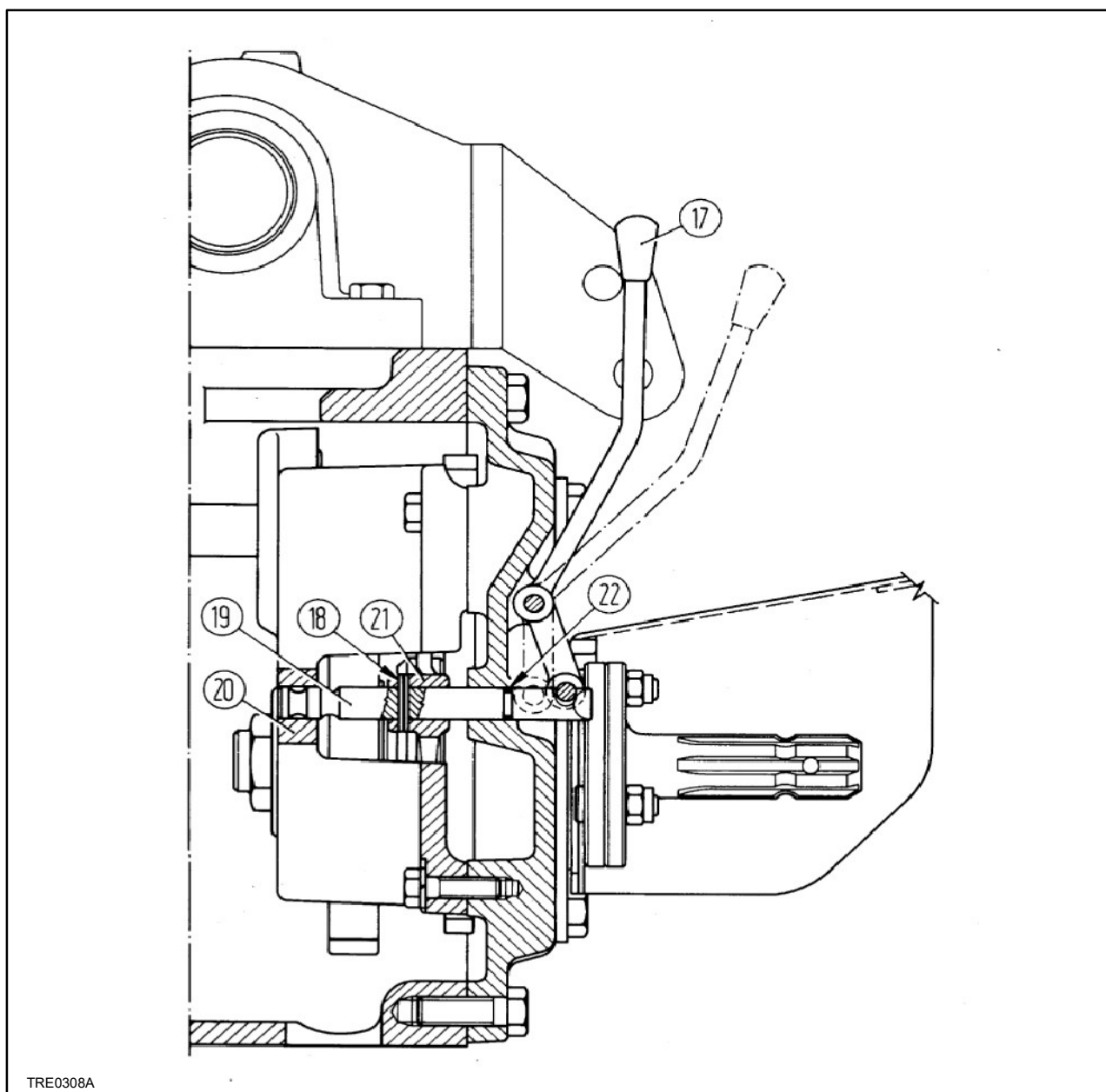


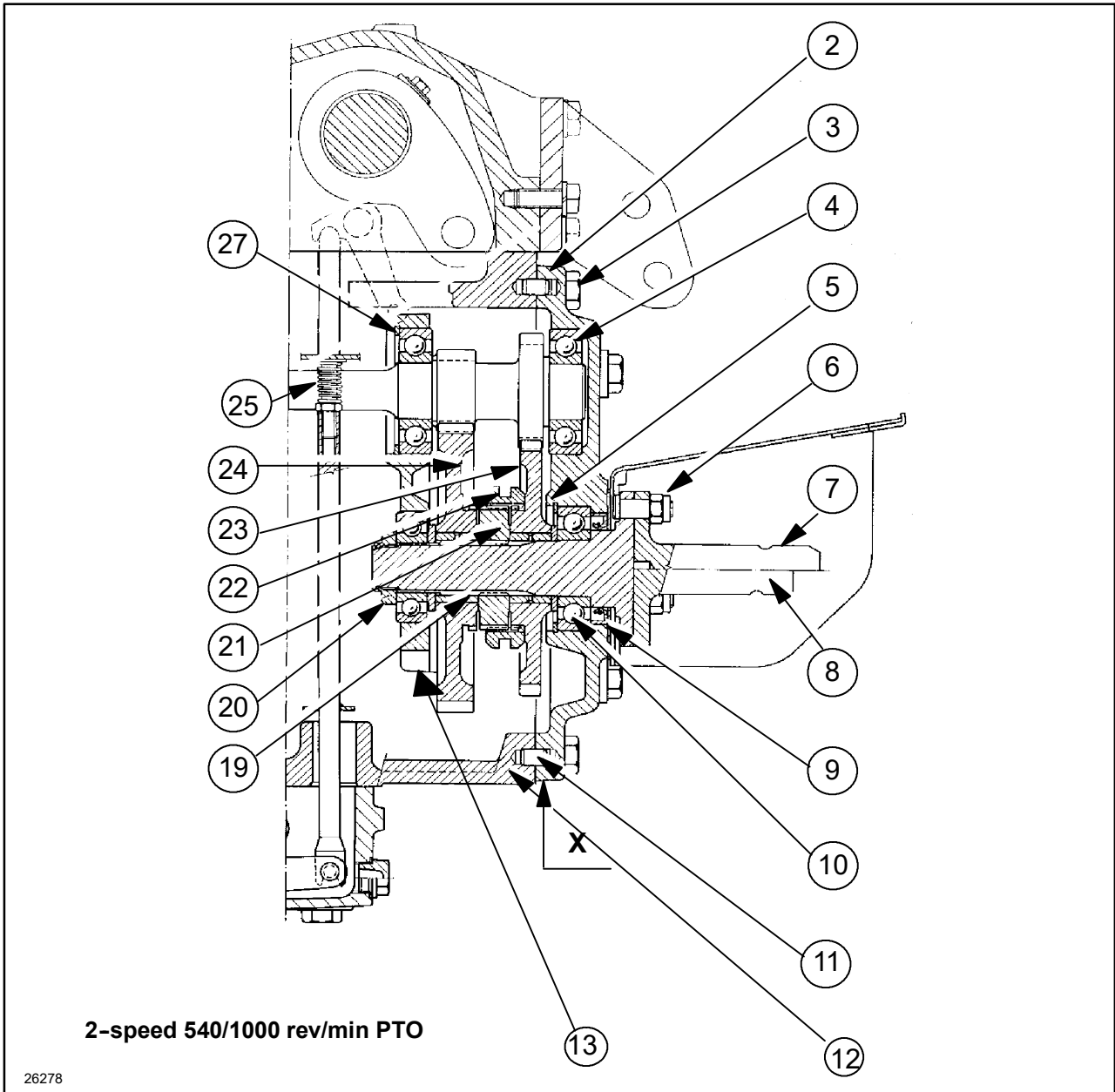


4

Sectional diagram of single- and 2-speed PTO

- 17. PTO speed selector lever.
- 18. Roll pin.
- 19. Shaft.

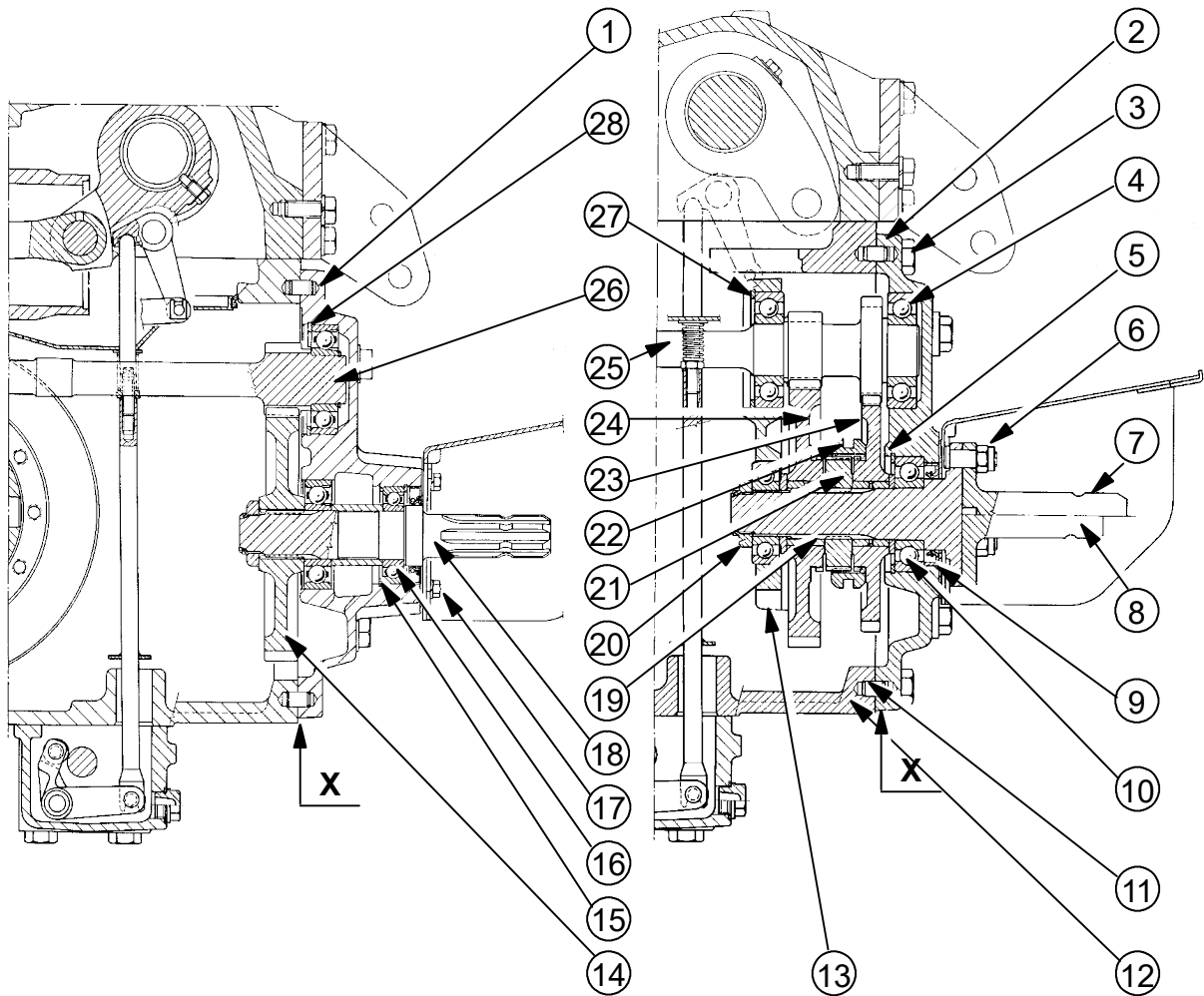
- 20. Rear cover.
- 21. Fork.
- 22. O-ring.



Sectional diagram of single- and 2-speed PTO

- | | |
|--|---|
| 2. 540/1000 rev/min PTO cover. | 12. Rear transmission casing. |
| 3. PTO unit retaining screw. | 13. Rear transmission support. |
| 4. Drive shaft bearings. | 19. Driven gear support bushings. |
| 5. Snap ring. | 20. Driven shaft lock nut. |
| 6. Self-locking nut to secure splined shaft. | 21. Fixed gear. |
| 7. 540 rev/min splined shaft. | 22. Coupling sleeve. |
| 8. 1000 rev/min splined shaft. | 23. Driven gear for 1000 rev/min speed. |
| 9. Seal. | 24. Driven gear for 540 rev/min speed. |
| 10. Driven shaft bearings. | 25. Double drive gear. |
| 11. Cover locating pin. | 27. Snap ring. |

NOTE: When installing use sealing compound of the type shown on page 1 section 00 on surface X as shown above.

**a - single-speed 540 rev/min PTO****b - 2-speed 540/750 rev/min PTO**

26278

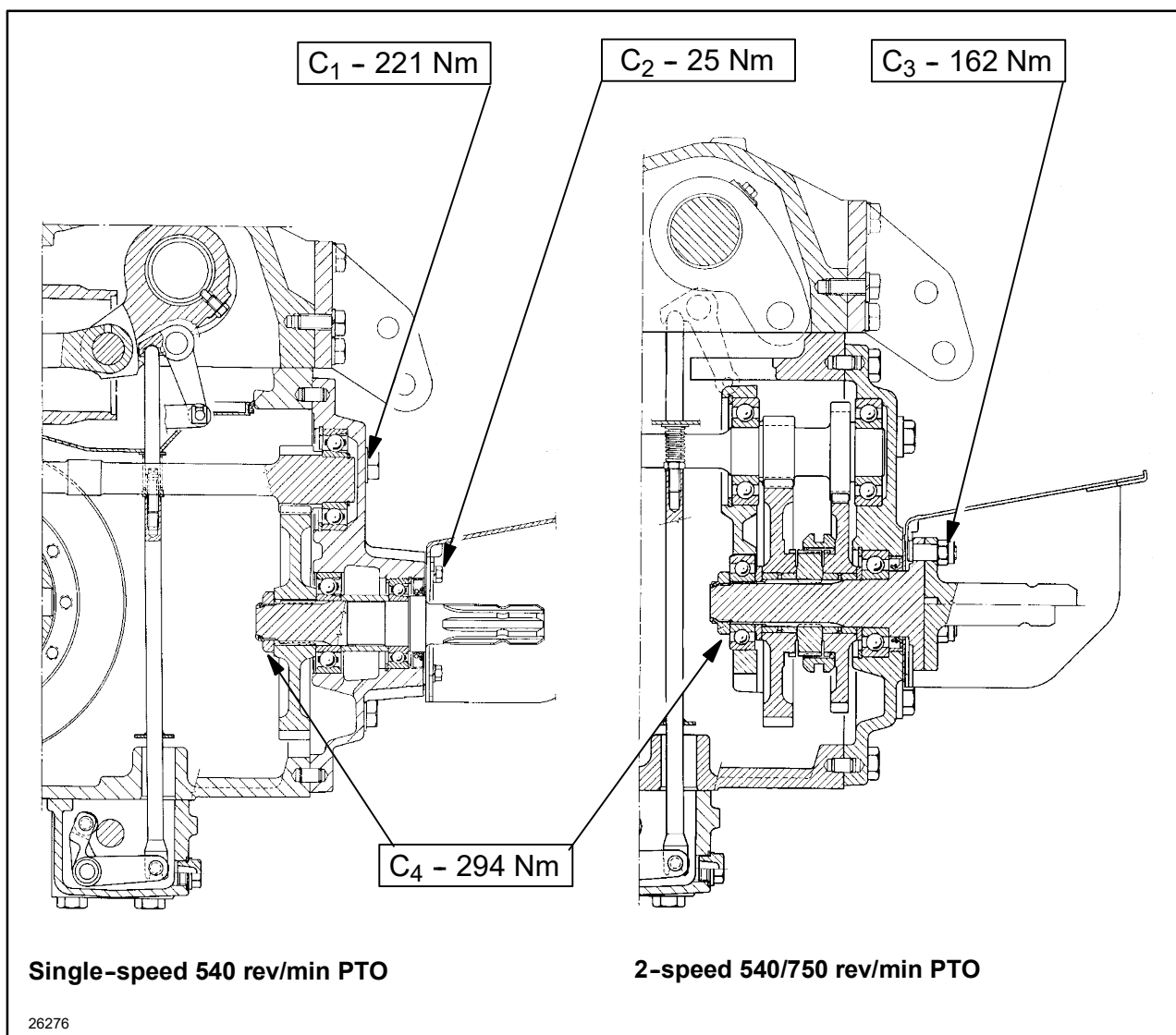
2

Sectional diagrams of single- and 2-speed PTO

- | | |
|---|---|
| a. Sectional diagram of single-speed PTO. | 13. Rear transmission support. |
| b. Sectional diagram of 2-speed PTO. | 14. Driven gear. |
| 1. 540 rev/min PTO cover. | 15, 27, 28, 16 and 5. Snap rings. |
| 2. 540/750 rev/min PTO cover. | 17. PTO guard retaining screws. |
| 3. PTO unit fixing screw. | 18. 540 rev/min PTO driven shaft |
| 4. Drive shaft bearings. | 19. Driven gear support bushings. |
| 6. Self-locking nut to secure splined shaft. | 20. Driven shaft lock nut. |
| 7. 540 rev/min splined shaft. | 21. Fixed gear. |
| 8. 750 rev/min splined shaft. | 22. Coupling sleeve. |
| 9. Seal. | 23. Driven gear for 750 rev/min speed. |
| 10. Driven shaft bearings. | 24. Driven gear for 540 rev/min speed. |
| 11. Cover locating pin. | 25. Double drive gear. |
| 12. Rear transmission casing. | 26. Drive gear. |

NOTE: When installing use sealing compound of the type shown on page 1 section 00 on surface X as shown above.

TORQUE SETTINGS



1

TORQUE SETTINGS

PART TO BE TORQUED	Thread	Torque setting	
		Nm	ft lb
PTO box fixing screws (C1, fig. 1)	M 16 x 1.5	221	163.0012
PTO guard fixing screws (C2, fig. 1)	M 8 x 1.25	25	18.439
Grooved endpiece self-locking nuts (2-speed PTO) (C3, fig. 1) .	M 12 x 1.25	162	119.485
Driven gear shaft locknut: (C4, fig. 1) for single- or 2-speed PTO	M 32 x 1.5	294	216.8432
Bearing support fixing screws (2- and 3-speed PTO) (C5, fig. 35)	M 12 x 1.25	98	72.281

MECHANICAL POWER TAKE-OFF

(continued)

		JX60 and JX70	JX80, JX90 and JX95
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 540/750 rev/min (30 and 40 km/h versions)	wheel speed rev/min	as for single-speed PTO	
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 1000 rev/min (30 km/h version)	wheel speed rev/min	14.1	15.2
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 1000 rev/min (40 km/h 4WD version)	wheel speed rev/min	11.5	12.4
Diameter of PTO shaft at splined end:			
- 540 rev/min		1 ³ / ₈ in. (6-spline)	
- 750 rev/min		1 ³ / ₈ in. (6-spline)	
- 1000 rev/min		1 ³ / ₈ in. (21-spline)	
External diameter of driven gear support bushings	mm (in.)	49.925 - 49.950 (1.9655 - 1.9665)	
Internal diameter of driven gears	mm (in.)	50.050 - 50.089 (1.9705 - 1.9720)	
Clearance between driven gears	mm (in.)	0.100 - 0.164 (0.0039 - 0.0065)	
Diameter of driven shaft at front and centre bushings	mm (in.)	39.166 - 39.191 (1.5420 - 1.5429)	
Diameter of driven shaft at rear bushing	mm (in.)	34.984 - 35.000 (1.3773 - 1.3780)	
Internal diameter of front and centre bushing	mm (in.)	39.200 - 39.239 (1.5433 - 1.5448)	
Internal diameter of rear bushing	mm (in.)	35.009 - 35.048 (1.3783 - 1.3798)	
Clearance between shaft and front and centre bushings ..	mm (in.)	0.009 - 0.073 (0.0004 - 0.0029)	
Clearance between shaft and rear bushing	mm (in.)	0.009 - 0.064 (0.0004 - 0.0025)	

TOOLS

Important – The operations described in this section must be performed solely with the **ESSENTIAL** tools marked below with (X).

To work in complete safety and to ensure optimal technical results with a minimum of time and effort, they must however be supplemented with the specific tools recommended below and with those to be specially constructed by you and for which the construction diagrams are given in this manual.

380000227 Hook for lifting PTO

380001597 Guide pins for PTO unit

380000233 Installer for PTO driving shaft bearings

MECHANICAL POWER TAKE-OFF

(continued)

	JX60 and JX70	JX80, JX90 and JX95
2-speed 540/750 rev/min PTO (option - all models)		
Type	as for single-speed PTO	
Engagement and control	as for single-speed PTO	
Direction of rotation (viewed from rear of tractor)	as for single-speed PTO	
Speed selection	by means of hand lever located to rear RH side of driver's seat	
Engine speed with PTO shaft rotating at 540 rev/min rev/min	2200	
Engine speed with PTO shaft rotating at 750 rev/min rev/min	2382	
PTO speed with engine at maximum power speed (2500 rev/min):		
- for 540 rev/min PTO rev/min	614	
- for 750 rev/min PTO rev/min	787	
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 540 rev/min (30 and 40 km/h versions) wheel speed rev/min	see 540 rev/min PTO	
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 750 rev/min (30 km/h version) wheel speed rev/min	10.51	11.4
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 750 rev/min (40 km/h 4WD version) wheel speed rev/min	8.59	9.36
Diameter of driven shaft at grooved terminal	1 ³ / ₈ in. (6-spline)	
2-speed 540/1000 rev/min PTO (option - all models)		
Type	as for single-speed PTO	
Engagement and control	as for single-speed PTO	
Direction of rotation (viewed from rear of tractor)	as for single-speed PTO	
Speed selection	by means of hand lever located on rear RH side of driver's seat	
Engine speed with PTO shaft rotating at 540 rev/min rev/min	2200	
Engine speed with PTO shaft rotating at 1000 rev/min rev/min	2380	
PTO speed with engine at maximum power (2500 rev/min):		
- for 540 rev/min PTO rev/min	614	
- for 1000 rev/min PTO rev/min	1050	

(continued overleaf)

SECTION 31 - POWER TAKE-OFF

Chapter 1 - Mechanical Power take-off

CONTENTS

Section	Description	Page
31 000	Main specification	1
	Tools	3
	Torque settings	4
	Sectional drawings	5
	Description and operation	9
	Troubleshooting	10
	Removal - Refitting	11
31 101	Bench overhaul	14

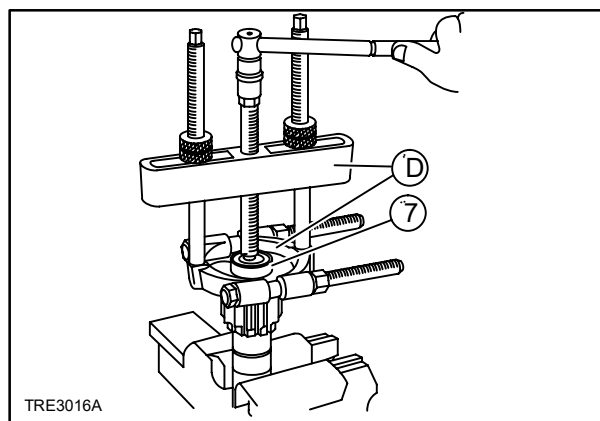
**31 000 - MAIN SPECIFICATION - TORQUE SETTINGS - TOOLS - SECTIONAL DRAWINGS -
DESCRIPTION AND OPERATION - TROUBLESHOOTING**

MECHANICAL POWER TAKE-OFF

		JX60 and JX70	JX80, JX90 and JX95
540 rev/min PTO		{ 1) Independent of tractor travel speed or: 2) Synchronized with gearbox mechanical by means of hand levers located on RH and LH side of driver's seat (see page 9 and 10) clockwise	
Type (Independent and ground speed PTO)			
Engagement and control			
Direction of rotation (viewed from rear of tractor)			
Engine speed with PTO shaft rotating at 540 rev/min	rev/min	2200	
PTO speed with engine at maximum power (2500 rev/min)	rev/min	614	
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 540 rev/min (30 km/h version)	wheel speed rev/min	8.2	8.9
Ground speed PTO. Rear wheel speed with PTO shaft rotating at 540 rev/min (4WD 40 km/h version)	wheel speed rev/min	6.73	7.25
Diameter of PTO shaft at position of bearings	mm (in.)	49.938 - 50.000 (1.9661 - 1.9685)	
Diameter of PTO shaft at splined end		1 ³ / ₈ in. (6-spline)	

(continued overleaf)

18. Remove the roller bearing internal ring (7) Fig.56, page 48, from the axle shaft, using puller separator as shown in Fig.57, and the ball bearing (7) Fig. 6, page 8, from the axle shaft (9) Fig. 56, having first removed the lockring;
19. Check and replace damaged and worn parts;
20. Check lip seals (11–12) Fig. 6, page 8, and replace if necessary; position as shown in Fig. 6.



57

ASSEMBLY

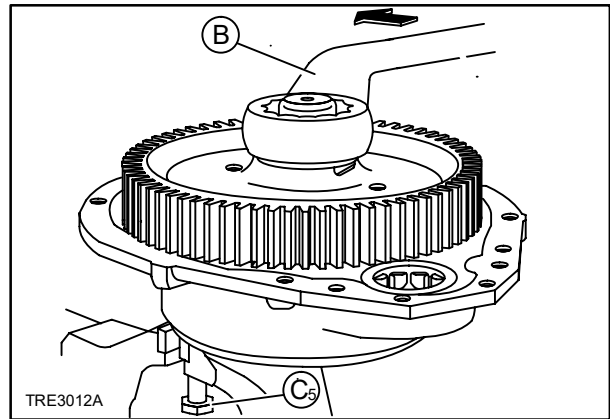
Carry out the above operations in the reverse order, bearing in mind the following:

21. Place the roller bearing (7) Fig. 55, outer ring in its seat in the final drive cover with mark on the outside;
22. Install the other bearings, using appropriate installers;
23. Fit the half shaft and wheel shaft, taking care not to damage the seals (11–12) Fig. 6;
24. Fit the roller bearing internal ring (7) Fig.56, page 48, on the half shaft (9) Fig. 56 having heated it in the oil to 80–90 °C (176–194 °F);
25. Tighten the gear locknut (C₅) Fig. 6 page 8, using wrench (B) Fig. 53 page 48, previously used for disassembly.
26. Tighten all the nuts and screws to the torque values given on page 3.
27. Clean and grease the surfaces in contact between the housing (10) Fig. 6 page 8 and the cover (3) Fig. 6 page 8, inserting a new seal (20) Fig. 6 page 8;
28. Thoroughly clean and grease the surfaces (X) Fig.64 page 25, applying jointing compound.

Driven gear retaining nut removal

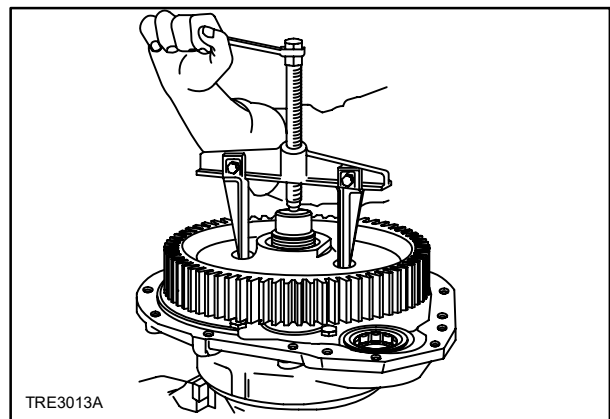
Remove the gear retaining :

10. Tighten two M16 x 1,5 screws (C₅) Fig. 53, into two of the wheel disc holes on hub and clamp wheel shaft in vice Fig. 53;
11. Unscrew nut (C₅, Fig. 6, page 8) as shown in Fig. 53 with a suitable spanner (B).



53

12. Withdraw driven gear (8). Fig. 6, page 8 from wheel shaft (2) using puller as shown in Fig. 54

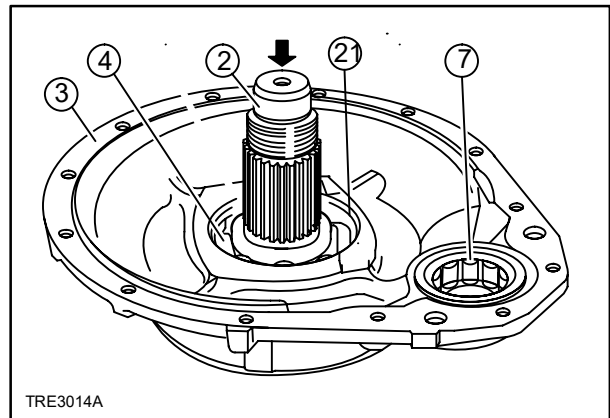


54

Wheel shaft removal (installation) (Fig. 55)

(Arrow indicates shaft removal direction)

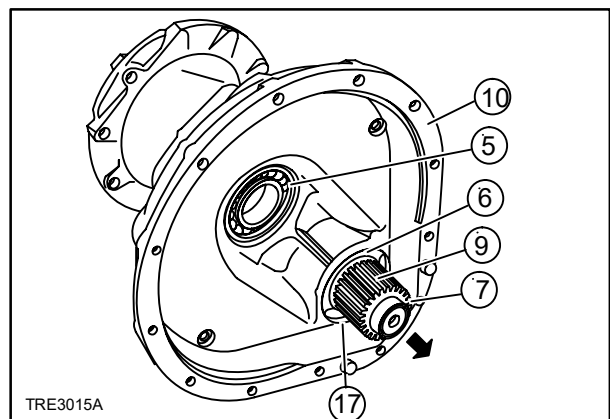
13. Knock out wheel shaft (2) by beating with lead hammer in the direction shown by arrow in Fig. 55.
14. Use puller to withdraw outer ring (7) from cover (3);
15. Finally, withdraw the bearing (4) from cover, having first removed retaining circlip (21).



55

DISASSEMBLY (housing) (Fig. – 56)

16. Remove the bearing (5) from the housing (10) Fig. 56, with a suitable puller;
17. Remove retaining ring (17) Fig. 56, and withdraw axle shaft (9) Fig. 56, together with bearing (6) Fig. 56, in the direction shown by arrow.



56

FINAL DRIVE REMOVAL**WARNING**

Handle all parts with great care.
Never place your hands or fingers between one part and another. Wear the prescribed safety clothing, including glasses, gloves and protective footwear.

**WARNING**

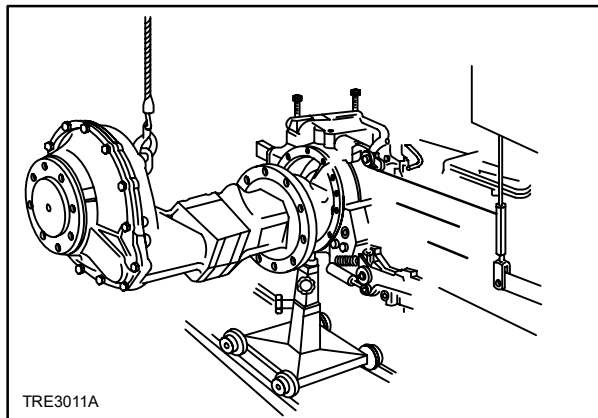
Always use appropriate tools to align the holes.
NEVER USE YOUR FINGERS OR HANDS.

**CAUTION**

Raise and handle all heavy components using a suitable lift.
Ensure that units or parts are supported by suitable slings or hooks. Ensure that there is no one in the vicinity of the load to be lifted

Remove the final drive as follows :

6. Drain oil from rear transmission and final drive housings.
7. Position a support stand under transmission housing and remove ROPS frame, wheels, fenders and platform.
8. Take out capscrews (C₅) Fig.1, Page 4 and remove final drive assembly as shown at Fig.52.

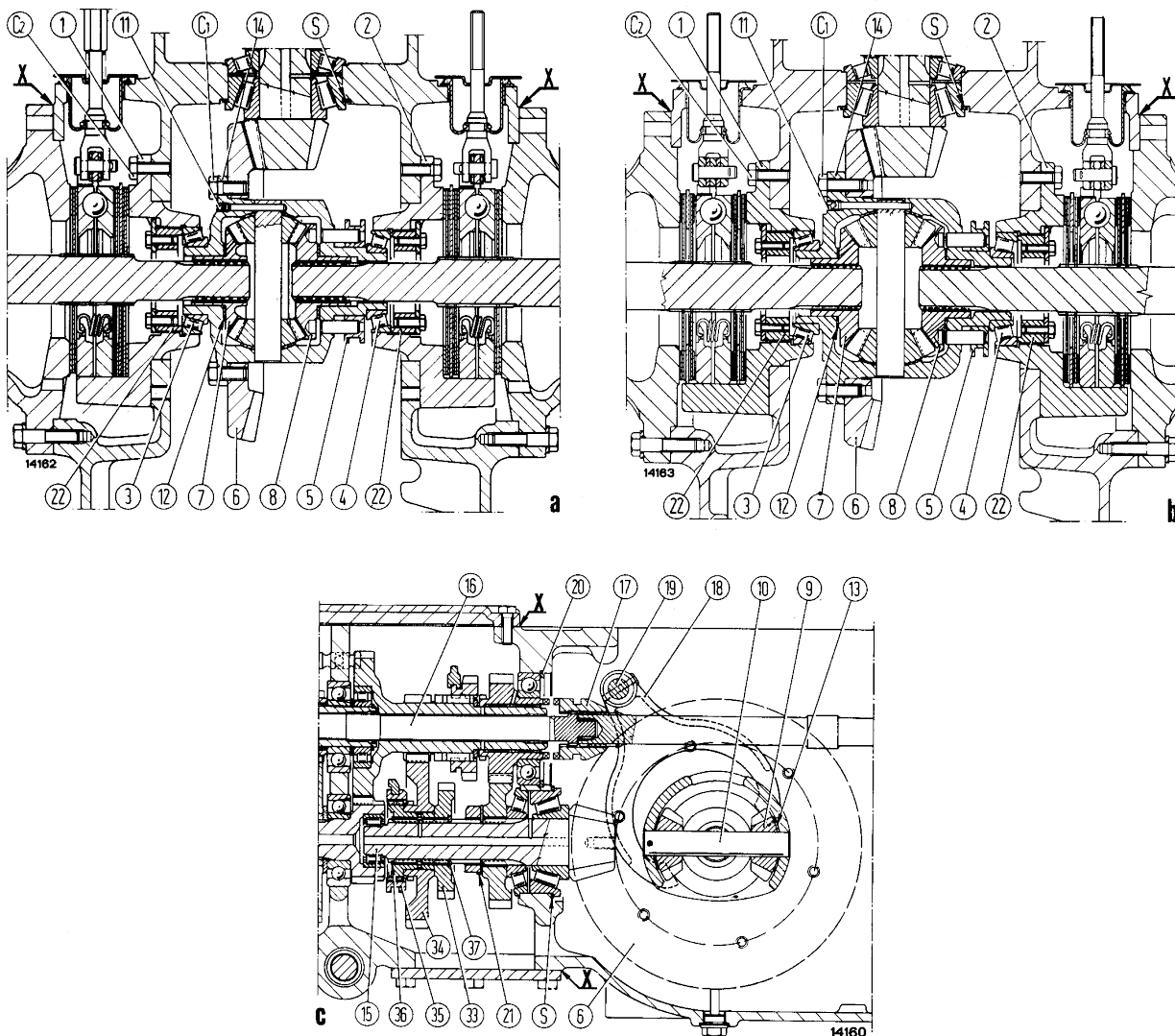


52

Disassembly (Cover)

Remove the final drive as follows :

9. Take off capscrews (C₁) Fig. 6, Page 8 and remove final drive cover (3) Fig. 6 with driven gear (8) Fig. 6.



TRE0554A

51

Longitudinal and Cross Sectional Views of Bevel Gear Pair and Differential Unit

- | | |
|---|---|
| a. JX60 and JX70 models | 12. Side gear shim |
| b. JX80, JX90 and JX95 models | 13. Side gear shim |
| c. Longitudinal section for all models | 14. Differential box |
| C ₁ . Ring gear retaining screw | 15. Bevel pinion shaft |
| C ₂ . Differential support retaining screw | 16. PTO shaft |
| S. Bevel pinion positioning shim | 17. PTO control sleeve |
| 1. Differential support | 18. Fork |
| 2. Differential support | 19. Differential lock shaft |
| 3. Taper roller bearing | 20. Range gear retaining ring |
| 4. Taper roller bearing | 21. Bevel pinion securing plate |
| 5. Differential lock sleeve | 22. Differential bearing ring nut |
| 6. Ring gear | 33. Reverse driven gear |
| 7. Side gear | 34. Driven gear for slow speed gears |
| 8. Side gear | 35. Engagement sleeve for slow and fast speed gears |
| 9. Differential pinion | 36. Transmission driven shaft ring |
| 10. Differential pinion shaft | 37. Retaining half-ring |
| 11. Differential pinion shaft retaining screw | |

5. Axial movement of each side gear (2) and (5) without shims is given as :

$$G_s \text{ or } G_d = H_1 - H_2$$

where :

G_s = axial movement of LH side gear;

G_d = axial movement of RH side gear;

H₁ and **H₂** = distances measured on LH or RH side gear (steps 2 and 3).

The normal clearance envisaged between the sides of the pinion and side gear teeth is 0.15 mm (0.0059 in.) for JX60 and JX70 models. It is 0.18 mm (0.0071 in.) for JX80, JX90 and JX95 models.

Bear in mind that the average ratio between the normal clearance of differential pinion-side gear and the equivalent axial movement of the side gears is 1–1.7.

The axial movement of the side gears corresponding to the normal prescribed clearance between the teeth is :

0.15 x 1.7 = **0.25 mm** (0.0059 x 1.7 = **0.0098 in.**) for JX60 and JX70 models;

0.18 x 1.7 = **0.30 mm** (0.0071 x 1.7 = **0.0118 in.**) for JX80, JX90 and JX95 models.

Thickness of the spacer rings (1) and (6) to be inserted on the differential box are :

$$S_s = G_s - 0.25 \text{ mm (0.0098 in.)}$$

(for LH side gear of JX60 and JX70 models)

$$S_d = G_d - 0.25 \text{ mm (0.0098 in.)}$$

(for RH side gear of JX60 and JX70 models)

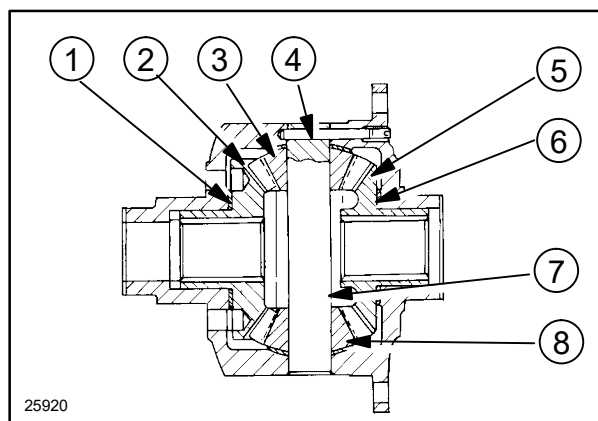
$$S_s = G_s - 0.30 \text{ mm (0.0118 in.)}$$

(for LH side gear of JX80, JX90 and JX95 models)

$$S_d = G_d - 0.30 \text{ mm (0.0118 in.)}$$

(for RH side gear of JX80, JX90 and JX95 models)

Available shims are 1.5 and 1.6 mm to use for the side gear as shown on page 2. Fit shims of the closest thickness for the LH and RH side gears according to calculations).



50

ADJUSTING THE BEVEL GEAR PAIR

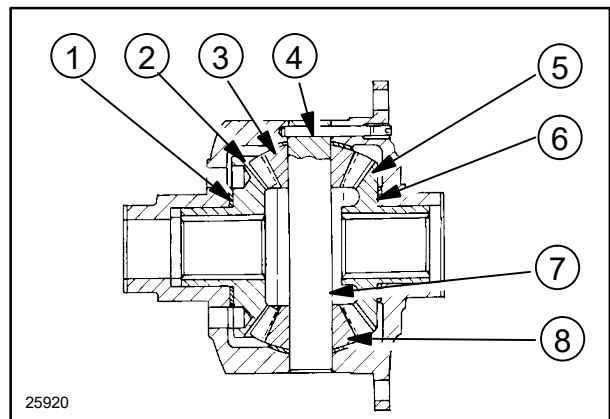
Differential pinion and side gear backlash adjustment

With the dismantled differential on the bench, proceed as follows :

IMPORTANT

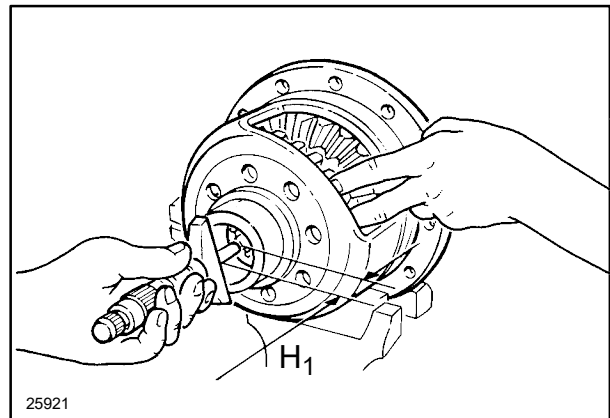
All parts of the differential must be cleaned so that oil residue does not effect the accuracy of the adjustment.

1. Mount the side gears (2) and (5) without rings (1) and (6) on the differential box. Insert the differential pinions (3) and (8) complete, with their related clearance rings and with the pin (7). Tighten the retaining bolt (4) by a few turns in order to prevent the pin from moving.



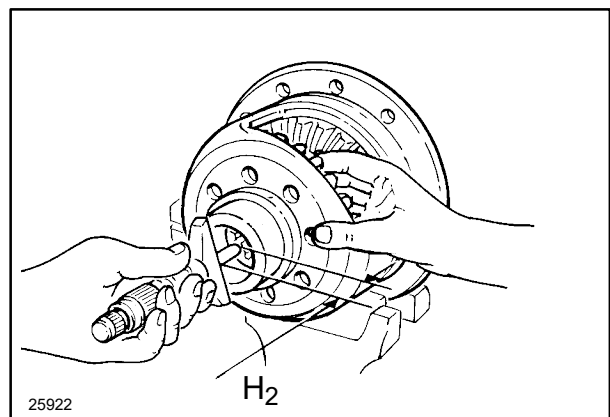
47

2. Manipulate the RH side gear so that it comes into contact with the side pinion and, using a depth micrometer, measure the distance (H_1), making two diametrically opposed measurements and taking the arithmetic mean of the two values measured.



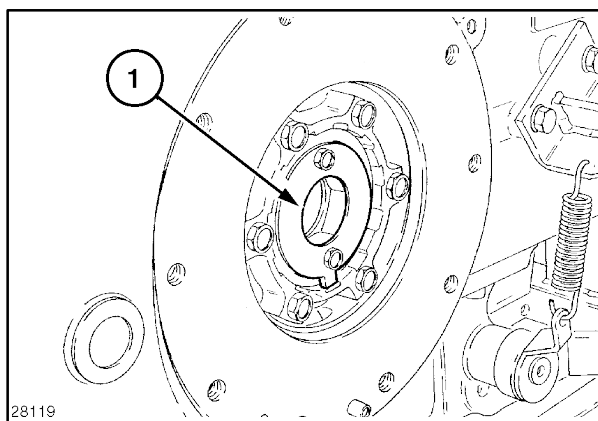
48

3. Push the side gear so that it touches the differential casing and measure the distance (H_2).
4. Repeat the same operations for the left-hand side gear.



49

10. Lock the right and left-hand ring nuts in position with the lock ring (1).

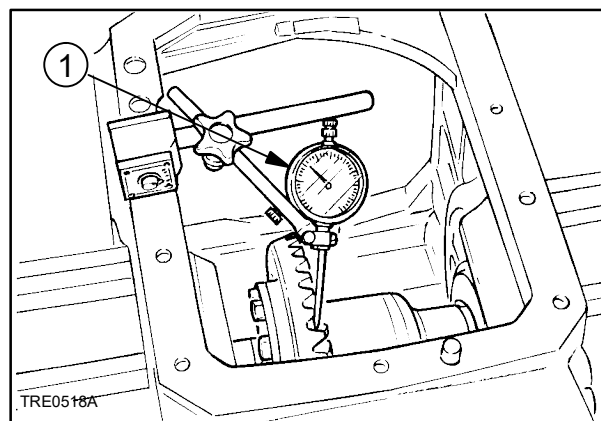


Differential casing $\varnothing$ 187 mm (7.3622 in.)					
Pinion rolling torque		Force of the pinion at the torque meter measured on the crown wheel (with bearings not pre-loaded)		Force of the pinion at the torque meter measured on the crown wheel (with bearings pre-loaded)	
ft lb	Nm	lb	N	lb	N
0.5421 to 1.0849	0.735 to 1.471	9.4401 to 16.5201	41.97 to 73.45	Force on pinion + (2.36 to 4.72)	Force on pinion + (10.49 to 20.99)
Differential casing $\varnothing$ 206 mm (8.1102 in.)					
Pinion rolling torque		Force of the pinion at the torque meter measured on the crown wheel (with bearings not pre-loaded)		Force of the pinion at the torque meter measured on the crown wheel (with bearings pre-loaded)	
ft lb	Nm	lb	N	lb	N
0.5421 to 1.0849	0.735 to 1.471	8.5578 to 14.9982	38.05 to 66.68	Force on pinion + (2.1394 to 4.2789)	Force on pinion + (9.51 to 19.02)

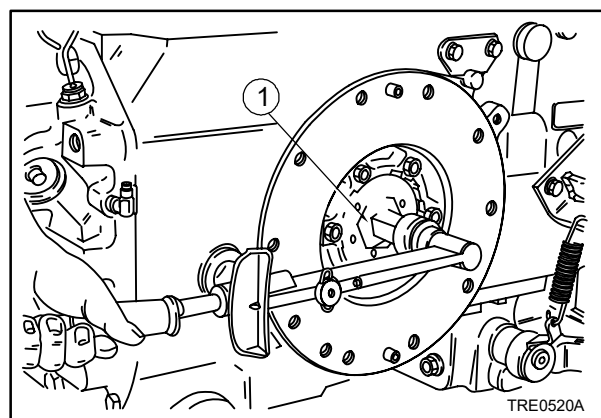
9. Using a 1/100 dial gauge (1), check the clearance between the teeth of the bevel drive; if this backlash remains between 0.18 ÷ 0.23 mm (0.0071 ÷ 0.0090 in.) (0.21 mm (0.0083 in.) on average) fine, otherwise:

- if the backlash is any greater, use the wrench **50027** (1) to unscrew the right-hand ring nut and tighten the left-hand one by an equal amount.
- if the backlash is any lower, unscrew the left-hand ring nut and tighten the right-hand one by an equal amount.

NOTE: It is important to unscrew one ring nut and alternately tighten the opposite one by an equal amount so as not to change the bearing pre-load that has already been calculated.



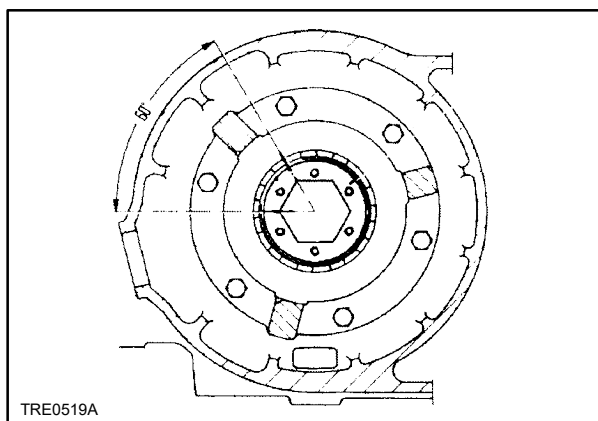
44



45

5. One complete turn of the ring nut corresponds to a 2 mm axial movement of the crown wheel. A 60° turn of the ring nut, equivalent to one side of the ring nut hexagon, corresponds to an axial movement of the ring nut of:

$$Z = (60 : 360) \times 2 = 0.33 \text{ mm (0.0130 in.)}$$

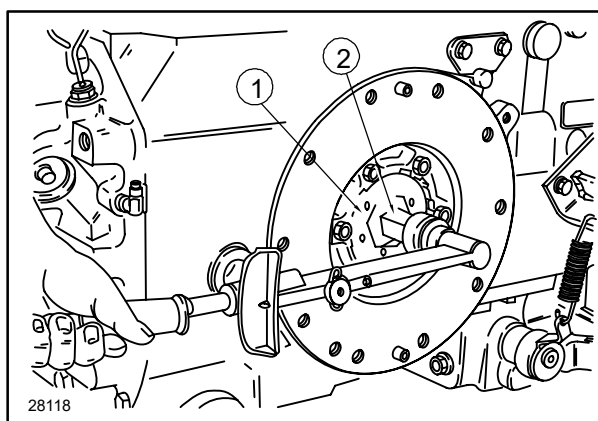


41

6. Making the differential turn, unscrew the right-hand ring nut with tool **50027** (2) and tighten the left-hand ring nut (1) by the same amount if $Z > 0$, otherwise unscrew the left-hand ring nut (1) and tighten the right-hand ring nut by the same amount if $Z < 0$ in order to obtain a backlash initially of 0.18 mm.

$$Z = (60 : 360) \times 2 = 0.33 \text{ mm (0.0130 in.)}$$

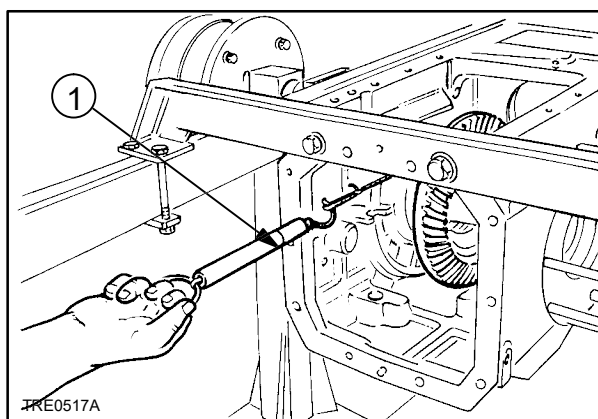
7. On obtaining a clearance of 0.18 mm, tighten the right-hand ring nut to obtain a rolling torque of:



42

Pinion rolling torque		Pinion rolling torque on crown wheel (with bearings not pre-loaded)		Total rolling torque of pinion measured on crown wheel (with bearings not pre-loaded)	
ft lb	Nm	ft lb	Nm	ft lb	Nm
0.5421 to 1.0849	0.735 to 1.471	2.8934 to 5.0634	3.923 to 6.865	torque measured on pinion + (0.7235 to 1.4463)	torque measured on pinion + (0.981 to 1.961)

8. Making sure you do not drive the shafts of the gearbox, it is possible to check the rolling torque with a torque meter (1) and a cord wound around the outer diameter of the differential casing, keeping to the values stated in the table:



43

BEVEL DRIVE ADJUSTMENTS

Adjusting the ring bevel gear bearings and checking the clearance between the teeth of the bevel gear pair.



WARNING



Handle all parts with great care.

Never place your hands or fingers between one part and another. Wear the prescribed safety clothing, including glasses, gloves and protective footwear.



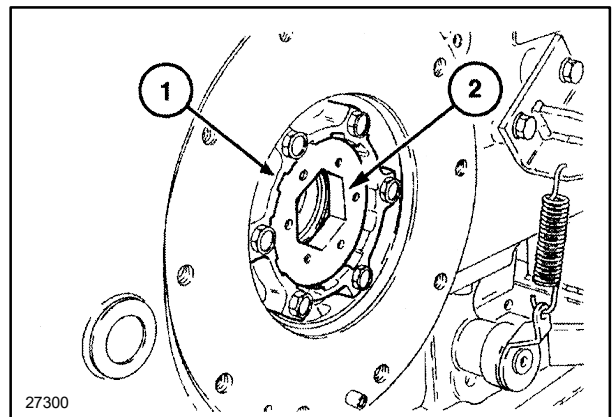
WARNING



Always use appropriate tools to align the holes. NEVER USE YOUR FINGERS OR HANDS.

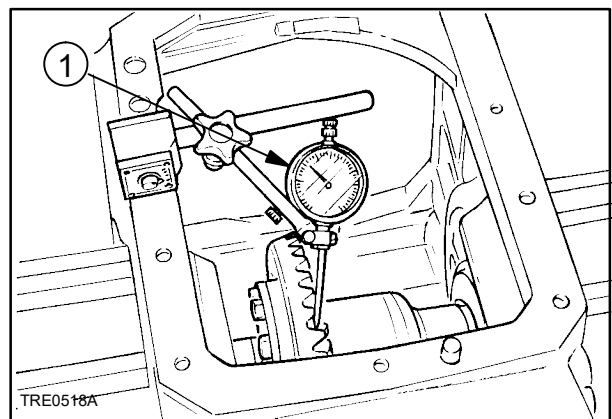
Proceed as follows :

1. With the bevel pinion fitted, insert the differential assembly complete with the bevel crown wheel. Secure the right- and left-hand supports on the gearbox transmission casing and bring the relevant ring nuts into contact with the races of the bearings.
2. Using wrench **50027** (see page 6) slightly screw the right-hand ring nut (2) onto the support (1), and then do the same for the left-hand ring nut. So as to obtain a slight pre-load on the bearings.



39

3. Using a 1/100 dial gauge (1) measure the radial clearance on the sides of the bevel drive teeth (three measurements at 120° and arithmetic mean of the three readings, the difference between the three measurements must not exceed 0.05 mm) and compare the result with the nominal clearance: 0.18 ÷ 0.23 mm (0.0071 ÷ 0.0090 in.). We will initially be looking for a clearance of 0.18 mm (0.0071 in.).



40

4. Setting high – low backlash depends on the ratio between the decrease – increase in clearance and the movement of the differential casing. As a result, the end displacement (Z) of the differential unit is:

$$Z = (G - 0.18) \times 1.4$$

where:

1.4 = Ratio between decrease–increase in backlash and movement of the differential casing.

G = bevel drive backlash, as previously measured.

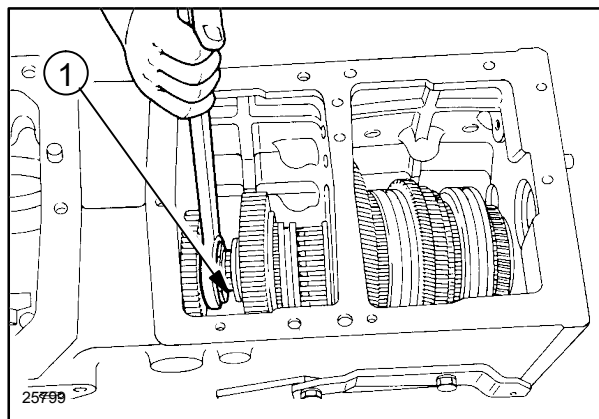
After calculating **Z**, proceed as follows:

if **Z < 0** move the crown wheel away from the pinion.

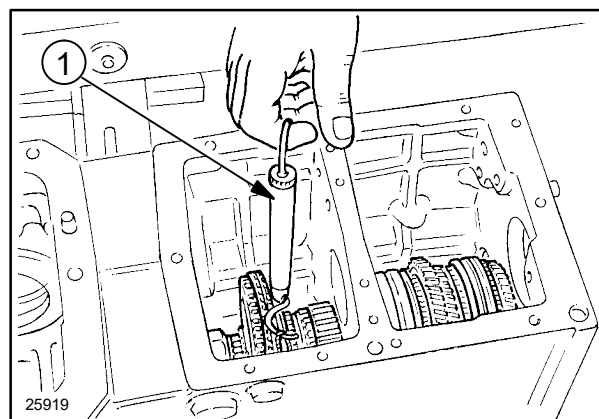
if **Z > 0** move the crown wheel nearer to the bevel pinion.

ADJUSTING THE BEVEL GEAR PAIR**Adjusting the taper-roller bearings for pinion shaft**

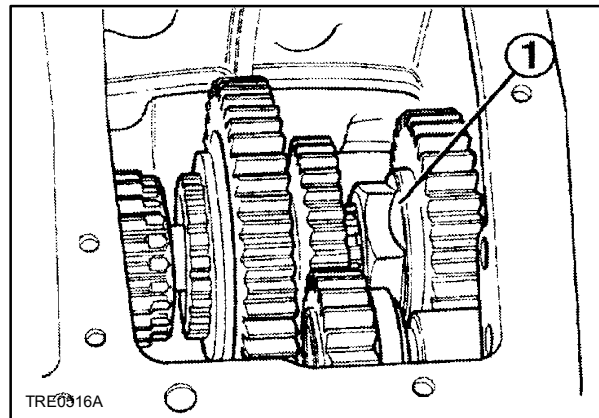
1. Mount the external track of the bearing together with the previously calculated adjuster shim (S) and the bevel pinion complete with its parts.
2. Tighten the bearing adjustment nut (1) while turning the pinion shaft to allow the bearings to bed in until rolling torque of 0.73–1.47 Nm (1.1063–1.4751 ft lb) is obtained.
3. Mesh the range selecting sleeve with the slow range gear. Then measure the rolling torque with a torque meter and a cord wound around the slow range gear of the pinion; the prescribed torque corresponds to a force measured with the torque meter (1) of 8.63 – 17.2 N (1.9409 – 3.8598 lb)
4. After obtaining the recommended torque, bend the securing thrust washer (1) onto the adjuster nut to prevent it unscrewing and decreasing the bearing pre-load.



36



37



38

6. Calculate the corrected nominal distance (H_3) between the ring gear axis and the major base of the bevel pinion :

$$H_3 = H_2 + C$$

where :

$H_2 = 145.5 \text{ mm (5.7283 in.)}$. Nominal distance between the ring gear axis and major base of the bevel pinion.

C = Correction value stamped on the pinion, expressed in mm and preceded by a + or – sign (if other than 0) to be added to or subtracted from the nominal distance (H_2) respectively.

7. Thickness of the adjuster ring (S) is given by :

$$S = H_1 + Sp - H_3$$

where :

H_1 = Distance measured with the micrometer gauge.

H_3 = Corrected nominal distance between the ring gear axis and the major base of the bevel pinion.

Sp = Test ring.

Examples:

Distance measured with the micrometer gauge $H_1 = 145.9 \text{ mm (5.7441 in.)}$.

Thickness of test ring $Sp = 1.90 \text{ mm (0.0748 in.)}$.

Nominal distance between the ring gear axis and major base of the bevel pinion $H_2 = 145.5 \text{ mm (5.7283 in.)}$.

a) Correction value $C = + 0.2 \text{ mm (0.0079 in.)}$.
Corrected nominal distance $H_3 = 145.5 + 0.2 = 145.7 \text{ mm (5.7283 + 0.0079 = 5.7362 in.)}$.

Thickness of adjuster ring :

$S = 145.9 + 1.90 - 145.7 = 2.10 \text{ mm (5.7441 + 0.0748 = 5.7362 in.)}$.

b) Correction value $C = - 0.2 \text{ mm (0.0079 in.)}$.
Corrected nominal distance $H_3 = 145.5 - 0.2 = 145.3 \text{ mm (5.7283 - 0.0079 = 5.7204 in.)}$.

Thickness of adjuster ring :

$S = 145.9 + 1.90 - 145.3 = 2.50 \text{ mm (5.7441 + 0.0748 - 5.7204 = 0.0985 in.)}$.

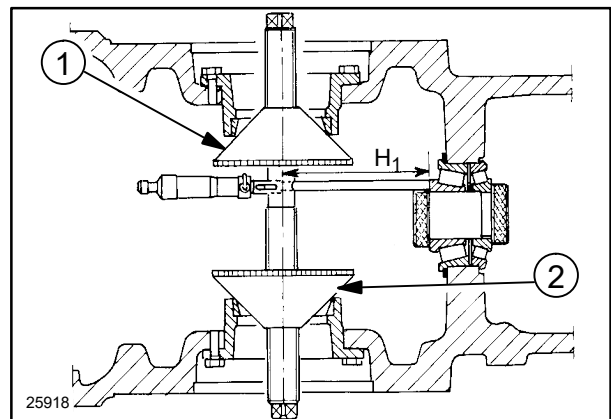
c) Correction value $C = 0 \text{ mm}$.

Corrected nominal distance $H_3 = H_2 = 145.5 \text{ mm (5.7283 in.)}$.

Thickness of adjuster ring:

$S = 145.9 + 1.90 - 145.5 = 2.30 \text{ mm (5.7441 + 0.0748 - 5.7283 = 0.0906 in.)}$.

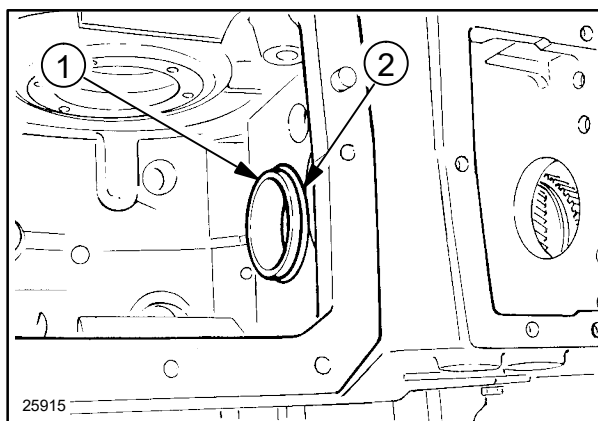
8. Remove the tools **380000249** and **50004**; take out the bearing external rings, the test shim and two differential supports.



ADJUSTING THE BEVEL GEAR PAIR**Determining the bevel pinion positioning adjustment ring**

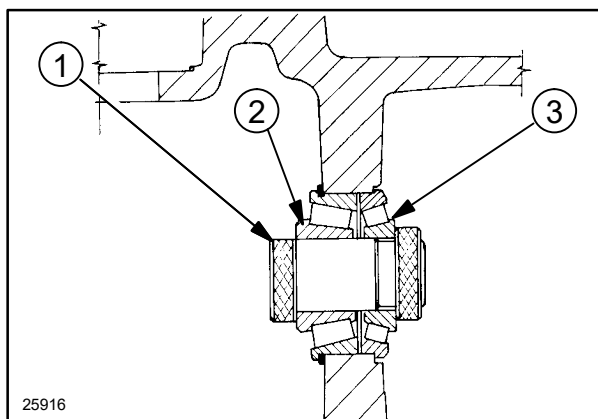
Proceed as follows:

1. On the transmission–gearbox case mount the outer ring of the bearing (1) fig. 31 with the test shim (2) and the outer bearing ring (3) fig. 32.



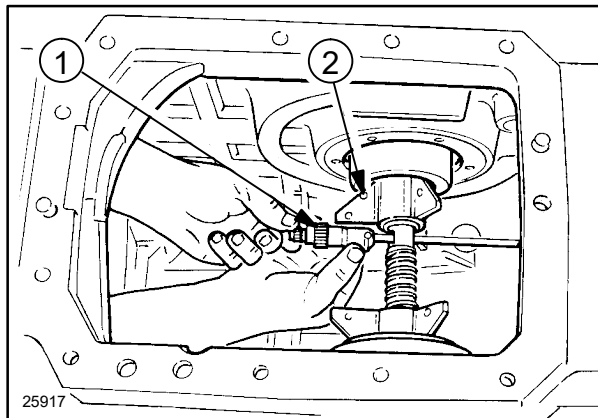
31

2. Position the bearing (2) on tool **50004** (1), insert the bearing (3) and lock the tool (1).



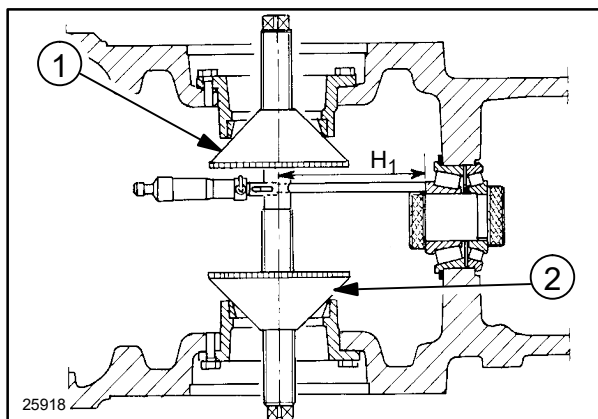
32

3. Position the tool **380000249** (2) with two conical parts in the ring gear supports and insert the micrometer (1) with depth rod into its seat and lock using the bolt.



33

4. Screw down or unscrew the cones (1) and (2) so as to align the micrometer rod with the bearing. Adjust the cones (1) and (2) to lock the tool on the supports and eliminate any axial clearance.
5. Move the depth rod of the micrometer into contact with the bearing and measure the value (H_1).



34

TRANSMISSION–GEARBOX**Adjusting the position of the differential lock engagement sleeve****WARNING**

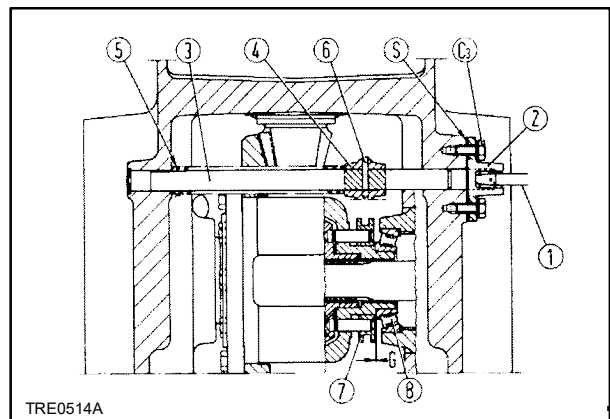
Use appropriate tools to align the holes. NEVER USE YOUR FINGERS OR HANDS.

Proceed as follows:

1. Mount the differential release device without the adjuster shim (S).
2. Fit the differential bevel crown wheel assembly on its supports.
- G. Clearance between differential lock sleeve and the right-hand bevel crown wheel bearing support.

0.5 ÷ 1.25 mm (0.0197 ÷ 0.0492 in.) All models

- C₃. Lock pedal support retaining bolt.
 S. Differential lock sleeve travel adjuster shim.
 1. Differential lock pedal.
 2. Pedal support.
 3. Fork control rod.
 4. Fork.
 5. Return spring.
 6. Spring pin.
 7. Sliding Sleeve.
 8. Differential support right-hand bearing.



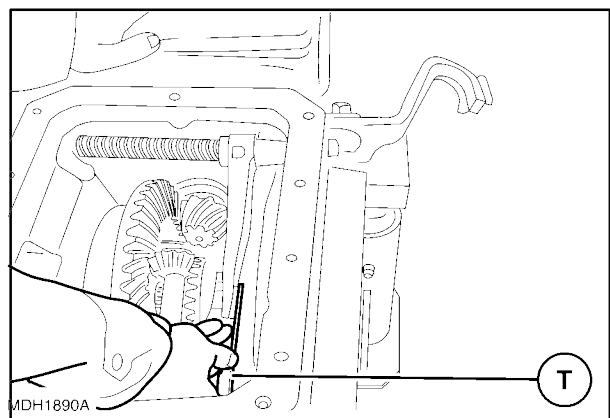
29

3. Check there is a clearance (G) between the sliding sleeve (7) of the differential lock and the right-hand support bearing of the differential (8) of:

0.5 ÷ 1.25 mm (0.0197 ÷ 0.0492 in.)
 mod. JX60 and JX70,
 JX80, JX90 and JX95

that can be measured with the feeler gauge (T).

4. Adjust this clearance by varying the shims (S) fitted between the support (2) and the transmission casing.



30

TRANSMISSION–GEARBOX CASE**Adjusting gearbox driving shaft axial clearance****⚠ WARNING ⚠**

Use appropriate tools to align the holes. NEVER USE YOUR FINGERS OR HANDS.

Proceed as follows :

NOTE: Once fitted, the driving shaft gears must have an axial clearance of 0–0.25 mm (0–0.0098 in.). The bearings must therefore be adjusted to prevent them from being mounted with an axial preload.

To perform this adjustment, it is recommended making a tool in the workshop according to the specifications given in the drawing on page 4, Section 21, Chapter 1.

1. On the bench mount all the various components on the driving shaft together with the snap ring (2), replacing the two rear bearings and the adjuster ring with the tool **50007** (1) (see page 4, Section 21, Chapter 1).

2. Insert a screwdriver between the gear and its bushing and use a feeler gauge to measure the clearance (H).

3. Measure the height (C) of the tool **50007** and the thickness of the inner rings of the two rear bearings (1 and 2).

4. The adjuster shims to be fitted is given by :

$$S = H + C - A - B$$

where:

H = measured clearance

A and **B** = **measured** thickness of the bearings

C = height of the tool.

Example :

– measured clearance **H** = 1.3 mm (0.0512 in.)

– height of tool = 43.5 mm (1.7126 in.)

– thickness of ball bearing (1) = 22.9 mm (0.9016 in.)

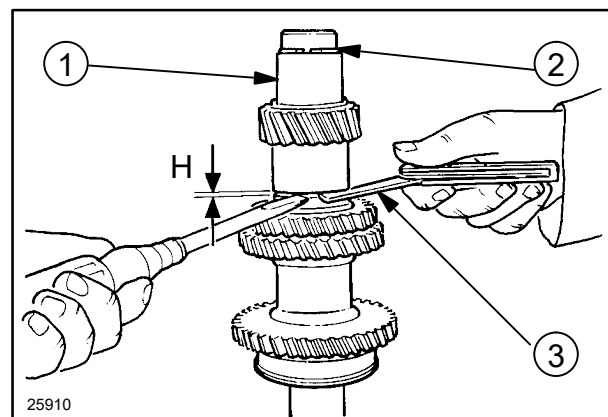
– thickness of roller bearing (2) = 18 mm (0.7087 in.)

Thickness of adjuster ring :

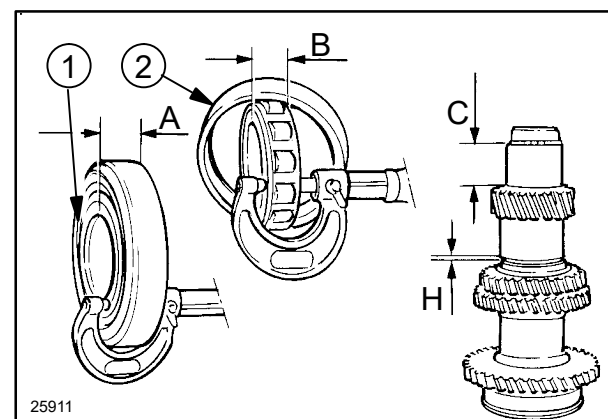
$$S = 1.3 + 43.5 - 22.9 - 18 = 3.9 \text{ mm}$$

$$(0.0512 + 1.7126 - 0.9016 - 0.7087 = 0.1535 \text{ in.})$$

NOTE: The gears should be mounted with an axial clearance of 0–0.25 mm. In this instance, it will be necessary to fit a shim (S) of 3.75 mm to provide an axial clearance of : 3.9–3.75 = 0.15 mm.

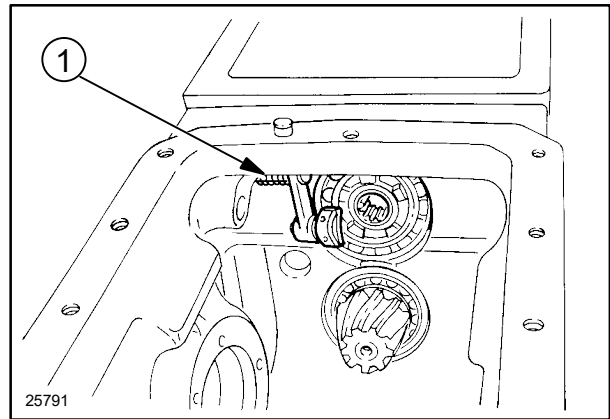


27

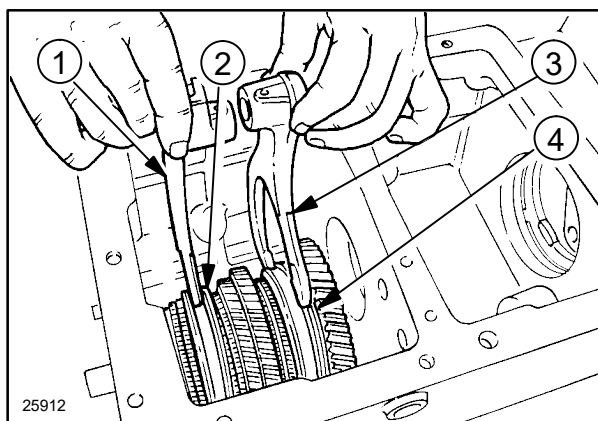


28

30. Fit the lever (1) that controls the PTO synchronised with the gearbox, complete with spring, pawl and external lever.
31. Fit the ring bevel gear complete with support and adjuster shims (see adjustments on pages 37 to 39).
32. Fit the differential lock engagement control fork complete with spring-rod unit, external plate and the corresponding adjuster shims (see page 36).
33. Fit the piston and the corresponding differential lock control union.
34. Fit all the rods, forks and gearbox and final drive control prongs.
35. Fit the transfer box assembly.

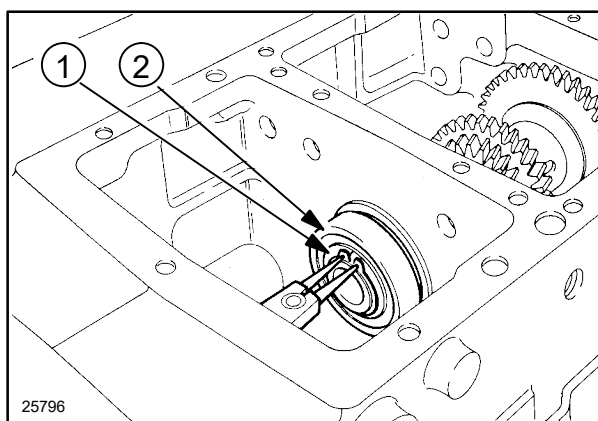


26. Insert the gear shift forks (1) and (3) on the sliding rings (2) and (4) of the synchronisers.
27. Fit the bevel pinion complete with all the parts and carry out the adjustments given on pages 37 to 39.



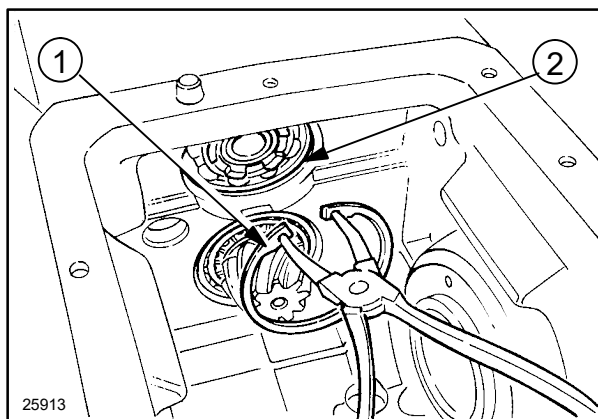
23

28. Fit the gearbox drive shaft complete with all parts and the adjuster shim, then position the bearing (2) and secure it using the snap ring (1).



24

29. Insert the final drive driving shaft from the rear end, fit the bearing (2) into its seat and secure with the snap ring (1).

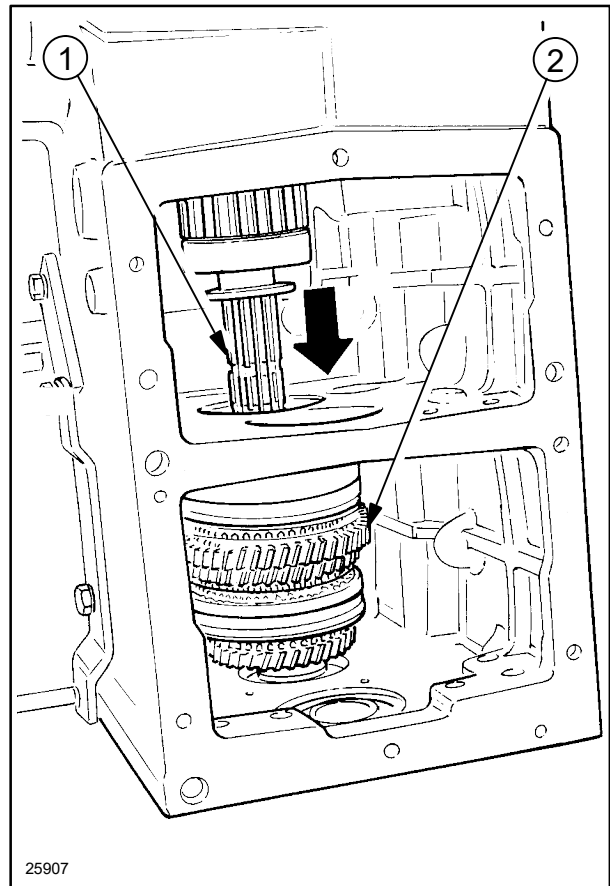


25

**WARNING**

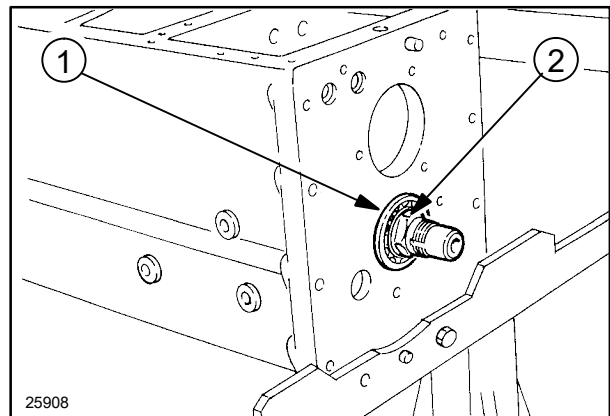
Use appropriate tools to align the holes. NEVER USE YOUR FINGERS OR HANDS.

23. Position the box vertically, insert the gearbox driven shaft gear set (2) and insert the shaft (1).



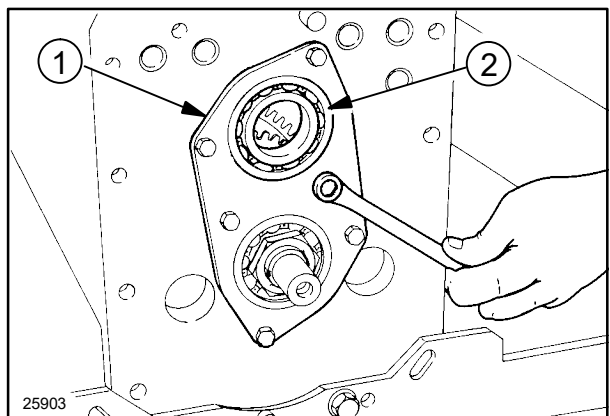
20

24. Turn the box by 90°, fit the front bearing (1) and the nut (2) and tighten to the prescribed torque.



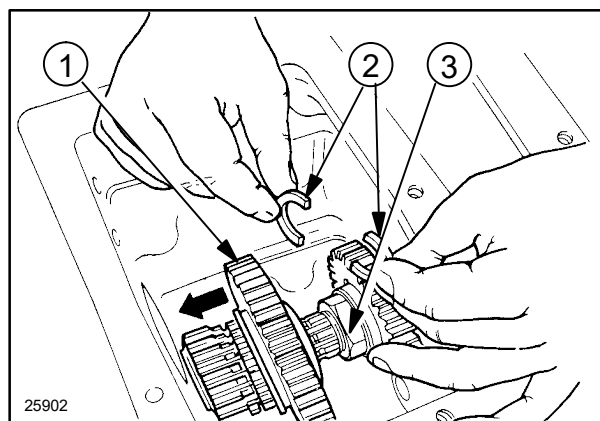
21

25. Fit the bearing (2) in its housing on the box (front end) and lock it using the plate (1).



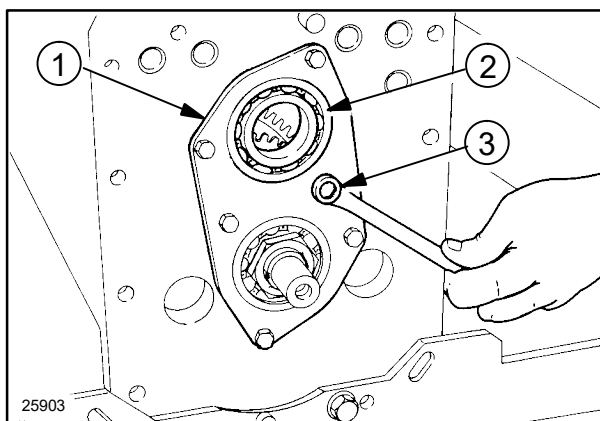
22

18. Move the gear (1) in the direction shown by the arrow and remove the two retaining half-rings (2). Undo the nut (3) completely and withdraw the bevel pinion, removing all parts.



17

19. Undo the bolts (3), take out the support plate (1) and remove the bearing (2).

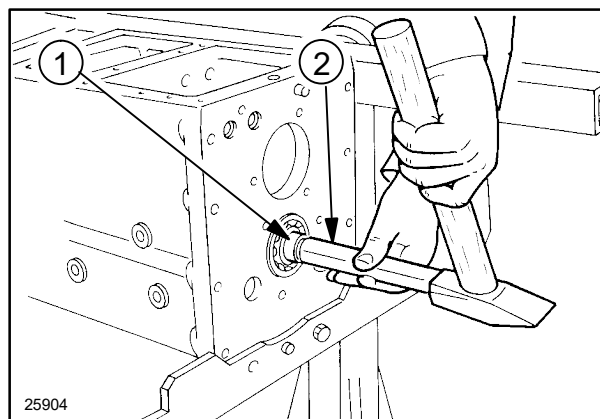


18

20. Use a brass punch (2) and a hammer to move the driven shaft (1), withdraw the shaft and remove all the parts.

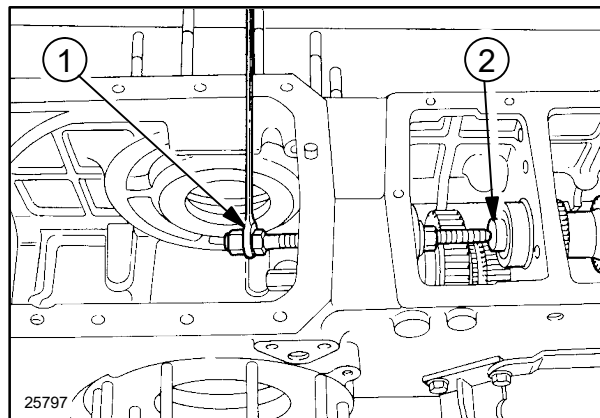
21. Mount the rear transmission-gearbox case by following sectional views and instructions given.

22. Apply the torque settings listed on page 3.



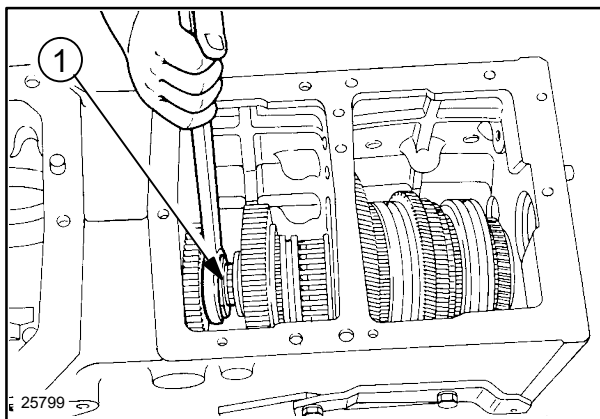
19

14. Fit the tool **50006** (2) (see page 4, Section 21, Chapter 1) onto the driving shaft and use the extractor (1) to withdraw the driving shaft. Remove the bearings, gears and respective bushings.



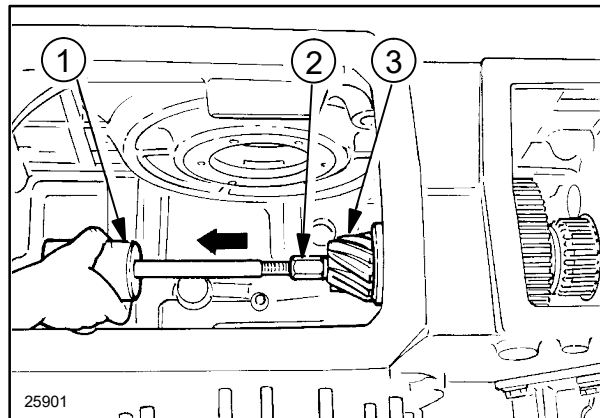
13

15. Straighten out the notches in the washer that retains the nut (1). Loosen the nut.



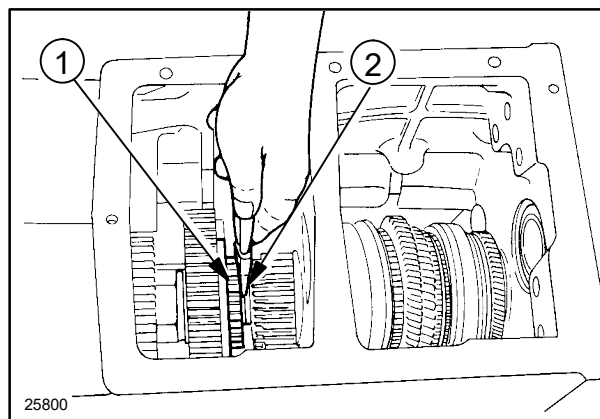
14

16. Screw the adapter **380000838** (2) onto the slide hammer **380000549** (1) to move the bevel pinion by a few millimetres in the direction shown by the arrow.



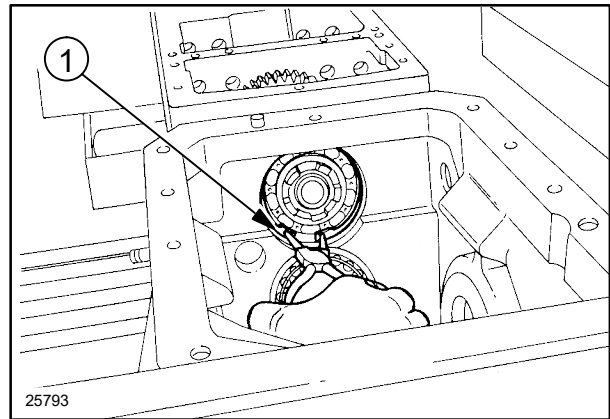
15

17. Move the engagement sleeve (1) until it is possible to gain access with pliers (2) to remove the retaining snap ring.



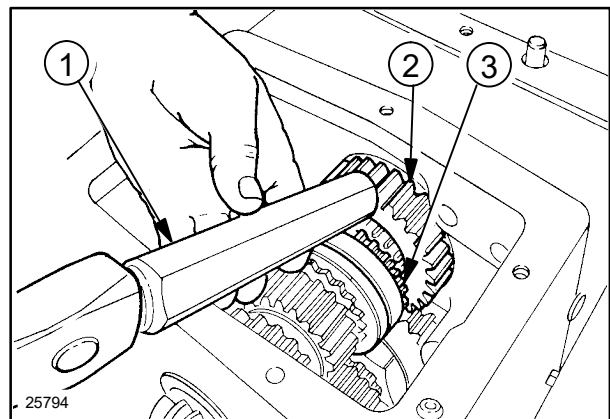
16

10. Remove from the rear the snap ring (1) that retains the final drive driving shaft bearing.



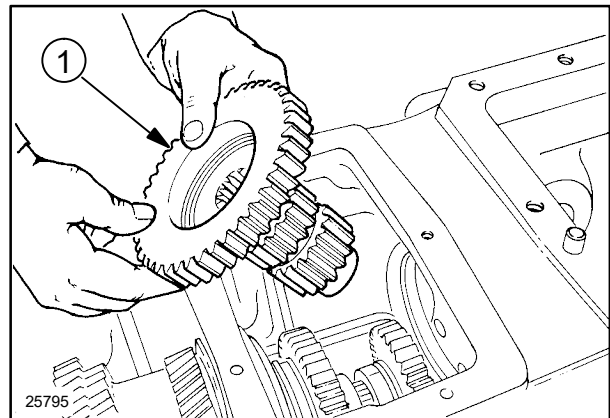
9

11. Using a hammer and a brass punch (1) withdraw the gear (2) for the mid-range speeds together with the related bearings and engagement sleeve (3).



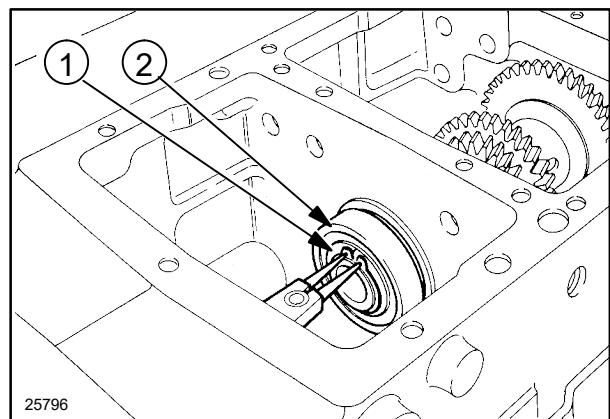
10

12. Withdraw the final drive driving shaft (1).



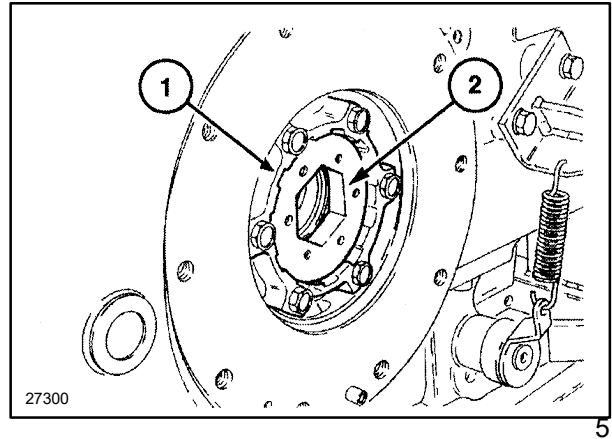
11

13. Remove the snap ring (1) that holds the bearing (2) onto the gearbox drive shaft.



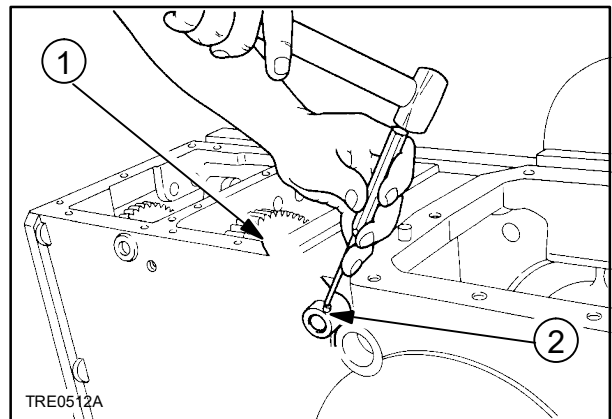
12

5. Unscrew the lock rings of the differential support bearing pre-load ring nuts (2) and slightly slacken the ring nuts.
6. Unscrew the differential support retaining bolts (1), retrieve the supports and then remove the entire differential bevel crown wheel assembly from the rear of the casing.



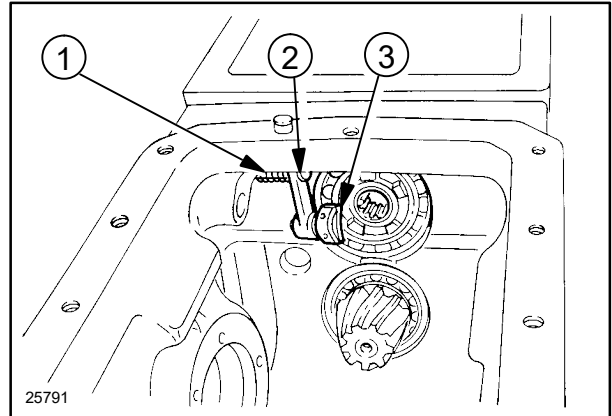
5

7. Remove the roll pin (2) and withdraw the external lever (1) that controls the PTO synchronised with the gearbox.



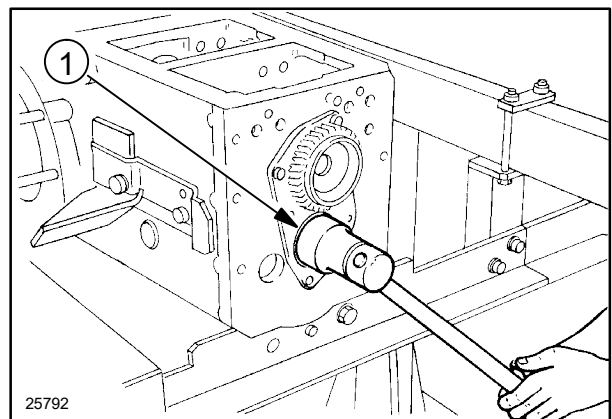
6

8. Extract the internal lever (2) complete with spring (1) and sliding block (3).



7

9. Straighten out the notches and undo the driven shaft locking nut (1).



8

TRANSMISSION–GEARBOX CASE Removal–Refitting (Op. 21 118 85)

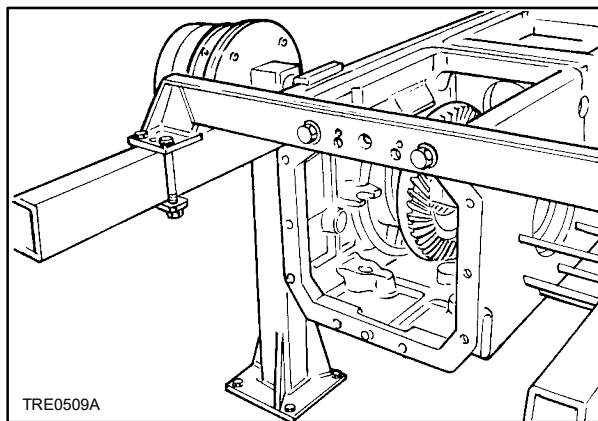


WARNING



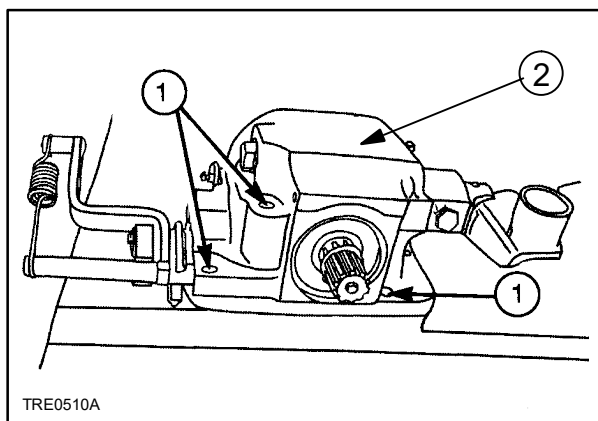
Handle all parts with great care.
Never place your hands or fingers between one part and another. Wear the prescribed safety clothing, including glasses, gloves and protective footwear.

1. Secure the transmission box–gearbox to the rotating stand **380000301** using the front **380000272** and rear **380000271** mountings.



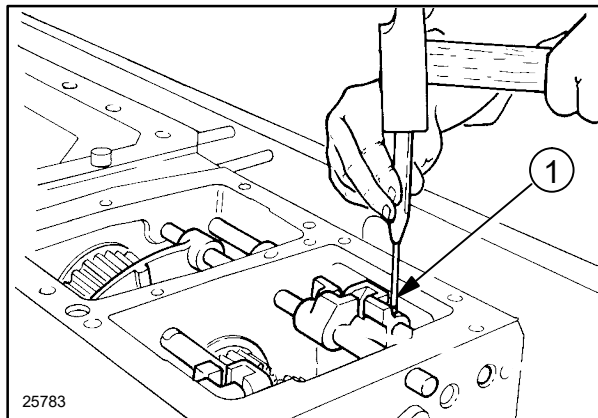
1

2. Turn the box by 180°, undo the bolts (1) and remove the transfer box (2).



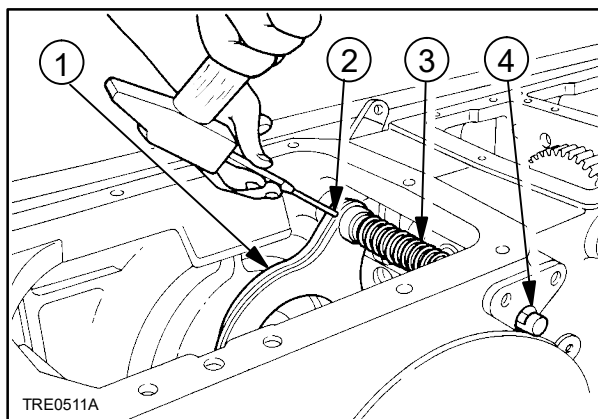
2

3. Turn the box back 180°, then use a punch to remove the roll pins (1) and take out the rods, the prongs, the gearbox and final drive control forks.



3

4. Use a punch to remove the roll pin (2) retaining the differential lock engagement fork (1). Withdraw the rod (4) and remove the helical spring (3) and the fork.



4

58. Refit the rear transmission–gearbox case as follows:



WARNING



Use appropriate tools to align the holes. NEVER USE YOUR FINGERS OR HANDS.

- For the correct orientation of the various parts, refer to the illustrations on pages 10 to 26.
- Before refitting boxes, supports and covers, thoroughly clean and degrease the mating surfaces and apply a strip of sealing compound of about 2 mm (0.0787 in.) diameter as shown in the diagram on page 25.
- Apply the torque settings given on page 3.
- Using the stand **380000326**, refit the rear transmission–gearbox case onto the clutch box.
- Fit the torion bar support complete with internal connecting rod.
- Position the left and right brake friction discs. Fit the brake assembly, and the lateral final drive assembly.
- Refit the PTO cover to the transmission–gearbox case.
- Fit the internal tank complete with oil discharge pipe.
- Fit the lower links and spacers.
- Fit the tow hook assembly.
- Re–install the hydraulic lift complete.
- Insert the springs and poppet balls and fit the gearbox and final drive control rod support cover to the rear transmission–gearbox case.
- Fit and connect the lift control and oil filler pipes.
- Fit the three–point linkage support together with the quick–release fitting support plate and electrical power sockets with related connectors.
- Fit the trailer brake valve complete with hydraulic valves. Fit and connect the auxiliary hydraulic valve and trailer brake valve pipes.
- Fit and connect all the hydraulic pump inlet and outlet pipes and the connection pipes to the auxiliary hydraulic valves, hydraulic lift, 4WD transfer box, etc.
- Fit the rear wheels and remove stand **380000326**.
- Fit the 4WD drive shaft and secure it by means of the central support and, the front and rear sliding sleeves.
- Fix the guard onto the transfer box shaft.
- Screw in the rear transmission–gearbox case oil drain plugs and the fuel tank drain plug.
- Lower the cab onto the transmission casing and secure using the retaining bolts.
- Connect the Lift–o–matic™ control cable.
- Connect the differential lock control rod.
- Connect the parking brake control cable.
- Fit the gearbox and final drive control levers and connect the HI–LO control connection, if present.
- Fit the reverser control lever.
- Connect the PTO speed selection cable.
- Connect the synchronised PTO control lever.
- Connect the auxiliary hydraulic valve control levers.
- Fix the fuel tank together with fixing brackets, mountings and rear transmission–gearbox breather pipes.
- Connect the pipes and connections to the fuel tank.
- Refit and secure the compressor, the condenser and the filter/dryer.
- Connect and secure the heater control pipes.
- Connect the gearbox clutch control rod.
- Connect the front service brake feed and control pipes.
- Connect the throttle control cable.
- Make good all electrical socket connections between the cab and the tractor body.
- Connect up the front headlights.
- Screw in the engine cooling system drain plug.
- Fill up the fuel tank, the rear transmission–gearbox case and the cooling system. Recommended products and quantities are given on page 6 of Section 00.
- Connect the negative terminal to the battery.

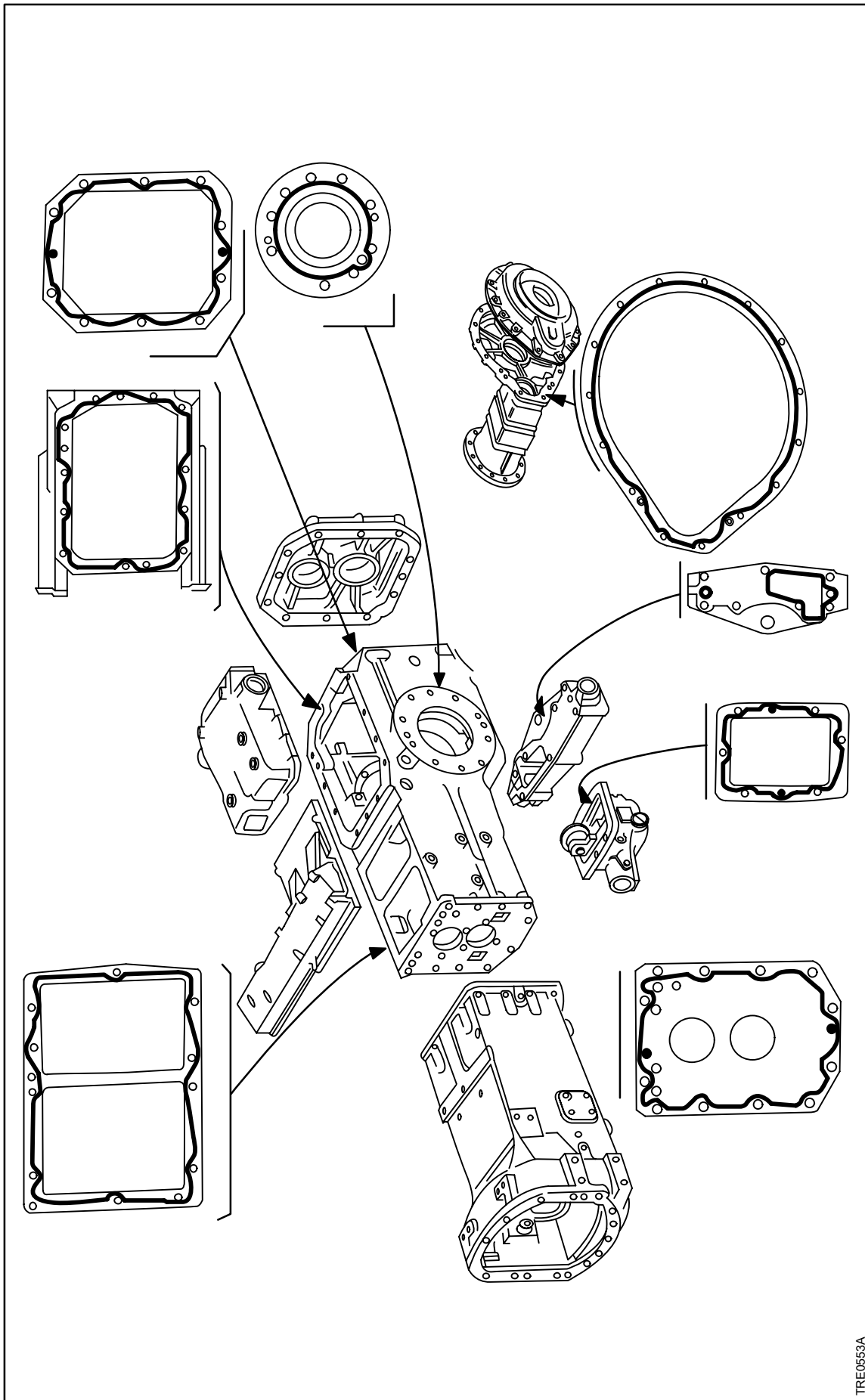
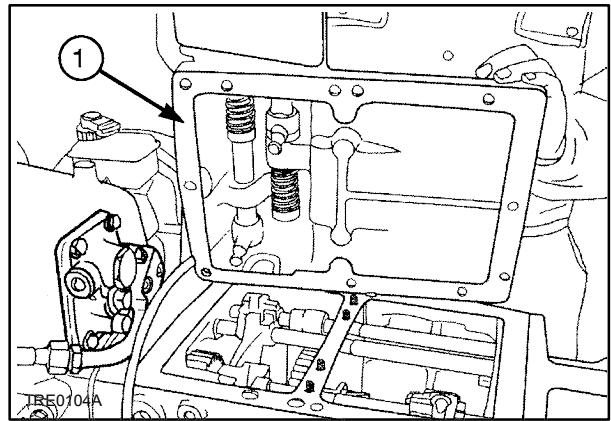


Diagram for application of sealing compound to the rear transmission-gearbox casing

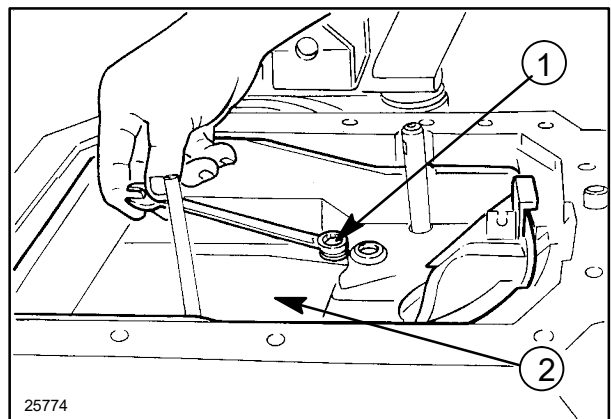
The types of sealing compound to be applied are listed on page 1 of Section 00.

55. Remove the bolts securing the gearbox cover (1). Remove the cover.



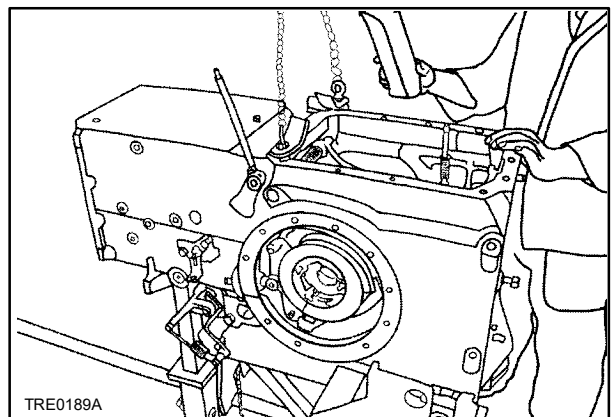
61

56. Unscrew the bolt (1) and remove the internal oil tank (2) from the rear transmission case.



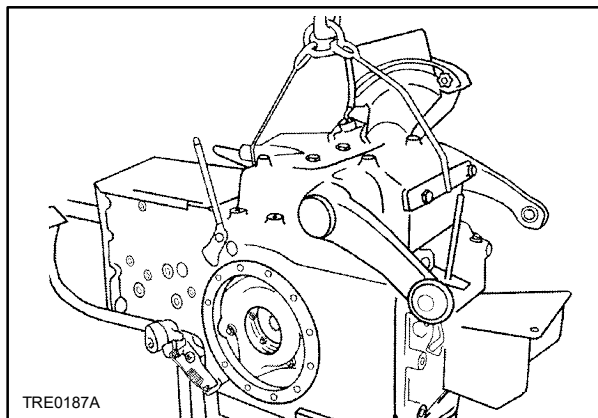
62

57. Connect the rear transmission-gearbox case to the hoist by chain. Remove the rear transmission-gearbox case using trolley stand 380000236.



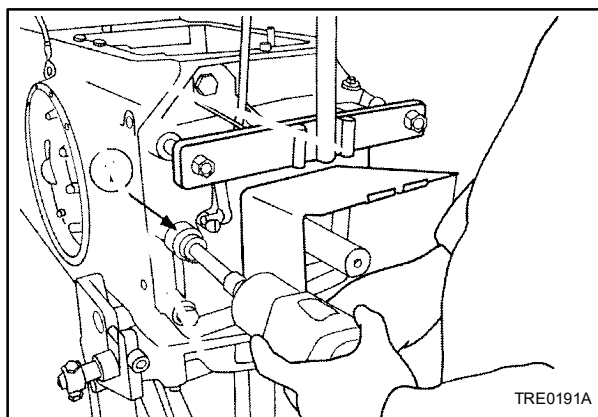
63

51. Remove the retaining bolts and lift the hydraulic housing using the hoist.



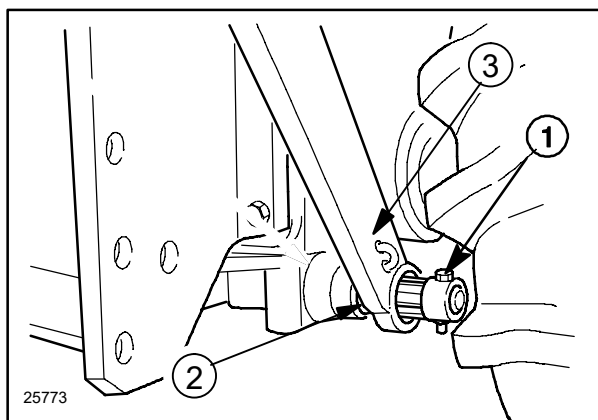
57

52. Use a chain to attach the tow hook and PTO to the hoist. Remove the three retaining bolts (1) from both sides and remove the unit from the rear transmission–gearbox case.



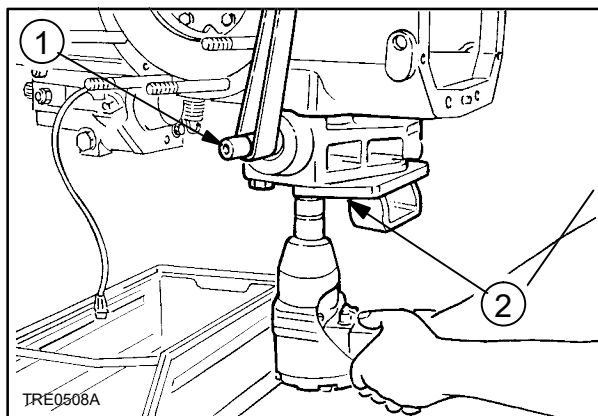
58

53. Unscrew the nut (1) and remove the bolt. Remove the right-hand lower link (3) and its spacer (2). Repeat on the left-hand lower link.



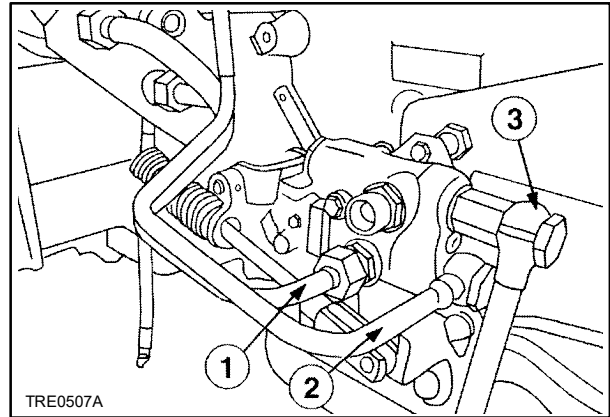
59

54. Attach a belt to both the ends of the torsion bar (1). Ensure that belt is strong enough to lift the assembly. Remove the retaining bolts (2) and take off the assembly.



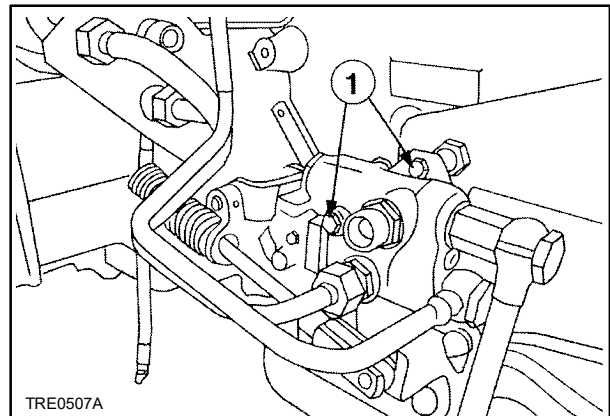
60

47. Disconnect the trailer brake pump inlet pipes (1) and (2) from the transmission-gearbox case. Remove the coupling from the trailer brake control valve supply pipe (3).



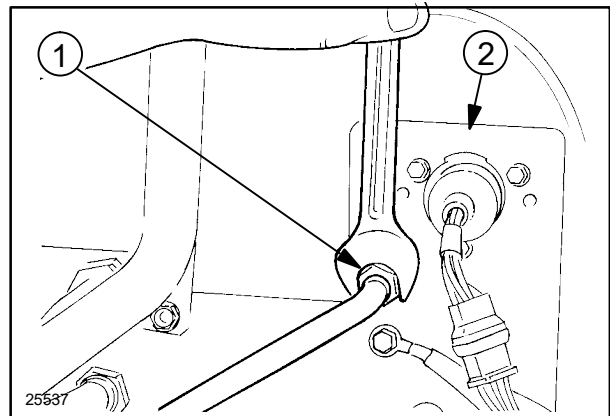
53

48. After removing the trailer brake control pipe, remove the retaining bolts (1) together with the complete trailer brake valve assembly.



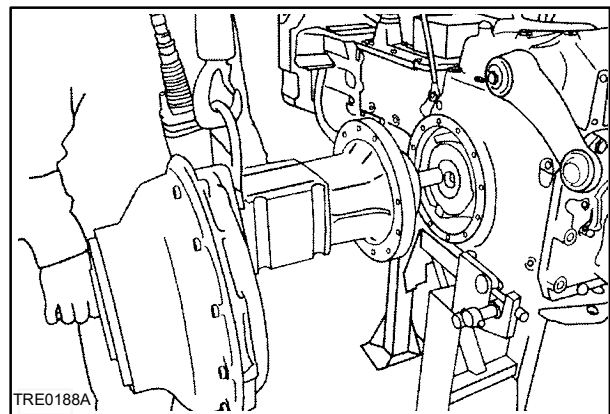
54

49. Disconnect the trailer brake control pipe (1) and the auxiliary valve pipes from the support plate (2).



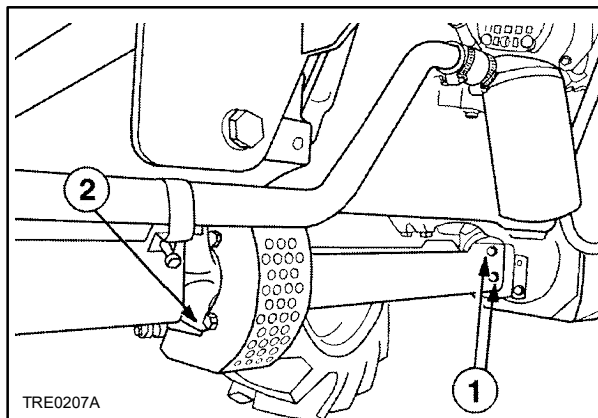
55

50. Connect a chain to one of the final drive assemblies and remove it from the transmission-gearbox case. Repeat on the other side.



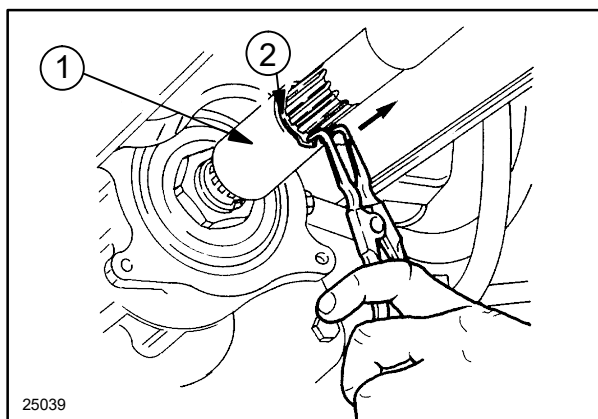
56

43. Remove the front retaining bolts (1), the centre bolts (2) and the rear retaining bolts from the 4WD drive shaft guard.



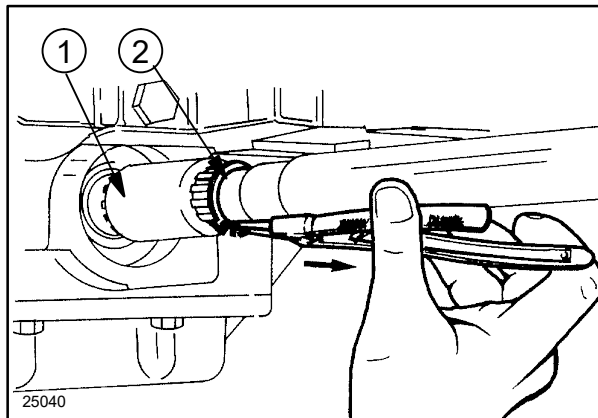
49

44. Remove the snap ring (2) and withdraw the sleeve (1) from 4WD transfer box, moving it in the direction of the arrow.



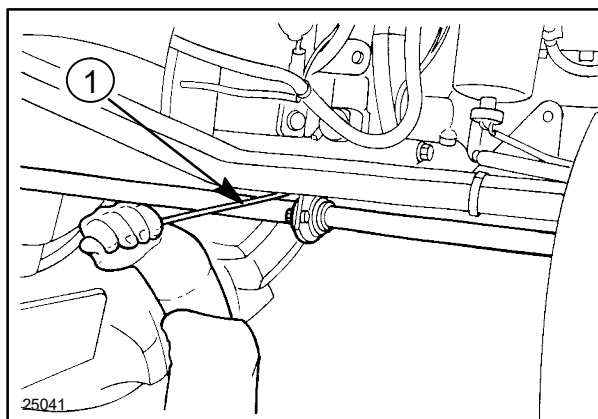
50

45. Remove the snap ring (2) and withdraw the sleeve (1) from the 4WD transfer box, moving it in the direction of the arrow.



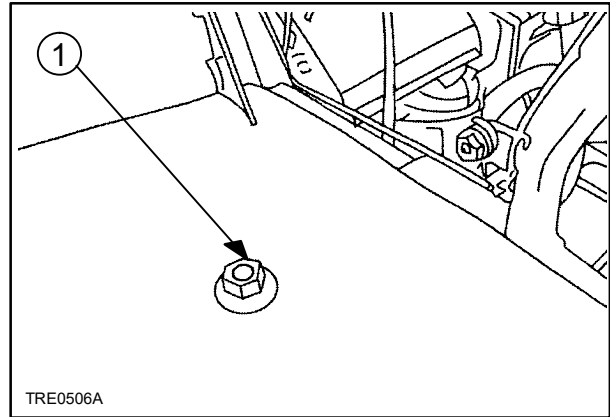
51

46. Unscrew the drive shaft centre support bolts (1) and remove the shaft complete with support.



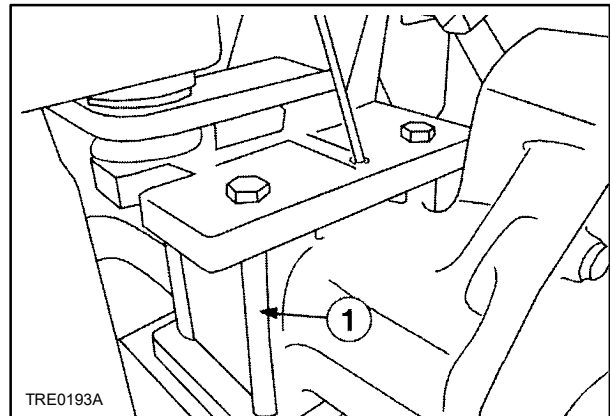
52

39. Remove the bolt (1) that secures each side of the front supports to the cab/platform.



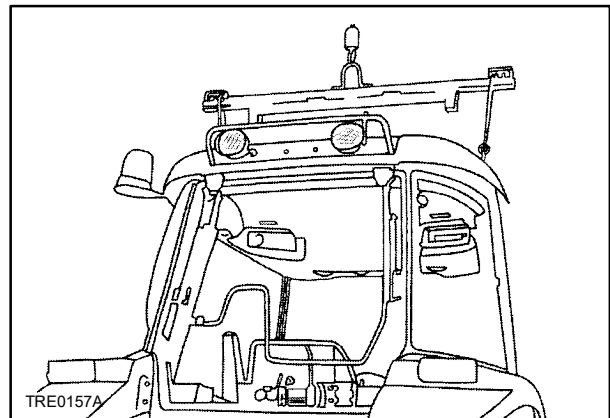
45

40. Remove four bolts (1) that secure the rear of the cab/platform to each end of the axle casing.



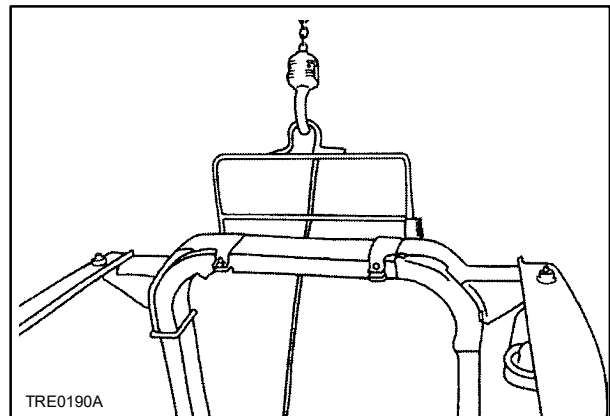
46

41. Attach the lifting bar to the lifting rings on the left and right side of the cab roof. Take all necessary precautions to prevent to prevent damaging the structure by using supports, where required. Raise the cab a little and check that there are no forgotten parts that will prevent the cab from being lifted further. If satisfactory, complete the lifting operation.



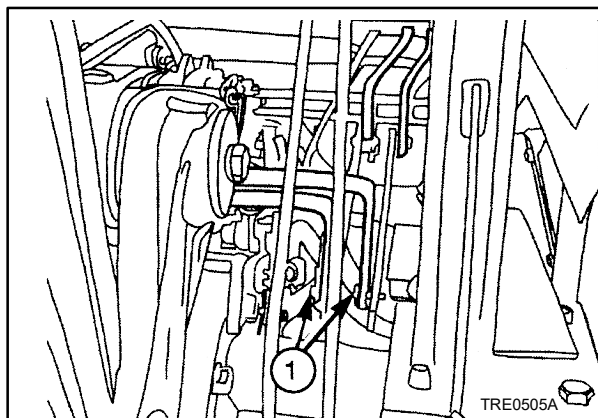
47

42. Attach two hooks to the signal support bar at the front and clamp the lifting tool to the roll-bar at the rear.



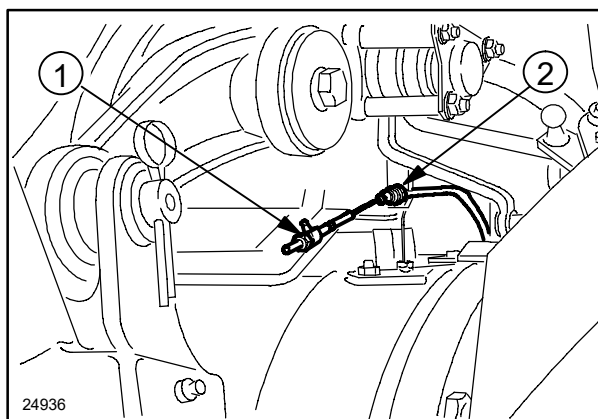
48

35. Remove the split pins (1) and respective draft and position control levers.



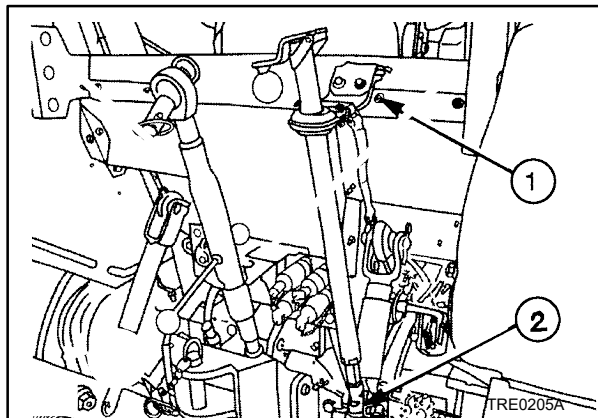
41

36. Remove the Lift-o-matic™ control cable (1) from the lever and from its mounting (2).



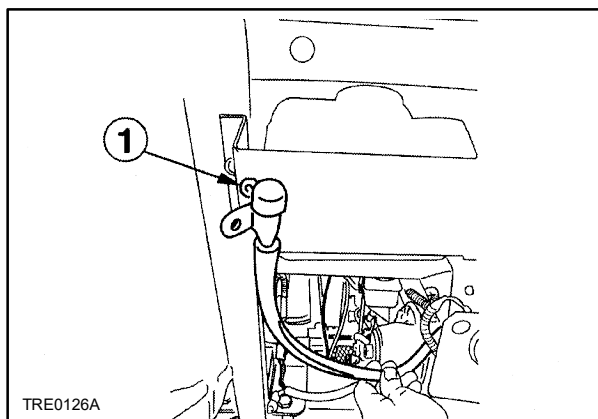
42

37. Remove the retaining pin (2) from the bottom and the support bracket bolts (1) from the top of the hydraulic lift control rod. Remove the left- and right-hand lift rods.



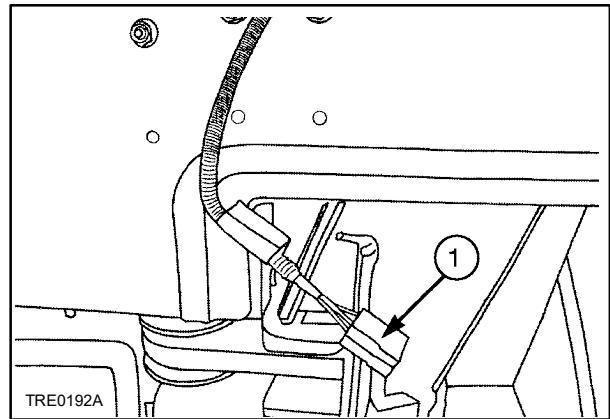
43

38. Remove the bolt (1) that secures the gearbox breather pipe clamp.



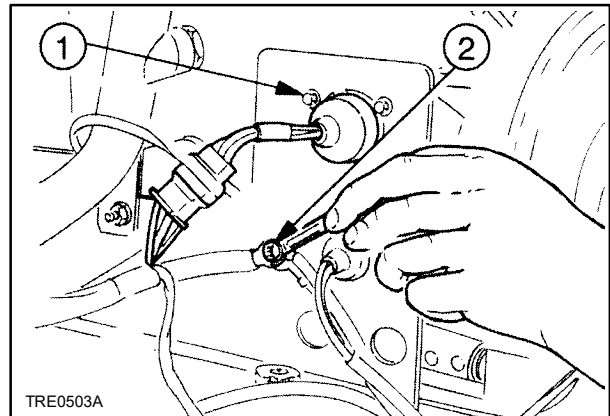
44

31. Remove the indicator and light connectors (1) from both sides of tractor.



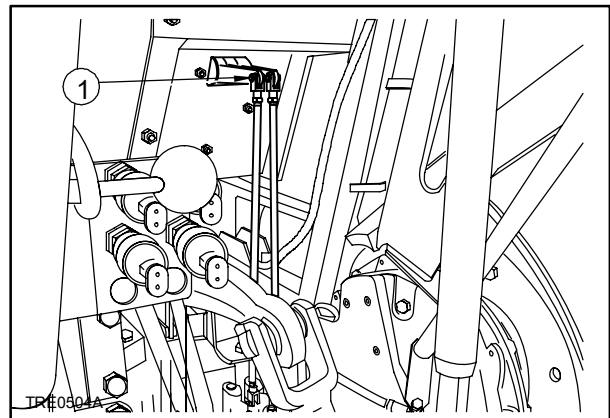
37

32. Disconnect the retaining bolts (1) from the electrical socket and remove the earth cable bolt (2).



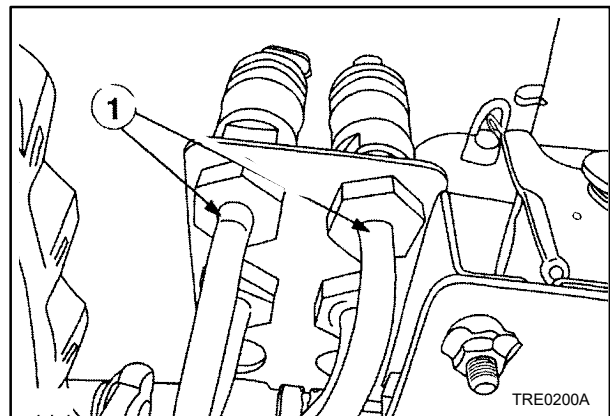
38

33. Remove the retaining pins (1) and take out the auxiliary hydraulic valve control rods.



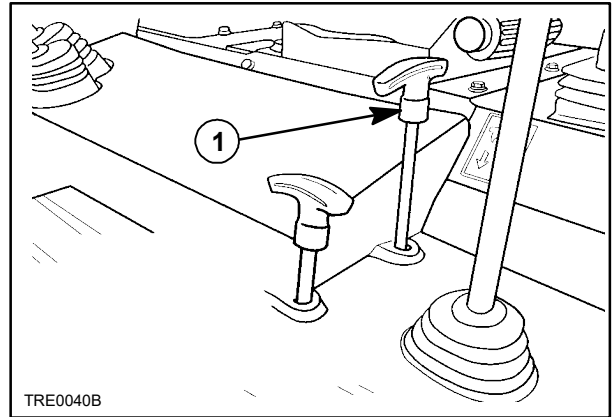
39

34. Disconnect the auxiliary valve nuts (1) from their pipes.



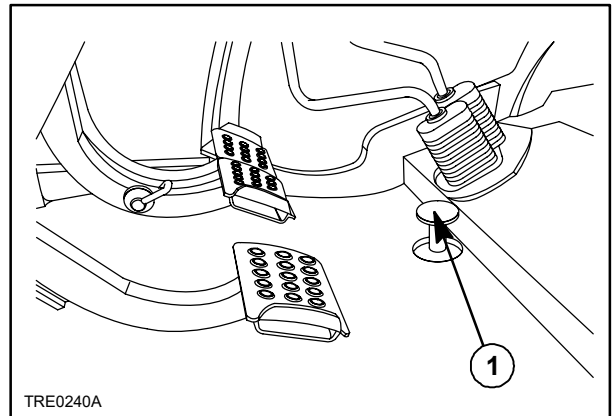
40

27. Remove the retaining pin (1) from the 4WD engagement lever and remove the lever.



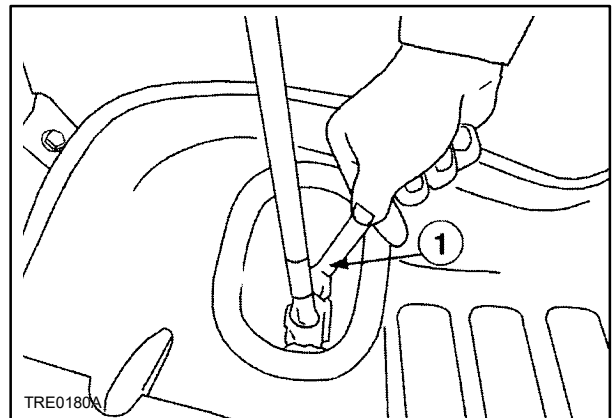
33

28. Remove the pin from the mechanical differential lock pedal and take off the pedal head (1).



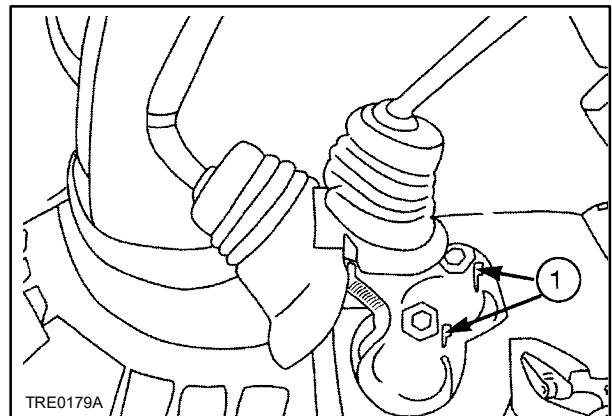
34

29. Pull up the plastic boot, remove the retaining bolt (1) and take out the reverser control lever.



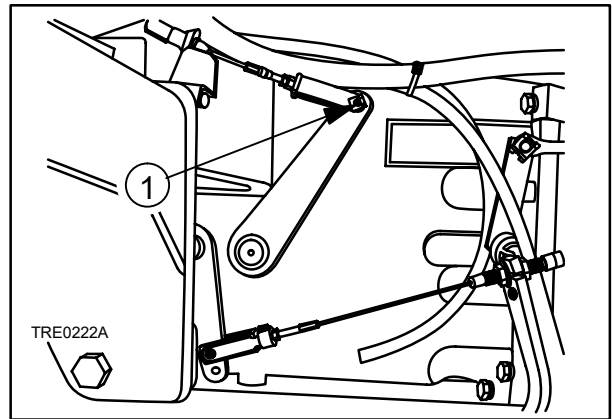
35

30. Unscrew the retaining bolts (1) and remove the main and range gear selector levers.



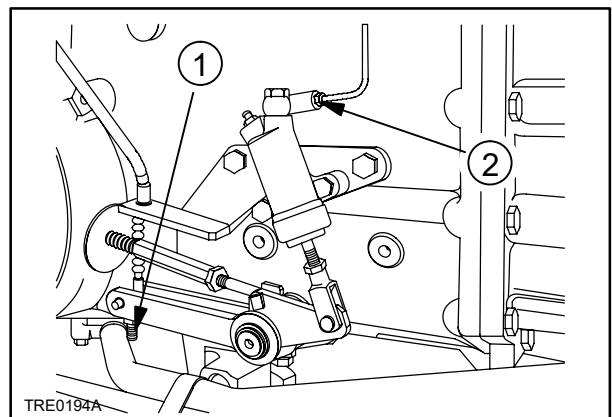
36

24. Remove the pin (1) and remove the clutch pedal cable from the upper surface of the cab/platform.



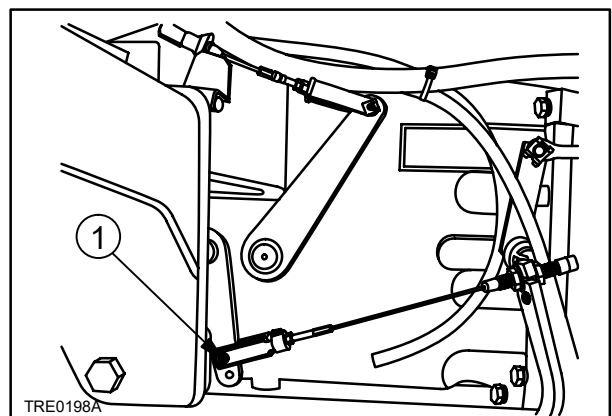
30

25. Remove the nut (1) from the parking brake control cable. Remove the slave cylinder pipes (2) on both sides.



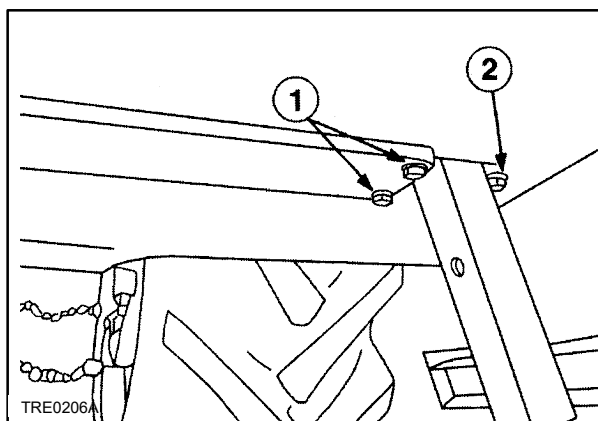
31

26. Remove the retaining pin (1) and disengage the PTO clutch cable.



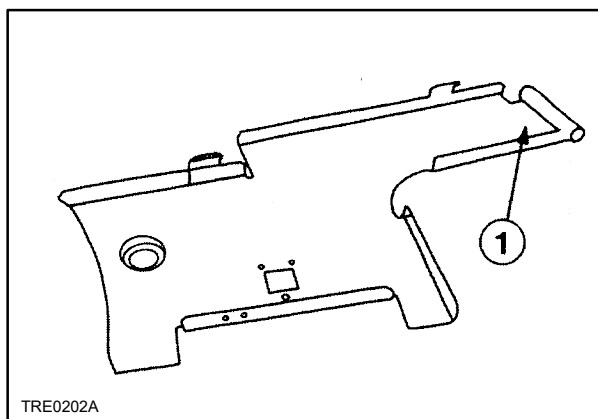
32

20. Remove the bolts (1) and (2) from steel support bracket beneath the fuel tank.



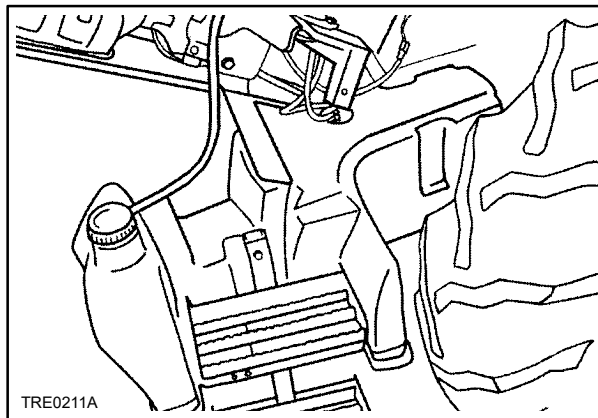
26

21. Remove the securing screws and remove the sheet metal protector (1) from beneath the fuel tank.



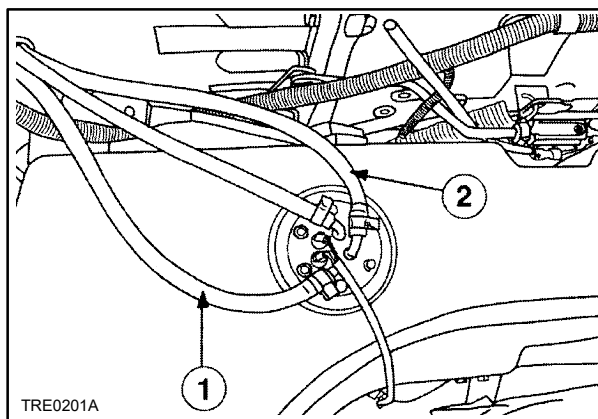
27

22. Rest the front edge of the fuel tank on the ground.



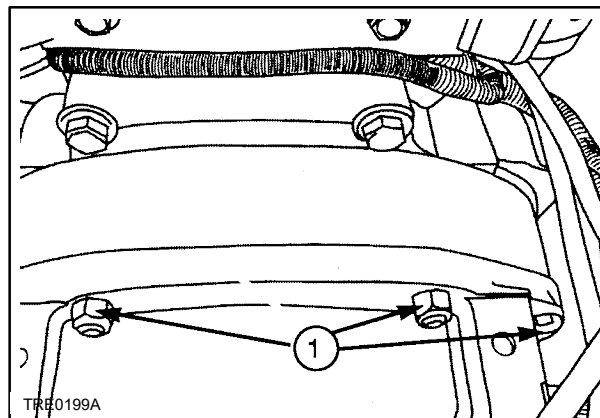
28

23. Loosen the clamps and remove the inlet (1) and return (2) pipes from the fuel tank. Remove the fuel tank completely.



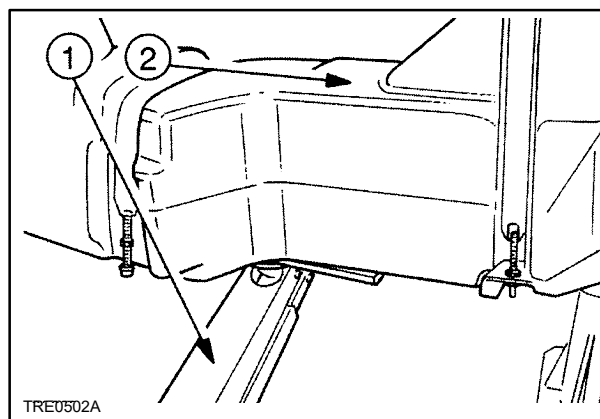
29

16. Remove the rubber floor mat from the cab/platform, then remove the surrounding bolts (1) securing engine-clutch assembly to the gear-box–rear transmission case.



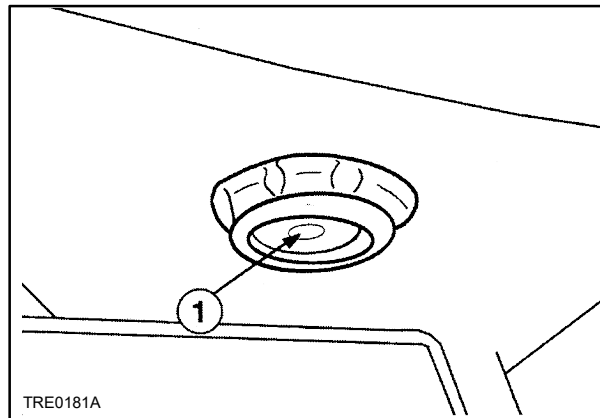
22

17. Place a hydraulic jack (1) underneath the centre of the fuel tank (2) and lift it, as necessary.



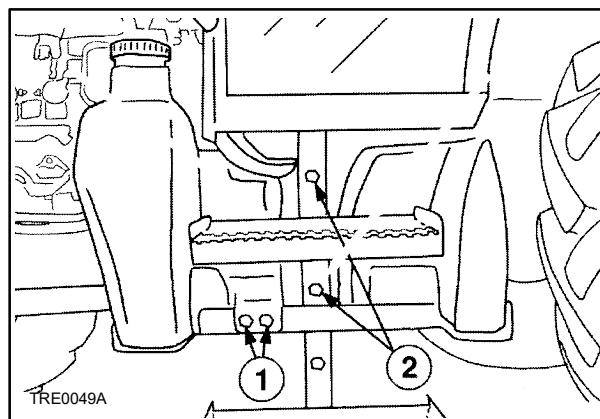
23

18. Using an Allen key, unscrew the plug (1) and drain the fuel tank using a suitable container (Choose a container taking into consideration the tank capacity of 90 litres (19.7879 gall. Imp.).



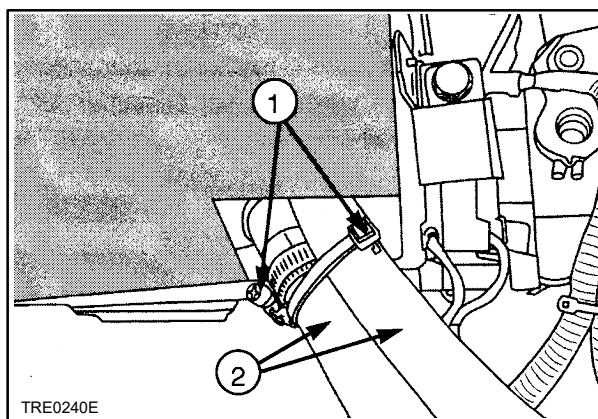
24

19. Remove the bolts (1) and (2) securing the fuel tank to the footstep.



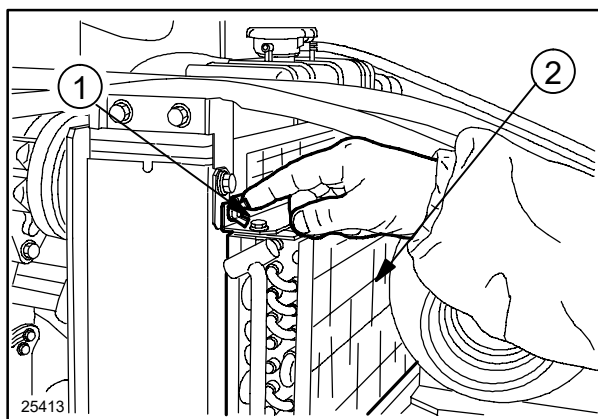
25

12. Loosen the clamps (1) and remove the cab heater outlet pipes (2). (Mark the hoses, before removal, to facilitate refitting in the correct position).



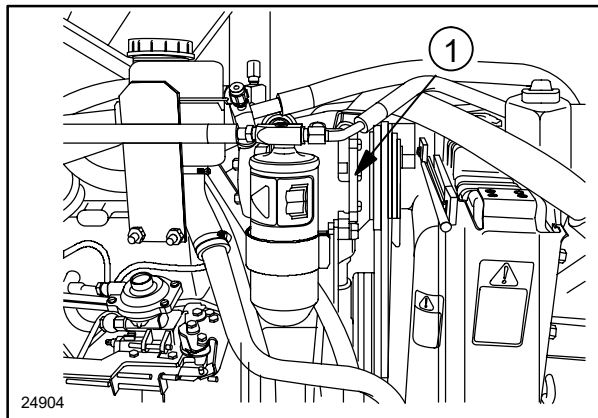
18

13. Remove the wing nut (1) securing the condenser (2).



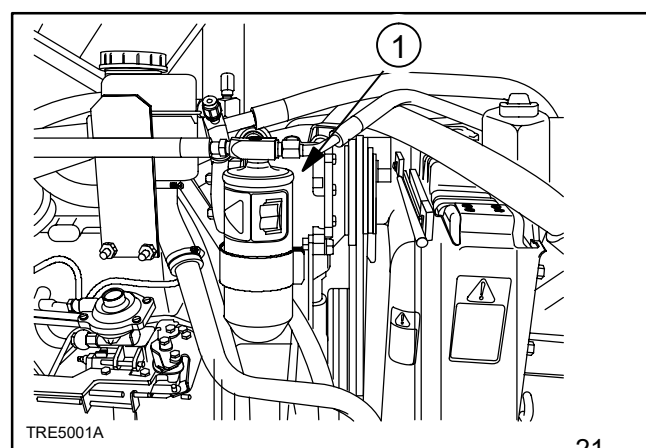
19

14. Remove the compressor retaining bolts (1) and take out the earth connection.



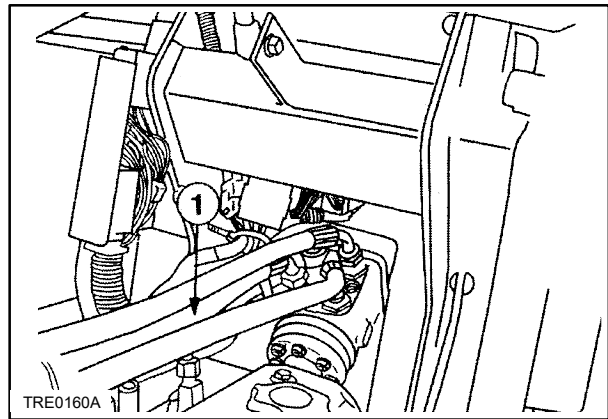
20

15. Move the disconnected compressor (1), condenser (2) Fig. 19 and filter/dryer, together with flexible hoses and valves, onto the platform.



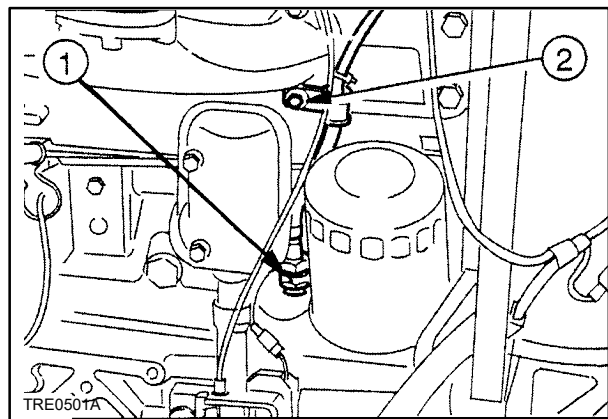
21

8. After retrieving the oil from the power steering tank, disconnect the hoses (1) from the power steering pump. (Mark the hoses, before removal, to facilitate refitting in the correct position).



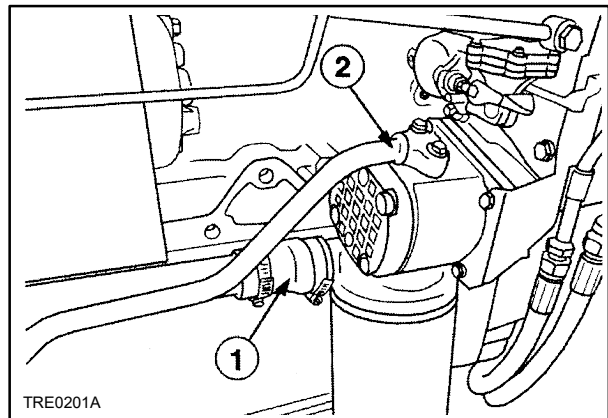
14

9. Disconnect the proofmeter drive cable from its adapter (1) and remove the retaining bolt (2).



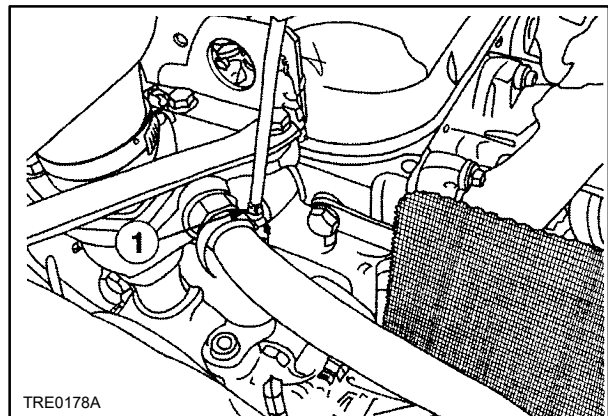
15

10. Remove the filter line (1) and pressure pipe (2) from hydraulic pump.



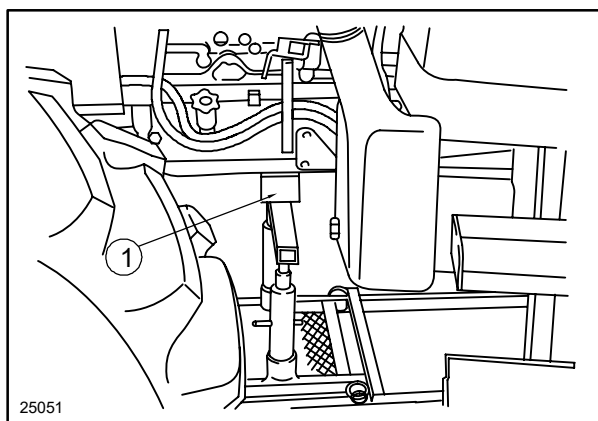
16

11. After draining off the coolant into suitable containers, unscrew the clamp (1) and remove the cab heating system intake pipe.



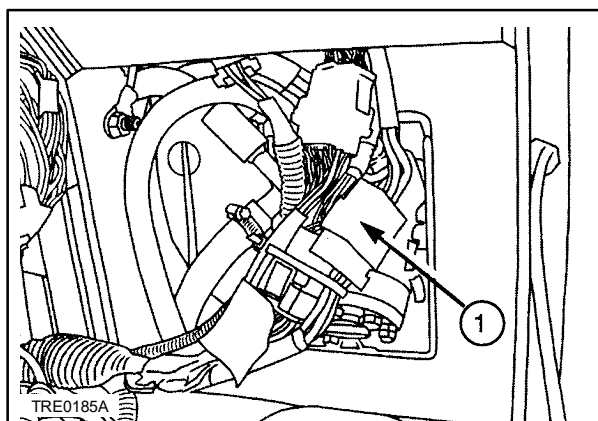
17

4. Place another moveable stand **380000236** under the front weight carrier to prevent any possibility of the engine tipping forwards when the gearbox is removed. Put wooden blocks (1) between the stands and the tractor body. Turn the stand height adjustment lever to bring the blocks (1) into contact with the tractor.



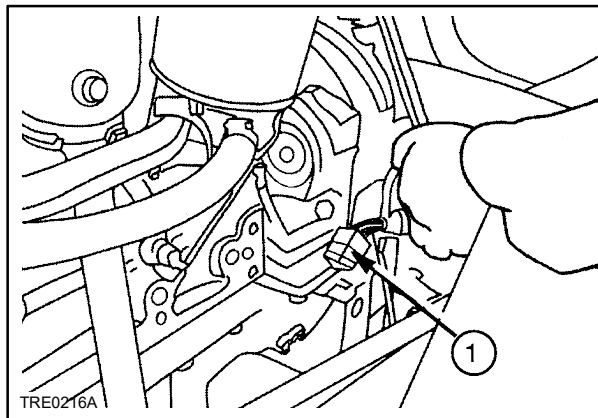
10

5. Remove electrical connections (1) going to the instrument panel.



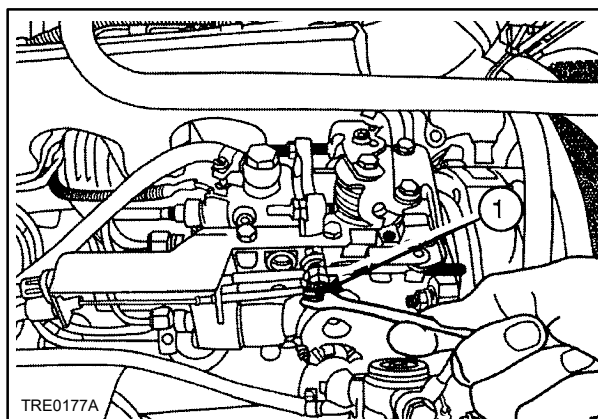
11

6. Remove the socket (1) with its cable that passes from the instrument panel and over the gearbox to the rear fender.



12

7. Remove the support bolt (1) from the injection pump and disconnect the hand and foot throttle cables.



13

REAR TRANSMISSION – GEARBOX CASE**Removal–Refitting (Op. 21 118 10 – 21 118 12)**

Related service instructions up to item 44 – see pages from 10 to 20. Also describes removal operations of suspended cab/platform (**Op. 90 110 36**) with the exception of heating pipes and air conditioning components removal.

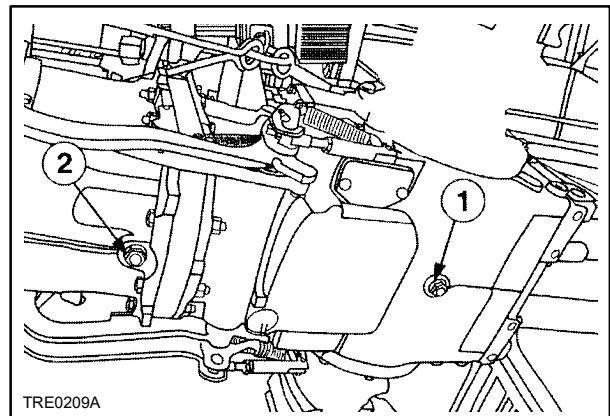
**WARNING**

Lift and handle all heavy parts using proper equipment of adequate lifting capacity.

Make sure that the assemblies and parts are supported by appropriate tools and hooks. Keep personnel away from the vicinity of the load to be lifted.

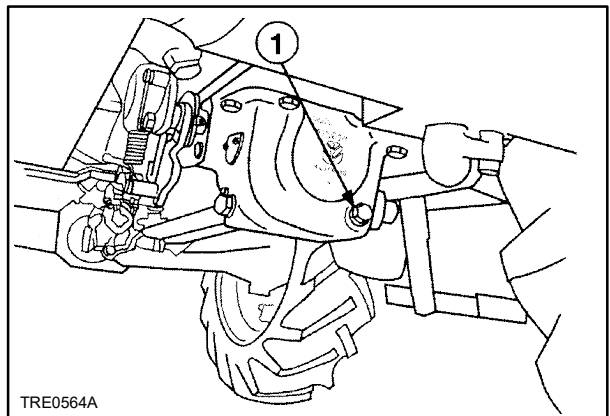
To remove the gearbox–rear transmission, proceed as follows:

1. Disconnect the negative terminal from the battery. Remove the rear transmission drain plug (1) and the gearbox drain plug (2). Drain the oil into suitable containers.



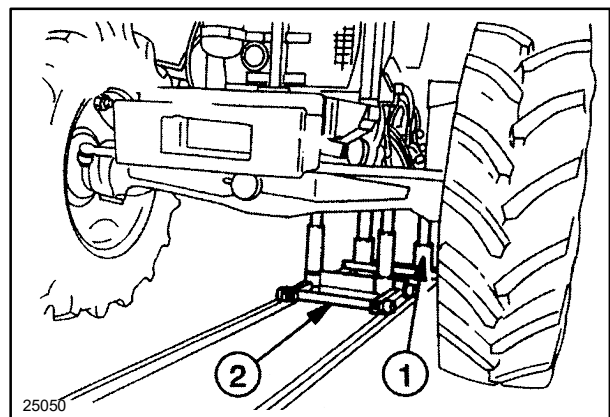
7

2. Remove the drain plug from the 4WD transfer box (1) and drain the oil into a suitable container.



8

3. Place the tractor dismantling stand **380000236**, so that the fixed support (1) is beneath the rear transmission case in supporting the engine coupling flange and the moveable support (2) under the engine in supporting the flange attached to the gearbox case.



9

DESCRIPTION AND OPERATION

The rear transmission transmits power from the gearbox to the lateral final drives by means of the bevel gear pair. The bevel gear pair is of the helical tooth type and is supported by taper-roller bearings.

The differential has two pinions and is equipped with a mechanically controlled differential lock.

Final drives are of the pinion type and are controlled by the bevel gear pair output half-shafts, the same shafts that control the footbrakes.

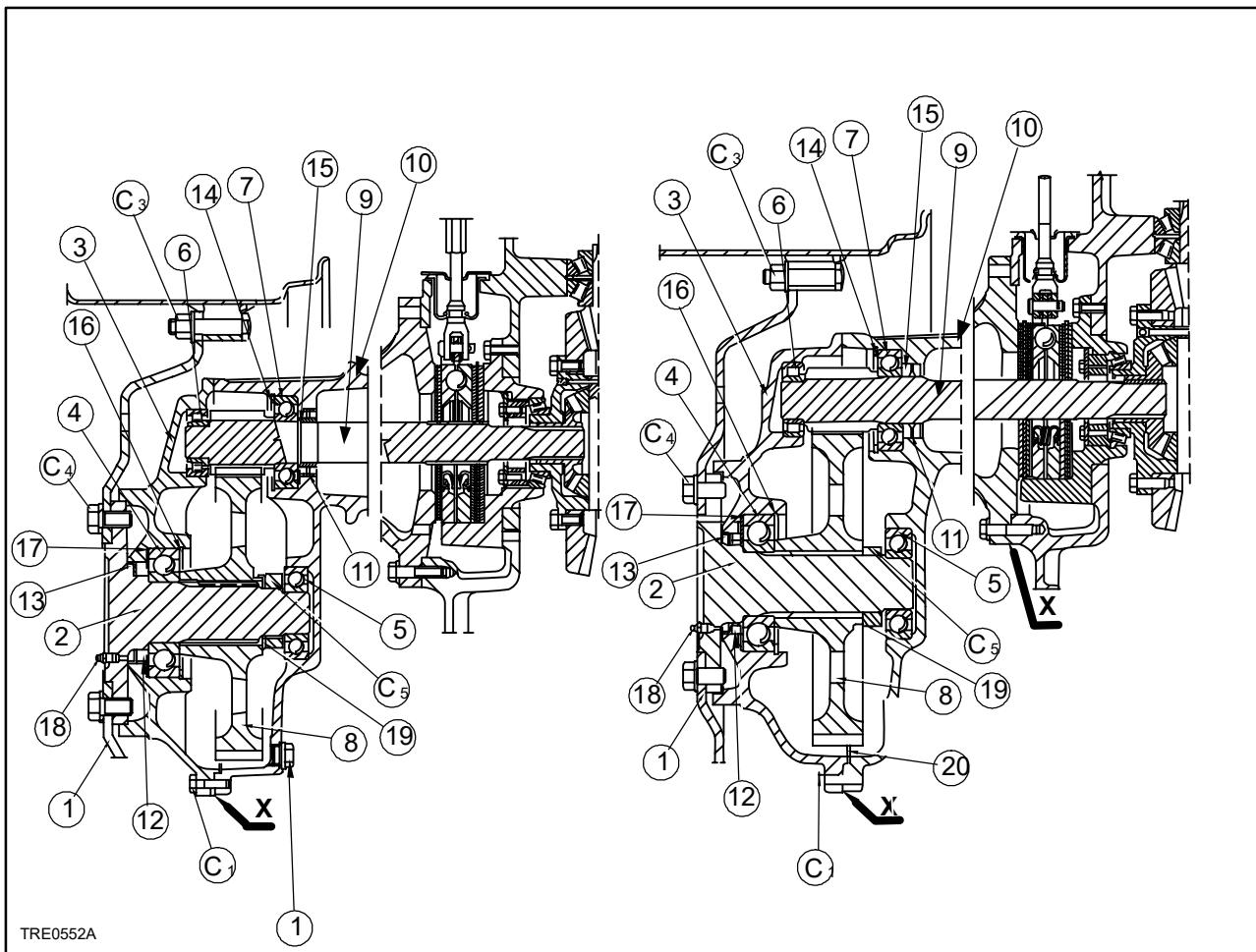
When the differential lock is not in use, it is kept disengaged by a spring that exerts a force on the fork.

FAULT FINDING FOR BEVEL GEAR PAIR AND DIFFERENTIAL

Problems	Possible causes	Remedies
Transmission noisy while the tractor is moving, even when the gearbox is in neutral (not arising from final drives).	1. Incorrect adjustment of bevel pinion and / or ring bevel gear bearings.	Remove the rear transmission box and adjust the pinion and ring bevel gear bearings correctly (page 36).
Transmission noisy when tractor is operated with or without load.	2. Excessive clearance between pinion and ring gear teeth.	Remove the rear transmission box and correctly adjust the pinion and ring gear bearings (page 36).
Differential repeats noise within short intervals.	3. An internal component is broken or defective.	Remove the rear transmission box, replace the worn parts and correctly adjust the differential gear clearance (page 39).
Transmission noisy and assembly overheats.	4. Pinion and / or ring gear bearing clearances insufficient.	Remove the rear transmission box and correctly adjust the pinion and ring bevel gear bearings (page 36).
	5. Insufficient coupling clearance between the teeth of the pinion and the ring gear.	Remove the rear transmission box and correctly adjust the ring bevel gear bearings (page 39).

FAULT FINDING FOR FINAL DRIVES

Problems	Possible causes	Remedies
Final drive noisy when tractor is moving, even with the gearbox in neutral.	6. An internal component is broken or defective.	Remove the final drive box and replace the damaged parts.

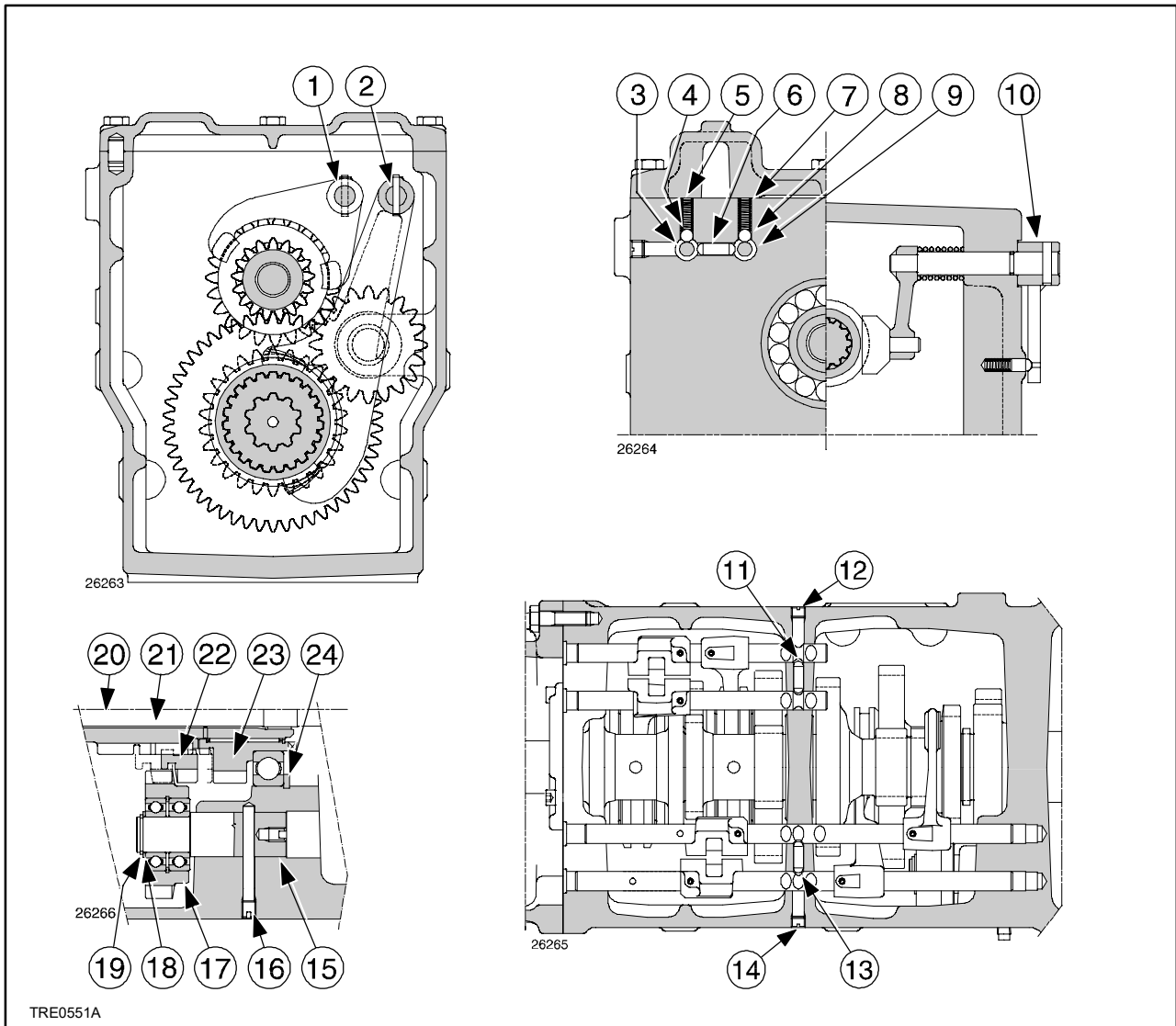


6

Cross-sectional view of final drive

- | | |
|---|----------------------------|
| a. JX70 models | 6. Roller bearing |
| b. JX80, JX90, JX95 models | 7. Ball bearing |
| C ₁ . Final drive housing cover capscrews | 8. Final drive driven gear |
| C ₂ . Capscrews securing final drive housing to transmission housing | 9. Axle shaft |
| C ₃ . Nuts securing disc to wheel rim | 10. Final drive casing |
| C ₄ . Capscrews securing disc to wheel hub | 11,12. Seals |
| C ₅ . Nut | 13. Seal guard |
| T Drain plug | 14,15,16. Retaining rings |
| 1. Wheel disc | 17. Seal thrust ring |
| 2. Wheel shaft | 18. Grease nipple |
| 3. Final drive housing cover | 19. Lockwasher |
| 4,5. Ball bearings | 20. Seal |

NOTE: During installation, apply sealing compound to surfaces **X** as shown in Section 00, Chapter 1, page 1.

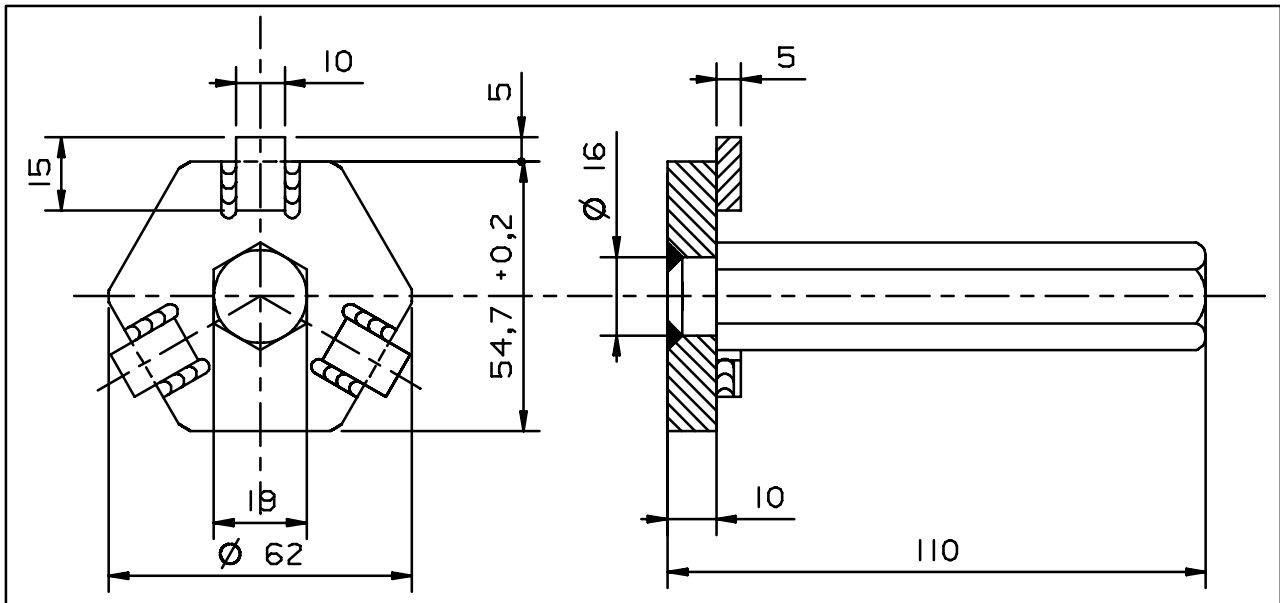


5

Sectional drawings of transmission-gearbox case

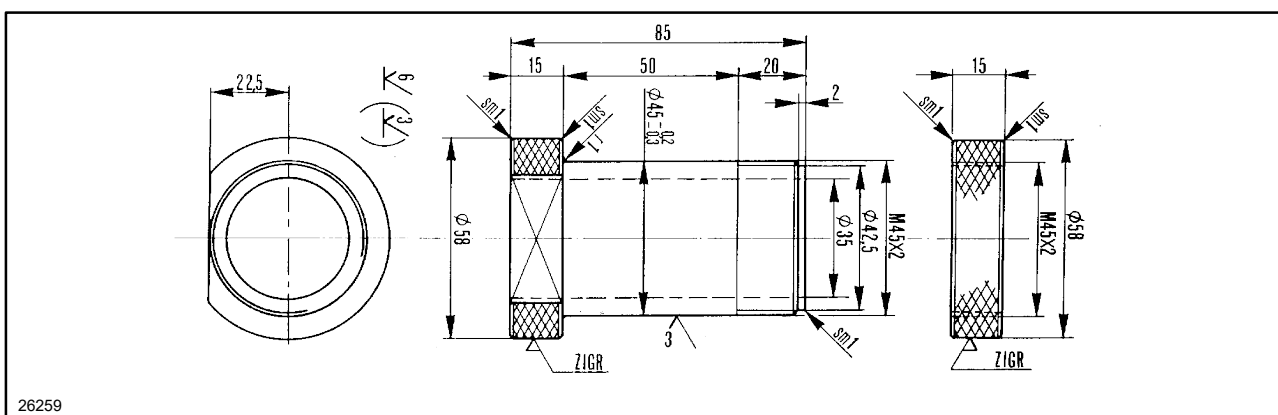
- | | |
|--|--|
| 1. Mid-range and reverse gear control rod. | 13. Range engagement safety pawl. |
| 2. Slow and fast gear control rod. | 14. Plug. |
| 3. 1st and 2nd gear control rod. | 15. Reverse gear support pin. |
| 4. Detent balls. | 16. Retaining bolt. |
| 5. Spring for ball (4). | 17. Reverse idler gear. |
| 6. Gear engagement safety pawl. | 18. Thrust bearing. |
| 7. Spring for ball (8). | 19. Snap ring. |
| 8. Detent ball. | 20. PTO shaft. |
| 9. 3rd and 4th gear control rod. | 21. Reverser drive shaft. |
| 10. PTO external control lever. | 22. Engagement gear for mid-range and reverse gears. |
| 11. Gear engagement safety pawl. | 23. Driving gear for mid-range gears. |
| 12. Plug. | 24. Snap ring. |

NOTE: Screw in plugs 12 and 14 using one of the sealing compounds listed on page 1, Section 00.



3

Tool to make for adjusting the bevel drive
(engrave number **50027** on the tool – measurements in mm)
Make in Fe 42 C material.



4

Tool to make for adjusting the assembly position of the bevel pinion shaft
(Mark tool with no. **50004** – Measurements in mm)
Make using Aq 45 material.

SPECIAL TOOLS

IMPORTANT: The operations described in this Section must be performed only with the **ESSENTIAL** tools marked with (X).

To work in complete safety and to ensure optimal technical results with a minimum of time and effort, they must be supplemented by the special tools recommended below and with those to be specially constructed by you and for which the construction diagrams are given in this manual.

List of special tools required for the various operations described in this Section :

380000236 Trolley for tractor disassembly.

380000277 Hook for lifting clutch box.

380000301 Rotating stand for overhaul.

380000271 Rear mounting (with **380000301**).

380000272 Front mounting (with **380000301**).

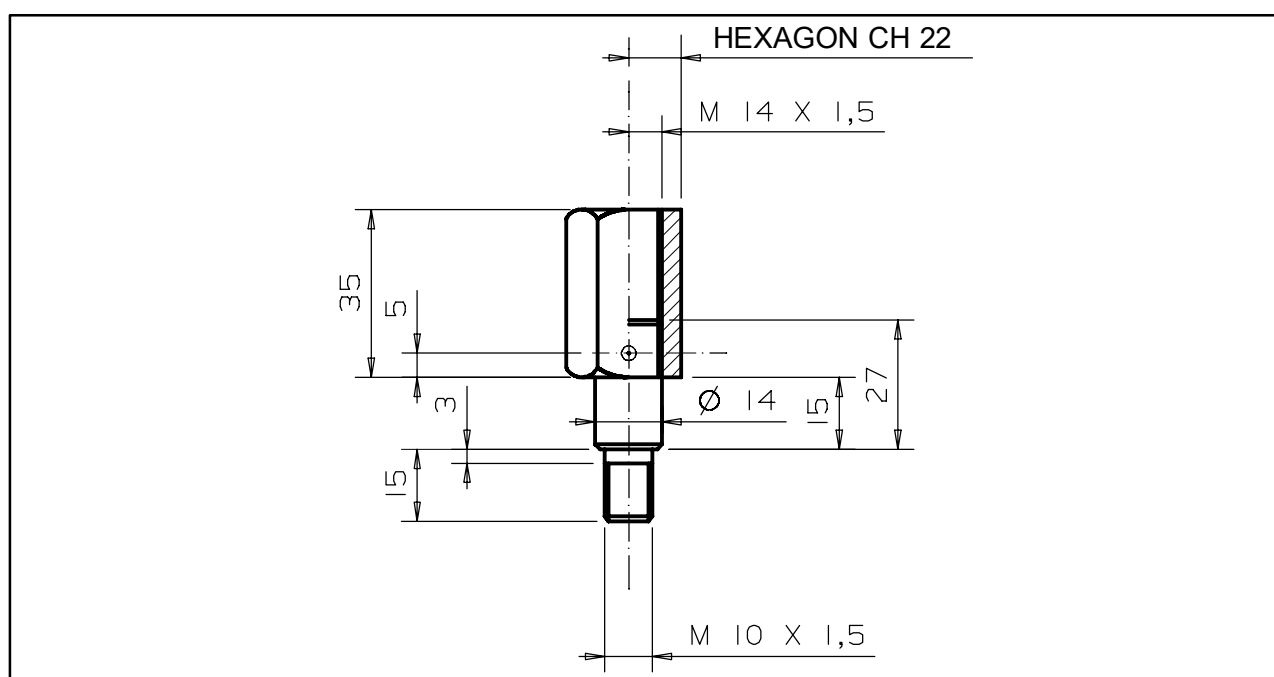
X 380000838 Adapter for extracting bevel pinion (with **380000549**).

380000549 Slide hammer.

380000249 Bevel pinion positioning gauge.

50006 Punch for removing gearbox drive shaft (see page 4, Sect.21, Chapter 1).

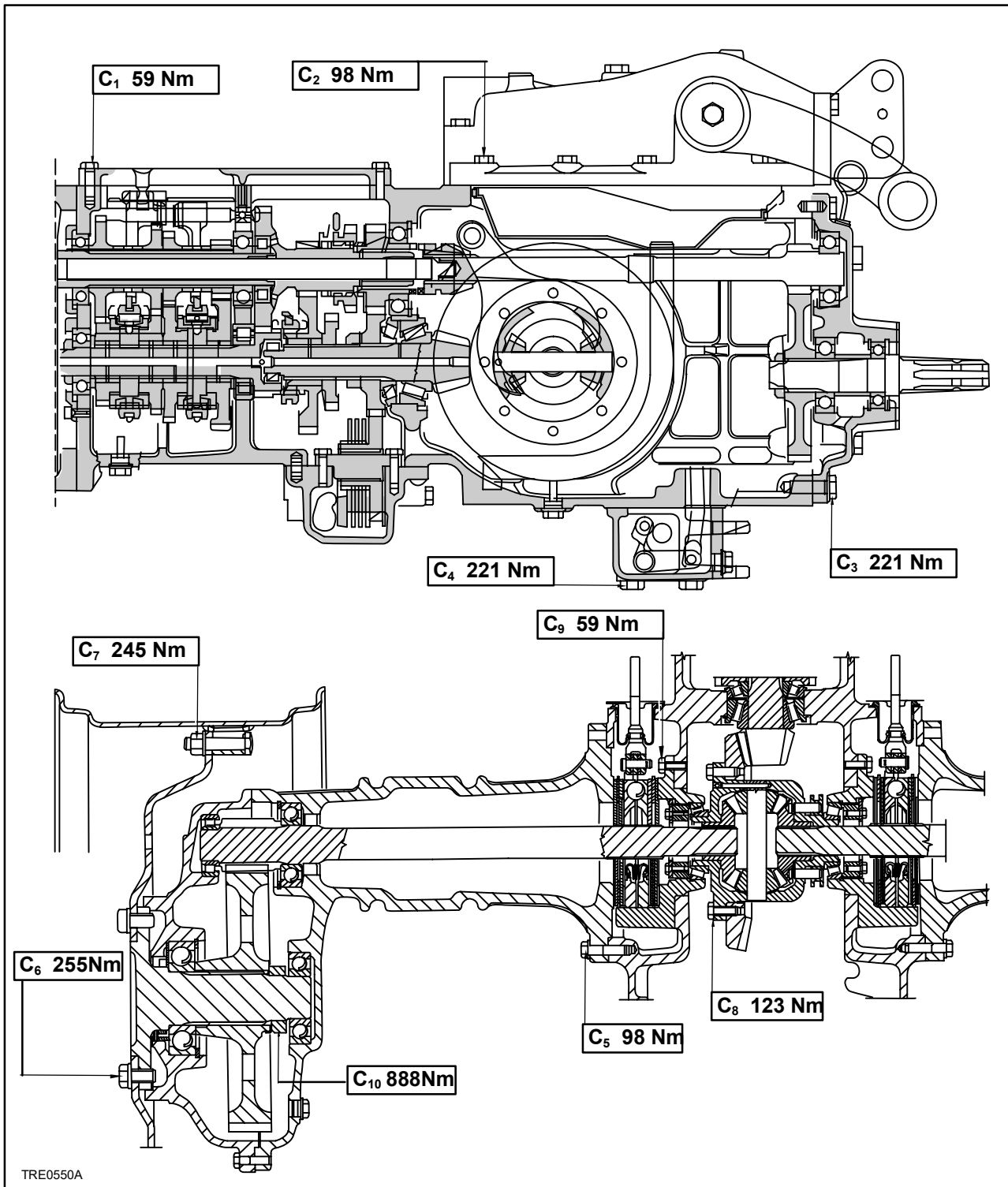
50007 Tool for adjusting gearbox drive shaft (see page 4, Section 21, Chapter 1).



2

Tool to make for bevel pinion extraction
(Mark part with No. **50144** – Measurements in mm)
Make in UNI C40 material. Spring pin 3 x 20 mm.

SECTIONAL VIEWS



TORQUE SETTINGS – Refer to fig. 1 on page 4

PART TO BE TIGHTENED	Thread	Torque settings	
		Nm	ft lb
Retaining bolts for rear transmission/gearbox upper cover (C ₁) . . .	M 10 x 1.25	59	43.5161
Bolts for securing lift to rear transmission box (C ₂)	M 12 x 1.25	98	72.2811
Bolts for securing PTO box to transmission / gearbox case (C ₃)	M 16 x 1.5	221	163.0012
Bolts for securing torsion bar to transmission / gearbox case (C ₄)	M 16 x 1.5	221	163.0012
Nuts for stud bolt securing final drive box to transmission / gearbox case (C ₅)	M 12 x 1.25	98	72.2811
Drive wheel hub to disc retaining nuts (C ₆)	M 18 x 1.5	255	188.0783
Drive wheel rim to disc retaining nuts (C ₇)	M 16 x 1.5	245	188.7027
Ring bevel gear retaining bolts (C ₈)	M 12 x 1.25	123	90.7201
Bevel drive – differential support retaining self-locking bolts (C ₉)	M 10 x 1.25	59	43.5161
Final drive casing cover retaining bolts (C ₁₀)	M 10 x 1.25	59	43.5161
Drive wheel axle retaining nut (C ₁₁)	M 55 x 1.5 M 60 x 2	882 882	650.5297 650.5297
Differential lock pedal support retaining bolts	M 10 x 1.25	49	36.1405
Nuts for drive wheel ballast ring retaining bolts	M 14 x 1.5	98	72.2811

MAIN SPECIFICATION OF BEVEL GEAR PAIR AND DIFFERENTIAL

(cont.)

	JX60 – JX70	JX80 – JX90 – JX95
Bevel pinion positioning adjustment	see pages 39	
Adjuster shims for bevel pinion positioning mm (in.)	1.85 – 1.90 – 1.95 – 2.00 – 2.05 – 2.10 – 2.15 – 2.20 – 2.40 – 2.45 – 2.50 – 2.55 – 2.60 – 2.65 – 2.70 (0.0728 – 0.0748 – 0.0768 – 0.0787 – 0.0807 – 0.0827 – 0.0846 – 0.0866 – 0.0945 – 0.0965 – 0.0984 – 0.1004 – 0.1024 – 0.1043 – 0.1063)	
Adjusting ring bevel gear bearings and bevel gear pair coupling clearance	see page 181	
Differential pinion and side gear backlash mm (in.)	0.15 (0.0059)	0.18 (0.0071)
Thickness of differential side gear clearance adjustment shims mm (in.)	1.5–1.6 (0.0591–0.0630)	
Thickness of differential pinion thrust bearings mm (in.)	1.47–1.53 (0.0579–0.0602)	
Adjusting clearance between pinion and side gear teeth	see page 185	
Adjusting differential lock	see page 177	
Differential lock control fork adjuster shim mm (in.)	0.5 (0.0197)	
Spring for differential lock control fork:		
– free spring length mm (in.)	220 (8.6614)	
– length of spring under load of 177–195 N (3.9922–4.3892 lb) mm (in.)	157.5 (6.2008)	

MAIN SPECIFICATIONS OF FINAL DRIVES

	JX60 – JX70	JX80 – JX90 – JX95
Type	pinion type and spur gears	
Reduction ratio	11:62= 1:5.6	11:67=1:6.1 (for JX80–JX90) 11:68=1:6.2 (for JX95)

SECTION 27 – REAR AXLE AND TRANSMISSION**Chapter 1 – Rear axle and transmission****CONTENTS**

Section	Description	Page
27 000	Main data	1
	Tightening torques	3
	Special tools	5
	Cross-sectional views	7
	Description and operation and troubleshooting	9
21.118.10 – 12	Transmission-gearbox casing Removal-Installation	10
21.118.85	Transmission-gearbox casing Disassembly-Overhaul	27
	Gearbox driven shaft end float adjustment	35
	Differential lock engagement sleeve adjustment	36
	Determining the bevel pinion positioning adjustment ring	37
	Adjusting the taper roller bearings for the bevel pinion shaft	39
	Adjusting the bearings and checking the backlash	40
	Differential pinion and side gear backlash adjustment	44

**27 000 – MAIN SPECIFICATION – TORQUE SETTINGS – SPECIAL TOOLS – SECTIONAL VIEWS –
DESCRIPTION AND OPERATION – FAULT FINDING**

MAIN SPECIFICATION OF BEVEL GEAR PAIR AND DIFFERENTIAL

		JX60 – JX70	JX80 – JX90 – JX95
Bevel gear pair gear ratio		9/43 = 1:4.8 (30 kph (18.6 mph)) 11/43 = 1:3.9 (40 kph (24.9 mph))	
Bevel gear pair tooth clearance	mm (in.)	0.18 – 0.23 (0.0071 – 0.0091)	
Type of differential		with two planet gears	
Mechanical differential lock control		by means of pedal	
Release for mechanically controlled differential lock		controlled by foot brake pedals	
Differential pinion internal seat diameter	mm (in.)	24.040 – 24.061 (0.9465 – 0.9473)	25.040–25.061 (0.9858 – 0.9867) (for JX80–JX90) 28.040–28.061 (1.1039 – 1.1048) (for JX95)
Differential pinion pin diameter	mm (in.)	23.939 – 23.960 (0.9425 – 0.9433)	24.939–24.960 (0.9818 – 0.9823) (for JX80–JX90) 27.939–27.960 (1.1000 – 1.1007) (for JX95)
Clearance between differential pinions and their pins ...	mm (in.)	0.080 – 0.122 (0.0031 – 0.0048)	0.080 – 0.122 (0.0031 – 0.0048)
Diameter of side gear hub seats on differential box	mm (in.)	44.080 – 44.119 (1.7354 – 1.7370)	51.100 – 51.146 (2.0118 – 2.0136)
Diameter of side gear hubs	mm (in.)	43.961 – 44.000 (1.7307 – 1.7323)	50.954 – 51.000 (2.0061 – 2.0079)
Clearance between side gears and their seats	mm (in.)	0.080 – 0.158 (0.0031 – 0.0062)	0.100 – 0.192 (0.0039 – 0.0076)

(see over)

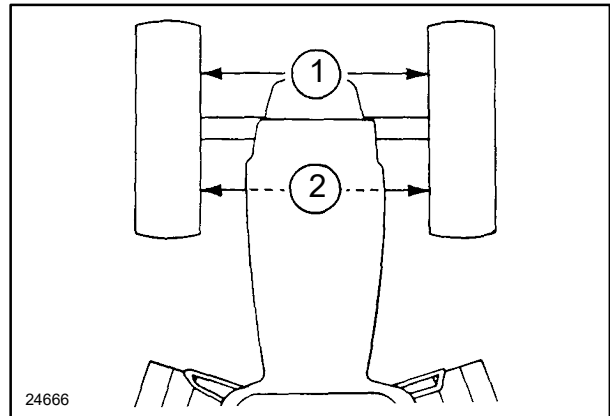
CHECKING THE ALIGNMENT OF STEERING DRIVE WHEELS (Op 44 511 80)

When travelling forward in a straight path, the wheels of four-wheel drive tractors must be parallel to the longitudinal axis of the tractor, alternatively a slight toe-in of the front wheels is permissible up to a maximum of 6 mm (0.2362 in.) as measured at the edges of the wheel rims.

To check the exact value of the toe-in setting of four-wheel drive tractors, proceed as follows.

1. Inflate the front tyres to the prescribed pressure.
2. Position the steering at the straight ahead position (along the longitudinal axis of the tractor).
3. Check that the wheels are parallel to the longitudinal axis of the tractor.
4. Make a chalk mark on the **front** inside edges of both wheel rims, at the height of the wheel hub centres. Measure the distance (1) between the chalk marks.
5. Move the tractor forward to turn both front wheels through 180°. The chalk marks will now be measure between the **rear** inside edges of the wheel rims at the height of the wheel hub centres. Now measure the distance (2) checking that this new measurement is equal to or greater than the distance (1) by a maximum of 6 mm.

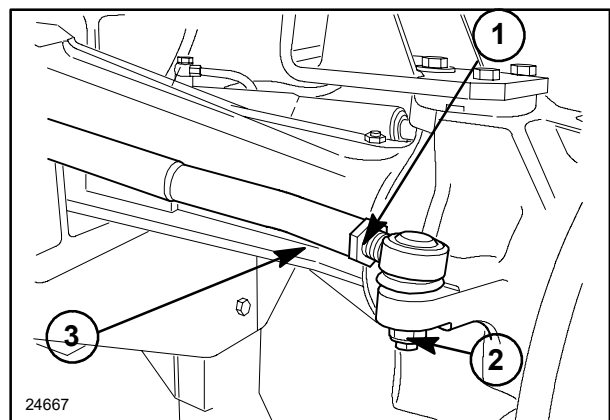
The rotation of the wheels through 180° is necessary to eliminate the effect of wear, misalignment or distortion of the wheel rims on the measurements obtained.



84

6. If it is necessary to correct the wheel alignment, remove nut (2) and pull the track rod end (1) out of its housing. Slacken off locknut (3) and screw the track rod end (1) in or out to increase or decrease the distance (2) fig. 84. Reposition the track rod end (1) in its housing and re-check alignment as described in points 4 and 5 above. After having adjusted the alignment to within the prescribed limits, tighten locknut (3) to a torque of 180 Nm (134.9738 ft lb) and nut (2) to 100 Nm (73.7562 ft lb).

NOTE: The self-locking nut (2) must be renewed each time it is removed or partially unscrewed.



85

FRONT AXLE DIFFERENTIAL WITH NO SPIN **OP. 25 102 26**

Overhaul



WARNING

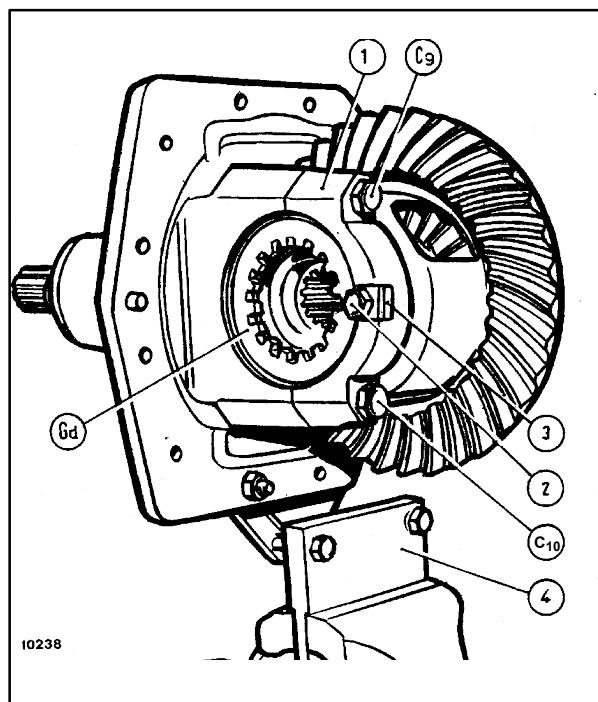


Handle all parts with care. Do not put your hands or fingers between parts. Wear suitable safety clothing, safety goggles, gloves and footwear.

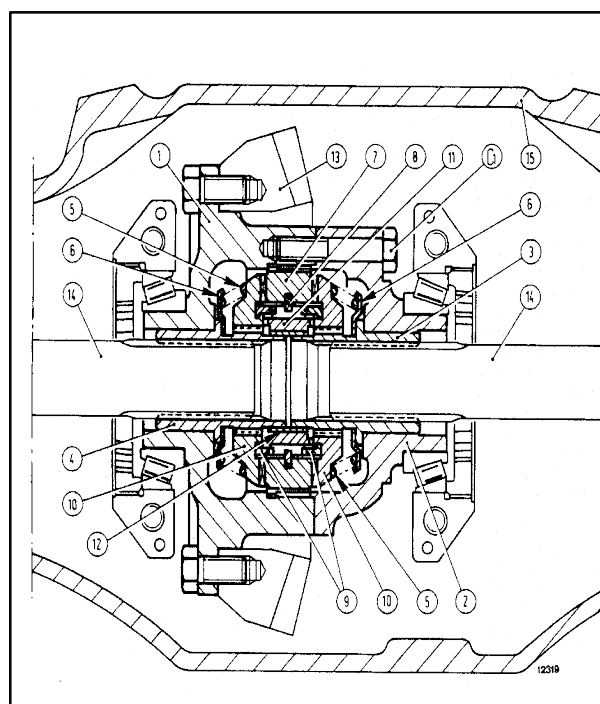
1. Remove the bevel drive-differential casing assembly from the front axle and attach to the support **380000255** (4). Lock the support in a vice and proceed with disassembly, as follows.
2. Remove the bolts (2) and the left- and right-hand ring nut lock plates (3).
3. Check that the right and left-hand caps (1) are clearly marked, so as not to mix the parts during reassembly.
4. Remove the left- and right-hand bearing adjustment ring nuts (Gd) from the crown wheel.
5. Remove the bolts (C₁₀), securing the caps (1) and separate the crown wheel from the bevel pinion support.
6. If necessary, unscrew the retaining bolts (C₃ page 4) and remove the crown wheel.

Disassemble the NO SPIN self-locking differential lock as follows.

7. Remove the retaining bolts (1) from the differential half-casing.
8. Open the differential casing
9. Remove the central driven (7), retaining the differential half - casing.
10. Proceed with self-locking the differential assembly operations, carrying out the previously described operations in reverse order Tighten the bolts (C₁, fig. 84) torque value of 56-62 Nm (41.3034-45.7288 ft lb)
11. Refit the crown wheel bolts (C₃, page 4) and torque to a value of 113 Nm (83.3445 ft lb)
12. Assemble the crown wheel, complete with NO SPIN self-locking differential lock, onto the bevel drive support. Remember to fit the previously marked crown wheel bearing support caps in the correct order and assemble and then adjust the crown wheel bearings as indicated on page 32 and following.



83



84

NOTE:

Check NO SPIN differential unit operation as follows:

- With the engine off, engage a gear and the front wheel drive, apply parking brake and raise front of tractor.
 - Rotate the front wheels in a forward direction to eliminate play. Hold the L.H. wheel and rotate the R.H. wheel rearwards. The NO SPIN differential will disengage and the wheel will rotate with an indexing or metallic clicking sound.
 - Stop the R.H. wheel, then turn forwards slightly. The NO SPIN differential will engage and stop the wheel. Rotate both wheels backwards to eliminate play, hold the L.H. wheel and rotate the R.H. wheel forwards. The NO SPIN differential will disengage and the wheel will rotate with an indexing or metallic clicking sound.
 - Stop R.H. wheel, then turn backwards slightly. The NO SPIN differential will engage and stop the wheel.
 - Repeat the above operations while holding the R.H. wheel.
-

OPERATION

The **NO SPIN** differential performs the following key functions:

- Permits full use of tractor pull.
- Prevents wheel-spin when one wheel loses traction.
- Compensates for differences in wheel travel which occur when turning or traveling over uneven ground.

When the tractor is in a straight forward or reverse mode of operation, the **NO SPIN** allows equal speed to be distributed to both wheels.

When the tractor makes a turn or a front wheel passes over an obstruction, the outer wheel or the wheel on the obstruction must travel faster and farther than the other. To do this it automatically disengages, passes over the obstruction or negotiates the curve and re-engages again automatically.

If one wheel should lose traction momentarily, the opposite wheel, which still has traction, continues to pull the vehicle until traction is regained by both wheels.

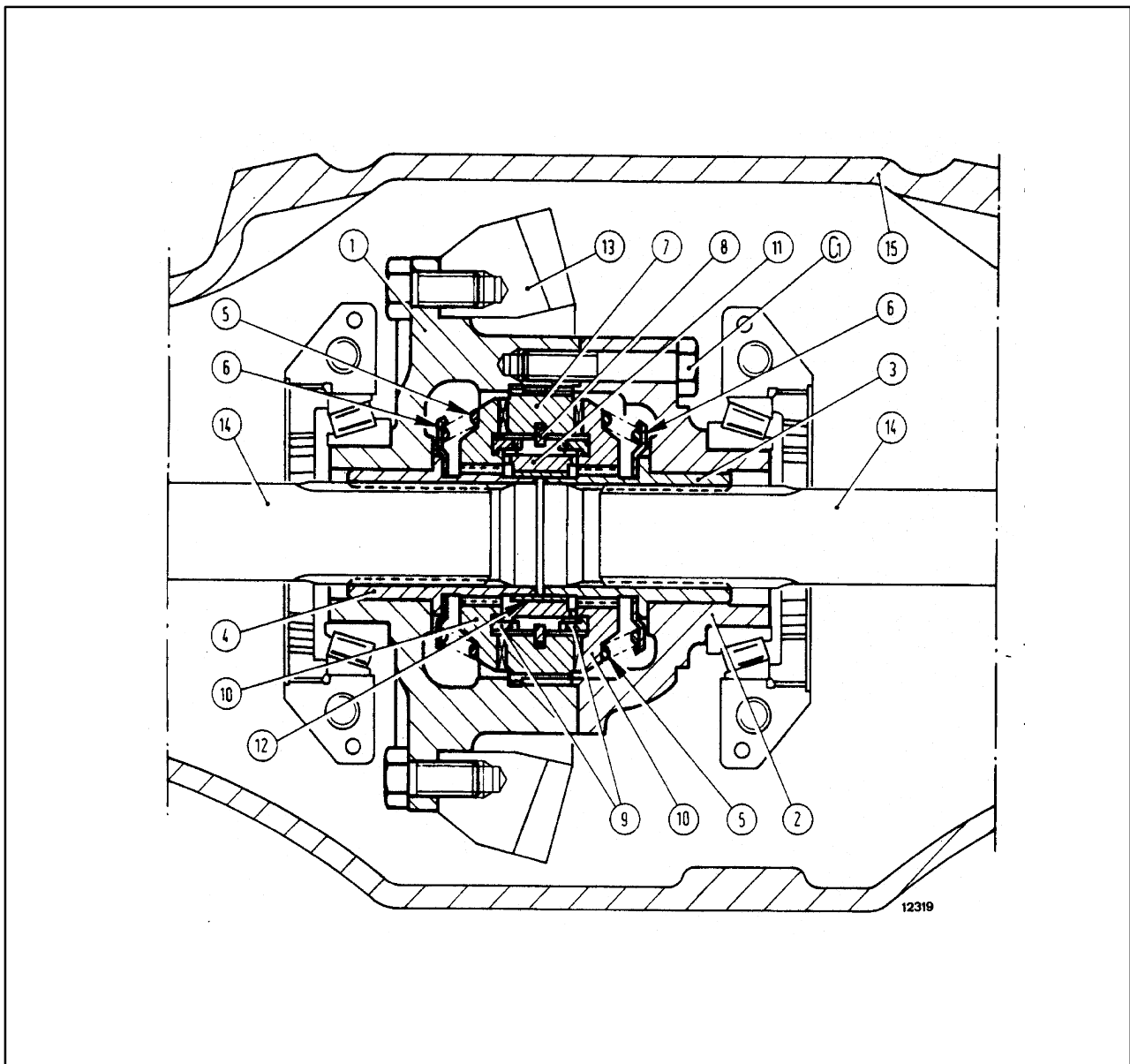
Turning: In a left turn, for instance, the right-hand wheel increases speed. The axle shaft (14) (page 39), transmits this speed increase to the left side gear (3) to the left driven clutch (10) and to the associated cam holdout ring (9). When the speed difference between the two wheels reaches a given value, ring (9) and clutch (10) overcome spring load and disengage from the centre cam (11), remaining in this position until the end of the curve.

NOTE: For correct **NO SPIN** differential operation, tyres must be equal (within a few millimetres) in rolling circumference. Small differences may be corrected by adjusting tyre inflation pressure. To check the rolling circumference of a tyre, proceed as follows:

With the tractor on a hard, level surface, mark the edge of the tyre, with chalk, at the lowest point (where it contacts the ground). Mark the ground at the same spot.

Move the tractor forward so that the tyre rotates exactly one revolution, i.e., when the chalk mark on the tyre contacts the ground again. Measure the distance travelled. This is the rolling circumference of the tyre.

Repeat on the opposite wheel to check that both tyres have the same rolling circumference.

NO SPIN DIFFERENTIAL (optional)**Section through differential with NO-SPIN unit**

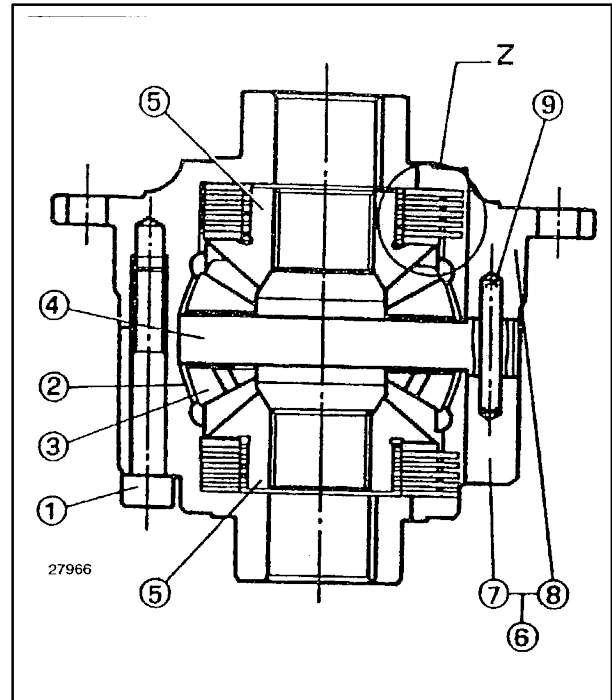
82

C1 = Case capscrew, tightening torque 56 to 62 Nm (41.3034 to 45.7288 ft lb)

- | | |
|-----------------------------|-------------------------|
| 1 - Case, flange half | 8 - Retaining ring |
| 2 - Case, cap half | 9 - Cam holdout rings |
| 3 - Side gear | 10 - Driven clutch |
| 4 - Side gear | 11 - Centre cam |
| 5 - Springs | 12 - Stop |
| 6 - Spring retainer | 13 - Ring gear |
| 7 - Central driven assembly | 14 - Axle shafts |
| | 15 - Front axle housing |

Disassemble the LIM-SLIP self-locking differential lock as follows:

7. Remove the retaining bolts (1) from the differential half-casing.
8. Open the differential casing (6).
9. Remove the half-casing (7) the differential pin (4), complete with the planet gears (3), the thrust washers (2) and the pins (9).
10. Remove the side gear (5) the friction disc (11), the metal discs (10) and the friction discs (12) from the half-casing (8).
11. Check the wear on the metal discs (10) and the friction discs (11) and (12) - see table below. Replace any parts that show signs of wear.
12. Proceed with the self-locking differential assembly operations, carrying out the previously described operations in reverse order. Apply LOCTITE 270 to the threads on the screws (1) and tighten to a torque value of 50 Nm (36.8781 ft lb).



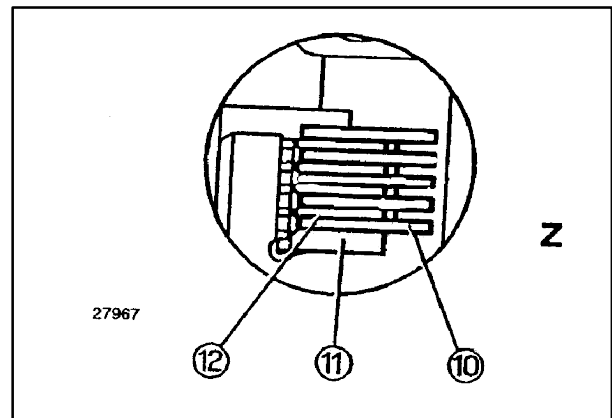
80

LIM-SLIP self-locking differential lock

13. Re-install the crown wheel (if previously disassembled) to the half-casing (8). Tighten the screws (C₃, page 4) to a torque of 113 Nm (11.5 kgm).

14. Check the rolling torque of the bevel pinion as indicated on page 32 and following.

15. Assemble the crown wheel, complete with LIM-SLIP self-locking differential lock, onto the bevel drive support. Do not forget to fit the previously marked crown wheel bearing support caps in the correct order. Assemble and then adjust the crown wheel bearings as indicated on page 32 and following.



Friction parts detail

81

LIM-SLIP SELF - locking differential lock friction discs				
Part no.	Description	Quantity	Thickness mm (in.)	Maximum wear per disc mm (in.)
10	Metal discs	10	1.5 (0.0591)	-
11	Friction discs	2	2.8 (0.1102)	0.10 (0.0039)
12	Friction discs	8	1.6 (0.0630)	0.15 (0.0059)

LIMITED-SLIP, SELF-LOCKING DIFFERENTIAL LOCK

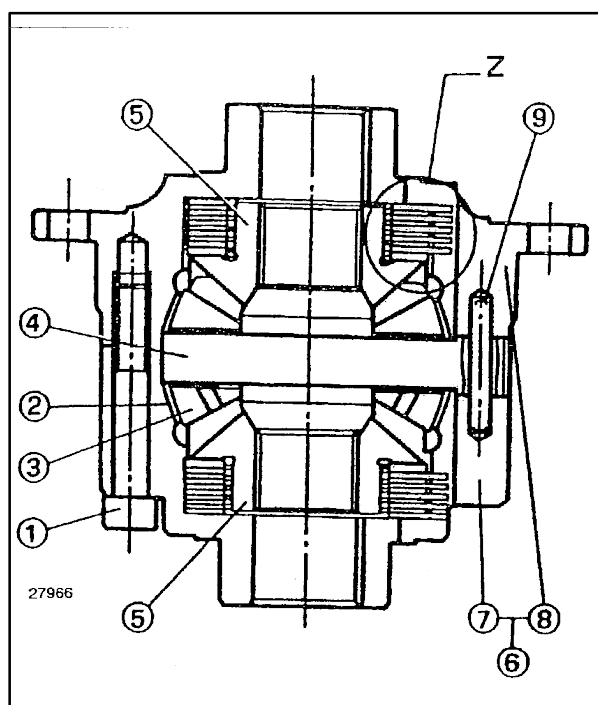
Operation

The differential with limited slip locking (LIM-SLIP) is of the two planet gear-type. It is provided with two multi-disc clutch assemblies fitted between the side gears and the differential casing.

This differential lock device is totally automatic. It requires no manual operation and significantly reduces (but does not completely eliminate) wheel slip.

The difference in speed between the side gears and the differential casing when a wheel loses grip and begins to slip, is prevented by the clutch assemblies that are compressed by axial thrust from the bevel drive torque transmitted to the side gears by means of the teeth on the two planet gears.

These torque values may be different, according to the nature of the ground and the route followed by the tractor. Torque may vary in intensity, thereby proportionally varying the axial thrust on the clutches. This causes the side gears to mesh with the differential casing which, in turn, permits the axle to overcome the unevenness of the ground.



78

LIMITED-SLIP self-locking differential lock

FRONT AXLE DIFFERENTIAL WITH LIMITED-SLIP UNIT

Overhaul (Op. 25 102 27)

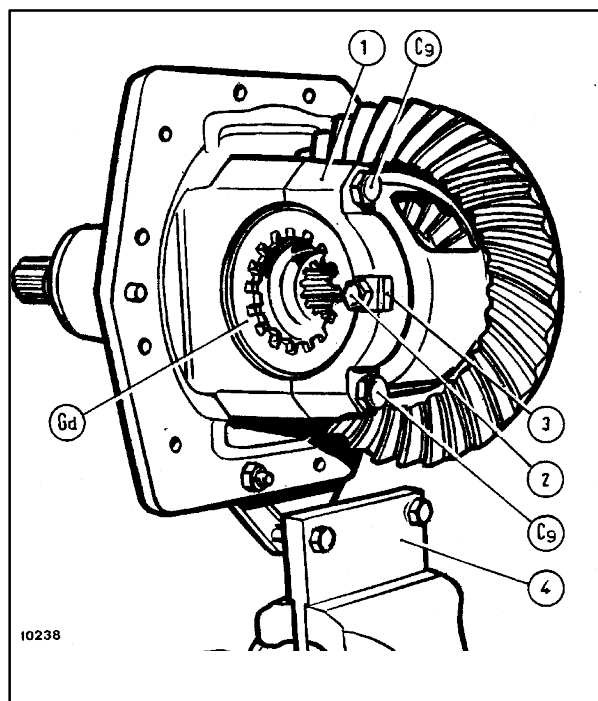


WARNING



Handle all parts with care. Do not put your hands or fingers between parts. Wear suitable safety clothing, safety goggles, gloves and footwear.

1. Remove the bevel drive-differential casing assembly from the front axle and attach to the support **380000255** (4). Lock the support in a vice and proceed with disassembly, as follows.
2. Remove the bolts (2) and the left- and right-hand ring nut lock plates (3).
3. Check that the right and left-hand caps (1) are clearly marked, so as not to mix the parts during reassembly.
4. Remove the left- and right-hand bearing adjustment ring nuts (Gd) from the crown wheel.
5. Remove the bolts (C₉), securing the caps (1) and separate the crown wheel from the bevel pinion support.
6. If necessary, unscrew the retaining bolts (C₃, page 4) and remove the crown wheel.



79

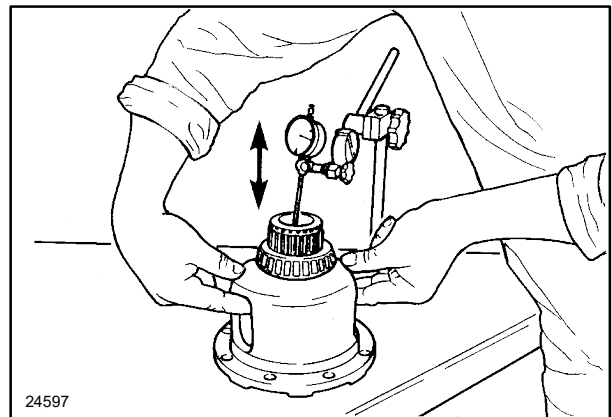
FRONT AXLE DIFFERENTIAL

Overhaul (Op. 25 102 24)

When overhauling the differential assembly it is necessary to adjust the backlash between the teeth of the planet pinions and the side gears.

Proceed as follows:

1. Thoroughly clean the components of the differential to remove any traces of oil which would otherwise prevent accurate backlash measurement.
2. Install the two side gears without thrust washers.
3. Fit the planet pinions complete with thrust washers and pins and screw the pin retaining bolts in by a few turns sufficient to hold the pins in place.
4. Position a dial gauge on the differential housing, as shown.
5. Move the left-hand side gear to bring it into full contact with the planet pinion and then push it up against the differential housing, reading the endfloat (G_s) on the dial gauge.



76

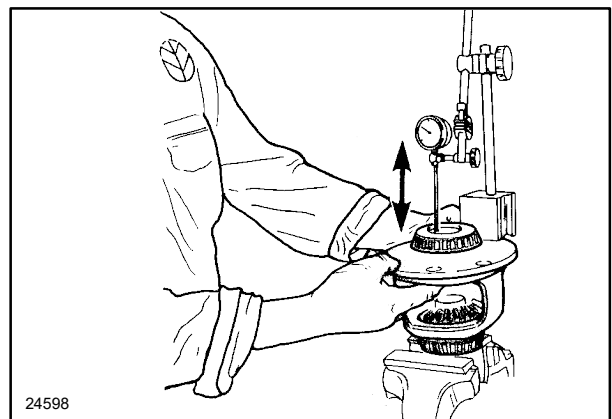
6. Repeat the above operations to measure the endfloat on the right-hand side gear (G_d).

The endfloat should be **0.25 mm (0.0098 in.)**. Therefore the shims to be inserted in the differential housing are given by:

$S_s = G_s - 0.25 \text{ mm (0.0098 in.)}$ for the left-hand side gear;

$S_d = G_d - 0.25 \text{ mm (0.0098 in.)}$ for the right-hand side gear.

7. Install shims as near as possible to the calculated value and, using a dial gauge and following the procedure described above, check that the endfloat of the left and right-hand side gears is approximately 0.25 mm (0.0098 in.).

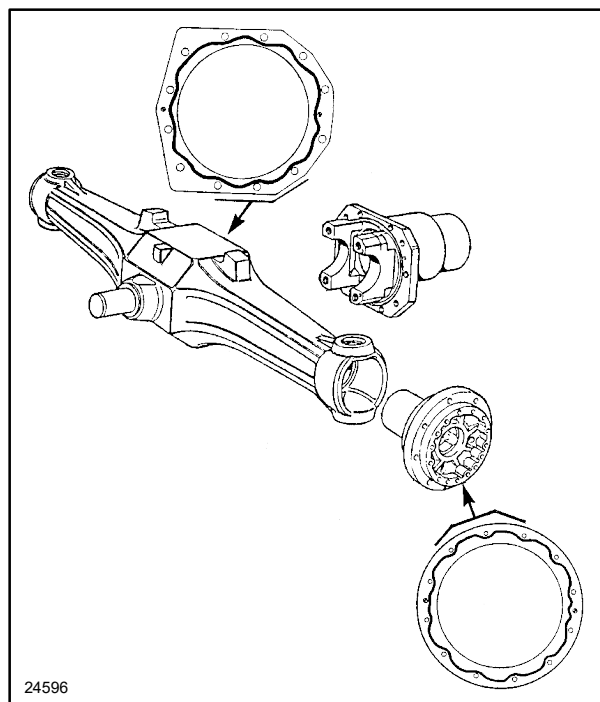


77

20. Attach the differential bevel drive carrier to the axle casing after having carefully cleaned and degreased the mating surfaces and apply sealing compound (approx. 2 mm) along the marked line shown in the drawing below.

Sealing compound application diagram for assembly of bevel drive unit and epicyclic final drive unit.

The types of mastic to use are listed on page 1 of section 00.



$$S = Sp + \{(0.18 - Gm) \times 1.35\}$$

where:

Sp = thickness of test shim installed in the bevel drive-differential housing.

Gm = average backlash measured between the sides of the teeth of the bevel drive.

15. Fit a shim of the calculated thickness and with a 1/100 scale dial gauge positioned perpendicular to the outside edge of one of the crown wheel teeth, check that the backlash between the pinion and the crown wheel is within the prescribed tolerance limits 0.15 ± 0.20 mm (0.0059 to 0.0079 in.).
16. Using wrench **380000252**, for JX60 or JX70 models, or wrench **380000253**, for JX80, JX90 or JX95 models, turn the adjuster ring nut and, using torque wrench **380001633** fitted on wrench **380000257** (1, fig. 73), check that the rolling resistance torque of the crown wheel and pinion bearings, as measured in the same conditions used to check only the pinion, is:

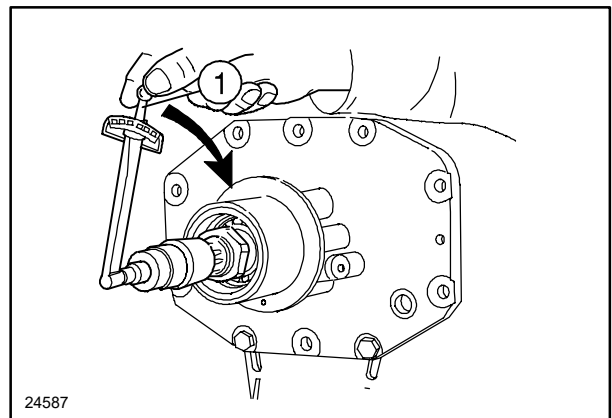
$$A_2 = A_1 + 1 + 1.5 \text{ Nm (0.7376.5 to 1.1063 ft lb)}$$

where:

A₂ = pinion-crown wheel rolling resistance torque;

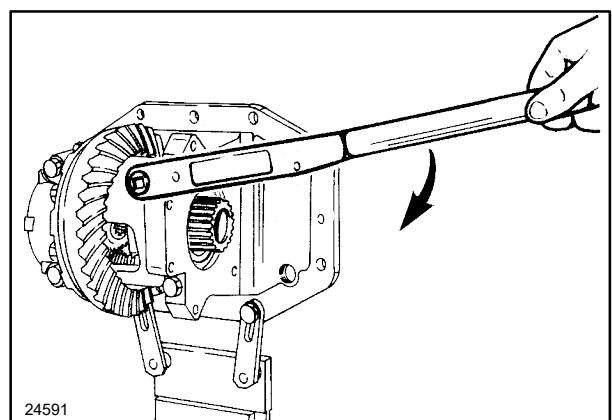
A₁ = rolling torque of pinion only, 0.5 Nm (0.3688 lb) for JX60 or JX70 models and 0.75 Nm (0.5532 ft lb) with the pinion fitted with the seal, measured previously;

1 + 1.5 Nm (0.7376.5 to 1.1063 ft lb) = rolling resistance torque of crown wheel only measured at the end of the pinion, using wrench **380000257** and torque wrench **380001633**.



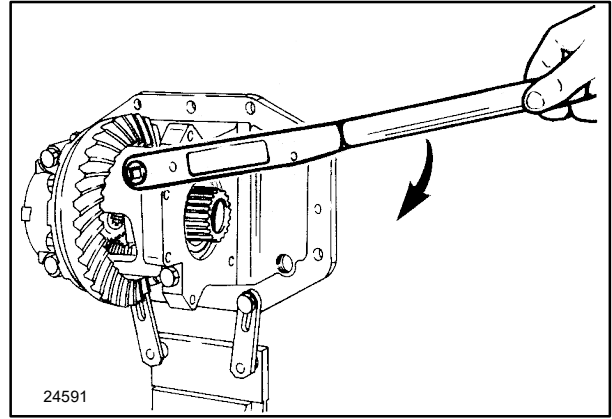
73

17. Tighten the cap bolts (C1, page 4) to a torque of 113 Nm (83.3445 ft lb).
18. Fit the safety plates, screwing the adjustment ring nut in or out, to reach the nearest notch.
19. Attach the differential bevel drive carrier to the axle casing after having carefully cleaned and degreased the mating surfaces and apply sealing compound (approx. 2 mm (0.0787) along the marked line shown in the drawing below.



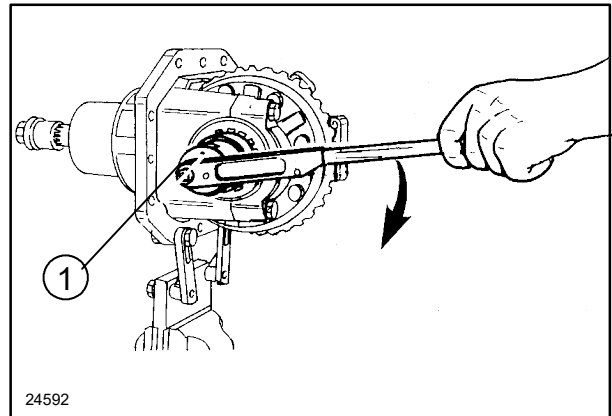
74

8. Install the differential unit in the carrier ensuring that ring gear is not forced onto the pinion. Tighten screws (C10) to 59 Nm (43.5162 ft lb) then slacken and retighten to 20 Nm (14.7512 ft lb).
9. Lubricate the ring gear bearings, fit the adjuster shim on the left-hand side (front brake side for four-cylinder models if this variant is included in the tractor version), rotate the bevel drive and tighten the differential bearing lock ring (G_S, page 7).



70

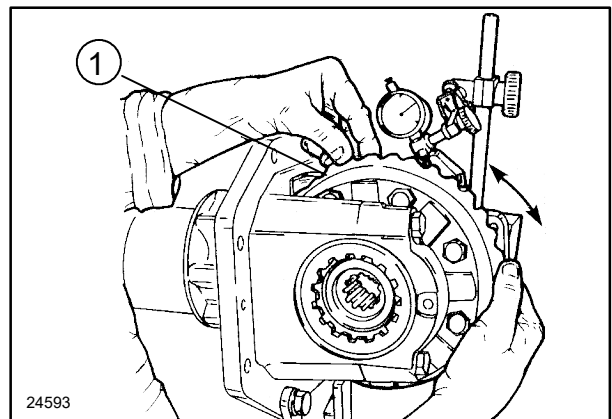
10. Using wrench (1) **380000252**, for JX60 or JX70 models, or wrench **380000253**, for JX80, JX90 or JX95 models, check that the torque is 39 to 59 Nm (28.7649 to 43.5162 ft lb) to establish the specified axial pre-load.
11. Measure bevel drive backlash (1, fig. 72) using a dial gauge positioned at right angles to a bevel gear tooth.
12. Repeat the measurement at two other equidistant points, 120° apart. Compare the average of the three readings with the specified backlash of 0.15 - 0.20 mm (0.0059 - 0.0079 in.) (average 0.18 mm (0.0071 in.)).



71

13. If the measured backlash exceeds the prescribed value, fit a thinner adjustment shim.

Note: On three-cylinder models or four-cylinder models without the front brake, if the clearance value is not within the prescribed field of tolerance, unscrew one of the ring nuts, whilst tightening the other to an equal amount, so as to reset the prescribed clearance.



72

The definitive value to fit on the bevel drive-differential support will be given by:

$$S = Sp + \{(0.18 - Gm) \times 1.35\}$$

where:

Sp = thickness of test shim installed in the bevel drive-differential housing.

Gm = average backlash measured between the sides of the teeth of the bevel drive.

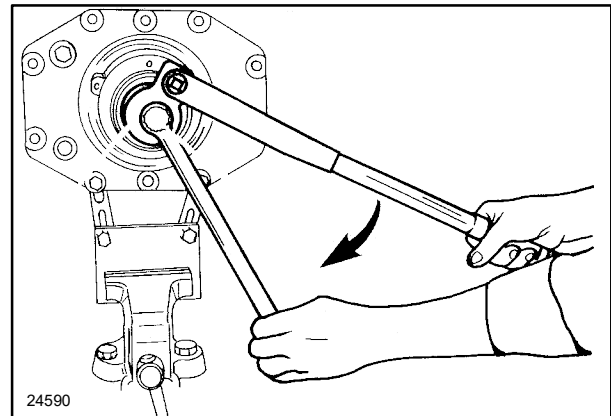
14. If the backlash measured is less than the prescribed value, it will be necessary to fit a thicker adjustment shim, the value being given by:

BEVEL DRIVE ADJUSTMENTS

Adjustment of the crown wheel bearings and checking the backlash between the pinion and crown wheel.

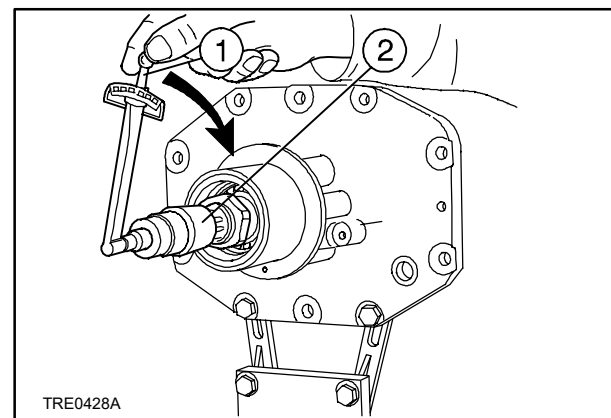
Proceed as follows.

1. Install the bevel pinion with all parts (less the seal but including shims (S1 and S2, page 7) in the differential carrier. Shim sizes to be as determined in the procedure described on pages 29 and 30.
2. Fit pinion retaining tool **380000257**.
3. Insert wrench **380000532** on the adjuster ring nut mod. JX60 and JX70 **380000268** mod. JX80, JX90 and JX95.
4. Using the torque wrench on the pinion retaining wrench, hold the bevel pinion in position and, using a torque wrench positioned exactly as in fig. 68 on the ring nut wrench, tighten the ring nut (C1) to a torque value of 294 Nm (216.84352 ft lb) while simultaneously rotating the pinion shaft to ensure that the bearings are seated correctly.



68

5. With torque wrench **380001633** (1) fitted on pinion retaining wrench **380000257** (2), check that the pinion rolling torque, without oil seal and relative dust seal, is $0.5 \div 1 \text{ Nm}$ ($0.3688 \div 0.7376 \text{ ft lb}$).
If the rolling torque is less than the prescribed value, fit a thinner adjustment shim (S1, page 7); on the contrary, if the torque is greater than the prescribed value, fit a thicker adjustment shim.
6. Unscrew the ring nut and fit the seal and the relative dust seal ring. Tighten the nut to a torque value of 294 Nm (216.84352 ft lb) while simultaneously rotating the pinion shaft to ensure that the bearings are seated correctly.
7. With torque wrench **380001633** (1) fitted on pinion retaining wrench **380000257** (2) check that the pinion rolling torque, with the oil seal and relative dust seal, is $- 0.50 \text{ Nm}$ (0.3688 ft lb) for mod. JX60 and JX70 or $- 0.75 \text{ Nm}$ (0.5532 ft lb) for mod. JX80, JX90 and JX95. Finally, secure the ring nut and fit the circlip on the bevel pinion shaft.



69

Examples (models JX60 and JX70)**Example 1:**

- Distance measured using micrometer $H_5 = 103.3$ mm (4.0669 in.).
- Nominal distance between crown wheel axis and large diameter base of pinion $H_4 = 100$ mm (3.9370 in.).
- Correction value $C = + 0.2$ mm (0.0079 in.).
- Corrected nominal distance $H_5 = 100 + 0.2 = 100.2$ mm (3.9370 + 0.0079 = 3.9449 in.).
- Thickness of adjustment shim
 $S_2 = 103.3 - 100.2 = 3.1$ mm (4.0669 - 3.9449 = 0.1220 in.).

Example 2:

- Distance measured using micrometer $H_3 = 103.3$ mm (4.0669 in.).
- Nominal distance between crown wheel axis and large diameter base of pinion $H_6 = 100$ mm (3.9370 in.).
- Correction value $C = - 0.2$ mm (0.0079 in.).
- Corrected nominal distance $H_7 = 100 - 0.2 = 99.8$ mm (3.9370 - 0.0079 = 3.9291 in.).
- Thickness of adjustment shim
 $S_2 = 103.3 - 99.8 = 3.5$ mm (4.0669 - 3.9291 = 0.1378 in.).

Example 3:

- Distance measured using micrometer $H_3 = 103.3$ mm (4.0669 in.).
- Nominal distance between crown wheel axis and large diameter base of pinion $H_4 = 100$ mm (3.9370 in.).
- Correction value $C = 0$ mm (0 in.).
- Corrected nominal distance $H_5 = H_6 = 100$ mm (3.9370 in.).
- Thickness of adjustment shim
 $S_2 = 103.3 - 100 = 3.3$ mm (4.0669 - 3.9370 = 0.1299 in.).

BEVEL DRIVE ADJUSTMENTS**Determining the thickness of the drive pinion position adjustment shim**

Proceed as follows.

1. Fit tool **380000249** (1) in the bevel drive-differential housing (2), complete with outer bearing rings, crown wheel bearings adjustment ring, crown wheel bearings adjustment shim, circlip and differential housing caps, taking care to tighten the bolts (C_{10}) to a torque of 113 Nm (84.3445 ft lb).
2. Screw the cones (3) of tool **380000249** (1) in or out in order to position the micrometer shaft (4) in the direction of the inner bearing ring (5) and eliminate end float between the cones and the outer rings of the bevel crown wheel bearings.
3. Adjust the micrometer so that the shaft (4) is in contact with the inner bearing ring (5) and measure the distance (H_3).
4. Determine the correct distance (H_5) between the crown wheel axis and the large diameter base of the pinion:

$$H_5 = H_4 \pm C$$

where:

H_4 = Nominal distance between crown wheel centreline and pinion big end

- 100 mm for JX60, JX70 models.
- 15 mm for JX80, JX90, JX95 models.

C = a correction value stamped on the pinion preceded by a + or - sign (if other than 0). This value to be added to or subtracted from the nominal distance (H_4) according to the sign.

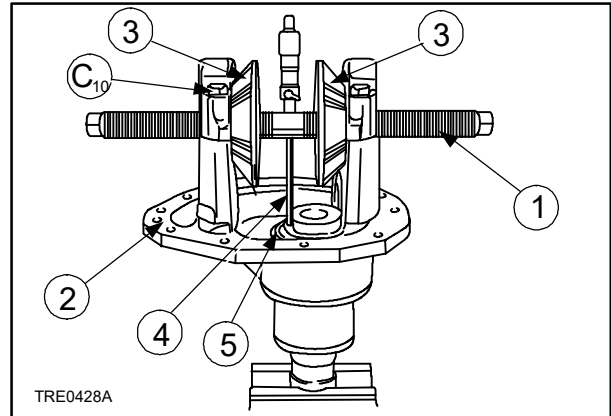
5. The thickness of the adjustment shim (S_2) will be given by:

$$S_2 = H_3 - H_5$$

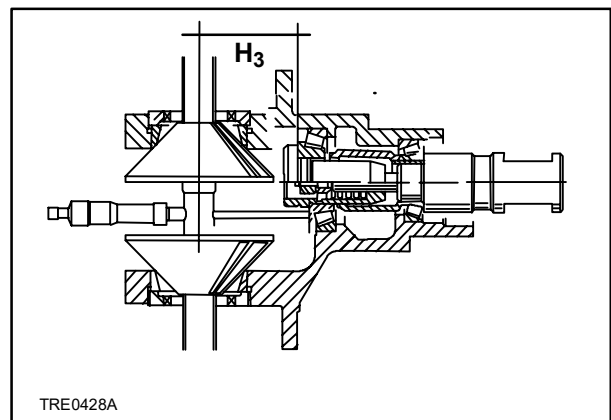
where:

H_3 = the distance measured using the micrometer;

H_5 = corrected nominal distance between the crown wheel axis and the large diameter base of the pinion.



66



67

BEVEL DRIVE ADJUSTMENTS

Adjustment of the preload of the pinion shaft bearings

**WARNING**

Handle all parts with care.
Do not insert hands or fingers between one part and another. Wear suitable safety clothing, i.e. safety goggles, gloves and footwear.

Proceed as follows.

1. Install the bevel pinion bearing cones (7) and (9) with spacer (8) on tool **293438** (E).

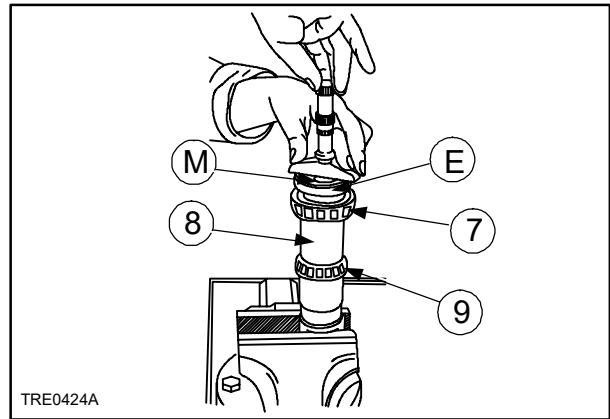
NOTE: For JX60 and JX70 models, place the spacer M outside the bearings.

2. Fully tighten tool nut (M).
3. Measure the distance (H1) between the end of the pin on the bottom of the tool and the top surface of the tool.
4. Remove the bearing cones and spacer from the tool. Lubricate bearings with engine oil and re-install onto the tool, inserting differential carrier (10) with bearing cups.
5. Fully tighten tool nut (M) while rotating the differential carrier through ten revolutions to settle the bearings.
6. Measure dimension (H3) of the tool in this condition.
7. Thickness of shims (S1) will be given by:

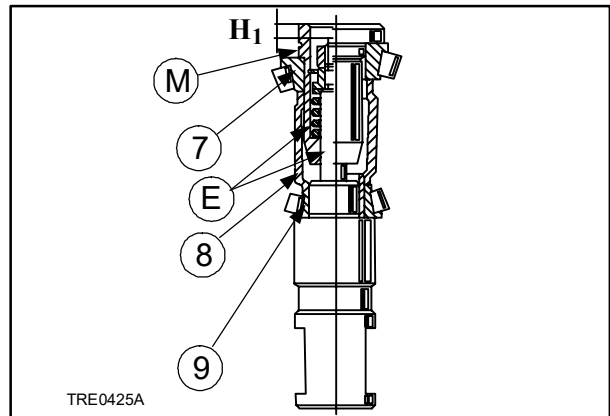
$$S1 = H_3 - H_1 + 0.10 \text{ mm (0.00039 in.)}$$

If necessary, round off (S1) to the nearest 0.05 mm (0.0020 in.)

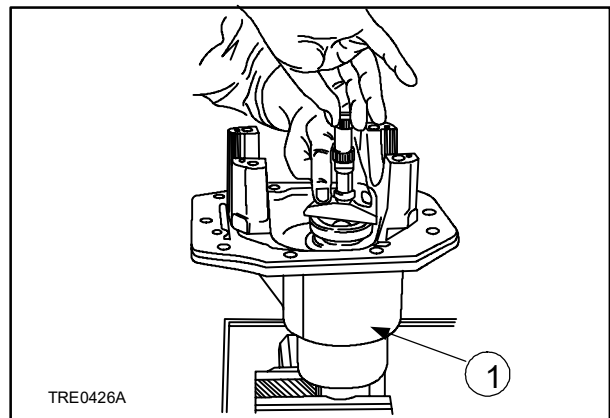
NOTE On completing the adjustment, do not remove the adjustment tool from the bevel drive-differential housing. Leave in place for adjustment of the drive pinion position. See following subject matter.



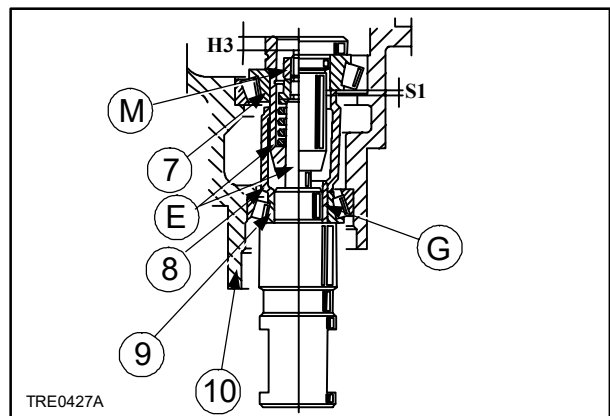
61



62



63

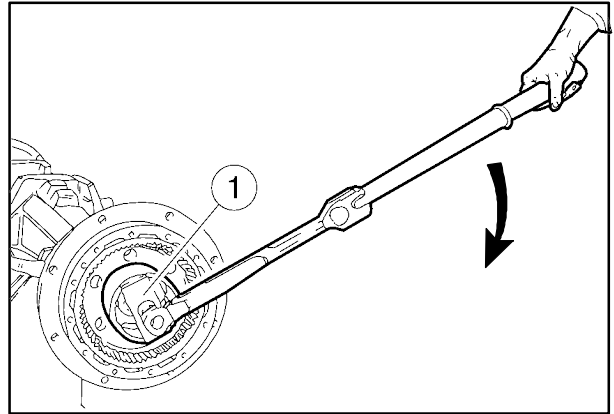


64

Second class axle mod. JX80, JX90 and JX95

Proceed as follows:

- Progressively tighten the ring nut, using the torque wrench and wrench **380000269** (1) to obtain a torque value of 392 Nm (289.12432 ft lb); at the same time, rotate the wheel hub to ensure that the bearings are correctly seated.
- Measure the rolling resistance (Rt) of the wheel hub using the relative torque wrench, or a torque meter and cord positioned on the base of the wheel disk flange.



61

- Loosen the ring nut by **half a turn** and measure the rolling resistance (R) as described previously. The difference between the two measurements is the rolling torque value of the wheel hub bearings (Rc):
- $Rc = Rt - R = 5.9 \div 14.7 \text{ Nm}$ ($4.3516 \div 10.8416 \text{ ft lb}$) or if measured with a torque meter.

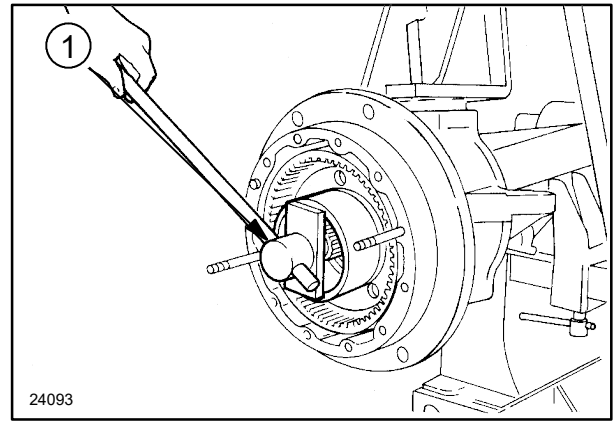
$$Rc = Rt - R = 7.5 \div 18.75 \text{ kg} (41.3554 \text{ lb}).$$

- If the measurement is less than 5.9 Nm (4.3516 ft lb) or with the torque meter on 4.8 kg (10.5870 lb) it is necessary to replace the affected parts and repeat the check.
- Progressively tighten the ring nut, using the torque wrench and wrench **380000269** (1) to obtain a torque value of 392 Nm (289.12432 ft lb); at the same time, rotate the wheel hub to ensure that the bearings are correctly seated.
- Carefully secure the ring nut.

WHEEL HUB BEARING ADJUSTMENT:**First class axle mod. JX60 and JX70**

Proceed as follows:

- Install wheel hub and fixed gear unit onto the steering knuckle;
- Using a torque wrench and lock ring wrench **380000616** (for JX60 and JX70 models) progressively tighten the ring nut (C6, page 8) to 147 - 196 Nm (15 - 20 kgm). While tightening the ring nut, rotate the hub to settle the bearings.
- Fully slacken the lock ring and retighten to 59 Nm (43.5162 ft lb) while rotating hub.
- Secure the lock ring by bending over a lock-washer tab (if necessary, further tighten the lock ring to align a slot with the tab)
- Turn the hub by hand to check for excessive play or binding.
- Carefully secure the ring nut.



60

6. Calculate the average of the three values measured. The total thickness of the adjustment shims (page 8) to be fitted under the lower cover is to be calculated as follows:

JX60 and JX70 $S_3 = H$

JX80, JX90 and JX95

$$S_3 = H - 0.20 \text{ mm} \\ (0.0079 \text{ in.})$$

If necessary, round up the value to the next 0.05 mm (0.0020 in.).

7. Partially unscrew the bolts of the lower cover, insert the selected shims (S_3 , page 8). Tighten the bolts (C_4 , page 5) to the following torque values:

JX60 and JX70 64 Nm

(47.2040 ft lb)

JX80, JX90 and JX95

113 Nm

(83.3445 ft lb)

8. After having rotated the casing a few times to allow the components to bed down, check that the torque necessary to rotate the casing (ignoring the initial torque) is follows:

JX60 and JX70 2.9 - 7.8 Nm

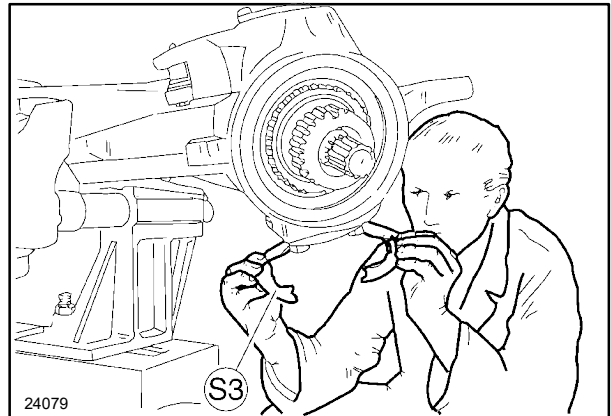
(2.1389 - 5.7530 ft lb)

JX80, JX90 and JX95

118 - 147 Nm

(87.0323 - 108.4216 ft lb)

9. If the torque value measured is greater than the prescribed value, increase the thickness of the shims. If the measured value is less than the prescribed value, reduce the thickness of the shims.
10. Fit the grease nipples in the upper and lower covers and grease the assembly.



59

STEERING KNUCKLE PINS AND BEARINGS Replacement (Op. 25 108 46 or 25 108 47)



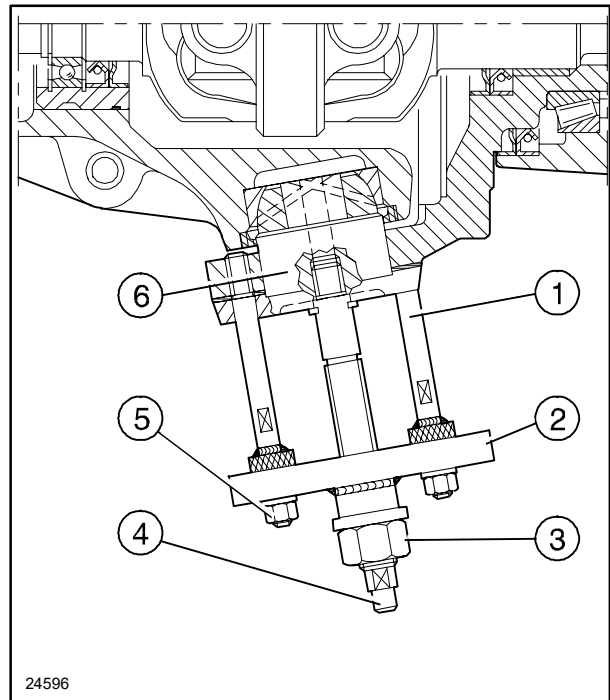
WARNING



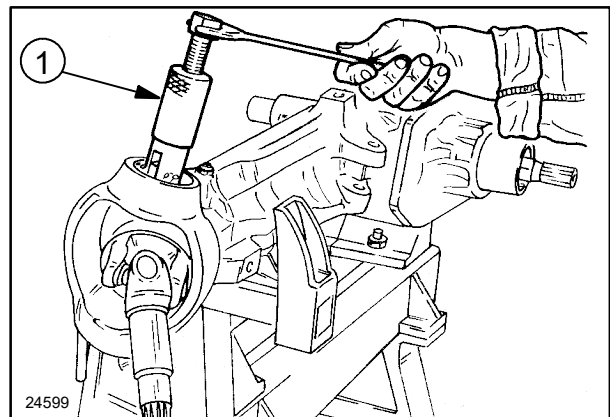
Handle all parts with great care.
Do not put your fingers or hands between one piece and another. Wear suitable safety clothing, i.e. safety goggles, gloves and footwear.

In the event that the steering knuckle pins prove difficult to remove, proceed as follows.

1. Remove the grease nipples and the steering knuckle pin retaining bolts.
 2. Fit the bolts (1) of tool **380000265**.
 3. Fit the plate (2) of the tool and fix it to the three bolts with nuts (5).
 4. Fit the central tie bolt (4) screwing it fully into the grease nipple bore on the pin (6).
 5. Screw in the nut (3) to drive the pin out of its bore.
-
6. Using extractor tool **380000234** (1) remove the steering knuckle bearings.
 7. Re-install the steering knuckle bearings using a suitable drift.

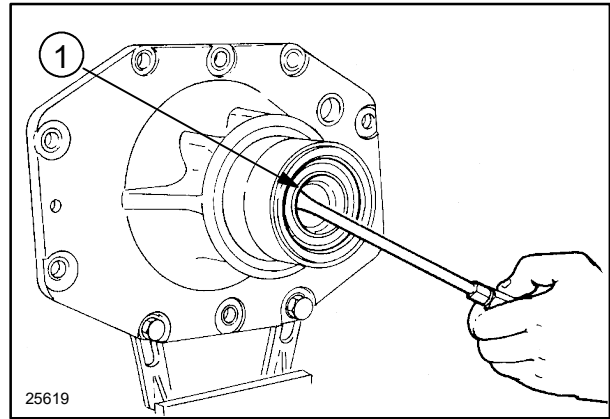


54



55

33. Using a screwdriver, detach and recover the dust seal, the oil seal (1) and the rear bearing.

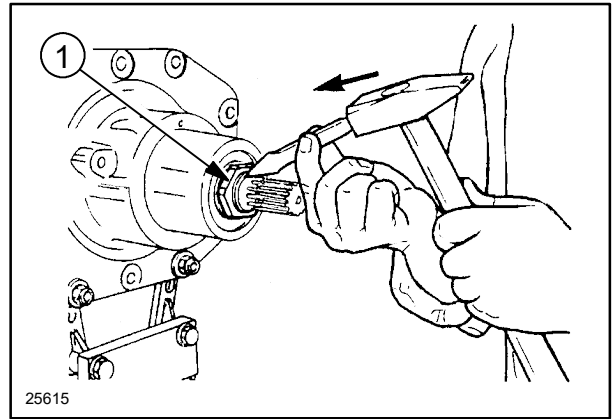


53

Reassemble the front axle adhering to the following instructions:

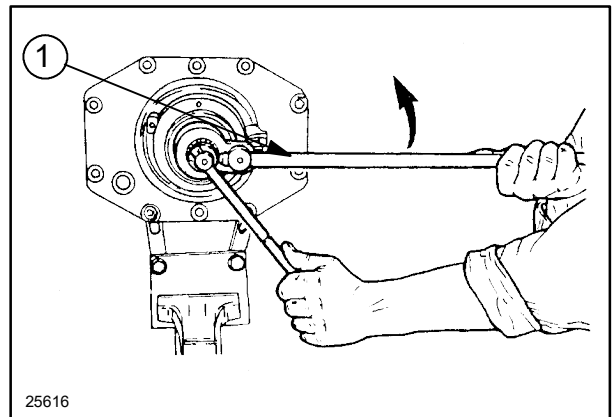
- Refer to the illustrations on pages 7, 8 and 9 to check the orientation of the various components.
- Respect the tightening torques prescribed on page 4.
- Carry out the adjustments described on pages 29 to 36.
- Install the rear bearing, the seal, the dust seal, the adjustment shims, the spacer and the bevel drive pinion shaft complete with front bearing.
- Position the detent ball, screw in the bevel drive pinion lock nut and secure in position by staking. Finally, replace the circlip.
- Install the crown wheel-differential assembly, the support caps and tighten the relative bolts.
- Install the front brake friction disc, metal disc hub gear, piston and front brake housing. Tighten the respective bolts.
- Install the bevel drive-differential housing on the front axle casing and fit the external front brake pipe.
- Install the axle shaft and relative bolt.
- Fit the stub axle, the adjustment shims, the upper and lower pivot pins, the mudguard bracket and related bolts.
- Fit the wheel hub, the ring gear of the final drive unit and the lock ring. Tighten to the prescribed torque value, while simultaneously turning the wheel hub, to ensure that the bearings are correctly seated.
- Fit the securing and stop circlips, the sun gear and the cover of the final drive unit.
- Fit the pins, washers, spacers and steering cylinders.
- Install the track rod, the front and rear supports and the oil drain plugs.

29. Straighten the locking tab on the splined shaft-lock nut (1).



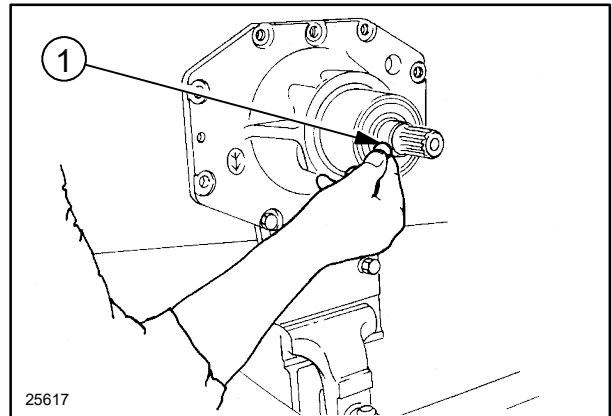
49

30. Unscrew the nut using wrench **380000268** (1) while preventing rotation of the bevel drive pinion shaft using wrench **380000257**.



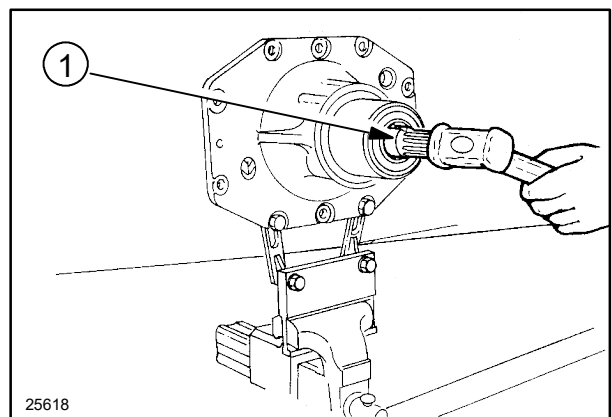
50

31. Recover the splined shaft detent ball (1).



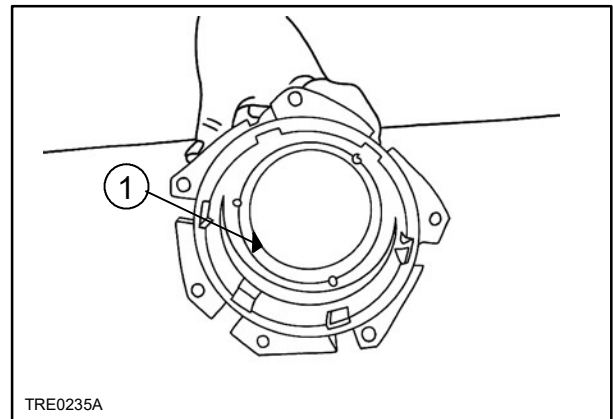
51

32. Withdraw the bevel drive pinion shaft (1) from the rear of the casing and recover the spacer, the adjustment shims and the bearing.



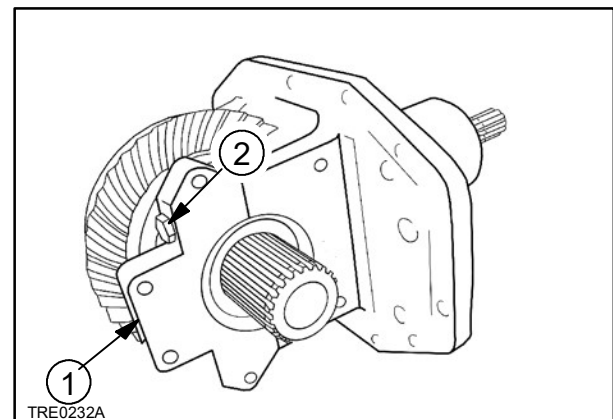
52

25. Remove front brake piston (1) and O-rings.



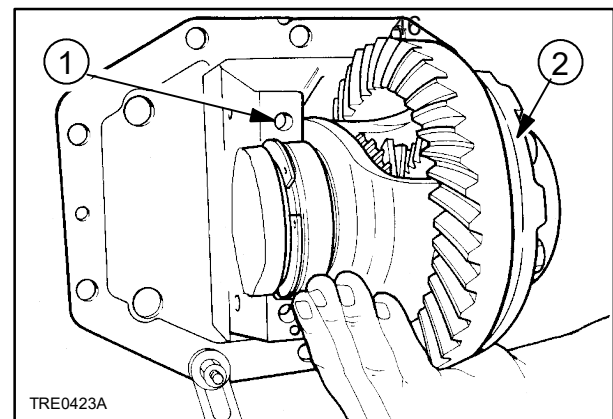
45

26. Unscrew the two bolts (2) of the crown wheel-differential support caps (1).



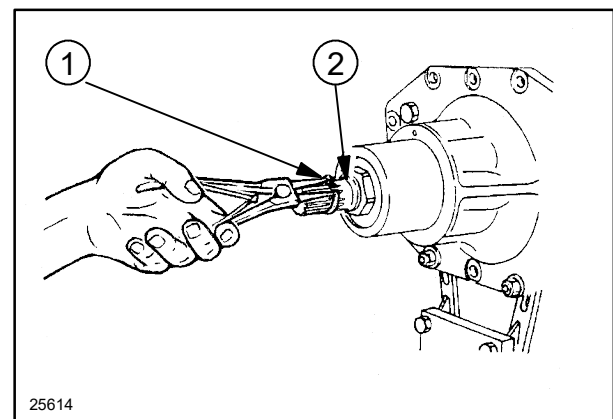
46

27. Remove the crown wheel-differential assembly (2) from the housing (1).



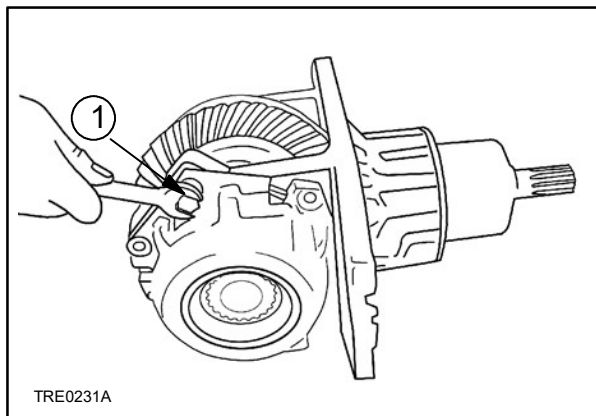
47

28. Remove the circlip (1) from the splined shaft (2).



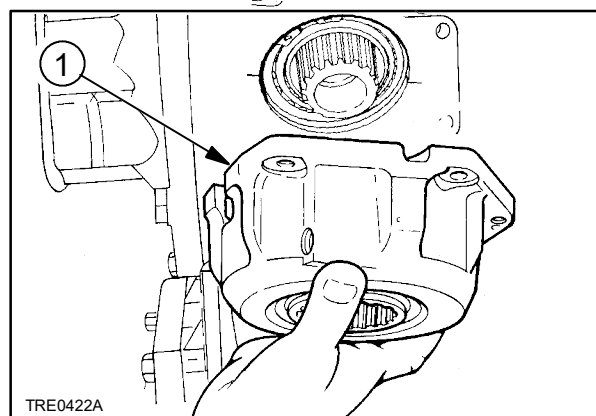
48

21. Remove the front brake bolts (1).



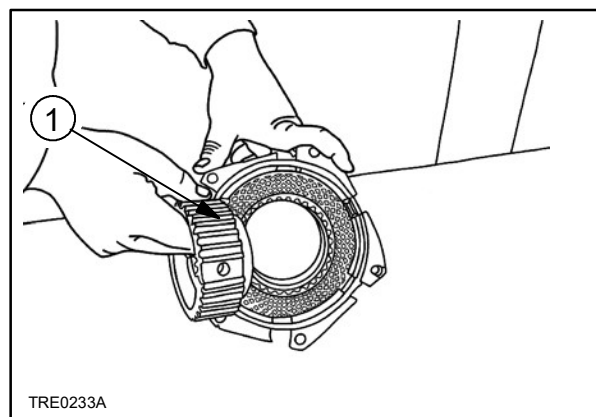
41

22. Remove the front brake housing (1).



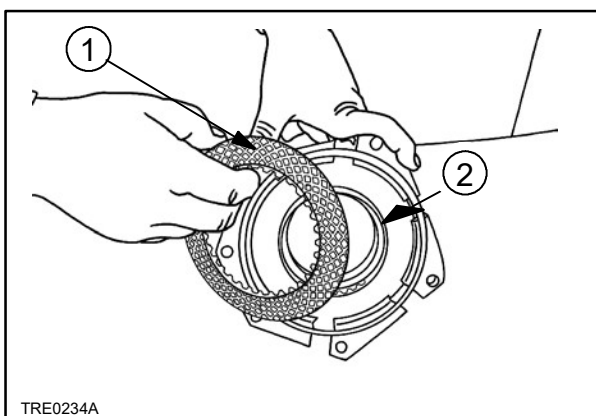
42

23. Remove the front brake hub gear (1).



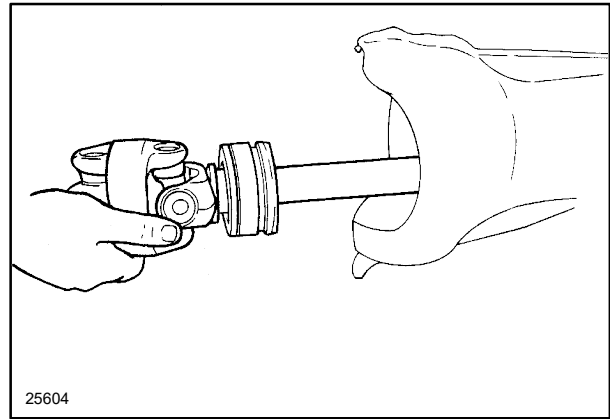
43

24. Remove the friction discs (1) and metal discs (2).



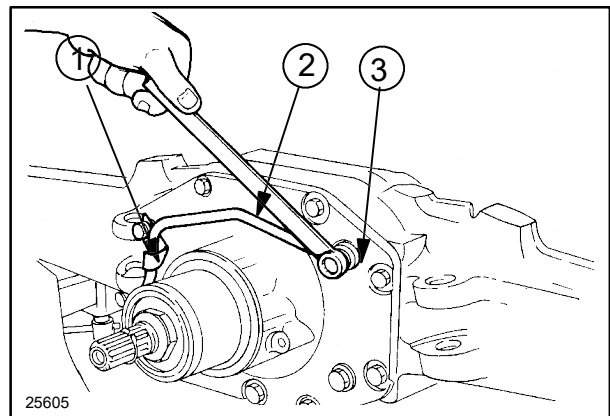
44

16. Unscrew the axle shaft retaining bolt and remove the axle shaft.



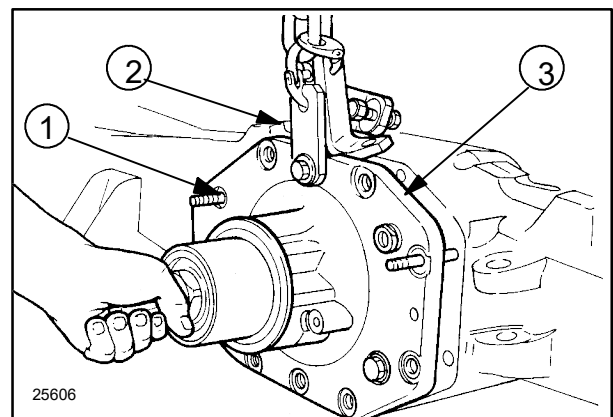
37

17. Remove bracket (1), unscrew the union (3) and detach the front brake pipe (2).



38

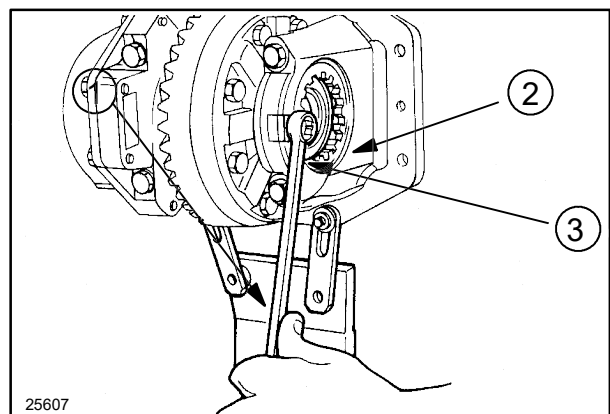
18. Unscrew two of the bolts fixing the bevel drive-differential support to the axle casing. Screw in the two dowels (1). Remove the remaining bolts and separate the bevel drive-differential support from the axle casing. Attach a cable (2) to the support and take up the strain with the hoist. Remove the bevel drive-differential support (3) from the axle casing.



39

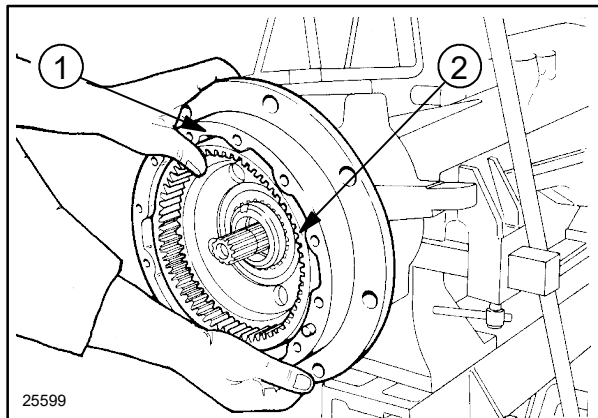
19. Install tool **380000255** (1) in the vice on the work bench. Bolt the bevel drive-differential support on to the tool. Detach the lifting cable.

20. Unscrew the bolt (2) and remove the ring nut lock tab (3).



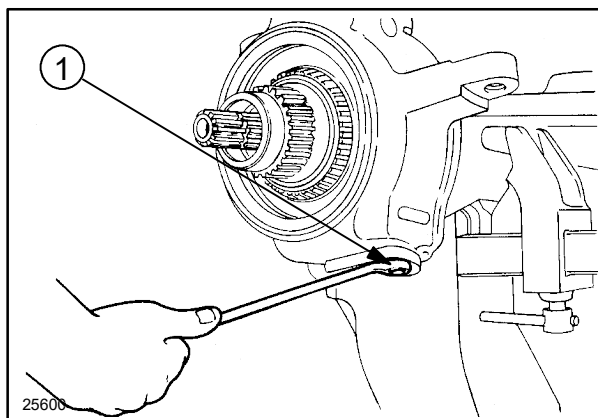
40

12. Remove the wheel hub (1) with the ring gear (2). Retrieve all disassembled parts.



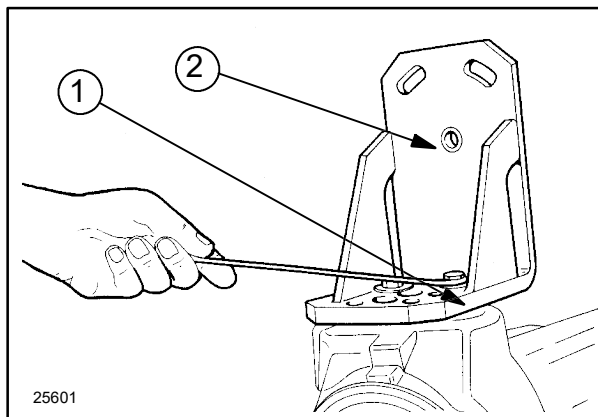
33

13. Unscrew the three retaining bolts (1) of the lower pin of the stub axle housing. Recover the lower pivot pin and the related adjustment shims.



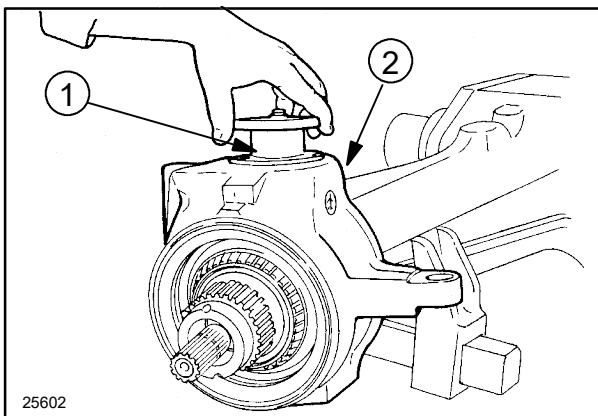
34

14. Unscrew the three retaining bolts (1) of the mudguard bracket (2).



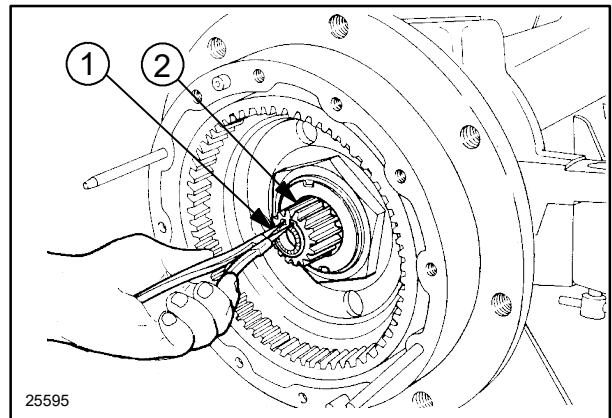
35

15. Withdraw the upper pivot pin (1) and detach the stub axle housing (2). Retrieve the disassembled parts.



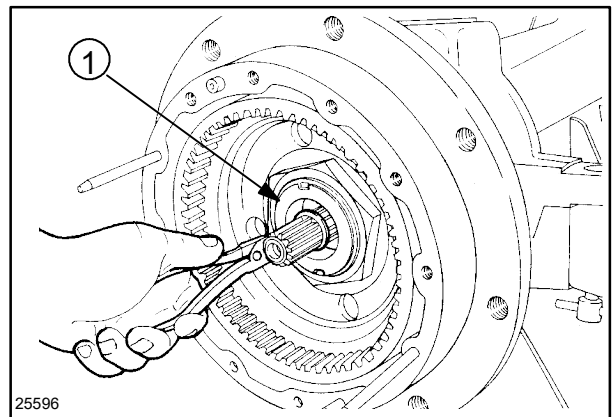
36

8. Remove the circlip (1) securing the sun gear (2) and remove the gear.



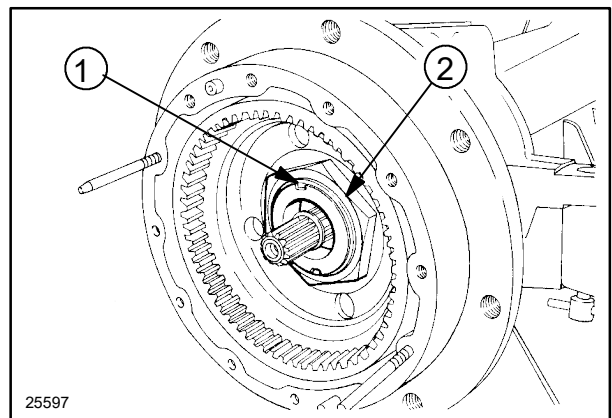
29

9. Remove the inner circlip (1) from the stub axle shaft.



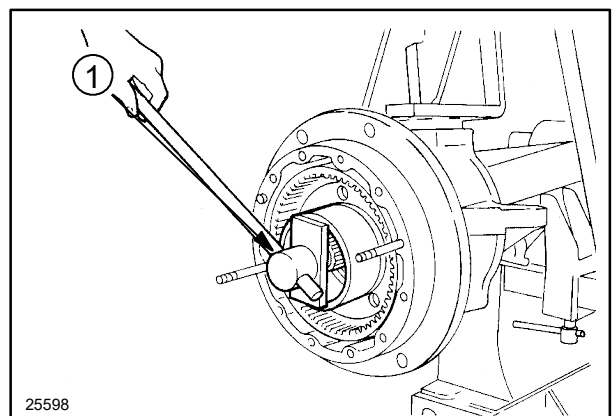
30

10. Remove the staking (1) on the wheel hub bearing lock ring (2).



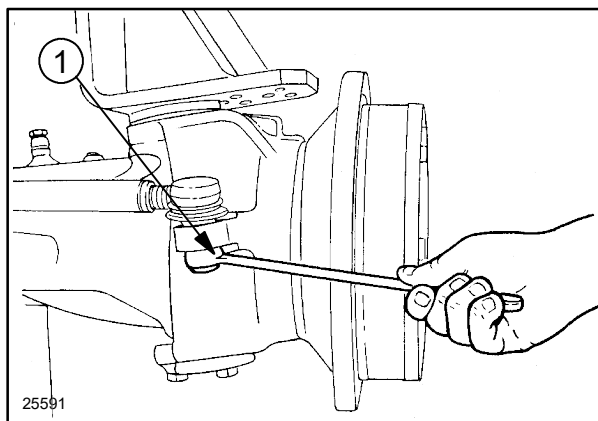
31

11. Remove the wheel hub bearing lock ring using wrench **380000269** (1) for models JX80, JX90 and JX95.



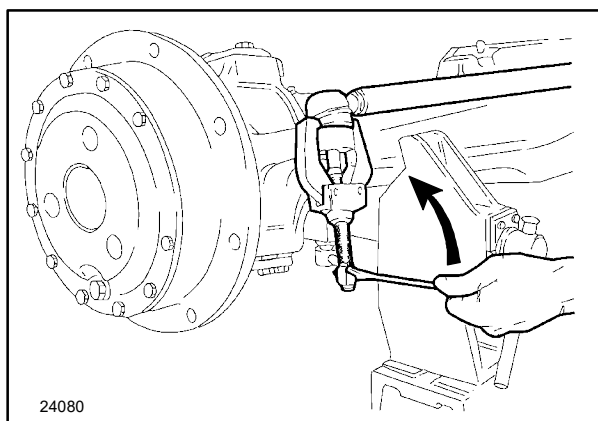
32

4. Unscrew the two track rod retaining bolts (1).



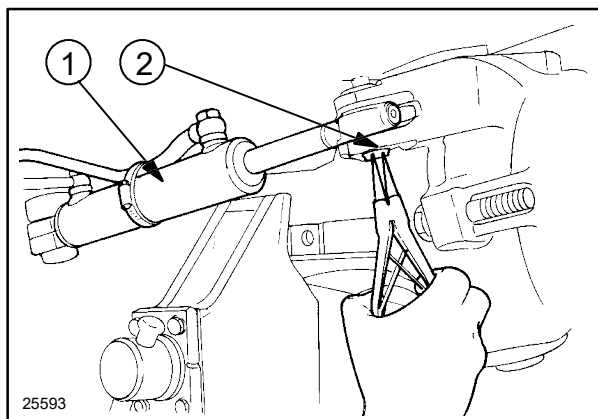
25

5. Using a suitable puller, withdraw the pins from their bores in the stub axle housing and remove the track rod.



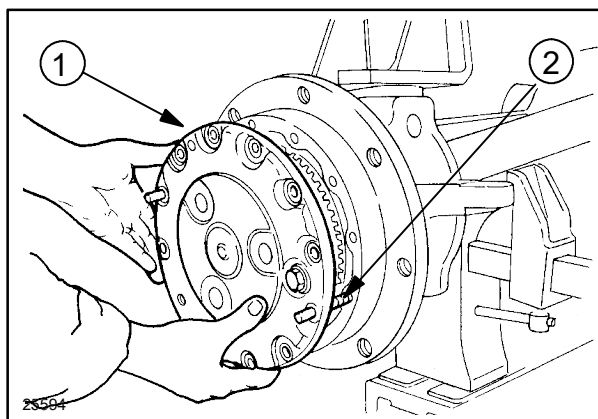
26

6. Remove the circlips (2) from the cylinder rod pivot pins, unscrew the pin retaining bolts of the cylinder (1), withdraw the pins and detach the two cylinders. Retrieve the four pins, washers, spacers and cylinders, complete with hoses.



27

7. Unscrew the retaining bolts from the left-hand final drive casing cover (1). Screw in the two dowels (2), as shown. Using a slide hammer screwed into the oil drain plug hole, detach the cover (1) from the casing.



28

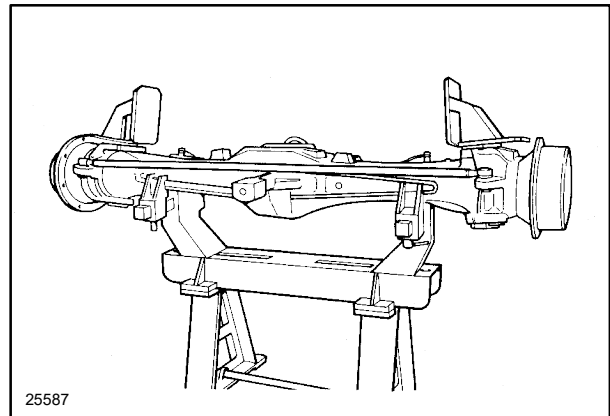
JX80, JX90 and JX95 Models

**WARNING**

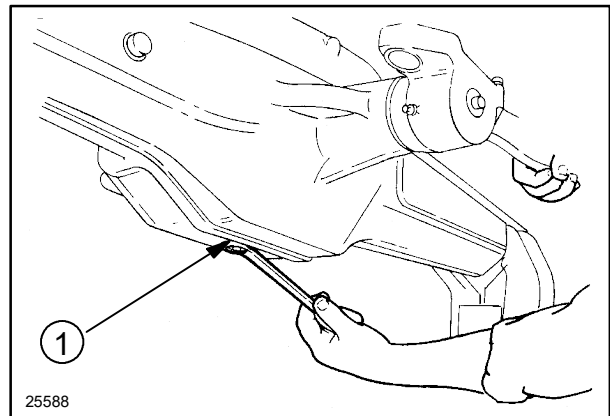
Handle all parts with care.
Do not insert hands or fingers between one part and another. Wear suitable safety clothing, i.e. safety goggles, gloves and shoes.

NOTE: For overhaul, the front axle should be mounted on stand No. **380000251**.

1. Unscrew the plug (1) and drain the oil from the axle casing.

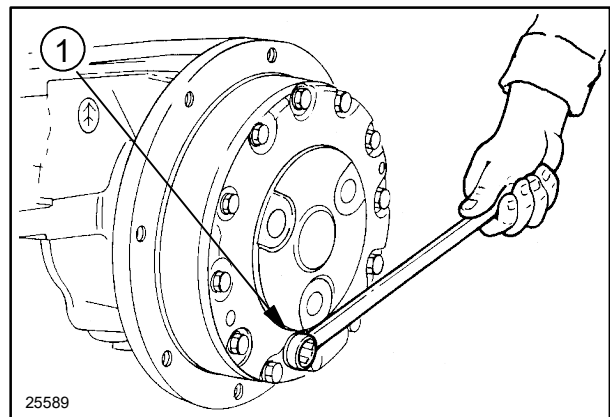


21



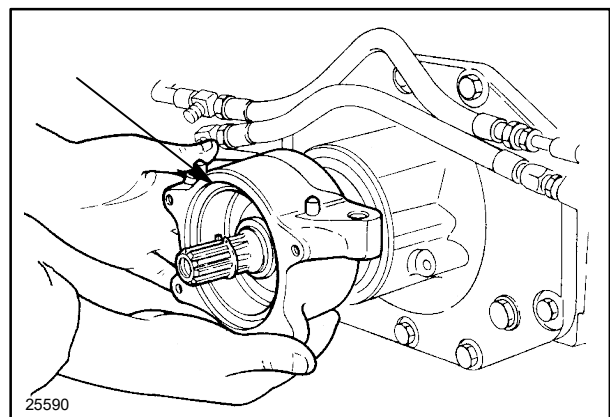
22

2. Unscrew plug (1) on the left-hand epicyclic final drive casing. Repeat this operation on the right-hand casing.



23

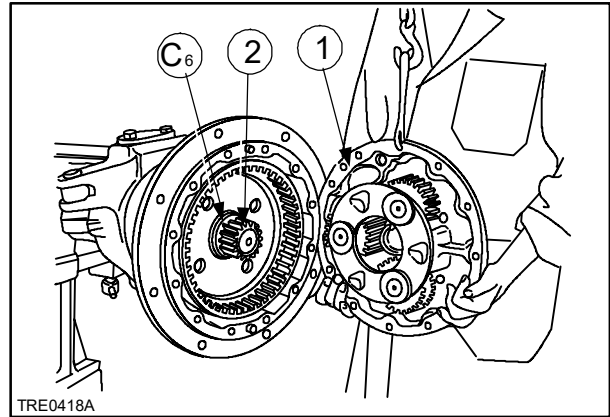
3. Remove the front axle rear support (1). Remove the front support and retrieve the washer.



24

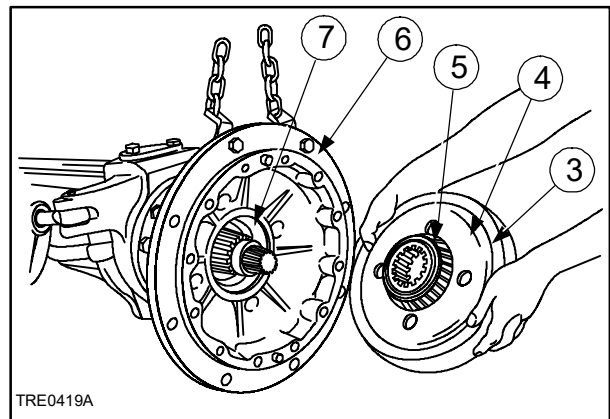
FRONT AXLE**Removal-Installation (Op 25 100 38)****JX60 and JX70 Models****WARNING**

Handle all parts with care.
Do not insert hands or fingers between one part and another. Wear suitable safety clothing, i.e. safety goggles, gloves and shoes.



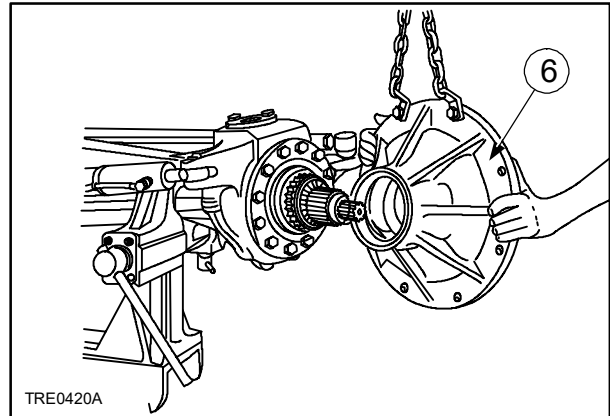
17

1. Unscrew the drain plug and drain the oil from the axle casing.
2. Remove the planetary final drive housing (1) complete with planet wheels.
3. Remove sun gear (2).
4. Remove final drive ring gear - fixed gear unit, slacken ring nut using wrench **380000616** and remove assy from knuckle.
5. Remove wheel hub (6) with taper roller bearing cups (7) and associated seal. Be careful to prevent seal damage.



18

6. Remove steering knuckle (10) with wheel hub support.
7. Remove articulated axle shaft (9) with bearing housing. Back off the capscrew before withdrawing the axle shaft.
8. Replace worn bearings using suitable punches and universal pullers. Check seal efficiency.

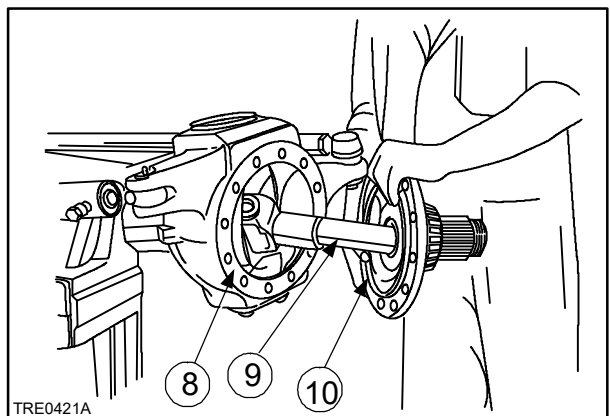


19

Assembly axle parts referring to

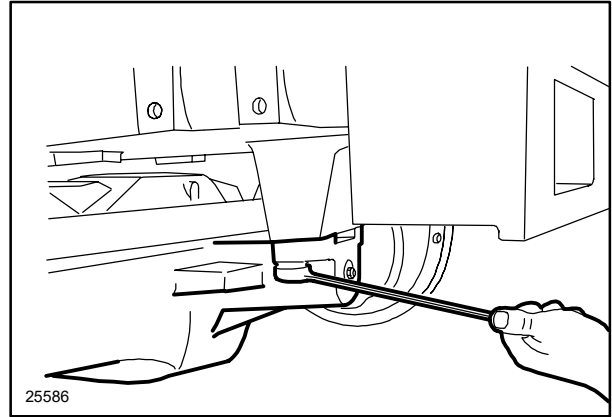
- Before installing the final drive housing (1) thoroughly clean and degrease mating surfaces and apply 2 mm (0.0787 in.) of searing compound.

- Insert articulated axle shaft (9) in axle case and install steering knuckle carrier (8)
- Adjust king pin bearing pre-load as directed in the appropriate section.
- Adjust wheel hub bearing pre-load as directed in the appropriate section.
- Fill wheel hubs and differential-bevel drive housing with the specified oil.



20

11. Unscrew the front axle front support retaining bolts (1).



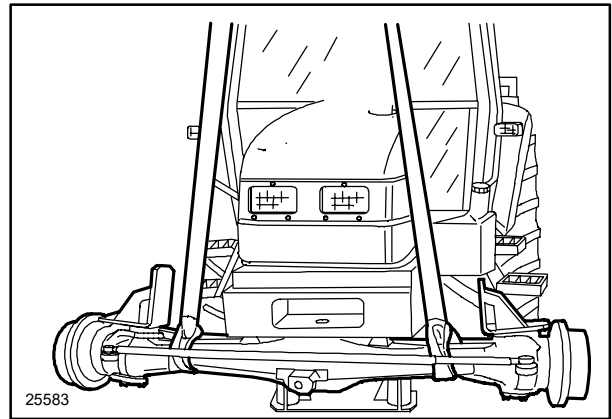
15

12. Using a hoist and two nylon cables (one for each side) detach the front axle from the tractor.
13. Refit the front axle following the instructions below.

**WARNING**

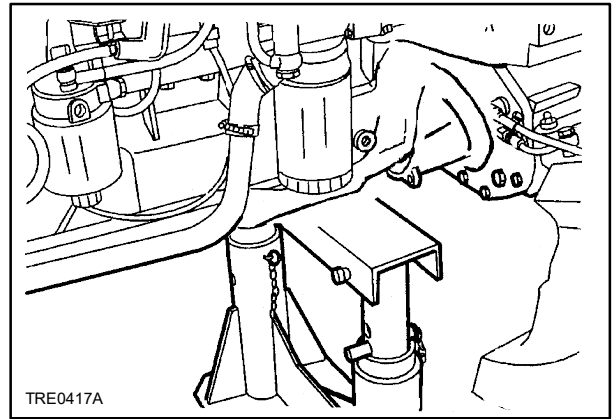
Always use appropriate tools to align fixing holes.
NEVER USE YOUR FINGERS OR HANDS.

- Refit the axle and bolt the front and rear supports in position.
- Reconnect the the power steering pipes.
- Fit the front wheels.
- Raise the front of the tractor using the hoist.
- Remove the fixed stand.
- Detach the nylon cables.
- Reconnect the drive shaft and refit the drive shaft guard.
- Refit the two front mudguards.
- Attach a nylon cable to the front weights, lift, refit to the tractor and secure with the locking screws.
- Reconnect the negative battery lead.
- Adhere to the tightening torques indicated on page 4.



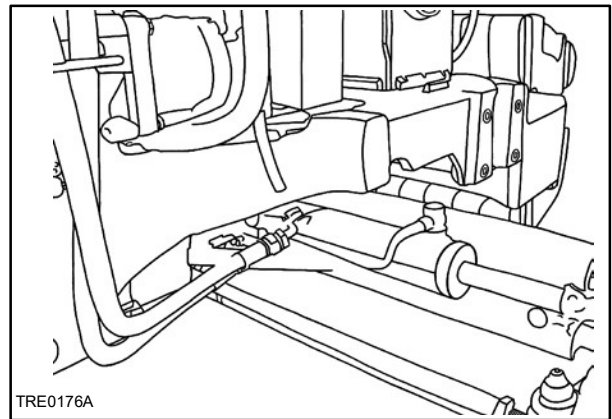
16

7. Lift the tractor with the hoist and place a stand under the sump pan.



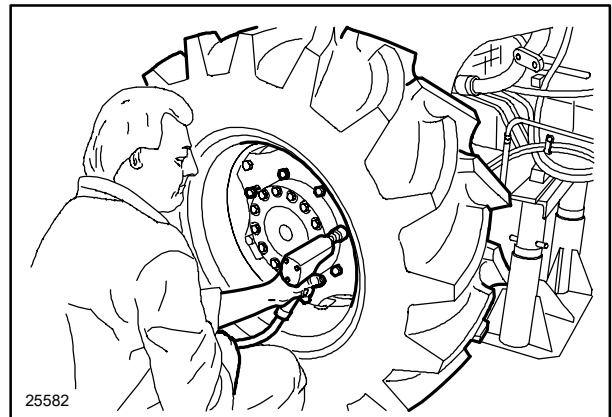
11

8. Unscrew unions (1) of the rigid pipes to the power steering cylinders and detach the two flexible hoses



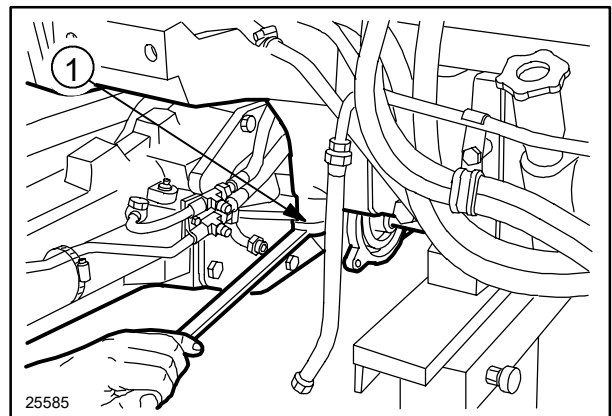
12

9. Unscrew the wheel bolts and remove the front wheels.



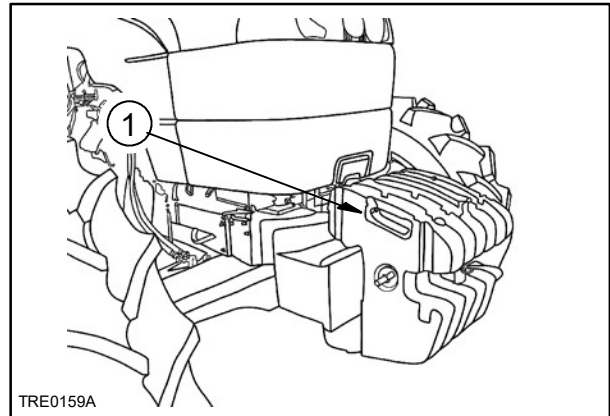
13

10. Unscrew the front axle rear support retaining bolts (1).



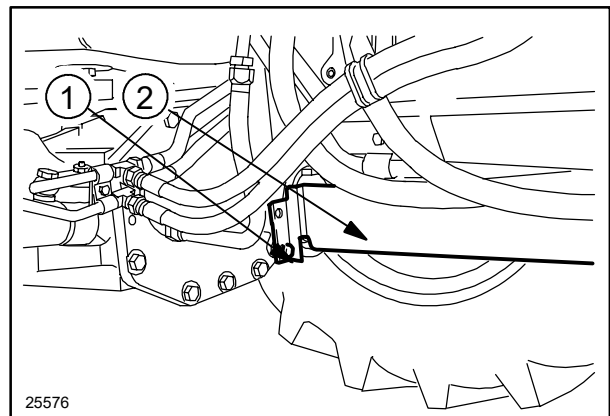
14

3. Attach nylon slings to the front weights (1). Loosen the locking screw from each weight, lift the weights clear of the tractor and place them in a safe position.



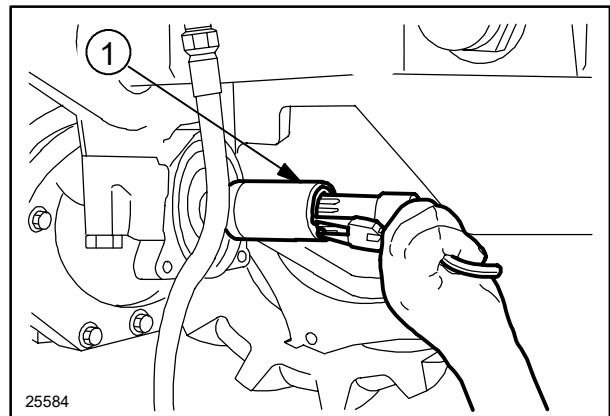
7

4. Unscrew bolts (1) and remove the drive shaft guard (2).



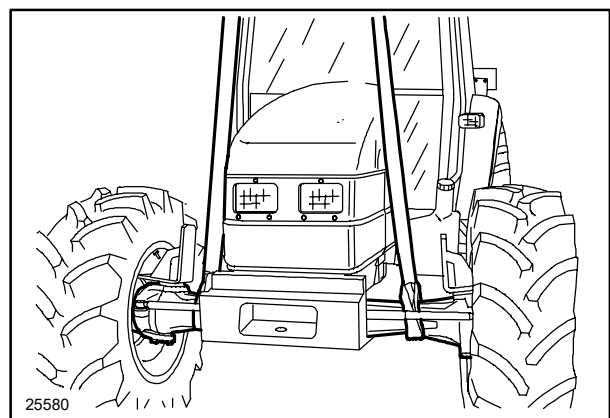
8

5. Remove the circlip (1) from the front of the drive shaft. Slide the sleeve rearwards and detach the drive shaft from the front axle.



9

6. Pass two nylon slings around the front axle and attach them to a hoist.



10

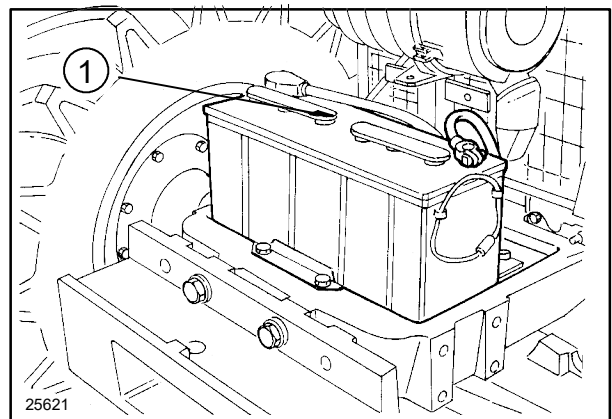
COMPLETE FRONT AXLE**Removal- installation (Op. 25 100 30)****DANGER**

Lift and handle all heavy parts using suitable lifting equipment with a sufficient lifting capacity. Check that the assemblies or parts are held firmly and supported by suitable slings and hooks. Make sure nobody is standing near to the load.

Proceed as follows:

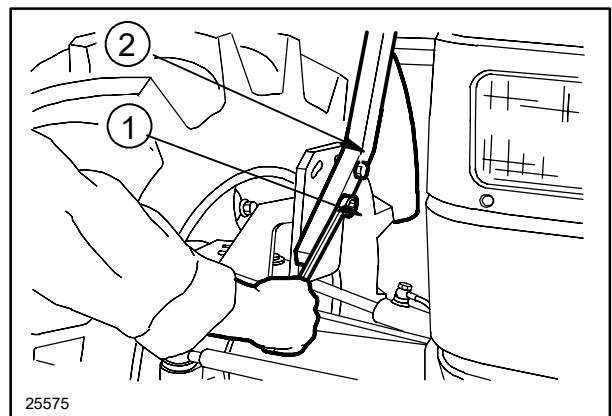
NOTE: The front axle assembly can be removed from the tractor either with or without previously removing the drive shaft. The description below refers to removal of the front axle with the drive shaft installed on the tractor. For removal of the drive shaft refer to section 23.

1. Disconnect the negative battery lead (1).

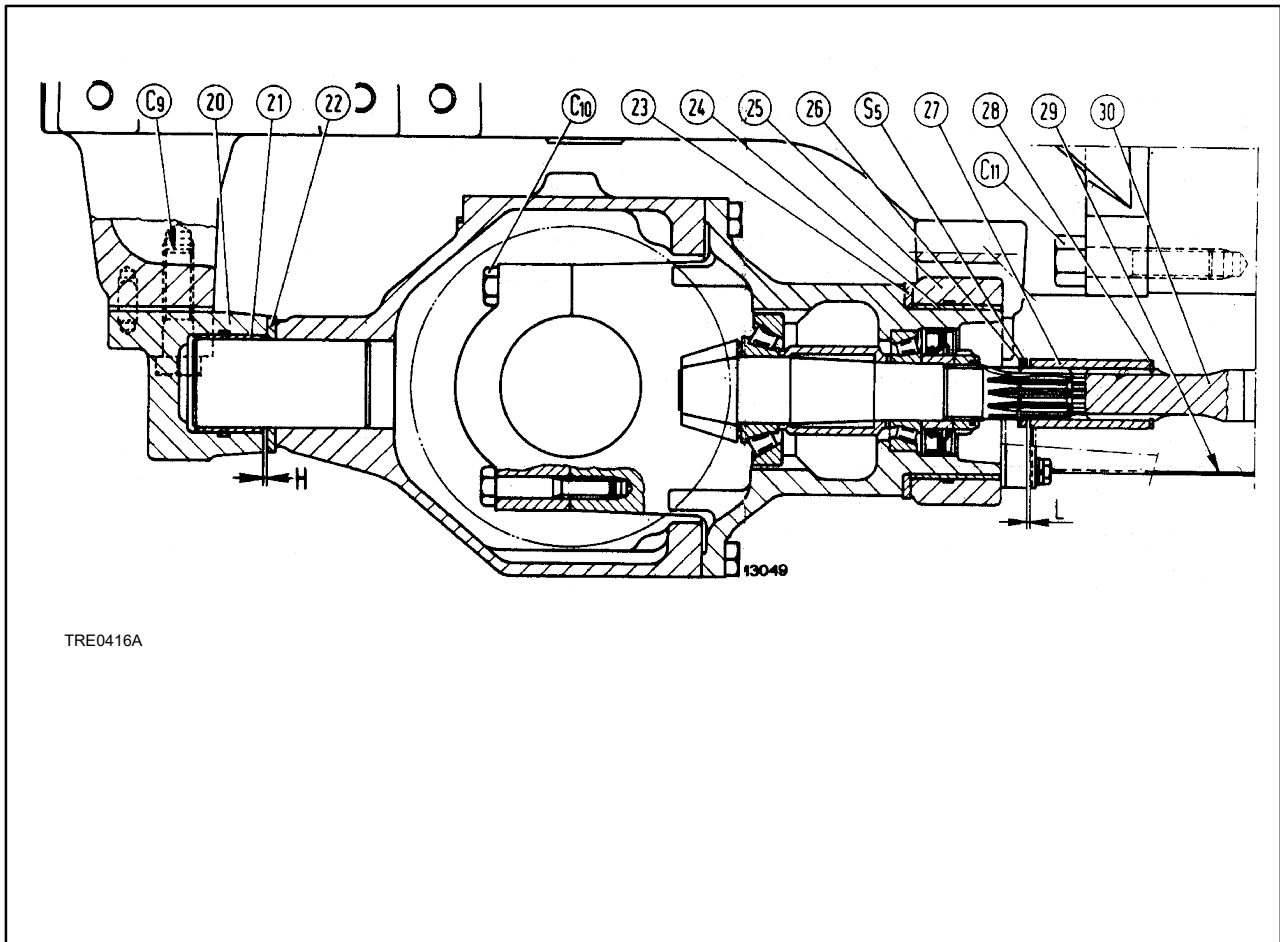


5

2. Unscrew bolts (1) and remove the front mudguard supports (2).



6



4

Cross-sectional view of front axle pivot

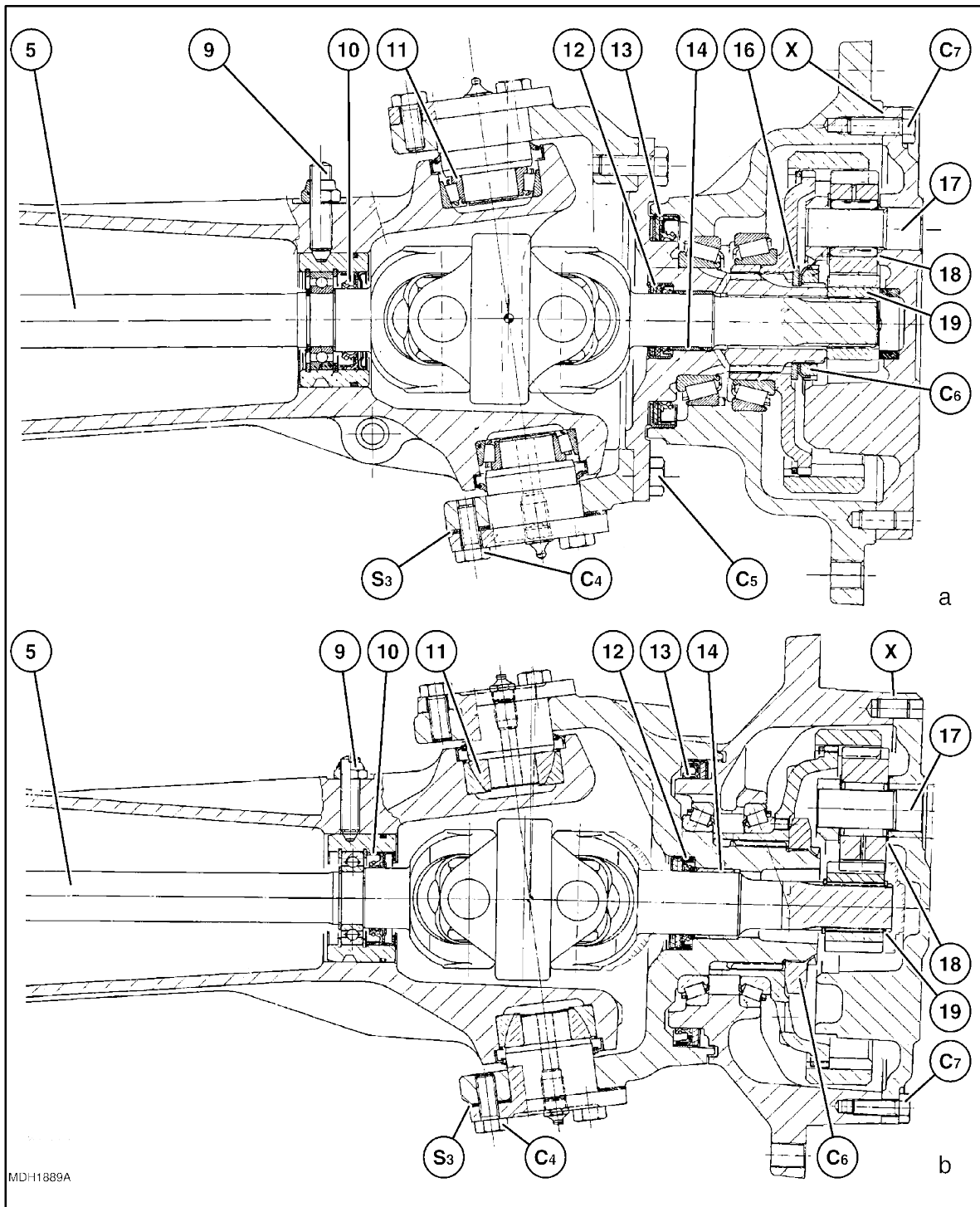
- H** = 1 mm (0.0394 in.)
L = 1 to 1.5 mm (0.0394 - 0.0590 in.)
S₅ = Sleeve position shim
C₉ = Axle pivot support capscrew
C₁₀ = Differential bearing cap capscrew.
C₁₁ = Capscrews securing front axle support to engine.
20. Front axle pivot support
21. Front bushing

- 22.** Front thrust washer
23. Rear thrust washer
24. Rear bushing
25. Rear axle pivot support
26. Retaining rings
27. Front splined sleeve
28. Retaining rings
29. Drive shaft guard
30. Drive shaft

DESCRIPTION AND OPERATION

JX60, JX70, JX80, JX90 and JX95 models have a centrally pivoting front axle with the pivot and the drive shaft coaxial with the longitudinal axis of the tractor. The drive shaft has no universal joints.

The differential has two planet pinions; drive is transmitted to lateral epicyclic final drive units (installed on the wheel hubs) through universal joints which require no maintenance.

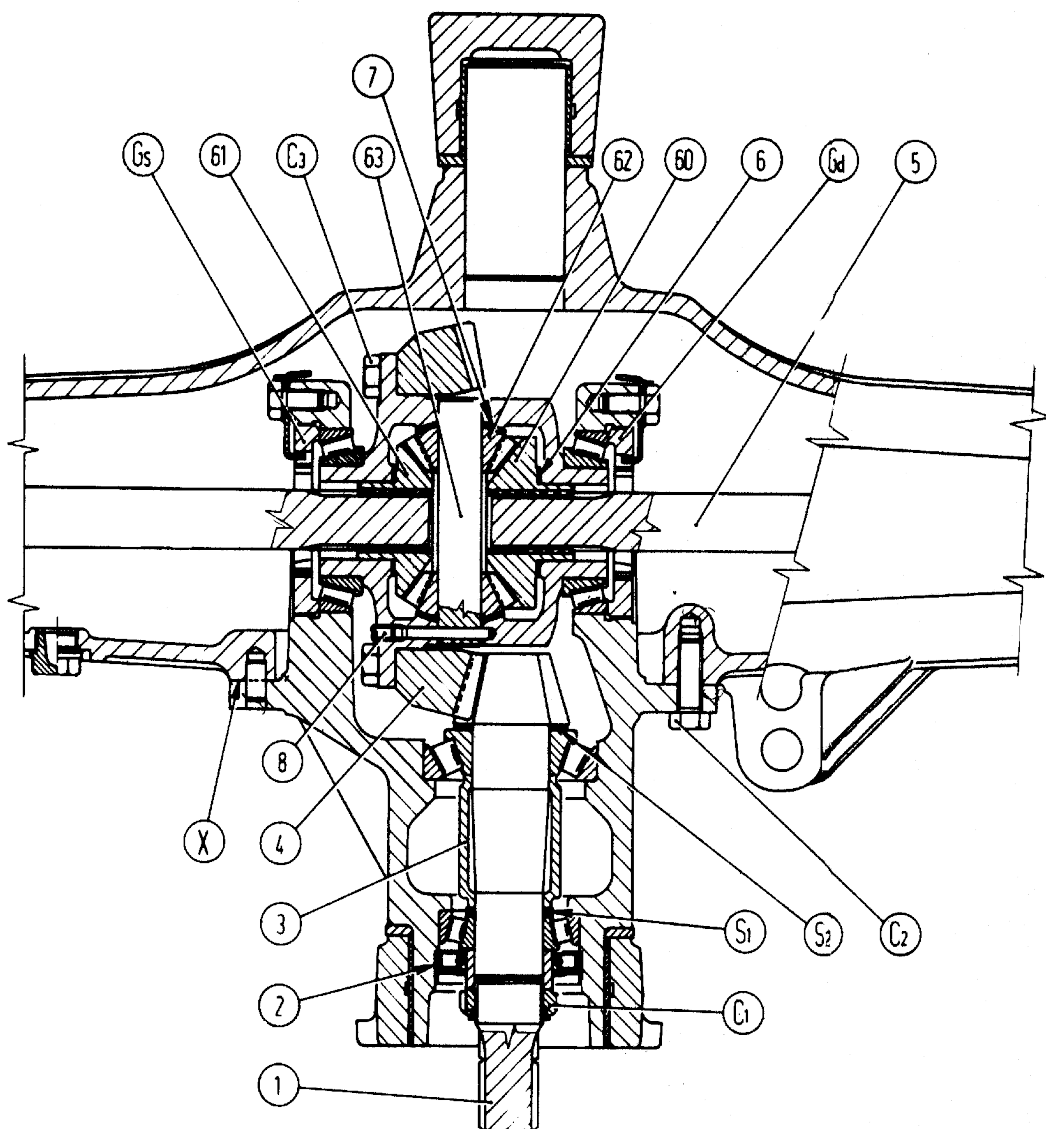


3

Cross-sectional view of front axle steering knuckle and hub

- | | |
|---|----------------------------------|
| S₃ = King pin bearing shim | 10. Seal |
| C₄ = King pin bearing cap screw. | 11. King pin bearing |
| C₅ = Steering knuckle cap screw. | 12. Seal |
| C₆ = Wheel hub bearing lockring | 13. Seal |
| C₇ = Final drive housing cap screw. | 14. Axle shaft bushing |
| 5. Wheel shaft | 15. Spacer |
| 9. Bearing carrier cap screw | 16. Thrust washers |
| | 17. Planet wheel journals |
| | 18. Planet wheel shims |
| | 19. Sun gear |

NOTE: During installation, apply sealing compound to surfaces **X** as shown in Section 00, Chapter 1, page 1.



TRE0414A

2

Cross-sectional view of front axle differential

- | | |
|--|--|
| S₁ = Bevel pinion bearing shim | 1. Bevel pinion |
| S₂ = Bevel pinion position shim | 2. Seal |
| C₁ = Bevel pinion bearing lockring. | 3. Bevel pinion bearing spacer |
| C₂ = Differential carrier capscrew. | 4. Ring gear |
| C₃ = Ring gear capscrew. | 5. Axle shaft with universal joint |
| Gd, Gs = R.H. and L.H. Differential bearing lockring. | 6. Side gear washers |
| | 7. Differential pinion washers |
| | 8. Differential pinion journal capscrew |
| | 60. Side gear |
| | 61. Side gear |
| | 62. Differential pinion |
| | 63. Differential pinion journal |

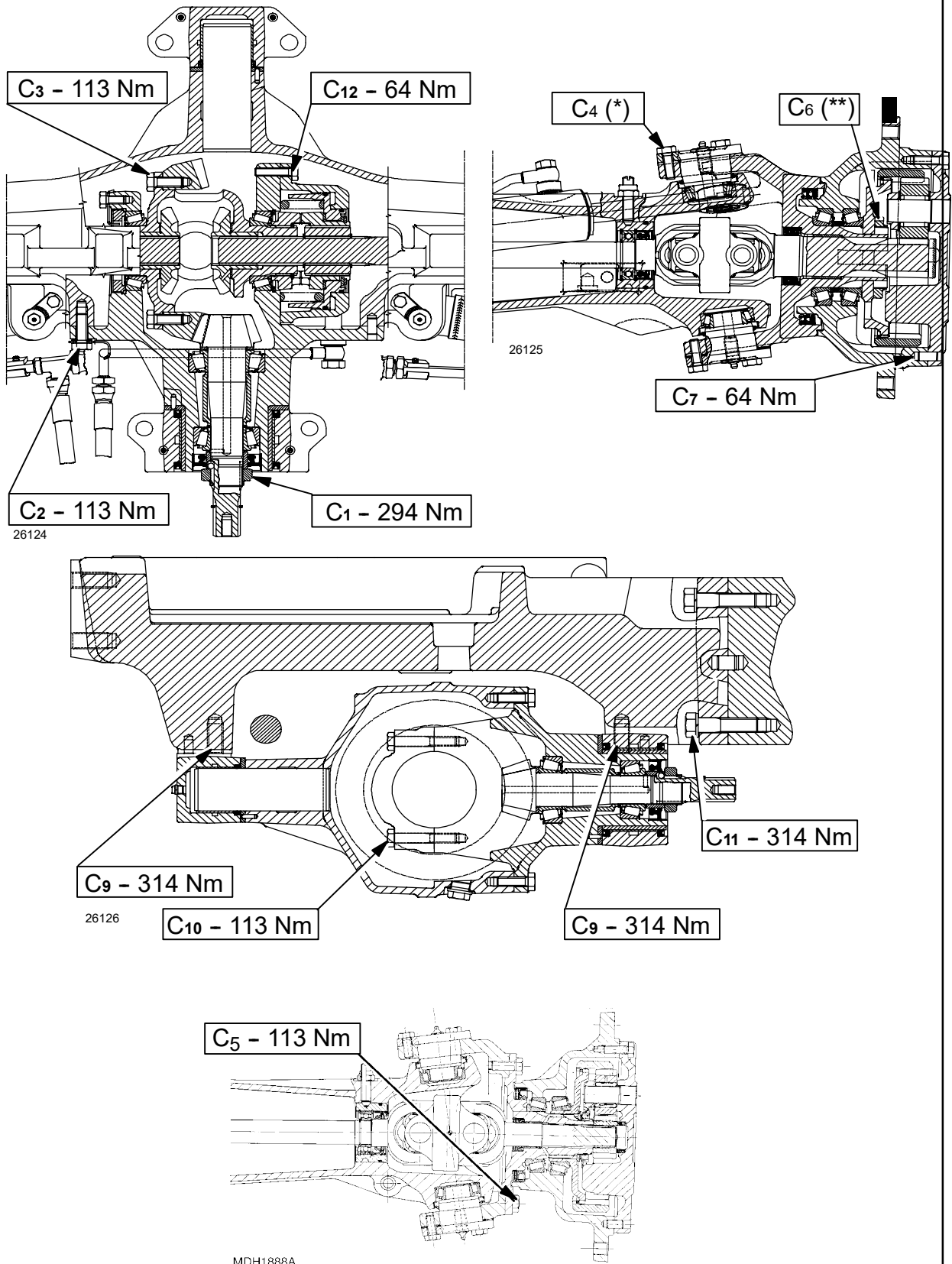
NOTE: During installation, apply sealing compound to surfaces **X** as shown in Section 00, Chapter 1, page 1.

TOOLS

WARNING: The tools marked below with an **(X)** are **ESSENTIAL** for the operations described in this section. To work in safety and obtain the best results whilst saving time and energy, these essential tools should be supplemented by the specific tools listed below and other tools which are to be made from the drawings provided in this manual.

List of specific tools required for the various operations described in this section.

380000251	Front axle overhaul stand.	X 380000248	Bevel pinion positioning adjustment tool
380000227	Hook for removal–installation of the front differential assembly.	X 380000532	Pinion ring nut wrench mod. JX60 and JX70
380000255	Overhaul support for front axle differential casing.	X 380000268	Pinion ring nut wrench mod. JX80, JX90 and JX95
380000249	Universal gauge for positioning of front bevel drive pinion.	X 380000257	Pinion grooved profile fastener wrench.
		X 380000252	Bevel drive bearing preloading ring nut wrench mod. JX60 and JX70
		X 380000253	Bevel drive bearing preloading ring nut wrench mod. JX80, JX90 and JX95
		X 380000234	Front axle pivot bearing outer ring removal tool.
		X 380000235	Tool for measurement of rolling drag torque of front axle bearings.
		X 380000616	Wheel hub ring nut wrench. (JX60, JX70 models)
		X 380000269	Wheel hub ring nut wrench. (JX80, JX90 and JX95 models)



(*) See pages 25 and 26

(**) See page 27

1

TIGHTENING TORQUES

PART	Thread	Tightening torque	
		Nm	ft lb
Front axle			
Lock ring, bevel pinion (C ₁)			
JX60 and JX70 Models	M 35 x 1.5	294	216.8432
JX80 JX90 and JX95 Models	M 40 x 1.5	294	216.8432
Capscrew, differential case to axle casing (C ₂)	M 12 x 1.25	113	83.3445
Capscrew, ring gear to differential case (C ₃)	M 12 x 1.25	113	83.3445
Steering knuckle capscrew (C ₅)			
- models JX60 and JX70	M 12 x 1.25	113	83.3445
Wheel hub bearings lock nut (C ₆):			
- JX60 and JX70 models	M 45 x 1.5	118	87.0323
- JX80, JX90 and JX95 models	M 75 x 2	392	289.11243
Capscrew, planetary final drive housing (C ₇)	M 10 x 1.25	64	47.2040
Front axle front and rear pivot support bolt (C ₉)	M 18 x 1.5	392	289.11243
Differential cage support cap bolt (C ₁₀)	M 12 x 1.25	113	83.3445
Front axle support to engine retaining bolt (C ₁₁)	M 18 x 1.5	314	231.5945

MAIN DATA

Axle shafts and steering knuckles		
- Diameter of outer axle shafts and corresponding bushes		
JX60 and JX70 Models	mm (in.)	29.914 – 29.935 (1.1777 – 1.1785)
JX80, JX90 and JX95 Models	mm (in.)	41.975 – 42.000 (1.6526 – 1.6535)
- Inside diameter of installed front bush		
JX60 and JX70 Models	mm (in.)	30.050 – 30.105 (1.1831 – 1.1852)
JX80, JX90 and JX95 Models	mm (in.)	42.100 – 42.175 (1.6575 – 1.6604)
- Clearance between pin and bush		
JX60 and JX70 Models	mm (in.)	0.115 – 0.191 (0.0045 – 0.0075)
JX80, JX90 and JX95 Models	mm (in.)	0.100 – 0.200 (0.0039 – 0.0079)
- Interference fit between bushes and respective bores	mm (in.)	0.064 – 0.129 (0.0025 – 0.0051)
- Thickness of steering knuckle bearing adjuster plates	mm (in.)	0.10–0.15–0.20–0.25–0.30 (0.0039–0.0059–0.0079–0.0098–0.0118)
Planetary Final Drives		
- Reduction ratio		
JX60 and JX70 Models	mm (in.)	$15:(15+54) = 1:4.6$ $0.5906:(0.5906+2.1260) = 1:4.6$
JX80 and JX90 Models	mm (in.)	$16:(16+62) = 1:4.88$ $0.6299:(0.6299+2.4409) = 1:4.88$
- Driven gear thrust washer thickness		0.77 – 0.83 (0.0303 – 0.0327)
Axle pivot		
Pivoting angle (on either side)		11°
Centre pivot and support end float	mm (in.)	0.3 – 1.1 (0.0118 – 0.0433)
Max. wear clearance	mm (in.)	2 (0.0787)
Centre pivot diameter	mm (in.)	52.652 – 52.671 (2.0729 – 2.0737)
Centre pivot front bushing fitted	mm (in.)	52.720 – 52.790 (2.0756 – 2.0783)
Centre pivot working clearance in bushing	mm (in.)	0.049 – 0.138 (0.0019 – 0.0054)
Rear bevel pinion carrier spigot	mm (in.)	99.040 – 99.72 (3.8992 – 3.9063)
Rear bushing fitted	mm (in.)	99.146 – 99.221 (3.9034 – 3.9063)
Spigot fitted clearance in bushing	mm (in.)	0.074 – 0.181 (0.0029 – 0.0071)
Axle front and rear thrust washer thickness	mm (in.)	4.95 – 5.00 (0.1949 – 0.1969)
Turning radius:		
- Live axle in Brakes on JX60 and JX70 Models	mm (in.)	3600 (141.732)
Brakes on JX80, JX90 and JX95 Models	mm (in.)	4100 (161.417)
- Live axle in Brakes off JX60 and JX70 Models	mm (in.)	5300 (208.661)
Brakes off JX80, JX90 and JX95 Models	mm (in.)	5600 (220.472)
- Live axle out Brakes on JX60 and JX70 Models	mm (in.)	4200 (141.732)
Brakes on JX80, JX90 and JX95 Models	mm (in.)	4500 (165.354)
- Live axle out Brakes off JX60 and JX70 Models	mm (in.)	4900 (192.913)
Brakes off JX80, JX90 and JX95 Models	mm (in.)	5100 (200.787)

(continued overleaf)

MAIN DATA

Bevel Drive and Differential		
- Thickness of pinion bearing adjustment spacer		
JX60 and JX70 Models	mm	2.5-2.55-2.6-2.65-2.7-2.75-2.8-2.85-2.9-2.95-3.00-3.05-3.10-3.15-3.2-3.25-3.3-3.35-3.4-3.45-3.5-3.55-3.6-3.65-3.7
	(in.)	(0.0984-0.1004-0.1024-0.1043-0.1063-0.1083-0.1102-0.1122-0.1142-0.1161-0.1181-0.1201-0.1220-0.1240-0.1260-0.1280-0.1299-0.1319-0.1339-0.1358-0.1378-0.1398-0.1417-0.1437-0.1457)
JX80, JX90 and JX95 Models	mm	2.2-2.25-2.30-2.35-2.40-2.45-2.5-2.55-2.6-2.65-2.7-2.75-2.8-2.85-2.9-2.95-3.00-3.05-3.1-3.15-3.2-3.25-3.3-3.35-3.4
	(in.)	(0.0866-0.0886-0.0906-0.0925-0.0945-0.0965-0.0984-0.1004-0.1024-0.1043-0.1063-0.1083-0.1102-0.1122-0.1142-0.1161-0.1181-0.1201-0.1220-0.1240-0.1260-0.1280-0.1299-0.1319-0.1339)
- Thickness of crown wheel position adjustment spacer		
JX60 and JX70 Models	mm	2.5-2.6-2.7-2.8-2.9-3.00-3.1-3.2-3.3-3.4-3.5-3.6-3.7
	(in.)	(0.0984-0.1024-0.1063-0.1102-0.1142-0.1181-0.1220-0.1260-0.1299-0.1339-0.1378-0.1417-0.1457)
JX80, JX90 and JX95 Models	mm	2.2-2.3-2.4-2.5-2.6-2.7-2.8-2.9-3.0-3.1-3.2-3.3-3.4-3.5
	(in.)	(0.0984-0.1024-0.1063-0.1102-0.1142-0.1181-0.1220-0.1260-0.1299-0.1339-0.1378-0.1417-0.1457)
- Clearance between sides of planet and side pinion teeth .	mm (in.)	0.15 (0.0059)
- Thickness of planet pinion thrust washers	mm (in.)	1.470 - 1.530 (0.0579 - 0.0602)
- Thickness of side gear thrust washers	mm (in.)	1.50 to 1.60 (0.0591 to 0.0630)
- Diameter of cross pin for planet pinions		
JX60 and JX70 Models	mm (in.)	21.939 - 21.960 (0.8637 - 0.8646)
JX80, JX90 and JX95 Models	mm (in.)	23.939 - 23.960 (0.9425 - 0.9433)
- Side diameter cross pin bore diameter		
JX60 and JX70 Models	mm (in.)	22.040 - 22.961 (0.8677 - 0.9040)
JX80, JX90 and JX95 Models	mm (in.)	23.940 - 23.961 (0.9425 - 0.9433)
- Clearance between cross pin and bores		0.080 - 0.122 (0.0031 - 0.0048)
- Diameter of outer axle shafts and corresponding bushes		
JX60 and JX70 Models	mm (in.)	37.961 - 38.000 (1.4945 - 1.4961)
JX80, JX90 and JX95 Models	mm (in.)	43.961 - 44.000 (1.7307 - 1.7323)
- Inside diameter of installed bushes		0.77 - 0.83 (0.0303 - 0.0327)
JX60 and JX70 Models	mm (in.)	38.080 - 38.199 (1.4992 - 1.5039)
JX80, JX90 and JX95 Models	mm (in.)	44.080 - 44.119 (1.7354 - 1.7370)
- Clearance between axle shafts and bushes		0.080 - 0.158 (0.0031 - 0.0062)

(continued overleaf)

SECTION 25 - FRONT AXLE MECHANICAL TRANSMISSION**Chapter 1 - Front axle mechanical transmission****CONTENTS**

Section	Description	Page
25 000	Main data	1
	Tightening torques	4
	Tools	6
	Cross-sectional views	7
	Description and operation	9
25 100 30	Complete front axle. Removal - Installation	10
25 100 38	Front axle. Removal - Installation	14
25 108 46-47	Steering knuckle bearing pins. Replacement	24
	Stub axle adjustment	25
	Wheel hub bearing adjustment	27
	Bevel drive adjustment	29
25 102 24	Front axle differential. Overhaul	36
25 100 27	Front axle differential with LIM-SLIP. Overhaul	37
	Front axle differential with NO SPIN. Overhaul	39
44 511 80	Leading drive wheels toe-in check	42

MAIN DATA

Type	steering, load bearing structure, pivoting at centre	
Bevel gear pair - differential		
Pinion-crown gear ratio: 30 km/h:		
- JX60 and JX70 Models		9/38 = 1:4.2
- JX80, JX90 and JX95 Models		9/39 = 1:4.3
Pinion-crown gear ratio: 40 km/h:		
- JX60 and JX70 Models		11/38 = 1:3.45
- JX80, JX90 and JX95 Models		11/39 = 1:3.54
Backlash between bevel gear pair:		
- JX60 and JX70 Models	mm (in.)	0.18 - 0.23 (0.0071 - 0.0091)
- JX80, JX90 and JX95 Models	mm (in.)	0.15 - 0.20 (0.0059 - 0.0079)
Ratio between front wheel revs and rear wheel bevel drive revs		
- JX60 and JX70 Models	mm (in.)	1.386 (0.545)
- JX80, JX90 and JX95 Models	mm (in.)	1.378 (0.542)
- JX95 Model		1.398 (0.550)

(continued overleaf)

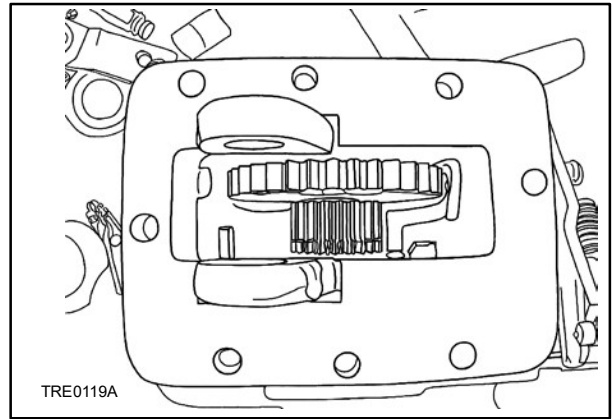
7. To refit the transfer box, proceed as follows:



WARNING



Use suitable tools to align holes. NEVER USE FINGERS OR HANDS.



13

Insert the shaft in the housing, then assemble the gear unit, washer and circlip.

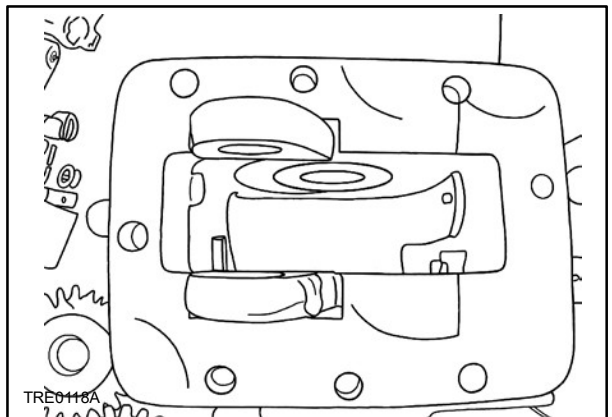
Fit the internal lever, the external lever, the coupling pad and secure in position by means of the washer and relative circlip.

Fit the bearing and relative circlips

Using tool **380000821**, fit the seal and dust ring (use the spacer to fit the dust ring).

Carry out operation **23101 40** Drive gear housing installation (see page 5).

Carry out operation **23 101 26** Transmission shafts and guard installation (see page 4).



14

TRANSFER BOX, UNIT REMOVED**Disassembly - Assembly (Op. 23 101 42)**

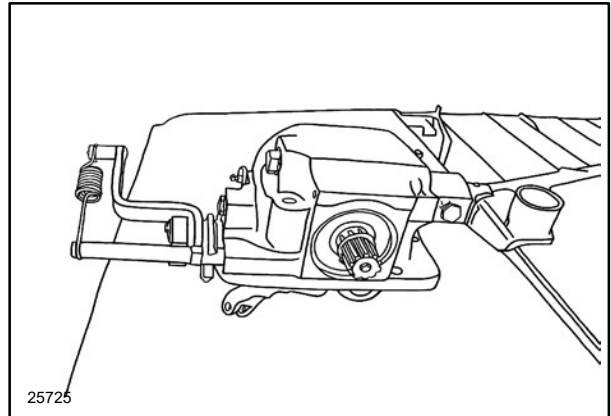
WARNING

Handle all parts with great care.
Do not place hands or fingers between one part and another.
Always wear the prescribed safety clothing, including protective glasses, gloves and shoes.

With the transfer box on the bench, proceed as follows:

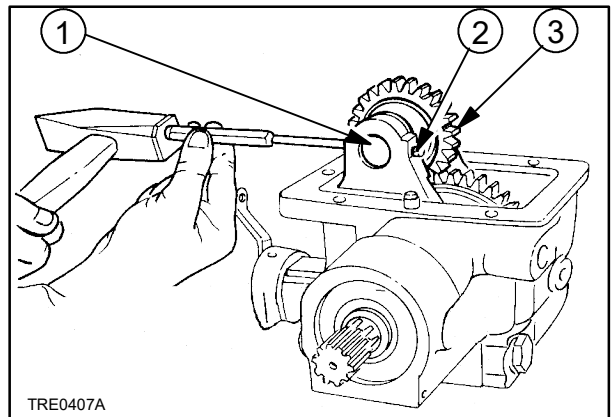
1. Carry out operation **23 101 26** Transmission shafts and guard removal (see page 4).
2. Carry out operation **23 101 40** Drive gear housing removal (see page 5).

S



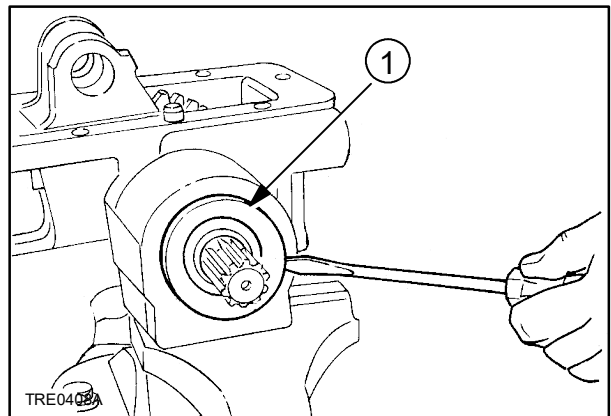
3. Use the special punch to withdraw the snap ring (1), then the pin (2). Remove the roller bearing, the spacer, the thrust washers and the intermediate gear (3).
4. Remove the parking brake control lever.

10



11

5. Use a screwdriver to remove the dust ring (1).
6. Remove the splined driven shaft, complete with parts, parking brake discs and the driven gear.



12

6.To refit the drive gear housing, proceed as follows:



WARNING



Use suitable tools for aligning holes. DO NOT USE YOUR HANDS OR FINGERS.

Refer to the tightening torques shown on page 2.

Carefully clean the contact surfaces.

Apply sealing compound (approx. 2 mm (0.0787 in.) wide strip) to the contact surface of the drive gear housing.

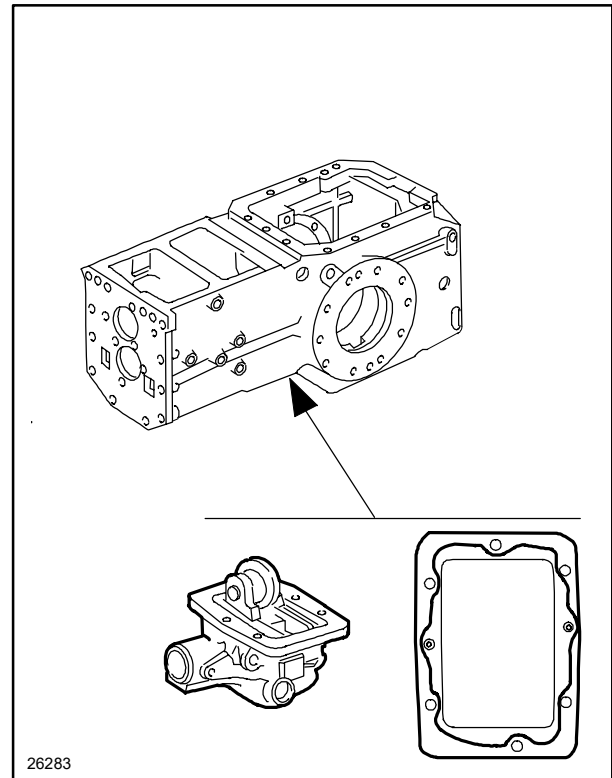
Fit the drive gear housing to the transmission housing.

Connect the drive gear engagement control lever

Replace the transmission oil drain plug.

Carry out operation **23 101 26** Transmission shafts and guard installation (see page 4).

Fit the drive shaft guard.



26283

9

Mastic application diagram for assembly of drive gear housing to transmission housing.

Op. 23 101 40

DRIVE GEAR HOUSING ASSEMBLY

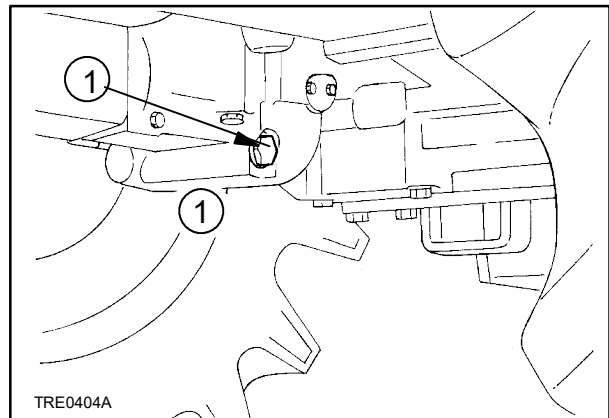
Removal- Installation

**WARNING**

Handle all parts with great care.
Do not place hands or fingers between one part and another.
Always wear the prescribed safety clothing, including protective glasses, gloves and shoes.

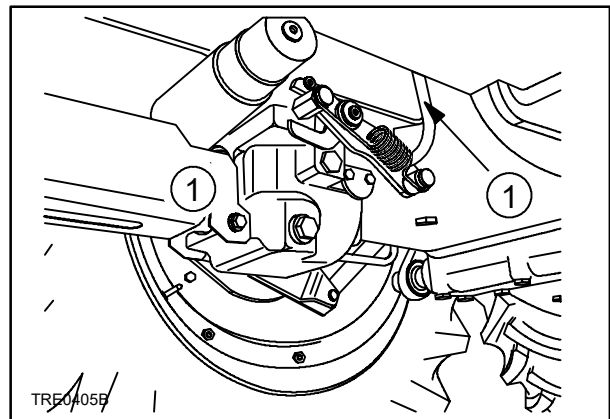
To remove, proceed as follows:

1. Carry out operation **23 101 26** Transmission shafts and guard removal (see page 4)
2. Remove the plug (1) and drain the oil from the transmission box/gearbox.



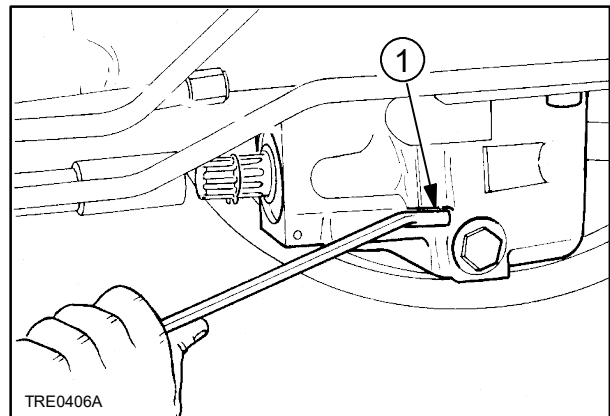
6

3. Detach the drive gear engagement control lever (1)



7

4. Remove the screws (1) that hold the drive gear housing (transfer box) to the transmission housing.



8

5. Remove the drive gear housing from the transmission housing.

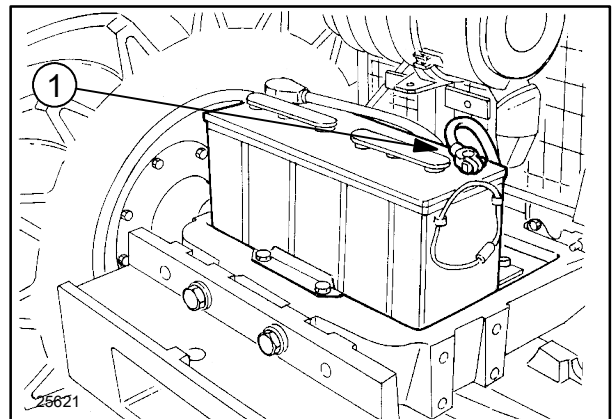
Op. 23 101 26

TRANSMISSION SHAFTS AND GUARD**Disassembly - Assembly****WARNING**

Handle all parts with great care.
Do not place hands or fingers between one part and another.
Always wear the prescribed safety clothing, including protective glasses, gloves and shoes.

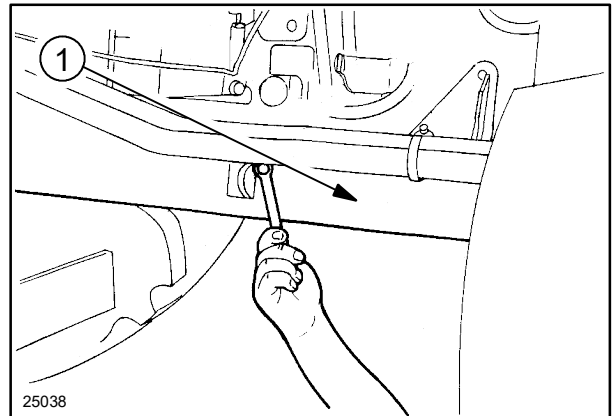
To remove, proceed as follows:

1. Disconnect the negative battery lead.



3

2. Remove the front, centre and rear screws securing the front axle prop shaft guard and remove the guard (1).
3. Remove circlip (2) fig. 5 and move sleeve (1) in the direction shown by the arrow to disengage it from the splined shaft of the front axle.
4. To re-fit the transmission shaft and guard, proceed as follows:



4

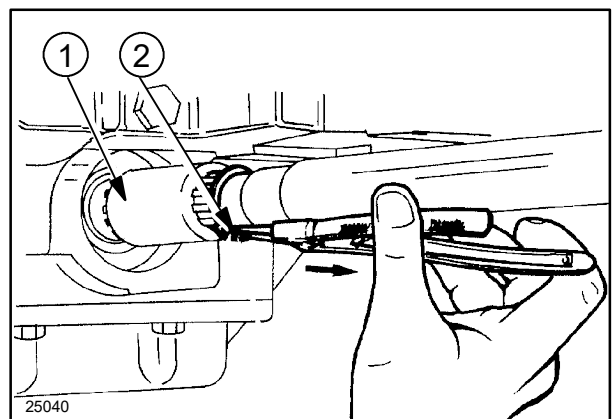
**WARNING**

Use suitable tools to align holes. NEVER USE FINGERS OR HANDS.

-Fit and secure the transmission shaft in position

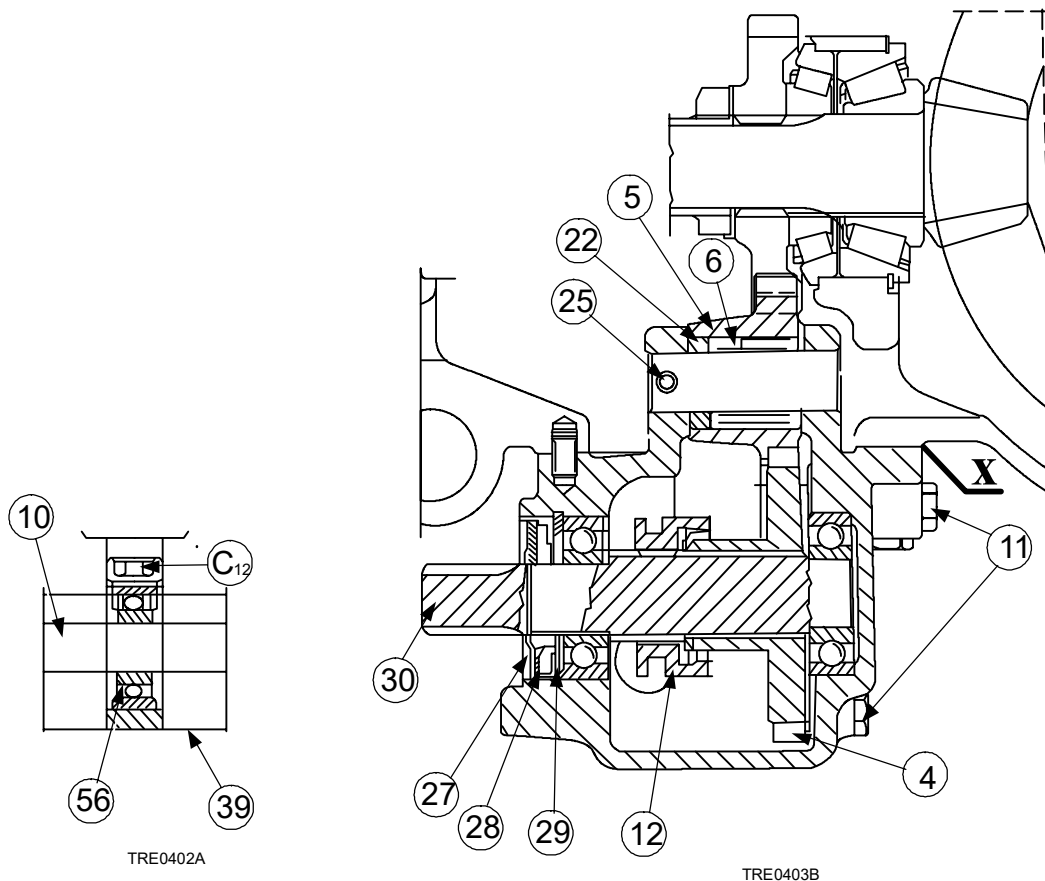
NOTE:

Move the front splined sleeve (27) against retaining ring (28). Using a feeler gauge, measure gap between the sleeve and the retaining ring (26) and install shim (S5) to obtain sleeve end play (L) of 1 to 1.5 mm (0.0394 to 0.0591 in.) (see Section 25 page 9).



5

- Fit and secure the guard.

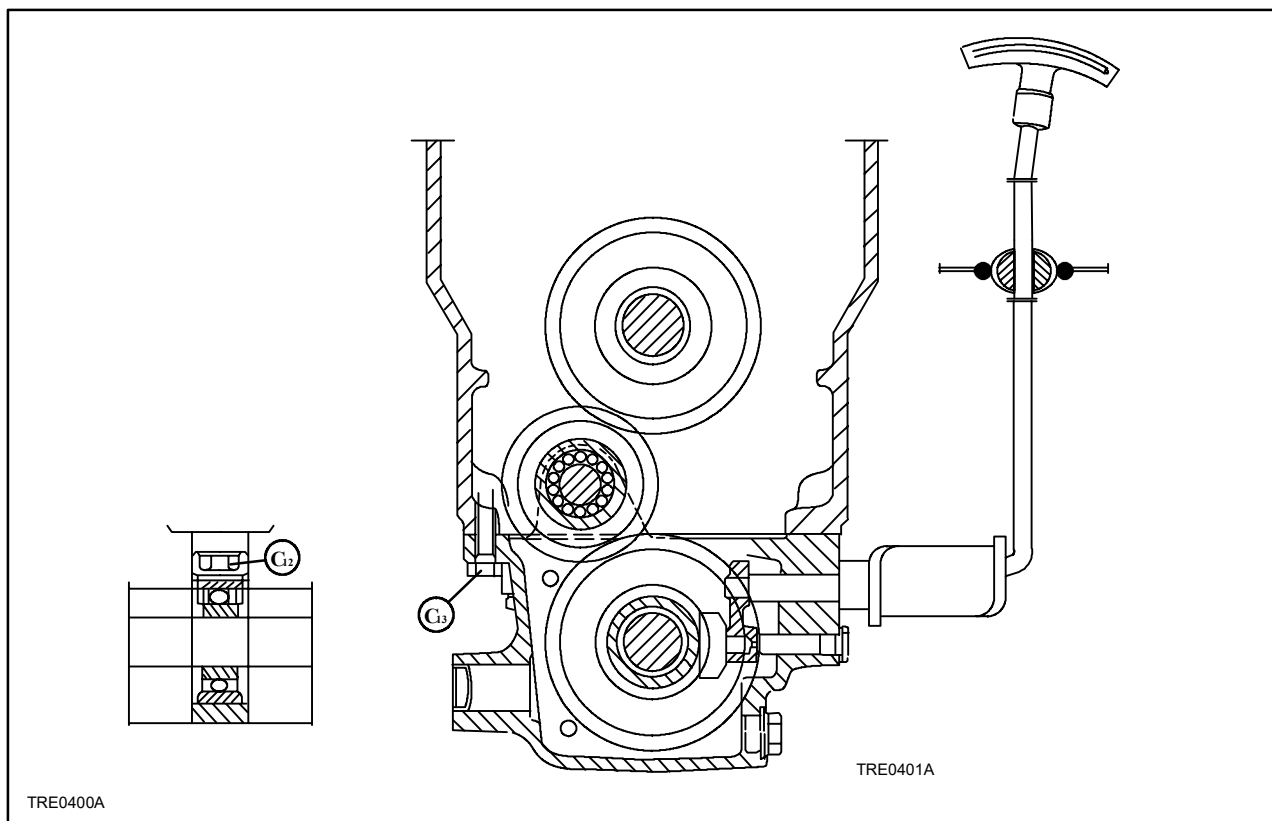


2

Sectional views of transfer box:

- | | |
|---|---------------------------------|
| C₁₂ = Drive shaft centre bearing capscrew | 25. Roll pin |
| C₁₃ = Axle drive housing capscrew | 26. Intermediate shaft |
| X = On assembly, thoroughly clean and degrease mating surface X. | 27. Dust excluder |
| 4. Driven gear | 28. Seal |
| 5. Intermediate gear | 29. Retaining ring |
| 6. Needle roller bearing | 30. Splined driven shaft |
| 10. Driven shaft | 39. Drive shaft guard |
| 11. Guide screws | 56. Centre bearing |
| 22. Dentent plunger | |

TORQUE SETTINGS



1

PART TO BE TORQUED	Thread	Torque setting	
		Nm	ft lb
Transmission shaft central support retaining bolt (C12)	M 12 x 1.5	98	72.2811
Drive gear housing retaining bolt (C13)	M 12 x 1.25	98	72.2811

TOOLS

380000821 Drive shaft seal key

SECTION 23 - DRIVE LINES

Chapter 1 - Drive Lines

CONTENTS

Section	Description	Page
23 000	Main specification	1
	Torque settings and Tools	2
	Cross-Sectional views	3
23 101 26	Transmission shafts and guard (Disassembly - Assembly)	4
23 101 40	Drive gear housing (Removal - Installation)	5
23 101 42	Drive gear housing removed (Disassembly - Assembly)	7

MAIN SPECIFICATION

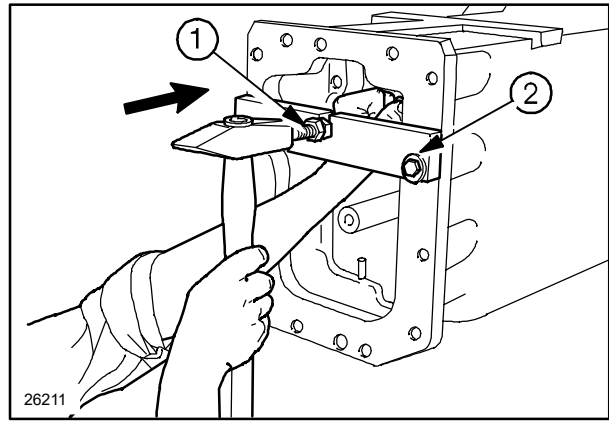
Reduction ratio		34/24x24/34= 1 to 1
Relay lever pad width	mm (in.)	7.978 - 8.000 (0.3141 - 0.3150)
Pad seat width in driven gear	mm (in.)	8.280 - 8.370 (0.3260 - 0.3295)
Pad clearance in seat	mm (in.)	0.280 - 0.460 (0.0110 - 0.315)
Relay lever pivot diameter	mm (in.)	15.973 - 16.000 (0.6289 - 0.6299)
Pivot housing bore in casing	mm (in.)	16.016 - 16.059 (0.6305 - 0.6322)
Pivot clearance in housing	mm (in.)	0.016 - 0.086 (0.0006 - 0.0124)
Relay lever detent spring length		
- Free	mm (in.)	130 (5.1181)
- Under 178.2 to 197.8 N (40 to 44 lb)	mm (in.)	142.5 (5.6102)

MAIN SPECIFICATION OF DRIVE SHAFT

Front drive sleeve adjustment		see page 4
Front drive sleeve shim thickness	mm (in.)	2.2.-2.5-2.8-3-3.3-3.7-4-4.3 (0.0866-0.0984-0.1102-0.1181- 0.1299-0.1457-0.1575-0.1693)

Note – Leave the drift (1) with the nut in the position reached on completion of the installation operation, and on future seal installation operations simply check that the distance (H, fig. 20) is as prescribed.

21. Remove the drift (1), the bracket (2) and the circlip (1, fig. 18).
22. Locate the new seal in its seat (see page 6 for correct orientation of seal), refit the bracket (2) on the clutch casing and insert the drift in the bracket.
23. Force the seal in until the nut (1, fig. 20) reaches up against the bracket (2).
24. Dismantle the bracket (2), remove the drift (1) and proceed with the installation of the other components.



21

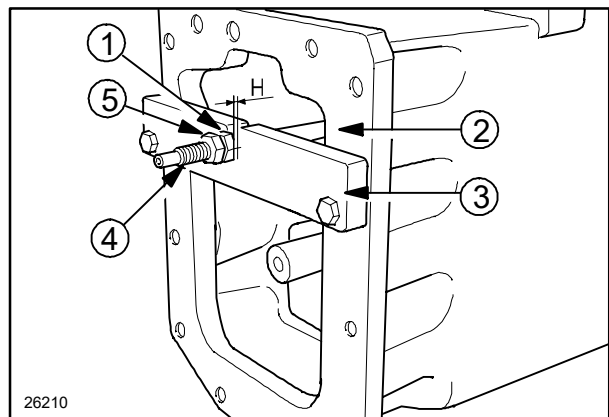
- 16.** To refit all the reverser and creeper components in the casing follow the instructions below :
- Refer to the illustrations on pages 4 and 5 for the orientation of the various components.
 - Adhere to the torque setting values prescribed on page 2.
 - To install the seal (1, fig.19) follow the instructions in steps 17.- 24.
 - Install the driveshaft complete with bearing and circlips.
 - Fit the cover-support.
 - Install the reverser and creeper driven gear shaft.
 - Fit the cover for the driven gear shaft and secure with the relative screws.
 - Install the reverser intermediate gear assembly and secure with the relative screw.
 - Install and fix the clutch control forks to the relative levers.
 - Install the pressure plate bearings and hold in place with the relative springs.
 - Install the driven gear complete with bearing and thrust washer.
 - Install the complete synchroniser assembly and secure with the relative circlip.
 - Fit the rod retaining screw coated with one of the sealing compounds listed on page 1, Sect. 00.
 - Install the gear on the reverser driven shaft and secure with the relative circlip.
 - Remove the clutch casing –reverser and creeper unit from the stand **380000301**.

! WARNING !

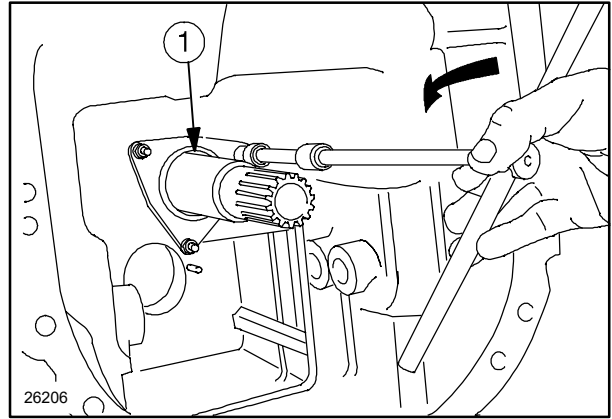


Always use suitable tools to align holes. NEVER USE YOUR FINGERS OR HANDS.

- 17.** Fit the circlip (1, fig.18) in its seat.
- 18.** Make the bracket of tool **50043** (4) and the tool **50137** (5) (see page 3).
- 19.** Fit the bracket (3) on the clutch casing, insert the installation drift (4) in the seal seat in contact with the circlip (1, fig. 18).
- 20.** Screw in nut (1) to obtain a distance (H) between the bracket and nut of 3.3 – 3.6 mm (0.1299 – 0.1417 in.) and secure the latter with the locknut (5).

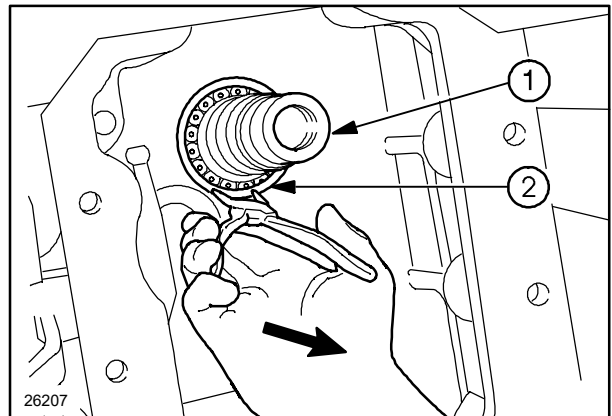


12. Unscrew the retaining bolts and remove the cover-support (1).



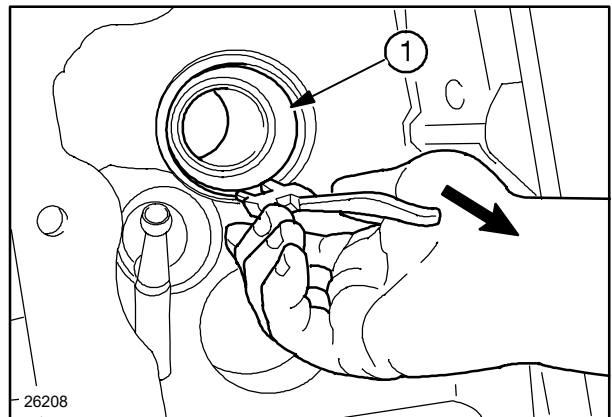
16

13. Remove the circlip (2) and withdraw the drive-shaft (1) complete with bearing.



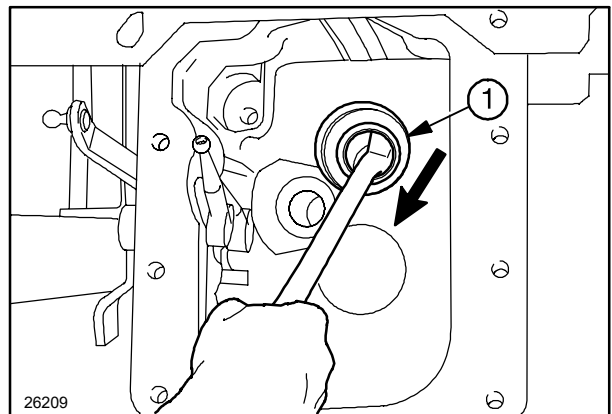
17

14. Remove the circlip (1).



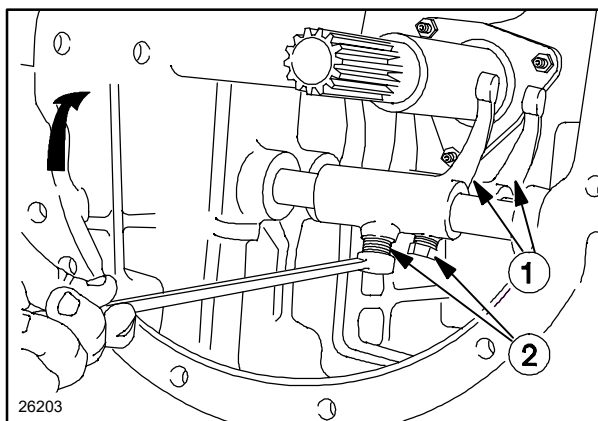
18

15. Remove the driveshaft seal (1) using a suitable implement.



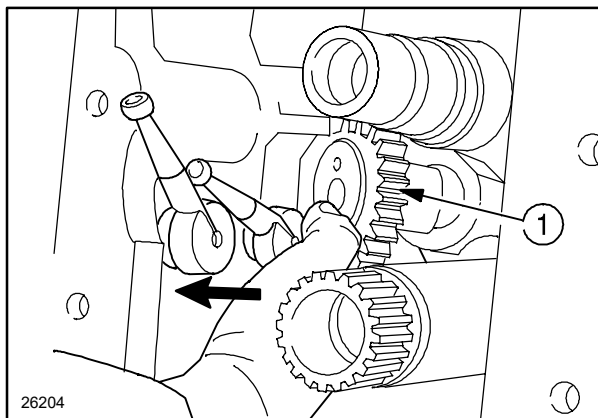
19

8. Unscrew the retaining screws (2) and remove the control forks (1).



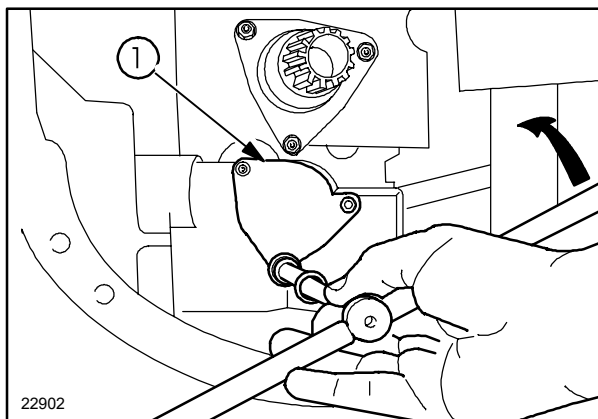
12

9. Unscrew the retaining screw (15, page 5) and withdraw the reverser intermediate gear assembly (1).



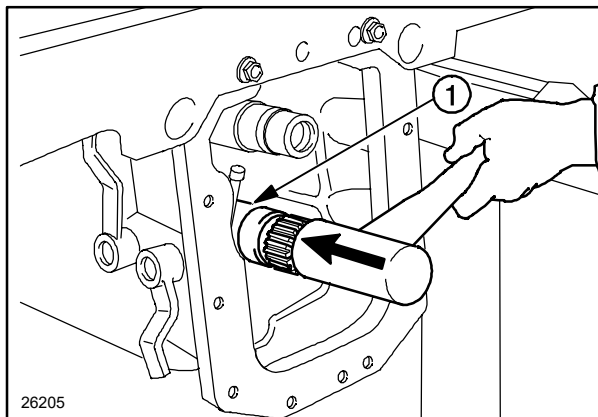
13

10. Unscrew the retaining bolts and remove the cover (1).



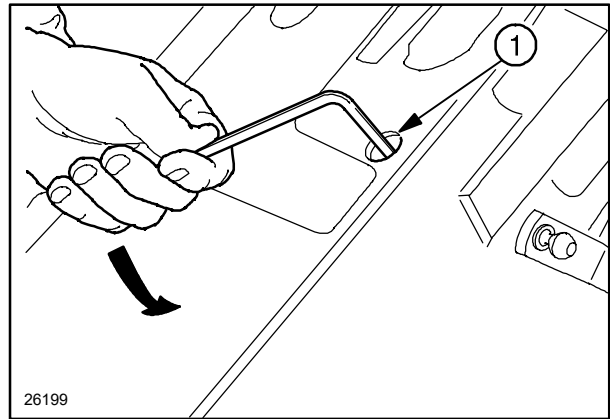
14

11. From the rear of the casing, withdraw the shaft (1) complete with the relative bearing.



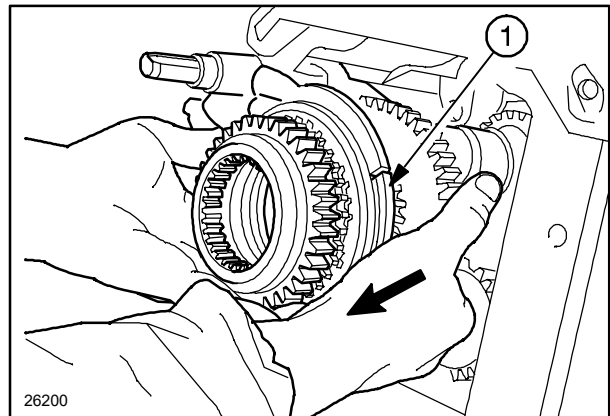
15

4. Remove plug and remove the control lever retaining pin (1).



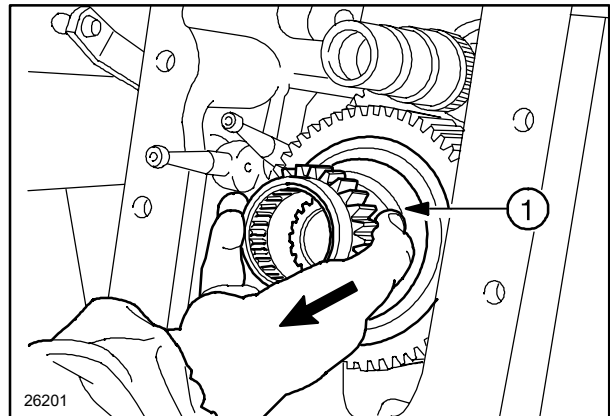
8

5. Remove the reverser synchroniser assembly (1) together with control forks and gears.



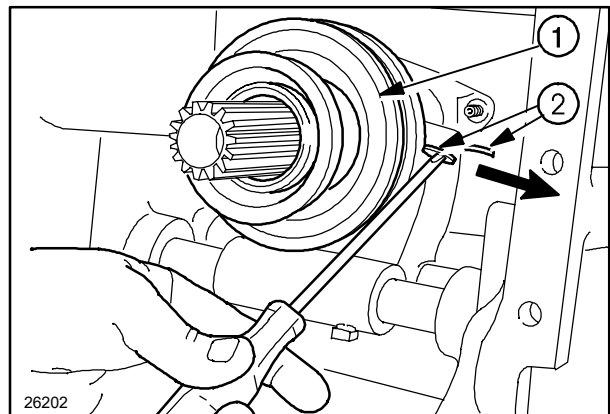
9

6. Withdraw the driven shaft gear (1) together with the roller bearings and remove the thrust washer.



10

7. Remove the control fork retaining springs (2) and withdraw the clutch pressure plate bearing assembly (1).



11

CLUTCH CASING - SYNCHRONISER REVERSER AND CREEPER UNIT

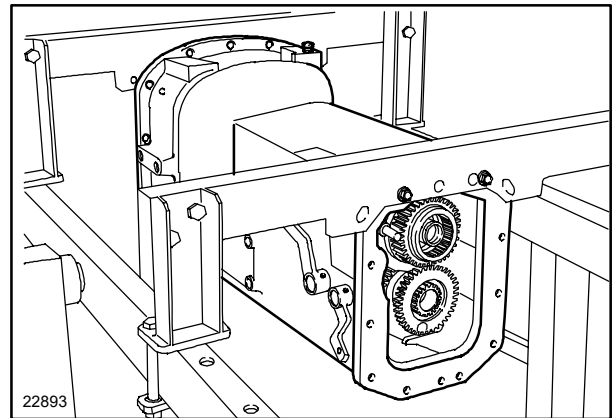
Replacement (Op. 21 110 87) 5.

WARNING!

Handle all parts with great care.
Never place your hands between one part and another. Wear suitable safety clothing, i.e. safety goggles, gloves and shoes.

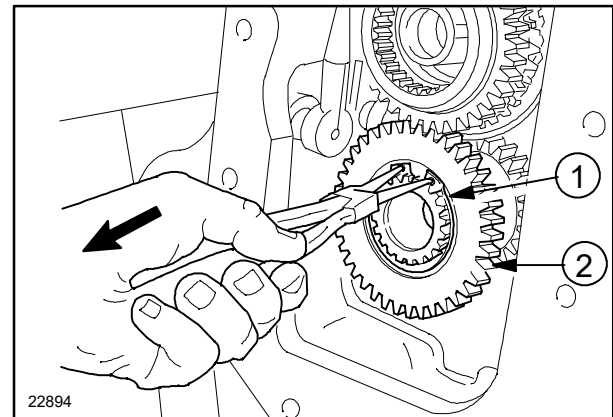
To gain access to the synchroniser reverser-creeper unit, first remove the cab or platform following the instructions given in Sect. 27 and remove the clutch casing as described in Sect. 18, and then proceed as follows :

1. Fix the casing to the rotating stand **380000301** using the brackets **380000271** and **380000272**.



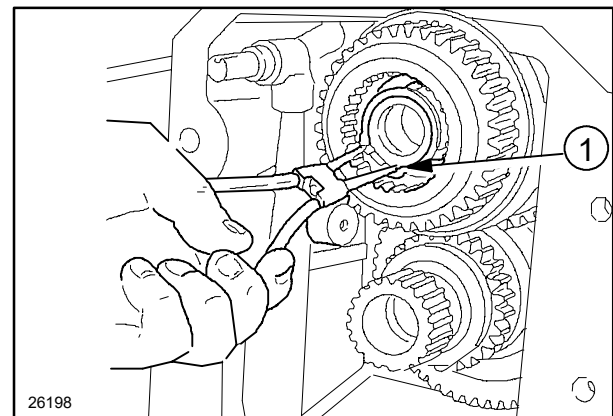
5

2. Remove circlip (1) and slide out constant mesh gear (2).



6

3. Remove circlip (1) of reverser transmission driving shaft.



7

DESCRIPTION AND OPERATION 4.

The reverser-creeper unit is a mechanical device providing the possibility to obtain 20 forward speeds and 12 reverse speeds.

The creeper unit engages only in slow and middle ranges, a mechanical interlock prevents creeper engagement in the fast ranges.

The creeper unit comprises a group of three spur gears : a sliding control gear, a synchroniser control gear and a driven gear; the unit utilises the same synchroniser as the reverser.

The creeper is installed in series with the reverser

and is controlled by a hand lever located on the right-hand side of the operator.

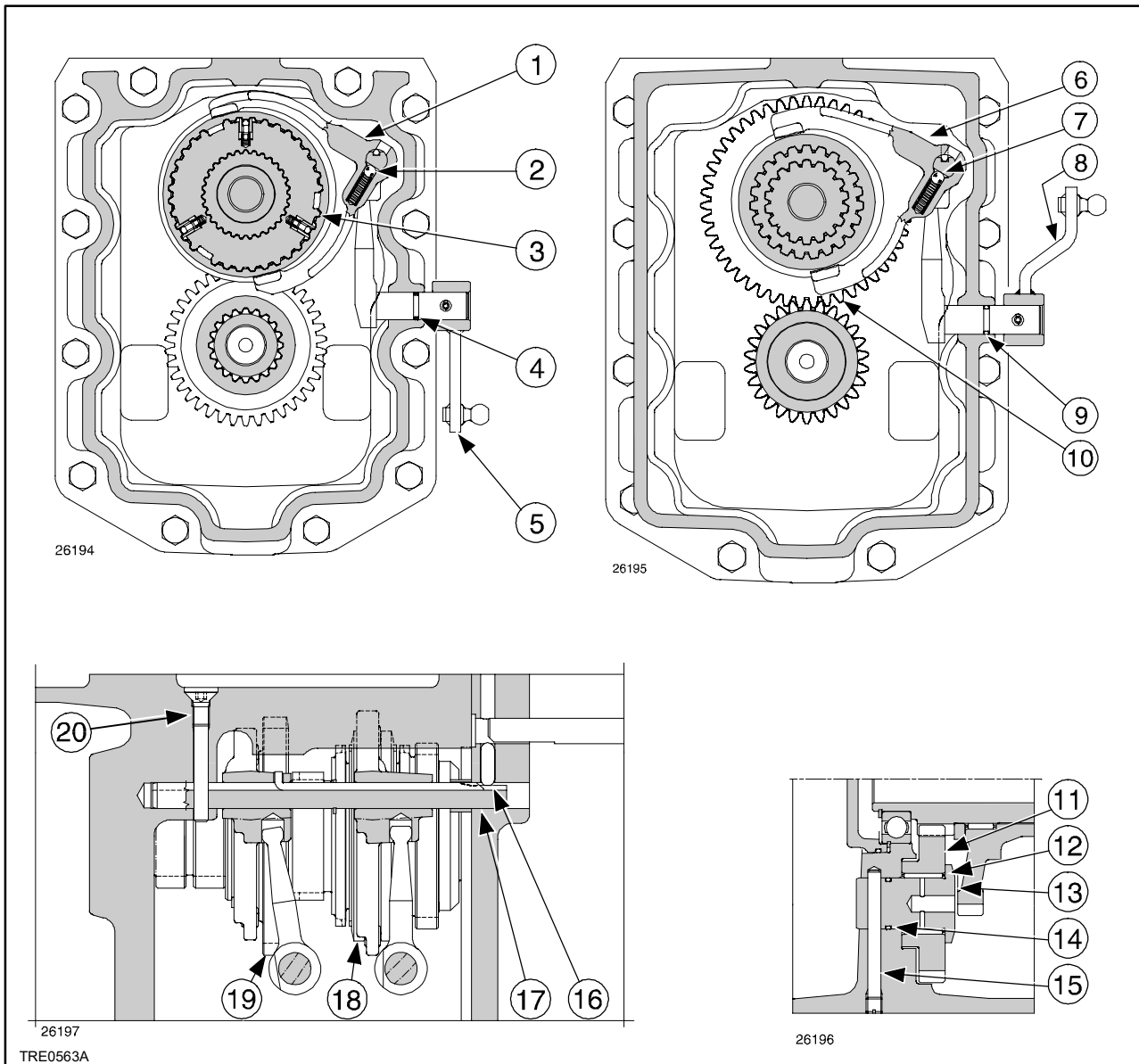
The reverser comprises three spur gears : the reverser driving gear, an intermediate gear and the reverser driven gear; the reverser is engaged by means of a synchroniser located in the gear assembly.

The reverser-creeper unit is installed inside the clutch casing between the clutch and the gearbox.

Lubrication is provided by the oil contained in the rear transmission-gearbox.

SYNCHRONISER REVERSER-CREEPER UNIT TROUBLESHOOTING

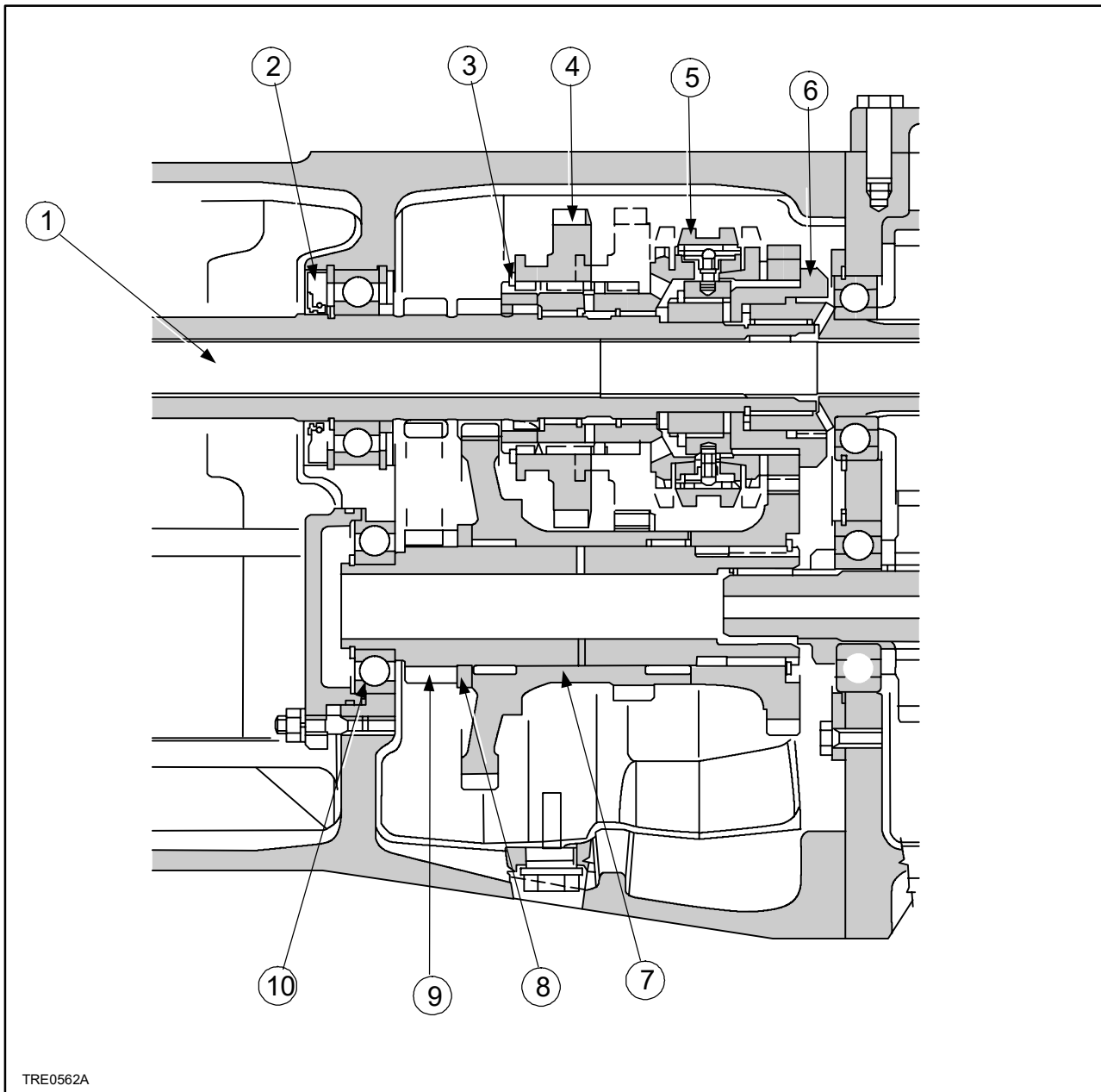
Problems	Possible causes	Remedies
Spontaneous disengagement of the reverser-creeper unit.	14. External levers and linkages incorrectly adjusted. 15. Synchroniser teeth damaged.	Adjust correctly. Remove the clutch casing and replace the synchroniser.
Difficulty in engaging the reverser-creeper unit.	16. Engagement incomplete. travel 1. External levers and linkages incorrectly adjusted. 2. Stiffness and / or partial seizure of external levers and linkages. 3. Main clutch drag. 4. Synchroniser defective. 5. Internal control elements do not slide freely : rods, forks and sleeves.	Eliminate the cause and restore full travel. Adjust correctly. Check pivot points and lubricate. See page 5, Sect. 18. Remove the clutch casing-gearbox and replace the synchroniser. Perform the checks and overhaul for needed parts.
Reverser-creeper unit unduly noisy.	1. Internal component/s worn or defective.	Remove clutch casing and replace defective parts.



4

Cross sectional views of synchroniser reverser - creeper unit

- | | |
|-------------------------------------|--|
| 1. Reverser control fork. | 12. Roller bearing. |
| 2. Detent ball. | 13. Journal for gear (11). |
| 3. Reverser synchroniser. | 14. Seal. |
| 4. Seal. | 15. Retaining screw for journal (13). |
| 5. External reverser control lever. | 16. Fast speeds lock pawl. |
| 6. Creeper unit control fork. | 17. Reverser and creeper unit control rod. |
| 7. Detent ball. | 18. Reverser synchroniser. |
| 8. External creeper control lever. | 19. Creeper unit control gear. |
| 9. Seal. | 20. Retaining screw for rod (17) (apply one of the sealing compounds listed on page 1, Sect. 00 to the screw). |
| 10. Creeper unit control gear. | |
| 11. Intermediate gear for reverser. | |



Longitudinal section through reverser-creeper unit

- | | |
|---|--|
| 1. Reverser and creeper unit control shaft. | 6. Gearbox driving shaft control gear. |
| 2. Seal. | 7. Creeper unit driven gear. |
| 3. Circlip. | 8. Thrust washer. |
| 4. Creeper unit control gear. | 9. Reverser driven shaft. |
| 5. Reverser-creeper unit synchroniser. | 10. Seal. |

Note – On assembly apply sealing compound to the surfaces **X** following the indications given on page 6 in Chapter 1.

TOOLS 3.

Warning - The operations described in this Section can only be carried out using the **ESSENTIAL** tools marked with an (X).

However, for greater safety and to obtain the best results while saving time and effort, it is recommended that these essential tools are used together with the special tools listed here as well as certain tools which are to be made following sectional drawings given in this manual.

List of special tools required for the various operations in this Section :

380000236 Tractor dismantling stand.

380000227 Clutch casing lifting hook.

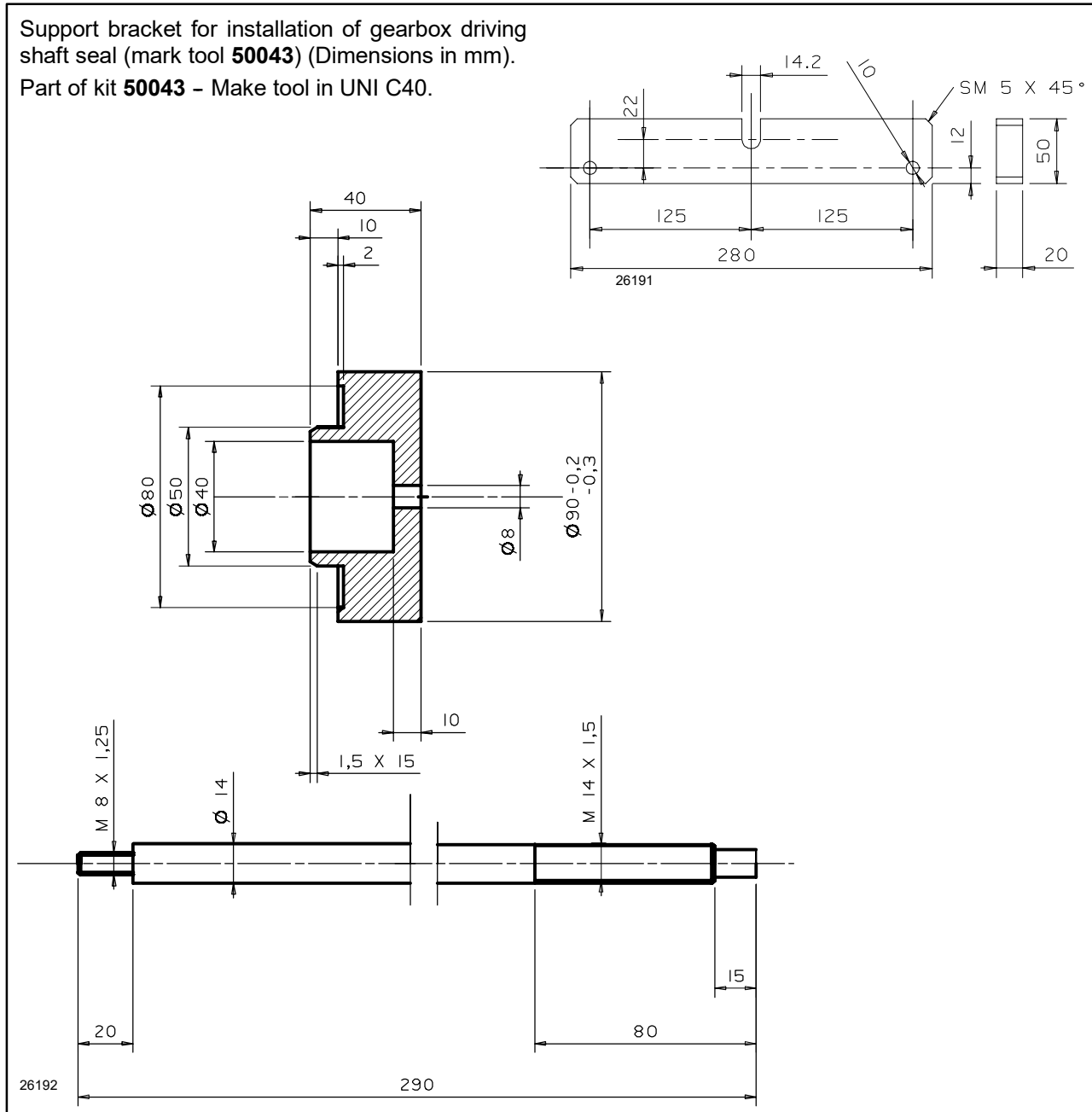
380000301 Rotating overhaul stand.

380000271 Front bracket (with **380000301**).

380000272 Rear bracket (with **380000301**).

Support bracket for installation of gearbox driving shaft seal (mark tool **50043**) (Dimensions in mm).

Part of kit **50043** - Make tool in UNI C40.

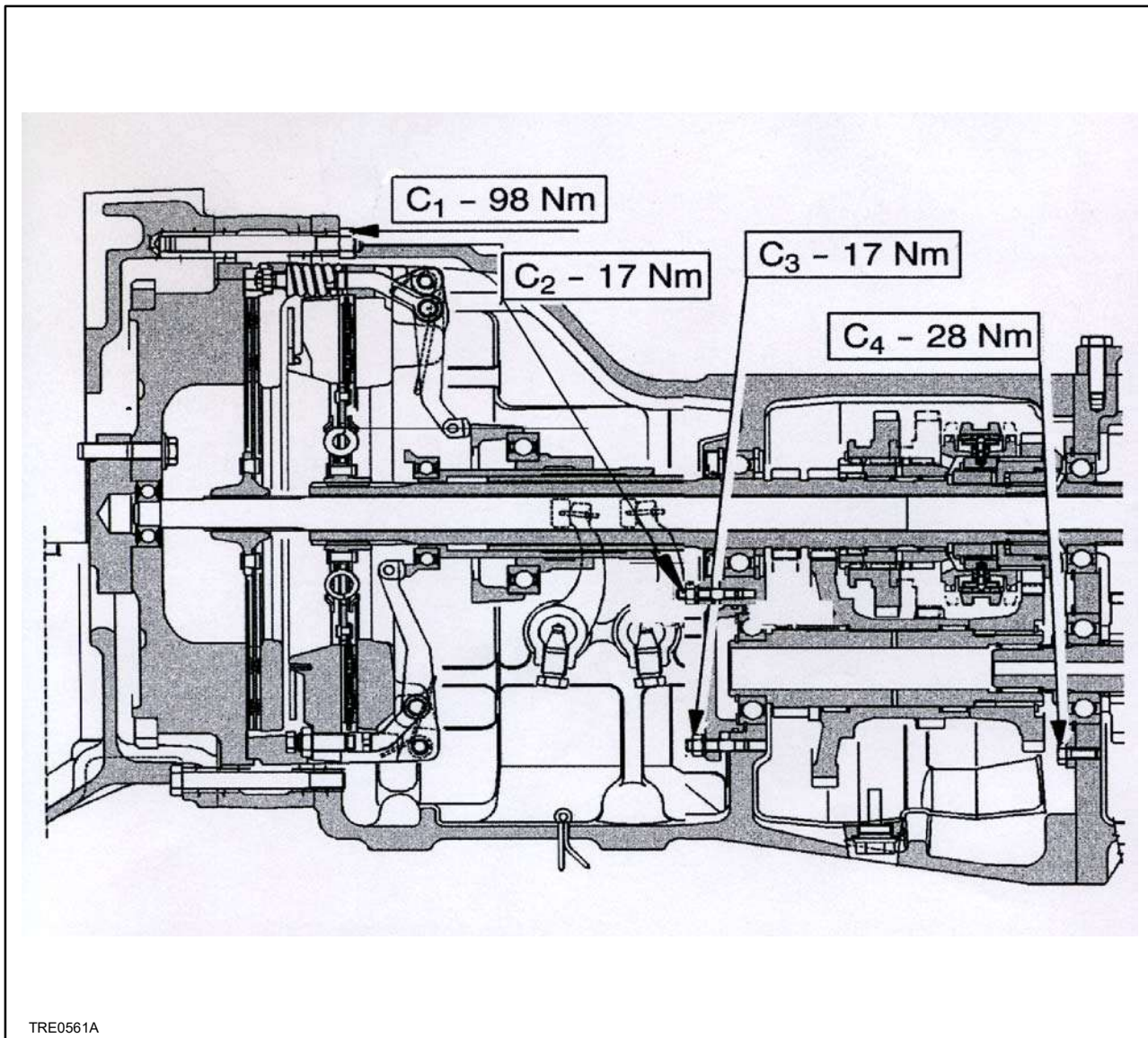


2

Tool for gearbox driving shaft seal (mark tool **50137**)
(Dimensions in mm)
make tool in UNI C40.

TORQUE VALUES 2.

PARTS	Thread	Torque Settings	
		Nm	ft lb
Bolt or nut securing clutch casing – reverser and creeper unit to the engine (C ₁)	M 12 x 1.25	98	72.2811
Sleeve cover nuts (C ₂)	M 8 x 1.25	17	12.5385
Synchroniser reverser – creeper unit driven shaft cover nuts (C ₃)	M 8 x 1.25	17	12.5385
Gearbox driving and driven shaft bearings cover screws (C ₄) ..	M 8 x 1.25	28	20.6517
Bolt securing clutch casing – reverse and creeper unit to the rear transmission-gearbox	M 12 x 1.25	98	72.281117



SECTION 21 - TRANSMISSIONS**Chapter 3- Reverser and creeper unit****CONTENTS**

Section	Description	Page
21 000	Main data	1
	Tightening torques	2
	Tools	3
	Section views	4
	Description and operation	6
	Fault diagnosis	6
21 110	Removal-Refitting	7

21 000 - MAIN DATA - TIGHTENING TORQUES - SECTION VIEWS - TOOLS - DESCRIPTION AND OPERATION - FAULT DIAGNOSIS

SYNCHRONISER REVERSER-CREEPER UNIT MAIN DATA 1.

Type	Mechanical, spur gears, located between engine and gearbox. Comprising 1 driving gear, 1 intermediate gear and 1 idle gear.
Control	by hand lever located on left-hand side of operator

CREEPER UNIT MAIN DATA

Type	Ordinary gear train with spur gears, located between main clutch and gearbox, in series with the reverser. Provides 20 forward speeds and 12 reverse speeds
Reduction ratio	$\frac{18 \times 26}{55 \times 47} = 1:5.524$
Control	by hand lever located on left-hand side of operator

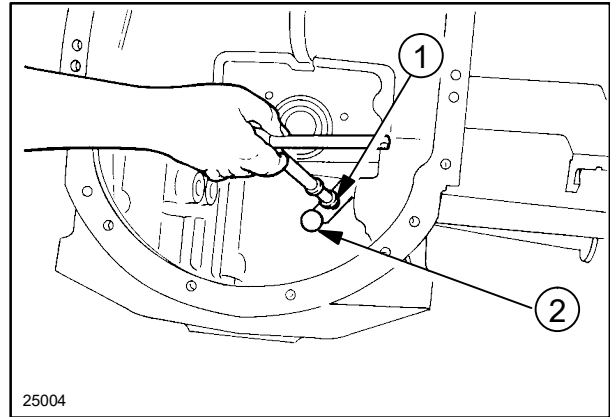
GEARBOX MAIN DATA

Gearbox	4-speed constant mesh, synchronised on all gears
Gearing type	helical
Range gear	Ordinary gear train with three ranges for a total of 12 speeds
Gearing type	spur gears
Gearbox and range gear controls	Independent, by two hand levers
For further data see chapter 1.	

12. Relieve the staking and unscrew bolt (1) securing the stop plate for the journal of the reverser driven shaft (2) and the intermediate gear journal, removing the latter from the rear of the casing.

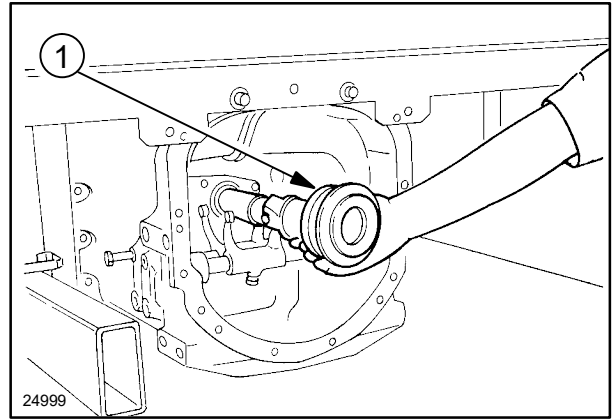
13. Refitting of the synchroniser reverser according to the following instructions:

- Refer to the illustrations on pages 3 and 4 to check the correct orientation of the various parts.
- Refer to the torque settings on page 2.
- Install the intermediate gear journal complete with the various associated parts, and the journal of the reverser driven gear and secure with the relative stop plate and bolt.
- Fit the sliding sleeve control forks on the relative clutch control levers and fix the previous to the latter.
- Fit the sliding sleeve cover and its support.
- Fit the sliding sleeve assembly to the relative support and secure with the springs.
- Insert the reverser driving shaft from the rear of the casing and fix it to the clutch / reverser casing with the circlip.
- Position the reverser driving gear complete with bearings on the driven shaft.
- Fit the reverser driving gear complete with the bearings and spacers.
- Fit the synchroniser assembly complete with control forks, rod, thrust washers and bearing, and fix in position with the relative circlip.
- Fit the detent ball, spring, and bolt in the locked position after covering the bolt using one of the sealants listed on page 1, Sect. 00.
- Position the internal lever and link lever and fix with the relative spring pin.
- Remove the clutch / reverser casing from the stand **380000301**.



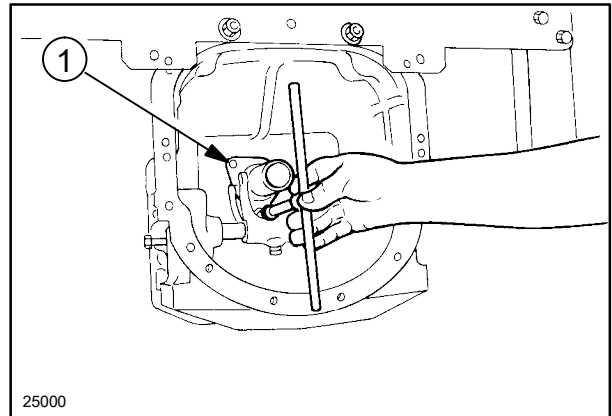
22

8. Detach the retaining springs and withdraw the sliding sleeves (1).



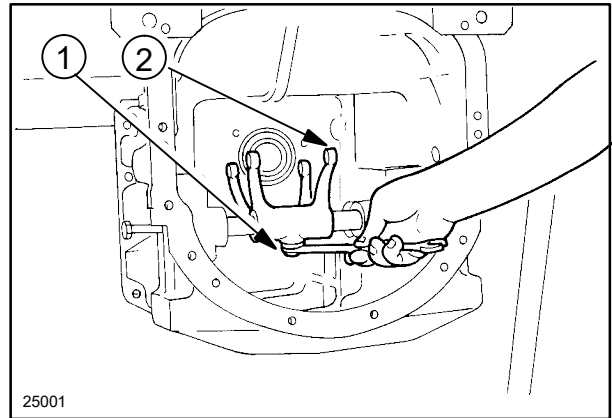
18

9. Unscrew the retaining bolts and remove the sleeve cover / support (1).



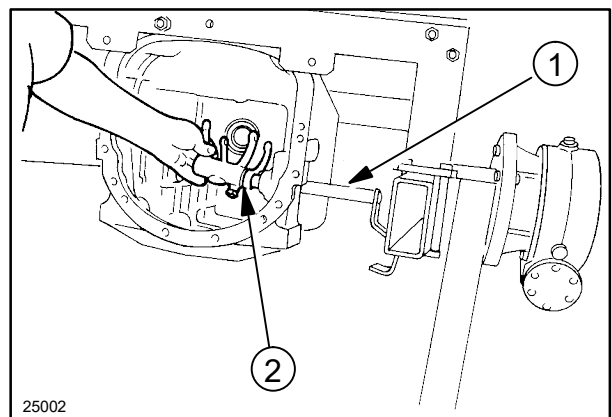
19

10. Unscrew the two securing bolts (1) of the sliding sleeve control forks (2).



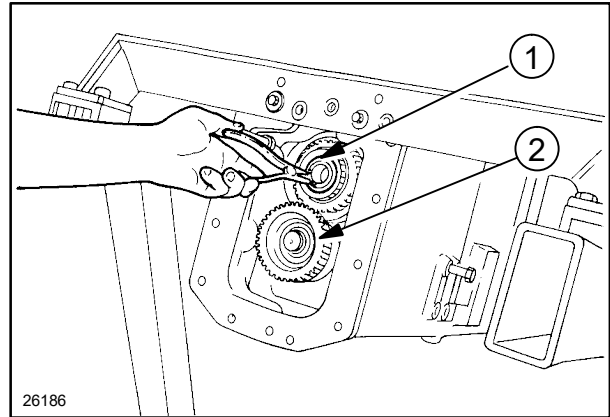
20

11. Withdraw the external clutch control levers (1) and remove the forks (2).



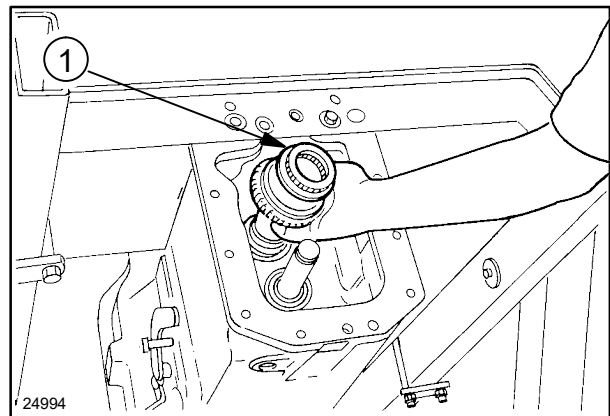
21

4. Remove the circlip (1) and take out : bearing, thrust washers, synchroniser assembly together with the selector fork and its rod, the reverser driven gear (2) complete with roller bearings and spacer.



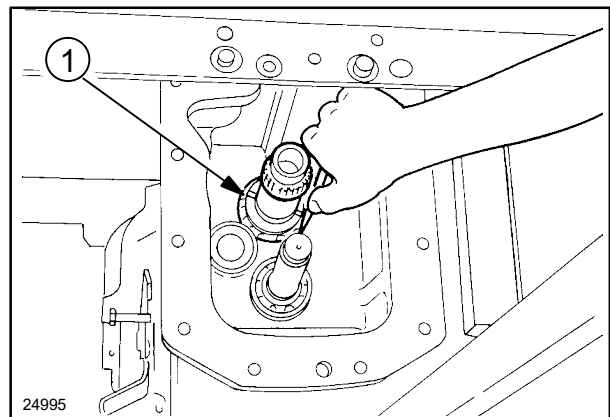
14

5. Remove the reverser driving gear (1) complete with roller bearings.



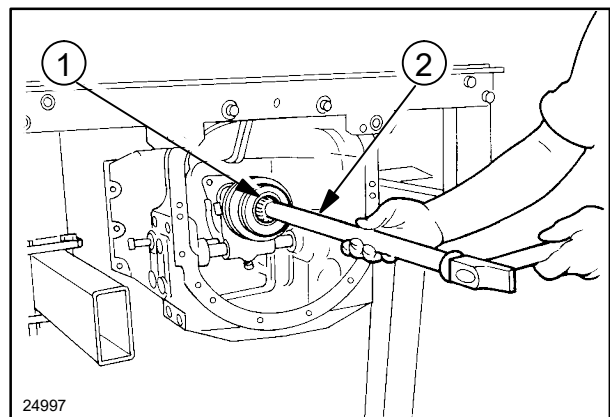
15

6. Remove the circlip (1) securing the reverser driving shaft.



16

7. Working from the front of the clutch / reverser casing with an aluminium drift (2), drive out the reverser driving shaft (1) and remove it from the rear of the casing.



17

CLUTCH/REVERSER CASING Replacement (Op. 21 110 85)

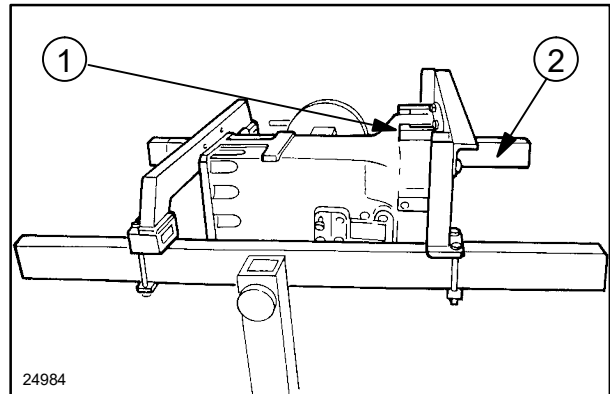


WARNING



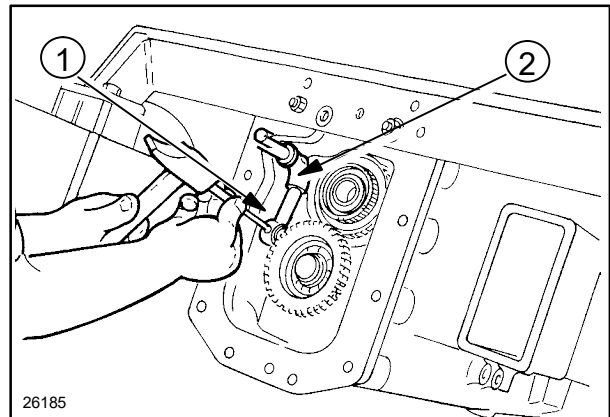
Handle all parts with great care.
Never insert fingers or hands between one piece and another. Wear suitable safety clothing, i.e., safety goggles, gloves and shoes.

1. Fix the clutch / reverser casing (1) to stand **380000301** (2) using the two brackets **380000271** and **380000272**.



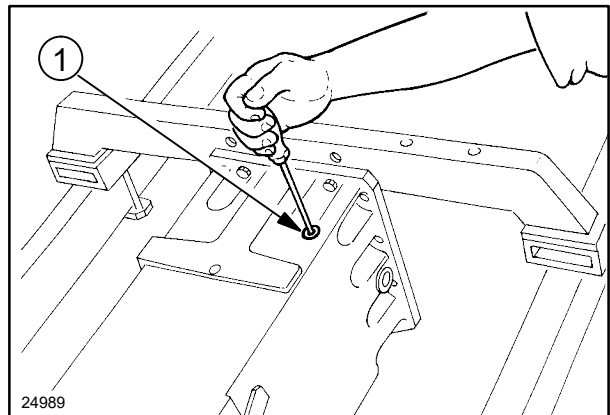
11

2. Withdraw the spring pin and recover the link lever (1) and the internal lever (2).



12

3. Unscrew the retaining bolt (1) and recover the detent ball and spring.



13

DESCRIPTION AND OPERATION

The synchroniser reverser is a mechanical device which makes it possible to obtain 12 forward and 12 reverse gears. It is controlled by a specific lever located on the platform to the left of the operator.

The synchroniser reverser is comprised of a group of three spur gears : driving reverser gear, intermediate gear and driven reverser gear. Selection is ef-

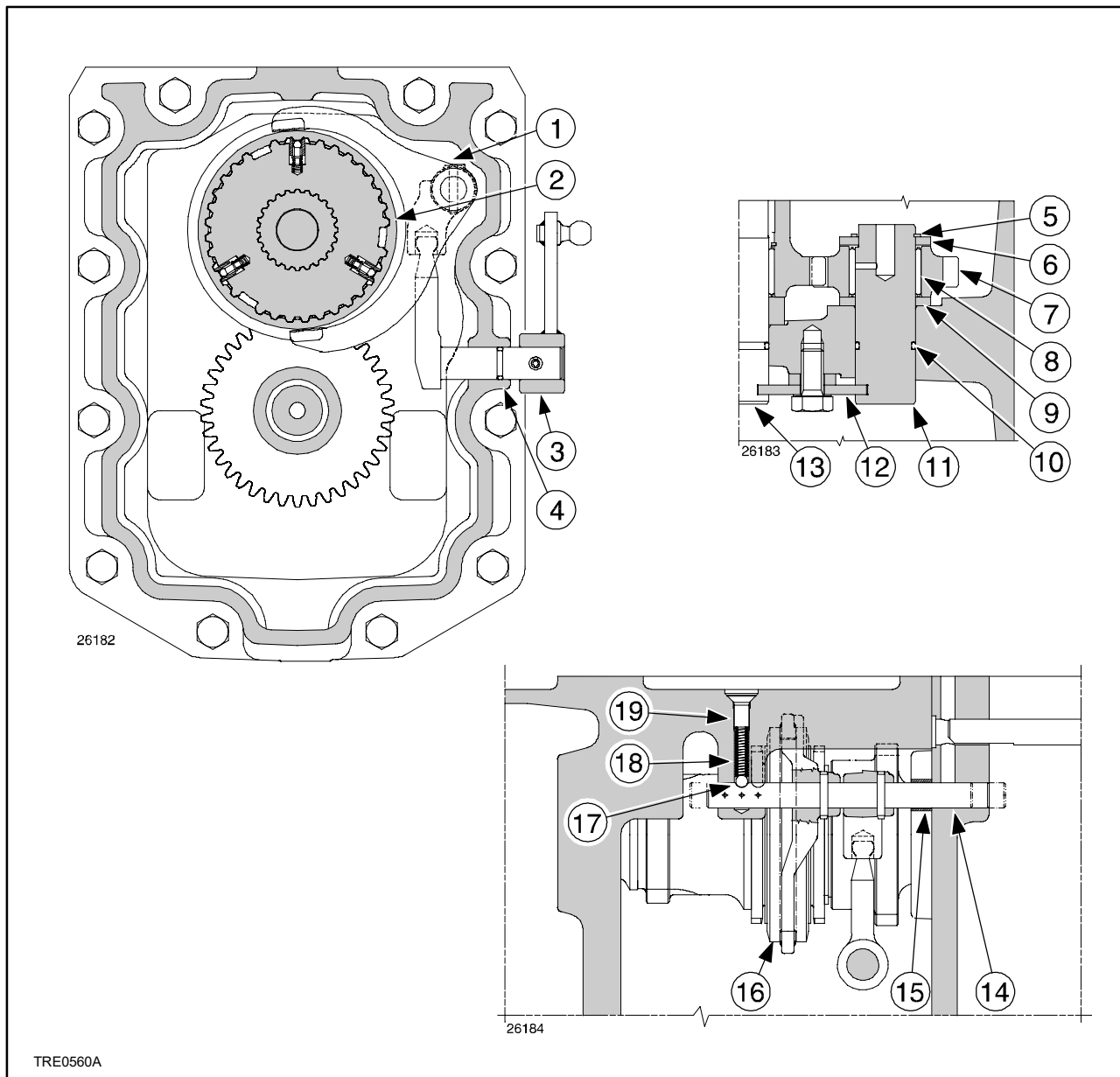
fectured by means of a synchroniser located in the group of gears.

The synchroniser reverser is installed inside the clutch casing between the clutch and the gearbox.

It is lubricated by the oil in the rear transmission / gearbox.

SYNCHRONISER REVERSER TROUBLESHOOTING

Problems	Possible causes	Remedies
Spontaneous disengagement of the synchroniser reverser.	2. Incorrect adjustment of external levers and linkages. 3. Synchroniser engagement teeth damaged. 4. Engagement travel incomplete.	Adjust correctly. Remove the clutch casing and replace the synchroniser. Eliminate the cause and restore full engagement travel.
Difficulty in engaging the reverser.	1. Incorrect adjustment of external levers and linkages. 2. Stiffness and / or partial seizure of external levers and linkages. 3. Dragging of main clutch. 4. Synchroniser damaged. 5. Internal controls do not slide freely: rods, forks and sleeves.	Adjust correctly. Check pivot points and lubricate. See page 5, Sect. 18. Remove the clutch casing and replace the synchroniser. Perform the checks and overhaul for needed parts.
Synchroniser reverser unduly noisy.	1. Worn or damaged internal part/s.	Remove the clutch casing and replace damaged part/s.



Synchroniser reverser sectional views

- | | |
|---|--|
| 1. Synchroniser reverser selector fork. | 11. Journal of idle gear (7). |
| 2. Reverser synchroniser. | 12. Stop plate for journals (11 and 13). |
| 3. External reverser control lever. | 13. Synchroniser reverser driven gear. |
| 4. Seal. | 14. Synchroniser reverser control rod. |
| 5. Circlip. | 15. Spacer. |
| 6. Thrust washer. | 16. Reverser synchroniser. |
| 7. Synchroniser reverser idle gear. | 17. Detent ball. |
| 8. Roller bearing. | 18. Spring for detent ball (17). |
| 9. Thrust washer. | 19. Detent ball retaining bolt (the bolt must be covered in one of the sealants listed on page 1, Sect. 00). |
| 10. Seal. | |

TOOLS

Warning – The operations described in this Section can only be carried out using the **ESSENTIAL** tools marked with an (X).

However, for greater safety and to obtain the best results while saving time and effort, it is recommended that these essential tools are used together with the special tools listed here as well as certain tools which are to be made following the sectional drawings given in this manual.

List of special tools required for the various operations described in this Section :

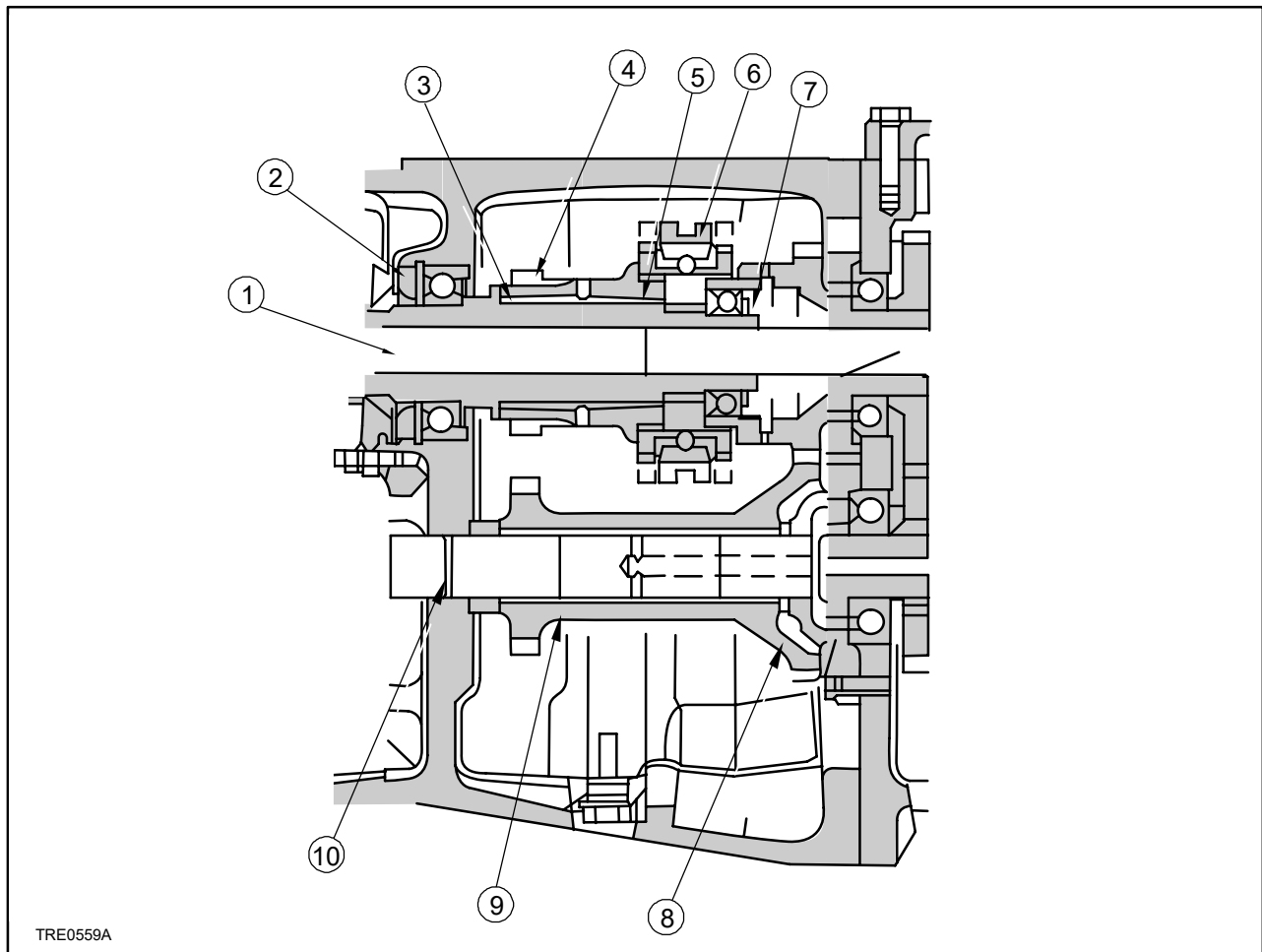
380000236 Tractor dismantling trolley.

380000227 Clutch casing lifting hook.

380000301 Rotating overhaul stand.

380000271 Front support bracket (with **380000301**).

380000272 Rear support bracket (with **380000301**).



TRE0559A

9

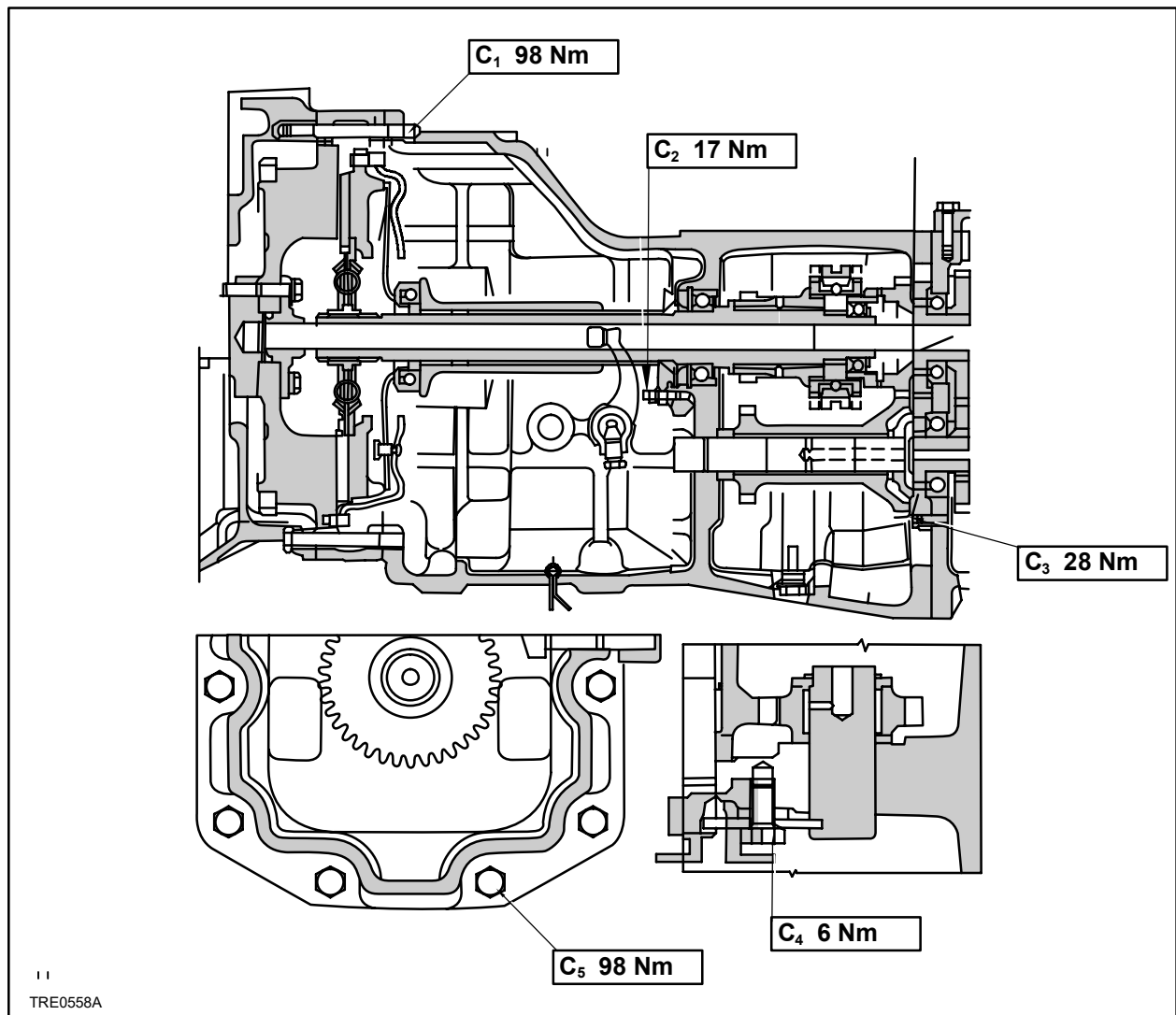
Longitudinal cutaway section of synchroniser reverser

- | | |
|---|---------------------------------------|
| 1. Synchroniser reverser control shaft. | 6. Reverser control synchroniser. |
| 2. Seal. | 7. Seal. |
| 3. Roller bearing. | 8. Synchroniser reverser driven gear. |
| 4. Synchroniser reverser driving gear. | 9. Journal for driven gear (8). |
| 5. Roller bearing. | 10. Seal. |

Note – On assembly apply jointing compound to surfaces X as indicated on page 6, chapter 1.

TORQUE VALUES

PARTS	Thread	Torque Settings	
		Nm	ft lb
Bolt or nut securing clutch / reverser casing to engine (C ₁)	M 12 x 1.25	98	72.2811
Sleeve cover retaining nuts (C ₂)	M 8 x 1.25	17	12.5386
Reverser driven shaft cover retaining bolts (C ₃)	M 8 x 1.25	28	20.6517
Reverser driven shaft plate retaining bolts (C ₄)	M 10 x 1.25	64	47.2040
Bolts securing clutch / reverser housing to gearbox / rear transmission (C ₅)	M 12 x 1.25	98	72.2811



SECTION 21 – TRANSMISSIONS

Chapter 2 – Reverser

CONTENTS

Section	Description	Page
21 000	Main data	1
	Tightening torques	2
	Tools	3
	Section views	3
	Description and operation	5
	Fault diagnosis	5
21 110	Removal–Refitting	6

21 000 – MAIN DATA – TIGHTENING TORQUES – SECTIONS – TOOLS – DESCRIPTION AND OPERATION – FAULT DIAGNOSIS

SYNCHRONISER REVERSER MAIN DATA

Type	Mechanical type spur gear unit, located between the main clutch and the gearbox. Comprises 1 driving gear, 1 intermediate gear and 1 idle gear.
Control	Hand lever located on left–hand side of the operator

GEARBOX MAIN DATA

Gearbox	4 speed, constant–mesh, with synchronisers on all gears
Gearing type	helical
Reduction unit	Ordinary gear train with 3 ranges providing a total of 12 gears
Gearing type	spur
Gearbox and reduction unit controls	Independent, with two hand levers located on right–hand side of the operator
For other main data see chapter 1.	

DESCRIPTION AND OPERATION

4-speed gearbox with constant-mesh helical gears controlled by two synchronisers.

The range gear has cascade-type constant-mesh spur gears, excluding reverse.

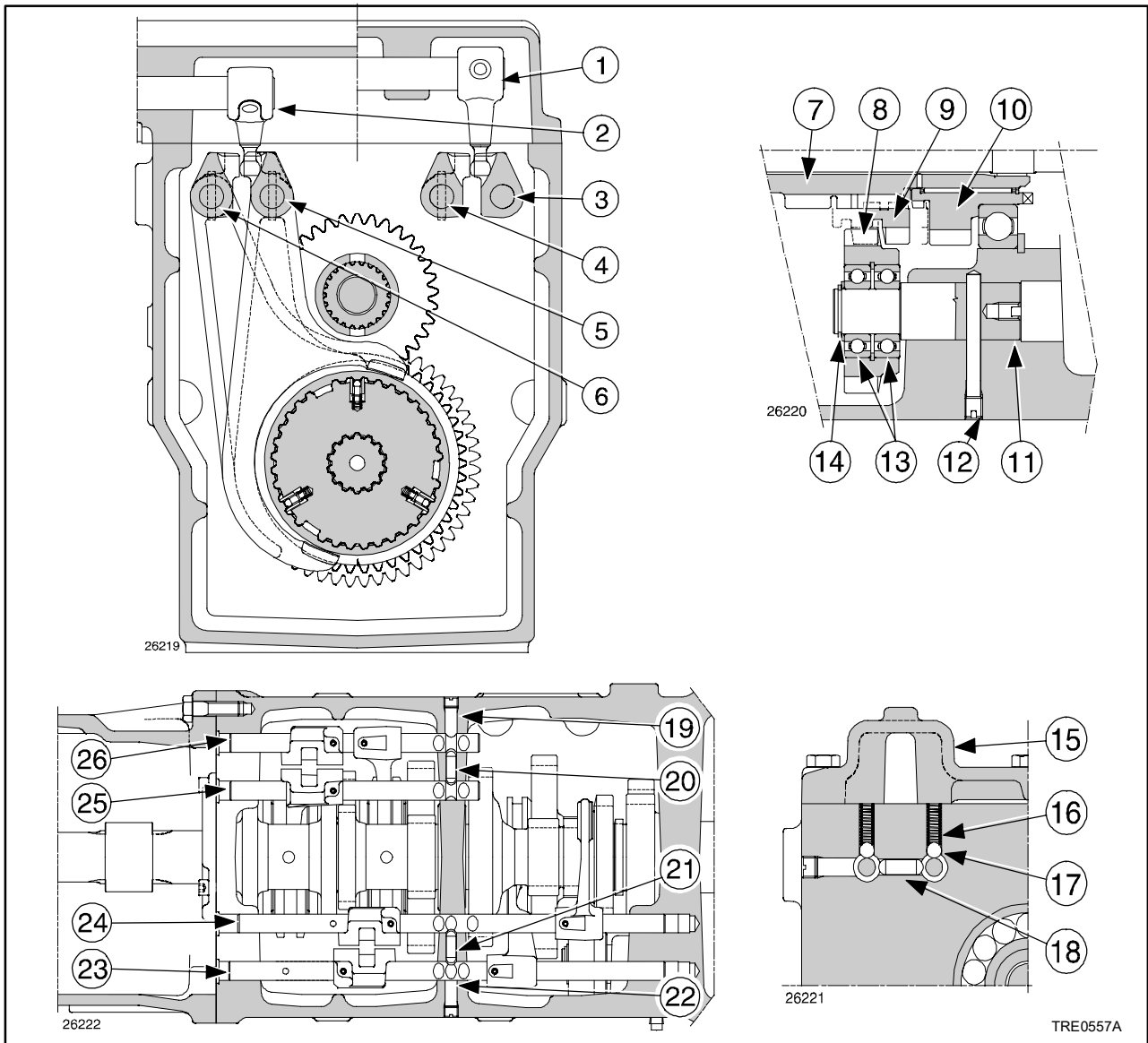
The driven gears of the range gear are keyed directly onto the bevel pinion shaft.

The range gear provides 3 forward ranges and 1 reverse range.

The gearbox and the range gears are controlled by two independent levers located on the right-hand side of the operator.

GEARBOX AND RANGE GEAR TROUBLESHOOTING

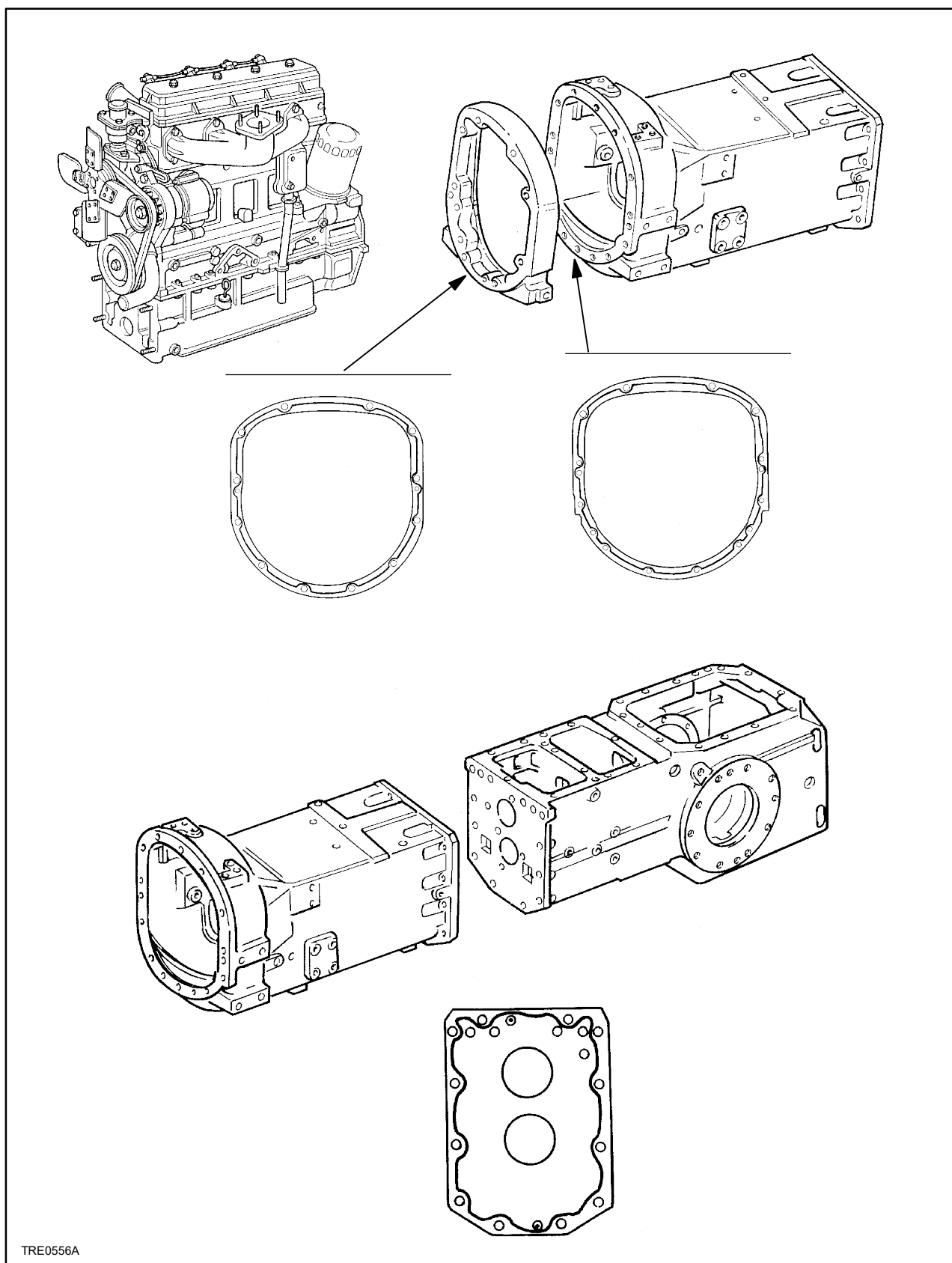
Problems	Possible causes	Remedies
Spontaneous disengagement of gearbox and range gear.	1. Levers and relay linkages incorrectly adjusted. 2. Selector rod retaining springs defective. 3. Defective teeth on synchroniser or engagement sleeve. 4. Incomplete engagement travel.	Adjust correctly. Replace the springs. Remove the transmission/gearbox and replace the synchronisers or the engagement sleeves. Eliminate the cause and restore full engagement travel.
Difficulty in engaging the gearbox and range gear.	1. Control levers and linkages incorrectly adjusted. 2. Stiffness and / or partial seizure of control levers and linkages. 3. Main clutch drag. 4. Synchronisers or engagement sleeves defective. 5. Internal controls do not slide freely : rods, forks and sleeves.	Adjust correctly. Check pivot points and lubricate. See page 5, Sect. 18. Remove the transmission / gearbox and replace the synchronisers or engagement sleeves. Perform the checks and overhaul for needed parts.
Gearbox or range gear unduly noisy.	1. Internal component/s worn or defective.	Remove the transmission / gearbox and replace the worn / defective parts.



Cross-section through gearbox and range gear

- | | |
|--|---|
| 1. Range gear control relay rod. | 14. Circlip. |
| 2. Gearbox control relay rod. | 15. Upper cover of transmission / gearbox. |
| 3. Low and high speeds selector rod. | 16. Spring. |
| 4. Normal and reverse speeds selector rod. | 17. Detent ball. |
| 5. 3 rd and 4 th speed selector rod. | 18. Speed control safety pawl. |
| 6. 1 st and 2 nd speed selector rod. | 19. Plug. |
| 7. Range gear driving shaft. | 20. Speed control safety pawl. |
| 8. Intermediate gear for reverse speeds. | 21. Range control safety pawl. |
| 9. Control gear for normal and reverse speeds. | 22. Plug. |
| 10. Driving gear for normal speeds. | 23. Selector rod for low and high speeds. |
| 11. Journal of intermediate gear (8). | 24. Selector rod for middle and reverse speeds. |
| 12. Journal bolt (11). | 25. 3 rd and 4 th speed selector rod. |
| 13. Bearings. | 26. 1 st and 2 nd speed selector rod. |

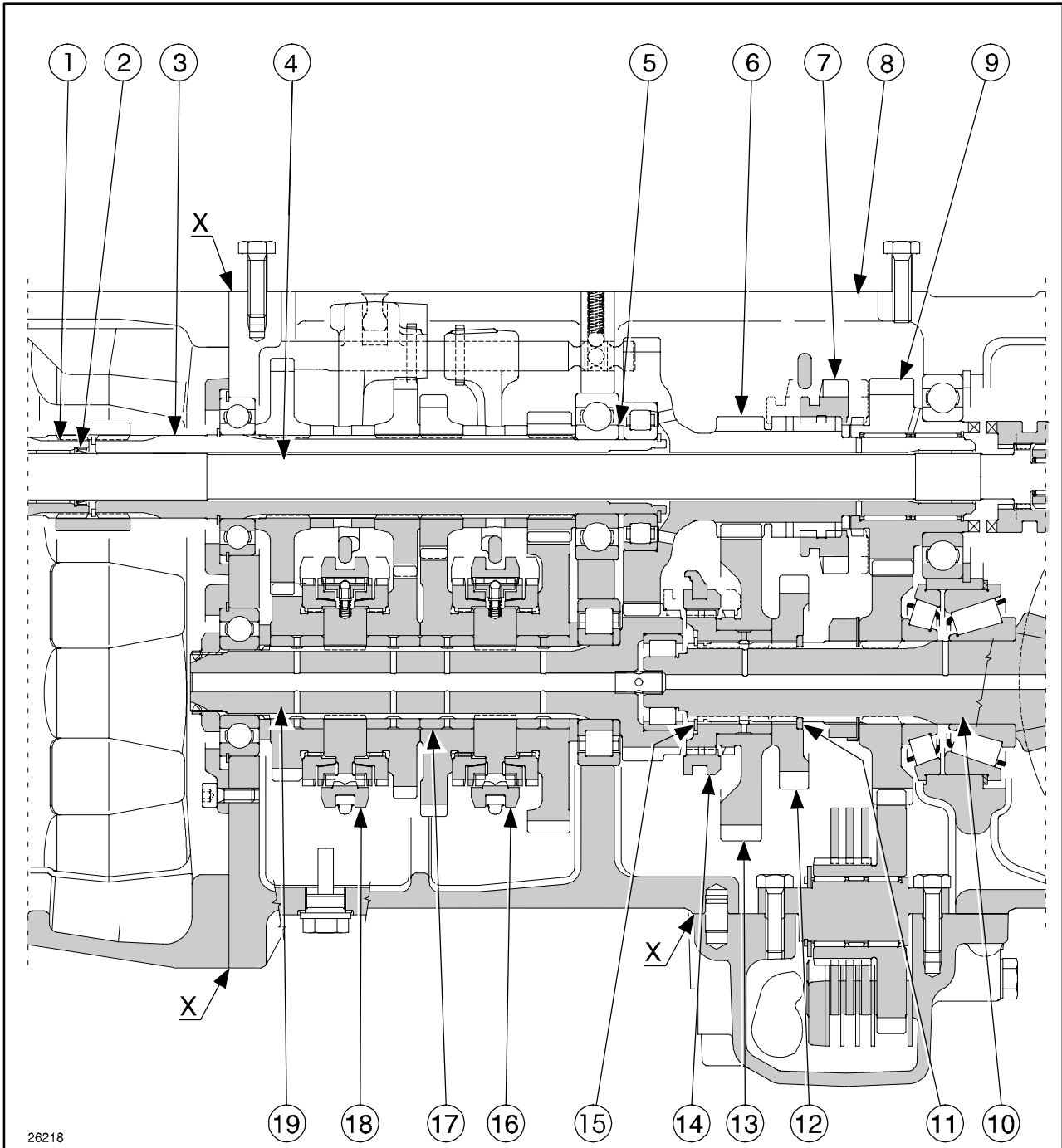
Note -Before plugs (19 and 22) are bolted in, they must be covered with one of the sealants listed on page 1, Sect. 00.



Sealing compound application diagram for mating surfaces between engine, clutch casing and rear transmission-gearbox.

The types of sealing compound to use are indicated on page 1, Sect. 00.

6-62720 - 09 - 2006



26218

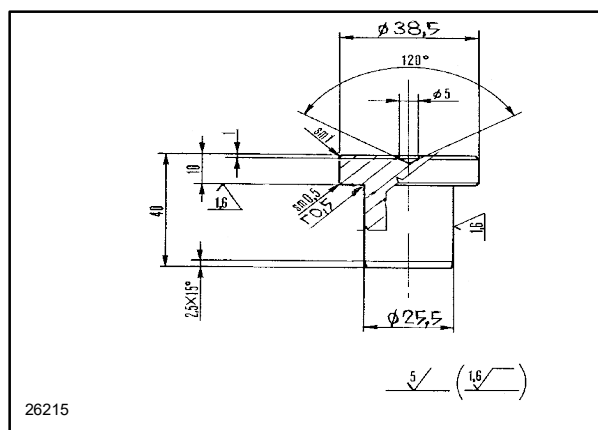
5

Longitudinal cutaway section through gearbox and range gear.

- | | |
|--|--|
| 1. Power take-off (PTO) shaft support bushing. | 11. Retaining half-rings. |
| 2. Seal. | 12. Driven gear for reverse speeds. |
| 3. Gearbox driving shaft. | 13. Driven gear for low speeds. |
| 4. PTO shaft. | 14. Selector sleeve for high and low speeds. |
| 5. Driving shaft adjustment ring. | 15. Circlip. |
| 6. Range gear driving shaft. | 16. Synchroniser for 1 st and 2 nd speeds. |
| 7. Control gear for reverse and middle speeds. | 17. Support bushings for gearbox driven gears. |
| 8. Upper cover. | 18. Synchroniser for 3 rd and 4 th speeds. |
| 9. Driving gear for middle speeds. | 19. Gearbox driven shaft. |
| 10. Bevel pinion shaft. | |

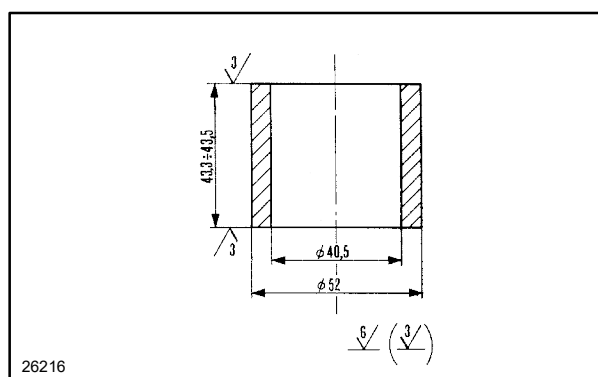
Note - On assembly apply sealant to surfaces **X** following the indications given on page 6 in this Section.

Drift to be made for removal of gearbox driving shaft (tool to be stamped no. **50006** - measurement in mm).
Make in material UNI C40.

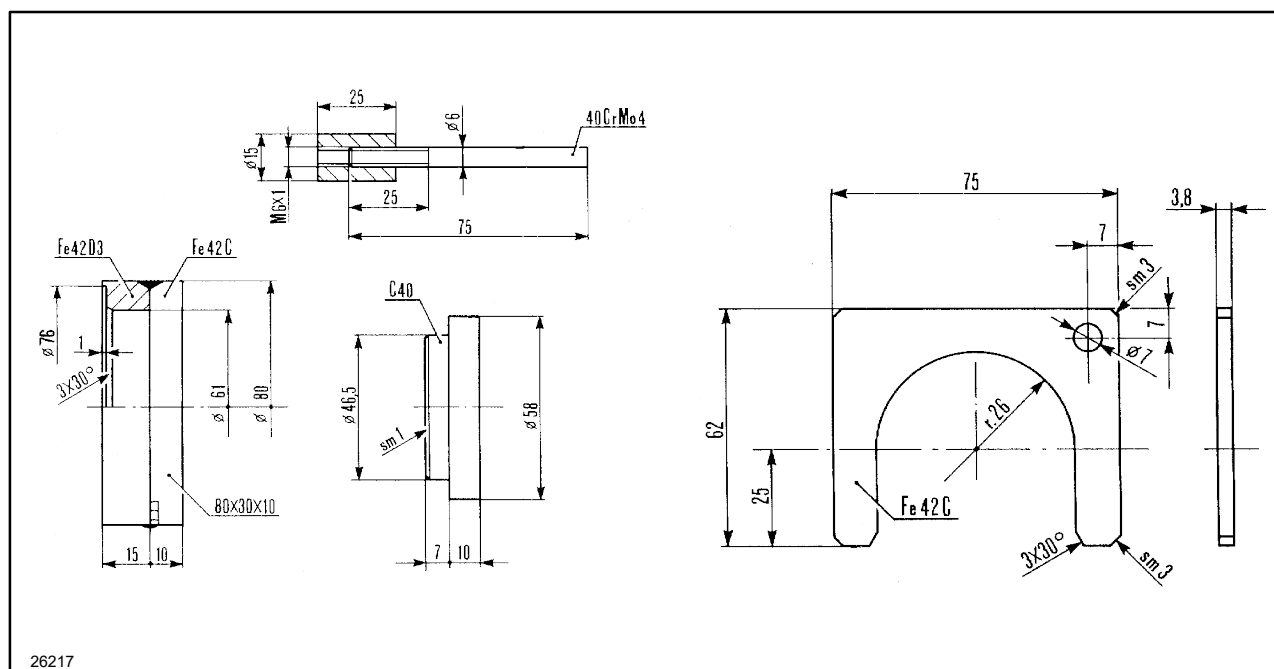


2

Tool to be made for adjustment of gearbox driving shaft bearings (tool be stamped no. **50007** – measurement in mm).
Make in material Ag 45.



3

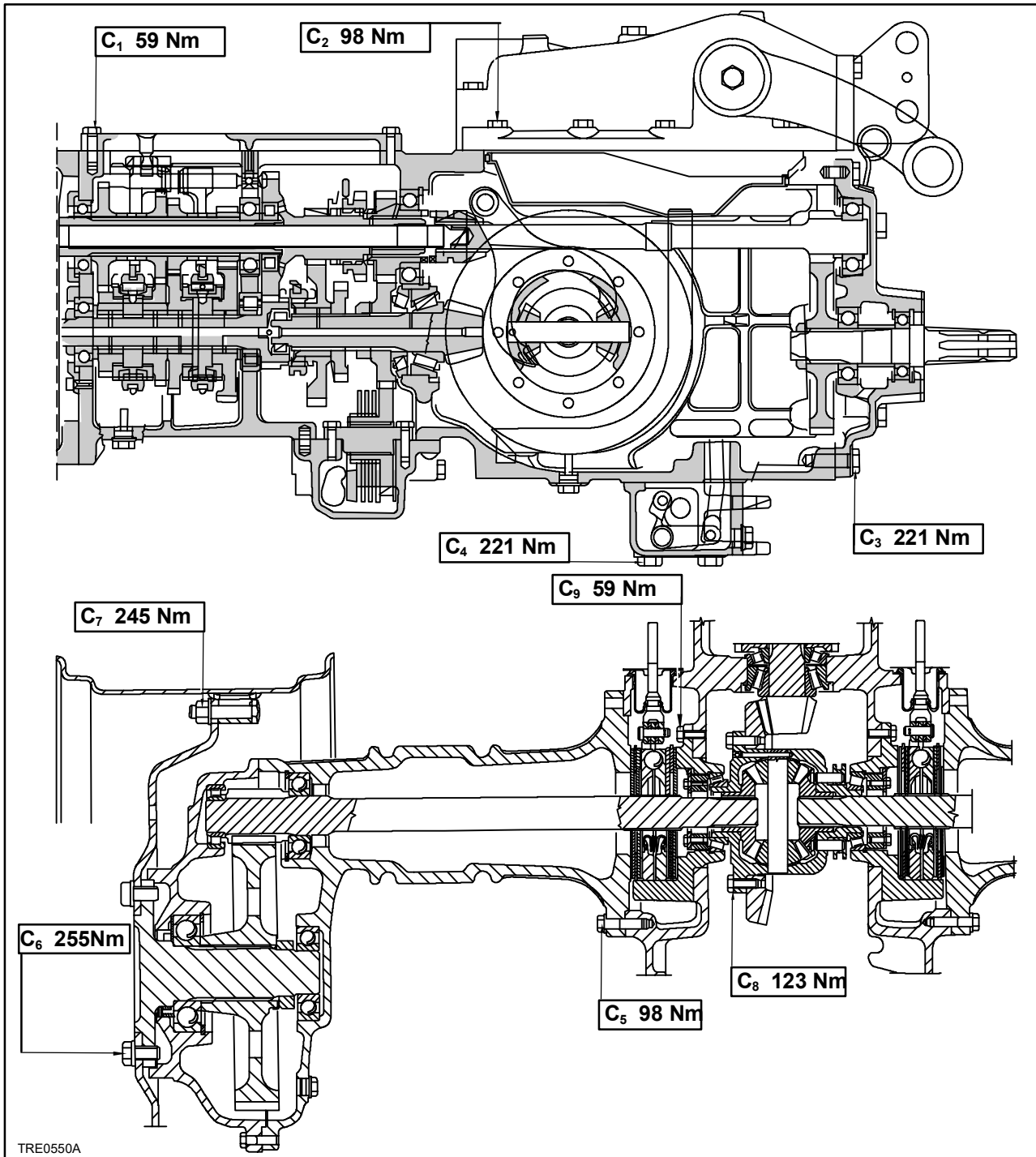


4

Tool to be made for removal of rear bearing of range gear driving shaft and the driving gear for the slow speeds (tool to be stamped no. **50028** – Measurements in mm).
Make in UNI C40.

Note – Make two parts from the tool shown at Figure 4, uppermost one .

MAIN DATA - GEARBOX AND RANGE GEAR



TOOLS

Warning - The operations described in this Section can only be carried out using the **ESSENTIAL** tools marked on the right side with an (X).

However, for greater safety and to obtain the best results while saving time and effort, it is recommended that these essential tools are used together with the special tools listed here as well as certain tools which are to be made following the sectional drawings given in this manual.

List of special tools required for the various operations described in this Section:

- 380000236** Tractor dismantling trolley.
- 380000227** Clutch casing lifting hook.
- 380000301** Rotating overhaul stand.
- 380000271** Front bracket (with **380000301**).
- 380000272** Rear bracket (with **380000301**).
- X 380000838** Adaptor for removal of reverse gear pin (with **380000549**).

TRANSMISSION AND RANGE GEAR MAIN DATA

(continued)

Diameter of power take off (PTO) clutch shaft (4, page 5)	mm (in.)	24.979 – 25.000 (0.9834 – 0.9843)
Inside diameter of fitted bushing (1, page 5)	mm (in.)	25.040 – 25.092 ⁽¹⁾ (0.9858 – 0.9879)
Clearance between PTO clutch shaft and relative bushing	mm (in.)	0.040 – 0.113 (0.0016 – 0.0044)
Interference fit between bushing on driving shaft	mm (in.)	0.037 – 0.091 (0.0015 – 0.0036)
Springs (16, page 7) for detent balls on gearbox and range gear control rods :		
- Spring free length	mm (in.)	30 (1.1811)
- Length of spring under load of 50–56 N (11.3148–12.5059 lb)	mm (in.)	25.5 (1.0039)
Gearbox and range gear control lever retaining springs:		
- Spring free length	mm (in.)	75 (2.9528)
- Length of spring under load of 94–104 N (21.1740–23.3796 lb)	mm (in.)	42 (1.6535)

(1) Measurement to obtain after fitting without reaming.

TORQUE VALUES

PARTS	Thread	Torque settings	
		Nm	ft lb
Retaining bolts for upper cover of rear transmission / gearbox (C ₁)	M 10 x 1.25	59	43.5162
Bolts for securing lift to rear transmission box (C ₂)	M 12 x 1.25	98	72.2811
Bolts for securing PTO box to transmission / gearbox (C ₃)	M 16 x 1.5	221	163.0012
Bolts for securing flexion bar to transmission / gearbox case (C ₄)	M 16 x 1.5	221	163.0012
Nuts for stud bolt securing final drive to transmission / gearbox (C ₅) .	M 12 x 1.25	98	72.2811
Nuts for securing steel plate disc to wheel drive hub (C ₆)	M 18 x 1.5	255	188.0783
Nuts for bolts securing steel plate disc to drive wheel rim (C ₇)	M 16 x 1.5	245	180.7027
Ring bevel gear retaining bolts (C ₈)	M 12 x 1.25	123	90.7201
Bevel gear pair support retaining bolts (C ₉)	M 10 x 1.25	59	43.5162

SECTION 21 - TRANSMISSIONS

Chapter 1 - Mechanical Transmission (12 x 4)

CONTENTS

Section	Description	Page
21 000	Main data	1
	Tightening torques	2
	Tools	3
	Section views	3&5
	Description and operation	8
	Fault diagnosis	8
21 110	Removal - Refitting	see sect 27

**21 000 - MAIN DATA - TIGHTENING TORQUES - SECTIONS - TOOL -
DESCRIPTION AND OPERATION - FAULT DIAGNOSIS**

Gearbox		4-speed, constant-mesh with synchronisers on all gears
Gearing type		helical gears
Range gear		Ordinary gear train with 3 forward ranges and 1 reverse range those giving a total of 12 forward and 4 reverse speeds
- Gearing type		spur gears
- Reduction ratios :		
• Slow		$\frac{23 \times 17}{43 \times 50} = 1:(5.49)$
• Normal		$\frac{23 \times 27}{43 \times 34} = 1:(2.35)$
• Fast		1
Gearbox and range gear controls		Independent, hand operated levers located on right-hand side of operator
Thickness of gearbox driving shaft adjustment ring (5, page 5)	mm (in.)	3.00-3.25-3.50-3.75-4.00 (0.1181-0.128-0.1378-0.1476-0.1575)
Inside diameter of gearbox driven gears	mm (in.)	50.050 - 50.075 (1.9705 - 1.9715)
Outside diameter of bushings (17, page 5)	mm (in.)	49.925 - 49.950 (1.9655 - 1.9665)
Clearance between gears and bushings	mm (in.)	0.100 - 0.150 (0.0039 - 0.0059)
Diameter of gearbox driven shaft (19, page 5)	mm (in.)	39.175 - 39.191 (1.5423 - 1.5429)
Inside diameter of bushings (17, page 5)	mm (in.)	39.200 - 39.239 (1.5433 - 1.5448)
Clearance between shaft and bushings	mm (in.)	0.009 - 0.064 (0.0004 - 0.0025)

(continued overleaf)

6-62720 - 09 - 2006