

Figure 39

Front View of Transmission Case

- | | |
|------------------------|------------------------|
| 1. Solenoid Connection | 5. Return Line |
| 2. Test Port Line | 6. Solenoid Connection |
| 3. Test Port Line | 7. Return Line |
| 4. Lock-Up Valve | 8. Solenoid Connection |

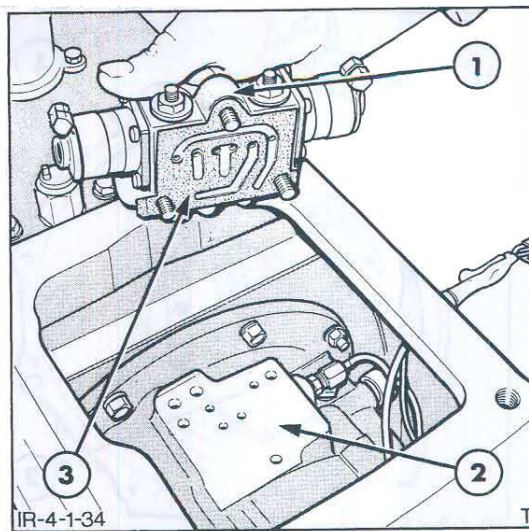


Figure 40

Solenoid Control Valve Removal

- | |
|------------------------------------|
| 1. Solenoid Control Valve Assembly |
| 2. Oil Distributor |
| 3. Gasket |

TRANSMISSION HYDRAULIC PUMP AND OIL DISTRIBUTOR HOUSING

1. Disconnect the oil cooler return pipe and elbow at the transmission case, Figure 39. Disconnect the return pipe at the oil distributor housing and remove the pipe from the transmission case.

2. Disconnect the pressure test port feed pipe and elbow at the transmission case. Disconnect the feed pipe at the oil distributor housing and remove the pipe from the transmission case, Figure 39.

3. Disconnect the wiring harness from the lock-up valve and the solenoid control valve and remove from the transmission case; note the colour and the position of the three connectors.

4. Remove the solenoid control valve securing bolts and remove the solenoid control valve from the distributor housing, Figure 40.

Refer to Section F for the disassembly of the solenoid control valve assembly.

5. Remove the distributor housing retaining bolts. Obtain two M8 jacking bolts, approximately 30 mm (1.25 in.) long. Screw the bolts into the housing as shown in Figure 41, then continue to tighten until the distributor housing is freed from the transmission case. Lift the housing from the transmission and remove the jacking bolts.

NOTE: The distributor housing is heavy, care should be exercised when removing the housing from the transmission case.

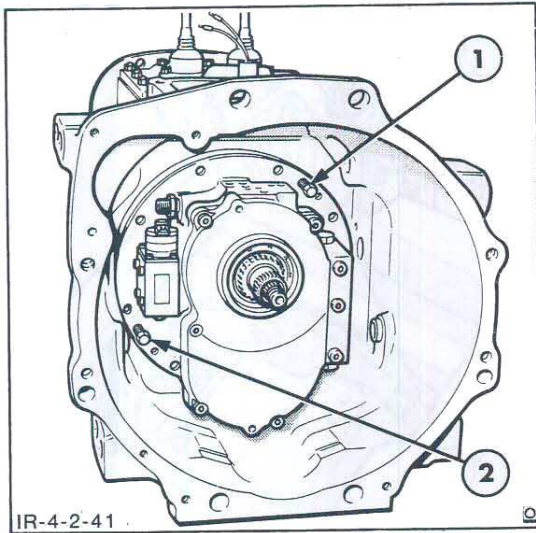


Figure 41
Distributor Housing Removal

1. Upper Jacking Bolt
2. Lower Jacking Bolt

Refer to Section F for disassembly of the distributor housing and hydraulic pump.

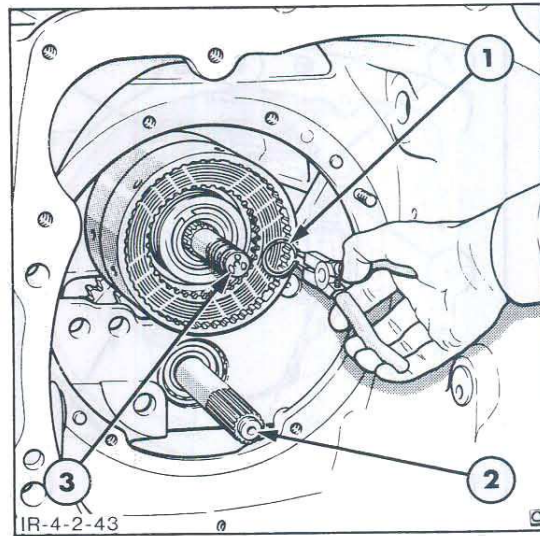


Figure 43
Clutch Housing Removal

1. Clutch Housing Snap Ring
2. P.T.O. Shaft
3. Rear Input Shaft

FRONT INPUT SHAFT AND CLUTCH HOUSING

1. Remove the front input shaft and bearing assembly from the clutch housing by removing the snap ring, Figure 42.

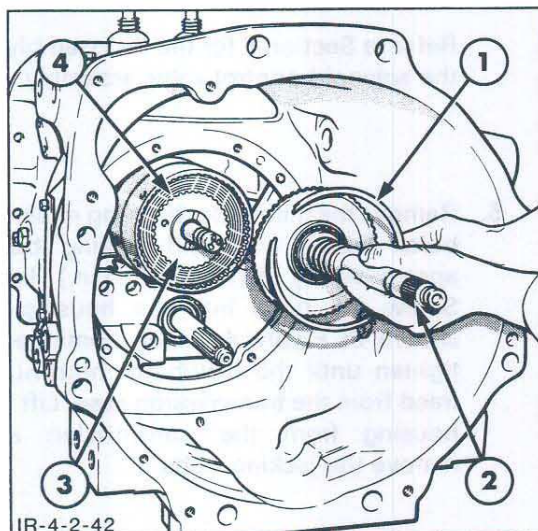


Figure 42
Front Input Shaft Removal

1. Snap Ring
2. Front Input Shaft
3. Forward Clutch Hub
4. Forward Clutch Plates

2. Pull the forward clutch hub, along with the thrust washer, from the rear input shaft, Figure 42, then remove the forward clutch plates.

The clutches have five steel and five graphite bronze plates. All the plates are "flat". The friction plates are available in thicknesses of 0.090 in. (2.30 mm), 0.096 in. (2.44 mm) and 0.10 in. (2.60 mm).

3. Remove the snap ring, Figure 43, then pull the clutch housing from the rear input shaft.

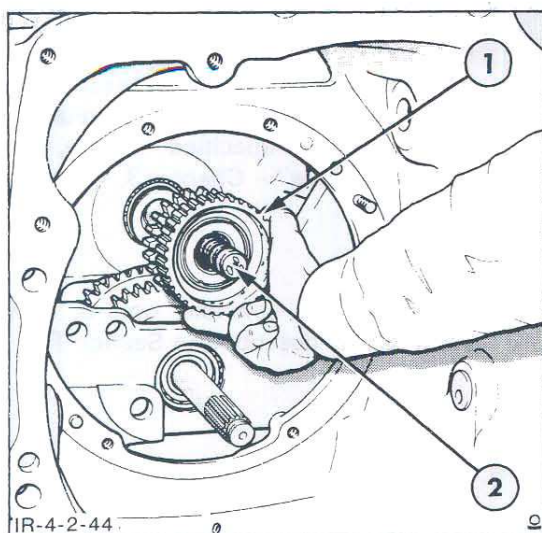


Figure 44
Reverse Idler Input Gear Removal

1. Reverse Idler Input Gear (Rear Clutch Hub)
2. Rear Input Shaft

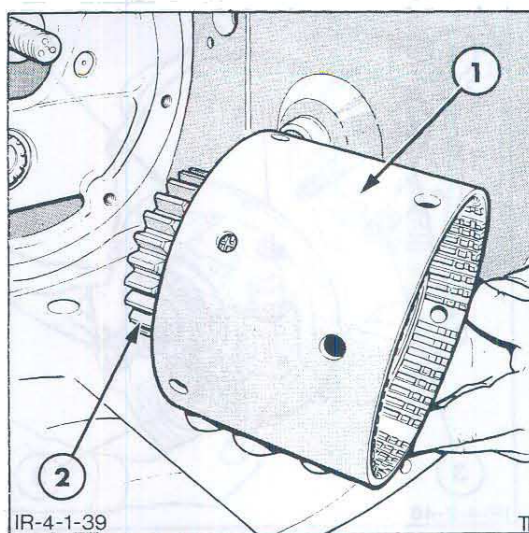


Figure 45
Clutch Housing Installation

1. Clutch Housing
2. Reverse Idler Input Gear

4. Remove the reverse idler input gear, thrust washer, needle bearings and shims from the rear input shaft, Figure 44, if not removed with the clutch housing.

5. Refer to Section F for disassembly of the rear clutch.

3. Retain the clutch on the shaft by installing the appropriate snap ring, Figure 43.

4. Place the clutch hub and thrust washer, Figure 42, on the rear input shaft, then install the ten clutch plates, one by one, starting with a steel plate then a bronze plate.

5. Coat the sealing rings on the front of the rear input shaft with petroleum jelly to hold them in position. Then, carefully install the front input shaft, Figure 42. Secure the shaft to the clutch housing with the snap ring.

ASSEMBLY

FRONT INPUT SHAFT AND CLUTCH HOUSING

1. Assemble the rear clutch as described in Section F.
2. Install the partially assembled clutch housing, Figure 45, over the rear input shaft while exercising care to prevent damaging the roller bearings. Make sure the spacer, shim and thrust washer are installed on the rear input shaft.

IMPORTANT: Do not force the front input shaft over the rear input shaft, Figure 42. If difficulty is encountered, one of the sealing rings could have dropped out of position. If necessary, remove the front input shaft and reposition the sealing rings.

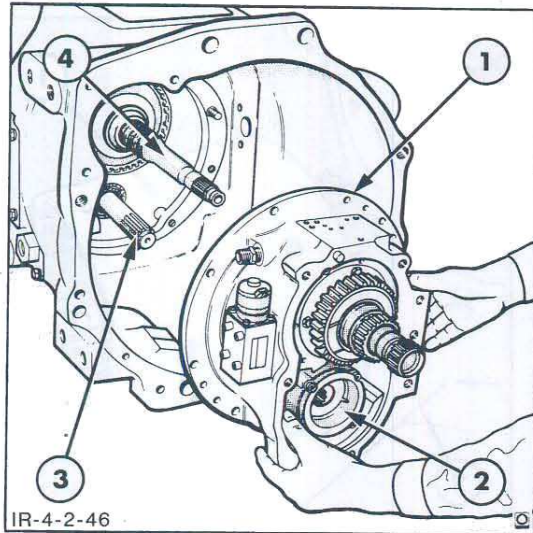


Figure 46
Oil Distributor Housing Installation

- | | |
|--------------------|----------------------|
| 1. Oil Distributor | 3. P.T.O. Shaft |
| 2. Hydraulic Pump | 4. Front Input Shaft |

TRANSMISSION HYDRAULIC PUMP AND OIL DISTRIBUTOR HOUSING

- Assemble the oil distributor as described in Section F.
- Apply gasket sealant, see "Specifications" – Chapter 3, to the portion of the new gasket between the lower two bolt holes, then install the gasket to the transmission casing.
- Install the oil distributor housing onto the transmission casing, Figure 41, and secure with the retaining bolts. Exercise care when installing the oil distributor to prevent the sealing rings on the front input shaft from being damaged or dislodged. If the P.T.O. shaft splines do not align with the hydraulic pump inner rotor turn the shaft at the rear axle to align them. Tighten the retaining bolts to the specified torque, see "Specifications" – Chapter 3.
- Install a new gasket to the distributor housing front cover then install the housing front cover plate and secure with the retaining bolts. Tighten the retaining bolts to the specified torque, see "Specifications" – Chapter 3.
- Assemble the solenoid control valve assembly as described in Section F.
- Install a new solenoid control valve gasket to the distributor housing. Install the solenoid control valve onto the oil distributor housing and secure with the retaining bolts. Tighten the retaining bolts to the specified torque, see "Specifications" – Chapter 3.
- Prior to installing the oil cooler return and the pressure test port feed elbows apply thread sealant to the threads, see "Specifications" – Chapter 3. Install the elbows to the transmission casing.
- Install the pressure test feed port pipe and tighten to the specified torque, see "Specifications" – Chapter 3.
- Install the oil cooler return pipe and tighten to the specified torque, see "Specifications" – Chapter 3.
- Thread the wiring harness through the transmission casing and connect to the solenoid control valve and lock-up valve. Ensure that the connectors are matched to the connectors on the control valve, i.e. grey-to-grey and black-to-black. Secure the harness with the clip installed to the top distributor housing bolt.

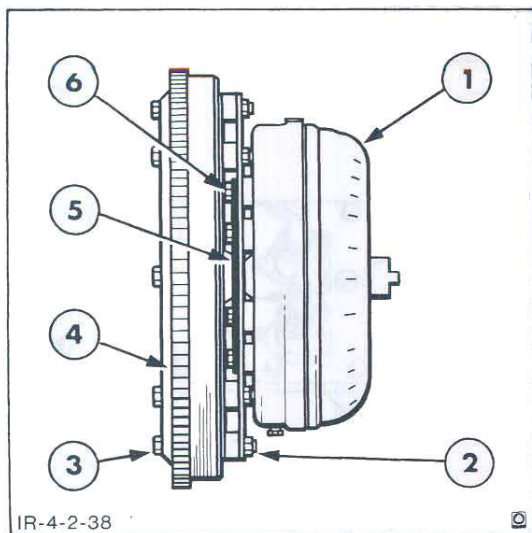


Figure 47
Torque Converter to Flywheel Assembly

1. Torque Converter Assembly
2. Drive Plate Assembly
3. Flywheel to Drive Plate Bolts
4. Flywheel
5. Reinforcing Plate
6. Drive Plate to Torque Converter Bolts

TORQUE CONVERTER

1. Secure the drive plate to the torque converter, Figure 47, with the six attaching bolts and flat washers. Tighten the bolts to the specified torque, see "Specifications" – Chapter 3.
2. Install the torque converter drain plug, if not previously installed, then push the assembled converter over the stator support. Exercise care to prevent damaging the oil seal on the front input shaft. Rotate the converter so the splines on the hub engage with the splines on the front input shaft.

CONNECTING THE TRANSMISSION TO THE ENGINE

1. Carefully move the engine towards the transmission making sure the converter pilot hub is aligned with the pilot of the torque converter.

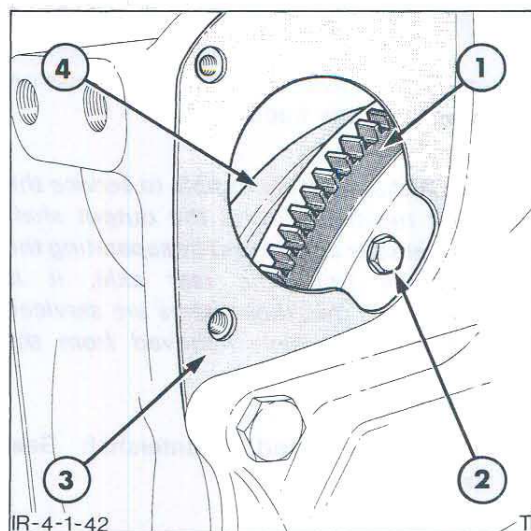


Figure 48
Starting Motor Aperture

1. Flywheel
 2. Flywheel to Drive Plate Bolts
 3. Engine Backplate
 4. Torque Converter
2. Install the transmission to engine attaching bolts and washers.
 3. Rotate the flywheel until the eight holes in the drive plate, align with the holes in the flywheel.
 4. Working through the starting motor aperture, Figure 48, install the attaching bolts and washers finger tight. Rotate the flywheel as required until all eight bolts and washers are installed.
 5. Rotate the flywheel approximately two full turns to centre the drive plate, then tighten the eight drive plate attaching bolts to the specified torque, see "Specifications" – Chapter 3.
 6. Complete the connection as described in Part 10 "Separating the Unit".

E. COMPLETE OVERHAUL

Assemblies serviced with transmission removed from the tractor.

NOTE: Although it is possible to service the gearshift mechanism and the output shaft bearing retainer and oil seal by separating the transmission from the rear axle, it is recommended that these items are serviced with the transmission removed from the tractor.

- Output Shaft and Countershaft Gear Assemblies
- P.T.O. Shaft
- Countershaft Pre-Load
- Rear Cover
- Output Shaft Pre-Load
- Gearshift Components

SEPARATING THE TRANSMISSION FROM THE ENGINE AND REAR AXLE

1. Separate the transmission from the engine and rear axle, as described in PART 10, "Separating the Unit".

COMPONENT REMOVAL

1. Remove the transmission hydraulic pump and oil distributor as described in Section D.
2. Remove the front input shaft and clutch housing as described in Section D.

GEARSHIFT COMPONENTS

1. Remove the dipstick from the gearshift cover plate.

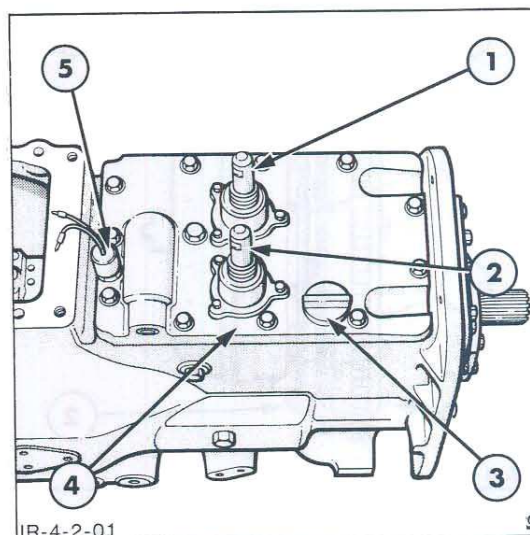


Figure 49
Transmission Top Cover

1. Gearshift Lever Spigot
2. Range Lever Spigot
3. Oil Filler and Dipstick
4. Top Cover
5. Safety Start Switch

2. Ensure the gearshift lever and range lever are in neutral. Remove the cover plate retaining bolts then remove the cover plate and gasket, Figure 49.

3. Remove the detents, springs and balls from the bores in the top of the transmission case, Figure 51. If the balls will not lift out with a magnet, the balls may be removed after the shift rails have been removed from the transmission case.

4. Using a suitable pin punch, remove the spring pins retaining the 1st/2nd gearshift gate and the gearshift selector arm, Figure 50.

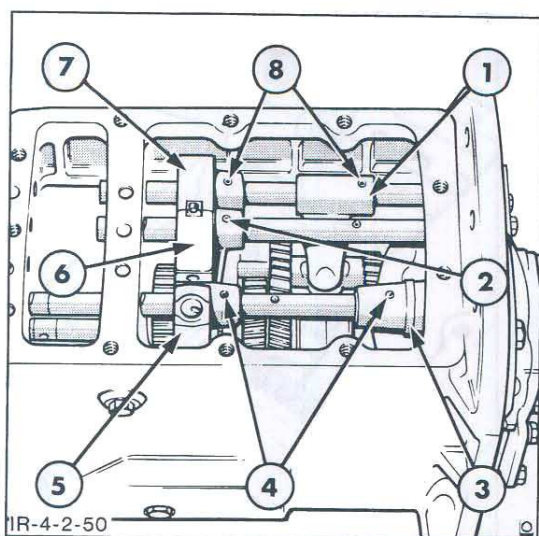


Figure 50
Gearshift Component Removal

1. 1st-2nd Shift Selector Arm
2. 3rd-4th Shift Fork and Roll Pin
3. H-L Shift Fork
4. H-L Shift Rail Roll Pins
5. H-L Shift Rail Gate
6. 3rd-4th Shift Rail Gate
7. 1st-2nd Shift Rail Gate
8. 1st-2nd Shift Rail Roll Pins

5. Remove the gearshift rail plugs from the rear end of the transmission case, then extract the gearshift rail rearwards, retrieving the gearshift gate and selector arm as the rail is removed from the transmission case. If the detent ball was not previously removed, exercise care to prevent the ball from falling into the transmission.

6. Using a suitable pin punch remove the spring pins retaining the 3rd/4th gearshift gate and gearshift fork, Figure 50.

7. Extract the gearshift rail by sliding the rail rearwards retrieving the gearshift gate and fork as the rail is removed from the transmission case.

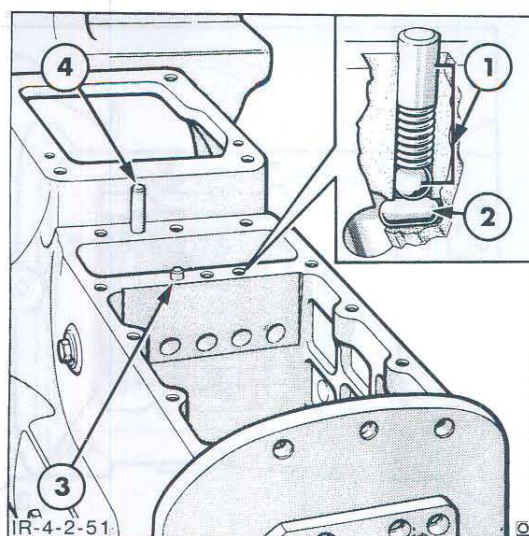


Figure 51
Gearshift Detents and Plungers

1. 1st-2nd Shift Rail Detent
2. Interlock Detent
3. 3rd-4th Shift Rail Detent
4. Safety Start Switch Plunger

8. Using a suitable pin punch remove the spring pins retaining the H-L gearshift gate and gearshift fork, Figure 50.

9. Extract the gearshift rail by sliding the rail rearwards retrieving the gearshift gate and fork as the rail is removed from the transmission case.

10. If necessary remove the interlock detent plug from the left-hand side of the transmission case and extract the interlock detent, Figure 51, which is positioned between the 1st/2nd and 3rd/4th gearshift rails.

11. Remove the 1st/2nd lower shift rail locating bolt and extract the rail from the rear of the transmission. Exercise care to prevent the detent ball in the fork from falling into the transmission.

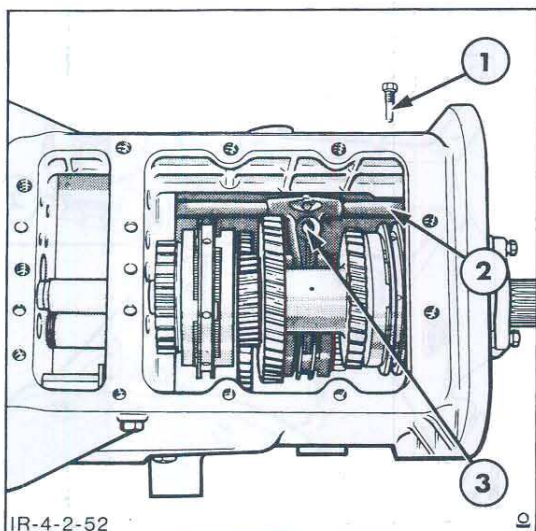


Figure 52
1st-2nd Lower Shift Rail Removal

1. Locating Bolt
2. Lower Shift Rail
3. Shift Fork

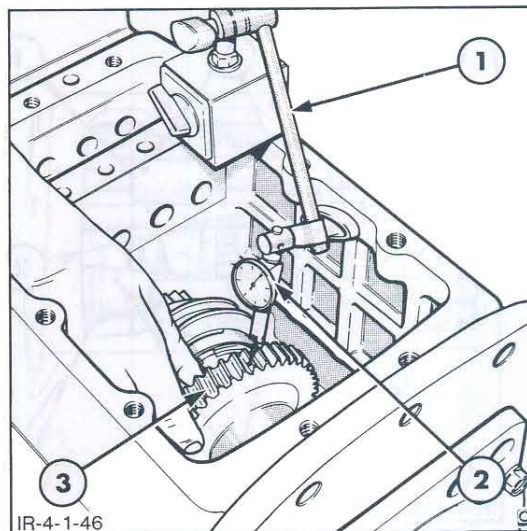


Figure 53
Gear Backlash Check

1. Gear Backlash Bracketry
2. Dial Indicator
3. Stylus

REAR COVER PLATE

1. If transmission gear wear is suspected then prior to removing the rear cover and output shaft bearing retainer check the gear backlash. Position a dial indicator gauge on the transmission casing as shown in Figure 53 and measure the backlash on output shaft gears.

2. Using a suitable pair of snap ring pliers remove the internal snap ring retaining the P.T.O. shaft bearing, Figure 54. Withdraw the P.T.O. shaft and bearing as an assembly from the rear cover plate.

4. Remove the rear cover retaining bolts then screw two jacking bolts into the rear cover as shown in Figure 55. Tighten the two jacking bolts equally until the rear

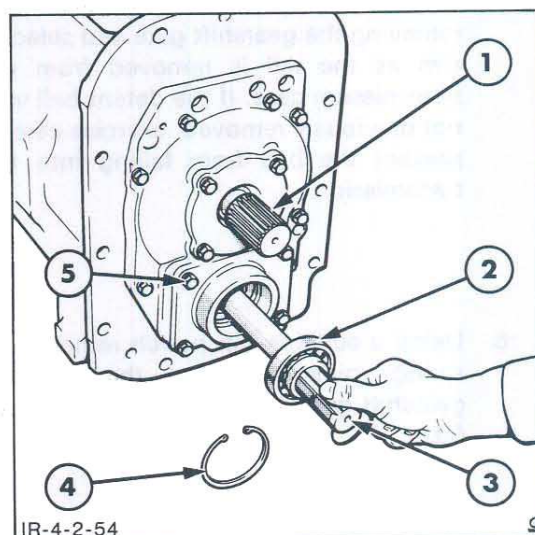


Figure 54
P.T.O. Shaft Removal

3. Prior to removing the rear cover and output shaft bearing retainer tie the output shaft and countershaft together with a suitable length of cord.

1. Output Shaft
2. Bearing
3. P.T.O. Shaft
4. Snap Ring
5. Bearing Cap

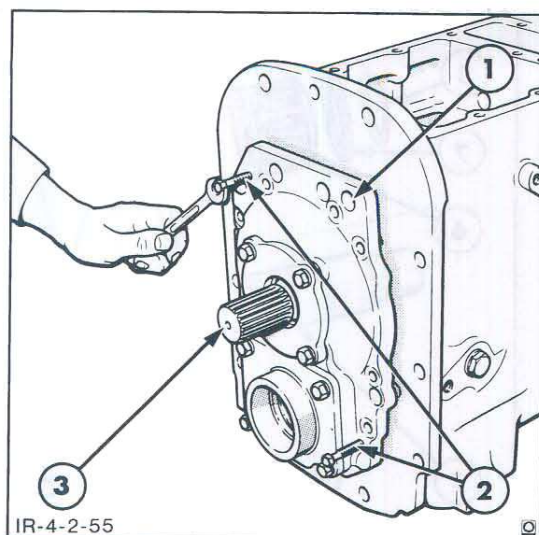


Figure 55
Rear Cover Plate Removal

1. Rear Cover
2. Jacking Bolts
3. Output Shaft

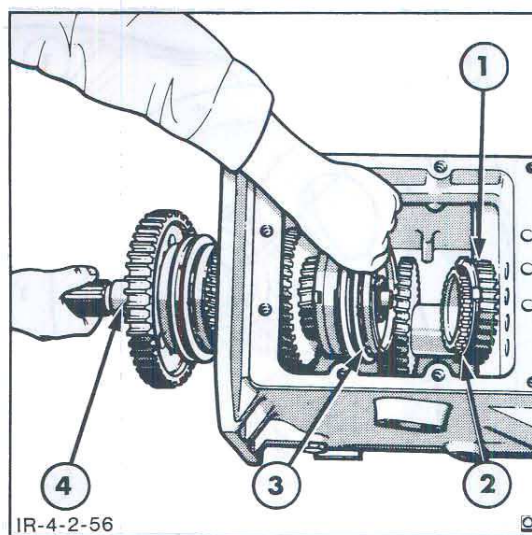


Figure 56
Output Shaft Removal

1. Rear Input Shaft
2. Retainer
3. Synchroniser Assembly
4. Output Shaft

cover is free of the transmission case. Remove the two jacking bolts and remove the rear cover assembly.

3. Remove the rear input shaft assembly from the transmission case through the gearshift cover plate aperture.

4. Lift the countershaft assembly Figure 57 and remove from the rear end of the transmission case.

OUTPUT SHAFT AND COUNTER-SHAFT GEAR ASSEMBLIES

1. Release the cord retaining the output shaft and countershaft assemblies together then lift the output shaft assembly rearwards from the transmission case as shown in Figure 56.

NOTE: Exercise care when removing the output shaft assembly. Hold the inner cone of the synchroniser to prevent the pins of the synchroniser assembly from falling into the transmission housing.

2. Remove the retainer from the rear input shaft and place with the output shaft assembly.

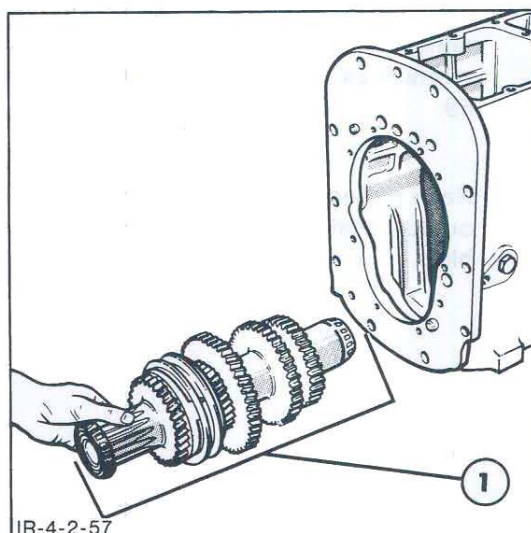


Figure 57
Countershaft Removal

1. Countershaft Assembly

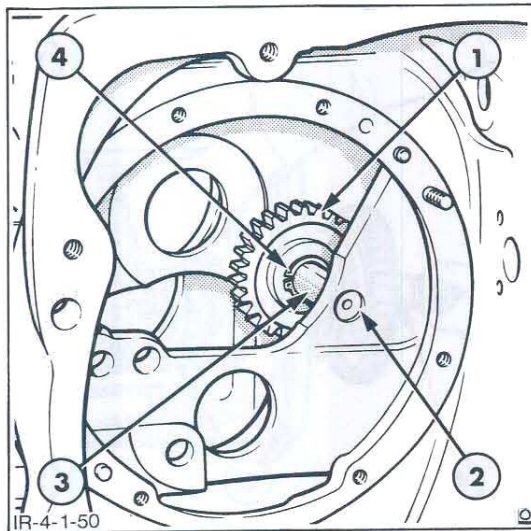


Figure 58
Reverse Gear Idler Removal

- | | |
|-----------------|--------------|
| 1. Gear | 3. Shaft |
| 2. Shaft Spigot | 4. Snap Ring |

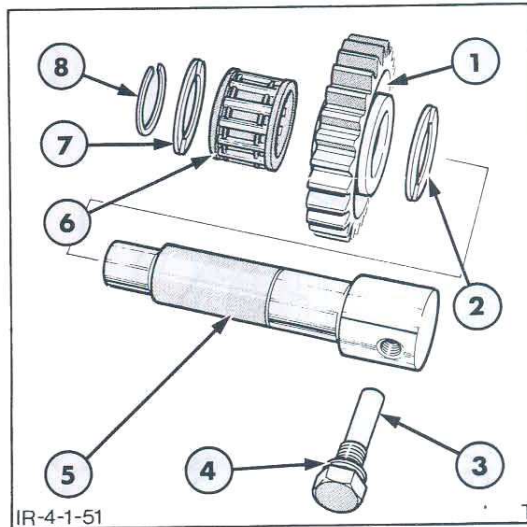


Figure 59
Reverse Gear Idler Components

- | | |
|------------------------|-------------------|
| 1. Gear | 5. Shaft |
| 2. Thrust Washer | 6. Roller Bearing |
| 3. Shaft Locating Bolt | 7. Thrust Washer |
| 4. Seal | 8. Snap Ring |

5. Remove the reverse gear idler shaft retaining bolt from the left-hand side of the transmission case.
6. Remove the snap ring from reverse gear idler shaft, Figure 58, and slide the shaft rearwards from the transmission case retrieving the gear, bearing and thrust washers as the shaft is removed, Figure 59.
7. Refer to Section F for disassembly of the output shaft and countershaft assemblies.

- Taper roller bearings.
- Countershaft.
- Thrust washers.

The pre-load is checked with all components removed from the transmission case except the countershaft. To determine the shims required to give the specified pre-load, see "Specifications" – Chapter 3, proceed as follows:

2. Assemble the countershaft and gear assembly as described in Section F.

INSTALLATION

COUNTERSHAFT PRE-LOAD CHECK

1. If any of the following parts have been renewed then it will be necessary to check the countershaft pre-load.

3. Install the assembled countershaft and gear assembly through the rear of the transmission case and position in such a way that the rear bearing just protrudes from the rear of the case.

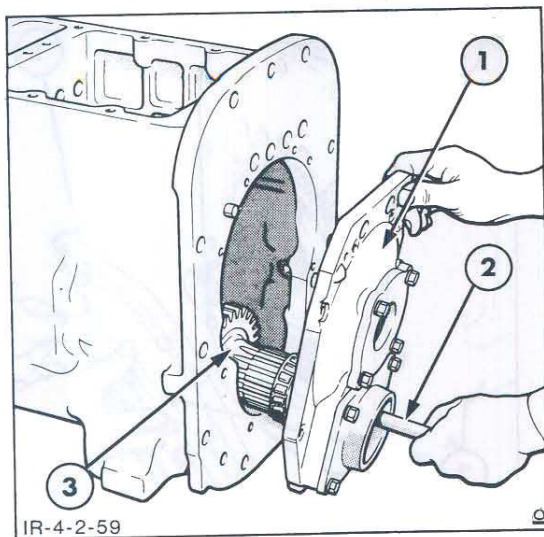


Figure 60
Countershaft Installation

1. Rear Cover
2. Rod
3. Point to Wrap Cord

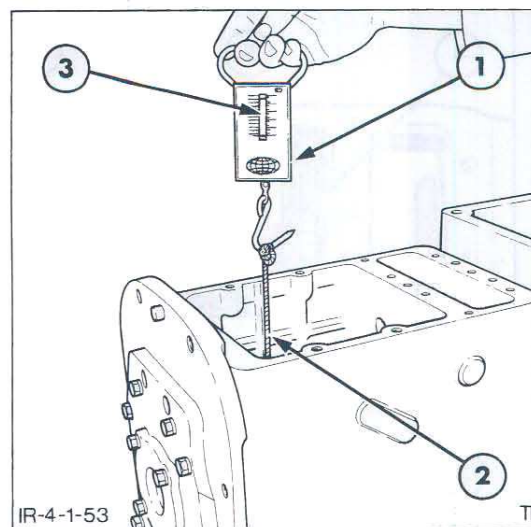


Figure 61
Countershaft Pre-Load Check

1. Pull Scale
2. Cord
3. Scale

4. Ensure the countershaft bearing cap attaching bolts are tightened to the specified torque, see "Specifications" – Chapter 3.
5. Insert a suitable rod through the bearing cap hole and into the countershaft assembly, Figure 60.
6. Position the rear cover to the transmission case while lifting the countershaft with the rod.
7. Secure the rear cover to the transmission case and tighten the retaining bolts to the specified torque, see "Specifications" – Chapter 3.
8. Rotate the countershaft assembly until the bearings run smoothly.
9. Using a suitable length of cord and a pull scale as shown in Figure 61, wrap the cord around the countershaft just ahead of the helical gear, Figure 60. Ensure that the cord does not overlap.
10. If the pull required to rotate the countershaft is outside the specified limits, see "Specifications" – Chapter 3, remove the rear cover and bearing cap and add or delete shims as required and repeat the procedure.
11. When the pre-load check is complete remove the rear cover.

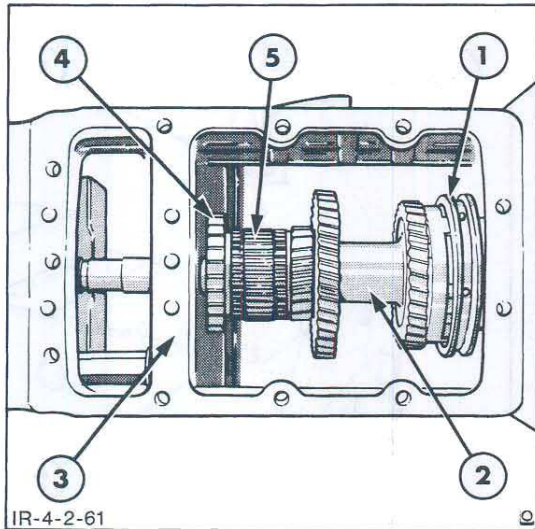


Figure 62
Rear Input Shaft Installation

1. H-L Synchroniser Assembly
2. Output Shaft
3. Transmission Case Inner Wall
4. Rear Input Shaft
5. 3rd-4th Gear Splined Hub

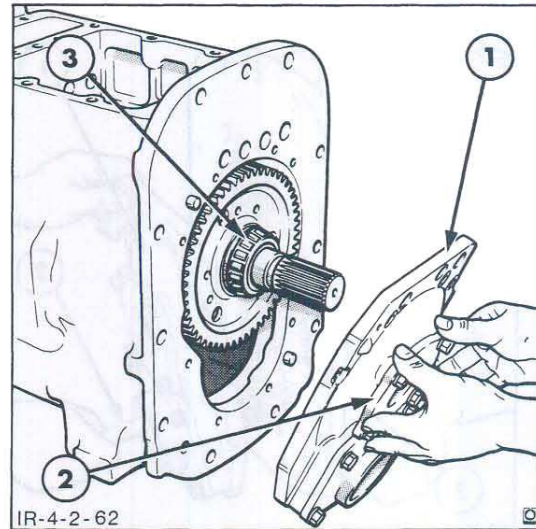


Figure 63
Output Shaft Installation

1. Rear Cover
2. Output Shaft Rear Bearing Cap
3. Output Shaft Bearing

OUTPUT SHAFT PRE-LOAD CHECK

1. The pre-load on output shaft must be checked if any of the following components have been renewed.

- Taper roller bearings.
- Output shaft.
- Thrust washers.
- Rear input shaft.

The pre-load must be checked with all components removed from the transmission case except for the output shaft and rear input shaft. It will be necessary, therefore, to remove the countershaft if previously installed.

It is also necessary to remove the 3rd/4th synchroniser assembly from the output shaft, prior to installing the output shaft into the transmission, for the pre-load check.

2. Assemble the output shaft and gear assembly as described in Section F.

3. Install the rear input shaft into the transmission case and rest across the transmission case inner wall, Figure 62.

4. Install the output shaft into the transmission case from the rear end and mate up with the rear input shaft. Temporarily support the output shaft as shown in Figure 63.

5. Ensure that the output shaft bearing cap retaining bolts are tightened to the specified torque, see "Specifications" – Chapter 3.

6. Install the rear cover plate to the transmission case. Install and tighten the cover retaining bolts to the specified torque, see "Specifications" – Chapter 3.

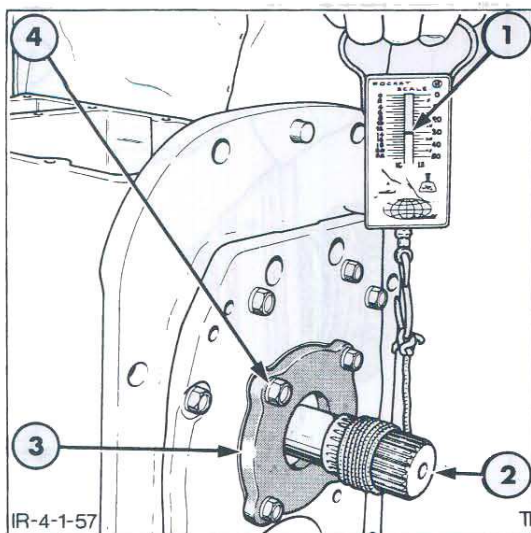


Figure 64
Output Shaft Pre-Load Check

1. Scale
2. Output Shaft
3. Bearing Cap
4. Retaining Bolts

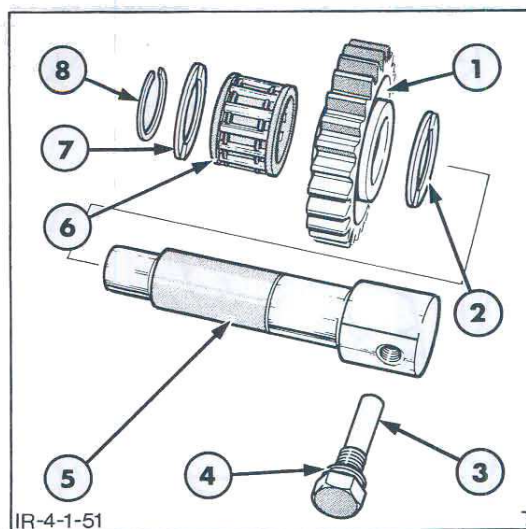


Figure 65
Reverse Gear Idler Components

- | | |
|------------------------|-------------------|
| 1. Gear | 5. Shaft |
| 2. Thrust Washer | 6. Roller Bearing |
| 3. Shaft Locating Bolt | 7. Thrust Washer |
| 4. Seal | 8. Snap Ring |

7. Rotate the output shaft several times to ensure the bearings are seated correctly.

8. Wrap a suitable length of cord around the output shaft splines, Figure 64. Ensure that the cord does not overlap. Attach a pull scale to the cord and measure the pull required to rotate the output shaft.

9. If the pull required to rotate the output shaft is outside the specified limits, see "Specifications" – Chapter 3, remove the rear bearing cap and cover assembly. Add or delete shims as required and repeat the pre-load procedure.

10. When the pre-load check is correct remove the rear cover assembly, the output shaft assembly and the rear input shaft from the transmission case.

OUTPUT SHAFT, COUNTERSHAFT AND REAR COVER ASSEMBLIES

1. Install the reverse gear idler shaft into the transmission casing and assemble the component parts for the assembly in the following sequence with reference to Figures 65 and 66.

- Thrust washer.
- Reverse idler gear and needle bearing.
- Thrust washer.
- Collar
- Snap Ring.

NOTE: Ensure that the thrust washers are installed with the oil grooves facing the reverse idler gear.

2. Install the reverse idler shaft retaining bolt into the transmission case ensuring the bolt aligns with the shaft. Tighten the bolt to the specified torque, see "Specifications" – Chapter 3.

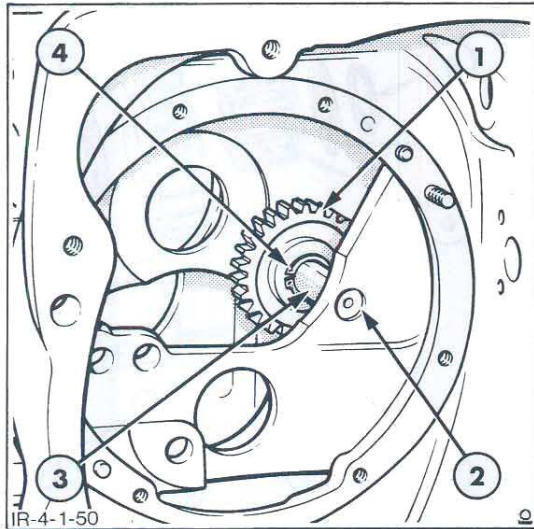


Figure 66
Reverse Gear Idler Installation

1. Gear
2. Shaft Spigot
3. Shaft
4. Snap Ring

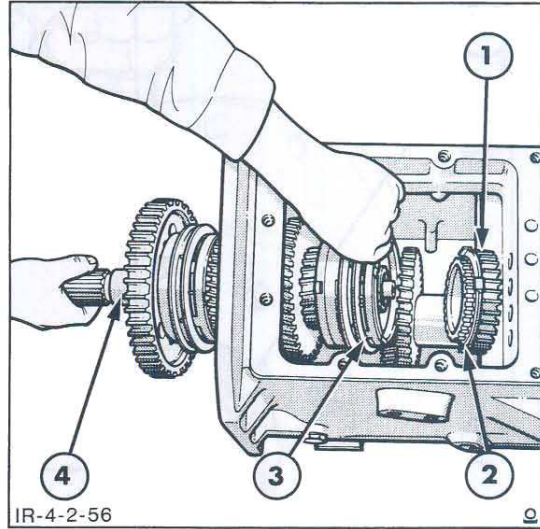


Figure 68
Output Shaft Installation

1. Rear Input Shaft
2. Retainer
3. 3rd/4th Synchroniser Assembly
4. Output Shaft

3. Install the countershaft and gear assembly into the transmission case from the rear end so that the front end taper roller bearing rests in the bearing cup.

4. Fabricate a detent ball retainer as outlined in "Special Tools" – Chapter 3.

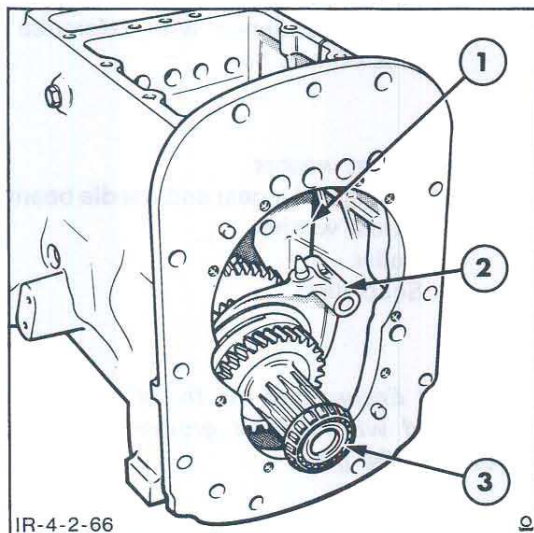


Figure 67
Countershaft Installation

1. Brazing Rod
2. 1st-2nd Shift Rail Fork
3. Countershaft Rear Bearing

5. Install the detent spring and ball into the 1st-2nd shift rail fork and retain in position using the detent retainer.

6. Position the shift rail fork onto the 1st-2nd synchroniser assembly and using a suitable length of brazing rod support the fork so that it is positioned approximately 2cm away from the transmission housing as shown in Figure 67.

7. Install the 3rd gear synchroniser cone retainer to the rear input shaft, Figure 68.

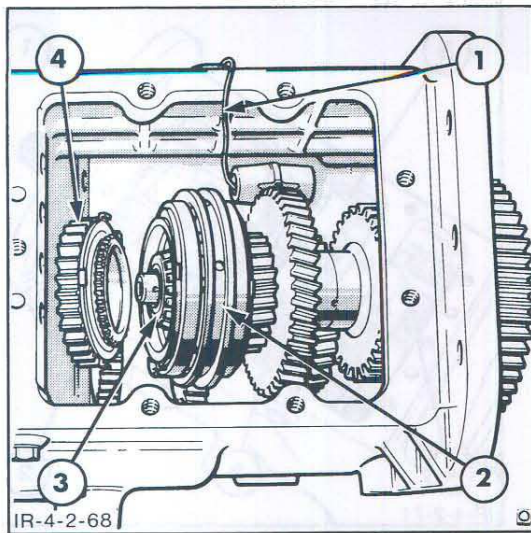


Figure 69
Output Shaft Installed

1. Brazing Rod
2. 3rd-4th Synchroniser
3. Output Shaft Front Bearing
4. Rear Input Shaft and Retainer

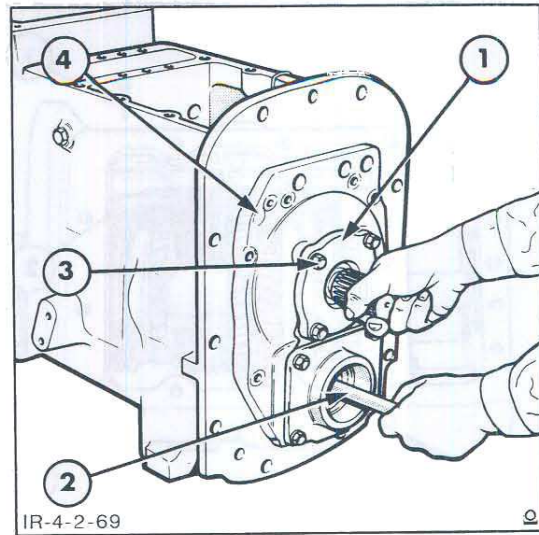


Figure 70
Rear Cover Plate Installation

1. Output Shaft Bearing Cap
2. Suitable Rod
3. Countershaft Bearing Cap
4. Rear Cover Plate

8. Install the rear input shaft and the retainer into the transmission case and rest across the transmission case inner wall.

9. Install the output shaft and gear assembly into the transmission case from the rear end, while holding the front end of the synchroniser assembly to prevent the cones and pins dropping out, Figure 67, and position onto the countershaft and gear assembly just behind the rear input shaft, Figure 69.

10. Engage the rear input shaft with the output shaft and gear assembly, then engage with the countershaft and gear assembly so that the taper roller bearings rest in the respective bearing cups.

NOTE: Ensure that the synchroniser retainer positioned on the rear input shaft is aligned with the synchroniser ring on the output shaft, and that both parts mesh correctly.

11. Apply gasket sealant to the rear cover face, see "Specifications" – Chapter 3 for the specified sealant, then position the cover over the output shaft until the output shaft taper roller bearing contacts the respective bearing cap.

12. Insert a suitable rod through the countershaft bearing cap hole into the countershaft, Figure 70. Lift the countershaft while positioning the rear cover plate onto the transmission case, Figure 70.

13. Secure the rear cover plate assembly to the transmission case with the retaining bolts. Tighten the retaining bolts to the specified torque, see "Specifications" – Chapter 3.

14. Rotate the gear train to ensure all gears turn smoothly.

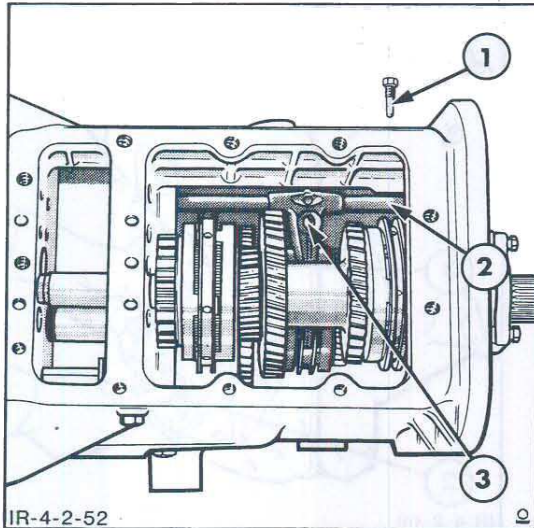


Figure 71
1st/2nd Lower Shift Rail Installation

1. Locating Bolt
2. Lower Shift Rail
3. Shift Fork

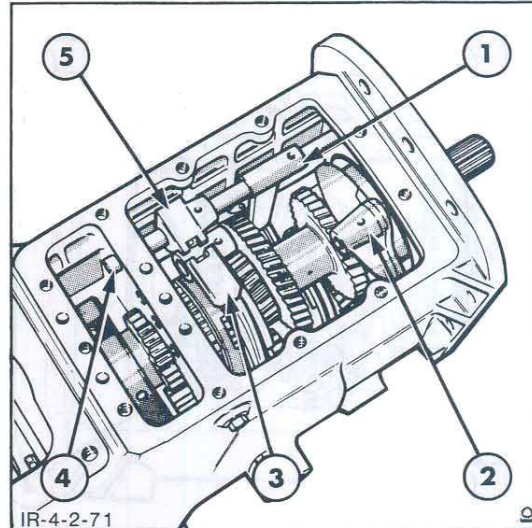


Figure 72
1st/2nd Gearshift Rail Installation

1. 1st/2nd Selector Arm
2. H/L Shift Fork
3. 3rd/4th Shift Fork
4. 1st/2nd Shift Rail
5. 1st/2nd Rail Gate

GEARSHIFT COMPONENTS

1. Install the 1st/2nd lower shift rail through the rear cover and engage with the shift fork. Drive the rail through the fork and retrieve the detent ball retainer from the opposite side of the fork.

2. Install the lower shift rail locating bolt, Figure 71. Remove the brazing rod used to support the fork from the transmission. Tighten the locating bolt to the specified torque, see "Specifications" – Chapter 3.

3. Install the 3rd/4th and H/L gearshift forks into the respective synchroniser assemblies, Figure 72.

4. Install the 1st/2nd shift rail selector arm into the shift fork.

5. Insert the 1st/2nd gearshift rail into the transmission case from the rear end of the transmission. Slide the rail through the 1st/2nd selector arm then install the 1st/2nd gearshift gate onto the rail. Continue sliding the rail until it is in approximately the neutral position, Figure 72.

6. Install the interlock detent into the drilling between the 1st/2nd and 3rd/4th gearshift rail bores of the transmission inner wall, Figure 73.

7. Insert the 3rd/4th gearshift rail into the transmission case from the rear end of the transmission. Slide the rail through the 3rd/4th gearshift forks, then install the 3rd/4th gearshift gate onto the rail. Continue sliding the rail until it is in approximately the neutral position.

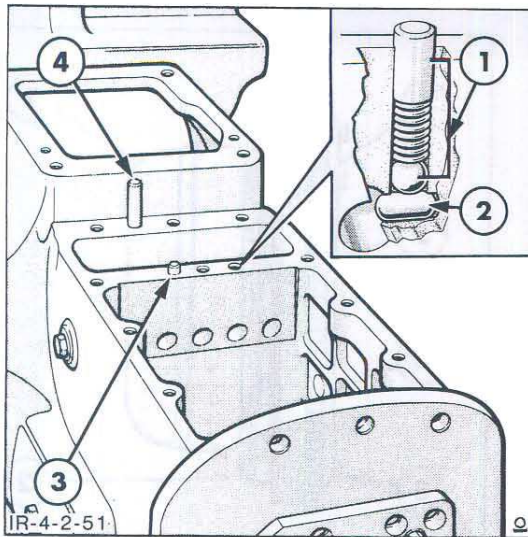


Figure 73
Gearshift Detents and Plungers

1. 1st/2nd Shift Rail Detent
2. Interlock Detent
3. 3rd/4th Shift Rail Detent
4. Safety Start Switch Plunger

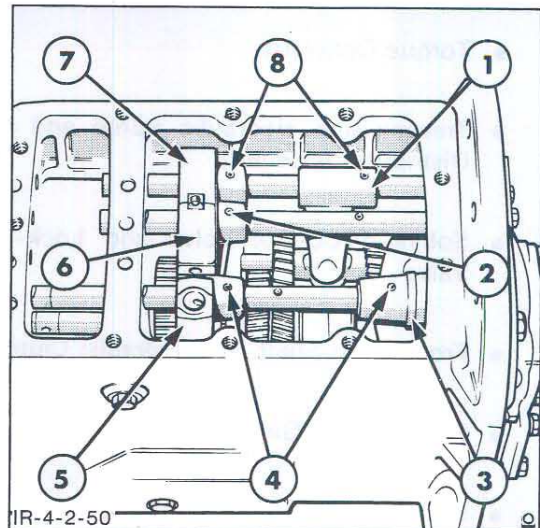


Figure 74
Gearshift Component Installation

1. 1st-2nd Shift Selector Arm
2. 3rd-4th Shift Fork and Roll Pin
3. H-L Shift Fork
4. H-L Shift Rail Roll Pins
5. H-L Shift Rail Gate
6. 3rd-4th Shift Rail Gate
7. 1st-2nd Shift Rail Gate
8. 1st-2nd Shift Rail Roll Pins

NOTE: If difficulty is encountered sliding the 3rd/4th gearshift rail into the neutral position check to ensure that the 1st/2nd gearshift rail is positioned in the neutral and the interlock detent is positioned correctly to the 1st/2nd gearshift rail. The interlock detent will prevent the 3rd/4th gearshift rail from entering the transmission case if the 1st/2nd gearshift rail is not in neutral.

8. Insert the H/L gearshift rail into the transmission case from the rear end of the transmission. Slide the rail through the H/L gearshift fork then install the H/L gearshift gate onto the rail. Continue sliding the rail until it is in approximately the neutral position, Figure 74.

9. Align the spring pin holes in the gearshift gate forks and rails then drive the spring pins into the holes.

10. Insert the safety start switch plunger into the respective bore, Figure 73. Insert the gearshift rail balls, springs and detents into their respective bores, Figure 73.

11. Install the blind covers into the gearshift rail bores at the rear end of the transmission case cover plate.

COMPONENT INSTALLATION

1. Install the front input shaft and clutch housing as described in Section D.
2. Install the transmission hydraulic pump and oil distributor as described in Section D.

F. COMPONENT OVERHAUL

- Torque Converter
- Transmission Hydraulic Pump and Oil Distributor Assembly
- Solenoid Control Valve and Lock-Up Valve
- Front Input Shaft and Hydraulic Clutch
- Reverse Idler Gear Assembly
- Rear Input Shaft
- Output Shaft and Gear Assembly
- Countershaft and Gear Assembly

TORQUE CONVERTER

The torque converter, Figure 75, is a welded unit and cannot be disassembled. The only maintenance performed on the converter, other than the stall test covered in Chapter 3, is cleaning and visual inspection. A commercial torque converter cleaner may be used to clean the converter. However, if a commercial cleaner is not available, the converter should be cleaned as outlined below.

1. If not previously drained, remove the drain plug, Figure 75 and drain as much oil as possible from the converter by tilting the converter in all directions.
2. Install the drain plug, then fill the converter about half full, through the hub, with paraffin base solvent or any cleaning solvent specified for cleaning transmissions.
3. Plug the opening in the hub, then circulate the solvent inside the converter by shaking.

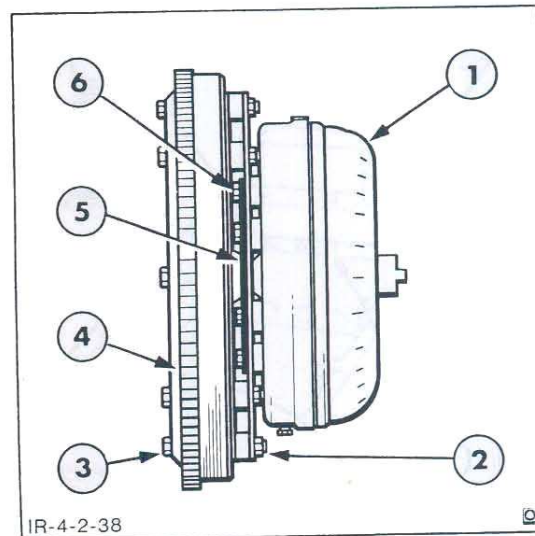


Figure 75
Torque Converter and Drive Plate

1. Torque Converter Assembly
 2. Drive Plate Assembly
 3. Flywheel to Drive Plate Bolts
 4. Flywheel
 5. Reinforcing Plate
 6. Drive Plate to Torque Converter Bolts
4. Remove the drain plug and the plug from the hub opening. Drain the solvent from the converter.
 5. Repeat Steps 1 to 4, as required, until the solvent that is drained from the converter is clean.
 6. Install the drain plug.

INSPECTION

Inspect the splines Figure 75 on the converter hub for wear or damage and the weld joints for cracks. If the hub is worn or damaged and/or the weld joints cracked, a new converter should be installed. A new drive plate should also be installed if it is warped.

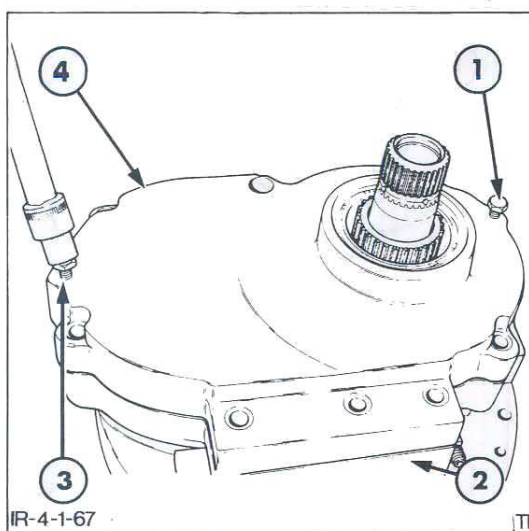


Figure 76
Front Cover Plate Removal

1. Jacking Bolt
2. Oil Distributor
3. Jacking Bolt
4. Front Cover Plate

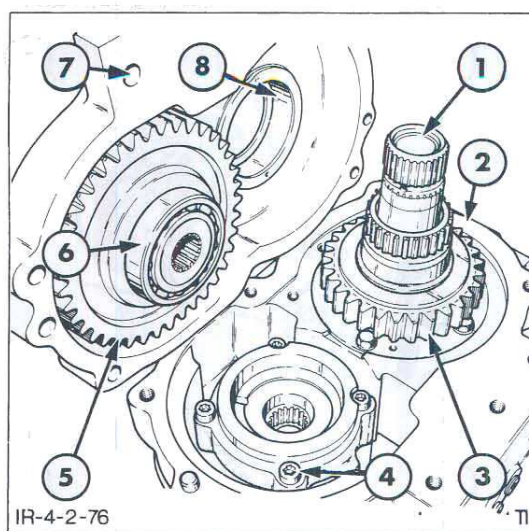


Figure 77
Pump Drive Gear Removal

- | | |
|----------------------|----------------------|
| 1. Stator Support | 5. Driven Gear |
| 2. Oil Distributor | 6. Bearing |
| 3. Drive Gear | 7. Front Cover Plate |
| 4. Transmission Pump | 8. Thrust Washer |

TRANSMISSION HYDRAULIC PUMP AND OIL DISTRIBUTOR ASSEMBLY

DISASSEMBLY

1. Install the two jacking bolts, previously used to remove the oil distributor assembly from the transmission case, into the cover bolt holes, Figure 76. Tighten the two bolts equally until the front cover is released from the housing. Remove the two bolts.
2. Strike the front cover plate with a suitable soft faced mallet to release the hydraulic pump driven gear from the housing, Figure 78.
3. Slide the gear from the stator support. Remove the stator support retaining bolts then remove the support from the oil distributor housing, Figure 77.

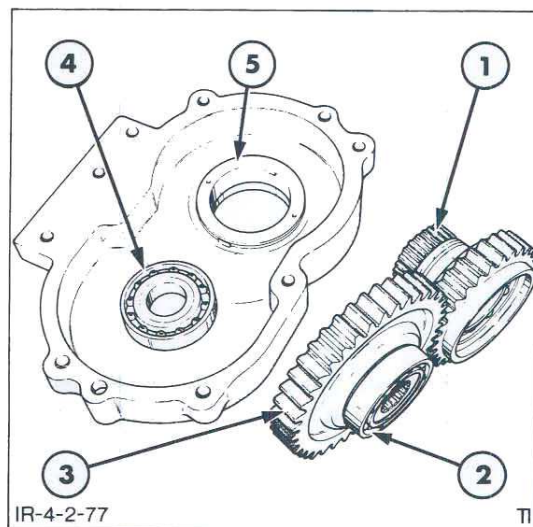


Figure 78
Pump Drive Gear Removal

- | | |
|-----------------------|------------------|
| 1. Drive Gear Splines | 4. Bearing |
| 2. Bearing | 5. Thrust Washer |
| 3. Driven Gear | |

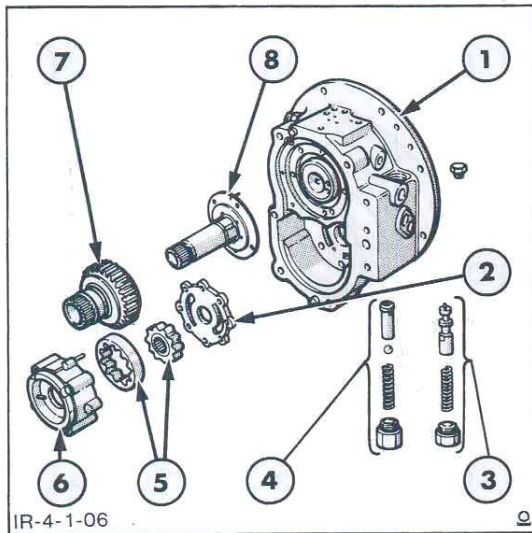


Figure 79
Oil Distributor Housing Components

- | | |
|------------------------|--------------------|
| 1. Distributor Housing | 5. Pump Rotors |
| 2. Pump End Plate | 6. Pump Body |
| 3. Regulating Valve | 7. Pump Drive Gear |
| 4. By-Pass Valve | 8. Stator Support |

4. Remove the hydraulic pump retaining bolts and lift the pump assembly from the distributor housing, Figure 79.

5. Remove the by-pass valve plug and extract the shim, spring ball and valve seat, Figure 79.

6. Remove the regulating valve plug and extract the spring, shim and spool.

7. Remove the 'O' ring seals from the valve plugs and discard. Install new 'O' rings on assembly.

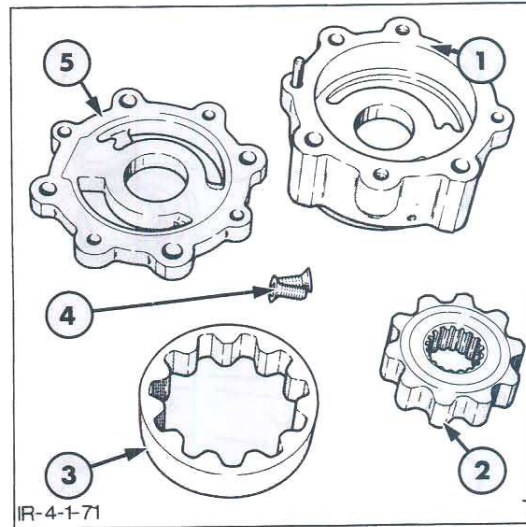


Figure 80
Transmission Pump Components

- | | |
|----------------|---------------------|
| 1. Pump Body | 4. End Plate Screws |
| 2. Inner Rotor | 5. End Plate |
| 3. Outer Rotor | |

INSPECTION

1. Thoroughly clean all the transmission hydraulic pump and oil distributor components with a suitable solvent and allow to dry. Use compressed air to clean the oil passages in the distributor housing.

2. Inspect the hydraulic pump driven gear and the bearings either side of the gear for wear or damage.

3. Inspect the front cover thrust washer for wear or scoring. If damaged, remove by prying the washer from the cover, do not remove if undamaged.

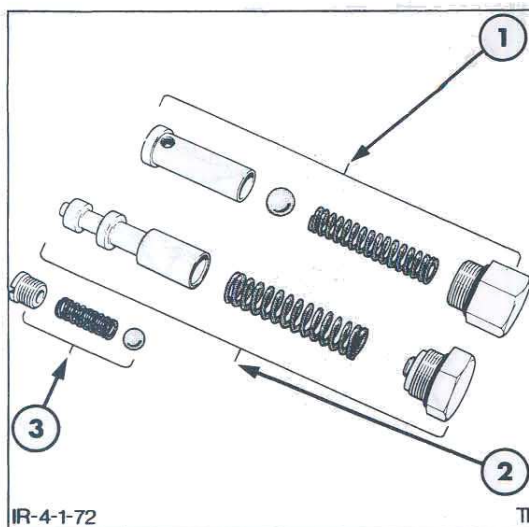


Figure 81
Transmission Hydraulic Valves

1. By-Pass Valve
2. Regulating Valve
3. Lubrication Valve

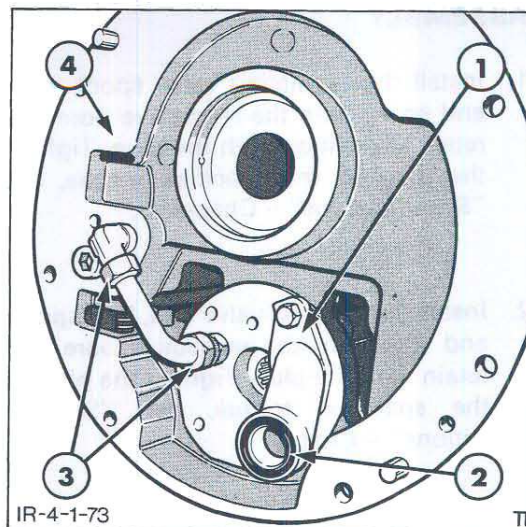


Figure 82
Transmission Pump Connections

1. Suction Tube
2. Seal
3. Pressure Tube Connections
4. Distributor Housing

4. Inspect the front cover torque converter oil seal for damage. Do not remove the oil seal unless the seal is damaged. If damaged, remove the snap ring and drive the seal from the cover with a suitable punch and hammer.

assembly. Check the spring and if suspect measure the spring, see "Specifications" – Chapter 3.

5. Inspect the stator support gear and bearing for wear or damage. Check the seal rings for wear, nicks or other damage.

6. Disassemble the hydraulic pump, if not already disassembled, and inspect the inner and outer rotors for scratching and scoring or excessive wear.

8. Inspect the regulating valve spool, Figure 81 for excess wear, grooves or scratches that may cause the spool to malfunction. If scratch marks cannot be removed by polishing, install new parts during assembly. Check the spring and if suspect, measure spring dimensions, see "Specifications" – Chapter 3.

7. Inspect the by-pass valve seat and ball for scratches and pitting, Figure 81. If scratch marks cannot be removed by polishing, install new parts during

9. Inspect the oil distributor housing for cracks and check the valve bores for wear or scoring. Check the pressure pipes connections are tight and renew the suction pipe seal on assembly, Figure 82.

TRACTOR-MANUALS-UK.COM ASSEMBLY

1. Install the regulating valve spool, shim and spring into the respective bore and retain in position with the plug. Tighten the plug to the specified torque, see "Specifications" – Chapter 3.
2. Install the by-pass valve seal, ball, spring and shim into the respective bore and retain with the plug. Tighten the plug to the specified torque, see "Specifications" – Chapter 3.
3. Assemble the transmission hydraulic pump components as shown in Figure 79. Install the pump onto the distributor housing and secure with the retaining bolts. Tighten the bolts to the specified torque, see "Specifications" – Chapter 3.
4. Install the stator support onto the distributor housing and secure with the retaining bolts. Tighten the bolts to the specified torque, see "Specifications" – Chapter 3.
5. Locate the gear onto the stator support, Figure 77.
6. If it was necessary to remove the oil seal from the front cover, install a new seal using Tool No. 630 or 9210 and a press. If the thrust washer was removed, install a new thrust washer using new knock pins.

7. Install the hydraulic pump drive gear and bearings to the front cover, the assembly is a push fit.
8. Do not install the front cover plate at this stage as it is necessary to align the P.T.O. shaft and pump drive gear during assembly.

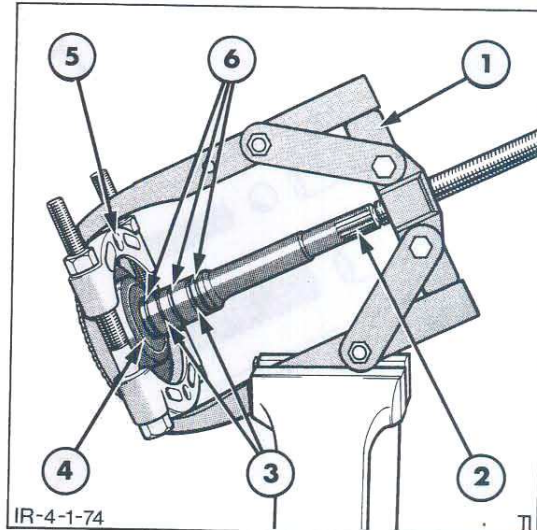


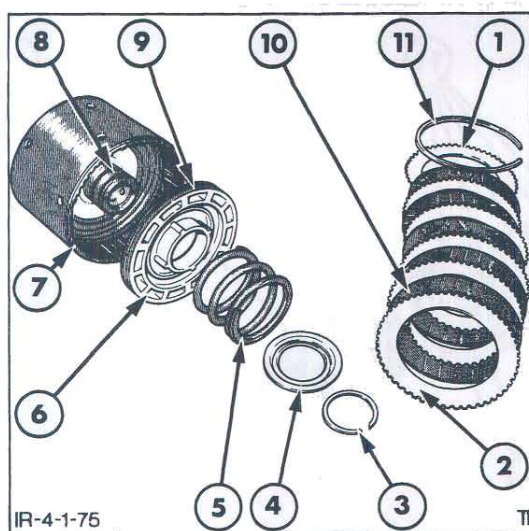
Figure 83
Front Input Shaft Bearing Removal

1. Puller – Tool No. 1003 or 9516
2. Front Input Shaft
3. Oil Passages
4. Front Input Shaft Bearing
5. Pulling Attachment – Tool No. 951 or 9190
6. Sealing Rings

FRONT INPUT SHAFT AND REAR CLUTCH ASSEMBLY

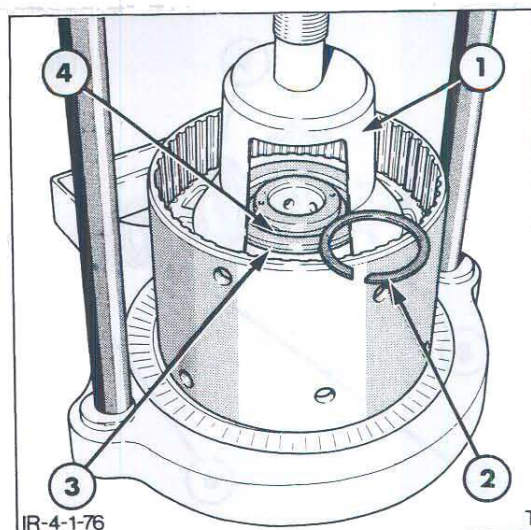
DISASSEMBLY

1. Normally it is not necessary to remove the ball bearing from the front input shaft, or the needle bearing from the rear face of the shaft. If the ball bearing is worn or damaged, it can be removed as shown in Figure 83. To remove the needle bearing, collapse the inner race with a hammer and chisel, then pull the outer race from the shaft with Tool Nos. 1003 and 951 or 9516 and 9190.
2. Unlock the sealing rings by squeezing them together, then remove them from the shaft.
3. If not previously removed, pull the bearings and spacer from the rear clutch hub (reverse idler input) and remove the gear from the clutch plates in the housing. Remove the thrust washer.

**Figure 84**

Rear Clutch Components

- | | |
|----------------------------------|--------------------------------------|
| 1. Drive Plate | 7. Clutch Housing |
| 2. Steel Disc – External Splines | 8. Inner Piston Seal |
| 3. Snap Ring | 9. Outer Piston Seal |
| 4. Spring Retainer | 10. Friction Disc – Internal Splines |
| 5. Return Spring | 11. Snap Ring |
| 6. Piston | |

**Figure 85**

Clutch Piston Return Spring Removal

- | |
|--------------------------------------|
| 1. Modified Tool No. FT 4101 or 1312 |
| 2. Snap Ring |
| 3. Spring Retainer |
| 4. Snap Ring Groove |

4. Remove the large snap ring, clutch drive plate and internal plates from the rear clutch.
5. Using a press and modified Tool No. FT4101 or 1312 see "Specifications" – Chapter 3 along with a suitable size washer as shown in Figure 85, compress the spring enough to remove the snap ring with a screwdriver. Gradually, relieve pressure on the spring, then remove the spring seat and spring.
6. Turn the clutch housing over and remove the snap ring, spring seat, and spring from the other end of the housing by repeating Step 5.
7. Remove the pistons (one in each end of the clutch housing) by directing compressed air into the oil passage in the hub of the clutch housing, Figure 84.
8. Remove the outer 'O' ring seal from each piston and the inner 'O' ring seals from the hub of the clutch housing.

INSPECTION

1. Thoroughly clean the front input shaft and bearings Figure 88 and the clutch components, Figure 86, with suitable solvent and allow to dry. Use air to clean out the oil passages in the input shaft and clutch housing. Do not spin the bearings with compressed air.

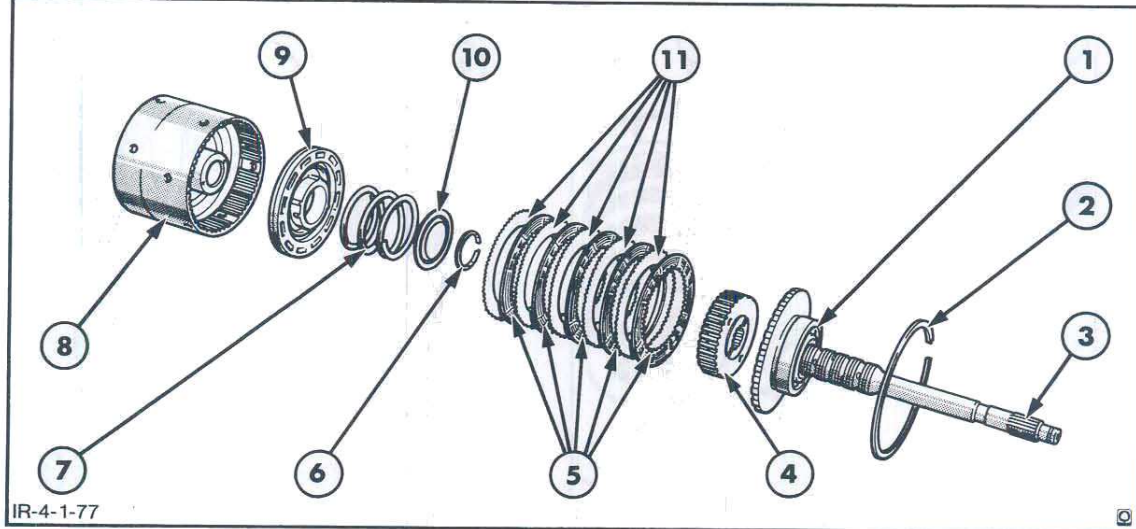


Figure 86
Forward Clutch Components

- | | | |
|----------------------|-------------------------------------|-----------------------------------|
| 1. Ball Bearing | 5. Friction Disc – Internal Splines | 8. Clutch Housing |
| 2. Snap Ring | 6. Snap Ring | 9. Piston |
| 3. Front Input Shaft | 7. Return Spring | 10. Spring Retainer |
| 4. Front Hub | | 11. Steel Disc – External Splines |

2. Check the ball bearing on the front input shaft, Figure 88, for smooth rotation. If the bearing is worn, a new one should be installed during assembly. Also check the needle pilot bearing in the rear face of the shaft for smooth rotation.
3. Inspect the front shaft sealing rings, Figure 89, for cracks and wear, and the sealing ring grooves for wear. Install new parts as required, during assembly. Check the shaft oil passages to be sure they are clean.
4. Inspect the working surface of the clutch pistons, Figure 86, for scoring. If scored, fine emery cloth may be used to smooth the surface. Ensure the 'O' ring seal grooves are clean and that burrs do not exist.
5. Check all of the plates for warpage or distortion. Install new plates if they have taken a set.
6. Check the clutch housing and bushing for hole alignment and wear.

ASSEMBLY

1. Install new 'O' ring seals on the clutch pistons, Figure 86, and on the hub of the clutch housing. Coat the 'O' ring seals with grease, then install the pistons (one in each end of the housing) so they are seated against the centre web of the housing.

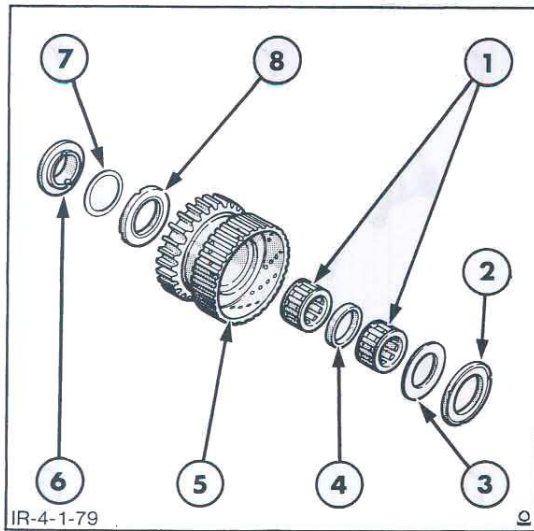


Figure 87

Rear Clutch Hub and Thrust Bearing

- | | |
|-------------------------|------------------------|
| 1. Bearings | 5. Rear Clutch Hub |
| 2. Front Thrust Bearing | 6. Spacer |
| 3. Spacer | 7. Thrust Bearing Seat |
| 4. Bearing Spacer | 8. Rear Thrust Bearing |

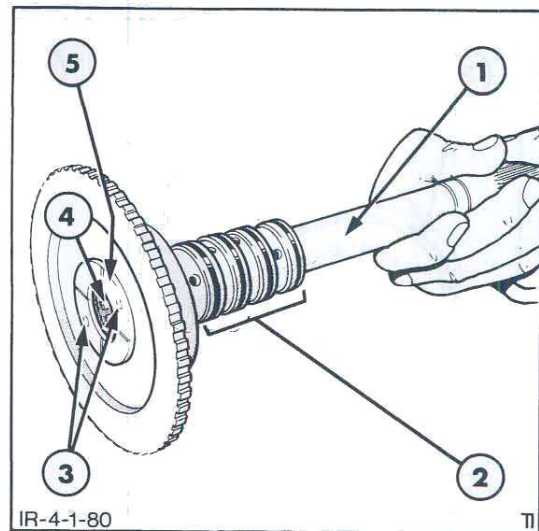


Figure 88

Front Input Shaft Assembly

- | | |
|------------------|-------------------|
| 1. Shaft | 4. Roller Bearing |
| 2. Sealing Rings | 5. Thrust Washer |
| 3. Knock Pins | |

- Position the spring and spring seat on the piston, then compress the spring with a press, using modified Tool No. FT 4101 or 1312, and a suitable washer, as shown in Figure 85, so the snap ring can be installed. Make sure the snap ring is fully seated before relieving pressure on the spring.
- Turn the clutch housing over and install the spring, spring seat, and the snap ring in the other end of the housing by repeating Step 2.
- Place the thrust washer, Figure 87, on the flat hub of the clutch housing (the hub in the front of the housing is recessed), then install the rear clutch hub (reverse idler input), bearings, and spacer. Install the clutch plates, one by one, starting with a steel plate then a bronze plate.
- Install the clutch drive plate and retain it in place by installing the appropriate snap ring.
- If it was necessary to remove the ball bearing from the front input shaft, drive or press a new bearing into place using a hammer or press, and a sleeve of the appropriate diameter and convenient length. If the needle bearing was removed from the rear of the front input shaft, press a new bearing into place using a step plate from Tool No. 630-S or 9210.
- Install the three sealing rings on the front input shaft, making sure each ring is locked in place.
- Installation of the clutch housing and front input shaft is covered in Section D.

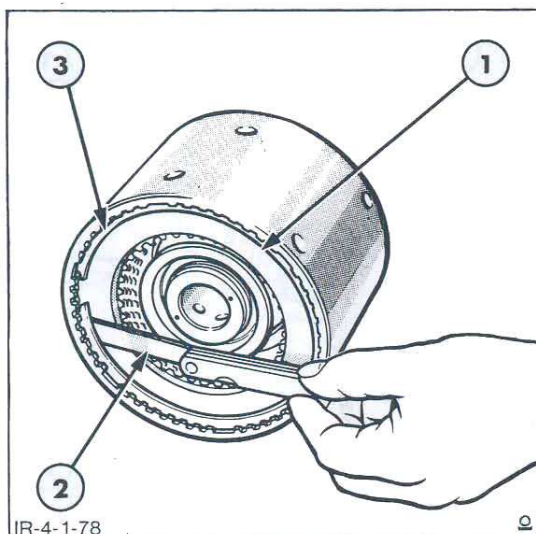


Figure 89
Clutch Pack Clearance

1. Pressure Plate
2. Feeler Gauge
3. Snap Ring

CLUTCH PACK CLEARANCE CHECK

1. If a new clutch pack has been installed in the clutch housing, use the following procedure to check the clutch pack clearance:
 - With the rear clutch pack assembly as previously described, use a feeler gauge to check the clearance between the clutch pressure plate and the snap ring, Figure 89, while holding the plate against the clutch disc.
 - The clearance must be measured at three points equally spaced around the housing (120° intervals).
 - Remove the clutch plate and install with the clutch discs on the opposite side of the housing using the same procedure.
 - If the clearance is not within the specified limits, see "Specifications" – Chapter 3, change a clutch disc or discs to obtain the correct clearance, clutch disc thicknesses are specified in "Specifications" – Chapter 3.

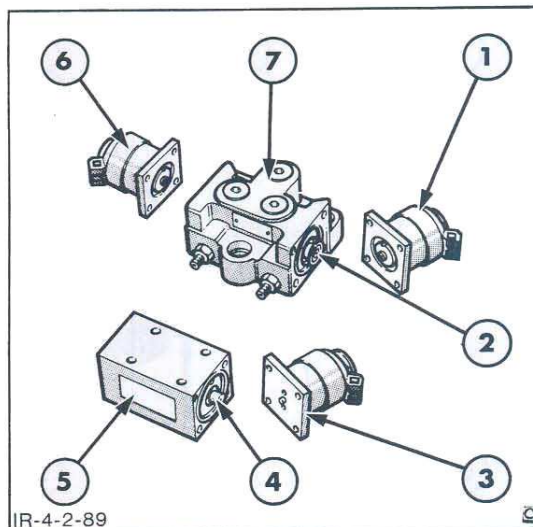


Figure 90
Solenoid Control Valve Assembly

- | | |
|---------------------|-----------------------|
| 1. Forward Solenoid | 5. Lock-Up Valve Body |
| 2. Spool | 6. Reverse Solenoid |
| 3. Lock-Up Solenoid | 7. Control Valve Body |
| 4. Spool | |

SOLENOID CONTROL VALVE AND LOCK-UP VALVE

DISASSEMBLY

1. Remove the lock-up valve and control valve solenoid retaining bolts and disassemble the solenoid assemblies from the valve bodies, Figure 90.

INSPECTION

1. Manually check that the spools slide smoothly within the valve bodies, then reassemble the lock-up and control valves and solenoids. Tighten the retaining bolts to the specified torque.

NOTE: *The internal parts of the valve assemblies are not serviced separately.*

The solenoid control valve and lock-up valve are serviced as complete assemblies, overhaul is limited to checking spool movement only.

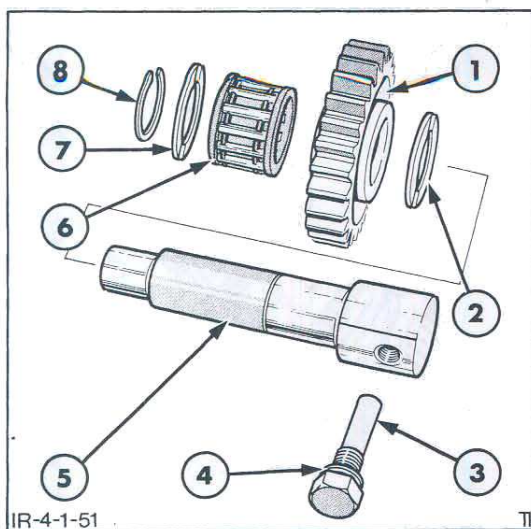


Figure 91
Reverse Idler Gear Components

- | | |
|------------------------|-------------------|
| 1. Gear | 5. Shaft |
| 2. Thrust Washer | 6. Roller Bearing |
| 3. Shaft Locating Bolt | 7. Thrust Washer |
| 4. Seal | 8. Snap Ring |

REVERSE IDLER GEAR ASSEMBLY

INSPECTION

1. Thoroughly clean the reverse idler gear components, Figure 91 with a suitable solvent and allow to dry.
2. Inspect the thrust washers either side of the reverse idler gear for scoring or excessive wear.
3. Inspect the needle roller bearing for smooth rotation. If the bearing is worn, install a new bearing during assembly.
4. Inspect the gear for cracks, burrs or chipped teeth. Remove burrs with fine emery cloth or a fine pumice stone. If the gear is chipped or cracked, a new gear should be installed.

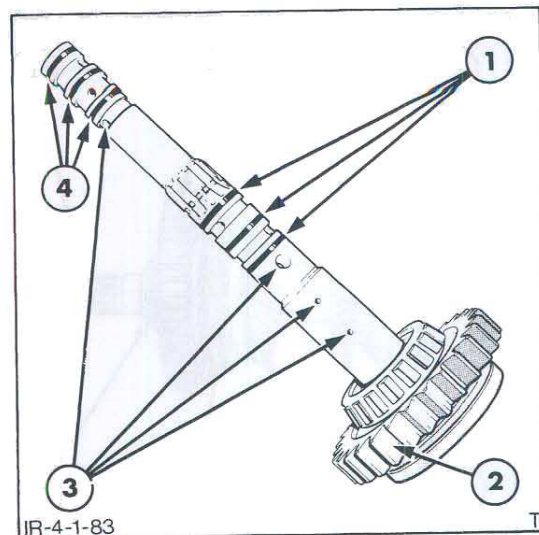


Figure 92
Rear Input Shaft Assembly

- | |
|----------------------------------|
| 1. Rear Sealing Rings |
| 2. Gear Shaft Assembly |
| 3. Lubrication Gallery Oil Holes |
| 4. Front Sealing Rings |

REAR INPUT SHAFT

INSPECTION

1. Thoroughly clean the rear input shaft, Figure 92, with a suitable solvent and allow to dry. Use compressed air to clean out the oil passages. Do not spin the bearing with compressed air.
2. Check the bearing for smooth rotation. Normally the rear input shaft bearing need not be removed, however, if the bearing is worn or damaged it can be removed by clamping the shaft between two blocks of wood and driving the bearing from the shaft with a punch and hammer. If the bearing is removed a new one must be installed as the cage will be damaged during removal.
3. Inspect the rear input shaft sealing rings for nicks, cracks or scratches. Any seals which are suspect should be renewed on assembly. Ensure all oil passages are clean.

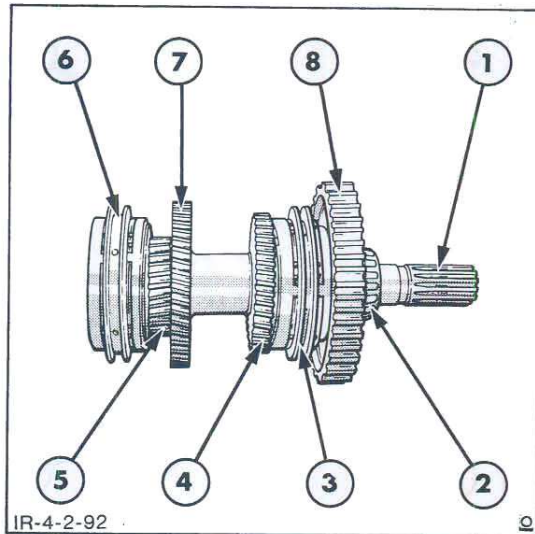


Figure 93
Output Shaft Assembly

- | | |
|---------------------|--------------------|
| 1. Output Shaft | 5. 4th Gear |
| 2. Rear Bearing | 6. 3rd/4th |
| 3. H/L Synchroniser | Synchroniser |
| 4. High Range Gear | 7. 2nd Gear Driven |
| | 8. Low Range Gear |

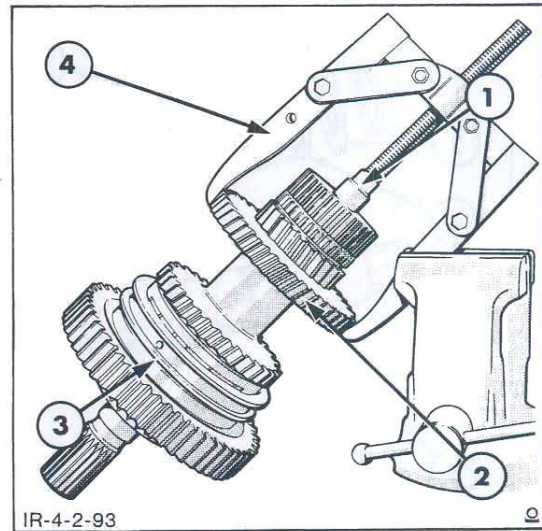


Figure 94
Output Shaft Front Bearing Removal

- | |
|---|
| 1. Shaft Protector, Tool No. 625A or 9212 |
| 2. 2nd Gear Driven |
| 3. H/L Synchroniser |
| 4. Puller, Tool No. 1003 or 9516 |

4. Inspect the gear teeth for burrs. Remove burrs with fine emery paper or a fine pumice stone. If the gear is chipped or cracked, a new one should be installed.

3. Remove the snap ring retaining the 3rd/4th gear coupler and remove the coupler from the gear cluster.

4. Remove the snap ring retaining the 4th gear to the gear cluster then remove the gear from the gear cluster.

OUTPUT SHAFT AND GEAR ASSEMBLY

DISASSEMBLY

1. Remove the 3rd/4th gear synchroniser from the output shaft assembly and wire the assembly together to prevent the mixing of components with other synchroniser assemblies.
2. Attach a puller, Tool No. 1003 or 9516 with shaft protector Tool No. 625A or 9212 to the 2nd gear driven and remove the front bearing, coupling, 4th gear and the 2nd gear driven and high range gear cluster, Figure 94.

5. Withdraw the H/L range synchroniser from the output shaft and wire the assembly together to prevent the mixing of components with other synchroniser assemblies.
6. Attach a puller, Tool No. 1003 or 9516 with shaft protector 625A or 9212 to the 'L' range gear and remove the rear bearing, thrust washer and 'L' range gear from the shaft.

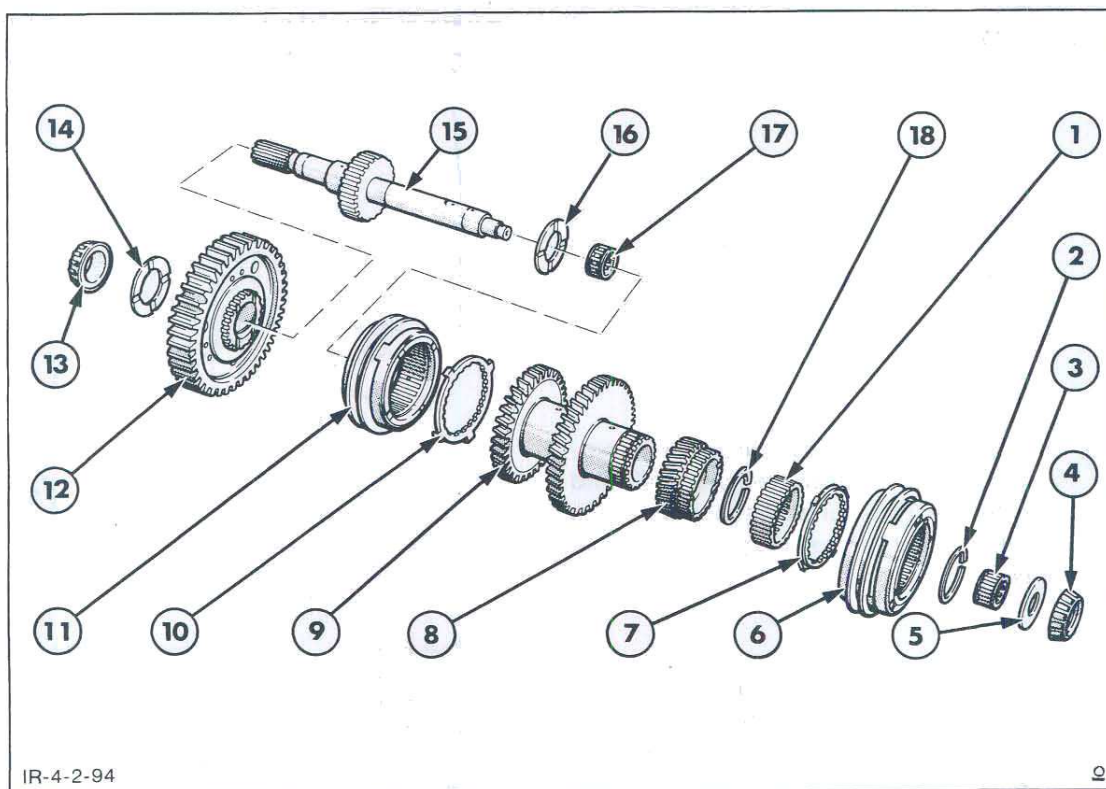


Figure 95
Output Shaft Components

- | | | |
|-------------------------------|----------------------------|-------------------------------|
| 1. Coupler | 7. Retainer | 13. Rear Taper Roller Bearing |
| 2. Snap Ring | 8. 4th Gear | 14. Thrust Washer |
| 3. Needle Roller Bearing | 9. Cluster Gear | 15. Output Shaft |
| 4. Front Taper Roller Bearing | 10. Retainer | 16. Thrust Washer |
| 5. Thrust Washer | 11. L/H Range Synchroniser | 17. Needle Roller Bearing |
| 6. 3rd/4th Synchroniser | 12. Low Range Gear | 18. Snap Ring |

OUTPUT SHAFT AND GEAR ASSEMBLY

INSPECTION

1. Thoroughly clean the output shaft components, Figure 95, with a suitable solvent, then blow dry with compressed air. Do not spin the bearings with compressed air.
2. Check the front and rear bearings for smooth rotation. If the bearings are worn install new bearings and bearing caps during assembly.
3. Inspect the output shaft gears for cracks, burrs, or chipped teeth. Remove burrs with fine emery cloth or a fine pumice stone. If the gears are chipped or cracked, new gears should be installed.
4. Place the gears on the output shaft and check for excessive play between the gear bushings and shaft. If the play feels excessive, new gears should be installed, as the bushings are not serviced separately.
5. Inspect the synchroniser assembly for scoring, cracks or excessive wear. Check the pins, springs and balls for wear or cracks. If any components of the synchroniser are damaged the complete assembly will require renewal as the components are not serviced separately.

ASSEMBLY

With reference to Figure 95.

1. Install the 'L' range gear, thrust washer and rear bearing onto the shaft, then drive or press the bearing into place using a hammer or press, and a sleeve of the appropriate diameter and length.
2. Install the L/H gear synchroniser assembly over the front end of the shaft and locate onto the splines. Engage the tangs on the synchroniser ring to the range gear.
3. Install the thrust washer and needle roller bearing onto the shaft then install the 'H' range and 2nd driven gear cluster over the bearing.
4. Install the second needle roller bearing onto the shaft and insert into the gear cluster.
5. Install the 4th gear onto the gear cluster and retain with the appropriate snap ring, then install the coupler onto the shaft and retain in position with the snap ring.
6. Install the thrust washer and front bearing onto the shaft then drive or press the bearing into place using a hammer or press, and a sleeve of appropriate diameter and convenient length.
7. Install the 3rd/4th gear synchroniser assembly onto the coupler.
8. Installation of the output shaft and gear assembly is covered in Section E.

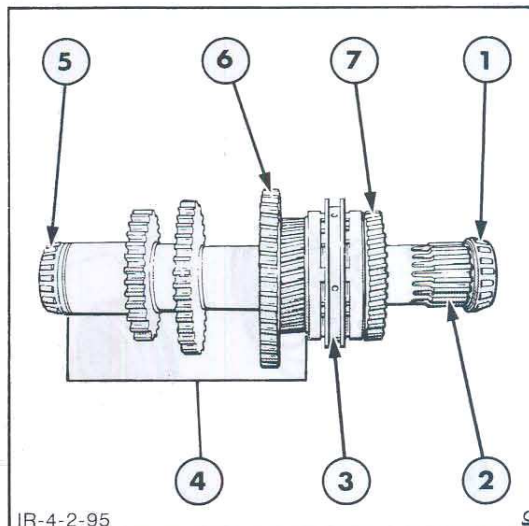


Figure 96
Countershaft Assembly

- | | |
|----------------------------|------------------|
| 1. Rear Bearing | 5. Front Bearing |
| 2. Shaft and Gear Assembly | 6. 2nd Gear |
| 3. 1st/2nd Synchroniser | 7. 1st Gear |
| 4. Cluster Gears | |

COUNTERSHAFT AND GEAR ASSEMBLY

DISASSEMBLY

1. Attach a puller, Tool No. 1003 or 9516 with shaft protector, Tool No. 625A or 9212 to the gear cluster as shown in Figure 97 and remove the front bearing, thrust bearing and thrust washer from the shaft.
2. Remove the gear cluster and 1st/2nd synchroniser from the shaft together with the needle roller bearings, thrust bearings and thrust washers, Figure 98.
3. Remove the 1st/2nd synchroniser assembly from the gear cluster and wire the assembly together to prevent the mixing of components with other synchroniser assemblies.

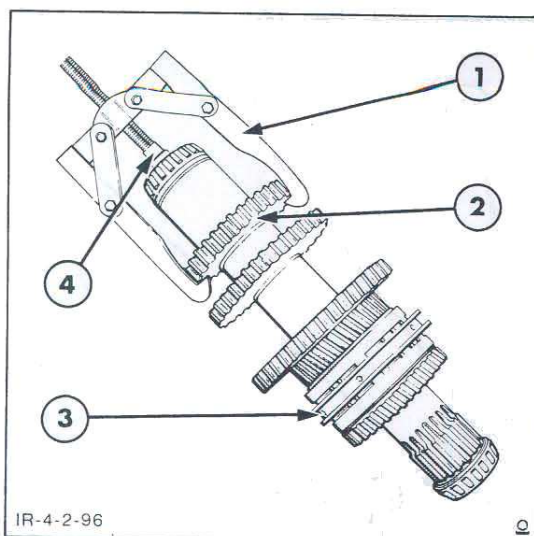


Figure 97
Countershaft Disassembly

1. Puller, Tool No. 1003 or 9516
2. Gear Cluster
3. 1st/2nd Synchroniser
4. Shaft Protector, Tool No. 625A or 9212

4. Remove the snap ring retaining the 1st/2nd gear coupler and remove the coupler thrust washers and 2nd gear from the gear cluster.

5. Normally, the countershaft rear bearing, Figure 98, need not be removed, however, if the bearing is worn or damaged it can be removed with a punch and hammer. If the bearing is removed, a new one must be installed as the cage will be damaged during removal.

NOTE: If the countershaft rear bearing is replaced, the countershaft bearing cap must also be replaced.

INSPECTION

1. Thoroughly clean the countershaft components, Figure 98, with suitable solvent, then blow dry with compressed air. Do not spin the bearings with compressed air.

2. Check the front and rear bearings for smooth rotation. If the bearings are worn, install new bearings during assembly.

3. Inspect the countershaft gears for cracks, burrs, or chipped teeth. Remove burrs with fine emery cloth or a fine stone. If the gears are chipped or cracked, new gears should be installed.

4. Place the gear on the countershaft and check for excessive play between the gear bushing and shaft. If the play feels excessive a new gear should be installed, as the bushing is not serviced separately.

5. Inspect the synchroniser assembly for scoring, cracks or excessive wear. Check the pins, springs and balls for wear or cracks. If any components of the synchroniser are damaged the complete assembly will require renewal as the components are not serviced separately.

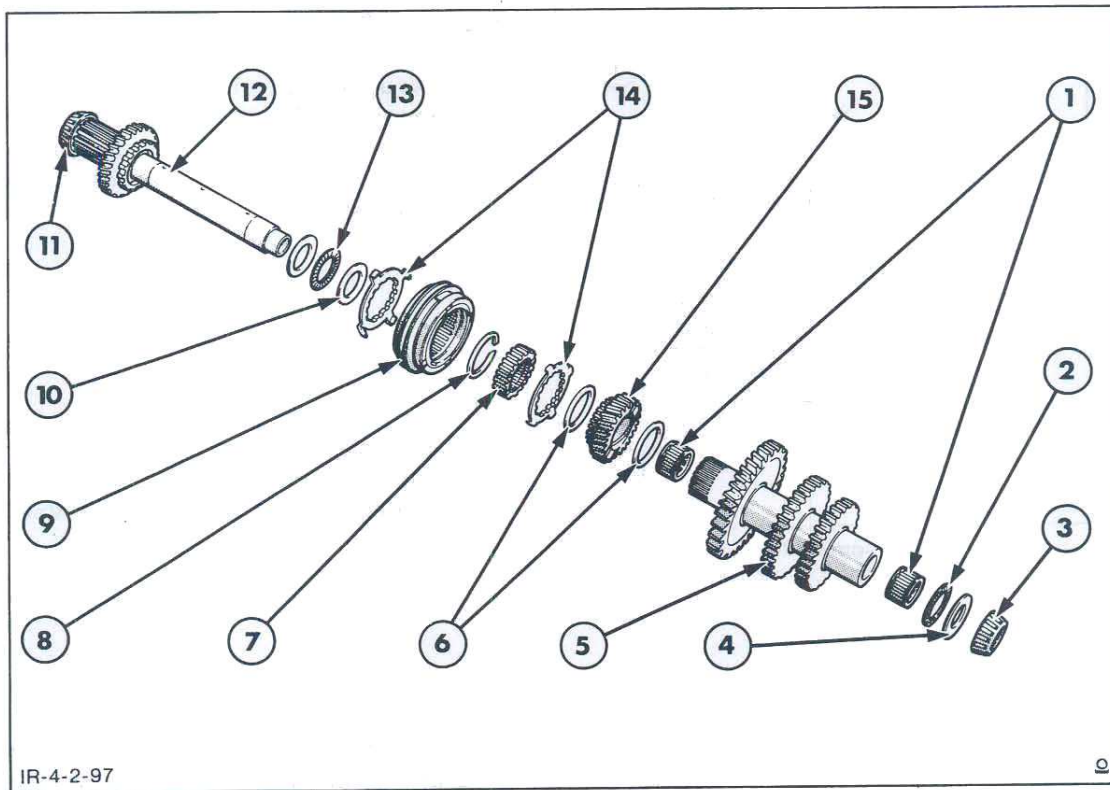


Figure 98
Countershaft Components

- | | | |
|---------------------------|--------------------|---------------------------|
| 1. Needle Roller Bearings | 6. Thrust Washers | 11. Rear Bearing |
| 2. Thrust Bearing | 7. Coupler | 12. Countershaft and Gear |
| 3. Front Bearing | 8. Snap Ring | 13. Thrust Bearing |
| 4. Thrust Washer | 9. Synchroniser | 14. Retainers |
| 5. Gear Cluster | 10. Thrust Washers | 15. 2nd Gear |

ASSEMBLY

With reference to Figure 98.

1. If it was necessary to remove the countershaft rear bearing press a new bearing into place using a sleeve of suitable diameter and of convenient length.
2. Install the 2nd gear and thrust washers onto the gear cluster then install the coupler and retain in position with the snap ring.
3. Install the 1st/2nd gear synchroniser onto the gear cluster then install the complete assembly with thrust bearing and thrust washers onto the countershaft.
4. Position the shaft and gears onto a press. Install the thrust bearing and thrust washer then position the front bearing onto the shaft, using Tool No. 630S or 9212 and a sleeve of the appropriate diameter and convenient length press the bearing onto the shaft.
5. Installation of the countershaft and gear assembly is covered in [Section E](#).

PART 4

POWER REVERSING TRANSMISSION

Chapter 3

TROUBLE SHOOTING SPECIFICATION AND SPECIAL TOOLS

Section	Page
A. TROUBLE SHOOTING	1
B. SPECIFICATIONS	6
C. SPECIAL TOOLS	11

A. TROUBLE SHOOTING

GENERAL

After the transmission has been overhauled, the tests outlined in this chapter should be performed to determine if the hydraulic pump, the modulator unit, the bypass valve, the control valve, the regulating valve, the torque converter, and the hydraulic clutch assemblies are operating satisfactorily. If at all possible, the tests should also be performed before servicing the transmission to help diagnose problems. The unit engine and brakes must be in satisfactory operating condition for the stall test to be effective. If the

engine is in need of attention or the brakes need adjusting, the stall test should not be performed until after the necessary repairs are made.

The diagnosis guide, at the end of this section, lists the possible causes of the conditions that may be encountered during the tests. The trouble shooting guide lists other problems, not relating to the tests. Making use of these guides will help eliminate unnecessary trial-and-error methods when trouble shooting the power reversing transmission.

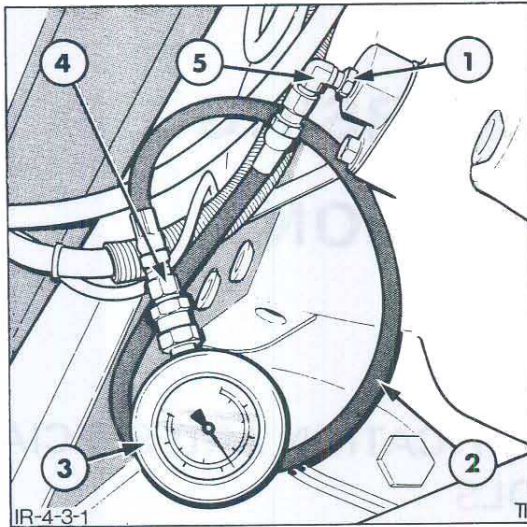


Figure 1

Gauge Installed in Pressure Test Port

1. Pressure Test Port
2. Hose FT 4100-1
3. Low Pressure Gauge – FT 4100
4. Adaptor – FT 8503-8
5. Elbow – Tool No. FT 5007

LINE PRESSURE TEST

The purpose of this test is to determine if the transmission hydraulic pump and pressure regulating valve are operating satisfactorily to produce the pressure required for hydraulic clutch operation. This test should be performed first.

- Attach gauge FT 4100 to the pressure test port connection using Pipe FT 4100-1 and connector Tool No. FT 5007 on the test port as shown in Figure 1.
- Operate the tractor engine 800-1000 revs/min until the transmission oil reaches 65°C (149°F).
- Run the first check at 800 rev/min. After one minute of operation, note the reading of the pressure gauge. It should register 130 lbf/in² (8.83 bar) with the oil temperature at 65°C (149°F).

- Run a second check at 1600 revs/min and again note the reading on the gauge. It should register 150 lbf/in² (10.3 bar) minimum.
- Run a third check at 2100 revs/min. The gauge should register 200 – 220 lbf/in² (13.7 – 15.2 bar) maximum.

INTERNAL LEAKAGE TEST

The purpose of this test is to determine if the sealing rings on the front and rear input shafts are sealing properly.

1. If not previously installed, attach gauge FT 4100 to the pressure test port connection using Pipe FT 4100-1 and connector Tool No. FT 5007 on the test port as shown in Figure 1.
2. With the gearshift lever and power reversing lever in the neutral positions, start the engine and set the engine speed at 800 rev/min. Note the reading of the pressure gauge, then move the power reversing lever to its forward and reverse positions, noting the pressure drop in each case. If the pressure drop is greater than 7 lbf/in² (0.49 bar), refer to the diagnosis guide for possible causes.

CONTROL VALVE CHECK

1. Remove the access cover from the top of the transmission. Attach a 0 to 300 lbf/in² pressure gauge to the reverse test port on the control valve, Figure 2.

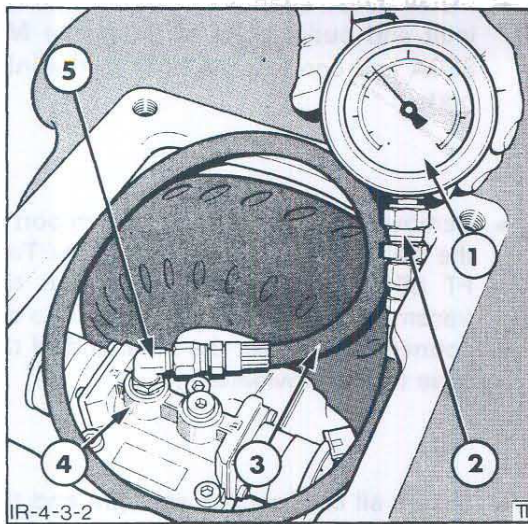


Figure 2

Control Valve Assembly – Attachment and Test Ports Through Upper Opening

1. Low Pressure Gauge
2. Adaptor FT 8503-8
3. Hose – FT 4100-1
4. Reverse Test Point
5. Elbow Part No. FT 5007

2. Operate the tractor engine at 800-1000 revs/min until the transmission oil temperature reaches 65°C (149°F).
3. With the power reversing lever and gearshift lever in neutral and the hand brake applied start the engine and set the engine speed at 1800 revs/min. The gauge should read zero.
4. Shift the power reversing lever into the Reverse position and record the time it takes the reverse clutch pressure to reach 100 lbf/in² (7 bar). The clutch pressure should reach 100 lbf/in² (6.9 bar) after 1.7 seconds.

5. With the power reversing lever still in the reverse position, note the maximum reading on the gauge. It should register 200 to 220 lbf/in² (13.7-15.2 bar).

NOTE: The maximum pressure should be reached after 2.3 seconds following power reversing lever engagement.

6. Attach the gauge to the forward test port on the control valve. Repeat steps 2 through 5, shifting the power reversing lever from neutral to the Forward position. The shift times and pressures should be the same as when shifting in reverse.

OIL-TO-COOLER TESTS

The purpose of these tests is to determine if the bypass valve and regulating valve are operating satisfactorily, and that the cooler tubes, the filter and the internal oil passages are free of obstructions.

Pressure Tests

- Install a low pressure gauge in the cooler return line connector on the right side of the transmission housing using a pipe FT 4100-1 and connector Tool No. FT 5006 and run a pressure test.
- Run these tests with the oil temperature at 65°C (149°F).
- Run the first pressure test at 1600 revs/min. the pressure gauge should read 71 lbf/in² (4.9 bar).
- Run a second pressure test at 2200 revs/min. The gauge should read 85 lbf/in² minimum to 114 lbf/in² maximum (5.88 bar minimum to 7.89 bar maximum).

Flow Test

The flow rate from the transmission oil cooler to the transmission lubrication circuit can be checked practically as follows:—

- Remove the transmission oil filter from the filter housing on the left hand side of the unit.
- Disconnect the fuel shut-off solenoid wire from the fuel injection pump.
- Place a suitable container under the filter housing.
- Crank the engine starting motor for 30 seconds and observe the oil flow from the filter housing.
- The Quantity of oil collected in the container should be 2 to 3 litres (3.5 to 5.25 Imp. Pts.) (4.2 to 6.3 U.S. Pts.).
- Install thread adaptors FT 820-1 into the inlet and outlet ports of flowmeter MS 820A and connect the hose to the inlet port.
- Remove the elbow from the return port in the transmission. Install connector Tool FT 8543 into the return port on the transmission and connect the hose to the connector. Connect the other end of the hose to the flowmeter.
- Ensure all connections are tight and the flowmeter load valve is fully open. Start the engine and run first flow test at 1600 rev/min. The oil flow should be 2.6 Imp. Gals. (12 litres) (3.2 U.S. Gals) minimum.
- Conduct a second flow test at 2200 rev/min. The oil flow should be 3.1 Imp. Gals (14 litres) (3.8 U.S. Gals) minimum.

If the oil flow from the cooler is not to the specified limits or is suspect, then a flowmeter must be used to determine the oil flow using the following procedure:—

- Install a flow meter into the cooler return line on the right hand side of the transmission housing using 2 hoses with 1 $\frac{1}{16}$ " JIC female ends. Install connector Tool FT 8543 into the return line and connect one hose to the connector.

STALL TEST

The purpose of this test is to determine if the torque converter and hydraulic clutch assemblies are operating satisfactorily. For the test to be conclusive, the transmission hydraulic pump and pressure regulating valve must be operating correctly. They can be checked by performing the 'Line Pressure Test'. The engine and brakes must also be in good working order.

1. Check the coolant level in the radiator and the oil level in the transmission. If low, add fluid as required to bring to the proper level.

2. With the gearshift lever and the power reversing lever in neutral, start the engine and run at 800-1000 revs/min until the transmission temperature reaches 29° to 35°C (85°-95°F).
3. Lock the brakes and shift into fourth gear, increase engine speed to approximately 900 revs/min then shift the power reversing lever to the forward position. This will position the control valve so as to direct high pressure oil to the front clutch.
4. Ensure the brakes are firmly locked so the unit will not move, gradually depress the foot accelerator and note the maximum engine speed obtained. Move the power reversing lever to the neutral position.
5. Allow the transmission oil to cool to 29° to 35°C (85° to 95°F). Check the rear hydraulic clutch by repeating steps 3 and 4, but with the power reversing lever in the rearward position. Again, cool the transmission oil by allowing the engine to run at approximately 1000 revs/min. for one minute.
6. The engine speed noted in Step 4 (stall speed) for both the front and rear clutch assemblies should be within 100 rev/min. If the stall speed is not within these limits, refer to the diagnosis guide for possible causes.
7. With the gearshift lever and power reversing lever in neutral set the engine speed at 600-800 revs/min., then shift into any gear ratio. If the gears clash, either the front or rear hydraulic clutch assembly is transmitting power, even though the power reversing lever is in neutral.

IMPORTANT: *To prevent the transmission from overheating, do not allow the engine to operate at wide open throttle for more than fifteen seconds.*

NOTE: *If the unit creeps forward and the gears clash, the front clutch is at fault. The rear clutch is at fault if the unit creeps backward. If the unit does not creep and the gears still clash use the stabilisers to raise the rear wheels off the ground, move the power reversing lever to neutral and shift into first gear. Check the rear wheels for rotational direction – if the wheels rotate rearward then the rear clutch is at fault.*

5. Allow the transmission oil to cool to 29° to 35°C (85° to 95°F). Check the rear hydraulic clutch by repeating steps 3

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MODULATOR UNIT VOLTAGE CHECK

If the forward or reverse clutch assemblies do not engage progressively (do not modulate) the modulator unit electrical circuit must be checked with a digital voltmeter using the following procedure:—

- Check the 12 volt supply to the modulator unit by using the probe tip on the brown wire of the connector.

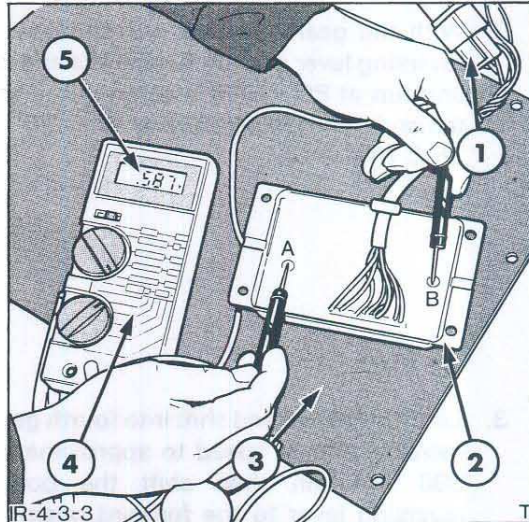


Figure 3
Modulator Unit Voltage Check

1. Connector
2. Modulator Unit
3. Steering Motor Access Plate
4. Multimeter
5. Voltage Reading

- Remove the modulator unit from the cab firewall.

- Move the power reversing lever from neutral to forward and then from neutral to reverse; the voltage should fluctuate momentarily and then rise gradually and settle at 0.5 – 0.6 volts in 5 seconds.

- Start and run the engine at 1000 – 1200 rev/min.

If the voltage does not modulate, install a new modulator unit.

- Ensure that the parking brake is applied and the transmission gearshift and power reversing levers are in neutral.

If the voltage does modulate and the clutch assemblies still fail to modulate, carry out the same checks on the solenoid control valve connectors to check if the wiring continuity or solenoids are the cause.

- Set the digital voltmeter to the low D.C. volt range and connect across the test pins as shown in Figure 3.

DIAGNOSIS GUIDE

TEST	CONDITION	CAUSE
Line pressure test	1. Low line pressure	<ul style="list-style-type: none"> ● Inaccurate proof-meter worn or damaged transmission hydraulic pump. ● Sticking regulation valve or valve spring is weak. ● Worn or damaged control valve lands. ● Clogged oil distributor passages. ● Clogged sump oil strainer.
	2. High line pressure	<ul style="list-style-type: none"> ● Inaccurate proof-meter. ● Sticking regulating valve or valve spring is too strong.
Oil-To-Cooler test	1. Low pressure	<ul style="list-style-type: none"> ● Inaccurate proof-meter ● Bypass valve spring too weak. ● Worn or damaged transmission hydraulic pump. ● Excessive leakage in control valve, clutch, or converter circuit.
	2. High Pressure	<ul style="list-style-type: none"> ● Inaccurate proof-meter. ● Bypass valve sticking closed or valve spring too strong. ● Clogged or restricted cooler lines. ● Clogged cooler oil filter. ● Cooler return regulator block spring too strong.
	3. Low output	<ul style="list-style-type: none"> ● Damaged or worn transmission hydraulic pump. ● Bypass valve spring too weak.
	4. High output	<ul style="list-style-type: none"> ● Bypass valve spring too strong.
Internal leakage test	1. Excess pressure drop	<ul style="list-style-type: none"> ● Sealing rings on front or rear input shaft broken or worn. ● Damaged O-rings in clutch housing; ● Cracked clutch housing.
Stall test	1. Low stall speed	<ul style="list-style-type: none"> ● Hydraulic clutch not releasing. ● Stator support broken. ● Defective torque converter. ● Low engine power.
	2. High stall speed	<ul style="list-style-type: none"> ● Hydraulic clutch not applying or is slipping. ● Low line pressure. ● Sealing rings on rear input shaft broken. ● Defective torque converter.

TROUBLE SHOOTING GUIDE

CONDITION	CAUSE
1. Transmission overheats.	<ul style="list-style-type: none"> ● Low engine coolant level. ● Low transmission oil level. ● Hydraulic clutch slippage. ● Clogged cooler filter. ● Defective one-way clutch in torque converter. ● Excessive countershaft and/or output shaft pre-load. ● Operating in a gear range too high for load requirement causing low torque converter efficiency.
2. Slow acceleration (Driving Tractor)	<ul style="list-style-type: none"> ● Poor engine performance. ● Defective torque converter. ● Brakes dragging. ● Broken sealing rings on rear input shaft.
3. No drive in any gear.	<ul style="list-style-type: none"> ● Hydraulic clutch not applying. ● Broken shifter forks. ● Broken front or rear input shaft, output shaft, or traction coupler. ● Dump valve activated or control valve spool stuck in neutral position. ● Short circuit in transmission wiring circuit.
4. Oil leak at transmission bell housing	<ul style="list-style-type: none"> ● Transmission distributor housing gasket leaking. Pump gasket leaking. ● Transmission hydraulic seal leaking. ● Engine rear main bearing leaking. ● Torque converter leaking. ● Control valve gasket leaking. ● Lock-up valve gasket leaking. ● Internal pipe work ruptured or loose connections.
5. Temperature warning light remains on.	<ul style="list-style-type: none"> ● Transmission overheated. ● Defective temperature sending unit. ● Short circuit.
6. Gear engagement difficult or gears clash	<ul style="list-style-type: none"> ● Operating without use of dump valve. ● Synchroniser unit worn.

B. SPECIFICATIONS**LUBRICANT**

Capacity 31.7 Imp. Pts. (18 litres) (38 U.S. Pts.)
 For lubricant viscosity and type refer to the Ford Tractor Loader Backhoe Operators Manual.

SEALANT

Gasket Sealant Ford Specification ESE – M4G234A1 (Loctite 515)
 Thread Sealant Ford Specification SJ-M4G9102A (Loctite 572)

GEAR RATIOS**Synchronised 4 × 4 Transmission**

1st	4.2656:1	R1	4.2875:1
2nd	2.5:1	R2	2.508:1
3rd	1.2735:1	R3	1.28:1
4th	0.7281:1	R4	0.7318:1

Synchronised 8 × 8 Transmission

1st	7.9608:1	R1	8.0016:1
2nd	5.3724:1	R2	5.4000:1
3rd	3.5265:1	R3	3.5446:1
4th	2.4014:1	R4	2.4137:1
5th	2.2574:1	R5	2.2690:1
6th	1.5234:1	R6	1.5313:1
7th	1.0000:1	R7	1.0051:1
8th	0.6810:1	R8	0.6844:1

BY-PASS VALVE SPRING

Outside Diameter	0.543 in.	(13.8 mm)
Free Length (Approx)	2.610 in.	(66.3 mm)
Maximum Solid Height	1.205 in.	(30.6 mm)
Height Under Load 8.6 kg	1.811 in.	(46.0 mm)

REGULATING VALVE SPRING

Outside Diameter	0.610 in.	(15.5 mm)
Free Length (Approx)	2.717 in.	(69.0 mm)
Maximum Solid Height	1.181 in.	(30.0 mm)
Height Under Load 6.83 kg	2.205 in.	(56.0 mm)

CLUTCH PISTON SPRING

Outside Diameter	3.012 in.	(76.5 mm)
Free Length (Approx)	2.362 in.	(60.0 mm)
Maximum Solid Height	1.043 in.	(26.5 mm)
Height Under Load 114.6 kg	1.181 in.	(30.0 mm)

PRE-LOAD

Output Shaft – Pull on cord	22 – 33 lbf.	(98 – 147N)	(10-15 kgf.)
Countershaft – Pull on cord	33 – 44 lbf.	147 – 196N)	(15-20 kgf.)
Pre-Load Shims Available	0.002 in.	(0.051 mm)	
	0.004 in.	(0.102 mm)	
	0.012 in.	(0.305 mm)	
	0.031 in.	(0.787 mm)	

HYDRAULIC TESTS

Oil Temperature.....	149°F ± 9°F	(65°C ± 5°C)	
Oil Pump Capacity @ 2200 rev/min.	6.6 Imp. Gals	(30 litres)	(7.9 U.S. Gals)

Line Pressure Test

@ 800 revs/min	130 lbf/in ²	(8.83 bar)	(9 kgf/cm ²)
@ 1600 revs/min	150 lbf/in ²	(10.30 bar)	(10.5 kgf/cm ²)
@ 2200 revs/min	200 lbf/in ²	(13.7 –	(14 – 15.5
	– 220 lbf/in ²	15.2 bar)	kgf/cm ²)

Internal Leakage

@ 800 revs/min	Less than 7 lbf/in ² (0.49 bar) (0.5 kgf/cm ²) pressure drop		
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Cooler Pressure Test

@ 1600 revs/min	71 lbf/in ²	(4.9 bar)	(5 kgf/cm ²)
@ 2200 revs/min – minimum.....	(85 lbf/in ²)	(5.88 bar)	6 kgf/cm ²
– maximum.....	(114 lbf/in ²)	(7.89 bar)	8 kgf/cm ²

Cooler Flow Test

@ 1600 revs/min – minimum.....	2.6 Imp. Gals	(12 litres/min)	(3.2 U.S. Gals)
@ 2200 revs/min – minimum.....	3.1 Imp. Gals	(14 litres/min)	(3.8 U.S. Gals)

By-Pass Valve Opening Pressure

@ 2200 revs/min	128 – 142 lbf/in ² (8.8 – 9.8 bar) (9-10 kgf/cm ²)		
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Control Valve Pressure Test

@ 1800 revs/min	100 lbf/in ² (6.9 bar) (7 kgf/cm ²) after 1.7 seconds as clutch is engaged, rising to 220 lbf/in ² (15.2 bar) (15.5 kgf/cm ²) after 2.3 seconds when clutch is engaged.		
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Stall speed	1700 – 1900 rev/min.		
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Lubrication Circuit By-Pass

Valve Opening Pressure	33 lbf/in ²	(2.3 bar)	(2.3 kgf/cm ²)
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Oil Filter By-Pass Opening Pressure.	7 – 9 lbf/in ²	(0.5 – 0.6 bar)	(0.5–0.6 kgf/cm ²)
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TORQUE VALVES

Item Description	lbf ft.	Nm	kgf m
Reverse idle gear shaft retaining bolt	47-54	64-73	6.5-7.4
Solenoid retaining bolt (Control valve)	2-4	3-5	0.3-0.5
Solenoid retaining bolt (Lock-up valve)	2-4	3-5	0.3-0.5
Output shaft retainer bolt	35-41	48-56	4.9-5.7
Countershaft retainer bolt	35-41	48-56	4.9-5.7
Safety start solenoid	21-29	29-39	3.0-4.0
Bypass valve plug	57-66	77-90	7.9-9.2
Regulating valve plug (Upper)	35-41	48-56	4.9-5.7
Regulating valve plug (Lower)	57-66	77-90	7.9-9.2
Lock-up valve plate bolt	7-8	10-11	1.0-1.15
Cooler return pipe union	36-58	49-78	5.0-8.0
Cooler return pipe elbow	36-58	49-78	5.0-8.0
Oil pressure check port pipe union	2-4	3-5	0.3-0.5
Oil pressure check port pipe elbow	2-4	3-5	0.3-0.5
Hydraulic pump feed pipe union	7-12	10-16	1.0-1.6
Hydraulic pump feed pipe elbow	7-12	10-16	1.0-1.6
8 × 8 lower shift rail locating bolt	45-54	62-73	6.3-7.4
4 × 4 interlock plug	13-15	18-21	1.8-2.1
4 × 4 rear cover plug	46-54	63-73	6.4-7.4
Cooler outlet connection plug	80-92	108-125	11.0-12.8
Control valve retaining bolt	17-20	23-27	2.3-2.7
Lock-up valve retaining bolt	6-7	8-10	0.8-1.0

C. SPECIAL TOOLS

DESCRIPTION	V.L. CHURCHILL TOOL NO.	NUDAY TOOL NO.
Shaft Protectors	625A	9212
Step Plate Adaptors	630S	9210
Step Plate Adaptors	630T	9211
Internal/External Puller	943	9507
Slide Hammer	943S	9567
Pulling Attachment	951	9190
Pilot Bearing Puller	954C	9508
Puller/Reversible Arm	1002	9198
Puller-Single End Arm	1003	9516
Pressure Gauge	FT 4100	—
Pressure Pipe	FT 4100-1	1552
Spring Compressor (modified)	FT 4101	1312
Connector – Pressure Test	FT 5006	—
Connector – Flow Test	FT 5007	—
Flowmeter	MS 820A	2015
Thread Adaptor	FT 820-1	—
Connector – Flow Test	FT 8543	—

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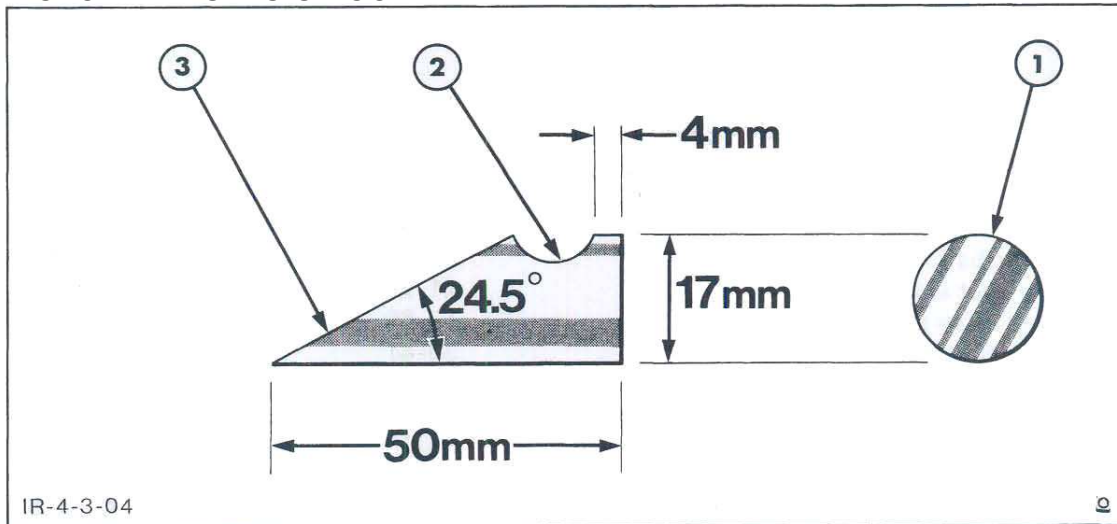


Figure 4
Lower Shift Rail Detent Retainer

1. 17 mm bar stock
2. Grind groove to accept detent ball
3. Grind ramp to give 24.5° angle (approx)

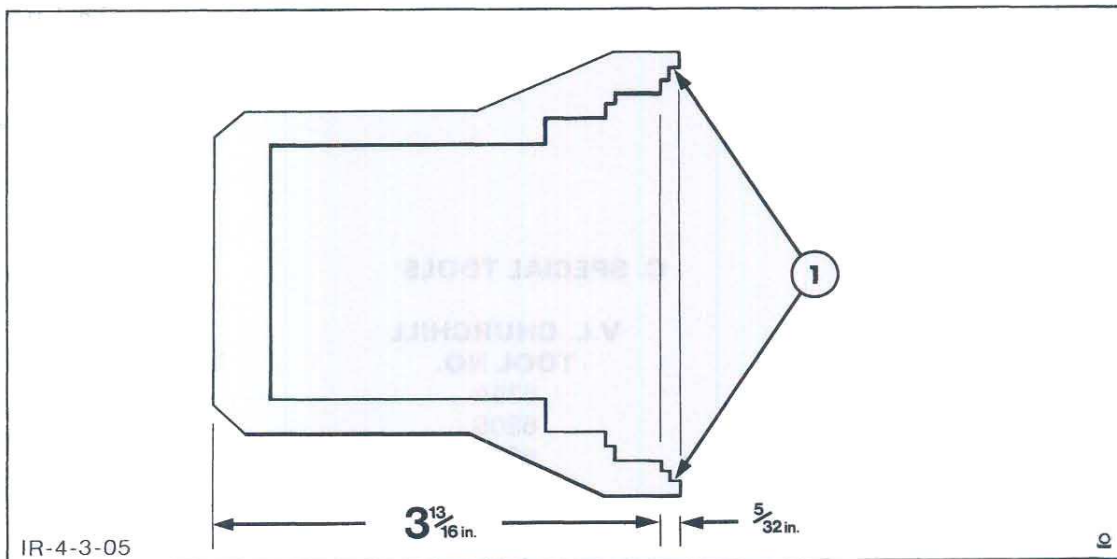


Figure 5
Spring Compressor FT4101 Modification

1. Remove stock from circumference of tool to give dimensions show

PART 5

REAR AXLE AND BRAKES

Chapter 1

REAR AXLE AND WHEEL BRAKES

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PART 5

REAR AXLE AND BRAKES

Chapter 1

REAR AXLE AND WHEEL BRAKES

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A. REAR AXLE–DESCRIPTION AND OPERATION

The rear axle contains the differential, brakes, final reduction gears, axle shaft and the differential lock, Figure 1.

Power from the transmission output shaft is transmitted to the pinion by the drive shaft coupling. The spiral bevel pinion is held by preloaded opposed taper roller bearings. The differential ring gear is bolted to the differential case and the drive from the case is transmitted through a conventional four pinion differential to two sun gear shafts which are splined into the side gear of the differential.

The differential lock sliding coupling is located on the splines of the differential side gear, Figure 2. The coupling has dog teeth which match with the dog teeth on the differential lock adaptor. The adaptor dog

teeth are in constant mesh with similar teeth machined in the differential case.

The differential lock operating spring separates the sliding coupling and adaptor. Depressing the differential lock pedal moves the differential lock fork which forces the sliding coupling into mesh with the adaptor, thus locking the side gear to the differential housing.

The transmission hand operated brake assembly is mounted on the differential drive pinion shaft. Refer to Chapter 2 for details and overhaul procedures.

A common supply of oil is used for lubricating the rear axle and differential assemblies. The differential ring gear and differential assembly is partly immersed in oil providing adequate lubrication for bearings and bushings.

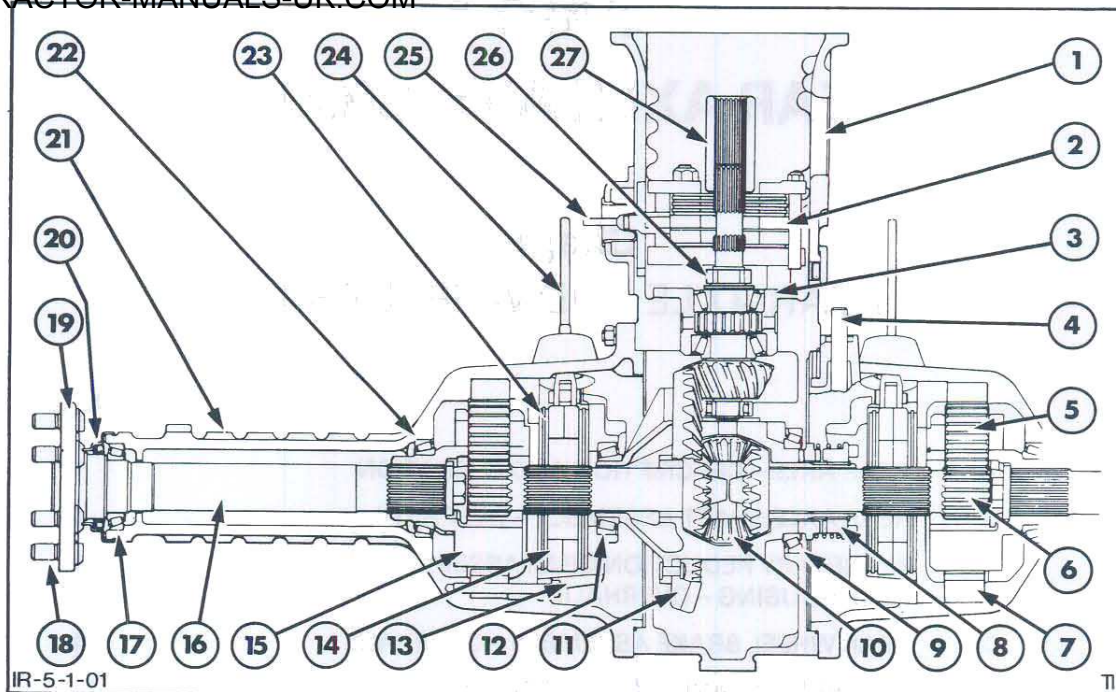


Figure 1
Rear Axle Sectional View

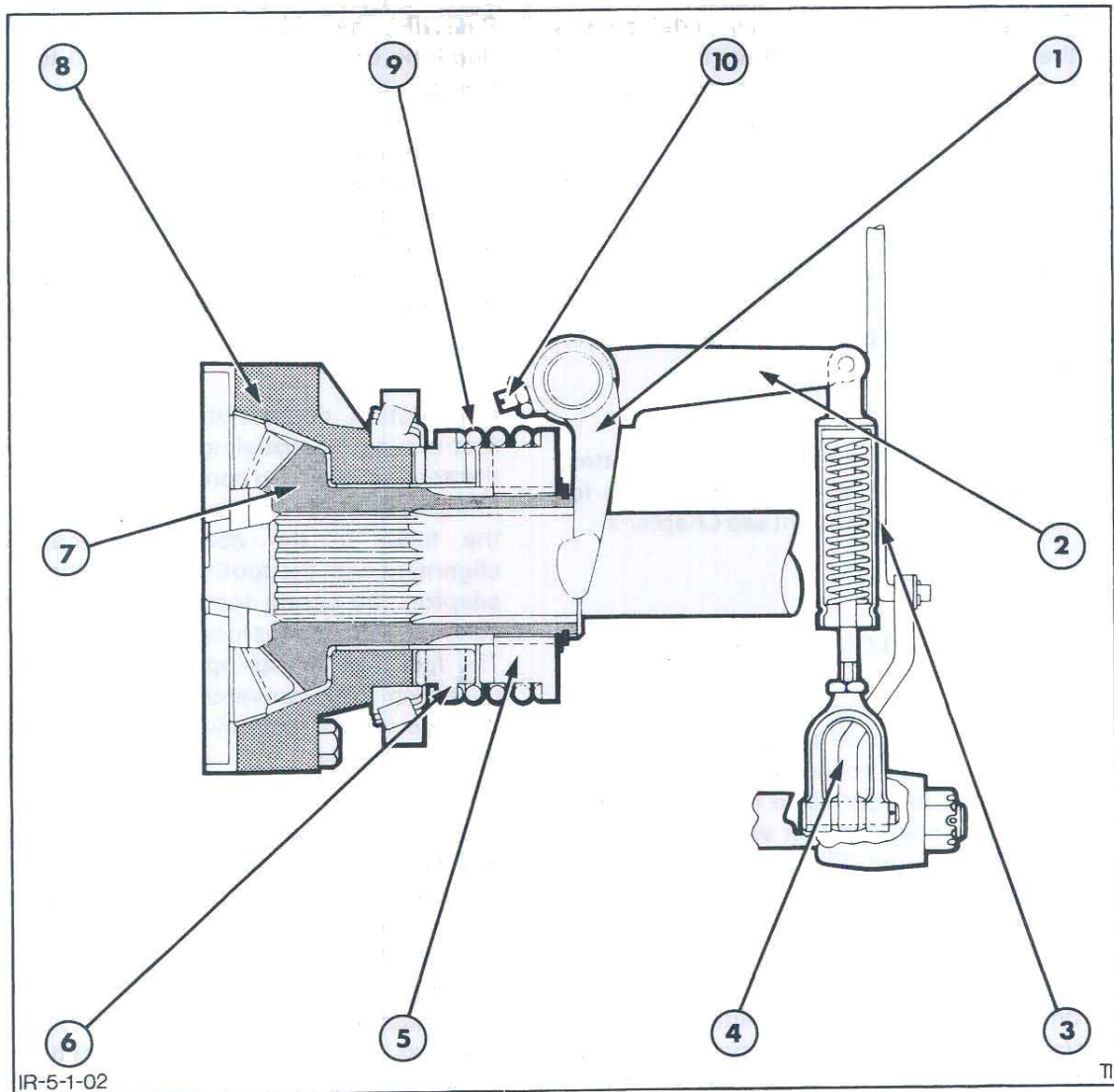
- | | | |
|--------------------------------------|-------------------------------|--|
| 1. Rear Axle Centre Housing | 11. Differential Ring Gear | 21. Axle Shaft Housing |
| 2. Transmission Handbrake Assembly | 12. Differential Bearing | 22. Axle Shaft Inner Bearing |
| 3. Drive Pinion Bearing Retainer | 13. Brake Outer Housing | 23. Brake Discs |
| 4. Differential Lock Operating Shaft | 14. Brake Actuating Discs | 24. Brake Actuating Rod |
| 5. Planet Gear | 15. Planet Gear Carrier | 25. Transmission Handbrake Actuating Rod |
| 6. Sun Gear and Shaft | 16. Rear Axle Shaft | 26. Bearing Preload Adjuster |
| 7. Ring Gear | 17. Axle Shaft Outer Bearing | 27. Transmission Coupling |
| 8. Differential Lock Assembly | 18. Rear Wheel Securing Studs | |
| 9. Differential Bearing | 19. Rear Wheel Flange | |
| 10. Differential Assembly | 20. Axle Shaft Oil Seal | |

In each rear axle assembly a shaft projects through the side gear. This shaft terminates in a spur gear which is the sun gear of the planetary reduction gear system. The planetary ring gear is pressed into the rear axle housing. The three planet gears are mounted in a carrier and are positioned around the sun gear and within the planetary ring gear.

The planet gears are mounted to the carrier by shafts and rotate on uncaged needle bearings. The carrier has internal splines into which the rear axle shaft locates.

As the sun gear is driven by the differential, the planet gears are forced to revolve inside the stationary planetary ring gear and force the carrier to revolve at a lower speed than the sun gear.

The rear axle shaft is held in opposed taper roller bearings and the end play is adjusted by means of selective shims held under the retaining bolt. The shaft terminates in a flange to which the rear wheel is bolted. An exploded view of one rear axle and brake half housing is shown in Figure 3.



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Figure 2
Differential Lock Assembly

- | | |
|------------------------------|---------------------------|
| 1. Differential Lock Fork | 6. Adaptor |
| 2. Lever | 7. Differential Side Gear |
| 3. Adjustable Rod and Clevis | 8. Differential Housing |
| 4. Pedal Lever | 9. Spring |
| 5. Coupling | 10. Ford Retaining Bolt |

The disc brakes consist of two sets of stationary and revolving discs. The revolving discs are splined to the shaft of the sun gear, located either side of an actuator assembly, Figure 3.

The Ford 455C incorporates three brake discs and one intermediate disc, while the Ford 555C and 655C incorporate four brake discs and two intermediate discs.

The actuator assembly consists of two thrust plates with ramped 'pockets' in which steel balls are located. The actuating discs are held in contact with the balls by four coil springs, and are connected by suitable linkage with the appropriate foot-brake pedal.

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Operation of the foot-brake pedal causes the rear brake actuating discs to rotate and the balls to rotate up the ramped 'pockets'. This expands the actuating discs and in so doing the actuating discs force the rear brake disc assemblies into contact with the intermediate disc, the actuating discs, and the inner and outer brake housings. Rotation of the stationary components of the brake unit is prevented by a large diameter torque pin held in the outer brake housing.

The twin cable hand-brake, where fitted, also actuates the rear axle disc brakes for operation and adjustment see Chapter 2.

DIFFERENTIAL LOCK OPERATION

When one rear wheel of a unit encounters a soft patch of ground and spins, the normal type differential action allows virtually all the drive to be applied to this wheel and a little to the opposite rear wheel which may be on firm ground. The result is that the unit is either brought to a complete halt or considerably slowed down.

When a differential lock is fitted, improved traction is possible because the lock enables traction to be obtained from the wheel which is on firm ground, thus enabling the unit to pull through the soft ground conditions.

Basically, the locking device consists of a dog-type coupling which is splined to, but free to slide on the differential side gear, and is designed to positively lock the differential side gear to the differential case. The connection is made through the differential lock adaptor which has dog teeth on both side faces. The teeth on the inside engaging with teeth machined on the differential case and the teeth on the outside with the differential lock coupling.

In operation, depression of the foot pedal first moves the coupling into contact with the adaptor and then compresses the spring in the operating rod assembly, Figure 2. As the teeth of the coupling come into alignment with the tooth spaces in the fixed adaptor, the spring tension will move the coupling into engagement with the adaptor. The fact that the spring supplies the final operating force prevents the possibility of damage should excessive force be applied to the foot pedal.

When full engagement has taken place (this will be noticeable by the reduced pedal pressure) the foot pedal should be released. The coupling and adaptor teeth side forces, resulting from the transfer of power from one wheel to another, will keep the coupling and adaptor teeth in mesh. As the drive becomes more equally distributed, the compressed operating spring overcomes the reduced teeth side forces and automatically disengages the differential lock.

B. REAR AXLE SHAFT ASSEMBLY – OVERHAUL

REMOVAL

1. Remove the backhoe or rear counter-weight as described in PART 8, Chapter 8.
2. Remove the rear axle from the unit as described in Section C of PART 10, Separating the Unit.
3. Support the rear axle housing and remove the bolts and nuts which secure the housing to the rear axle centre housing.
4. Separate the axle housing from the centre housing. If the left hand axle housing has been removed lift out the differential to prevent it falling.

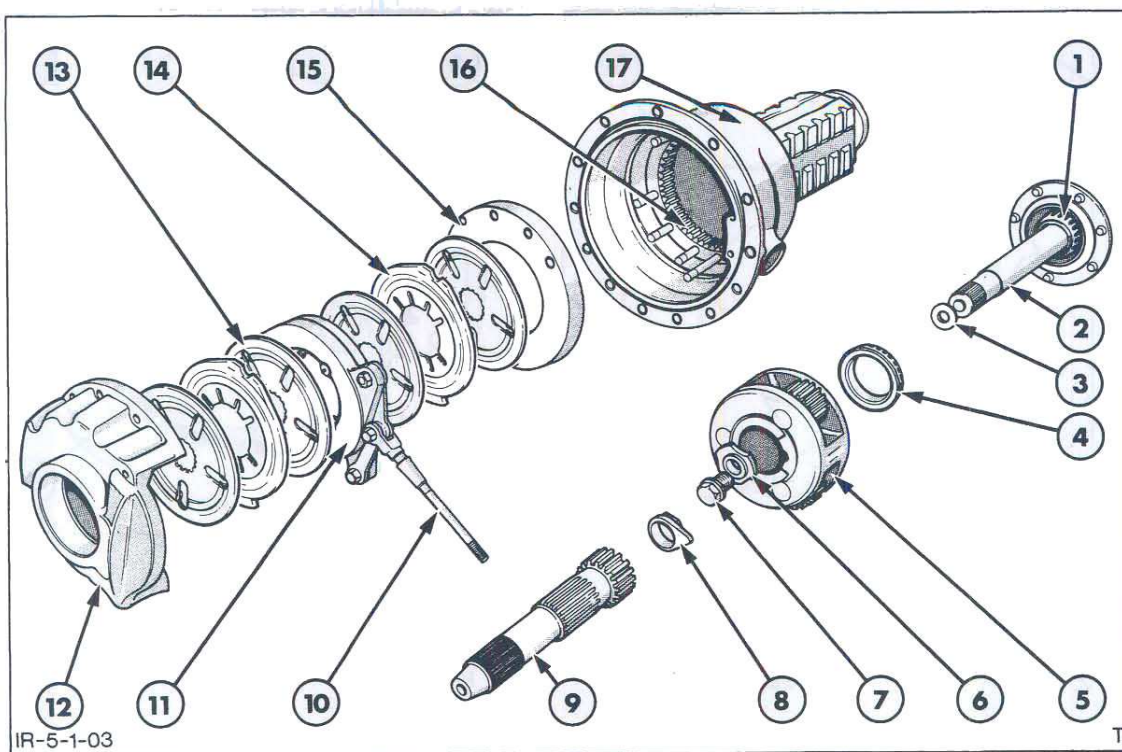


Figure 3
Axle Housing Assembly – Exploded View

- | | | |
|-----------------------------|---------------------------|--------------------------|
| 1. Axle Shaft Outer Bearing | 7. Retaining Bolt | 13. Rotating Brake Discs |
| 2. Axle Shaft | 8. Lock Plate | 14. Fixed Brake Discs |
| 3. Spacer | 9. Sun Gear and Shaft | 15. Outer Brake Housing |
| 4. Bearing | 10. Brake Actuating Rod | 16. Ring Gear |
| 5. Planet Gear Carrier | 11. Brake Actuating Discs | 17. Axle Housing |
| 6. Retaining Washer | 12. Inner Brake Housing | |

DISASSEMBLY

1. Remove the large 'O' ring seal from the axle housing.
2. Left Hand Axle Housings – Remove the two bolts securing the differential ring gear thrust block to the axle housing and remove the thrust block.

Right Hand Axle Housing – Remove the differential lock fork by loosening the differential lock fork screw and locknut Figure 4 and remove the differential lock lever shaft.

3. Remove the eight nuts that retain the inner disc brake housing assembly in the axle housing. Lift the brake housing out of the axle housing.
4. Remove the brake control rod fastener. Remove the brake rod seal if damaged. To remove the seal, place a sharp tool between the seal flange and the rear axle housing and pry the seal out. Remove the brake disc assemblies, intermediate discs, and actuating disc assembly.

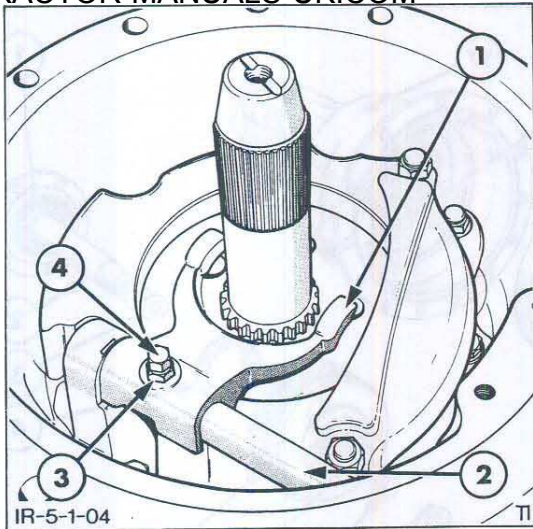


Figure 4

Differential Lock Operating Fork

- | | |
|-------------------|------------------|
| 1. Operating Fork | 3. Locknut |
| 2. Shaft | 4. Securing Bolt |

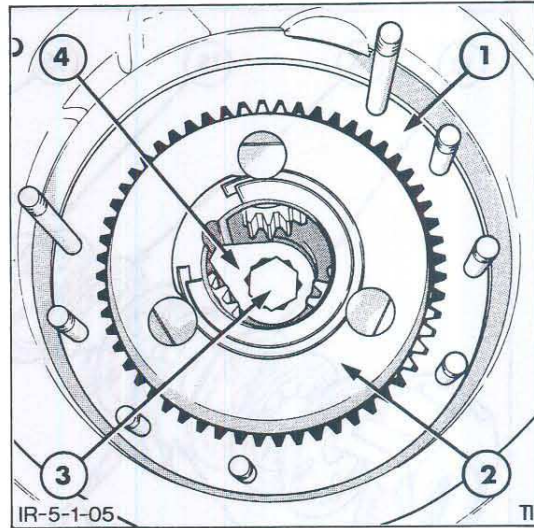


Figure 5

Axle Shaft Retaining Bolt

- | | |
|------------------------|-------------------|
| 1. Ring Gear | 3. Retaining Bolt |
| 2. Planet Gear Carrier | 4. Lock Plate |

- Lift the sun gear out of the planet gear carrier.
- Remove the outer brake housing from the axle housing.
- Remove the axle shaft bolt lock, axle shaft retaining bolt, axle shaft retaining washer, and selective spacer. The planet gears may have to be rotated to permit removal of the bolt lock, Figure 5.
- Lift the planet gear carrier assembly out of the axle housing.
- Separate the seal retainer from the end of the axle housing, by tapping down the staking with a copper drift and hammer. Remove the axle shaft from the axle housing.

- If necessary remove the axle shaft cone and roller assembly, seal and seal retainer using Tool Nos. P61, 952, 938, 930B, 930E and 924, or Tool Nos. 9162, 9526, 9506, 9521, 9207 and 9537, Figure 6.

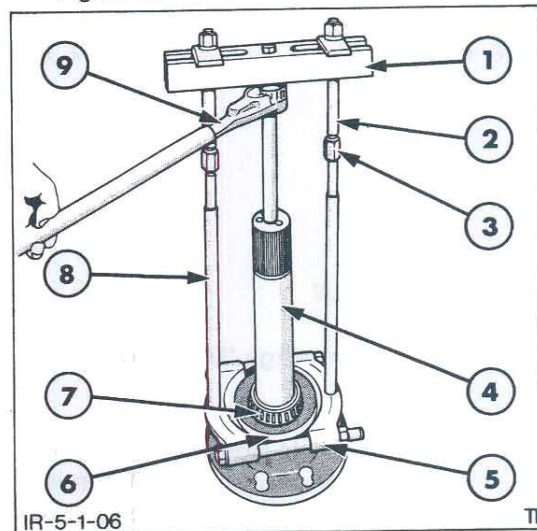


Figure 6

Removing Axle Shaft Outer Bearing and Oil Seal

- | | |
|--------------------------|--------------------------|
| 1. Tool No. 938 or 9506 | 6. Oil Seal Retainer |
| 2. Tool No. 930E or 9207 | 7. Outer Bearing |
| 3. Tool No. 924 or 9537 | 8. Tool No. 930B or 9521 |
| 4. Axle Shaft | 9. Tool No. P61 or 9162 |
| 5. Tool No. 952 or 9526 | |

INSPECTION AND REPAIR

- Clean and repair all parts and install new parts where worn or damaged.

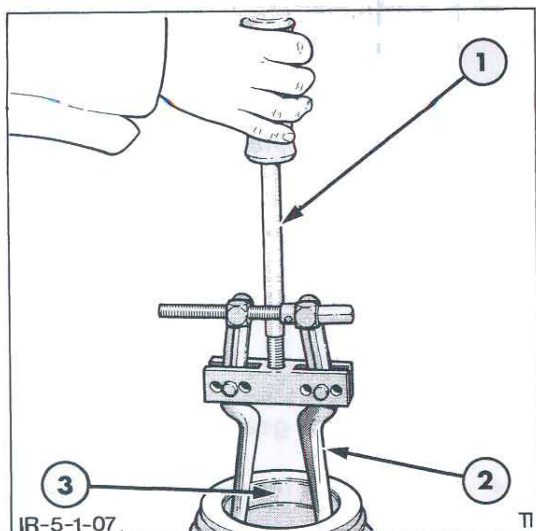


Figure 7

Removing Outer Bearing Track from Axle Housing

1. Tool No. 943S or 9567 3. Bearing Track
2. Tool No. 943 or 9507

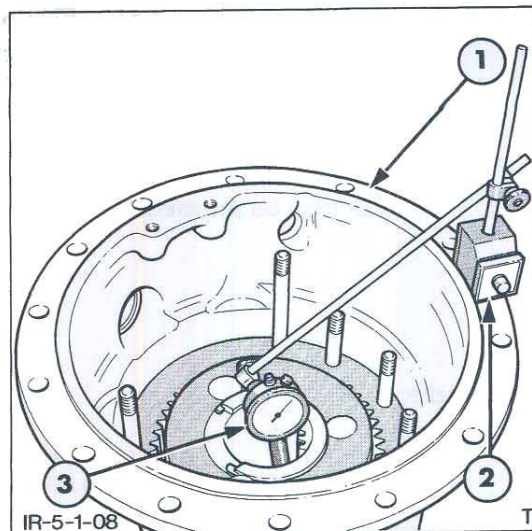


Figure 8

Checking Axle Shaft Bearing Pre-load

1. Axle Housing 3. Dial Indicator
2. Magnetic Base

3. If necessary remove the axle shaft outer bearing cup from the housing using Tool Nos. 943 or 9507 and 943S or 9567, Figure 7.

NOTE: It will be necessary at this stage to adjust the axle shaft bearing pre-load for which the following procedure should be adopted.

RE-ASSEMBLY

1. Position a new oil seal and retainer assembly on the axle shaft and place a new oil seal retainer gasket in the seal retainer. Use a 2.68 in. (68.2 mm) inside diameter and 3.12 in. (79.4 mm) outside diameter sleeve of a suitable length to install the new outer bearing assembly onto the axle shaft. Apply a coat of petroleum jelly to both the seal and cone and roller assembly prior to installation.
 2. Install the axle housing on the axle shaft and, using a hammer and drift, stake the seal retainer to the housing in four equally spaced places.
 3. Place the planet gear carrier assembly in the axle housing so that the planet gears mesh correctly with the planetary ring gear.
- a. Using the largest spacer available, .089 in (2.261 mm), fit the spacer, retaining washer and tighten the axle shaft bolt.
 - b. Set up a dial indicator, as shown in Figure 8. It will be necessary to use an extended plunger on the dial indicator to enable a reading to be taken from the top of the axle shaft bolt.
 - c. Set the dial indicator to zero and lift the axle housing. This can be done by prying up against the outer surface of the axle housing. Lifting the housing will result in a reading on the dial indicator. This is the free movement between the inner and outer bearing cone and roller assemblies and the cups.

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To determine the correct bearing pre-load the reading obtained should be subtracted from the spacer size fitted, i.e. 0.089 in. (2.261 mm), and with the resulting figure, from the table below, the correct spacer may be selected.

Example:

SPACER FITTED	0.089 in. (2.261 mm)
READING OBTAINED	0.026 in. (0.660 mm)
RESULTANT FIGURE	0.063 in. (1.600 mm)

FROM TABLE BELOW THE CORRECT SPACER TO BE USED: 0.065 in (1.651 mm)

RESULTANT FIGURE	SPACER TO BE FITTED
0.051–0.054 in (1.295–1.371 mm)	0.053 in. (1.346 mm)
0.055–0.058 in. (1.397–1.472 mm)	0.057 in. (1.448 mm)
0.059–0.062 in. (1.499–1.575 mm)	0.061 in. (1.549 mm)
0.063–0.066 in. (1.600–1.676 mm)	0.065 in. (1.651 mm)
0.067–0.070 in. (1.702–1.778 mm)	0.069 in. (1.753 mm)
0.071–0.074 in. (1.803–1.880 mm)	0.073 in. (1.855 mm)
0.075–0.078 in. (1.905–1.988 mm)	0.077 in. (1.956 mm)
0.079–0.082 in. (2.007–2.083 mm)	0.081 in. (2.057 mm)
0.083–0.086 in. (2.108–2.184 mm)	0.085 in. (2.159 mm)
0.087–0.090 in. (2.210–2.286 mm)	0.089 in. (2.261 mm)

4. Position the selected spacer, shaft retaining washer and tighten the axle shaft bolt to the torque specified in the 'Specifications' Section, Chapter 3. To position the bolt lock may require that the bolt be tightened slightly so that the lock notches will fit the bolt head corners. Ensure the bolt has the correct torque when the lock is installed.

5. Install the disc brake outer housing and brake torque pin.

NOTE: Prior to installing the sun gear and brake discs in the left hand axle housing, it will be necessary to carry out the differential bearing pre-load adjustment if any of the following parts have been replaced with new components.

- Rear axle housing
- Planetary ring gear
- Outer brake housing
- Inner brake housing

Differential Bearing Pre-Load Adjustment

The bearing pre-load adjustment is made by adding or subtracting shims between the differential bearing cup and the inner brake housing. The bearing pre-load should be made to the left hand axle housing.

- a. Install the inner brake housing in the axle housing and secure with the eight nuts.
- b. Remove the differential bearing cup, together with the shims, from the inner disc brake housing, Figure 9.
- c. Position the gauge ring Tool No. FT 4501 or 2141 in the inner disc brake housing. Ensure that the gauge ring seats correctly in the bearing cup recess.
- d. Line up the pads of the bridge bar with three holes in the axle housing flange and, bolt the bridge bar to the axle housing flange.
- e. Using a feeler gauge measure the gap between the bridge bar and the gauge ring, Figure 10.

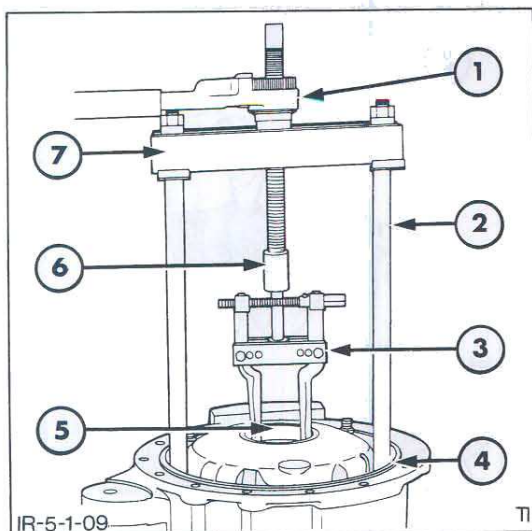


Figure 9
Removing Bearing Cup from
Inner Brake Housing

- | | |
|-------------------------|------------------|
| 1. Tool No. P61 or 9162 | 5. Bearing Cup |
| 2. Tool No. 930B or 952 | 6. Tool No. 9554 |
| 3. Tool No. 943 or 9507 | 7. Tool No. 938 |
| 4. Tool No. 938 or 9472 | or 9506 |

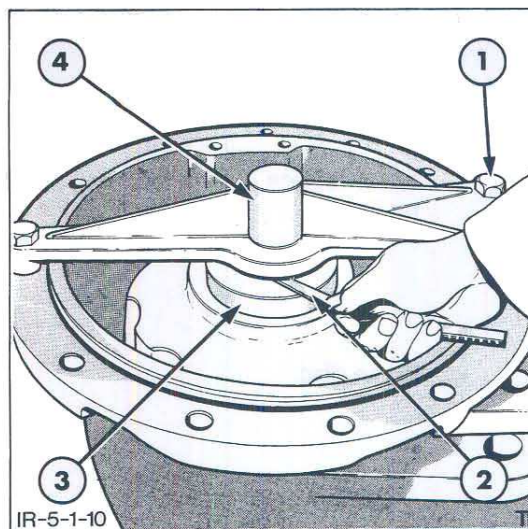


Figure 10
Checking Differential Bearing Pre-load

- | | |
|-----------------|-------------------------------|
| 1. Bolt | 4. Tool No. FT4501 or
2141 |
| 2. Feeler Gauge | |
| 3. Gauge Ring | |

- f. With the resulting gap reading the shim to be installed can be selected from table A or table B depending on which tool was used, FT4501 Churchill or 2141 Nuday.

IMPORTANT: Ensure the correct table is used.

- g. Remove the bridge bar and gauge from the axle housing.
- h. Install the selected shim together with the differential bearing cup in the inner disc brake housing.
- i. Remove the inner disc brake housing from the axle housing and proceed as follows.

6. Position the sun gear in the planet gear carrier.
7. Install the brake assembly in the following order.
- Brake disc.
 - Intermediate disc with notch on the torque pin.
 - Brake disc.
 - Brake actuating disc assembly with the control rod passing through the brake control rod seal assembly, Figure 12. Position the notch over the torque pin. If the brake control rod seal assembly has been removed, install a new seal by tapping it into the rear axle housing and locking the seal in the annular groove on the brake control rod. Secure a new control rod fastener.

e. Brake disc.

f. Intermediate disc with notch on the torque pin.

g. Brake disc.

NOTE: Prior to installing the inner disc brake housing ensure the intermediate discs and actuating disc assembly are correctly centred. This will permit easier installation of the housing.

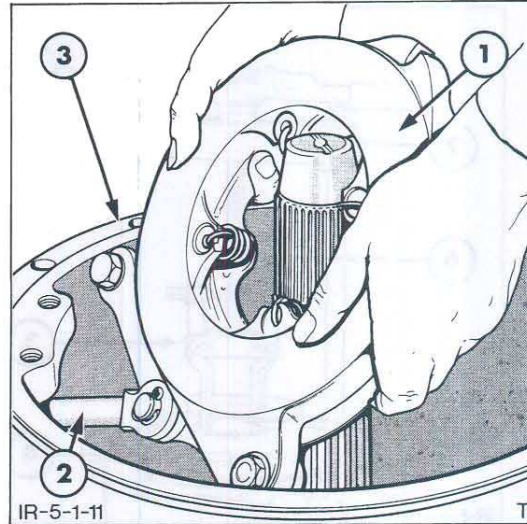


Figure 11
Installing Brake Actuating Mechanism

1. Actuating Discs 3. Axle Housing
2. Actuating Link

8. Install the inner disc brake housing and secure with eight nuts and tighten the nuts to the torque specified in 'Specifications' – Chapter 3.

9. Position the differential ring gear thrust block and secure with two bolts and lockwashers. Install a new large 'O' ring seal on the axle housing.

TABLE A – Use with Churchill Tool No. FT4501		
Gap Measured	Shim Size To Be Installed	Shim Part No. To Be Installed
0.012–0.017 in. (0.305–0.432 mm)	0.038–0.040 in. (0.965–1.016 mm)	C5NN-4548-A
0.018–0.023 in. (0.457–0.584 mm)	0.044–0.046 in. (1.118–1.168 mm)	C5NN-4548-B
0.024–0.029 in. (0.610–0.737 mm)	0.050–0.052 in. (1.270–1.321 mm)	C5NN-4548-C
0.030–0.035 in. (0.762–0.889 mm)	0.056–0.058 in. (1.422–1.473 mm)	C5NN-4548-D
0.036–0.041 in. (0.914–1.041 mm)	0.062–0.064 in. (1.575–1.626 mm)	C5NN-4548-E
0.042–0.047 in. (1.067–1.194 mm)	0.068–0.070 in. (1.727–1.778 mm)	C5NN-4548-F
0.048–0.053 in. (1.219–1.346 mm)	0.074–0.076 in. (1.880–1.930 mm)	C5NN-4548-G
0.054–0.059 in. (1.372–1.499 mm)	0.080–0.082 in. (2.032–2.083 mm)	C5NN-4548-H

TABLE B – Use with Nuday Tool No. 2141		
Gap Measured	Shim Size To Be Installed	Shim Part No. To Be Installed
0.037–0.042 in. (0.94–1.08 mm)	0.038–0.040 in. (0.965–1.016 mm)	C5NN-4548-A
0.043–0.048 in. (1.09–1.23 mm)	0.044–0.046 in. (1.118–1.168 mm)	C5NN-4548-B
0.049–0.054 in. (1.24–1.38 mm)	0.050–0.052 in. (1.270–1.321 mm)	C5NN-4548-C
0.055–0.060 in. (1.39–1.53 mm)	0.056–0.058 in. (1.422–1.473 mm)	C5NN-4548-D
0.061–0.066 in. (1.54–1.68 mm)	0.062–0.064 in. (1.575–1.626 mm)	C5NN-4548-E
0.067–0.072 in. (1.69–1.83 mm)	0.068–0.070 in. (1.727–1.778 mm)	C5NN-4548-F
0.073–0.078 in. (1.84–1.98 mm)	0.074–0.076 in. (1.880–1.930 mm)	C5NN-4548-G
0.079–0.084 in. (1.99–2.13 mm)	0.080–0.082 in. (2.032–2.083 mm)	C5NN-4548-H

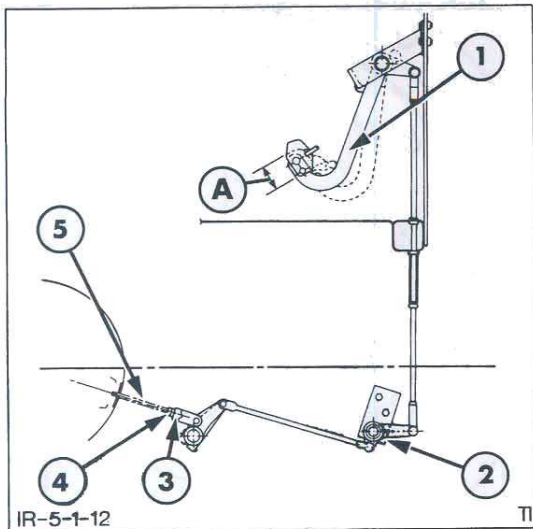


Figure 12
Brake Linkage

- | | |
|--------------------------|------------------|
| A. 1.5 in (38.0 mm) | 3. Adjusting Nut |
| 1. Pedal | 4. Lock Nut |
| 2. Pin and Bracket Assy. | 5. Pull Rod |

- Right Hand Axle Housing: Install the differential lock fork and differential lock lever. Tighten the screw and lock nut.

INSTALLATION

- Left Hand Axle Housing: Install the differential assembly into the centre housing.
- Install the axle housing to the centre housing. Tighten the securing nuts and bolts to the correct torque, see 'Specifications' – Chapter 3.
- Install the rear axle assembly to the transmission as described in PART 10.
- Reconnect the brake linkage and adjust the linkage to provide the specified free pedal travel, Figure 12. See 'Specifications' – Chapter 3.
- Install the rear wheels and the rear axle drain plug. Refill the rear axle with the specified oil, see 'Specifications' – Chapter 3.

C. PLANETARY REDUCTION GEAR ASSEMBLY AND AXLE HOUSING – OVERHAUL

REMOVAL

- Remove the axle housing as described in Section B and remove the planetary reduction gear assembly.

DISASSEMBLY

- To disassemble the planetary gear assembly bend up one end of the planet gear shaft retaining ring and withdraw the retaining ring. Push the planet gear shafts from the carrier and remove the planet gears complete with needle roller bearings and thrust washer, Figure 13.
- If the bearing on the planet gear carrier requires replacing remove the roller and inner track assembly using Pulling attachment Tool No. 952 or 9526 and Puller Tool No. 1003 or 9516. Install a step plate adaptor into the end of the shaft.

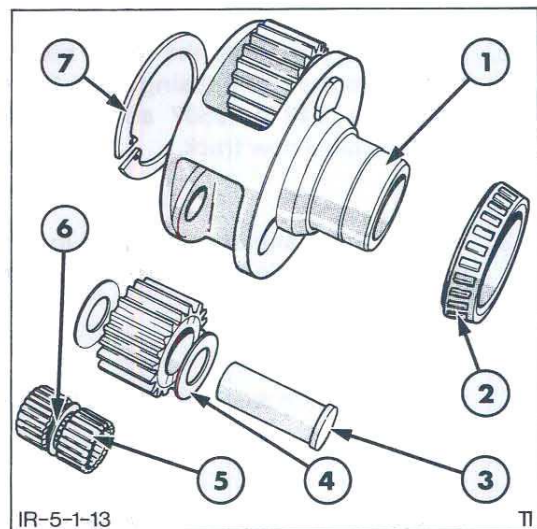


Figure 13
Planet Gear Carrier Assembly

- | | |
|----------------------|-------------------|
| 1. Carrier | 5. Needle Rollers |
| 2. Bearing | 6. Spacer |
| 3. Planet Gear Shaft | 7. Retaining Ring |
| 4. Thrust Washer | |

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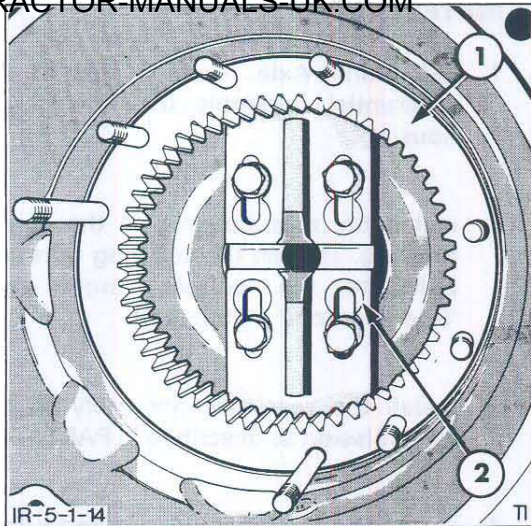


Figure 14
Removing Planetary Ring Gear

1. Ring Gear 2. Tool No. FT4500

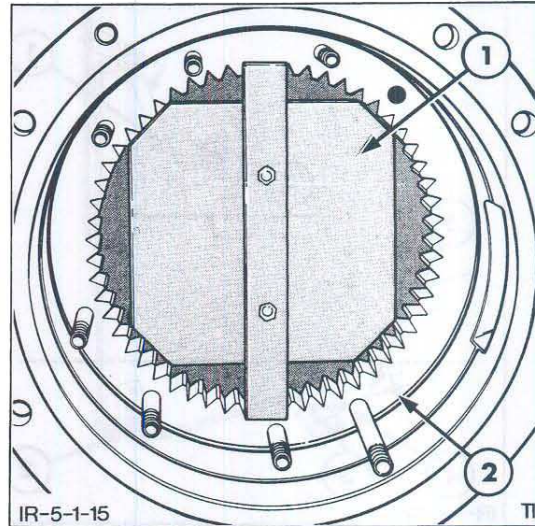


Figure 15
Removing Planetary Ring Gear

1. Tool No. FT2122 2. Ring Gear

INSPECTION AND REPAIR

1. Clean and inspect all parts and install new parts where worn or damaged.
2. If necessary remove the inner bearing track from the axle housing using Puller, Tool Nos. 943 or 9507 and 943-S or 9567. Install a new track.
3. Inspect the planetary ring gear located in the axle housing. If damaged or worn renew as follows:
 - a. Remove the axle shaft from the axle housing.
 - b. Position Tool No. FT4500 behind the ring gear, expand the movable plates and tighten the four locknuts, Figure 14. If tool 2122 is used position the tool behind the ring gear and tighten the retaining nuts, Figure 15.
 - c. Place the axle housing on a press beam with the large end down. Insert a bar of suitable length into the small end of the housing and place one end of the bar against the Tool No. FT4500 or 2122. Position the other end of the bar under the press ram and press out the ring gear.
 - d. Clean the new ring gear and the housing shoulder and position the ring gear in the axle housing, ensuring that the studs in the housing are aligned with the holes in the ring gear.
 - e. Place the axle housing on a press beam with the large end up. Position Tool No. FT4500 or 2122 on the ring gear, Figure 16 and press the ring gear into the housing. Ensure the ring gear is pressed squarely into the housing.

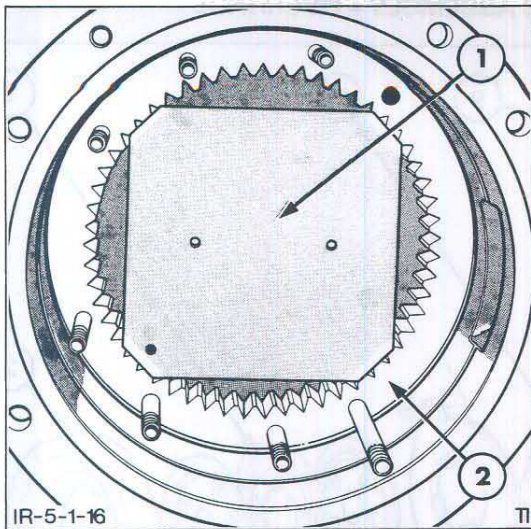


Figure 16
Installing Planetary Ring Gear

1. Tool FT4500 or 2122 2. Ring Gear

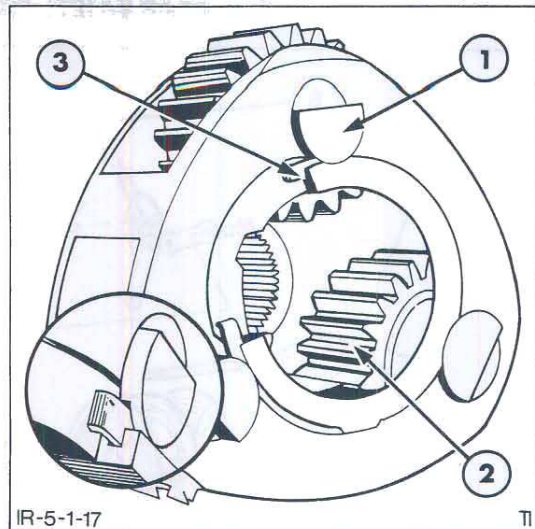


Figure 17
Plate Gear Carrier Assembly

1. Planet Gear Shaft 3. Planet Gear Shaft Retainer
2. Planet Gear

- f. To check that the ring gear is seated correctly, use a feeler gauge to ascertain if there is a gap between the ring gear and housing shoulder.

4. Install the planet gear shaft retainer, bending the ends of the retainer into the recess.
5. If the inner bearing track has been removed install a new track using a hollow sleeve of suitable internal diameter.

RE-ASSEMBLY

1. Coat the spacers in grease and position in the planet gears. Install sixteen needle rollers each side of the spacer in the planet gears and place a grease coated thrust washer on each end of the planet gears.
2. Place the three planet gears, complete with thrust washers, in the carrier. Align the bores in the planet gears with the bores in the carrier.
3. Insert all three planet gear shafts in the carrier housing. Position the shafts so that the flat portion of the shaft head is away from the centre of the carrier housing, Figure 17.

INSTALLATION

1. Re-assemble the rear axle following procedures described in Section B. Fill the rear axle with the specified lubricant and recheck the oil level after operation.

NOTE: If a new planetary ring gear has been installed in the left hand axle housing the differential bearing pre-load must be checked as described in Section B.

D. REAR WHEEL BRAKE ASSEMBLY – OVERHAUL

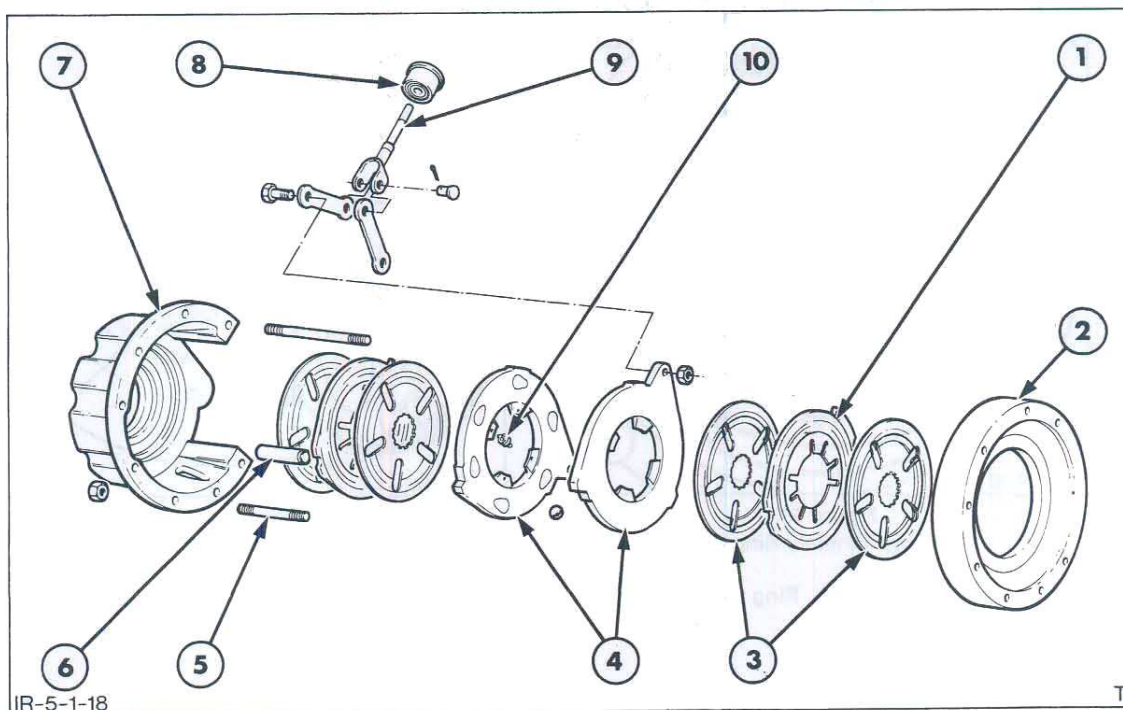


Figure 18

Brake Actuating Components (Ford 555C and 655C shown)

- | | | |
|------------------------|---------------------------------|------------------------------------|
| 1. Fixed Disc | 5. Brake Housing Securing Studs | 8. Actuating Rod Seal |
| 2. Outer Brake Housing | 6. Torque Pin | 9. Actuating Rod |
| 3. Rotating Disc | 7. Brake Inner Housing | 10. Actuating Discs Return Springs |
| 4. Actuating Discs | | |

REMOVAL

1. Remove the rear axle housing as described in Section B.
2. Remove the brake assembly from the axle housing as described in Section B.

DISASSEMBLY

1. Detach the brake control rod and actuating links by removing the cotter pins, clevis pins and nuts, Figure 18.
2. Remove the four actuating disc return springs and separate the actuating discs, Figure 19.
3. Remove the six steel balls.

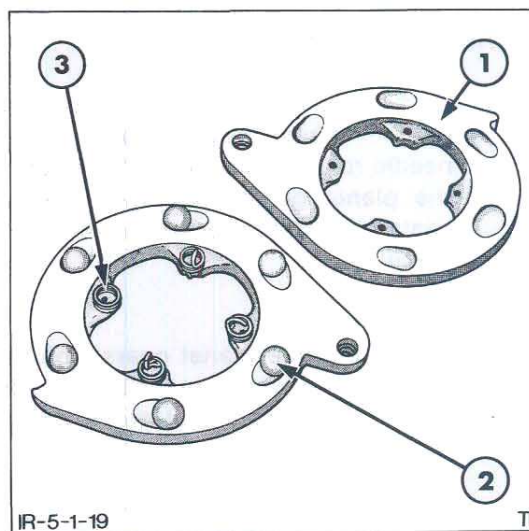


Figure 19

Brake Actuating Discs

- | | |
|-------------------|------------------|
| 1. Actuating Disc | 3. Return Spring |
| 2. Actuating Ball | |

INSPECTION AND REPAIR

1. Inspect the steel fixed plates for wear and warp. The inspection should include the inner and outer brake housings. Replace parts which are scored or warped.
2. Inspect the rotating discs for wear and warp. Replace the discs if the friction material has worn to the bottom of any grooves, or if the plates are warped more than maximum specified – see 'Specifications', Chapter 3.
3. Replace the actuating rod seal.
2. Position the other actuating disc over the first with the pockets locating on the steel balls. The actuating lugs should be approximately 1 in. (25.4 mm) apart.
3. Install the four actuating disc return springs on the lugs on the inner edge of the actuating discs.
4. Install the actuating links and secure using the clevis pins, cotter pins and nuts.

INSTALLATION

1. Install the brake actuating assembly and disc assemblies as described in Section B.
2. Install the axle housing to the rear axle centre housing, and install the rear axle assembly as described in PART 10.
3. Reconnect the brake actuating linkage and adjust the brake linkage as described in PART 10.

RE-ASSEMBLY

1. Place one actuating disc with the pockets uppermost on a flat surface and position a steel ball in each pocket.

**E. DIFFERENTIAL AND DIFFERENTIAL LOCK ASSEMBLY
– OVERHAUL****REMOVAL**

1. Remove the left hand axle housing as described in Section B and lift out the differential assembly.

DISASSEMBLY

1. Remove the differential lock ring that secures the sliding coupling to the side gear. Remove the stop washer, sliding coupling, coupling spring and gear case adaptor, Figure 20.
2. Mark the two halves of the differential case so that the two halves may be reassembled in the same relative position.

3. Loosen the securing bolts and separate the two halves of the differential case as the bolts are loosened.
4. Remove the bolts which secure the differential ring gear to the differential case and separate the ring gear from the case.

INSPECTION AND REPAIR

1. Thoroughly clean and inspect all parts. Install new parts where worn or damaged.

NOTE: If a new differential ring gear is installed a new drive pinion must also be fitted as outlined in Section F.

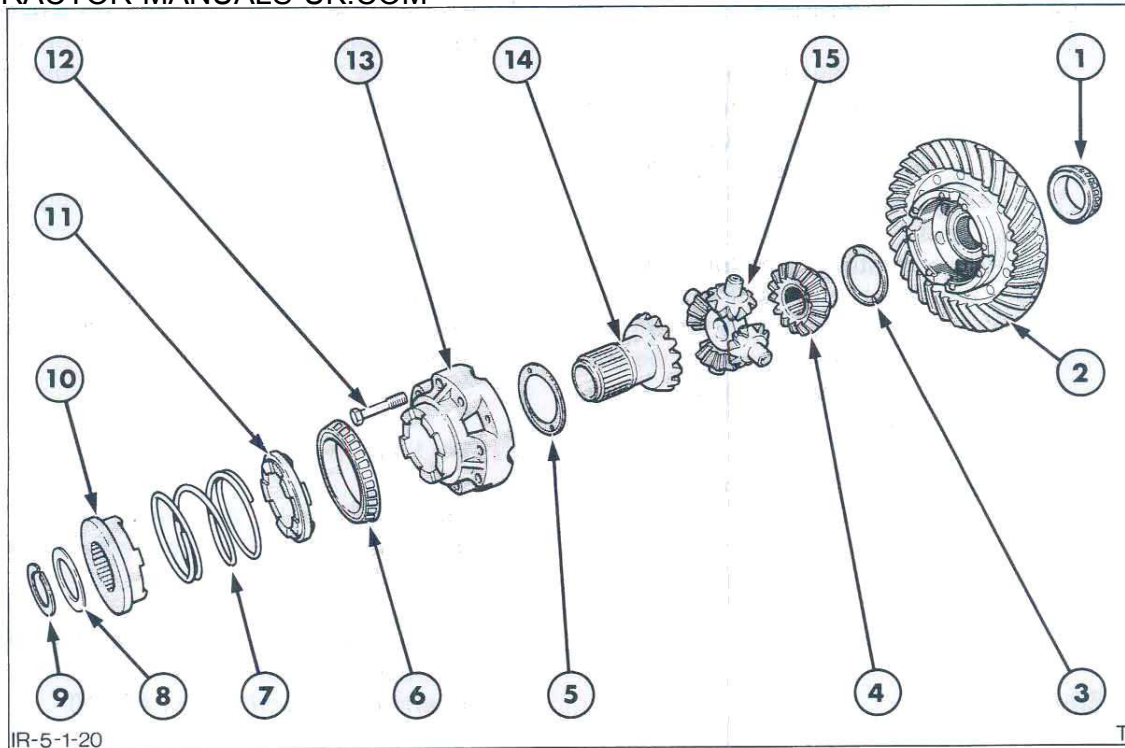


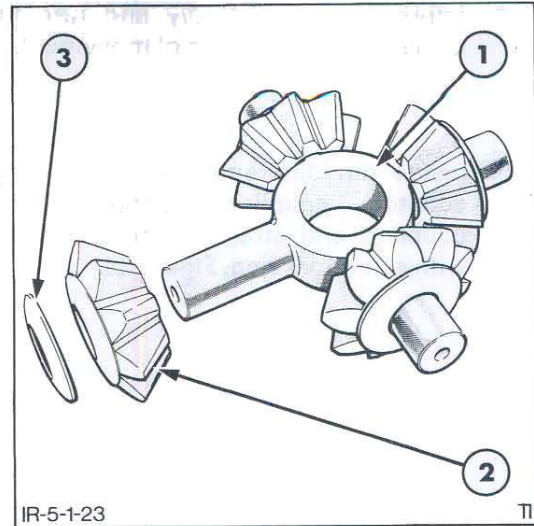
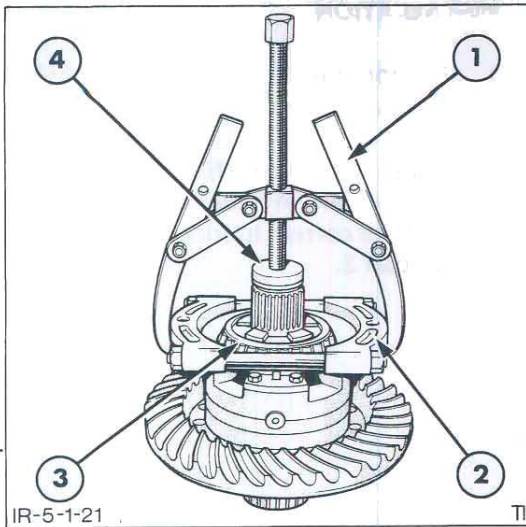
Figure 20
Differential Assembly – Exploded View

- | | | |
|------------------|----------------------|-----------------------|
| 1. Bearing | 6. Bearing | 11. Adaptor |
| 2. Ring Gear | 7. Spring | 12. Securing Bolt |
| 3. Thrust Washer | 8. Stop Washer | 13. Differential Case |
| 4. Side Gear | 9. Lock Ring | 14. Side Gear |
| 5. Thrust Washer | 10. Sliding Coupling | 15. Pinion Gears |

2. If it is necessary to replace the differential case bushings drive out the old bushings using a suitable drift. Install new bushings from the inside face of the case.
3. If it is necessary to remove the differential bearing roller and track assembly from the differential case using Tool Nos. 952, 1003 and 630S or Tool Nos. 9526, 9516 and 9210 on right and left hand cases, Figure 21. Install new bearings using a press and suitable size step plate, Figure 22. Coat the bearings with petroleum jelly prior to installation. Install the differential case bolts before installing the right hand bearing.
4. The right hand differential bearing outer track, located in the rear axle centre housing, can be removed using slide hammer Tool Nos. 943 or 9507 and 943S or 9567.
5. The left hand differential bearing outer track located in the brake housing can be removed using Tool Nos. 943 or 9507 and 943S or 9567. Replace the shims that are positioned behind this bearing track.

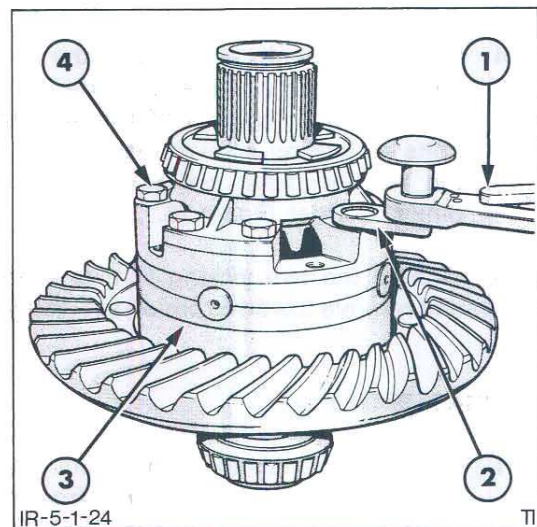
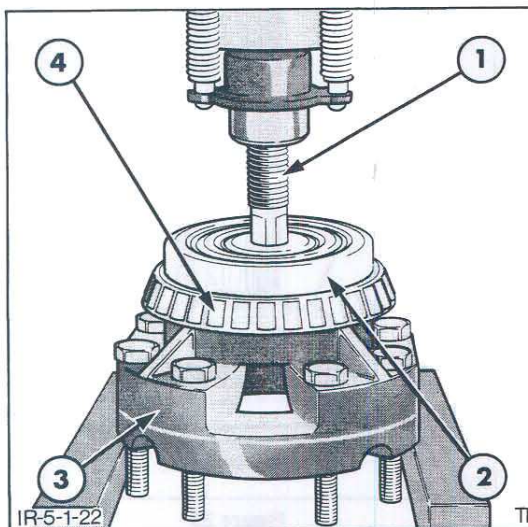
RE-ASSEMBLY

1. Install the bolts which secure the differential ring gear to the differential half case and tighten the nuts to the specified torque, see 'Specifications' – Chapter 3. Ensure that the ring gear locates securely on the differential case.



1. Spider
2. Pinion Gear
3. Thrust Washer

3. Assemble the two halves of the differential case, aligning the marks made prior to disassembly. Tighten the securing bolts evenly and finally torque to the specified value, see 'Specifications' – Chapter 3. If the differential bearing is installed use a crowfoot adaptor to enable a torque wrench to be used with the bearing in position, Figure 24.



1. Torque Wrench
2. Adaptor
3. Differential Case
4. Differential Case Bolts

4. Lubricate the assembly and turn the gears to check freedom of movement.
5. Install the differential lock gear case adaptor, coupling spring, sliding coupling and stop washer and retain with a new lock ring, Figure 25.

INSTALLATION

1. Position the differential assembly in the rear axle centre housing.
2. Re-assemble the left hand and housing as described in Section B. Refill the axle with the correct lubricant as specified in Chapter 3.

F. DRIVE PINION ASSEMBLY – OVERHAUL

REMOVAL

1. Separate the rear axle from the unit as described in Section C of PART 10.
2. Remove the handbrake components, as described in Chapter 2, from the drive pinion (where fitted).
3. Remove the left hand axle housing and lift out the differential assembly.
4. Remove the bolts that secure the drive pinion assembly to the rear axle centre housing. Utilising two of the securing bolts as jacking screws install them in the two threaded holes in the drive pinion retainer, Figure 25.
5. Tighten the two jacking screws evenly and remove the drive pinion assembly.

3. Remove the lock ring from the rear end of the pinion gear and using Tool Nos. 1002 or 9198 and 951 or 9190 pull the pilot bearing off the end of the shaft, Figure 27.

DISASSEMBLY

1. Relieve the staking then remove the bearing pre-load adjusting nut from the shaft. Remove the thrust washer from the shaft.
2. Remove the front pinion bearing and the housing from the pinion shaft.

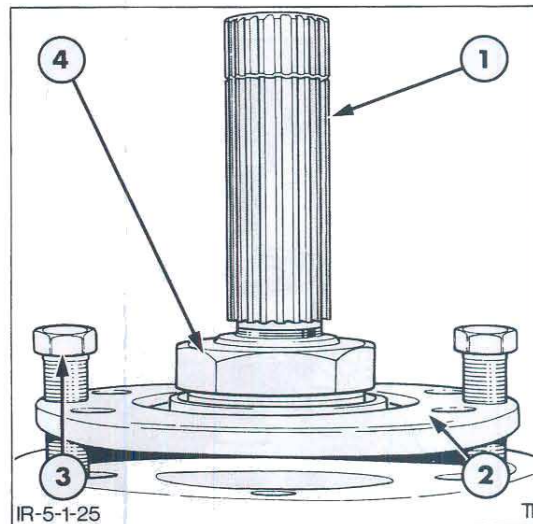
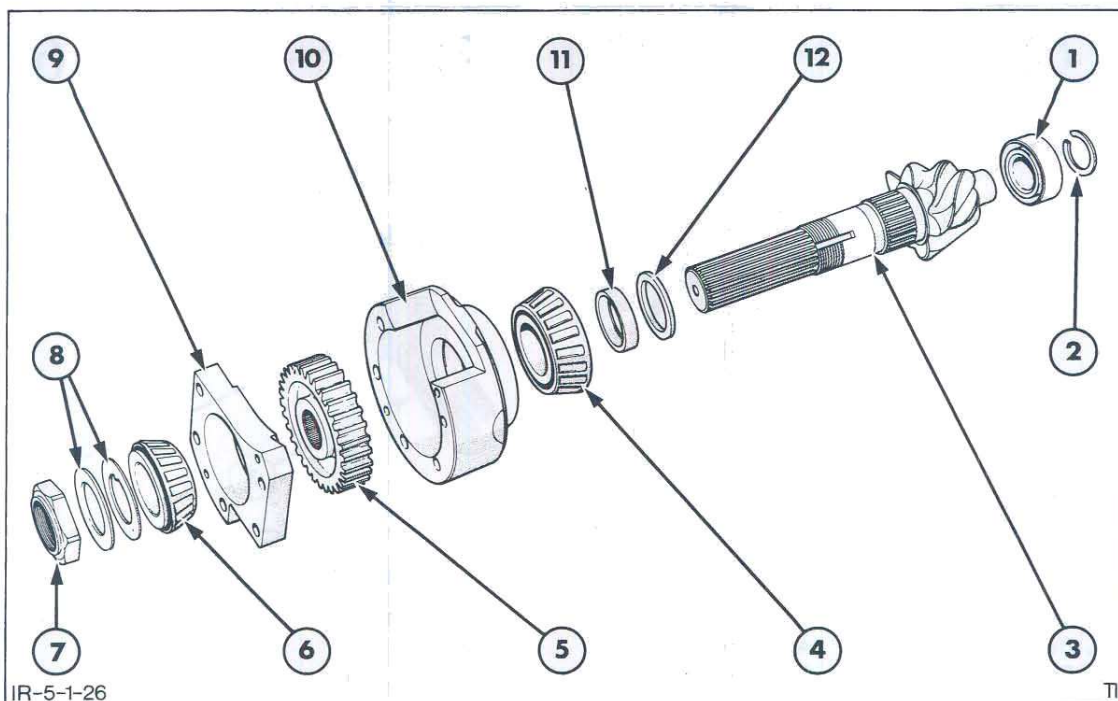


Figure 25
Removing Drive Pinion Assembly

- | | |
|-----------------------|-----------------------------|
| 1. Drive Pinion Shaft | 4. Bearing Preload Adjuster |
| 2. Bearing Retainer | |
| 3. Jacking Bolts | |

**Figure 26**

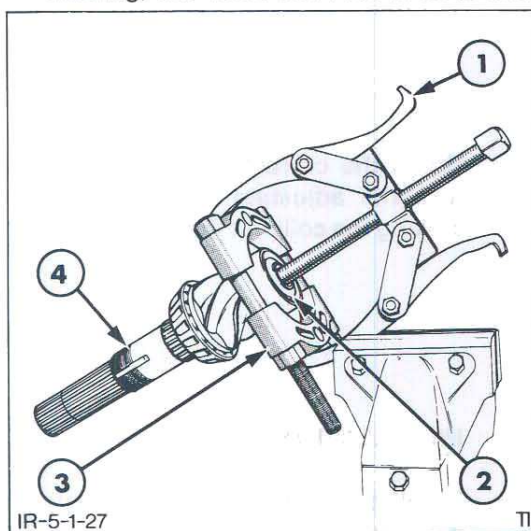
Drive Pinion Assembly - Exploded View

- | | | | |
|-----------------------|------------------|-------------------|---------------------------|
| 1. Pilot Bearing | 4. Rear Bearing | 7. Adjusting Nut | 10. Drive Pinion Retainer |
| 2. Lock Ring | 5. F.W.D. Gear | 8. Thrust Washer | 11. Spacer |
| 3. Drive Pinion Shaft | 6. Front Bearing | 9. Retainer Plate | 12. Spacer |

INSPECTION AND REPAIR

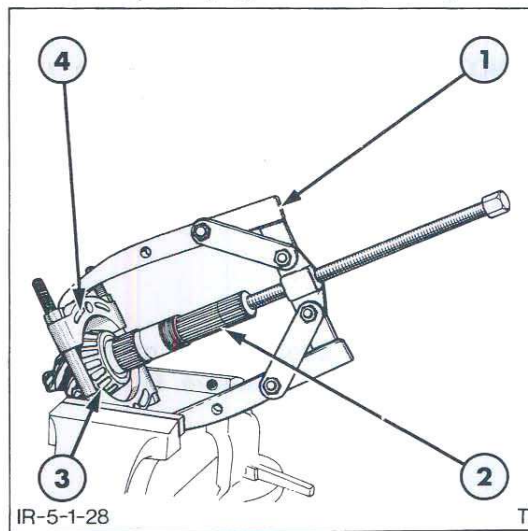
1. Thoroughly clean and inspect all parts and install new parts if worn or damaged.
2. If necessary, to remove the rear pinion bearing, use Tool Nos. 1003 or 9516 and

951 or 9190 as shown in Figure 28. To install a new bearing use the same tool in conjunction with a sleeve of suitable size, Figure 29 to press the inner bearing track squarely against the pinion gear.

**Figure 27**

Removing Drive Pinion Pilot Bearing

- | | |
|--------------------------|-------------------------|
| 1. Tool No. 1002 or 9198 | 3. Tool No. 951 or 9190 |
| 2. Pilot Bearing | 4. Drive Pinion Shaft |

**Figure 28**

Removing Drive Pinion Rear Bearing

- | | |
|--------------------------|-------------------------|
| 1. Tool No. 1003 or 9516 | 3. Bearing Assembly |
| 2. Drive Pinion Shaft | 4. Tool No. 951 or 9190 |

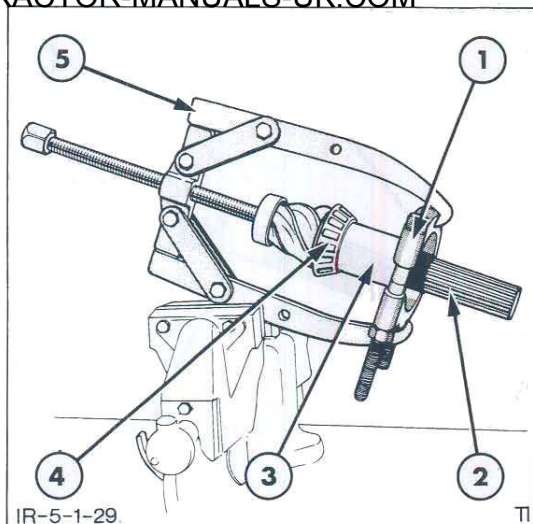


Figure 29

Installing Drive Pinion Rear Bearing

- | | |
|-------------------------|--------------------------|
| 1. Tool No. 951 or 9190 | 4. Rear Bearing Assembly |
| 2. Drive Pinion Shaft | |
| 3. Sleeve | 5. Tool No. 1003 or 9516 |

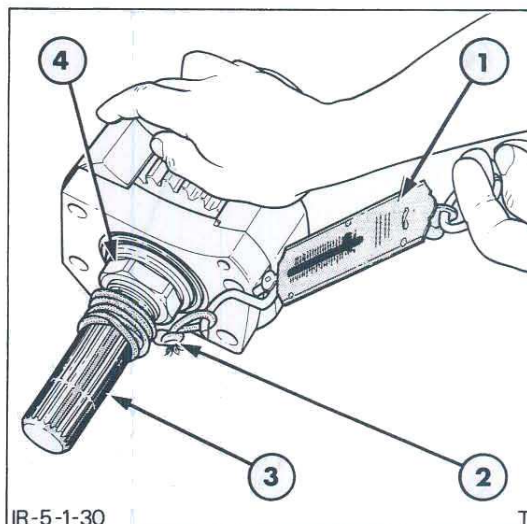


Figure 30

Checking Drive Pinion Bearing Pre-Load

- | | |
|-----------------|------------------------------|
| 1. Pull Scale | 4. Bearing Pre-Load Adjuster |
| 2. Cord | |
| 3. Drive Pinion | |

- To remove the bearing outer tracks from the bearing housing use Slide Hammer and pulling attachment Tool Nos. 943 or 9507 and 943S or 9567.

NOTE: If a new drive pinion is to be installed a new differential ring gear must also be fitted. Refer to Section E for overhaul procedures.

- Install the adjusting nut onto the shaft. Tighten the nut until the correct pre-load is obtained using a pull scale, see 'Specifications' – Chapter 3.

- When the correct pre-load is obtained lock the adjusting nut in position by staking the collar of the nut.

RE-ASSEMBLY

- Install the pilot bearing on the pinion using a suitable sleeve. Fit a new lock ring.
- Position the pinion shaft and rear bearing assembly in the bearing housing. Install the front bearing and the thrust washer onto the shaft.

INSTALLATION

- Install the drive pinion assembly into the rear axle centre housing and secure with the retaining bolts. Tighten to the correct torque, see 'Specifications' – Chapter 3.

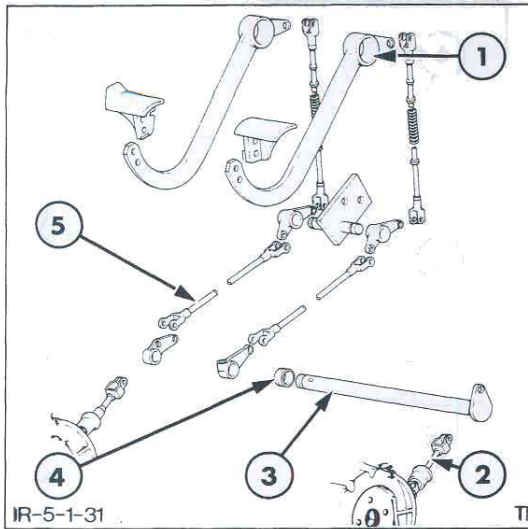


Figure 31
Brake Pedal and Linkage
(Power Reversing Transmission)

- | | |
|-------------------------|----------------------|
| 1. Pedal | 4. Cross Shaft Seal |
| 2. Control Rod Assembly | 5. Brake Control Rod |
| 3. Brake Cross Shaft | |

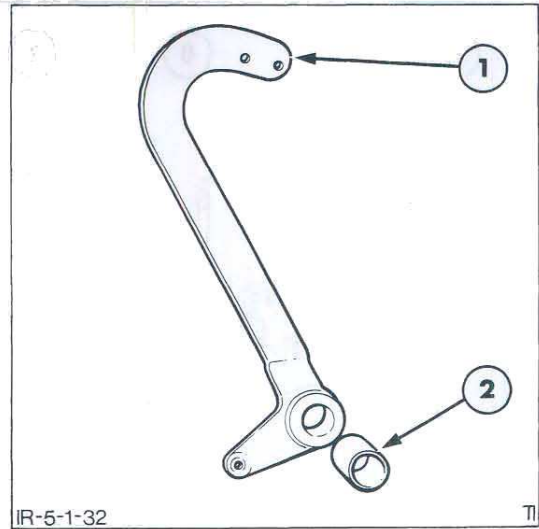


Figure 32
Brake Pedal Shank and Bushing Replacement

- | | |
|----------|------------|
| 1. Shank | 2. Bushing |
|----------|------------|

2. Install the differential assembly in the rear axle centre housing and reassemble the left hand axle housing to the centre housing.

3. Install the handbrake components as described in Chapter 2 (where fitted).

4. Assemble the rear axle to the transmission as described in Section C of PART 10. Refill the axle with the specified lubricant, and check the level with the dipstick. Reconnect the brake linkage and adjust as outlined in PART 10.

G. BRAKE PEDAL LINKAGE AND CROSS SHAFT – OVERHAUL

Refer to Figure 31.

Operating linkage from the pedals extends along side of the transmission housing. The inner set of linkage connects to a cross-shaft that extends through the rear axle centre housing to operate the brake on the opposite side of the tractor. The brake cross-shaft is sealed in the centre housing by replaceable seals installed in the centre housing casting side walls.

Whenever installing a new cross shaft seal assembly, do not remove the grease coating from the seal lip. This coating was placed on the seal lip at time of manufacture to lubricate the lips which do not touch oil. Install the new seal as follows.

1. Remove and discard the dust seal.

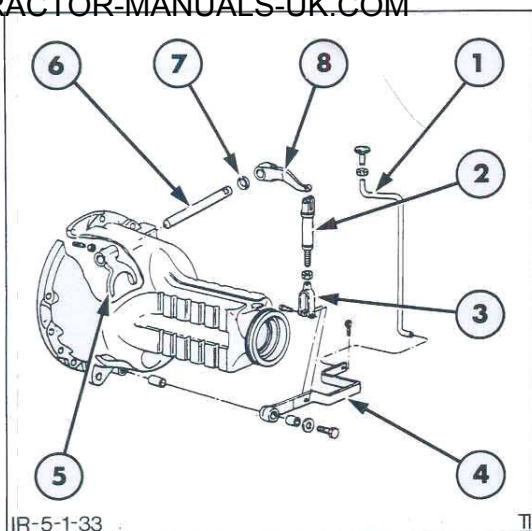


Figure 33
Differential Lock Linkage

- | | |
|-------------------|--------------------|
| 1. Pedal Assembly | 5. Fork |
| 2. Operating Rod | 6. Shaft |
| 3. Clevis | 7. Seal |
| 4. Lever Assembly | 8. Operating Lever |

2. Inspect the brake cross shaft for gouges, corrosion and scratches on the sealing surfaces. If the shaft is severely gouged, pitted or scratched, it should be replaced.

3. Carefully press the seal into the rear axle centre housing with the closed end of the seal facing outwards.

The brake pedal shank contains a replaceable bushing, Figure 32. Following installation of a new bushing it may be necessary to burnish the inside of the bushing for the shaft to fit correctly.

H. DIFFERENTIAL LOCK LINKAGE – OVERHAUL

The differential lock linkage, Figure 33, serves to operate the differential lock fork located in the right hand rear axle assembly.

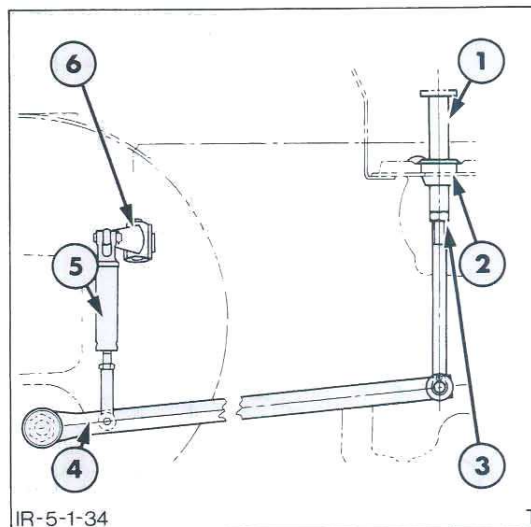


Figure 34
Differential Lock Adjustment

- | | |
|--------------------------------------|----------------------------|
| 1. Differential Lock Operating Pedal | 4. Connecting Lever |
| 2. Pedal Bushing | 5. Rod and Clevis Assembly |
| 3. Locknut | 6. Operating Lever |

Adjustment of the linkage is as follows, refer to Figure 34.

1. With the differential lock linkage assembled, loosen the locknut.
2. Adjust the pedal assembly until a gauge block can be inserted between the underside of the pedal assembly and the top side of the pedal bushing. For gauge dimensions, see 'Specifications' – Chapter 3.
3. Re-tighten the locknut to the specified torque, see 'Specifications' – Chapter 3.
4. Check that when the load is removed from the pedal assembly and the rear wheels are free to rotate, the differential lock linkage disengages automatically and the pedal assembly returns to the raised position. The wheels should then rotate independently.

PART 5

REAR AXLE AND BRAKES

Chapter 2 HANDBRAKE

Section	Page
A. TRANSMISSION HANDBRAKE – DESCRIPTION AND OPERATION	1
B. TRANSMISSION HANDBRAKE – OVERHAUL	1
C. TWIN CABLE HANDBRAKE – DESCRIPTION AND OPERATION	6
D. TWIN CABLE HANDBRAKE – OVERHAUL	6

A. TRANSMISSION HANDBRAKE – DESCRIPTION AND OPERATION

The hand operated brake mechanism is mounted on the rear axle differential drive pinion shaft. The mechanism consists of a rear re-action plate bolted to the rear axle centre housing and a front re-action plate bolted to the rear re-action plate. The disc and actuator assembly are located on the pinion shaft between the two re-action plates. The actuator assembly consists of two plates held together by springs and separated by steel balls located in pockets machined in the plates.

Operation of the brake rotates the two actuator plates causing the steel balls to ride up the ramps and separate the two actuator plates. This forces the intermediate discs, secured by the re-action plate bolts, to compress the sintered metal disc brake assemblies which are splined to the pinion shaft. Return springs pull the actuating discs together when the brake is released. The brake mechanism is connected to the operating lever by a cable. Cable tension is maintained by an adjuster on the operating lever.

B. TRANSMISSION HANDBRAKE – OVERHAUL

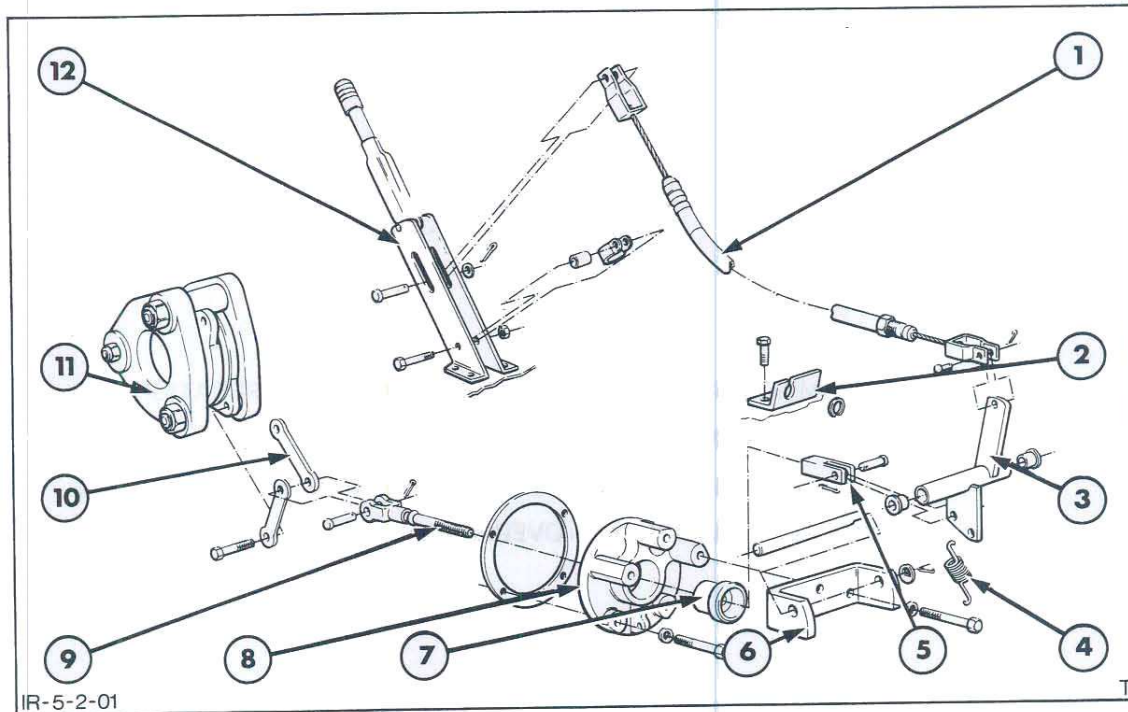


Figure 1
Transmission Handbrake Components

- | | | |
|--------------------|-------------------------|------------------------|
| 1. Operating Cable | 5. Actuating Rod Clevis | 9. Actuating Rod |
| 2. Cable Bracket | 6. Bellcrank Bracket | 10. Links |
| 3. Bellcrank | 7. Actuating Rod Seal | 11. Actuating Assembly |
| 4. Return Spring | 8. Cover | 12. Control Lever |

REMOVAL

1. Separate the rear axle from the transmission as outlined in PART 10 Section C.
2. Disconnect the handbrake cable from the bellcrank located on the left hand side of the rear axle centre housing.
3. Remove the actuating rod clevis pin to disconnect the bellcrank from the actuating rod, Figures 1 and 2. Disconnect the return spring from the bellcrank. Remove the bellcrank bracket
4. Remove the brake mechanism cover plate retaining bolts and lift the cover from the rear axle. Remove and discard the actuator rod seal and cover plate gasket.
5. Disconnect the actuator rod clevis pin and remove the actuator rod from the links, Figure 3.

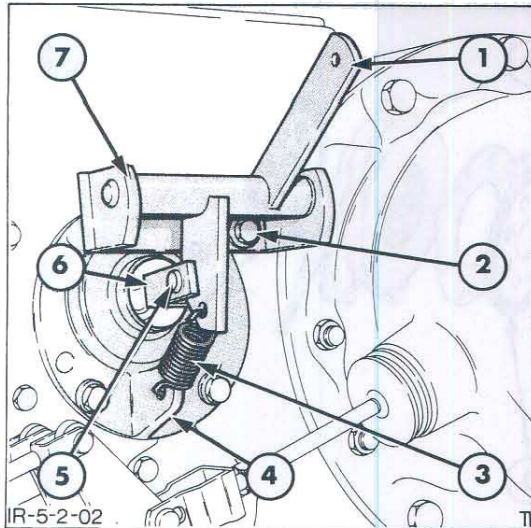


Figure 2
Bellcrank and Linkage

- | | |
|---------------------------|-------------------------|
| 1. Bellcrank | 4. Cover |
| 2. Bracket Securing Bolts | 5. Clevis Pin |
| 3. Return Spring | 6. Actuating Rod Clevis |
| | 7. Bellcrank Bracket |

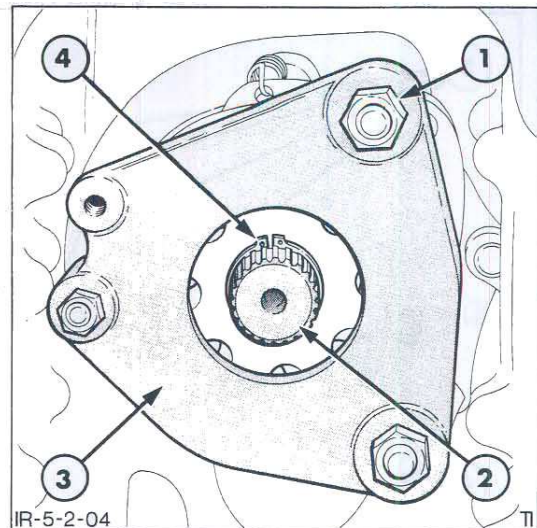


Figure 4
Front Reaction Plate

- | | |
|-----------------------|-------------------------|
| 1. Securing Nut | 3. Front Reaction Plate |
| 2. Drive Pinion Shaft | 4. Snap Ring |

6. Remove the nuts that retain the front reaction plate, Figure 4. Disassemble the front reaction plate, brake discs and actuating plates from the drive pinion shaft after removing the snap ring.

7. Remove the rear reaction plate retainer bolts, Figure 5, and separate the rear reaction plate from the centre housing.

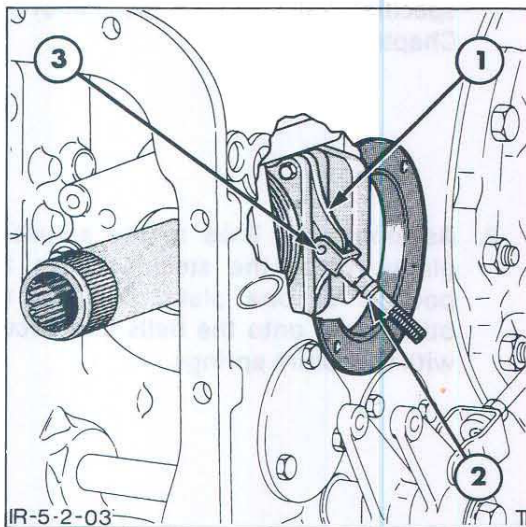


Figure 3
Handbrake Actuating Linkage

- | | |
|-------------------|-----------------------------|
| 1. Actuating Link | 3. Actuating Rod Clevis Pin |
| 2. Actuating Rod | |

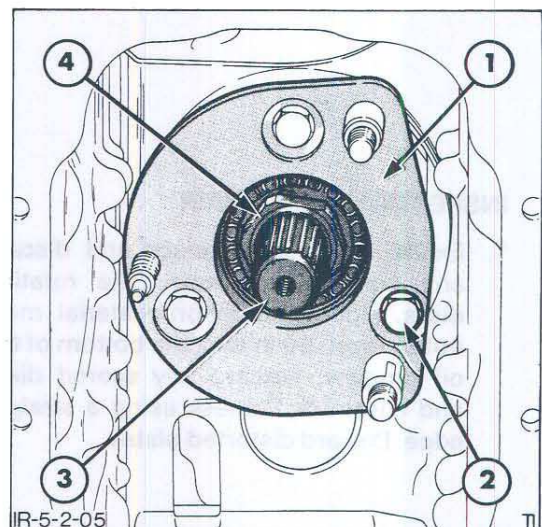


Figure 5
Rear Reaction Plate

- | | |
|------------------------|------------------------------|
| 1. Rear Reaction Plate | 3. Drive Pinion Shaft |
| 2. Securing Bolt | 4. Bearing Pre-Load Adjuster |

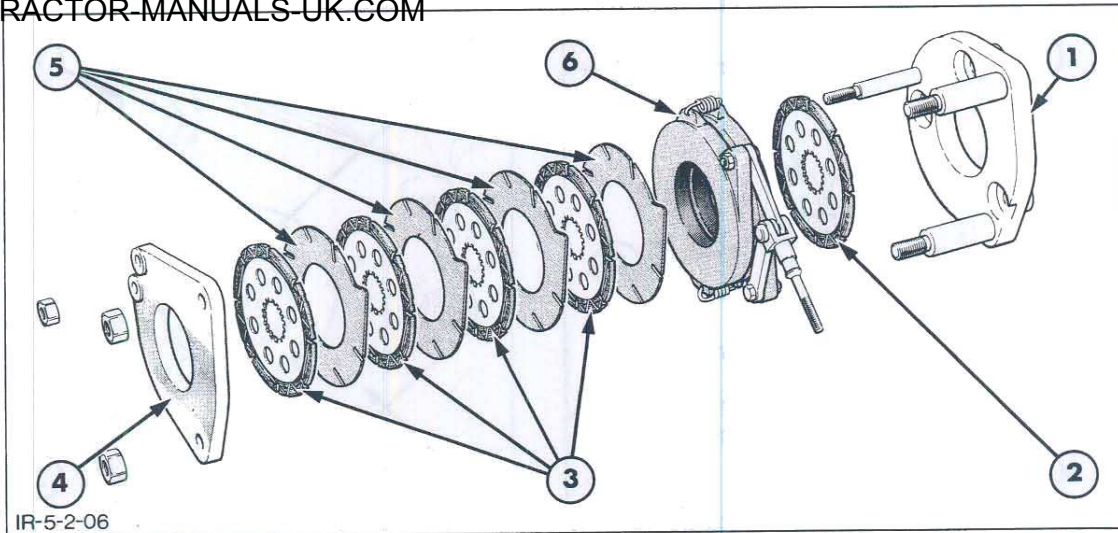


Figure 6
Transmission Handbrake Components

- | | |
|------------------------|-------------------------|
| 1. Rear Reaction Plate | 4. Front Reaction Plate |
| 2. Rotating Disc | 5. Fixed Discs |
| 3. Rotating Discs (4) | 6. Actuator Assembly |

8. Disconnect the actuating plate return springs and separate the plates. Lift out the balls and remove the links from the actuator plates.

INSTALLATION

1. Install the rear reaction plate and torque the securing bolts to the specified value, see 'Specifications' – Chapter 3.

INSPECTION AND REPAIR

1. Examine the brake discs and discard any worn components. The rotating discs, Figure 6, friction material must not be worn flush with the bottom of the oil grooves. Discard any scored discs and check for flatness using a straight edge. Discard distorted plates.
2. Assemble the links to the actuating plates, place the steel balls in the pockets of one plate, position the other plate onto the balls and secure with the return springs.
2. Inspect the operating cable and renew if damaged or worn.
3. Assemble the disc plates onto the drive pinion in the order shown in Figure 6. Ensure that the reaction lugs on the fixed discs engage with the two large diameter pins.

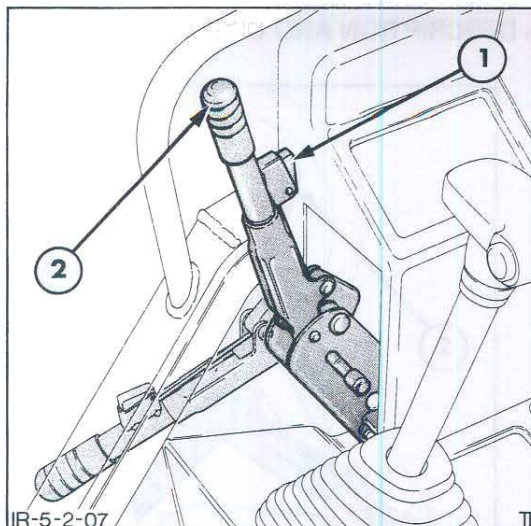


Figure 7
Handbrake

1. Tension Knob 2. Release Button

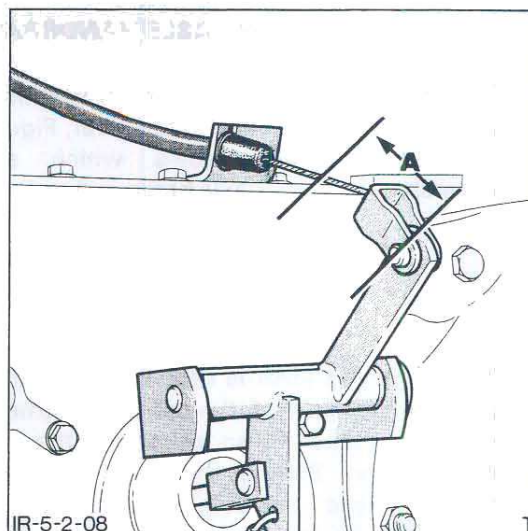


Figure 8
Brake Actuator Rod Adjustment

A – 1.25 in. (31.8 mm)

4. Position the front reaction plate onto the pins and secure with the nuts. Tighten the nuts to the specified torque, see 'Specifications' – Chapter 3.
5. Position the actuator rod clevis with the links and install the clevis pin.
6. Install a new seal in the brake cover and position the gasket and cover on the centre housing. Be sure that the actuating rod seal locates in the groove on the actuating rod.
7. Position the bellcrank bracket on the cover and install the securing bolts. Install the cover lower securing bolts and tighten the bolts to the specified torque, see 'Specifications' – Chapter 3. Reconnect the cable return spring.
8. Re-assemble the rear axle to the transmission as described in PART 10, Section C. Refill the rear axle with the specified lubricant.
9. Adjust the handbrake tension knob on the end of the lever, Figure 7, until a full travel of 1.25 in. (32 mm) is obtained at the lower end of the cable, Figure 9.
10. Adjust the clevis at the centre housing, Figure 8, until an effort of 50–60 lbs. (67.8–81.3 Nm) is required to pull the handbrake lever, to the full up (applied) position. The cable tension should allow the lever to engage the 'over centre position' with the brake applied.

C. TWIN CABLE HANDBRAKE – DESCRIPTION AND OPERATION

The twin cable handbrake mechanism consists of a single hand brake lever, Figure 9, operating two cables which are connected to the rear axle brake pull rods.

The handbrake lever is of the 'over-centre' type mechanism with the cable adjustment being maintained by an adjuster at the end of the lever. Pulling the lever into the vertical 'raised' position actuates via the twin cables, levers mounted on the rear axle housing, Figure 2, which in turn actuate the tractor disc brake, as described in Chapter 1.

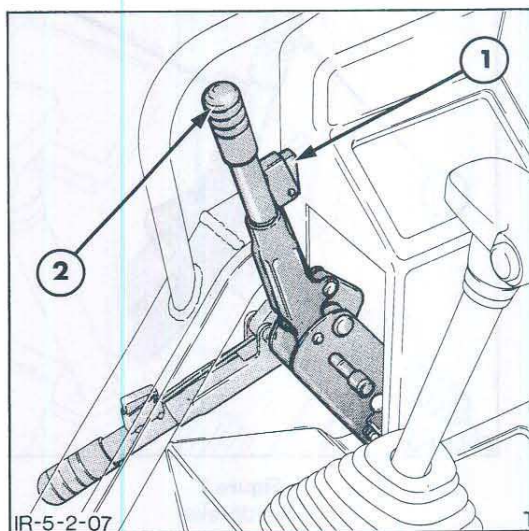


Figure 9
Handbrake Lever

- | | |
|-----------------|-------------------|
| 1. Tension Knob | 2. Release Button |
|-----------------|-------------------|

D. TWIN CABLE HANDBRAKE – OVERHAUL

REMOVAL

1. Disconnect the handbrake cables from the levers mounted on the rear axle housing, Figure 10. Remove the return spring and bracket from the cable.
2. Remove the cable retaining snap ring and pull the cable through the bracket mounted on the axle housing.
3. Remove the loader control lever/handbrake lever housing, see Part 9, CAB.
4. Remove the clevis pins from the handbrake lever to disconnect the cables.

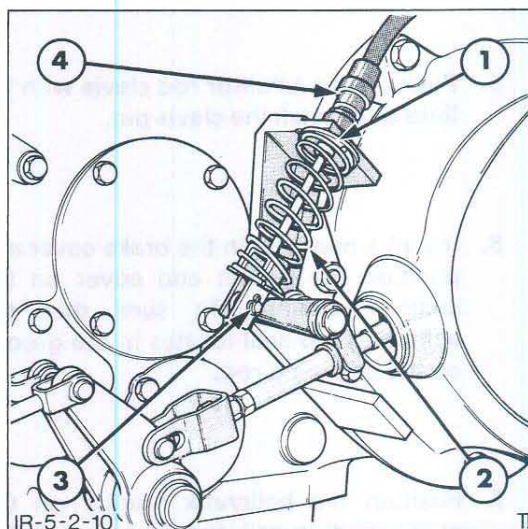


Figure 10
Handbrake Components

- | | |
|------------------|---------------|
| 1. Snap Ring | 3. Clevis Pin |
| 2. Return Spring | 4. Cable |

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INSTALLATION

Installation of the handbrake assembly follows the removal procedure in reverse. On installation observe the following:

Adjust the handbrake to achieve the specified pull, see 'Specifications' – Chapter 3.

PART 5

REAR AXLE AND BRAKES

Chapter 3

SPECIFICATIONS AND SPECIAL TOOLS

Section	Page
A. SPECIFICATIONS	1
B. SPECIAL TOOLS	2

A. SPECIFICATIONS

Brake Pedal Free Travel	1.0–2.5 in. (50–63 mm) with a pressure of 15 lbf. (67 N) applied to pedals
Brake Pedal Drop Rod Length:	
4 x 4 Transmission	35 in. (890 mm)
8 x 8 Transmission	27.5 in. (700 mm)
Transmission Handbrake Bellcrank Free Travel.....	1.25 in. (32 mm)
Handbrake Pull	50–60 lbf. (222–266 N)
Differential Lock Gauge Block Thickness	1.20–1.25 in. (30.5–31.5 mm)
Differential Drive Pinion Bearing Pre-load:	
With Transmission Handbrake	20–26 lbf. (89–116 N) Pull Scale
Less Transmission Handbrake	16–21 lbf. (71–93 N) Pull Scale
Rear Axle Shaft End Play	0.001 in. loose – 0.003 in. tight (0.025 mm loose – 0.0076 mm tight)

TORQUE SPECIFICATIONS

TORQUE VALUES	lbf.ft	Nm	kgm
Axle Housing Bolts	150	203	21
Axle Housing Nuts	188	255	23
Disc Brake Housing Nuts	81	110	14
Axle Shaft Retaining Bolt	395	536	55
Differential Case Bolts	70	95	10
Differential Ring Gear Nuts	48	65	7
Differential Pinion Bearing Retainer Bolts	110	149	15
Handbrake Rear Reaction Plate Retaining Bolts	110	149	15
Handbrake Cover Retaining Bolts	35	47	5
Handbrake Mechanism Retaining Nuts – Small	28	38	4
Handbrake Mechanism Retaining Nuts – Large	82	111	11
Differential Pinion Bearing Pre-Load Adjuster Clamp Bolts	23	31	3
Wheel Securing Nuts	350	475	48
Brake Pin and Bracket Mounting Bolts	30	41	4
Differential Lock Fork Retaining Bolt	22	30	3
Differential Lock Oper. Rod Clevis Locknut	55	75	8
Differential Pedal Locknut	55	75	8
Axle Top Cover Plate Bolts	66	90	9
Axle Top Cover Plate Breather Bolt	44	60	6

TRACTOR-MANUALS-UK.COM

B. SPECIAL TOOLS

DESCRIPTION	V. L. CHURCHILL TOOL NO.	NUDAY TOOL NO.
Heavy Duty Ratchet	P61	9162
Double Threaded Adaptors (set)	924	9537
Step Plate Adaptors (set)	630S	9210
Push/Puller Legs (set)	930B	9521
Push/Puller Legs (set)	930E	9207
Push/Puller	938	9506
Internal/External Puller	943	9507
Slide Hammer	943S	9567
Pulling Attachment (small)	951	9190
Pulling Attachment (large)	952	9526
Puller/Reversible Arm (medium)	1002	9198
Puller/Single End Arm (large)	1003	9516
Rear Axle Planetary Ring Gear Remover/ Replacer	FT4500	2122 2123 2119
Differential Bearing Preload Gauge	FT4501	2141

PART 6

POWER TAKE-OFF

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TROUBLE SHOOTING, SPECIFICATIONS AND SPECIAL TOOLS

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PART 6

POWER TAKE-OFF

Chapter 1

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A. I.P.T.O. – DESCRIPTION AND OPERATION

The drive for the independent power take-off (I.P.T.O.) as featured for the Ford 455C Tractors with 8 × 8 transmission, is taken from transmission hydraulic pump driven gear, Figure 1.

A gear on the stator support, driven by the rear hub of the torque converter, drives the driven gear. The driven gear incorporates a splined centre for the I.P.T.O. counter shaft to engage.

The I.P.T.O. countershaft transmits the drive through the hollow transmission countershaft to the rear of the front transmission assembly. The I.P.T.O. countershaft is splined at the rear end to accept the hydraulic pump drive gear and the I.P.T.O. clutch input shaft.

The independent P.T.O. is controlled by an hydraulically operated clutch assembly located on and between the clutch input shaft and the rear shaft.

The clutch assembly comprises 7 internally splined sintered bronze drive plates, mounted

on the clutch shaft hub, and sandwiched between these plates are 7 driven steel plates, which together with a pressure plate are externally splined to the clutch housing.

The I.P.T.O. rear shaft, which protrudes from the rear of the tractor, is splined into the rear of the clutch housing and is externally guarded by a screw-on cap. A piston, located within the clutch housing to the rear of the plates, is retained in the disengaged position by a spring, washer and snap ring.

Mounted on the rear of the I.P.T.O. clutch is a brake and support assembly. The brake is controlled by a double sided piston assembly. When the brake is applied a brake pad is forced against the I.P.T.O. clutch housing to stop the rotation of the P.T.O. shaft. When the I.P.T.O. clutch is engaged the brake is automatically released.

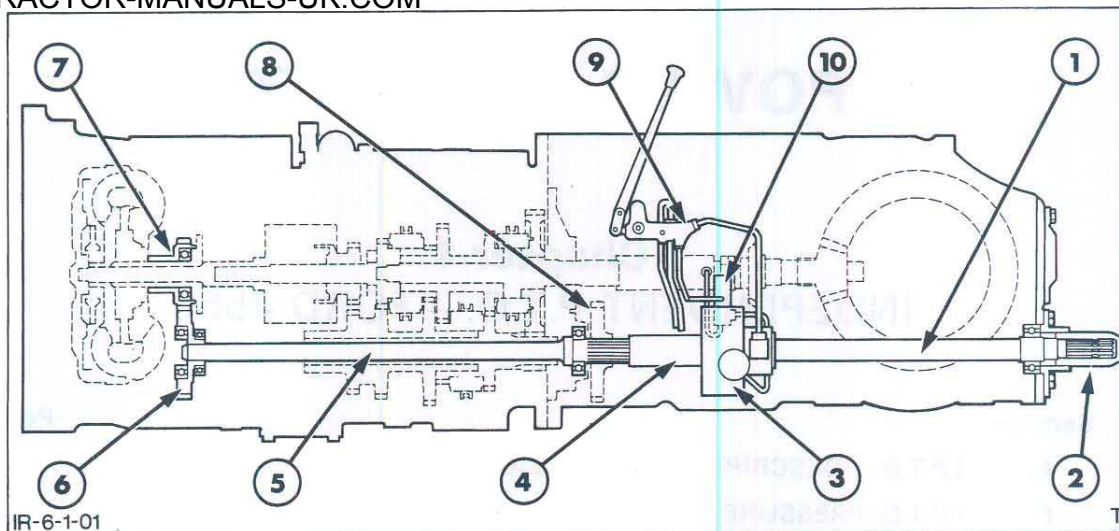


Figure 1
Independent P.T.O. – Schematic

- | | | |
|--------------------------------|--------------------------------|------------------------------|
| 1. I.P.T.O. Rear Shaft | 5. I.P.T.O. Countershaft | 8. Hydraulic Pump Drive Gear |
| 2. I.P.T.O. Rear Shaft Cap | 6. Transmission Hydraulic Pump | 9. I.P.T.O. Valve Assembly |
| 3. I.P.T.O. Clutch Assembly | Driven Gear | 10. Brake Regulating Valve |
| 4. I.P.T.O. Clutch Input Shaft | 7. Stator Support | |

Also when the tractor engine is stopped the hydraulic pressure acting on the brake piston diminishes, releasing the brake and allowing the P.T.O. shaft to be turned.

Located on the left-hand side within the rear axle centre housing is the I.P.T.O. control valve assembly and on the right-hand side is the brake pressure regulating valve.

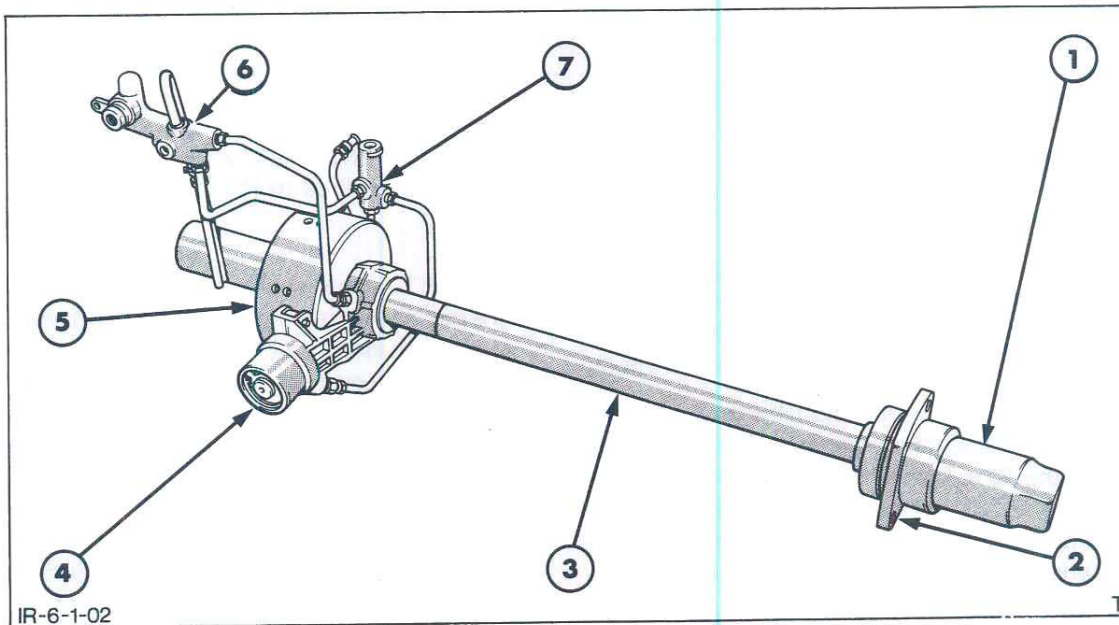


Figure 2
Independent P.T.O. Assembly

- | | |
|--|------------------------------------|
| 1. Shaft Cap | 5. Clutch Assembly |
| 2. Rear Shaft Bearing and End Plate Assembly | 6. Control Valve Assembly |
| 3. Rear Shaft | 7. Brake Pressure Regulating Valve |
| 4. Brake Assembly | |

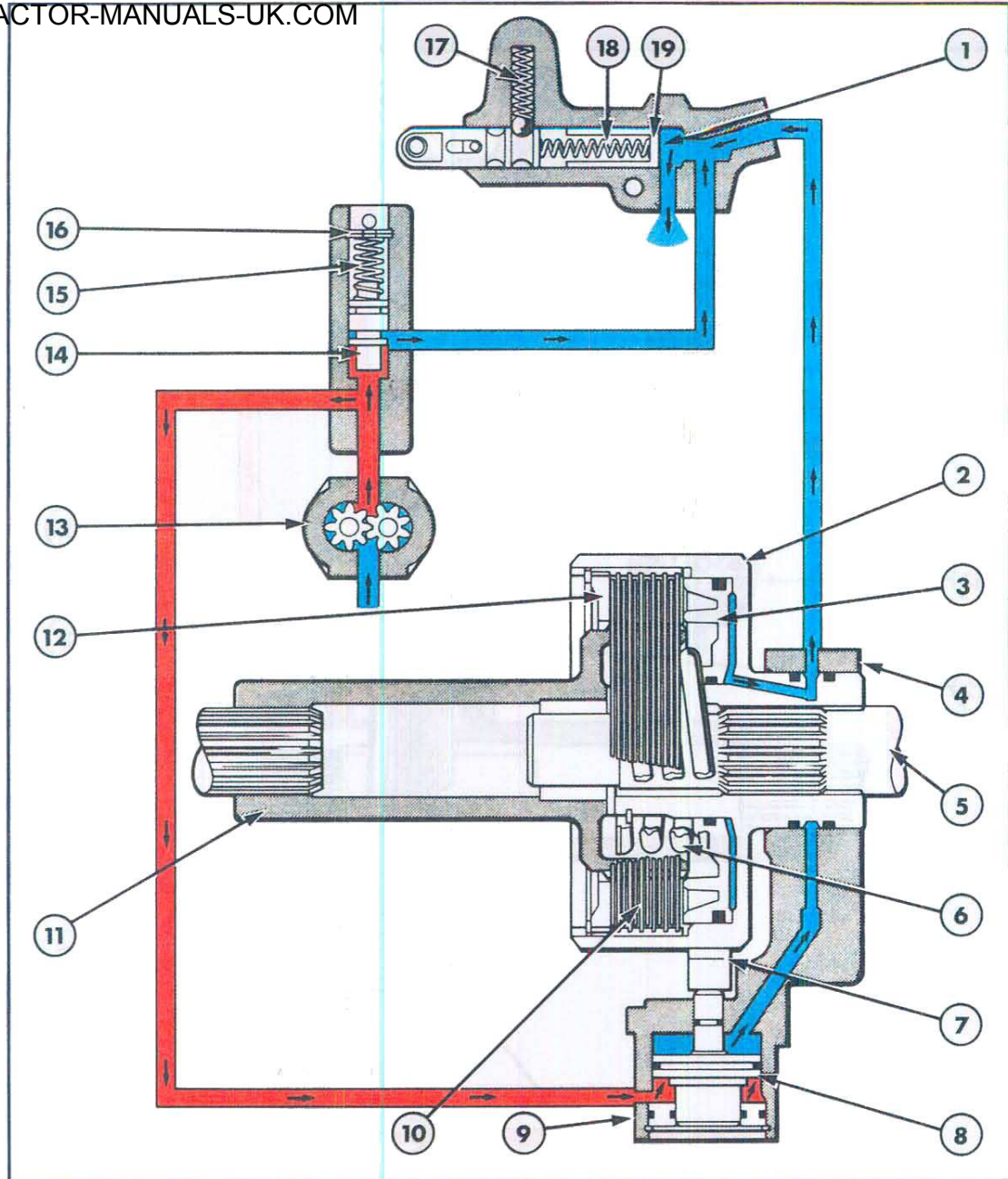


Figure 3
Oil Flow in the Disengaged Position

■ Pressure Oil

■ Exhaust Oil

1. Control Valve Piston
2. Clutch Housing
3. Clutch Piston
4. Support Assembly
5. Rear Shaft
6. Clutch Spring
7. Brake Arm and Pad Assembly
8. Brake Piston
9. Brake Housing
10. Clutch Discs

11. Coupling
12. Pressure Plate
13. I.P.T.O. Pump
14. Brake Pressure Regulating Valve Plunger
15. Brake Pressure Regulating Valve Spring
16. Shims
17. Control Valve Detent
18. Control Valve Spring
19. Shims

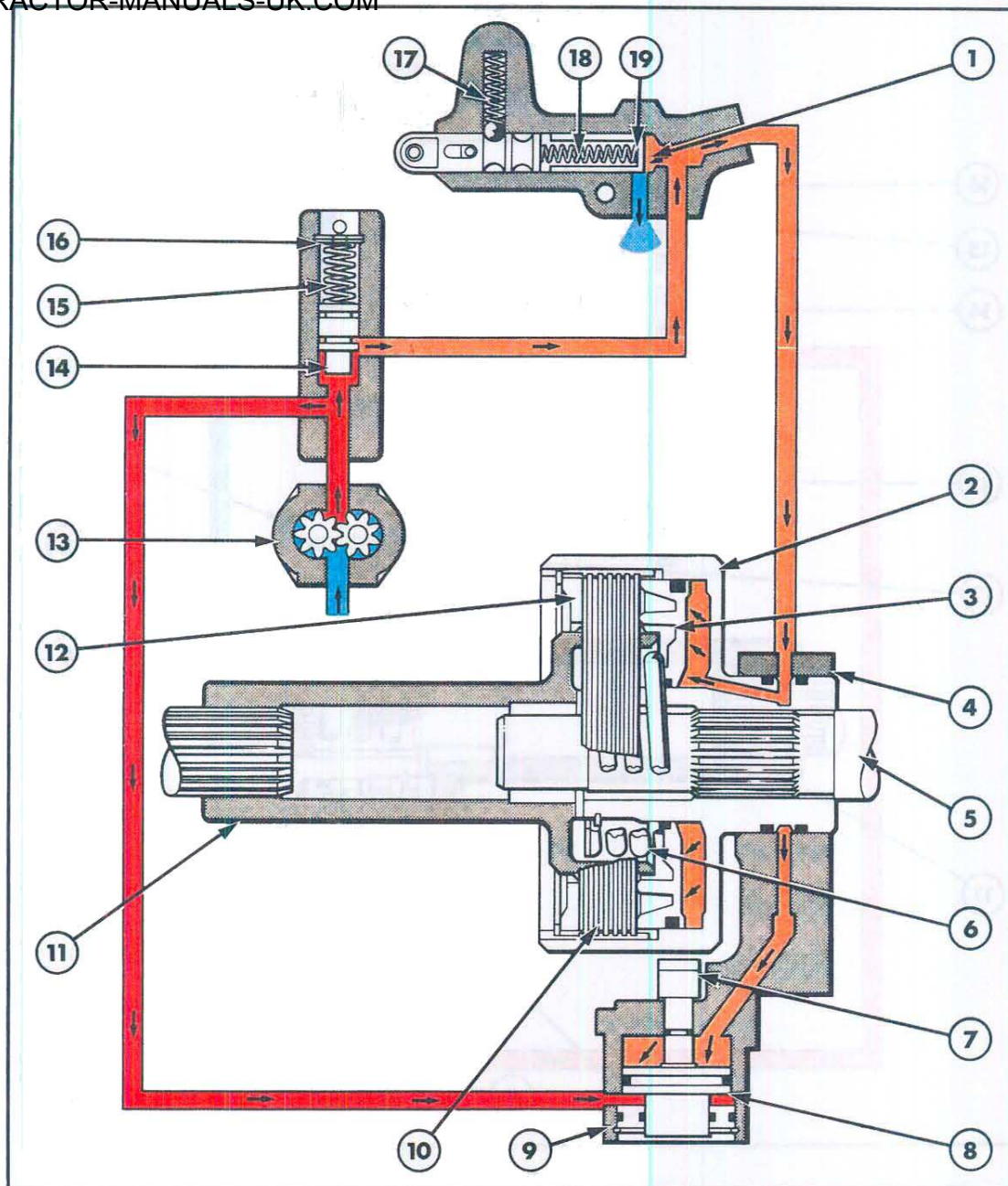


Figure 4
Oil Flow in Engaged Position

■ Pressure Oil

■ Reduced Pressure Oil

■ Exhaust Oil

1. Control Valve Piston
2. Clutch Housing
3. Clutch Piston
4. Support Assembly
5. Rear Shaft
6. Clutch Spring
7. Brake Arm and Pad Assembly
8. Brake Piston
9. Brake Housing
10. Clutch Discs

11. Coupling
12. Pressure Plate
13. I.P.T.O. Pump
14. Brake Pressure Regulating Valve Plunger
15. Brake Pressure Regulating Valve Spring
16. Shims
17. Control Valve Detent
18. Control Valve Spring
19. Shims

The oil supply from the rear section of the hydraulic pump is fed to the pressure regulating valve. Oil at constant pressure is supplied to the brake piston. The outlet port from the Pressure Regulating Valve is connected to the control valve which either exhausts the oil to dump or directs the oil under pressure to the clutch piston and brake release piston.

The control valve is operated by an externally mounted selector lever which may be controlled from the operator's seat.

OPERATION

With the engine running oil is supplied to the brake pressure regulating valve. The spring loaded plunger in the regulating valve ensures that irrespective of engine speed, oil at a constant pressure acts on one side of the brake piston forcing the brake against the clutch housing, Figure 3. Oil from the regulating valve outlet passes through a tube to the control valve. Placing the control in the disengaged position fully opens the dump port in the valve and allows the oil to pass directly to sump, Figure 3. The return spring in the clutch forces the clutch piston rearwards to disengage the clutch plates, allowing the drive plates to rotate freely within the stationary clutch assembly.

Moving the I.P.T.O. control lever to the engaged position, Figure 4, forces the control valve plunger rearwards to cover the dump port in the valve. Pressurised oil is directed through the tube and clutch support to the clutch piston. The oil forces the piston forwards against the action of the piston return spring and compresses the clutch plates together to engage the clutch.

Simultaneously, the pressurised oil flows around the clutch hub and through a drilling to act on the larger surface of the double-sided brake piston. The pressurised oil acting on the larger surface area forces the piston away from the clutch and releases the brake allowing the clutch housing to rotate.

The drive from the I.P.T.O. countershaft is thus transmitted via the clutch plates to the I.P.T.O. rear shaft.

When the clutch is fully engaged and the brake released the build up of oil pressure forces the control valve piston forwards against the control spring, to uncover the dump port and allow the excess oil to return to sump.

With the engine stopped, the hydraulic pressure in the circuit diminishes releasing the brake and allowing the clutch piston spring to force the clutch piston rearwards, disengaging the clutch.

A small groove in the brake pressure regulating valve plunger allows the oil trapped in the brake circuit to return through the Pressure Regulating Valve to dump. With the clutch disengaged and the brake released the external P.T.O. shaft can be turned to align the splines for coupling to an implement shaft.

**B. I.P.T.O. PRESSURE REGULATING VALVE AND CONTROL VALVE
– PRESSURE TESTS**

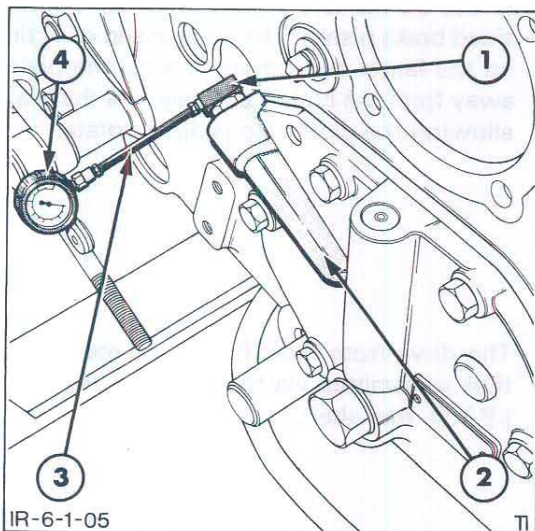


Figure 5
Brake Pressure Regulating Valve Pressure Test

1. Adaptor Tool No. FT.4100-2 or 4657
2. Hydraulic Pump
3. Tube, Tool No. FT.4100 or 1552
4. Pressure Gauge, Tool No. FT.4100 or 0074

If the I.P.T.O. clutch fails to operate as described in Section A of this Chapter, or following overhaul of the clutch control valve and pressure regulating valve, the following pressure tests must be carried out.

Run the tractor until the hydraulic oil is at operating temperature then stop the engine.

BRAKE PRESSURE REGULATING VALVE

1. Remove the I.P.T.O. pressure test plug from the rear of the hydraulic pump.
2. Install Adaptor Tool No. FT.4100-2 or 4657, Tube Tool No. FT.4100-1 or 1552 and the Pressure Gauge, Tool No. FT.4100 or 0074 onto the pressure test point, Figure 5.
3. Start the tractor and set the speed to 2300 rev/min and set the I.P.T.O. control lever to the disengaged position. Note the pressure gauge reading.
4. If the pressure obtained is outside the specified range, see "Specifications" – Chapter 2, adjust the pressure regulating valve setting by adding or removing shim(s) located in the pressure regulating valve.

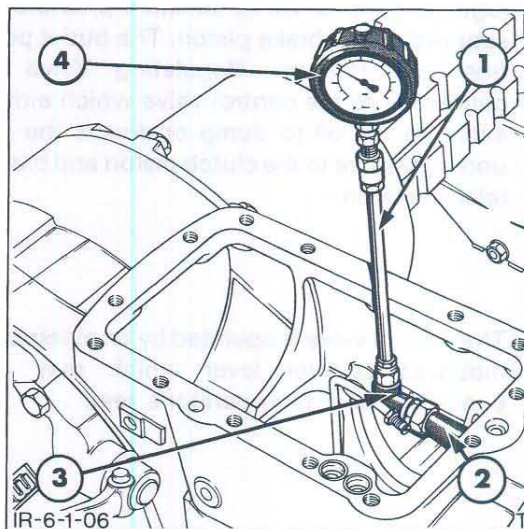


Figure 6
I.P.T.O. Control Valve Pressure Test

1. Tube, Tool No. FT.4100-1 or 1552
 2. I.P.T.O. Control Valve
 3. Adaptor, Tool No. FT.4097 or 1221
 4. Pressure Gauge, Tool No. FT.4100 or 0074
5. Check that the pressure reading remains within the specified limits with an engine speed of 1000 rev/min to 2300 rev/min.
 6. Remove the gauge, tube and adaptors from the pressure test point and install the plug.

I.P.T.O. CONTROL VALVE

The I.P.T.O. Control Valve pressure setting can be checked with the test equipment installed as for the Brake Pressure Regulating Valve, Figure 5. With the engine speed set to 2300 rev/min engage the I.P.T.O. clutch and note the pressure gauge reading. If the pressure reading is not greater than that obtained for the Brake Pressure Regulating Valve or is not within the specified range, see "Specifications" Chapter 2 the control valve pressure setting must be checked as follows:–

1. Remove the axle top cover assembly, see "REAR AXLE AND BRAKES" – Part 5 and use hose, Tool No. T8503-4 or 1392 to connect the hydraulic lift cover feed to the rear axle sump, Figure 6.
2. Disconnect the control valve to clutch support housing tube from the control valve, Figure 6.

3. Install Adaptor Tool No. FT.4097 or 1221, tube Tool No. FT.4100-1 or 1552 and the Pressure Gauge, Tool No. FT.4100 or 0074 onto the control valve, Figure 6.
4. Start the tractor and place the I.P.T.O. control lever in the engaged position. Set the engine speed to 1300 rev/min. then disengage and engage the I.P.T.O. clutch several times noting the pressure gauge readings. The readings obtained with the clutch engaged should be within the specified range, see "Specifications" – Chapter 2.
5. If necessary adjust the pressure setting by adding or removing shims located between the valve piston and spring. Do not exceed a maximum of five shims, for shim thicknesses see "Specifications" – Chapter 2.
6. After testing remove the gauge, tube and adaptor and re-connect the tube to the control valve. Replace the rear axle top cover, see "REAR AXLE AND BRAKES" Part 5.

C. PRESSURE REGULATING VALVE-OVERHAUL

REMOVAL

1. Remove the rear axle top cover, see "REAR AXLE AND BRAKES" – Part 5. Drain the rear axle oil until the pressure regulating valve is fully exposed.
2. Disconnect the tubes from the pressure regulating valve and remove the valve from the rear axle centre housing.

DISASSEMBLY

With reference to Figure 7.

1. Remove the split pin and withdraw the shims, spring and plunger.

INSPECTION AND REPAIR

1. Inspect the plunger and valve bore for damage and wear and renew if necessary.
2. Check the spring for damage and if necessary renew.

RE-ASSEMBLY

1. Re-assemble the components, coating the plunger in oil prior to re-assembly. The plunger must be installed into the bore with the notched land towards the base of the valve.

INSTALLATION

1. Install the pressure regulating valve, tightening the tube connection to the specified torque – see "Specifications" – Chapter 2.
2. Prior to installing the rear axle top cover pressure test the valve as previously described in Section B of this Chapter.

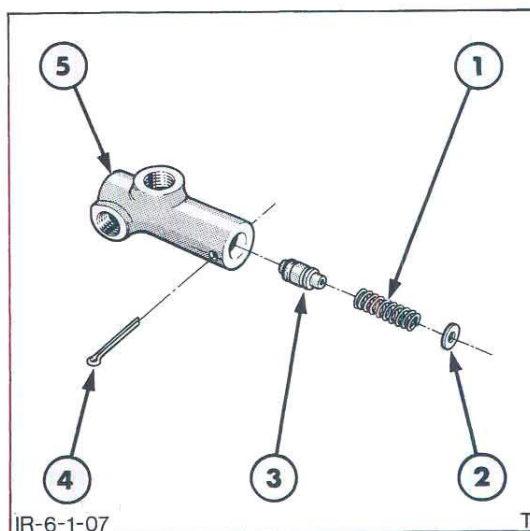


Figure 7
Pressure Regulating Valve

- | | |
|------------|---------------|
| 1. Spring | 4. Split Pin |
| 2. Shims | 5. Valve Body |
| 3. Plunger | |

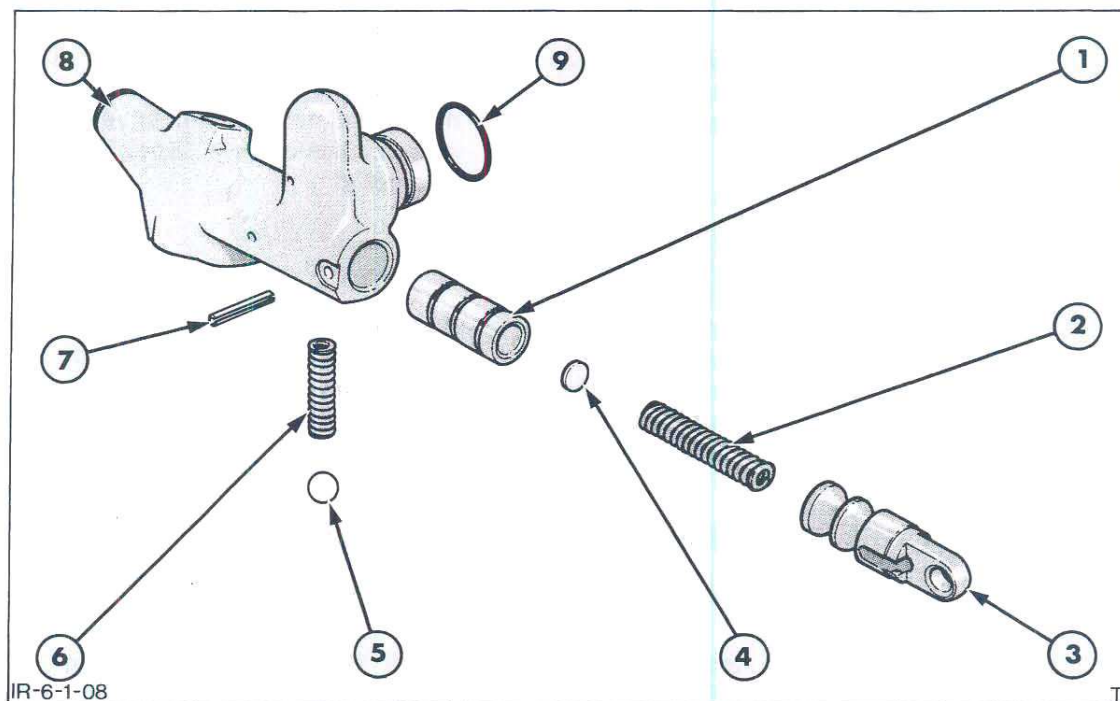


Figure 8
I.P.T.O. Control Valve Assembly

- | | |
|------------------|-------------------------------|
| 1. Piston | 6. Detent Spring |
| 2. Valve Spring | 7. Plunger Retaining Roll Pin |
| 3. Valve Plunger | 8. Valve Body |
| 4. Shim | 9. O-Ring |
| 5. Detent Ball | |

D. I.P.T.O. CONTROL VALVE – OVERHAUL

REMOVAL

1. Remove the rear axle top cover, see "REAR AXLE AND BRAKES" – Part 5.
2. Disconnect the control valve to clutch and brake assembly tube at the control valve.
3. Disconnect the brake pressure regulating valve to control valve tube at the control valve.
4. Remove the split pin and clevis pin and disconnect the valve plunger from the control lever link.

5. Remove the valve spigot bolt and retaining bolt and withdraw the valve assembly from the rear axle centre housing.
6. Unscrew the retaining bolt and remove the exhaust tube clamp.
7. Pull the exhaust tubes free from the valve body.

DISASSEMBLY

With reference to Figure 8.

1. Punch the plunger retaining roll pin out of the valve housing.
2. Withdraw the plunger, detent ball and spring from the valve housing.
3. Remove the control valve spring and piston from the valve housing. Extract the shim(s) from within the piston.

INSPECTION AND REPAIR

1. Inspect the valve piston for excessive wear or scoring.
2. Inspect the control valve spring for weakness or distortion. Inspect the valve body for excessive wear or scoring of the piston bore.
3. Check the valve plunger detent spring for weakness or wear. Renew any component which shows signs of excessive wear or damage.

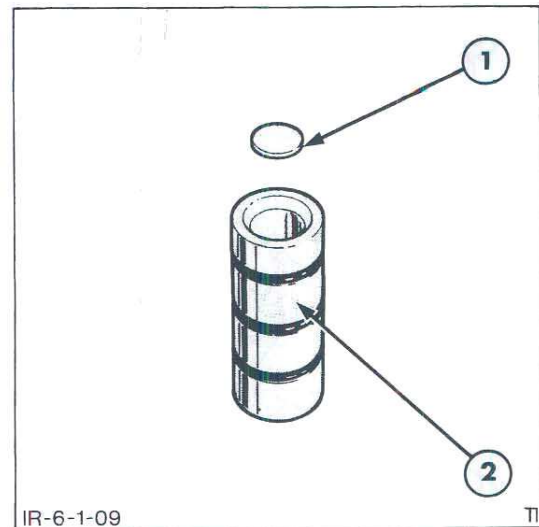
RE-ASSEMBLY

Re-assembly of the control valve follows the disassembly procedure in reverse. Prior to re-assembly observe the following requirements:

- Clean all components with a suitable solvent then dry with compressed air.
- Lightly lubricate all machined surfaces with hydraulic oil.
- Renew all O-ring seals.

INSTALLATION

Installation of the control valve follows the removal procedure in reverse.

**Figure 9**

I.P.T.O. Control Valve Piston and Shim

1. Shim
2. Piston

When installing the control valve observe the following requirements:

- Install the control valve retaining bolt finger tight.
- Install the control valve spigot bolt and tighten to the specified torque, see "Specifications" – Chapter 2.
- Tighten the control valve retaining bolt to the specified torque, see "Specifications" – Chapter 2.
- Prior to installing the rear axle top cover, pressure test the control valve as previously described in Section B. If the pressure obtained is incorrect, add or subtract shims between the valve piston and the valve spring, Figure 9.

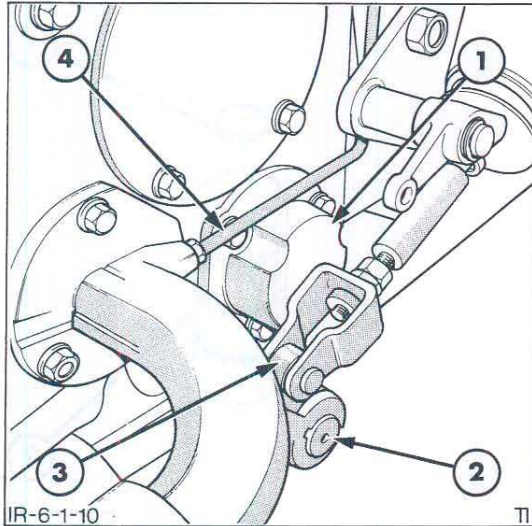


Figure 10

Left-Hand Side of Rear Axle Assembly

1. Clutch Brake Plate
2. Brake Cross-Shaft
3. Left Hand Brake Operating Lever
4. Dipstick Tube (if equipped)

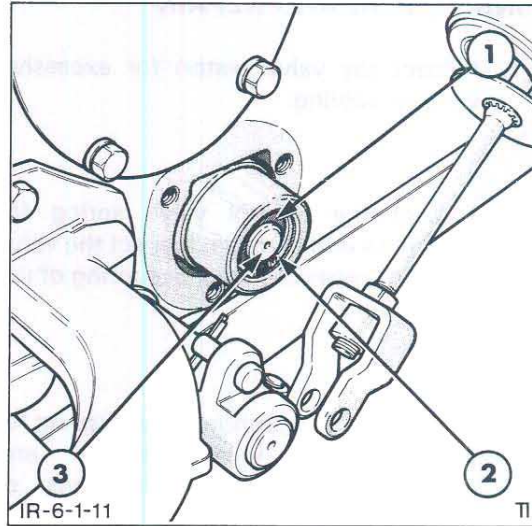


Figure 11

Clutch Brake Installation

1. Piston Guide
2. Retaining Ring
3. Piston

E. I.P.T.O. CLUTCH ASSEMBLY – OVERHAUL

NOTE: Replacement of the clutch brake seals may be performed without removing the rear axle top cover or separating the tractor as follows:

CLUTCH BRAKE SEALS

REMOVAL

With reference to Figures 10 and 11.

1. Release the pinch bolt then pull the left-hand brake operating lever off the brake cross-shaft.
2. Drain the rear axle oil and disconnect the dipstick tube from the filter support (if equipped).

3. Remove the retaining bolts and withdraw the clutch brake plate.
4. Remove the ring retaining the piston guide in the cylinder and withdraw the piston guide and piston from the brake cylinder.
5. Separate the piston from the guide and renew the seals located on the piston and piston guide.

INSTALLATION

Installation of the piston follows the removal procedure in reverse. Ensure the plate retaining bolts are tightened to the specified torque, see "Specifications" – Chapter 2, and refill the rear axle with oil.

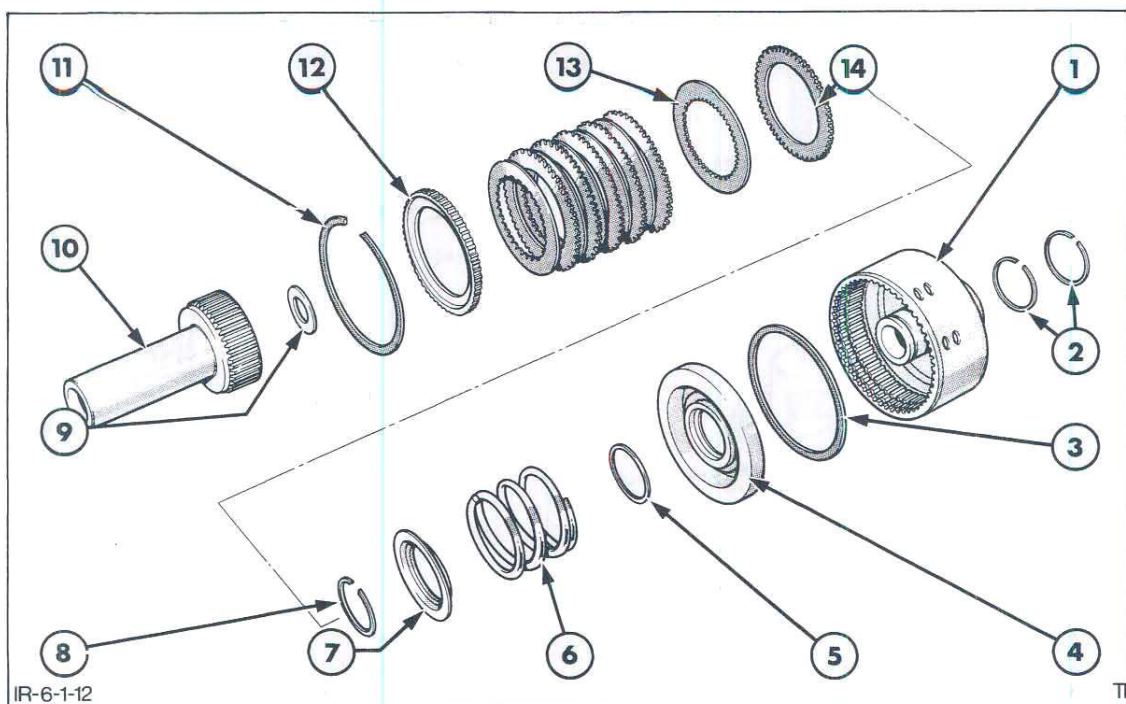


Figure 12
I.P.T.O. Clutch Assembly

- | | | |
|------------------------------|----------------------------|--------------------|
| 1. Housing | 6. Piston Spring | 11. Snap Ring |
| 2. Housing Sealing Rings | 7. Spring Retaining Washer | 12. Pressure Plate |
| 3. Outer Piston Sealing Ring | 8. Snap Ring | 13. Drive Plate |
| 4. Piston | 9. Thrust Washer | 14. Driven Plate |
| 5. Inner Piston Sealing Ring | 10. Clutch Drive Coupling | |

I.P.T.O. CLUTCH AND BRAKE ASSEMBLY

REMOVAL

1. Separate the tractor between the front and rear transmission assemblies, see "SEPARATING THE TRACTOR" – Part 10.
2. Remove the hydraulic pump, see Section H in this Chapter.
3. Remove the retaining bolts and withdraw the hydraulic pump inlet filter and tube assembly.
4. Extract the bolts and withdraw the I.P.T.O. shaft bearing and plate assembly and shaft from the rear of the tractor.

5. Withdraw the clutch drive coupling and disconnect the tube connection to the clutch support from the control valve. Disconnect from the pressure regulating valve the tube that is located under the clutch support connecting to the brake cylinder.
6. Remove the clutch pack and brake support as an assembly.

DISASSEMBLY

I.P.T.O. Clutch

With reference to Figure 12.

1. Separate the brake and support assembly from the clutch by pulling the support off the rear of the clutch.
2. Remove the snap ring which retains the pressure plate in the clutch housing then withdraw the drive and driven plates.

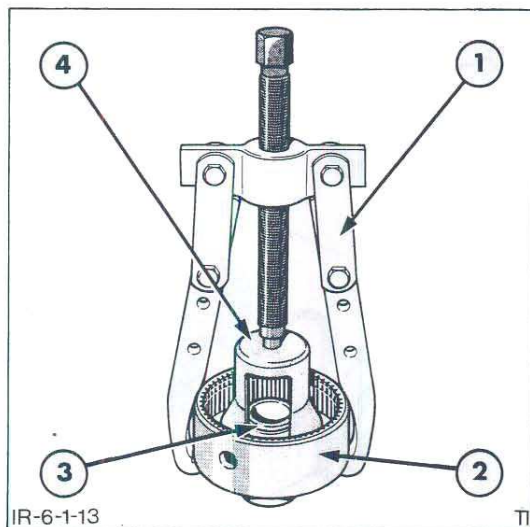


Figure 13
Compressing Clutch Spring

1. Puller, Tool No. 1003 or 9516
2. Clutch Housing
3. Snap Ring
4. Compressor, Tool No. FT.4101 or 1312

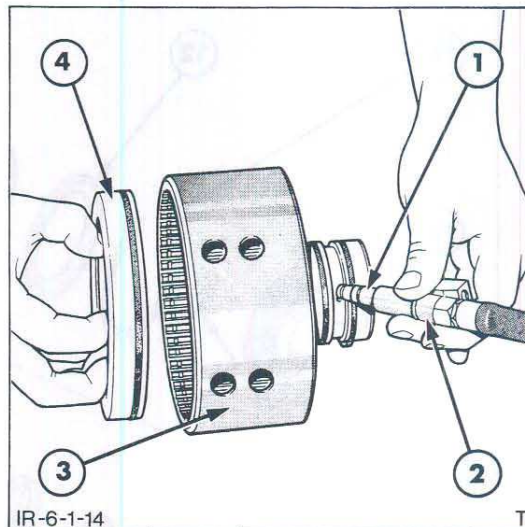


Figure 14
Clutch Piston Removal

1. Tyre Valve
2. Air-line
3. Clutch Housing
4. Piston

3. Using Puller, Tool No. 1003 or 9516 and Compressor Tool No. FT.4101 or 1312, compress the clutch piston return spring and withdraw the snap ring, Figure 13.
4. Slowly release the puller then remove the retaining washer and return spring.
5. Use an air-line and a tyre valve to extract the piston from the clutch housing, Figure 14.
6. Remove the housing and piston sealing rings.

I.P.T.O. Brake and Support Assembly

With reference to Figure 15.

1. Remove the ring retaining the brake piston guide and withdraw the piston and guide.
2. Remove the split pin and clevis pin then withdraw the arm and pad assembly from the brake housing.

INSPECTION AND REPAIR

1. Examine the clutch housing for excessive wear or scoring on the spigot or the bore.
2. Check the drive and driven plates for excessive wear, damaged splines or warping.
3. Examine the clutch spring for weakness or breakage.
4. Inspect the brake housing bore for excessive wear or scoring.
5. Examine the brake arm and pad for excessive wear or scoring.
6. Renew any defective components and all 'O'-rings prior to re-assembly.

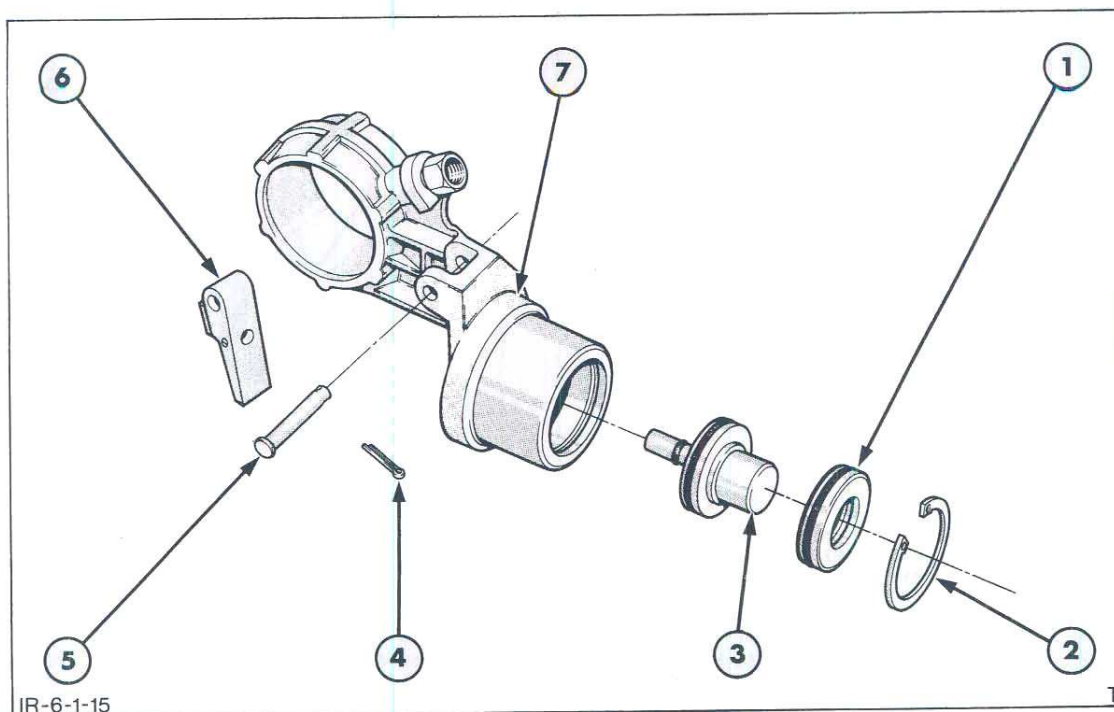


Figure 15
I.P.T.O. Clutch Brake Assembly

- | | | |
|-------------------|---------------|-------------------------------|
| 1. Piston Guide | 4. Split Pin | 6. Brake Arm and Pad Assembly |
| 2. Retaining Ring | 5. Clevis Pin | 7. Brake Housing |
| 3. Brake Piston | | |

RE-ASSEMBLY

Re-assembly of the P.T.O. clutch and brake assembly follows the disassembly procedures in reverse. On re-assembly observe the following requirements:

- Clean all components with a suitable solvent and dry with compressed air.
- Lightly lubricate all 'O'-rings to prevent damage on assembly.

INSTALLATION

Installation of the I.P.T.O. clutch and brake assembly follows the removal procedure in reverse. On installation ensure all retaining bolts are tightened to the specified torque, see "Specifications" – Chapter 2.

Check that the clutch engages and disengages correctly and that the brake stops the shaft at 2200 engine rev/min. Ensure that the P.T.O. shaft is free to rotate with the engine stopped and clutch disengaged.

If new parts have been installed which affect the shimming dimension between the hydraulic pump drive gear lock ring and the I.P.T.O. clutch drive coupling the following procedure must be carried out to determine the shim thickness:

- With the hydraulic pump removed, install the shims previously installed and reconnect the rear axle to the transmission.
- Through the hydraulic pump opening in the rear axle centre housing, measure the gap between the hydraulic pump drive gear snap ring and the I.P.T.O. clutch drive coupling using a feeler gauge.
- Refer to the table in "Specifications" – Chapter 2 for the specified shim thickness for the gap measured.
- Separate the transmission from the rear axle and install the specified shims. Re-connect the rear axle to transmission and install the hydraulic pump.

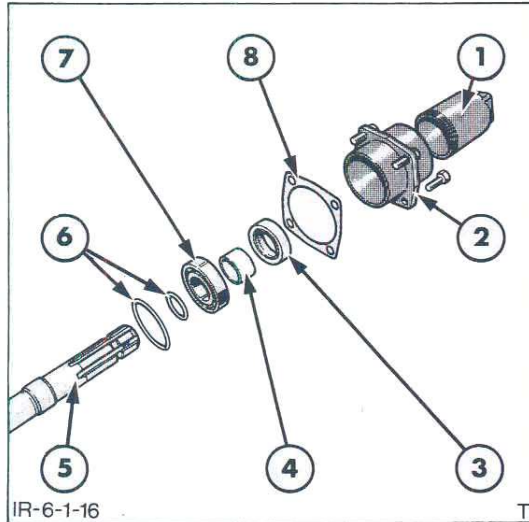


Figure 16
I.P.T.O. Rear Shaft Assembly

- | | |
|-------------|---------------|
| 1. Cap | 5. Shaft |
| 2. Cover | 6. Snap Rings |
| 3. Oil Seal | 7. Bearing |
| 4. Sleeve | 8. Gasket |

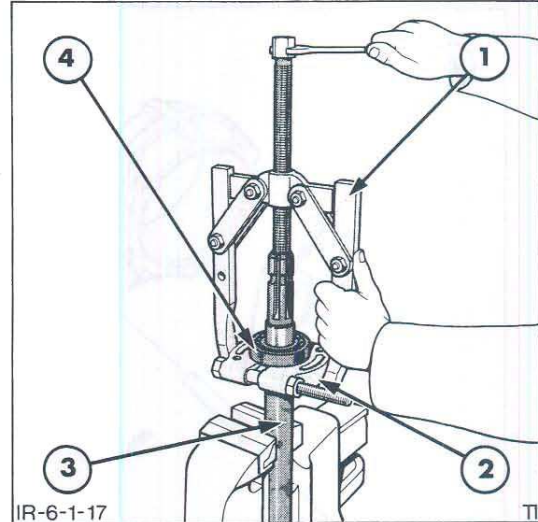


Figure 17
Removing Rear Shaft Bearing

- | |
|---|
| 1. Puller, Tool No. 1003 or 9516 |
| 2. Puller, Attachment, Tool No. 951 or 9190 |
| 3. P.T.O. Rear Shaft |
| 4. Bearing |

F. I.P.T.O. SHAFT – OVERHAUL DISASSEMBLY

With reference to Figure 16.

1. Remove the rear shaft cap and drain the oil from the rear axle centre housing.
2. Remove the bolts retaining the I.P.T.O. cover to the rear axle centre housing.
3. Withdraw the shaft and cover as an assembly from the centre housing.
4. Remove the snap ring retaining the shaft and bearing assembly in the cover, Figure 16.
5. Tap the rear end of the shaft using a mallet to withdraw the shaft and bearing assembly from the cover.
6. Use Puller, Tool No. 943 or 9507, and Slide Hammer, Tool No. 943S or 9567 to remove the oil seal from the cover.
7. Extract the snap ring locating the bearing on the shaft.
8. Using Puller, Tool No. 1003 or 9516 and Pulling Attachment, Tool No. 951 or 9190, pull the bearing and sleeve off the shaft, Figure 17.

INSPECTION AND REPAIR

1. Inspect the bearing for excessive wear or discolouration due to overheating, renew if necessary.
2. Inspect the sleeve for wear or scoring, if damaged renew.
3. Inspect the shaft for chipped or worn splines and discolouration, renew if necessary.

RE-ASSEMBLY

IMPORTANT: *Prior to re-assembly clean all components with a suitable solvent and dry with compressed air.*

Re-assembly of the I.P.T.O. rear shaft follows the disassembly procedure in reverse.

Install the oil seal with the lip towards the front of the shaft.

When re-assembling the I.P.T.O. rear shaft ensure the I.P.T.O. cover retaining bolts are tightened to the specified torque, see "Specifications" – Chapter 2.

G. HYDRAULIC PUMP – TRANSMISSION MOUNTED GEAR TYPE – DESCRIPTION AND OPERATION

A cross-section of the transmission mounted gear type hydraulic pump is shown in Figure 18.

The pump is a tandem gear type unit mounted in the lower right-hand side of the rear axle centre housing.

The pump is driven directly by a gear splined to the rear end of the I.P.T.O. countershaft.

Two sets of spur gears are incorporated within the pump body. The gears, which are coupled together and revolve at the same speed, are in constant operation whenever the engine is running. The front gears pump oil to the hydraulic system (if equipped) whilst the smaller rear gears pump oil to the independent P.T.O. clutch and brake energising circuits.

OIL FLOW

With reference to Figure 19.

Hydraulic oil is supplied to the pump from the rear axle centre housing reservoir via a replaceable full flow micronic intake filter. On entering the pump the oil fills the spaces between the teeth of the revolving front gears and is carried around, within the pump body, to a point where the teeth of the two gears come into mesh. The oil is then expelled through an outlet port via a passage formed in the pump flange into the rear axle centre housing reservoir.

Hydraulic intake oil also passes to the pump rear gears via a transfer passage drilled within the pump body. The oil is carried around by the rotating gears and is expelled through a rear outlet port into a passage formed in the pump flange.

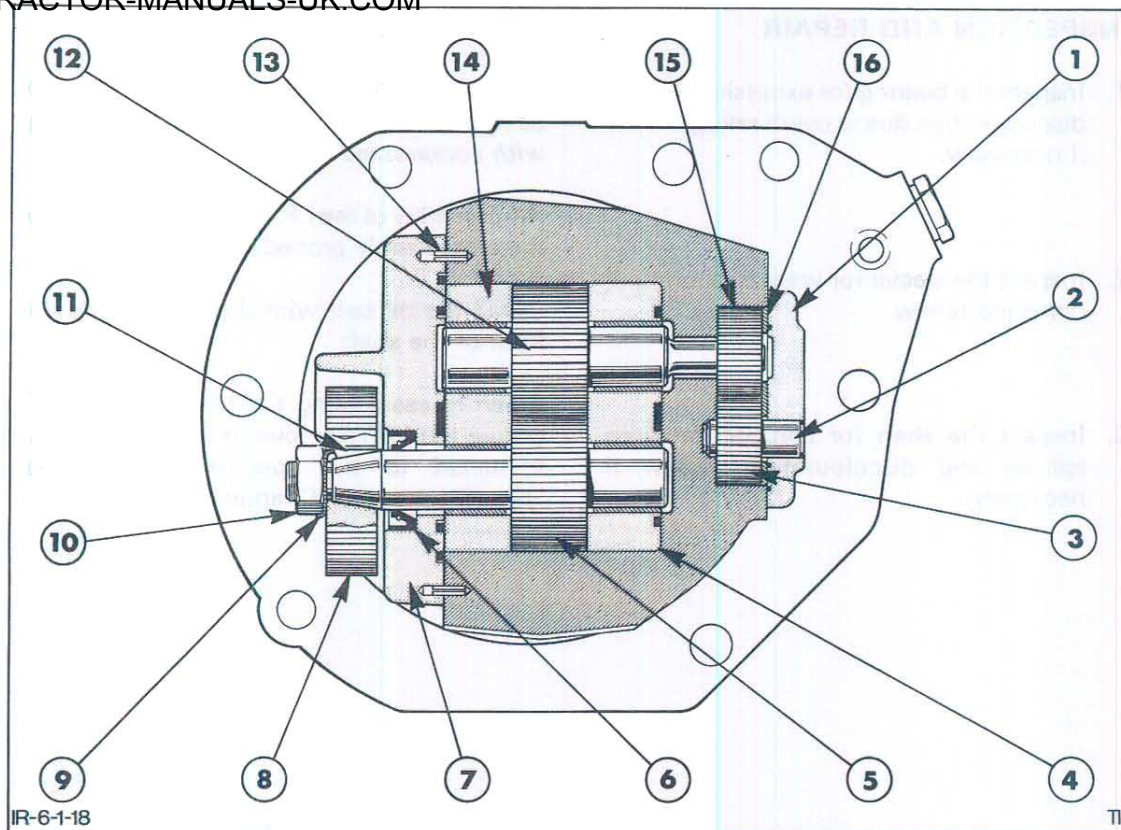


Figure 18

Cross-Section of Transmission Mounted Hydraulic Gear Type Pump

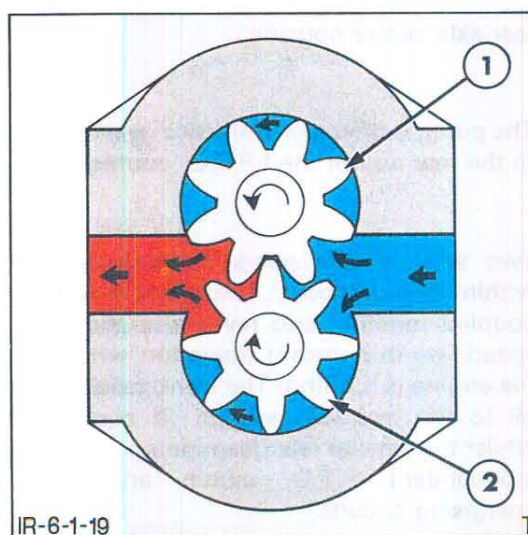
- | | | |
|---------------------------|----------------|------------------------|
| 1. Rear Cover | 7. Front Cover | 12. Front Driven Gear |
| 2. Rear Driven Gear Shaft | 8. Driven Gear | 13. Roll Pin Dowel |
| 3. Rear Driven Gear | 9. Tab Washer | 14. Front Gear Bearing |
| 4. Rear Gear Bearing | 10. Nut | 15. Rear Drive Gear |
| 5. Front Drive Gear | 11. Shaft Key | 16. Pressure Plate |
| 6. Shaft Seal | | |

This passage leads to a port on the pump mounting face which directs the oil, through the wall of the rear axle centre housing, into a rigid pipe leading to the independent P.T.O. brake pressure regulating valve.

Figure 19

Oil Flow in Hydraulic Gear Type Pump

- | | |
|--|--|
| Pressure Oil | Suction Oil |
| A. To Hydraulic Circuit | B. From Reservoir |
| 1. Driven Gear | 2. Drive Gear |



H. HYDRAULIC PUMP – TRANSMISSION MOUNTED GEAR TYPE – OVERHAUL**REMOVAL**

1. Drain the oil from the rear axle centre housing.
2. Disconnect the brake control rods.
3. Disconnect the brake levers from the pull rods.
4. Withdraw the pump to rear axle centre housing retaining bolts.
5. Remove the pump from the side of the rear axle centre housing.

DISASSEMBLY

With reference to Figure 20.

1. Straighten the locking tab and remove the external driven gear retaining nut.
2. Withdraw the external driven gear from the shaft.
3. Remove the shaft key.
4. Remove the front cover retaining bolts and washers and withdraw the front cover.

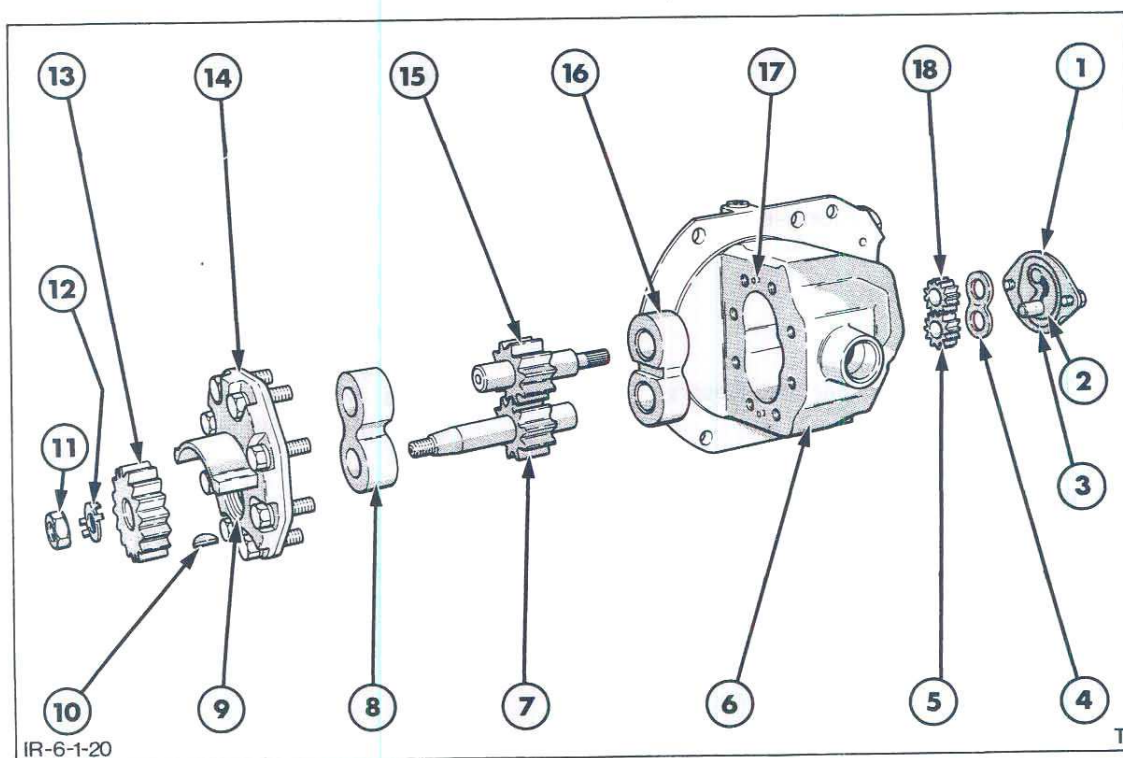


Figure 20
Hydraulic Gear Pump – Exploded

- | | | |
|--------------------------|-----------------------|--------------------------|
| 1. Rear Cover | 7. Front Drive Gear | 13. External Driven Gear |
| 2. Pressure Loading Ring | 8. Front Gear Bearing | 14. Front Cover |
| 3. Outer Sealing Ring | 9. Front Seal | 15. Front Driven Gear |
| 4. Pressure Plate | 10. Shaft Key | 16. Rear Gear Bearing |
| 5. Rear Driven Gear | 11. Nut | 17. Roll Pin Dowel |
| 6. Pump Body | 12. Tab Washer | 18. Rear Drive Gear |

5. Pull the front drive gear and bearing from the pump body.
6. Separate the front drive gear from the bearing.
7. Withdraw the front driven gear from the pump body.
8. Remove the rear cover retaining bolts and washers and withdraw the rear cover.
9. Extract the pressure plate from the rear of the pump.
10. Using a pair of long-nose pliers remove the rear gears.
11. Withdraw the rear gear bearing.

NOTE: To facilitate removal of the rear gear bearing it may be necessary to push the bearing from the rear end using a suitable rod inserted in the oil transfer passage.

INSPECTION AND REPAIR

1. Wash all parts in a suitable solvent to remove any foreign particles and dry with a clean, lint-free cloth or compressed air.
3. Inspect the pump body for external damage and cracks. Examine the bores for wear and damage.

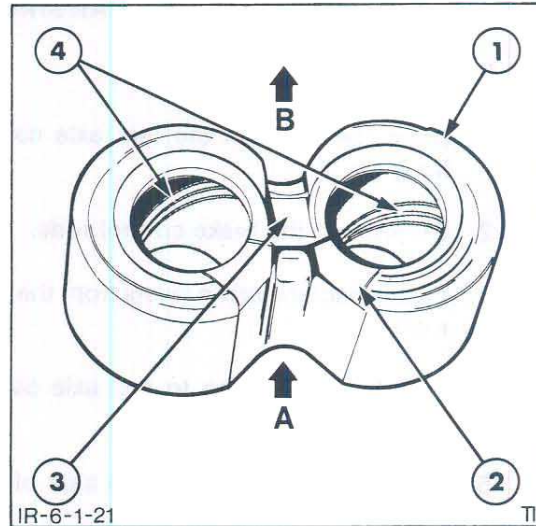


Figure 21
Pump Bearing

- A. Pump Inlet B. Pump Outlet
1. Relieved Radius
 2. Recess on Face adjacent to Gears
 3. Seal Bridge
 4. Lubrication Scrolls
2. Examine each bearing for wear on the face and in the bore. Pay particular attention to the condition of the lubrication scrolls and the seal bridge, Figure 21. At the stage of major overhaul, bearings should be renewed but light score marking may be removed by polishing as follows:
 - (i) Place a sheet of 'O' grade emery paper, lubricated with paraffin, on a truly flat surface, then polish the bearing face using light rotary motion.
 - (ii) Outer diameter may be lightly polished to obtain free movement in the body.

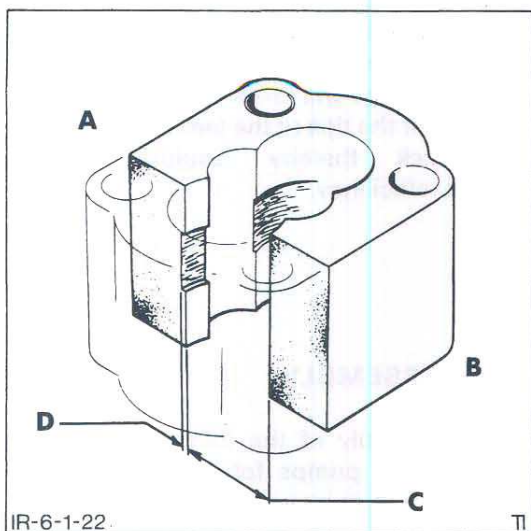


Figure 22
Gear Track in Body

- A. Inlet Side
- B. Outlet Side
- C. Bore Diameter (Bearing Location)
- D. Depth of Gear Track

NOTE: It is normal for the gears to cut a light track on the inlet side of the body bore and, providing the depth of the track does not exceed 0.004 in. (0.10 mm), the body is reusable. Using an internal micrometer measure the body at the bearing location and then at the track position to assess the track depth, see Figure 22.

Burrs at the edge of the gear track should be removed with 'O' grade emery paper.

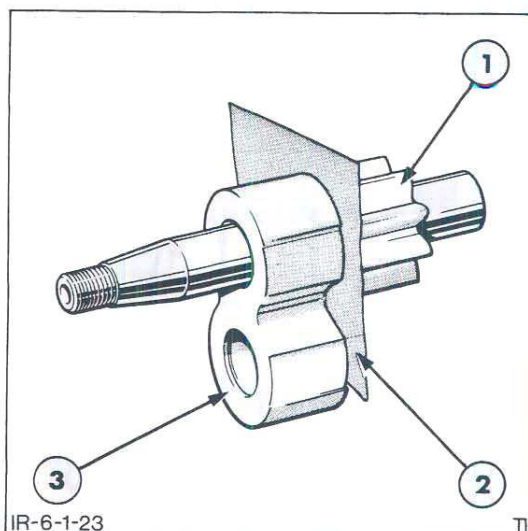


Figure 23
Polishing Gear Faces

- 1. Gear
- 2. Emery Paper 'O' Grade
- 3. Scrap Bearing

IMPORTANT: Whilst servicing the drive and driven gears, particular attention must be paid to the following points:

- (i) Gear widths of drive and driven gears must be within 0.0002 in (0.005 mm) of each other to ensure satisfactory pump efficiency, see Figure 24.
 - (ii) Journals must be within 0.0005 in. (0.013 mm) of each other, Figure 24.
 - (iii) Gear faces must be flat. This feature may be checked by blueing a bearing face and rotating against the gear. This check will also reveal any sharp edges on the teeth.
4. Examine the gears for scored or worn side faces or journals, damaged teeth, thread or keyway and surface cracks. Slight wear and scoring on the journals may be erased by mounting between lathe centres and polishing with 'O' grade emery paper lubricated with paraffin. Lightly scored side faces may be renovated by sandwiching emery paper between the gear face and a scrap bearing and rotating the gear, Figure 23.
 5. Inspect the cover for damage or cracks, particularly adjacent to the ports, filter connection and pump face. Ensure the internal passages are clear.

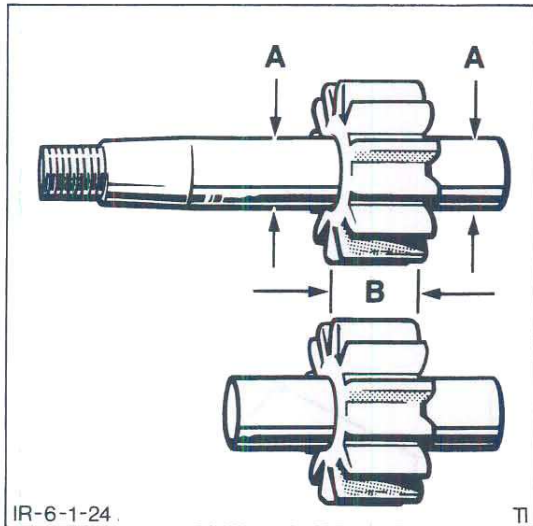


Figure 24
Gear Pairing

- A. Journals Paired within
0.0005 in (0.013 mm)
- B. Gear Widths Paired within
0.0002 in (0.005 mm)

6. Check the external gears and housing for damage, wear or cracks. Ensure the idler gear runs freely on the shaft.
7. New seals and 'O' rings should be installed when servicing the pump.

In the event of components being unsuitable for further use the advisable action is to clean out the hydraulic system and renew the complete pump unit. Worn components can, in an emergency be replaced but the following points must be noted:

- Under working conditions, hydraulic pressure within the pump loads the gears towards the inlet side of the body thereby cutting the running track. If the bearings or gear journals wear, the gears move over thus deepening the track.

- If the running track is worn to or beyond the limit for re-use, the installation of new bearings will re-centre the gears and prevent the tips of the teeth bottoming in the track thereby resulting in pump inefficiency.

RE-ASSEMBLY

Re-assembly of the transmission mounted gear type pumps follows the disassembly procedure in reverse.

IMPORTANT: *If used bearings are to be refitted, they should be installed in their original positions. Inspection of the bearings indicates two distinct features which may be used to ensure correct location.*

- (i) A Y-shaped recess in the bearing face.
- (ii) Relieved radii on one side of the bearing.

Assemble the bearings with the Y-shaped recesses adjacent to the gear faces and the relieved radii facing the outlet side of the body, see Figure 25.

On re-assembly observe the following requirements:

- Lubricate all parts with hydraulic oil.
- Coat all seals and 'O'-rings with petroleum jelly and ensure the pump sealing rings are correctly positioned, Figure 25. Ensure the sealing strips are flush to 0.01 in. (0.25 mm) proud of the bearing block on re-assembly.