

TRUCK, LIGHTWEIGHT, MC2, LAND ROVER 110 4X4 - ALL TYPES WITH MANUAL STEERING BOX

REPAIR OF MANUAL STEERING BOX SECTOR SHAFT END FLOAT

MODIFICATION INSTRUCTION

This instruction is authorised for use by command of the Chief of the General Staff. It provides direction, mandatory controls and procedures for the operation, maintenance and support of equipment. Personnel are to carry out any action required by this instruction in accordance with GENERAL A 001.

Introduction

1. This instruction shows how to rectify excessive sector shaft end float in the Land Rover 110 4x4 manual steering box, and how to adjust backlash correctly. End float is caused by excessive clearance between the sector shaft adjuster and the securing plug. It causes vertical movement of the sector shaft when the steering wheel is turned.

2. The modification involves machining the sector shaft, adding a hardened washer under the adjusting screw and fitting a new plug. Initially, it requires the steering box to be partially disassembled to allow the sector shaft to be machined; thereafter however, further occurrences of excessive end float can be rectified by removing the top of the steering box, and by fitting a new adjuster securing plug, as detailed in Para 20 of this instruction or VEHICLE G 199-3. VEHICLE G 104-1, Group 14, describes the overhaul of the steering box. Land Rover 110 4x4 were subject to a HQ Log Comd Equipment Maintenance Program (EMP) 1/92 which controlled the inspection and reporting of vehicles.

General

3. *Associated Publications.* The latest issue of the following references should be read in conjunction with this instruction:

- a. EMEI Vehicle G 104 - Truck Lightweight MC2, Land Rover 110 4x4, Field Repair, Group 14;
- b. EMEI Vehicle G 104-1 - Truck Lightweight MC2, Land Rover 110 4x4, Base Repair, Group 14;
- c. EMEI Vehicle G 199-3 - Truck Lightweight MC2, Land Rover 110 4x4, Manual Steering Box Adjustment to Rectify Sector Shaft Endfloat;

d. Rover Australia Newsletter Military 1/1993;

e. HQ Log Comd EMP 1/92; and

f. HQ Log Comd EMP 65/93.

4. *Authority.* Rover Australia Engineering Change 2260 and Rover Australia Newsletter Military 1/1993.

5. *Modification Application.* All Land Rover 110 4x4 variants fitted with manual steering box.

6. *Items Affected.* Manual steering box.

7. *Priority - Group 2.* The manual steering box is to be modified when the sector shaft end float exceeds 0.5 mm.

8. *Action Required.* Action is required by RAEME units or sub units authorised to carry out field or base repairs when sector shaft end float exceeds 0.5 mm.

NOTE

The Rover Australia dealer network has the capability to carry out the modification, subject to the availability of unit funding to pay for repairs. The information is contained in Rover Newsletter Military 1/1993.

9. *Estimated Manhours to Perform.* For initial planning purposes only, it is estimated that this repair will take 4.0 manhours to perform.

10. *Stores Required.* EMP 65/93 controls the distribution and issue of special tools, shown in Table 1, that are required to carry out the adjustments. The stores required to repair the steering box are listed in Table 2. These are to be demanded as required through normal supply channels. Read Paras 15 to 19 before ordering parts.

Table 1 - Special Tools Required (to be issued to units as detailed in EMP 65/93)

Item	NSN	Description	Qty per Equip
1	5120-66-128-7273	Inserting Tool, Cup, for Land Rover 110 4x4 Manual Steering Box Sector Shaft	1
2	5120-66-128-7272	Locking Tool, Cup, for Land Rover 110 4x4 Manual Steering Box Sector Shaft	1

Table 2 - Stores Required (to be demanded through normal supply channels on an as required basis)

Item	NSN	Mfr Part No	Description	Qty per Equip
1		STC1179	Washer Hardened	1
2		STC1178	Cup, Threaded, Sector Shaft	1
3	5330-99-784-7055	BAU4865	Gasket, Top Cover	1
4	5330-99-784-7051	AEU4024	Seal, Plain	1
5		STC1055	Bearing	2
6		AEU4013	Plate, Top Cover	1
7	2530-66-128-6243	RTC5908	Sector Shaft, Steering (Reworked to Include Hardened Washer)	1
8	5310-99-122-5496	NY108041	Nut, Self Locking, 8 mm Dia for Steering Column Shaft	4
9	5310-99-941-7650	NY607041	Nut, Self Locking, 7/16 in UNF for Tie Bar	2
10	5310-99-943-4300	NY608041	Nut, Self Locking, 1/2 in UNF for Panhard Rod Mounting Arm	1

11. **Special Tools.** The special tools required are as follows:

- a. Tools which are to be supplied in accordance with EMP 65/93 to insert the threaded cup in the sector shaft, shown in Figure 1, are:
 - (1) Inserting Tool, Cup; and
 - (2) Locking Tool, Cup.
- b. In service special tools required to remove the steering box, shown in Figure 2, are:
 - (1) 18G1063 - Drop Arm Ball Joint Remover, or equivalent; and
 - (2) M252A - Sector Shaft Drop Arm Remover, or equivalent.

Steering Box Inspection

12. **End Float.** Sector shaft end float which should not be confused with steering wheel free play, is evident as vertical movement of the sector shaft and is caused by play between the sector shaft adjuster screw and the adjuster screw plug. Rectifying end float requires the partial disassembly of the steering box.

13. **Steering Wheel Free Play.** Free play is normally caused by worn steering linkage components or by backlash between the worm and sector shafts. Free play can be rectified by replacing worn components or by turning the sector shaft adjusting screw to reduce backlash.

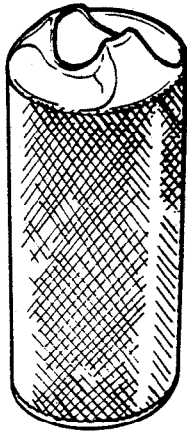
14. End float is set at zero during assembly of the steering box sector shaft, however, to allow for in service wear the maximum tolerance is 0.5 mm. End float can be detected in two ways:

- a. grasp the steering box drop arm and lift it up and down; no more than 0.5 mm play should be evident; and
- b. have an assistant turn the steering wheel and observe the lower part of the sector shaft; no more than 0.5 mm play should be evident.

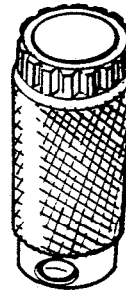
Manual Steering Box Sector Shaft Modification Procedure

15. The special tools shown in Figure 1 are to be used during the reassembly of the sector shaft, as detailed in Paras 18 to 20. Proceed with the modification as follows, with reference to Table 2 for repair parts and Figure 3 for the component identification.

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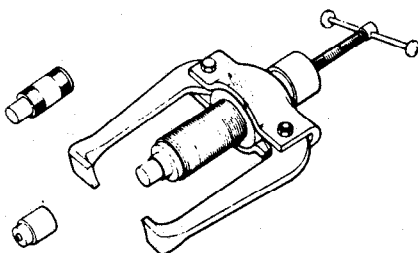


Locking Tool



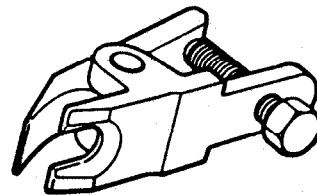
Inserting Tool

Figure 1 - Special Tools Sector Shaft Repair



**Jaw Opening 3"
MS252A**

Sector Shaft Drop Arm Remover



18G1063

Drop Arm Ball Joint Remover

Figure 2 - In Service Special Tools

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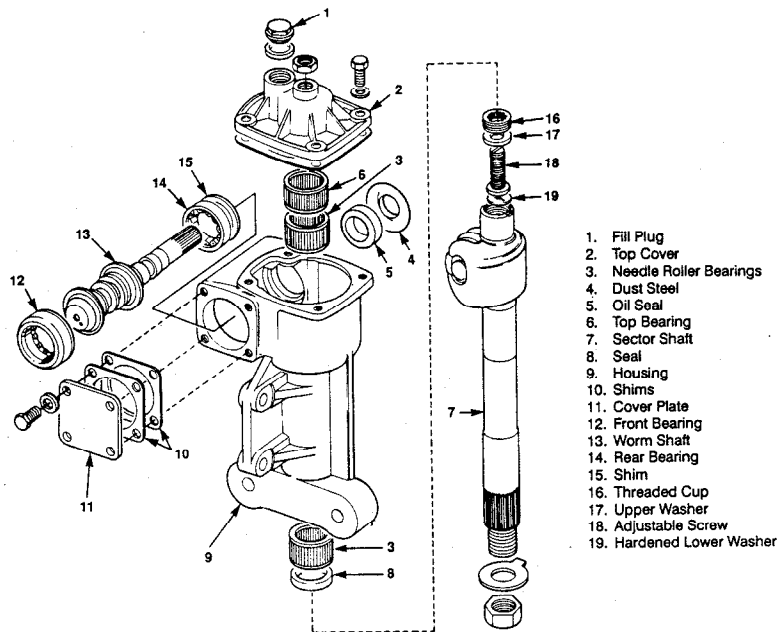


Figure 3 - Steering Box Exploded View

16. *Disassembly.*

- a. Remove the steering box from the vehicle as detailed in VEHICLE G 104, Group 14, using drop arm ball joint special tool or equivalent, as shown in Figure 2, to disconnect the drop arm ball joint from the drop arm.

NOTE

The lower jaw of the tool may require a small amount of material removed to fit the ball joint.

- b. Using the special tool MS252A or equivalent, as shown in Figure 2, remove the drop arm from the steering box.
- c. Remove the adjuster locknut and the four bolts securing the top cover to the steering box housing.
- d. Remove the top cover from the adjuster, empty the oil in to a suitable container and lift out the sector shaft.

NOTE

The adjuster is threaded into the housing.

- e. Remove the sector shaft oil seal.

17. *Inspection of components.*

- a. Inspect the worm shaft and sector shaft and if either is worn or damaged reassemble the steering box and fit a replacement steering box assembly. The old steering box is to be returned through the normal supply system for base overhaul.
- b. Inspect the sector shaft bearings and if worn fit new bearings (Item 5), using a suitable arbor, as follows:

NOTE

The top cover (Item 6) and bearing must be replaced as an assembly.

- (1) press out the sector shaft roller bearings;
- (2) press the sector shaft top bearing in to a depth of 83 mm (3.150 inches) from the top machined face of the steering box housing; and
- (3) press the lower bearing in until it is 1.0 mm (0.040 inch) below the chamfer.

18. *Sector Shaft Modification.*

- a. Remove the adjusting screw securing plug.
- b. Machine the sector shaft adjuster screw seat area to the dimensions shown in Figure 4 and ensure that the hardened washer (Item 1) is seated fully in the machined recess.
- c. Clean all components and fit the hardened washer, adjuster screw, upper washer and new securing plug (Item 2), as shown in Figure 3.
- d. Tighten the threaded plug, using the inserting tool shown in Figure 1, until the adjusting screw is firmly clamped, then back off the plug until the adjusting screw is free to rotate.

NOTE

Ensure there are no tight spots and there is no detectable axial end float of the adjuster screw.

- e. Peen the screwed plug at the adjacent slots in the sector shaft, using a hammer and the locking tool shown in Figure 1, to lock the plug in position.
- f. Emboss the letter 'W' on the circular casting protrusion, on the rear of the sector shaft shoulder boss (opposite side of worm wheel).

NOTE

Sector shafts reworked for stock are to be tagged with NSN shown in Table 1, Item 7.

19. *Installation.*

- a. Install the sector shaft with the roller positioned in the centre of the worm. Fit a new top housing gasket (Item 3) and then screw the top cover onto the adjuster screw until the top cover is correctly positioned. Install the four securing bolts and lock washers and tension to 25 - 30 N.m (18 - 22 lb ft).

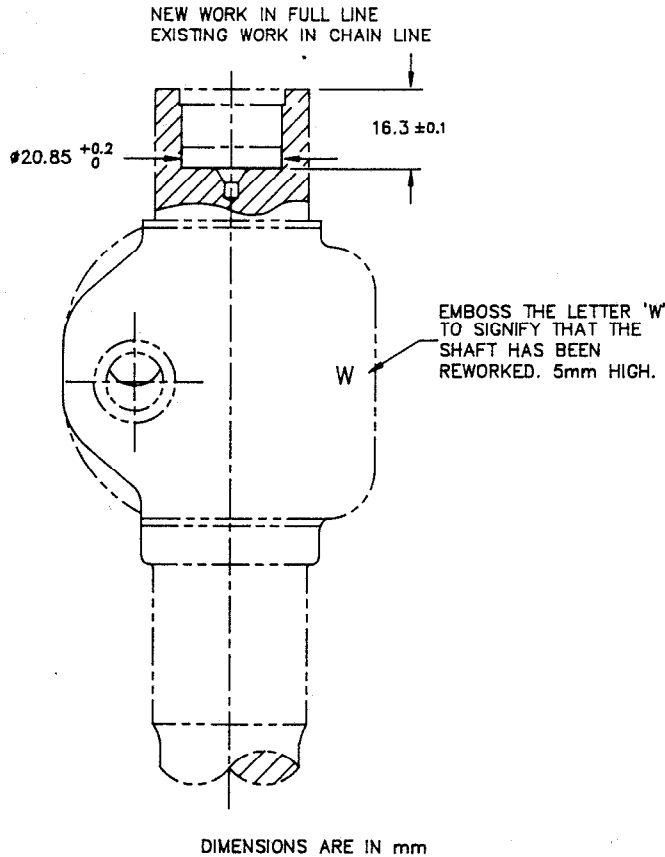


Figure 4 - Sector Shaft Rework

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- b. Fit a new sector shaft oil seal (Item 4) over the shaft and into the housing.
- c. With the sector shaft in the straight ahead position, fit the drop arm, align the master drive spline and check the position of the arm to the housing, as shown in Figure 5.

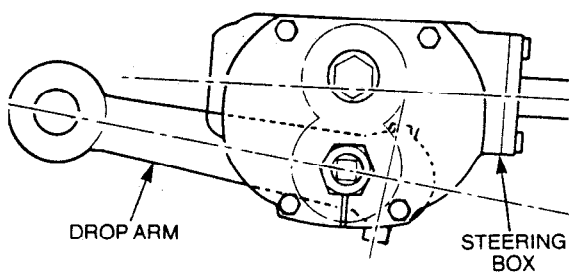


Figure 5 - Drop Arm Alignment

- d. Fit the lock washer, install the locknut and tension to 169 N.m (125 lb ft).
- e. Install the adjuster locknut loosely and turn the adjuster clockwise until a pre-load is applied to the sector shaft, then back off to allow a slight backlash when the shaft is turned half a turn in either direction. Tighten the locknut and recheck the backlash.
- f. Remove the oil filler plug and add approximately 0.43 litres (0.75 pints) of clean OEP 220 to 25 mm (one inch) below the top of the fill hole. Install and tighten the filler plug.
- g. Using a letter stamp (6 mm or larger lettering) emboss the letter 'W' on the steering box top cover then overpaint the letter 'W' in yellow paint, to indicate to tradesmen that the sector shaft has been machined and hardened washer fitted.
- h. Install the steering box to the vehicle, as detailed in VEHICLE G 104, Group 14, using new locknuts (Items 8 to 10) during the reassembly of the tie bar and steering column to the steering box.



THE STEERING SHAFT UNIVERSAL JOINT PINCH BOLTS ARE TO BE TENSIONED TO 25 N.m. OVER TENSIONING WILL RESULT IN STRIPPING OF THE THREADS.

Subsequent End Float Adjustment

20. This paragraph, an extract of VEHICLE G 199-3, details how any future occurrences of end float can be rectified or adjusted. This repair procedure is abbreviated and can be used on all manual steering boxes with the letter 'W' embossed on the top cover. This letter indicates that the sector shaft has been machined and fitted with a hardened washer, and therefore does not have to be removed for rework. Proceed as follows:

- a. Remove the steering box from the vehicle as detailed in VEHICLE G 104, Group 14, using drop arm ball joint special tool or equivalent, as shown in Figure 2, to disconnect the drop arm ball joint from the drop arm.
- b. Remove the adjuster locknut and the four bolts securing the top cover to the steering box housing and remove the top cover.
- c. Drain the oil and remove the adjusting screw securing plug.
- d. Inspect the hardened washer and replace as necessary (Item 1).

NOTE

If there is any damage to internal steering box components, the steering box is to be reassembled and a replacement assembly fitted. The old steering box is to be returned through the normal supply system for base repair.

- e. Fit the hardened washer, adjuster screw, upper washer and new securing plug (Item 2), as shown in Figure 3.
- f. Tighten the threaded plug using the inserting tool shown in Figure 1 until the adjusting screw is firmly clamped, then back off the plug until the adjusting screw is free to rotate.

NOTE

Ensure there are no tight spots and no detectable axial end float of the adjuster screw.

- g. Peen the screwed plug at the adjacent slots in the sector shaft, using a hammer and the locking tool shown in Figure 1, to lock the plug in position.
- h. Fit a new top housing gasket (Item 3) and then screw the top cover onto the adjuster screw until the top cover is correctly positioned. Install the four securing bolts and lock washers and tension to 25 - 30 N.m (18 - 22 lb ft).
- i. With the sector shaft in the straight ahead position, check that the alignment of the drop is correct as shown in Figure 5, and that the lower seal is serviceable.
- j. If necessary, replace the lower seal (Item 4) or align the drop arm and tension the locknut to 169 N.m (125 lb ft); use special tool M252A to remove the drop arm.
- k. Turn the adjuster clockwise until a pre-load is applied to the sector shaft, then back off to allow a slight backlash when the shaft is turned half a turn in either direction. Tighten the locknut and recheck the backlash.
- l. Remove the oil filler plug and add approximately 0.43 litres (0.75 pints) of clean OEP 220 to 25 mm (one inch) below the top of the fill hole. Install and tighten the plug.

- m. Install the steering box in the vehicle, as detailed in VEHICLE G 104, Group 14, using new locknuts (Items 8 to 10) during the reassembly of the tie bar and steering column to the steering box.



THE STEERING SHAFT UNIVERSAL JOINT PINCH BOLTS ARE TO BE TENSIONED TO 25 N.m. OVER TENSIONING OF THE BOLT WILL RESULT IN STRIPPED THREADS.

- 21. **Recording Action.** On completion of the repair:
 - a. paint the letter 'W' in yellow paint on the steering box top cover;
 - b. deface the number 27 from the modification plate located on the driver's seat base;
 - c. enter the details of the rework in Part 3 of the GM 120, Record Book for Service Equipment; and
 - d. notify the fleet manager at HQ Log Comd of the completion of the modification.

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END

List VEH G 16.0 - Code 4 (MEA 900354)