

---

# **SECTION 1**

## **Introduction and Safety**

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

---

## **SECTION 4**

### **Splitting the Tractor**

## 7A.2 FRONT WHEEL TOE-IN ADJUSTMENT

### Procedure

1. The tractor must be on firm level ground with the wheels facing straight ahead position.
2. To check the toe-in, see illustrations given in Fig. 2. Distance A must be 0.039 - 0.196 inch (1–5 mm), greater than the distance B, measured on the center line of the axle at the wheel rim.

### If adjustment is required

1. Loosen the tie-rod assy. clamp bolt and nut (Item 1 in Fig.3).
2. Slacken the track adjusting set screw and nut (Item 2 in Fig.3).
3. Screw out the tie-rod tube to increase toe-in. Screw in the tie-rod tube to decrease toe-in.
4. Re-tighten the clamp nut and bolt to a torque of 37 lbf. ft. (50 Nm) and tighten the lock nut.

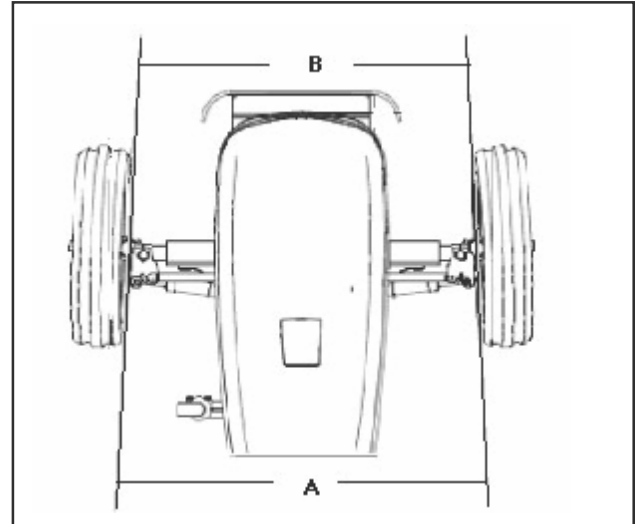


Fig. 2

## 7A.3 FRONT HUB OVER HAUL

### Dis-assembly

1. Apply the tractor parking brake and fit wheel chocks to hold the rear wheels.
2. Raise the front of the tractor.
3. Remove the front wheel.
4. Remove the hub cap and gasket (Item 1 in Fig.4).
5. Remove and discard the cotter pin (Item 2 in Fig.4).
6. Remove the nut hex castle and washer (Item 3 in Fig.4).
7. Remove the hub assy. complete with bearing and seal from the spindle assy. (Item 4 in Fig.4).
8. Remove the outer bearing cone (Item 5 in Fig.4).
9. Tap out the outer bearing cup (Item 6 in Fig.4).
10. Remove the seal (Item 7 in Fig.4).
11. Drive out the inner bearing cone (Item 8 in Fig.4).
12. Drive out the inner bearing cup (Item 9 in Fig.4).

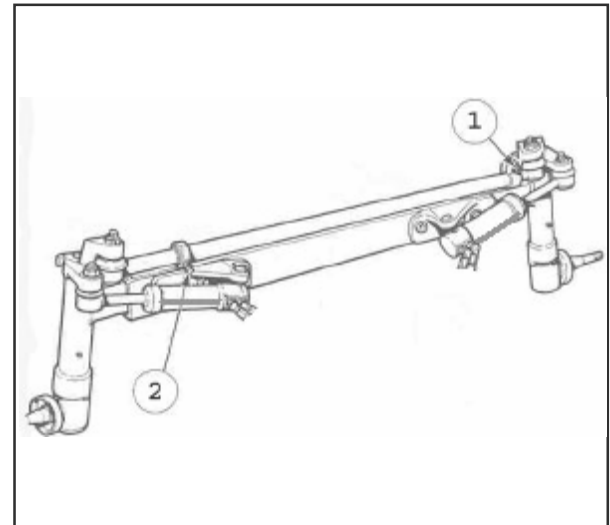


Fig. 3

### Examination :

**Completely clean the hub components and check the condition of the hub, spindle and bearings. Any worn or damaged components should be replaced.**

### Re-assembly

For re-assembling, follow the reverse procedure given above, and

1. Pack the bearings with approved grease.

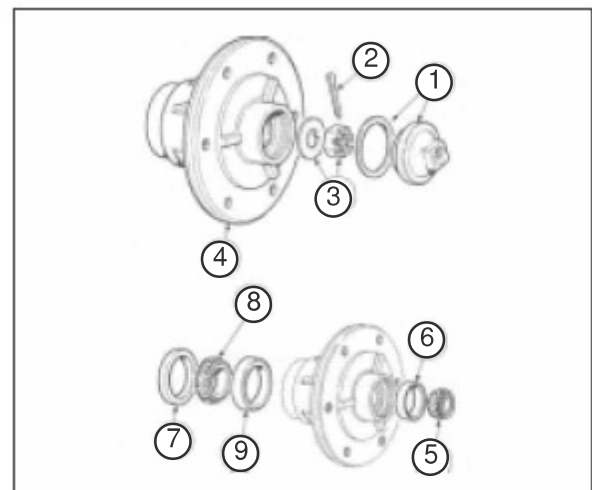


Fig 4

## 7C.1 WHEEL ALIGNMENT AND STEERING STOPS

### Adjust

#### Procedure Wheel alignment

1. Drive the tractor onto firm level ground and put the front wheels in the straight ahead position.
2. Check the wheel toe-in measured on the centre line of the axle at the wheel rim. Distance 'A' must be 0 - 0.196 inch (0- 5mm) greater than distance 'B'.
3. If adjustment is necessary, slacken the locknut on the track rods on one side.
4. Rotate the inner steering ball joint to either increase or decrease the track rod length to obtain the correct setting.
5. Tighten the track rod locknut to a torque of 83 lbf.ft (112Nm). Ensure that both track rods are the same length. **Steering stops**
6. The steering stop adjustment is made according to the maximum steering angle required.
7. Adjust the length of the bolt according to the table below and tighten the locknut.

Steering angle Dimension 'X'

35° ..... 3.051 inch (77.5 mm)

40° ..... 2.6378 inch (67.0 mm)

50° ..... 1.7126 inch (43.5 mm)



**CAUTION: The normal setting is 50 ° . Ensure that the tire does not foul the tractor when on full lock and full axle tilt.**

## 7C.2 TRACK ROD AND BALL JOINT

### Removal and refitment

#### Removal

1. Remove the split pin and nut from the ball joint.
2. Remove the ball joint from the housing by using an extractor or by striking the housing with a hammer adjacent to the ball joint to release the taper.
3. Slacken the locknut and unscrew the ball joint from the track rod.
4. To remove the inner joint, hold the end of the steering ram piston rod with a spanner and unscrew the joint.

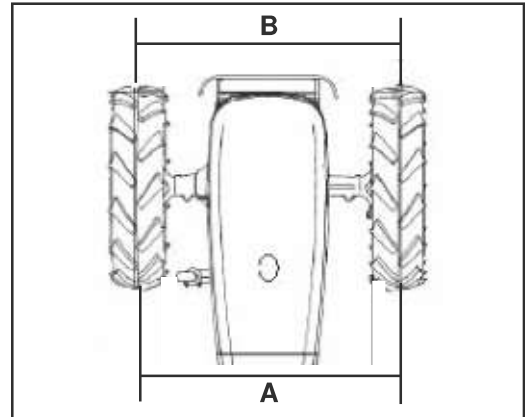


Fig 2

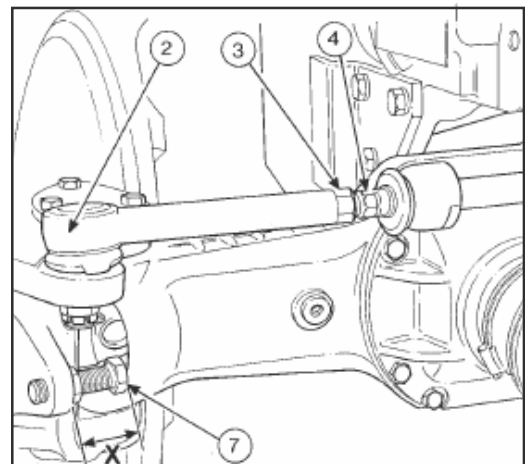


Fig 3

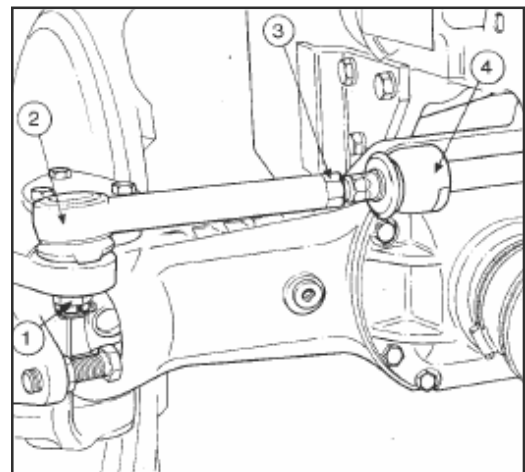


Fig 4

12. Hold the housing in position and partly fit the upper pivot pin to locate the assembly.
13. Refit the lower pivot pin, bearing cup, cap and bolts. NO shims are fitted to the lower cap.
14. Tighten two opposing bolts evenly and in sequence to pull the lower pivot pin into the housing. Tighten the four bolts to a torque of 52 lbf.ft (70Nm).
15. Fit the upper bearing cup, shims, cap and bolts. Add additional shims to ensure that the pivot pins are seated on the axle casing. Tighten two opposing bolts evenly and in sequence to press the pivot pin into the housing.
16. Check that both pivot pins are fully seated onto the axle casing.
17. Remove the upper cap and shims.
18. Replace the cap and tighten the four bolts to torque of 52 lbf.ft (70Nm).
19. Using a dial indicator gauge and lever as shown in the illustration, determine the end-float of the two pivot bearings.

When lifting the housing up and down with the lever ensure that you get the maximum reading on the dial indicator gauge. The correct bearing pre-load is 0.006 - 0.0098 inch (0.15 - 0.25 mm).

20. Select the required shims by the following method:  
Shims required = End-float + Pre-load  
Select shims from the following chart:

Part number	Thickness	
	mm	inch
3427 190 M1	0.1	0.004
3427 191 M1	0.15	0.006
3427 192 M1	0.3	0.012
3427 193 M1	0.5	0.020
3427 194 M1	0.7	0.028
3427 195 M1	1.0	0.040

21. Remove the upper cap and bearing cup. Fill the bearing with grease, fit the correct number of shims, replace the cap.
22. Apply lubricating oil to the threads of the bolts and tighten to a torque of 52 lbf.ft (70Nm).
23. Remove the lower bearing cap and cup and fill the bearing with grease. Tighten the bolts as described in procedure 22.
24. Grease both bearings with a grease gun to ensure that they are full.
25. Apply lubricating oil to the thread and tighten the ball joint nut to a torque of 78 lbf.ft (106 Nm). Then tighten further as required to align the nut for the split pin. Renew the split pin.

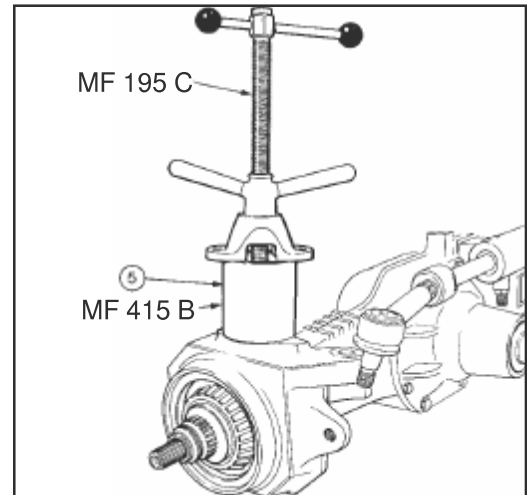


Fig 21

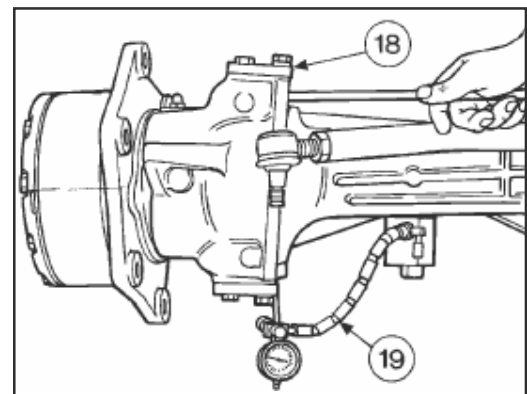


Fig 22

Check the thickness of the pack with a micrometer. It may be necessary to round-off to the nearest value that can be made into a shim pack. Select the higher value if new bearings are being fitted. Shims are available in the following sizes:

Part number	Thickness	
	mm	inch
3428 722 M1	0.1	0.004
3428 723 M1	0.15	0.006
3428 724 M1	0.3	0.012
3428 725 M1	0.5	0.020
3428 726 M1	0.7	0.028
3428 727 M1	1.0	0.040

20. Remove the bearing, place the shim pack into the housing and fit the inner taper roller bearing cup.
21. Fit the outer taper roller bearing cup.
22. Press the inner taper roller bearing cone on to the pinion.
23. Replace the bearing spacer with the chamfered end facing the drive coupling.
24. Replace the shims that were removed on dis-assembly as a starting point, bearing cone, coupling and a new nut. DO NOT fit the oil seal.
25. Tighten the nut dry to a torque of 218 lbf.ft (295 Nm). Tap the pinion in both directions to ensure that the bearings are fully seated.
26. Lightly lubricate the bearings.

#### Pinion bearing pre-load

27. It is now necessary to set the taper roller bearing pre-load by selecting the correct shims to be placed between the spacer and outer bearing. The correct rotational torque is 18 lbf.inch (2 Nm). This can be determined by using special service tool FT 4062A or making a special gauge as shown in the illustration.
28. Special service tool FT 4062A is calibrated in pounds force inches (lbf in.) moving the 2 lb weight to the 18 inch. mark on the rod represents 18 lbf.inch (2Nm).
29. Alternatively, select a length of flat bar and cut off 450mm. Drill two 10mm diameter holes 80mm apart in the center of the bar. Cut a notch 200mm from the center in the top of the bar. Obtain a weight of 2.204 lbs (1 Kg), if this is not available, cut a 63mm length of 50mm diameter steel bar and attach a length of cord to the top.
30. Attach special tool FT.4062A, or bolt the tool you have made to the drive coupling with two bolts. With the bar horizontal hang the weight from the notch, this is equal to a rotational torque of 18 lbf.inch (2Nm).

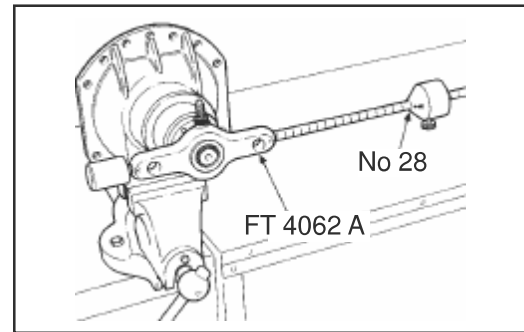


Fig 41

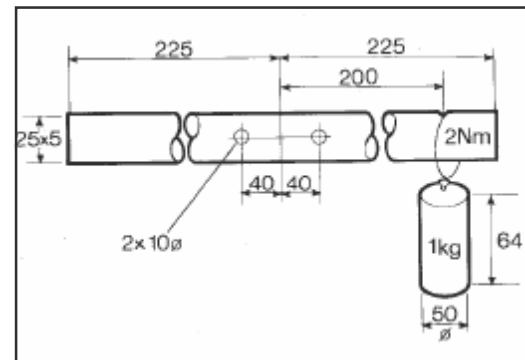


Fig 42

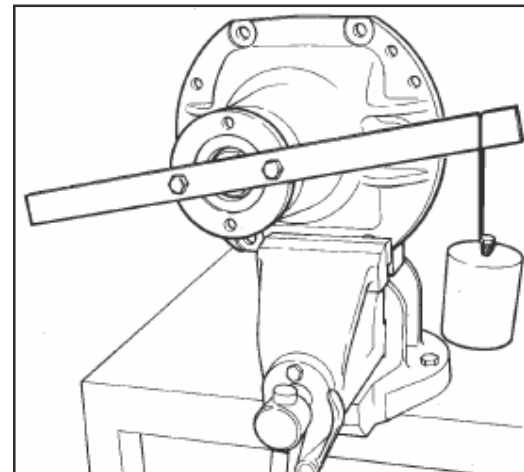


Fig 43

## 7B - 2 General description.

The axle described in this manual designed and manufactured following the client requests, consists of a beam casing housing the differential and a wheel hub unit at each end.

The differential, type “open”, is supported by two bearings mounted on a suitable structure allowing the bevel gear set to be adjusted.

The ring bevel gear is adjusted by means of ring nuts located opposite each other.

The position of the bevel pinion, supported by two bearings, is adjusted by inserting adjusting shims.

The drive torque is transmitted from differential side gears to planetary sun gears through drive shaft.

The drive shaft is supported at axle housing and swivel housing by needle roller bearings with proper seals in position.

The wheel hubs containing the epicyclic reduction gears are supported by two tapered roller bearings. The wheels ends are steered by hydrostatic power steering.

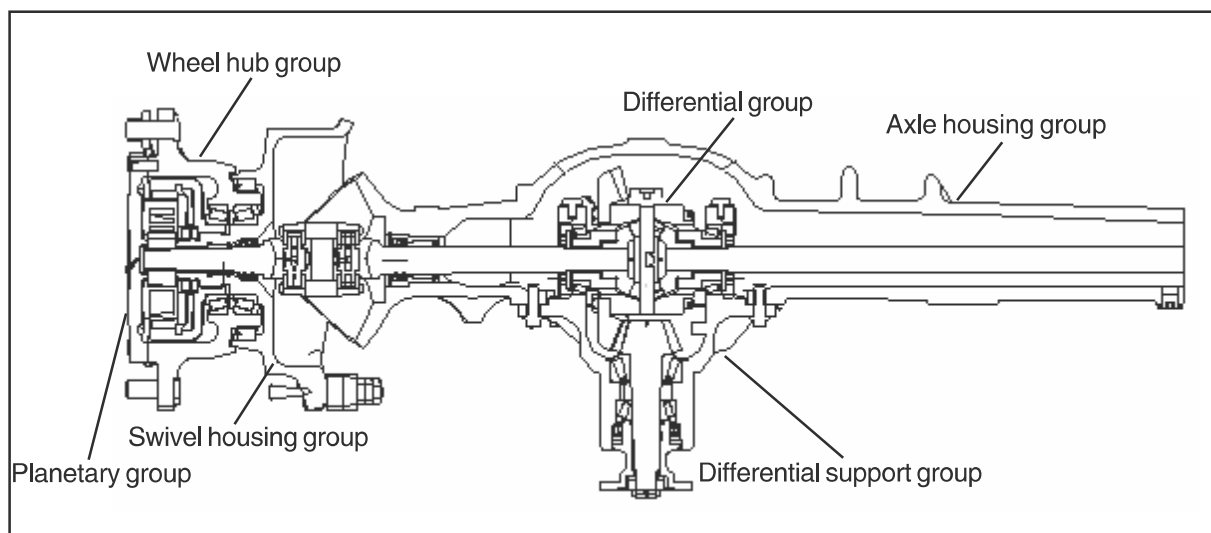


Fig 1

## 7B- 5 FRONT AXLE

### Removal and refitment

Special Tools:

MF 485 / 1 Pivot Pin Seal Installer

MF 444 Axle pivot pin remover

### Removal

1. Place a floor jack under the engine sump and take the weight of the front of the tractor. **DO NOT** lift the front wheels off the ground.
2. Remove the front weights, if fitted.
3. Remove the front weight frame.
4. Disconnect the steering ram hoses at the cylinder end. Cap the ends of the pipes and hoses to prevent the ingress of dirt.
5. Disconnect the front axle propeller shaft guard.
6. Disconnect the propeller shaft.
7. Remove the Battery tray from the tractor.
8. Remove the axle pivot pin. If difficulty is experienced in removal, use special tool MF 444 to extract the pin from the front support.



**WARNING: Prevent the axle from tilting or rotating about the wheels if the axle is wheeled from under the tractor on its wheels. It could cause injury if precautions are not taken.**

9. Jack up the front of the tractor so that the axle can be wheeled out from under the tractor.

or

Remove the wheels, and with the aid of a crane, sling the axle on ropes and lift out from under the tractor.

10. Recover the two seals and thrust washers located each side of the axle pivot.
11. Place the axle on two axle stands and remove the wheels.

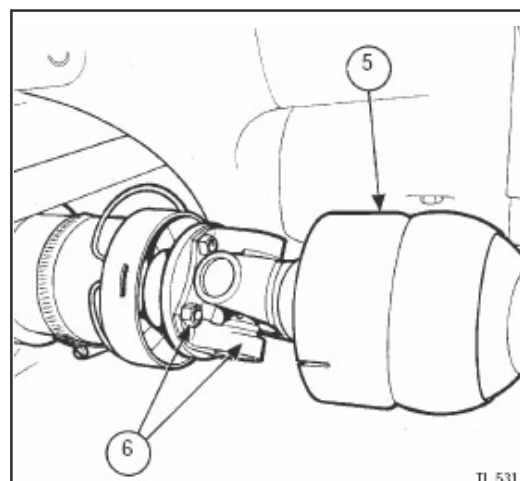


Fig 9

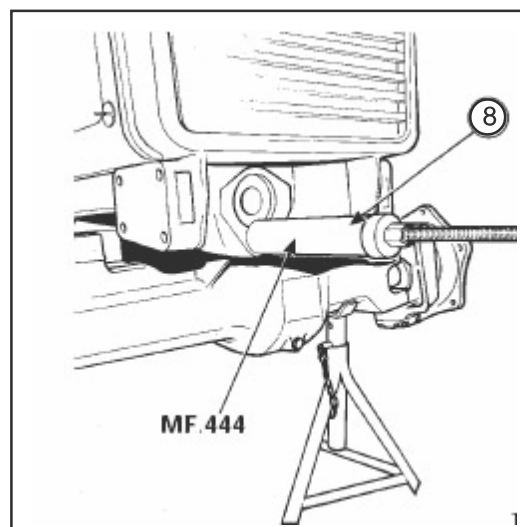


Fig 10

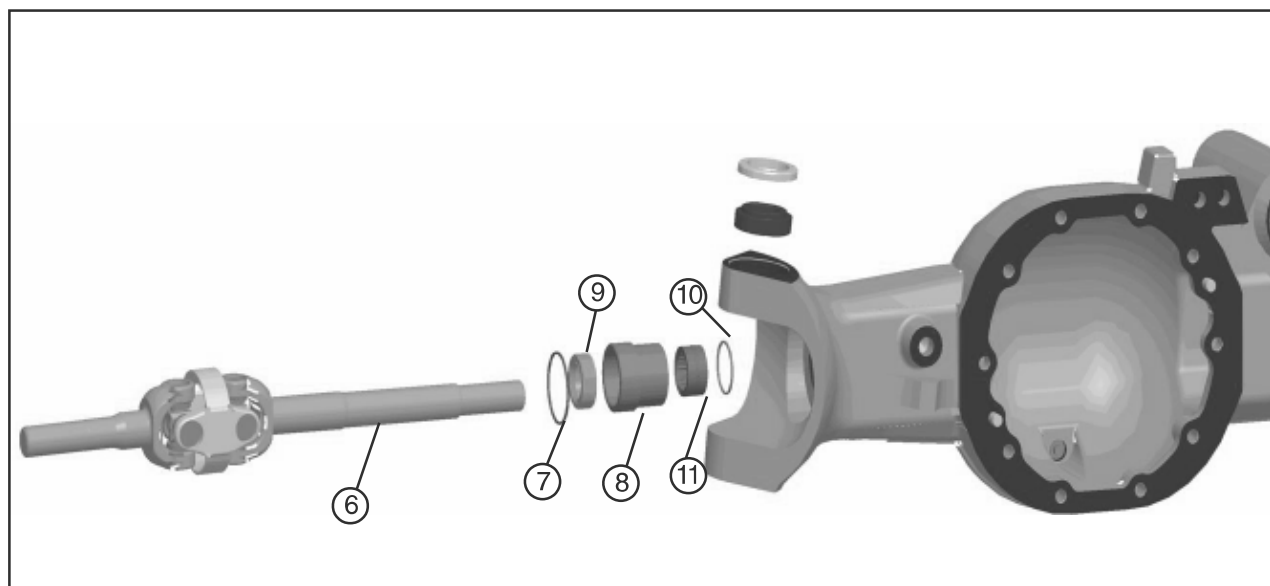


Fig 33

## 7B - 10 DRIVE SHAFT AND OIL SEALS

### Removal and refitment

#### Special tools :

- |           |   |
|-----------|---|
| SER / 317 | Press needle roller bearing into the sleeve assembly. |
| SER / 318 | Press oil seal into the sleeve assembly.              |
| SER / 360 | Drive shaft end float checking tool                   |

### Removal

1. Drain oil from the axle housing.
2. Remove the planetary carrier, see operation 7B - 6.
3. Remove the circlip and sun gear.
4. Remove the wheel hub see operation 7B - 8.
5. Remove the swivel housing, see operation 7B - 9.
6. Remove the drive shaft from axle casing.
7. Remove the circlip by using suitable circlip plier.
8. Remove the sleeve assembly by using suitable extractor
9. Lever the seal out of the sleeve assembly.
10. Remove the internal circlip.

11. Remove the needle roller bearing.

### Examination

*Carefully inspect the universal joints in the drive shaft, if there is any sign of wear renew the joints or fit new shafts. Inspect the condition of the drive*

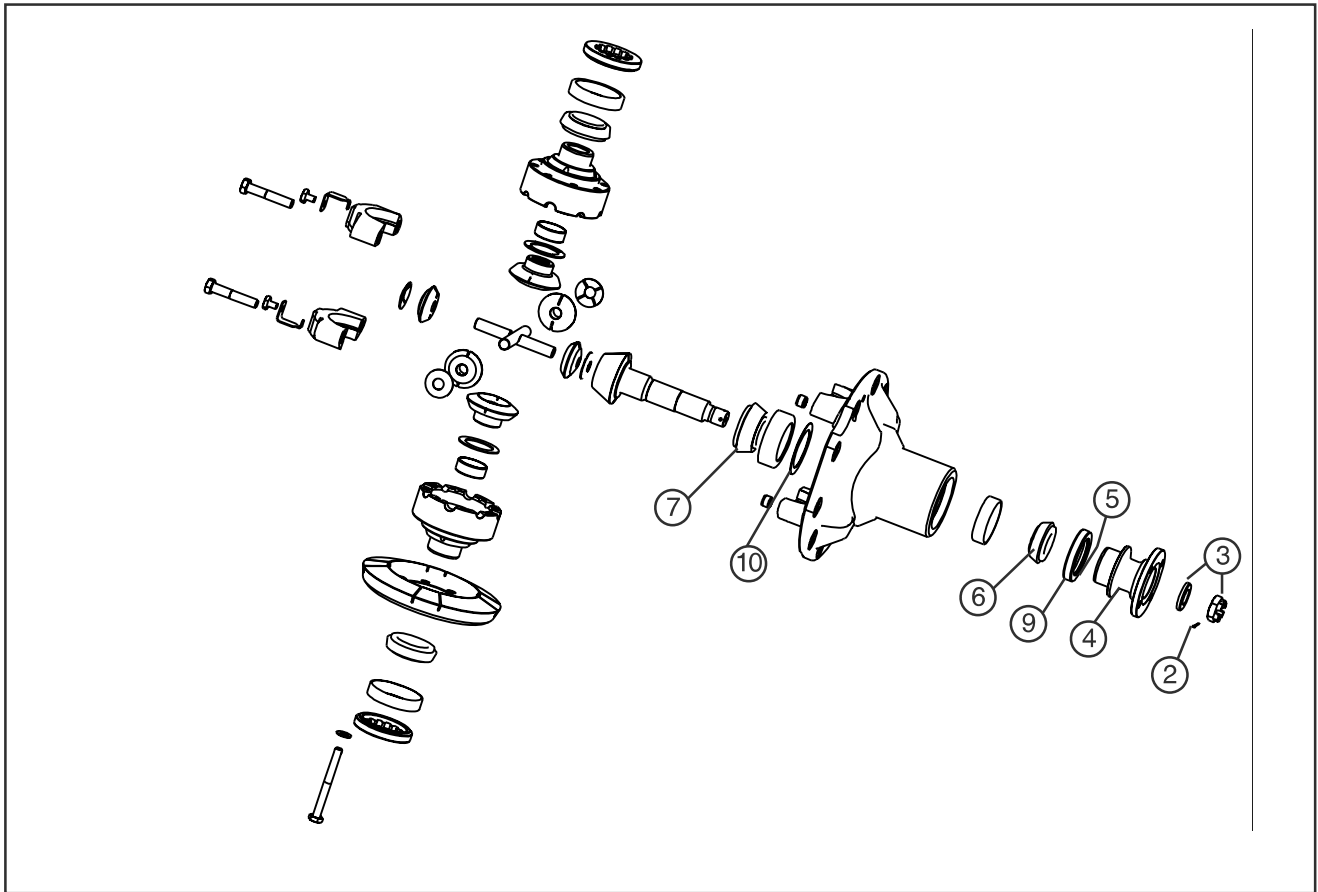


Fig 56

## 7B - 15 CROWNWHEEL AND PINION

### Overhaul

#### Special Tools:

SER / 304	Press cone into pinion.
SER / 305	Pusher to press bearing cup into inner differential carrier
SER / 306	Pusher to press bearing cup into outer differential carrier.
SER / 307	Pusher to press oil seal into the differential carrier.

### Dis-assembly

1. Remove and dismantle the crownwheel and differential assembly, see operation 7B - 12.
2. With a narrow cold chisel and hammer carefully unstake the spilt pin securing it to the castle nut.
3. Using castle Nut Wrench, remove the castle nut and washer .

4. Remove the end flange.
5. Remove the 'O' ring and discard.
6. With the aid of a soft faced hammer or press remove the pinion with bearings from the differential carrier.
7. Remove the outer bearing cone.
8. Remove the inner and outer bearing cups.
9. Remove the oil seal.
10. Remove the bearing pre-load shims and retain for re-assembly.

### Examination

**Thoroughly clean and inspect all components. Any parts showing signs of wear or damage must be renewed. Renew all 'O' rings, seals and circlips. Ensure that all parts are free from dents or damage.**

22. Assemble the rod seal.

**Note :** Mind the orientation of the lips. The seal lips shall be orientated to the oil pressure ( Inner side of the cylinder).



Fig 82

23. Use the screw driver to let the rod seal fit into the its groove. Avoid to make damage on rod seal.



Fig 83

24. Assemble the rod wiper manually.



Fig 84

PAGE LEFT BLANK INTENTIONALLY

## 8 A - 8 FLYWHEEL PILOT BEARING

### Removal and Refitment

#### Removal

1. Remove the clutch assembly, see 8B.2 or 8A.5
2. Remove the six bolts and washers.
3. Remove the flywheel.
4. Fill the pilot bearing bore with heavy grease, then insert a suitable length of 0.665 inch (16.9 mm) diameter rod into the pilot bearing bore. Tap the rod sharply to hydraulically eject the bearing.

#### Refitment

5. Fit a new pilot bearing.

6. Locate the flywheel, aligning the untapped hole in the flange to the unused hole in the flywheel.
7. Fit the flywheel bolts and washers then torque to 100 Nm (74 lbf.ft).
8. Refit the clutch.

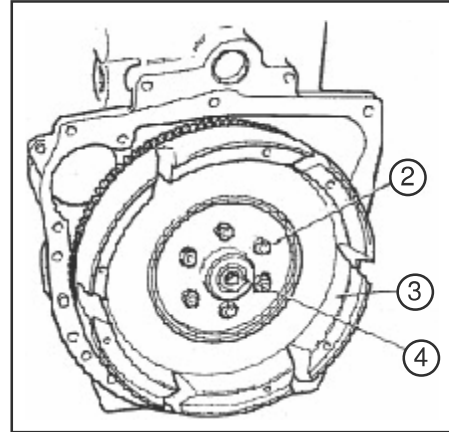


Fig 10

### 8.A.9 FAULT FINDING :

Symptom	Cause	Remedy
Improper Clutch Function	Oil or grease on friction plate.	Install new friction plate.
	Improper pedal adjustment.	Adjust clutch pedal free travel.
	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 recommended grease.
	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.
	Rust formation on the clutch / Flywheel interface	Separate transmission case and engine. Clean clutch and flywheel face and assemble.
Clutch slip	Oil or grease on friction plate.	Install new friction plate.
	Weak or soft pressure springs.	Install new pressure springs.
	Bindings or 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.	Adjust clutch pedal free play
	Clutch facing worn.	Install new friction plate.

## Part A

8 Speed Transmission – Dual Clutch  
Table of Contents

Operation No.	Description	Page No.
9A.1	Specification ... ..	9A - 3
9A.2	General Description - Center shift ... ..	9A - 4
9A.3	General Description - Side shift ... ..	9A - 5
9A.4	Gear Shift Levers - Center shift ... ..	9A - 7
9A.5	Gear Shift Levers - Side shift ... ..	9A - 8
9A.6	Selector Rails and Forks - Center shift ... ..	9A - 27
9A.7	Selector Rails and Forks - Side shift ... ..	9A - 28
9A.8	Epicyclic Unit - Center shift ... ..	9A - 29
9A.9	Epicyclic Unit - Center shift ... ..	9A - 30
9A.10	Clutch Release Mechanism ... ..	9A - 31
9A.11	Main Drive Housing and PTO Pinion Shaft ... ..	9A - 32
9A.12	PTO Drive Shaft Bearing Housing ... ..	9A - 34
9A.13	Main Shaft, Counter Shaft and Gears ... ..	9A - 35
9A.14	Side shift service tool details ... ..	9A - 38

**Refitment**

5. Place the service tool (SER3000007) on the side cover housing as shown

**NOTE :** Refer page no:39 for service tool details



6. Fix the seal on the service tool (SER3000007)

**NOTE:** The lip of the seal to be faced up

Refer page no:39 for service tool details



7. Place the seal on the side cover housing and press using a hand press



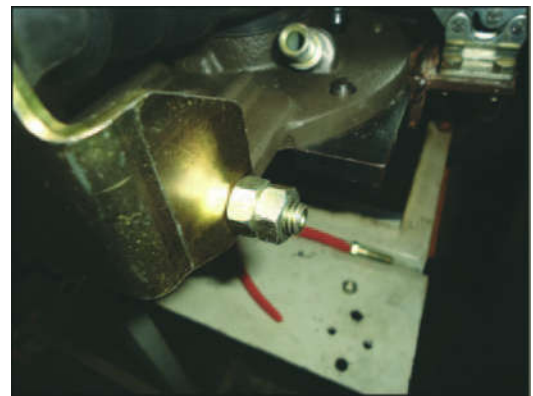
8. Place the service tool (SER3000007) on the work bench as shown

**NOTE :** Refer page no:39 for service tool details



**Refitment**

51. Fix the pivot plate with side cover housing using pin assembly
52. Secure with two bolts



53. Secure the rubber boot using a plastic strap
54. Tighten all the fasteners



55. Assemble the Side shift sub assembly to the tractor



4. Remove the locking wire and the two locking screws from the clutch release fork. (Item 6 in Fig. 19).
5. Slide out the left - hand clutch pedal pivot shaft with the release arm from the transmission housing.(Item 7 in Fig 19).
6. Remove the right - hand clutch pedal shaft plug.
7. Slide out the right - hand clutch pedal pivot shaft from the transmission housing. ( Item 5 in Fig 19).
8. Remove the clutch release fork. (Item 4 in Fig. 19).
9. Remove the bearing from the carrier. (Item 3 in Fig. 19) by using SER / 038 Hand press tool.

#### **Examination**

**Clean and carefully examine all the components, and replace any item that show signs of damage/wear.**

#### **Re-assembly and Refitment**

For reassembling and refitment, follow the reverse procedures given above, and

1. Install the clutch pedal shaft with a new 'O' ring. (Item 8 in Fig. 19).
2. Install clutch pivot shaft plug .
3. Use new wire lock for locking screws.
4. Lightly smear grease on both input shaft splines and the release bearing carrier bore.
5. Check the free sliding of the carrier assembly over the retainer main drive housing.

## **9A.11 MAIN DRIVE HOUSING AND PTO PINION SHAFT**

### **Removal and Refitment**

#### **Special Tools:**

- SER / 054 : Tractor splitting stand.
- SER / 038 : Hand Press Tool
- SER / 076 : Input shaft oil seal replacer.
- SER / 075 : Housing Main drive needle bearing remover and replacer.
- SER / 036 : PTO Pinion oil seal replacer.
- SER / 099 : Oil seal replacer.
- SER / 056 : Adaptor for multipurpose bearing remover / replacer.

## Part A

8 Speed Transmission – Dual Clutch  
Table of Contents

Operation No.	Description	Page No.
9A.1	Specification ... ..	9A - 3
9A.2	General Description - Center shift ... ..	9A - 4
9A.3	General Description - Side shift ... ..	9A - 5
9A.4	Gear Shift Levers - Center shift ... ..	9A - 7
9A.5	Gear Shift Levers - Side shift ... ..	9A - 8
9A.6	Selector Rails and Forks - Center shift ... ..	9A - 27
9A.7	Selector Rails and Forks - Side shift ... ..	9A - 28
9A.8	Epicyclic Unit - Center shift ... ..	9A - 29
9A.9	Epicyclic Unit - Center shift ... ..	9A - 30
9A.10	Clutch Release Mechanism ... ..	9A - 31
9A.11	Main Drive Housing and PTO Pinion Shaft ... ..	9A - 32
9A.12	PTO Drive Shaft Bearing Housing ... ..	9A - 34
9A.13	Main Shaft, Counter Shaft and Gears ... ..	9A - 35
9A.14	Side shift service tool details ... ..	9A - 38

**Refitment**

5. Place the service tool (SER3000007) on the side cover housing as shown

**NOTE :** Refer page no:39 for service tool details



6. Fix the seal on the service tool (SER3000007)

**NOTE:** The lip of the seal to be faced up

Refer page no:39 for service tool details



7. Place the seal on the side cover housing and press using a hand press



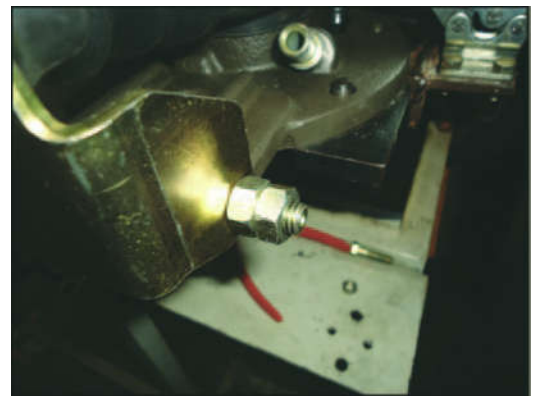
8. Place the service tool(SER3000007) on the work bench as shown

**NOTE :** Refer page no:39 for service tool details



**Refitment**

- 51. Fix the pivot plate with side cover housing using pin assembly
- 52. Secure with two bolts



- 53. Secure the rubber boot using a plastic strap
- 54. Tighten all the fasteners



- 55. Assemble the Side shift sub assembly to the tractor



4. Remove the locking wire and the two locking screws from the clutch release fork. (Item 6 in Fig. 19).
5. Slide out the left - hand clutch pedal pivot shaft with the release arm from the transmission housing.(Item 7 in Fig 19).
6. Remove the right - hand clutch pedal shaft plug.
7. Slide out the right - hand clutch pedal pivot shaft from the transmission housing. ( Item 5 in Fig 19).
8. Remove the clutch release fork. (Item 4 in Fig. 19).
9. Remove the bearing from the carrier. (Item 3 in Fig. 19) by using SER / 038 Hand press tool.

#### **Examination**

**Clean and carefully examine all the components, and replace any item that show signs of damage/wear.**

#### **Re-assembly and Refitment**

For reassembling and refitment, follow the reverse procedures given above, and

1. Install the clutch pedal shaft with a new 'O' ring. (Item 8 in Fig. 19).
2. Install clutch pivot shaft plug .
3. Use new wire lock for locking screws.
4. Lightly smear grease on both input shaft splines and the release bearing carrier bore.
5. Check the free sliding of the carrier assembly over the retainer main drive housing.

## **9A.11 MAIN DRIVE HOUSING AND PTO PINION SHAFT**

### **Removal and Refitment**

#### **Special Tools:**

- SER / 054 : Tractor splitting stand.
- SER / 038 : Hand Press Tool
- SER / 076 : Input shaft oil seal replacer.
- SER / 075 : Housing Main drive needle bearing remover and replacer.
- SER / 036 : PTO Pinion oil seal replacer.
- SER / 099 : Oil seal replacer.
- SER / 056 : Adaptor for multipurpose bearing remover / replacer.

**TABLE OF CONTENTS**

<b>Operation no.</b>	<b>Description</b>	<b>Page no.</b>
9B . 1	Specification	9B - 3
9B . 2	General description	9B - 3
9B . 3	Gear shift levers - Center shift	9B - 8
9B . 4	Gear shift levers - Side shift	9B - 9
9B . 5	Shuttle control lever	9B - 28
9B . 6	Forward/Reverse (Shuttle) control lever	9B - 29
9B . 7	Selector rails and forks - Center shift	9B - 30
9B . 8	Selector rails and forks - Side shift	9B - 31
9B . 9	Normal duty epicyclic unit - Removal - Center shift	9B - 32
9B . 10	Normal duty epicyclic unit - over haul - Center shift	9B - 33
9B . 11	Epicyclic unit - Side shift	9B - 34
9B . 12	Input shafts and housing - Removal	9B - 35
9B . 13	PTO drive shaft front bearing - removal	9B - 36
9B . 14	Layshaft , mainshaft , PTO shaft and gears - Overhaul	9B - 37
9B . 15	Side shift service tool details	9B - 44

**Refitment**

1. Place the collar on the table



2. Place the bush in the service tool (SER3000007) as shown

**NOTE** : Refer page no:45 for service tool details



3. Press the bush inside the collar using a hand press



4. Place the side cover housing on a suitable work bench as shown



**Refitment**

46. Assemble the rubber boot with gear shift lever assembly
47. Secure the assembly using bolt & nut



48. Assemble the gear shift assembly with side cover housing assembly by aligning the holes of gear shift lever and synchro block



49. Secure using a solid pin



50. Align the hole of solid pin with gear shift lever and secure using a spirol pin



## 9B.9 NORMAL-DUTY EPICYCLIC UNIT - CENTER SHIFT

### Removal and refitment

#### Removal

1. Split the tractor between the gearbox and the spacer or centre housing,
2. Remove the locking wire and discard.
3. Remove the locking screw.
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 dowels are correctly located in the gearbox casing.
  - c. Locate the cover plate with the cut out, to the bottom left hand corner.
  - d. Fit a lockwasher to the lower right hand retaining bolt.
  - e. Tighten the retaining bolts progressively and evenly to a torque of 32 lbs.ft. (44Nm)
  - f. Tighten the selector fork lock screw to a torque of 32 lbs.ft (44 Nm).
  - g. Wire lock all fixings affected by procedure 2 using new locking wire.

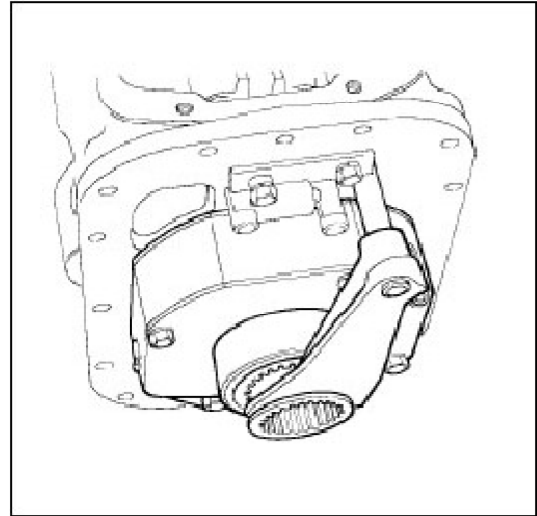


Fig 17

72. Place the PTO constant mesh gear in the bottom of the gearbox and refit the PTO shaft from the rear of the gearbox.
73. Refit the PTO drive shaft front bearing, see operation 9B.9 .

**Mainshaft**

74. Assemble the mainshaft complete with all hubs, gears, bushes, bearing and thrust washers. Refit circlip. Measure the gap 'B' between the front bearing and the circlip. The gap (end float) should be between 0.080 mm and 0.30 mm. If your measurement falls outside the set limits, replace the calibrated thrust washer 'C', which sits between the bearing and first gear, with one of a choice of varying thickness thrust washers to achieve the desired end float. Calibrated shims part numbers and sizes are as follows:

Shim thickness		Part number
mm	inch	
4.14 - 4.19	0.162 - 0.164	1671 888 M2
4.39 - 4.44	0.172 - 0.174	1671 889 M2
4.62 - 4.67	0.181 - 0.183	1671 890 M2
4.85 - 4.90	0.190 - 0.192	1671 891 M2

75. Slide the mainshaft through the rear of the gearbox, progressively fitting in the following order:
  76. Steel thrust washer.
  77. 3rd gear (35T) with steel bush and synchromesh cone.
  78. Synchromesh hub assembly and baulk ring.
  79. 4th gear (40T) with steel bush and synchromesh cone.
  80. Steel thrust washer.
  81. Assemble the 2nd (40T) and 1st (42T helical) gear pack with the synchromesh hub and steel bushes. Lower the assembly down into the box and slide the main shaft through the assembly.
  82. Fit the pre-selected calibrated thrust washer with flat side towards first gear.
  83. Refit the epicyclic reduction unit, see operation 9B.6.
  84. Drive the front roller bearing onto the mainshaft and into the centre web of the gearbox.
  85. Replace the circlip.

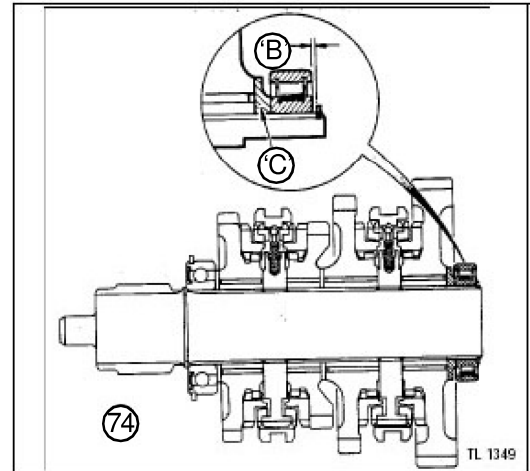


Fig 33

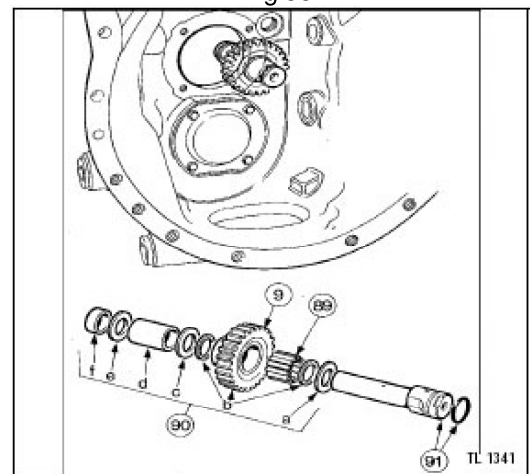


Fig 34

86. Locate the tagged thrust washer in the gearbox centre web with the convex side facing forwards.
87. Refit the needle roller bearing into the front of the mainshaft.
88. Locate the forward/reverse selector fork into the coupler of the layshaft synchromesh assembly.
89. Replace the rollers in the reverse idler pinion, a smear of petroleum jelly, NOT GREASE, will help retain them. There is a single row of 23 rollers with a spacer ring each side.
90. Refit the reverse idler to the gearbox, the order of assembly is as follows:
  - a. Thrust washer
  - b. Pinion
  - c. Thrust washer
  - d. Long spacer
  - e. Thrust washer
91. Renew the 'O' ring on the idler shaft and enter from the bell housing end. Align the cut away portion on the front of the idler shaft to allow fitment of the input housing.

**TEST 4 - Checking alternator maximum output (Fig. 7)**

The alternator should run for a few minutes to ensure that the tests are carried out at the normal operating temperature. Then stop the engine.

1. Switch on all lights to create a load, and discharge the battery for 1 minute.
2. Disconnect the battery ground cable.
3. Disconnect the wires on the back of the alternator.
4. Connect a test link (jump lead) between the small terminal (IND) on the alternator and the IND connection wire on the harness
5. Connect the ammeter between B positive terminal on alternator and the mating wire on harness

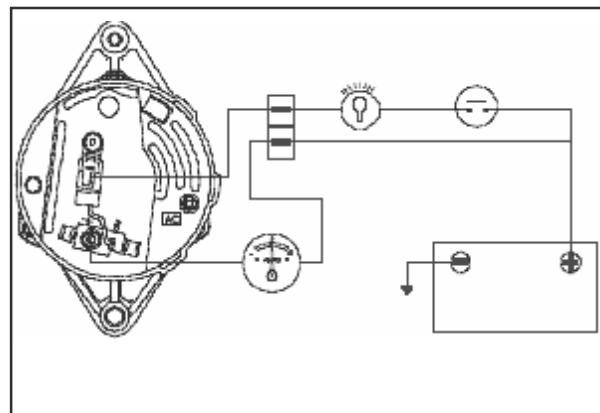


Fig 7

**NOTE:** The clips or test probes on the ammeter **MUST NOT** touch the alternator casing before or during the test. A short circuit will result which will damage the alternator.

6. Re-connect the battery ground cable.
7. Switch on, check that the warning light comes on.
8. Start the engine and slowly increase to maximum rated speed, the ammeter reading should equal the maximum rated output of the alternator of 30 to 35 Amps.

**NOTE:** As the state of charge of the battery increases so the output of the alternator will decrease. The rated output of the alternator should be checked quickly.

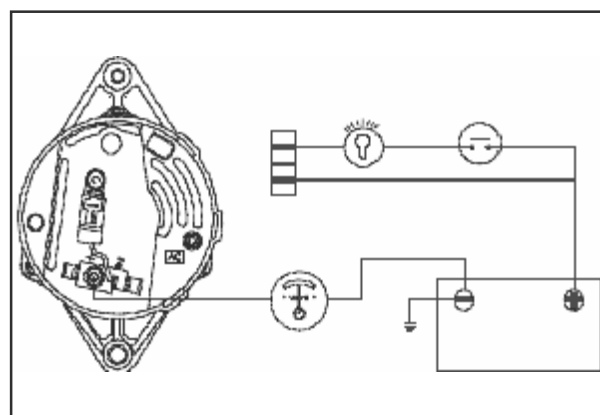


Fig 8

**Diagnosis:**

Result	Action
Ammeter reading low	Replace or repair alternator
Ammeter reading 40 - 45 Volts	Proceed to test 5

**TEST 5 - Checking voltage drop in charging circuit (Fig. 8)**

Use a voltmeter to check for high resistance (poor connections) in the charging circuit, see Fig. 8.

1. Connect a voltmeter between the battery insulated (+) terminal and the alternator main output terminal.
2. Switch on all lights to create a load. Start the engine and increase to maximum rated speed. The voltmeter reading should not exceed 0.5 volts.

3. Transfer the voltmeter connections to the battery ground (-) terminal and the alternator body.
4. Start and run the engine as in (2).The voltmeter reading should not exceed 0.25 volts.

S.NO	RESULT	ACTION
1	2. Reading above 0.5 volts	Check all wirings for loose connections
2	4. Reading above 0.35 volts	
3	Reading below 0.5 volts	Proceed to test 6

## 11B . 6 AUXILIARY PUMP AND PLATED DRIVE

### Removal and refitment

#### Removal

1. Remove the lift cover, see operation 11A . 5
2. Drain the transmission oil.
3. Split the tractor between the gearbox and spacer or centre housing, see operation 4A . 4
4. Disconnect the flexible pipe supplying the IPTO clutch.
5. Disconnect the pipe to the side cover.
6. Disconnect the pipe at the side cover and remove.
7. Remove the hydraulic lift and auxiliary pump filter.
8. Remove the two nuts and the dowel pins each side of the transmission case holding the lift pump.
9. Withdraw the hydraulic lift pump complete with plated drive and auxiliary pump from the front of the centre housing.

#### Auxiliary Pump

10. Place the lift pump, plated drive and auxiliary pump assembly on a bench, remove the external circlip holding the pump gear in place.
11. Remove the socket head setscrew.
12. Remove the two bolts and spacers.
13. Remove the auxiliary pump.
14. Remove the elbow between the auxiliary pump and the filter manifold.
15. Remove the auxiliary pump drive gear.

#### Plated Drive

16. Remove the two external retaining clip holding the plated drive to the hydraulic lift pump.
17. Withdraw the drive off the pump drive shaft.

#### Re-assembly

18. Reverse procedures 1 to 17 except:
  - (a) Do not forget the elbow between the auxiliary pump and the filter manifold.
  - (b) Tighten the two bolts and spacers to a torque of 21 lbf.ft (30 Nm), plated drive to pump.
  - (c) Tighten the socket head cap screw to a torque of 20 lbf.ft (27 Nm), plated drive to pump.
  - (d) Check the total backlash between the three gears, it must be between 0.0019 inch (0.05 mm) and 0.0161 inch (0.41 mm).
  - (e) Refit the two external retaining clip holding the plated drive to the bottom left and top right nuts on the lift pump body.
  - (f) Do not forget that the right hand dowel pin (8) is a tight fit while the left hand is an easy fit.

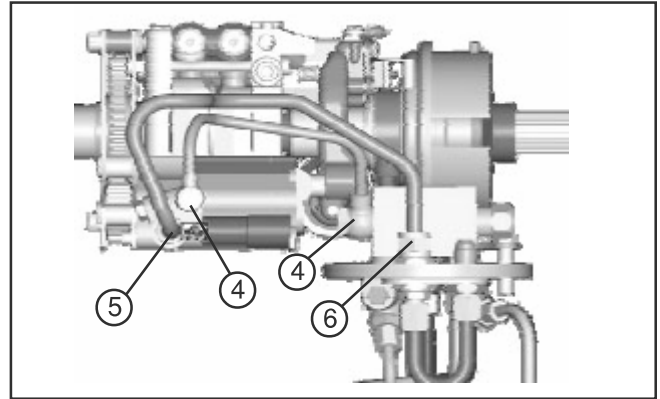


Fig 5

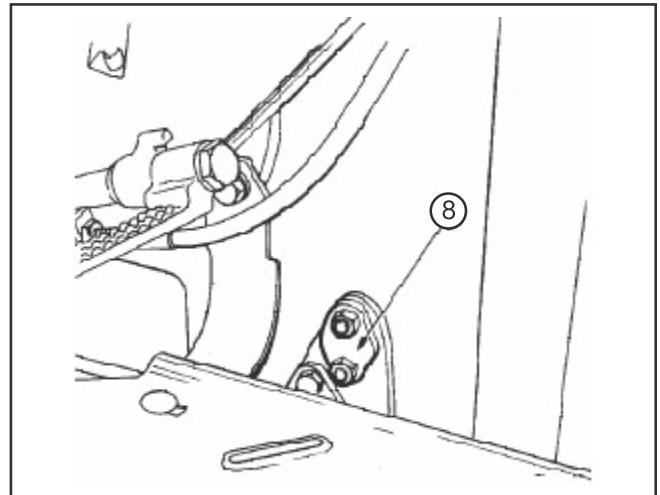


Fig 6

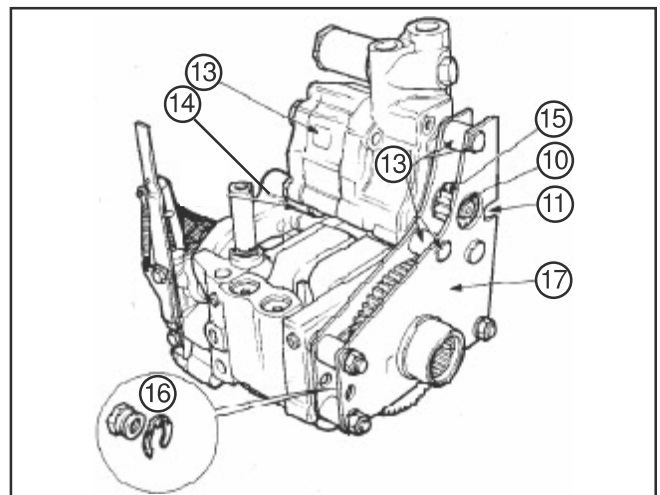


Fig 7

7. Simultaneously press and turn the Dished washer until released, then remove the two washers and the spring. (Item 1 & 2 in Fig. 4). Repeat this procedure for the 4 sets of fixings
8. Force apart the brake shoes (Item 5 in Fig. 4) at the adjuster end to allow the adjuster to drop out of position.
9. Remove the spring. (Item 22 in Fig. 4).
10. Remove the two springs by levering with a screw driver between the springs and the anchor plate. (Item 4 in Fig. 4).
11. Remove the anchor plate. (Item 3 in Fig. 4).
12. Lift off the two brake shoes. (Item 5 in Fig. 4).
13. Remove the two spacer washers. (Item 7 in Fig. 4).
14. Clean of all parts. Ensure that the adjuster threads are free to rotate.
6. Refit the brake drum. (Item 25 in Fig. 4).
7. Slacken the anchor pin nuts. (Item 11 in Fig. 4).
8. Using the adjuster, expand the brake shoes, then tap the anchor pin nuts to ensure that the shoes are seating correctly.
9. Repeat this procedure until the adjuster can not be tightened any further.
10. Coat the threads of the anchor pins with grease and tighten to a torque of 148 lbf.ft (200 Nm) .
11. Slacken off the adjuster and remove the brake drum.
12. Screw in the steady posts until they touch the brake shoe webs. Then secure the post with nuts.
13. Re fit the brake drum.
14. Reconnect the brake rods.
15. Refit the rear wheel and tighten the nuts progressively and evenly to a torque of 200 lbf.ft. (271 Nm).

#### Refitment

1. Lightly smear both ends of the new brake shoes and the flat end of the cam shaft with white brake grease.
2. For refitment follow the reverse procedures of removal and except
  - (a) To facilitate refitment of the spring, use a length of wire, looped around the hook of the spring and pull the spring over the anchor pin.
  - (b) Ensure that the adjuster is fitted with the star wheel adjacent to the adjusting hole in the back plate.
3. Slacken the steady post nuts. (Item 19 in Fig. 4).
4. Screw the steady post well into the back plate. (Item 20 in Fig. 4).
5. Turn the adjuster to the fully off position. (Item 23 in Fig. 4).

16. Adjust and balance the brakes.

**NOTE :** *Sponginess and lack of braking power even after adjusting brakes may indicate that brake lining are excessively or unevenly worn or perhaps contaminated by oil or grease. Brakes squeal may indicate that the linings are unevenly worn or the rivet heads are protruding above the lining face. The brake shoes and lining should be examined when these symptoms become evident and should be changed. If the lining is worn to less than 1/3 of its original thickness at any one point (less than 3/32 inch – 2.38 mm). Or if the rivet heads are less than 1/10 inch – 1.5 mm below the lining face. Different lining materials must not be used as it will be found difficult to achieve satisfactory braking power or balance.*

## 16A.6 SWINGING DRAW BAR :

Swinging Draw Bar is used for pulling trailed equipments. The Swinging Draw bar consists of a clevis bar (1 in Fig. 5) with a bolted on clevis adapter (2 in Fig. 5) attached to the mounting frame (3 in Fig. 5) by an anchor pin (2 in Fig. 6) and located radially by two headed pins (4 in Fig. 5) which can be fitted in various holes to allow offsetting of bar. A mounting plate is (4 in Fig. 6) is bolted to the base of the center housing by four studs and nuts and the mounting frame gets fixed onto the mounting plate by two securing pins (5 in Fig. 5 and 3 in Fig. 6) which are retained by lynch pins (6 in Fig. 5 and 1 in Fig. 6).

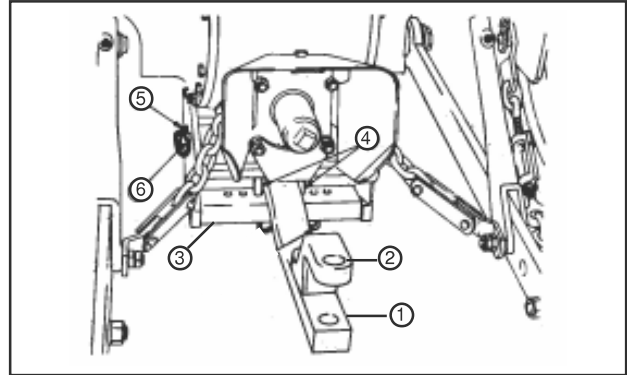


Fig. 5

### ADJUSTMENTS:

- 1. LENGTH :** The clevis bar has two holes at the front end for getting two different length adjustments as shown in Fig 7.

Remove the lynch pin (1 in Fig. 6) and withdraw the supporting pin (3 in Fig. 6). Push the draw bar anchor pin (2 in Fig. 6) from the underside of the draw bar frame. Adjust the draw bar for the required length and refit the anchor pin on the required hole on the clevis bar. Raise the draw bar frame and secure it with supporting pin and lock it with lynch pin.

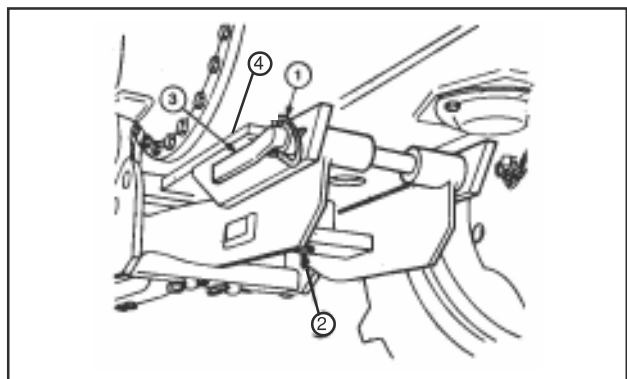


Fig. 6

Refer fig for obtaining two different lengths. Refer below for fig reference number.

Fig 8 - MF2605

Fig 9 - MF2615

- 2. HEIGHT :** The draw bar can be adjusted for different heights in relation to the PTO shaft centerline.

Fig 7 for gives the center line distance of the clevis hole from the PTO shaft end and also the various height adjustments that are possible.

- 3. OFFSET :** The swinging draw bar can be adjusted in a radial and horizontal plane as shown in

#### 1st and 2nd Positions

The adjustment procedure for obtaining the 1st and 2nd Offset position to the left or right from the center position is as follows. (Refer Fig 5)

Remove the lynch pin (6) and the securing pin(5) and lower the rear end of the frame to the ground. Remove the two hair pins and two

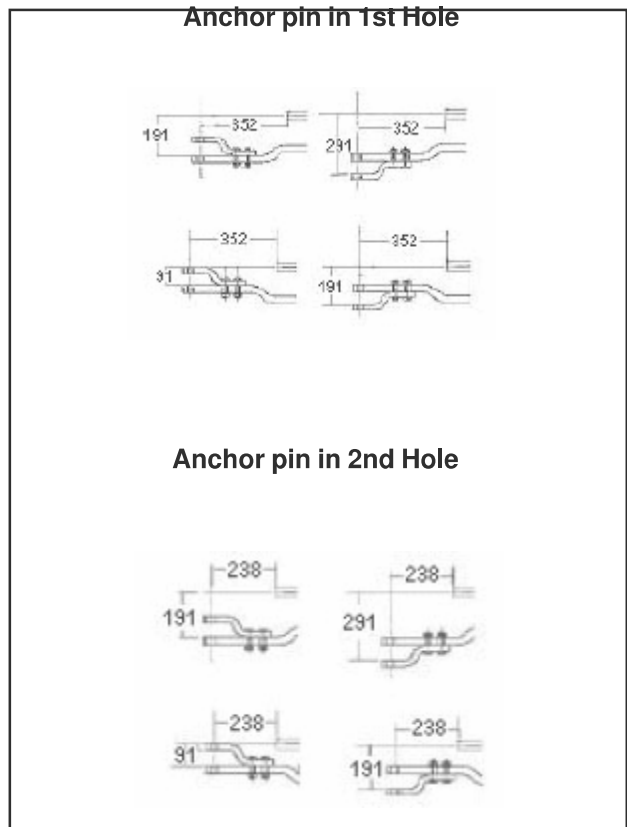


Fig. 7

## Manufacturing Data and Dimensions

The following data of clearances and tolerances are given as a guide for personnel engaged in major overhauls and the figures are those used in the factory for production purposes.

### Cylinder Block

Height of Cylinder Block from Top and Bottom Face	...	13.7405/13.7435 inch (349.01/349.08 mm)
Parent Bore Dia. for Cylinder Liner	...	3.6875/3.6885 inch (93.66/93.69 mm)
Depth of Recess for Liner Flange (Cast Iron Liners)	...	0.152/0.148 inch (3.76/3.86 mm)
Dia. Recess of Liner Flange (Cast Iron Liners)	...	3.825/3.820 inch (97.16/97.03 mm)
Main Bearing Parent Bore Dia	...	2.9165/2.9175 inch (74.08/74.10 mm)
Camshaft Bore Dia. - No. 1	...	1.874/1.877 inch (47.60/47.68 mm)
Camshaft Bore Dia. - No. 2	...	1.864/1.867 inch (47.35/47.42 mm)
Camshaft Bore Dia. - No. 3	...	1.844/1.847 inch (46.84/46.91 mm)

### Cylinder Liners - Cast Iron

Type – Production Liner	...	Dry- semi finished interference Fit
– Service Liner	...	Dry-Pre-finished-Transition Fit
Outside Dia. of Production Liner	...	3.6895/3.6905 inch (93.71/93.74 mm)
Outside Dia. of Service Liner	...	3.6875/3.6885 inch (93.66/93.69 mm)
Interference Fit of Production Liner in Block	...	0.001/0.003 inch (0.025/0.076 mm)
Transition Fit of Service Liner in Block	...	0.001/ 0.001 inch (0.025/0.025 mm) or Interference Fit of 0.001 inch
Inside Dia. of Finished Liner in Block	...	3.6015/3.6025 inch (91.48/91.50 mm)
Outside Dia. of Liner Flange	...	3.803/3.808 inch (96.60/96.72 mm)
Flange Thickness	...	0.148/0.150 inch (3.76/3.81 mm)
Depth of Liner Flange relative to Top Face of Cylinder Block	...	+0.002 to - 0.004 inch (+0.05/-0.10 mm.)

**NOTE:** Reboring to oversize is not recommended

### Piston :

Type	...	Alfin Piston with Re-entrant bowl. Offset of re-entrant bowl on piston crown should be towards fuel pump side while assembly. An arrow (or) 'F' mark is stamped on top surface of piston for identification
Piston Height in relation to Cylinder Block Top Face	...	0.005 - 0.002 inch (0.150 / 0.060 mm) Above block surface
Bore Dia. for Gudgeon Pin	...	1.2503 / 1.2501 inch (31.758 / 31.753 mm)
Top Ring Groove Width	...	0.118 inch (3.0 mm) – Nominal width
2nd Ring Groove Width	...	0.080 / 0.815 inch (2.05 / 2.03 mm)
3rd Ring Groove Width	...	0.159 / 0.158 inch (4.05 / 4.03 mm)

### Ring Gaps

The ring gaps quoted below are for a bore diameter of 3.6015 inch (91.48 mm). When checking ring gaps in a worn bore, 0.003 inch (0.076 mm) should be added to these ring gaps for every 0.001 inch (0.025 mm) increase in bore diameter.

**EVERY 250 HOURS:**

Drain and renew lubricating oil. Refer to list of Approved lubricating Oils in Sec. Q page 64.

Renew lubricating oil filter element or canister

Check drive belt tension.

Clean oil bath air cleaner and renew oil.

Clean lift pump pre-filter (where fitted).

Check engine for leakage of oil and coolant

Lubricate alternator rear bush (where fitted).

**EVERY 500 HOURS.**

Check hoses and clips.

Check atomisers.

Examine valve springs and check tappet clearances.

Inspect valve rocker shaft assembly for lubrication.

Clean and treat battery terminals.

**EVERY 1,000 HOURS:**

Drain fuel tank, remove and clean.

Flush radiator with clean coolant.

Inspect commutator and brushes of dynamo (if applicable).

**NOTE:** *The time for cleaning the air cleaner depends on operating conditions; therefore under extremely dusty conditions, the time limit recommended above for cleaning should be decreased.*

The correct maintenance of the air cleaner will greatly assist in reducing bore wear, thereby extending the life of the engine.

**FUEL FILTERS MAINTENANCE**

Do not clean filter inserts.

Drain filter bowls after every 125 hrs. of operation by loosening sludge screws (wherever provided), until clean fuel flows out.

**0.5 LITRE DUAL FILTERS (Spin on type)**

Replace first stage filter (primary) after every 500 hrs.

Replace second stage filter (secondary) after every 750 hrs.

**FUEL INJECTION PUMP MAINTENANCE**

(a) Check the oil level every 125 hrs. Drain off excess oil.

Top up fresh engine oil if the level is low.

Replace oil every 2500 hrs.

(b) Clean air breather every 125 hrs. (if provided)

(c) Clean nylon sleeve every 125 hrs. Clean hollow screw with sleeve every 50 hrs. (wherever provided).

Operators of S 325.3 engines are reminded that the above Preventive Maintenance are general in application: therefore the operator should compare the routine maintenance for his engine with the schedules specified by the manufacturer of the application to which the engine is fitted and where necessary adopt the shorter periods.

while we have given specific periods for preventive maintenance, you should have due regard for the local regulations concerning your machine and ensure that the engine is operating within those regulations.

**Post-Delivery Checkover**

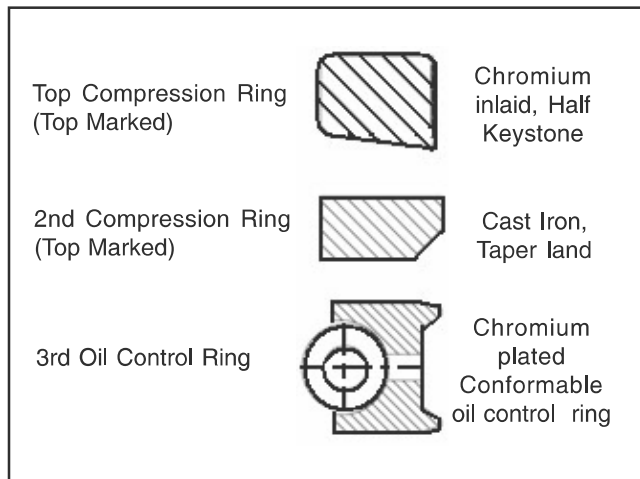
After a customer has taken delivery of their diesel engine, it is advisable, in their own interest that a general checkover of the engine be carried out after the **first 25 hours** in service.

It is also recommended that the following procedure be adopted where an engine has been out of service for a considerable period before it is again put into service.

The checkover should comprise the following points:-

1. Drain lubricating oil sump and re-fill up to the full mark on the dipstick with new clean oil (Do not overfill).
2. Renew the lubricating oil filter (Spin on type).
3. Check external nuts for tightness.
4. Check and adjust tappet clearances 0.012 in (0.30 mm) cold.
5. Check fuel pipes from tank to fuel injection pump for leaks.
6. Check for lubricating oil leaks and rectify if necessary.
7. Check hose clamps for tightness.

PROBLEM	POSSIBLE CAUSES	REMEDY
<b>ENGINE KNOCKS</b>	Faulty fuel feed/supply pump	Overhaul fuel feed/supply pump
	Faulty injectors	Overhaul injectors
	Incorrect fuel pump timing	Check and reset
	Incorrect valve timing	Check and reset
	Incorrect type or grade of fuel	Drain and refill with correct grade of fuel
	Overheating	See Problem – Overheating
	Incorrect tappet adjustment	Check and reset the adjustment
	Sticking valves	Replace valve with new standard or oversize, and / or machine the valve guide bores
	Worn cylinder bores	Re-sleeve block and fit ne pistons
	Broken, worn or sticking piston ring/s	Fit new rings, check bore and pistons for damage
	Overfilled cleaner or use of Incorrect grade of oil (Wet type Air cleaner)	Check the level or drain out and refill with correct grade oil
	Worn or damaged big end bearings	Renew the bearings
	Piston seized damage	Replace piston assembly and check the bore for
	Broken valve spring	Replace new springs



**Fig F.2 Ring layout**

Insert the pistons and connecting rods into the cylinder bores from the top, ensuring the piston and rod stamped No. 1 are fitted into No. 1 bore and No. 2 into No. 2 bore and so on commencing from the front of the engine.

To minimise the possibility of breaking piston rings it is advisable to use a piston guide. Take care not to damage the rings. Should the piston accidentally drop partly into the cylinder bore and is held suspended by a piston ring, it must be taken out again and the ring examined to see if it is cracked or broken.

Turn the crankshaft until the appropriate crankpin is at bottom center, pull the connecting rod to the crankpin and insert the half bearing.

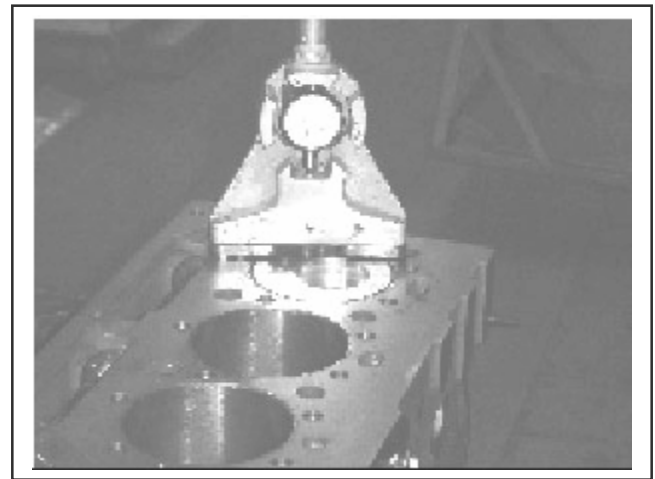
Fit the cap and cap half bearing, ensuring that the markings on connecting rod and cap coincide.

The nuts used on the big end bolts should not be used a second time but should be replaced by new whenever they are removed.

Tighten the connecting rod nuts using a torque wrench set to the tension given on Section B / Page 6.

Rotate crankshaft by hand and note that all parts move freely.

Check the piston height in relation to the top face of the cylinder as described below.



**Fig F.3 Checking Piston topping limit**

### Fitting New Pistons

An important point to note is that when the crankpin is at top dead center the crown of the piston must be 0.005 / 0.002 inch (0.150 / 0.060 mm) above block surface.

Pretopped pistons are being used with letter "L" or "H" marked on piston crown for identification

"L" – Low grade / "H" – High grade.

**(NOTE : This grade does not refer to material grade.)**

To determine the piston level, the piston assembly and connecting rod should be fitted to the cylinder block and crankshaft as previously described.

When assembled, turn the crankshaft to bring the piston to T.D.C. and check the distance between the piston crown and the top face of the cylinder block as shown in Fig. F.3.

Carry out this operation with each new piston in turn. If necessary, it has to be replaced by another new piston. The piston should not be machined for any reason in an attempt to correct this height.

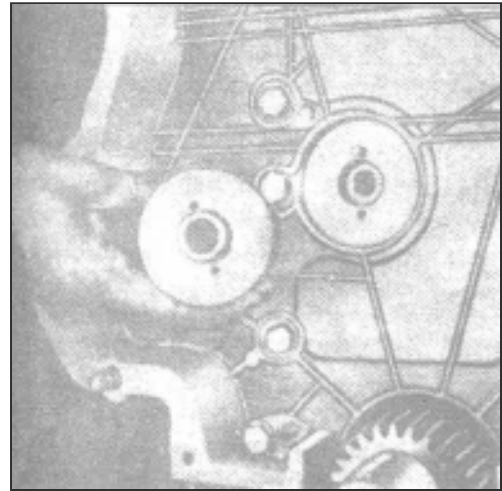
The distance between the cylinder block face and piston crown should now be checked to ensure the limit has been maintained when the piston is at Top Dead Center (TDC).

### To Remove the Timing Case

1. Remove the timing case cover as previously detailed.
2. Release and remove the rocker shaft assembly.
3. Remove the sump as explained under "Lubricating System" (Section L).
4. Remove timing case bottom cover.
5. Unscrew the retaining setscrew and remove the locking washer, idler gear and spigot.
6. Lift the tappets and remove the camshaft, complete with its gear, taking care not to damage the cams or bearing journals.
7. Release the three setscrews and remove the driving gear from the fuel pump.
8. Remove all cables and pipes from the fuel injection pump. When removing the high pressure pipes from the pump, release the pipes at the atomiser end and remove the pipes.
9. Unscrew and release the three nuts, spring washers and flat washers securing the fuel pump flange to the timing case and remove the fuel injection pump. Ensure that all inlet and outlet connections of the fuel injection system are effectively sealed against the ingress of dust and dirt by the use of suitable caps and plugs.
10. Remove the setscrews and spring washers securing the timing case to the block and with a light tap remove the timing case from the cylinder block.

### To Replace the Timing Case

1. For the purpose of correct location of the timing case, it is advisable to fit and fully locate the idler gear hub to the cylinder block.
2. Fit a new gasket to the cylinder block front face and replace the timing case.



**Fig. J. 3 Idler Gear Hub Location**

3. Replace timing case bottom cover ensuring it is correctly aligned with the front face of the timing case.
4. Secure the fuel injection pump to the back of the timing case matching the scribed marks.
5. Turn the engine crankshaft until No. 1 piston is at top dead center (key on the front of the crankshaft vertically upwards)
6. Fit the fuel pump gear to the fuel pump, locating the dowel between the gear and pump.
7. Lift the tappets and replace the camshaft and its gear, turning the camshaft as it is being entered into the camshaft tunnel.
8. Replace the idler gear on its spigot, with the long tapered flange of the gear towards the cylinder block and the timing marks on the crankshaft gear, fuel pump gear, camshaft gear and idler in line.
9. Replace the sump as described in the "Lubricating System".
10. Replace the timing case cover.
11. Refit all fuel pipes and controls.

## Section N

### Fuel System and Air Cleaners

The principal components of the equipment for delivering the fuel oil to the engine are as follows:

Filters

Fuel Lift Pump (when fitted).

Fuel Injection Pump

Atomisers

So accurate is the manufacture of the fuel injection equipment that the importance of cleanliness when handling fuel cannot be overstressed.

Adequate filters are provided in the system, but much can be done by the operator to ensure that the equipment is maintained in first class condition.

All fuel used must conform to :-

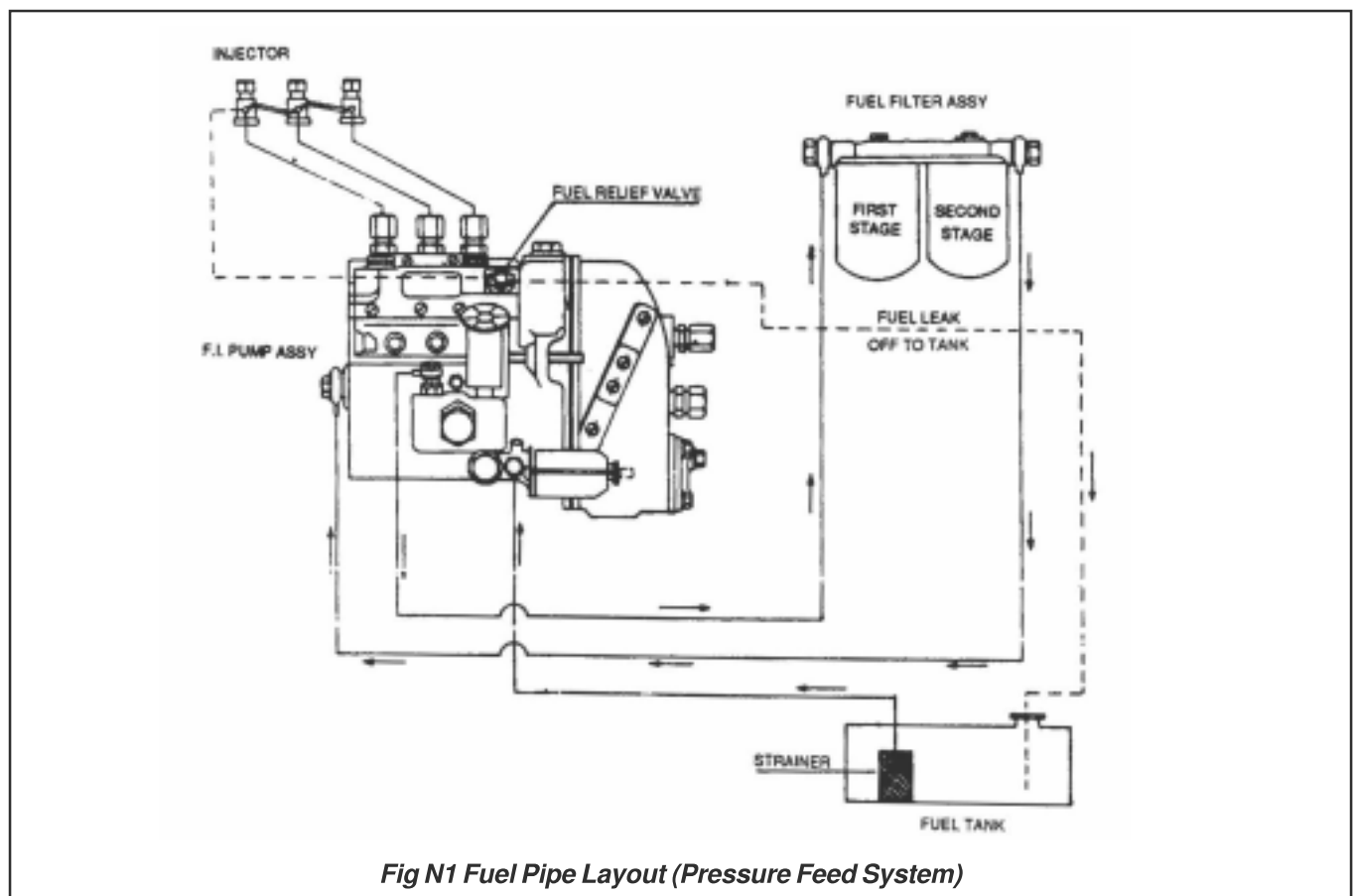
BRITISH STANDARD No. BS. 2869: 1970 CLASS A or I.S: 1460/2000 Grade special or Grade A and must be clean, free from coolant, suspended dirt

and other foreign matter. Filtering of fuel before it enters the tank will help, and regular filter changing will ensure that only perfectly clean fuel reaches the fuel injection pump.

Given these conditions, ninety per cent, at least of potential engine troubles would be eliminated. Attention is on that account earnestly directed towards the section of this manual which refers to the care and upkeep of filtering apparatus.

In a pressure fed system, the lift pump lifts the fuel from the tank via the pre-filter (fitted) and then passes it through the dual filter to the fuel injection pump, which delivers it in measured quantities and at appropriate intervals, to the atomisers (Ref. Fig. N1)

Where no lift pump is fitted, i.e. in a gravity fed fuel system, fuel flows from the tank, through a pre-filter, to the dual filter. From there, filtered fuel enters the injection pump which delivers it to the atomisers.



**Fig N1 Fuel Pipe Layout (Pressure Feed System)**







CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

ILLUSTRATION	DESCRIPTION	TOOL NUMBER & APPLICATION
	<p><b>Used for checking pump timing :</b>                      (Applicable for In-line pump)                      Fuel pump spill pipe supplied with gravity tank, connecting banjo and pipe                      (Used for checking spill timing)</p>	 <p style="writing-mode: vertical-rl; transform: rotate(180deg);">SER 289</p>
	<p>Compressor tester</p>	 <p>SER 285</p>
	<p>Angle gauge</p>	 <p>SER 292</p>

## 14 A . 15 WORK LIGHT BULB Removal and refitment

### Removal

1. Remove the retaining screws.



Fig 11

2. Ease the light unit out of the body.



Fig 12

3. Remove the spring clip from the back of the bulb.



Fig 13

4. Remove the bulb .



Fig 14

### Refitment

5. Reverse the procedure 1 to 4 except .
  - a. Replace the failed bulb with a new one.

## 14 A . 27 Instrument cluster

### Removal and Refitment:

#### Removal

1. Pull the hood latch cable and lift the hood.
2. Disconnect the battery terminals.
3. Remove the bottom surround mounting screws.
4. Remove the top surround mounting screws.
5. Disconnect the wiring harness from the cluster.
6. Place the cluster with surround in scratch free area and remove the six mounting screws.

#### Refitment:

7. Reverse the procedure 1 to 6.except
  - a.Ensure that the wiring harness connectors and connector cover are correctly fitted in the back of the instrument cluster.



Fig 30



Fig 31

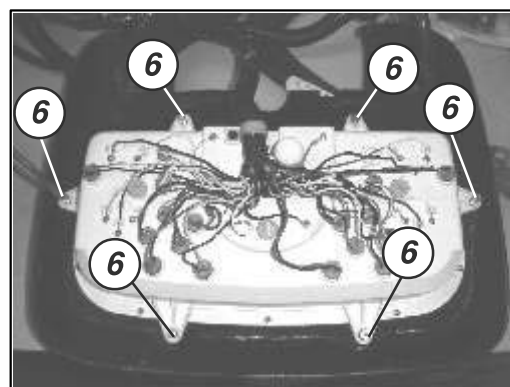


Fig 32

---

**Key to wiring diagram MF 2605**

1	Battery	29	Amper flashing lamp- right - hand rear
2	Starter motor	30	Red lamp- left - hand
3	Primary fuse	31	Red lamp- right - hand
4	Alternator	32	Trailer socket
5	Instrument cluster	33	Head lamp- right - hand
6	Air restriction switch	34	Head lamp- left - hand
7	Fuel sensor	35	4 Wheel drive switch
8	Oil pressure switch	36	IPTO switch
9	Temperature sensor	37	IPTO solenoid
10	Starter relay	38	Diode
11	PTO switch		
12	neutral start switch		
13	Ignition switch		
14	Heater		
15	Light switch		
16	Work lamp		
17	Horn		
18	Horn switch		
19	Turn indicator switch		
20	Flasher		
21	Head lamp main beam relay		
22	Head lamp dip beam relay		
23	Hazard relay		
24	Turn lights(red) relay		
25	CA diode module		
26	Amper flashing lamp-left - hand front		
27	Amper flashing lamp- left -hand rear		
28	Amper flashing lamp- right - hand front		

**Recommended grade of oil**

<b>BP</b>	....	Terrac Autra C3 10W Vanellus C3 10W Aytran GMMP or DX III	<b>TEXACO</b>	....	Torque fluid C3 Ursa super LA SAE 10 W Texamatic 9226 (Dextron III)
<b>CALTEX</b>	....	RPM Delo 200 Oil 10W Texamatic Fluid - (Dextron III )	<b>TOTAL</b>	....	HTF Type C3 Dextron III Rubia S 10 W
<b>CASTROL</b>	....	Castrol II C 310 Agricastrol ATF TQ dextron III Castrol TQ Type A - Suffix A			
<b>ESSO</b>	....	Esso torque Fluid 46 Essoulbe XD3 + 10W Esso AIF LASA			
<b>MOBIL</b>	....	Mobil ATF 200 Mobil ATF 220 Mobil delvac 1310			
<b>SHELL</b>	....	Dextron III Donax TF Rimula X 10 W			

## HYDRAULIC GEAR PUMPS

### Re-assembly Procedure

1. Take care to see that bearing bushes and the gear shafts are assembled correctly (Observe the A,B,C, & D marks made earlier)

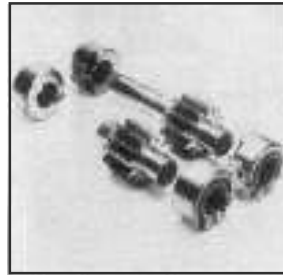


Fig 16



Fig 17

2. Assemble bearing bushes and gear shafts in the housing. See also the exploded view of the pump.

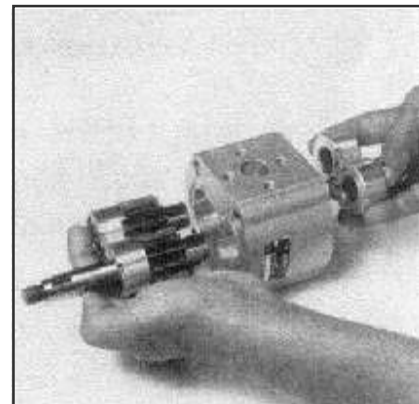


Fig 18

3. Place the assembly on the table with drive gear shaft projecting up. Fix the seals on the mounting flange side. Assemble the mounting flange.

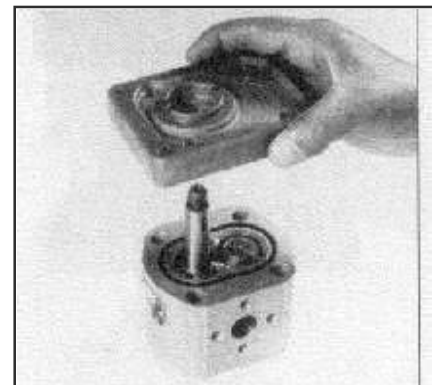


Fig 19

11. Take ring, bearing races and needle bearing from sleeve and spool. The outer (thin) bearing race can sometimes "stick" in the housing, therefore check that it has come out.

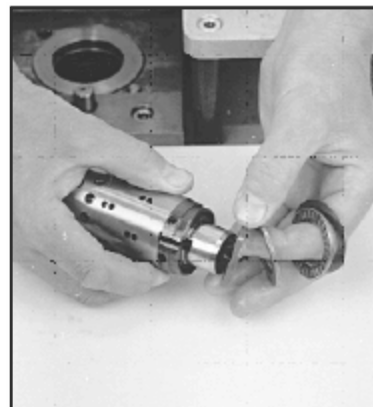


Fig 38

12. Press out the cross pin. Use the special screw from the end cover. Note next point / paragraph

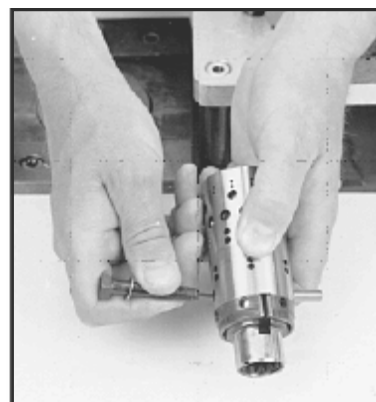


Fig 39

A small mark has been made with a soap stone on both spool and sleeve close to one of the slots for the neutral position springs.

If the mark is not visible, make a mark (non abrasive mark that can be wipe off) of your own on sleeve and spool before the neutral position springs are dismantled.



Fig 40

### Installation instruction for 'O' rings

Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool (SER279) into the bore for the spool/ sleeve.

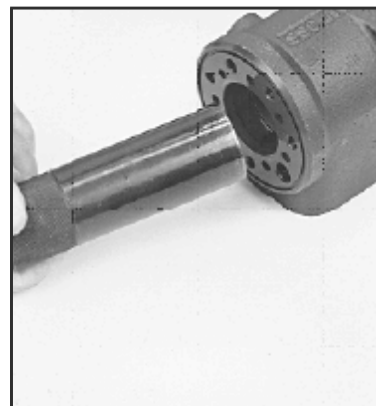


Fig 69

40. Grease o-ring and king-ring/roto Glyd with hydraulic oil and place them on the tool (SER280).

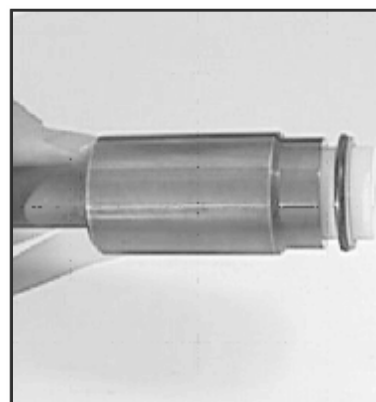


Fig 70

41. Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



Fig 71

42. Press and turn the o-ring/kin-ring into position in the housing.

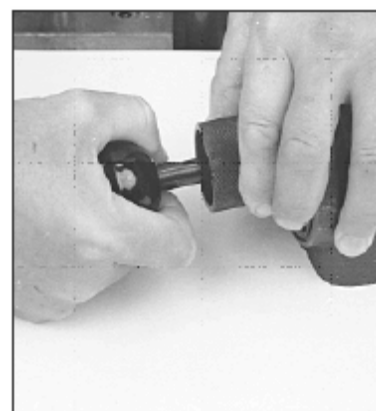


Fig 72

## 13 A . 11 Steering cylinder

### over hauling

#### Work condition:

It is a must that the system be kept free of dirt or foreign matter in the oil circuit. Cleanliness in servicing this power steering cylinder is absolutely essential.

If it is necessary to disassemble the cylinder, make sure a clean table or work bench is used.

Outside dirt should be cleaned off before disconnecting lines and port holes should be plugged immediately after disconnecting lines.

Finish cleaning off outside dirt before placing on work bench.

When disassembled, parts should be cleaned only in clear clean petroleum base solvent and blown dry with clean dry air. Other solvents may cause deterioration of seals. Avoid wiping parts with cloth.



**Warning: It is imperative that the instruction in this manual are followed to the letter. Failure to observe the procedures set out in this manual may result in loss of steering.**

#### Dismantling:

1. Clean the cylinder by wiping the exteriors completely. Open the ports. Hold the cylinder body in one hand and move the piston rod back and forth to purge oil from the cylinder.
2. Hold the cylinder body in bench vise as shown in figure.
3. Unscrew the head end cover from the cylinder body using SER 298.



Fig 107



Fig 108

# Independent power take off

## Part B

### Table of contents

<b>Operation NO.</b>	<b>Description</b>	<b>Page no.</b>
12B . 1	Specification	12B - 3
12B . 2	General description	12B - 4
12B . 3	IPTO operating switch	12B - 5
12B . 4	IPTO clutch unit removal from tractor	12B - 8
12B . 5	IPTO clutch unit over hauling	12B - 9
12B . 6	IPTO Pressure test and flow test	12B - 15
12B . 7	Removal and refitment of left hand side cover	12B - 16

9. Remove the internal snap ring from inner case.



Fig 21

10. Pull the shaft forward and remove the shaft from housing along with bearing and also remove the needle roller bearing from the shaft.



Fig 22

11. Remove the piston by passing the high pressure through the feed ring.



Fig 23

**Bolt torques:**

Control spring screw	...	5 lbf.ft.(7 Nm )
Lift cover bolts	...	65 lbf.ft.(88 Nm )
Front ram cylinder nuts	...	162 lbf.ft.(220 Nm)
Rear ram cylinder nuts	...	225 lbf.ft.(305 Nm)
Pump body retaining nuts	...	29 lbf.ft. (40 Nm)
Vertical lever end plate bolts	...	15 lbf.ft. (20 Nm)
Pressure relief valve assembly	...	81 lbf.ft. (110 Nm)
Relief valve	...	18 lbf.ft. (25 Nm)
Transfer cap	...	32 lbf.ft. (44 Nm)

**11A . 2 GENERAL DESCRIPTION****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 from the cylinder piston engages in the ram arm which is splined on to the lift shaft 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.

Conversely, when the oil is allowed out of the cylinder, the piston moves back under the load of the lift arms.

The hydraulic pump is driven by the PTO drive from the main clutch, via the gearbox constant mesh gears and the PTO drive shaft. It is therefore rotating whenever the forward part of the PTO system is being driven.

Oil flow from the pump is controlled by an integral control valve on the suction side of the pump.

The pump control valve is moved by the quadrant levers, forces down the top link, or the cam on the cross shaft.

The speed of movement of the valve into discharge (lower) is controlled by the Response unit.

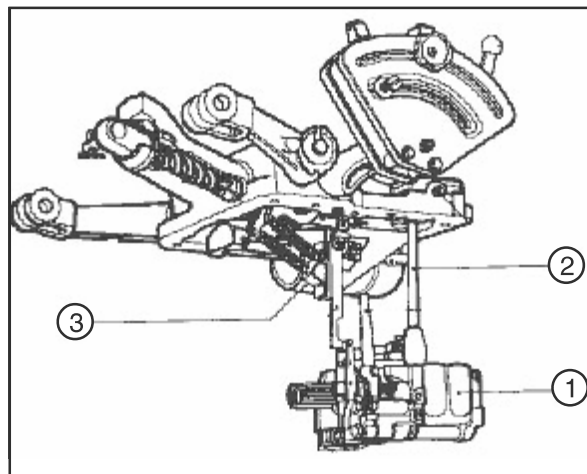


Fig 1

21. Withdraw the pivot shaft.
22. Lift out the links.
23. Release the tabwasher.
24. Remove the bolt and washer.
25. Slide off the lift arm.
26. Remove and discard the 'O' ring.
27. Release the tabwasher.
28. Remove the bolt and washer.
29. Slide off the lift arm.
30. Remove the 'O' ring, see procedure 26.
31. Drive the lift shaft out of the lift cover.
32. Remove the ram arm.
33. Remove the two bushes.

#### Re-assembly

34. Reverse procedures 1 to 33, except:
  - a. Fit new bushes if necessary.
  - b. Fit new 'O' rings and tab washers.
  - 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 hexagon socket screw.
  - f. When refitting the connecting rod hexagonsocket screw, apply a drop of MF Lock and Seal (Loctite 542) or equivalent to the threads, and screw the hexagon socket 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 front ram cylinder retaining nuts to a torque of 162 lbf.ft (220 Nm) and the rear retaining bolts to a torque of 225 lbf.ft (305 Nm).
35. Carry out hydraulic static adjustments, see operation 11A . 9.

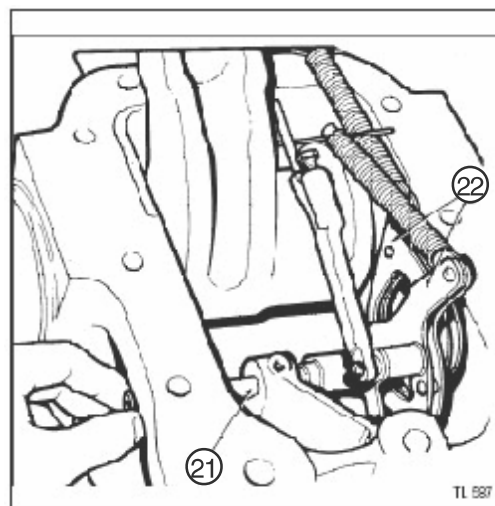


Fig 22

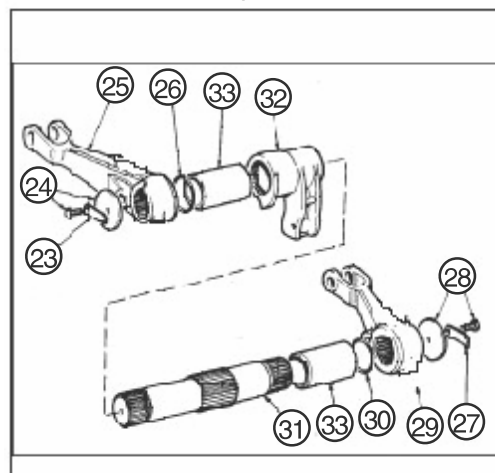
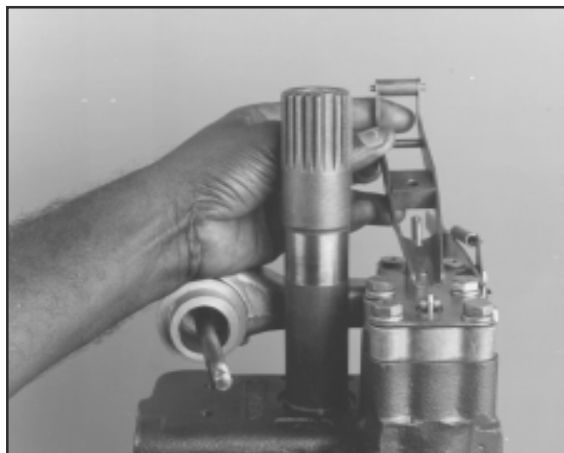


Fig 23



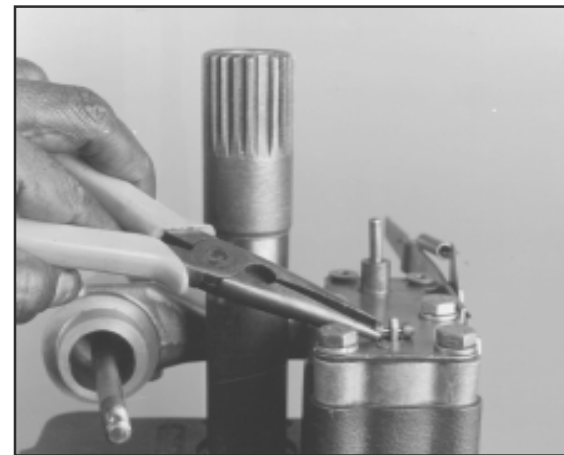
9. Remove the strainer inner shroud (fig 48).



12. Remove the lever (fig 51).



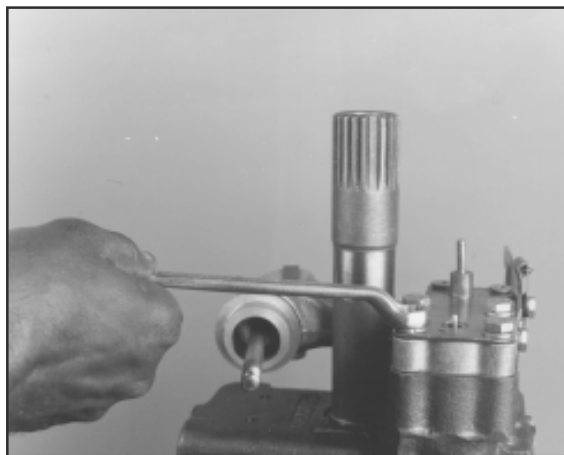
10. Remove the "O" ring and discard (fig 49).



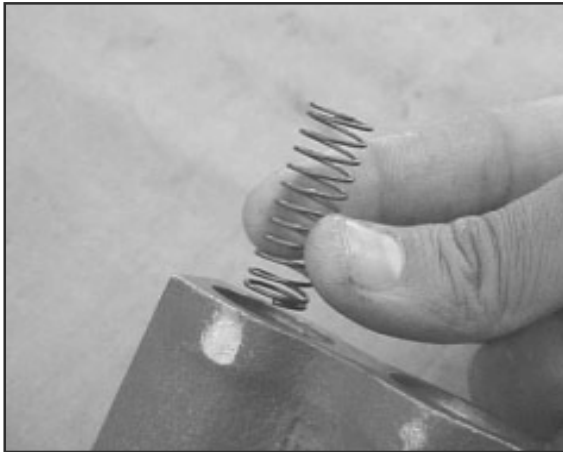
13. Remove the two rollers and the pin (fig 52).



11. Remove the clip (fig 50).



14. Remove the four lower bolts and washers (fig 53).  
(13 mm)



72. Remove the spring (fig 108).



75. Remove the inlet valve (fig 111).

76. Repeat procedure 66 to 73 for the other three valves.

#### Examination

**Check the condition of all components for wear or damage. Replace any defective components. Always replace “O” rings, back-up washer, gaskets and circlips. Lubricate the “O” rings with oil before fitting.**

#### Assembly

Reverse the above procedure for assembly.



73. Remove the valve (fig 109).



74. Remove the spring (fig 110).

77. If necessary, form new valve seats, using MF.349 valve seat cutter and forming tool in the following sequence:
78. Carry out the following:
  - a. Cut the top seat in the valve chamber using the large end of the cutter and tommy bar provided.
  - b. When satisfactory seat has been formed remove the tool and fit the sleeve to the small end of the cutter.
  - c. Insert the small end and carefully rotate the cutter to remove the burr around the top seat.
  - d. Remove the cutter and sleeve, re-insert and cut the bottom seat until a satisfactory result has been obtained. The cutter has been designed to ensure the correct depth of the bottom seat.

## 12A - 4 PTO SHAFT, BEARING AND OIL SEAL

### Removal and Refitment

#### Special Tools:

SER / 046 Seal Remover

#### Removal

1. Drain the transmission oil.
2. Unscrew the PTO cap.
3. Remove the 4 bolts from the cover and two centre bolts and washers. refer arrow
4. Remove the PTO oil seal housing.
5. Withdraw the shaft from rear axle.
6. Remove the snap ring.
7. Remove the bearing from the PTO shaft.

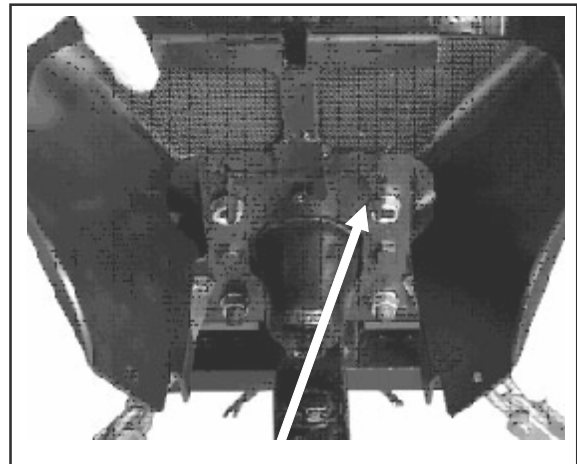


Fig 4

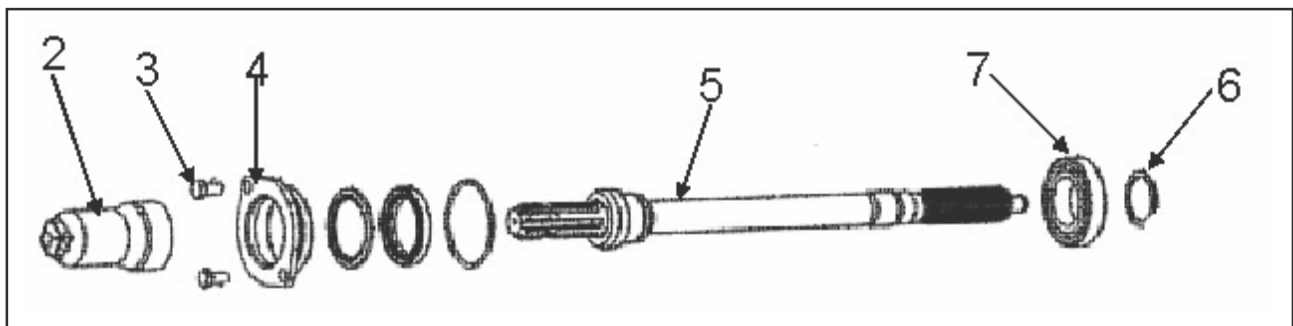


Fig 5

#### Refitment

8. Using SER / 046 to press the oil seal into PTO housing.
9. Fit a new 'O' ring.
10. Using a hydraulic press, press the new ball bearing onto the PTO shaft.
11. Fit a new snap ring and ensure that it locates correctly in its groove.
12. Slide the PTO shaft into the rear housing, taking care to keep it horizontal to align the internal spline.
13. Reinstall the PTO housing to the centre housing.
14. Tighten the four retaining nuts with spacers to a torque of 83-125 lbf.ft.(113 - 169 Nm)
15. Tighten the two bolts retaining the draw bracket to the check chain bracket to a torque of 170-192 lbf .ft. (230 - 260 Nm)

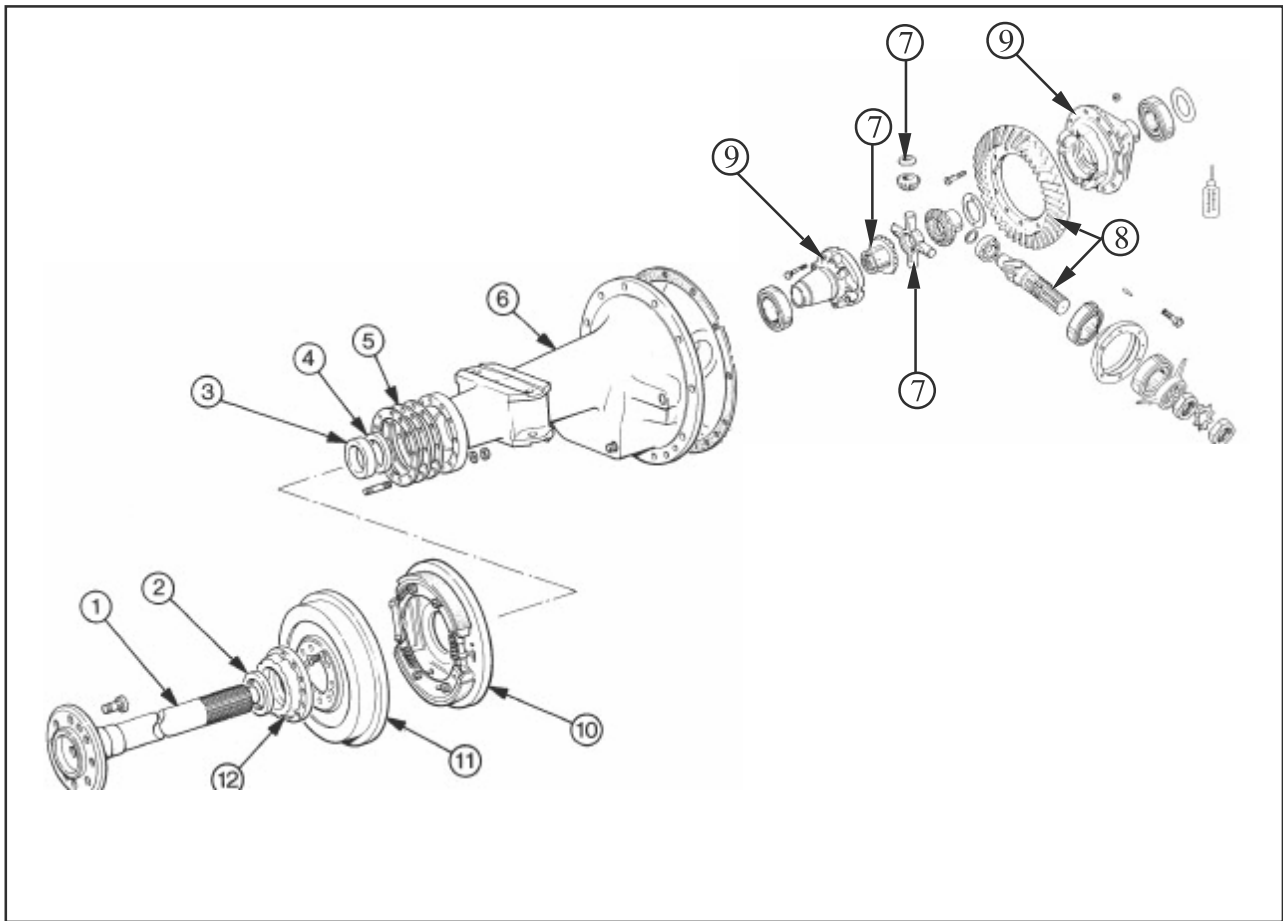


Fig. 1

- |    |              |     |                                |
|----|--------------|-----|--------------------------------|
| 1. | Axle shaft   | 7.  | Differential Gears and Pinions |
| 2. | Oil Seal     | 8.  | Crown wheel and Pinion         |
| 3. | Retainer     | 9.  | Diff case LH and RH            |
| 4. | Oil Seal     | 10. | Brake assembly                 |
| 5. | Axle Shims   | 11. | Brake drum                     |
| 6. | Axle Housing | 12. | Retainer housing               |

## 10A. 2 GENERAL DESCRIPTION

The direct drive rear axle construction is shown in Fig.1. The axle shafts are splined directly into the differential gears and fitted with drum type brakes.

**Pinion:**

1. Remove the six mounting bolts. (Item 1 in Fig. 6).
2. Screw one of the bolts into each of the two tapped holes. (Item 2 in Fig. 6).
3. Tighten the bolts as shown using a ring spanner thus withdrawing the pinion assembly.
4. Remove the locking nut as follows.



**WARNING : Eye protection goggle must be worn during the following operations**

**NOTE :** Great care should be taken to avoid damaging the threads of the pinion if it is to be reused.

- (a) Place the pinion in a vice with soft jaws, 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". (as shown in Fig.7).
- (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.

5. Remove the oil slinger. (Item 2 in Fig.8).
6. Remove the sleeve pinion assembly, pinion and the bearing cone. (Item1 in Fig. 8).

7. Use a hand or hydraulic press and remove the front taper roller bearings. (Fig. 9).

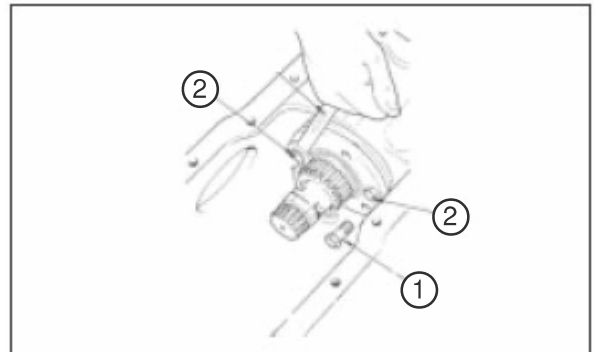


Fig.6

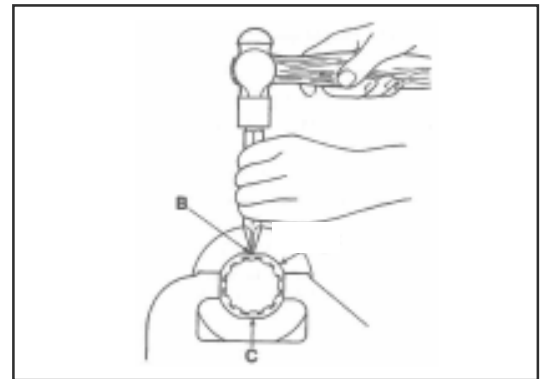


Fig. 7



Fig. 8

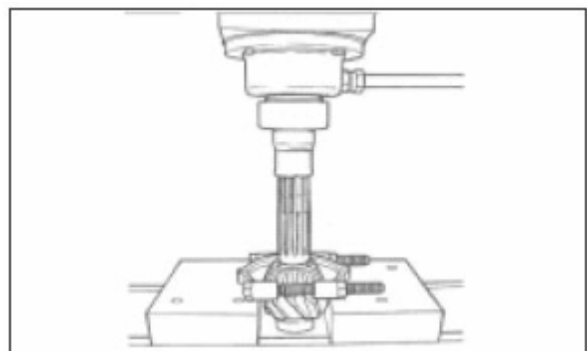


Fig. 9

SER / G / 224	...	Carrier bush pusher
SER / G / 194	...	Adaptor.
SER / G / 195	...	Adaptor
SER / G / 196	...	Bearing cup and seal remover.
SER / G / 198	...	Bearing cup assembler.
SER / G / 197	...	Seal replacer.
SER / G / 199	...	Bearing cone remover.
SER / G / 200	...	Bearing cone remover.
SER / G / 201	...	Bearing replacer.

**Bolt torques:**

Rear Wheels nuts	...	200 lbf.ft (270 Nm)
Epicyclic unit housing bolts	...	55 lbf.ft (75 Nm)
Stabliser mounting bolts	...	170 lbf.ft (230 Nm).
Differential case mounting bolts	...	80 lbf.ft ( 108 Nm)
Centre mounting bolts	...	18 lbf.ft (25 Nm)
Sleeve mounting bolts	...	118 lbf.ft (160 Nm)

**10B . 1 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 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 taper roller bearings.

The Crownwheel is attached to the split differential case, which is supported on each side by a taper 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 are mounted in rear wheel disc.

This tractor is fitted with 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 housing.

The right pedal operates the right hand brake and the left pedal operates the left hand brake, to assist turning.

For off-field use, the brakes are used together by operating an interlocking latch which joins the two brake pedals.

When only single brakes are applied 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 disc, held together by tension springs and separated by steel balls located in inclined seats. Pressure on the brake pedal, 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 disc apart. These come into contact with the rotating (friction disc), which are splined to the shaft being braked. The actuating assembly will move slightly in the direction of rotation until the torque ear of the 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.

## 10B.7 AXLE HOUSING LEFT HAND

### Removal and Refitment

**Special tools :** SER / 054 Tractor splitting stand.

#### 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 stabilizer bracket underneath the axle housing.
5. Release the forward end of the lower link from the axle 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 axle housing being serviced.

9. Remove the left hand rear wheel.
10. Place the SER / 054 tractor splitting stand under the centre housing and lower the tractor until the jack is just taking the axle housing weight.
11. Remove all the nuts and bolts securing the axle housing to the centre housing.
12. Lower the axle housing slightly and withdraw it far enough to clear the half shaft from the differential splines.
13. Withdraw the axle housing completely.
14. Remove the 'O' ring from the flange on the carrier plate.

#### Refitment

15. Reverse procedures 1 to 14 except:
  - a. Fit a new 'O' ring, using petroleum jelly.
  - b. When manoeuvring the axle housing assembly back into position, take care to align the axle shaft splines in the differential unit

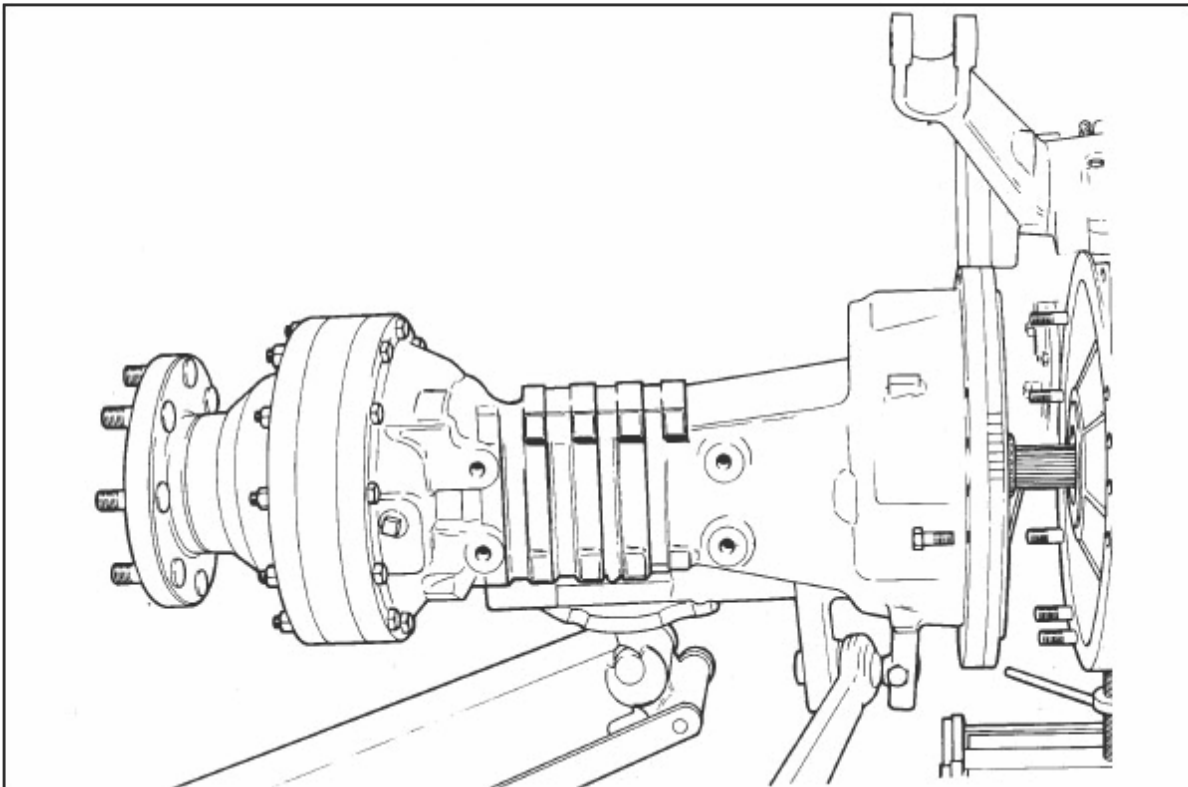


Fig 15

## 10B.16 RIGHT HAND BRAKE

### Servicing

**Special Tools:** SER / 054 Tractor splitting stand

#### Disassembly

1. Remove the right-hand axle housing. (see operation 10B.8)
2. Manoeuvre the axle housing assembly off the 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.
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 grooves depth of 0.12 inch (0.3 mm) 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 0.005 inch (0.13 mm) 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 housing.

12. Reverse the procedure for reassembly

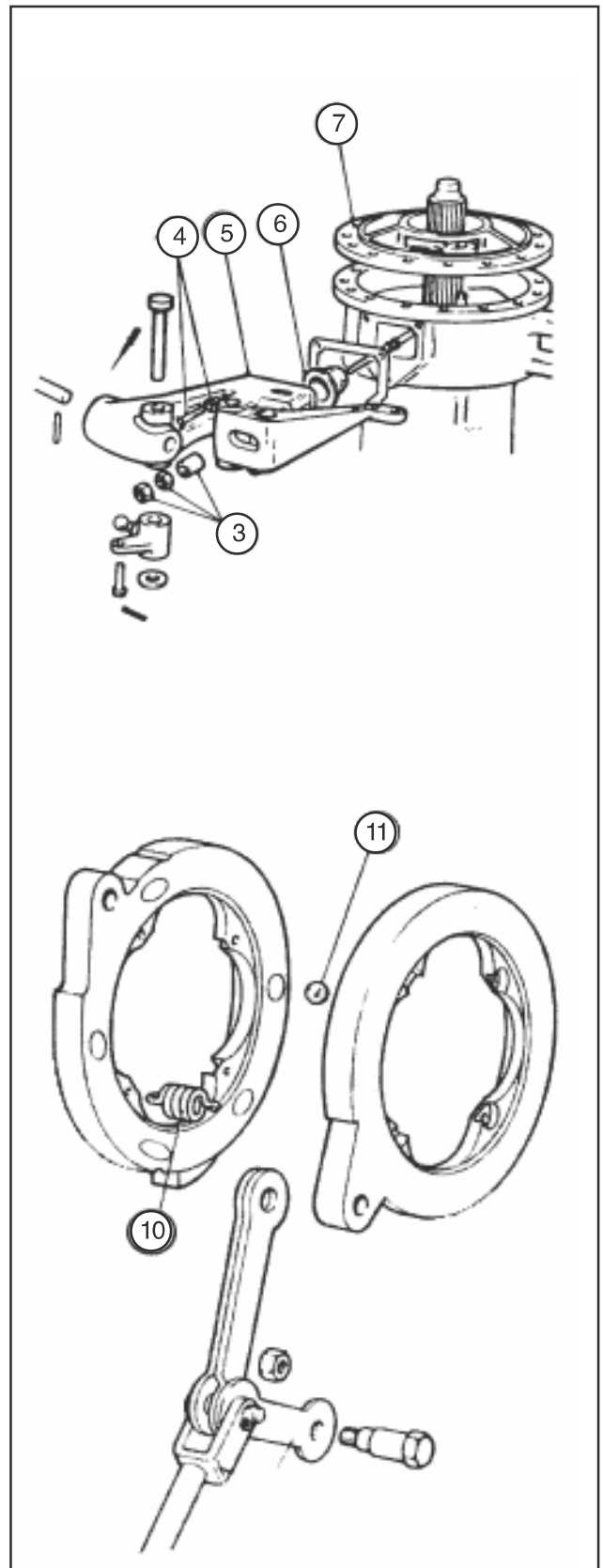


Fig 25

- 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. Release the tab washer from the lock nut.
- c. Remove the lock nut by using SER / 060 and SER / 064.
- d. Remove the tab washer and locknut

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

3. Remove the oil slinger.
4. Remove the housing, complete with the front bearing cone.
5. Fit the pinion to SER/038 with SER/059 and SER/056. Press off the bearing.
6. Remove the snap ring securing the pilot bearing to the pinion.
7. Fit the pinion to SER/038 using adaptor SER/059 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.**

#### **Note:**

- a. If the pinion is damaged the crown wheel 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 SER/038 and SER/059, press the pilot bearing on the pinion.
9. Secure the pilot bearing with a new snap ring.
10. Using SER/038 and SER/059 and SER/056 press the bearing onto the pinion.
11. Locate the pinion in its housing and fit the front bearing cone.
12. Refit the oil slinger and a new locking ring, hand tightened.
13. Hold the housing in a soft faced vice.
14. Fit a SER/061 pre-load gauge to the pinion and tighten the locking ring to give a pre-load reading of 18 - 22 lbs.inch (2 - 2.5 Nm).
15. Remove the gauge, tap the pinion firmly to centralize the bearings, then re-check the pre-load.

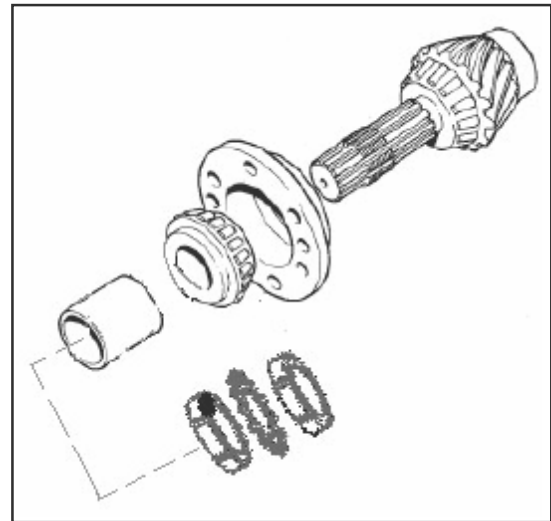


Fig 44

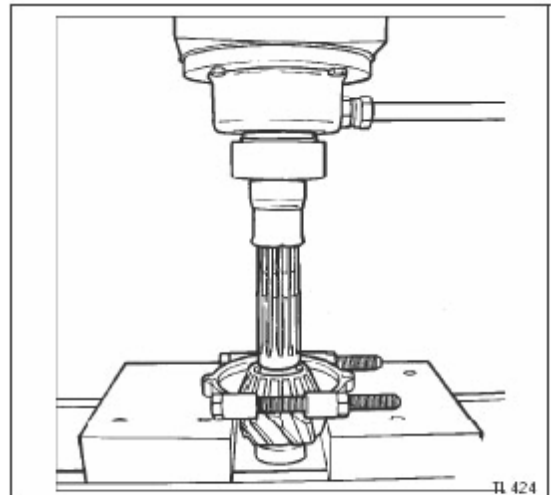


Fig 45

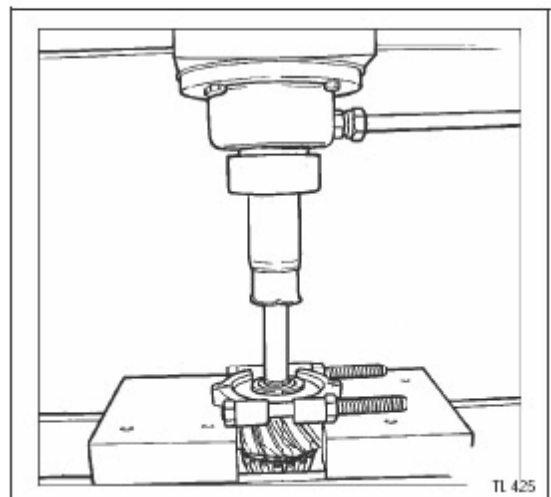


Fig 46

4. Again ,NEVER use the service cover to push t h e filter into place .Using the cover to push the filter in could cause damage to the housing and will void the warranty.
5. If the service cover hits the filter before it is fully in place remove the cover and push the filter (by hand) further into the air cleaner and try again. The cover should go on with no extra force.Once the filter is in place ,secure the service cover or dust cap.

***Check connections for tight fit:***

1. Make sure that all mounting bands ,clamps, bolts and connections in the aircleaner system are tight.Check for holes in piping and repair if needed.Any leaks in your intake piping will send dust directly to the engine.

## 5.5 HEAD LAMP MOUNTING BRACKET

### Removal and refitment

**Removal:**

1. Pull the hood latch cable and lift the hood.
2. Remove hood see operation 5.2
3. Remove the vertical stiffner mounting bolts.
4. Remove the head light mounting bracket mounting bolts.
5. Remove the centre support light bracket.

**Refitment:**

6. Reverse the procedure 1 to 5 except

a. Tighten all the bolts

## 5.6 FRONT GRILL :

### Removal and Refitment:

**Removal:**

1. Remove the hood see operation 5.2.
2. Remove the lock bracket with lock rod.
3. Remove the front vertical stiffner.
4. Remove the front grill mounting bolts.
5. Remove the front grill.

**Refitment:**

6. Reverse the procedure 1 to 5.

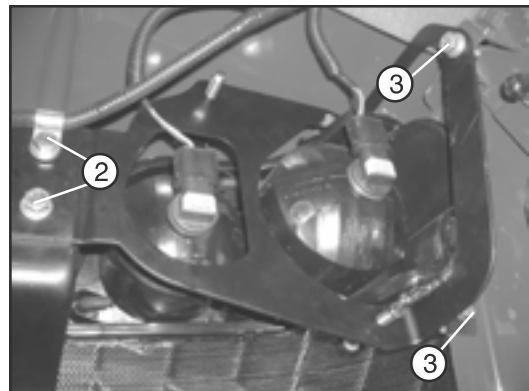


Fig 13

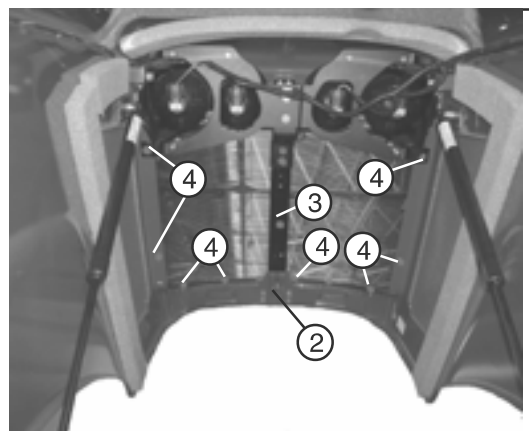


Fig 14

## CONTENTS

<b>Section</b>	<b>Description</b>	<b>Page No.</b>
A	ENGINE NUMBER LOCATION	... 6B - 3
	EPA STICKER LOCATION	... 6B - 4
	THREADS	... 6B - 5
B	TECHNICAL DATA	... 6B - 7
	MANUFACTURING DATA AND DIMENSIONS	... 6B - 9
C	OPERATING AND MAINTENANCE	... 6B - 18
D	FAULT FINDING CHART	... 6B - 24
E	CYLINDER HEAD	... 6B - 36
F	PISTONS AND CONNECTING RODS	... 6B - 41
G	CYLINDER BLOCK AND LINERS	... 6B - 45
H	CRANKSHAFT AND MAIN BEARINGS	... 6B - 48
J	TIMING CASE AND DRIVE	... 6B - 54
K	TIMING	... 6B - 61
	FUEL INJECTION PUMP CALIBRATION CHART	... 6B - 63
L	LUBRICATING SYSTEM	... 6B - 67
M	COOLING SYSTEM	... 6B - 73
N	FUEL SYSTEM AND AIR CLEANERS	... 6B - 76
P	FLY WHEEL AND FLY WHEEL HOUSING	... 6B - 81
Q	APPROVED LUBRICATING OILS	... 6B - 83
<b>Appendix - I</b>		... 6B - 84

## Main Bearings

Type	...	Pre-finished. Steel Backed. Aluminium Tin/Copper Lead
Inside Dia. (fitted)	...	2.7519 / 2.7535 inch (69.90 / 69.94 mm)
Running clearance	...	0.0027 / 0.0051 inch (0.07 / 0.13 mm)
Recommended size in service	...	0.0098 inch (0.25 mm) ;0.020 inch (0.51 mm) ;0.0299 inch (0.76 mm)

## Camshaft

Type	...	Polydine ( <i>Hollow shaft. Journals are pressure feed lubrication. located with thrust washer</i> )
No. 1 Journal Dia.	...	1.8700 / 1.8694 inch (47.5 / 47.484 mm)
Running Clearance	...	0.0039 / 0.0055 inch (0.10 / 0.141 mm)
No. 2 Journal Dia.	...	1.8602 / 1.8596 inch (47.25 / 47.234 mm)
Running Clearance	...	0.0039 / 0.0055 inch (0.10 / 0.141 mm)
No. 3 Journal Dia.	...	1.8503 / 1.8497 inch (47.00 / 46.984 mm)
Running Clearance	...	0.0039 / 0.0055 inch (0.10 / 0.141 mm)
No. 4 Journal Dia.	...	1.8401 / 1.8395 inch (46.74 / 46.724 mm)
Running Clearance	...	0.0039 / 0.0055 inch (0.10 / 0.141 mm)
Oil way for rocker shaft lubrication	...	From head to 1st rocker bracket top face
Cam Lift <i>Inlet</i>	...	0.2512 inch (6.3814 mm)
<i>Exhaust</i>	...	0.292 inch (7.4169 mm)
Gear–Spigot dia	...	1.3779 / 1.3769 inch (35.000 / 34.975 mm)
Camshaft end float	...	0.0157 / 0.039 inch (0.40 / 0.10 mm)

## Cylinder Head

Cylinder head total height	...	4.645 inch (118 mm)
Skimming allowance on head face	...	A maximum of 0.0118 inch (0.30 mm) may be removed from the Head Face provided the atomiser nozzle protrusion does not exceed 0.147 inch (3.75 mm) after skimming
Leak Test	...	4 Bar for 1 minute
Valve seat angle	...	Inlet 30° / Exhaust 45°
Tappet bore in cylinder head	...	0.6306 / 0.6299 inch (16.018 / 16.000 mm)
Valve guide bore in cylinder head	...	0.5125 / 0.5118 inch (13.018 / 13.000 mm)
Permissible cylinder head bow transverse and longitudinal	...	0.00314 inch (0.080 mm)

## Valve Guides (Sintered) – Inlet and Exhaust

Inside Dia.	...	0.3110 / 0.3116 inch (7.900 / 7.915 mm)
Outside Dia	...	0.5127 / 0.5131 inch (13.023 / 13.034 mm)
Overall Length	...	2.3228 / 2.3149 inch (59.00 / 58.8 mm)
Guide Protrusion above Cyl. head Top Face	...	0.3917 / 0.3956 inch (9.95 / 10.05 mm)
Interference fit of guide in head	...	0.0013 / 0.00019 inch (0.034 / 0.005 mm)

**NOTE :** Valve stem seal (with Sintered metal insert) is fitted in both inlet and exhaust valves.

## Inlet and Exhaust Valves

Valve Stem Dia ( <i>Inlet</i> )	...	0.3101 / 0.3095 inch (7.877 / 7.863 mm)
Valve Stem Dia. ( <i>Exhaust</i> )	...	0.3096 / 0.3090 inch (7.864 / 7.850 mm)
Clearance fit of valve in guide ( <i>Inlet</i> )	...	0.00091 / 0.0025 inch (0.023 / 0.052 mm)
Clearance fit of valve in guide ( <i>Exhaust</i> )	...	0.0014 / 0.0025 inch (0.036 / 0.065 mm)
Valve face Angle ( <i>Inlet</i> )	...	29° 40'
Valve face Angle ( <i>Exhaust</i> )	...	44° 40'
Valve depth below cylinder head face	...	0.0079 inch (0.203 mm) above or below ( <i>Inlet and Exhaust</i> ) cylinder head machined surface

initial start. allow it to run at slow speed for approximately two minutes to ensure good oil circulation before accelerating to higher speeds.

**NOTE:** *Where a preservative is used in the lubricating oil sump. this should be drained off and replaced by normal lubricant prior to restarting the engine at the end of the storage period. In the case of a preservative being utilised to charge the fuel system. this need not necessarily be drained off before returning the engine to service. Therefore. where a preservative is used in this respect. the relevant manufacturers of the fluid should be contacted seeking their guidance as to whether their product should be drained away prior to restarting the engine.*

### Frost Precautions

Precautions against damage by frost should be taken if the engine is to be left exposed to inclement weather either by adequately draining the coolant system or where this is not convenient an anti-freeze of reputable make and incorporating a suitable corrosion inhibitor may be used.

Should it be the policy to protect engines from frost damage by adding anti-freeze to the cooling system. it is advisable that the manufacturers of the relevant mixture be contacted to ascertain whether their products are suitable for use in Simpsons engines. and also to ensure that their products will have no harmful effect on the cooling system generally. It is our experience that the best results are obtained from anti-freeze which conforms to **British Standard 3151** or has been approved by testing in accordance with **BS 5117. Clause 5.** to give atleast as good a result as **BS 3151:1959.**

The coolant solution containing 25 per cent **anti-freeze manufactured to BS 3151** in coolant in a properly

maintained engine should maintain its anti-freeze and anti-corrosive properties throughout the winter season and in general. a safe life of 12 months may be reasonably expected.

When draining the coolant circulating system it is not enough merely to open the radiator drain tap. The one on the cylinder block must also be opened. This tap is on the rear side of the cylinder block. near the flywheel housing.

Where a pressurised radiator filler cap is fitted. this should be removed before draining the cooling system.

When draining the cooling system ensure that the engine is level.

When the engine cooling coolant is drained. in the majority of applications the water pump is also drained. but rotation of the pump may be prevented by :

- (a) Locking of the impeller by ice due to the pump drain hole being blocked by sediment.
- (b) The locking of the seal through the freezing of globules of moisture between the seal and the gland.

Operators are therefore advised to take these precautions when operating in temperatures below freezing point:

1. Before starting the engine. turn the fan and water pump by hand: this will indicate if freezing has taken place. If freezing has taken place. this should free any ice formation.
2. If it is impossible to turn the pump by hand. the radiator and engine should be filled with warm water.

After an anti-freeze solution has been used. the cooling system should be thoroughly flushed in accordance with the manufacturer's instructions before refilling with normal coolant.

If the foregoing action is taken. no harmful effects should be experienced. but manufacturer cannot be held responsible for any frost damage or corrosion which may be incurred.

PROBLEM	POSSIBLE CAUSES	REMEDY
<b>VIBRATION</b>	Faulty fuel injection pump	Overhaul injection pump
	Faulty injectors	Overhaul injectors
	Poor compression	See Problem – Poor Compression
	Sticking throttle or restricted movement	Check, clean, lubricate and adjust settings.
	Cylinder head gasket leaking	Check the cylinder head bolts torque or renew the gasket.
	Overheating	See Problem – Overheating
	Sticking valves	Replace valve with new standard or oversize, and/or machine the valve guide bores
	Incorrect high pressure pipes	Renew with pipes of correct specifications
	Broken worn or sticking piston ring/s	Fit new rings, check bore and pistons for damage
	Piston seized damage	Replace piston assembly and check the bore for
	Faulty engine mounting	Check and redo the installation of engine
	Incorrectly aligned flywheel housing or flywheel	Check and align flywheel housing and flywheel
<b>HIGH OIL PRESSURE</b>	Incorrect grade of lubricating oil	Drain and refill with specified grade of oil
	Inaccurate relief gauge	Check and renew gauge
	Pressure relief valve faulty	Fit new relief valve
<b>STARTS &amp; STOPS</b>	Restriction Plugged fuel filter	Fit new filter
	Restriction in air cleaner or induction system	Remove the restriction
	Air in fuel system	Remove the air lock/Bleed air

Assemble the connecting rod to the pistons and insert the gudgeon pin.

Fit the circlips to the piston. It is difficult to advise as to when new circlips should be fitted but in the event of an engine being in service for a lengthy period it is advisable that new circlips be used during re-assembly.

### Fitting New Rings

The piston and rings should be thoroughly washed to remove any oil and grease.

Check piston rings for correct gap (Ref. Section B)

In worn cylinder bores the gaps should be checked at the unworn top of the bore. *after any carbon has been removed.*

Fit the rings to the piston in the following position (reading from the top of the piston).

1. Ring compression (Chromium inlaid. Half Keystone with 'Top' marked).
2. Ring compression (Cast Iron Taper land with 'Top' marked).
3. Conformable oil control Ring

When fitting new rings to original pistons clean out the piston ring grooves.

The pistons should be carefully examined for bruising of the ring grooves and to ensure that the rings move truly in their grooves. In addition the piston skirt should be examined and if there is any scoring the piston must not be used again.

### To Fit Conformable oil Ring

1. Fit the helical coil spring onto the 3rd groove of the piston.
2. Insert the latch into the coil spring aligning both the ends.
3. Fit the outer C.I. ring over the coil spring Ensure coil spring gets seated properly inside the ring groove.
4. Also ensure the coil spring latch is on the opposite side of the ring open end gap.

### To Replace Pistons and Connecting Rods

Connecting rods and caps are plainly marked to indicate their original position in the engine. The numbers are stamped on that side of the connecting rod and cap which is machined to take the locating lips of the big end bearings.

Before fitting pistons, the cylinder bores should be given a liberal coating of clean lubricating oil.

When fitting pistons and connecting rods to the cylinder block and crankshaft ensure that the side of the connecting rod which is stamped with the number goes to the fuel pump side of the engine.

For SJ327 E engines ensure that the words "F" marked on the piston crown is towards the front of the engine. (Offset of combustion bowl in the crown toward fuel injection pump side).

Insert the pistons and connecting rods into the cylinder bores from the top, ensuring the piston and rod stamped No. 1 are fitted into No. 1 bore and No. 2 into No. 2 bore and so on commencing from the front of the engine.

To minimise the possibility of breaking piston rings it is advisable to use a piston guide. Take care not to damage the rings. Should the piston accidentally drop partly into the cylinder bore and is held suspended by a piston ring it must be taken out again and the ring examined to see if it is cracked or broken.

Turn the crankshaft until the appropriate crankpin is at bottom center pull the connecting rod to the crankpin and insert the half bearing.

Fit the cap and cap half bearing ensuring that the markings on connecting rod and cap coincide.

The nuts used on the big end bolts should not be used a second time but should be replaced by new whenever they are removed.

Tighten the connecting rod nuts using a torque wrench set to the tension given on Section B.

Rotate crankshaft by hand and note that all parts move freely.

Check the piston height in relation to the top face of the cylinder as described below.



Fig. H 9



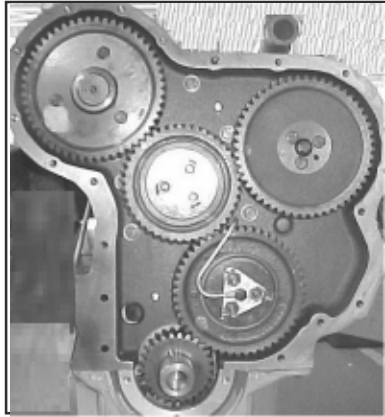
Fig. H 10

**Fitment Pcedure :**

- Check for crankshaft end float.
- Assemble rear end oil seal retainer housing to Pt. No. : 37424611 onto the cylinder block rear face with joint and tighten all bolts as per sequence (Torque 20 lbf.ft or 27 Nm) using a torque wrench.
- Ensure proper torque tightening on all the bolts
- Check the bore of the oil seal retainer housing and crankshaft sealing surfaces. Remove any surface burr, dust, dirt or metal chips before seal installation.
- Verify that the oil seal and installation tool are available and are in good and clean condition.
- Dismantle installation tool (Ref. Fig.H7).
- Position the adaptor plate and mount it on the

crankshaft palm face using two screws and tighten the screws (Ref. Fig. H8).

- Apply molykote – 111 compound uniformly on the OD of the crankshaft flange and ID of the oil seal.
- Position the new oil seal over the adaptor. (Seal surface with the part number identification should be positioned towards the operator Ref. Fig. H9).
- Position the installer plate over the oil seal (Ref. Fig. H10)
- Position the Hexagonal nut over the adaptor plate stud and drive the same until the installer plate bottoms out on the seal retainer housing face (Ref. Fig. H10).
- Remove the Hexagonal nut, installer plate and adaptor plate.
- The seal installation is now complete.



**Fig. K.1 – Timing Gear Marks**

The timing or the resetting of the timing can be simply and quickly carried out if the following instructions are kept in mind.

It is well to remember that the removal of the cylinder head does not in any way affect the timing of the engine.

### Timing Marks

When the engine is timed at the factory, certain marks are stamped on the gears, so that if for any reason the timing must be disturbed, then the engine can easily be reset to its original timing.

The method of marking is as follows:- With the engine timing correctly set, the engine is turned until No. 1 piston is at T.D.C. on its compression stroke. In this position, scribed lines or center punch marks are marked on the idler gear to correspond with lines or center punch marks on the camshaft, fuel pump and crankshaft gears respectively (Ref. Fig. K1).

### Fuel Injection Pump Timing Marks (VE Type Pump)

Refer section K 51 for detailed setting procedure for MICO VE type pump timing.

### To Reset Engine Timing

Remove atomisers.

**Bring No. 1 piston to T.D.C.**, No. 1 piston being on its compression stroke. The T.D.C. hat has been obtained can be checked by examining the flywheel where the T.D.C. **mark should be central within the**

## TIMING

**inspection opening, or the front of the crankshaft where the key for pulley should be at the top of its periphery.**

**Fit the camshaft gear** on locating dowel provided on camshaft hub.

**Fit the fuel pump gear.** This is dowelled and will only go in one position.

(Check that the fuel pump is correctly fitted to the engine and set the spill timing as recommended in Section B)

With the crankshaft gear fitted, **replace the Idler gear** ensuring the timing marks coincide (Ref. Fig. K.1).

**After testing the engine, final adjustments may be necessary to find the perfect injection point. Adjustment may be made by releasing the fuel pump securing setscrews and turning the pump in the direction required.**

### To Check Valve Timing

Turn the engine until maximum lift is obtained on No. 3 cylinder exhaust valve. In this position, set the clearance between rocker lever and No. 1 inlet valve to 0.048 inch (1.222 mm).

Now, turn the engine in the normal direction of rotation until the No. 1 inlet valve tip just tightens (clearance reduces to zero).

At this point, No. 1 piston should be at T.D.C. This can be checked by examining the T.D.C. provision given on the engine flywheel. A notch mark on the periphery of the crankshaft pulley has been provided and a pointer is located on the timing case cover. To set No. 1 piston to T.D.C. bring the notch mark on the pulley in line with the pointer. The **spill timing mark** is also provided on the periphery of the crankpulley. The tolerance for valve timing is plus or minus  $2\ 1/2^\circ$ . When the valve timing is found to be correct, adjust the valve tip clearance of No. 1 inlet valve to 0.012 inch (0.3 mm). No adjustment is provided in respect of valve timing. If the timing is found to be incorrect after the cam gear is fitted to the camshaft, then the gear may be one or more teeth out of correct mesh.

**Note :** *The removal of cylinder head does not in any way affect the timing of the engine.*

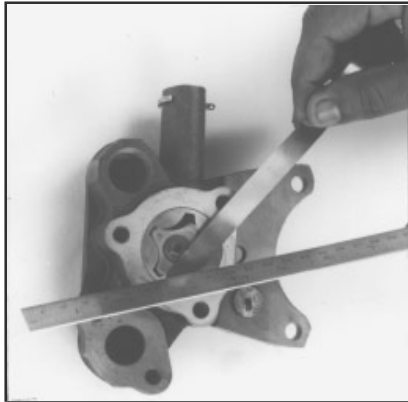


Fig. L 6 – Checking Oil pump Clearance  
(Top of rotors to body)

Closed Breather Oil Separator

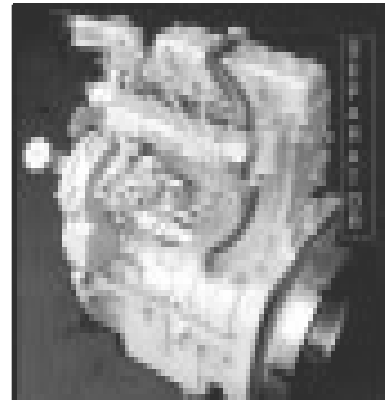


Fig. L 7 – Oil Separator Location (Sealed Unit)

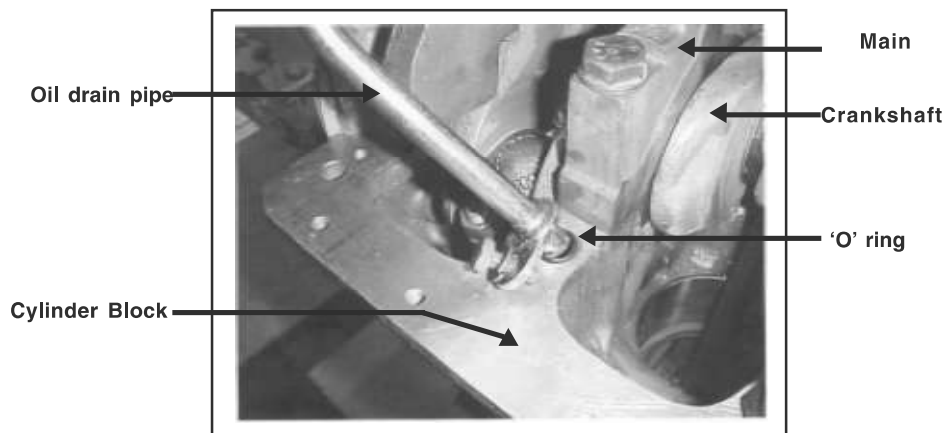


Fig. L 8 – Closed Breather Oil Drain Pipe



**CAUTION**

- < For effective functioning of closed loop breathing system the oil filler cap and oil dipstick should not be disturbed while engine is running.
- < Perfect sealing is required between oil drain pipe 'O' ring and cylinder block machined surface as shown in Fig. L 8.

## FLYWHEEL AND FLYWHEEL HOUSING

### Alignment of the Flywheel Housing and Flywheel

It is most important that the flywheel housing be correctly aligned with the crankshaft. Misalignment may give rise to difficulty in changing gear, etc. If the housing has been removed, as is necessary for a complete overhaul, the greatest care must be taken on replacement to ensure accuracy of alignment. The appropriate procedure is as follows:-

See that the face of both the rear of the cylinder block and flywheel housing are perfectly clean and free from burrs.

Set the housing on to the studs and tighten, but not overtight so as to allow adjustment.

### Alignment of the Flywheel Housing Bore

Secure the base of a "dial" gauge to the flange of the crankshaft.

Set the needle of the gauge to the inside of the bored hole in the flywheel housing.

Turn the crankshaft and check that this is truly central. The housing is adjusted until it is central.

For convenience in turning the engine it is advisable to release (but not remove) the nut holding the atomisers in place.

The flywheel housing bore should be truly central with the crankshaft within the limits given in the table (total indicator reading).

### Alignment of the Flywheel Housing Face

With the face of the "dial gauge" still bolted to the crankshaft flange, adjust the "dial" so as to set the needle against the vertical machined face of the flywheel housing, and, again turning the crankshaft, check that this face is perpendicular to the crankshaft axis. When carrying out this check, the crankshaft should be pressed forward to take up end float.

This facing should be within the limits given in the table (total indicator reading) of being truly at right angles to the crankshaft axis.

All adjustments to bring the flywheel housing within the limits must be on the flywheel housing and under NO CONDITIONS must the rear of the cylinder block be interfered with.

When the housing is properly aligned to the above limits, tighten the securing nuts evenly.

Ream the dowel holes and fit the correct length and size dowels.

### Fitting Flywheel and Checking Alignment

With the flywheel and crankshaft flange perfectly clean and free from burrs and with two suitable guide studs fitted in the crankshaft flange, position the flywheel on the crankshaft.

Insert the setscrews complete with locking plates into the flywheel holes and tighten evenly.

Secure the base of the "dial" gauge to the flywheel housing. With the flywheel at top center, set the needle of the gauge on the periphery.

Turn the crankshaft and check the dial, the flywheel should run truly within 0.011 inch (0.30 mm) (total indicator reading).

With the base of the "dial" gauge still bolted to the flywheel housing, adjust the dial so as to set the needle against the vertical machined face of the flywheel.

Again turn the crankshaft and check the dial. The flywheel should be truly at right angles to the crankshaft axis within the limit of 0.001 inch (0.025 mm) per 0.9842 inch (25 mm) of flywheel radius from the crankshaft axis to the dial gauge plunger (total indicator reading).

When the flywheel has been checked for correct alignment, lock setscrews with locking plates. Finally grease the spigot ball race if fitted.

## LIMITS FOR FLYWHEEL /HOUSING ALIGNMENT

Housing Dia			
Upto 14.25 inch (362 mm)	....	...	0.0059 inch (0.15 mm)
Over 14.25 inch (362 mm) to 20.11 inch (511 mm)	....	...	0.0078 inch (0.20 mm)
Over 20.11 inch (511 mm) to 25.51 inch (648 mm)	....	...	0.0098 inch (0.25 mm)
Over 25.51 inch (648 mm) to 31.06 inch (789 mm)	....	...	0.011 inch (0.30 mm)

#### **4. REAR AXLE & FINAL DRIVE**

Type	...	Crown wheel and pinion (38 X 11) with differential lock and epicyclic at wheel end
Rear Track Adjustments	...	60.5 inch - 84.3 inch (1537 - 2140 mm) adjustable in steps of 4 inch (102 mm) - STD track - 60.5 inch (1537mm)

#### **5. STEERING**

Type	...	Hydrostatic, DANFOSS steering unit, Bosch hydraulic driven by engine timing case gears with separate reservoir
Location	...	Above clutch housing
Diameter of Steering Wheel	...	14.8 inch (378 mm)

#### **6a. FRONT AXLE – 2WD**

Type	...	Three piece, telescopic heavy duty straight front axle.
Front Track Adjustments	...	56 inch - 72 inch (1422 - 1830 mm), adjustable in steps of 4 inch(102 mm)

#### **6b. FRONT AXLE – 4WD**

Type	...	4WD front axle
Front Track Adjustments	...	56 inch - 60.4 inch (1424 mm -1534 mm), adjustable in steps of 4 inch (102 mm)

#### **7. BRAKES**

Type	...	Oil immersed brakes, wet multiple plate disc
Method of operation	...	Manual, foot operated, individual left-hand / right-hand or combined through pendant pedal operation
Parking Brake Type & Location	...	Mechanical, hand operated, mounted on the left-hand side fender
Method of Operation	...	By hand lever on left-hand side through cables, independent of foot brakes
Size of Liners and Liner Material	...	8.81 inch (224 mm) x 0.189 inch (4.82 mm) - 8 no's with paper based non-asbestos

#### **8. HYDRAULIC SYSTEM**

Pump	...	Mark III 4 cylinder scotch yoke piston pump with suction strainer
Auxiliary Hydraulic System	...	Integral with mark III pump(MF piggyback type)
Pump Capacity	...	5.15 gpm (19.5 lpm) @ 665 PTO rpm (2200 Erpm)(basic) 10.69 gpm (40.5 lpm) @ 665 PTO rpm (2200Erpm) (auxiliary) (First pump) 5.62 gpm (21.3 lpm) @ 665 PTO rpm (2200Erpm) ( auxiliary) (second pump)
Lower links	...	Cat I & II (combined ball), leveling of implement by adjustable lift rod on right-hand side
Lifting Capacity	...	2050 kgf - Horizontal Range 1850 kgf - Throughout Range

## 8B.2 GENERAL DESCRIPTION:

### Split-torque Clutch - 305 mm:

The split torque clutch differs from the dual clutch in that the drive to the Ferguson linkage pump and Power Take- Off (PTO) is taken from the clutch cover and is always engaged when the engine is running. The clutch is therefore fitted to tractors with Independent Power Take- Off (IPTO) which employs a separate hydraulic clutch to engage or disengage the PTO.

The drive to the gearbox and rear wheels is transmitted from either a 305 mm driven plate. The friction disc (10) is operated by the pressure plate (9) against the flywheel. Pressure plate movement is obtained by three release levers (5), pivoted on the clutch cover plate (13). Release lever movement operating against the Nine coil springs (12) moves the pressure plate (9) rearwards and releases the friction disc (10). The clutch release levers (5) are operated by a release bearing (15) which is moved by the clutch pedal.

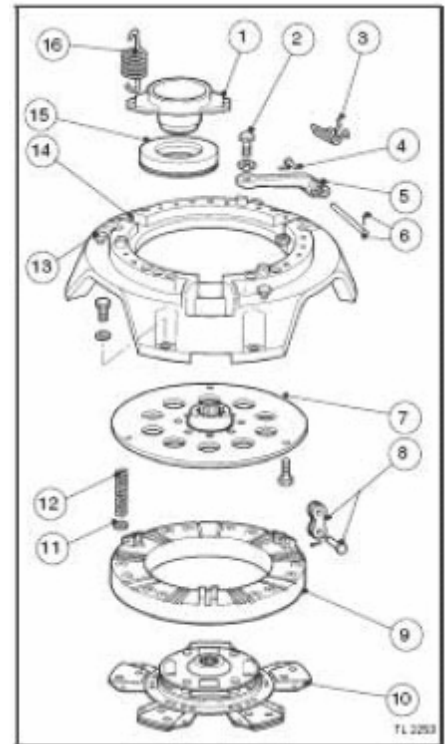


Fig 1

- |                   |                   |
|-------------------|-------------------|
| 1. Carrier        | 9. Pressure plate |
| 2. Screw          | 10. Friction disc |
| 3. Spring         | 11. Washer        |
| 4. Retaining clip | 12. Springs       |
| 5. Lever          | 13. Cover plate   |
| 6. Pin            | 14. Bolt          |
| 7. PTO plate      | 15. Bearing       |
| 8. Link           | 16. Spring        |

## 14B . 5 TRANSMISSION NEUTRAL START SWITCH

### Removal and refitment

#### Removal

1. 2600 tractors - Pull the cable and lift the hood
2. Disconnect the battery, removing the negative cable (-) first in the interest of safety.
3. Disconnect the two wires.
4. Unscrew the switch from the top of the gearbox.

#### Refitment

5. Reverse procedures 1 to 4.

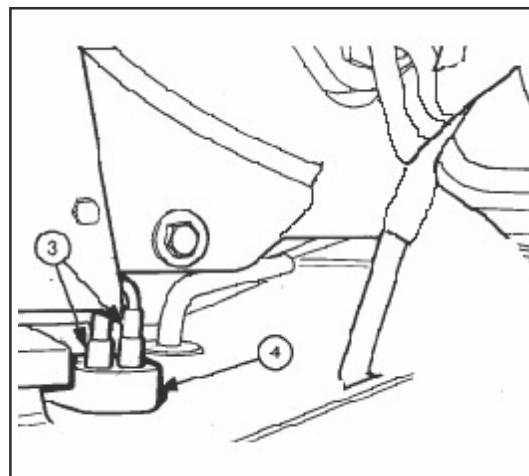


Fig 9

## 14B . 6 PTO NEUTRAL START SWITCH

### Removal and refitment

#### Removal

1. Disconnect the battery, removing the negative cable (-) first in the interest of safety.
2. Turn back the rubber boot.
3. Disconnect the two wires.
4. Unscrew the retaining nut.
5. Remove the switch.

#### Refitment

6. Reverse procedures 1 to 5.

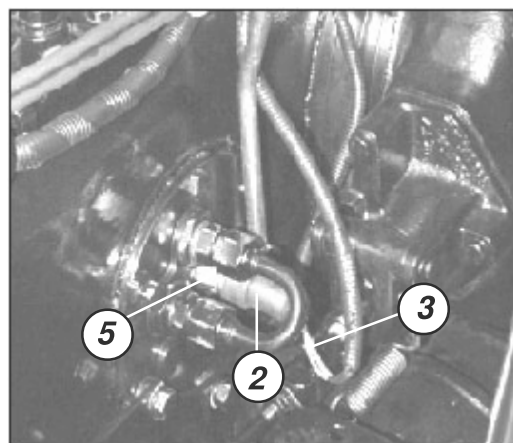
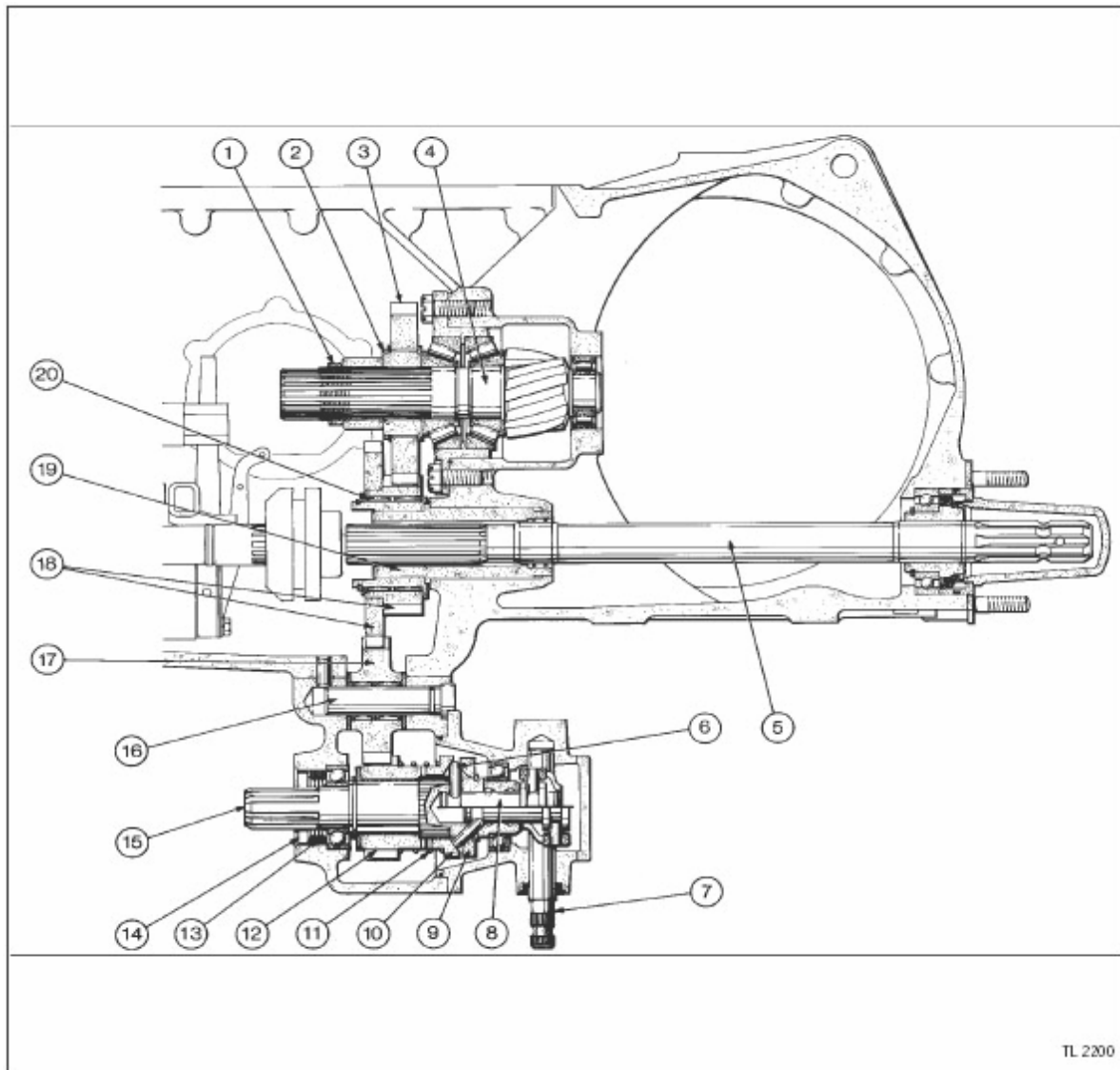


Fig 10



TL 2200

Fig 1

- |                     |                            |
|---------------------|----------------------------|
| 1. Retaining nut.   | 11. Retaining spring.      |
| 2. Drive gear hub.  | 12. Drive gear.            |
| 3. Drive gear.      | 13. Oil seal.              |
| 4. Pinion shaft.    | 14. Dirt seal.             |
| 5. PTO shaft.       | 15. Drive shaft.           |
| 6. Toggle pin.      | 16. Intermediate shaft.    |
| 7. Actuator shaft.  | 17. Intermediate gear.     |
| 8. Actuator piston. | 18. Idler gears.           |
| 9. Abutment ring    | 19. Support sleeve.        |
| 10. Clutch coupler. | 20. Needle roller bearing. |

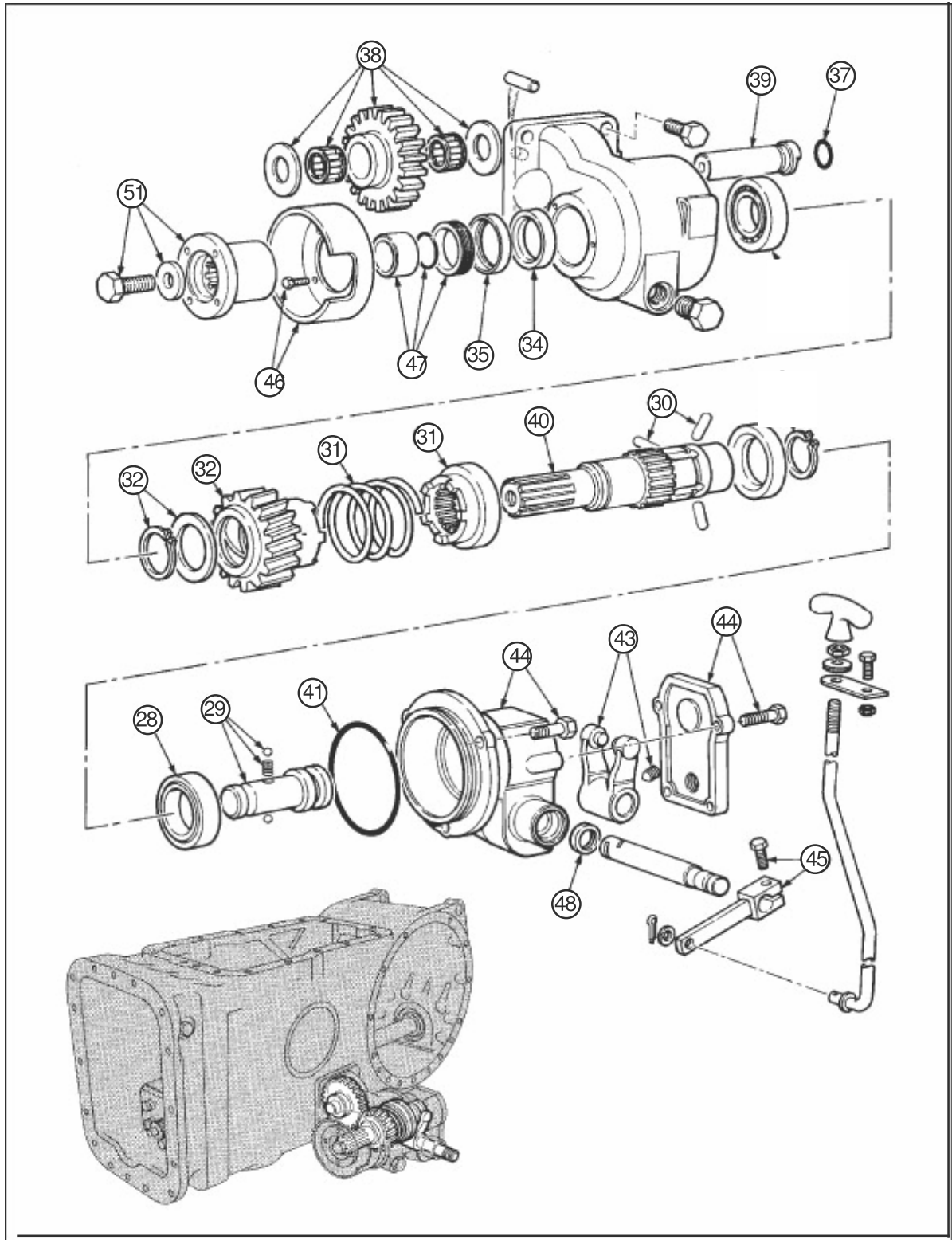


Fig 19

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL

- Thank you very much for reading the preview of the manual.
- You can download the complete manual from: [www.heydownloads.com](http://www.heydownloads.com) by clicking the link below



- Please note: If there is no response to CLICKING the link, please download this PDF first and then click on it.

CLICK HERE TO **DOWNLOAD** THE COMPLETE MANUAL