm (7.25 in)
2. 92 mm (3.62 in)
3. 4 holes tap $\frac{5}{8}$ in 11 UNC 3B x 32 mm (1 $\frac{1}{2}$ in) 102 mm (4 in)
4. 1 243 mm (49 in)
5. 4 holes tap $\frac{3}{8}$ in 10 UNC
6. 38 x 27 mm (1 $\frac{1}{8}$ in)
7. 76 mm (3 in)
8. 152 mm (6 in)
9. 43 mm (1.69 in)
10. 86 mm (3.38 in)

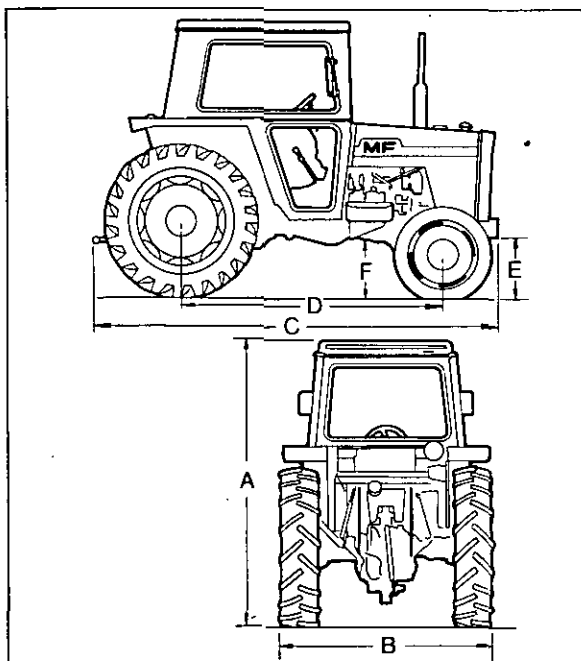


FIG. 1

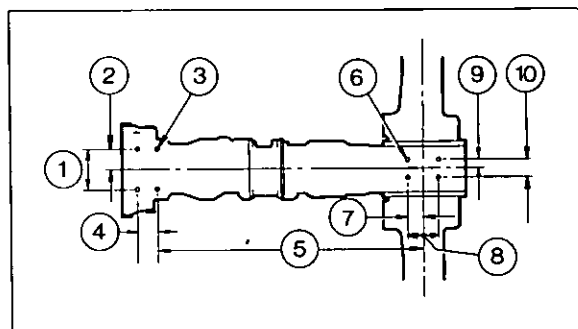


FIG. 2

AD4. 203 ENGINE

Part 4 — Section A

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GENERAL

The Perkins AD4. 203 engine is a four cylinder, water cooled, direct injection diesel unit. It has a nominal bore of 91,44 mm (3-6 in) and a stroke of 127 mm (5 in). The engine has overhead valves mounted vertically in the cylinder head. A gear driven camshaft located in the right hand side of the cylinder block operates the valves via tappets, and a series of rocker levers located on a shaft mounted on top of the cylinder head.

The cylinder block and crankcase form an integral casting and are fitted with full length replaceable flanged cast iron liners.

The aluminium pistons have a toroidal cavity in the head and are fitted with five piston rings. The pistons are attached to their connecting rods by fully floating gudgeon pins retained by circlips. The big end bearings are replaceable and consist of a thin steel shell, lined with an aluminium-tin alloy.

The engine is lubricated by force feed. The oil is drawn from the sump, via a strainer, by a rotary pump driven by the crankshaft. The oil passes through a filter before being circulated under pressure around the engine.

The crankshaft is mounted in five replaceable aluminium-tin alloy lined bearings held in position by cast iron bearing caps. Thrust is absorbed by four washers located on both sides of the rear main bearing cap and cylinder block housing.

Maximum Engine Power at 2000 rev/min.

- 56 p.s. (Din 70020)
- 58 h.p. (B.S. AU 141 Ambient Conditions)

Maximum Torque at 1200 rev/min.

- 22,25 kg f m (Din) (160 lbf ft).

FAULT	POSSIBLE CAUSE
Low cranking speed	1, 2, 3, 4
Will not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33
Difficult starting	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 29, 31, 32, 33
Lack of power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 33
Misfiring	8, 9, 10, 12, 13, 14, 16, 18, 19, 20, 25, 26, 28, 29, 30, 32
Excessive fuel consumption	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33
Black exhaust	11, 13, 14, 16, 18, 19, 20, 22, 24, 25, 27, 28, 29, 31, 32, 33
Blue/white exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 35, 45, 56
Low oil pressure	4, 36, 37, 38, 39, 40, 42, 43, 44
Knocking	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 48
Erratic running	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 48
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 49
High oil pressure	4, 41
Overheating	11, 13, 14, 16, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57
Excessive crankcase pressure	25, 31, 33, 34, 45, 55
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 48
Starts and stops	10, 11, 12

Key to Fault Finding Chart

1. Battery capacity low.
2. Bad electrical connection.
3. Faulty starter motor.
4. Incorrect grade of lubricating oil.
5. Low cranking speed.
6. Fuel tank empty.
7. Faulty stop control operation.
8. Blocked fuel feed pipe.
9. Faulty fuel lift pump.
10. Choked fuel filter.
11. Restriction in air cleaner.
12. Air in fuel system.
13. Faulty fuel injection pump.
14. Faulty atomisers or incorrect type.
15. Incorrect use of cold start equipment.
16. Faulty cold start equipment.
17. Broken fuel injection pump drive.
18. Incorrect fuel pump timing.
19. Incorrect valve timing.
20. Poor compression.
21. Blocked fuel tank vent.
22. Incorrect type or grade of fuel.
23. Sticking throttle or restricted movement.
24. Exhaust pipe restriction.
25. Cylinder head gasket leaking.
26. Overheating.
27. Cold running.
28. Incorrect tappet adjustment.
29. Sticking valves.
30. Incorrect high pressure pipes.
31. Worn cylinder bores.
32. Pitted valves and seats.
33. Broken, worn or sticking piston ring(s).
34. Worn valve stems and guides.
35. Overfull oil bath air cleaner or incorrect grade of oil.
36. Worn or damaged bearings.
37. Insufficient oil in sump.
38. Blocked sump strainer.
39. Oil pump worn.
40. Pressure relief valve sticking open.
41. Pressure relief valve sticking closed.
42. Broken relief valve spring.
43. Faulty suction pipe.
44. Choked oil filter.
45. Piston seizure/pick up.
46. Incorrect piston height.
47. Damaged fan.
48. Broken valve spring.
49. Incorrect aligned flywheel.
50. Faulty thermostat.
51. Restriction in water jacket.
52. Loose fan belt.
53. Choked radiator.
54. Faulty water pump.
55. Choked breather pipe.
56. Damaged valve stem oil seals.
57. Coolant level too low.

ROCKER COVER**Removal and Refitment**

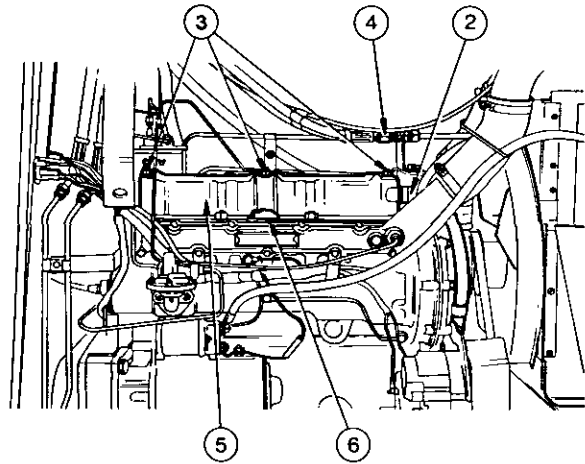
4A-80-74

Removal

1. Remove the hood, Part 2A.
2. Disconnect the hose.
3. Remove the three self locking nuts, washers and rubber seals.
4. Disconnect the two power steering hoses. (cover pipe ends to stop ingress of dirt).
5. Remove the rocker cover.
6. Discard the gasket.

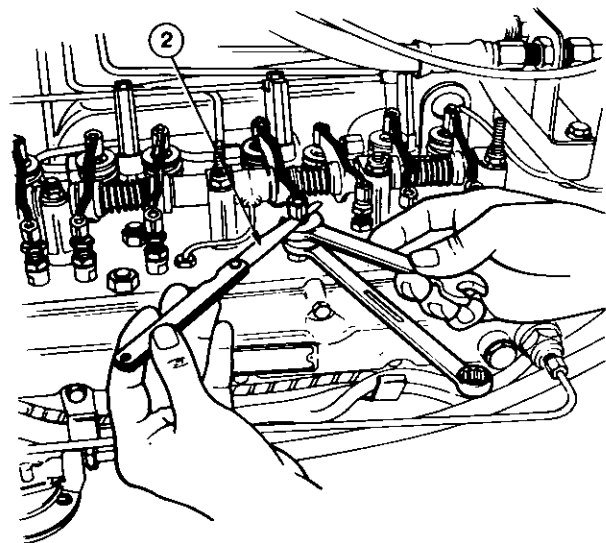
Refitment

7. Reverse procedures 1 to 6, except:
Fit a new gasket, dry.

**VALVE TIP CLEARANCE****Adjustment**

4A-81-74

1. Remove the rocker cover, operation 4A-80-74.
2. Set the valve clearances to 0,30 mm (0.012 in) cold, or to 0,254 mm (0.010 in) hot.
The clearance is measured between the rocker lever and the adjustable tappet. The sequence for adjusting the clearance is as follows:—
With the valves of No. 4 cylinder rocking, set both valves of No. 1 cylinder.
With the valves of No. 2 cylinder rocking, set both valves of No. 3 cylinder.
With the valves of No. 1 cylinder rocking, set both valves of No. 4 cylinder.
With the valves of No. 3 cylinder rocking, set both valves of No. 2 cylinder.
3. Refit the rocker cover, operation 4A-80-74.



ROCKER ASSEMBLY**Removal and Refitment**

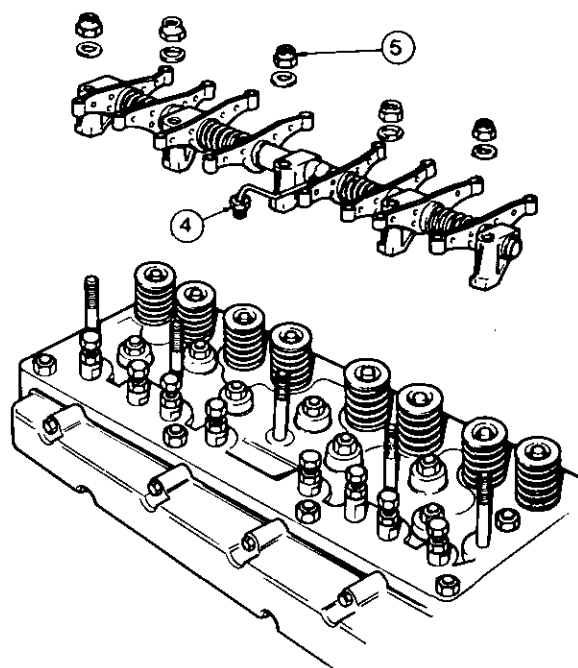
4A-82-75

Removal

1. Remove the rocker cover, operation 4A-80-74.
2. Disconnect the screen-washer pipe at the bulk head and lay the pipe over the nose assembly.
3. Remove the fuel pipe from the lift pump and fuel filter.
4. Disconnect the oil feed pipe.
5. Remove the five self locking nuts and washers.
6. Remove the rocker assembly.

Refitment

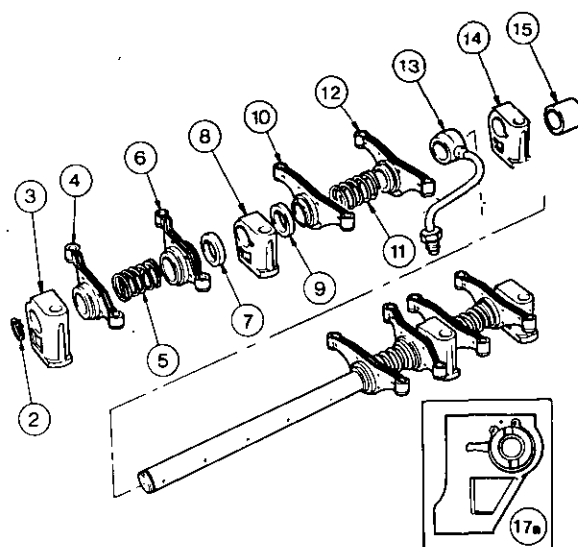
7. Reverse procedures 2 to 6.
8. Adjust the valve tip clearance, operation 4A-81-74.
9. Refit the rocker cover, operation 4A-80-74.

**ROCKER ASSEMBLY****Servicing**

4A-83-75

Disassembly

1. Remove the rocker assembly, operation 4A-82-75.
2. Remove the circlip from the front end of rocker shaft.
3. Slide the support bracket clear of the shaft.
4. Slide No. 1 valve rocker lever clear of the shaft.
5. Slide the spring clear of the shaft.
6. Slide No. 2 valve rocker lever clear of the shaft.
7. Slide the washer clear of the shaft.
8. Slide the support bracket clear of the shaft.
9. Slide the washer clear of the shaft.
10. Slide No. 3 valve rocker lever clear of the shaft.
11. Slide the spring clear of the shaft.
12. Slide No. 4 valve rocker lever clear of the shaft.
13. Slide the oil feed connection and pipe clear of the shaft.
14. Slide the support bracket clear of the shaft.
15. Slide the spacer clear of the shaft.
16. Repeat procedures 2 to 12 for the other end of the rocker shaft, which is identical.
Examine the rocker lever bores and rocker shaft for wear. The rockers should be an easy fit on the shaft without excessive side play.

**Reassembly**

17. Reverse procedures 1 to 16 except:
 - (a) The front end of the rocker shaft has a slot cut in it, position it as shown in the inset.
 - (b) Fit rocker arm with the long section towards the valve and the dimples on the arm facing towards the front.
 - (c) Lubricate all parts with clean engine oil prior to reassembly.

ENGINE**INLET MANIFOLD****Removal and Refitment**

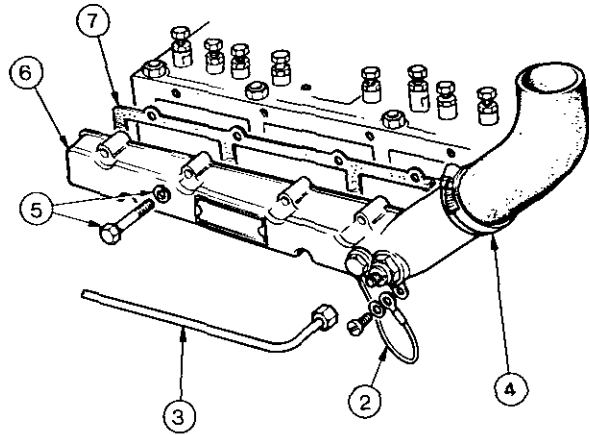
4A-84-76

Removal

1. Remove the hood, Part 2A.
2. Disconnect the thermostart cable.
3. Disconnect the thermostart fuel pipe.
4. Slacken the hose clip.
5. Remove the nine bolts and spring washers.
6. Remove the manifold, at the same time removing it from the rubber air-inlet hose.
7. Remove and discard the gasket.

Refitment

8. Fit a new gasket.
9. Reverse procedures 1 to 6.

**EXHAUST MANIFOLD****Removal and Refitment**

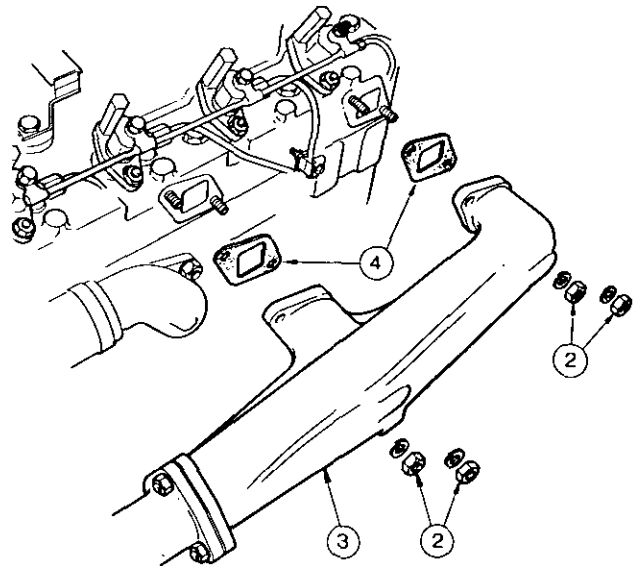
4A-85-76

Removal

1. Remove the hood, Part 2A.
2. Remove the four nuts and washers.
3. Remove the exhaust manifold.
4. Remove and discard the sealing gaskets.

Refitment

5. Fit new gaskets.
6. Reverse procedures 1 to 3.

**VALVE SPRINGS****Removal and Refitment**
(Cylinder head fitted)

4A-86-76

Special Tools: PD 6118B Valve Spring Compressor
PD 6118-3 Adaptor

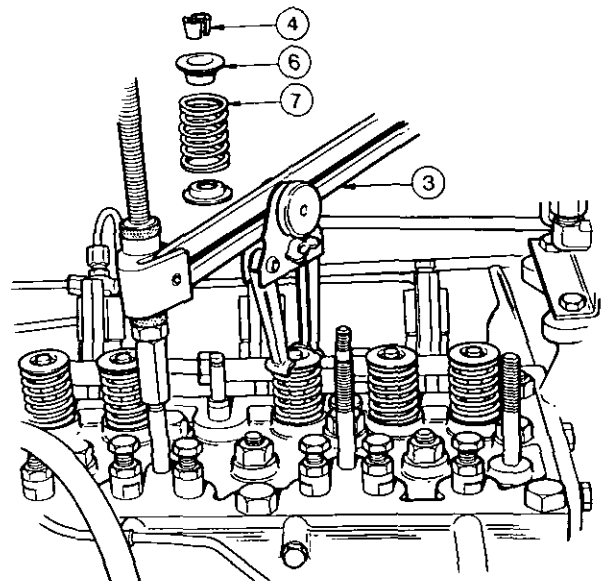
Removal and Refitment

1. Remove the rocker assembly, operation 4A-82-75.
2. Turn the crankshaft to T.D.C. Nos. 1 and 4 cylinders.
3. Using PD 6118-B and PD 6118-3, compress the valve springs on Nos. 1 and 4 cylinders.
4. Remove the collets.
5. Release PD 6118-B and PD 6118-3 slowly.
6. Remove the spring cap.
7. Remove the spring.

NOTES: (a) Do not turn the crankshaft again, until the valve springs have been refitted, and secured with the collets.

(b) If valve springs are being replaced, a complete new set should be fitted.

8. Reverse procedures 3 to 7.
9. Turn the crankshaft to T.D.C. Nos. 2 and 3 cylinders.
10. Repeat procedures 3 to 7 for the valves on Nos. 2 and 3 cylinders.
11. Reverse procedures 1, and 3 to 7.



CYLINDER HEAD**Removal and Refitment**

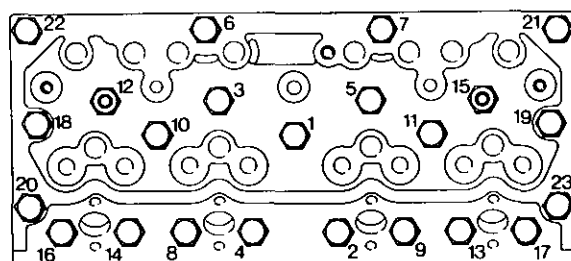
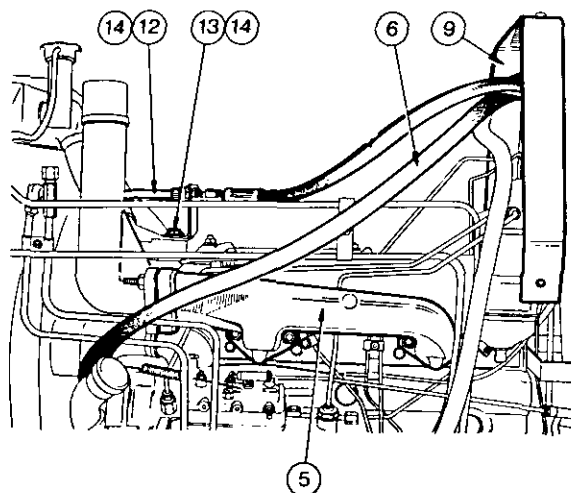
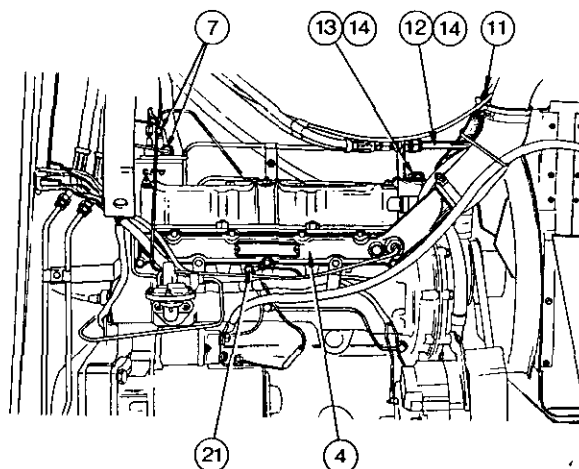
4A-87-77

Removal

1. Remove the rocker assembly, operation 4A-82-75.
2. Disconnect the battery cables.
3. Drain the cooling system via the drain taps on the radiator and the engine block.
4. Remove the inlet manifold, operation 4A-84-76.
5. Remove the exhaust manifold, operation 4A-85-76.
6. Disconnect the two heater hoses at the bulkhead.
7. Disconnect the fuel pipes from the fuel filter.
8. Remove the four bolts securing the hood support frame.
9. Remove the hood support frame and fuel filter.
10. Position the two steering hoses (disconnected when rocker assembly was removed) clear of the top of the cylinder head.
11. Disconnect the radiator top hose.
12. Disconnect the two steering pipes alongside top of radiator.
13. Remove two bolts and one nut securing the two steering pipes and bracket to the thermostat housing.
14. Remove the two steering pipes and bracket.
15. Remove two bolts securing the by pass hose upper housing to the front of the cylinder head.
16. Remove the bolt securing the thermostat housing cover and stabiliser bracket.
17. Remove the thermostat housing cover.
18. Remove the high pressure fuel pipes.
19. Remove the injectors, Part 4C.
20. Disconnect the water temperature sensor cable.
21. Disconnect the cylinder head oil feed pipe.
22. Remove the bolts and nuts in the reverse order of their tightening sequence.
23. Remove the cylinder head.
24. If necessary, remove the five bolts and one nut and remove the thermostat housing.
25. If necessary, remove the six bolts, and remove the rear cover, gasket and hood support frame mounting bracket.
26. Remove the cylinder head gasket.

Refitment

27. Ensure that all parts are thoroughly clean and that all joint faces are degreased.
28. Reverse procedures 1 to 23, except:
 - (a) Fit a new cylinder head gasket with a thin coating of Welseal.
 - (b) The cylinder head securing nuts and bolts must be tightened in the correct sequence, in three equal stages to a torque of 100 Nm (75 lbf ft).
 - (c) Lightly coat the rear cover gasket and securing bolts, and thermostat housing gasket in recommended sealant 'A'.
29. Adjust the valve tip clearance 4A-81-74, but do not refit the hood.
30. Bleed the fuel system, Part 4C.
31. Start the engine and run it at a fast idle speed for approximately ten minutes, until the normal operating temperature is reached, and stop the engine.
32. Remove the rocker assembly, operation 4A-82-75.
33. Re-tighten the cylinder head securing nuts and bolts in the correct sequence to a torque of 100 Nm (75 lbf ft).
34. Refit the rocker assembly, operation 4A-82-75.
35. Start the engine and check for any leaks.



28b

ENGINE**CYLINDER HEAD****Servicing**

4A—88—78

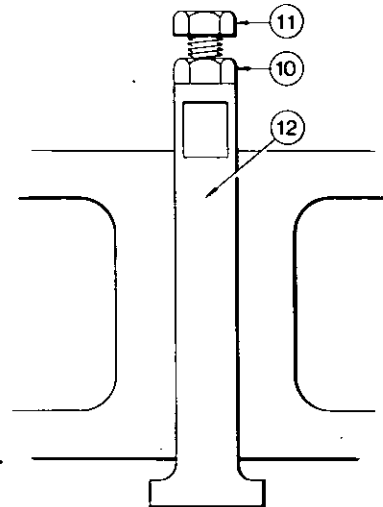
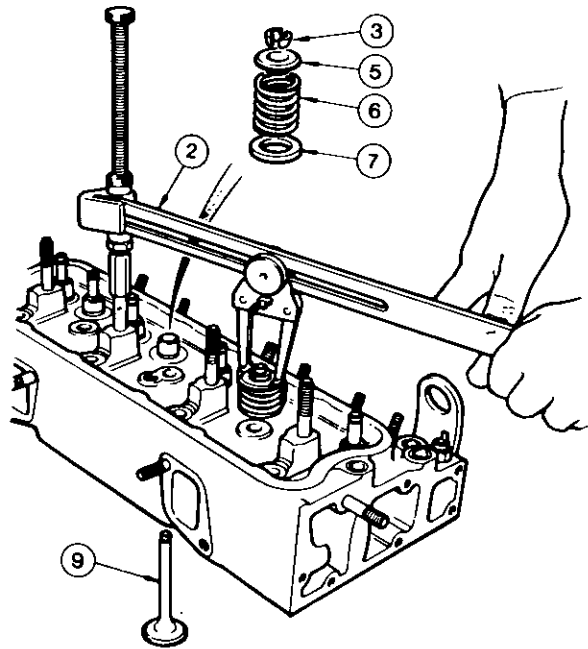
Special Tools: PD. 1D Valve Guide Remover and Replacer
 PD. 1D-1A Adaptor
 PD. 41B Valve Depth Gauge
 316X Valve Seat Cutter Handle
 316-10 Pilot for $\frac{1}{8}$ " dia. valve guides
 317-30 Valve Seat Cutter (inlet and exhaust)
 317G-30 Valve Seat Glaze breaker (inlet and exhaust)
 PD 6118B Valve Spring Compressor
 PD 6118-3 Adaptor

Disassembly and Reassembly

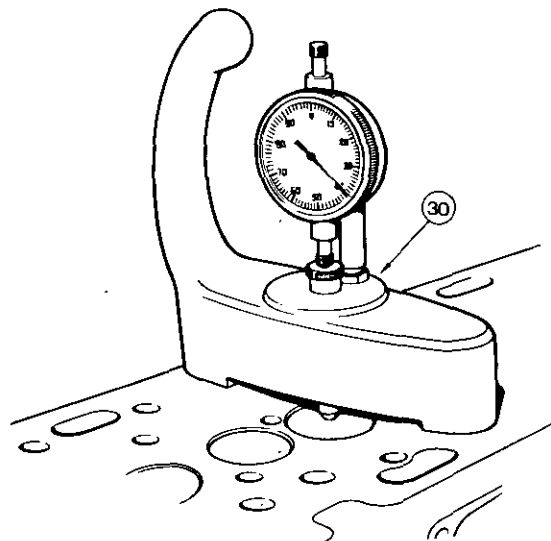
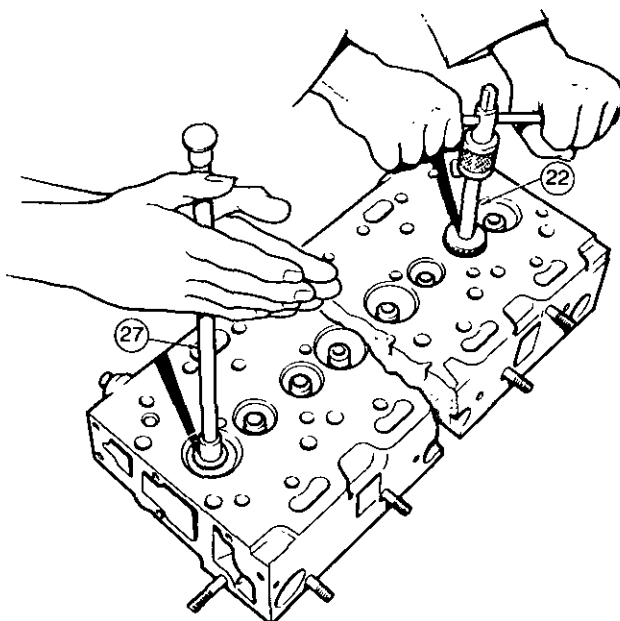
1. Remove the cylinder head, operation 4A—87—77.
2. Using PD 6118B and PD 6118-3, compress the valve spring.
3. Remove the collets.
4. Release and remove PD 6118B and PD 6118-3.
5. Remove the valve spring cap.
6. Remove the spring.
7. Remove the spring seat.
8. Repeat procedures 2 to 7 for the remaining valves.
9. Position the cylinder head on its side and remove the valves.

NOTE: Keep the valves in the order in which they were removed.

10. Slacken the locknut.
11. Remove the bolt and locknut.
12. Remove the cam follower.
13. Repeat procedures 10 to 12 for the remaining cam followers.
14. Remove the five bolts and one nut, and remove the thermostat housing and gasket.
15. Remove the six bolts, and remove the rear cover, gasket and hood support frame mounting bracket.
16. Clean all the cylinder head ports free of any carbon or other deposits.
17. If the water jacket of the cylinder head shows signs of excessive scale, a proprietary brand of de-scaling solution should be used.
18. Check the valve guide bores for wear.
19. If necessary, remove the valve guides using PD. 1D.
20. Using PD. 1D and PD. 1D-1A, fit the new valve guides. Ensure that the valve guides are fitted the correct way round. Both ends are chamfered, one at 45° and the other at 20° (the 20° end is also recessed). The end with the 20° chamfer should be inserted into the cylinder head top face until the opposite end (45° chamfer) protrudes 14,83 to 15,09 mm (0.584 to 0.594 in) above the top face.



21. Check the valve seats for excessive pitting or wear.
22. If necessary, re-cut the valve seats using the appropriate combination of cutter handle, pilot, valve seat cutter and valve seat glaze breaker. Remove the minimum amount of metal consistent with giving a good, gas tight seal.
23. Thoroughly clean all the valves and examine them for pitting, wear and burning.
24. If necessary, machine grind the valve jointing flange to an angle of 45°, removing the minimum amount of metal consistent with a good, smooth finish.
25. Thoroughly clean the valves.
26. Lubricate the valve stems with clean engine oil.
27. Hand grind the valves and their respective valve seats, until all pitting is removed and a good seat is produced. Only use medium or fine grinding paste.
28. Wash the cylinder head and valves thoroughly with clean paraffin and dry.
29. Lightly oil the valve stems and insert the valves in the cylinder head.
30. Using PD. 41B, check the valve head depth relative to the cylinder head face, the depth should be between 1,52 to 2,13 mm (0.060 to 0.084 in).
31. If the maximum of these limits are exceeded; the offending valve must be discarded and a new one hand ground in its place, again the valve head depth must be measured, and if it is still not within these limits, a new valve seat insert must be fitted (exhaust valves only) operation 4A-89-80. If the offending valve is an inlet and still not within the maximum limits after fitting a new valve, the cylinder head must be replaced.
32. Check the flatness of the cylinder head face and if necessary, skim the face to a maximum of 0,30 mm (0.012 in), providing the injector nozzle protrusion does not exceed 4,60 mm (0.181 in). This figure must not be obtained by fitting additional injector sealing washers.
33. Thoroughly clean the cylinder head.
34. Reverse procedures 1 to 15, except:
 - (a) Refit the valves in their correct positions.
 - (b) Lightly coat the cylinder head rear plate gasket and thermostat housing gasket in recommended sealant 'A'.



VALVE SEAT INSERTS

Fitting Procedure

4A—89—80

Special Tools: See Operation 4A—88—78

Valve seat inserts can only be fitted on EXHAUST valve applications, and then only as a last resort to Cylinder Head Servicing, operation 4A—88—78.

Valve seat inserts differ according to engine type and it is most important that the correct insert is fitted. The fitting of inserts is a precision operation and therefore should only be undertaken by a skilled machinist.

This operation must never be attempted with a worn valve guide in position.

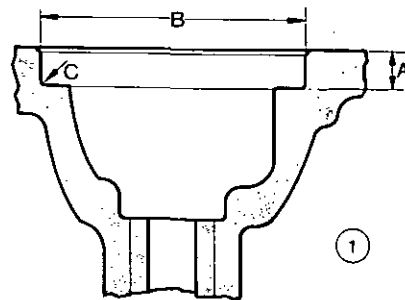
1. Service the cylinder head, operation 4A—88—78.
2. Using the valve guide bore as a pilot, machine the recess in the cylinder head face, to the dimensions given.

NOTE: Work as closely as possible to the minimum machining dimensions to allow for a possible re-seating at a later date.

3. Remove all machining swarf and clean the insert recess.
4. Using the valve guide bore as a pilot, press the insert home using an inserting tool made to the given dimensions.

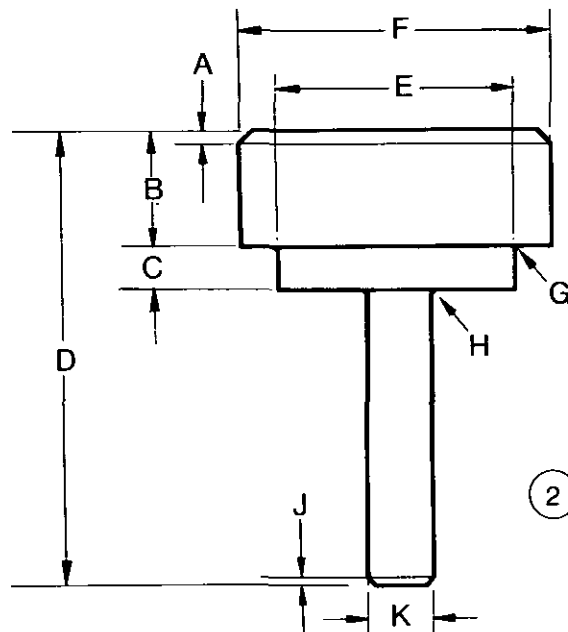
NOTE: The insert must not be hammered in or lubricated.

5. Check that the insert is pressed fully home and is flush with the bottom of the recess.
6. Remove all machining swarf and burrs, and if necessary, skim the cylinder head face, operation 4A—88—78, procedure 32.
7. Re-cut the valve seat at an included angle of 90° so that the valve head depth below the cylinder head face is within the production limits of 1,52 to 1,85 mm (0-060 to 0-073 in) for exhaust valves.



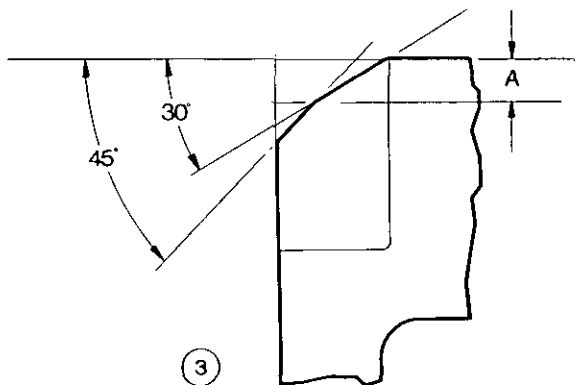
Key to Fig. 1.

- A. 7,87 to 7,92 mm (0-310 to 0-312 in).
 B. 42,62 to 42,6 mm (1,678 to 1-679 in).
 C. 0,38 mm (0-015 in) Max. radius.



Key to Fig. 2

- A. 1,59 mm (0-63 in) at 45°.
 B. 19,05 mm (0-75 in).
 C. 6,35 mm (0-250 in).
 D. 88,90 mm (3-5 in).
 E. 30,48 to 30,50 mm (1-200 to 1-201 in).
 F. 42,34 to 42,59 mm (1-667 to 1-677 in).
 G. 0,79 mm (0-031 in) radius.
 H. 1,59 mm (0-063 in) radius.
 J. 1,59 mm (0-063 in) at 45°.
 K. 7,85 to 7,87 mm (0-309 to 0-310 in).



Key to Fig. 3

- A. 3,30 to 3,51 mm (0-130 to 0-138 in).
 Flare cut to 30°.

TIMING CASE COVER**Removal and Refitment**

4A-90-81

Removal

1. Split the tractor between the engine and front axle, Part 3A.
2. Remove the crankshaft pulley securing bolt and washer.
3. Remove the crankshaft pulley.
4. Remove the water pump, Part 4B.
5. Remove the breather pipe.
6. Disconnect the throttle return spring on the injector pump.
7. Remove the four bolts.
8. Remove the two Allen bolts securing the alternator mounting bracket.
9. Remove the fourteen bolts securing the timing case cover to the timing case.

NOTE: The three long bolts also secure the power steering pump.

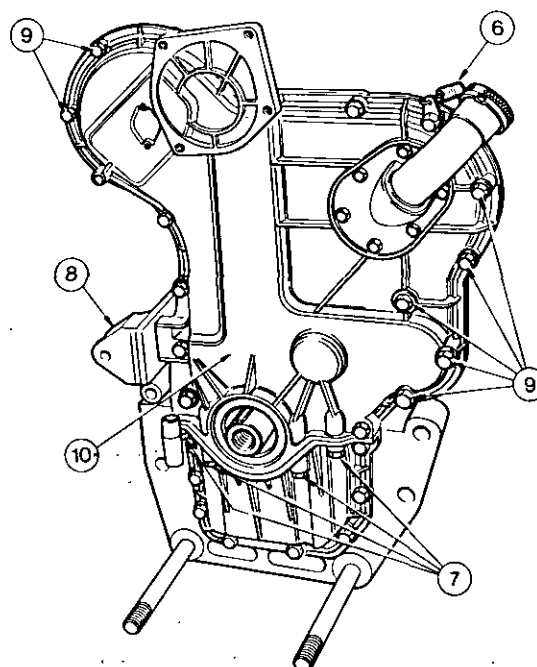
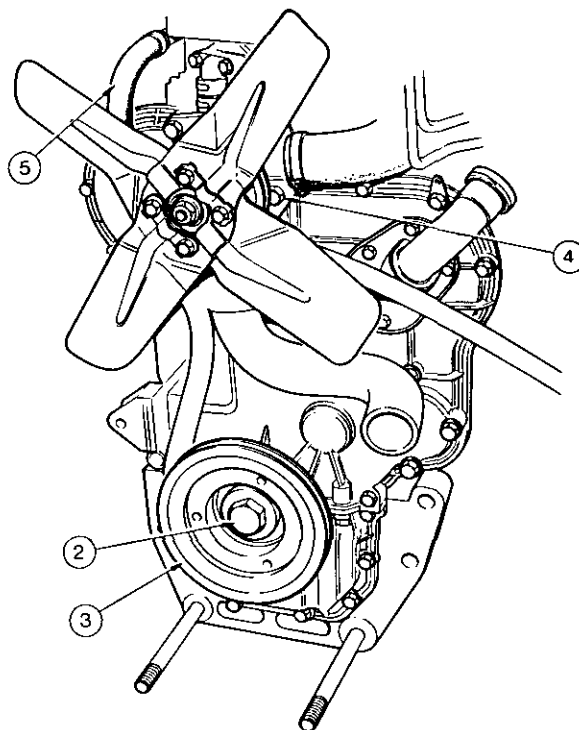
10. Remove the timing case cover.
11. Remove and discard the gasket.
12. Remove the oil seal.

Refitment

13. Fit a new oil seal, with the toe of the seal towards the engine. Position the seal 2,4 mm (0.094 in) below the front face of the timing cover.
14. Place the timing case cover and a new gasket in position.

NOTE: Lightly coat the gasket in recommended sealant 'A'.

15. Slide the crankshaft pulley into position on the crankshaft to centralize the timing case cover.
16. Fit and tighten some of the bolts and washers to secure the timing case cover.
17. Remove the crankshaft pulley.
18. Refit the remaining timing case cover retaining bolts and washers.
19. Reverse procedures 1 to 8, except tighten the crankshaft pulley securing bolt to a torque of 150 Nm (110 lbf ft).



ENGINE

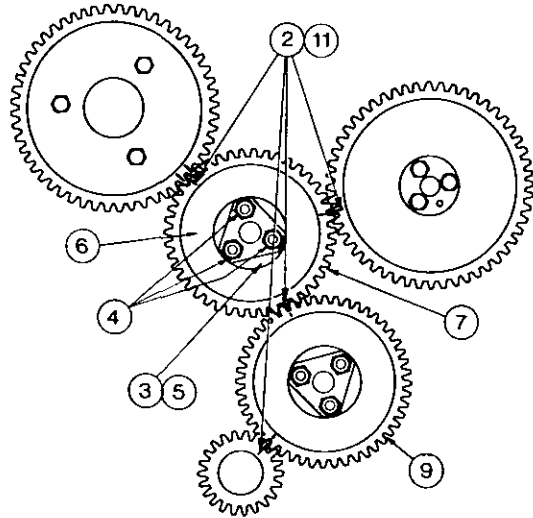
TIMING GEARS

Idler Gears Removal and Refitment 4A-91-82

Special Tool: Dial Test Indicator Gauge

Removal

1. Remove the timing case cover, operation 4A-90-81.
2. Turn the crankshaft until the marks on the fuel pump, camshaft and crankshaft gears are aligned with their corresponding marks on both idler gears.
3. Bend back the tabwashers.
4. Remove the three nuts.
5. Remove the tabwasher.
6. Remove the retaining plate.
7. Remove the upper idler gear.
8. If necessary, remove the idler gear hub.
9. Repeat procedures 3 to 8 for the lower idler gear.

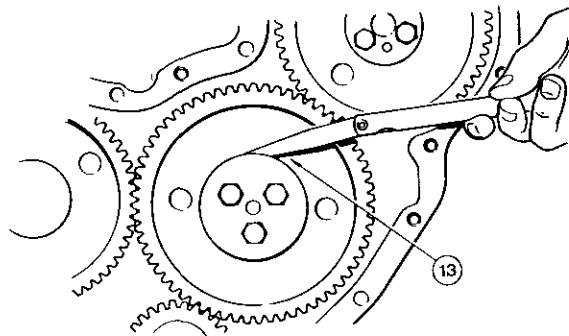
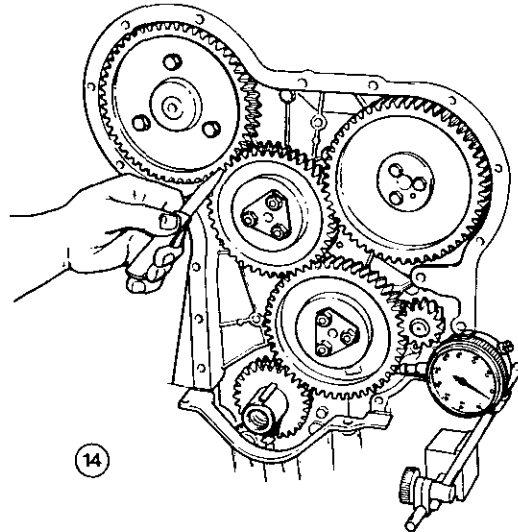


Refitment

10. Refit the idler gear hub ensuring that the oil feed hole is aligned with the oil feed hole in the cylinder block.
11. Refit the gear ensuring the timing marks on the fuel pump, camshaft and crankshaft are all aligned with those on the idler gears.
12. Reverse procedures 3 to 6.
13. Check the idler gear end float, which should be between 0,025 and 0,1778 mm (0-001 and 0-007 in).
14. Check the timing gear backlash using either a dial test indicator gauge or feeler gauges. The backlash should be between 0,076 and 0,152 mm (0-003 and 0-006 in) between any two meshed gears. Check all points of mesh.

NOTE: Should the backlash obtained not be within the prescribed limits, replace the affected timing gears.

15. Refit the timing case cover, operation 4A-90-81.

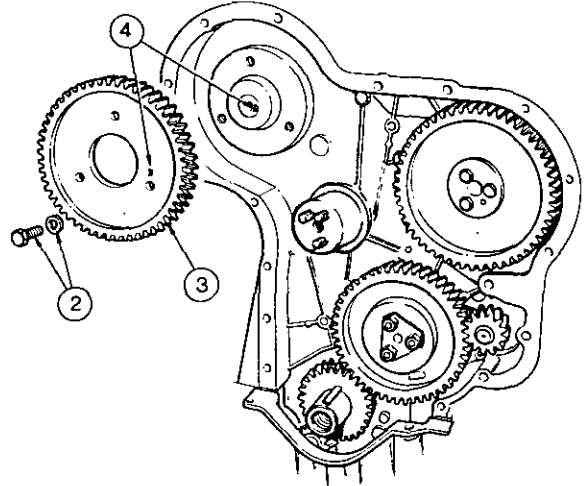


TIMING GEARS**Camshaft Drive Gear Removal and Refitment****Removal** 4A-92-83

1. Remove the upper idler gear, operation 4A-91-82, procedures 1 to 7.
2. Remove the three bolts and washers.
3. Remove the gear.

Refitment

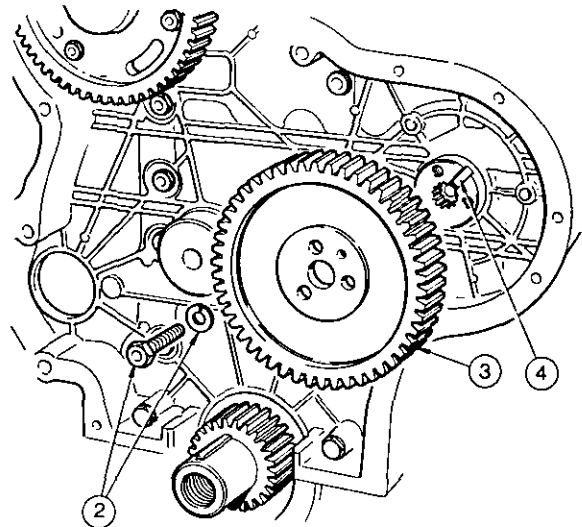
4. Reverse procedures 2 and 3, except: ensure that the letters on the gear and flange are aligned.
5. Refit the upper idler gear, operation 4A-91-82, procedures 11 to 15.

**TIMING GEARS****Fuel Pump Drive Gear Removal and Refitment****Removal** 4A-93-83

1. Remove the upper idler gear, operation 4A-91-82, procedures 1 to 7.
2. Remove the three bolts and washers.
3. Remove the gear.

Refitment

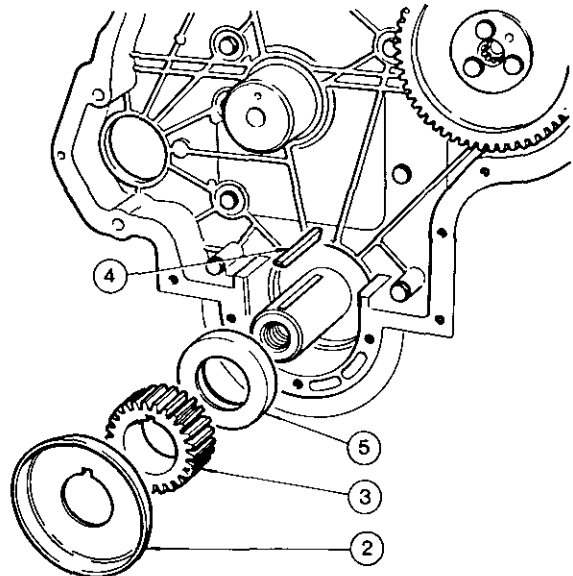
4. Reverse procedures 2 and 3 except:
 - (a) Ensure that the dowel in the gear locates in the slot in the D.P.A. pump flange.
 - (b) Tighten the bolts to a torque of 28 Nm (21 lbf ft).
5. Refit the upper idler gear, operation 4A-91-82, procedures 11 to 15.

**TIMING GEARS****Crankshaft Drive Gear Removal and Refitment****Removal** 4A-94-83

1. Remove the lower idler gear, operation 4A-91-82, procedures 1 to 7.
2. Remove the oil thrower.
3. Withdraw the crankshaft gear.
4. Tap out the key (if necessary).
5. Withdraw the spacer (if necessary).

Refitment

6. Reverse procedures 2 to 5.
7. Refit the lower idler gear, operation 4A-91-82, procedures 11 to 15.

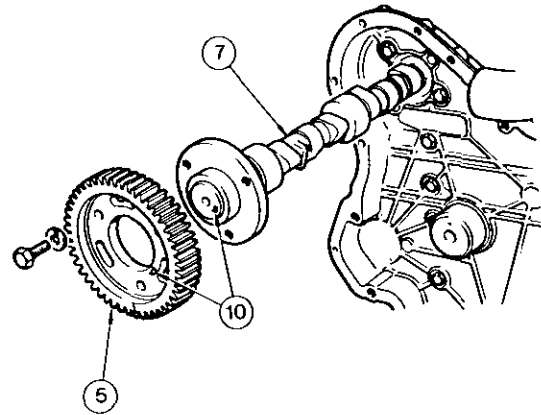


ENGINE**CAMSHAFT****Removal and Refitment**

4A-95-84

Removal

1. Remove the rocker assembly, operation 4A-82-75.
2. Remove the upper idler gear, operation 4A-91-82, procedures 1 to 7.
3. Disconnect the tractometer drive cable from the rear of the camshaft housing in the engine block.
4. Remove the fuel lift pump, Part 4C.
5. Remove the camshaft drive gear, operation 4A-92-83.
6. Raise the tappets.
7. Remove the camshaft from the front of the engine, taking care that the camshaft lobes do not damage the bearings.
8. Remove the camshaft thrust washer (if necessary).

**Refitment**

9. Ensure that the camshaft thrust washer is correctly located on the dowel in the cylinder block.
10. Reverse procedures 3 to 7, except: ensure that the letter marks on the gear and flange are aligned when refitting.
11. Refit the upper idler gear, operation 4A-91-82, procedures 11 to 15.
12. Refit the rocker assembly, operation 4A-82-75.

TIMING CASE**Removal and Refitment**

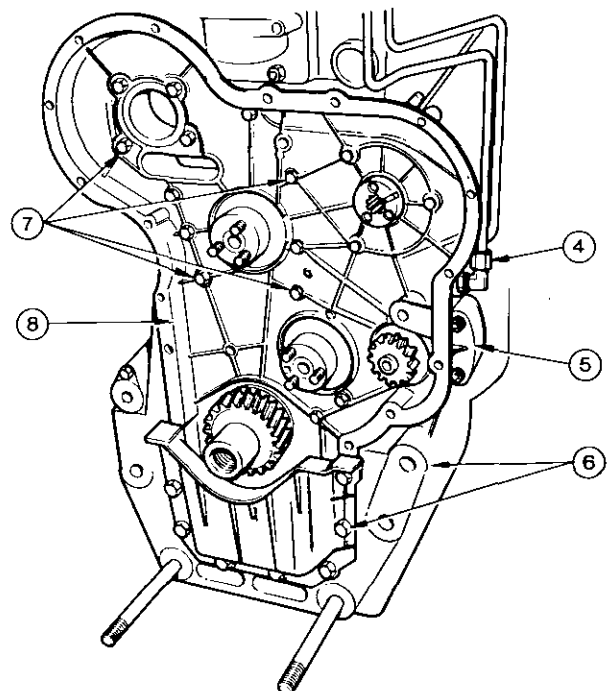
4A-96-84

Removal

1. Remove the camshaft, operation 4A-95-84.
2. Remove the fuel pump drive gear, operation 4A-93-83, procedures 2 and 3.
3. Remove the fuel injection pump, Part 4C.
4. Disconnect the power steering pipes at the power steering pump.
5. Remove the power steering pump.
6. Remove the engine sump, operation 4A-101-88.
7. Remove the thirteen bolts and washers securing the timing case to the cylinder block.
8. Remove the timing case.
9. Remove the gasket.

Refitment

10. Reverse procedures 3 to 9, except: Fit a new gasket lightly coated in recommended sealant 'A'.
11. Refit the fuel pump drive gear, operation 4A-93-83 procedure 4.
12. Refit the camshaft, operation 4A-95-84.



FLYWHEEL**Removal and Refitment**

4A-97-85

Special Tool: Dial Test Gauge Indicator

Removal

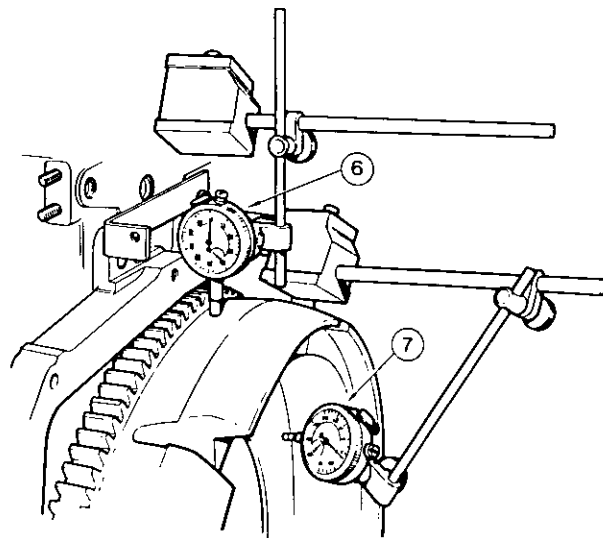
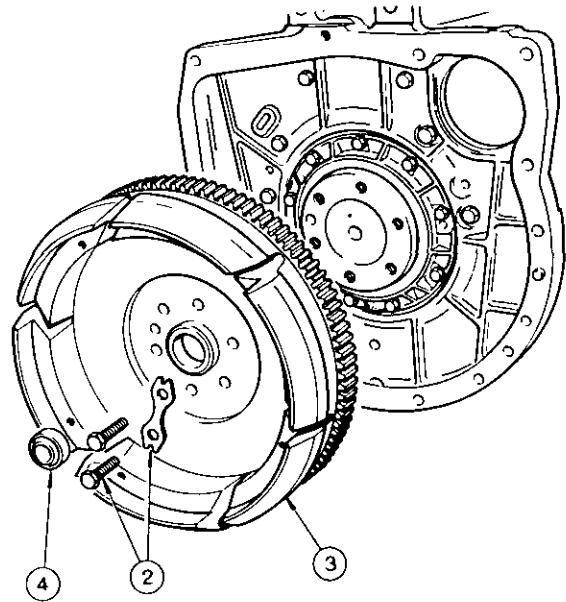
1. Remove the clutch, Part 5A.
2. Remove the six bolts and tabwashers.
3. Remove the flywheel.
4. If necessary, remove the pilot bearing.

Refitment

5. Reverse procedures 2 to 4, except:
 - (a) Locate the flywheel on the crankshaft so that the untapped hole in the flange is in line with the unused hole in the flywheel.
 - (b) Tighten the flywheel bolts to a torque of 100 Nm (75 lbf ft), and secure them with new tabwashers.
6. Using a dial test indicator gauge, adjust the dial so that the stylus is contacting the flywheel periphery. Turn the crankshaft and check the total reading. The flywheel should run true within 0,30 mm (0.012 in) total indicator reading.
7. Adjust the dial test indicator so that the stylus rests on the clutch face of the flywheel, parallel to the crankshaft at the outermost point of the face. Push the crankshaft forwards to take up the end float, and turn the flywheel. The run-out on the flywheel face should be within 0,025 mm (0.001 in) per 25 mm (1 in) of flywheel radius, measured from the crankshaft axis to the stylus of the dial test indicator gauge. If the run-out is excessive, remove the flywheel, check and remove any burrs or foreign matter.

NOTE: If the flywheel is removed, procedures 5, 6 and 7 must be repeated.

8. Refit the clutch, Part 5A.



ENGINE**FLYWHEEL****Ring Gear Removal and Replacement**

4A—98—86

Special Tools: See Operation 4A—97—85

Removal

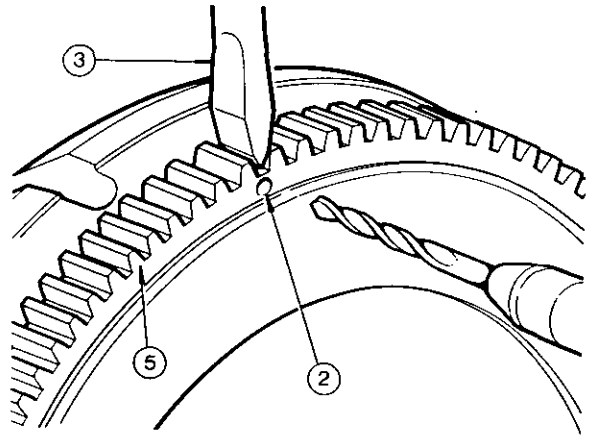
1. Remove the flywheel, operation 4A—97—85.
2. Drill a 5mm ($\frac{3}{16}$ in) diameter hole axially midway between the inside diameter of the ring gear, and the root of any tooth to a depth of 16 mm ($\frac{5}{8}$ in) only, (otherwise the flywheel may be damaged).
3. Place a chisel in the root above the drilled hole.
4. Cover the flywheel and chisel point in a heavy cloth to protect the operator and others against flying fragments.

WARNING: Take precautions against flying fragments as the starter ring gear may disintegrate when struck.

5. Support the flywheel and strike the chisel sharply and the ring gear should split.

Replacement

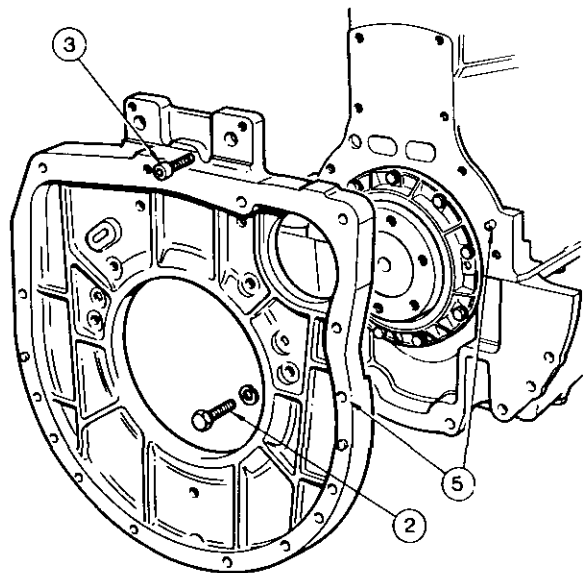
6. Heat the new ring gear to a temperature of 245 C (475 F) approximately, using an oven, NOT A NAKED FLAME.
7. Fit the ring gear over the flywheel with the lead-in on the teeth facing towards the front of the flywheel, push the ring gear fully home and allow to cool slowly.
8. Refit the flywheel, operation 4A—97—85.

**FLYWHEEL****Housing Removal and Refitment** 4A—99—86**Removal**

1. Remove the flywheel, operation 4A—97—85.
2. Remove the six bolts and washers.
3. Remove the two Allen bolts.
4. Remove the six bolts and washers securing the rear of the sump to the housing.
5. Lift the housing clear of the dowels.

Refitment

6. Reverse procedures 1 to 5, except:
 - (a) Ensure that the flywheel housing and engine block faces are scrupulously clean.
 - (b) Lightly coat the bolt threads with recommended seafant 'B'.



CRANKSHAFT REAR MAIN OIL SEAL**Removal and Replacement 4A-100-87**

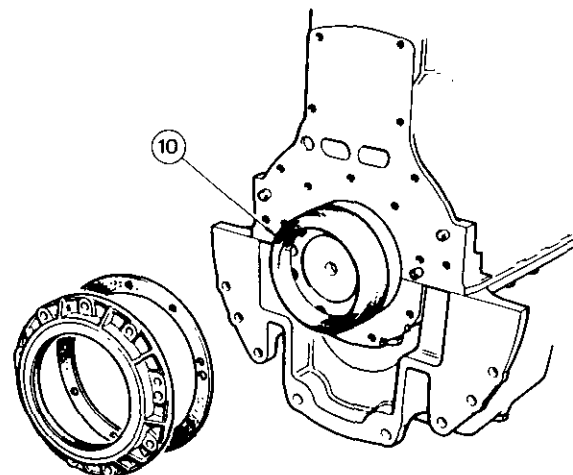
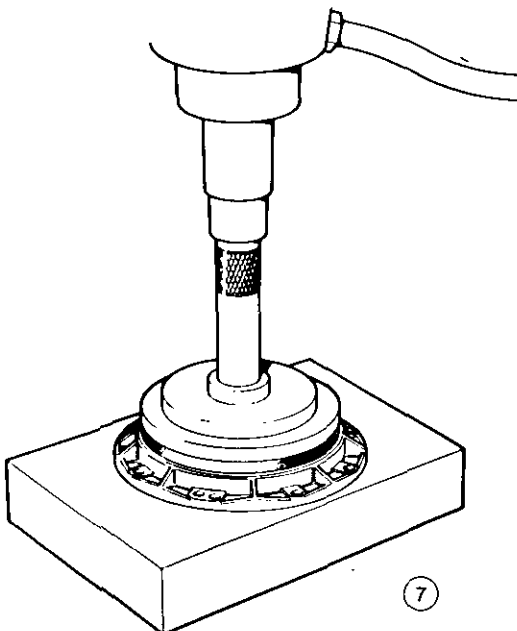
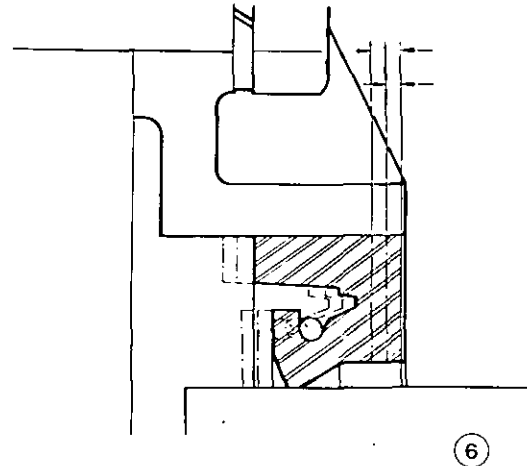
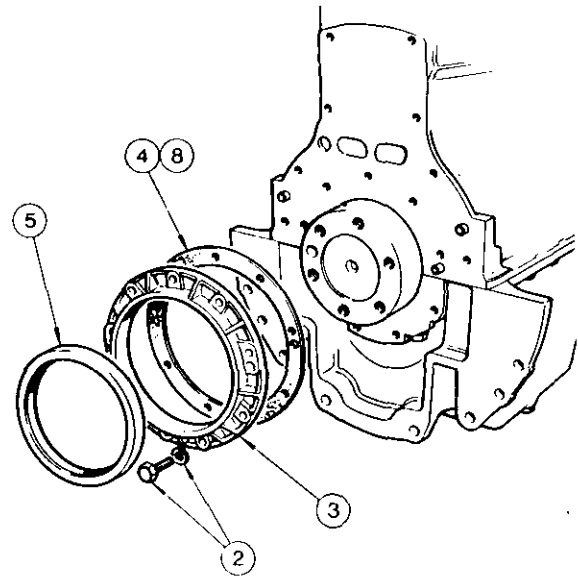
Special Tools: See Operation 4A-97-85
 PD 145-1 Oil Seal Replacer
 PD 145-2 Oil Seal Pilot

Removal

1. Remove the flywheel housing, operation 4A-99-86
2. Remove the bolts and washers.
3. Remove the seal housing complete with the oil seal.
4. Remove and discard the gasket.
5. Remove the seal from the housing.

Replacement

6. On production, the lip seal is fitted with its rear face flush with the rear face of the seal housing. Examine the crankshaft flange, and if it is found to be grooved, the new seal should be pressed further into the housing; in the first instance to 3,2 mm (0.125 in) and if required, a further equal distance, resulting in a total of 6,4 mm (0.25 in). If all these positions have been used the worn sealing area of the crankshaft must be machined.
7. Lubricate the seal and the housing with clean engine oil, then using PD 145-1, press the seal into the housing to the required depth.
8. Fit a new gasket, lightly coated in recommended sealant 'A'.
9. Lubricate the seal, the crankshaft flange and PD 145-2 with clean engine oil.
10. Using PD 145-2, fit the seal and housing assembly, ensuring that the housing is correctly located on the dowels in the cylinder block.
11. Remove PD 145-2.
12. Reverse procedures 1 and 2.



ENGINE**ENGINE SUMP****Removal and Refitment**

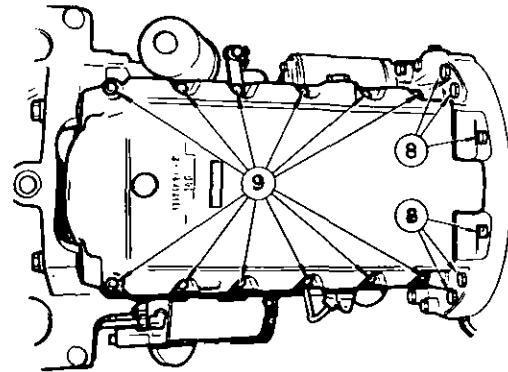
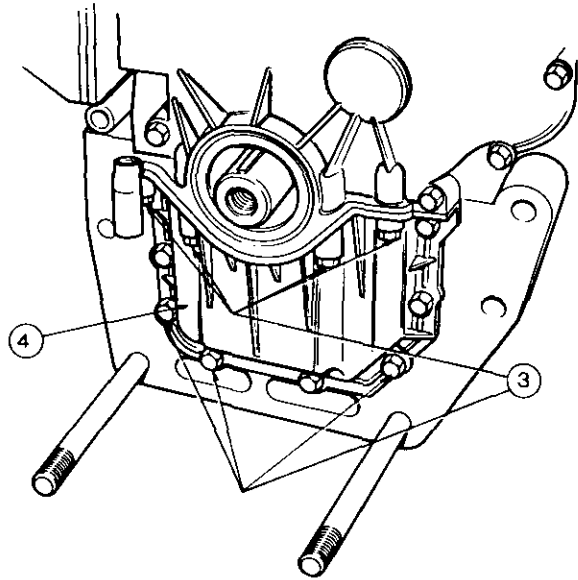
4A-101-88

Removal

1. Split the tractor between the front axle and the engine, Part 3A, except:
 - (a) Support the tractor under the gearbox and not the engine sump.
2. Remove the sump drain plug and drain the oil into a suitable container.
3. Remove eight bolts and washers and four vertical bolts and washers securing the front cover plate.
4. Remove the front cover plate and gasket.
5. Remove the one bolt and washer securing the right hand front axle spacer.
6. Remove the right hand front axle spacer.
7. Remove the two nuts and washers, securing the front vertical studs to the timing case.
8. Remove the six bolts securing the sump to the flywheel housing.
9. Support the sump and remove the six bolts and washers, and six self locking nuts securing the sump to the engine.
10. Separate the sump from the engine.
11. Remove and discard the sealing gaskets.

Refitment

12. Reverse procedures 1 to 11, except:
 - (a) Ensure mating surfaces are clean.
 - (b) Fit new gaskets, lightly coated with recommended sealant 'A'.
 - (c) Fit a new cork insert into the groove, which is located across the rear main bearing cap butt face.
 - (d) Refill the sump with an approved engine oil to the correct level indicated on the dip stick.

**OIL PUMP****Removal and Refitment**

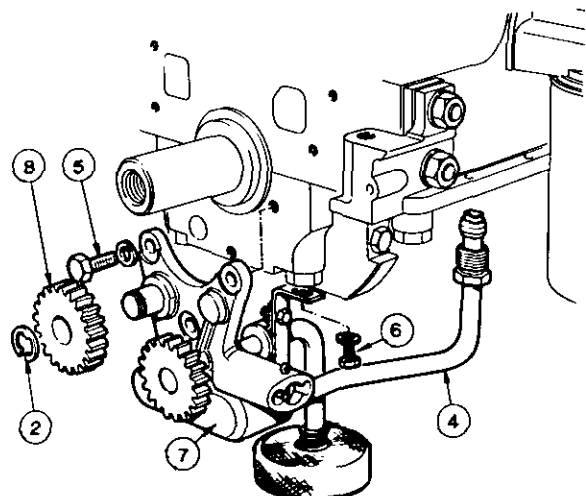
4A-102-88

Removal

1. Remove the sump, operation 4A-101-88.
2. Remove the idler gear circlip.
3. Remove the idler gear.
4. Disconnect the pipe.
5. Remove the three setscrews.
6. Remove the bolt and washer.
7. Remove the oil pump.

Refitment

8. Reverse procedures 1 to 7.



OIL PUMP**Servicing**

4A-103-89

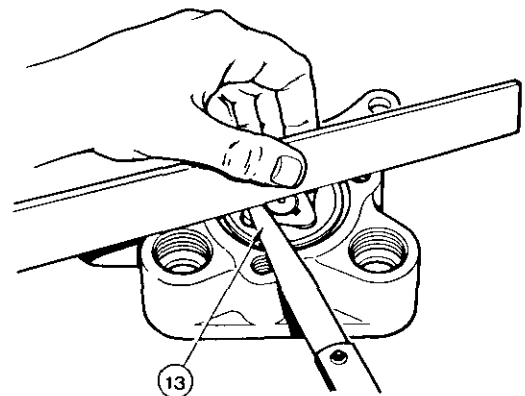
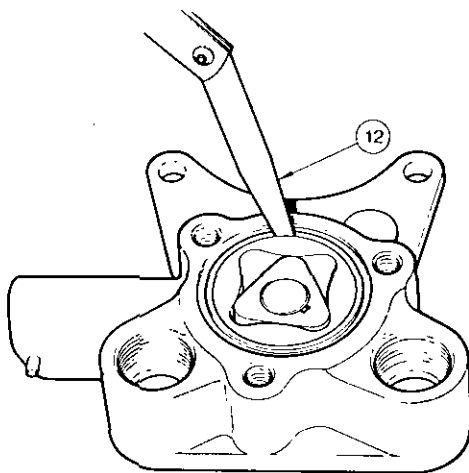
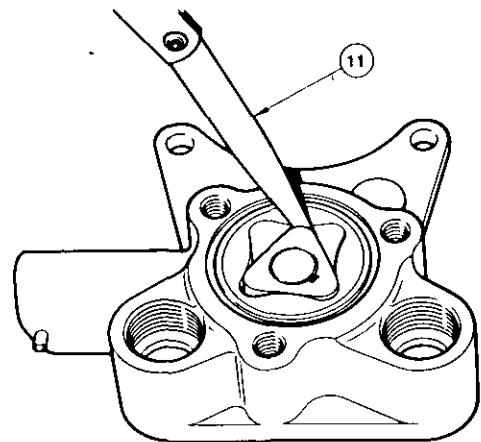
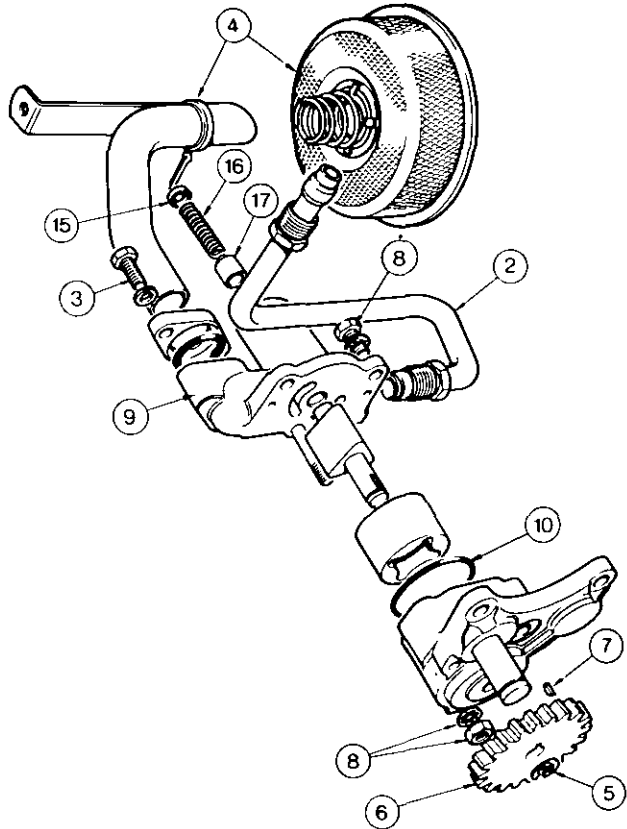
Disassembly

1. Remove the oil pump, operation 4A-102-88.
2. Remove the pipe.
3. Remove the two bolts and washers securing the strainer pipe.
4. Remove the pipe and strainer assembly.
5. Remove the circlip.
6. Withdraw the pump drive gear, using a suitable pulling tool.
7. Remove the key from the keyway.
8. Remove the two truss-headed screws and the nut securing the end plate.
9. Remove the end cover and relief valve.
10. Remove the seal.
11. Check the clearance between the maximum diameter of the inner rotor and the minimum diameter of the outer rotor at all points. If the clearance exceeds 0,1524 mm (0.006 in) a new oil pump must be fitted.
12. Check the clearance between the outer rotor and the pump body. If the clearance exceeds 0,254 mm (0.010 in) a new oil pump must be fitted.
13. Check the clearance between the top of the rotors and the pump body. If the clearance exceeds 0,762 mm (0.030 in) a new oil pump must be fitted.
14. If necessary, remove the split pin.
15. Remove the cap.
16. Remove the spring.
17. Remove the relief valve.

Examine all parts for wear or damage and if necessary replace them.

Reassembly

18. Reverse procedures 14 to 17 and 1 to 10, except:
 - (a) Press on the drive gear with the flat face outwards, until it is level with the circlip groove.
 - (b) Fit a new seal.



ENGINE

CONNECTING ROD BIG END BEARINGS

Removal and Refitment

4A-104-90

Removal

1. Remove the oil pump, operation 4A-102-88.
2. Rotate the crankshaft until the required bearing is at B.D.C.
3. Remove the two nuts from the big end bolts.
4. Remove the big end cap complete with the shell bearing.
5. Remove the shell bearing from the big end cap.
6. Remove the big end bolts.
7. Rotate the crankshaft until the shell bearing can be removed from the connecting rod.
8. Repeat procedures 2 to 7 for the remaining big end bearings.

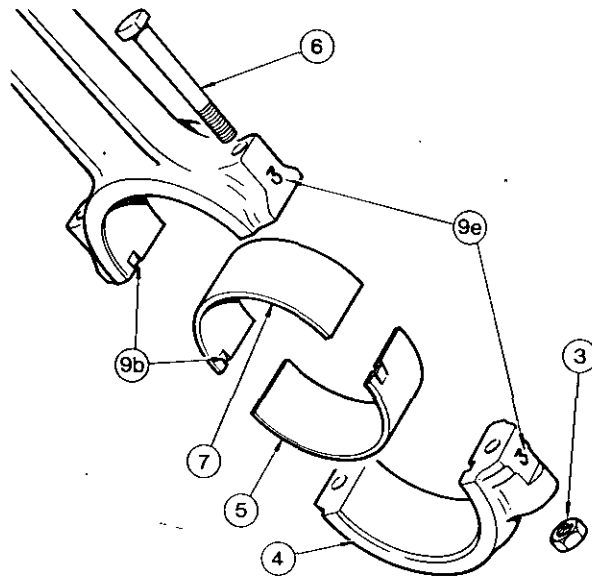
Examine the shell bearings for wear and scoring. If any bearing is found defective, replace the complete set.

Check the crankpins for wear and ovality using a micrometer. Check the diameter of the crankpins in the horizontal plane and the vertical plane at each end of the crankpin.

Crankpin wear and ovality should not exceed 0,0381 mm (0.0015 in). The crankshaft should be reground or replaced if these limits are exceeded.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Ensure that all components are scrupulously clean and lubricated with clean engine oil.
 - (b) Ensure that the steps on the shell bearing halves fit into the slots on the connecting rods and that the bearings are refitted in their original position and are properly seated.
 - (c) The connecting rod nuts and bolts are of a special type and should be replaced by new items supplied by the engine manufacturer whenever they are removed.
 - (d) Ensure that the flats on the connecting rod bolts are located against the shoulders on the connecting rods.
 - (e) Ensure that the connecting rod and the end cap are fitted with the identification marks together and on the left hand side of the engine.
 - (f) Tighten the big end nuts to a torque of 68 Nm (50 lbf ft).



PISTONS AND CONNECTING RODS

Removal and Refitment 4A-105-91

Special Tools: 38 U3 Piston Ring Compressor
PD 41B Piston Height Gauge

Removal

1. Remove the cylinder head, operation 4A-87-77.
2. Remove the connecting rod big end bearings, operation 4A-104-90.
3. Push the pistons and connecting rods out of the top of the cylinders.

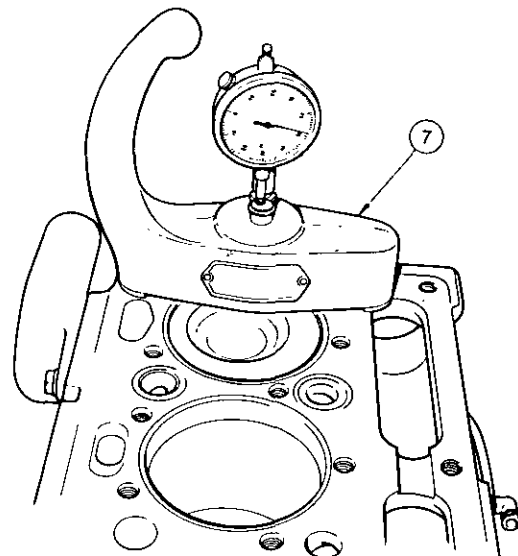
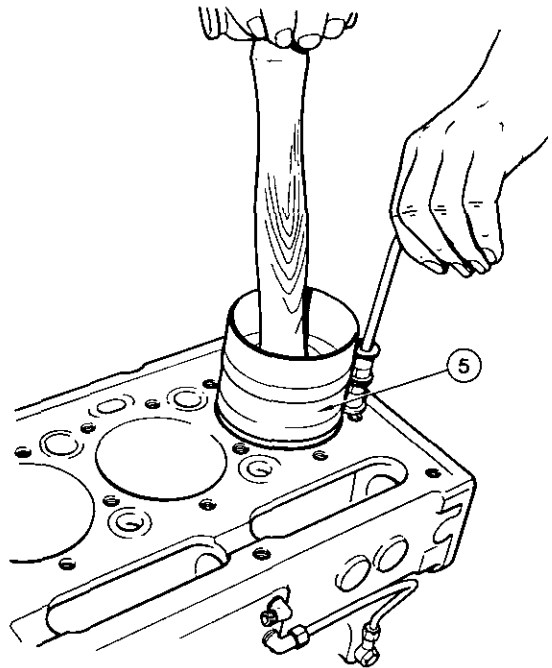
Refitment

Check the condition of the pistons, piston rings and cylinder liners, and if any doubt as to the serviceability, replace them.

4. Clean all parts thoroughly, and freely lubricate with clean engine oil.

NOTE: Position the piston rings on the pistons so that the ring gap on each piston ring is 180° from the gap in the previous piston ring.

5. Using 38 U3 and a suitable piece of hardwood, insert the piston and connecting rod assemblies into the top of their respective cylinder bores ensuring that the word 'FRONT' on the piston crown is towards the front of the engine.
6. Refit the connecting rod big end bearings, operation 4A-104-90, except, do not refit the oil pump.
7. Using PD 41B, check the piston height. The piston should be 0,0127 to 0,2159 (0-0005 to 0-0085 in) above the top face of the cylinder block.
8. Refit the oil pump, operation 4A-102-88.
9. Refit the cylinder head, operation 4A-87-77.



ENGINE

PISTONS AND CONNECTING RODS

Servicing

4A-106-92

Special Tools: See Operation 4A-105-91.
335 Con Rod Alignment Jig
336-102 Arbor Adaptor

Disassembly

1. Remove the pistons and connecting rods, operation 4A-105-91.
2. Remove the rings from each piston.
3. Remove the circlips.
4. Warm the piston in clean liquid to a temperature of 38 to 50 C (110 to 120 F).
5. Carefully withdraw the gudgeon pins.
6. Remove all traces of carbon deposits from the pistons, with particular attention to the ring grooves.
7. Check the vertical groove clearance with a new ring fitted. The piston should be replaced if the limits are exceeded.
8. Examine the pistons for signs of scoring.
9. Check the gap of the piston rings when they are fitted in the unworn portion at the top of the cylinder bore.
10. Check the fit of the gudgeon pins in the piston bores and small end bearings.
11. If necessary, press out the small end bushes from the connecting rods.

Reassembly

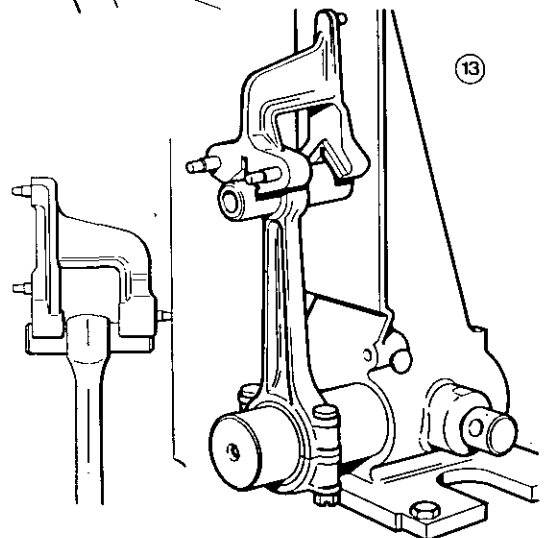
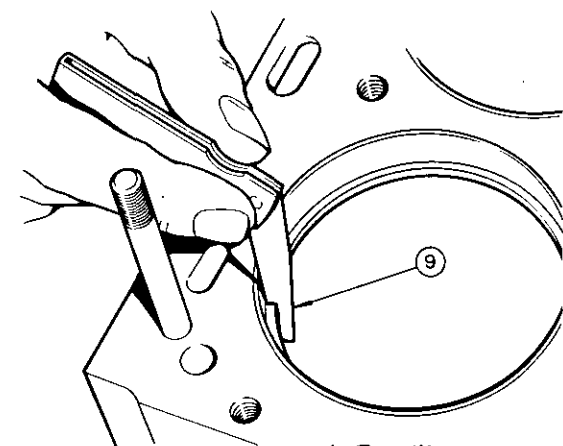
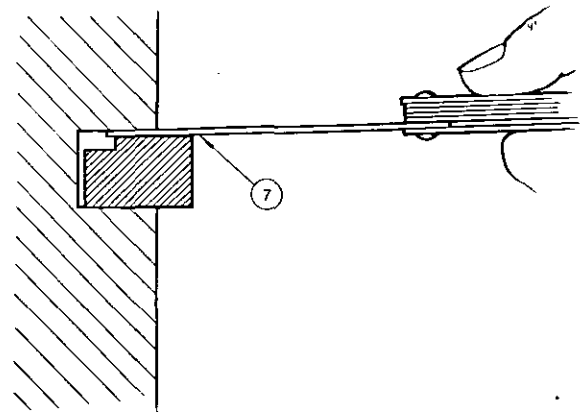
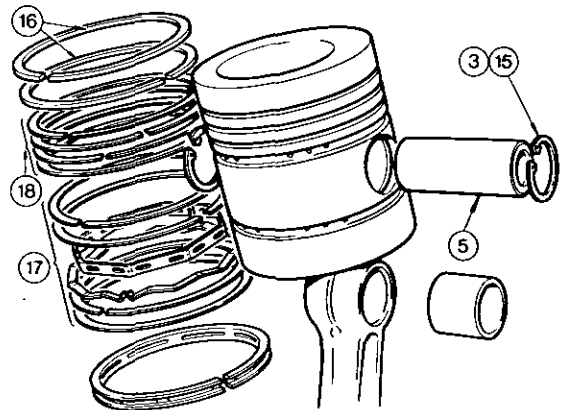
12. If required, press new small end bushes into the connecting rod, aligning the oil hole in the bush with the hole in the top of the connecting rod.

NOTE: The reaming of the small end bush is a precision task and should only be undertaken by a skilled machinist.

13. Using 335, check the connecting rod for parallelism and squareness, if any distortion is found, the connecting rod must be replaced.
14. Warm the piston in clean liquid, assemble the pistons to their corresponding connecting rods and insert the gudgeon pins.

NOTE: The cavity in the piston crown is off-set towards one side of the piston. Assemble the pistons to the connecting rods with the cavity towards the side of the connecting rod which carries the connecting rod and big end cap identification.

15. Fit two new circlips.
16. Fit the piston rings in the following order:
Top — Plain cast iron parallel faced compression ring with chrome plated insert.
2nd — Plain cast iron parallel faced compression ring.
3rd — Cord type four segment laminated compression ring.
4th — Duraflex or Cord Oil guard laminated scraper ring.
5th — Maxigroove cast iron slotted scraper ring.



17. To fit the 'Cord Oil Guard' laminated scraper ring:

Assemble the ring from the top of the piston in the following order:

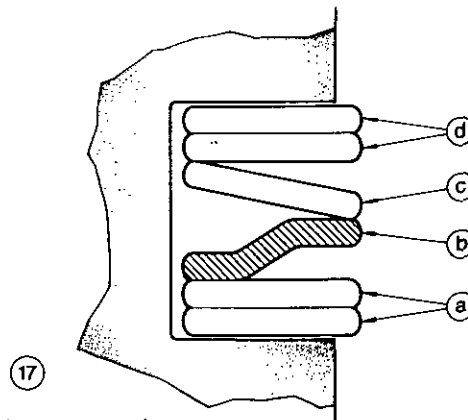
- (a) Fit two flat segments.
 - (b) Fit the spacer.
 - (c) Fit the cupped segment with the cup down, immediately above the spacer.
 - (d) Fit the remaining flat segments above the cupped segment.
 - (e) The segment gaps should be equally spaced around the piston.
- or to fit the alternative "Duraflex" spring loaded scraper ring.
17. (f) Fit the internal expander ring.
 - (g) Fit lower two rail rings.
 - (h) Fit spiral ring.
 - (j) Fit upper two rail rings.

18. To fit the four segment laminated compression ring. Assemble the ring from the top of the piston in the following order:

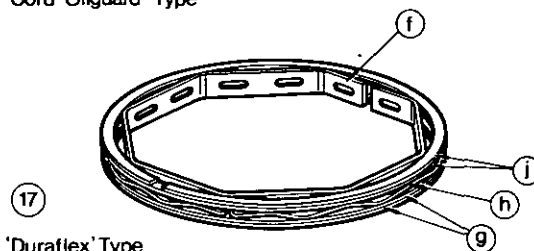
- (a) Fit the first segment to the piston so that when held horizontally in the palm of the hand and radially compressed, the ring ends point downwards. Position this ring at the bottom of the groove with the gap over the gudgeon pin bore.
- (b) Fit the second segment on top of the first, so that when held compressed the ring ends point upwards. Position the gap at 180° to the first segment gap.
- (c) The third segment should be fitted on the top of the second so that when held compressed the ring ends point downwards. Position the gap immediately above that of the first segment.
- (d) Fit the fourth segment on top of the third so that when held compressed the ring ends point upwards. Position the gap immediately above that of the second segment.

NOTE: Position the piston rings on the piston, so that the ring gap on each piston ring is 180° from the gap on the previous ring.

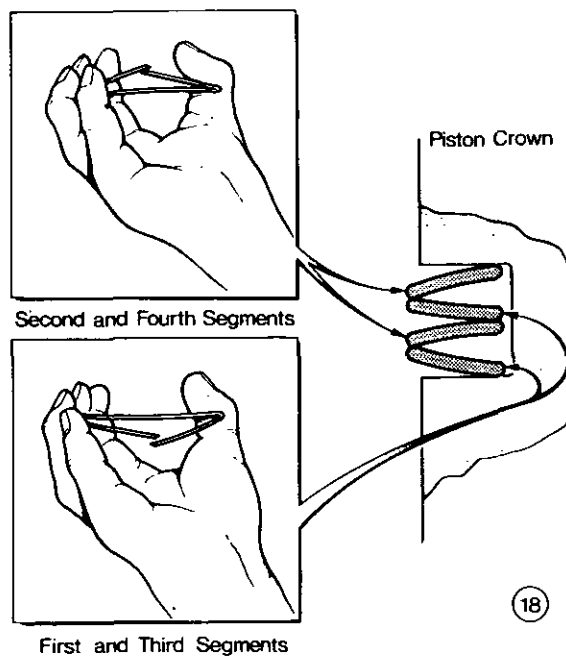
19. Refit the pistons and connecting rods, operation 4A-105-91.



'Cord Oilguard' Type



'Duraflex' Type



First and Third Segments

ENGINE

CYLINDER LINERS

Removal and Replacement 4A-107-94

Special Tools: See Operation 4A-105-91
 PD 150A Cylinder Liner Remover and Replacer
 PD 150-1B Adaptors
 30 Ton Hollow Hydraulic Ram

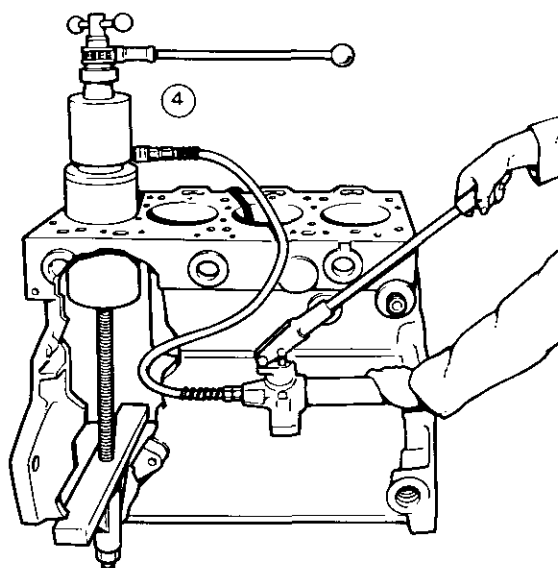
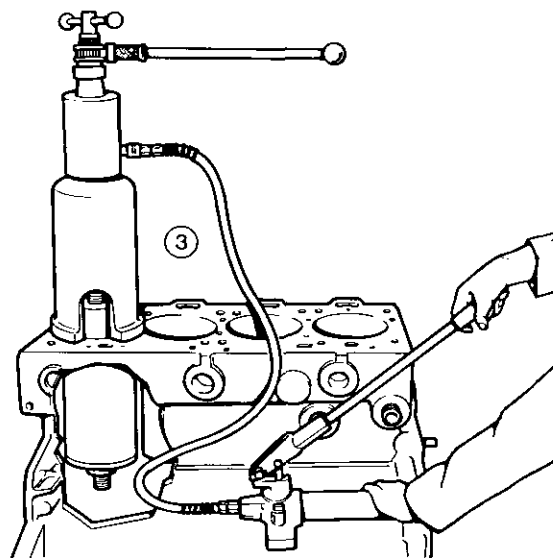
Removal

1. Remove the pistons and connecting rods, operation 4A-105-91.
2. Remove the studs from the cylinder block face.
3. Using PD 150A, the appropriate adaptor and the 30 ton hollow hydraulic ram, withdraw the cylinder liners through the top of the cylinder block.

NOTE: The PD 150 cylinder liner remover and replacer tool, is designed for the field service of single liners. Should the tool be required for general workshop overhaul duties, it is advisable to use it in conjunction with a 30 ton hollow hydraulic ram (suitable examples are Epco P382 or Pickavant LRH 30), with a hand, or electrically operated hydraulic pump.

Replacement

4. Reverse procedures 1 to 3, except:
 - (a) Care must be taken in the handling and storage of cylinder liners. The slightest burr or damage will cause considerable distortion when the liner is put into the cylinder block.
 - (b) Flanged cast iron liners must not be rebored, but must be replaced with new pre-finished service liners.
 - (c) Prior to pressing in the new liner, the cylinder block parent bore and new liner must be thoroughly cleaned, in particular the recess for the liner flange in the top of the parent bore.
 - (d) All parts should be lubricated freely with clean approved engine oil before refitment.
 - (e) Ensure that the liner flange does not foul the counter bore at the top of the parent bore.
 - (f) The top face of the liner should be between 0,000 and 0,102 mm (0-000 and 0-004 in) below the top face of the cylinder block when fully home.
 - (g) Check the condition of the pistons and piston rings, and if in any doubt as to their serviceability, replace them.
 - (h) Allow a settling period to elapse before checking the fitted internal bore diameter of the liners.
 - (i) Each liner should be checked in three positions, top, centre and bottom, the readings being taken transversely and parallel to the centre of the cylinder block.



CRANKSHAFT**Thrust Washers Removal and Replacement****Removal and Replacement 4A-108-95**

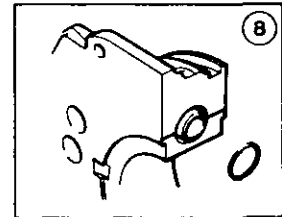
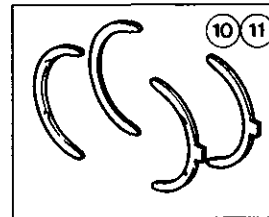
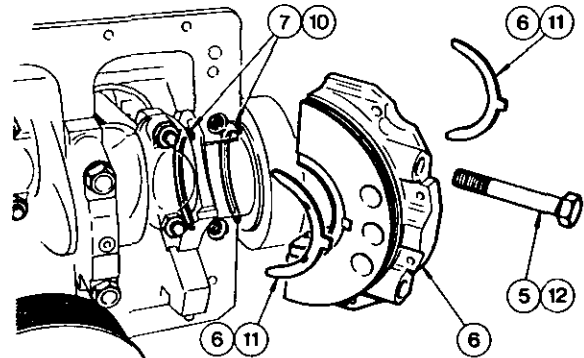
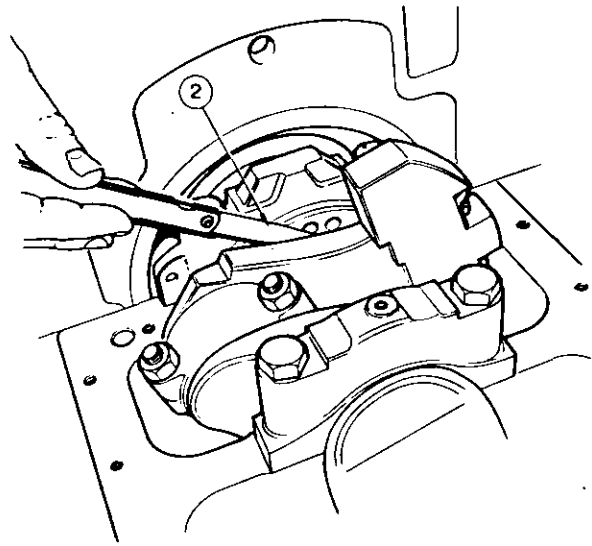
1. Remove the engine sump, operation 4A-101-88.
2. Push the crankshaft rearwards and check the crankshaft end float between the thrust washer and the crankshaft. The clearance should be between 0,05 and 0,264 mm (0-002 and 0-014 in).
3. If the end float is not within these limits, proceed as follows:—
4. Remove the crankshaft rear main oil seal, operation 4A-100-87.
5. Remove the two bolts.
6. Remove the rear main bearing cap complete with the two bottom half thrust washers.
7. Push the two top half thrust washers around the crankshaft journal with a piece of wire, until they can be removed.
8. Replace the two seals.
9. Lubricate all components with clean engine oil before refitting.
10. Slide two new top half thrust washers into position with the plain side towards the bearing housing.
11. Locate the two new bottom half thrust washers onto the rear main bearing cap, and refit the bearing cap.

NOTE: Lightly coat the edge of the rear main bearing cap butt face, out board of the set screws with a recommended sealant 'A'.

12. Refit the bolts and tighten them to a torque of 160 Nm (115 lbf ft).
13. Recheck the end float (procedure 2).
14. If the end float is still not correct, oversize thrust washers can be fitted, repeat procedures 5 to 13.

NOTE: The top and bottom thrust washer halves must be of the same thickness.

15. Refit the crankshaft rear main oil seal, operation 4A-100-87.
16. Refit the engine sump, operation 4A-101-88.



ENGINE**CRANKSHAFT****Crankshaft Removal and Refitment 4A-109-96****Removal**

1. Drain the engine oil into a suitable container.
2. Split the tractor between the front axle and the engine, and between the engine and the transmission, Part 3A.
3. Mount the engine on a suitable stand.
4. Remove the timing case, operation 4A-96-84.
5. Remove the connecting rod big end bearings, operation 4A-104-90.
6. Remove the crankshaft thrust washers, operation 4A-108-95 procedures 4 to 7.
7. Remove the oil pump, operation 4A-102-88, procedures 2 to 7.
8. Remove the crankshaft drive gear, operation 4A-94-83.
9. Remove the eight bolts securing the remainder of the crankshaft main bearing caps.
10. Remove the four remaining main bearing caps complete with the half shell bearings.
11. Lift out the crankshaft.
12. Remove the five half shell bearings from the engine casing.
13. Thoroughly clean all components.

Check the crankpins and journals for wear and ovality using a micrometer. The diameter of the crankpins and journals must be checked in the vertical and horizontal planes at both ends of the crankpins and journals. The wear and ovality must not exceed 0,0361 mm (0.0015 in).

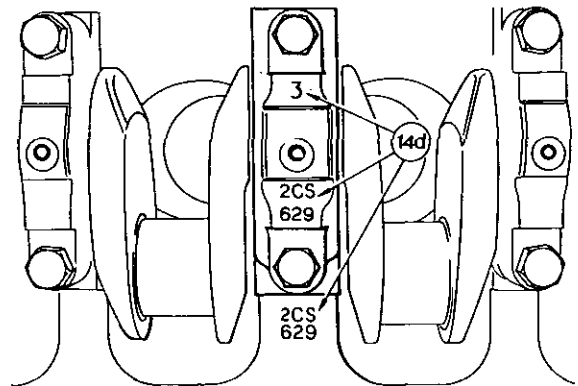
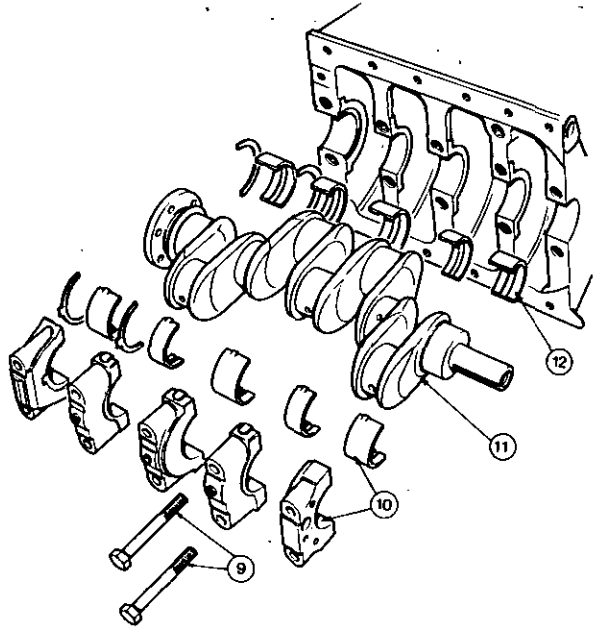
Crack detect and de-magnetize the crankshaft. The main journals and crankpin diameters can be reground by the following amounts:—

- (a) Minus 0,254 mm (0.010 in).
- (b) Minus 0,508 mm (0.020 in).
- (c) Minus 0,762 mm (0.030 in).

If the crankshaft requires to be reground below 0,762 mm (0.030 in), a new crankshaft must be fitted.

Crankpin width may increase with regrinding, but must not exceed 39,88 mm (1.570 in). It is important that the radii on the main and crank pin journals are maintained. After regrinding, the sharp corners on the oil holes must be removed. Tufftrided crankshafts must be re-Tufftrided after regrinding. If Tufftriding facilities are not available, a new crankshaft must be fitted.

If all three positions for the rear main oil seal have been used, the sealing area of the crankshaft flange must be re-ground. Only the minimum amount of metal should be ground off to ensure removal of the seal wear grooves. The oil seal flange must not be machined below 113,17 mm (5.243 in) minimum diameter. It is not necessary to re-Tufftride the flange. Crack test and de-magnetize the crankshaft.



Refitment

14. Reverse procedures 8 to 13 except:
 - (a) Ensure that the oilways in the cylinder block and camshaft are free from obstruction.
 - (b) Check the main bearing cap attachment bolts for stretching. Only bolts supplied by the engine manufacturers should be used, as they are special bolts.
 - (c) Ensure that all components are scrupulously clean and lubricated freely with clean approved engine oil.
 - (d) The main bearing caps are numbered, number 1 commencing at the front of the engine. Each cap is also marked with a serial number as stamped on the cylinder block face. These should read in line.
 - (e) Tighten the main bearing bolts to a torque of 160 Nm (115 lbf ft).
15. Refit the crankshaft thrust washers, operation 4A-108-95 procedures 8 to 13.
16. Refit the oil pump, operation 4A-102-88.
17. Refit the connecting rod big end bearings, operation 4A-104-90.
18. Refit the timing case, operation 4A-96-84.
19. Reverse procedure 2.
20. Refill the engine with an approved oil.

COOLING SYSTEM
(AD4. 203 Engine)

Part 4 — Section B

Operation Number	Table of Contents	Page Number
	GENERAL	11
	FAULT DIAGNOSIS	12
	FROST PRECAUTIONS	12
4B-12-13	RADIATOR Removal and Refitment	13
4B-13-13	THERMOSTAT Removal and Refitment	13
4B-14-14	Servicing	14
4B-15-14	THERMOSTAT HOUSING Removal and Refitment	14
4B-16-14	WATER PUMP Removal and Refitment	14
4B-17-15	Servicing	15

GENERAL

The coolant is circulated by thermo-syphon action assisted by a centrifugal type pump. The system is controlled by a thermostat which prevents the coolant from flowing through the radiator until the correct working temperature has been achieved, and a pressure-sensitive radiator cap, which, by allowing the radiator to pressurise, raises the temperature at which the coolant will boil. A fan attached to the front of the engine assists cooling by drawing air through the radiator.

The water pump and cooling fan are driven by a belt, which is driven by a pulley splined to the front of the crankshaft.

COOLING SYSTEM

FAULT	POSSIBLE CAUSE	SUGGESTED REMEDY
OVERHEATING	Engine racing or pulling hard	Select the correct gear to suit conditions.
	Radiator water level	Fill to the correct level, check for leaks at joints and hoses, rectify as necessary.
	Loose fan belt	Adjust the fan belt tension, Part 9A.
	Radiator cap leaking or valve spring defective	Replace the radiator cap.
	Radiator matrix blocked	Clean the radiator using a reverse flow of air or water.
	Water flow restricted	Check the thermostat operation and replace if necessary, operation 4B-14-14 (AD4. 203 Engine).
	Water flow restricted	Reverse flush the cooling system.
	Water flow restricted	Service or renew the water pump, operation 4B-17-15 (AD4. 203 Engine).
ENGINE RUNS COOL	Operating conditions (i.e. Cold head winds)	Blank off a portion of the radiator.
	Thermostat stuck open	Replace the thermostat, operation 4B-13-13 (AD4. 203 Engine).

FAULT DIAGNOSIS

The faults listed are cooling system faults only and do not cover *engine* defects which may contribute towards overheating.

FROST PRECAUTIONS

There are three main methods of protecting the cooling system during frost conditions.

1. Draining the cooling system after each day's work.
This method leaves the system unprotected in the idle periods during the day, and in extreme conditions the cooling system may freeze while the engine is running. Erosion of the water pump impeller may be accelerated in hard water conditions due to the frequent draining and refilling of the system.
2. Use of heated premises, engine or sump heaters.
This method also leaves the engine unprotected during the idle periods in the day and in extremely cold conditions.

3. Anti-Freeze Solutions.

Generally the most efficient method of protecting cooling systems, but due to the penetrating properties of the solution, all hoses and joints should be in good condition. A cooling system which is normally free of leaks may well develop them when filled with an Anti-freeze solution. Leakage may not occur immediately after initial filling of the system, but may develop shortly afterwards. This should be considered and the necessary checks carried out.

NOTE: Only the Anti-freeze solutions listed in the Specification section should be used. The use of inferior grades of Anti-freeze (including some solutions conforming to BS 3151) can cause severe damage to the cooling system.

RADIATOR (AD4. 203 Engines)**Removal and Refitment**

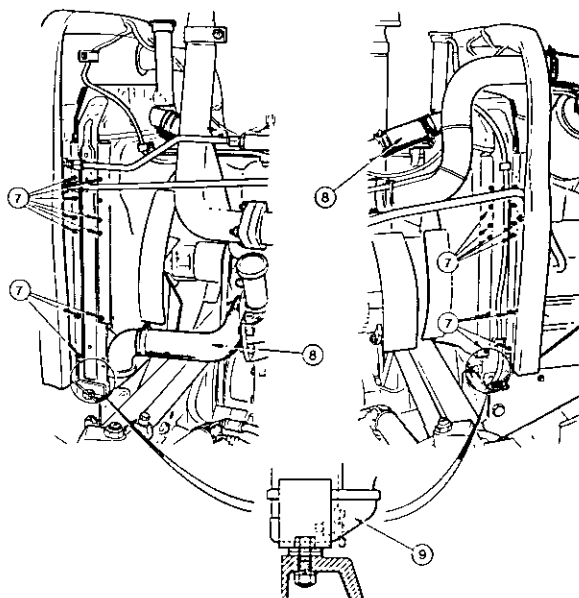
4B-12-13

Removal

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Remove the side panels, Part 2A.
4. Remove the stay bar.
5. Remove the 11 screws securing the fan shroud to the radiator.
6. Move the fan shroud rearwards.
7. Remove the 12 screws securing the radiator to the bulkhead (both sides).
8. Disconnect the radiator top and bottom hoses.
9. Remove the two bolts and washers from the lower support brackets.
10. Manoeuvre the radiator upwards clear of the engine.
11. Remove the fan shroud (if necessary).

Refitment

12. Reverse procedures 2 to 11.
13. Close the radiator and engine drain taps.
14. Fill the radiator with an approved coolant.
15. Refit the radiator cap.
16. Run the engine until the normal operating temperature is reached, and check the coolant level again.

**THERMOSTAT (AD4. 203 Engine)****Removal and Refitment**

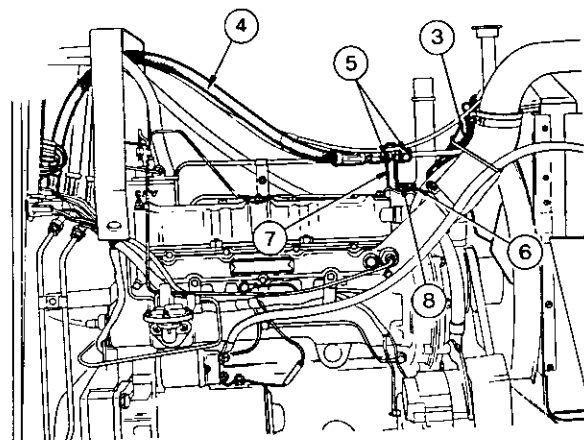
4B-13-13

Removal

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Remove the radiator top hose.
4. Disconnect the two power steering hoses.
5. Remove the two power steering pipe union lock nuts and unions.
6. Remove the two bolts, nut and washers securing the steering pipe bracket.
7. Remove the power steering pipe support bracket.
8. Remove the bolt and washer securing the stay bar.
9. Remove the stay bar.
10. Remove the thermostat cover.
11. Remove the thermostat.
12. Remove and discard the gasket.

Refitment

13. Reverse procedures 1 to 12, except:
 - (a) Fit a new gasket lightly coated with recommended sealant 'A'.



COOLING SYSTEM**THERMOSTAT**

Servicing 4B—14—14

Special Tools: Thermometer

Servicing

Thermostats are not repairable and, if faulty, should be replaced.

1. Remove the thermostat, operation 4B—13—13 (AD4. 203 engines).
2. Check the operating temperature, which is stamped on the top face of the thermostat, next to the valve seat.
NOTE: Ensure that the thermometer has a range of 0° to 110°C (32° to 230°F).
3. Immerse the thermostat and the thermometer in water.
4. Gradually heat the water.
5. Monitor the reading on the thermometer and check the temperature at which the thermostat starts to open.
6. Refit or replace the thermostat as required, operation 4B—13—13 (AD4. 203 engines).

THERMOSTAT HOUSING (AD4. 203 Engines)

Removal and Refitment 4B—15—14

Removal

1. Remove the cylinder head, operation 4A—87—77.
2. Remove the five bolts, washers and one nut securing the thermostat housing.
3. Remove the thermostat housing from the cylinder head.
4. Remove and discard the gasket.

Refitment

5. Reverse procedures 2 to 4 except:
(a) Fit new gaskets lightly coated with recommended sealant 'A'.
6. Refit the cylinder head, operation 4A—87—77 procedures 28 to 35.

WATER PUMP (AD4. 203 Engine)

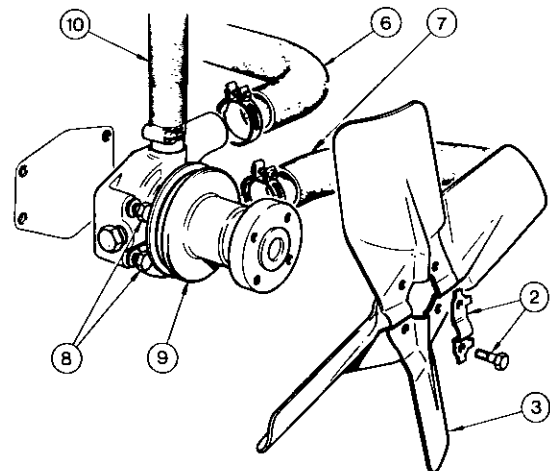
Removal and Refitment 4B—16—14

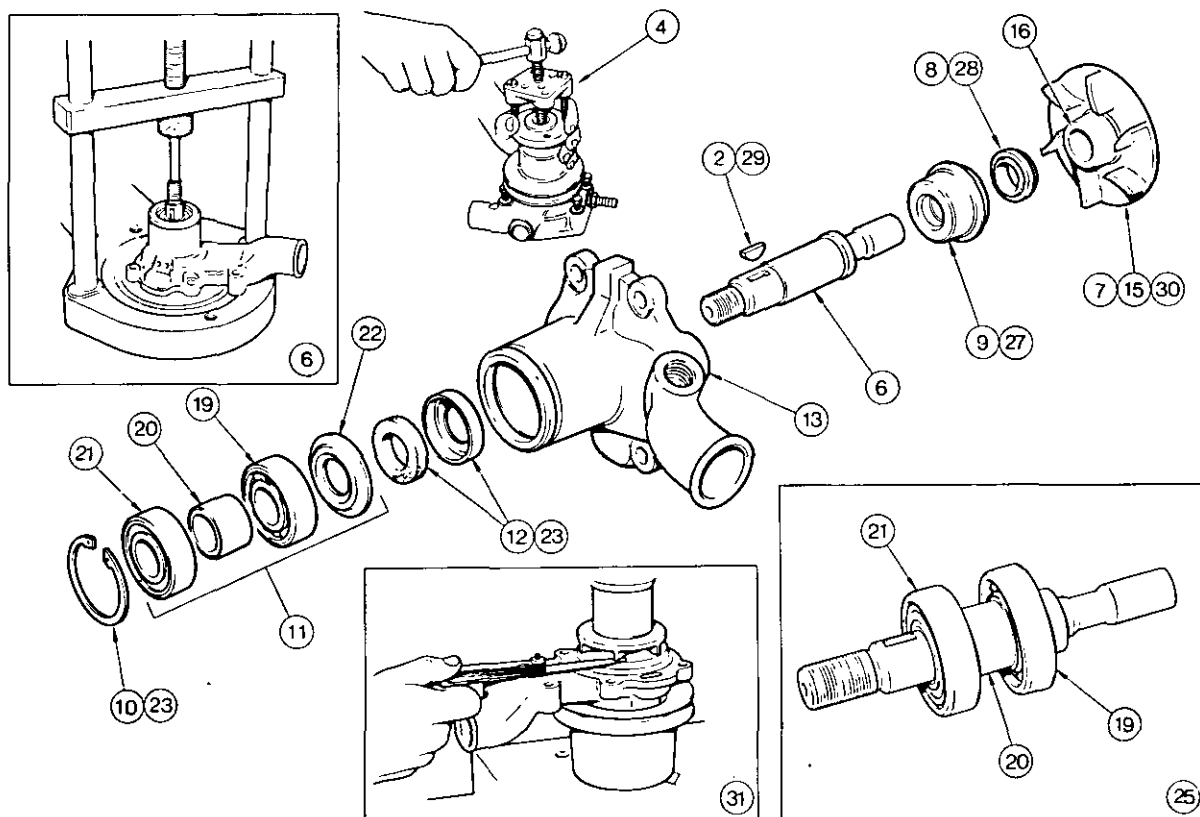
Removal

1. Remove the radiator, operation 4B—12—13.
2. Remove the four bolts and tab washers.
3. Remove the fan blades.
4. Slacken the alternator bolts and remove the fan belt.
5. Remove the two bolts securing the bypass hose adaptor to the thermostat housing.
6. Disconnect the radiator bottom hose.
7. Disconnect the water pump outlet hose.
8. Progressively slacken the four bolts.
9. Remove the water pump complete with back plate and by-pass hose adaptor.
10. Remove the bypass hose and adaptor (if necessary).

Refitment

11. Reverse procedures 1 to 10 except:
(a) When refitting the fan blades, fit new tab washers.
(b) Adjust the fan belt tension, Part 9A.



**WATER PUMP (AD4. 203 Engine)****Servicing**

4B-17-15

Special Tools: PD 155B Puller
 PD 155-1 Adaptors
 MF 200 Handpress
 MF 200-26A Water Pump Overhaul Kit
 MF 200-25 Multi-Purpose Bearing Remover

Disassembly

1. Remove the water pump, operation 4B-16-14.
2. Remove the back plate and gasket.
3. Remove the self locking nut and washer securing the water pump pulley.
4. Using PD 155B and PD 155-1, remove the pulley from the water pump.
5. The water pump securing bolts and washers can now be removed from their locations.
6. Using MF 200 and MF 200-26A, press the shaft and bearing assembly complete with the impeller rearwards out of the housing.
7. Using MF 200 and MF 200-26A, press the drive shaft out of the impeller.
8. Remove the ceramic faced seal.
9. Remove the spring loaded seal.
10. Remove the circlip.
11. Using MF 200, MF 200-26A and MF 200-25 press the two bearings out of the housing complete with the spacer and retaining plate.
12. Remove the felt seal and retainer housing.
13. Examine the pump body for cracks, damage or corrosion.
14. Examine the drive shaft for wear, ensure that the bearings are a transition fit on the shaft. If the inner races of the bearing rotate on the shaft, the shaft must be renewed.
15. Remove any rust and scale from the impeller and inspect the impeller for cracks or damage.

16. Examine the impeller hub sealing face for excessive wear or scoring.
17. Inspect the bearing for pitting, corrosion or wear.
18. Replace all seals.

Re-assembly

19. Press the rear bearing onto the shaft with the shielded face towards the rear of the shaft.
20. Fit the spacer.
21. Press the front bearing onto the shaft with the shielded face towards the front of the shaft.
22. Fit the retaining plate into the housing with the 'dished' portion towards the rear of the housing.
23. Fit the felt seal and retainer housing into the pump housing with the felt seal against the retaining plate.
24. Half fill the space between the bearings on the shaft with high melting point grease.
25. Press the complete bearing and shaft assembly into the housing from the front end.
26. Fit the circlip.
27. Fit the spring loaded seal.
28. Fit the ceramic faced seal with the ceramic face to the rear.
29. Spin the shaft assembly to ensure freedom of rotation.
30. Press the impeller onto the shaft.
31. Check the clearance between the impeller vanes and the pump body, this should be between 0,381 and 0,635 mm (0-015 and 0-025 in).
32. Insert the four securing bolts and washers into the water pump housing.
33. Using MF 200 and MF 200-26A, press the pulley onto the front end of the shaft.
34. Refit the back plate and a new gasket, lightly coated in recommended sealant 'A'.
35. Refit the water pump, operation 4B-16-14.

MK II 8 SPEED CONSTANT MESH TRANSMISSION

GENERAL

The transmission has four forward gears and one reverse gear which are doubled by a planetary unit to give eight forward and two reverse gears.

All gear teeth are of involute, straight cut spur type, designed to run in constant mesh, except for first gear which is now introduced with an increased width gears of constant mesh design, with a helical gear tooth form.

Where movement of the gears is required to change ratio, a sliding coupler arrangement has been introduced, except second gear which slides on a splined shaft.

Principle of Operation

Refer to figures 1, 2 and 3.

The Transmission

The tractor engine drives a clutch with divided drive, each plate being splined onto a separate gearbox shaft.

Drive is transmitted to:

- The p.t.o. shaft (14), which is hollow and has gear teeth on its rear end.
- The main drive shaft (17), (which runs inside the p.t.o. shaft) has gear teeth on its rear end and is spigot located in the front end of the mainshaft.

Layshaft and P.t.o. Shaft

Rotation of the p.t.o. input shaft (14) drives the p.t.o. constant mesh gear (109) which is splined onto the p.t.o. drive shaft (82). When the main input shaft (17) rotates, the drive is transmitted to the constant mesh gear (111), which is splined onto the layshaft (85).

The layshaft, which is hollow and externally splined, has 14 gear teeth machined on its outside diameter to provide the first gear layshaft pinion.

It is supported by a roller bearing (84) located in the centre web and a ball race (86) located in the rear wall of the transmission case. Mounted on the layshaft (85) are three other gears, which are second (23 teeth) (112), fourth (33 teeth) (114) and third (28 teeth) (115) gears respectively. None of the layshaft gears are free to move along the shaft, being retained, either by abutment with other gears, bearings or snap rings.

Mainshaft

The mainshaft (62) has 31 shallow splines on its external surface, has gear teeth at its rear end and has a bore at its front end to accept the spigot on the main input shaft. It is supported by a roller bearing (95) located in the centre web and a ball race (59) located in the rear wall of the transmission case.

Mounted on the mainshaft are five sets of gears, which are in constant mesh with the layshaft gears, and when viewed from the front of the gearbox these gears are, second (46 teeth) (93), first (42 teeth) (97), reverse (44 teeth) (100), fourth (36 teeth) (106) and third (41 teeth) (105).

The mainshaft gears are mounted on bushes which run on a sleeve, splined onto the mainshaft. When a gear is required, the dog clutch (sliding coupler) (99, 103), which is splined to the mainshaft, is slid along by the selector to engage with dog teeth formed on the gear. This has the effect of locking the gearwheel to the shaft. The sliding couplers are used to engage and disengage, first, reverse, fourth and third gears whilst second gear is moved into and out of mesh by a selector fork sliding the gear on the mainshaft splines.

Reverse Gear Cluster

The compound gear cluster (122) has 14/21 teeth respectively. The 21 tooth portion of the gear is in constant mesh with the fourth gear pinion (33 teeth) (114) on the layshaft. The 14 tooth portion is in constant mesh with the reverse gear pinion (44 teeth) (100) on the mainshaft.

Reverse gear engagement is made by a dog clutch (sliding coupler) (99), engaging with the reverse gear pinion (100) on the mainshaft. The reverse gear, acting as an idler gear between the layshaft and the mainshaft drive, reverses the rotation of the mainshaft, epicyclic unit and the final drive.

Epicyclic Unit

The basic four forward and one reverse gears are doubled by the epicyclic unit (Heavy Duty) mounted on the rear end of the transmission case. The epicyclic unit comprises a ring gear (66), inside which run three planetary pinions mounted in a carrier (70). The planetary pinions are driven by gear teeth on the end of the mainshaft (62) which acts as the sun gear.

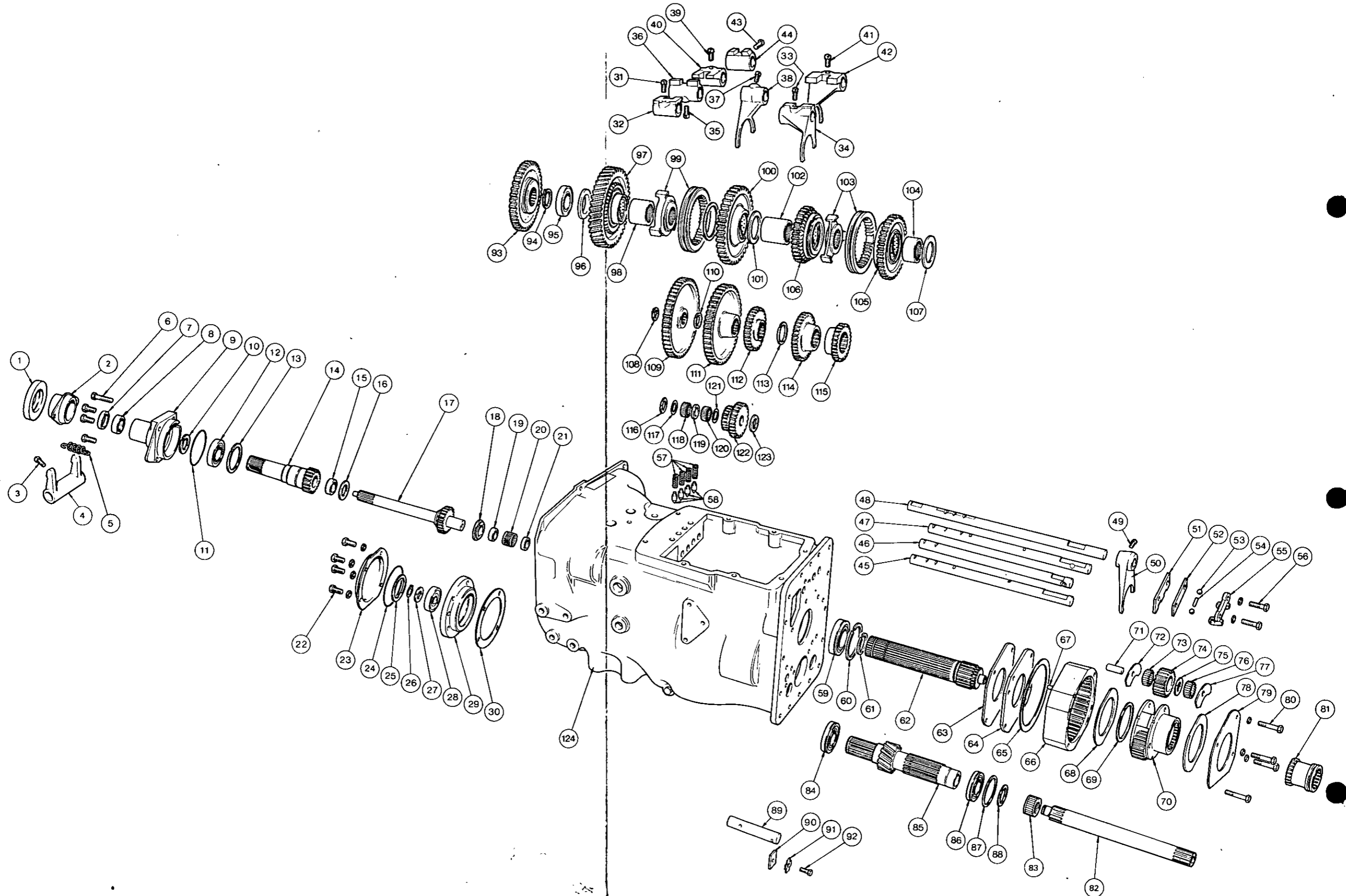
When the mainshaft rotates, the planetary pinions also rotate, but being meshed with the teeth on the inside of the ring gear the rotational speed of the carrier is reduced by a ratio of 4:1.

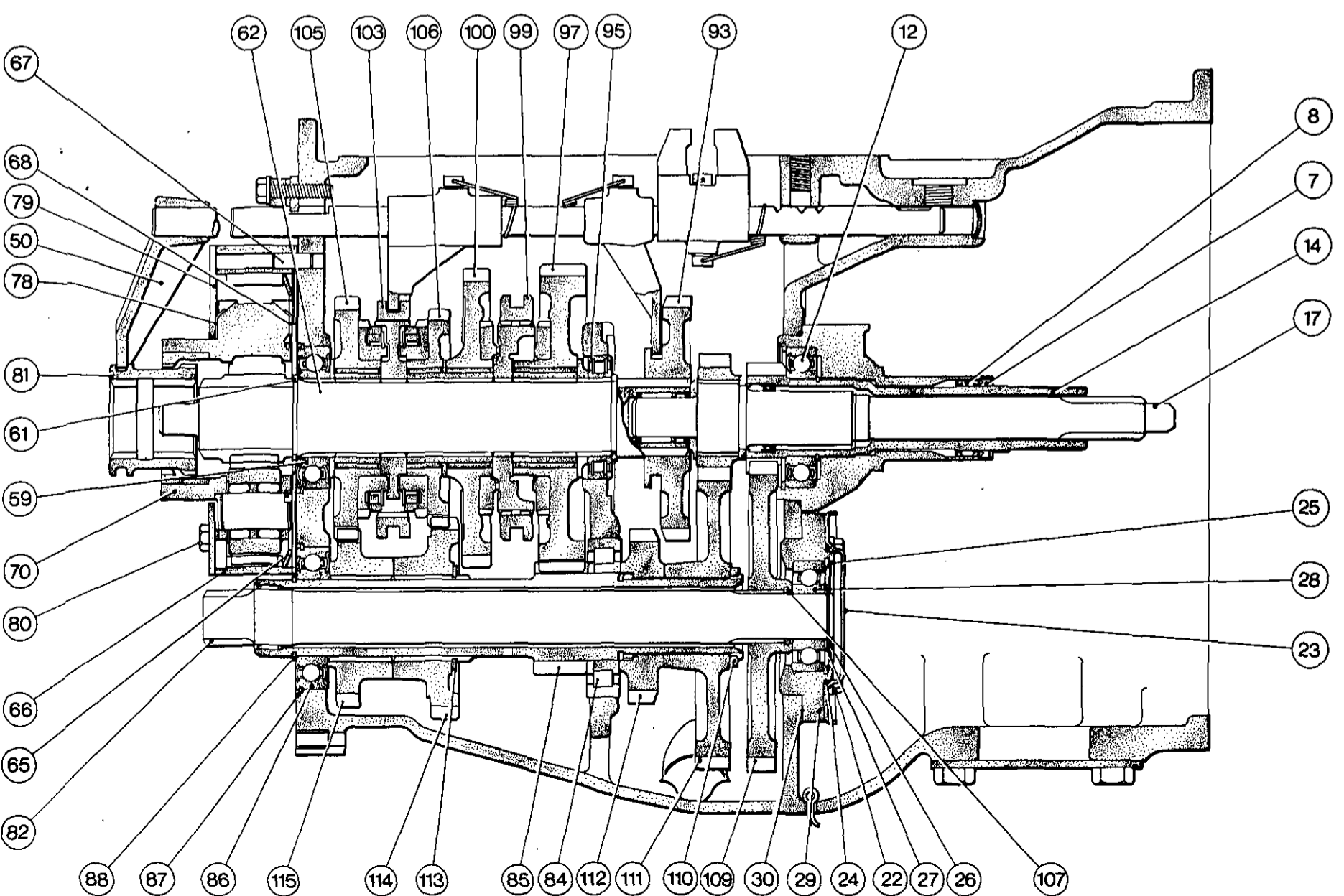
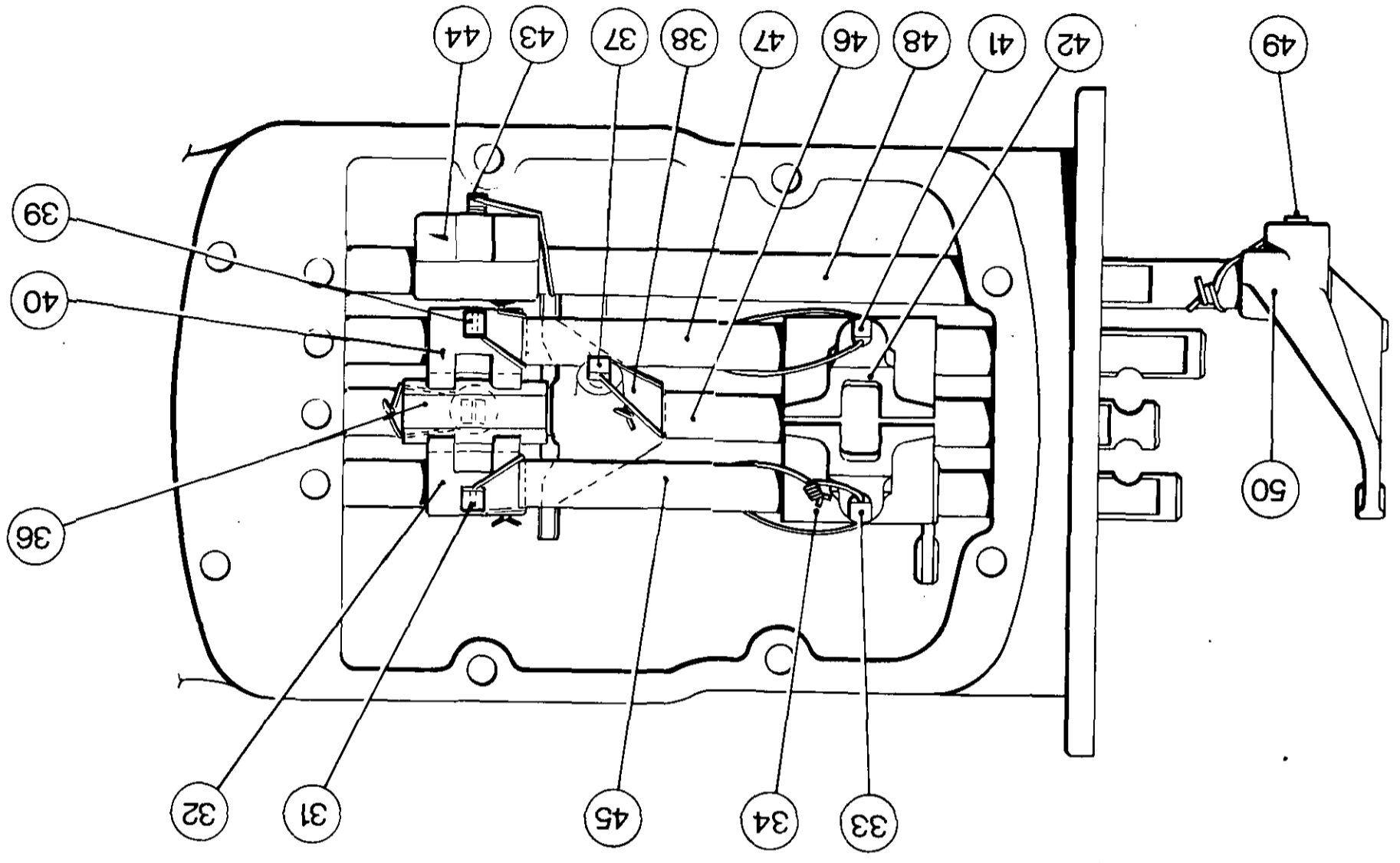
To transmit the drive from the epicyclic unit to the rear axle, a driveshaft is connected by the coupler (81), either directly to the gearbox mainshaft (HIGH range), or to the planetary pinion carrier (70) (LOW range).

Movement of the dual range selector lever actuates the rod attached to the selector fork (50) which moves the coupler (81) into, or out of mesh with either the end of the mainshaft (62) or the planetary pinion carrier (70).

Between the two engaged (HIGH or LOW range) positions, there is a neutral position, where the coupler splines are disengaged from both the mainshaft and the planetary pinion carrier.

MK II 8 SPEED CONSTANT MESH TRANSMISSION





MK II 8 SPEED CONSTANT MESH TRANSMISSION

MK II 8 SPEED CONSTANT MESH TRANSMISSION**KEY TO FIGURES 1, 2 and 3**

- | | |
|--|--|
| 1 Clutch release bearing | 68' Epicyclic front thrust ring |
| 2 Clutch release bearing carrier | 69 Epicyclic planetary pinion shaft securing circlip |
| 3 Clutch release fork locking peg | 70 Epicyclic planetary pinion carrier |
| 4 Clutch release fork | 71 Epicyclic planetary pinion shaft |
| 5 Clutch release bearing return spring | 72 Planetary pinion front thrust washer |
| 6 Input housing securing bolts | 73 Planetary front roller set |
| 7 P.t.o. input shaft seal | 74 Planetary pinion |
| 8 P.t.o. input shaft needle roller bearing | 75 Planetary roller spacer |
| 9 Input housing | 76 Planetary rear roller set |
| 10 P.t.o. input shaft bearing securing external circlip | 77 Planetary pinion rear thrust washer |
| 11 Input housing 'O' ring | 78 Epicyclic rear thrust ring |
| 12 P.t.o. input shaft bearing | 79 Epicyclic cover plate |
| 13 P.t.o. input shaft securing internal circlip | 80 Epicyclic securing bolts |
| 14 P.t.o. input shaft | 81 High/Low shift coupler |
| 15 Main drive input shaft seal | 82 P.t.o. drive shaft |
| 16 Main drive input shaft front bush | 83 Layshaft rear needle roller bearing |
| 17 Main drive input shaft | 84 Layshaft front bearing |
| 18 Main drive input shaft rear bush | 85 Layshaft |
| 19 Main shaft needle roller bearing front spacer | 86 Layshaft rear bearing |
| 20 Main shaft needle roller bearing | 87 Layshaft rear bearing location snap ring |
| 21 Main shaft needle roller bearing rear spacer | 88 Layshaft rear bearing securing snap ring |
| 22 P.t.o. front bearing cover securing bolts | 89 Reverse gear cluster |
| 23 P.t.o. front bearing cover | 90 Reverse gear cluster shaft retaining bolt |
| 24 P.t.o. front bearing cover 'O' ring | 91 Tab washer |
| 25 P.t.o. front bearing securing circlip | 92 Reverse gear cluster shaft securing bolt |
| 26 P.t.o. shaft securing circlip | 93 Second gear (Mainshaft) |
| 27 P.t.o. shaft spacer washer | 94 Mainshaft front bearing front securing snap ring |
| 28 P.t.o. shaft front bearing | 95 Mainshaft front bearing |
| 29 P.t.o. front bearing housing | 96 Mainshaft front bearing thrust washer |
| 30 P.t.o. front bearing housing gasket | 97 First gear (mainshaft) |
| 31 Third and fourth gear lever engagement dog locking peg | 98 Splined sleeve (first gear) |
| 32 Third and fourth gear lever engagement dog | 99 First/Reverse sliding coupler |
| 33 Third and fourth selector fork locking peg | 100 Reverse gear (mainshaft) |
| 34 Third and fourth selector fork | 101 Thrust washer—reverse/fourth gear |
| 35 Second gear lever engagement dog locking peg | 102 Splined sleeve—reverse/fourth gear |
| 36 Second gear lever engagement dog | 103 3rd/4th sliding coupler |
| 37 Second gear selector fork locking peg | 104 Splined sleeve—third gear |
| 38 Second selector fork | 105 Third gear (mainshaft) |
| 39 First and reverse gear lever engagement dog locking peg | 106 Fourth gear (mainshaft) |
| 40 First and reverse gear lever engagement dog | 107 Mainshaft rear bearing thrust washer |
| 41 First and reverse selector fork locking peg | 108 P.t.o. constant mesh gear location circlip |
| 42 First and reverse selector fork | 109 P.t.o. constant mesh gear |
| 43 High/Low gear lever engagement dog locking peg | 110 Main drive constant mesh gear securing circlip |
| 44 High/Low gear lever engagement dog | 111 Main drive constant mesh gear |
| 45 Third and fourth selector rail | 112 Second gear (layshaft) |
| 46 Second selector rail | 113 Fourth gear (layshaft) securing snap ring |
| 47 First and reverse selector rail | 114 Fourth gear (layshaft) |
| 48 High/Low selector rail | 115 Third gear (layshaft) |
| 49 High/Low selector fork locking peg | 116 Reverse gear front thrust washer |
| 50 High/Low selector fork | 117 Needle roller front retaining ring |
| 51 Interlock stop plate | 118 Front needle roller set |
| 52 Interlock plain plate | 119 Needle roller spacer |
| 53 Interlock ball | 120 Rear needle roller set |
| 54 Interlock cross peg | 121 Needle roller rear retaining ring |
| 55 Interlock ball carrier | 122 Reverse gear cluster |
| 56 Interlock mechanism securing bolts | 123 Reverse gear rear thrust washer |
| 57 Detent springs | 124 Gearbox case |
| 58 Detent plungers | |
| 59 Mainshaft rear bearing | |
| 60 Mainshaft bearing locating snap ring | |
| 61 Mainshaft rear bearing rear securing snap ring | |
| 62 Mainshaft | |
| 63 Epicyclic shim | |
| 64 Epicyclic front plate | |
| 65 Epicyclic Belleville spring disc | |
| 66 Epicyclic ring gear | |
| 67 Epicyclic ring gear dowel | |

MK II 8 SPEED CONSTANT MESH TRANSMISSION**SELECTOR RAIL MECHANISM****Removal and Refitment**

5D—01—06

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

MF 365/8 Stands

Removal**NOTE: Beware of the sharp edges around the top of the gearbox case.**

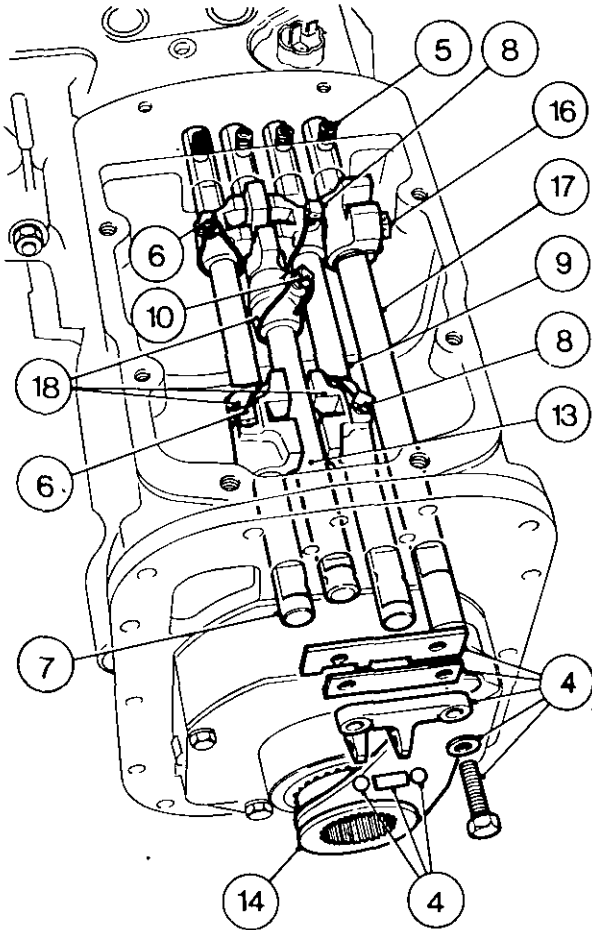
1. Split the tractor between the spacer and the centre housing and remove the transmission, Part 3A.
2. Remove the gearbox top cover and gasket, and spacer and gasket.
3. Release the locking wires.
4. Remove the bolts, fork, balls, peg, stop plate and plain plate.
5. Lift out the springs and plungers.
6. Remove the locking pegs.
7. Slide the rail rearwards out of the housing.

NOTE: When removing the selector rails, retain the gear lever engagement dogs.

8. Remove the locking pegs.
9. Slide the rail rearwards out of the housing.
10. Remove the locking peg.
11. Rotate the second gear selector rail through 180°.
12. Remove the second gear engagement dog locking peg.
13. Slide the rail rearwards out of the housing.
14. Slide the High/Low rail rearwards and remove the coupling.
15. Rotate the High/Low rail through 90°.
16. Remove the locking peg.
17. Slide the rail rearwards out of the housing.
18. Remove the selector forks from the gearbox.

Refitment

19. Reverse procedures 1 to 18, except:
 - (a) Apply a few drops of oil to the selector rails before refitment.
 - (b) Tighten the locking mechanism retaining bolts to a torque of 47 Nm (35 lbf ft).
 - (c) On completion of the refitting procedure, place all the gear lever engagement-dogs in the neutral position.



MK II 8 SPEED CONSTANT MESH TRANSMISSION**GEARBOX EPICYCLIC****Removal and Refitment**

5D-02-07

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

MF 365/8 Stands

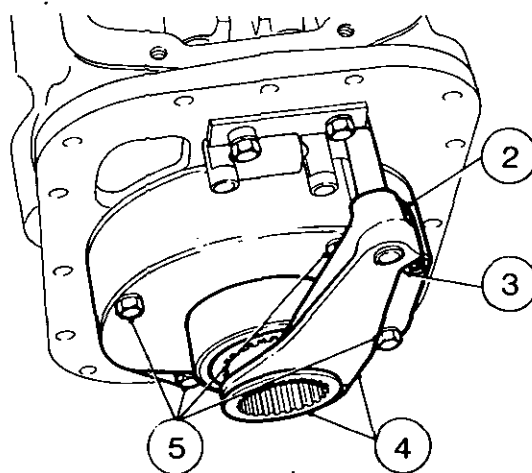
Removal

1. Split the tractor between the spacer housing, and remove the transmission, Part 3A.
2. Remove the locking wire.
3. Remove the locking peg.
4. Remove the selector fork and coupling.
5. Remove the bolts.
6. Remove the complete assembly.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the front and rear thrust rings are correctly located before refitment.
 - (b) Ensure that the epicyclic dowels are correctly located in the gearbox casing.
 - (c) Locate the cover plate with the cut out in the bottom left hand corner.
 - (d) Do not fit a lock washer to the lower left hand retaining bolt.
 - (e) Tighten the retaining bolts progressively and evenly to a torque of 47 Nm (35 lbf ft).

- (g) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.

**GEARBOX EPICYCLIC****Servicing**

5D-03-07

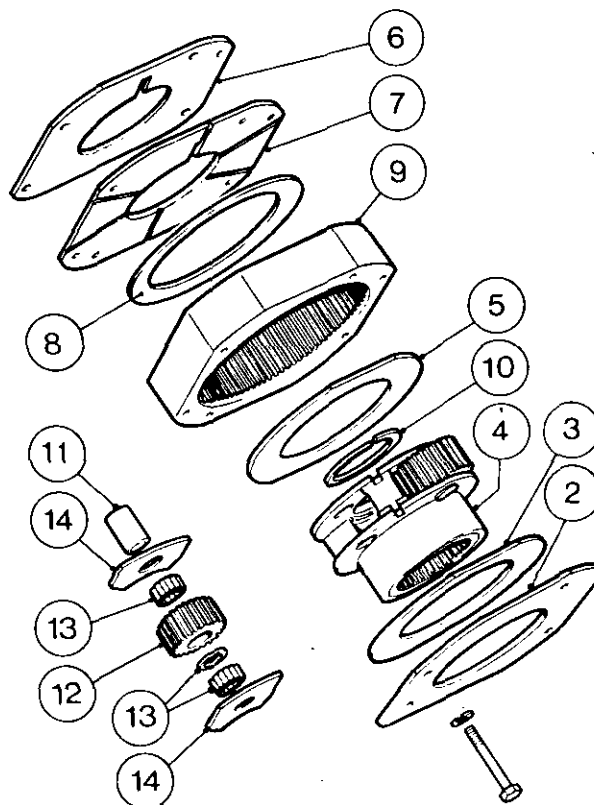
Special Tool: See operation 5D-02-07

Disassembly

1. Remove the gearbox epicyclic, operation 5D-02-07.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. Remove the Belleville spring disc.
9. If necessary, remove the dowel pins from the planetary ring gear.
10. Remove the external snap ring.
11. Gently tap out the three pinion shafts towards the front.
12. Remove the planetary pinions.
13. Remove the two sets of rollers and spacer from each pinion.
14. Remove the wear plates from each side of each pinion.

Reassembly

15. Reverse procedures 1 to 14, except:
 - (a) When replacing the rollers in the pinions, a smear of petroleum jelly (not grease) will help retain them. Do not omit the spacer from between the two runs of rollers. Each run consists of 16 rollers.
 - (b) Ensure the Belleville spring disc is located correctly in the epicyclic ring gear with the concave face rearwards.
 - (c) The front plate and the cover plate must be positioned with the oil grooves towards the pinion carrier.
 - (d) Ensure that the pinion wear plates are refitted with the flats positioned innermost to the centre of the pinion carrier.
 - (e) Ensure the gap of snap ring is located midway between the planetary pinion shafts.
 - (f) Always fit the same thickness of shims as those removed.



MK II 8 SPEED CONSTANT MESH TRANSMISSION**CLUTCH RELEASE MECHANISM****Removal and Refitment**

5D-04-08

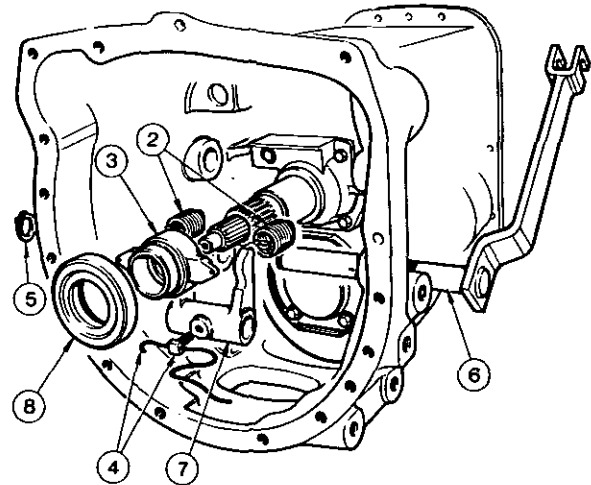
Special Tool; 270 Rail Trolley

Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the two springs.
3. Slide the carrier and release bearing off the input housing.
4. Remove the locking wire and locking peg.
5. Remove the circlip.
6. Remove the shaft, but to obtain sufficient clearance on MF 550 and MF 560 tractors, the left hand front cab mounting bracket must be removed, and on all versions the fuel tank must be removed, Part 4C.
7. Remove the clutch release fork.
8. Press the release bearing off the carrier.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Lightly lubricate the input shaft splines and the release bearing carrier bore, with approved grease Mobilplex 47. Do not fill splines with excess grease.
 - (b) Ensure that the locking peg locates in the hole in the shaft.



MK II 8 SPEED CONSTANT MESH TRANSMISSION

INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Removal and Refitment

5D-05-09

Special Tools: 270 Rail Trolley

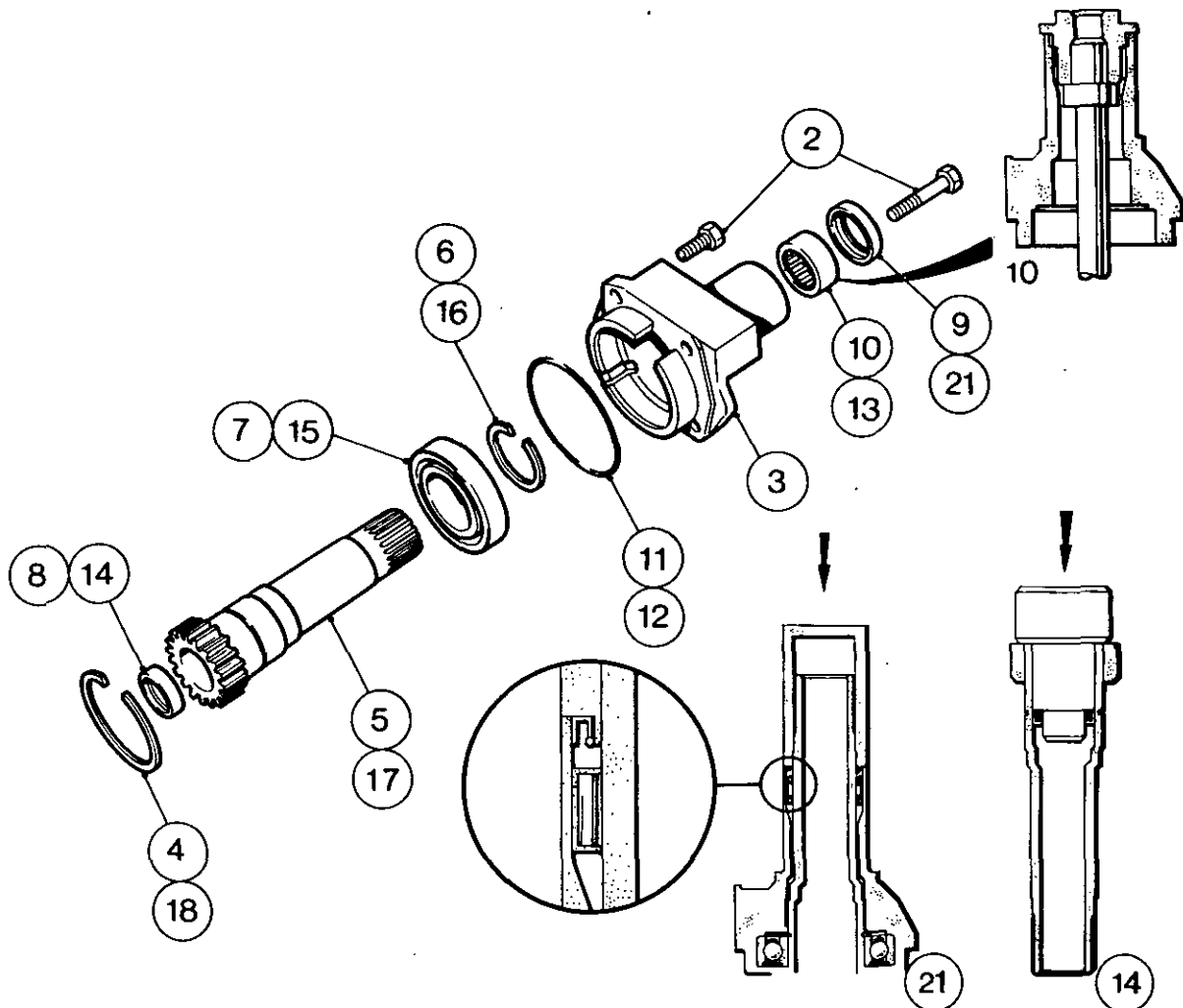
MF 177 Seal Protector
 MF 255 B Oil Seal Replacer
 MF 255 B-2 Cone
 MF 256 A Oil Seal Replacer
 MF 315 Needle Roller Bearing
 Removal Tool
 MF 331 Needle Roller Bearing
 Refitting Tool.

Removal

1. Remove the clutch release mechanism, operation 5D-04-08.
2. Remove the four bolts.
3. Withdraw the input housing complete with the p.t.o. input shaft.
4. Remove the large internal circlip.
5. Push the p.t.o. input shaft complete with bearing rearwards out of the housing.
6. If necessary, remove the circlip.
7. If necessary press the bearing off.
8. Lever the seal out.
9. Lever the seal out.
10. Using MF 315, remove the needle roller bearing.
11. Remove the 'O' ring (p.t.o. input shaft housing).

Refitment

12. Fit a new 'O' ring (p.t.o. input shaft).
13. Using MF 331, replace the needle roller bearing.
14. Using MF 256 A, fit a new seal, with the toe of the seal facing the tool.
15. Refit the bearing with the shield towards the gear teeth.
16. Refit the circlip (check that it is properly seated).
17. Refit the p.t.o. input shaft and bearing into the input housing.
18. Refit the circlip (check that it is properly seated).
19. Place the cone adaptor MF 255B-2 onto seal replacer MF 255 B.
20. Place the seal over the cone and onto the tool with the seal toe facing away from the tool and remove the cone.
21. Place the tool over the p.t.o. input shaft and tap the seal into place.
22. Place the MF 177 over the splines of the main input shaft.
23. Reverse procedures 1 to 3, except:
 - (a) Use petroleum jelly (not grease) to lubricate all seals and the needle roller bearing when when refitting.
 - (b) Lightly coat the bolt threads in recommended sealant 'B' when refitting, and tighten the bolts to a torque of 60 Nm (45 lbf ft).

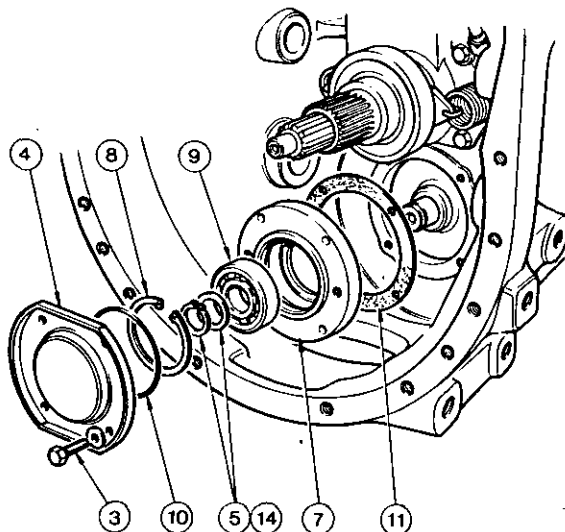


MK II 8 SPEED CONSTANT MESH TRANSMISSION**P.T.O. DRIVESHAFT FRONT BEARING****Removal and Refitment** 5D-06-10

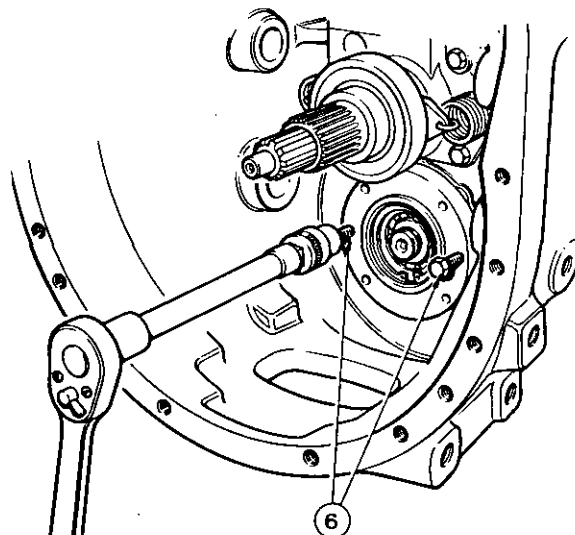
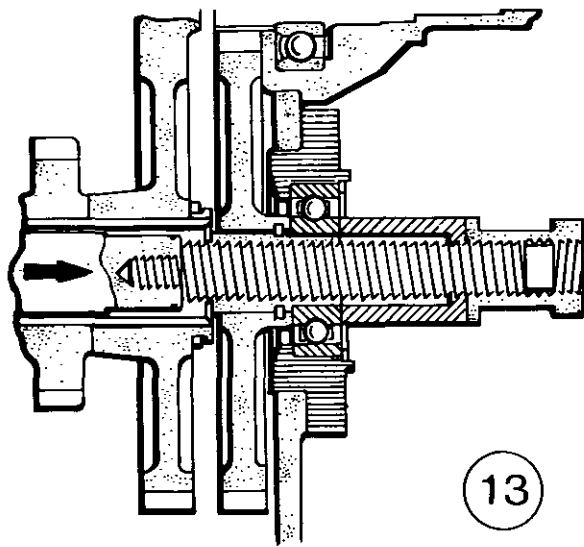
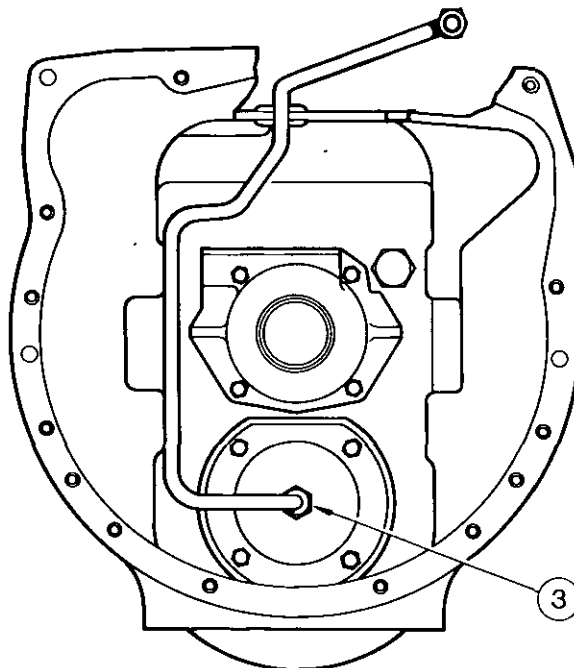
Special Tools: 270 Rail Trolley
 MF 218 A P.t.o. Drive Shaft Puller
 MF 218 A-2 Adaptor

Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the clutch cross shaft, operation 5D-04-08, procedures 2 to 6.
3. On l.p.t.o. versions, remove the pipe, and then on all versions remove the four bolts and washers.
4. Remove the plate.
5. Remove the external circlip and washers.
6. Screw two $\frac{3}{8}$ UNC \times 75 mm (3 in) bolts into the bearing housing and tighten them evenly.
7. Remove the housing.
8. Remove the circlip.
9. Press out the bearing.
10. Discard the 'O' ring.
11. Discard the gasket.

**Refitment**

12. Reverse procedures 8 to 11, except:
 - (a) Fit a new 'O' ring, gasket and circlip.
 - (b) Coat the gasket with recommended sealant 'A'.
13. Using MF 218 A and MF 218 A-2, refit the bearing and housing assembly on the front end of the p.t.o. drive shaft ensuring that the splines on the shaft locate in those in the p.t.o. constant mesh gear.
14. Fit a new circlip and the washer.
15. Reverse procedures 1 to 4, except:
 - (a) Lightly coat the securing bolt threads in recommended sealant 'B'.
 - (b) Tighten the bolts to a torque of 60 Nm (45 lbf ft).



MK II 8 SPEED CONSTANT MESH TRANSMISSION**MAIN INPUT SHAFT****Removal and Refitment**

5D-07-11

Special Tools: 270 Rail Trolley

MF 177 Seal Protector

MF 218 A P.t.o. Drive Shaft Puller

MF 218 A-2 Adaptor

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

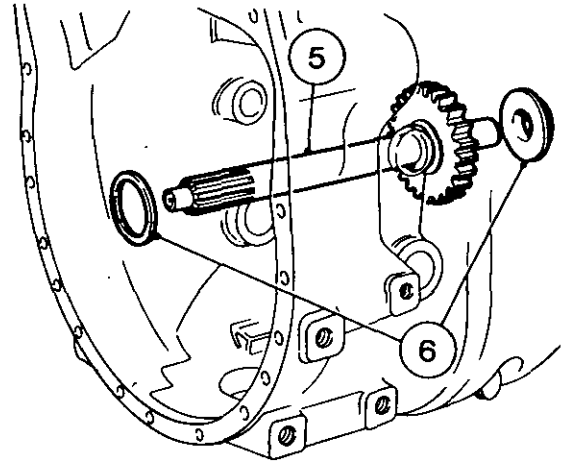
MF 365/8 Stands

Removal

1. Split the tractor between the spacer housing and the centre housing, Part 3A.
2. Remove the input housing and p.t.o. input shaft, operation 5D-05-09 procedures 1 to 3.
3. Remove the p.t.o. drive shaft front bearing, operation 5D-06-10.
4. Withdraw the p.t.o. drive shaft rearwards, this will allow the p.t.o. constant mesh gear to drop into the bottom of the gearbox.
5. Remove the main input shaft, complete with the two thrust washers.
6. Remove the thrust washers.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the thrust washer, with oil grooves, is placed on the rear of the main input shaft, with the oil grooves facing the rear of the gearbox, and that it is lightly oiled.
 - (b) Before refitting the input housing and p.t.o. input shaft, place MF 177 over the splines of the main input shaft, to protect the seal.

**SECOND GEAR (MAINSHAFT)****Removal and Refitment**

5D-08-11

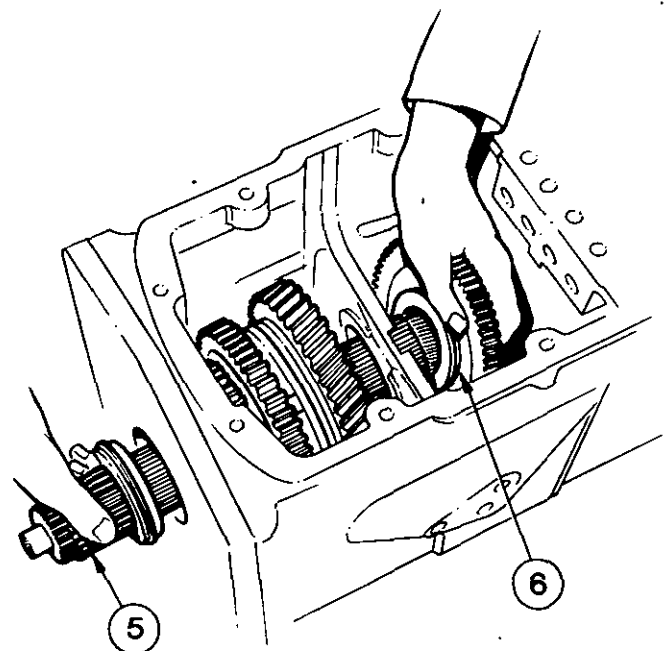
Special Tools: See operation 5D-07-11.

Removal

1. Remove the selector rail mechanism, operation 5D-01-06.
2. Remove the gearbox epicyclic unit, operation 5D-02-07.
3. Remove the main input shaft, operation 5D-07-11.
4. Release the snap ring and manoeuvre it towards the front of the mainshaft.
5. Using a soft faced drift, drive the mainshaft rearwards until it is clear of the second gear, and the rear bearing is no longer located in the gearbox casing.
6. Withdraw the second gear pinion.

Refitment

7. Reverse procedures 1 to 5.



MK II 8 SPEED CONSTANT MESH TRANSMISSION**MAINSHAFT, FIRST, REVERSE, FOURTH AND THIRD GEARS****Removal and Refitment** 5D-09-12

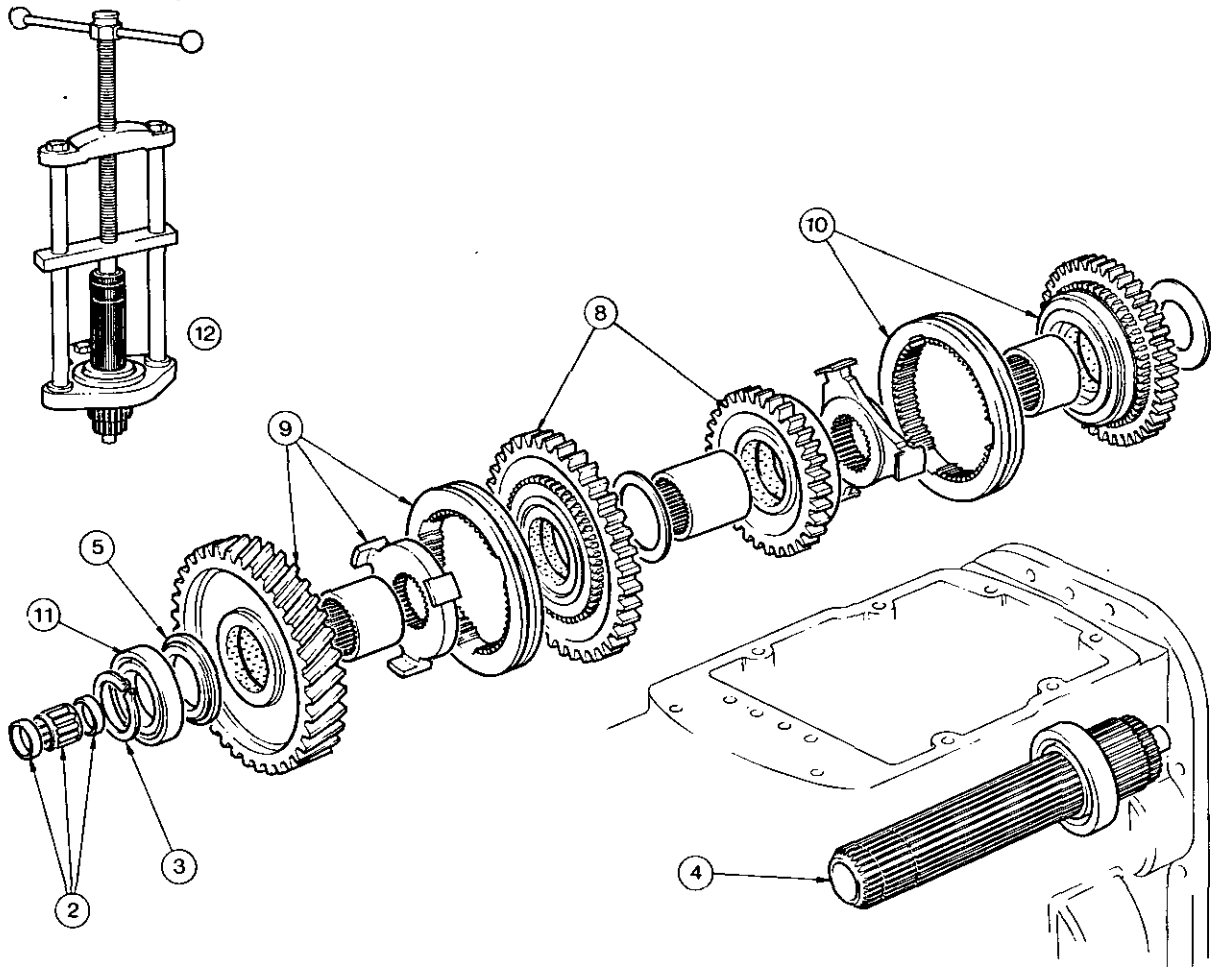
Special Tools: See operation 5D-07-11, and
 MF 200 Hand Press
 MF 200-25 Adaptor

Removal

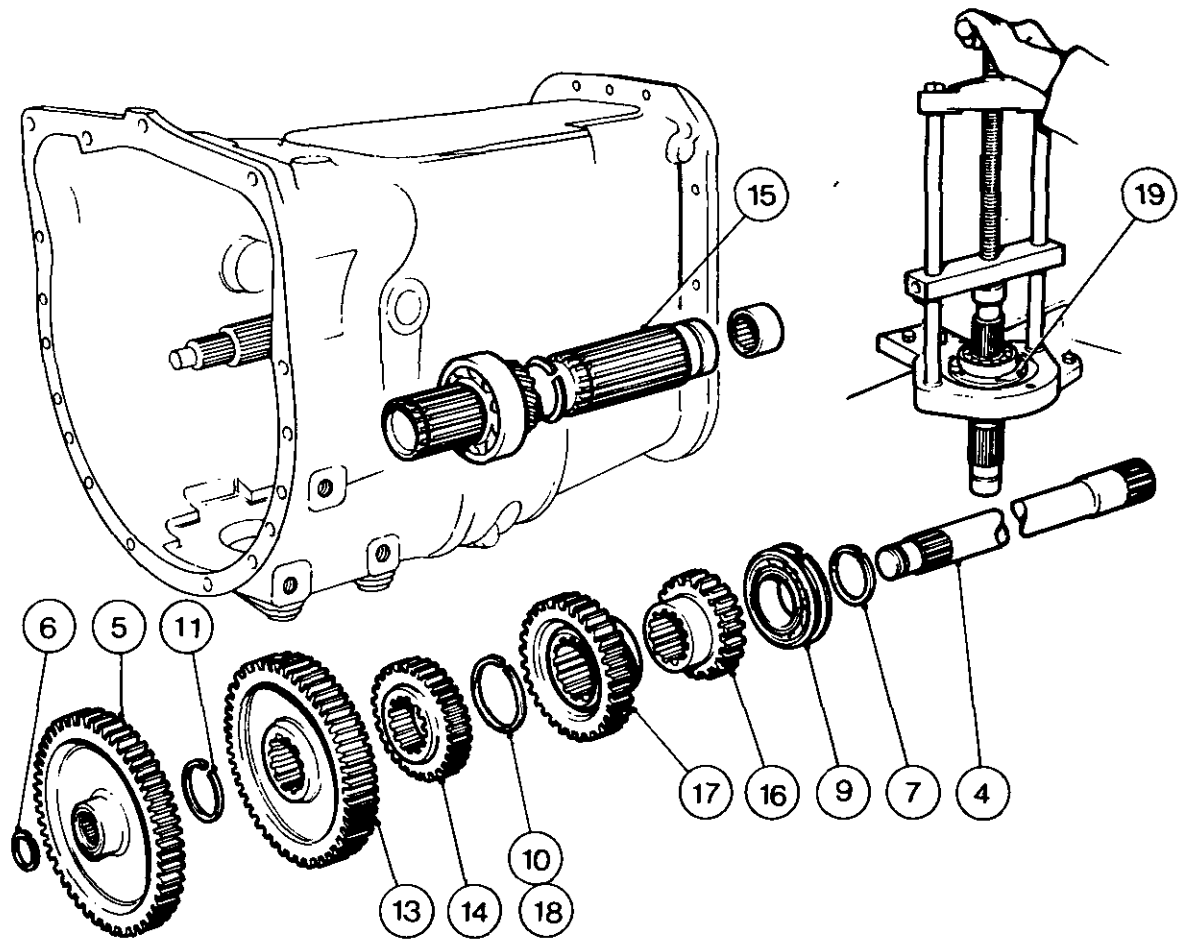
1. Remove the second gear pinion, operation 5D-08-11.
2. Remove the spigot needle roller bearing and two spacers.
3. Remove the snap ring from off the front of the mainshaft.
4. Withdraw the mainshaft rearwards out of the gearbox casing.
5. Remove the thrust washer from between the front bearing and first gear.
6. Engage sliding coupler with first gear.
7. Engage sliding coupler with third gear.
8. Withdraw reverse and fourth gears, twisting them slightly to clear the edges of the gearbox case.
9. Remove first gear and the sliding coupler.
10. Remove third gear and the sliding coupler.
11. If necessary, remove the bearing from the centre web of the gearbox casing.
12. If necessary, press the bearing of the FRONT end of the mainshaft using MF 200 and MF 200-25.
13. If necessary, remove the circlip from the bearing.

Refitment

14. Reverse procedures 1 to 12, except:
 - (a) Ensure that all snap rings are correctly located in their grooves.
 - (b) Ensure that the front thrust washer is correctly located with the shoulder towards the bearing.



MK II 8 SPEED CONSTANT MESH TRANSMISSION



LAYSHAFT AND GEARS, P.T.O. SHAFT AND GEAR

Removal and Refitment 5D-10-13

Special Tools: See operation 5D-07-11, and
MF 200 Hand Press
MF 200-25 Adaptor

Removal

1. Remove the main input shaft, operation 5D-07-11.
2. Remove the second gear pinion, operation 5D-08-11.
3. Remove the mainshaft and gears, operation 5D-09-12.
4. Withdraw the p.t.o. driveshaft rearwards out of the gearbox casing.
5. Withdraw the p.t.o. constant mesh gear.
6. Remove the small internal snap ring, (only if necessary).
7. Remove the snap ring from the rear of the layshaft.
8. Tap the layshaft forwards.
9. Remove the rear bearing.

10. Expose the snap ring, open it and slide it forwards onto the unsplined portion of the shaft.
11. Remove the snap ring from the front of the layshaft.
12. Relocate the front bearing in its web and tap the layshaft rearwards.
13. Remove the constant mesh gear.
14. Remove the second gear pinion.
15. Manoeuvre the layshaft forwards out of the gearbox.
16. Remove the third gear pinion.
17. Remove the fourth gear pinion.
18. Remove the snap ring.
19. Using MF 200 and MF 200-25, press the bearing of the front end of the layshaft.

Refitment

20. Reverse procedures 1 to 19, except: Ensure that all snap rings are correctly located in their grooves.

MK II 8 SPEED CONSTANT MESH TRANSMISSION**Reverse Gear Cluster****Removal and Refitment** 5D-11-14

Special Tools: See operation 5D-07-11, and
55×25 mm (2 $\frac{1}{4}$ ×1 in) dia. Mild Steel
Dummy Shaft

Removal

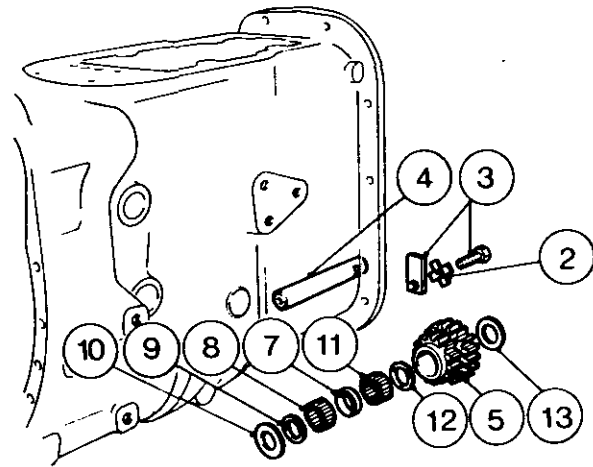
1. Remove the mainshaft and gears, operation 5D-09-12, procedures 1 to 10.
2. Release the tabwasher.
3. Remove the bolt and locating tab.
4. Slide the dummy shaft from the front of the reverse gear shaft towards the rear. This will push out the reverse gear shaft, and prevent the needle rollers from dropping into the transmission case.
5. Remove the idler gear cluster complete with all parts and the dummy shaft.
6. Withdraw the dummy shaft from the idler gears, and allow all parts to drop out, onto a clean work surface.

Refitment

7. Fit the spacer in the reverse gear cluster.
8. Refit the first set of rollers. Each run consists of 28 rollers.

NOTE: Smear the rollers in petroleum jelly (not grease) to facilitate reassembly.

9. Refit the retaining ring.
10. Refit the thrust washer.
11. Refit the second set of rollers.
12. Refit the retaining ring.
13. Refit the thrust washer.
14. Slide the dummy shaft into the reverse gear cluster rollers.
15. Reverse procedures 1 to 5.



MK II 8 SPEED CONSTANT MESH TRANSMISSION**TRANSMISSION CASE REMOVAL AND
REFITMENT OR COMPLETE GEARBOX OVER-
HAUL****5D—12—15**

Special Tools: MF 177 Seal Protector
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 218 A P.t.o. Shaft Puller
 MF 218-2 Adaptor
 MF 255 B Oil Seal Replacer
 270 Rail Trolley
 MF 315 Needle Roller Bearing
 Removal Tool
 MF 331 Oil Seal Replacer
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands
 V.L. Churchill 50 ton Hydraulic Press
 (alternative to MF 200)
 55 mm × 25 mm ($2\frac{1}{4}$ × 1 in) dia
 Mild Steel Dummy Shaft

Disassembly

1. Remove the selector rail mechanism, operation 5D—01—06.
2. Remove the gearbox epicyclic unit, operation 5D—02—07.
3. Disassemble the gearbox epicyclic unit, operation 5D—03—07.
4. Remove the clutch release mechanism, operation 5D—04—08.
5. Remove and dismantle the input housing and p.t.o. input shaft, operation 5D—05—09.
6. Remove the p.t.o. drive shaft front bearing, operation 5D—06—10.
7. Remove the main input shaft, operation 5D—07—11.
8. Remove the second gear (mainshaft), operation 5D—08—11.
9. Remove the mainshaft, first, reverse, fourth and third gears operation 5D—09—12.
10. Remove the layshaft and gears and p.t.o. shaft and gear, operation 5D—10—13.
11. Remove the reverse gear cluster, operation 5D—11—14.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings, needle rollers, gear sliding couplers, gear selector forks, also shaft splines and main shaft gear bushes and sleeves. All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webs. Maximum acceptable clearance is 0,033 mm (0.013 in). Where the clearance between bearing and bore exceeds this figure, recommended sealant 'C' may be used to refit the bearings into the transmission case. After inspection, lubricate bearings with clean transmission oil. Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tab washer must be fitted.

Reassembly

12. Reverse procedures 1 to 11, except:
 - (a) Use only petroleum jelly for reassembly purposes—Never Grease.
 - (b) Ensure all snap rings are correctly located in their grooves.
 - (c) Lightly oil all bushes, bearings and splines prior to reassembly.

MK II 8 SPEED CONSTANT MESH TRANSMISSION**HIGH/LOW AND GEAR SHIFT LEVERS****Removal and Refitment**

5D-13-16

Removal

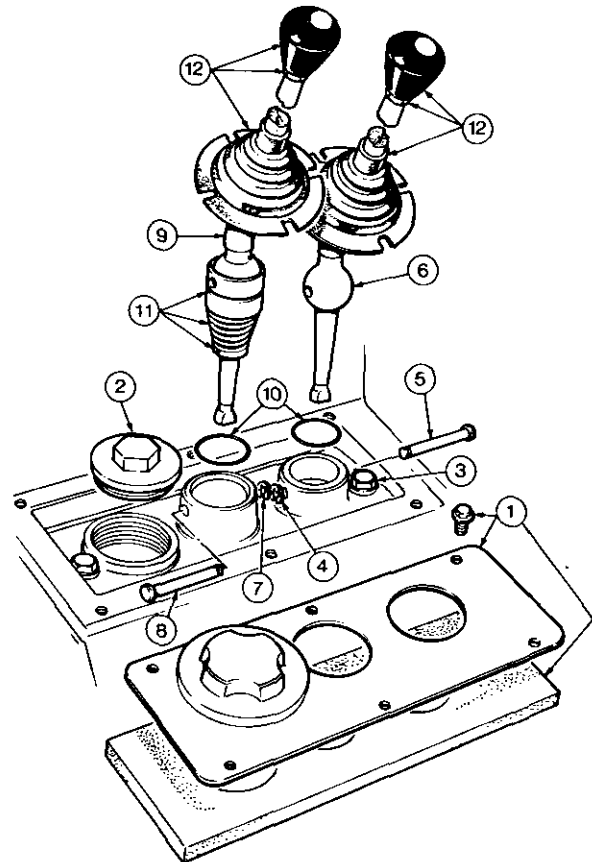
1. Remove the bolts, plate and sound proofing pad.
2. Remove the filler plug.
3. Remove the bolt.
4. Remove the clip.
5. Remove the pin.
6. Withdraw the lever.
7. Remove the clip.
8. Remove the pin, taking care not to drop it into the gearbox.
9. Withdraw the lever and cup assembly.
10. Discard the 'O' rings.
11. If necessary, press the spring retaining washer towards the spring, slide it sideways and remove it. This will release the spring and support cup.

WARNING: When removing the spring retaining washer, care must be taken to prevent the spring from flying out and causing possible injury and damage.

12. If necessary, remove the knobs, nuts and dust caps.

Refitment

13. Reverse procedures 1 to 12, except:
 - (a) Fit new 'O' rings.
 - (b) Ensure that the gearlevers locate correctly in the gearlever engagement dogs.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION**GENERAL**

Refer to Figures 1, 2, 3 and 4

Multi-Power transmission provides twelve forward gears and four reverse gears. This is achieved by combining with the standard transmission, low driving (109) and driven (132) constant mesh gears, operated by a free wheel coupler (131), and high driving (107), and driven (129) constant mesh gears operated by a multi-plate hydraulic clutch (98). By driving the layshaft (88) with either of these two pairs of gears, an alternative speed for each gear becomes available. To provide Multi-Power, the following components are added to the standard transmission; a pair of constant mesh gears, free wheel unit (131), multi-plate clutch unit (98), oil pump, oil control valve and shift mechanism (147). The high driving gear (107), runs on a bush on the main input shaft (60), next to the low driving gear (109). The front end of the high driving gear (107) is splined to engage the clutch disc splines. The three clutch discs, plates, piston and return springs are held into the clutch housing (98) by a retainer plate and snap ring. The three clutch plates are splined into the clutch housing, and the housing is splined to the main input shaft (60). The high driven gear (129) is splined to the lay shaft (88) and is retained by a snap ring. The low driven gear (132) runs on a bush on the layshaft, next to the high driven gear (129). A spring loaded coupler (131) is fitted between the driven gears and operates on a helical spline on the layshaft (88). The coupler is spring loaded towards the low driven gear (132), and the teeth on the rear face of the coupler engage similar teeth on the front face of the low driven gear (132).

The oil pump supplies oil to the control valve for operation of the clutch unit (98). The control valve is fitted to the input housing (9) and directs oil to the clutch or returns oil into the transmission housing. The Multi-Power shift lever is fitted to the instrument panel and a mechanical linkage connects the shift lever to the oil control valve.

Multi-Power high or low can be selected whilst the tractor is moving and is engaged in any gear.

Mounted on the mainshaft are four sets of gears, which are in constant mesh with the layshaft gears, and when viewed from the front of the gearbox these gears are, first (42 teeth) (114), reverse (44 teeth) (118) third (36 teeth) (121) and second (40 teeth) (124).

The gear levers, reduction unit and sliding couplers are identical to those used for the eight speed transmission.

The input shaft (60) has been redesigned to simplify assembly, which also allows a larger needle roller bearing (61) to be fitted.

Mounted on the layshaft are three gears, first (14 teeth) (88), third (33 teeth) (135) and second (20 teeth) (136).

Reverse gear layout and operation is identical to the eight speed transmission, except that the 21 tooth portion of the compound reverse gear runs in constant mesh with the third gear pinion (33 teeth) (135) on the layshaft.

Operation**Shift Lever in Low**

Oil is pumped through the control valve and back into the transmission housing. The drive is transmitted to the layshaft (88) through the low constant mesh gears (109, 132) and the free wheel coupler (131). The coupler is forced into engagement with the low driven gear (132) by its spring and the thrust exerted by the helical splines. When the coupler is in this engaged (low) position, no engine braking is available. If engine braking is required, move the Multi-Power shift lever to high.

Shift Lever in High

Oil is pumped to the control valve and is then directed through drillings to the clutch unit (98) which engages the high driving gear (107). The higher ratio of the high gears increases the speed of the layshaft (88). This speed increase, exerts an opposite thrust on the helical splines of the coupler (131), which overcomes the spring pressure and disengages the coupler from the low driven gear (132), so allowing the low driven gear to free wheel.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION

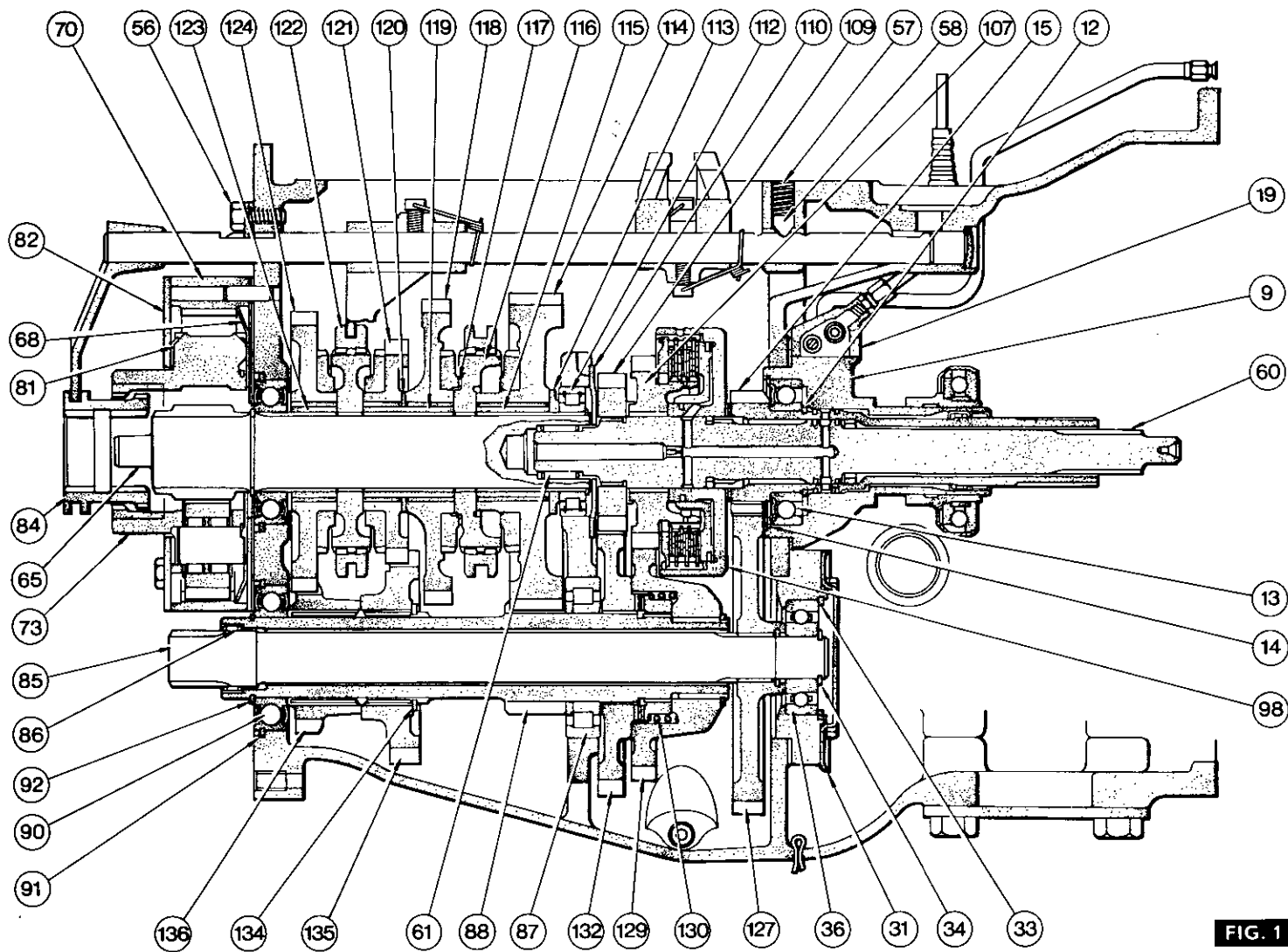


FIG. 1

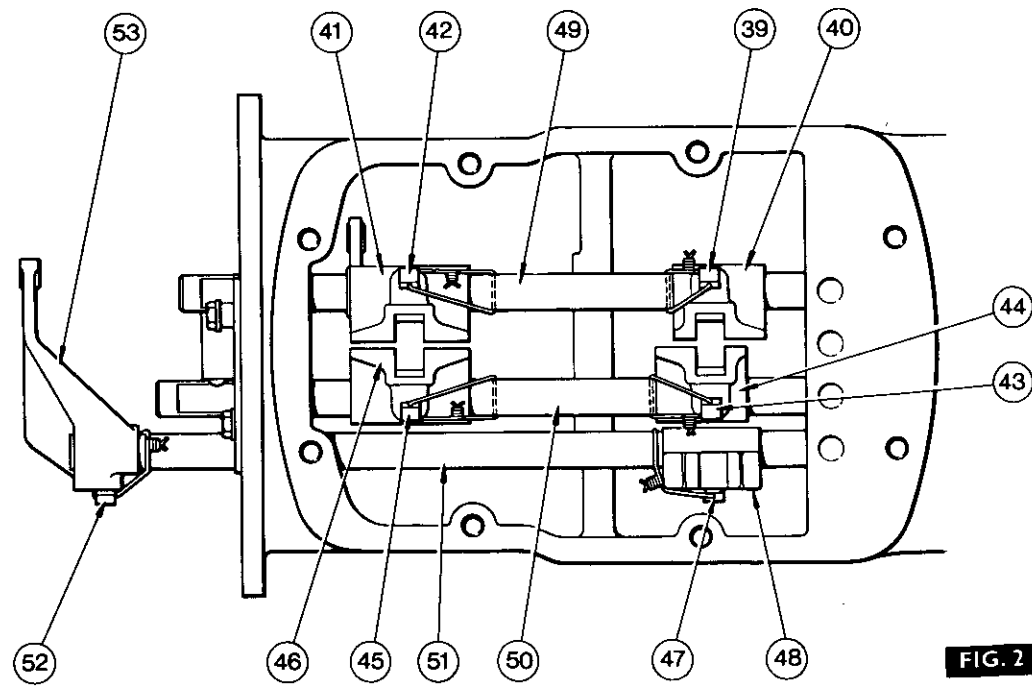


FIG. 2

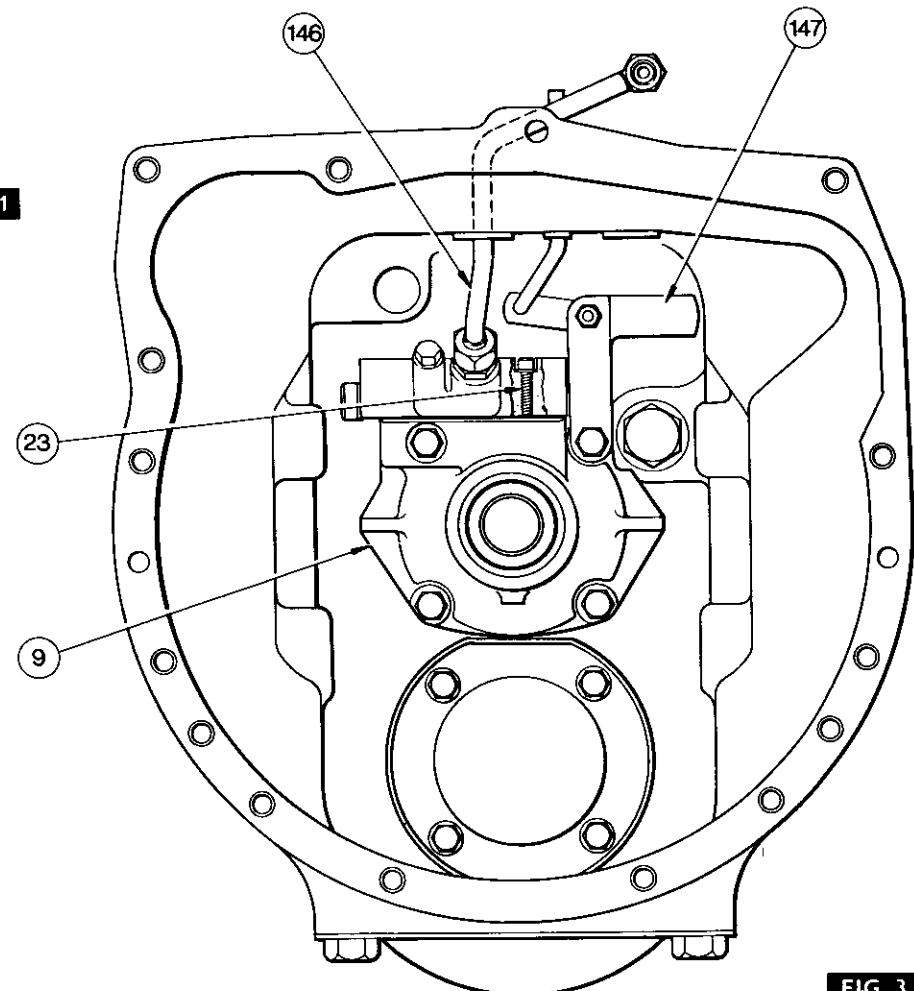
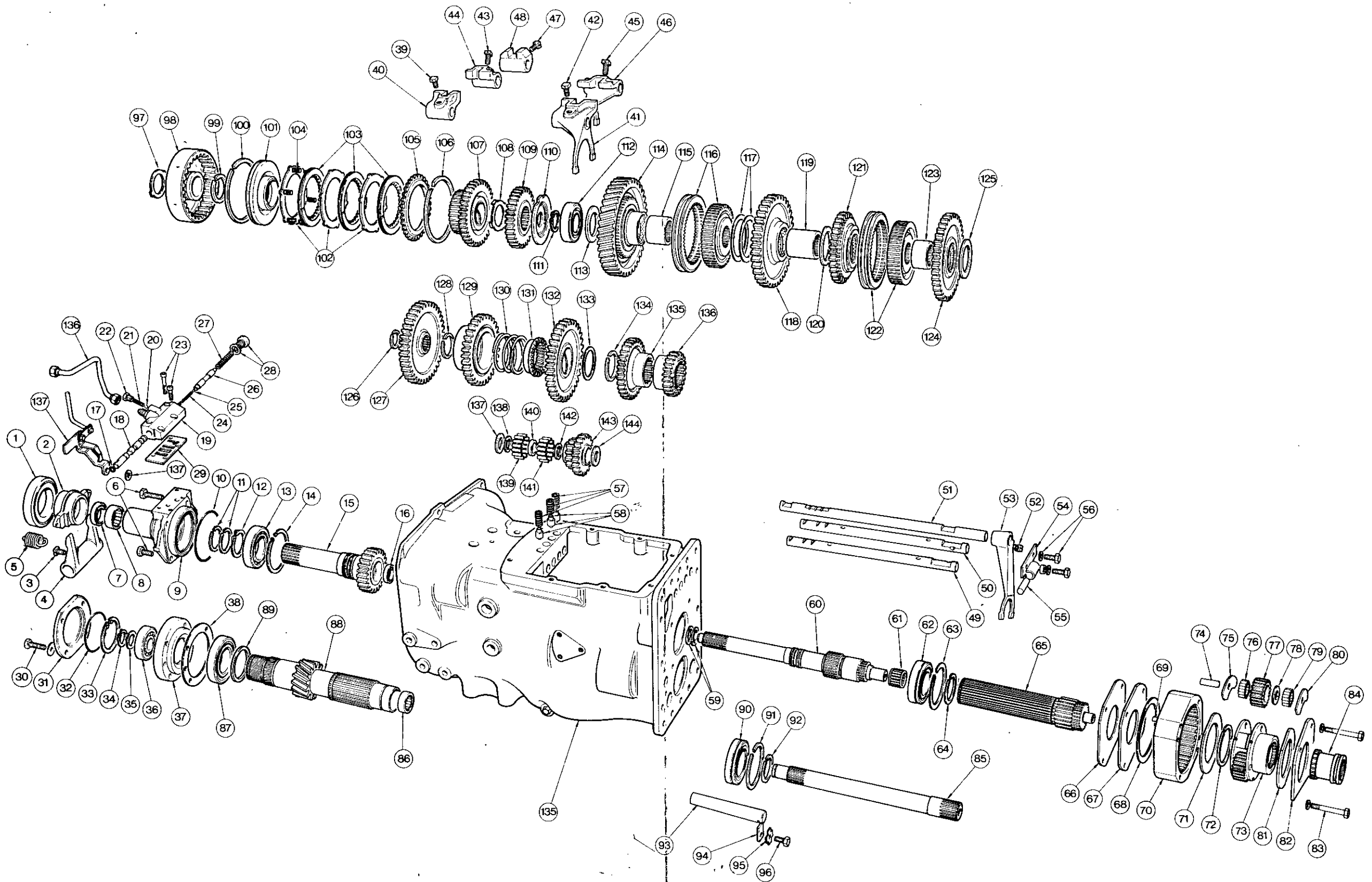


FIG. 3

MK II CONSTANT MESH MULTI-POWER TRANSMISSION



MK II CONSTANT MESH MULTI-POWER TRANSMISSION**KEY TO FIGS. 1, 2, 3 and 4**

1. Clutch release bearing
2. Clutch release bearing carrier
3. Clutch release fork locking peg
4. Clutch release fork
5. Clutch release bearing return spring
6. Input housing securing bolts
7. P.t.o. input shaft seal
8. P.t.o. input shaft needle roller bearing
9. Input housing
10. Input housing 'O' ring
11. P.t.o. input shaft cast iron sealing rings
12. P.t.o. input shaft securing external circlip
13. P.t.o. input shaft bearing
14. P.t.o. input shaft securing internal circlip
15. P.t.o. input shaft
16. Main drive input shaft seal
17. Multi-Power spool valve 'O' ring
18. Multi-Power spool valve
19. Multi-Power spool block
20. Multi-Power detent ball
21. Multi-Power detent spring
22. Multi-Power spool detent spring securing plug
23. Multi-Power spool block securing bolts
24. Anti-transient spring
25. Anti-transient ball
26. Multi-Power spool block pressure regulating valve
27. Multi-Power pressure regulating valve spring
28. Multi-Power pressure regulating valve spring retaining plug and washer
29. Multi-Power spool block gasket
30. P.t.o. front bearing cover securing bolts
31. P.t.o. front bearing cover
32. P.t.o. front bearing cover 'O' ring
33. P.t.o. front bearing securing circlip
34. P.t.o. shaft securing circlip
35. P.t.o. shaft spacer washer.
36. P.t.o. shaft front bearing
37. P.t.o. front bearing housing
38. P.t.o. front bearing housing gasket
39. Second and third gear lever engagement dog locking peg.
40. Second and third gear lever engagement dog
41. Second and third selector fork.
42. Second and third selector fork locking peg
43. First and reverse gear lever engagement dog locking peg
44. First and reverse gear lever engagement dog
45. First and reverse selector fork locking peg
46. First and reverse selector fork
47. High/Low gear lever engagement dog locking peg
48. High/Low gear engagement dog
49. Second and third gear selector rail
50. First and reverse gear selector rail
51. High/Low gear selector rail
52. High/Low selector fork locking peg
53. High/Low selector fork
54. Interlock stop plate
55. Interlock plunger
56. Interlock mechanism securing bolt and washer
57. Detent springs
58. Detent plungers
59. Main input shaft cast iron sealing rings
60. Main input shaft
61. Mainshaft needle roller bearing
62. Mainshaft rear bearing
63. Mainshaft rear bearing locating snap ring
64. Mainshaft rear bearing rear securing snap ring
65. Mainshaft
66. Epicyclic shim
67. Epicyclic front plate
68. Epicyclic Belleville spring disc
69. Epicyclic ring gear dowel
70. Epicyclic ring gear
71. Epicyclic front thrust ring
72. Epicyclic planetary pinion shaft securing circlip
73. Epicyclic planetary pinion carrier
74. Epicyclic planetary pinion shaft
75. Planetary pinion front thrust washer
76. Planetary front roller set
77. Planetary pinion
78. Planetary roller spacer
79. Planetary rear roller set
80. Planetary pinion rear thrust washer
81. Epicyclic rear thrust ring
82. Epicyclic cover plate
83. Epicyclic securing bolts
84. High/Low shift coupler
85. P.t.o. drive shaft
86. Layshaft rear needle roller bearing
87. Layshaft front bearing
88. Layshaft
89. Layshaft front bearing spacer washer
90. Layshaft rear bearing
91. Layshaft rear bearing location snap ring
92. Layshaft rear bearing securing snap ring
93. Reverse gear cluster shaft
94. Reverse gear cluster shaft retaining plate
95. Tab washer
96. Reverse gear cluster shaft securing bolt
97. Multi-Power clutch front thrust washer
98. Multi-Power clutch unit housing
99. Multi-Power clutch unit housing cast iron sealing rings.
100. Multi-Power clutch unit piston ring
101. Multi-Power clutch unit piston
102. Multi-Power clutch unit interplates
103. Multi-Power clutch unit friction discs
104. Multi-Power clutch piston return springs
105. Multi-Power friction disc retainer plate
106. Multi-Power retainer plate securing circlip
107. Main input overdrive pinion
108. Multi-Power clutch unit rear thrust washer
109. Main drive pinion
110. Tab located spacer
111. Mainshaft front bearing securing circlip
112. Mainshaft front bearing
113. Mainshaft front bearing thrust washer
114. First gear (mainshaft)
115. First gear sleeve
116. First/Reverse gear sliding coupler
117. Needle bearing-thrust washer
118. Reverse gear (Main shaft)
119. Reverse/third gear sleeve
120. Reverse/third gear thrust washer
121. Third gear (Mainshaft)
122. Second/third gear sliding coupler
123. Second gear sleeve
124. Second gear (Mainshaft)
125. Second gear thrust washer
126. P.t.o. constant mesh gear internal circlip
127. P.t.o. constant mesh gear
128. Layshaft front snap ring
129. Overdrive layshaft gear
130. Coupler spring
131. Coupler
132. Main drive layshaft gear
133. Main drive layshaft gear thrustwasher
134. Third gear layshaft securing snap ring
135. Third gear (layshaft)
136. Second gear (layshaft)

MK II CONSTANT MESH MULTI-POWER TRANSMISSION**KEY TO FIGS. 1, 2, 3 and 4 Contd.**

- | | |
|---|--|
| 137. Reverse gear front thrust washer | 142. Needle roller rear retaining ring |
| 138. Needle roller front retaining ring | 143. Reverse gear cluster |
| 139. Front needle roller set | 144. Reverse gear rear thrust washer |
| 140. Needle roller spacer | 145. Gear box case |
| 141. Rear needle roller set | 146. Multi-Power pipe |
| | 147. Multi-Power internal linkage and washer |

SELECTOR RAIL MECHANISM**Removal and Replacement**

5E-01-06

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

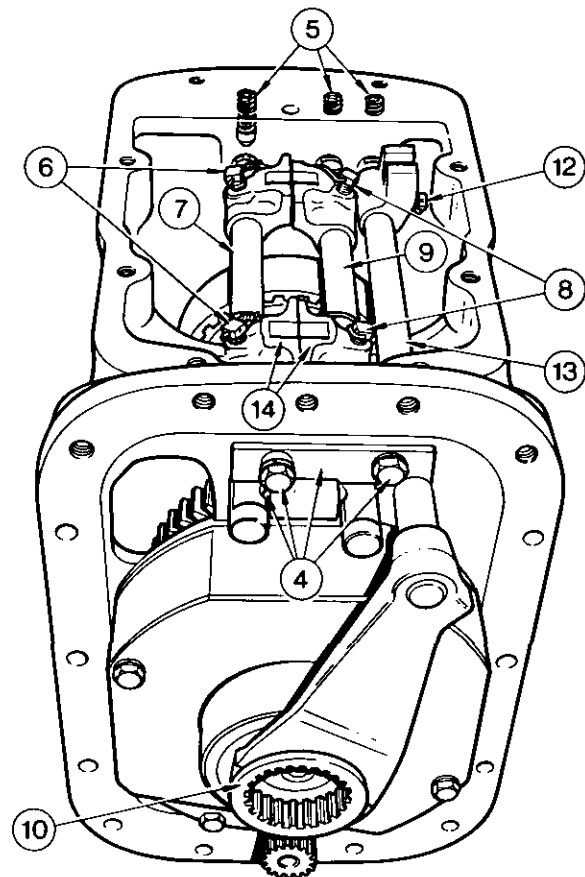
MF 365/8 Stands

Removal**NOTE: Beware of the sharp edges around the top of the gearbox case.**

1. Split the tractor between the transmission and the centre housing, Part 3A.
 2. Remove the gearbox top cover and gasket.
 3. Release the locking wires.
 4. Remove the bolts, stop plate and peg.
 5. Lift out the springs and plungers.
 6. Remove the locking pegs.
 7. Slide the rail rearwards out of the housing.
- NOTE: When removing the selector rails, retain the gear lever engagement dogs.**
8. Remove the locking pegs.
 9. Slide the rail rearwards out of the housing.
 10. Slide the High/Low rail rearwards and remove the coupling.
 11. Rotate the High/Low rail through 90°.
 12. Remove the locking peg.
 13. Slide the rail rearwards out of the housing.
 14. Remove the selector forks from the gearbox.

Refitment

15. Reverse procedures 1 to 14, except:
 - (a) Apply a few drops of oil to the selector rails before refitment.
 - (b) Tighten the locking mechanism retaining bolts to 47 Nm (35 lbf ft).
 - (c) On completion of the refitting procedure, place all the gear lever engagement dogs in the neutral position.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION**CLUTCH RELEASE MECHANISM****Removal and Refitment**

5E-02-07

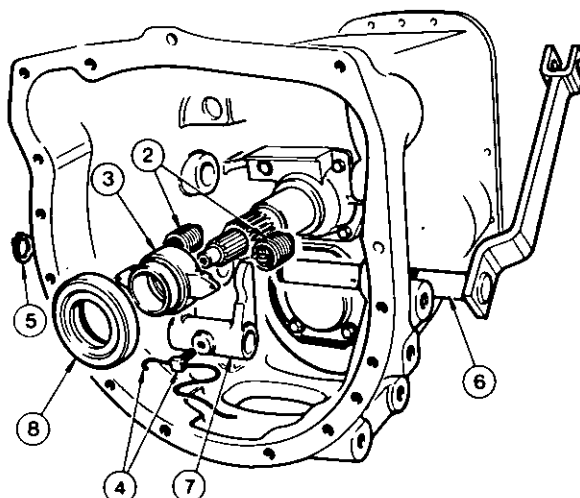
Special Tool: 270 Rail Trolley

Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the two springs.
3. Slide the carrier and release bearing off the input housing.
4. Remove the locking wire and locking peg.
5. Remove the circlip.
6. Remove the shaft. To obtain sufficient clearance on MF 550 and MF 560 tractors, the left hand front cab mounting bracket must be removed, and on all versions the fuel tank must be removed, Part 4C.
7. Remove the clutch release fork.
8. Press the release bearing off the carrier.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Lightly lubricate the input shaft splines and the release bearing carrier bore, with approved grease Mobilplex 47.
 - (b) Ensure that the locking peg locates on the hole in the shaft.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION**EPICYCLIC UNIT****Removal and Refitment**

5E-03-08

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

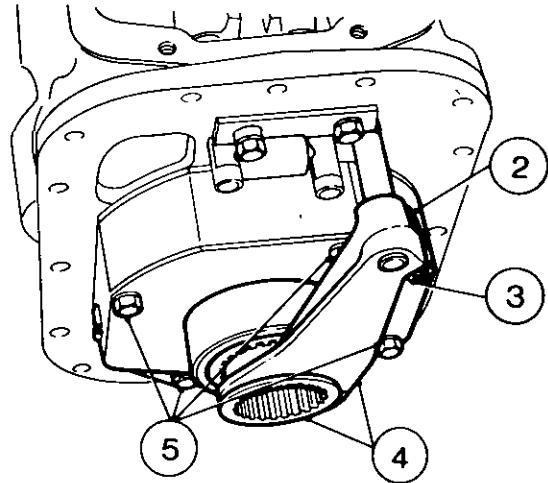
MF 365/8 Stands

Removal

1. Split the tractor between the transmission and the centre housing, Part 3A.
2. Remove the locking wire.
3. Remove the locking peg.
4. Remove the selector fork and coupling.
5. Remove the bolts.
6. Remove the complete assembly.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the front and rear thrust rings are correctly located before refitment.
 - (b) Ensure that the epicyclic dowels are correctly located in the gearbox casing.
 - (c) Locate the cover plate with the cut out in the bottom left hand corner.
 - (d) Do not fit a lockwasher to the lower left hand retaining bolt.
 - (e) Tighten the retaining bolts progressively and evenly to a torque of 47 Nm (35 lbf ft).

**EPICYCLIC UNIT****Servicing**

5E-04-08

Special Tools: See operation 5E-03-08

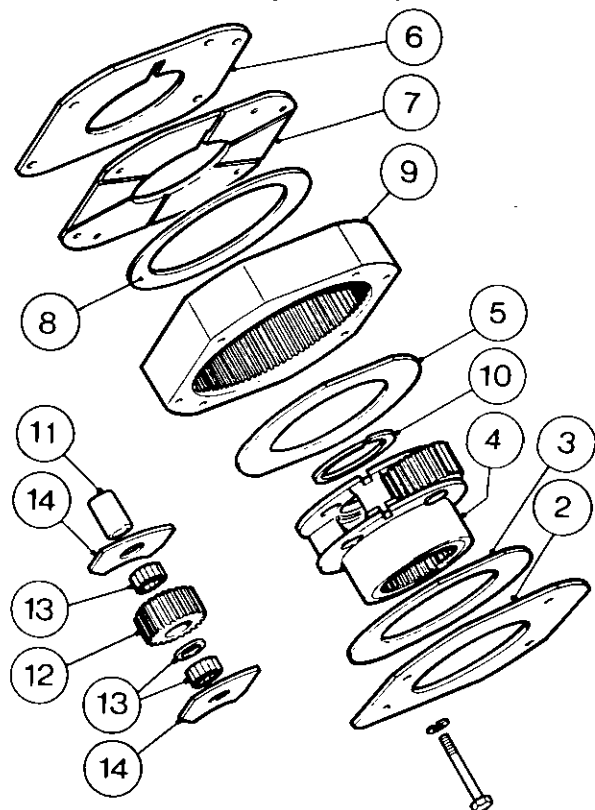
Disassembly

1. Remove the gearbox epicyclic unit, operation 5E-03-08.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. Remove the Belleville spring disc.
9. If necessary, remove the dowel pins from the planetary ring gear.
10. Remove the external snap ring.
11. Gently tap out the three pinion shafts towards the front.
12. Remove the planetary pinions.
13. Remove the two sets of rollers and the spacer from each pinion.
14. Remove the wear plates from each pinion.

Reassembly

15. Reverse procedure 1 to 14, except:
 - (a) When replacing the rollers in the pinions, a smear of petroleum jelly (not grease) will help retain them. Do not omit the spacer from between the two runs of rollers. Each run consists of 16 rollers.
 - (b) Ensure the Belleville spring disc is located correctly in the epicyclic ring gear with the concave face rearwards.
 - (c) The front plate and the cover plate must be positioned with the oil grooves towards the pinion carrier.
 - (d) Ensure that pinion wear plates are refitted with the flats innermost to the centre of the pinion carrier.
 - (e) Ensure the gap of snap ring is located mid-way between planetary pinion shafts.

- (f) Always fit the same thickness of shims as those removed.
- (g) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION

P.T.O. DRIVESHAFT FRONT BEARING

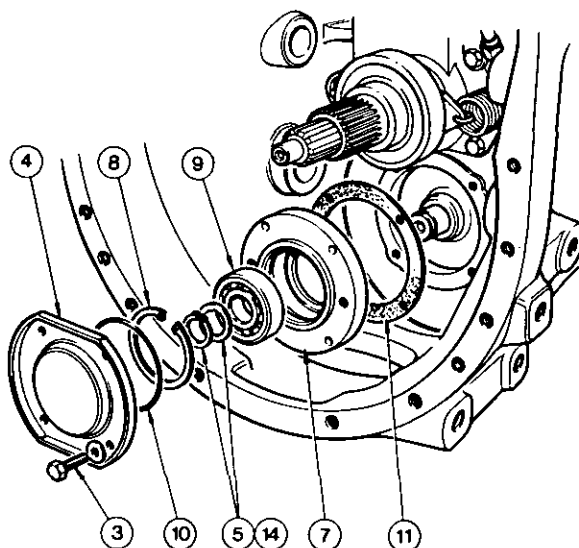
Removal and Refitment

5E-05-09

Special Tools: 270 Rail Trolley
MF 218A P.t.o. Drive Shaft Puller
MF 218A-2 Adaptor

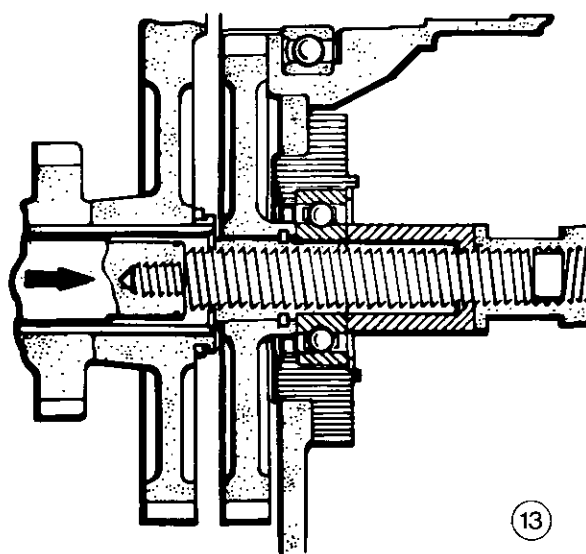
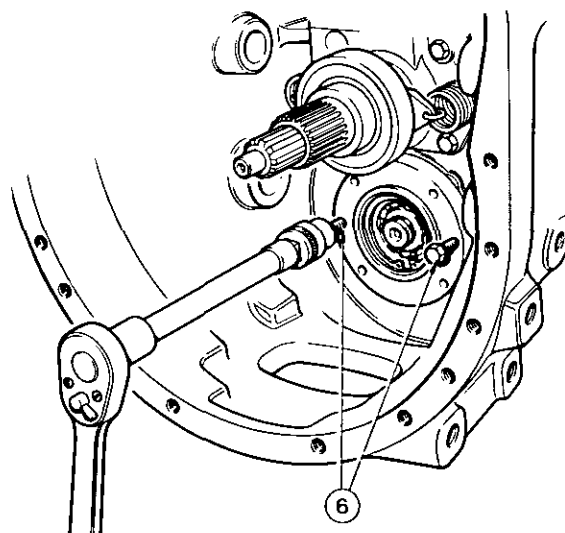
Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the clutch release shaft, operation 5E-02-07, procedures 4 to 7.
3. Remove the four bolts.
4. Remove the cover-plate and gasket.
5. Remove the external circlip and washer.
6. Screw two $\frac{3}{8}$ U.N.C. \times 75 mm (3 in) bolts into the bearing housing and tighten them evenly.
7. Remove the housing and gasket.
8. Remove the circlip.
9. Press out the bearing.
10. Discard the 'O' ring.
11. Discard the gasket.

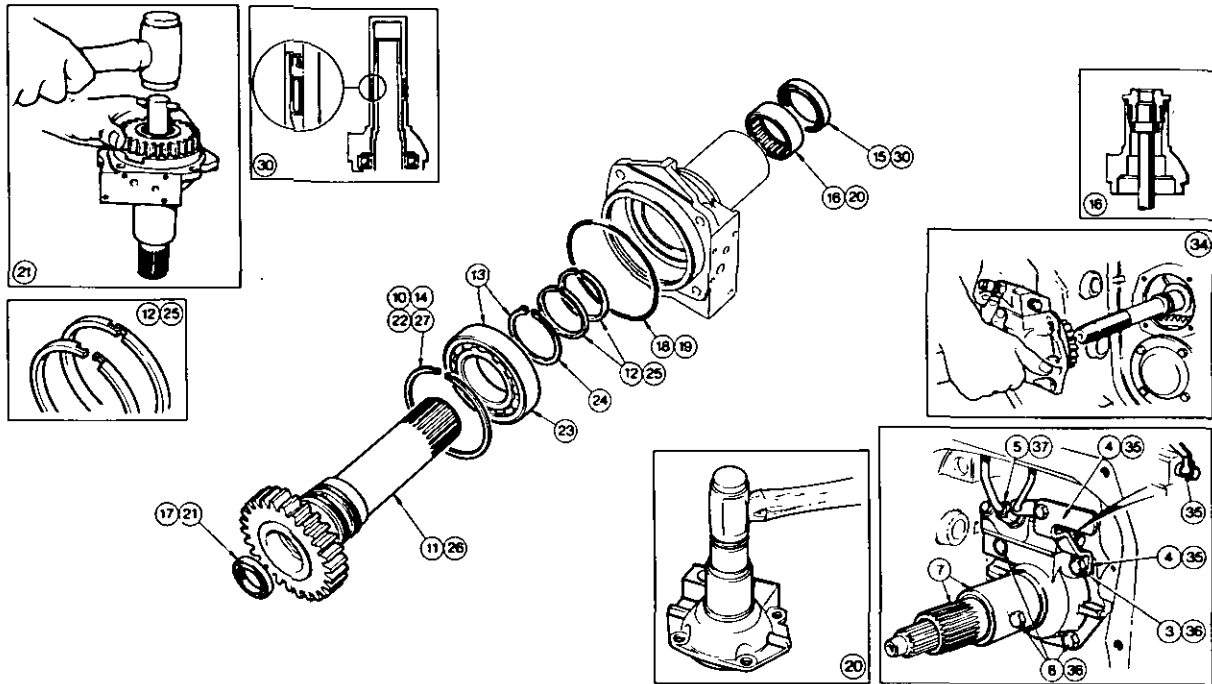


Refitment

12. Reverse procedures 8 to 11, except:
 - (a) Fit a new 'O' ring, gasket and circlip.
 - (b) Coat the gasket with recommended sealant 'A'.
13. Using MF 218 A and MF 218 A-2, refit the bearing and housing assembly on the front end of the p.t.o. shaft, ensuring that the splines on the shaft locate with the splines in the p.t.o. constant mesh gear.
14. Refit the washer and a new circlip.
15. Reverse procedures 1 to 4, except:
 - (a) Lightly coat the securing bolt threads with recommended sealant 'B'.
 - (b) Tighten the bolts to a torque of 60 Nm (45 lbf ft).



MK II CONSTANT MESH MULTI-POWER TRANSMISSION



INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Servicing

5E-06-10

Special Tools: 270 Rail Trolley

MF 177 Seal Protector
 MF 255 B-1 Oil Seal Replacer
 MF 255 B-2 Cone
 MF 256 A Oil Seal Replacer
 MF 315 Needle Bearing Removal Tool
 MF 331 Needle Roller Bearing Re-fitting Tool

Disassembly

1. Remove the clutch release mechanism, operation 5E-02-07.
2. Disconnect the Multi-Power linkage on the top of the transmission case.
3. Remove the R. H. upper bolt.
4. Remove the internal Multi-Power linkage and washer.
5. Disconnect the pipe.
6. Remove the remaining three bolts.
7. Withdraw the input housing complete with the p.t.o. shaft.
8. Remove the four Allen screws securing the spool valve to the input housing.
9. Remove the spool valve and gasket.
10. Dislocate the large internal circlip from the input housing groove.
11. Push the p.t.o. shaft complete with bearing rearwards out of the housing.
12. Unclip and remove the two sealing rings.
13. If necessary, remove the circlip and press the bearing off the front of the shaft.
14. Remove the circlip.
15. Lever the seal out.
16. Using MF 315, remove the needle roller bearing.
17. Remove the seal.
18. Remove the 'O' ring (input shaft housing).

Examine the bore of the p.t.o. input shaft and the input housing for grooves, where the sealing rings locate. If any of the above parts show signs of wear or damage, they must be replaced. Check (and if necessary, replace) the ball and needle roller bearings for wear.

Lubricate all new seals with petroleum jelly (not grease) when reassembling.

Reassembly

19. Fit a new 'O' ring (input shaft housing).
20. Using MF 331 replace the needle roller bearing.
21. Using MF 256A, fit a new seal, with the toe of the seal facing the tool.
22. Refit the circlip on the shaft.
23. Refit the bearing with the shield towards the gear teeth.
24. Refit the circlip (check that it is properly seated).
25. Fit two new cast iron sealing rings on the p.t.o. input shaft and ensure that they are correctly clipped, then lubricate the shaft with clean transmission oil.
26. Carefully refit the p.t.o. input shaft and bearing into the input housing, ensuring that the cast rings are not damaged.
27. Re-locate the circlip in the input housing (check that it is properly seated).
28. Place the cone adaptor MF 255B/2 onto seal replacer MF 255B/1.
29. Place a new seal over the cone and onto the tool, with the toe of the seal facing away from the tool and remove the cone.
30. Place the tool over the p.t.o. shaft and tap the seal into place.
31. Refit the spool valve and a new gasket (fitted dry) and tighten the Allen screws evenly.
32. Fit two new cast iron sealing rings on the main input shaft.
33. Place MF 177 over the splines of the main input shaft.
34. Carefully refit the input housing, and withdraw MF 177.
35. Refit the washer and Multi-Power linkage, ensuring that the actuator locates in the slot in the spool.
36. Lightly coat the bolt threads in a recommended sealant 'B', refit and tighten them to a torque of 60 Nm (45 lbf ft).
37. Refit the pipe.
38. Refit the external Multi-Power linkage.
39. Refit the clutch release mechanism, operation 5E-02-07.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION

Main Input Shaft and Multi-Power Clutch Unit Removal and Refitment 5E-07-11

Special Tools: See operation 5E-06-10, and
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

1. Split the tractor between the engine and transmission, and the transmission and centre housing, Part 3A.
2. Remove the gear selector mechanism, operation 5E-01-06, procedures 2 to 9.
3. Remove the input shaft housing and p.t.o. input shaft, operation 5E-06-10, procedures 1 to 7.
4. Remove the Multi-Power clutch front thrust washer.
5. Withdraw the main input shaft forwards out of the transmission casing and simultaneously steady the Multi-Power clutch unit, main input overdrive pinion and the main drive pinion whilst the splines are disengaged.

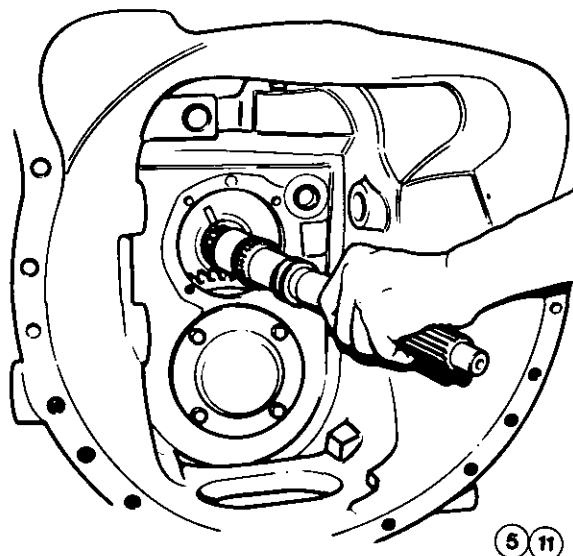
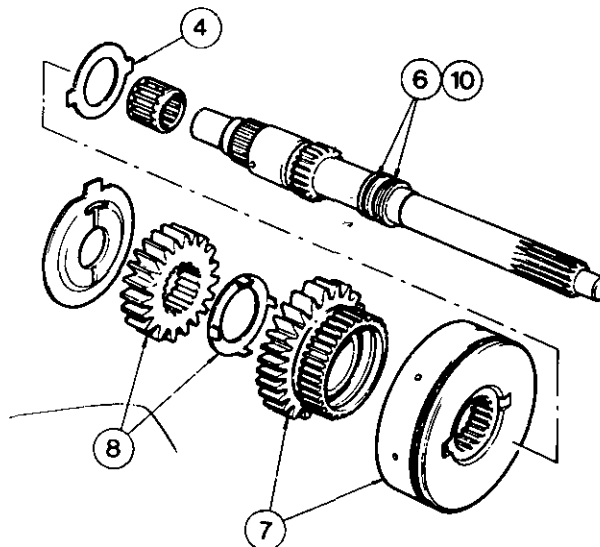
NOTE: Ensure that the Multi-Power clutch rear thrust washer does not fall into the bottom of the transmission casing.

6. Unclip and remove the cast iron sealing rings.
7. Remove the clutch unit and main input overdrive pinion.
8. Remove the Multi-Power clutch rear thrust washer and the main drive pinion.
 Examine the bore of the input p.t.o. shaft for grooves where the sealing rings locate and replace the shaft if any scoring or grooves are found. If excessive wear or scoring is found, the input housing and p.t.o. input shaft must be serviced as in operation 5E-06-10, procedures 8 to 31.

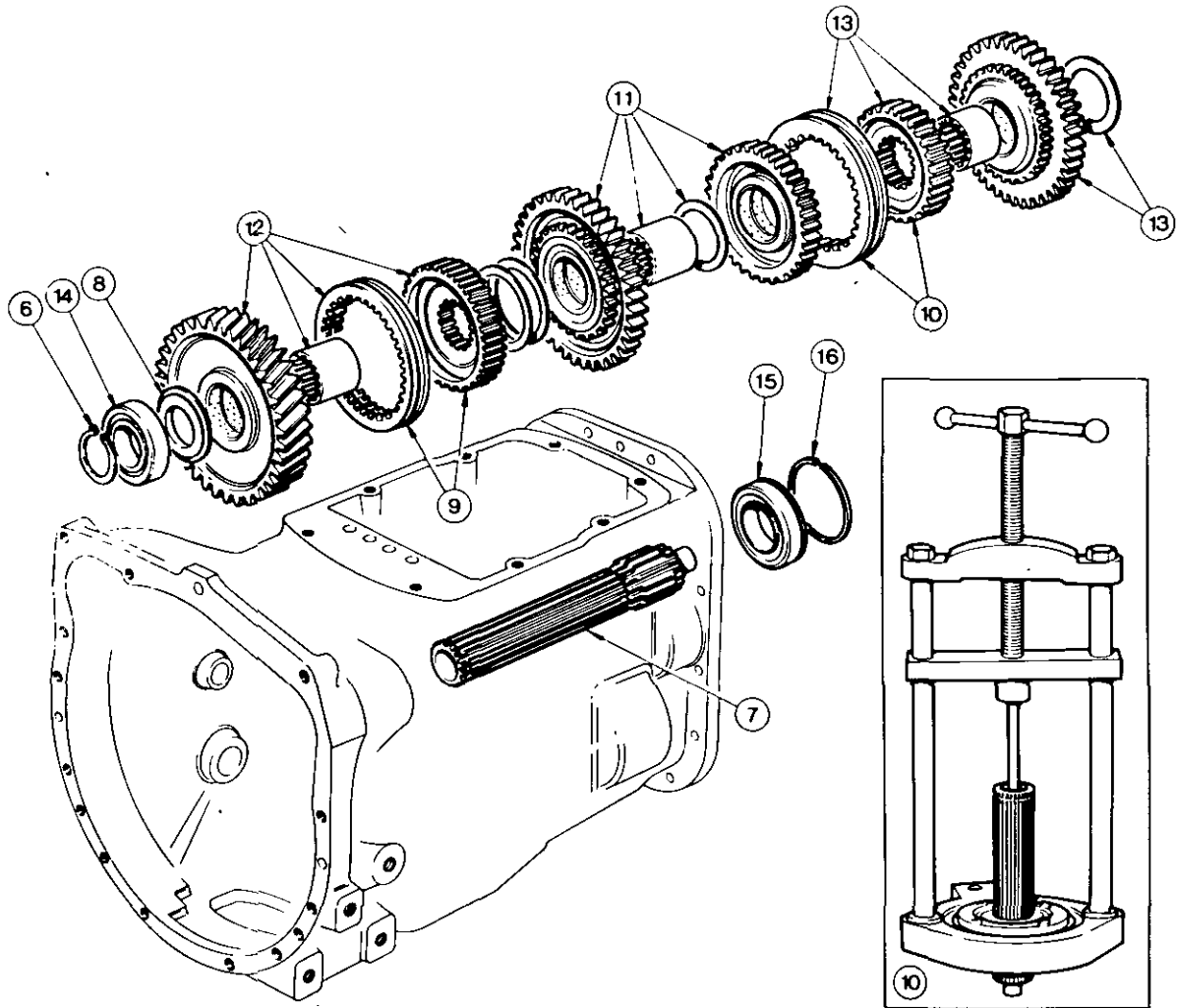
MAIN INPUT SHAFT AND MULTI-POWER CLUTCH UNIT

Refitment

9. Place the Multi-Power clutch unit, main input overdrive pinion, rear thrust washer and the main drive pinion forward of the centre web in the transmission casing, locating the gears with the overdrive and main drive layshaft gears.
NOTE: Lightly smear the rear thrust washer with petroleum jelly (to help refitment) and fit the tabs facing forwards and located correctly on the rear boss of the main input overdrive pinion.
10. Fit two new cast iron sealing rings to the main input shaft and ensure they are properly clipped.
11. Carefully push the shaft rearwards into the front of the Multi-Power clutch unit and on into mesh with the main drive pinion. Ensure that the Multi-Power clutch unit and the main drive pinion are both located on the main input shaft splines and that the main input shaft is correctly located in the mainshaft needle roller bearing.
12. Refit the Multi-Power clutch unit front thrust washer and ensure the two tabs are correctly located in the cut-outs on the clutch unit.
13. Lubricate the main input shaft with clean transmission oil and refit the input shaft housing and p.t.o. input shaft, operation 5E-06-10, procedures 33 to 39.
14. Reverse procedures 1 and 2.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION



MAINSHAFT, FIRST, REVERSE, SECOND AND THIRD GEARS

Removal and Refitment 5E-08-12

Special Tools: See operation 5E-06-10

MF 200 Hand Press
 MF 200-25 Adaptor
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

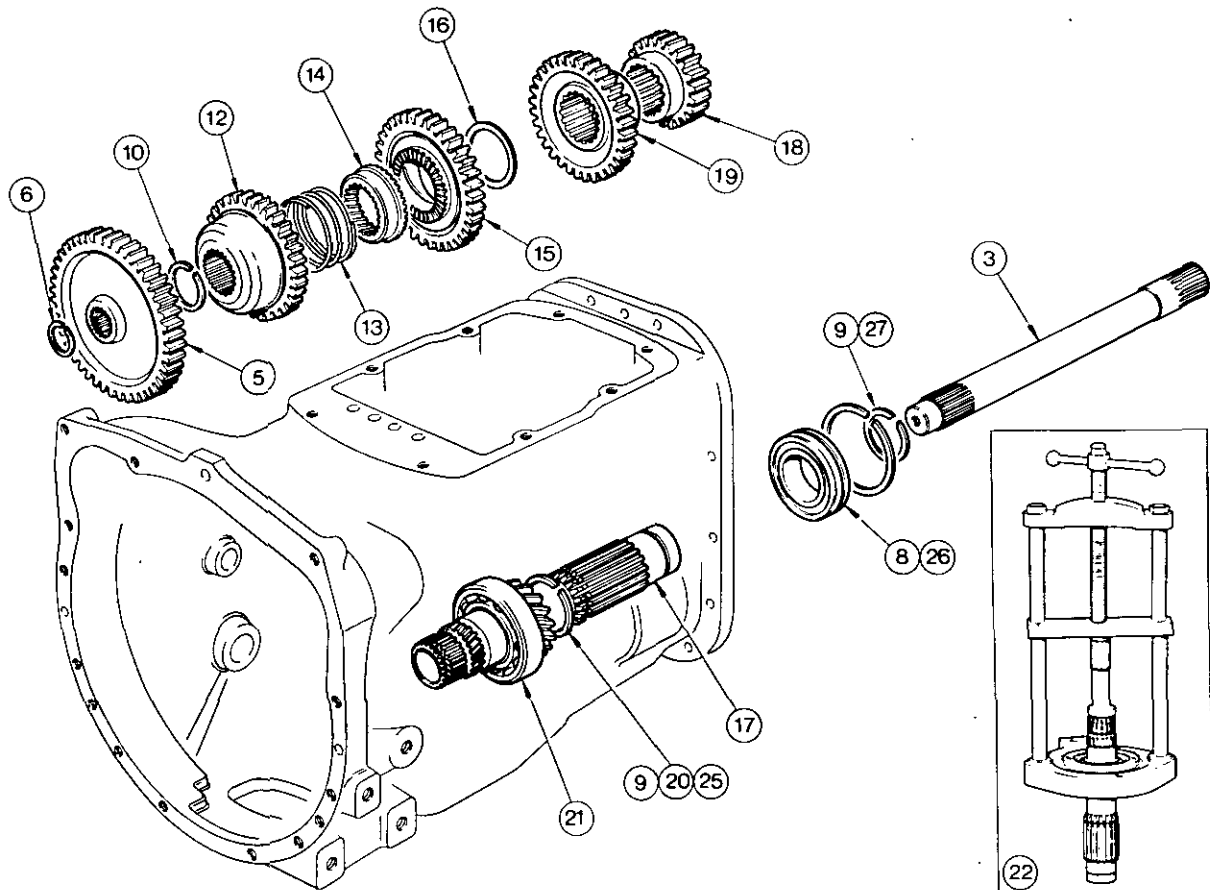
1. Split the tractor between the engine and transmission, and the transmission and centre housing, Part 3A.
2. Remove the gear selector mechanism, operation 5E-01-06.
3. Remove the gearbox epicyclic, operation 5E-03-08.
4. Remove the main input shaft and Multi-Power clutch unit, operation 5E-07-11, procedures 3 to 8.
5. Remove the tab located spacer.
6. Remove the circlip.
7. Withdraw the mainshaft rearwards out of the transmission casing.

8. Remove the front thrust washer from between the bearing (fitted in the centre webbing of the transmission casing) and first gear.
9. Engage sliding coupler with first gear.
10. Engage sliding coupler with second gear.
11. Withdraw the reverse and third gears, twisting them slightly to clear the edges of the transmission casing.
12. Remove first gear and the sliding coupler.
13. Remove second gear and the sliding coupler.
14. If necessary, remove the bearing from the centre web of the transmission casing.
15. If necessary, press the bearing of the FRONT end of the mainshaft using MF 200 and MF 200-25.
16. If necessary, remove the circlip.

Refitment

17. Reverse procedures 1 to 16 except:
 - (a) Ensure that all snap rings and circlips are correctly located in their grooves.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION

**LAYSHAFT AND GEARS, P.T.O. SHAFT AND GEAR****Removal and Refitment**

5E-09-13

Special Tools: See operations 5E-05-09
and 5E-08-12

Removal

1. Remove the mainshaft and gears, operation 5E-06-10, procedures 1 to 13.
2. Remove the p.t.o. driveshaft front bearing, operation 5E-05-09.
3. Withdraw the p.t.o. drive shaft rearwards out of the transmission casing.
4. Remove the p.t.o. constant mesh gear.
5. Remove the small internal snap ring (only if necessary).
6. Remove the snap ring from the rear of the layshaft.
7. Tap the layshaft forwards.
8. Remove the rear bearing.
9. Expose the snap ring, open it and slide it forwards onto the unsplined portion of the shaft.
10. Remove the snap ring from the front of the layshaft.
11. Relocate the front bearing in the centre web and tap the layshaft rearwards.
12. Remove the overdrive layshaft gear.
13. Remove the spring.
14. Remove the coupler.
15. Remove the main drive layshaft gear.
16. Remove the thrust washer.
17. Locate the front bearing in the centre web and gently drive the layshaft forwards out of the gearbox.

18. Remove the second gear from the gearbox.
19. Remove the third gear from the gearbox.
20. If necessary, remove the circlip.
21. If necessary, press the bearing of the FRONT end of the layshaft using MF 200 and MF 200-25.

Examination

Check all components for wear or damage, and if they are faulty, they must be replaced.

Check the coupler spring, which should have a free length of 47,5 mm (1.75 in), a compressed length of 16,5 mm (0.65 in) and a maximum load of 10,2 kg (22.5 lb) when compressed, if not, it must be replaced. When reassembling the layshaft, fit a new thrust washer and snap rings, and lubricate all parts with clean transmission oil.

Refitment

22. Reverse procedures 18 to 21.
23. Refit the layshaft, locating the third and second gears on the splines at the same time, push the layshaft rearwards enough to allow the components on its front end to be fitted.
24. Reverse procedures 10 to 16.
25. Push the layshaft forwards and second and third gears back far enough to allow the snap ring to be correctly refitted.
26. Refit the rear bearing in the gearbox.
27. Tap the layshaft rearwards (locating it correctly in the bearing) far enough to allow the snap ring to be replaced correctly.
28. Reverse procedures 1 to 5.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION**REVERSE GEAR CLUSTER 5E-10-14**

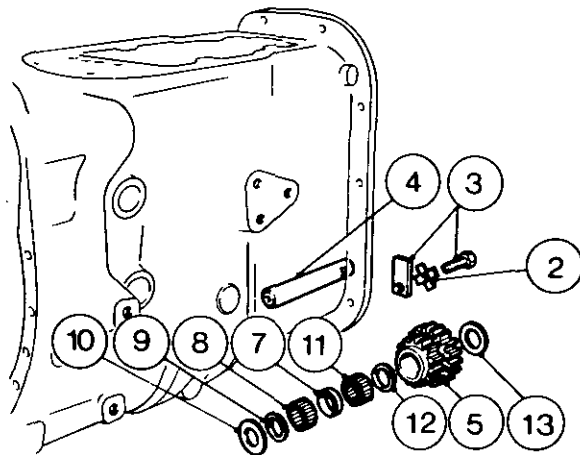
Special Tools: See operation 5E-08-12 and
55×25 mm (2 $\frac{1}{4}$ ×1 in) dia Mild Steel
Dummy Shaft

Removal

1. Remove the mainshaft and gears, operation 5E-08-12, procedure 1 to 13.
2. Release the tabwasher.
3. Remove the bolt and locating tab.
4. Slide the dummy shaft from the front of the reverse gear shaft towards the rear. This will push out the reverse gear shaft, and prevent the needle rollers from dropping into the transmission case.
5. Remove the idler gear cluster complete with all parts and the dummy shaft.
6. Withdraw the dummy shaft from the idler gears, and allow parts to drop out, onto a clean work surface.

Refitment

7. Fit the spacer in the reverse gear cluster.
8. Refit the first set of rollers. Each run consists of 28 rollers.
NOTE: Smear the rollers in petroleum jelly (not grease) to help reassembly.
9. Refit the retaining ring.
10. Refit the thrust washer.
11. Refit the second set of rollers.
12. Refit the retaining ring.
13. Refit the thrust washer.
14. Slide the dummy shaft into the reverse gear cluster rollers.
15. Reverse procedures 1 to 5.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION

MULTI-POWER CLUTCH UNIT 5E-11-15

Servicing

Special Tools: See operation 5E-07-11.

Disassembly

1. Remove the multi-power clutch unit, operation 5E-07-11.
2. Place the clutch unit assembly on a flat surface, push down the retainer plate and remove the snap ring.
3. Remove the retainer plate.
4. Remove the six springs.
5. Remove the three interplates and the three friction discs.
6. Slide the piston out of the clutch housing.
7. If necessary, remove the piston ring.

Examination

Check the condition of all components for signs of wear, scoring, damage, distortion or overheating.

Check the friction plates for the following dimensional tolerances;

Thickness 2,41 to 2,59 mm (0.095 to 0.102 in).

Maximum Height (permissible distortion) 2,92 mm (0.115 in).

Groove Depth 0,38 to 0,63 mm (0.015 to 0.025 in).

Check the interplates as follows:

Thickness 1,67 to 1,75 mm (0.66 to 0.69 in).

Maximum Dish 0,25 mm (0.010 in).

Maximum Height (permissible distortion) 2,21 mm (0.0875 in).

Check the six coil springs as follows:

Free length 17,8 mm (0.70 in).

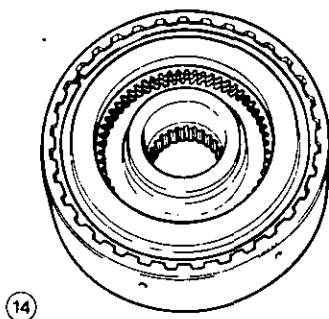
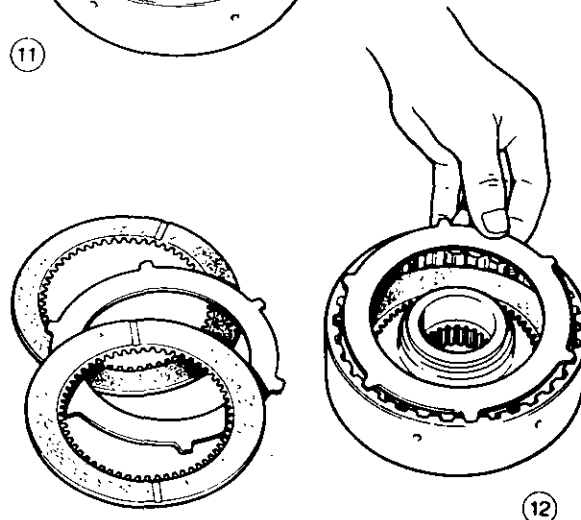
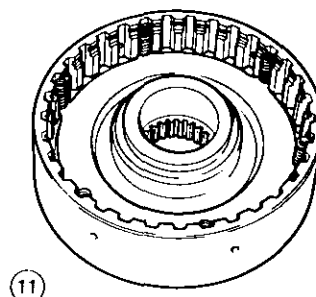
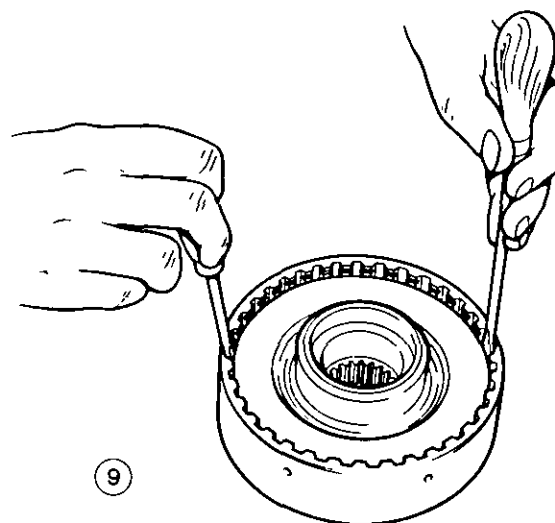
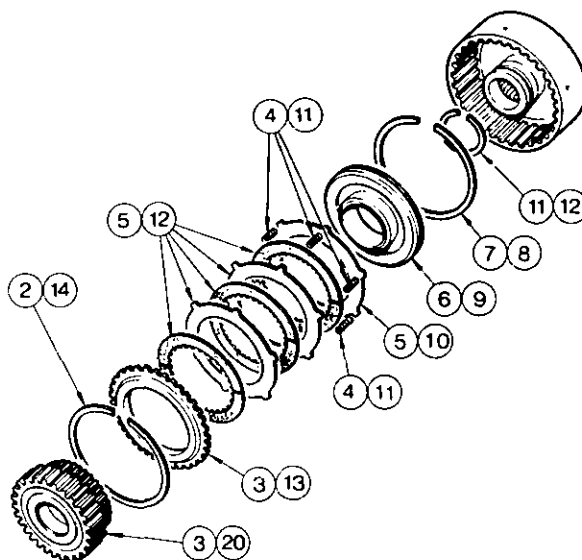
Working Length 12,7 mm (0.50 in).

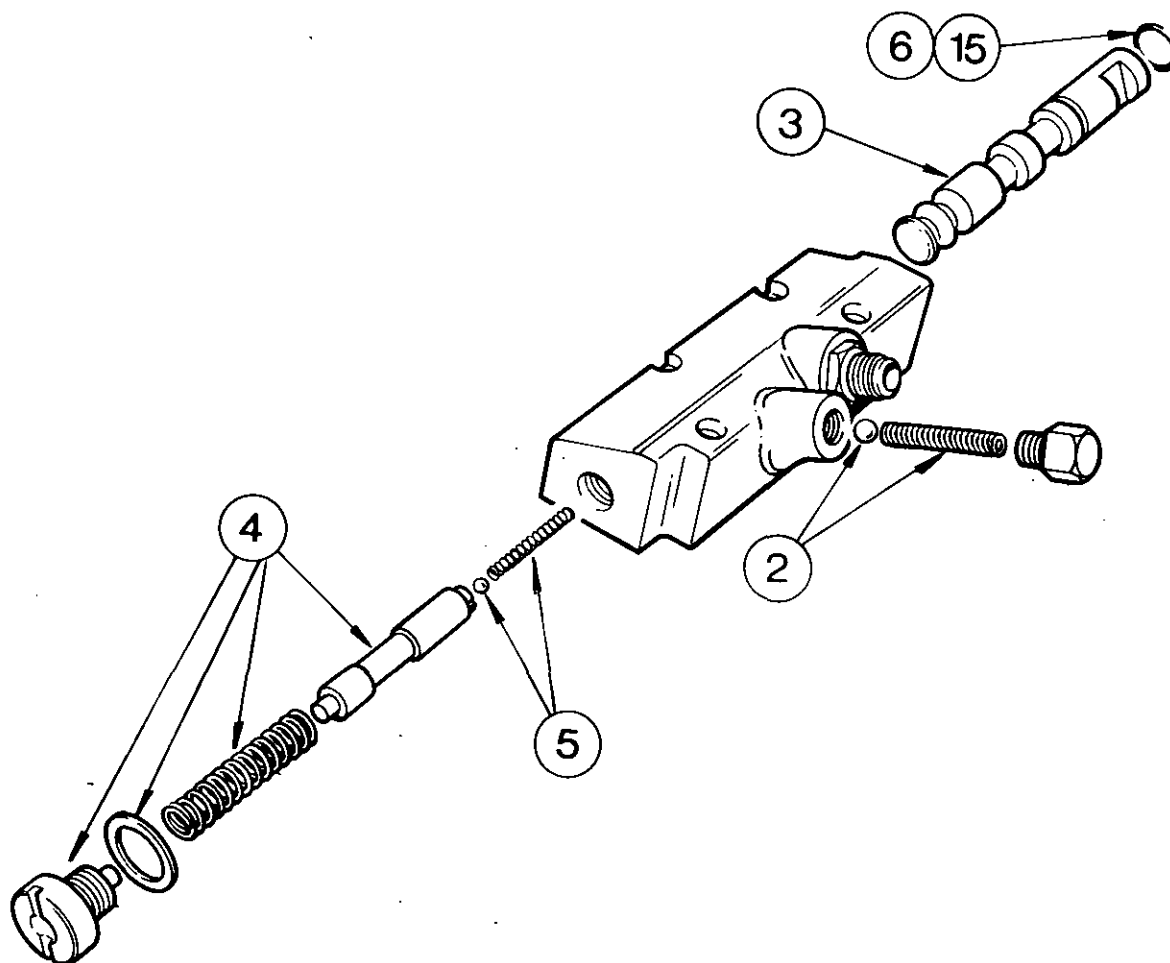
Load at Working Length 2,98 to 3,64 kg (6.57 to 8.03 lb).

Replace any worn or damaged components, as required.

Reassembly

8. If necessary, refit the piston ring.
9. Compressing the piston ring, carefully refit the piston into the housing.
10. Fit one interplate to the clutch housing, with the lugs on the interplate located in the housing splines immediately to the right of the six holes in the housing.
11. Refit the six springs, placing one spring onto each lug of the first interplate.
12. Refit the three friction plates and the remaining two interplates alternately, locating the lugs on each interplate one spline further to the right of one previously fitted.
13. Refit the retainer plate.
14. Refit the snap ring, and ensure it is located correctly.
15. Refit the Multi-Power clutch unit and the Main Input Shaft as stated in operation 5E-07-11.



MK II CONSTANT MESH MULTI-POWER TRANSMISSION**MULTI-POWER SPOOL VALVE****Servicing**

5E-12-16

Special Tools: See operation 5E-06-09.

Disassembly

1. Remove the p.t.o. input housing, p.t.o. input shaft, and spool valve, operation 5E-06-09, procedures 1 to 9.
2. Remove the plug, spring and ball.
3. Withdraw the large spool.
4. Remove the plug, washer, spring and spool.
5. Remove the small ball and spring from the spool.

Reassembly

6. Fit a new 'O' ring to the large spool.
7. Slide the spool into the spool block.
8. Refit the ball, spring and plug.
9. Refit the small ball and spring into the spool.
10. Refit the small spool, spring, new washer and plug.
11. Tighten the plug to 27,11 Nm (20lbf ft).
12. Refit the spool valve, p.t.o. input shaft housing and p.t.o. input shaft, operation 5E-06-10, procedures 31 to 39.

NOTE: Ensure that all parts are scrupulously clean and are lubricated with clean transmission oil.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION

TRANSMISSION CASE REMOVAL AND REPLACEMENT OR COMPLETE TRANSMISSION OVERHAUL 5E-13-17

Special Tools: MF 177 Seal Protector
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 218 A P.t.o. Drive Shaft Puller
 MF 218 A-2 Adaptor
 MF 255 B-1 Oil Seal Replacer
 MF 255 B-2 Cone
 MF 256 A Oil Seal Replacer
 MF 270 Rail Trolley
 MF 315 Needle Bearing Removal Tool
 MF 331 Needle Roller Bearing Refitting Tool
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands
 V.L. Churchill 50 ton Hydraulic Press
 (alternative to MF 200)
 55 mm x 25 mm (2 $\frac{1}{4}$ in x 1 in) dia
 Mild Steel Dummy Shaft

Disassembly

1. Remove the selector rail mechanism, operation 5E-01-06.
2. Remove the gearbox epicyclic unit, operation 5E-03-08.
3. Disassemble the transmission epicyclic unit, operation 5E-04-08.
4. Remove the clutch release mechanism, operation 5E-02-07.
5. Remove and dismantle the input housing and p.t.o. shaft operation 5E-06-10.
6. Remove the main input shaft and multi-power clutch unit, operation 5E-07-11.
7. Remove the p.t.o. driveshaft front bearing, operation 5E-05-09.
8. Remove first, reverse, second, third gears and mainshaft, operation 5E-08-12.
9. Remove the layshaft and gears and p.t.o. shaft and gears operation 5E-09-13.
10. Remove the reverse gear cluster, operation 5E-10-14.
11. Dismantle the Multi-Power Clutch Unit, operation 5E-11-15.
12. Dismantle the Multi-Power Spool Valve, operation 5E-12-16.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings, needle rollers, gear selector forks, gear selector couplers, multi-power clutch plates and spool valve.

All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webs. Maximum acceptable clearance is 0.003 mm (0.0013 in). Where the clearance between bearing and bore exceeds this figure, recommended sealant 'C' may be used to refit the bearings into the transmission case. After inspection, lubricate bearings with clean transmission oil.

Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tabwasher must be fitted.

Reassembly

13. Reverse procedures 1 to 12 except:
 - (a) Use only petroleum jelly for reassembly purposes—Never Grease.
 - (b) Ensure all snap rings are correctly located in their grooves.
 - (c) Lightly oil all bushes, bearings and splines prior to reassembly.

MK II CONSTANT MESH MULTI-POWER TRANSMISSION

HIGH/LOW AND GEAR SHIFT LEVERS

Removal and Refitment

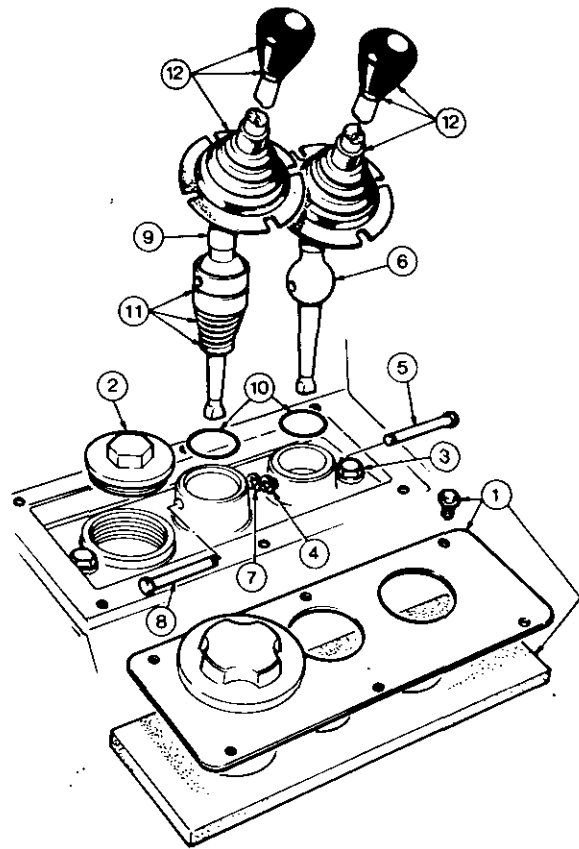
5E-14-18

Removal

1. Remove the bolts, plate and sound proofing pad.
 2. Remove the filler plug.
 3. Remove the bolt.
 4. Remove the clip.
 5. Remove the pin.
 6. Withdraw the lever.
 7. Remove the clip.
 8. Remove the pin, taking care not to drop it into the gearbox.
 9. Withdraw the lever and cup assembly.
 10. Discard the 'O' rings.
 11. If necessary, press the spring retaining washer towards the spring, slide it sideways and remove it. This will release the spring and support cup.
- WARNING: When removing the spring retaining washer, care must be taken to prevent the spring from flying out and causing possible injury and damage.**
12. If necessary, remove the knobs nuts and dust caps.

Refitment

13. Reverse procedures 1 to 12, except:
 - (a) Fit new 'O' rings.
 - (b) Ensure that the gearlevers locate correctly in the gear lever engagement dogs.



MK II 8 SPEED SYNCHROMESH TRANSMISSION**MK II 8 SPEED SYNCHROMESH TRANSMISSION****Part 5—Section F**

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MK II 8 SPEED SYNCHROMESH TRANSMISSION

GENERAL

The transmission has four forward gears and one reverse gear which are doubled by a planetary unit to give eight forward and two reverse gears.

All gear teeth are of involute, straight cut spur type, designed to run in constant mesh, except for first gear which is now introduced with an increased width gears of constant mesh design, with a helical gear tooth form.

Where movement of the gears is required to change ratio, synchromesh engagement is used on the top two gears, which allows a heavy load to be accelerated in a lower gear and then allow the higher gears to be engaged on the move; it also allows a change down from top gear for hill climbing with a heavy load, or to increase engine braking down hill.

Thus the 8 speed synchromesh gearbox has eight speeds of the same ratio as on the non-synchromesh 8 speed gearbox but with synchromesh on 3rd, 4th, 7th and 8th gears.

Principle of Operation

Refer to figures 1, 2, 3 and 4.

The Transmission

The tractor engine drives a clutch with divided drive, each plate being splined onto a separate gearbox shaft.

Drive is transmitted to:

- The p.t.o. shaft (14), which is hollow and has gear teeth on its rear end.
- The main drive shaft (17), (which runs inside the p.t.o. shaft) has gear teeth on its rear end and is spigot located in the front end of the mainshaft.

Layshaft and P.t.o. Shaft

Rotation of the p.t.o. input shaft (14) drives the p.t.o. constant mesh gear (109) which is splined onto the p.t.o. drive shaft (82). When the main input shaft (17) rotates, the drive is transmitted to the constant mesh gear (111), which is splined onto the layshaft (85). The layshaft, which is hollow and externally splined, has 14 gear teeth machined on its outside diameter to provide the first gear layshaft pinion.

It is supported by a roller bearing (84) located in the centre web and a ball race (86) located in the rear wall of the transmission case. Mounted on the layshaft (85) are three other gears, which are second (23 teeth) (112), fourth (33 teeth) (114) and third (28 teeth) (115) gears respectively. None of the layshaft gears are free to move along the shaft, being retained, either by abutment with other gears, bearings or snap rings.

Mainshaft

The mainshaft (62) has 31 shallow splines on its external surface, has gear teeth at its rear end and has a bore at its front end to accept the spigot on the main input shaft. It is supported by a roller bearing (95) located in the centre web and a ball race (59) located in the rear wall of the transmission case.

Mounted on the mainshaft are five sets of gears, which are in constant mesh with the layshaft gears, and when viewed from the front of the gearbox these gears are, second (46 teeth) (93), first (42 teeth) (97), reverse (44 teeth) (100), fourth (36 teeth) (106) and third (41 teeth) (105).

The mainshaft gears are mounted on bushes which run on a sleeve, splined onto the mainshaft. When a gear is required, the synchromesh sliding coupler (99 and 103) which is splined to the mainshaft, is slid along by the selector to engage with dog teeth formed on the gear. This has the effect of locking the gearwheel to the shaft. The sliding couplers are used to engage and disengage, first, reverse, fourth and third gears whilst second gear is moved into and out of mesh by a selector fork sliding the gear on the mainshaft splines.

The synchromesh cone assembly (refer to Fig. 4) consists of two locking bands (4 and 11), two stops (5 and 12) and a synchronizing ring (6 and 10). These are held in location on the respective gears by a circlip (7 and 9).

Reverse Gear Cluster

The compound gear cluster (122) has 14/21 teeth respectively. The 21 tooth portion of the gear is in constant mesh with the fourth gear pinion (33 teeth) (114) on the layshaft. The 14 tooth portion is in constant mesh with the reverse gear pinion (44 teeth) (100) on the mainshaft.

Reverse gear engagement is made by a dog clutch (sliding coupler) (99), engaging with the reverse gear pinion (100) on the mainshaft. The reverse gear, acting as an idler gear between the layshaft and the mainshaft drive, reverses the rotation of the mainshaft, epicyclic unit and the final drive.

Epicyclic Unit

The basic four forward and one reverse gears are doubled by the epicyclic unit (Heavy Duty) mounted on the rear end of the transmission case. The epicyclic unit comprises a ring gear (66), inside which run three planetary pinions mounted in a carrier (70). The planetary pinions are driven by gear teeth on the end of the mainshaft (62) which acts as the sun gear.

When the mainshaft rotates, the planetary pinions also rotate, but being meshed with the teeth on the inside of the ring gear the rotational speed of the carrier is reduced by a ratio of 4:1.

To transmit the drive from the epicyclic unit to the rear axle, a driveshaft is connected by the coupler (81), either directly to the gearbox mainshaft (HIGH range), or to the planetary pinion carrier (70) (LOW range).

Movement of the dual range selector lever actuates the rod attached to the selector fork (50) which moves the coupler (81) into, or out of mesh with either the end of the mainshaft (62) or the planetary pinion carrier (70).

Between the two engaged (HIGH or LOW range) positions, there is a neutral position, where the coupler splines are disengaged from both the mainshaft and the planetary pinion carrier.

MK II 8 SPEED SYNCHROMESH TRANSMISSION

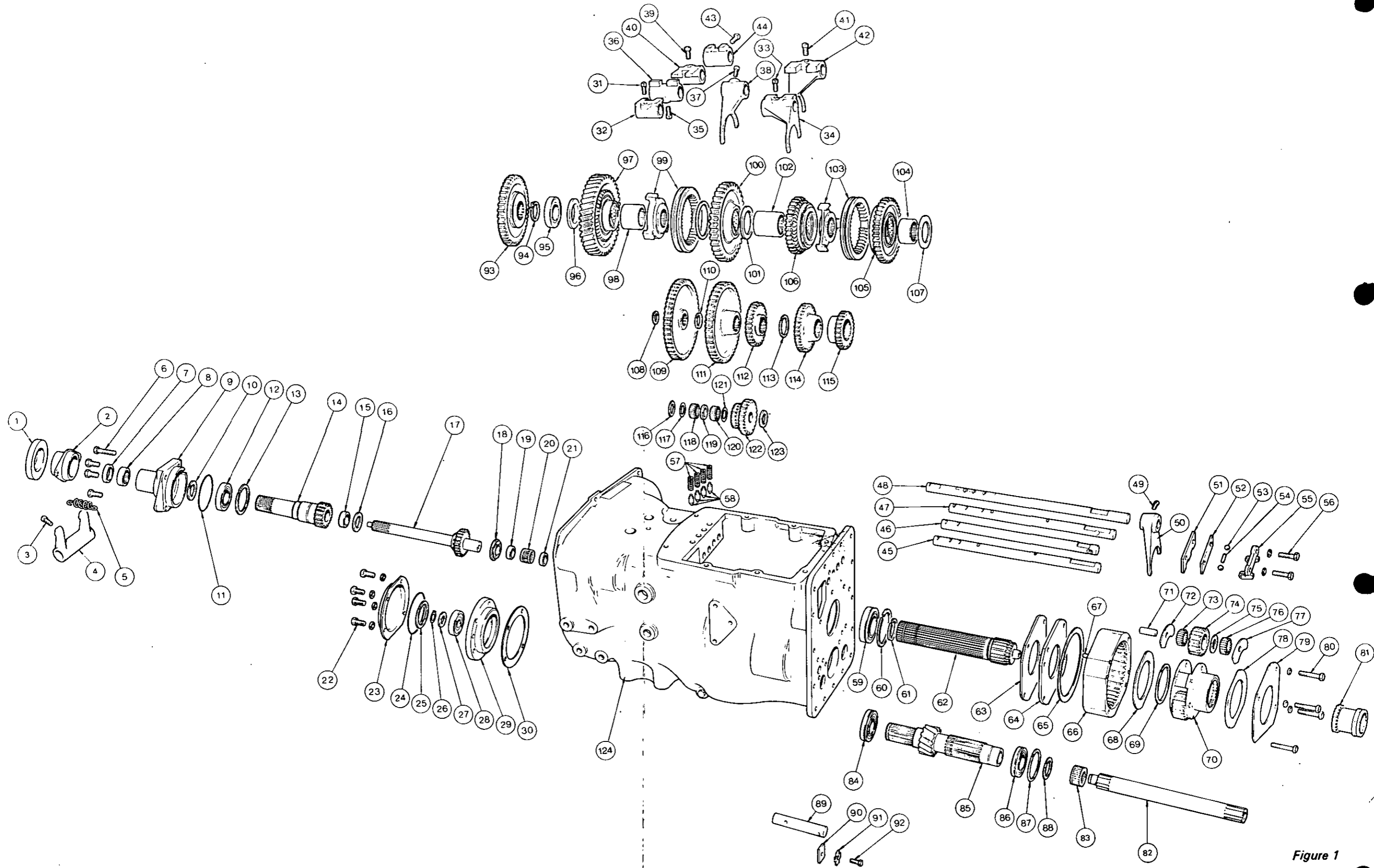


Figure 1

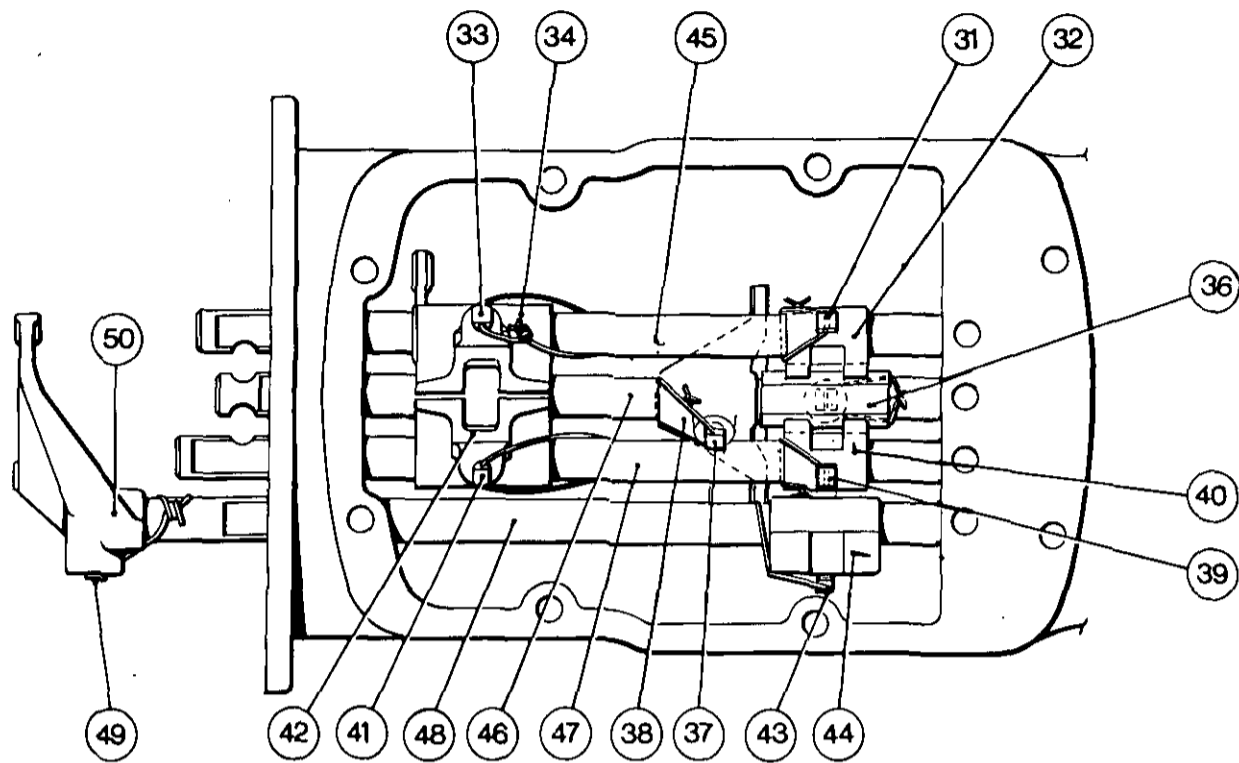


Figure 3

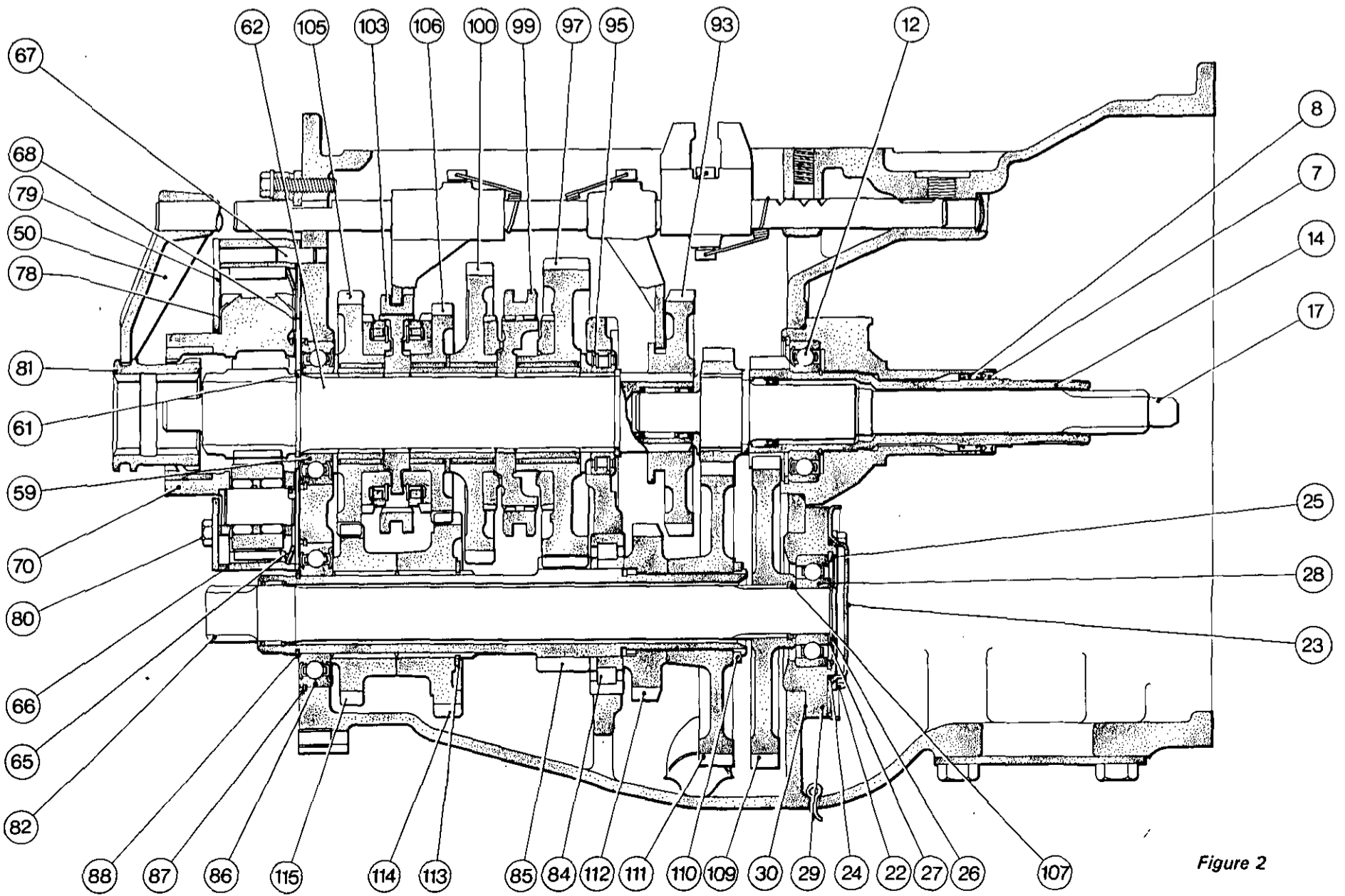
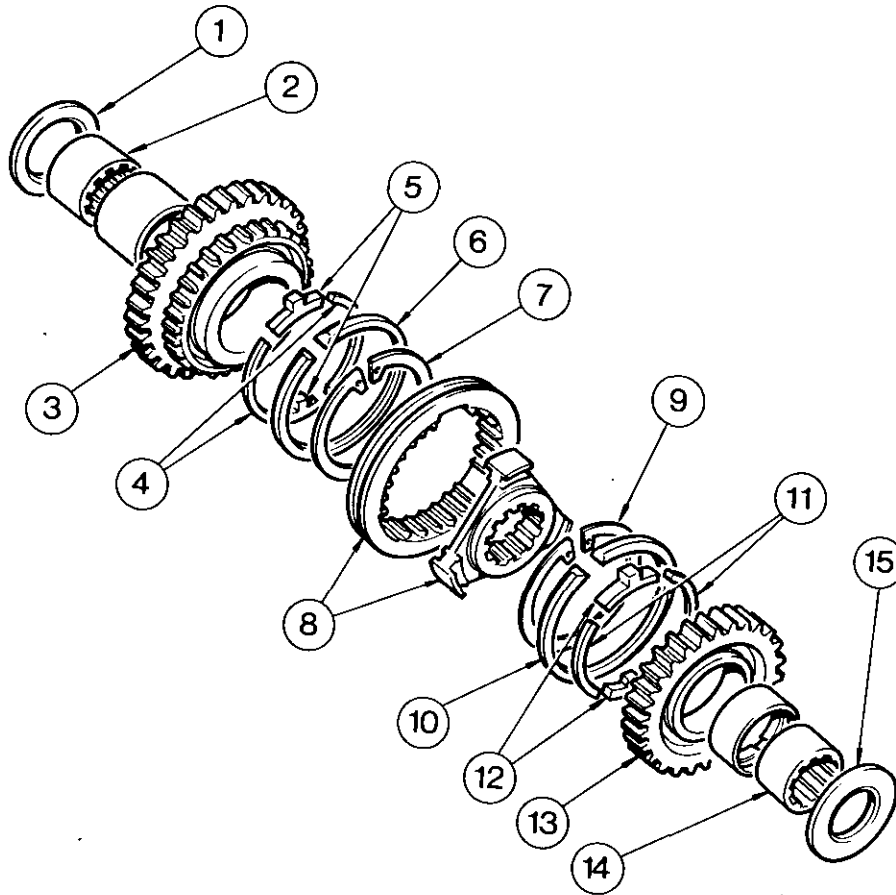


Figure 2

MK II 8 SPEED SYNCHROMESH TRANSMISSION

KEY TO FIGURES 1, 2 and 3

- | | |
|--|--|
| 1 Clutch release bearing | 67 Epicyclic ring gear dowel |
| 2 Clutch release bearing carrier | 68 Epicyclic front thrust ring |
| 3 Clutch release fork locking peg | 69 Epicyclic planetary pinion shaft securing circlip |
| 4 Clutch release fork | 70 Epicyclic planetary pinion carrier |
| 5 Clutch release bearing return spring | 71 Epicyclic planetary pinion shaft |
| 6 Input housing securing bolts | 72 Planetary pinion front thrust washer |
| 7 P.t.o. input shaft seal | 73 Planetary front roller set |
| 8 P.t.o. input shaft needle roller bearing | 74 Planetary pinion |
| 9 Input housing | 75 Planetary roller spacer |
| 10 P.t.o. input shaft bearing securing external circlip | 76 Planetary rear roller set |
| 11 Input housing 'O' ring | 77 Planetary pinion rear thrust washer |
| 12 P.t.o. input shaft bearing | 78 Epicyclic rear thrust ring |
| 13 P.t.o. input shaft securing internal circlip | 79 Epicyclic cover plate |
| 14 P.t.o. input shaft | 80 Epicyclic securing bolts |
| 15 Main drive input shaft seal | 81 High/Low shift coupler |
| 16 Main drive input shaft front bush | 82 P.t.o. drive shaft |
| 17 Main drive input shaft | 83 Layshaft rear needle roller bearing |
| 18 Main drive input shaft rear bush | 84 Layshaft front bearing |
| 19 Main shaft needle bearing front spacer | 85 Layshaft |
| 20 Main shaft needle roller bearing | 86 Layshaft rear bearing |
| 21 Main shaft needle roller bearing rear spacer | 87 Layshaft rear bearing location snap ring |
| 22 P.t.o. front bearing cover securing bolts | 88 Layshaft rear bearing securing snap ring |
| 23 P.t.o. front bearing cover | 89 Reverse gear cluster |
| 24 P.t.o. front bearing cover 'O' ring | 90 Reverse gear cluster shaft retaining bolt |
| 25 P.t.o. front bearing securing circlip | 91 Tab washer |
| 26 P.t.o. shaft securing circlip | 92 Reverse gear cluster shaft securing bolt |
| 27 P.t.o. shaft spacer washer | 93 Second gear (Mainshaft) |
| 28 P.t.o. shaft front bearing | 94 Mainshaft front bearing front securing snap ring |
| 29 P.t.o. front bearing housing | 95 Mainshaft front bearing |
| 30 P.t.o. front bearing housing gasket | 96 Mainshaft front bearing thrust washer |
| 31 Third and fourth gear lever engagement dog locking peg | 97 First gear (mainshaft) |
| 32 Third and fourth gear lever engagement dog | 98 Splined sleeve (first gear) |
| 33 Third and fourth selector fork locking peg | 99 First/Reverse sliding coupler |
| 34 Third and fourth selector fork | 100 Reverse gear (mainshaft) |
| 35 Second gear lever engagement dog locking peg | 101 Thrust washer—reverse/fourth gear |
| 36 Second gear lever engagement dog | 102 Splined sleeve—reverse/fourth gear |
| 37 Second gear selector fork locking peg | 103 3rd/4th sliding coupler |
| 33 Second selector fork | 104 Splined sleeve—third gear |
| 39 First and reverse gear lever engagement dog locking peg | 105 Third gear (mainshaft) |
| 40 First and reverse gear lever engagement dog | 106 Fourth gear (mainshaft) |
| 41 First and reverse selector fork locking peg | 107 Mainshaft rear bearing thrust washer |
| 42 First and reverse selector fork | 108 P.t.o. constant mesh gear location circlip |
| 43 High/Low gear lever engagement dog locking peg | 109 P.t.o. constant mesh gear |
| 44 High/Low gear lever engagement dog | 110 Main drive constant mesh gear securing circlip |
| 45 Third and fourth selector rail | 111 Main drive constant mesh gear |
| 46 Second selector rail | 112 Second gear (layshaft) |
| 47 First and reverse selector rail | 113 Fourth gear (layshaft) securing snap ring |
| 48 High/Low selector rail | 114 Fourth gear (layshaft) |
| 49 High/Low selector fork locking peg | 115 Third gear (layshaft) |
| 50 High/Low selector fork | 116 Reverse gear front thrust washer |
| 51 Interlock stop plate | 117 Needle roller front retaining ring |
| 52 Interlock plain plate | 118 Front roller set |
| 53 Interlock ball | 119 Needle roller spacer |
| 54 Interlock cross peg | 120 Rear needle roller set |
| 55 Interlock ball carrier | 121 Needle roller rear retaining ring |
| 56 Interlock mechanism securing bolts | 122 Reverse gear cluster |
| 57 Detent springs | 123 Reverse gear rear thrust washer |
| 58 Detent plungers | 124 Gearbox case |
| 59 Mainshaft rear bearing | |
| 60 Mainshaft bearing locating snap ring | |
| 61 Mainshaft rear bearing rear securing snap ring | |
| 62 Mainshaft | |
| 63 Epicyclic shim | |
| 64 Epicyclic front plate | |
| 65 Epicyclic belleville spring disc | |
| 66 Epicyclic ring gear | |

MK II 8 SPEED SYNCHROMESH TRANSMISSION**KEY TO FIG. 4**

1. Rear thrust washer
2. Splined sleeve
3. 3rd gear (Mainshaft)
4. Locking bands
5. Stops
6. Synchronizing ring
7. Circlip
8. Sliding coupler
9. Circlip
10. Synchronizing ring
11. Locking bands
12. Stops
13. 4th gear (mainshaft)
14. Splined sleeve
15. Thrust washer—4th to reverse gear

MK II 8 SPEED SYNCHROMESH TRANSMISSION

SELECTOR RAIL MECHANISM

Removal and Refitment

5F-01-07

Special Tools: 270 Rail Trolley
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

NOTE: Beware of the sharp edges around the top of the gearbox case.

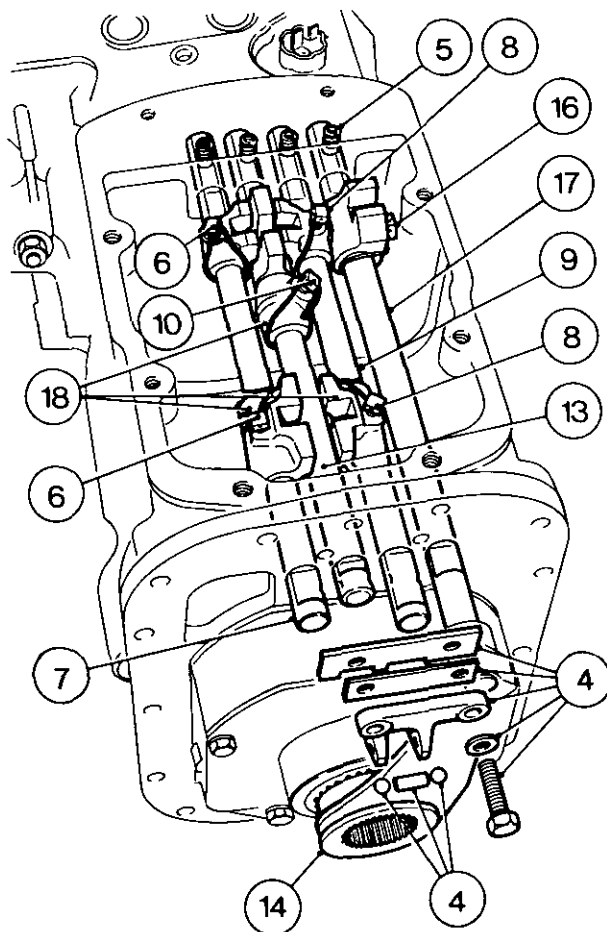
1. Split the tractor between the spacer and the centre housing and remove the transmission, Part 3A.
2. Remove the gearbox top cover and gasket, and spacer and gasket.
3. Release the locking wires.
4. Remove the bolts, fork, balls, peg, stop plate and plain plate.
5. Lift out the springs and plungers.
6. Remove the locking pegs.
7. Slide the rail rearwards out of the housing.

NOTE: When removing the selector rails, retain the gear lever engagement dogs.

8. Remove the locking pegs.
9. Slide the rail rearwards out of the housing.
10. Remove the locking peg.
11. Rotate the second gear selector rail through 180°.
12. Remove the second gear engagement dog locking peg.
13. Slide the rail rearwards out of the housing.
14. Slide the High/Low rail rearwards and remove the coupling.
15. Rotate the High/Low rail through 90°.
16. Remove the locking peg.
17. Slide the rail rearwards out of the housing.
18. Remove the selector forks from the gearbox.

Refitment

19. Reverse procedures 1 to 18, except:
 - (a) Apply a few drops of oil to the selector rails before refitment.
 - (b) Tighten the locking mechanism retaining bolts to a torque of 47 Nm (35 lbf ft).
 - (c) On completion of the refitting procedure, place all the gear lever engagement-dogs in the neutral position.



MK II 8 SPEED SYNCHROMESH TRANSMISSION**GEARBOX EPICYCLIC****Removal and Refitment**

5F-02-08

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

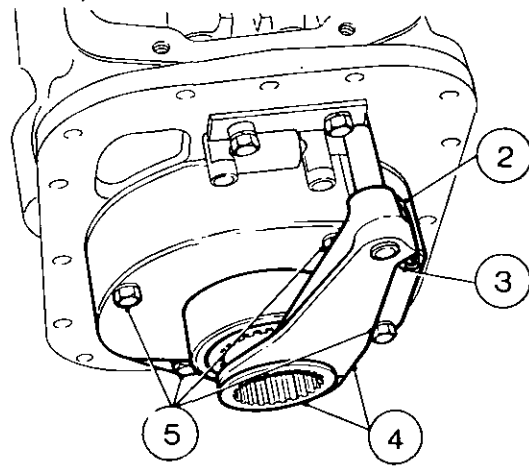
MF 365/8 Stands

Removal

1. Split the tractor between the spacer housing, and remove the transmission, Part 3A.
2. Remove the locking wire.
3. Remove the locking peg.
4. Remove the selector fork and coupling.
5. Remove the bolts.
6. Remove the complete assembly.

Refitment

7. Reverse the procedures 1 to 6, except:
 - (a) Ensure that the front and rear thrust rings are correctly located before refitment.
 - (b) Ensure that the epicyclic dowels are correctly located in the gearbox casing.
 - (c) Locate the cover plate with the cut out in the bottom left hand corner.
 - (d) Do not fit a lock washer to the lower left hand retaining bolt.
 - (e) Tighten the retaining bolts progressively and evenly to a torque of 47 Nm (35 lbf ft).

**GEARBOX EPICYCLIC****Servicing**

5F-03-08

Special Tool: See operation 5F-02-08

Disassembly

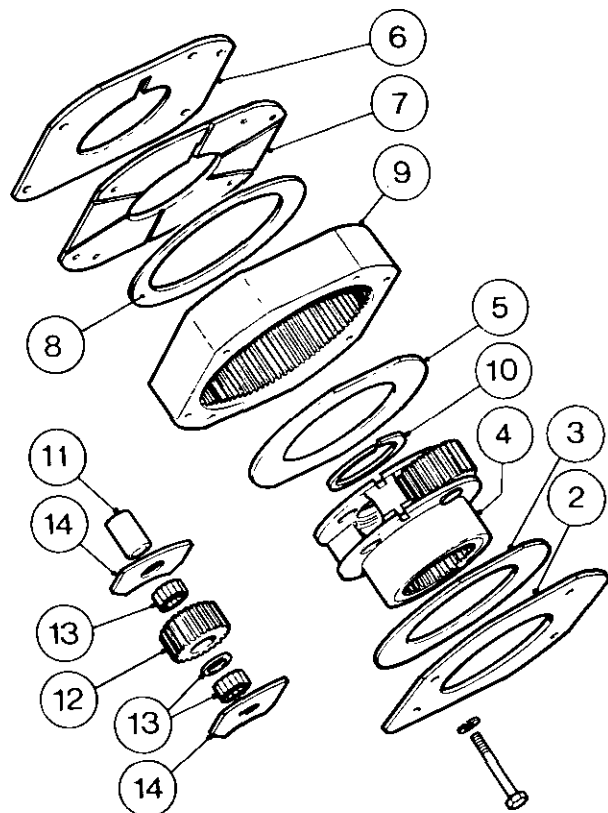
1. Remove the gearbox epicyclic, operation 5F-02-08.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. Remove the spring Belleville disc.
9. If necessary, remove the dowel pins from the planetary ring gear.
10. Remove the external snap ring.
11. Gently tap out the three pinion shafts towards the front.
12. Remove the planetary pinions.
13. Remove the two sets of rollers and spacer from each pinion.
14. Remove the wear plates from each side of each pinion.

Reassembly

15. Reverse procedures 1 to 14, except:
 - (a) When replacing the rollers in the pinions, a smear of petroleum jelly (not grease) will help retain them. Do not omit the spacer from between the two runs of rollers. Each run consists of 16 rollers.
 - (b) Ensure the Belleville spring disc is located correctly in the epicyclic ring gear with the concave face rearwards.
 - (c) The front plate and the cover plate must be positioned with the oil grooves towards the pinion carrier.
 - (d) Ensure that the pinion wear plates are refitted with the flats positioned innermost to the centre of the pinion carrier.
 - (e) Ensure the gap of snap ring is located midway between the planetary pinion shafts.

(f) Always fit the same thickness of shims as those removed.

(g) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.



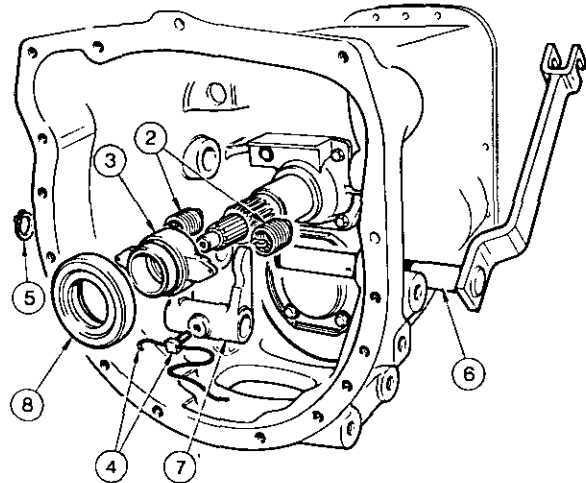
MK II 8 SPEED SYNCHROMESH TRANSMISSION**CLUTCH RELEASE MECHANISM****Removal and Refitment**

5F-04-09

Special Tool: 270 Rail Trolley

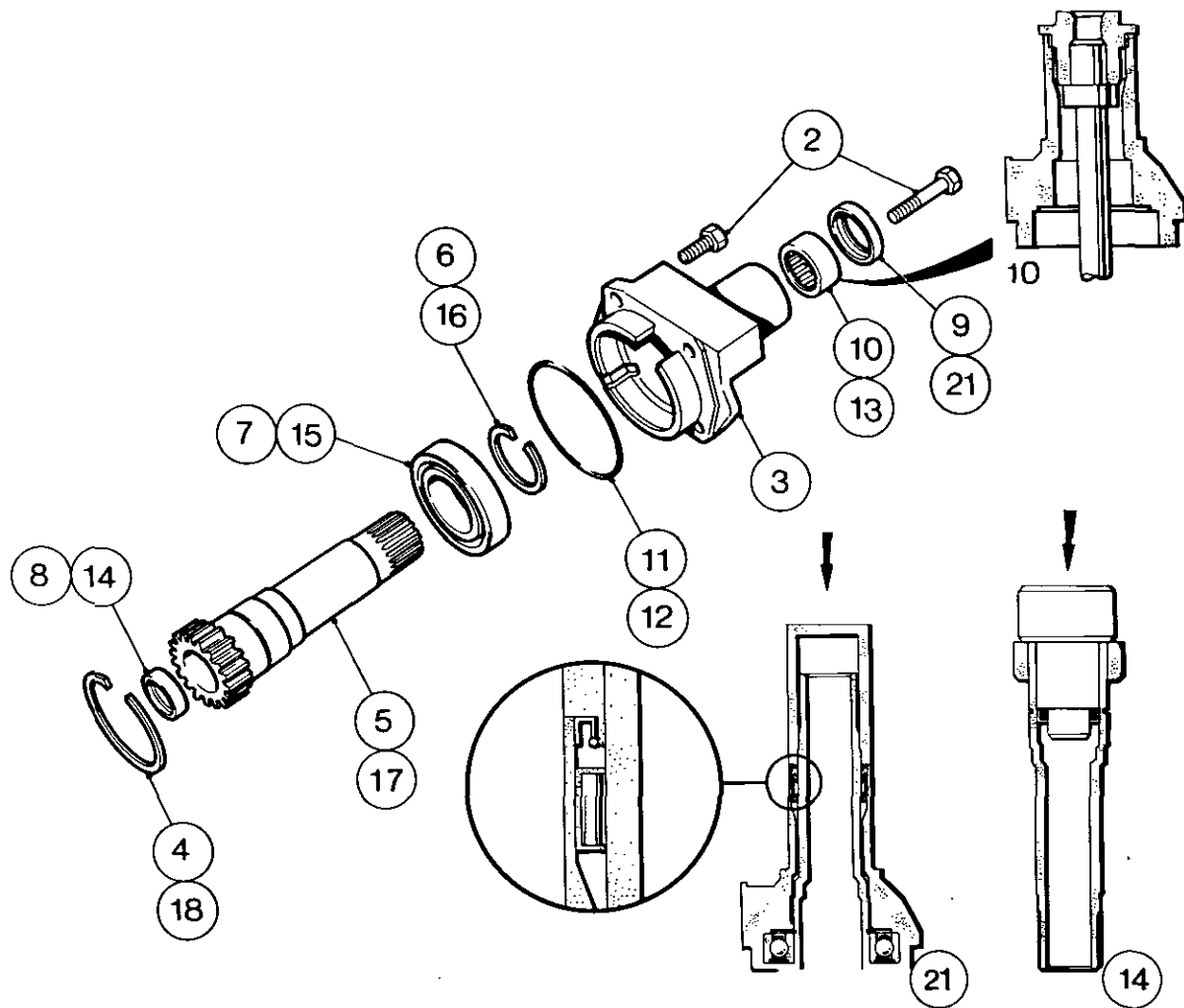
Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the two springs.
3. Slide the carrier and release bearing off the input housing.
4. Remove the locking wire and locking peg.
5. Remove the circlip.
6. Remove the shaft, but to obtain sufficient clearance on MF 550 and MF 560 tractors, the left hand front cab mounting bracket must be removed, and on all versions the fuel tank must be removed, Part 4C.
7. Remove the clutch release fork.
8. Press the release bearing off the carrier.

**Refitment**

9. Reverse procedures 1 to 8, except:
 - (a) Lightly lubricate the input shaft splines and the release bearing carrier bore, with approved grease Mobilplex 47. Do not fill splines with excess grease.
 - (b) Ensure that the locking peg locates in the hole in the shaft.

MK II 8 SPEED SYNCHROMESH TRANSMISSION



INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Removal and Refitment

5F-05-10

Special Tools: 270 Rail Trolley

MF 177 Seal Protector

MF 255 B Oil Seal Replacer

MF 255 B-2 Cone

MF 256 A Oil Seal Replacer

MF 315 Needle Roller Bearing

Removal Tool

MF 331 Needle Roller Bearing

Refitting Tool

Removal

1. Remove the clutch release mechanism, operation 5F-04-09.
2. Remove the four bolts.
3. Withdraw the input housing complete with the p.t.o. input shaft.
4. Remove the large internal circlip.
5. Push the p.t.o. input shaft complete with bearing rearwards out of the housing.
6. If necessary, remove the circlip.
7. If necessary press the bearing off.
8. Lever the seal out.
9. Lever the seal out.
10. Using MF 315, remove the needle roller bearing.
11. Remove the 'O' ring (p.t.o. input shaft housing).

Refitment

12. Fit a new 'O' ring (p.t.o. input shaft).
13. Using MF 331, replace the needle roller bearing.
14. Using MF 256 A, fit a new seal, with the toe of the seal facing the tool.
15. Refit the bearing with the shield towards the gear teeth.
16. Refit the circlip (check that it is properly seated).
17. Refit the p.t.o. input shaft and bearing into the input housing.
18. Refit the circlip (check that it is properly seated).
19. Place the cone adaptor MF 255B-2 onto seal replacer MF 255 B.
20. Place the seal over the cone and onto the tool with the seal toe facing away from the tool and remove the cone.
21. Place the tool over the p.t.o. input shaft and tap the seal into place.
22. Place the MF 177 over the splines of the main input shaft.
23. Reverse procedures 1 to 3, except:
 - (a) Use petroleum jelly (not grease) to lubricate all seals and the needle roller bearing when refitting.
 - (b) Lightly coat the bolt threads in recommended sealant 'B' when refitting, and tighten the bolts to a torque of 60 Nm (45 lbf ft).

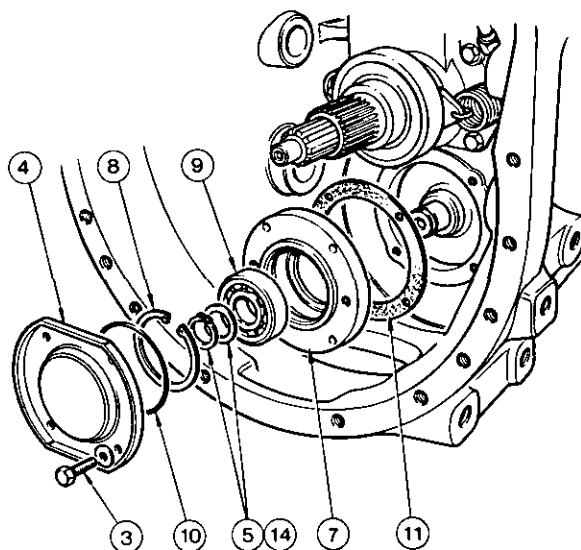
MK II 8 SPEED SYNCHROMESH TRANSMISSION

P.T.O. DRIVESHAFT FRONT BEARING**Removal and Refitment** 5F-06-11

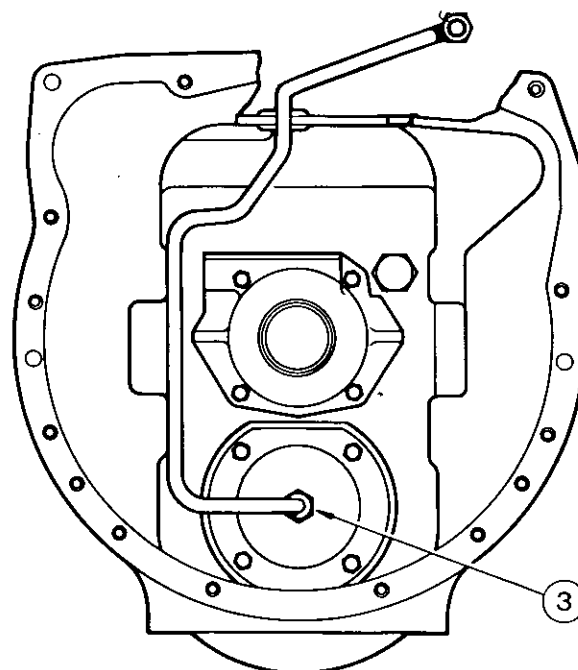
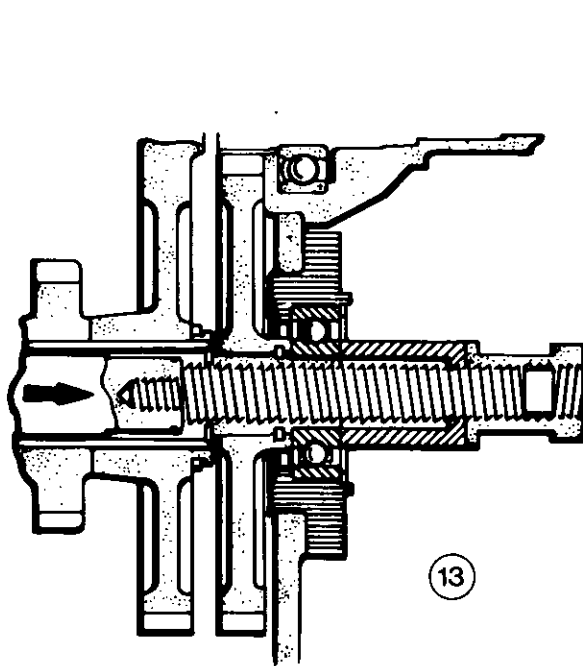
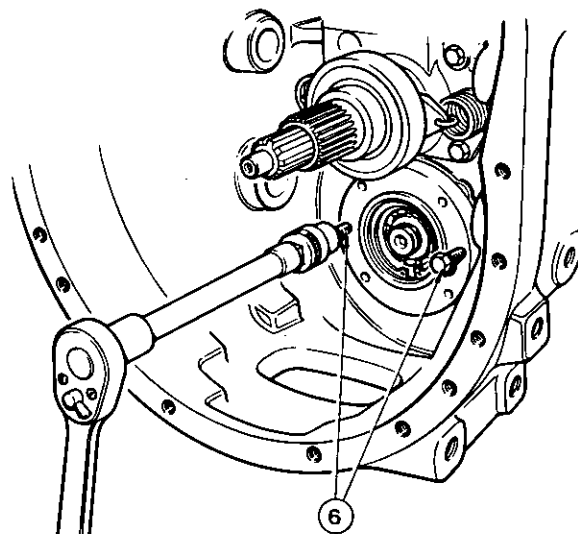
Special Tools: 270 Rail Trolley
MF 218 A P.t.o. Drive Shaft Puller
MF 218 A-2 Adaptor

Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the clutch cross shaft, operation 5F-04-09, procedures 2 to 6.
3. On l.p.t.o. versions, remove the pipe, and then on all versions remove the four bolts and washers.
4. Remove the plate.
5. Remove the external circlip and washers.
6. Screw two $\frac{3}{8}$ UNC \times 75 mm (3 in) bolts into the bearing housing and tighten them evenly.
7. Remove the housing.
8. Remove the circlip.
9. Press out the bearing.
10. Discard the 'O' ring.
11. Discard the gasket.

**Refitment**

12. Reverse procedures 8 to 11, except:
 - (a) Fit a new 'O' ring, gasket and circlip.
 - (b) Coat the gasket with recommended sealant 'A'.
13. Using MF 218 A and MF 218 A-2, refit the bearing and housing assembly on the front end of the p.t.o. drive shaft ensuring that the splines on the shaft locate in those in the p.t.o. constant mesh gear.
14. Fit a new circlip and the washer.
15. Reverse procedures 1 to 4, except:
 - (a) Lightly coat the securing bolt threads in recommended sealant 'B'.
 - (b) Tighten the bolts to a torque of 60 Nm (45 lbf ft).



MK II 8 SPEED SYNCHROMESH TRANSMISSION**MAIN INPUT SHAFT****Removal and Refitment**

5F-07-12

Special Tools: 270 Rail Trolley

MF 177 Seal Protector

MF 218 A P.t.o. Drive Shaft Puller

MF 218 A-2 Adaptor

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

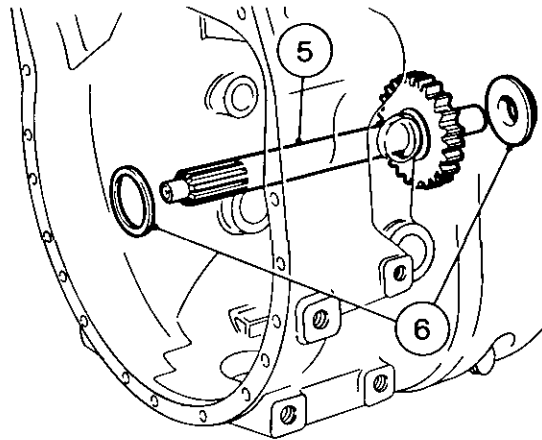
MF 365/8 Stands

Removal

1. Split the tractor between the spacer housing and the centre housing, Part 3A.
2. Remove the input housing and p.t.o. input shaft, operation 5F-05-10, procedures 1 to 3.
3. Remove the p.t.o. drive shaft front bearing, operation 5F-06-11.
4. Withdraw the p.t.o. drive shaft rearwards, this will allow the p.t.o. constant mesh gear to drop into the bottom of the gearbox.
5. Remove the main input shaft, complete with the two thrust washers.
6. Remove the thrust washers.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the thrust washer, with oil grooves, is placed on the rear of the main input shaft, with the oil grooves facing the rear of the gearbox, and that it is lightly oiled.
 - (b) Before refitting the input housing and p.t.o. input shaft, place MF 177 over the splines of the main input shaft, to protect the seal.

**SECOND GEAR (MAINSHAFT)****Removal and Refitment**

5F-08-12

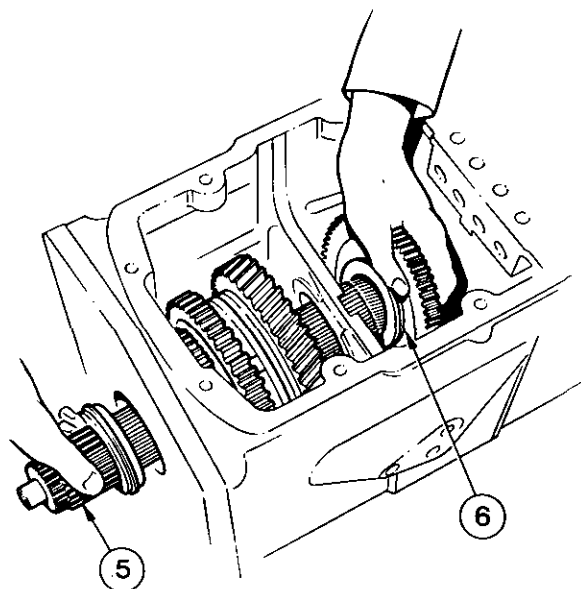
Special Tools: See operation 5F-07-12.

Removal

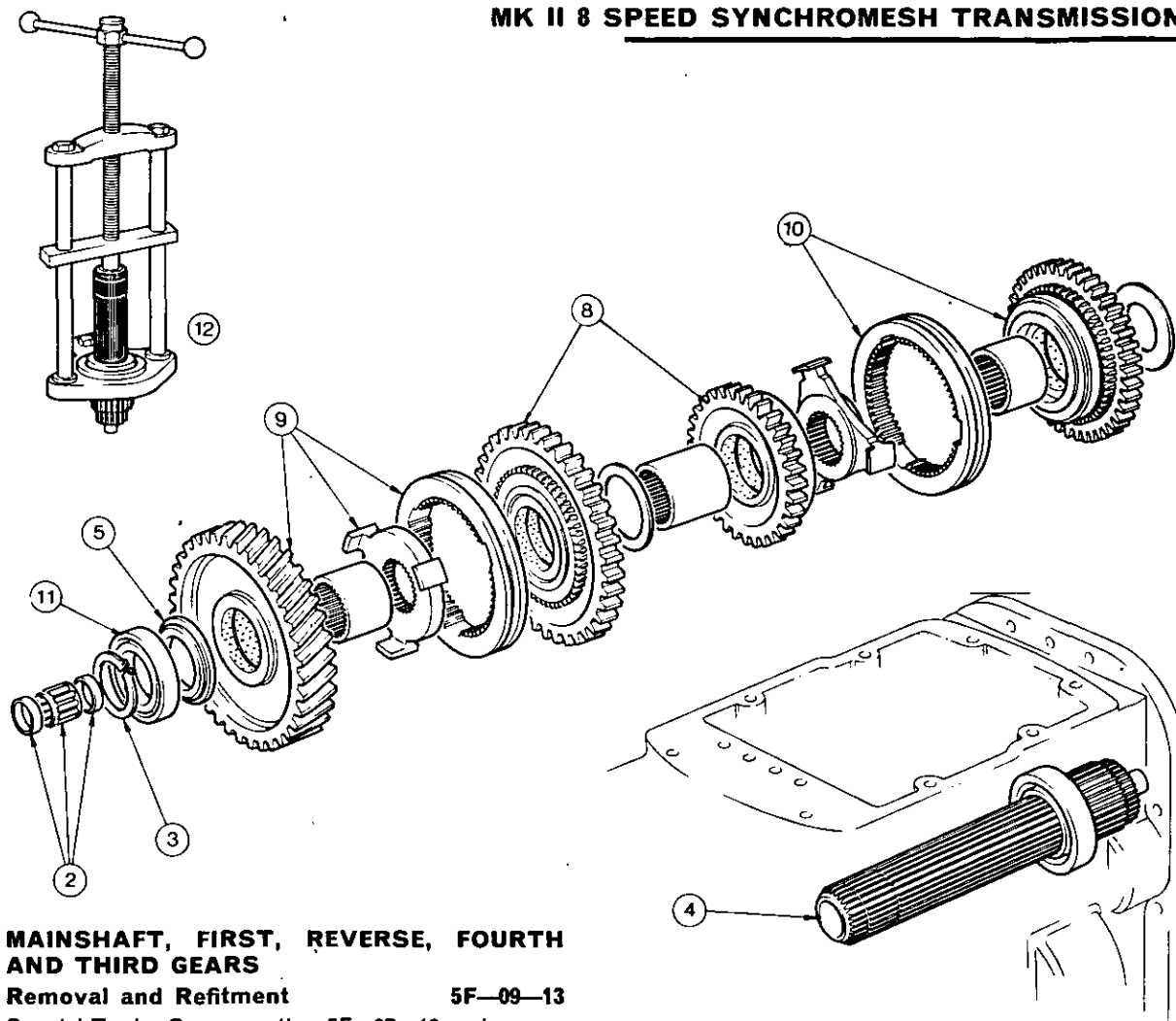
1. Remove the selector rail mechanism, operation 5F-01-07.
2. Remove the gearbox epicyclic unit, operation 5F-02-08.
3. Remove the main input shaft, operation 5F-07-12.
4. Release the snap ring and manoeuvre it towards the front of the mainshaft.
5. Using a soft faced drift, drive the mainshaft rearwards until it is clear of the second gear, and the rear bearing is no longer located in the gearbox casing.
6. Withdraw the second gear pinion.

Refitment

7. Reverse procedures 1 to 5.



MK II 8 SPEED SYNCHROMESH TRANSMISSION

**MAINSHAFT, FIRST, REVERSE, FOURTH AND THIRD GEARS****Removal and Refitment** 5F-09-13

Special Tools: See operation 5F-07-12 and
 MF 200 Hand Press
 MF 200-25 Adaptor

Removal

1. Remove the second gear pinion, operation 5F-08-12.
2. Remove the spigot needle roller bearing and two spacers.
3. Remove the snap ring from off the front of the mainshaft.
4. Withdraw the mainshaft rearwards out of the gearbox casing.
5. Remove the thrust washer from between the front bearing and first gear.
6. Engage sliding coupler with first gear.
7. Engage sliding coupler with third gear.
8. Withdraw reverse and fourth gears, twisting them slightly to clear the edges of the gearbox case.
9. Remove first gear and the sliding coupler.
10. Remove third gear and the sliding coupler.
11. If necessary, remove the bearing from the centre web of the gearbox casing.
12. If necessary, press the bearing of the FRONT end of the mainshaft using MF 200 and MF 200-25.
13. If necessary, remove the circlip from the bearing.

Refitment

14. Reverse procedures 1 to 12, except:
 - (a) Ensure that all snap rings are correctly located in their grooves.
 - (b) Ensure that the front thrust washer is correctly located with the shoulder towards the bearing.

MK II 8 SPEED SYNCHROMESH TRANSMISSION**SYNCHROMESH CONE ASSEMBLY****Servicing**

5F-10-14

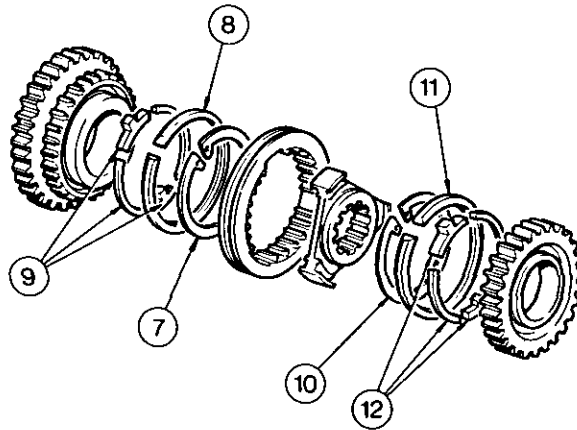
Special Tools: See operation 5F-09-13

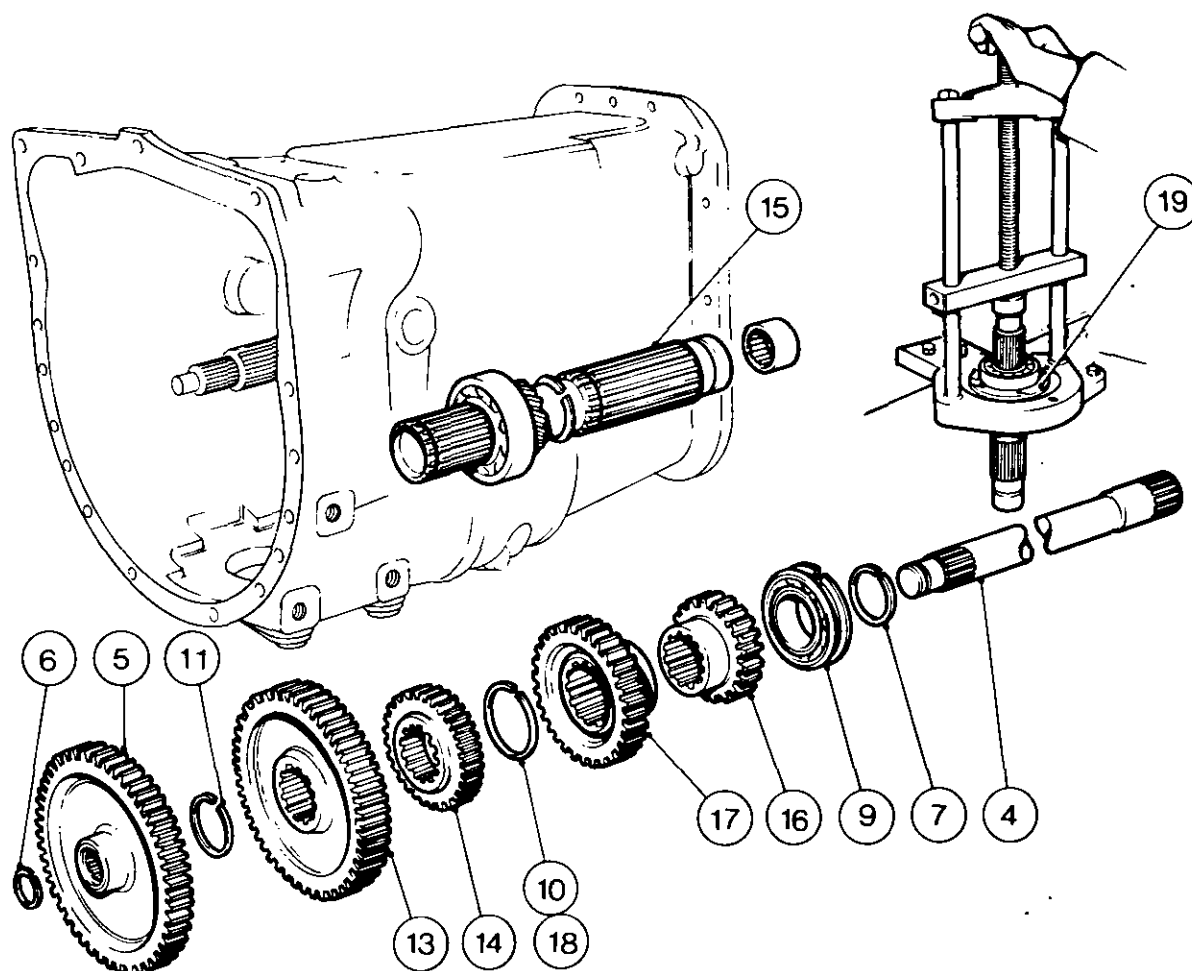
Disassembly

1. Split the tractor between the engine and transmission, and the transmission and centre housing, Part 3A.
2. Remove the gear selector mechanism, operation 5F-01-07.
3. Remove the gearbox epicyclic, operation 5F-02-08.
4. Remove the main input shaft, operation 5F-07-12.
5. Remove the second gear pinion, operation 5F-08-12, procedures 4 to 6.
6. Remove the main shaft and gears, operation 5F-09-13, procedures 2 to 10.
7. Remove the circlip from 3rd gear.
8. Remove the synchronizing ring.
9. Remove the locking bands and stops.
10. Remove the circlip from 4th gear.
11. Remove the synchronizing ring.
12. Remove the locking bands and stops.

Reassembly

13. Reverse procedures 1 to 12, except:
 - (a) Ensure all snap rings and circlips are correctly located in their grooves.
 - (b) Ensure the locking bands and the two stops (large and small) are correctly located inside the circumference of the synchronizing ring.



MK II 8 SPEED SYNCHROMESH TRANSMISSION**LAYSHAFT AND GEARS, P.T.O. SHAFT AND GEAR****Removal and Refitment 5F-11-15**

Special Tools: See operation 5F-07-12 and
MF 200 Hand Press
MF 200-25 Adaptor

Removal

1. Remove the main input shaft, operation 5F-07-12.
2. Remove the second gear pinion, operation 5F-08-12.
3. Remove the mainshaft and gears, operation 5F-09-13.
4. Withdraw the p.t.o. driveshaft rearwards out of the gearbox casing.
5. Withdraw the p.t.o. constant mesh gear.
6. Remove the small internal snap ring, (only if necessary).
7. Remove the snap ring from the rear of the layshaft.

8. Tap the layshaft forwards.
9. Remove the rear bearing.
10. Expose the snap ring, open it and slide it forwards onto the unsplined portion of the shaft.
11. Remove the snap ring from the front of the layshaft.
12. Relocate the front bearing in its web and tap the layshaft rearwards.
13. Remove the constant mesh gear.
14. Remove the second gear pinion.
15. Manoeuvre the layshaft forwards out of the gearbox.
16. Remove the third gear pinion.
17. Remove the fourth gear pinion.
18. Remove the snap ring.
19. Using MF 200 and MF 200-25, press the bearing off the front end of the layshaft.

Refitment

20. Reverse procedures 1 to 19, except; Ensure that all snap rings are correctly located in their grooves.

MK II 8 SPEED SYNCHROMESH TRANSMISSION**Reverse Gear Cluster****Removal and Refitment** 5F-12-16

Special Tools: See operation 5F-07-12 and
55×25 mm (2 $\frac{1}{4}$ ×1 in) dia. Mild Steel
Dummy Shaft

Removal

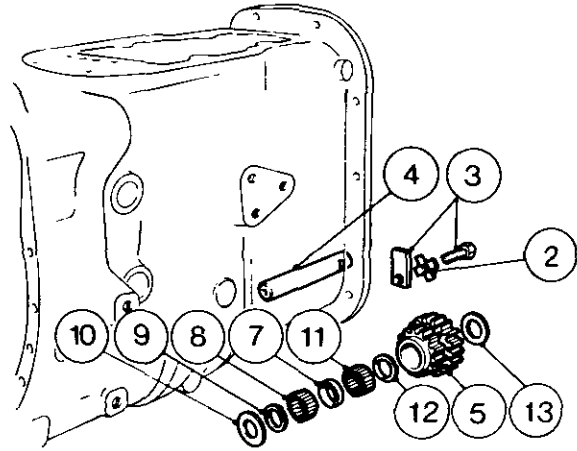
1. Remove the mainshaft and gears, operation 5F-09-13, procedures 1 to 10.
2. Release the tabwasher.
3. Remove the bolt and locating tab.
4. Slide the dummy shaft from the front of the reverse gear shaft towards the rear. This will push out the reverse gear shaft, and prevent the needle rollers from dropping into the transmission case.
5. Remove the idler gear cluster complete with all parts and the dummy shaft.
6. Withdraw the dummy shaft from the idler gears, and allow all parts to drop out, onto a clean work surface.

Refitment

7. Fit the spacer in the reverse gear cluster.
8. Refit the first set of rollers. Each run consists of 28 rollers.

NOTE: Smear the rollers in petroleum jelly (not grease) to facilitate reassembly.

9. Refit the retaining ring.
10. Refit the thrust washer.
11. Refit the second set of rollers.
12. Refit the retaining ring.
13. Refit the thrust washer.
14. Slide the dummy shaft into the reverse gear cluster rollers.
15. Reverse procedures 1 to 5.



MK II 8 SPEED SYNCHROMESH TRANSMISSION**TRANSMISSION CASE REMOVAL AND
REFITMENT OR COMPLETE GEARBOX OVER-
HAUL** 5F-13-17

Special Tools: MF 177 Seal Protector
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 218 A P.t.o. Shaft Puller
 MF 218-2 Adaptor
 MF 255 B Oil Seal Replacer
 270 Rail Trolley
 MF 315 Needle Roller Bearing
 Removal Tool
 MF 331 Oil Seal Replacer
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands
 V.L. Churchill 50 ton Hydraulic Press
 (alternative to MF 200)
 55 mm x 25 mm ($2\frac{1}{4}$ x 1 in) dia
 Mild Steel Dummy Shaft

Disassembly

1. Remove the selector rail mechanism, operation 5F-01-07.
2. Remove the gearbox epicyclic unit, operation 5F-02-08.
3. Disassemble the gearbox epicyclic unit, operation 5F-03-08.
4. Remove the clutch release mechanism, operation 5F-04-09.
5. Remove and dismantle the input housing and p.t.o. input shaft, operation 5F-05-10.
6. Remove the p.t.o. drive shaft front bearing, operation 5F-06-11.
7. Remove the main input shaft, operation 5F-07-12.
8. Remove the second gear (mainshaft), operation 5F-08-12.
9. Remove the mainshaft, first, reverse, fourth and third gears, operation 5F-09-13.
10. Remove the synchromesh cone assembly, operation 5F-10-14.
11. Remove the layshaft and gears and p.t.o. shaft and gear, operation 5F-11-15.
12. Remove the reverse gear cluster, operation 5F-12-16.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings, needle rollers, gear sliding couplers, gear selector forks, also splines and main shaft gear bushes and sleeves. All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webs. Maximum acceptable clearance is 0,033 mm (0.013 in). Where the clearance between bearing and bore exceeds this figure, recommended sealant 'C' may be used to refit the bearings into the transmission case. After inspection, lubricate bearings with clean transmission oil. Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tab washer must be fitted.

Reassembly

12. Reverse procedures 1 to 11, except:
 - (a) Use only petroleum jelly for reassembly purposes—Never Grease.
 - (b) Ensure all snap rings are correctly located in their grooves.
 - (c) Lightly oil all bushes, bearings and splines prior to reassembly.

MK II 8 SPEED SYNCHROMESH TRANSMISSION**HIGH/LOW AND GEAR SHIFT LEVERS****Removal and Refitment**

5F-14-18

Removal

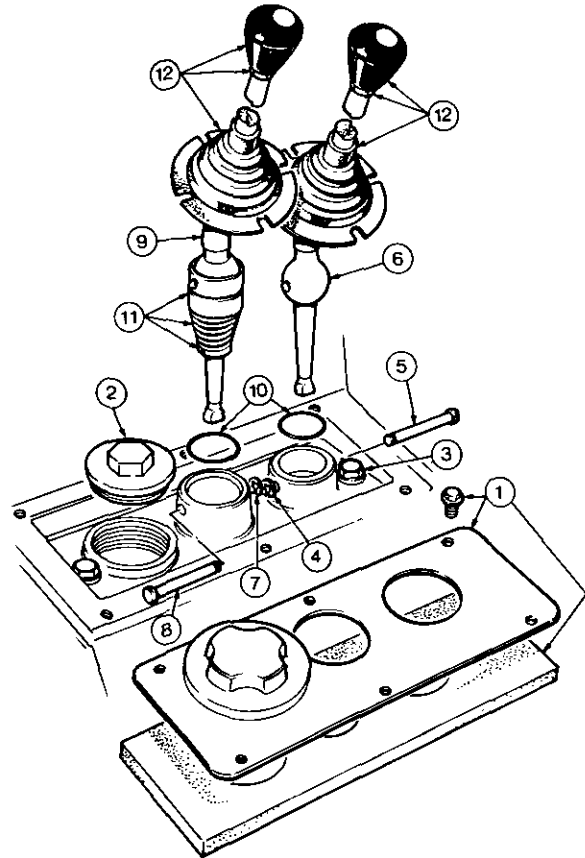
1. Remove the bolts, plate and sound proofing pad.
2. Remove the filler plug.
3. Remove the bolt.
4. Remove the clip.
5. Remove the pin.
6. Withdraw the lever.
7. Remove the clip.
8. Remove the pin, taking care not to drop it into the gearbox.
9. Withdraw the lever and cup assembly.
10. Discard the 'O' rings.
11. If necessary, press the spring retaining washer towards the spring, slide it sideways and remove it. This will release the spring and support cup.

WARNING: When removing the spring retaining washer, care must be taken to prevent the spring from flying out and causing possible injury and damage.

12. If necessary, remove the knobs, nuts and dust caps.

Refitment

13. Reverse procedures 1 to 12, except:
 - (a) Fit new 'O' rings.
 - (b) Ensure that the gearlevers locate correctly in the gearlever engagement dogs.



KONTAK SPOOL VALVE KITS

FITTING INSTRUCTIONS

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KONTAK SPOOL VALVES**SPECIFICATION****Output flow data****Linkage pump only**

<i>Tractor</i>	<i>Pump Type</i>	<i>Max. Pressure</i>		<i>Max. Oil Flow</i>		<i>Max. Power</i>	
		<i>N/mm²</i>	<i>lb/in²</i>	<i>litre/min</i>	<i>Imp gal/min</i>	<i>PS</i>	<i>hp</i>
MF 550	Standard	17,6	2 550	17,0	3.75	5,9	5.8
	High Flow	17,6	2 550	26,5	5.8	9,3	9.1
MF 565 and 575	Standard	20,7	3 000	15,0	3.3	6,5	6.4
	High Flow	20,7	3 000	26,5	5.8	11,4	11.2
MF 590	High Flow	20,7	3 000	25,7	5.7	11,0	10.8

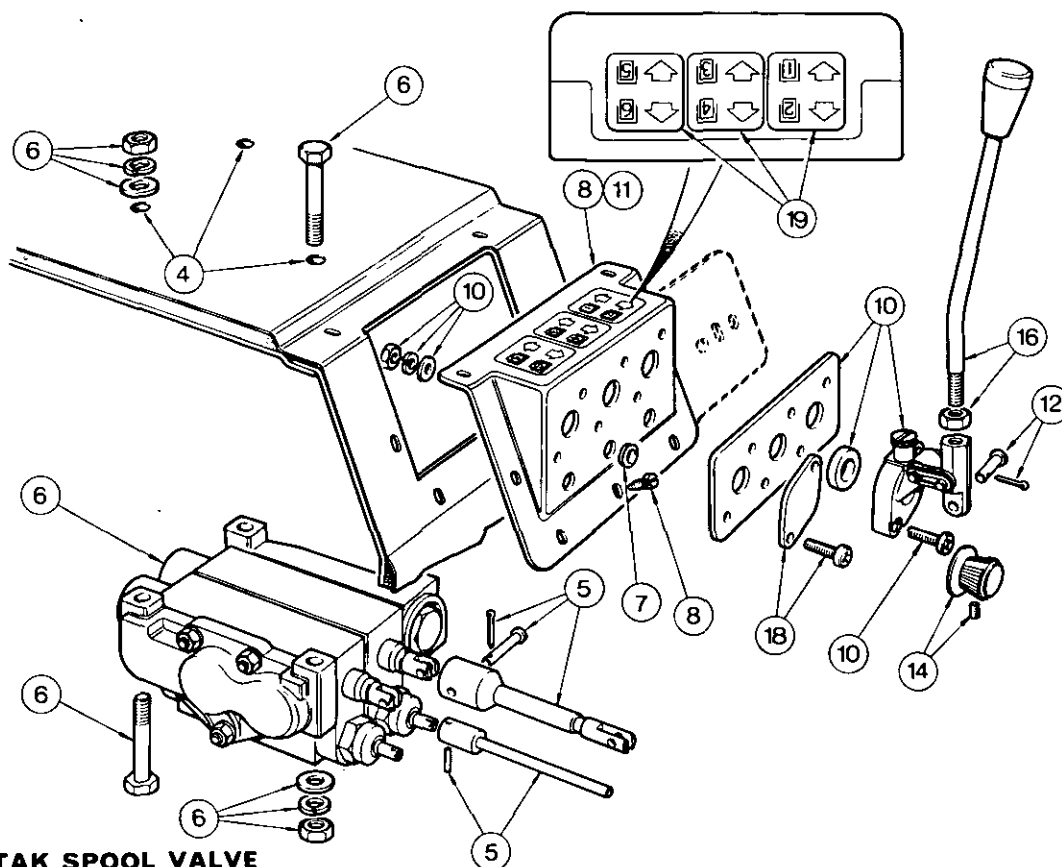
Auxiliary Pump Only

MF 550, 565 and 575	17,2	2 500	35,0	7.7	11,1	10.9
MF 590	17,2	2 500	36,0	7.9	11,5	11.3

Combined Pumps

MF 550	Standard	17,6	2 550	53,0	11.7	16,8	16.5
	High Flow	17,6	2 550	62,5	13.7	19,9	19.5
MF 565 and 575	Standard	20,7	3 000	51,0	11.25	16,3	16.0
	High Flow	20,7	3 000	62,5	13.7	19,9	19.5
MF 590	High Flow	20,7	3 000	61,0	13.4	19,4	19.1

KONTAK SPOOL VALVES



KONTAK SPOOL VALVE

Fitting Instructions

One or Two Spool Valves

10A-15-17

NOTE: During fitment of all the following kits it is recommended that the aperture between the fuel tank and the rear of the heel panel is blanked off with a suitable piece of material. This will prevent any items from falling between the tank and the cab floor and subsequently require removal of the tank itself to retrieve the items.

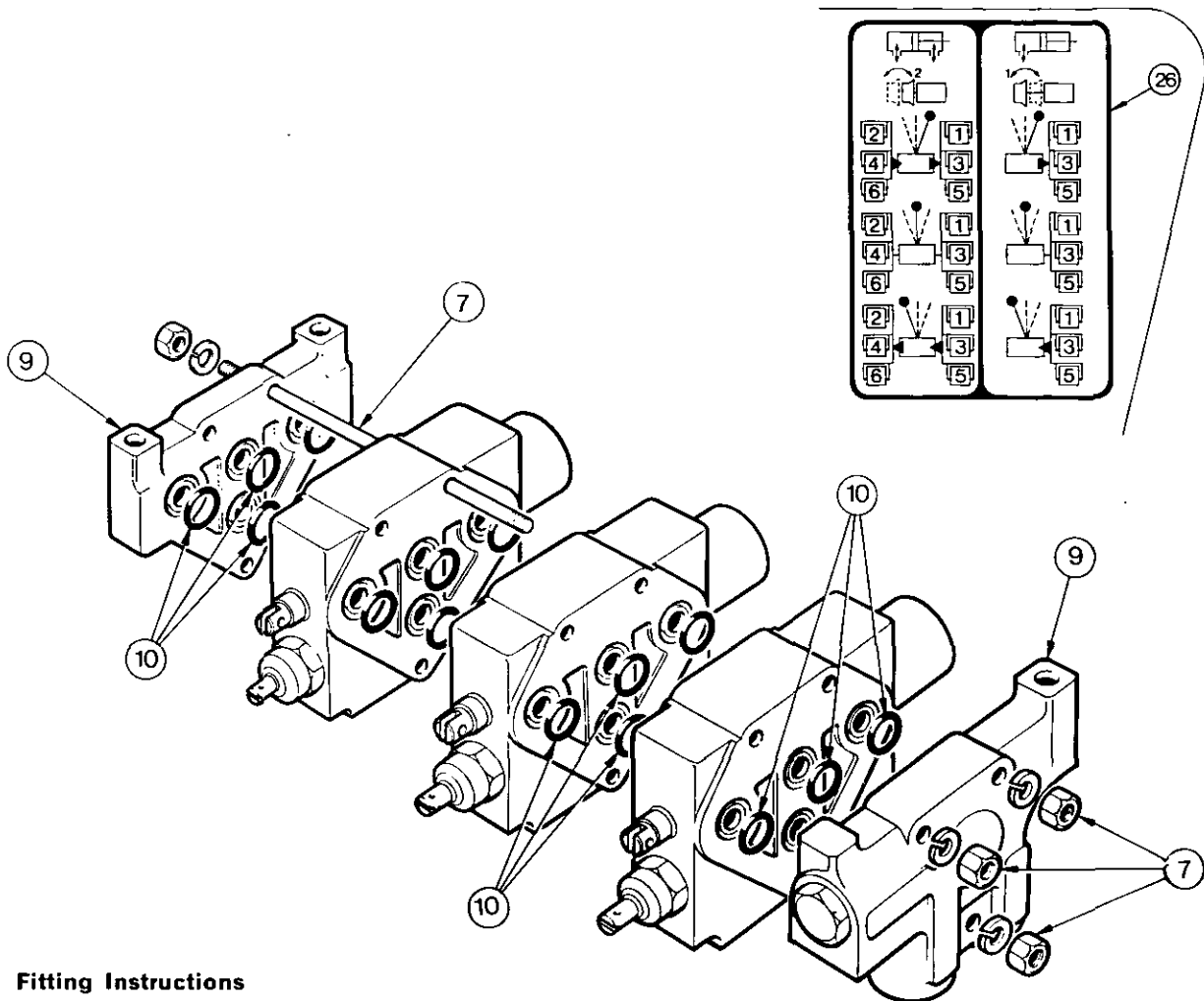
1. Remove the seat assembly by disengaging the seat runner lock and withdrawing the seat from the runners.
2. Remove the seat floor inspection panel by removing the nine securing bolts.
NOTE: The three rearmost bolts (adjacent to the rear cross brace) are secured with nuts and washers. To gain access to the nuts remove the two inner rear sheet metal panels.
3. On MF 550 Tractors remove the response control lever and mounting plate.
4. Locate the spool valve mounting holes in the seat floor and pierce the acoustic foam floor.
5. Attach the extension rods to the spool valves using a clevis pin and split pin for the spool valve extension rod and a spring pin for the single/double acting extension rod.
6. Locate the spool valve assembly against the seat floor and secure it with three $\frac{3}{8}$ in \times 63 mm (2 $\frac{1}{2}$ in) UNF bolts, plus flat washers, lockwashers and nuts.
NOTE: Fit the two rearmost bolts from underneath the seat floor and the remaining bolt from above.
7. Fit the rubber grommets to the single/double acting extension rod apertures in the extension housing.

8. Fit the extension housing to the cab using the seven securing bolts, but do not fully tighten at this stage.
9. On MF 550 Tractors only transfer the response control components to the extension housing.
10. Assemble the mounting plate, support washer and operating lever cranks to the extension housing using the two securing screws, plain washers, lockwashers and nuts.
11. If necessary adjust the position of the extension housing using the slotted mounting holes to align the extension rods with the operating lever cranks.
12. Fit the clevis pin retaining the operating levers to the extension rods and secure with the split pins.
13. Fully tighten the securing bolts. If required, increase the size of the holes in the extension housing to achieve alignments.
14. Fit the single/double acting control knobs to the extension rods using the grub screws.
15. Thoroughly degrease the threads on the operating levers and cranks and apply Loctite 270 to the threads.
16. Screw the operating levers into the cranks and tighten the locknuts. The lever can be rotated and locked in various positions to suit individual requirements.
17. When replacing the seat/floor inspection panel clean the joint faces and apply a suitable sealing compound. Use 'BOSTIK BLUE TACK' or similar.
18. Fit the blanking plate to the remaining apertures using the two securing screws.
19. Fit the required decals to the housing.

FUNCTION

Consult the appropriate operator instruction book regarding the operation and adjustment of the spool valves.

KONTAK SPOOL VALVES

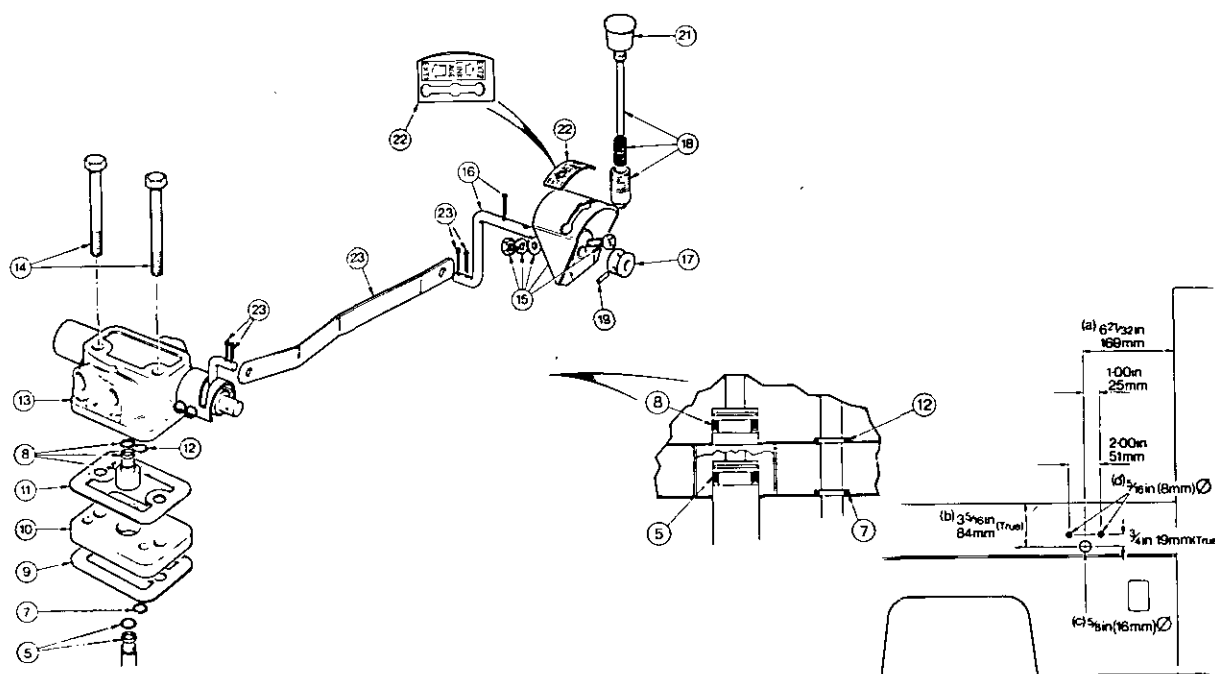


Fitting Instructions

Third Spool Valve

10A-16-18

1. Remove the seat/floor inspection panel. See procedure 2, 10A-15-17.
2. Disconnect the operating lever cranks from the extension rods.
3. Remove the grub screws and remove the single /double acting control knobs.
4. On MF 550 tractors remove the response control lever.
5. Remove the seven (eight—MF 550) screws securing the extension housing and remove.
6. Disconnect the feed, return and outlet hoses from the spool valve. Fit blanking plugs to the ports and hoses.
7. Remove the three bolts securing the spool valves.
8. Remove the three nuts and studs securing the spool valve assembly.
9. Remove the end plates.
10. Remove the 'O' rings.
11. Thoroughly clean the mating faces of the spool blocks and end plates.
12. Fit new 'O' rings to the recesses in the Spool blocks including the new spool.
13. Place the valves on a flat surface with the feed ports uppermost and then add the new spool block. The spool block should always be fitted adjacent to the right hand end plate.
14. Align the valve sections and fit the new longer studs, nuts and lockwashers.
15. Re-tighten the nuts to a torque of 20 Nm (15 lbf ft).
NOTE: Do not overtighten the nuts as this could cause the spools to stick.
16. Attach the extension rod to the spool valve using a clevis pin and split pin for the spool valve extension rod and a spring pin for the single/double acting extension rod.
17. Locate the new front mounting hole and the captive nut at the R.H. rear mounting point and pierce the foam floor.
18. Remove the blanking plate from the extension housing to receive the operating lever crank.
19. Locate the spool valve assembly against the seat floor and secure it with the three $\frac{3}{8}$ in \times 63 m (2 $\frac{1}{2}$ in) UNF bolts, plus flat washers, lockwashers and nuts.
20. Fit the R.H. rear bolt from under the floor utilising the captive nut.
21. Reverse procedures 2-6 for the original spool valves.
22. Fit the support washer and operating lever crank to the extension housing using the two securing screws, lockwashers and nuts.
23. Thoroughly degrease the threads on the operating lever and crank and apply loctite 270 to the threads.
24. Screw the operating lever into the crank and tighten the locknut. The lever position can be adjusted to suit individual requirements.
25. Fit the single/double acting control knob to the extension rod using the grub screw.
26. Fit the spool valve lever function decal to the R.H. lower cab window.



SELECTOR VALVE KIT

Fitting Instructions—MF 550 and 560 Tractor 10A-17-19

- Initial production of cab tractors will not have the required drillings to accommodate the remote selector valve control lever. Where this is the case the holes must be drilled as follows:—
NOTE: Measurements (a) and (b) are critical and MUST be measured with accuracy i.e., to within ($\frac{1}{16}$ in) MAX.

- Measure a distance of 169 mm ($6\frac{21}{32}$ in) from the inner wheel arch surface (NOT the trim panel surface). A steel rule will slide underneath the trim at the seat floor level; it is therefore unnecessary to remove the trim.
- Measure 84 mm ($3\frac{1}{4}$ in) (true) from the seat floor down the surface of the heel panel to the point of intersection. It is not necessary to remove the trim from the mounting point area.
- Drill a 16 mm ($\frac{5}{8}$ in) hole through the panel.
- Drill two 8 mm diameter ($\frac{5}{16}$ in) holes 19 mm ($\frac{3}{4}$ in) above the first hole and 25 mm (1 in) either side of the centre line as shown.

NOTE: The Health and Safety Executive have accepted the cab modifications required to fit and accommodate the selector valve lever.

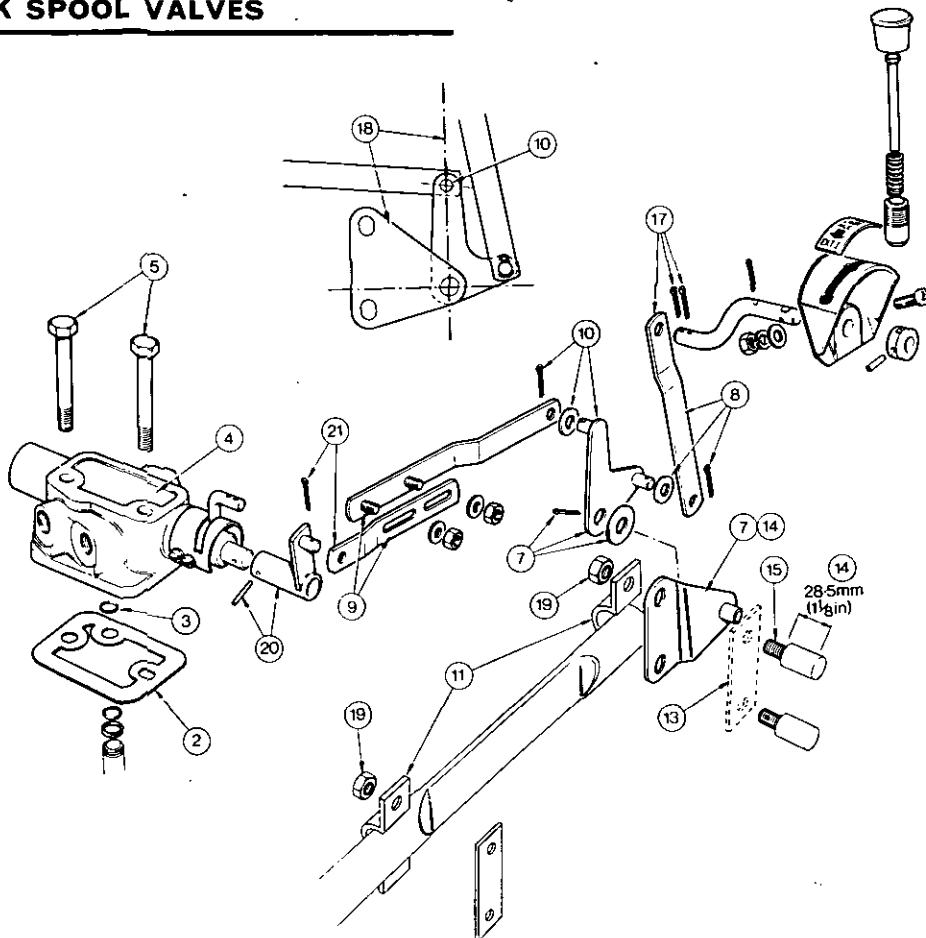
- Remove the seat floor inspection panel. See procedures 1, 2 and 17, 10A-15-17.
- Place the 'Draft Control' lever in the 'Down' position.
- Remove the two bolts and spring washers securing the transfer cap to the lift cover, then carefully ease off the cap, ensuring that the standpipe is not displaced from its location in the hydraulic pump.
- Remove the old 'O' ring and back-up washer from the standpipe.
- Fit a new 'O' ring and back-up washer to the standpipe.
- Clean the bottom face of the selector valve spacer and fit an 'O' ring to the shallow recess in the bottom face.

- Fit the adaptor with the 'O' ring and back-up washer in position onto the standpipe.
- Place the spacer gasket in position on the lift cover.
- Fit the spacer to the lift cover ensuring the holes are aligned.
- Fit the selector valve gasket to the spacer.
- Clean the bottom of the selector valve and fit an 'O' ring to the shallow recess in the bottom face.
- Fit the selector valve to the adaptor and spacer.
- Fit the two $\frac{7}{16}$ —14 UNF×90 mm ($3\frac{1}{2}$ in) bolts and tighten the bolts to a torque of 34 Nm (25 lbf ft).

NOTE: Do not overtighten the bolts, as this can cause leakage and result in the spool valve sticking.

- Fit the selector lever plate to the heel panel using the two screws, flat washers, lock-washers and nuts.
- Fit the operating shaft to the lever plate (lightly coat the bearing bush in the plate with grease) and fit the split pin.
- Slide the boss onto the shaft with the spring pin hole aligned.
- Lightly grease the spring and assemble the spring, lever shaft and spacer tube together and fit the shaft through the plate and into the boss.
- Retain the lever shaft in the boss with the spring pin.
- Thoroughly degrease the threads on the spacer tube and selector knob and apply Loctite 270.
- Fit the selector lever knob to the spacer tube.
- Fit the decal to the lever plate adjacent to the gate as shown.
WARNING: Ensure that the decal is fitted as shown.
- Fit the operating link between the selector valve and operating lever using the split pins (fit one each side of the link). Ensure the hinge joints do not bind, then lubricate all pivots with a suitable grease.
- Check operation of the selector lever. The lever should operate through the complete gate without binding.

KONTAK SPOOL VALVES



SELECTOR VALVE KIT

Fitting Instructions

MF 565 Tractors

10A-18-20

1. See procedures 1 to 6, 10A-17-19.
2. Fit the selector valve gasket into position on the lift cover.
3. Clean the bottom of the selector valve and fit an 'O' ring to the shallow recess in the bottom face.
4. Fit the selector valve onto the lift cover.
5. Fit the two $\frac{7}{16}$ -14 UNF \times 90 mm ($3\frac{1}{2}$ in) bolts and tighten the bolts to a torque of 34 Nm (25 lbf ft).

NOTE: Do not overtighten the bolts, as this can cause leakage and result in the spool valve sticking.

6. See procedures 15 to 22, 10A-17-19.
7. Assemble the bellcrank and washer to the plate and retain the bellcrank using a split pin. Lightly grease the bellcrank bearing bush prior to assembly.
8. Assemble the short link and washer to the bellcrank using a split pin.
9. Assemble the adjustable link using the two locknuts and flat washers but do not tighten the nuts.
10. Connect the adjustable link with washer to the bellcrank and retain with a split pin.

NOTE: The link has an offset pivot and should be assembled as shown.

11. Remove the three brackets securing the handbrake shaft.
12. Disconnect the operating rods from the handbrake shaft.
13. Pull the handbrake shaft assembly away from the L.H. securing studs and remove the backing plate and DISCARD.

14. **NOTE: Check the length of the handbrake mounting support spacers. The correct length of the spacers should be 28,5 mm ($1\frac{1}{4}$ in). If the length exceeds this figure trim until correct.**

Fit the linkage pivot plate in place of the original backing plate and then refit the handbrake shaft and securing brackets.

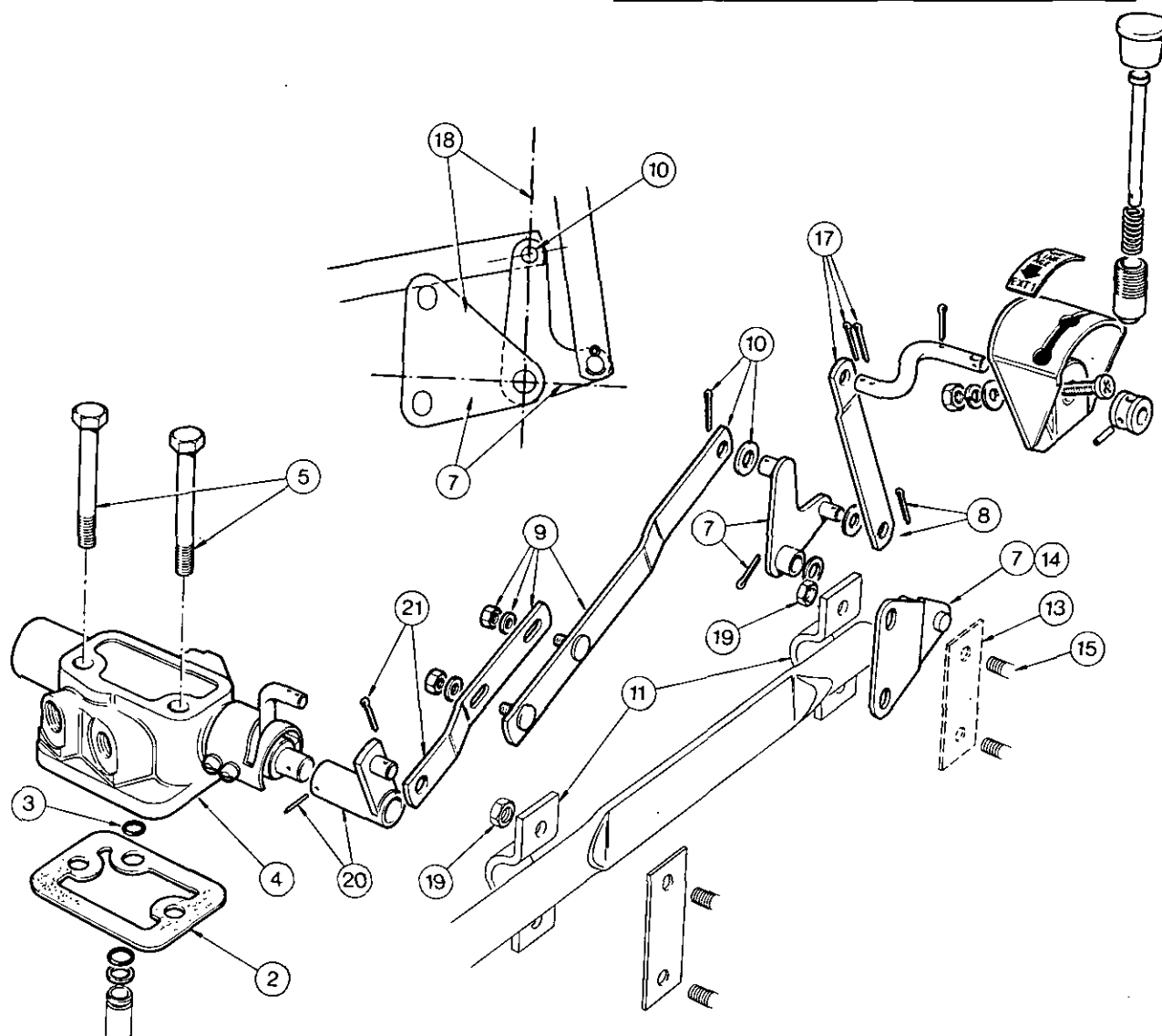
15. Check that the selector valve link does not foul the uppermost securing stud. If necessary trim the stud.
16. Reconnect the handbrake operating rods.
17. Connect the bellcrank link to the selector valve lever using the two split pins.
18. Adjust the position of the linkage pivot plate such that the axis of the lower pivot and the adjustable link pivot is vertical when the control knob is in the linkage position.

NOTE: If the bellcrank lever fouls the I.P.T.O. mounting bracket, remove excess material from the bracket.

19. Tighten the handbrake bracket securing nuts.
20. Connect the extension shaft to the selector valve using the spring pin.
21. Connect the adjustable link to the shaft using a split pin. Check that the linkage does not bind then lubricate all pivots with a suitable grease.
22. Adjust the length of the adjustable link such that the detent position of the cab control knob gives the positions at the stops on the selector valve camplate.

NOTE: If the slotted link to selector valve fouls the selector valve operating lever when engaging EXT 2, remove material from the lower edge of the link.

KONTAK SPOOL VALVES

**SELECTOR VALVE KIT 10A-19-21****Fitting Instructions—MF 575 and 590 Tractors**

1. See procedures 1 to 6, 10A-17-19.
2. Fit the selector valve gasket into position on the lift cover.
3. Clean the bottom of the selector valve and fit an 'O' ring to the shallow recess in the bottom face.
4. Fit the selector valve onto the lift cover.
5. Fit the two $\frac{7}{8}$ -14 UNF \times 90 mm (3½ in) bolts and tighten the bolts to a torque of 34 Nm (25 lbf ft).

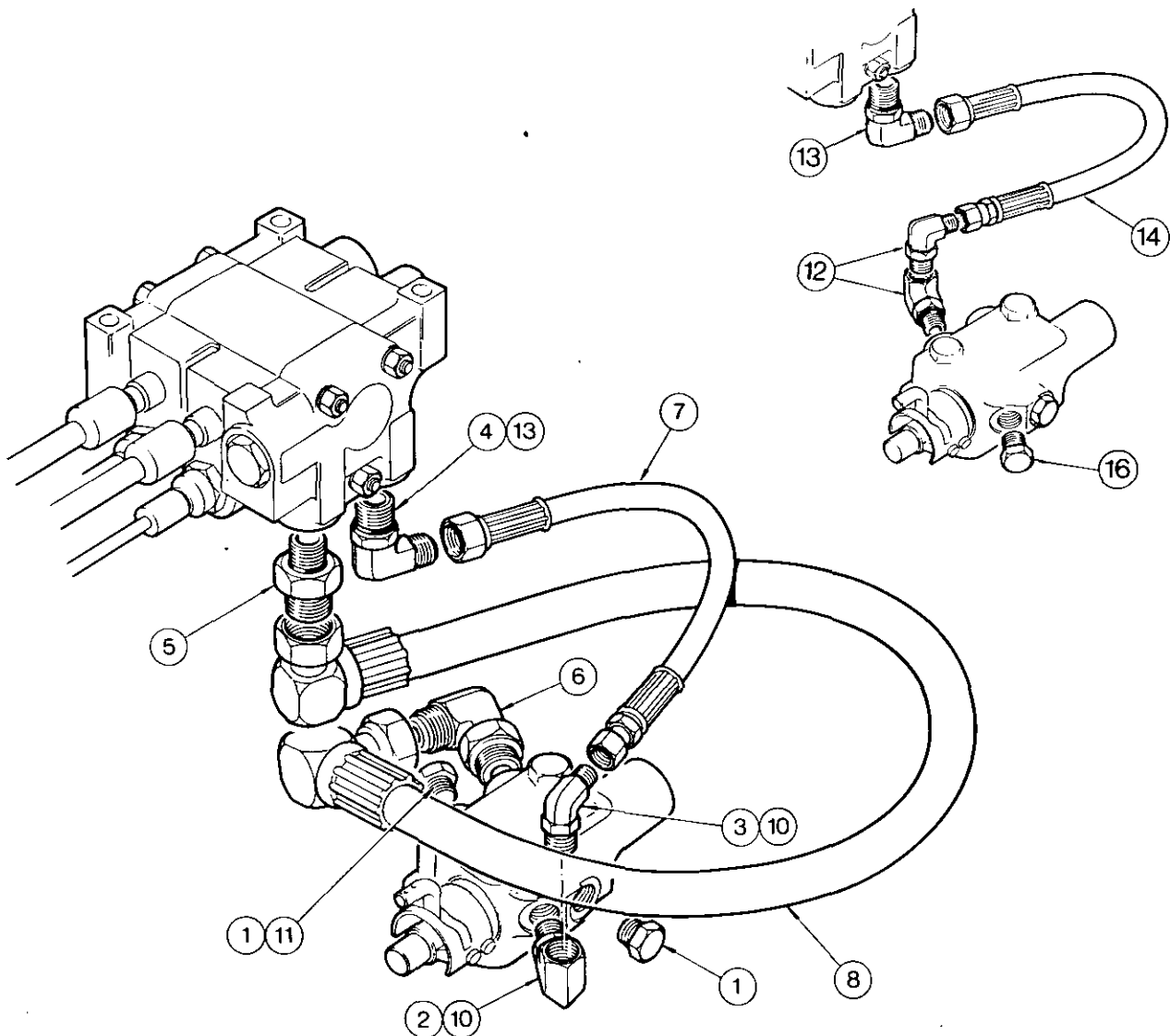
NOTE: Do not overtighten the bolts, as this can cause leakage and result in the spool valve sticking.

6. See procedures 15 to 22, 10A-17-19.
7. Assemble the bellcrank and washer to the plate and retain the bellcrank using a split pin. Lightly grease the bellcrank bearing bush prior to assembly.
8. Assemble the short link and washer to the bellcrank using a split pin.
9. Assemble the adjustable link using the two locknuts and flat washers but do not tighten the nuts.
10. Connect the adjustable link with washer to the bellcrank and retain with a split pin.

NOTE: The link has an offset pivot and should be assembled as shown.

11. Remove the three brackets securing the handbrake shaft.
12. Disconnect the operating rods from the handbrake shaft.
13. Pull the handbrake shaft assembly away from the L.H. securing studs and remove the backing plate and DISCARD.
14. Fit the linkage pivot plate in place of the original backing plate and then refit the handbrake shaft and securing brackets.
15. Check that the selector valve link does not foul the uppermost securing stud. If necessary trim the stud.
16. Reconnect the handbrake operating rods.
17. Connect the bellcrank link to the selector valve lever using the two split pins.
18. Adjust the position of the linkage pivot plate such that the axis of the lower pivot and the adjustable link pivot is vertical when the control knob is in the linkage position.
19. Tighten the handbrake bracket securing nuts.
20. Connect the extension shaft to the selector valve using the spring pin.
21. Connect the adjustable link to the shaft using a split pin. Check that the linkage does not bind then lubricate all pivots with a suitable grease.
22. Adjust the length of the adjustable link such that the detent position of the cab control knob gives the positions at the stops on the selector valve camplate.

KONTAK SPOOL VALVES

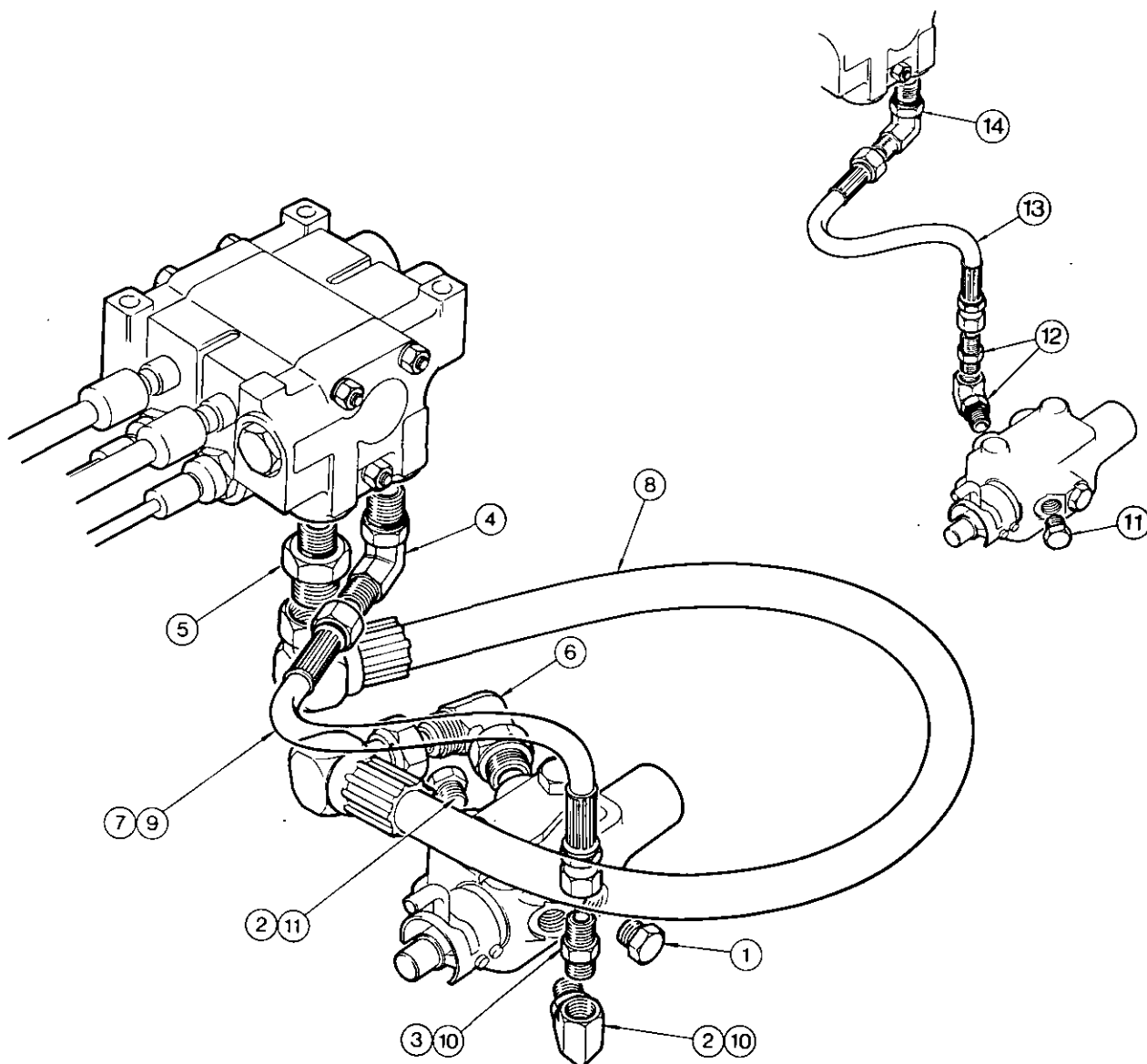
**LINKAGE FEED HOSE KIT****Fitting Instructions—MF 550 and 560 Tractors—
from Feed Port 1****10A-20-22**

1. Fit the $\frac{5}{16}$ in—18 UNF plug to feed port 2 and to the rear port at 1.
2. Screw the $\frac{3}{8}$ in—18 UNF 90° elbow into port 1 on the selector valve. Lock the elbow to face vertically upwards.
3. Screw a second $\frac{3}{8}$ in—18 UNF 90° elbow into the elbow at port 1. Lock the elbow to face rearwards.
4. Screw the $\frac{3}{4}$ in—16 UNF 90° elbow into the rear feed port at the spool valve. Lock the elbow in the position shown.
5. Screw the $\frac{3}{4}$ in—16/1 $\frac{1}{4}$ —12 UNF straight adaptor into the return port in the spool valve.
6. Screw the $\frac{3}{4}$ in—16 UNF 90° elbow into the 'R' port on the selector valve and lock the elbow in the position shown.
7. Attach the selector valve feed hose ($\frac{3}{8}$ in—18 UNF end fittings) from the selector valve to the spool valve.
8. Attach the return hose ($1\frac{1}{8}$ in—12 UNF end fittings) from the selector valve to the spool valve. Lock the hose end unions in the positions shown.

**Fitting Instructions—MF 550 and 560 Tractors—
from Feed Port 2****10A-21-22**

9. Detach the feed hose from the elbows at feed port 1.
10. Remove the elbows from feed port 1.
11. Remove the plug from feed port 2.
12. Assemble the elbows from feed port 1 to feed port 2, and lock the elbows in the position shown.
13. Loosen the feed hose elbow at the spool valve union.
14. Connect the feed hose to the elbows at feed port 2.
15. Adjust the position of the elbow at the feed port on the spool valve as shown and lock the elbow.
16. Fit the $\frac{3}{8}$ in—18 UNF plug to feed port 1 on the selector valve.

KONTAK SPOOL VALVES

**LINKAGE FEED HOSE KIT**

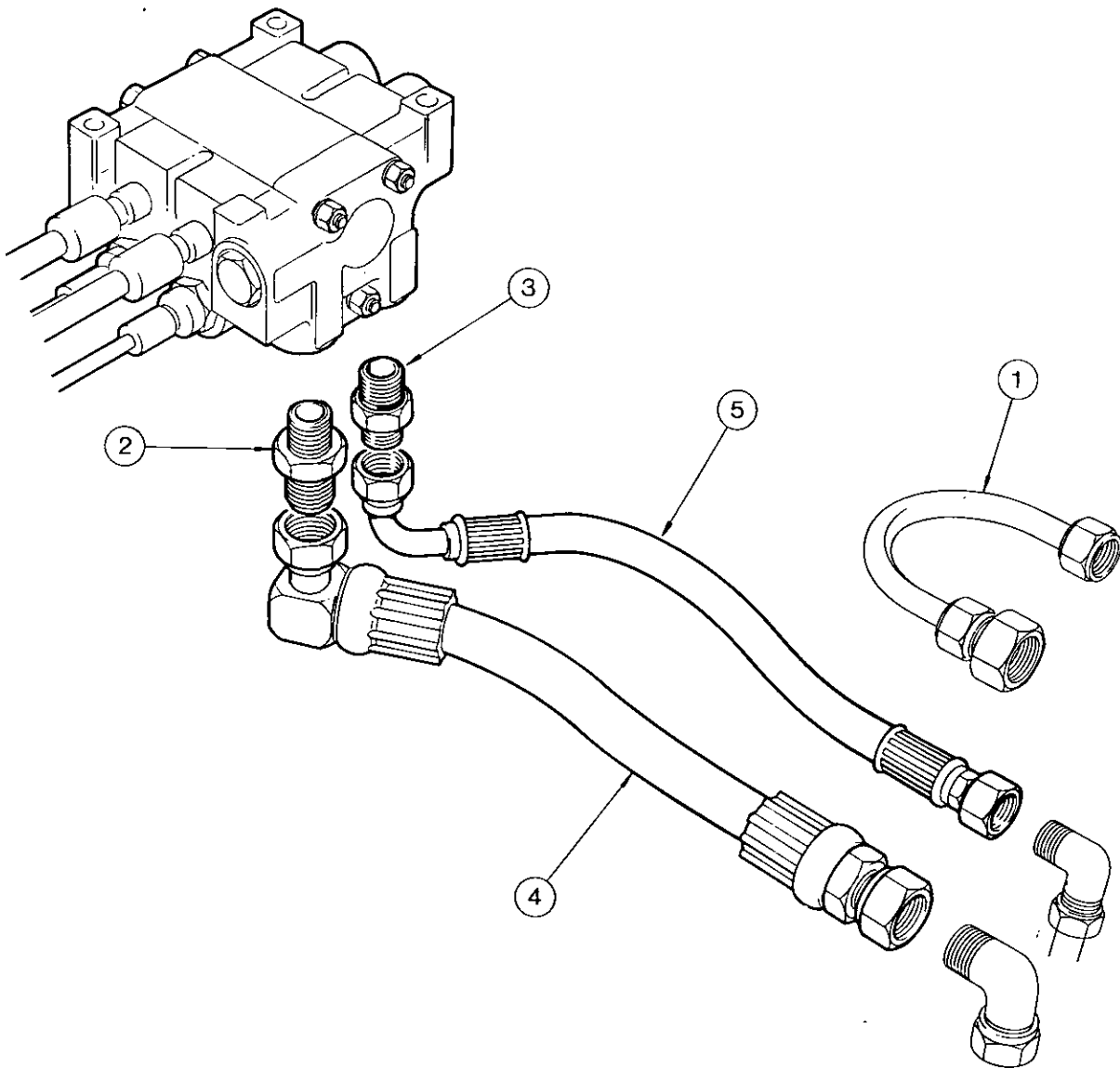
**Fitting Instructions—MF 565, 575, 590 Tractors
from Feed Port 1**
10A-22-23

1. Fit the $\frac{1}{8}$ in—18 UNF plugs to port 2 and rear port 1 on the selector valve.
2. Screw the $\frac{1}{8}$ in—18 UNF 90° elbow into port 1 on the selector valve. Lock the elbow to face vertically upwards.
3. Screw the $\frac{1}{8}$ in—18 UNF straight adaptor into the elbow at port 1.
4. Screw in the $\frac{3}{8}$ in—16 UNF elbow into the rear feed port in the spool valve. Lock the elbow in the position shown.
5. Screw the $\frac{1}{2}$ in—16/1 $\frac{1}{4}$ —12 UNF straight adaptor into the return port in the spool valve.
6. Screw the $\frac{3}{8}$ in—16 UNF 90° elbow into the 'R' port in the selector valve. Lock the elbow in the position shown.
7. Attach the selector valve feed hose ($\frac{1}{8}$ in—18 UNF end fittings) from the selector valve to the spool valve.
8. Attach the return hose (1 $\frac{1}{4}$ in—12 UNF end fittings) from the selector valve to the spool valve. Lock the hose unions in the position shown.

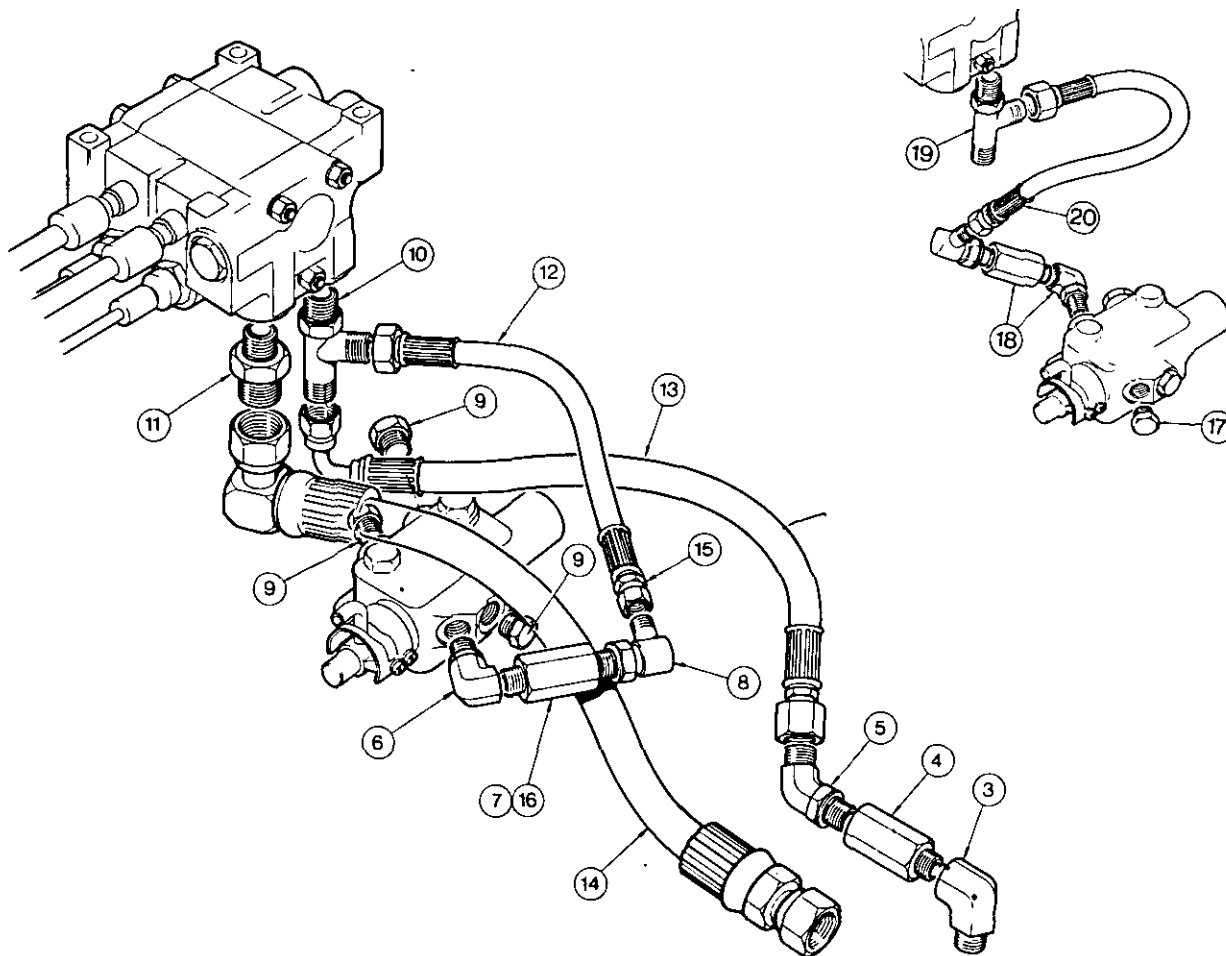
**Fitting Instructions—MF 565, 575, 590 Tractors
from Feed Port 2**
10A-23-23

9. Detach the feed hose from the selector valve port 1.
10. Remove the elbow and adaptor from the selector valve port 1.
11. Remove the plug from the selector valve port 2 and fit to feed port 1.
12. Screw in the elbow and adaptor from port 1 into port 2. Lock the elbow to face vertically upwards.
13. Connect the feed hose to the elbow at port 2.
14. If necessary loosen the union at the spool valve rear feed port and adjust the position for the smoothest hose run.

KONTAK SPOOL VALVES

**AUXILIARY HYDRAULIC FEED HOSE KIT****Fitting Instructions****10A-24-24**

1. Remove the loop pipe from the pump feed and return pipes.
2. Screw the straight adaptor ($\frac{3}{8}$ in—16 UNF/ $1\frac{1}{8}$ in—12 UNF) into the front return port in the spool valve.
3. Screw the straight adaptor ($\frac{3}{8}$ in—16 UNF) into the rear feed port in the spool valve.
4. Attach the return hose ($1\frac{1}{8}$ in—12 UNF end fittings) between the pump return pipe and the spool valve front port.
5. Attach the feed hose ($\frac{3}{8}$ in—16 UNF end fittings) between the pump feed pipe and the spool valve rear port.



COMBINED FLOW FEED HOSE KIT

Fitting Instructions—MF 550 and 560 Tractors— from Feed Port 1 10A-25-25

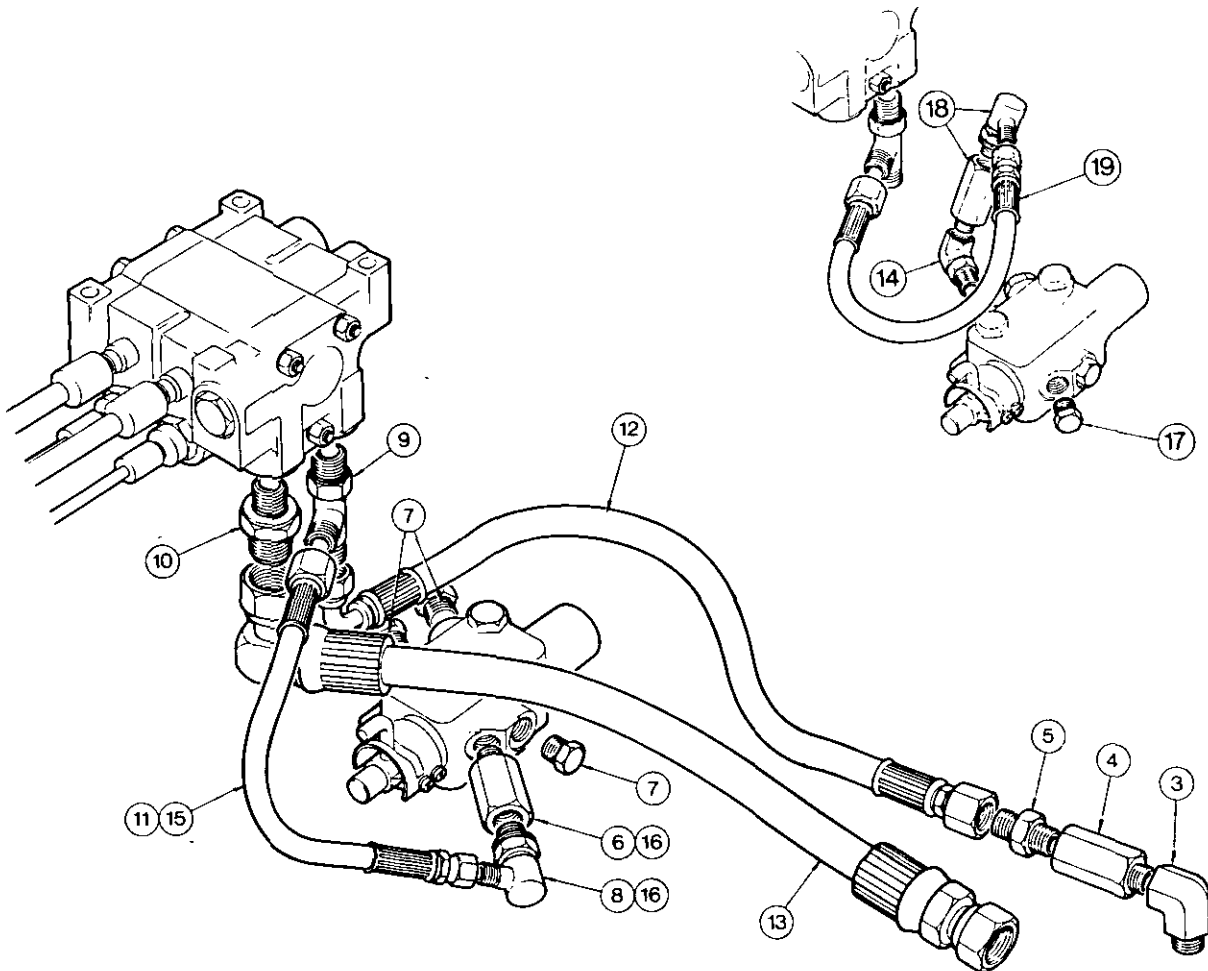
1. Remove the loop pipe.
2. Remove the elbow from the rear feed pipe from the auxiliary pump.
3. Fit the $\frac{3}{8}$ in—16 UNF special 90° elbow to the feed pipe. Lock the elbow in the position shown.
4. Fit the non-return valve to the elbow.
5. Fit the $\frac{3}{8}$ in—16 UNF angled elbow to the non-return valve. Lock the elbow in the position shown.
6. Fit the $\frac{3}{8}$ in—18 UNF 90° elbow to port 1 on the selector valve. Lock in the position shown.
7. Fit the non-return valve to the elbow at port 1.
8. Fit the special $\frac{3}{8}$ in—18 UNF 90° elbow to the non-return valve and lock in the position shown.
9. Fit the $\frac{3}{8}$ in—18 UNF plugs to valve port 2 and the rear port 1. Fit the $\frac{3}{8}$ in—16 UNF plug to port 'R'.
10. Fit the Tee-piece ($\frac{3}{8}$ in—16 UNF) to the rear feed port in the spool valve. Lock in the position shown.
11. Fit the straight adaptor ($\frac{3}{8}$ in—16 UNF/1 $\frac{1}{8}$ in—12 UNF) to the front return port in the spool valve.

12. Attach the feed hose ($\frac{3}{8}$ in—18 UNF end fittings) to the elbow from port 1 to the horizontal outlet from the Tee-piece at the rear feed port in the spool valve.
13. Attach the pump feed hose ($\frac{3}{8}$ in—16 UNF end fittings) from the Tee-piece to the rear pump feed elbow.
14. Attach the return hose (1 $\frac{1}{8}$ in—12 UNF end fittings) from the front return port in the spool valve to the return pipe from the pump.

Fitting Instructions—MF 550 and 560 Tractors— from Feed Port 2 10A-26-25

15. Detach the feed hose from port 1 in the selector valve.
16. Remove the non-return valve and elbows from port 1 in the selector valve.
17. Fit a $\frac{3}{8}$ in—18 UNF plug to port 1.
18. Remove the plug and fit the elbows and non-return valve from port 1 to port 2 and lock in the position shown.
19. Loosen the pump feed hose and elbow at the feed port in the spool valve.
20. Connect the feed hose to valve port 2.
21. Adjust the hose route to give a smooth run and lock the elbow in position.

KONTAK SPOOL VALVES

**COMBINED FLOW FEED HOSE KIT**

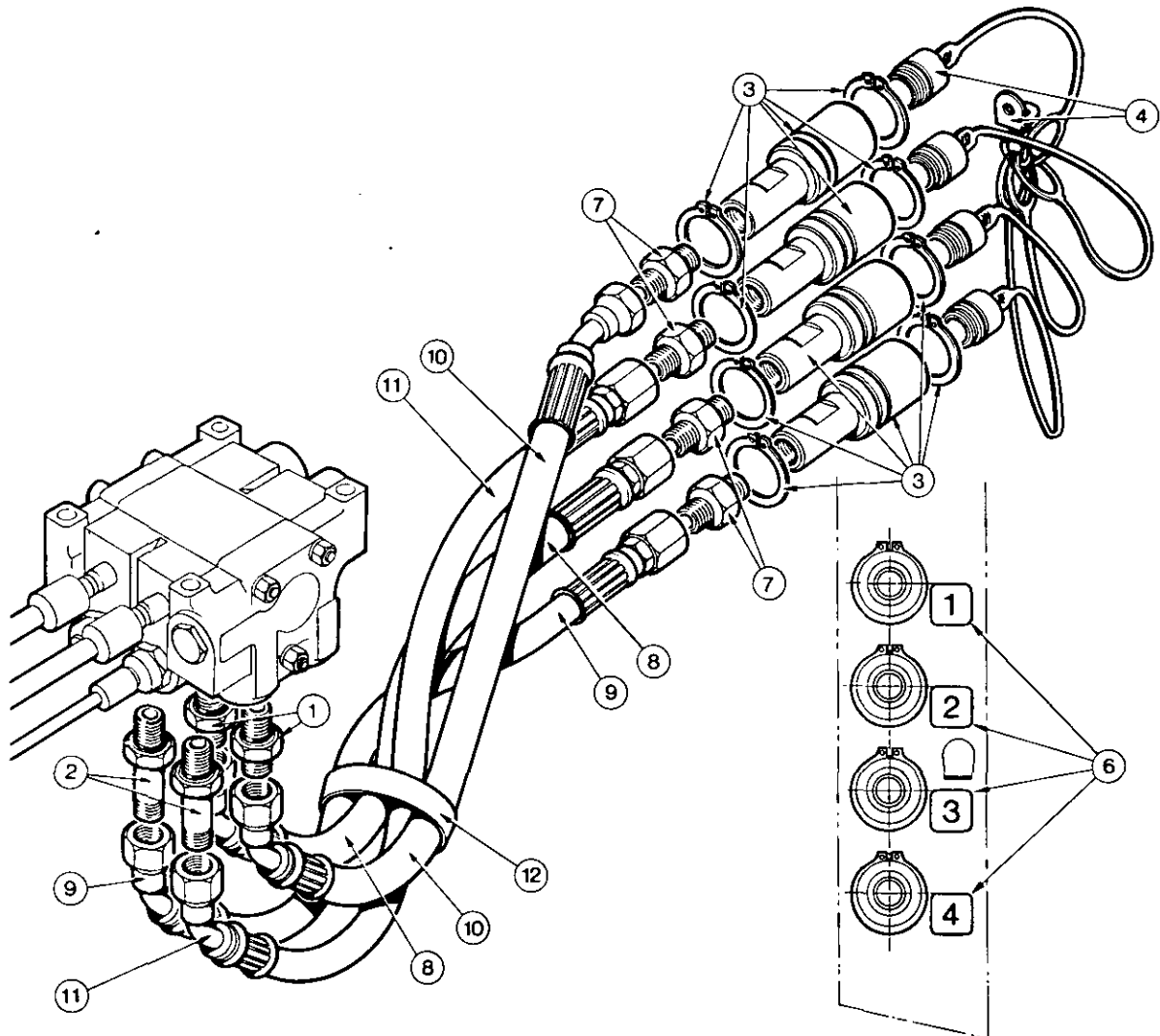
**Fitting Instructions—MF 565, 575, 590 Tractors—
from Feed Port 1** 10A-27-26

1. Remove the loop pipe.
2. Remove the elbow from the rear feed pipe from the auxiliary pump.
3. Fit the $\frac{3}{4}$ in—16 UNF elbow to the feed pipe. Lock the elbow in the position shown.
4. Fit the non-return valve to the elbow.
5. Fit the straight connector ($\frac{3}{4}$ in—16 UNF) to the non-return valve.
6. Fit the second non-return valve to port 1 in the selector valve.
7. Fit the blanking plugs to valve parts 1, 2 and R in the selector valve.
8. Fit the $\frac{3}{8}$ in—18 UNF special elbow to the non-return valve in the selector valve.
9. Fit the Tee-piece ($\frac{1}{2}$ in—16 UNF) to the rear feed port in the spool valve. Lock the Tee-piece in the position shown.
10. Fit the straight adaptor ($\frac{3}{4}$ in—16 UNF/ $1\frac{1}{8}$ in—12 UNF) to the front return port in the spool valve.
11. Attach the feed hose ($\frac{3}{8}$ in—18 UNF end fittings) to the elbow from port 1 to the horizontal outlet from the Tee-piece at the rear feed port in the spool valve.
12. Attach the pump feed hose ($\frac{1}{2}$ in—16 UNF end fittings) from the Tee-piece to the rear pump feed outlet.
13. Attach the return hose ($1\frac{1}{8}$ in—12 UNF end fittings) from the front return port in the spool valve to the return pipe from the pump.

**Fitting Instructions—MF 565, 575, 590 Tractors—
from Feed Port 2** 10A-28-26

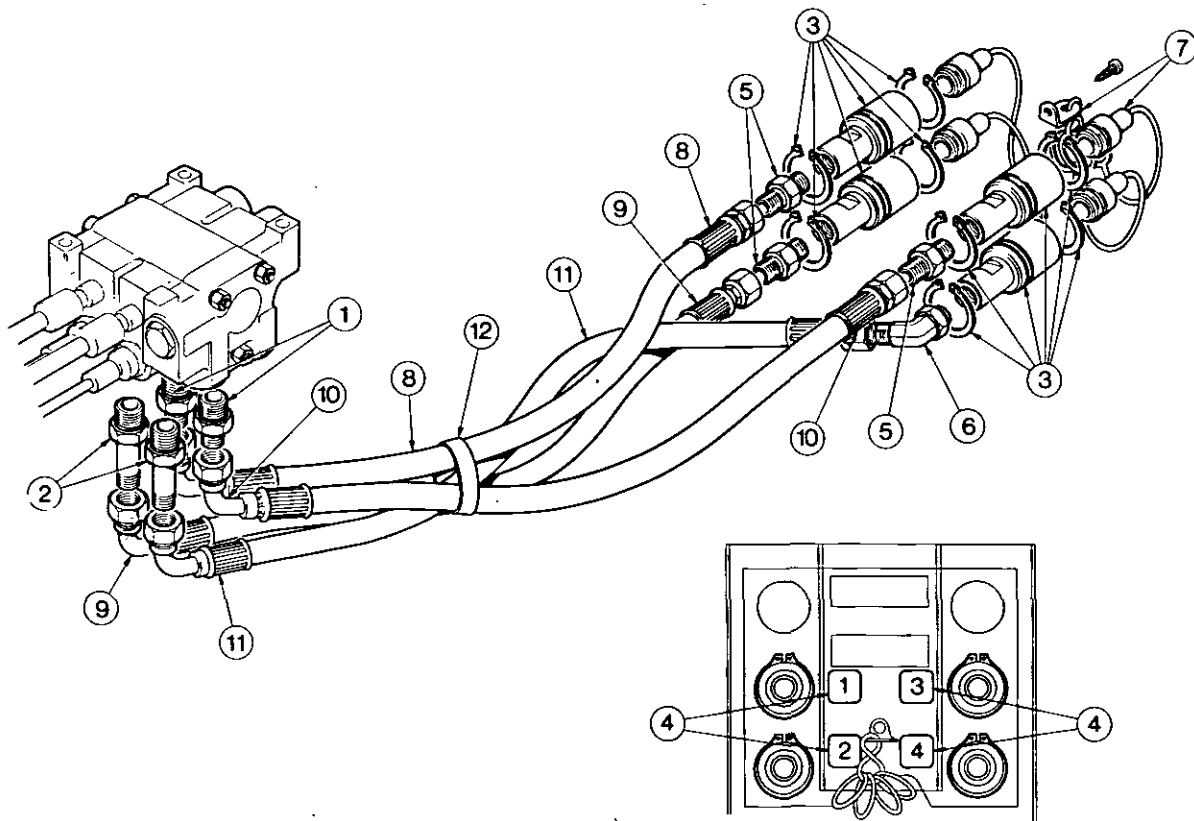
14. Remove the plug from port 2 and fit the $\frac{3}{8}$ in—18 UNF 90° elbow.
15. Detach the feed hose from port 1 in the selector valve.
16. Remove the non-return valve and elbow from port 1 in the selector valve.
17. Fit the $\frac{3}{8}$ in—18 UNF plug to port 1.
18. Fit the non-return valve and elbow from port 1 to port 2 and lock in the position shown.
19. Connect the feed hose to port 2.

KONTAK SPOOL VALVES

**OUTLET HOSE KIT****Fitting Instructions—MF 550 and 560 Tractors**

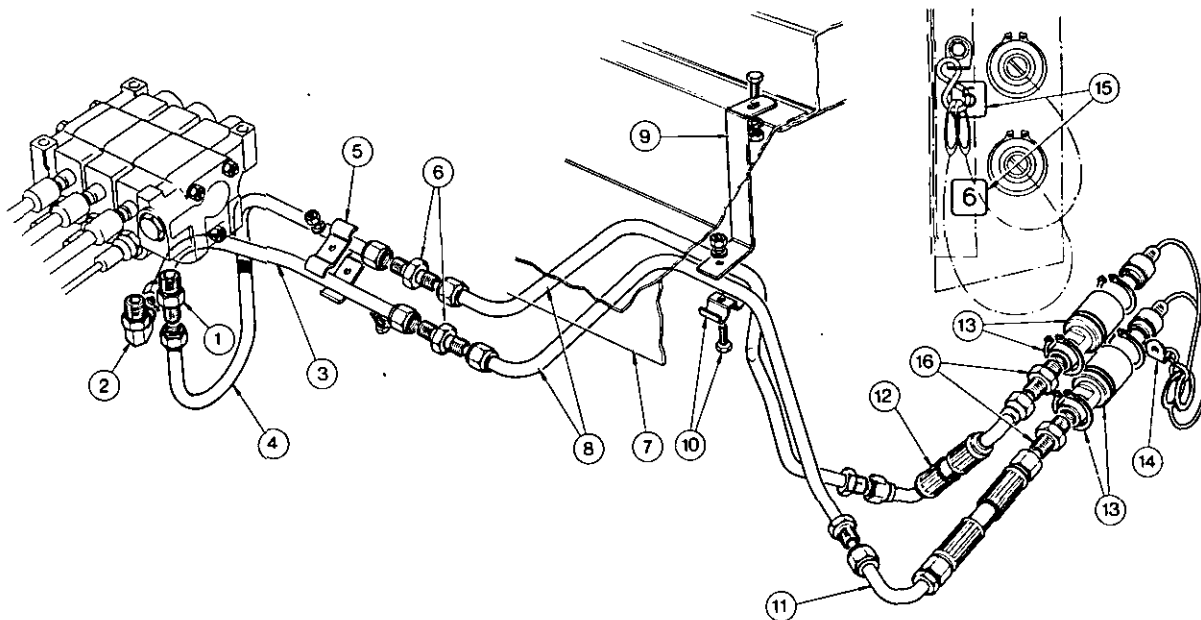
10A-29-27

1. Screw the $\frac{3}{8}$ in—16 UNF straight connectors in the rear ports in the spool valves.
2. Screw the extended $\frac{3}{8}$ in—16 UNF straight connector into the front ports.
3. Assemble the rear couplers to the R.H. trim panel using two circlips per coupler.
4. Fit the dust plugs and hook to the bracket on the trim panel.
5. Fit the dust plugs in position.
6. Fit the numbered decals adjacent to the couplers as shown.
7. Fit the straight connectors to the couplers.
8. Connect the 12,7 mm ($\frac{1}{2}$ in) bore hose (the larger diameter hose) from the RH outlet port in the spool valve to number 3 coupler.
9. Connect the 9,5 mm ($\frac{3}{8}$ in) bore hose (the smaller diameter hose) from the R.H. front outlet port in the spool valve to number 4 coupler.
10. Connect the 12,7 mm ($\frac{1}{2}$ in) bore hose (the larger diameter hose) from the L.H. rear outlet port in the spool valve to number 1 coupler.
11. Connect the 9,5 mm ($\frac{3}{8}$ in) bore hose (the smaller diameter hose) from the L.H. front outlet port in the spool valve to number 2 coupler.
12. Fit the retaining strap round the hoses.
13. Fit the decals behind the spool valve operating levers. Decal 1-2 fits behind the R.H. lever. Decal 3-4 fits behind the L.H. lever.

KONTAK SPOOL VALVES**OUTLET HOSE KIT****Fitting Instructions****MF 565, 575 and 590 Tractors****10A-30-28**

1. Screw the $\frac{1}{2}$ in—16 UNF straight connectors into the rear ports in the spool valves.
2. Screw the extended $\frac{1}{2}$ in—16 UNF straight connectors into the front ports.
3. Assemble the rear couplers to the rear mounting plate using two circlips per coupler.
4. Fit the numbered decals adjacent to the couplers as shown.
5. Fit the straight connector to the couplers marked 1, 3 and 4.
6. Fit the 45° elbow to coupler number 2 and lock in the position shown.
7. Fit the dust plugs and hook to the centre bracket.
8. Connect the 12,7 mm ($\frac{1}{2}$ in) bore hose (the larger diameter hose) from the rear outlet port in the R.H. spool valve to coupler number 3.
9. Connect the 9,5 mm ($\frac{3}{8}$ in) bore hose (the smaller diameter hose) from the front outlet port in the R.H. spool valve to coupler number 4.
10. Connect the 12,7 mm ($\frac{1}{2}$ in) bore hose (the larger diameter hose) from the rear outlet port in the L.H. spool valve to coupler marked number 1.
11. Connect the 9,5 mm ($\frac{3}{8}$ in) bore hose (the smaller diameter hose) from the front outlet port in the L.H. spool valve to coupler marked number 2.
12. Fit the retaining strap around the hoses.
13. Fit the decals supplied behind the spool valve operating levers. Decal 1-2 fits behind the R.H. lever. Decal 3-4 fits behind the L.H. lever.

KONTAK SPOOL VALVES

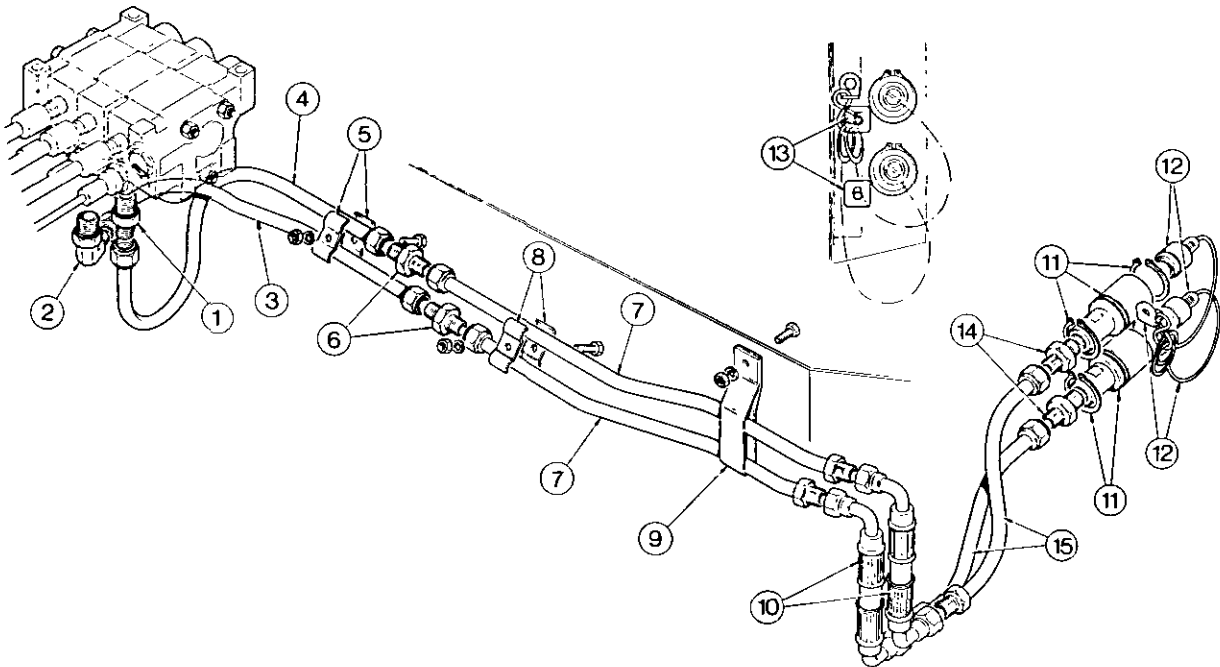


Fitting Instructions—MF 550 only from a Third Spool
10A-31-29

1. Screw the $\frac{1}{2}$ in—16 UNF straight connector into the rear port in the spool valve.
2. Fit the $\frac{1}{2}$ in—16 UNF 90° elbow to the front port in the spool valve.
3. Fit the angled pipe to the elbow at the front port and lock in the position shown.
4. Fit the second angled pipe to the rear straight connector and lock in the position shown.
5. Fit the clamp to the pipes in the position shown.
6. Fit the straight connectors to the pipe unions.
7. **NOTE: It will be necessary to either delete or cut-away the filler panel to permit passage of the pipes. (Later tractors do not have a filler panel fitted).**
8. Fit the two pipes to the connectors and lock in the positions shown.
9. Fit the support bracket to the cab rear cross brace using the existing bolt, lockwasher and nut.
10. Locate the pipes against the bracket and fit the securing clamp using the bolt, lockwasher and nut.
11. Fit the hosepipe to the pipe from the front port in the spool valve.
12. Fit the second hose to the remaining pipe and lock the union in the position shown.
13. Fit the rear couplers to the L.H. trim plate using the four circlips.
14. Fit the bracket and eye to the trim plate and fit the protective plugs to the couplers.
15. Fit the decals adjacent to the couplers.
16. Fit the straight connectors to the rear couplers.
17. Connect the hoses to the rear couplers.

NOTE: The hose from the rear port in the spool valve is fitted to coupler number 6, and the hose from the rear port is fitted to coupler number 5.

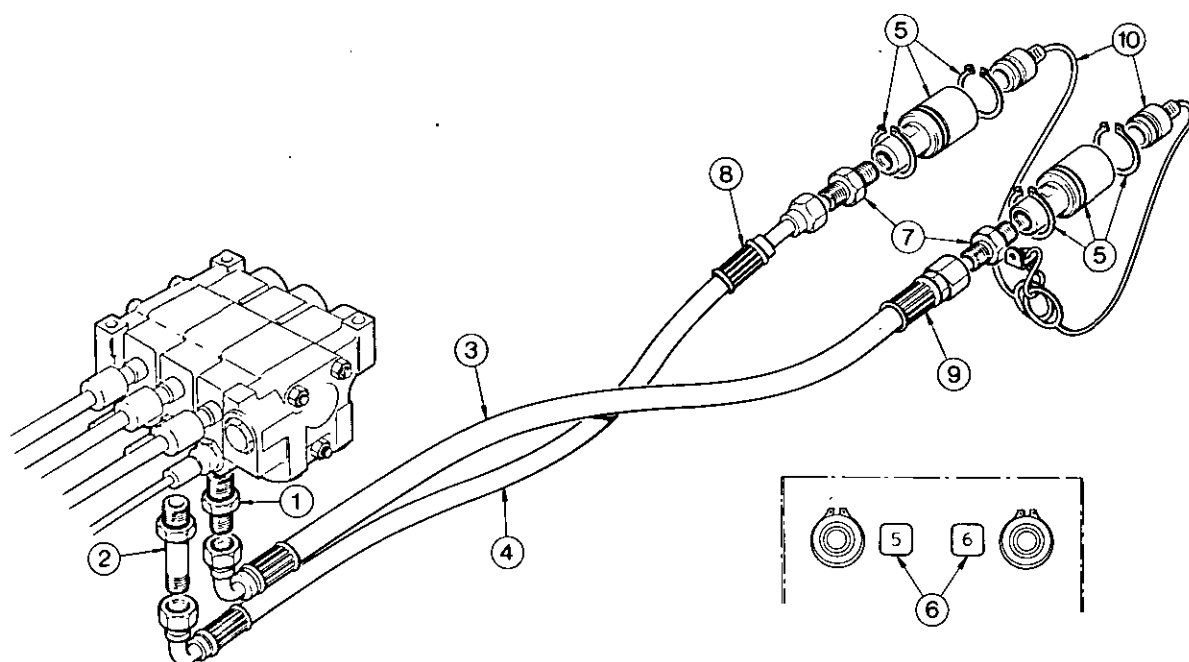
KONTAK SPOOL VALVES



**Fitting Instructions—MF 560 only Tractors from a
Third Spool 10A—32—30**

1. Screw the $\frac{1}{2}$ in—16 UNF straight connector into the rear port in the spool valve.
2. Fit the $\frac{1}{2}$ in—16 UNF 90° elbow to the front port in the spool valve.
3. Fit the angled pipe to the elbow at the front port and lock in the position shown.
4. Fit angled pipe to the rear connector in the spool valve and lock in the position shown.
5. Fit the clamp to the pipes in the position shown.
6. Fit the straight connectors to the pipe unions.
7. Fit the two pipes to the straight connectors and lock in the positions shown.
8. Fit the second pipe clamp in the position shown.
9. Assemble the third pipe clamp in a position such that the pipes are clear of the lift cover and fuel filler pipe and mark the position of the mounting hole required in the centre trim panel. Remove the clamp end drill a 7,0 mm ($\frac{9}{32}$ in) hole into the trim panel. Refit the clamp.
10. Fit the two hoses to each pipe union and lock the hoses to face vertically downwards.
11. Fit the rear couplers to the L.H. rear trim plate using the four circlips.
12. Fit the bracket and eye to the trim plate and fit the protective plugs to the couplers.
13. Fit the decals adjacent to the couplers.
14. Fit the straight connectors to the rear couplers.
15. Fit the angled pipes between the hoses and the rear couplers.

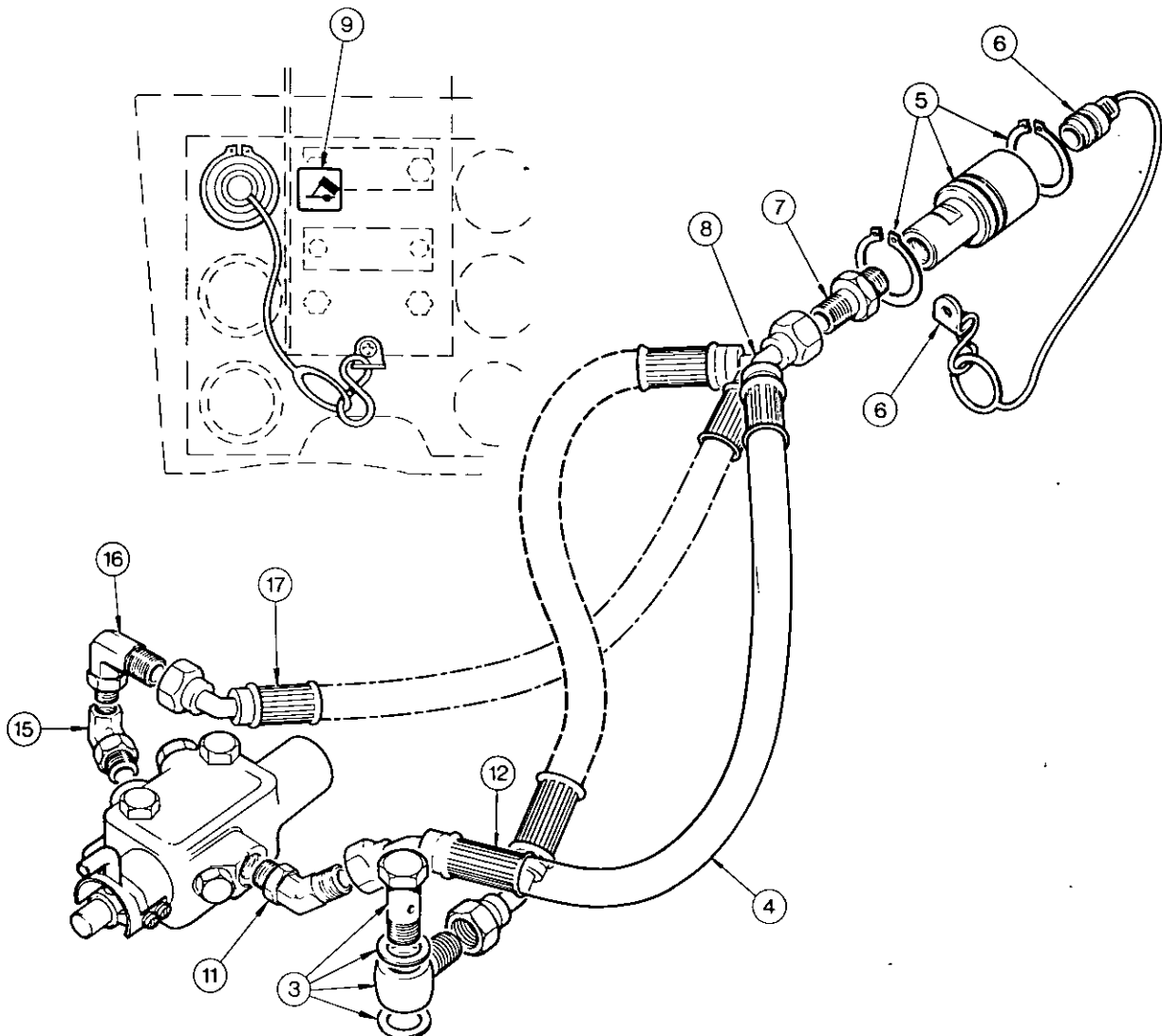
NOTE: The hose from the front port in the spool valve is fitted to coupler number 6, and the hose from the rear port is fitted to coupler number 5.



**Fitting Instructions—MF 565, 575 and 590 Tractors
from a Third Spool** **10A-33-31**

1. Screw the short $\frac{1}{4}$ —16 UNF straight connector into the rear outlet port in the spool valve.
2. Screw the long $\frac{1}{4}$ —16 UNF straight connector into the front outlet port in the spool valve.
3. Connect the 12,7 mm ($\frac{1}{2}$ in) bore hose (the larger diameter hose) to the rear outlet port in the spool valve.
4. Connect the 9,5 mm ($\frac{3}{8}$ in) bore hose (the smaller diameter hose) to the front outlet port in the spool valve.
5. Fit the two rear couplers to the upper apertures in the rear mounting plate using the four circlips.
6. Fit the decals adjacent to the couplers as shown.
7. Fit the two straight connectors to the couplers.
8. Connect the hose from the rear outlet port in the spool valve to coupler number 6. (On MF 565 tractor, route the hose to pass under the fuel filler pipe).
9. Connect the hose from the front outlet port in the spool valve to coupler number 5.
10. Fit the protective plugs to the couplers.

KONTAK SPOOL VALVES

**TRAILER TIPPING KIT****Fitting Instructions—MF 565, 575 and 590 Tractors from the Lift Cover****10A-34-32**

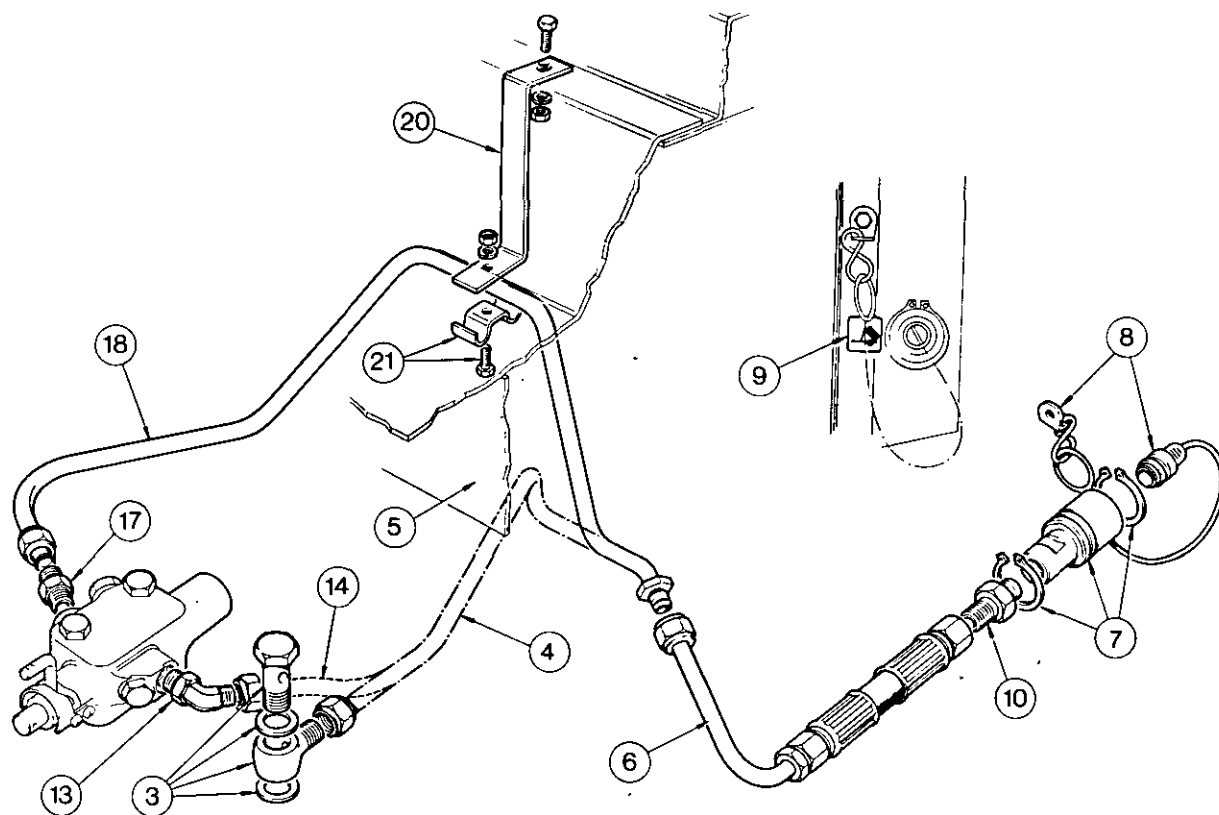
1. Remove the seat floor inspection panel, Page 3.
2. Remove the plug from the L.H. lift cover tapping point.
3. Fit the banjo with sealing washers to the lift cover. Lock the banjo in the position shown.
4. Fit the 12,7 mm ($\frac{1}{2}$ in) bore hose to the banjo. Lock the hose elbow in the position shown.
5. Fit the rear coupler to the top L.H. aperture in the rear mounting plate using a circlip each side of the plate.
6. Fit the bracket and eye assembly to the rear trim plate and fit the bung into the coupler.
7. Fit the straight connector to the rear coupler.
8. Fit the hose to the straight connector and lock the elbow in the position shown.
9. Fit the decal adjacent to the coupler.

Fitting Instructions—MF 565, 575 and 590 Tractors from Valve Port 1 in the Selector Valve**10A-35-32**

10. Remove the blanking plug from valve port 1 (rear).
11. Fit the 45° elbow to valve port 1. Lock in the position shown.
12. Fit the hose to the elbow and lock in the position shown.
13. Connect and fit the rear coupler and hose, see procedures 5 to 9.

Fitting Instructions—MF 565, 575 and 590 Tractors from Valve Port 2 in the Selector Valve**10A-36-32**

14. Remove the blanking plug from valve port 2.
15. Fit the 90° elbow to valve port 2 and lock to face vertically upwards.
16. Fit the second 90° elbow to the elbow at valve port 2 and lock in the position shown.
17. Fit the hose to the elbow and lock in the position shown.
18. Connect and fit the rear coupler and hose, see procedures 5 to 8.



**Fitting Instructions—MF 550 and 560 Tractors
from the Lift Cover** 10A-37-33

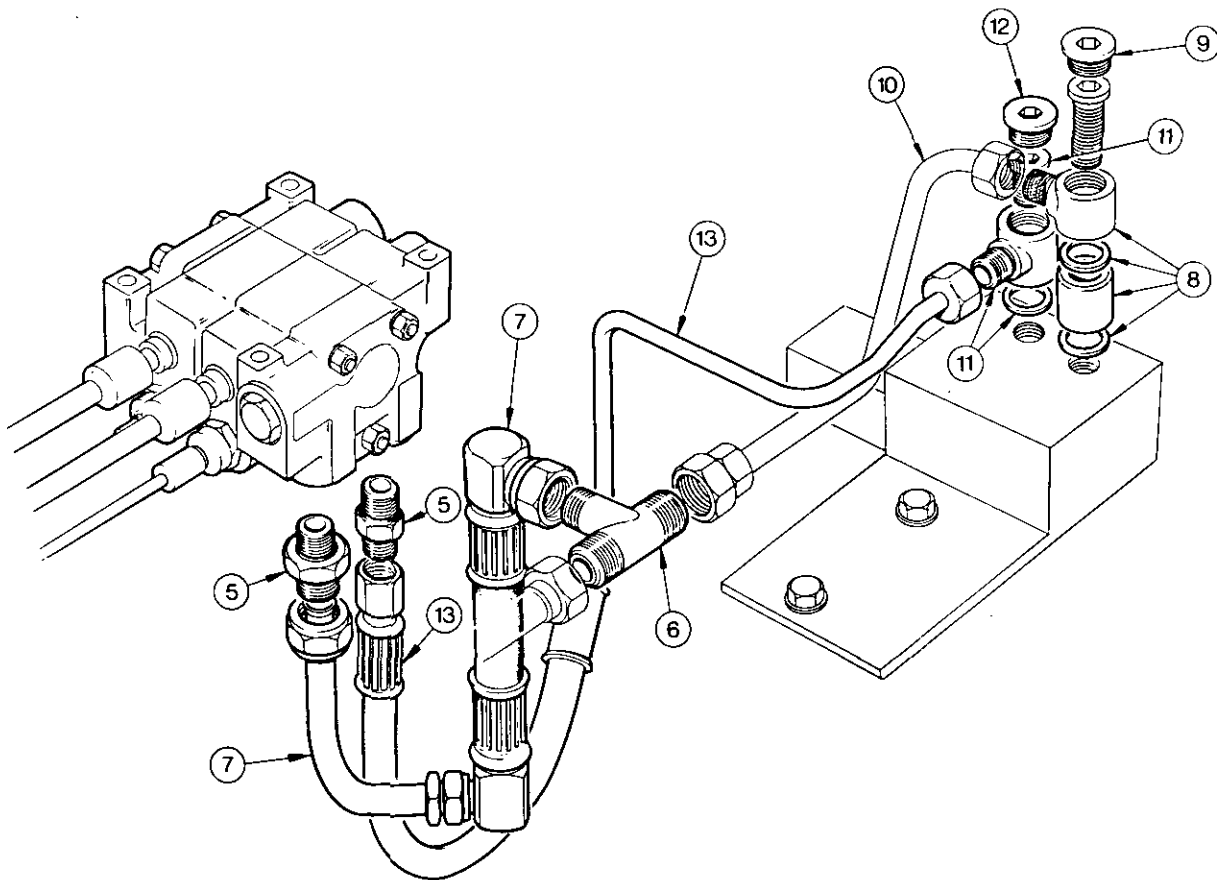
1. Remove the seat floor inspection panel, Page 3.
2. Remove the plug from the L.H. lift cover tapping point.
3. Fit the banjo with sealing washers to the lift cover. Lock the banjo to face rearwards.
4. Fit the pipe to the banjo and lock in the position shown.
5. **NOTE: It will be necessary to either delete or cut away the filler panel to permit passage of the pipe. (Later tractors do not have a filler panel fitted).**
6. Fit the second pipe and lock in the position shown.
7. Fit the rear coupler to the lowest aperture in the rear L.H. trim plate using the two circlips.
8. Fit the bracket and eye assembly to the rear trim plate and fit the dust plug into the coupler.
9. Fit the decal adjacent to the coupler.
10. Fit the straight adaptor to the rear coupler.
11. Fit the hose between the coupler and the pipe.

**Fitting Instructions—MF 550 and 560 Tractors
from Valve Port 1 in the Selector Valve** 10A-38-33

12. Remove the blanking plug from valve port 1 (rear).
13. Fit the 45° elbow to valve port 1 and lock in the position shown.
14. Fit the special angled pipe to the elbow and lock in the position shown.
15. Continue with procedures 5 to 11.

**Fitting Instructions—MF 550 and 560 Tractors
from Valve Port 2 in the selector Valve.** 10A-39-33

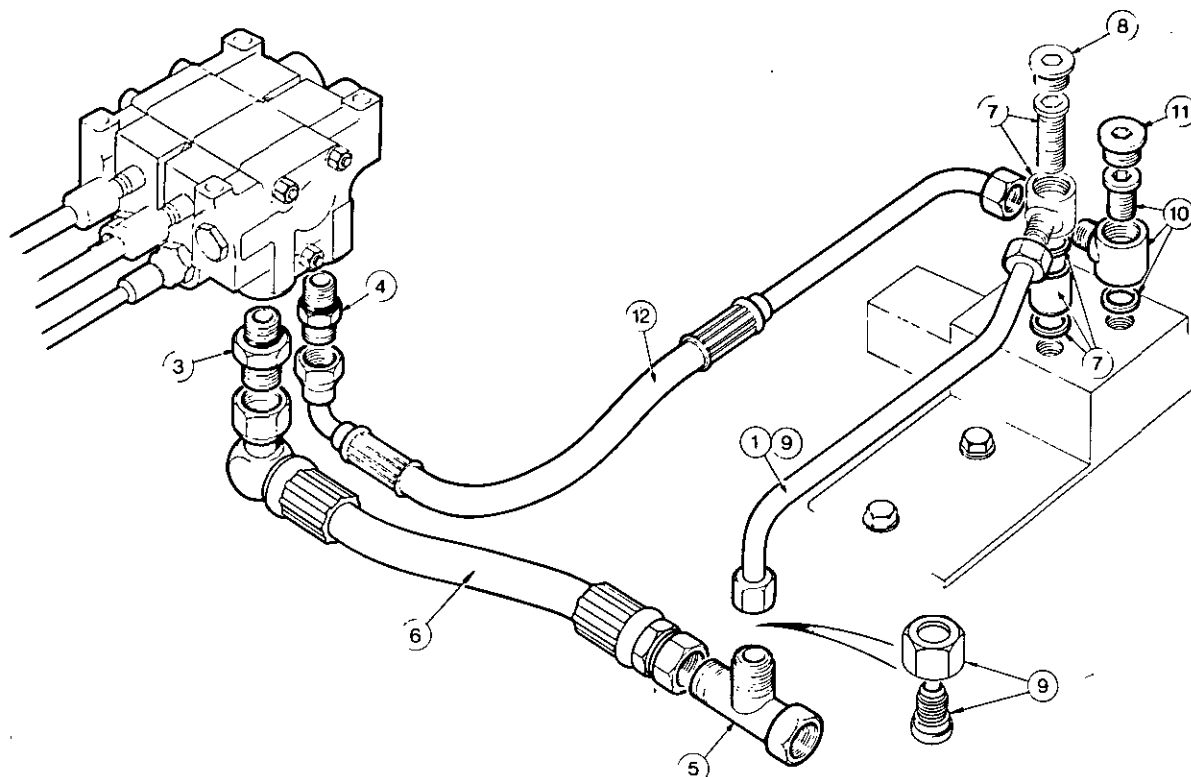
16. Remove the blanking plug from valve port 2.
17. Fit the straight connector to valve port 2.
18. Fit the special angled pipe to the connector at valve port 2.
19. Continue with procedures 5 to 11.
20. Fit the support bracket to the cab rear cross brace using the existing bolt, lockwasher and nut.
21. Fit the pipe securing clamp to the bracket as shown using the bolt, lockwasher and nut.

KONTAK SPOOL VALVES

**SUPPLY HOSE KITS FOR TRACTORS
EQUIPPED WITH TRAILER BRAKING
(EXCEPT U.K. TERRITORY)**

Fitting Instructions—MF 560 Tractors 10A-40-34

1. Remove the existing union and pipe from the manifold on the trailer braking valve.
2. Remove the straight connector from the existing return pipes.
3. Remove the manifold from the brake valve.
4. Fit the $1\frac{1}{8}$ in—12 UNF/ $\frac{3}{4}$ in—16 UNF straight adaptor to the front return port in the spool valve.
5. Fit the $\frac{3}{4}$ —16 UNF straight adaptor to the rear feed port in the spool valve.
6. Fit the Tee-piece to the return pipe from the auxiliary pump. Lock in the position shown.
7. Fit the return hose. Lock in the position shown.
8. Refit the existing banjo with its retaining allen screw using the new spacer and two sealing washers to maintain the original position. Tighten the retaining allen screw to a torque of 49—59 Nm (36—43 lbf ft). Lock the banjo in the position shown.
9. Fit the end plug to the banjo and tighten to a torque of 59—69 Nm (43—50 lbf ft).
10. Refit the existing return pipe from the banjo to the Tee-piece.
11. Fit the feed port banjo to the braking valve using the allen screw and sealing washer. Tighten the screw as in procedure 8. Lock the banjo in the position shown.
12. Fit the end plug to the banjo. Tighten the plug as in procedure 9.
13. Fit the feed hose between the banjo and the spool valve. Lock the hose elbow at the spool valve feed port as shown.



SUPPLY HOSE KIT FOR TRACTORS EQUIPPED WITH TRAILER BRAKING

Fitting Instructions

MF 575 or 590 Tractors

10A-41-35

1. Remove the existing union and pipe from the manifold on the trailer braking valve.
2. Remove the manifold from the brake valve.
3. Fit the $1\frac{1}{2}$ in-12 UNF/ $\frac{1}{4}$ in-16 UNF straight adaptor to the front return port in the spool valve.
4. Fit the $\frac{3}{4}$ -16 UNF straight adaptor to the rear feed port in the spool valve.
5. Fit the Tee-piece to the return pipe from the auxiliary pump. Lock in the position shown.
6. Fit the return hose. Lock in position shown.
7. Refit the existing banjo with its retaining allen screw using the new spacer and two sealing washers to maintain the original position. Tighten the retaining allen screw to a torque of 49-59 Nm (36-43 lbf ft). Lock the banjo in the position shown.
8. Fit the end plug to the banjo and tighten to a torque of 50-69 Nm (43-50 lbf ft).
9. Discard the pipe but retain the reducer adaptor and securing nut. Fit the return pipe from the banjo to the Tee-piece, including the reducer and adaptor removed in procedure 1.
10. Fit the feed port banjo to the braking valve using the allen screw and sealing washer. Tighten the screw as in procedure 7. Lock the banjo in the position shown.
11. Fit the end plug to the banjo. Tighten the plug as in procedure 9.
12. Fit the feed hose between the banjo and the spool valve. Lock the hose elbow at the spool valve feed port as shown.

KONTAK SPOOL VALVES

HYDRAULIC MOTOR SPOOL VALVE KIT

Fitting Instructions

Motor Spool Valves

See 10A—15—17, except delete procedures referring to the single/double acting control rod.

Fitting Instructions

Standard Spool Valves

Although not specifically designed for use with hydraulic motors, the standard spool valves can be used satisfactorily provided the following installation requirements are observed:—

- (a) Always connect the motor feed to couplers 1, 3 or 5.
- (b) Connect the motor return hose to couplers 4, 5 or 6.

NOTE: Always contact your Distributor/Dealer when fitting hydraulic motors to ensure that the hydraulic circuit is completely satisfactory.

Fitting Instructions—Outlet Hoses

See Outlet Hose Kit page 10A—27.

SPOOL VALVE UNIT

Removal and Refitment

10A—42—36

Removal

1. Remove the seat floor inspection panel, Part 2B.
2. Disconnect the operating lever cranks from the extension rods.
3. Remove the grub screws and remove the single/double action control knobs.
4. On MF 550 tractors remove the response control lever.
5. Remove the seven (eight—MF 550 tractor) screws securing the extension housing and withdraw the housing.
6. Disconnect the feed, return and outlet hoses from the spool valve. Fit protective plugs to the ports and hoses.
7. Remove the three bolts securing the spool valve assembly and lift out.

Refitment

3. Reverse procedures 1 to 7, except:
 - (a) When replacing the seat floor inspection panel apply a suitable sealer to the joint face. Use 'Evostik Colourseal or similar.

SPOOL BLOCK

Removal and Refitment

10A—43—36

Removal

1. Remove the spool valve unit, operation 10A—42—36.
2. Remove the three nuts and studs securing the spool valve assembly.
3. Remove the end plates.
4. Remove the 'O' rings.
5. Thoroughly clean the mating faces of the spool blocks and end plates.

Refitment

6. Fit new 'O' rings to the recesses in the spool blocks.
7. Place the spool blocks on a flat surface with the feed ports uppermost.

8. Align the valve sections and fit the new longer studs, nuts and lockwashers.
9. Re-tighten the nuts to a torque of 2 kg.m (15 lbf. ft).

NOTE: Do not overtighten the nuts as this could cause the spools to stick.

10. Refit the spool valve unit, operation 10A—42—36.

KONTAK SPOOL VALVES**Servicing**

10A-44-37

Disassembly

1. Remove the spool block, operation 10A-43-36.
2. Remove the spring pin securing the single/double acting extension rod and withdraw the rod.
3. Remove the split pin and clevis pin securing the spool valve extension rod and withdraw the rod.
4. Remove the plug.
5. Remove both the 'O' rings from the plug.
6. Remove the single/double acting valve housing and withdraw complete with the valve.
7. Unscrew and remove the valve.
8. Remove the 'O' ring.
9. Remove the two 'O' rings from the valve housing.
10. Withdraw the check valve body from the spool block.
11. Remove the poppet and spring.
12. Remove the 'O' ring.
13. Remove the two screws and withdraw the centreing spring cover.
14. Remove the retaining screw.
15. Remove the end plates, spring and washer.
16. Gently rotate and pull the spool forwards until the new 'O' ring is exposed. **DO NOT COMPLETELY REMOVE THE SPOOL.**
17. Remove the exposed 'O' ring from the spool block.
18. Gently rotate and push the spool rearwards until the front 'O' ring is exposed. **DO NOT COMPLETELY REMOVE THE SPOOL.**
19. Remove the exposed 'O' ring from the spool block.

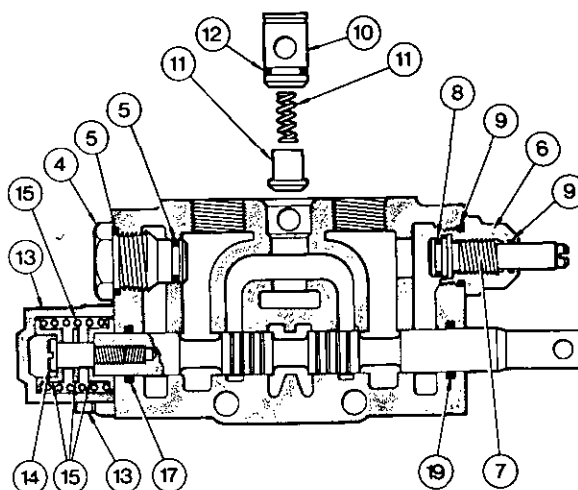
Examination

Check the condition of the check valve poppet and its seat in the spool valve block. Poor seating of the check valve can result in jerky operation. Check that the spool slides freely in the block but **DO NOT REMOVE THE SPOOL COMPLETELY.** Always fit new 'O' rings.

Reassembly

Reverse procedures 1 to 19 except:

- (a) Thoroughly degrease the thread-in and the screw and apply one drop of Loctite Hydraulic Seal to the threads of the retaining screw, procedure 14.



MF 500 SERIES TRACTOR WORKSHOP SERVICE MANUAL

SUPPLEMENT A1/1856 072 M1

To keep your MF 500 Series Tractor Workshop Service Manual No. 1856 072 M1 up dated you should file the following Issue II pages in their appropriate place immediately and destroy the Issue 1 pages of the same number.

<i>Part/Section</i>	<i>Description</i>	<i>Page Number</i>
	SEALANTS	
	CONTENTS CARD	
0	INTRODUCTION	0—11 and 0—12
1A	GENERAL SPECIFICATION	1A—01 and 1A—02
2B	CAB AND FITTINGS	2B—03 and 2B—04 2B—15 and 2B—16
4A	ENGINE	4A—57 to 4A—60
5A	DUAL CLUTCH	5A—05 and 5A—06
6A	REAR AXLE AND BRAKES	6A—19 and 6A—20 6A—55 and 6A—56
7B	STEERING	7B—03 and 7B—04
10A	ACCESSORIES	10A—01 to 10A—04

New sections to be filed in the appropriate place:

<i>Part/Section</i>	<i>Description</i>	<i>Page Number</i>
1A	SPECIFICATION	1A—15 to 1A—18
4A	ENGINE AD4 203	4A—71 to 4A—98
4B	ENGINE COOLING	4B—11 to 4B—16
5D	TRANSMISSION—8 SPEED Mk. II	5D—01 to 5D—16
5E	TRANSMISSION—MULTI-POWER Mk. II	5E—01 to 5E—18
5F	TRANSMISSION SYNCHROMESH Mk. II	5F—01 to 5F—18
10A	KONTAK SPOOL VALVE	10A—15 to 10A—38

Change by hand:

Page 3A—10, Item 27, third line should read:

Tighten them to a torque of **105 Nm (75 lbf ft)**.

SEALANTS

Sealants quoted in this Workshop Service Manual may be obtained from, as follows :

<i>Sealant</i>	<i>Description</i>	<i>Part No.</i>	<i>Obtained from</i>
A	PERKINS HYLOMAR UNIVERSAL JOINTING COMPOUND		Massey-Ferguson Central Part Operation Urmston Manchester
	Aerosol	1861127	
	Gel	1861117	
B	MASSEY-FERGUSON LOCTITE 221		
	10 cc Bottle	1810 590 M1	
	50 cc Bottle	1889 794 M1	
C	MASSEY-FERGUSON LOCTITE 270		
	10 cc Bottle	1810 581 M1	
	50 cc Bottle	1810 589 M1	
D	BOSTIK BLUE TACK		Normal trade retail outlets
E	DUNLOP THIXOFIX		
F	LOCTITE SUPERFLEX RTV3		

MF500 SERIES TRACTOR WORKSHOP SERVICE MANUAL

Publication No. 1856 072 M1

CONTENTS

PART	SECTION	DESCRIPTION	Page Number			
			MF550	MF565	MF575	MF590
		INTRODUCTION	0-01			
1	A	GENERAL SPECIFICATION	1A-02	1A-05	1A-08	1A-11
	B	MAINTENANCE	1B-01			
	C	PRE-DELIVERY	1C-01			
2	A	SHEET METAL	2A-01			
	B	CAB	2B-01			
3	A	SPLITTING THE TRACTOR	3A-01			
4	A	ENGINE	4A-01	4A-39	4A-39	4A-39
	B	ENGINE COOLING	4B-01			
	C	ENGINE FUEL SYSTEM	4C-01			
5	A	CLUTCH (DUAL) (SPLIT TORQUE)	5A-01			
			5A-11			
	B	TRANSMISSION—8 SPEED	5B-01			
	C	TRANSMISSION—MULTI-POWER	5C-01			
6	A	REAR AXLE AND BRAKES	6A-01	6A-33	6A-33	6A-33
	B	POWER TAKE-OFF	6B-01			
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7	A	FRONT AXLE	7A-01	7A-15	7A-15	7A-15
	B	STEERING	7B-01			
	C	WHEELS AND TYRES	7C-01			
8	A	HYDRAULIC SYSTEM	8A-01			
	B	AUXILIARY HYDRAULICS	8B-01			
	C	DRAWBAR AND LINKAGE	8C-01			
9	A	ELECTRICAL SYSTEM	9A-01			
10	A	ACCESSORIES	10A-01			

SEALANTS

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<i>Sealant</i>	<i>Description</i>	<i>Part No.</i>	<i>Obtained from</i>
A	PERKINS HYLOMAR UNIVERSAL JOINTING COMPOUND		Massey-Ferguson Central Part Operation Urmston Manchester
	Aerosol	1861 127 M1	
Gel	1861 117 M1		
B	MASSEY-FERGUSON LOCTITE 221		
	10 cc Bottle	1810 590 M1	
	50 cc Bottle	1889 194 M1	
C	MASSEY-FERGUSON LOCTITE 270		
	10 cc Bottle	1810 581 M1	
	50 cc Bottle	1810 589 M1	
D	EVOSTICK COULERSEAL		
E	DUNLOP THIXOFIX		Normal trade retail outlets

INTRODUCTION

	Page Number
INTRODUCTION	01
SPECIAL TOOLS	01
REPAIRS AND REPLACEMENTS	01
REPAIR TIME SCHEDULE	02
AMENDMENTS	02
GENERAL INSTRUCTIONS	04
SAFETY	04
SYSTEM FAULTS	04
HANDLING HEAVY COMPONENTS	04
REMOVAL AND INSTALLATION OF COMPONENT PARTS	04
CONVERSION TABLES	06
SPECIAL TOOLS	09

INTRODUCTION

The purpose of this manual is to assist dealers and distributors in the efficient repair and maintenance of Massey-Ferguson farm machinery. Carrying out the procedures as detailed, together with the use of special tools where appropriate, will enable the operations to be completed within the time stated in the repair time schedule.

NOTE—To assist with locating information, each division of the manual is preceded by a contents page listing the operation in numerical order.

Each instruction within an operation has a sequence number, and to complete the operation in the minimum time it is essential that these instructions are performed in numerical sequence commencing at 1 unless otherwise stated. When applicable, these sequence numbers identify the components in the appropriate illustration. Where performance of an operation requires the use of a special tool, the tool number is quoted under the operation heading and is repeated in, or following, the instruction involving its use.

INDEXING

For convenience the manual is divided into parts and sections, each page bearing a part and section number.

Example:—7A—15

Part 7 Section A Page 15

This simplifies cross referencing and enables the subject to be found easily.

SPECIAL TOOLS

Where the use of a special tool is specified in an

operation the tool number will be shown under the operation heading and also following the instruction requiring its use.

The use of the special tools mentioned in the text contributes to a safe, efficient and profitable repair. Some operations are impracticable without their use, for example the assembly of the differential unit. Distributors are therefore urged to check their tools against the list provided. Where necessary, tools may be ordered from: V. L. Churchill & Co. Ltd., London Road, Daventry, England.

REPAIRS AND REPLACEMENTS

When service parts are required it is essential that only genuine Massey-Ferguson replacements are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features embodied in the tractor may be impaired if other than genuine parts are fitted.

In certain territories, legislation prohibits the fitting of parts not to the tractor manufacturers specification. Torque wrench setting figures given in the Workshop Manual must be strictly adhered to. Locking devices where specified must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.

The tractor warranty may be invalidated by the fitting of other than genuine Massey-Ferguson parts. All Massey-Ferguson replacements have the full backing of the manufacturers warranty. Massey-Ferguson Distributors and Dealers are obliged to supply only genuine service parts.

INTRODUCTION

REPAIR TIME SCHEDULE

The operations listed in the Repair Time Schedule refer to those described in this manual. The time set against each operation in the schedule is established by performing the actual operations on standard machines using special tools where applicable. The Repair Time Schedule for use with this manual is issued as a separate publication.

NOTE—Repair Time Schedules are issued to Massey-Ferguson Distributors and Dealers only and are not for general publication.

AMENDMENTS

Under normal conditions revised pages are issued carrying the same number as the existing pages requiring amendment. The new pages are inserted in place of the existing ones. The old pages should then be discarded.

In some cases additional pages or completely new sections may be issued. These pages are to be inserted immediately following the page carrying the next lowest page number, or section number as appropriate.

Where new pages are required to be positioned between existing pages, the new page numbers will contain a suffix letter—

Example:—New page number 7A—16a.

This page is inserted after existing page number 7A—16 and before page number 7A—17. Correspondingly a further new page numbered 7A—16b would be positioned after 7A—16a but before 7A—17. To assist in identifying amendments on revised pages, two asterisks (**) will be inserted at the beginning and at the end of the amended paragraph, section, instruction or illustration.

To ensure that a record of amendments to this manual is readily available, the list of amendments will be re-issued with each set of revised pages, quoting the amendment number, date of issue, appropriate instructions and revised page numbers.

NOTE—Service Bulletins and Amendment Sheets are issued to the Massey-Ferguson Distributors and Dealers only and are not for general publication.

Amendment No.	Date	Page Issued

INTRODUCTION

Amendment No.	Date	Page Issued

INTRODUCTION

GENERAL INSTRUCTIONS

SAFETY

Your safety and that of others is always the first consideration when working around machines. Safety is a matter of thoroughly understanding the job to be done, the correct use of tools and equipment, and the application of good common sense.

SYSTEM FAULTS

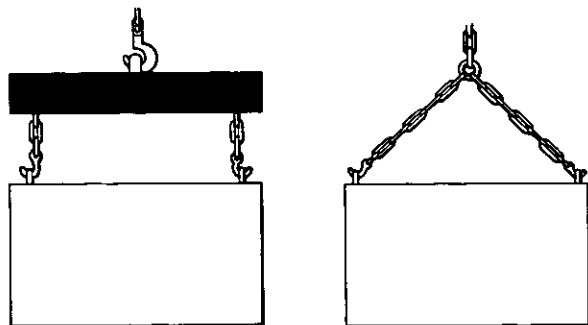
The following procedure combined with the information contained in the workshop manual will be helpful in tracing system faults accurately. It consists of following a number of logical steps to locate and correct the problem.

1. Determine the problem.
2. List possible causes.
3. Devise checks.
4. Conduct checks in logical order to determine cause.
5. Consider remaining service life against cost of parts and labour.
6. Make necessary repair.
7. Recheck.

HANDLING OF HEAVY COMPONENTS

Unless otherwise specified, all removals should be accomplished using an adjustable lifting beam and hoisting equipment. All supporting chains or cables should be parallel to each other and as near vertical as possible in relation to the object being lifted.

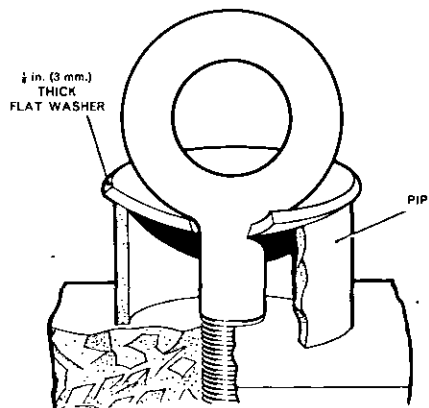
When removing a component on an angle remember that the capacity of an eyebolt diminishes as the angle between the supporting members and the object becomes less than 90° (Fig. 1).



Correct and incorrect method of lifting a component

Eyebolts and brackets should never be bent and should only have stress in tension. A length of pipe and a washer can be used to help relieve these stresses on eyebolts (Fig. 2). In some cases special lifting fixtures are available to obtain correct balance and provide for safe handling. If in doubt consult relevant section of workshop manual.

WARNING—If a part resists removal check to be certain all nuts and bolts have been removed and that an adjacent part is not interfering.



Forged eyebolt support

REMOVAL AND INSTALLATION OF COMPONENT PARTS

Cleanliness

The most important single item in preserving the long life of the machine is to keep dirt out of vital working parts. Precautions have been taken to safeguard against this. Enclosed compartments, seals and filters have been provided to keep the supply of air, fuel and lubricants clean. These safeguards must be maintained.

Whenever hydraulic, fuel, lubricating oil or air lines are disconnected, clean the point of disconnection as well as the adjacent area. As soon as the disconnection is made, cap, plug or tape the line or opening to prevent entry of foreign material. The same recommendations for cleaning and covering apply when access covers or inspection plates are removed.

Clean and inspect all parts. Be sure all passages and holes are open. Cover all parts to keep them clean. Be sure parts are clean when they are installed. Leave new parts in their containers until ready for assembly.

Assembly

When reassembling a machine, complete each step in turn. Do not partially assemble one part and start assembling some other part. Make all adjustments as recommended. Always check the job after it is completed to see nothing has been overlooked.

Recheck the various adjustments before returning the machine to the job.

NOTE—Clean the rust preventative compound from all machined surfaces of new parts before installing them.

Lubrication

Where applicable, fill the compartments of the components serviced with the amount, type and grade of lubricant recommended in the Regular Maintenance Section (1B) of this Manual.

Shims

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

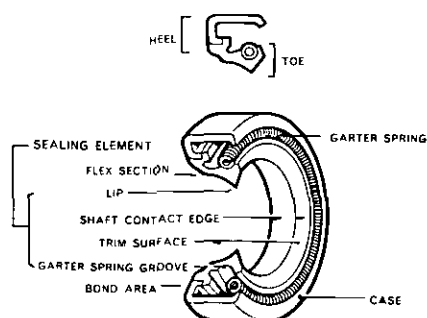
Gaskets

Be sure the holes in the gaskets correspond with the lubricant passages in the mating parts. If gaskets are to be made, select material of the proper type and thickness. Be sure to cut holes in the right places. Blank gaskets can cause serious damage.

Lip Type Rubber Seals

Lubricate the lips of lip-type rubber seals before installation. Use petroleum jelly. Do not grease on any seal except a grease seal.

The main parts of a lip-type seal are the case, sealing element, and garter spring. The picture below illustrates the construction of a simple lip-type seal. The cross section at the top shows the terms "heel" and "toe" used to identify the sides of a single element seal. With few exceptions, the toe of an oil seal with one lip is next to the lubricant that is sealed. Some seals have a second auxiliary lip, which does not carry a garter spring.



Lip-type seal construction

If, during installation, the seal lip must pass over a shaft that has splines, a keyway, rough surface or a sharp edge, the lip can be easily damaged. Always use a seal protector, when one is provided.

Cables and Wires

When removing or disconnecting a group of cables or wires, tag each one to assure proper assembly.

Bearing Bushes and Press Fits

Do not install bearing bushes with a hammer.

Use a press if possible and be sure to apply the pressure directly in line with the bore. If necessary, drive on a bearing using a bearing driver or a bar with a smooth flat end. If a sleeve bearing has an oil hole, align it with the oil hole in the mating part.

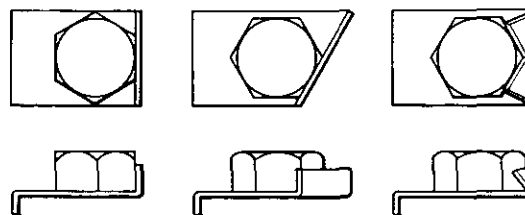
When one part is pressed into another lubricate the mating surfaces.

Assemble tapered parts dry. Before assembling, be sure the tapers are clean, dry and free from burrs.

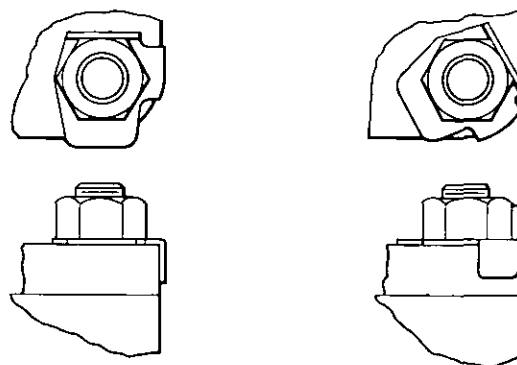
Use of Bolts in Blind Holes

Use bolts of the correct length. A bolt which is too long may "bottom" before the head is tight against the part it is to hold. The threads can be damaged when a "long" bolt is removed.

If a bolt is too short, there may not be enough threads engaged to hold the part securely.



Correct and incorrect methods of installing flat metal locks.



Correct and incorrect method for lock positioning and bending.

Locking Devices

Lockwashers, flat metal locks or cotter pins are used to lock nuts and bolts.

Flat metal locks must be installed properly to be effective. Bend one end of the lock around the edge of the part. Bend the other end against one flat surface of the nut or bolt head.

Always install new locks in compartments which house moving parts.

When installing lockwashers on housings made of aluminium, use a flat washer between the lockwasher and the housing.

INTRODUCTION

PRESSURE (KN/m² to lbf/m², lbf/in² to KN/m²)

KN/m ²		lbf/in ²	KN/m ²		lbf/in ²	KN/m ²		lbf/in ²
6-8948	1	0-1450	234-423	34	4-9300	461-952	67	9-7150
13-7896	2	0-2900	241-318	35	5-0750	468-846	68	9-8600
20-6844	3	0-4350	248-213	36	5-2200	475-741	69	10-0050
27-5792	4	0-5800	255-108	37	5-3650	482-636	70	10-1500
34-4740	5	0-7250	262-002	38	5-5100	489-531	71	10-2950
41-3688	6	0-8700	268-898	39	5-6550	496-426	72	10-4400
48-2636	7	1-0150	275-792	40	5-8000	503-320	73	10-5850
55-1584	8	1-1600	282-687	41	5-9450	510-215	74	10-7300
62-0532	9	1-3050	289-582	42	6-0900	517-110	75	10-8750
68-9480	10	1-4500	296-476	43	6-2350	524-005	76	11-0200
75-8428	11	1-5950	303-371	44	6-3800	530-899	77	11-1650
82-7376	12	1-7400	310-266	45	6-5250	537-794	78	11-3100
89-6324	13	1-8850	317-161	46	6-6700	544-689	79	11-4550
96-5272	14	2-0300	324-056	47	6-8150	551-584	80	11-6000
103-422	15	2-1750	330-950	48	6-9600	558-479	81	11-7450
110-317	16	2-3200	337-845	49	7-1050	565-374	82	11-8900
117-212	17	2-4650	344-740	50	7-2500	572-268	83	12-0350
124-106	18	2-6100	351-635	51	7-3950	579-163	84	12-1800
131-001	19	2-7550	358-529	52	7-5400	586-058	85	12-3250
137-896	20	2-9000	365-424	53	7-6850	592-953	86	12-4700
144-791	21	3-0450	372-319	54	7-8300	599-848	87	12-6150
151-686	22	3-1900	379-214	55	7-9750	606-742	88	12-7600
158-580	23	3-3350	386-109	56	8-1200	613-637	89	12-9050
165-475	24	3-4800	393-004	57	8-2650	620-532	90	13-0500
172-370	25	3-6250	399-898	58	8-4100	627-427	91	13-1950
179-265	26	3-7700	406-793	59	8-5550	634-322	92	13-3400
186-159	27	3-9150	413-688	60	8-7000	641-216	93	13-4850
193-054	28	4-0600	420-583	61	8-8450	648-111	94	13-6300
199-949	29	4-2050	427-478	62	8-9900	655-006	95	13-7750
206-844	30	4-3500	434-372	63	9-1350	661-901	96	13-9200
213-739	31	4-4950	441-267	64	9-2800	668-796	97	14-0650
220-634	32	4-6400	448-162	65	9-4250	675-690	98	14-2100
227-528	33	4-7850	455-057	66	9-5700	682-585	99	14-3550

TORQUE (Nm to lbf/ft, lbf/ft to Nm)

Nm		lbf/ft	Nm		lbf/ft	Nm		lbf/ft
1-3558	1	0-7376	46-0972	34	25-0784	90-8386	67	49-4912
2-7116	2	1-4752	47-4530	35	25-8160	92-1944	68	50-1568
4-0674	3	2-2128	48-8088	36	26-5536	93-5502	69	50-8944
5-4232	4	2-9504	50-1646	37	27-2912	94-9060	70	51-6320
6-7790	5	3-6880	51-5204	38	28-0288	96-2618	71	52-3696
8-1348	6	4-4256	52-8762	39	28-7664	97-6176	72	53-1072
9-4906	7	5-1632	54-2320	40	29-5040	98-9734	73	53-8448
10-8464	8	5-9008	55-5878	41	30-2416	100-329	74	54-5824
12-2022	9	6-6384	56-9436	42	30-9792	101-685	75	55-3200
13-5580	10	7-3760	58-2994	43	31-7168	103-041	76	56-0576
14-9138	11	8-1136	59-6552	44	32-4544	104-397	77	56-7952
16-2696	12	8-8512	61-0110	45	33-1920	105-752	78	57-5328
17-6254	13	9-5888	62-3668	46	33-9296	107-108	79	58-2704
18-9812	14	10-3264	63-7226	47	34-6672	108-464	80	59-0080
20-3370	15	11-0640	65-0784	48	35-4048	109-820	81	59-7456
21-6928	16	11-8016	66-4342	49	36-1424	111-176	82	60-4832
23-0486	17	12-5392	67-7900	50	36-8800	112-531	83	61-2208
24-4044	18	13-2768	69-1458	51	37-6176	113-887	84	61-9584
25-7602	19	14-0144	70-5016	52	38-3552	115-243	85	62-6960
27-1160	20	14-7520	71-8574	53	39-0928	116-600	86	63-4336
28-4718	21	15-4896	73-2132	54	39-8304	117-955	87	64-1712
29-8276	22	16-2272	74-5690	55	40-5680	119-310	88	64-9088
31-1834	23	16-9648	75-9248	56	41-3056	120-666	89	65-6464
32-5392	24	17-7024	77-2806	57	42-0432	122-022	90	66-3840
33-8950	25	18-4400	78-6364	58	42-7808	123-378	91	67-1216
35-2508	26	19-1776	79-9922	59	43-5184	124-734	92	67-8592
36-6066	27	19-9152	81-3480	60	44-2560	126-089	93	68-5968
37-9624	28	20-6528	82-7038	61	44-9936	127-445	94	69-3344
39-3182	29	21-3904	84-0596	62	45-7312	128-801	95	70-0720
40-6740	30	22-1280	85-4154	63	46-4688	130-157	96	70-8096
42-0298	31	22-8656	86-7712	64	47-2064	131-513	97	71-5472
43-3856	32	23-6032	88-1270	65	47-9440	132-868	98	72-2848
44-7414	33	24-3408	89-4828	66	48-6816	134-224	99	73-0224

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CAPACITY (Imp. gall to litre, litre to Imp. gal)

Imp. gal		litre	Imp. gal		litre	Imp. gal		litre
0-2199	1	4-5459	7-4766	34	154-561	14-733	67	304-575
0-4398	2	9-0918	7-6965	35	159-107	14-9532	68	309-121
0-6597	3	13-6377	7-9164	36	163-652	15-1731	69	313-667
0-8796	4	18-1836	8-1363	37	168-198	15-393	70	318-213
1-0995	5	22-7295	8-3562	38	172-744	15-6129	71	322-759
1-3194	6	27-2754	8-5761	39	177-290	15-8328	72	327-305
1-5393	7	31-8213	8-7960	40	181-836	16-0527	73	331-851
1-7592	8	36-3672	9-0159	41	186-382	16-2726	74	336-397
1-9791	9	40-9131	9-2358	42	190-929	16-4925	75	340-943
2-1990	10	45-4590	9-4557	43	195-474	16-7124	76	345-488
2-4189	11	50-0049	9-6756	44	200-019	16-9323	77	350-034
2-6388	12	54-5508	9-8955	45	204-566	17-1522	78	354-580
2-8587	13	59-0967	10-1154	46	209-111	17-3721	79	359-126
3-0786	14	63-6426	10-3353	47	213-657	17-5920	80	363-672
3-2985	15	68-1885	10-5552	48	218-203	17-8119	81	368-218
3-5184	16	72-7344	10-7751	49	222-749	18-0318	82	372-764
3-7383	17	77-2803	10-995	50	227-295	18-2517	83	377-310
3-9582	18	81-8262	11-2149	51	231-841	18-4716	84	381-856
4-1781	19	86-3721	11-4348	52	236-387	18-6915	85	386-402
4-3980	20	90-9180	11-6547	53	240-933	18-9114	86	390-947
4-6179	21	95-4639	11-8746	54	245-479	19-1313	87	395-493
4-8378	22	100-009	12-0945	55	250-025	19-3512	88	400-039
5-0577	23	104-556	12-3144	56	254-570	19-5711	89	404-585
5-2776	24	109-102	12-5343	57	259-116	19-7910	90	409-131
5-4975	25	113-648	12-7542	58	263-662	20-0109	91	413-677
5-7174	26	118-193	12-9741	59	268-209	20-2308	92	418-223
5-9373	27	122-739	13-1940	60	272-754	20-4507	93	422-769
6-1572	28	127-285	13-4139	61	277-299	20-6706	94	427-315
6-3771	29	131-831	13-6338	62	281-846	20-8905	95	431-861
6-5970	30	136-377	13-8537	63	286-392	21-1104	96	436-406
6-8169	31	140-923	14-0736	64	290-938	21-3303	97	440-952
7-0368	32	145-469	14-2935	65	295-483	21-5502	98	445-498
7-2567	33	150-015	14-5134	66	300-029	21-7701	99	450-044

CAPACITY (Imp. pt. to litres, litres to Imp. pt.)

Imp. pt.		litres	Imp. pt.		litres	Imp. pt.		litres
1-7599	1	0-5682	59-8366	34	19-3188	117-913	67	38-0694
3-5198	2	1-1364	61-5965	35	19-8870	119-673	68	38-6376
5-2797	3	1-7046	63-3564	36	20-4552	121-433	69	39-2058
7-0396	4	2-2728	65-1163	37	21-0234	123-193	70	39-7740
8-7995	5	2-8400	66-8762	38	21-5916	124-953	71	40-3422
10-5594	6	3-4902	68-6361	39	22-1598	126-713	72	40-9104
12-3193	7	3-9774	70-3960	40	22-7280	128-473	73	41-4786
14-0792	8	4-5456	72-1559	41	23-2962	130-233	74	42-0468
15-8391	9	5-1138	73-9158	42	23-8644	131-993	75	42-6150
17-5990	10	5-6820	75-6757	43	24-4326	133-752	76	43-1832
19-3589	11	6-2502	77-4356	44	25-0008	135-512	77	43-7514
21-1188	12	6-8184	79-1955	45	25-5690	137-272	78	44-3196
22-8787	13	7-3866	80-9554	46	26-1372	139-032	79	44-8878
24-6386	14	7-9548	82-7153	47	26-7054	140-792	80	45-456
26-3985	15	8-5230	84-4752	48	27-2736	142-552	81	46-0242
28-1854	16	9-0912	86-2351	49	27-8418	144-312	82	46-5924
29-9183	17	9-6594	87-9950	50	28-4100	146-072	83	47-1606
31-6782	18	10-2276	89-7549	51	28-9782	147-832	84	47-7288
33-4381	19	10-7958	91-5148	52	29-5464	149-592	85	48-2970
35-1980	20	11-3640	93-2747	53	30-1146	151-351	86	48-8652
36-9579	21	11-9322	95-0346	54	30-6828	153-111	87	49-4334
38-7178	22	12-5004	96-7945	55	31-2510	154-871	88	50-0016
40-4777	23	13-0686	98-5544	56	31-8192	156-631	89	50-5698
42-2376	24	13-6368	100-314	57	32-3874	158-391	90	51-1380
43-9975	25	14-2050	102-074	58	32-9556	160-151	91	51-7062
45-7574	26	14-7732	103-834	59	33-5238	161-912	92	52-2744
47-5173	27	15-3414	105-594	60	34-0920	163-671	93	52-8426
49-2772	28	15-9096	107-354	61	34-6602	165-431	94	53-4108
51-0371	29	16-4778	109-114	62	35-2284	167-191	95	53-9790
52-7970	30	17-0460	110-874	63	35-7966	168-950	96	54-5472
54-5569	31	17-6142	112-634	64	36-3648	170-710	97	55-1154
56-3168	32	18-1824	114-394	65	36-9330	172-470	98	55-6836
58-0767	33	18-7506	116-153	66	37-5012	174-230	99	56-2518

INTRODUCTION**LENGTH (m to ft, ft to m)**

m		ft	m		ft	m		ft
0-3048	1	3-2808	10-3632	34	111-549	20-4216	67	219-816
0-6096	2	6-5617	10-6680	35	114-829	20-7264	68	223-097
0-9144	3	9-8425	10-9728	36	118-110	21-0312	69	226-378
1-2192	4	13-1234	11-2776	37	121-391	21-3360	70	229-659
1-5240	5	16-4042	11-5824	38	124-672	21-6408	71	232-940
1-8288	6	19-6850	11-8872	39	127-953	21-9456	72	236-220
2-1336	7	22-9659	12-1920	40	131-234	22-2504	73	239-501
2-4384	8	26-2467	12-4968	41	134-514	22-5552	74	242-782
2-7432	9	29-5276	12-8016	42	137-795	22-8600	75	246-063
3-0480	10	32-8084	13-1064	43	141-076	23-1648	76	249-344
3-3528	11	36-0892	13-4112	44	144-357	23-4696	77	252-625
3-6576	12	39-3701	13-7160	45	147-638	23-7744	78	255-906
3-9624	13	42-6509	14-0208	46	150-919	24-0792	79	259-186
4-2672	14	45-9318	14-3256	47	154-199	24-3840	80	262-467
4-5720	15	49-2126	14-6304	48	157-480	24-6888	81	265-748
4-8768	16	52-4934	14-9352	49	160-761	24-9936	82	269-029
5-1816	17	55-7743	15-2400	50	164-042	25-2984	83	272-310
5-4864	18	59-0551	15-5448	51	167-323	25-6032	84	275-591
5-7912	19	62-3360	15-8496	52	170-604	25-9080	85	278-871
6-0960	20	65-6168	16-1544	53	173-885	26-2128	86	282-152
6-4008	21	68-8976	16-4592	54	177-165	26-5176	87	285-433
6-7056	22	72-1785	16-7640	55	180-446	26-8224	88	288-714
7-0104	23	75-4593	17-0688	56	183-727	27-1272	89	291-995
7-3152	24	78-7402	17-3736	57	187-008	27-4320	90	295-276
7-6200	25	82-0210	17-6784	58	190-289	27-7368	91	298-556
7-9248	26	85-3018	17-9832	59	193-570	28-0416	92	301-837
8-2296	27	88-5827	18-2880	60	196-850	28-3464	93	305-118
8-5344	28	91-8635	18-5928	61	200-131	28-6512	94	308-399
8-8392	29	95-1444	18-8976	62	203-412	28-9560	95	311-680
9-1440	30	98-4252	19-2024	63	206-693	29-2608	96	314-961
9-4488	31	101-706	19-5072	64	209-974	29-5656	97	318-241
9-7536	32	104-987	19-8120	65	213-255	29-8704	98	321-522
10-0584	33	108-268	20-1168	66	216-535	30-1752	99	324-803

WEIGHT (Kg to lb, lb to Kg)

Kg		lb	Kg		lb	Kg		lb
0-4536	1	2-2046	15-4224	34	74-9564	30-3912	67	147-708
0-9072	2	4-4092	15-8760	35	77-1610	30-8448	68	149-913
1-3608	3	6-6138	16-3296	36	79-3656	31-2984	69	152-117
1-8144	4	8-8184	16-7832	37	81-5702	31-7520	70	154-322
2-2680	5	11-0230	17-2368	38	83-7748	32-2056	71	156-527
2-7216	6	13-2276	17-6904	39	85-9794	32-6592	72	158-731
3-1752	7	15-4322	18-1440	40	88-1840	33-1128	73	160-936
3-6288	8	17-6368	18-5976	41	90-3886	33-5664	74	163-140
4-0824	9	19-8414	19-0512	42	92-5932	34-0200	75	165-345
4-5360	10	22-046	19-5048	43	94-7978	34-4736	76	167-549
4-9896	11	24-2506	19-9584	44	97-0024	34-9272	77	169-754
5-4432	12	26-4552	20-4120	45	99-2070	35-3808	78	171-958
5-8968	13	28-6598	20-8656	46	101-412	35-8344	79	174-163
6-3504	14	30-8644	21-3192	47	103-616	36-2880	80	176-368
6-8040	15	33-0690	21-7728	48	105-821	36-7416	81	178-573
7-2576	16	35-2736	22-2264	49	108-025	37-1952	82	180-777
7-7112	17	37-4782	22-6800	50	110-230	37-6488	83	182-982
8-1648	18	39-6828	23-1336	51	112-435	38-1024	84	185-186
8-6184	19	41-8874	23-5872	52	114-639	38-5560	85	187-391
9-0720	20	44-0920	24-0408	53	116-844	39-0096	86	189-596
9-5256	21	46-2966	24-4944	54	119-048	39-4632	87	191-800
9-9792	22	48-5012	24-9480	55	121-253	39-9168	88	194-005
10-4328	23	50-7058	25-4016	56	123-458	40-3704	89	196-209
10-8864	24	52-9104	25-8552	57	125-662	40-8240	90	198-414
11-3400	25	55-115	26-3088	58	127-867	41-2776	91	200-619
11-7936	26	57-3196	26-7624	59	130-071	41-7312	92	202-823
12-2472	27	59-5242	27-2160	60	132-276	42-1848	93	205-028
12-7008	28	61-7288	27-6696	61	134-481	42-6384	94	207-232
13-1544	29	63-9334	28-1232	62	136-685	43-0920	95	209-437
13-6080	30	66-1380	28-5768	63	138-889	43-5456	96	211-642
14-0616	31	68-3426	29-0304	64	141-094	43-9992	97	213-846
14-5152	32	70-5472	29-4840	65	143-299	44-4528	98	216-051
14-9688	33	72-7518	29-9376	66	145-504	44-9064	99	218-255

INTRODUCTION

CONVERSION TABLES

Inches	Decimals	Milli- metres	Inches to Millimetres		Millimetres to Inches		Fahrenheit and Centigrade				
			Inches	Milli- metres	mm	inches	°F	°C	°C	°F	
1/16	1/64	.015625	.3969		0.001	.000039	-20	-28.9	-30	-22	
	1/32	.03125	.7937	Inches		0.002	.000079	-15	-26.1	-28	-18.4
	3/64	.046875	1.1906		Milli- metres	0.003	.000118	-10	-23.3	-26	-14.8
1/8	5/64	.0625	1.5875	.0001	.00254	0.004	.000157	-5	-20.6	-24	-11.2
	3/32	.078125	1.9844	.0002	.00508	0.005	.000197	0	-17.8	-22	-7.6
	7/64	.09375	2.3812	.0003	.00762	0.006	.000236	1	-17.2	-20	-4
3/16	9/64	.109375	2.7781	.0004	.01016	0.007	.000276	2	-16.7	-18	-0.4
	5/32	.125	3.1750	.0005	.01270	0.008	.000315	3	-16.1	-16	3.2
	11/64	.140625	3.5719	.0006	.01524	0.009	.000354	4	-15.6	-14	6.8
1/4	13/64	.15625	3.9687	.0007	.01778	0.01	.00039	5	-15.0	-12	10.4
	7/32	.171875	4.3656	.0008	.02032	0.02	.00079	10	-12.2	-10	14
	15/64	.1875	4.7625	.0009	.02286	0.03	.00118	15	-9.4	-8	17.6
5/16	17/64	.203125	5.1594	.001	.0254	0.04	.00157	20	-6.7	-6	21.2
	9/32	.21875	5.5562	.002	.0508	0.05	.00197	25	-3.9	-4	24.8
	19/64	.234375	5.9531	.003	.0762	0.06	.00236	30	-1.1	-2	28.4
3/8	25/64	.25	6.3500	.004	.1016	0.07	.00276	35	1.7	0	32
	13/32	.265625	6.7469	.005	.1270	0.08	.00315	40	4.4	2	35.6
	27/64	.28125	7.1437	.006	.1524	0.09	.00354	45	7.2	4	39.2
7/16	29/64	.296875	7.5406	.007	.1778	0.1	.00394	50	10.0	6	42.8
	15/32	.3125	7.9375	.008	.2032	0.2	.00787	55	12.8	8	46.4
	31/64	.328125	8.3344	.009	.2286	0.3	.01181	60	15.6	10	50
9/16	33/64	.34375	8.7312	.01	.254	0.4	.01575	65	18.3	12	53.6
	17/32	.359375	9.1281	.02	.508	0.5	.01969	70	21.1	14	57.2
	35/64	.375	9.5250	.03	.762	0.6	.02362	75	23.9	16	60.8
5/8	25/32	.390625	9.9219	.04	1.016	0.7	.02756	80	26.7	18	64.4
	23/32	.40625	10.3187	.05	1.270	0.8	.03150	85	29.4	20	68
	47/64	.421875	10.7156	.06	1.524	0.9	.03543	90	32.2	22	71.6
11/16	49/64	.4375	11.1125	.07	1.778	1	.03937	95	35.0	24	75.2
	23/32	.453125	11.5094	.08	2.032	2	.07874	100	37.8	26	78.8
	43/64	.46875	11.9062	.09	2.286	3	.11811	105	40.6	28	82.4
3/4	41/64	.484375	12.3031	.1	2.54	4	.15748	110	43.3	30	86
	19/32	.5	12.7000	.2	5.08	5	.19685	115	46.1	32	89.6
	37/64	.515625	13.0969	.3	7.62	6	.23622	120	48.9	34	93.2
7/8	35/64	.53125	13.4937	.4	10.16	7	.27559	125	51.7	36	96.8
	27/32	.546875	13.8906	.5	12.70	8	.31496	130	54.4	38	100.4
	53/64	.5625	14.2875	.6	15.24	9	.35433	135	57.2	40	104
15/16	51/64	.578125	14.6844	.7	17.78	10	.39370	140	60.0	42	107.6
	25/32	.59375	15.0812	.8	20.32	11	.43307	145	62.8	44	112.2
	49/64	.609375	15.4781	.9	22.86	12	.47244	150	65.6	46	114.8
1	47/64	.625	15.8750	1	25.4	13	.51181	155	68.3	48	118.4
	23/32	.640625	16.2719	2	50.8	14	.55118	160	71.1	50	122
	43/64	.65625	16.6687	3	76.2	15	.59055	165	73.9	52	125.6
1 1/16	41/64	.671875	17.0656	4	101.6	16	.62992	170	76.7	54	129.2
	23/32	.6875	17.4625	5	127.0	17	.66929	175	79.4	56	132.8
	45/64	.703125	17.8594	6	152.4	18	.70866	180	82.2	58	136.4
1 1/8	43/64	.71875	18.2562	7	177.8	19	.74803	185	85.0	60	140
	27/32	.734375	18.6531	8	203.2	20	.78740	190	87.8	62	143.6
	51/64	.75	19.0500	9	228.6	21	.82677	195	90.6	64	147.2
1 1/4	49/64	.765625	19.4469	10	254.0	22	.86614	200	93.3	66	150.8
	25/32	.78125	19.8437	11	279.4	23	.90551	205	96.1	68	154.4
	51/64	.796875	20.2406	12	304.8	24	.94488	210	98.9	70	158
1 3/8	53/64	.8125	20.6375	13	330.2	25	.98425	215	100.0	75	167
	27/32	.828125	21.0344	14	355.6	26	1.02362	220	104.4	80	176
	55/64	.84375	21.4312	15	381.0	27	1.06299	225	107.2	85	185
1 1/2	53/64	.859375	21.8281	16	406.4	28	1.10236	230	110.0	90	194
	29/32	.875	22.2250	17	431.8	29	1.14173	235	112.8	95	203
	57/64	.890625	22.6219	18	457.2	30	1.18110	240	115.6	100	212
1 5/8	57/64	.90625	23.0187	19	482.6	31	1.22047	245	118.3	105	221
	29/32	.921875	23.4156	20	508.0	32	1.25984	250	121.1	110	230
	59/64	.9375	23.8125	21	533.4	33	1.29921			115	239
1 3/4	61/64	.953125	24.2094	22	558.8	34	1.33858				
	31/32	.96875	24.6062	23	584.2	35	1.37795				
	63/64	.984375	25.0031	24	609.6	36	1.41732				
				25	635.0	37	1.45669				
				26	660.4	38	1.49606				
						39	1.53543				
						40	1.57480				

INTRODUCTION

Torque Loading

Apply proper torque values to all bolts and nuts when re-assembling equipment. When a specific value is required, the value is quoted in the text. All other nuts, bolts and taperlock studs should be tightened to the values detailed in the Standard Torque loading Chart.

NOMINAL SIZE (diameter)	WRENCH SETTING Nm (lbf-ft)	
	A	B
$\frac{1}{8}$ in	6-78 to 8-13 (5 to 6)	10-85 to 13-55 (8 to 10)
$\frac{1}{4}$ in	13-55 to 16-27 (10 to 12)	20-34 to 24-40 (15 to 18)
$\frac{3}{8}$ in	25-76 to 29-82 (19 to 22)	40-67 to 47-45 (30 to 35)
$\frac{1}{2}$ in	44-74 to 51-52 (33 to 38)	67-79 to 74-57 (50 to 55)
$\frac{5}{8}$ in	63-72 to 71-86 (47 to 53)	103-04 to 115-24 (76 to 85)
$\frac{3}{4}$ in	88-13 to 98-97 (65 to 73)	155-92 to 169-47 (115 to 125)
$\frac{7}{8}$ in	135-58 to 169-47 (100 to 125)	200-05 to 230-48 (155 to 170)
1 in	237-26 to 271-16 (175 to 200)	271-16 to 406-74 (270 to 300)

Standard Torque Loadings

COLUMN A

Non-Rigid Joints

Column "A" specifies the spanner torques to be used with non-rigid joints where extrusion, deformity or other damage would result when higher clamping forces are used.

Limited Strength Nuts

The torque values in column "A" are also the maximum recommended for weld nuts, slotted nuts or other limited strength nuts.

Standard Nuts with Lock Washers

When lock washers are used under the nut, the torque values in column "A" should be applied. Laboratory tests indicate that lock washers substantially reduce the friction under the nut. This is especially true if the bolt, nut and lock washer are oiled. Due to this reduction in friction, proper bolt elongation is obtained by use of the torque in column "A". Column "B" torques may cause failure of the nut or bolt during assembly.

COLUMN B

Column "B" is the wrench torque to be used for assembly of rigid joints where extrusion, deformity or other damage will not result, and it is desirable to obtain more elastic elongation of the bolt or stud to ensure that it remains tight.

SPECIAL TOOLS

Tool No.	Description	Tool No.	Description
ENGINE			
PD.1C	Valve Guide Remover and Replacer (Main Tool)	MF.195-4	Front Axle Pivot Pin Bush Remover/Replacer and P.t.o. Bush Remover/Replacer
PD.1C-1	Adaptor for PD.1C	MF263	Front Axle and Steering Bush Remover (Main Tool)
PD.1C-4	Adaptor for PD.1C	MF.263-2	Front Axle and Steering Bush Remover/Replacer Adaptors (1½ in)
4RL	Tension Wrench	MF.263-3	Front Axle and Steering Bush Remover/Replacer Adaptors (1⅞ in)
No. 13	Tension Wrench	MF.264	Front Axle and Steering Bush Reamer (Main Tool)
38 U3	Piston Ring Compressor	MF.264-1	Reamer and Pilot
PD.41B	Piston Height and Valve Depth Gauge	MF.264-2	Reamer and Pilot
PD.137	Valve Guide Reamer 0.015 in oversize	MF.268A	Steering Wheel Remover
PD.138	Valve Guide Reamer 0.030 in oversize	MF.322	Front Axle Pivot Pin Bush Remover and Replacer
PD.141	Oil Seal Replacer	MF.332	Power Steering Pump Oil Seal Protector
PD.145	Crankshaft Rear Oil Seal Pilot	6312A	Steering Drop Arm Remover
PD.150	Cylinder Liner Remover and Replacer (Main Tool)		
PD.152-2	Oil Seal Pilot		
PD.150-1A	Adaptors for PD.150		
PD.150-1B	Adaptor		
PD.150-7B	Adaptor		
PD.150-7	Adaptors for PD.150		
PD.155B	Basic Puller	REAR AXLE	
PD.155-1	Adaptor for PD.155A	MF.9A	Differential Housing Holder
335	Con Rod Jig and Master Arbor	MF.10	Bench Plate
PD.336-6	Arbor Adaptor 2.6459 in dia.	MF.26A	Handle
6000C	Diesel Compression Tester	MF.26B	Axle Shaft Bearing Remover (Main Tool)
6000C-3	Adaptor for 6000C	MF.197	Wheel Axle Outer Bearing Cone and Differential Cone Replacer (Main Tool)
6000C-4A	Adaptor for 6000C	MF.197-2	Differential Carrier-Plate Bearing Cone Replacer Adaptor
6118B	Valve Spring Compressor	MF.200-2	Drive Cover Assembly and Bearing Remover
PD.6118-3	Adaptor for 6118B	MF.200-3	Differential Carrier Plate Bearing Cone Remover Adaptor
7600	Bearing Remover	MF.200-22	Differential Bearing Remover Adaptor
7066	Circlip Pliers	MF.200-23	Driving Pinion Bearing and Pilot Bearing Remover/Replacer Adaptor
FC.9900	Injector Tester	MF.200-24	Epicyclic Hub Inner Bearing Cone Remover Adaptor
MF.200-26	Water Pump Overhaul Kit	MF.200-27	Driver Cover and Bearing Assembly Remover Adaptor
6200C	Small End Reaming Fixture	MF.202A	Rear Drive Shaft Needle Bearing Remover
316X	Valve Seat Cutter Handle	MF.203A	Rear Drive Shaft Needle Bearing Replacer and P.t.o. Remover/Replacer
316-10	Pilot (⅝ in dia. Valve Guide)	MF.245D	Rear Axle Preload Gauge
316-12	Pilot (⅜ in dia. Valve Guide)	MF.245D-1	Straight Edge
316-13	Pilot	MF.257	Differential Bearing Cone Replacer
316-125	Pilot (0.015 in oversize on ⅜ in Guide)	MF.258	Differential Housing Holder
PD.317-22	Valve Seat Cutter	MF.265A	Planetary Carrier Assembly Remover
PD.317-23	Valve Seat Cutter		
317-30	Valve Seat Cutter		
317-G19	Valve Seat Glazebreaker		
317G-25	Valve Seat Glazebreaker		
317G-30	Valve Seat Glazebreaker		
FRONT AXLE AND STEERING			
MS.62-3	Danfoss Oil Seal and Spring Plate Kit		
MF.147-7	Power Steering Adaptor		

SPECIAL TOOLS

Tool No.	Description	Tool No.	Description
MF.266B	Planetary Carrier Bush Inner Coil Seal Bearing Cone and Unit Replacer	MF.333	Draft Control Rod Gauge (Increased Tension Range)
MF.267A	Epicyclic Hub Pre-load Gauge	MF.349	Valve Seal Forming Tool
MF.295B	Wheel Guide Pilots	MF.350	Valve Circlip Replacer
MF.555-2A	Differential Coupling Bearing Cone Remover	MF.351	Valve Plug Remover and Replacer
MF.1105-2A	Differential Bearing Cup Remover/Replacer	MF.352	Control Valve Spring Retainer
MF.1105-7A	Differential Bearing Cup Remover/Replacer Adaptor	MF.353	Control Valve Body 'O' Ring Guide
MF.1105-8	Epicyclic Hub Inner Bearing Cup Remover/Replacer Adaptor	MF.354	Control Valve Body Replacer
MF.1105-11	Rear Axle Shaft Oil Seal Remover and Replacer	MF.356	Position and Draft Control Setting Gauge
CLUTCH & TRANSMISSION		MF.357A	Dummy Bolt and Screwdriver Adjuster
MF.159A	Single and Dual Clutch Centraliser	MF.357	Screwdriver Adjuster
MF.177	Transmission Main Drive Shaft Oil Seal Pilot	MF.359	Pressure Control Bleed Pipe
MF.178	P.t.o. Main Drive Shaft Pilot	MF.360	Hydraulic Pump Adjusting Kit
MF.200-25	Multi-Purpose Bearing Remover	MF.363	Quadrant Lever Retainer Tool
MF.215	Secondary Clutch Setting Gauge	MF.364	Oil Seal Replacer (P.t.o.)
MF.218A	Front P.t.o. Housing Replacer (Main Tool)	810	Hydraulic Pressure and Flow Test Fixture (Main Tool)
MF.218A-2	Front P.t.o. Housing Replacer Adaptor	MF.810-1	Adaptor
MF.255B	Multi-Power Pinion Oil Seal Replacer and Assembly Sleeve	MF.810-4	Multi-Power Pump Flow Adaptor
MF.256A	Multi-Power Pinion Assembly Inner Oil Seal Replacer	MF.810-6	I.p.t.o. Pressure Gauge Adaptor
MF.314	Lever Fulcrum Height Setting Gauge	MULTI-PURPOSE & MISCELLANEOUS TOOLS	
MF.315	Main Drive Shaft Retainer Needle Bearing and Seal Remover/Replacer	13	Tension Wrench
MF.331	Transmission Input Shaft Oil Seal Replacer	MF.148A	Hydraulic Pressure Test Equipment (Main Tool)
MF.347	Transmission Case Drill and Ream Jig	MF.195	Bearing Cups Remover/Replacer (Main Tool)
MF.1105-6	Differential Carrier Plate Oil Seal Remover/Replacer Adaptor	MF.200	Hand Press (Main Tool)
7600B	Flywheel Spigot Bearing Remover (Main Tool)	MF.260	Low Pressure Hydraulic Test Set (Main Tool)
MF.7600-1	Flywheel Spigot Bearing Remover Adaptor	270	Tractor Splitting Kit
P.T.O. & HYDRAULICS		MF.365-1	Plates
MF.163	Spring Retainer Nut Wrench	MF.356-3	Short Support Bars
MF.166	Hydraulic Adaptor for Life Cover	MF.356-4	Long Support Bars
MF.167	P.t.o. Oil Seal Pilot	MF.365-6	Bar Pins
MF.195-6	Two Speed P.t.o. Shaft Needle Bearing Remover/Replacer	MF.365-7	Tommy Bar
MF.226A	Hydraulic Life Cover Remover/Replacer	MF.365-8	Stands
MF.226A-3	Lift Cover Cradle Adaptor Set	550	Driver Handle (Main Tool)
		555	Three Leg Adjustable Puller (Main Tool)
		MF.1105	Bearing Remover (Main Tool)
		7065M	Heavy Duty Circlip Pliers
		7066	Circlip Pliers
		HD.3	Circlip Plier Points

**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 1

Publication No. 1856 072 M1

comprising

- A GENERAL SPECIFICATION
- B REGULAR MAINTENANCE
- C PRE-DELIVERY AND INSTALLATION

SPECIFICATION
Part 1 — Section A

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SPECIFICATION

MF550 TRACTOR**ENGINE**

Make: Perkins, to MF specification
Type and Model: Four-stroke, direct injection diesel AD3.152
Number of Cylinders: Three
Bore: 91.44 mm (3.6 in)
Stroke: 127 mm (5 in)
Capacity: 2.5 litre (152.7 in³)
Compression Ratio: 16.5:1
Firing Order: 1, 2, 3
Horsepower: 47 PS (34.5 kW) at 2250 rev/min (DIN 70020). 49 hp at 2250 rev/min (B.S. AU 141: 1967 Ambient Conditions)
Maximum Torque (at 1400 rev/min): 169 Nm (125 lbf ft) (DIN 70020). 177 Nm (131 lbf ft) (B.S. AU 141: 1967 Ambient Conditions)
Lubrication: Throwaway, canister type full flow external filter
Valves: Overhead, pushrod operated
Valve tip Clearance (Inlet and Exhaust): 0.30 mm (0.012 in) cold, 0.25 mm (0.010 in) hot

FUEL SYSTEM AND AIR CLEANER

Fuel Lift Pump: A.C. Delco with hand primer
Fuel Filter: C.A.V. filter with transparent sediment bowl
Injection Pump: C.A.V. Distributor type, with mechanical governor
Engine Speeds (no load): Idling—700 to 750 rev/min. Maximum—2390 rev/min
Injection Timing: 16° B.T.D.C.
Injectors: C.A.V. type nozzles and nozzle holders
 Initial setting pressure 19.25 N/mm² (190 Atmosphere). Working pressure 17.27 N/mm² (170 Atmosphere)
Easy Starting Aid: C.A.V. Thermostart Mark III C
Air Cleaner: Two stage, dry element, removable for cleaning with warning light and buzzer

ELECTRICAL SYSTEM

Voltage: 12 volt NEGATIVE EARTH
Battery: 17 plate, 96 Ah. Lucas Mono Lid. Exide Mono Lid. Lucas Aqualok. Exide Auto-Fil
Starter Motor: Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector
Alternator: Lucas 23ACR or Motorola 9AR 2501K
Light Bulb Sizes:
 Headlights UK 36/36W, Others 45/40W
 Side Lights 5W
 Rear Lights 5W
 Indicator Lights 21W
 Brake Lights 21W
 Number Plate Lights 5W
 Plough Light 36W
 Panel Lights 2.2W
 Interior Light 5W

Fuses:

Dipped Headlights 15A
 Side Lights 10A
 Brake Lights 10A
 Warning Light 15A
 Main Beam Headlights 15A
 Flashing Indicators 10A
 Plough Light 10A
 Blower Motor 17A
 Wiper Motor 10A
 Interior Light 2A
 Horn 35A
 Cigar Lighter 35A
Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)

COOLING SYSTEM

Type: Thermostat controlled with centrifugal pump to assist circulation. Four bladed fan driven by a belt from the crankshaft.
Fan Belt Deflection (Total): 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley

TRANSMISSION

Clutch Live P.t.o. Tractors: Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated.
I.p.t.o. Tractors: Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories.
Eight Speed Gearbox: The eight speed gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, compounded by an epicyclic unit.
Eight Speed Synchromesh Gearbox (Certain Territories): The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh as third and fourth gears, compounded by an epicyclic unit.
Multi-Power Gearbox: The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears actuated by a hydraulic clutch
Epicyclic Reduction: 4:1
Final Drive Ratio: 6:17:1

POWER TAKE-OFF

Live Power Take-off: Engine, or engine and ground speed drives are engaged by a lever to the left of the operator's seat

Independent Power Take-off: Engine speed i.p.t.o. is engaged by a lever to the left of the operator's seat. The i.p.t.o. clutch is a multi-plate, wet clutch

Reduction Ratio (Standard Pump): 3:12:1. (High Flow Pump)—3:51:1.

Speeds (Standard Pump): 540 rev/min at 1 685 engine rev/min. (High Flow Pump)—540 rev/min at 1 893 engine rev/min

Ground Speeds: Forward travel for each revolution of the p.t.o. shaft

551 mm (21.7 in)—11-32 tyres

520 mm (20.5 in)—11-28 tyres

519 mm (20.4 in)—13-24 tyres

P.t.o. shaft rotates clockwise for forward travel and anticlockwise for reverse travel.

Power Take-off Shaft: Six splines, 35 mm (1.38 in) diameter, with an annular groove for securing p.t.o. couplings

HYDRAULIC SYSTEM

Ferguson Pump: Four cylinder scotch yoke type pump driven from the forward end of the p.t.o. shaft, supplies oil, under pressure to the ram cylinder and four external take-off points

Tapping Point Thread Sizes: Top— $\frac{3}{8}$ N.P.S.M.

Side— $\frac{3}{8}$ N.P.T.F.

Pressure Control System: The Pressure Control System operates from 0,69 to 18,2 N/mm² (100 to 2 650 lbf/in²)

Pump Maximum Output (Standard Pump): 17 litre/min (3.8 Imp. gal/min) at 2 250 engine rev/min

(High Flow Pump) 26,5 litre/min (5.9 Imp. gal/min) at 2 250 engine rev/min

Pump Maximum Pressure: 17,6 N/mm² (2 550 lbf/in²)

Linkage: Three point linkage, with Category 1 or 2 interchangeable ball ends. A barrel turnbuckle type, adjustable top link is fitted plus check chains adjustable for Category 1 and 2

Maximum Lift Capacity: 1 415 kg (3 120 lb)

AUXILIARY HYDRAULICS

Auxiliary Pump: Gear type pump with separate gear train and output for Multi-Power and i.p.t.o. supply

Pump Output Standard Ferguson Pump: To auxiliaries—36 litre/min (7.9 Imp. gal/min). To Multi-Power/i.p.t.o.—21,3 litre/min (4.7 Imp. gal/min)

High Flow Ferguson Pump: To auxiliaries—36 litre/min (7.9 Imp. gal/min). To Multi-Power/i.p.t.o.—19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: Auxiliaries—17,3 to 19,3 N/mm² (2 500 to 2 800 lbf/in²). Multi-Power/i.p.t.o.—4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o. Pump: Gear type pump
Pump Output Standard Ferguson Pump: 21,3 litre/min (4.7 Imp. gal/min)

High Flow Ferguson Pump: 19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: 4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o./Auxiliary Filtration: Externally mounted 25 micron filter with replaceable cartridge type element

Standard Flow Ferguson Pump				
Application	Output at 2 250 engine rev/min (720 p.t.o. rev/min)			
	litre/ min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	17,0	3.8	5,9	5.8
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	53,0	11.7	16,5	16.3

High Flow Ferguson Pump				
Application	Output at 2 250 engine rev/min (1 185 p.t.o. rev/min)			
	litre/ min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	26,5	5.9	9,1	9.0
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	62,5	13.8	19,6	19.3

BRAKES

Type: Girling 355 x 50 mm (14 x 2 in) twin shoe, internally expanding, full servo brakes, mechanically operated, either together or independently to assist steering.

Parking Brake: Operates on both rear wheels simultaneously

STEERING

Type: Hydrostatic, with a gear pump and integral reservoir

Toe-in: 3 mm ($\frac{1}{8}$ in)

Turns Lock to Lock: 3:1

FRONT AXLE

Type: Three section, adjustable for track width

Wheel Camber: 3° 30'

Wheel Castor: 4° 56'

SPECIFICATION

TRACK ADJUSTMENTS

Front Track: 1321 to 1828 mm (52 to 72 in) in 102 mm (4 in) increments

Rear Track: 1321 to 1930 mm (52 to 76 in) in 102 mm (4 in) increments

WHEELS AND TYRES

Front:

4.50 x 16 wheels fitted with 6.00-16, 6 ply tyres

5.50 x 16 wheels fitted with 7.50-16, 6 ply tyres

4.50 x 19 wheels fitted with 6.00-19, 6 ply tyres

Rear:

W10 x 28 wheels fitted with 11-28, 6 ply tyres

W10 x 32 wheels fitted with 11-32, 6 ply tyres

W12 x 24 wheels fitted with 13-24, 6 ply tyres

Water Ballasting: Additional weight for each rear tyre:-

11-28 tyres—94 kg (208 lb)

11-32 tyres—143 kg (316 lb)

13-24 tyres—194 kg (428 lb)

CAPACITIES

Fuel Tank: 67 litre (15 Imp. gal)

Engine Sump (including filter): 6,8 litre (12 Imp. pt)

Cooling System: 10,2 litre (18 Imp. pt)

Transmission:

Eight Speed—28 litre (49.5 Imp. pt)

Multi-Power—27 litre (48 Imp. pt)

Power Steering Reservoir: 0,8 litre (1.3 Imp. pt)

GENERAL DIMENSIONS (Fig. 1)

A. Overall Height: 2261 mm (91 in)

B. Overall Width: 1651 mm (65 in)

C. Overall Length: 3556 mm (140 in)

D. Wheelbase: 2076 mm (81.8 in)

Ground Clearance:

E. Under Drawbar Frame: 287 mm (11.3 in)

F. Under Engine Sump: 375 mm (14.8 in)

Turning Circle: 7,1 m (23.3 ft) Without Brakes. 6,2 m (20.3 ft) With Brakes

Weight (with fuel, oil and water): 2083 kg (4592 lb)

Note: The above dimensions are for a tractor fitted with 6.00-19 front tyres and 11-32 rear tyres at 1321 mm (52 in) track setting.

MOUNTING POINTS (Fig. 2)

1. 184 mm (7.25 in)

2. 92 mm (3.62 in)

3. 4 holes tap $\frac{5}{8}$ in 11 UNC 3B x 32 mm (1 $\frac{1}{4}$ in)

4. 102 mm (4 in)

5. 1243 mm (49 in)

6. 4 holes tap $\frac{3}{4}$ in 10 UNC 3B x 27 mm (1 $\frac{1}{8}$ in)

7. 76 mm (3 in)

8. 152 mm (6 in)

9. 43 mm (1.69 in)

10. 86 mm (3.38 in)

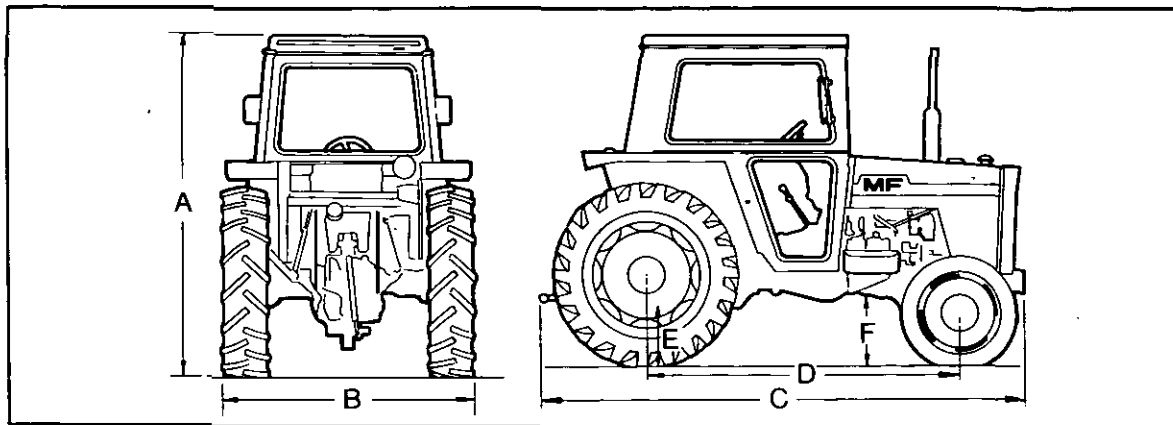


FIG. 1

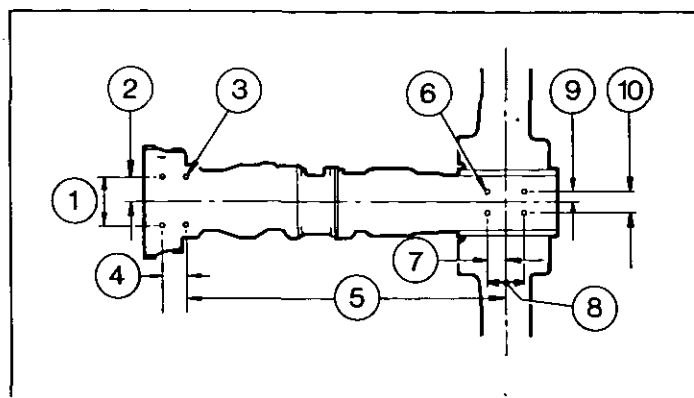


FIG. 2

MF565 TRACTOR**ENGINE****Make:** Perkins, to MF specification**Type and Model:** Four-stroke, direct injection diesel A4.236**Number of Cylinders:** Four**Bore:** 98,4 mm (3.875 in)**Stroke:** 127 mm (5 in)**Capacity:** 3,86 litre (236 in³)**Compression Ratio:** 16:1**Firing Order:** 1, 3, 4, 2**Horsepower:** 60 PS (44 kW) at 2 000 rev/min (DIN 70020). 63 hp at 2 000 rev/min (B.S. AU 141: 1967 Ambient Conditions)**Maximum Torque** (at 1 200 rev/min): 230 Nm (170 lbf ft) (DIN 70020)**Lubrication:** Throwaway, canister type full flow external filter**Valves:** Overhead, pushrod operated**Valve Tip Clearance** (Inlet and Exhaust): 0,30 mm (0.012 in) cold. 0,25 mm (0.010 in) hot**FUEL SYSTEM AND AIR CLEANER****Fuel Lift Pump:** A.C. Delco, with hand primer**Fuel Filter:** C.A.V. filter, with transparent sediment bowl**Injection Pump:** C.A.V. Distributor type, with mechanical governor**Engine Speeds** (no load): Idling: 700 to 750 rev/min
Maximum—2 160 rev/min**Injection Timing:** 23° B.T.D.C.**Injectors:** C.A.V. type nozzles and nozzle holders
Initial setting pressure 17,73 N/mm² (175 Atmosphere). Working pressure 17,23 N/mm² (170 Atmosphere)**Easy Starting Aid:** C.A.V. Thermostart Mark III C**Air Cleaner:** Two stage, dry element, removable for cleaning with warning light and buzzer**ELECTRICAL SYSTEM****Voltage:** 12 volt NEGATIVE EARTH**Battery:** 17 plate, 96 or 125 Ah. Lucas Mono Lid. Exide Mono Lid. Lucas Aqualok. Exide Auto-Fil**Starter Motor:** Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector.**Alternator:** Lucas 23ACR or Motorola 9AR 2501K**Light Bulb Sizes:**

Headlights UK 36/36W, others 45/40W

Side Lights 5W

Rear Lights 5W

Indicator Lights 21W

Brake Lights 21W

Number Plate Lights 5W

Plough Light 36W

Panel Lights 2.2W

Interior Light 5W

Fuses:

Dipped Headlights 15A

Side Lights 10A

Brake Lights 10A

Warning Lights 15A

Main Beam Headlights 15A

Flashing Indicators 10A

Plough Light 10A

Blower Motor 17A

Wiper Motor 10A

Interior Light 2A

Horn 35A

Cigar Lighter 35A

Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)**COOLING SYSTEM****Type:** Thermostat controlled with centrifugal pump to assist circulation. Four bladed fan driven by a belt from the crankshaft**Fan Belt Deflection** (Total): 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley**TRANSMISSION****Clutch** Live p.t.o. Tractors: Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated

I.p.t.o. Tractors: Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories

Eight Speed Gearbox: The eight speed gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, compounded by an epicyclic unit**Eight Speed Synchromesh Gearbox** (Certain Territories): The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh on third and fourth gears, compounded by an epicyclic unit**Multi-Power Gearbox:** The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears actuated by a hydraulic clutch**Gearbox Epicyclic Reduction:** 4:1**Final Drive:** Bevel drive with epicyclic final hub reduction giving an overall ratio of 10.83:1

SPECIFICATION

POWER TAKE-OFF

Live Power Take-off: Engine, or engine and ground speed drives are engaged by a lever to the left of the operator's seat

Independent Power Take-off: Engine speed i.p.t.o. is engaged by a lever to the left of the operator's seat. The i.p.t.o. clutch is a multi-plate, wet clutch

Reduction Ratio:

Standard Pump—3:12:1

High Flow Pump—3:12:1 (540 rev/min). 1:69:1 (1 000 rev/min)

Speeds:

Standard Pump—540 rev/min at 1 685 engine rev/min

High Flow Pump—540 rev/min at 1 686 engine rev/min. 1 000 rev/min at 1 690 engine rev/min

Ground Speeds: Forward travel for each revolution of the p.t.o. shaft.

442 mm (17.41 in)—11-32 tyres

477 mm (18.80 in)—11-36 tyres

494 mm (19.45 in)—12-36 tyres

469 mm (18.49 in)—14-30 tyres

493 mm (19.46 in)—15-30 tyres

509 mm (20.05 in)—12-38 tyres

452 mm (17.77 in)—13-28 tyres

P.t.o. shaft rotates clockwise for forward travel and anticlockwise for reverse travel

Power Take-off Shaft: Six spline (540 rev/min), 21 spline (1 000 rev/min), 35 mm (1.38 in) diameter, with an annular groove for securing p.t.o. couplings

HYDRAULIC SYSTEM

Ferguson Pump: Four cylinder, scotch yoke type pump driven from the forward end of the p.t.o. shaft, supplies oil, under pressure to the ram cylinder and four external take-off points

Tapping Point Thread Sizes: Top— $\frac{3}{8}$ N.P.S.M. Side— $\frac{3}{8}$ N.P.T.F.

Pressure Control System: The Pressure Control system operates from 0.69 to 20.7 N/mm² (100 to 3 000 lbf/in²)

Pump Maximum Output:

Standard Pump—15 litre/min (3.4 Imp. gal/min) at 2 000 engine rev/min

High Flow Pump—26.5 litre/min (5.9 Imp. gal/min) at 2 000 engine rev/min

Pump Maximum Pressure: 20.7 N/mm² (3 000 lbf/in²)

Linkage: Three point linkage, with Category 1 or 2 interchangeable ball ends. A barrel turnbuckle type, adjustable top link is fitted, plus check chains adjustable for Category 1 and 2

Maximum Lift Capacity: 1 542 kg (3 400 lb)

AUXILIARY HYDRAULICS

Auxiliary Pump: Gear type pump with separate gear train and output for Multi-Power and i.p.t.o. supply

Pump Output: To auxiliaries—36 litre/min (7.9 Imp. gal/min). To Multi-Power/i.p.t.o.—19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: Auxiliaries—19.3 N/mm² (2 500 to 2 800 lbf/in²). Multi-Power/i.p.t.o.—4.8 to 6.9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o. Pump: Gear type pump

Pump Output: 19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: 4.8 to 6.9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o./Auxiliary Filtration: Externally mounted 25 micron filter with replaceable cartridge type element

Standard Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (640 p.t.o. rev/min)			
	litre/min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	15.0	3.4	6.5	6.4
Auxiliary Pump Only	36.0	7.9	11.3	11.1
Combined Flow	51.0	11.3	16.0	15.8

High Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (1 185 p.t.o. rev/min)			
	litre/min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	26.5	5.9	11.2	11.0
Auxiliary Pump Only	36.0	7.9	11.3	11.1
Combined Flow	62.5	13.8	19.6	19.3

BRAKES

Type: Girling, oil immersed 222.4 mm (8.75 in) mechanical five plate disc brakes, operated together or independently to assist steering

Parking Brake: Operates on both rear wheels simultaneously

STEERING

Type: Hydrostatic, with a gear pump and integral reservoir

Toe-in: 3 mm ($\frac{1}{8}$ in)

Turns Lock to Lock: 3:3

FRONT AXLE

Type: Three section, adjustable for track width

Wheel Camber: 4° Normal Duty. 3° 30' Heavy Duty

Wheel Castor: 5° 30' Normal Duty. 0° Heavy Duty

TRACK ADJUSTMENTS**Front Track:**

Normal Duty—1 220 to 1 828 mm (48 to 72 in) in 102 mm (4 in) increments

Heavy Duty (Std. Cl.)—1 321 to 1 727 mm (52 to 68 in) in 102 mm (4 in) increments

Heavy Duty (Hi. Cl.)—1 346 to 1 753 mm (53 to 69 in) in 102 mm (4 in) increments

Rear Track:

1 321 to 2 235 mm (52 to 88 in) in 102 mm (4 in) increments

WHEELS AND TYRES**Front:**

- 4.50 x 16 wheels fitted with 6.00-16, 4 or 6 ply tyres
- 4.50 x 19 wheels fitted with 6.00-19, 4 or 6 ply tyres
- 5.50 x 16 wheels fitted with 7.50-16, 6 ply tyres
- 5.50 x 18 wheels fitted with 7.50-18, 8 ply tyres

Rear:

- W10 x 32 wheels fitted with 11-32, 6 ply tyres
- W10 x 36 wheels fitted with 11-36 or 12-36, 6 ply tyres
- DW14 x 30 wheels fitted with 14-30 or 15-30, 6 ply tyres
- DW12 x 38 wheels fitted with 12-38, 6 ply tyres
- W12 x 28 wheels fitted with 13-28, 6 ply tyres

Water Ballasting: Additional weight for each tyre:-

- 11-32 tyres: 143 kg (316 lb)
- 11-36 tyres: 159 kg (349 lb)
- 12-36 tyres: 143 kg (316 lb)
- 14-30 tyres: 266 kg (627 lb)
- 15-30 tyres: 352 kg (787 lb)
- 12-38 tyres: 222 kg (457 lb)
- 13-28 tyres: 200 kg (440 lb)

CAPACITIES

- Fuel Tank:** 80 litre (17.4 Imp. gal)
- Engine Sump (including filter):** 7.1 litre (12.5 Imp. pt)
- Cooling System:** 14.2 litre (25 Imp. pt)
- Transmission Eight Speed:** 33 litre (57 Imp. pt)
- Multi-Power:** 32 litre (56 Imp. pt)
- Epicyclic Hubs:** 1.71 litre (3 Imp. pt)
- Power Steering Reservoir:** 0.9 litre (2 Imp. pt)

GENERAL DIMENSIONS (Fig. 1)

- A. Overall Height:** 2 413 mm (95 in)
- B. Overall Width:** 1 854 mm (73 in)
- C. Overall Length:** 3 772 mm (148.5 in)
- D. Wheelbase:** 2 248 mm (88.5 in)
- Ground Clearance:**
 - E. Under Drawbar Frame:** 328 mm (12.9 in)
 - F. Under Engine Sump:** 431 mm (17 in)
- Turning Circle:** 7.2 m (23.8 ft) Without Brakes. 6.6 m (21.8 ft) With Brakes
- Weight (with fuel, oil and water):** 2 824 kg (6 225 lb)

Note: The above dimensions are for a tractor fitted with 7.50-16 front tyres and 14-30 rear tyres at 1 524 mm (60 in) track setting.

MOUNTING POINTS (Fig. 2)

1. 102 mm (4 in)
2. 102 mm (4 in)
3. 10 holes (5 each side) tap $\frac{3}{8}$ in 10 UNC 23 x 32 mm (1 $\frac{1}{2}$ in)
4. 57 mm (2.25 in)
5. 73 mm (2.87 in)
6. 60 mm (2.38 in)
7. 1 989 mm (80.8 in)
8. 254 mm (10 in)
9. 184 mm (7.25 in)
10. 92 mm (3.62 in)
11. 4 holes tap $\frac{5}{8}$ in 11 UNC 33 x 32 mm (1 $\frac{1}{2}$ in)
12. 102 mm (4 in)
13. 1 243 mm (49 in)
14. 4 holes tap $\frac{3}{8}$ in 10 UNC 33 x 27 mm (1 $\frac{1}{8}$ in)
15. 76 mm (3 in)
16. 152 mm (6 in)
17. 43 mm (1.69 in)
18. 86 mm (3.38 in)

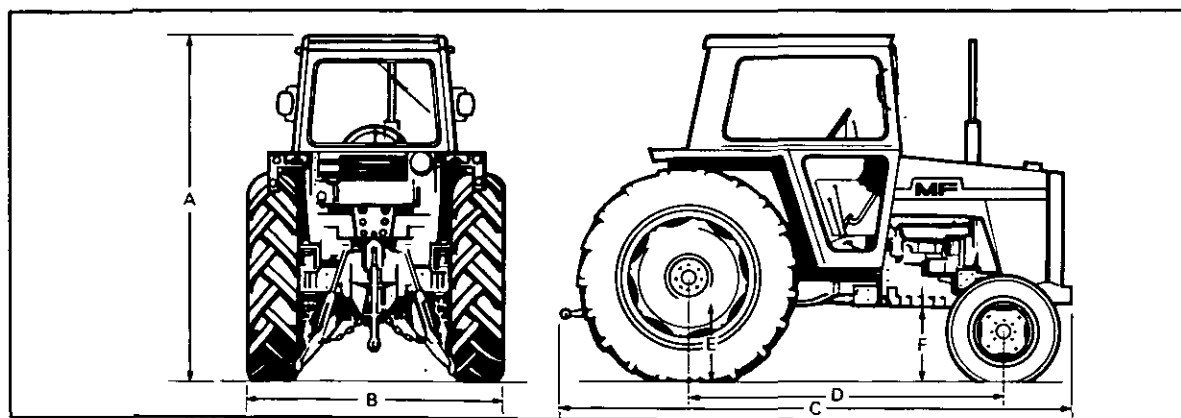


FIG. 1

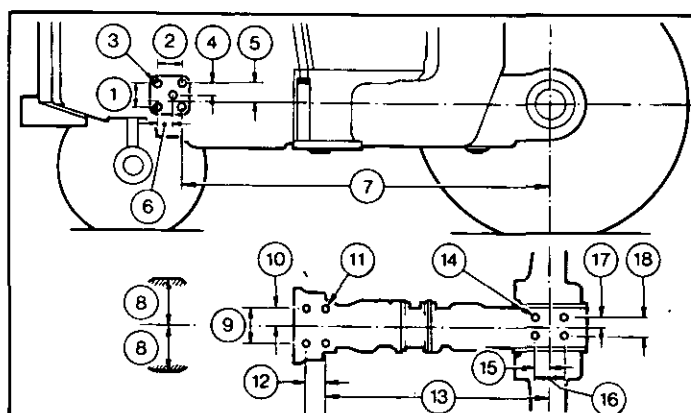


FIG. 2

SPECIFICATION

MF575 TRACTOR

ENGINE

Make: Perkins, to MF specification
Type and Model: Four-stroke, direct injection diesel A4.236
Number of Cylinders: Four
Bore: 98,4 mm (3.875 in)
Stroke: 127 mm (5 in)
Capacity: 3,86 litre (236 in³)
Compression Ratio: 16:1
Firing Order: 1, 3, 4, 2
Horsepower: 66 PS (48,5 kW) at 2000 rev/min (DIN 70020). 69 hp at 2000 rev/min (B.S. AU 141: 1967 Ambient Conditions)
Maximum Torque (at 1 250 rev/min): 255 Nm (188 lbf ft) (DIN 70020)
Lubrication: Throwaway, cannister type full flow external filter
Valves: Overhead, pushrod operated
Valve Tip Clearance (Inlet and Exhaust): 0,30 mm (0.012 in) cold. 0,25 mm (0.010 in) hot

FUEL SYSTEM AND AIR CLEANER

Fuel Lift Pump: A.C. Delco, with hand primer
Fuel Filter: C.A.V. filter, with transparent sediment bowl
Injection Pump: C.A.V. Distributor type, with mechanical governor
Engine Speeds (no load): Idling—700 to 750 rev/min. Maximum—2160 rev/min
Injection Timing: 23° B.T.D.C.
Injectors: C.A.V. type nozzles and nozzle holders
 Initial setting pressure 17,73 N/mm² (175 Atmosphere). Working pressure 17,23 N/mm² (170 Atmosphere)
Easy Starting Aid: C.A.V. Thermostart Mark III C
Air Cleaner: Two stage, dry element, removable for cleaning with warning light and buzzer

ELECTRICAL SYSTEM

Voltage: 12 volt NEGATIVE EARTH
Battery: 17 plate, 96 or 125 Ah. Lucas Mono Lid. Exide Mono Lid. Lucas Aqualok. Exide Auto-Fil
Starter Motor: Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector
Alternator: Lucas 23ACR or Motorola 9AR 2501K
Light Bulb Sizes:
 Headlights UK 36/36W, others 45/40W
 Side Lights 5W
 Rear Lights 5W
 Indicator Lights 21W
 Brake Lights 21W
 Number Plate Lights 5W
 Plough Light 36W
 Panel Lights 2.2W
 Interior Light 5W

Fuses:

Dipped Headlights 15A
 Side Lights 10A
 Brake Lights 10A
 Warning Lights 15A
 Main Beam Headlights 15A
 Flashing Indicators 10A
 Plough Light 10A
 Blower Motor 17A
 Wiper Motor 10A
 Interior Light 2A
 Horn 35A
 Cigar Lighter 35A
Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)

COOLING SYSTEM

Type: Thermostat controlled with centrifugal pump to assist circulation. Four bladed fan driven by a belt from the crankshaft
Fan Belt Deflection (Total): 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley

TRANSMISSION

Clutch:
 Live p.t.o. Tractors—Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated
 I.p.t.o. Tractors—Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories
Eight Speed Gearbox: The eight speed gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, compounded by an epicyclic unit
Eight Speed Synchromesh Gearbox (Certain Territories): The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh on third and fourth gears, compounded by an epicyclic unit
Multi-Power Gearbox: The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears actuated by a hydraulic clutch
Gearbox Epicyclic Reduction: 4:1
Final Drive: Bevel drive with epicyclic final hub reduction giving an overall ratio of 10.83:1

POWER TAKE-OFF

Live Power Take-off: Engine, or engine and ground speed drives are engaged by a lever to the left of the operator's seat

Independent Power Take-off: Engine speed p.t.o. is engaged by a lever to the left of the operator's seat. The i.p.t.o. clutch is a multi-plate, wet clutch

Reduction Ratio:

Standard Pump—3-12:1

High Flow Pump—3-12:1 (540 rev/min), 1-69:1 (1 000 rev/min)

Speeds:

Standard Pump—540 rev/min at 1 685 engine rev/min

High Flow Pump—540 rev/min at 1 686 engine rev/min, 1 000 rev/min at 1 690 engine rev/min

Ground Speeds: Forward travel for each revolution of the p.t.o. shaft.

469 mm (18.5 in)—14-30 tyres

506 mm (19.9 in)—14-34 tyres

494 mm (19.5 in)—12-36 tyres

477 mm (18.8 in)—11-36 tyres

509 mm (20 in)—12-38 tyres

P.t.o. shaft rotates clockwise for forward travel and anticlockwise for reverse travel

Power Take-off Shaft: Six spline (540 rev/min), 21 spline (1 000 rev/min), 35 mm (1.38 in) diameter for securing p.t.o. couplings.

HYDRAULIC SYSTEM

Ferguson Pump: Four cylinder, scotch yoke type pump driven from the forward end of the p.t.o. shaft, supplies oil, under pressure to the ram cylinder and four external take-off points

Tapping Point Thread Sizes: Top— $\frac{3}{8}$ N.P.S.M. Side— $\frac{3}{8}$ N.P.T.F.

Pressure Control System: The Pressure Control system operates from 0,69 to 20,7 N/mm² (100 to 3 000 lbf/in²)

Pump Maximum Output: Standard Pump—15 litre/min (3.4 Imp. gal/min) at 2 000 engine rev/min

High Flow Pump—26,5 litre/min (5.9 Imp. gal/min) at 2 000 engine rev/min

Pump Maximum Pressure: 20,7 N/mm² (3 000 lbf/in²)

Linkage: Three point linkage, with Category 1 or 2 interchangeable ball ends. A barrel turnbuckle type, adjustable top link is fitted, plus check chains adjustable for Category 1 and 2

Maximum Lift Capacity: 1 796 kg (3 960 lb)

AUXILIARY HYDRAULICS

Auxiliary Pump: Gear type pump with separate gear train and output for Multi-Power and i.p.t.o. supply

Pump Output: To auxiliaries—36 litre/min (7.9 Imp. gal/min). To Multi-Power/i.p.t.o.—19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: Auxiliaries—17,3 to 19,3 N/mm² (2 500 to 2 800 lbf/in²). Multi-Power/i.p.t.o.—4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o. Pump: Gear type pump
Pump Output: 19 litre/min (4.2 Imp. gal/min)

Relief Valve Pressure: 4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o./Auxiliary Filtration: Externally mounted 25 micron filter with replaceable cartridge type element

Standard Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (640 p.t.o. rev/min)			
	litre/min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	15,0	3.4	6,5	6.4
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	51,0	11.3	16,0	15.8

High Flow Ferguson Pump				
Application	Output at 2 000 engine rev/min (1 185 p.t.o. rev/min)			
	litre/min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	26,5	5.9	11,2	11.0
Auxiliary Pump Only	36,0	7.9	11,3	11.1
Combined Flow	62,5	13.8	19,5	19.3

BRAKES

Type: Girling, oil immersed 222,4 mm (8.75 in) mechanical five plate disc brakes, operated together or independently to assist steering

Parking Brake: Operates on both rear wheels simultaneously

STEERING

Type: Hydrostatic, with a gear pump and integral reservoir

Toe-in: 3 mm ($\frac{1}{8}$ in)

Turns Lock to Lock: 3-3

FRONT AXLE

Type: Three section, adjustable for track width

Wheel Camber: 3° 30'

Wheel Castor: 0°

TRACK ADJUSTMENTS

Front Track: 1 346 to 1 753 mm (53 to 69 in) in 102 mm (4 in) increments

Rear Track: 1 422 to 2 134 mm (56 to 84 in) in 102 mm (4 in) increments

SPECIFICATION

WHEELS AND TYRES

Front:

- 5-50 x 16 wheels fitted with 7-70-16, 6 or 8 ply tyres
- 5-50 x 18 wheels fitted with 7-50-18, 6 ply tyres
- 4-50 x 19 wheels fitted with 6-00-19, 4 or 6 ply tyres

Rear:

- W16L x 30 wheels fitted with 14-30, 6 ply tyres
- DW14 x 30 wheels fitted with 14-30, 6 ply tyres
- W14 x 34 wheels fitted with 14-34, 6 tyres
- W10 x 36 wheels fitted with 11-36 or 12-36, 6 ply tyres
- W12 x 38 wheels fitted with 12-38, 6 ply tyres

Water Ballasting: Additional weight for each rear tyre:-

- 14-30 tyres: 284 kg (627 lb)
- 14-34 tyres: 308 kg (680 lb)
- 11-36 tyres: 159 kg (349 lb)
- 12-36 tyres: 143 kg (316 lb)
- 12-38 tyres: 222 kg (457 lb)

CAPACITIES

Fuel Tank: 98 litre (21.6 Imp. gal)

Engine Sump (including filter): 7.1 litre (12.5 Imp. pt)

Cooling System: 11.4 litre (20 Imp. pt)

Transmission:

Eight Speed—33 litre/min (57 Imp. pt)

Multi-Power—32 litre (56 Imp. pt)

Epicyclic Hubs: 1.7 litre (3 Imp. pt)

Power Steering Reservoir: 1.1 litre (2 Imp. pt)

GENERAL DIMENSIONS (Fig. 1)

A. Overall Height: 2496 mm (98.2 in)

B. Overall Width: 1854 mm (73 in)

C. Overall Length: 3772 mm (148.5 in)

D. Wheelbase: 2248 mm (88.5 in)

Ground Clearance:

E. Under Drawbar Frame: 328 mm (13 in)

F. Under Engine Sump: 457 mm (18 in)

Turning Circle: 8.7 m (28.5 ft) Without Brakes. 7.9 m (25.9 ft) With Brakes

Weight (with fuel, oil and water): 2824 kg (6225 lb)

Note: The above dimensions are for a tractor fitted with 7.50-16 front tyres and 14-30 rear tyres at 1524 mm (60 in) track setting.

MOUNTING POINTS (Fig. 2)

1. 102 mm (4 in)
2. 102 mm (4 in)
3. 10 holes (5 each side) tap $\frac{3}{8}$ in 10 UNC 23 x 32 mm (1 $\frac{1}{4}$ in)
4. 57 mm (2.25 in)
5. 73 mm (2.87 in)
6. 60 mm (2.38 in)
7. 1989 mm (78.3 in)
8. 254 mm (10 in)
9. 184 mm (7.25 in)
10. 92 mm (3.62 in)
11. 4 holes tap $\frac{5}{8}$ in 11 UNC 33 x 32 mm (1 $\frac{1}{2}$ in)
12. 102 mm (4 in)
12. 1243 mm (49 in)
14. 4 holes tap $\frac{3}{8}$ in 10 UNC 33 x 27 mm (1 $\frac{1}{8}$ in)
15. 76 mm (3 in)
16. 152 mm (6 in)
17. 43 mm (1.69 in)
18. 86 mm (3.38 in)

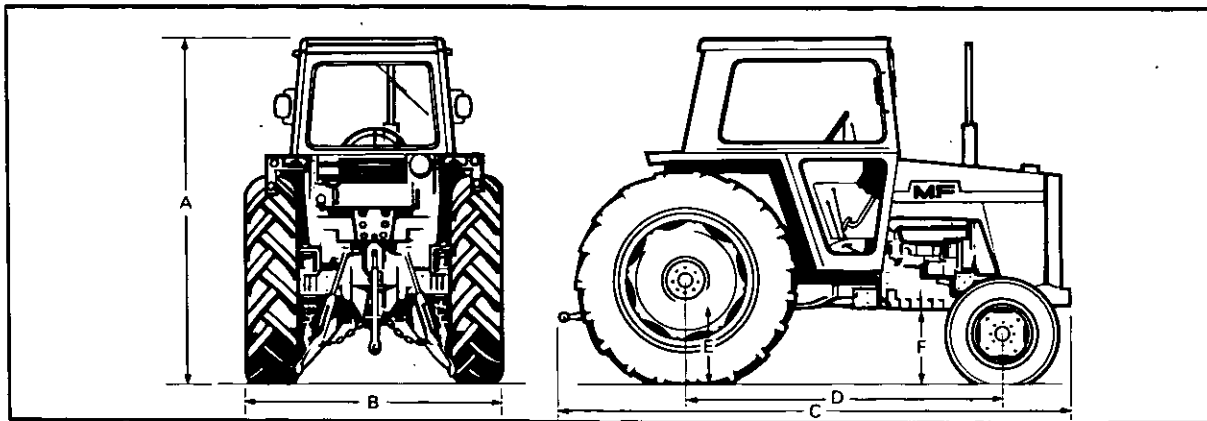


FIG. 1

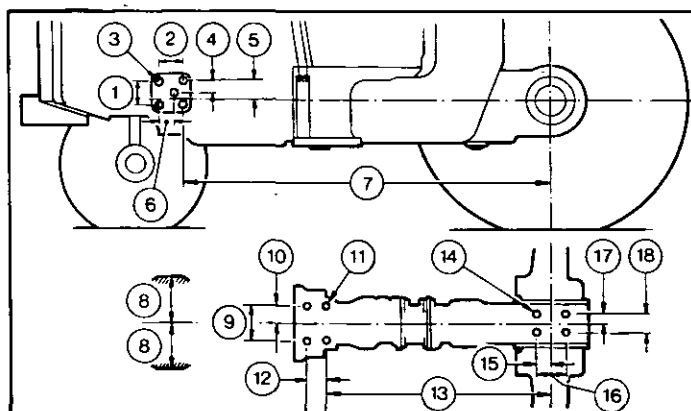


FIG. 2

MF590 TRACTOR**Engine****Make:** Perkins, to MF specification**Type and Model:** Four-stroke, direct injection diesel A4.248**Number of Cylinders:** Four**Bore:** 100,96 mm (3.975 in)**Stroke:** 127 mm (5 in)**Capacity:** 4,06 litre (248 in³)**Compression Ratio:** 16:1**Firing Order:** 1, 3, 4, 2**Horsepower:** 75 PS (56 kW) at 2 200 rev/min (DIN 70020). 79 hp at 2 200 rev/min (B.S. AU 141: 1967 Ambient Conditions)**Maximum Torque (at 1 400 rev/min):** 275 Nm (202.5 lbf ft) (DIN 70020). 287 Nm (212 lbf ft) (B.S. AU 141: 1967 Ambient Conditions)**Lubrication:** Throwaway, canister type full flow external filter**Valves:** Overhead, pushrod operated**Valve Tip Clearance (Inlet and Exhaust):** 0,30 mm (0.012 in) cold. 0,25 mm (0.010 in) hot**FUEL SYSTEM AND AIR CLEANER****Fuel Lift Pump:** A.C. Delco, with hand primer**Fuel Filter:** C.A.V. filter, with transparent sediment bowl**Injection Pump:** C.A.V. Distributor type, with mechanical governor**Engine Speeds (no load):** Idling—700 to 750 rev/min. Maximum—2 350 rev/min**Injection Timing:** 24° B.T.D.C.**Injectors:** C.A.V. type nozzles and nozzle holdersInitial setting pressure 18,74 N/mm² (185 Atmosphere). Working pressure 17,23 N/mm² (170 Atmosphere)**Easy Starting Aid:** C.A.V. Thermostat Mark III C**Air Cleaner:** Two stage, dry element, removable for cleaning with warning light and buzzer**ELECTRICAL SYSTEM****Voltage:** 12 volt NEGATIVE EARTH**Battery:** 17 plate, 96 or 125 Ah. Lucas Mono Lid. Exide Mono Lid. Lucas Aqualok. Exide Auto-Fil**Starter Motor:** Lucas M45G or M50G with a solenoid engaged pinion. Safety device operated by the dual range selector**Alternator:** Lucas 23ACR or Motorola 9AR 2501K**Light Bulb Sizes:**

Headlights UK 36/36W, others 45/40W

Side Lights 5W

Rear Lights 5W

Indicator Lights 21W

Brake Lights 21W

Number Plate Lights 5W

Plough Light 36W

Panel Lights 2.2W

Interior Light 5W

Fuses:

Dipped Headlights 15A

Side Lights 10A

Brake Lights 10A

Warning Lights 15A

Main Beam Headlights 15A

Flashing Indicators 10A

Plough Light 10A

Blower Motor 17A

Wiper Motor 10A

Interior Light 2A

Horn 35A

Cigar Lighter 35A

Fresh Air Blower: Two speed blower with a maximum output of 12 m³/min (425 ft³/min)**COOLING SYSTEM****Type:** Thermostat controlled with centrifugal pump to assist circulation. Six bladed fan driven by a belt from the crankshaft**Fan Belt Deflection (Total):** 13 mm (0.5 in) midway between the fan pulley and the crankshaft pulley**TRANSMISSION****Clutch:**

Live p.t.o. Tractors—Dual clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated, and a 254 mm (10 in) p.t.o. disc, Belleville spring operated

I.p.t.o. Tractors—Single clutch, Auburn ventilated type, with a 305 mm (12 in) main drive disc, coil spring operated. There is a continuous drive to the i.p.t.o. shaft via a plate bolted to the clutch cover. A dual clutch is fitted for certain cold climate territories

Eight Speed Gearbox: The eight speed gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, compounded by an epicyclic unit**Eight Speed Synchromesh Gearbox (Certain Territories):** The eight speed synchromesh gearbox has eight forward and two reverse speeds. This is achieved by using a four forward and one reverse speed gearbox, with synchromesh on third and fourth gears, compounded by an epicyclic unit**Multi-Power Gearbox:** The Multi-Power gearbox has twelve forward and four reverse speeds. This is achieved by using a three forward and one reverse speed gearbox, compounded by an epicyclic unit and an additional set of high ratio constant mesh gears actuated by a hydraulic clutch**Gearbox Epicyclic Reduction:** 4:1**Final Drive:** Bevel drive with epicyclic final hub reduction giving an overall ratio of 14.6:1

SPECIFICATION

POWER TAKE-OFF

Live Power Take-off: Engine speed drive is engaged by a lever to the left of the operator's seat

Independent Power Take-off: Engine speed i.p.t.o. is engaged by a lever to the left of the operator's seat. The i.p.t.o. clutch is a multi-plate, wet clutch

Reduction Ratio:

540 rev/min—3.51:1

1 000 rev/min—1.90:1

Speeds: 540 rev/min at 1 893 engine rev/min. 1 000 rev/min at 1 900 engine rev/min

Power Take-off Shaft: Six spline (540 rev/min), 21 spline (1 000 rev/min), 35 mm (1.38 in) diameter, with an annular groove for securing p.t.o. couplings

HYDRAULIC SYSTEM

Ferguson Pump: Four cylinder, scotch yoke type pump driven from the forward end of the p.t.o. shaft, supplies oil, under pressure to the ram cylinder and four external take-off points

Tapping Point Thread Sizes: Top— $\frac{3}{8}$ N.P.S.M.
Side— $\frac{3}{8}$ N.P.T.F.

Pressure Control System: The Pressure Control system operates from 0,69 to 20,7 N/mm² (100 to 3 000 lbf/in²)

Pump Maximum Output: 25,7 litre/min (5.7 Imp. gal/min) at 2 200 engine rev/min

Pump Maximum Pressure: 20,7 N/mm² (3 000 lbf/in²)

Linkage: Three point linkage, with Category 2 ball ends. A barrel turnbuckle type, adjustable top link is fitted, plus check chains

Maximum Lift Capacity: 2 223 kg (4 900 lb)

AUXILIARY HYDRAULICS

Auxiliary Pump: Gear type pump with separate gear train and output for Multi-Power and i.p.t.o. supply

Pump Output: To auxiliaries—35 litre/min (7.7 Imp. gal/min). To Multi-Power/i.p.t.o.—16,6 litre/min (3.7 Imp. gal/min)

Relief Valve Pressure: Auxiliaries—17,3 to 19,3 N/mm² (2 500 to 2 800 lbf/in²). Multi-Power/i.p.t.o.—4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o. Pump: Gear type pump
Pump Output: 16,6 litre/min (3.7 Imp. gal/min)

Relief Valve Pressure: 4,8 to 6,9 N/mm² (700 to 1 000 lbf/in²)

Multi-Power/i.p.t.o./Auxiliary Filtration: Externally mounted 25 micron filter with replaceable cartridge type element

Application	Output at 2 200 engine rev/min (1 157 p.t.o. rev/min)			
	litre/ min	Imp. gal/min	Hydraulic PS	Hydraulic hp
Ferguson Pump Only	25,7	5.7	10,9	10.7
Auxiliary Pump Only	35,0	7.7	11,0	10.8
Combined Flow	61,0	13.4	19,1	18.8

BRAKES

Type: Girling, oil immersed 222,4 mm (8.75 in) mechanical five plate disc brakes, operated together or independently to assist steering

Parking Brake: Operates on both rear wheels simultaneously

STEERING

Type: Hydrostatic, with a gear pump and integral reservoir

Toe-in: 3 mm ($\frac{1}{8}$ in)

Turns Lock to Lock: 3.3

FRONT AXLE

Type: Three section, adjustable for track width

Wheel Camber: 3° 30'

Wheel Castor: 0°

TRACK ADJUSTMENTS

Front Track: 1 346 to 1 753 mm (53 to 69 in) in 102 mm (4 in) increments

Rear Track P.A.V.T. Wheels: 1 422 to 2 388 mm (56 to 94 in)—12-38 tyres. 1 524 to 2 388 mm (60 to 94 in)—14-34, 15-30 and 15-34 tyres
Pressed Steel Wheels—1 524 to 2 261 mm (60 to 89 in)

All track settings are adjustable in 102 mm (4 in) increments

WHEELS AND TYRES**Front:**

5-50 x 16 wheels fitted with 7-50-16, 6 or 8 ply tyres

5-50 x 18 wheels fitted with 7-50-18, 8 ply tyres

Rear:

W12 x 38 pressed steel or P.A.V.T. wheels fitted with 12-38, 6 ply tyres

W14 x 34 P.A.V.T. wheels fitted with 14-34 or 15-34, 6 ply tyres

W14 x 30 P.A.V.T. wheels fitted with 15-30, 6 ply tyres

Water Ballasting: Additional weight for each rear tyre:-

12-38 tyres: 222 kg (457 lb)

14-34 tyres: 329 kg (725 lb)

15-30 tyres: 352 kg (787 lb)

15-34 tyres: 385 kg (850 lb)

CAPACITIES

Fuel Tank: 98 litre (21.6 Imp. gal)

Engine Sump (including filter): 8 litre (14.5 Imp. pt)

Cooling System: 14.2 litre (25 Imp. pt)

Transmission:

Eight Speed—33 litre (57 Imp. pt)

Multi-Power—32 litre (56 Imp. pt)

Epicyclic Hubs: 3.1 litre (5.4 Imp. pt)

Power Steering Reservoir: 1.1 litre (2 Imp. pt)

GENERAL DIMENSIONS (Fig. 1)

A. Overall Height: 2540 mm (100 in)

B. Overall Width: 2032 mm (80 in)

C. Overall Length: 3886 mm (153 in)

D. Wheelbase: 2286 mm (90 in)

Ground Clearance:

E. Under Drawbar Frame: 381 mm (15 in)

F. Under Engine Sump: 483 mm (19 in)

Turning Circle: 8.8 m (28.9 ft) Without Brakes. 7.8 m (25.6 ft) With Brakes

Weight (with fuel, oil and water): 3 378 kg (7 448 lb)

Note: The above dimensions are for a tractor fitted with 7-50-16 front tyres and 12-38 rear tyres at 1 626 mm (64 in) track setting.

MOUNTING POINTS (Fig. 2)

1. 102 mm (4 in)

2. 102 mm (4 in)

3. 10 holes (5 each side) tap $\frac{3}{8}$ in 10 UNC 23 x 32 mm (1 $\frac{1}{2}$ in)

4. 57 mm (2.25 in)

5. 73 mm (2.87 in)

6. 60 mm (2.38 in)

7. 2 052 mm (80.8 in)

8. 254 mm (10 in)

9. 184 mm (7.25 in)

10. 92 mm (3.62 in)

11. 4 holes tap $\frac{5}{8}$ in 11 UNC 33 x 32 mm (1 $\frac{1}{2}$ in)

12. 102 mm (4 in)

13. 1 243 mm (49 in)

14. 4 holes tap $\frac{3}{8}$ in 10 UNC 33 x 27 mm (1 $\frac{1}{8}$ in)

15. 76 mm (3 in)

16. 152 mm (6 in)

17. 43 mm (1.69 in)

18. 86 mm (3.38 in)

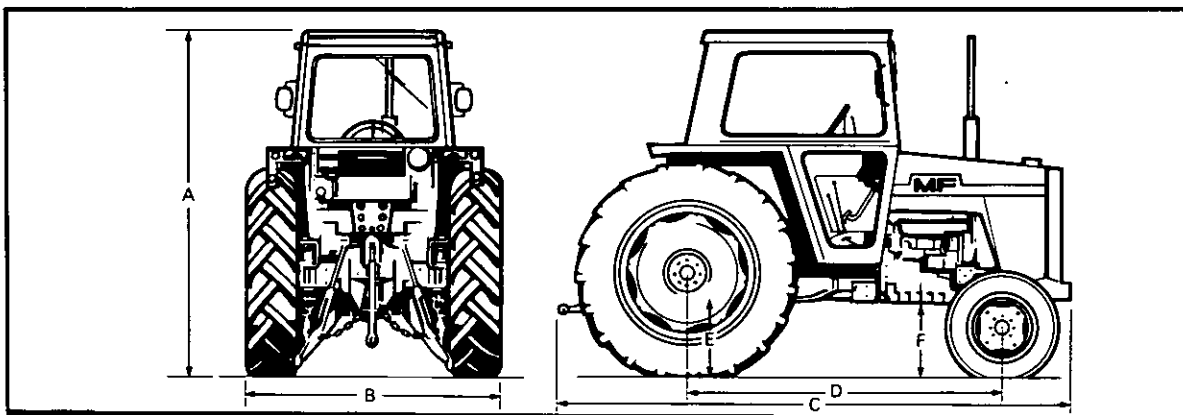


FIG. 1

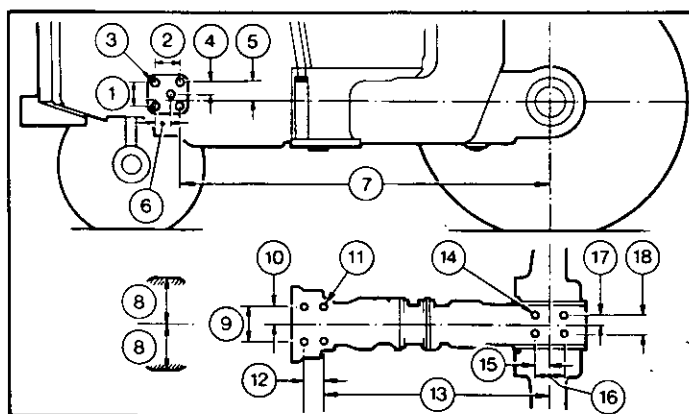


FIG. 2

MAINTENANCE**Part 1—Section B**

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RUNNING-IN	01
50 HOUR FREE SERVICE	02
250 HOUR FREE SERVICE	02
MAINTENANCE PERIODS	03

GENERAL

This section has been compiled to enable the reader to ascertain quickly what action is necessary at any maintenance period. Also detailed is the 'Running-in' procedure and the obligatory maintenance specified in the 50 and 250 Hour Free Service Vouchers. These recommended services will safeguard the life of the tractor when properly carried out.

RUNNING-IN

The following precautions should be taken during the running in period:

1. Diesel engines require a different type of running in from petrol engines. Experience has shown that usage of the tractor, during its first 50 hours of operation, can have a marked difference on the performance and life of the engine. From new the tractor should be engaged in work which will load the engine as near to full conditions as possible.
2. Use a low gear when pulling heavy loads.
3. During the running in period, check frequently the tightness of all screws, bolts, nuts, etc.
4. To ensure proper clutch life, care must be taken to bed-in the friction plates properly. During the first 15 hours of the tractor's life, frequently, but carefully engage and disengage the clutch(es). During the first 50 hours a careful watch must be kept on the clutch pedal free travel, which should be adjusted as soon as the pedal travel increases.
5. Do not forget your free service entitlement, which entails changing oil and filters.

MAINTENANCE**50 HOUR FREE SERVICE**

To be carried out after 50 hours running

Engine

Change the engine oil.
Change the engine oil filter.
Check and adjust the engine slow running speed.

Fuel System and Air Cleaner

Change the primary fuel filter element.
Check the dry air cleaner hoses and unloader valve.

Cooling System

Check the radiator coolant level and replenish if necessary.
Check the alternator/fan belt tension and adjust if necessary.

Electrical System

Check the battery electrolyte level and replenish if necessary.
Wipe the battery top and smear the terminals with petroleum jelly.
Check the alternator/fan belt tension and adjust if necessary.
Check the tightness of all cable clips and terminals and check all wiring for chafing.
Check the safety start switch for correct operation.
Check all lights for operation.

Steering

Check the front hub adjustment and adjust if necessary.
Check the power steering oil level and replenish if necessary.
Change the power steering pump filter element.
Change the power steering oil.

Transmission and Hydraulics

Change the transmission oil.
Clean the hydraulic pump oil strainer.
Change the transmission oil filter element.
Check the oil level in the epicyclic hubs and replenish if necessary. Not MF 550 tractors.
Check the operation of all hydraulics.

Clutch and Brakes

Check the clutch pedal free travel and adjust if necessary.
Check the live p.t.o. clutch setting and adjust if necessary.
Check the brakes and adjust if necessary.

Cab

Check the screenwasher bottle level and replenish if necessary.
Clean the cab air filter.
Check the torque of the cab securing bolts and tighten if necessary.

Miscellaneous

Check the torque of the wheel nuts and tighten if necessary.
Check the tyre pressures and adjust if necessary.
Lubricate all points with grease or oil where necessary.
Examine for external leaks, generally check all other nuts, bolts, clips and hoses for tightness.
Road test the tractor, checking the instruments and services for correct functioning.

250 HOUR FREE SERVICE

To be carried out before 250 hours of running

Engine

Change the engine oil.
Change the engine oil filter.
Check and adjust the engine slow running speed.

Fuel System and Air cleaner

Change the primary fuel filter element.
Check the dry air cleaner hoses and unloader valve.

Cooling System

Check the radiator coolant level and replenish if necessary.
Check the alternator/fan belt tension and adjust if necessary.

Electrical System

Check the battery electrolyte level and replenish if necessary.
Wipe the battery top and smear the terminals with petroleum jelly.
Check the alternator/fan belt tension and adjust if necessary.
Check the safety start switch for correct operation.
Check all lights for operation.

Steering

Check the front hub adjustment and adjust if necessary.
Check the power steering oil level and replenish if necessary.

Transmission and Hydraulics

Check the transmission oil level and replenish if necessary.
Change the transmission oil filter element.
Check the oil level in the epicyclic hubs and replenish if necessary. Not MF 550 tractors.
Check the operation of all hydraulics.

Clutch and Brakes

Check the clutch pedal free travel and adjust if necessary.
Check the live p.t.o. clutch setting and adjust if necessary.
Check the brakes and adjust if necessary.

Cab

Check the screenwasher bottle level and replenish if necessary.
Clean the cab air filter.
Check the torque of the cab securing bolts and tighten if necessary.

Miscellaneous

Check the torque of the wheel nuts and tighten if necessary.
Check the tyre pressures and adjust if necessary.
Lubricate all points with grease or oil where necessary.
Examine for external leaks, generally check all other nuts, bolts, clips and hoses for tightness.
Road test the tractor, checking the instruments and services for correct functioning.

MAINTENANCE

MAINTENANCE PERIODS

Carry out operation below when Tachometer reads—	10	100	200	250	300	400	500	600	700	750	800	900	000
GREASING	O	O	O	O	O	O	O	O	O	O	O	O	O
ENGINE Check the engine oil level and replenish if necessary Change the engine oil—See note 2 Change the engine oil filter—See note 2 Check the tappets and adjust if necessary Clean the engine breather pipe	O	O	O	O	O	O	O	O	O	O	O	O	O
FUEL SYSTEM AND AIR CLEANER Inspect the fuel filter glass bowl and drain off any water Renew the fuel filter element Service the injectors Drain clean and refill the fuel tank Check the dry air cleaner hoses and unloader valve Replace the dry air cleaner elements—See note 3	O	O	O	O	O	O	O	O	O	O	O	O	O
COOLING SYSTEM Check the radiator coolant level and replenish if necessary Clean the radiator fins Drain flush and refill the cooling system	O	O	O	O	O	O	O	O	O	O	O	O	O
ELECTRICAL SYSTEM Check the battery electrolyte level and replenish if necessary Wipe the battery top and smear the terminals with petroleum jelly Check the alternator fan belt tension and adjust if necessary Examine the alternator	O	O	O	O	O	O	O	O	O	O	O	O	O
STEERING Check the power steering oil level and replenish if necessary Change the power steering pump filter element Check the front hub adjustment and adjust if necessary Check the front wheel alignment and adjust if necessary	O	O	O	O	O	O	O	O	O	O	O	O	O
TRANSMISSION AND HYDRAULICS Check the transmission oil level and replenish if necessary Change the transmission oil Clean the hydraulic oil strainer Change the transmission oil filter element Check the oil level in the epicyclic hubs and replenish if necessary. Not MF 550 Tractors Change the oil in the epicyclic hubs—See note 4. Not MF 550 Tractors	O	O	O	O	O	O	O	O	O	O	O	O	O
CLUTCH AND BRAKES Check the clutch pedal free travel and adjust if necessary* Check the live p.t.o. clutch setting and adjust if necessary* Check the brakes and adjust if necessary* *See note 5	O	O	O	O	O	O	O	O	O	O	O	O	O
SAFETY CAB Check the screenwasher bottle level and replenish if necessary Clean the cab air filter Replace the cab air filter Check the torque of the cab securing bolts and tighten in necessary	O	O	O	O	O	O	O	O	O	O	O	O	O
MISCELLANEOUS Check the differential lock and adjust if necessary Check the torque of the wheel nuts, bolts and tighten if necessary Check the tyre pressures and adjust if necessary	O	O	O	O	O	O	O	O	O	O	O	O	O

NOTES

- All operations marked X are to be carried out by your Massey-Ferguson Distributor or Dealer.
- The oil change period at 250 hours assumes proper maintenance of the engine and auxiliaries (i.e. air cleaner and lubrication filter) and that the fuel and oil used have been of the approved type and specification. If inadequate maintenance, or inferior oils have been used, engine oil changes must be more frequent.
- The dry air cleaner elements must be renewed every 1000 hours, or yearly or after a maximum of ten washings of the main element.
- If conditions are wet, muddy, or exceptionally humid, change the oil in the epicyclic hubs every 200 hours.
- If heavy work is involved the clutch and brake adjustments must be made more frequently.

PRE-DELIVERY AND INSTALLATION**Part 1—Section C**

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TRACTOR STORAGE	02
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TRACTOR WATERPROOFING	04

GENERAL

To ensure the regular maintenance of the tractor during the 12 month Warranty period, two free services must be carried out by the supplying Distributor or Dealer.

The two Free Service Vouchers, detailing the servicing to be carried out, cover the first 50 and 250 hours running of the tractor.

The timing of these two services has been calculated to provide maximum tractor efficiency throughout the Warranty period thus safeguarding the subsequent life of the tractor.

PRE-DELIVERY CHECK

The following items must be checked by the Distributor before delivery to a Dealer and by the Dealer before delivery to an Owner or Operator.

1. Check and replenish the battery electrolyte level. Clean the battery top and smear the terminals with petroleum jelly. Charge the battery if necessary.
2. Check all electrical connections, cable clips and lights.
3. Check and replenish the levels in the following:
 - Hydro-Static steering reservoir
 - Engine sump
 - Centre housing
 - Epicyclic hubs.
4. Lubricate all greasing points.
5. Check and adjust the alternator/fan belt tension.
6. Except when an anti-freeze solution is provided, flush the cooling system and refill with soft water.
7. Remove the clutch pedal keeper and check the clutch adjustment.
8. Check that the correct fuel is in the tank and the content is sufficient.
9. Check the torque of the cylinder head, inlet and exhaust manifold nuts and bolts.
10. Check and adjust the tappets and inspect the valve springs.
11. Check the injectors, de-aerate the fuel system and tighten all fuel pipe connections.
12. Check the security of the engine air cleaner hoses.
13. Fit the lower and top links and free the linkage joints.
14. Start the engine.
15. Check the instruments and warning lights for efficient operation.
16. Check the engine governor with the foot and hand linkage and the tachometer.
17. Attach an implement and check the tractor hydraulics for efficient operation.
18. Check and adjust the tyre pressures.
19. Check the security of all nuts, bolts, plugs, unions and clips.
20. Check all hoses for chafing and leaks.
21. Check the headlamp alignment.
22. Road test the tractor, checking the brakes, instruments and services for efficient operation.

PRE-DELIVERY AND INSTALLATION

TRACTOR INSTALLATION

Instructions are to be given to the Owner or Operator on the items listed below:

1. Safety Precautions.
2. Location and Significance of Tractor and Engine Serial Numbers.
3. Instruments and Controls.
4. Running In.
5. Starting and Stopping Procedures.
6. Gear Selection and danger of changing gear on the move.
7. Coasting and Towing.
8. Use of Multi-Power.
9. Use and Adjustment of Brakes and Interlock Latch.
10. Use and Adjustment of Clutch.
11. Use and Adjustment of Differential Lock.
12. P.t.o. Speed and Usage.
13. Operation of Hydraulic Lift System.
14. Attaching and Detaching Implements.
(Danger of towing from Top Link).
15. Lubrication and Grease Points.
16. Changing of Factory Fill Oils.
17. Engine and Transmission Filter Replacements.
18. Operation of Fuel System. De-aeration and Air Cleaner.
19. Cooling System, Frost Precautions and Alternator/Fan Belt Adjustment.
20. Maintenance of Electrical Equipment. Negative Earth System.
21. Power Steering.
22. Wheel Track Settings.
23. Tyre Pressures.
24. Security of all Nuts and Bolts.
25. Fuel Handling and Storage.
26. Use and Attachment of Auxiliary Hydraulic Equipment.
27. Fill in the Serial No. etc., details in the Operator Instruction Book.

TRACTOR STORAGE

General

When preparing a tractor for storage, comply with the following recommendations to ensure that the tractor is in good condition when required for use. Thoroughly clean the tractor, giving particular attention to the greasing points and oil filler plugs. Park the tractor in a dry, level and covered area away from the weather and livestock with easy exit in case of fire.

When the tractor has to be stored in the open air, park it on level ground in the shelter of a building or wall and completely cover it with a good tarpaulin.

Tyres

1. Jack up the tractor and position wooden blocks under the axles to relieve the tyres of all weight.
2. Inflate the tyres a little above the normal pressure and chalk that pressure on the tyre wall. Protect the tyres from direct sunlight.
3. When ballasted tyres are not filled with calcium chloride, deflate the tyres, empty out the water and re-inflate with air.
4. When wheel weights are fitted, remove, clean and paint any bare metal and refit.

Hydraulic Lift System

1. Check and replenish the transmission oil level in the centre housing to the high mark on the response cover dipstick.
2. Using the tractor hydraulics, with the response control in "FAST", raise and lower the linkage several times.
3. Engage the p.t.o. for a short period to obtain the maximum circulation of transmission oil around the centre housing.
4. Raise the linkage to the "Transport" position and support the two lift arms in this position with wooden props.
5. Leave the two quadrant levers in the 'Transport' position i.e., the "Draft" control (outer) lever past the "UP" and the "Position" control (inner) lever in "TRANSPORT". Do NOT MOVE the quadrant control levers from these positions.

Hydro-Static Steering

1. Remove the filler plug from the reservoir and add the approved oil to the bottom of the oil filler plug hole. Refit the filler plug.
2. Clean and coat the exposed steering rams with grease.

Engine

1. Drain the engine sump, when hot if possible.
2. Change the filter element.
3. Refill the engine sump with an approved grade of oil.
4. Seal the crankcase breather, exhaust and air cleaner pipes with adhesive tape.
5. Clean the dry air cleaner unit.

Cooling System

1. Drain the radiator and cylinder block, when hot if possible and leave the taps in the open position.
2. Rest the radiator cap on the filler neck.

Fuel System

1. Clean the fuel filler bowls, renew the elements and drain the fuel tank.
2. Adding a rust inhibitor, refill the fuel tank and bleed the fuel system of air.
3. Start the engine and run at half speed for 15 minutes to circulate the fuel through the lift and distributor pumps, filters, pipework and ejectors.
4. Top-up the fuel tank completely to prevent condensation forming on the unfilled portion of the tank thus resulting in rust and water contaminating the fuel. Rust if permitted to form in any large quantity can cause filter blockage.
5. Seal the gap between the sides of the fuel filler cap and pipe.
6. Remove the injectors and spray approximately 18 ccs (1/32 pt) of engine oil into each cylinder bore. Using new joint washers, refit the injectors and slowly rotate the crankshaft one complete revolution. Do not bleed the fuel system of air.
7. Lubricate the foot and hand throttle control linkage.

PRE-DELIVERY AND INSTALLATION**Clutch**

Fully depress the clutch pedal and hold down with a wooden keeper or wedge. The clutch friction plates (main and p.t.o.) will not then bond themselves to the flywheel or pressure plates.

Battery

1. Remove the battery from the tractor.
2. Check the electrolyte level and top up as necessary.
3. Clean the battery top and coat the terminals with petroleum jelly.
4. Fully charge the battery from an external source.
5. Repeat the external charge every month during the storage period and top up the electrolyte as necessary.
6. Store the battery in a cool, dry, dust free location but not directly on a concrete or metal surface. There must be no possibility of freezing.

Alternator and Starter Motor

1. Smear the alternator terminals with petroleum jelly.
2. Smear the starter motor and solenoid terminals with petroleum jelly.

Sheet Metal, Exposed Castings and Bright Metal Components

1. All rusty, scratched or bare patches of castings and/or sheet metal must be cleaned with abrasive papers and repainted. Matching colours are available for all M.F. Tractors.
2. The bright metal components and surfaces must be cleaned and/or degreased and the protectives sprayed or brushed on.

Cab

1. Empty the windscreen washer bottle.
2. Remove and exclude the windscreen wiper blade from daylight.
3. Remove and store the rear view mirrors, free and lubricate all hinges and locking devices.
4. Close the cab side and rear windows.
5. Wash and dry the inside and outsides of the cab windscreen, side and rear windows with soap and water.
9. Cover the windscreen, side and rear windows.
7. Lock the cab door, note the number of the door key. Store the key in a known spot in case of fire.

PREPARING THE TRACTOR PRIOR TO RETURN TO WORK**Cab**

1. Remove the covers and wash the cab windscreen, side and rear windows.
2. Refit the windscreen wiper blade.
3. Refit the rear view mirrors.
4. Fill the windscreen washer bottle.

Sheet Metal and Bright Metal Components

1. Clean off the protective from the bright metal parts and surrounding sheet metal.
2. Wash the sheet metal.

Alternator and Starter Motor

1. Clean the petroleum jelly from the alternator terminals.
2. Clean the petroleum jelly from the starter motor and solenoid terminals.

Battery

1. Check that the battery is fully charged. Do not check the electrolyte strength immediately after adding distilled water.
2. Check that the electrolyte is at the correct level.
3. Clean the battery top and smear the terminals with petroleum jelly.
4. Refit the battery to the tractor.

Clutch

Remove the wooden keeper or wedge from the clutch pedal linkage.

Fuel System

1. Remove the adhesive tape seal from the fuel filler cap and pipe.
2. Check the level in the fuel tank: investigate any loss and eliminate the cause.
3. Bleed the fuel system of air.

Cooling System

1. Close the taps in the cylinder block and radiator.
2. Refill the cooling system slowly with clean rain or soft water.
3. In winter, refill the cooling system with an anti-freeze solution.
4. Check all connections and joints for leaks.
5. After the engine has been run for fifteen minutes, see 'Starting the Engine', permit the radiator to cool, check the coolant level and replenish as necessary.

Engine

1. Remove the adhesive tape seals from the crankcase breather, exhaust and air cleaner pipes.
2. Check the engine oil level, investigate any loss and eliminate the cause.

Hydro-static Steering

1. Check the hydro-static steering reservoir oil level, investigate any loss and eliminate the cause.
2. Clean the steering rams of grease and leave clean and dry.

Hydraulic Lift System

1. Check the centre housing transmission oil level, investigate any loss and eliminate the cause.
2. Remove the two wooden props from the lift arms.

Tyres

1. Check the tyre pressures, investigate any loss and eliminate the cause.
2. Adjust the tyre pressures or deflate the tyres, replace the ballast as before and re-inflate as necessary.
3. Jack up the axles and remove the wooden blocks,

Fuel Gauge and Warning Lights

Turn the starter key to '+' and check that the fuel gauge begins to register and all warning lights glow. Investigate any mal-function and eliminate the cause.

Starting the Engine

1. Start the engine and run on a light load.
2. Check that the tachometer and fuel gauge register and all warning lights become extinguished. Investigate any mal-function and eliminate the cause.
3. Continue to run the engine for no more than 15 minutes, check all system for correct function. Investigate any mal-function and eliminate the cause.

PRE-DELIVERY AND INSTALLATION

TRACTOR WATERPROOFING

General

Before working in water, such as in Paddy Fields or flooded areas, certain waterproofing modifications must be made to the tractor.

Ideally, only tractors with disc brakes should be used in water as little can be done to ensure the efficiency of drum brakes when the water depth exceeds 600 mm (24 in).

In addition, two extra maintenance services are required.

ELECTRICAL EQUIPMENT

'VYPATCH' Putty and 'VYCOAT'

The 'VYPATCH' Putty and 'VYCOAT' recommended for sealing the starter motor and solenoid assembly is available from:

Products Division,
Plastic Coatings Ltd.
Trading Estate,
Farnham,
Surrey,
England.

Starter Motor and Solenoid Assembly

1. Remove the starter motor and solenoid assembly.
2. Thoroughly clean the exterior of the starter motor and solenoid assembly.
3. Blank off the drive end bracket.
4. Seal all the openings in the starter motor and solenoid assembly with 'VYPATCH'.
5. Apply a thick coating of grease to the starter motor and solenoid terminals and ensure that the drive end bracket is blanked off.
6. Spray the exterior of the starter motor and solenoid assembly with a thick coat of 'VYCOAT'.
7. Dry for at least 10 minutes and spray the exterior of the starter motor and solenoid assembly with a second thick coat of 'VYCOAT'.
8. Let the 'VYCOAT' harden and clean the grease coating from the starter motor and solenoid terminals and remove the blank from the drive end bracket.
9. Refit the starter motor and solenoid assembly to the engine.
10. Reconnect the wiring harness.

Battery

Clean the battery top and smear the battery terminals with petroleum jelly.

Engine

Engine Breather Pipe

NOTE: The engine breather pipe is of a critical length and after modification it can be longer but NEVER shorter. When refitted it must point generally in a downward direction without 'U' bends or restrictions to trap liquid or dirt.

1. Shorten the existing breather pipe by approximately 200 mm (8 in).
2. Attach a 225 mm (9in) length of rubber piping to the shortened engine breather pipe.
3. Route the rubber piping to the front of the engine and secure it to one of the timing case bolts with a suitable clip.

Engine Dipstick

1. Remove the engine dipstick and store in the tool box.
2. Fit a tapered rubber plug to the engine dipstick tube.

Transmission

Clutch Housing Drain Hole

1. Discard the split pin in the drain hole in the clutch housing.
2. Enlarge the drain hole, tap and fit a screwed plug.

Clutch Housing Cover Plate Gasket

1. Remove the four bolts and the cover plate beneath the clutch housing.
2. Refit the cover plate to the clutch housing with the gasket (part No. 180 481 M1) between and the four original bolts.

Clutch Pedal Cross-shaft

1. Drill and tap the two bosses from which the pedal cross-shaft protrudes.
2. Fit two grease nipples to the tappings. Should the grease nipples foul the pedal cross-shaft, fit small fibre washers to the threaded shank.
3. Grease the cross-shaft until the grease just exudes from around the pedal cross-shaft but do not over grease.

P.T.O. Shaft Cap

1. Remove the p.t.o. cap.
2. Grease both threads.
3. Refit the p.t.o. cap and screw it fully home.

Centre Housing Dipstick

1. Remove the centre housing dipstick from the response control cover and store in the dipstick.
2. Fit a tapered rubber plug to the response control cover.

Brakes

Pedal Cross-shaft

1. Drill and tap the two bosses from which the pedal and cross-shaft protrudes.
2. Fit two grease nipples to the tappings. Should the grease nipples foul the pedal cross shaft, fit small fibre washers to the threaded shanks.
3. Grease the two nipples until the grease just exudes from around the pedal cross shaft.

Extra Maintenance

Every 10 hours or Daily

Charge all grease points with an approved grease until it exudes from the seals or shafts.

Every 50 hours or Weekly

1. Remove the clutch housing, drain plug, permit any water to drain away and refit the drain plug.
2. Ensure that the engine breather pipe is unobstructed.

**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL
PART 2**

Publication No. 1856 072 M1

comprising

- A SHEET METAL
- B CAB AND FITTINGS

SHEET METAL

Part 2 — Section A

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2A-17-08	Rear Upper Panel Removal and Refitment (MF 565)	
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SHEET METAL**GENERAL**

The hood, grille and front side panels are shown. The sheet metal components are easily removed and refitted, and provide protection for the tractor.

The tractor must not be operated with any of these panels removed, except for the power take off guard, which has to be removed when certain implements are used.

To prevent corrosion, always keep the sheet metal clean, respraying the metal as soon as possible when any parts become chipped.

FRONT SIDE PANEL**Removal and Refitment**

2A-01-02

Removal

1. Remove the four bolts securing the side panel.
2. Lift the side panel clear and remove the clamp plate.

Refitment

3. Reverse procedures 1 and 2 except:
 - (a) Tighten the side panel securing bolts to a torque of 20 Nm (15 lbf ft).

HOOD**Removal and Refitment**

2A-02-02

Removal

1. Remove the front side panels, operation 2A-01-02.
2. Remove the air cleaner.
3. Remove the exhaust silencer.
4. Remove the radiator cap.
5. Remove the bolts securing the hood.
6. Lift off the hood.

Refitment

7. Reverse procedures 1 to 6 except:
 - (a) Ensure that the rubber sealing strip at the rear of the hood is fully located on the hood, then push the hood rearwards until it seats against the cab.
 - (b) Tighten the hood securing bolts to a torque of 20 Nm (15 lbf ft).

HOOD SEAL**Removal and Replacement**

2A-03-02

Removal

1. Remove the hood, operation 2A-02-02.
2. Pull off the rubber seal.

Replacement

3. Clean the rear edge of the hood.
4. Fit a new rubber sealing strip to the rear edge of the hood, engaging the edge of the hood into the slot in the strip.
5. The strip should be fitted evenly to the hood, without an overhang at one end and too little rubber at the other end.
6. Refit the hood, operation 2A-02-02.

FRONT GRILLE**Removal and Refitment**

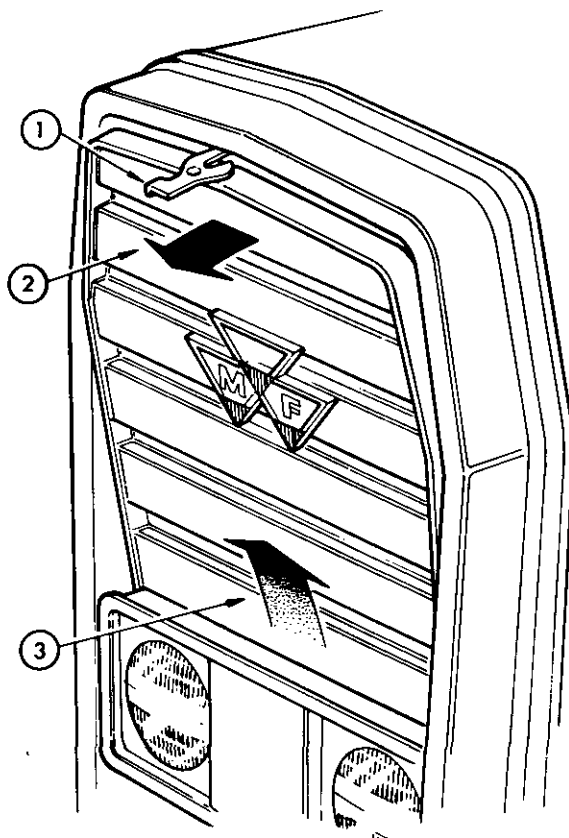
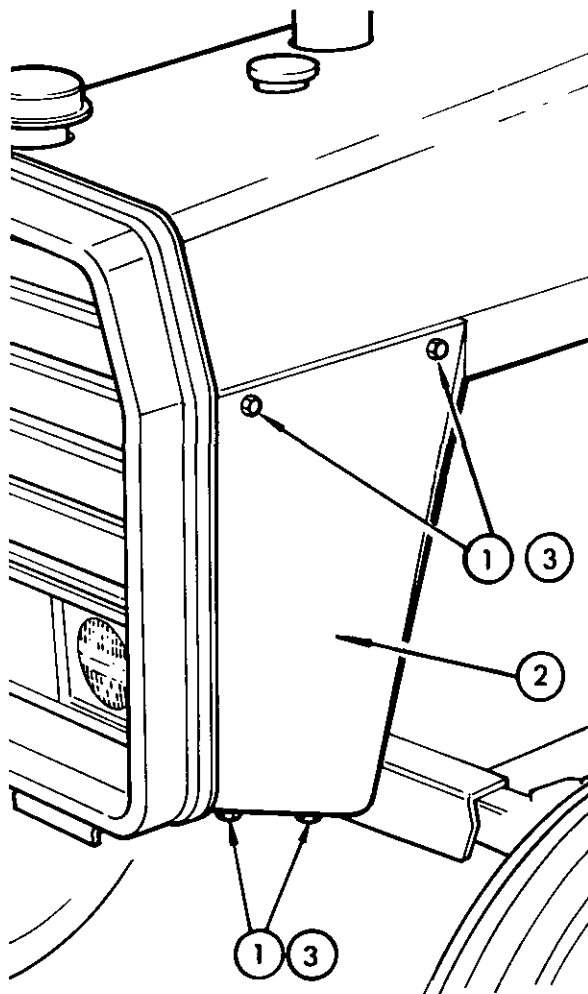
2A-04-02

Removal

1. Pull the front grille release catch forward.
2. Pull the grille forwards.
3. Lift off the grille.

Refitment

4. Reverse procedures 1 to 3.



FRONT LOWER PANEL**Removal and Refitment**

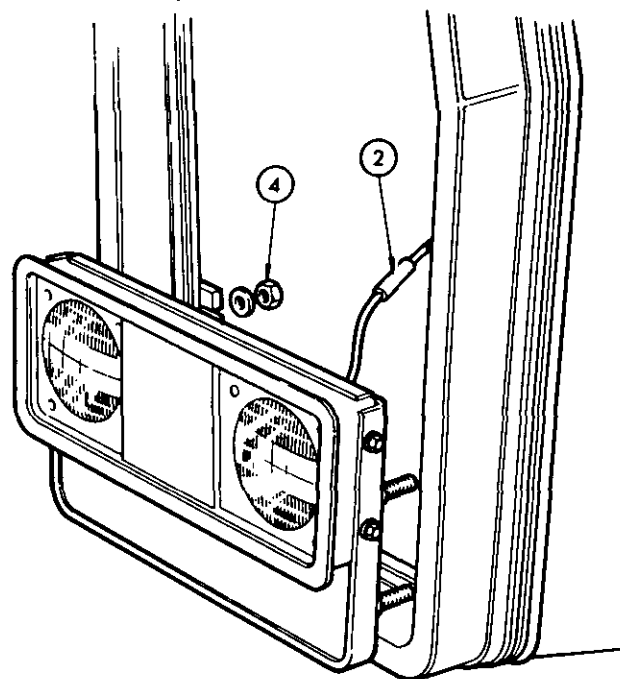
2A-05-03

Removal

1. Disconnect the battery, Part 9A.
2. Disconnect the headlamp wires at the Lucas connector.
3. Remove the nut and washer securing the headlight earthing wire.
4. Remove the nuts and washers securing the lower panel to the front frame.

Refitment

5. Reverse procedures 1 to 4.

**RADIATOR SUPPORT FRAME****Removal and Refitment**

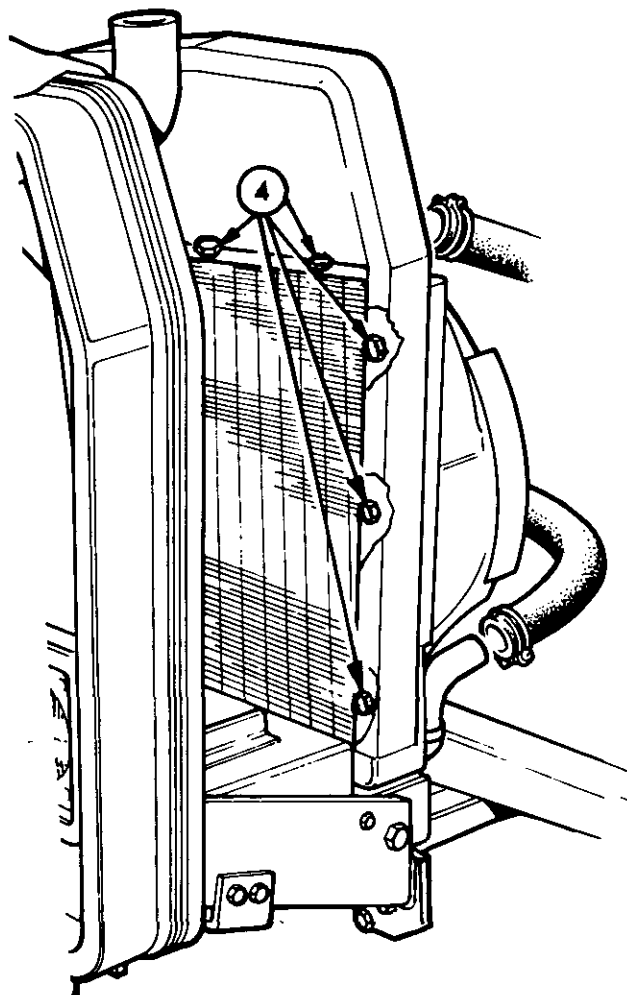
2A-06-03

Removal

1. Remove the hood, operation 2A-02-02.
2. Remove the nose assembly, operation 2A-09-05.
3. Remove the radiator assembly, Part 4B.
4. Remove the nine bolts securing the radiator support frame to the nose assembly.

Refitment

5. Reverse procedures 1 to 4.



SHEET METAL

HOOD SUPPORT (MF 550)

Removal and Refitment

2A—07—04

Removal

1. Remove the hood, operation 2A—02—02.
2. Remove the screw and clamp supporting the L.H. steering cylinder metal pipework.
3. Remove the fuel filter and bracket.
4. Remove the nuts and washers retaining the hood support.
5. Lift the hood support clear.

Refitment

6. Reverse procedures 1 to 5 except:
 - (a) Tighten the hood support nuts to a torque of 27 Nm (20 lbf ft).

HOOD SUPPORT (MF 565, 575 & 590)

Removal and Refitment

2A—08—04

Removal

1. Remove the hood, operation 2A—02—02.
2. Disconnect the battery.
3. Drain the cooling system by opening the engine drain tap.
4. Disconnect the heater hoses.
5. Remove the four hose connections to the steering hand pump.
6. Disconnect both bulkhead connector plugs.
7. Disconnect the tachometer cable from the engine.
8. Remove the four hood support bracket bolts.
9. Lift the hood support clear.

Refitment

10. Reverse procedures 1 to 9.
11. Refill the cooling system, ensuring that the engine drain tap is closed.
12. Refill and bleed the steering system, Part 7B.

NOSE ASSEMBLY**Removal and Refitment** 2A-09-05

SAFETY NOTE: The nose section is very heavy and awkward to handle, therefore extreme care must be exercised.

Removal

1. Remove the hood, operation 2A-02-02.
2. Remove the front side panel, operation 2A-01-02.
3. Disconnect the headlight wiring at the Lucas connector.
4. Remove the front lower panel (MF 550 Tractors), operation 2A-05-03.
5. Remove the battery.
6. Disconnect the horn and the air cleaner indicator wire.
7. Disconnect the air cleaner hose.
8. Disconnect the windscreen washer bottle.
9. Support the nose assembly using a jib crane and sling.
10. Remove the four nose securing bolts, ensuring that the nose assembly is at all times supported by the crane while being removed from the tractor.

Refitment

11. Raise the nose assembly on to the front chassis.
12. Ensure that the bottom edge of the nose assembly is seated against the abutment stops.
13. Tighten the four securing bolts to a torque of 271 Nm (200 lbf ft).
14. Remove the sling.
15. Reverse procedures 1 to 8.

REAR NUMBER PLATE**Removal and Refitment** 2A-10-05**Removal**

1. Disconnect the number plate lights at the connectors.
2. Remove the two bolts securing the number plate to the brackets.
3. Remove the bolts securing each bracket.

Refitment

4. Reverse procedures 1 to 3.
5. Tighten the bolts to a torque of 20 Nm (14 lbf ft).

PLOUGH LAMP BRACKET

(MF 550, 565, 575 and 590 Tractors)

Removal and Refitment 2A-11-05**Removal**

1. Disconnect the wiring at the connector.
2. Remove the two nuts, washers and bolts.
3. Remove the nut, washers and bolt.

Refitment

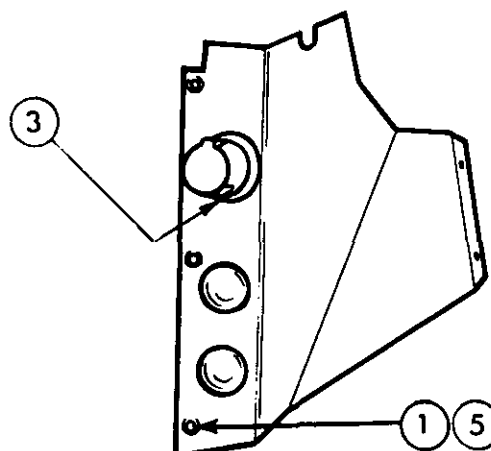
4. Reverse procedures 1 to 3 except:
 - (a) Connect the lamp earth wire to the upper bracket bolt.

REAR SHEET METAL**L.H. and R.H. Rear Trim Panels (MF 550 Tractor)****Removal and Refitment** 2A-12-05**Removal**

1. Remove the five screws and lift the appropriate panel clear.
2. On the L.H. trim panel, label and disconnect the trailer plug wiring.
3. Remove the trailer plug screws.

Refitment

4. Reverse procedures 1 to 3.
5. Tighten the screws to a torque of 20 Nm (15 lbf ft).



SHEET METAL**REAR SHEET METAL**

L.H. and R.H. Rear Trim Panels (MF 565, 575 and 590)

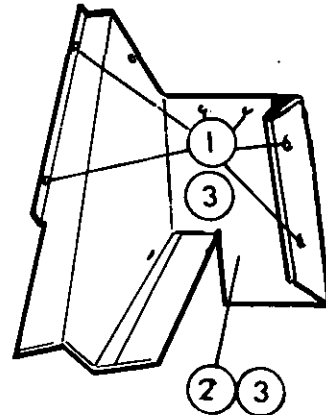
Removal and Refitment 2A-13-06

Removal

1. Remove the screws securing the L.H. or R.H. panel.
2. Lift the panel clear.

Refitment

3. Reverse procedures 1 and 2 except:
 - (a) Tighten the screws to a torque of 11 Nm (8 lbf ft).



REAR SHEET METAL
Rear Centre Panel (MF 550 Tractor)

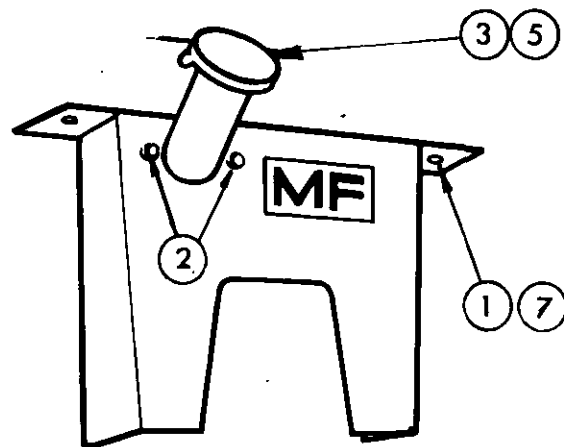
Removal and Refitment 2A-14-06

Removal

1. Remove the two panel retaining screws.
2. Remove the two fuel pipe retaining screws.
3. Remove the fuel cap.
4. Manoeuvre the panel over the pipe.
5. Replace the fuel cap.

Refitment

6. Reverse procedures 1 to 5.
7. Tighten the screws to a torque of 11 Nm (8 lbf ft).



REAR SHEET METAL**Rear Centre Panel (MF 565, 575 and 590 Tractors)****Removal and Refitment** 2A-15-07**Removal**

1. Remove the L.H. and R.H. rear trim panels, operation 2A-13-06.
2. Remove the two screws securing the panel to the upper panel.
3. Lift the panel clear.

Refitment

4. Reverse procedures 1 to 3.
5. Tighten the screws to a torque of 11 Nm (8 lbf ft).

REAR SHEET METAL**Rear Filler Panel (MF 550)**

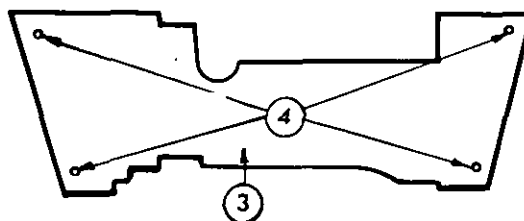
2A-16-07

Removal and Refitment**Removal**

1. Remove the L.H. and R.H. rear trim panels, operation 2A-12-05.
2. Remove the rear centre panel, operation 2A-14-06.
3. Manoeuvre the panel clear.

Refitment

4. Reverse procedures 1 to 3 except:
 - (a) Torque tighten the screws to a torque of 20 Nm (15 lbf ft).



SHEET METAL**REAR SHEET METAL****Rear Upper Panel (MF 565 Tractor)****Removal and Refitment**

2A—17—08

Removal

1. Remove the rear number plate, operation 2A—10—05.
2. Remove the number plate grommets and push the wiring connectors through the appropriate panel holes.
3. Remove the L.H. and R.H. rear trim panels, operation 2A—13—06.
4. Remove the rear centre panel, operation 2A—15—07.
5. Disconnect the plough lamp wiring at the connector and feed the connector and grommet through the panel hole.
6. Loosen the upper fuel hose clip.
7. Remove the screws and remove the fuel pipe.
8. Remove the trailer plug, Part 9A.
9. Remove the three screws from the window assembly.

Refitment

10. Reverse procedures 1 to 9.
11. Tighten the screws to a torque of 11 Nm (8 lbf ft).

REAR SHEET METAL**Rear Upper Panel (MF 575 and 590)****Removal and Refitment**

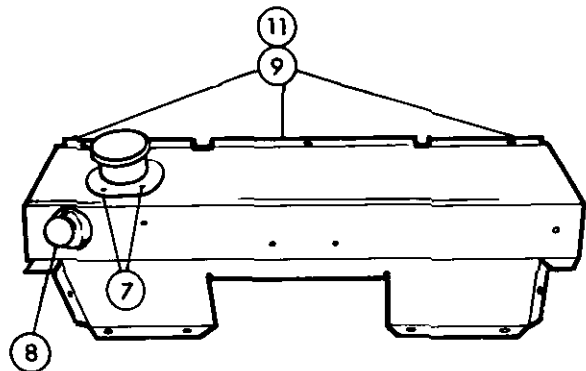
2A—18—08

Removal

1. Remove the rear number plate, operation 2A—10—05.
2. Remove the number plate grommets and push the wiring connectors through the appropriate panel holes.
3. Remove the L.H. and R.H. rear trim panels, operation 2A—13—06.
4. Remove the rear centre panel, operation 2A—15—07.
5. Disconnect the plough lamp wiring at the connector and feed the connector and grommet through the panel hole.
6. Loosen the upper fuel hose clip.
7. Remove the screws and remove the fuel pipe clear.
8. Remove the trailer plug, Part 9A.
9. Remove the three screws from the window assembly.

Refitment

10. Reverse procedures 1 to 9.
11. Tighten the screws to a torque of 11 Nm (8 lbf ft).



REAR SHEET METAL**Rear Spool Valve Plate (MF 575 and 590 Tractors)****Removal and Refitment**

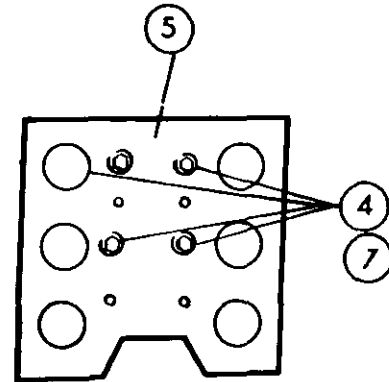
2A-19-09

Removal

1. Remove the L.H. and R.H. rear trim panels, operation 2A-13-06.
2. Remove the rear centre panel, operation 2A-15-07.
3. Remove the rear upper panel, operation 2A-17-08 or 2A-18-08.
4. Remove the four screws.
5. Lift the plate clear.

Refitment

6. Reverse procedures 1 to 5.
7. Tighten the screws to a torque of 11 Nm (8 lbf ft).

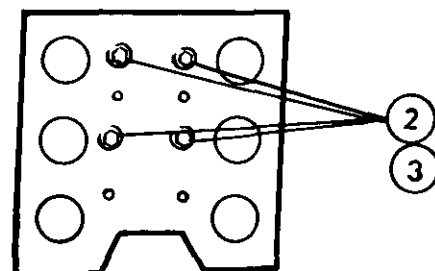
**REAR SHEET METAL (MF 565 TRACTOR)****Rear Spool Valve Plate****Removal and Refitment**

2A-20-09

1. Remove the rear centre panel, operation 2A-15-07.
2. Remove the four screws.

Refitment

3. Reverse procedures 1 and 2 except:
 - (a) Tighten the screws to a torque of 20 Nm (15 lbf ft).



Part 2 — Section B

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2B-04-06	SEAT HYDRAULIC SHOCK ABSORBER—(Type XL and XH) Removal and Replacement	06
2B-05-07	SEAT WEIGHT ADJUSTING MECHANISM (Type XL and XH) Servicing—Disassembly and Reassembly	07
2B-06-07	FLOOR MAT—(MF 590, 575 Tractors) Removal and Refitment	07
2B-07-08	FLOOR MAT—(MF 565 Tractor) Removal and Refitment	08
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CAB AND FITTINGS

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GENERAL

The cab is a welded all steel fabrication with an integral safety frame of square section steel tube. It is lined throughout with anticoustic vinyl faced foam which reduces the interior noise level to meet new legislation.

A laminated rubber and foam floor mat is also fitted. The cab is glazed with toughened safety glass. The right hand side window and rear screen are both hinged to permit opening. A hinged lower window is fitted below the rear view screen to give convenient access to the implement controls.

The door (a two-door version is supplied for certain market requirements) is lockable and a latch is fitted to retain the door in the open position.

The cab is fitted with a comprehensive manually

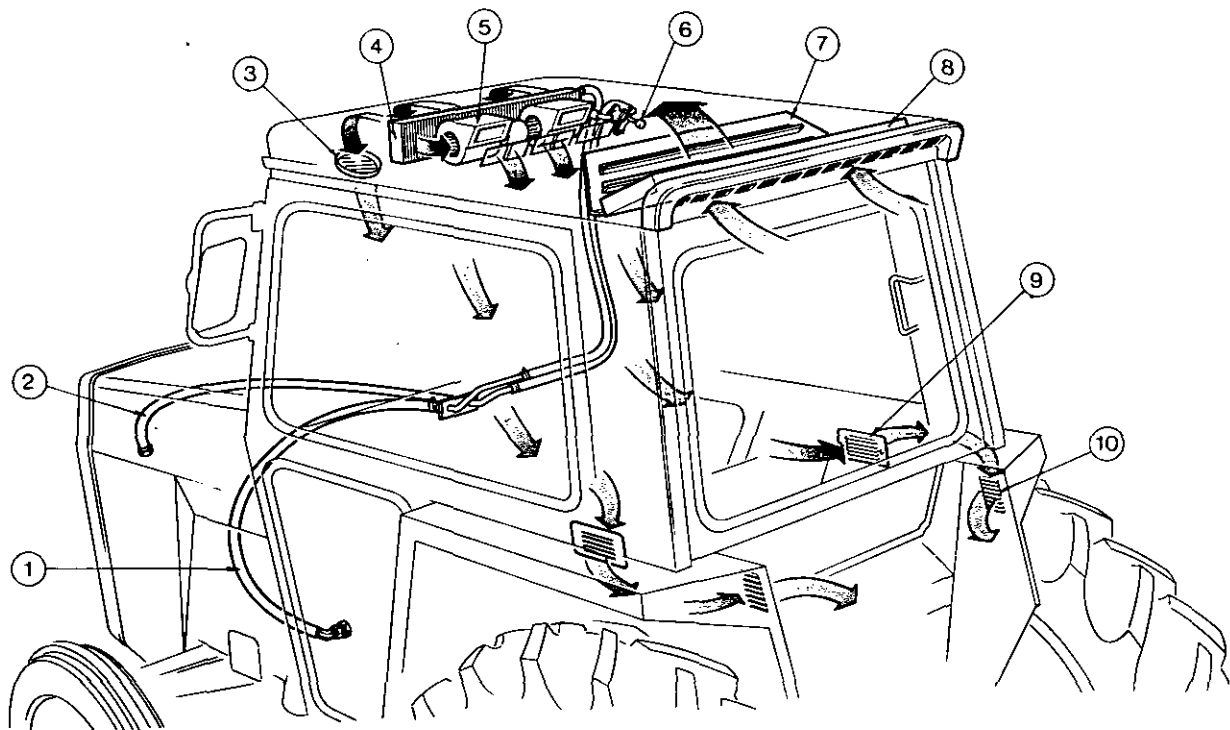
controlled air ventilation/heating system. Filtered air entering the cab roof from the rear passes to twin blowers in the roof mounted plenum chamber assembly.

Here the air is either heated or fed at ambient air temperature to the windscreen or cab interior by means of adjustable vents.

Air recirculation is obtainable by sealing off the rear air intake, whereby the cab interior air is re-cycled using the twin blowers.

A heat exchanger is fitted adjacent to the air blowers and fed by hot water from the engine water pump. The temperature is controlled by a flow valve mounted in the plenum chamber which is operated from within the cab.

CAB AND FITTINGS



KEY TO FIGURE 1

- 1. Hose—water return
- 2. Hose—water feed
- 3. Windscreen demister duct
- 4. Heat exchanger
- 5. Blower unit

- 6. Water flow control valve
- 7. Recirculation flap
- 8. Air filter
- 9. Air outlet grille—cab interior
- 10. Air outlet grille—cab exterior

DOOR**Removal and Replacement**

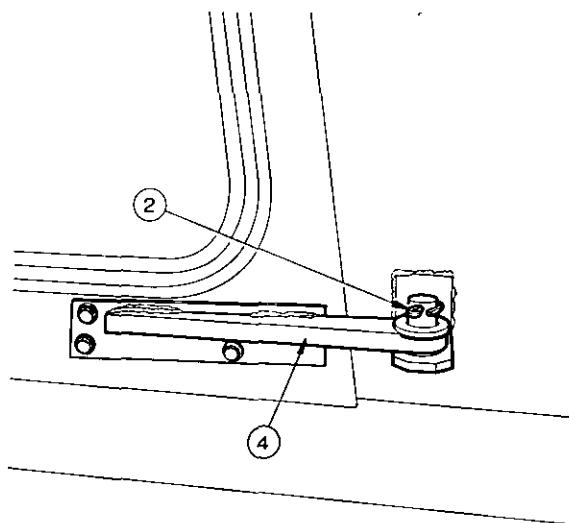
2B-01-05

Removal

1. Remove the two bolts securing the door catch bracket.
2. Remove the two split pins and washers from the door hinges.
3. Lift the door and remove.
4. Remove the door hinge brackets.

Replacement

4. Reverse procedures 1-3 except:
 - (a) Align the new door having the hinge bracket to door bolts finger tight only. Check that the top edge is parallel with the cab roof.

**DOOR HANDLES****Removal and Replacement**

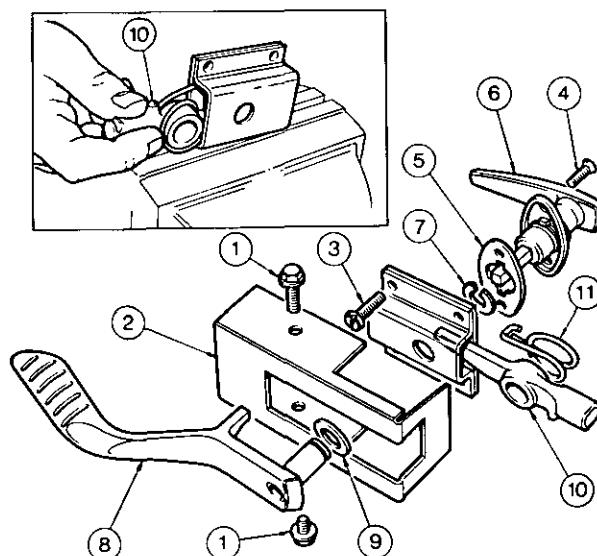
2B-02-05

Removal

1. Remove the two bolts securing the inner cover plate.
2. Withdraw the cover plate.
3. Remove the four screws retaining the striker housing.
4. Remove the two screws securing the exterior door handle.
5. Remove the gasket.
6. Withdraw the exterior door handle.
7. With the striker housing secured in a vice remove the circlip retaining the interior door handle.
8. Withdraw the interior door handle.
9. Remove the fibre washer.
10. With the striker housing in a vice withdraw the striker.
11. Remove the return spring.

Replacement

12. Reverse procedures 1-11.



CAB AND FITTINGS

SEAT ASSEMBLY

Removal and Refitment 2B-03-06

Removal

1. Disengage the seat runner lock by operating the lever.
2. Maintain pressure on the lever, withdraw the seat assembly forwards until it is clear of the seat runners.
3. Remove the seat assembly from the cab.

Refitment

4. Reverse procedures 1-3.

SEAT HYDRAULIC SHOCK ABSORBER (Type XL and XH)

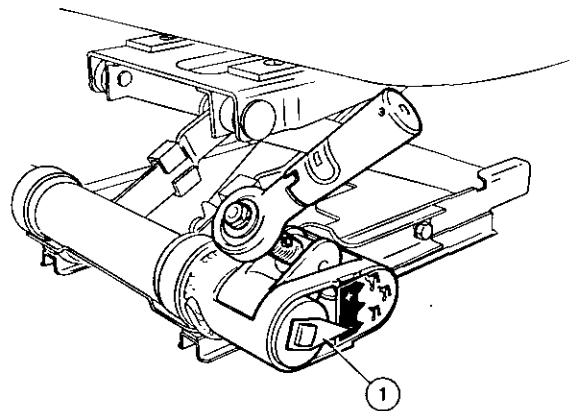
Removal and Replacement 2B-04-06

Removal

1. Remove the seat assembly operation 2B-03-06.
WARNING: Before proceeding release the seat spring tension by operating the ratchet to bring the indicator to position '—'.
2. Remove the circlips and clevis pin securing the shock absorber front pivot.
3. Invert the assembly and remove the circlip and clevis pin from rear pivot.
4. Remove the shock absorber.

Replacement

5. Reverse procedures 1-4.



SEAT WEIGHT ADJUSTING MECHANISM (Type XL and XH)

Servicing

2B-05-07

Disassembly

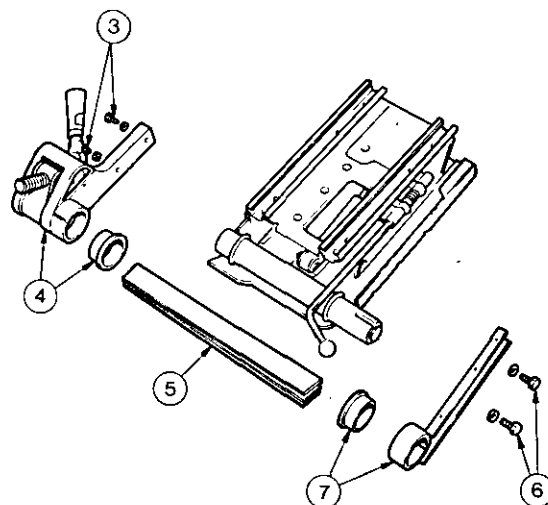
1. Remove the seat assembly, operation 2B-03-06.
2. Remove the four screws securing the seat pan and remove the pan.

WARNING: Before proceeding release the seat spring tension by operating the ratchet to bring the indicator to position '-', operation 2B-04-06.

3. Remove the two screws and washers (three on 'XH' units) securing the ratchet assembly bracket to the frame.
4. Fully depress the frame assembly and remove the ratchet and sintered bronze bearing.
5. Remove the torsion bar.
6. Remove the two screws and washers (three on 'XH' units) securing the bearing support bracket.
7. Remove the bracket and sintered bearing.

Reassembly

8. Check condition of components and replace as necessary.
9. Reverse procedures 1-7.



FLOOR MAT—(MF 590-575 Tractors)

Removal and Refitment

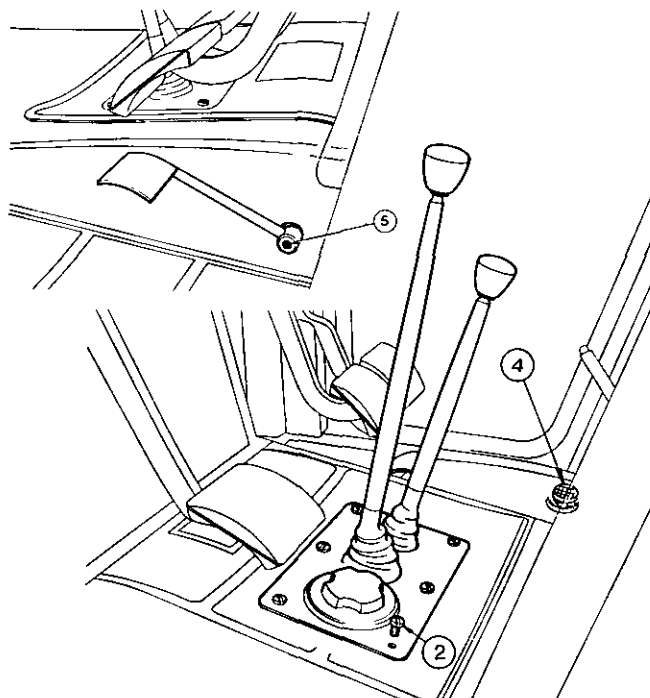
2B-06-07

Removal

1. Remove the floor mat kick plate.
2. Remove the gearbox filler plug cover plate by removing the six securing screws.
3. From underneath the cab remove the circlip retaining the differential lock pedal gaiter support.
4. Withdraw the gaiter and support.
5. Slacken off the allen screw and remove the foot throttle pedal.
6. Remove the floor mat from the cab.

Refitment

7. Reverse procedures 1-6.

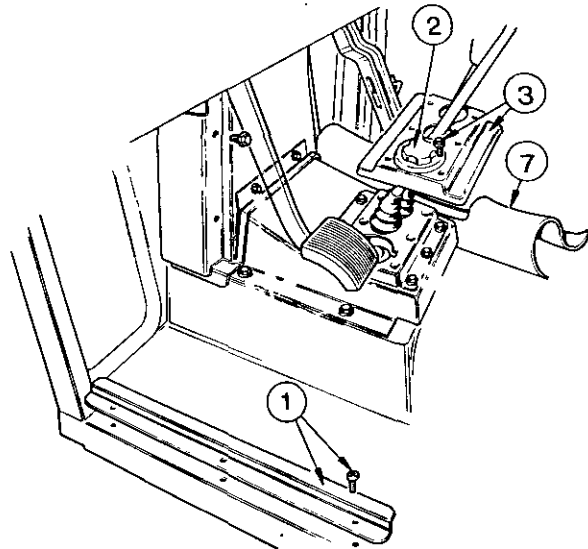


CAB AND FITTINGS**FLOOR MAT—(MF 565 Tractor) 2B-07-08****Removal and Refitment****Removal**

1. Remove the floor mat kick plate.
2. Remove the gearbox filler plug access cover.
3. Remove the six bolts and remove the trim panel.
4. From underneath the cab remove the circlip retaining the differential lock pedal gaiter support.
5. Withdraw the gaiter and support.
6. Remove the foot throttle pedal by slackening the securing allen screw.
7. Remove the floor mat from the cab.

Refitment

8. Reverse procedures 1-7.

**FLOOR MAT—(MF 550 Tractor)****Removal and Refitment**

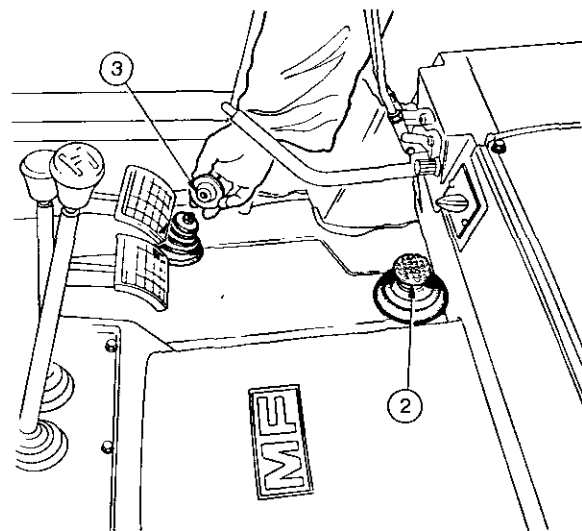
2B-08-08

Removal

1. Remove the floor mat kick plate.
2. Unscrew the differential lock pedal and remove.
3. Release the locknut and unscrew the foot throttle pedal.
4. From underneath the cab remove the two circlips retaining the throttle and differential lock pedal gaiter supports and remove.
5. Remove the floor mat from the cab.

Replacement

6. Reverse procedures 1-5.

**SEAT FLOOR/INSPECTION PANEL****Removal and Refitment**

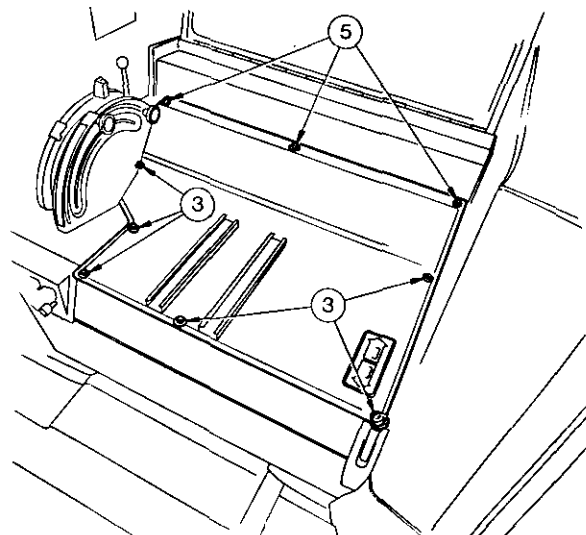
2B-09-08

Removal

1. Remove the seat, operation 2B-03-06.
2. Remove six of the floor securing bolts.
3. Remove the two rear sheet metal cover panels, Part 2A.
4. Remove the three remaining bolts and securing nuts, from beneath the floor.
5. Lift the floor panel and remove from the cab.

Refitment

6. Clean the joint faces between the panel and the floor and apply recommended sealing compound (D).
7. Reverse procedures 1-6.



FLOOR INSPECTION PANEL (MF 590-575 Tractors)

Removal and Refitment

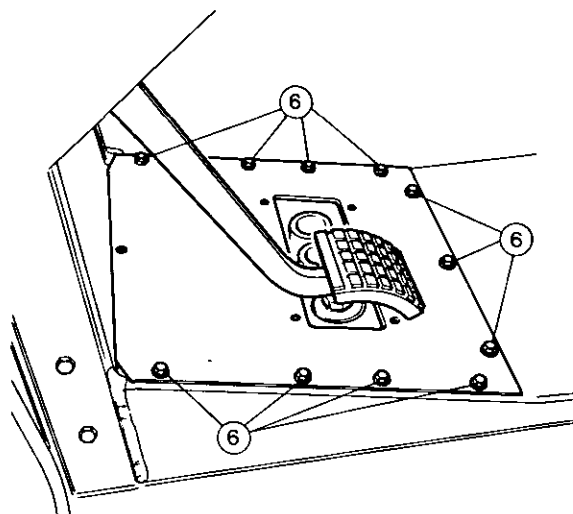
2B-10-09

Removal

1. Remove the bulkhead inspection panel, operation 2B-13-10.
2. Remove L.H. floor mat kick plate.
3. Remove the gearbox filler plug cover plate by removing the six screws.
4. Remove the gear levers, Part 5B.
5. Lift the floor mat to gain access to the floor inspection panel.
6. Remove the retaining bolts and lift out the panel.

Refitment

7. Clean the joint face between the panel and the cab floor and apply recommended sealing compound (D) to both joint faces.
8. Reverse procedures 1-6.



FRONT FLOOR INSPECTION PANEL (MF 565 Tractor)

Removal and Refitment

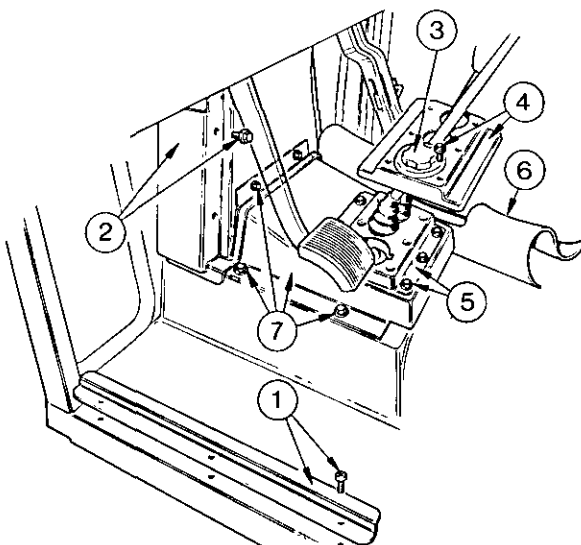
2B-11-09

Removal

1. Remove the floor mat kick plate.
2. Remove the four bolts and withdraw the bulkhead trim panel.
3. Remove the gearbox filler plug access cover.
4. Remove the six bolts and remove the trim panel.
5. Remove the six bolts and remove the gear lever dust cover.
6. Lift the floor mat clear to the right hand side of the cab.
7. Remove the six bolts securing the floor panel and remove.

Refitment

8. Clean the joint faces between the panel and the cab floor. Apply recommended sealing compound (D) to both faces.
9. Reverse procedures 1-7.



BULKHEAD INSPECTION PANEL (MF 565 Tractor)

Removal and Refitment

Removal

2B-12-09

1. Remove the front floor inspection panel, operation 2B-11-09.
2. Remove the two remaining securing bolts and withdraw the bulkhead panel.

Refitment

3. Clean the joint faces between the panel and the bulkhead. Apply a suitable sealing compound to both faces.
4. Reverse procedures 1-2.

CAB AND FITTINGS

**BULKHEAD INSPECTION PANEL
(MF 590, 575 Tractors)**

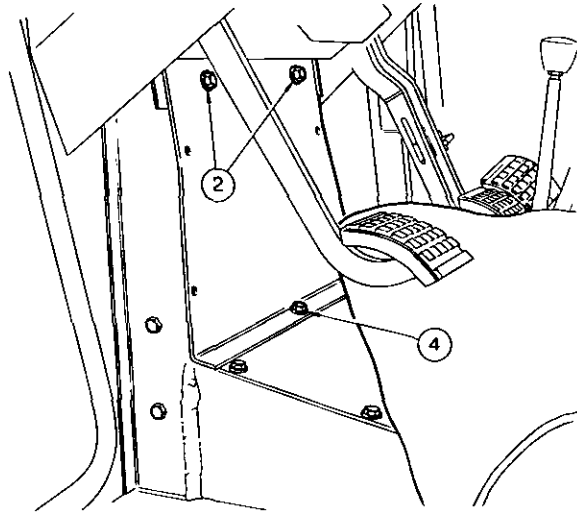
Removal and Refitment 2B—13—10

Removal

1. Remove the bulkhead trim panel.
2. Remove the two retaining bolts.
3. Loosen the floor mat kick plate.
4. Pull back the floor mat and remove remaining securing bolt.
5. Withdraw the panel from the cab.

Refitment

6. Clean the joint faces between the panel and the bulkhead. Apply recommended sealing compound (D) to both faces.
7. Reverse procedures 1-5.



**INSPECTION PANEL—TRANSMISSION
SPACER—(MF 550 Tractor)**

Removal and Refitment 2B—14—10

Removal

1. Remove the floor mat. See 2B—08—08.
2. Remove the securing bolts and remove the inspection panel.
3. Remove the sealing compound and clean the joint faces.

Refitment

4. Apply recommended sealing compound (D) to both joint faces.
5. Reverse procedures 1-3.

**INSPECTION PANEL—TRANSMISSION
SPACER—(MF 565 Tractor)**

Removal and Refitment 2B—15—10

Removal

1. Remove the floor mat kick plate.
2. Remove the gearbox filler plug access cover.
3. Remove the six screws and remove the trim panel.
4. Pull back the floor mat to clear the inspection panel.
5. Remove the securing bolts and remove the inspection panel.
6. Remove the sealing compound and clean the joint faces.

Refitment

7. Apply recommended sealing compound (D) to both joint faces.
8. Reverse procedures 1-6.

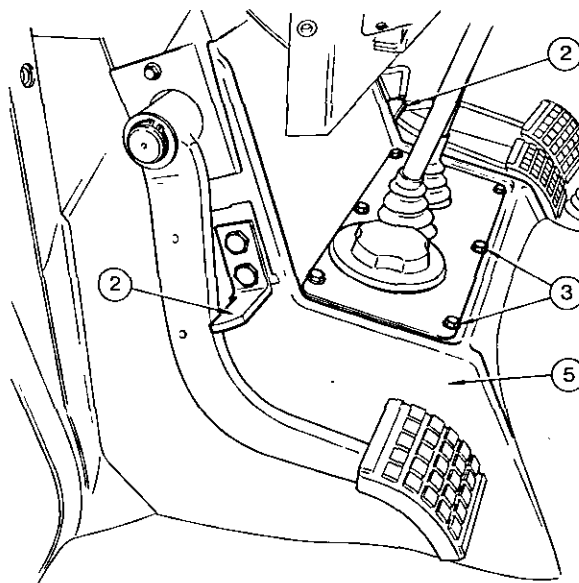
BULKHEAD TRIM PANEL—(MF 550 Tractor)
Removal and Refitment 2B-16-11

Removal

1. Remove the instrument panel cowl, operation 2B-27-16.
2. Remove the clutch and brake pedal stops.
3. Remove the gearbox filler plug mounting plate by removing the six bolts.
4. Remove the gear levers, Part 5B.
5. Withdraw the trim panel from the cab.

Refitment

Reverse procedures 1-5.



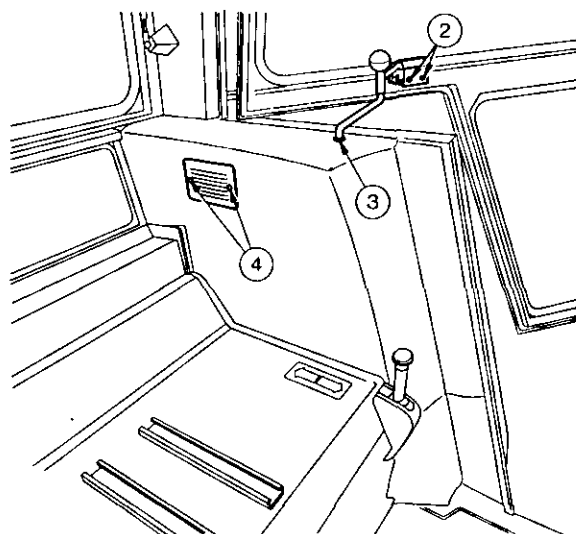
INTERIOR WHEEL ARCH TRIM—L.H.
Removal and Replacement 2B-17-11

Removal

1. Remove seat assembly, operation 2B-03-06.
2. Disconnect the door catch by removing the two retaining bolts.
3. Remove the door catch assembly by unscrewing the assembly from the threaded boss located in the wheel arch.
4. Remove the two screws securing the air outlet grill and withdraw the grill.
5. Peel the foam backed trim away from the wheel arch.
6. Remove all traces of adhesive and foam using a scraper.

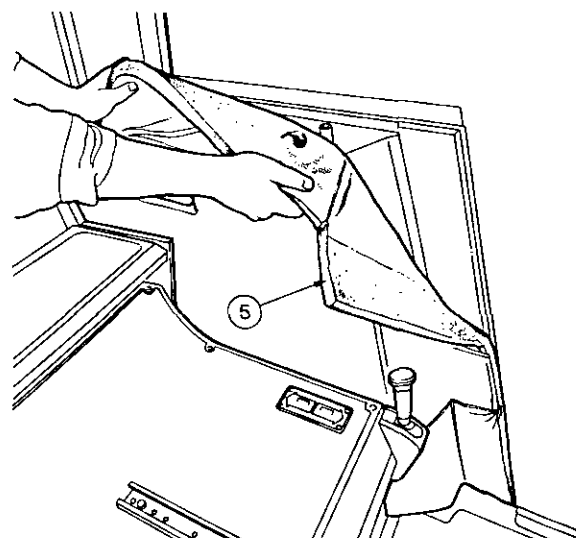
Replacement

7. Using recommended contact adhesive (E) lay the new trim into position.
8. Reverse procedures 1-6.



INTERIOR WHEEL ARCH TRIM—R.H.
2B-18-11

1. Remove seat assembly.
2. Read as for operation 2B-17-11 but omit procedures 2 and 3.

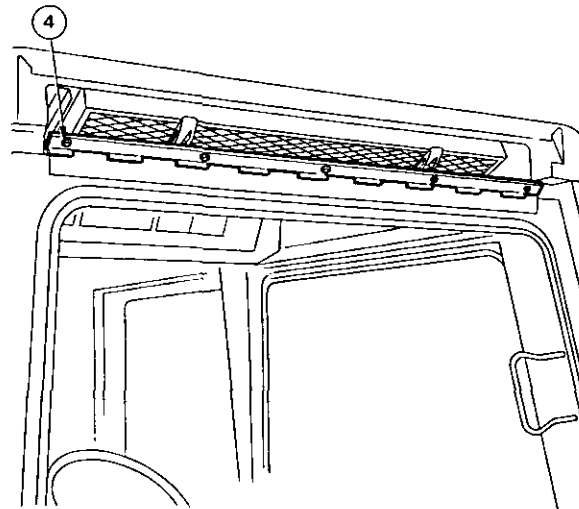


CAB AND FITTINGS**REAR WINDOW ASSEMBLY****Removal and Refitment** 2B-19-12**Removal**

1. Unscrew the two knurled screws and lift off the roof filter cover.
2. Raise and support the window.
3. Disconnect the window struts by removing the retaining nuts.
4. Close window and remove the five bolts and nuts securing the window assembly.
5. Withdraw the window assembly from the cab.

Refitment

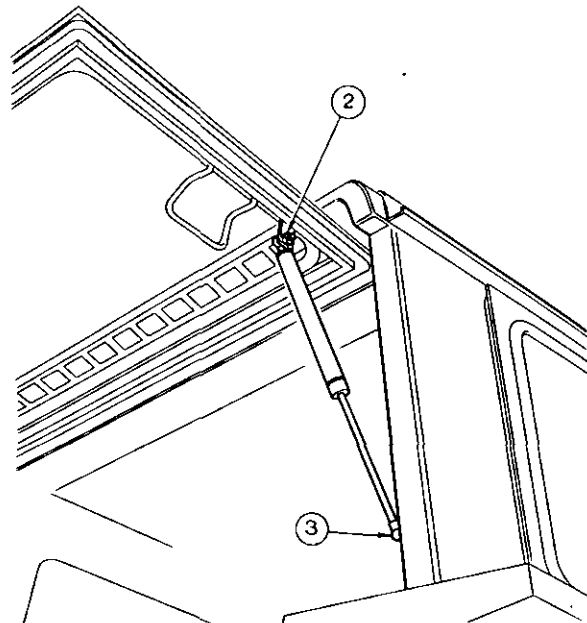
6. Reverse procedures 1-5.

**REAR WINDOW STRUTS****Removal and Replacement** 2B-20-12**Removal**

1. Raise the window. If replacing both struts fit a suitable support.
2. Disconnect the strut from the window frame by removing the securing nut.
3. Unscrew the lower ball connector from the cab and remove the strut assembly.
4. If necessary repeat operations 1-3 for the other strut.

Replacement

5. Reverse procedures 1-4.

**REAR LOWER WINDOW ASSEMBLY****Removal and Refitment** 2B-21-12

1. Remove the number plate, Part 2A.
2. Remove the five bolts securing the rear lower window to the cross-member.
3. Remove the window assembly.

Refitment

4. Reverse procedures 1-3.

SIDE WINDOW ASSEMBLY**Removal and Refitment** 2B-22-12**Removal**

1. Remove the bolts securing the window catch to the window frame.
2. Remove the five bolts securing the window assembly to the cab.
3. Remove the window assembly.

Refitment

4. Reverse procedures 1-3.

SIDE WINDOW CATCH**Removal and Refitment**

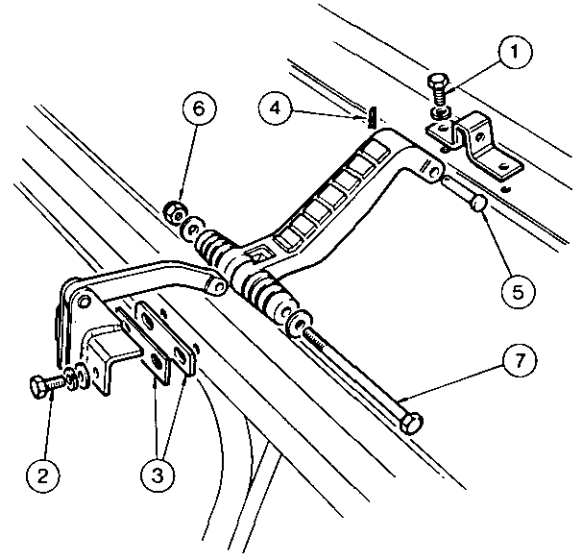
2B-23-13

Removal

1. Remove the two bolts and washers securing the catch to the window frame.
2. Remove the two bolts and washers securing the catch to the cab.
3. Remove the catch assembly.
4. Remove the 'R' clip.
5. Withdraw the clevis pin.
6. Remove retaining nut.
7. Withdraw the hinge bolt.

Refitment

8. Reverse procedures 4-7.
9. Refit the catch to the cab but do not tighten the bolts.
10. Refit the catch to the window frame.
11. Fully tighten the catch to cab securing bolts.

**WINDOW GLASS****Removal and Replacement**

2B-24-13

Special Tools: Locking strip replacer, Pt. No. 468 and adaptor 18G 468A.

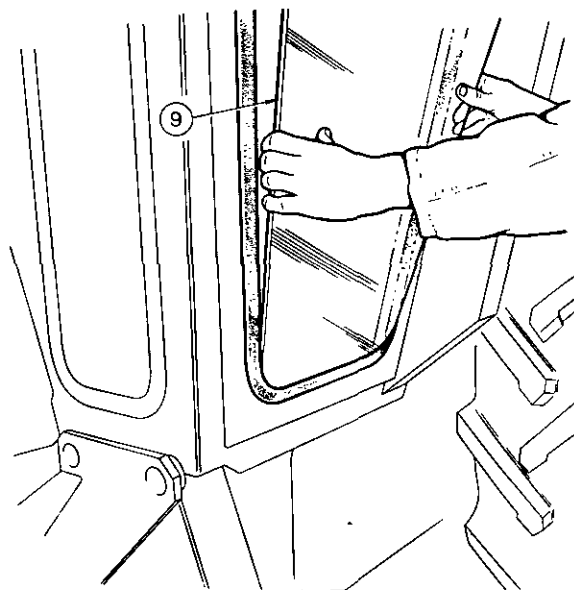
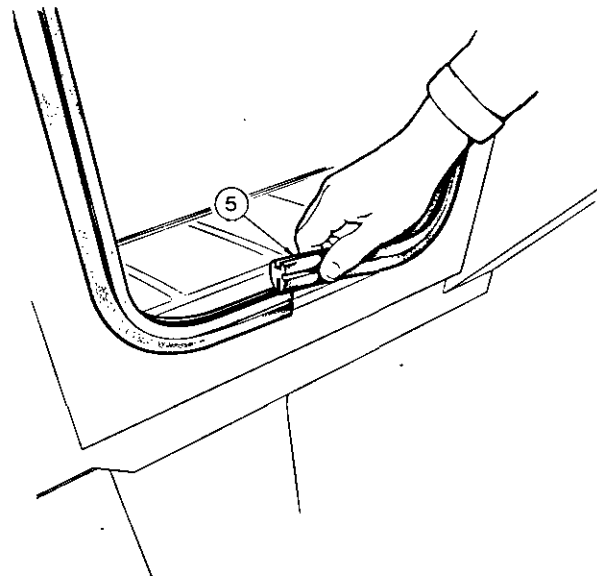
NOTE: the following procedure is used for all the window glass with the exception of the rear lower window.

Removal

1. To remove the glass if defective, scratched, chipped etc., prise out the locking strip at the butt joint and remove completely from the rubber moulding. (If the glass has shattered remove all broken pieces).
2. With a firm pressure at one of the bottom corners, press out the screen from the interior of the cab.
3. Remove the rubber moulding and ensure that the cab frame is clean and undamaged.

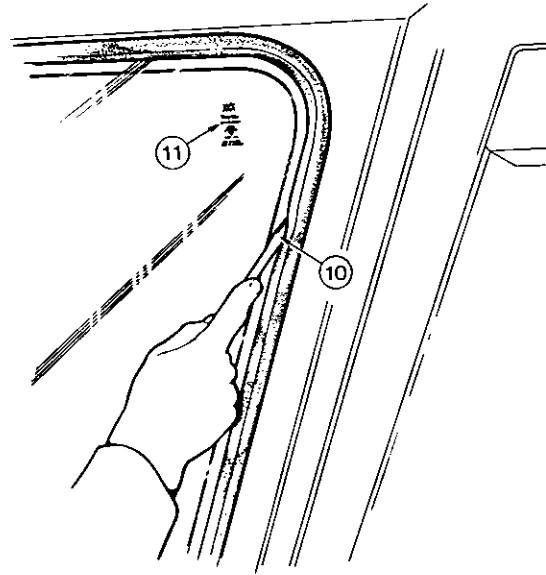
Replacement

4. Press the glass rubber moulding into the cab frame aperture with the butt joint at the bottom, centre position.
5. With a knife trim off the moulding with a 9,5 mm ($\frac{3}{8}$ in) overlap.
6. Force the overlap into position, producing a neat tight butt joint.
7. Lubricate the screen rubber moulding with a soft soap and water solution, petroleum jelly or a silicone base lubricant to assist replacement of the glass.
8. **WARNING:** Before handling the glass ensure that hands are clean, dry and free of lubricant.
9. Position the new glass into the bottom channel of the rubber moulding.

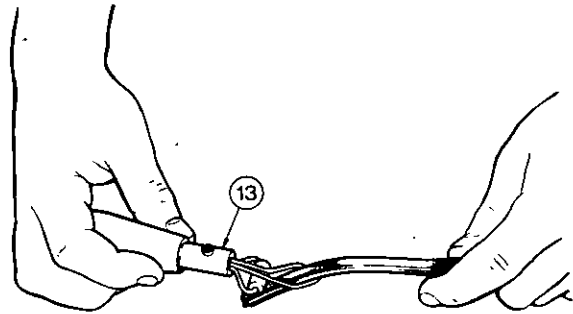


CAB AND FITTINGS

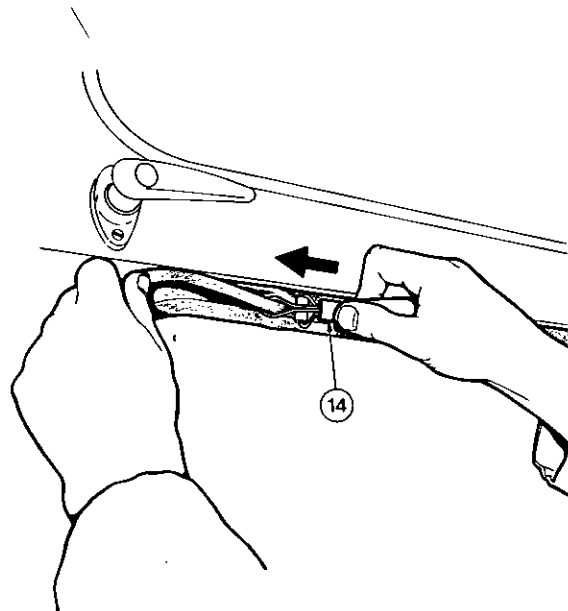
10. Using a smooth edge lever feed the glass into its correct seating in the rubber moulding. Use the lever between the inner edge of the rubber moulding and the glass.
11. **NOTE:** Replace the glass with the 'TRIPLEX' legend facing the outside of the cab.
12. Continue using the lever from the bottom R.H. corner until the glass is in position.

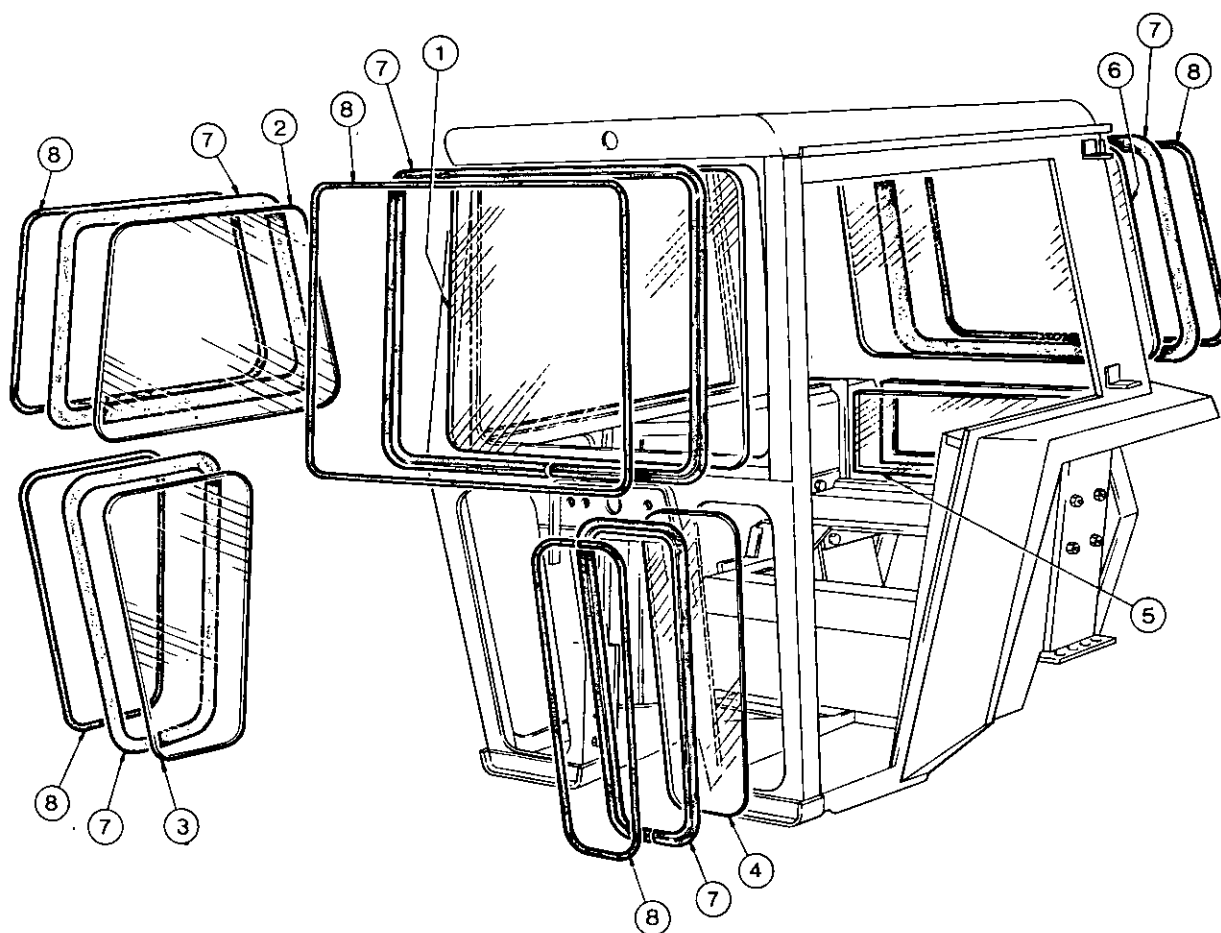


13. Using the lubricant as in procedure (7) smear the locking strip liberally and load it onto the special tool.



14. Using the special tool insert the locking strip into the rubber moulding using a firm pressure. Start at a point opposite the butt joint of the rubber surround. i.e., the top of the frame—centre position.
15. Trim the locking strip with an overlap of 3 mm ($\frac{1}{8}$ in) approx. Force in the overlap producing a neat and tight butt joint.



**KEY TO FIGURE 2**

- 1 Windscreen glass
- 2 Side window and door glass
- 3 Lower side window and lower door glass
- 4 Bulkhead glass
- 5 Rear lower window glass
- 6 Rear window glass
- 7 Rubber moulding
- 8 Locking strip

CAB AND FITTINGS**REAR LOWER WINDOW GLASS****Removal and Replacement** 2B-25-16**Removal**

1. Remove all broken glass from the window frame.
2. Scrape off all the sealer and clean the frame.

Replacement

3. Using suitable sealant strip, place it in position onto the window frame as close to the inner edge of the aperture as possible.
4. Place the new glass into position, laying it onto the sealing strip. Place the 'TRIPLEX' legend in the top R.H. corner facing the outside of the cab.
5. Apply a firm even pressure onto the glass until the sealant strip is compressed and has spread to a rectangular section approximately half the original thickness.

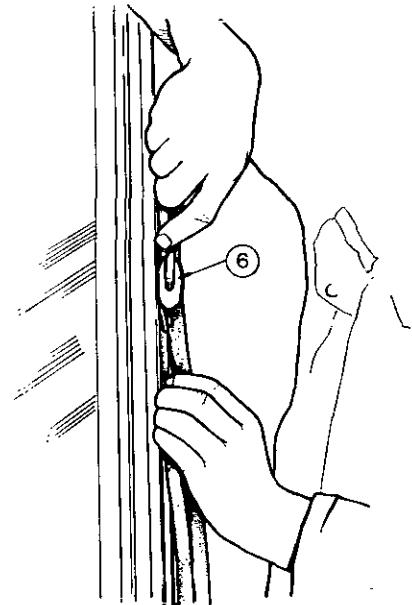
DOOR, SIDE WINDOW AND REAR WINDOW SEALS**Removal and Replacement** 2B-26-16

Special Tools: Wheel Part No. 600-358.

1. Remove the rear window, operation 2B-19-12.
2. Remove the side window, operation 2B-22-12.
3. Remove the rubber seal moulding from the windows and door.

Replacement

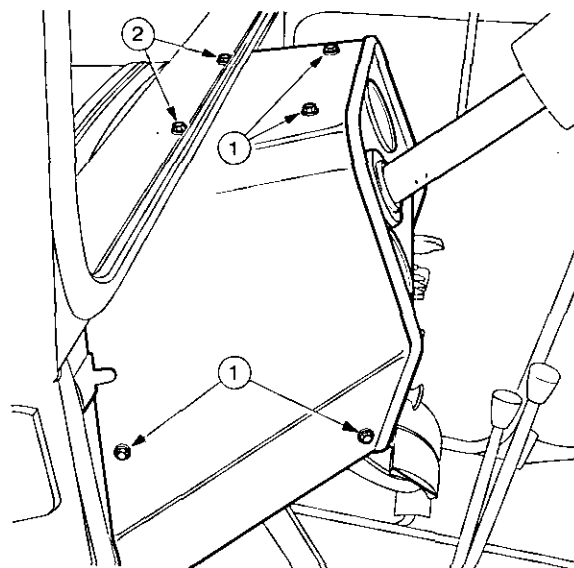
4. Ensure the retaining channel is clean and undamaged.
5. Lubricate the channel and the new seal with a soft soap solution, petroleum jelly or silicone base grease.
6. Using Special Tool Pt. No. 600-358 press the seal rubber into position. Position the wheel onto the inner edge of the moulding and using a firm pressure roll the moulding into the channel.
7. Work around the frame in one direction only ensuring a good fit at each corner.
8. Trim the seal approximately 13 mm (0.5 in) beyond the joint.
9. Force in the overlap to obtain a tight butt joint.
10. Reverse procedures 1-2.

**INSTRUMENT PANEL COWL****Removal and Refitment** 2B-27-16**Removal**

1. Remove the six bolts securing the cowl inside the cab.
2. From outside the cab remove the two bolts securing the cowl to the front cross member.
3. Withdraw and remove the cowl from the cab.

Refitment

4. Reverse procedures 1-3.

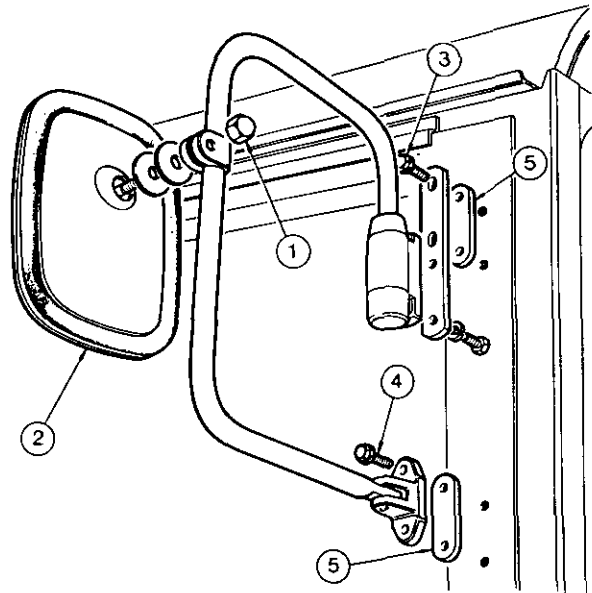


REAR VIEW MIRROR AND BRACKET**Removal and Refitment** 2B-28-17**Removal**

1. Remove the domed securing nut.
2. Remove the mirror.
3. Remove the two securing bolts at the upper hinge.
4. Remove the two securing bolts at the lower hinge.
5. Remove the spacers and bracket assembly.

Replacement

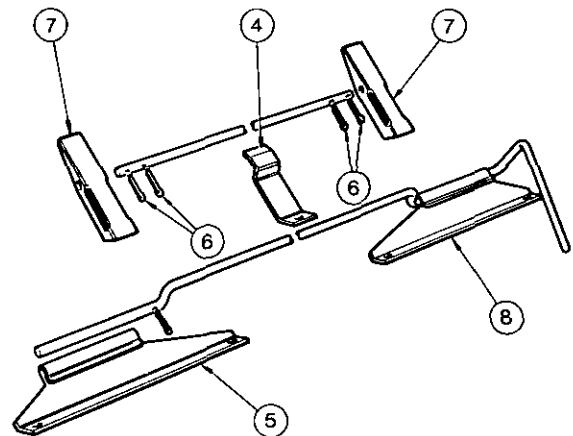
6. Reverse procedures 1-5.

**ROOF FILTER RETAINER****Removal and Refitment** 2B-29-17**Removal**

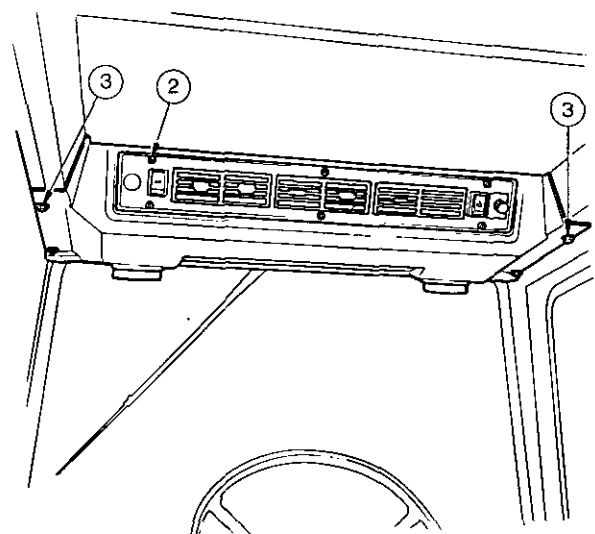
1. Remove the rear window, operation 2B-19-12.
2. Remove the filter element.
3. Lift out the retainer assembly.
4. Remove the centre retaining bracket.
5. Remove the L.H. retaining bracket and split pin.
6. Remove the four split pins securing the filter catches and remove the support rod.
7. Remove the filter catches from the support rod.
8. Remove the R.H. main retaining bracket.

Refitment

9. Reverse procedures 1-8.

**REAR HEADLINER****Removal and Refitment** 2B-30-17**Removal**

1. Release the interior light unit by removing the two retaining screws.
2. Release the air flow vent unit by removing the eight retaining screws.
3. Remove the two rearmost bolts from the plenum chamber cover panel.
4. Remove the ten bolts securing the headliner.

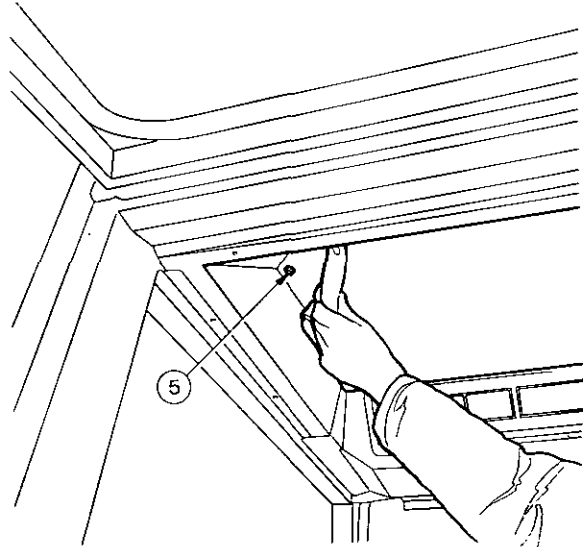


CAB AND FITTINGS

5. Pull back each corner of the foam insulating panel to reveal the four remaining securing bolts and remove the bolts.
6. With the aid of a second operator lower the headliner slowly from the rear of the cab and thread the interior light unit out through its aperture.
7. Disengage the front edge of the rear headliner from the front headliner.
8. Remove the headliner from the cab.

Refitment

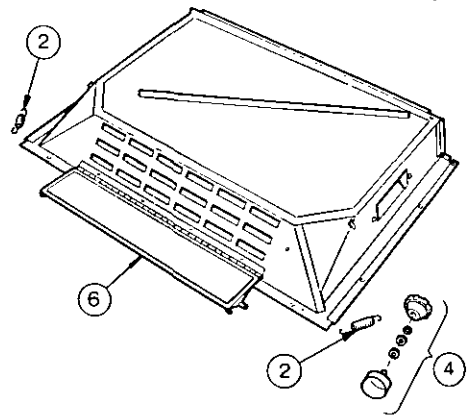
9. Reverse procedures 1-8.

**RECIRCULATION AIR FLAP CONTROL****Removal and Replacement 2B-31-18****Removal**

1. Remove the rear headliner operation 2B-30-17.
2. Remove the two return springs.
3. Slacken the grub screw securing the control knob.
4. Remove the control knob, two nylon washers, spring washer and the cam.
5. Check all components for wear.

Replacement

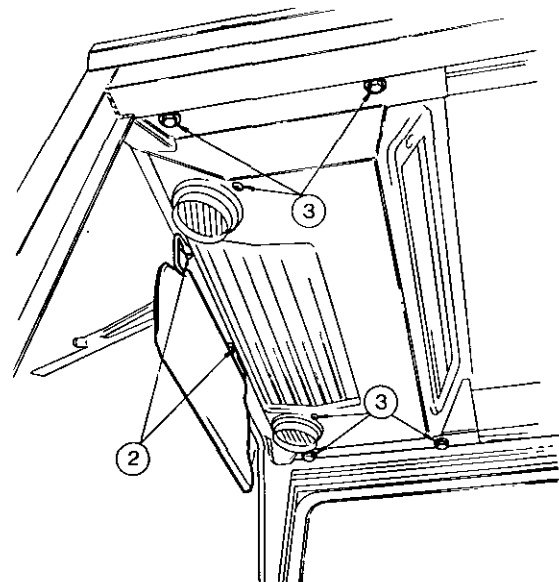
6. Check the condition of the foam air sealing on the air flap. If damaged remove the strip completely from the flap and ensure that the sealing face is clean.
7. Remove backing paper from the new self-adhesive strip and place into position using a firm pressure.
8. Reverse procedures 1-5.

**FRONT HEADLINER****Removal and Refitment 25-32-18****Removal**

1. Remove the vent panel, operation 2B-33-19.
2. Remove the two bolts securing the sun visor and remove the visor.
3. Remove the four bolts and four screws securing the panel.
4. Disengage the front headliner from the rear headliner.
5. Remove the headliner.

Refitment

6. Reverse procedures 1-5.



AIR FLOW VENT PANEL**Removal and Refitment**

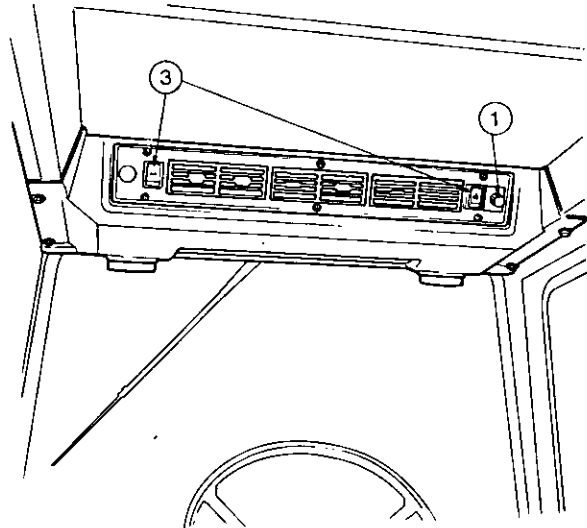
2B-33-19

Removal

1. Slacken the grub screw and withdraw the heater control knob.
2. Remove the six securing screws and withdraw the panel.
3. Disconnect the cables from the blower and wiper switches.

Refitment

Reverse procedures 1-3.
See Part 9 for correct position for re-wiring the wiper and blower switches.

**PLENUM CHAMBER****Removal and Refitment**

2B-34-19

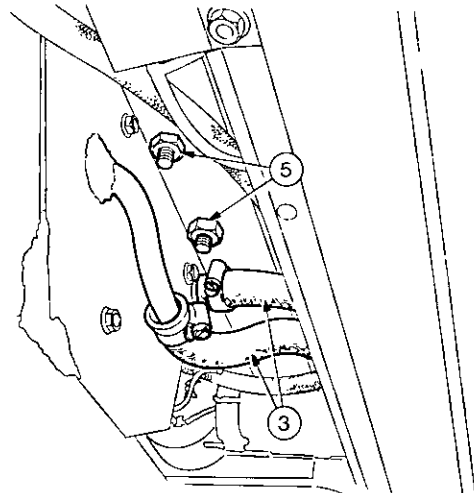
Removal

1. Remove the front headliner, operation 2B-32-18.
2. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and cylinder block.
3. Disconnect the supply and return heater hoses.
4. Pull the wiper and blower switch wires through the grommet in the plenum chamber.
5. Remove the four nuts and washers securing the plenum chamber assembly to the roof.

CAUTION: The Plenum Chamber assembly is heavy. Exercise care when lowering the assembly from the roof. Use of a second operator is recommended.

Refitment

6. Reverse procedures 1-5.

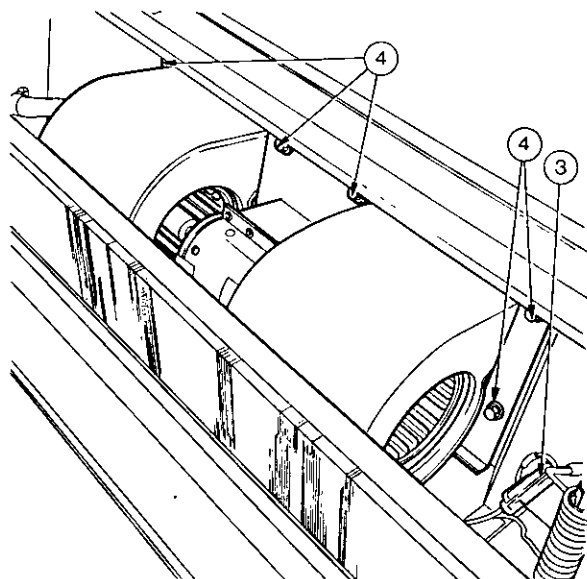
**BLOWER ASSEMBLY****Removal and Replacement**

2B-35-19

1. Remove the plenum chamber, operation 2B-34-19.
2. Remove the heat exchanger, operation 2B-39-22.
3. Disconnect the blower motor lead.
4. Remove the six bolts securing the blower and motor assembly to the centre panel.

Replacement

Reverse procedures 1-4.



CAB AND FITTINGS

BLOWER IMPELLORS

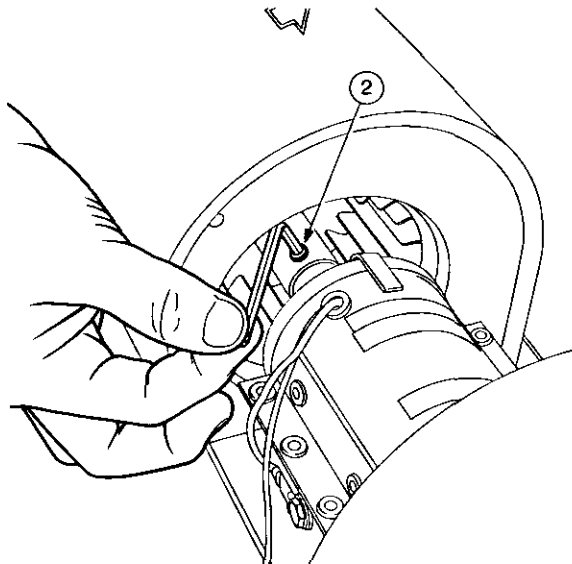
Removal and Replacement 2B-36-20

Removal

1. Remove the motor and blower assembly, operation 2B-35-19.
2. Slacken the two grub screws and withdraw the impellers.

Replacement

3. Reverse procedures 1-2, except:
NOTE: Ensure adequate clearance between the impellor and the casing.



HEATER CONTROL VALVE

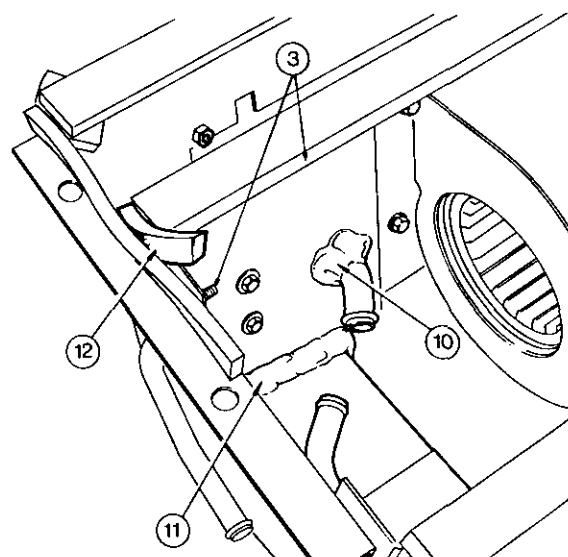
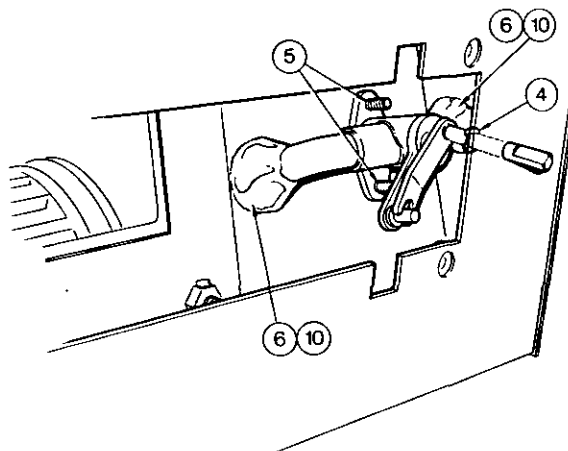
Removal and Refitment 2B-37-20

Removal

1. Remove the plenum chamber assembly. See 2B-34-19.
2. Disconnect the hose at the control valve.
3. Remove the four bolts that secure the centre panel.
4. Remove the circlip and pull the control lever forward to disengage.
5. Remove the two bolts that retain the control valve to the centre panel.
6. Remove the sealer from the stub pipe apertures in the plenum chamber. Retain the plastic type sealing compound and re-use during reassembly.
7. By displacing the centre panel slightly remove the control valve from the housing and centre panel.
8. Withdraw the control lever.

Refitment

9. Reverse procedures 1-8.
10. Re-seal the control valve stub pipes at the plenum chamber with the original sealer. See procedure 6.
11. Re-seal any openings between the centre panel and the plenum chamber with recommended sealing compound (D).
12. Replace foam air seals if necessary.

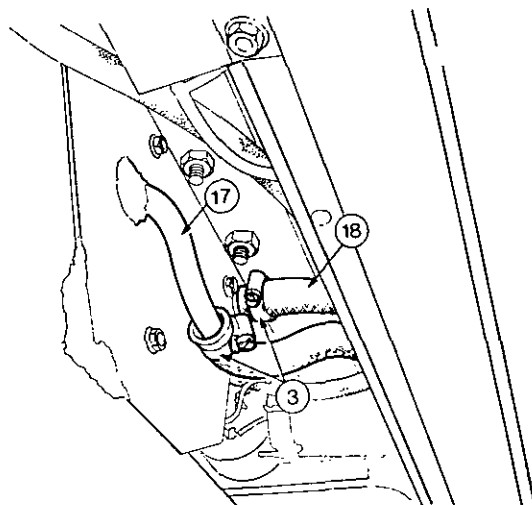


HEATER HOSES**Removal and Replacement**

2B-38-21

Removal

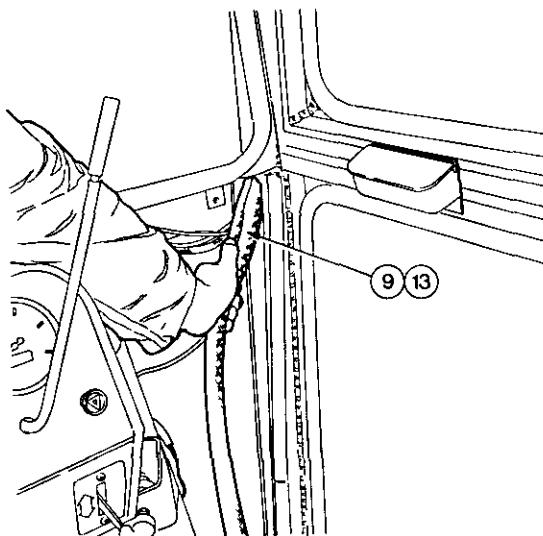
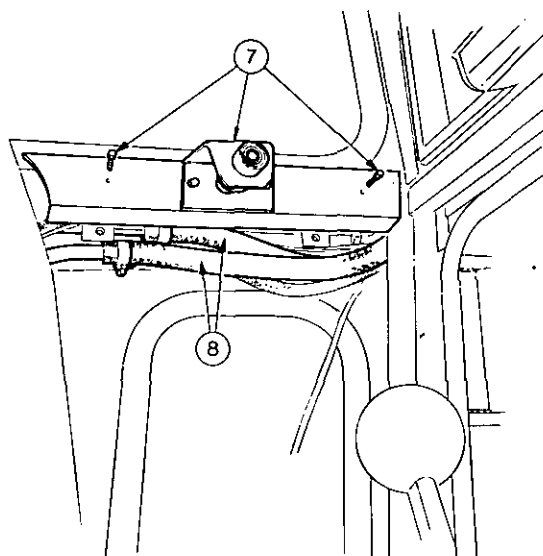
1. Remove the front headliner, operation 2B-32-18
2. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and cylinder block.
3. Disconnect the heater hoses from the inlet and outlet stub pipes.
4. Remove the plenum chamber, operation 2B-34-19.
5. Release the windscreen wiper motor, Part 9A.
6. Remove the protective sponge insert.
7. Remove the two securing bolts and withdraw the trip switch mounting panel.
8. Disconnect the hoses from the bulkhead stub pipes.
9. Withdraw both hoses from the R.H. cab pillar.
10. Remove the hood, Part 2A.
11. Detach the hoses from the bulkhead to engine block and from the bulkhead to water pump and remove.

**Replacement**

12. Reverse procedures 10 and 11.
13. Lubricate the exterior of the new hoses with petroleum jelly, soap and water or similar and feed the hoses into position from the bottom of the R. H. cab pillar.
14. When the hoses appear at the roof pull them into the cab with a pair of tongs or pliers. Take care not to damage the hose.
15. Reconnect the hoses to the control valve (INLET) and heat exchanger (OUTLET).
16. Refit the protective sponge insert ensuring that the wiring harness also passes between the sponge.
17. Reconnect the hoses at the bulkhead transfer pipes.

NOTE: The feed hose from the water pump is connected to the control valve (INLET) in the plenum chamber.

18. The return hose from the heat exchanger is connected through to the engine cylinder block.
19. Replenish the cooling system.
20. Open the heater control valve fully then run the engine and replenish the cooling system as necessary.

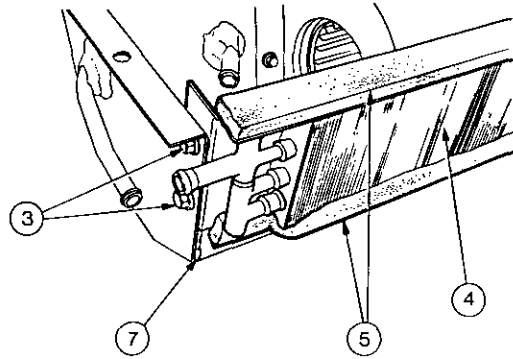


CAB AND FITTINGS**HEAT EXCHANGER****Removal and Replacement** 2B-39-22**Removal**

1. Remove the plenum chamber, operation 2B-34-19.
2. Disconnect the hose at the heat exchanger stub pipe.
3. Remove the four bolts securing the heat exchanger.
4. Lift out the heat exchanger.

Replacement

5. Fit new self-adhesive foam air seals to the lower front edge of the heat exchanger.
6. Replace the heat exchanger with the four securing bolts.
7. Re-seal any openings between the heat exchanger and the plenum chamber with recommended sealing compound (D).

**WINDSCREEN DEMISTER DUCTS****Removal and Refitment** 2B-40-22**Removal**

1. Pull the duct assembly from the front headliner.
2. Press out the fluted plate from the grommet.

Refitment

3. Reverse procedures 1-2.
Use a soap and water solution, petroleum jelly or a similar lubricant to assist replacing the rubber grommet.

REAR CROSS BRACE**Removal and Refitment** 2B-41-22**Removal**

1. Remove the rear lower window, operation 2B-21-12.
2. Remove the rear sheet metal panels, Part 2A.
3. Remove the three rear seat floor retaining bolts and nuts.
4. Remove the eight attachment bolts securing the cross brace.
5. Withdraw the cross brace downwards and then rearwards.

Refitment

6. Ensure the joint faces are clean and undamaged.
7. Apply a recommended sealing compound (D) to both faces.
8. Replace the cross brace. If necessary expand the rear cab frame with a hydraulic ram or similar to ease replacement.
9. Replace retaining bolts and tighten to a torque of 80 lb. ft. (11 kgm).

CAB ASSEMBLY— (MF 565, 575 & 590 Tractors)**Removal and Replacement 2B—42—23**

Special Tools: A crane of 2000 kg (2 tons) MINIMUM capacity.

A bracket secured to the cab roof (there are two tapped holes in the cab roof designed solely for this purpose) capable of supporting 2000 kg (2 tons).

Removal

1. Carry out procedures 1-15, 17 and 18, operation 3A—04.
2. Carry out procedures 2 and 3, 5-10, 13 and 14, operation 3A—08.
3. Carry out procedures 4, 5, 7, 9, 10 and 13, operation 3A—06.

NOTE: Under no circumstances should attempts be made to lift the tractor using roof mountings.

4. Lift off the cab, taking care not to foul any components.
5. Strip out all components to be transferred to the new cab.

Replacement

6. Transfer all required components to the new cab.
7. Carry out procedures 24 (a) and (b), operation 3A—08.
8. Carry out procedures 30 (a), operation 3A—06.
9. Reverse procedures 1-4.

CAB ASSEMBLY (MF 550) Tractor**Removal and Replacement 2B—43—23**

Special Tools: A crane of 2000 kg (2 Tons) MINIMUM capacity.

A bracket screwed to the cab roof (There are two tapped holes in the cab roof designed solely for this purpose) capable of supporting 2000 kg (2 Tons).

Removal

1. Carry out procedures 1-7, 9-15, 17 and 18, operation 3A—03.
2. Carry out procedures 4, 5, 6, 9 and 10, operation 3A—05.
3. Carry out procedures 2, 5, 6, 7 and 8, operation 3A—07.
4. Lift off the cab, taking care not to foul any components.

NOTE: Under no circumstances should attempts be made to lift the tractor using the roof mountings.

5. Strip out all components to be transferred to the new cab.

Replacement

6. Transfer all required components to the new cab.
7. Carry out procedure 29 (a), operation 3A—05.
8. Carry out procedures 22 (a) and (b), operation 3A—07.
9. Reverse procedures 1-4.

**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 3

Publication No. 1856 072 M1

comprising

A SPLITTING THE TRACTOR

SPLITTING THE TRACTOR

Part 3 — Section A

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GENERAL

This section gives the procedures for splitting the tractor at four main points allowing access to the four major mechanical assemblies of the tractor.

SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE FRONT AXLE AND ENGINE

Splitting Procedure (MF 550)

3A—01—02

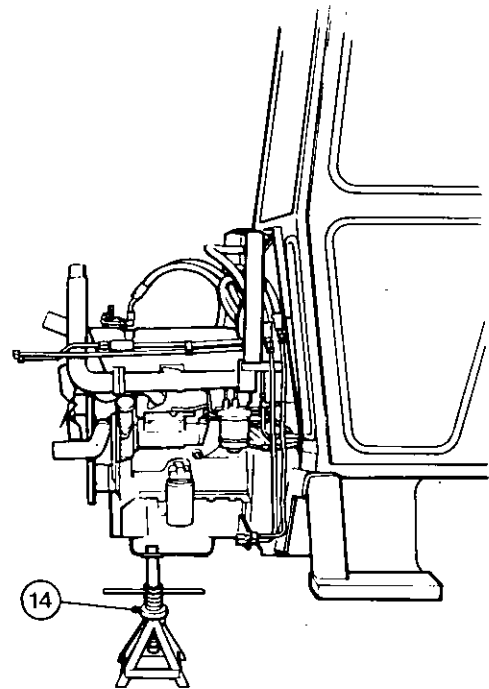
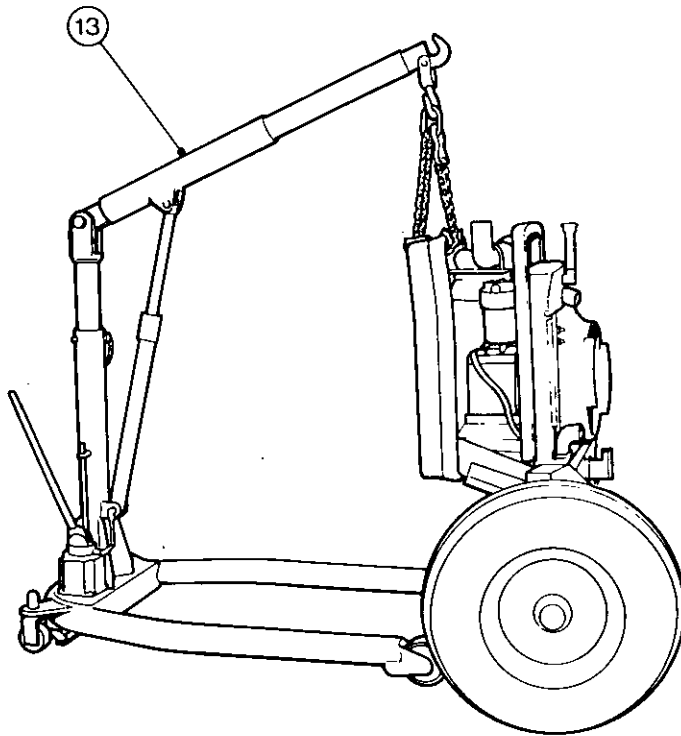
Disassembly

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and cylinder block.
2. Disconnect the battery negative cable at the battery and the positive cable at the starter solenoid.
3. Remove the hood, Part 2A.
4. Disconnect the steering pipes.
5. Remove the pipe.
6. Disconnect the oil pipes (if fitted).
7. Disconnect the radiator top and bottom hoses.
8. Disconnect the headlight and horn wires and thread them through the retaining clips to leave the cable on top of the engine.
9. Disconnect the air cleaner indicator wires.
10. Disconnect the radiator support bar.
11. Disconnect the windscreen washer pipe.
12. Apply the tractor handbrake.
13. Support the nose assembly using a jib crane and chain.
14. Support the tractor under the sump using a suitable jack stand.
15. Fit hard wood wedges between the front axle casting and beam on both sides to prevent the beam from pivoting.
16. Remove the two bolts, one nut and washers from the left hand side of the tractor.
17. Remove the two bolts, spacer, nut and washers from the right hand side of the tractor.
18. Carefully wheel the two front wheels, front axle and jib crane forwards away from the engine.

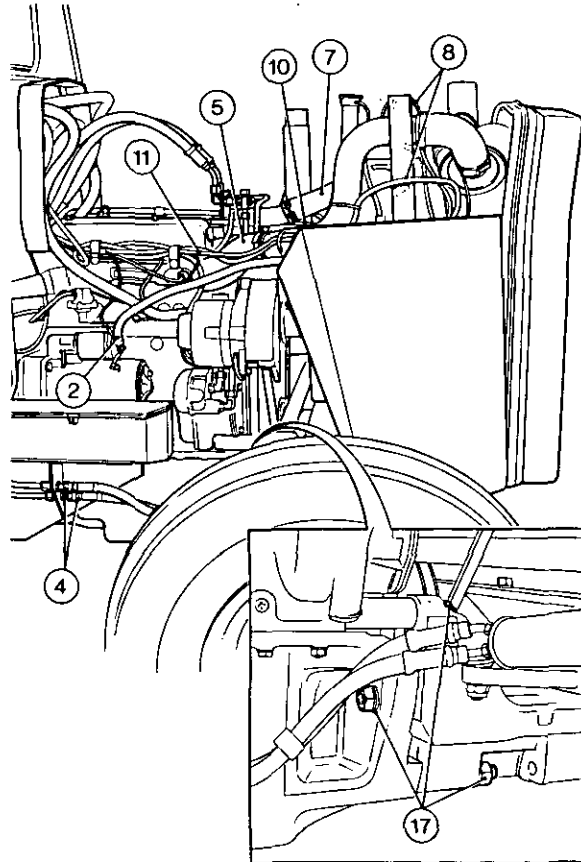
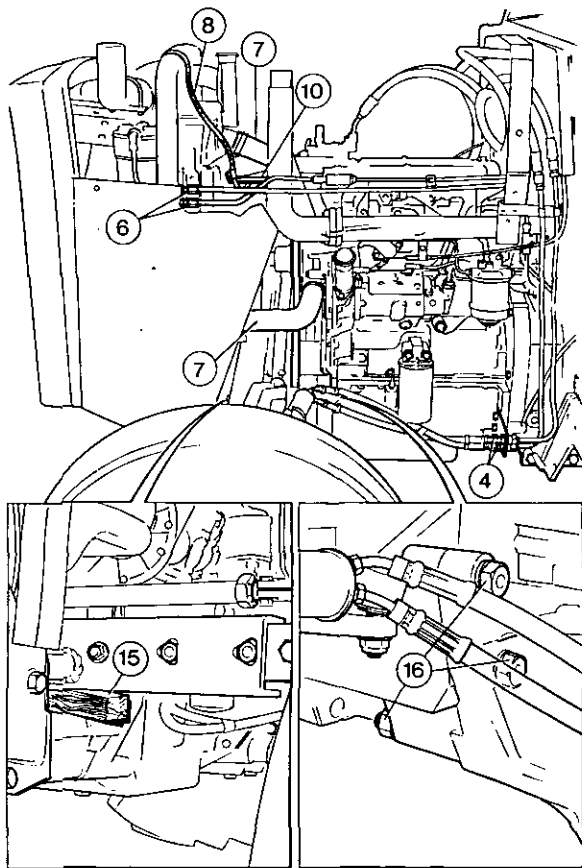
WARNING: Take care to keep the front axle assembly level once it has been withdrawn from the engine, otherwise it could overbalance and cause injury.

Reassembly

19. Reverse procedures 1 to 18, except: Tighten the front axle retaining nuts and bolts to a torque of 235 Nm (175 lbf ft).



SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE FRONT AXLE AND ENGINE

Splitting Procedure
(MF 565, MF 575 and MF 590)

3A-02-04

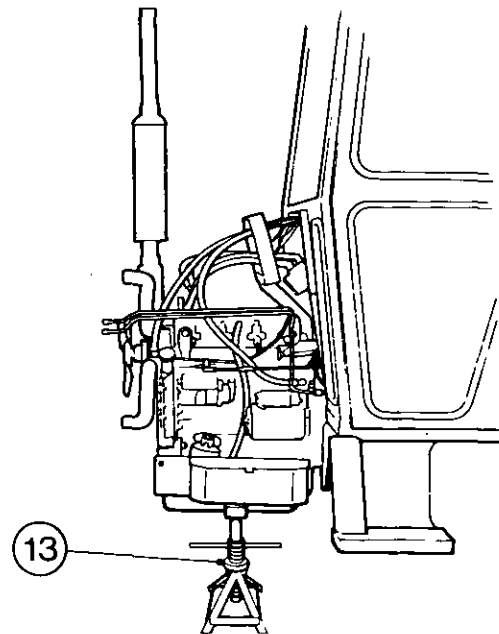
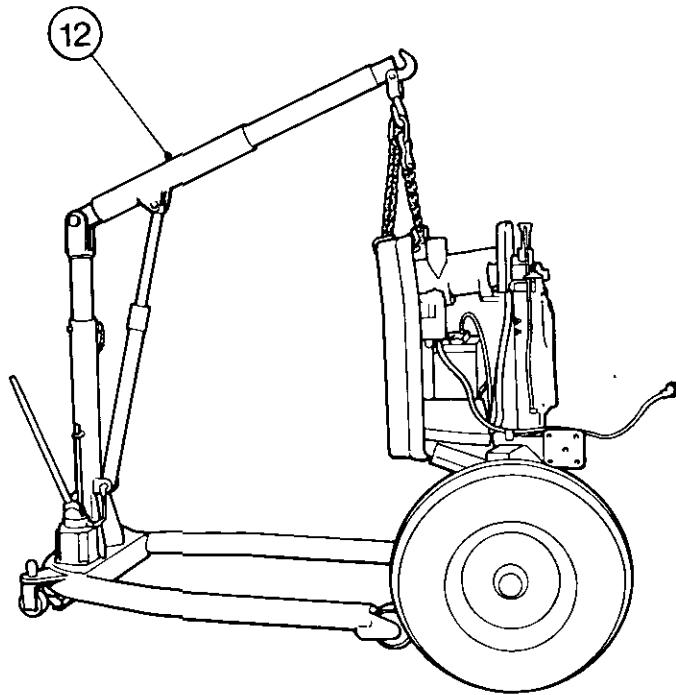
Disassembly

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and cylinder block.
2. Disconnect the battery negative cable at the battery, and the positive cable at the starter solenoid.
3. Remove the hood, Part 2A.
4. Disconnect the steering pipes.
5. Remove the pipe.
6. Disconnect the oil pipes (if fitted).
7. Disconnect the radiator top and bottom hoses.
8. Disconnect the head lights and horn wiring.
9. Disconnect the windscreen washer pipe.
10. Disconnect the air cleaner indicator cables and thread them through the retaining clips, to leave the cables on top of the engine.

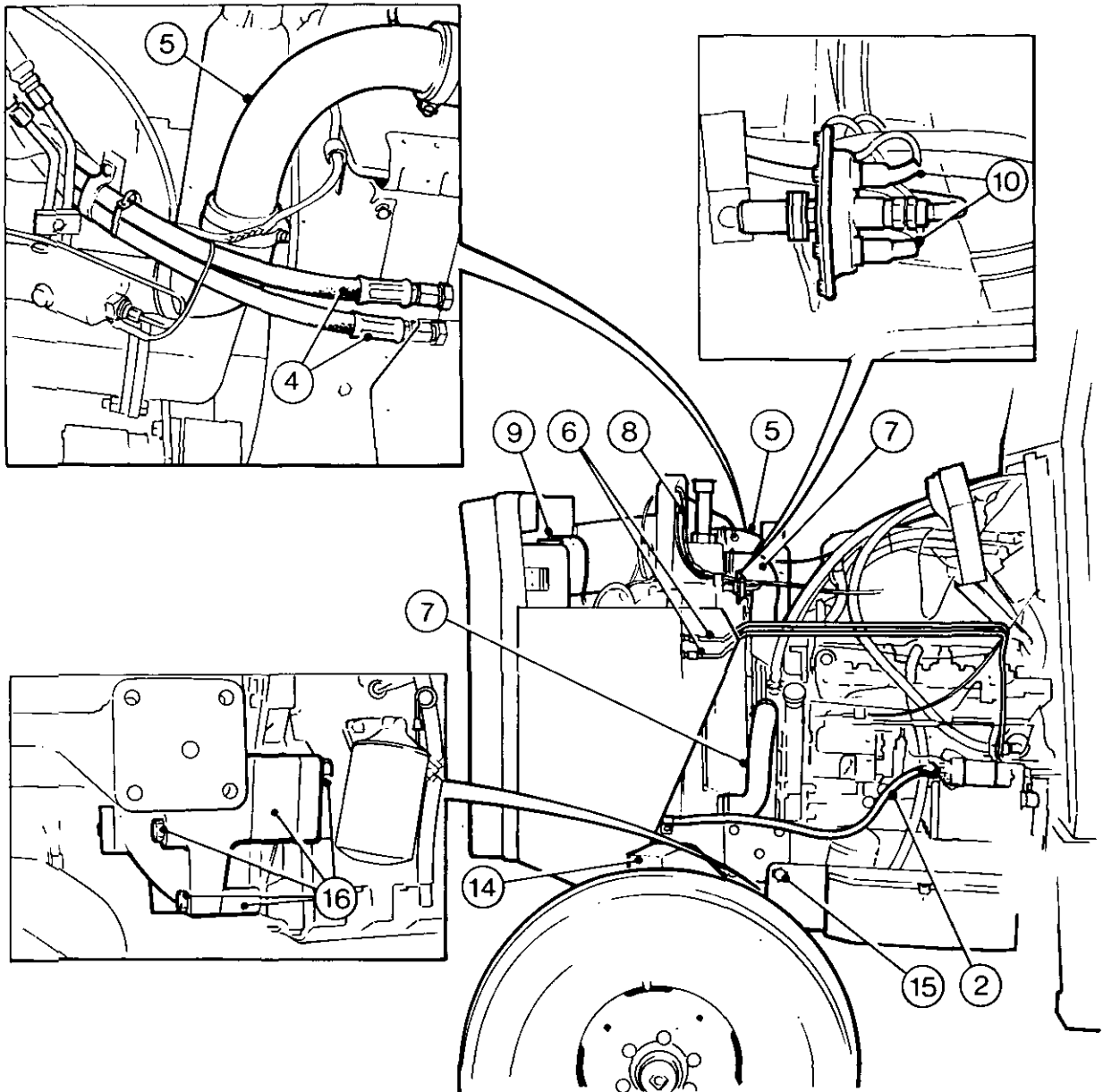
11. Apply the tractor hand brake.
12. Support the nose assembly using a jib crane and chain.
13. Support the tractor under the sump using a suitable jack stand.
14. Fit hard wood wedges in between the front axle casting and axle beam on both sides to prevent the beam from pivoting.
15. Remove the bolt.
16. Remove the four bolts, two nuts, washers, shims and spacers (if fitted).
17. Carefully wheel the two front wheels, front axle and jib crane forwards away from the engine.
WARNING: Take care to keep the front axle assembly level once it has been withdrawn from the engine, otherwise it could overbalance and cause injury.

Re-assembly

18. Reverse procedures 1 to 17 except:
Tighten the front axle retaining nuts and bolts to a torque of 270 Nm (200 lbf ft).



SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE ENGINE AND THE TRANSMISSION

Splitting Procedure (MF 550)

3A—03—06

Special Tool: 270 Rail Trolley

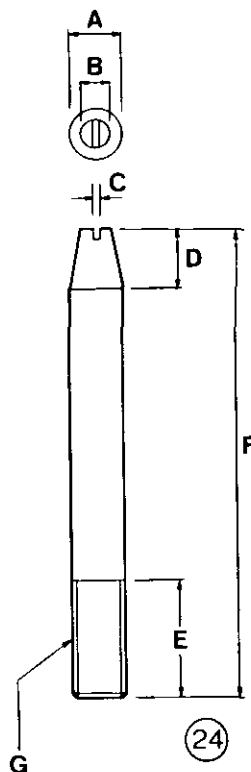
Disassembly

1. Apply the tractor hand brake.
2. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and engine block.
3. Remove the hood, Part 2A.
4. Disconnect the battery.
5. Remove the orbital steering pump, but leave the pipes connected, Part 2A.
6. Disconnect the throttle rod, slacken the two bolts on the right hand bracket, pull the throttle cross rod to the right, until it is dislocated from the left hand bracket.
7. Disconnect the fuel feed and return pipes.
8. Disconnect the oil pipes (if fitted).
9. Disconnect the lower of the two top wire connectors.
10. Disconnect both bottom wire connectors and the screw retained wire.
12. Disconnect the safety start wires.
13. Disconnect the fuel gauge sender wire.
14. Disconnect the heater hoses.
15. Disconnect the tachometer drive cable.
16. Remove the starter motor, Part 9A.
17. Disconnect the windscreen washer feed and return pipes.
18. Disconnect the stop control cable.
19. Remove the tool box and the two bolts.
20. Place hardwood wedges between the front axle support casting and the front axle beam on both sides, to prevent the beam from pivoting.
21. Using 270, support the tractor under the transmission with the fixed stand, and under the engine sump with the rails and trolley.
22. Remove the fourteen bolts and one nut.
23. Withdraw the engine and front axle forwards.

Reassembly

24. Align the engine with the transmission (two guide studs made to the given dimensions and fitted in each side of the transmission flange, will assist in alignment).
25. Turn the flywheel, and at the same time push the engine and front axle towards the transmission. Turning the flywheel aligns the clutch plate splines with the gearbox main and p.t.o. input shaft splines. Continue pushing and turning until the engine and transmission flanges meet.

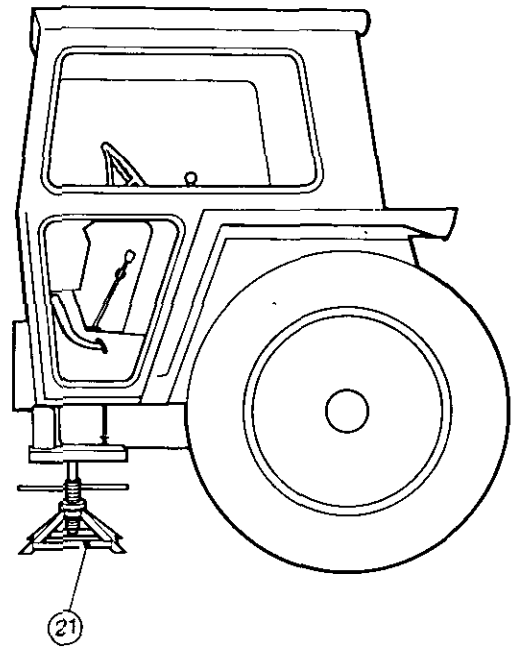
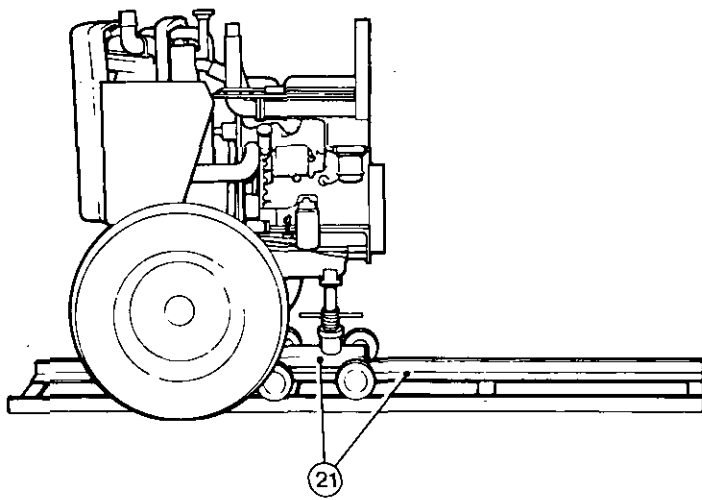
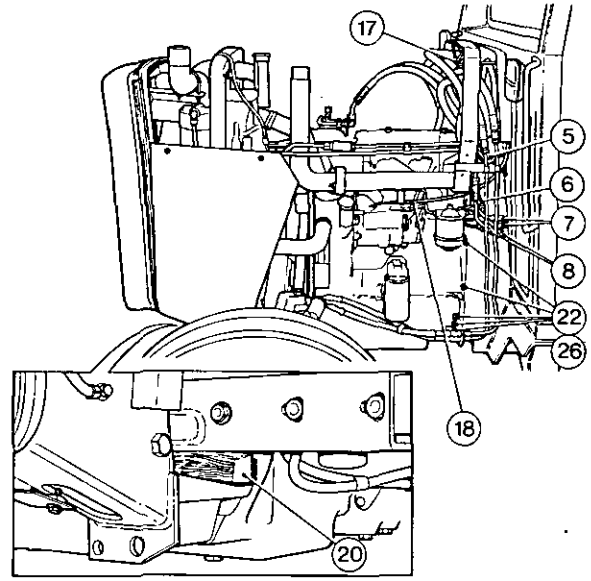
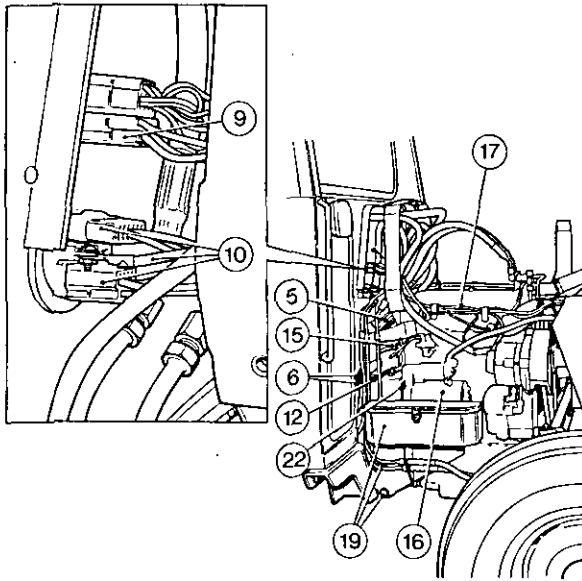
NOTE: Do not fit and tighten any of the bolts until the two flanges meet, or serious damage may occur to the transmission and clutch.
26. Fit some of the bolts, remove the guide studs, fit the remainder of the bolts and nut, and tighten them to a torque of 75 Nm (55 lbf ft).
27. Reverse procedures 2 to 21.
28. Adjust the clutch linkage, Part 5A.



KEY TO Fig. 24

- | | |
|--------------------------------------|--------------------------------|
| A. 11,1 mm ($\frac{7}{8}$ in) | D. 12,7 mm ($\frac{1}{2}$ in) |
| B. 6,4 mm ($\frac{1}{4}$ in) | E. 25 mm (1 in) |
| C. 3,2 mm ($\frac{1}{8}$ in) | F. 100 mm (4 in) |
| G. $\frac{7}{8}$ in—14 UNC—2A THREAD | |

SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE ENGINE AND THE TRANSMISSION

Splitting Procedure

3A—04—08

(MF 565, MF 575 and MF 590)

Special Tool: 270 Rail Trolley

Disassembly

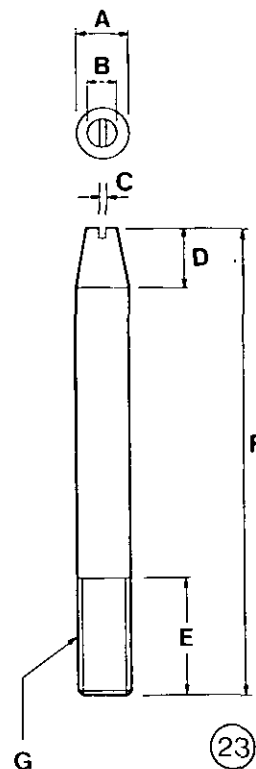
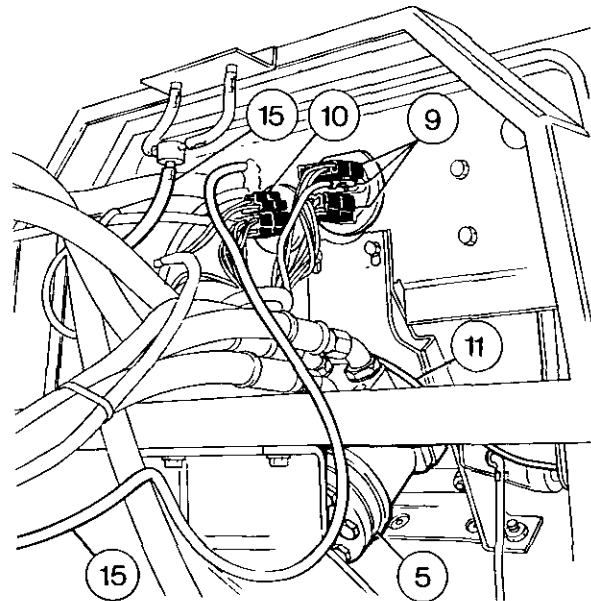
1. Apply the tractor hand brake.
2. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and engine block.
3. Remove the hood. Part 2A.
4. Disconnect the battery.
5. Remove the orbital steering pump, but leave the pipes connected. Part 7B.
6. Release the spring, remove the bolts and bracket.
7. Disconnect the fuel feed and return pipes.
8. Disconnect the oil pipes (if fitted).
9. Disconnect the wire connectors and wire from the left hand connector block.
10. Disconnect the headlight wire connector from the right hand connector block.
11. Disconnect the fuel gauge sender wire.
12. Disconnect the earth wire at the rear of the engine, near the throttle cross rod.
13. Disconnect the safety start wires.
14. Disconnect the heater hoses.
15. Disconnect the windscreen washer feed and return pipes at the front of the cab.
16. Remove the starter motor, Part 9A.
17. Disconnect the tachometer drive cable (and unclip it) from the front of the engine.
18. Disconnect the stop control cable.
19. Place hardwood wedges between the front axle support casting, and the front axle beam on both sides, to prevent the beam from pivoting.
20. Using 270, support the tractor under the transmission with the fixed stand, and under the engine sump with rails and trolley.
21. Remove the fourteen bolts and one nut.
22. Withdraw the engine and front axle forwards.

Reassembly

23. Align the engine with the transmission, (two guide studs made to the given dimensions and fitted in each side of the gearbox flange, will assist in alignment).
24. Remove the plug.
25. Using a suitable lever turn the flywheel, and at the same time push the engine and front axle towards the transmission. Turning the flywheel aligns the clutch plate splines with the gearbox main and p.t.o. input shaft splines. Continue pushing and turning until the engine and transmission flanges meet.

NOTE: Do not fit any of the bolts until the two flanges meet, or serious damage may occur to the transmission and clutch.

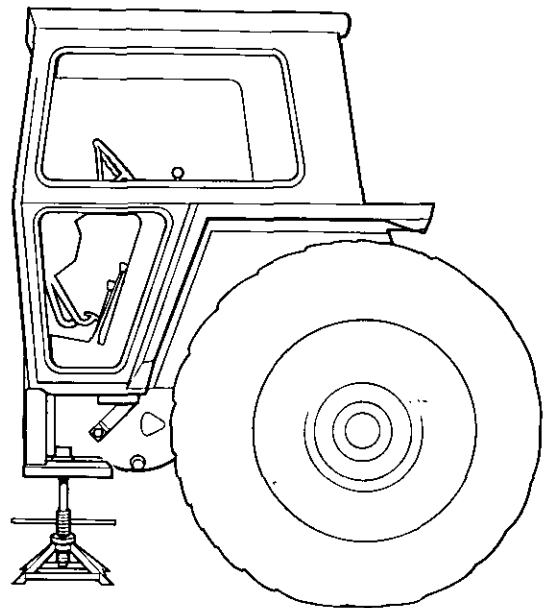
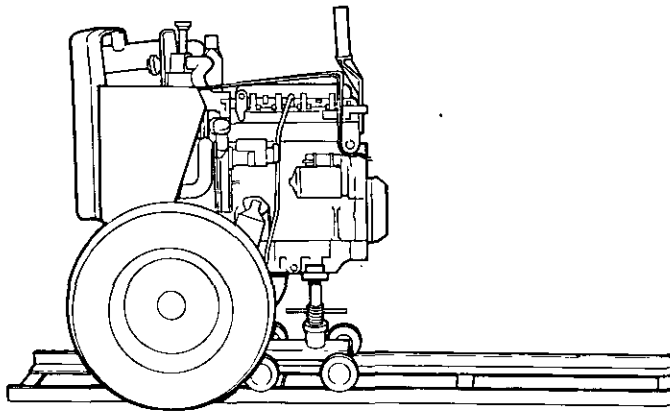
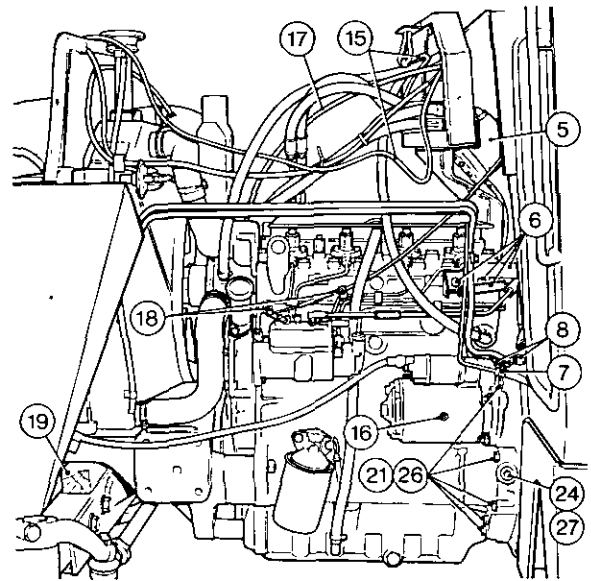
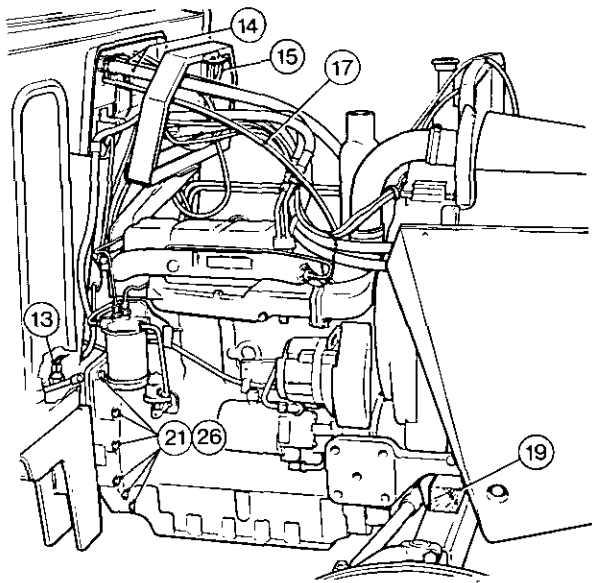
26. Fit some of the bolts, remove the guide studs, fit the remainder of the bolts and nut, and tighten them to a torque of 75Nm (55 lbf ft).
27. Refit the plug.
28. Reverse procedures 2 to 20.
29. Adjust the clutch linkage, Part 5A.



KEY TO Fig. 23

- | | |
|---------------------------------------|--------------------------------|
| A. 11,1 mm ($\frac{7}{16}$ in) | D. 12,7 mm ($\frac{1}{2}$ in) |
| B. 6,4 mm ($\frac{1}{4}$ in) | E. 25 mm (1 in) |
| C. 3,2 mm ($\frac{1}{8}$ in) | F. 100 mm (4 in) |
| G. $\frac{7}{16}$ in—14 UNC—2A THREAD | |

SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE TRANSMISSION AND SPACER HOUSING AND WITHDRAWING THE ENGINE AND TRANSMISSION FORWARDS

Splitting Procedure (MF 550)

3A-05-10

Special Tools: 270 Rail Trolley

MF 365-1 Plates

MF 365-3 Short Support Bars

MF 365-6 Bar Pins

MF 365-7 Tommy Bar

MF 365-8 Stands

Disassembly

1. Split the tractor between the engine and transmission, operation 3A-03-06, procedures 1 to 20.
2. Remove the fuel tank Part 4C.
3. Drain the transmission oil via the drain plugs on the transmission case and centre housing.
4. Disconnect the Multi-Power linkage, (if fitted).
5. Remove the gear levers, Part 5B.
6. Disconnect the cab earth strap.
7. Remove the access panel, Part 2B.
8. Disconnect the oil pipe (if fitted).
9. Slacken the nut and disconnect the rod from the clutch arm.
10. Remove the four locknuts, nuts, washers, spacers, shims, bolts and washers securing the front of the cab to the brackets.
11. Using 365-1, 3, 6, 7 and 8 raise the cab approximately 50 mm (2 in) at the front.
12. Using 270 support under the centre housing with the stand, and under the transmission with the trolley and rails.
13. Remove the 16 bolts and nine nuts securing the gearbox and spacer flanges.
14. Withdraw the front axle, engine and transmission forwards.
15. Discard the gasket.
16. Remove the split pin from the shear tube only if absolutely necessary.

Re-assembly

17. If the split pin has been removed, refit it in the centre of the five pairs of holes in the shear tube.
18. Fit the rear drive shaft into the epicyclic high/low coupler, with the high/low gear lever in low gear, and the main gear lever in the third gear position.
19. Fit the shear tube on to the pinion with the holes around the tube towards the front.
20. Fit two guide studs (made to the dimensions given), in to the top left and right hand sides of the transmission flange, using them to support a new, dry gasket.
21. Using a suitable lever, turn the flywheel.
22. Push the front axle, engine and transmission towards the spacer and centre housing, aligning the guide studs in the transmission with the corresponding holes in the centre housing.

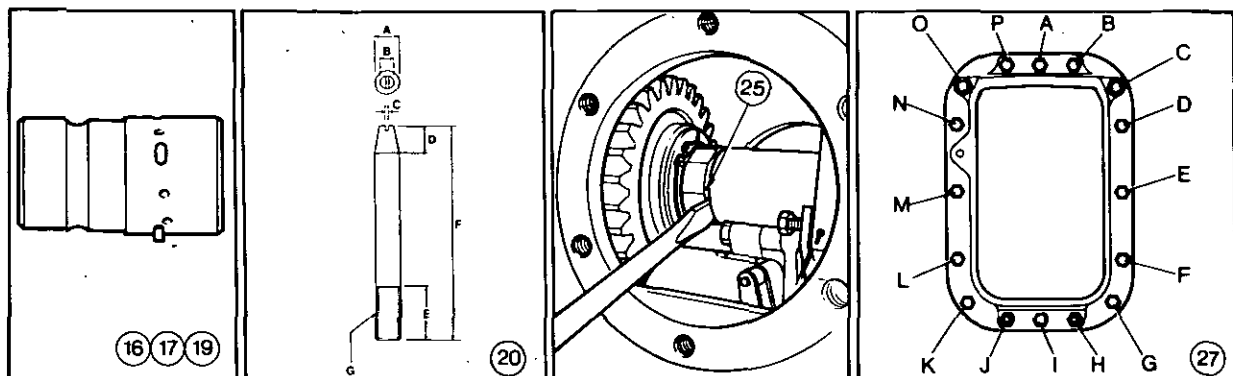
Continue turning and pushing until the two flanges meet.

NOTE: Do not fit and tighten any of the bolts until the two flanges meet, or serious damage may occur to the p.t.o. and main drive components. To facilitate easy re-assembly, the spacer and transmission flanges must be aligned as near as possible.

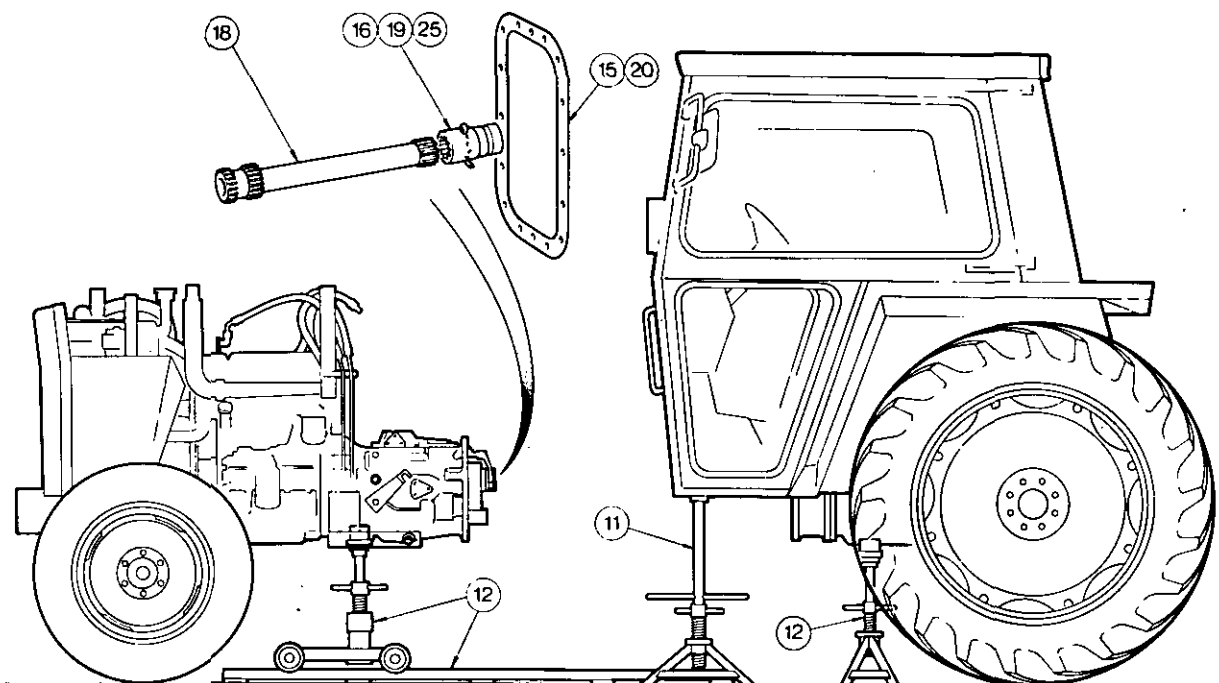
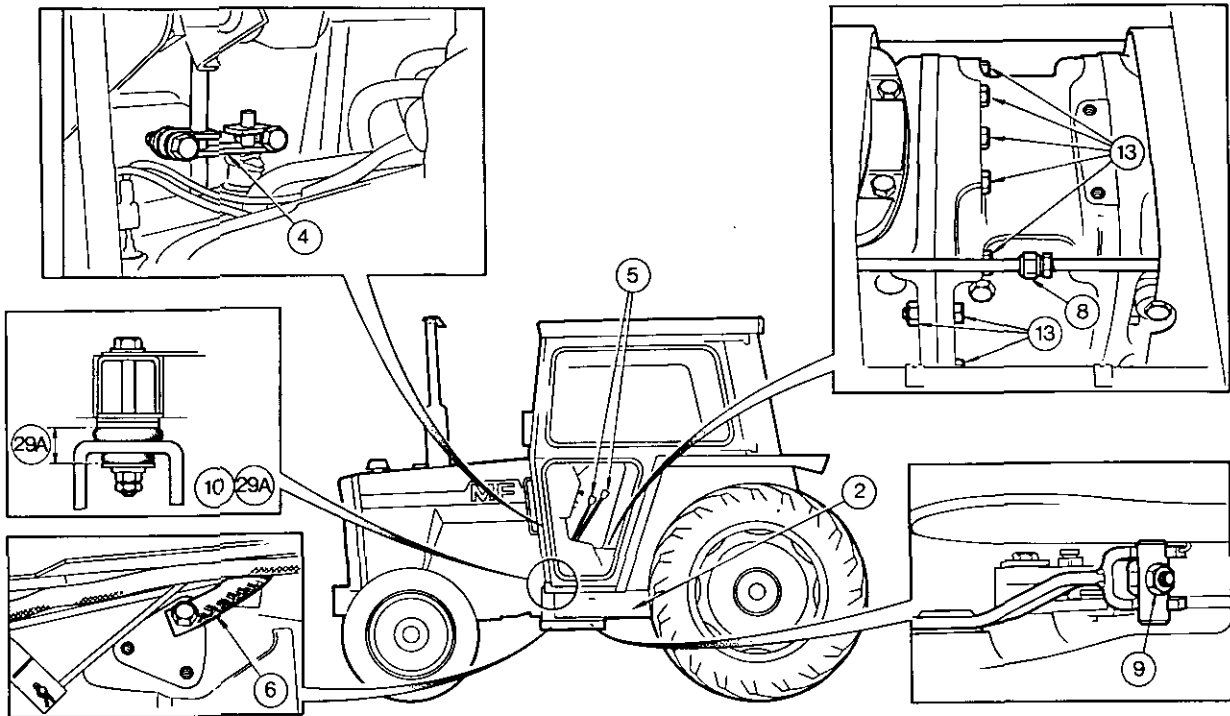
23. Secure the two flanges with a nut and bolt on each side.
24. Remove the Response Control side cover, operation 8A-03, procedures 14 to 20.
25. Push the shear tube forwards (which will push the rear drive shaft against a spring, continue pushing until the spring is fully compressed) and measure the distance between the shear tube and locking collar. This measurement should be 0,4 to 2,5 mm (0-015 to 0-100 in).
26. If the end float is not within the specified limits, separate the spacer and centre housing. Remove the split pin and reposition it nearer the front of the shear tube if the measurement is too large, or nearer the rear of the shear tube if the measurement is too small. Repeat procedures 20 to 23 and 25 until the end float obtained is within the specified limits.
27. Remove the guide studs, fit the gearbox and spacer flange securing nuts and bolts, and tighten them to a torque of 88Nm (65 lbf ft) starting at bolt 'A' and working in a clockwise direction (viewing the tractor from the rear) to bolt 'P', two rotations around the flange are to be completed, and finish by tightening bolts 'A' and 'B' a third time.
28. Refit the Response Control side cover, operation 8A-10, procedures 1 to 9 of 'Response Control'.
29. Reverse procedures 1 to 12, except:
 - (a) Tighten the four cab front mounting primary nuts and bolts until the distance between the top and bottom of the rubber mounting is 25,4 mm (1 in).
Apply a few drops of recommended sealant 'C' to the bolt threads protruding from the primary nuts. With a spanner securely retaining the primary nuts, fit and tighten the locknuts to a torque of 68 Nm (50 lbf ft).
 - (b) Adjust the clutch linkage, Part 5A.
 - (c) Fill the transmission with an approved oil to the required level.

KEY TO Fig. 20

- | | |
|---------------------------------------|--------------------------------|
| A. 11,1 mm ($\frac{7}{16}$ in) | D. 12,7 mm ($\frac{1}{2}$ in) |
| B. 6,4 mm ($\frac{1}{4}$ in) | E. 25 mm (1 in) |
| C. 3,2 mm ($\frac{1}{8}$ in) | F. 100 mm (4 in) |
| G. $\frac{7}{16}$ in-14 UNC-2A THREAD | |



SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE SPACER HOUSING AND THE CENTRE HOUSING AND WITHDRAWING THE ENGINE AND TRANSMISSION FORWARDS

Splitting Procedure

3A—06—12

(MF 565, MF 575 and MF 590)

Special Tools: 270 Rail Trolley

MF 365-1 Plates

MF 365-4 Long Support Bars

MF 365-6 Bar Pins

MF 367-7 Tommy Bar

MF 365-8 Stands

Disassembly

1. Split the tractor between the engine and transmission, operation 3A—04—08, procedures 1 to 15 and 17 to 19.
2. Remove the fuel tank, Part 4C.
3. Drain the transmission oil via the drain plugs on the transmission case and centre housing.
4. Remove the Multi-Power rod (if fitted).
5. Remove the gear levers, Part 5B.
6. On MF 565 tractors, remove the access panel, Part 2B.
7. Slacken the turnbuckle, and disconnect the rod from the clutch arm.
8. Disconnect the oil pipe (if fitted).
9. Remove the three cab rear lower panels, Part 2A.
10. Remove the four locknuts, nuts, washers, spacers, shims, bolts and washers securing the front of the cab to the brackets.
11. Using MF 365-1, 4, 6, 7 and 8, raise the cab approximately 50 mm (2 in) at the front.
12. Using 270, support under the centre housing with the stand, and under the spacer with the trolley and rails.
13. Disconnect the cab earth strap.
14. Remove the 16 bolts and nine nuts securing the spacer and centre housing flanges.
15. Withdraw the front axle, engine, transmission and spacer forwards.
16. Discard the gasket.
17. Remove the split pin from the shear tube only if absolutely necessary.

Re-assembly

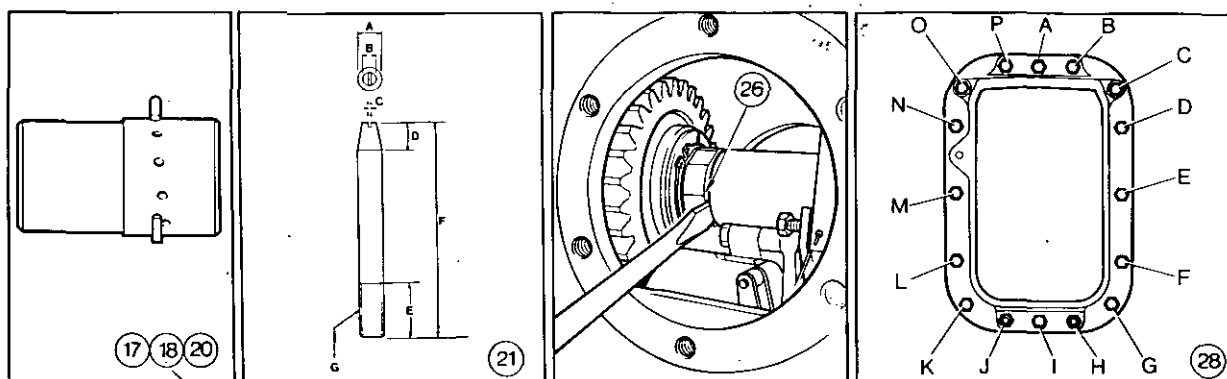
18. If the split pin has been removed, refit it in the centre of the five pairs of holes in the shear tube.
19. Fit the rear drive shaft into the epicyclic high/low coupler, with the high/low gear lever in low gear, and the main gear lever in the third gear position.
20. Fit the shear tube on to the pinion with the holes around the tube towards the front.
21. Fit two guide studs (made to the dimensions given), in to the top left and right hand sides of the spacer rear flange, using them to support a new, dry gasket.
22. Remove the plug and, using a suitable lever, turn the flywheel.

23. Push the front axle, engine, transmission and spacer towards the centre housing, aligning the guide studs in the spacer with the corresponding holes in the centre housing. Continue turning and pushing until the two flanges meet.

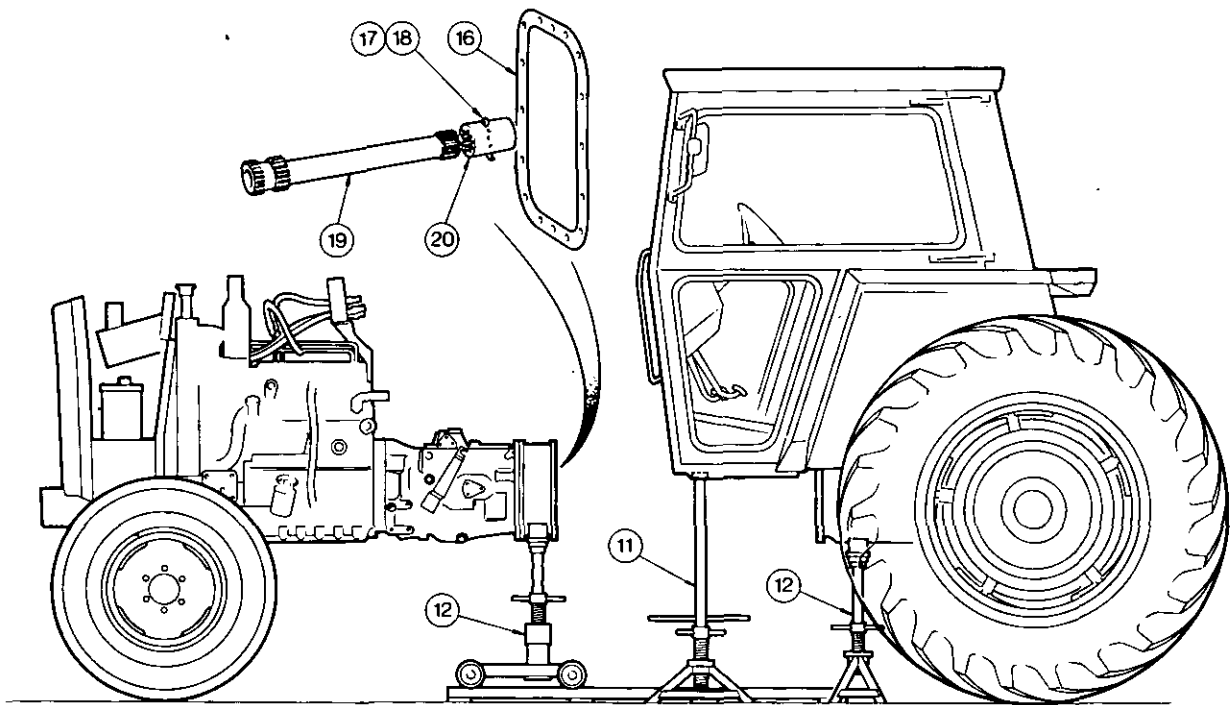
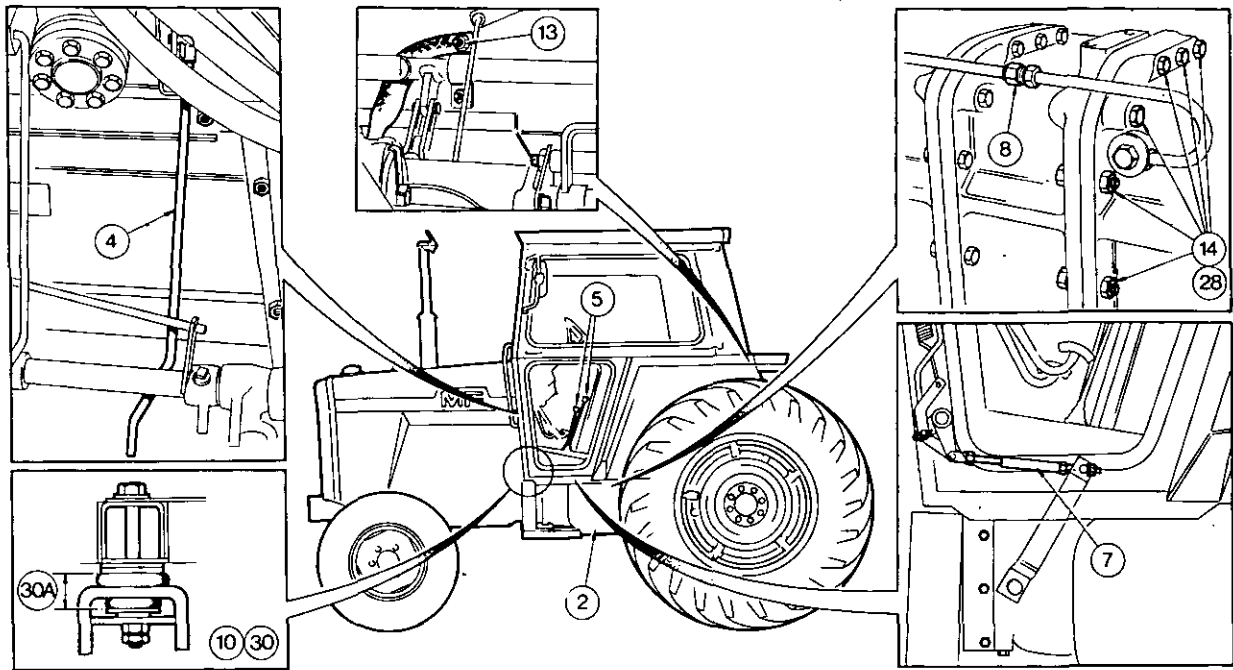
NOTE: Do not fit and tighten any of the bolts until the two flanges meet, or serious damage may occur to the p.t.o. and main drive components. To facilitate easy re-assembly, the spacer and centre housing flanges must be aligned as near as possible.
24. Secure the two flanges with a nut and bolt on each side.
25. Remove the Response Control side cover, operation 8A—03, procedures 14 to 20.
26. Push the shear tube forwards (which will push the rear drive shaft against a spring, continue pushing until the spring is fully compressed) and measure the distance between the shear tube and locking collar. This measurement should be 0,4 to 2,5 mm (0.015 to 0.0100 in).
27. If the end float is not within the specified limits, separate the spacer and centre housing. Remove the split pin and reposition it nearer the front of the shear tube if the measurement is too large, or nearer the rear of the shear tube if the measurement is too small. Repeat procedures 21 to 24 and 26, until the end float obtained is within the specified limits.
28. Remove the guide studs, fit the nuts and bolts, and tighten them to a torque of 88 Nm (65 lbf ft) starting at bolt 'A' and working in a clockwise direction (viewing the tractor from the rear) to bolt 'P', two rotations around the flange are to be completed, and finish by tightening bolts 'A' and 'B' a third time.
29. Refit the Response Control side cover, operation 8A—10, procedures 1 to 9 of 'Response Control'.
30. Reverse procedures 1 to 13, except:
 - (a) Tighten the four cab front mounting primary nuts and bolts until the distance between the top and bottom of the rubber mountings is 25,4 mm (1 in), apply a few drops of recommended sealant 'C' to the bolt threads protruding from the primary nuts. With a spanner securely retaining the primary nuts, fit and tighten the locknuts to a torque of 68 Nm (50 lbf ft).
 - (b) Adjust the linkage, Part 5A.
 - (c) Check the Multi-Power for correct operation.
 - (d) Fill the transmission with an approved oil to the required level.

KEY TO Fig. 21

- | | |
|---------------------------------------|--------------------------------|
| A. 11,1 mm ($\frac{7}{16}$ in) | D. 12,7 mm ($\frac{1}{2}$ in) |
| B. 6,4 mm ($\frac{1}{4}$ in) | E. 25 mm (1 in) |
| C. 3,2 mm ($\frac{1}{8}$ in) | F. 100 mm (4 in) |
| G. $\frac{7}{16}$ in—14 UNC—2A THREAD | |



SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE TRANSMISSION AND SPACER HOUSING AND WITHDRAWING THE CENTRE HOUSING AND REAR AXLE REARWARDS

Splitting Procedure (MF 550) 3A-07-14

Special Tools: See Operation 3A-05-10

Disassembly

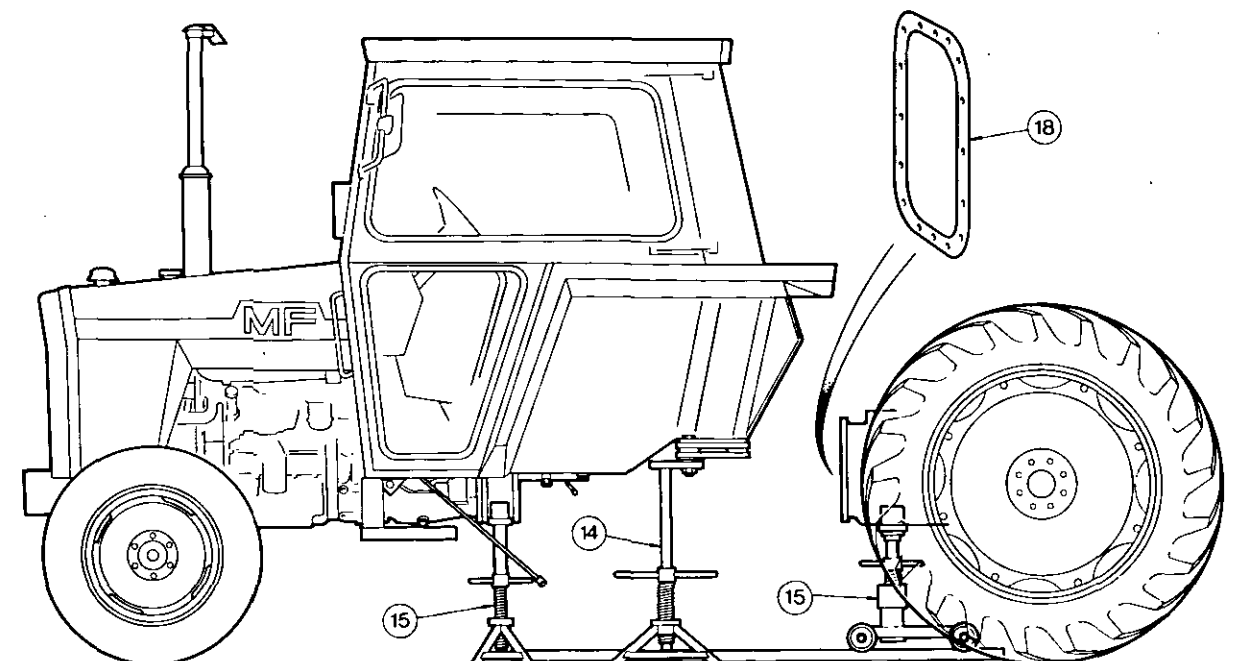
NOTE: Ensure that there is a minimum distance of 1143 mm (45 in) between the inside edges of the rear wheels.

1. Remove the hood, Part 2A.
2. Remove the three cab rear lower panels Part 2A.
3. Remove the fuel tank, Part 4C.
4. Drain the transmission oil via the drain plugs on the transmission case and centre housing.
5. Disconnect the response control rod.
6. Disconnect the differential lock rod.
7. Disconnect the footbrake and handbrake rods.
8. Disconnect the auxiliary feed and return hoses (if fitted).
9. Disconnect the p.t.o. rod.
10. Remove the access panel, Part 2B.
11. Disconnect the oil pipe, (if fitted).
12. Disconnect the hydraulic quadrant rods.
13. Remove the nuts and bolts securing the cab mounting plates to the trumpet housings.
14. Using MF 365-1, 3, 6, 7 and 8 raise the cab approximately 150 mm (6 in) at the rear.
15. Using 270, support under the transmission with the stand, and under the centre housing with the trolley and rails.
16. Remove the 16 bolts and 9 nuts securing the gearbox and spacer flange.
17. Withdraw the rear axle, centre housing and spacer housing rearwards.
18. Discard the gasket.
19. Remove the split pin from the shear tube only if absolutely necessary.

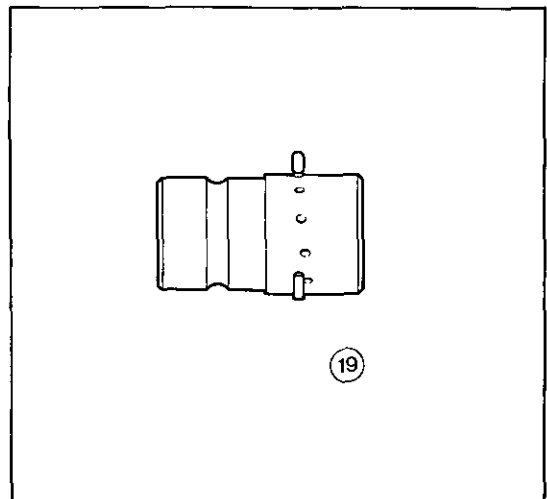
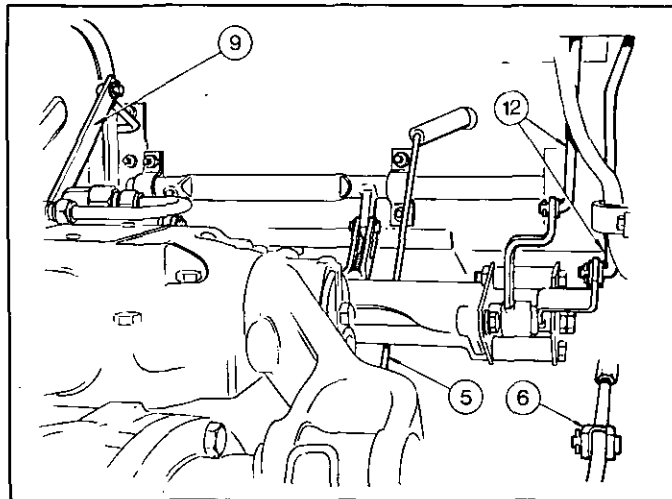
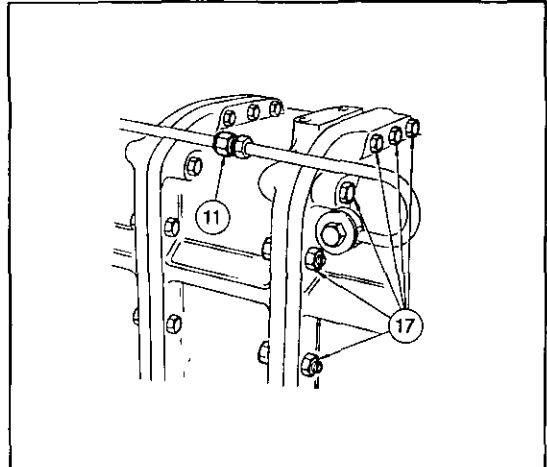
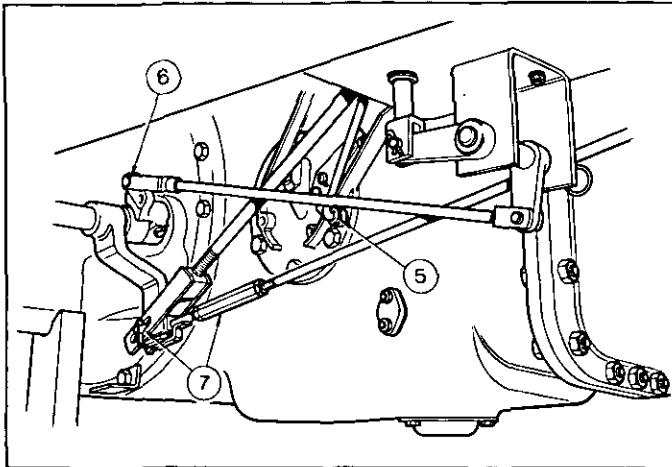
Reassembly

20. Carry out operation 3A-05-10, procedures 17 to 21.
21. Push the rear axle, centre housing and spacer housing towards the transmission aligning the guide studs in the transmission with the corresponding holes in the centre housing. Continue turning and pushing until the two flanges meet.

NOTE: Do not fit and tighten any of the bolts until the two flanges meet, or serious damage may occur to the p.t.o. and main drive components
To facilitate easy re-assembly, the spacer and transmission flanges must be aligned as near as possible.
22. Carry out operation 3A-05-10, procedures 23 to 28.
23. Reverse procedures 1 to 15, except:
 - (a) Apply a few drops of recommended sealant 'C' to the threads of the cab mounting bracket bolts, and tighten them to a torque of 230Nm (170 lbf ft).
 - (b) Tighten the rear mounting primary nuts and bolts (forward pair only) until the distance between the top and bottom of the rubber mounting is 45 mm (1.75 in), then apply a few drops of recommended sealant 'C' to the bolt threads protruding from the primary nuts. Fit and tighten the locknut to a torque of 68 Nm (50 lbf ft).
 - (c) Adjust the brake linkage, Part 6A.
 - (b) Fill the transmission with an approved oil to the required level.



SPLITTING THE TRACTOR



SPLITTING THE TRACTOR

SPLITTING THE TRACTOR BETWEEN THE SPACER HOUSING AND THE CENTRE HOUSING AND WITHDRAWING THE CENTRE REAR AXLE REARWARDS

Splitting Procedure
(MF 565, MF 575 and MF 560)

3A-08-16

Special Tools: See Operation 3A-06-12.

Disassembly

NOTE: Ensure that there is a minimum distance of 1143 mm (45 in) between the inside edges of the rear wheels.

1. Remove the hood, Part 2A.
2. Remove the three cab rear lower panels, Part 2A.
3. Remove the fuel tank, Part 4C.
4. Drain the transmission oil via the drain plugs on the transmission case and centre housing.
5. Disconnect the response control rod.
6. Disconnect the differential lock rod.
7. Remove the handbrake rods, allowing the foot brake rods to drop down at the rear.
8. Disconnect the cab earth strap.
9. Disconnect the auxiliary feed and return hoses (if fitted).
10. Disconnect the p.t.o. rod.
11. On MF 565 tractors, remove the access panel Part 2B.
12. Disconnect the oil pipe (if fitted).
13. Disconnect the hydraulic quadrant rods.
14. Remove the four rear mounting bolts and stabiliser chain brackets securing the cab risers to the trumpet housing.
15. Using MF 365-1, 4, 6, 7 and 8, raise the cab approximately 50 mm (2 in) at the rear.
16. Using 270, support under the spacer with the stand and under the centre housing with the trolley and rails.
17. Remove the 16 bolts and 9 nuts securing the spacer and centre housing flanges.

18. Withdraw the rear axle and centre housing rearwards.
19. Discard the gasket.
20. Remove the split pin from the shear tube only if absolutely necessary.

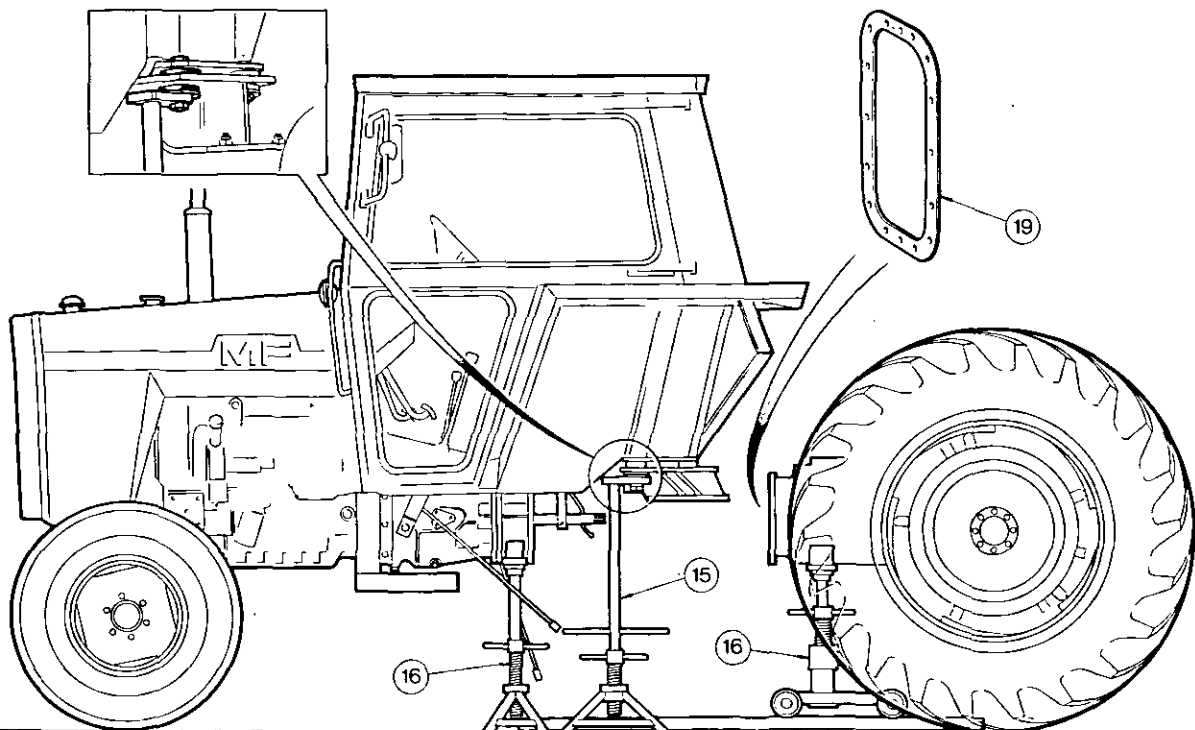
Re-assembly

21. Carry out operation 3A-06-12, procedures 18 to 22.
22. Push the rear axle and centre housing towards the spacer, aligning the guide studs in the spacer with the corresponding holes in the centre housing. Continue turning and pushing until the two flanges meet.

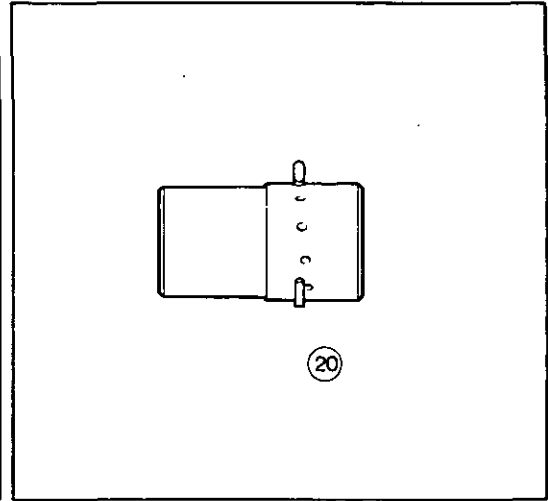
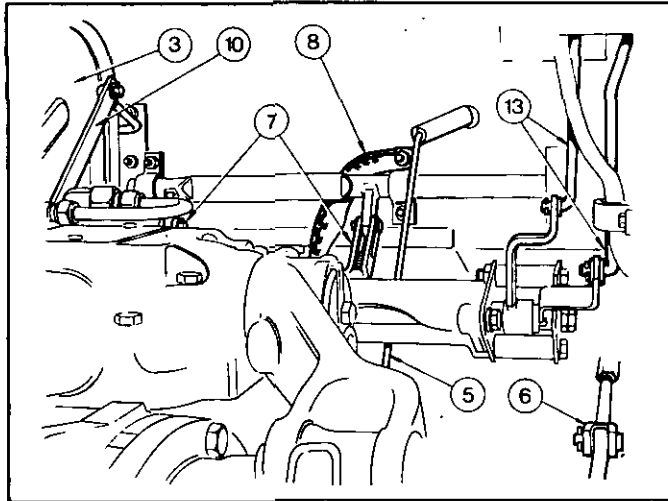
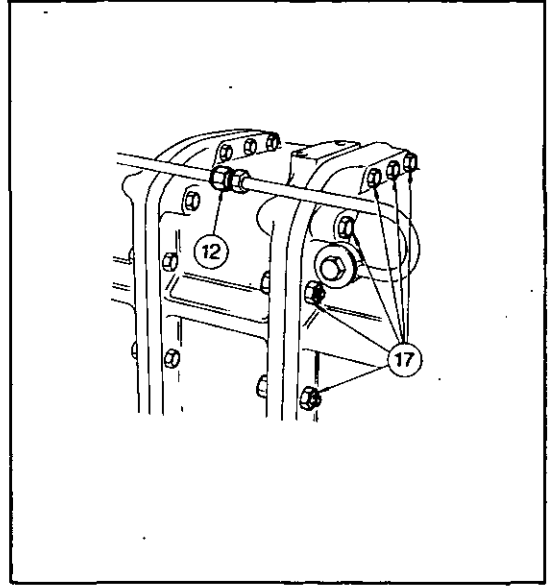
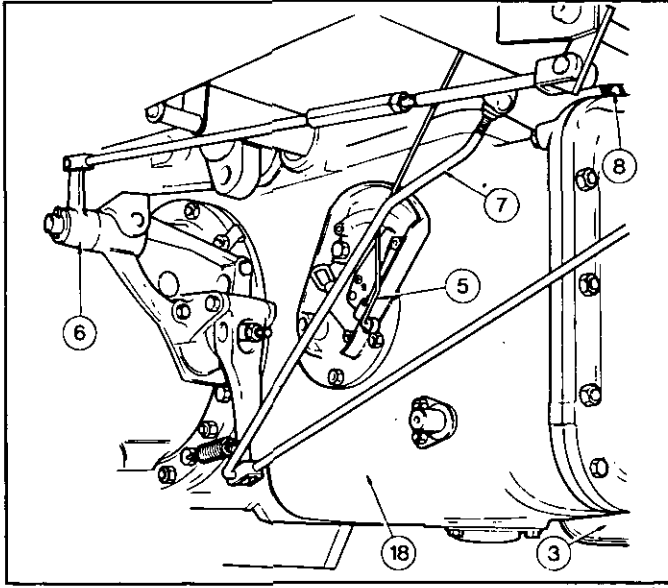
NOTE: Do not fit and tighten any of the bolts until the two flanges meet, or serious damage may occur to the p.t.o. and main drive components.

To facilitate easy re-assembly, the spacer and centre housing flanges must be aligned as near as possible.

23. Carry out operation 3A-06-12, procedures 24 to 29.
24. Reverse procedures 1 to 16, except:
 - (a) Apply a few drops of recommended sealant 'C' to the threads of the cab riser/stabiliser mounting bracket bolts, and tighten them to a torque of 230 Nm (170 lbf ft).
 - (b) Tighten the rear mounting primary nuts and bolts (forward pair only) until the distance between the top and bottom of the rubber mounting is 45 mm (1.75 in), then apply a few drops of recommended sealant 'C' to the bolt threads protruding from the primary nuts. Fit and tighten the locknut to a torque of 68 Nm (50 lbf ft).
 - (c) Adjust the brake linkage, Part 6A.
 - (d) Fill the transmission with an approved oil to the required level.



SPLITTING THE TRACTOR



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 4

Publication No. 1856 072 M1

comprising

- A ENGINE
- B COOLING SYSTEM
- C FUEL SYSTEM AND AIR CLEANER

AD3. 152 ENGINE

Part 4—Section A

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ENGINE

GENERAL

The Perkins AD3. 152 engine is a three cylinder, water cooled, direct injection diesel unit. It has a nominal bore diameter of 91,44 mm (3.6 in) and a stroke of 127 mm (5 in).

The engine has overhead valves mounted vertically in the cylinder head. A gear driven camshaft located in the right hand side of the cylinder block operates the valves via tappets, and a series of rocker levers located on a shaft mounted on top of the cylinder head.

The cylinder block and crankcase form an integral casting and are fitted with full length replaceable flanged cast iron liners.

The aluminium pistons have a toroidal cavity in the head and are fitted with four piston rings. The pistons are attached to their connecting rods by fully floating gudgeon pins retained by circlips. The big end bearings are replaceable and consist of a thin steel-shell lined with an aluminium-tin alloy.

The engine is lubricated by force feed: The oil is drawn from the sump, via a strainer, by a rotary pump driven by the crankshaft. The oil passes through a filter before being circulated under pressure around the engine.

The crankshaft is mounted in four replaceable aluminium-tin alloy lined bearings held in position by cast iron bearing caps. Thrust is absorbed by four washers located on both sides of the rear main bearing cap and cylinder block housing.

Maximum Engine Power at 2 250 rev/min.

MF 550 — 47 PS (DIN 70020)

— 49 hp (BS. AU 141 Ambient Conditions).

FAULT FINDING CHART

Fault	Possible Cause
Low cranking speed	1, 2, 3, 4.
Will not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33.
Difficult starting	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 29, 31, 32, 33.
Lack of power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 33.
Misfiring	8, 9, 10, 12, 13, 14, 16, 18, 19, 20, 25, 26, 28, 29, 30, 32.
Excessive fuel consumption	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33.
Black Exhaust	11, 13, 14, 16, 18, 19, 20, 22, 24, 25, 27, 28, 29, 31, 32, 33.
Blue/white exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 35, 45, 56.
Low oil pressure	4, 36, 37, 38, 39, 40, 42, 43, 44.
Knocking	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 48.
Erratic running	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 48.
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 49.
High oil pressure	4, 41.
Overheating	11, 13, 14, 16, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57.
Excessive crankcase pressure	25, 31, 33, 34, 45, 55.
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 48.
Starts and stops	10, 11, 12.

Key to Fault Finding Chart

- | | |
|---|--|
| 1. Battery capacity low. | 30. Incorrect high pressure pipes. |
| 2. Bad electrical connection. | 31. Worn cylinder bores. |
| 3. Faulty starter motor. | 32. Pitted valves and seats. |
| 4. Incorrect grade of lubricating oil. | 33. Broken, worn or sticking piston ring/s. |
| 5. Low cranking speed. | 34. Worn valve stems and guides. |
| 6. Fuel tank empty. | 35. Overfull oil bath air cleaner or incorrect grade of oil. |
| 7. Faulty stop control operation. | 36. Worn or damaged bearings. |
| 8. Blocked fuel feed pipe. | 37. Insufficient oil in sump. |
| 9. Faulty fuel lift pump. | 38. Blocked sump strainer. |
| 10. Choked fuel filter. | 39. Oil pump worn. |
| 11. Restriction in air cleaner. | 40. Pressure relief valve sticking open. |
| 12. Air in fuel system. | 41. Pressure relief valve sticking closed. |
| 13. Faulty fuel injection pump. | 42. Broken relief valve spring. |
| 14. Faulty atomisers or incorrect type. | 43. Faulty suction pipe. |
| 15. Incorrect use of cold start equipment. | 44. Choked oil filter. |
| 16. Faulty cold start equipment. | 45. Piston seizure/pick up. |
| 17. Broken fuel injection pump drive. | 46. Incorrect piston height. |
| 18. Incorrect fuel pump timing. | 47. Damaged fan. |
| 19. Incorrect valve timing. | 48. Broken valve spring. |
| 20. Poor compression. | 49. Incorrect aligned flywheel. |
| 21. Blocked fuel tank vent. | 50. Faulty thermostat. |
| 22. Incorrect type or grade of fuel. | 51. Restriction in water jacket. |
| 23. Sticking throttle or restricted movement. | 52. Loose fan belt. |
| 24. Exhaust pipe restriction. | 53. Choked radiator. |
| 25. Cylinder head gasket leaking. | 54. Faulty water pump. |
| 26. Overheating. | 55. Choked breather pipe. |
| 27. Cold running. | 56. Damaged valve stem oil seals. |
| 28. Incorrect tappet adjustment. | 57. Coolant level too low. |
| 29. Sticking valves. | |

ENGINE**ROCKER COVER****Removal and Refitment**

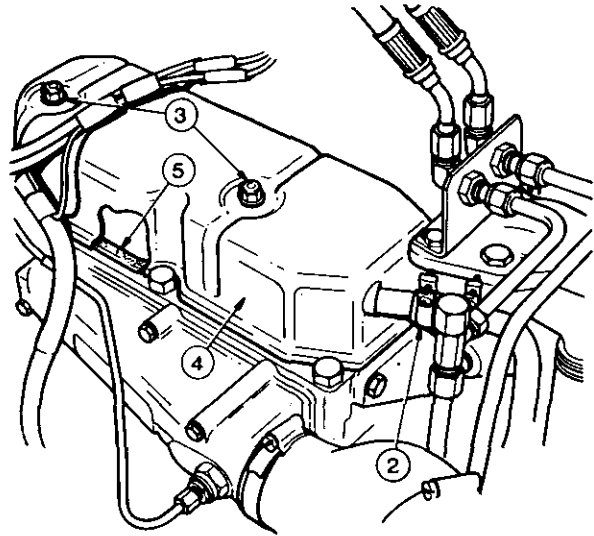
4A-01-04

Removal

1. Remove the hood, Part 2A.
2. Disconnect the breather pipe.
3. Remove the rocker cover securing nuts and washers.
4. Remove the rocker cover.
5. Remove the gasket.

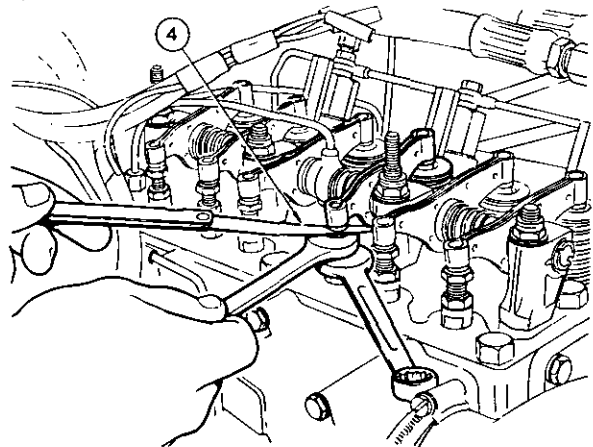
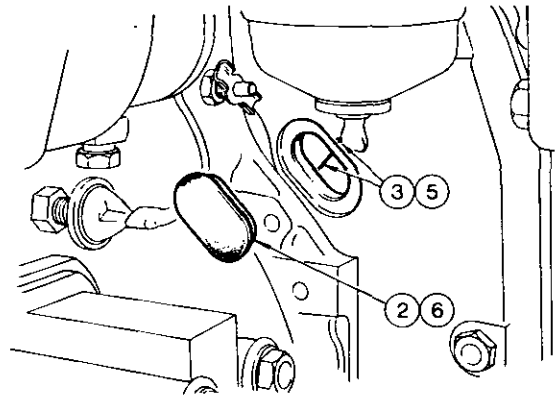
Refitment

6. Reverse procedures 1 to 5, except:
 - (a) Lightly coat the gasket in recommended sealant 'A' before refitting.
 - (b) Do not overtighten the rocker cover securing nuts.

**VALVE TIP CLEARANCE****Adjustment**

4A-02-04

1. Remove the rocker cover, operation 4A-01-04.
2. Remove the rubber plug.
3. Rotate the crankshaft until the T.D.C. line on the flywheel is in line with the punch mark, and No. 1 piston is on the compression stroke (both valves fully closed).
4. Check and adjust the clearances on Nos. 1, 2, 3 and 5 valves. (The valve tip clearance should be adjusted to 0,254 mm (0.010 in) *hot*, and 0,395 mm (0.012 in) *cold*).
5. Turn the crankshaft one revolution clockwise, until the T.D.C. mark is visible through the inspection hole, and adjust the clearances on Nos. 4 and 6 valves.
6. Refit the plug.
7. Refit the rocker cover, operation 4A-01-04.



ROCKER ASSEMBLY**Removal and Refitment**

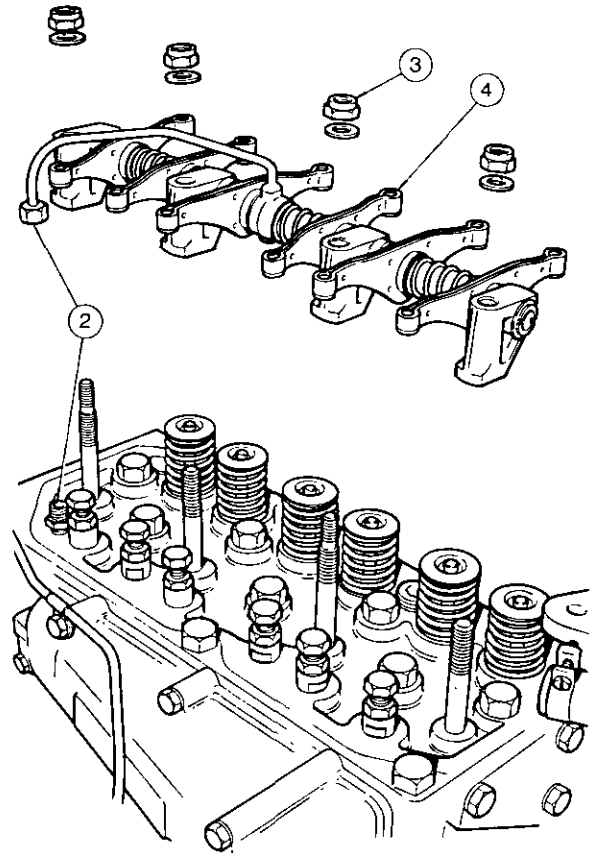
4A-03-05

Removal

1. Remove the rocker cover, operation 4A-01-04.
2. Disconnect the rocker shaft oil feed connection.
3. Remove the retaining nuts and washers.
4. Remove the complete rocker assembly.

Refitment

5. Reverse procedures 2 to 4.
6. Reset the valve tip clearances, operation 4A-02-04 procedures 2 to 7.

**ROCKER ASSEMBLY****Servicing**

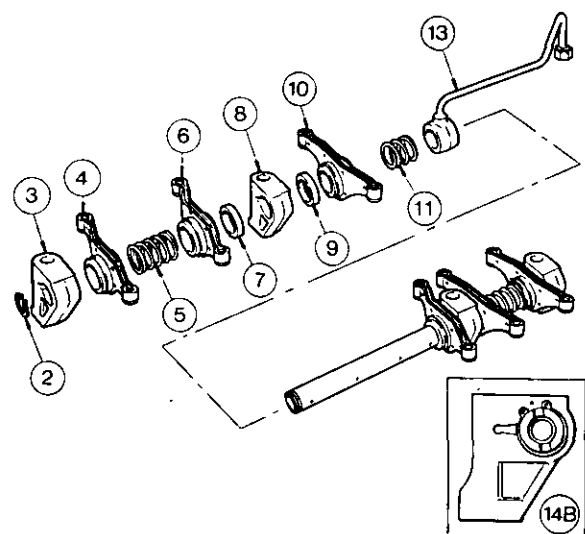
4A-04-05

Disassembly

1. Remove the rocker assembly, operation 4A-03-05.
2. Remove the circlip.
3. Remove the support bracket.
4. Remove the rocker lever.
5. Remove the long spring.
6. Remove the rocker lever.
7. Remove the spacer.
8. Remove the support bracket.
9. Remove the spacer.
10. Remove the rocker lever.
11. Remove the short spring.
12. Repeat procedures 2 to 10 for the rear end of the rocker assembly.
13. Remove the oil feed pipe and union from the rocker shaft.
Examine the rocker shaft and rocker lever bushes for wear and damage. If the rocker lever bushes are worn, the rockers must be replaced.

Reassembly

14. Reverse procedures 1 to 13, except:
 - (a) Ensure that all parts are clean, and are lubricated with clean engine oil before reassembly.
 - (b) The *front* end of the rocker shaft has a slot cut in it, position it as shown in the inset.



ENGINE**INLET MANIFOLD****Removal and Refitment**

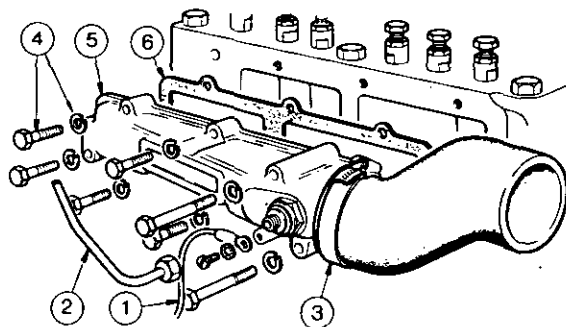
4A-05-06

Removal

1. Disconnect the thermostart cable.
2. Disconnect the thermostart fuel pipe.
3. Slacken the clip.
4. Remove the seven bolts and spring washers.
5. Remove the manifold, at the same time removing it from the rubber air-inlet hose.
6. Remove and discard the gasket.

Refitment

7. Fit a new gasket.
8. Reverse procedures 1 to 5.

**EXHAUST MANIFOLD****Removal and Refitment**

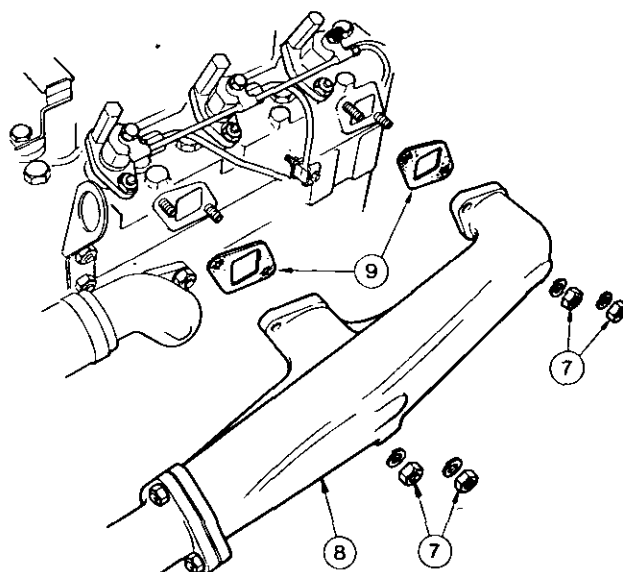
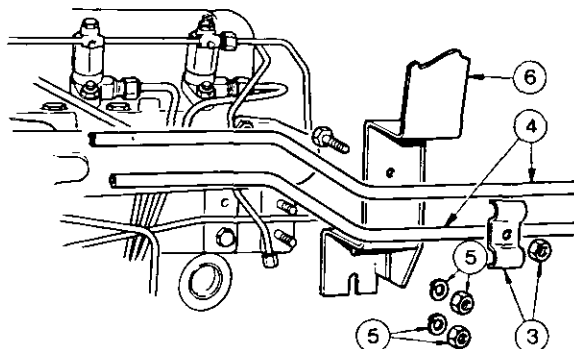
4A-06-06

Removal

1. Remove the hood, Part 2A.
2. Remove the fuel filter and mounting bracket complete, Part 4C.
3. Remove the nut and the pipe clamp.
4. Remove the two oil pipes (if fitted).
5. Remove the two nuts and washers, securing the hood support bracket.
6. Move the hood support bracket clear of the exhaust manifold.
7. Remove the four nuts and washers.
8. Remove the exhaust manifold.
9. Remove and discard the sealing gaskets.

Refitment

10. Fit new gaskets.
11. Reverse procedures 1 to 8.



VALVE SPRINGS**Removal and Refitment
(Cylinder head fitted)**

4A-07-07

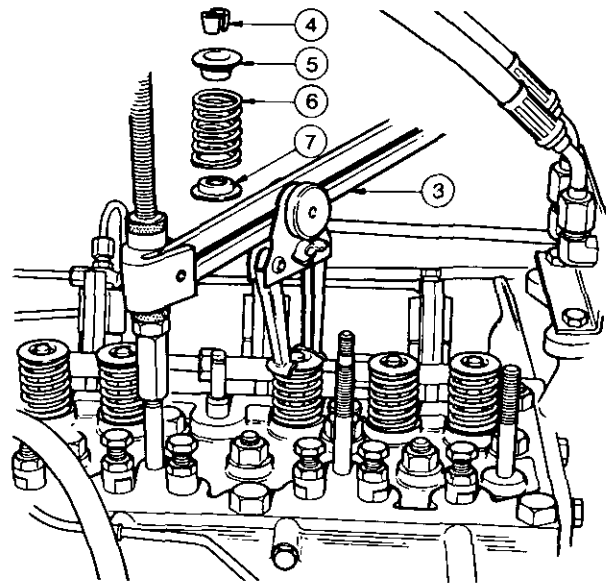
Special Tools: 6118B Valve Spring Compressor
6118-3 Adaptor.

Removal and Refitment

1. Remove the rocker assembly, operation 4A-03-05.
2. Turn the crankshaft to T.D.C. No. 1 Cylinder.
3. Using 6118B and 6118-3, compress Nos.1 and 2 valve springs in turn.
4. Remove the collets.

NOTE: Do not turn the crankshaft again until the valve springs have been re-fitted, and secured with the collets.

5. Remove the spring caps.
6. Remove the springs.
7. Remove the spring seat.
8. Check the free length of the springs. This should be between 19,81 mm and 20,04 mm (1.780 and 1.803 in).
9. Refit the spring seats, and refit or replace the springs as necessary on Nos. 1 and 2 valves.
10. Reverse procedures 4 and 5.
11. Turn the crankshaft to T.D.C. No. 2 cylinder.
12. Repeat procedures 3 to 9 for Nos. 3 and 4 valves.
13. Turn the crankshaft to T.D.C. No. 3 cylinder.
14. Repeat procedures 3 to 9 for Nos. 5 and 6 valves.
15. Refit the rocker assembly, operation 4A-03-05.



ENGINE

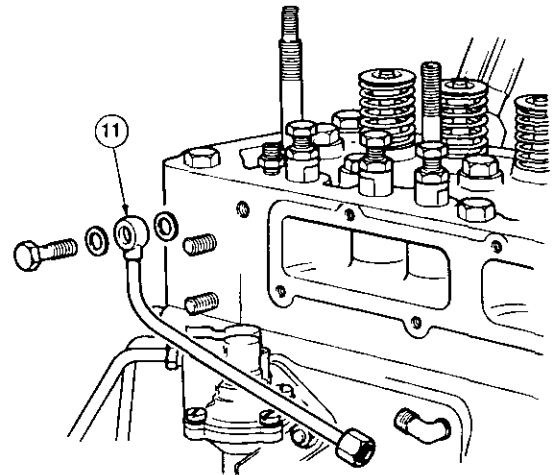
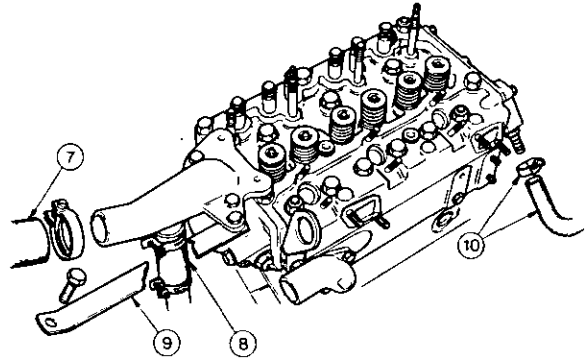
CYLINDER HEAD

Removal and Refitment

4A-08-08

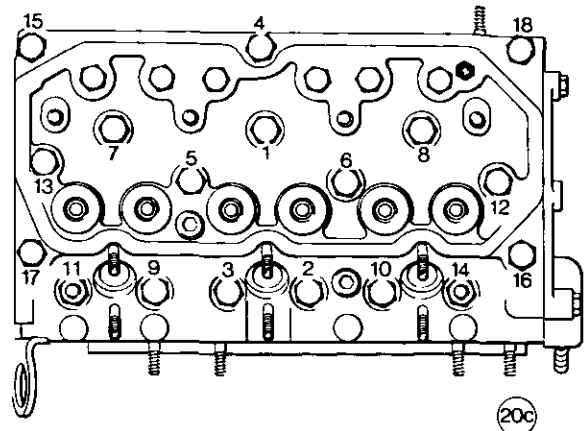
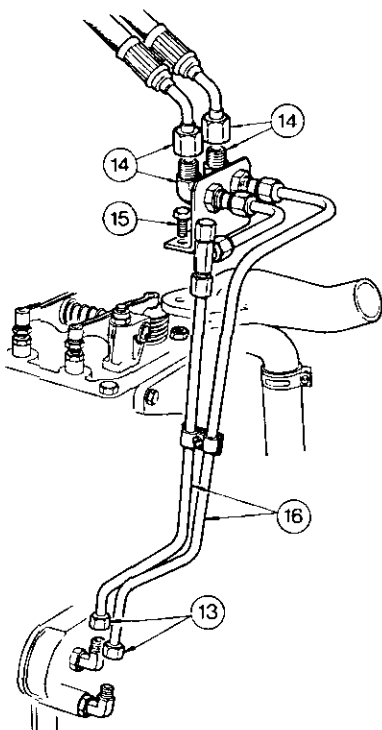
Removal

1. Drain the cooling system.
2. Remove the rocker assembly, operation 4A-03-05.
3. Remove the inlet manifold, operation 4A-05-06.
4. Remove the exhaust manifold, operation 4A-06-06.
5. Remove the high pressure injector pipes, Part 4C.
6. Remove the injectors and sealing washers, Part 4C.
7. Disconnect the radiator top hose.
8. Disconnect the hose connecting the thermostat housing to the water pump.
9. Disconnect the stabilizer arm.
10. Disconnect the heater rear hose.
11. Disconnect the external oil feed pipe.
12. Disconnect the heater front hose.
13. Disconnect the hydraulic pipes at the pump connectors.
14. Disconnect the hydraulic pipes at the support bracket.
15. Remove the two nuts and bolts.
16. Remove the hydraulic pipes complete.
17. Remove the two cylinder head securing nuts and sixteen bolts in reverse order of their tightening sequence.
18. Remove the cylinder head.
19. If necessary, remove the thermostat housing, Part 4B.



Refitment

20. Reverse procedures 1 to 19, except:
 - (a) Fit a new cylinder head gasket with a thin coating of Welseal.
 - (b) Fit a new gasket to the thermostat housing (if removed).
 - (c) Tighten the cylinder head securing bolts and nuts in the correct sequence, in three equal stages to a torque of 100Nm (75 lbf ft).



CYLINDER HEAD**Servicing**

4A-09-09

Special Tools: PD 1C Valve Guide Tool
 PD 1C-4 Adaptor (15 mm)
 PD 41 B Valve Depth Gauge
 PD317-35M Exhaust Valve Seat Cutter
 35°
 PD 317-35M Inlet Valve Seat Cutter
 35°
 316X Valve Seat Cutter Handle
 316-10 Pilot

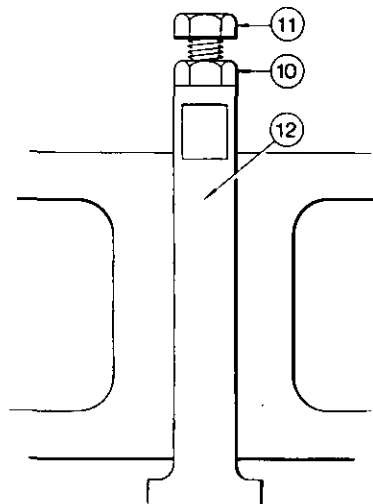
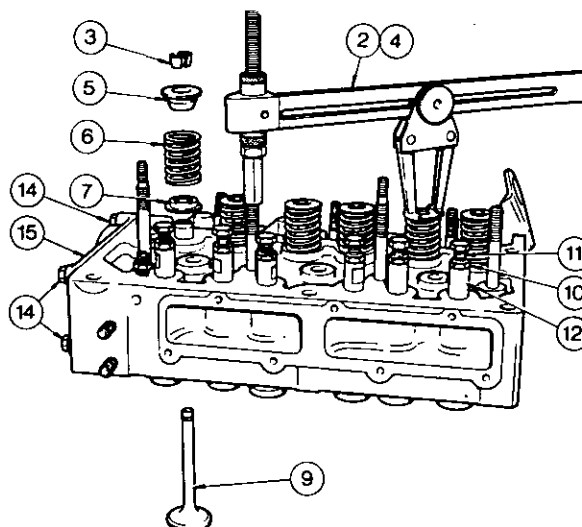
Disassembly and Reassembly

1. Remove the cylinder head, operation 4A-08-08.
2. Using 6118B and PD 6118-3, compress the spring.
3. Remove the collets.
4. Release and remove 6118B and PD 6118-3.
5. Remove the valve spring cap.
6. Remove the spring.
7. Remove the spring seat.
8. Repeat procedures 2 to 7 for the remaining valves.
9. Position the cylinder head on its side and remove the valves.

NOTE: Keep the valves in the order in which they were removed.

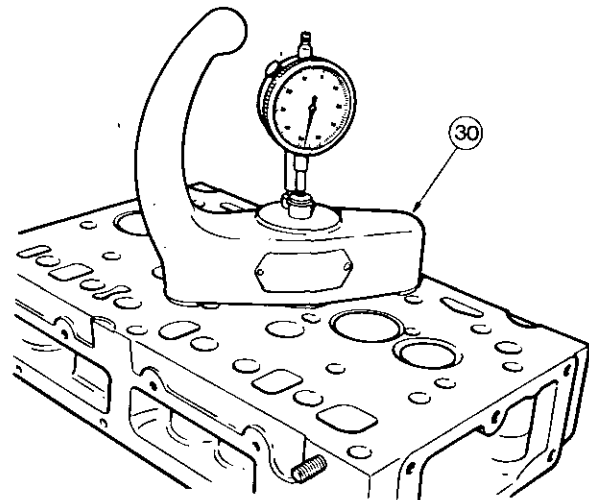
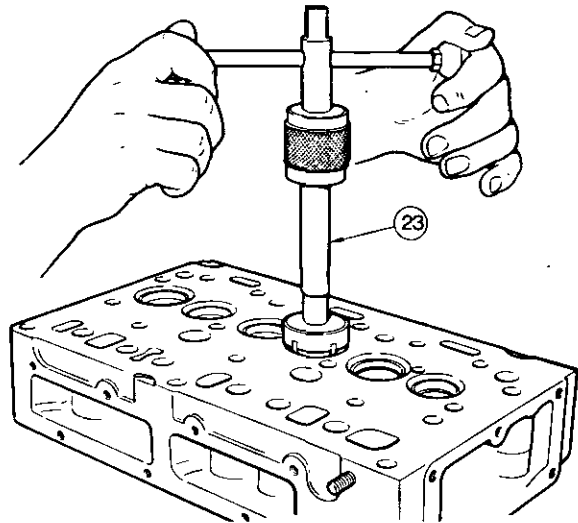
10. Slacken the locknut.
11. Remove the bolt and locknut.
12. Remove the cam follower.
13. Repeat procedures 10 to 12 for the remaining cam followers.
14. Remove the five bolts and one setscrew.
15. Remove the cylinder head rear plate.
16. Remove the cylinder head rear plate gasket.
17. Clean all the cylinder head ports free of any carbon or other deposits.
18. If the water jacket of the cylinder head shows signs of excessive scale, a proprietary brand of de-scaling solution should be used.
19. Check the valve guide bores for wear.
20. If necessary, remove the valve guides using PD. 1C.
21. Using PD1C and PD1C-4, fit the new valve guides. Ensure that the valve guides are fitted the correct way round. Both ends are chamfered, one at 45° and the other at 20° (the 20° end is also recessed). The end with the 20° chamfer should be inserted into the cylinder head top face until the opposite end (45° chamfer) protrudes 14,83 to 15,09 mm (0.584 to 0.594) above the top face.

Continued—



ENGINE

22. Check the valve seats for excessive pitting or wear.
23. If necessary, re-cut the valve seats using the appropriate combination of cutter handle, pilot and valve seat cutter. Remove the minimum amount of metal consistent with giving a good smooth, gas tight seal.
24. Thoroughly clean all the valves and examine them for pitting, wear and burning.
25. If necessary, machine grind the valve jointing flange to an angle of 35° , removing the minimum amount of metal consistent with a good smooth finish.
26. Thoroughly clean the valves.
27. Lubricate the valve stems with clean engine oil.
28. Hand grind the valves and their respective valve seats, until all pitting is removed and a good seat is produced.
29. Wash the cylinder head and valves thoroughly with clean paraffin and dry.
30. Using PD 41B, check the valve head depth relative to the cylinder head face, the depth should be between 1,245 and 1,829 mm (0.049 and 0.072 in) for inlet valves and 1,575 and 2,108 mm (0.062 and 0.083 in) for exhaust valves.
31. If the maximum of these limits are exceeded; the offending valve must be discarded and a new one hand ground in its place, again the valve head depth must be measured, and if it is still not within these limits, a new valve seat insert must be fitted (exhaust valves only) operation 4A-10-11. If the offending valve is an inlet and still not within the maximum limits after fitting a new valve, the cylinder head must be replaced.
32. Check the flatness of the cylinder head face and if necessary, skim the face to a maximum of minus 0,30 mm (0.012 in), providing the injector nozzle protrusion does not exceed 4,67 mm (0.184 in). This figure must not be obtained by fitting additional injector sealing washers.
33. Thoroughly clean the cylinder head.
34. Reverse procedures 1 to 16, except:
 - (a) Refit the valves in their correct positions.
 - (b) Lightly coat the cylinder head rear plate gasket in recommended sealant 'A', and the plate retaining bolt threads in recommended sealant 'B'.



VALVE SEAT INSERTS

Fitting Procedure

4A-10-11

Special Tools: See Operation 4A-09-09.

Valve seat inserts can only be fitted on EXHAUST valve applications, and then only as a last resort to Cylinder Head Servicing, operation 4A-09-09.

The fitting of inserts is a precision operation and therefore should only be undertaken by a skilled machinist.

This operation must never be attempted with a worn valve guide in position.

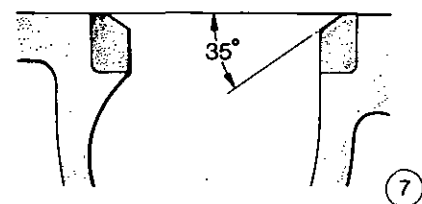
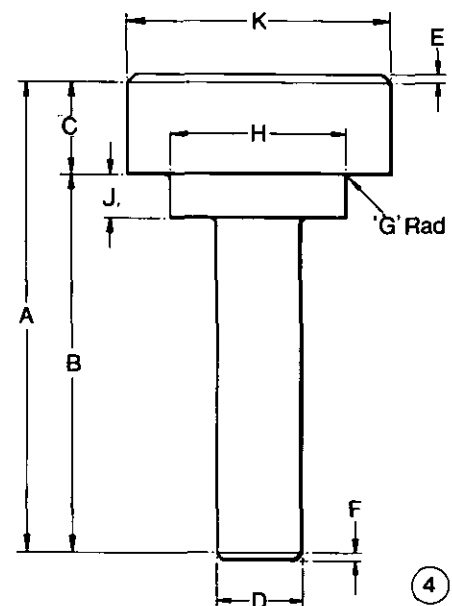
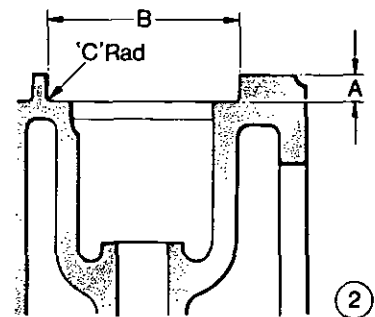
1. Service the cylinder head, operation 4A-09-09.
2. Using the valve guide bore, as a good centre, machine the recess in the cylinder head face, to the dimensions given.

NOTE: Work as closely as possible to the minimum machining dimensions to allow for a possible re-seating at a later date.

3. Remove all machining swarf and clean the insert recess.
4. Using the valve guide bore as a pilot press the insert home using an inserting tool made to the given dimensions.

NOTE: The insert must not be hammered in or lubricated.

5. Check that the insert is pressed fully home and is flush with the bottom of the recess.
6. Remove all machining swarf and burrs, and if necessary, skim the cylinder head face, operation 4A-09-09, procedure 32.
7. Re-cut the valve seat at an included angle of 110° so that after hand grinding, the valve head depth below the cylinder head face is within the production limits 1,575 to 1,829 mm (0.062 to 0.072 in) for exhaust valves.



KEY TO FIGURE 2.

- A. 7,87 to 7,92 mm (0.310 to 0.312 in).
- B. 42,62 to 42,64 mm (1.678 to 1.679 in).
- C. 0,38 mm (0.0015 in) Max. radius.

KEY TO FIGURE 4.

- A. 88,90 mm (3.5 in).
- B. 69,95 mm (2.75 in).
- C. 19,05 mm (0.75 in).
- D. 7,85 to 7,87 mm (0.309 to 0.310 in).
- E. 1,6 mm (0.063 in) at 45° .
- F. 1,6 mm (0.063 in) at 45° .
- G. 0,8 mm (0.031 in).
- H. 30,02 to 30,05 mm (1.182 to 1.183 in).
- J. 5,38 to 5,46 mm (0.212 to 0.215 in).
- K. 40,77 to 41,02 mm (1.605 to 1.615 in).

ENGINE**TIMING CASE COVER****Removal and Refitment**

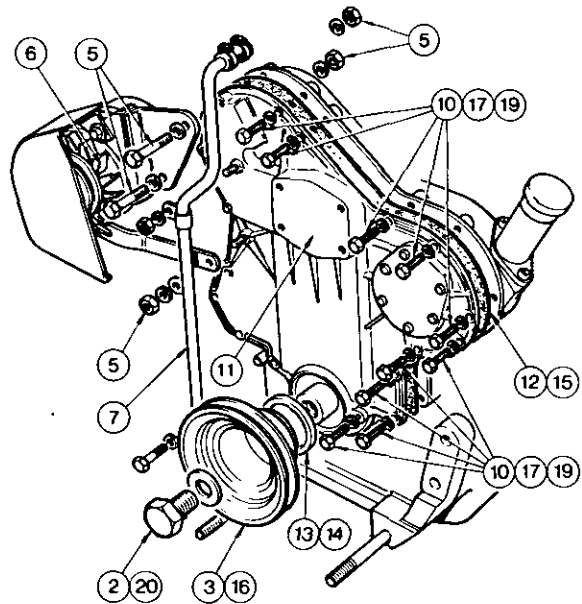
4A-11-12

Removal

1. Split the tractor between the front axle and engine, Part 3A, and remove the water pump, Part 4B.
2. Remove the bolt and washer.
3. Remove the pulley.
4. Disconnect the alternator cables.
5. Remove the two bolts, three nuts and washers.
6. Remove the alternator, complete with support brackets.
7. Remove the breather pipe.
8. Remove the power steering pump, Part 7B.
9. Disconnect the power steering pipe bracket at the thermostat housing.
10. Remove the fourteen bolts securing the timing case cover to the timing case.
11. Remove the timing case cover.
12. Discard the timing case cover gasket.
13. Remove the seal.

Refitment

14. Refit the seal from the front.
15. Reposition the timing case cover on the front of the engine with a new gasket lightly coated in recommended sealant 'A'.
16. Place the crankshaft pulley onto the crankshaft (carefully to avoid damaging the timing case lip seal) to centralize the seal and timing case cover to the crankshaft.
17. Refit and tighten several bolts to retain the timing case cover.
18. Remove the pulley.
19. Refit the remaining timing case cover retaining bolts and washers.
20. Reverse procedures 1 to 9, except tighten the crankshaft pulley securing bolt to a torque of 150 Nm (110 lbf ft).



TIMING GEARS**Idler Gear and Hub Removal and Refitment**

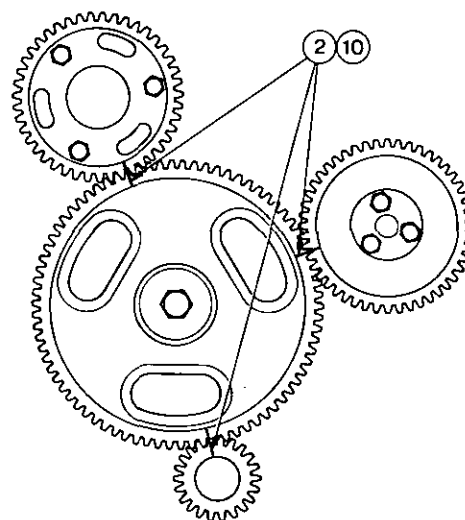
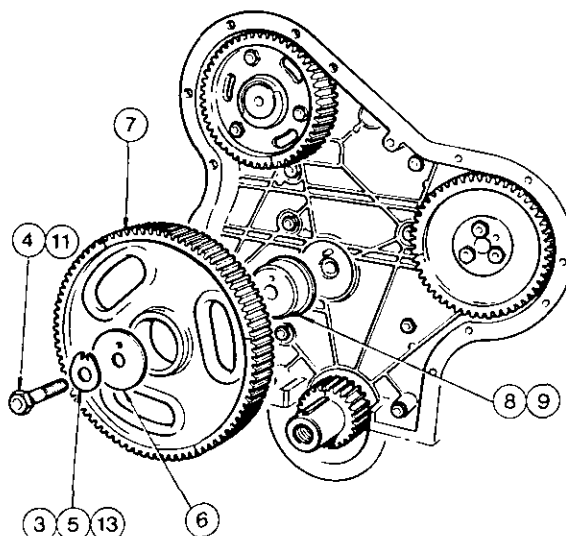
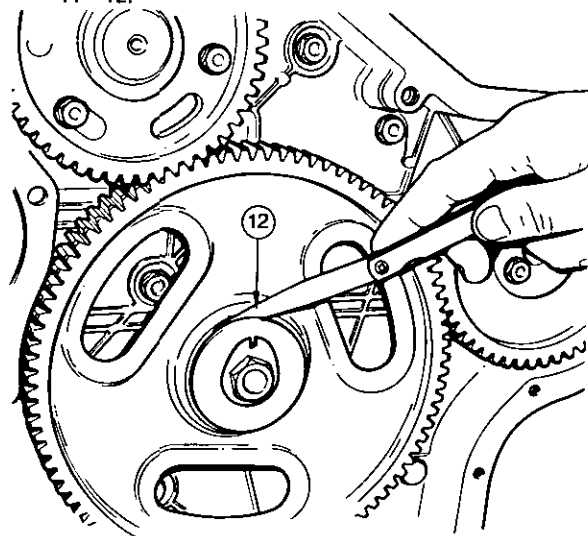
4A-12-13

Removal

1. Remove the timing case cover, operation 4A-11-12.
2. Turn the crankshaft until the marks on the fuel pump, camshaft and crankshaft gears are aligned with their corresponding marks on the idler gear.
3. Bend back the tabwasher.
4. Remove the bolt.
5. Remove the tabwasher.
6. Remove the retaining plate.
7. Remove the gear.
8. If necessary, remove the idler gear hub.

Refitment

9. Refit the idler gear hub ensuring that the dowel is positioned in the locating hole on the hub.
10. Refit the gear ensuring that the timing marks on the fuel pump, camshaft and crankshaft are all aligned with those on the idler gear.
11. Reverse procedures 4 to 6, except tighten the bolt to a torque of 68 Nm (50 lbf ft).
12. Check the idler gear end float, which should be between 0,13 and 0,38 mm (0.005 and 0.015 in).
13. Bend the bottom of the tabwasher over one flat of the bolt.
14. Refit the timing case cover, operation 4A-11-12.

**TIMING GEARS****Camshaft Drive Gear Removal and Refitment**

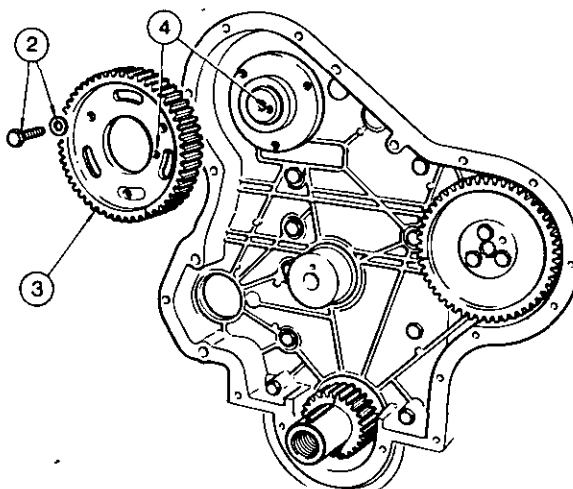
4A-13-13

Removal

1. Remove the idler gear, operation 4A-12-13, procedures 1 to 7.
2. Remove the bolts and washers.
3. Remove the gear.

Refitment

4. Reverse procedures 2 and 3, except: ensure that the letters on the gear and flange are aligned.
5. Refit the idler gear, operation 4A-12-13, procedures 10 to 14.



ENGINE**TIMING GEARS****Fuel Pump Drive Gear Removal and Refitment**

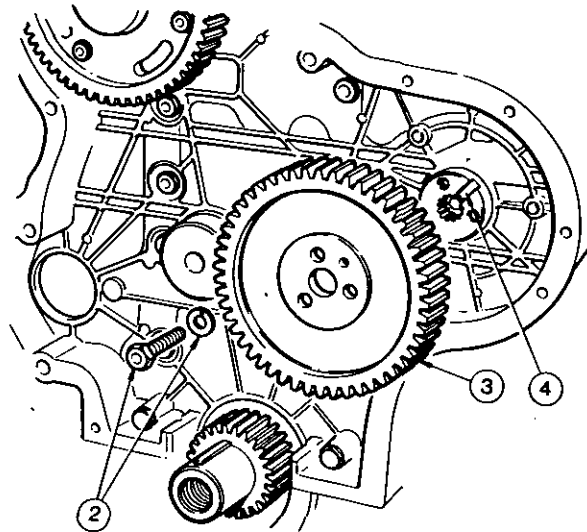
4A-14-14

Removal

1. Remove the idler gear, operation 4A-12-13, procedures 1 to 7.
2. Remove the bolts and washers.
3. Remove the gear.

Refitment

4. Reverse procedures 2 and 3, except:
 - (a) Ensure that the dowel in the gear locates in the slot in the D.P.A. pump flange.
 - (b) Tighten the bolts to a torque 28 Nm (21 lbf ft).
5. Refit the idler gear, operation 4A-12-13, procedures 10 to 14.

**CRANKSHAFT DRIVE GEAR****Removal and Refitment**

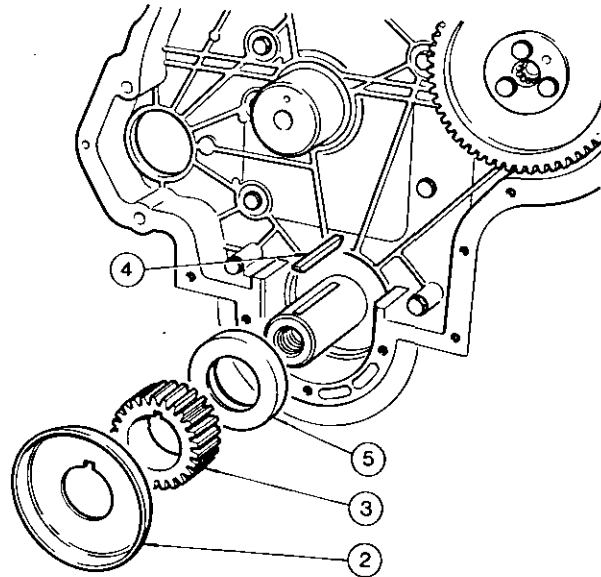
4A-15-14

Removal

1. Remove the idler gear, operation 4A-12-13, procedures 1 to 7.
2. Remove the chip shield.
3. Withdraw the crankshaft drive gear.
4. Tap out the key (if necessary).
5. Withdraw the spacer (if necessary).

Refitment

6. Reverse procedures 2 to 5.
7. Refit the idler gear, operation 4A-12-13, procedures 10 to 14.

**CAMSHAFT****Removal and Refitment**

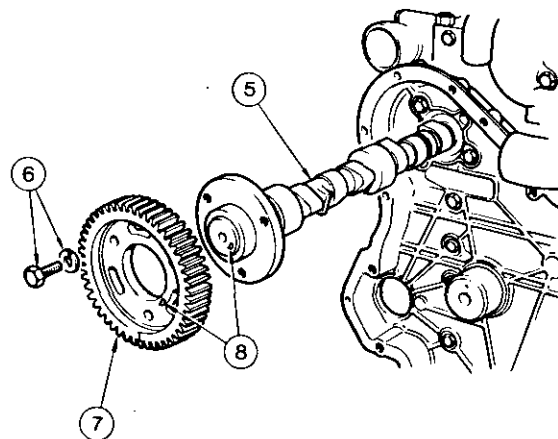
4A-16-14

Removal

1. Remove the rocker assembly, operation 4A-03-05.
2. Remove the idler gear, operation 4A-12-13, procedures 1 to 7.
3. Remove the fuel lift pump, Part 4C.
4. Raise the tappets.
5. Remove the camshaft and drive gear from the front of the engine, taking care that the camshaft lobes do not damage the bearings.
6. Remove the bolts and washers.
7. Remove the gear.

Refitment

8. Reverse procedures 3 to 7, except: ensure that the letter marks on the gear and flange are aligned when refitting.
9. Refit the idler gear, operation 4A-12-13, procedures 10 to 14.
10. Refit the rocker assembly, operation 4A-03-05.



TIMING CASE**Removal and Refitment**

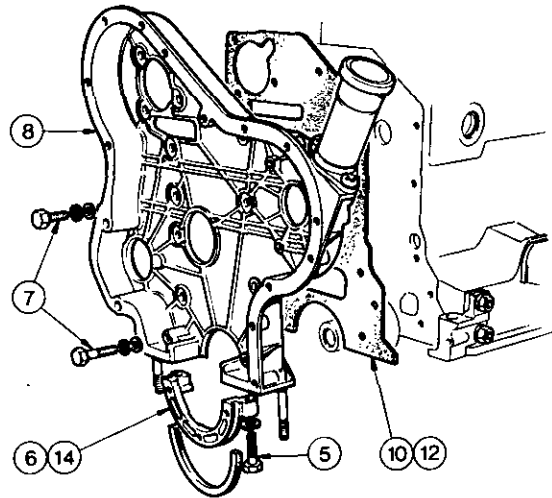
4A-17-15

Removal

1. Remove the camshaft, operation 4A-16-14, procedures 1 to 5.
2. Remove the fuel pump drive gear, operation 4A-14-14 procedures 2 and 3.
3. Remove the fuel injection pump, Part 4C.
4. Remove the engine sump, operation 4A-22-18.
5. Remove the two bolts and washers.
6. Remove the timing case bottom cover.
7. Remove the 14 bolts and washers.
8. Remove the timing case.
9. Remove the idler gear hub.
10. Remove and discard the gasket.

Refitment

11. Refit the idler gear hub in the front face of the cylinder block.
12. Fit a new gasket lightly coated with recommended sealant 'A' and locate it on the cylinder block front face.
13. Reverse procedures 7 and 8.
14. Refit the timing case bottom cover ensuring that the front face of the cover is flush with the front face of the timing case.
15. Reverse procedures 3 and 4.
16. Refit the fuel pump drive gear, operation 4A-14-14, procedure 4.
17. Refit the camshaft, operation 4A-16-14.

**FLYWHEEL****Removal and Refitment**

4A-18-15

Special Tool: Dial Test Indicator Gauge

Removal

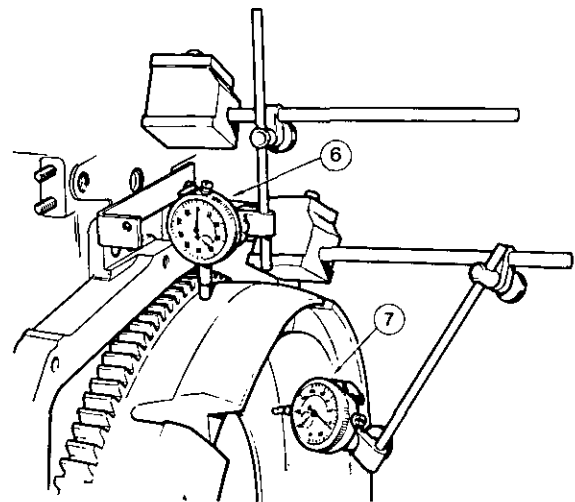
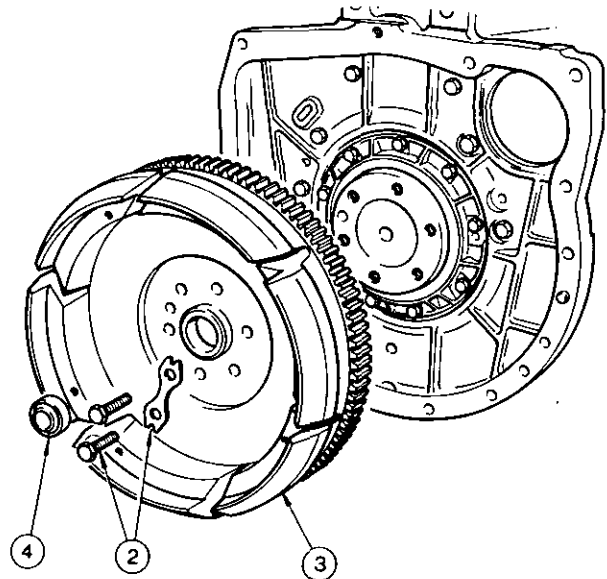
1. Remove the clutch, Part 5A.
2. Remove the six bolts and tab washers.
3. Remove the flywheel.
4. If necessary, remove the pilot bearing.

Refitment

5. Reverse procedures 2 to 4, except:
 - (a) Locate the flywheel on the crankshaft flange so that the untapped hole in the flange is in line with the unused hole in the flywheel.
 - (b) Tighten the flywheel bolts to a torque of 100 Nm (75 lbf ft), and secure them with new tabwashers.
6. Using a dial test indicator gauge, adjust the dial so that the stylus is contacting the flywheel periphery. Turn the crankshaft and check the total reading. The flywheel should run true within 0,30 mm (0.012 in) total indicator reading.
7. Adjust the dial test indicator so that the stylus rests on the clutch face of the flywheel, parallel to the crankshaft at the outermost point of the face. Push the crankshaft forwards to take up the end float, and turn the flywheel. The run out on the flywheel face should be within 0,025 mm (0.001 in) per 25 mm (1 in) of flywheel radius, measured from the crankshaft axis to the stylus of the dial test indicator gauge. If the run-out is excessive, remove the flywheel, check and remove any burrs or foreign matter.

NOTE: If the flywheel is removed, procedures 5, 6 and 7 must be repeated.

8. Refit the clutch, Part 5A.



ENGINE**FLYWHEEL****Ring Gear Removal and Replacement**

4A-19-16

Special Tools: See Operation 4A-18-15.

Removal

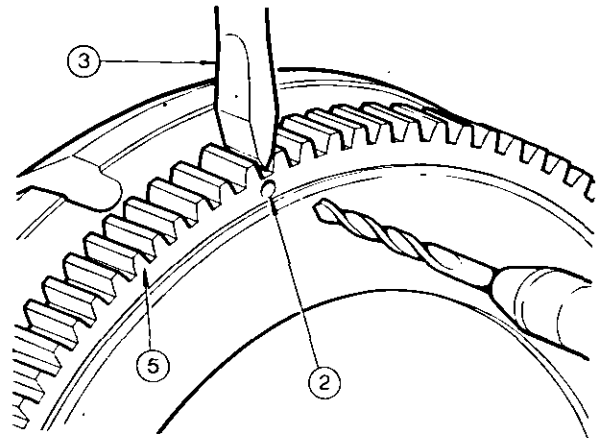
1. Remove the flywheel, operation 4A-18-15.
2. Drill a 5 mm ($\frac{3}{16}$ in) diameter hole axially midway between the inside diameter of the ring gear, and the root of any tooth to a depth of 16 mm ($\frac{5}{8}$ in) only, (otherwise the flywheel may be damaged).
3. Place a chisel in the root above the drilled hole.
4. Cover the flywheel and chisel point in a heavy cloth to protect the operator and others against flying fragments.

WARNING: Take precautions against flying fragments as the starter ring gear may disintegrate when struck.

5. Support the flywheel and strike the chisel sharply and the ring gear should split.

Replacement

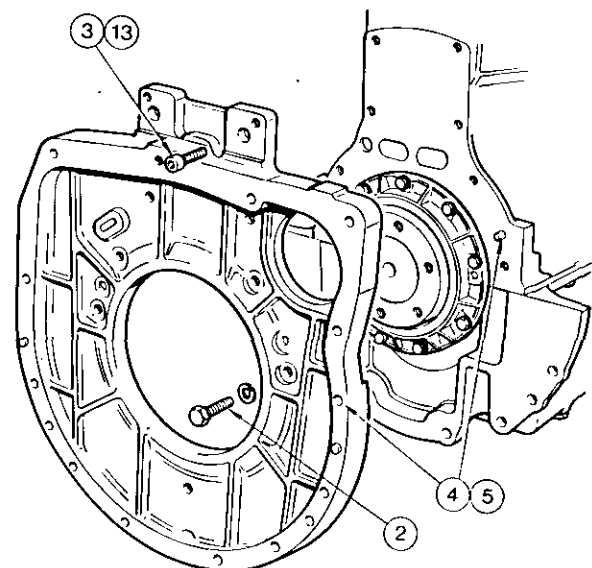
6. Heat the new ring gear to a temperature of 245 °C (475 °F) approximately, using an oven, NOT A NAKED FLAME.
7. Fit the ring gear over the flywheel with the lead-in on the teeth facing towards the front of the flywheel, push the ring gear quickly fully home and allow to cool slowly.
8. Refit the flywheel, operation 4A-18-15.

**FLYWHEEL****Housing Removal and Refitment** 4A-20-16**Removal**

1. Remove the flywheel, operation 4A-18-15.
2. Remove the bolts and washers.
3. Remove the allen bolts.
4. Lift the housing clear of the dowels.

Refitment

5. Reverse procedures 1 to 4, except:
 - (a) ensure that the flywheel housing and engine block faces are scrupulously clean.
 - (b) lightly coat the bolt threads with recommended sealant 'B'.



CRANKSHAFT REAR MAIN OIL SEAL**Removal and Replacement 4A-21-17**

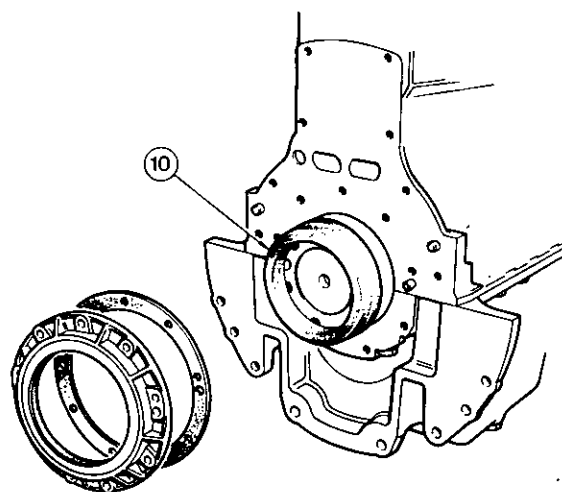
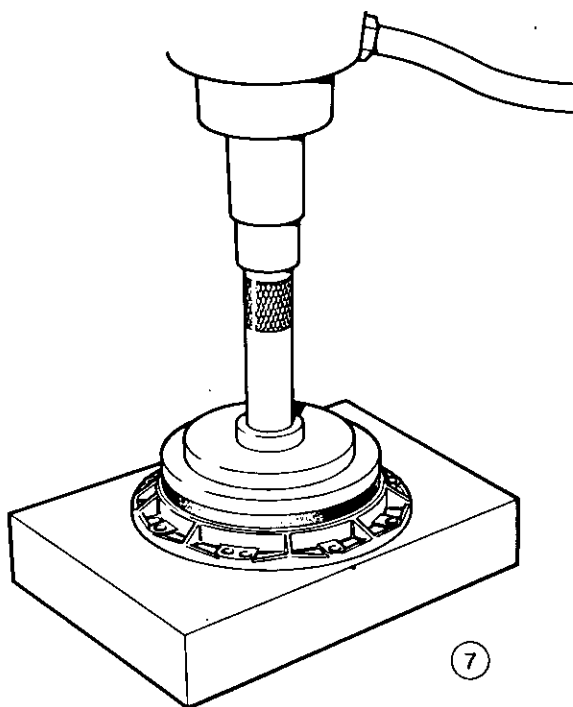
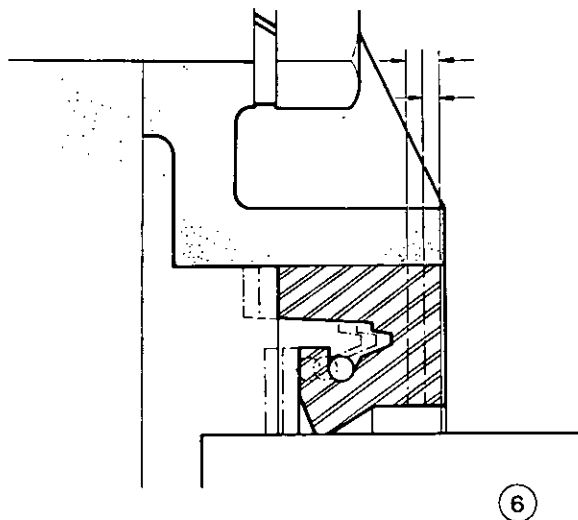
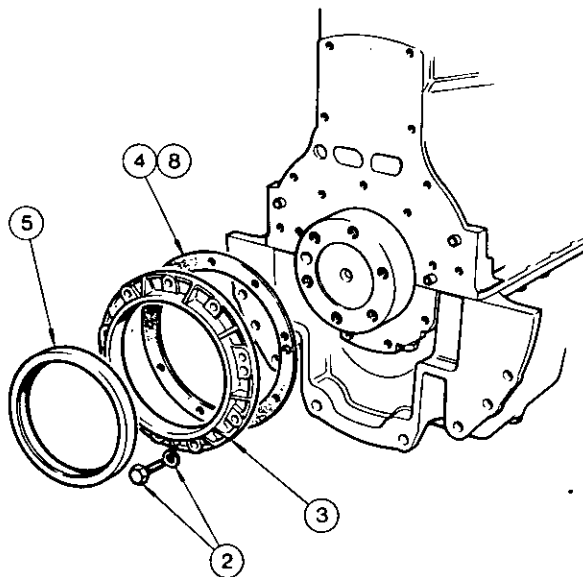
Special Tools: See Operation 4A-18-15, and
 PD 145-1 Oil Seal Replacer
 PD 145-2 Oil Seal Pilot

Removal

1. Remove the flywheel housing operation 4A-20-16.
2. Remove the bolts and washers.
3. Remove the seal housing complete with the oil seal.
4. Remove and discard the gasket.
5. Remove the seal from the housing.

Replacement

6. On production, the lip seal is fitted with its rear face flush with the rear face of the seal housing. Examine the crankshaft flange, and if it is found to be grooved, the new seal should be pressed further into the housing; in the first instance to 3,2 mm (0.125 in) and if required, a further equal distance, resulting in a total of 6,4 mm (0.25 in). If all these positions have been used the worn sealing area of the crankshaft must be machined.
7. Lubricate the seal and the housing with clean engine oil, then using PD 145-1, press the seal into the housing to the required depth.
8. Fit a new gasket, lightly coated in recommended sealant 'A'.
9. Lubricate the seal, the crankshaft flange, and PD 145-2 with clean engine oil.
10. Using PD 145-2, fit the seal and housing assembly, ensuring that the housing is correctly located on the dowels in the cylinder block.
11. Remove PD 145-2.
12. Reverse procedures 1 and 2.



ENGINE**ENGINE SUMP****Removal and Refitment**

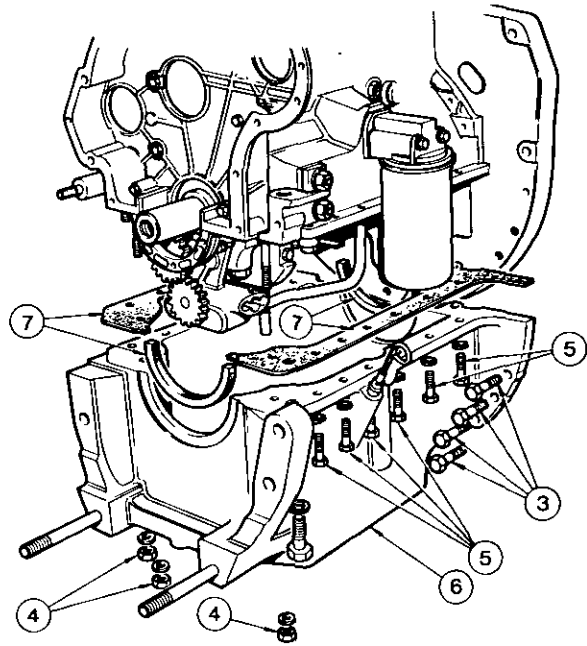
4A-22-18

Removal

1. Split the tractor between the front axle and the engine, Part 3A, except;
 - (a) Support the tractor under the gearbox and not the engine sump.
2. Remove the sump drain plug and drain the oil into a suitable container.
3. Remove the eight bolts and washers.
4. Remove the three nuts and washers.
5. Support the sump and remove the thirteen bolts and washers.
6. Separate the sump from the engine.
7. Remove and discard the sealing gaskets.

Refitment

8. Reverse procedures 1 to 6, except:
 - (a) Ensure mating surfaces are clean.
 - (b) Fit new gaskets, lightly coated with recommended sealant 'A'.
 - (c) Refill the sump with an approved engine oil to the correct level indicated on the dipstick.

**OIL PUMP****Removal and Refitment**

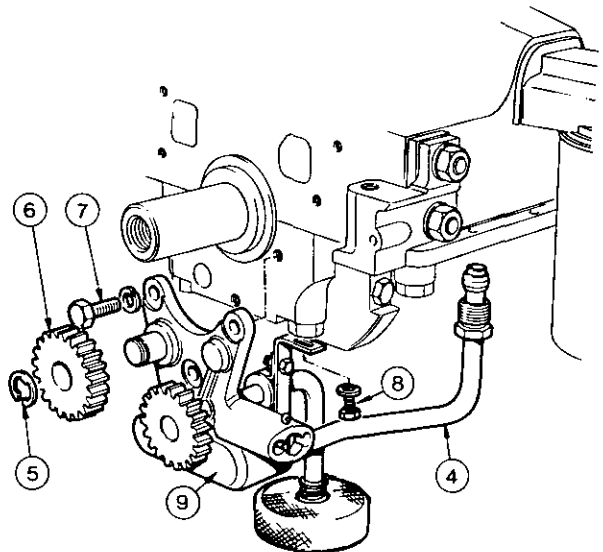
4A-23-18

Removal

1. Remove the engine sump, operation 4A-22-18.
2. Remove the timing case cover, operation 4A-11-12.
3. Remove the timing case bottom cover, operation 4A-17-15, procedures 5 and 6.
4. Disconnect the pipe.
5. Remove the idler gear circlip.
6. Remove the idler gear.
7. Remove the three set screws.
8. Remove the bolt and washer.
9. Remove the oil pump.

Refitment

10. Reverse procedures 1 to 9.



OIL PUMP**Servicing**

4A-24-19

Special Tools: PD 155B Puller
PD 155-4A Adaptors

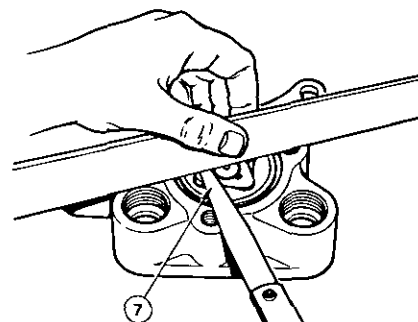
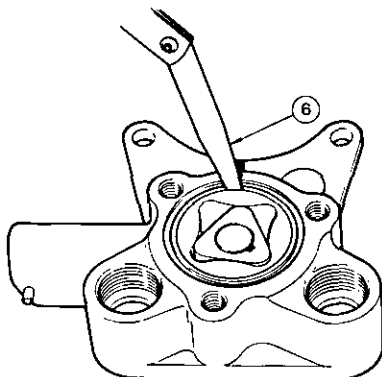
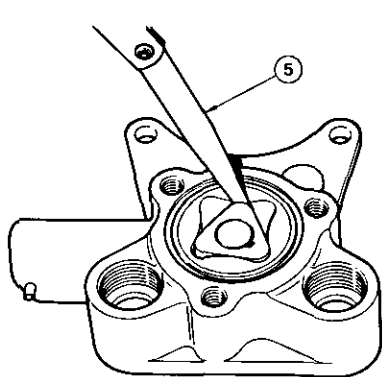
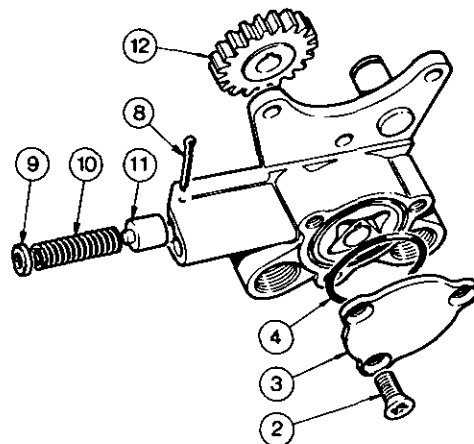
Disassembly

1. Remove the oil pump, operation 4A-23-18.
2. Remove the three screws.
3. Remove the plate.
4. Remove the seal.
5. Check the clearance between the maximum diameter of the inner rotor and the minimum diameter of the outer rotor at all points. If the clearance exceeds 0,1524 mm (0-006 in) a new oil pump must be fitted.
6. Check the clearance between the outer rotor and the pump body. If the clearance exceeds 0,254 mm (0-010 in) a new oil pump must be fitted.
7. Check the clearance between the top of the rotors and the pump body. If the clearance exceeds 0,762 mm (0-003 in) a new oil pump must be fitted.
8. If necessary remove the split pin.
9. Remove the cap.
10. Remove the spring.
11. Remove the relief valve.
12. If necessary, remove the gear using PD 155B and PD 155-4A.

Examine all parts for wear or damage and if necessary replace them.

Reassembly

13. Reverse procedures 8 to 12 and 1 to 4, except:
 - (a) Press on the drive gear with the flat face outwards, until it is flush with the end of the drive shaft, ensuring that the key in the shaft slides in the keyway in the gear.
 - (b) Fit a new seal.



ENGINE

CONNECTING ROD BIG END BEARINGS

Removal and Refitment

4A-25-20

Removal

1. Remove the oil pump, operation 4A-22-18.
2. Rotate the crankshaft until the required bearing is at B.D.C.
3. Remove the two nuts from the big end bolts.
4. Remove the big end cap complete with the shell bearing.
5. Remove the shell bearing from the big end cap.
6. Remove the big end bolts.
7. Rotate the crankshaft until the shell bearing can be removed from the connecting rod.
8. Repeat procedures 2 to 7 for the remaining big end bearings.

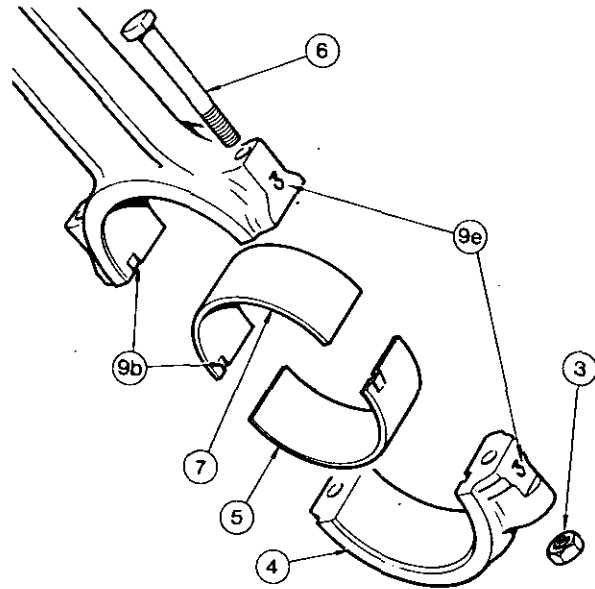
Examine the shell bearings for wear and scoring. If any bearing is found defective, replace the complete set.

Check the crankpins for wear and ovality using a micrometer. Check the diameter of the crankpins in the horizontal plane and the vertical plane at each end of the crankpin.

Crankpin wear and ovality should not exceed 0,0381 mm (0-0015 in). The crankshaft should be re-ground or replaced if these limits are exceeded.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Ensure that all components are scrupulously clean and lubricated freely with clean approved engine oil.
 - (b) Ensure that the steps on the shell bearing halves fit into the slots on the connecting rods and that the bearings are refitted in their original positions and are properly seated.
 - (c) The connecting rod nuts and bolts are of a special type and should be replaced by new items supplied by the engine manufacturer whenever they are removed.
 - (d) Ensure that the flats on the connecting rod bolts are located against the shoulders on the connecting rods.
 - (e) Ensure that the connecting rod and the end cap are fitted with the identification marks together and on the left hand side of the engine.
 - (f) Tighten the big end nuts to a torque of 68 Nm (50 lbf ft).



PISTONS AND CONNECTING RODS**Removal and Refitment 4A-26-21**

Special Tools: 38U3 Piston Ring Compressor
PD41B Piston Height Gauge

Removal

1. Remove the cylinder head, operation 4A-08-08.
2. Remove the connecting rod big end bearings, operation 4A-25-20.
3. Push the pistons and connecting rods out of the top of the cylinders.

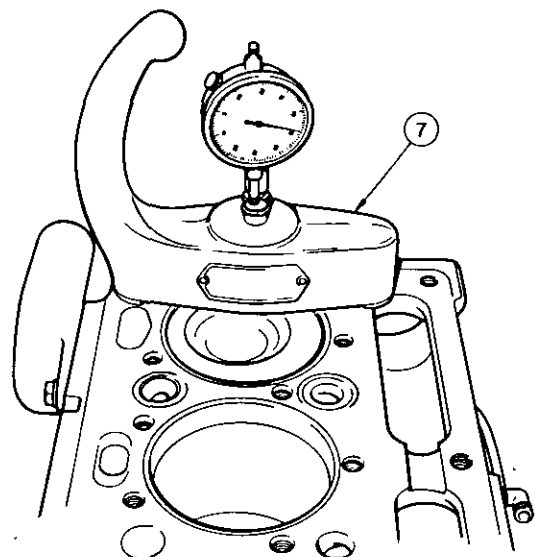
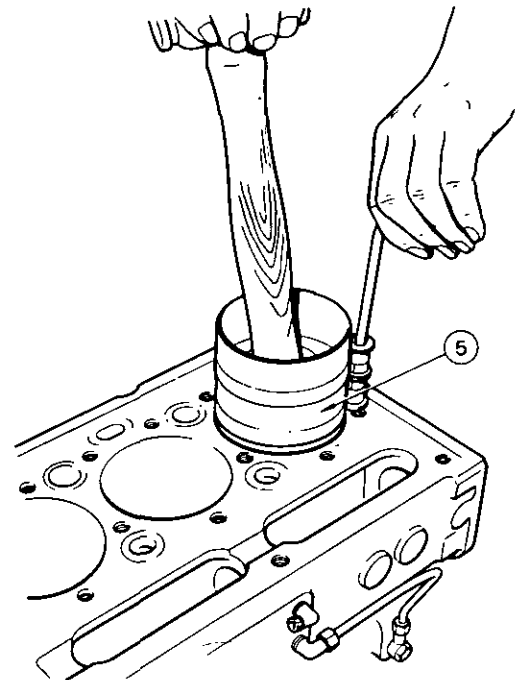
Refitment

Check the condition of the pistons, piston rings and cylinder liners, and if in any doubt as to their serviceability, replace them.

4. Clean all parts thoroughly and freely lubricate with clean approved engine oil.

NOTE: Position the piston rings on the pistons, so that the ring gap on each piston ring is 180° from the gap in the previous piston ring.

5. Using 38U3 and a suitable piece of hardwood, insert the piston and connecting rod assemblies into the top of their respective cylinder bores ensuring that the word 'FRONT' on the piston crown is towards the front of the engine.
6. Refit the connecting rod big end bearings, operation 4A-25-20 except do not refit the oil pump.
7. Using PD41B, check the piston height. The piston should be 0,025 to 0,152 mm (0-001 to 0-006 in) below the top face of the cylinder block, when at T.D.C.
8. Refit the oil pump, operation 4A-23-18.
9. Refit the cylinder head, operation 4A-08-08.



ENGINE

PISTONS AND CONNECTING RODS

Servicing 4A-27-22

Special Tools: See Operation 4A-26-21, and
336-102 Arbor Adaptor.

335 Connecting Rod Alignment Jig

Disassembly

1. Remove the pistons and connecting rods, operation 4A-26-21.
2. Remove the rings from each piston.
3. Remove the circlips.
4. Warm the piston in clean liquid to a temperature of 38 to 50°C (100 to 120°F).
5. Carefully withdraw the gudgeon pins.
6. Remove all traces of carbon deposits from the pistons, with particular attention to the ring grooves.
7. Examine the pistons for signs of scoring.
8. Check the fit of the gudgeon pins in the piston bores and small end bearings.
9. If necessary, press out the small end bushes from the connecting rods.
10. Check the gap of the piston rings when they are fitted in the clean unworn portion at the top of the cylinder bore.
11. Check the vertical groove clearance with a new ring fitted. The piston should be replaced if the limits are exceeded.

Reassembly

12. If required, press new small end bushes into the connecting rod aligning the oil hole in the bush with the hole in the top of the connecting rod.

NOTE: The reaming of the small end bush is a precision task, and should only be undertaken by a skilled machinist.

13. Using 335, check the connecting rod for parallelism and squareness, if any distortion is found, the connecting rod must be replaced.
14. Warm the piston in clean liquid, assemble the pistons to their corresponding connecting rods and insert the gudgeon pins.

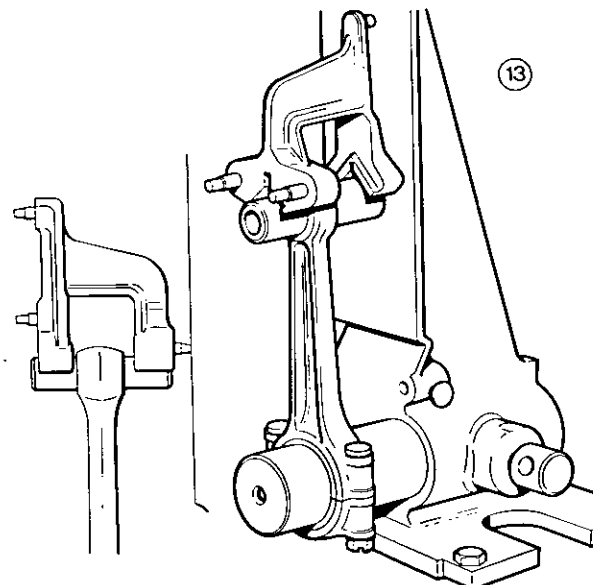
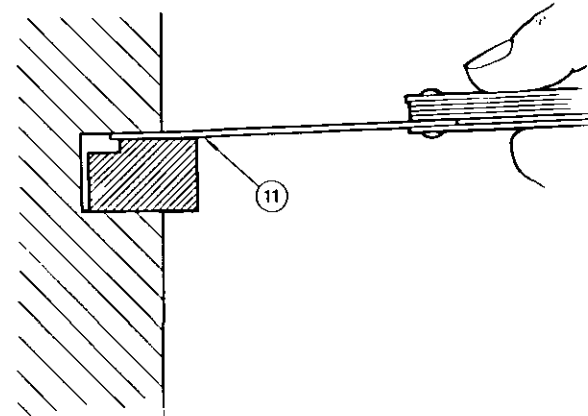
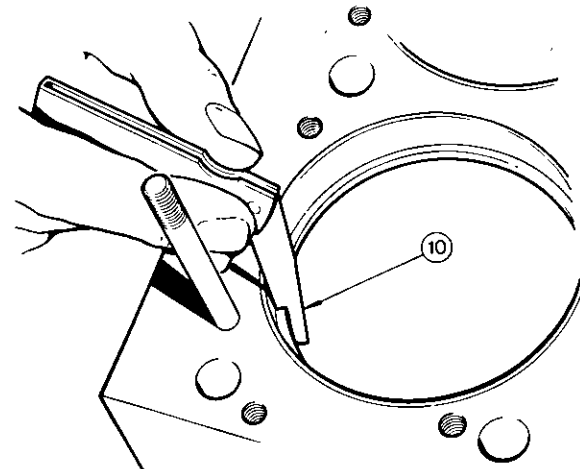
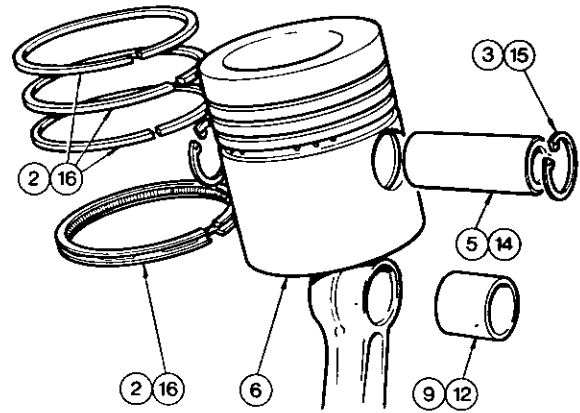
NOTE: The cavity in the piston crown is off-set towards one side of the piston. Assemble the pistons to the connecting rods with the cavity towards the side of the connecting rod which carries the connecting rod and big end cap identification.

15. Fit two new circlips.
16. Fit the piston rings in the following order:
 - Top — Chromium inlaid ring.
 - 2nd — Internally stepped compression ring.
 - 3rd — Internally stepped compression ring.
 - 4th — Conformable scraper ring.

NOTES: The internally stepped compression rings must be fitted with the step towards the crown.

Position the piston rings on the piston, so that the ring gap on each piston ring is 180° from the gap in the previous piston ring.

17. Refit the pistons and connecting rods operation 4A-26-21.



CYLINDER LINERS**Removal and Replacement** 4A-28-23

Special Tools: See Operation 4A-26-21, and
 PD150 Cylinder Liner Remover and
 Replacer
 PD150-1B Adaptors
 30 Ton Hollow Hydraulic Ram

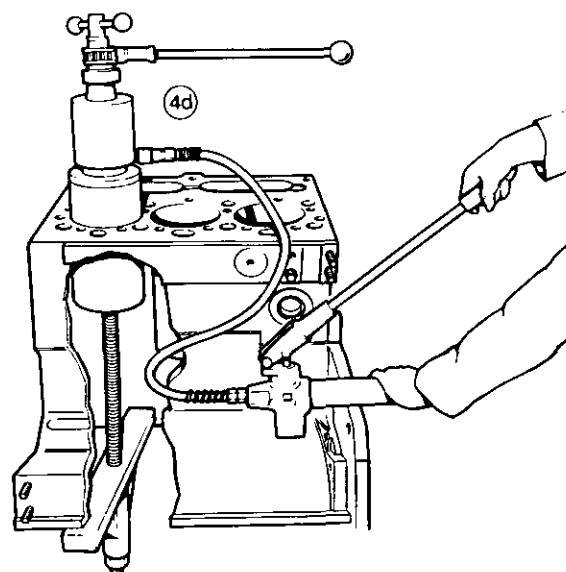
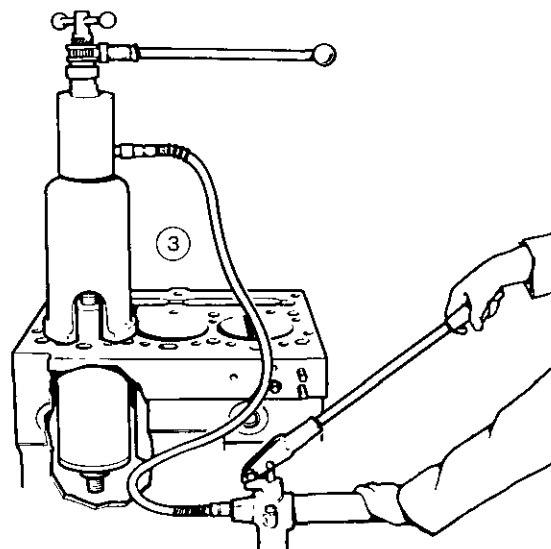
Removal

1. Remove the pistons and connecting rods, operation 4A-26-21.
2. Remove the studs from the cylinder block face.
3. Using PD150, the appropriate adaptor and the 30 ton hollow hydraulic ram, withdraw the cylinder liners through the top of the cylinder block.

NOTE: The PD150 cylinder liner remover and replacer tool is designed for the field service of single liners. Should the tool be required for general workshop overhaul duties, it is advisable to use it in conjunction with a 30 ton hydraulic ram (suitable examples are Epcoc P382 or Pickavant LRH30), with a hand or electrically operated hydraulic pump.

Replacement

4. Reverse procedures 1 to 3, except:
 - (a) Care must be taken in the handling and storage of cylinder liners. The slightest burr or damage will cause considerable distortion when the liner is put into the cylinder block.
 - (b) Flanged cast iron liners must not be re-bored, but must be replaced with new pre-finished service liners.
 - (c) Prior to pressing in the new liner, the cylinder block parent bore and new liner must be thoroughly cleaned, in particular the recess for the liner flange in the top of the parent bore.
 - (d) All parts should be lubricated freely with clean approved engine oil before refitment.
 - (e) Ensure that the liner flange does not foul the counter bore at the top of the parent bore.
 - (f) The top face of the liner should be between 0,000 and 0,102 mm (0-000 and 0-004 in) below the top face of the cylinder block when fully home.
 - (g) Check the condition of the pistons and piston rings, and if in any doubt as to their serviceability, replace them.
 - (h) Fit a new set of piston rings.
 - (i) Allow a settling period to elapse before checking the fitted internal bore diameters of the liners.
 - (j) Each liner should be checked at six positions, top, centre and bottom, the readings being taken transversely and parallel to the centre line of the cylinder block.



ENGINE

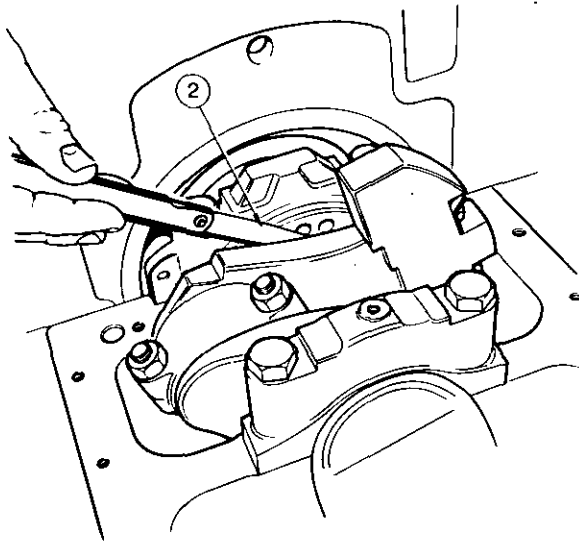
CRANKSHAFT

Thrust Washers Removal and Replacement

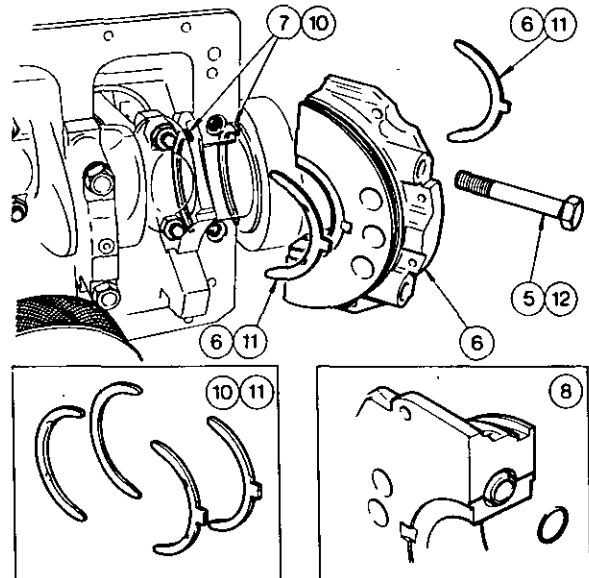
4A-29-24

Removal and Replacement

1. Remove the engine sump, operation 4A-22-18.
2. Push the crankshaft rearwards and check the crankshaft end float between the thrustwasher and the crankshaft. The clearance should be between 0,050 and 0,380mm (0.002 and 0.015 in).
3. If the end float is not within these limits, proceed as follows:—
4. Remove the crankshaft rear main oil seal, operation 4A-21-17.
5. Remove the two bolts.
6. Remove the rear main bearing cap complete with the two bottom half thrust washers.
7. Push the two top half thrust washers around the crankshaft journal with a piece of wire, until they can be removed.
8. Replace the two seals.



9. Lubricate all components with clean engine oil before refitting.
 10. Slide two new top half thrust washers into position with the plain side towards the bearing housing.
 11. Locate the two new bottom half thrust washers onto the rear main bearing cap, and refit the bearing cap.
 12. Refit the bolts and tighten them to a torque of 160 Nm (115 lbf ft).
 13. Re-check the end float (procedure 2).
 14. If the end float is still not correct, oversize thrust washers can be fitted, repeat procedures 5 to 13.
- NOTE: The top and bottom thrust washer halves must be of the same thickness.**
15. Refit the crankshaft rear main oil seal operation 4A-21-17.
 16. Refit the engine sump, operation 4A-22-18.



CRANKSHAFT**Crankshaft Removal and Refitment 4A-30-25****Removal**

1. Drain the engine oil.
2. Split the tractor between the front axle and the engine, and between the engine and the transmission, Part 3A.
3. Mount the engine on a suitable stand.
4. Remove the timing case, operation 4A-17-15.
5. Remove the connecting rod big end bearings, operation 4A-25-20.
6. Remove the crankshaft thrust washers operation 4A-29-24 procedures 4 to 7.
7. Remove the oil pump, operation 4A-23-18.
8. Remove the crankshaft drive gear operation 4A-15-14.
9. Remove the six bolts securing the remainder of the crankshaft main bearing caps.
10. Remove the three remaining main bearing caps complete with half-shell bearings.
11. Lift out the crankshaft.
12. Remove the four half shell bearings from the engine casing.
13. Thoroughly clean all components.

Check the crankpins and journals for wear and ovality using a micrometer. The diameter of the crankpins and journals must be checked in the vertical and horizontal planes at both ends of the crankpins and journals. The wear and ovality must not exceed 0,0361mm (0-0015 in).

Crack detect and de-magnetize the crankshaft. The main journals and crankpin diameters can be re-ground by the following amounts:—

- (a) Minus 0,254 mm (0-010 in).
- (b) Minus 0,508 mm (0-020 in).
- (c) Minus 0,762 mm (0-030 in).

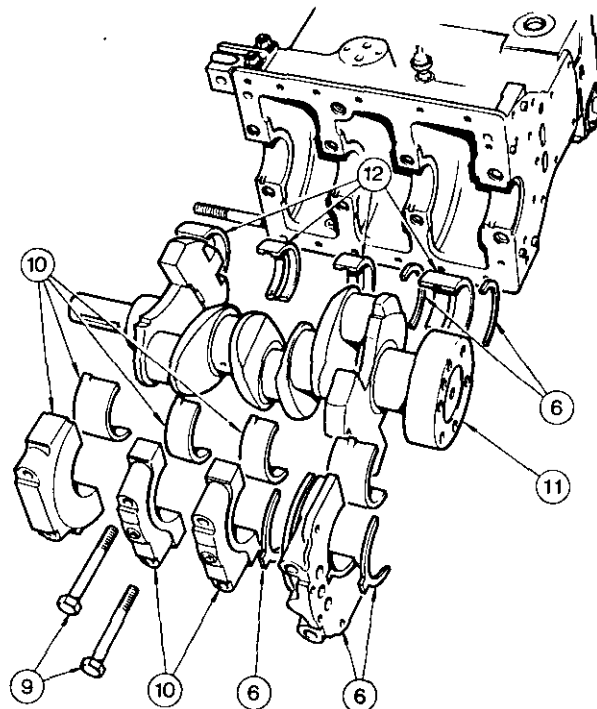
If the crankshaft requires to be re-ground below 0,762 mm (0-030 in), a new crankshaft must be fitted.

Crankpin width may increase with regrinding, but must not exceed 39,88 mm (1-570 in). It is important that the radii on the main and crankpin journals are maintained. After regrinding, the sharp corners on the oil holes must be removed.

Tufftrided crankshafts must be re-Tufftrided after re-grinding. If Tufftriding facilities are not available, a new crankshaft must be fitted.

If all three positions for the rear main oil seal have been used, the sealing area of the crankshaft flange must be re-ground. Only the minimum amount of metal should be ground off to ensure removal of the seal wear grooves. The oil seal flange must not be machined below 113,17 mm (5-243 in) minimum diameter. It is not necessary to re-Tufftride the flange.

Crack test and de-magnetize the crankshaft.

**Refitment**

14. Reverse procedures 8 to 13 except:
 - (a) Ensure that the oilways in the cylinder block and crankshaft are free from obstruction.
 - (b) Check the main bearing cap attachment bolts for stretching. Only bolts supplied by the engine manufacturer should be used, as they are special bolts.
 - (c) Ensure that all components are scrupulously clean and lubricated freely with clean approved engine oil.
 - (d) The main bearing caps are numbered, number 1 commencing at the front of the engine. Each cap is also marked with a serial number as stamped on the cylinder block bottom face. These should read in line.
 - (e) Tighten the main bearing bolts to a torque of 160 Nm (115 lbf ft).
15. Refit the crankshaft thrust washers operation 4A-29-24 procedures 8 to 13.
16. Refit the oil pump, operation 4A-23-18.
17. Refit the connecting rod big end bearings, operation 4A-25-20.
18. Refit the timing case, operation 4A-17-15.
19. Reverse procedure 2.
20. Refill the engine with an approved oil.

A4. 236 and A4. 248 ENGINES

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ENGINE**GENERAL**

The Perkins A4. 236 engine and the A4. 248 engine are four cylinder water cooled, direct injection diesel units. The A4. 236 has a stroke of 127 mm (5.0 in) and a nominal bore diameter of 98.42 mm (3.875 in). The A4. 248 has a stroke of 127 mm (5.0 in) and a nominal bore diameter of 101 mm (3.98 in).

Both types of engines incorporate overhead valves mounted vertically in the cylinder head. A gear driven camshaft located in the right hand side of the cylinder block operates the valves via tappets, push rods and a series of rocker levers located on a shaft mounted on top of the cylinder head. Valves with oversize stems are available if excessive wear should occur in the cylinder head.

The cylinder block and crankcase form an integral casting and are fitted with full length replaceable flanged cast iron liners.

The aluminium pistons have a toroidal cavity in the head and are fitted with four piston rings on A4. 248 engines, and five piston rings on A4. 236 engines. The pistons are attached to their connecting rods by fully floating gudgeon pins retained by circlips. The big end bearings are replaceable and consist of a thin steel-shell lined with an aluminium-tin alloy.

The engine is lubricated by force feed. The oil is drawn from the sump via a strainer, by a rotary pump

driven by the crankshaft via the balancer unit. The oil passes through a filter before being circulated under pressure around the engine.

The crankshaft is mounted in five replaceable aluminium-tin alloy lined bearings held in position by cast iron bearing caps. Thrust is absorbed by four washers located on both sides of the centre main bearing cap and cylinder block.

A balancer unit is fitted to the cylinder block and driven via gears by the crankshaft. The oil pump is mounted on the rear of this unit inside the lubricating oil sump.

Maximum Engine Power at 2 000 rev/min

A4. 236 engine

MF 565	63 hp	(BS. AU 141 Ambient Conditions)
	60 PS	(DIN 70020)
MF 575	69 hp	(BS. AU 141 Ambient Conditions)
	66 PS	(DIN 70020)

Maximum Engine Power at 2 200 rev/min

A4. 248 engine

MF 590	79 hp	(BS. AU 141 Ambient Conditions)
	75 PS	(DIN 70020)

FAULT DIAGNOSIS

FAULT FINDING CHART

FAULT	POSSIBLE CAUSE
Low cranking speed	1, 2, 3, 4
Will not start	5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 31, 32, 33
Difficult starting	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 24, 29, 31, 32, 33
Lack of power	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 31, 32, 33
Misfiring	8, 9, 10, 12, 13, 14, 16, 18, 19, 20, 25, 26, 28, 29, 30, 32
Excessive fuel consumption	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 31, 32, 33
Black exhaust	11, 13, 14, 16, 18, 19, 20, 22, 24, 25, 27, 28, 29, 31, 32, 33
Blue/White exhaust	4, 16, 18, 19, 20, 25, 27, 31, 33, 34, 35, 45, 56,
Low oil pressure	4, 36, 37, 39, 40, 42, 43, 44
Knocking	9, 14, 16, 18, 19, 22, 26, 28, 29, 31, 33, 35, 36, 45, 46, 48
Erratic running	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 23, 26, 28, 29, 30, 33, 35, 45, 48
Vibration	13, 14, 20, 23, 25, 26, 29, 30, 33, 45, 47, 49
High oil pressure	4, 38, 41
Overheating	11, 13, 14, 16, 18, 19, 24, 25, 45, 50, 51, 52, 53, 54, 57
Excessive crankcase pressure	25, 31, 33, 34, 45, 55
Poor compression	11, 19, 25, 28, 29, 31, 32, 33, 34, 46, 48
Starts and stops	10, 11 12

Key to Fault Finding Chart

1. Battery capacity low.
2. Bad electrical connection.
3. Faulty starter motor.
4. Incorrect grade of lubricating oil.
5. Low cranking speed.
6. Fuel tank empty.
7. Faulty stop control operation.
8. Blocked fuel feed pipe.
9. Faulty fuel lift pump.
10. Choked fuel filter.
11. Restriction in air cleaner.
12. Air in fuel system.
13. Faulty fuel injection pump.
14. Faulty atomisers or incorrect type.
15. Incorrect use of cold start equipment.
16. Faulty cold starting equipment.
17. Broken fuel injection pump drive.
18. Incorrect fuel pump timing.
19. Incorrect valve timing.
20. Poor compression.
21. Blocked fuel tank vent.
22. Incorrect type or grade of fuel.
23. Sticking throttle or restricted movement.
24. Exhaust pipe restriction.
25. Cylinder head gasket leaking.
26. Overheating.
27. Cold running.
28. Incorrect tappet adjustment.
29. Sticking valves.
30. Incorrect high pressure pipes.
31. Worn cylinder bores.
32. Pitted valves and seats.
33. Broken, worn or sticking piston rings.
34. Worn valve stems and guides.
35. Overfull oil bath air cleaner or incorrect grade of oil.
36. Worn or damaged bearings.
37. Insufficient oil in sump.
38. Blocked sump strainer.
39. Oil pump worn.
40. Pressure relief valve sticking open.
41. Pressure relief valve sticking closed.
42. Broken relief valve spring.
43. Faulty suction pipe.
44. Choked oil filter
45. Piston seizure/pick up.
46. Incorrect piston height.
47. Damaged fan.
48. Broken valve spring.
49. Incorrectly aligned flywheel.
50. Faulty thermostat.
51. Restriction in water jacket.
52. Loose fan belt.
53. Choked radiator.
54. Faulty water pump.
55. Choked breather pipe.
56. Damaged valve stem oil deflectors (if fitted).
57. Coolant level too low.

ENGINE**ROCKER COVER****Removal and Refitment**

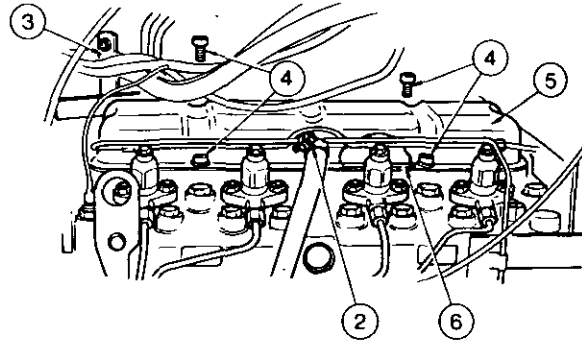
4A-40-42

Removal

1. Remove the hood, Part 2A.
2. Disconnect the hose.
3. Disconnect the steering hose clip.
4. Remove the four Allen bolts.
5. Remove the rocker cover.
6. Discard the gasket.

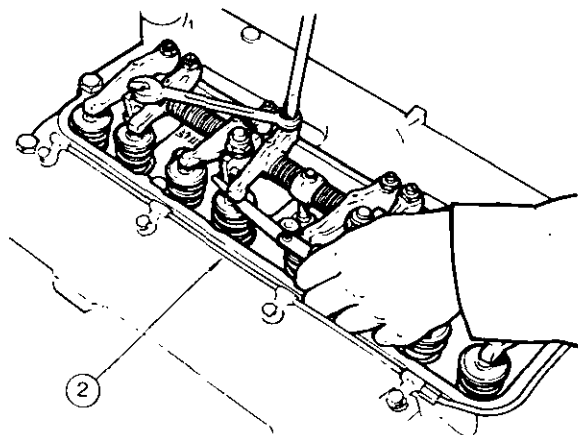
Refitment

7. Reverse procedures 1 to 6, except:
Fit a new gasket, dry.

**VALVE TIP CLEARANCE****Adjustment**

4A-41-42

1. Remove the rocker cover, operation 4A-40-42.
2. Set the valve clearance to 0,30 mm (0.012 in) cold. The clearance is measured between the rocker lever and the top of the valve stem. The sequence for adjusting the clearance is as follows:—
Valve No. 8. Fully open (fully compressed) set No. 1. valve clearance.
Valve No. 7. Fully open (fully compressed) set No. 2. valve clearance.
Valve No. 6. Fully open (fully compressed) set No. 3. valve clearance.
Valve No. 5. Fully open (fully compressed) set No. 4. valve clearance.
Valve No. 4. Fully open (fully compressed) set No. 5. valve clearance.
Valve No. 3. Fully open (fully compressed) set No. 6. valve clearance.
Valve No. 2. Fully open (fully compressed) set No. 7. valve clearance.
Valve No. 1. Fully open (fully compressed) set No. 8. valve clearance.
3. Refit the rocker cover, operation 4A-40-42.



ROCKER ASSEMBLY**Removal and Refitment**

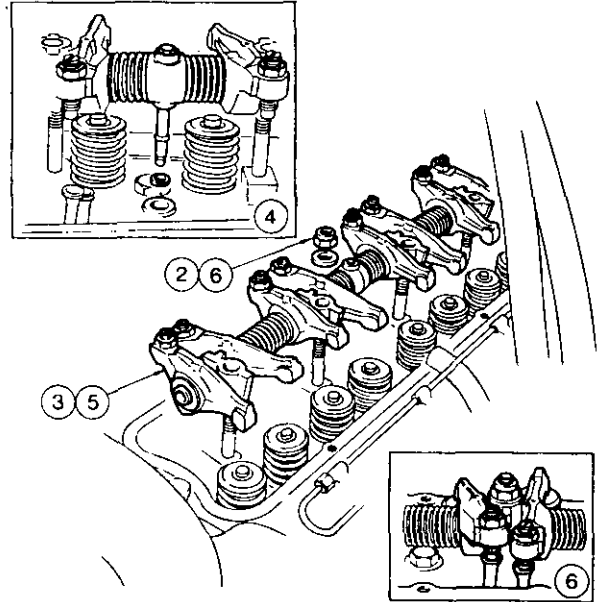
4A-42-43

Removal

1. Remove the rocker cover, operation 4A-40-42.
2. Remove the four nuts and washers.
3. Remove the rocker assembly.

Refitment

4. Fit a new oil feed connection seal into the recess in the cylinder head.
5. Refit the rocker assembly.
6. Refit the four nuts and washers, ensuring that the push rods are correctly located in the rocker levers.
7. Adjust the valve tip clearances, operation 4A-41-42.

**ROCKER ASSEMBLY****Servicing**

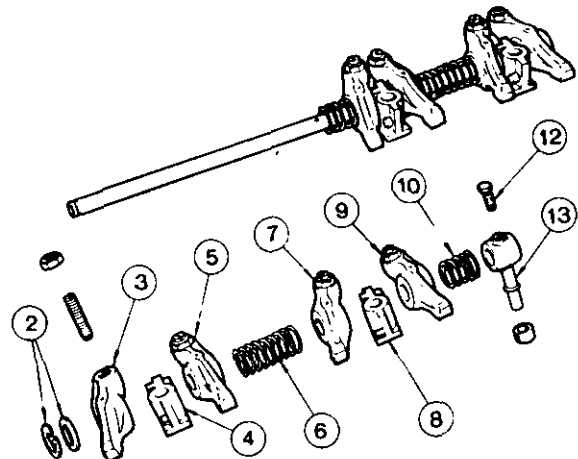
4A-43-43

Disassembly

1. Remove the rocker assembly, operation 4A-42-43.
2. Remove the circlip and washer from the front end of rocker shaft.
3. Slide No. 1 valve rocker lever clear of the shaft.
4. Slide the support bracket clear of the shaft.
5. Slide No. 2 valve rocker lever clear of the shaft.
6. Slide the long spring clear of the shaft.
7. Slide No. 3 valve rocker lever clear of the shaft.
8. Slide the support bracket clear of the shaft.
9. Slide No. 4 valve rocker lever clear of the shaft.
10. Slide the short spring clear of the shaft.
11. Repeat procedures 4 to 12 for the other end of the rocker shaft, which is identical.
12. Remove the bolt from the oil feed connection.
13. Slide the oil feed connection clear of the shaft. Examine the rocker lever bores and rocker shaft for wear. The rockers should be an easy fit on the shaft without excessive side play.

Reassembly

14. Reverse procedures 1 to 13 except:—
 - (a) The support brackets are interchangeable and when refitting them, ensure that the securing stud holes are to the right when viewing the shaft from the front end, with each pair of rockers inclined away from each other on the valve side.
 - (b) Lubricate all parts with clean engine oil prior to reassembly.

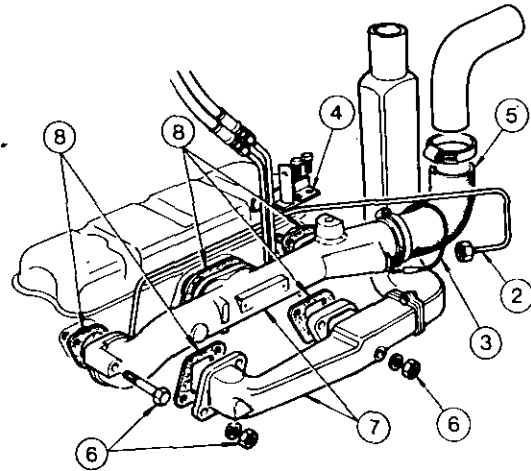


ENGINE**INLET AND EXHAUST MANIFOLDS****Removal and Refitment 4A-44-44****Removal**

1. Remove the hood, Part 2A.
2. Disconnect the thermostart fuel pipe.
3. Disconnect the cable.
4. Remove the steering hose bracket.
5. Remove the rubber inlet hose.
6. Remove the five bolts, nuts and washers.
7. Remove the manifolds.
8. Discard the gaskets.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Fit new gaskets.
 - (b) The manifolds must be fitted simultaneously and not one at a time.
 - (c) Bleed the thermostart fuel pipe, Part 4C.

**VALVE SPRINGS****Removal and Refitment 4A-45-44**
(Cylinder Head Fitted)

Special Tools: 6118-B Valve Spring Compressor
PD 6118-4 Adaptor

Removal and Refitment

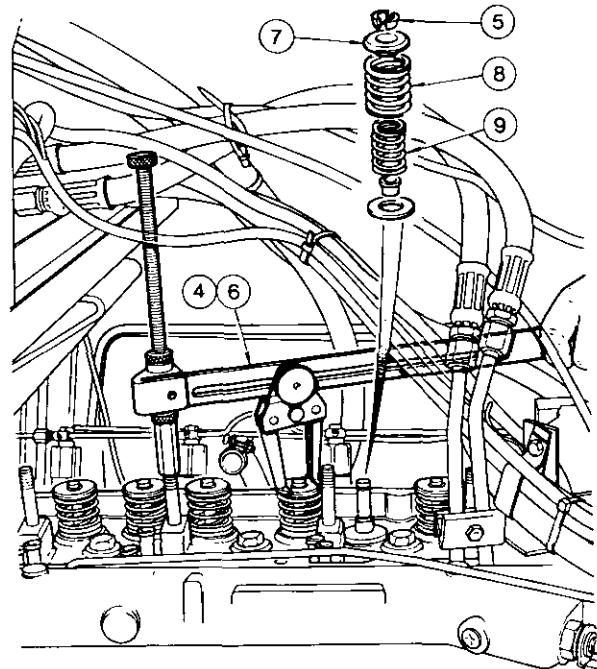
1. Remove the rocker assembly, operation 4A-42-43.
2. Turn the crankshaft to T.D.C. Nos. 1 and 4 cylinders.
3. Remove the hood support frame as described in MF575 and MF590, cab removal and refitment, Part 3A.
4. Using 6118-B and PD 6118-4, compress the valve springs on Nos. 1 and 4 cylinders.
5. Remove the collets.
6. Release 6118-B and PD 6118-4 slowly.
7. Remove the spring cap.
8. Remove the spring.
9. On A4. 248 engines only, remove the spring.

NOTES: (a) Do not turn the crankshaft again, until the valve springs have been refitted, and secured with the collets.

(b) Double valve springs are fitted to A4. 248 engines only.

(c) If valve springs are being replaced, a complete new set should be fitted.

10. Reverse procedures 4 to 9, ensuring that the damper coils of the springs are fitted nearest to the cylinder head.
11. Turn the crankshaft to T.D.C. Nos. 2 and 3 cylinders.
12. Repeat procedures 4 to 9 for the valves on Nos. 2 and 3 cylinders.
13. Reverse procedures 1, and 3 to 9.



CYLINDER HEAD**Removal and Refitment**

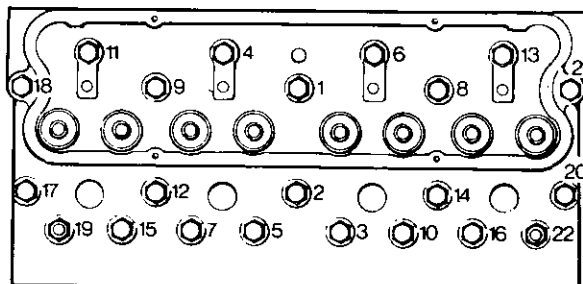
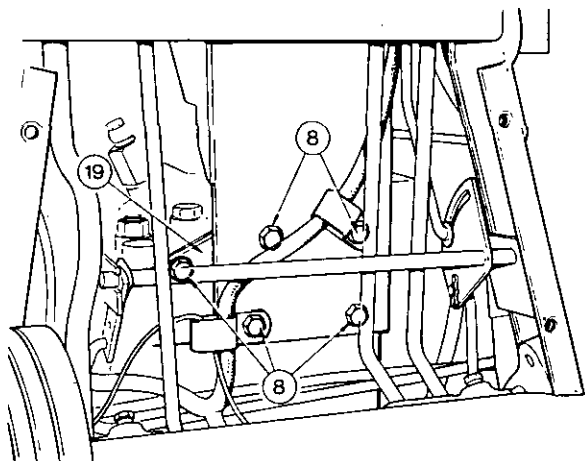
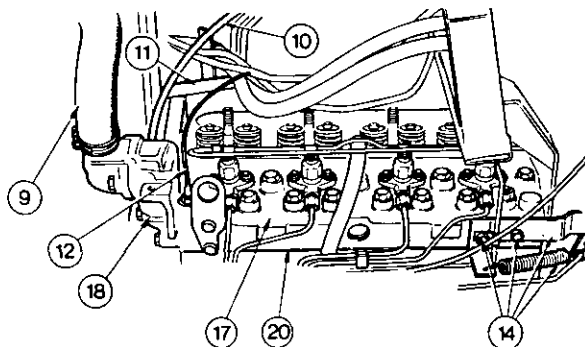
4A-46-45

Removal

1. Remove the rocker assembly, operation 4A-42-43.
2. Disconnect the battery cables.
3. Drain the cooling system via the drain taps on the radiator and the engine block.
4. Remove the inlet and exhaust manifolds, operation 4A-44-44.
5. Remove the injectors, Part 4C.
6. Remove the high pressure fuel pipes.
7. On MF 575 and MF 590 tractors, remove the cab interior front panel, Part 2B.
8. Remove the 5 bolts, remove the cable from the clip, and retain the hood support frame in such a way that it will not obstruct the cylinder head removal.
9. Disconnect the radiator top hose.
10. Disconnect the tachometer drive cable at the timing case cover.
11. Remove the pipe support bracket.
12. Disconnect the water temperature sensor cable.
13. Remove the heat start fuel pipe.
14. Release the spring and remove the two bolts and bracket.
15. Remove the pushrods and retain them in the order in which they were removed.
16. Remove the bolts and nuts in the reverse order of their tightening sequence.
17. Remove the cylinder head.
18. If necessary, remove the thermostat housing, operation 4B-07-05, procedures 9 to 11.
19. If necessary, remove the rear cover and gasket.
20. Remove the gasket.

Refitment

21. Ensure that all parts are thoroughly clean and that all joint faces are de-greased.
22. Reverse procedures 1 to 22, except:
 - (a) Fit a new cylinder head gasket, dry.
 - (b) The cylinder head securing nuts and bolts must be tightened in the correct sequence, in three equal stages to a torque of 122Nm (90 lbf ft).
 - (c) Lightly coat the rear cover gasket and securing bolts, and the thermostat housing gasket in recommended sealant 'A'.
23. Adjust the valve tip clearance 4A-41-42, but do not refit the hood.
24. Bleed the fuel system, Part 4C.
25. Start the engine and run it at a fast idle speed for approximately ten minutes, until the normal operating temperature is reached, and stop the engine.
26. Remove the rocker assembly, operation 4A-42-43.
27. Re-tighten the cylinder head securing nuts and bolts in the correct sequence to a torque of 122Nm (90 lbf ft).
28. Refit the rocker assembly, operation 4A-42-43.
29. Start the engine and check for any leaks.



ENGINE

CYLINDER HEAD

Servicing

4A-47-46

Special Tools: PD 137 Valve Guide Reamer 0,381 mm (0.015 in) oversize
 PD 138 Valve Guide Reamer 0,762 mm (0.030 in) oversize
 316 x Valve Seat Cutter Handle
 316-12 Normal Pilot
 316-125 Pilot, 0,381 mm (0.015 in) oversize
 316-13 Pilot, 0,762 mm (0.030 in) oversize
 PD 317-22 Valve Seat Cutter (Exhaust)
 317-30 Valve Seat Cutter (Inlet)
 317G-22 Valve Seat Glazebreaker (Exhaust)
 317G-30 Valve Seat Glazebreaker (Inlet)
 6118 B Valve Spring Compressor
 PD 6118-4 Adaptor
 PD 41 B Valve Depth Gauge

Disassembly and Reassembly

1. Remove the cylinder head, operation 4A-46-45.
2. Using 6118 B and PD 6118-4, compress the spring(s).
3. Remove the collets.
4. Release and remove the 6118B and PD 6118-4.
5. Remove the valve spring cap.
6. Remove the spring(s).

NOTE: Only A4. 248 engines are fitted with double valve springs.

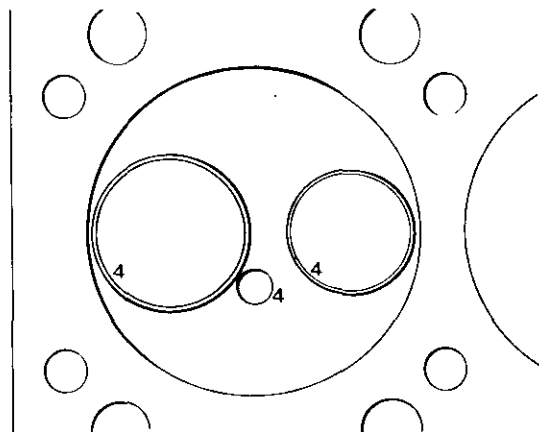
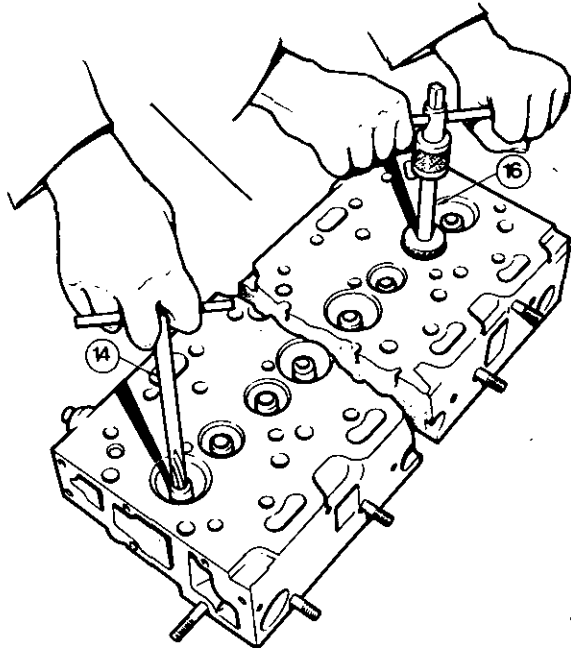
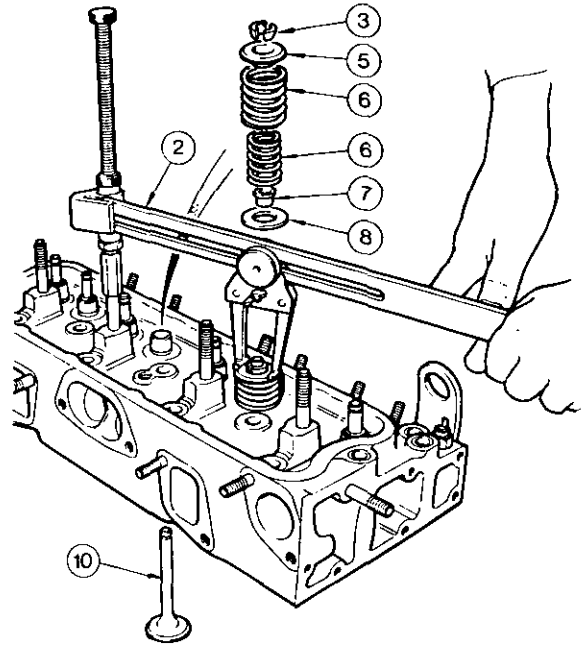
7. Remove the valve stem oil seal.
8. Remove the spring seat.
9. Repeat procedures 2 to 8 for the remaining valves.
10. Invert the cylinder head and remove the valves.

NOTE: The valves are numbered 1, 1:2, 2:3, 3:4, 4 from the front of the engine with the corresponding numbers adjacent to each valve seat to facilitate correct refitment.

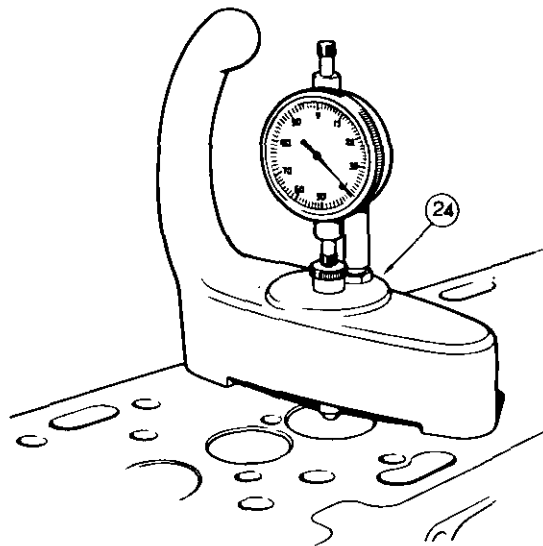
11. Clean all ports free of any carbon or other deposits.
12. If the water jacket of the cylinder head shows signs of excessive scale, a proprietary brand of de-scaling solution should be used.
13. Check the valve guide bores for wear.
14. If necessary, ream the bores to 0,381 mm (0.015 in) or 0,762 mm (0.030 in) oversize as required, using PD 137, or PD 138.

NOTE: When the valve guides have been reamed out, new valves with corresponding larger diameter stems must be fitted, and must have corresponding larger stem seals. The new valves should be numbered to correspond with the old valves.

15. Check the valve seats for excessive pitting or wear.
16. If necessary, recut the valve seats using the appropriate combination of cutter handle and valve seat cutter. Remove the minimum amount of metal consistent with giving a good smooth, gas tight seal.
17. Thoroughly clean all the valves and examine them for pitting, wear and burning.
18. If necessary, machine grind the valve jointing flange to an angle of 45°, removing the minimum amount of metal consistent with a good smooth finish.



19. Thoroughly clean the valves.
20. Lubricate the valve stems with clean engine oil.
21. Hand grind the valves and their respective valve seats until all pitting is removed and a good seal is produced.
22. Wash the cylinder head and valves thoroughly with clean paraffin and dry.
23. Lightly oil the valve stems and insert the valves in the cylinder head.
24. Using PD 41B, check the valve head depths relative to the cylinder head face, these should be between 0,74 and 1,4 mm (0.029 and 0.055 in) exhaust valves, and 0,89 and 1,55 mm (0.035 and 0.061 in) inlet valves.
25. If these limits are exceeded; the offending valve must be discarded, and a new one fitted in its place, again the valve head depth must be measured, and if it is still not within these limits, a new valve seat insert must be fitted (exhaust valves only), operation 4A-48-48. If the offending valve is an inlet, and still not within the limits after fitting a new valve, the cylinder head must be discarded and a new replacement fitted.
26. Check the flatness of the cylinder head face and if necessary, skim the face to a maximum of 0,30 mm (0.012 in) providing the injector nozzle protrusion is not greater than 4,44 mm (0.175 in). This figure must not be obtained by fitting additional injector sealing washers.
27. Thoroughly clean the cylinder head.
28. Reverse procedures 1 to 9 except:
 - (a) When refitting the valve springs, ensure that the damper coils of the springs are nearest the cylinder head.
 - (b) Refit the valves in the same order in which they were removed.



VALVE SEAT INSERTS

Fitting Procedure

4A-48-48

Special Tools: See Operation 4A-47-46 and Valve Seat Inserting Tool (see procedure 4).

Valve seat inserts can only be fitted on EXHAUST valve applications, and then only as a last resort to Cylinder Head Servicing, operation 4A-47-46. The fitting of inserts is a precision operation, and therefore should only be undertaken by a competent, skilled machinist.

1. Service the cylinder head, operation 4A-47-46.
2. Using the valve guide bore, machine the recess in the cylinder head face, to the dimensions given.

NOTE: Work as closely as possible to the minimum machining dimensions to allow for a possible re-seating at a later date.

3. Remove all machining swarf and clean the insert recess.
4. Using the valve guide bore as a pilot, press the insert home using an inserting tool made to the given dimensions.

NOTE: The insert must not be hammered in or lubricated.

5. Check that the insert is pressed fully home and is flush with the bottom of the recess.
6. Using the valve guide as a pilot, machine the 'flare' to the dimensions given.
7. Remove all machining swarf and burrs.
8. Re-cut the valve seat at an included angle of 90° so that the valve head depth below the cylinder head face is within the production limits of 0,74 and 0,99 mm (0-029 and 0-039 in) for exhaust valves.

KEY TO FIG. 2

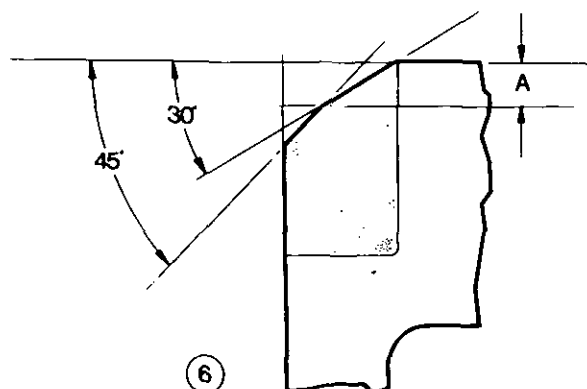
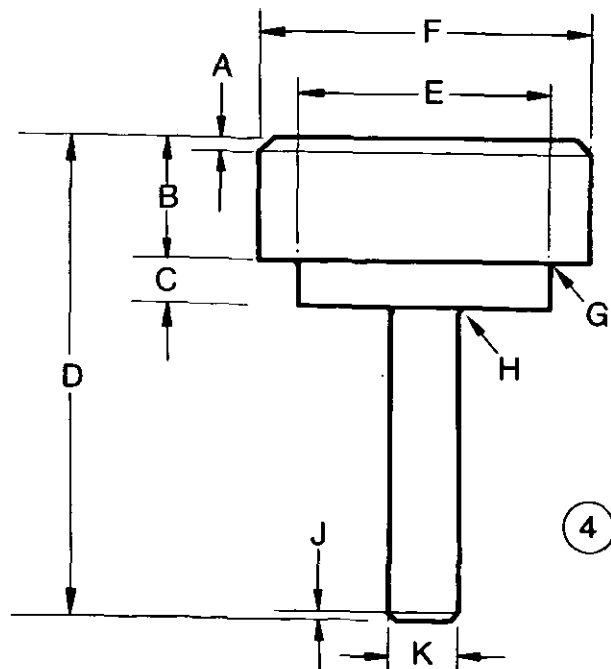
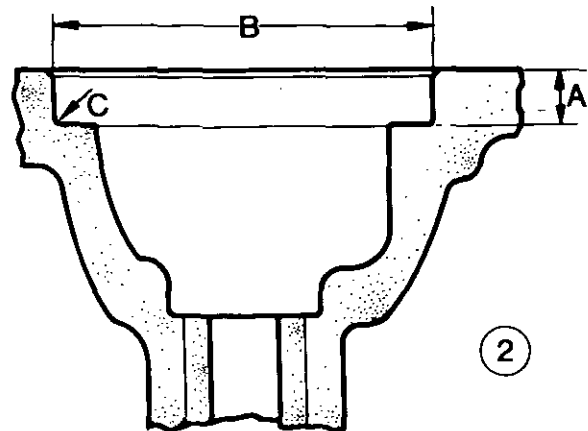
- A. 9,52 to 9,65 mm (0-375 to 0-380 in).
- B. 42,62 to 42,64 mm (1.678 to 1.679 in).
- C. 0,38 mm (0.015 in) maximum radius.

KEY TO FIG. 4

- A. 1,59 mm (0-63 in) at 45°.
- B. 19,05 mm (0-75 in).
- C. 7,92 mm (0-312 in).
- D. 76,20 mm (3 in).
- E. 31,70 to 31,72 mm (1-248 to 1-249 in).
- F. 43,42 to 43,67 mm (1-670 to 1-680 in).
- G. 0,79 mm (0-031 in) radius.
- H. 1,59 mm (0-063 in) radius.
- J. 1,59 mm (0-063 in) at 45°.
- K. 9,45 to 9,47 mm (0-372 to 0-373 in).

KEY TO FIG. 6

- A. 2,39 to 2,51 mm (0-094 to 0-099 in).
Flare cut to 30°.



TIMING CASE COVER**Removal Refitment**

4A-49-49

Removal

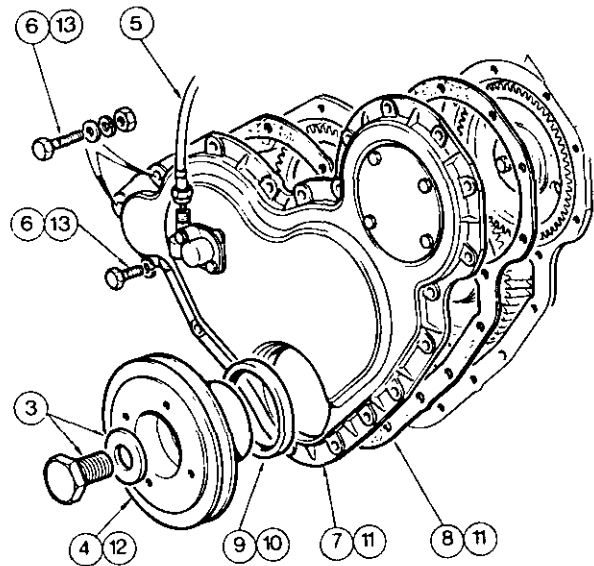
1. Split the tractor between the engine and the front axle, Part 3A.
2. Remove the fan belt.
3. Remove the crankshaft pulley securing bolt and washer.
4. Remove the crankshaft pulley.
5. Disconnect the tachometer drive cable.
6. Remove the 20 bolts and washers and the two nuts securing the timing case cover.
7. Remove the timing case cover.
8. Remove and discard the gasket.
9. Remove the oil seal.

Refitment

10. Fit a new oil seal, with the toe of the seal towards the engine.
11. Place the timing case cover and a new gasket in position.

NOTE: Lightly coat the gasket in recommended sealant 'A'.

12. Slide the crankshaft pulley into position on the crankshaft to centralize the timing case cover.
13. Fit and tighten some of the bolts and washers to secure the timing case cover.
14. Remove the crankshaft pulley.
15. Fit and tighten the remainder of the bolts, washers and nuts.
16. Reverse procedures 1 to 5, except:
Tighten the crankshaft pulley securing bolt to a torque of 400 Nm (300 lbf ft).



ENGINE

TIMING GEARS

Idler Gear Removal and Refitment 4A-50-50

Special Tool: Dial Test Indicator Gauge.

Removal

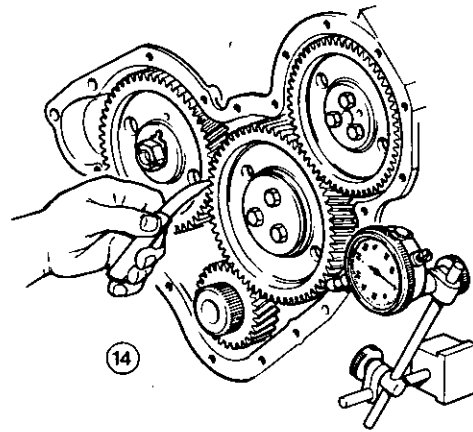
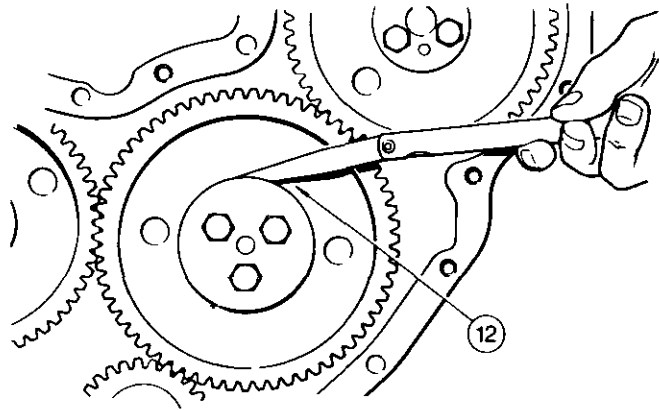
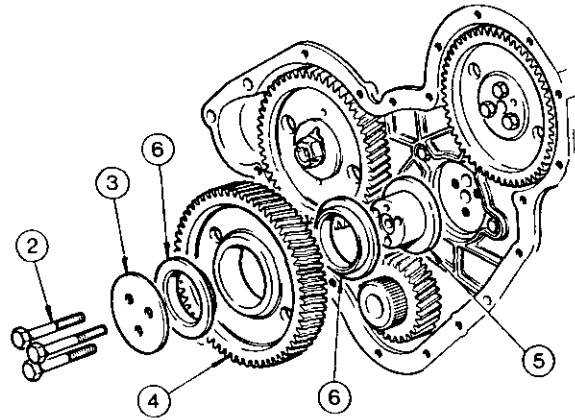
1. Remove the timing case cover, operation 4A-49-49.
2. Remove the bolts.
3. Remove the retaining plate.
4. Remove the gear.
5. Withdraw the hub.
6. If necessary, remove the bushes.

Refitment

7. Remove the rocker assembly, operation 4A-42-43.
8. Turn the crankshaft to T.D.C. Nos. 1 and 4 cylinders. (i.e. with the crankshaft gear keyway at the top of its periphery).
9. Reverse procedures 5 and 6, except:
 - (a) If new bushes are fitted, they must be bored to finished size after fitting.
 - (b) When refitting the hub, ensure that the oilway in the hub is aligned with the oilway in the cylinder block.
 - (c) Lubricate the hub and bushes with clean engine oil.
10. Refit the gear, aligning the timing marks on the crankshaft, camshaft, fuel pump and idler gears.
11. Reverse procedures 2 and 3, except: Tighten the bolts to a torque of 33 Nm (24 lbf ft).
12. Check the idler gear end float which should be between 0,076 and 0,178 mm (0-003 and 0-007 in).
13. Refit the rocker assembly, operation 4A-42-43, procedures 4, 5 and 6.
14. Check the timing gear backlash using either a dial test indicator gauge or feeler gauges. The backlash should be between 0,076 and 0,153 mm (0-003 and 0-006 in) between any two meshed gears. Check all points of mesh.

NOTE: Should the backlash obtained not be within the prescribed limits, replace the affected timing gears.

15. Refit the timing case cover, operation 4A-49-49.

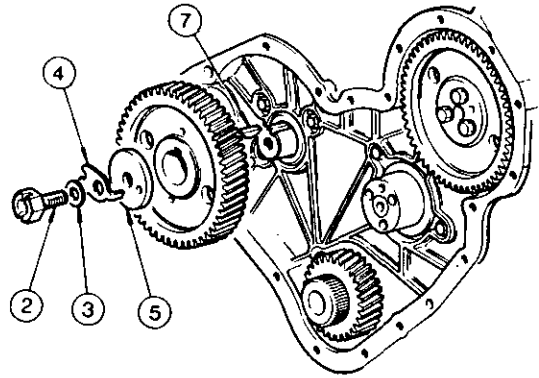


TIMING GEARS**Camshaft Drive Gear Removal and Refitment**
4A-51-51

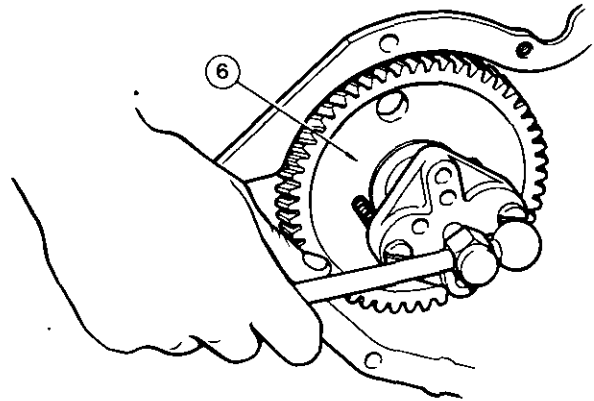
Special Tools: See Operation 4A-50-50, and
PD 155B Puller.
PD 155-1 Adaptor.

Removal

1. Remove the idler gear, operation 4A-50-50 procedures 1 to 5.
2. Remove the bolt.
3. Remove the washer.
4. Remove the tab washer.
5. Remove the retaining plate.
6. Using PD 155B and PD 155-1, remove the gear.
7. Remove the key.

**Refitment**

8. Reverse procedures 2 to 7, except:
 - (a) Ensure that the camshaft key is in good condition.
 - (b) Fit a new tab washer and bolt.
 - (c) Tighten the camshaft bolt to a torque of 68 Nm (50 lbf ft).
9. Refit the idler gear, operation 4A-50-50 procedures 7, 8 and 10 to 15.



ENGINE**TIMING GEARS****Fuel Pump Drive Gear Removal and Refitment**
4A-52-52

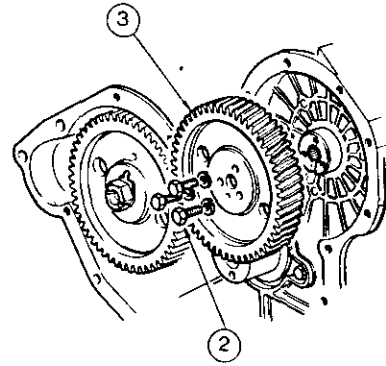
Special Tools: See Operation 4A-50-50.

Removal

1. Remove the idler gear, operation 4A-50-50 procedures 1 to 5.
2. Remove the bolts and the spring washers.
3. Remove the gear.

Refitment

4. Reverse procedures 2 and 3, except: Ensure that the dowel in the gear locates in the corresponding slot in the pump drive flange.
5. Refit the idler gear, operation 4A-50-50, procedures 7, 8 and 10 to 15.

**TIMING GEARS****Crankshaft Gear Removal and Refitment**
4A-53-52

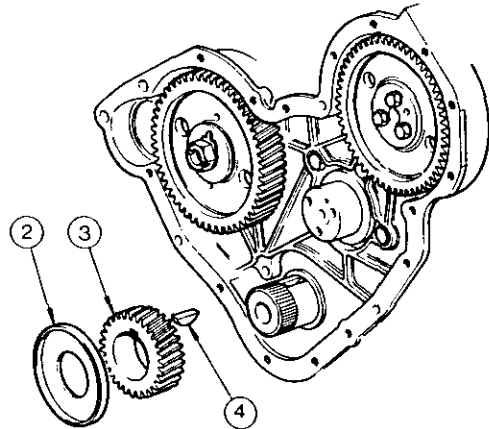
Special Tools: See Operation 4A-50-50.

Removal

1. Remove the idler gear, operation 4A-50-50, procedures 1 to 5.
2. Remove the oil thrower.
3. Withdraw the gear.
4. Remove the key.

Refitment

5. Reverse procedures 3 and 4.
6. Remove and refit the balancer unit, operation 4A-61-58 procedures 1 to 3, and 7 to 13.
7. Refit the idler gear, operation 4A-50-50.



TIMING CASE**Removal and Refitment**

4A-54-53

Special Tools: PD 155D Puller

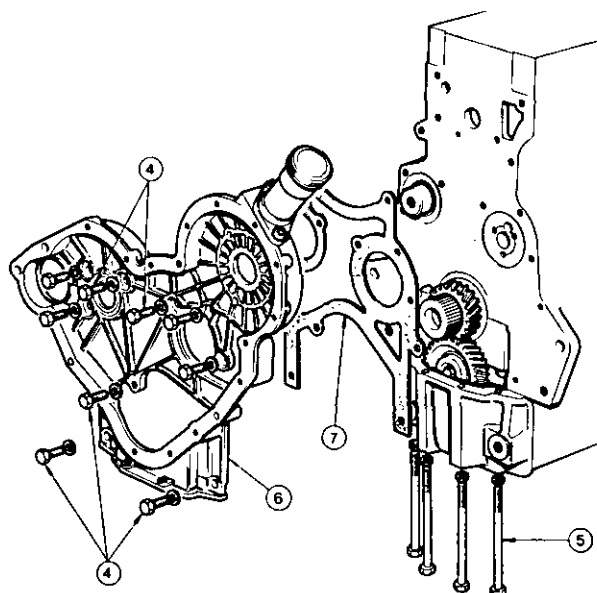
Dial Test Indicator Gauge

Removal

1. Remove the camshaft drive gear, operation 4A-51-51.
2. Remove the fuel pump drive gear, operation 4A-52-52, procedures 2 and 3.
3. Remove the fuel injection pump, Part 4C.
4. Remove the nine bolts and washers securing the timing case to the cylinder block.
5. Remove the four bolts and washers securing the timing case to the engine sump.
6. Remove the timing case.
7. Remove the gasket.
8. Remove the idler gear hub from the cylinder block.

Refitment

9. Reverse procedures 3 to 8, except: Fit a new gasket lightly coated in recommended sealant 'A'.
10. Refit the fuel pump drive gear, operation 4A-52-52, procedure 4.
11. Refit the camshaft drive gear, operation 4A-51-51, procedures 8 and 9.



ENGINE**FLYWHEEL****Removal and Refitment**

4A-55-54

Special Tools: See Part 5A, and
Dial Test Indicator Gauge.

Removal

1. Remove the clutch, Part 5A.
2. Remove the six bolts and tab washers.
3. Remove the flywheel.
4. If necessary, remove the pilot bearing.

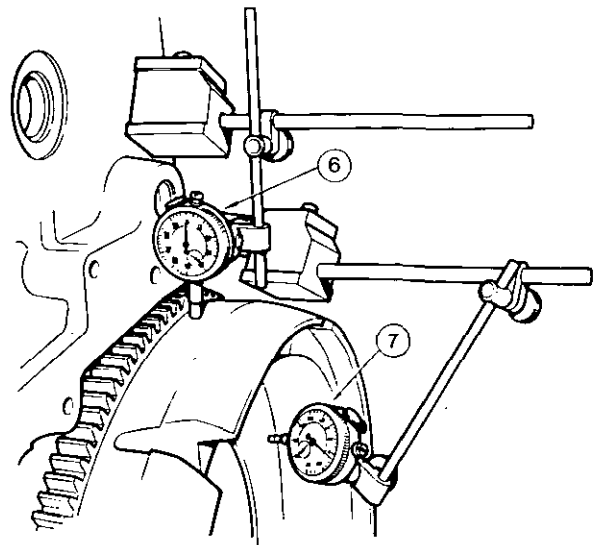
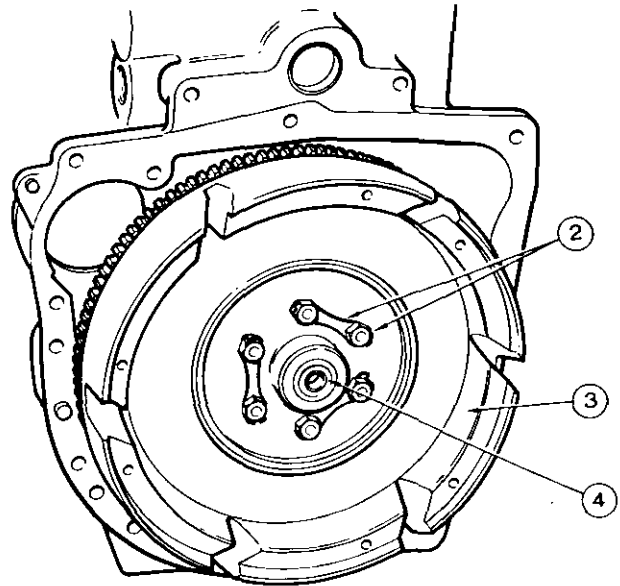
Refitment

5. Reverse procedures 2 to 4, except:
 - (a) Locate the flywheel on the crankshaft flange so that the untapped hole in the flange is in line with the unused hole in the flywheel.
 - (b) Tighten the flywheel bolts to a torque of 100 Nm (75 lbf ft) and secure with new tabwashers.
6. Using a dial test indicator gauge, adjust the dial so that the stylus is contacting the flywheel periphery. Turn the crankshaft and check the *total reading*. The flywheel should run true within 0,30 mm (0.012 in) total indicator reading.
7. Adjust the dial test indicator so that the stylus rests on the clutch face of the flywheel, parallel to the crankshaft at the outermost point of the face.

Press the crankshaft forwards to take up the end float, and turn the flywheel. The run out on the flywheel face should be within 0,025 mm (0.001 in) per 25 mm (1 in) of flywheel radius, measured from the crankshaft axis to the stylus of the dial test indicator gauge. If the run out is excessive, remove the flywheel, check and remove any burrs or foreign matter.

NOTE: If the flywheel is removed, procedures 5, 6 and 7 must be repeated.

8. Refit the clutch, Part 5A.



FLYWHEEL**Ring Gear Removal and Replacement 4A-56-55**

Special Tools: See Operation 4A-55-54

Removal

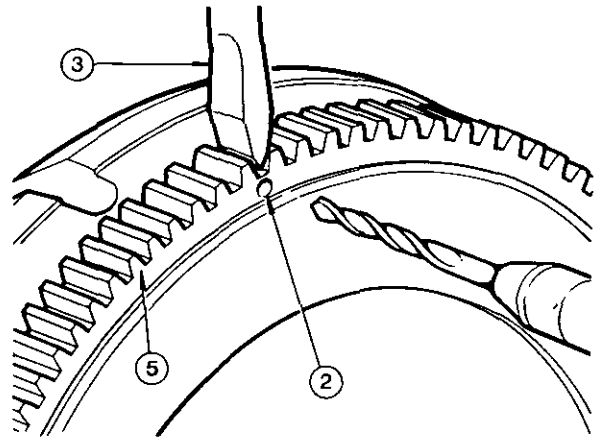
1. Remove the flywheel, operation 4A-55-54
2. Drill a 5 mm ($\frac{7}{16}$ in) diameter hole axially midway between the inside diameter of the ring gear, and the root of any tooth, to a depth of 16 mm ($\frac{5}{8}$ in) only, (otherwise damage to the flywheel will ensue).
3. Place a chisel in the root above the drilled hole.
4. Cover the flywheel and chisel point in a heavy cloth to protect the operator and others against flying fragments.

WARNING: Take precautions against flying fragments as the starter ring gear may disintegrate when struck.

5. Support the flywheel and strike the chisel sharply, and the ring gear should split.

Replacement

6. Heat the new ring gear to a temperature of 245°C (475°F) approximately, using an oven, NOT A NAKED FLAME.
7. Fit the gear ring over the flywheel with the 'lead in' on the teeth facing towards the front of the flywheel, push the ring gear towards the flywheel, push the ring gear fully home and allow to cool slowly.
8. Refit the flywheel, operation 4A-55-54.



ENGINE

CRANKSHAFT REAR MAIN OIL SEAL

Removal and Replacement 4A-57-56

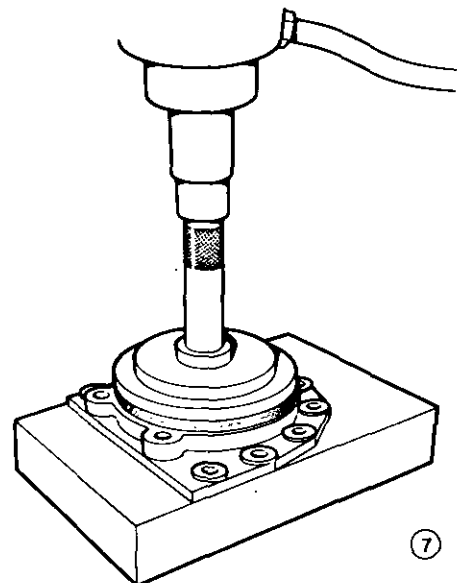
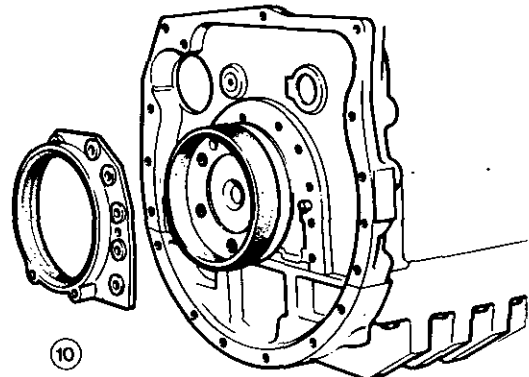
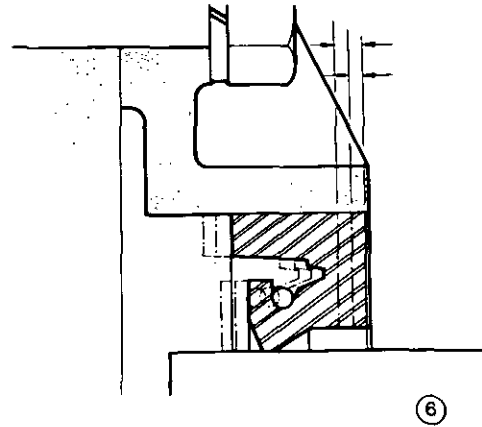
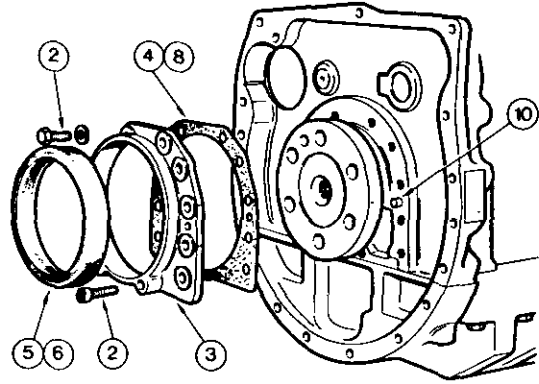
Special Tools: See Operation 4A-55-54 and
 PD 145-1 Oil Seal Replacer
 PD 145-2 Oil Seal Pilot

Removal

1. Remove the flywheel, operation 4A-55-54.
2. Remove the bolts, Allen screws and washers from the seal housing.
3. Remove the seal housing complete with oil seal.
4. Remove the gasket.
5. Remove the seal.

Replacement

6. On production, the lip seal is fitted with its rear face flush with the rear face of the seal housing. Examine the crankshaft flange and if it is found to be grooved the new seal should be pressed further into the housing in the first instance to 3.2 mm (0.125 in) and if required, a further equal distance resulting in a total of 6.4 mm (0.25 in). If all three positions have been used, the worn sealing area of the crankshaft may be machined. (See Operation 4A-68-65, procedure 14).
7. Lubricate the seal and the housing with clean engine oil, then using PD 145-1, press the seal into the housing to the required depth.
8. Fit a new gasket lightly coated in recommended sealant 'A'.
9. Lubricate the seat, the crankshaft flange and PD145-2.
10. Using PD 145-2, fit the seal and housing assembly, ensuring that the housing is correctly located on the dowels in the cylinder block.
11. Remove PD 145-2.
12. Reverse procedures 1 and 2.



ENGINE SUMP**Removal and Refitment**

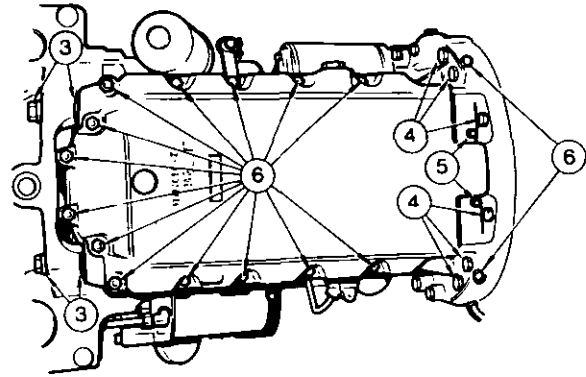
4A-58-57

Removal

1. Drain the engine oil.
2. Lightly support the centre of the sump with a trolley jack.
3. Remove the bolts, washers and shims.
4. Remove the bolts and washers.
5. Remove the nuts and washers.
6. Remove the bolts and washers.
7. Lower the jack and remove the sump.
8. Remove the old gasket.

Refitment

9. Reverse procedures 1 to 8 except:
 - (a) Use a new gasket lightly coated with recommended sealant 'A'.
 - (b) Ensure that the two shims are correctly located between the front axle casting and the engine sump casting.
 - (c) Tighten the sump to transmission casing bolts to a torque of 75 Nm (55 lbf ft).
 - (d) Tighten the front axle to sump bolts to a torque of 270 Nm (200 lbf ft).

**OIL PUMP****Removal and Refitment**

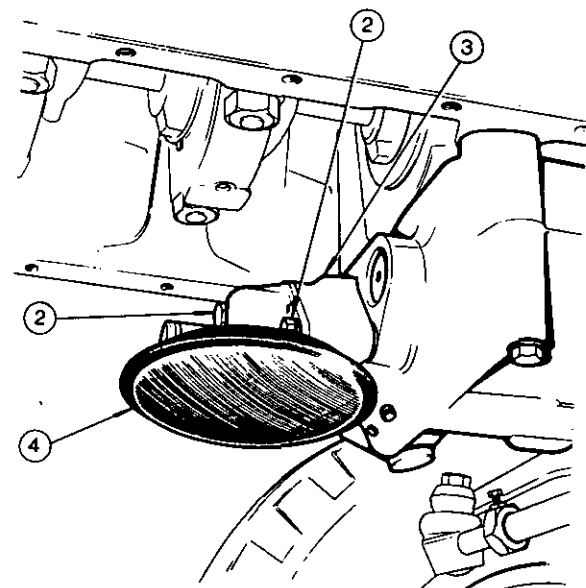
4A-59-57

Removal

1. Remove the sump operation 4A-58-57.
2. Remove the seven bolts.
3. Remove the pump.
4. Remove the strainer.

Refitment

5. Reverse procedures 1 to 4, except: Tighten the oil pump securing bolts to a torque of 28 Nm (21 lbf ft).



ENGINE

OIL PUMP

Servicing

4A-60-58

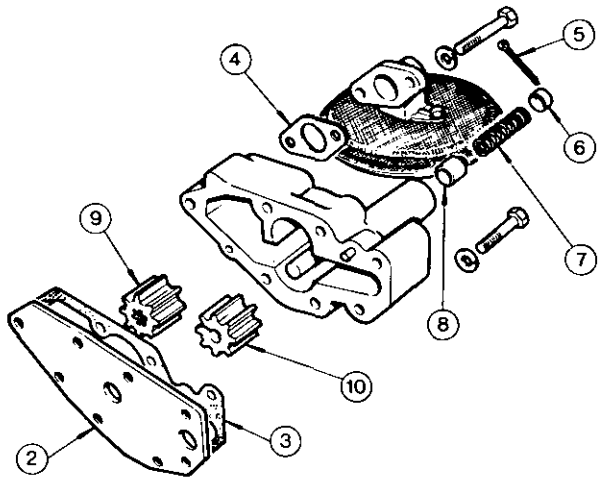
Disassembly

NOTE: The balancer unit drive and driven shafts, needle roller bearings, keys and oil pump gears must be changed after 5 000 hours work.

1. Remove the oil pump operation 4A-59-57.
 2. Remove the back plate.
 3. Remove the gasket.
 4. Remove the gasket.
 5. Remove the split pin.
 6. Remove the cap.
 7. Remove the relief valve spring.
 8. Remove the relief valve plunger.
 9. Remove the driving gear.
 10. Remove the driven gear.
- Examine all parts for wear, replace any parts whose condition is suspect.
New drive and driven gears must only be replaced in pairs.

Reassembly

11. Reverse procedures 1 to 10.



ENGINE BALANCER UNIT

Removal and Refitment

4A-61-58

Removal

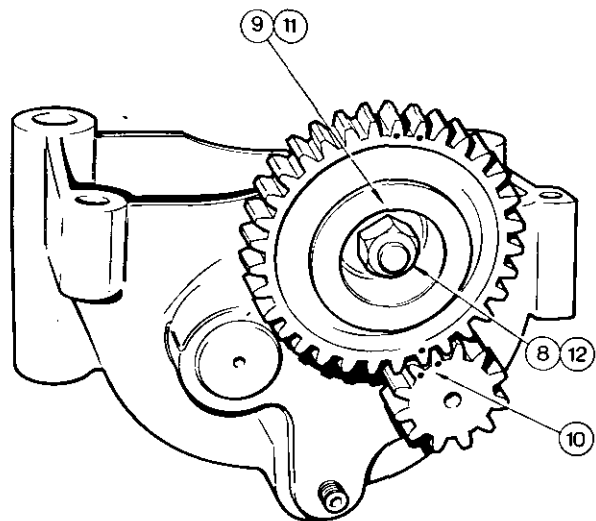
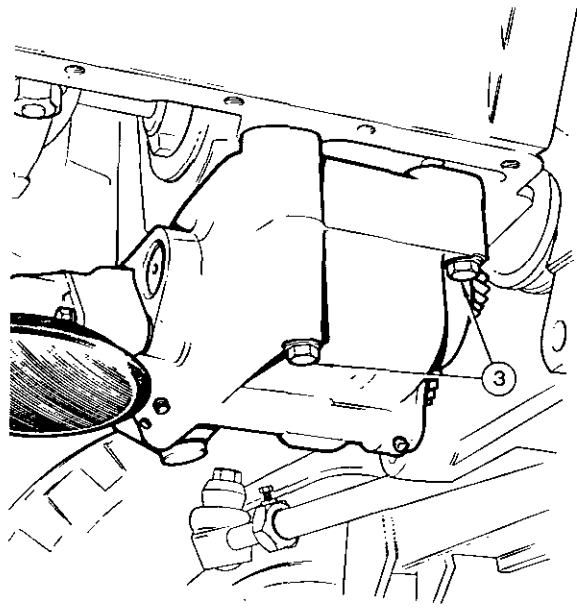
1. Remove the sump, operation 4A-58-57.
2. Support the balancer unit.
3. Remove the four bolts and washers, and remove the balancer unit.
4. Remove the oil pump, operation 4A-59-57, procedures 2 and 3.

Refitment

5. Refit the oil pump, operation 4A-59-57, except do not refit the sump.
6. Remove the timing case cover, operation 4A-49-49.
7. Turn the crankshaft to T.D.C. Nos. 1 and 4 cylinders, (i.e. with the crankshaft gear keyway at the top of its periphery).
8. Remove the nut.
9. Remove the idler gear hub.
10. Align the single mark on the idler gear between the double marks on the driven gear.
11. Refit the idler gear hub.

NOTE: Ensure that the dowel on the idler gear hub, locates through the thrust plate and into the corresponding hole in the balancer casing.

12. Refit the nut and tighten it to a torque of 49 Nm (36 lbf ft).
13. Ensure that the two thimbles on the rear upper face of the balancer casing are correctly located. Refit the balancer unit ensuring that the timing marks on the balancer unit driven gear, and idler gear, and idler gear and crankshaft gear are all aligned.
14. Refit the timing case cover, operation 4A-49-49.



ENGINE BALANCER UNIT**Servicing**

4A-62-59

Special Tool: 50 ton Hydraulic Press

Disassembly

NOTE: The balancer drive and driven shafts, needle roller bearings, keys and oil pump gears must be changed after 5 0000 hours work.

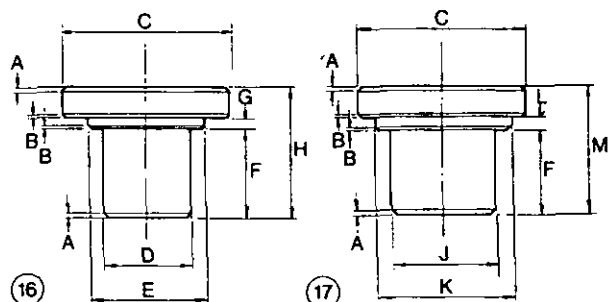
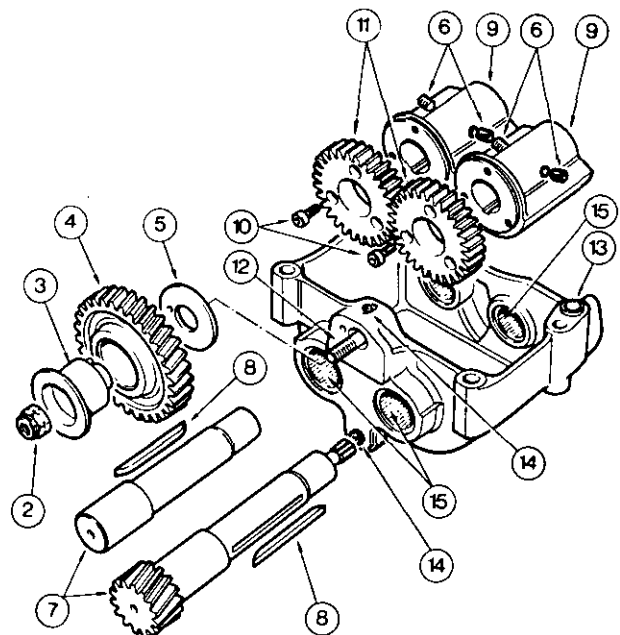
1. Remove the balancer unit, operation 4A-61-58.
2. Remove the nut.
3. Remove the idler gear hub.
4. Remove the idler gear.
5. Remove the idler gear thrust plate.
6. Remove the grub screws.
7. Using the 50 ton hydraulic press, press the shafts forwards out of the housing taking care that the keys do not damage the needle roller bearings.
8. Remove the keys.
9. Remove the balance weights complete with the drive gears.
10. If necessary, remove the Allen screws from each weight.
11. Remove the drive gears.
12. Remove the idler gear hub stud.
13. Remove the oilway thimbles.
14. Remove the seven oilway blanking plugs and flush the oilways clean.
15. If necessary, press out the needle roller bearings.

Reassembly

16. Press new small needle roller bearings into the rear end of the balancer unit, (ensuring that the writing on the rim of the bearing faces away from the balancer frame) using a tool made to the given dimensions and the 50 ton Hydraulic Press.
17. Press new large needle roller bearings into the front end of the balancer unit (ensuring that the writing on the rim of the bearing faces away from the balancer frame) using a tool made to the given dimensions, and the 50 ton Hydraulic Press.
18. Reverse procedures 1 to 14, except:
 - (a) Thoroughly degrease all male and female threads and apply a few drops of recommended sealant 'C' to the threads prior to reassembly.
 - (b) Tighten the six Allen screws, securing the gears to the balance weights, to a torque of 15 Nm (11 lbf ft).
 - (c) When refitting the two shafts, ensure that the balancer drive gears are enmeshed so that both keyways are at either T.D.C. or B.D.C.
 - (d) Extreme care must be taken when pressing in the shafts to ensure fouling of the keys and needle roller bearings does not occur.
 - (e) Tighten the two balance weight grub screws to a torque of 10 Nm (7 lbf ft).
 - (f) Ensure that the dowel on the idler gear hub locates in the corresponding hole in the balancer frame.
 - (g) Tighten the idler hub securing nut to a torque of 49 Nm (36 lbf ft).

Key to Figs 16 and 17

- A. 1,6 mm (0.63 in) \times 45° CHAMFER
- B. 0,8 mm (0.31 in) \times 45° CHAMFER
- C. 51 mm (2 in) dia.
- D. 25,298 mm (0.996 in) dia.
- E. 32,944 mm (1.297 in) dia.
- F. 25,4 mm (1 in)
- G. 2,769 mm (0.109 in)
- H. 37,719 mm (1.485 in)
- J. 31,648 mm (1.246 in) dia.
- K. 40,869 mm (1.609 in) dia.
- L. 3,572 mm (0.141 in)
- M. 38,506 mm (1.516 in)



ENGINE**CONNECTING ROD BIG END BEARING****Removal and Refitment**

4A-63-60

Removal

1. Remove the balancer unit, operation 4A-61-58, procedures 1 to 3.
2. Rotate the crankshaft until the required bearing is at B.D.C.
3. Remove the two nuts from the big end bolts.
4. Remove the big end cap complete with the shell bearing, and then remove the bearing from the big end cap.
5. Remove the big end bolts.
6. Rotate the crankshaft until the shell bearing can be removed from the connecting rod.
7. Repeat procedures 2 to 6 for the remaining big end bearings.

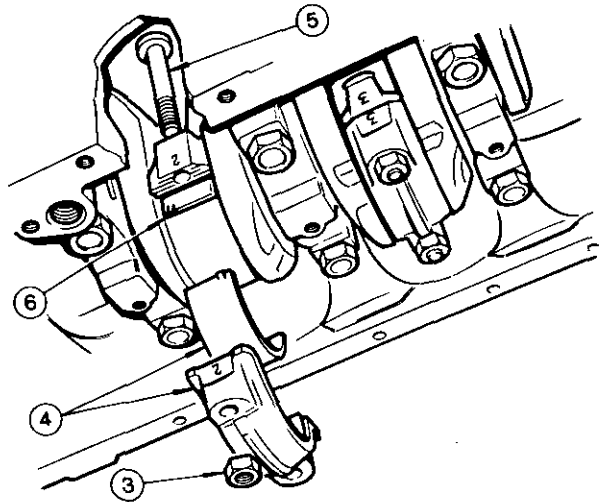
Examine the shell bearings for wear and scoring. If any bearing is found to be suspect, replace the complete set.

Check the crankpins for wear and ovality using a micrometer. Check the diameter of the crankpins in the horizontal plane and the vertical plane at each end of the crankpin.

Crankpin wear and ovality should not exceed 0,0381 mm (0,0015 in). The crankshaft should be re-ground or replaced if these limits are exceeded.

Refitment

8. Reverse procedures 1 to 7, except:
 - (a) Ensure that all components are scrupulously clean and lubricated with clean engine oil.
 - (b) Ensure that the steps on the shell bearing halves fit into the slots on the connecting rods and that the bearings are re-fitted in their original positions and are properly seated.
 - (c) Ensure that the flats on the connecting rod bolts are located against the shoulders on the connecting rods.
 - (d) Ensure that the connecting rod and the end cap are refitted with the identification marks together and are on the left hand side of the engine.
 - (e) Tighten the big end nuts to a torque of 95 Nm (70 lbf ft).
 - (f) The connecting rod big end cap attachment bolts are special bolts and should they require replacement, only bolts supplied by the manufacturer should be used.



PISTONS AND CONNECTING RODS**Removal and Refitment 4A-64-61**

Special Tools: 38 U3 Piston Ring Compressor
PD 41B Piston Height Gauge

Removal

1. Remove the cylinder head, operation 4A-46-45.
2. Remove the connecting rod big end bearings, operation 4A-63-60.
3. Push the pistons and connecting rods out of the top of the cylinders.

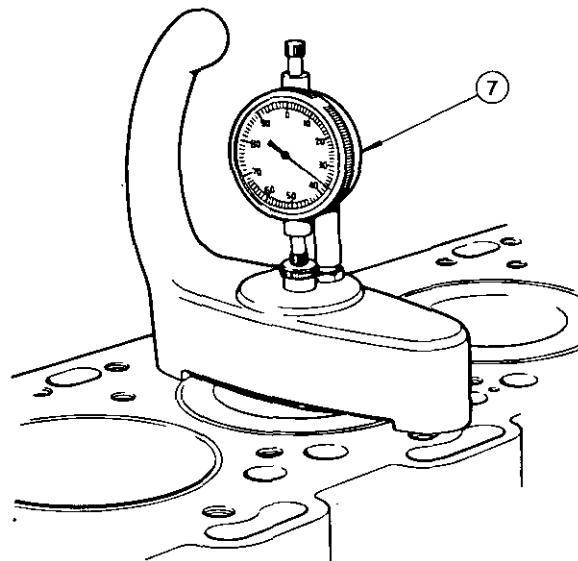
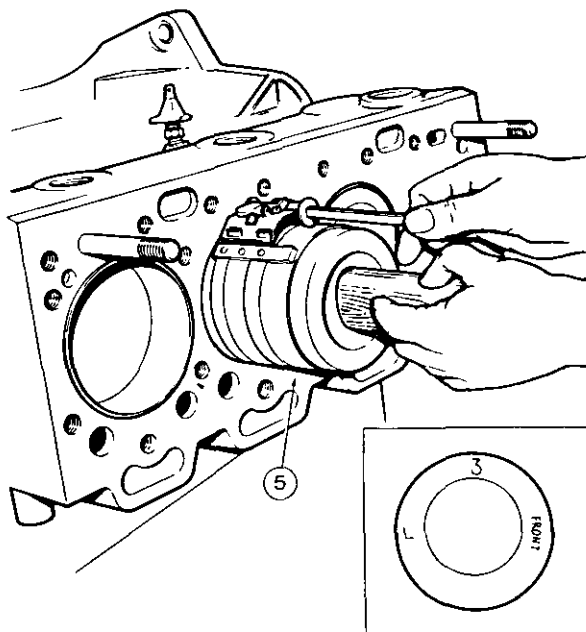
Refitment

Check the condition of the pistons, piston rings and cylinder liners, and if any doubt as to their serviceability, replace them.

4. Clean all parts thoroughly, and freely lubricate with clean engine oil.

NOTE: Position the piston rings on the pistons so that the ring gap on each piston ring is 180° from the gap in the previous piston ring.

5. Using 36 U3 and a suitable piece of hardwood, insert the piston and connecting rod assemblies into the top of their respective cylinder bores, ensuring that the word "front" on the piston crown is towards the front of the engine.
6. Refit the connecting rod big end bearings, operation 4A-63-60, except, do not refit the balancer unit and sump.
7. Using PD 41B, check the piston height. The piston should be 0,08 to 0,25 mm (0.003 to 0.010 in) above the top face of the cylinder block.
8. Refit the balancer unit, operation 4A-61-58, except do not refit the front axle.
9. Refit the cylinder head, operation 4A-46-45.



ENGINE

PISTONS AND CONNECTING RODS

Servicing

4A-65-62

Special Tools: See Operation 4A-63-60
 335 Connecting Rod Alignment Jig
 336.102 Arbor Adaptor

Disassembly

1. Remove the pistons and connecting rods, operation 4A-63-60.
2. Remove the rings from each piston.
3. Remove the circlips.
4. Warm the piston in clean liquid to a temperature of 38 to 50°C (100 to 120°F).
5. Carefully withdraw the gudgeon pins.
6. Remove all traces of carbon deposits from the pistons with particular attention to the ring grooves.
7. Check the vertical groove clearance with a new ring fitted. The piston should be replaced if the limits are exceeded.
8. Examine the pistons for signs of scoring.
9. Check the gap of the piston rings when they are fitted in the unworn portion at the top of the cylinder bore.
10. Check the fit of the gudgeon pins in the piston bores and small end bearings.
11. If necessary, press out the small end bushes from the connecting rods.

Reassembly

12. If necessary, press new small end bushes into the connecting rod aligning the oil hole in the bush with the hole in the top of the connecting rod.

NOTE: The reaming of the small end bush is a precision task and should only be undertaken by a skilled machinist.

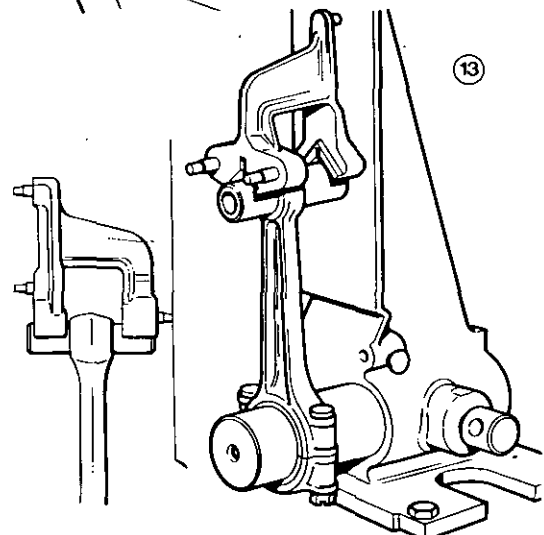
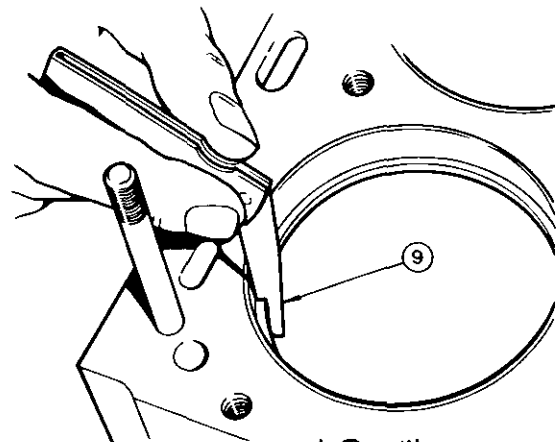
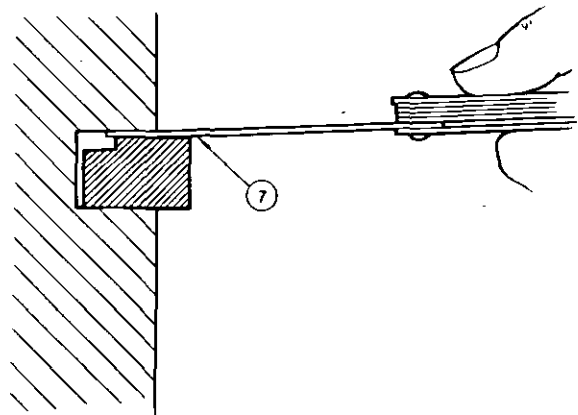
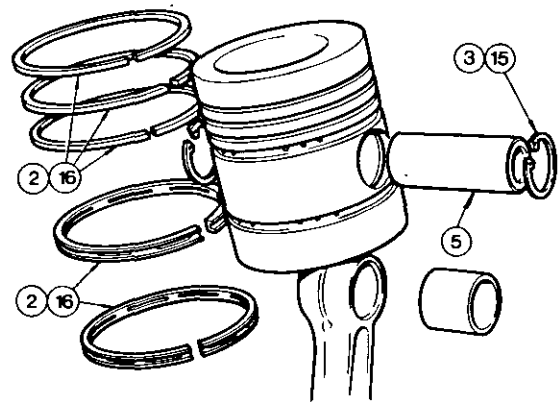
13. Using 335, check the connecting rod for parallelism and squareness, if any distortion is found, the connecting rod must be replaced.
14. Warm the piston in clean liquid, assemble the pistons to their corresponding connecting rods and insert the gudgeon pins.

NOTE: The cavity in the piston crown is off-set towards one side of the piston. Assemble the pistons to the connecting rods with the cavity towards the side of the connecting rod which carries the connecting rod and big end cap identification.

15. Fit two new circlips.
16. Fit the piston rings in the following order:
 - A4.236 Engines:
 - (a) Slotted scraper—below gudgeon pin.
 - (b) Slotted scraper—above gudgeon pin.
 - (c) Internally stepped compression—third groove.
 - (d) Internally stepped compression—second groove.
 - (e) Parallel chrome plated compression—top groove.
 - A4.248 Engines:
 - (a) Spring loaded scraper—above gudgeon pin.
 - (b) Internally stepped compression—third groove.
 - (c) Internally stepped compression—third groove.
 - (d) Parallel chrome plated compression—top groove.

NOTE: The internally stepped compression rings must be fitted with the step towards the piston crown.

17. Refit the pistons and connecting rods, operation 4A-63-60.



CYLINDER LINERS**Removal and Refitment** 4A-66-63

Special Tools: See Operation 4A-64-61, and
 PD 150 Liner Remover and Replacer
 PD 150-1B Adaptors (A4. 236
 Engine)
 PD 150-7A Adaptors (A4. 248
 Engine)
 30 ton Hollow Hydraulic Ram

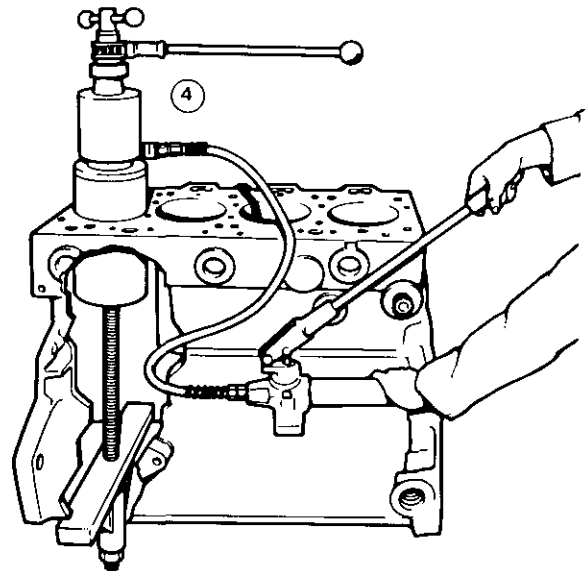
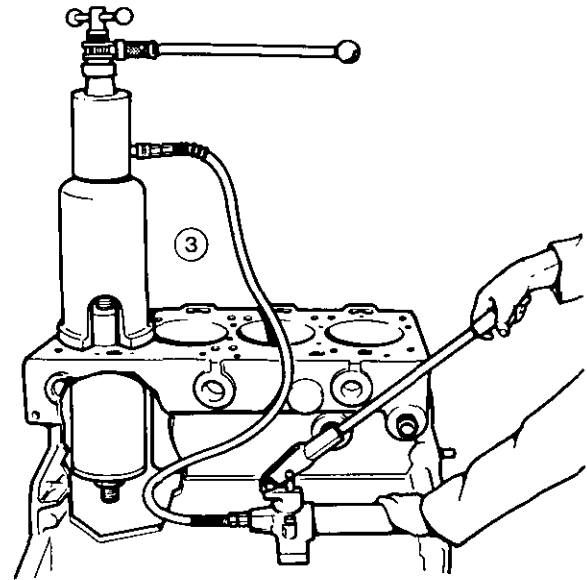
Removal

1. Remove the pistons and connecting rods, operation 4A-64-61.
2. Remove the studs from the cylinder block face.
3. Using PD 150, the appropriate adaptors and a 30 ton hollow hydraulic ram, withdraw the cylinder liners through the top of the cylinder block.

NOTE: The PD 150 cylinder liner remover and replacer tool, is designed for the field service of single liners. Should the tool be required for general workshop overhaul duties, it is advisable to use it in conjunction with a 30 ton hollow hydraulic ram, (Suitable examples are Epco P382 or Pickavant LRH 30), with a hand, or electrically operated hydraulic pump.

Replacement

4. Reverse procedures 1 to 3, except:
 - (a) Care must be taken in the handling and storage of cylinder liners. The slightest burr or damage will cause considerable distortion when the liner is put into the cylinder block.
 - (b) Flanged cast iron liners must not be rebored, but must be replaced with new pre-finished service liners.
 - (c) Prior to pressing in the new liner, the cylinder block parent bore and the new liner must be thoroughly cleaned, in particular the recess for the liner flange in the top of the parent bore.
 - (d) Liberally lubricate all parts with clean engine oil before refitment.
 - (e) Ensure that the liner flange does not foul the counter bore at the top of the parent bore.
 - (f) The top face of the liner should be between 0,102 and 0,203 mm (0-004 and 0-008 in) below the top face of the cylinder block, when fully home.
 - (g) Check the condition of the piston rings, if in any doubt as to their serviceability, replace them.
 - (h) Allow a settling period to elapse before checking the fitted internal bore diameters of the liners.
 - (i) Each liner should be checked in three positions, top, centre and bottom, and the readings being taken transversely and parallel to the centre of the cylinder block.



ENGINE**CRANKSHAFT****Thrust Washers Removal and Replacement**

4A-67-64

Removal and Replacement

1. Remove the oil pump, operation 4A-59-57.
2. Push the crankshaft rearwards, and check the crankshaft end float between the rear thrust bearing and the crankshaft. The clearance obtained should be between 0,050 and 0,380 mm (0-002 and 0-015 in).
3. If the end float is not within these limits, proceed as follows:
4. Remove the two bolts.
5. Remove the centre main bearing cap, complete with the two bottom half thrust washers.
6. Push the two top half thrust washers around the crankshaft journal with a piece of wire, until they can be removed.
7. Lubricate all components before refitting.
8. Slide two new top half thrust washers, with the steel side towards the bearing housing, into position.
9. Locate the two new bottom half thrust washers on the centre main bearing cap, and refit the bearing cap.
10. Refit the bolts, and tighten them to a torque of 203 Nm (150 lbf ft).
11. Repeat procedure 2.
12. If the end float is still not correct, oversize thrust washers can be fitted, repeat procedures 3 to 10.

NOTE: The top and bottom thrust washer halves must be the same thickness.

13. Refit the oil pump, operation 4A-59-57.



CRANKSHAFT**Removal and Refitment**

4A-68-65

Special Tools: See Part 5A

PD 145-1 Oil Seal Replacer

PD 145-2 Oil Seal Pilot

PD 155B Puller

550 Universal Handle

Dial Test Indicator Gauge

Removal

1. Drain the engine oil.
2. Split the tractor between the front axle and the engine and between the engine and the transmission, Part 3A.
3. Mount the engine on a suitable stand.
4. Remove the crankshaft rear main oil seal, operation 4A-57-56.
5. Remove the timing case, operation 4A-54-53.
6. Remove the connecting rod big end bearings, operation 4A-63-60.
7. Remove the crankshaft thrust washers, operation 4A-67-64, procedures 4 to 6.
8. Remove the rear main bearing bridge piece and seals.
9. Remove the crankshaft gear and key.
10. Remove the eight bolts securing the remainder of the crankshaft main bearing caps.
11. Remove the four remaining main bearing caps complete with the half shell bearings.
12. Lift out the crankshaft.
13. Remove the five half shell bearings from the engine casing.
14. Thoroughly clean all parts.

Check the crankpins and journals for wear and ovality, using a micrometer. The diameter of the crankpins and journals must be checked in the vertical and horizontal planes at both ends of the crankpins and journals. The wear and ovality must not exceed 0,0361 mm (0-0015 in).

Crack detect and de-magnetize the crankshaft.

The main journals and crankpin diameters can be re-ground to the following sizes:—

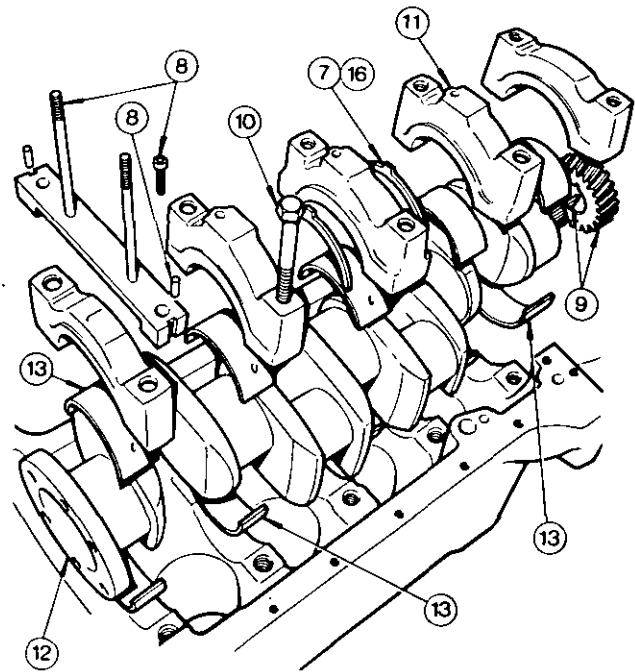
- (a) 0,254 mm (0-010 in)
- (b) 0,508 mm (0-020 in)
- (c) 0,762 mm (0-030 in)

If the crankshaft needs to be re-ground below 0,762 mm (0-030 in), a new crankshaft must be fitted.

Crankpin width may increase with regrinding, but must not exceed 40,55 mm (1-5965 in). It is important that the radii on the main and crankpin journals are maintained. After regrinding, the sharp corners on the oil holes must be removed.

Tufftrided crankshafts must be re-Tufftrided after re-grinding. If Tufftriding facilities are not available, a new crankshaft must be fitted.

If all three positions for the rear main oil seal have been used, the sealing area of the crankshaft flange must be re-ground. Only the minimum amount of metal should be ground off to ensure removal of the seal wear grooves. The oil seal flange must not be machined below 113,17 mm (5-243 in) minimum diameter. It is not necessary to re-Tufftride the flange. Crack test and de-magnetize the crankshaft.

**Refitment**

15. Reverse procedures 8 to 14, except:
 - (a) Ensure that the oilways in the cylinder block and crankshaft are free from obstruction.
 - (b) Check the main bearing cap attachment bolts for stretch. Only bolts supplied by the engine manufacturer should be used, as they are special bolts.
 - (c) Ensure all components are scrupulously clean and freely lubricated with clean engine oil.
 - (d) The main bearing caps are numbered, No. 1 commencing at the front of the engine. Each cap is also marked with a serial number as stamped on the cylinder block bottom face. These should read in line.
 - (e) Tighten the main bearing bolts to a torque of 203 Nm (150 lbf ft).
 - (f) The rear face of the bridge piece must be flush with the rear face of the block.
16. Refit the crankshaft thrust washers, operation 4A-67-64, procedures 7 to 12.
17. Refit the connecting rod big end bearings, operation 4A-63-60.
18. Refit the timing case, operation 4A-54-53.
19. Refit the crankshaft rear main oil seal, operation 4A-57-56.
20. Refit the engine, Part 3A.
21. Refill the engine with an approved oil.

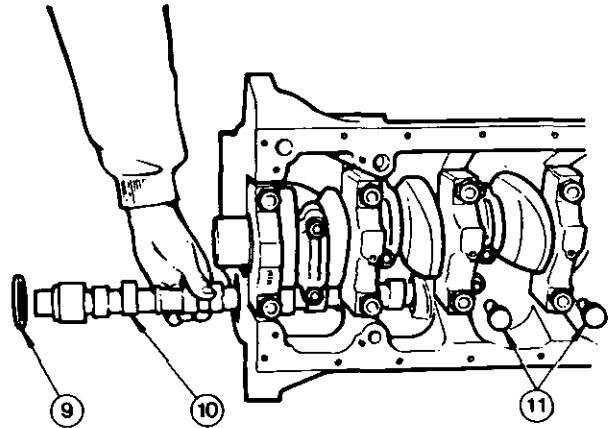
ENGINE**CAMSHAFT AND TAPPETS****Removal and Refitment**

4A-69-66

Special Tools: See Part 3A
PD 155-B Puller.

Removal

1. Drain the engine oil.
2. Split the tractor between the front axle and the engine, and between the engine and the transmission.
3. Remove the rocker assembly, operation 4A-42-43.
4. Remove the timing case, operation 4A-54-53.
5. Remove the pushrods.
6. Remove the fuel lift pump, Part 4C.
7. Invert the engine on a suitable stand.
8. Remove the balancer unit, operation 4A-61-58.
9. Withdraw the camshaft thrust washer.
10. Withdraw the camshaft.
11. Remove the tappets and retain them in the order in which they were removed.

**Refitment**

12. Reverse procedures 1 to 11, except:
 - (a) Clean and freely lubricate all parts prior to reassembly.
 - (b) Ensure when refitting the camshaft thrust plate, that the hole in the plate locates correctly over the dowel protruding from the engine block.
 - (c) Check the protrusion of the camshaft thrust washer above the face of the cylinder block, this should be between 0,10 and 0,41 mm (0-004 and 0-016 in).

COOLING SYSTEM

Part 4 - Section B

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GENERAL

The coolant is circulated by thermo-syphon action assisted by a centrifugal type pump. The system is controlled by a thermostat which prevents the coolant from flowing through the radiator until the correct working temperature has been achieved, and a pressure-sensitive radiator cap, which, by allowing the radiator to pressurise, raises the temperature at which the coolant will boil. A fan attached to the front of the engine assists cooling by drawing air through the radiator.

The water pump and cooling fan are driven by a belt, which is driven by a pulley splined to the front of the crankshaft.

COOLING SYSTEM

FAULT	POSSIBLE CAUSE	SUGGESTED REMEDY
OVERHEATING	Engine racing or pulling hard	Select the correct gear to suit conditions.
	Radiator water level	Fill to the correct level, check for leaks at joints and hoses, rectify as necessary.
	Loose fan belt	Adjust the fan belt tension, Part 9A.
	Radiator cap leaking or valve spring defective	Replace the radiator cap.
	Radiator matrix blocked	Clean the radiator using a reverse flow of air or water.
	Water flow restricted	Check the thermostat operation and replace if necessary, operation 4B-04-05 (AD3. 152 Engine) 4B-09-08 (A4. 236/A4. 248 Engine)
	Water flow restricted	Reverse flush the cooling system
ENGINE RUNS COOL	Water flow restricted	Service or renew the water pump, operation 4B-10-07 (AD3. 152 Engine) 4B-11-08 (A4. 236/A4. 248 Engine)
	Operating conditions (i.e. Cold head winds)	Blank off a portion of the radiator.
	Thermostat stuck open	Replace the thermostat, operation 4B-03-04 (AD3. 152 Engine) 4B-04-04 (A4. 236/A4. 248 Engine)

FAULT DIAGNOSIS

The faults listed are cooling system faults only and do not cover *engine* defects which may contribute towards overheating.

FROST PRECAUTIONS

There are three main methods of protecting the cooling system during frost conditions.

1. Draining the cooling system after each day's work.

This method leaves the system unprotected in the idle periods during the day, and in extreme conditions the cooling system may freeze while the engine is running. Erosion of the water pump impeller may be accelerated in hard water conditions due to the frequent draining and refilling of the system.

2. Use of heated premises, engine or sump heaters. This method also leaves the engine unprotected during the idle periods in the day and in extremely cold conditions.

3. Anti-Freeze Solutions.

Generally the most efficient method of protecting cooling systems, but due to the penetrating properties of the solution, all hoses and joints should be in good condition. A cooling system which is normally free of leaks may well develop them when filled with an Anti-freeze solution. Leakage may not occur immediately after initial filling of the system, but may develop shortly afterwards. This should be considered and the necessary checks carried out.

NOTE : Only the Anti-freeze solutions listed in the Specification section should be used. The use of inferior grades of Anti-freeze (including some solutions conforming to BS 3151) can cause severe damage to the cooling system.

COOLING SYSTEM

RADIATOR (AD3. 152 Engine)**Removal and Refitment**

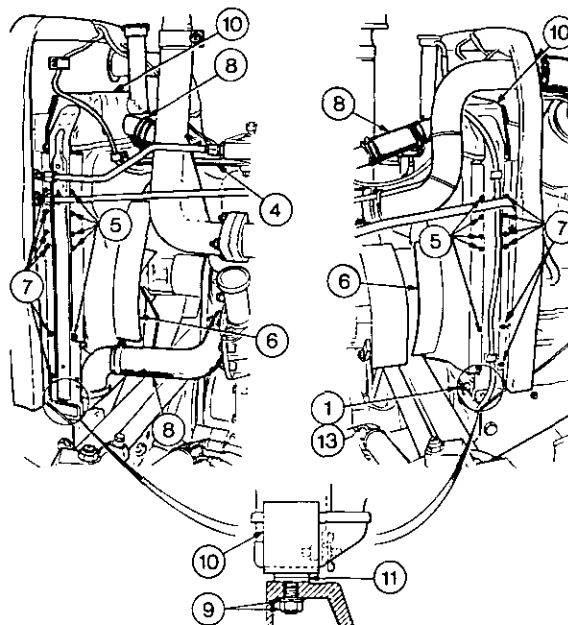
4B-01-03

Removal

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Remove the side panels, Part 2A.
4. Remove the stay bar.
5. Remove the 11 screws securing the fan shroud to the radiator.
6. Move the fan shroud rearwards.
7. Remove the 12 screws securing the radiator to the front bulkhead.
8. Disconnect the radiator top and bottom hoses.
9. Remove the two nuts and washers from underneath the front axle support casting.
10. Manoeuvre the radiator upwards, clear of the engine.
11. If necessary, remove the steel and rubber blocks.

Refitment

12. Reverse procedures 2 to 11.
13. Close the radiator and engine drain taps.
14. Fill the radiator with an approved coolant.
15. Refit the radiator cap.
16. Run the engine until the normal operating temperature is reached, and check the coolant level again.

**RADIATOR (A4. 236 and A4. 248 Engines)****Removal and Refitment**

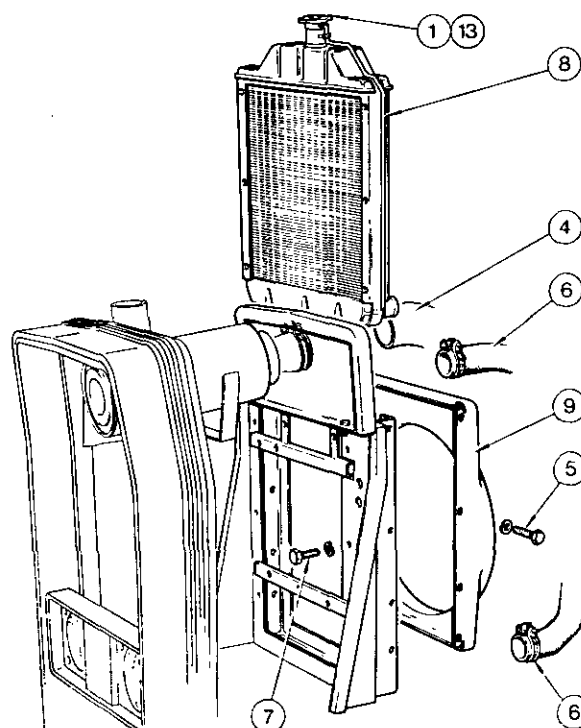
4B-02-03

Removal

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Remove the front grille.
4. Disconnect the hose at the rear of the air cleaner.
5. Remove the eight bolts securing the fan shroud to the radiator.
6. Disconnect the radiator top and bottom hoses.
7. Remove the six bolts securing the radiator to the front bulkhead.
8. Manoeuvre the radiator upwards clear of the engine.
9. Remove the fan shroud (if necessary).

Refitment

10. Reverse procedures 2 to 9.
11. Close the radiator and engine drain taps.
12. Fill the radiator with an approved coolant.
13. Refit the radiator cap.
14. Run the engine until the normal operating temperature is reached, and check the coolant level again.

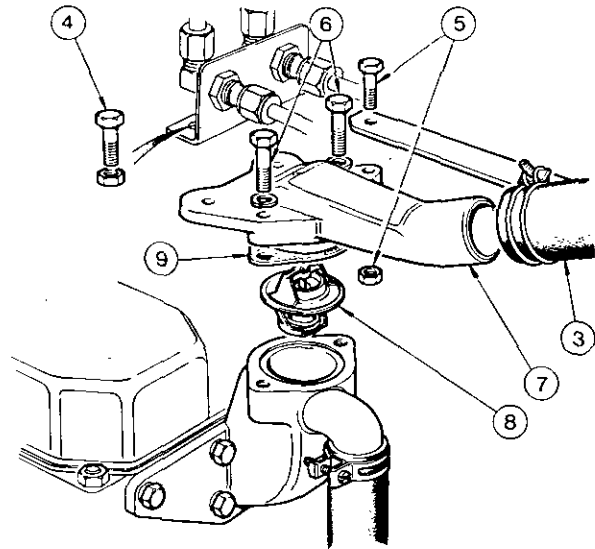


COOLING SYSTEM**THERMOSTAT (AD3. 152 Engine)****Removal and Refitment 4B-03-04****Removal**

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and engine block.
2. Remove the hood, Part 2A.
3. Disconnect the radiator top hose.
4. Remove the two nuts and bolts.
5. Remove the nut and bolt.
6. Remove the two bolts.
7. Remove the cover.
8. Remove the thermostat.
9. Remove and discard the gasket.

Refitment

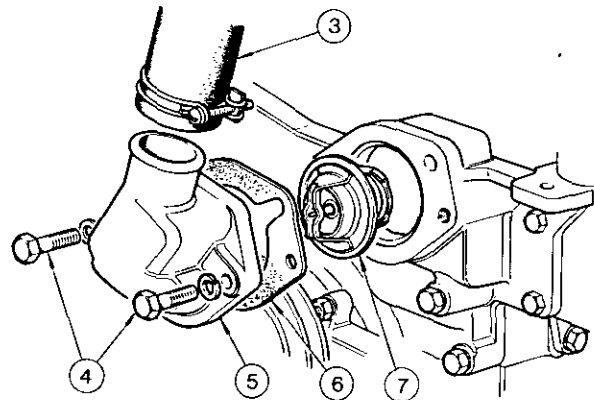
10. Reverse procedures 1 to 9, except:
 - (a) Fit a new gasket lightly coated with recommended sealant 'A'.

**THERMOSTAT (A4. 236 and A4. 248 Engines)****Removal and Refitment 4B-04-04****Removal**

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Remove the radiator top hose.
4. Remove the two bolts and spring washers.
5. Remove the thermostat cover.
6. Remove and discard the gasket.
7. Withdraw the thermostat.

Refitment

8. Reverse procedures 1 to 7, except:
 - (a) Fit a new gasket lightly coated with recommended sealant 'A'.

**THERMOSTAT****Servicing 4B-05-04**

Special Tool: Thermometer

Servicing

Thermostats are not repairable and, if faulty, should be replaced.

1. Remove the thermostat, operation 4B-03-04 (AD3. 152 engines).
4B-04-04 (A4. 236 and A4. 248 engines)
2. Check the operating temperature of the thermostat, which is stamped on the top face of the thermostat next to the valve seat.

NOTE: Ensure that the thermometer has a range of 0° to 110°C (32° to 230°F).

3. Immerse the thermostat and the thermometer in water.
4. Gradually heat the water.
5. Monitor the reading on the thermometer and check the temperature at which the thermostat starts to open.
6. Refit or replace the thermostat as required, operation 4B-03-04 (AD3. 152 engines).
4B-04-04 (A4. 236 and A4. 248 engines)

THERMOSTAT HOUSING (AD3. 152 Engine)**Removal and Refitment**

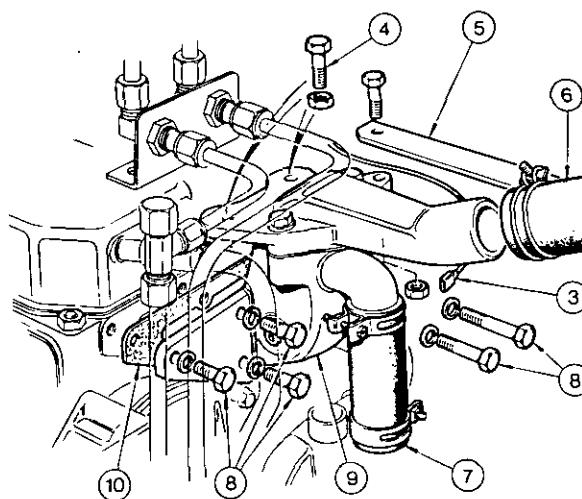
4B-06-05

Removal

1. Remove the radiator cap and drain the cooling system via the drain taps on the radiator and the engine block.
2. Remove the hood, Part 2A.
3. Disconnect the water temperature sensor cable.
4. Remove the two nuts and bolts.
5. Disconnect the stabilizer arm.
6. Disconnect the radiator top hose.
7. Disconnect the water pump hose.
8. Remove the five bolts and washers.
9. Separate the thermostat housing from the cylinder head.
10. Remove and discard the gasket.

Refitment

11. Reverse procedures 1 to 10, except:
 - (a) Fit a new gasket lightly coated with recommended sealant 'A'.

**THERMOSTAT HOUSING (A4. 236 and A4. 248 Engines)****Removal and Refitment**

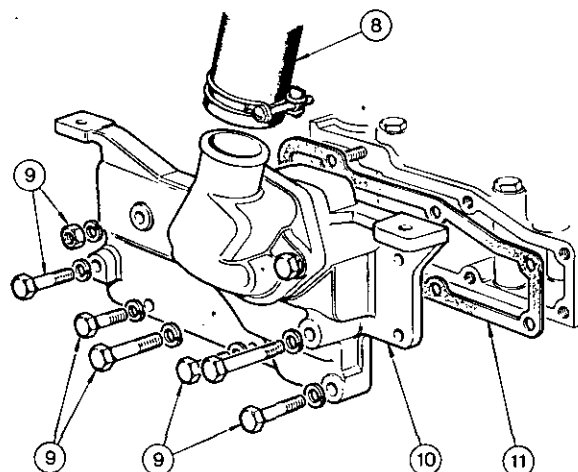
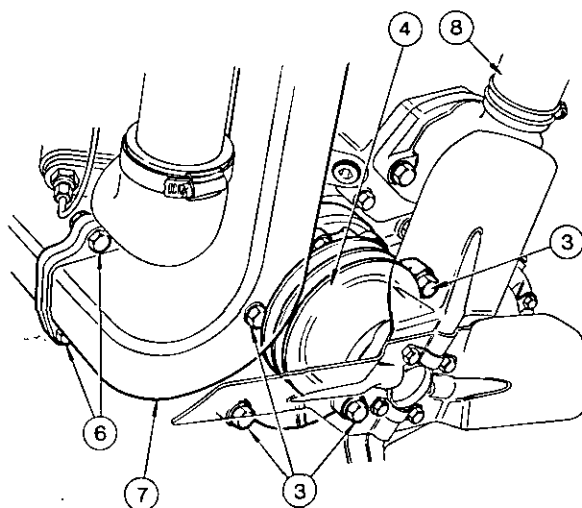
4B-07-05

Removal

1. Split the tractor between the engine and the front axle, Part 3A.
2. Remove the alternator, Part 9A.
3. Remove the four bolts and washers.
4. Remove the water pump complete with rear body.
5. Remove and discard the gasket.
6. Remove the three nuts and bolts.
7. Remove the front section of the exhaust manifold.
8. Disconnect the radiator top hose.
9. Remove the six bolts and one nut complete with washers.
10. Remove the thermostat housing.
11. Remove and discard the gasket.

Refitment

12. Reverse procedures 1 to 11, except:
 - (a) Fit new gaskets lightly coated with recommended sealant 'A'.



COOLING SYSTEM

WATER PUMP (AD3. 152 Engine)

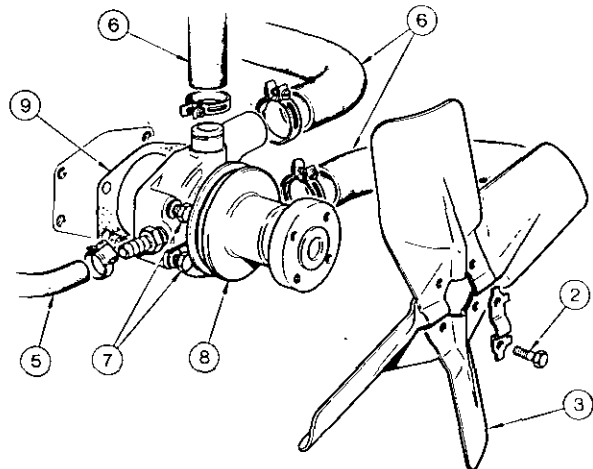
Removal and Refitment 4B-08-06

Removal

1. Remove the radiator, operation 4B-01-03.
2. Remove the four bolts and tab washers.
3. Remove the fan blades.
4. Slacken the alternator mounting bolts and remove the fan belt.
5. Disconnect the heater hose.
6. Disconnect the inlet and the outlet hoses.
7. Progressively slacken the four bolts.
8. Remove the water pump.
9. Remove and discard the sealing gasket.

Refitment

10. Reverse procedures 1 to 9, except:
 - (a) Fit a new gasket, lightly coated with recommended sealant 'A'.
 - (b) When refitting the fan blades, fit new tab washers.
 - (c) Adjust the fan belt tension, Part 9A.



WATER PUMP (A4. 236 and A4. 248 Engines)

Removal and Refitment 4B-09-06

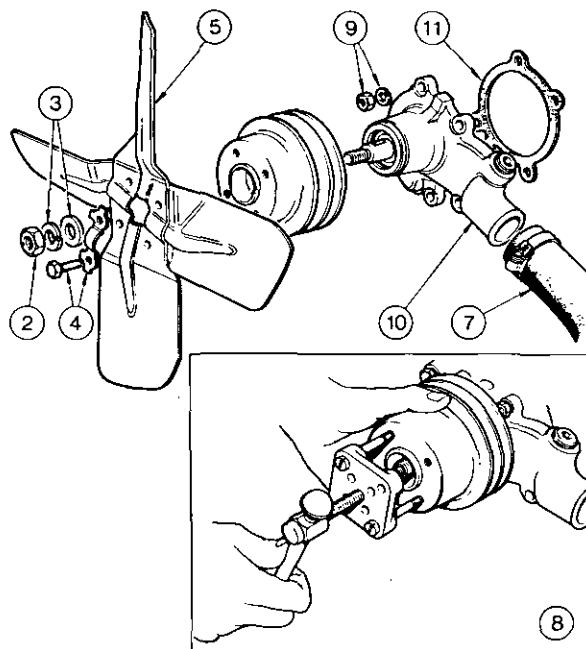
Special Tools: PD 155B Puller
PD 155-1 Adaptors

Removal

1. Split the tractor between the engine and the front axle, Part 3A.
2. Remove the nut.
3. Remove the spring washer and the plain washer.
4. Remove the bolts and tab washers.
5. Remove the fan blades.
6. Slacken the alternator mounting bolts and remove the fan belt.
7. Disconnect the radiator bottom hose.
8. Using PD 155B and PD 155-1, remove the pulley.
9. Remove the four nuts and washers.
10. Separate the water pump from the water pump rear body.
11. Remove and discard the gasket.

Refitment

12. Reverse procedures 1 to 10 except:
 - (a) Fit a new gasket lightly coated with recommended sealant 'A'.
 - (b) PD 155B and PD 155-1 are not required for refitting the pulley.
 - (c) When refitting the fan blades, use new tab washers.
 - (d) Tighten the pulley retaining nut to a torque of 80 Nm (60 lbf ft).
 - (e) Adjust the fan belt tension, Part 9A.



WATER PUMP (AD3. 152 Engine)**Servicing**

4B-10-07

Special Tools: PD 155B Puller

PD 155-1 Adaptors

MF 200 Handpress

MF 200-26A Water Pump Overhaul Kit

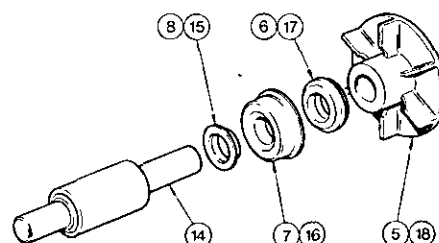
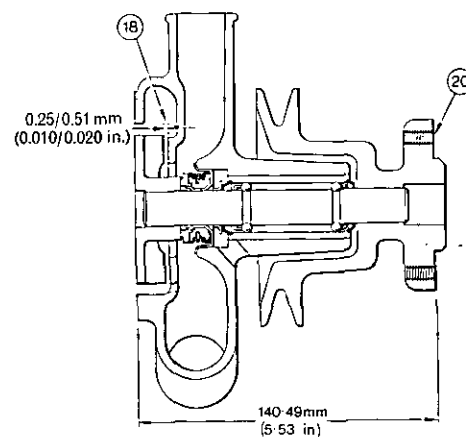
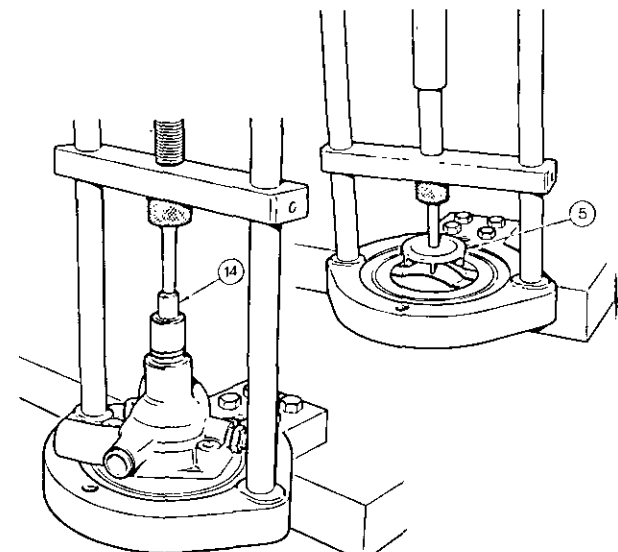
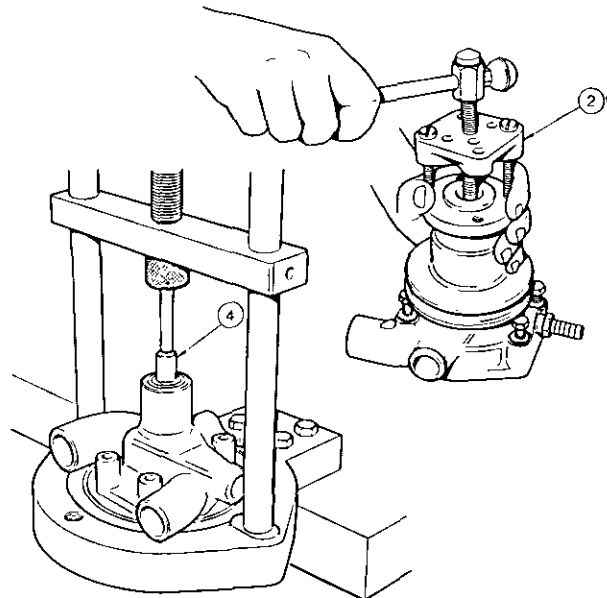
MF 200-25 Multi-Purpose Bearing Remover.

Disassembly

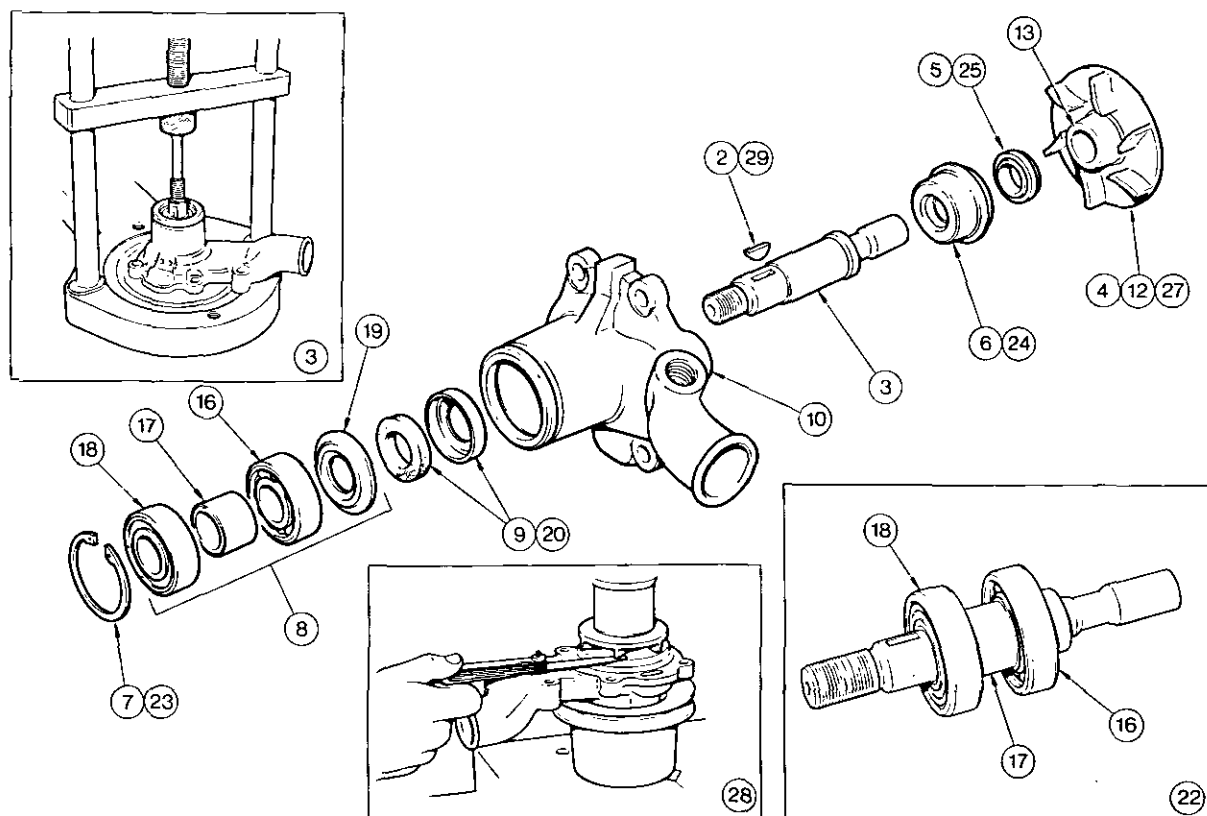
1. Remove the water pump, operation 4B-02-03.
2. Using PD 155B and PD 155-1, remove the pulley from the water pump.
3. The water pump securing bolts and washers can now be removed from their locations.
4. Using MF 200 and MF 200-26A, press the shaft and bearing assembly complete with impeller rearwards out of the housing.
5. Using MF 200 and MF 200-26A, press the shaft and bearing assembly out of the impeller.
6. Remove the ceramic faced seal.
7. Remove the spring loaded seal.
8. Remove the flange (water thrower).
9. Examine the pump body for damage, cracks or corrosion.
10. Remove any rust and scale from the impeller and inspect the impeller for cracks or damage.
11. Examine the impeller hub sealing face for excessive wear or scoring.
12. Inspect the shaft and bearing assembly for pitting, corrosion or wear. The shaft and bearings form a complete unit and cannot be separated, if defective the whole assembly must be replaced.
13. Replace all seals.

Reassembly

14. Using MF 200 and MF 200-26A, press the shaft and bearing assembly into the housing until the bearing housing is flush with the front of the pump body and the long end of the shaft is positioned towards the impeller end of the housing.
15. Refit the flange (water thrower) with the flange towards the bearing assembly.
16. Refit the spring loaded seal, ensure that it is correctly seated.
17. Refit the ceramic faced seal with the ceramic face towards the impeller.
18. Using MF 200 and MF 200-26A, press the impeller onto the shaft until a clearance of 0,25 to 0,51 mm (0.010 to 0.020 in) is obtained between the impeller blades and the housing face.
19. Insert the four securing bolts and washers into the water pump housing.
20. Using MF 200 and MF 200-26A, press the pulley onto the front end of the shaft until the distance between the fan attachment face of the pulley and the rear face of the pump body is 140,49 mm (5.530 in).
21. Spin the shaft assembly to ensure freedom of rotation.
22. Refit the water pump, operation 4B-02-03.



COOLING SYSTEM

**WATER PUMP (A4. 236 and A4. 248 Engines)****Servicing**

4B-11-08

Special Tools: MF 200 Handpress

MF 200-26A Water Pump Overhaul Kit

MF 200-25 Multi-Purpose Bearing Remover.

Disassembly

1. Remove the water pump, operation 4B-09-06.
2. Tap out the key.
3. Using MF 200 and MF 200-26A, press the shaft complete with the impeller out of the housing.
4. Using MF 200 and MF 200-26A, press the drive shaft out of the impeller.
5. Remove the ceramic faced seal.
6. Remove the spring loaded seal.
7. Remove the circlip.
8. Using MF 200, MF 200-26A and MF 200-25 press the two bearings out of the housing complete with the spacer and retaining plate.
9. Remove the felt seal and retainer housing.
10. Examine the pump body for cracks, damage or corrosion.
11. Examine the drive shaft for wear, ensure that the bearings are a transition fit on the shaft. If the inner races of the bearings rotate on the shaft, the shaft must be renewed.
12. Remove any rust and scale from the impeller and inspect the impeller for cracks or damage.
13. Examine the impeller hub sealing face for excessive wear or scoring.

14. Inspect the bearings for pitting, corrosion or wear.
15. Replace all seals.

Reassembly

16. Press the rear bearing onto the shaft with the shielded face towards the rear of the shaft.
17. Fit the spacer.
18. Press the front bearing onto the shaft with the shielded face towards the front of the shaft.
19. Fit the retaining plate into the housing with the 'dished' portion towards the rear of the housing.
20. Fit the felt seal and retainer housing into the pump housing with the felt seal against the retaining plate.
21. Half fill the space between the bearings on the shaft with high melting point grease.
22. Press the complete bearing and shaft assembly into the housing from the front end.
23. Fit the circlip.
24. Fit the spring loaded seal.
25. Fit the ceramic faced seal with the ceramic face to the rear.
26. Spin the shaft assembly to ensure freedom of rotation.
27. Press the impeller onto the shaft.
28. Check the clearance between the impeller vanes and the pump body, this should be between 0,03 and 0,81 mm (0-012 and 0-032 in).
29. Refit the key.
30. Refit the water pump, operation 4B-09-06.

FUEL SYSTEM AND AIR CLEANER

Part 4 — Section C

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4C-02-02	Removal and Refitment (MF 565, MF 575 and MF 590)	
	FUEL TANK	03
4C-03-03	Removal and Refitment (MF 550)	
4C-04-04	Removal and Refitment (MF 565, MF 575 and MF 590)	
	FUEL GAUGE SENDER UNIT	05
4C-05-05	Removal and Refitment	
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4C-06-05	Removal and Refitment	
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4C-07-06	Removal and Refitment	
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4C-13-11	FUEL SYSTEM DE-AERATION	11

GENERAL

Cleanliness must always be observed when servicing any components of the fuel system. Suitable caps or masking tape should be available for blanking off open fuel connections as soon as a union has been removed. Do not use cotton waste or rag producing lint to clean out any part of the fuel system. When working with Diesel equipment, the hands should always be protected with a protective

cream. Servicing of fuel and air system components should be limited to the recommendations given in the following pages.

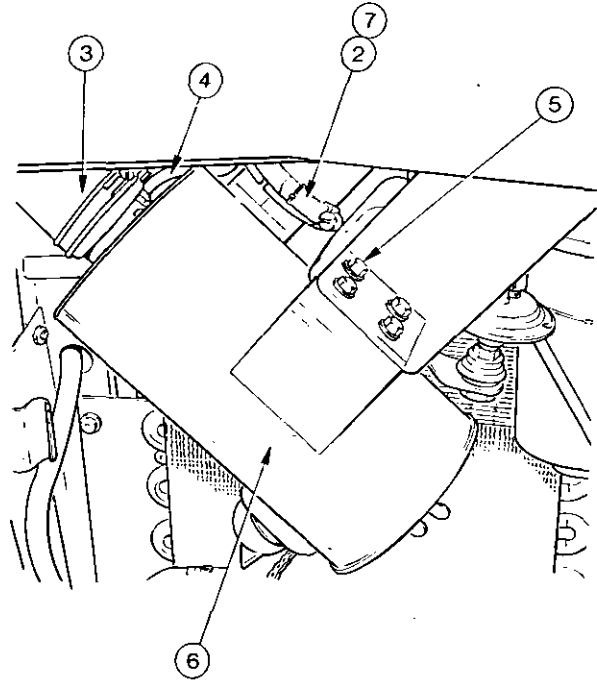
This section of the Workshop Manual gives only partial details of the fuel systems components. For more comprehensive details of the fuel system components, particularly related to servicing, see the Perkins and CAV Workshop Manuals.

FUEL SYSTEM AND AIR CLEANER**DRY ELEMENT AIR CLEANER ASSEMBLY****Removal and Refitment (MF 550) 4C-01-02****Removal**

1. Remove the hood, Part 2A.
2. Disconnect the inlet pipe.
3. Disconnect the outlet pipe.
4. Disconnect the air cleaner indicator tube.
5. Remove the four bolts with washers.
6. Take out the air cleaner assembly.

Refitment

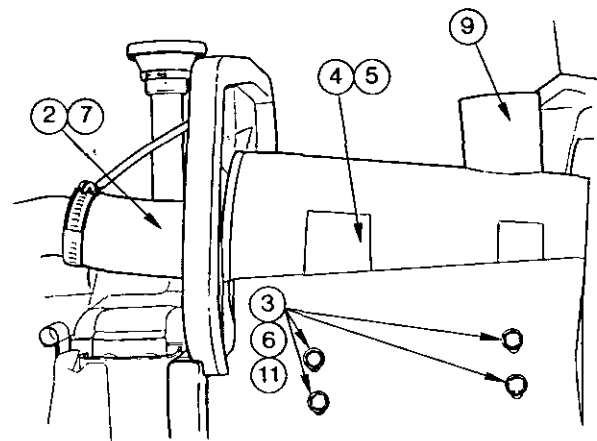
7. Reverse procedures 1 to 6, except:
Ensure that the air cleaner inlet pipe is positioned in the centre of the hole in the hood.

**DRY ELEMENT AIR CLEANER ASSEMBLY****Removal and Refitment (MF 565, MF 575 and MF 590) 4C-02-02****Removal**

1. Remove the hood, Part 2A.
2. Disconnect the pipe.
3. Remove the four bolts and spring washers.
4. Remove the air cleaner assembly.

Refitment

5. Refit the air cleaner assembly.
6. Refit the bolts, finger tight.
7. Reconnect the pipe.
8. Refit the hood (without its securing bolts).
9. Ensure that the air cleaner inlet pipe is positioned in the centre of the hole in the hood.
10. Remove the hood.
11. Tighten the bolts.
12. Refit the hood, Part 2A.

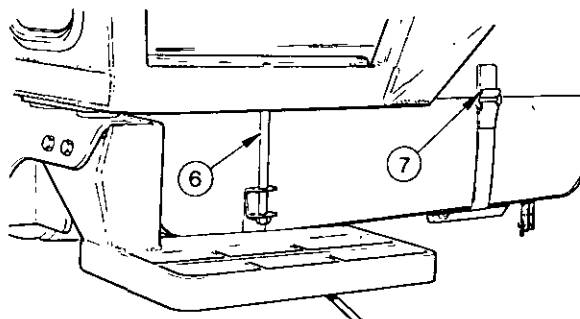
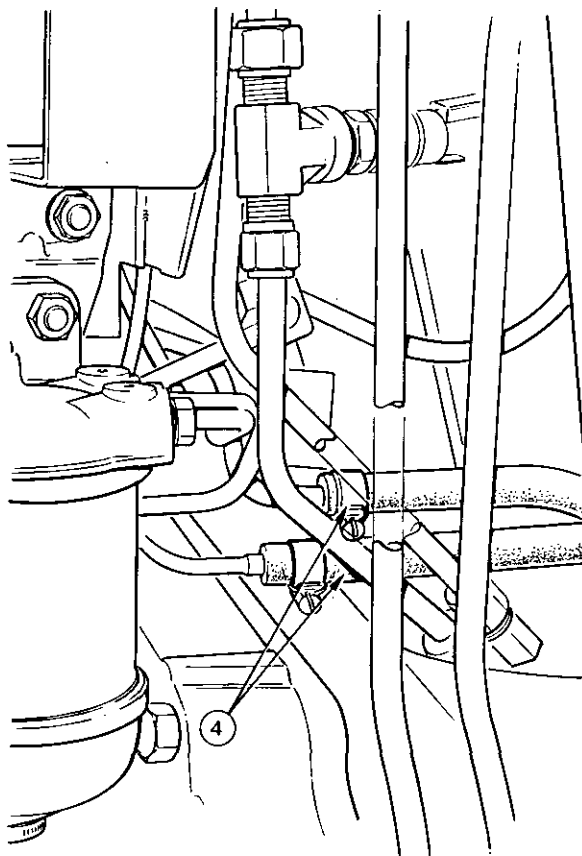
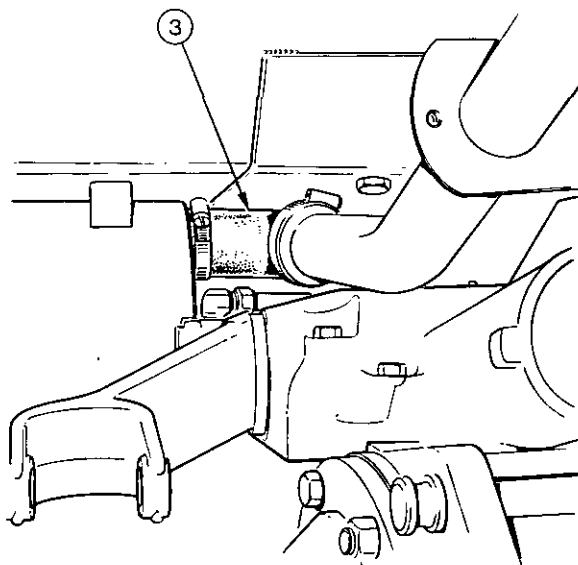


FUEL TANK**Removal and Refitment (MF 550) 4C-03-03****Removal**

1. Drain the fuel tank via the drain plug.
2. Disconnect the fuel gauge sender wires.
3. Remove the rubber fuel inlet hose.
4. Disconnect the rubber fuel pipes at the engine end.
5. Lightly support the tank with a jack.
6. Remove the bolts, opposite sides front and rear.
7. Unclip the tank retaining straps, opposite sides front and rear.
8. Lower the tank to the floor.

Refitment

9. Reverse procedures 2 to 8.
10. Refit the drain plug, the thread being coated with hydraulic sealant, and tighten to a torque of 54-81 Nm (40-60 lbf ft).

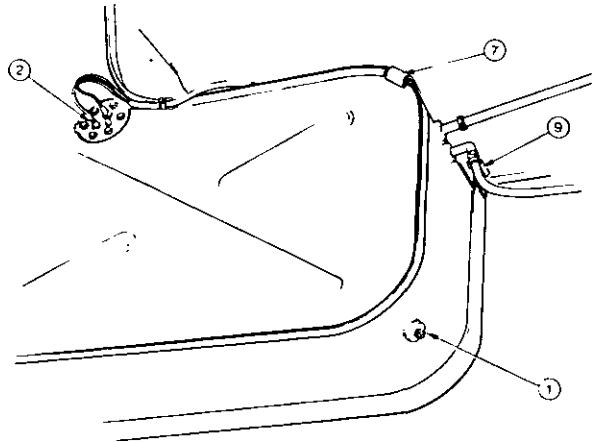


FUEL SYSTEM AND AIR CLEANER**FUEL TANK****Removal and Refitment (MF 565, MF 575 and MF 590)**

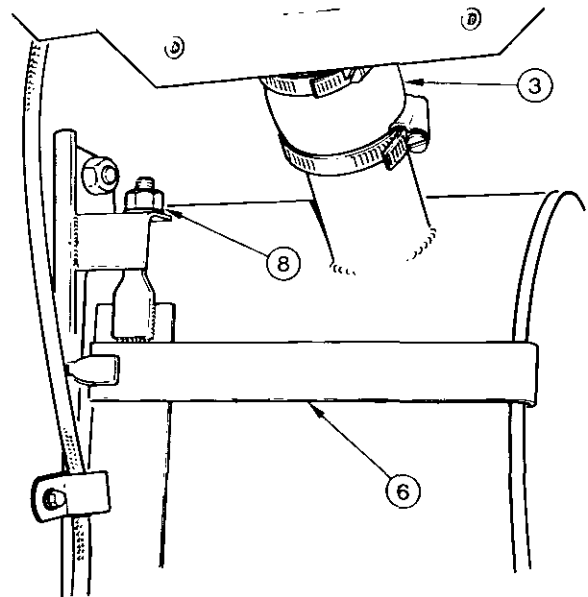
4C-04-04

Removal

1. Drain the fuel tank via the drain plug.
2. Disconnect the fuel gauge sender wires.
3. Remove the rubber fuel inlet hose.
4. Disconnect the rubber fuel pipes at either side of the rear of the cylinder block.
5. Lightly support the fuel tank with a jack.
6. Remove the rear lateral clamp.
7. Remove the front lateral clamp.
8. Remove the nut and washer.
9. Unclip the main strap.
10. Lower the fuel tank to the floor.

**Refitment**

11. Reverse procedures 2 to 10.
12. Refit the drain plug, the thread being coated with hydraulic sealant, and tighten to a torque of 54-81 Nm (40-60 lbf ft).



FUEL GAUGE SENDER UNIT**Removal and Refitment**

4C-05-05

Removal

1. Drain the fuel tank via the drain plug.
2. Disconnect the wires to the sender unit.
3. Remove the six screws and washers.
4. Manoeuvre the sender unit out through the aperture in the tank.
5. Remove the sealant or the gasket.

Refitment

6. Replace the sealant (SILASTIC 732 RTV) or gasket.
7. Reverse procedures 2 to 4.
8. Refit the drain plug, the thread being coated with hydraulic sealant, and tighten to a torque of 54-81 Nm (40-60 lbf ft).

THERMOSTART**Removal and Refitment**

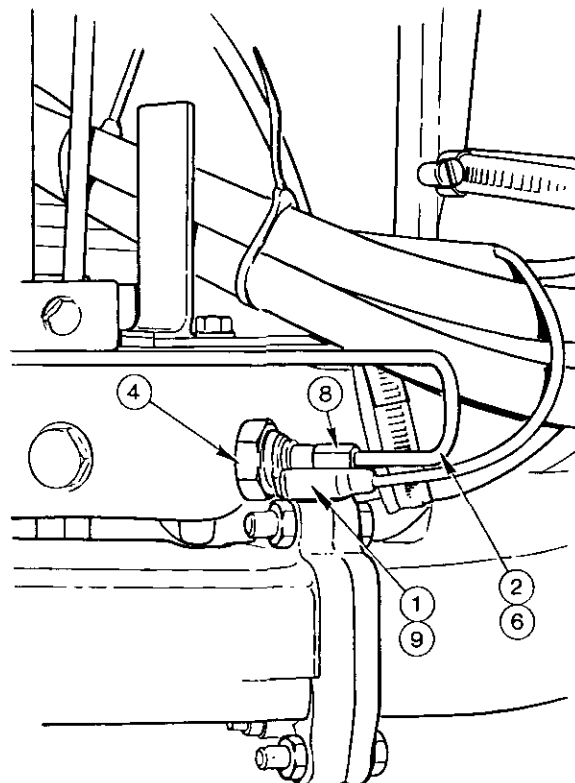
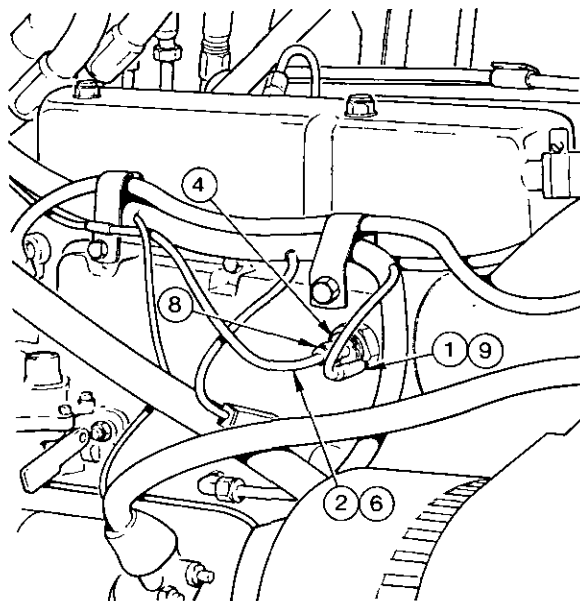
4C-06-05

Removal

1. Disconnect the electrical wire.
2. Disconnect the fuel pipe.
3. Blank off the open end of the fuel pipe.
4. Unscrew the unit from the manifold.

Refitment

5. Reverse procedures 3 and 4.
6. Refit the fuel pipe, but leave the union loose.
7. Operate the lift pump priming lever until air in the fuel pipe to the unit is eliminated.
8. Tighten the fuel pipe union.
9. Refit the electrical wire.



FUEL SYSTEM AND AIR CLEANER**FUEL LIFT PUMP****Removal and Refitment**

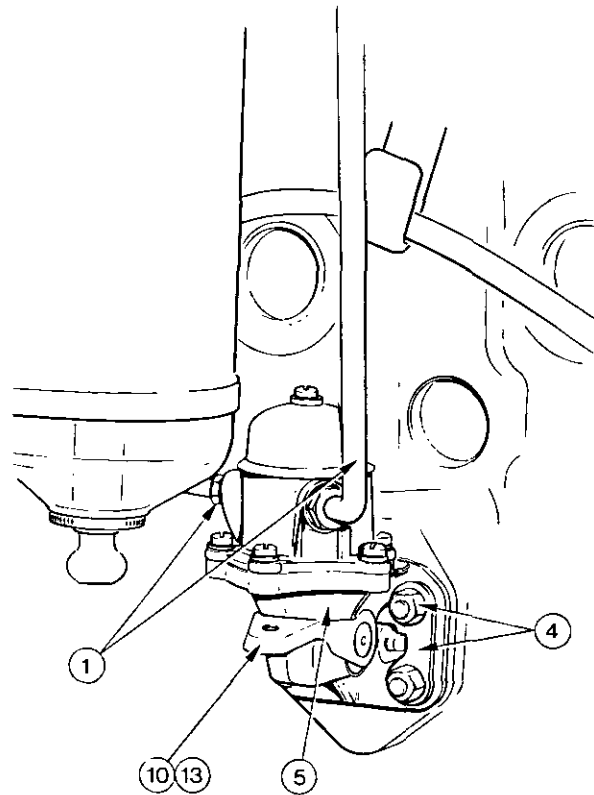
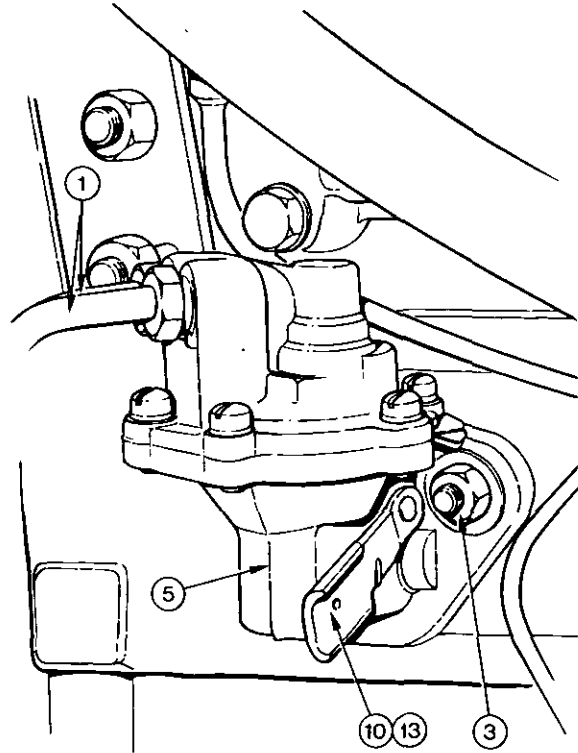
4C-07-06

Removal

1. Disconnect the two fuel pipes at the pump.
2. Blank off the open ends of the fuel pipes.
3. On MF 550 tractors—remove the nuts and washers.
4. On MF 565, 575 and 590 tractors—remove the nuts and keeper plates.
5. Remove the pump, manoeuvring the rocker arm through the aperture in the crankcase.
6. Remove the sealing gasket between the pump and the engine crankcase.

Refitment

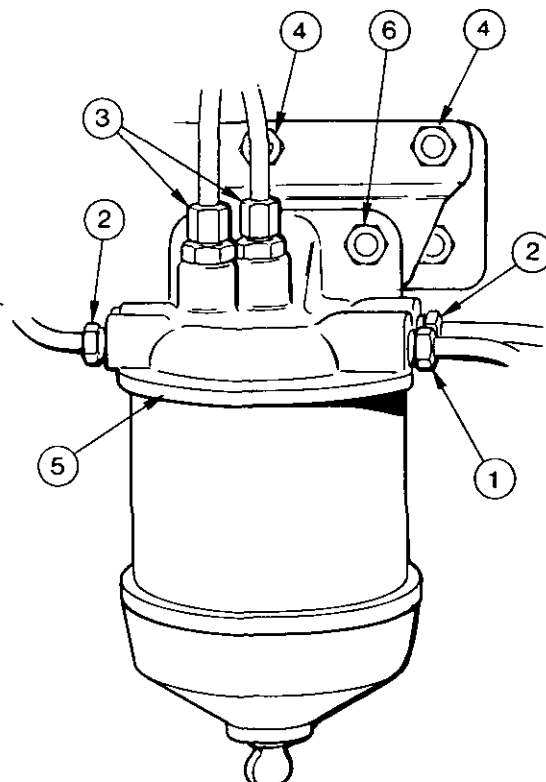
7. Fit a new sealing gasket coated with Hylomar SQ 32M.
8. Reverse procedures 1 to 5.
9. Loosen the leak back union on the filter.
10. Operate the lift pump priming lever until air is eliminated.
11. Retighten the leak back union.
12. Loosen the thermostart fuel union.
13. Operate the lift pump priming lever until air is eliminated.
14. Retighten the thermostart fuel union.



FUEL LIFT PUMP**Servicing**

4C-08-07

1. Make a file mark across the two flanges for guidance in re-assembly of the pump.
2. Remove the six screws and spring washers.
3. Separate the two halves of the pump.
4. Release the diaphragm by pushing it into the pump body and then turning it through 90 degrees.
5. Remove the diaphragm.
6. Withdraw the diaphragm spring.
7. Remove the pump cover retaining screw.
8. Remove the pump cover and seal.
9. Remove the gauze strainer, clean thoroughly in engine fuel, and then dry with compressed air.
10. Lever the two valves from their seats.
11. Remove the valve gaskets.
12. Examine the diaphragm spring, and replace if corroded or distorted.
13. Examine the flanges of the two pump halves for distortion and, if necessary, lightly finish to restore flatness.
14. Thoroughly clean the valve seats in the pump body and ensure that all previous stopping marks are removed.
15. Fit two new valves together with new gaskets to the valve body. The inlet valve must be fitted so that it opens to admit fuel to the pump chamber. The outlet valve must be fitted the opposite way round to the inlet valve.
16. Lock the valves in position by staking in six places with a suitable punch.
17. Refit the gauze strainer.
18. Refit the pump cover, together with a new sealing ring, and secure with the retaining screw.
19. Reverse procedures 2 to 6.

**FUEL FILTER****Removal and Refitment**

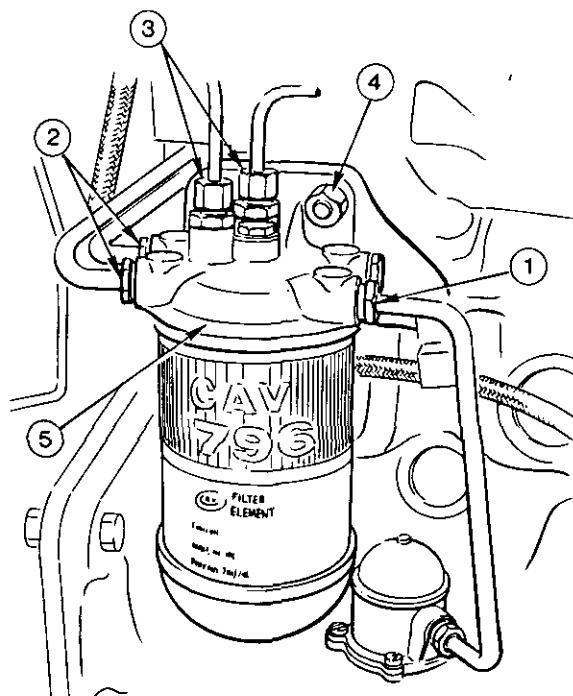
4C-09-07

Removal

1. Disconnect the lift pump input to the filter and blank off the open union.
2. Disconnect the two pipes to the fuel injection pump and blank off the open unions.
3. Disconnect the two pipes serving the injector leak-back system and the thermostart unit and blank off the open unions.
4. Remove the two nuts and, on the MF 550 tractor, the two washers.
5. Remove the filter unit.
6. On the MF 550 tractor—remove the two nuts to separate the filter unit from its mounting bracket if necessary.

Refitment

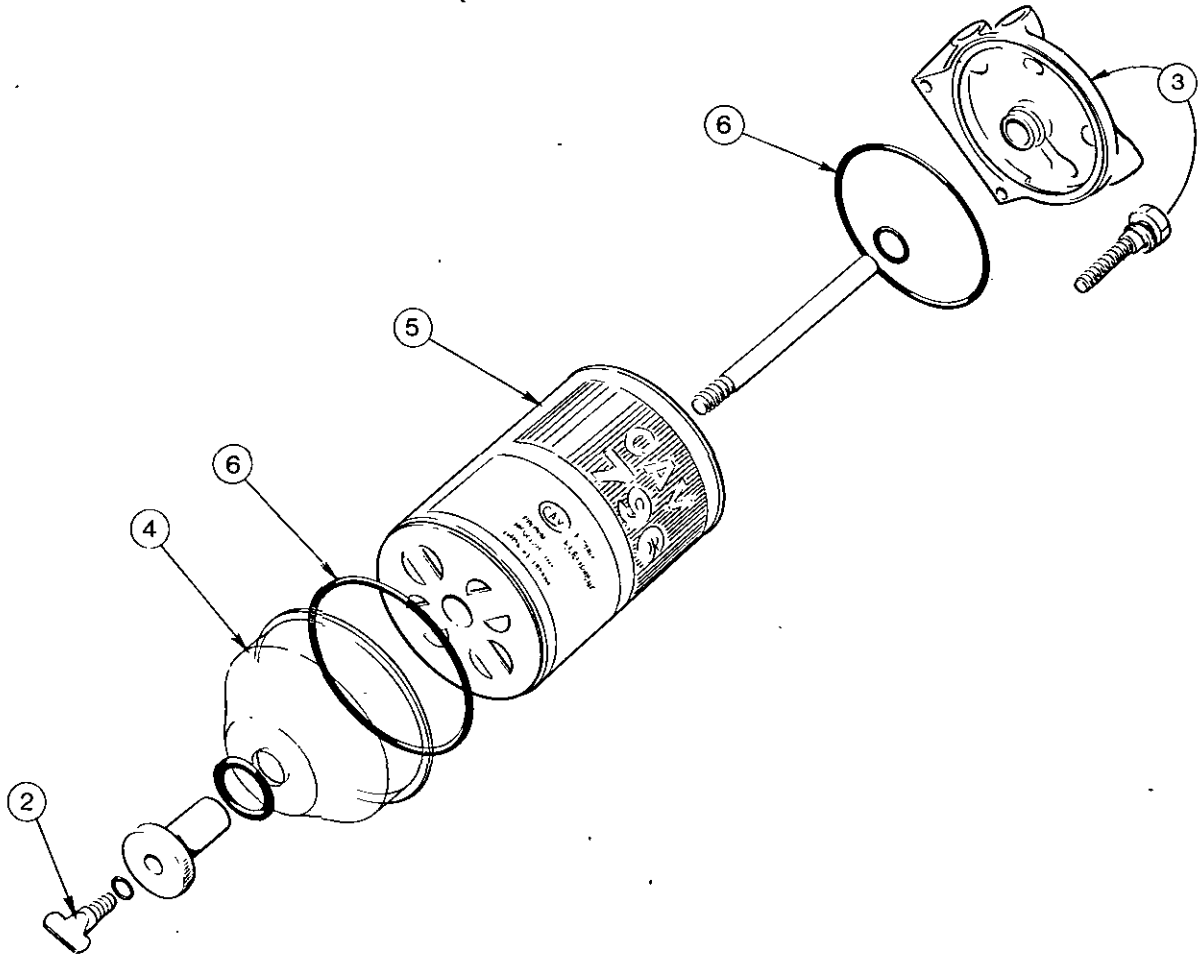
7. Reverse procedures 1 to 5.
8. Bleed the fuel system, 4C-13-11.



FUEL SYSTEM AND AIR CLEANER**FUEL FILTER****Servicing**

4C-10-08

1. Clean the outside of the filter unit.
2. Drain the filter via the drain tap.
3. Remove the centre bolt.
4. Remove the bowl and carefully clean it.
5. Remove the filter element and discard it.
6. Check the condition of the seals.
7. Reassemble the filter unit with a new filter element, reversing procedures 3 to 5.
8. Bleed the fuel system, 4C-13-11.



FUEL SYSTEM AND AIR CLEANER

FUEL INJECTION PUMP

Removal and Refitment

4C-11-09

Removal

NOTE: (a) Unless the necessary equipment and experienced personnel are available, dismantling of the fuel injection pump must not be attempted.

(b) Blank off the open ends of fuel pipes and unions with correctly fitted blanks.

(c) Thoroughly clean all parts prior to dismantling.

(d) To facilitate refitment of the fuel injection pump, a line should be scribed across the edge of the pump flange and on to the timing case.

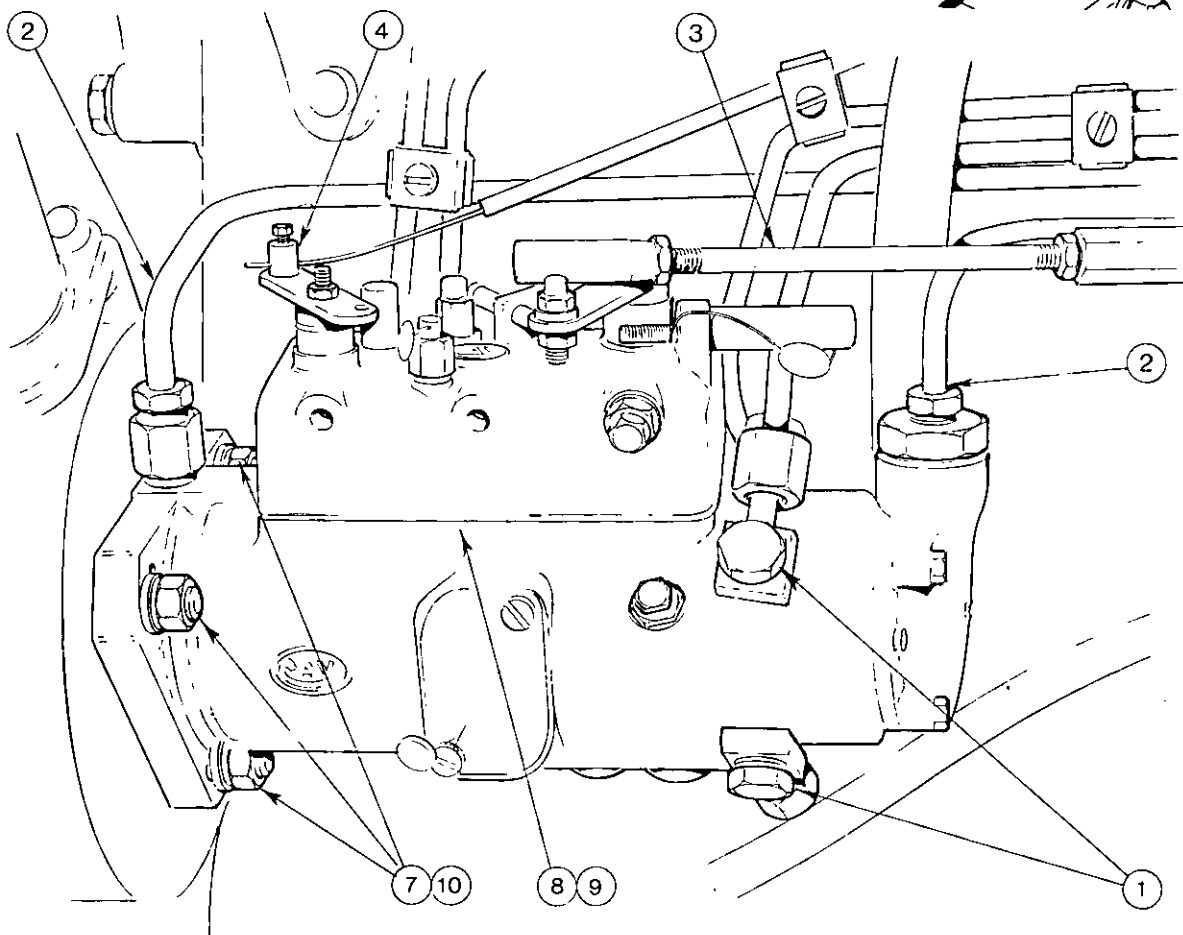
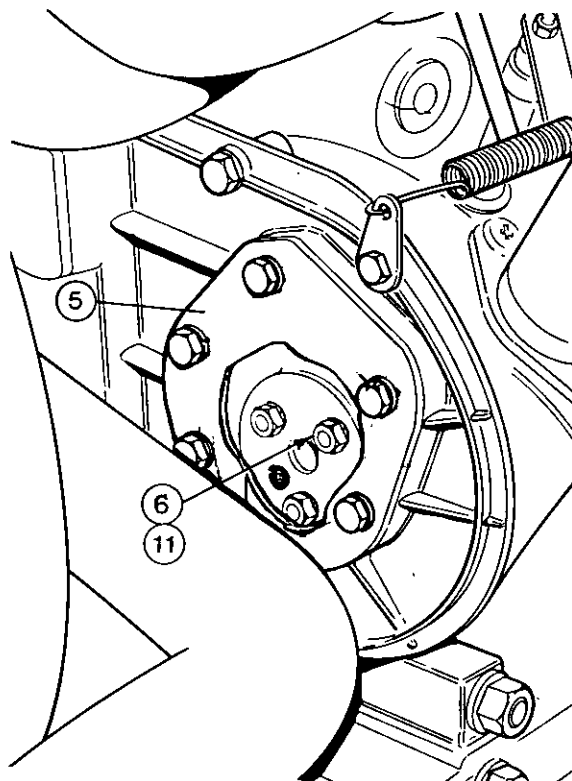
1. Remove the high-pressure fuel pipes.
2. Disconnect the two low-pressure fuel pipes.
3. Disconnect the throttle control and return spring.
4. Disconnect the engine stop control.
5. Remove the timing case front cover inspection plate.
6. Remove the three bolts and spring washers securing the fuel pump to the drive gear.
7. Remove the three nuts and spring washers securing the pump to the timing case.
8. Withdraw the fuel pump.

Refitment

NOTE: When fitting a new pump, it may be necessary to adjust the maximum and idling speeds.

9. Replace the fuel pump, ensuring that the slot in the pump hub is aligned with the dowel in the drive gear.

10. Position the pump so that the scribed line on the pump flange aligns with the mark on the timing case and secure with the three nuts and spring washers:
11. Secure the drive gear to the pump shaft with the three bolts and spring washers, ensuring that the dowel is properly located in its slot.
12. Reverse operations 1 to 5.
13. Bleed the fuel system, 4C-13-11.



FUEL SYSTEM AND AIR CLEANER**FUEL INJECTORS****Removal and Refitment**

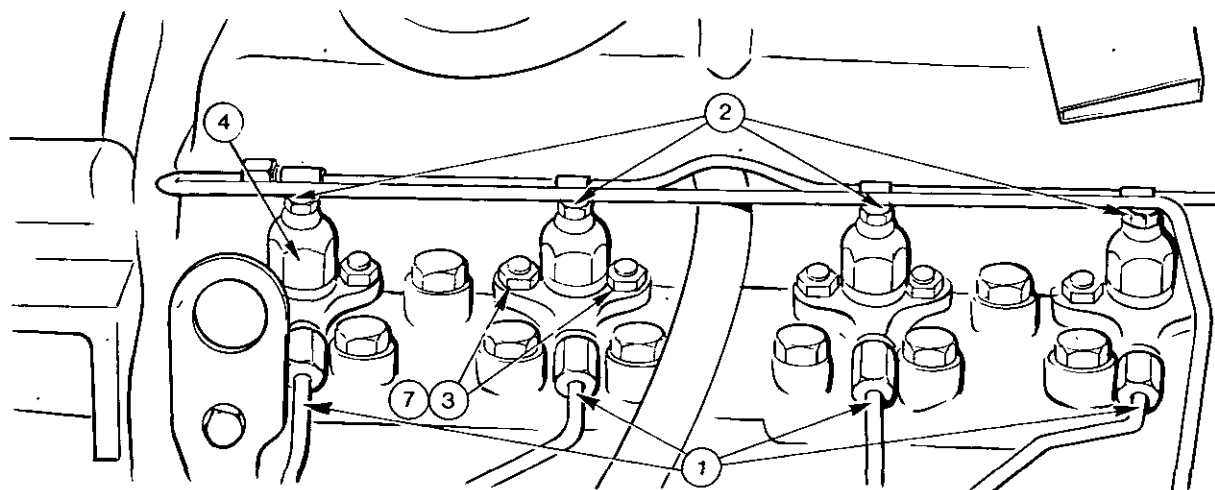
4C-12-10

Removal

1. Disconnect the high-pressure fuel pipes at the injector unions and blank off the open ends.
2. Disconnect the leak-back system union at the head of each injector.
3. Remove the two nuts.
4. Withdraw the injector.

Refitment

5. Replace the copper seating washer at each injector.
6. Reverse procedures 3 and 4.
7. Tighten the two nuts to a torque of 16 Nm (12 lbf ft) in three equal stages.
8. Reverse procedures 1 and 2, but leave the unions for the high-pressure fuel pipes to No's. 1 and 3 injectors (MF 550 Tractor) or No's. 1 and 4 injectors (MF 565, 575 and 590 Tractors) loose.
9. Bleed the high-pressure fuel pipes to the injectors by opening the throttle fully, ensuring that the fuel cut-off knob is pushed fully in and, then, turning the engine over with the starter until it begins to fire.
10. Retighten the unions at No's. 1 and 3 or No's. 1 and 4 injectors as the case may be.

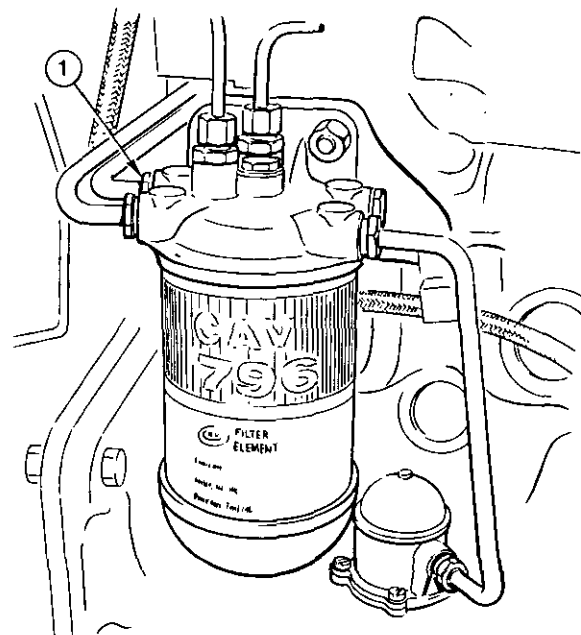
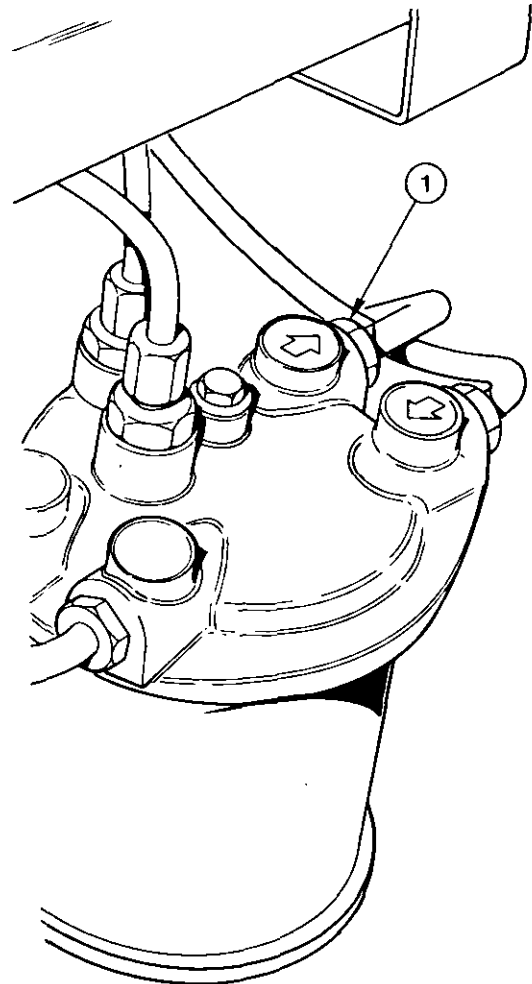


FUEL SYSTEM DE-AERATION 4C-13-11

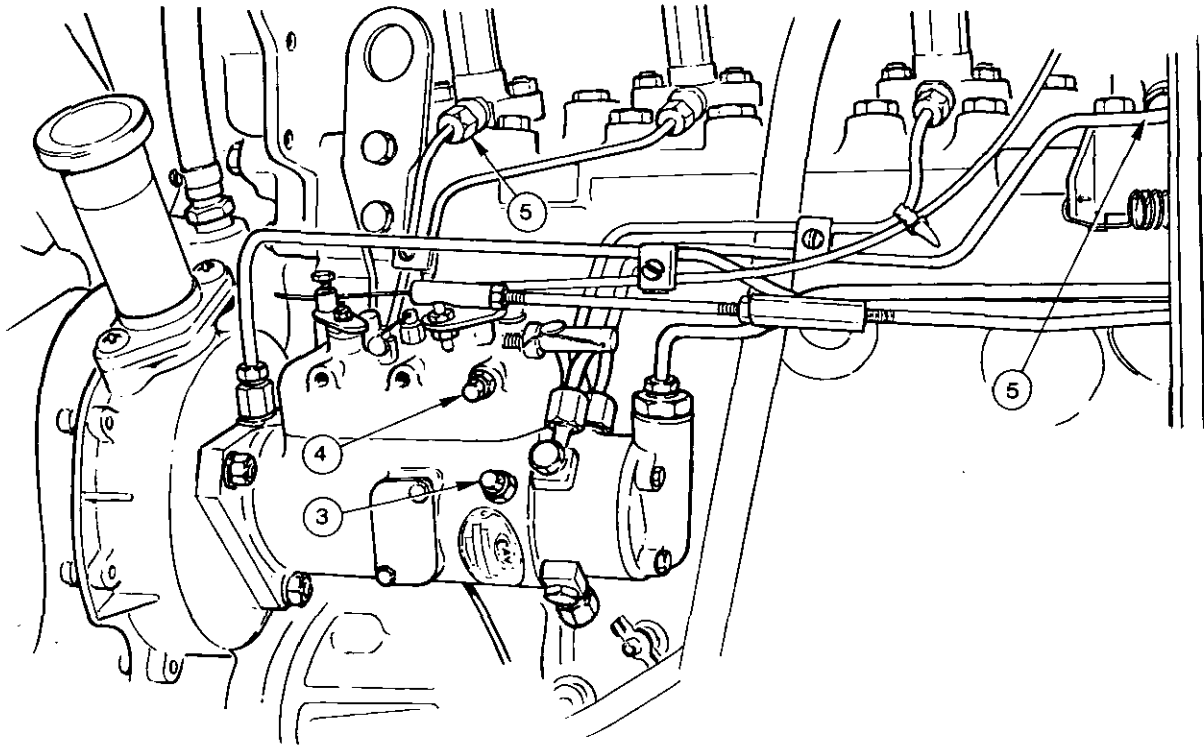
NOTE: (a) No attempt must be made to start the engine until the injection pump has been filled with fuel and the air removed, as serious damage can be caused to the pump due to lack of lubrication.

(b) The method detailed for the removal of air ensures that only fuel which has passed through the filter can reach the interior of the pump.

1. Slacken the outlet union on the fuel filter.
2. Operate the hand priming lever on the fuel lift pump until fuel, free of air bubbles, issues from the union, then retighten the union.
3. Slacken the lower vent plug on the fuel injection pump and operate the fuel lift pump until fuel, free of air bubbles, issues from the vent, then retighten the vent plug.
4. Slacken the upper vent plug on the fuel injection pump and operate the fuel lift pump until fuel, free of air bubbles, issues from the vent, then retighten the vent plug.
5. Slacken the unions at No's. one and three (MF 550) or one and four (MF 565, 575 and 590) injectors as the case may be.
6. Disconnect the thermostart fuel feed pipe at the thermostart and operate the fuel lift pump until fuel, free of air bubbles, issues from the pipe, then reconnect the pipe.
7. Set the throttle fully open and ensure that the fuel cut-off knob is pushed fully in, then turn the engine over with the starter until the engine begins to start. Retighten the unions.



FUEL SYSTEM AND AIR CLEANER



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 5

Publication No. 1856 072 M1

comprising

- A CLUTCH (DUAL AND SPLIT TORQUE)
- B 8 SPEED TRANSMISSION
- C MULTI-POWER TRANSMISSION

DUAL CLUTCH**Part 5 — Section A**

Operation Number	Table of Contents	Page Number
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	Operation	02
	FAULT FINDING	03
	MAIN FRICTION DISC OR CLUTCH ASSEMBLY	04
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	CLUTCH PEDAL	05
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5A-03-05	Adjustment (MF 565 Tractor)	
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	CLUTCH ASSEMBLY	07
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	CLUTCH RELEASE BEARING	08
5A-06-08	Removal and Replacement	

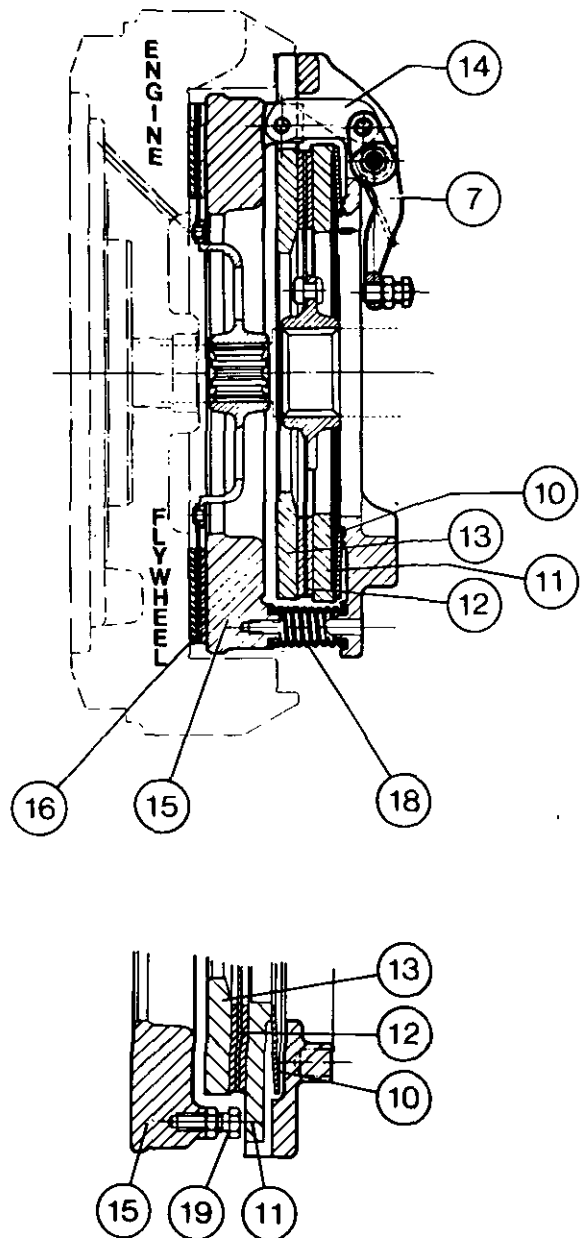
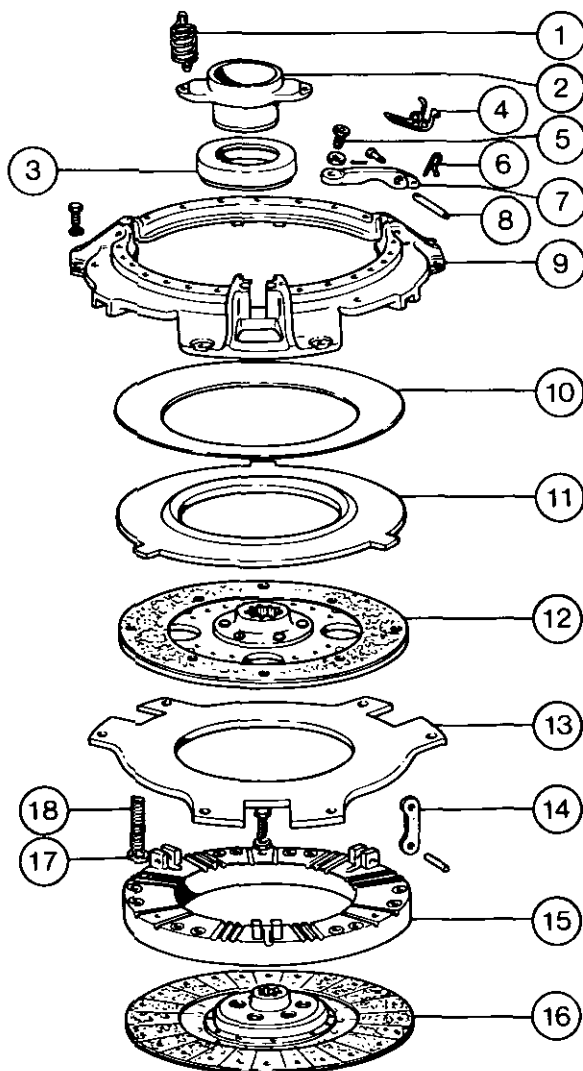
GENERAL

The Dual Clutch assembly consists of a main 305 mm (12 in) friction disc driving the main transmission input shaft, and a p.t.o. 245 mm (10 in) friction disc driving the p.t.o. input shaft. This allows the main transmission drive to be disconnected without interrupting the drive to the p.t.o. and hydraulic pump. The clutch is operated by a single pedal having two stages of operation.

DUAL CLUTCH

KEY TO FIGURES 1 and 2

- | | |
|------------------|---------------------------|
| 1 Spring | 10 Belleville Spring Disc |
| 2 Carrier | 11 P.t.o. Pressure Plate |
| 3 Bearing | 12 P.t.o. Friction Disc |
| 4 Spring | 13 False Flywheel |
| 5 Setscrew | 14 Connecting Links |
| 6 Clip | 15 Main Pressure Plate |
| 7 Release Levers | 16 Main Friction Disc |
| 8 Pin | 17 Washer |
| 9 Cover Plate | 18 Springs |



Operation

During operation the main friction disc (16) is held against the engine flywheel by the main pressure plate (15) under the influence of twelve coil springs (18). The p.t.o. friction disc (12) is held against a false flywheel (13) by the p.t.o. pressure plate under the influence of a belleville spring disc (10).

Initial movement of the clutch pedal rotates a cross-shaft which slides a release bearing into contact with three release levers (7). The release levers (7) pivot on the cover plate (9) and via connecting links (14) withdraw the main pressure plate (15) rearwards compressing the coil springs (18). This action releases the main friction disc (16).

Further downward movement of the clutch pedal will continue to withdraw the main pressure plate (15) until the three setscrews (19) attached to the main pressure plate (15) contact the p.t.o. pressure plate (11). The belleville spring (10) is then compressed by the action of the p.t.o. pressure plate (11) which releases the p.t.o. friction disc (12). When the clutch pedal is released the pressure plates return under the action of their respective spring mechanisms.

FAULT FINDING

<i>Symptom</i>	<i>Cause</i>	<i>Remedy</i>
Clutch will not release	Oil or grease on friction plate	Install new friction plate.
	Improper pedal adjustment	Adjust clutch pedal free travel and linkage.
	Damaged pressure plate on clutch cover	Replace defective part.
	Friction plate hub binding on splined drive pinion	Clean up splines and smear with small quantity of Mobilgrease Super
	Distorted friction plate Broken facings on friction plate	Install new friction plate
	Dirt or foreign matter in the clutch	Remove clutch from flywheel and clean with dry rag. See that all working parts are free.
Clutch slip	Oil or grease on friction plate	Install new friction plate.
	Weak or soft pressure springs	Install new set of pressure springs
	Binding of clutch pedal mechanism preventing its full return to stop	Free bearings. (NOTE: The clutch shaft bearings in the transmission case are self-lubricating. Oil or grease should not be applied).
	Improper pedal adjustment preventing full engagement	Correct pedal adjustment
	Clutch facing worn	Install new friction plate.

DUAL CLUTCH

MAIN FRICTION DISC OR CLUTCH ASSEMBLY

Removal and Refitment

5A-01-04

Special Tools: MF 159A Clutch Centraliser
MF 215 P.t.o. Clutch Setting Gauge
MF 314 Lever Height Setting Gauge

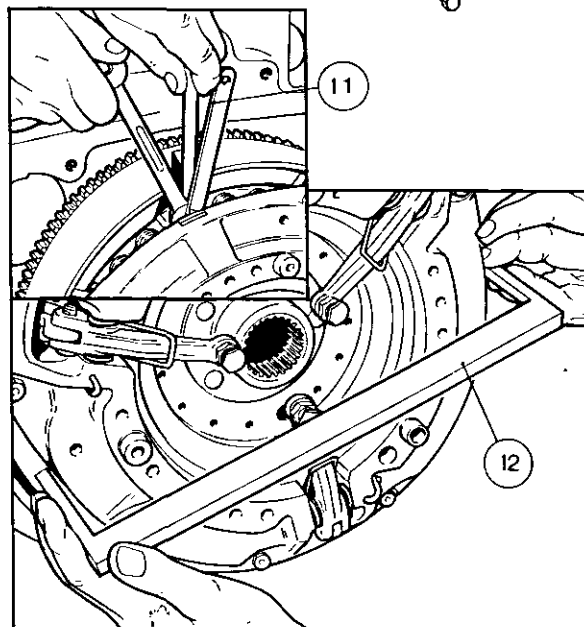
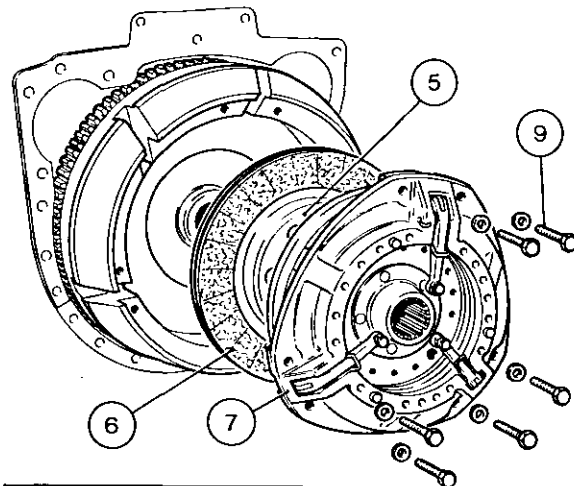
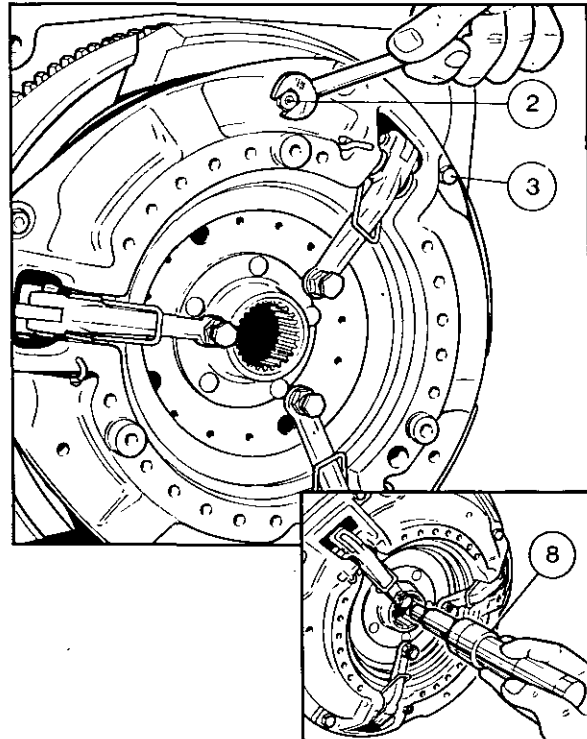
WARNING: The following sequence of instructions must be followed carefully, as spring pressure will cause the clutch cover to fly apart if pressure is not released slowly and evenly.

Removal

1. Split the tractor between the engine and the transmission, Part 4A.
2. Fit three slave bolts $\frac{1}{4}$ in UNC \times 54 mm (2 $\frac{1}{8}$ in) to the three equi-spaced holes in the clutch cover.
3. Progressively slacken and remove the six bolts and washers.
4. Lift the clutch assembly clear of the flywheel. The main friction disc will remain separate from the clutch assembly.

Refitment

5. Lightly lubricate the splines of the friction disc with *Mobilgrease Super*.
6. Fit the main friction disc onto the flywheel.
7. Position the clutch assembly onto the flywheel.
8. Using MF 159A, centralise the clutch and the main friction disc.
9. Refit the six bolts and washers.
10. Remove the three slave bolts and then remove MF 159A.
11. Using MF 215, check the clearance between the p.t.o. clutch adjusting setscrew and the p.t.o. pressure plate. Adjust the setscrews as required. Re-tighten the locknuts.
12. Using MF 314, check the adjustment of each release lever. The domed end of the release lever setscrew must be just touching the gauge. Adjust the setscrews as required and re-tighten the locknuts.
13. Connect the engine to the rear half of the tractor, Part 4A.
14. Adjust the clutch pedal free travel, operation 5A-02-05 or 5A-03-05 or 5A-04-06.

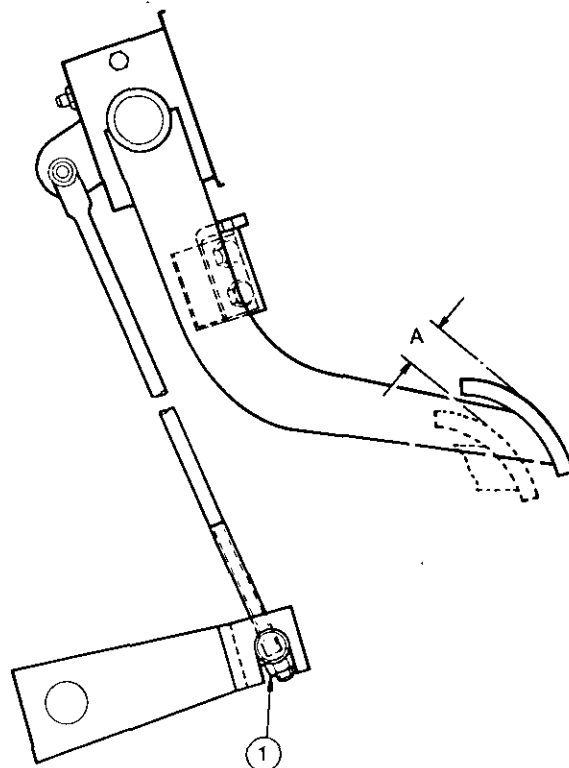


CLUTCH PEDAL

Adjustment (MF 550 Tractor)

5A-02-05

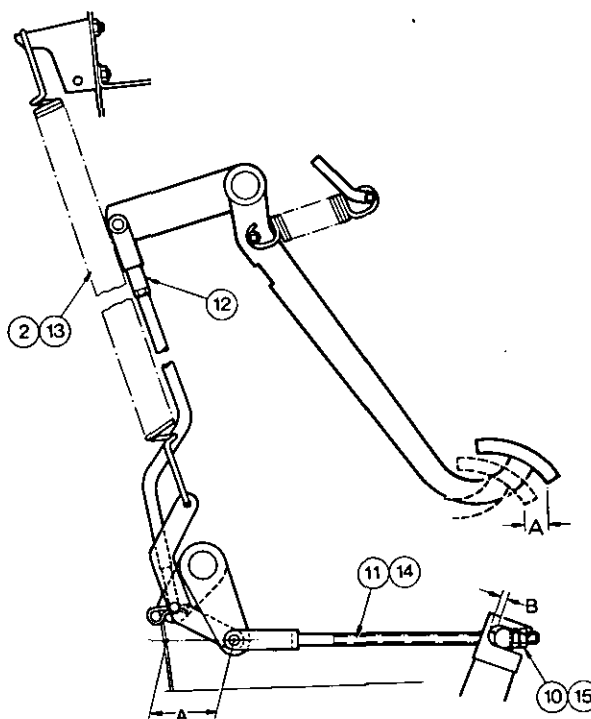
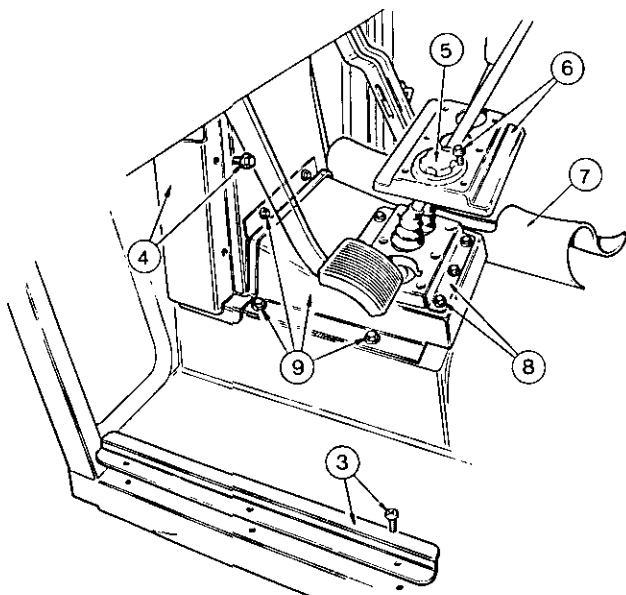
1. Adjust the nut on the linkage to give 22 to 28 mm ($\frac{7}{8}$ to $1\frac{1}{8}$ in) free pedal travel 'A'.

**CLUTCH PEDAL**

Adjustment (MF 565 Tractor)

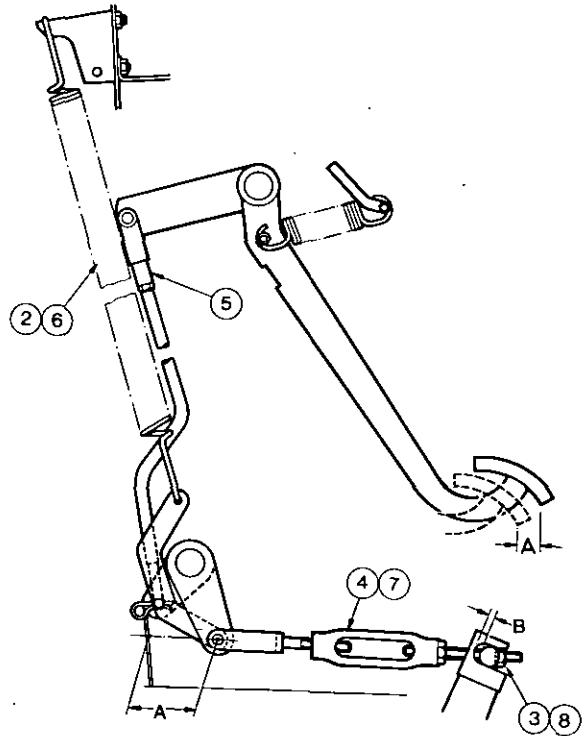
5A-03-05

1. Remove the hood, Part 3B.
2. Release the spring from its top attachment.
3. Remove the screws and the kick plate.
4. Remove the four bolts and the front panel.
5. Remove the gearbox filler plug cover.
6. Remove the screws and the top cover.
7. Roll the floor mat to the right hand side of the cab.
8. Remove the six bolts and the panel.
9. Remove the bolts and the floor panel.
10. Slacken the locknut.
11. Slacken the bolt as much as possible.
12. Adjust the clevis until 'A' is 56 to 60 mm ($2\frac{3}{16}$ to $2\frac{3}{8}$ in).
13. Reconnect the spring.
14. Adjust the bolt until 'B' is 5 to 9 mm ($\frac{3}{16}$ to $\frac{1}{8}$ in), which should give a clutch pedal free travel of 13 to 25 mm ($\frac{1}{2}$ to 1 in).
15. Retighten the locknut.
16. Operate the clutch pedal through its full travel a minimum of five times and recheck the clutch pedal free travel.
17. Reverse procedures 1 and 3 to 9.



DUAL CLUTCH**CLUTCH PEDAL****Adjustment (MF575 and 590 Tractors) 5A-04-06**

1. Remove the hood, Part 3B.
2. Release the spring from its top attachment.
3. Slacken the locknut.
4. Slacken the turnbuckle as much as possible.
5. Adjust the clevis until 'A' is 56 to 60 mm ($2\frac{1}{8}$ to $2\frac{3}{8}$ in).
6. Reconnect the spring.
7. Adjust the turnbuckle until 'B' is 5 to 9 mm ($\frac{3}{16}$ to $\frac{1}{2}$ in) which should give a clutch pedal free travel of 13 to 25 mm ($\frac{1}{2}$ to 1 in).
8. Retighten the turnbuckle locknut.
9. Operate the clutch pedal through its full travel a minimum of five times and recheck the clutch pedal free travel.
10. Refit the hood, Part 3B.



CLUTCH ASSEMBLY**Servicing**

5A-05-07

Special Tools: MF 159A Clutch Centraliser
 MF 215 P.t.o. Clutch Setting Gauge
 MF 314 Lever Height Setting Gauge
 Hydraulic Press

Disassembly

1. Remove the clutch assembly, operation 5A-01-04.
2. Mark all following components to permit their refitment in the same relative positions:
 Cover plate
 P.t.o. pressure plate
 False flywheel
 Main pressure plate
3. Place the clutch assembly on the hydraulic press and locate a suitable bar.
4. Apply pressure until the three $\frac{1}{4}$ in slave bolts can be easily removed.
5. Remove the retaining clips.
6. Remove the pivot pins.
7. Remove the lever springs.
8. Disconnect the release levers from the links.
9. Slowly release the pressure from the press until the springs are out of compression.
10. Lift off the cover plate.
11. Lift off the belleville spring.
12. Lift off the p.t.o. pressure plate.
13. Lift off the p.t.o. friction disc.
14. Lift off the false flywheel.
15. Remove the 12 springs and the fibre washers.
16. Remove the links.

EXAMINATION

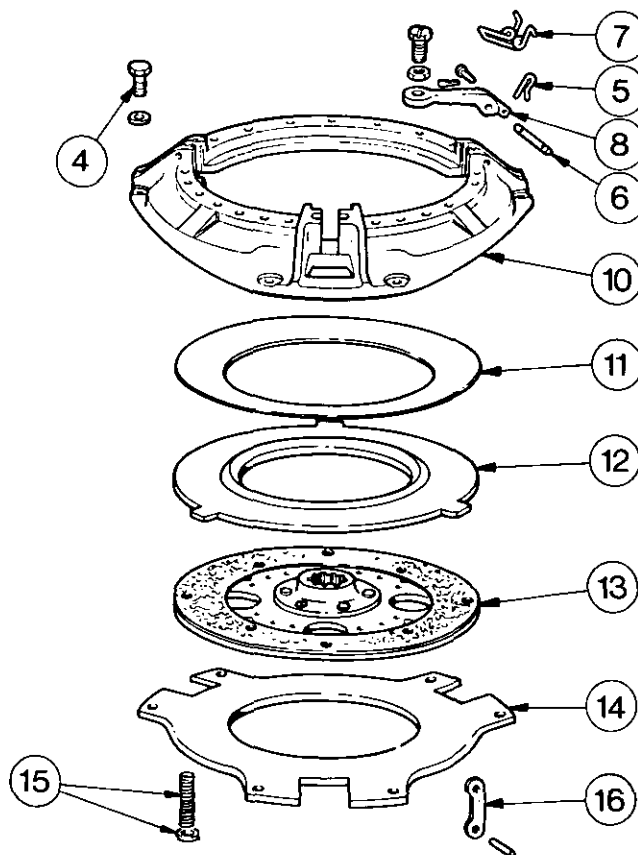
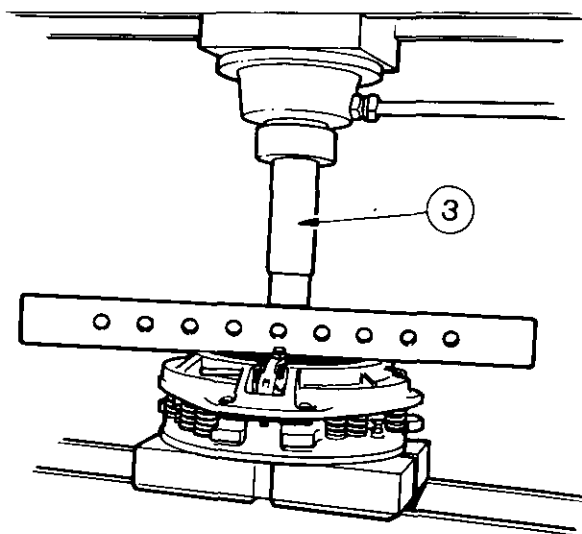
Inspect all components for wear, scoring, cracks, distortion or signs of overheating. Check the coil springs and the belleville spring for correct loading and pressures as given in the Specification Section. If the tractor flywheel is scored, skimming is permissible in 0,254 mm (0.010 in) increments up to a maximum of 1,00 mm (0,040 in).

The ledge to which the clutchcover is bolted must be skimmed by the same amount to maintain the distance from the clutch face to 39,75 to 39,62 mm (1.565 to 1.560 in).

WARNING: Never under any circumstances, skim either the false flywheel or the pressure plates as this will severely impair their heat dissipation characteristics.

Reassembly

17. Reverse procedures 1 to 16 except:
 Fit new friction discs and 12 fibre washers.



DUAL CLUTCH

CLUTCH RELEASE BEARING

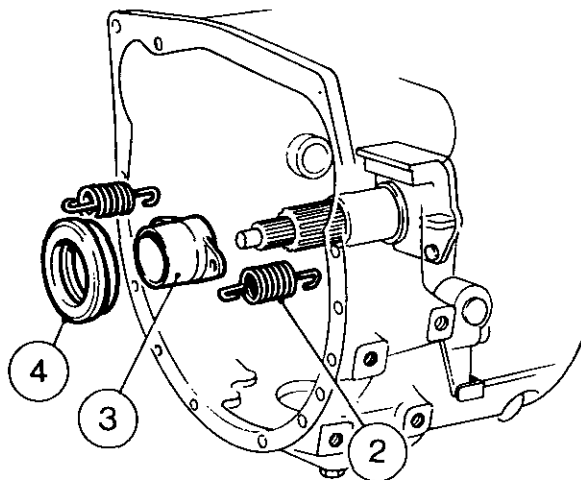
Removal and Replacement 5A-06-08

Removal

1. Split the tractor between the engine and the transmission, Part 4A.
2. Release the two springs.
3. Remove the bearing and carrier assembly.
4. Drive out the carrier from the bearing.

Replacement

5. Reverse procedures 1 to 4 except:
 - (a) Press a new bearing onto the carrier.
 - (b) Lightly lubricate the splines of the carrier with Mobilgrease Special.



SPLIT TORQUE CLUTCH**Part 5 — Section A**

Operation Number	Table of Contents	Page Number
	GENERAL	12
	Operation	12
	FAULT FINDING	13
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	CLUTCH PEDAL	15
5A-12-15	Adjustment (MF 550 Tractor)	
5A-13-15	Adjustment (MF 565 Tractor)	
5A-14-16	Adjustment (MF 575/590 Tractors)	
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5A-16-18	Removal and Replacement	

SPLIT TORQUE CLUTCH**GENERAL**

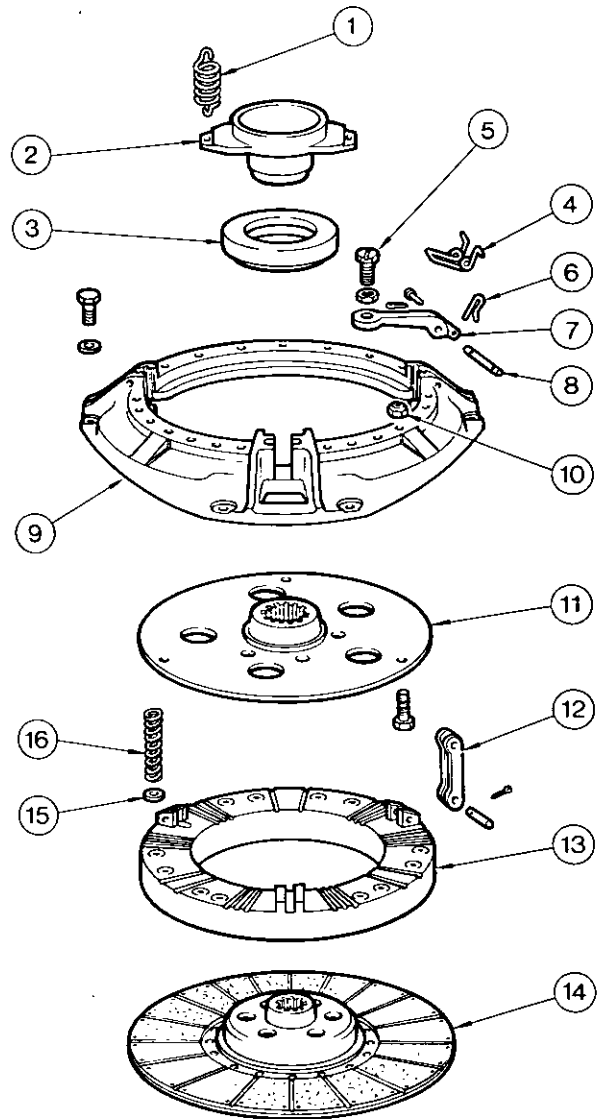
The Split Torque Clutch consists of a 305 mm (12 in) friction disc driving the transmission main input shaft and a plate having a splined boss which engages the p.t.o. input shaft. This allows the main transmission drive to be disconnected without interrupting the drive to the hydraulic pumps and p.t.o. shaft. When the main transmission drive is stopped, driven implements can still be operated and; raised and lowered by the hydraulic system

Operation

The friction disc (14) is operated by the pressure plate (13) against the flywheel. Pressure plate movement is obtained by three release levers (7), pivoted on the clutch cover plate (9). Release lever movement operating against the twelve coil springs (16), moves the pressure plate (13), rearwards and releases the friction disc (14). The clutch release levers (7) are operated by a release bearing (3) which is moved by the clutch pedal.

KEY TO FIGURE 1

1 Spring	9 Cover Plate
2 Carrier	10 Nut
3 Bearing	11 P.t.o. plate
4 Spring	12 Link
5 Screw	13 Pressure Plate
6 Retaining Clip	14 Friction Disc
7 Levers	15 Washer
8 Pin	16 Springs



SPLIT TORQUE CLUTCH**FAULT FINDING**

<i>Symptom</i>	<i>Cause</i>	<i>Remedy</i>
Clutch will not release	Oil or grease on friction plate	Install new friction plate.
	Improper pedal adjustment	Adjust clutch pedal free travel and linkage.
	Damaged pressure plate on clutch cover	Replace defective part.
	Friction plate hub binding on splined drive pinion	Clean up splines and smear with small quantity of Mobilgrease Super
	Distorted friction plate Broken facings on friction plate	Install new friction plate
	Dirt or foreign matter in the clutch	Remove clutch from flywheel and clean with dry rag. See that all working parts are free.
Clutch slip	Oil or grease on friction plate	Install new friction plate
	Weak or soft pressure springs	Install new set of pressure springs
	Binding of clutch pedal mechanism preventing its full return to stop.	Free bearings. (NOTE: The clutch shaft bearings in the transmission case are self-lubricating. Oil or grease should not be applied).
	Improper pedal adjustment preventing full engagement	Correct pedal adjustment
	Clutch facing worn	Install new friction plate

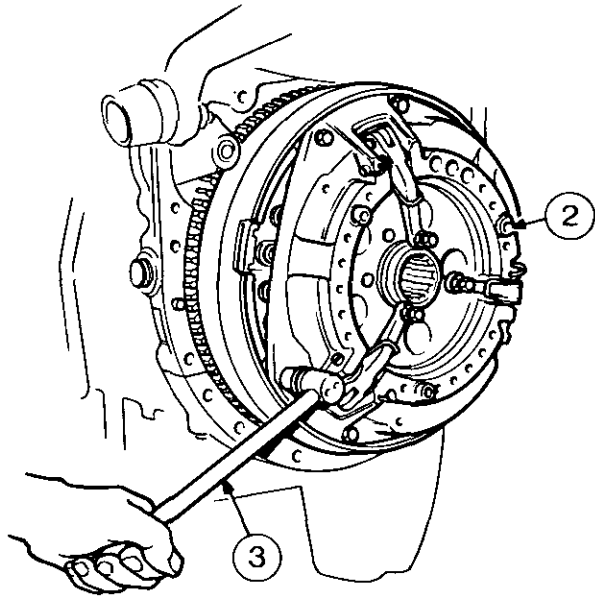
SPLIT TORQUE CLUTCH**FRICITION DISC OR CLUTCH ASSEMBLY****Removal and Refitment** 5A-11-14

Special Tools: MF 159A Clutch Centraliser
MF 314 Lever Height Setting Gauge

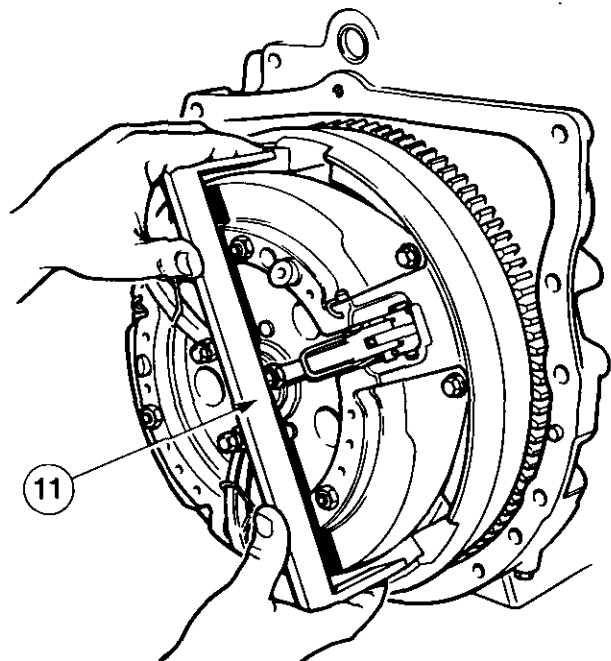
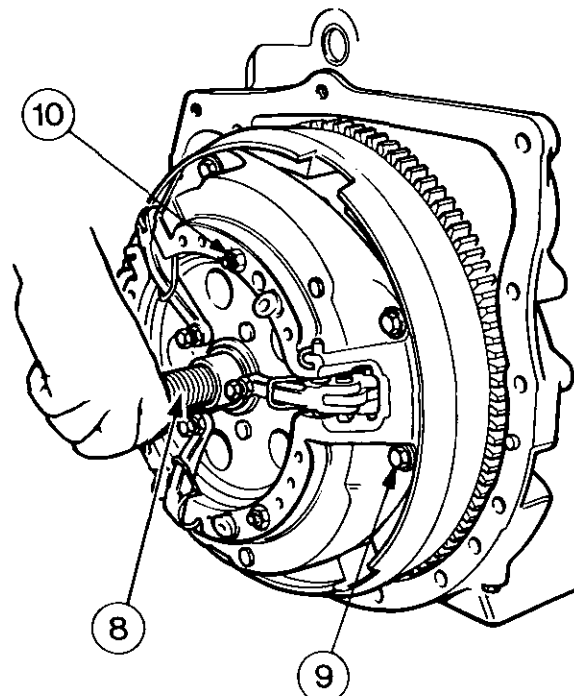
WARNING: The following sequence of instructions must be followed carefully, as spring pressure will cause the clutch cover to fly apart if pressure is not released slowly and evenly.

Removal

1. Split the tractor between the engine and the transmission, Part 4A.
2. Fit three slave bolts $\frac{1}{2}$ in UNC \times 54 mm ($2\frac{1}{4}$ in) to the three equi-spaced holes in the clutch cover.
3. Progressively slacken and remove the six bolts and washers.
4. Lift the clutch assembly clear of the flywheel. The friction disc will remain separate from the clutch assembly.

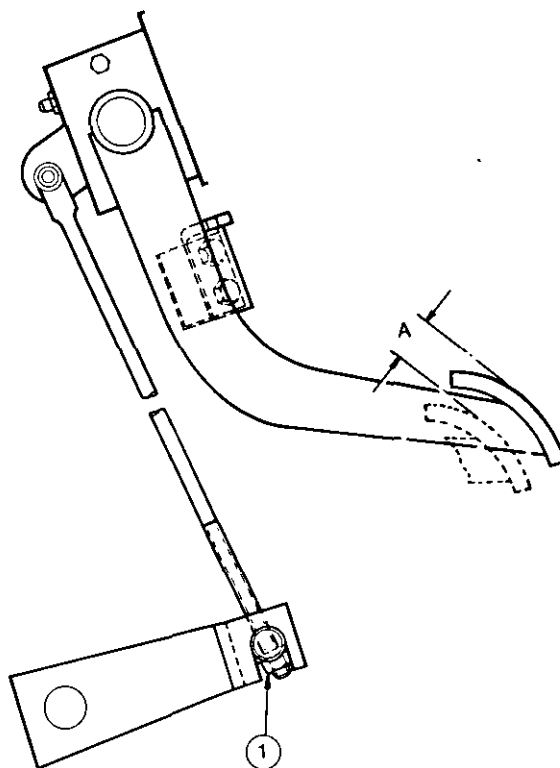
**Refitment**

5. Lightly lubricate the splines of the friction disc with Mobilgrease Super.
6. Fit the friction disc onto the flywheel.
7. Position the clutch assembly onto the flywheel.
8. Using MF 159A, centralise the clutch assembly and the friction disc.
9. Refit the six bolts and washers.
10. Remove the three slave bolts and then remove MF 159A.
11. Using MF 314, check the adjustment of each release lever. The domed end of the release lever set screw must be just touching the gauge. Adjust the setscrews as required and retighten the locknut.
12. Connect the engine to the rear half of the tractor, Part 4A.
13. Adjust the clutch pedal free travel, operation 5A-12-15 or 5A-13-15 or 5A-14-16.

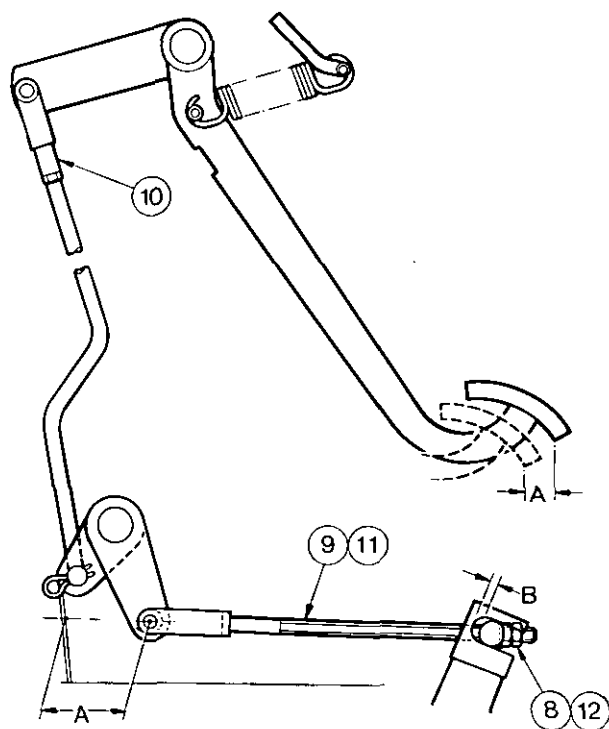
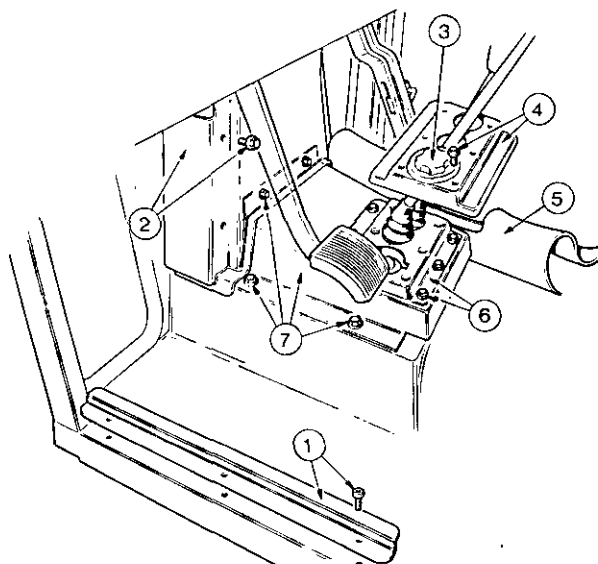


CLUTCH PEDAL**Adjustment (MF 550 Tractor) 5A-12-15**

1. Adjust the nut on the linkage to give 22 to 28 mm ($\frac{7}{8}$ to $\frac{1}{4}$ in) free pedal travel 'A'.

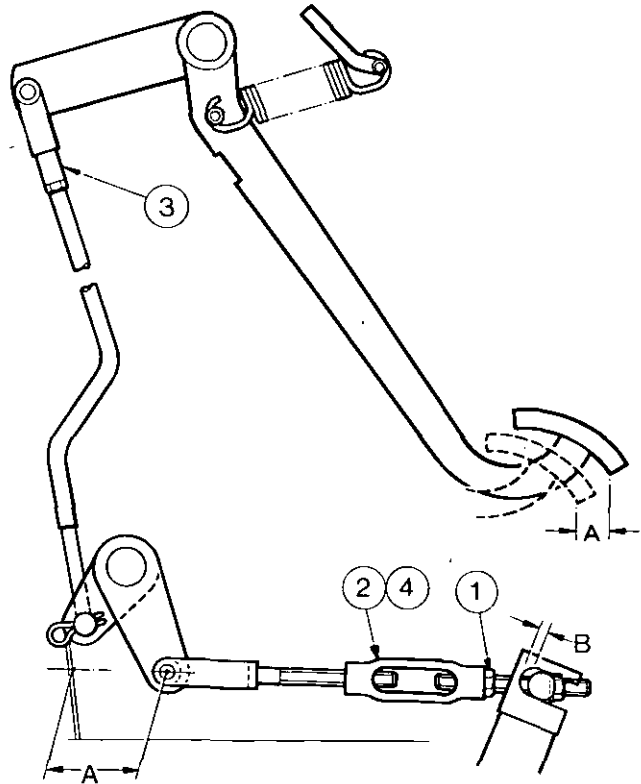
**CLUTCH PEDAL****Adjustment (MF 565 Tractor) 5A-13-15**

1. Remove the screws and the kick plate.
2. Remove the four bolts and the front panel.
3. Remove the gearbox filter plug cover.
4. Remove the screws and the top cover.
5. Roll the floor mat to the right hand side of the cab.
6. Remove the six bolts and the panel.
7. Remove the bolts and the floor panel.
8. Slacken the locknut.
9. Slacken the bolt as much as possible.
10. Adjust the clevis until 'A' is 56 to 60 mm ($2\frac{1}{8}$ to $2\frac{3}{8}$ in).
11. Adjust the bolt until 'B' is 5 to 9 mm ($\frac{3}{16}$ to $\frac{1}{8}$ in), which should give a clutch pedal free travel of 13 to 25 mm ($\frac{1}{2}$ to 1 in).
12. Retighten the locknut.
13. Operate the clutch pedal through its full travel a minimum of five times and recheck the clutch pedal free travel.
14. Reverse procedures 1 to 7.



SPLIT TORQUE CLUTCH**CLUTCH PEDAL****Adjustment (MF 575 and 590 Tractors) 5A-14-16**

1. Slacken the locknut.
2. Slacken the turnbuckle as much as possible.
3. Adjust the clevis until 'A' is 56 to 60 mm ($2\frac{1}{8}$ to $2\frac{3}{8}$ in).
4. Adjust the turnbuckle until 'B' is 5 to 9 mm ($\frac{3}{8}$ to $\frac{1}{2}$ in), which should give a clutch pedal free travel of 13 to 25 mm ($\frac{1}{2}$ to 1 in).
5. Retighten the turnbuckle locknut.
6. Operate the clutch pedal through its full travel a minimum of five times and recheck the clutch pedal free travel.



SPLIT TORQUE CLUTCH

CLUTCH ASSEMBLY

Servicing

5A-15-17

Special Tools: MF 159A Clutch Centraliser
MF 314 Level Height Setting Gauge
Hydraulic Press

Disassembly

1. Remove the clutch assembly, operation 5A-11-14.
2. Place the clutch assembly on the hydraulic press and locate a suitable bar.
3. Apply pressure until the three $\frac{1}{4}$ in slave bolts can be easily removed.
4. Removing the retaining clips.
5. Remove the pivot pins.
6. Remove the lever springs.
7. Disconnect the release levers from the links.
8. Slowly release the pressure from the press until the springs are out of compression.
9. Lift off the cover plate assembly.
10. Remove the 12 springs and the fibre washers.
11. Remove the links.
12. Remove the three bolts and nuts.
13. Remove the p.t.o. plate.

Examination

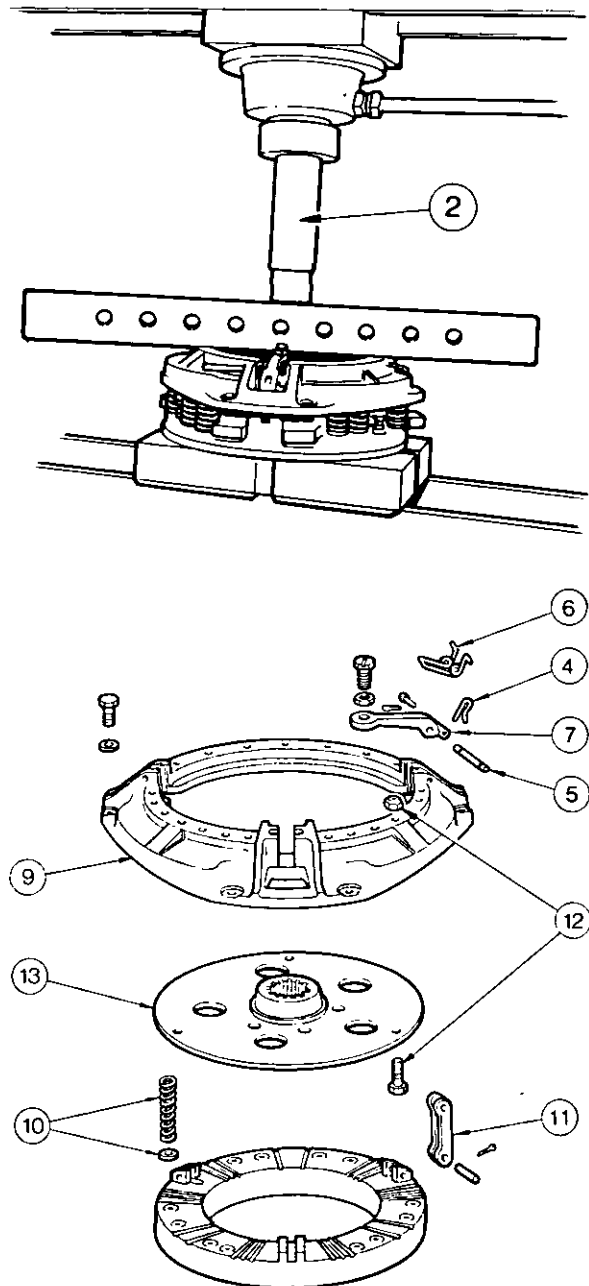
Inspect all components for wear, scoring, cracks, distortion or signs of overheating. Check the coil springs for correct loading and pressures as given in the Specification Section.

If the tractor flywheel is scored, skimming is possible in 0,254 mm (0.010 in) increments up to a maximum of 1,00 mm (0.040 in). The ledge to which the clutch cover is bolted must be skimmed by the same amount to maintain the distance from the clutch face to 39,75 to 39,62 mm (1.565 to 1.560 in).

Warning: Never under any circumstances, skim the pressure plate as this will severely impair its heat dissipation characteristics.

Reassembly

14. Reverse procedures 1 to 13 except:
Fit a new friction disc and 12 fibre washers.



SPLIT TORQUE CLUTCH

CLUTCH RELEASE BEARING

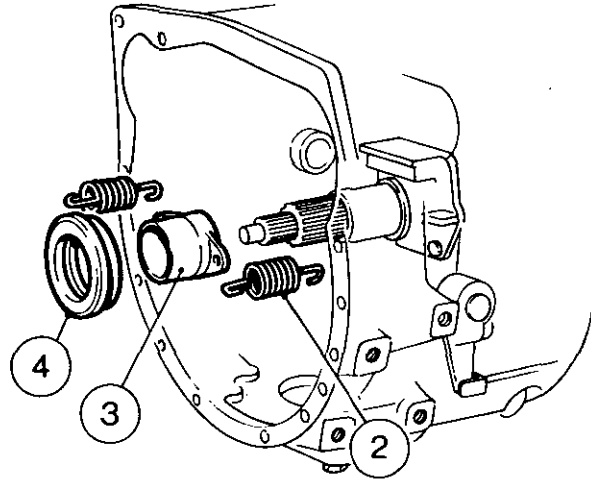
Removal and Replacement 5A-16-18

Removal

1. Split the tractor between the engine and the transmission, Part 4A.
2. Release the two springs.
3. Remove the bearing and carrier assembly.
4. Drive out the carrier from the bearing.

Replacement

5. Reverse procedures 1 to 4 except:
 - (a) Press a new bearing onto the carrier.
 - (b) Lightly lubricate the spline of the carrier with Mobilgrease Special.



8 SPEED TRANSMISSION

Part 5 — Section B

Operation Number	Table of Contents	Page Number
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5B-03-07	NORMAL DUTY GEARBOX EPICYCLIC Servicing	07
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5B-05-08	CLUTCH RELEASE MECHANISM Removal and Refitment	08
5B-06-09	INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT Removal and Refitment	09
5B-07-10	P.T.O. DRIVESHAFT FRONT BEARING Removal and Refitment	10
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5B-09-11	THIRD GEAR (MAINSHAFT) Removal and Refitment	11
5B-10-12	FIRST, SECOND, FOURTH GEAR, AND MAINSHAFT Removal and Refitment	12
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5B-14-16	HIGH/LOW AND GEAR SHIFT LEVERS Removal and Refitment	16

8 SPEED TRANSMISSION

GENERAL

The transmission has four forward gears and one reverse gear which are doubled by a planetary unit to give eight forward and two reverse gears.

All gear teeth are of involute, straight cut spur type. Where movement of the gears is required to change ratio, the gears slide on a splined shaft.

PRINCIPLE OF OPERATION

Figures 1, 2 and 3.

The Transmission

The tractor engine drives a clutch with divided drive. Each plate is splined on to a separate gearbox shaft.

Drive is transmitted to:—

- (a) The p.t.o. input shaft (14), which is hollow and has gear teeth on its rear end.
- (b) The main drive shaft (17) (which runs inside the p.t.o. input shaft) has gear teeth on its rear end and is spigot located in the front end of the mainshaft (63).

Layshaft and P.t.o. Shaft

Rotation of the p.t.o. input shaft (14), drives the p.t.o. constant mesh gear (100) which is splined on to the p.t.o. drive shaft (82). When the main input shaft (17) rotates, the drive is transmitted to the constant mesh gear (102) which is splined on to the layshaft (85). The layshaft, which is hollow and externally splined, has 15 gear teeth machined on its outside diameter to provide the first gear layshaft pinion. It is supported on two ball races located in the centre web and rear wall of the transmission case. Mounted on the layshaft are three other gears (103, 105 and 106), which are third, fourth and second gears respectively. None of the layshaft gears are free to move along the shaft, being retained, either by abutment with other gears, bearings or snap rings.

Mainshaft

The mainshaft (63) is externally splined, has gear teeth at its rear end and has a bore at its front end to accept the spigot on the main input shaft and its caged roller bearing (20). Mounted on the mainshaft are three gears (93, 97 and 98). One being a compound gear having two sets of teeth which mesh with the

layshaft gears and give third, first, fourth and second gears respectively. The mainshaft gears are moved into and out of mesh by selector forks (33, 34 and 42), the gears sliding on the mainshaft splines.

The engine speed is reduced by the selected gear ratio (variable reduction) and by the input constant mesh gears (fixed reduction).

Reverse Gear Cluster

Reverse gear is achieved by the engagement of a compound gear cluster (113). The 21 tooth half of the gear is in constant mesh with the fourth gear pinion on the layshaft. The first gear pinion on the mainshaft is moved into, or out of mesh with the 13 tooth portion of the reverse gear cluster.

The reverse gear, by acting as an idler gear between the layshaft and the mainshaft drive, reverses the rotation of the mainshaft, epicyclic unit and the final drive.

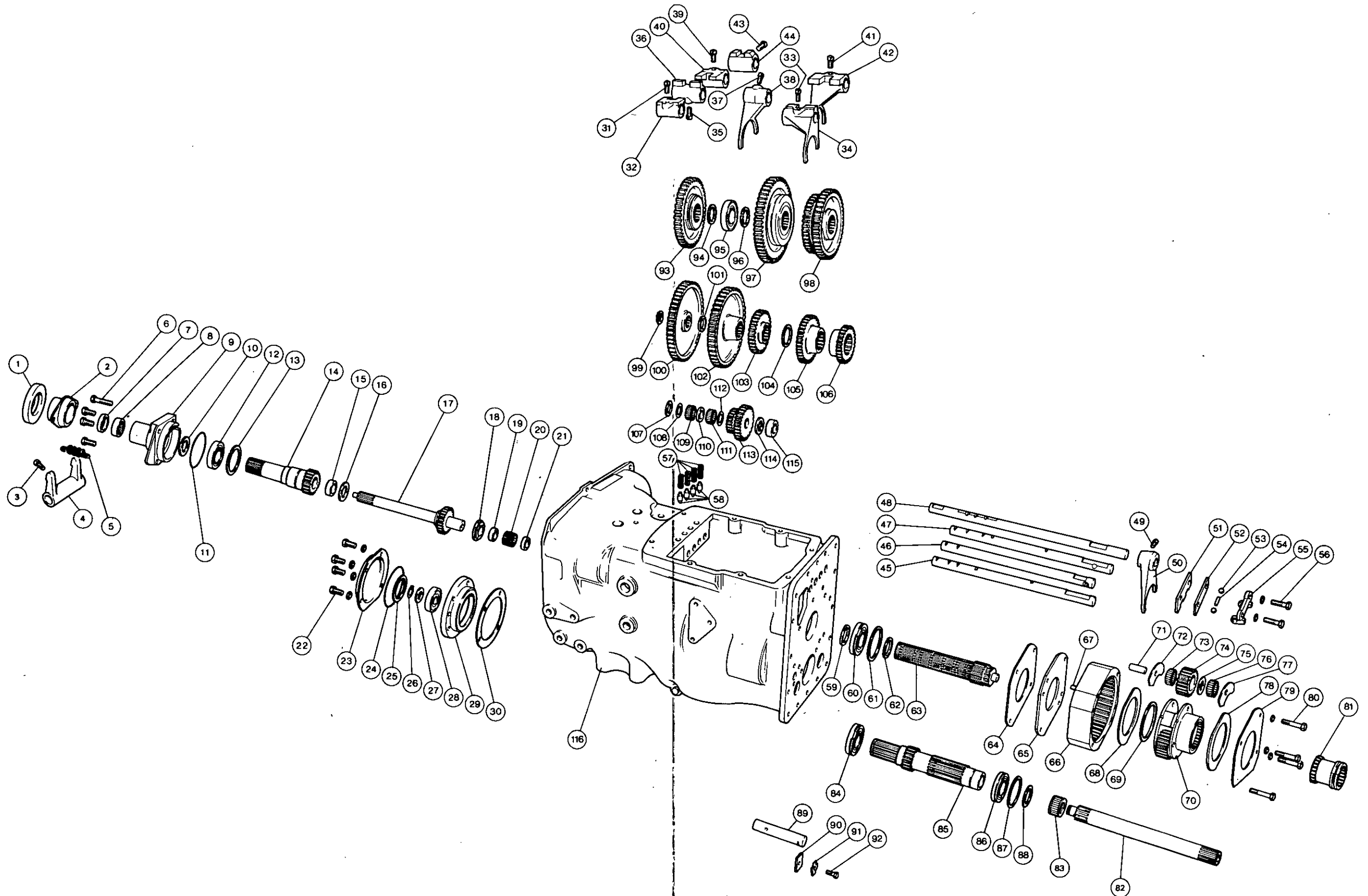
Epicyclic Unit

The basic four forward and one reverse gears are doubled by the epicyclic unit mounted on the rear end of the transmission case. The epicyclic unit comprises a ring gear (66), inside which runs three planetary pinions mounted in a carrier (70). The planetary pinions are driven by gear teeth on the end of the mainshaft (63) which acts as the sun gear. When the mainshaft rotates, the planetary pinions also rotate, but being meshed with the teeth on the inside of the ring gear the rotational speed of the carrier is reduced by a ratio of 4:1.

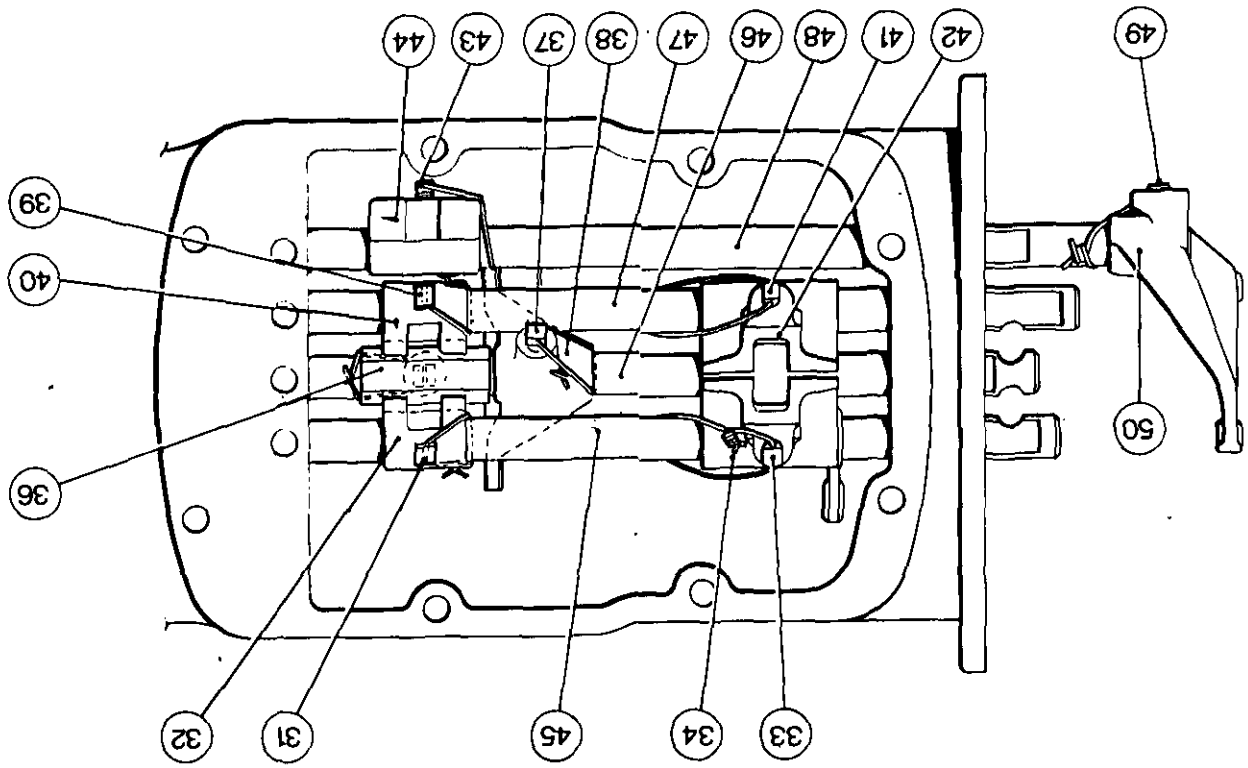
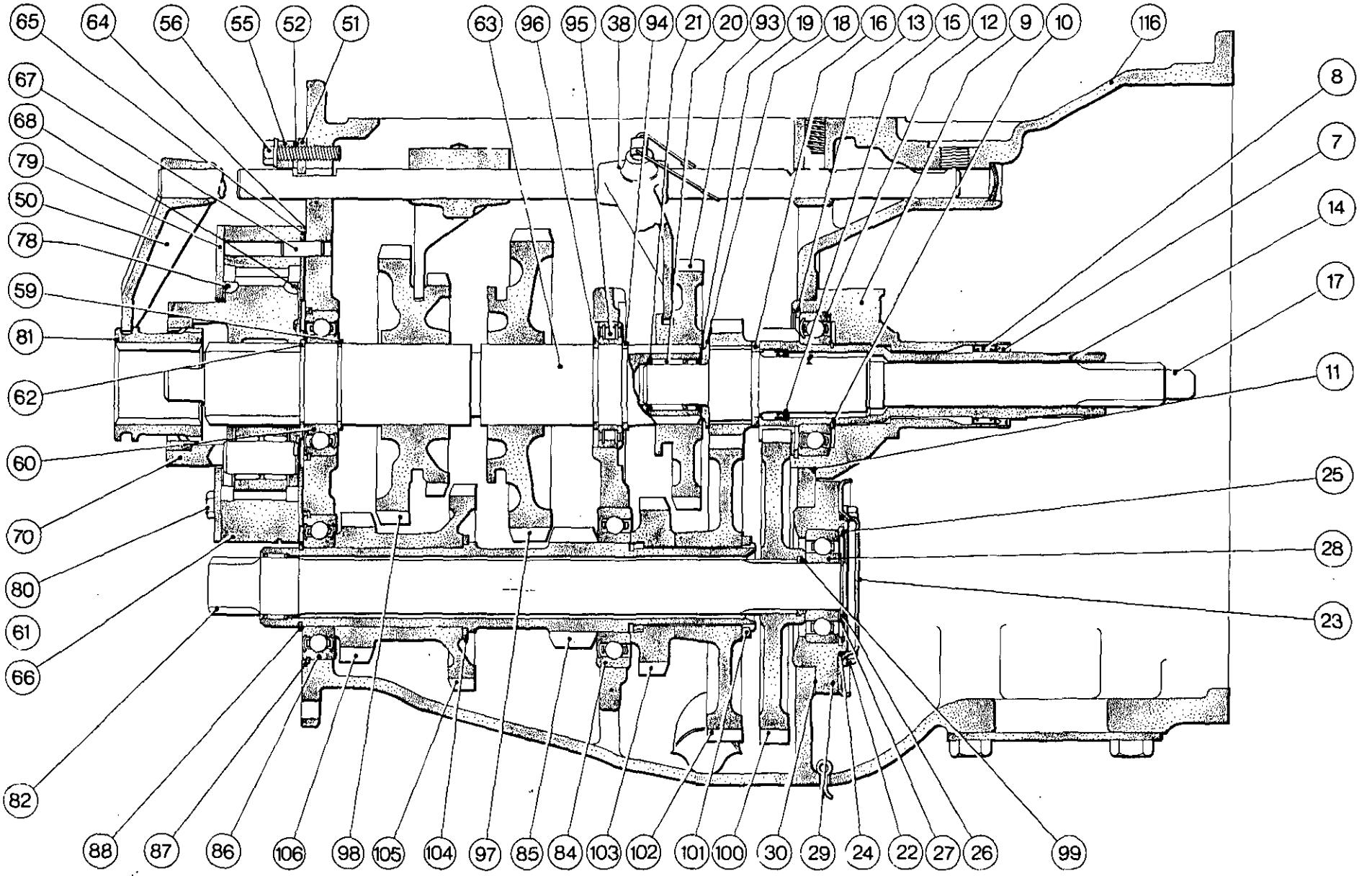
To transmit the drive from the epicyclic unit to the rear axle, a driveshaft is connected by the coupler (81), either directly to the gearbox mainshaft (HIGH range), or to the planetary pinion carrier (70) (LOW range).

Movement of the dual range selector lever actuates the rod attached to the selector fork (50) which moves the coupler (81) into, or out of mesh with either the end of the mainshaft (63) or the planetary pinion carrier (70).

Between the two engaged (HIGH or LOW range) positions, there is a neutral position, where the coupler splines are disengaged from both the mainshaft and the planetary pinion carrier.



8 SPEED TRANSMISSION



8 SPEED TRANSMISSION

KEY TO FIGURES 1, 2 and 3

- | | | | |
|----|---|-----|---|
| 1 | Clutch release bearing | 58 | Detent plungers |
| 2 | Clutch release bearing carrier | 59 | Mainshaft rear bearing front securing snap ring |
| 3 | Clutch release fork locking peg | 60 | Mainshaft rear bearing |
| 4 | Clutch release fork | 61 | Mainshaft rear bearing locating snap ring |
| 5 | Clutch release bearing return spring | 62 | Mainshaft rear bearing rear securing snap ring |
| 6 | Input housing securing bolts | 63 | Mainshaft |
| 7 | P.t.o. input shaft seal | 64 | Epicyclic shim |
| 8 | P.t.o. input shaft needle roller bearing | 65 | Epicyclic front plate |
| 9 | Input housing | 66 | Epicyclic ring gear |
| 10 | P.t.o. input shaft bearing securing external circlip | 67 | Epicyclic ring gear dowel |
| 11 | Input housing 'O' ring | 68 | Epicyclic front thrust ring |
| 12 | P.t.o. input shaft bearing | 69 | Epicyclic planetary pinion shaft securing circlip |
| 13 | P.t.o. input shaft securing internal circlip | 70 | Epicyclic planetary pinion carrier |
| 14 | P.t.o. input shaft | 71 | Epicyclic planetary pinion shaft |
| 15 | Main drive input shaft seal | 72 | Planetary pinion front thrust washer |
| 16 | Main drive input shaft front bush | 73 | Planetary front roller set |
| 17 | Main drive input shaft | 74 | Planetary pinion |
| 18 | Main drive input shaft rear bush | 75 | Planetary roller spacer |
| 19 | Mainshaft needle roller bearing front spacer | 76 | Planetary rear roller set |
| 20 | Mainshaft needle roller bearing | 77 | Planetary pinion rear thrust washer |
| 21 | Main shaft needle roller bearing rear spacer | 78 | Epicyclic rear thrust ring |
| 22 | P.t.o. front bearing cover securing bolts | 79 | Epicyclic cover plate |
| 23 | P.t.o. front bearing cover | 80 | Epicyclic securing bolt |
| 24 | P.t.o. front bearing cover 'O' ring | 81 | High/low shift coupler |
| 25 | P.t.o. front bearing securing circlip | 82 | P.t.o. drive shaft |
| 26 | P.t.o. shaft securing circlip | 83 | Layshaft front needle roller bearing |
| 27 | P.t.o. shaft spacer washer | 84 | Layshaft front bearing |
| 28 | P.t.o. shaft front bearing | 85 | Layshaft |
| 29 | P.t.o. front bearing housing | 86 | Layshaft rear bearing |
| 30 | P.t.o. front bearing housing gasket | 87 | Layshaft rear bearing location snap ring |
| 31 | Second and fourth gear lever engagement dog locking peg | 88 | Layshaft rear bearing securing snap ring |
| 32 | Second and fourth gear lever engagement dog | 89 | Reverse gear cluster shaft |
| 33 | Second and fourth selector fork locking peg | 90 | Reverse gear cluster shaft retaining plate |
| 34 | Second and fourth selector fork | 91 | Tab washer |
| 35 | Third gear lever engagement dog locking peg | 92 | Reverse gear cluster shaft securing bolt |
| 36 | Third gear lever engagement dog | 93 | Third gear (mainshaft) |
| 37 | Third gear selector fork locking peg | 94 | Mainshaft front bearing front securing snap ring |
| 38 | Third selector fork | 95 | Mainshaft front bearing |
| 39 | First and reverse gear lever engagement dog locking peg | 96 | Mainshaft front bearing rear securing snap ring |
| 40 | First and reverse gear lever engagement dog | 97 | First/reverse gear (mainshaft) |
| 41 | First and reverse selector fork locking peg | 98 | Second and fourth gear cluster |
| 42 | First and reverse selector fork | 99 | P.t.o. constant mesh gear location circlip |
| 43 | High/low gear lever engagement dog locking peg | 100 | P.t.o. constant mesh gear |
| 44 | High/low gear lever engagement dog | 101 | Main drive constant mesh gear securing circlip |
| 45 | Second and fourth selector rail | 102 | Main drive constant mesh gear |
| 46 | Third selector rail | 103 | Third gear (layshaft) |
| 47 | First and reverse selector rail | 104 | Fourth gear (layshaft) securing snap ring |
| 48 | High/low selector rail | 105 | Fourth gear (layshaft) |
| 49 | High/low selector fork locking peg | 106 | Second gear (layshaft) |
| 50 | High/low selector fork | 107 | Reverse gear front thrust washer |
| 51 | Interlock stop plate | 108 | Needle roller front retaining ring |
| 52 | Interlock plain plate | 109 | Front needle roller set |
| 53 | Interlock ball | 110 | Needle roller spacer |
| 54 | Interlock cross peg | 111 | Rear needle roller set |
| 55 | Interlock ball carrier | 112 | Needle roller rear retaining ring |
| 56 | Interlock mechanism securing bolt | 113 | Reverse gear cluster |
| 57 | Detent springs | 114 | Reverse gear rear thrust washer |
| | | 115 | Reverse gear cluster spacer |
| | | 116 | Gearbox case |

8 SPEED TRANSMISSION**SELECTOR RAIL MECHANISM****Removal and Refitment**

5B-01-06

Special Tools: 270 Rail Trolley
 MF 365/1 Plates
 MF 365/3 Short Bars
 MF 365/4 Long Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

NOTE: Beware of the sharp edges around the top of the gearbox case.

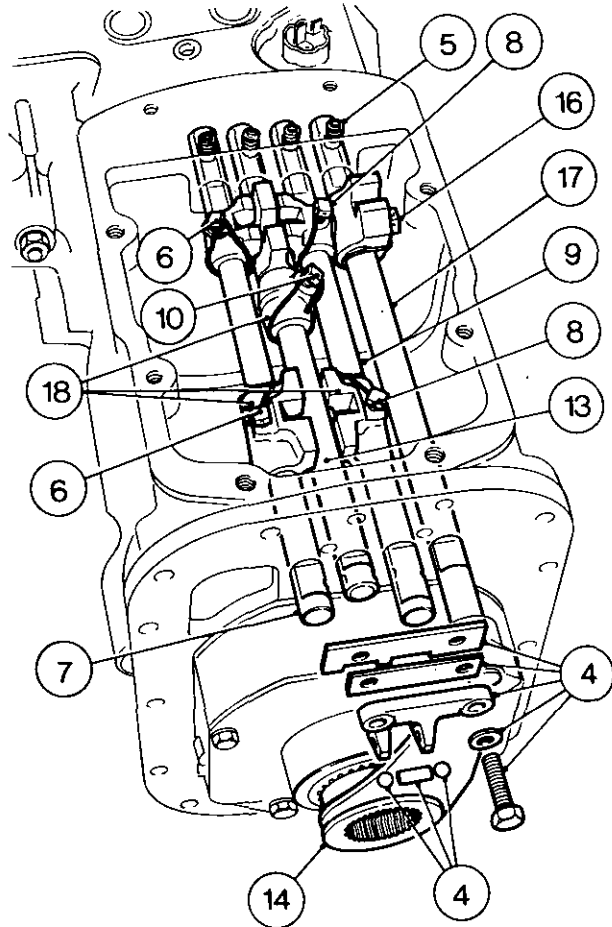
1. Split the tractor between the spacer and the centre housing and remove the transmission Part 3A.
2. Remove the gearbox top cover and gasket, and spacer and gasket.
3. Release the locking wires.
4. Remove the bolts, fork, balls, peg, stop plate and plain plate.
5. Lift out the springs and plungers.
6. Remove the locking pegs.
7. Slide the rail rearwards out of the housing.

NOTE: When removing the selector rails, retain the gear lever engagement dogs.

8. Remove the locking pegs.
9. Slide the rail rearwards out of the housing.
10. Remove the locking peg.
11. Rotate the third gear selector rail through 180°.
12. Remove the third gear engagement dog locking peg.
13. Slide the rail rearwards out of the housing.
14. Slide the High/Low rail rearwards and remove the coupling.
15. Rotate the High/Low rail through 90°.
16. Remove the locking peg.
17. Slide the rail rearwards out of the housing.
18. Remove the selector forks from the gearbox.

Refitment

19. Reverse procedures 1 to 18, except:
 - (a) Apply a few drops of oil to the selector rails before refitment.
 - (b) Tighten the locking mechanism retaining bolts to a torque of 47 Nm (35 lbf ft).
 - (c) On completion of the refitting procedure, place all the gear lever engagement dogs in the neutral position.



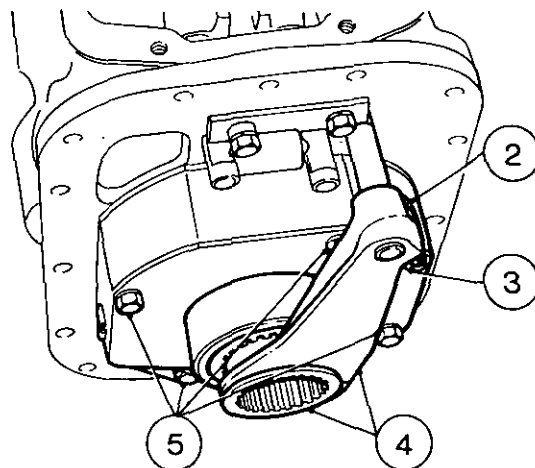
NORMAL AND HEAVY DUTY GEARBOX EPICYCLIC

Removal and Refitment 5B-02-07

Special Tools: 270 Rail Trolley
 MF 365/1 Plates
 MF 365/3 Short Bars
 MF 365/4 Long Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

1. Split the tractor between the spacer and the centre housing, and remove the transmission Part 3A.
2. Remove the locking wire.
3. Remove the locking peg.
4. Remove the selector fork and coupling.
5. Remove the bolts.
6. Remove the complete assembly.



Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the front and rear thrust rings are correctly located before refitment.
 - (b) Ensure that the epicyclic dowels are correctly located in the gearbox casing.
 - (c) Locate the cover plate with the cut out in the bottom left hand corner for heavy duty, and the bottom right hand corner for normal duty epicyclics.
 - (d) Do not fit a lockwasher to the lower left hand retaining bolt.
 - (e) Tighten the retaining bolts progressively and evenly to a torque of 47 Nm (35 lbf ft).

NORMAL DUTY GEARBOX EPICYCLIC

Servicing 5B-03-07

Special Tools: See operation 5B-02-06

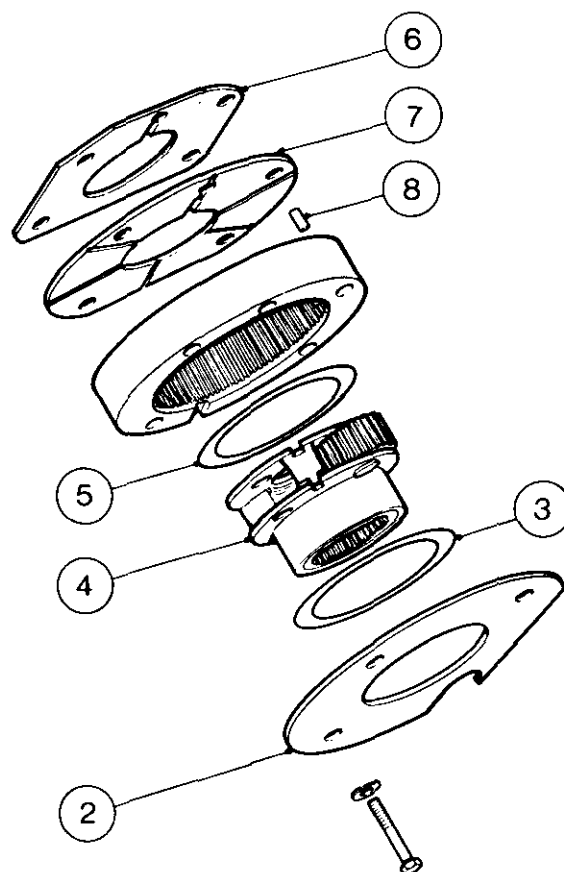
Disassembly

1. Remove the gearbox epicyclic, operation 5B-02-06.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. If necessary, remove the dowel pins from the ring gear.

NOTE: The planetary pinion carrier cannot be serviced, and must be replaced as a complete assembly if found defective.

Reassembly

9. Reverse procedures 1 to 8 except:
 - (a) The front and cover plates must be positioned with the oil grooves towards the pinion carrier.
 - (b) Always fit the same thickness of shims as those removed.
 - (c) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.



8 SPEED TRANSMISSION**HEAVY DUTY GEARBOX EPICYCLIC****Servicing**

5B-04-08

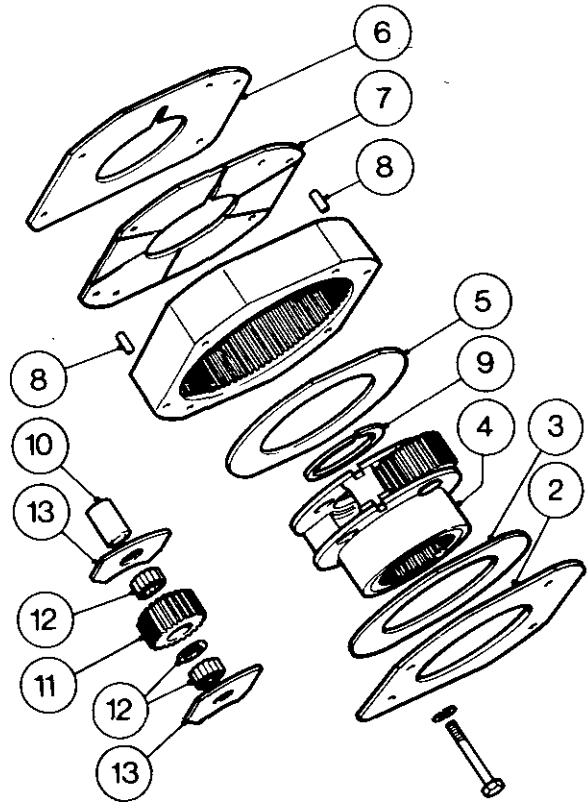
Special Tool: See operation 5B-02-06

Disassembly.

1. Remove the gearbox epicyclic, operation 5B-02-06.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. If necessary, remove the dowel pins from the planetary ring gear.
9. Remove the external snap ring.
10. Gently tap out the three pinion shafts towards the front.
11. Remove the planetary pinions.
12. Remove the two sets of rollers and spacer from each pinion.
13. Remove the wear plates from each side of each pinion.

Reassembly

14. Reverse procedures 1 to 13, except:
 - (a) When replacing the rollers in the pinions, a smear of petroleum jelly (not grease) will help retain them. Do not omit the spacer from between the two runs of rollers. Each run consists of 16 rollers.
 - (b) The front plate and the cover plate must be positioned with the oil grooves towards the pinion carrier.
 - (c) Always fit the same thickness of shims as those removed.
 - (d) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.

**CLUTCH RELEASE MECHANISM****Removal and Refitment**

5B-05-08

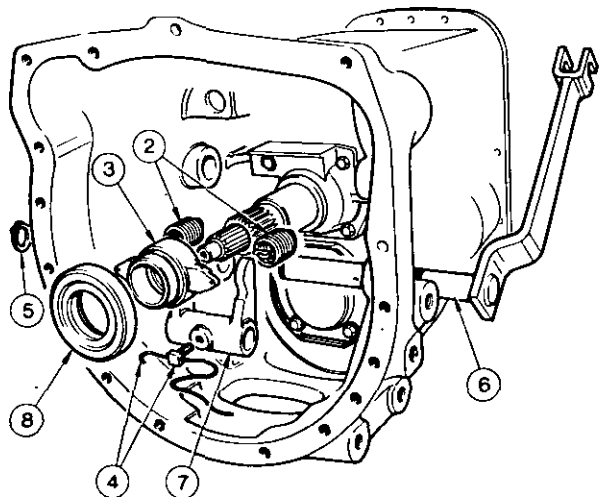
Special Tool: 270 Rail Trolley

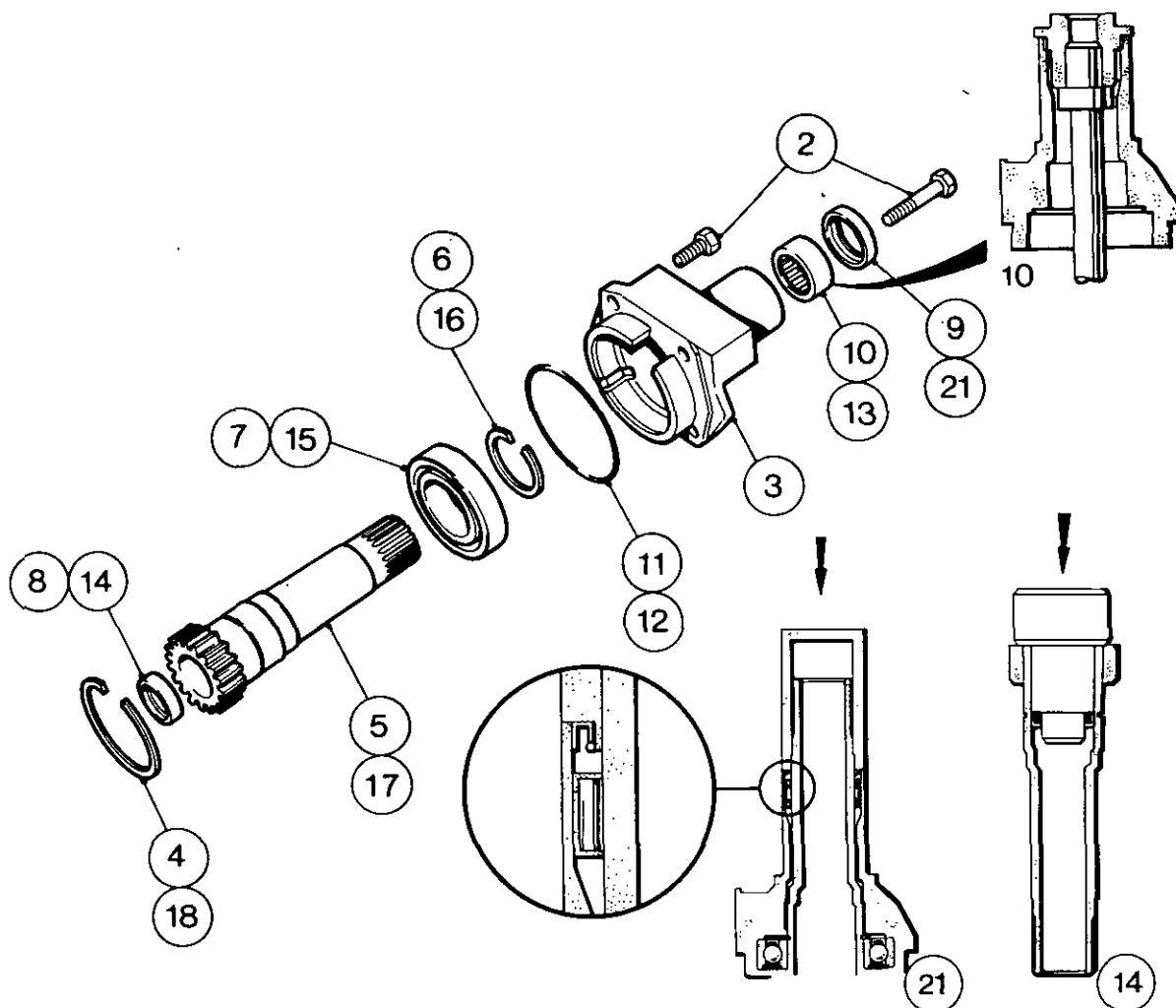
Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the two springs.
3. Slide the carrier and release bearing off the input housing.
4. Remove the locking wire and locking peg.
5. Remove the circlip.
6. Remove the shaft, but to obtain sufficient clearance on MF 550 and MF 560 tractors, the left hand front cab mounting bracket must be removed, and on all versions the fuel tank must be removed, Part 4C.
7. Remove the clutch release fork.
8. Press the release bearing off the carrier.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Lightly lubricate the input shaft splines and the release bearing carrier bore, with special grease Mobilgrease Super.
 - (b) Ensure that the locking peg locates in the hole in the shaft.





INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Removal and Refitment

5B-06-09

Special Tools: 270 Rail Trolley
 MF 177 Seal Protector
 MF 255B Oil Seal Replacer
 MF 331 Oil Seal Replacer
 MF 315 Needle Roller Bearing Removal and Refitting Tool.

Removal

1. Remove the clutch release mechanism, operation 5B-05-08.
2. Remove the four bolts.
3. Withdraw the input housing complete with p.t.o. input shaft.
4. Remove the large internal circlip.
5. Push the p.t.o. input shaft complete with bearing rearwards out of the housing.
6. If necessary remove the circlip.
7. If necessary press the bearing off.
8. Lever the seal out.
9. Lever the seal out.
10. Using MF 315, remove the needle roller bearing.
11. Remove the 'O' ring (p.t.o. input shaft housing).

Refitment

12. Fit a new 'O' ring (p.t.o. input shaft).
13. Using MF 315, replace the needle roller bearing.
14. Using MF 331, fit a new seal, with the toe of the seal facing the tool.
15. Refit the bearing with the shield towards the gear teeth.
16. Refit the circlip (check that it is properly seated).
17. Refit the p.t.o. input shaft and bearing into the input housing.
18. Refit the circlip (check that it is properly seated).
19. Place the cone adaptor on MF 255B.
20. Place the seal over the cone and onto the tool with the seal toe facing away from the tool and remove the cone.
21. Place the tool over the p.t.o. input shaft and tap the seal into place.
22. Place MF 177 over the splines of the main input shaft.
23. Reverse procedures 1 to 3, except:
 - (a) Use petroleum jelly (not grease) to lubricate all seals and the needle roller bearing when refitting.
 - (b) Lightly coat the bolt thread in recommended sealant 'B' when refitting, and tighten the bolts to a torque of 60 Nm (45 lbf ft).

8. SPEED TRANSMISSION

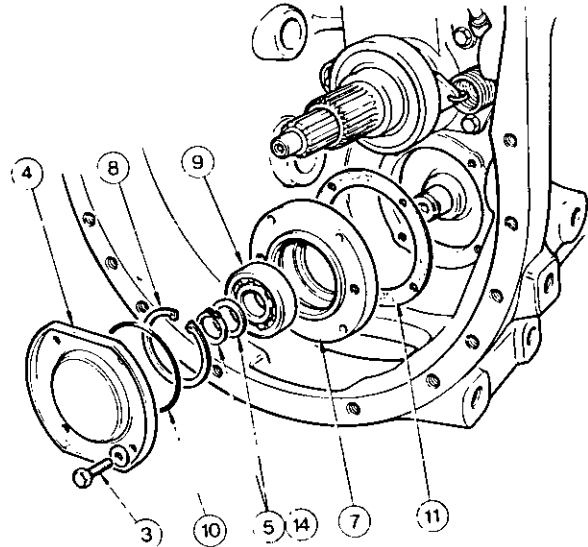
P.T.O. DRIVESHAFT FRONT BEARING

Removal and Refitment 5B-07-10

Special Tools: 270 Rail Trolley
MF 218A P.t.o. Drive Shaft Puller
MF 218A-2 Adaptor

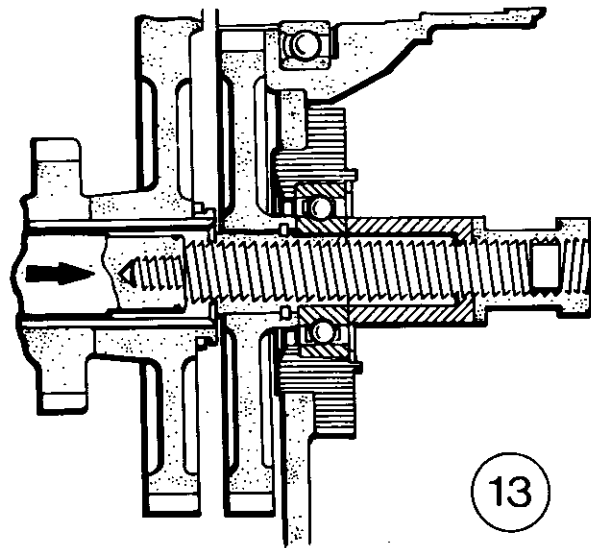
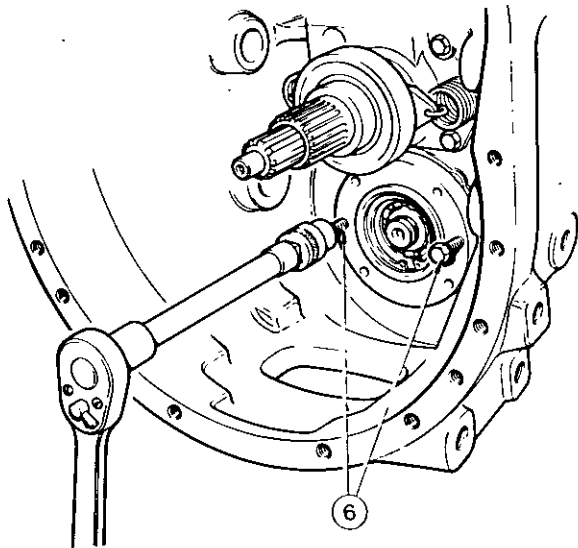
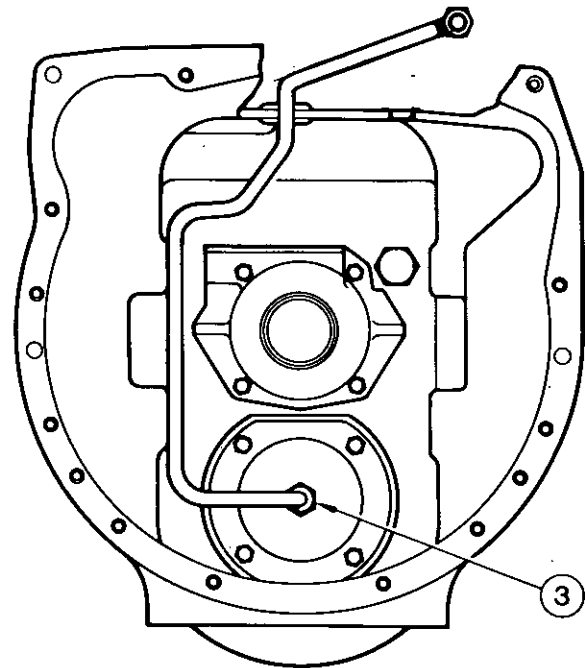
Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the brake cross shaft, operation 5B-06-09. procedures 2 to 5.
3. On i.p.t.o. versions, remove the pipe, and then on all versions remove the four bolts and washers.
4. Remove the plate.
5. Remove the external circlip and washer.
6. Screw two $\frac{1}{2}$ UNC x 75 mm (3 in) bolts into the bearing housing and tighten them evenly.
7. Remove the housing.
8. Remove the circlip.
9. Press out the bearing.
10. Discard the 'O' ring.
11. Discard the gasket.



Refitment

12. Reverse procedures 8 to 11, except:
 - (a) Fit a new 'O' ring, gasket and circlip.
 - (b) Coat the gasket with recommended sealant 'A'.
13. Using MF 218A and MF 218A-2, refit the bearing and housing assembly on the front end of the p.t.o. input shaft ensuring that the splines on the shaft locate in those in the p.t.o. constant mesh gear.
14. Fit a new circlip and the washer.
15. Reverse procedures 1 to 4, except:
 - (a) Lightly coat the securing bolt threads in recommended sealant 'B'.
 - (b) Tighten the bolts to a torque of 60 Nm (45 lbf ft).



MAIN INPUT SHAFT**Removal and Refitment**

5B-08-11

Special Tools: 270 Rail Trolley

MF 177 Seal Protector

MF 218A P.t.o. Driveshaft Puller

MF 218A-2 Adaptor

MF 365/1 Plates

MF 365/3 Short Bars

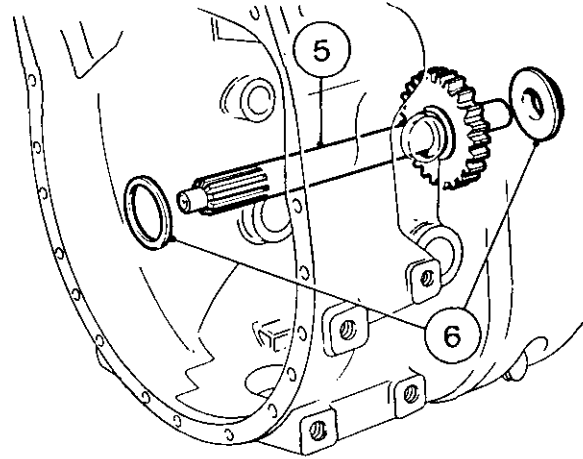
MF 365/4 Long Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

MF 365/8 Stands

1. Split the tractor between the spacer housing and centre housing, Part 3A.
2. Remove the input housing and p.t.o. input shaft operation 5B-06-09.
3. Remove the p.t.o. driveshaft front bearing, operation 5B-07-10.
4. Withdraw the p.t.o. driveshaft rearwards, this will allow the p.t.o. constant mesh gear to drop into the bottom of the gearbox.
5. Remove the main input shaft, complete with the two thrust washers.
6. Remove the thrust washers.

**Refitment**

7. Reverse procedures 1 to 6, except:
Ensure that the thrust washer, with oil grooves, is placed on the rear of the main input shaft, with the oil grooves facing the rear of the gearbox, and that it is lightly oiled.

THIRD GEAR (MAINSHAFT)**Removal and Refitment**

5B-09-11

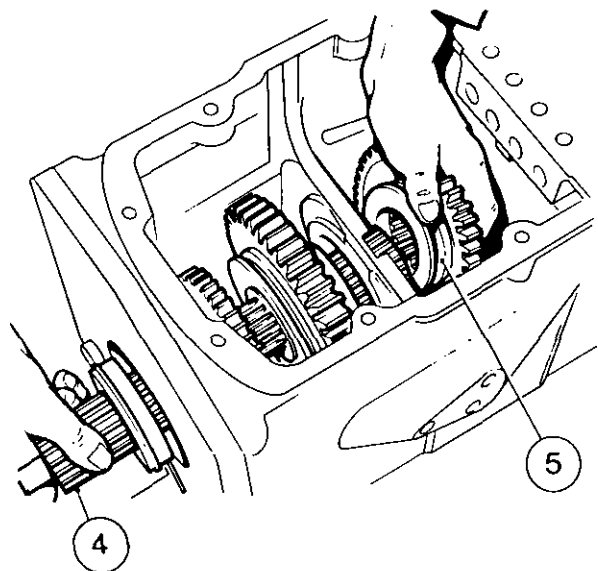
Special Tools: See operation 5B-08-11

Removal

1. Remove the selector rail mechanism, operation 5B-01-06.
2. Remove the gearbox epicyclic unit, operation 5B-02-06.
3. Remove the main input shaft, operation 5B-08-11.
4. Using a soft faced drift, drive the mainshaft rearwards until its bearings are no longer located in their gearbox webs.
5. Withdraw the third gear pinion.

Refitment

6. Reverse procedures 1 to 5.



8 SPEED TRANSMISSION

**MAINSHAFT, FIRST/REVERSE GEAR,
SECOND AND FOURTH GEAR****Removal and Refitment** 5B-10-12

Special Tools: See Operation 5B-08-11, and
MF 200 Hand Press
MF 200-25 Adaptor

Removal

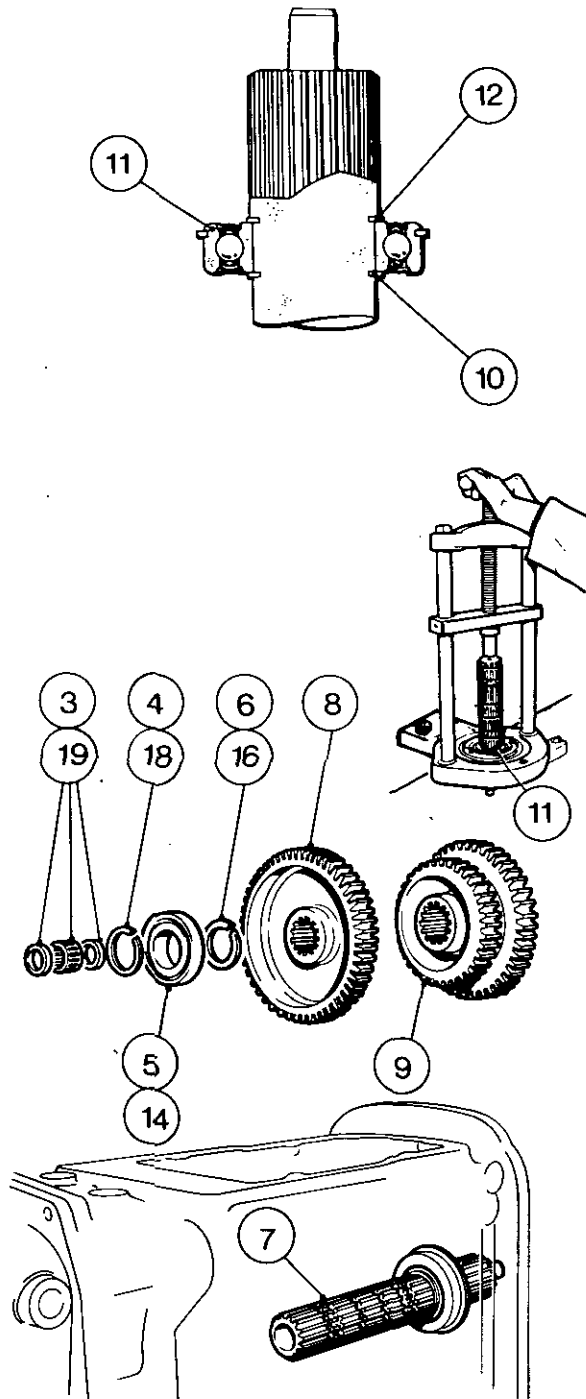
1. Remove the third gear pinion, operation 5B-09-11.
2. Pull the mainshaft rearwards to release the mainshaft front bearing from the centre web.
3. Remove the bearing and two spacers.
4. Remove the circlip.
5. Tilt the mainshaft upwards, then slide the bearing towards the front of the mainshaft.
6. Manoeuvre the circlip towards the front of the mainshaft, then slide the mainshaft further rearwards and remove the bearing and circlip.
7. Slide the mainshaft out the back of the gearbox.
8. Remove the first/reverse gear.
9. Remove the second and fourth gear.
10. Remove the circlip.
11. Using MF 200 and MF 200-25, remove the bearing off the FRONT of the mainshaft.
12. Remove the circlip.

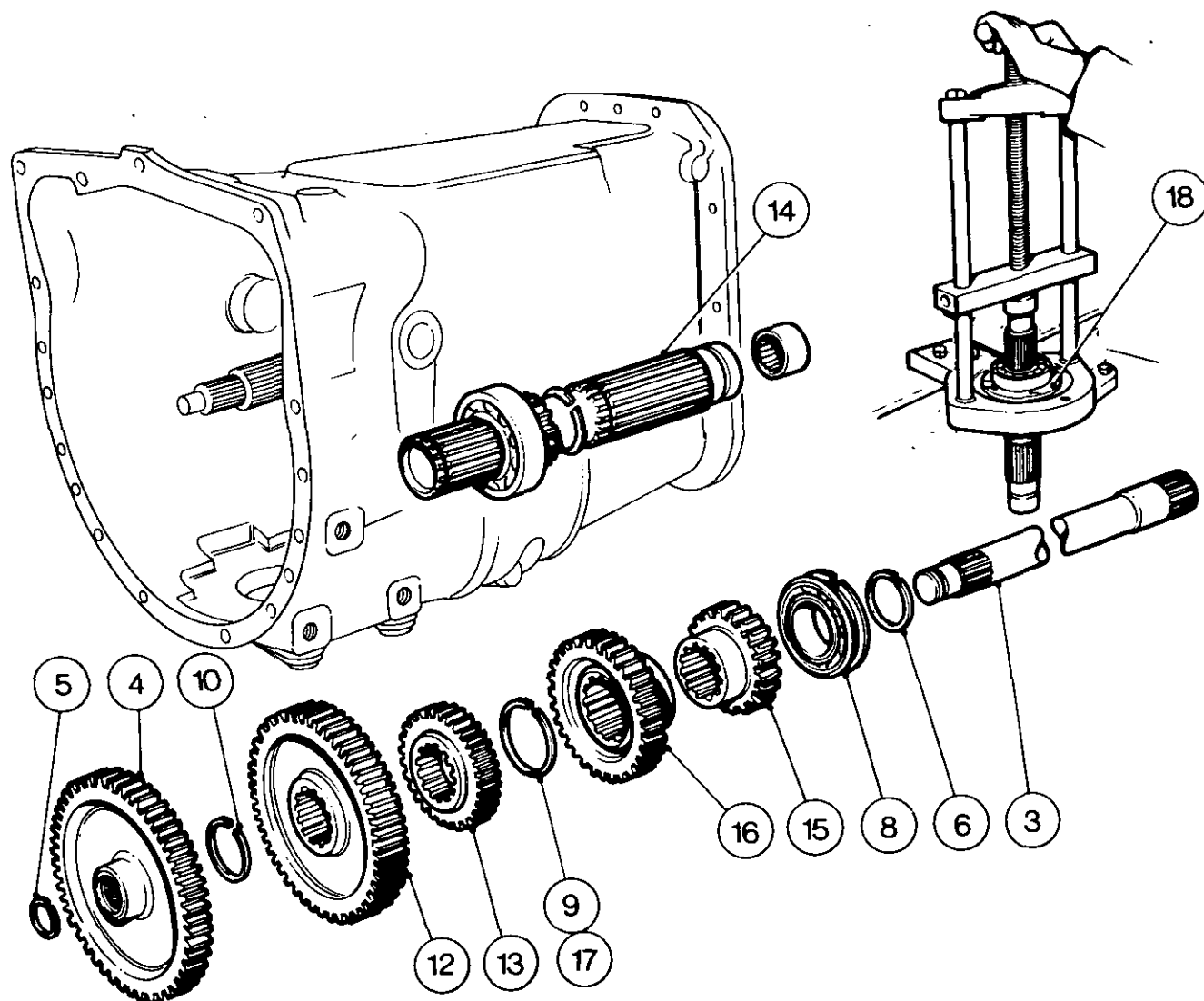
Refitment

13. Reverse procedures 8 to 12.
14. Place the centre bearing in its web.
15. Slide the mainshaft through the rear of the gearbox, then through the second and fourth and first/reverse gears.
16. Refit the circlip.
17. Insert the mainshaft through the centre bearing.
18. Refit the circlip.
19. Refit the bearing and spacers.

NOTE: Ensure that all snap rings are correctly located in their grooves.

20. Refit the third gear pinion, operation 5B-09-11.





LAYSHAFT AND GEARS, P.T.O. SHAFT AND GEAR

Removal and Refitment

5B-11-13

Special Tools: See Operation 5B-08-11, and
MF 200 Hand Press
MF 200-25 Adaptor

Removal

1. Remove the mainshaft and gears, operation 5B-10-12.
2. Remove the p.t.o. driveshaft front bearing, operation 5B-07-10.
3. Remove the p.t.o. driveshaft from the rear of the gearbox.
4. Remove the p.t.o. constant mesh gear.
5. Remove the small internal snap ring, (only if necessary).
6. Remove the snap ring from the rear of the layshaft.
7. Tap the layshaft forwards.

8. Remove the bearing.
9. Expose the snap ring, open it and slide it forwards onto the unsplined portion of the shaft.
10. Remove the snap ring.
11. Relocate the front bearing in its web and tap the layshaft rearwards.
12. Remove the constant mesh gear.
13. Remove the third gear pinion.
14. Manoeuvre the layshaft forwards out of the gearbox.
15. Remove the second gear pinion.
16. Remove the fourth gear pinion.
17. Remove the snap ring.
18. Using MF 200 and MF 200-25, press the bearing off the front end of the layshaft.

Refitment

19. Reverse procedures 1 to 18, except: Ensure that all snap rings are correctly located in their grooves.

8 SPEED TRANSMISSION**REVERSE GEAR CLUSTER****Removal and Refitment** 5B-12-14

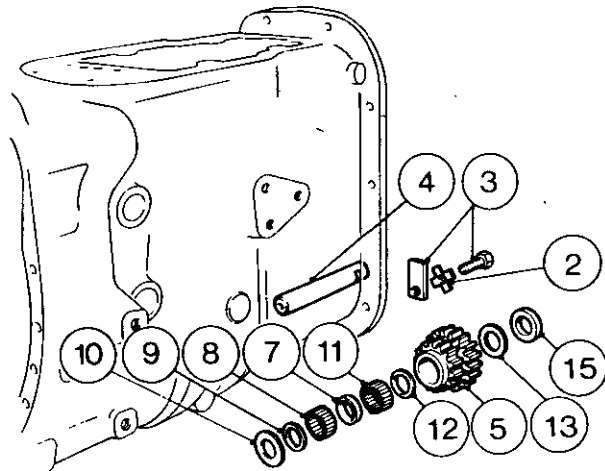
Special Tools: See Operation 5B-08-11 and
55 x 25 mm ($2\frac{1}{8}$ x 1 in) dia. Mild Steel
Dummy Shaft

Removal

1. Remove the mainshaft and gears, operation 5B-10-12, procedures 1 to 9.
2. Release the tabwasher.
3. Remove the bolt and locating tab.
4. Slide the dummy shaft from the front of the reverse gear shaft towards the rear. This will push out the reverse gear shaft, and prevent the needle rollers from dropping into the transmission case.
5. Remove the idler gear cluster complete with all parts and the dummy shaft.
6. Withdraw the dummy shaft from the idler gears, and allow all parts to drop out, onto a clean work surface.

Refitment

7. Fit the spacer in the reverse gear cluster.
8. Refit the first set of rollers. Each run consists of 28 rollers.
NOTE: Smear the rollers in petroleum jelly (not grease) to facilitate re-assembly.
9. Refit the retaining ring.
10. Refit the thrust washer.
11. Refit the second set of rollers.
12. Refit the retaining ring.
13. Refit the thrust washer.
14. Slide the dummy shaft into the reverse gear cluster rollers.
15. Slide the distance piece over the dummy shaft on the rear end of the reverse gear cluster.
16. Reverse procedures 1 to 5.



8 SPEED TRANSMISSION**TRANSMISSION CASE REMOVAL AND
REFITMENT OR COMPLETE GEARBOX
OVERHAUL** 5B-13-15

Special Tools: MF 177 Seal Protector
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 218A P.t.o. Shaft Puller
 MF 218-2 Adaptor
 MF 255B Oil Seal Replacer
 MF 331 Oil Seal Replacer
 MF 315 Needle Roller Bearing
 Remover and Refitting Tool
 MF 365/1 Plates
 MF 365/3 Short Bars
 MF 365/4 Long Bars.
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands
 V.L. Churchill 50 ton Hydraulic Press
 (alternative to MF 200)
 55 mm x 25 mm (2 $\frac{1}{8}$ in x 1 in) Dia
 Mild Steel Dummy Shaft.

Disassembly

1. Remove the selector rail mechanism, operation 5B-01-06.
2. Remove the gearbox epicyclic unit, operation 5B-02-06.
3. Disassemble the transmission epicyclic unit operation 5B-03-07 or 5B-04-08.
4. Remove the clutch release mechanism, operation 5B-05-08.
5. Remove and dismantle the input housing and p.t.o. shaft, operation 5B-06-09.
6. Remove the p.t.o. shaft front bearing, operation 5B-07-10.
7. Remove the main input shaft, operation 5B-08-11.
8. Remove the third gear (mainshaft), operation 5B-09-11.
9. Remove the mainshaft, first/reverse gear, and the second and fourth gear, operation 5B-10-12.
10. Remove the layshaft and gears and p.t.o. shaft and gear, operation 5B-11-13.
11. Remove the reverse gear cluster, operation 5B-12-14.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings, needle rollers, gear selector forks, also shaft splines which are subject to wear from the sliding action of the gears.

All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webs. Maximum acceptable clearance is 0,033 mm (0.0013 in). Where the clearance between bearing and bore exceeds this figure, recommended sealant 'C' may be used to refit the bearings into the transmission case. After inspection, lubricate bearings with transmission oil.

Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tabwasher must be fitted.

Reassembly

12. Reverse procedures 1 to 11 except:
 - (a) Use only petroleum jelly for reassembly purposes—Never Grease.
 - (b) Ensure all snap rings are correctly located in their grooves.
 - (c) Lightly oil all bushes, bearings and splines prior to reassembly.

8 SPEED TRANSMISSION**HIGH/LOW AND GEAR SHIFT LEVERS****Removal and Refitment**

5B-14-16

Removal

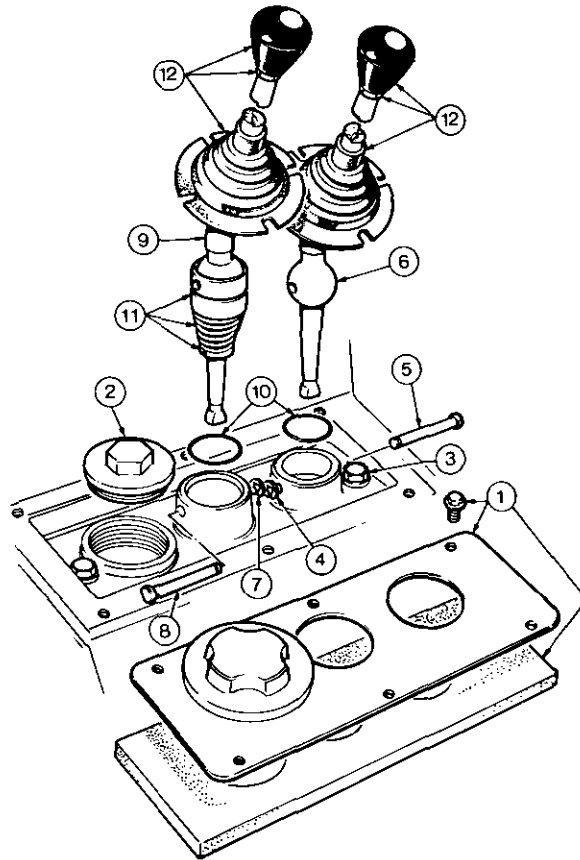
1. Remove the bolts, plate and sound proofing pad.
2. Remove the filler plug.
3. Remove the bolt.
4. Remove the clip.
5. Remove the pin.
6. Withdraw the lever.
7. Remove the clip.
8. Remove the pin, taking care not to drop it into the gearbox.
9. Withdraw the lever and cup assembly.
10. Discard the 'O' rings.
11. If necessary, press the spring retaining washer towards the spring, slide it sideways and remove it. This will release the spring and support cup.

WARNING: When removing the spring retaining washer, care must be taken to prevent the spring from flying out and causing possible injury and damage.

12. If necessary, remove the knobs, nuts and dust caps.

Refitment

13. Reverse procedures 1 to 12, except:
 - (a) Fit new 'O' rings.
 - (b) Ensure that the gearlevers locate correctly in the gearlever engagement dogs.



MULTI-POWER TRANSMISSION**Part 5—Section C**

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MULTI-POWER TRANSMISSION**GENERAL****Figures 1 and 2**

Multi-Power transmission provides twelve forward gears and four reverse gears. This is achieved by combining with the standard transmission, low driving (59A or 109) and driven (121) constant mesh gears, operated by a free wheel coupler (120), and high driving (107), and driven (118) constant mesh gears operated by a multi-plate hydraulic clutch (98). By driving the layshaft (89) with either of these two pairs of gears, an alternative speed for each gear becomes available.

To provide Multi-Power, the following components are added to the standard transmission; a pair of constant mesh gears, free-wheel unit (120), multi-plate clutch (98), oil pump, oil control valve and shift mechanism (137).

The high driving gear (107), runs on a bush on the main input shaft (59 or 59A), next to the low driving gear. The front end of the high driving gear (107) is splined to engage the clutch disc splines. The three clutch discs, plates, piston and return springs are held into the clutch housing (98) by a retainer plate and snap ring. The three clutch plates are splined into the clutch housing, and the housing is splined to the main input shaft (59 or 59A).

The high driven gear (118) is splined to the layshaft (89) and is retained by a snap ring. The low driven gear (121) runs on a bush on the layshaft, next to the high driven gear (118). A spring loaded coupler (120) is fitted between the driven gears and operates on a helical spline on the layshaft (89). The coupler is spring loaded towards the low driven gear (121), and the teeth on the rear face of the coupler engage similar teeth on the front face of the low driven gear (121).

The oil pump supplies oil to the control valve for operation of the clutch (98). The control valve is fitted

to the input housing (9) and directs oil to the clutch or returns oil into the transmission housing. When the shift lever is in the high position, oil is directed from the control valve through drillings in the housing (9), input shafts and clutch housing to the clutch piston. When the shift lever is in the low position, oil is returned from the control valve into the transmission housing. The Multi-Power shift lever is fitted to the instrument panel and mechanical linkage connects the shift lever to the oil control valve. Multi-Power high or low can be selected whilst the tractor is moving and in any gear. The gear levers and reduction unit are identical to those used for the eight speed transmission.

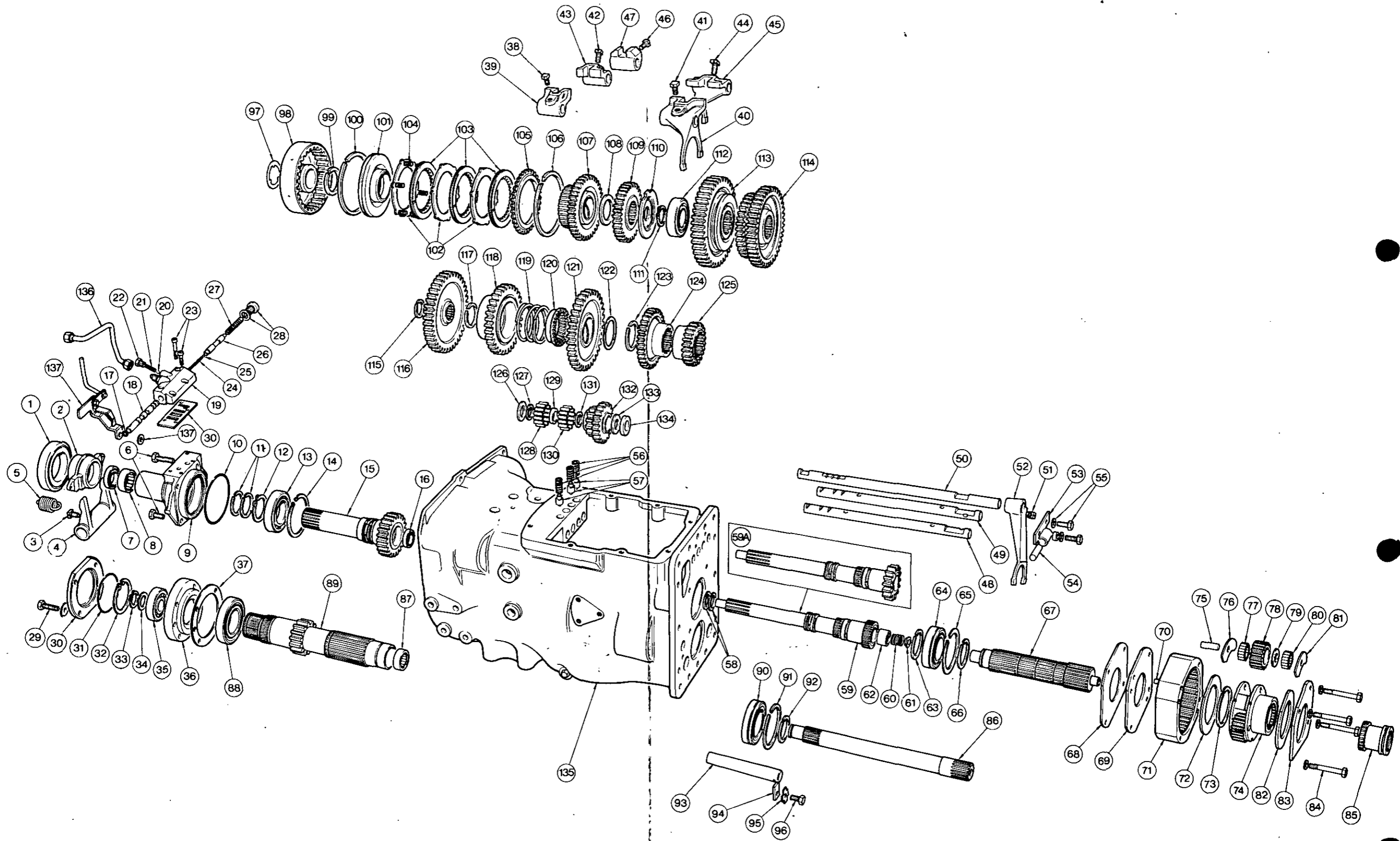
OPERATION**Shift Lever in Low**

Oil is pumped through the control valve and back into the transmission housing. The drive is transmitted to the layshaft (89) through the low constant mesh gears (59A or 109, and 121), and the free wheel coupler (120). The coupler is forced into engagement with the low driven gear (121) by its spring and the thrust exerted by the helical splines. When the coupler is in this engaged (low) position, no engine braking is available. If engine braking is required, move the Multi-Power shift lever to high.

Shift Lever in High

Oil is pumped to the control valve and is then directed through drillings to the clutch (98) which engages the high driving gear (107). The higher ratio of the high gears increases the speed of the layshaft (89). This speed increase, exerts an opposite thrust on the helical splines of the coupler (120), which overcomes spring pressure and disengages the coupler from the low driven gear (121), so allowing the low driven gear to free-wheel.

MULTI-POWER TRANSMISSION



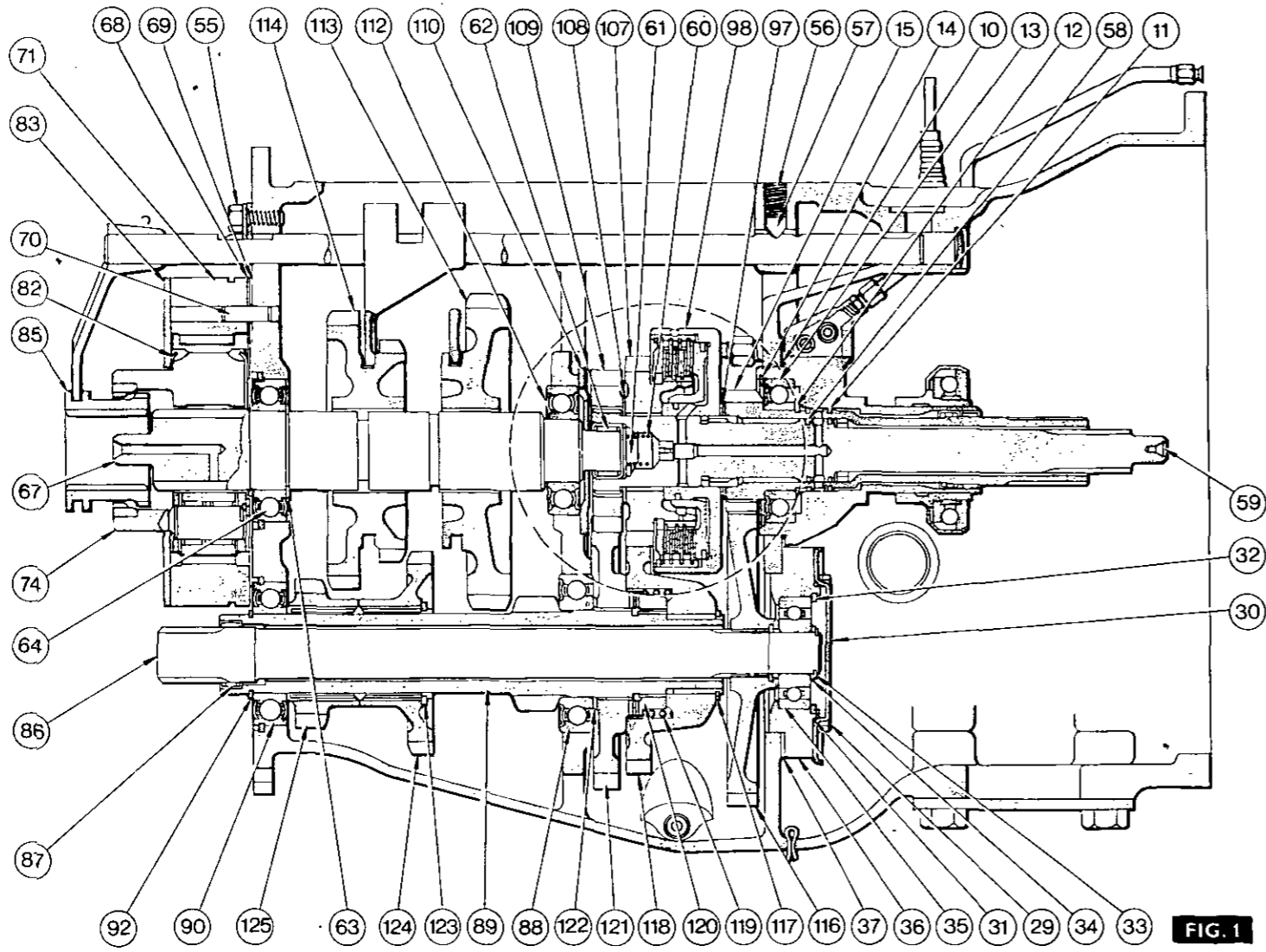


FIG. 1

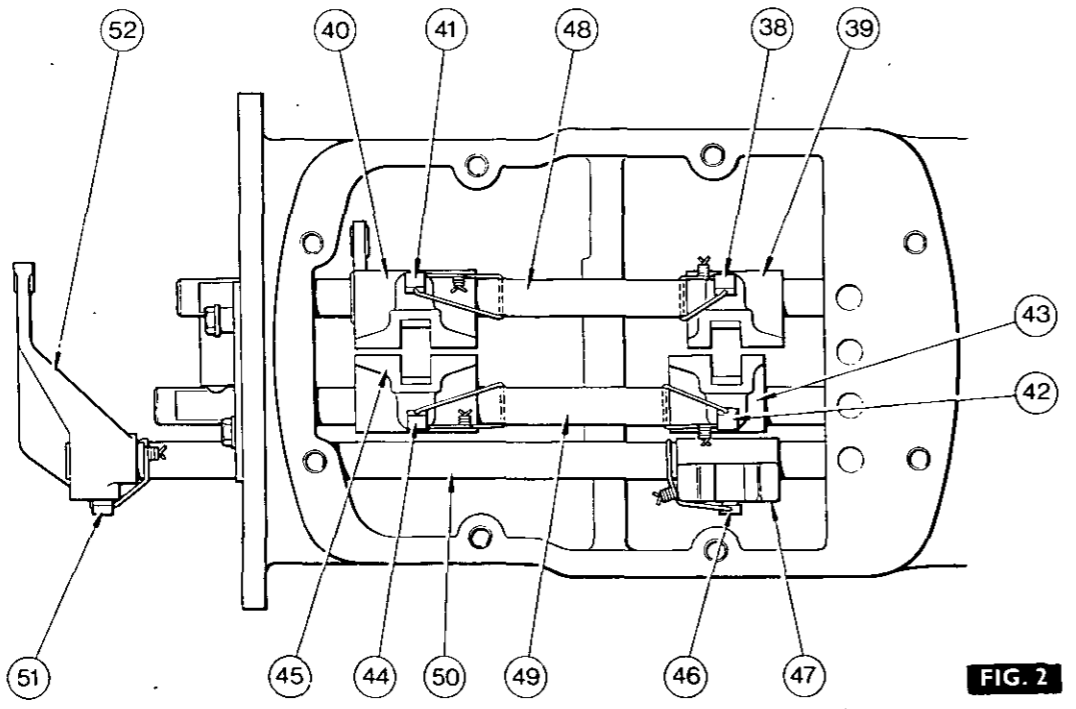


FIG. 2

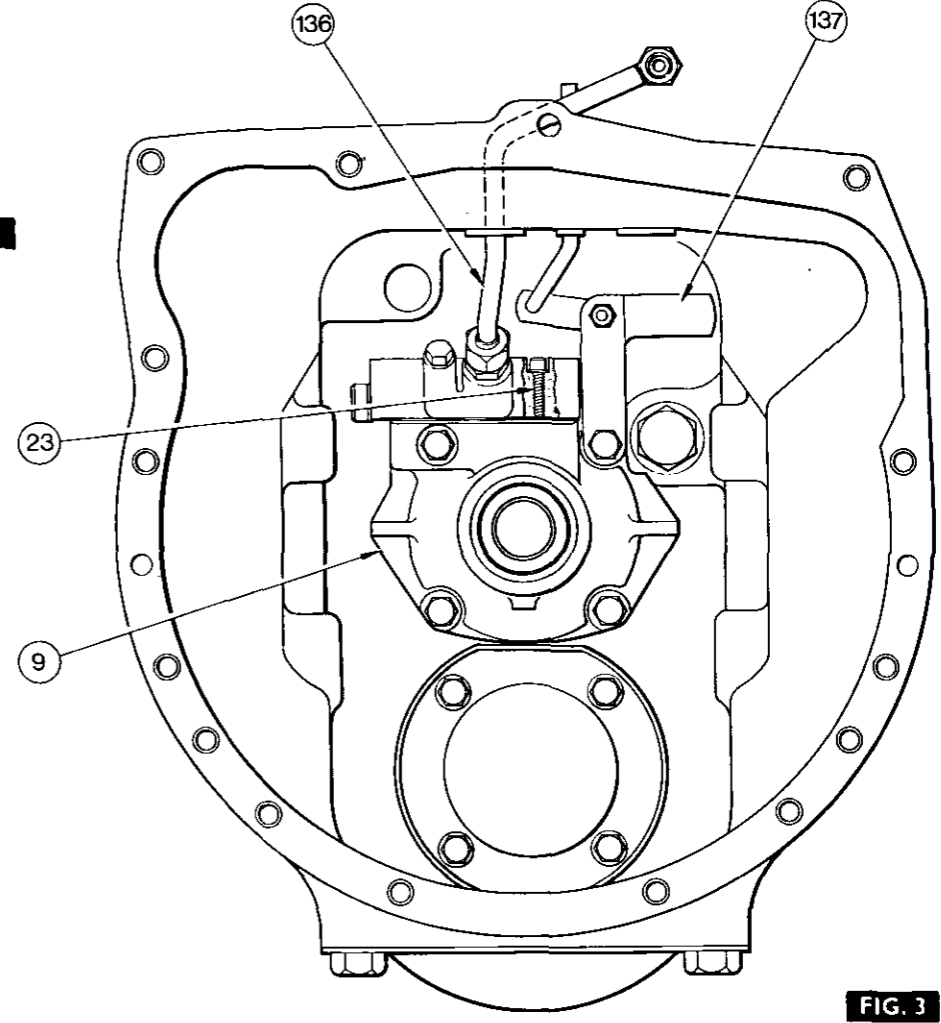


FIG. 3

MULTI-POWER TRANSMISSION

Key to Figs. 1, 2, 3 and 4.

1. Clutch release bearing.
2. Clutch release bearing carrier.
3. Clutch release fork locking peg.
4. Clutch release fork.
5. Clutch release bearing return spring.
6. Input housing securing bolts.
7. P.t.o. input shaft seal.
8. P.t.o. input shaft needle roller bearing.
9. Input housing.
10. Input housing 'O' ring.
11. P.t.o. input shaft cast iron sealing rings.
12. P.t.o. input shaft securing external circlip.
13. P.t.o. input shaft bearing.
14. P.t.o. input shaft securing internal circlip.
15. P.t.o. input shaft.
16. Main drive input shaft seal.
17. Multi-Power spool valve 'O' ring.
18. Multi-Power spool valve.
19. Multi-Power spool block.
20. Multi-Power spool detent ball.
21. Multi-Power spool detent spring.
22. Multi-Power spool detent spring securing plug.
23. Multi-Power spool block securing bolts.
24. Anti-transient spring.
25. Anti-transient ball.
26. Multi-Power spool block pressure regulating valve.
27. Multi-Power pressure regulating valve spring.
28. Multi-Power pressure regulating valve spring retaining plug and washer.
29. P.t.o. front bearing cover securing bolts.
30. P.t.o. front bearing cover.
31. P.t.o. front bearing cover 'O' ring.
32. P.t.o. front bearing securing-circlip.
33. P.t.o. shaft securing circlip.
34. P.t.o. shaft spacer washer.
35. P.t.o. shaft front bearing.
36. P.t.o. front bearing housing.
37. P.t.o. front bearing housing gasket.
38. Second and third gear lever engagement dog locking peg.
39. Second and third gear lever engagement dog.
40. Second and third selector fork.
41. Second and third selector fork locking peg.
42. First and reverse gear lever engagement dog locking peg.
43. First and reverse gear lever engagement dog.
44. First and reverse selector fork locking peg.
45. First and reverse selector fork.
46. High/low gear lever engagement dog locking peg.
47. High/low gear lever engagement dog.
48. Second and third gear selector rail.
49. First and reverse selector rail.
50. High/ low selector rail.
51. High/low selector fork locking peg.
52. High/low selector fork.
53. Interlock stop plate.
54. Interlock plunger.
55. Interlock mechanism securing bolt and washer.
56. Detent springs.
57. Detent plungers.
58. Main input shaft cast iron sealing rings.
59. Main input shaft (Not MF 550 tractor).
- 59A Main input shaft (MF 550 tractor only).
60. Mainshaft/input shaft separator spring.
61. Mainshaft/input shaft separator abutment.
62. Mainshaft needle roller bearing.
63. Mainshaft rear bearing front securing circlip.
64. Mainshaft rear bearing.
65. Mainshaft rear bearing locating snap ring.
66. Mainshaft rear bearing rear securing snap ring.
67. Mainshaft.
68. Epicyclic shim.
69. Epicyclic front plate.
70. Epicyclic ring gear dowel.
71. Epicyclic ring gear.
72. Epicyclic front thrust ring.
73. Epicyclic planetary pinion shaft securing circlip.
74. Epicyclic planetary pinion carrier.
75. Epicyclic planetary pinion shaft.
76. Planetary pinion front thrust washer.
77. Planetary front roller set.
78. Planetary pinion.
79. Planetary roller spacer.
80. Planetary rear roller set.
81. Planetary pinion rear thrust washer.
82. Epicyclic rear thrust ring.
83. Epicyclic cover plate.
84. Epicyclic securing bolts.
85. High/low shift coupler.
86. P.t.o. drive shaft.
87. Layshaft front needle roller bearing.
88. Layshaft front bearing.
89. Layshaft.
90. Layshaft rear bearing.
91. Layshaft rear bearing location snap ring.
92. Layshaft rear bearing securing snap ring.
93. Reverse gear cluster shaft.
94. Reverse gear cluster shaft retaining plate.
95. Tab washer.
96. Reverse gear cluster shaft securing bolt.
97. Multi-Power clutch front thrust washer.
98. Multi-Power clutch unit housing.
99. Multi-Power clutch unit housing cast iron sealing ring.
100. Multi-Power clutch unit piston ring.
101. Multi-Power clutch unit piston.
102. Multi-Power clutch unit interplates.
103. Multi-Power clutch unit friction discs.
104. Multi-Power clutch piston return springs.
105. Multi-Power friction disc retainer plate.
106. Multi-Power retainer plate securing circlip.
107. Main input overdrive pinion.
108. Multi-Power clutch unit rear thrust washer (Not MF 550 tractor).
109. Main drive pinion (Not MF 550 tractor).
110. Tab located spacer.
111. Mainshaft front bearing front securing circlip.
112. Mainshaft front bearing.
113. First gear (mainshaft).
114. Second and third gear cluster (mainshaft).
115. P.t.o. constant mesh gear internal circlip.
116. P.t.o. constant mesh gear.
117. Layshaft front snap ring.
118. Overdrive layshaft gear.
119. Coupler spring.
120. Coupler.
121. Main drive layshaft gear.
122. Main drive layshaft gear thrustwasher.
123. Third gear layshaft securing snap ring.
124. Third gear (layshaft).
125. Second gear (layshaft).
126. Reverse gear front thrust washer.
127. Needle roller front retaining ring.
128. Front needle roller set.
129. Needle roller spacer.
130. Rear needle roller set.
131. Needle roller rear retaining ring.
132. Reverse gear cluster.
133. Reverse gear rear thrust washer.
134. Reverse gear cluster spacer.
135. Gearbox case.
136. Multi-Power pipe.
137. Multi-Power internal linkage and washer.

MULTI-POWER TRANSMISSION**SELECTOR RAIL MECHANISM****Removal and Refitment**

5C-01-06

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

MF 365/8 Stands

Removal**NOTE: Beware of the sharp edges around the top of the gearbox case.**

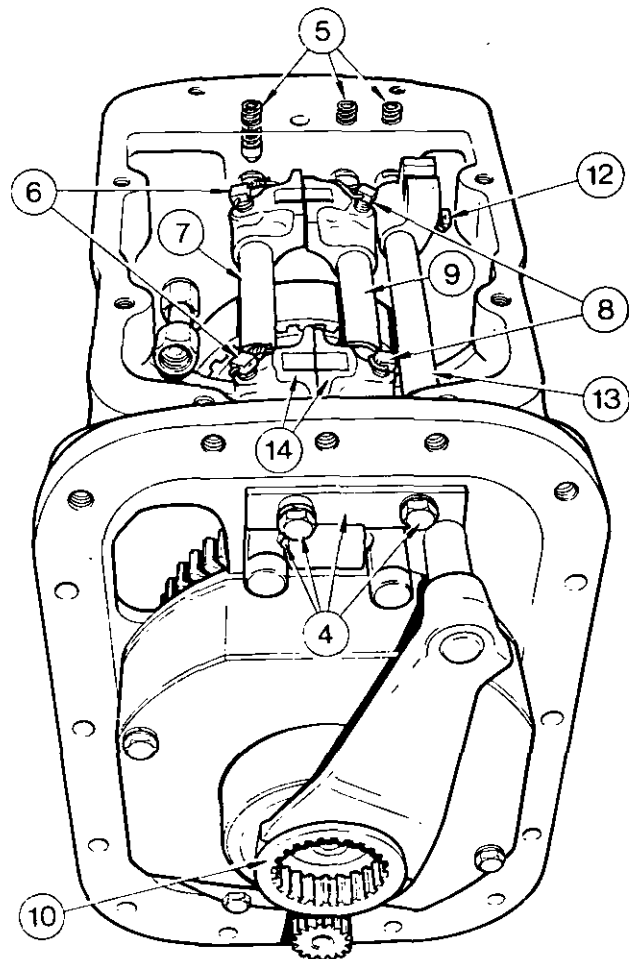
1. Split the tractor between the transmission and the centre housing, Part 3A.
2. Remove the gearbox top cover, and gasket.
3. Release the locking wires.
4. Remove the bolts, stop plate and peg.
5. Lift out the springs and plungers.
6. Remove the locking pegs.
7. Slide the rail rearwards out of the housing.

NOTE: When removing the selector rails, retain the gear lever engagement dogs.

8. Remove the locking pegs.
9. Slide the rail rearwards out of the housing.
10. Slide the High/Low rail rearwards and remove the coupling.
11. Rotate the High/Low rail through 90°.
12. Remove the locking peg.
13. Slide the rail rearwards out of the housing.
14. Remove the selector forks from the gearbox.

Refitment

1. Reverse procedures 1 to 14, except:
 - (a) Apply a few drops of oil to the selector rails before refitment.
 - (b) Tighten the locking mechanism retaining bolts to a torque of 47 Nm (35 lbf ft).
 - (c) On completion of the refitting procedure, place all the gear lever engagement dogs in the neutral position.



NORMAL AND HEAVY DUTY GEARBOX EPICYCLIC**Removal and Refitment**

5C-02-07

Special Tools: 270 Rail Trolley

MF 365/1 Plates

MF 365/3 Short Support Bars

MF 365/4 Long Support Bars

MF 365/6 Bar Pins

MF 365/7 Tommy Bar

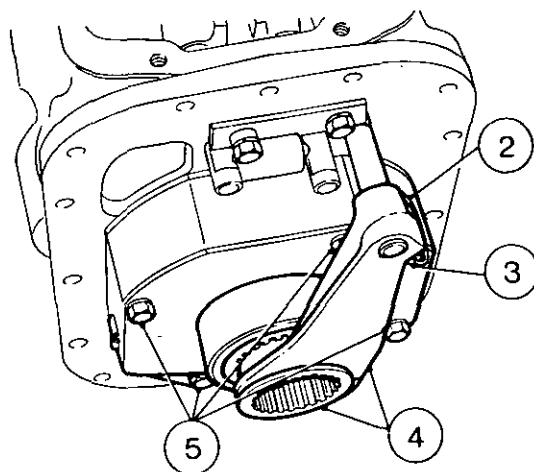
MF 365/8 Stands

Removal

1. Split the tractor between the transmission and the centre housing, Part 3A.
2. Remove the locking wire.
3. Remove the locking peg.
4. Remove the selector fork and coupling.
5. Remove the bolts.
6. Remove the complete assembly.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) Ensure that the front and rear thrust rings are correctly located before refitment.
 - (b) Ensure that the epicyclic dowels are correctly located in the gearbox casing.
 - (c) Locate the cover plate with the cut out in the bottom left hand corner for heavy duty, and the bottom right hand corner for normal duty epicyclics.
 - (d) Do not fit a lockwasher to the lower left hand retaining bolt.
 - (e) Tighten the retaining bolts progressively and evenly to a torque of 47 Nm (35 lbf ft).

**NORMAL DUTY GEARBOX EPICYCLIC****Servicing**

5C-03-07

Special Tools: See operation 5C-02-07

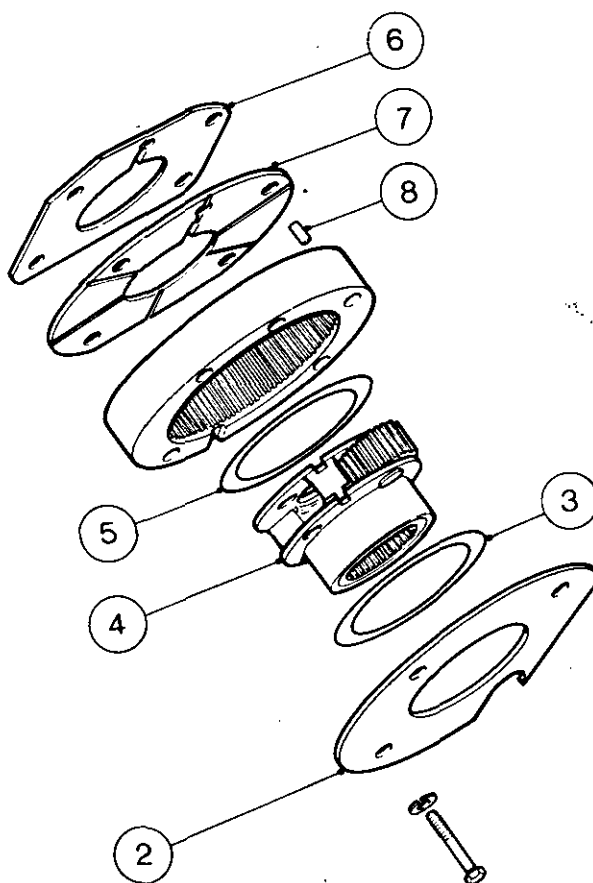
Disassembly

1. Remove the gearbox epicyclic, operation 5C-02-07.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. If necessary, remove the dowel pins from the ring gear.

NOTE: The planetary pinion carrier cannot be serviced, and must be replaced as a complete assembly if found defective.

Reassembly

9. Reverse procedures 1 to 8, except:
 - (a) The front and rear cover plates must be positioned with the oil grooves towards the pinion carrier.
 - (b) Always fit the same thickness of shims as those removed.
 - (c) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.



MULTI-POWER TRANSMISSION**HEAVY DUTY GEARBOX EPICYCLIC****Servicing** 5C-04-08

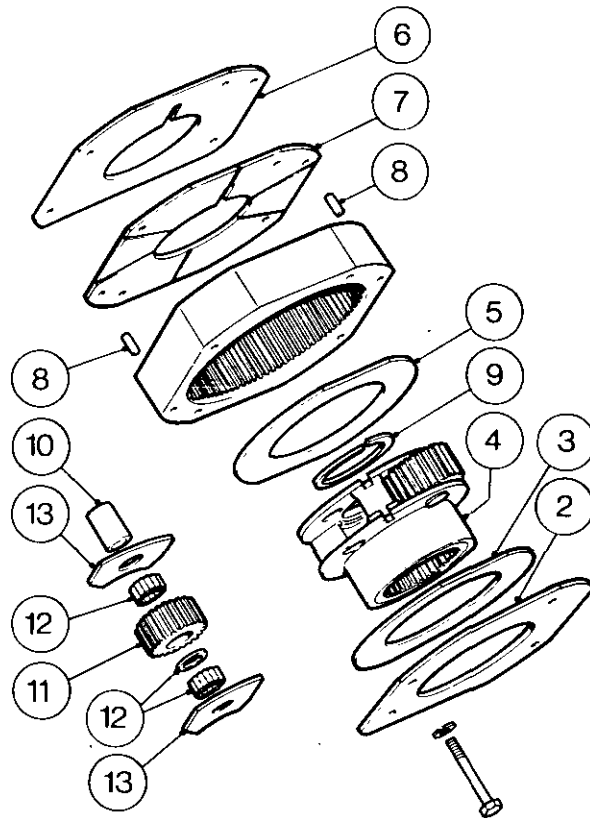
Special Tools: See operation 5C-02-07

Disassembly

1. Remove the gearbox epicyclic, operation 5C-02-07.
2. Remove the cover plate.
3. Remove the rear thrust ring.
4. Remove the planetary pinion carrier.
5. Remove the front thrust ring.
6. Remove the shim.
7. Remove the front plate.
8. If necessary, remove the dowel pins from the planetary ring gear.
9. Remove the external snap ring.
10. Gently tap out the three pinion shafts towards the front.
11. Remove the planetary pinions.
12. Remove the two sets of rollers and the spacer from each pinion.
13. Remove the wear plates from each pinion.

Reassembly

14. Reverse procedures 1 to 13, except:
 - (a) When replacing the rollers in the pinions, a smear of petroleum jelly (not grease) will help retain them. Do not omit the spacer from between the two runs of rollers. Each run consists of 27 rollers.
 - (b) The front plate and the cover plate must be positioned with the oil grooves towards the pinion carrier.
 - (c) Always fit the same thickness of shims as those removed.
 - (d) To facilitate fitment of the front and rear thrust rings on the pinion carrier, smear with petroleum jelly (not grease). Ensure that the tabs on the thrust rings locate in the pinion carrier cut-outs, and that the brass faces are away from the pinion carrier.

**CLUTCH RELEASE MECHANISM****Removal and Refitment** 5C-05-08

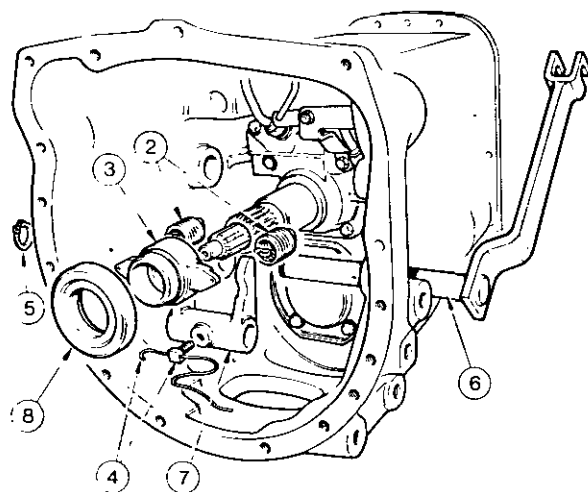
Special Tool: 270 Rail Trolley

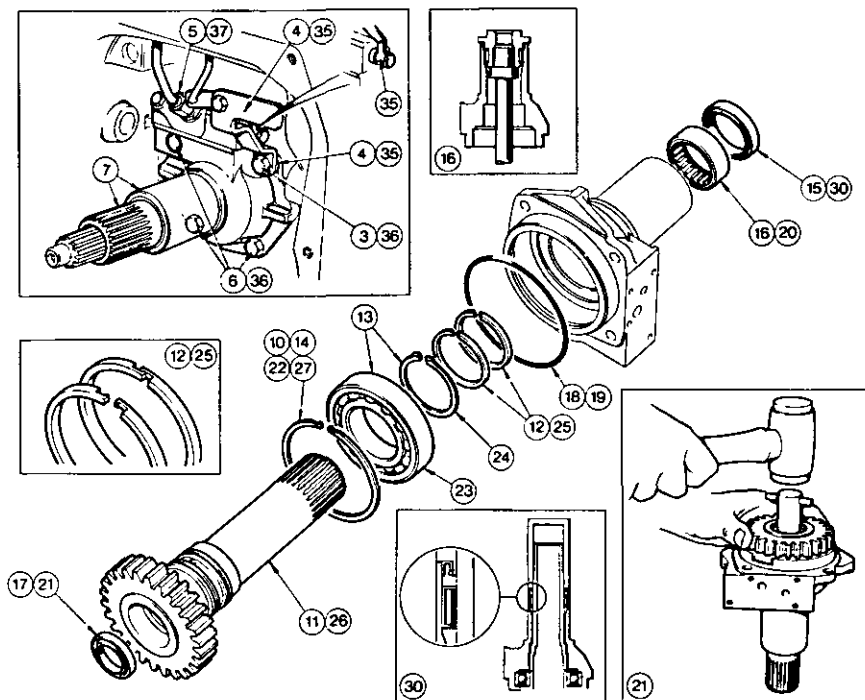
Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the two springs.
3. Slide the carrier and release bearing off the input housing.
4. Remove the locking wire and locking peg.
5. Remove the circlip.
6. Remove the shaft. To obtain sufficient clearance on MF 550 and MF 560 tractors, the left hand front cab mounting bracket must be removed, and on all versions the fuel tank must be removed, Part 4C.
7. Remove the clutch release fork.
8. Press the release bearing off the carrier.

Refitment

9. Reverse procedures 1 to 8, except:
 - (a) Lightly lubricate the input shaft splines and the release bearing carrier bore, with special grease Mobilgrease Super.
 - (b) Ensure that the locking peg locates in the hole in the shaft.





INPUT SHAFT HOUSING AND P.T.O. INPUT SHAFT

Servicing

5C-06-09

Special Tools: 270 Rail Trolley
MF 177 Seal Protector
MF 255B Oil Seal Replacer
MF 256A Oil Seal Replacer
MF 315 Needle Roller Bearing Removal
and Refitting Tool.

Disassembly

1. Remove the clutch release mechanism, operation 5C-05-08.
2. Disconnect the Multi-Power linkage on the top of the transmission case.
3. Remove the R.H. upper bolt.
4. Remove the internal Multi-Power linkage and washer.
5. Disconnect the pipe.
6. Remove the remaining three bolts.
7. Withdraw the input housing complete with the p.t.o. input shaft.
8. Remove the four Allen screws securing the spool valve to the input housing.
9. Remove the spool valve and gasket.
10. Dislocate the large internal circlip from the input housing groove.
11. Push the p.t.o. shaft complete with bearing rearwards out of the housing.
12. Unclip and remove the two sealing rings.
13. If necessary, remove the circlip and press the bearing off the front of the shaft.
14. Remove the circlip.
15. Lever the seal out.
16. Using MF 315, remove the needle roller bearing.
17. Remove the seal.
18. Remove the 'O' ring (input shaft housing). Examine the bore of the p.t.o. input shaft and the input housing for grooves, where the sealing rings locate. If any of the above parts show signs of wear or damage, they must be replaced. Check (and if necessary, replace) the ball and needle roller bearings for wear. Lubricate all new seals with petroleum jelly (not grease) when reassembling.

Reassembly

19. Fit a new 'O' ring (input shaft housing).
20. Using MF 315, replace the needle roller bearing.
21. Using MF 256A, fit a new seal, with the toe of the seal facing the tool.
22. Refit the circlip on the shaft.
23. Refit the bearing with the shield towards the gear teeth.
24. Refit the circlip (check that it is properly seated).
25. Fit two new cast iron sealing rings on the p.t.o. input shaft and ensure that they are correctly clipped, then lubricate the shaft with clean transmission oil.
26. Carefully refit the p.t.o. input shaft and bearing into the input housing, ensuring that the cast iron sealing rings are not damaged.
27. Re-locate the circlip in the input housing (check that it is properly seated).
28. Place the cone adaptor on MF 255B.
29. Place a new seal over the cone and onto the tool, with the toe of the seal facing away from the tool, and remove the cone.
30. Place the tool over the p.t.o. shaft and tap the seal into place.
31. Refit the spool valve and a new gasket (fitted dry) and tighten the Allen screws evenly.
32. Fit two new cast iron sealing rings on the main input shaft.
33. Place MF 177 over the splines of the main input shaft.
34. Carefully refit the input housing, and withdraw MF 177.
35. Refit the washer and Multi-Power linkage, ensuring that the actuator locates in the slot in the spool.
36. Lightly coat the bolt threads in a recommended sealant 'B', refit and tighten them to a torque of 60 Nm (45 lbf ft).
37. Refit the pipe.
38. Refit the external Multi-Power linkage.
39. Refit the clutch release mechanism, operation 5C-05-08.

MULTI-POWER TRANSMISSION**MAIN INPUT SHAFT****Removal and Refitment**

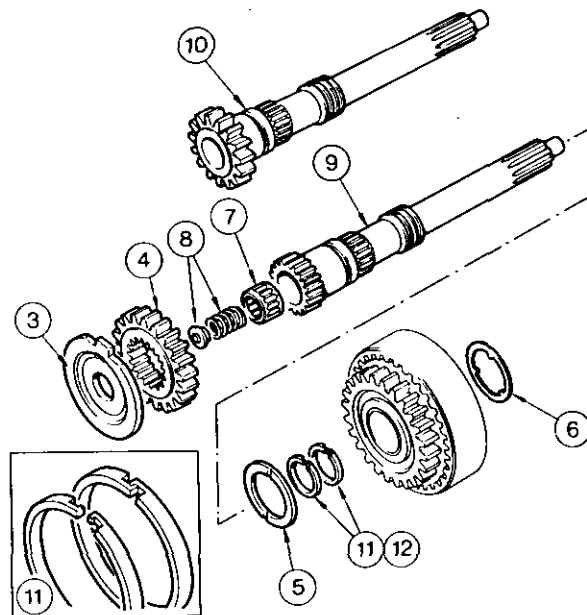
5C-07-10

Special Tools: See Operation 5C-06-09, and

- MF 365/1 Plates
- MF 365/3 Short Support Bars
- MF 365/4 Long Support Bars
- MF 365/6 Bar Pins
- MF 365/7 Tommy Bar
- MF 365/8 Stands

Removal

1. Remove the mainshaft and gears, operation 5C-09-12.
2. Remove the input housing and p.t.o. input shaft, operation 5C-06-09, procedures 1 to 7.
3. Remove the tab located spacer.
4. Remove the main drive pinion (Not MF 550 tractor).
5. Remove the thrust washer (Not MF 550 tractor).
6. Remove the thrust washer.
7. Remove the roller bearing.
8. Remove the spring and abutment.
9. Push the shaft rearwards out of the gearbox (Not MF 550 tractor).
10. Push the shaft rearwards out of the gearbox (MF 550 tractor only).
11. Unclip and remove the cast iron sealing rings. Examine the bore of the input p.t.o. shaft for grooves where the sealing rings locate, and replace the shaft if any scoring or grooves are found. If excessive wear or scoring is found, the input housing and p.t.o. input shaft must be serviced as in operation 5C-06-09, procedures 8 to 31.

**Refitment**

12. Fit two new cast iron sealing rings to the main input shaft and ensure they are properly clipped. Lubricate the shaft with clean transmission oil.
13. Reverse procedures 3 to 10, except: Ensure that the tab located washer is fitted with its convex side towards the Multi-Power clutch unit, and that the tab is correctly located.
14. Refit the input housing and p.t.o. input shaft, operation 5C-06-09 procedures 33 to 39.
15. Refit the mainshaft and gears, operation 5C-09-12.

P.T.O. DRIVESHAFT FRONT BEARING**Removal and Refitment**

5C-08-11

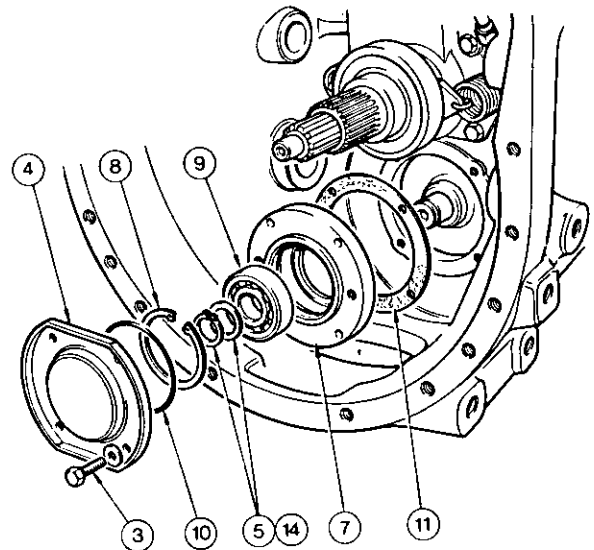
Special Tools: 270 Rail Trolley

MF 218A P.t.o. Drive Shaft Puller

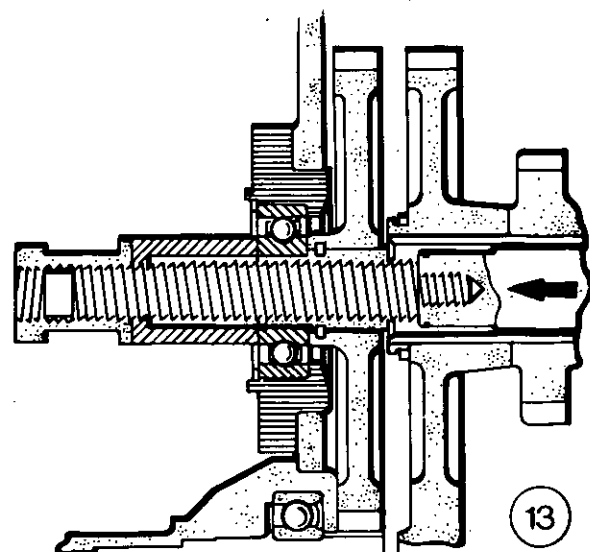
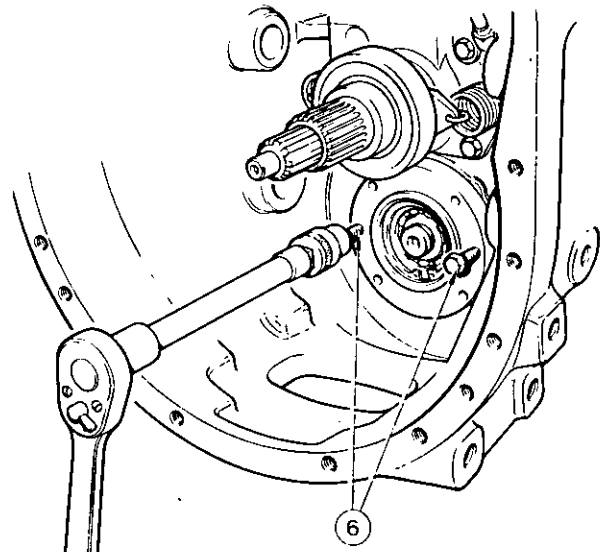
MF 218A-2 Adaptor

Removal

1. Split the tractor between the engine and the transmission, Part 3A.
2. Remove the clutch release shaft, operation 5C-05-08, procedures 4 to 7.
3. Remove the four bolts.
4. Remove the plate.
5. Remove the external circlip and washer.
6. Screw two $\frac{3}{4}$ UNC \times 75 mm (3 in) bolts into the bearing housing and tighten them evenly.
7. Remove the housing.
8. Remove the circlip.
9. Press out the bearing.
10. Discard the 'O' ring.
11. Discard the gasket.

**Refitment**

12. Reverse procedures 8 to 11, except:
 - (a) Fit a new 'O' ring, gasket and circlip.
 - (b) Coat the gasket with recommended sealant 'A'.
13. Using MF 218A and MF 218A-2, refit the bearing and housing assembly on the front end of the p.t.o. input shaft, ensuring that the splines on the shaft locate in those in the p.t.o. constant mesh gear.
14. Fit the washer and a new circlip.
15. Reverse procedures 1 to 4, except:
 - (a) Lightly coat the securing bolt threads with recommended sealant 'B'.
 - (b) Tighten the bolts to a torque of 60 Nm (45 lbf ft).



MULTI-POWER TRANSMISSION**MAINSHAFT, FIRST/REVERSE GEAR
SECOND AND THIRD GEAR****Removal and Refitment**

5C-09-12

Special Tools: 270 Rail Trolley
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 365/1 Plates
 MF 365/3 Short Support Bar
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

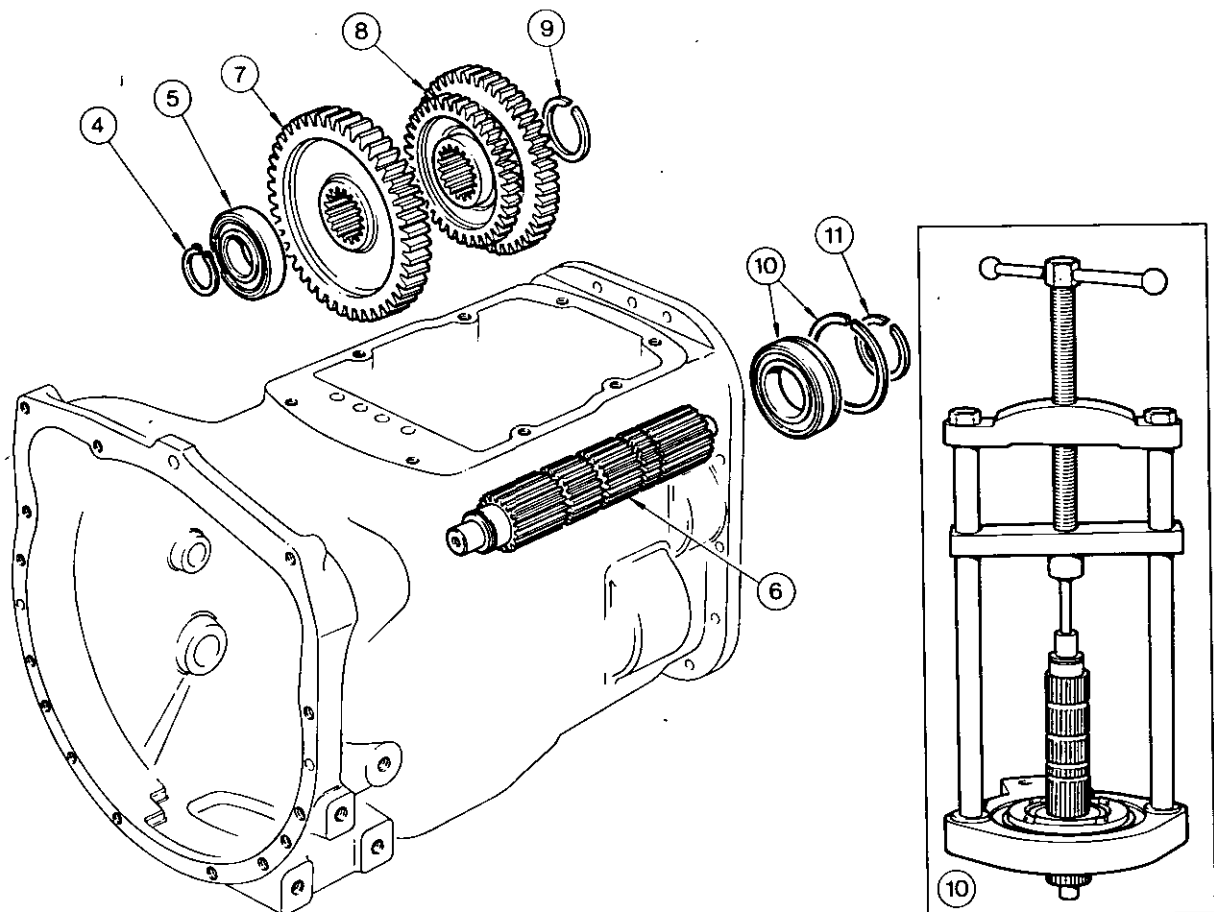
Removal

1. Remove the selector rail mechanism, operation 5C-01-06.
2. Remove the gearbox epicyclic, operation 5C-02-07.
3. Pull the mainshaft rearwards to release the mainshaft front bearing from the centre web in the gearbox.
4. Remove the circlip.
5. Drive the bearing off the front of the mainshaft.
6. Pull the mainshaft rearwards out of the gearbox.
7. Remove the first/reverse gear.

8. Remove the second and third gear.
9. If necessary, remove the circlip.
10. If necessary, press the bearing off the FRONT end of the mainshaft using MF 200 and MF 200-25.
11. If necessary, remove the circlip.

Refitment

12. Reverse procedures 1 to 11, except:
 Ensure that all snap rings are correctly located in their grooves.



MULTI-POWER TRANSMISSION

LAYSHAFT AND GEARS,
P.T.O. SHAFT AND GEAR

Removal and Refitment

5C-10-13

Special Tools: See Operations 5C-06-09, and 5C-08-11, and
 MF 200 Hand Press
 MF 200-25 Adaptor
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

1. Remove the mainshaft and gears, operation 5C-09-12.
2. Remove the main input shaft, operation 5C-07-10.
3. Remove the p.t.o. driveshaft front bearing, operation 5C-08-11.
4. Remove the p.t.o. driveshaft from the rear of the gearbox.
5. Remove the p.t.o. constant mesh gear.
6. Remove the small internal snap ring (only if necessary).
7. Remove the snap ring from the rear of the layshaft.
8. Tap the layshaft forwards.
9. Remove the bearing.
10. Expose the snap ring, open it and slide it forwards onto the unsplined portion of the shaft.
11. Remove the snap ring from the front of the layshaft.
12. Relocate the front bearing in its web and tap the layshaft rearwards.

13. Remove the overdrive layshaft gear.
14. Remove the spring.
15. Remove the coupler.
16. Remove the main drive layshaft gear.
17. Remove the thrust washer.
18. Locate the front bearing in its web and gently drive the layshaft forwards out of the gearbox.
19. Remove the second gear from the gearbox.
20. Remove the third gear from the gearbox.
21. If necessary, remove the circlip.
22. If necessary, press the bearing off the FRONT end of the layshaft using MF 200 and MF 200-25.

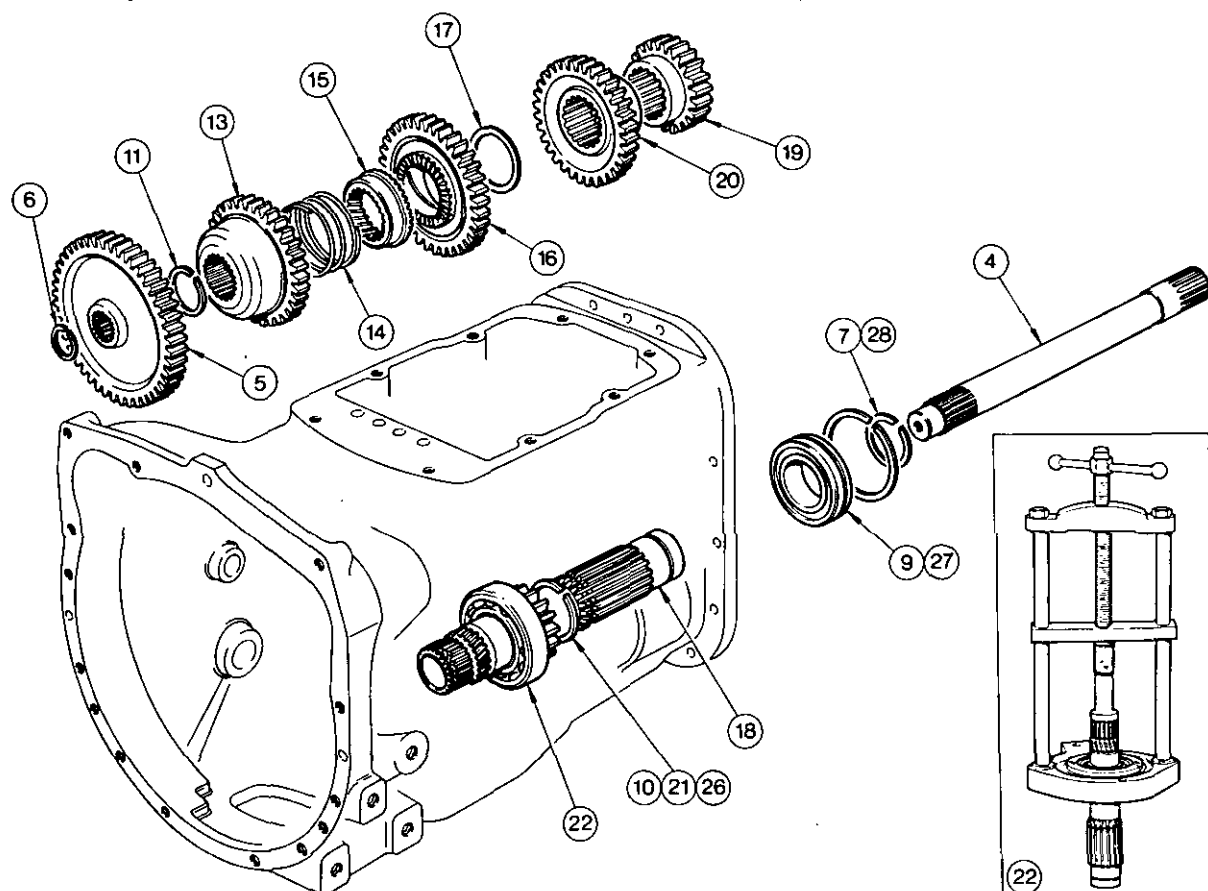
Examination

Check all components for wear or damage, and if they are faulty, they must be replaced.

Check the coupler spring, which should have a free length of 47,5 mm (1.75 in) a compressed length of 16,5 mm (0.65 in) and a maximum load of 10,2 kg (22.5 lb) when compressed, if not, it must be replaced. When reassembling the layshaft, fit a new thrust washer and snap rings, and lubricate all parts with clean transmission oil.

Refitment

23. Reverse procedures 19 to 22.
24. Refit the layshaft, locating the third and second gears on the splines at the same time, push the layshaft rearwards enough to allow the components on its front end to be fitted.
25. Reverse procedures 11 to 17.
26. Push the layshaft forwards and second and third gears back far enough to allow the snap ring to be correctly refitted.
27. Refit the bearing in the gearbox.
28. Tap the layshaft rearwards (locating it correctly in the bearing) far enough to allow the circlip to be replaced correctly.
29. Reverse procedures 1 to 6.



MULTI-POWER TRANSMISSION**REVERSE GEAR CLUSTER****Removal and Refitment** 5C-11-14

Special Tools: See Operation 5C-09-12 and 55 x 25 mm (2 $\frac{1}{8}$ x 1 in) dia. Mild Steel Dummy Shaft.
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands

Removal

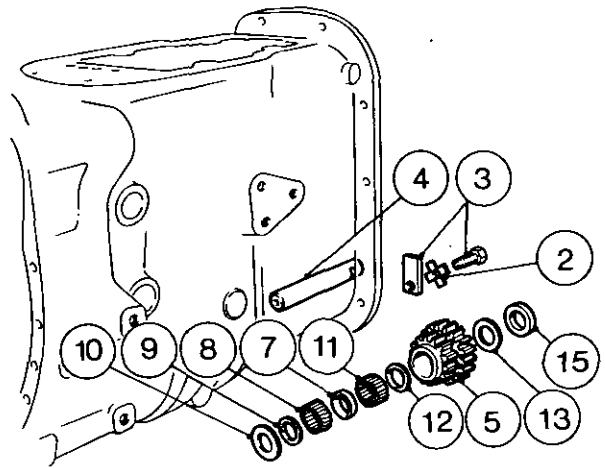
1. Remove the mainshaft and gears, operation 5C-09-12, procedures 1 to 8.
2. Release the tabwasher.
3. Remove the bolt and locating tab.
4. Slide the dummy shaft from the front of the reverse gear shaft towards the rear. This will push out the reverse gear shaft, and prevent the needle rollers from dropping into the transmission case.
5. Remove the idler gear cluster complete with all parts and the dummy shaft.
6. Withdraw the dummy shaft from the idler gears, and allow all parts to drop out, onto a clean work surface.

Refitment

7. Fit the spacer in the reverse gear cluster.
8. Refit the first set of rollers. Each run consists of 28 rollers.

NOTE: Smear the rollers in petroleum jelly (not grease) to help reassembly.

9. Refit the retaining ring.
10. Refit the thrust washer.
11. Refit the second set of rollers.
12. Refit the retaining ring.
13. Refit the thrust washer.
14. Slide the dummy shaft into the reverse gear cluster rollers.
15. Slide the distance piece over the dummy shaft on the rear end of the reverse gear cluster.
16. Reverse procedures 1 to 5.



MULTI-POWER CLUTCH UNIT

Servicing

5C-12-15

Special Tools: See Operation 5C-07-10

Disassembly

1. Remove the main input shaft, operation 5C-07-10.
2. Remove the clutch unit from the gearbox.
3. Remove the input overdrive pinion.
4. Push down the retainer plate.
5. Remove the snap ring.
6. Remove the retainer plate.
7. Remove the three friction discs and the three inter plates.
8. Remove the six springs.
9. Remove the piston.
10. Remove the piston ring.
11. Remove the sealing ring.

Examination

Check the condition of all components for signs of wear, damage, distortion or overheating.

Check the friction discs for the following dimensional tolerances:—

- Thickness 2,41 to 2,59 mm (0.095 to 0.102 in).
- Maximum permissible distortion 2,92 mm (0.115 in).
- Oil groove depth 0,38 to 0,63 mm (0.015 to 0.025 in).

Check the inter plates for:

- Thickness 1,67 to 1,75 mm (0.66 to 0.69 in).
- Maximum dish 0,25 mm (0.010 in).
- Maximum permissible distortion 2,21 mm (0.088 in).

Check the six coil springs for:

- Free length 17,8 mm (0.70 in).
- Working length 12,7 mm (0.05 in).
- Load at working length 2,98 to 3,64 kg (6.57 to 8.03 lb).

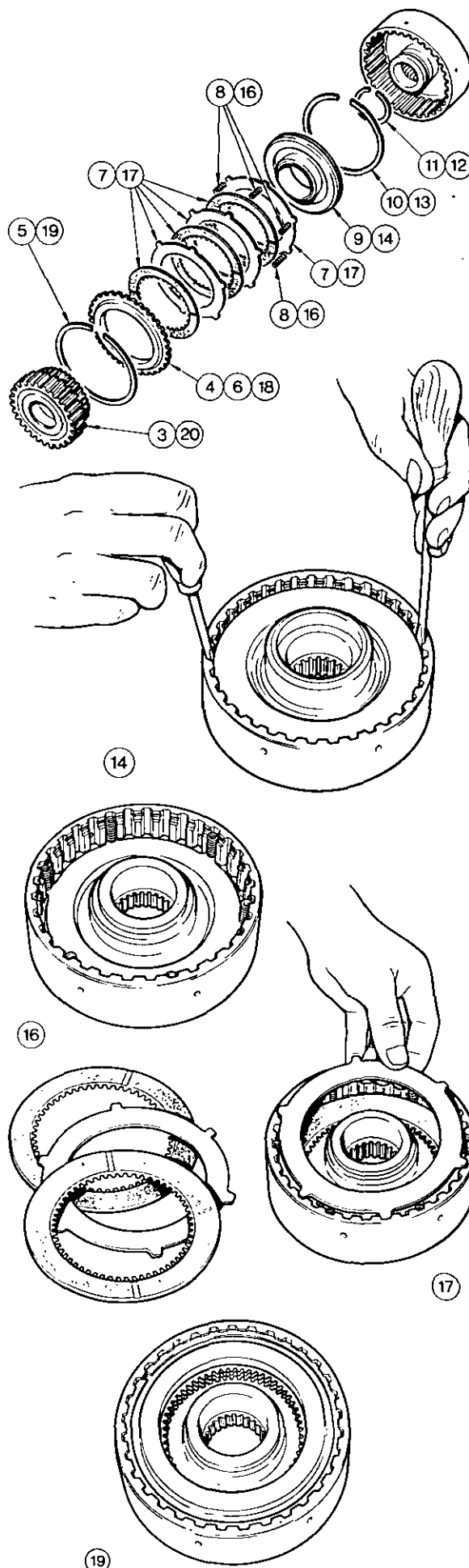
Any components which are not within the above tolerances must be replaced but the friction disc and interplates must be replaced as a complete set, i.e., if one friction disc is worn, then three new friction discs AND three new interplates must be fitted.

Reassembly

12. Fit a new sealing ring.
13. Fit a new piston ring.
14. Using two small screwdrivers to compress the piston ring, refit the piston, ensuring that the piston ring is not damaged.
15. Fit one interplate to the clutch housing with the lugs on the interplate located in the splines immediately to the right of the six holes in the housing.
16. Fit the six springs, placing them on the lugs of the first interplate.
17. Refit the three friction plates and the remaining two interplates alternately, locating the lugs on each interplate one spline further to right of the one previously fitted.

NOTE: The springs must only contact the first interplate.

18. Refit the retainer plate.
19. Refit the circlip and ensure that it is properly seated.
20. Refit the input overdrive pinion, aligning the splines on the friction discs.
21. Refit the clutch unit in the gearbox.
22. Refit the main input shaft, operation 5C-07-10.
23. Test the Multi-Power system, Part 7.



MULTI-POWER TRANSMISSION

MULTI-POWER SPOOL VALVE

Servicing

5C-13-16

Special Tools: See Operation 5C-06-09

Disassembly

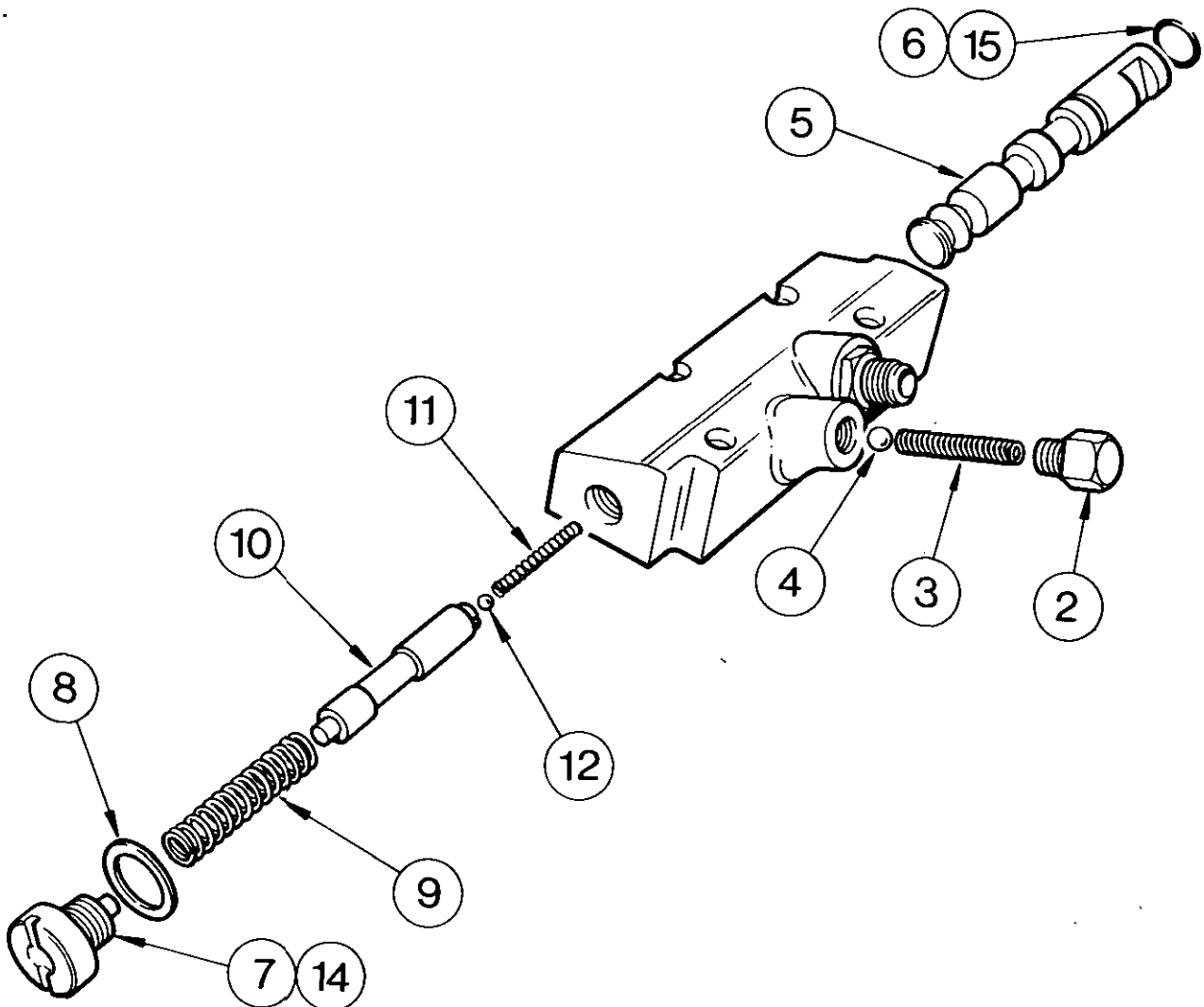
1. Remove the Multi-Power spool valve as stated in operation 5C-06-09, procedures 1 to 9.
2. Remove the plug.
3. Remove the spring.
4. Remove the ball.
5. Withdraw the spool.
6. Discard the 'O' ring.
7. Remove the plug.
8. Remove the washer.
9. Remove the spring.

10. Remove the spool.
11. Remove the spring.
12. Remove the small ball.

Reassembly

NOTE: Ensure that all parts are scrupulously clean and are lubricated with clean transmission oil.

13. Reverse procedures 8 to 12.
14. Refit the plug and tighten it to a torque of 27 Nm (20 lbf ft).
15. Fit a new 'O' ring to the spool.
16. Reverse procedures 1 to 5.
17. Test the Multi-Power system, Part 7.



TRANSMISSION CASE REMOVAL AND REPLACEMENT OR COMPLETE TRANSMISSION OVERHAUL

Special Tools: MF 177 Seal Protector
 MF 200 Hand Press
 MF 200—25 Adaptor
 MF 218A P.t.o. Shaft Puller
 MF 218A-2 Adaptor
 MF 255B Oil Seal Replacer
 MF 256A Oil Seal Replacer
 MF 270 Rail Trolley
 MF315 Needle Roller Bearing Remover and Refitting Tool
 MF 365/1 Plates
 MF 365/3 Short Support Bars
 MF 365/4 Long Support Bars
 MF 365/6 Bar Pins
 MF 365/7 Tommy Bar
 MF 365/8 Stands
 V.L. Churchill 50 ton Hydraulic Press (alternative to MF 200)
 55 mm x 25 mm (2- $\frac{1}{4}$ in x 1 in). Dia Mild Steel Dummy Shaft

Disassembly

1. Remove the selector rail mechanism, operation 5C-01-06.
2. Remove the gearbox epicyclic, operation 5C-02-07.
3. Disassemble the transmission epicyclic, operation 5C-03-07, or 5C-04-08.
4. Remove the clutch release mechanism, operation 5C-05-08.
5. Remove and dismantle the input housing and p.t.o. input shaft, operation 5C-06-09.
6. Remove the mainshaft and gears, operation 5C-09-12.
7. Remove the main input shaft, operation 5C-07-10.
8. Remove the p.t.o. driveshaft front bearing, operation 5C-08-11.
9. Remove the layshaft and gears and p.t.o. shaft and gear operation 5C-10-13.
10. Remove the reverse gear cluster, operation 5C-11-14.
11. Service the Multi-Power clutch, operation 5C-12-15.
12. Service the Multi-Power spool valve, operation 5C-13-16.

Examination

After disassembly of the transmission, examine all the components for scoring, wear or chipping. Pay particular attention to the gear teeth, bearings, needle rollers, gear selector forks, also shaft splines which are subject to wear from the sliding action of the gears.

All bearings should be washed in clean paraffin, blown dry, inspected for wear or scoring on the outer circumference and measured for fit in transmission case webs. Maximum acceptable clearance is 0,033 mm (0-0013 in). Where the clearance between bearing and bore exceeds this figure, recommended sealant 'B' may be used to refit the bearings into the transmission case. After inspection, lubricate the bearings with transmission oil.

Any worn or damaged components should be replaced; also, a complete set of new gaskets, 'O' rings and a new tabwasher must be fitted.

Reassembly

13. Reverse procedures 1 to 12, except:
 - (a) Use only petroleum jelly for reassembly purposes—Never Grease.
 - (b) Ensure that all snap rings are correctly located in their grooves.
 - (c) Lightly oil all bushes, bearings and splines prior to reassembly.
 - (d) Test the Multi-Power system, Part 7.

MULTI-POWER TRANSMISSION**HIGH/LOW AND GEAR SHIFT LEVERS****Removal and Refitment**

5C-15-18

Removal

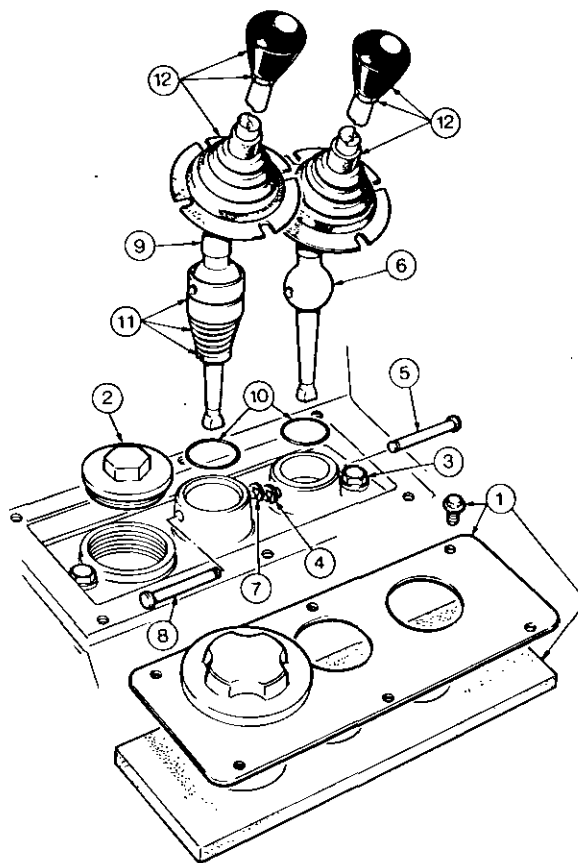
1. Remove the bolts and plate.
2. Remove the filler plug.
3. Remove the bolt.
4. Remove the clip.
5. Remove the pin.
6. Withdraw the lever.
7. Remove the clip.
8. Remove the pin taking care not to drop it into the gearbox.
9. Withdraw the lever and cup assembly.
10. Discard the 'O' rings.
11. If necessary, press the spring retaining washer towards the spring and slide sideways and remove it. This will release the spring and support cup.

WARNING: When removing the spring retaining washer, care must be taken to prevent the spring from flying out and causing possible injury and damage.

12. If necessary, remove the knobs, nuts and dust caps.

Refitment

13. Reverse procedures 1 to 12 except:
 - (a) Fit new 'O' rings
 - (b) Ensure that the gearlevers locate correctly in the gearlever engagement dogs.



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 6

Publication No. 1856 072 M1

comprising

- A REAR AXLE AND BRAKES
- B POWER TAKE-OFF

REAR AXLE AND BRAKES

Part 6 — Section A

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REAR AXLE AND BRAKES

GENERAL

The drive from the transmission mainshaft is transmitted through the rear drive shaft and shear tube to a spiral bevel driving pinion and crown wheel, then through the axle shafts to the rear wheels.

The driving pinion is supported in the centre housing by a straight roller pilot bearing and a pre-loaded housing assembly carrying two tapered roller bearings.

The crownwheel is attached to the split differential case, which is supported each side by a tapered roller bearing. The differential pinions run on a cross joint and thrust is taken by thrust washers behind the pinions.

The axle shaft inner ends are splined into the differential gears, and the outer ends run on tapered roller bearings in the hubs. The hub bearings are retained by collars shrunk onto the axle shafts.

The differential lock is fitted to the R.H. axle housing. When the spring loaded pedal is depressed, a cam engages a coupler with a coupling cap on the differential case, and locks the differential.

This tractor is fitted with Girling double acting, floating cam type brakes which operate on the rear

wheels only. They are internally expanding 356 x 51 mm (14 x 2 in) drum brakes fitted with bonded linings in production but the shoes are drilled to receive riveted linings in service.

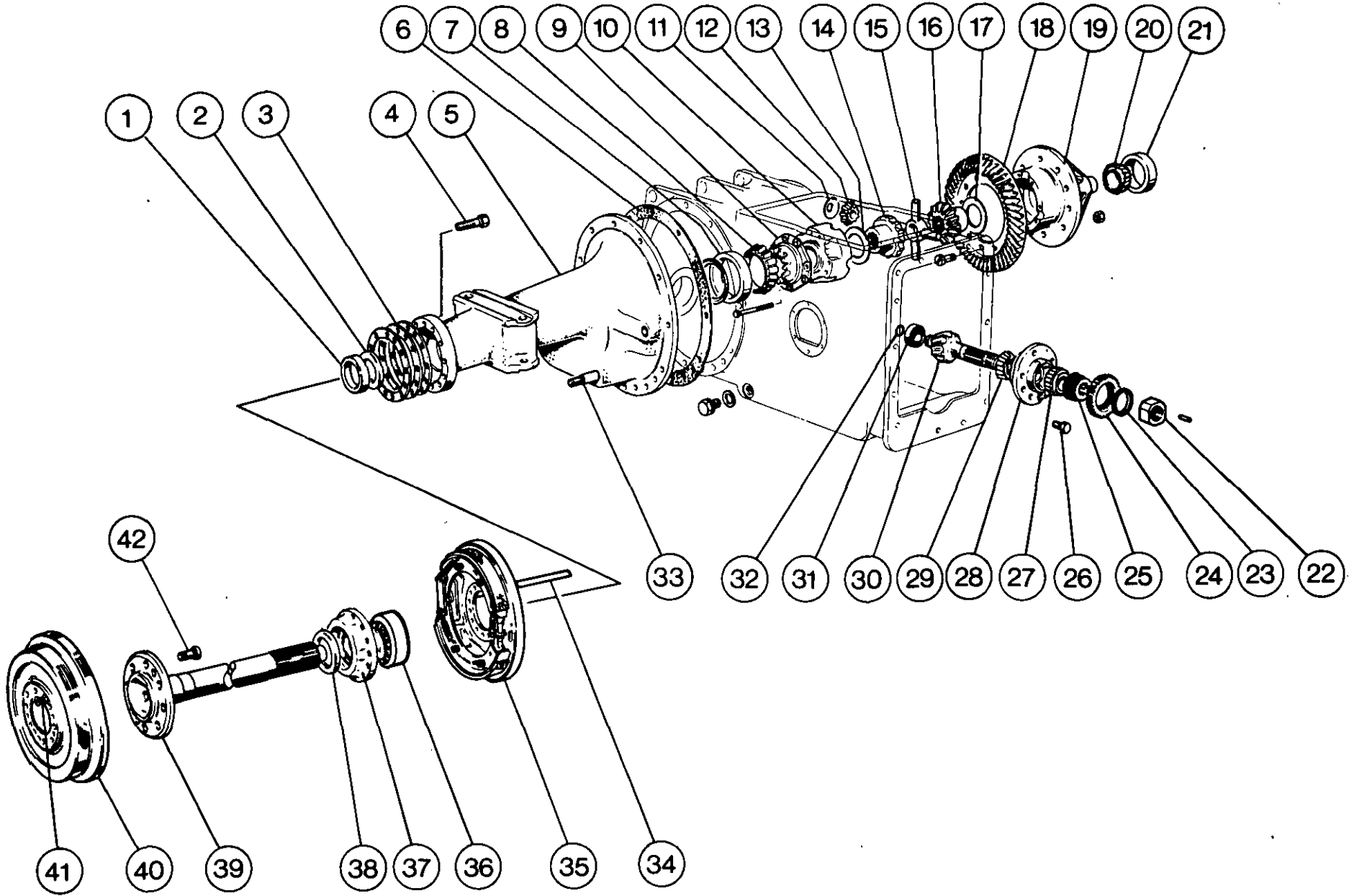
Each brake consists of a backplate on which is mounted the double anchor pin assembly securing one end of each shoe. The other end of each shoe fits into slots in the adjuster assembly and is held in position by a spring.

Between the shoe webs at the anchor pin end is the operating camshaft which is connected by linkage to the pedal. A shoe to anchor pin spring is connected between the anchor pin and shoe web of each shoe. The shoes are kept square in relation to the backplate by steady posts and shoe hold down pins. The backplate is secured to the rear axle housing and is enclosed within a drum which is fitted to the rear axle shaft assembly.

The brakes are operated by two independent brake pedals situated on the right hand side of the transmission tunnel. Each pedal can be operated independently to assist turning during field work or locked together by means of the combining brake lock pivoting on the right hand pedal.

Key to Figure 1

- | | |
|----------------------------------|------------------------------------|
| 1. Locking Collar | 22. Locking Collar |
| 2. Oil Seal | 23. Snap Ring |
| 3. Shim | 24. Ground Speed Gear |
| 4. Bolt | 25. Hub. |
| 5. Trumpet Housing | 26. Pinion Retaining/Removing Bolt |
| 6. Gasket | 27. Front Bearing Cone |
| 7. RH Differential Bearing Cup | 28. Bearing Housing |
| 8. RH Differential Bearing Cone | 29. Rear Bearing Cone |
| 9. Differential Lock Coupler Cap | 30. Pinion |
| 10. RH Differential Case | 31. Pilot Bearing |
| 11. Thrust Washer | 32. Snap Ring |
| 12. Spider Gear | 33. Lower Link Pin |
| 13. Thrust Washer | 34. Camshaft |
| 14. RH Differential Gear | 35. Brake Assembly |
| 15. Cross Joint | 36. Bearing |
| 16. LH Differential Gear | 37. Hub |
| 17. Thrust Washer | 38. Oil Seal |
| 18. Crownwheel | 39. Axle Shaft |
| 19. LH Differential Case | 40. Brake Drum |
| 20. LH Differential Bearing Cone | 41. Retaining screw |
| 21. LH Differential Bearing Cup | 42. Wheel Stud |



REAR AXLE AND BRAKES

REAR AXLE AND BRAKES

REAR WHEEL STUD

Removal and Replacement 6A-01-04

Removal

1. Jack up the tractor under the trumpet housing adjacent to the wheel being serviced.
2. Remove the rear wheel.
3. Remove the two countersunk screws.
4. Remove the brake drum.
5. Drive out the stud to be replaced, using a suitable drift and hammer.

Replacement

6. Fit a new stud to the hole in the axle and tap the stud gently to locate the splines.
7. Fit a new wheel nut, with the flat side against the axle, to the stud and pull the stud through the axle to its correct position. Remove the nut.
8. Refit the brake drum.
9. Secure the brake drum with the two countersunk screws.
10. Refit the rear wheel and nuts, then tighten the nuts progressively and evenly to a torque of 270 Nm (200 lbf ft).
11. Adjust the brakes, operation 6A-07-08.

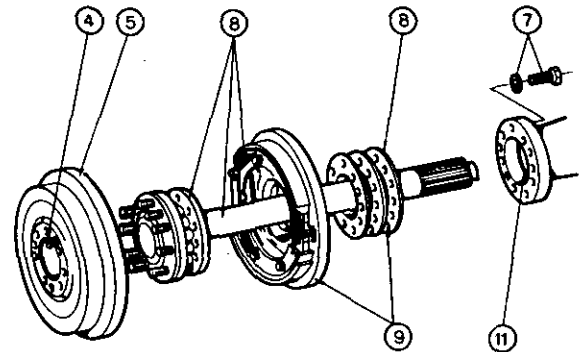
AXLE SHAFT ASSEMBLY

Removal and Refitment 6A-02-04

Special Tools: Dial Test Indicator Gauge

Removal

1. Jack up the tractor under the trumpet housing to be serviced.
2. Drain the transmission oil.
3. Remove the rear wheel.
4. Remove the two countersunk screws securing the brake drum.
5. Remove the brake drum.
6. Release the brake pull rods from the brake camshaft lever.
7. Remove the 12 tap bolts and spring washers securing the hub to the trumpet housing.
8. Withdraw the axle shaft complete with shims, hub and bearing assembly and brake assembly.
9. Remove the shims and the brake assembly from the shaft.



Refitment

10. Place the brake assembly and more shims than will be necessary on the axle shaft.
11. Taking care not to damage the oil seal, place the axle shaft in the trumpet housing, simultaneously locating the brake camshaft.
12. Secure with three of the bolts and spring washers, equi-spaced and tightened to a torque of 74 Nm (55 lbf ft).
13. Check the axle shaft end float, using a suitable dial test indicator gauge. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
14. Refit the remaining bolts and spring washers and tighten them to a torque of 74 Nm (55 lbf ft).
15. Reconnect the brake pull rods to the brake camshaft lever.
16. Refit the brake drum.
17. Secure the brake drum with the two countersunk screws.
18. Refit the rear wheels and nuts, then tighten the nuts progressively and evenly to a torque of 270 Nm (200 lbf ft).
19. Refill the transmission with an approved oil to the correct level.
20. Adjust the brakes, operation 6A-07-08.

AXLE SHAFT ASSEMBLY**Servicing**

6A-03-05

Special Tools: MF 26A Wrench

MF 26B Bearing Remover

MF 26B-1 Adapter

Dial Test Indicator Gauge

Disassembly

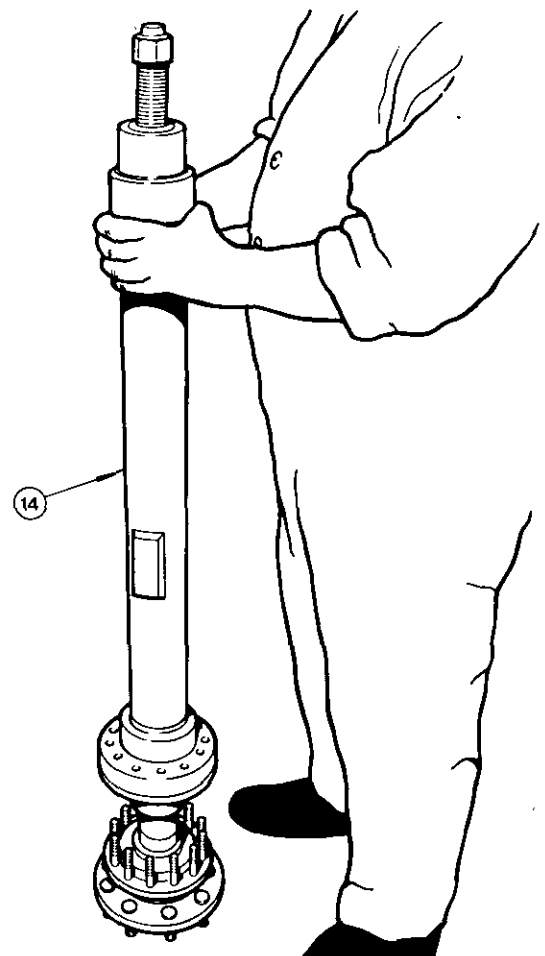
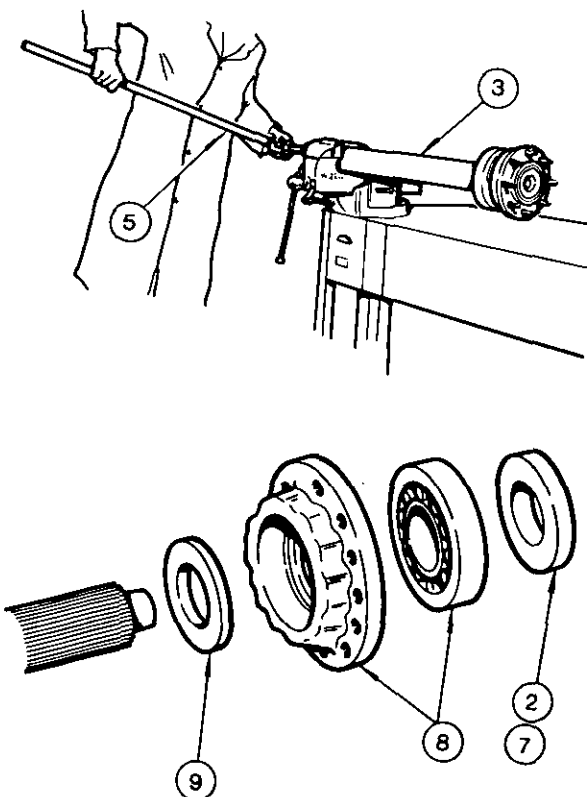
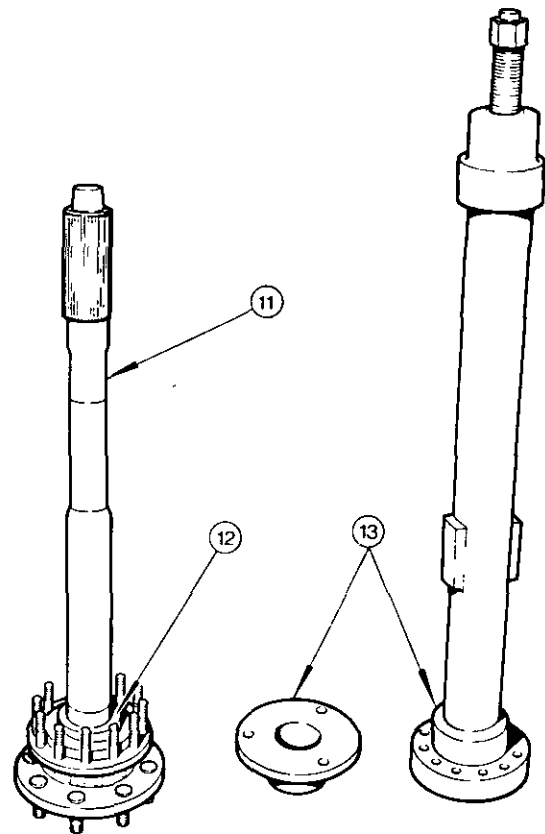
1. Remove the axle shaft assembly, operation 6A-02-04.
2. Drill into the side of the bearing retaining collar, then using a cold chisel, fracture the collar.
3. Assemble MF 26B over the axle shaft.
4. Secure the tool with the twelve tap bolts.
5. Place the axle shaft and service tool assembly in a vice, and using MF 26A, force the axle shaft out of the hub assembly.
6. Remove MF 26A and MF 26B.
7. Remove the collar.
8. Remove the bearing and hub assembly (remove the bearing cup only if necessary).
9. Tap out and discard the oil seal.

Reassembly

10. Fit a new oil seal to the hub (fit a new bearing cup if necessary).
11. Stand the axle shaft on end and position the hub and bearing assembly.
12. Heat a new bearing locking collar, until dull red, and place it in position on the axle shaft.
13. Assemble MF 26B and MF 26B-1.
14. Place the Special Tool over the half shaft and drive the locking collar and the hub and bearing assembly into position on the axle shaft.

NOTE: Ensure that the threaded centre section of MF 26B is unscrewed sufficiently to avoid contact with the end of the axle shaft.

15. Refit the axle shaft assembly, operation 6A-02-04.



REAR AXLE AND BRAKES

BRAKE ASSEMBLY

Brake Shoes

Removal and Replacement

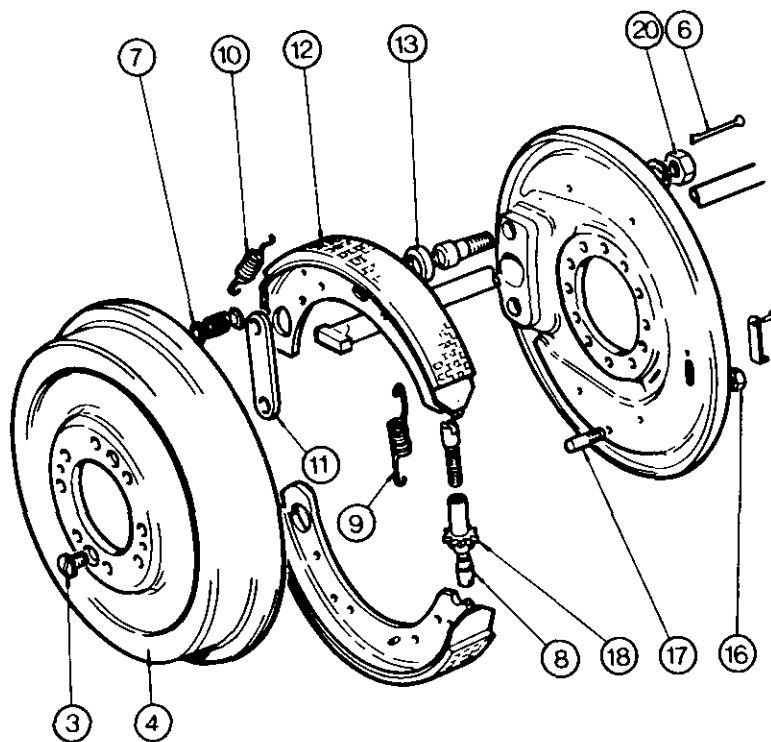
6A-04-06

Removal

1. Jack up the tractor.
2. Remove the rear wheel.
3. Remove the two countersunk screws.
4. Remove the brake drum.
5. Release the brake pull rods from the brake camshaft lever.
6. Grip the pin with a pair of pliers.
7. Simultaneously, press and turn the dished washer until released, then remove the two washers and the spring. Repeat this procedure for the four sets of fixings.
8. Force apart the brake shoes at the adjuster end to allow the adjuster to drop out of position.
9. Remove the spring.
10. Remove the two springs by levering with a screwdriver between the springs and the anchor pin plate.
11. Remove the anchor pin plate.
12. Lift off the two brake shoes.
13. Remove the two spacer washers.

Replacement

14. Lightly smear both ends of the new brake shoes and the flat end of the camshaft with *Girling White Brake Grease*.
15. Reverse procedures 6 to 13 except:
 - a. To facilitate refitment of the springs, use a length of wire looped around the hook of the spring and pull the spring over the anchor pin.
16. Slacken the steady post nuts.
17. Screw the steady posts well into the back plate.
18. Turn the adjuster to the fully 'off' position.
19. Refit the brake drum and secure it with the two countersunk screws.
20. Slacken the anchor pin nuts.
21. Using the adjuster, expand the brake shoes, then tap the anchor pin nuts to ensure that the shoes are seating correctly.
22. Repeat this procedure until the adjuster cannot be tightened any further.
23. Tighten the anchor pin to a torque of 200 Nm (150 lbf ft).
24. Slacken off the adjuster, remove the two countersunk screws and remove the brake drum.
25. Screw in the steady posts until they touch the brake shoe webs, then secure the posts with the nuts.
26. Refit the brake drum and secure it with the two countersunk screws.
27. Reconnect the brake pull rods.
28. Refit the rear wheel and tighten the nuts, progressively, and evenly to a torque of 270 Nm (200 lbf ft).
29. Adjust the brakes, operation 6A-07-08.



BRAKE ASSEMBLY**Brake Shoes Re-lining** 6A-05-07

Special Tools: Brake Re-lining Equipment or
Brake Riveting Anvil
Clamps and Punch

It is permissible to reline brake shoes when genuine reconditioned shoes are not available, but it must be stressed that it is advisable to use factory reconditioned brake shoes whenever possible.

Disassembly

1. Remove the brake shoes, operation 6A-04-06.
2. Place the brake shoes in an oven and heat to 700°C (1 300°F) until the lining material turns white.
3. Remove the brake shoes from the oven and peel off the old lining.

NOTE: If no oven is available, place the brake shoes in boiling water until the lining can be peeled off.

4. Thoroughly clean the brake shoes, paying particular attention to the lining contact surface.
5. Ensure that all of the drillings are clear.

Reassembly

6. Offer up the lining to the brake shoe and align the holes.
7. Locate the lining on the brake shoe by inserting two rivets at the centre of the lining.
8. Place the clamps in position and tighten them securely.
9. Using the brake riveting anvil and the appropriate punch or brake re-lining equipment, secure the centre rivets in position.
10. Working alternately from the centre of the brake shoe, move the clamps, insert the rivets and secure them in position.

NOTE: The gap between the brake shoe and the lining must not exceed 0,1 mm (0.004 in).

11. Refit the brake shoes, operation 6A-04-06.

REAR AXLE AND BRAKES**BRAKE ASSEMBLY****Servicing**

6A-06-08

Special Tools: Dial Indicator

Disassembly

1. Remove the brake shoes, operation 6A-04-06.
2. Remove the steady posts and nuts.
3. Remove the anchor pins, spring washers and nuts.
4. Unscrew the grub screws.
5. Remove the brake lever and woodruff key.
6. Slide the washer and conical spring off the camshaft.
7. Remove the camshaft.
8. Remove the 12 bolts and spring washers.
9. Remove the axle shaft complete with the shims, hub and bearing assembly, and back plate.
10. Remove the shims and back plate.

Examination

Any components showing signs of excess wear or damage should be replaced.

Reassembly

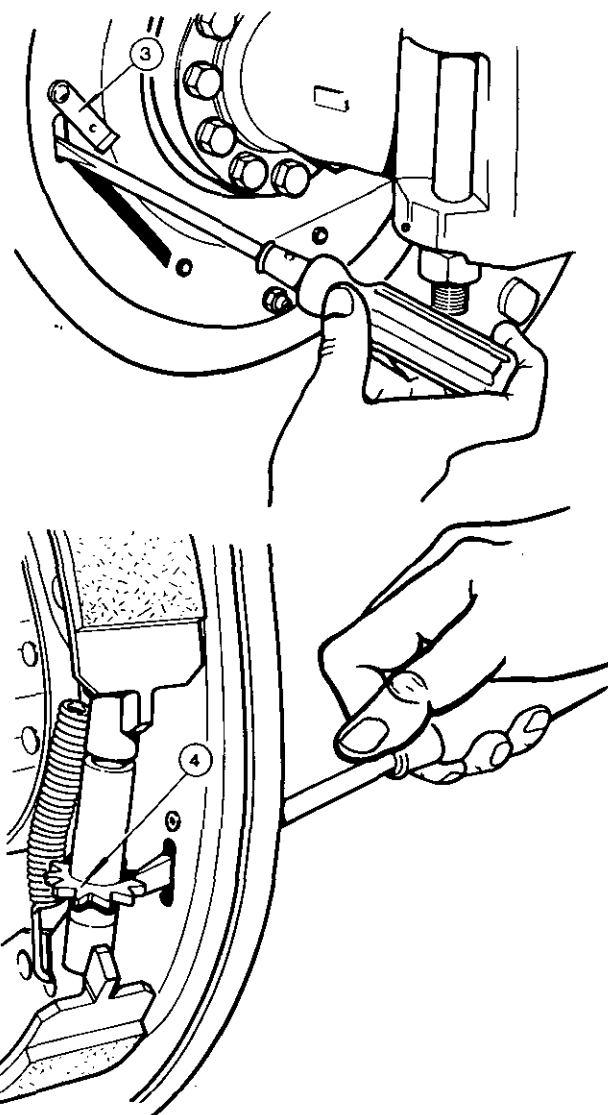
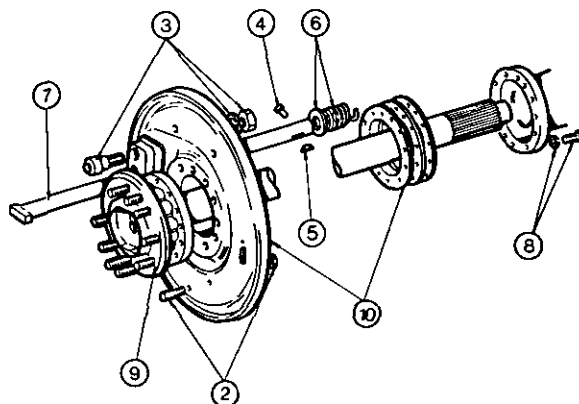
11. Reverse procedures 1 to 10 except:
 - a. Place more shims than will be necessary on the axle shaft.
 - b. Taking care not to damage the trumpet housing oil seal, refit the axle shaft and secure with three equi-spaced bolts and spring washers tightened to a torque of 75 Nm (55 lbf ft).
Using a suitable dial gauge, check the axle shaft end float. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
 - c. Refit, and tighten the remainder of the 12 bolts to a torque of 75Nm (55 lbf ft).
 - d. Refit the washer then the conical spring (large diameter towards the back plate). Half compress the spring to load the camshaft.
 - e. Fit a new woodruff key.
 - f. Fit a new grub screw.
 - g. Refit the anchor pins, spring washers and nuts but do not tighten at this stage.
 - h. Refit the steady posts and nuts but do not tighten at this stage.
12. Refit the brake shoes, operation 6A-04-06.

BRAKE ADJUSTMENT AND BALANCING

6A-07-08

Procedure is as follows:

1. Chock the front wheels and jack the tractor rear wheels clear of the ground, release the parking brake, and disconnect the brake return springs.
2. Unlatch the brake pedals.
3. Move back the cover plate.
4. Insert a screwdriver through the slot in the backplate and lever the adjuster towards the front of the tractor until the wheel is locked.
5. Slacken the adjuster until the wheel rotates freely.
6. Repeat items 3 to 5 for the other brake, reconnect the brake return springs and remove the jack.
7. Slacken the locknuts.
8. Adjust the turnbuckle until the pedal free travel is 25 mm (1 in) measured at the pedal pad. Tighten the locknuts.
9. Lock the brake pedals together and drive the tractor checking for pulling to one side. Any tendency to pull to one side should be counteracted as follows:—
10. Slacken the adjuster on the side to which the tractor pulls.
11. Re-adjust the brake pedal free travel as stated in items 7 and 8.



TRUMPET HOUSING**Removal and Refitment**

6A-08-09

Special Tools: 270 Rail Trolley

Removal

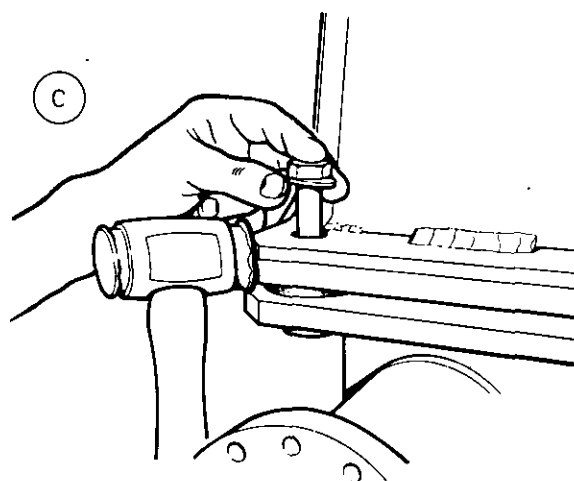
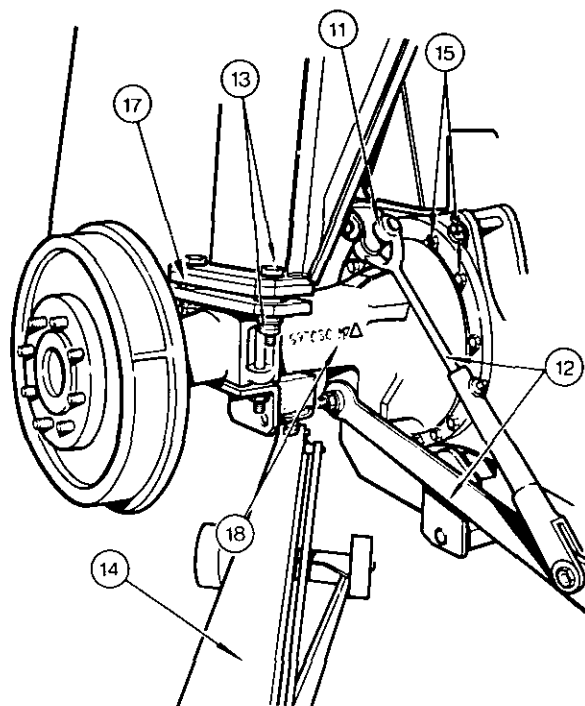
1. Drain the transmission oil.
2. Remove the split pin, nut and washer securing the lower link to the trumpet housing.
3. Jack up the tractor under the trumpet housing being serviced.
4. Remove the rear wheel.
5. Support the tractor on the 270 rail trolley.
6. Release the brake pull rods from the brake camshaft lever.
7. When removing the RH trumpet housing, release the differential lock pull rod.
8. Release the check chain at the check chain anchor bracket.
9. Remove the two nuts securing the stabiliser bracket to the trumpet housing.
10. Remove the stabiliser bracket.
11. Release the lift rod at the knuckle.
12. Remove the lower link assembly complete.
13. Remove the locknuts, nuts, bolts and washers from the cab mounting plate.
14. Place a trolley jack under the centre of the trumpet housing being serviced, just supporting the housing.
15. Remove all of the nuts and bolts securing the trumpet housing to the centre housing.
16. Lower the trumpet housing slightly on the trolley jack.
17. Remove the top mounting plate.
18. Withdraw the trumpet housing on the trolley jack.

NOTE: When removing the LH trumpet housing, the differential unit must be supported.

19. Remove the gasket from the centre housing.

Refitment

20. Reverse procedures 1 to 19 except:
 - a. Fit a new gasket to the centre housing using petroleum jelly.
 - b. When refitting the trumpet housing, take care to align the axle shaft splines in the differential unit and the studs through their holes in the trumpet housing.
 - c. When fitting the top mounting plate, it may be necessary to use pry-bars or a hammer to align the holes in the mounting plates, rubber bushes and cab mounting flange.
 - d. Do not forget to refit the brake return spring and attachment plate.
 - e. Tighten the trumpet housing nuts and bolts to a torque of 115 Nm (85 lbf ft).
 - f. Refit the cab mounting bolts and tighten the nuts until the distance between the upper face of the washer and the lower face of the upper cab mounting plate is 45 mm (1.75 in). Tighten the locknuts to a torque of 110 Nm (80 lbf ft).
 - g. Apply a few drops of recommended sealant 'C', then fit and tighten the stabiliser bracket bolts to a torque of 230 Nm (170 lbf ft).
 - h. Tighten the wheel nuts progressively and evenly to a torque of 270 Nm (200 lbf ft).
 - i. Refill the transmission to the correct level with an approved oil.



REAR AXLE AND BRAKES

LOWER LINK PIN

Removal and Replacement

6A-09-10

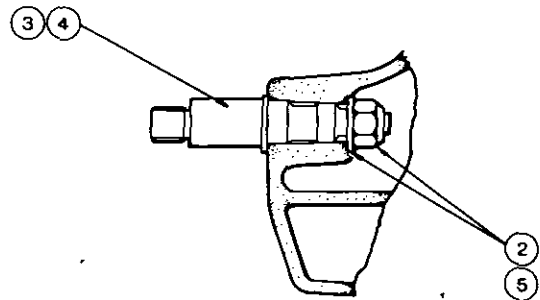
Special Tools: 270 Rail Trolley

Removal

1. Remove the trumpet housing, operation 6A-08-09.
2. Remove the nut and washer.
3. Remove the pin.

Replacement

4. Place a new pin in the trumpet housing.
5. Refit the washer and nut.
6. Tighten the nut to a torque of 163 Nm (120 lbf ft).
7. Refit the trumpet housing, operation 6A-08-00.



DIFFERENTIAL LOCK MECHANISM

Removal and Refitment

6A-10-00

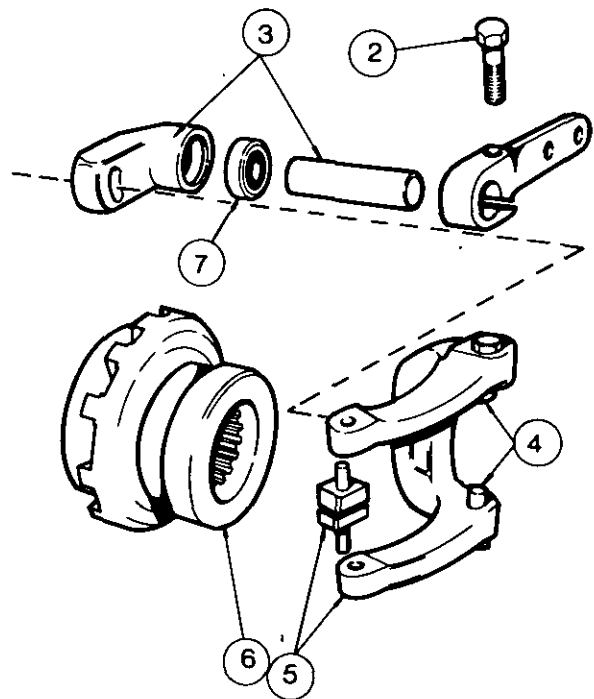
Special Tools Required: 270 Rail Trolley

Removal

1. Remove the RH trumpet housing, operation 6A-08-09.
2. Remove the bolt securing the lever to the actuating shaft.
3. Withdraw the cam and shaft.
4. Remove the two bolts securing the shifter fork.
5. Manoeuvre the shifter fork, with its two guide shoes out of the trumpet housing.
6. Slide the coupler off the axle shaft splines.
7. Remove the seal from the trumpet housing.

Refitment

8. Reverse procedures 1. to 7. except:
 - a. Fit a new seal with the lip facing towards the differential.
 - b. Slide the coupler onto the axle shaft with the teeth facing towards the differential.
 - c. Clean and degrease the threads of the shifter fork securing bolts and their locating holes in the trumpet housing. When refitting the shifter fork, ensure that the shoe guides locate correctly on the coupler.
 - d. Apply a small quantity of recommended sealant C to the threads of the bolts and secure the shifter fork to the trumpet housing, then tighten the bolts to a torque of 54 Nm (40 lbf ft).
 - e. Smear the shaft bushes lightly with engine oil. Carefully insert the shaft through the lip seal, simultaneously locating the lever on the shaft and the dowel on the shifter fork in the cam.
8. Adjust the differential lock pedal, operation 6A-12-11.



DIFFERENTIAL LOCK SHAFT BUSH**Removal and Replacement** 6A-11-11

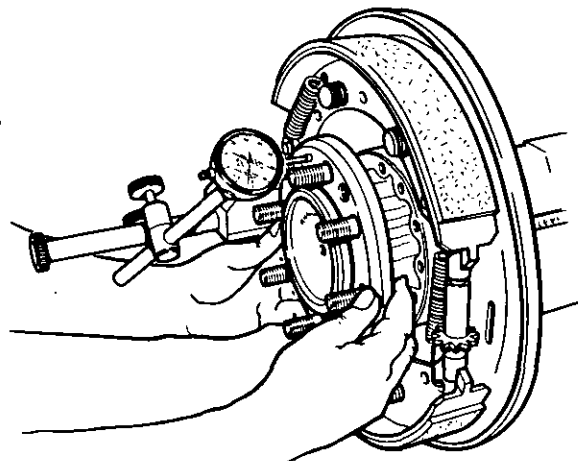
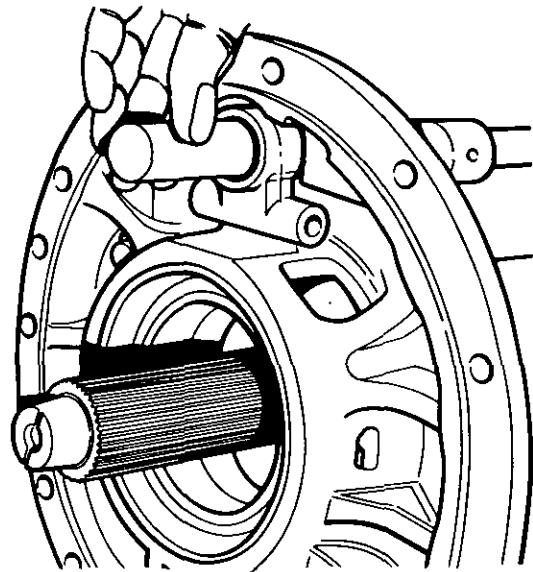
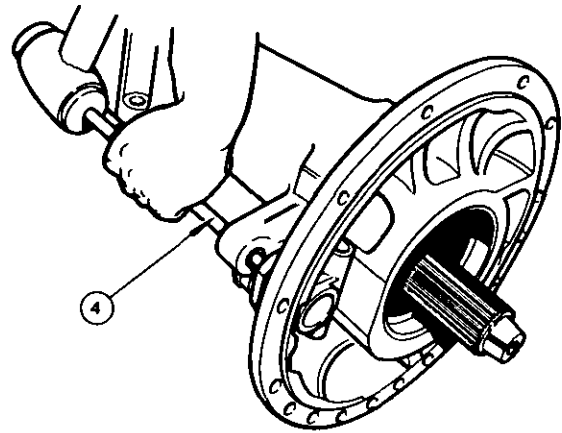
Special Tools: 270 Rail Trolley
Dial Test Indicator Gauge

Removal

1. Remove the differential lock mechanism, operation 6A-10-10.
2. Remove the 12 bolts and spring washers, securing the hub to the trumpet housing.
3. Withdraw the axle shaft complete with shims, hub and bearing assembly, and brake assembly from the trumpet housing.
4. Drive out the bush using a suitable punch or drift.

Replacement

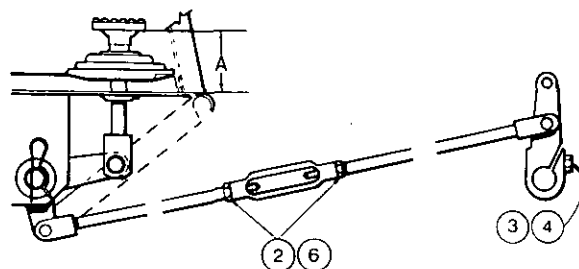
5. Using a suitable mandrel, fit a new bush into the trumpet housing.
6. Place the axle shaft, brake assembly and more shims than will be necessary in the trumpet housing, simultaneously locating the brake camshaft.
7. Refit the differential lock mechanism, operation 6A-10-10 but do not refit the wheel.
8. Remove the two countersunk screws.
9. Remove the brake drum.
10. Check the axle shaft end float using a suitable dial test indicator gauge.
11. Remove shims as necessary to give an end float of 0,05 to 0,2 mm (0.002 to 0.008 in).
12. Refit the brake drum and secure it with the two countersunk screws.
13. Refit the rear wheel and nuts. Tighten the nuts progressively and evenly to a torque of 270 Nm (200 lbf ft).
14. Adjust the brakes, operation 6A-07-08.
15. Adjust the differential lock, operation 6A-12-11.

**DIFFERENTIAL LOCK ADJUSTMENT**

6A-12-11

Procedure is as follows:

1. Ensure that the pedal operates freely throughout its complete travel.
2. Slacken the turnbuckle locking nuts.
3. Slacken the lever locking bolt.
4. Set the lever in the vertical position and tighten the locking bolt.
5. Adjust the rod length until the pedal height (Dimension A) is 60 mm (2 $\frac{3}{8}$ in).
6. Tighten the turnbuckle locking nuts.



REAR AXLE AND BRAKES

DIFFERENTIAL LOCK COUPLER CAP

Removal and Replacement 6A-13-12

Special Tools: 555 Universal Puller
MF 555-2A/1 Puller Adapter
MF 257 Bearing Driver

Removal

1. Remove the R.H. trumpet housing, operation 6A-08-09.
2. Fit puller 555 and MF 555-2A/1 to the differential bearing cone then pull off the cone.

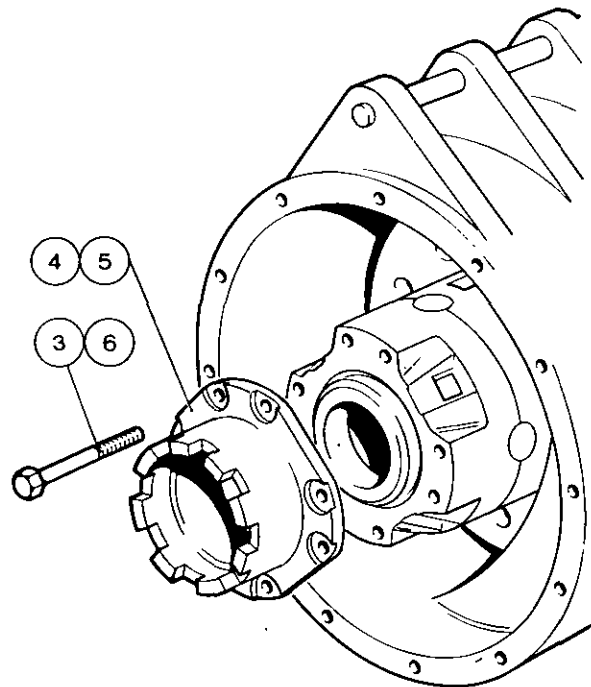
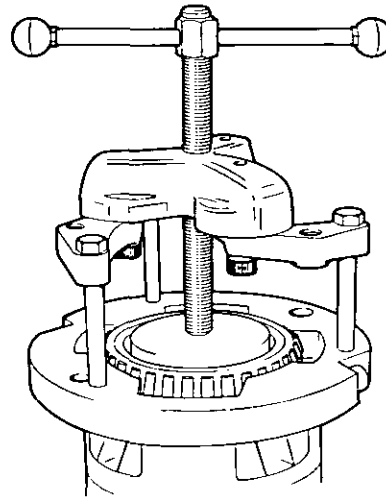
NOTE: For clarity the illustration shows the differential removed. However for the actual operation this is not necessary.

Replacement

3. Remove the eight bolts.
4. Prise off the cap taking care not to dislodge the case which would allow the differential gears to fall out.

Replacement

5. Fit the new coupler cap.
6. Insert and hand tighten the eight bolts.
7. Tighten the bolts progressively but evenly to a torque of 108 Nm (80 lbf ft).
8. Refit the bearing cone using MF 257.
9. Refit the trumpet housing, operation 6A-36-42.



DIFFERENTIAL**Pre-Load Checking and Adjustment 6A-14-13**

Special Tools: 270 Rail Trolley

MF 245D Pre-Load Gauge

MF 245D-1 Straight Edge

MF 1105 Bearing Remover/Replacer

MF 1105-7A/1 and 2 Adapters

550 Driver Handle

Dial Test Indicator Gauge

NOTE: This check must be carried out whenever the differential unit is disassembled, or if the bearings have been replaced.

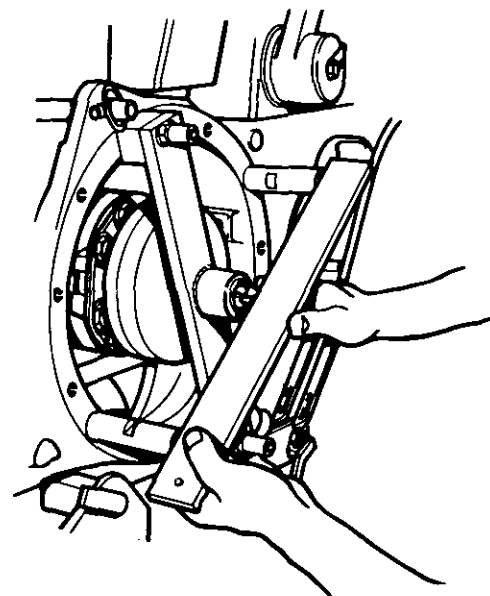
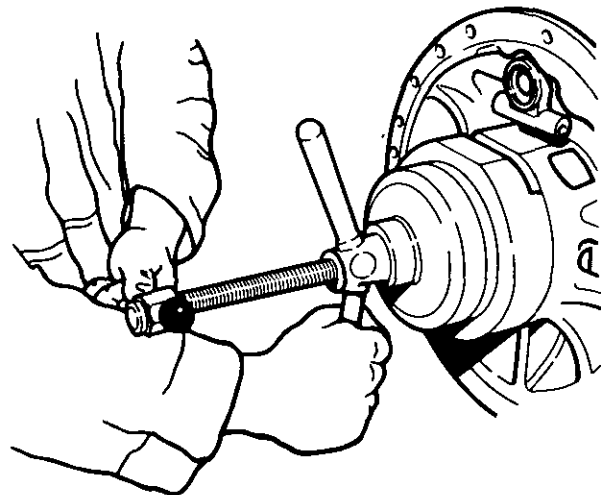
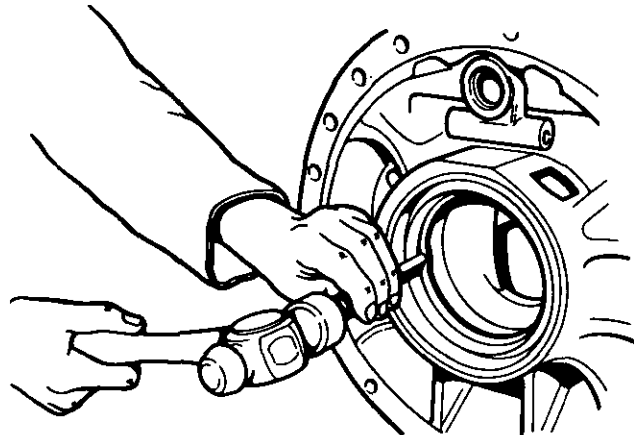
Procedure is as follows:

1. Remove the axle shaft assembly, operation 6A-02-04.
2. Remove the differential lock mechanism, operation 6A-10-10.
3. Using a suitable punch, tap out the chip shield from behind the bearing cup in the trumpet housing.
4. Remove the bearing cup from the trumpet housing using MF 1105, and adapters MF 1105-7A/1 and MF 1105-7A/2.
5. Screw the two setting blocks on to two centre housing studs. Remove one stud from an adjacent location to permit fitment of the upper block.
6. Remove the two studs from the opposite trumpet housing, refit one in the tapped hole adjacent to the long pin, and one in the tapped hole diametrically opposite.
7. Place the bearing cup on the bearing cone.
8. Fit the bearing centraliser.
9. Place the clamp bar in position.
10. Secure the clamp bar with the two tube nuts.
11. Tighten the clamp bar nuts to a torque of 27 Nm (20 lbf ft), turning the differential unit, by use of a lever, but keeping the bearing cup stationary, to fully centralise and seat both bearings.
12. Place the straight edge in position as shown, then measure the gap between the straight edge and the end of the centraliser pin.

The gap measured, directly indicates the required chip shield, which should be selected from the table below:

FEELER GAP (Equals Shield Thickness)		MEANS OF IDENTIFICATION	PART No.
mm	in		
0,74 to 0,79	0.29 to 0.31	No Dots	187 689 M1
0,86 to 0,91	0.34 to 0.36	One Dot	892 173 M1
0,99 to 1,04	0.39 to 0.41	Two Dots	892 172 M1
1,12 to 1,17	0.44 to 0.46	Three Dots	892 171 M1
1,25 to 1,30	0.49 to 0.51	Four Dots	892 170 M1
1,37 to 1,42	0.54 to 0.56	Five Dots	191 124 M1

13. Remove the tube nuts, clamp bar, centraliser and the setting blocks.
14. Refit the studs to their original holes.
15. Place the new chip shield in the trumpet housing, with the 'dished' face towards the differential.
16. Using MF 1105-7A/1 and the 550 handle, refit the bearing cup.
17. Refit the differential lock mechanism, operation 6A-10-10.
18. Refit axle shaft assembly, operation 6A-02-04.



REAR AXLE AND BRAKES**RH DIFFERENTIAL BEARING****Removal and Replacement** 6A-15-14

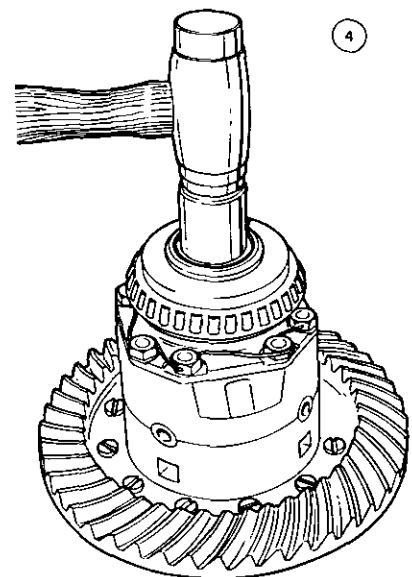
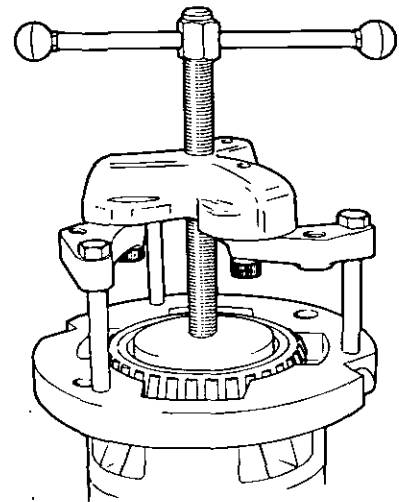
Special Tools: See operation 6A-14-13
and 555 Universal Puller
MF 555-2A/1 Puller Adapter
MF 257 Bearing Driver

Removal

1. Remove the differential lock mechanism, operation 6A-10-10.
2. Fit puller 555 and MF 555-2A/1 to the differential then pull off the bearing cone.
3. Remove the axle shaft assembly, operation 6A-02-04.

Replacement

4. Drive a new bearing cone onto the differential lock coupler cap using MF 257.
5. Check the differential preload as stated in items 3 to 18, operation 6A-14-13.

**DIFFERENTIAL UNIT****Removal and Refitment** 6A-16-14

Special Tools: 270 Rail Trolley

Removal

1. Remove the L.H. trumpet housing, operation 6A-08-09.
2. Manoeuvre the differential assembly out of the centre housing.

Warning

The differential unit is heavy and awkward to handle; take care when both removing and refitting.

Refitment

3. Manoeuvre the differential assembly back into the centre housing, engaging the splines of the differential unit on those of the R.H. axle shaft.
4. Refit the L.H. trumpet housing, operation 6A-08-09.
5. If for any reason, any of the components of the differential unit have been replaced, check the differential pre-load, operation 6A-14-13.

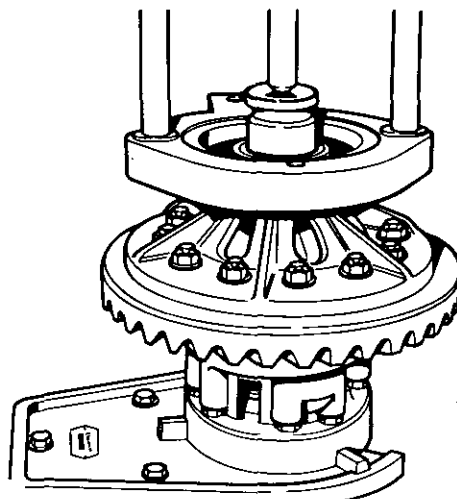
L.H. DIFFERENTIAL BEARING**Removal and Replacement** 6A-17-15

Special Tools: See operation 6A-14-13
and

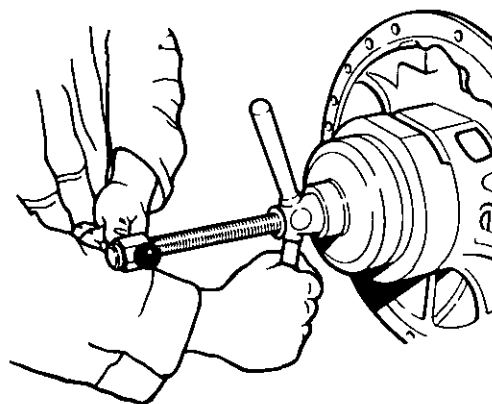
MF 200 Hand Press
MF 200-22 Adapter
MF 10 Bench Adapter
MF 258 Holder
MF 257 Bearing Driver
MF 1105-2A Adapter

Removal

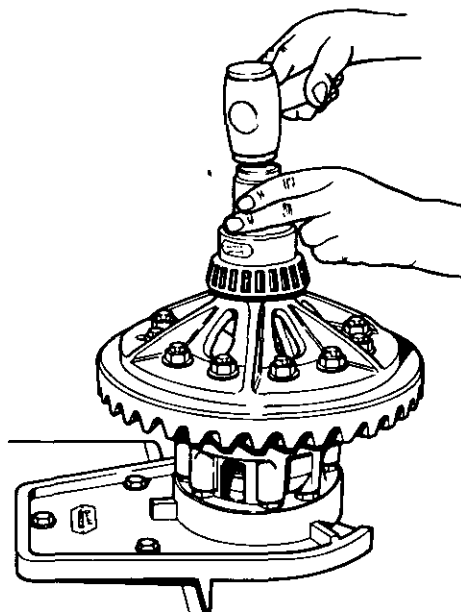
1. Remove the differential assembly, operation 6A-16-14.
2. Fit the bench adapter MF 10 to the bench.
3. Fit the holder, MF 258 to the bench adapter.
4. Place the differential on the adapter.
5. Assemble MF 200 with MF 200-22, then pull off the bearing cone.
6. Remove the axle shaft assembly, operation 6A-02-04.



7. Remove the bearing cup from the trumpet housing, using MF 1105 with MF 1105-2A.

**Replacement**

8. Drive the new bearing cone on to the differential using MF 257.
9. Fit the new bearing cup in the trumpet housing, using a suitable punch and hammer.
10. Refit the differential assembly, operation 6A-16-14.
11. Check the differential pre-load, operation 6A-14-13.



REAR AXLE AND BRAKES

DIFFERENTIAL UNIT

Servicing

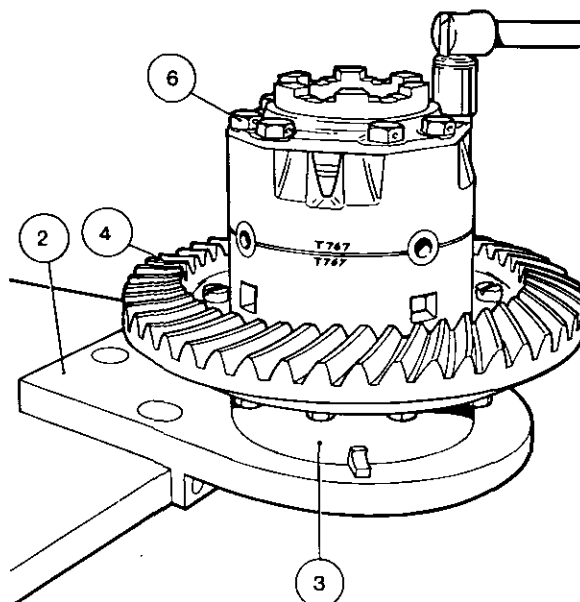
6A-18-16

Special Tools: See operation 6A-14-13

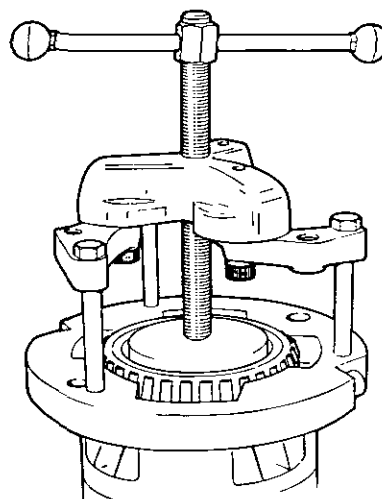
and
 MF 10 Bench Adapter
 MF 258 Holder
 MF 257 Bearing Driver
 555 Universal Puller
 MF 555-2A/1 Adapter

Disassembly

1. Remove the differential unit, operation 6A-16-14.
2. Fit the bench adapter MF 10 to the bench.
3. Fit the holder MF 258 to the bench adapter.
4. Place the differential on the adapter.



5. Fit puller 555 and MF 555-2A/1 to the differential bearing cone then pull off the cone.



6. Remove the eight bolts securing the coupler cap.
7. Remove the coupler cap and R.H. differential case.
8. Remove the cross joint and pinions with their thrust washers.
9. Lift out the differential gears with their thrust washers.

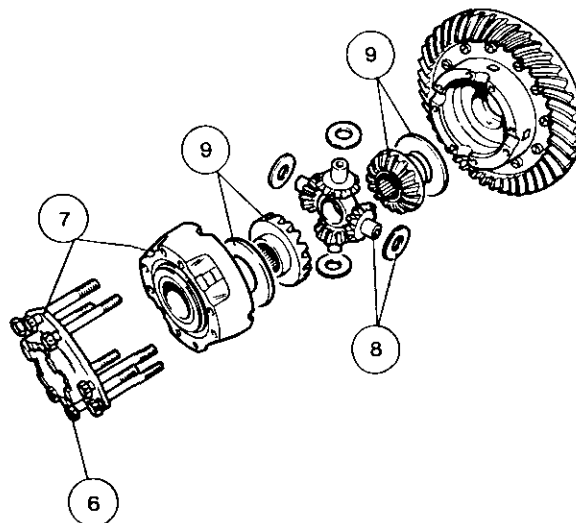
Examination

Examine all differential components, particularly gears, thrust washers and shafts, for scoring, chipping or wear. Any component showing signs of wear should be renewed.

NOTE: If any of the spider gears are worn, a full set of four new gears should be fitted. In such circumstances, differential gears may also need replacing.

Reassembly

10. Reverse procedures 1 to 9 except:
 - a. Refit the R.H. differential case with the markings aligned.
 - b. Tighten the eight bolts to a torque of 108 Nm (80 lbf ft).
 - c. Drive the bearing cone onto the coupler cap using MF 257.



CROWNWHEEL**Removal and Replacement 6A-19-17**

Special Tools: See operation 6A-18-16 and
MF 9A Holder
Epoxy Resin Bonding Kit,
Part No. 1852 913 M91

Removal

1. Remove the differential components, operation 6A-18-16.
2. Place the differential unit on a bench with the teeth facing downwards.
3. Centre punch each of the rivet heads centrally.
4. Using a 13 mm ($\frac{1}{2}$ in) drill, drill out each of the rivet heads until they become detached from their shanks.
5. Drive out the rivets.
6. Drive off the crownwheel.

NOTE: When fitting a new crownwheel, the pinion must also be replaced.

Replacement

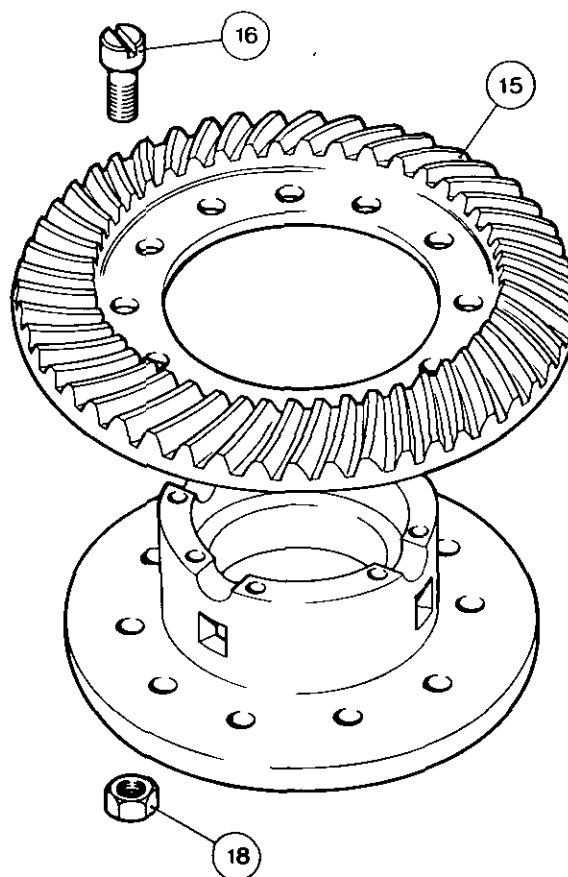
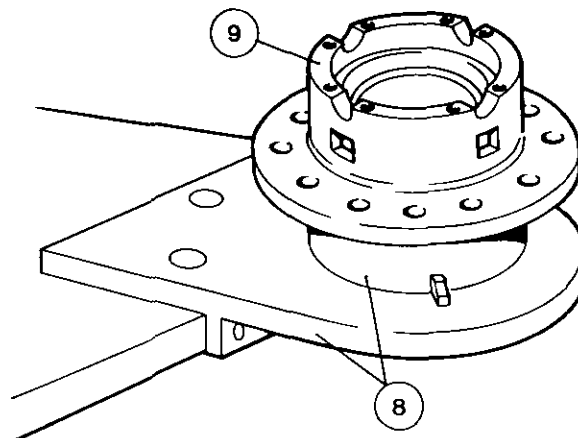
7. Ensure that the mating faces of the differential case and the new crownwheel are perfectly flat.
8. Fit the adapter MF 9A, and holder MF 10 to the bench.
9. Fit the L.H. differential case, with the mating face upwards.
10. Degrease the crownwheel, L.H. differential case, differential bolts and nuts with trichloroethylene.
11. Collect together all items necessary for speedy assembly. These items are:
A torque wrench, the correct size socket and either Loctite Grade 270 Part Number 1810 581 M91.
12. Open the epoxy resin kit 1852 913 M91. Its contents are:
One jar containing 10 ml of resin. (This jar is also used as a mixing vessel).
One jar containing 5 ml of hardener.
One glass stirring rod.
One brush.
13. Pour the hardener into the resin jar and mix thoroughly using the glass rod.
14. Apply an even coating of adhesive to both mating surfaces.
15. Fit the crownwheel to the differential case.

NOTE: These two components are an interference fit and must, therefore, have their bolt holes aligned accurately before being fitted together.

16. Fit the 12 bolts with their heads nearest to the crownwheel teeth.
17. Apply two drops of recommended sealant C to the first thread of each bolt.
18. Fit the nuts, and tighten them progressively and evenly to a torque of 160 Nm (120 lbf ft).

NOTE: Operations 14 to 18 must be completed within 30 minutes of mixing the resin and hardener.

19. Cure the resin bonding by subjecting the differential assembly to uniform heating as follows:
120°C (245°F) for a minimum of 1 hour
or
40°C (105°F) for a minimum of 12 hours
or
30°C (85°F) for a minimum of 16 hours
or
20°C (68°F) for a minimum of 24 hours.
20. Refit the differential components, operation 6A-18-16.



REAR AXLE AND BRAKES**PINION ASSEMBLY (STANDARD FLOW PUMP)****Removal and Refitment** 6A-20-18

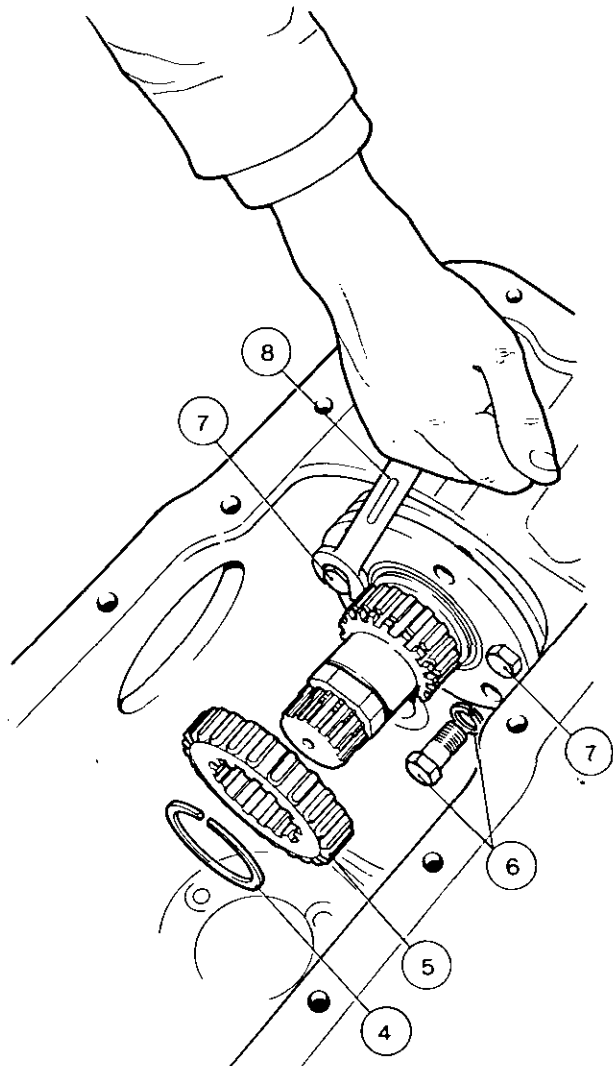
Special Tools: 270 Rail Trolley

Removal

1. Remove the lift cover and the hydraulic pump(s), Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted) Part 6B.
3. Remove the differential unit, operation 6A-16-14.
4. Release the snap ring.
5. Slide off the gear.
6. Remove the six bolts and spring washers.
7. Screw one of the bolts into each of the two tapped holes.
8. Tighten the bolts, thus withdrawing the pinion assembly.

Refitment

9. Reverse procedures 1 to 6 except:
 - a. Freely lubricate the pinion with clean transmission oil before refitment.
 - b. Ensure that the locating pin is aligned before pressing the housing into place.
 - c. Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - d. Fit a new snap ring.

**PINION ASSEMBLY (HIGH FLOW PUMP)****Removal and Refitment** 6A-21-18

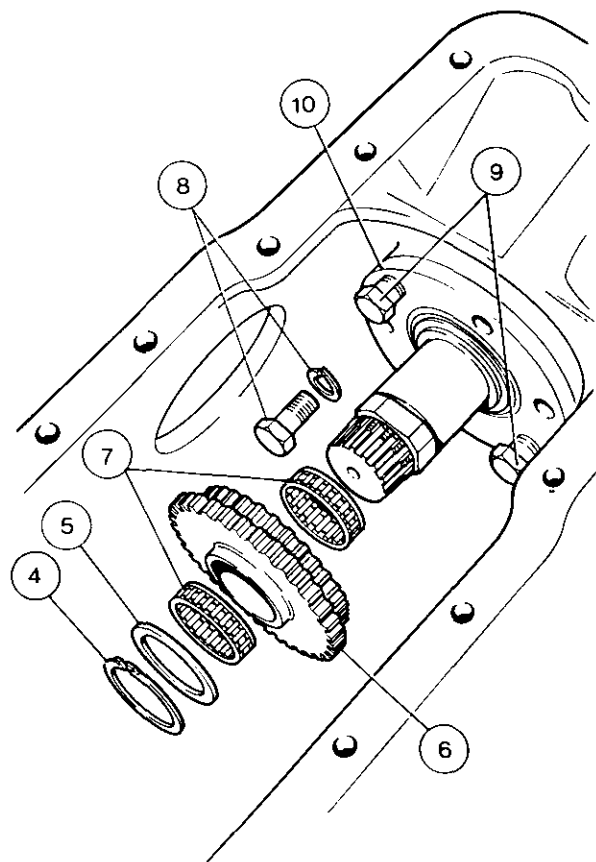
Special Tools: 270 Rail Trolley

Removal

1. Remove the lift cover and the hydraulic pump(s), Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted), Part 6B.
3. Remove the differential unit, operation 6A-16-14.
4. Release the circlip.
5. Remove the thrust washer.
6. Remove the gear cluster.
7. Slide the needle roller bearings off the bearing sleeve.
8. Remove the six bolts and spring washers.
9. Screw one of the bolts into each of the two tapped holes.
10. Tighten the bolts thus withdrawing the pinion assembly.

Refitment

11. Reverse procedures 1 to 8 except:
 - a. Freely lubricate the pinion with clean transmission oil before refitment.
 - b. Ensure that the locating pin is aligned before pressing the housing into place.
 - c. Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - d. When the thrust washer shows signs of wear it should be renewed.
 - e. Fit a new circlip.
 - f. Refit the hydraulic pump(s) and lift cover Part 8A.



PINION ASSEMBLY**Servicing**

6A-22-19

Special Tools: MF 200 Hand Press
MF 200-23 Adapter
MF 200-25 Adapter
Pre-load Gauge

Disassembly

1. Remove the pinion assembly, 6A-20-21 (Standard Flow Pump) 6A-21-21 (High Flow Pump).
2. Remove the locking ring as follows:
 - a. Place the pinion in a soft faced vice with the jaws of the vice holding the flats, adjacent to the locking rollers of the collar.
 - b. Using a cold chisel, cut one half to two thirds into the locking collar at points B and C.
 - c. Reposition the pinion in the vice and chisel down the splines into the cuts made at points B and C. A few hefty blows will fracture the locking collar enabling it to be removed.

NOTE: Great care should be taken to avoid damaging the threads of the pinion.

3. Remove the sleeve and the splined hub (Standard Flow Pump) or the bearing sleeve, sleeve keeper and thrust washer (High Flow Pump).
4. Remove the housing, complete with the front bearing cone.
5. Fit the pinion to MF 200 with MF 200-23 and MF 200-25—Press off the bearing.
6. Remove the snap ring securing the pilot bearing to the pinion.
7. Fit the pinion to MF 200, using MF 200-23, then press off the pilot bearing.

Examination

Examine all components for signs of wear, scoring or pitting. Any faulty or worn parts must be replaced.

NOTES:

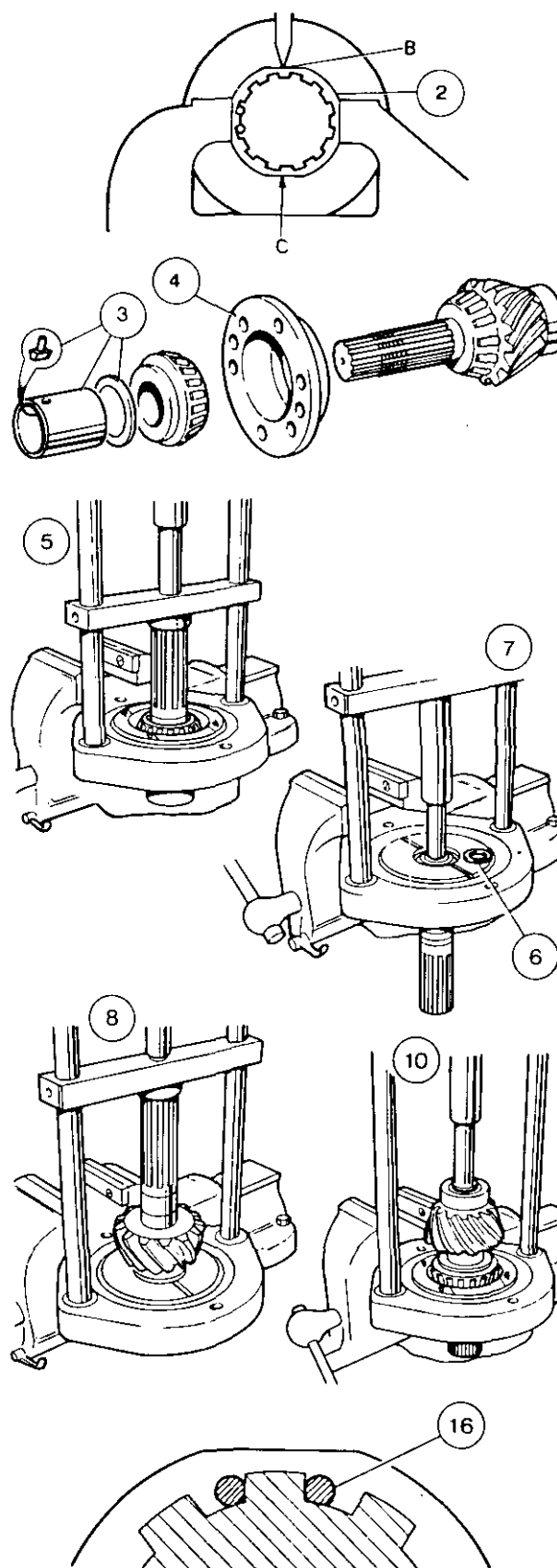
1. If the pinion is damaged the crownwheel must also be replaced as these are only supplied in matched sets.
2. The taper roller bearings are serviced as a pair, assembled with the housing.

Reassembly

8. Using MF 200 and MF 200-23, press the pilot bearing on to the pinion.
9. Secure the pilot bearing with a new snap ring.
10. Using MF 200, MF 200-23 and MF 200-25 press the bearing onto the pinion.
11. Locate the pinion in its housing and fit the front bearing cone.
12. Refit the splined hub (Standard Flow Pump) or the thrust washer, sleeve keeper and bearing sleeve (High Flow Pump) and a new locking ring, hand tightened.
13. Hold the housing in a soft faced vice.
14. Using a suitable pre-load gauge, tighten the locking ring to a torque of 24 kg cm (20 lbf in).
15. Remove the gauge, tap the pinion firmly to centralise the bearings, then re-check the pre-load.
16. Secure the locking ring by tapping a locking roller down either side of one of the pinion splines.

NOTE: The needle rollers must be driven flush with the locking collar.

17. Refit the pinion assembly, operation 6A-20-18, or 6A-21-18.



REAR AXLE AND BRAKES

REAR DRIVE SHAFT

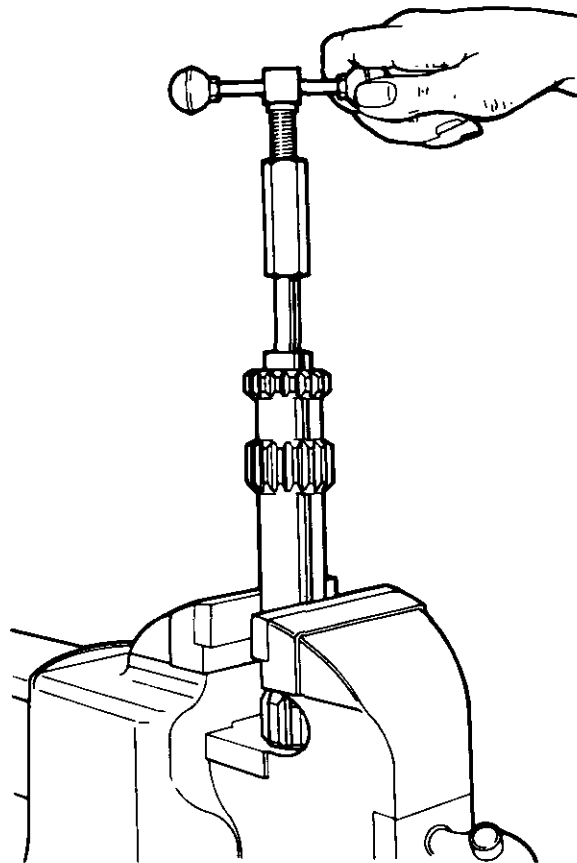
Servicing

6A-23-20

Special Tools: MF 202A Needle Roller Bearing Puller
MF 203A Needle Roller Bearing Driver
550 Universal Handle

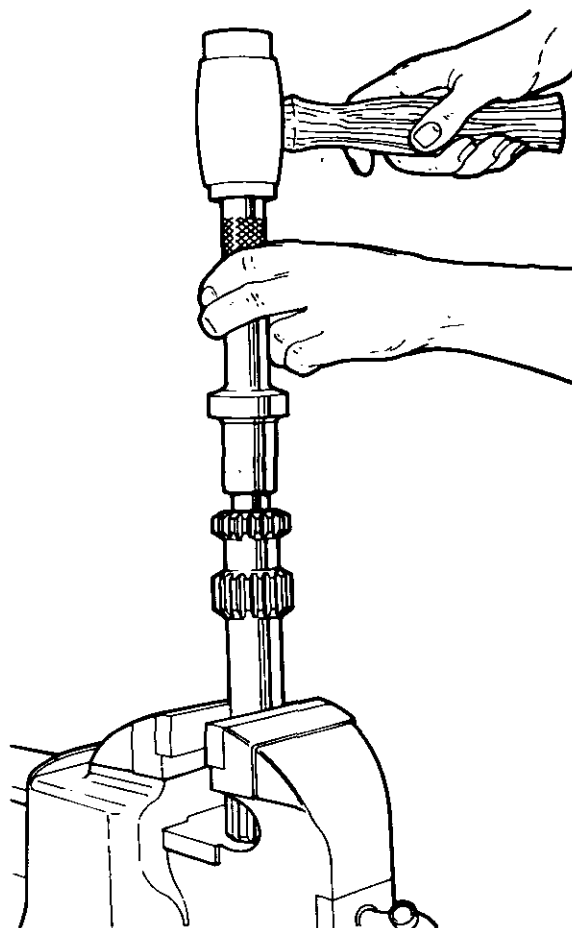
Disassembly

1. Remove the lift cover, Part 8A.
2. Remove the split pin from the shear tube.
3. Remove the shear tube.
4. Remove the rear drive shaft.
5. Locate the end of MF 202A underneath the bearing cage.
6. Extract the bearing.
7. Remove the plunger and spring.



Reassembly

8. Reverse procedures 1 to 7 except:
 - a. Place the bearing depth control collar (part of MF203A) on the end of the driveshaft over the new bearing. Drive the bearing into the drive shaft using MF203A and the 550 handle until the tool contacts the depth control collar.
 - b. Fit a new split pin to give an end float of 0,40 to 2,50 mm (0.015 to 0.100 in).



Part 6 — Section A

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REAR AXLE AND BRAKES

GENERAL

The drive from the transmission mainshaft is transmitted through the rear drive shaft and shear tube to a spiral bevel driving pinion and crown wheel, then through the axle shafts and epicyclic reduction units to the rear wheel axles.

The driving pinion is supported in the centre housing by a straight roller pilot bearing and a pre-loaded housing assembly carrying two tapered roller bearings.

The crownwheel is attached to the split differential case, which is supported each side by a tapered roller bearing. The differential pinions run on a cross joint and thrust is taken by thrust washers behind the pinions.

The axle shaft inner ends are splined into differential gears, and the outer ends which run on a bush in the epicyclic carrier (except MF 590 tractor) are splined into the sun gear in the epicyclic unit.

The wheel axles are splined into the epicyclic carrier which is driven by the sun gear and planetary pinions.

A differential lock is fitted to the R.H. axle housing. When the spring loaded pedal is pressed, a shaft engages a coupler with a coupling cap on the differential case, thus locking the differential.

This tractor is fitted with Girling multi-disc oil cooled brakes between the axle housings and the differential carrier plates adjacent to the centre housing.

The brakes are operated by two independently operated pedals located on the right of the transmission tunnel.

The right pedal operates the right hand brake and the left pedal operates the left hand brake, to assist turning.

For highway use the brakes are used together by operating an interlocking latch which joins the two brake pedals.

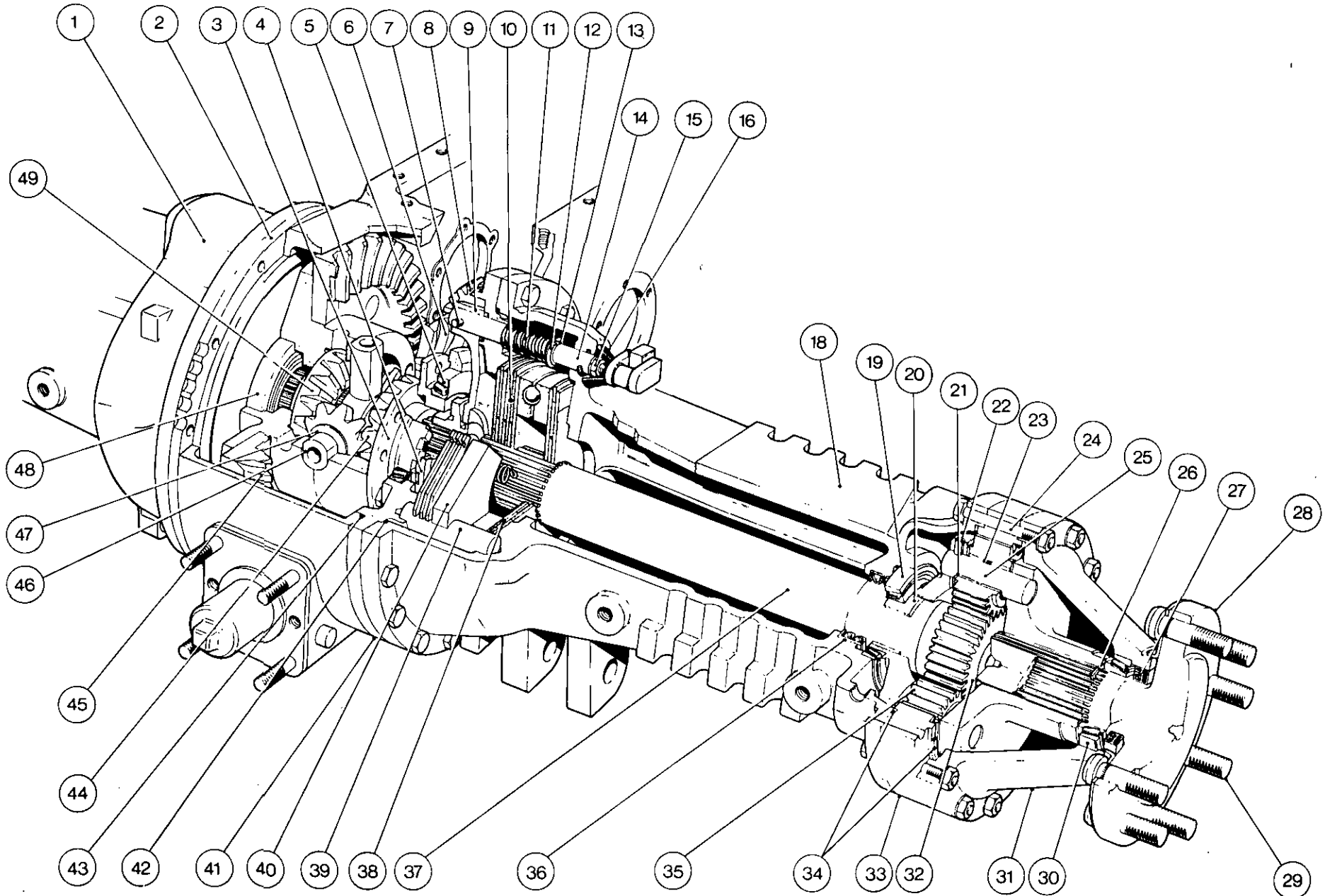
When only single brakes are supplied on the tractor the parking brake also actuates these disc brakes.

Pressure on the brake pedal brings an actuating assembly in contact with two rotating middle (friction) discs splined to each axle shaft, these in turn contact fixed friction faces provided in the axle housing and in the differential carrier plate fitted between the centre and axle housings. The mechanism of each brake consists of two cast iron actuating discs, held together by tension springs and separated by steel balls located in inclined seats. Pressure on the brake pedal, by pulling on the operating rod, rotates one actuating disc relative to the other, and the steel balls ride up their inclined seats and so spread the actuating discs apart. These come into contact with the rotating (friction) discs, which are splined to the shaft being braked. The actuating assembly will move slightly in the direction of rotation until the torque ear of one actuating disc comes into contact with a shaft in the housing. The other actuating disc tends to rotate further, increasing the angular displacement between the discs, and assisting the braking action. When the operating pull is released, the tension springs cause the discs to return to their normal position.

Dual brake tractors are fitted with disc brakes at the inner end of the two rear axle shafts and have an additional and entirely separate mechanical braking system comprising two brake assemblies mounted at the outer ends of the rear axle housings. These secondary brakes are Girling 356 x 51 mm (14 x 2 in), two shoes, double acting floating cam, full servo turning.

KEY TO FIGURE 1

1 Trumpet Housing—LH	18 Trumpet Housing—RH	34 Gasket
2 Carrier Plate—LH	19 Epicyclic Hub—Inner Bearing	35 Planet Gear
3 Differential Lock Coupler Cap	20 Epicyclic Hub—Bush	36 Inner Oil Seal
4 Differential Lock Coupler	21 Thrust Washer	37 Axle Shaft
5 RH Differential Bearing	22 Roll Pin (except 590)	38 Brake Friction Plate
6 Pinion Assembly	23 Needle Rollers	39 Brake Stop Rod
7 Roll Pin	24 Epicyclic Unit Securing Bolts	40 Actuator Unit
8 Ground Speed Gear	25 Planet Gear—Shaft	41 Carrier Plate—RH
9 Differential Lock Coupler Fork	26 Half Ring (Snap Ring, 590)	42 'O' Ring—Outer
10 Brake Interplate	27 Outer Oil Seal	43 'O' Ring—Inner
11 Differential Lock Return Spring	28 Stub Axle	44 Differential Gear—RH
12 Washer	29 Wheel Stud	45 Crownwheel
13 Circlip	30 Outer Bearing	46 Cross Shaft
14 Differential Lock Actuator Shaft	31 Outer Housing	47 Thrust Washer
15 Differential Lock Adjusting Nut	32 Sun Gear	48 Differential Bearing
16 Dust Cover	33 Ring Gear	49 Differential Gear—LH



Issue 1

REAR AXLE AND BRAKES

REAR WHEEL STUD

Removal and Replacement 6A-30-36

Special Tools: MF 295B Guide Pegs, (P.A.V.T. wheels only)

Removal

1. Jack up the tractor.
2. Remove the rear wheel.



NOTE: P.A.V.T. wheels are extremely heavy and should only be removed with the assistance of a crane.

3. Drive out the damaged stud.

Examine the stud hole, the other studs and the wheel disc for signs of fretting or damage.

Replacement

4. Locate a new stud in the wheel axle.
5. Tap the stud gently to locate the splines.
6. Fit a new wheel nut, with the flat side against the axle to the stud and pull the stud through the axle to its correct position.
7. Remove the nut.
8. Fit a guide peg MF 295B to two of the wheel studs (P.A.V.T. wheels only).
9. Refit the rear wheel and nuts and tighten the nuts progressively and evenly to a torque of 270 Nm (200 lbf ft).
10. Remove the jack.

EPICYCLIC UNIT OUTER HOUSING AND RING GEAR.

Removal and Refitment 6A-31-36

Removal

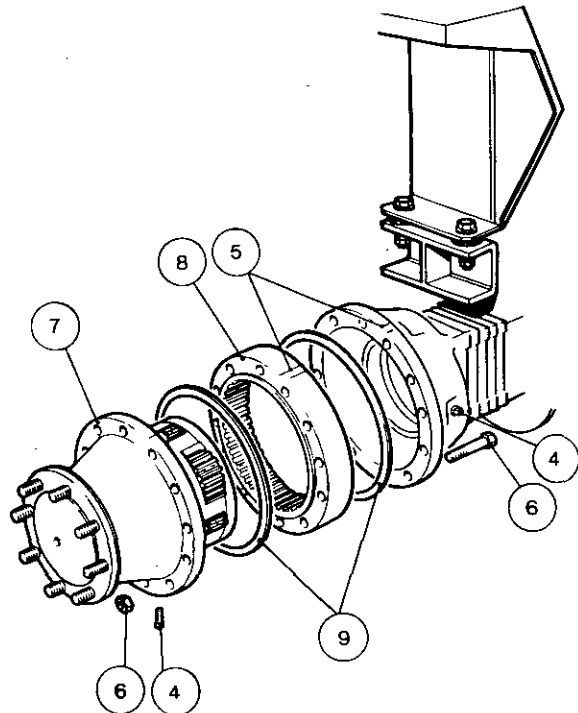
1. Apply the parking brake.
2. Jack up the tractor.
3. Remove the rear wheel.
4. Remove the drain and level plugs and drain the oil from the epicyclic unit.
5. Scribe a mark across the outer housing, ring gear, and trumpet housing to facilitate refitment. Also scribe a mark across the outer housing and ring gear only; this will ensure that the ring gear is replaced with the teeth in full engagement.
6. Remove the nuts and bolts.
7. Remove the outer housing and ring gear assembly.
8. Remove the ring gear.

NOTE: Do not withdraw the axle shaft.

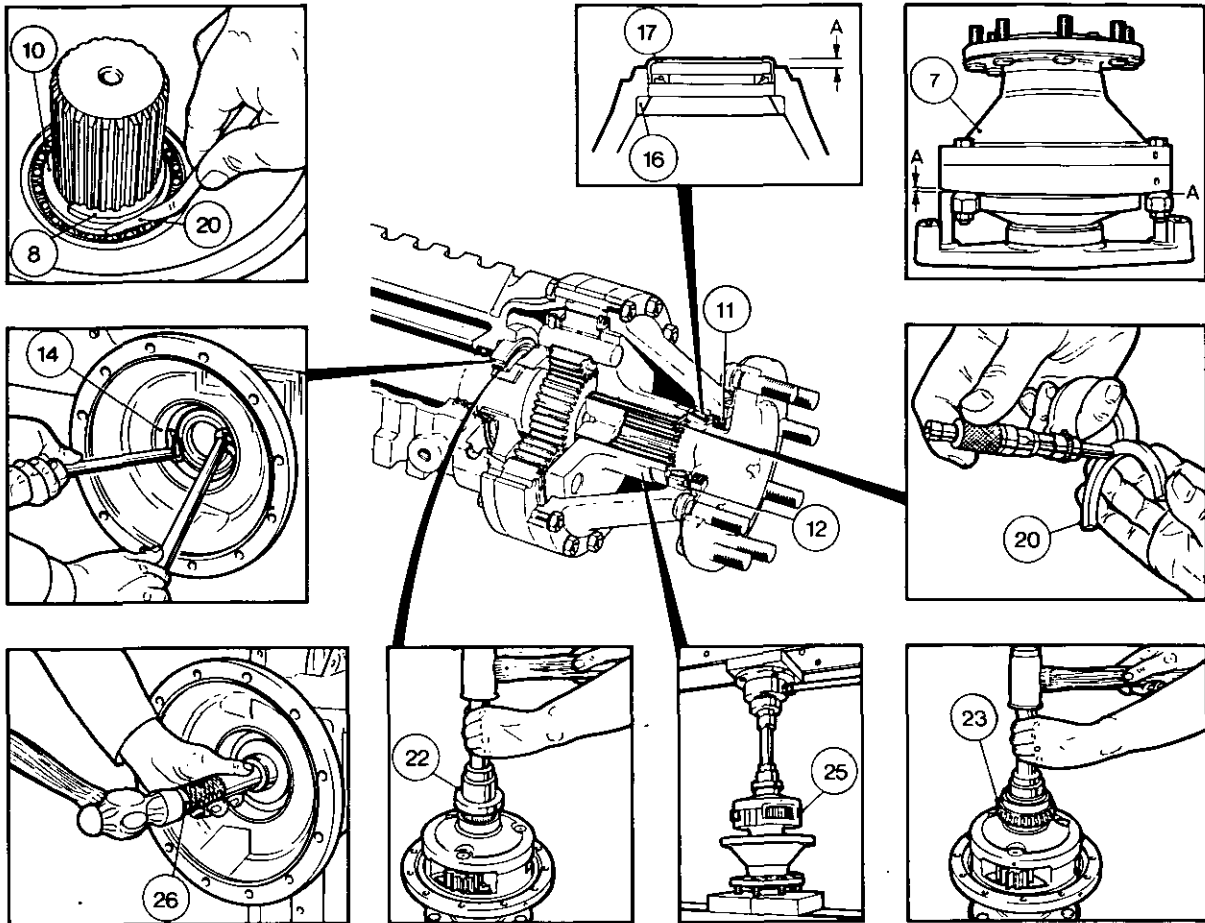
9. Remove and discard the two cork gaskets. Clean the recesses in which the ring gear spigots are located and check that there is no burr or deformity which could cause leakage.

Refitment

10. Reverse procedures 1 to 9 except:
 - (a) Fit new cork gaskets.
 - (b) Ensure that the scribe marks are correctly aligned ensuring that the teeth of the ring gear are in full engagement OTHERWISE SEVERE DAMAGE CAN OCCUR.
 - (c) Tighten the nuts and bolts to a torque of 75 Nm (55 lbf ft).
 - (d) Refill to the correct level with an approved oil.



REAR AXLE AND BRAKES



20. Except MF 590 Tractor.

Using the number 0 half ring and feeler gauges measure the gap between the bearing cone and the half ring. If there is no clearance, the No. 0 half ring can be used. If the clearance is measurable, select a pair of half rings to give a clearance of 0,00 to 0,025 mm (0,00 to 0,001 in) by using the following procedure and the table below.

Half Ring + Feeler Gap mm in	Half Ring Thickness mm in	Part No.	Identifi- cation No.
5,92 0-233 5,94 0-234	5,84 0-230 5,89 0-232	882 601 M1	0
5,95 0-2341 5,99 0-236	5,90 0-2321 5,94 0-234	882 602 M1	1
6,00 0-2361 6,04 0-238	5,95 0-2341 5,99 0-236	882 603 M1	2
6,05 0-2381 6,09 0-240	6,00 0-2361 6,04 0-238	882 604 M1	3

(a) Using a micrometer, measure the thickness of the No. 0 half ring.

(b) Add the No. 0 half ring thickness to the feeler gauge measurement to give the thickness of the half rings required.

21. Except MF 590 Tractor.

Fit the two half rings, ensuring that they seat fully in the groove.

MF 590 Tractor only.

Fit the snap ring, ensuring that it seats fully in the groove. Using a suitable puller, draw the outer housing assembly back tightly onto the snap ring.

22. Except MF 590 tractor.

Using the 550 handle and MF 266B, fit a new bearing bush in the epicyclic hub.

23. Using the 550 handle and MF 266B, drive the bearing cone onto the spigot on the epicyclic hub.

24. Reassemble the planet gears and the sun gear in the epicyclic hub, operation 6A-32-37.

25. Using the 550 handle, MF 266B and a hydraulic press, drive the epicyclic hub onto the wheel axle.

26. Apply a thin coating of recommended sealant 'A' to the bore of the trumpet housing, then fit a new oil seal using MF 1105-11 and the 550 handle. Smear the lips of the seal with petroleum jelly.

27. Check the epicyclic preload, operation 6A-34-40.

28. Refit the inner bearing cup in the trumpet housing.

29. Refit the ring gear and outer housing assembly, operation 6A-31-36.

REAR AXLE AND BRAKES**EPICYCLIC PRE-LOAD**

6A-34-40

Special Tools: MF 267A Preload Checking Tool
MF 1105 Puller
MF 1105-8 Adaptor

Procedure

1. Remove the outer housing and ring gear, operation 6A-31-36.
2. Remove the two cork gaskets and thoroughly clean the mating faces of the ring gear and outer housing.
3. Bolt the ring gear to the outer housing using four bolts from the epicyclic unit with four wheel nuts as spacers. These bolts should be equally spaced around the ring gear.

NOTE: Ensure that the ring gear is correctly fitted i.e., with the teeth in full engagement.

4. Ensure that the oil level is no higher than the FULL mark on the dipstick, fully apply the handbrake and remove the half-shaft.
5. Except MF 590 Tractor.
Using MF 1105 and 1105-8 remove the inner bearing cup from the trumpet housing.
MF 590 Tractor.
Lever the inner bearing cup out of the trumpet housing.
6. Remove the old shims.
7. Place the bearing cup on the spigot in the centre of MF 267A. Do not fit the shims.
8. Place the epicyclic unit on MF 267A and measure the gap at points 'A' using two feeler gauges.
9. Note the clearance, which must be equal at both sides, then select a shim or shims from the table below.

Gap Measured by Feeler Gauges (Both Sides)		Shim Thickness Required	
mm	in	mm	in
0,025 to 0,13	0-001 to 0-005	0,76	0-030
0,15 to 0,25	0-006 to 0-010	0,64	0-025
0,28 to 0,38	0-011 to 0-015	0,51	0-020
0,41 to 0,51	0-016 to 0-020	0,38	0-015
0,53 to 0,64	0-021 to 0-025	0,25	0-010
0,66 to 0,76	0-026 to 0-030	0,13	0-005
0,79 to 0,89	0-031 to 0-035	0	0

The shims are available as follows:

Shim Thickness		Part No.
mm	in	
0,13	0-005	894 757 M1
0,25	0-001	894 758 M1
0,38	0-015	894 759 M1

10. Fit the shims to the trumpet housing.
11. Refit the inner bearing cup, ensuring that it is fully seated.
12. Refit the axle shaft.
13. Remove the four bolts and spacers securing the ring gear to the outer housing.
14. Using new cork gaskets, refit the ring gear and outer housing, operation 6A-31-36.

EPICYCLIC PLANET AND SUN GEAR

Excluding MF 590 Tractor

Servicing

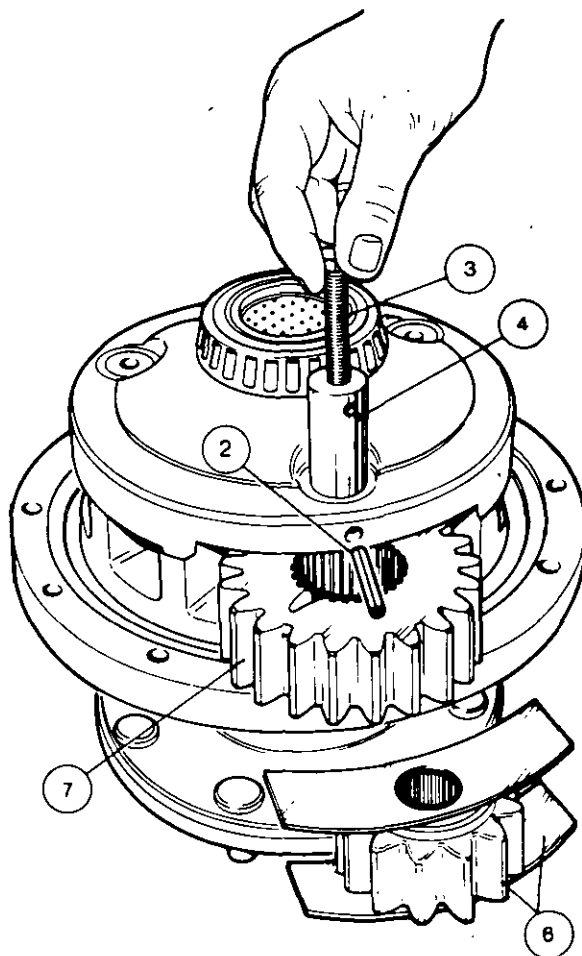
6A-32-37

Special Tools: $\frac{3}{8}$ in UNF Bolt**Disassembly**

1. Remove the outer housing assembly, operation 6A-31-36. To service the sun gear it is only necessary to remove one planet gear.
2. Drive out and discard the roll pin.
3. Fit the $\frac{3}{8}$ in bolt to the planet gear shaft.
4. Withdraw the shaft trying not to dislodge the needle rollers.
5. Remove the $\frac{3}{8}$ in bolt.
6. Remove the thrust washers and the planet gear. Repeat operations 2 to 6 only if the epicyclic hub is to be completely overhauled.
7. Withdraw the sun gear.
Inspect all parts and replace any which show signs of undue wear or damage.

Reassembly

8. Reverse procedures 1 to 7 except:
 - (a) If the needle rollers were dislodged, refit them using petroleum jelly, not grease. There are 58 needle rollers per planet gear (two rows of 29, plus a spacer washer).
 - (b) Ensure that the holes in the casting and shaft are aligned.
 - (c) Fit a new roll pin.

**EPICYCLIC PLANET AND SUN GEAR**

MF 590 Tractor

Servicing

6A-32-37

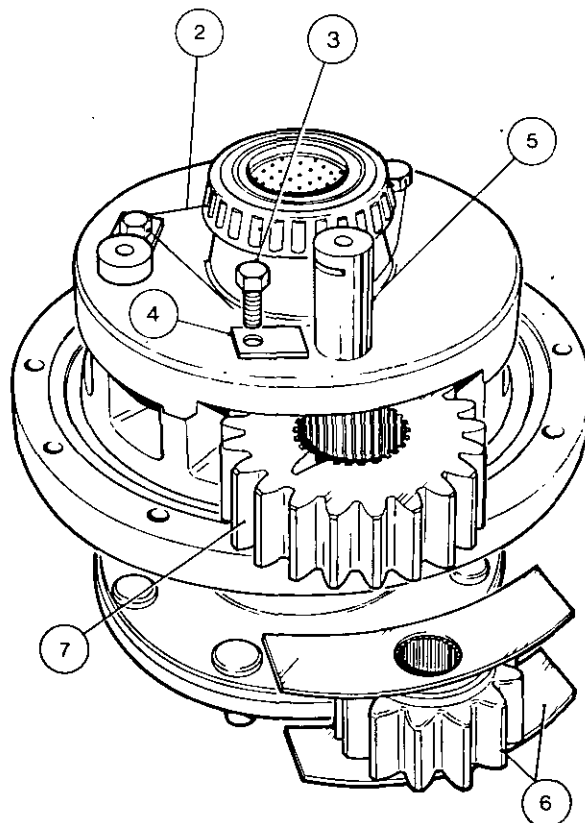
Disassembly

1. Remove the outer housing assembly, operation 6A-31-36. To service the sun gear it is only necessary to remove one planet gear.
2. Remove the locking wire.
3. Remove the setscrews.
4. Remove the retaining plates.
5. Withdraw the shaft, trying not to dislodge the needle rollers.
6. Remove the thrust washers and the planet gear. Repeat operations 3 to 6 only if the epicyclic hub is to be completely overhauled.
7. Withdraw the sun gear.

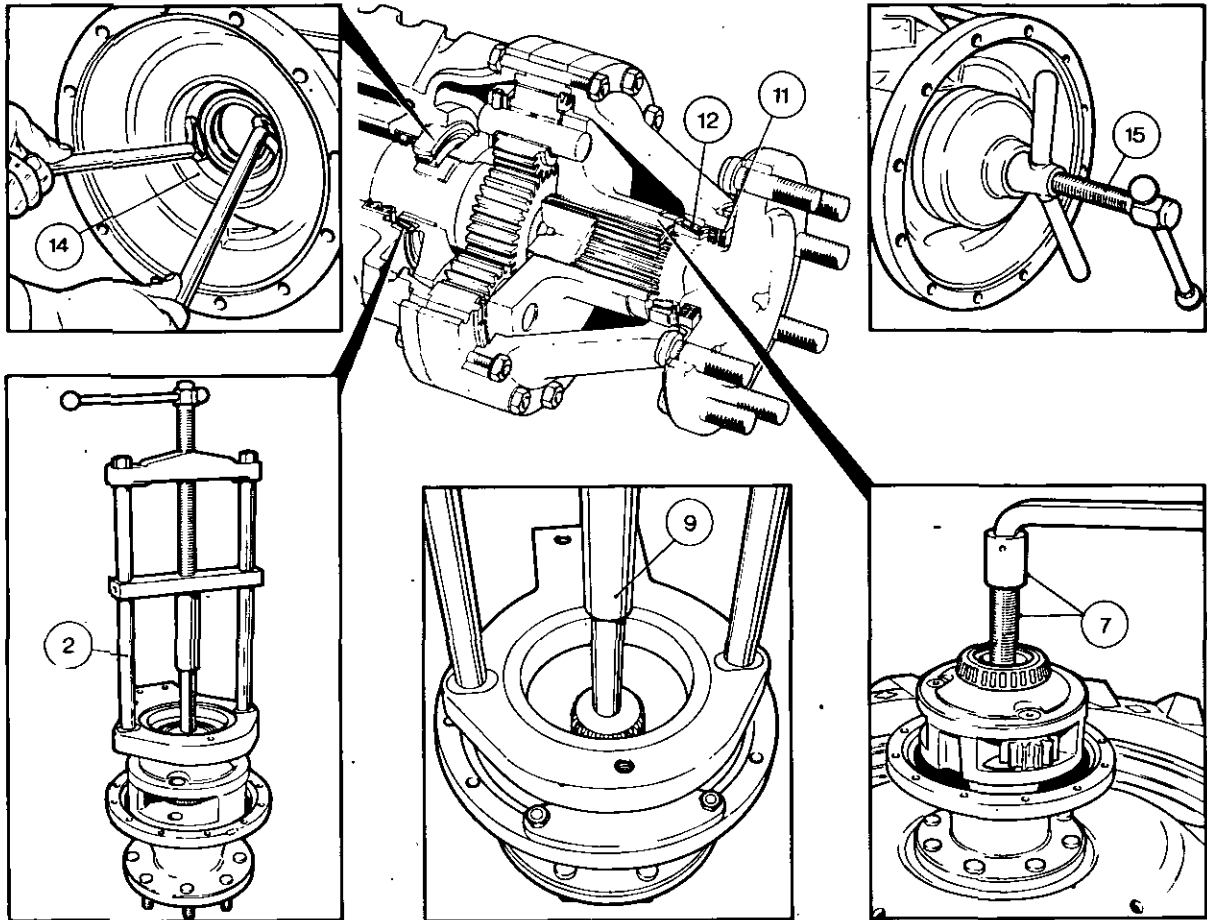
Inspect all parts, and replace any which show signs of undue wear or damage.

Reassembly

8. Reverse procedures 1 to 7 except:
 - (a) If the needle rollers were dislodged, refit them using petroleum jelly, not grease. There are 44 needle rollers per planet gear (two rows of 22, plus a spacer washer).
 - (b) Tighten the setscrews to a torque of 45 Nm (35 lbf ft).



REAR AXLE AND BRAKES



EPICYCLIC UNIT

Servicing

6A-33-38

Special Tools: MF 26A Wrench
 MF 200 Hand Press
 MF 200-2/1 Adaptor
 MF 200-3/3 Plug
 MF 200-24 Adaptor
 MF 265A Extractor
 MF 266B Wheel axle and Bearing Replacer
 MF 1105 Puller
 MF 1105-8 Adaptor
 MF 1105-11 Adaptor
 550 Universal Handle
 50 Ton Press

Disassembly

1. Remove the planet gear and sun gear, operation 6A-32-37.
2. Remove the bearing cone using MF 200 and MF 200-24.
3. Except MF 590 Tractor.
Tap the bearing bush into the hub using MF 200-3/3.
4. Except MF 590 tractor.
Remove the bush and MF 200-3/3 from the hub.
5. Place the dismantled wheel on the workshop floor.
6. Fit the outer housing and hub assembly and secure with two wheel nuts.
7. Fit MF 265A and MF 26A and remove the hub from the housing.
8. Remove the two half rings. (Snap ring on MF 590 Tractor).

9. Using MF 200 and MF 200-2/1 press out the wheel axle.
10. Lift out the bearing cone.
11. Tap out the outer seal.
12. Tap out the bearing cup.
13. Fully apply the parking brake and check that the transmission oil is no higher than the FULL mark on the dipstick. Remove the axle shaft.
14. Using MF 1105 and 1105-8, remove the inner bearing cup and shims.

NOTE: The illustration shows the method of removal using pry bars which must be adopted for the MF 590 tractor.

15. Using MF 1105 and MF 1105-11, pull the inner oil seal out of the trumpet housing. Inspect all parts and replace any which show signs of undue wear or damage. Replace all seals and gaskets.

Reassembly

16. Refit the bearing cup, making sure it is fully seated.
 17. Smear a new outer seal lightly with recommended sealant 'A', then drive it into the housing, metal face outwards, and 2 mm (0.080 in) proud of the housing (dimension A). Smear the lip, and fill the seal cavity with petroleum jelly.
- NOTE:** For the MF 590 tractor, the seal must be driven flush with the outer housing.
18. Carefully, insert the wheel axle through the outer seal.
 19. Drive the bearing cone fully onto the wheel axle, seating the rollers in the cup.

L.H. TRUMPET HOUSING**Removal and Refitment**

6A-35-41

Special Tools: 270 Rail Trolley

Removal

1. Drain the transmission oil.
2. Release the lift rod at the knuckle.
3. Release the check chain at the check chain anchor bracket.
4. Release the stabiliser bracket underneath the trumpet housing.
5. Release the forward end of the lower link from the trumpet housing bracket.
6. Remove the lift arm and lower link assembly complete.
7. Release the brake pull rods and the return spring.
8. Jack up the tractor under the trumpet housing being serviced.
9. Remove the L.H. rear wheel.
10. Place the 270 rail trolley under the centre housing and lower the tractor until the trolley jack is just taking the trumpet housing weight.
11. Remove all of the nuts and bolts securing the trumpet housing to the centre housing.
12. Lower the trumpet housing slightly and withdraw it far enough to clear the half shaft from the differential splines.
13. Lower the trumpet housing further to clear the cab riser.

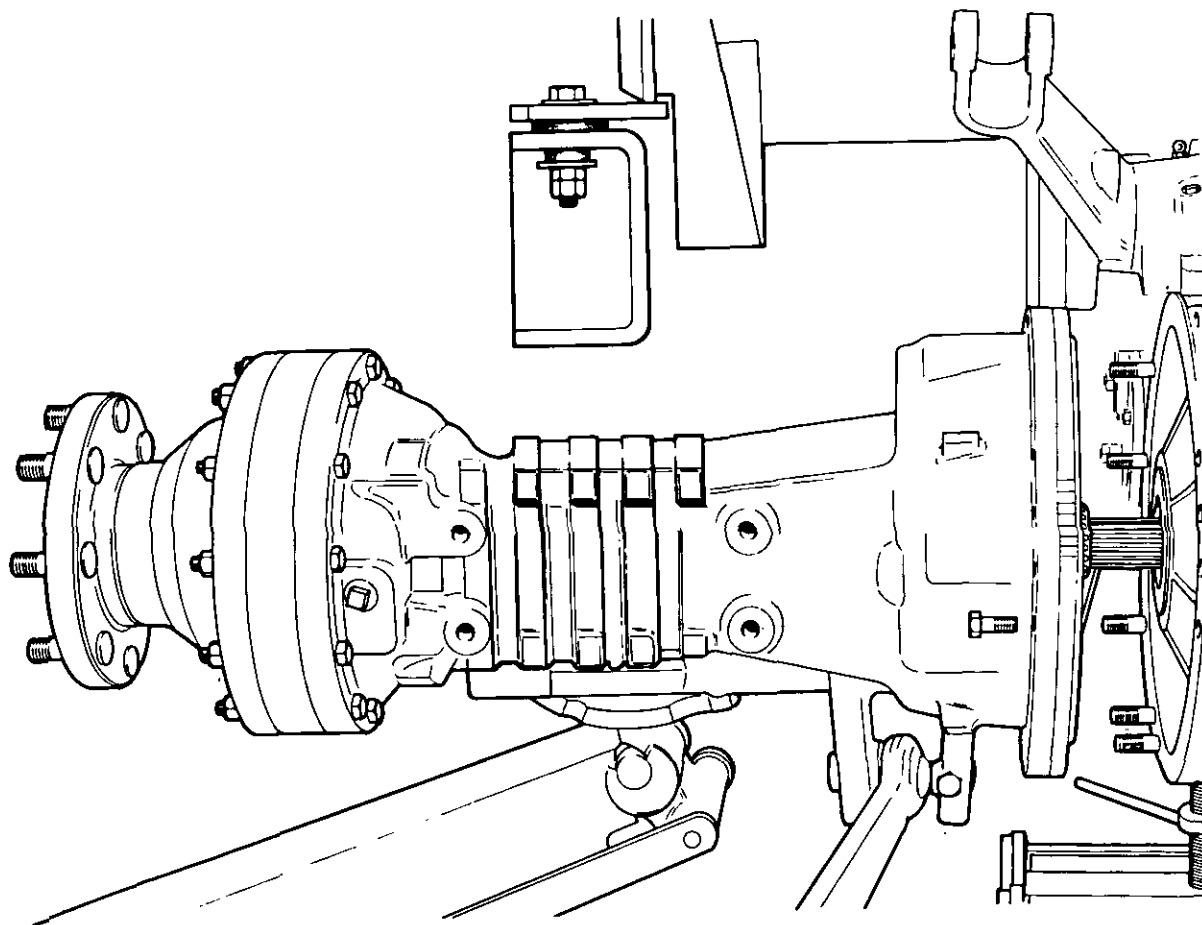
14. Withdraw the trumpet housing completely.
15. Remove the 'O' ring from the flange on the carrier plate.

Refitment

16. Reverse procedures 1 to 15 except:
 - (a) Fit a new 'O' ring, using petroleum jelly.
 - (b) When manoeuvring the trumpet housing assembly back into position, take care to align the axle shaft splines in the differential unit and the studs through their holes in the centre housing.
 - (c) Apply a few drops of recommended sealant 'C', then fit and tighten the cab riser/stabiliser mounting bolts to a torque of 230 Nm (170 lbf ft).

NOTE: The full quantity of oil, as stated in the specification will not be required as approximately 2,5 litre (4 Imp. pt) will be trapped by the carrier plates in the trumpet housing.

17. Adjust and balance the brakes, operation 6A-41-45.



REAR AXLE AND BRAKES**R.H. TRUMPET HOUSING****Removal and Refitment**

6A-36-42

Special Tools: 270 Rail Trolley

Removal

1. Drain the transmission oil.
2. Release the levelling box at the knuckle.
3. Release the check chain at the check chain anchor bracket.
4. Remove the stabiliser mounting bracket from underneath the trumpet housing.
5. Release the forward end of the lower link from the trumpet housing bracket.
6. Remove the lift arm and lower link assembly complete.
7. Release the brake pull rods and the return spring.
8. Release the differential lock pull rod.
9. Jack up the tractor under the trumpet housing being serviced.
10. Remove the R.H. rear wheel.
11. Place the 270 rail trolley under the centre housing and lower the tractor until the trolley jack is just taking the trumpet housing weight.
12. Remove all of the nuts and bolts securing the trumpet housing to the centre housing.
13. Lower the trumpet housing slightly and withdraw it far enough to clear the half shaft from the differential splines.

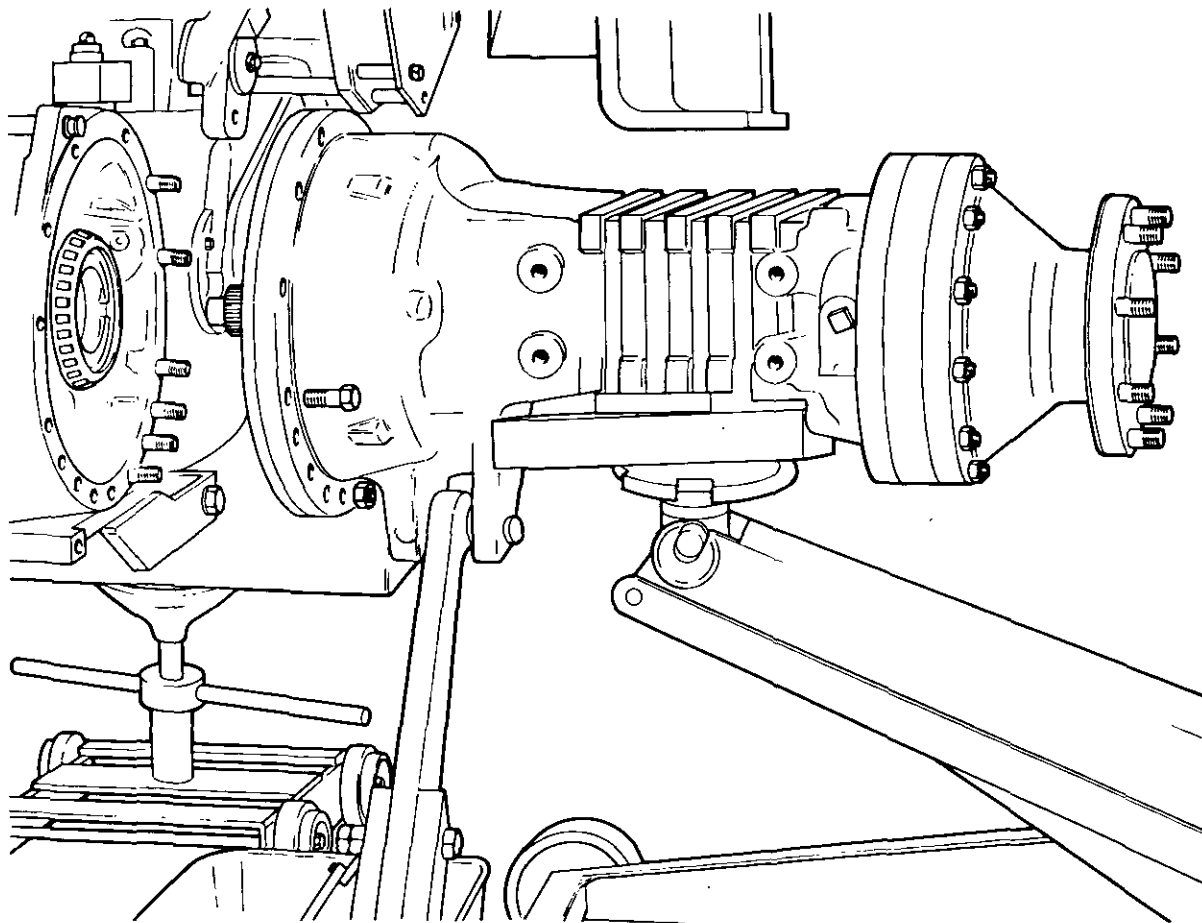
14. Lower the trumpet housing further to clear the cab riser.
15. Withdraw the trumpet housing completely.
16. Remove the 'O' ring from the flange on the carrier plate.

Refitment

17. Reverse procedures 1 to 16, except:
 - (a) Fit a new 'O' ring using petroleum jelly.
 - (b) Carefully manoeuvre the trumpet housing into position, taking care to align the axle shaft splines in the differential unit and the studs through their holes in the centre housing.
 - (c) Apply a few drops of recommended sealant 'C', then fit and tighten the cab riser/stabiliser mounting bolts to a torque of 230 Nm (170 lbf ft).

NOTE: The full quantity of oil, as stated in the Specification will not be required, as approximately 2,5 litre (4 Imp. pt) will be trapped by the carrier plates in the trumpet housing.

18. Adjust and balance the brakes, operation 6A-41-45.



L.H. CARRIER PLATE**Removal and Refitment**

6A-37-43

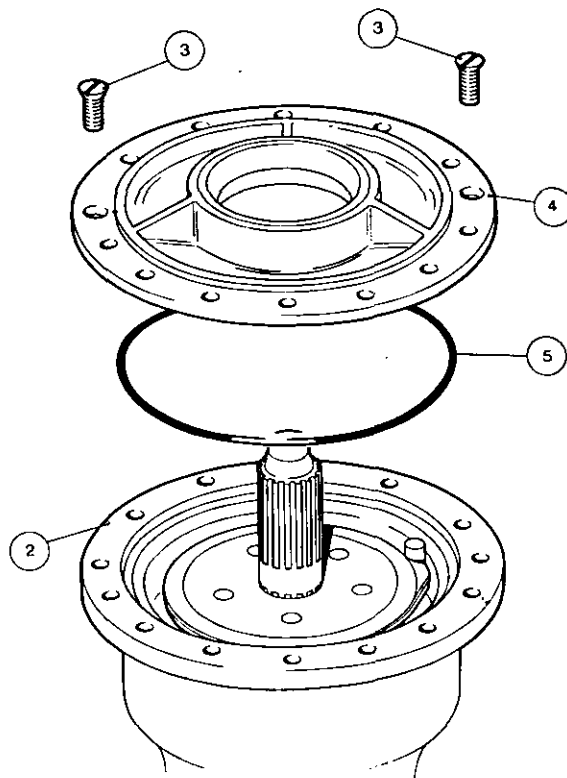
Special Tools: 270 Rail Trolley

Removal

1. Remove the trumpet housing, operation 6A-35-41.
2. Manoeuvre the trumpet housing, off the trolley jack and stand it on end.
3. Remove the two countersunk screws.
4. Withdraw the carrier plate from the trumpet housing.
5. Remove and discard the inner 'O' ring.

Refitment

6. Reverse procedures 1 to 5, except:
 - (a) Place a new 'O' ring in the recess in the trumpet housing using a smear of petroleum jelly for location. DO NOT attempt to fit the 'O' ring to the carrier plate.
 - (b) Secure each countersunk screw with a centre punch mark.

**R.H. CARRIER PLATE****Removal and Refitment**

6A-38-43

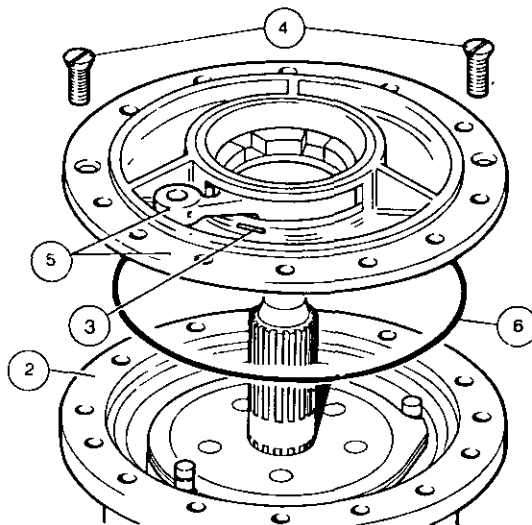
Special Tools: 270 Rail Trolley

Removal

1. Remove the trumpet housing, operation 6A-36-42.
2. Manoeuvre the trumpet housing assembly off the trolley jack and stand it on end.
3. Remove, and discard the roll pin.
4. Remove the two countersunk screws.
5. Remove the carrier plate complete with the differential lock coupler fork and coupler.
6. Remove and discard the inner 'O' ring.
7. Remove the differential lock coupler fork and coupler.

Refitment

8. Reverse procedures 1 to 7, except:
 - (a) Fit a new 'O' ring to the recess in the trumpet housing using petroleum jelly. Do not attempt to fit the 'O' ring to the carrier plate.
 - (b) Assemble the differential lock coupler fork and coupler to the carrier plate, then refit the assembly, aligning the coupler splines on the axle shaft and the coupler fork on its shaft.
 - (c) Secure each countersunk screw with a centre punch mark.
 - (d) Fit a new roll pin.



REAR AXLE AND BRAKES**L.H. BRAKE ACTUATOR HOUSING****Servicing**

6A-39-44

Disassembly

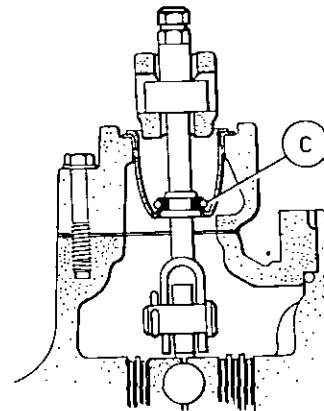
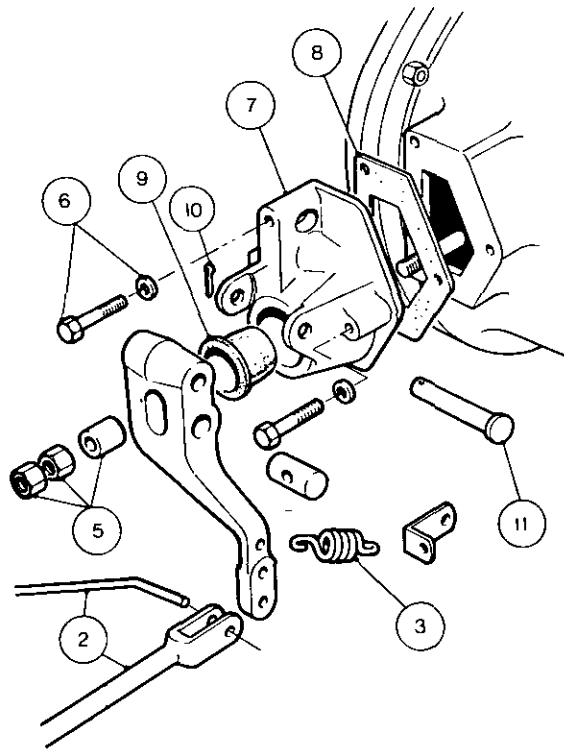
1. Drain the transmission oil to the MIN mark on the dipstick
2. Disconnect the brake pull rods.
3. Remove the brake return spring.
4. Remove the fuel tank, operation 4C-00.
5. Remove the locknut, nut and spacer.
6. Remove the three bolts and spring washers.
7. Remove the housing.
8. Remove and discard the gasket.
9. Tap out and, if damaged, discard the rubber boot.
10. If necessary, remove the brake pull lever by removing the split pin and pushing out the pivot shaft (11).

Examination

Examine the mating faces of the actuator housing and the trumpet housing for damage. Clean both surfaces before reassembly.

Reassembly

11. Reverse procedures 1 to 9, except:
 - (a) If necessary fit a new rubber boot, preferably using a hydraulic press.
 - (b) Fit a new gasket.
 - (c) Before refitting the housing, smear the brake actuator rod with petroleum jelly. When refitting the housing take care to seat the lips of the rubber boot in the step on the actuator rod, without disturbing the garter spring.
 - (d) The three bolts are of varying lengths according to their position in the actuator housing.
12. Adjust and balance the brakes, operation 6A-41-45.

**R.H. BRAKE ACTUATOR HOUSING AND DIFFERENTIAL LOCK MECHANISM****Servicing**

6A-40-44

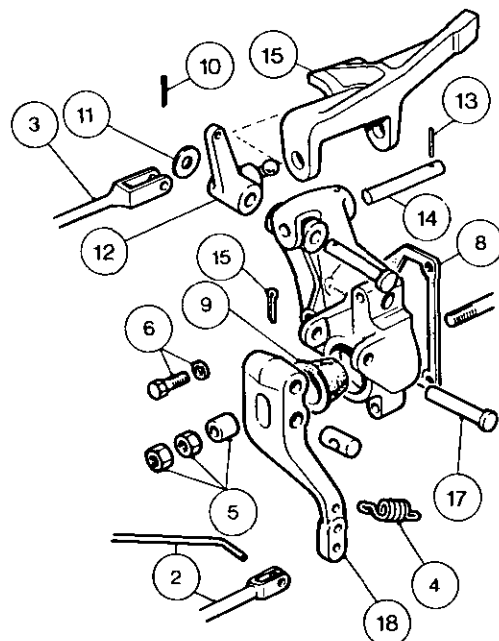
Disassembly

1. Drain the transmission oil to the MIN mark on the dipstick.
2. Disconnect the brake pull rods.
3. Disconnect the differential lock pull rod.
4. Remove the brake return spring.
5. Remove the locknut, nut and spacer.
6. Remove the three bolts and spring washers.
7. Remove the actuator housing complete with the differential lock lever mechanism.
8. Remove and discard the gasket.
9. Tap out and, if damaged, discard the rubber boot.

NOTE: Do not remove the differential lock lever mechanism or the brake pull lever unless they are to be serviced.

Only if necessary continue as follows:

10. Tap out and discard the cotter pin.
11. Remove the washer.
12. Remove the lever assembly.
13. Tap out and discard the grooved pin.



[Continued]

14. Remove the pivot shaft.
15. Remove the lever.
16. Remove and discard the split pin.
17. Push out the pivot shaft.
18. Remove the brake pull lever.
Examine the joint faces of the actuator housing and the trumpet housing for damage, clean both surfaces thoroughly before reassembly.

Reassembly

19. Reverse procedures 1 to 9 or 1 to 18 depending on the extent of disassembly, except:
 - (a) If necessary, fit a new rubber boot, preferably using a hydraulic press.
 - (b) Fit a new gasket.
 - (c) Before refitting the actuator housing, smear the brake actuator rod with petroleum jelly. When refitting the housing take care to seat the lips of the rubber boot in the step on the actuator rod, without disturbing the garter spring.
 - (d) The three bolts are of varying lengths according to their position in the actuator housing.
20. Adjust and balance the brakes, operation 6A-41-45.

BRAKE ADJUSTMENT AND BALANCING

6A-41-45

Procedure is as follows:—

1. Jack up the tractor until both rear wheels are clear of the ground.
2. Disengage the brake return springs and release the parking brake.
3. Unlatch the brake pedals.
4. Measure the height of the right hand pedal from the cab floor.
5. Apply a light load to the brake pedal and re-measure the pedal height. The pedal free travel should be 25 mm (1 in).
6. If adjustment is required, slacken the locknut, turn the adjustment nut clockwise to reduce free travel and anti-clockwise to increase free travel; tighten the locknut.
7. Having adjusted the right hand pedal, adjust the L.H. pedal to match for height so that the latch freely engages.
8. Re-connect the brake return springs.
9. Road test the tractor, checking for binding or pulling to one side. Any tendency to pull to one side should be counteracted by slackening the adjuster on the side to which pulling takes place.

REAR AXLE AND BRAKES

LH BRAKE

Servicing

6A-42-46

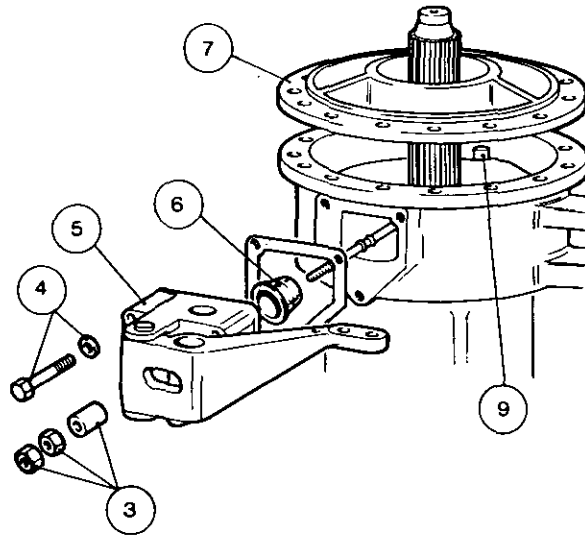
Special Tools: 270 Rail Trolley

Disassembly

1. Remove the LH trumpet housing, operation 6A-35-41.
2. Manoeuvre the trumpet housing assembly off the trolley jack and stand it on end.
3. Remove the locknut, nut and spacer.
4. Remove the three bolts and spring washers.
5. Withdraw the actuator housing.
6. Tap out and discard the rubber boot.
7. Remove the carrier plate, operation 6A-37-43.
8. Remove the brake components, turning each plate over and stacking in reverse order to ensure correct refitment.
9. If necessary, remove the brake stop rod from the housing.

Only if necessary dismantle the actuator unit as follows.

10. Release the four springs.
11. Remove the actuator rod and links and the ball bearings.



Examination

Friction plates: These have a minimum groove depth of 0,3 mm (0.12 in) when new. When worn to the extent that the grooves begin to disappear, the plates must be replaced.

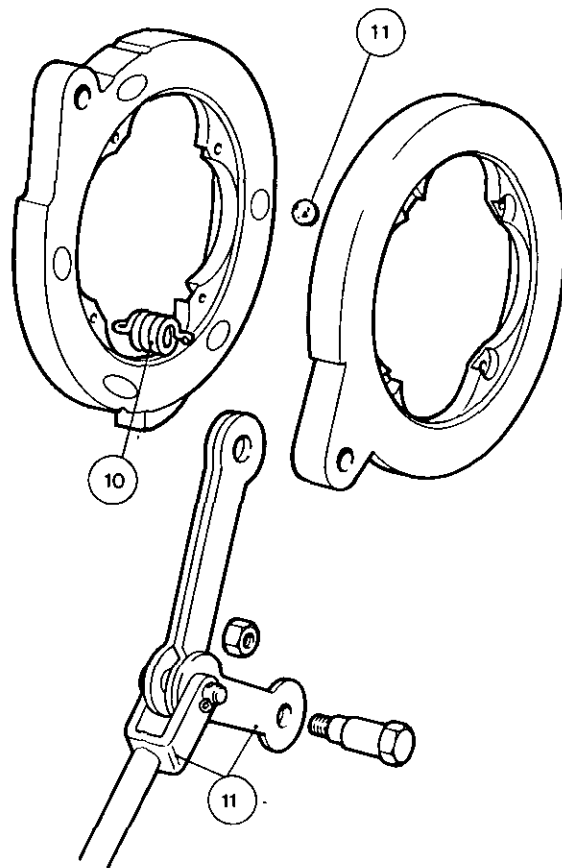
Interplates: The interplates can generally be refitted, but should be replaced either when badly scored or worn more than 0,13 mm (0.005 in) per face. The interplates should also be replaced when the friction plates are renewed.

Check all plates for signs of severe overheating or distortion.

NOTE: Never attempt to reclaim friction plates or interplates by lapping or grinding.

Actuator Plates: The actuator plates do not normally need replacing, but should be checked for severe scoring.

Thoroughly clean out the brake housing and remove any burrs or pieces of old gasket from the actuator and trumpet housings.



Reassembly

12. Reverse procedures 1 to 8 or 1 to 11 depending on the extent of disassembly, except:
 - (a) Dip each friction plate, interplate and the actuator unit in clean transmission oil before refitting them into the housing **THIS IS MOST IMPORTANT.** Refit all plates in the order in which they were originally assembled.
 - (b) Refit the carrier plate, operation 6A-37-43.
 - (c) Fit a new rubber boot, preferably using a hydraulic press.
 - (d) Smear the actuator rod with petroleum jelly, then refit the actuator housing ensuring that the lip of the rubber boot seats correctly in the ridge on the actuator rod. **DO NOT DISPLACE THE GARTER SPRING.**
 - (e) The three bolts are of varying lengths according to their location in the actuator housing.
- 13 Adjust and balance the brakes, operation 6A-41-45.

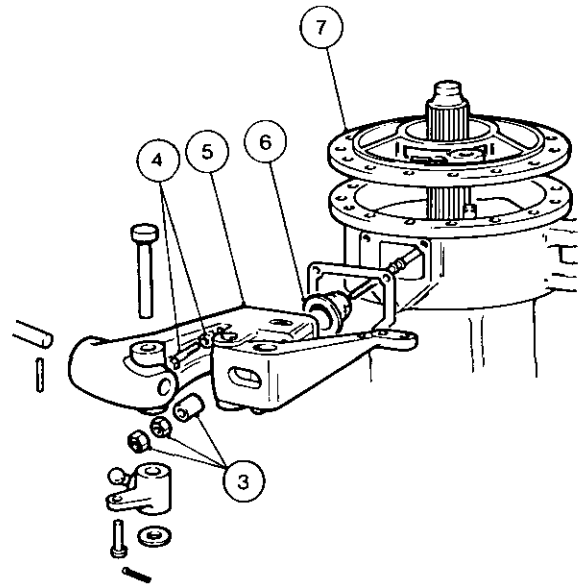
RH BRAKE**Servicing**

6A-43-47

Special Tools: 270 Rail Trolley

Disassembly

1. Remove the RH trumpet housing, operation 6A-36-42.
2. Manoeuvre the trumpet housing assembly off the trolley jack and stand it on end.
3. Remove the brake adjusting locknut, nut and spacer.
4. Remove the three bolts and spring washers.
5. Remove the actuator housing complete with the differential lock lever mechanism.
6. Tap out and discard the rubber boot.
7. Remove the carrier plate, operation 6A-38-43.
8. Remove the brake components, turning each plate over and stacking in reverse order to ensure correct refitment.
9. If necessary, remove the brake stop rod from the housing.



Only if necessary dismantle the actuator unit as follows.

10. Release the four springs.
11. Remove the actuator rod and links and the ball bearings.

Examination

Friction Plates: These have a minimum groove depth of 0,3 mm (0.12 in) when new. When worn to the extent that the grooves begin to disappear, the plates must be replaced.

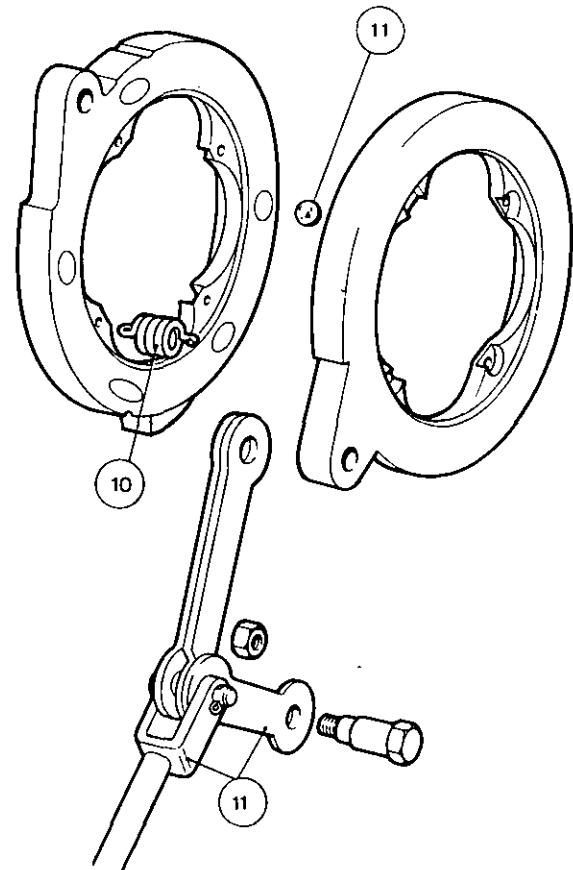
Interplates: These plates can generally be refitted, but should be replaced if worn more than 0,13 mm (0.005 in) per face. The interplates should also be replaced when the friction plates are renewed.

Check all plates for signs of severe overheating or distortion.

NOTE: Never attempt to reclaim friction plates or interplates by lapping or grinding.

Actuator Plates: The actuator plates do not normally need replacement, but should be checked for severe scoring.

Thoroughly clean out the brake housing and remove any burrs or pieces of old gasket from the actuator and trumpet housings.

**Reassembly**

12. Reverse procedures 1 to 8 or 1 to 11 depending on the extent of disassembly, except:
 - (a) Dip each friction plate, interplate and the actuator unit in clean transmission oil before reassembly. **THIS IS MOST IMPORTANT.** Refit all plates in the order in which they were originally assembled.
 - (b) Refit the carrier plate, operation 6A-38-43.
 - (c) Fit a new rubber boot, preferably using a hydraulic press.
 - (d) Smear the actuator rod with petroleum jelly, then refit the actuator housing, ensuring that the lip of the rubber boot seats correctly in the ridge on the actuator rod. **DO NOT DISPLACE THE GARTER SPRING.**
 - (e) The three bolts are of varying lengths according to their location in the actuator housing.
13. Adjust and balance the brakes, operation 6A-41-45.

REAR AXLE AND BRAKES**DIFFERENTIAL LOCK ACTUATOR MECHANISM****Removal and Refitment**

6A-44-48

Removal

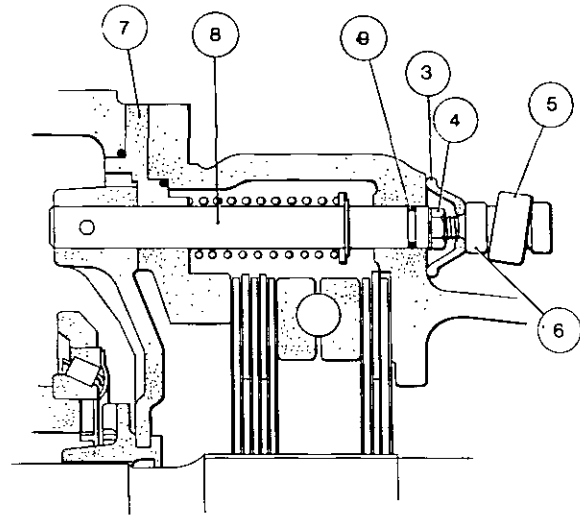
1. Remove the RH trumpet housing, operation 6A-36-42.
2. Manoeuvre the trumpet housing assembly off the trolley jack and stand it on end.
3. Lift up the rubber seal.
4. Release the locknut.
5. Rotate the differential lock operating lever out of engagement with the actuator fork.
6. Unscrew the fork from the shaft complete with its locknut and rubber seal.
7. Remove the carrier plate, operation 6A-38-43.
8. Remove the shaft, complete with the spring, washer, circlip and 'O' ring.

Examination

Examine the shaft for signs of wear or scoring. Clean and degrease the threads in the end of the shaft, and on the actuator fork.

Refitment

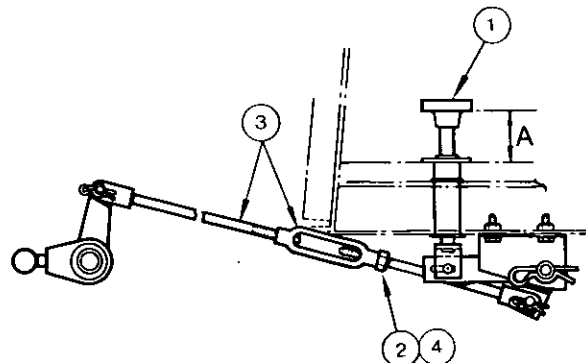
9. Fit a new 'O' ring to the shaft. If renewing the shaft, a new washer and circlip should be fitted.
10. Refit the shaft taking care not to damage the 'O' ring.
11. Refit the spring.
12. Refit the carrier plate, operation 6A-38-43.
13. Smear the threads of the actuator fork with recommended sealant 'B', then screw the fork fully into the shaft.
14. Unscrew the actuator fork until it will engage the differential lock operating lever in the horizontal position.
15. Tighten the locknut.
16. Push the rubber seal into position.

**DIFFERENTIAL LOCK ADJUSTMENT**

6A-45-48

Procedure is as follows:

1. Ensure that the pedal operates freely throughout its complete travel.
2. Slacken the turnbuckle locking nut.
3. Adjust the rod length until the pedal height (Dimension A) is 95 mm (3.75 in).
4. Tighten the turnbuckle locking nut.
5. Re-check the pedal height.



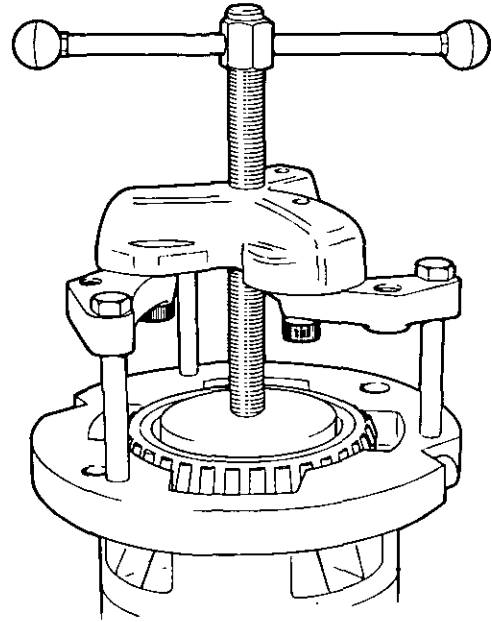
DIFFERENTIAL LOCK COUPLER CAP**Removal and Replacement** 6A-46-49

Special Tools: 555 Universal Pulley
MF 555-2A/1 Puller Adaptor
MF 257 Bearing Driver

Removal

1. Remove the RH trumpet housing, operation 6A-36-42.
2. Remove the bearing cone using puller 555 and MF 555-2A/1.

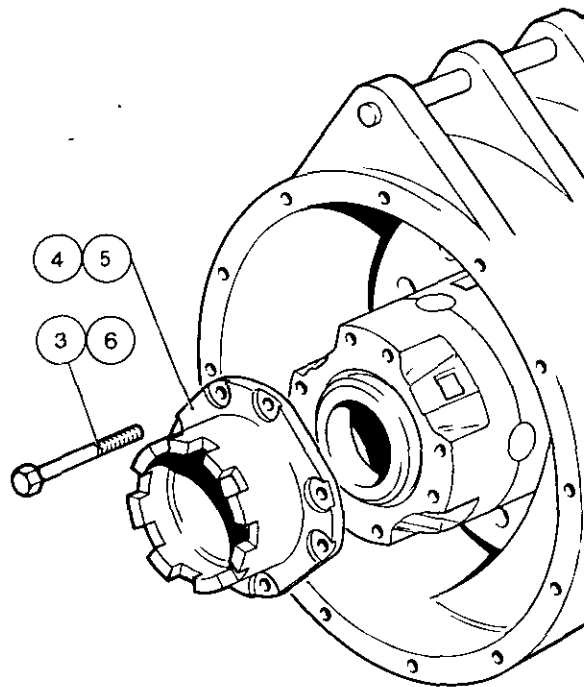
NOTE: For clarity, the illustration shows the differential removed. However for the actual operation this is not necessary.



3. Remove the eight bolts.
4. Prise off the cap taking care not to dislodge the case which would allow the differential gears to fall out.

Replacement

5. Fit the new coupler cap.
6. Insert and hand tighten the eight bolts.
7. Tighten the bolts progressively, and evenly to a torque of 108 Nm (80 lbf ft).
8. Refit the bearing cone using MF 257.
9. Refit the trumpet housing, operation 6A-36-42.



REAR AXLE AND BRAKES

DIFFERENTIAL

Pre-load Checking and Adjustment 6A-47-50

Special Tools: MF 245D Pre-load Gauge

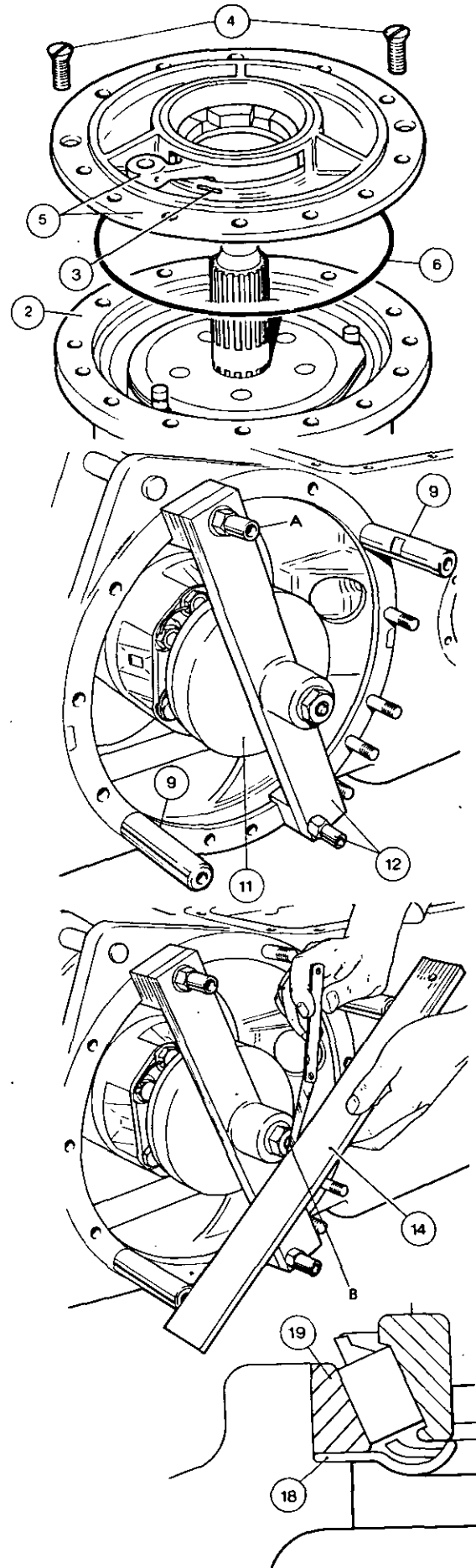
NOTE: This check must be carried out whenever the differential unit is disassembled, or if the bearings have been replaced.

Procedure is as follows:

1. Remove the RH trumpet housing, operation 6A-36-42.
2. Manoeuvre the trumpet housing assembly off the trolley jack and stand it on end.
3. Drive out the roll pin securing the coupler fork to the shaft.
4. Remove the two countersunk screws.
5. Withdraw the carrier plate complete with the differential lock coupler fork and coupler.
6. Remove the inner 'O' Ring.
7. Drive the bearing cup out of the carrier plate.
8. Remove the chip shield.
9. Screw a setting block onto each of two diametrically opposed studs. Remove one stud from an adjacent location to fit the upper block.
10. Remove another stud from the centre housing and fit it in the tapped hole at position 'A'.
11. Place the bearing cup on the bearing cone and fit the centraliser.
12. Position the clamp bar and secure it with the two tube nuts.
13. Torque the clamp bar nut to 27 Nm (20 lbf ft) whilst using a lever to turn the differential unit. This will ensure correct seating and location of the bearings.
14. Place the straight edge in position, and measure the gap (B) using feeler gauges.
15. Use the table below to determine the correct chip shield.

Feeler Gap (Equals Shield Thickness)		Means of Identifi- cation	Part No.
mm	in		
0,74 to 0,79	0-029 to 0-031	NO DOTS	187 689 M1
0,86 to 0,91	0-034 to 0-036	ONE DOT	892 173 M1
0,99 to 1,04	0-039 to 0-041	TWO DOTS	892 172 M1
1,12 to 1,17	0-044 to 0-046	THREE DOTS	892 171 M1
1,25 to 1,30	0-049 to 0-051	FOUR DOTS	892 170 M1
1,37 to 1,42	0-054 to 0-056	FIVE DOTS	191 124 M1

16. Remove the tube nuts, clamp bar, centraliser and setting blocks.
17. Refit the two studs in their correct holes.
18. Place the new chip shield in the carrier plate, with the dished face towards the differential.
19. Refit the bearing cup, ensuring that it is fully seated.
20. Refit the carrier plate, operation 6A-38-43.

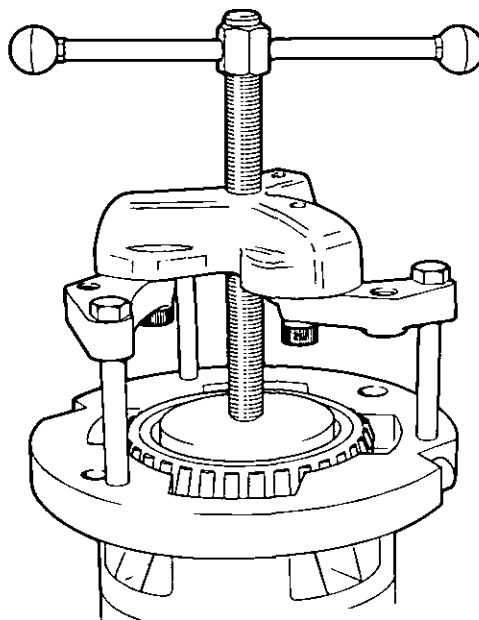


RH DIFFERENTIAL BEARING**Removal and Replacement** 6A-48-51

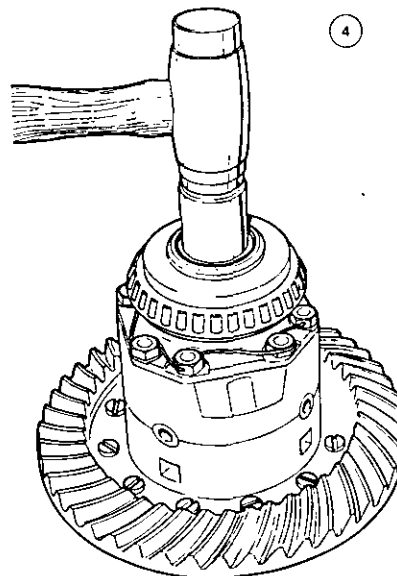
Special Tools Required: 555 Universal Puller
MF 555-2A/1 Puller Adaptor
MF 257 Bearing Driver

Removal

1. Remove the RH trumpet housing, operation 6A-36-42.
2. Pull off the bearing cone using puller No. 555 and MF 555-2A/1.
3. Remove the carrier plate and drive out the bearing cup as stated in items 3 to 8 of Operation 6A-47-50.

**Replacement**

4. Drive the new bearing cone on to the differential lock coupler cap using MF 257.
5. Check the bearing pre-load, operation 6A-47-50, but using a new bearing cup.

**DIFFERENTIAL UNIT****Removal and Refitment** 6A-49-51**Removal**

1. Remove the LH trumpet housing, operation 6A-35-41.
2. Manoeuvre the differential assembly out of the centre housing.

WARNING: The differential unit is heavy and awkward to handle. Take care when both removing and refitting it.

Refitment

3. Manoeuvre the differential unit into the centre housing, engaging the splines in those of the RH axle shaft.

NOTE: If any of the differential components have been replaced, the pre-load should be checked, operation 6A-47-50.

4. Refit the LH trumpet housing, operation 6A-35-41

REAR AXLE AND BRAKES**DIFFERENTIAL LH BEARING****Removal and Replacement**

6A-50-52

Special Tools: MF 300 Hand Press
 MF 200-3 Adaptor
 MF 197 Bearing Driver
 MF 197-2 Adaptor
 MF 1105 Universal Puller
 MF 1105-2A/1 Adaptor
 MF 1105-2A/4 Adaptor

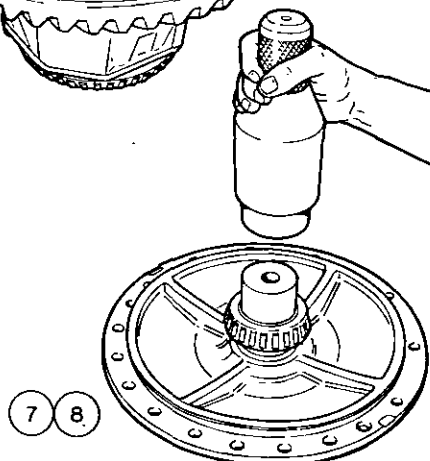
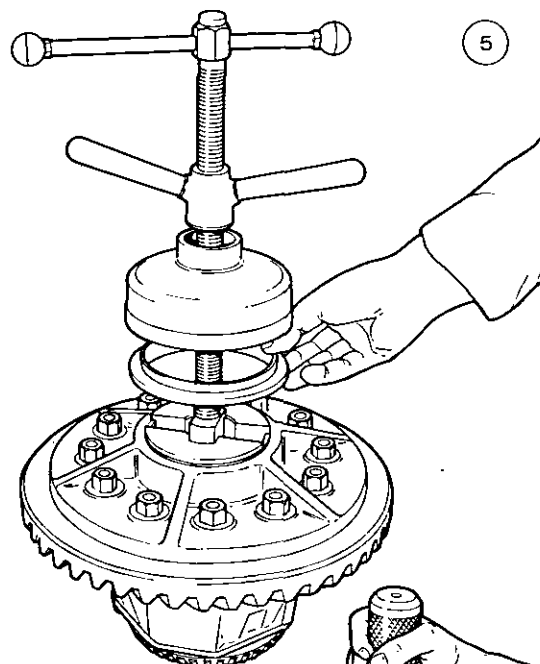
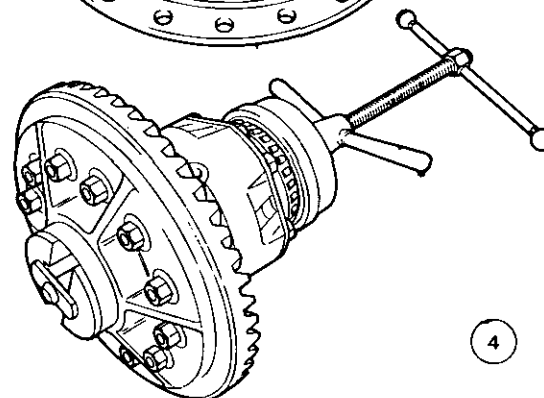
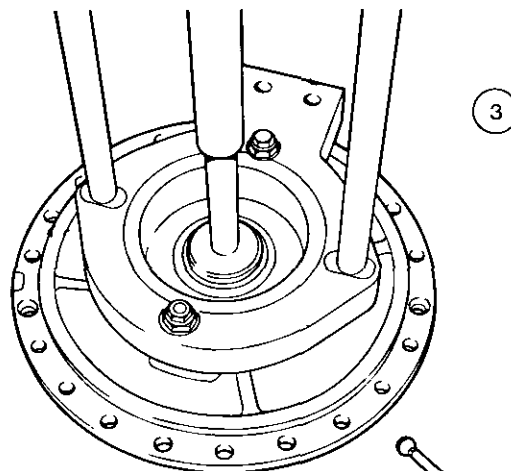
Removal

1. Remove the differential, operation 6A-49-51.
2. Remove the LH carrier plate, operation 6A-37-43.
3. Assemble MF 200 with MF 200-3, then pull off the bearing cone.
4. Assemble MF 1105 with MF1105-2A/1 and MF 1105-2A/4, and pull out the bearing cup.

Replacement

5. Assemble MF 1105, MF 1105-2A/1 and MF 1105-2A/4 with a new bearing cup.
6. Pull the new cup into the differential unit.

7. Fit the MF 197-2 to the bore of the carrier plate.
8. Slide the new bearing cone on to MF 197-2, then drive it fully on to the carrier plate using a hammer and MF 197.
9. Refit the differential unit, operation 6A-49-51.
10. Check the differential pre-load, operation 6A-47-50.



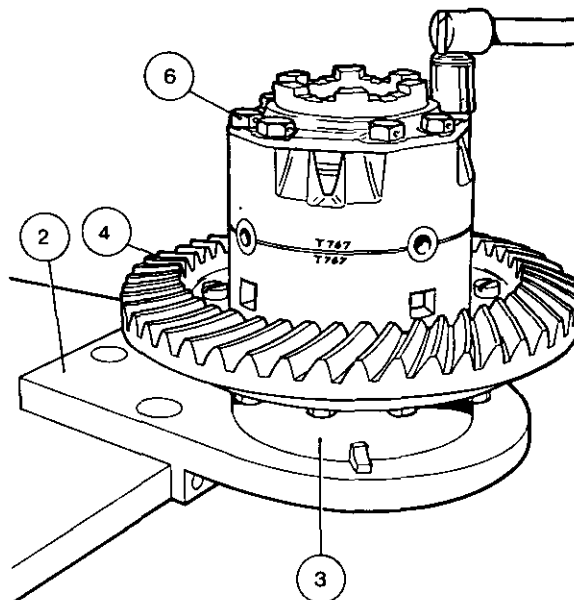
DIFFERENTIAL UNIT**Servicing**

6A-51-53

Special Tools: MF 9A Holder
 MF 10 Bench Adaptor
 MF 258 Holder
 555 Universal Puller
 MF 555-2A/1 Adaptor

Disassembly

1. Remove the differential unit, operation 6A-49-51.
2. Fit MF 10 to the bench.
3. Fit MF 9A to MF 10.
4. Place the differential on MF 10.
5. Remove the bearing cone using puller 555 and MF 555 2A/1 (See operation 6A-48-51).



6. Remove the eight bolts.
7. Remove the coupler cap and RH case.
8. Remove the cross joint and pinions assembly with the thrust washers.
9. Remove the differential gears and their thrust washers.

Examination

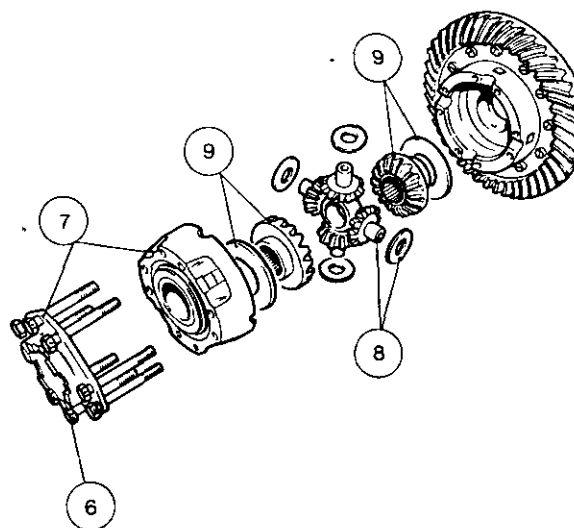
Examine all of the differential components and replace any that are worn or damaged.

NOTE: If any of the spider gears are worn, a full set of four new gears should be fitted. In such circumstances, differential gears may also need to be replaced.

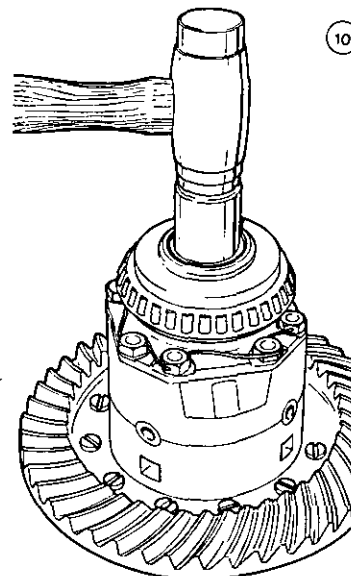
Reassembly

Reverse procedures 2 to 9 except:

- (a) Refit the RH differential case with the markings aligned.
- (b) Tighten the eight bolts to a torque of 108 Nm (80 lbf ft).



- (c) Refit the bearing cone using MF 257.
10. Refit the differential unit, operation 6A-49-51.



REAR AXLE AND BRAKES

CROWNWHEEL

Removal and Replacement

6A-52-54

Special Tools: MF 9A Holder
 MF 10 Adaptor
 MF 258 Holder
 Epoxy Resin Bonding Kit
 No. 1852 913 M91

Removal

1. Remove the differential gears, operation 6A-51-53.
2. Place the differential unit on a bench with the teeth facing downwards.
3. Centre punch each of the rivet heads centrally.
4. Using a 13 mm ($\frac{1}{2}$ in) drill, drill out each of the rivet heads until they become detached from their shanks.
5. Drive out the rivets.
6. Drive off the crownwheel.

NOTE: When fitting a new crownwheel, the pinion must also be replaced.

Replacement

7. Ensure that the mating faces of the differential case and the new crownwheel are perfectly flat.
8. Fit MF 9A and MF 10 to the bench.
9. Fit the LH differential case, with the mating face upwards.
10. Degrease the crownwheel, LH differential case, differential bolts and nuts with trichlorethylene.
11. Collect together all items necessary for speedy assembly.

These items are:

A torque wrench, the correct size socket and recommended sealant 'C'.

12. Open the epoxy resin kit 1852 913 M91. Its contents are:
 One jar containing 10 ml of resin. (This jar is also used as a mixing vessel).
 One jar containing 5 ml of hardener.
 One glass stirring rod.
 One brush.
13. Pour the hardener into the resin jar and mix thoroughly using the glass rod.
14. Apply an even coating of adhesive to both mating surfaces.
15. Fit the crownwheel to the differential case.

NOTE: These two components are an interference fit and must, therefore, have their bolt holes aligned accurately before being fitted together.

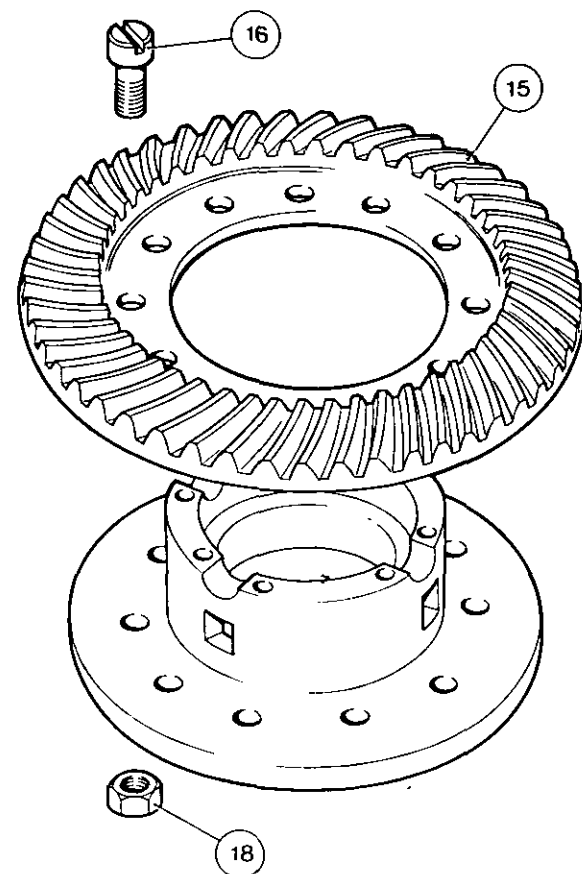
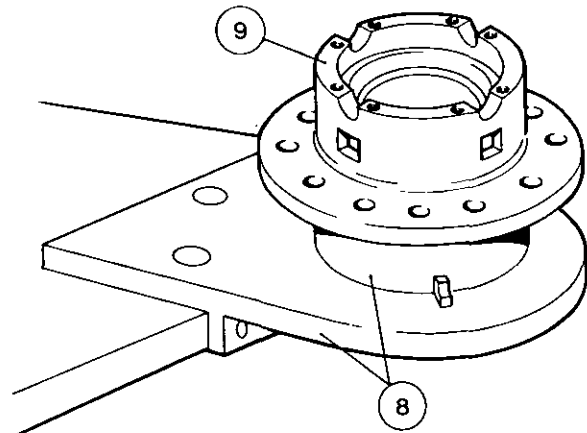
16. Fit the twelve bolts with their heads nearest the crownwheel teeth.
17. Apply two drops of recommended sealant 'C' to the first thread of each bolt.
18. Fit the nuts, and tighten them progressively and evenly to a torque of 160 Nm (120 lb ft).
19. Refit the differential components, operation 6A-51-53.

NOTE: Operations 14 to 18 must be completed within 30 minutes of mixing the resin and hardener.

20. Cure the resin bonding by subjecting the differential assembly to uniform heating as follows:—

120°C (248°F) for a minimum of 1 hour.
 or 40°C (105°F) for a minimum of 12 hours.
 or 30°C (86°F) for a minimum of 16 hours.
 or 20°C (68°F) for a minimum of 24 hours.

21. Refit the differential unit, operation 6A-31-34.



PINION ASSEMBLY (STANDARD FLOW PUMP)

Removal and Refitment

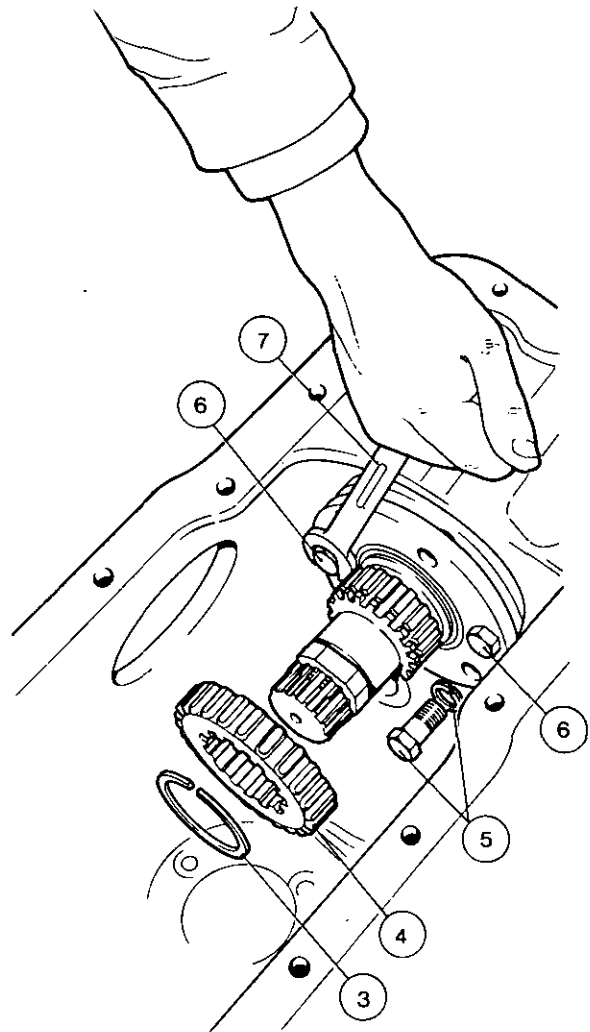
6A-53-55

Removal

1. Remove the lift cover and the hydraulic pump(s) as stated in Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted), Part 6B.
3. Release the snap ring.
4. Slide off the gear.
5. Remove the six bolts and spring washers.
6. Screw one of the bolts into each of the two tapped holes.
7. Tighten the bolts, thus withdrawing the pinion assembly.

Refitment

8. Reverse procedures 1 to 7 except:
 - (a) Ensure that the locating pin is aligned before pressing the housing into place.
 - (b) Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - (c) Fit a new snap ring.



PINION ASSEMBLY (HIGH FLOW PUMP)

Removal and Refitment

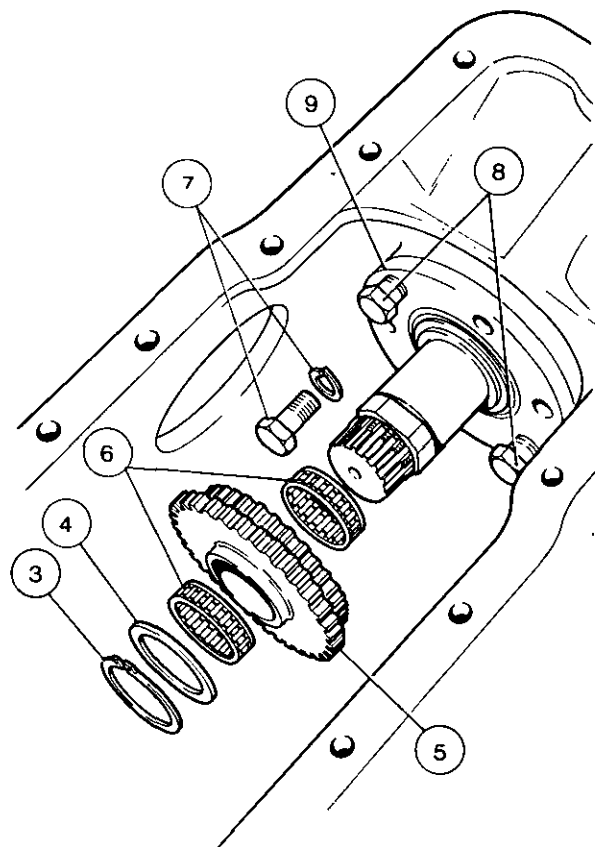
6A-54-55

Removal

1. Remove the lift cover and the hydraulic pump(s) as stated in Part 8A.
2. Remove the i.p.t.o. clutch pack (if fitted), Part 6B.
3. Release the circlip.
4. Remove the thrust washer.
5. Remove the gear cluster.
6. Slide the needle roller bearings off the bearing sleeve.
7. Remove the six bolts and spring washers.
8. Screw one of the bolts into each of the two tapped holes.
9. Tighten the bolts thus withdrawing the pinion assembly.

Refitment

10. Reverse procedures 1 to 9 except:
 - (a) Ensure that the locating pin is aligned before pressing the housing into place.
 - (b) Tighten the six bolts to a torque of 108 Nm (80 lbf ft).
 - (c) When the thrust washer shows signs of wear it should be renewed.
 - (d) Fit a new circlip.



REAR AXLE AND BRAKES

PINION ASSEMBLY

Servicing

6A-55-56

Special Tools: MF 200 Hand Press
MF 200-23 Adaptor
MF 200-25 Adaptor
Pre-load Gauge

Disassembly

1. Remove the pinion assembly, operation 6A-53-55 (Standard Flow Pump), 6A-54-55 (High Flow Pump).
2. Remove the locking ring as follows:
 - (a) Place the pinion in a soft faced vice with the jaws of the vice holding the flats, adjacent to the collar locking rollers.
 - (b) Using a cold chisel, cut one half to two thirds into the locking collar at points b and c.
 - (c) Reposition the pinion in the vice and chisel down the splines into the cuts made at points b and c. A few hefty blows will fracture the locking collar enabling it to be removed.

NOTE: Great care should be taken to avoid damaging the threads of the pinion.

3. Remove the sleeve and the splined hub (Standard Flow Pump) or the bearing sleeve, sleeve keeper and thrust washer (High Flow Pump).
4. Remove the housing, complete with the front bearing cone.
5. Fit the pinion to MF 200 with MF 200-23 and MF 200-25. Press off the bearing.
6. Remove the snap ring securing the pilot bearing to the pinion.
7. Fit the pinion to MF 200, using adaptor MF 200-23, then press off the pilot bearing.

Examination

Examine all components for signs of wear, scoring or pitting. Any faulty or worn parts must be replaced.

NOTES:

- (a) If the pinion is damaged the crownwheel must also be replaced as these are only supplied in matched sets.
- (b) The taper roller bearings are serviced as a pair, assembled with the housing.
- (c) New snap rings should always be fitted.

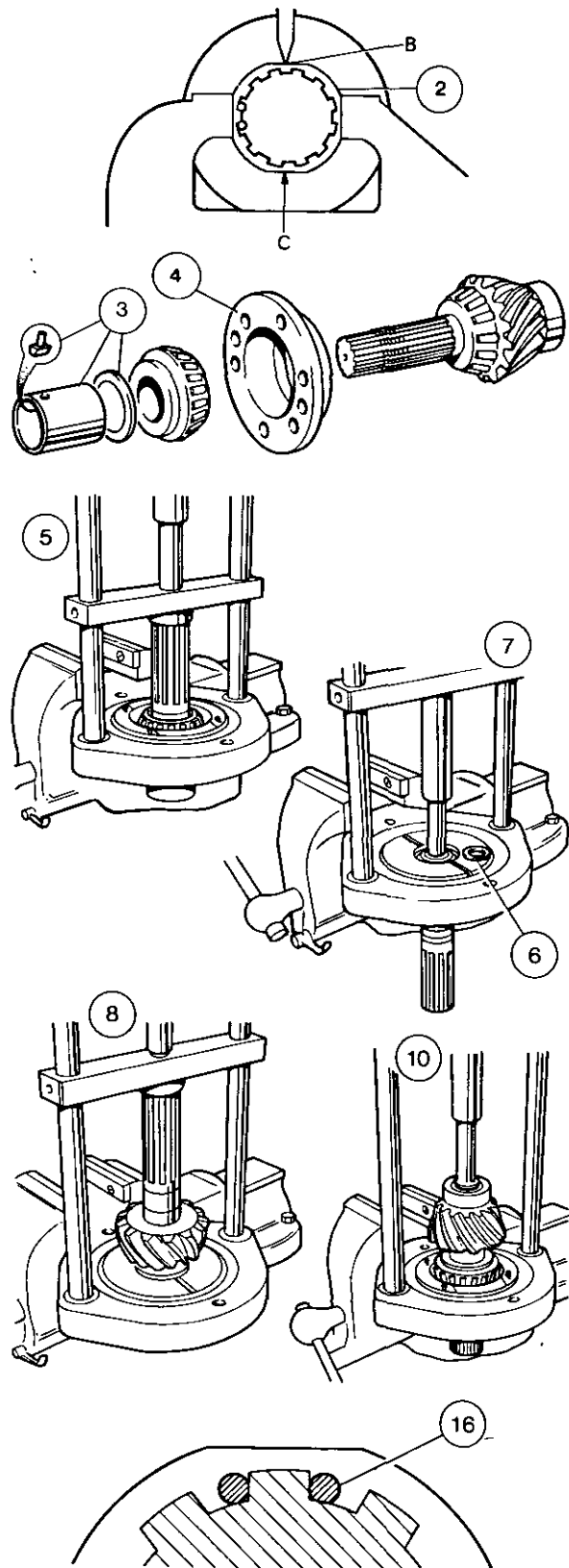
Reassembly

8. Using MF 200 and MF 200-23, press the pilot bearing on the pinion.
9. Secure the pilot bearing with a new snap ring.
10. Using MF 200 and MF 200-23 and MF 200-25 press the bearing onto the pinion.
11. Locate the pinion in its housing and fit the front bearing cone.
12. Refit the sleeve and the splined hub (Standard Flow Pump) or the thrust washer and bearing sleeve with the sleeve keeper (High Flow Pump) and a new locking ring, hand tightened.
13. Hold the housing in a soft faced vice.
14. Using a suitable pre-load gauge tighten the locking ring, to a torque of 24 kg cm (20 lbf in).
15. Remove the gauge, tap the pinion firmly to centralise the bearings, then re-check the pre-load.
16. Secure the locking ring by tapping a locking roller down either side of one of the pinion splines.

NOTE: The needle rollers must be driven flush with the locking collar.

Before refitment, the pinion assembly should be freely lubricated with clean transmission oil.

17. Refit the pinion assembly, operation 6A-53-55 (Standard Flow Pump), 6A-55-55 (High Flow Pump).



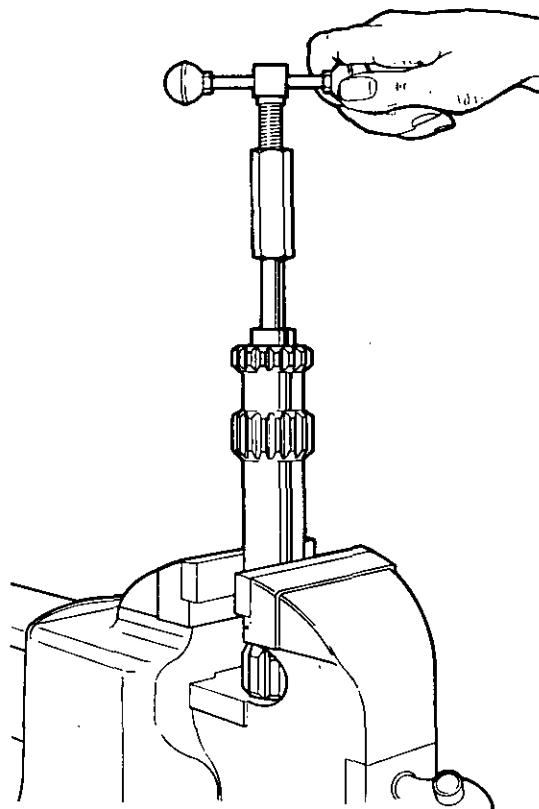
REAR DRIVE SHAFT**Servicing**

6A-56-57

Special Tools: MF 202A Needle Roller Bearing Puller
 MF 203A Needle Roller Bearing Driver
 550 Universal Handle

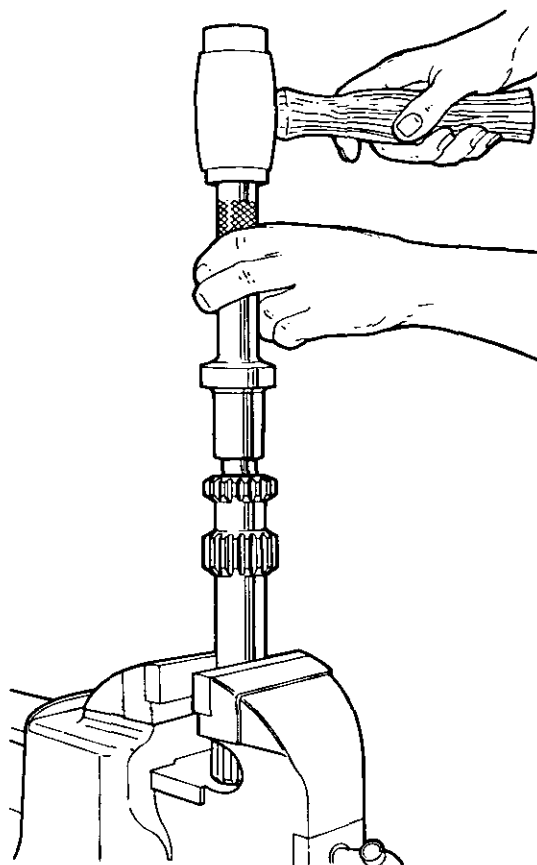
Disassembly

1. Remove the lift cover, Part 8A.
 2. Remove the split pin from the shear tube.
 3. Remove the shear tube.
 4. Remove the rear drive shaft.
 5. Locate the end of MF 202A underneath the bearing cage.
 6. Extract the bearing.
 7. Remove the plunger and spring.
- Examine the drive shaft for signs of wear, and fit a new needle roller bearing.

**Reassembly**

Reverse procedures 1 to 7 except:

- (a) Place the bearing depth control collar (part of 203A) on the end of the driveshaft over the new bearing. Drive the bearing into the drive shaft using MF 203A and the 550 handle until the tool contacts the depth control collar.
- (b) Fit a new split pin to give an end float of 0,40 to 2,50 mm (0-015 to 0-100 in).



POWER TAKE OFF

Part 6—Section B

Operation Number	Table of Contents	Page Number
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6B—02—05	P.T.O. SHAFT Removal and Refitment (Standard Flow Linkage Pump)	05
6B—03—05	Removal and Refitment (High Flow Linkage Pump)	
6B—04—06	P.T.O. SHAFT REAR BEARING Removal and Replacement (Standard Flow Linkage Pump)	06
6B—05—06	Removal and Replacement (High Flow Linkage Pump)	
6B—06—07	NEEDLE BEARING Removal and Replacement (Standard Flow Linkage Pump)	07
6B—07—08	GROUND SPEED GEAR, BUSH AND PINION SHAFT GEAR ASSEMBLY (Standard Flow Linkage Pump) Removal and Replacement	08
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6B—10—10	Servicing (Non Multi-Power/I.P.T.O. or Auxiliary Pump Tractors)	10
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6B—12—12	Servicing (Multi-Power/I.P.T.O. or Auxiliary Pump Tractors)	12

GENERAL

The p.t.o. can be one of the following according to the specification and /or type of tractor:

- (i) Proportional ground speed p.t.o. and proportional engine speed p.t.o. with the standard flow linkage pump and a three-position control lever.
- (ii) Proportional engine speed p.t.o. with the high flow linkage pump, reduction gears and a two position control lever.
- (iii) Proportional engine two speed p.t.o. with the high flow linkage pump, reduction gears and the two-position control lever. The second speed being obtained by exchanging the p.t.o. shaft, 540 rev/min or 1000 rev/min.

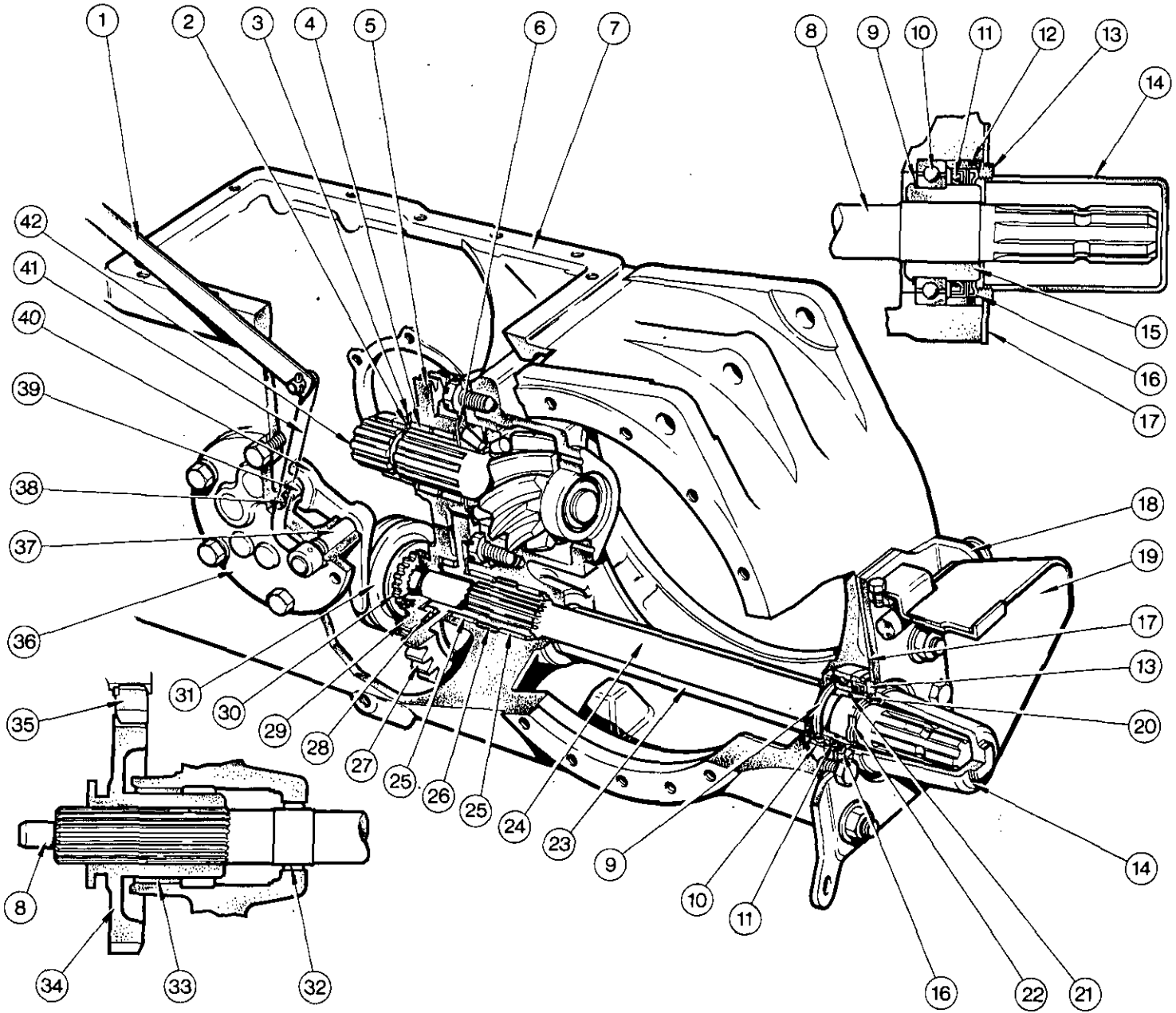
The p.t.o. shaft projects rearward from the lower section of the centre housing and when not in use a screwed cap is fitted.

The front end of each p.t.o. shaft is supported by a needle bearing in the rear end of the linkage pump camshaft but the p.t.o. shaft of (i) is also supported by a needle bearing in a centre housing web.

The driven ground speed p.t.o. gear of (i) which slides on the splines of the p.t.o. shaft, is supported by a bush bearing but the drive, compound reduction and driven gears of (ii) and (iii) are all supported on needle bearings.

The rear end of each p.t.o. shaft is supported by a ball bearing together with two seals; one of metal to exclude external dirt and a lip type seal to retain the transmission oil within the centre housing.

In the instance of (iii) a guide tube assembly is fitted within the centre housing, which prevents transmission oil running out when the 540 rev/min or 1000 rev/min p.t.o. shafts are exchanged.



6B-02
POWER TAKE OFF

KEY TO FIGURE 1

- | | |
|--|--|
| 1 P.t.o. shift link | 22 Snap ring |
| 2 Circlip | 23 P.t.o. shaft guide tube (Two speed p.t.o. only) |
| 3 Thrust washer | 24 Low speed p.t.o. shaft (Two speed p.t.o. only) |
| 4 Needle bearing | 25 Needle bearing |
| 5 Compound reduction gear | 26 Spacer |
| 6 Thrust washer | 27 P.t.o. driven gear |
| 7 Centre housing | 28 Needle bearing |
| 8 Ground speed/engine speed p.t.o. shaft | 29 P.t.o. drive gear |
| 9 Circlip | 30 Splined hub |
| 10 Ball bearing | 31 Shift collar |
| 11 Lip seal | 32 Needle bearing |
| 12 "O" Ring | 33 Bush bearing |
| 13 Seal housing | 34 Ground speed driven gear |
| 14 P.t.o. cap | 35 Ground speed drive gear |
| 15 Bearing collar | 36 Side cover |
| 16 Metal shield | 37 Shift lever shaft |
| 17 Seal housing plate | 38 Plunger spring |
| 18 Control beam bracket | 39 Plunger |
| 19 P.t.o. shield | 40 Shift lever |
| 20 Bearing sleeve | 41 P.t.o. lever |
| 21 "O" Ring | 42 Rear axle pinion shaft |

POWER TAKE OFF**P.T.O. SHAFT OIL SEAL (Standard and High Flow Linkage Pump)****Removal and Replacement**

6B—01—04

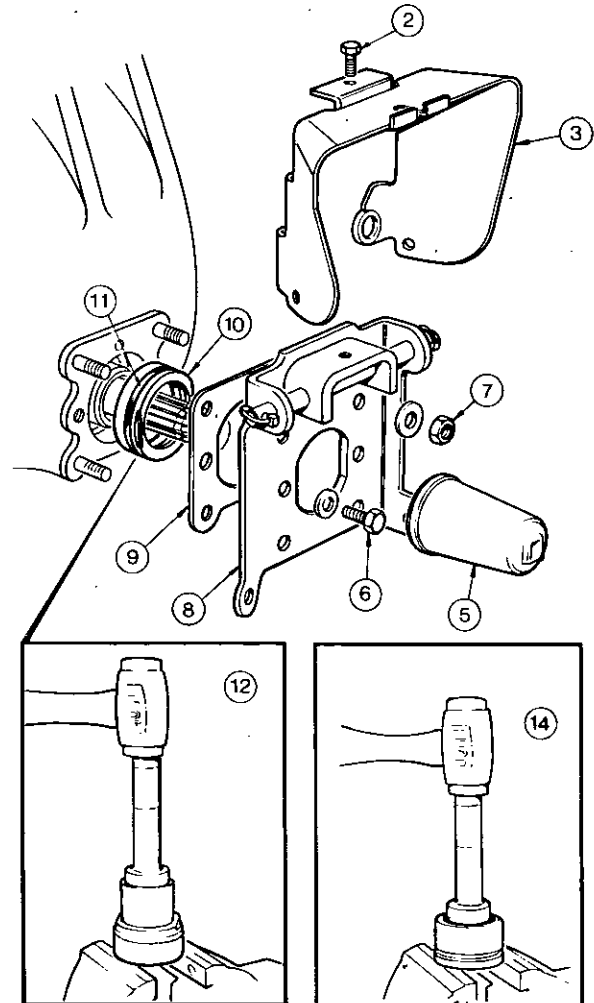
Special Tools: MF 168 Seal Remover
 MF 364 Seal Replacer
 550 Universal Handle

Removal

1. Drain the centre housing of transmission oil.
2. Remove the bolt.
3. Remove the p.t.o. shield.
4. Detach the top or bottom of the control beam.
5. Unscrew the p.t.o. cap.
6. Remove two bolts and washers.
7. Remove four nuts and washers.
8. Remove the control beam bracket.
9. Remove the seal housing plate.
10. Withdraw the oil seal housing.
11. Remove and discard the 'O' ring.
12. Using MF 168 and 550, remove and discard the lip seal and metal shield.

Replacement

13. Press in a new metal shield, lip curving upwards, to the full limit of its travel.
14. Using MF 364 press in the lip seal, lip curving upwards; this will ensure that the inner face of the seal is 1,78 mm (0.07 in) below the edge of the housing.
15. Fit a new 'O' ring.
16. Fit the oil seal housing so the two flats are vertical.
17. Reverse procedures 1 to 8.



P.T.O. SHAFT (Standard Flow Linkage Pump)

Removal and Refitment 6B—02—05

Removal

1. Remove the oil seal housing, operation 6B—01—04, procedures 1 to 10.
2. Withdraw the p.t.o. shaft.

Refitment

3. Slide in the p.t.o. shaft, taking care to align the internal splines and to keep it horizontal.
4. Refit the oil seal housing, operation 6B—01—04, procedures 16 and 17.

P.T.O. SHAFT (High Flow Linkage Pump)

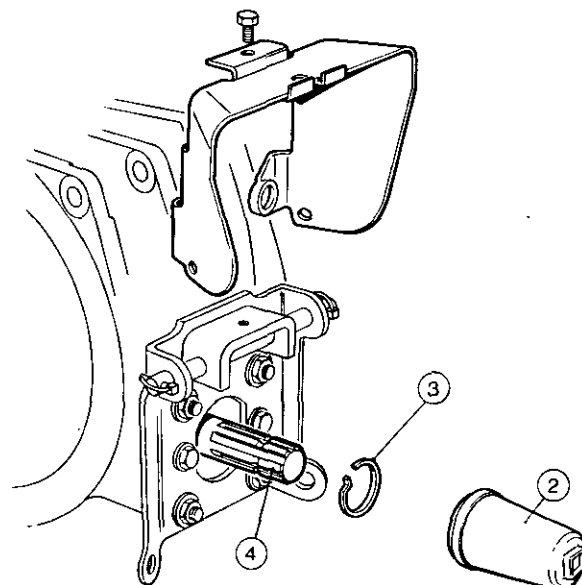
Removal and Refitment 6B—03—05

Removal

1. MF 550 Tractors only: drain the centre housing of transmission oil.
2. Unscrew the p.t.o. cap.
3. Remove the snap ring.
4. Remove the p.t.o. shaft.

Refitment

5. Reverse procedures 1 to 4 except:
 - (a) When refitting the p.t.o. shaft, take care to align the splines and keep the shaft horizontal.
 - (b) Ensure that the snap ring locates correctly in its groove.



POWER TAKE OFF**P.T.O. SHAFT REAR BEARING
(Standard Flow Linkage Pump)****Removal and Replacement**

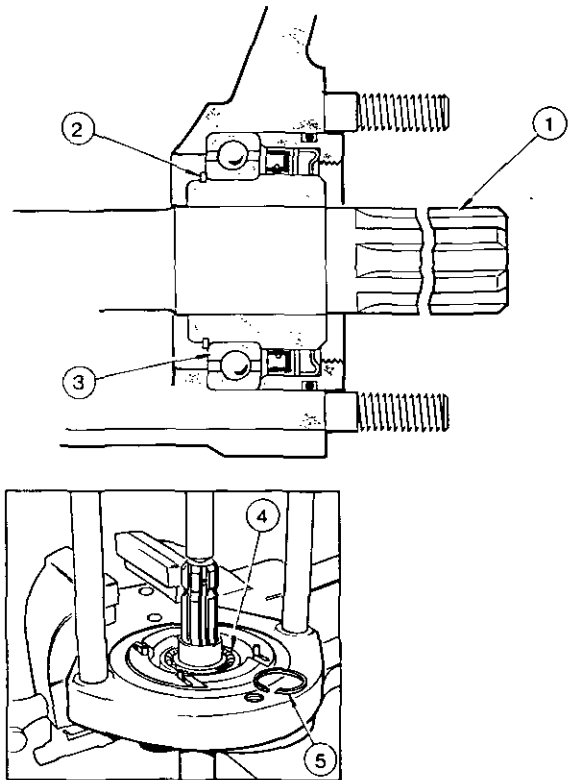
6B-04-06

Special Tools: MF 200 Hand Press
MF 200-25 Adaptor**Removal**

1. Remove the p.t.o. shaft operation 6B-02-05.
2. Remove the snap ring.
3. Using a length of 60 mm (2½ in) internal diameter tube, drive the ball bearing off forwards.

Replacement

4. Using MF 200-25 and MF 200 press the new ball bearing onto the p.t.o. shaft.
5. Fit a new snap ring and ensure that it locates correctly in its groove.
6. Refit the p.t.o. shaft, operation 6B-02-05.

**P.T.O. SHAFT REAR BEARING
(High Flow Linkage Pump)****Removal and Replacement**

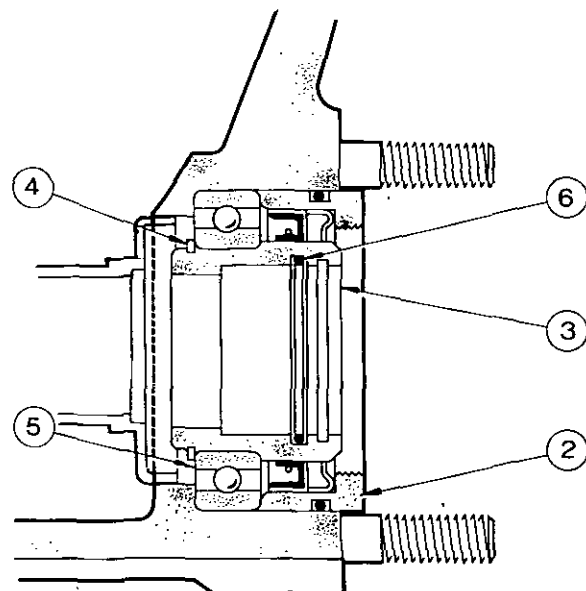
6B-05-06

Removal

1. Remove the p.t.o. shaft, operation 6B-03-05.
2. Remove the seal housing operation 6B-01-04.
3. Remove the ball bearing and sleeve.
4. Remove the snap ring.
5. Using a length of 60 mm (2½ in) internal diameter tube, drive off the ball bearing.
6. Remove and discard the 'O' ring.

Replacement

7. Reverse procedures 1 to 6 except:
 - (a) Fit a new 'O' ring.
 - (b) Ensure that the snap ring locates correctly in its groove.
 - (c) Fit the ball bearing and sleeve assembly, snap ring end first.
 - (d) When feeding in the p.t.o. shaft, take care to align the splines and keep the shaft horizontal.



NEEDLE BEARING (Standard Flow Linkage Pump)**Removal and Replacement** 6B-06-07

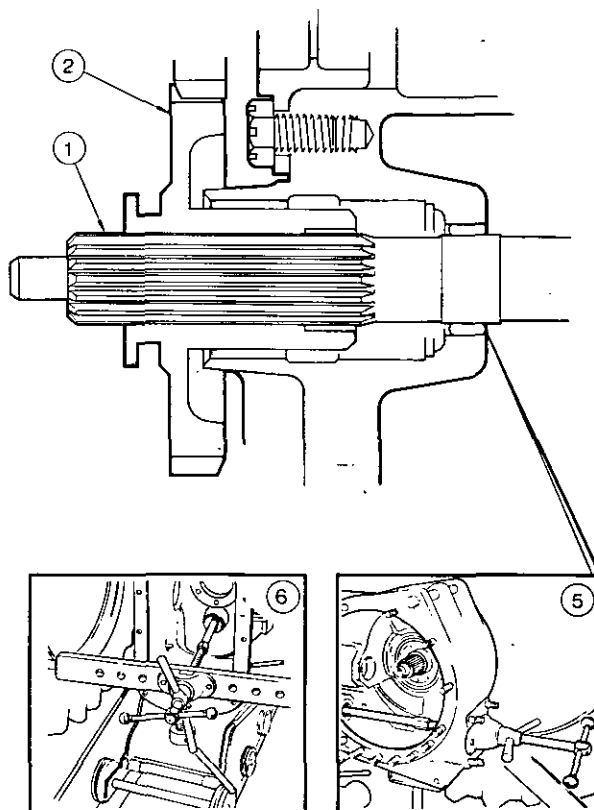
Special Tools: MF 195 Puller
MF 195-5-2 Adaptor
MF 195-5A Bar

Removal

1. Remove the p.t.o. shaft and the hydraulic pump(s), Part 8A.
Tractors without Multi-Power/i.p.t.o. or auxiliary pumps.
2. Remove the ground speed p.t.o. driven gear.
Tractors without Multi-Power/i.p.t.o. or auxiliary pumps.
3. Remove the i.p.t.o. clutch unit, operation 6B-13-15.
4. Remove the differential unit Part 6A.
5. Using MF 195, MF 195-2 and MF 195-5A, remove the needle bearing rearwards.

Replacement

6. Using MF 195, MF 195-5-2 and MF 195-5A, in conjunction with a linkage drawbar, pull the needle bearing into its bore until it is flush with the rear face.
7. Reverse procedures 1 to 4 except:
 - (a) When fitting the linkage pump, ensure that the needle bearing in the rear end of the camshaft, is in good condition.



POWER TAKE OFF**GROUND SPEED GEAR, BUSH AND PINION SHAFT GEAR ASSEMBLY (Standard Flow Linkage Pump)****Removal and Replacement**

6B—07—08

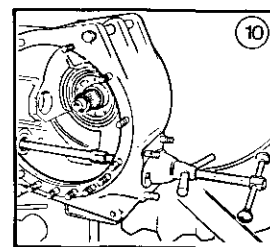
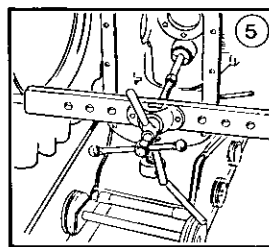
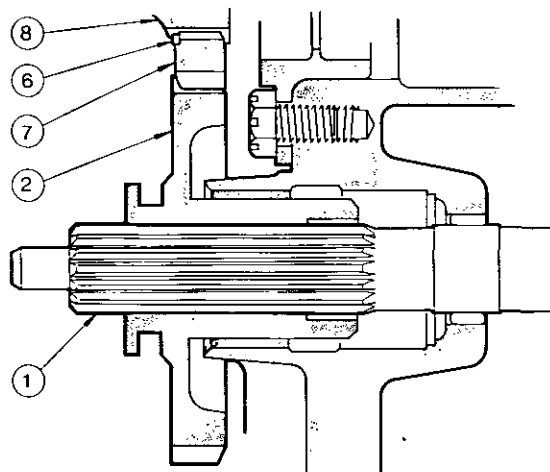
Special Tools: MF 195 Puller
 MF 195—5A Bar
 MF 195—6 Bush Remover
 MF 168 Bush Replacer

Removal

1. Remove the p.t.o. shaft and the hydraulic pump(s), Part 8A.
Tractors without Multi-Power/i.p.t.o. or auxiliary pumps.
2. Remove the ground speed driven gear.
Tractors with Multi-Power/i.p.t.o. or auxiliary pumps.
3. Remove the i.p.t.o. clutch unit, operation 6B—13—15.
4. Remove the differential unit, Part 6A.
5. Using MF 195, MF 195-5A and MF 195-6 in conjunction with a linkage drawbar, pull the bush out.
6. Remove the retainer ring.
7. Remove the ground speed drive gear.
8. Renew the drive gear splined hub if necessary, Part 6A.

Replacement

9. Reverse procedures 6 to 8 except:
 - (a) Ensure that the retainer ring locates correctly in its groove.
10. Using MF 195, MF 195-5A and MF 168, pull the bush into its bore until it is flush with the inner end of the chamfer.
11. Reverse procedures 1 to 7 except:
 - (a) When fitting the linkage pump, ensure that the needle bearing in the rear of the camshaft is in good condition.



NEEDLE BEARINGS & REDUCTION GEARS (High Flow Linkage Pump)

Removal and Replacement

6B-08-09

Special Tools: MF 195 Puller

MF 195-5A Bar

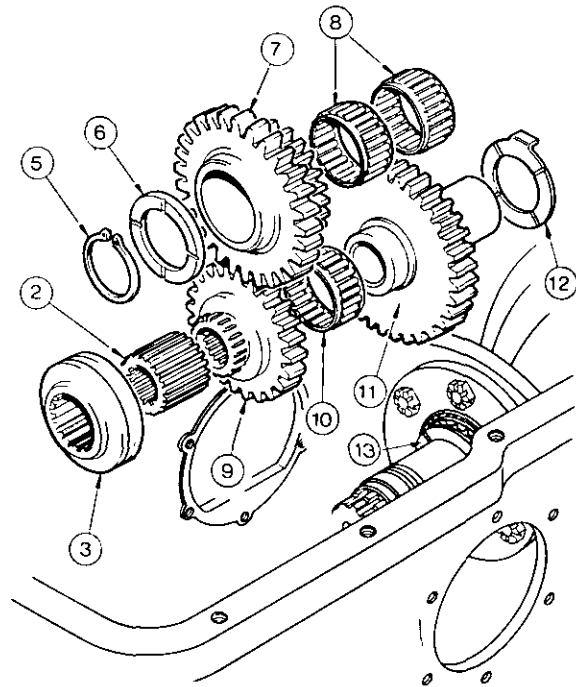
MF 195-6 Two Speed, p.t.o. Shaft
Needle Bearing, Remover
and Replacer

Removal

1. Remove the p.t.o. shaft and the hydraulic pump(s), Part 8A.
Tractors without Multi-Power/i.p.t.o. or auxiliary pumps.
2. Remove the splined hub.
3. Remove the shift collar.
Tractors with Multi-Power/i.p.t.o. or auxiliary pumps.
4. Remove the i.p.t.o. clutch unit, operation 6B-13-15.
All tractors.
5. Remove the pinion shaft retaining ring.
6. Remove the outer thrust washer.
7. Remove the compound reduction gear.
8. Remove the two caged needle bearings.
9. Remove the drive p.t.o. gear.
10. Remove the drive p.t.o. gear needle bearing.
11. Remove the driven p.t.o. gear.
12. Remove the tabbed thrust washer.
13. Remove the inner thrust washer if necessary, Part 6A.
14. Remove the shaft rear bearing, operation 6B-05-06.
15. Remove the differential unit, Part 6A.
Tractors fitted with two speed p.t.o.
16. Drive out the p.t.o. shaft guide tube.
17. Using MF 195, MF 195-5A and MF 195-6 in conjunction with a linkage drawbar, pull out the two needle bearings and spacer.

Replacement

18. Using MF 195, MF 195-5A and MF 195-6 (longer end from collar), pull in one needle bearing, **NO PART NUMBER END** first, up to the collar. Feed in the spacer. Reverse MF 195-6 (shorter end from collar) and pull in the second needle bearing; this will ensure a clearance of 0,25 mm (0.010 in) between the spacer and the two needle bearings.
Tractors fitted with two speed p.t.o.
19. Press in the p.t.o. shaft guide tube until its rear end is no more than 1.5 mm (0.060 in) past the shaft ball bearing recess.
20. Reverse procedures 1 to 15 except:
 - (a) Ensure that the retaining ring locates correctly in its groove.
 - (b) When fitting the linkage pump ensure that the needle bearing, in the rear end of the camshaft, is in good condition.



POWER TAKE OFF**P.T.O. SIDE COVER (Non Multi-Power/i.p.t.o. or Auxiliary Pump Tractors)****Removal and Refitment**

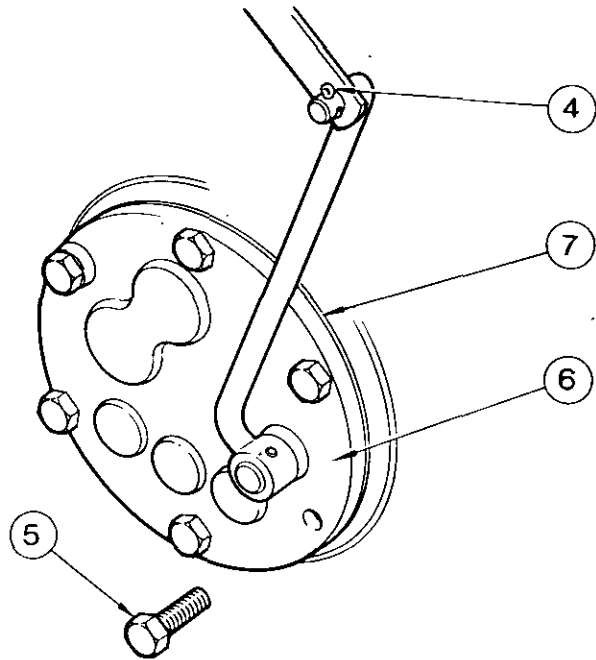
6B-09-10

Removal

1. Remove the fuel tank, Part 4C.
2. Drain the transmission oil to the LOW mark on the dipstick.
3. Remove and discard the two split pins and disconnect the parking and foot brake rods at the actuating lever.
4. Remove and discard the split pin and disconnect the p.t.o. linkage at the side cover.
5. Remove the six bolts.
6. Remove the side cover.
7. Remove and disconnect the gasket.

Refitment

8. Reverse procedures 1 to 7 except:
 - (a) Locate the shift lever in the annulus of the ground speed gear or shift collar.
 - (b) Fit a new gasket and split pins.

**P.T.O. SIDE COVER (Non Multi-Power/i.p.t.o. or Auxiliary Pump Tractors)****Servicing**

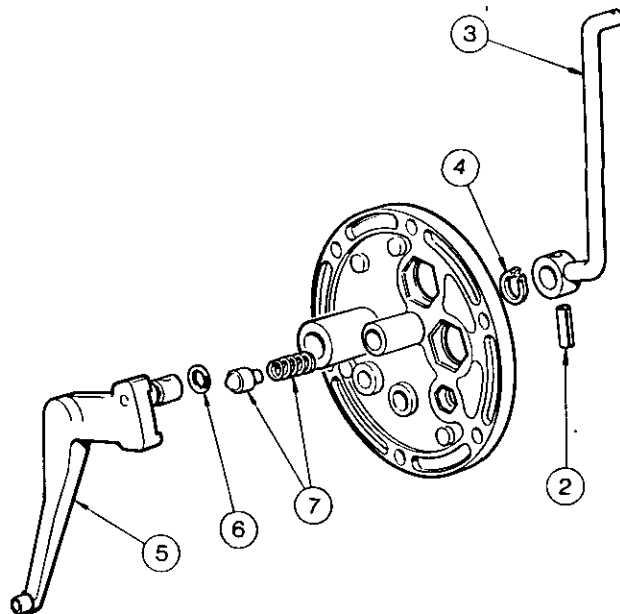
6B-10-10

Disassembly

1. Remove the side cover, operation 6B-09-10.
2. Drift out and discard the roll pin.
3. Remove the p.t.o. lever.
4. Remove the circlip.
5. Remove the shift lever.
6. Remove and discard the 'O' ring.
7. Remove the detent plunger and spring.

Reassembly

8. Reverse procedures 1 to 7 except:
 - (a) Fit a new 'O' ring.
 - (b) Fit a new roll pin.



P.T.O. SIDE COVER (Multi-Power/i.p.t.o. or Auxiliary Pump Tractors)

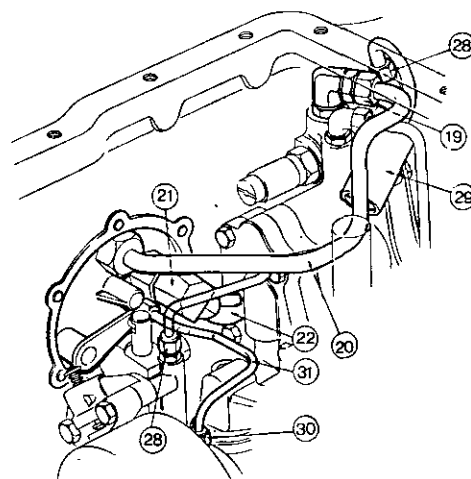
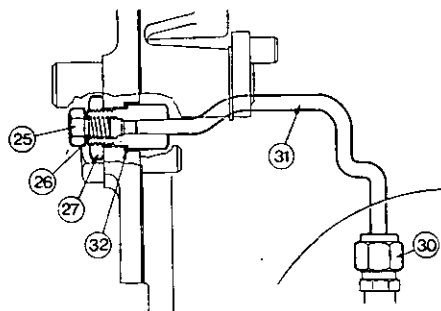
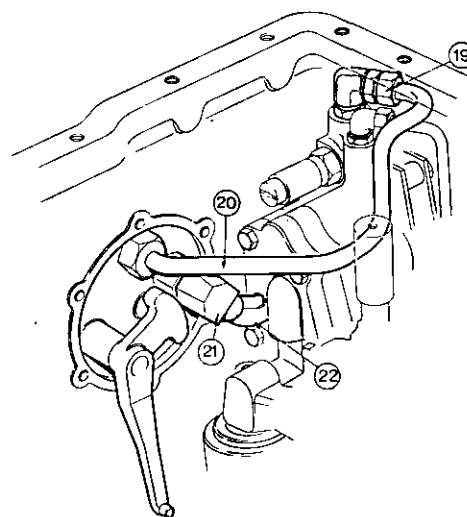
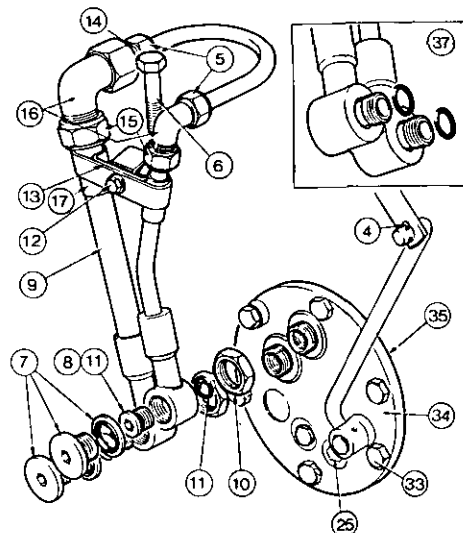
Removal and Refitment

6B-11-11

Removal

Multi-Power/i.p.t.o. and/or Auxiliary Pump Tractors Only.

1. Remove the fuel tank, Part 4C.
 2. Drain the transmission oil to the LOW mark on the dipstick.
 3. Remove and discard the two split pins and disconnect the parking and foot brake rods at the actuating lever.
 4. Remove and discard the split pin and disconnect the p.t.o. shift linkage at the side cover.
 5. Release the two nuts and remove the 'U' pipe or the spool valve feed and return pipes.
 6. Remove the lift cover pipe bracket bolt.
 7. Remove the two Allen key side cover plugs and Dowty washers.
 8. Release the two Allen key side cover connections.
 9. Remove the feed and return pipe assembly.
 10. Remove the feed and return pipe side cover locknuts.
 11. Remove and discard the two 'O' rings and withdraw the Allen key connections.
 12. Remove the pipe bracket bolt and washer.
 13. Remove the pipe locating and locking plates.
 14. Remove the return pipe reducer.
 15. Release the feed and return pipe elbow nuts.
 16. Remove the feed (small) and return (large) pipe elbows.
 17. Remove and discard the two neoprene pipe insulators if necessary.
 18. Remove the lift cover, Part 8A.
 19. Release the larger auxiliary pump pipe nut.
 20. Remove the side cover to auxiliary pump pipe.
 21. Remove the side cover to return pipe and adaptor.
 22. Remove the return pipe.
 23. Remove and discard the two fibre pipe washers.
 24. Remove and discard the two return pipe 'O' rings.
- Tractors with i.p.t.o. only.*
25. Remove the side cover i.p.t.o. pressure test plug.
 26. Remove and discard the test plug 'O' ring.
 27. Remove the i.p.t.o. pressure test pipe locknut.
 28. Release the two i.p.t.o. control valve to pump pipe nuts.
 29. Remove the i.p.t.o. control valve to pump pipe with integral filter.
 30. Release the i.p.t.o. pressure test pipe control valve nut.
 31. Remove the side cover to i.p.t.o. pressure test pipe.
 32. Remove and discard the fibre pipe washer.
- Multi-Power/i.p.t.o. and Auxiliary Pump Tractors.*
33. Remove the six bolts.
 34. Remove the side cover.
 35. Remove and discard the gasket.



POWER TAKE OFF**Refitment**

36. Reverse procedures 12 to 35 except:
 - (a) Fit new gaskets, fibre washers, 'O' rings, neoprene pipe insulators and split pins.
 - (b) Ensure that the side cover pin locates the hole in the i.p.t.o. clutch valve and the actuating lever locates the cut-out in the valve plunger alternatively the live p.t.o. shift lever locates the annulus of the ground speed gear or shift collar.
 - (c) Tighten the i.p.t.o. control valve to pump pipe nut to a torque of 47 Nm (35 lbf ft).
 - (d) Tighten the side cover i.p.t.o. pressure test plug to a torque of 10 Nm (8 lbf ft).
37. The two Allen key connections are fed through the banjos of the feed and return pipes BEFORE the 'O' rings are fitted to the protruding threaded shanks.
38. Reverse procedures 1 to 11 except:
 - (a) Tighten the two Allen key side cover connections to a torque of 34 Nm (25 lbf ft).
 - (b) Tighten the two Allen key side cover plugs to a torque of 68 Nm (50 lbf ft).
 - (c) Tighten the lift cover bracket bolt to a torque of 88 Nm (65 lbf ft).

P.T.O. SIDE COVER (Multi-Power/i.p.t.o. or Auxiliary Pump Tractors).**Servicing**

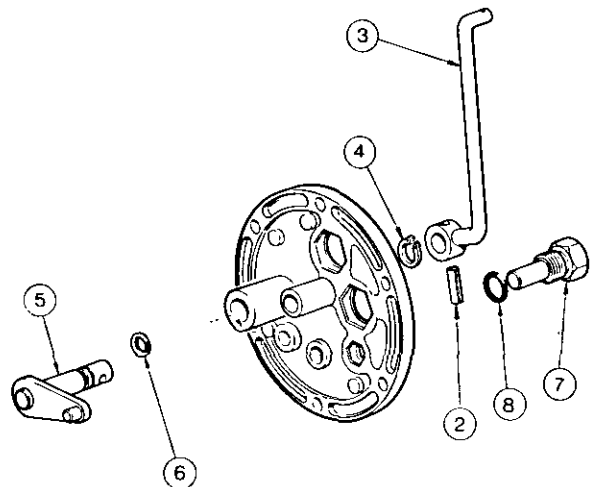
6B—12—12

Disassembly

1. Remove the side cover, operation 6B—11—11.
2. Drift out and discard the roll pin.
3. Remove the p.t.o. lever.
4. Remove the circlip.
5. Remove the i.p.t.o. clutch actuating lever.
6. Remove and discard the 'O' ring.
7. Remove the i.p.t.o. clutch control valve locating pin.
8. Remove and discard the 'O' ring.

Reassembly

9. Reverse procedures 1 to 8.
 - (a) Fit new 'O' rings.
 - (b) Tighten the i.p.t.o. clutch control valve locating pin to a torque of 16 Nm (12 lbf ft).
 - (c) Ensure that the circlip locates correctly in its groove.
 - (d) Fit a new roll pin.



	INDEPENDENT POWER TAKE OFF CLUTCH UNIT	
	GENERAL	13
	I.P.T.O. CLUTCH UNIT	15
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	I.P.T.O. CONTROL VALVE	16
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	I.P.T.O. BRAKE UNIT	17
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	I.P.T.O. HYDRAULIC TEST	18
6B—19—18	Hydraulic Test Procedure	

INDEPENDENT POWER TAKE OFF CLUTCH UNIT

GENERAL

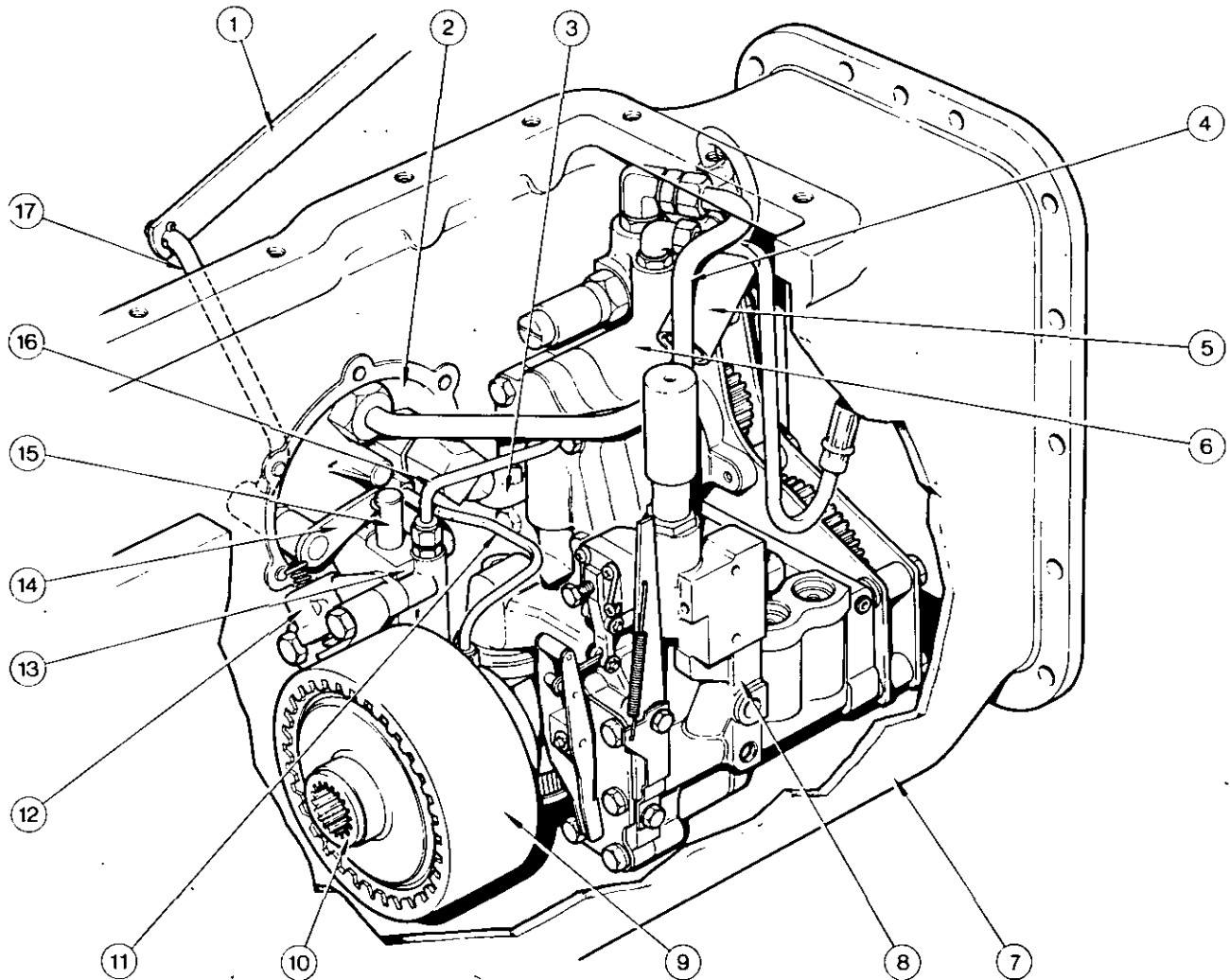
The independent power take off consists of a hydraulically actuated clutch unit whose engagement and disengagement is controlled by a two position spool type valve freely mounted on the spigotted front end of the clutch housing.

The drive hub of the clutch is splined to the rear end of the linkage pump camshaft, while the clutch housing is connected to the front end of the p.t.o. shaft or the drive gear of the reduction gear by the clutch plate retainer external splines and retaining ring. The friction discs are splined to the drive hub and the

clutch plates are splined to the clutch housing, which also accommodates the Belleville washer and piston assembly.

Hydraulic pressure applied to the piston assembly closes the clutch plates to the friction plates, thus transmitting the drive of the linkage pump to the p.t.o. shaft or drive gear of the reduction gearing.

When the hydraulic pressure is released, the wave springs, fitted outside the friction discs and between the outer peripheries of the clutch plates keep these components apart.

INDEPENDENT POWER TAKE OFF**KEY**

- | | |
|-----------------------------------|---|
| 1 Shift link | 9 I.p.t.o. clutch unit |
| 2 Side cover | 10 P.t.o. shaft drive (Clutch plate retainer) |
| 3 Spool valve return pipe | 11 I.p.t.o. pressure test pipe |
| 4 Spool valve feed pipe | 12 Brake unit |
| 5 Oil filter (Integral with pipe) | 13 Control valve |
| 6 Auxiliary pump | 14 Control valve actuating lever |
| 7 Centre housing | 15 Control valve plunger |
| 8 Linkage pump | 16 Control valve feed pipe |
| | 17 P.t.o. lever |

I.P.T.O. CLUTCH UNIT**Removal and Refitment**

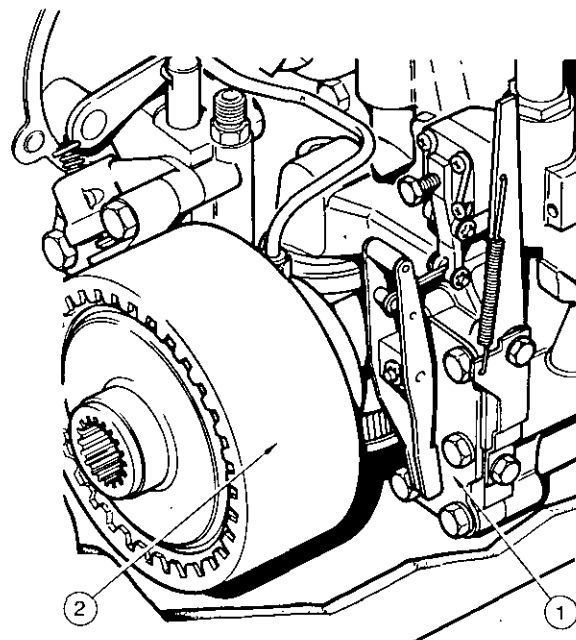
6D-13-15

Removal

1. Remove the p.t.o. shaft and the hydraulic pumps, Part 8A.
2. Remove the i.p.t.o. clutch unit.

Refitment

3. Reverse procedures 1 and 2.
 - (a) When fitting the linkage pump, ensure that the needle bearing, in the rear end of the camshaft, is in good condition.

**I.P.T.O. CLUTCH UNIT****Clutch Assembly Servicing**

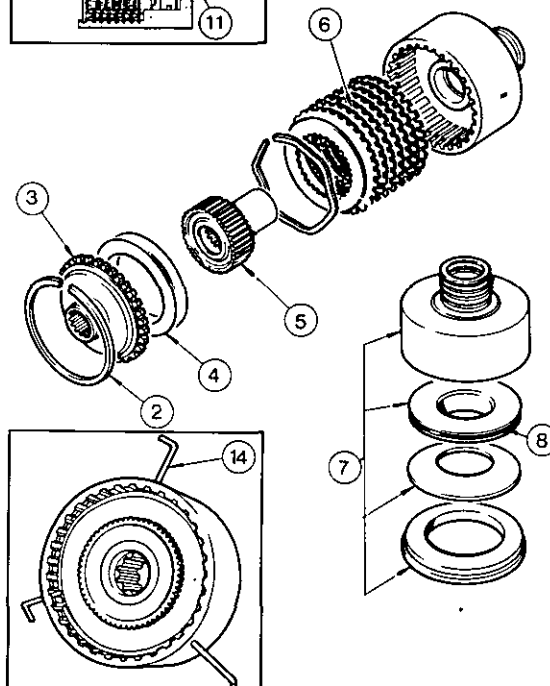
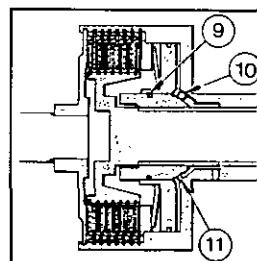
6B-14-15

Disassembly

1. Remove the control valve, operation 6B-15-16.
2. Remove the retaining ring.
3. Remove the retainer plate.
4. Remove the shims and retain for re-use, if fitted.
5. Remove the clutch drive hub.
6. Remove and keep in order, the seven wave springs, friction discs and clutch plates.
7. Invert the clutch housing and tap out the piston front plate, Belleville washer and the clutch piston.
8. Remove and discard the large seal.
9. Remove and discard the small seal.
10. Press out the check valve, if necessary.
11. Press out the restrictor valve, if necessary.

Reassembly

12. Reverse procedures 6 to 11 except:
 - (a) Press in the restrictor valve (either end first) from the drive end of the housing.
 - (b) Press in the check valve (steeper conical end first) from the drive end of the housing.
 - (c) Fit new large and small seals.
 - (d) Fit the piston, flat face first.
 - (e) Fit the Belleville washer, convex face first.
 - (f) Fit the piston front plate, stepped edge first.
 - (g) Renew any clutch plate that is soft, blue or distorted and any friction disc when the friction material has lost its scrolling.
 - (h) With the wave spring installed, unloaded in a 137,41 mm (5.41 in) ring gauge, the gap must be 10,3 to 15,09 mm (0.4 to 0.6 in). With the wave spring laying flat on a surface plate, the free height should be 5,21 mm (0.205 in) and all waves must be within 0,51 mm (0.020 in) of the same height.
13. To facilitate the fitting of the clutch plates (external teeth), friction discs (internal teeth) and wave springs, insert 4,0 mm (0.16 in) diameter pins through the clutch housing vent holes.
14. Reverse procedures 1 to 5 except:
 - (a) Ensure that the retaining ring locates correctly in its groove.



INDEPENDENT POWER TAKE OFF**I.P.T.O. CONTROL VALVE****Removal and Refitment**

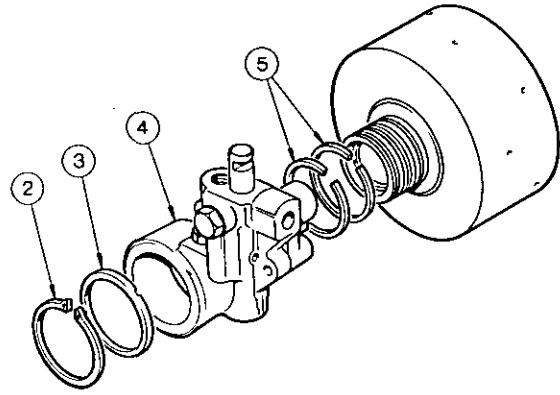
6B—15—16

Removal

1. Remove the i.p.t.o. clutch unit, operation 6B—13—15.
2. Remove the circlip.
3. Remove the thrust washer.
4. Remove the control valve and brake unit.
5. Remove the two cast iron piston rings.

Refitment

6. Fit new piston rings and ensure that there is a piston ring gap of 0,050 to 0,305 mm (0.002 to 0.012 in).
7. Reverse procedures 1 to 5 except:
 - (a) Ensure that the circlip locates correctly in its groove.

**I.P.T.O. CONTROL VALVE****Servicing**

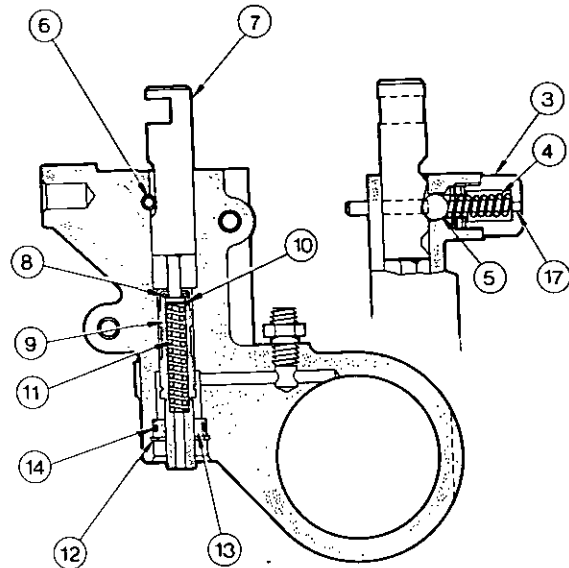
6B—16—16

Disassembly

1. Remove the control valve, operation 6B—15—16.
2. Remove the brake unit, operation 6B—17—17.
3. Remove the detent plug.
4. Remove the detent spring.
5. Remove the detent ball.
6. Drift out the roll pin.
7. Remove the plunger, spool and spring assembly.
8. Remove the circlip.
9. Remove the spool.
10. Remove and retain the shim pack for re-use.
11. Remove the spring.
12. Remove the circlip.
13. Remove the sleeve.
14. Remove and discard the 'O' ring.

Reassembly

15. Reverse procedures 1 to 14 except:
 - (a) Fit a new 'O' ring.
 - (b) Ensure that the circlip locates correctly in its groove.
16. Fit the shim pack above the plunger spring.
17. Ensure that the detent plug vent is unobstructed.
18. Reverse procedures 1 to 10 except:
 - (a) Ensure that the circlip locates correctly in its groove.
 - (b) Fit a new roll pin and position the split away from the plunger.
 - (c) Tighten the detent plug to a torque of 47 Nm (35 lbf ft).



I.P.T.O. BRAKE UNIT**Removal and Refitment**

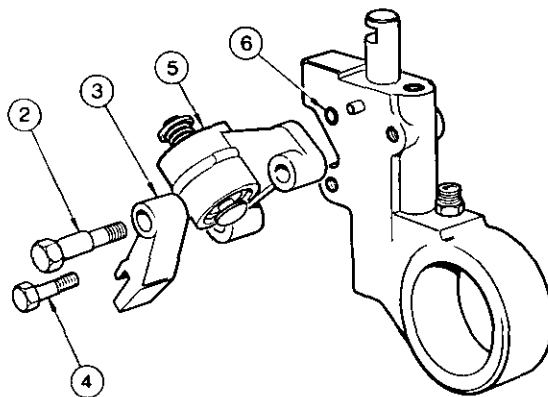
6B-17-17

Removal

1. Remove the i.p.t.o. clutch unit, operation 6D-13-15.
2. Remove the shouldered brake pad bolt.
3. Remove the pad.
4. Remove the short bolt.
5. Remove the brake housing.
6. Remove and discard the 'O' ring.

Refitment

7. Reverse procedures 1 to 5 except:
 - (a) Fit a new 'O' ring.
 - (b) Ensure that the brake pad has complete freedom of movement.

**I.P.T.O. BRAKE UNIT****Servicing**

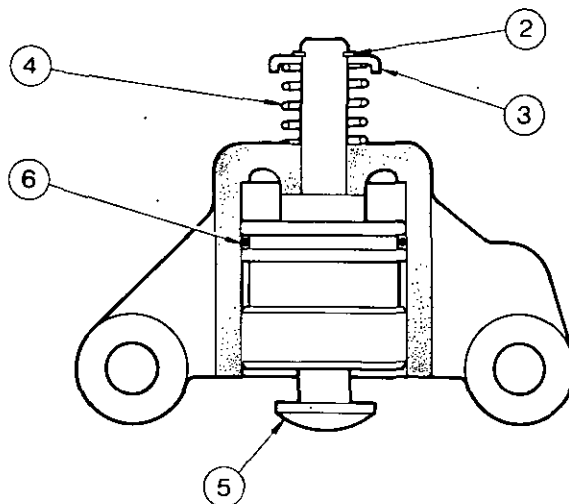
6B-18-17

Disassembly

1. Remove the brake unit, operation 6B-17-17.
2. Remove the circlip.
3. Remove the spring retainer.
4. Remove the return spring.
5. Withdraw the piston.
6. Remove and discard the 'O' ring.

Reassembly

7. Reverse procedures 1 to 6 except:
 - (a) Fit a new 'O' ring.
 - (b) Ensure that the circlip locates correctly in its groove.



INDEPENDENT POWER TAKE OFF**I.P.T.O. HYDRAULIC TEST**

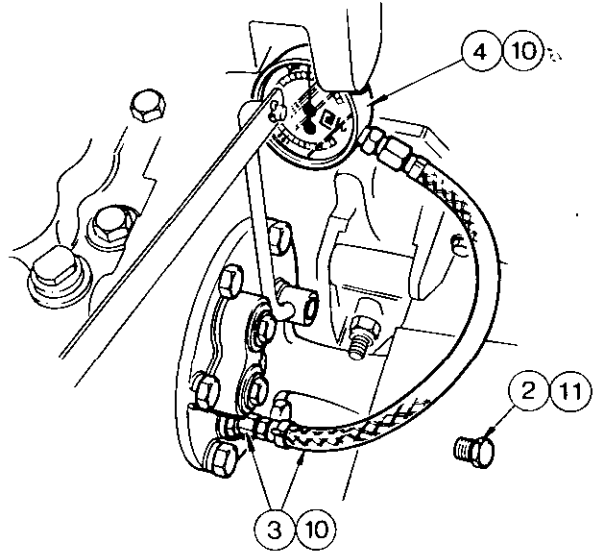
Before effecting a hydraulic test, clean fresh transmission oil of the approved grade must fill the centre housing and its temperature must be raised to 50° to 60°C (120° to 140°F) by running the hydraulic system under load; this is important as excessively cold or hot transmission oil can effect the pressure gauge readings.

Hydraulic Test Procedure

6B—19—18

Special Tools: MF 840 Pressure Gauge
MF 819-6 Adaptor

1. Remove the fuel tank, Part 4C and fit a slave tank to the fuel lift pump.
2. Remove the pressure test plug.
3. Fit MF 810-6 Adaptor and hose.
4. Fit MF 840 pressure gauge.
5. Start the engine and run to raise the transmission oil temperature.
6. Engage the p.t.o. and increase the engine speed to 2000 rev/min.
7. With the transmission oil at the specified temperature the pressure gauge should read:
Standard flow pump
1,73 to 2,07 N/mm² (250 to 300 lbf/in²).
High flow pump
1,38 to 1,73 N/mm² (200 to 250 lbf/in²).
8. Reduce engine speed to idling and disengage the p.t.o.
9. Stop the engine.
10. Remove MF 840 and MF 810-6.
11. Refit the pressure test plug.



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 7

Publication No. 1856 072 M1

comprising

- A FRONT AXLE
- B STEERING
- C WHEELS AND TYRES

FRONT AXLE

Part 7 — Section A

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7A-07-08	BEAM ASSEMBLY Removal and Refitment	08
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7A-09-09	FRONT AXLE SUPPORT Bush Removal and Refitment	09

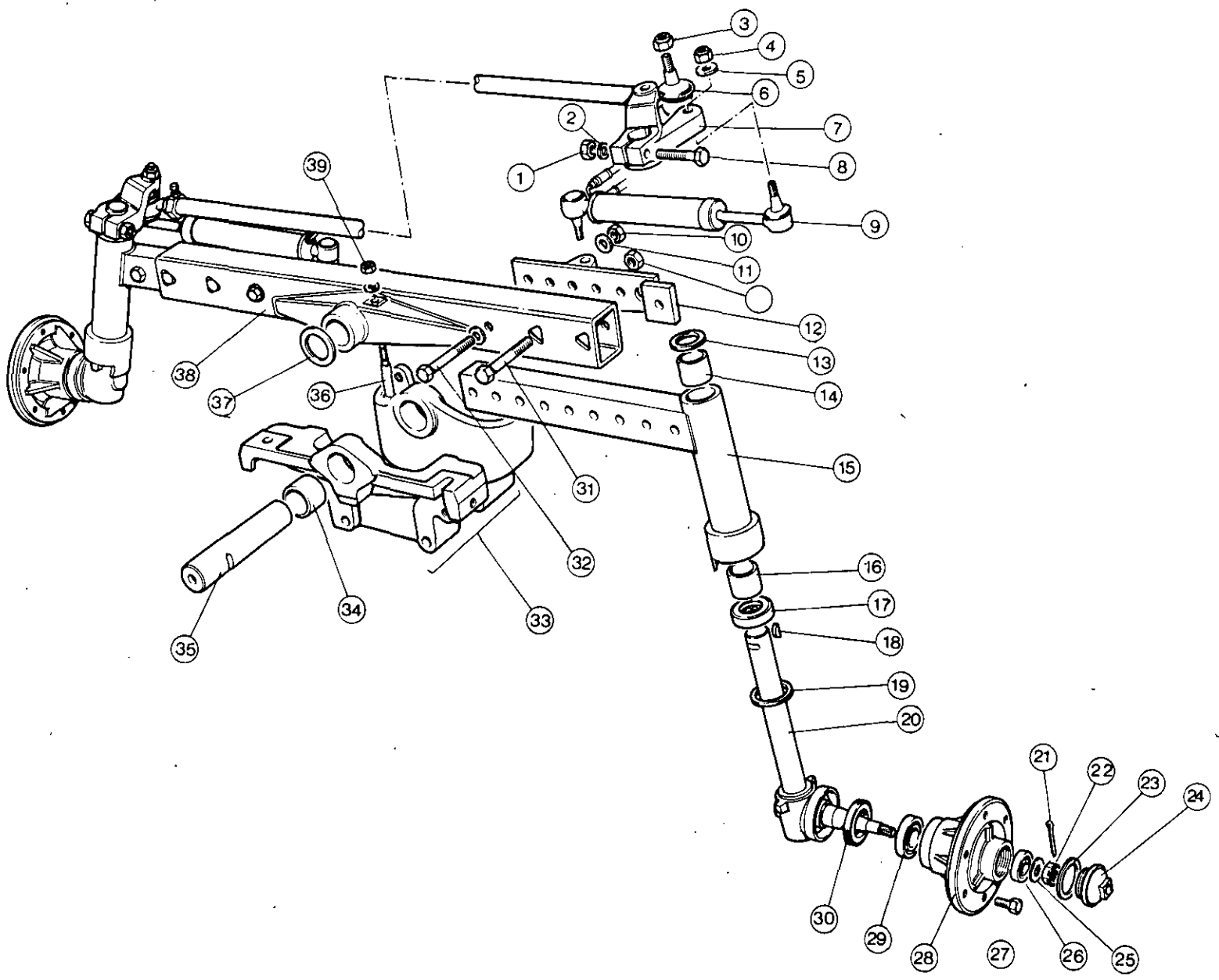
GENERAL

The front axle assembly consists of a centre beam and two outer axles.

The centre beam pivots on a pin, which is located in bushes in the axle support. The pin is secured to the centre beam by a pin and locknut.

The outer axles can be bolted to the centre beam in alternative positions to provide front wheel track adjustments.

FRONT AXLE



KEY TO FIGURE 1

- | | | |
|---------------------------|----------------------|-------------------------|
| 1 Nut | 15 Arm Assembly L.H. | 28 Hub Assembly |
| 2 Washer | 16 Bush | 29 Cone and Roller |
| 3 Nut | 17 Bearing | Assembly—Inner |
| 4 Nut | 18 Key | 30 Seal—Dust |
| 5 Washer | 19 Seal | 31 Bolt |
| 6 Track Rod Assembly | 20 Shaft Spindle | 32 Bolt |
| 7 Steering Arm L.H. | 21 Pin Cotter | 33 Support Assembly— |
| 8 Bolt | 22 Nut Slotted | Front Axle |
| 9 Cylinder L.H. | 23 Gasket | 34 Bearing |
| 10 Nut | 24 Hub Cap Assembly | 35 Pin—Pivot |
| 11 Washer | 25 Washer | 26 Pin |
| 12 Reaction Bracket, L.H. | 26 Cone and Roller | 37 Shim |
| 13 Seal | Assembly—Outer | 38 Centre Beam Assembly |
| 14 Bush | 27 Bolt—Wheel | 39 Nut and Washer |

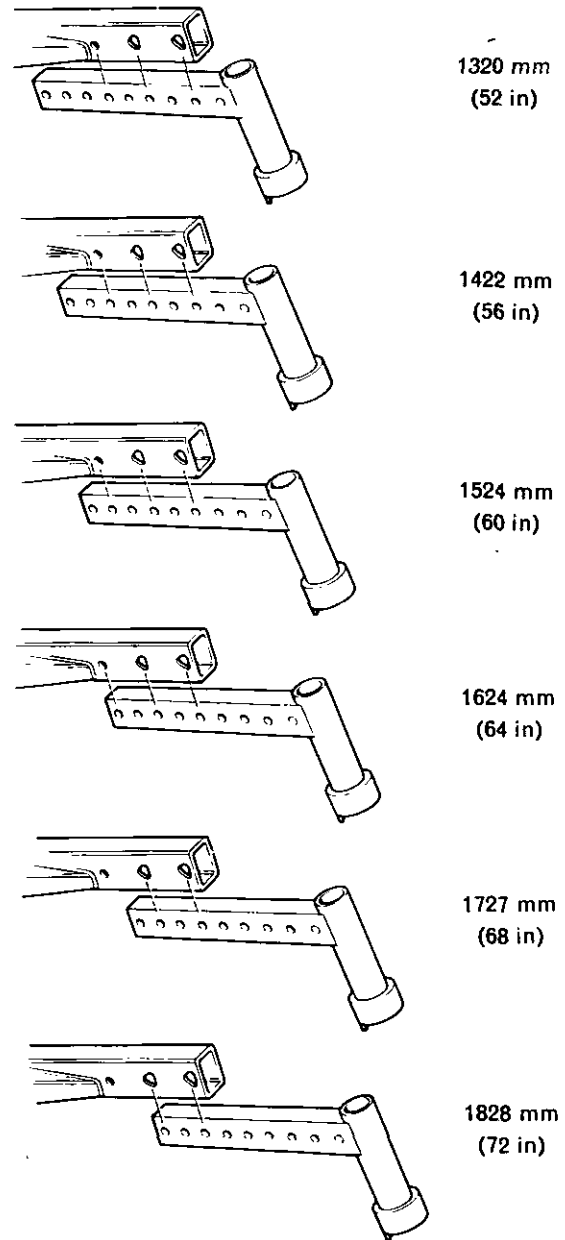
FRONT AXLE

FRONT TRACK

The front track is adjustable in 102 mm (4 in) steps from 1320 to 2032 mm (52 to 80 in).

For track settings of 1930 mm (76 in) and 2032 mm (80 in), reverse the front wheels and set the outer axles to 1727 mm (68 in) and 1828 mm (72 in) respectively.

NOTE: The 1930 mm (76 in) and 2032 mm (80 in) settings should only be used when absolutely necessary and never with front mounted equipment.



FRONT TRACK

Adjustment

7A-01-04

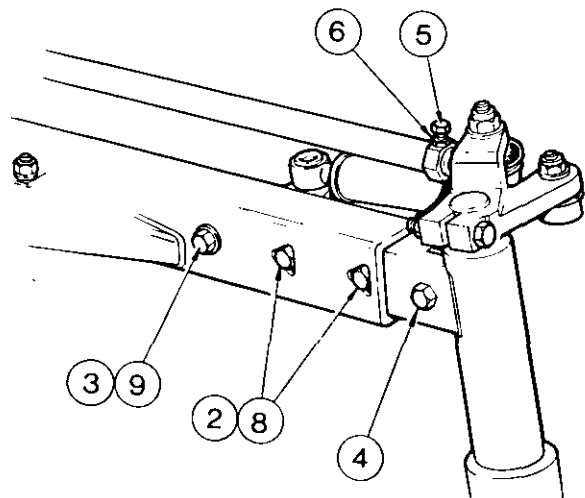
1. Jack up the front axle of the tractor.
2. Remove the two nuts and bolts securing each outer axle arm to the centre beam.
3. Remove the bolt, nut and washer.
4. Loosen the locknut and bolt.

NOTE: Do not remove the bolt securing each ram bracket to the outer axle arms.

5. Loosen the locknut.
6. Loosen the bolt.
7. Adjust the outer axle arms and ball ends to the required track setting.
8. Refit the bolts, nuts and washers ensuring that the bolt heads are correctly located in the triangular holes in the centre beam. Tighten the bolt to a torque of 215 Nm (150 lbf ft).
9. Refit the bolt, nut and washer and tighten to a torque of 70 Nm (50 lbf ft).

NOTE: These bolts are not used for settings above 1422 mm (56 in) but should be retained in the centre beam for use when reverting back to settings of 1422 mm (56 in) or less.

10. Tighten the bolt to a torque of 45 Nm (35 lbf ft) and then tighten the locknut.

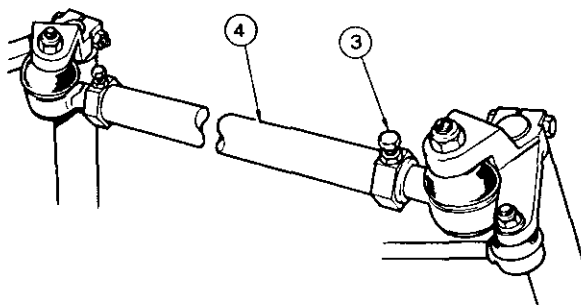


FRONT TRACK**Toe-in Adjustment**

7A-02-05

Special Tool: Track Gauge

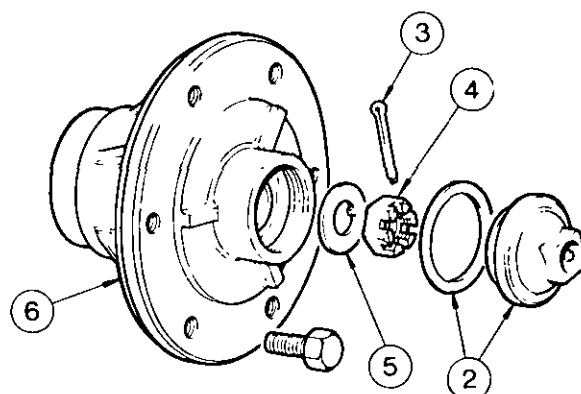
1. Locate the tractor on firm level ground and place the front wheels in a "straight forward" position.
2. Using a suitable track gauge, check the toe-in which should be 3,2 mm ($\frac{1}{8}$ in).
3. If adjustment is necessary, slacken the bolt and nut.
4. Rotate the tie rod tube clockwise or anti-clockwise to increase or decrease the toe-in as required.
5. Tighten the nut and bolt and recheck the setting.

**FRONT HUB****Servicing**

7A-03-05

Disassembly

1. Jack up the front of the tractor and remove the wheel.
2. Remove the hub cap and the gasket.
3. Remove and discard the split pin.
4. Remove the castellated nut.
5. Remove the washer.
6. Lift the hub complete with bearings and seal from the axle spindle.
7. Remove the outer bearing cone.
8. Remove the outer bearing cup.
9. Remove the seal.
10. Remove the inner bearing cone.
11. Remove out the inner bearing cup.
12. Remove the dust shield.

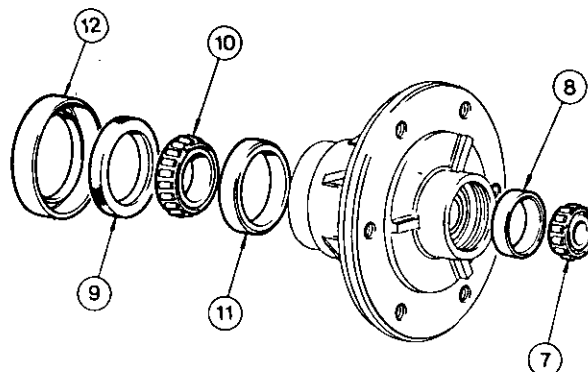
**Examination**

Thoroughly wash out old grease or dirt from the hub components using clean paraffin, check condition of hub, spindle and bearings.

Any worn or damaged components should be replaced.

Reassembly

13. Reverse procedures 1 to 12 except:
 - (a) Fit a new seal with the flat face towards the centre hub; and tap the seal right into the recess in the hub.
 - (b) Fit a new split pin.
 - (c) Fit a new gasket.
 - (d) Tighten the nut to a torque of 80 Nm (60 lbf ft) then slacken it off two flats to give the correct hub float.
 - (e) Tighten the wheel bolts to a torque of 80 Nm (60 lbf ft).



FRONT AXLE**SPINDLE SHAFT****Removal and Refitment**

7A-04-06

Removal

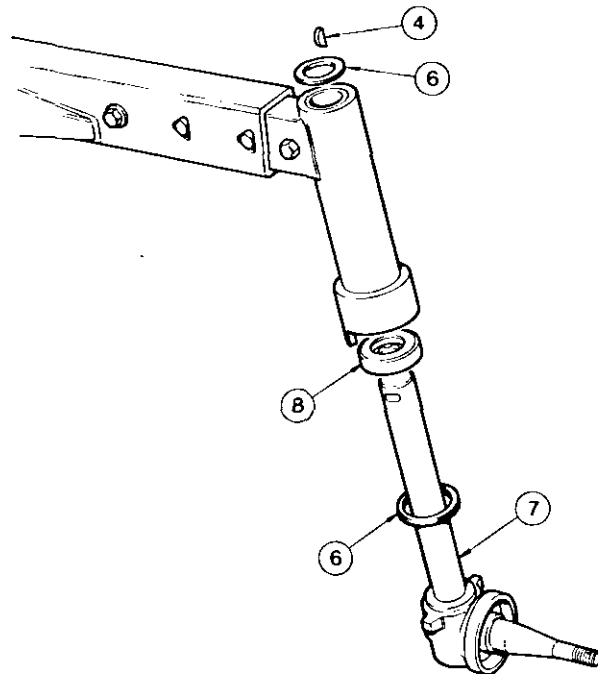
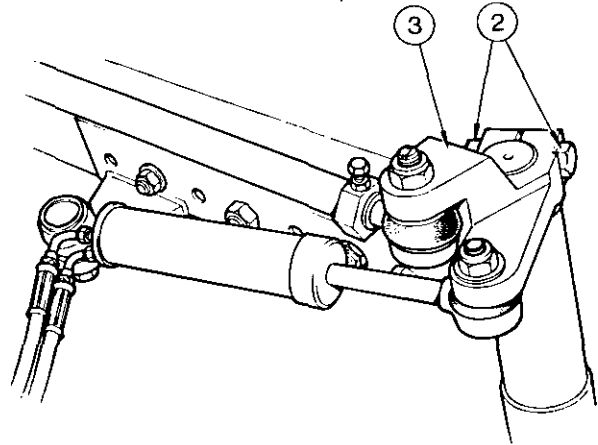
1. Remove the hub, operation 7A-03-05.
2. Remove the nut and bolt.
3. Detach the arm
4. Remove and discard the Woodruff key.
5. Remove the friction ring.
6. Remove the seal.
7. Lower the spindle shaft from the housing.
8. Remove the bearing.

Examination

Examine the spindle shaft bearing for wear or damage. When reassembling, use a new seal, key and replace the bearing if necessary (with the thrust face downwards).

Refitment

9. Reverse procedures 1 to 8 except
 - (a) Tighten the nut to a torque of 65 Nm (50lbf ft).



SPINDLE HOUSING**Servicing**

7A-05-07

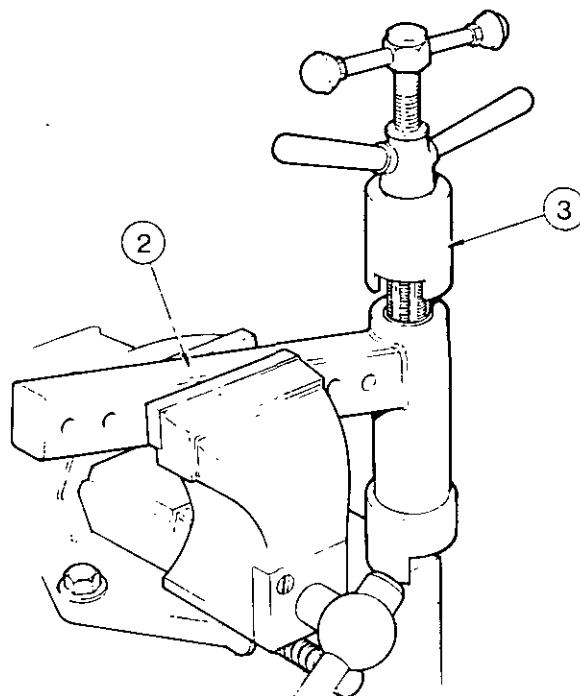
Special Tools: MF 263 Bush Remover
MF 263-2 Adaptor
MF 264 Reamer Handle
MF 19A Reamer
550 Universal Handle

Disassembly

1. Remove the outer axle arm, operation 7A-06-07.
2. Secure the outer arm in a vice.
3. Using MF 263 and MF 263-2, extract the bush by turning the lower handle.
4. Invert the outer arm and similarly extract the other bush.

Reassembly

5. Using the 550 handle and MF 263-2, drive in a new bush, invert the outer axle and similarly drive in the other bush.
6. Using MF 264 and MF 19A, ream the upper and lower bushes to size.
7. Remove all swarf from the housing by washing the housing in clean paraffin and ensure that the grease nipple hole is clear.
8. Refit the outer axle arm, operation 7A-06-07.

**OUTER AXLE ARM****Removal and Refitment**

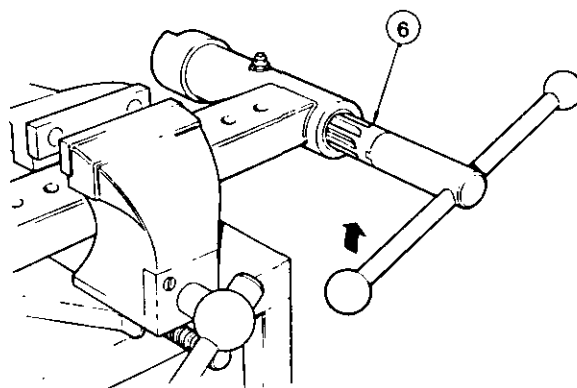
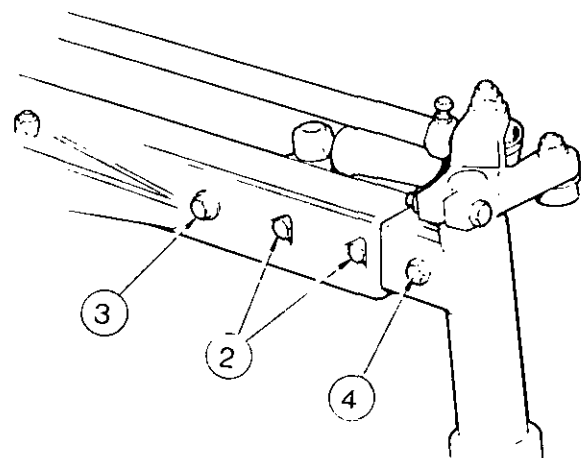
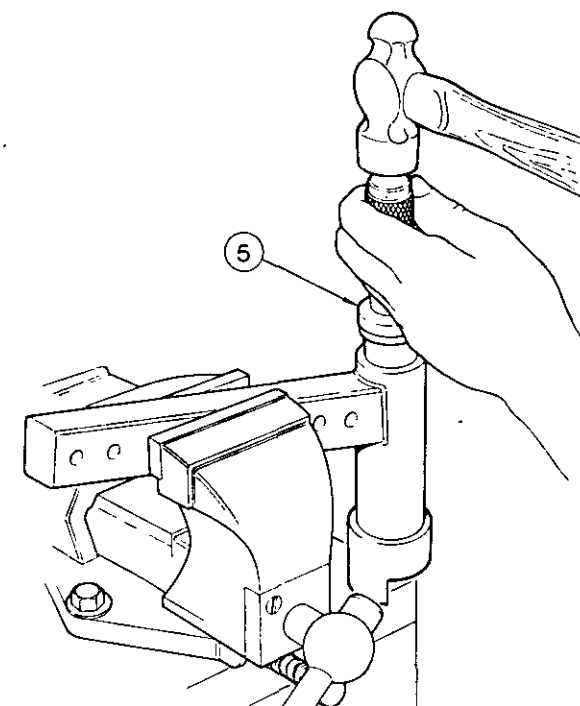
7A-06-07

Removal

1. Remove the spindle shaft, operation 7A-05-07.
2. Remove the two nuts and bolts.
3. Remove the nut, bolt and washer.
4. Remove the nut, bolt and washer.
5. Withdraw the axle arm.

Refitment

6. Reverse procedures 1 to 5 except:
 - (a) Tighten the axle to beam nuts to a torque of 215 Nm (160 lbf ft).
 - (b) Tighten the ram bracket to beam nuts to a torque of 65 Nm (50 lbf ft).



FRONT AXLE

BEAM ASSEMBLY

Removal and Refitment

7A-07-08

Removal

1. Remove the nose assembly, Part 2A.
2. Jack up the front of the tractor.
3. Remove both the outer axle arms, operation 7A-06-07 procedures 2, 3 and 5.
4. Remove the nut and pin.
5. With one operator each side supporting the beam remove the pivot pin.
6. Remove the beam, thrust washer and shims.

Examination

Check the end faces of the centre beam journals, the pivot pin and thrust washer for wear.

Examine all bores and threads for wear or damage. In the event of accident damage, check the beam for bending or twisting. If the beam has been in any way deformed, it must be replaced, as steering characteristics and tyre wear can be severely affected. Also the beam may have been dangerously weakened due to straining of the welded seams.

Refitment

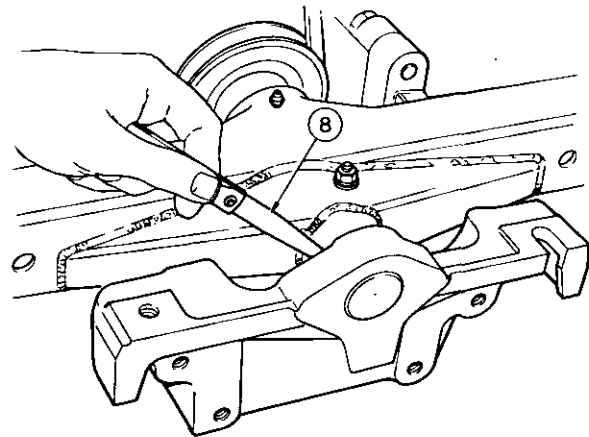
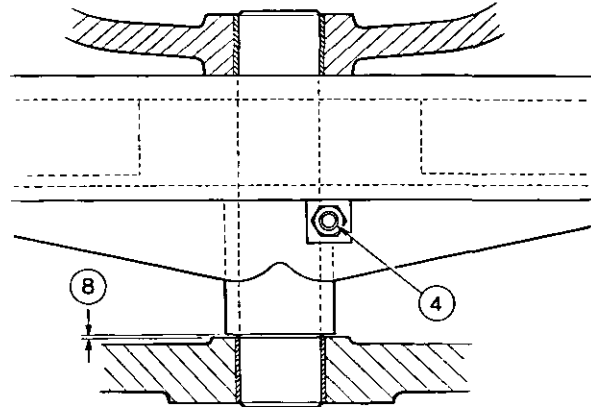
7. Place the beam in position on the axle support and fit the pivot pin.
8. Push the beam fully rearwards, then measure the end float using feeler gauges. If new shims are to be fitted, select from the table below. Select shims to give 0,05 to 0,25 mm (0-002 to 0-010 in).

PART NUMBER	SHIM THICKNESS	
	mm	in
1660 607 M1	0,86 to 0,91	0-034 to 0-036
1660 459 M1	0,99 to 1,04	0-039 to 0-041
1660 460 M1	1,12 to 1,17	0-044 to 0-046

To fit Shims:

Remove the pivot pin, fit shim(s) then refit the pivot pin with the locking pin hole aligned with the hole in the casting; and the thrust washer.

9. Reverse procedure 1 to 6 except:
 - (a) Fit a new locking pin, nut and washer.
 - (b) Apply a few drops of recommended sealant 'B' to the locking pin threads.
 - (c) Tighten the nut to a torque of 55 Nm (40 lbf ft).



FRONT AXLE SUPPORT**Removal and Replacement**

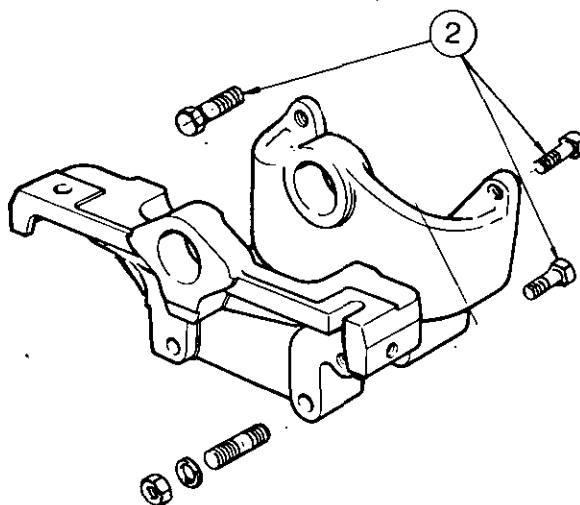
7A-08-09

Removal

1. Support the centre beam with a hoist, whilst the centre beam is in position on the front axle support.
2. Remove the three bolts retaining the front axle support assembly to the engine casing.
3. Manoeuvre the axle support free and lift clear.
4. Remove the beam, operation 7A-07-08.

Refitment

5. Reverse procedures 1 to 4.
Tighten the axle support casting bolts to a torque of 170 Nm (125 lbf ft).

**FRONT AXLE SUPPORT****Bush Removal and Replacement**

7A-09-09

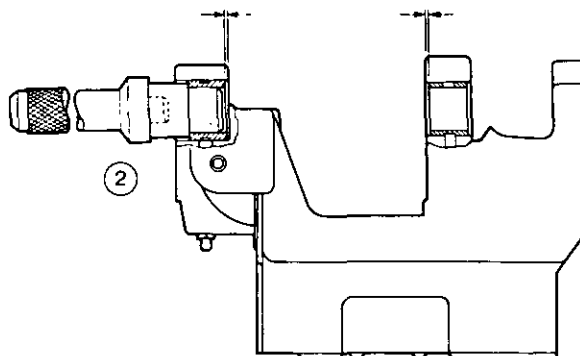
Special Tools: MF 322 Bush Remover and Replacer
550 Handle

Removal

1. Remove the centre beam, operation 7A-07-08.
2. Using MF 322 and 550, drive out the two bushes.

Refitment

3. Reverse procedures 1 and 2 except:
The bushes must be 0,508 mm (0.020 in) below the faces in the support adjacent to the centre beam.

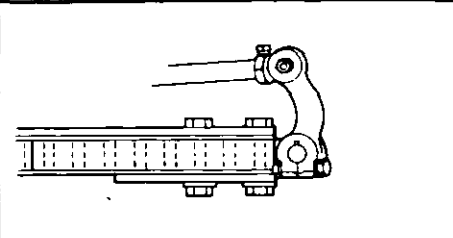
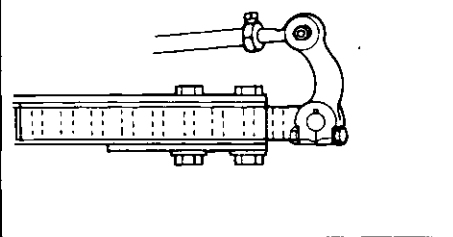
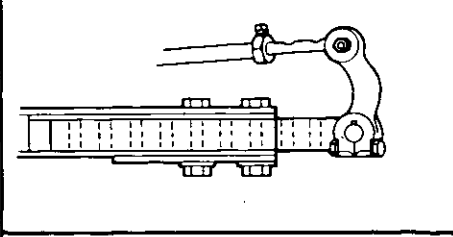
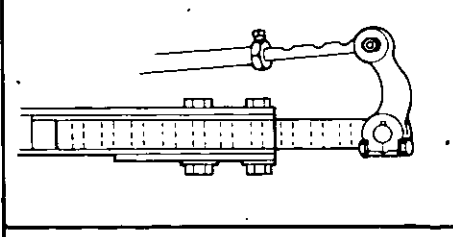
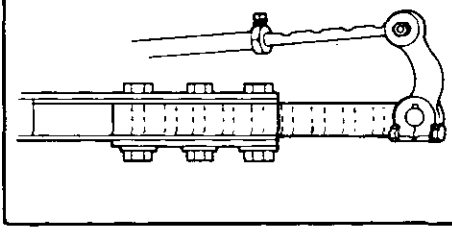


KEY TO FIGURE 1

- | | | | |
|-----------------------------------|---|----------------------|----------------------|
| 1 Circlip | 12 Shim .028"—.051" | 24 Nipple, Straight | 36 Hub Cap Assembly |
| 2 Arm, Main Steering | 13 Bush | 25 Arm | 37 Washer |
| 3 Seal | 14 Bolt | 26 Bush | 38 Bearing—Outer |
| 4 Shaft, Main Steering | 15 Adjuster | 27 Thrust Bearing | 39 Bearing—Inner |
| 5 Bolt | 16 Stem—Tie Rod | 28 Spindle, LH | 40 Drop Arm Assy. RH |
| 6 Bolt | 17 Nut—Nyloc | 29 Shield | 41 Arm |
| 7 Bolt | 18 Boot | 30 Seal | 42 Nut |
| 8 Support Assembly—
Front Axle | 19 Bolt $\frac{3}{8}$ "—24 UNF x $4\frac{1}{2}$ " | 31 Bearing Cup—Inner | 43 Thrust Washer |
| 9 Bush | 20 Key, Woodruff | 32 Hub Assembly | 44 Pin—Front Axle |
| 10 Screw | 21 Arm, Axle Spindle LH | 33 Cup—Outer | 45 Stud |
| 11 Seal | 22 Seal Dust | 34 Split Pin | 46 Bolt |
| | 23 Bush | 35 Nut Slotted | 47 Stud |

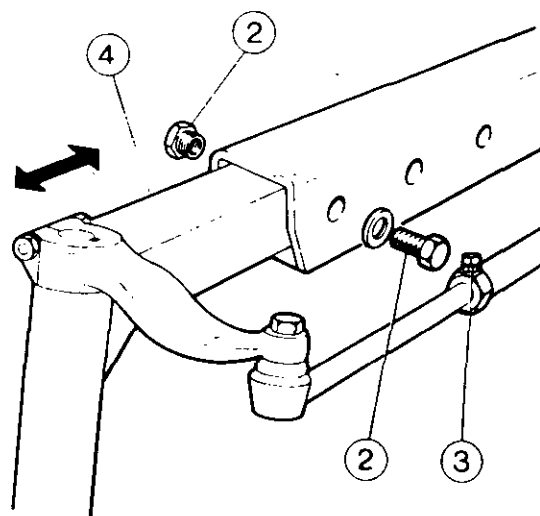
FRONT AXLE**FRONT TRACK**

The front track is adjustable in 102 mm (4 in) steps, as shown in Fig. 2.

	52" 1320 mm.
	56" 1422 mm.
	60" 1524 mm.
	64" 1625 mm.
	68" 1727 mm.

ADJUSTMENT PROCEDURE 7A-15-18

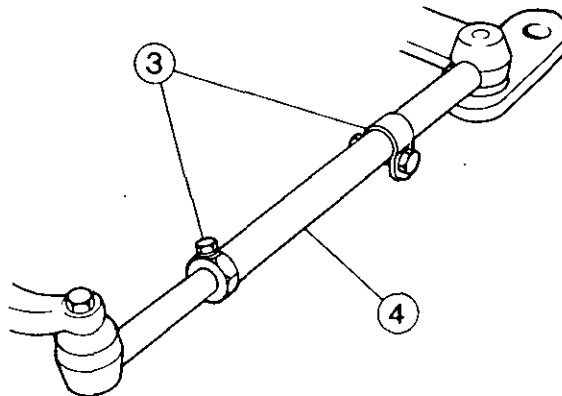
1. Jack up front axle of the tractor.
2. Remove the jamb nuts and bolts securing each front axle arm to centre member.
3. Remove bolt and nut.
4. Spread the outer axle arm and the telescopic tie rod to the required track setting.
5. Obtain partial engagement of the jamb nuts and bolts, then tighten the jamb nuts to 245 Nm (180 lbf ft) and then the bolts to 245 Nm (180 lbf ft).
6. Refit bolt and secure the lock nut, do not over tighten.



TOE-IN**Adjustment**

7A-16-19

1. Locate the tractor on firm level ground and place the front wheel in the "straight forward" position.
2. Using a suitable track gauge, check the toe-in which should be 3,2 mm ($\frac{1}{8}$ in).
3. If adjustment is necessary, slacken the bolt and nut.
4. Rotate the tie rod tube clockwise or anti-clockwise to increase or decrease the toe-in as required.
5. Retighten the nuts and bolts.

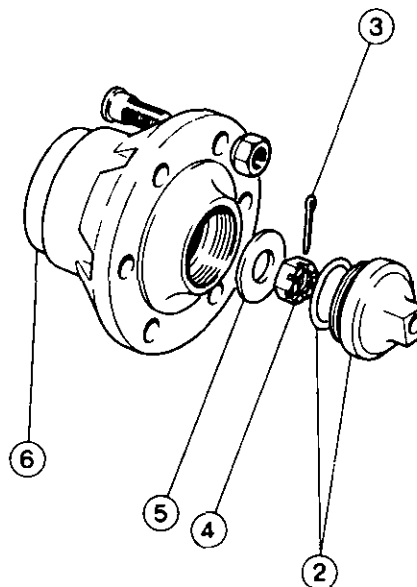
**FRONT HUB****Servicing**

7A-17-19

Special Tools Required: Torque wrench

Disassembly

1. Jack up front of the tractor and remove the wheel.
2. Remove the hub cap.
3. Remove and discard the split pin.
4. Remove the nut.
5. Remove the washer.
6. Lift the hub, complete with bearing and seal from the axle spindle.
7. Remove the outer bearing cone.
8. Tap out the outer bearing cup.
9. Remove the seal.
10. Remove the inner cone.
11. Drive out the bearing cup.
12. Remove the dust shield.

**Examination**

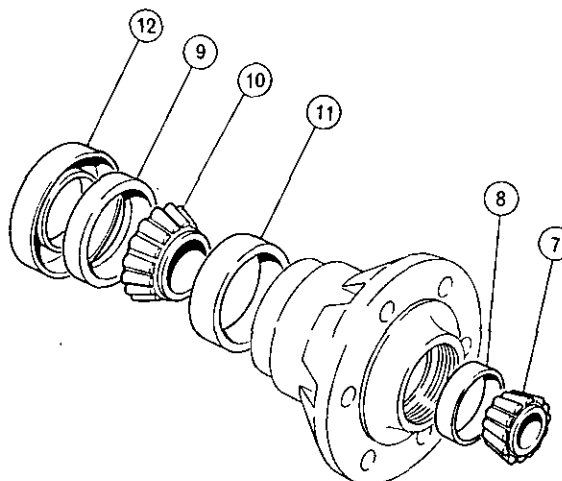
12. Thoroughly wash out the old grease or dirt from the hub components using clean paraffin, check conditions of the hub, spindle and bearings. Any worn or damaged components should be replaced. Always fit a new seal with flat face towards the centre hub and tap the seal right into the recess in the hub.

Fit a new split pin.

Reassembly

Reverse the procedure 1-11.

13. Tighten the nut to 80 Nm (60lbf ft) then slacken it off $1\frac{1}{2}$ flats to give correct hub float.



FRONT AXLE**SPINDLE SHAFT****Removal and Refitment**

7A-18-20

Removal

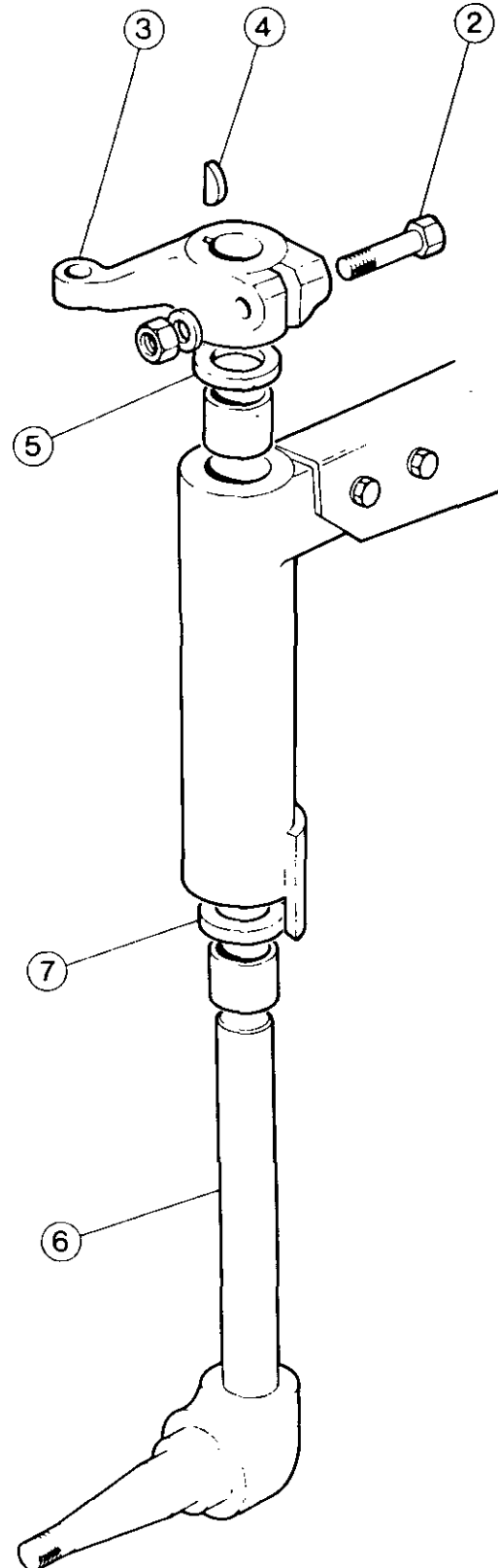
1. Remove the hub as stated in operation 7A-03-05.
2. Remove the nut, washer and bolt.
3. Detach the arm.
4. Remove and discard the key.
5. Remove the seal.
6. Lower the spindle shaft from the housing.
7. Remove the bearing.

Examination

8. Examine the spindle shaft bearing for wear or damage. When reassembling, use a new seal and replace the bearing if necessary (with the thrust face downwards).

Refitment

9. Reverse the procedure 1 to 7.
 - (a) A new key must be fitted.



SPINDLE HOUSING**Servicing**

7A-19-21

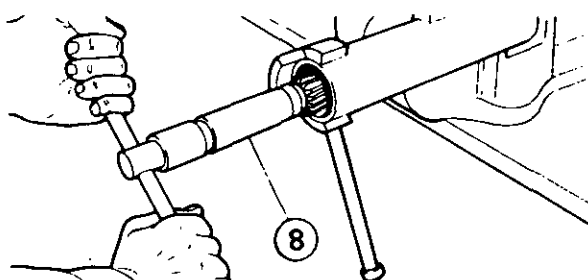
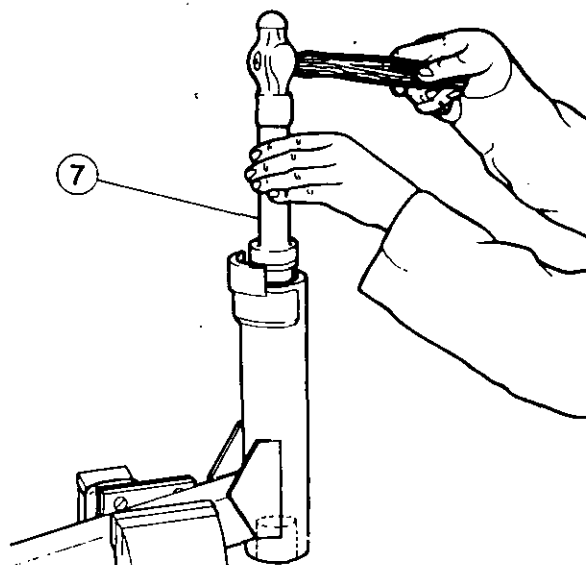
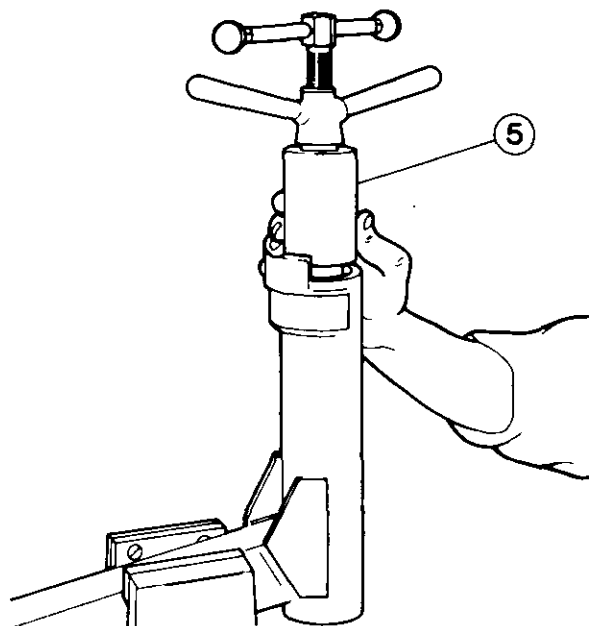
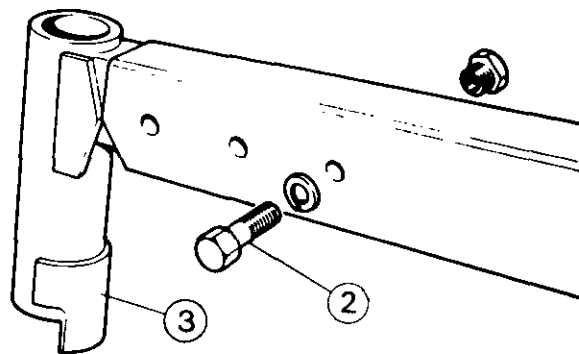
Special Tools Required: MF 263 Bush Remover
 MF 263-2 Adaptor
 MF 264 Reamer Handle
 MF 264 Reamer
 550 Universal Handle

Disassembly

1. Remove items 1 to 6 as stated in operation 7A-18-20.
2. Remove jamb outer nuts and bolts.
3. Remove outer arm.
4. Secure the outer arm in a vice.
5. Using MF 263 and MF 263-2 extract the bush by turning the lower handle.
6. Invert the outer arm and similarly extract the other bush.

Reassembly

7. Using the 550 handle and MF 263-2 drive in a new bush, invert the outer axle and similarly drive in the other new bush.
8. Using MF 264 Reamer Handle and MF 264 Reamer, ream the upper bush to size.
9. Fit the pilot MF 264- $\frac{1}{2}$ to the upper end of the reamer handle and the reamer MF 264-1 to the handle, then line ream the lower bush to size.
10. Remove all swarf from the housing by washing the housing in clean paraffin and ensure that the nipple hole is clear.
11. Reverse procedure 1-3.
 Noting: To obtain partial engagement of jamb nuts and bolts, then tighten the nuts to 245 Nm (180 lbf ft) and then the bolts to 245 Nm (180 lbf ft).
12. Refit wheels.



FRONT AXLE

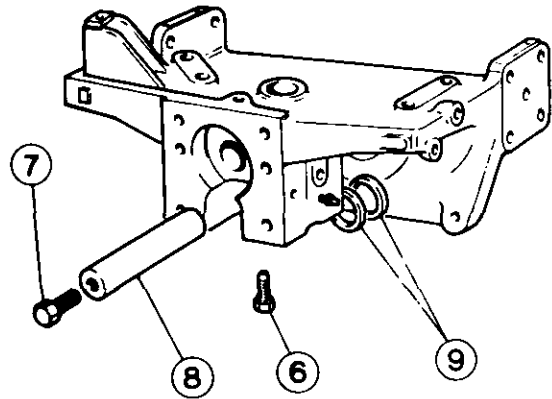
BEAM ASSEMBLY

Removal and Refitment

7A-20-22

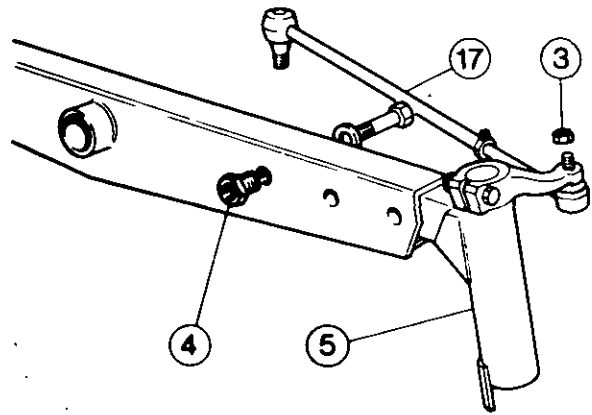
Removal

1. Remove the nose as stated in operation 2A-00-00.
2. Jack up the tractor under the sump.
3. Remove the nuts and release both tie rods.
4. Remove jamb nuts and bolts.
5. Withdraw the outer arm complete with wheel.
6. Remove the locknut and screw.
7. Fit a $\frac{7}{8}$ " UNC bolt into the pivot pin (to assist removal).
8. With one assistant each side supporting the beam, remove the pivot pin.
9. Remove the beam, thrust washer and shims.



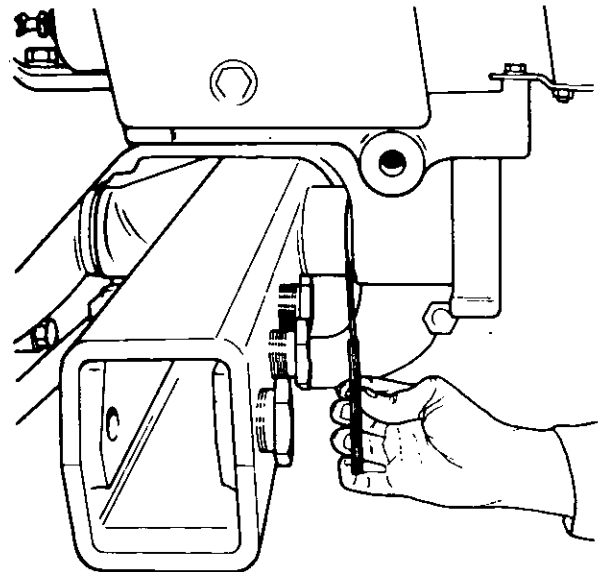
Examination

10. Check the end faces of the centre beam journals, the pivot pin and thrust washer for wear. Examine all bores and threads for wear or damage. In the event of accident damage, check the beam for bending or twisting. If the beam has been in anyway deformed, it must be replaced, as steering characteristics and tyre wear can be severely affected. Also the beam may have been dangerously weakened due to straining of the welded seams.



Refitment

11. Push the beam fully rearwards, then measure the end float using feeler gauges. If new shims are to be fitted, select shims from the table below. Select shims to give 0.8 to 0.24 mm. To fit shims: Remove the pivot pin, fit shim(s) then refit the pivot pin with the locking screw hole aligned with the hole in the casting, and thrust washer, remove the $\frac{7}{8}$ UNC bolt from the pivot pin.
12. Thoroughly degrease the tapped hole, the locking screw and locknut. Apply a few drops of either Loctite Grade AV (red) or Casco Metalock ML 15 to the screw, then refit the locknut and lockscrew, tightening the screw to 75 Nm (55 lbf ft) and locknut to 55 Nm (40 lbf ft).
13. Reverse procedure 1-5. Noting: (a) obtain partial engagement of the jamb nuts and bolts, then tighten the jamb nuts to 245 Nm (180 lbf ft) and then the bolts to 245 Nm (180 lbf ft).



PART NUMBER	SHIM THICKNESS	
	mm	in
898 018 M1	0,7 to 0,76	0-028 to 0-030
898 019 M1	0,86 to 0,91	0-034 to 0-036
898 020 M1	0,99 to 1,04	0-039 to 0-041
882 868 M1	1,12 to 1,17	0-044 to 0-046
882 869 M1	1,24 to 1,30	0-049 to 0-051

BEAM ASSEMBLY**Servicing**

7A-21-23

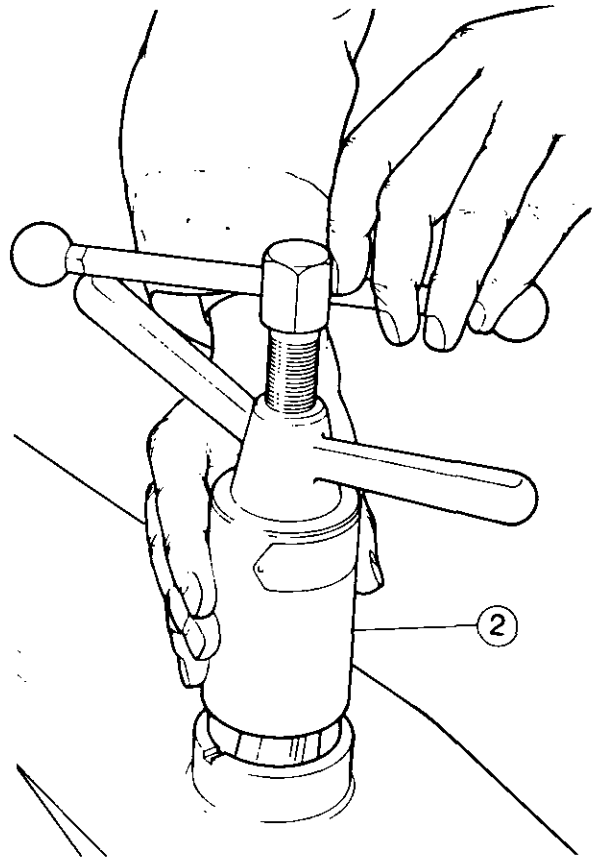
Special Tools Required: MF 263² Bush Remover
M 263-2 Adaptor
550 Universal Handle

Disassembly

1. Remove the beam as stated in operation 7A-20-22.
2. Using MF 263 and MF 263-2, extract the bush by turning the lower handle.
3. Invert the beam and similarly extract the other bush.

Reassembly

4. Drive in the new bush with the cut out positioned vertically and facing the top tube, with the adaptor MF 263-2/2.
5. Invert the beam and similarly fit the other bush.
6. Refit the beam as stated in operation 7A-20-22.

**AXLE SUPPORT CASTING****Removal and Refitment**

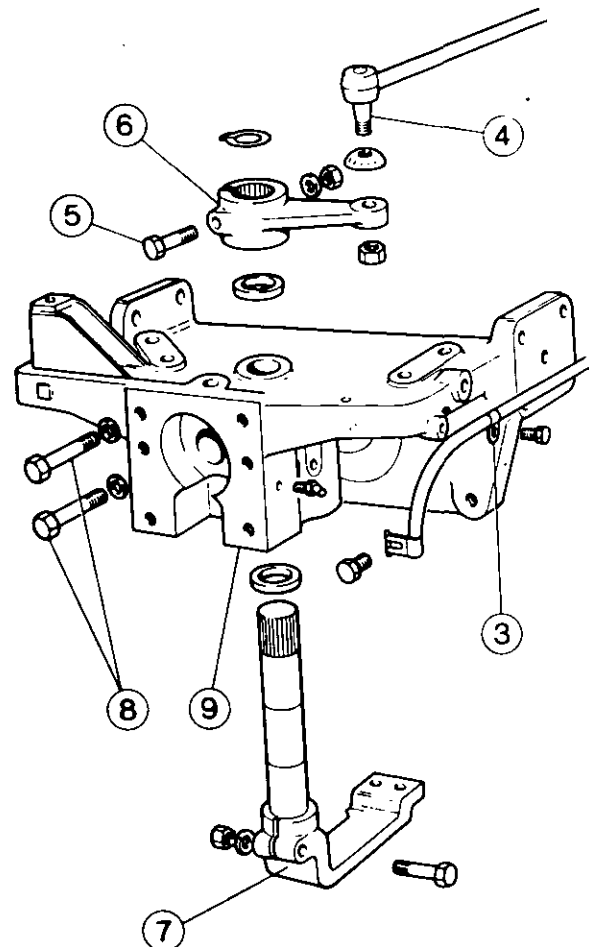
7A-22-23

Removal

1. Remove the beam as stated in operation 7A-20-22.
2. Remove the radiator as stated in operation 4B.
3. Remove the battery clip bolt.
4. Remove the nut and release the drag bar link.
5. Remove the bolt, nut and washer.
6. Remove the arm.
7. Withdraw the shaft and arm assembly complete with the tie rods.
8. Remove the nuts, bolts and washers.
9. Remove the axle support castings.

Refitment

10. Reverse procedure 1 to 9.
Noting. Axle support casting bolts to be torqued to 170 Nm (125 lbf ft). Steering linkage top arm bolt to be torqued to 120 Nm (90 lbf ft).



STEERING

Part 7—Section B

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GENERAL (MF 550 TRACTOR)

The hydrostatic steering system comprises a gear pump attached to the rear of the timing case, having a spur gear driven by the timing idler gear. The pump has an integral oil reservoir and supplies oil under pressure to an orbitrol steering hand pump mounted at the end of the steering column. Rotation of the steering wheel activates the spool valve contained within the orbitrol unit, allowing oil under pressure to flow through hoses to two double acting rams.

Each ram cylinder is mounted on a reaction bracket bolted to the centre axle beam.

The ram piston rod is attached to the steering arm keyed to the top of each axle spindle.

Rotation of the steering wheel causes movement of the spool valve to allow oil to flow under pressure to the appropriate side of each ram piston. Oil from the opposite side is expelled through the orbitrol pump back to the pump reservoir. A filter element is located within the reservoir.

GENERAL (MF 565, 575 & 590 TRACTORS)

The hydrostatic steering mechanism comprises a hydraulic ram engine driven pump, reservoir, steering hand pump and piping.

The hydraulic ram cylinder assembly is bolted to the ram arm pivot pin, the ram arm being splined to the main steering shaft. The piston rod is retained in the R.H. side of the front axle support casting by a pin fitted into the R.H. side of the front axle support casting.

The gear type oil pump is bolted to the engine timing case and is driven from the timing gears. The reservoir contains a micronic filter and is attached to the rear of the pump.

The Danfoss orbitrol steering hand pump is splined onto the end of the steering column. Hydraulic pipe connects the orbitrol unit to the steering ram and gear pump.

Oil is pumped from the reservoir via the micronic filter to the steering hand pump. Oil from the steering hand pump is fed to the cylinder at the appropriate side of the ram, determined by the steering wheel movement, and hydraulic force turns the road wheels in the direction required. Excess oil from the steering hand pump is returned to the reservoir.

The tractor can be manually steered if the power steering mechanism fails, or if the tractor is being moved without the engine running.

STEERING**STEERING SYSTEM (MF 550, 565, 575 and 590 TRACTORS)****System Bleeding 7B—01—02**

1. Fill the reservoir on the rear of the steering pump with clean steering oil to the filler plug level.
2. Replace the plug.
3. Start the engine and run it at 900 rev/min for thirty seconds.
4. Rotate the steering wheel in one direction, then in the other until each time a full lock is obtained.
5. Switch off the engine and refill the reservoir to the filler plug level.
6. Restart the engine and run it at 1200 rev/min.
7. Repeat procedure 4.
8. The relief valve can be heard functioning when the steering is on full lock. Keep the relief valve operating for ten seconds with the steering wheel on full lock in each direction.
9. Repeat procedure 8, three times.
10. Switch off the engine, check all unions for leaks. If there are any leaks, tighten the unions and repeat procedures 1 to 9.

STEERING PUMP (MF 550 TRACTOR)**Oil Level Checking 7B—02—02****Procedure**

1. Ensure the tractor is standing on level ground with the front wheels in the straight ahead position.
2. Remove the filler plug.
3. Fill the reservoir to the FULL level with the recommended fluid.
4. With the engine STOP control fully out, operate the engine starter motor to actuate the pump.
5. Refill the reservoir to the FULL level and replace the filler plug.
6. Start the engine and run at idling speed.
7. Turn the steering wheel from lock to lock several times to expel air from the system.
8. If necessary slacken the cap to assist in the bleeding of air.
9. Remove the filler plug and when fluid can be seen through the filler hole, to be returning to the reservoir free of air bubbles, retighten the cap.
10. Stop the engine, top up the reservoir and refit the filler plug.

**STEERING PUMP
(MF 565, 575 & 590 TRACTORS)****Oil Level Checking 7B—03—02****Procedure**

1. Start the tractor engine, turn the steering wheel one turn to left only.
2. Run the engine for thirty seconds before removing the filler plug and washer from reservoir. The oil level should be to the plug level.
3. If necessary, fill the reservoir with clean approved oil to the plug level.
4. Refit the plug. Restart the engine and run it for a further two or three minutes.
5. Remove the plug and recheck the oil level, adding more oil if necessary.
6. Tighten the plug to a torque of 12 Nm (9 lbf ft).

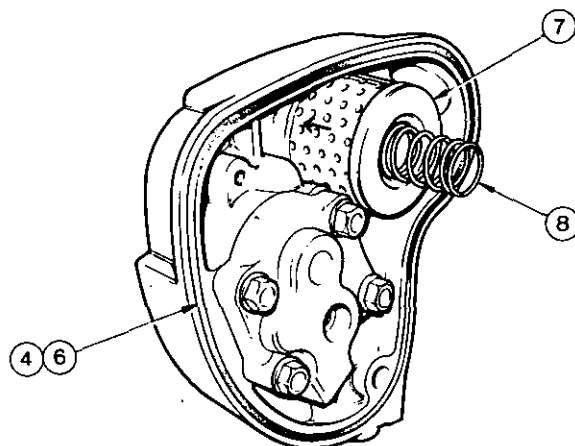
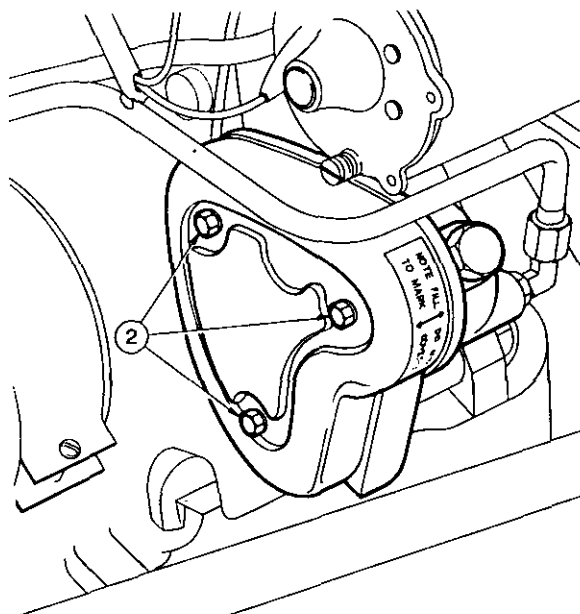
STEERING PUMP (MF 550 TRACTOR) Element Removal and Replacement 7B-04-03

Removal

1. Place a container beneath the pump body.
2. Remove the bolts and washers.
3. Remove the reservoir cover complete with the filter element and spring.
4. Remove the seating ring.

Replacement

5. Coat the outside edge of the new seating with petroleum jelly.
6. Fit sealing ring into recess.
7. Fit new filter element with the arrow pointing towards the pump body.
8. Locate spring in element recess.
9. Fit reservoir cover.
10. Compress the spring and tighten the securing bolts until the cover is in contact with the sealing ring, then tighten the bolts a further turn.
11. Refill the reservoir, operation 7B-03-02.



STEERING PUMP (Plessey) (MF 565, 575 & 590 TRACTORS)

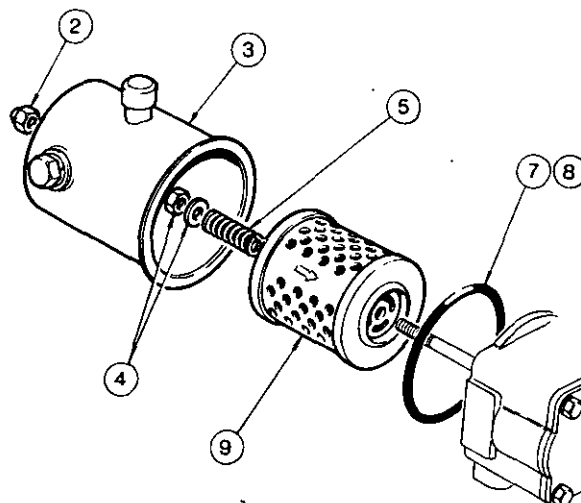
Element Removal and Replacement 7B-05-03

Removal

1. Place a suitable drain tray below the filter.
2. Remove the nut and sealing washer.
3. Remove the canister.
4. Remove the nut and washer.
5. Remove the spring.
6. Remove and discard the filter element then wash all components in clean paraffin and dry them with fluff free cloth.
7. Remove the sealing ring.

Replacement

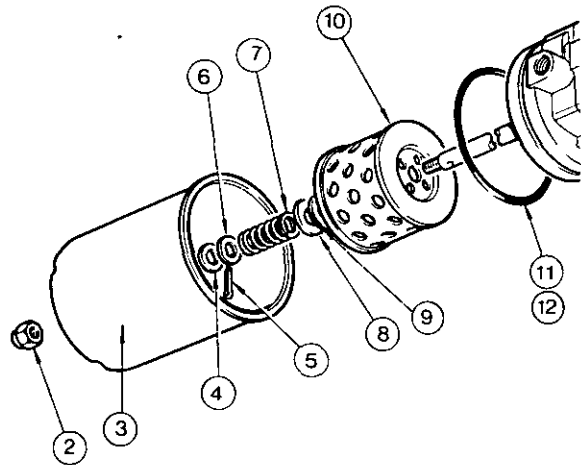
8. Fit a new sealing ring.
9. Fit a new filter element with the arrows pointing towards the pump body.
10. Reverse procedures 1 to 5 except:
 - (a) Tighten the canister retaining nut to a torque of 27 Nm (20 lbf ft).
11. Check the steering system oil level, operation 7B-03-02.



STEERING**STEERING PUMP (Aero-quip) (MF 565, 575 & 590 TRACTORS)****Element Removal and Replacement****Removal**

7B-06-04

1. Place a suitable drain tray below the filter
2. Remove the nut.
3. Remove the canister.
4. Remove the washer.
5. Remove the split pin.
6. Remove the washer.
7. Remove the spring.
8. Remove the washer.
9. Remove the seal.
10. Remove and discard the filter element, wash all components in clean paraffin and dry them with a fluff free cloth.
11. Remove the sealing ring if necessary.

**Replacement**

12. Fit a new sealing ring if necessary.
13. Fit a new filter element with the arrows pointing towards the pump body.
14. Reverse procedures 1 to 9 except:
 - (a) Tighten the canister retaining nut to a torque of 27 Nm (20 lbf ft).
15. Check the steering system oil level, operation 7B-03-02.

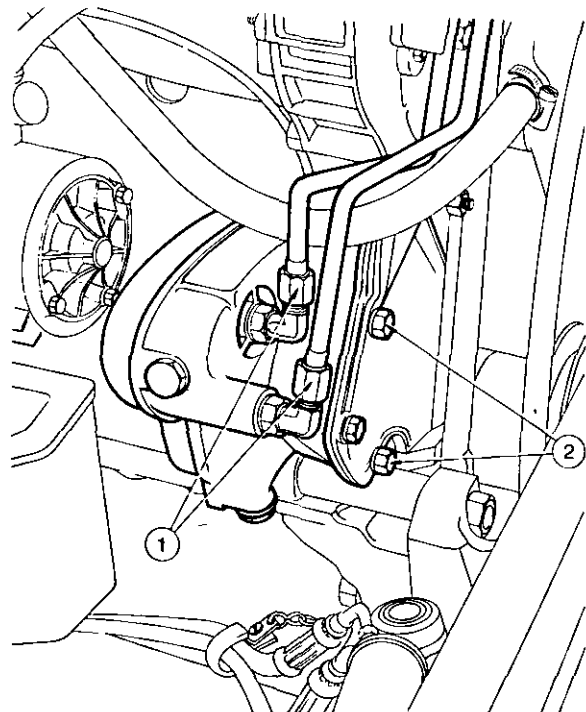
STEERING PUMP (MF 550 TRACTORS)**Removal and Refitment**

7B-07-04

1. Disconnect the pipes from the pump.
2. Remove the two bolts and washers.
3. Remove the pump.

Refitment

4. Reverse procedures 1 to 3 except:
 - (a) Tighten the two bolts to a torque of 27Nm (20 lbf ft).
5. Check the steering pump oil level, operation 7B-02-02.



STEERING PUMP (MF 565, 575 & 590)**Removal and Refitment**

7B-08-05

Removal

1. Disconnect the pipes from the pump.
2. Remove the two nuts, washers and bolts.
3. Remove the bolt.
4. Remove the pump.

Refitment

5. Reverse procedures 1 to 4 except:
 - (a) Tighten the nuts and bolt to a torque of 27 Nm (20 lbf ft).
6. Check the steering pump oil level, operation 7B-03-02.

STEERING PUMP (MF 550 TRACTOR)**Servicing**

7B-09-05

Disassembly

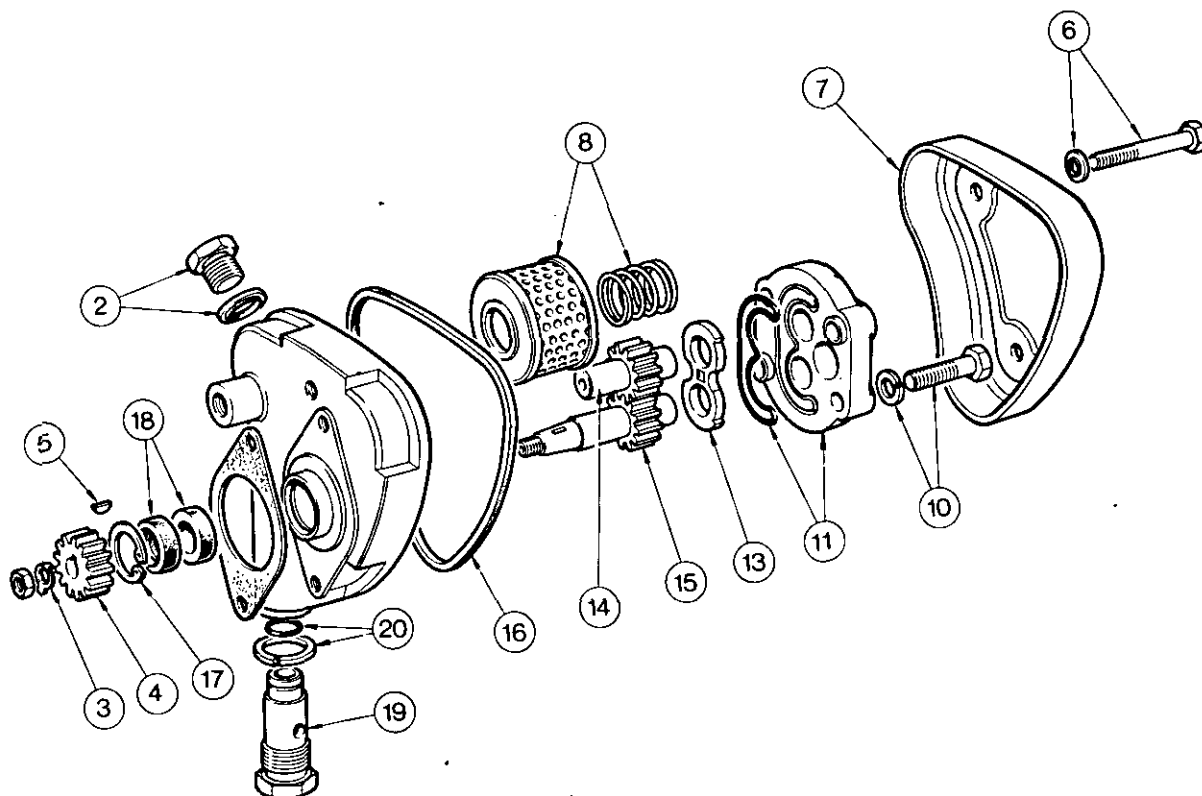
1. Remove the pump, operation 7B-00-00.
2. Remove the reservoir filler plug and washer; and drain the pump of oil.
3. Release the tabwasher and remove together with the nut.
4. Remove the gear.
5. Remove the key.
6. Remove the three bolts and washers.
7. Remove the reservoir cover.
8. Remove the spring and element.
9. Mark the cover body to facilitate reassembly.
10. Remove the four bolts and spring washers.
11. Remove the cover and sealing ring.
12. Mark the pressure plate to facilitate reassembly.
13. Remove the pressure plate.
14. Withdraw the driven gear.
15. Remove the drive gear.
16. Remove the reservoir sealing ring.
17. Remove the circlip.
18. Remove the duplex seals.
19. Remove the relief valve.
20. Remove the washer and sealing ring.

Examination

21. Examine all parts for wear, scoring or damage; and replace any defective components. Always fit new 'O' rings, seals, tab washer and key.

Reassembly

22. Reverse procedures 1 to 20 except:
 - (a) Fit a new washer to the relief valve.
 - (b) Tighten the relief valve to a torque of 54Nm (40 lbf ft).
 - (c) Pack the cavity between the seals and pump body with petroleum jelly.



STEERING**STEERING PUMP (Plessey)
(MF 565, 575 & 590 TRACTORS)****Servicing**

7B—10—06

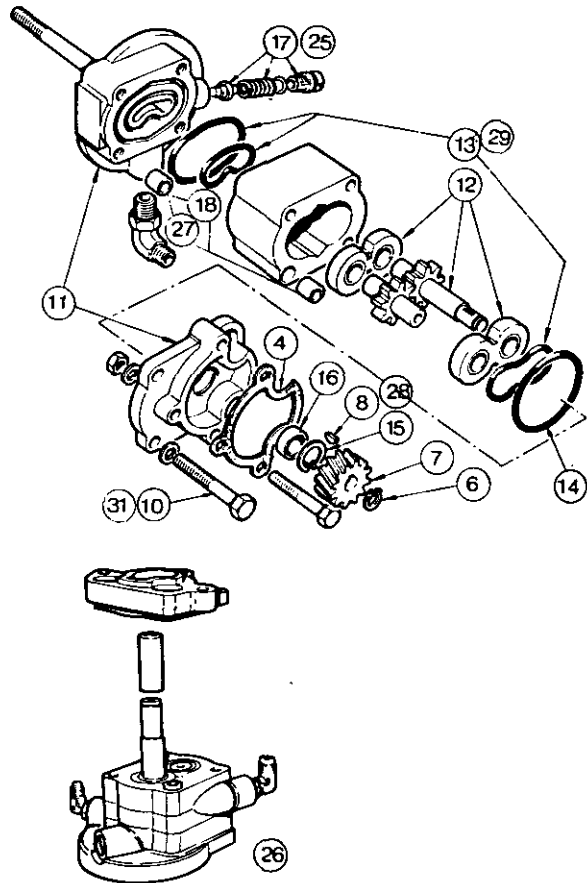
Special Tools: MF 148A Pressure Gauge
MF 148/11 Adaptor
MF 332 Seal Protector

Removal

1. Thoroughly clean the pump exterior.
2. Disconnect the pump feed and return pipes.
3. Remove the bolts securing the pump to the engine housing.
4. Remove the gasket.
5. Remove the filter element, operation 7B—05—03.
6. Remove the circlip.
7. Remove the gear.
8. Remove the key.
9. Mark the pump body and end plates to facilitate their correct refitment.
10. Remove the four bolts and spring washers.
11. Separate the pump end plates from the body.
12. Remove the drive and driven gears, and the two floating bearings.
13. Remove the inner and outer seals.
14. Remove the 'O' ring.
15. Remove the circlip.
16. Drive out the lip seal.
17. Remove the plug sealing washer, spring relief valve.
18. If necessary, remove the dowels.

Examination

19. Check the floating bearings for wear, both on the faces and in the bores. Pay particular attention to the condition of the lubricating scrolls and the portion of the bearing between the bearing bores. Score marks or damage at this point can cause very high leakage losses.
20. During servicing, the floating bearings should normally be replaced. However, if new bearings are not available, the existing bearings can be salvaged (if only lightly marked) by polishing as follows:—
 - (a) Place a sheet of 'O' grade emery paper lubricated with paraffin on a truly flat surface (e.g., surface plate or a piece of plate glass), then polish the surface, using a light circular motion. Check that the bearings can move freely in the pump body, if necessary, polishing the outside diameters of the bearings to ensure free movement. After polishing, thoroughly wash the bearings in clean paraffin to remove all traces of aluminium dust.
21. Visually check the pump body and end plates for signs of cracks or damage. Check the bores for wear, cracks or scoring. Due to the action of the oil pressure, the gears normally cut a track on the inlet side of the pump body bores. The depth of this track must not exceed 0,01 mm (0.004 in), otherwise the body must be replaced. The only salvage work possible on the pump body is to very carefully remove the burrs from the edge of the track, using fine emery cloth.



22. Inspect the gear teeth for scored, or worn faces or journals, damaged teeth, or surface scratches. Slight wear or scoring of the journals can be removed by polishing between lathe centres, using grade 'O' emery cloth lubricated with paraffin. Slightly scored gear faces can be salvaged by sandwiching emery paper between the gear face and a scrap bearing. Also check that the gear widths of the drive and driven gears, are within 0,005 mm (0-0002 in) of each other. If the gears cannot be reclaimed by light polishing, as described above, a pair of gears (only matched sets are supplied) must be fitted.
23. Always check that the gear faces are flat. This can be checked by lightly smearing a bearing face with 'Engineering Blue' and rotating the gear against the face. This will reveal any sharp edges on the teeth which can be removed with a fine cut needle file. Check the diameter of the journal on each gear. These must be within 0,013 mm (0.0005 in) of each other (per gear) for efficient operation.
Examine the reservoir for damage, particularly the retaining nut. Check that the 'O' ring sealing face is also undamaged.
24. Examine the relief valve and its seat for erosion, or damage if necessary, lightly re-lap the seat using fine lapping paste; then thoroughly flush out the seat and circlip valve.
36. ALTERNATIVELY fitting MF 148-11 and MF 148A to the front hose connection. Apply full lock (in either direction) with the engine running at 2000 rev/min. The gauge should indicate 105 to 112 kg/cm² (1500 to 1600 lb/in²). Adjust the regulator screw as necessary.
37. Stop the engine.
38. Disconnect MF 148A and MF 148-11 and re-connect the return pipe.
39. Check the oil level in the reservoir and replenish if necessary.

Reassembly

25. Refit the relief valve spring, sealing washer and plug.
26. Using MF 332 fit a new oil seal.
27. Slide the end plate into position, locating the dowels in their holes.
28. Fit the circlip.
29. Renew the inner and outer seals.
30. Assemble the drive and driven gears to the floating bearings with the relieved side of the floating bearings on the outlet side of the pump. To ensure correct sealing, measure the thickness of the assembled 'sandwich' of gears and bearings then measure the thickness of the pump body. The sandwich should be 0,01 to 0,20 mm (0-004 to 0-008 in) less than the body thickness.
31. Replace the four bolts and spring washers, remove MF 332.
32. Reverse procedure 1 to 6 omitting item 3.
 - (a) Tighten the four bolts to a torque of 41 Nm (30 lbf ft).
 - (b) Lightly coat the gasket in recommended sealant A.
 - (c) Tighten the pump securing bolts to a torque of 38 Nm (28 lbf ft).
33. Turn the steering wheel one turn to the left, refill the reservoir to the base of the filler hole. Start the engine and recheck the level, adding oil as required.
34. Keep the engine running at 2000 rev/min and the steering on full lock until the oil temperature is 50°C (120°F). Switch off the engine.
35. Using MF 810-4/1 and MF 148, screw the adaptor to the outlet port of the pump. Start the engine. The relief valve will discharge and should indicate a pressure of 105 to 112 kg/cm² (1500 to 1600 lb/in²). If the pressure is incorrect, adjust by turning the regulator thus:
 - Clockwise to increase pressure.
 - Anticlockwise to decrease pressure.

STEERING**STEERING PUMP (Aero-quip)
(MF 565, 575 & 590 TRACTORS)****Servicing**

7E—11—08

Special Tools: MF 148A Pressure Gauge
MF 148-11 Adaptor

Removal

1. Thoroughly clean the pump exterior.
2. Disconnect the pump-feed and return pipe.
3. Remove the bolts securing the pump to the engine housing.
4. Remove the pump.
5. Remove the filter element, operation 7B—06—04.
6. Remove the circlip.
7. Remove the washer.
8. Remove the external gear.
9. Remove the key.
10. Mark the pump body and end plates to facilitate their correct refitment.
11. Remove the four Allen bolts.
12. Separate the pump and front plate from the body tapping very gently with a plastic loaded hammer.
13. Remove the drive and driven gears complete with bearing blocks.
14. Carefully separate the bearing blocks, taking care not to lose the locating dowel.
15. Remove the 'O' rings from the end plates.
16. Remove the gaskets.
17. Drive out the shaft oil seals.
18. Remove the nut and washer.
19. Remove the screw.
20. Remove the spring.
21. Remove the valve seat.
22. Remove the valve body.
23. Remove the washer.
24. Remove the ball.
25. Remove the ball seat.
26. Remove the bush.

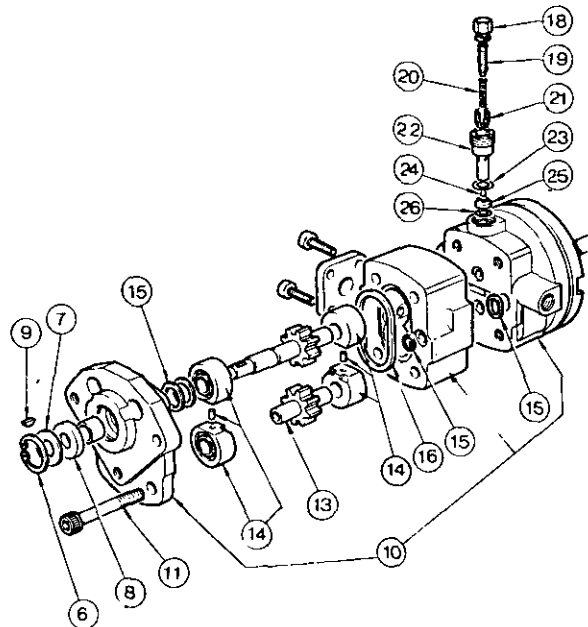
Examination

27. Clean all parts thoroughly.
28. Check bearing blocks for wear, both on faces and in the bores, replace the bearing blocks if they are worn.
29. If either of the pump gears show sign of wear or fracture, replace both gears.
30. Visually check the pump body, boxes and end plates for sign of wear.

Reassembly

31. Reverse procedures 1 to 26 except:
 - (a) Fit a new shaft oil seal.
 - (b) Fit new 'O' rings and gaskets.
 - (c) Refit the drive and driven gears complete with bearing faces, with the machined side towards the drive.
32. Remove the reservoir filler plug and ensure there is adequate oil in the system.
33. Run the engine until the oil temperature reaches 50°C (120°F).
34. Switch off the engine.
35. Disconnect the return pipe and fit the adaptor MF 148-11.
36. Connect MF 148A to the adaptor union.
37. Run the engine at 2000 r.p.m.
38. Adjust the regulator until a pressure of 105 to 112 kg/cm² (1500 to 1600 lb/in²) is obtained. If the pressure is incorrect, adjust by turning the regulator thus:
 - Clockwise to increase pressure.
 - Anticlockwise to decrease pressure.

39. Run the engine and check the indicated pressure at which the relief valve operates.
40. Stop the engine.
41. Disconnect MF 148A and MF 148-11.
42. Reconnect the return pipe.
43. Check the oil level in the reservoir and replenish if necessary.



STEERING WHEEL (MF 550, 565, 575 & 590 TRACTORS)

Removal and Refitment 7B-12-09

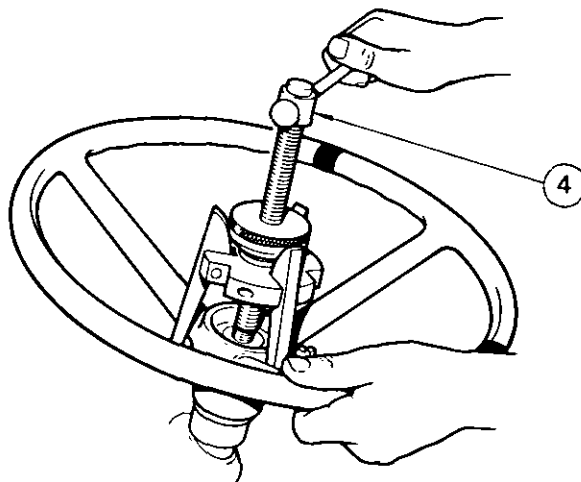
Special Tool: MF 268 Steering Wheel Remover

Removal

1. Ensure that the front wheels are set straight ahead.
2. Detach the motif cap from the centre of the steering wheel.
3. Remove the nut.
4. Using MF 268, detach the steering wheel.

Replacement

5. Reverse procedures 1 to 4 except:
 - (a) Ensure that the splines in the steering wheel, mesh correctly with those in the steering column.
 - (b) Tighten the nut to a torque of 58 Nm (43 lbf ft).



STEERING COLUMN (MF 550 TRACTOR)

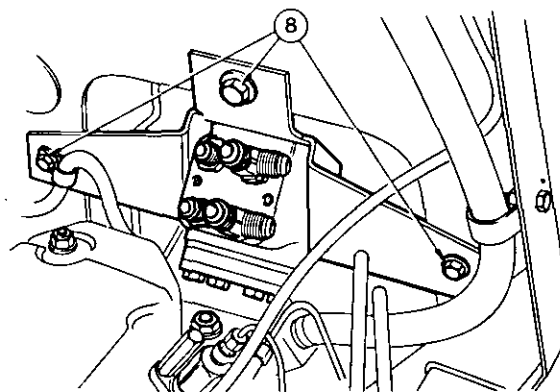
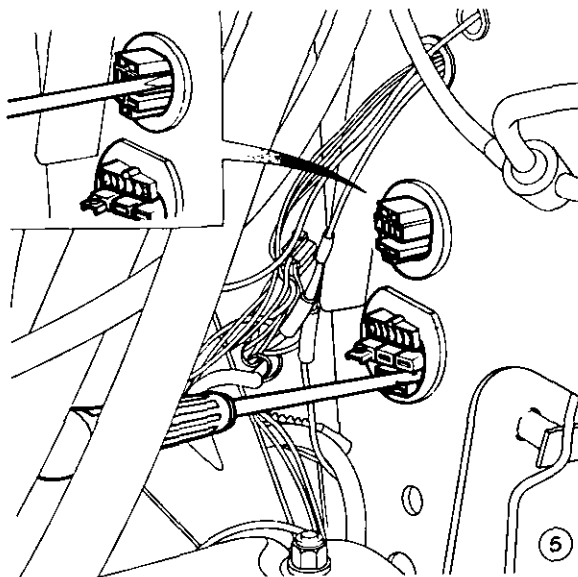
Removal and Refitment 7B-13-09

Removal

1. Disconnect the battery.
2. Remove the steering hand pump, operation 7B-19-00.
3. Remove the steering wheel, operation 7B-12-09.
4. Remove the instrument panel cowling Part 2B.
5. Push the bulkhead block connectors into the cab.
6. Disconnect the STOP lead.
7. Remove the split pin from the Multipower lever.
8. Remove the orbitrol bracket retaining bolts.
9. Disconnect the U-clamp.
10. Lower the steering column to clear the instrument panel hole.
11. Manoeuvre the instrument panel to the right and lift the steering column through the gasket.

Refitment

12. Reverse procedures 1 to 11.



STEERING**STEERING COLUMN
(MF 565, 575, & 590 TRACTORS)****Removal and Refitment**

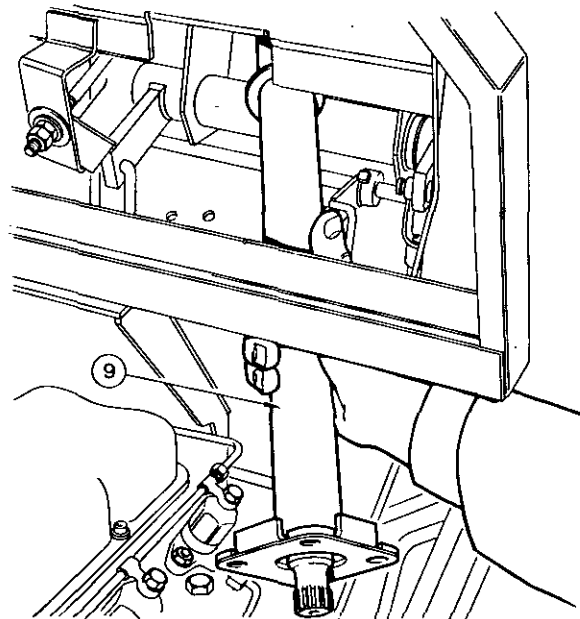
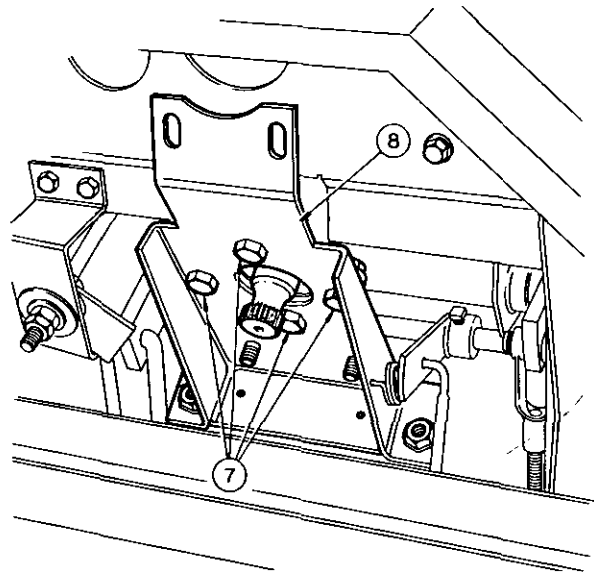
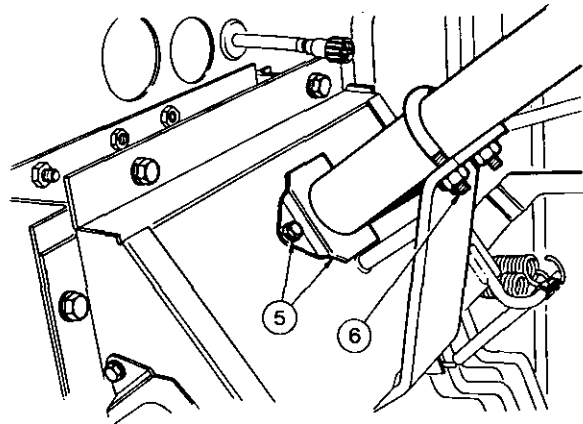
7B-14-10

Removal

1. Disconnect the battery, Part 9.
2. Remove the steering hand pump, operation 7B-20-14.
3. Remove the steering wheel, operation 7B-12-09.
4. Remove the instrument cowling, Part 2B.
5. Remove the bolt and seal retainer.
6. Remove the U clamp.
7. Remove the four bracket retaining bolts.
8. Remove the bracket.
9. Withdraw and remove the steering column downwards.

Refitment

10. Reverse procedures 1 to 9.



HYDROSTATIC STEERING CYLINDER (MF 550 TRACTOR)

Removal and Refitment

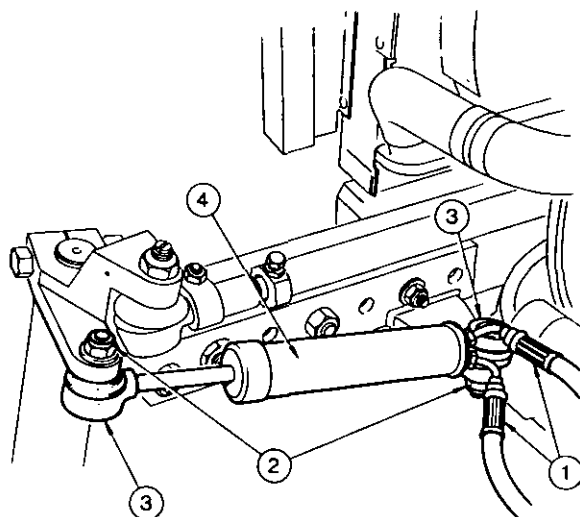
7B-15-11

Removal

1. Disconnect the two hoses.
2. Remove the nuts.
3. Release the two ball ends.
4. Remove the steering cylinder.

Refitment

5. Reverse procedures 1 to 4 except:
 - (a) Tighten the nuts to a torque of 115 Nm (85 lbf ft).



HYDROSTATIC STEERING CYLINDER (MF 565, 575 & 590 TRACTORS)

Removal and Refitment

7B-16-11

Special Tools: PD 1C Puller
MF 334 Adaptor

Removal

1. Remove the front and side panels Part 2B.
2. Remove the battery and shelf assembly Part 9A.
3. Label each hydrostatic steering hose to facilitate correct refitment.
4. Remove the hydrostatic steering hoses from the top of the steering cylinder; and blank off the open ends of the hoses and cylinder ports with suitable plugs.
5. Remove the cotter pin securing the steering cylinder pin to the front axle support casting.
6. Using PD 1C and MF 334, extract the cylinder pin.
7. Remove the snap ring.
8. Remove the nut, washer and bolt.
9. Remove the piston rod from the front axle support casting.
10. Lift the ram cylinder complete with the main steering arm off the main steering shaft splines.
11. Remove the two bolts, washers, nuts and pin; and detach the cylinder from the main steering arm.

Refitment

12. Reverse procedures 1 to 11 except:
 - (a) Tighten the two cylinder clamp nuts to a torque of 65 Nm (48 lbf ft).
 - (b) Tighten the main steering arm clamp nut to a torque of 115 Nm (85 lbf ft).
 - (c) Fit a new cotter pin to the cylinder pin.

STEERING**HYDROSTATIC STEERING CYLINDER
(MF 550)****Servicing**

7B—17—12

Disassembly

1. Remove the steering cylinder, operation 7B—15—11.
2. Clean the outside of the cylinder.
3. Unscrew the gland nut.
4. Withdraw the piston and inner tube assemblies.
5. Remove the copper washer.
6. Withdraw the piston from the inner tube.
7. Remove the roll pin.
8. Unscrew the ball end.
9. Remove the gland nut.
10. Remove the seal.
11. Remove the washer.
12. Remove the 'O' ring.
13. Remove the seal.
14. Remove the rod guide.
15. Remove the piston rings.

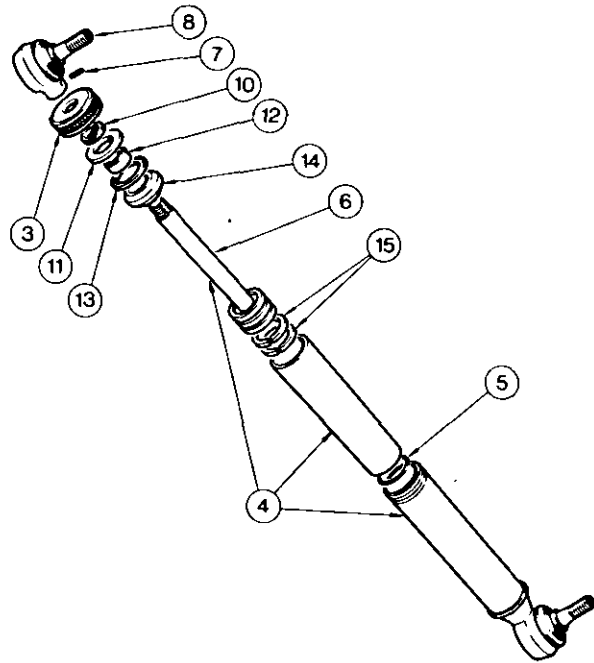
Examination

16. Examine all components for wear, scoring or damage. Replace any defective parts.
17. When reassembling, always fit new seals, 'O' rings, roll pins and copper washer.

Reassembly

18. Reverse procedures 1 to 15.

NOTE: If replacing the piston rod or the ball end, the piston rod or the ball end will have to be drilled 3 mm ($\frac{1}{8}$ in) to accept the roll pin.



HYDROSTATIC STEERING CYLINDER (MF 565, 575 & 590 TRACTORS)

Servicing

7B-18-13

Special Tools: 'C' Wrench

Disassembly

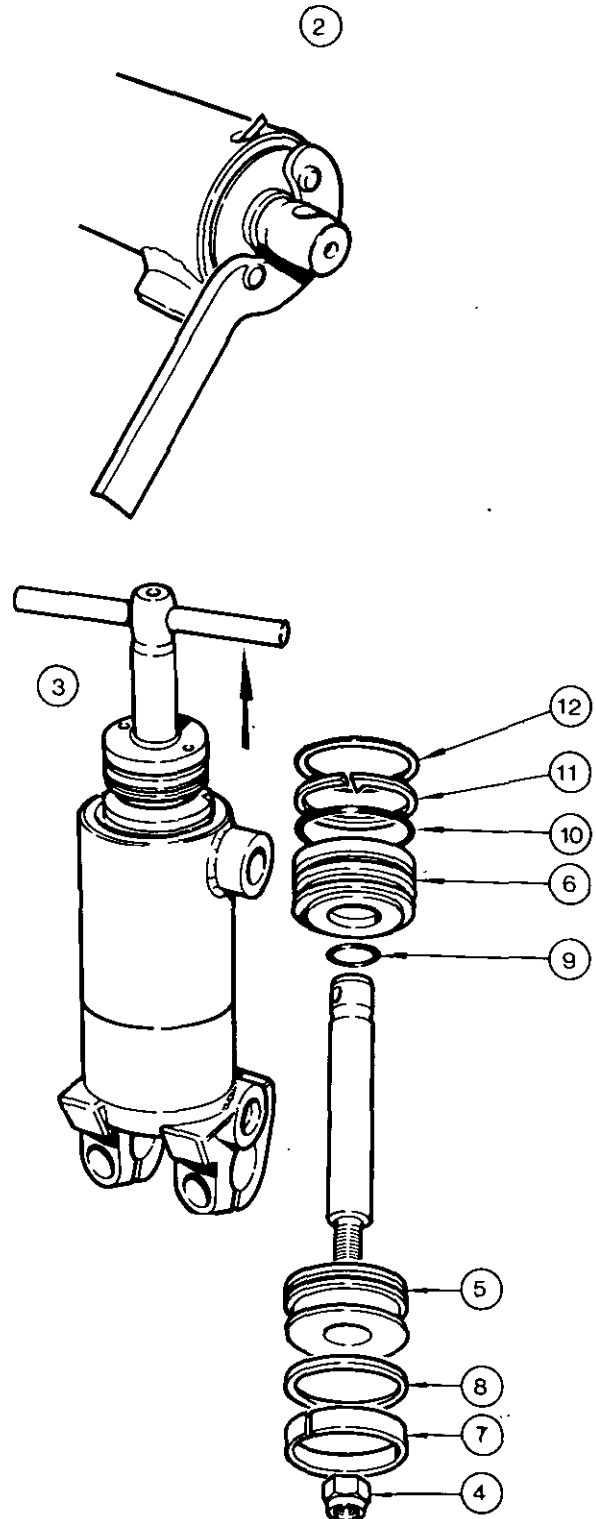
1. Remove the hydrostatic steering cylinder, operation 7B-16-11.
2. Using a 'C' wrench which has its peg centres 50 mm apart, the retainer ring by rotating the wiper seal in a clockwise direction.
3. Using a suitable bar, withdraw the piston rod complete with the piston wiper seal assemblies.
4. Remove the nut.
5. Remove the piston assembly.
6. Remove the wiper seal assembly.
7. Remove the wear ring.
8. Remove the friction ring.
9. Remove the inner 'O' ring.
10. Remove the large 'O' ring.
11. Remove the back-up ring.

Examination

12. Examine all components for wear, or damage and replace all defective parts. Always fit new 'O' rings and Nylock self locking nut.

Reassembly

13. Reverse procedures 1 to 12 except:
 - (a) The spiral back-up ring is fitted to the rear of the 'O' ring.
 - (b) Tighten the nut to a torque of 441 Nm (325 lbf ft).

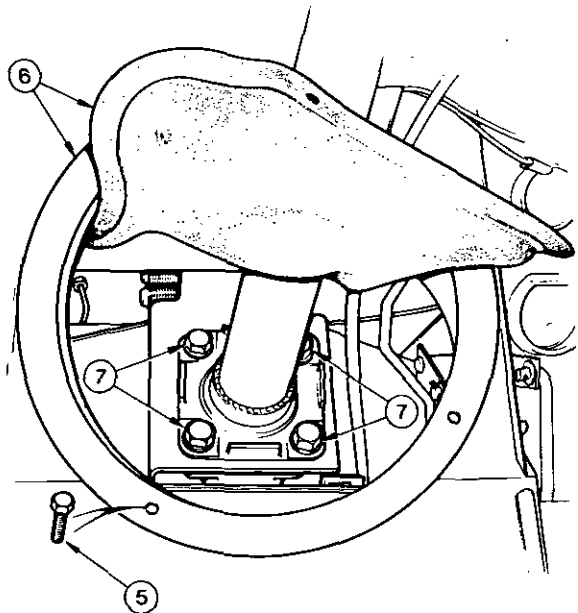


STEERING**STEERING HAND PUMP (MF 550 TRACTOR)****Removal and Refitment 7B-19-14****Removal**

1. Remove the hood, Part 2B.
2. Mark, and disconnect all hose connections to the steering hand pump.
3. Blank off the open ends of the hoses and elbows with suitable plugs.
4. Remove the instrument cowl, operation 2B-27-16.
5. Remove the six seal retaining plate screws.
6. Slide the seal and plate up the steering column, thereby providing access to the rear orbitrol bracket.
7. Whilst an assistant supports the steering hand pump, remove the four bolts.
8. Remove the steering hand pump off the steering shaft splines.

Refitment

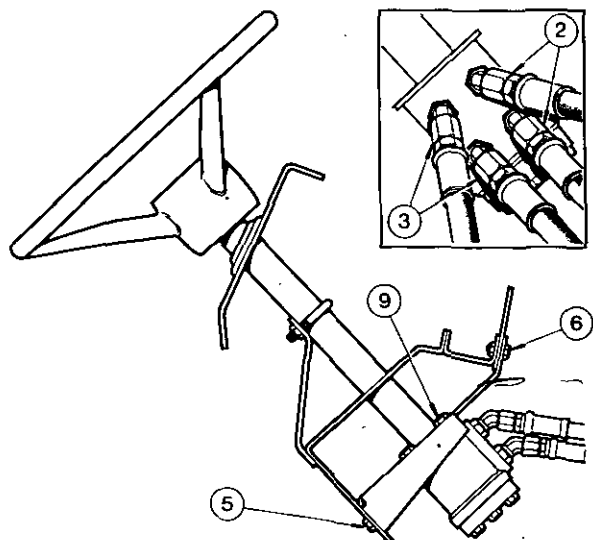
9. Reverse procedures 1 to 8.
10. Tighten the four bolts to a torque of 39 Nm (29 lbf ft).
11. Fill the steering pump reservoir with clean steering oil and carry out the System Bleeding operation 7B-01-02.

**STEERING HAND PUMP (MF 565, 575 & 590 TRACTORS)****Removal and Refitment 7B-20-14****Removal**

1. Remove the hood Part 2B.
2. Mark, and disconnect the left and right hand hose connections.
3. Mark, and disconnect the in and out hose connections.
4. Blank off the open ends of the hoses and elbows with suitable plugs.
5. Remove the two nuts.
6. Supporting the steering hand pump, remove the two bolts from the steering bracket.
7. Lower the steering hand pump clear of the steering column splines.
8. Manoeuvre the pump clear of the steering bracket assembly.
9. Remove the four bolts.

Refitment

10. Reverse procedures 1 to 9.
11. Tighten the four bolts to a torque of 43Nm (32 lbf ft).
12. Fill the Power Steering pump reservoir with clean steering oil and carry out the System Bleeding operation 7B-01-02.



STEERING HAND PUMP (MF 550, 565, 575 & 590 TRACTORS)

Servicing

7B-21-15

Special Tools: MS 62 'O' Ring and Kin Ring Fitting Tool
MS 63 Spring Fitting Tool

Disassembly

NOTE: This operation must be carried out in scrupulously clean conditions.

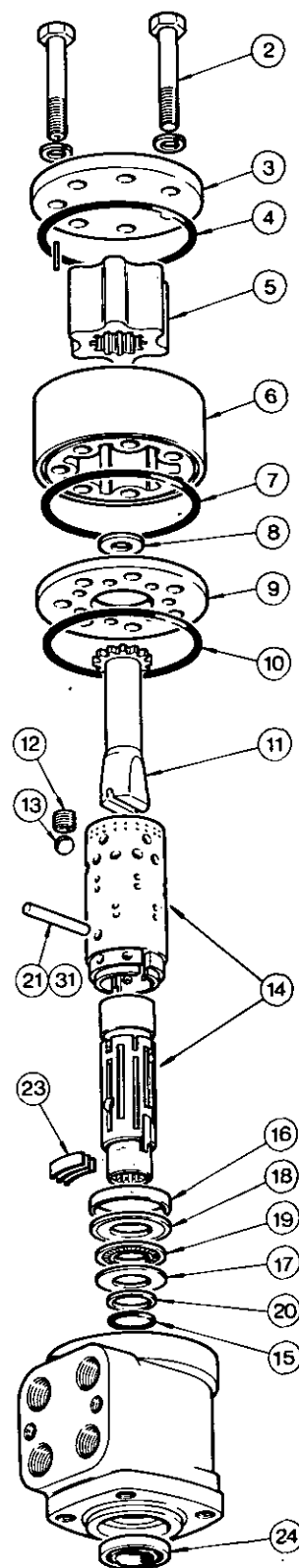
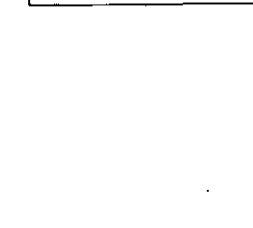
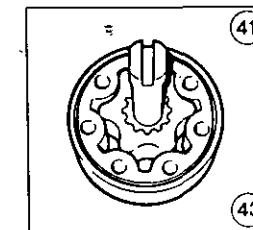
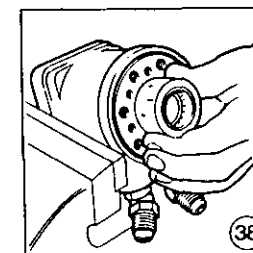
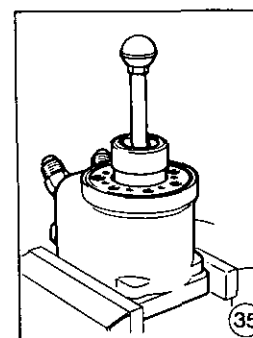
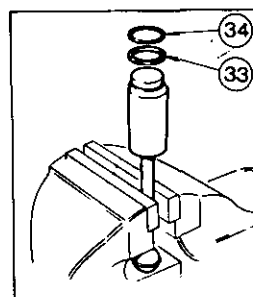
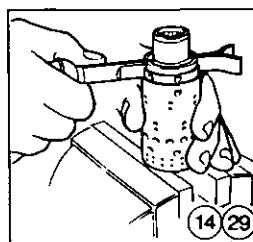
1. Remove the hand pump, operation 7B-19-14 for MF 550 Tractor, and operation 7B-20-14 for MF 565, 575 and 590 Tractors.
2. Mount the hand pump in a vice, then remove the seven bolts.
3. Lift off the end plate.
4. Remove the 'O' ring.
5. Lift off the rotor.
6. Lift off the stator.
7. Remove the 'O' ring.
8. Remove the spacer washer.
9. Lift off the valve plate.
10. Remove the 'O' ring.
11. Withdraw the drive shaft.
12. Remove the threaded insert.
13. Remove the ball.
14. Slide the spool and sleeve assembly out of the body.
15. Remove the 'O' ring off the spool.
16. Remove the kin ring from the valve body.
17. Slide the outer thrust washer off the spool.
18. Remove the inner thrust washer.
19. Slide the needle bearing off the spool.
20. Slide the kin ring off the spool.
21. Press out the cross pin from the spool and sleeve.
22. Very carefully slide the spool out of the sleeve.
23. Push out the six plate springs from the cross slot in the spool.
24. Carefully lever out the upper seal from the top of the body.

Examination

25. Carefully clean all components in a degreasing solvent, then examine all components for wear or damage.
26. If either the spool, sleeve or body is scored, the whole pump must be replaced. The only components which are serviced are the 'O' rings, kin ring and the upper seal.

Reassembly

27. Before reassembly, lubricate all components with clean steering oil.
28. Carefully slide the spool into the sleeve, with the centering spring slots aligned.
29. Push MS 63 through the centering spring slot, then fit the six centering springs to the slot in the end of MS 63.
30. Carefully push the springs into the slot in the spool and sleeve until they are central, then withdraw MS 63.
31. Refit the cross pin to the sleeve and spool assembly.
32. Reverse procedures 15 to 20.
33. Fit the kin ring to MS 62
34. Fit the 'O' ring to MS 62.



STEERING

35. Place the body in a vice, slide in the sleeve of MS 62. Carefully slide the inner piece of MS 62 into the sleeve, pushing it downwards and and rotating it slightly until a firm resistance is felt.
36. Withdraw the inner piece of MS 62, then the sleeve, leaving the 'O' ring and kin ring seated in the body.
37. Invert the body in the vice, then very carefully drive in the upper seal.
38. Carefully slide the spool and sleeve assembly into the body until the top of the spool appears through the upper seal.
39. Refit the ball to the bore of the body.
40. Refit the threaded insert.

NOTE: Assemble the driveshaft to the rotor with the slot in the end of the driveshaft aligned with a cut out in the rotor.

41. Using new 'O' rings, refit the valve plate.
42. Reverse procedure 1 to 9:
 - (a) Smear the inner 'O' ring with an approved grease.
 - (b) Tighten the seven bolts to a torque of 27 Nm (20 lbf ft).

**MAIN STEERING SHAFT
(MF 565, 575 & 590 TRACTORS)**

Removal and Refitment 7B-22-16

Removal

1. Remove the front grille and side panel. Part 2B.
2. Remove the battery and shelf assembly. Part 9.
3. Remove the hydrostatic steering cylinder, operation 7B-16-11.
4. Remove the nut, spring washer and bolt securing the lower crank arm.
5. Drive the main steering shaft upwards out of the lower crank arm.
6. Remove the shaft.
7. Remove the felt sealing rings.

Refitment

8. Reverse procedures 1 to 7 except:
 - (a) Fit new felt sealing rings.
 - (b) Tighten the lower crank arm clamp nut to a torque of 115 Nm (85 lbf ft).

WHEELS AND TYRES**Part 7—Section C**

Operation Number	Description	Page Number
7C-01-02	INNER TUBE Removal and Refitment	02
7C-02-04	TYRES Removal and Refitment	04
	FAULT FINDING CHART	05

WHEELS AND TYRES**INNER TUBE****Removal and Refitment**

7C-01-02

Special Tools: 'Bead-breaking' tool
3 lb Hammer
Tyre Levers

Removal

1. Lay the wheel on the ground with the valve uppermost.
2. Deflate the tyre by removing the valve core. Remove the valve retaining nut.
3. Drive the 'bead-breaking' tool between the tyre and rim, taking care not to damage the rim or the tyre.
4. After the bead has been released from the rim, invert the wheel and repeat Item 3.
5. Lubricate the rim, tyre and base of the tube with a solution of soap and water or similar rubber lubricant.

NOTE: Never use petroleum or silicone base greases.

6. Starting at the valve location, pry the tyre off the rim, taking small bites with tyre levers, and ensuring that the bead on the opposite side is fully located in the mounting well.
7. With the wheel in a vertical position, pull the tyre forwards and remove the tube.

Examine the bead seating area of the rim. Remove any build-up of rust, corrosion or old rubber. Inspect inside the tyre casing for foreign matter or damage.

Refitment

8. Inflate the tube until 'rounded out'. Place the tube in the tyre with the valve located in the valve hole. Refit the valve retaining nut finger tight.
9. Refit the tyre, starting opposite the valve location taking small bites with long tyre levers and keeping the fixed part of the bead fully located in the well.

A Solution of soap and water, or similar rubber lubricant, brushed on to the rim and bead will help fitment.

NOTE: Care must be taken not to pinch the tube when fitting.

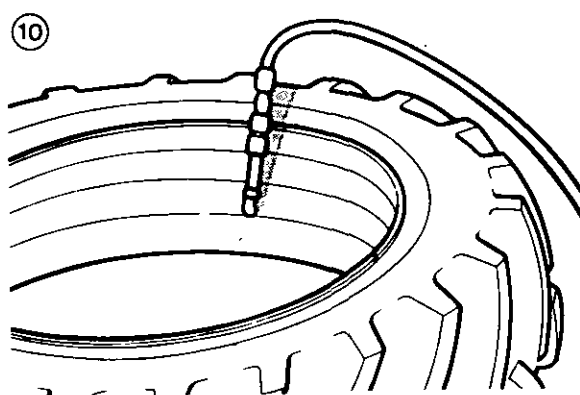
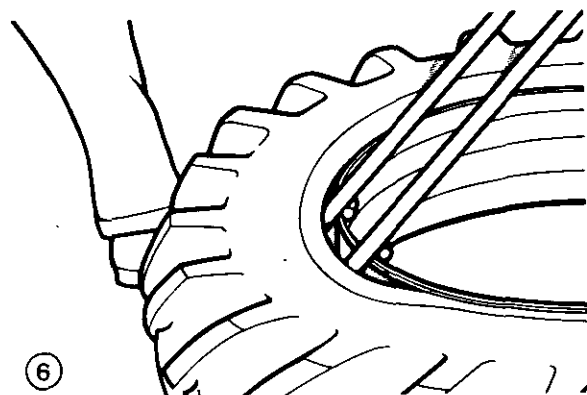
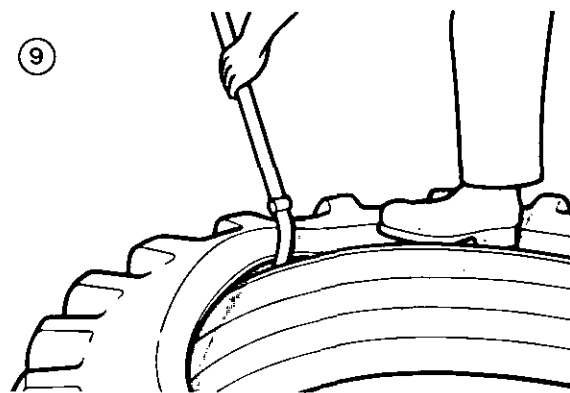
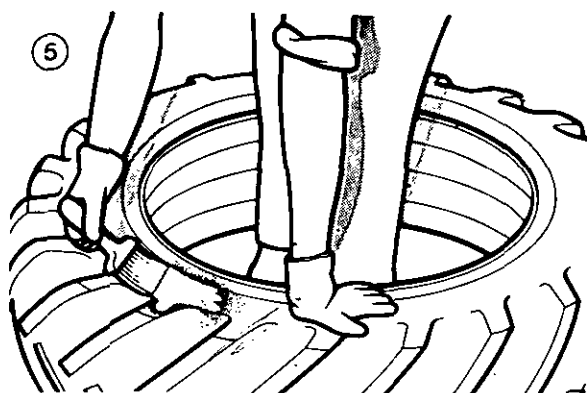
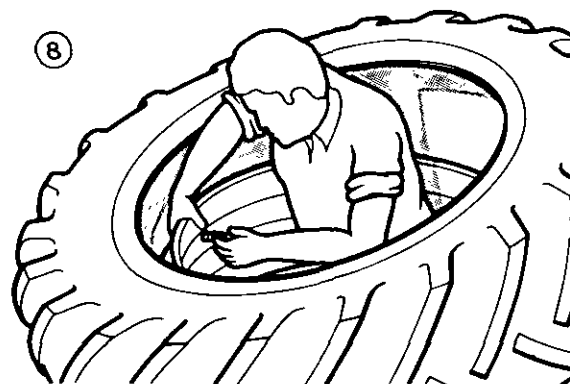
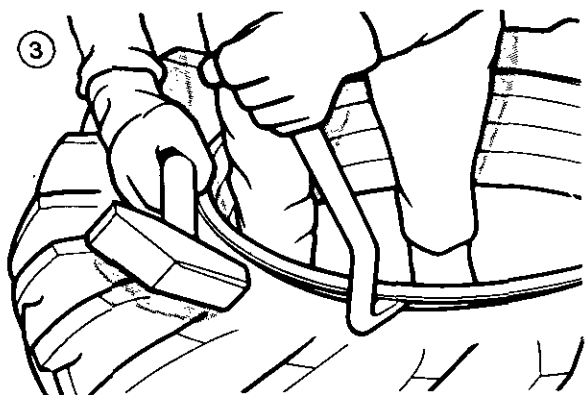
10. Centre the tyre on the rim and inflate to approx. 2,5 kg/cm² (35 lb/in²).

NOTE: Never stand over the assembly when inflating, remote control inflation equipment should be used.

11. Remove the valve core and completely deflate the tyre.
12. Refit the valve core and inflate to recommended pressure.

NOTE: If beads fail to seat at 2,5 kg/cm² (35 lb/in²) the tube may be pinched, do not increase the pressure but remove the valve core and release tyre from rim. Lubricate tyre, bead and rim and re-inflate to 2,5kg/cm² (35 lb/in²) repeat process until both beads are properly seated.

WHEELS AND TYRES



WHEELS AND TYRES

TYRE

Removal and Refitment

7C-02-04

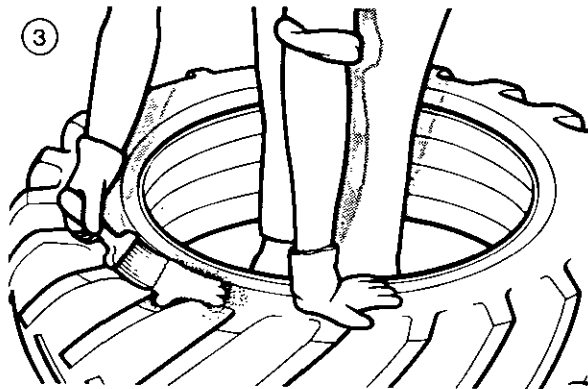
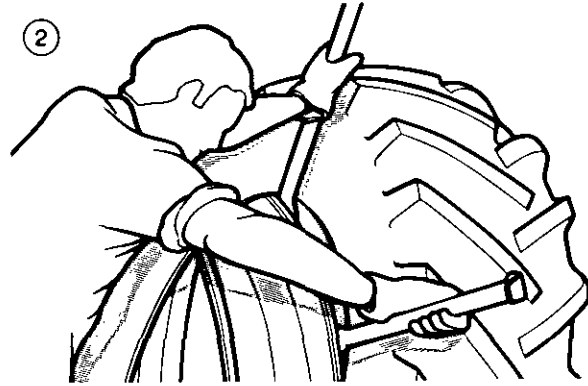
Special Tools: 'Bead-breaking' tool
3 lb Hammer
Tyre levers

Removal

1. Remove inner tube as stated in operation 7C-01-04.
2. With the wheel in a vertical position pry off the tyre taking small bites with the tyre levers. The use of rubber lubricant will help removal.

Refitment

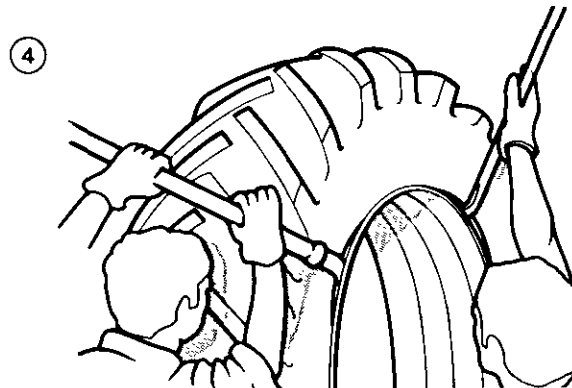
3. Place the rim on the ground, lubricate the bead and rim and place the tyre on rim.
4. Refit the tyre to rim, using long tyre levers.
5. Refit the inner tube.



FRONT WHEELS AND TYRES

Tyre Pressures

The tyre pressures are shown in the Specification Section. However, if a very heavy front end weight is fitted, such as a loader, the pressure should be raised to 2,81 to 3,09 kg/cm² (40-44 lb/in²).



Inner Tube Removal and Refitment 6B-03-04
See operation 6B-01-02

Tyre Removal and Refitment 6B-04-04
See operation 6B-02-04

WHEELS AND TYRES**FAULT FINDING CHART**

Symptom	Possible Cause	Suggested Cure
Wheelspin	Too low gear	Use the highest gear that the tractor will pull without labouring
Wheelspin due to tyres loading with soil	Tyre pressures excessive	Adjust the pressures to the manufacturer's recommended minimum
	Inadequate tyre pressures	Raise the tyre pressures to that correct for the load on the rear end of tractor
	Insufficient weight acting of the rear end of the tractor	<ol style="list-style-type: none"> 1. Fit wheel weights 2. Water ballast tyres 3. Increase 'Pressure Control' pressure if fitted 4. Try narrower section tyres
Wheelspin The tyre retains its self-cleaning action and sinks into the ground	Inadequate weight on the front end of the tractor	Fit weight frame and front-end weights
	Too narrow section tyre for the weight being carried by the rear end of the tractor	<ol style="list-style-type: none"> 1. Fit wider section tyres 2. Reduce the weight on the rear end of the tractor
	Lug-bar type tyres being used in sand	Use either grassland/sand type tyres, or heavily worn lug-bar type tyres
Tractor slews from side to side when being driven on hard ground (e.g. road)	Tyre squirms due to excessively low pressures	Raise the tyre pressures. This complaint can cause rapid tyre wall wear and consequent failure
Tyre tread worn unevenly when used for long periods on the road	<ol style="list-style-type: none"> 1. Too low pressure 2. Overloading 	Raise pressure— This complaint is indicated by wear on the leading and trailing edges of the lug-bar
Uneven tread wear	Over inflation	Adjust pressures to those recommended by tyre manufacturers. This problem is indicated by wear to the centre of the tread only
	Wheels running out of true	<ol style="list-style-type: none"> 1. Jack up the axle to relieve wheel of weight slacken and re-tighten wheel nuts 2. Check that the tyre is located accurately on the rim.
Tyre creep	Too low tyre pressure	<ol style="list-style-type: none"> 1. Increase tyre pressure 2. Check the condition of both the rim and bead and replace as necessary Certain sizes of wheel are available with knurled rims.
Split sidewall	Under-inflated tyre striking a sharp object	Minor splits are repairable. In cases of severe damage the tyre must be replaced

**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 8

Publication No. 1856 072 M1

comprising

- A HYDRAULIC SYSTEM
- B AUXILIARY HYDRAULICS
- C DRAWBAR AND LINKAGE

HYDRAULIC SYSTEM

Part 8—Section A

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HYDRAULIC SYSTEM

GENERAL

Fig. 1. The Ferguson hydraulic system comprises a four cylinder scotch yoke type pump (1) which delivers oil, through a vertical pipe (2) to the cylinder (3).

A connecting rod (4) from the cylinder piston (5) engages in the ram arm (6) which is splined on to the lift shaft (7) which carries the linkage lift arms.

When oil, under pressure from the pump, is delivered to the ram cylinder (3), the piston is forced rearwards and pushes the ram arm upwards, causing the lift shaft to rotate and raise the lift arms.

The hydraulic pump is driven by the p.t.o. drive from the p.t.o. clutch plate, via the gearbox constant mesh gears and the p.t.o. drive shaft.

Hydraulic Pump (Fig. 2)

The pump consists of two piston yokes (1) which ride on cam blocks over eccentrics on a camshaft (2). The pistons, reciprocate in two opposed valve chambers (3), each housing two inlet (4) and outlet valves (5) and springs. A sealing plug and snap ring secure the valves in the chambers.

Front and rear castings incorporate the oil galleries connecting the two valve chambers, and also house the control valve (6) and the oscillator (7).

Attached to the rear casting is the Response Control and strainer housing (9) and also the Pressure Control valve (8).

As each of the pump pistons moves down its cylinder it creates suction which lifts the inlet valve from its seat and draws in oil past the control valve (if open) along the intake gallery into the cylinder. During this inlet stroke the outlet valve is held closed by the spring acting on it. When the piston reaches the end of its inlet stroke, the suction ceases and the inlet valve is closed by the inlet valve spring. As the piston returns into the cylinder, the resultant pressure in the oil keeps the inlet valve closed and lifts the outlet valve. This pressure forces the oil past the outlet valve into the discharge passage.

Control Valve (Figs. 3, 4 and 5)

The control valve has intake and discharge slots at either end and is spring loaded to the intake position by the oscillator spring. The valve slides within a sleeve which has ports leading to both the intake and the pressure side of the pump.

With the valve held in the intake position (Fig. 3) by the oscillator spring, oil is drawn through the intake slots into the pump. In this position the lower links would raise.

With the valve in the neutral position (Fig. 4), both the intake and the discharge slots are outside the sleeve. In this position the lower links would be stationary.

With the valve in the discharge position (Fig. 5), the discharge slots are in the pressure chamber and oil can flow from the ram cylinder back to the sump. In this position the lower links would be lowering.

OPERATION

Draft Control—Implement Lowering (Fig. 6)

To lower the implement, place the Position Control lever in the TRANSPORT position, and move the Draft Control lever downwards through the quadrant. This action presses the eccentric roller (1), on the end of the Draft Control lever shaft, down onto the upper cam face of the Draft Control cam (2), causing the lower face of the cam (2) to be forced downwards into contact with the roller (3) on the Draft Control linkage. The cam (2) is then moved rearwards causing the vertical lever (4) to pivot and move the pump control valve, via the lever (5), into the discharge position against the influence of the control valve spring. The Draft Control linkage will move because the force from the control valve is less than the break-out spring (6) force.

Draft Control—Compression Force in the Top Link (Fig. 7)

When the control valve is in the fully discharge position, and with further downward movement of the Draft Control lever, the eccentric roller (3) acting on the upper cam face of the Draft Control cam (4), forces the lower cam face of the Draft Control cam (4) to move the roller (5) forwards. Forward movement of the roller (5) leaves a gap between the Draft Control rod (2) and the Draft Control spring plunger (1) and simultaneously compresses the spring on the guide rod (7).

Forward movement of the tractor will cause an implement to gain depth (as the control valve is in the discharge position), until resultant implement draft reaction compression forces, applied through the top link, deflect the control spring and cause the Draft Control spring plunger (1) to contact the Draft Control rod (2), and move the Draft Control linkage forwards. This permits the Draft Control cam (4) to move forwards, acting under the influence of the control valve spring and limited by the position of the roller (5), until the control valve reaches the neutral position.

Draft Control—Tension Force in the Top Link (Fig. 8)

Variations in ground conditions will cause fluctuations in the draft force in the top link. If the draft force decreases, the compression force in the control spring decreases.

The Draft Control linkage follows the control spring plunger (1) under the influence of the spring in the guide rod (7), and moves the Draft Control link rearwards. The vertical lever (4) pivots and moves the pump control valve, via the lever (5), towards discharge. When the correct depth is obtained, the valve is restored to neutral. An increase of draft force in the top link will have an opposite effect.

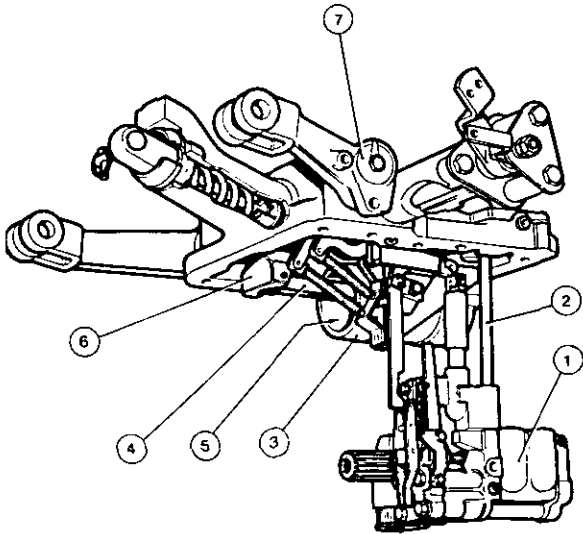


Fig.1

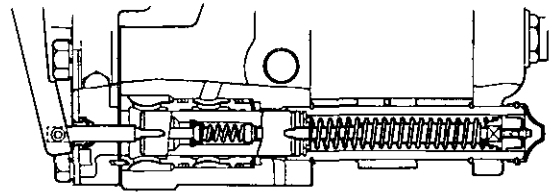


Fig.3

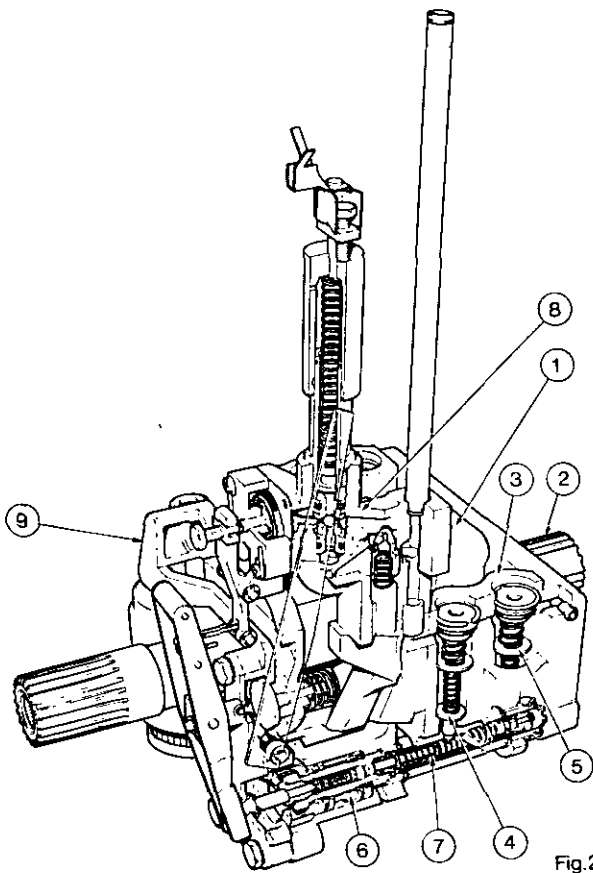


Fig.2

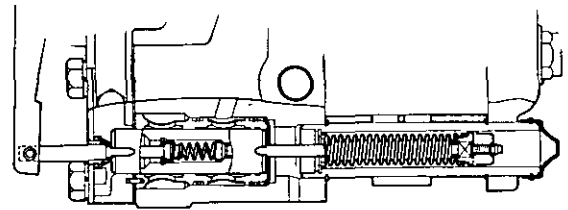


Fig.4

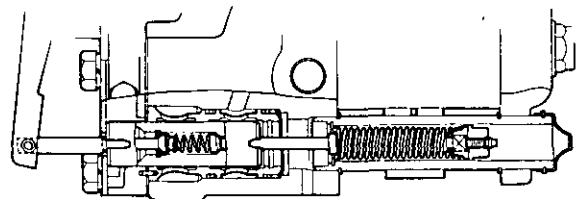


Fig.5

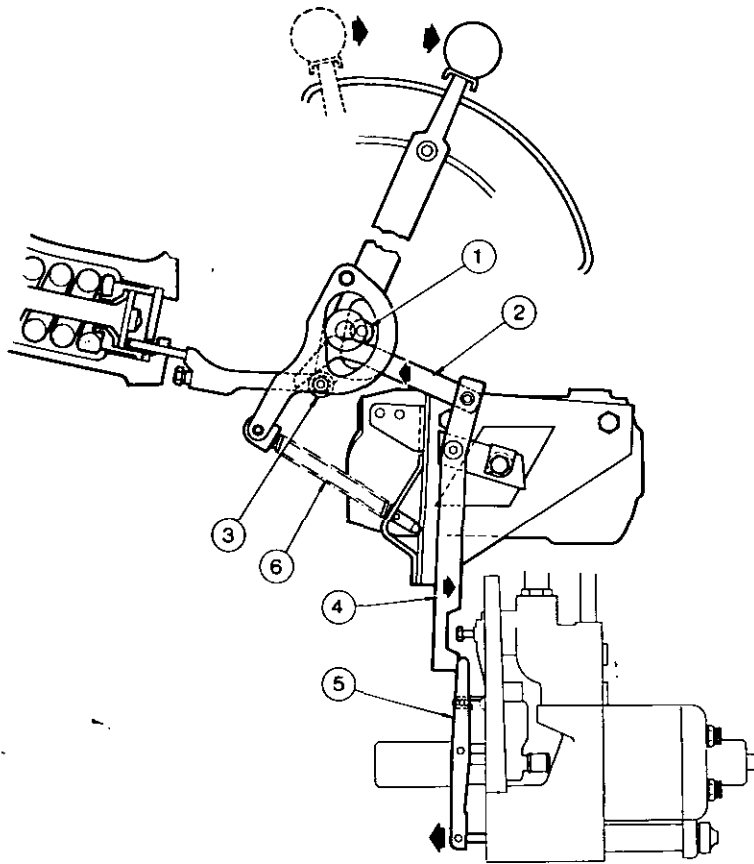


Fig.6

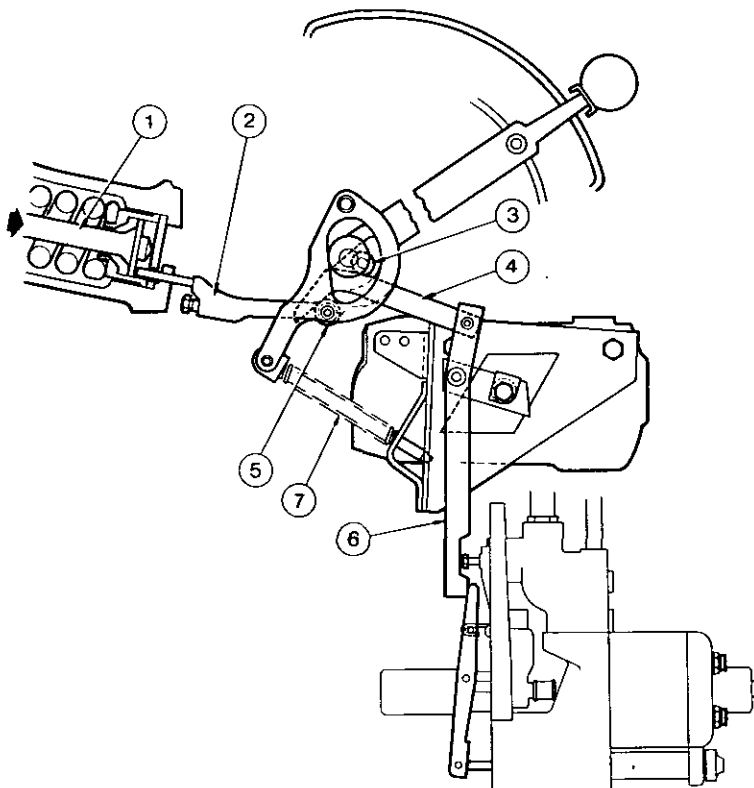


Fig.7

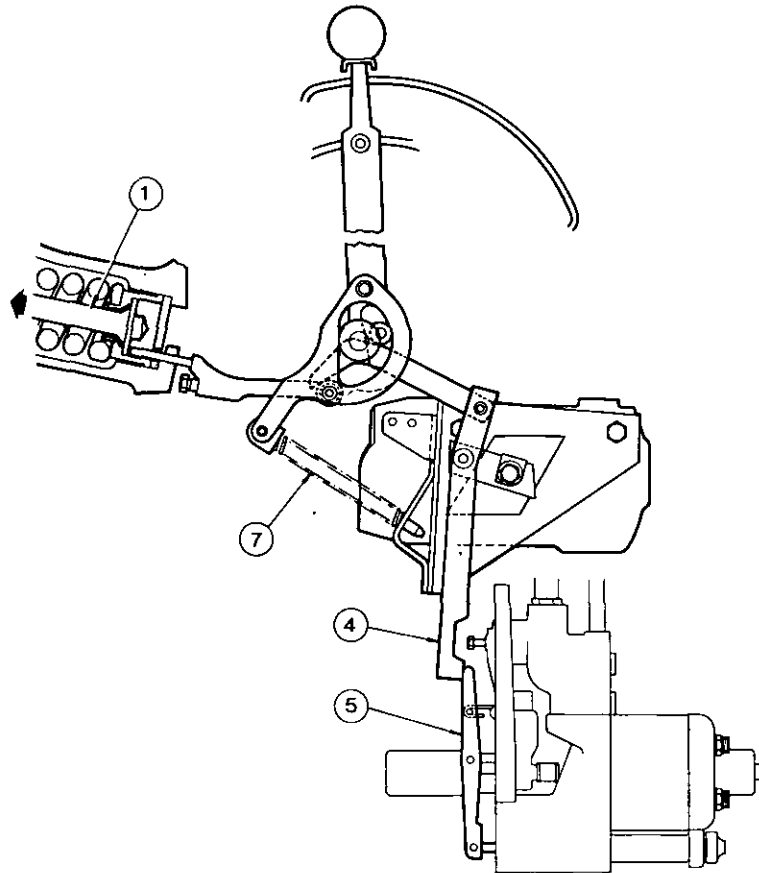


Fig. 8

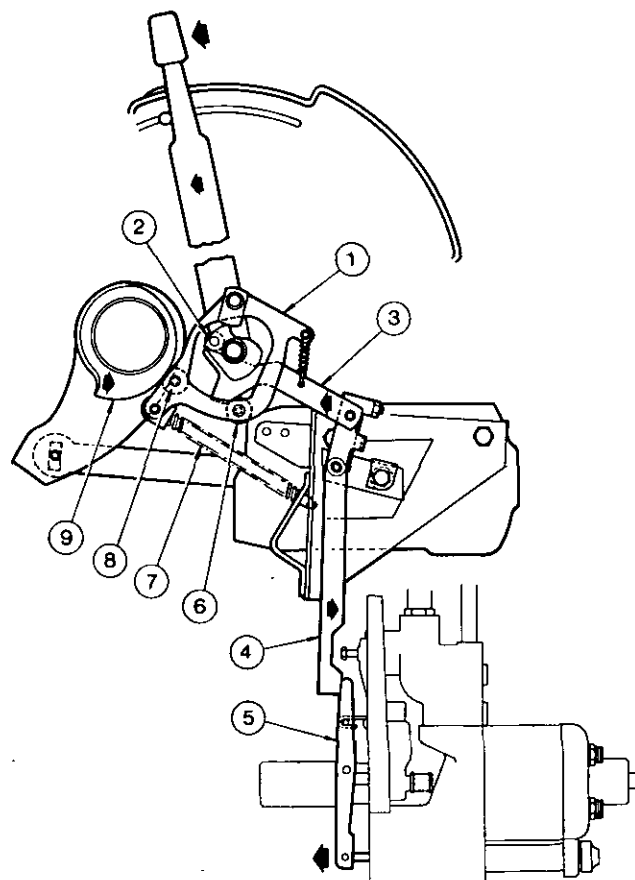


Fig. 9

HYDRAULIC SYSTEM

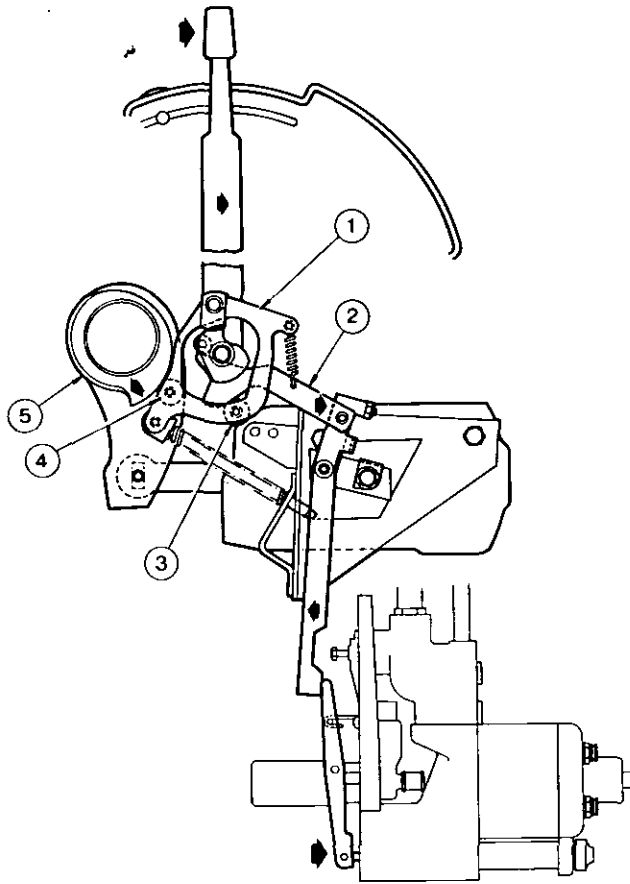


Fig. 10

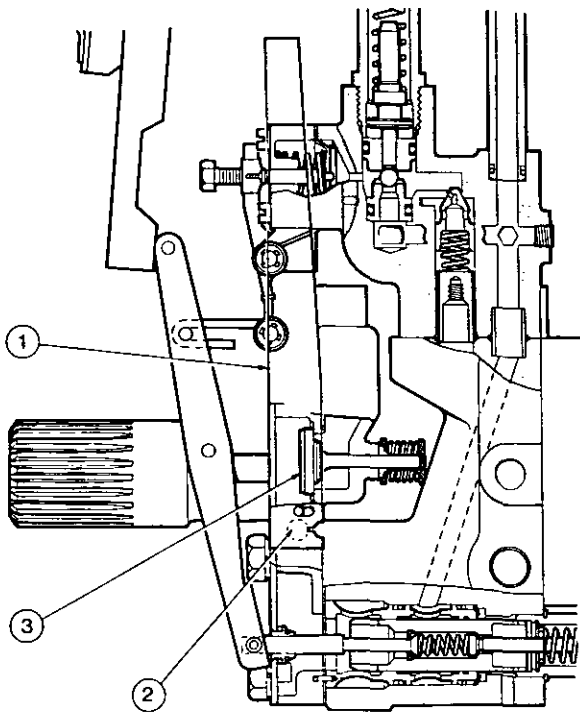


Fig. 11

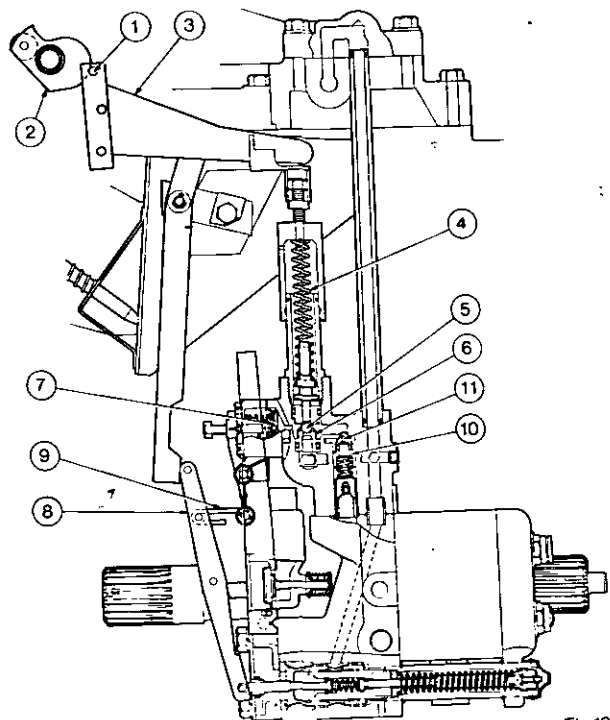


Fig. 12

HYDRAULIC SYSTEM**Position Control—Implement Lowering (Fig. 9)**

Downward movement of the Position Control lever causes the eccentric roller (2) to force the cam (3) downwards. The breakout spring pushes the Position Control link (1) to maintain contact between the roller (8) and the ram arm (9), and the front roller (6) moves the cam (3) rearwards, causing the vertical lever (4) to pivot and move the pump control valve, via the lever (5), into the discharge position.

Position Control—Implement Raising (Fig. 10)

Release of oil from the ram cylinder allows the ram arm (5) to rotate and force the rear roller (4), mounted on the Position Control link (1), forward. This action allows the pump control valve spring to move the Position Control cam (2), which is in contact with the front roller (3), forward, until the control valve reaches the neutral position, which has been determined by the Position Control lever.

For every position that the Position Control lever is moved to, there is a position where the cam moves the control valve to neutral.

Response Control (Fig. 11)

Response Control, incorporated in the pump, regulates the speed that the control valve moves to the discharge position, and therefore can control the initial rate of flow from the cam cylinder and speed of drop of an implement.

Movement of the Response Control switch actuates an internal slide valve (1), which varies the size of an orifice (2), in the intake gallery, from which oil can escape. When the control valve moves to the discharge position, oil has to be displaced from the intake gallery. The oil is prevented from returning

through the strainer by a non-return valve (3), therefore it passes through the inlet gallery orifice (2). The slide valve (1) controls the size of the orifice and therefore the speed of movement of the control valve.

Pressure Control (Fig. 12)

The relief valve for the hydraulic circuit is the Pressure Control valve. The valve consists of a main Pressure Control valve, a low pressure relief valve and a diaphragm actuator with a lever system connecting it to the pump control valve. The main Pressure Control valve comprises a ball valve which is loaded onto its seat by a spring. The Compression of the spring is regulated by the Pressure Control lever.

When the Pressure Control lever is moved to its lowest position on the quadrant, the roller (1) on the internal lever (3) moves to the lowest position on the cam (2), allowing the lever (3) to exert minimum pressure on the spring (4).

Pump pressure is fed to underside of the ball valve (5) and when the pressure acting on the ball valve exceeds the selected spring load, the ball lifts off its seat, allowing a flow to the chamber (6). As the pressure builds up the diaphragm (7) deflects, extending the plunger, which, in the linkage (9) pushes the pump control valve lever (8) and the control valve to a reduced flow situation.

A relief valve (10) maintains a safe pressure at the diaphragm.

As the lever is moved towards the high pressure position, the load on the spring increases. Oil in the diaphragm escapes through the bleed hole (11) and the diaphragm (7) allows the control valve to move to the full intake position. When the desired increase in pressure is achieved, oil enters the diaphragm which moves the control valve to a reduced flow situation.

HYDRAULIC SYSTEM**CONTROL SPRING ASSEMBLY****Removal and Refitment**

8A-01-08

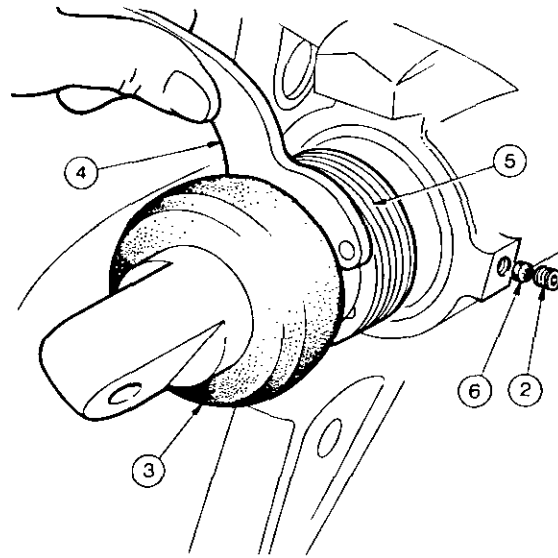
Special Tools: MF 163 Wrench

Removal

1. Remove the control beam.
2. Remove the Allen screw.
3. Pull back the rubber boot.
4. Using MF 163, unscrew the retainer from the lift cover.
5. Withdraw the control spring assembly from the lift cover.
6. Remove and discard the nylon plug.

Refitment

7. Reverse procedures 1 to 6, except:
 - (a) With the Draft Control lever in the fully DOWN position, tighten the retainer, until the end float is eliminated. Do not over-tighten otherwise the end float will reappear.
 - (b) Fit a new nylon plug.
 - (c) Tighten the Allen screw to a torque of 7 Nm (5 lbf ft).

**CONTROL SPRING ASSEMBLY****Servicing**

8A-02-08

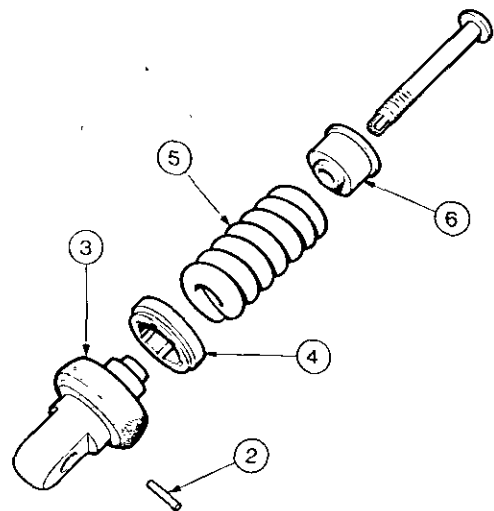
Special Tools: MF 163 Wrench

Disassembly

1. Remove the control spring assembly, operation 8A-01-08.
2. Drive out the pin.
3. Unscrew the head.
4. Remove the retainer.
5. Remove the spring.
6. Remove the spring seat.

Reassembly

7. Reverse procedures 1 to 6, except:
 - (a) Screw the plunger into the head until the end float is eliminated and the spring is tight to turn by hand.
 - (b) Fit a new pin.



HYDRAULIC SYSTEM

HYDRAULIC LIFT COVER

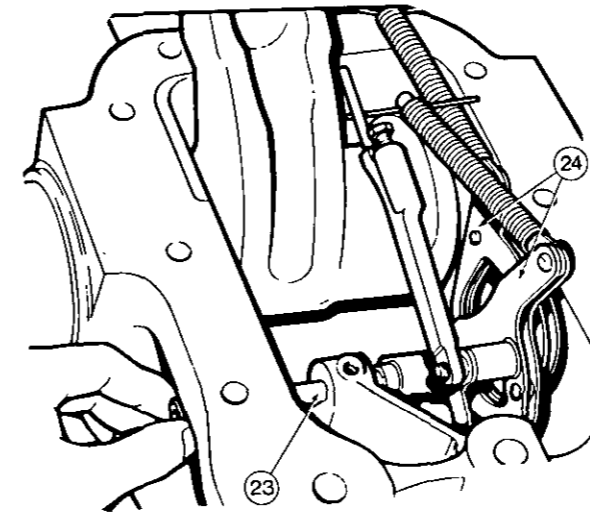
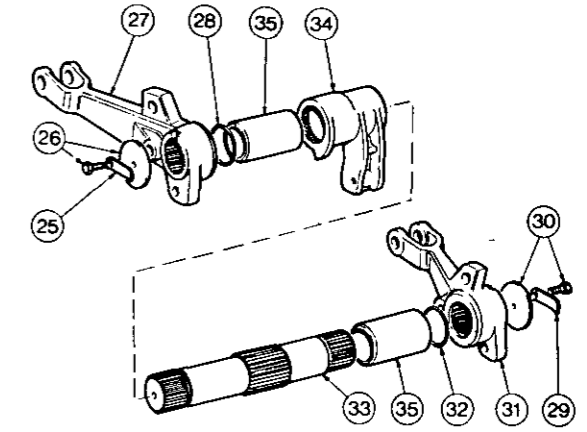
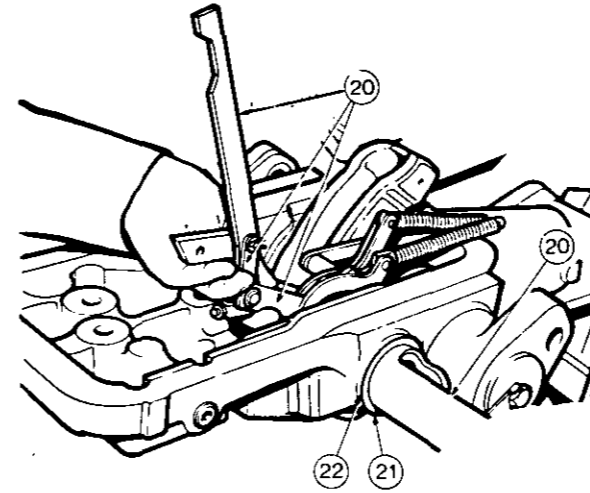
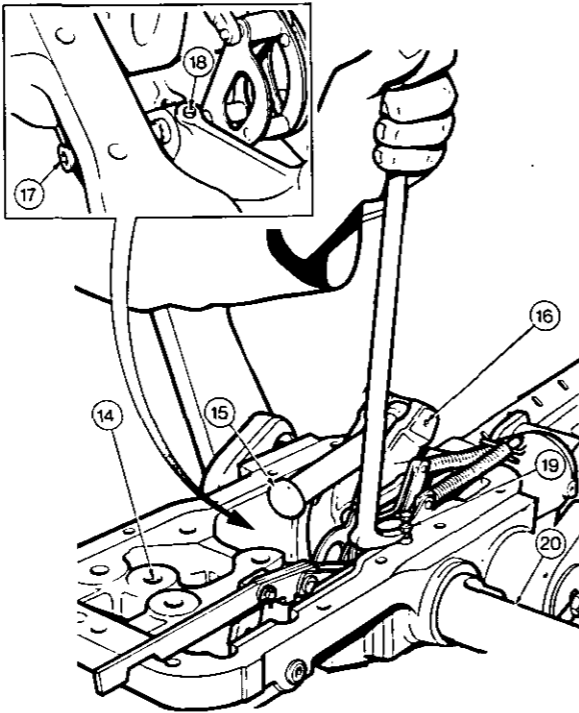
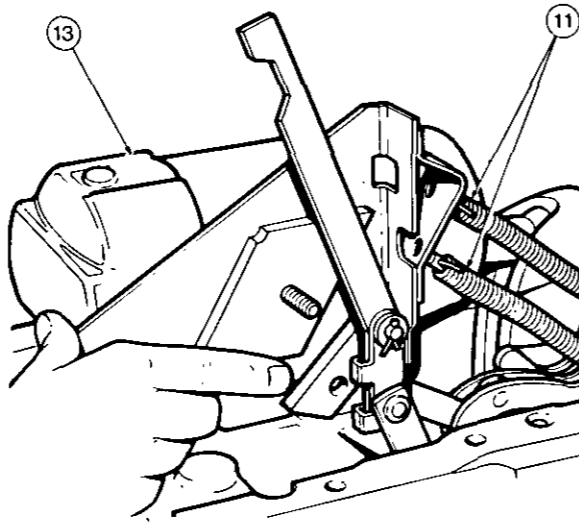
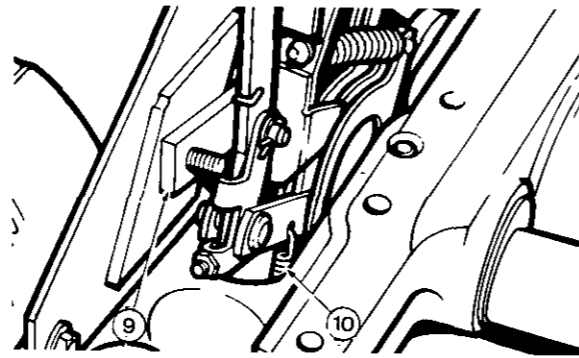
Servicing

8A-04-10

Special Tools: See Operation 8A-03-09

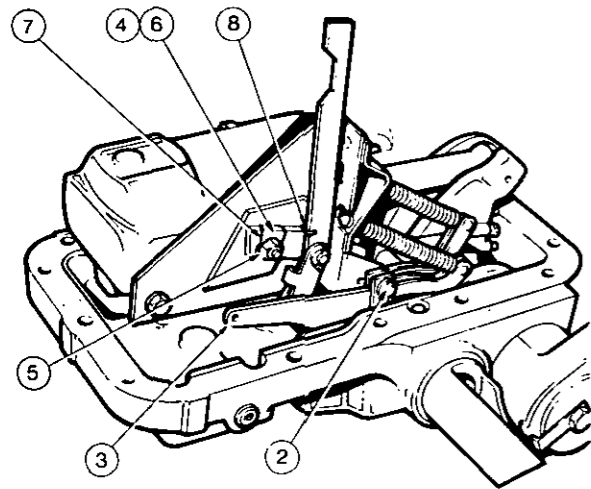
Disassembly

1. Remove the lift cover, operation 8A-03-09.
2. Remove the split pin and washer.
3. Remove the link.
4. Release the tabwasher.
5. Remove the nut.
6. Remove the tabwasher.
7. Remove the spacer.
8. Release the spring.
9. Release the slide pivot from the bolt.
10. Remove the spring.
11. Fit a pair of pins to retain the springs.
12. Remove the four nuts securing the ram cylinder to the lift cover.
13. Lift off the ram cylinder.
14. Remove and discard the 'O' ring.
15. Remove the connecting rod.
16. Remove the Allen screw.
17. Remove the Allen plug.
18. Remove the screw.
19. Screw a No. 10 32 UNF bolt into the pin and remove the pin.
20. Withdraw the quadrant control support assembly, simultaneously lifting out the vertical lever and the cams.
21. Remove the shim(s), if fitted.
22. Remove the Belleville washer.
23. Withdraw the pivot shaft.
24. Lift out the links.
25. Release the tabwasher.
26. Remove the bolt and washer.
27. Slide off the lift arm.
28. Remove and discard the 'O' ring.
29. Release the tabwasher.
30. Remove the bolt and washer.
31. Slide off the lift arm.
32. Remove the 'O' ring.
33. Drive the lift shaft out of the lift cover.
34. Remove the ram arm.
35. Remove the two bushes.



Reassembly

36. Reverse procedures 1 to 35, except:
 - (a) Fit new bushes if necessary.
 - (b) Fit new 'O' rings and tabwashers.
 - (c) Align the master spline when refitting the shaft and the two lift arms.
 - (d) Fit the Belleville washer with the concave side towards the lift cover.
 - (e) Ensure that the pivot shaft is fully located against the side of the lift cover before tightening the Allen screw.
 - (f) When refitting the connecting rod Allen screw, apply a drop of recommended sealant 'C' to the threads, and screw the Allen screw into the ram arm until the screw bottoms on the annular groove in the connecting rod, then back it off 1/4 turn.
 - (g) When refitting the ram cylinder, locate the connecting rod in the piston and the two rods in the holes in the bracket.
 - (h) Tighten the ram cylinder retaining nuts to a torque of 160 Nm (120 lbf ft).



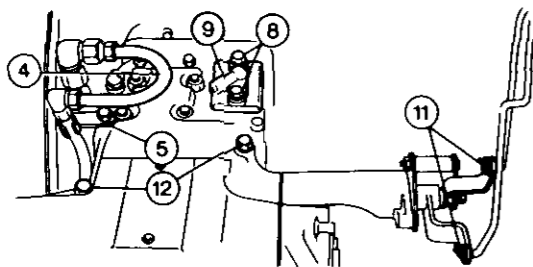
HYDRAULIC LIFT COVER**Removal and Refitment**

8A-03-09

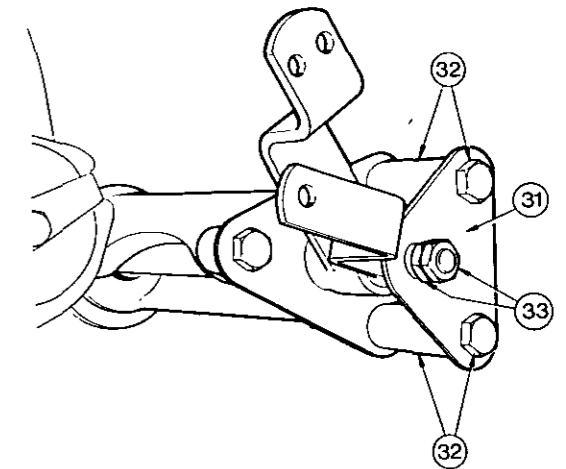
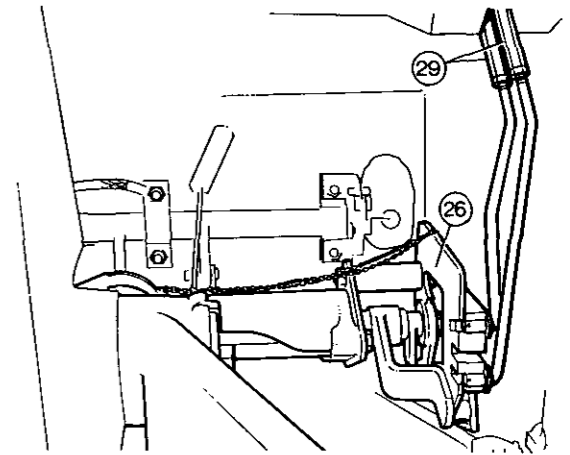
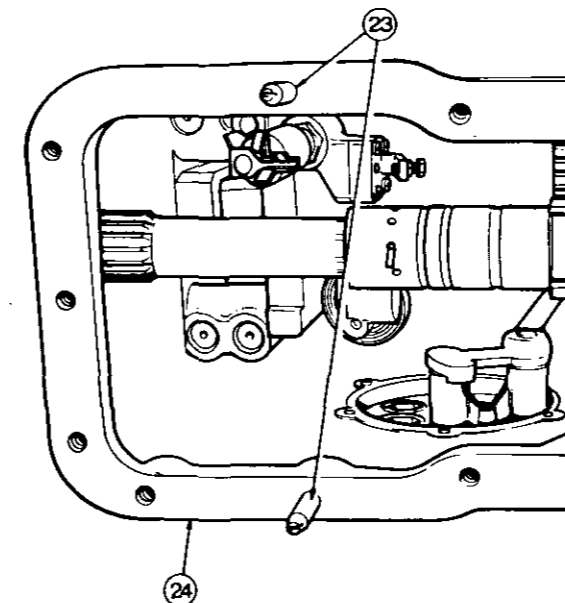
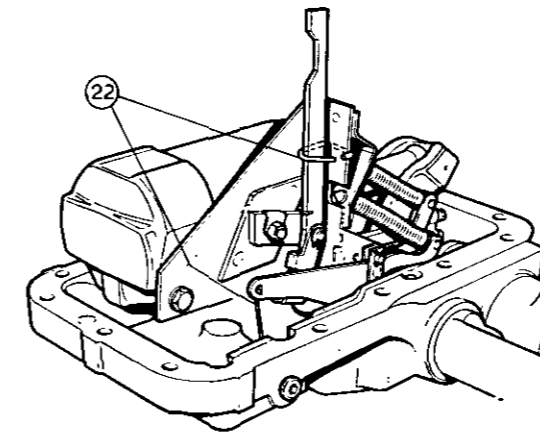
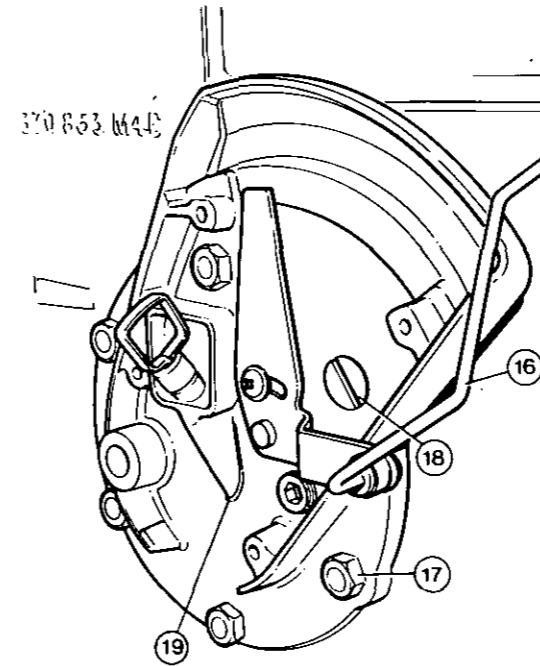
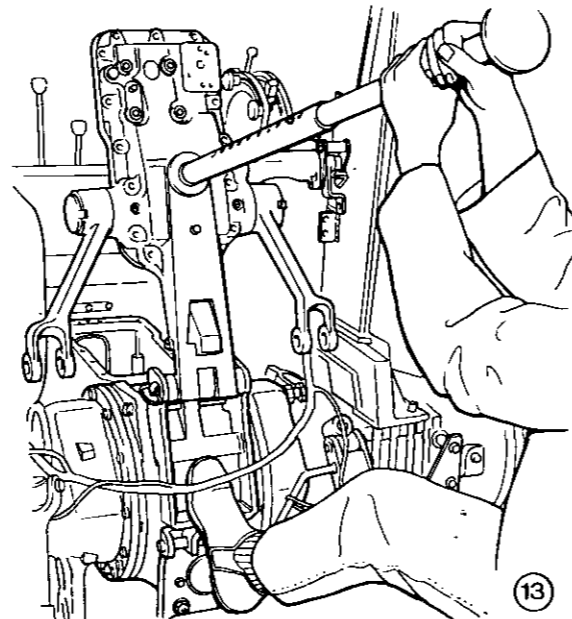
Special Tools: MF 148 A Pressure Test Kit
 MF 163 Wrench
 MF 166 Adaptor
 MF 226A Lift Cover Remover and Replacer
 MF 226A-3 Lift cover Adaptor
 MF 272 Ram Arm Fixture
 MF 273 Hydraulic Setting Fixture
 MF 333 Draft Control Rod Gauge
 MF 356 Position and Draft Control Setting Gauge
 MF 357 Screwdriver Adjuster
 MF 359 Pressure Control Bleed Pipe
 MF 363 Quadrant Lever Retainer Tool
 1,4 kg (3 lb) Weight

Removal

1. Remove the cab rear cross brace and the seat floor, Part 2B.
 2. Disconnect the lift rods from the lift arms.
 3. Remove the control beam.
- Tractors fitted with an auxiliary pump, carry out procedure 4, 5 and 6.
4. Disconnect the 'U' pipe or the two hoses (tractors with spool valves) at the unions and remove the pipe or place the hoses clear of the lift cover.
 5. Remove the bracket securing the two pipes.
 6. Place the hoses and the rear panel (tractors with spool valves) clear of the lift cover.
 7. Place the Draft Control lever in the fully DOWN position.
 8. Remove the two bolts and washers.
 9. Remove the caps and the stand pipe.
 10. Place the Draft Control lever in the fully UP position and the Position Control lever in the TRANSPORT position.
 11. Disconnect the two rods at the quadrant support tube.
 12. Remove the lift cover bolts.
 13. Using MF 226A and MF 226A-3, carefully hinge back the lift cover and place the support leg on the ground.
 14. Remove and discard the lift cover gasket.
 15. Drain the oil to the LOW mark on the dipstick.
 16. Disconnect the rod at the Response Control side cover.
 17. Remove the five bolts.
 18. Remove the screw.
 19. Remove the side cover.
 20. Remove and discard the side cover gasket.

**Refitment**

21. Carry out the external adjustments, operation 8A-11-13.
22. Using suitable pieces of wire retain the vertical lever and Pressure Control link.
23. Fit the two guide studs.
24. Fit a new gasket.
25. Reverse procedures 12 to 14, except:
 - (a) Take care, when refitting the lift cover, that the vertical lever does not foul any internal components.
 - (b) Remove the two guide studs.
 - (c) Tighten the lift cover bolts to a torque of 88 Nm (65 lbf ft).
26. Remove the quadrant control support nut and fit MF 363 to the support, refit the nut.
27. Place the Draft Control lever between the sector marks on the quadrant.
28. Place the Position Control lever in the TRANSPORT position.
29. Set the lengths of the rods, by adjusting the turnbuckles, so that the rods locate in the top and bottom slots in MF 363.
30. Remove MF 363.
31. Refit the plate.
32. Refit the two spacers and bolts.
33. Refit the nut and the locknut. Do not over-tighten the nut.
34. Reverse procedures 2 to 11.
35. Carry out the internal adjustments, operation 8A-12-16.



RAM CYLINDER**Servicing**

8A-05-11

Special Tools: See Operation 8A-03-09

Disassembly

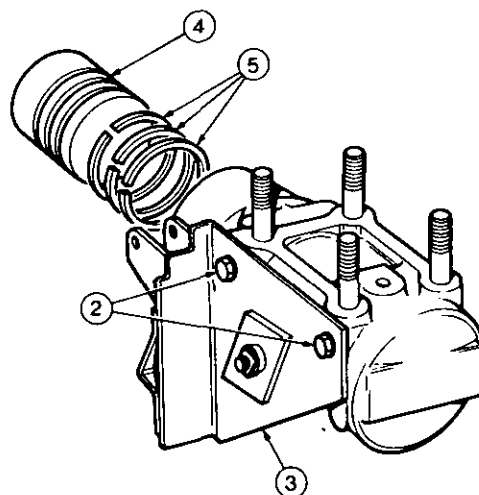
1. Remove the ram cylinder, operation 8A-04-10, procedures 1 to 14.
2. Remove the two bolts.
3. Remove the support bracket.
4. Withdraw the piston from the cylinder.
5. Remove the piston rings, if necessary.

Examination

Examine all components for wear or damage, replacing any defective components.

Reassembly

6. Reverse procedure 1 to 5.

**HYDRAULIC LINKAGE****Removal and Replacement**

8A-06-11

Special Tools: See Operation 8A-03-09

Removal

1. Remove the linkage, operation 8A-04-10, procedures 1 to 14 and 17 to 24.

Refitment

2. Reverse procedure 1.

QUADRANT CONTROL SUPPORT ASSEMBLY**Removal and Refitment**

8A-07-11

Special Tools: See Operation 8A-03-09

Removal

1. Remove the quadrant control support assembly, operation 8A-04-10, procedures 1 to 14 and 19 to 22.

Refitment

2. Reverse procedure 1.

QUADRANT CONTROL SUPPORT ASSEMBLY**Servicing**

8A-08-11

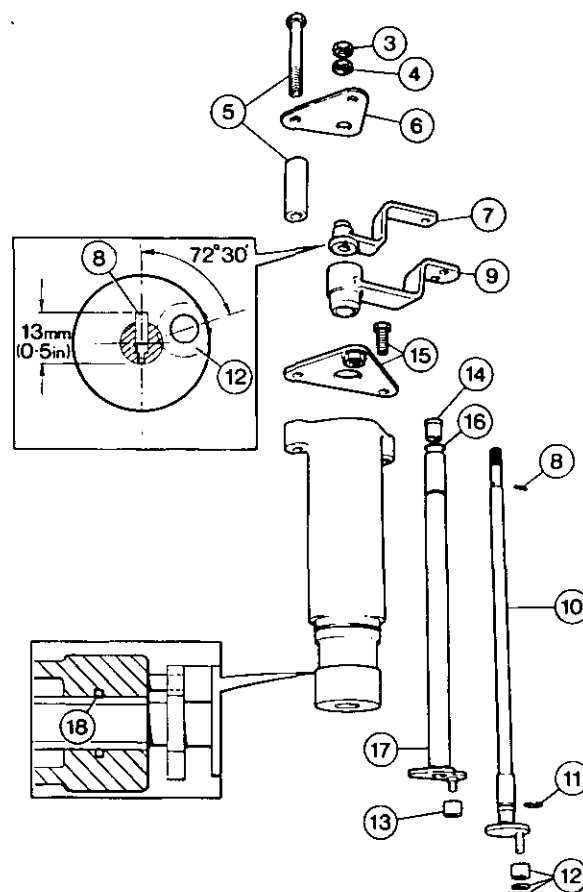
Special Tools: See Operation 8A-03-09

Disassembly

1. Remove the quadrant control support assembly, operation 8A-07-11.
2. Align the two rollers and scribe a line across the Draft and Position Control levers.
3. Remove the locknut.
4. Remove the nut.
5. Remove the two bolts and spacers.
6. Remove the plate.
7. Remove the Draft Control lever.
8. Drive out and discard the pin.
9. Remove the Position Control lever.
10. Withdraw the Draft Control Shaft.
11. Remove and discard the 'O' ring.
12. If necessary, remove the split pin, washer and roller.
13. Remove the roller.
14. Remove the bush.
15. Remove the bolt and the plate.
16. Remove the retaining ring.
17. Withdraw the Position Control Shaft.
18. Remove and discard the 'O' rings.

Reassembly

19. Reverse procedures 1 to 18, except:
 - (a) Fit the 'O' rings, split pin, pin and retaining ring.
 - (b) Do not overtighten the Draft Control shaft nut, as the roller will not turn freely.



HYDRAULIC SYSTEM**HYDRAULIC QUADRANT ASSEMBLY****Removal and Refitment** 8A—09—12

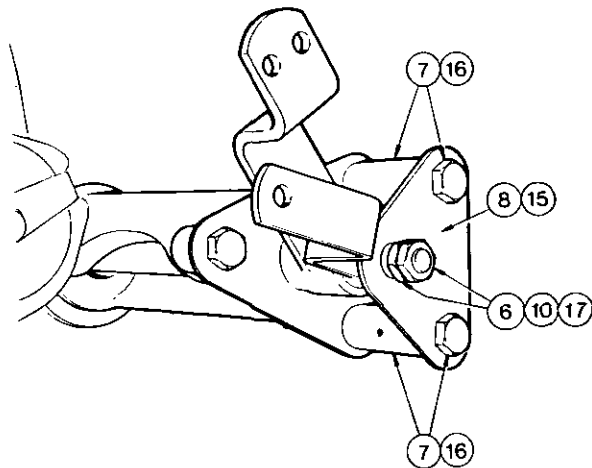
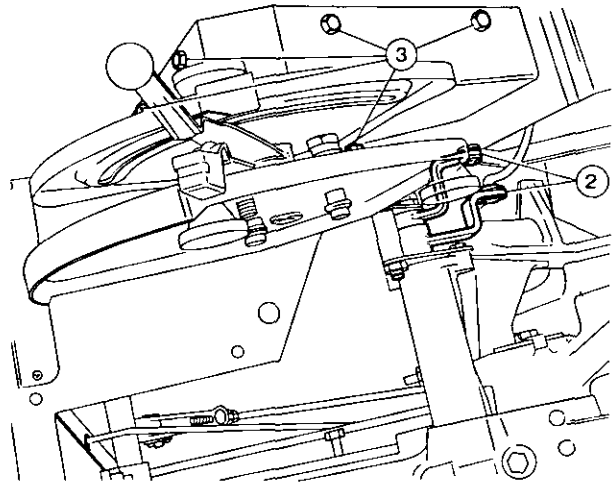
Special Tools: MF 363 Quadrant Lever Retainer Tool

Removal

1. Remove the seat floor, Part 2B.
2. Disconnect the two rods at the quadrant control support.
3. Remove the five bolts.
4. Remove the hydraulic quadrant assembly.

Refitment

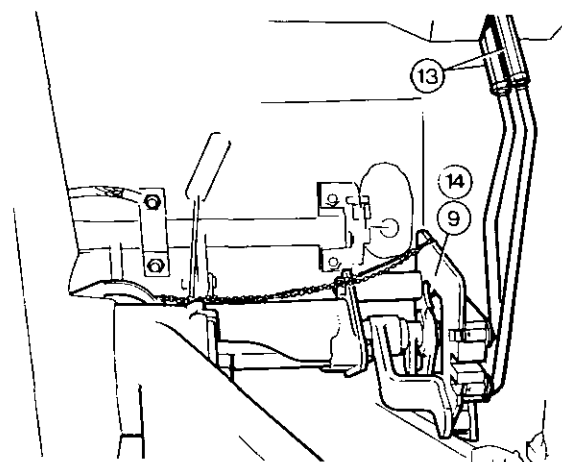
5. Reverse procedures 3 and 4, except use recommended sealant 'D' to seal the quadrant assembly to the cab floor.
6. Remove the locknut and the nut.
7. Remove the two bolts and the spacers.
8. Remove the plate.
9. Fit MF 363 to the quadrant control support.
10. Refit and tighten the nut.
11. Place the Draft Control lever between the sector marks on the quadrant.
12. Place the Position Control lever in the TRANSPORT position.
13. Set the rod lengths, by adjusting the turnbuckles, so that the rods locate in the top and bottom slots in MF 363.
14. Remove MF 363.
15. Refit the plate.
16. Refit the two spacers and the bolts.
17. Refit the nut and the locknut. Do not overtighten the nut.
18. Reverse procedures 1 and 2 except, before refitting the seat floor, carry out 'Draft Control Setting' and 'Position Control Setting' of operation 8A—12—16. (Page 8A—17 and 8A—18).

**HYDRAULIC QUADRANT ASSEMBLY****Servicing** 8A—10—12

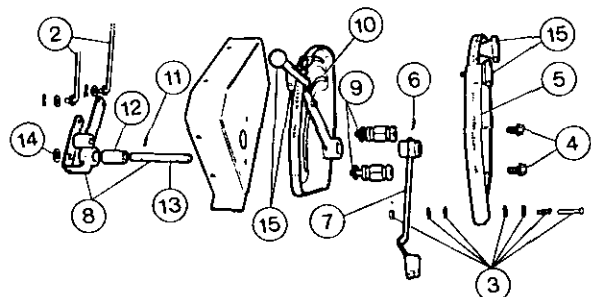
Special Tools: MF 363 Quadrant Lever Retainer Tool

Disassembly

1. Remove the hydraulic quadrant assembly, operation 8A—09—12.
2. Disconnect the two rods from the levers.
3. Remove the nut, washers, spring and screw.
4. Remove the two bolts and washers.
5. Remove the Position Control quadrant.
6. Drive out and discard the roll pin.
7. Remove the Position Control lever.
8. Withdraw the levers and shaft assembly.
9. Remove the barrel nuts and washers.
10. Remove the Draft Control quadrant.
11. Drive out and discard the roll pin.
12. Remove the bush.
13. Withdraw the shaft.
14. If necessary, remove and discard the nylon bush.
15. If necessary, remove the lever and the stop knobs.

**Reassembly**

16. Reverse procedures 1 to 15, except:
 - (a) Fit new roll pins.
 - (b) Tighten the lever screws to give a clearance of approximately 20 mm (0.75 in) between the screw head and the steel washer.
 - (c) Before tightening the barrel nuts and the bolts, locate the quadrants in the middle of their elongated holes.



HYDRAULIC ADJUSTMENTS

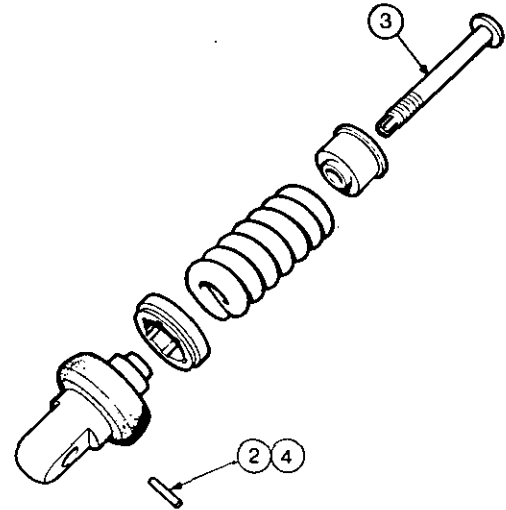
External Adjustments 8A-11-13
Special Tools: See Operation 8A-03-09

Procedure

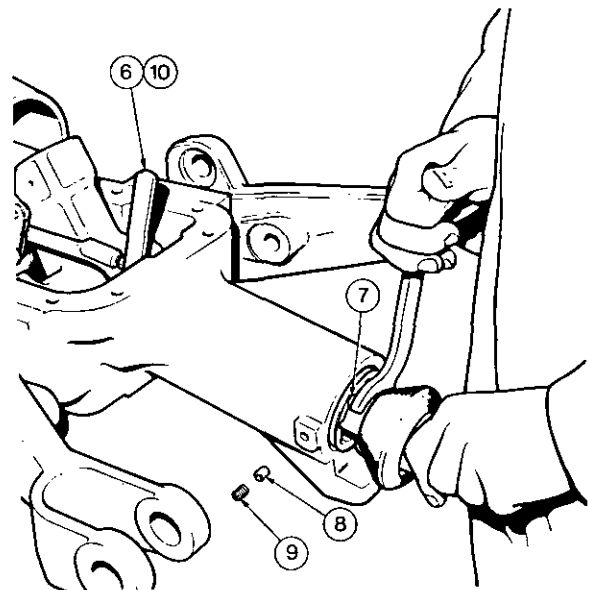
1. Remove the lift cover, operation 8A-03-09.

Control Spring Internal and External End Float

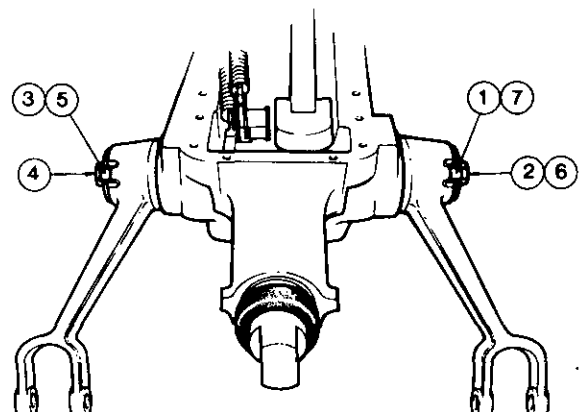
1. Remove the control spring assembly, operation 8A-01-08, procedures 2 to 6.
2. Drive out the pin.
3. Screw the plunger into the head until all the end float is eliminated and the spring is tight to turn by hand.
4. Fit a new pin.
5. Slide the control spring assembly into the lift cover.



6. Using a suitable wedge, ensure that the draft rod is not touching the control spring plunger.
7. Using MF 163, tighten the retainer until all the end float is eliminated. Do not overtighten the retainer otherwise the end float will reappear.
8. Fit a new nylon plug.
9. Tighten the Allen screw to a torque of 7 Nm (5 lbf ft).
10. Remove the wedge.

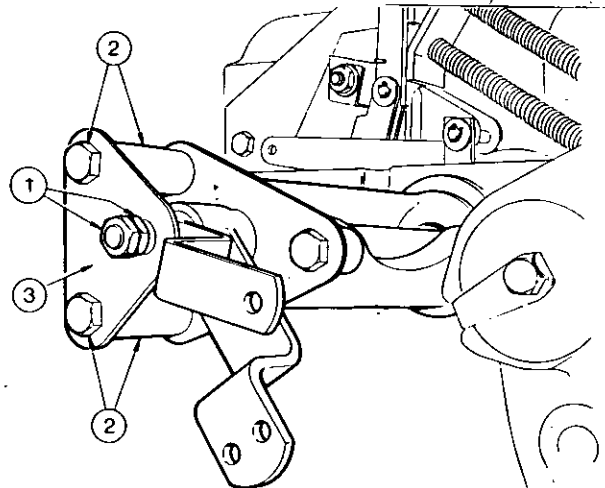
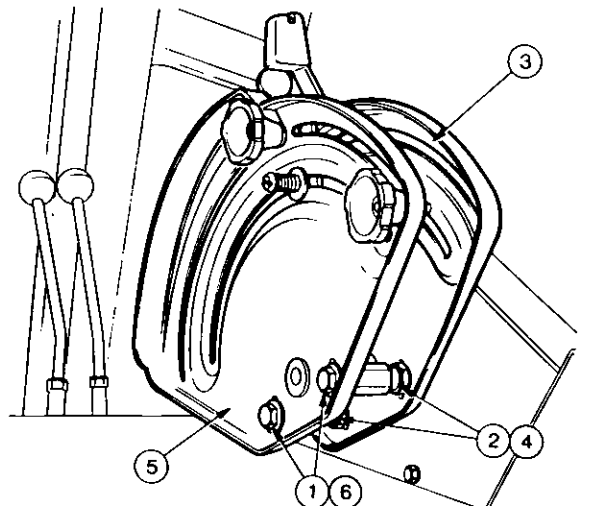
**Lift Arm End Float**

1. Release the tabwasher.
2. Slacken the bolt.
3. Release the tabwasher.
4. Fully tighten the bolt.
5. Secure the bolt with the tabwasher.
6. Tighten the bolt, until the lift arms will move freely throughout their range, but without any end float.
7. Secure the bolt with the tabwasher.

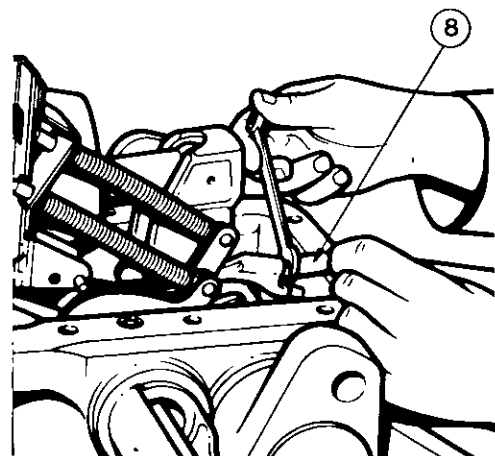
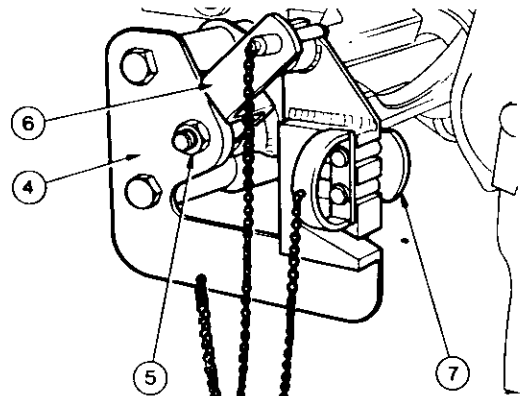


HYDRAULIC SYSTEM**Quadrant Location**

1. Slacken the two bolts.
2. Slacken the two barrel nuts.
3. Locate the outer quadrant in the centre of the elongated hole.
4. Tighten the two barrel nuts.
5. Locate the inner quadrant in the centre of the elongated hole.
6. Tighten the two bolts.

**Draft Control Rod**

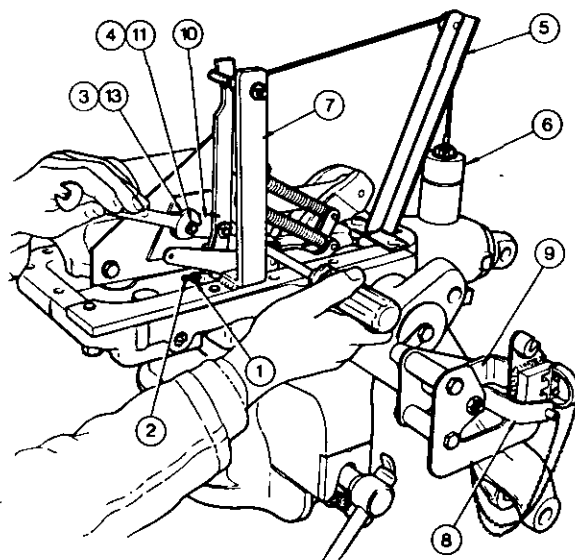
1. Remove the locknut and the nut.
2. Remove the two bolts and the spacers.
3. Remove the plate.
4. Fit MF 363 to the quadrant control support assembly.
5. Refit and tighten the nut.
6. Place the 'Draft Control lever' in the 'up' position and secure it with the pin.
7. Place the 'Position Control lever' in the 'transport' position and secure it with the double pin.
8. Using MF 333, adjust the set screw to give a clearance of 5,8 mm (0.230 in) between the setscrew and the lift cover casting.



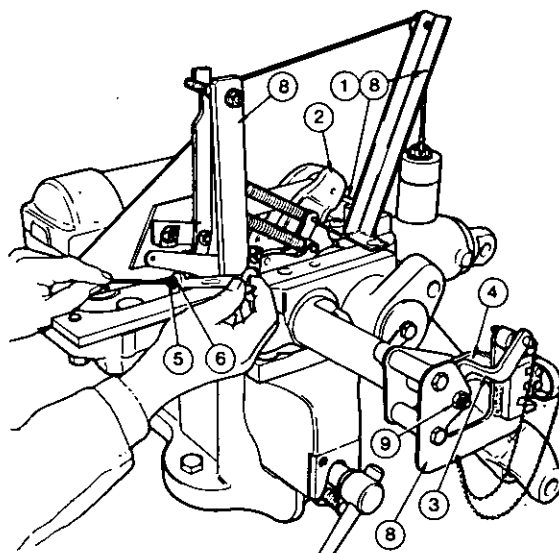
HYDRAULIC SYSTEM

Draft Control

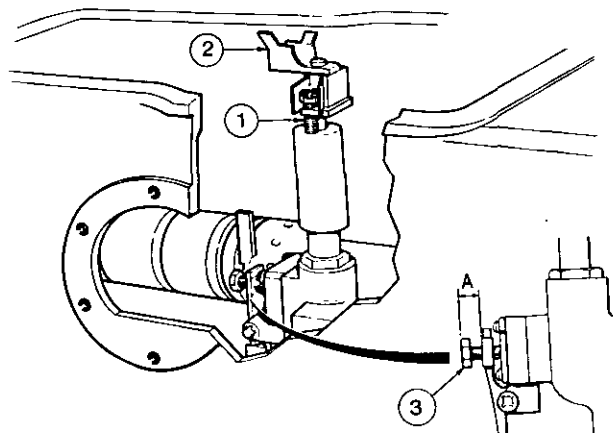
1. Slacken the locknut.
2. Unscrew the Allen screw to the end of its thread.
3. Release the tabwasher.
4. Slacken the nut.
5. Position MF 273 on the lift cover.
6. Apply a load of 1,4 kg (3 lb) to the end of the vertical lever.
7. Locate MF 356 on the lift cover.
8. Place the 'Draft Control lever' in the 'sector' position and secure it with the pin.
9. Place the 'Position Control lever' in the 'transport' position and secure it with the double pin.
10. Adjust the slide pivot, until the vertical lever just touches the pin on MF 356.
11. Tighten the nut.
12. Recheck the setting.
13. Secure the nut with the tabwasher.

**Position Control**

1. Position MF 272 on the lift cover.
2. Locate the ram arm on MF 272.
3. Place the 'Draft Control lever' in the 'up' position and secure it with the pin.
4. Place the 'Position Control lever' in the 'transport' position and secure it with double pin.
5. Adjust the Allen screw until the vertical lever just contacts the pin on MF 356.
6. Tighten the locknut.
7. Recheck the setting.
8. Remove MF 272, MF 273, MF 356 and MF 363.
9. Refit the nut to retain the lever. DO NOT fit the plate, spacers and bolts at this stage.

**Pressure Control**

1. Set the setscrew in the middle of its travel.
2. Set the butterfly adjuster as shown.
3. Set the setscrew to 14 mm (0.56 in) at 'A'.
4. Refit the lift cover, operation 8A-03-09.



HYDRAULIC SYSTEM

HYDRAULIC ADJUSTMENTS

Internal Adjustments

8A-12-16

Special Tools: MF 148A Pressure Test Kit

MF 166 Adaptor

MF 357 Screwdriver Adjuster

MF 359 Pressure Control Bleed Pipe

Preparation for Internal Adjustments

1. Remove the side cover, operation 8A-03-09, procedures 15 to 20.
2. Remove the cab seat floor, Part 2B.
3. Locate MF 359, in the Pressure Control valve body and place the other end in the side cover aperture.
4. Attach a weight of 400 kg (900 lb) to the lower links.
5. Place the Draft Control lever in the fully DOWN position.
6. Connect MF 148A and MF 166 to the tapped port in the lift cover.
7. Place the Draft Control lever in the fully UP position.
8. Start the engine and set the engine speed at 'tick-over', then operate the Position Control lever through the quadrant range to expel all the air from the system.
9. Warm up the oil in the transmission to a temperature of 50 to 70°C (120 to 160°F) and then stop the engine.

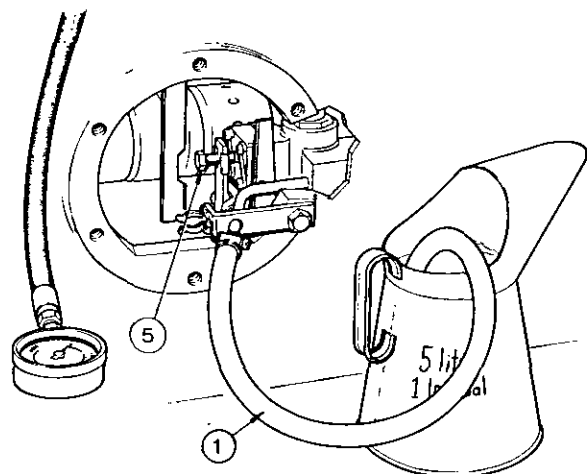
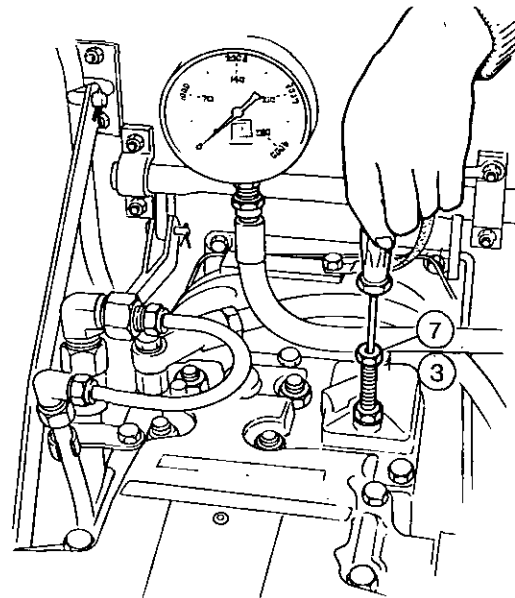
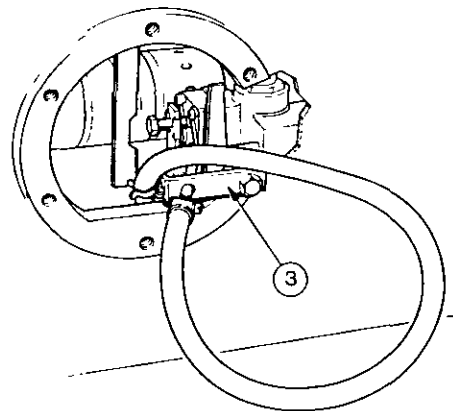
Pressure Control Maximum Setting

1. Place the Draft Control lever in the fully DOWN position.
2. Remove the bolt and washer.
3. Fit MF 356 to the stand pipe cap.
4. Start the engine, and set the engine speed at 1200 rev/min.
5. Place the Draft Control lever in the fully UP position.
6. Place the Position Control lever in the CONSTANT PUMPING position.
7. Using MF 357, adjust the screw to give a pressure on the gauge of:

MF 550 Tractor	—	18 to 19 N/mm ²
		(2 650 to 2 800 lbf/in ²)
MF 565, 575		
and 590 Tractors	—	21 to 22 N/mm ²
		(3 100 to 3 250 lbf/in ²)
8. Fully lower the links and stop the engine.
9. Remove MF 357.
10. Refit the washer and bolt.

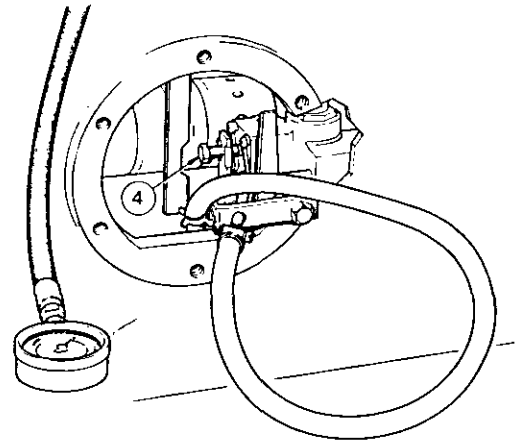
Pressure Control Final Adjustment

1. Remove the tube of MF 359, from the side cover aperture and place it in a five litre (one gallon) container.
2. Start the engine, and set the engine speed at 1200 rev/min.
3. Place the Draft Control lever in the fully UP position.
4. Place the Position Control lever in the CONSTANT PUMPING position.
5. Adjust the setscrew until a flow of 5 litre/40s (1 Imp. gal/35s) is obtained.
6. Stop the engine, and place the tube of MF 359 in the side cover aperture.



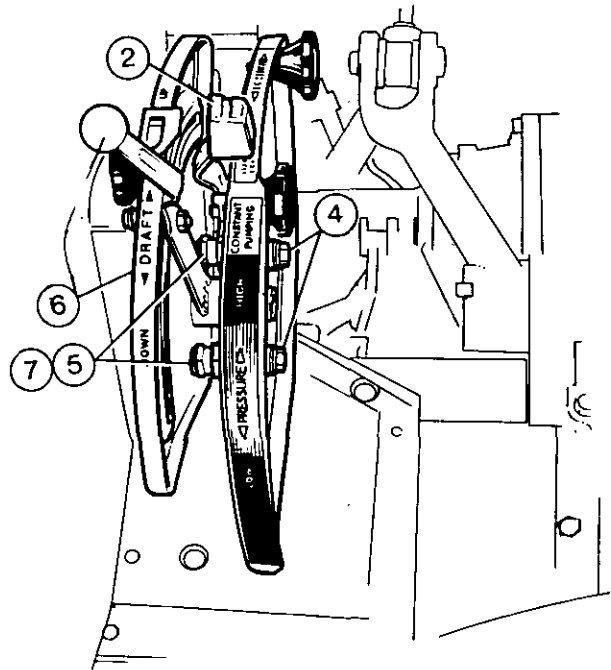
NOTE: The following can be used as an alternative. But it must be emphasised that it is an approximate setting and the first method should be carried out as soon as the opportunity arises.

1. Start the engine, and set the engine speed at 1200 rev/min.
2. Place the Draft Control lever in the fully UP position.
3. Place the Position Control lever in the CONSTANT PUMPING position.
4. Screw the setscrew in until the needle of the gauge begins to fluctuate.
5. Screw the setscrew out until the fluctuating ceases, then unscrew a further **eight flats**.
6. Stop the engine.



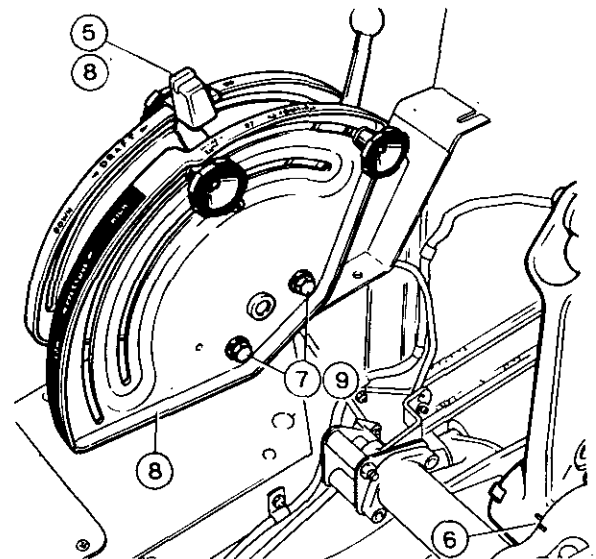
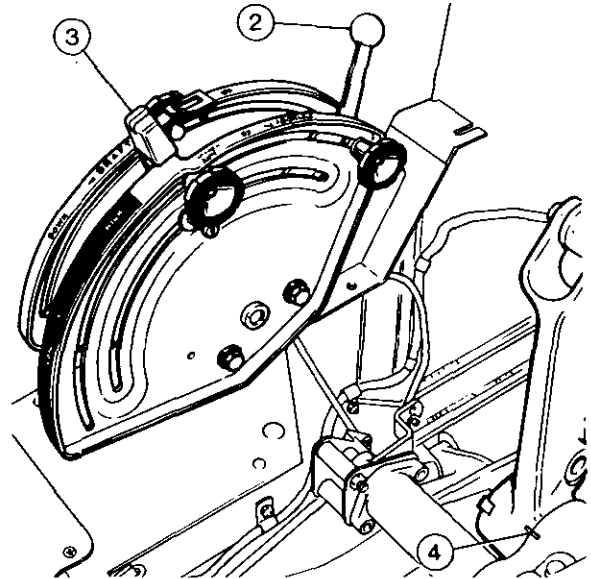
Draft Control Setting

1. Start the engine, and set the engine speed at 1200 rev/min.
2. Place the Position Control lever in the TRANSPORT position.
3. Using the Draft Control lever, set the lower links in the horizontal position: The Draft Control lever should be in the sector marks on the quadrant, if not carry out procedures 4 to 7.
4. Slacken the two bolts.
5. Slacken the two barrel nuts.
6. Rotate the Draft Control quadrant and lever until the links remain stationary in the horizontal position.
7. Tighten the two barrel nuts and recheck the setting.
8. Stop the engine.

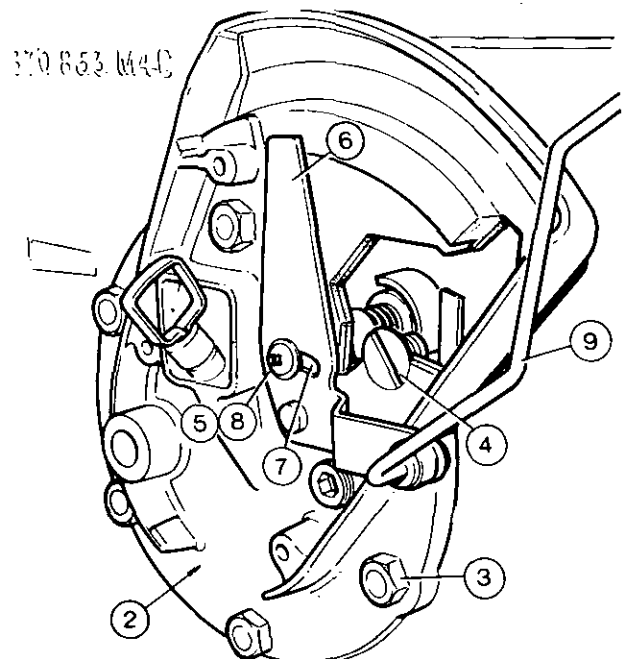


HYDRAULIC SYSTEM**Position Control Setting**

1. Start the engine, and set the engine speed at 1200 rev/min.
2. Place the Draft Control lever in the fully UP position.
3. Place the Position Control lever in the CONSTANT PUMPING position.
4. When the links are fully raised scribe a line across the top cover casting and lift arm.
5. Place the Position Control lever in the TRANSPORT position.
6. The links should drop until the scribe lines are 1,6 to 4,7 mm (0.06 to 0.19 in) apart, if the distance is incorrect carry out procedures 7 to 10.
7. Slacken the two bolts.
8. Rotate the Position Control quadrant and lever until the setting is correct.
9. Tighten the two bolts and recheck the setting.
10. Fully lower the links and stop the engine.
11. Remove MF 359, MF 148A and MF 166.

**Response Control.**

1. Fit a new gasket.
2. Refit the side cover.
3. Refit the five bolts.
4. Refit the screw.
5. Release the locking screw.
6. Place the Response Control lever 6 mm (0.25 in) from the rear end of its quadrant.
7. Rotate the inner lever, until the cam just contacts the vertical lever on the pump.
8. Tighten the screw.
9. Reconnect the rod.
10. Add approved oil to the transmission until the required level is reached.
11. Refit the cab rear cross beam and the seat floor, Part 2B.



HYDRAULIC PUMP**Removal and Refitment**

8A-13-19

Special Tools: See Operation 8A-03-09

Removal

Tractors not fitted with an i.p.t.o./Multi-Power or auxiliary pump.

1. Remove the lift cover, operation 8A-03-09.
2. Remove the butterfly adjuster.
3. Remove the tube.
4. Remove the spring.
5. Remove and discard the split pin.
6. Remove the shear tube and the rear drive shaft.
7. Remove the p.t.o. shaft, Part 6B.
8. Remove the two nuts and the dowel pins each side.
9. Manoeuvre the hydraulic pump out of the top of the centre housing.
10. Remove and discard the split pin.
11. Remove the coupler.

Refitment

12. Reverse procedures 1 to 12 except:
 - (a) Fit new split pins and 'O' rings.
 - (b) Fit the new shear tube split pin to give 0,38 to 2,54 mm (0.015 to 0.100 in) end float.

Removal

Tractors fitted with an i.p.t.o./Multi-Power or auxiliary pump.

1. Remove the lift cover, operation 8A-03-09.
2. Split the tractor between the spacer housing and the centre housing (transmission and spacer housing—MF 550 Tractor) and withdraw the rear axle assembly rearwards, Part 3A.
- 2a. MF 550 tractors only. Remove the spacer housing, Part 6B.
3. Remove the butterfly adjuster.
4. Remove the tube and the spring.
5. Remove the p.t.o. side cover, Part 6B.

Tractors fitted with an auxiliary pump, carry out procedures 6 and 7.

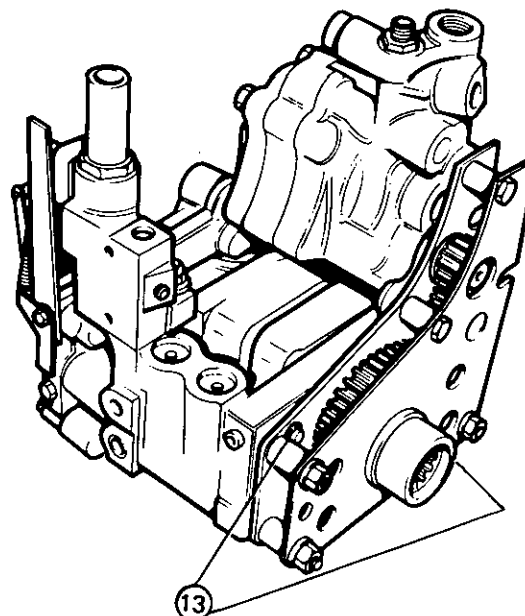
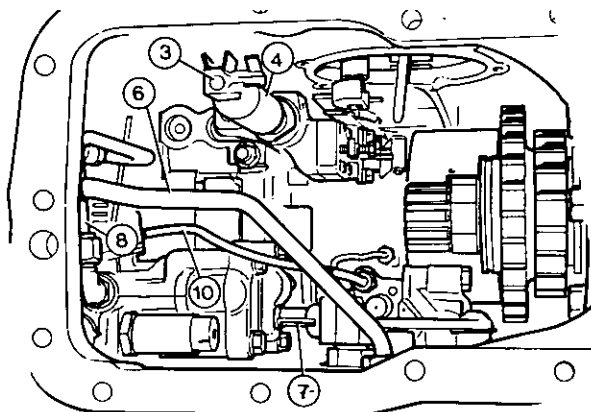
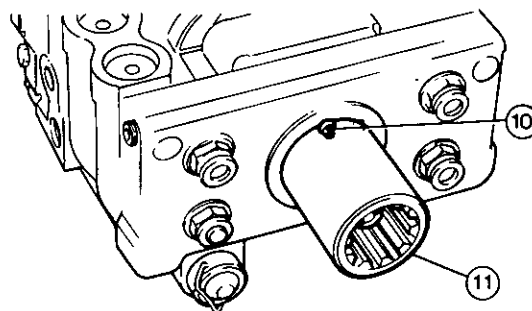
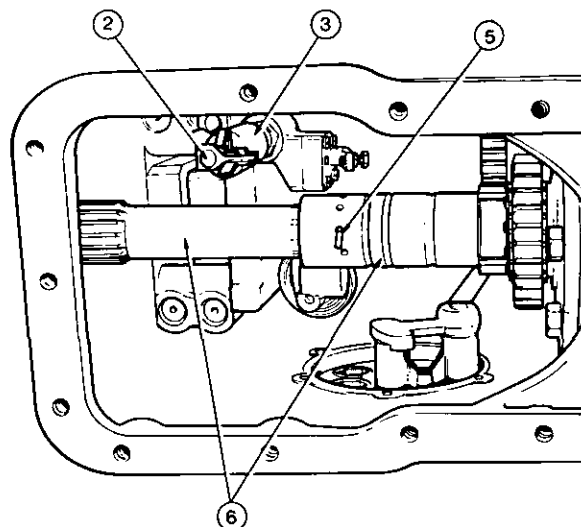
6. Disconnect the pipe.
7. Remove the pipe.
8. Remove the pipe.
9. Remove the two nuts and the dowel pin each side.

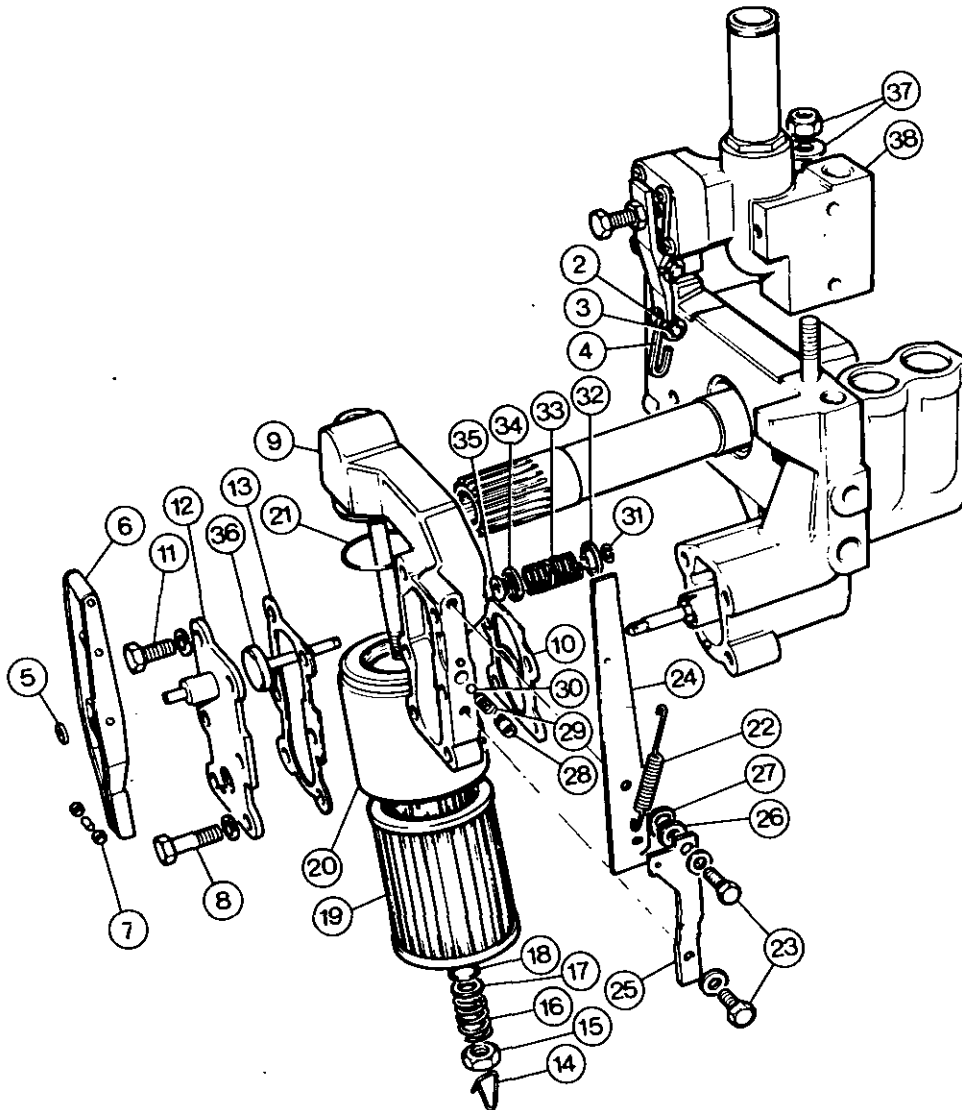
Tractors fitted with i.p.t.o., carry out procedures 10 and 11.

10. Disconnect the pipe at the i.p.t.o./Multi-Power pump.
11. Move the hydraulic pump, i.p.t.o./Multi-Power or auxiliary pump, and the i.p.t.o. unit forwards.
12. Withdraw the hydraulic pump and the p.t.o./Multi-Power or auxiliary pump, as a complete assembly from the front of the centre housing.
13. Remove the two 'C' clips.
14. Withdraw the i.p.t.o./Multi-Power or auxiliary pump from the hydraulic pump.

Refitment

15. Reverse procedures 1 to 14 except:
 - (a) Locate the i.p.t.o. unit (if fitted) on the p.t.o. splines and then locate the hydraulic pump camshaft in the i.p.t.o. unit.
 - (b) Fit new 'O' rings.



HYDRAULIC SYSTEM**HYDRAULIC PUMP****Servicing**

8A-14-20

Special Tools: See Operation 8A-03-09, and
 MF 349 Valve Seat Forming Tool
 MF 350 Valve Circlip Replacer
 MF 351 Valve Plug Remover and
 Replacer
 MF 352 Control Valve Spring
 Retainer
 MF 353 Control Valve Body 'O'
 Ring Guide
 MF 354 Control Valve Body Replacer

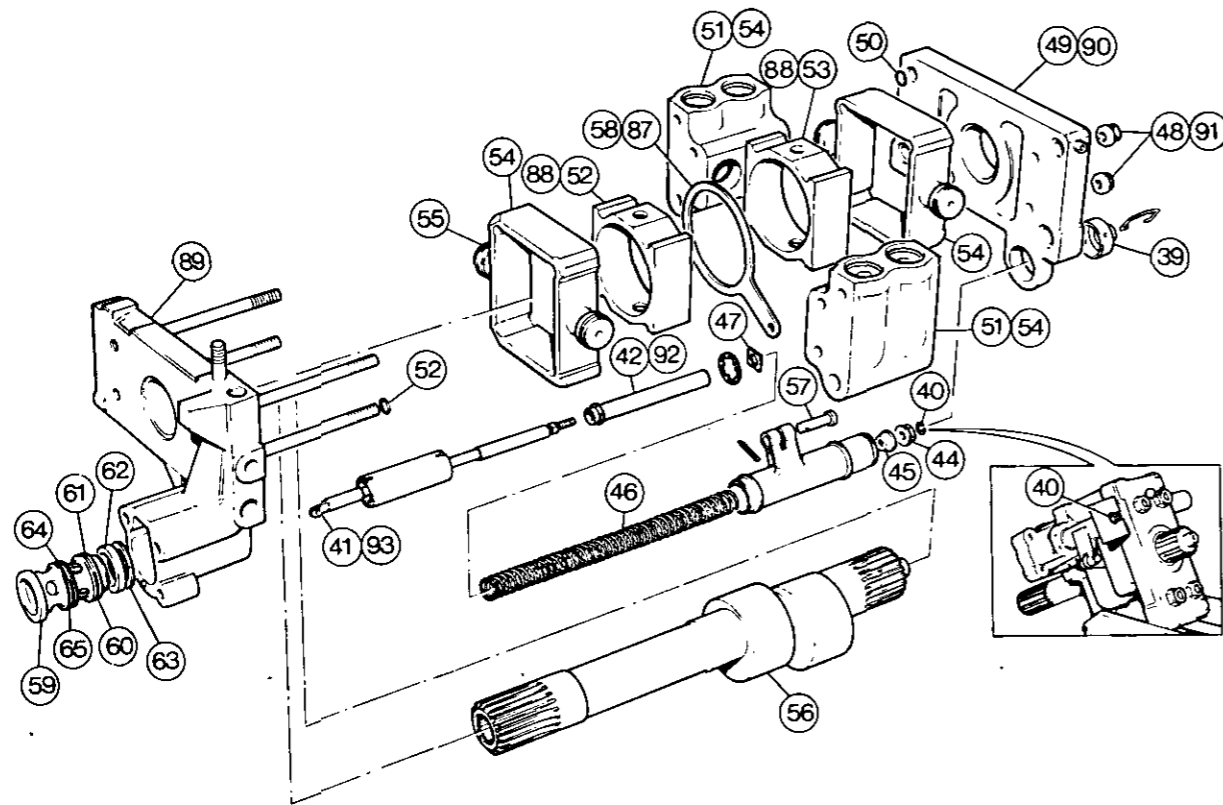
Disassembly

1. Remove the hydraulic pump, operation
 8A-13-19.

Remove the following:

2. Clip.
3. Pin.
4. Link.
5. Clip.
6. Lever.
7. Two rollers and the pin.
8. Four bolts and washers.
9. Strainer housing.
10. Gasket and discard it.
11. Two bolts and washers.
12. End plate.
13. Gasket and discard it.

14. Clip.
15. Nut.
16. Spring.
17. Washer.
18. 'O' ring and discard it.
19. Strainer.
20. Cover.
21. 'O' ring and discard it.
22. Spring.
23. Two bolts and washers.
24. Lever.
25. Retainer.
26. Bush.
27. Washer.
28. Bush.
29. Spring.
30. Ball.
31. Circlip.
32. Cap.
33. Spring.
34. Retainer.
35. Seal and discard it.
36. Valve.
37. Nut and washer.
38. Carefully remove the Pressure Control valve.



39. Remove the cap.
40. Using MF 352, remove and discard the retaining ring.
41. Withdraw the control valve.
42. Remove the balancer tube.
43. Taking care that the spring is not ejected, remove MF 352.
44. Remove the collar.
45. Remove the guide.
46. Remove the spring.
47. Remove the square disc.
48. Remove the four nuts.
49. Detach the front body.
50. Remove and discard the 'O' rings.
51. Withdraw the two valve chambers from the rear body, complete with the cam blocks, pistons, cam follower and oscillator tube as an assembly.
52. Remove and discard the 'O' rings.
53. Remove the cam blocks from the pistons.
54. Separate the valve chambers from the pistons.
55. Remove the piston rings, if necessary.
56. Withdraw the camshaft from the rear body.
57. Remove the split pin and the pin.
58. Remove the cam follower from the oscillator tube.
59. Carefully drive out the body.
60. Remove and discard the 'O' ring.
61. Remove and discard the back-up washer.
62. Remove the sleeve.
63. Remove the washer.
64. Remove and discard the 'O' ring.
65. Remove and discard the back-up washer.
66. Remove and discard the circlip.

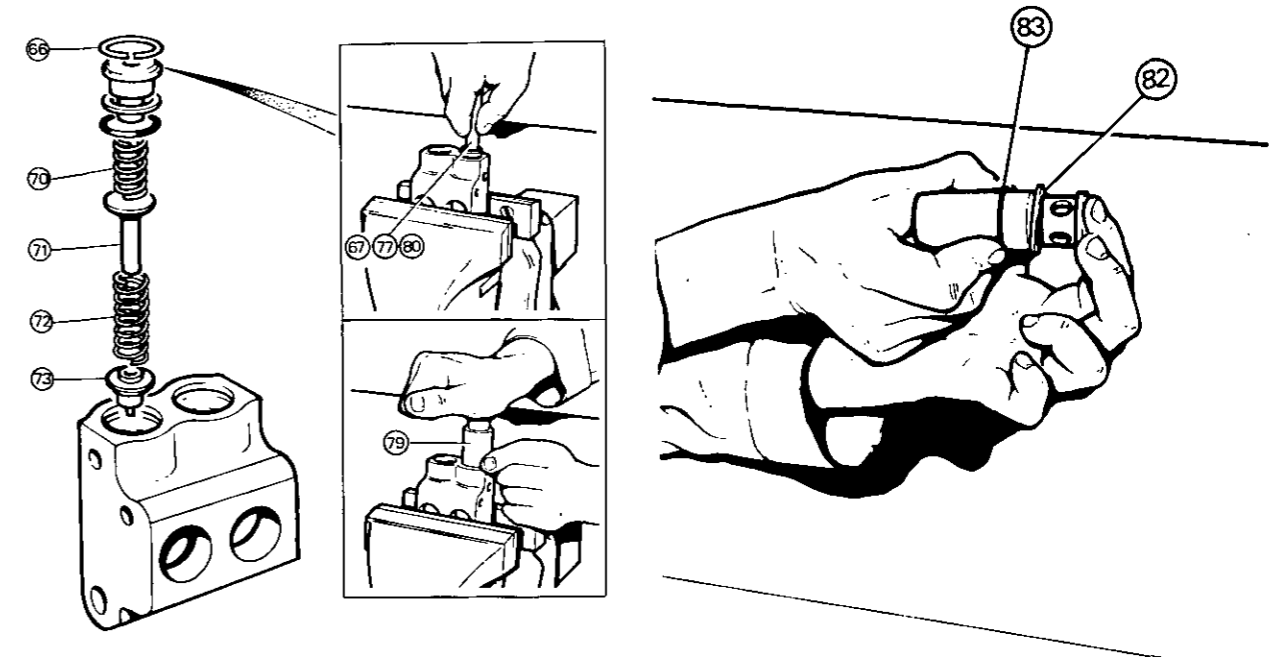
67. Using MF 351, remove the plug.
68. Remove and discard the back-up washer.
69. Remove and discard the 'O' ring.
70. Remove the spring.
71. Remove the valve.
72. Remove the spring.
73. Remove the valve.
74. Repeat procedures 66 to 73 for the other three valves.

Examination

Check the condition of all components for wear or damage, replacing any defective components. Always replace 'O' rings, back-up washers, gaskets and circlips. Lubricate the 'O' rings with an approved oil before fitting.

Reassembly

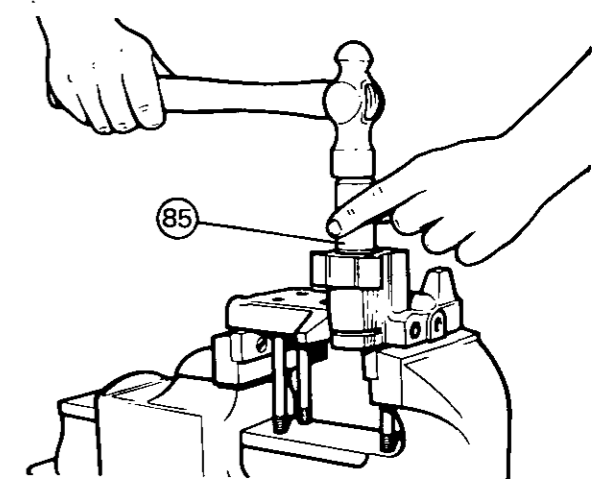
75. If necessary, form new valve seats, using MF 349 as follows:
Cut out the old top seat, then the bottom seat using the refacing tool. Using the seat forming tool, form a new top seat by tapping the tool with hammer, invert the tool and form a new bottom seat in the same manner. Thoroughly clean the valve chambers.
76. Reverse procedure 68 to 73.
77. Using MF 351, push the plug into the valve chamber until the circlip groove can just be seen.



78. Position a new circlip in MF 350.
79. Using MF 350, fit the circlip.
80. Using MF 351, pull the plug up against the circlip.
81. Repeat procedures 76 to 80 for the other three valves.
82. Using MF 353, fit a new back-up washer to the valve body.
83. Using MF 353, fit a new 'O' ring to the valve body.
84. Reverse procedures 60 and 63.
85. Using MF 354, carefully drive the body into the front body, aligning the pin at six o'clock.
86. Reverse procedures 52, 54, 55, 57 and 58.
87. Place the cam follower between the pistons.
88. Fit the two cam blocks to the camshaft.
89. Refit the rear body.
90. Refit the front body.
91. Lubricate the studs with an approved oil, and refit the four nuts and tighten them to a torque of 40 Nm (30 lbf ft) ensuring at all times that the pistons move freely.

NOTE: The special nuts must be fitted to the top right hand and the bottom left hand studs.

92. Refit the balancer tube to the control valve.
93. Lubricate the control valve with an approved oil and slide it into the rear body.
94. Reverse procedures 1 to 40 and 43 to 47 except:
 - (a) Tighten the Pressure Control valve nut to a torque of 40 Nm (30 lbf ft).
 - (b) Coat the vertical lever upper bolt with recommended sealant 'A' and tighten the bolt to a torque of 14 Nm (10 lbf ft).
 - (c) Coat the strainer end plate bolts with recommended sealant 'A' and tighten the bolts to a torque of 20 Nm (15 lbf ft) checking at all times that the control valve continues to move freely.



HYDRAULIC SYSTEM**HYDRAULIC PUMP****Control Valve Removal and Refitment**

8A-15-22

Special Tools: See Operation 8A-03-09 and,
MF 352 Control Valve Spring Retainer
MF 353 Control Valve Body 'O' Ring Guide
MF 354 Control Valve Body Replacer

Removal

1. Remove the control valve, operation 8A-14-20, procedures 1 to 10 and 39 to 52.
2. Remove the control valve body, operation 8A-14-20, procedures 59 to 64.

Examination

Check all components for wear or damage, replacing any defective parts. Always replace back-up washers, 'O' rings, gaskets and circlips. Lubricate the 'O' rings with an approved oil before refitting.

Refitment

3. Reverse procedures 1 and 2.

PRESSURE CONTROL VALVE**Removal and Refitment**

8A-16-22

Special Tools: See Operation 8A-03-09.

Removal

1. Remove the hydraulic pump, operation 8A-13-19.
2. Remove the clip.
3. Remove the pin.
4. Remove the link.
5. Remove the nut and washer.
6. Carefully remove the valve.

Refitment

2. Reverse procedures 1 to 6 except, tighten the nut to a torque of 40 Nm (30 lbf ft).

PRESSURE CONTROL VALVE**Servicing**

8A-17-22

Special Tools: See Operation 8A-03-09

Disassembly

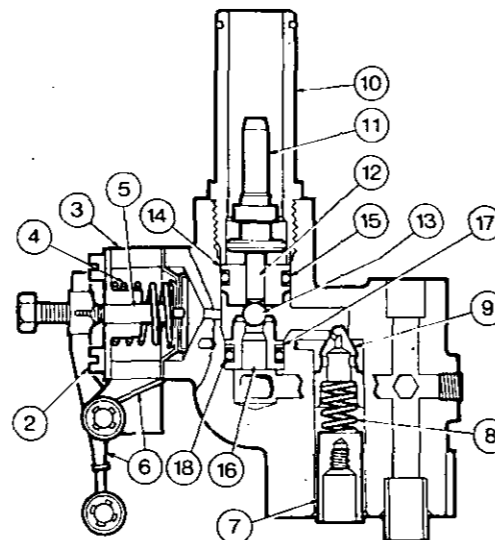
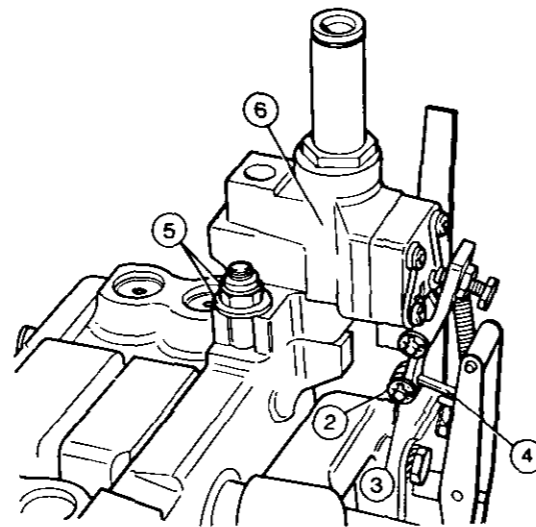
1. Remove the Pressure Control valve, operation 8A-16-22.
2. Remove the four screws and spring washers.
3. Remove the body.
4. Remove the spring.
5. Remove the diaphragm.
6. If necessary, remove the lever and the spring.
7. Remove the distance piece.
8. Remove the spring.
9. Remove the valve.
10. Unscrew the guide.
11. Remove the spring support.
12. Remove the plunger.
13. Remove the ball.
14. Taking care not to damage the valve body, withdraw the guide.
15. Remove and discard the 'O' ring.
16. Taking care not to damage the valve body, withdraw the seat.
17. Remove and discard the back-up washer.
18. Remove and discard the 'O' ring.

Examination

Examine all components for signs of wear, damage, scoring or pitting and replace if necessary. Always fit new 'O' rings and back-up washers.

Reassembly

19. Reverse procedures 1 to 18 except:
 - (a) Fit the plunger with the taper towards the ball.
 - (b) Lightly coat the threads of the guide with recommended sealant 'C' and tighten the guide to a torque of 40 Nm (30 lbf ft).
 - (c) Fit the distance piece so that it is flush with the face of the valve body.

**STRAINER HOUSING AND RESPONSE CONTROL****Removal and Refitment**

8A-18-22

Special Tools: See Operation 7A-03-09

Removal

1. Remove the strainer housing, operation 8A-14-20, procedures 1 to 10.

Refitment

2. Reverse procedure 1.

STRAINER HOUSING AND RESPONSE CONTROL**Servicing**

8A-19-22

Special Tools: See Operation 8A-03-09

Disassembly

1. Remove the strainer housing, operation 8A-18-22
2. Disassemble the strainer housing and the Response Control, operation 8A-14-20, procedures 11 to 36.

Examination

Check the condition of all components for wear or damage, replacing any defective components. Always replace 'O' rings and gaskets.

Reassembly

3. Reverse procedures 1 and 2.

AUXILIARY HYDRAULICS

Part 8 — Section B

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AUXILIARY HYDRAULICS

GENERAL

The auxiliary hydraulic system provides oil under pressure for up to three services:— Multi-power, Independent P.T.O. and auxiliary (external) services. Spool control valves are available for use with auxiliary tractors (fitted with dual element pump) and can be used for both single-acting and double-acting hydraulic services.

Auxiliary hydraulic tractors are normally fitted with an oil cooler and micronic filter as standard equipment. The combined flow of both the auxiliary pump and linkage pump is available for external service provided that the pressure required is not in excess of 186.3 kg/cm² (1650 lb/in²) and that a selector valve is fitted.

OIL COOLER

Removal and Refitment

8B—01—02

Removal

1. Remove the front grille.
2. Remove the battery, Part 9A.
3. Detach the windscreen washer bottle (if fitted).
4. Disconnect the two pipe unions at the cooler.
5. Mask off the hose connections with suitable plugs or masking tape to prevent the ingress of foreign matter.
6. Remove the four securing bolts.
7. Withdraw the oil cooler.

Refitment

8. Reverse procedures 1—7.

TRANSMISSION OIL FILTER

Maintenance

8B—02—02

Disassembly

1. Remove the front grille.
2. Unscrew the filter housing.
3. Remove the element.
4. Remove the spring from the base of the element.
5. Remove the 'O' ring from the filter head.
6. Clean all components with paraffin.
7. Examine the filter head and filter housing for cracks or leaks.
8. Always fit a new element and filter head 'O' ring.

Reassembly

9. Fit a new 'O' ring to the filter head.
10. Fit a new element with the spring.
11. Reverse procedures 1—2.

TRANSMISSION OIL FILTER

Removal and Refitment

8B—03—02

Removal

1. Remove the hood, Part 2A.
2. Remove the front grille.
3. Disconnect both pipe unions at the filter head.
4. Disconnect the horn circuit fuse (MF 550 only).
5. Remove the two securing bolts and washer retaining the filter unit.
6. Block off the pipes with suitable sealing caps or masking tape to prevent the ingress of dirt or foreign matter.

Refitment

7. Reverse procedures 1—6.

TRANSMISSION OIL FILTER

By-Pass Valve Servicing

8B—04—02

Disassembly

1. Remove the auxiliary oil filter unit, operation 8B—03—02.
 2. Unscrew the filter housing.
 3. Remove the inlet union.
 4. Remove the spring.
 5. Remove the ball valve.
 6. Clean all components in paraffin.
- Check all components for wear or damage.

Reassembly

8. Reverse procedures 1—6.

AUXILIARY OR MULTI-POWER/I.P.T.O. PUMP

Removal and Refitment

8B—05—02

Special Tools: See Part 8A

Removal

1. Remove the auxiliary pump, complete with the plated drive and separate this assembly from the hydraulic lift pump as stated in Part 8A.
2. Remove the circlip securing the drive gear.
3. Remove the bolts and the Allen screw securing the pump.
4. Withdraw the pump from the plated drive.
5. Remove the gear and the spacers if necessary.

Refitment

6. If necessary, refit the spacers and the gear to the plated drive.
7. Engage the splines of the pump shaft into the gear and refit the circlip.
NOTE: Ensure that the machined flat on the plated drive idler gear shaft engages against the bottom of the pump.
8. Refit the securing bolts and Allen screw. Tighten to a torque of 27 Nm (20 lbf ft).

9. Check the backlash between the plated drive gears. The total backlash between the three gears (two measurements) should be in the range 0,050 to 0,406 mm (0-002 to 0-016 in). If the backlash is incorrect, slacken the bolts and move the pump in relation to the plated drive, then retighten the bolts and recheck the backlash.
10. Reconnect the plated drive and pump assembly to the hydraulic lift pump, as stated in Part 8A.

AUXILIARY OR MULTI-POWER/I.P.T.O. PUMP UNIT

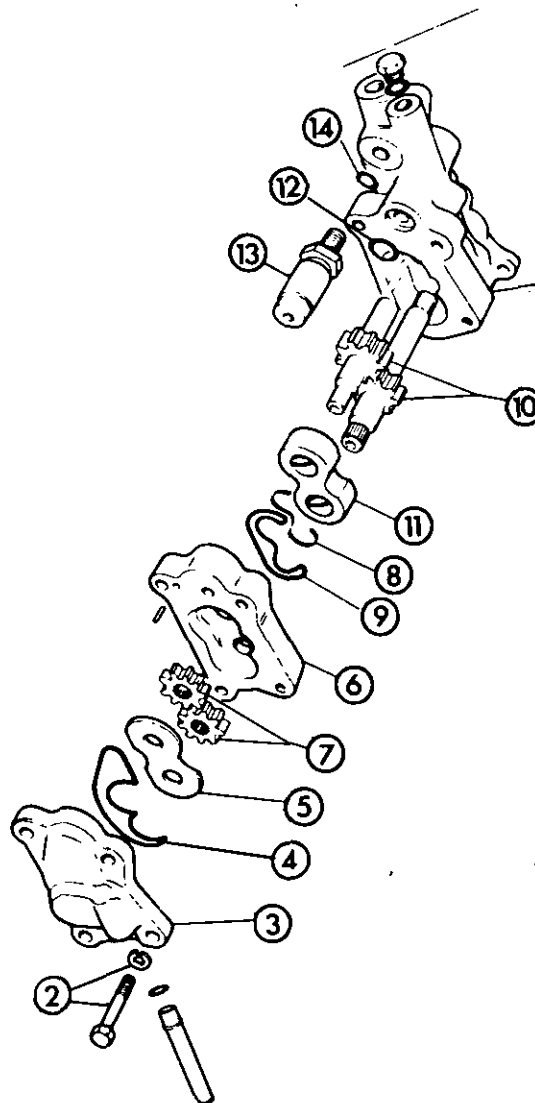
Auxiliary Pump Servicing

8B-06-03

Special Tools: See Part 8A

Disassembly

1. Remove the Auxiliary pump, Part 8A.
2. Remove the end cover securing bolts and locking washers.
3. Remove the end cover.
4. Remove the seal.
5. Remove the bearing plate.
6. Remove the centre body complete with the gears and seals.
7. Withdraw the gears.
8. Remove the P.T.F.E. seal (white).
9. Remove the centre body seal.
10. Withdraw the shafts complete with the bearing.
11. Remove the bearing.
12. Remove the 'O' ring.
13. If necessary remove the main relief valve.
14. If necessary remove the 'O' ring.
15. If necessary service the Multi-power/I.P.T.O. relief valve, operation 8B-08-06.



AUXILIARY HYDRAULICS**Examination****Bearings**

Examine the bearings for wear on their faces and in their bores. Pay particular attention to the lubricating scrolls. Score marks, between the bearing bores can cause high leakage losses. During major overhaul the bearings should be renewed, but if not badly worn, they can be salvaged, by polishing as follows:

Place a sheet of 'O' grade emery paper, lubricated with paraffin on a true, flat surface (e.g., a surface plate, or sheet of plate glass), then polish the bearing face, using a light rotary motion.

Outer diameters of the bearings can be lightly polished to obtain free movement in the body.

Bodies

Inspect the bodies for external damage and cracks. Examine bores for wear and damage. The gears always cut a light track on the inlet side of the body bores. The depth of this track must not exceed 0,010 mm (0-004 in). Examine the bearing face in the pump body for wear and damage, as this can cause high leakage losses.

Examine the bearing bores for wear. If they are worn excessively, the pump body must be replaced.

Gears

Examine the gears for scored or worn faces or journals, damaged teeth and surface cracks. Slight wear or scoring on the journals can be removed by polishing between lathe centres, using 'O' grade emery paper lubricated with paraffin. Check the widths of the drive and driven gears. Their actual width is relatively unimportant, provided that each pair are within 0,005 mm (0-002 in) of each other and that the journals are within 0,013 mm (0-005 in) of one another. Spare gears are only available as matched pairs.

Check the gear faces for flatness by smearing a bearing face with engineer's "blue" and rotating the gear against it. This will also reveal any sharp edges on the teeth which can be removed with a fine needle or by stoning.

Under working conditions, hydraulic pressure within the pump loads the gears towards the inlet side of the body, thus cutting the running track. If the bearings, or gear journals wear, the gears move over and deepen the running track. Therefore, if the running track is worn past, or to the limit, for re-use, the fitting of a new floating bearing may not improve the pump efficiency, as the new bearing will hold the gears and prevent them from bottoming in the running track.

Always fit a set of new seals and 'O' rings on reassembly.

Reassembly

1. Reverse procedures 1 to 15 except:

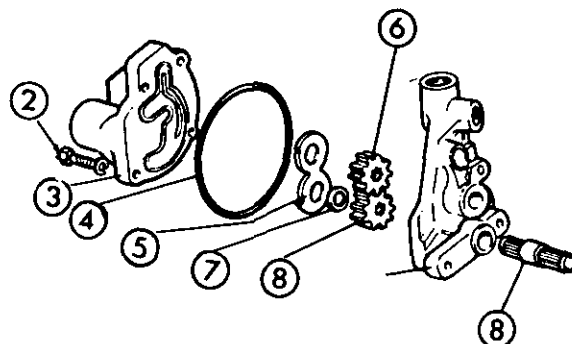
- (a) After checking that all parts are clean, lubricate all parts with a clean, approved oil.
- (b) Fit the floating bearing with its machined recess adjacent to the gears and the relieved radii on the outlet side of the pump (i.e. the R.H. side of the pump, when viewed from the rear). Check that the floating bearing is 0,05 to 0,13 mm (0-002 to 0-0055 in) BELOW the face of the pump body.
- (c) Fit a new seal to the centre body then fit the P.T.F.E. seal (white) between the OUTER edge of the rubber seal and the pump body.
- (d) When refitting the centre body to the pump, DO NOT DISPLACE THE SEALS.
- (e) Refit the rear bearing with the recess adjacent to the gears. Check that the face of the rear bearing is 0,05 to 0,18 mm (0-002 to 0-007 in) BELOW the face of the centre body. Fit a new seal to the rear cover, then fit the cover, plus the bolts and lockwasher. Tighten the bolts to 27 Nm (20 lbf ft).

AUXILIARY OR MULTI-POWER/I.P.T.O. PUMP**Multi-Power I.P.T.O. pump** 8B-07-05**Servicing**

Special Tools: See Part 8A

Disassembly

1. Remove the pump, operation 8B-05-02.
2. Remove the securing bolts and locking washers.
3. Remove the end cover.
4. Remove the seal.
5. Remove the bearing plate.
6. Remove the idler gear.
7. Remove the circlip.
8. Slide out the shaft and gear.

**Examination**

Examine the pressure plate for wear on the faces and bores. Score marks between the bearing bores can cause high leakage losses. During major overhaul, the pressure plate can be renewed, but if not badly worn, it can be salvaged, by polishing, as follows:

Place a sheet of 'O' grade emery paper, lubricated with paraffin, on a true, flat surface (e.g. a surface plate, or sheet of plate glass). then polish the bearing plate, using a light, rotary motion.

Outer diameters of the pressure plate can be lightly polished to obtain free movement in the body.

Inspect the body for external damage or cracks and examine the bores for wear, or damage. The gears always cut a light track on the inlet side of the body bores. The depth of this track must not exceed 0,10 mm (0-004 in). Examine the bearing face in the pump body for wear or damage, as this can also cause high leakage losses.

Examine the diameter of the driven gear spigot for wear. This will normally show up as a step on the diameter and if wear has taken place, the running track wear in the body bore will be excessive, necessitating replacement of the body.

Inspect the gears for scored or worn faces, damaged teeth, or surface cracks. Slight wear or scoring on the gear faces can be polished in a similar manner to that of the bearing plate. Check the width of the gears. Their actual width is relatively unimportant, provided that they are within 0,005 mm (0-002 in) of each other.

Visually inspect the sealing face of the end plate for damage, cracks, or scoring and check the flatness with a straight edge.

Replace any defective components and fit a new seal and circlip.

Reassembly

1. Reverse procedures 1 to 8 except:
 - (a) Refit the floating bearing with the relieved edge and the recessed face to the outlet side of the pump.
 - (b) Check that the floating bearing is 0,05 to 0,18 mm (0-002 to 0-007 in) BELOW the body joint face.
 - (c) Re-tighten the end cover bolts to a torque of 27 Nm (20 lbf ft).

AUXILIARY HYDRAULICS

AUXILIARY OR MULTI-POWER/I.P.T.O. PUMP

Multi-power/I.p.t.o. relief valve Servicing

8B—08—06

Special Tools: 840 Test Kit
 MF 166, MF 810-1/4 and MF 260-4/4
 Adaptors
 357 197×91 90° Elbow
 Seat replacer, See page 8B—08
 Peening tool, See page 8B—08

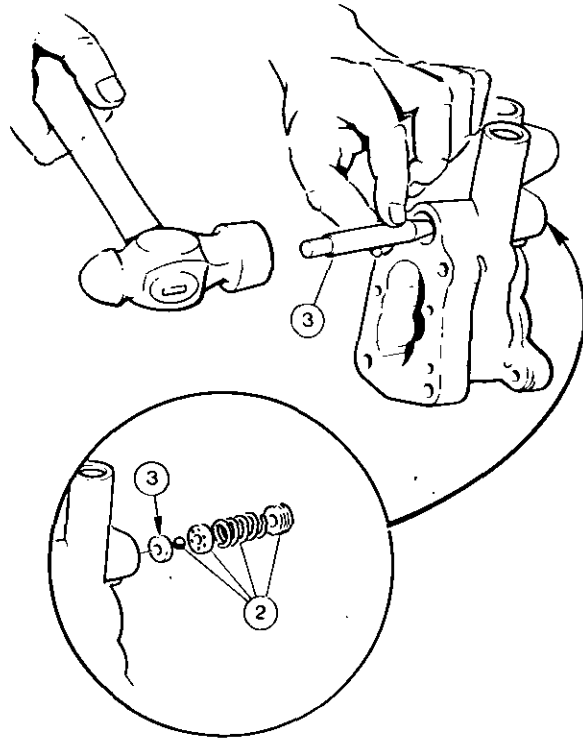
NOTE: The relief valve cannot be properly serviced without these tools.

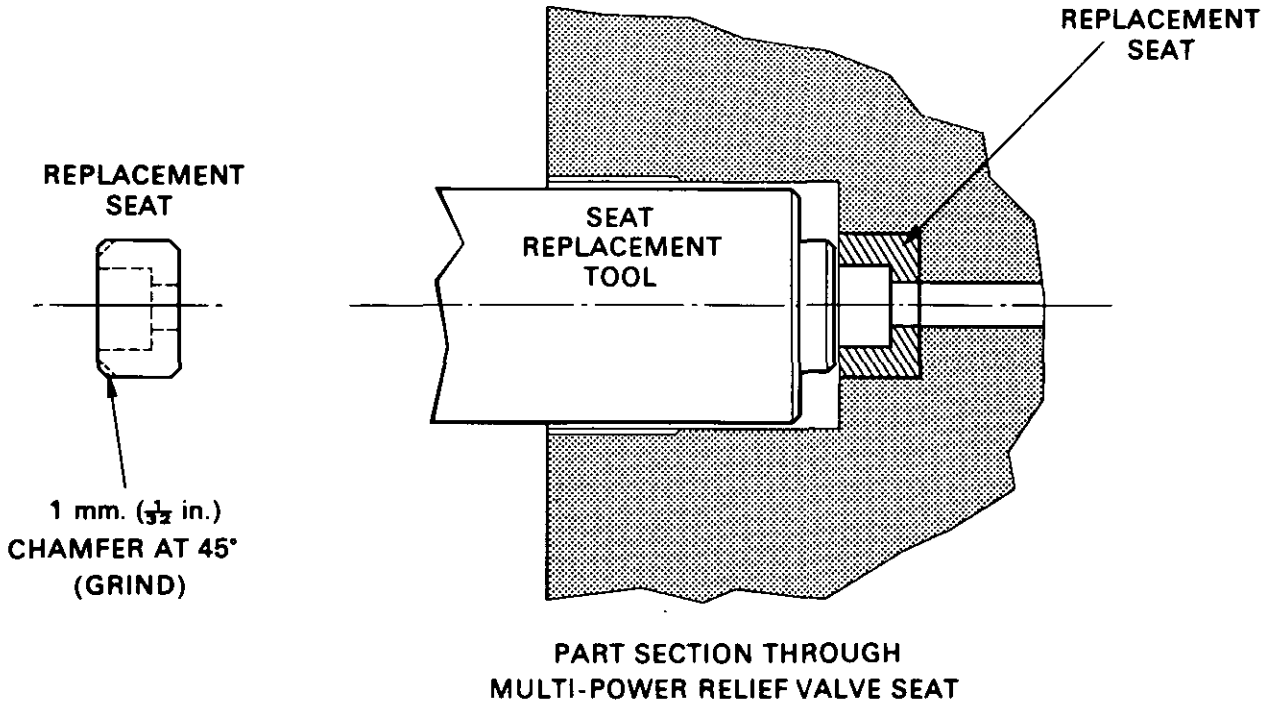
Procedure

1. Remove the pump. Operation 8B—05—02.
2. Unscrew the locking screw and remove the spring, guide and ball.
3. Drive out the seat.
4. Degrease the seating in the pump body.
5. Grind a chamfer on the new seat.
6. Apply two or three drops of Loctite Sealant (C) to the pump body seat.
7. Carefully drive the new seat into the body, using the seat replacing tool.

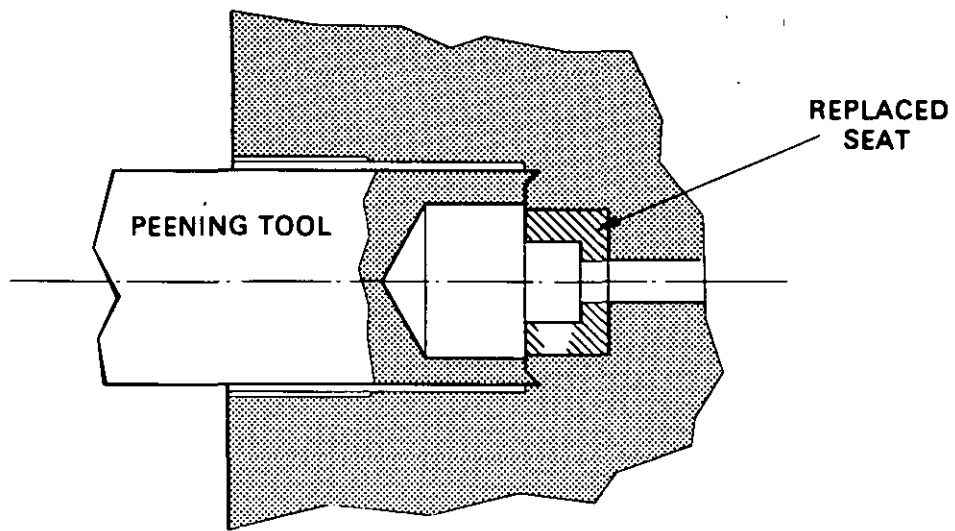
NOTE: Ensure that the seat is fully seated and squarely located in the pump body.

8. Using the peening tool, peen the seat into body. Rotate the tool between each hammer blow to ensure even displacement of the metal.
9. Fit a new tungsten carbide ball, the guide, spring and screw. **DO NOT FULLY SCREW IN THE ADJUSTING SCREW.**
10. Fit the 357 197×91 elbow to the Multi-Power outlet of the pump.
11. Fit the MF 260-4/4 blanking cap to the p.t.o. feed outlet on the pump (i.e. NOT the auxiliary outlet).
12. Connect the INLET hose of the 840 Test Kit to the 357 197×91 adapter.
13. Fit the MF 166 adapter to the trailer tipping pipe outlet of another tractor (which **MUST** have Pressure Control).
14. Place the pump in suitable container on drip tray.
15. Route the OUTLET hose of the 840 Test Kit into the gearbox filler of the tractor.
16. Move the Draft Control lever to Transport and the Position Pressure Control lever to LOW.
17. Start the tractor engine and run it at 1000 rev/min.
18. Screw the restrictor on the 840 test kit fully in.
19. Move the Pressure Control lever towards the HIGH end of the Pressure sector and observe the pressure at which the relief valve opens.
20. Adjust the pressure to initially open at 6200 kn/m² (900 lbf/in²) at an oil temperature of 6±10°C (140±20° F).
21. With the pressure correctly set, stake the adjuster screw in position with a centre punch. Recheck the pressure.
22. Stop the tractor engine.
23. Remove the adaptors and the 840 test kit.
24. Refit the pump. Operation 8B—05—02.





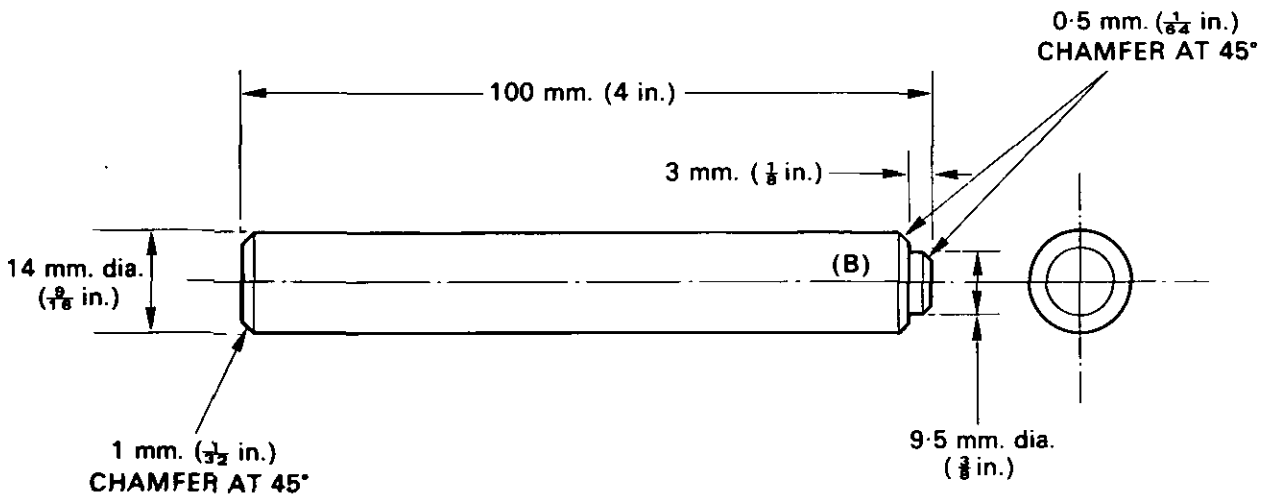
REPLACING THE SEAT



PART SECTION THROUGH
MULTI-POWER RELIEF VALVE SEAT

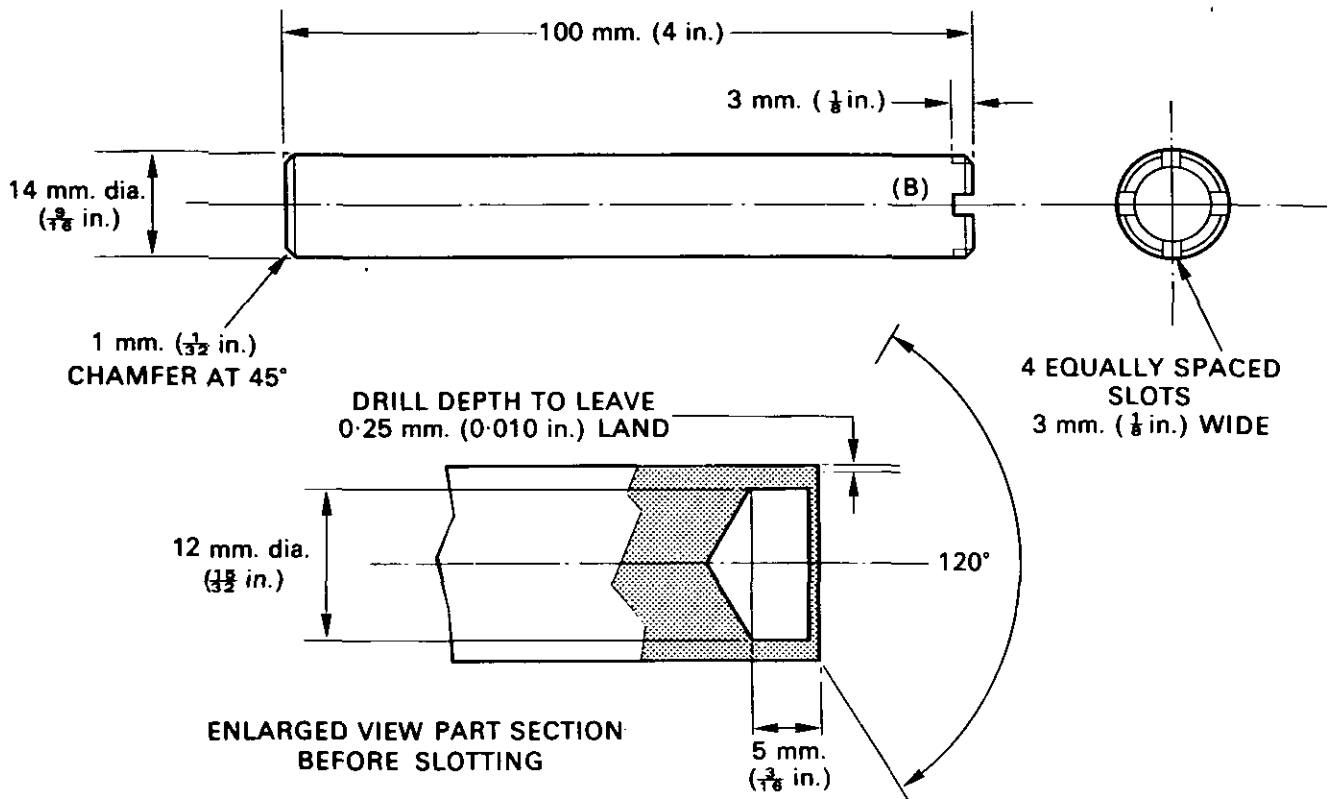
PEENING THE SEAT AFTER FITTING

AUXILIARY HYDRAULICS



MATERIAL: SILVER STEEL B.S. 1407 OR B.S. 970 EN 31
TREATMENT: HARDEN & TEMPER AT APPROX. 260°C TO
HRC 56-59 (END 'B' ONLY)

SEAT REPLACER



MATERIAL & TREATMENT: AS ABOVE

PEENING TOOL

AUXILIARY PUMP-AIR EQUIPMENT (ALTERNATIVE)

Servicing

8B-09-09

Disassembly

1. Remove the Auxiliary pump, operation 8B-05-02.
2. Remove the four securing bolts and remove the end cover.

NOTE: The bolts are of varying length. Two are 85 mm (3 $\frac{1}{2}$ in) long and the remainder 80 mm (3 $\frac{3}{4}$ in) long.

3. Remove the 'O' ring.
4. Withdraw the centre body complete with gear wheels.
5. Remove the gear wheels from the body.
6. Remove the two 'O' ring seals.
7. Remove the centre body bearings together as follows; using a plastic mallet shock the centre body using a number of sharp blows to release their fit in the bores. Then very gently using THE FINGERS ONLY press out the bearings. If an even pressure is applied, the bearings will move easily without using excessive force. Under no circumstances should a drift and hammer be used to drive out the bearings.

NOTE: If the bearings are to be refitted identify the bores from which they were removed.

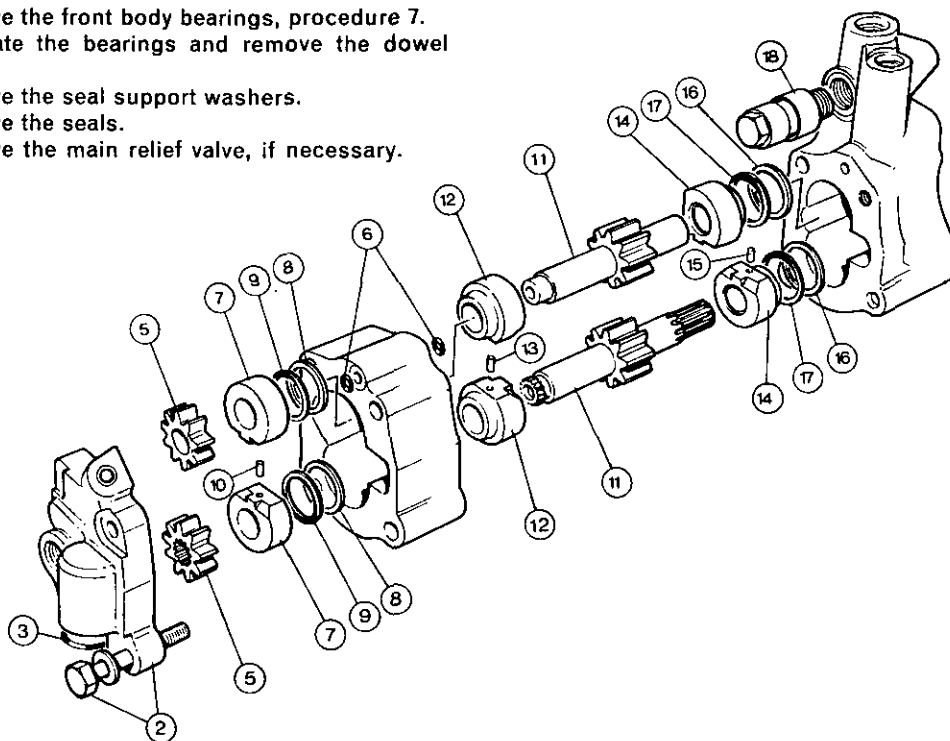
8. Remove the seal support washers.
9. Remove the seals.

WARNING: Take care not to damage the bearings when removing the seals as the material is very soft.

10. Separate the centre body bearings and remove the dowel pin.
11. Withdraw both shafts complete with the centre bearings from the front body. DO NOT use force or a hammer and drift to remove the shafts.
12. Remove the centre bearings from the shafts.
13. Separate the bearings and remove the dowel pin.

NOTE: If the bearings are to be refitted identify the bores from which they were removed.

14. Remove the front body bearings, procedure 7.
15. Separate the bearings and remove the dowel pin.
16. Remove the seal support washers.
17. Remove the seals.
18. Remove the main relief valve, if necessary.



Examination

Bearings

Examine the bearings for wear on their faces and in their bores. During a major overhaul the bearings should be renewed, but if not badly worn they can be salvaged as follows:

Place a sheet of 'O' grade emery paper, lubricated with paraffin on a true flat surface (e.g., a surface plate, or plate glass), then polish the bearing face, using a light rotary motion.

Bodies

Inspect the front and centre bodies for external damage and cracks. Examine the bores for wear and damage. The gears will always cut a light track on the inlet side of the body bores. The depth of this track must not exceed 0,005 mm (0.002 in). The depth of the track can be very difficult to measure with such accuracy. If in doubt replace the body.

Gears

Examine the gears for scored or worn faces or journals, damaged teeth and surface cracks. Always fit replacement gears as a pair and never individually. Under working conditions, hydraulic pressure within the pump loads the gears towards the inlet side of the body, thus cutting the running track. If the bearings or gear journals wear, the gears move over and deepen the running track. Therefore if the running track is worn past or to the limit for re-use, the fitting of new bearings may not improve the pump efficiency, as the new bearings will retain the gears and prevent them from bottoming in the running track.

Bearing Seals

Check the seals for any signs of cracking, damage or hardness due to the pump overheating.

'O' Rings

Always fit new 'O' ring seals on re-assembly.

AUXILIARY HYDRAULICS

Multi-Power/l.p.t.o. Relief Valve

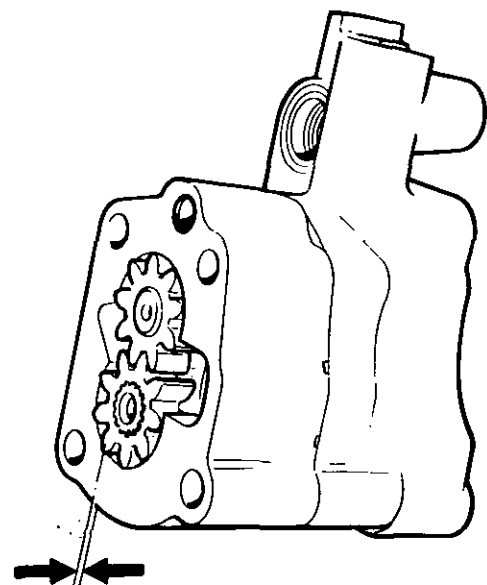
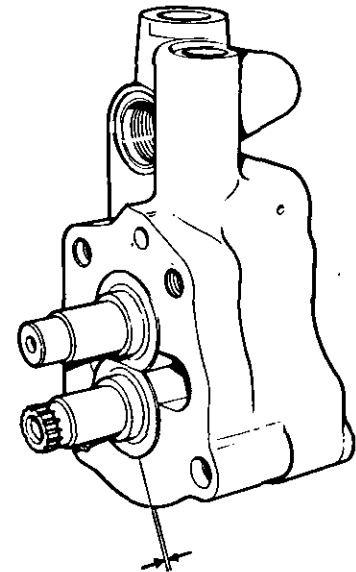
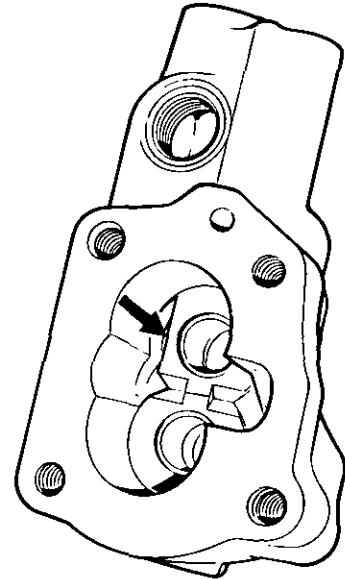
If the valve is suspect it is permissible to service the seat by removing the staking and unscrewing the end plug, withdrawing the spring and valve and removing the slotted seat with a screwdriver.

NOTE: If the seat has been replaced twice or more use a suitable loctite sealant on the threads.

Re-assemble the valve and set the spring tension at the correct relief pressure, operation 8B—16—12 and re-stake the end plug.

Reassembly

19. Reverse procedures 1 to 18 except:
 - (a) Retighten the main relief valve to a torque of 50 Nm (37 lbf ft).
 - (b) When replacing the front body and centre body bearings DO NOT use unnecessary force, e.g., a hammer and drift. Using hand pressure only gently ease the bearings into the bores until they have seated onto their seals.
 - (c) When replacing the front body bearings ensure that the uppermost bearing is fitted with its relieved face adjacent to the outlet port.
 - (d) Measure the protrusion of the bearings above the joint face of the front body and the protrusion of the gear wheels from the centre body face. This dimension must lie between 0 to 0,3 mm (0 to 0.019 in) MAXIMUM. If the dimension falls below zero and the bearings become recessed renew the seals. If this dimension is above 0,3 mm (0.019 in) then the bearings have not seated correctly because of a slight seizure in the bores.
 - (e) Retighten the end cover bolts to a torque of 45 Nm (33 lbf ft).
 - (f) The drive shaft will be difficult to turn by hand when the pump is reassembled. This condition is quite normal. Check for rotation by temporarily assembling a drive gear to the shaft and turn using a cloth wrapped around the gear.



AUXILIARY HYDRAULICS**PLATED DRIVE****Servicing**

8B—10—11

Special Tools: See Part 8A

Disassembly

1. Remove the pump. Operation 8B—05—02.
2. Remove the nuts and lockwashers.
3. Remove the plate and spacers.
4. Lift out the drive gear.
5. Remove the thrust washers, idler gear, and needle rollers.
6. Push the idler shaft out of the rear plate.

Examination

Check the gear teeth for wear, chipping, or other damage. Examine the bores of the gears the needle rollers for wear. Check the idler shaft and thrust washers for wear, scoring or pitting. Replace any defective components.

Reassembly

7. Refit the idler shaft to the rear plate.
 8. Fit a thrust washer to the idler shaft.
 9. Fit the idler gear, needle rollers and the second thrust washer.
- NOTE: Use petroleum jelly to retain the needle rollers. NEVER USE GREASE.**
10. Refit the drive gear.
 11. Refit the spacers and the plate, then refit the nuts. Tighten the nuts progressively to 27 Nm (20 lbf ft).
 12. Refit the pump, Operation 8B—05—02.

PRESSURE MAINTAINING VALVE (EIGHT SPEED I.P.T.O. Tractors Only)**Removal and Refitment**

8B—11—11

Removal

1. Remove the front grille.
2. Remove the hood, Part 2A.
3. Disconnect the inlet and outlet pipes from the valve. (The valve is situated in the line to the oil cooler and transmission oil filter, between the bulkhead and the radiator.)
4. Remove the valve assembly.

Refitment

5. Reverse procedures 1 to 4.

PRESSURE MAINTAINING VALVE**Servicing**

8B—12—11

1. Remove the valve. Operation 8B—11—11.
2. Unscrew the adaptor and remove the sleeve, spring and poppet.
3. Examine the poppet and its seat.

Reassembly

4. Reverse procedures 1 to 3 except:
 - (a) Refit the adaptor with a new 'O' ring.

HYDRAULIC TESTING**Auxiliary Relief Valve**

8B—13—11

Special Tools: 840 Test Kit

MF 810—1/1 'Pioneer' Adaptor—2 off

NOTE: Ensure the spool valve is adjusted for double acting operation.

1. Fit the MF 810-1/1 adapters to the hoses of the 840 Test Kit.
2. Fit the INLET hose adapter to the No. 1 coupler at the rear of the tractor.
3. Fit the outlet hose adapter to the No. 2 coupler at the rear of the tractor.
4. Start the tractor engine and warm up the oil to at least 50°C (120°F).
5. Fully unscrew the restrictor on the 840 Test Kit.
6. Move the R.H. spool valve lever rearwards.
7. Screw in the restrictor fully.
8. At an engine speed of 2000 rev/min the pressure should be 169 kgf/cm² (2400 lbf/in²).

For the AIR EQUIPMENT PUMP**(ALTERNATIVE):**

9. At an engine speed of 1000 rev/min the pressure should read 162 kgf/cm² (2300 lbf/in²) minimum.
10. At an engine speed of 2000 rev/min the pressure should read (197 kgf/cm² (2800 lbf/in²) maximum.

HYDRAULIC TESTING**Auxiliary Pump Flow Test (High Capacity)**

8B—14—11

1. See procedures 1 to 7, operation 8B—13—11.
2. Adjust the pressure with the restrictor until 127 kgf/cm² (1800 lbf/in²) is obtained.
3. Switch on the flow meter.
The meter should read:
28,5 litre/min (6.3 Imp. gal/min) minimum.
For the AIR EQUIPMENT PUMP (Alternative) the meter should read:
36 litre/min (7.9 Imp. gal/min) minimum.

AUXILIARY HYDRAULICS

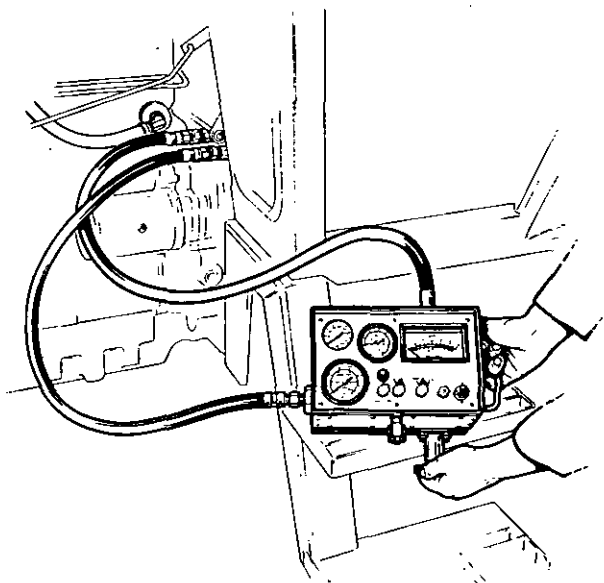
HYDRAULIC TESTING

Multi-Power Pressure Test 8B-15-12

Special Tools: 840 Test Kit
Two off MF 810-1/4 Adaptors.

1. Remove the hood, Part 2A.
2. Disconnect the Multi-Power feed and return lines.
3. Fit the MF 810 1/4 Adaptors.
4. Connect the INLET hose of the 840 Test Kit in the line to the oil cooler.
5. Connect the OUTLET hose of the 840 Test Kit in the line from the oil filter.
6. Fully unscrew the restrictor of 840.
7. In Multi-Power HIGH or LOW, the pressure should be:—

IDLING	14-16,2 kgf/cm ² (200-230 lbf/in ²)
2000 Engine rev/min	16,2-19 kgf/cm ² (230-270 lbf/in ²)
8. Fully close the restrictor.

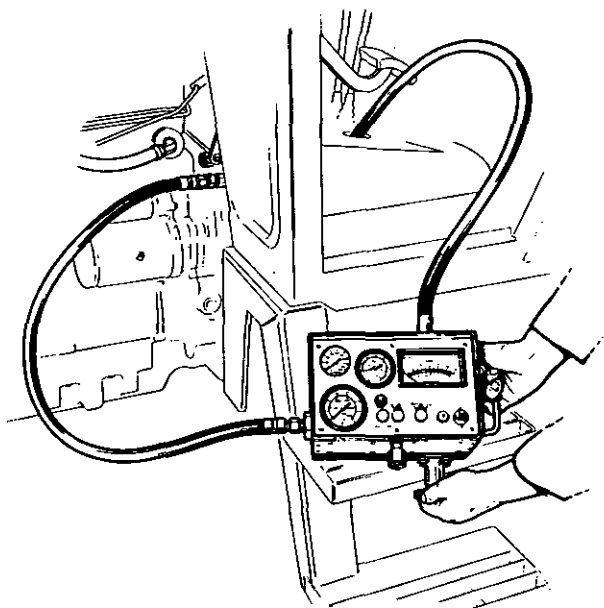


HYDRAULIC TESTING

Multi-Power Relief Valve Test 8B-16-12

1. See Procedures 1 to 5 and 8, Operation 8B-15-12.
2. With the i.p.t.o. lever in the OFF position, the pressure should be:—

IDLING	49,2 kgf/cm ² (700 lbf/in ²)
	MINIMUM
2000 Engine rev/min	70,3 kgf/cm ² (1000 lbf/in ²)
	MAXIMUM
3. Stop the engine.



HYDRAULIC TESTING

Multi-Power Flow Test 8B-17-12

1. See Procedures 1 to 6, Operation 8B-15-12
2. Disconnect the OUTLET hose.
3. Route the hose into the gearbox filler hole.

WARNING: Do not insert the pipe into the gearbox filler hole otherwise serious damage may result. Only direct the return flow into the hole.

4. Start the engine. With the restrictor fully unscrewed, the flow should be:—

IDLING	5,5 litre/min (1,2 Imp. gal/min) MINIMUM
2000 Engine rev/min	7,7 litre/min (1,7 Imp. gal/min) MINIMUM.

HYDRAULIC TESTING

I.p.t.o. Pressure Test 8B-18-12

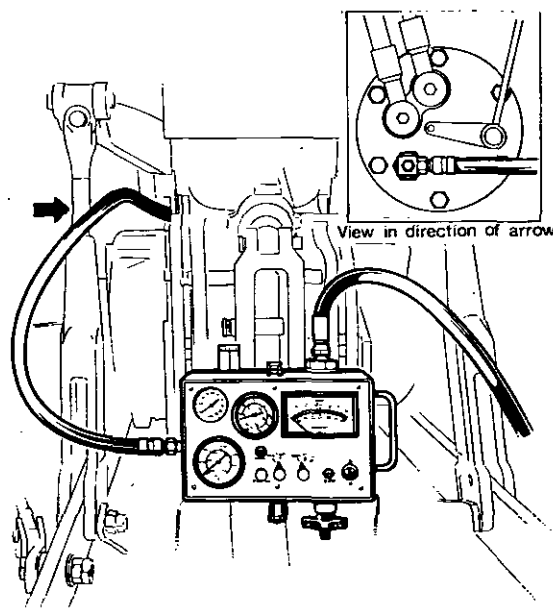
Special Tools: 840 Test Kit
MF 810-6 Adaptors

Procedure

1. Remove the plug from the p.t.o. side cover.
2. Fit MF 810-6 to the INLET hose of 840.
3. Fit MF 810-6 to the side cover.
4. Start the tractor engine.
5. At 2000 Engine rev/min the pressure should read:—

With the lever OFF	ZERO
With the lever ON	17,5 to 21 kgf/cm ² (250-300 lbf/in ²) for MF 550
With the lever ON	14 to 17,5 kgf/cm ² (200-250 lbf/in ²) for tractors

 with either 1000 rev/min only, or two speed p.t.o.



HYDRAULIC TESTING**Pressure Maintaining Valve Check 8B-19-13
(Eight Speed I.P.T.O. Tractor Only)**

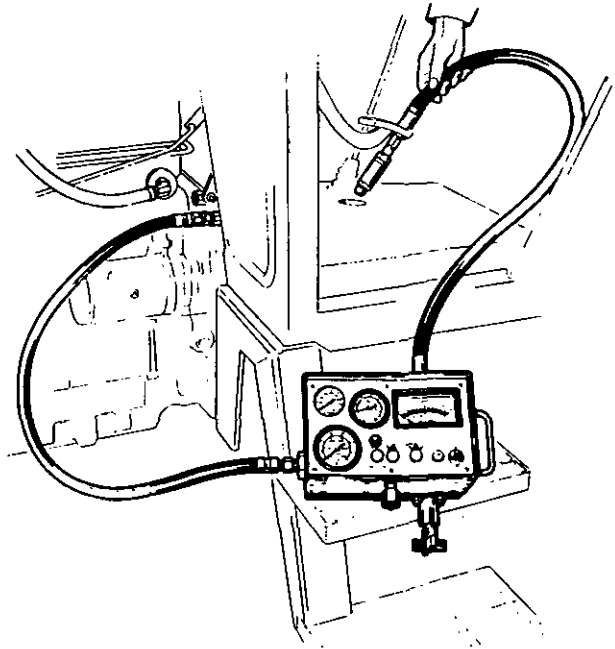
Special Tools: 840 Test kit
MF 810-1/4 Adaptors

Procedure

1. Disconnect the Multi-power feed line, (the outer pipe, nearest the cab step).
2. Fit the MF 810-1/4 adaptors.
3. Remove the pressure maintaining valve, operation 8B-11-11.
4. Connect the pressure maintaining valve to the end of the return pipe.
5. Place the end of pipe at the gearbox filler hole.

WARNING: Do not insert the pipe into the gearbox filler hole otherwise serious damage may result. Only direct the return flow into the hole.

6. Open the regulator valve and check the operating pressure which should be:
1000 rev/min
16,2-19 kgf/cm² (230-270 lbf/in²).



DRAWBAR AND LINKAGE**Part 8—Section C**

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	TOP LINK	02
	LOWER LINK	02
	LIFT RODS	02
	CONTROL BEAM	02
	LEVELLING BOX	
8C-01-07	SERVICING	07

DRAWBAR AND LINKAGE

GENERAL

The three point linkage controls the vertical movement of the mounted and semi-mounted implements.

The linkage consists of:

- 1 Top Link
- 2 Two lower links
- 3 Two lift rods
- 4 Two check chains
- 5 Control beam
- 6 Interchangeable ball ends
- 7 Levelling box

The linkage (9 hole) drawbar can be fitted to the two rear ends of the lower links together with a pair of adjustable stays, the upper ends of which are attached to the top of the centre housing by the long hitch pin. The height of the linkage drawbar is set and then locked in that position by tightening the bolts of the adjustable stays. The adjustable stays also arrest the excessive transverse movement of the two lower links.

TOP LINK

The top link transmits the draft reaction forces from the ground engaging implements to the control spring and plunger assembly in the lift cover.

The top link consists of three main components:

- Top ball end
- Turnbuckle barrel and spring locking clip
- Bottom ball end (Implement end)

The top link is adjustable for length, seven rings are machined on each ball and shank; the centre or wider marker ring indicates its normal length. The turnbuckle is prevented from rotating by the spring locking chip at its top end.

LOWER LINKS

General

The two lower links have interchangeable balls at their rear ends and normally Category 2 balls are fitted.

In the instance of the heavy duty tractors, the front ends, of the two lower links have alternative attachment holes, one vertically above the other and the size of the tyre governs the attachment hole in use. The two lift rods are fitted to the opposite hole to that of the lower link attachment hole.

The lower link check chains are always fitted to the lift rod bolts and the stabiliser chains (when fitted) are secured to the hole at the rear of the lift rod.

A spring clip is inserted into the lower link towards the implement end to accommodate the linch pin and ring assembly when it is not in use.

LIFT RODS

General

The two lift rods connect the lift arms to the lower links having a knuckle type joint at the top end with the link arms, and a swivelling bolt at the bottom end with the lower links.

The left hand lift rod consists of three main components, knuckle joint, yoke section and lower fork. The lift rod is of a set length and the yoke section is "pop" marked as it enters the lower fork.

The right hand lift rod is similarly constructed but the yoke section incorporates a bevel gear levelling box, thus the length can be adjusted for attachment to the implement. By rotating the handle of the levelling box, the yoke shank is screwed out of or into the lower fork.

The lower fork section of both lift rods may have an alternative elongated lower link attachment hole, this will permit lift rod float when working with wide implements. In this instance the lift rods are detached from the lower links, rotated 180° and refitted using the elongated holes thus the lubricators will point downwards.

CHECK CHAINS

The two check chains restrict the movement of the lower links in the transverse plane thus preventing the lower links or implement fouling the inside walls of the rear tyres.

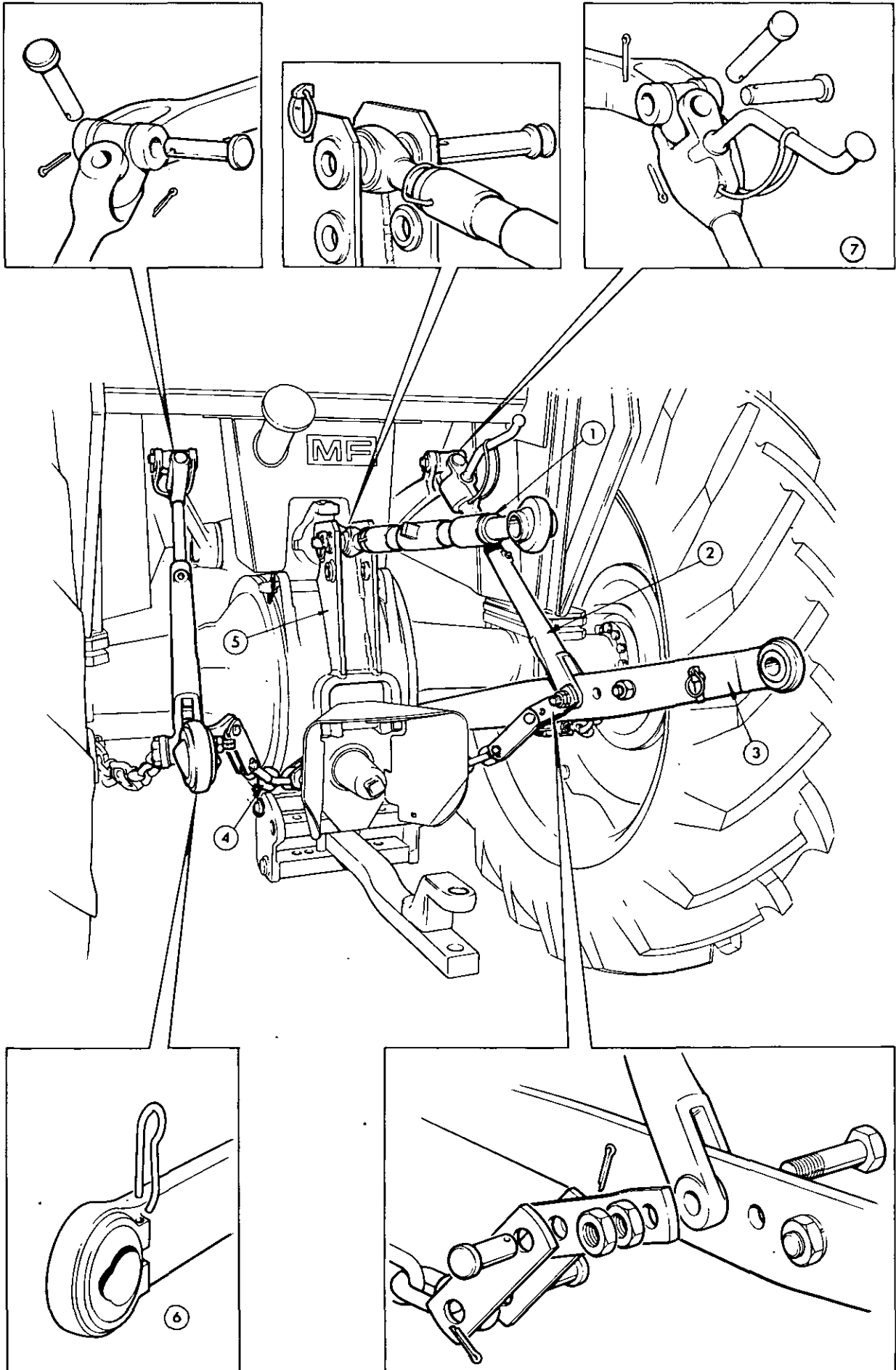
The check chains are fitted between the bottom end of the control beam bracket and the inner face of each lower link using the lift rod bolts.

The check chains are set longer for Category 2 implements.

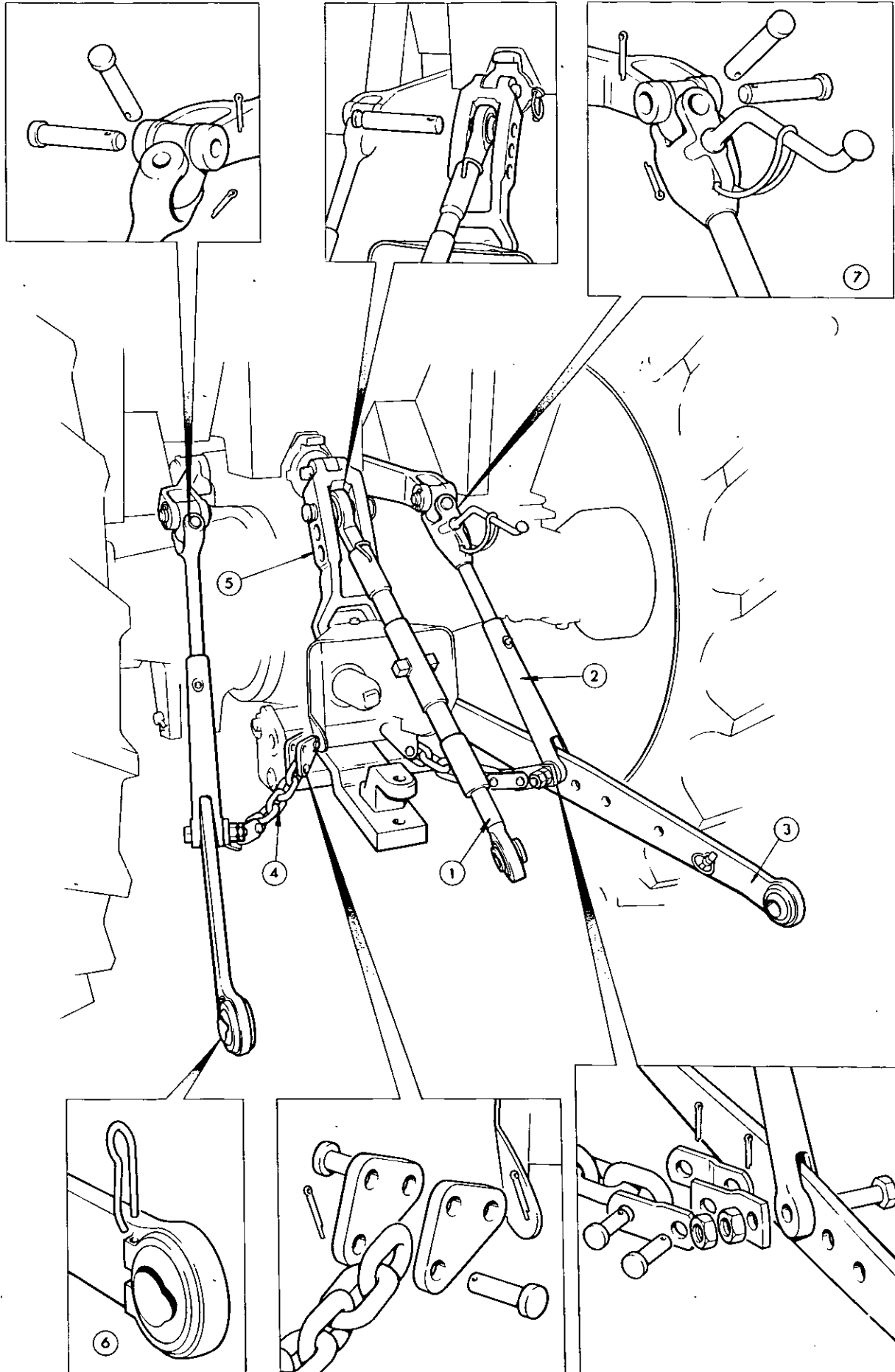
CONTROL BEAM

The control beam connects the top link to the control spring rod of the tractor hydraulic system when the Draft control is in use and thus governs the action of the implement.

DRAWBAR AND LINKAGE

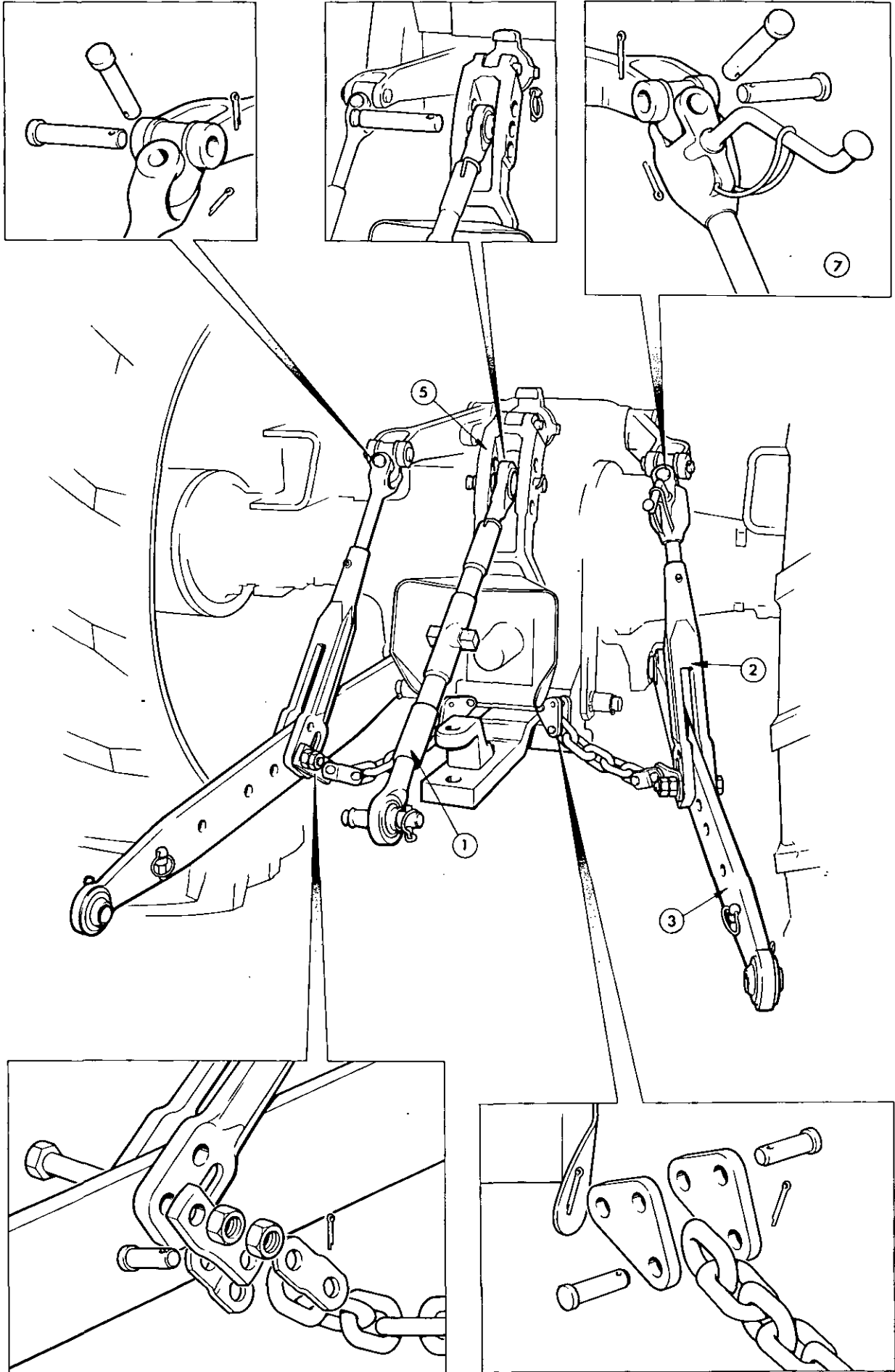


DRAWBAR AND LINKAGE

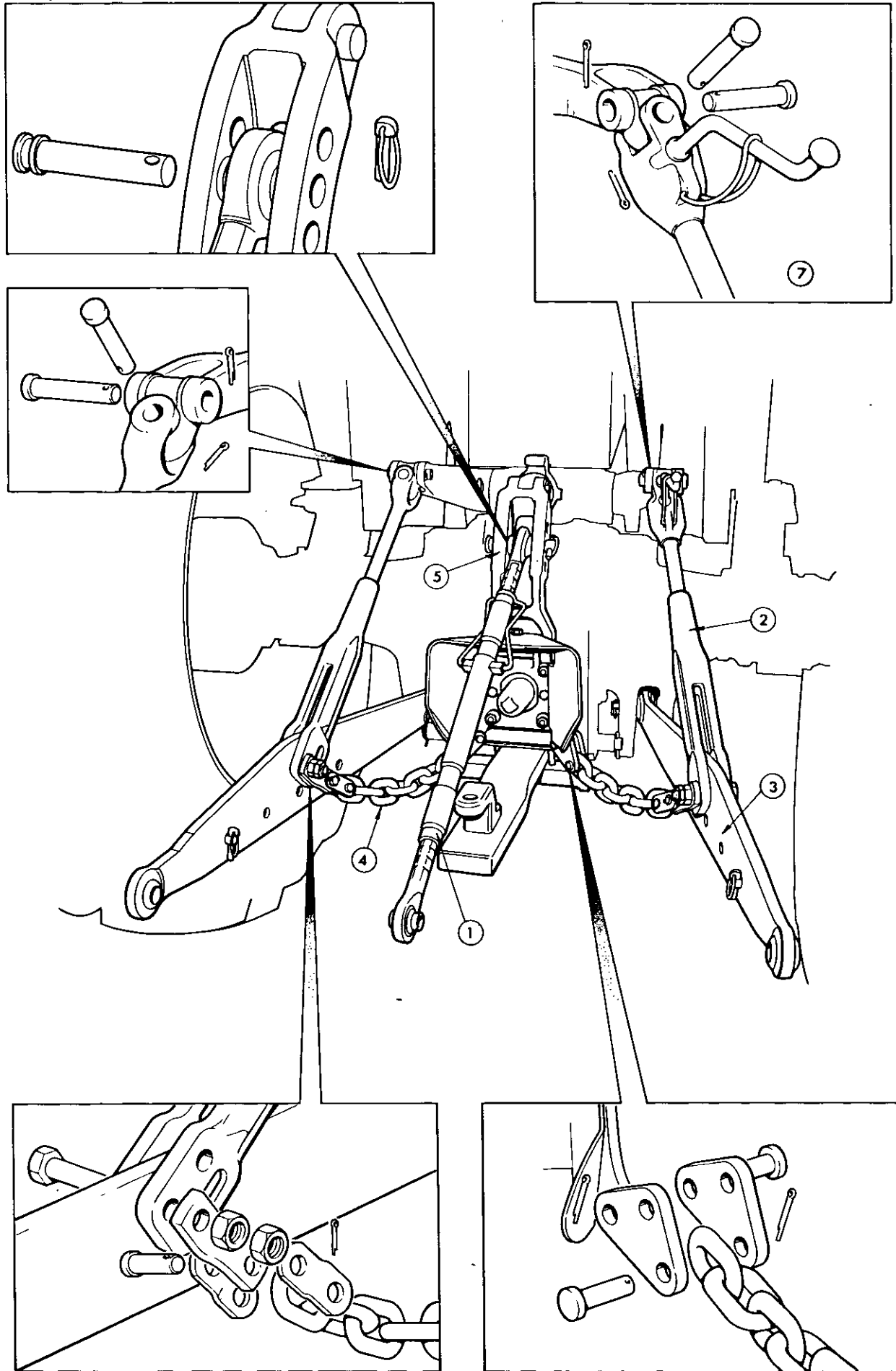


MF 565 Tractor Drawbar and Linkage

DRAWBAR AND LINKAGE



DRAWBAR AND LINKAGE



LEVELLING BOX**Servicing**

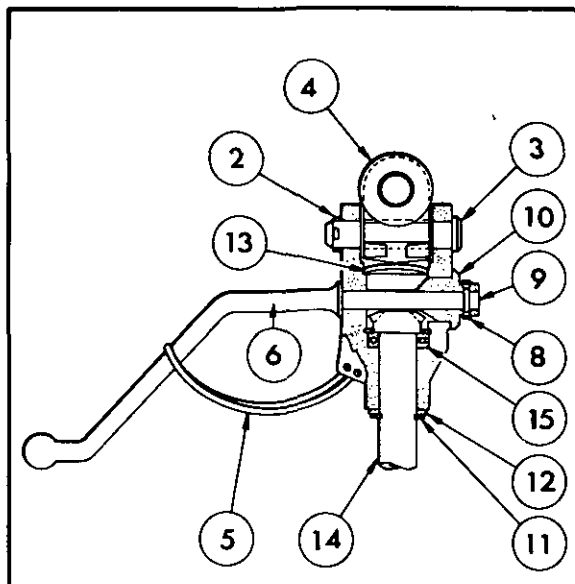
8C-01-07

Dis-assembly

1. Remove the right-hand lift rod.
2. Discard the split pin.
3. Remove the knuckle clevis pin.
4. Remove the knuckle.
5. Release, spring apart and remove the spring clip.
6. Rotate the handle.
7. Lay aside the lower fork.
8. Drill off the head and eject the handle rivet.
9. Withdraw the handle shaft.
10. Withdraw the bevel gear.
11. MF 590 tractor only, remove the circlip.
12. MF 590 tractor only, remove the thrust washer.
13. Collapse and remove the welch washer.
14. Remove the levelling gear shaft.
15. Remove the roller bearing.

Re-assembly

16. Reverse procedure 1 to 15.
 - (a) Position the roller bearing within the levelling box, casing face first.
 - (b) Fit the welch washer concave face first and using a large diameter drift, flatten the convex face sufficiently for the welch washer to grip the bore.
 - (c) Renew the handle rivet.
 - (d) Renew the split pin.



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 9

Publication No. 1856 072 M1

comprising

A ELECTRICAL SYSTEM AND EQUIPMENT

ELECTRICAL SYSTEM

Part 9 — Section A

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GENERAL

The electrical system of this tractor comprises either a 90, 96 or 125 Ampere hour 12 Volt negative earth system, charged by either a Lucas or Motorola 55 Ampere alternator, both makes of alternator incorporate an integral rectifier and control box.

The battery is mounted in the front of the tractor, and access is gained through the detachable front grille panel.

The alternator is mounted on the right hand side of the engine and is driven by an endless belt from the crankshaft pulley. The alternator has adjustable mountings to enable the correct belt tension to be maintained.

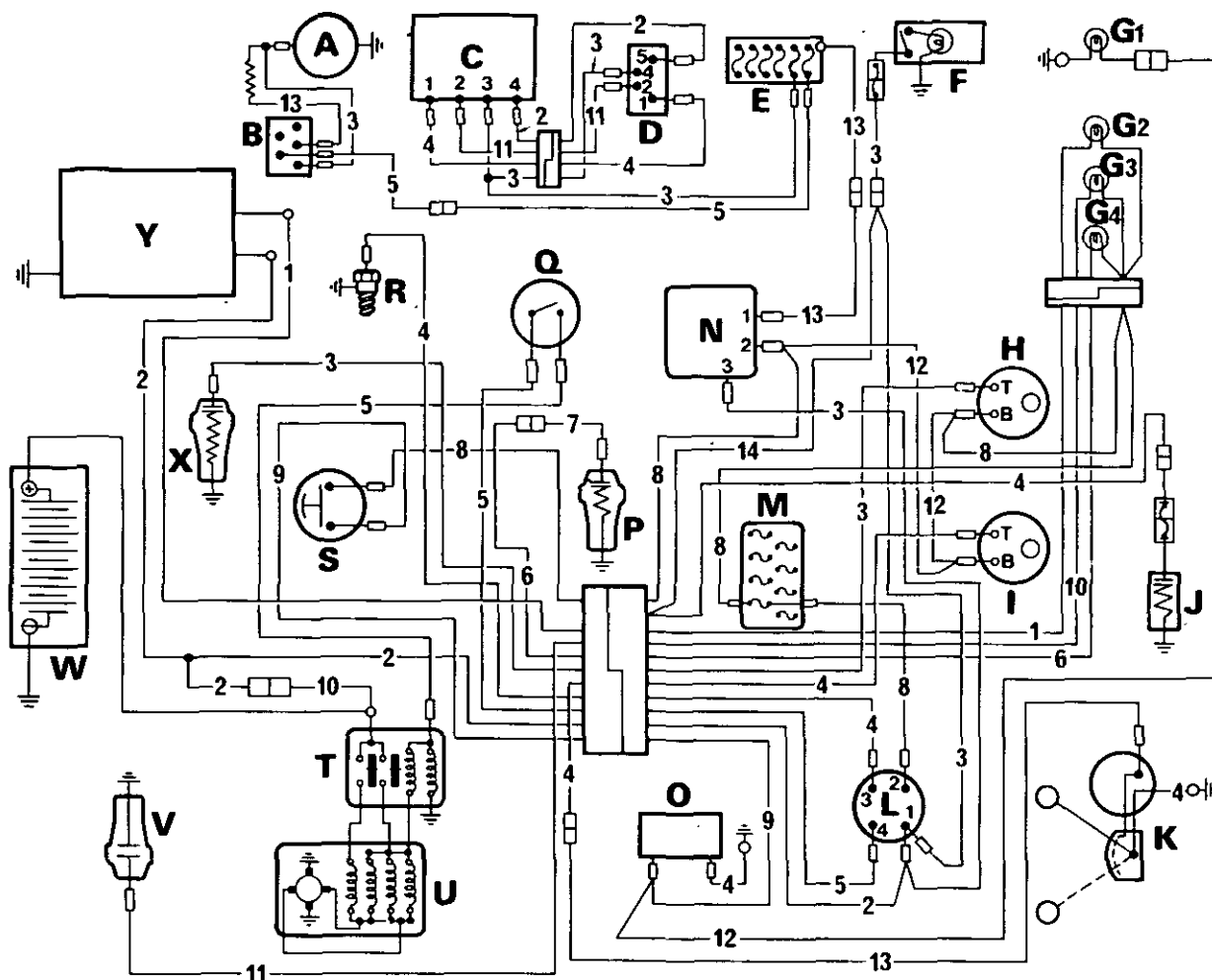
A Lucas M45G or M50G starter motor is bolted to the

left hand side of the engine. A neutral safety start switch is fitted on the top of the transmission case, which renders the starter motor inoperative until the dual range selector level is in the neutral position.

The electrical equipment should be serviced at the times stated in Part 1 Section B Maintenance Section with particular attention paid to the cleanliness and tightness of battery terminals.

Fuses are fitted to protect the lighting, fresh air blower, cigar lighter, wiper and horn circuits. A blown fuse must always be replaced with one of the same capacity.

Before any operation is carried out on the electrical system, always disconnect the battery terminals.



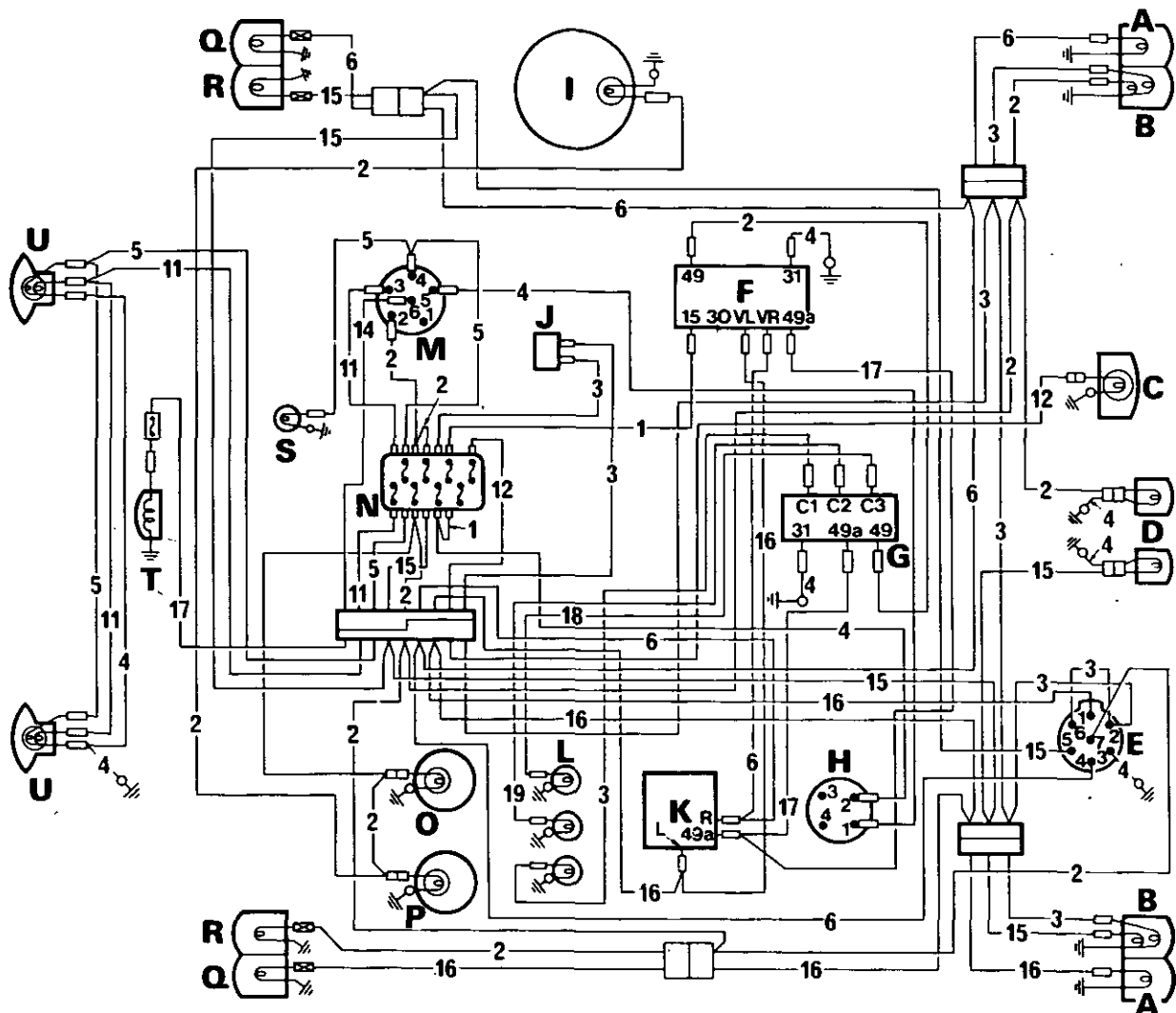
WIRING DIAGRAM

- A. Blower Motor
- B. Blower Switch
- C. Wiper Motor
- D. Wiper Switch
- E. Fuse Block
- F. Interior Light
- G1. Air Cleaner Warning Light
- G2. Alternator Charge Warning Light
- G3. Engine Oil Pressure Warning light
- G4. Multi-Power Oil Pressure Warning Light
- H. Temperature Gauge
- I. Fuel Gauge
- J. Cigar Lighter
- K. Fuel Gauge Sender Unit
- L. Starter Switch
- M. Fuse Box
- N. Relay
- O. Air Cleaner Buzzer
- P. Multi-Power Oil Pressure Switch
- Q. Safety Start Switch
- R. Thermostat
- S. Air cleaner Indicator Switch
- T. Starter Motor Solinoid
- U. Starter Motor
- V. Engine Oil Pressure Switch
- W. Battery
- X. Temperature Gauge Switch
- Y. Alternator

Colour Code

- 1. Purple
- 2. Red
- 3. White
- 4. Black
- 5. Yellow
- 6. Brown
- 7. Tan/Brown
- 8. Light Green
- 9. Light Blue
- 10. Dark Brown
- 11. Green
- 12. Blue
- 13. Orange
- 14. Grey
- 15. Red/Black
- 16. Pink
- 17. Dark Green
- 18. White/Red
- 19. White/Blue

ELECTRICAL SYSTEM



WIRING DIAGRAM

- A. Flashing Indicator Light (Rear)
- B. Tail/Brake Light
- C. Plough Light
- D. Number Plate Lights
- E. Trailer Socket
- F. Hazard Warning Lights Switch
- G. Flashing Indicator Relay
- H. Starter Switch
- I. Tachometer Bulb
- J. Brake Light Switch
- K. Flashing Indicator Switch
- L. Flashing Indicator Warning Lights
- M. Light Switch
- N. Fuse Box
- O. Temperature Gauge Bulb
- P. Fuel Gauge Bulb
- Q. Flashing Indicator Light (Front)
- R. Side Light (Front)
- S. Headlight Main Beam Warning light
- T. Horn
- U. Headlight

Colour Code

- 1. Purple
- 2. Red
- 3. White
- 4. Black
- 5. Yellow
- 6. Brown
- 7. Tan/Brown
- 8. Light Green
- 9. Light Blue
- 10. Dark Brown
- 11. Green
- 12. Blue
- 13. Orange
- 14. Grey
- 15. Red/Black
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- 17. Dark Green
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- 19. White/Blue

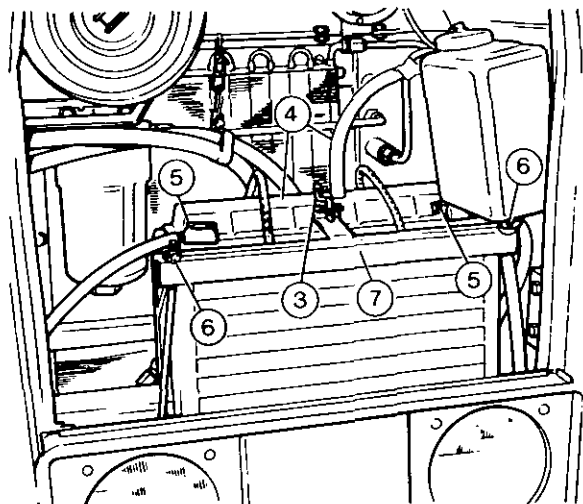
ELECTRICAL SYSTEM**BATTERY****Removal and Refitment (MF 550 TRACTOR)****Removal**

9A-01-05

1. Remove the front grille Part 2A.
2. Remove the front lower panel Part 2A.
3. Release the vent cover retainer.
4. Remove the vent cover and tube.
5. Disconnect the battery cables.
6. Remove the wing nuts and washers.
7. Remove the retaining strap.
8. Lift out the battery bolts.
9. Lift out the battery.

Refitment

10. Reverse procedures 1 to 9 except:
 - (a) Smear the battery terminals and wing nuts with petroleum jelly.

**BATTERY****Removal and Refitment (MF 565, 575 and 590 TRACTORS)**

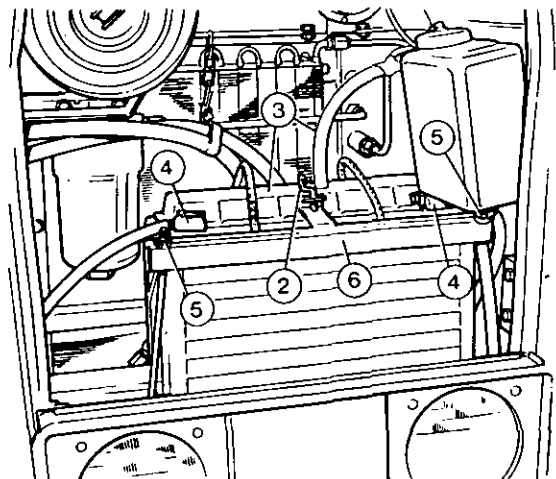
9A-02-05

Removal

1. Remove the front grille Part 2A.
2. Release the vent cover retainer.
3. Remove the vent cover and tube.
4. Disconnect the battery cables.
5. Remove the wing nuts and washers.
6. Remove the retaining strap.
7. Lift out the battery bolts.
8. Lift out the battery.

Refitment

9. Reverse procedures 1 to 8 except:
 - (a) Smear the battery terminals and wing nuts with petroleum jelly.



ELECTRICAL SYSTEM**BATTERIES****Preparation of Batteries for Service 9A-03-06****Preparation of Dry-Charged Batteries**

Batteries intended for export markets are supplied "dry-charged" and must be filled with electrolyte of the correct specific gravity (S.G.) according to the climate before being put into service.

Dry-charged batteries leave the manufacturer in a fully charged state but may slowly discharge whilst in storage.

Batteries should not be filled with electrolyte until required for service.

Initial charging after filling is not normally necessary; but a freshening charge at the specified recharging rate for 4 hours may be advantageous.

Remove the vent covers and fill each cell with electrolyte of the correct S.G. to the top of the perforated separator guard in one operation.

The temperature of the charging room, battery and electrolyte should be maintained between 15.6°C and 37.7°C (60°F and 100°F). If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

If the temperature of any cell rises above the permissible maximum, the charge must be interrupted until the temperature has fallen to 5.5°C (10°F) below that figure.

During charging, ensure the electrolyte is level with the top of the separator guard, by the addition of electrolyte of the same S.G. as used in the initial filling of the battery, until the S.G. and voltage readings have remained constant for five successive hourly readings.

If the charging continues when the S.G. has remained constant for 5 hours, top up the battery to the level of the separator guard with distilled water. Electrolyte 'frothing' may occur during the first few hours of charging. This can be overcome by REDUCING the charging current.

On completion of charging, check the S.G. in each cell, to ensure that it is within the specified units at 15.5°C (60°F).

If any cell requires adjustment, some of the electrolyte must be syphoned OFF and replaced, either by distilled water, or by electrolyte of the S.G. used originally in the filling of the battery, depending on whether the S.G. is too high or low.

NEVER TRANSFER ELECTROLYTE FROM ONE BATTERY OR CELL TO ANOTHER.

Continue the charging for an hour to ensure adequate mixing of the electrolyte, and again check the S.G. readings. If necessary, repeat the adjustment process until the desired S.G. reading is obtained in each cell. Allow the battery to cool and syphon off any electrolyte above the top of the separator guard.

Electrolyte Filling Precautions

When dry uncharged batteries are filled, heat is created from the mixing of the filling acid with moisture in the plates, and also as a result of chemical action on the negative plates.

With batteries in moulded containers this heat may crack the containers, therefore must be filled in two stages.

In the first stage the battery should be half filled and allowed to cool for 6 to 12 hours.

The battery should then be filled to the level of the separator guard and allowed to cool for a further 2 hours to complete the second stage.

Initial Charging

Ensure the battery has stood for 12 hours before commencing the initial charging procedure. Ascertain the electrolyte level is correct prior to charging.

The initial charging rate is given in the specification section.

Charge the battery at the specified rate until the voltage and specific gravity (S.G.) readings show no increase over 5 successive hourly readings.

The charging duration is from 48 to 80 hours, dependent upon the storage period of the battery. Maximum permissible electrolyte temperature during charge is: Climates below 26.6°C (80°F): 37.7°C (100°F).

Climates over 26.6°C (80°F): 48.8°C (120°F).

Keep the current constant by varying the series resistance of the circuit. This charge should not be broken by long rest periods.

Preparation of Electrolyte

Approximately 790 cc (1½ pint) of sulphuric acid is required for each 2 volt cell.

The specific gravity (S.G.) of the electrolyte required when filling is:

Climates normally below 26.6°C (80°F)—1.260 (corrected to 15.5°C (60°F)).

Climates normally above 26.6°C (80°F)—1.210 (corrected to 15.5°C (60°F)).

Electrolyte is prepared by mixing distilled water and concentrated sulphuric acid to the required S.G. (usually S.G. 1.840).

The mixing of the electrolyte must be carried out either in a lead lined tank or in a suitable glass or earthenware vessel.

SLOWLY add the acid to the distilled water. **NEVER ADD THE WATER TO THE ACID**, as the resultant chemical reaction causes violent spurting of the sulphuric acid.

The approximate proportion of sulphuric acid and distilled water is as follows:

To obtain a specific gravity (corrected to 15.5°C (60°F)) of:

1.260

1.210

Add 1 vol. of acid of 1.840 S.G. (corrected to 15.5°C (60°F)) to

3.2 volumes of water (1.260 S.G.)

4.3 volumes of water (1.210 S.G.)

Heat is produced by the mixture of acid and water, therefore the electrolyte should be allowed to cool before taking hydrometer readings and pouring the electrolyte into the battery.

Hydrometer Tests

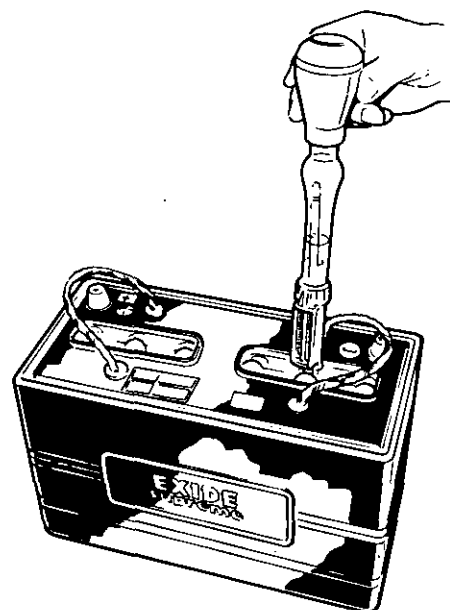
The specific gravity (S.G.) of acid is measured using a hydrometer. Never take a hydrometer reading immediately after replenishing the battery with distilled water. The readings given by each cell should be approximately the same. If one cell differs appreciably from the others, an internal fault in the cell is indicated. The appearance of the electrolyte drawn into the hydrometer gives an indication of the state of the plates. If the electrolyte is very dirty, or contains small particles in suspension, the plates may be in a poor condition.

The electrolyte S.G. varies with temperature. All calculations are always corrected to 15.5°C (60°F). This is known as the reference temperature.

NOTE: The temperature must be that indicated by a thermometer actually immersed in the electrolyte and not the air temperature.

For every 2.8°C (5°F) **BELOW** 15.5°C (60°F), **DEDUCT** 0.002 from the S.G. reading to obtain the true S.G. at 15.5°C (60°F).

For every 2.8°C (5°F) **ABOVE** 15.5°C (60°F), **ADD** 0.002 from the S.G. reading, to obtain the true S.G. at 15.5°C (60°F).



ELECTRICAL SYSTEM

Recharging From an External Supply

If a high discharge rate test indicates that the battery is nearly discharged, and is otherwise in good condition, it should be recharged, either on the tractor by a period of daytime running, or on a bench from an external supply.

If the battery is to be charged on the bench, the charging rate should not exceed 5 amperes.

The battery is fully charged when the specific gravity of the electrolyte and voltage, show no increase over three successive hourly readings. During the charge, the electrolyte level should be checked regularly and replenished as necessary with distilled water.

Boost Charging

Boost charging must be regarded as an **emergency measure only**.

Boost charging must be limited to a maximum period of one hour only, with a charge rate not greater than the ampere hour capacity of the battery.

As the battery state-of-charge rises, the charging rate will fall, but must **NOT** be re-adjusted to the original state.

Ah. Rating of Battery	At 10 hr Rate	At 20 hr Rate	MAXIMUM Boost Charging Rate
90 Ah	9.0 A	4.5 A	9 Amps
96 Ah	9.6 A	4.8 A	9 Amps
125 Ah	12.5 A	6.25 A	12 Amps

Maintenance Precautions

The maintenance is identical for each type of battery. Wipe away any foreign matter or moisture from the top of the batteries. Use diluted ammonia on a lint free cloth to neutralise acid spillage or sulphation. Ensure all connections are clean and tight.

Remove the battery vent covers and check the electrolyte level.

Clean the surfaces of the battery connectors and posts; and lightly coat them with petroleum jelly. Each day, inspect the level of electrolyte in the cells.

NOTE: Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery on charge, and to a lesser extent when standing idle, can be dangerously explosive.

If necessary, add distilled water to bring the level of electrolyte to the top of the perforated separator guard.

Distilled water should always be used for topping up. Clean rainwater or melted snow can be used in an emergency.

The following **MUST NOT BE USED**, salt water, chlorinated water, chemically softened water, boiled water or stagnant water.

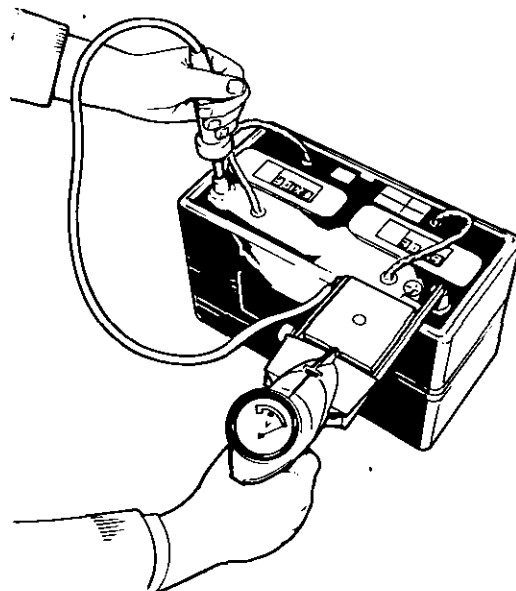
BATTERIES**Capacitance Testing**

9A-04-09

Special Tools: Crypton Battery Tester Model B51

Battery Testing

1. The gases given off by the cells of a battery are explosive. Always use the battery tester in a well ventilated area.
2. Ensure the tester is set for 12 volt battery operation.
3. Connect the prod on the tester to the battery positive (+) terminal.
4. Connect the prod on the flexible cable to the battery negative (-) terminal.
5. Test the battery for fifteen (15) seconds only, whilst noting the voltmeter behaviour on the upper colour scale.
6. A reading in the GREEN zone indicates the battery to be in a satisfactory condition.
7. If the reading is in the YELLOW zone, charge the battery for five (5) minutes at 30 Amps (or for the appropriate period indicated) and retest.



Charging Time in Minutes	Charging Amperage
5	30
10	15
20	10
30	5

8. If the meter reading is now in the GREEN zone, the battery is serviceable but needs further charging. A continued reading in the YELLOW zone usually indicates a faulty battery.
9. When the meter reading falls progressively during the 15 seconds and ends in the RED zone, the battery needs replacing.

ELECTRICAL SYSTEM**BATTERY****Electrolyte Replenishment**

9A--05--10

(a) Lucas and Exide Mono Lid:

1. Remove the front grille, Part 2A.
2. Release the vent cover retainer.
3. Remove the cover and tube.
4. Remove the vent cover from the battery and check the electrolyte level. The electrolyte *should just cover the plates. If the level is incorrect, replenish each cell with distilled water to the correct level.*
5. Reverse procedures 1 to 4 except:
Wipe the battery top and smear the terminals with petroleum jelly.

(b) Lucas Aqualok and Exide Auto-Fil

1. Remove the front grille, Part 2A.
2. Release the vent cover retainer.
3. Remove the cover and tube.
4. Remove the two cover plates and check the electrolyte level.
5. If the electrolyte is below the bottom of the filling tube, pour distilled water into the trough until all of the cell filling tubes and the trough are full. Refit the cover plates immediately. The *correct amount of distilled water will be automatically distributed to each cell.*
6. Reverse procedures 1 to 4 except:
 - (a) The two cover plates must be filled at all times.
 - (b) Wipe the battery top and smear the terminals with petroleum jelly.

ALTERNATOR**Removal and Refitment**

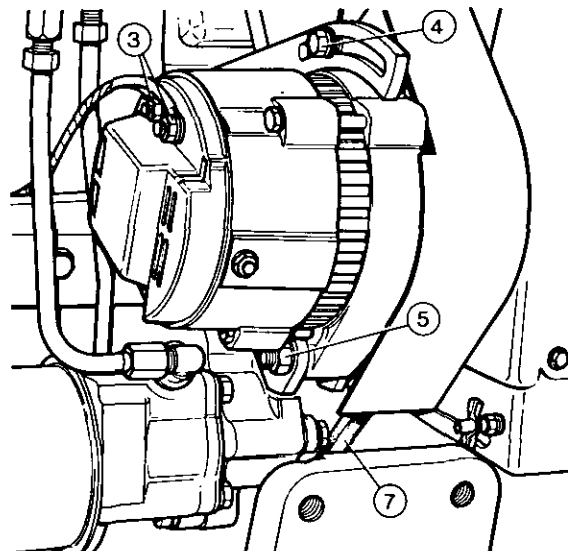
9A—06—11

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery.
3. Disconnect the wires by removing the nuts and washers.
4. Slacken the bolt.
5. Remove the nut and washer.
6. Push the alternator towards the engine.
7. Remove the fan belt from the pulley.
8. Whilst supporting the alternator, remove the bolt.
9. Remove the belt guard.
10. Remove the alternator.

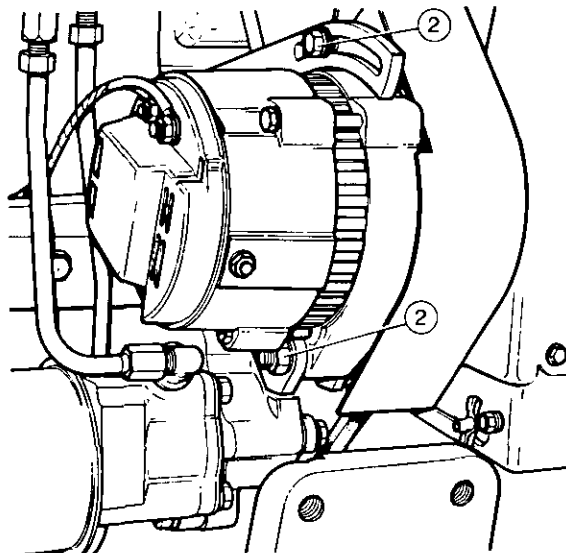
Refitment

11. Reverse procedures 1 to 10.
12. Adjust the belt tension, operation 9A—07—11.

**ALTERNATOR****Belt Tension**

9A—07—11

1. Check the belt tension at a point midway between the longest span. It should be 13 mm (0.5 in).
2. If the belt tension is incorrect, slacken the mounting bolts.
3. Adjust the tension to 13 mm (0.5 in).
4. Re-tighten the bolts and recheck the belt tension.



ELECTRICAL SYSTEM**STARTER MOTOR****Removal and Refitment**

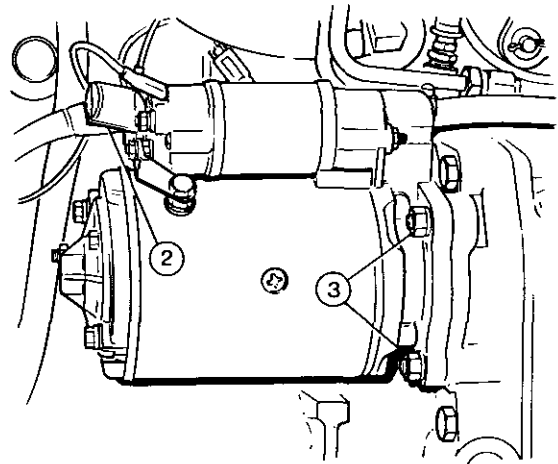
9A-08-12

Removal

1. Disconnect the battery.
2. Disconnect the cables from the solenoid.
3. Remove the mounting bolts.
4. Withdraw the motor.

Refitment

5. Reverse procedures 1 to 4.

**STARTER SWITCH****Removal and Replacement**

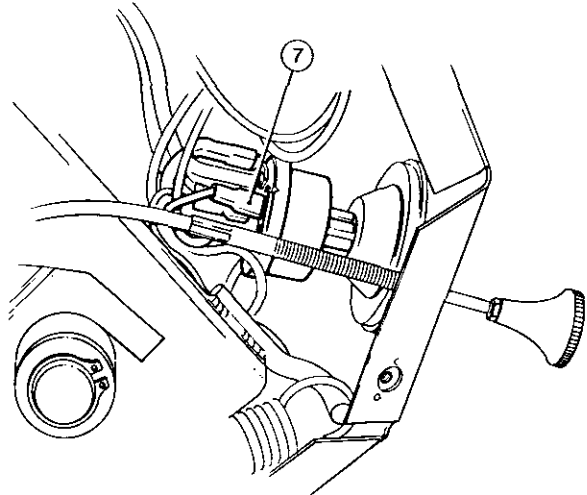
9A-09-12

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument panel cowl, Part 2B.
4. Disconnect the fuel cut-off control knob and cable, operation 9A-10-12, procedures 2 to 5.
5. Remove the nut.
6. Withdraw the switch.
7. Label and disconnect the wires from the rear of the starter switch.
8. Remove the switch and split-ring.

Replacement

9. Reverse procedures 1 to 8.

**FUEL CUT-OFF CONTROL****Removal and Refitment**

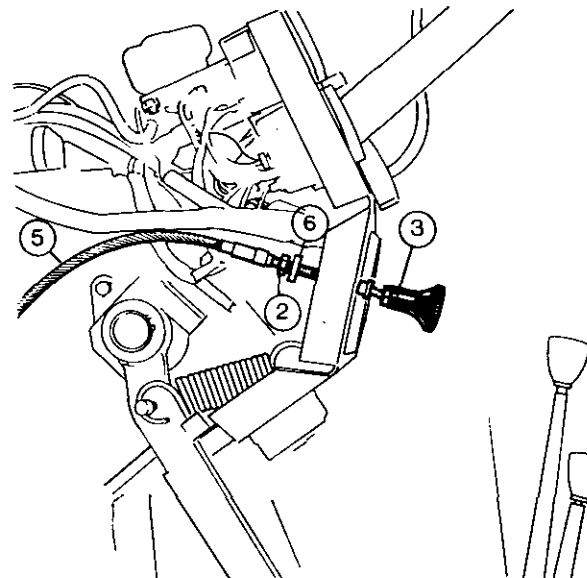
9A-10-12

Removal

1. Remove the instrument panel cowl, Part 2B.
2. Slacken the locknut behind the instrument panel.
3. Slacken the locknut and unscrew the knob.
4. Remove the locknut and the collar.
5. Withdraw the cable from the instrument panel.
6. Remove the nylon bush and the locknut.
7. Slacken the locking screw at the fuel pump, and disconnect the inner cable.
8. Slacken the screw and disconnect the outer cable from its clamp.
9. Feed the cable through the cab bulkhead and remove the cable from the tractor.

Refitment

10. Reverse procedures 1 to 9.

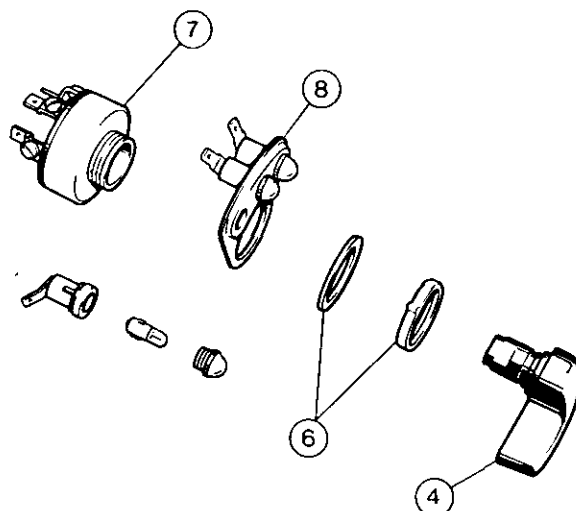


FLASHING INDICATOR SWITCH**Removal and Replacement** 9A-11-13**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the fuel gauge, operation 9A-44-27.
4. Pull off the switch knob.
5. Label and disconnect the wires from the rear of the switch and light cluster.
6. Remove the nut and washer.
7. Remove the switch and light cluster from the instrument panel.
8. Remove the flashing indicator light cluster from the switch.

Replacement

9. Reverse procedures 1 to 8.

**WIPER SWITCH****Removal and Replacement** 9A-12-13**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Prise the switch from the air flow vent panel.
4. Label and disconnect the wires from the switch terminals.
5. Remove the switch.

Replacement

6. Reverse procedures 1 to 5.

BLOWER SWITCH**Removal and Replacement** 9A-13-13**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Prise the switch from the air flow vent panel.
4. Label and disconnect the wires from the switch terminals.
5. Remove the switch.

Replacement

6. Reverse procedures 1 to 5.

ELECTRICAL SYSTEM**LIGHT SWITCH AND HORN PUSH****Removal and Replacement** 9A—14—14

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument panel cowl, Part 2B.
4. Slacken the screw and remove the switch knob.
5. Remove the spring.
6. Remove the locknut.
7. Withdraw the switch from the instrument panel.
8. Label and disconnect the wires from the switch terminals.
9. Remove the switch.

Replacement

10. Reverse procedures 1 to 9.

HAZARD WARNING LIGHTS SWITCH**Removal and Replacement** 9A—15—14**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument panel cowl, Part 2B.
4. Pull the switch to the ON position and slacken the locking collar.
5. Unscrew and remove the knob.
6. Label and disconnect the wires from the switch terminals.
7. Remove the switch.

Replacement

8. Reverse procedures 1 to 7.

NEUTRAL SAFETY START SWITCH**Removal and Replacement** 9A—16—14**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the rubber cover.
4. Disconnect the two wires.
5. Unscrew the switch from the top of the gearbox.

Replacement

6. Reverse procedures 1 to 5.

ENGINE OIL PRESSURE WARNING LIGHT SWITCH UNIT**Removal and Replacement** 9A—17—14**Removal**

1. Remove the front grille.
2. Disconnect the battery.
3. Disconnect the Lucar connector.
4. Unscrew the switch unit from the cylinder block.

Replacement

5. Reverse procedures 1 to 4.

TEMPERATURE GAUGE SENDER UNIT**Removal and Replacement** 9A—18—14**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery.
3. Drain the engine coolant to a level below that of the bulb, by opening the engine block drain tap.
4. Disconnect the sensor units electrical connector.
5. Unscrew the bulb from the cylinder block.

Replacement

6. Reverse procedures 1 to 5.

MULTI-POWER OIL PRESSURE WARNING LIGHT SWITCH**Removal and Replacement** 9A—19—14**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery.
3. Disconnect the Lucar connector.
4. Unscrew the switch unit.

Replacement

5. Reverse procedures 1 to 4.

INSTRUMENT PANEL AND WIRING HARNESS (MF 550)**Removal and Refitment**

9A-20-15

Removal

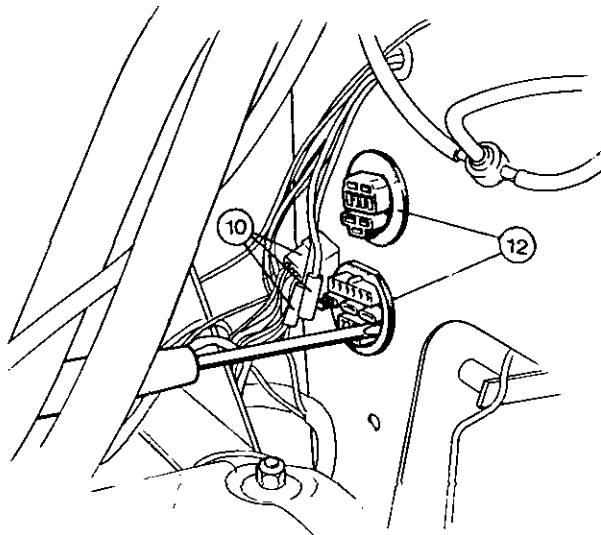
1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the steering wheel, Part 7C.
4. Remove the instrument panel cowling, Part 2B.
5. Remove the steering column dust seal.
6. Disconnect the fuel cut-off switch and the Multi-Power switch (if fitted).
7. Disconnect the tachometer drive cable, operation 9A-45-27.
8. Unscrew the hand throttle lever.
9. Disconnect the windscreen washer pump.
10. Disconnect both bulkhead connectors by withdrawing the connector plugs and disconnecting the earth wire.
11. Label and disconnect the blower motor and sidelight wires.
12. Push the bulkhead harness block connectors into the cab.
13. Lift the instrument panel over the steering column.
14. Label and disconnect the instrument harness on the bench.

Refitment

15. Refit the instrument panel over the steering column.
16. Separate the harness into two halves to determine the correct wiring route, secure the harness with retaining clips.
17. Using the wiring diagram, reconnect the harness to the panel; reconnecting the wiring from the fuse-box to the warning lights at the top.
18. Reverse procedures 1 to 13.

Refitment

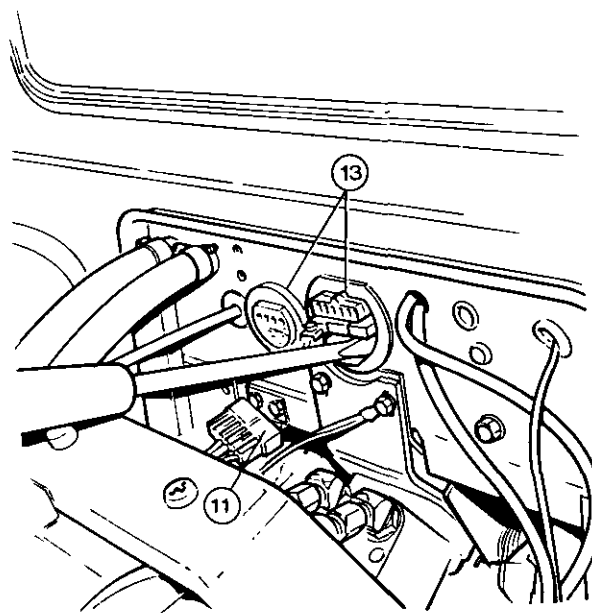
18. Separate the harness into two halves to determine the correct wiring route, secure the harness with retaining clips.
19. Refit the instrument panel over the steering column.
10. Using the wiring diagram, reconnect the harness to the panel; reconnecting the wiring from the fuse box to the warning lights at the top.
21. Reverse procedures 1 to 15.

**INSTRUMENT PANEL AND WIRING HARNESS (MF 565, 575 and 590)****Removal and Refitment**

9A-21-15

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the steering wheel, Part 7C.
4. Remove the instrument panel cowl, Part 2B.
5. Remove the steering column dust seal.
6. Slacken the locknut and remove the handle from the hand throttle lever.
7. Remove the rubber end cup from the Multi-Power lever.
8. Disconnect the wiring from the stop light switch.
9. Remove the two bolts retaining the instrument panel.
10. Disconnect the tachometer drive cable.
11. Disconnect both bulkhead connectors by withdrawing the connector plugs and disconnecting the earth wire.
12. Label and disconnect the blower motor wires.
13. Press the bulkhead block connectors into the cab.
14. Label and disconnect the L.H. and R.H. side light connector.
15. Disconnect the windscreen washer pump.
16. Lift the instrument panel over the steering column.
17. Label and disconnect the instrument panel.



ELECTRICAL SYSTEM**HEADLIGHTS****Removal and Replacement**

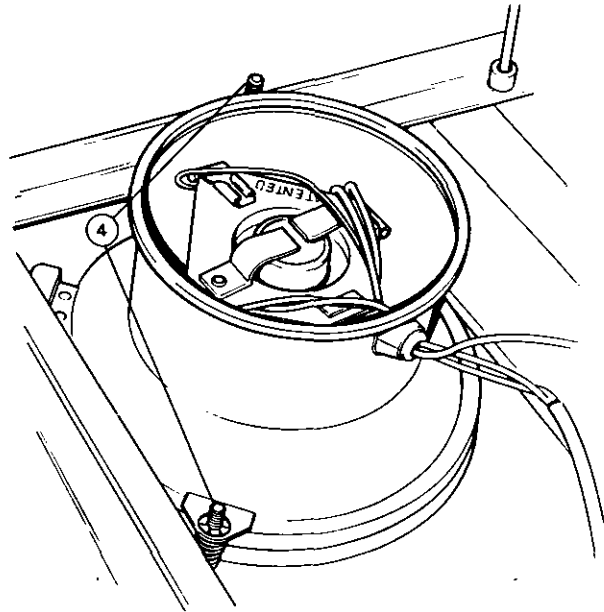
9A-22-16

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery.
3. Remove the front lower panel, Part 2A.
4. Remove the three headlight adjustment screws and springs.
5. Withdraw the headlight.
6. Remove the bulb, operation 9A-34-22.

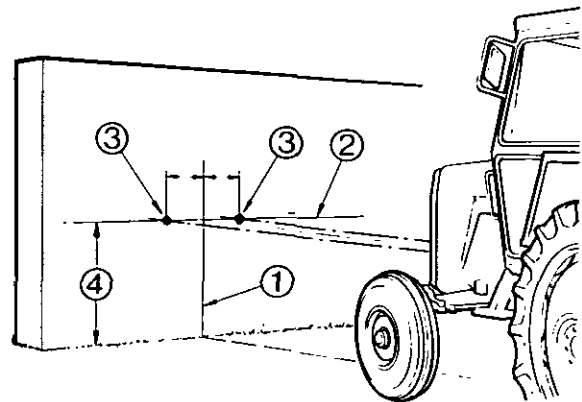
Replacement

7. Reverse procedures 1 to 6.

**HEADLAMPS****Beam Setting Adjustments**

9A-23-16

1. Position the tractor 2 m (6 ft) away from and at right angles to a wall or screen.
2. Mark a point on the wall or screen by sighting down the hood centre line (1).
3. Draw a vertical line through point (2).
4. Draw a horizontal line (3) through the vertical line (1) at headlamp height.
5. Mark two points (3) on the horizontal line to represent the distance between headlights, spaced equally either side of vertical line (1).
6. Adjust each headlamp individually by obscuring the other, so that point (3) marked on the wall are in the centre of the beam. The centre of the headlamp beam may be found by marking the extremities of the beam both vertically and horizontally, and dividing by two.



BLOWER RESISTOR**Removal and Replacement**

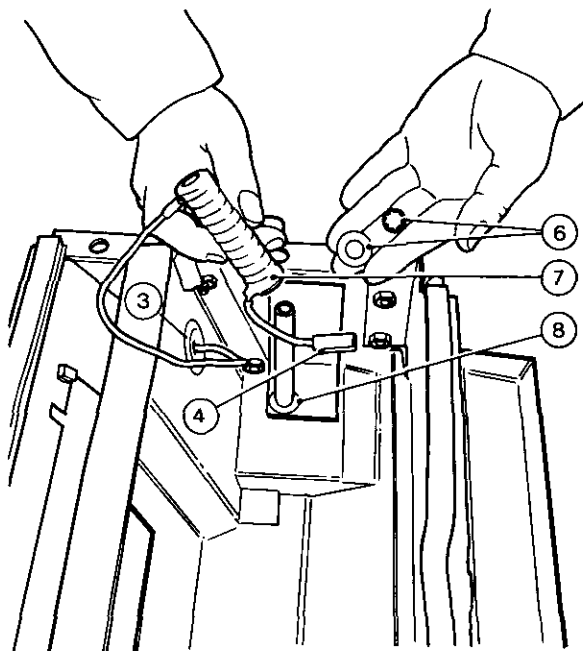
9A-24-17

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the plenum chamber, Part 2B.
4. Disconnect the wiring connectors.
5. Feed the wiring through the grommet and remove the insulating tape.
6. Remove the circlip and fibre insulating washer.
7. Remove the resistor.
8. Remove the fibre insulating washer.

Replacement

9. Reverse procedures 1 to 8.

**BLOWER MOTOR****Removal and Replacement**

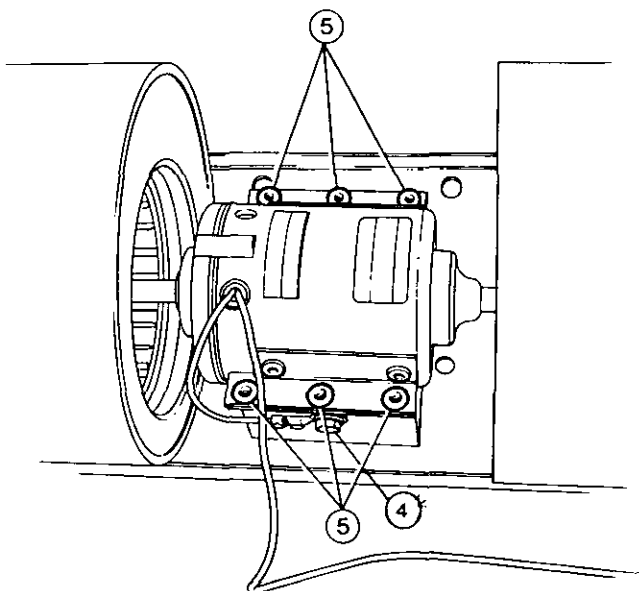
9A-25-17

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the blower impellers, Part 2B.
4. Remove the screw and disconnect the earth cable.
5. Remove the six rivets.
6. Remove the motor.

Replacement

7. Reverse procedures 1 to 6.



ELECTRICAL SYSTEM

WIPER MOTOR

Removal and Replacement

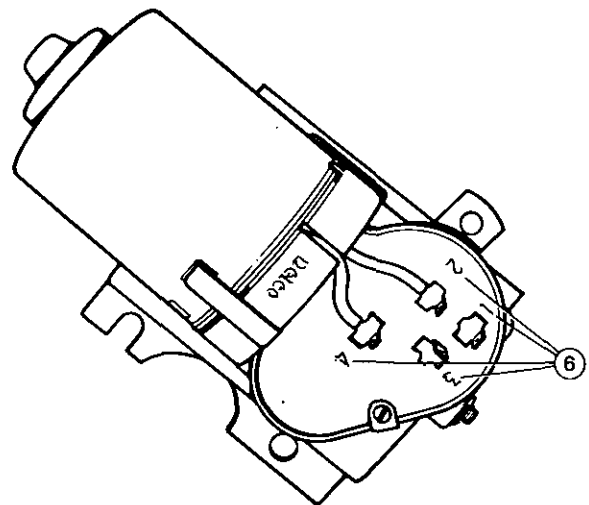
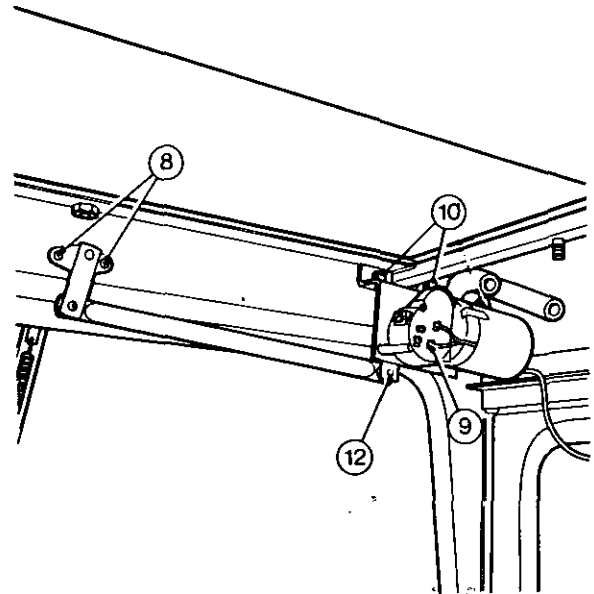
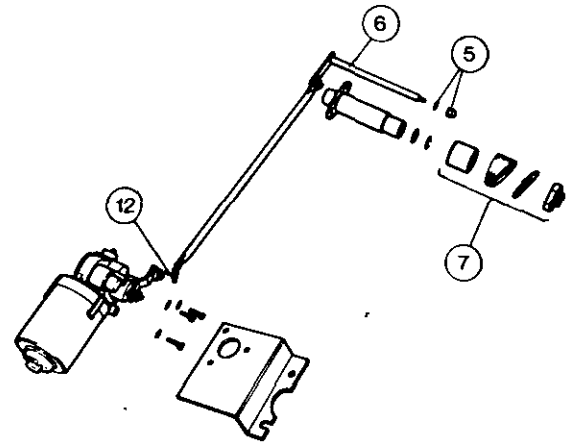
9A-26-18

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the heater unit cover, Part 2B.
4. Remove the plenum chamber, Part 2B.
5. Remove the domed nut and washer.
6. Remove the windscreen wiper arm.
7. Remove the slotted nut and spacer.
8. Remove the two screws and washers.
9. Disconnect the wiring to the wiper motor.
10. Remove the two bolts and washers.
11. Withdraw the motor and arm.
12. Remove the circlip and washer.
13. Disconnect the wiper motor from the arm.

Replacement

14. Reverse procedures 1 to 13.



CIGAR LIGHTER**Removal and Replacement**

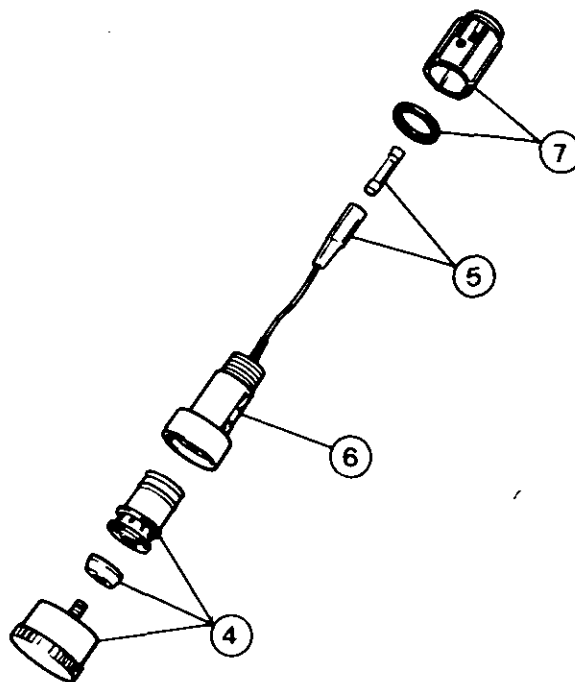
9A-27-19

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument panel cowl, Part 2B.
4. Pull the lighter element from the holder.
5. Disconnect the cable at the in-line fuse.
6. Unscrew and remove the sleeve from the holder at the rear of the instrument panel.
7. Withdraw the holder, together with the rubber gasket from the instrument panel.

Replacement

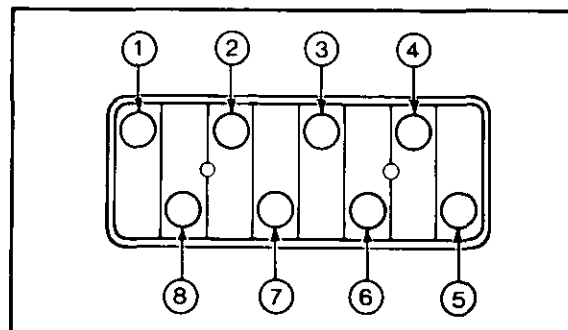
8. Reverse procedures 1 to 7.

**LIGHT CIRCUIT FUSES**

Eight fuses protect the light circuits, the same procedure is used to replace any of the fuses.

The layout and capacities of the fuses are as follows:—

- | | |
|-------------------------|-----|
| 1. Dipped Headlights | 15A |
| 2. Side Lights | 10A |
| 3. Brake Lights | 10A |
| 4. Warning Lights | 15A |
| 5. Plough Light | 10A |
| 6. Flashing Indicators | 10A |
| 7. Side Lights | 10A |
| 8. Main Beam Headlights | 15A |

**Removal and Replacement**

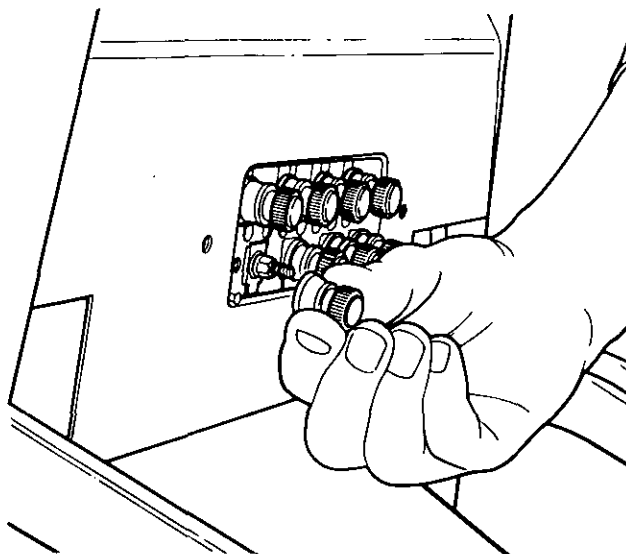
9A-28-19

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the two screws.
4. Remove the cover.
5. Remove the fuse retainer.
6. Remove the fuse.

Replacement

6. Reverse procedures 1 to 6 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.



ELECTRICAL SYSTEM**BLOWER CIRCUIT FUSE****Removal and Replacement** 9A—29—20

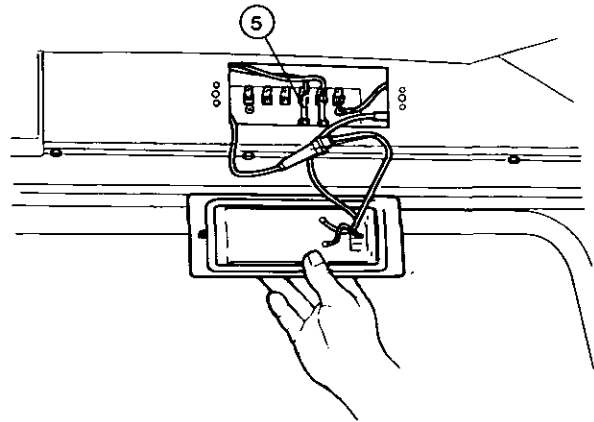
The blower circuit fuse is situated behind the interior light.

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the two screws.
4. Withdraw the light assembly.
5. Remove the failed fuse.

Replacement

6. Reverse procedures 1 to 5 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.

**WIPER CIRCUIT FUSE****Removal and Replacement** 9A—30—20

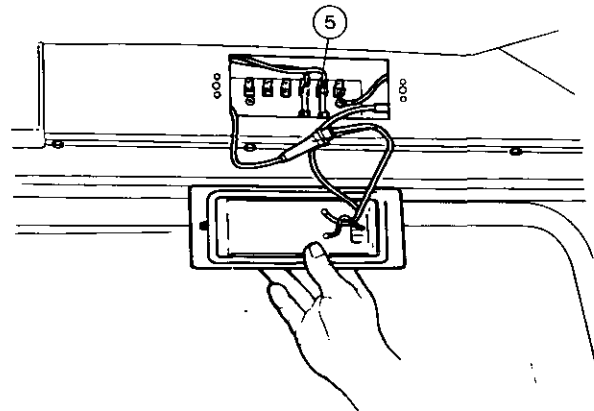
The wiper circuit fuse is situated behind the interior light.

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the two screws.
4. Withdraw the light assembly.
5. Remove the failed fuse.

Replacement

6. Reverse procedures 1 to 5 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.



INTERIOR LIGHT FUSE**Removal and Replacement** 9A-31-21

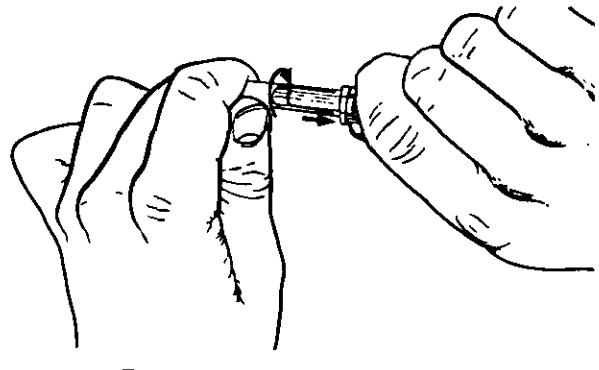
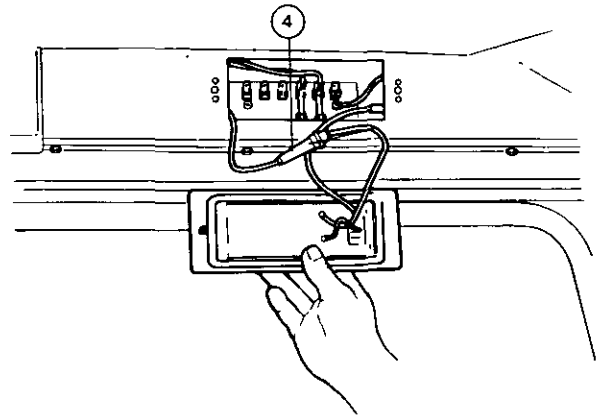
The interior light fuse is situated behind the interior light.

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the two screws.
4. Hold one end of the line fuse casing, push in, twist and pull off the other end.
5. Tip out the fuse.

Replacement

6. Reverse procedures 1 to 4 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.

**HORN CIRCUIT FUSE****Removal and Replacement** 9A-32-21

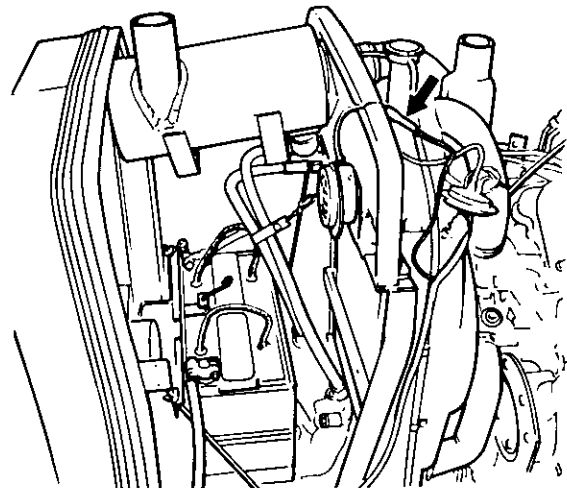
The horn circuit line fuse is located adjacent to the horn in the nose assembly.

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Hold one end of the fuse casing, push in, twist and pull off the other end.
4. Tip out the fuse.

Replacement

5. Reverse procedures 1 to 4 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.



ELECTRICAL SYSTEM

CIGAR LIGHTER FUSE

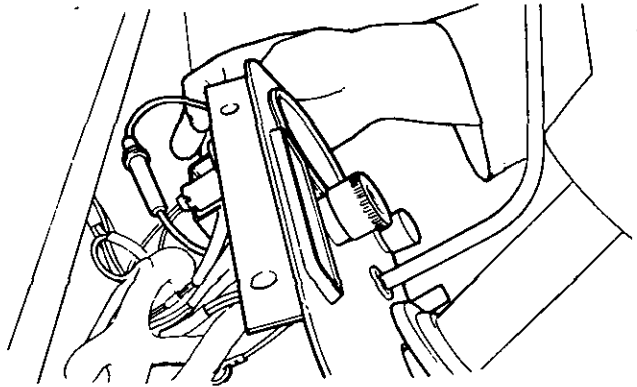
Removal and Replacement 9A-33-22

The cigar lighter fuse is situated behind the instrument adjacent to the cigar lighter.

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument cowl, Part 2B.
4. Hold one end of the fuse casing, push in, twist and pull off the other end.
5. Tip out the fuse.

Replacement

6. Reverse procedures 1 to 4 except:
 - (a) Always fit a replacement fuse of the correct capacity.
 - (b) Ascertain and rectify the cause of the fuse failure.



HEADLAMP BULB

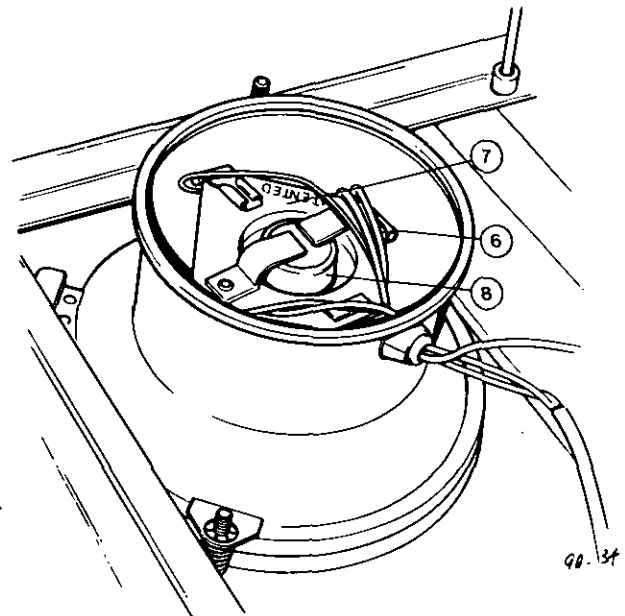
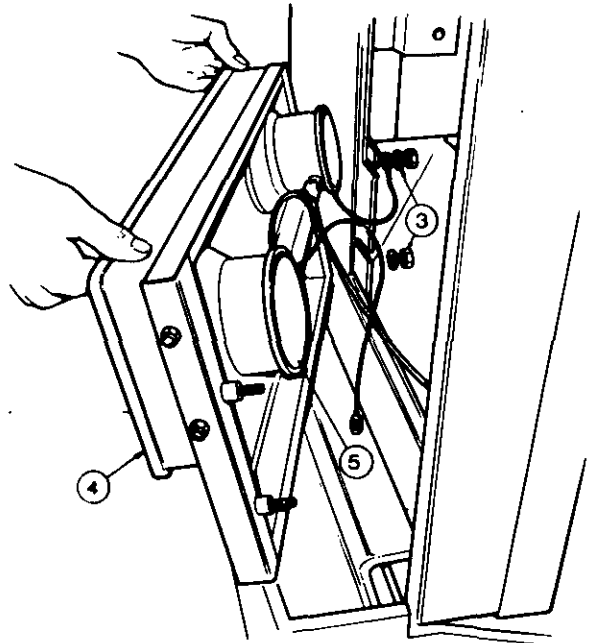
Removal and Replacement 9A-34-22

Removal

1. Remove the front grille.
2. Disconnect the battery cables.
3. Remove the four nuts.
4. Lift out the headlight housing and disconnect the wiring.
5. Remove the plastic cover from the rubber surround.
6. Remove the earth wire to free the clamping plate.
7. Remove the clamping plate.
8. Remove the bulb.

Replacement

9. Reverse procedures 1 to 8.



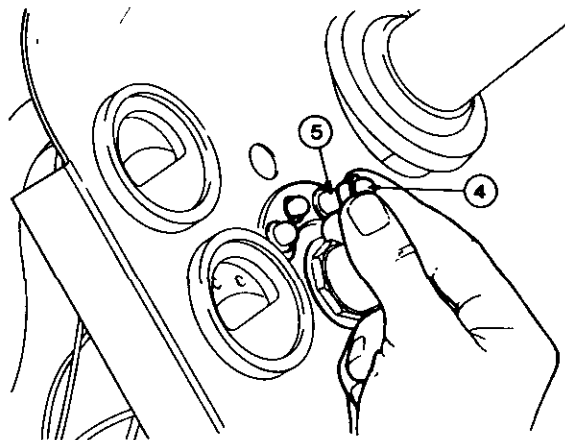
98-134

INDICATOR WARNING LIGHT BULB**Removal and Replacement** 9A-35-23**Removal**

1. Remove the front grille, Part 2A.
2. Disconnect the battery cables.
3. Remove the instrument cowl, Part 2B.
4. Whilst holding the bulb holder from behind the instrument panel, unscrew the lens.
5. Remove the bulb.

Replacement

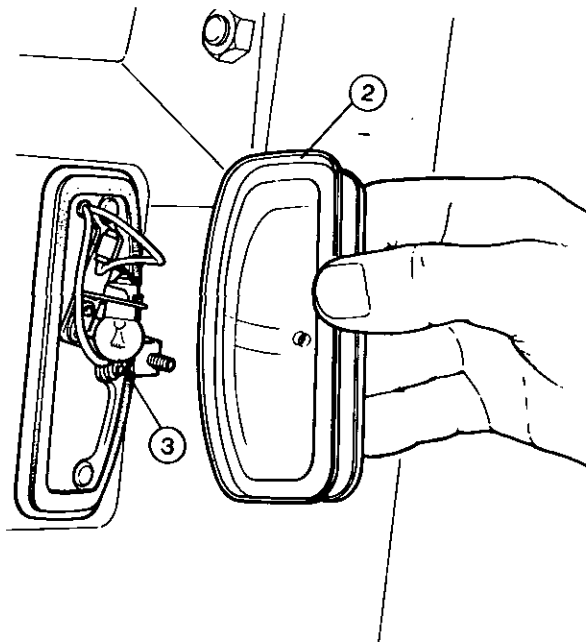
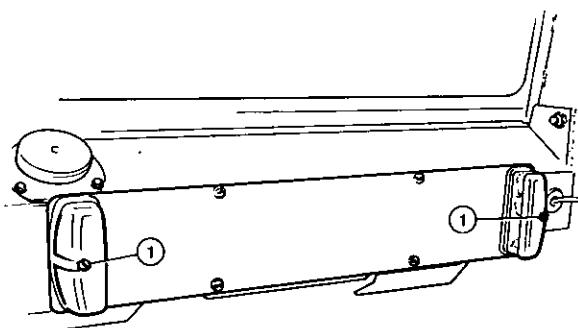
6. Reverse procedures 1 to 5.

**NUMBER PLATE LIGHT BULB****Removal and Replacement** 9A-36-23**Removal**

1. Slacken the screw.
2. Remove the cover and lens.
3. Remove the bulb from the bayonet fitting.

Replacement

4. Reverse procedures 1 to 3.



ELECTRICAL SYSTEM**PLOUGH LIGHT BULB****Removal and Replacement**

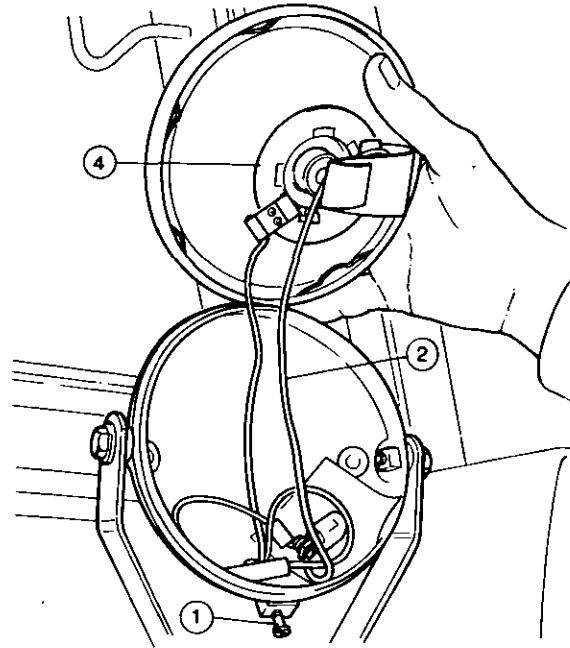
9A—37—24

Removal

1. Slacken the screw.
2. Hinge the lens and rim upwards.
3. Remove the lens and rim from the lamp body.
4. Turn the bulb retainer anti-clockwise.
5. Remove the bulb retainer and bulb.

Replacement

6. Reverse procedures 1 to 5.

**SIDE LIGHTS/FLASHING INDICATOR BULBS****Removal and Replacement**

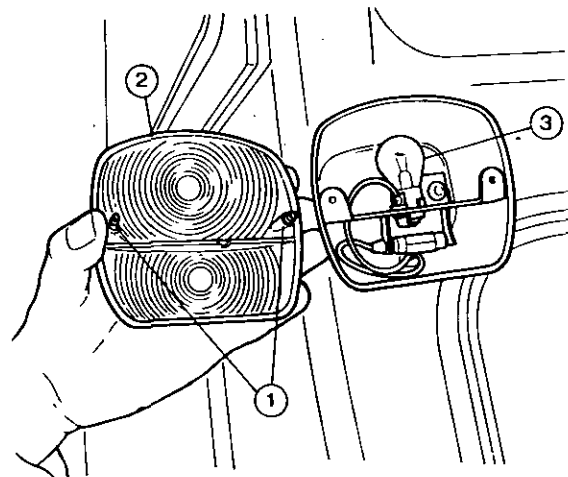
9A—38—24

Removal

1. Remove the two screws.
2. Lift off the cover.
3. Remove the bulb.

Replacement

4. Reverse procedures 1 to 3.

**TAIL/BRAKE LIGHTS/FLASHING INDICATOR BULB****Removal and Replacement**

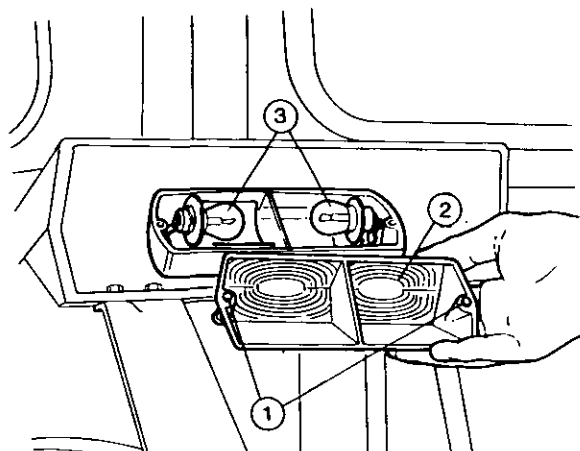
9A—39—24

Removal

1. Remove the two screws.
2. Lift off the cover.
3. Remove the appropriate failed bulb from its bayonet fitting.

Replacement

4. Reverse procedures 1 to 3.



INSTRUMENT LIGHTS BULB**Removal and Replacement**

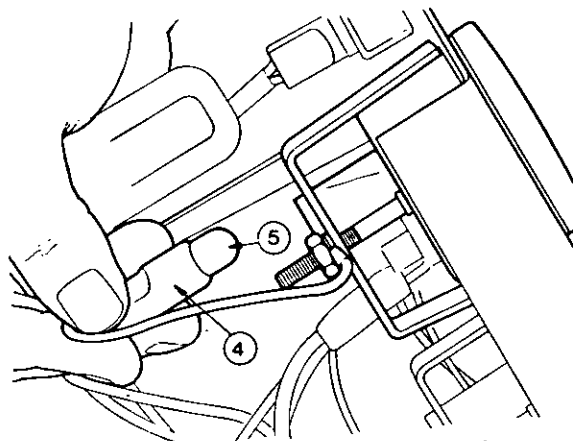
9A-40-25

Removal

1. Remove the front grille, Part 2A.
2. Disconnect the battery.
3. Remove the instrument cowl, Part 2B.
4. Withdraw the capless bulb and its holder from the instrument.
5. Remove the bulb.

Replacement

6. Reverse procedures 1 to 5.

**INTERIOR LIGHT BULB****Removal and Replacement**

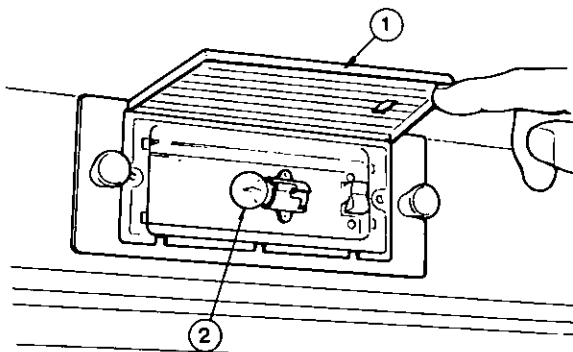
9A-41-25

Removal

1. Hinge open the cover from the bottom.
2. Remove the bulb from the bayonet fitting.

Replacement

3. Reverse procedures 1 and 2.

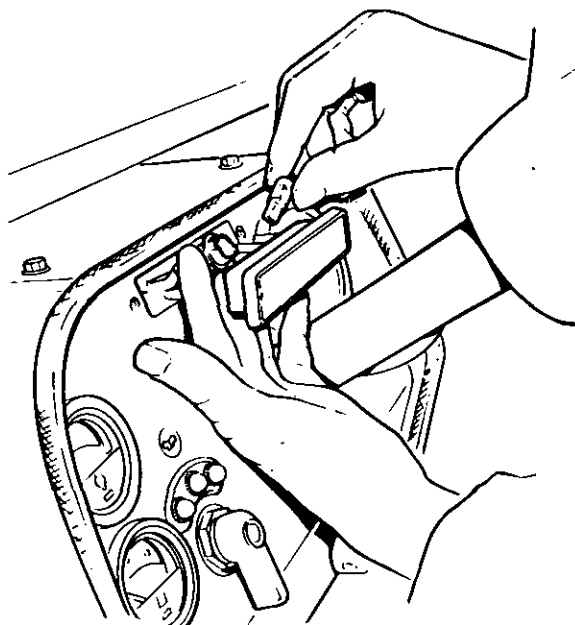


ELECTRICAL SYSTEM**WARNING LIGHTS BULB
(PANEL ASSEMBLY)****Removal and Replacement** 9A-42-26**Removal**

1. Remove the warning light lens, operation 9A-43-26.
2. Turn the failed bulb and its holder anti-clockwise, and withdraw them from the light panel assembly.
3. Remove the capless bulb.

Replacement

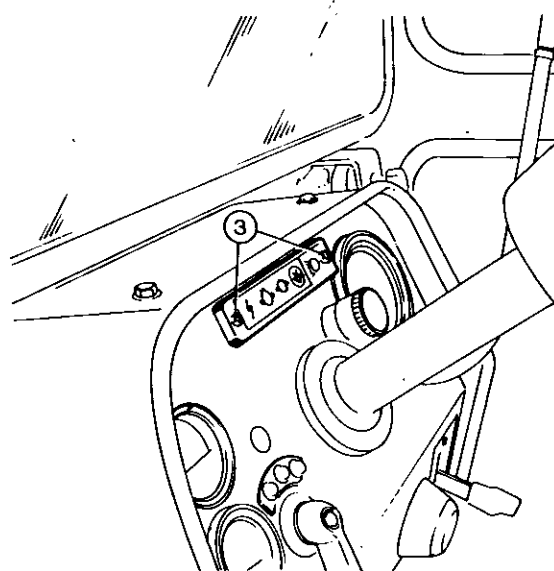
4. Reverse procedures 1 to 3.

**WARNING LIGHTS LENS****Removal and Refitment** 9A-43-26**Removal**

1. Remove the front grille.
2. Disconnect the battery cables.
3. Remove the two screws securing the lens to the instrument panel; release the lens.
4. Label and disconnect the bulb holders from the lens; remove the lens.

Refitment

5. Reverse procedures 1 to 4.



FUEL AND TEMPERATURE GAUGES**Removal and Refitment**

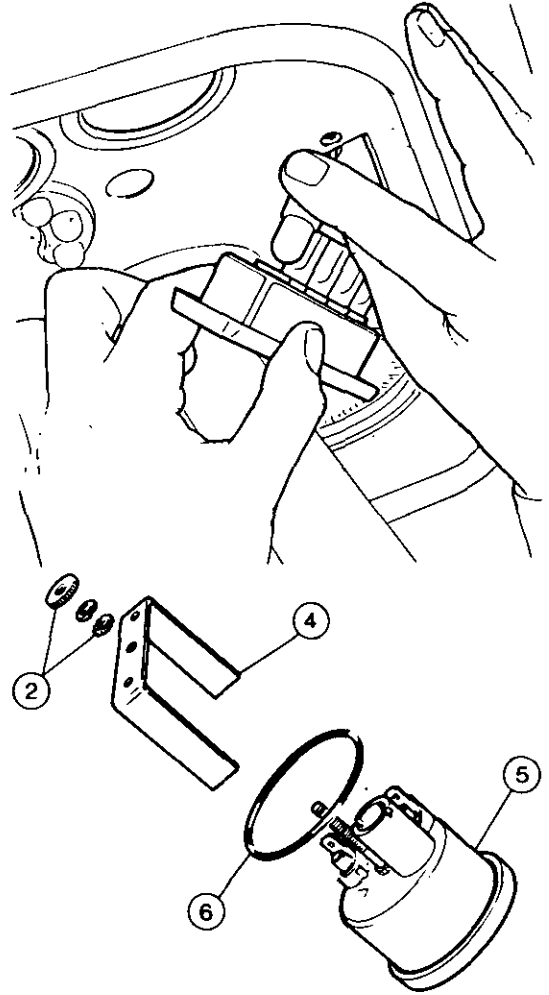
9A-44-27

Removal

1. Remove the bulb holder, operation 9A-40-25 procedures 1 to 4.
2. Remove the knurled nut and spring washer.
3. Disconnect the earth wire and remove the washer.
4. Remove the bracket.
5. Remove the instrument.
6. Remove the gasket from the instrument panel.

Refitment

7. Reverse procedures 1 to 6.

**TACHOMETER****Removal and Refitment**

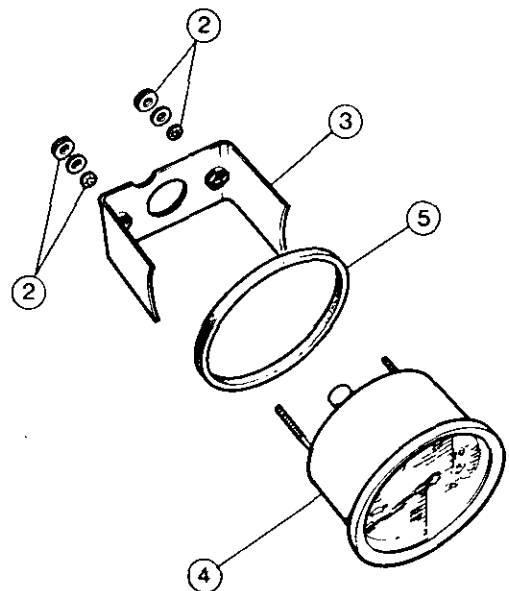
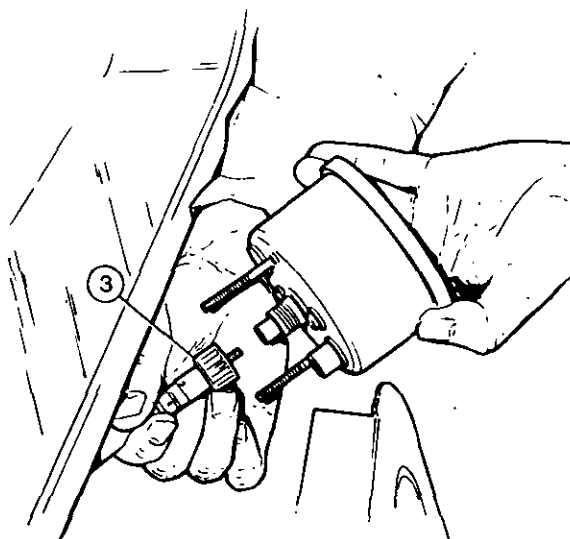
9A-45-27

Removal

1. Remove the bulb holder, operation 9A-40-25 procedures 1 to 4.
2. Remove the two nuts and washers securing the bracket.
3. Release the bracket and disconnect the drive cable.
4. Remove the instrument.
5. Remove the gasket from the instrument panel.

Refitment

6. Reverse procedures 1 to 5.



**MF 500 SERIES TRACTOR
WORKSHOP SERVICE MANUAL**

PART 10

Publication No. 1856 072 M1

comprising

A ACCESSORIES

ACCESSORIES

Part 10 — Section A

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10A-03-06	Kit Fitment	
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10A-05-07	Kit Fitment (MF 565, 575, 590 Tractor)	07
	STABILISER EXTENSION KIT	08
10A-06-08	Kit Fitment	
	HYDRAULIC ASSISTER RAM	08
10A-07-08	Fitment	

ACCESSORIES

GENERAL

The auto hitch is a supplementary lifting mechanism fitted to the swinging drawbar frame which enables ring type drawbar implements to be hitched to the tractor, without the operator leaving his seat, by actuating a release lever and operating the hydraulic quadrant levers.

If required, the hitch hook can be replaced by the swinging drawbar by lowering the hitch, removing the pivot pin and sliding out the hitch hook, then replacing it by the drawbar.

Operation

WARNING: Always operate the Auto Hitch from the tractor seat.

To Lower the Hitch

1. Place the Draft Control lever in the fully UP position.
2. Select CONSTANT PUMPING with the Position Control lever.
3. Push the release lever rearwards.
4. Whilst holding the release lever in the rearward position, move the Position Control lever to DOWN. The hitch will then lower.

To Raise the Hitch

Move the Position Control lever to TRANSPORT; the hitch will then raise and latch automatically.

The maximum lift capacity with the hitch hook fitted is 2268 kg (5000 lb).

AUTO HITCH

Kit Fitment

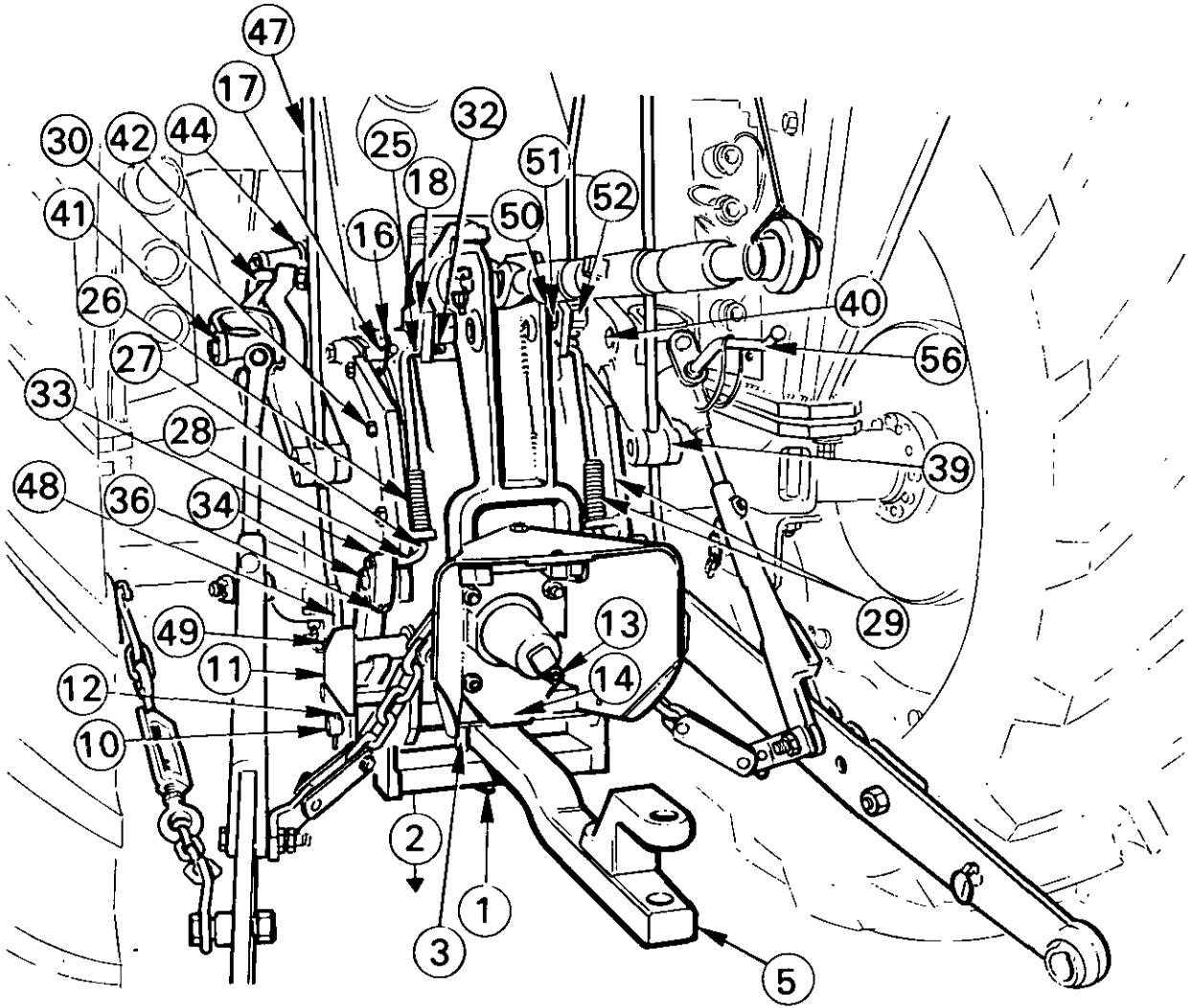
10A—01—02

These instructions assume that the tractor is already equipped with a swinging drawbar to which certain additions and modifications must be made.

To obtain the maximum downward travel of the lift arms, it may be necessary on certain tractors to grind off the two location pads on the top rear section of both trumpet housings.

The long and shallow rear number plate must be exchanged for the shorter deeper type.

1. Remove the two locating pin hair pins.
2. Lower the drawbar mounting frame onto a jack.
3. Remove the two locating pins.
4. Remove the pivot pin.
5. Remove the swinging drawbar.
6. Feed in the hitch hook.
7. Fit the pivot pin.
8. Fit the two locating pins.
9. Fit the two locating pin hair pins.
10. Feed in the mounting frame lift shaft.
11. Fit the two catches, guide plates rearwards.
12. Fit the two lift shaft split pins.
13. Remove the two bottom control beam bracket nuts and washers.
14. Fit the hook stop, outer cranked face rearwards.
15. Refit the two bottom control beam bracket washers and nuts.
16. Remove the linch pin.
17. Remove the long hitch pin.
18. Locate the pivot assembly, welded bar upwards and forwards between the two long hitch pin lugs.
19. Refit the long hitch pin.
20. Refit the linch pin.
21. Heavy duty swinging drawbar only, remove the six support bracket bolts.
22. Heavy duty swinging drawbar only, remove the two support brackets.
23. Heavy duty swinging drawbar only, remove the two trumpet/centre housing bolts above the six removed in procedure 21.
24. Normal duty swinging drawbar only, remove the eight rear trumpet/centre housing bolts, similar to procedures 21 and 23.
25. Fit the two outer push rod split pins. MF 550 only, other tractors use the centre hole.
26. Feed the two push rod springs onto the bottom ends.
27. Feed the bottom ends of the two push rods downward through the spring abutments on the lower ends of the support bracket.
28. Compress the two springs and trap the bottom ends of the push rods under the support brackets.
29. With the two springs innermost, locate the push rods in the pivot assembly plates and the two support brackets on the trumpet housing flanges.
30. Fit the eight trumpet/centre housing bolts.
31. Tighten the eight trumpet/centre housing bolts to a torque of 130 Nm (95 lbf ft).
32. Fit the two push rod split pins.
33. Locate each latch opening to the rear on each support bracket spigot and push rod end simultaneously.
34. Fit the two snap rings.
35. Check the two latches for freedom of movement.
36. Lubricate the two latches.
37. Support the two lower links and discard the lift arm split pins.
38. Discard the two lift arm clevis pins.
39. Locate the two extensions against the inner faces of the lift arms.
40. Fit the two clevis pins through the extensions, lift arms and lift rod knuckles. Remove the lower link supports.
41. Fit the two split pins.
42. Normal duty auto-hitch only. Screw the four adjuster buttons into the two extension arms.
43. Normal duty Auto-hitch only. Fit the two 'U' bolts and the four locking nuts.
44. Normal duty Auto-hitch only. Close any gaps between the two lift arms and the 'U' bolts by rotating the protruding threaded shanks of the four adjuster buttons before tightening the four locking nuts.
45. Heavy-duty Auto-hitch only, fit the two front extension bolts and washers, heads outwards.
46. Jack up the mounting frame and locate the two catches in the latches; remove the jack.
47. Feed the two lift rods through the lift arm extensions and run the tube nuts, unslotted ends first, half on.
48. Fit the two lift rods, offsets to the right hand side, to the catch spigots.
49. Fit the two split pins.
50. Fit the handle trunnion to the pivot assembly plate, normally the right hand.
51. Half run the trunnion nut.
52. Feed on the trunnion sleeve, long end first and align the holes.
53. Feed in the control handle, set in position.
54. Tighten the trunnion nut.
55. Adjust the auto-hitch as detailed later, the two roll pins are fitted to the slotted nuts during this procedure.
56. Reduce the "throw" of the levelling box handle to 70 mm (3½ in) to avoid a foul condition occurring with the lift arm extension or rod.



ACCESSORIES**AUTO-HITCH****Removal and Refitment**

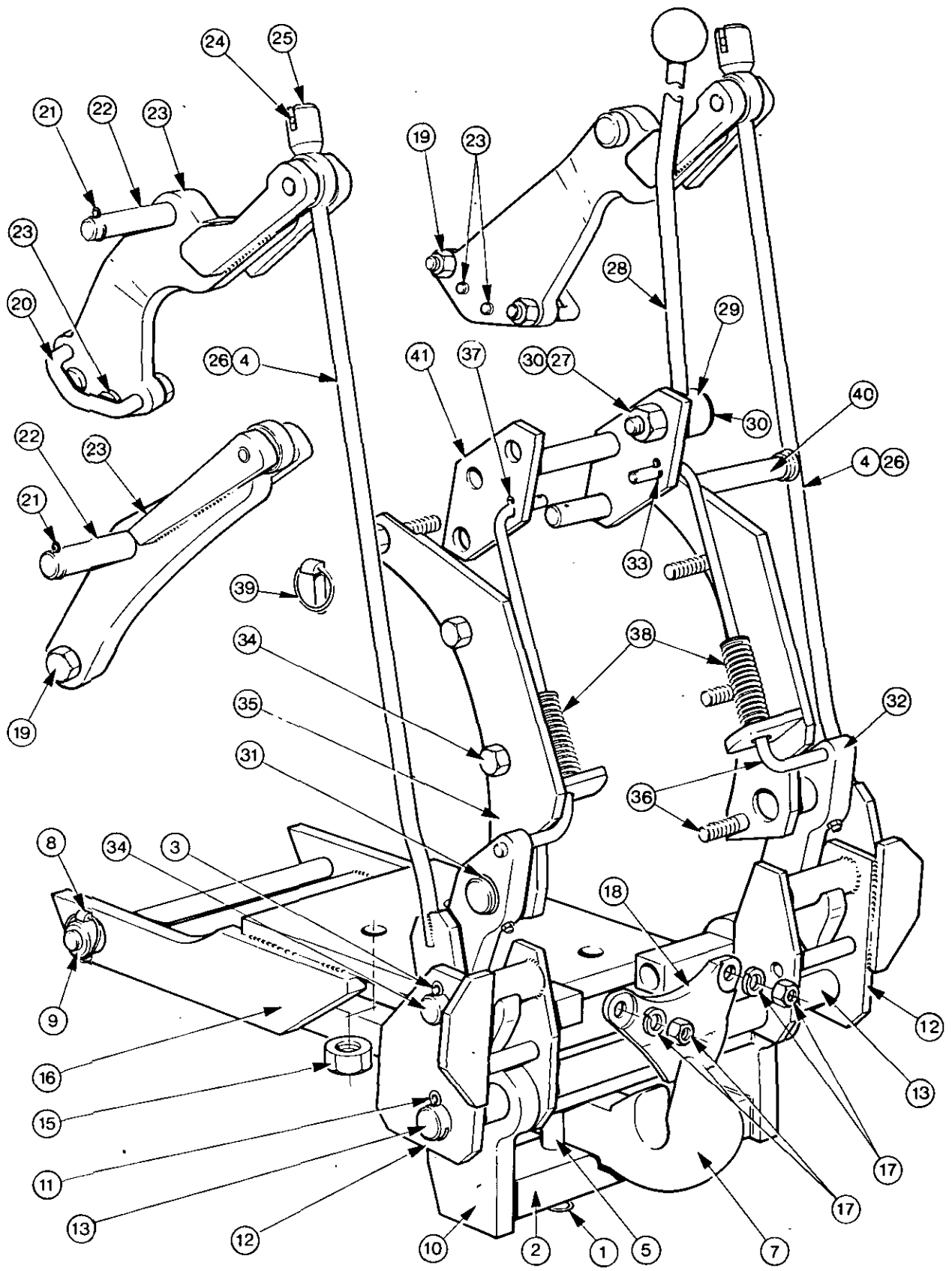
10A-02-04

Removal

1. Remove the two hair pins.
2. Lower the auto-hitch onto a trolley jack.
3. Discard the two lift rod split pins.
4. Detach the two lift rods.
5. Remove the two locating pins.
6. Remove the pivot pin.
7. Remove the hitch hook.
8. Remove the front linch pin.
9. Remove the support pin.
10. Remove the mounting frame on a trolley jack.
11. Discard the two split pins.
12. Match mark and remove the two catches.
13. Remove the lift shaft.
14. Support the attachment bracket on a trolley jack.
15. Remove the four locking nuts.
16. Remove the attachment bracket with the trolley jack.
17. Remove the two bottom control beam nuts and washers.
18. Match mark and remove the hook stop.
19. Remove the four locking nuts or two bolts and lockwashers.
20. Normal duty auto-hitch only, remove the two 'U' bolts.
21. Discard the two split pins.
22. Remove the two clevis pins.
23. Remove the two lift arm extensions or lift arm extensions four adjuster buttons and lift rod assemblies.
24. Remove the two roll pins.
25. Remove the two nuts.
26. Remove the two lift rods.
27. Slacken off the handle trunnion nut.
28. Withdraw the handle.
29. Remove the trunnion tube.
30. Remove the trunnion nut and trunnion.
31. Remove the two snap rings.
32. Match mark and remove the two latches.
33. Discard the two inner push rod split pins (MF 550 Tractor shown, all other Tractors use end hole).
34. Remove the eight support bracket bolts.
35. Remove the two support brackets.
36. Remove the two push rods.
37. Discard the two outer push rod split pins (MF 550 Tractor shown, all other Tractors use the centre hole).
38. Remove the two springs.
39. Remove the linch pin.
40. Remove the long pin.
41. Match mark and remove the pivot bracket.

Refitment

42. Reverse procedures 1 to 41 except:
 - (a) The pivot assembly is fitted welded bar upwards and forwards.
 - (b) The bottom ends of the two push rod and spring assemblies are trapped under the cut outs in the support brackets.
 - (c) Tighten the eight support bracket bolts to a torque of 130 Nm (85 lbf ft).
 - (d) Fit new split pins.
 - (e) The two latches are fitted open face rearwards.
 - (f) Ensure that the two snap rings locate correctly in their grooves.
 - (g) The handle is normally fitted to the right hand plate of the pivot assembly.
 - (h) The lift rod nuts are fitted unslotted end first.
 - (i) The fitting of the lift rod roll pins is delayed until after the auto-hitch has been adjusted.
 - (j) The heads of the two extension arm clevis pins are positioned on the extension arm side.
 - (k) Normal duty auto-hitch only, after the two 'U' bolts have been fitted to the lift arms and extensions, size the four adjuster buttons by rotating the two flats in each protruding threaded shank to touch the lift arm before finally tightening the four locking nuts.



ACCESSORIES

SWINGING DRAWBAR

GENERAL

The swinging drawbar has two clevis hitch points, 356 mm (14 in) and 254 mm (10 in) from the p.t.o. shaft and this is effected by using an alternative pivot pin hole in the drawbar frame.

Depending on the tractor model, either a heavy duty or a normal duty swinging drawbar may be fitted. The maximum static load for the drawbar is 771 kg (1700 lb)—normal duty, 1179 kg (2600 lb)—heavy duty with the drawbar in the outer position, or 998 kg (2200 lb)—normal duty, 1633 kg (3600 lb)—heavy duty in the inner position.

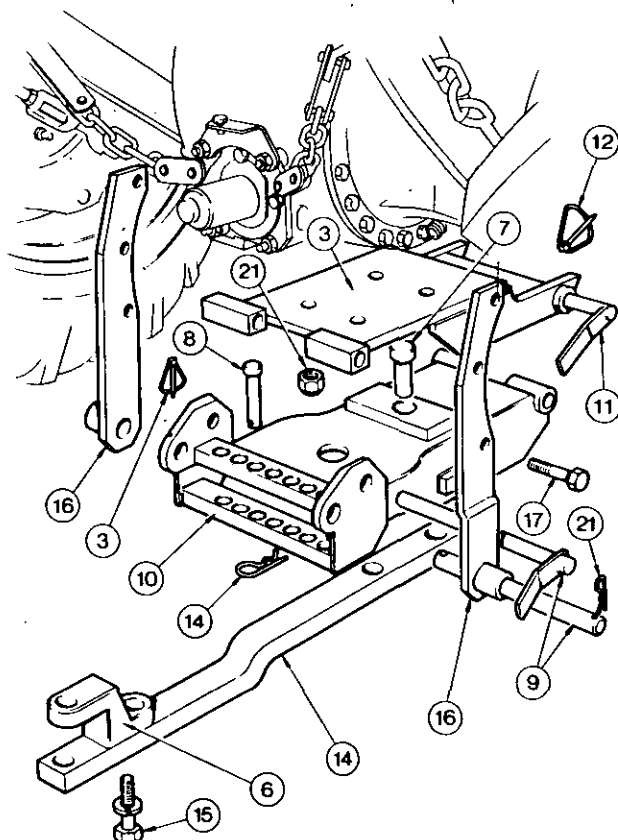
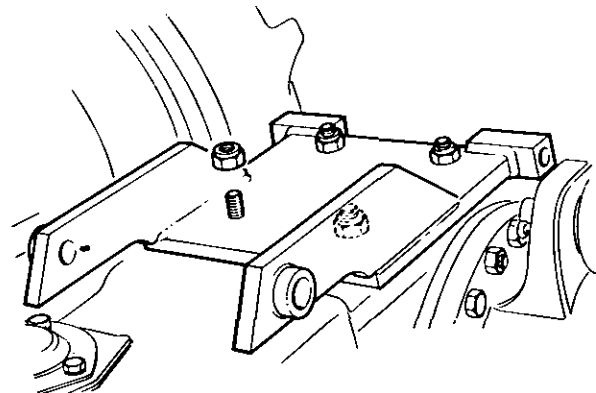
The heavy duty swinging drawbar differs from the normal duty drawbar in that it has two support brackets, secured to the outer flanges of the centre housing, to which the rear end of the drawbar frame is attached by a large diameter horizontal lift shaft and not to the frame attachment bracket fitted beneath the centre housing. Thus the normal duty smaller diameter support pin is not required. A heavy duty drawbar is also fitted.

SWINGING DRAWBAR

Kit Fitment

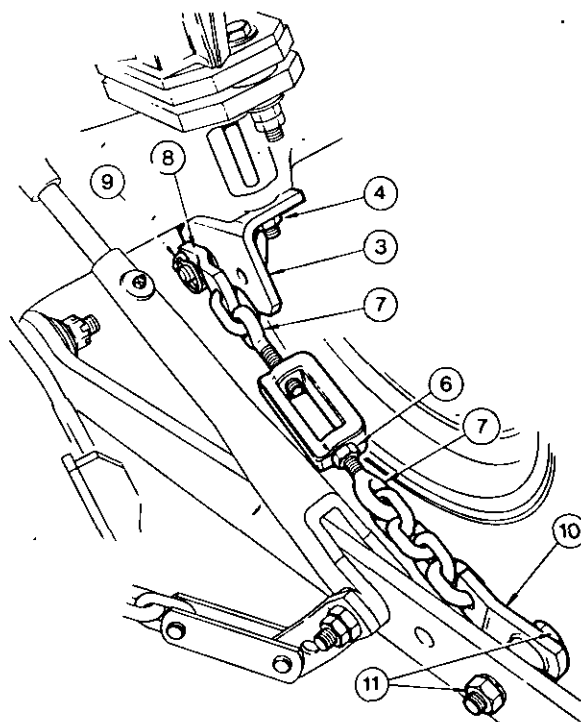
10A-03-06

1. Clean the underside of the centre housing and the four $\frac{1}{2}$ or $\frac{3}{8}$ in UNC tappings.
2. Screw the four $\frac{1}{2}$ or $\frac{3}{8}$ in UNC studs into the centre housing tappings.
3. Using a trolley jack, locate the attachment bracket on the four $\frac{1}{2}$ or $\frac{3}{8}$ in UNC studs.
4. Fit the four washers and locking nuts, remove the trolley jack.
5. Tighten the four locking nuts to a torque of $\frac{1}{2}$ in UNC—170 Nm (125 lbf ft)
 $\frac{3}{8}$ in UNC—305 Nm (225 lbf ft).
6. Set the clevis adaptor to the height required and feed the swinging drawbar into the mounting frame according to the height required.
7. Fit the pivot pin (according to the length required).
8. Fit the two locating pins.
9. Fit the two locating pin hair pins.
10. Using a trolley jack, locate the mounting frame within the attachment bracket.
11. Fit the support pin (front).
12. Fit the linch pin to the handle end of the support pin.
13. Normal duty drawbar only. fit the support bar (rear) through the top mounting frame holes and the attachment bracket.
14. Fit the linch pin to the no-handle end of the support bar, remove the trolley jack.
15. Heavy duty drawbar only, discard the six rear-most trumpet/centre housing bolts.
16. Heavy duty drawbar only, offer up the two support brackets, tubing ends downwards and outwards.
17. Heavy duty drawbar only, fit the six bolts.
18. Heavy duty drawbar only, tighten the six bolts to a torque of 110 Nm (80 lbf ft).
19. Heavy duty drawbar only, fit the lift shaft through one support bracket, the rear holes of the mounting frame and second support bracket.
20. Heavy duty drawbar only, fit a split pin to one end.
21. Heavy duty drawbar only, fit a hair pin to the second end, remove the trolley jack.



STABILISERS**Kit Fitment (MF 550 Tractor) 10A-04-07**

1. Remove the four nuts securing the two plates to the underside of the trumpet housings.
2. Remove and discard the two plates.
3. Fit the stabiliser brackets with the vertical faces towards the centre housing.
4. Apply a few drops of recommended sealant 'C' to the cab mounting/stabiliser bracket bolts, then refit and tighten the nuts to a torque of 230 Nm (170 lbf ft).
5. Screw an eyebolt with four chain links and a bossed bracket into one end of each turnbuckle.
6. Thread the eyebolt with a single chain link and bracket into the other end of each turnbuckle.
7. Secure the bossed bracket to the next hole from the linch pin clip (in the lower link) using the bolt (head outwards), spring, washer and nut.
8. Attach the other end of the stabilisers to the stabiliser mounting bracket pins and secure each with a linch pin.
9. Liberally coat the eyebolt threads with grease to facilitate adjustment.
10. Adjust the turnbuckles to give approximately 50 mm (2 in) of sideways movement measured at the lower link ends.
11. Tighten the turnbuckle locknuts.

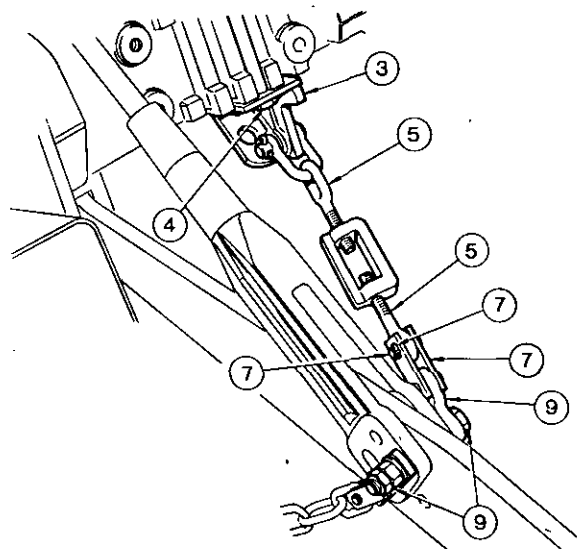
**STABILISERS****Kit Fitment (MF 565, 575, 590 Tractor) 10A-05-07**

1. Remove the four nuts securing the two plates to the underside of the trumpet housing.
2. Remove and discard the two plates.
3. Fit the stabiliser mounting brackets with the bossed holes facing rearwards.
4. Apply a few drops of recommended sealant 'C' to the cab riser/stabiliser mounting bracket bolts, then refit and tighten the nuts to a torque of 230 Nm (170 lbf ft).
5. Screw two eyebolts into each turnbuckle approximately equal amounts.
6. Fit the 'U' shackles so that lettering on the turnbuckles will face inwards when the stabiliser assembly is fitted.
7. Assemble the four plates and two cranked brackets using the clevis pins and split pins.
8. Align the shackles with the holes in the stabiliser mounting brackets and fit the clevis pins and split pins.
9. MF 590 Tractor. Remove the locknut, nut and bolt securing the check chain and lift rod. Secure the stabiliser bracket, lift rod and check chain to the same hole in the lower link, using the special bolt provided in the kit. Refit the nut and locknut so that the check chain bracket is just free to rotate. Repeat for the other stabiliser.

MF 575 Tractor. Secure cranked stabiliser bracket to the second hole from the lift rod attachment point using the bolt (head outwards), spacer, washer nut and locknut. The nut must be tightened so that the stabiliser is just free to rotate. Repeat for the other stabiliser.

MF 565 Tractor. The attachment procedure is as for the MF 575 tractor except that the long bolt is used without the spacer; the extra bolt length being required for check chain attachment.

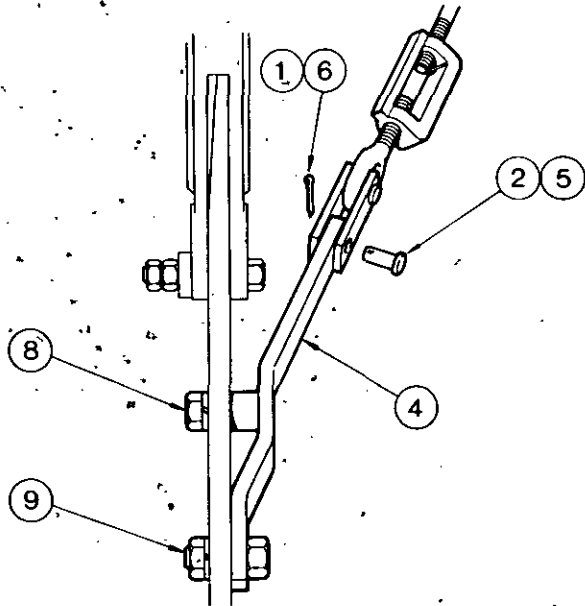
10. Liberally coat the eyebolt threads with grease to facilitate adjustment.
11. Adjust the turnbuckles to give approximately 50 mm (2 in) of sideways motion measured at the lower link ends.



ACCESSORIES**STABILISER EXTENSION KIT**

Kit Fitment (MF 565, 575, 590 Tractor) 10A—06—08

1. Discard the two rear parallel link split pins or remove the hair pins.
2. Remove the clevis pins.
3. Remove the cranked brackets.
4. Fit the extensions brackets.
5. Fit the clevis pins.
6. Fit new split pins or refit the hair pins.
7. Remove the rear linch pins and stowage clips; store in tool box.
8. Fit the bolts and lockwashers to the last lift rod bolt hole in each lift rod and extension bracket boss.
9. Fit the bolts, lock washers and nuts to the second extension bracket holes and the linch pin stowage clip holes.

**HYDRAULIC ASSISTER RAM 10A—07—08****Fitment**

The hydraulic assister ram is fitted, ram end upwards, between the left hand lift arm and the cab riser. It is anchored by a pin and snap ring to a special stabiliser bracket situated beneath the left hand rear cab mounting bracket and under the axle. The ram end has a spherical joint and is fitted by a long clevis pin which passes through the ball end, lift arm and knuckle.

The hydraulic connection is half way along the assister cylinder and is connected by a flexible hose and adaptor to a tapping in the left hand side of the lift cover and by a drilling to the ram cylinder of the tractor linkage. Thus, when the tractor linkage is actuated the assister ram is actuated simultaneously providing 20% more lift capacity. Extended stabilisers must be fitted to counteract the additional sideloads created when lifting heavier implements.

The assister ram is a sealed unit and requires no maintenance.

