

# 41 - TRANSFER BOX

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**DESCRIPTION**

The Borg Warner transfer gearbox incorporates a single epicyclic gear set which is driven by the main gearbox output shaft to provide high, neutral or low gear ratios.

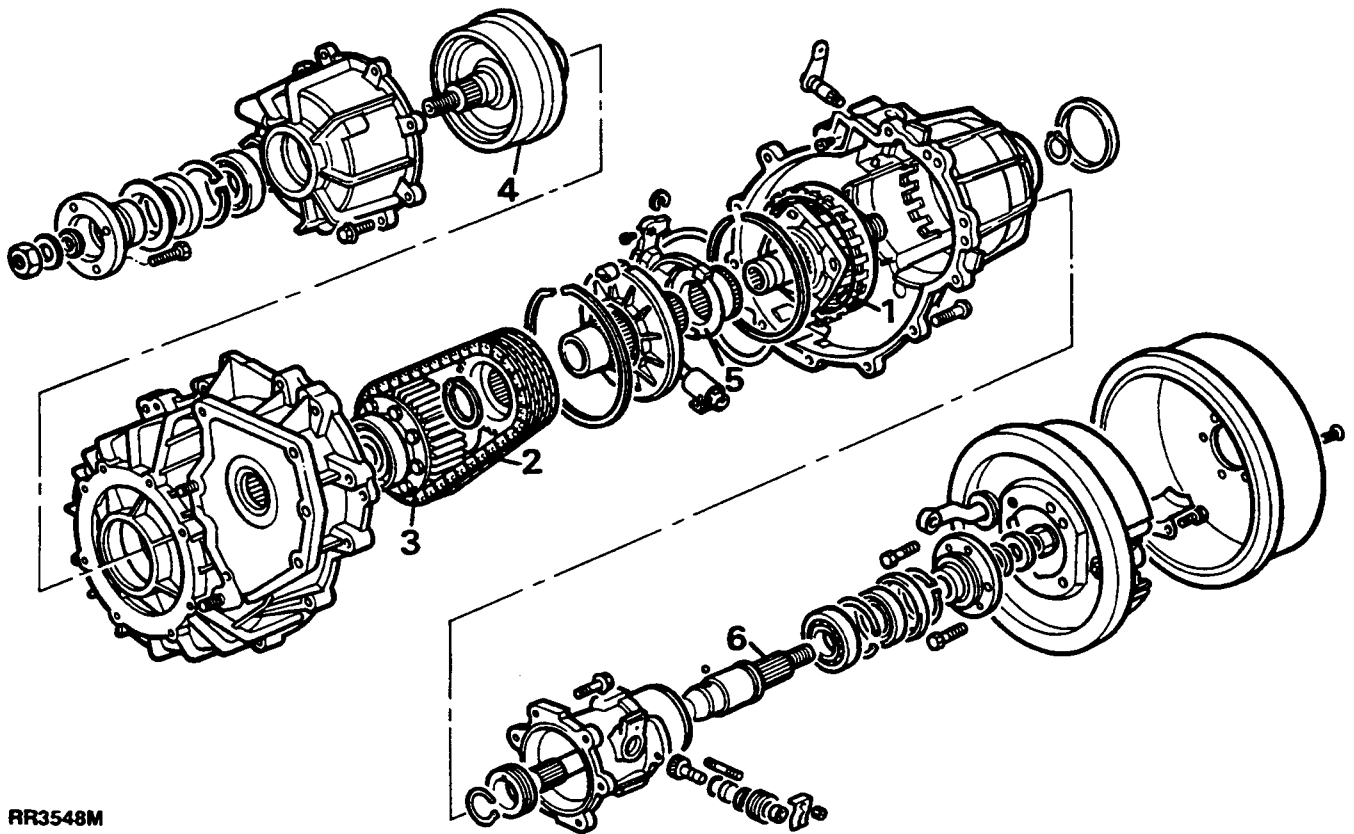
With high or low gear selected, power is transmitted by a Morse Chain to the front and rear output shafts via a differential and a limited slip viscous unit.

The gear lever allows neutral, high or low to be selected. A differential lock is not necessary as this function is automatically performed by the viscous coupling unit.

Lubrication is by a low pressure plunger type oil pump, driven by the epicyclic gear set. Oil is delivered to the gears and bearings via oilways in the components.

The viscous coupling though partly immersed in lubricating oil, is a self contained and sealed unit.

Illustration RR3548M showing the component parts of the transfer box, is a useful cross reference when studying the following power flow diagrams.



RR3548M

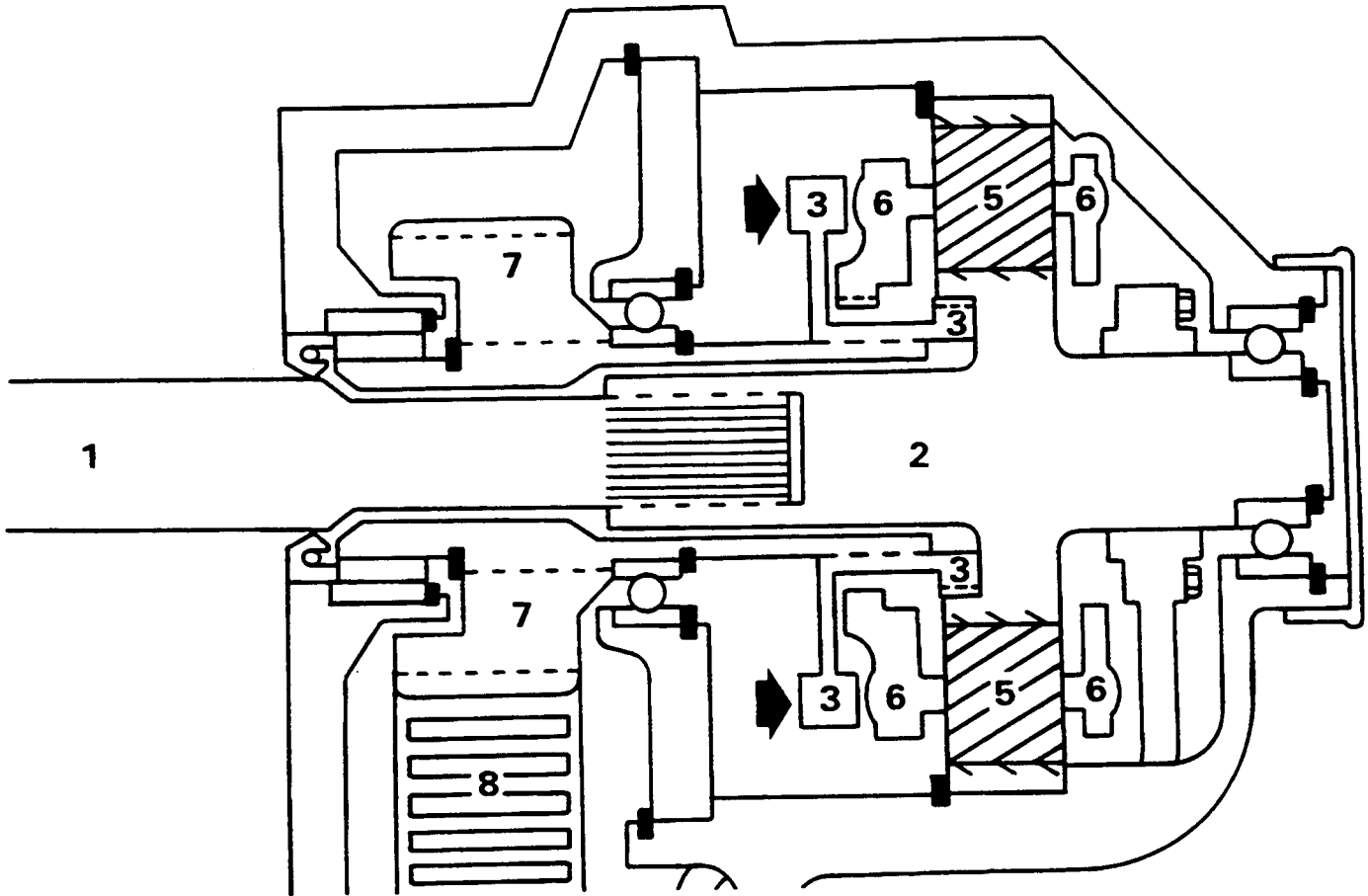
- 1. Epicyclic gear set
- 2. Morse chain
- 3. Differential
- 4. Viscous unit/front output shaft
- 5. High,neutral,low selection sleeve
- 6. Rear output shaft

Power flow - operation

Broken lines in the following illustration indicate gear or sliding splined connections.

High ratio

Moving the gear lever to the high position seen in RR3551M causes the sleeve 3 to engage directly with the sun gear 2, allowing the power to by-pass the planetary gear set 5 and provide a direct drive to the drive sprocket 7, and Morse chain 8 to the differential and output shafts.

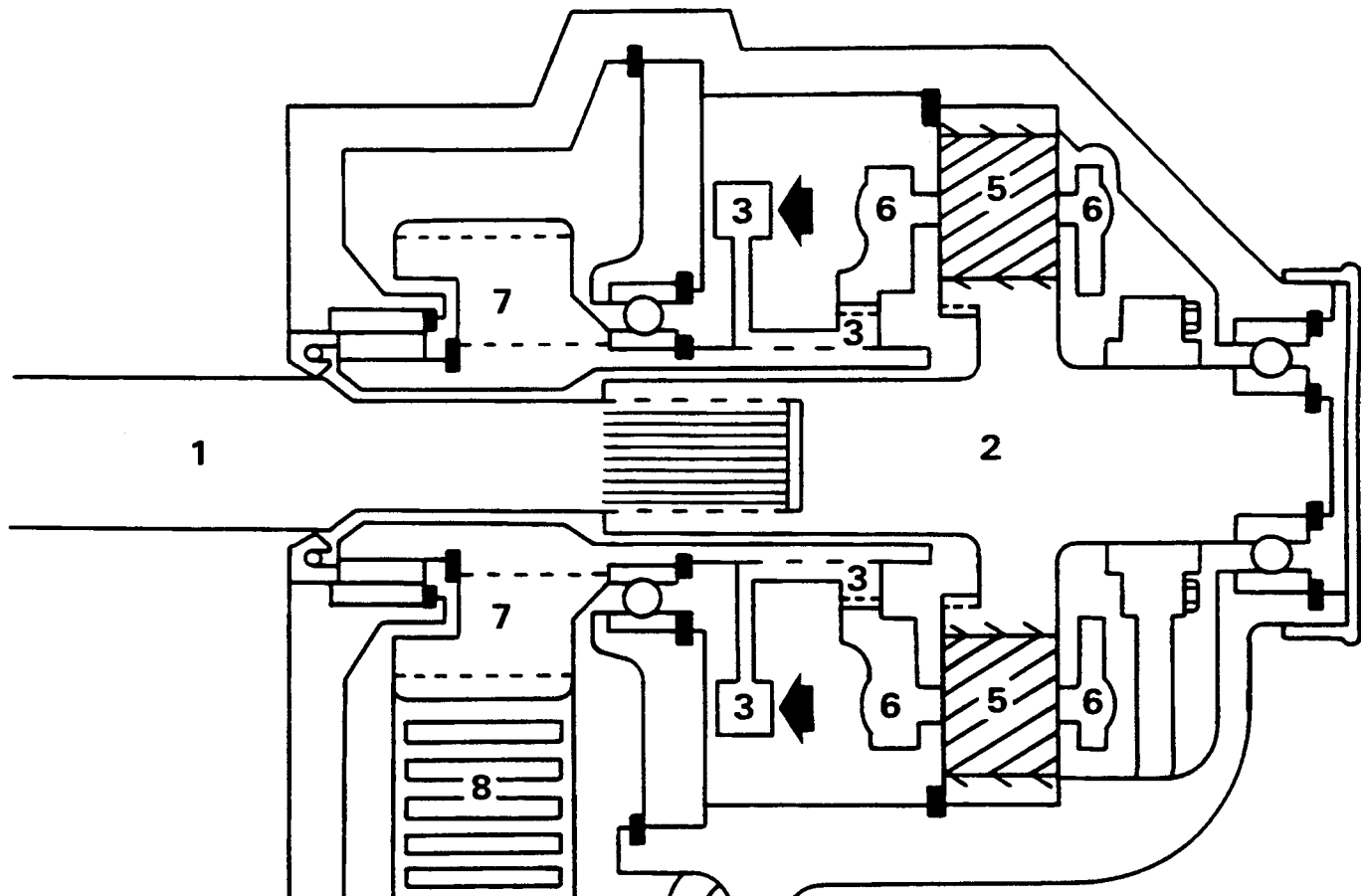


RR3551M



**Low ratio**

In low gear the selector sleeve 3 connects with the planet carrier 6 and planet gears 5 to provide low ratio.



RR3550M

### Differential and viscous coupling

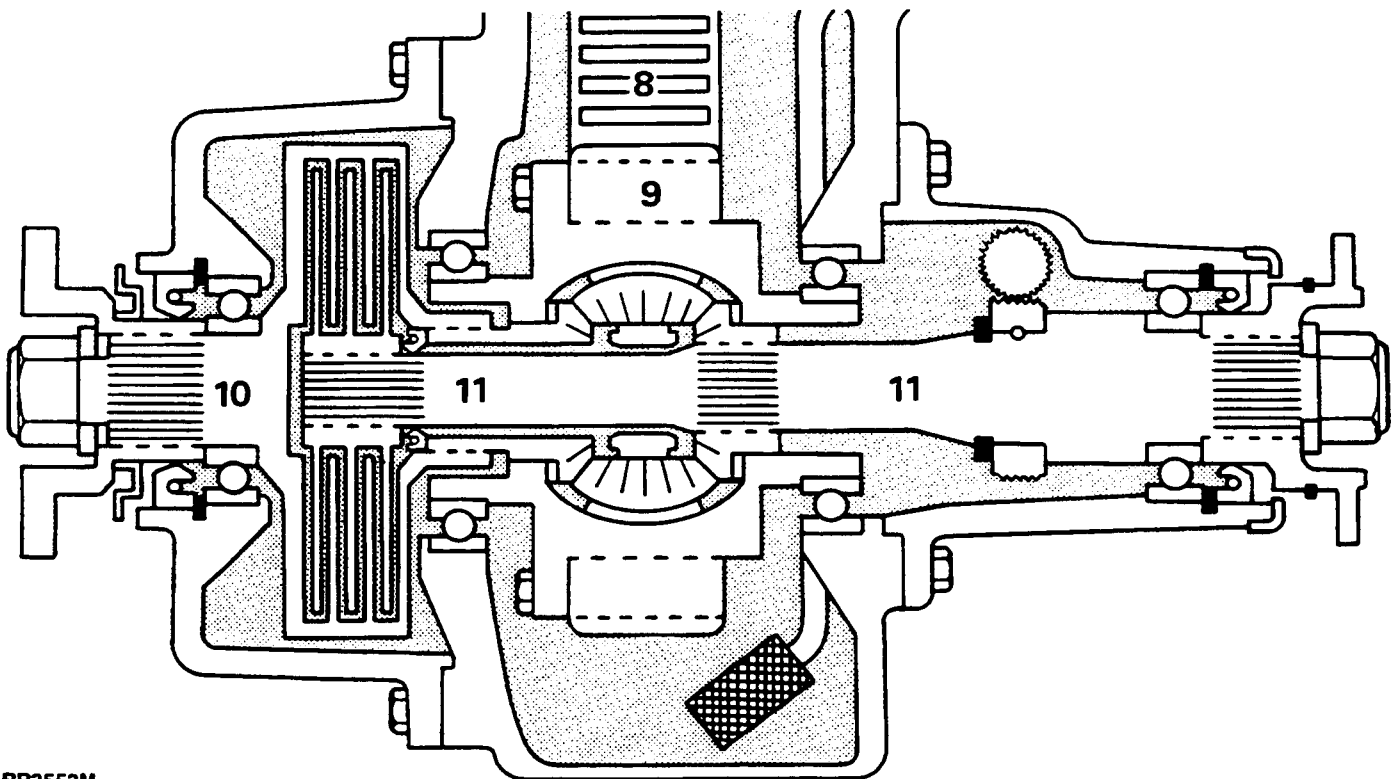
The Morse chain 8 drives a conventional type differential 9. The front and rear output shafts 10 and 11 are splined to the differential output pinions. The front output shaft 10 forms the outer member of the viscous coupling, while the inner member plates are splined to the rear output shaft 11.

Its only function is to limit the maximum difference in speed between the two shafts, with the effect of automatically locking the differential.

The maximum difference in speed permitted by the viscous coupling must however be sufficient to allow the vehicle to be driven on a dry road surface, in a circle on full lock, without inducing 'wind up' or causing damage to the transmission caused by wind up.

The viscous coupling has alternate plates splined to the inner and outer members.

One set of plates is splined to 10, the outer member/front shaft and the other plates are splined to the rear output shaft 11. The coupling is filled with a special silicone jelly which allows sufficient slip to occur in normal driving conditions but, which increase the drag between the plates as the speed difference and temperature rises, thus eliminating the need for a manual differential lock.



RR3553M




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**BORG WARNER - SYMPTOMS**


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**Oil leaks**

1. Check that nylon ventilation pipes are not blocked or damaged.
2. Check lubrication level and specification in both boxes and recheck leaks.
3. Location area of leak.
  - A - Transfer box front output flange oil seal.
  - B - Transfer box rear output flange oil seal.
  - C - Oil leaking from vent hole between main and transfer boxes.  
The oil may be leaking from the main or transfer box oil seals. Renew the faulty seal.
  - D - Oil leaking from engine flywheel housing.  
The oil may be leaking from the gearbox front seal, torque converter seal or the engine crankshaft rear seal. Renew the faulty seal.

**Loss of drive - no abnormal noise from box.**

1. Check that the main transmission unit is satisfactory and confirm that loss of drive is in the transfer box.
2. Check by 'feel' the operation of the High/Low transfer gear selection. Suspect failed viscous unit.

**Knocking or rattling noise in high and low ratio.**

1. Check lubricant specification and level, if low do not top up at this stage.
2. Drain lubricant and check for contamination or metal particles.  
Suspect drive chain has stretched.

**Abnormal noise in operation.**

1. Check lubricant specification and level, if low do not top up at this stage.
2. Drain lubricant and check for contamination or metal particles.  
Suspect oil pump failure, mechanical wear or damage.

**Transmission wind up**

'Transmission wind up' is a build up of tension in the transmission which will only occur if either the differential or viscous unit is partially or completely seized.

**Vibration - harshness**

1. Check operation of differential and viscous units.  
Ensure that neither is partially seized.



**NOTE: If both are satisfactory, but the vibration - harshness is still present, the alignment of the propeller shafts and balance of the road wheels should be checked.**

For balancing of road wheels. *See WHEELS AND TYRES, Repair, Wheel balancing*

For propeller shaft alignment. *See PROPELLER SHAFTS, Description and operation, Propeller shaft alignment*



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**REAR OUTPUT SHAFT OIL SEAL**

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**Service tool: 18G1422**

1. Disconnect rear propeller shaft from output drive flange and tie shaft to one side.
2. Apply parkbrake and release drive flange nut.
3. Release parkbrake and remove brake drum secured with two screws.
4. Remove oil catcher secured to backplate with two bolts.
5. Remove output shaft nut, steel washer, rubber seal and withdraw flange.
6. Tap dust cover from housing and remove oil seal.
7. Lubricate and fit new seal using service tool 18G1422. Fit so spring side of seal abuts circlip.
8. Fit dust cover.
9. If necessary release circlip from drive flange to allow new bolts to be installed.
10. Examine flange, if surface is corroded or a groove worn by previous seal discard flange.
11. Lubricate running surface and fit flange. Do not tighten nut.
12. Seal oil catcher to back plate using silicone rubber sealant and secure with two bolts.
13. Fit brake drum and secure with two screws. Apply parkbrake and tighten drive flange nut to **224 Nm**
14. Fit propeller shaft. Tighten nuts to **46 Nm**

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**FRONT OUTPUT SHAFT OIL SEAL**

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**Service tool: 18G1422**

1. Disconnect front propeller shaft from flange.
2. Apply parkbrake and release drive flange nut.
3. Remove output shaft nut, steel washer, rubber seal and withdraw flange.
4. Prise out oil seal.
5. Lubricate and fit new seal using service tool 18G1422. Fit spring side of seal abutting circlip.
6. Examine flange if surface is corroded or worn by previous seal discard flange.
7. Lubricate seal running surface of flange.
8. Fit flange. Tighten to **224 Nm**
9. Refit propeller shaft. Tighten nuts to **46 Nm**

**BORG WARNER TRANSFER GEARBOX**

Service repair no - 41.20.25.

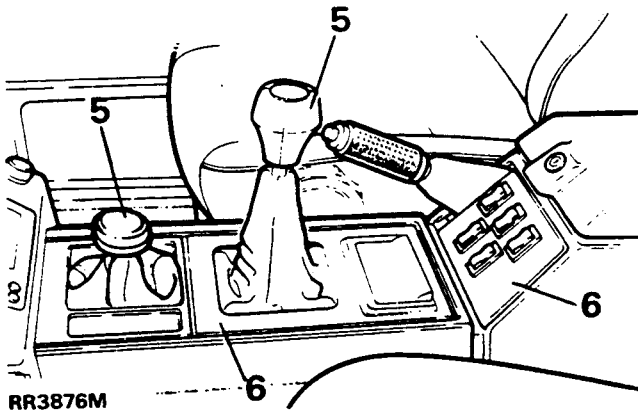
**Remove and refit****Remove**

1. Site vehicle on ramp and chock wheels.
2. Disconnect the battery negative lead.
3. Remove fan blade assembly.



**NOTE:** The nut securing viscous unit has left hand thread.

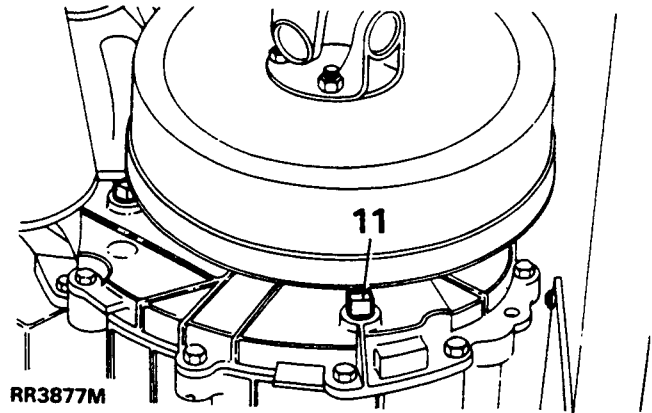
4. Disconnect airflow meter to plenum chamber hose.
5. Remove two gear lever knobs. If Automatic type remove gear selector. *See ELECTRICAL, Repair, Automatic gear selector - panel illumination*



6. Remove floor mounted console assembly. *See CHASSIS AND BODY, Repair, Glovebox and floor mounted console assembly*
7. Remove padding from top of transmission tunnel.
8. Loosen pinch bolt and remove upper gear lever.
9. Remove screws and detach high low lever and main gearlever retaining plates.

**Underneath vehicle**

10. Drain oil from transfer gearbox.
11. Refit plug.



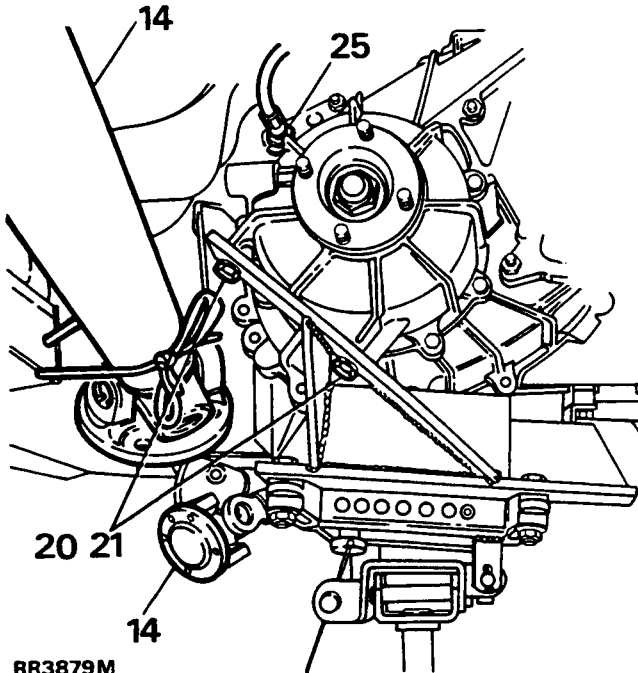
12. Disconnect Lambda sensor and remove front section of exhausts.
13. Remove chassis cross member secured by eight nuts and bolts.
14. Mark each drive flange for reassembly and disconnect front and rear propeller shafts from transfer box. Tie the shafts to one side.
15. Release clamp and disconnect speedometer cable from rear output housing.
16. Release cable from left hand side of transfer gearbox. Tie cable to one side.
17. Remove two bolts and withdraw clutch slave cylinder from bell housing. If automatic remove fixings securing tie bar to transmission.





### Remove transmission assembly

18. Position a suitable transmission hoist on rear output housing to support weight of assembly.
19. Remove fixings and withdraw transfer gearbox mountings.

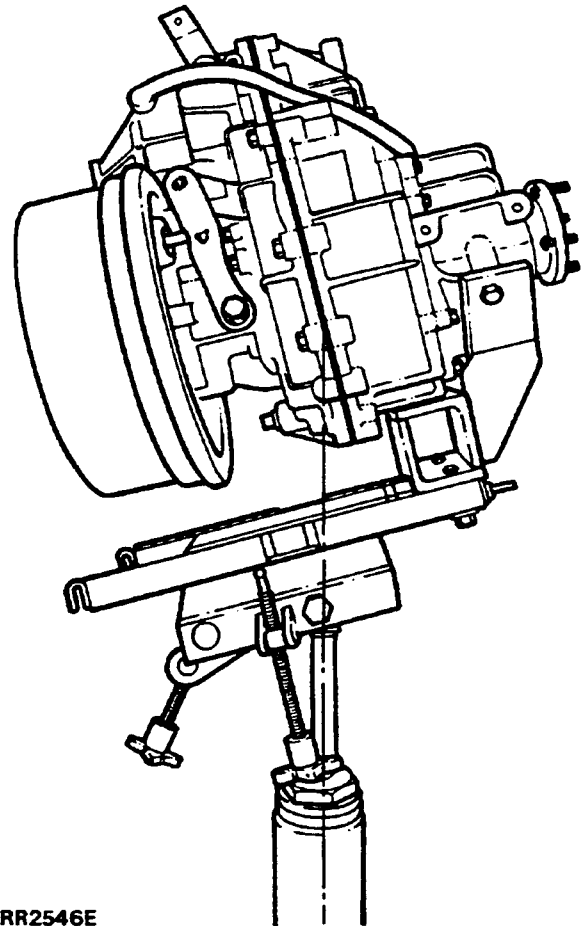


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20. Fit adaptor plate to transmission hoist. Raise hoist and position under transfer box. See **Service tools, Adapter plate transfer box**

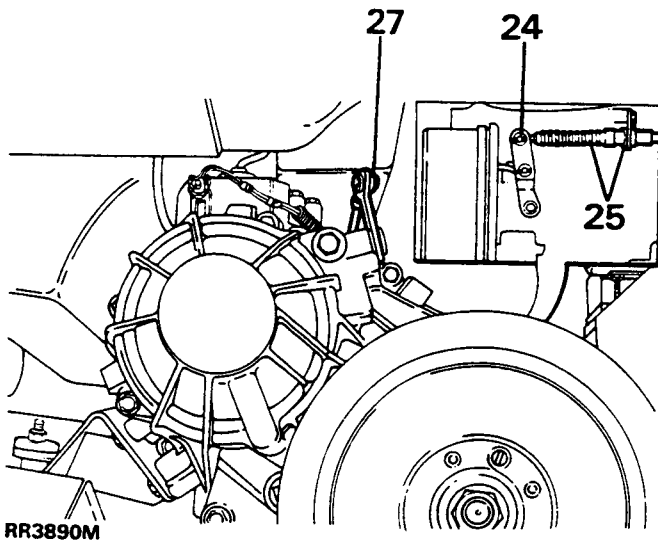


**NOTE:** Centralise adaptor plate on hoist platform so split line of gearbox is aligned with centre of ram.



RR2546E

21. Secure fixture to transfer box mounting points.
22. Remove hoist from rear of transfer box.
23. Lower transmission until top of transfer gearbox clears rear floor.
24. Disconnect handbrake cable.
25. Remove clip securing handbrake outer cable to support bracket, feed cable through bracket, and tie to one side.
26. Remove breather pipe from top of gearbox.
27. Remove high/low rod from gearbox selector lever.



RR3890M

28. Support main gearbox with hoist and detach transfer gearbox.
29. Remove upper and lower bolts and two nuts securing transfer box to main gearbox.
30. Move transfer gearbox rearwards to detach it.

#### Refit Transfer Gearbox

1. Clean joint faces of transfer gearbox and main gearbox.
2. Lubricate oil seal in joint face of transfer gearbox.
3. Fit gearbox to adaptor plate on hoist. Raise hoist until input shaft enters transfer gearbox.

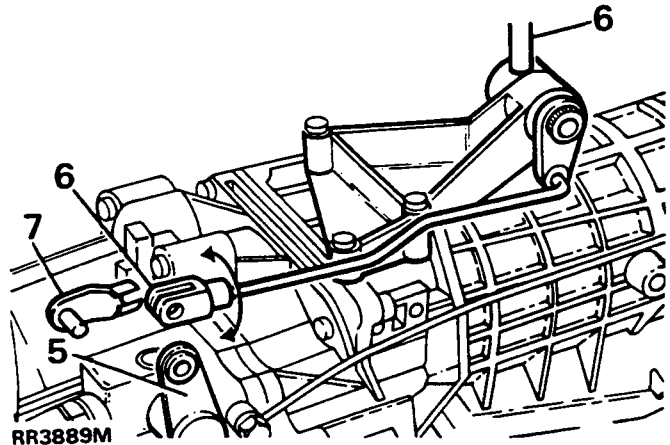


**CAUTION: Ensure input shaft splines do not damage oil seal in transfer gearbox.**

4. Fit transfer gearbox to main gearbox with nuts onto two studs. Fit remaining bolts.

#### Transfer gearbox high/low link adjustment

5. Select neutral gear position.
6. Set transfer gearbox lever in a vertical position. Rotate clevis on end of rod until hole aligns with hole in selector lever.
7. Fit clevis pin and retaining clip. Select high and low transfer to prove operation



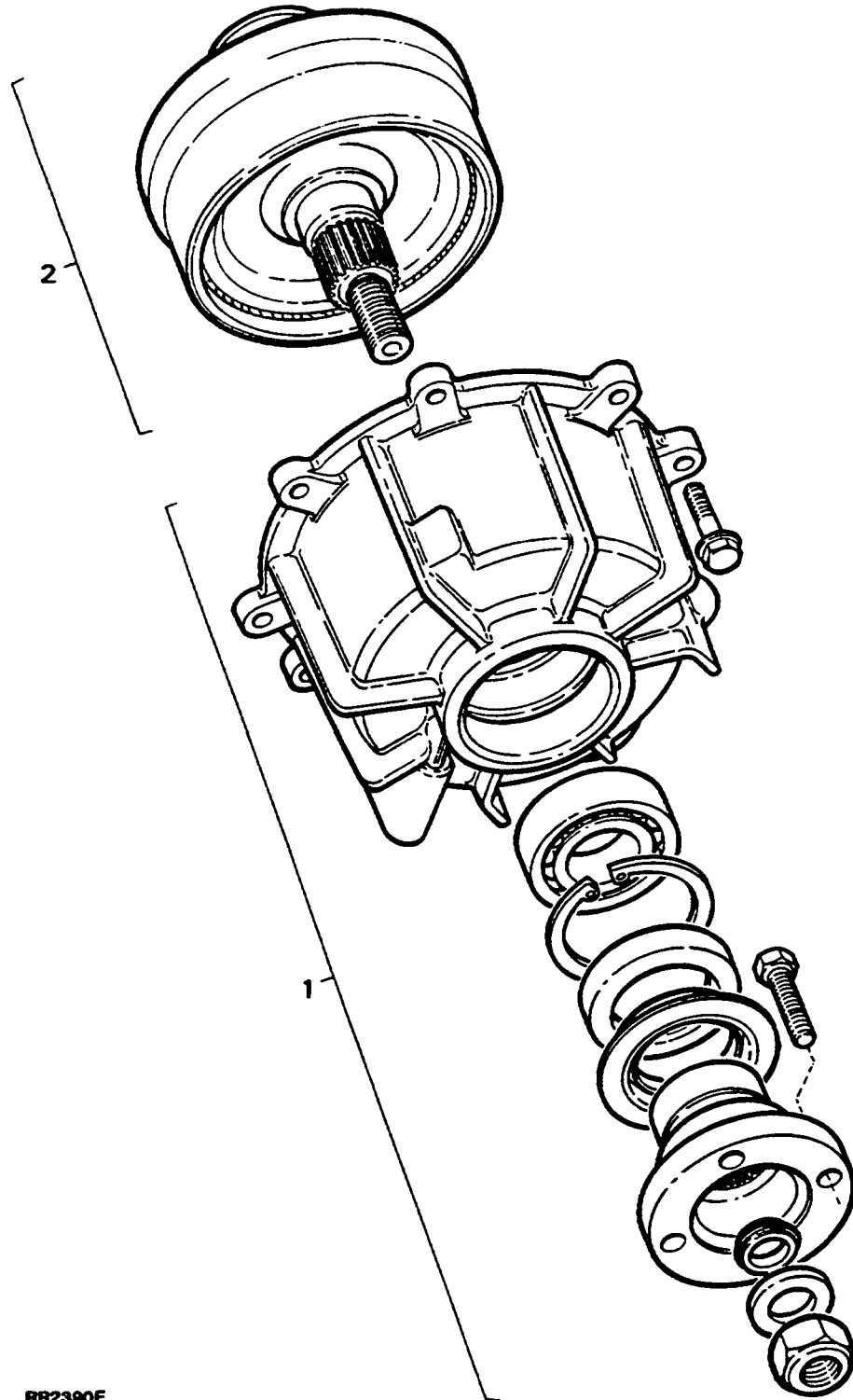
RR3889M

8. Reverse removal instructions, noting following points.
9. Fit mounting bracket to gearbox. Tighten to **102 Nm**
10. Fit three fixings which secure right hand mounting bracket to chassis. Tighten to **45 Nm**
11. Fit propeller shafts. Tighten nuts to **46Nm**
12. Refill transfer gearbox with oil. See maintenance schedule - check / top up transfer gearbox oil. **See LUBRICANTS, FLUIDS AND CAPACITIES, Information, Recommended lubricants and fluids**
13. Check operation of parkbrake and adjust if necessary. **See BRAKES, Repair, Parking brake cable**



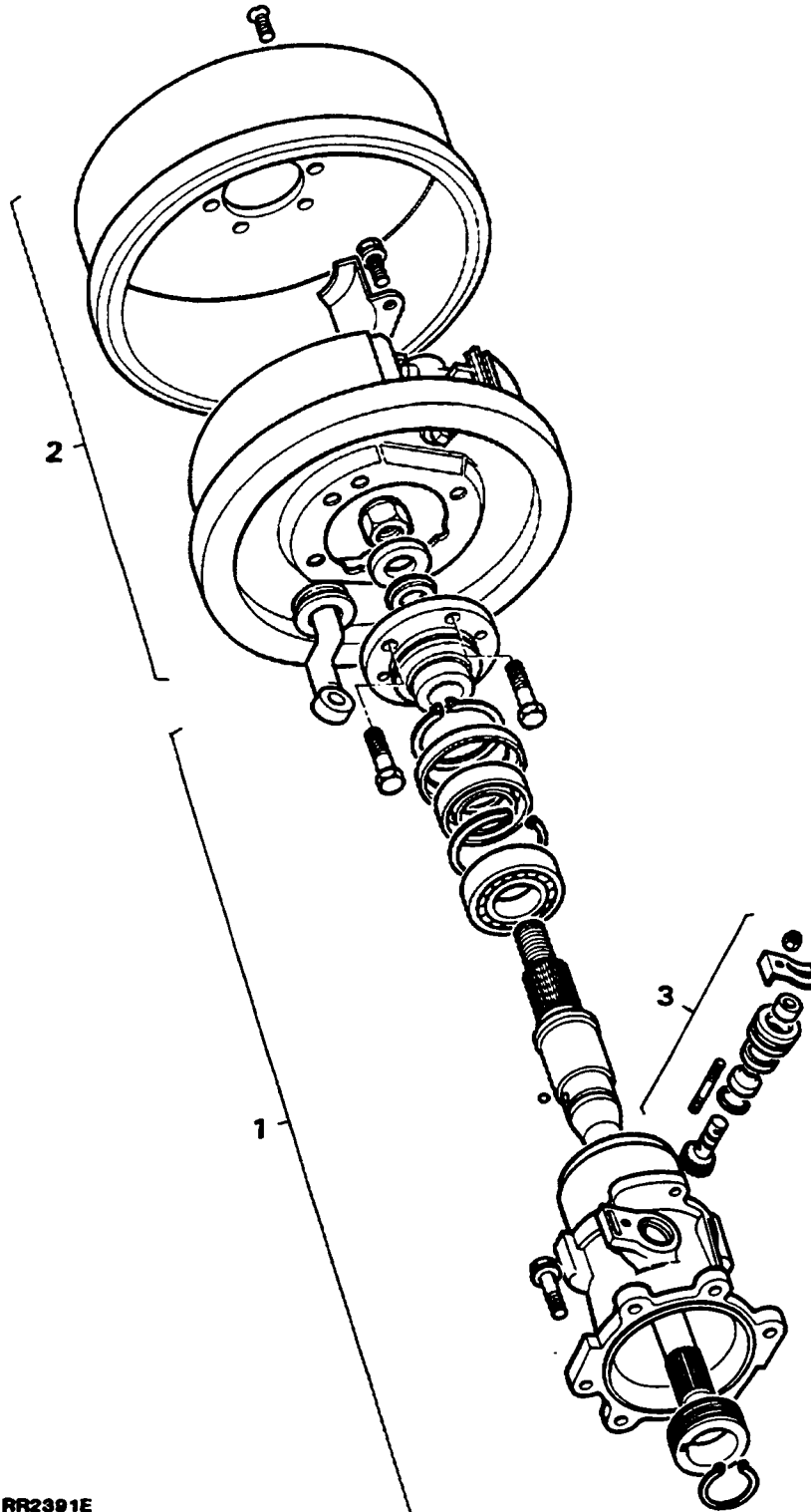
**BORG WARNER GEARBOX ILLUSTRATED ASSEMBLIES**

- 1. Front output housing assembly
- 2. Viscous unit



RR2390E

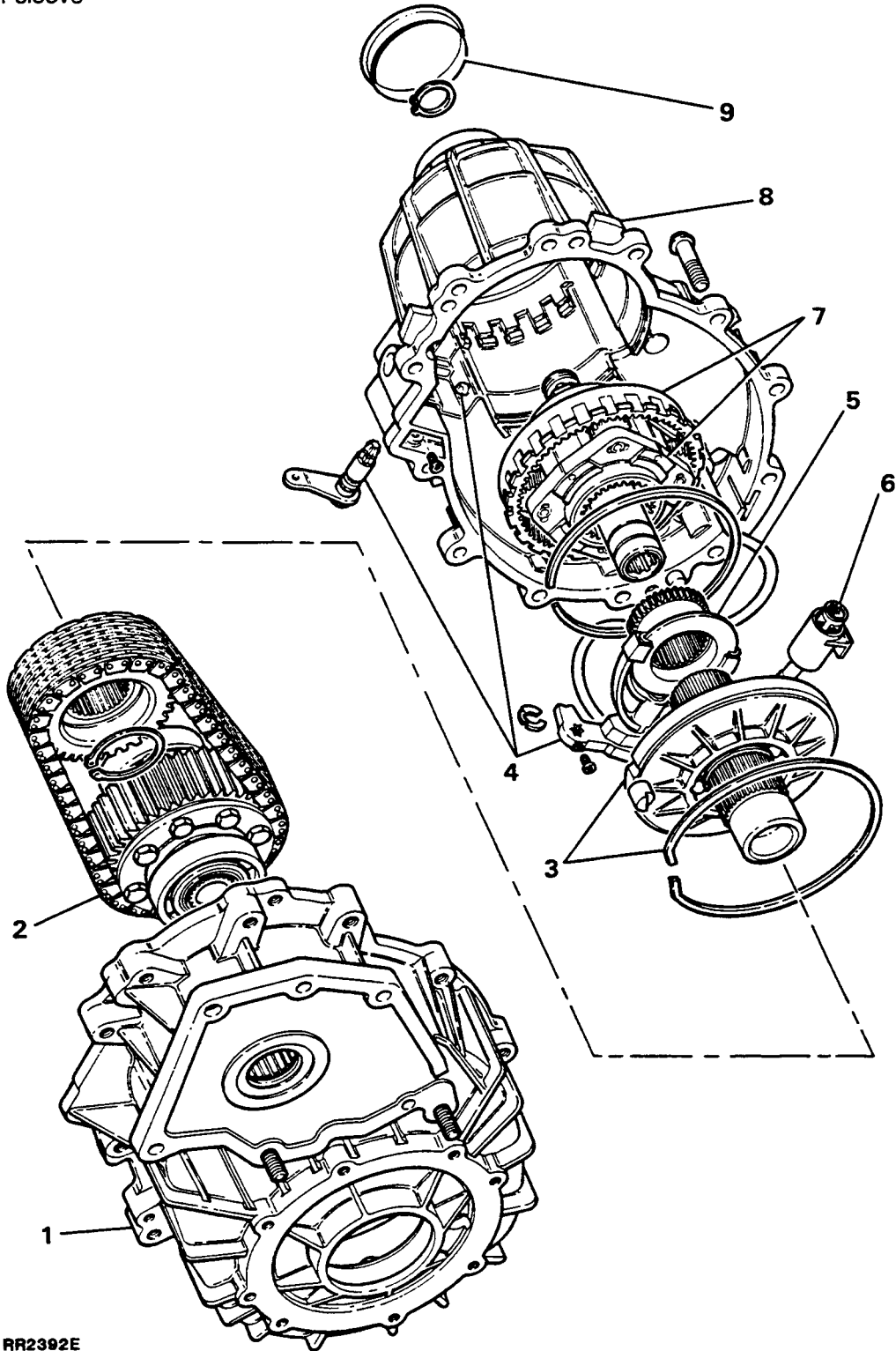
1. Rear output housing and output shaft assembly
2. Transmission brake drum assembly
3. Speedometer drive pinion assembly



RR2391E



1. Front cover - main casing
2. Transfer sprocket, centre differential assembly, driven sprocket and chain
3. Bearing carrier and transfer shaft
4. Selector fork and lever assembly
5. Selector sleeve
6. Oil pickup pipe and filter
7. Planetary set (epicyclic unit)
8. Rear cover - main case
9. End cap



RR2392E

**BORG WARNER TRANSFER GEARBOX****DISMANTLING, OVERHAUL AND REASSEMBLY**

**Service Tools** See *Service tools, Adapter plate transfer box*

18G1422 - Oil seal replacer

18G1205 - Adjustable flange holding wrench

18G134 - Bearing and oil seal replacer

LST550 - 6 - Input shaft oil seal replacer



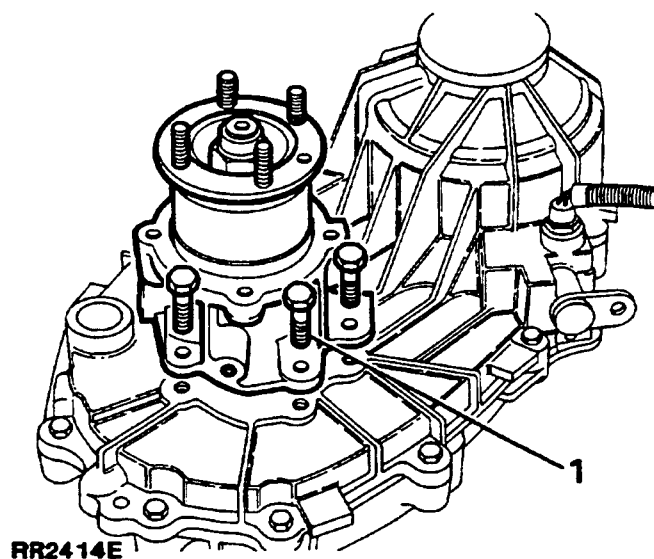
**NOTE:** Before commencing the overhaul procedure thoroughly clean the exterior of the transfer gearbox. If the gearbox oil has not previously been drained, drain the oil into a suitable container.

**DISMANTLING**

**NOTE:** Before commencing the dismantling procedure remove the brake drum assembly.

**Rear output housing**

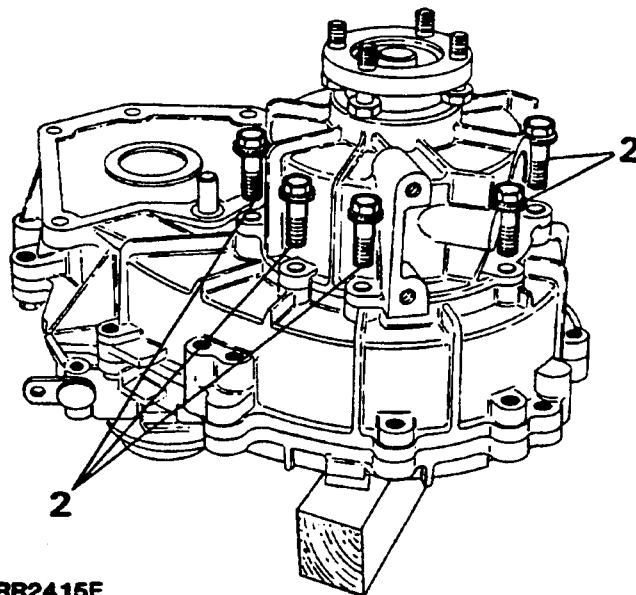
1. Remove the six bolts and withdraw the rear output housing complete with output shaft.

**Front output housing**

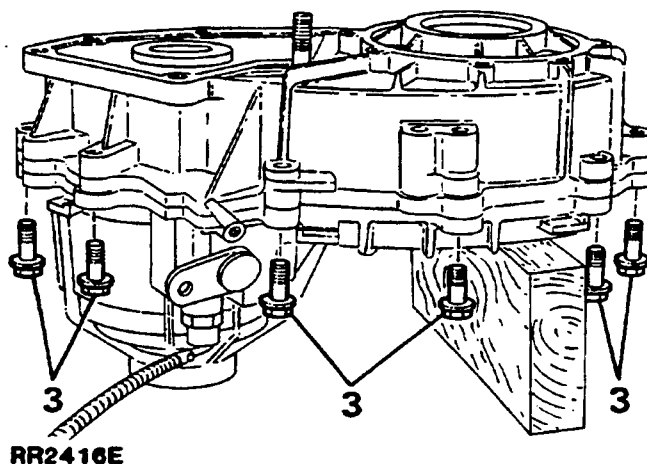
face.

**NOTE:** Invert the gearbox. Level up the assembly by placing wooden blocks under the transfer gearbox to main gearbox joint face.

2. Remove the eight bolts and withdraw the front output housing complete with viscous unit.

**Front cover - main casing**

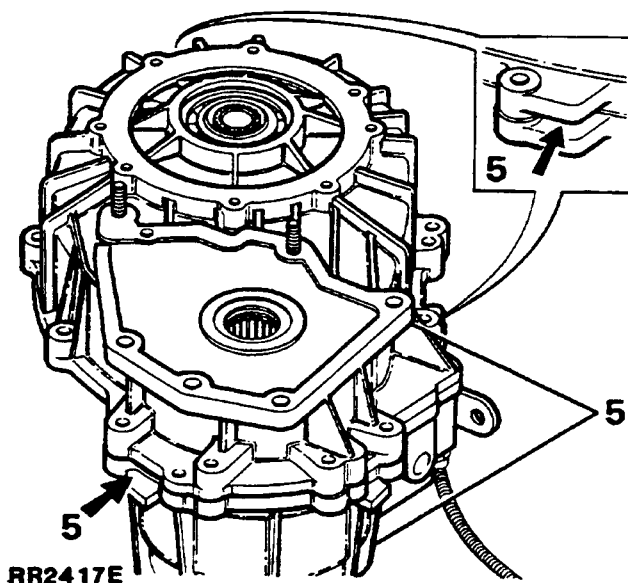
3. Remove the eleven bolts securing the front and rear cover (main case) together.





4. Clean any previous sealant from the threads of the bolts.
5. Using two levers between the cast lugs on the outer edges of the casing, to assist in separating the gearbox, carefully prise the front cover from the rear cover.

**CAUTION:** Do not lever between the mating faces.



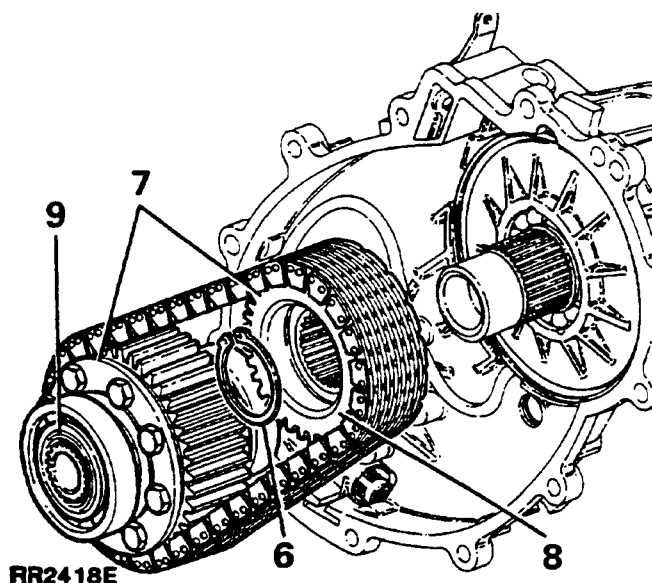
RR2417E

**Transfer sprocket, centre differential, assembly and chain**

**NOTE:** Before dismantling, mark one chain link and corresponding tooth on the transfer sprocket with an identification line. This is to ensure that the balance of the unit is maintained when reassembled with original components and that the chain is fitted the correct way up.

6. Remove the circlip retaining the transfer sprocket to the transfer shaft.
7. Place two thin pieces of wood on the joint face to prevent damage and using two levers behind the differential assembly carefully lever the differential bearing from its bore while simultaneously easing the transfer sprocket off the transfer shaft to maintain alignment during removal.

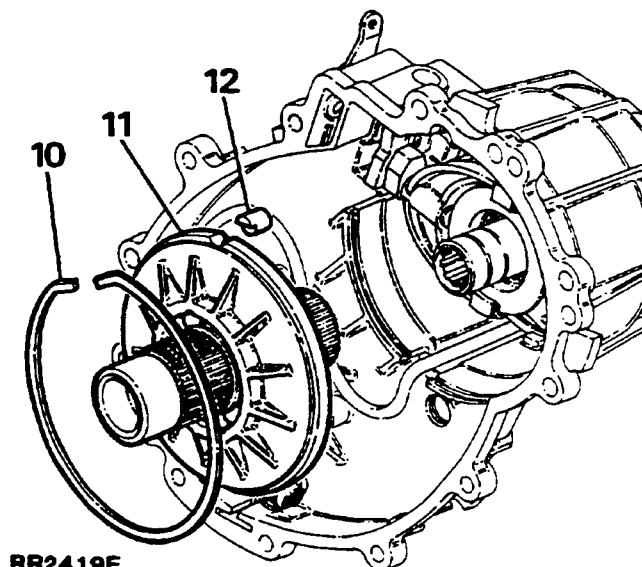
8. Remove the transfer sprocket from the chain.
9. Remove the differential assembly from the chain.



RR2418E

**Bearing carrier and transfer shaft**

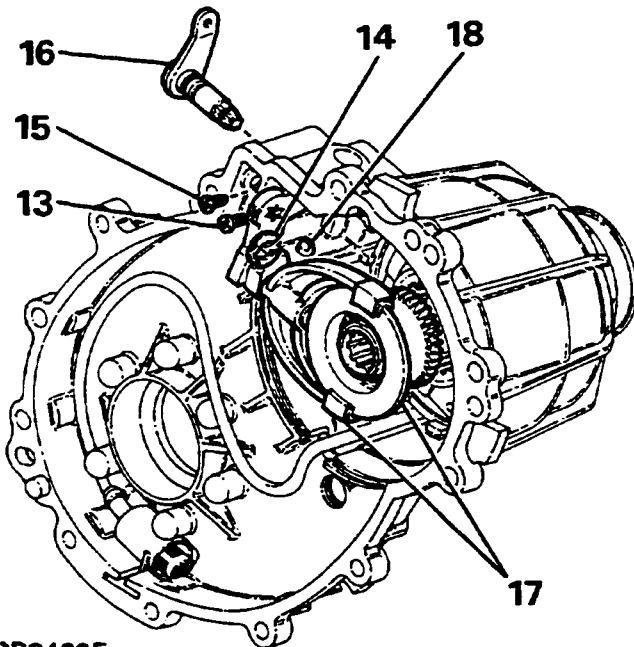
10. Insert a screw driver between the anti-rotation dowel and snap ring gently prise the snap ring out of the groove.
11. Withdraw the carrier complete with transfer shaft.
12. Withdraw the anti-rotation dowel.



RR2419E

**Selector fork assembly**

13. Using Torx bit 25 remove the screw securing the selector arm to the selector lever shaft.
14. Remove the retaining clip securing the selector fork arm to the selector lever shaft.
15. Using Torx bit 25 remove the screw retaining the selector lever.
16. Remove the selector lever shaft from the case and fork assembly.
17. Withdraw the selector fork assembly and selector sleeve.

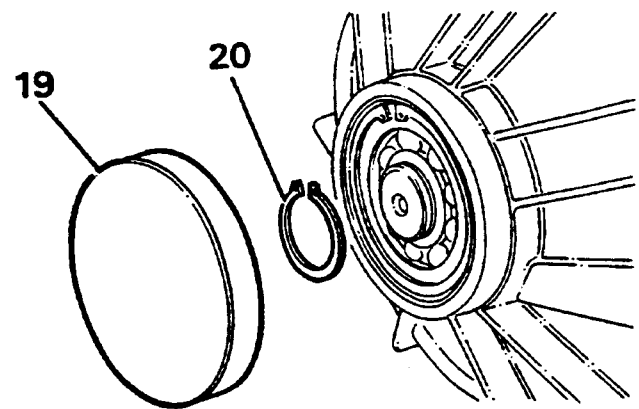


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18. Retrieve the selector plunger and spring from the rear cover.

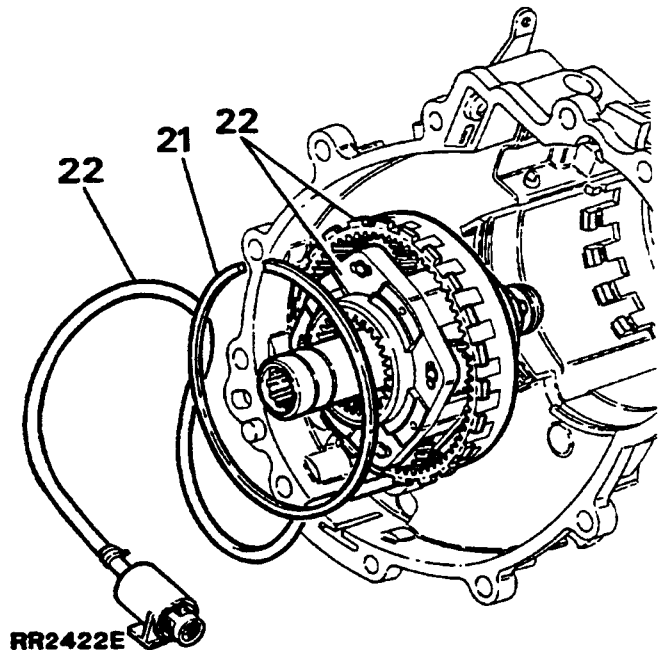
**Planetary set (Epicyclic unit)**

19. Turn the case over and prise the end cap off the planetary set housing.
20. Remove the circlip retaining the sun gear shaft.



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21. Turn the casing over and remove the large snap ring retaining the planetary set.
22. Withdraw the annulus and planetary assembly from the planetary set housing, complete with oil pump, feed pipe and filter.



RR2422E

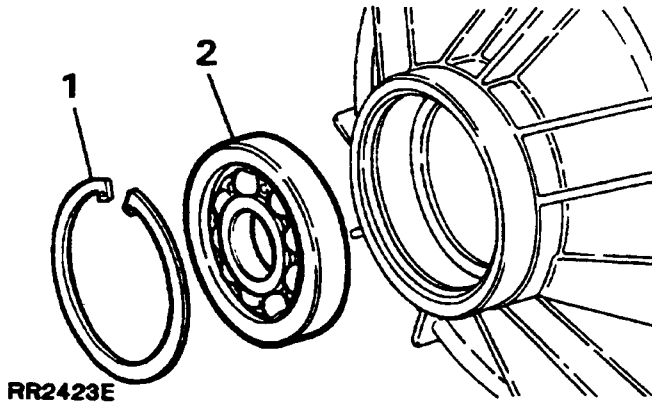




**DISMANTLE, INSPECTION AND OVERHAUL**

**Rear cover main case - Dismantle and inspection**

1. Remove the circlip retaining the bearing in the rear cover.
2. Drive or press the bearing from the cover and discard the bearing.



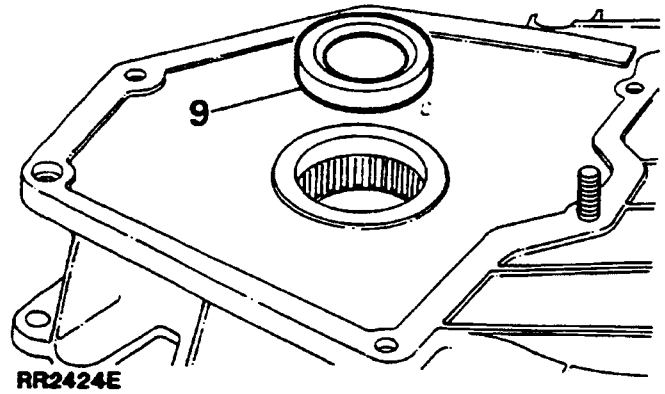
3. Remove any previous sealant evident on the rear cover joint faces.
4. Using a suitable solvent thoroughly clean the cover.
5. Examine the cover for damage, cracks and porosity, renew if necessary.
6. Check the selector lever shaft bore, for ovality and wear. If worn renew the cover.

**Rear cover main case - Assemble**

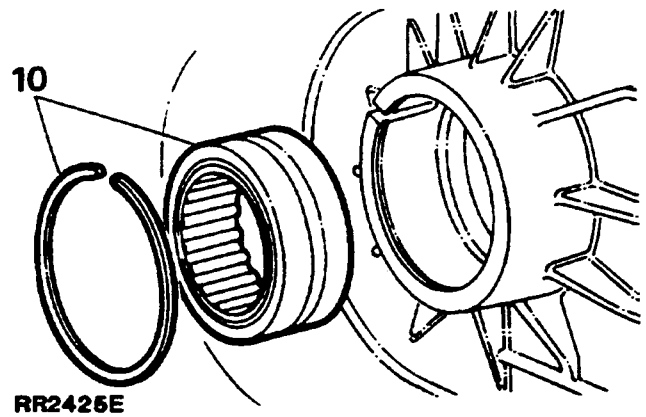
7. Drive or press a new bearing into the cover and secure in position with the circlip.
8. Place the cover aside until the gearbox is ready to be assembled.

**Front cover main case - Dismantle and inspection**

9. Prise the input shaft oil seal from the front cover and discard the oil seal.



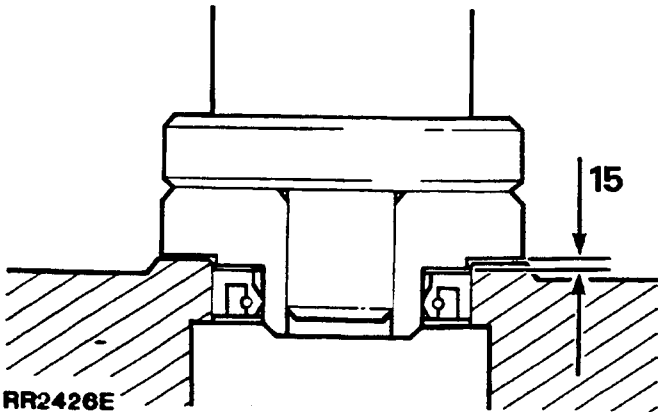
10. Remove the snap ring retaining the needle roller bearing, withdraw the bearing and discard.



11. Remove any previous sealant from the joint faces of the front cover.
12. Thoroughly clean the cover using a suitable solvent.
13. Examine the cover for damage, cracks and porosity, renew if necessary.
14. Check the inside edges of the case for witness marks which may indicate a chain that has stretched.


## Front cover main case - Assemble

15. Lubricate a new oil seal. Using service tool LST 550 - 6 in conjunction with bearing and oil seal replacer 18G134 fit the seal, open side of the seal leading, until the face of the seal is 1 mm (0.039 in) below the surface of the boss.

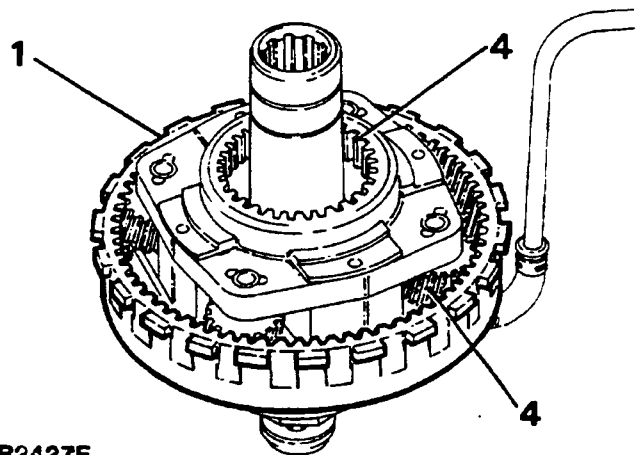


16. Lubricate a new needle roller bearing and drive or press the bearing into its recess until contact is made with the shoulder at the bottom of the bore.  
 17. Fit the snap ring to retain the bearing.  
 18. Place the cover aside until the gearbox is ready to be assembled.

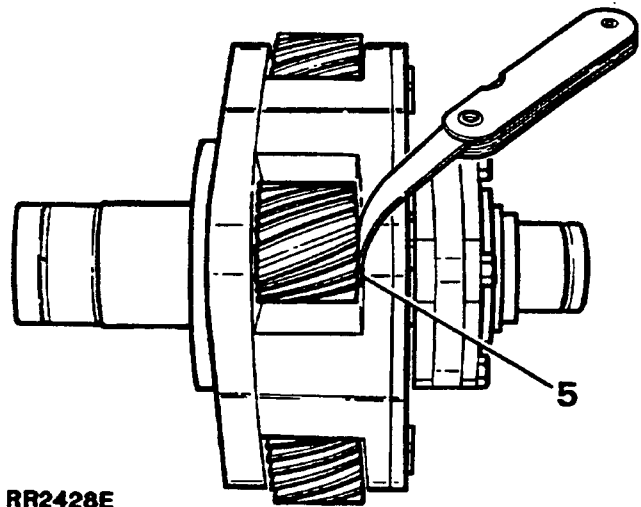
## Planetary set (Epicyclic unit) and oil pump - Dismantle and inspection

 **NOTE: The Epicyclic unit and oil pump are serviced as a complete assembly, if after inspection either of the units is found to be worn a complete new assembly must be fitted.**

1. Remove the annulus from the planetary set.

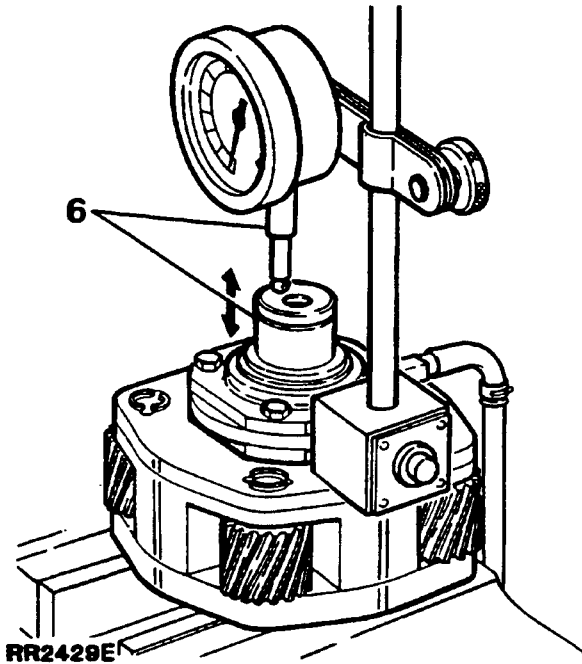


2. Thoroughly clean all components using a suitable solvent.  
 3. Examine the helical teeth of the annulus for wear or damage. If damage is evident it will be necessary to renew both the annulus and planetary set.  
 4. Examine the planetary gears and high/low gear teeth for wear or damage. If damaged renew both the annulus and planetary set.  
 5. Check the end float of the four planet gears, between the end of the gear and planetary set carrier. End float of each planet gear should not exceed 0.83 mm (0.033 in) if any one of the planet gears is out of limits renew the planetary set assembly.



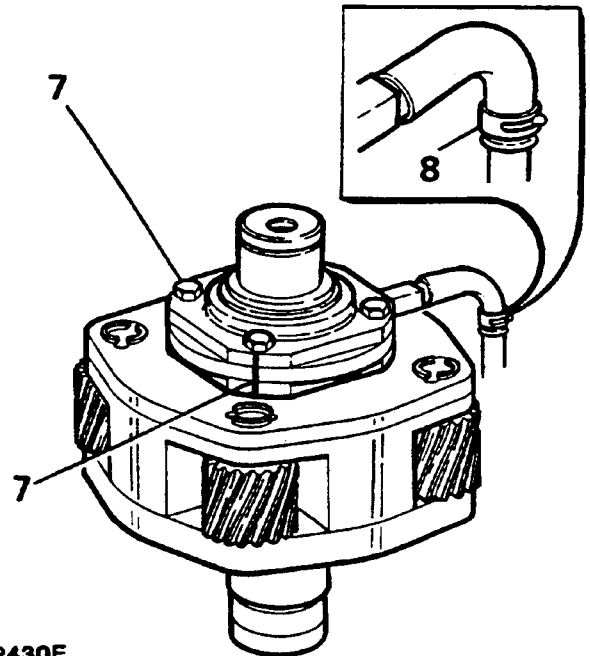


6. Check the end float of the sun gear to the planetary set carrier by supporting the body of the assembly on the top of a vice. Using a dial test indicator attached to a magnetic base, position the base on top of the assembly and zero the indicator on the end of the sun gear shaft, lift the shaft and check the end float. End float should not exceed 0.83 mm (0.033 in). Fit a new planetary set assembly if out of limits.



**NOTE:** The front plate of the oil pump is stamped 'TOP', the centre bearing plate is stamped 'REAR' and the rear plate is stamped 'TOP REAR'. The fixing holes of the plates and body are also offset to ensure correct re - assembly of the pump.

8. Depress the retaining clips, remove the oil pick - up pipe and rubber connection tubes. Examine the tubes and pipe for damage or fractures, renew as necessary.



**NOTE:** If the previous inspection instructions prove the assembly to be in an acceptable condition carry out the following examination of the oil pump.

**Oil pump and filter  
- Dismantle and inspection**

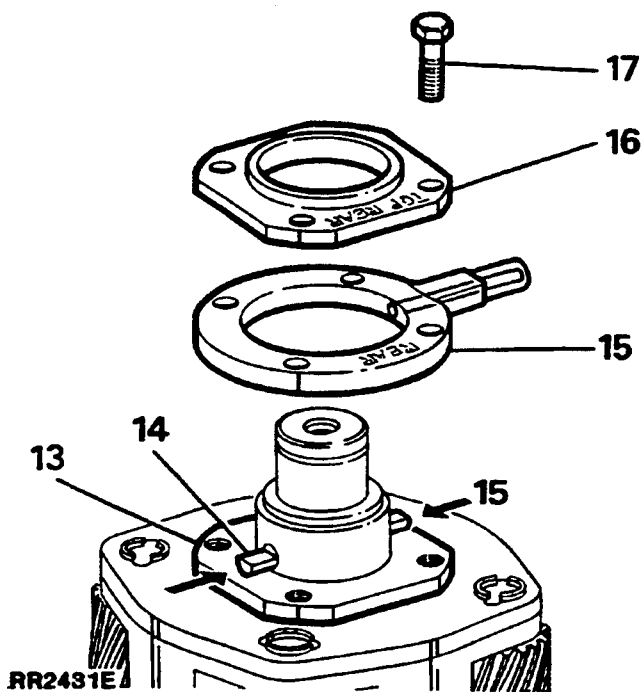
7. To aid re - assembly mark an identification line on the edges of the oil pump plates. Remove the four bolts securing the pump front and rear plates, separate the pump by removing the plungers, spring and bearing plate.

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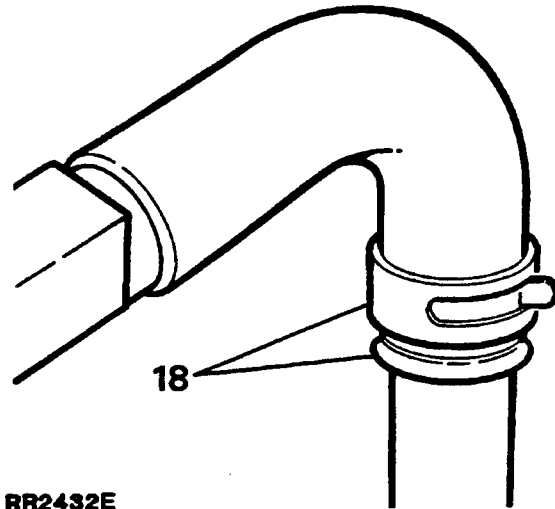
9. Clean the pump components and check for damage and wear, i.e. blueing of the pump plungers, scoring of the centre bearing plate, if any wear is evident a new planetary set must be fitted, as the pump is part of the complete assembly.
10. Thoroughly clean the oil pick - up filter, examine the filter screen for damage and blockage, renew or clean the filter as necessary.

## Oil pump and filter - Assemble

11. Clean the sealant from the oil pump securing screws.
12. Prior to assembly lubricate the pump components with clean oil.
13. Fit the plate stamped 'TOP' to the sun gear shaft with the word 'TOP' facing the planetary assembly.
14. Fit the plungers and spring noting that the flats on the plungers must be uppermost to enable the 'TOP REAR' plate to be fitted.
15. Compress the plungers and fit the middle bearing plate with the word 'REAR' uppermost. Align the offset fixing holes and also noting the previously marked identification line.
16. Fit the top rear plate with the words 'TOP REAR' uppermost.
17. Apply Loctite 242 to the threads of the four screws and fit the screws, tighten to the specified torque.



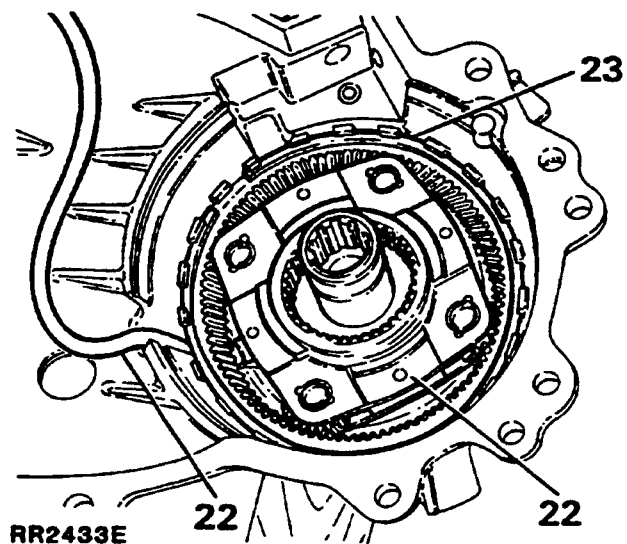
18. Fit the rubber connection tube and oil pick - up pipe to the oil pump, fit the retaining clip. Note that the clip securing the tube to the pick - up pipe is positioned in front of the flare on the pipe.



19. Fit the rubber connection tube to the filter end of the pipe, fit the clip ensuring that the tube is clamped by the clip in front of the flare on the pipe.
20. Push the filter into the tube. The radial position of the filter to pipe at this stage is unimportant.

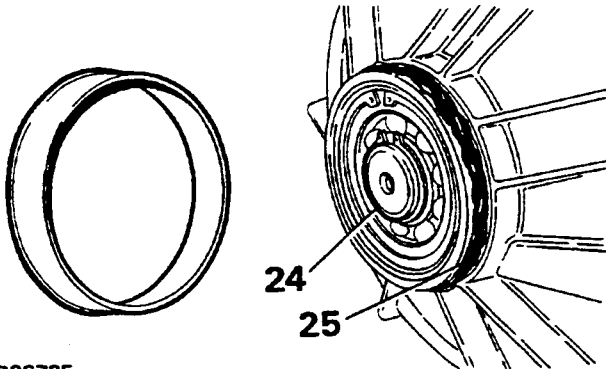
## Planetary set and annulus - assemble

21. Lubricate the planetary set and annulus with clean oil.
22. Position the annulus around the planetary set, fit the assembly to the rear cover locating the oil pump inlet port in the groove at the bottom of the planetary set housing, the sun gear shaft in the bearing and the lugs on the outer edge of the annulus in the anti - rotation lugs. It may be necessary to tap the sun gear shaft into the bearing to enable the large ring gear snap ring to be fitted.



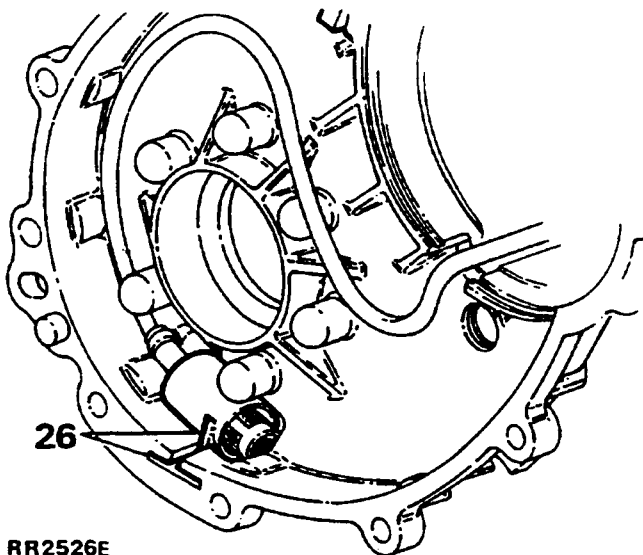


23. Fit the snap ring with the stepped ends adjacent to the selector shaft bore.
24. Turn the rear cover over and fit the circlip to retain the sun gear shaft.
25. Remove any previous sealant from the end cap. Apply Dow Corning 732 silicon sealant or a suitable equivalent to the outside diameter of the rear cover, evenly tap the cap into position.



RR2673E

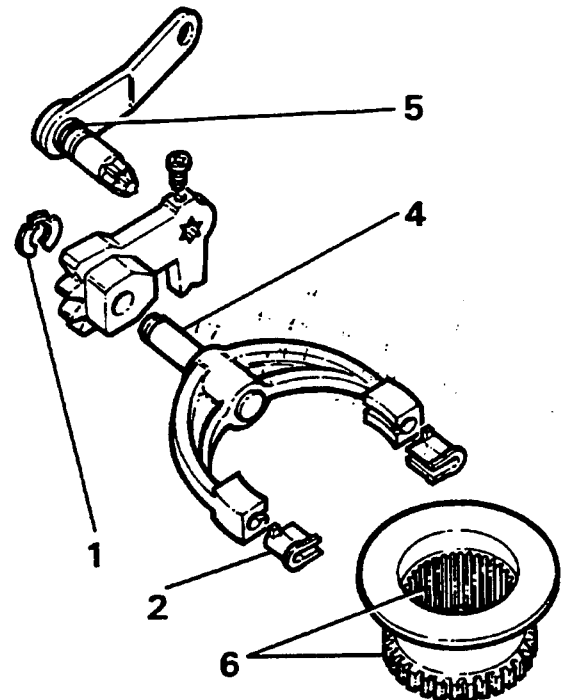
26. If necessary re - position the filter on the oil pick - up pipe until the lug on the filter can be pushed into the slot in the rear cover.



RR2526E

**Selector fork  
- Dismantle and inspection**

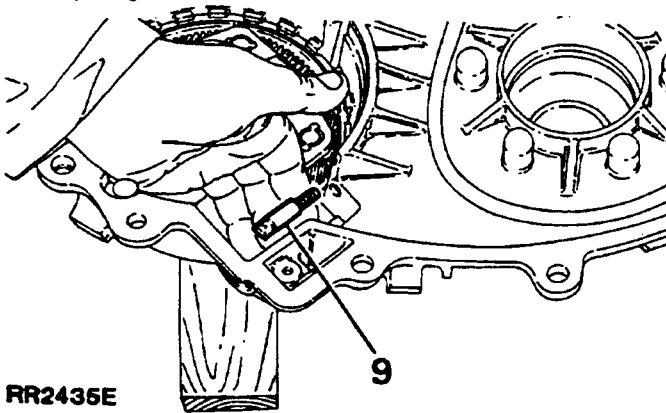
1. Remove the retaining clip and separate the fork from the arm.
2. Detach the two nylon slippers from the selector fork feet and discard.
3. Thoroughly clean all components.
4. Examine the fork, arm and pivot pin for wear. Renew as necessary.
5. Remove the 'O' ring and discard. Examine the shaft and lever for wear and damage, renew as necessary.
6. Examine the selector sleeve teeth and internal splines for damage and wear. Renew as necessary.



RR2434E

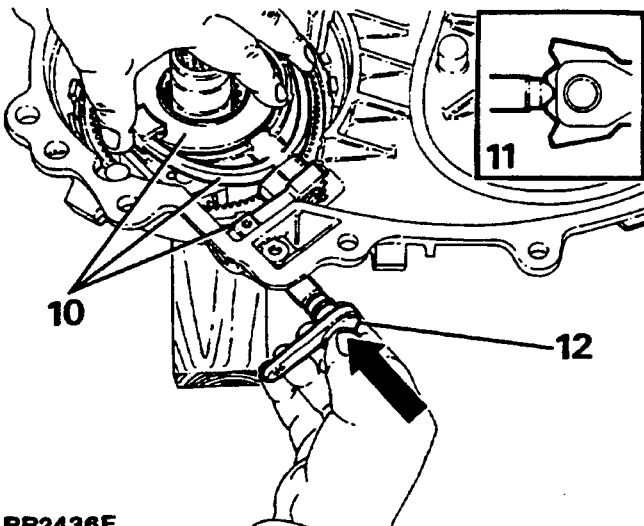
### Selector fork - Assemble

7. Fit new nylon slippers to the fork.
8. Assemble the fork to the selector arm and secure in position using a new retaining clip.
9. Lightly lubricate and fit the spring and selector plunger.



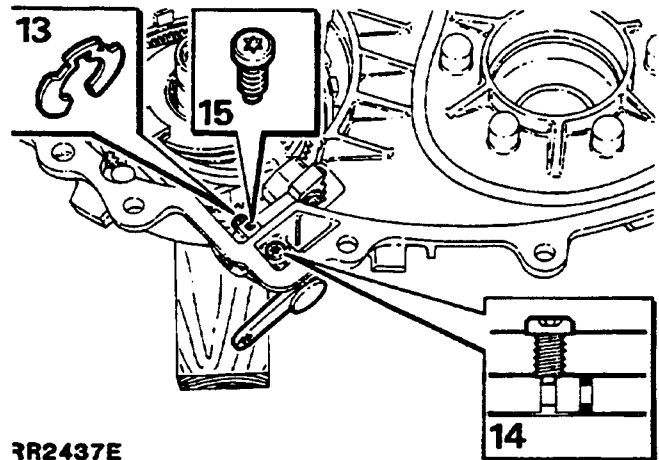
RR2435E

10. While compressing the plunger and spring, fit the selector fork, operating arm assembly and selector sleeve simultaneously.
11. Select neutral gear position at the operating arm.
12. Fit a new 'O' ring to the selector lever shaft. Lubricate the 'O' ring and fit the lever assembly to the rear cover, noting that when fully assembled the lever should lie parallel with the joint face of the rear cover.
13. Fit a new retaining clip to secure the selector fork operating arm to the selector lever shaft.



RR2436E

14. Remove any previous sealant from the Torx screw. Align the selector lever shaft groove to the retaining screw hole, apply a small amount of Loctite 242 to the screw threads and using Torx bit 25 fit and tighten the screw to the specified torque. Ensure that the screw locates in the groove of the shaft.
15. Clean any previous sealant from the Torx screw. Apply a small amount of Loctite 242 to the threads of the screw and fit to the selector fork operating arm, tighten using Torx bit 25 to the specified torque.

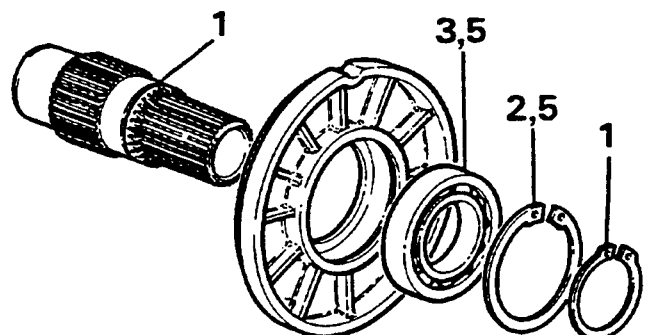


RR2437E

### Bearing carrier

#### - Dismantle, inspection and assemble

1. Remove the circlip and drive or press the transfer shaft from the bearing.
2. Remove the circlip retaining the bearing in the carrier.
3. Drive or press the bearing from the carrier and discard the bearing.
4. Clean and examine the carrier for cracks and general condition. Renew as necessary.
5. Press or drive a new bearing into the carrier and secure with the circlip.

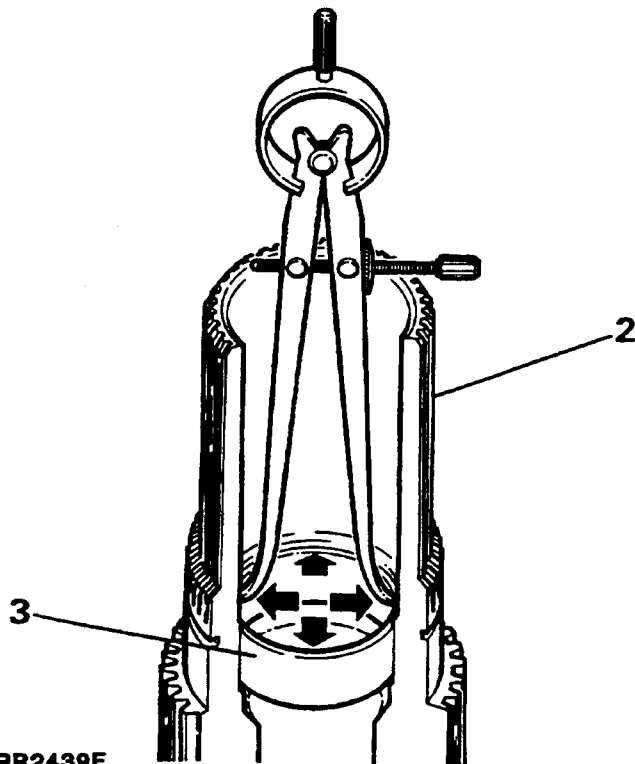


RR2438E



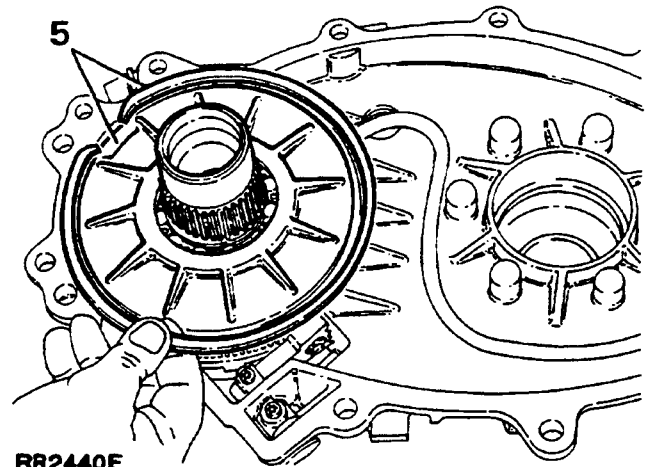
### Transfer shaft - Inspection and assemble

1. Clean the transfer shaft.
2. Visually examine the external splines for damage and wear, if worn fit a new the component.
3. Check the phospher bronze bush for wear by measuring the internal diameter of the bush with internal calipers and a micrometer or with an internal micrometer. The bush diameter must not exceed 38.515 mm (1.516 in) fit a new transfer shaft if the bush has worn above the figure given.



RR2439E

4. Drive or press the transfer shaft into the bearing in the carrier. Secure the shaft with the circlip.
5. Fit the carrier to the rear cover, fit the anti-rotation dowel and secure the assembly with the snap ring, noting that the open ends of the snap ring must be positioned by the cast relief in the bearing carrier upper face.




RR2440E

### Transfer sprocket - Inspection

1. Examine the sprocket teeth and splines for wear and damage, if either are evident discard the sprocket, otherwise clean and place to one side.

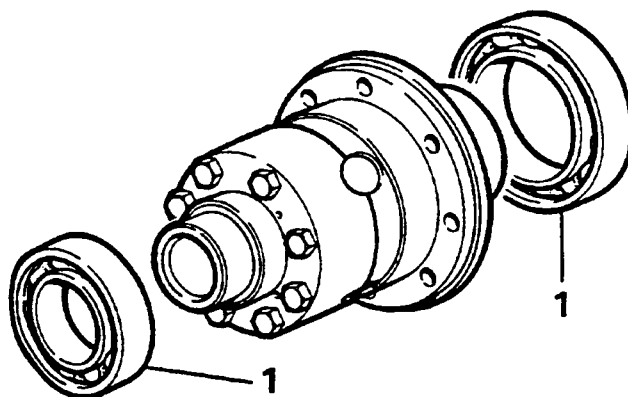
### Chain - Inspection

 **NOTE:** A stretched chain can be identified by either excessive noise when the gearbox is operational or by witness marks on the inside edges of the case. If either is evident, renew the chain.

1. Using a suitable solvent thoroughly clean the chain.
2. Check the chain links for wear and damage, if necessary renew the chain.
3. Place the chain to one side.

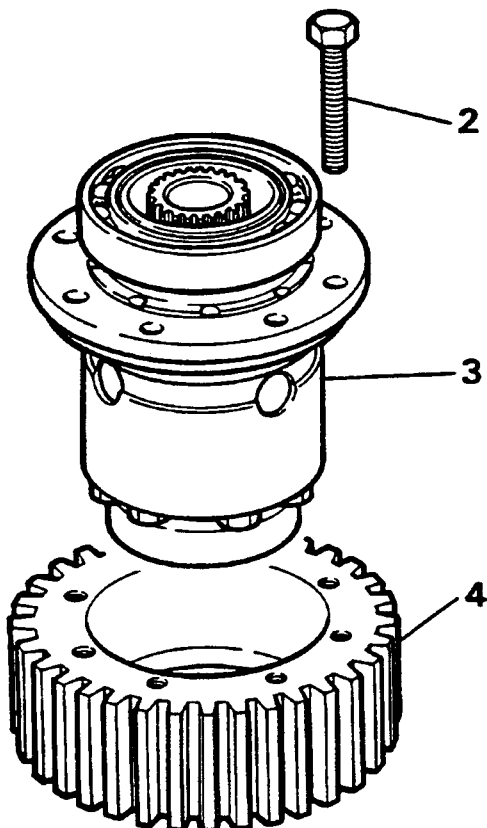
**Centre differential and sprocket  
- Dismantle and inspection**

1. Place the differential unit in a vice fitted with soft jaws. If the original components are to be refitted mark an identification line on the sprocket and differential unit.
2. Remove the bolts securing the sprocket to the differential.
3. Lift the differential assembly from the sprocket.



RR2460E

2. Secure the front half of the differential unit in a vice fitted with soft jaws, remove the eight retaining bolts securing the front and rear halves of the assembly together, lift off the rear part of the differential unit. Note the identification marks on the exterior of the differential unit.

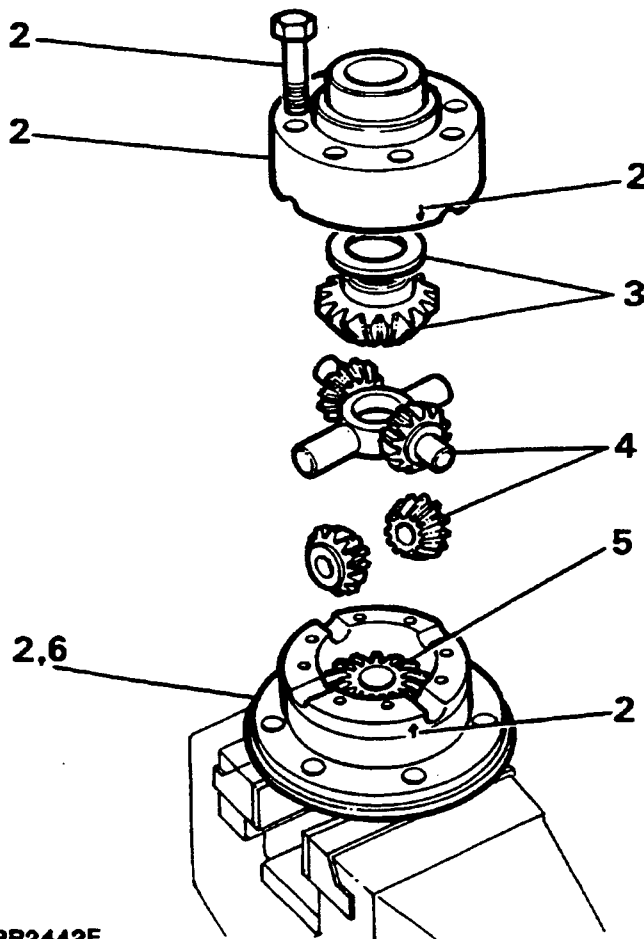


RR2441E

4. Examine the sprocket teeth for wear and damage, if either are evident renew the sprocket. Place the sprocket aside until the differential is ready to be assembled.

**Centre differential  
- Dismantle and inspection**

1. Using a two legged puller, ease the bearings from the differential assembly and discard the bearings.



RR2442E

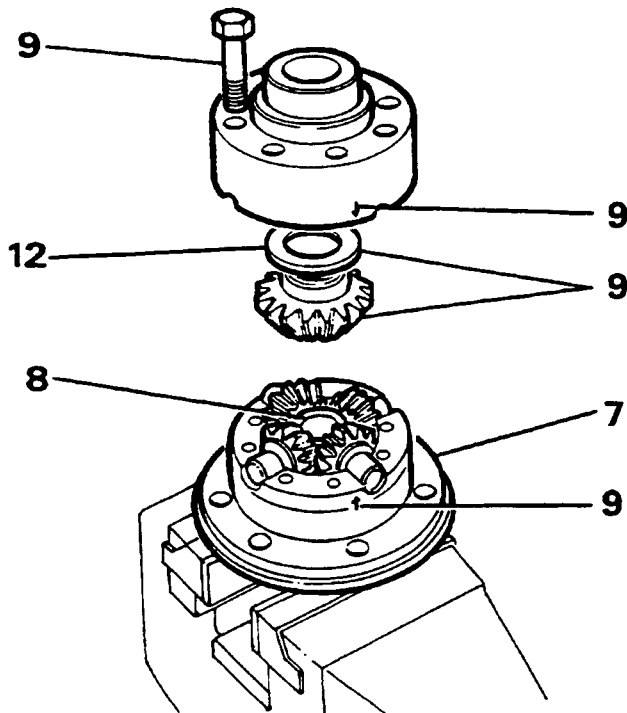




3. Remove the rear upper bevel gear and thrust washer.
4. Remove the pinion gears and dished washers along with the cross shaft.
5. Remove the front lower bevel gear and thrust washer from the front half of the differential unit.
6. Remove the front half of the differential unit from the vice and clean all components. Examine for wear or damage, renew if necessary.

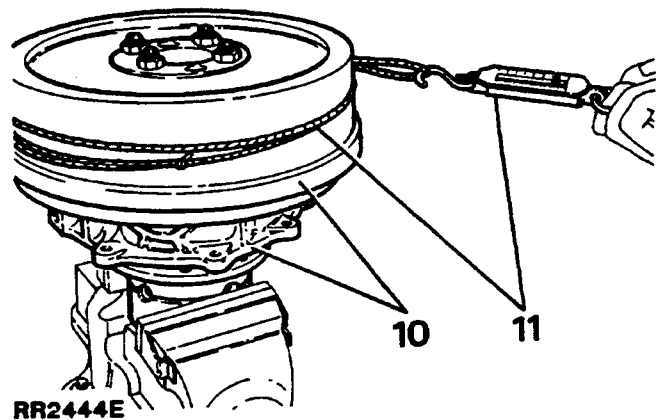
**Differential pinions - rolling resistance**

7. Using soft jaws secure the front half of the differential unit in the vice.
8. Fit the front bevel gear without the thrust washer. Lightly lubricate and fit the cross shaft, pinion gears and new dished washers.
9. Fit the rear bevel gear together with the thinnest thrust washer to the rear half of the differential. Assemble both halves of the differential noting the identification marks. Fit the bolts and tighten to the specified torque.



RR2443E

10. Invert the differential unit in the vice, fit the front output housing to the differential, locating the viscous unit splines on the front bevel gear. Fit the drive flange to the viscous unit and place the brake drum on top of the drive flange, secure with the nut. Check that the gears are free to rotate.
11. Tie a length of string around the brake drum, attach a spring balance to the free end and carefully tension the string until a load to turn is achieved. Alternatively use a torque wrench applied to the drive flange nut. Rotate the brake drum slowly by hand to overcome the initial load when using either method.



RR2444E

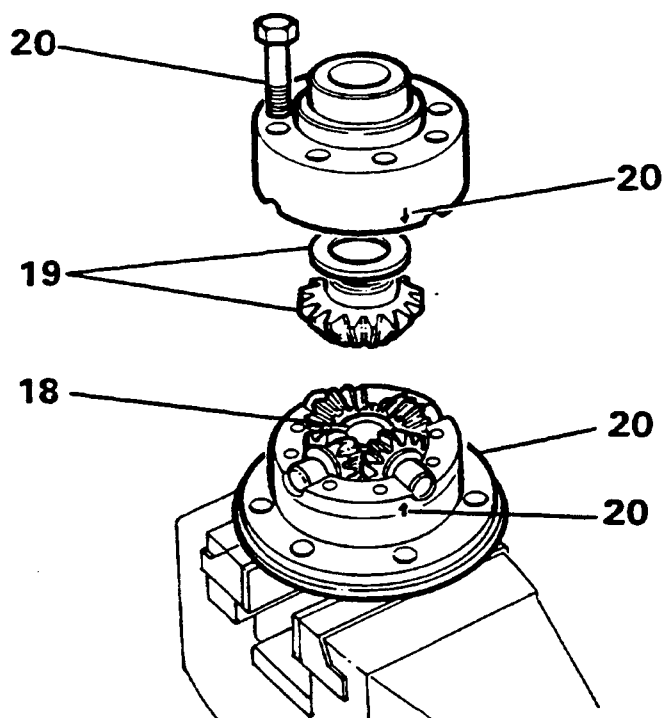
**NOTE:** Gears that have been run will rotate smoothly and will require a torque of 0.56 Nm (5 in lb), equivalent force using a spring balance 0.45 kg (1 lb). New gears will rotate with a notchy feel and will require a torque of not more than 2.26 Nm (20 in lb), equivalent force using a spring balance 7.72 Kg (3.8 lb). Keep all components lubricated when carrying out these adjustments.

12. Change the thrust washer for a thicker one if the torque reading is too low and re - check the torque. Five thrust washers are available in 0.10mm steps ranging from 1.05 to 1.45mm.
13. Dismantle the unit when the rear bevel gear thrust washer has been selected.
14. Remove and retain the rear bevel gear and thrust washer combination.

15. Repeat the procedure to obtain the correct thrust washer for the front bevel gear, it is not necessary to fit the rear bevel gear when checking the front bevel gear rolling resistance.
16. When the thrust washer has been selected for the front bevel gear, again dismantle the differential unit and retain the thrust washer and front bevel gear combination.

#### Centre differential - Assemble

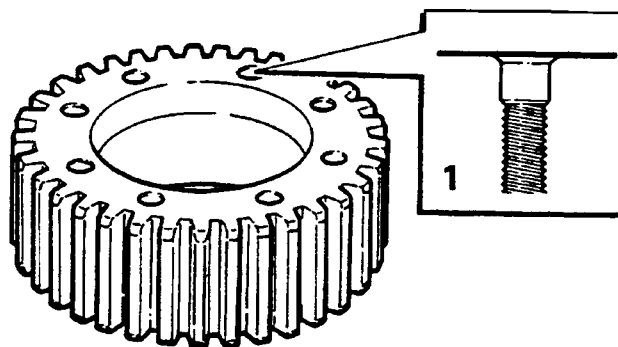
17. Fit the thrust washer and front bevel gear into the front half of the differential unit.
18. Fit the pinion gears with dished washers to the cross shaft and fit the assembly to the differential unit.
19. Fit the thrust washer and rear bevel gear to the rear half of the differential unit.
20. Align both halves of the differential noting the identification marks. Secure both halves together with the eight bolts. Tighten the bolts to the specified torque.



21. Check the overall torque required to turn the differential, this should be approximately equal to both bevel gears added together.
22. Drive or press new bearings onto the differential, noting that the smaller of the two bearings is fitted to the rear half of the differential.

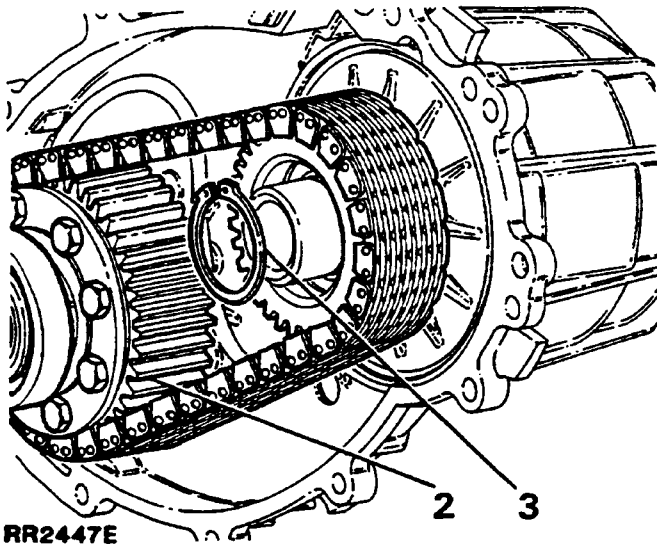
#### Centre differential sprocket - Assemble

1. Fit the sprocket to the differential noting that the face of the sprocket with the relieved threads must contact the flange of the differential housing. Observe the previously marked identification lines if the original components are being refitted.
2. Fit new bolts and tighten evenly to the specified torque.



#### Transfer sprocket, centre differential assembly and chain - Assemble

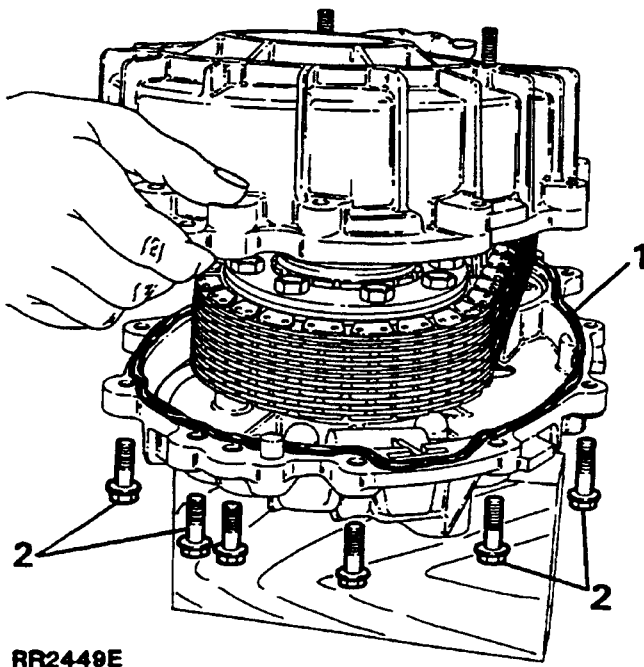
1. Place the differential assembly and transfer sprocket inside the chain. If the original components are being refitted observe the identification marks previously applied to the chain and transfer sprocket. Fit the complete assembly simultaneously.
2. Carefully tap the differential bearing into its bore while easing the transfer sprocket onto the transfer shaft.



3. Ensuring that the transfer sprocket is fully down, secure the sprocket to the transfer shaft with the circlip.

**Front and rear cover - main casing - Assemble**

1. Ensuring that the joint faces of the front and rear covers are clean, apply a bead of Dow Corning 732 or a suitable equivalent silicone sealant to the joint face of the rear cover and evenly spread the sealant over the face. Do not over apply the sealant.



2. Fit the front cover, secure with the eleven bolts, tightening evenly to the specified torque. Do not wipe away the surplus sealant which is forced out of the joint.

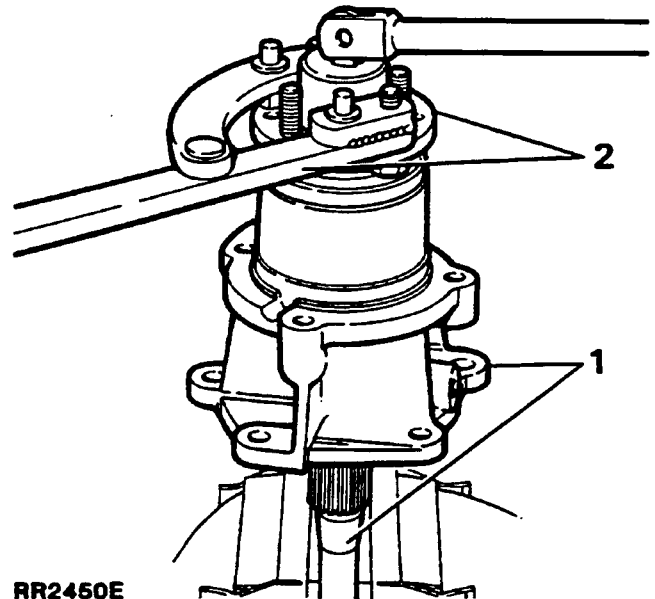
**Rear output housing  
- Dismantle and inspection**

**Service tools:**

18G1422 - Oil seal replacer

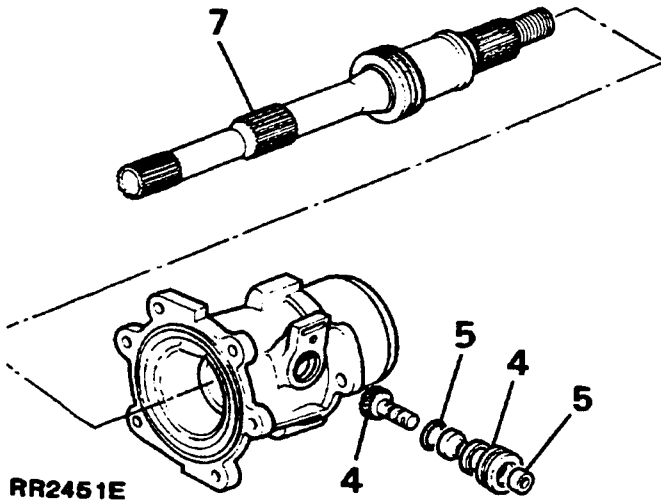
18G1205 - Adjustable flange holding wrench

1. Support the rear output housing by the output shaft in a vice fitted with soft jaws.
2. Using service tool 18G1205 to restrain the drive flange, release and remove the nyloc nut and plain washer securing the drive flange to the output shaft, withdraw the rubber seal. Discard the nut and seal.

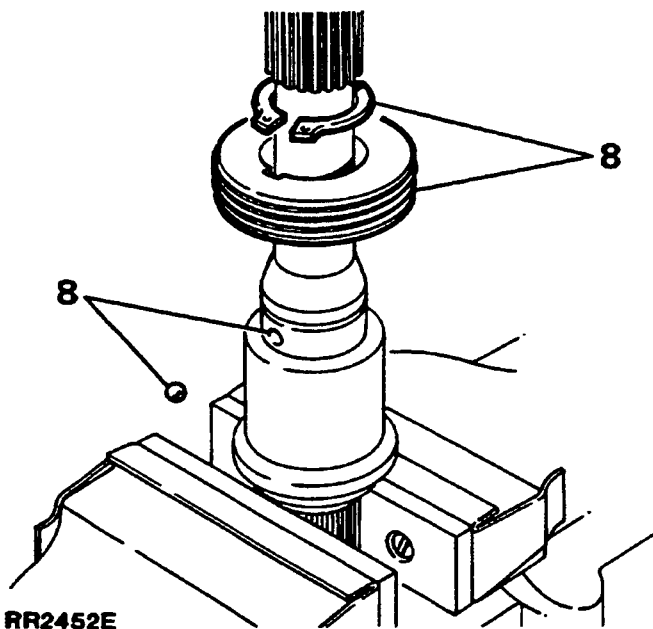


3. Remove the drive flange from the output shaft. Examine the flange for damage or wear particularly the seal running surface, if the surface is corroded or a groove has been worn by the previous seal discard the flange.
4. Prise the speedometer sleeve and driven gear from the housing. Examine the gear teeth for wear, if worn discard the gear.
5. Prise the oil seal from the sleeve and remove the 'O' ring, discard both the seal and 'O' ring.

6. Clean the sleeve and place to one side.
7. Drive or press the output shaft from the housing.



8. Clean and examine the splines and speedometer drive gear for wear or damage. The output shaft can be further dismantled if either the speedometer drive gear or output shaft is worn: remove the circlip and slide the gear from the shaft, retrieve the ball bearing from the indent in the shaft. Discard the worn component.

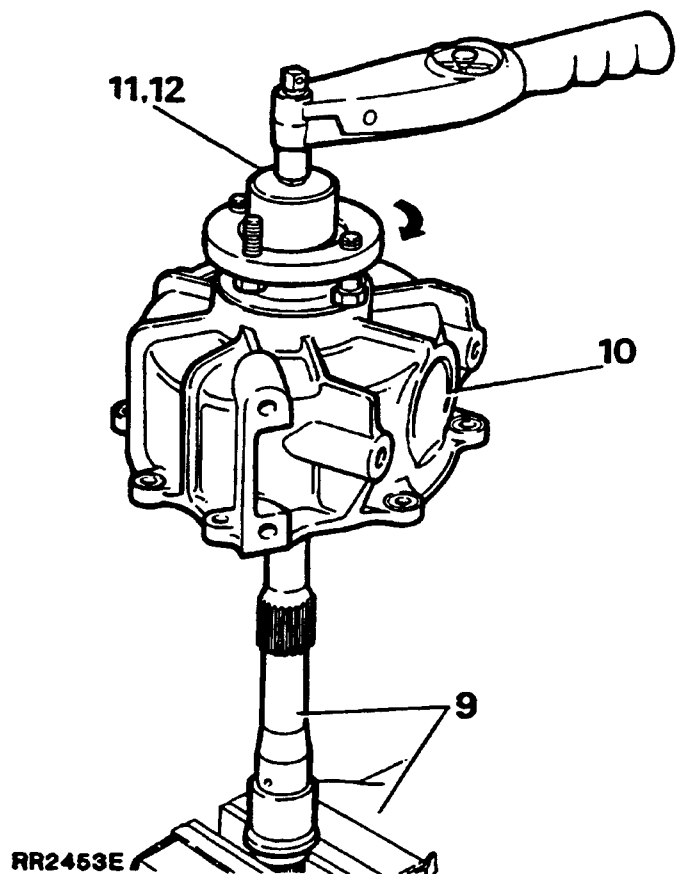


### Viscous unit - rolling resistance Bench check



**NOTE:** Testing should be carried out in an ambient of 20 °C.

9. Secure the output shaft in a vice fitted with soft jaws, gripping the shaft on the drive flange splines.
10. With the viscous unit still installed in the front output housing place the assembly on the rear output shaft spline.
11. Apply a clockwise torque of 27 Nm to output flange nut. If no resistance to turn is felt, unit requires replacing.
12. If resistance to turn is felt, apply a clockwise torque of 20 Nm, to output flange nut for 1 minute, this should result in a rotation of approximately 25° - 30°. If no rotation or a greater force is required, unit requires replacing.

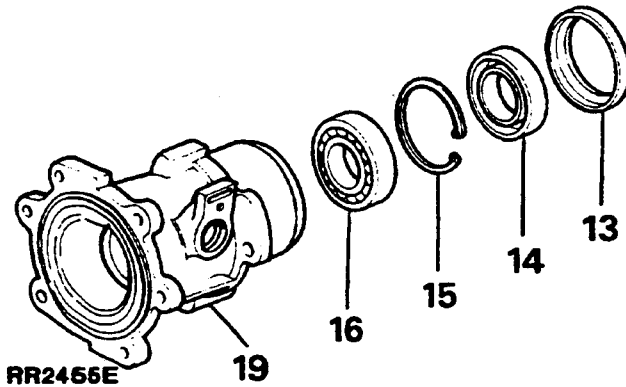


**NOTE:** While the output shaft is removed from the rear output housing, the shaft can be utilised for checking the rolling resistance of the viscous unit as follows.



**Rear output housing (continued)**

13. Lever off the dust shield.
14. Prise the oil seal from the housing and discard the seal.
15. Remove the circlip retaining the bearing.
16. Drive or press the bearing from the housing. Discard the bearing.
17. Remove any previous sealant from the housing joint face.



18. Thoroughly clean all components with a suitable solvent.
19. Examine the housing for damage and wear. Renew as necessary.

**Rear output housing - Assemble**

20. Drive or press a new bearing into the housing until the bearing contacts the shoulder.
21. Fit the circlip.
22. Lubricate a new oil seal. Using oil seal replacer 18G1422 fit the seal, lip side leading until it contacts the circlip.
23. Fit the dust shield.
24. Place the ball bearing in the indent on the output shaft, fit the speedometer drive gear to the shaft, secure together with the circlip.
25. Press or drive the output shaft into the housing until the shoulder of the shaft contacts the bearing.
26. Lubricate the oil seal bearing surface of the drive flange and fit the flange followed by a new rubber seal. Fit the steel washer and secure the flange to the shaft using a new nut. Tighten to the specified torque.
27. Lubricate a new speedometer sleeve oil seal, press the seal into the top of the sleeve.

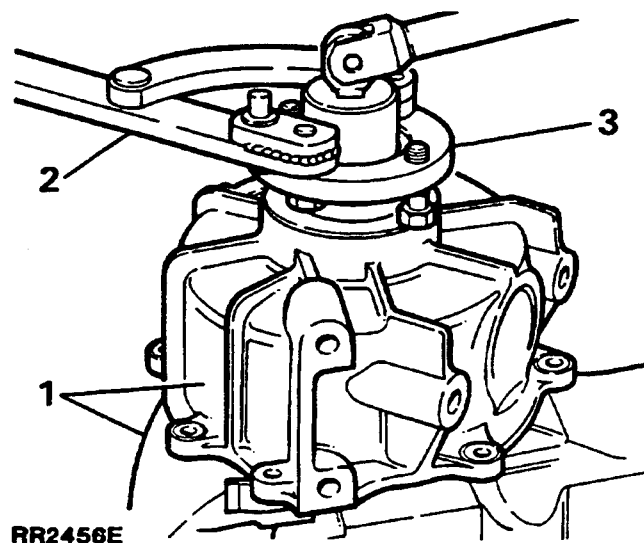
28. Fit a new 'O' ring to the outside of the sleeve, push the driven gear spindle into the sleeve.
29. Lubricate the 'O' ring and push the sleeve and gear assembly into the housing. It may be necessary to rotate the output shaft to ensure that the driven gear engages with the drive gear on the shaft.
30. Apply Dow Corning 732 or a suitable equivalent silicone sealant to the rear output housing joint face on the main casing. Evenly spread the sealant on the face to ensure a good seal.
31. Fit the housing to the main casing and secure with the six bolts tightened to the specified torque.

**Front output housing  
- Dismantle and Inspection**

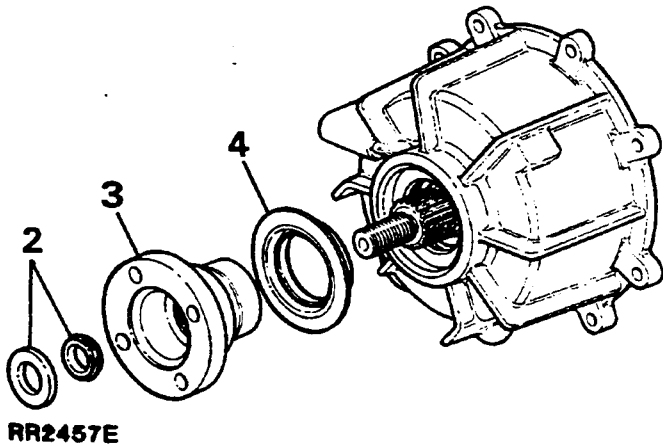
**Service tools:**

- 18G1422 - Oil seal replacer.
- 18G1205 - Adjustable flange holding wrench

1. Support the viscous unit and front output housing in a vice fitted with soft jaws gripping on the two flats of the viscous unit.
2. Using service tool 18G1205 to restrain the drive flange, release and remove the nyloc nut and plain washer securing the drive flange to the output shaft, withdraw the rubber seal. Discard the nut and seal.
3. Remove the drive flange from the viscous unit. Examine the flange for damage or wear particularly the seal running surface, if the surface is corroded or a groove has been worn by the previous seal discard the flange.

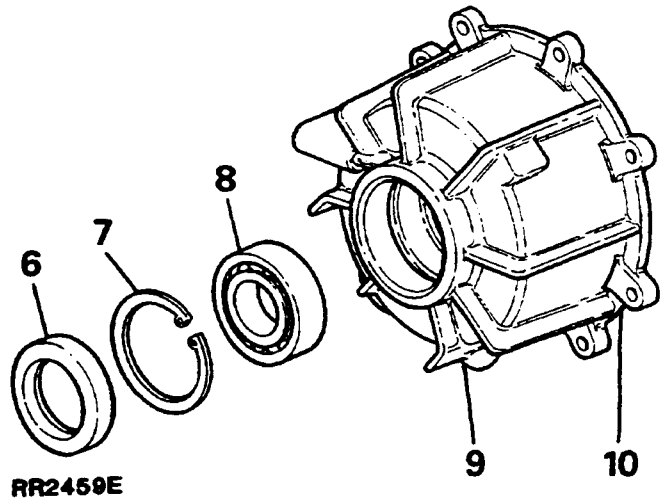


4. If necessary the oil catcher can be carefully pressed from the drive flange, if either a new oil catcher or bolts are being fitted.



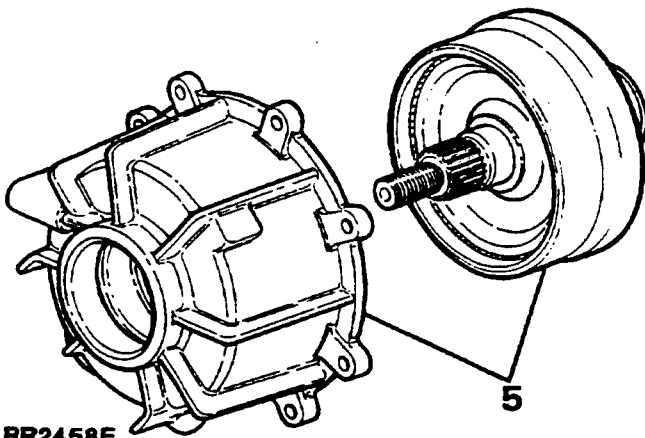
RR2457E

9. Clean the housing with a suitable solvent.  
10. Remove any previous sealant from the joint face of the housing.



RR2459E

5. Carefully tap the viscous unit out of the housing. If the original unit is being refitted wipe clean with a clean cloth.



RR2458E

11. Examine the housing for damage and wear, renew the housing if necessary.

#### Front output housing - Assemble

12. Drive or press a new bearing into the housing  
13. Fit the circlip to retain the bearing.  
14. Lubricate a new oil seal. Using oil seal replacing tool 18G1422 fit the seal, lip side of the seal leading until it contacts the circlip.  
15. Carefully tap the original or new viscous unit into the housing until contact is made with the face of the bearing.  
16. Lubricate the lips of the seal and fit the flange followed by a new rubber seal; fit the steel washer and secure the flange with a new nut. Tighten to the specified torque.  
17. Apply Dow Corning 732 or a suitable equivalent silicone sealant to the output housing joint face of the main casing. Evenly spread the sealant on the face to ensure a good seal.  
18. Fit the housing to the main casing and secure in position with the eight bolts tightened evenly to the specified torque.  
19. Refit the gearbox to the vehicle. (Refer to transfer gearbox remove and refit).



**NOTE:** The viscous unit is a sealed assembly and cannot be further dismantled, a new unit should be fitted if the unit is damaged or if the torque to turn is out of limits.

6. Prise the oil seal out from the front output housing and discard.  
7. Remove the circlip retaining the bearing.  
8. Drive or press the bearing from the housing and discard.



**TORQUE VALUES**



**NOTE: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.**

	Nm
Brake drum back plate to rear output housing.....	73
Brake drum to drive flange .....	25
Centre differential (front to rear) .....	60
Drive flanges to transfer gearbox .....	224
Driven gear to centre differential .....	50
Front cover to rear cover - main case.....	40
Front output housing to main case .....	33
Gearbox mounting brackets to chassis .....	45
Mounting bracket to gearbox .....	102
Neutral warning switch .....	47
Oil drain plug .....	25
Oil filler/level plug .....	25
Oil pump fixings .....	7
Propeller shafts to drive flanges .....	46
Rear output housing to main case .....	40
Selector lever shaft .....	8
Selector fork operating arm .....	8

**Torque values below are for all screws and bolts used except for those that are specified otherwise.**

**METRIC**

M5 .....	6
M6 .....	9
M8 .....	25
M10 .....	45
M12 .....	90
M14 .....	105
M16 .....	180

**UNC / UNF**

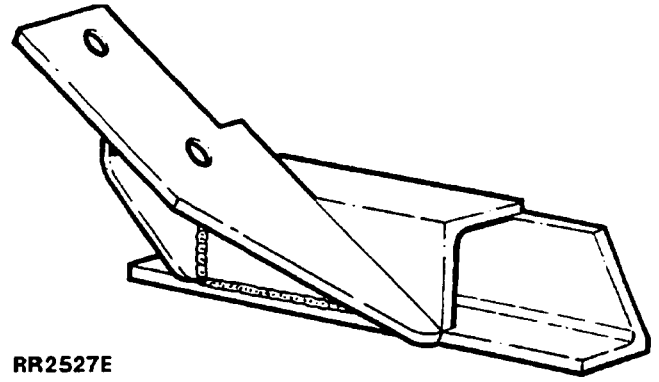
1/4 .....	9
5/16 .....	24
3/8 .....	39
7/16 .....	78
1/2 .....	90
5/8 .....	136



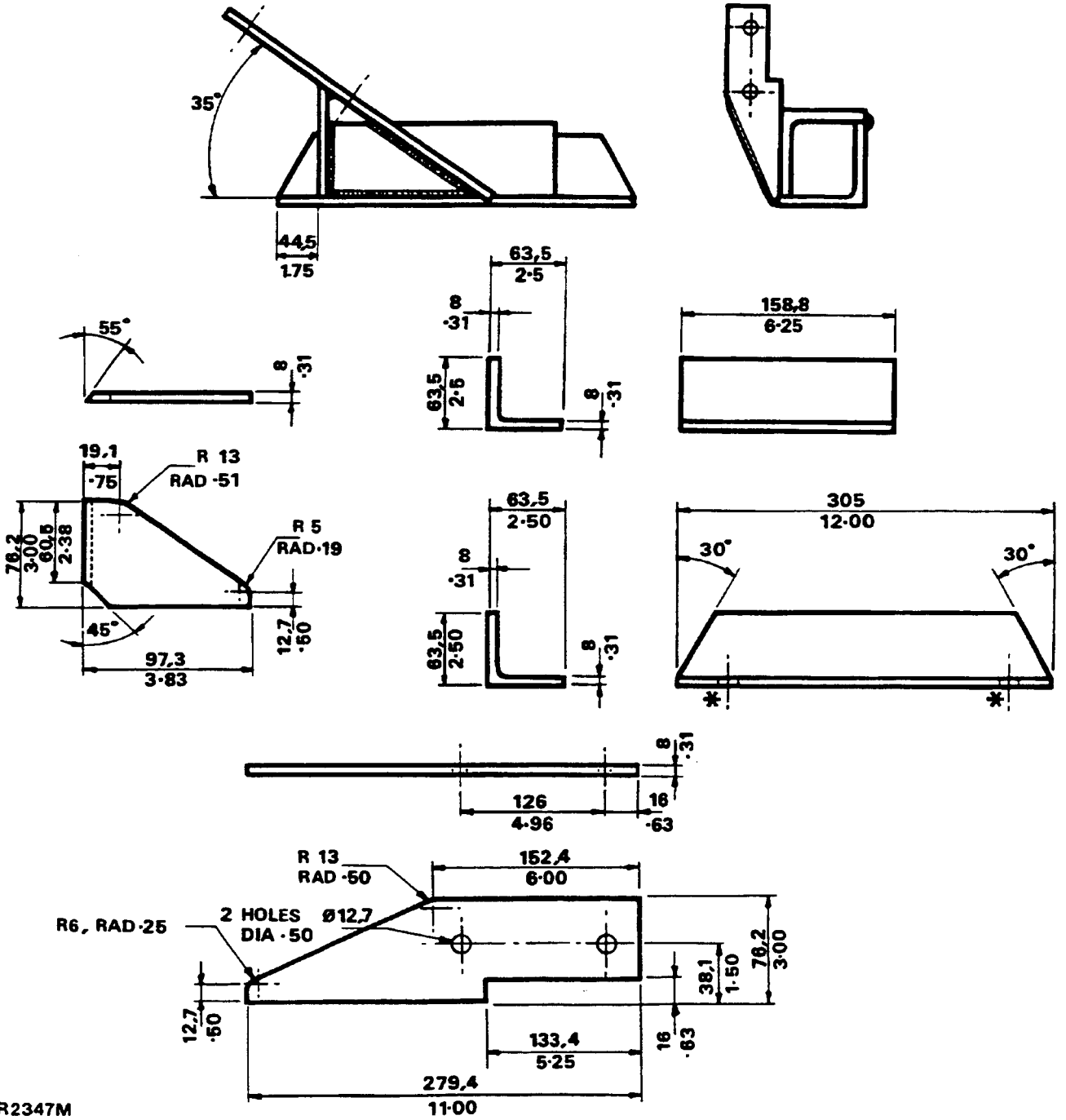
**ADAPTER PLATE TRANSFER BOX**

Adaptor plate for removing Borg Warner transfer gearbox. This can be manufactured locally to drawing shown.

Material: Steel BS 1449 Grade 4 or 14.  
Drill holes marked \* to fit hoist used.



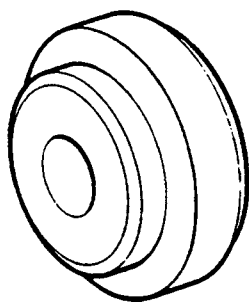
RR2527E



RR2347M



LRT-41-010 Oil seal replacer.  
LST.550-6



LST5506