Ministry of Defence

Defence Equipment and Support
Secretariat
#2043 Maple 0a
Ministry of Defence
Abbey Wood
Bristol BS34 8JH

Email: DES SEC-PolSec LE-JSC-WPNS@mod.uk

[redacted]

Our Reference:
FOI2020/11079
Date:
20 November 2020

Dear [redacted]

I am writing about your recent request for the following information:

> **Please may I kindly have a copy of the repair instructions and operation instructions for the Foden Drops 8x6 IMMLC vehicle.**
>
> **I have purchased one and I'm looking to repair and maintain it myself.**
>
> **Repair instructions believed to be: AESP 2320R302523. Dated June 1994**
>
> **Operation instruction: Unknown**

Your request has been handled in accordance with the Freedom of Information (FOI) Act 2000.

In my letter of 28 October 2020, I advised you that the Ministry of Defence (MOD) holds documents falling within the scope of your request. These are:

- Army Equipment Support Publication (AESP) 2320-R-302-201 (Edition November 2017) - TRUCK LOAD HANDLING (DROPS) 15 TONNE, 8X6 LHD, (IMMLC) FODEN - Operating Information; and

- Army Equipment Support Publication (AESP) 2320-R-302-523 - (Edition November 2027) - TRUCK LOAD HANDLING (DROPS) 15 TONNE, 8X6 LHD, (IMMLC) FODEN - Repair Instructions

Copies are attached to this letter.

Section 40(2) has been applied in order to protect personal information as governed by the General Data Protection Regulations. Section 40 is an absolute exemption and there is no requirement to consider the public interest in deciding to withhold the information.

However, for AESP 2320-R-302-201, it was necessary to withhold information under Section 26(1)(a) and (b) (Defence) and Section 38(1) (a and b) of the FOI Act.

Section 26(1)(b) (Defence) applies to information which if disclosed would, or would likely prejudice the capability, effectiveness or security of any relevant forces. Section 38(1) (a and b) (Health and Safety) applies to information which if disclosed would or would likely endanger the physical or mental health of any individual or endanger the safety of any individual.

As these two exemptions are both qualified it was necessary to undertake a Public Interest Test to determine whether the balance for withholding the information outweighs that for public disclosure.

There would be public interest in enhancing the accountability of government by releasing, which would also demonstrate the MOD's commitment to openness and transparency, thus making the Government more accountable to the electorate. The FOI Act also contains a presumption of release. However, releasing information about certain onboard equipment and components of the vehicle you own would provide a tactical advantage to those wishing to inhibit the MOD's current capability, effectiveness and security, thus resulting in the potential physical and mental harm to military personnel.

On balance, the weight of public interest lies in withholding under qualified exemptions Section 26 (Defence) and Section 38 (Health and Safety) of the FOI Act. I have set the level of prejudice against release of the exempted information at the higher level of "would" rather than "would be likely to".

If you have any queries regarding the content of this letter, please contact this office in the first instance. If you wish to complain about the handling of your request, or the content of this response, you can request an independent internal review by contacting the Information Rights Compliance team, Ground Floor, MOD Main Building, Whitehall, SW1A 2HB (e-mail CIO-FOI-IR@mod.gov.uk). Please note that any request for an internal review should be made within 40 working days of the date of this response.

If you remain dissatisfied following an internal review, you may raise your complaint directly to the Information Commissioner under the provisions of Section 50 of the Freedom of Information Act. Please note that the Information Commissioner will not normally investigate your case until the MOD internal review process has been completed. The Information Commissioner can be contacted at: Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF. Further details of the role and powers of the Information Commissioner can be found on the Commissioner's website at https://ico.org.uk/.

Yours sincerely

DE&S Secretariat

ARMY EQUIPMENT
SUPPORT PUBLICATION

2320-R-302-523
2nd Edition dated November 2017
(Superseding 1st Edition dated March 1994)

~~FOR OFFICIAL USE ONLY~~

TRUCK, LOAD HANDLING (DROPS) 15 TONNE

8X6, LHD, IMMLC (FODEN)

REPAIR INSTRUCTIONS

REPRINTED INCORPORATING AMDTS 1-3

BY COMMAND OF THE DEFENCE COUNCIL

[redacted]

Ministry of Defence
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PRELIMINARY MATERIAL Page

PREFACE

Sponsor:
DGES(A)
File ref: D/DGES (A) 125/11/20

Publications Approving Authority:
Vehs & Wpns Br REME
Project No: ES52c1721A(5)
File ref: ES52c1721A/AESP/BVP

INTRODUCTION

1 Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013. An AESP Form 10 is provided at the end of this publication; it should be photocopied and used for forwarding comments on this AESP.

2 The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standing Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

3 The Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication. The availability of the publications can be checked by reference to the relevant Group Index (see AESP 0100-P-001-013).

CATEGORIES AND INFORMATION LEVELS																	
Category	1	2			3	4		5				6		7		8	
Level	0	0	1	2	0	1	2	1	2	3	4	0	1	1	2	1	2
1 USER/OPERATOR	101	201	•	•	•	•	•	•	•	•	•	601	•	711	•	•	•
2 UNIT MAINTENANCE	•	•	•	•	302	•	•	512	522	532	•	•	•	•	•	•	•
3 FIELD MAINTENANCE	•	•	•	•	•	•	•	•	523	533	•	•	•	•	•	•	•
4 BASE MAINTENANCE	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

1.0 Purpose & Planning Information
2.0 Operating Information
2.1 Special to Arms
2.2 Training Aids
3.0 Technical Description
4.1 Installation Instructions
4.2 Prep for Special Environments
5.1 Failure Diagnosis
5.2 Repair Instructions
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5.4 Calibration Procedures
6.0 Maintenance Schedules
6.1 Maintenance Schedules (RAF)
7.1 Illustrated Parts Catalogue
7.2 Commercial Parts List
8.1 Modification Instructions
8.2 General Instructions

* Not published

Associated publications

4	Reference	Title
	AESP 2815-K-720	Engine, Diesel, RR/Perkins Eagle Type 350 (DROPS)
	AESP 2520-C-116	Gearbox, Automatic, ZF HP600 (DROPS)
	AP 3260 Book 1	Mechanical Transport Maintenance Regulations for the Royal Air Force
	AP 4545 Volume 2	Mechanical Transport - General Orders and Modifications (RAF only)

ARMY EQUIPMENT
SUPPORT PUBLICATION

2320-R-302-523

This proforma should be retained in this publication. When required for use, reproduce locally.

COMMENT ON AESP

To: Vehicles and Weapons Branch REME
Chobham Lane
Chertsey
Surrey KT16 0EE

From: .....
.....
.....
.....

Sender's Reference:

Tel No: .....

Date:

Title of AESP .....

COMMENT

Signed .....

To: .....
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From: Vehicles and Weapons Branch REME
Chobham Lane
Chertsey
Surrey KT16 0EE

Thank you for commenting on AESP.....

* Action is being taken to:

  * (i) Revise the AESP
  * (ii) Amend the AESP

* No action is considered necessary for the following reasons:

* Delete as necessary

Signed: .....

Date .....

CHAPTER 1

ENGINE

CONTENTS

GENERAL

1 This chapter details the procedure for removing the engine from the vehicle and refitting repaired or replacement engine. All other engine related tasks for level 3 and 4 are covered in AESP 2815-K-720-523. Removal instructions for ancillary fittings, steering pump, air compressor, fuel pump etc are detailed in Cat 522 Chap 1.

SPECIAL TOOLS AND TEST EQUIPMENT

2 The special tools and test equipment required to carry out the tasks detailed in this chapter are listed in Table 1.

TABLE 1 - SPECIAL TOOLS AND TEST EQUIPMENT

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)
1			Engine barring tool
2		GA5071	Beam, engine lifting

ENGINE REMOVAL

WARNINGS

(1) BEFORE ATTEMPTING ANY WORK ON THE ENGINE, THE MASTER SWITCH MUST BE TURNED TO 'OFF' AND THE START KEY REMOVED.

(2) ALL PERSONNEL MUST STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. OPERATOR MUST STAND CLEAR OF PIVOTING CAB WHEN PERFORMING THE RAISING AND LOWERING FUNCTION.

(3) NEVER WORK UNDER A PARTIALLY TILTED CAB. THE CAB MUST BE RAISED OR LOWERED TO FULL EXTENT OF TRAVEL.

(4) THE ENGINE AND GEARBOX WEIGH 1430KG (3152 LB). WHEN LIFTING INTO OR OUT OF THE VEHICLE DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

(5) WHEN LIFTING THE ENGINE AND MAIN GEARBOX, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

CAUTION

The cab doors must be shut and the front grille raised before the cab is tilted.

NOTES

(1) It is recommended that the engine and main gearbox are removed as a complete unit.

(2) When disconnecting pipes or hoses suitable blanks are to be fitted to all open ends. All disconnected electrical cable/harnesses are to be tagged for identification and tied back clear of working or lifting area.

3 To remove the engine from the vehicle proceed as follows:

3.1 Turn the electrical master switch to OFF, remove the start switch key, raise the front grille and tilt the cab.

3.2 Disconnect the negative and positive leads from the vehicle batteries.

3.3 Chock the vehicle road wheels and deplete the air brake system reservoirs.

3.4 Remove the Load Handling System (LHS) as detailed in Chapter 14 of this publication.

NOTE

When lifting the LHS take care not to foul and damage the main gearbox oil filler pipe.

3.5 Drain and remove the radiator as detailed in Cat 522 Chap 12.

3.6 At the right hand side of the vehicle, disconnect in turn:

3.6.1 Feed and return hoses from steering primary pump.

3.6.2 Compressor to air dryer armoured hose at compressor end, remove securing clips back to the chassis.

3.6.3 Oil pressure switch connectors.

3.6.4 Small bore oil pressure gauge pipe at engine block below oil pressure switch location.

3.6.5 Cab lock switch cable from switch, remove securing clips from switch back to engine.

3.6.6 Cold start at engine.

3.6.7 Starter motor electrical connectors.

3.6.8 Main electrical harness from engine.

3.7 At the left hand side of the engine, disconnect/remove in turn:

3.7.1 Coolant thermostat housing electrical connectors.

3.7.2 Alternator electrical connectors.

3.7.3 At the fuel injection pump; load sensor electrical connectors.

3.7.4 Fuel heater/sedimenter electrical connectors.

3.7.5 Starter solenoid electrical connectors.

3.7.6 Oil switch electrical connectors.

3.7.7 Air pipe to anti-gas cylinder, located behind the fuel injection pump.

3.7.8 Engine stop cables from either side of the fuel injection pump, remove securing clips back clear of engine/gearbox.

3.7.9 Turbocharger exhaust pipe.

3.7.10 Accelerator cable securing clip and bracket at engine end, remove securing clips back to cab.

3.7.11 Dipstick tube and oil filler tube.

3.7.12 Fuel return pipe to filter housing.

3.8 Disconnect in the following order:

3.8.1 Gearbox output prop shaft.

3.8.2 Gearbox Power-take-off (PTO) electrical connections.

3.8.3 Gearbox oil temperature controller and retarder electrical connections and gear solenoid harness.

3.9 Unclip cable ties securing; electrical ties LHS electrical conduits, gearbox heat exchanger pipes and emergency steering pump hydraulic pipes.

3.10 Disconnect in the following order:

3.10.1 Gearbox oil pipes at heat exchanger, and securing clips.

3.10.2 Gearbox emergency select linkage at gearbox end.

3.10.3 Gearbox earth strap.

3.10.4 Gearbox speedometer drive cable.

3.10.5 Harness securing bracket.

3.10.6 Retarder air pipe at chassis connection.

3.10.7 Emergency steering pump hydraulic pipes at pump.

3.10.8 Steering hydraulic pipes at reservoir, unbolt the reservoir and pull clear of the engine and gearbox.

3.10.9 Disconnect air braking system pipes from components secured to the overbell cross-member and remove the overbell cross member.

3.11 Fit the engine lifting beam (Table 1 Serial 2) and attach suitable lifting slings. Attach a suitable lifting appliance.

WARNINGS

(1) WHEN LIFTING THE COMBINED ENGINE/MAIN GEARBOX, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

(2) THE COMBINED ENGINE/GEARBOX WEIGHS 1430 KG (3146 LB). WHEN LIFTING INTO OR OUT OF THE VEHICLE DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

3.12 Taking weight of combined engine/gearbox on the lifting appliance, remove the three bolts on each side securing the engine rear mounting bracket to the rear support brackets.

3.13 Remove the rear support brackets from the vehicle.

3.14 Remove the engine front mounting bolts.

3.15 Lift the engine slightly and guide the electrical harnesses clear of the engine front. Carry out a visible inspection to ensure there is no connection between engine/gearbox and the vehicle.

3.16 With the weight on the lifting appliance, move the engine/gearbox slightly to the rear, and when clear, start to slowly lift clear of the vehicle. If trouble is encountered guiding the unit through the cab tilt pipes, disconnect the cab tilt pipes across the chassis at the connection adjacent to the right hand cab roller bracket.

3.17 When completely free, lift the engine/gearbox clear of the vehicle and rest on a support stand or wooden blocks. Ensure the unit is firmly seated before removing the lifting appliance.

Engine/gearbox separation

4 With the engine/gearbox safely supported, separate the engine from the gearbox as follows:

4.1 Mark the engine and bell housing to aid reassembly.

4.2 Remove the eight bolts securing the engine mountings bridging pieces and remove the bridging pieces.

4.3 At both sides of the gearbox, remove the four bolts securing the rear mounting brackets to the gearbox.

4.4 Remove access plug to flexi-bolts on bell housing.

4.5 Using the engine barring tool (Table 1 Serial 1) to align the flexi-bolts with the access hole, remove the ten flexi-bolts.

4.6 Support the gearbox with suitable lifting gear (or a fork lift truck) and remove the bell housing bolts. Separate the gearbox from the engine. Ensure the engine is still safely located.

ENGINE REFITTING

NOTE

The flex-coupling to torque converter screws are not to be re-used. NSN: 7ZF 5305-12-332-9015.

5 Refit the main gearbox to the engine and the assembly to the vehicle in reverse order to removal ensuring the engine mounting bolts are tightened in the order, and to the torque figures quoted in Cat 522 Chap 1. When all pipework and cables are reconnected, top-up lubricating and hydraulic oil reservoirs with correct fluids in accordance with Cat 601 Table 2. If doubt exists as to the correct mixture of the coolant drained during removal, use new coolant at 50/50 mixture of water and anti-freeze. Bleed the power steering as detailed in Cat 522 Chap 7.

5.1 On completion of checks ensure that all fasteners and electrical connectors are secure, all pipes hoses, cables and harnesses are correctly clipped as per removal. Run the engine as detailed in Cat 201 Chapter 3, check for and make good any leaks from lubricating, fuel, coolant, hydraulic oil or air systems. Road test the vehicle using all correct forms of gear change.

5.2 On completion of road test check all lubricating oil, hydraulic oil and coolant levels and carry out a further check for leaks.

CHAPTER 3

MAIN GEARBOX

CONTENTS

GENERAL

1 This chapter details the procedure for removing the engine from the vehicle and refitting repaired or replacement gearbox with the engine left fitted to the vehicle. All other main gearbox related tasks for level 3 and 4 are covered in AESP 2520-C-116-523. Removal instructions for ancillary fittings, emergency steering pump, power-take-off etc are detailed in Cat 522 Chap 3.

2 If the gearbox is to be removed as complete unit with the engine, disregard instructions for removing the bell housing and flexi-bolts and combine these instructions with engine removal instructions detailed in Chap 1 of this publication.

SPECIAL TOOLS AND TEST EQUIPMENT

3 The special tools and test equipment required to carry out the tasks detailed in this chapter are listed in Table 1.

TABLE 1 - SPECIAL TOOLS AND TEST EQUIPMENT

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)
1			Engine barring tool
2			Engine rear support

MAIN GEARBOX REMOVAL

WARNINGS

(1) BEFORE ATTEMPTING ANY WORK ON THE ENGINE OR GEARBOX, THE MASTER SWITCH MUST BE TURNED TO 'OFF' AND THE START SWITCH KEY REMOVED.

(2) ALL PERSONNEL MUST STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. OPERATOR MUST STAND CLEAR OF PIVOTING CAB WHEN PERFORMING THE RAISING AND LOWERING FUNCTION.

(3) NEVER WORK UNDER A PARTIALLY TILTED CAB. THE CAB MUST BE RAISED OR LOWERED TO FULL EXTENT OF TRAVEL.

(4) THE GEARBOX WEIGHS 366 KG (806 LB). WHEN LIFTING INTO OR OUT OF THE VEHICLE DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

(5) WHEN LIFTING THE MAIN GEARBOX, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

CAUTION

The cab doors must be shut and the front grille raised before the cab is tilted.

4 To remove the main gearbox from the vehicle proceed as follows:

4.1 Turn the electrical master switch to OFF, remove the start switch key, raise the front grille and tilt the cab.

4.2 Disconnect the negative and positive leads from the vehicle batteries.

4.3 Chock the vehicle road wheels and deplete the air brake system reservoirs.

4.4 Remove the Load Handling System (LHS) as detailed in Cat 522 Chap 14.

4.5 Remove the air intake filter GRP ducting.

4.6 Disconnect in the following order:

4.6.1 Gearbox output prop shaft.

4.6.2 Gearbox Power-take-off (PTO) electrical connections.

4.6.3 Gearbox oil temperature controller and retarder electrical connections.

4.7 Unclip cable ties securing; electrical ties LHS electrical conduits, gearbox heat exchanger pipes and emergency steering pump hydraulic pipes.

4.8 Disconnect in the following order:

4.8.1 Gearbox oil pipes at heat exchanger, and securing clips.

4.8.2 Gearbox emergency select linkage at gearbox end.

4.8.3 Gearbox earth strap.

4.8.4 Gearbox speedometer drive cable.

4.8.5 Harness securing bracket.

4.8.6 Retarder air pipe at chassis connection.

4.8.7 Emergency steering pump hydraulic pipes at pump.

4.8.8 Steering hydraulic pipes at reservoir.

4.9 Remove access plug to flexi-bolts on bell housing.

4.10 Using the engine barring tool (Table 1 Serial 1) to align the flexi-bolts with the access hole, remove the ten flexi-bolts.

4.11 Disconnect the engine remote stop cable at the fuel pump, unclip cable ties and lift cable clear of working area.

4.12 Fit the engine support bar (Table 1 Serial 2).

4.13 Fit suitable lifting gear to the gearbox.

4.14 If gearbox to bell housing alignment marks are not easily visible, make new alignment marks to aid reassembly.

WARNINGS

(1) WHEN LIFTING THE MAIN GEARBOX, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

(2) THE GEARBOX WEIGHS 366 KG (806 LB). WHEN LIFTING INTO OR OUT OF THE VEHICLE DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

4.15 Taking weight of gearbox on the lifting appliance, remove the gearbox mounting bolts and engine rear mounting assembly complete.

4.16 Remove the overbell cross member.

4.17 Remove bell housing bolts and lift the main gearbox clear of the vehicle.

MAIN GEARBOX REFITTING

5 Refit the main gearbox in reverse order to removal, ensuring correct alignment between gearbox and bell housing (marks sighted/made during removal) and correct torque tightness of all bolts in accordance with Table 2.

NOTE

The flex-coupling to torque converter screws are not to be re-used. NSN: 7ZF 5305-12-332-9015.

5.1 Fill the gearbox with approved lubricating oil to correct level Cat 201 Chap 4 refers. Check for leaks and security of fittings.

5.2 On completion of checks ensure that all fasteners and electrical connectors are secure, all pipes hoses, cables and harnesses are correctly clipped as per removal. Run the engine as detailed in Cat 201 Chap 3 and road test the vehicle using all correct forms of gear change.

5.3 On completion of road test check the gearbox oil level and carry out a further check for leaks.

TABLE 2 GEARBOX FASTENERS TIGHTENING TORQUE

Size (1)	**Quality (grade)**			
	8.8 and 8 (2)		**10.9 and 10 (3)**	
	ft lb	Nm	ft lb	Nm
M5	4.4	6.0	6.3	8.5
M6	7.4	10.0	10.3	14.0
M8	18.0	25.0	26.0	35.0
M10	36.0	49.0	51.0	69.0
M12	63.0	86.0	89.0	120.0
M14	100.0	135.0	140.0	190.0

NOTE

Quality mark for screws and bolts - 8.8 and 10.9 according to DIN 267 page 3.
Quality mark for nuts - 8 and 9 according to DIN 267 page 4.

CHAPTER 4

TRANSMISSION

CONTENTS

GENERAL

1 Transmission repairs at maintenance levels 3 and 4 are confined to transfer gearbox removal/fitting and shim adjustment at level 3 and overhaul at level 4. Removal and replacement of coupling flanges and flange seals for input and output shafts are detailed in Cat 522 Chap 4.

SPECIAL TOOLS AND TEST EQUIPMENT

2 Special tools and test equipment required to carry out the tasks detailed in this chapter are listed in Table 1.

TABLE 1 SPECIAL TOOLS AND TEST EQUIPMENT

Serial (1)	NSN (2)	Manfr No (3)	Designation (4)
1		1X56 045 808	Mounting tool, deep groove bearings
2		1X56 088 561	Adaptor, taper roller puller
3		1X56 112 761	Adaptor, puller
4		1X56 112 758	Adaptor, shaft seals
5		1X56 122 306	Puller
6		1X56 122 321	Puller, deep groove output shaft bearings
7		1X56 136 341	Short sleeve for use with Ser 1
8		1X56 136 732	Adaptor roller bearings for use with Ser 5
9		1X56 136 733	Puller, drive gear bearings used with Ser 5
10		1X56 136 971	Puller, intermediate gear shaft
11		1X56 137 252	Adaptor used with Ser 1
12		1X56 103 755	Adaptor used with Ser 1
13		1X56 136 260	Adaptor, lifting output assembly

SEALANTS AND LUBRICANTS

3 Sealants and lubricants required to carry out the tasks detailed in this chapter are listed in Table 2.

TABLE 2 SEALANTS AND LUBRICANTS

Ser (1)	NSN (2)	Designation (3)
1	H1-8030-99-225-0242	Sealing compound
2	H1-9150-99-220-2418	Grease XG 279
3	H1-8030-99-224-7304	Thread locking compound

TRANSFER GEARBOX

Removal (See Fig 1)

WARNINGS

(1) WHEN WORKING UNDERNEATH THE VEHICLE, THE ENGINE MUST BE STOPPED, THE HANDBRAKE APPLIED TO THE 'PARK' POSITION AND THE ROAD WHEELS CHOCKED.

(2) THE TRANSFER GEARBOX WEIGHS 252 KG (555 LB). WHEN SUPPORTING THE GEARBOX DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

(3) WHEN LIFTING THE ENGINE AND MAIN GEARBOX, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

4 Remove the transfer gearbox from the vehicle as follows:

4.1 Remove Load Handling System (LHS) framework as detailed in Cat 523 Chap 14.

4.2 Disconnect input and both output propshafts at transfer gearbox flanges.

4.3 Disconnect air pipe connector to front wheel drive actuator.

4.4 Fit suitable lifting tackle and take slight strain and remove mounting bracket bolts. Lift transfer gearbox clear of vehicle.

NOTE

If the LHS cannot be removed for any reason the transfer gearbox can be removed by positioning a transmission trolley beneath the gearbox and, when free, lowering clear of vehicle instead of lifting.

Refitting

5 Refit the transfer gearbox in reverse order to removal ensuring that oil level is checked for correct level on completion of fitting. Torque tighten mounting bolts as follows:

5.1 Bracket to transfer gearbox, 12 bolts, 200 Nm (148 lbf ft)

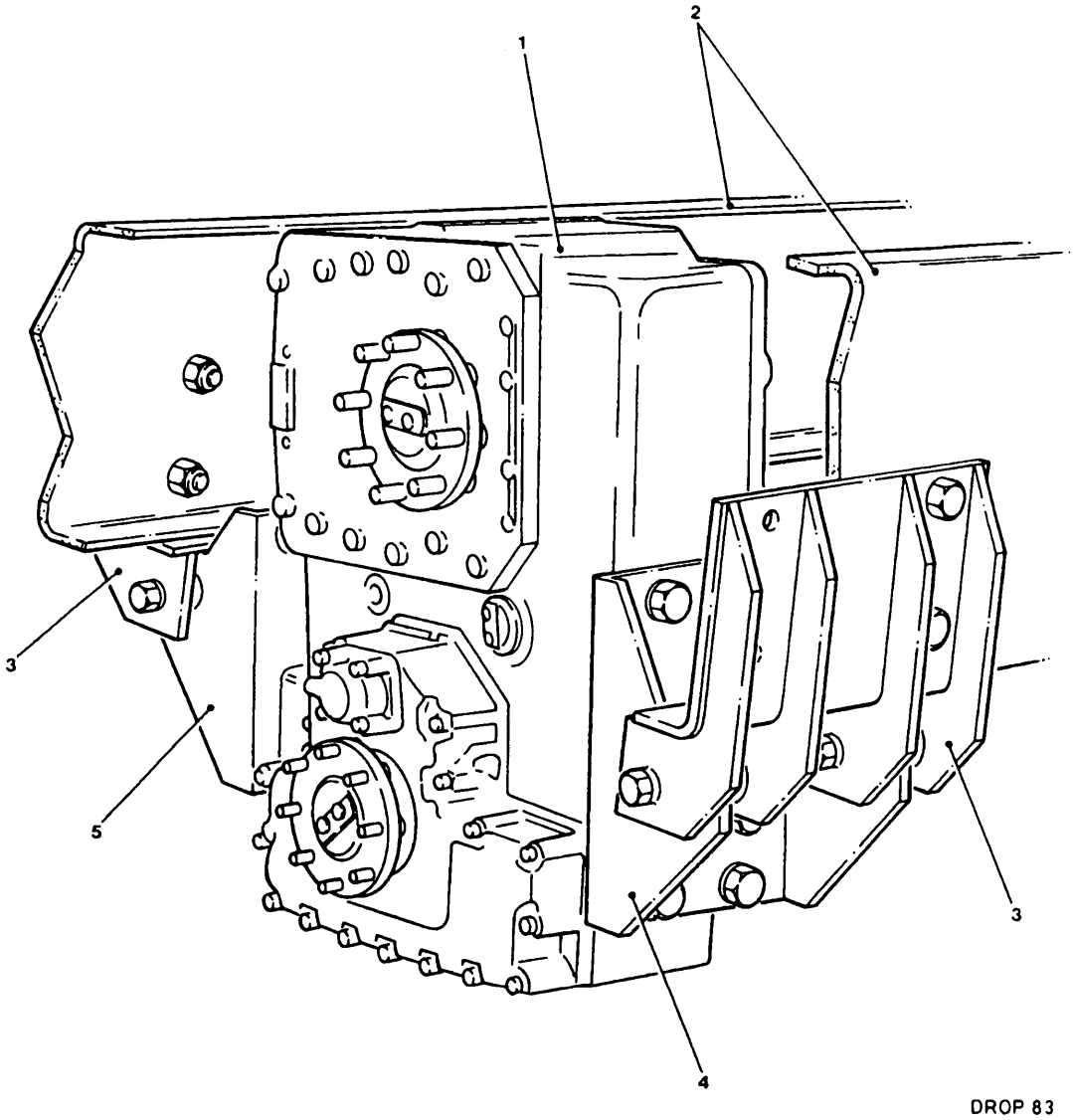
5.2 Mounting bracket, 4 bolts, 725 Nm (535 lbf ft).

Guide to dismantling

6 Thoroughly clean exterior of gearbox, completely drain all oil and mount in a suitable turnover fixture or set upright on a clean bench.

7 Discard all 'O' rings, seals and gaskets on dismantling and obtain new replacement items.

8 The dismantling procedure can be carried out as three major steps, input shaft and gear including oil pump, intermediate gear and output shafts (including dog clutch and actuator).



1 Transfer gearbox
2 Vehicle chassis frame
3 Chassis brackets
4 Gearbox mounting brackets r.h.
5 Gearbox mounting brackets l.h.

Fig 1 Transfer gearbox - mounting arrangements

Dismantling - input shaft and gear, including oil pump (See Fig 2)

9 Dismantle the input shaft as follows:

9.1 Remove input shaft closed end cover (21).

9.2 Drive out input shaft end cap (24).

9.3 Remove oil pump drive end cover (23).

9.4 Lift out shim pack (34), baffle plate (35) and spacer ring (36) from the closed end cover or the housing cover (11).

9.5 Remove unions (26) and (30) and oil suction pipe (28) together with 'O' rings (27) and (31) and filter (32).

9.6 Remove unions (14) oil pipe (13) and 'O' rings (12).

9.7 Remove breather (15) together with adaptor (29).

9.8 Remove the screws from the housing cover (11), and using mounting leaves in the recesses provided, ease the housing cover clear of the two locating dowels.

9.9 If the throttle valve (8) requires to be removed, heat the area around the thread to a maximum of 120°C to break the thread sealing compound.

9.10 Pull out the oil tube (7) and remove 'O' ring (10).

9.11 Using a suitable drift, drive outer race of bearing (37) from the housing cover.

9.12 Remove circlip (1) and use a standard puller to remove spur gear (2).

9.13 Drive out the oil pump drive shaft (16) in the direction of the bush (19).

9.14 Slide the oil pump drive shaft together with ball bearing (17) clear of the bush (19).

9.15 Remove the spring clip (18) and press the bearing (17) from the shaft (16).

9.16 Remove the bolts securing the oil pump housing (4) to the gearbox housing cover (11) and press the oil pump housing clear.

9.17 Remove the oil pump ring gear (5) and pump wheel (6) from the oil pump housing.

9.18 Press the ball bearing (3) from the oil pump housing.

9.19 Remove tab washer (47), screws (48), pressure disc (49) and input flange (50) from input shaft (33).

9.20 Lift the input shaft/gear assembly clear of housing and remove washer (46) from end of shaft (33).

9.21 Press the input shaft (33) from the input gear (39).

9.22 Use bearing extractor and adaptor (Table 1 Serial 2 and 9) to remove taper roller bearings (37) and (40) inner races from the input gear.

9.23 Use a standard puller to remove the spur gear (38) from the input gear.

9.24 Remove the screws and bolts securing the input shaft cover (52) to the gearbox housing (43).

9.25 Remove the input shaft cover and centring ring (44).

9.26 Prise or press the tapered roller bearing (40) outer race from the gearbox housing, recover washer (41).

KEY TO FIG 2

1 Circlip
2 Oil pump spur gear
3 Ball bearing
4 Oil pump housing
5 Oil pump ring gear
6 Oil pump wheel
7 Oil tube
8 Throttle valve
9 Cap
10 'O'ring
11 Housing cover
12 Copper washers
13 Oil pipe
14 Union
15 Breather
16 Oil pump drive shaft
17 Ball bearing
18 Spring clip
19 Bush
20 Gasket
21 Input shaft closed end cover
22 Gasket
23 Oil pump drive end cover
24 Input shaft end cap
25 Sealing cap
26 Union
27 Copper washers
28 Oil suction pipe
29 Adaptor
30 Union
31 Copper washers
32 Filter
33 Input shaft
34 Shim pack
35 Baffle plate
36 Spacer ring
37 Roller bearing
38 Spur gear
39 Input gear
40 Roller bearing
41 Washer
42 Gasket
43 Gearbox housing
44 Centring ring
45 Gasket
46 Washer
47 Tab washer
48 Screw
49 Pressure disc
50 Input flange
51 Oil seal
52 Input shaft cover

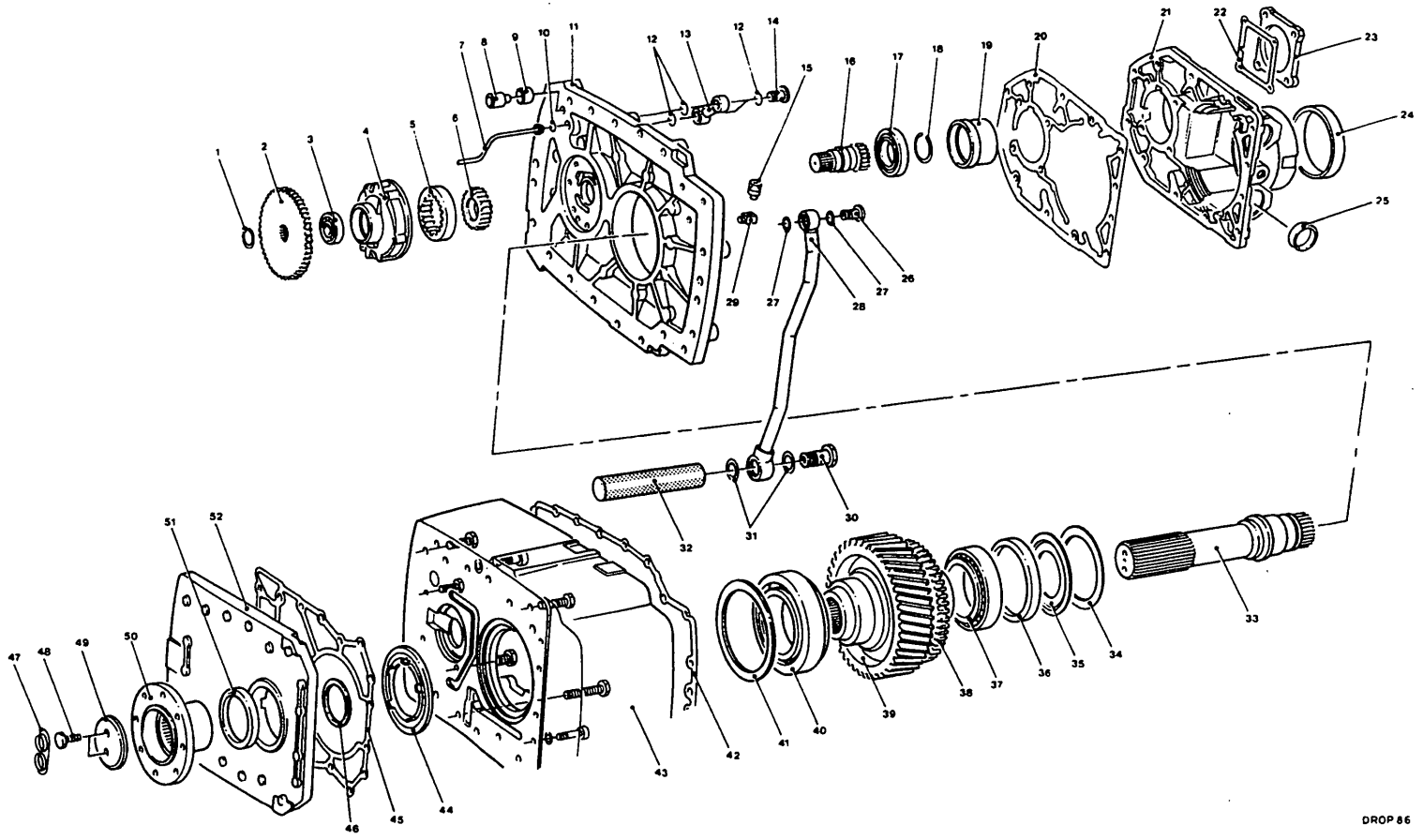


Fig 2 Input shaft and oil pump

Dismantling - intermediate shaft (See Fig 3)

10 Dismantle the intermediate shaft as follows:

10.1 Remove tab washer (1), screws (2) and pressure disc (3) from end of intermediate shaft (10).l

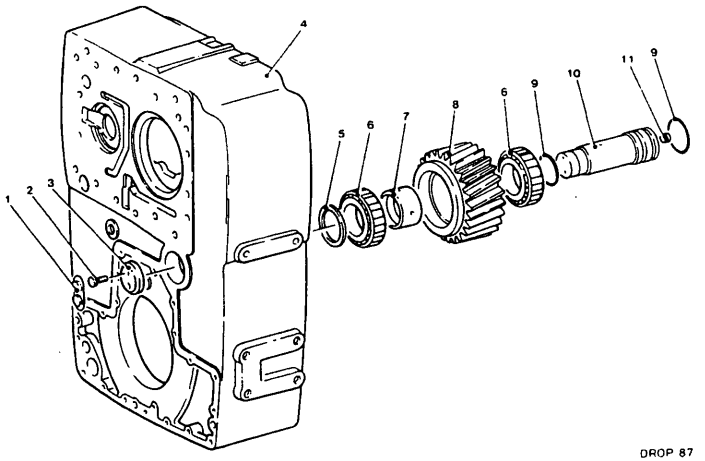
10.2 Remove blanking plug (M18 x 1.5) from end of intermediate shaft.

10.3 Use M18 threaded puller (Table 1 Serial 10) to pull the intermediate shaft clear of the intermediate gear (8). If shaft is tight, assist the puller by striking the free end of the shaft with a hammer.

10.4 Lift the intermediate gear sub-assembly from the gearbox housing, recover washer (5).

10.5 Remove the 'O' rings (9) from the intermediate shaft.

10.6 Press the bearings (6) and bush (7) from the intermediate gear (8).



1 Tab washer
2 Screw
3 Pressure disc
4 Gearbox housing
5 Washer
6 Roller bearing
7 Spacer bush
8 Intermediate gear
9 'O' ring
10 Intermediate shaft
11 Plug

Fig 3 Intermediate shaft

Dismantling - output shafts, including dog clutch and actuator (See Fig 4)

11 Dismantle both output shafts, front wheel drive selector clutch and actuator as follows:

11.1 Remove tab washer (28), screws (27) and pressure disc (26) from ends of forward and rear output shafts (20) and (37). Withdraw both output flanges (25) and (29) and oil seals (24) and (30).

11.2 Fit puller (Table 1 Serial 6) to the deep groove ball bearing (23) with an extension arbour between the forward output shaft and puller spindle.

11.3 Pull the bearing (and hence the selector housing) clear of the forward output shaft. Recover the sliding sleeve (19), stop ring (21) and sliding pads (16).

11.4 Remove circlip (22) and withdraw bearing (23) from selector housing.

11.5 Withdraw the forward output shaft (20).

11.6 Remove screws (6) and withdraw pivot pins (5) with 'O' rings (4). Lift out shift fork (7).

11.7 Unscrew the pressure switch (7), recover sealing ring (8) and headless pin (9).

11.8 Remove screws securing piston housing (2) remove housing, piston (13) complete with piston ring (12), spring (14) and spring sleeve (15).

11.9 Remove the rear axle drive output cover (31) retaining screws.

11.10 Use a standard two leg puller to remove the output cover (31) complete with ball bearing (35) (and probably cylindrical roller bearing (38)).

11.11 Remove circlip (34) and drive out bearings (35) and (38).

NOTE

The outer race of the cylindrical roller bearing (38) is liable to suffer damage during removal.

11.12 Fit the output gear lifting device (Table 1 Serial 13) to the outer end of the rear axle output shaft (37).

11.13 Lift the complete output shaft/gear sub-assembly at the same time, using a hammer and a suitable drift, tap the inner end of the output shaft upwards.

11.14 Remove circlip (43) and drift bearing (44) clear of casing.

11.15 If still in position draw inner race of bearing (38) from output gear, recover spacer (39).

11.16 Remove snap ring (42) and withdraw needle bearing (41) from inner bore of output gear.

Cleaning and inspection

12 Clean all components using standard workshop procedures and equipment, ensuring removal of all traces of gaskets and sealants. Lay out cleaned items in disassembly order, including new replacement seals, gaskets and bearings.

13 Inspect cleaned components as follows:

13.1 Inspect all bearing components in accordance with EMER T & M A 028 Chap 060. Where parts of bearing sets are unserviceable, discard complete set and obtain new replacement set.

13.2 Inspect all moving contact surfaces, including sliding splines, gear teeth, clutch dog teeth, clutch dog sleeves and yokes, for unacceptable wear as detailed in Cat 302-533. Discard any unserviceable items and obtain new replacement parts.

13.3 Inspect casings and covers for damage, distortion or cracking, and for scratched., corroded or pitted machined mating surfaces, burred or damaged threaded holes.

13.4 Check for loose fit of bearings in casing seats. Where necessary, if casing or cover cannot be made good, discard and obtain new replacement parts.

13.5 If new studs require to be fitted to the gearbox housing, the housing end threads are to be coated with thread sealing compound (Table 2 Serial 3) and the studs tightened to the following torques:

Stud M8 - 7.5 to 10 Nm (5.55 to 7.4 lbf ft)
Stud M10 - 10.0 to 15 Nm (7.4 to 11.1 lbf ft)

13.6 Clean the drain plug in the gearbox housing and refit with new copper washer, torque tighten to 55 to 65 Nm (40.7 to 48 lbf ft).

13.7 Check the air filter insert (1) is clean and correctly located.

KEY TO FIG 4

1 Filter insert
2 Piston housing
3 Gasket
4 'O' ring
5 Pivot pin
6 Screw
7 Electrical switch
8 Sealing ring
9 Headless pin
10 Selector housing
11 Gasket
12 Piston ring
13 Piston
14 Spring
15 Spring sleeve
16 Sliding pads
17 Shift fork
18 Gearbox housing
19 Sliding sleeve
20 Forward output shaft
21 Stop ring
22 Circlip
23 Ball bearing
24 Oil seal
25 Forward output flange
26 Pressure disc
27 Screw
28 Tab washer
29 Rear output flange
30 Oil seal
31 Rear axle drive output cover
32 Dowel
33 Gasket
34 Shim
35 Ball bearing
36 Circlip
37 Rear axle output shaft
38 Roller bearing
39 Spacer ring
40 Output gear
41 Needle bearing
42 Snap ring
43 Snap ring
44 Ball bearing

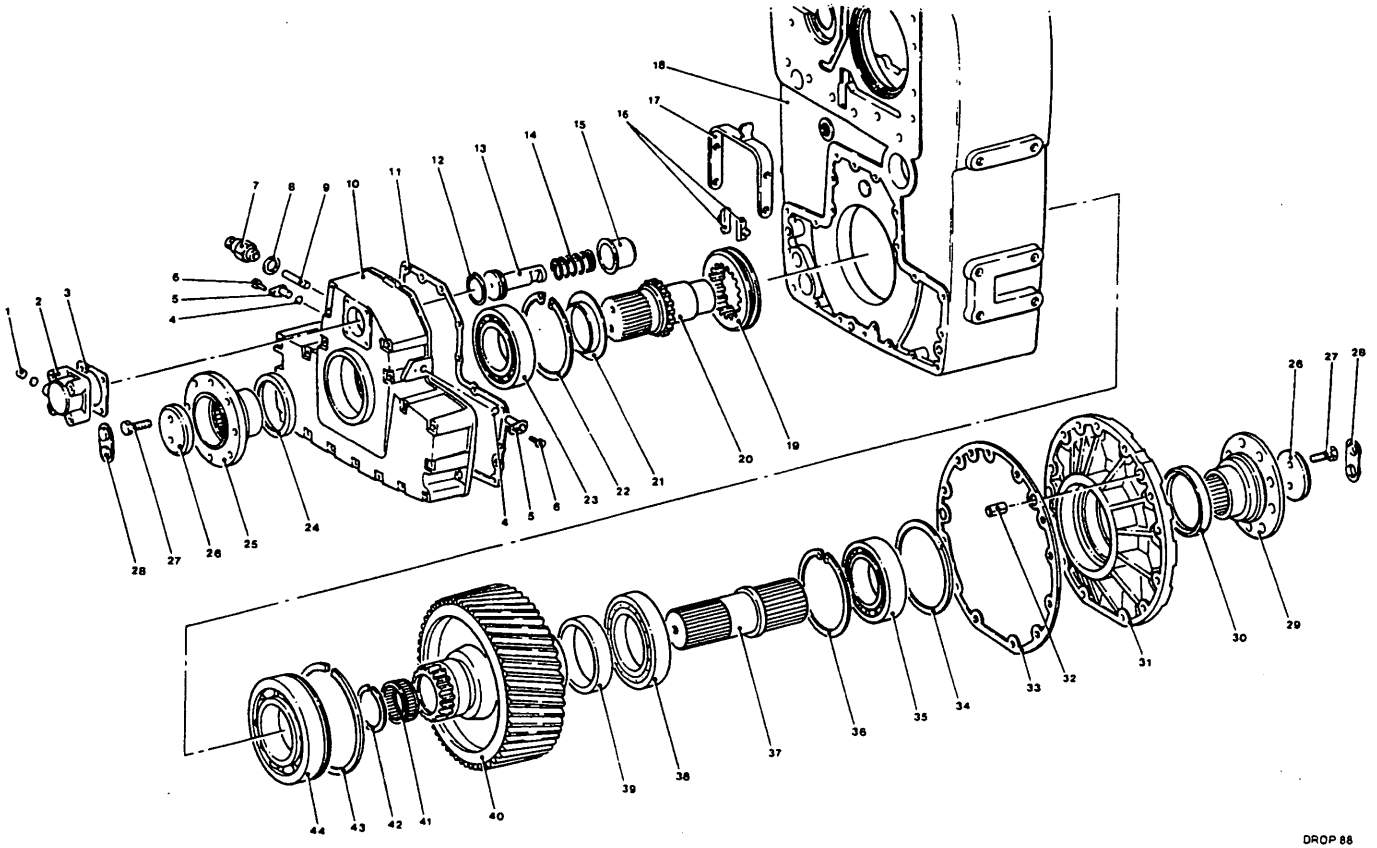


Fig 4 Output shafts and dog clutch

Reassembly - output shafts, including dog clutch and actuator (See Fig 4)

14 Reassemble both output shafts, front wheel drive selector clutch and actuator as follows:

14.1 Fit needle roller bearing (41) to bore of output gear (40) and secure with circlip (42).

14.2 Fit the circlip (43) to bearing (44), heat the bearing to 85°C (185°F) and press it onto the forward end of the output gear with the circlip nearest to the gear.

14.3 Press the rear axle output shaft (37) into the outer gear until the shoulder on the shaft abuts the output gear.

14.4 Press ball bearing (35) into rear axle drive output cover (31), secure with circlip (36).

14.5 Press the output shaft/gear sub-assembly into the gearbox housing until the circlip (43) is in contact with the inner face of the housing.

14.6 Locate the spacer ring (39) and press the bearing (38) onto the output gear rear boss.

14.7 Place the gasket (33) in position on the rear sealing face of the gearbox housing.

14.8 Using a depth gauge measure the distance from the sealing face to the outer face of the bearing outer race, (dimension 'A' in Fig 5) record the reading.

NOTE

The circlip (43) and securing bearing (44) in the gearbox casing must abut axially with no free movement whilst these calculations are being made.

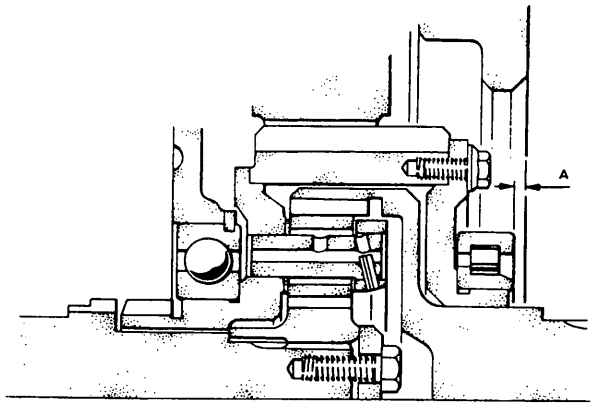


Fig 5 Rear output shaft axial clearance - dimension 'A'

14.9 Place the rear axle drive output cover (31), sealing face uppermost, onto a flat surface, place two gauge blocks onto the sealing face and bridge them with a gauge bar.

14.10 Use a depth gauge to measure from the gauge bar to the upward facing shoulder of the cover recess that houses bearing (38), (dimension 'B' in Fig 6).

14.11 Use a micrometer to measure the thickness of either gauge block and the gauge bar, (dimension 'C' in Fig 6).

14.12 With the three readings calculate the shim thickness required for shim pack (34), (dimension 'D') A + B - C = D where 'D' is equal to the axial play of the rear output shaft.

14.13 Acceptable axial play is 0.2 to 0.5 mm, if outside these limits adjust shim pack (34), adding shims to reduce the play and subtracting shims to increase the play. Shims are supplied in thicknesses of 0.2, 0.3 and 0.5 mm.

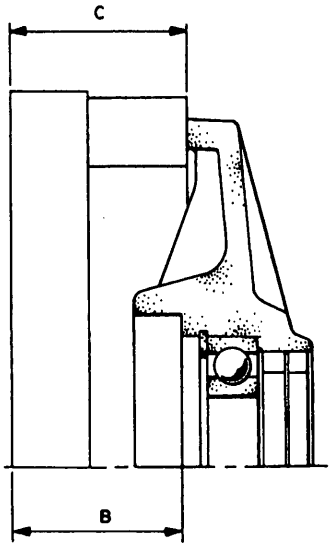


Fig 6 Rear output shaft axial clearance - dimension 'B' and 'C'

14.14 Locate the correct size shim pack into position and press the outer ring of bearing (Fig 4 (38)) into the cover recess until the shim pack is firmly held.

14.15 Fit a new gasket (33) to the outer cover (31) and press the cover onto the output shaft ensuring correct alignment of the locating dowels.

14.16 If difficulty is encountered getting the cover fully down fit adaptor (Table 1 Serial 12) and puller (Table 1 Serial 1) and pull the cover down.

14.17 When the rear axle drive output cover is fully located, fit securing screws and torque tighten in diametrically opposed sequence to 86 Nm (63.43 lbf ft).

14.18 Fit the rear output shaft oil seal (30) using adaptor (Table 1 Serial 4).

14.19 Heat the rear output flange to approx 85°C (185°F), locate the flange screws, coat the area of the flange that will contact the oil seal (30) with clean system oil (Cat 601 Table 2 refers) and then fit to the shaft.

14.20 If necessary, use adaptor (Table 1 Serial 12) with puller (Table 1 Serial 1) fitted with short tube (Table 1 Serial 7) to force the output flange fully onto the shaft.

14.21 Apply sealing compound (Table 2 Serial 1) to the inner face of pressure disc (26), locate and secure with screws (27) torque tightened to 60 Nm (44.25 lbf ft).

14.22 Lock the screws with tab washer (28).

14.23 Working at the selector housing side of the gearbox housing, place the spring sleeve (15) into the selector housing (10).

14.24 Fit the piston ring (12) to piston (13), locate spring (14) over piston shank, and the piston head into the piston housing (2).

14.25 Fit a new gasket (3) and locate the piston housing and secure with two screws finger tight.

14.26 Fit headless pin (9) into its bore and fit pressure switch (7) with new copper washer (8), torque tighten the pressure switch to 50 Nm (37 lbf ft) max.

14.27 Drive or press ball bearing (23) into the selector housing, when fully home fit circlip (22) to groove in housing.

14.28 Locate the shift fork (17) into the selector housing with the lug of the fork engaged in the wide recess of the piston (13).

14.29 Insert the pivot pins (5), with 'O' rings (4) fitted, into the selector housing to engage with the holes in the shift fork.

14.30 Secure pivot pins with screws (6) torque tightened to 10 Nm (7.4 lbf ft).

14.31 Fit sliding pads (16) to the shift fork, locate the sliding sleeve (19) over the sliding pads and check the clearance between pads and the groove in the sleeve with two sets of feeler gauges. Allowable clearance is 0.25 to 0.75 mm on each side, if the readings are outside the range check for faulty/worn components and renew as necessary.

14.32 Place new gasket (11) onto the gearbox housing.

14.33 Fit forward output shaft (20) to the output gear (40).

14.34 Secure stop ring (21) to sliding sleeve (19) with bearing grease (Table 2 Serial 2).

14.35 Holding the sliding sleeve and stop ring central with a screwdriver or similar implement until they are located over the forward output shaft (20), locate the selector housing onto the gearbox housing.

14.36 Screw the threaded adaptor (Table 1 Serial 12) onto the forward output shaft, fit mounting tool (Table 1 Serial 1) and force the selector housing down. Ensure the housing passes cleanly over the location dowels and the sliding sleeve passes over the dog teeth of the output shaft, rotate the shaft if necessary for alignment.

14.37 When the selector housing is fully located secure with screws and nuts torque tightened to 25 Nm (18.5 lbf ft) (M8 size) and 49 Nm (36.15 lbf ft) (M10 size).

14.38 Fit the oil seal (24) and forward output flange (25) as detailed in Para 14.18 to 14.22.

Reassembly - intermediate shaft (See Fig 3)

15 Reassemble the intermediate shaft as follows:

15.1 Insert one cage of roller bearing (6), spacer bush (7) and the cage of the second roller bearing into the bore of the intermediate gear (8) with stamped side of roller cages facing outwards.

15.2 Place the sub-assembly onto a hand press, with pressure piece (Table 1 Serial 2) over the upper bearing cage, and press both cages against the spacer bush until all clearance is removed.

15.3 Maintaining pressure on the press, position a standard dial gauge to contact the intermediate gear and measure for axial play by moving the gear upward and downward over the bearings and bush. Allowable play is 0.15 to 0.30 mm, if these figures are not met a new spacer bush (7) is required to be fitted.

NOTE

If a new spacer bush (7) is fitted it may require to be ground to the required length. This is achieved by measuring the length of the original bush and adding the amount that the original reading was over its limit plus half of allowable play ie 0.15 mm.

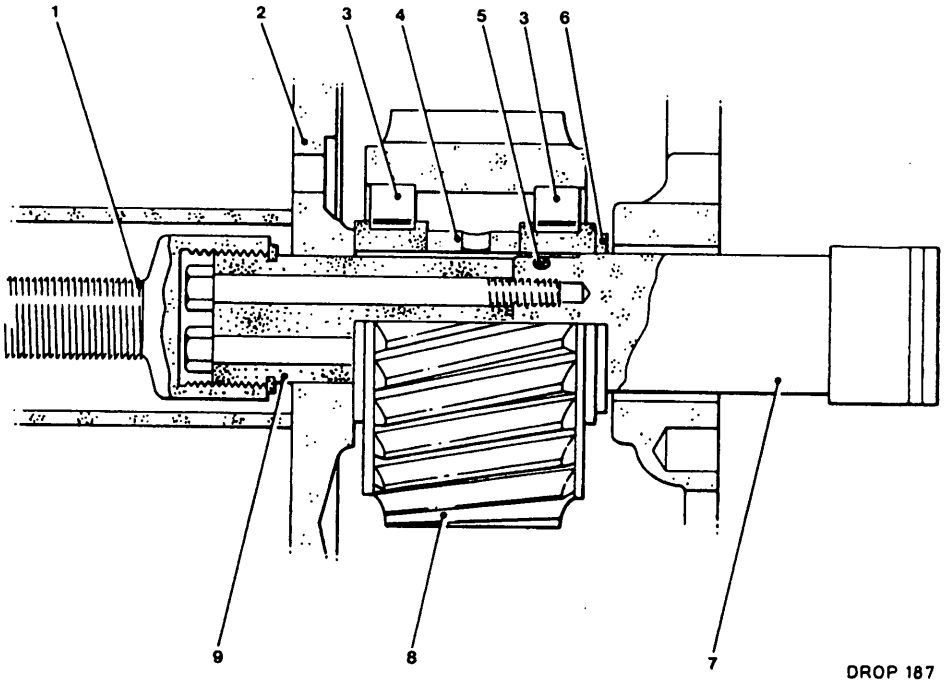
15.4 Feed the assembled intermediate gear (8) and intermediate washer (5) into the gearbox housing and align both to the casing bore for the intermediate shaft.

15.5 Fit new 'O' rings (9) into the intermediate shaft recesses, apply gear oil to the shaft and fit into the gearbox housing.

15.6 Drive the intermediate shaft into the gearbox housing checking correct alignment of teeth, until solid resistance is felt then fit the threaded adaptor (Table 1 Serial 11) and puller (Table 1 Serial 1) as shown in Fig 7 and pull the intermediate shaft until the shaft shoulder contacts the housing casing.

15.7 Coat the sealing face of the pressure disc (3) with sealing compound (Table 2 Serial 1), locate over the end of the intermediate shaft (10), secure with screws (2) torque tightened to 49 Nm (36.15 lbf ft) and held by tab washer (1).

15.8 Screw the M18 plug into the opposite end of the intermediate shaft and torque tighten to 35 Nm (25.8 lbf ft).



1 Puller, Table Serial 1
2 Transfer cage housing
3 Roller cage
4 Spacer bush
5 'O' ring
6 Intermediate washer
7 Intermediate gear axle
8 Intermediate gear
9 Threaded adaptor Table 1 Serial 11

Fig 7 Intermediate shaft - fitting to gearbox housing

Reassembly - input shaft and gear, including oil pump (See Fig 2)

16 Reassemble the input shaft and oil pump as follows:

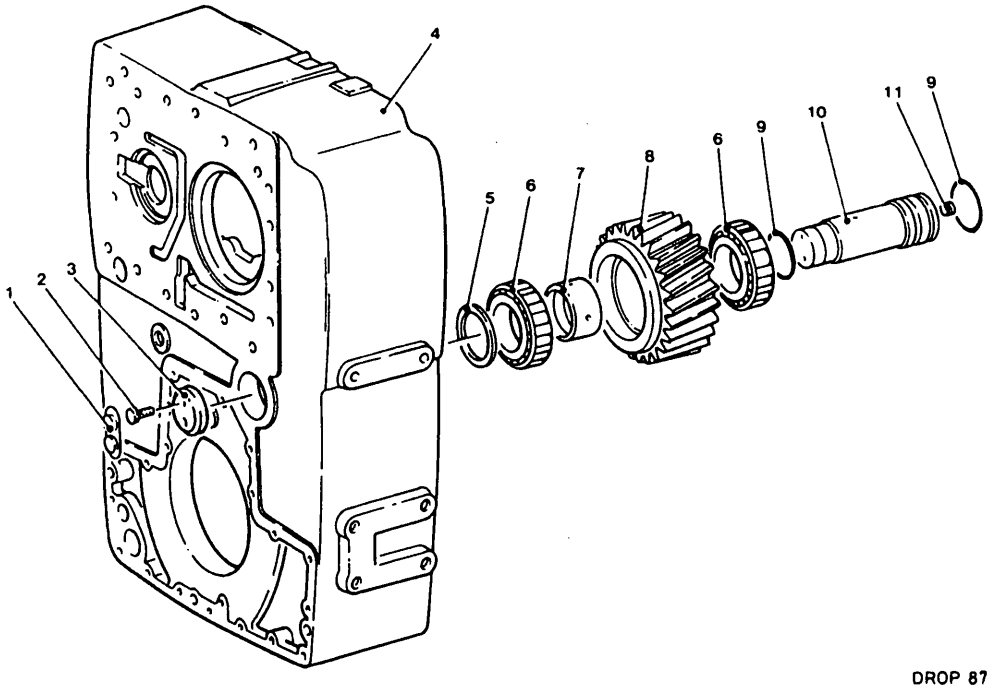
16.1 Locate the washer (41) into the gearbox housing and drive in the tapered bearing (40) outer race until it abuts the washer.

16.2 From the other side of the casing locate the centring ring (44).

16.3 Fit new gasket (45) and input shaft cover (52). Secure with hexagon head and socket head screws, ensure correct screws in correct holes, torque tighten; 49 Nm (36.15 lbf ft) (M10 size), 135 Nm (99.5 lbf ft) (M14 size).

16.4 If the screw plug was removed from the input shaft cover, apply sealing compound (Table 2 Serial 1) and torque tighten to 55 to 65 Nm (40.6 to 48.0 lbf ft).

16.5 Heat the input gear (39) to 140°C (284°F) and fit it onto the input shaft (33).



1 Tab washer	5 Washer	9 'O' ring
2 Screw	6 Roller bearing	10 Intermediate shaft
3 Pressure disc	7 Spacer bush	11 Plug
4 Gearbox housing	8 Intermediate gear	

Fig 3 Intermediate shaft

16.6 Allow the sub-assembly to cool then fit spur gear (38) to the input gear with the bevel on its internal diameter towards the input gear.

16.7 Heat the inner races of both taper roller bearings (37) and (40) to 85°C (185°F), and fit them to the input shaft noting that the bearings are of different size and the rollers fit taper outwards.

16.8 Apply a film of grease (Table 2 Serial 2) to the inner face of washer (46) and locate the washer onto the input shaft.

16.9 Place the input gear sub-assembly into the gearbox housing so that the input shaft protrudes through the input shaft cover.

16.10 Insert the pump wheel (6) into the ring gear (5) and both into the pump housing.

16.11 Using a dial gauge measure the difference between the pump housing datum face and the front face of the ring gear at several points around the circumference. Design difference is 0.03 to 0.06 mm, if any reading is outside these limits renew the pump housing.

16.12 Fit a new 'O' ring seal to the pump housing (4) and pump housing to the housing cover (11). Secure and torque tighten to 10 Nm (7.4 lbf ft).

16.13 Fit the spring clip (18) to the pump shaft (16), heat the ball bearing (17) to 85°C (185°F), and press it onto the pump shaft until it contacts the snap ring.

16.14 Insert the pump shaft (16) through the housing cover into the pump housing, press the ball bearing (3) onto the pump shaft until it abuts the pump housing shoulder.

16.15 Heat the spur gear (2) to 85°C (185°F). position the collar to face the pump housing, slide it onto the pump shaft.

16.16 Fit circlip (1) to secure the spur gear.

16.17 Press the bearing bush (19) over the bearing (17) into the housing cover.

16.18 Drive the outer race of bearing (37) into the housing cover (11) until it is depressed approximately 7 mm (0.28 in.) past the outer sealing face of the housing cover.

16.19 Apply thread locking compound (Table 2 Serial 3) to throttle valve (8) torque tighten to 25 Nm (18.5 lbf ft).

16.20 Fit 'O' ring (10) to oil pipe (7) and insert oil pipe into housing cover in the correct orientation.

16.21 Fit gasket (24) to gearbox housing (43) and press housing cover onto gearbox housing over location dowels. Secure with screws torque tightened to 49 Nm (36.15 lbf ft).

16.22 Screw in adaptor (29) and breather (15). Torque tighten to 10 Nm (7.4 lbf ft).

16.23 Refit oil pipe (13) and oil suction pipe (28) using new copper washers, torque tighten unions (14), (26) and (30) 45 Nm (33.2 lbf ft) (M16 size) 50 Nm (37 lbf ft) (M18 size) and 90 Nm (66.4 lbf ft) (M26 size).

KEY TO FIG 2

1 Circlip
2 Oil pump spur gear
3 Ball bearing
4 Oil pump housing
5 Oil pump ring gear
6 Oil pump wheel
7 Oil tube
8 Throttle valve
9 Cap
10 'O' ring
11 Housing cover
12 Copper washers
13 Oil pipe
14 Union
15 Breather
16 Oil pump drive shaft
17 Ball bearing
18 Spring clip
19 Bush
20 Gasket
21 Input shaft closed end cover
22 Gasket
23 Oil pump drive end cover
24 Input shaft end cap
25 Sealing cap
26 Union
27 Copper washers
28 Oil suction pipe
29 Adaptor
30 Union
31 Copper washers
32 Filter
33 Input shaft
34 Shim pack
35 Baffle plate
36 Spacer ring
37 Roller bearing
38 Spur gear
39 Input gear
40 Roller bearing
41 Washer
42 Gasket
43 Gearbox housing
44 Centring ring
45 Gasket
46 Washer
47 Tab washer
48 Screw
49 Pressure disc
50 Input flange
51 Oil seal
52 Input shaft cover

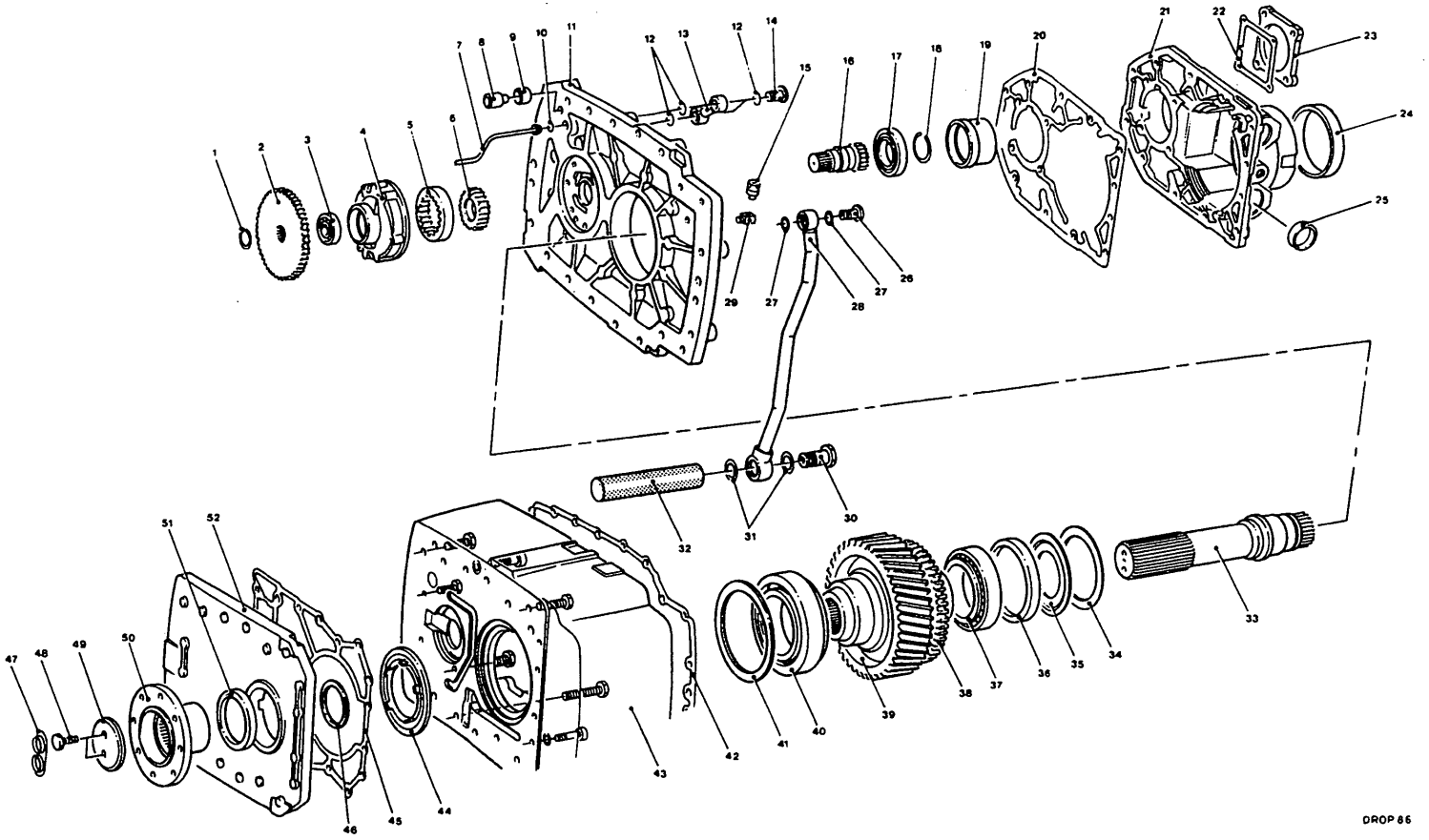


Fig 2 Input shaft and oil pump

16.24 Apply sealing compound (Table 2 Serial 1) to outer circumference of input shaft end cap (24) and drive home until it is recessed approximately 5 mm (0.2 in.) past the edge of the housing.

16.25 Locate new gasket (20) onto the input shaft closed end cover (21).

16.26 Use a dial gauge to measure the depth of the recess in the input shaft closed end cover (as shown in Fig 8) with the gasket (20) in place, record the reading - dimension 'A'.

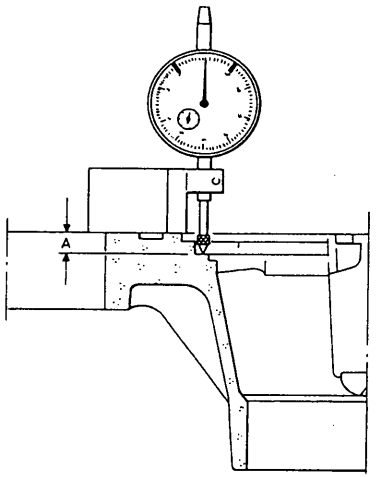


Fig 8 Input shaft closed end cover - dimension 'A'

16.27 By gently tapping the spacer ring (36) squarely onto the taper roller bearing whilst rotating the gear drive, pre-load the bearing (37) until there is no free play on the taper rollers.

NOTE

The rollers are correctly pre-loaded when two rollers on opposite sides can only be displaced with difficulty using a screwdriver.

16.28 When the bearing is pre-loaded measure dimension 'C' as shown in Fig 9. Dimension 'C' is the distance from the face of the cover to the face of the distance ring.

16.29 Use a micrometer to measure the thickness of baffle plate (35). The thickness of the baffle plate plus dimension 'C' = dimension 'B'.

16.30 Dimension 'A' minus dimension 'B' = the axial play of the drive gear. Designed axial play is 0.02 to 0.07 mm. Various sized shims (34) can be made up to ensure the axial play within limits.

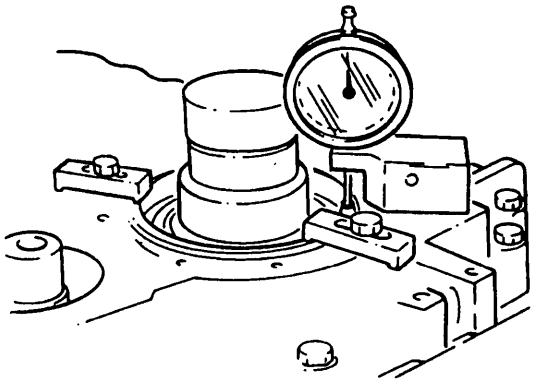


Fig 9 Gearbox housing/input shaft bearing - dimension 'C'

16.31 Insert correct size shim pack (34) and baffle plate (35) into input shaft closed end cover, locate cover onto gearbox housing and secure. Torque tighten to 49 Nm (36.15 lbf ft).

16.32 Apply sealing compound (Table 2 Serial 1) to oil pump drive end cover (23), fit gasket and secure. Torque tighten to 86 Nm (63.45 lbf ft).

16.33 Insert flange bolts into input flange (50).

16.34 Heat input flange to 85°C (185°F) and press it onto the input shaft until it abuts.

16.35 Apply sealing compound (Table 2 Serial 1) to the sealing surface of pressure disc (49) and secure to flange. Torque tighten screws (48) to 60 Nm (44.4 lbf ft) and secure with tab washer (47)

16.36 Top up to working level with oil Cat 201 (Chap 3 refers).

Testing

17 To test correct operation of the transfer gearbox proceed as follows:

17.1 Turn the input flange and check that the rear output flange turns in the same direction and the forward output flange remains static.

17.2 Use an air line with appropriate connections to pressurise the actuator piston, turn the input flange and check that both output flanges turn in the same direction.

17.3 Further testing can only be carried out with the gearbox fitted to a vehicle when the standard road test can be applied.

CHAPTER 5

REAR AXLES

CONTENTS

(continued)

CONTENTS (continued)

GENERAL

1 This chapter details repairs procedures for both rear axles at maintenance levels 3 and 4. Level 3 tasks comprise overhauling hub reduction gears, and removing and refitting complete axles for level 4 overhaul.

2 Instructions for overhaul of hub reduction gears are as details for Foremost Front Axle repairs (Cat 523, Chap 6 refers).

3 Prior to starting any of the following repair activities on the vehicle, park the vehicle on firm level ground, fully apply parking brake, set vehicle electrical master switch to OFF, and chock wheels of axles not subject of repair activity.

SPECIAL TOOLS

4 Special tools and equipment required are detailed in Table 1.

TABLE 1 - SPECIAL TOOLS

Ser (1)	**NSN** (2)	**Manfr No** (3)	**Designation** (4)	**Qty** (5)
1		E464	Helical pinion setting tool	1

SEALANTS, ADHESIVES AND LUBRICANTS

5 Sealants, adhesives and lubricants required, other than standard vehicle lubricants details in Cat 601 (Maintenance Schedule), are detailed in Table 2.

Ser (1)	NSN (2)	Manf. No. (3)	Designation (4)	Qty (5)
1	H1/8030-99-224-0136	Loctite Bush Fit	Adhesive	A/R
2	H1/8030-99-224-7304	Loctite 275	stud lock	A/R
3	H1/8040-99-225-1152	Loctite 641	Bearing fit (medium strength)	A/R
4	H1/6850-99-224-9504	Loctite 706	Cleaning solvent	A/R
5	8040-99-792-7208	Loctite 638	Bearing fit (high strength)	A/R

REMOVING AND REPLACING AXLES

General

WARNINGS

(1) USE SUITABLE SLINGING AND HOIST EQUIPMENT WHEN REMOVING AND REFITTING AXLES AND AXLE SUB-ASSEMBLIES, DUE TO HEAVY WEIGHTS OF ITEMS CONCERNED.

(2) DO NOT WORK UNDER A VEHICLE SUPPORTED SOLELY BY HYDRAULIC JACKS. SUITABLE CHASSIS STANDS ARE TO BE UTILISED AT ALL TIMES.

6 If conditions and facilities available permit, clean exterior of axle(s) and mountings and fittings concerned. Park vehicle on firm level ground before commencing removal activites.

Rearmost rear axle (See Fig 1)

7 To remove the rearmost axle from the vehicle:

7.1 Park vehicle on firm level ground, fully apply the parking brake, set vehicle electrical master switch to OFF and chock wheels of axles not being worked on.

7.2 Deplete air system through reservoir drains.

7.3 Slacken wheel nuts of axle being removed.

7.4 Jack up the axle and support the chassis at spring mountings.

7.5 Position transmission jack under the rear axle to support the differential casing.

7.6 Remove slackened wheel nuts and road wheels.

7.7 Disconnect input propshaft at axle rear coupling flange (Fig 1(2)).

7.8 Mark and disconnect air lines at spring brake actuators and differential lock.

7.9 If required, tag the differential lock electrical connectors for identification, and remove.

7.10 Disconnect air breather pipe.

7.11 Remove air piping bracket and secure to chassis.

7.12 Disconnect torque arms (3) and (7) and suspension dampers (4) at axle mountings.

7.13 Pull transmission jack to the rear until the slipper bracket ends (5) are clear of springs (8). Lower axle until it is clear of chassis then pull clear of vehicle.

8 To replace the rearmost rear axle:

8.1 To replace the rearmost rear axle is the reverse of removal.

8.2 Tighten nuts on torque arm bolts to a torque of 405.5 to 432.5 Nm (300 to 320 lbf ft).

Foremost rear axle (See Fig 1)

9 To remove the foremost rear axle from the vehicle:

9.1 Park vehicle on firm level ground, fully apply the parking brakes, set vehicle electrical master switch to OFF and chock wheels of axles not being worked on.

9.2 Deplete air system through reservoir drains.

9.3 Slacken road wheel nuts of axle being removed.

9.4 Jack up the axle and support chassis at spring mountings.

9.5 Position transmission jack under the foremost rear axle to support differential casing.

9.6 Remove slackened wheel nuts and road wheels.

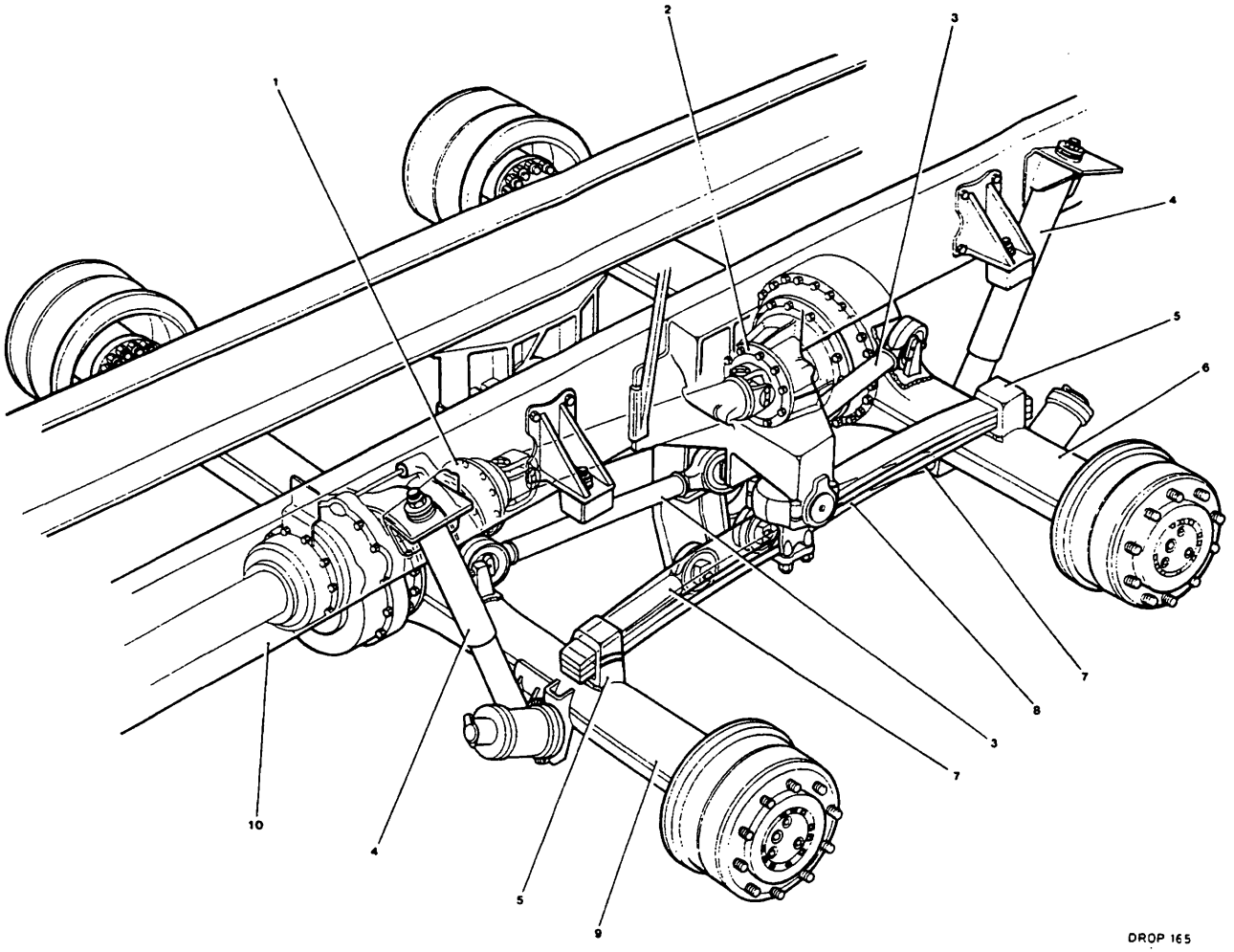
9.7 Disconnect input and output propshafts at axle flanges.

9.8 Mark and disconnect air lines at spring brake actuators and differential lock.

9.9 If required, tag the third differential and axle cross lock electrical connectors for identification, and remove.

9.10 Disconnect air breather pipe.

9.11 Remove air pipe bracket and secure to chassis.



1 Front coupling flange
2 Rear coupling flange
3 Upper torque arm
4 Suspension dampers
5 Slipper end brackets
6 Rearmost rear axle
7 Lower torque arm
8 Spring assembly
9 Foremost rear axle
10 Chassis frame

Fig 1 Rear bogie arrangement

9.12 Disconnect suspension dampers (4) at axle mountings.

9.13 Disconnect torque arms (3) and (7) at axle mountings.

9.14 Pull transmission jack forward until the slipper bracket ends (5) are clear of springs (8). Lower axle until clear of chassis then pull clear of the vehicle.

10 To replace the foremost rear axle on the vehicle:

10.1 Replacement of the foremost rear axle is the reverse of removal.

10.2 Tighten nuts on torque arms to a torque of 405 to 432 Nm (300 to 320 lbf ft).

DISMANTLING REAR AXLES

WARNINGS

(1) USE SUITABLE SLINGING AND HOIST EQUIPMENT WHEN REMOVING AND REFITTING AXLES AND AXLE SUB-ASSEMBLIES, DUE TO HEAVY WEIGHTS OF ITEMS CONCERNED.

(2) DO NOT WORK UNDER A VEHICLE SUPPORTED SOLELY BY HYDRAULIC JACKS. SUITABLE CHASSIS STANDS ARE TO BE UTILISED AT ALL TIMES.

11 To aid reassembly it is recommended to retain dismantled components in dismantled sequence.

Rearmost rear axle

12 Remove hub assemblies, including hub reduction gears, brake drums, hubs, brake assemblies and drive half-shafts as detailed in Cat 522 Chap 5 and 7. Dismantle and overhaul the following axle assemblies in the same manner as detailed for corresponding assemblies in front axle (Cat 523 Chap 6 refers):

12.1 Hub assembly, including reduction gears and hub bearings and seals.

12.2 Differential assembly, including input bevel pinion and differential lock assembly.

Foremost rear axle

13 Remove, dismantle and overhaul hub assemblies, including hub reduction gears, brake drums, hubs, brake assemblies and drive half-shafts in the same manner as detailed for rearmost rear axle (Para 12 refers).

DRIVE HEAD UNIT OVERHAUL

WARNINGS

(1) USE SUITABLE SLINGING AND HOIST EQUIPMENT WHEN REMOVING AND REFITTING AXLES AND AXLE SUB-ASSEMBLIES, DUE TO HEAVY WEIGHTS OF ITEMS CONCERNED.

(2) DO NOT WORK UNDER A VEHICLE SUPPORTED SOLELY BY HYDRAULIC JACKS. SUITABLE CHASSIS STANDS ARE TO BE UTILISED AT ALL TIMES.

14 If suitable lifting equipment is available the complete drive head assembly can be removed from the axle casing and the various sub-assemblies then removed. Each sub-assembly can be removed separately but should be removed and refitted in sequence as described in the following paragraphs.

Cleaning and inspection

15 When assemblies have been removed and dismantled carry out cleaning and inspection as follows:

15.1 Using standard workshop procedures and equipment, thoroughly clean and dry all components, including casings, removing all traces of old sealing compounds and adhesives.

15.2 Place cleaned components onto clean surface in assembly groups and in removal sequence.

15.3 Thoroughly inspect all components for serviceability as follows (discard unserviceable items and obtain new replacement parts):

15.3.1 Inspect all bearings in accordance with EMER T & M A028 Chapter 060.

NOTE

All bearings and related spacers are supplied in sets and are to be removed and/or replaced as sets. Part sets are not to be inter-changed.

15.3.2 Check fit of bearing outer cups in casing seatings, if any slackness is present replace casing(s).

15.3.3 Check contact surfaces of all gears and moving parts, including shaft and hub splines, for damage, cracking, excessive wear or pitting.

15.3.4 Check casings for impact damage/cracking and machined mating surfaces for 'out of flat', burrs, nicks, scratches and corrosion pitting.

15.3.5 Size and part numbers of the various shims and spacers required are detailed in Cat 711.

Drive head removal (See Fig 2)

16 To remove the complete drive head assembly:

16.1 Remove planet assembly, driveshaft and sun gear assemblies from both hubs as detailed in Cat 522 Chap 5.

16.2 Remove the rear end cap nuts and washers (8).

16.3 Tap the through-driveshaft assembly out of the axle casing (1).

16.4 Remove axle casing nuts (Fig 5(43) and washers (Fig 5(42)).

16.5 With suitable lifting equipment, support the drive head and, using a soft faced mallet, knock it from its register in the axle casing.

Rear output through-driveshaft assembly removal (See Fig 2)

17 To remove the rear output through-driveshaft assembly:

17.1 Remove the rear end cap nuts and washers (8).

17.2 Tap the through-driveshaft assembly out of the axle casing (1).

Rear output through-driveshaft assembly dismantling

18 To dismantle the rear output through-driveshaft assembly:

18.1 Secure assembly in a vice and, using a suitable pry bar, straighten the lockwasher (4) tab.

18.2 Remove the shaft nut (3) and washer (4), discard the washer.

18.3 Using a soft faced hammer, tap the rear end cap (6) complete with oil seal (9) and bearing (5) from the through-driveshaft.

18.4 Using a suitable drift, remove the oil seal from the end cap and discard.

18.5 Clan off any sealent on axle casing and end cap mating surfaces, ensuring surfaces do not suffer scratching or abrasion.

Rear output through-driveshaft assembly reassembly

19 To reassemble rear output through-driveshaft assembly:

19.1 Fit oil seal (9) into rear end cap with spring loaded lip uppermost i.e. to face inboard when fitted to axle.

19.2 Fill oil seal cavity with high melting point grease.

19.3 Carefully slide rear end cap assembly onto through driveshaft (7).

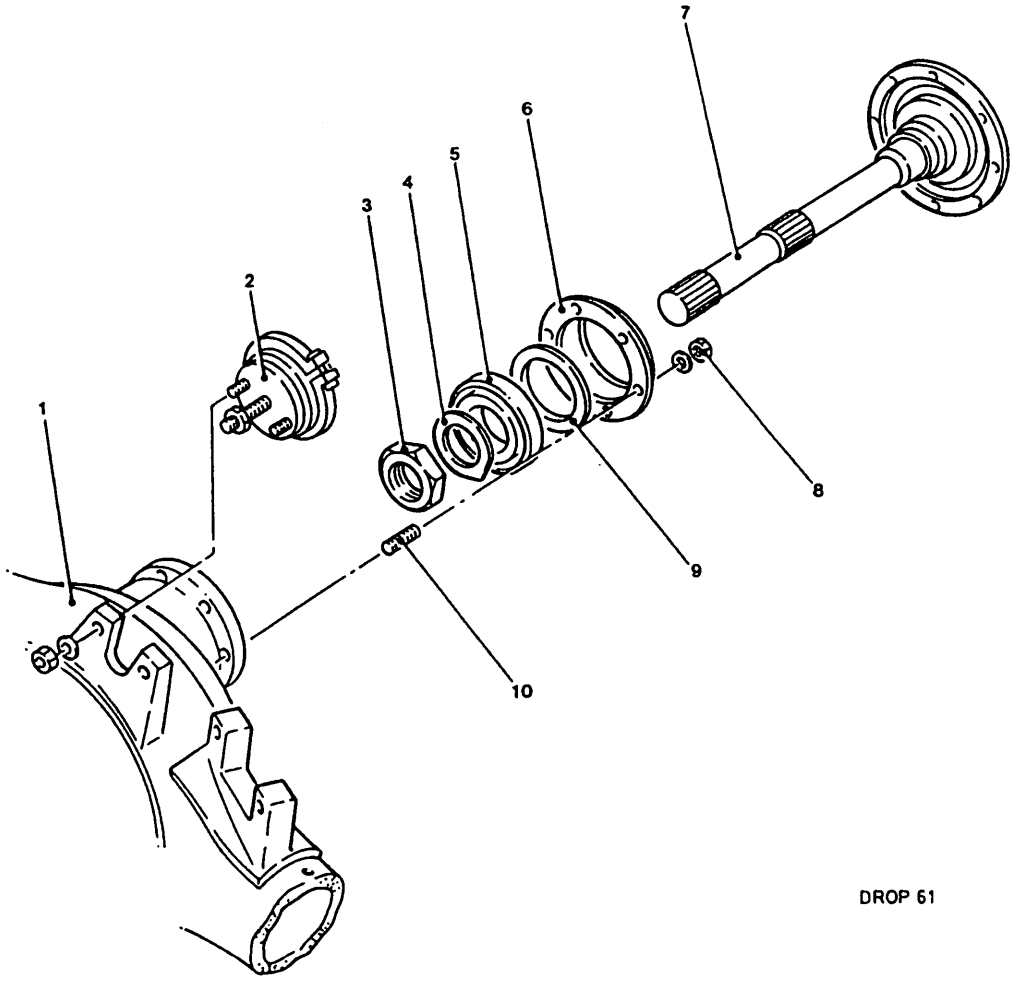
19.4 Press bearing (5) onto shaft and secure with lock washer (4) and shaft nut (3).

19.5 Secure the assembly in a vice and tighten shaft nut to a torque of 509 to 678 Nm (375 to 500 lbf ft).

19.6 Bend lockwasher tab over shaft nut flats to secure in position.

Third differential lock linkage removal and replacement

20 The third differential lock linkage is removed/replaced as detailed in Cat 522 Chap 5.



1 Axle casing	6 Rear end cap
2 Air chamber	7 Through-driveshaft
3 Shaft nut	8 Nut and washer
4 Lock washer	9 Oil seal
5 Ball bearing	10 Stud

Fig 2 Through-driveshaft assembly

Third differential assembly removal (See Fig 3)

21 To remove the third differential assembly:

21.1 Slacken off evenly and remove the four set screws (10) and four nuts (24) and washers securing the third differential housing (23) to the helical gear casing.

21.2 Tap the third differential assembly from the helical gear casing.

21.3 Lift off and discard the gasket (22) (if fitted).

Third differential assembly dismantling (See Fig 3)

22 To dismantle the third differential assembly:

22.1 Secure third differential housing (23) in a vice and remove stake nut (1).

22.2 With a suitable extractor pull coupling flange (2) from its splines.

22.3 Remove front cap nuts and washers (3).

22.4 Pull off front end cap (5), complete with oil seal (6), prise out and discard oil seal.

22.5 Lift off bearing spacer (7).

22.6 Knock third differential assembly from third differential housing.

22.7 Inspect bearing (8) for wear/corrosion. If required tap bearing from housing.

22.8 Secure the third differential assembly in a vice and then cut the lockwire securing the setscrews (10).

22.9 Mark the two differential cage halves (12) and (16) to ensure that on reassembly they are fitted as previously assembled.

22.10 Remove the setscrews (10) and separate the cage halves, lift out the differential centre parts (items 13, 14, 15, 17, 18, 19, 20 and 21).

22.11 Clean off sealant from the front end cap (5) and differential housing (23) mating surfaces and, if the gasket (22) is not fitted, from the third differential housing and helical gear housing mating surfaces, ensuring mating surfaces are not damaged.

Third differential assembly reassembly (See Fig 2)

23 To reassemble the third differential assembly:

23.1 Ensure that the two halves of the differential cages (12) and (16) are correctly paired, make sure that stamped numbers correspond. If new cages are being fitted, they must be replaced in pairs.

23.2 Place inner half of differential cage (16), rear end down, onto clean bench and locate thrust washer (17) and bevel wheel (18) into position in cage half (16).

23.3 Press four bushes (20) onto four bevel pinions (19) ensuring that they are flush with the spherical face of each pinion.

23.4 Assemble the four pinion and bush assemblies and the pinion thrust washers (21) onto the trunnion spider (15).

23.5 Lay the trunnion assembly onto the bevel wheel (18) ensuring that teeth are correctly meshed.

23.6 Position front bevel wheel (14) and thrust washer (13) onto bevel pinions, ensuring correct meshing of bevel wheel (14) with pinion gears (19).

23.7 Aligning mating marks made during disassembly, position front half (12) of differential cage onto assembly.

23.8 Fit eight differential cage bolts (11), tighten evenly in a diametrically-opposed sequence, then tighten to a torque of 98 to 108 Nm (72 to 80 lbf ft). Secure bolts, in pairs, with suitable lockwire.

23.9 Press ball bearing (8) into seating in third differential housing (23), ensure that the bearing is driven home.

23.10 Fit bearing spacer (7).

23.11 If required, fit six front end cap studs (4).

23.12 Using a suitable fitting tool, fit oil seal (6) into front end cap (5), take care not to distort or damage the seal and ensure that it sits squarely into the end cap bore. Fill oil seal cavity with high melting point grease.

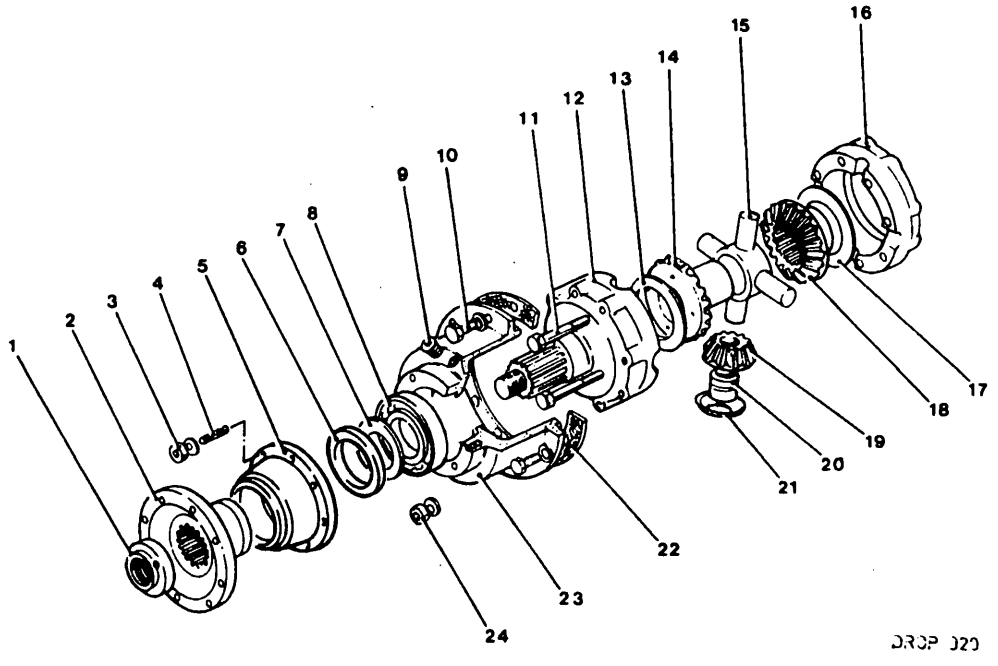
23.13 Using cleaning fluid (Table 2, Serial 4) clean the front end cap (5) and third differential housing (23) mating surfaces.

23.14 Apply a complete bead of liquid gasket (Table 2, Serial 3) to front end cap face, position end cap onto end cap studs (4). Fit, but do not tighten at this stage, the end cap nuts and washers (3).

23.15 Apply adhesive (Table 2, Serial 2) by brush to front half differential cage (12) splines and threads.

23.16 Press coupling flange (2) onto cage splines and fit stake nut (1). Tighten stake nut to a torque of 1085 to 1220 Nm (800 to 900 lbf ft).

23.17 Tighten front end cap nuts (3) to a torque of 39 to 43 Nm (29 to 32 lbf ft).



1 Stake nut	10 Set screw & washer	17 Thrust washer
2 Coupling flange	11 Bolt	18 Bevel wheel
3 Nut and washer	12 Third differential cage (front half)	19 Pinion gear
4 Stud	13 Thrust washer	20 Pinion bush
5 Front end cap	14 Bevel wheel	21 Pinion thrust washer
6 Oil seal	15 Trunnion	22 Gasket
7 Bearing spacer	16 Third differential cage (rear half)	23 Third differential housing
8 Ball bearing		24 Nut and washer
9 Oil filler plug		

Fig 3 Drive input and third differential assembly

Helical pinion assembly removal (See Fig 4)

24 To remove the helical pinion assembly:

24.1 Position a suitable container under helical gear casing (1).

24.2 Remove set screws and washers (17). Insert two 1/2 in. UNF bolts in threaded jacking holes provided and tighten evenly to separate helical gear casing (1) from bevel casing (11).

24.3 Take care to recover the three locating dowels (6).

24.4 If fitted remove and discard gasket (2).

24.5 Lift helical pinion (4), complete with inner cones of both bearings (3) and (5), from bevel casing (11).

24.6 Inspect bearing cones and cups for signs of wear and/or damage and remove from pinion shaft and casings if required.

24.7 Remove bearing retainer socket screws (21) and remove bearing retainer (20) and shims (19) from helical gear casing (1).

24.8 Draw cones of bearings (3) and (5) from helical pinion (4) and extract or drift cups from helical gear casing (1) and bevel casing (11).

Helical pinion assembly dismantling and inspection (See Fig 4)

25 To dismantle and inspect the helical pinion assembly:

25.1 Remove the pinion stake nut (16).

25.2 Using a suitable extractor, pull off the helical gear (15).

25.3 Knock the bevel pinion (7), complete with inner bearing (8) cone, inner bearing spacer (13) and outer bearing spacer (12) out of the bevel casing (11). The outer bearing (14) cone remains with its cup in the bevel casing.

25.4 Lift out the outer bearing cone, inspect cone and both bearing cups for wear/damage. If required, drift out bearing cups for replacement.

25.5 Inspect bevel pinion (7), inner bearing (8) cone, inner spacer (12) and outer spacer (13).

25.6 Lift out the bearing shims (9) from their position behind the inner bearing (8) cup in the bevel casing.

NOTE

If original pinion (7) and crownwheel (Fig 5(14)) are to be used for reassembly, the shims should be retained. If replacement components are being used, new shims will be required.

Main differential assembly removal and dismantling (See Fig 5)

26 To remove and dismantle the main differential assembly:

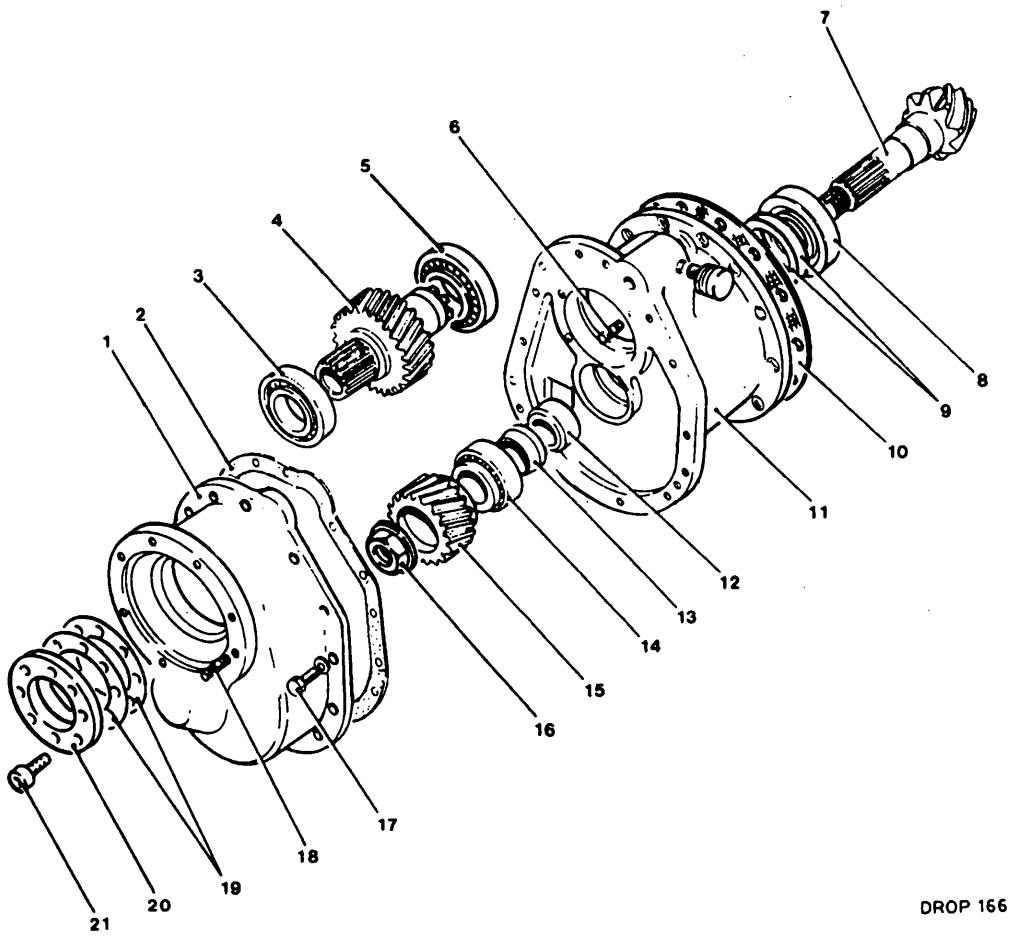
26.1 Remove the driveshafts, differential lock air chamber and differential lock linkage as detailed in Cat 522 Chap 5.

26.2 Support the bevel gear casing (6) with suitable lifting gear.

26.3 Remove the axle casing nuts (43) and washers (42).

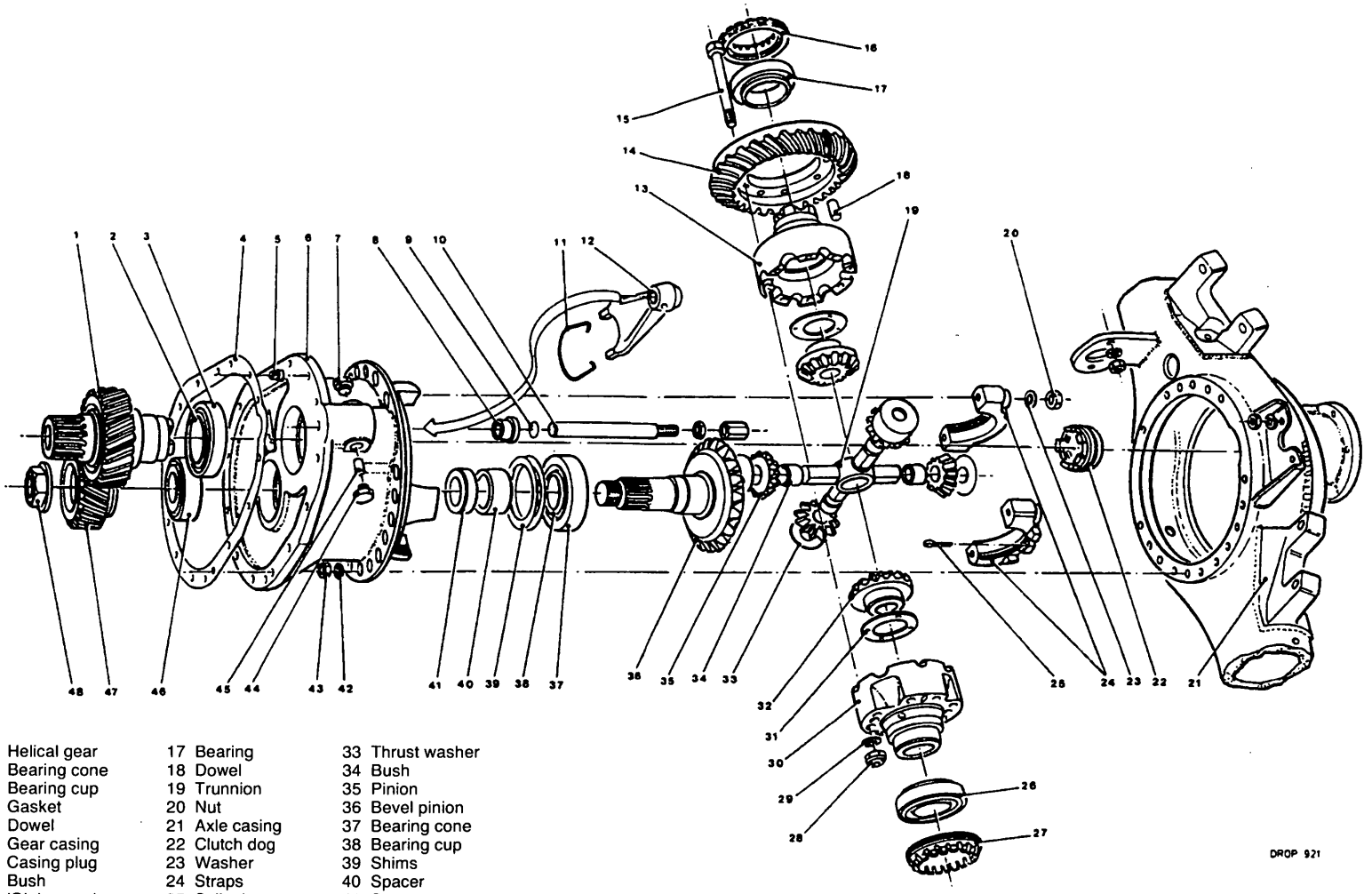
26.4 Insert two 5/8 in. UNF extraction bolts into the tapped holes in gear casing flange, tighten evenly to draw gear casing (6) from axle casing (21).

26.5 Secure the assembly in a suitable differential build stool, crownwheel (14) end downwards.



1 Helical gear casing
2 Gasket
3 Bearing
4 Helical pinion
5 Bearing
6 Dowels
7 Bevel pinion
8 Bearing (inner)
9 Shims
10 Gasket
11 Bevel casing
12 Bearing spacer (inner)
13 Bearing spacer (outer)
14 Bearing (outer)
15 Helical gear
16 Stake nut
17 Set screw (and washer)
18 Stud
19 Shims
20 Bearing retainer
21 Socket screw

Fig 4 Helical gears and bevel pinion assembly.



1 Helical gear	17 Bearing	33 Thrust washer
2 Bearing cone	18 Dowel	34 Bush
3 Bearing cup	19 Trunnion	35 Pinion
4 Gasket	20 Nut	36 Bevel pinion
5 Dowel	21 Axle casing	37 Bearing cone
6 Gear casing	22 Clutch dog	38 Bearing cup
7 Casing plug	23 Washer	39 Shims
8 Bush	24 Straps	40 Spacer
9 'O' ring seal	25 Split pin	41 Spacer
10 Operating shaft	26 Bearing	42 Washer
11 Retaining spring	27 Adjusting nut	43 Nut
12 Operating fork	28 Nut	44 Casing plug
13 Differential cage	29 Washer	45 Lockpin
14 Crownwheel	30 Differential cage	46 Bearing
15 Bolt	31 Thrust washer	47 Helical gear
16 Adjusting nut	32 Bevel wheel	48 Stake nut

Fig 5 Main differential assembly

26.6 Using a suitable lever, release the peened portion of the pinion stake nut (47).

26.7 Place a suitable wedge (eg timber) between crown wheel (14) and bevel pinion (36) teeth to prevent rotation, loosen stake nut (48), but do not remove at this stage. Remove wedge.

26.8 Position assembly in build stool, differential up.

26.9 Remove dog clutch retaining spring (11) from operating fork (12) and lift out clutch dog (22).

26.10 Remove casing plugs (44) and (7).

26.11 Using a 1/4 in. diameter drift, through lock indicator switch hole, knock out the operating shaft lockpin (45).

26.12 Pull the operating shaft (10) and operating fork (12) from the gear casing (6).

26.13 Remove and discard operating shaft 'O' ring seal (9) from bush (8). Inspect bush for signs of oil seepage around its outside diameter and pull out for replacement if required.

26.14 Remove the differential strap nuts (20) and washers (23). Mark strips (24) and gear casing (6) to ensure correct reassembly. Lift off the differential straps (24) complete with split pins (25) from the casing legs. Remove and discard split pins.

26.15 Take out adjusting nuts (16) and (27) and lift out complete crownwheel and differential assembly.

26.16 Remove the bearings (17) and (26) cups and cones from the differential cage halves ends (13) and (30).

26.17 Remove the differential cage nuts (28) and washers (29) and pull out the differential cage/crownwheel bolts (15).

26.18 Separate the crownwheel (14) from the differential cage halves (13) and (30).

26.19 Mark to ensure correct reassembly and separate the two halves of the differential cage.

26.20 Lift the differential bevel wheels (32) and washers (31) from the differential cage halves.

26.21 Lift the differential pinions (35), bushes (34) and thrust washers (33) from the trunnion (19).

Main differential lock dismantling (See Fig 6)

27 To dismantle main differential lock:

27.1 Remove pin (3) from clevis (2) and remove air chamber (7) if necessary as detailed in Cat 522 Chap 5.

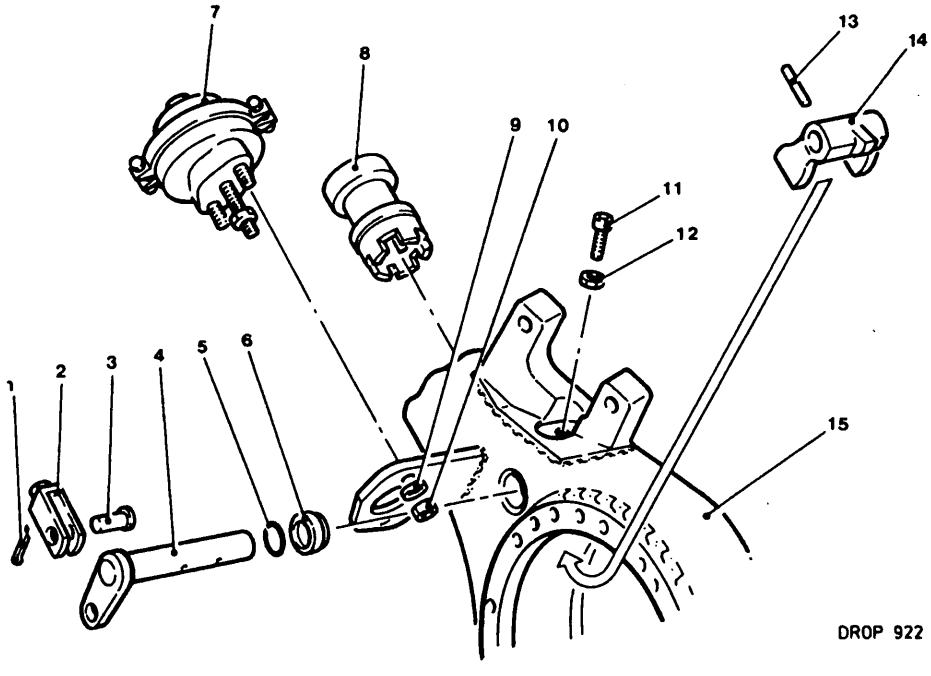
27.2 Tap out the roll pin (13) that secures the fork (14) to the lever (4).

27.3 Lift the fork and the clutch dog (8) out of the axle casing (15).

27.4 Check for signs of oil leakage around the bush (6), if necessary knock bush out for replacement.

27.5 Take out and discard 'O' ring seal (4).

27.6 Remove the stop screw (11) and locknut (12).



1 Split pin	6 Bush	11 Stop screw
2 Clevis	7 Air chamber	12 Lock nut
3 Pin	8 Clutch dog	13 Roll pin
4 Lever	9 Washer	14 Fork
5 'O' ring seal	10 Nut	15 Axle casing

Fig 6 Main differential lock assembly

REFITTING DRIVE HEAD ASSEMBLY

WARNINGS

(1) USE SUITABLE SLINGING AND HOIST EQUIPMENT WHEN REMOVING AND REFITTING AXLES AND AXLE SUB-ASSEMBLIES, DUE TO HEAVY WEIGHTS OF ITEMS CONCERNED.

(2) DO NOT WORK UNDER A VEHICLE SUPPORTED SOLELY BY HYDRAULIC JACKS. SUITABLE CHASSIS STANDS ARE TO BE UTILISED AT ALL TIMES.

28 Carry out refitting of assemblies in the sequence detailed in the following paragraphs.

Helical pinion assembly refitting (See Fig 4)

29 To reassemble the helical pinion assembly:

29.1 If replacement bevel pinion (Fig 5(36)) and/or crownwheel (Fig 5(14)) is being used, calculate the shim (Fig 4(19)) thckness using the formula 0.34 in. + 0.00A in. + 0.00B in. + 0.00C in. where:

29.1.1 0.34 in. = Nominal thickness of shims selected.

29.1.2 'A' = Select shim thickness equivalent to figure stamped on end face of pinion.

29.1.3 'B' = Select shim thickness equivalent to figure stamped on gear casing.

29.1.4 'C' = Variation in bearing height from 1.758 in. reference diameter.

29.2 Place selected shims in bearing bore of bevel casing (11).

29.3 Press inner bearing (8) cup into bevel casing to abut shims.

29.4 Turn bevel casing over and press outer bearing (14) cup into its location.

29.5 Press inner bearing (8) cone onto bevel pinion.

29.6 Fit inner bearing spacer (12), large chamfer end first, then fit outer bearing graded spacer (13) with the large outside diameter abutting up to the inner bearing spacer.

29.7 Place the bevel pinion (7) onto a piece of metal or a wooden block approximately 8 in. high x 6 in. diameter.

29.8 With the aid of suitable approved lifting gear, lift the bevel casing (11) and position it onto the bevel pinion (7).

NOTE

If new parts are being fitted, assemble with the largest available spacers (12) and (13). This ensures that bearing pre-load is low, thus preventing too great a pre-load and resultant bearing damage.

29.9 Fit outer bearing (14) cone onto bevel pinion (7) shaft.

29.10 Fit helical gear (15) and stake nut (16) onto the bevel pinion.

29.11 With a suitable tool, lock the helical gear and tighten the stake nut (16) to a torque of 1085 to 1220 Nm (800 to 900 lbf ft).

Setting the pinion bearing pre-load (See Fig 4)

30 To set the pinion bearing pre-load:

30.1 Shock load the bevel pinion bearings.

30.2 As shown in Fig 7 secure a length of cord to the helical gear and attach the free end to a spring balance reading in excess of 5.5 Kg (12 lb).

30.3 Wrap cord around the outside diameter of the helical gear and pull on spring balance to rotate bevel pinion.

30.4 Ignoring the initial starting force, note the force required to maintain rotation.

30.5 Calculate, using the following figures to determine the pre-load torque:

30.5.1 T = F x R where:

30.5.1.1 T = Torque

30.5.1.2 F = Force to maintain rotation (lbs)

30.5.1.3 R = Radius of secured cord (ins)

30.6 The pre-load torque obtained should be between the limits 15 to 25 lbf in (1.7 to 2.8 Nm).

30.7 If pre-load torque is below the above limits a smaller outer spacer (13) needs to be fitted.

30.8 If pre-load torque is over the above limits fit a larger outer spacer.

NOTE

If the largest available combination of spacers are already fitted (See Note para 20.8), then a defect is present in one or more parts of the assembly and this must be traced and rectified before continuing differential build.

30.9 When correct pre-load has been achieved, remove stake nut (16) and helical gear (15).

30.10 With a brush apply adhesive (Table 2, Serial 5) to the splines and thread of the bevel pinion (7) and the stake nut (16) clamping face.

30.11 Refit helical gear (15) and stake nut (16).

30.12 With a suitable tool, lock the helical gear and tighten the stake nut to a torque (16) to 1085 to 1220 Nm (800 to 900 lbf ft).

30.13 Lock stake nut in position by peening the raised collar of the nut into the slop cut in the end face of the bevel pinion (7).

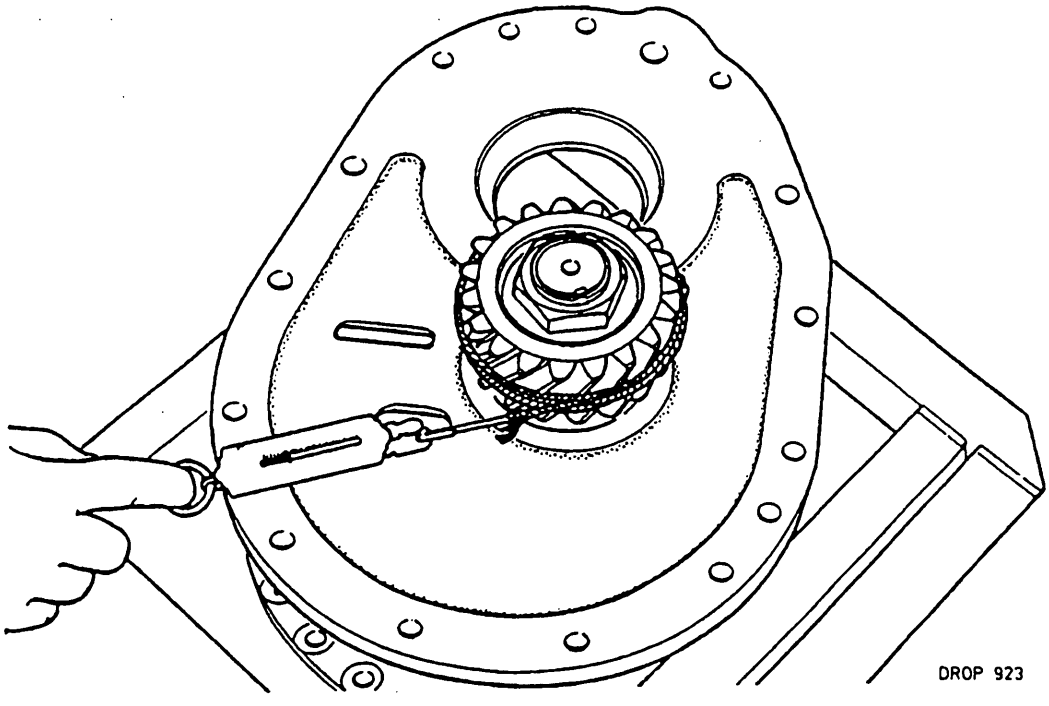


Fig 7 Setting pinion bearing pre-load

Refitting the third differential lock assembly (See Fig 5)

31 To refit the third differential lock:

31.1 If the bush (8) has been removed for renewal, apply adhesive (Table 2, Serial 1) to the small outside diameter surface of the bush and fit into the gear casing (6).

31.2 Fit 'O' ring seal (9) into bush and smear with grease.

31.3 Hold the operating fork (12) in position in gear casing and pass the operating shaft through the following:

Operating shaft bush (8).

Operating fork (12) boss.

Hole in the front of gear casing (6).

31.4 Align roll pin holes of the operating shaft (10) and fork (12), insert lock pin (45) through plug mounting hole and drive home.

31.5 Fit clutch dog (22) in position with operating fork and then fit retaining spring (11).

31.6 Fit plugs (7) and (44) to gear casing (6).

Reassembling the main differential assembly (See Fig 5)

32 To reassemble the main differential assembly:

32.1 During reassembly, smear the differential gears with clean gear oil.

32.2 Press differential bearing (17) cone onto its mating differential cage half (13), repeat this action with bearing (26) cone onto cage half (30).

32.3 Fit crownwheel (14) onto differential cage half (13) ensuring that dowels (18) locate correctly.

32.4 Fit differential cage bolts (15) through crownwheel and differential cage half (13), place assembly on bench, supported on blocks, crownwheel downwards.

32.5 Fit a differential bevel wheel thrust washer (31) and differential bevel wheel (32) into differential cage half (13).

32.6 Onto the trunnion (19) fit four bush (34) and bevel pinion (35) assemblies and four thrust washers (33).

NOTE

If a new bush (34) is to be fitted into the bore of a pinion (35), it must be done using a suitable press due to tight fit between pinion and bush. The bush is pressed in flush with the spherical face of the pinion. If no press is available a complete new pinion and bush assembly must be fitted.

32.7 Lay trunnion (19) onto bevel wheel (32), ensure the teeth mesh correctly.

32.8 Place second bevel wheel and washer onto differential bevel pinions, ensure that teeth mesh correctly.

32.9 Carefully fit differential cage half (30) onto assembly, aligning the matching marks on the cages. Fit the washers (29) and nuts (28) to the cage bolts (15), tighten nuts to a torque of 225 to 249 Nm (166 to 184 lbf ft).

Check fitting the bearing adjusting nuts (See Fig 5)

33 To check fit the bearing adjusting nuts:

33.1 Secure the bevel pinion and gear casing assembly in a suitable differential build stool.

33.2 Check fit the bearing adjusting nuts as follows:

33.2.1 Clean and deburr the gear casing (6) and gear casing straps (24).

33.2.2 Fit bearing cups (17) and (26) into half bores of bevel casing (7).

33.2.3 Inspect the four bevel casing strap studs and replace as necessary. Tighten to a torque of 119 to 133 Nm (88 to 98 lbf ft).

33.2.4 Carefully fit the two bevel casing straps (24) and adjusting nuts (16) and (27) to locate on the bearing (17) and (26) cups.

33.2.5 Check alignment of marks on bevel casing legs and straps to ensure that straps are not transposed, the bearing cups should seat snugly in the bores. The bearing adjusting nuts should be free to turn with hand pressure only, if not cross threading may have occurred.

33.2.6 On no account use any additional pressure i.e. hammer to turn adjusting nuts. Remove and deburr and repeat procedure.

33.2.7 Fit the four bevel casing strap washers (23) and temporarily place nuts (20) onto studs. Tighten to a torque of 142 Nm (142 lbf ft).

33.2.8 As shown in Fig 8. Check the freedom of the adjusting nuts by unscrewing and replacing, to assist this operation tap the top of the bevel casing straps (24) with a 2lb hammer.

33.2.9 Having checked the fit of the adjusting nuts, remove bevel casing straps bearing cups and adjusting nuts.

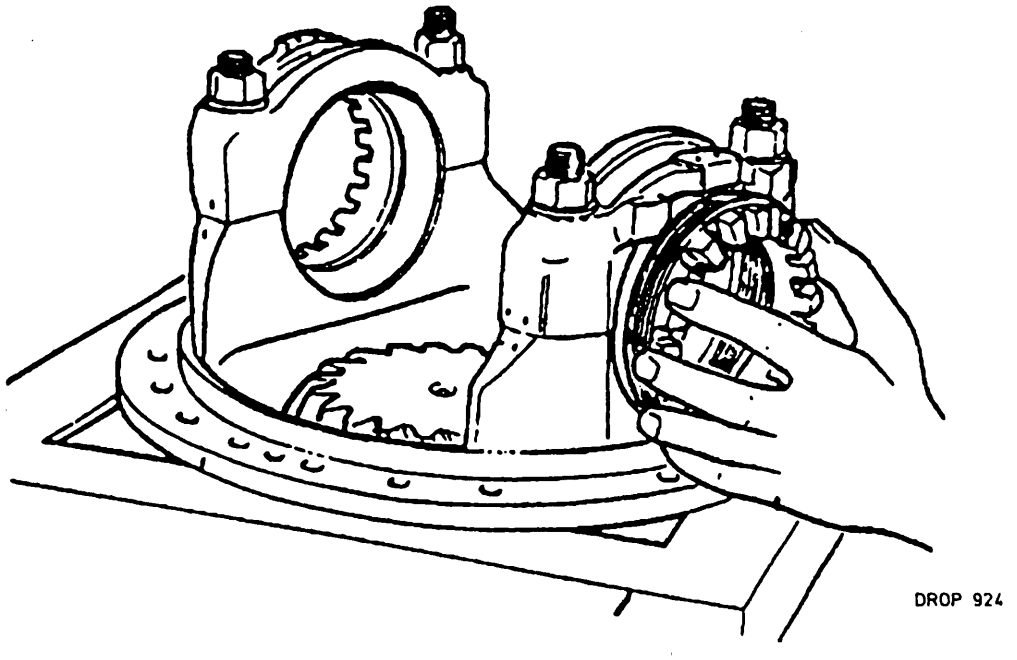


Fig 8 Check fitting bearing adjusting nut

Fitting main differential into casing (See Fig 5)

34 To fit the main differential into casing:

34.1 Using the correct applicator apply a 1/8 in. wide band of adhesive (Table 2, Serial 3) into bevel casing strap (24) bores. This prevents the possibility of bearing cuts spinning in service.

NOTE

Assembly and setting procedures are to be completed immediately so as to avoid the adhesive hardening and preventing adjustment of bearing cups.

34.2 Hold differential bearing (17) and (26) cups in position on differential bearing cones and place crownwheel (14) and differential assembly in position in the gear casing (5).

34.3 Fit the two adjusting nuts (16) and (27) onto the half threads of the bevel casing legs. Check freedom of the nuts on the threads.

34.4 Ensuring matching marks coincide to prevent misalignment. Hand fit the bevel casing straps (24) onto the strap studs to locate on the bearing (17) and (26) and the adjusting nuts (16) and (27).

34.5 Turn adjusting nuts hand tight against the bearings.

34.6 Fit the four washers (23) and nuts (20) onto the strap studs, tighten nuts to a torque of 142 Nm (105 lbf ft).

Setting 'no end float' condition: (See Figs 5 and 9)

35 To set 'no end float' condition:

35.1 As shown in Fig 9 set up a dial indicator on the back face of the crownwheel (14) and screw in each adjusting nut (16) and (27) just sufficiently to ensure no crownwheel axial movement is registered on the dial indicator.

35.2 Tap bevel casing straps (24) and rotate the crownwheel, re-check that no axial movement is present.

Setting crownwheel and pinion backlash (See Fig 5)

36 To set crownwheel and pinion backlash:

36.1 Move the dial indicator onto a crownwheel tooth as shown in Fig 10.

36.2 Hold the bevel pinion (36) still and rock crownwheel (14) backwards and forwards to check free play between gears (backlash), note the variation of indicator reading.

36.3 At equally spaced positions around the crownwheel repeat the above operation three more times.

36.4 The variations of readings on the dial indicator must be within the limits of 0.203 to 0.330 mm (0.008 to 0.013 in.).

36.5 If the difference in backlash of more than half backlash tolerance exists between positions, then the assembly must be examined for cause and cause rectified.

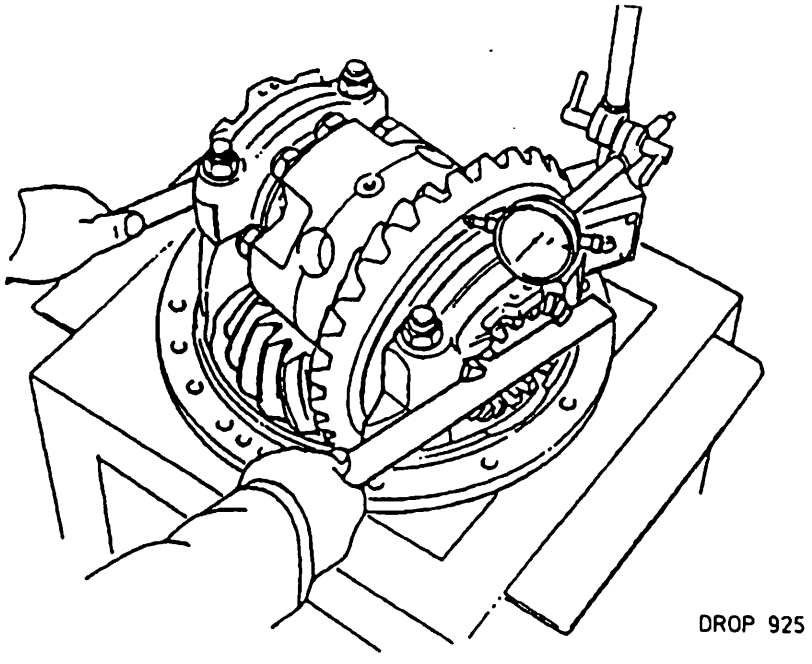


Fig 9 Setting 'no end float' condition

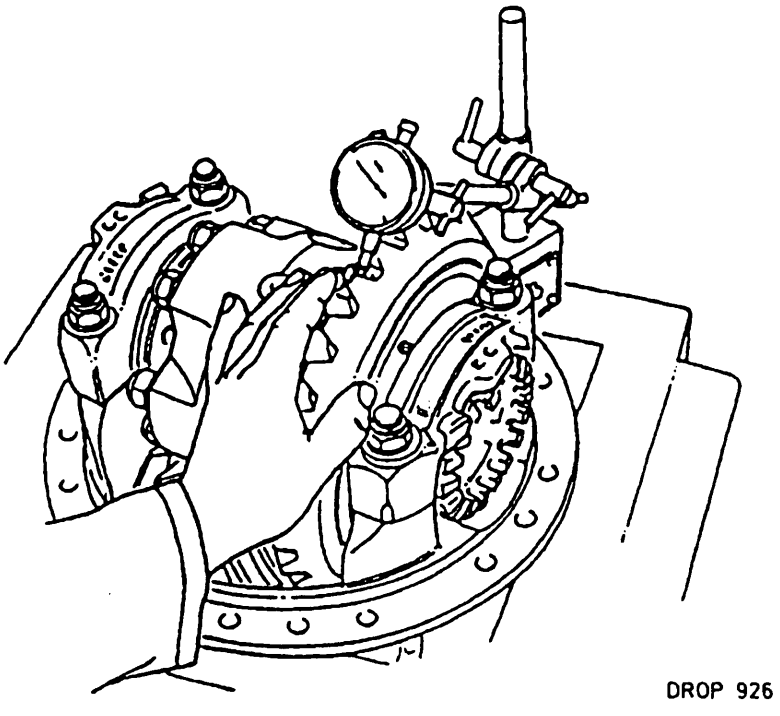


Fig 10 Setting crownwheel and pinion backlash

Setting the crownwheel bearings (See Fig 5)

37 To set the crownwheel bearings:

37.1 Set two dial indicators diametrically opposite on the bearing strap register point as shown in Fig 11, set each indicator to zero.

37.2 Mark the position of each adjusting nut (16) and (27) and then slacken each one slightly, to ensure no spread is present (the dial indicators remain at zero).

37.3 Re-tighten each adjusting nut back to its marked position and then tighten a further notch on each end to pre-load the bearings (17) and (26), (the pre-load is correct with a spring balance pull of $2^1/_2$ lb i.e. rolling resistance, at the outside diameter of the differential cage).

37.4 The sum of the dial indicator readings should total between 0.051 and 0.102 mm (0.002 and 0.004 in). The adjuster nut slots should line up with one of the two split pin holes in the casing straps (24).

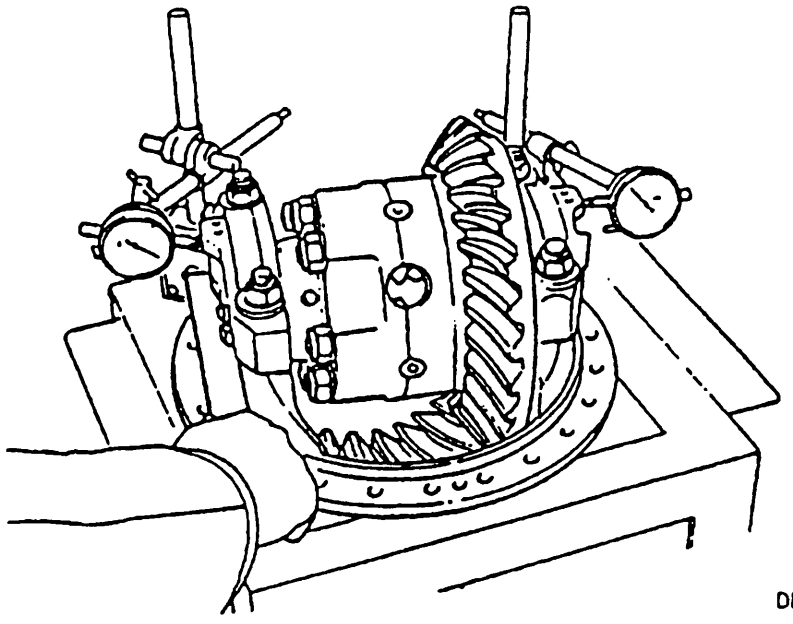


Fig 11 Setting the crownwheel bearings

37.5 Fit the two split pins (25) as shown in Fig 12.

37.6 Tighten casing strap nuts (20) to a torque of 174 to 193 Nm (128 to 142 lbf ft).

37.7 Set up a dial indicator on the crownwheel and re-check backlash is still as set in Para 36.

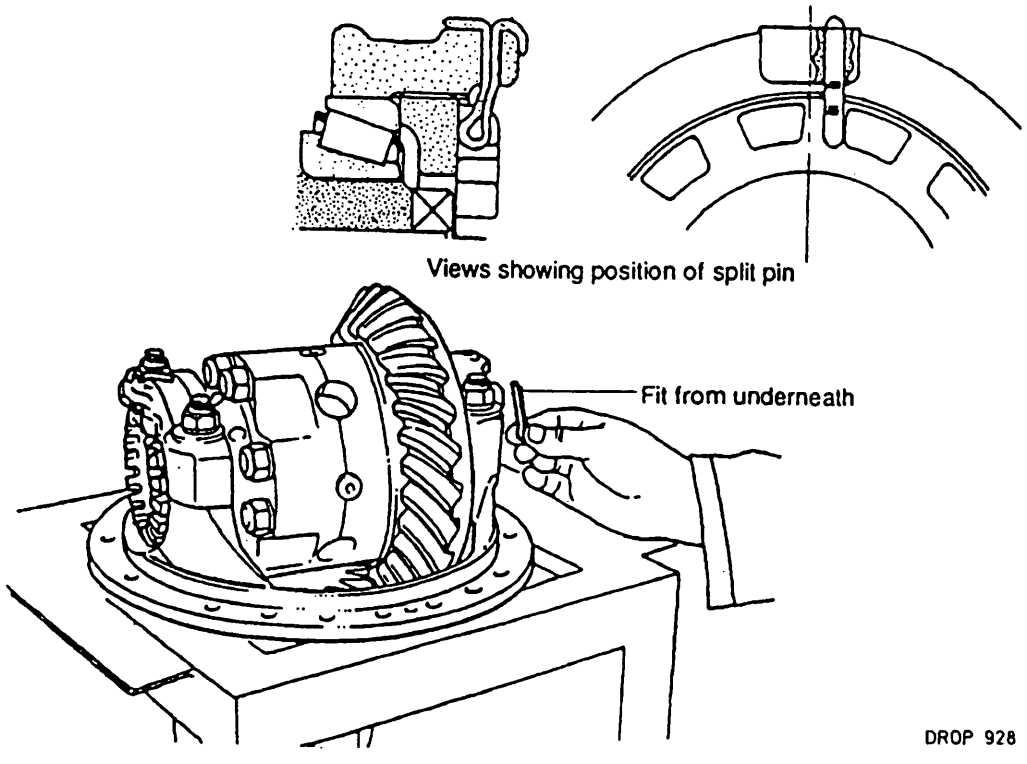


Fig 12 Fitting split pins

Checking crownwheel and pinion mesh (See Fig 5)

38 To check crownwheel and pinion mesh:

NOTE

Gears fitted/supplied may be one of three different types, identification and meshing details are given in Figs 13, 14 and 15.

38.1 After identifying gear type, apply a thin coating of standard engineers marking compound to the crownwheel and pinion teeth.

38.2 Rotate the crownwheel several times in both directions to make a positive tooth contact impression on crownwheel and pinion teeth.

38.3 Inspect markings and compare them with the relevant figures on Fig 13, 14 or 15.

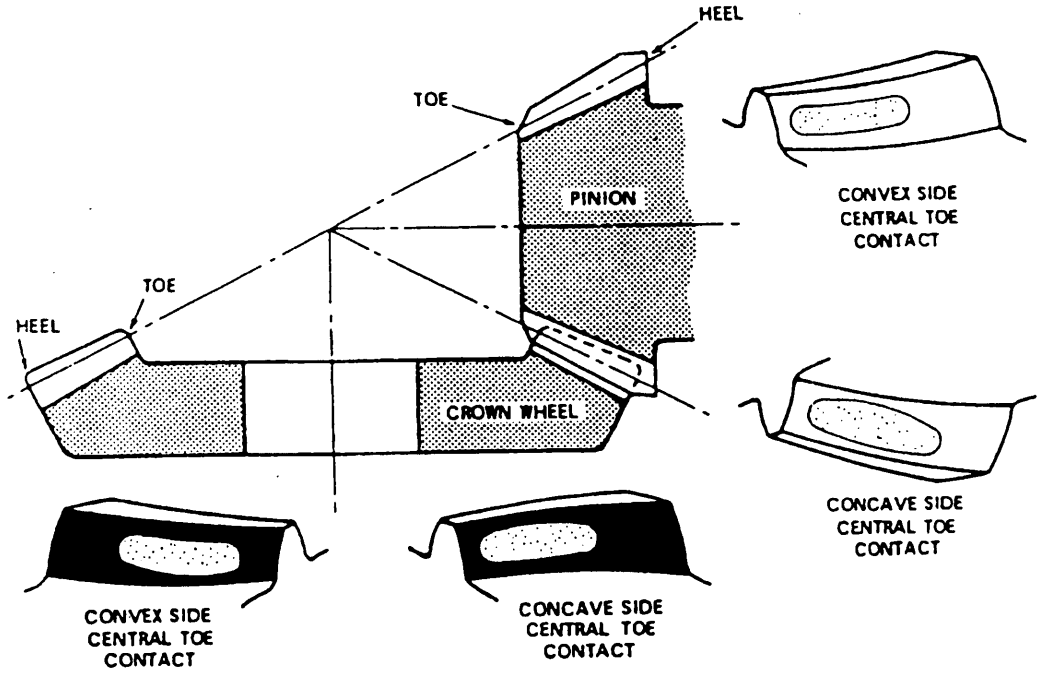
38.4 In all cases any action required is to be taken as shown below:

Fig A Correct mesh. No further action required.

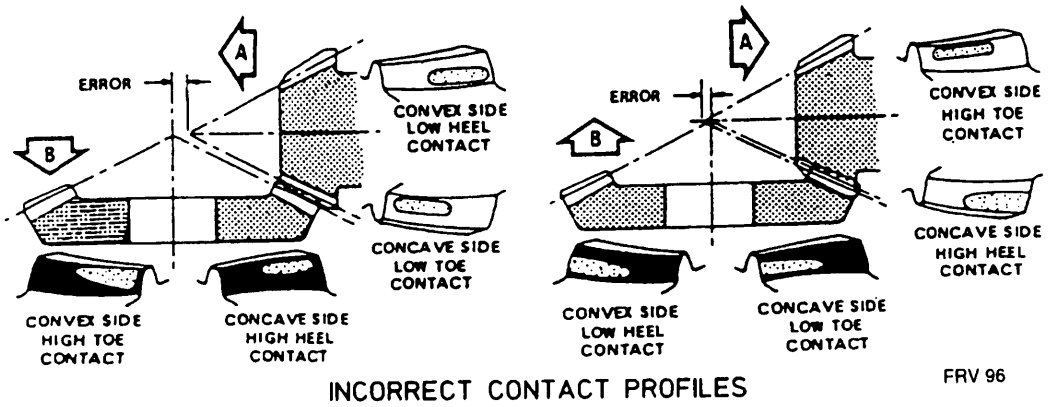
Fig B Indicates pinion and crownwheel are too far out of mesh. To remedy, move pinion inwards towards crownwheel. To maintain backlash, move crownwheel away from pinion in direction of arrow B.

Fic C Indicates pinion and crownwheel too far into mesh. To remedy, move pinion outwards away from crownwheel. To maintain backlash, move crownwheel towards pinion in direction of arrow B.

38.5 Adjust pinion position by altering the thickness of the pinion bearing shims (38) i.e. remove shims to move pinion away from crownwheel and add shims to move pinion towards crownwheel.



CORRECT CONTACT PROFILE



INCORRECT CONTACT PROFILES

FRV 96

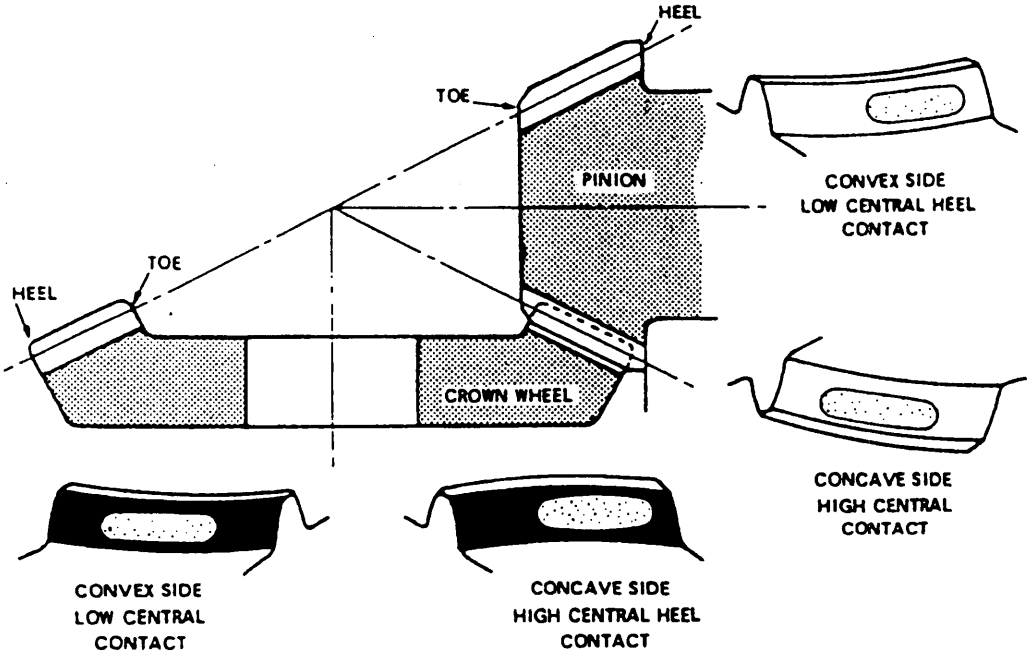
To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

NOTE

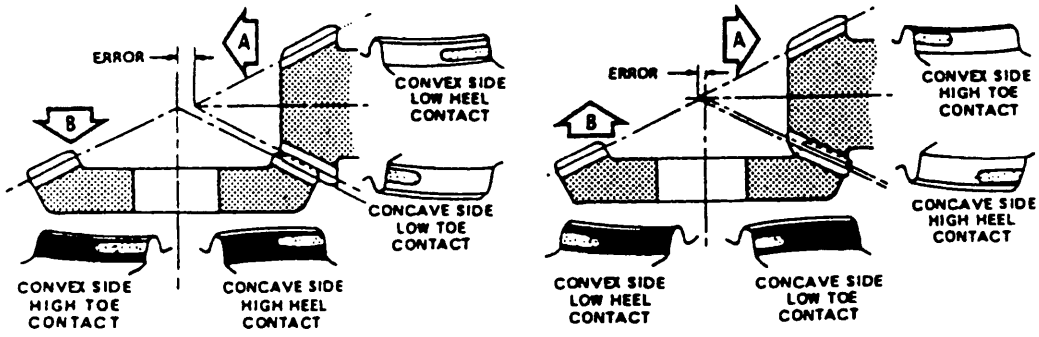
Identification of Oerlikon 'N' form gears:

1 Pinion shank and crownwheel back face have identification groove.
2 Gear teeth parallel to pitch line.
3 Suffix letter 'N' in part number (eg R8579/1N/2N)

Fig 13 Meshing check/adjustment (Oerlikon 'N' form gears)



CORRECT CONTACT PROFILE



INCORRECT CONTACT PROFILES FRV 97

To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

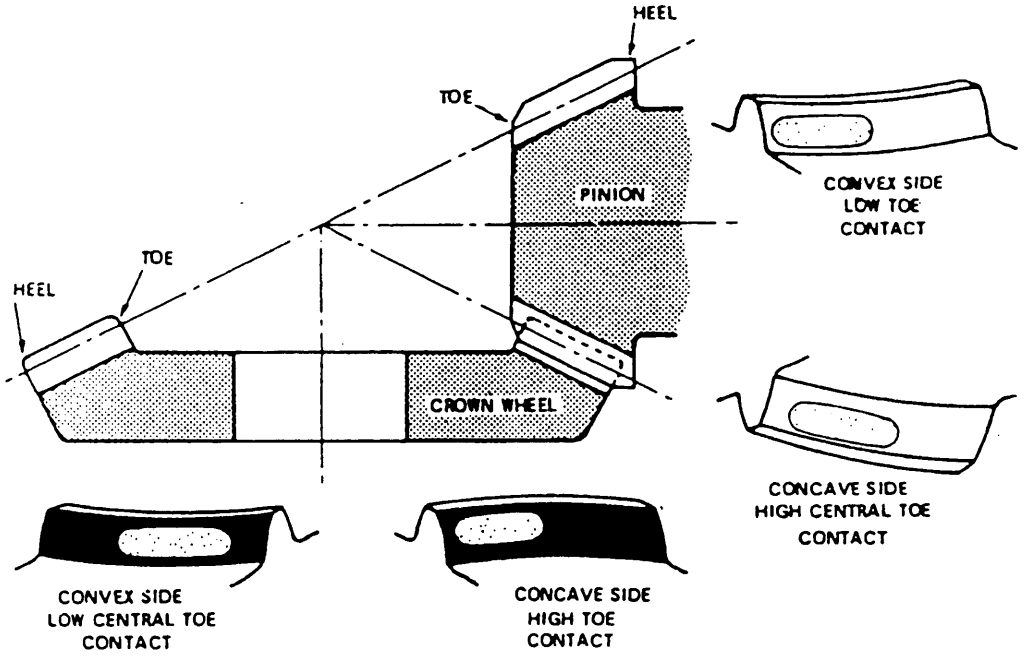
NOTE

Identification of Oerlikon 'G' form gears:

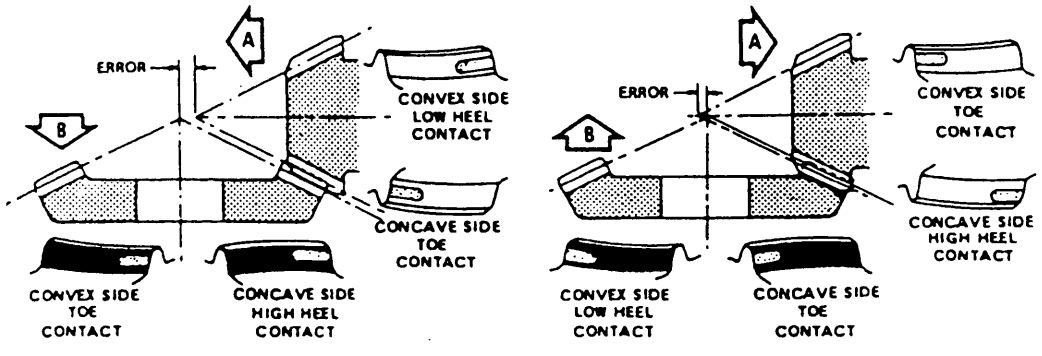
As 'N' form but only the following part numbers apply:

R8929/1N/2N, R8858/1N/2N, R8859/1N/2N.

Fig 14 Meshing check/adjustment (Oerlikon 'G' form gears)



CORRECT CONTACT PROFILE



INCORRECT CONTACT PROFILES FRV 98

To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

NOTE

Identification of Gleason gears:

1 No identification groove on pinion shank or crownwheel back face
2 Gear teeth taper towards centre ('toe end') of teeth
3 No suffix letter in part number (eg R8579/1/2)

Fig 15 Meshing check/adjustment (Gleason gears)

Refitting the helical pinion assembly (See Fig 4)

39 To refit the helical pinion assembly:

NOTE

If main differential has been removed it must be re-fitted before refitting the helical pinion assembly.

39.1 Press cup of bearing (5) into seating in bevel casing (11), press cones of bearings (3) and (5) onto helical gear (4).

39.2 Place helical gear in position on bevel casing (11).

39.3 Locate three dowels (6) into their relevant holes in bevel casing (11) flange.

39.4 Apply thin coat of gasket sealant to helical casing clamping face on bevel casing (11), fit new gasket (2) (if fitted).

NOTE

For assemblies not fitted with a gasket, using cleaning fluid (Table 2, Serial 4), clean mating surfaces and apply a complete bead of approved liquid gasket to one of the mating surfaces prior to assembly.

39.5 Fit helical gear casing onto bevel casing (11) ensuring correct location of dowels.

39.6 Fit thirteen set screws and washers (17) to secure helical gear casing, and tighten to a torque of 98 to 108 Nm (72 to 80 lbf ft).

39.7 Locate outer cup of bearing (3) onto its cone (already on helical gear) (4)).

39.8 Fit nominal 0.76 mm (0.030 in.) shim pack (19) in position in bearing and gear casing 91).

39.9 Place retainer (20) on shims and fit eight retainer socket screws (22). Tighten screws to a torque of 33 to 35 Nm (24 to 26 lbf ft).

39.10 Using a soft faced mallet shock load helical pinion bearings.

40 Check and if necessary adjust helical gear (4) end float as follows:

40.1 As shown in Fig 16, fit adjusting tool (Table 1, Serial 1) into helical gear (4).

40.2 Tighten locknut on tool clockwise to secure tool in bore.

41 Mount a dial indicator gauge on the gear casing (1), with the pointer positioned on the end face of the helical gear.

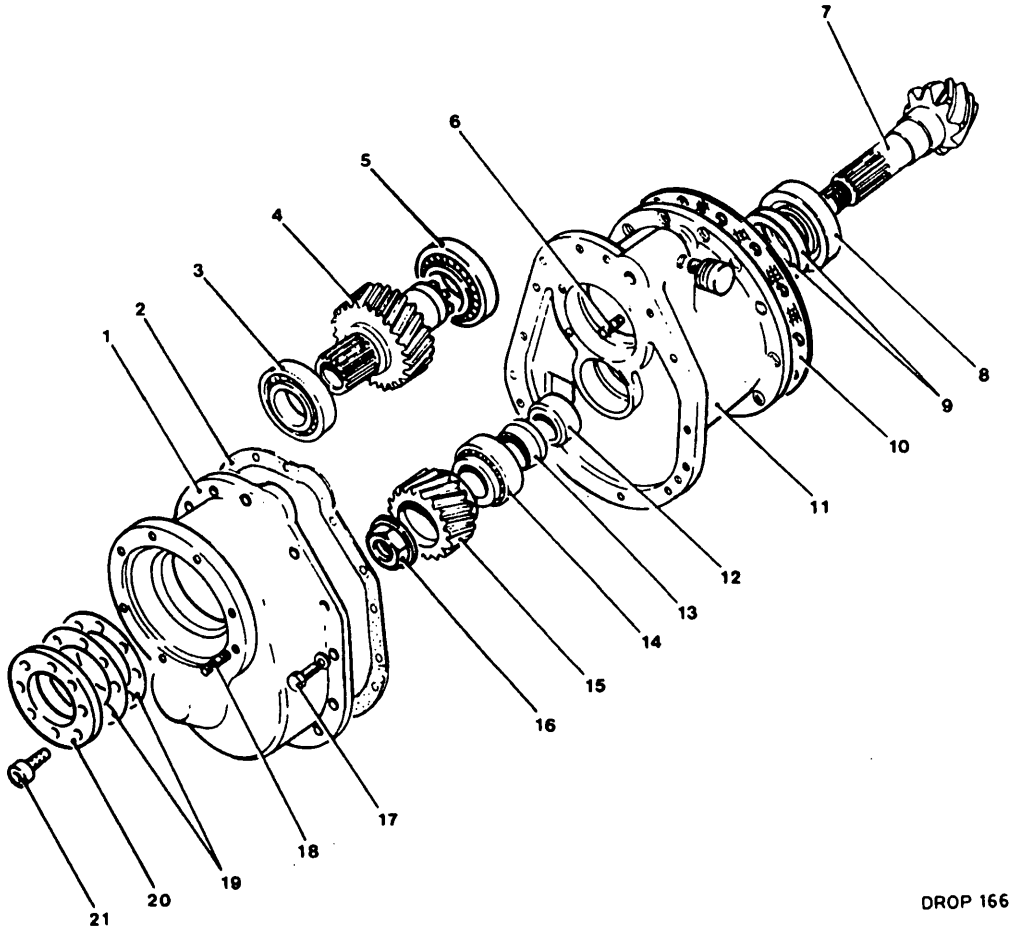
41.1 Pull the helical gear (4) backwards and forwards by means of the adjusting tool, and note the dial indicator movement.

41.2 The correct end float is between 0.013 to 0.05 mm (0.0005 in. to 0.002 in.).

41.2.1 To increase end float, add shims.

41.2.2 To decrease end float, subtract shims.

41.3 On completion of adjustment remove the adjusting tool.



1 Helical gear casing	8 Bearing (inner)	15 Helical gear
2 Gasket	9 Shims	16 Stake nut
3 Bearing	10 Gasket	17 Set screw (and washer)
4 Helical pinion	11 Bevel casing	18 Stud
5 Bearing	12 Bearing spacer (inner)	19 Shims
6 Dowels	13 Bearing spacer (outer)	20 Bearing retainer
7 Bevel pinion	14 Bearing (outer)	21 Socket screw

Fig 4 Helical gears and bevel pinion assembly

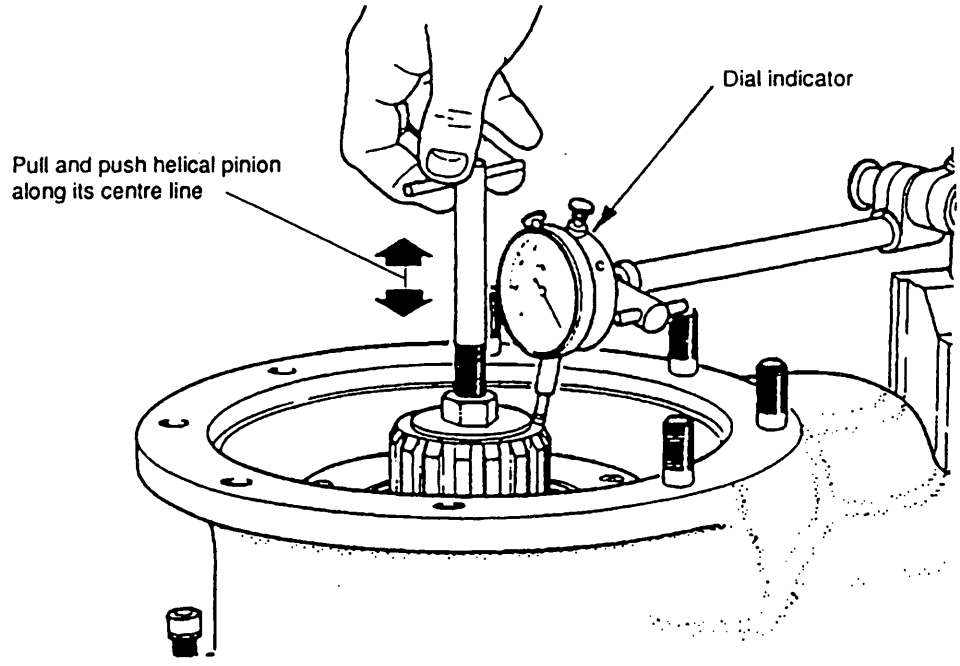


Fig 16 Adjusting helical gear end float

Fitting third differential assembly (See Fig 3)

42 To fit the third differential assembly:

42.1 With third differential cage assembly completed, apply a thin coat of approved jointing compound to gear casing and bevel casing and fit gasket (Fig 4(2)) (if fitted).

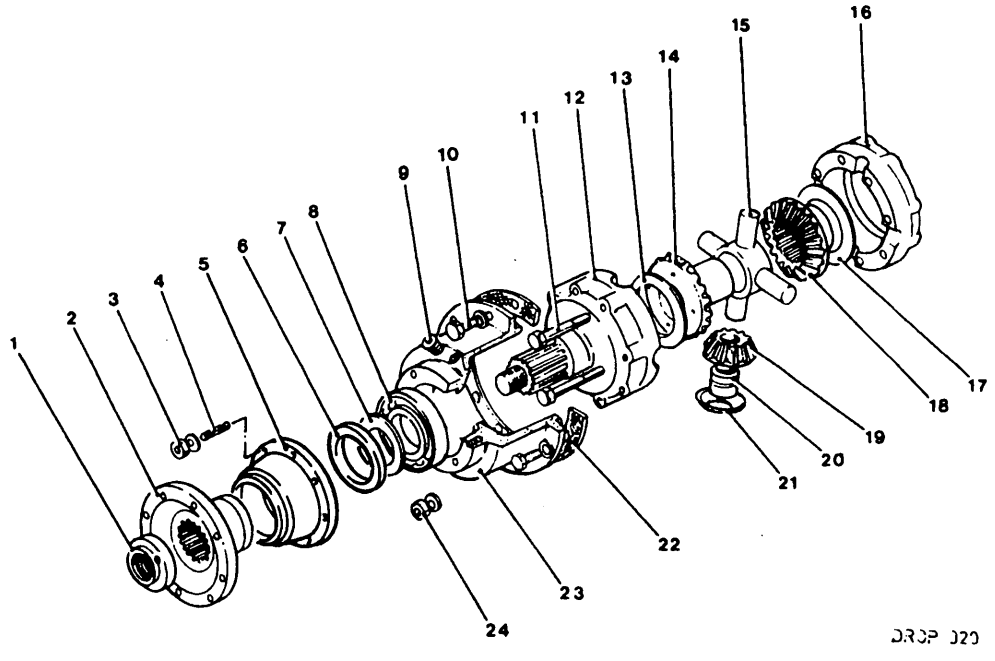
NOTE

If no gasket is fitted clean mating surfaces with an approved chlorinated cleaning fluid and apply a complete bead of approved liquid gasket onto one of the mating surfaces prior to assembly.

42.2 Lift the third differential cage assembly and position it onto the third differential housing studs (Fig 4(18)), ensure that the bevel wheel splines locate onto the helical gear (Fig 4(4)) and that the third differential housing oil filler plug (10) is at its highest point.

42.3 Fit the four nuts and washers (24) and the four setscrews and washers (9).

42.4 Tighten the nuts and setscrews to a torque of 98 to 108 Nm (72 to 80 lbf ft).



1 Stake nut
2 Coupling flange
3 Nut and washer
4 Stud
5 Front end cap
6 Oil seal
7 Bearing spacer
8 Ball bearing
9 Oil filler plug
10 Set screw & washer
11 Bolt
12 Third differential cage (front half)
13 Thrust washer
14 Bevel wheel
15 Trunnion
16 Third differential cage (rear half)
17 Thrust washer
18 Bevel wheel
19 Pinion gear
20 Pinion bush
21 Pinion thrust washer
22 Gasket
23 Third differential housing
24 Nut and washer

Fig 3 Drive input and third differential assembly

Fitting the main differential lock (See Fig 6)

43 To fit the main differential lock:

43.1 Assemble the fork (14) into the groove in the clutch dog (8) and place on the plate positioned in the axle casing (15).

43.2 If bush (6) has been removed for renewal, coat the stepped diameter of the replacement with adhesive (Table 2, Serial 1) prior to fitting into the axle casing, then fit bush.

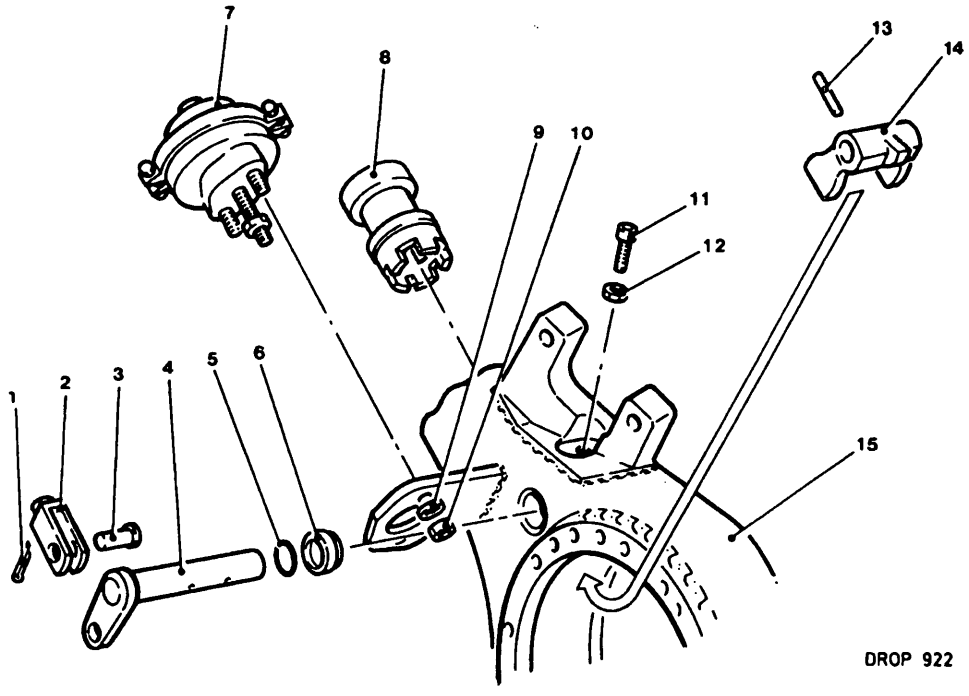
43.3 Fit replacement 'O' ring seal (5) into bush.

43.4 Hold lock fork/clutch dog assembly inside axle casing in line with bush hole.

43.5 Feed operating lever (4) fully into position in casing.

43.6 Align roll pin holes in fork (14) and operate lever (4) and secure with roll pin (13).

43.7 Feed lock side driveshaft into hub until it just locates in clutch dog splines.



1 Split pin	6 Bush	11 Stop screw
2 Clevis	7 Air chamber	12 Lock nut
3 Pin	8 Clutch dog	13 Roll pin
4 Lever	9 Washer	14 Fork
5 'O' ring seal	10 Nut	15 Axle casing

Fig 6 Main differential lock assembly

Final assembly and adjustments (See Fig 5)

44 To carry out final assembly and adjustments:

44.1 Using cleaning fluid (Table 2, Serial 4) clean the mating faces of the bevel casing (6) and the axle casing (21), apply a complete bead of approved liquid gasket to one face.

44.2 With suitable lifting equipment, offer up the complete drive head assembly to the axle casing.

44.3 Fit axle casing washers (42) and nuts (43), and tighten nuts to a torque of 84 to 92 Nm (62 to 68 lbf ft).

Through-driveshaft assembly refitting (See Fig 2)

45 To refit through-driveshaft assembly:

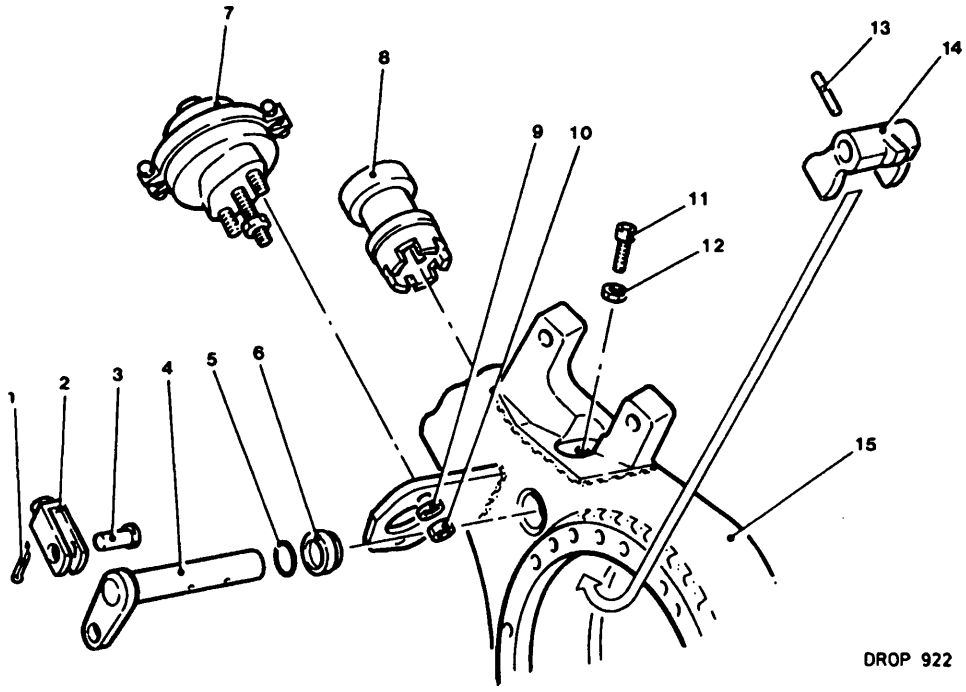
45.1 Using cleaning fluid, (Table 2, Serial 4) clean the mating surfaces of the bearing (5), rear end cap (6) and axle casing (1).

45.2 Apply a small amount of approved liquid gasket to the bearing abutment face in the axle casing and rear end cap.

45.3 Insert the through-driveshaft (7) into the axle casing (1) and ease it carefully into position, so as not to damage splines, through hole in back of the gear casing, third differential lock clutch dog (Fig 5(22)), hollow shaft of helical gear (Fig 5(1)) and into the splines of the outer bevel wheel (Fig 4(14)).

45.4 When shaft is correctly located, drive it home.

45.5 Fit rear end cap nuts and washers (8) and tighten nuts to a torque of 39 to 43 Nm (29 to 32 lbf ft).



1 Axle casing
2 Air chamber
3 Shaft nut
4 Lock washer
5 Ball bearing
6 Rear end cap
7 Through-driveshaft
8 Nut and washer
9 Oil seal
10 Stud

Fig 2 Through-driveshaft assembly

46 Proceeding as detailed in Cat 522 Chap 5, reassemble and refit drive half-shafts and hub assemblies, including hub reduction gears, hubs, brake assemblies and brake drums and adjust differential locks.

TESTING/STORAGE

47 Ensure that all oil drain plugs, fill/level plugs and air cylinder connection caps are fitted. If applicable, refit axle(s) to vehicle (Para 8 and 10 refer), refill with oil (Cat 601 and 201 refer), and test run vehicle to check for satisfactory axle performance. On completion of test, check axle for signs of oil leaks and overheating and, if necessary, rectify.

48 If axle(s) to be stored, carry out standard preservation procedures as detailed in EMER WORKSHOPS N111.

CHAPTER 6

FRONT AXLES

CONTENTS

(continued)

CONTENTS (continued)

GENERAL

WARNINGS

(1) THE VEHICLE ROAD WHEEL ASSEMBLIES EACH WEIGH 330 KG (728 LBS). WHEN REMOVING OR FITTING A ROAD WHEEL, DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

(2) BEFORE ATTEMPTING TO JACK UP A VEHICLE, THE WHEELS TO REMAIN ON THE GROUND MUST BE CHOCKED. WHEELS MUST ALSO BE CHOCKED BEFORE ADJUSTING THE BRAKES. THIS PREVENTS ACCIDENTAL VEHICLE MOVEMENT.

(3) DO NOT RELY ON JACKS ALONE TO SUPPORT A VEHICLE. USE SUITABLE ADDITIONAL AXLE SUPPORTS.

(4) WHEN LIFTING HEAVY WEIGHTS, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

1 This chapter details repair procedures for both front axles at maintenance levels 3 and 4. Overhaul of the complete axle assemblies is carried out at level 4. Procedures allocated to level 3 comprise repair by exchange of the complete axle assembly and/or the following sub-assemblies (all of which can be removed and refitted with the axle in situ on the vehicle:

1.1 Foremost front axle hub reduction gears (for level 3 overhaul)

1.2 Foremost front axle drive shafts

1.3 Differential lock assembly

1.4 Bevel drive and differential assembly

2 Prior to starting any of the following repair activities on the vehicle, park the vehicle on firm level ground, fully apply parking brake, set vehicle electrical MASTER switch to OFF, and chock wheels of axles not subject of repair activity.

SPECIAL TOOLS

3 Special tools and equipment required are detailed in Table 1.

SEALANTS, ADHESIVES AND LUBRICANTS

4 Sealants, adhesives, lubricants and solvents required, other than standard vehicle lubricants detailed in Cat 601, are detailed in Table 2.

TABLE 1 SPECIAL TOOLS

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)
1	7DP/5120-99-452-9109	E413	UJ shaft bush/oil seal bumper

TABLE 2 SEALANTS, ADHESIVES, LUBRICANTS AND SOLVENTS

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)
1	H1/5330-99-789-4943	Loctite 574	Liquid gasket
2	H1/8040-99-438-5637	Loctite 326	Compound, sealing
3	H1/6850-99-224-9504	Loctite 706	Cleaning solvent
4	H1/8040-99-224-9438	Loctite 601	Adhesive

FOREMOST FRONT AXLE REMOVAL AND REFITTING

Foremost front axle removal

5 To remove the foremost front axle:

5.1 Park the vehicle on firm level ground, set the vehicle electrical MASTER switch to 'OFF' and chock all other road wheels.

5.2 Deplete the air system through the reservoir drains.

5.3 Slacken road wheel nuts on front axle wheels.

5.4 Jack up axle and place supports under front frame brackets.

5.5 Position transmission jack under the front axle.

5.6 Remove wheel nuts and both road wheels.

5.7 Disconnect front propshaft at front axle flange.

5.8 Disconnect both shock absorbers at lower mountings.

5.9 Remove both shock absorber mounting brackets.

5.10 Disconnect torque arms.

5.11 Label for identification if necessary and disconnect differential lock electrical connections.

5.12 Disconnect differential lock air pipe connection and axle breather pipe.

5.13 Disconnect the drag link at axle end.

5.14 Mark and remove air pipes from chassis mounted connectors to spring brake actuators.

5.15 Pull the transmission jack forward until slipper brackets on front axle are clear of springs.

5.16 Lower the axle until it can be pulled clear of vehicle.

Foremost front axle refitting

6 Refit the foremost front axle in reverse order to removal, ensuring that the road wheels are tightened in order and to torque figures detailed in Cat 201, and that the following torque figures are applied:

6.1 Propshaft flange nuts and bolts 61 Nm (45 lbf ft)

6.2 Shock absorber bolts 47 to 57 Nm (35 to 42 lbf ft)

6.3 Shock absorber bracket bolts 298 to 352 Nm (220 to 260 lbf ft)

6.4 Torque arm bolts 2 to 237 Nm (300 to 330 lbf ft)

6.5 Drag link to axle bolts 220 to 240 Nm (162 to 177 lbf ft) and the drag link nuts are split pinned on completion. Check/adjust road wheel alignment, steering lock stops and PAS pressure limit (Cat 522 Chap 7 refers).

FOREMOST FRONT AXLE DISMANTLING

7 Before commencing the foremost front axle overhaul drain axle oil, refit drain plug, and thoroughly clean exterior of axle assembly. Support axle assembly securely on suitable stands, ensuring that bevel pinion casing is supported to prevent axle assembly rotation.

NOTE

To aid reassembly, retain dismantled components in related groups, in dismantled order.

8 Dismantle the following sub-assemblies as detailed for level 3 in this chapter:

8.1 Hub reduction gear assembly.

8.2 Drive shafts and universal joints.

8.3 Bevel drive and differential assembly.

Hub reduction gears assembly dismantling (See Fig 1)

9 To dismantle the foremost front axle hub reduction gears:

9.1 Clean all loose dirt from exterior of hub, remove reduction gear planet carrier (31) and annulus carrier assembly (17) from hub (20) (Cat 522, Chap 6 refers), and place on firm clean surface.

9.2 Remove and discard 'O' ring (30) from planet carrier (31).

9.3 Inspect planet carrier dowels (19) for signs of wear and/or damage and if replacement is necessary, drive out towards inboard side.

10 To dismantle the planet carrier assembly:

10.1 Remove planet pin set screws (4), ease out the planet pin collar and 'O' ring seal (5).

10.2 Support the planet wheel, inner face down, on blocks and knock out the planet pins (12).

10.3 The planet wheels, thrust washers (6) and (11), needle rollers (7) and (10), and spacer (8) can now be lifted from the planet carrier.

10.4 Remove breather (36) from the planet carrier.

10.5 If planet wheel(s) are unserviceable, discard set and obtain new set of three replacement gears.

10.6 If radial play is excessive, check planet pin (8) for wear and if necessary, discard, and obtain replacement planet pin (12). If planet pin satisfactory, discard both sets of needle rollers (7) and (10) and spacer (8), obtain replacement parts kit in accordance with Cat 711.

10.7 Straighten the tabs of lock plate (25) remove and retain the set screws (24) with lock plates, separate annulus gear (16) from carrier assembly (17).

10.8 Using approved materials and procedures, thoroughly clean and dry, planet carrier assembly, sun wheel (13) and annulus gear (16).

10.9 Place the assembly on a clean, firm surface.

10.10 Inspect all gear teeth for excessive wear, and check planet wheels (9) for excessive axial play (worn thrust washers (6) and (11) and/or excessive radial play (worn needle roller bearings (7) and (10) and/or planet pins (12)).

10.11 If unacceptable wear is found, discard worn annulus gear (16) and/or sun wheel (13) and obtain replacement parts.

Hub reduction gear re-assembly (See Fig 1)

11 If planet carrier assembly was disassembled, reassemble each planet wheel to carrier as follows:

11.1 Place planet carrier (31) inner face up on clean work surface with a planet wheel location towards operator.

11.2 Lightly grease with the bore of each planet wheel (9) with general purpose (to retain needle rollers and spacer in place after insertion).

11.3 Insert one set of 22 rollers (7), followed by spacer (8) and a second set of 22 needle rollers (10), into each planet wheel bore.

11.4 Locate a new thrust washer (6) into position in the planet carrier (31) opening, ensuring that the washer lock tab locates in the hole provided in the carrier casting.

11.5 Carefully locate a planet wheel assembly into position centrally on the thrust washer (6), followed by a second new thrust washer (11) also with its lock tab correctly located in the carrier (31) casting.

11.6 Avoiding dislodging needle rollers or spacer, carefully insert a planet pin (12) fully into position, down through the carrier inner face and the planet wheel assembly, to carrier outer face. Ensure that head of planet pin is correctly seated.

11.7 Holding the planet pin in position, insert the carrier on the bench (outer face up).

11.8 Fit a new 'O' ring onto a planet pin collar (5), and locate the collar in position in the carrier outer face, over the installed planet pin.

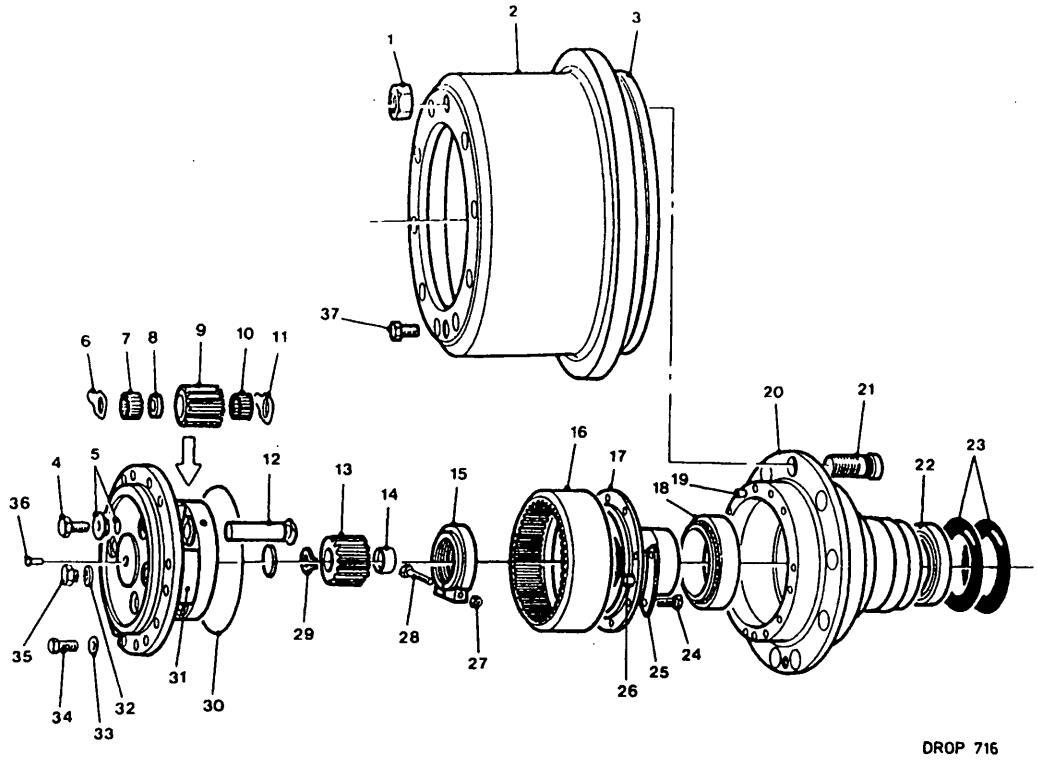
11.9 Screw a set screw (4) through the collar into the planet pin and torque-tighten to 88 to 102 Nm (65 to 75 lbf ft). Re-invert carrier on bench.

11.10 Repeat procedure in Para 5.7.4 to 5.7.9 inclusive for each of the two other planet wheel assemblies.

11.11 Fit new 'O' ring (30) to groove in planet carrier (31).

11.12 Reassemble annulus gear (16) to annulus carrier (17), fit new lock plates (25) insert set screws (24) and torque-tighten to approximately 142 Nm (105 lbf ft). Bend up lock plate tabs to secure set screws.

12 Lightly lubricate all moving part contact surfaces and refit hub reduction gears to front axle in reverse of removal sequence (Cat 522, Chap 6 refers).



1	Wheel nut	20	Hub
2	Brake drum	21	Wheel stud
3	Brake drum seal	22	Inner hub bearing
4	Planet pin collar setscrew	23	Hub oil seals
5	Planet pin collar and 'O' ring seal	24	Annulus gear set screw
6	Planet wheel thrust washer	25	Annulus gear lockplate
7	Needle rollers	26	Annulus gear dowel
8	Spacer	27	Pinch bolt nut
9	Planet wheel	28	Pinch bolt
10	Needle rollers	29	Sunwheel circlip
11	Planet wheel thrust washer	30	Planet carrier 'O' ring seal
12	Planet pin	31	Planet carrier
13	Sun wheel	32	Planet carrier plug washer
14	Sun wheel/universal joint thrust sleeve	33	Planet carrier washer
15	Axle tube nut	34	Planet carrier setscrew
16	Annulus gear	35	Planet carrier level plug
17	Annulus carrier assembly	36	Breather
18	Outer hub bearing	37	Brake drum retaining screw
19	Planet carrier dowel		

Fig 1 Foremost front axle hub reduction gear assembly

Drive shaft removal (See Fig 3)

13 To remove the driveshaft:

13.1 Before removal of the driveshaft assembly from the axle it will be necessary to drain the oil from the axle drive head.

13.2 Place a container capable of holding about eight litres (14 pints) beneath the axle and remove drain plug. Refit plug when drainage is complete.

13.3 Fit a suitable withdrawal tool into position on the driveshaft assembly/axle casing assembly as shown in Fig 2.

13.4 Tighten the two jacking screws evenly to draw the driveshaft assembly (1) out of the axle casing (9).

13.5 Remove the drive shaft circlip (8).

13.6 Tap the driveshaft bearing (7) followed by shims (6) and oil seal assembly (items (2) to (5)) from the drive shaft.

13.7 Prise out dirt excluder (2) and shaft oil seal (3) from housing (5), discard both the oil seal and dirt excluder.

13.8 Remove the oil seal housing spacer (4) from the housing.

13.9 Using an approved cleaning solvent (Table 2 Serial 3), remove any sealant from the oil seal housing (5) and its mating face in axle casing (9).

Driveshaft replacement (See Fig 3)

14 To replace the drive shaft:

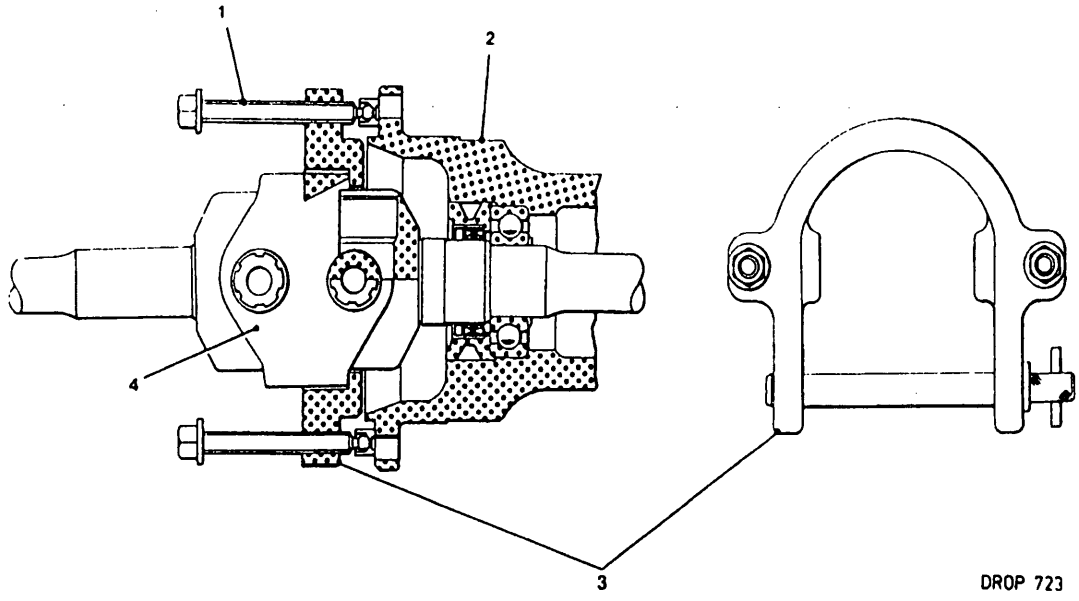
14.1 Place the oil seal spacer (4) in position in the oil seal housing (5).

14.2 Using oil seal bumper (Table 1 Serial 1), tap a new shaft oil seal (3), metal face first, to bottom onto the spacer (4). Fit new dirt excluder (2) to abut the shaft oil seal.

14.3 Lightly oil the lip of the shaft oil seal (3) and carefully push the oil seal housing assembly into position on the driveshaft assembly.

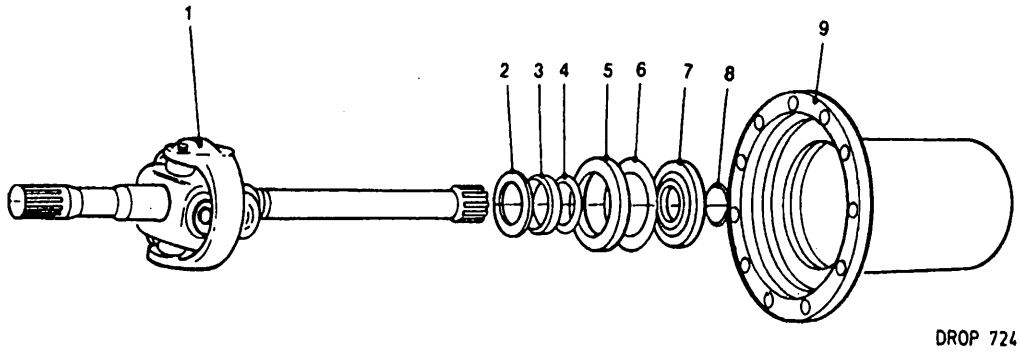
14.4 Place bearing shim (6) into position on the drive shaft abutting the oil seal housing (5).

14.5 Pack the bearing (7) with general purpose grease and, with a soft faced hammer, tap into position to abut the driveshaft shoulder. Fit the circlip (8).



1 Jacking screws 2 Axle casing 3 Withdrawal tool 4 Driveshaft

Fig 2 Withdrawing the driveshaft assembly from the axle casing



1	Driveshaft and universal joint assembly	5	Oil seal housing
2	Dirt excluder	6	Shims
3	Shaft oil seal	7	Bearing
4	Oil seal housing spacer	8	Circlip
		9	Axle casing

Fig 3 Driveshaft and universal joint assembly

Bevel pinion assembly dismantling (See Fig 4)

15 To remove the bevel pinion assembly:

15.1 Withdraw both drive shaft assemblies from the axle casing as detailed in Para 5.

15.2 Using suitable hoist and sling, support bevel casing (12), and remove nuts (35) and spring washers.

15.3 To aid assembly scribe a line on the bevel casing flange o/dia and the axle casing.

15.4 Screw two off 7/16 in. UNF x 1 1/2 in. long extractor bolts into threaded jacking holes in bevel casing (12) flange, tighten evenly to draw complete drive head assembly from axle casing and discard gasket (21) (if fitted).

15.5 Using suitable cleaning solvent (Table 2 Serial 3), clean off any sealant from the axle casing and bevel casing mating faces.

15.6 Place a wedge between crownwheel (28) and pinion (10), to prevent movement.

15.7 Using a suitable pry bar, carefully lever peened portion of stake nut (1) to clear bevel pinion threads.

15.8 Loosen the stake nut, but do not remove at this stage.

15.9 Remove housing nuts (6) and washers, pull pinion housing (5) from bevel casing (12). Lift off setting shims (11).

16 To dismantle the bevel pinion assembly:

16.1 Using a suitable sealant solvent (Table 2 Serial 3), clean off any sealant from between the setting shims and also from housing and casing mating faces.

16.2 With assembly resting on pinion face remove the stake nut (1).

16.3 Using a suitable extractor pull the coupling flange (2) from the pinion (10).

16.4 Pull pinion along with inner bearing (9) cone and bearing spacers (7) and (8) from pinion housing (5).

16.5 Lift off spacers and remove inner bearing cone.

16.6 Prise out and discard oil seal 93) and lift out outer bearing (4) cone.

16.7 Using a soft metal drift, tap inner (9) and outer (4) bearing cups from pinion housing (5).

Differential and gear casing dismantling (See Fig 4)

17 To dismantle the differential and gear casing assembly:

17.1 To ensure correct reassembly, mark bearing straps (19) and mating half cup on the bevel casing.

17.2 Remove nuts (20) and washers and lift off straps (19).

17.3 Remove and discard adjusting nut split pins (26).

17.4 Remove the differential bearings adjusting nuts (18), and lift out crownwheel and differential unit assembly.

17.5 Lift differential bearing (17) cups off their cones and inspect for wear/damage. Tap cones from register on cage halves (15) and (30) if replacement is required.

17.6 Remove crownwheel nuts (16) and washers, carefully drift out eight crownwheel bolts (29).

17.7 With a soft faced hammer, knock the crownwheel from its register on the right hand cage half (30), take care not to lose crownwheel dowels (27).

17.8 To aid in correct reassembly, using indelible marker or quick-drying paint, put mating marks on two halves (15) and (30) of differential cage.

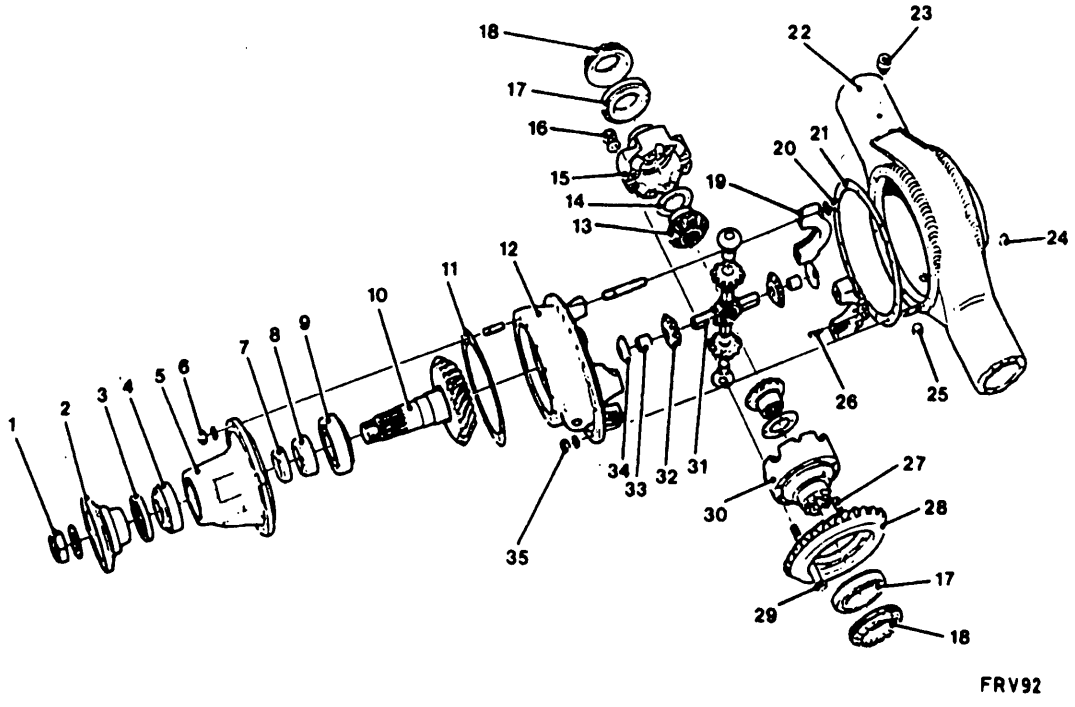
18 To dismantle the differential cage sub-assembly:

18.1 Set cage assembly, left side down, onto clean bench, and remove right half (30) of case, leaving complete differential trunnion assembly in left half (15) of cage.

18.2 Separate the differential cage halves, this enables the bevel wheels (13), thrust washers (14), trunnion (31), differential bevel pinion (32) and bush (33) assembly and thrust washer (33) to be removed.

NOTE

The bush (33) is a press fit in the bevel pinion (32) bore and should be inspected for wear/damage in situ.



1	Stake nut	13	Bevel wheel	25	Drain plug
2	Coupling flange	14	Thrust washer	26	Split pin
3	Oil seal	15	Cage half (l.h.)	27	Dowel
4	Outer bearing	16	Nut	28	Crownwheel
5	Pinion housing	17	Bearing	29	Bolt
6	Nut	18	Adjusting nut	30	Cage half (r.h.)
7	Spacer	19	Strap	31	Trunnion
8	Spacer	20	Nut	32	Bevel pinnion
9	Inner bearing	21	Casket	33	Pinion bush
10	Pinion	22	Axle casing	34	Thrust washer
11	Setting shim(s)	23	Breather adaptor	35	Nut
12	Bevel casing	24	Fill/level plug		

Fig 4 Bevel drive and differential assembly

Differential lock assembly dismantling (See Fig 5)

19 To dismantle the differential lock assembly:

19.1 Extract split pin (10) and withdraw clevis pin (8) from operating lever (6) and clevis fork (9).

19.2 Tap out roll pins (17) which secure differential lock operating fork (16).

19.3 Withdraw differential operating lever (6).

19.4 Remove and discard 'O' ring seal (11).

19.5 Remove the differential lock operating fork (16) and clutch dog (15) from inside the axle casing (1).

19.6 Check for signs of oil seepage around bush (12). Remove for replacement if necessary.

20 To remove the air chamber assembly:

20.1 Loosen locknut (7) and unscrew clevis fork (9) from air chamber (4) push rod. Disconnect air chamber from its air supply and pull off connections to differential lock switch (5).

20.2 Remove air chamber nut (14) and washer (13) and pull air chamber from mounting plate.

CLEANING AND INSPECTION

21 Using standard workshop procedures and equipment, thoroughly clean and dry all components, including casing removing all traces of old sealants and adhesives. Place cleaned components onto clean surface in assembly groups and in removal sequence.

22 Thoroughly inspect all components for serviceability as follows (discard unserviceable items and obtain new replacement parts):

22.1 Inspect all bearings in accordance with EMER T & M A 028 Chapter 060.

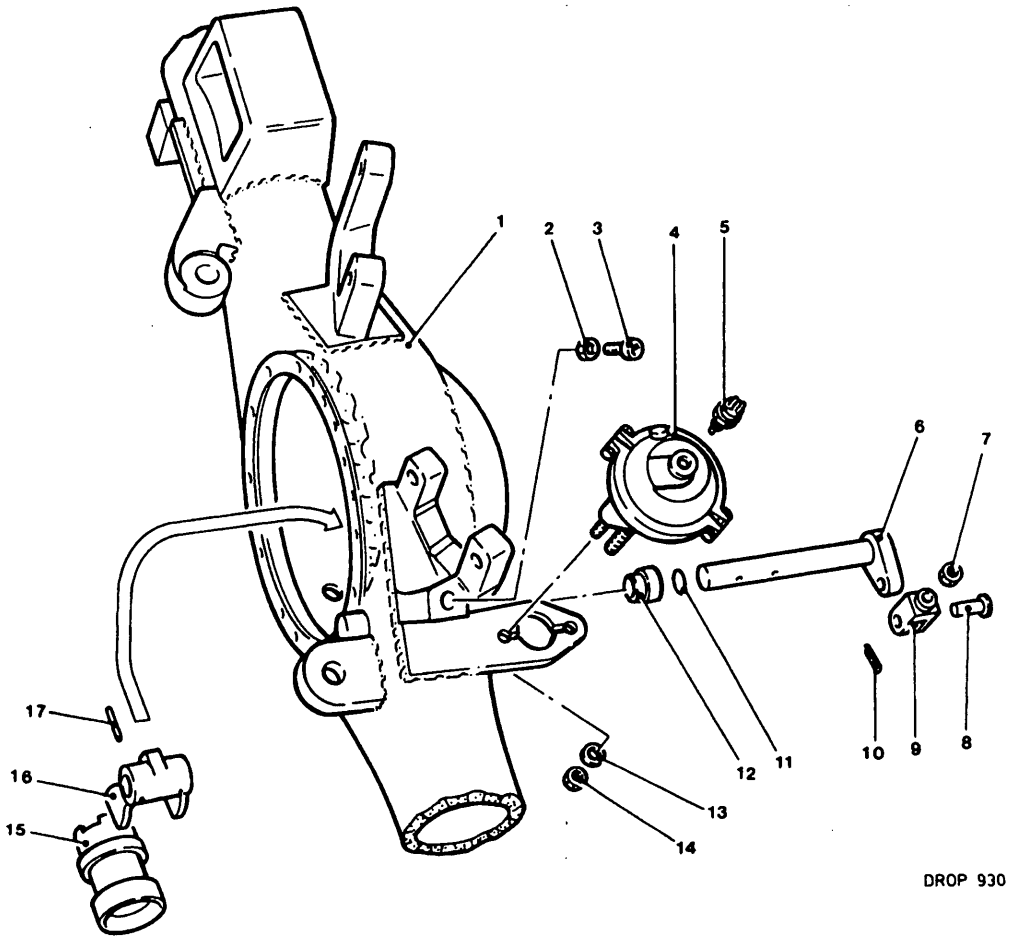
NOTE

All bearings and related spacers are supplied in sets and are to be removed and/or fitted as sets. Part sets are not to be inter-changed.

22.2 Check fit of bearing outer cups in casing seatings, if any slackness is present replace casing(s).

22.3 Check contact surfaces of all gears and moving parts, including shaft and hub splines, for damage, cracking, excessive wear, pitting.

22.4 Check casings for impact damage, cracking and machined mating surfaces for 'out of flat', burrs, nicks, scratches and corrosion pitting.



1	Axle casing	10	Split pin
2	Lock nut	11	'O' ring seal
3	Stop screw	12	Bush
4	Air chamber	13	Washer
5	Lock switch	14	Nut
6	Operating lever	15	Clutch dog
7	Locknut	16	Operating fork
8	Clevis pin	17	Roll pin
9	Clevis fork		

Fig 5 Differential lock assembly

REASSEMBLY

23 Reassemble the front axle generally in the reverse of the dismantling sequence, using new gaskets and oil seals throughout, pre-greasing with general purpose grease all bearings, and pre-lubricating all other moving parts.

NOTE

Sizes and part numbers of the various shims and spacers required are detailed in Cat 711.

Differential lock reassembly (See Fig 5)

24 To reassemble the differential lock:

24.1 Assembly differential lock operating fork (16) into groove in clutch dog (15) and place onto plate positioned inside the axle casing (1).

24.2 If the bush (12) has been disturbed or renewed secure in position as follows:

24.2.1 Ensure mating surfaces of bush and casing are clean and free from grease.

24.2.2 Apply a bead of sealing compound (Table 2 Serial 4) to the leading outer edge of the bush and leading edge of bore in casing.

24.2.3 Press bush fully home and allow 30 minutes for sealant to cure.

24.3 Fit a new 'O' ring seal (11) into position in the bush.

24.4 Hold the lock operating fork/clutch dog assembly in line with the bush bore and feed the operating lever (6) fully into position in the axle casing, passing through the lock operating fork and into the boss on the other side of the axle casing.

24.5 Align roll pin holes in operating fork (16) and operating lever (6) and secure with the roll pins (17).

24.6 Feed the differential lock side driveshaft into axle arm until it just locates in clutch dog splines.

Bevel pinion assembly reassembly (See Fig 4)

25 To reassemble the bevel pinion assembly:

25.1 Press cups of inner (9) and outer (4) bearings into position in the pinion housing (5).

25.2 Press cone of inner bearing (9) onto pinion (10), followed by inner bearing spacer (8) large inside chamfer first, then outer spacer (7) large outside chamfer outwards. Feed assembly into position in housing.

NOTE

If new components are being fitted assemble with the largest available spacers. This ensures that bearing pre-load is on the low side, thus preventing too great a pre-load and possible bearing damage.

25.3 Press outer bearing (4) cone into position on pinion.

25.4 Press coupling flange (2) fully onto splined end of pinion shaft and secure finger tight with stake nut (1).

25.5 Mount assembly in soft-jawed vice, (clamp onto a holding plate fitted to coupling flange).

25.6 Lightly oil bearings with clean gear oil then progressively tighten stake nut whilst rotating and, with a soft faced hammer, shock loading the bevel casing (12), tighten to a torque of 1085 to 1220 Nm (800 to 900 lbf ft).

25.7 Remove assembly from vice and take off holding plate.

26 To check bearing pre-load:

26.1 As shown in Fig 6 position bevel pinion assembly, coupling flange uppermost on a bench.

26.2 Secure a length of cord to the pinion housing and attach the free end to a spring balance.

26.3 Wrap the cord around the outside diameter of the bearing housing and pull on the spring balance to rotate housing. Note the force required, ignoring initial starting force, to maintain rotation.

26.4 Determine the radius (R in.) of the housing and calculate the pre-load as follows:

26.4.1 T = F x R, where;

26.4.1.1 T = Torque (Pre-load)

26.4.1.2 F = Force to maintain rotation (lbs)

26.4.1.3 R = Radius of cord

26.4.2 The pre-load obtained should be between limits 15 to 25 lbf in. (1.7 to 2.8 Nm).

26.5 If torque calculated outside limits, adjust by dismantling pinion shaft and fitting different thickness outer spacers (7) to suit. Use thinner spacer to increase, or thicker spacer to decrease, pre-loading torque.

26.6 When pre-loading correctly set, remove stake nut (1) and coupling flange (2).

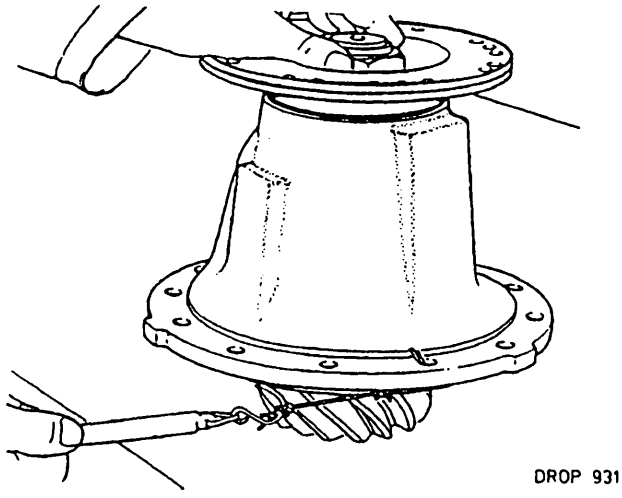


Fig 6 Checking pinion bearing pre-load

27 To carry out final assembly of bevel pinion assembly:

27.1 Check coupling flange (2) for damage in the area polished by the oil seal (3) lip. Even slight damage in this area will cause leakage. Very slight marks may be polished out with fine emery cloth, but it is essential that polishing marks are parallel to the seal lip.

27.2 Where there is no more serious damage it is permissible, if there is room in the housing, to fit two seals back-to-back, ie with the outer seal spring facing outwards, inner seal spring facing inwards. The outer seal acts as a spacer and ensures that the inner seal is fitted squarely and runs on a different part of the coupling flange.

27.3 Smear the lip of the oil seal (3) with clean gear oil.

27.4 Using a suitable fitting tool fit the oil seal (3) into the bearing housing (5) as follows:

27.4.1 The seal must be fitted using a circular tool which bears on the seal close to its outside diameter where the casing is strongest.

27.4.2 The seal must remain square to bore during fitting. If seal cocks over and one side enters the bore first it will almost certainly result in distortion of the casing which will not be corrected by straightening up the seal further down the bore.

27.4.3 Where possible the seal should be fitted under a press.

27.4.4 The seal must be truly square in bore after fitting, a cocked seal will act as an oil pump.

27.5 Refit coupling flange (2) and stake nut (1). Tighten nut to a torque of 1085 to 1220 Nm (800 to 900 lbf ft).

27.6 Lock stake nut in position by peening locking flange into slot in pinion shaft (10).

27.7 If any housing/casing studs have been removed, replace and tighten to a torque of 45 to 50 Nm (33 to 37 lbf ft).

27.8 Place setting shim (11) into position on studs, then offer complete assembly up to bevel casing (12), tap into position with a soft faced hammer.

NOTE

If new crownwheel or pinion are fitted, a nominal shim pack of 1.27 mm (0.050 in.) should be fitted.

27.9 Secure in position with nuts (6) and washers. Tighten nuts progressively using diagonal sequence until tightened to a torque of 64 t 72 Nm (47 to 53 lbf ft).

Differential assembly reassembly (See Fig 4)

28 To reassemble the differential assembly:

28.1 During re-assembly, smear the differential gears with clean gear oil.

28.2 Press differential bearing (17) cone onto its mating differential cage half (15), repeat this action with other bearing cone onto cage half (30).

28.3 Fit crownwheel (28) onto differential cage half (30) ensuring that dowels (27) locate correctly.

28.4 Fit differential cage bolts (29) through crownwheel and differential cage half (30), place assembly on bench, supported on blocks, crownwheel downwards.

28.5 Fit a differential bevel wheel thrust washer (14) and differential bevel wheel (13) into differential cage half (30).

28.6 Onto the trunnion (31) fit four bushes (33) and bevel pinion (32) assemblies and four thrust washers (34).

NOTE

If a new bush (33) is to be fitted into the bore of a pinion (32), it must be done using a suitable press due to tight fit between pinion and bush. The bush is pressed in flush with the spherical face of the pinion. If a press is not available a complete new pinion and bush assembly must be fitted.

28.7 Lay trunnion (31) onto bevel wheel (13), ensure the teeth mesh correctly.

28.8 Place second bevel wheel and washer onto differential bevel pinions, ensure that teeth mesh correctly.

28.9 Carefully fit differential cage half (15) onto assembly, aligning the matching marks on the cages. Fit the washers and nuts (16) to the cage bolts (29), tighten nuts to a torque of 225 to 249 Nm (166 to 184 lbf ft).

Check fitting the bearing adjusting nuts (See Fig 4)

29 To check fit the bearing adjusting nuts:

29.1 Secure the bevel pinion and gear casing assembly in a suitable differential build stool.

29.2 Check fit the bearing adjusting nuts as follows:

29.2.1 Clean and deburr the bevel casing (12) legs and the bevel casing straps (19).

29.2.2 Fit bearing (17) cups into half bores of bevel casing legs.

29.2.3 Inspect the four bevel casing strap studs and replace as necessary. Tighten to a torque of 119 to 133 Nm (88 to 98 lbf ft).

29.2.4 Carefully fit the two bevel casing straps (19) and adjusting nuts (18) to locate on the bearing cups.

29.2.5 Check alignment of marks on bevel casing legs and straps to ensure that straps are not transposed, the bearing cups should seat snugly in the bores. The bearing adjusting nuts should be free to turn with hand pressure only, if not cross threading may have occurred.

29.2.6 On no account use any additional pressure, i.e. hammer to turn adjusting nuts, remove and deburr and repeat procedure.

29.2.7 Fit the four bevel casing strap washers and place temporary plain nuts (20) onto studs. Tighten to a torque of 142 Nm (105 lbf ft).

29.2.8 As shown in Fig 7. Check the freedom of the adjusting nuts by unscrewing and replacing, to assist this operation tap the top of the bevel casing straps (24) with a 2 lb hammer.

29.2.9 Having checked the fit of the adjusting nuts, remove bevel casing straps bearing cups and adjusting nuts.

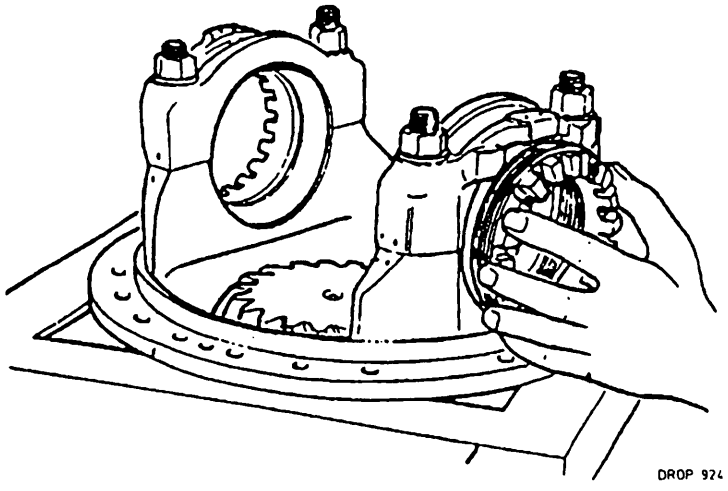


Fig 7 Check fitting bearing adjusting nut

Fitting differential into casing (See Fig 4)

30 To fit the differential into casing:

30.1 Using the correct applicator apply a 1/8 in. wide band of sealing compound (Table 2 Serial 2) into bevel casing strap (19) bores. This prevents the possibility of bearing cups spinning in service.

NOTE

Assembly and setting procedures are to be completed immediately so as to avoid the adhesive hardening and preventing adjustment of bearing cups.

30.2 Hold differential bearing (17) cups in position on differential bearing cones and place crownwheel (28) and differential assembly in position in the bevel casing (12).

30.3 Fit the two adjusting nuts (18) onto the half threads of the bevel casing legs. Check freedom of the nuts on the threads.

30.4 Ensuring matching marks coincide to prevent misalignment. Hand fit bevel casing straps (19) onto the strap studs to locate on bearing (17) cups and adjusting nuts (18).

30.5 Turn adjusting nuts hand tight against the bearings.

30.6 Fit the four washers and nuts (20) onto the strap studs, tighten nuts to a torque of 174 to 193 Nm (128 to 142 lbf ft).

Setting 'no end float' condition: (See Fig 4)

31 To set 'no end float' condition:

31.1 As shown in Fig 8 set up a dial indicator on the back face of the crownwheel (28) and screw in each adjusting nut (18) just sufficiently to ensure no crownwheel axial movement is registered on the dial indicator.

31.2 Tap bevel casing straps (19) and rotate the crownwheel, re-check that no axial movement is present.

Setting crownwheel and pinion backlash (See Fig 4)

32 To set crownwheel and pinion backlash:

32.1 Move the dial indicator onto a crownwheel tooth as shown in Fig 9.

32.2 Hold pinion (10) still and rock crownwheel (28) backwards and forwards to check free play between gears (backlash), note the variation of indicator reading.

32.3 At equally spaced positions around the crownwheel repeat the above operation three more times.

32.4 The variations of readings on the dial indicator must be within the limits of 0.203 to 0.330 mm (0.008 to 0.013 in.).

32.5 If the difference in backlash of more than half backlash tolerance exists between positions, then the assembly must be examined for cause and cause rectified.

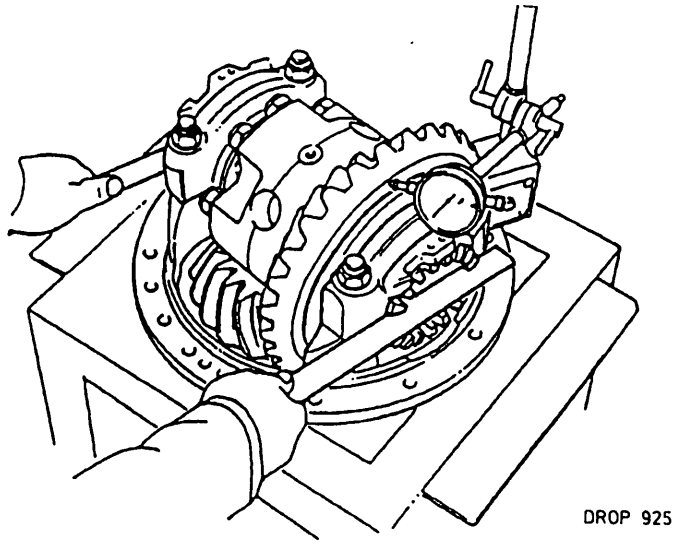


Fig 8 Setting 'no end float' condition

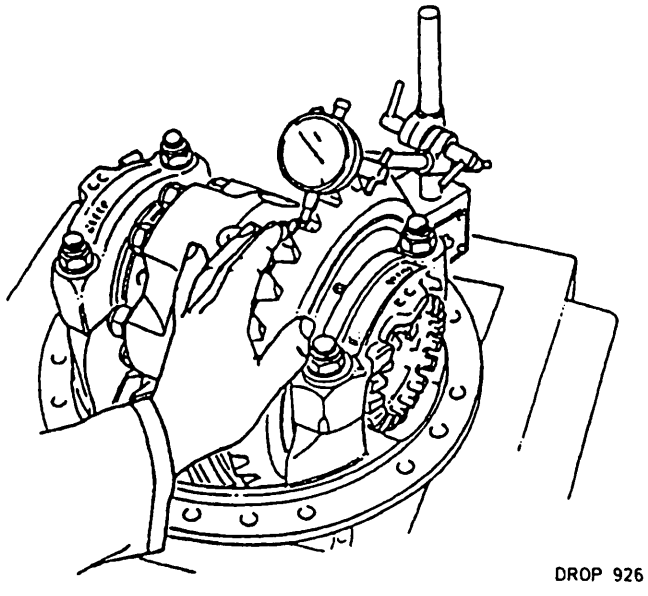


Fig 9 Setting crownwheel and pinion backlash

Setting the crownwheel bearings (See Fig 4)

33 To set the crownwheel bearings:

33.1 Set two dial indicators diametrically opposite on the bearing strap register point as shown in Fig 10, set each indicator to zero.

33.2 Mark the position of each adjusting nut (18) and then slacken each one slightly, to ensure no spread is present (the dial indicators remain at zero).

33.3 Re-tighten each adjusting nut back to its marked position and then tighten a further notch on each end to pre-load the bearings (17), (the pre-load is correct with a spring balance pull of 2.5 lb, i.e. rolling resistance, at the outside diameter of the differential cage.

33.4 The sum of the dial indicator readings should total between 0.051 and 0.102 mm (0.002 and 0.004 in.). The adjuster nut slots should line up with one of the two split pin holes in the casing straps (19).

33.5 Fit the two split pins (26) as shown in Fig 11.

33.6 Tighten casing strap nuts (Fig 4 (20)) to a torque of 174 to 193 Nm (128 to 142 lbf ft).

33.7 Set up a dial indicator on the crownwheel and re-check backlash is still as set in Para 36.

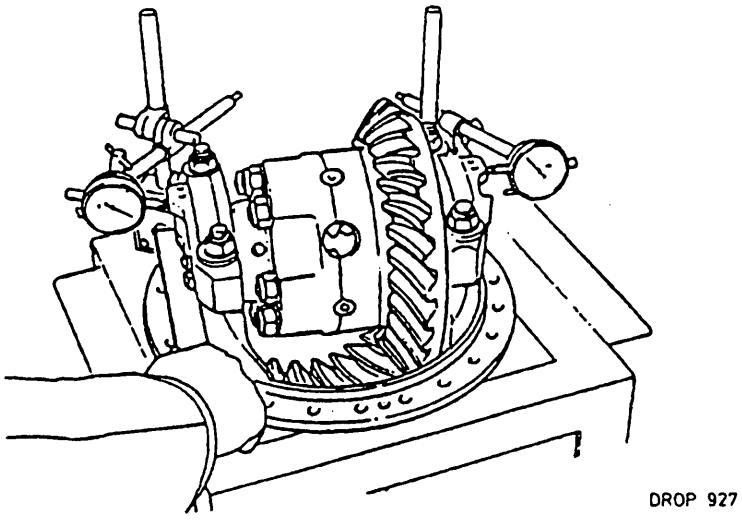


Fig 10 Setting the crownwheel bearings

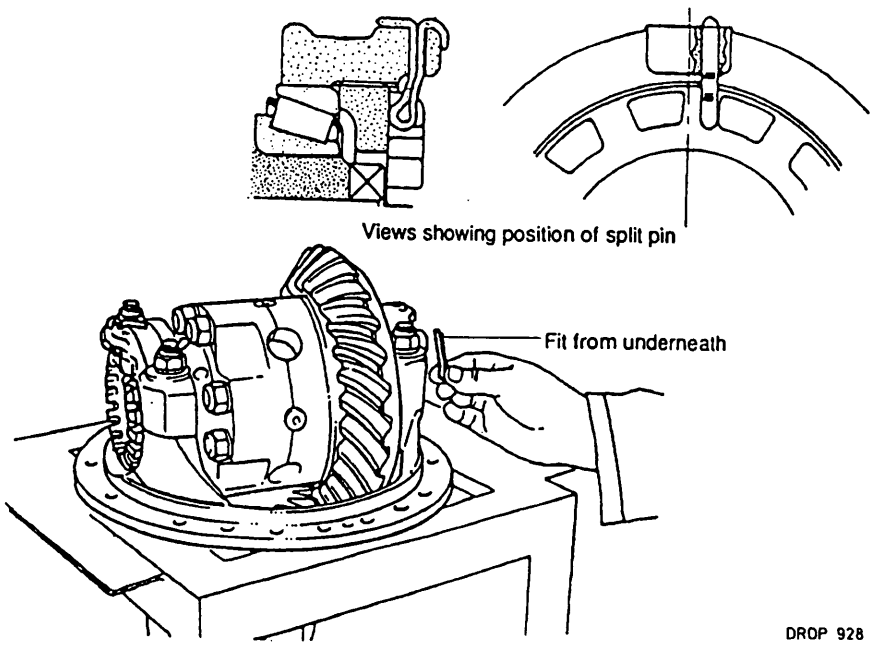


Fig 11 Fitting split pins

Checking crownwheel and pinion mesh

34 To check crownwheel and pinion mesh:

NOTE

Gears fitted/supplied may be one of three different types, identification and meshing details are given in Figs 12, 13 and 14.

34.1 After identifying gear type, apply a thin coating of standard engineers marking compound to the crownwheel and pinion teeth.

34.2 Rotate the crownwheel several times in both directions to make a positive tooth contact impression on crownwheel and pinion teeth.

34.3 Inspect markings and compare them with the relevant figures on Figs 12, 13 or 14.

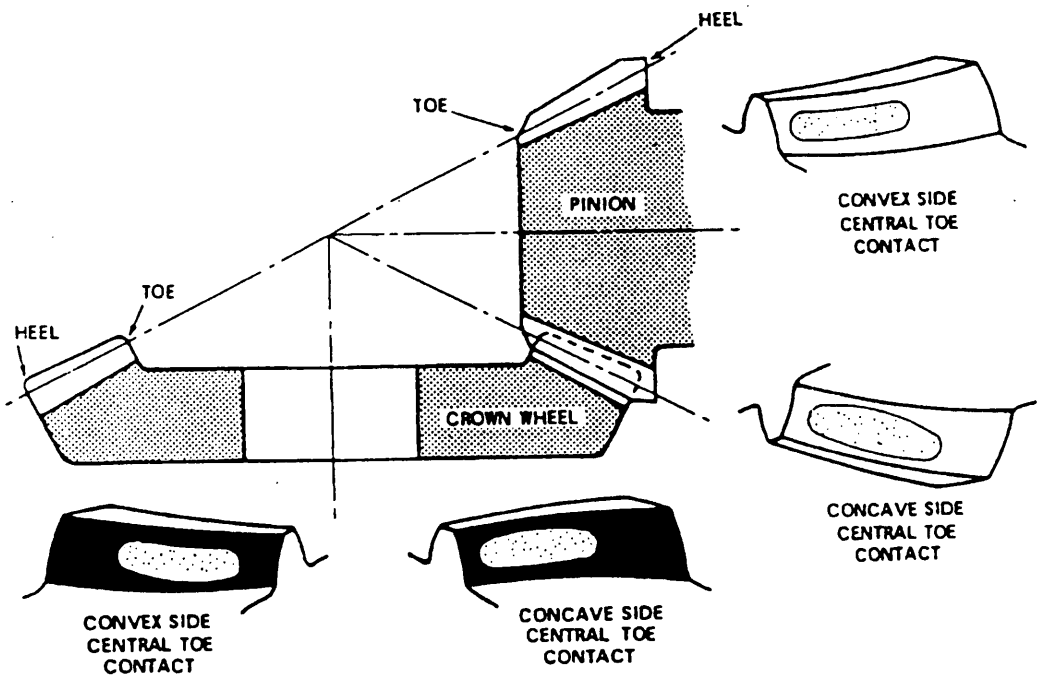
34.4 In all cases any action required is to be taken as shown below:

34.4.1 Fig A Correct mesh. No further action required.

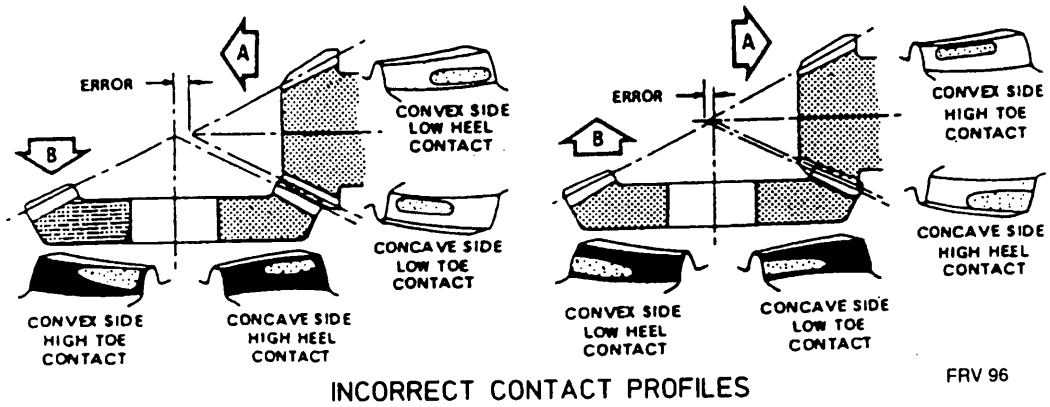
34.4.2 Fig B Indicates pinion and crownwheel are too far out of mesh. To remedy, move pinion inwards towards crownwheel. To maintain backlash, move crownwheel away from pinion in direction of arrow B.

34.4.3 Fig C Indicates pinion and crownwheel too far into mesh. To remedy, move pinion outwards away from crownwheel. To maintain backlash, move crownwheel towards pinion in direction of arrow B.

34.5 Adjust pinion position by altering the thickness of the pinion bearing shims (39), i.e. remove shims to move pinion away from crownwheel and add shims to move pinion towards crownwheel.



CORRECT CONTACT PROFILE



INCORRECT CONTACT PROFILES

To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

NOTE

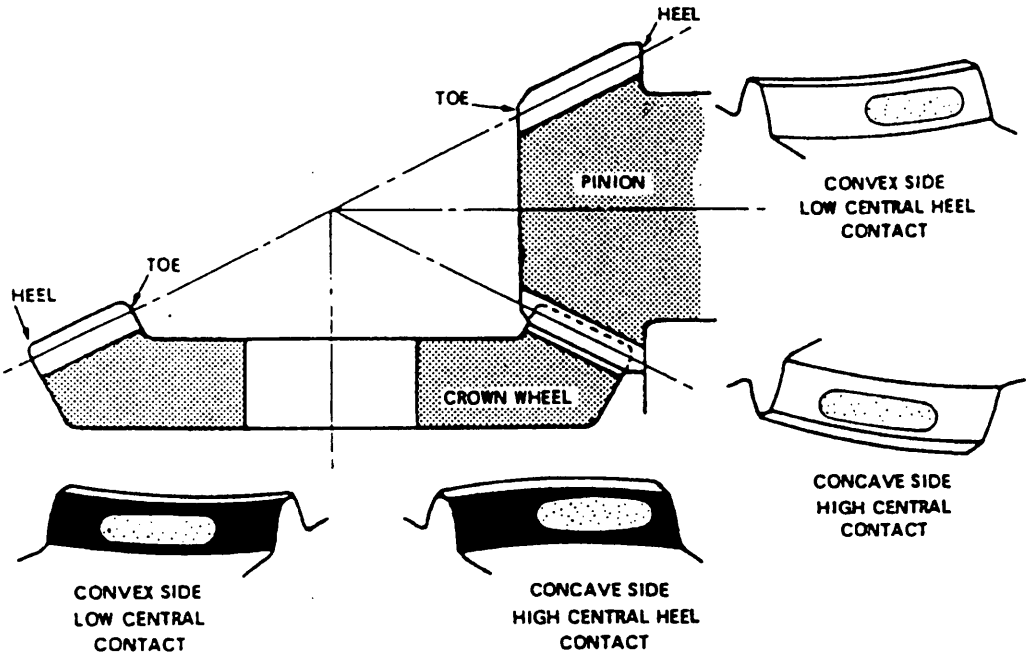
Identification of Oerlikon 'N' form gears:

1 Pinion shank and crownwheel back face have identification groove

2 Gear teeth parallel to pitch line

3 Suffix letter 'N' in part number (eg R8579/1N/2N)

Fig 12 Meshing check/adjustment (Oerlikon 'N' form gears)



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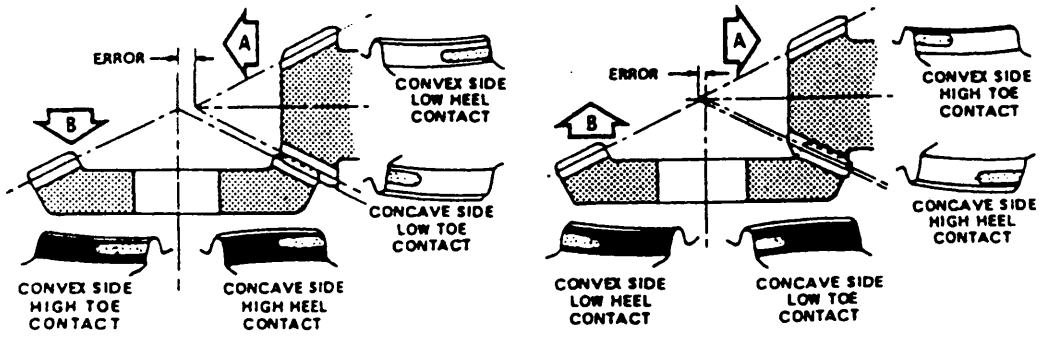


INCORRECT CONTACT PROFILES FRV 97

To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

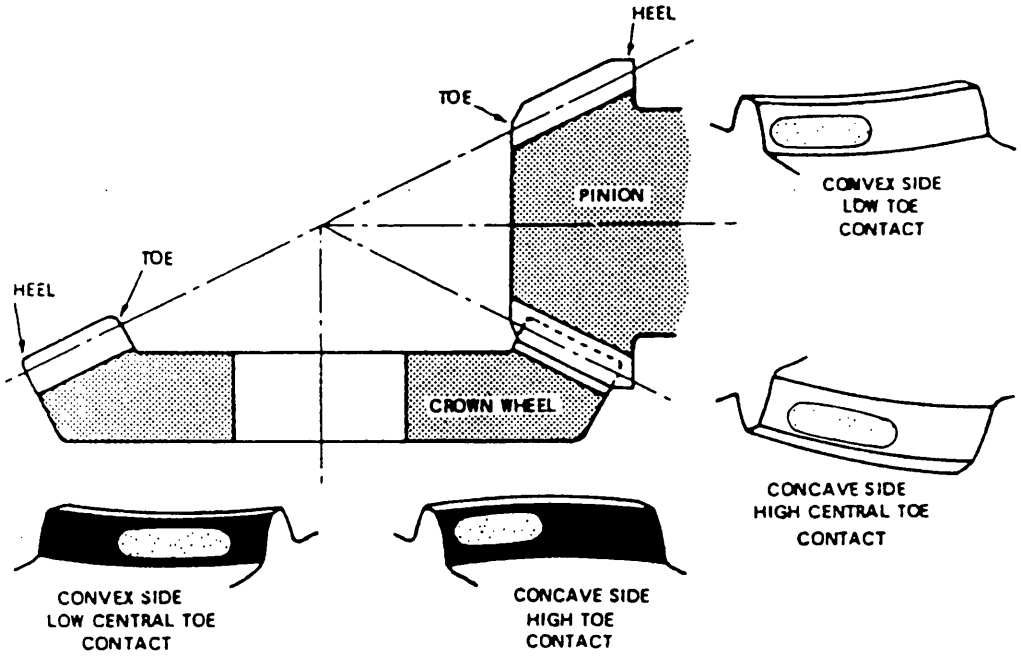
NOTE

Identification of Oerlikon 'G' form gears:

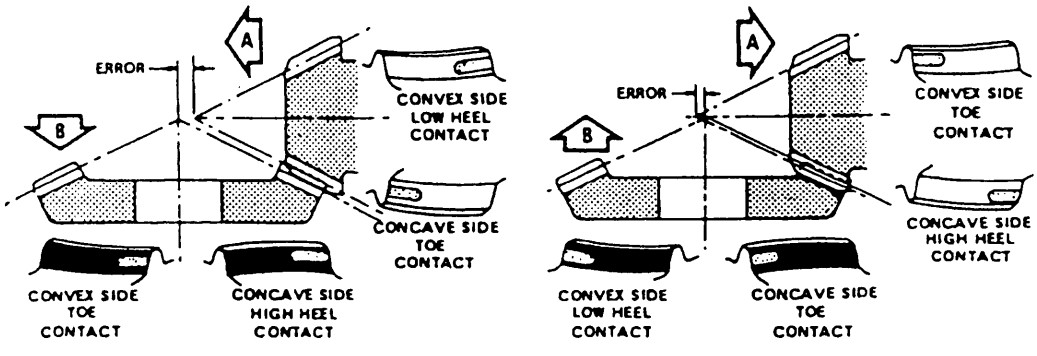
As 'N' form but only the following parts numbers apply:

R8929/1N/2N, R8858/1N/2N, R8859/1N/2N.

Fig 13 Meshing check/adjustment (Oerlikon 'G' form gears)



CORRECT CONTACT PROFILE



INCORRECT CONTACT PROFILES FRV 98

To correct. Move pinion direction 'A' (Mesh profile), crownwheel direction 'B' (backlash)

NOTE

Identification of Gleason gears:

1 No identification groove on pinion shank or crownwheel back face
2 Gear teeth taper towards centre ('toe end') of teeth.
3 No suffix letter in part number (eg R8579/1/2)

Fig 14 Meshing check/adjustment (Gleason gears)

Differential assembly refitting to axle (See Fig 4)

35 To refit differential assembly to axle:

35.1 If removed refit axle casing studs and tighten to a torque of 85 to 94 Nm (63 to 69 lbf ft).

35.2 Coat gear casing mating face of axle casing (22) with liquid gasket (Table 2 Serial 1).

35.3 Using a suitable sling support the differential assembly and offer it up to the axle casing and, using a soft faced hammer tap it into position.

35.4 Fit axle casing washers and nuts (35) and tighten to a torque of 134 to 148 Nm (99 to 109 lbf ft)

35.5 Refit the drive shaft assembly as described in Para 6 of this Chapter.

REARMOST FRONT AXLE REMOVAL

36 To remove the rearmost front axle:

36.1 Park the vehicle on firm level ground, set the vehicle electrical MASTER switch to 'OFF' and chock all other road wheels.

36.2 Deplete the air system through the reservoir drains.

36.3 Slack road wheel nuts on hub to be removed.

36.4 Jack up axle and place supports under front frame brackets.

36.5 Position transmission jack under rearmost front axle.

36.6 Remove slackened wheel nuts and road wheel.

36.7 Back off the brake adjustment as described in Cat 522 Chap 7.

36.8 Remove the hub as described in Cat 522 Chap 6.

36.9 Remove the stub axles as described in Cat 522 Chap 6.

36.10 Disconnect steering ram (boost cylinder) at axle end, secure loose end to chassis.

36.11 Disconnect upper and lower torque arms.

36.12 Disconnect drag link at axle end.

36.13 Disconnect shock absorbers at axle mounting.

36.14 Pull the complete assembly to the rear until slipper ends are clear of springs.

36.15 Lower jack until the axle can be pulled clear of the vehicle.

CLEANING AND INSPECTION

37 Thoroughly clean all components, inspect for wear or damage, renew as necessary.

REFITTING THE REARMOST FRONT AXLE

38 Refit the rearmost front axle in reverse order to removal, ensuring that the road wheels are tightened in order to torque figures detailed in Cat 201 Chap 4, heeding all relevant warnings and cautions and that the following torque figures are applied and the drag link nuts are split pinned on completion:

38.1 Shock absorber bolts 47 to 57 Nm (35 to 42 lbf ft).

38.2 Torque arm bolts 2 to 237 Nm (300 to 320 lbf ft).

38.3 Drag link to axle bolts 220 to 240 Nm (162 to 177 lbf ft).

39 Check/adjust road wheel alignment, steering lock stops and power assisted steering pressure limit as described in Cat 522 Chap 7.

40 Refit the stub axle as described in Cat 522 Chap 6.

41 Refit brake assembly as described in Cat 522 Chap 10.

TESTING/STORAGE

42 Ensure that oil drain and fill/level plugs and air cylinder connection caps are fitted. If applicable, refit axle assembly to vehicle, refill with oil (Cat 601 Table 2 refers), test run vehicle to check for satisfactory axle performance and, on completion of test, check axle for signs of oil leaks and overheating and, if necessary, rectify.

43 If axle is to be stored, carry out standard preservation procedures as detailed in EMER WORKSHOPS N 111.

CHAPTER 7

STEERING

CONTENTS

STEERING BOX

WARNING

THE STEERING BOX WEIGHS APPROXIMATELY 38 KG (84 LB). WHEN LIFTING DUE REGARD IS TO BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

General

1 The following tasks assume that the steering box has been removed from the vehicle as detailed in Cat 522 Chap 7.

2 The steering box is designed to be service free therefore it is recommended that whenever a steering box is removed from a vehicle as faulty a full overhaul is carried out and all sealing components renewed.

3 The piston assembly comprising the piston and worm sub-assembly are a matched set and if any component is found faulty a new assembly is to be fitted.

4 The worm sub-assembly is dynamically balanced and pinned at the factory and should not require to be separated.

Special tools

5 Special tools required to carry out the tasks detailed are listed in Table 1.

TABLE 1 SPECIAL TOOLS

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)
1	7ZF/2530-99-252-8914	ZF 7671 798 651	Valve piston clamping sleeve
2	7ZF/5120-12-317-6323	ZF 7672 798 151	Valve seat bolt box spanner
3	7ZF/5120-12-317-6324	ZF 7673 798 053	Rotary shaft seal mandrel
4	7ZF/2530-99-252-8913	ZF 8052 798 201	Rotary seal extractor
5	7ZF/6635-12-173-4227	ZF 7470 798 703	Recirculating ball torque setting tool
6	7ZF/5365-12-321-2959	ZF 8090 798 003	Oil seal protection sleeve
7	7ZF/5210-12-321-2203	ZF 8095 798 101	Dial test indicator clamp
8	7ZF/4910-12-321-3212	ZF 8090 798 151	Eccentric bearing adjuster
9	7ZF/4910-12-321-4271	ZF 8098 798 551	Adjuster rings for serial 8
10	7ZF/5120-99-149-2045	ZF 8090 798 654	Centre pot alignment tool
11	7ZF/4910-12-173-4226	7419 798 551	Worm sleeve adaptor

Steering box dismantling (See Fig 1)

6 To dismantle the steering box:

6.1 Thoroughly clean all external surfaces paying particular attention to the bearing ends.

6.2 Place steering box on a suitable stand where it can be firmly supported.

6.3 Remove the mitre box (21).

6.4 Remove plastic bearing covers (10) and (26) and plastic shaft cover (20).

6.5 Scribe an alignment mark on both bearings (14) and (25) and housing (19) to aid reassembly.

6.6 Remove end cover (1) bolts, if necessary fit steering arm and loosen rocker shaft (22) to enable end cover to be removed.

6.7 When the end cover is removed the needle bearing (6), washer (5), sealing ring (4) and 'O' ring seal (3) can be recovered. Discard sealing ring (4) and 'O' ring seal (3).

6.8 By further movement of the steering arm the piston can be pushed out of the housing and the teeth of the rocker shaft turned clear of the piston so that the whole piston assembly (36) can be withdrawn from the housing.

6.9 Once the piston assembly is removed from the housing (19) the oil seal (30), washer (31) and needle bearing (32) can be recovered from the inner end of the housing. Discard the oil seal.

(See Fig 2)

NOTE

A pintle has been left on the plug (10) to aid removal from the piston (15), if this fails a drilled hole and easy-out can be used.

6.10 Remove the plug (10), gasket (11), 'O' ring seal (12), sealing ring (13) and recirculating ball tube (14) from piston (15).

6.11 Split the recirculating ball tube and recover the balls (9). Turn the wormshaft in the piston to eject the remainder of the balls. Recover all balls, count them and store them safely.

6.12 Remove and discard sealing rings (1), (2), 'O' ring seal (16) and gasket (17).

6.13 Remove snap ring (3) and sliding tube (4) from the worm, ensuring plastic plugs (18) are recovered if they fall free from their housing.

6.14 Remove and discard 'O' ring seal (19) and sealing rings (5) and (8).

(See Fig 1)

6.15 Remove the internal circlip (11) from bearing housing at splined shaft end of rocker shaft (22).

6.16 Use thin lip puller to remove bearing (14) from housing. Recover gasket (13) backing ring (12) 'O' ring seal (16) and housing cover (15). Discard gasket backing ring and 'O' ring seal.

6.17 Repeat steps 6.12 and 6.13 at other end of housing and then remove rocker shaft from housing noting relationship of rocker shaft to shaft housing.

Steering box cleaning and inspection

7 Thoroughly clean all components, visually inspect all components are free from burrs, scores or wear. Renew any worn components noting that the piston assembly is to be fitted as a new assembly if any one component is faulty.

Steering box reassembly (See Fig 1)

8 The reassembly of the steering box is to be carried out in a clean environment, all components being fitted are to be coated with a thin layer of oil or grease as applicable.

9 To re-assemble the steering box:

9.1 Fit oil seal (30) into housing (19) through inner bore and ensure correct seating using a suitable drift if required.

9.2 Fit 'O' ring seals (16) and (23) to each end of housing.

9.3 Fit bearing (14), gasket (13) and backing ring (12) to housing ensuring alignment marks on bearing and housing are lined up.

9.4 Using a suitable drift, tap the bearing (14) into the housing until the internal circlip (11) can be fitted to the housing recess then drive the bearing back onto the circlip.

9.5 Fit housing cover (24) onto boss of rocker shaft (22) with relieved chamfer of bore facing outwards.

9.6 Fit rocker shaft into housing, locate housing cover (15) onto rocker shaft with relieved chamfer of bore facing outwards.

9.7 Fit bearing (25) with gasket (29) and backing ring (28) to housing ensuring alignment marks on housing and bearing are lined up.

9.8 Use a suitable drift or hand press, as available, to press bearing (25) into housing so that internal circlip (27) can be fitted. Fit circlip.

(See Fig 2)

9.9 Fit oil seal protection sleeve (Table 1 Serial 6) onto spline of wormshaft and push control sleeve/worm shaft (6) into the piston (15) until start of thread is just visible through hole normally occupied by the recirculating ball tube.

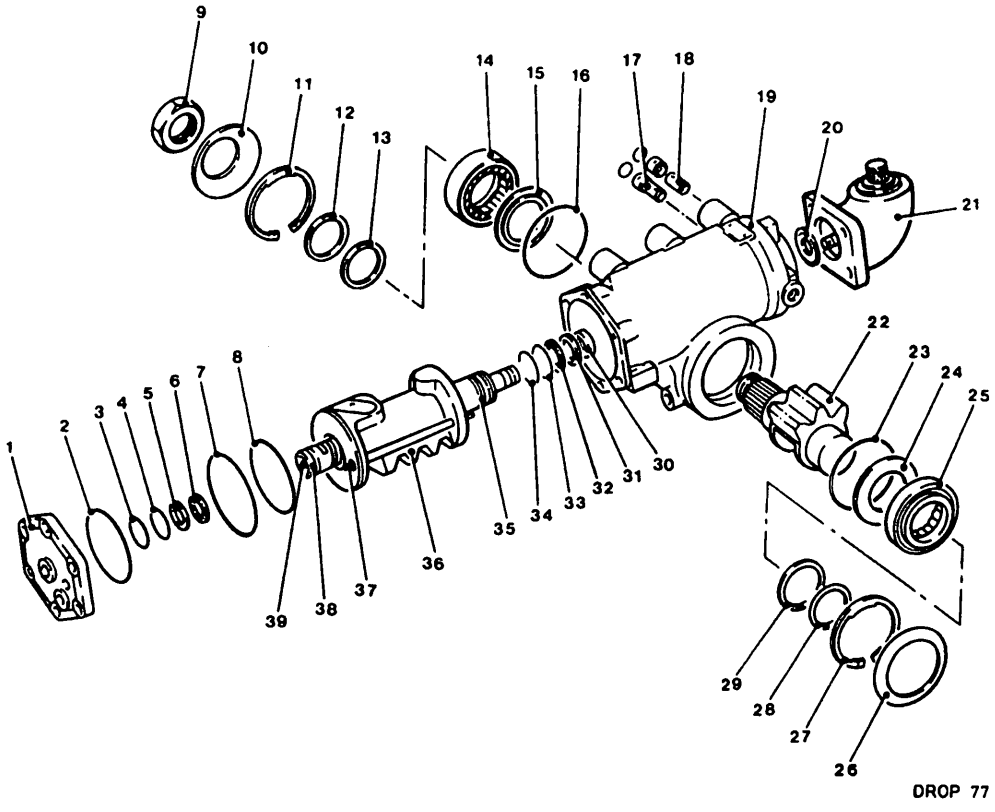
9.10 Start feeding balls (9) into the thread turning the thread anti-clockwise to allow the balls to feed around the piston.

9.11 When no more balls can be fed into the holes pack the remaining balls (normally seven) into one half of the recirculating ball tube and pack with vaseline to hold them in position.

9.12 Fit upper half of tube then fit to piston.

9.13 Check the friction torque of the ball circulation section as follows:

9.13.1 Fit torque setting tool (Table 1 Serial 5) and adaptor (Table 1 Serial 11) to splined end of the control sleeve/wormshaft. Fit dial test indicator.



1 End cover
2 'O' ring seal
3 'O' ring seal
4 Sealing ring
5 Washer
6 Needle bearing
7 Gasket
8 'O' ring seal
9 Nut
10 Plastic bearing cover
11 Circlip
12 Backing ring
13 Gasket
14 Bearing
15 Housing cover
16 'O' ring seal
17 Pressure limiting valve
18 Recuperation valve
19 Housing
20 Plastic shaft cover
21 Mitre box
22 Rocker shaft
23 'O' ring seal
24 Housing cover
25 Bearing
26 Plastic bearing cover
27 Circlip
28 Backing ring
29 Gasket
30 Oil seal
31 Washer
32 Needle bearing
33 Sealing ring
34 Sealing ring
35 Rotary valve/steering spindle
36 Piston assembly
37 Steering limiting valve
38 Control sleeve/wormshaft
39 Torsion bar

Fig 1 Steering box

9.13.2 Holding the recirculating ball tube fully depressed with thumb, rotate handle of torque setting tool 90 degrees either side of a preset position and record the highest deflection.

9.13.3 For correct operation friction torque is between 15 and 20 Ncm.

9.13.4 If the balls fitted are those removed from a previously used steering box the friction torque is likely to be lower than 15 Ncm, in this instance:

9.13.4.1 Use a micrometer to measure the diameter of a ball, then draw from stores a new set of recirculating balls of the same number but one size larger than the ones fitted.

NOTE

If a new set of balls are fitted and the friction torque is greater than 20 Ncm, the ball size will require to be reduced.

9.14 Refit to the piston as detailed in Para 9.9 to 9.11. Re-measure and check highest deflection.

9.15 Repeat the above procedure as necessary until largest deflection is between 15 Ncm and 20 Ncm.

9.16 Remove all unused recirculating balls from the area to avoid mixing different sets together.

9.17 Remove recirculating ball tube and balls from the piston and withdraw the wormshaft.

9.18 Fit sealing ring (5) and 'O' ring seal (19) to worm.

9.19 Fit plastic plugs (18) and sliding tube (4), with inner chamfered edge of sliding tube facing the shoulder on the worm, and secure with snap ring (3).

9.20 Fit the two sealing rings (8), ensure that when fitted the rings are bedded into their recesses and do not stand proud.

9.21 Fit sealing rings (1) and (2) to worm and 'O' ring seal (16) with gasket (17) to piston.

9.22 Refit recirculating balls to piston as detailed in Paras 9.9 to 9.10.

9.23 Fit sealing ring (13), 'O' ring seal (12) and gasket (11) to hole in piston.

9.24 Fit plug (10) and tap into place so that it does not stand proud of piston.

(See Fig 1)

9.25 Fit washer (31) needle bearing (32) to inner face of oil seal (8) in housing.

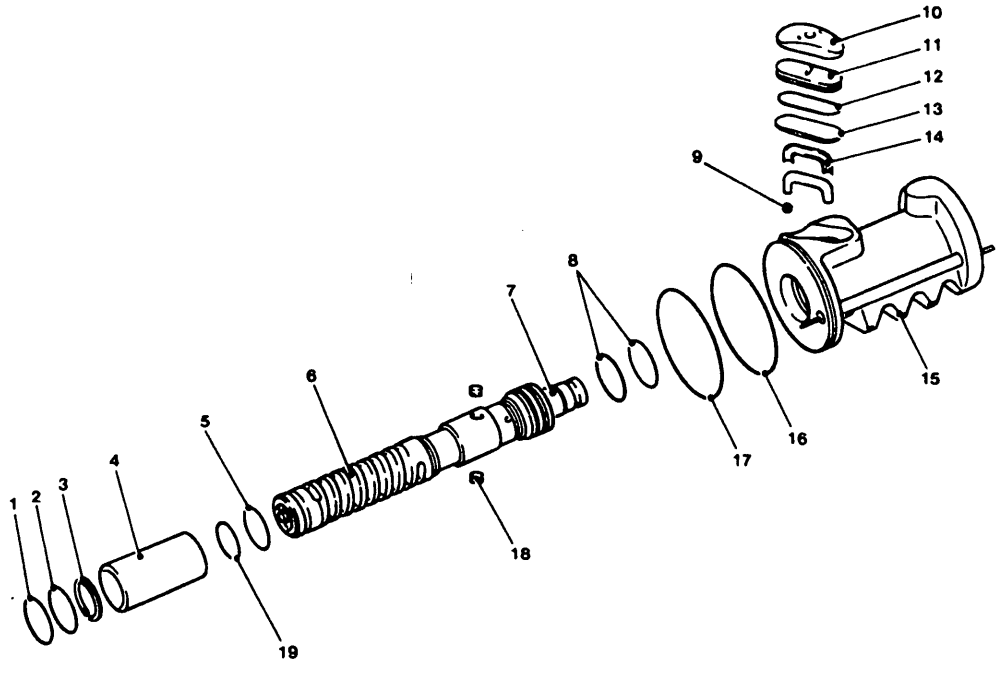
9.26 Turn rocker shaft so that teeth are facing forward towards the large bore of the housing but clear of the housing bore.

9.27 Fit oil seal protection sleeve (Table 1 Serial 6) over spline of worm and fit worm to housing until the piston is far enough in for the teeth to align with the teeth of the rocker arm as shown in Fig 3.

9.28 Turn the rocker arm to fully wind the piston into the housing. Remove the seal protective sleeve.

9.29 Fit washer (5), needle bearing (6), sealing ring (4), 'O' ring seals (3) and (2) to end cover (1).

9.30 Fit end cover to housing and secure. Torque tighten to 189 Nm (139 lbf ft).



1 Sealing ring	10 Plug
2 Sealing ring	11 Gasket
3 Snap ring	12 'O' ring seal
4 Tube	13 Sealing ring
5 Sealing rings	14 Ball tube
6 Control sleeve/wormshaft	15 Piston
7 Rotary valve/steering spindle	16 'O' ring seal
8 Sealing ring	17 Gasket
9 Balls	18 Plastic plugs
	19 'O' ring seal

Fig 2 Piston, control sleeve/wormshaft and rotary valve/steering spindle assembly

Adjusting bearing end float (See Fig 1)

10 To adjust bearing end float:

10.1 Fit dial test indicator clamp (Table 1 Serial 7) and clock gauge to splined end of worm, adjust clock gauge to run against machined end of housing.

10.2 Fit steering arm and operate rocker arm in both directions checking reading of dial test indicator.

10.3 If end float registered on clock exceeds 0.015 mm change washer (5) for a washer of sufficient thickness to reduce the end float to less than 0.015 mm.

10.4 When end float correct remove clock gauge and clamp, fit torque setting tool (Table 1 Serial 5) with worm sleeve adaptor (Table 1 Serial 11) and dial test indicator to splined end of worm.

10.5 Turn torque setting tool handle through 90 degrees each side of central setting and record torque reading.

10.6 If readings are outside the limits 20 Ncm to 40 Ncm, as shown in Fig 4 fit adjuster rings (Table 1 Serial 9) and eccentric bearing adjuster (Table 1 Serial 8), adjust bearings to bring torque setting within limits.

10.7 As shown in Fig 5, align gap of internal circlip equally each side of the uppermost point of the eccentric bearing.

10.8 As shown in Fig 6 fit centre pot alignment tool (Table 1 Serial 10) and torque tighten bolt (1) to 18 to 21 Nm (13.27 to 15.48 lbf ft).

10.9 Reverse centre pot alignment tool and repeat procedure at other bearing.

Testing

11 With suitable test equipment the steering box can be tested to ensure correct operation. On refitting to the vehicle a complete test of the steering as detailed in Cat 522 Chap 7 is to be carried out.

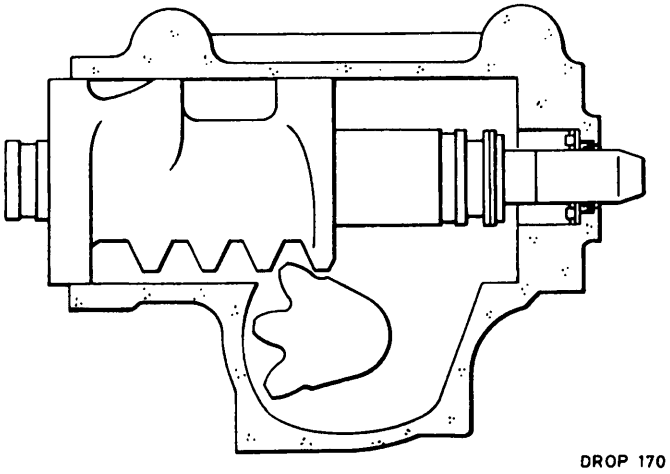


Fig 3 Rocker shaft alignment for fitting piston

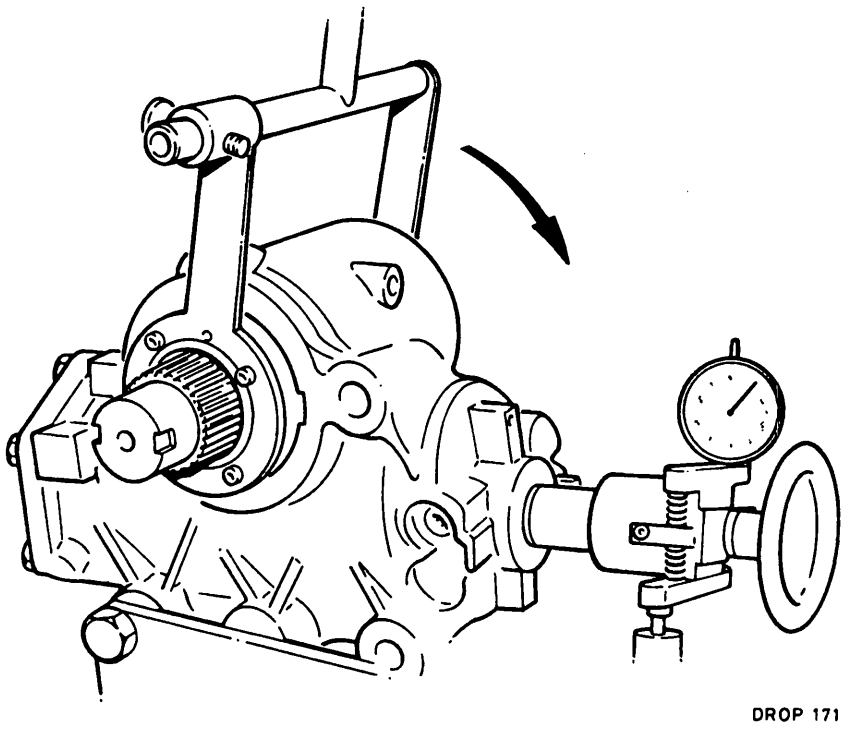


Fig 4 Bearing adjustment using special tool

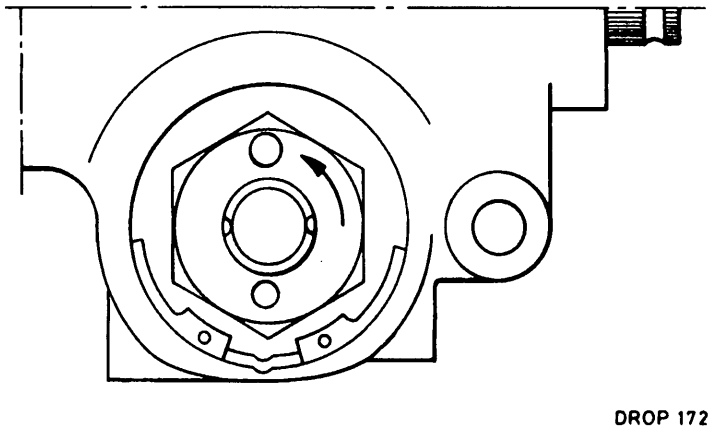
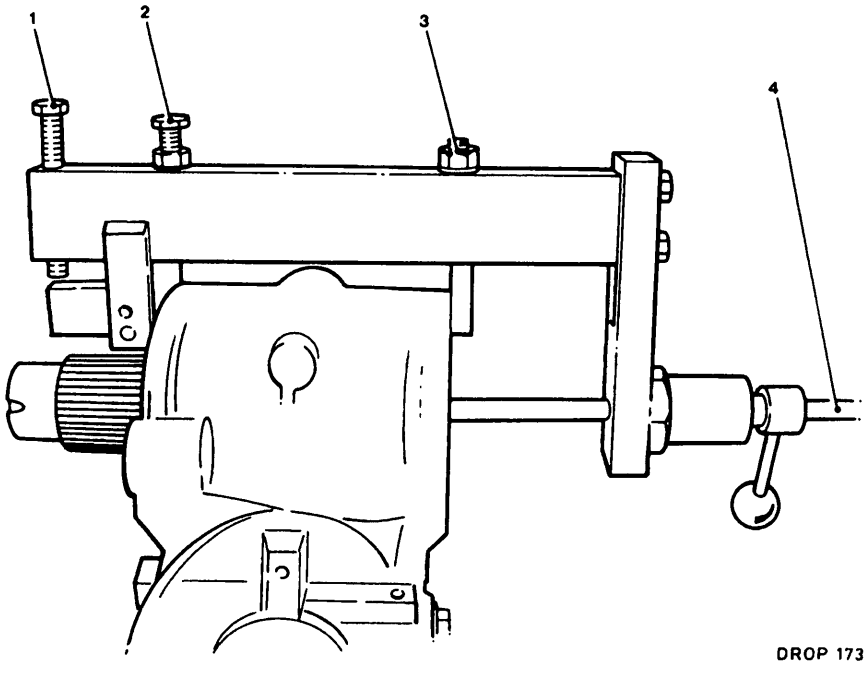


Fig 5 Circlip to bearing alignment



1 Torque setting bolt
2 Height adjustment bolt
3 Length setting bar
4 Centralising bar

Fig 6 Centre pot alignment tool

MAIN STEERING PUMP

General

12 The following tasks assume that the main steering pump has been removed from the vehicle as detailed in Cat 522 Chap 7.

Main steering pump dismantling (See Fig 7)

13 To dismantle the main steering pump:

13.1 Thoroughly clean all external surfaces.

13.2 Release the spring ring (1) and remove the end cover (2) from the housing (12). Withdraw the pressure spring (5).

NOTE

If the cover is found to be difficult to remove, clean off paint and dirt from the cover and housing. Lightly tap the drive end of the drive shaft with a suitable soft hammer to free the cover.

13.3 Remove the cover side faceplate (6).

13.4 Taking care not to damage components, lightly tap the housing, cover end down, onto a wooden surface to free the rotor set (9) and drive-side faceplate (10) and allow them to fall onto the wooden surface. Note the arrow on the cam ring showing direction of rotation. Remove circlip (17).

13.5 Clamp the drive end of the drive shaft (18) in a soft jawed vice and using a suitable soft hammer drive the housing clear of the bearing and shaft.

13.6 Remove the retaining ring (15) from the drive shaft and press off the ball bearing (16).

13.7 Remove shaft seal (14), 'O' ring seals (4), (7), (13) and (20) and backing rings (3) and (8) from housing.

13.8 Remove the screw plug (25), withdraw the pressure spring (23) and piston valve (22) from the housing.

13.9 If necessary remove set pins (11) and (26).

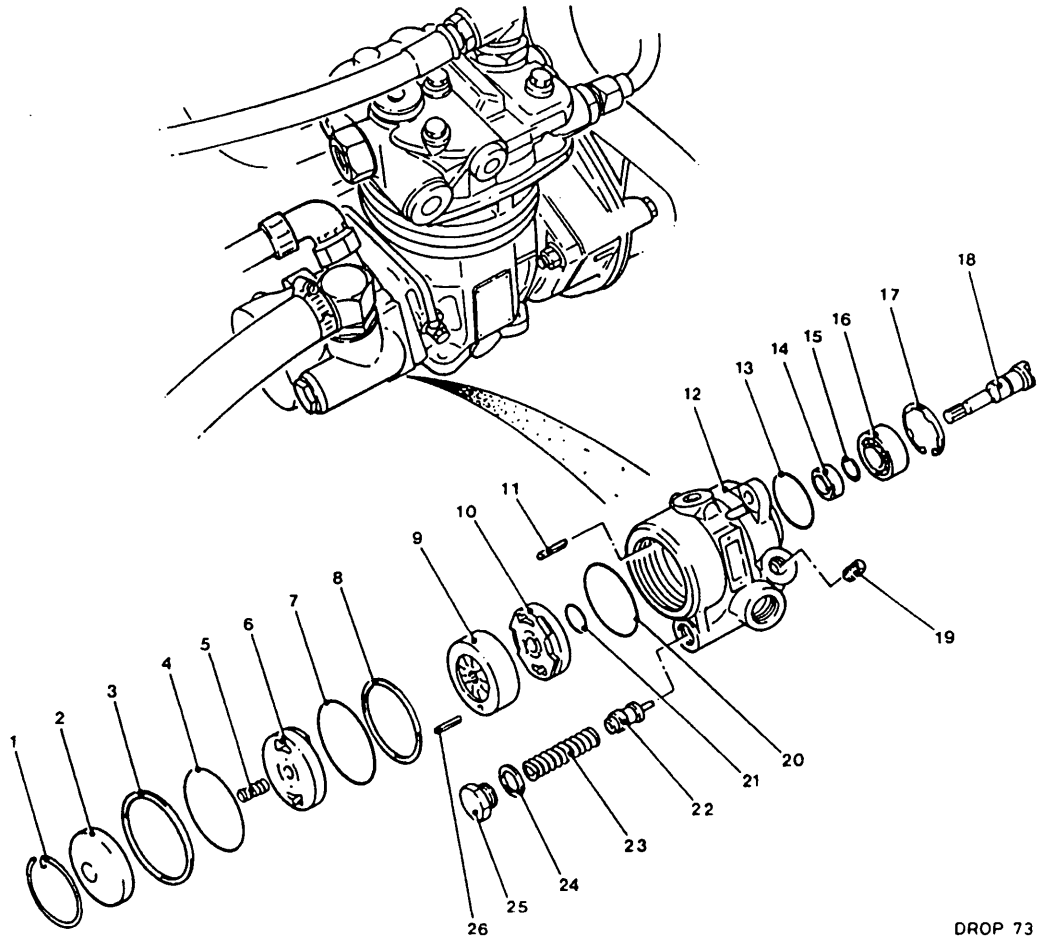
Main steering pump cleaning and inspection

14 Clean and inspect the main steering pump as follows:

14.1 Thoroughly clean all components, check that all machined faces and threads are free from burrs, scores and other damage. Renew any damaged bolts, washers etc.

14.2 If there is wear on the cam ring, rotor or vanes the whole rotor unit is to be renewed.

14.3 Examine the ball bearing as detailed in EMER T & M A 028 Chapter 060.



1 Spring ring
2 End cover
3 Backing ring
4 'O' ring seal
5 Pressure spring
6 Faceplate, cover side
7 'O' ring seal
8 Backing ring
9 Rotor set
10 Faceplate, drive side
11 Set pin
12 Housing
13 'O' ring seal
14 Shaft seal
15 Retaining ring
16 Ball bearing
17 Circlip
18 Driveshaft
19 Throttle insert
20 'O' ring seal
21 'O' ring seal
22 Piston valve
23 Pressure spring
24 Sealing ring
25 Screw plug
26 Set pin

Fig 7 Main steering pump

Main steering pump reassembly (See Fig 7)

15 To reassemble main steering pump:

15.1 Assemble the main steering pump ensuring that new 'O' ring seals and shaft seal are used where appropriate, lightly grease components before reassembly.

15.2 With the writing facing into the pump, using a suitable mandrel, press the shaft seal (14) into the housing (12).

15.3 Fit the long set pin (11) into the housing, fit the 'O' ring seal (13) into housing.

15.4 Press the ball bearing (16) onto the driveshaft (18) and fit retaining ring (15). Fit the bearing and shaft assembly into the housing and ensure that the bearing contacts the housing collar.

15.5 Fit the circlip (17) into the housing.

15.6 Fit 'O' ring seal (20) onto drive side faceplate (10). Slide the drive side faceplate into the housing and over the set pin with the broader side opposite the valve hole.

15.7 With the bezel side facing the drive end insert the rotor into the cam ring. Fit the ten vanes into the rotor with the rounded, polished surfaces facing the cam ring. Ensure vanes are free and move easily.

15.8 Ensuring that the face marked with the arrow is in the same position as when removed, insert the rotor set (9) into the housing.

15.9 Insert the short set pin (26) into the cam ring.

15.10 Fit the two 'O' ring seals (4) and (7) and backing rings (3) and (8) into the housing. The backing rings are fitted so that the inner ring (8) is towards the rotor and the outer ring (3) towards the cover.

15.11 Ensuring that the set pin locates in the hole, fit the cover side faceplate (6).

15.12 Insert the pressure spring (5) into the faceplate. With the entry chamfer facing the pump housing press the end cover (2) into the housing until the spring ring (1) can be inserted. Install the spring ring so that the gap is towards the pressure limiting valve.

15.13 Insert the piston valve (22) and pressure spring (23) into the housing, fit sealing ring and screw in plug (25). Tighten plug, torque to 70 to 80 Nm (52 to 59 lbf ft).

Testing

16 With the main steering pump rigged on suitable test equipment, proceed as follows:

16.1 The test duration will be 8 to 10 minutes at a working temperature of 50°C to 60°C (122°F to 140°F). With a back pressure of 50 bar (725 lbf/in^2).

16.2 Run the pump for approximately 1 min at 500 rev/min at pressure of 10 bar (145 lbf/in^2), to ensure correct running temperature of 50°C to 60°C (122°F to 140°F) is reached.

16.3 Increase pump speed, the pump must reach its maximum pressure of 100 bar (1450 lbf/in^2).

16.4 The minimum flow rate at 500 rev/min is 6.1 ltr^3/min (1.35 gal/min) with a pressure of 50 bar.

16.5 The set flow rate, tested at 1300 rev/min and 50 bar (725 lbf/in^2) is;

High - 15 ltr^3/min (3.3 gal/min)

Low - 10.8 ltr^3/min (2.4 gal/min)

16.6 No leaks are to occur during testing and no abnormal noise or vibration should be apparent over the test range.

EMERGENCY STEERING PUMP

General

17 The following tasks assume that the emergency steering pump has been removed from the vehicle as detailed in Cat 522 Chap 7.

Emergency steering pump dismantling (See Fig 8)

18 To dismantle the emergency steering pump:

18.1 Thoroughly clean all external surfaces.

18.2 Mark each piston (14) and bore to ensure they match on reassembly.

18.3 Carefully remove each of the 16 piston assemblies in turn by unscrewing the slotted screw, remove the 'O' ring seal and withdraw the compression spring (13) and piston (14).

18.4 Release the circlip (19) from the drive end of the eccentric shaft (10).

18.5 Remove the socket headed through bolts securing the drive end cover (2) and free end cover (11) to the housing (15). Stand the pump on its free end cover.

18.6 Separate the drive end cover from the housing, remove the 'O' ring seals (3) and (12) and needle bearing (4) from the inner face of the cover and the ball bearing (18), backing ring (17) and shaft seal (16) from the outer face of the cover.

18.7 Remove the spring washer (5), keyed washer (6) and thrust washer (7). Withdraw the eccentric shaft (10) complete with slip rings (8) and sleeves (9) from the housing.

18.8 Turn the pump to rest on the drive end of the housing Separate the free end cover (11) from the housing.

18.9 Remove the 'O' ring seals (3) and (12), needle bearing (4), thrust washer (7), spring washer (5) and keyed washer (6).

Emergency steering pump cleaning and inspection

19 Clean and inspect the emergency steering pump as follows:

19.1 Thoroughly clean all components, check that all machined faces and threads are free from burrs, scores and other damage.

19.2 Examine the ball bearing as detailed in EMER T & M A 028 Chapter 060.

Emergency steering pump reassembly (See Fig 8)

20 Emergency pump reassembly is the reverse of dismantling, using new 'O' ring seals and shaft seal, lightly grease components before assembly. Torque tighten the cover securing bolts to 50 Nm (37 lbf ft) and the slotted screws to 70 to 80 Nm (51.6 to 59.0 lbf/ft).

Testing

21 With suitable test equipment the pump may be tested to ensure correct operation, with the pump rigged on the test equipment, proceed as follows:

21.1 The test duration will be 8 to 10 minutes at a working temperature of 50°C to 60°C (122 °F to 140°F).

21.2 Run the pump for approximately 1 minute at 100 rev/min at a pressure of 10 bar (145 lbf/in^2) to attain working temperature.

21.3 Increase speed, the pump must reach its maximum pressure of 180 bar (2610 lbf/in^2).

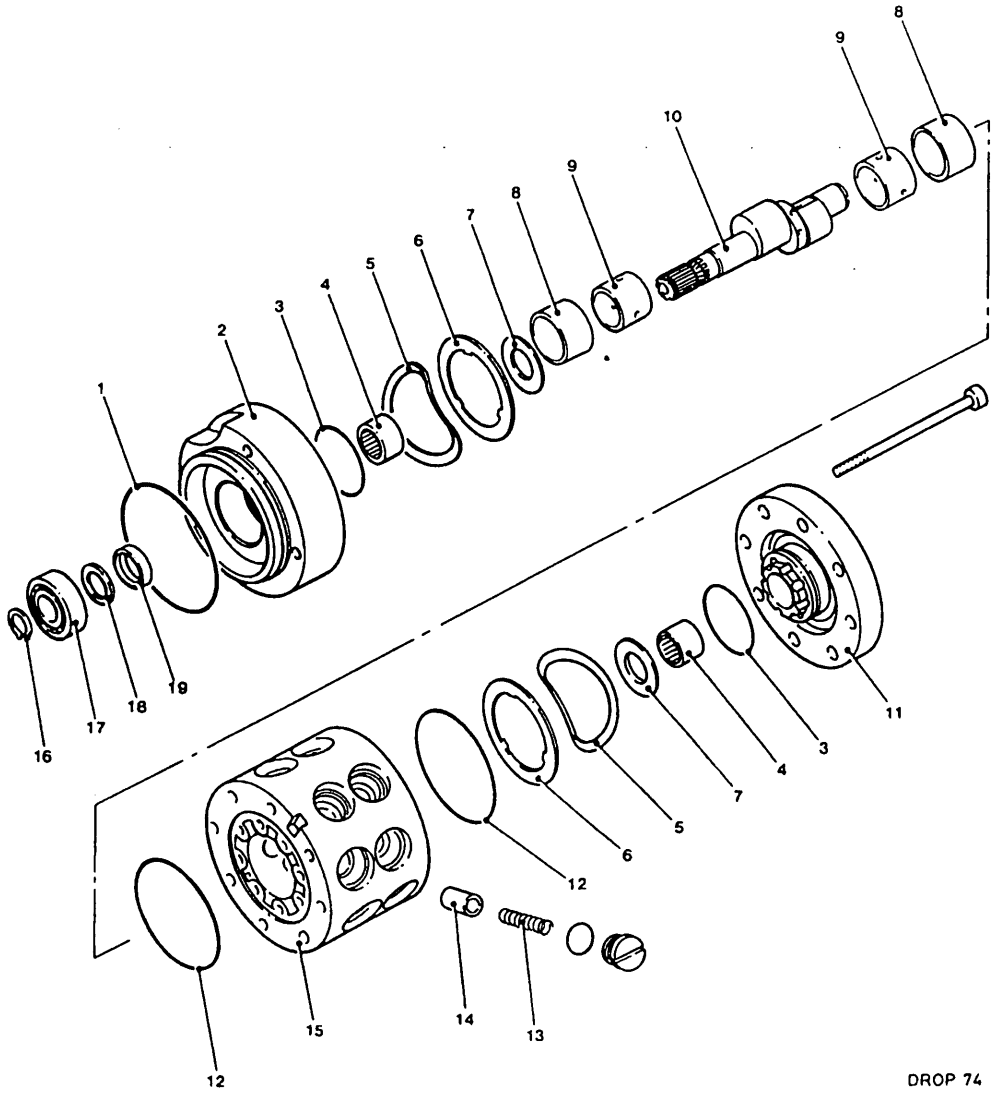
21.4 The minimum flow rate at 350 rev/min at 50 bar (725 lbf/in^2) is 10.0 ltr/min (2.2 gal/min).

21.5 The set flow rate, tested at 1300 rev/min and 50 bar (725 lbf/in^2) is;

High 25 ltr/min (5.5 gal/min).

Low 18 ltr/min (3.9 gal/min).

21.6 No leaks are to occur during testing and no abnormal noise or vibration should be apparent over the test range.



1 'O' ring seal	7 Thrust washer	14 Piston
2 Drive end cover	8 Slip ring	15 Housing
3 'O' ring seal	9 Sleeves	16 Circlip
4 Needle bearing	10 Eccentric shaft	17 Ball bearing
5 Spring washer	11 Outer end cover	18 Backing ring
6 Keyed washer	12 'O' ring seal	19 Shaft seal
	13 Spring	

Fig 8 Emergency steering pump

BOOST CYLINDER (See Fig 9)

General

22 The following tasks assume that the boost cylinder has been removed from the vehicle as detailed in Cat 522 Chap 7.

Boost cylinder dismantling

23 Thoroughly clean all external surfaces. With the cylinder (1) firmly supported proceed as follows:

23.1 Remove ball joints from cylinder and rod.

23.2 Remove circlip (6) from the piston rod end of the cylinder (1).

23.3 Push down slightly on the piston rod guide (10) to free the snap ring (9), remove the snap ring.

23.4 Withdraw the piston rod (12) complete with piston rod guide (10) and piston (3) from the cylinder.

23.5 Remove the piston rod guide from the piston rod. Push the wiper ring (7) out of the guide and remove the sealing ring (8) and 'O' ring seal (11) from the guide.

23.6 Remove piston sealing ring (4) and scraper rings (2) and (5) from the piston.

23.7 Hold the piston rod between the soft jaws of a vice and remove the self locking nut. To aid in this fit a suitable spanner to the flats on the piston rod and apply counter pressure.

23.8 With the self locking nut removed the piston can be freed from the piston rod by tapping with a soft hammer.

Boost cylinder cleaning and inspection

24 Clean and inspect the cylinder components as follows:

24.1 Discard all old seals and gaskets, thoroughly clean all other components.

24.2 Check the piston rod for damage or wear, check bore of cylinder and piston circumference for signs of wear caused by contamination. Inspect all components for damage, ensure all machined faces and threads are free from burrs.

Boost cylinder reassembly

25 Reassembly of the boost cylinder is the reverse of dismantling but the following must be observed:

25.1 When inserting the piston assembly into the cylinder use valve piston clamping sleeve (Table 1 Serial 1) to prevent damage to the piston sealing ring and scraper rings.

25.2 When inserting the piston rod guide into the cylinder ensure that the flat machined on the guide aligns with the inlet hole in the cylinder.

1 Cylinder
2 Scraper ring
3 Piston
4 Sealing ring
5 Scraper ring
6 Circlip
7 Wiper ring
8 Sealing ring
9 Snap ring
10 Guide
11 'O' ring seal
12 Piston rod

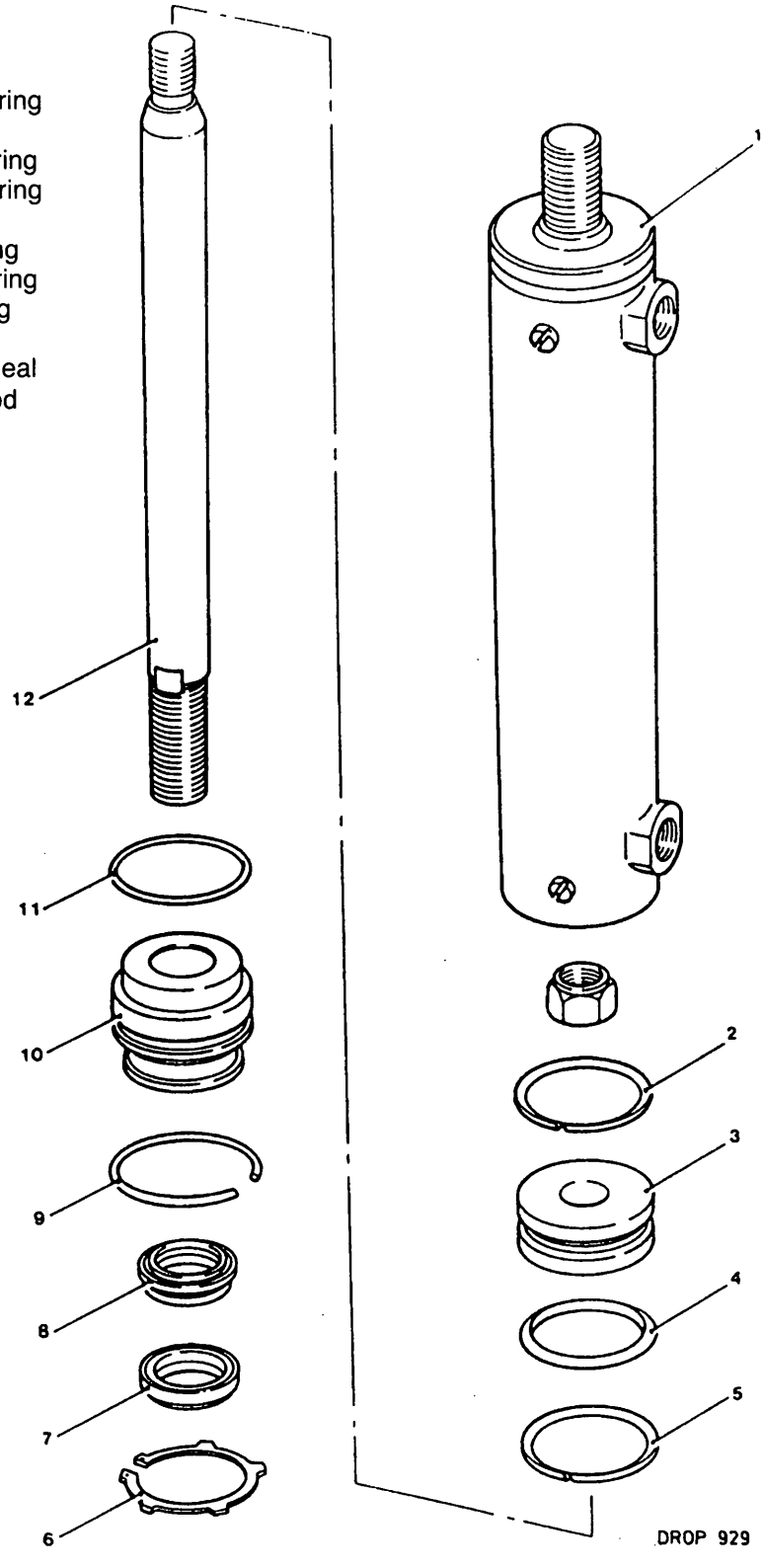


Fig 9 Boost cylinder

CHAPTER 8

SUSPENSION

CONTENTS

GENERAL

1 Suspension repairs at Maintenance Levels 3 and 4 are confined to the exchange of frame brackets, spring trunnions, side plates, bearings and oil retainers.

SPECIAL TOOLS AND TEST EQUIPMENT

2 No special tools or test equipment are required to carry out the tasks detailed in this chapter.

SUSPENSION

NOTE

The front and rear suspension assemblies are of similar construction, the only difference being the shape of the frame bracket, lower bracket and cap support bracket. The procedures detailed in this chapter are for a front suspension unit but can be followed for the same tasks on the rear suspension units.

Dismantling (See Fig 1)

3 With the suspension removed from the vehicle and the springs and torque rods removed as detailed in Cat 522 Chap 8, dismantle the suspension unit as follows:

3.1 Separate the lower brackets (15) from the frame bracket (1) by removing the self locking nuts (16) and (17) together with bolt (18) and spring washer. Withdraw the lower bracket from studs (2) and (22), noting the position of the two longer studs (2).

3.2 Mark cap support bracket (23) and frame bracket cap (32) to ensure correct reassembly.

3.3 Remove the split pins (31) and unscrew self locking nuts (24) and (29), ease off each nut in a diagonal sequence so that the frame bracket caps are released evenly.

3.4 Remove the frame bracket caps, releasing the side plates (8) complete with the trunnion assembly.

3.5 Place the side plates and trunnion assembly onto a suitable working surface, from each end of the trunnion shaft (36) remove the end cap (13) complete with 40 needle rollers (12). Retain the rollers safely together for assembly.

3.6 Once the end caps are removed from the trunnion shafts, remove felt washer (11), oil retainer (10) and dowel pin (20). Retain the dowel pin and discard the felt washer.

3.7 If a new end cap is being fitted, remove the nipples (14) for assembly into replacement.

3.8 Clamp the side plates and trunnion shaft into a vice, remove the split pins (34) and remove the castellated nuts (33). Withdraw the bolts (9) from the side plates.

3.9 Using a soft headed mallet, tap the side plates free of the trunnion shaft.

3.10 If required, the thrust buttons (35) can be removed from the ends of the trunnion shaft.

Cleaning and inspection (See Fig 1)

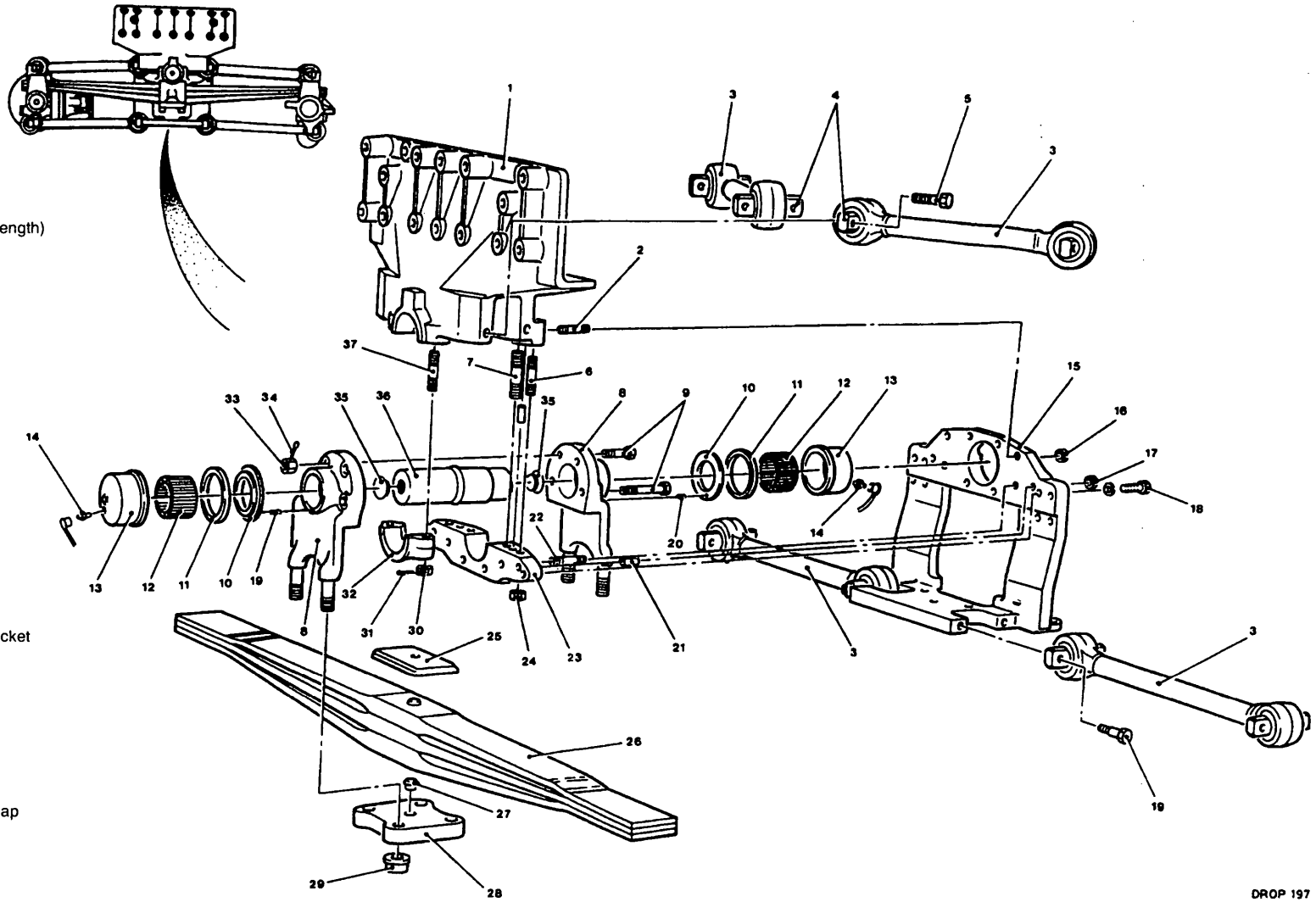
4 Using approved methods and materials, thoroughly clean all components. Obtain new felt washers (11) and soak in clean oil OÉP 220 until fully impregnated.

5 Inspect all bearing components in accordance with EMER T&M A 028 Chap 060. Inspect for signs of indentation on the upper half of the trunnion shaft (36) and end caps (13).

NOTE

If indentations are present on the upper half of the trunnion shaft and/or end caps it is permissible to rotate them through 180° on reassembly to obtain further service.

6 Inspect all items for wear or damage, renew items as necessary.



1 Frame bracket
2 Stud (2 x extra length)
3 Torque rods
4 Mounting bars
5 Bolt
6 Stud
7 Stud
8 Side plate
9 Bolts
10 Oil retainer
11 Felt washer
12 Needle rollers
13 End cap
14 Nipple
15 Lower bracket
16 Self locking nut
17 Self locking nut
18 Bolt
19 Bolt
20 Dowel pin
21 Dowel
22 Stud
23 Cap support bracket
24 Self locking nut
25 Packing plate
26 Road spring
27 Pip
28 Clamp plate
29 Self locking nut
30 Castellated nut
31 Split pin
32 Frame bracket cap
33 Castellated nut
34 Split pin
35 Thrust button
36 Trunnion shaft
37 Stud

Fig 1 Front suspension assembly

Reassembly (See Fig 1)

7 Reassemble the suspension unit as follows:

7.1 Locate the side plates (8) onto the trunnion shaft (36) ensuring that the bolt holes align.

NOTE

Some torque figures differ between front and rear suspension units, both figures are stated in the relevant text.

7.2 Fit bolts (9) and castellated nuts (33) to the side plates, torque tighten nuts to 232 to 256 Nm (171 to 189 lbf ft). Fit split pins (34). If removed, refit the thrust buttons (35) to the ends of the trunnion shaft.

7.3 Fit the oil impregnated felt washers (11), (See Para 4), onto the oil retainers (10).

7.4 Fit the dowel pins (20) into the oil retainers and locate the retainers onto the trunnion shaft taking care that the dowel pins locate into the holes in the side plates.

7.5 Smear a thin layer of XG 279 grease inside each end cap (13) and locate the 40 needle rollers (12) into each cap.

7.6 Push the assembled end caps and rollers onto the trunnion shaft.

7.7 Using a stud box and torque wrench, check the tightness of studs (6) (front suspension only) 77 to 85 Nm (57 to 63 lbf ft) and studs (7) and (37) 232 to 256 Nm (171 to 189 lbf ft).

7.8 With the frame bracket (1) suitably secured, locate the side plate and trunnion assembly into the frame bracket.

7.9 Fit the cap support bracket (23) and frame bracket cap (32) ensuring correct fit onto the locating dowels and alignment to the markings, scribed on removal.

7.10 Secure the caps in position with four castellated nuts (30), torque tighten diagonally in sequence, 335 to 370 Nm (247 to 273 lbf ft).

7.11 Fit two self locking nuts (24) (front suspension only), torque tighten both nuts, 354 to 392 Nm (261 lbf ft to 289 lbf ft).

7.12 Using a stud box and torque wrench, check the tightness of studs (2) and (22), to 85 Nm (57 to 63 lbf ft) (front suspension), 117 to 127 Nm (86 to 94 lbf ft) (rear suspension).

7.13 Ensuring correct location of the two longer studs (2), fit the lower brackets onto the studs (2) and (22), ensure bracket locates on dowel (21). Secure with self locking nuts (16) and (17), torque tighten, 354 to 392 Nm (261 to 289 lbf ft) (front suspension), 387 to 427 Nm (285 to 315 lbf ft) (rear suspension).

7.14 Refit nipples (14) onto end caps and charge the assembly with XG 279 grease until grease is seen to issue from around the felt washer.

7.15 Refit springs and torsion arms and refit to the vehicle as detailed in Cat 522 Chap 8.

CHAPTER 10

AIR PRESSURE AND BRAKING SYSTEM

CONTENTS

TABLE 1 SEALANTS, ADHESIVES AND LUBRICANTS

Serial (1)	NSN (2)	Manfr No (3)	Designation (4)
1	H1/8030-99-224-9318	Loctite 270	Adhesive
2	H1/8040-99-914-4933	Bostik 772	Adhesive
3		XG 261	Silicone grease

AIR COMPRESSOR (See Fig 1)

General

1 The following tasks assume the compressor has been removed from the vehicle as detailed in Cat 522 Chap 10.

Dismantling

2 Before dismantling thoroughly clean all external surfaces of the compressor and ensure that the working area is clean. Place the compressor upright on the working surface and proceed as follows:

2.1 With a suitable container available to catch any oil, remove the blanking plugs (22) from the base of the crank case (23).

2.2 Unscrew and remove the four cylinder head bolts (2) and washers. Lift the cylinder head (3) complete with valve plate (7) clear of the cylinder block (23). Remove and discard the cylinder gasket (24).

2.3 Unscrew the bolt (1) securing the valve plate (7) to the cylinder head (3). Separate the valve plate and cylinder head, remove and retain disc valves (6) and (26) and springs (5) and (25). Remove and discard gasket (4).

2.4 Using a suitable socket key wrench unscrew and remove the big end cap screws (19). Carefully, so as to avoid damage to the bearing shells (12) and (17) separate the big end cap (18) and connecting rod (11).

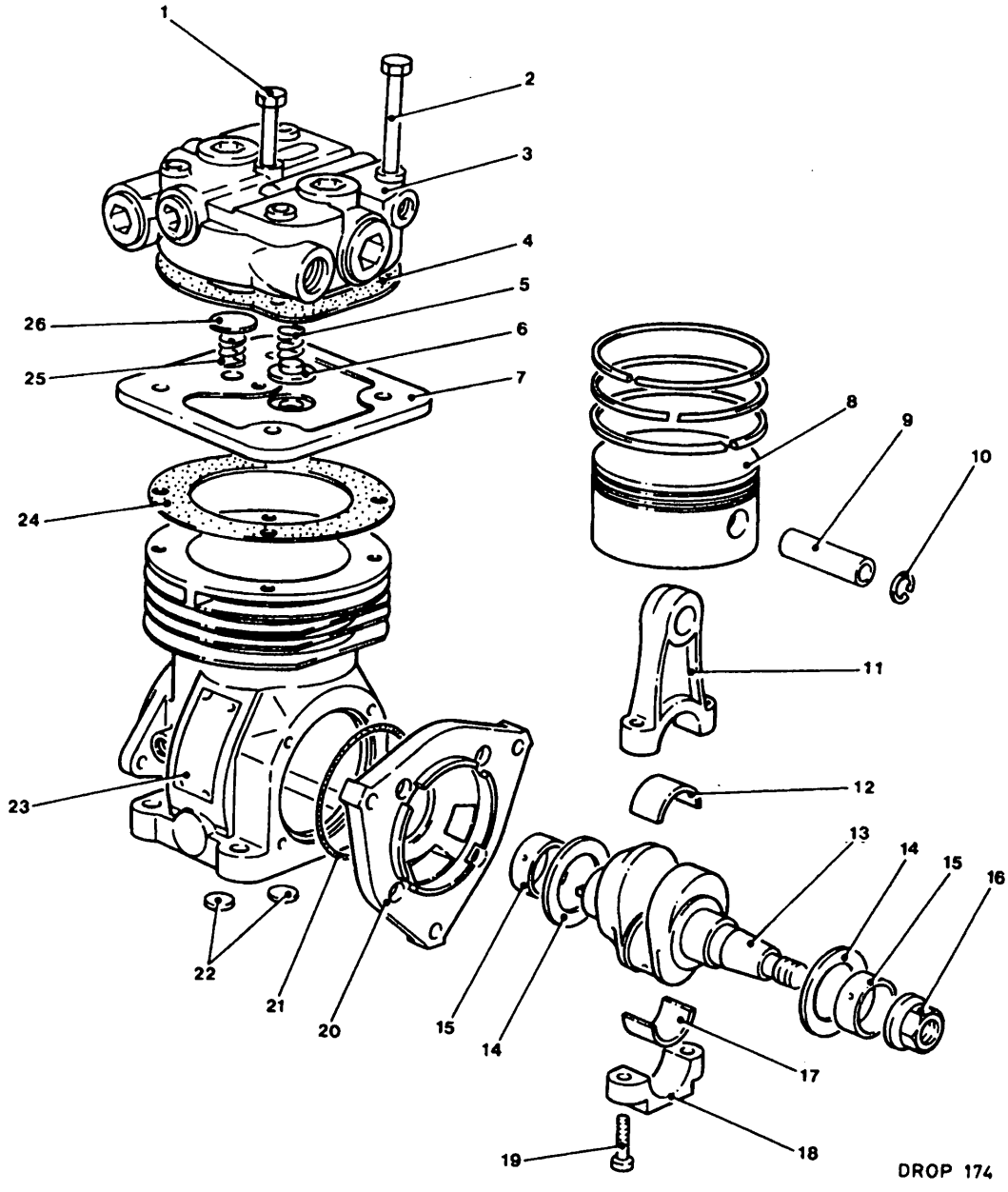
2.5 Withdraw the piston (8) complete with connecting rod through the top of the cylinder. Recover the big end cap and bearing shells.

2.6 Release the circlips (10) and separate the piston and connecting rod by withdrawing the gudgeon pin (9).

2.7 Unscrew and remove the four socket head bolts securing the mounting plate (20). Remove the mounting plate complete with plain bearing (15) from crank case and crank shaft (13). Remove and discard sealing ring (21).

2.8 Withdraw the crank shaft from crank case, ensure that the thrust washers (14) are removed and retained.

2.9 Remove plain bearing (15) from free end of crank case.



1 Bolt	10 Circlip	19 Cap screws
2 Cylinder head bolts	11 Connecting rod	20 Mounting plate
3 Cylinder head	12 Bearing shell	21 Sealing ring
4 Gasket	13 Crank shaft	22 Blanking plugs
5 Spring	14 Thrust washer	23 Crank case/cylinder block
6 Disc valve	15 Plain bearing	24 Cylinder gasket
7 Valve plate	16 Nut	25 Spring
8 Piston	17 Bearing shell	26 Disc valve
9 Gudgeon pin	18 Big end cap	

Fig 1 Air compressor

Inspection and cleaning

3 Using an approved cleaning fluid thoroughly clean all components and inspect for wear and damage, renew as necessary. Pay particular attention to cylinder bore and piston for signs of scuffing, crankshaft journals and valve seats.

Reassembly

4 Use new gaskets and circlips on reassembly. Lubricate bearings, shells and seals with SAE 20/30 oil. To reassemble the compressor proceed as follows:

4.1 Ensure plain bearing (15) is correctly located in the free end of the crank case.

4.2 Locate the thrust washer (14) onto the crank shaft (13) and fit the crank shaft into the free end bearing.

4.3 Locate the thrust washer (14) onto the crank shaft. Ensure plain bearing (15) is correctly located in the mounting plate.

4.4 Fit new sealing ring (21) and locate mounting plate onto crank shaft and crank case, secure with four socket headed bolts.

4.5 Check crank shaft for freedom of rotation. Ensure end float is within the limits 0.08 mm minimum to 0.38 mm maximum (0.003 in min to 0.015 in max).

4.6 Ensure piston rings are fitted to the piston (8) correctly, with gaps at approximately 120 degrees to each other and with TOP mark on rings uppermost.

4.7 Ensure the gudgeon pin (9) is a sliding fit in the small end bush. Fit the piston to the connecting rod and fit circlip (10).

4.8 Using a light smear of grease to hold them into position, fit the bearing shells to the connecting rod and big end cap (18). Locate big end cap onto crank shaft.

4.9 Lubricate the piston and, using a suitable ring compressor, insert the piston and connecting rod into cylinder.

4.10 With the connecting rod and big end cap correctly positioned, fit big end cap screws (19), tighten down evenly. Rotate crank shaft to check for freedom of movement.

4.11 Locate the disc valves (6), (26) and springs (5), (25) to the valve plate (7) and cylinder head (3), fit the gasket (4) and secure the valve plate to the cylinder head with the single bolt (1). Check, through the valve ports, valve discs for freedom of movement.

4.12 Position the cylinder gasket (24), fit the cylinder head and valve plate assembly. Fit the four cylinder head bolts (2) and washers, tighten down evenly.

4.13 Smear the blanking plugs (22) with sealant (Table 1 Serial 1). Fit into the crank case ensuring they fit square to the base.

Testing

5 On reassembly mount the compressor on a suitable test rig. Run to a maximum speed of 3000 rev/min and ascertain that a maximum working pressure of 10 bar (145 lbf/in^2) is reached and maintained for 10 min. Check for leaks and smooth running with no signs of overheating, maximum working temperature is 220°C (428°F).

COMPRESSED AIR DRYER (See Fig 2)

General

6 The following tasks assume that the compressed air dryer has been removed from the vehicle as detailed in Cat 522 Chap 10.

Dismantling

7 To dismantle air dryer proceed as follows:

7.1 Unscrew the bolts (10), release the clamps (9) and retaining ring (17), remove the bottom end plate.

7.2 Unscrew the long stud (21), withdraw the desiccant cartridge (7) and desiccant plate (25) from dryer body (18).

7.3 Check that the oil filter (19) is not clogged with oil or dirt. When the oil filter requires renewal or there is evidence of desiccant contamination, unscrew the desiccant cartridge (7) from the desiccant plate (25).

7.4 Unscrew the spring seat (6) from the long stud, remove the conical spring (24), remove the top perforated filter plate (23), desiccant pellets, bottom perforated filter plate (20 and oil filter (19).

Inspection and cleaning

8 Clean the dryer body (18), body division plate and desiccant plate (25). Examine the first non-return valve (5) for correct seating and check the purge vent (4) is clear. Examine the purge valve (15), renew valve spring, 'O' seal or complete valve assembly as required. Clean the heater element (11), check operation of the thermostat (cut in at 10°C (50°F)) by placing into a container of water containing a thermometer and heating the water to the operating temperature.

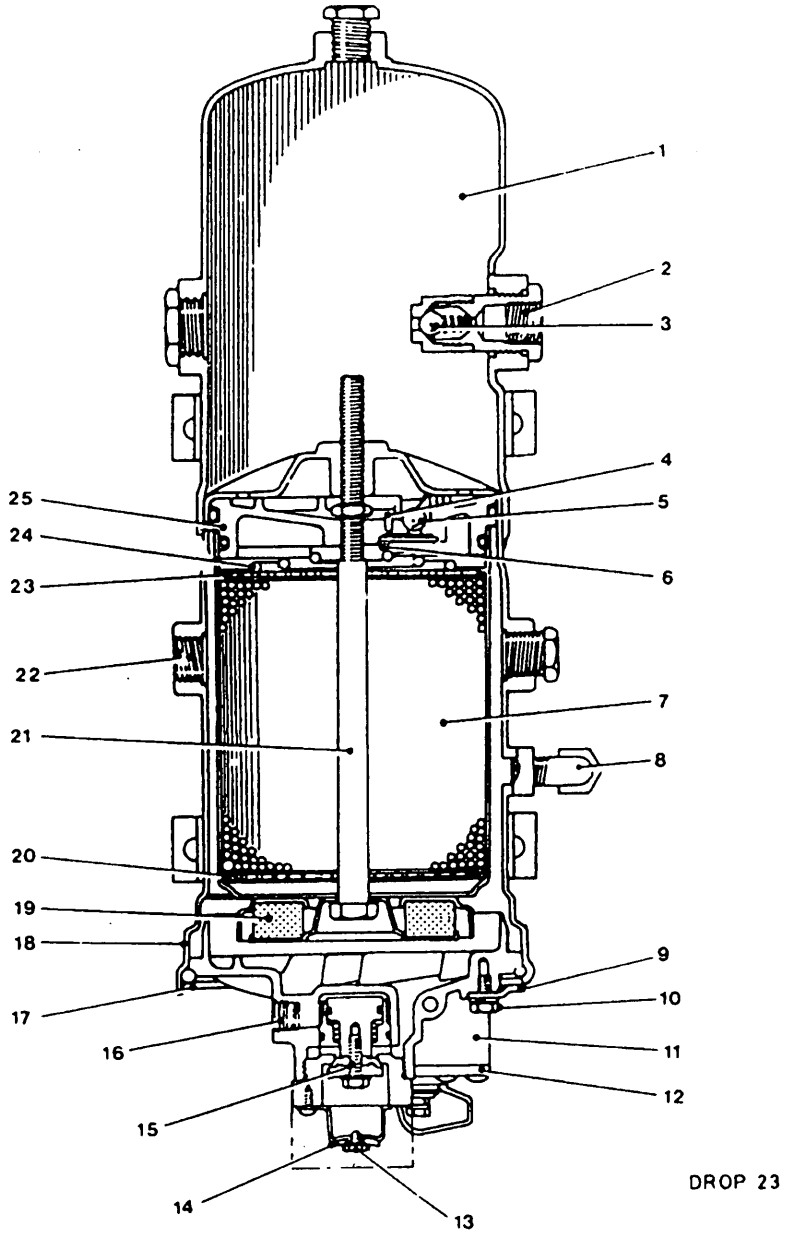
9 Examine the safety valve for signs of damage, check the ball valve for signs of pitting or scratches. Clean valve seat thoroughly.

Reassembly

10 Use overhaul kit on reassembly. Lubricate all 'O' seals with silicone grease (Table 1 Serial 3). To reassemble the dryer proceed as follows:

10.1 Locate the ball valve in the safety valve body, replace the pin, spring and spring seat, into the spring cage. Screw the spring cage into the valve body.

10.2 Before fitting the safety valve to the dryer, using suitable test equipment check the correct operation of the valve ensuring it lifts at 11 bar (160 lbf/in^2).



1 Purge chamber
2 Output port
3 Second non-return valve
4 Purge vent
5 First non-return valve
6 Spring seat
7 Desiccant cartridge
8 Safety valve
9 Clamp
10 Bolt
11 Heater
12 Thermostat
13 Screw
14 Diaphragm
15 Purge valve
16 Governor valve connection
17 Retaining ring
18 Dryer body
19 Oil filter
20 Perforated filter plate
21 Long stud
22 Inlet port valve
23 Perforated filter plate
24 Conical spring
25 Desiccant plate

Fig 2 Compressed air dryer

10.3 Screw the safety valve onto the dryer body.

10.4 Fit 'O' seals to the desiccant plate (25).

10.5 Fit oil filter (19) and lower filter plate (20) onto the long stud, fit the desiccant cartridge (7) and refill with desiccant pellets, fit the upper perforated filter plate (23).

10.6 Locate the conical spring (24) and screwed spring seat (6) onto the long stud.

10.7 Screw the complete cartridge assembly into the dryer body.

10.8 Replace the bottom end plate, fit retaining ring (17), secure with clamps (9) and bolts (10).

SPRING BRAKE ACTUATOR (See Fig 3)

General

11 The following tasks assume that the actuator has been removed from the vehicle as detailed in Cat 522 Chap 10.

Dismantling

WARNING

A POWERFUL SPRING UNDER HIGH PRESSURE IS FITTED IN THE SPRING BRAKE ACTUATOR POWER SPRING CHAMBER. ON NO ACCOUNT IS A SPRING BRAKE ACTUATOR CLAMP RING TO BE RELEASED BEFORE THE POWER SPRING RELEASE BOLT IS WOUND OFF AND THE SERVICE BOLT PUSH ROD IS HOLDING THE RETURN SPRING UNDER SLIGHT TENSION.

NOTE

The manufacturer only supplies spare service brake diaphragm (21) and return spring (22), therefore there is no requirement to gain entry into the power spring chamber (17).

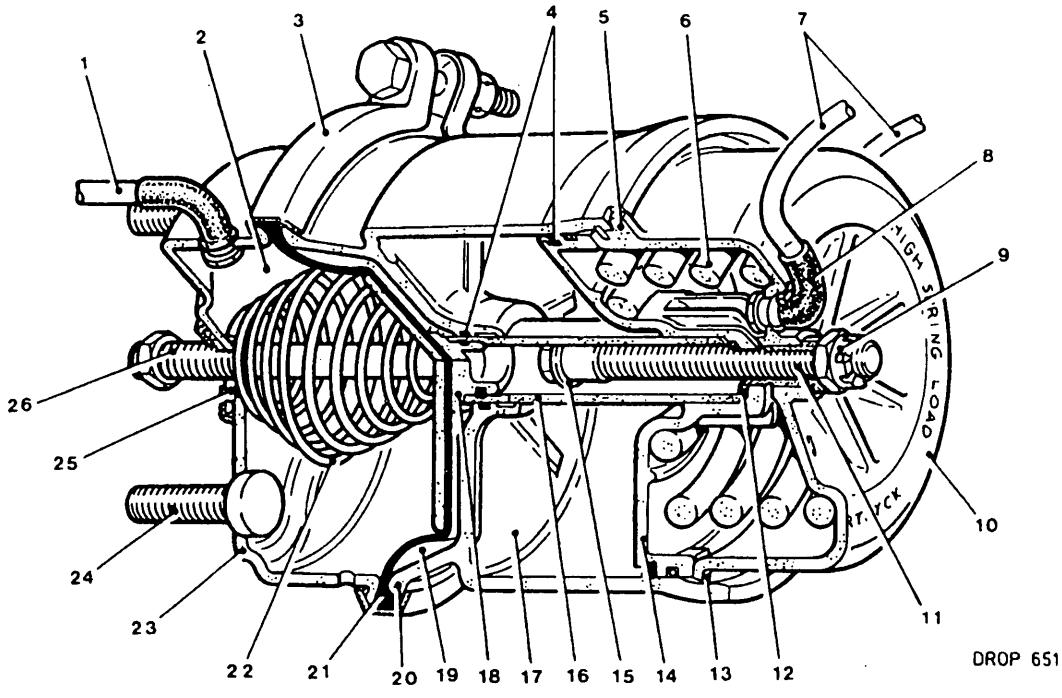
12 Dismantle the service brake chamber (2) of the actuator as follows:

12.1 Remove the split pin from the castle nut (9) and wind off the power spring release bolt (11) until the bolt collar (15) contacts the shoulder (12) (at this point the free end of the spring release bolt will protrude approximately 3 in.).

12.2 Remove the nut from the end of the push rod (26), locate a length of tube or a collar over the push rod, of sufficient length as to allow the nut to engage the thread, and of sufficient diameter to sit over the push rod wiper (25) and still fit under the nut (it may require that a large plain washer is fitted over the tube/collar to allow the nut to be effective).

12.3 Tighten the nut onto the tube/collar sufficiently to allow the push rod to put the return spring (22) under slight tension.

12.4 Disconnect the breather pipe (1) from the elbow connector (8).



1 Breather pipe
2 Service brake chamber
3 Clamp ring
4 Seals
5 Alignment lug
6 Power spring
7 Breather pipe
8 Elbow connector
9 Castle nut and pin
10 Casing head
11 Spring release bolt
12 Shoulder
13 Snap ring
14 Spring brake piston
15 Bolt collar
16 Piston tube
17 Power spring chamber
18 Push pad
19 Service pressure chamber
20 Power spring housing
21 Service brake diaphragm
22 Return spring
23 Service brake housing
24 Mounting stud
25 Push rod wiper
26 Push rod

Fig 3 Spring brake actuator

12.5 Slacken the retaining nut of the clamp ring (3) and remove the clamp ring. Separate the service brake sub-assembly from the power spring housing (20) and remove the power spring housing to a place of safety, noting that the power spring is still under tension.

12.6 If the push pad (18) was adhered to rear face of the service brake diaphragm (21), remove and retain for reassembly.

12.7 Remove the service brake diaphragm from the push rod plate and discard.

12.8 If it is required to exchange the return spring, slowly slacken back on the push rod nut until all tension is removed from the return spring.

12.9 Remove the nut and tube/collar and feed the free end of the push rod through the end plate of the service brake chamber (2), remove the return spring.

Reassembly

13 Reassemble the service brake chamber as follows:

13.1 If removed, fit the return spring (22) over the push rod (26) and locate the free end of the push rod through the hole in the service brake chamber (2) end plate, taking care not to damage the push rod wiper (25).

13.2 Fit the nut and tube/collar to the free end of the push rod and tighten the nut until the return spring is under slight tension.

13.3 Locate the service brake diaphragm (21) centrally onto the push pad (18) in a manner that the edges overlap the outer rim of the power spring housing (20).

13.4 Position the service brake housing (23) to enclose the diaphragm and secure with the clamp ring (3). Torque tighten the clamp ring nut to 20 Nm (15 lbf ft).

13.5 Slacken the nut on the end of the push rod and remove the tube/collar, replace the nut.

13.6 Ensure the clamp ring fully encloses the rims of both the service brake case and the power spring housing before proceeding to slacken the castle nut (9).

13.7 Slacken back the castle nut until all tension is removed from the power spring and the split pin can be engaged through the castle nut and the power spring release bolt.

13.8 Fit the plastic breather pipe to the elbow connector (8).

Testing

14 The unit can only be tested on a working system unless a clean air supply of approximately 8.5 bar (123 lb/in^2) and fittings to suit the actuator connections (3/8 in. NPTF are available. If testing facilities are available proceed as follows:

14.1 Connect air lines to the air connections on both the service brake case and the power spring housing.

14.2 With no air applied, measure the exposed length of the push rod.

14.3 Apply air pressure to the power spring brake chamber. Measure the exposed length of the push rod. For correct operation it should retract a minimum of 64mm (2.5 in) with air in the power spring chamber.

14.4 Apply air to the service brake chamber. Measure the exposed length of the push rod, it should be the same length as that measured at Para 14.2.

14.5 Remove air pressure from both chambers, vent the chambers and check that the push rod is still fully extended.

14.6 Disconnect and remove test equipment.

CHAPTER 11

FUEL AND EXHAUST SYSTEM

CONTENTS

GENERAL

1 All level 3 repair tasks detailed for the fuel and exhaust systems are detailed in existing documentation as listed below.

ASSOCIATED PUBLICATIONS

2 Associated publications used for this document are detailed below:

Reference	Title
AESP 2815-K-720-523	Engine, Diesel, 6CYL, RR/Perkins Eagle Type 350 (DROPS)
AESP 2910-C-101-523	Bosch Fuel Injection Pump PS 7100 Series
EMER Pwr M 102 Chap 5 Pt 1	Inspecting and Testing Fuel Injection Pumps and Governors
EMER Pwr M 102 Chap 6	General Requirements for Repair Testing
EMER Pwr M 340	Fuel Injection Equipment - Fuel Injectors

FUEL INJECTOR OPENING PRESSURES

3 The figures used when setting the fuel injectors are:

Set Pressure - 230 Atmospheres
Working Pressure - 220 Atmospheres

CHAPTER 13

ELECTRICAL SYSTEM

CONTENTS

WIRING LOOM/CABLE REPLACEMENT

General

1 Four principle chassis wiring looms can be replaced at this level. The remainder of the field and base level repair tasks for the electrical system are detailed in Chap 3 or 14 of this publication or in the associated publications listed below:

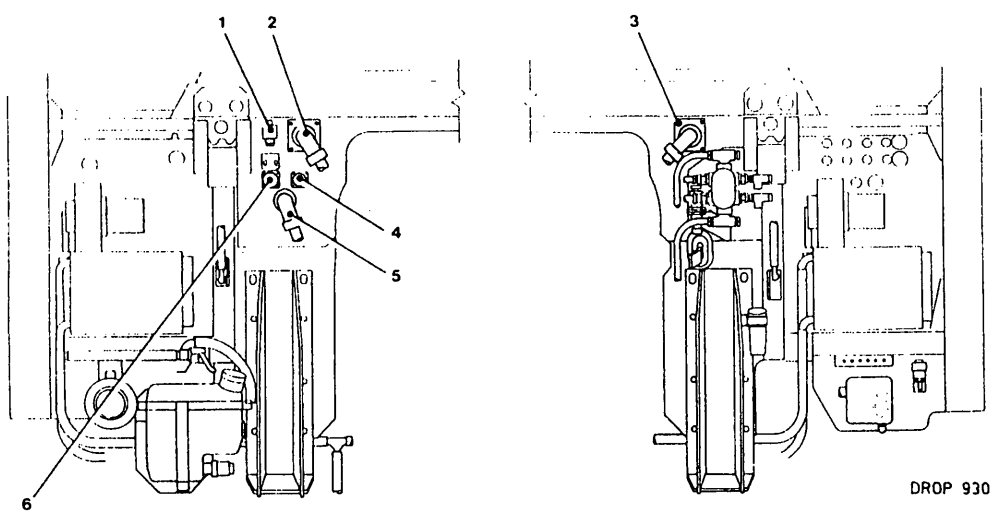
Associated publications

2 The following associated publications are to be used for the field and base level repair tasks detailed for the electrical system and not covered by this publication:

Code	Type	Title
2920-C-102-523	AESP	LUCAS AC172R Alternators
320/5 and 329/5	EMER	Power SU Butec Starter Motors
2520-C-116-513	AESP	ZF Transmission Control Panel
2520-C-116	AESP	Gearbox, Automatic, ZF HP600 (DROPS)

Cab front bulkhead plugged connectors (See Fig 1)

3 The four principle chassis wiring looms are connected to the cab control panels by through plugs, fitted to the cab front bulkhead. Secondary cables are connected through housing terminals to the selected units. Looms and cables are secured throughout the vehicle with expendable plastic tie-wraps.



1 Anti-gas solenoid (MV7)
2 Tailrun loom
3 Engine loom
4 ZF main gearbox loom (10 pole)
5 Cooking pot loom
6 ZF main gearbox loom (19 pole)

Fig 1 Cab front bulkhead plugged connections

Tailrun loom replacement (See Fig 2)

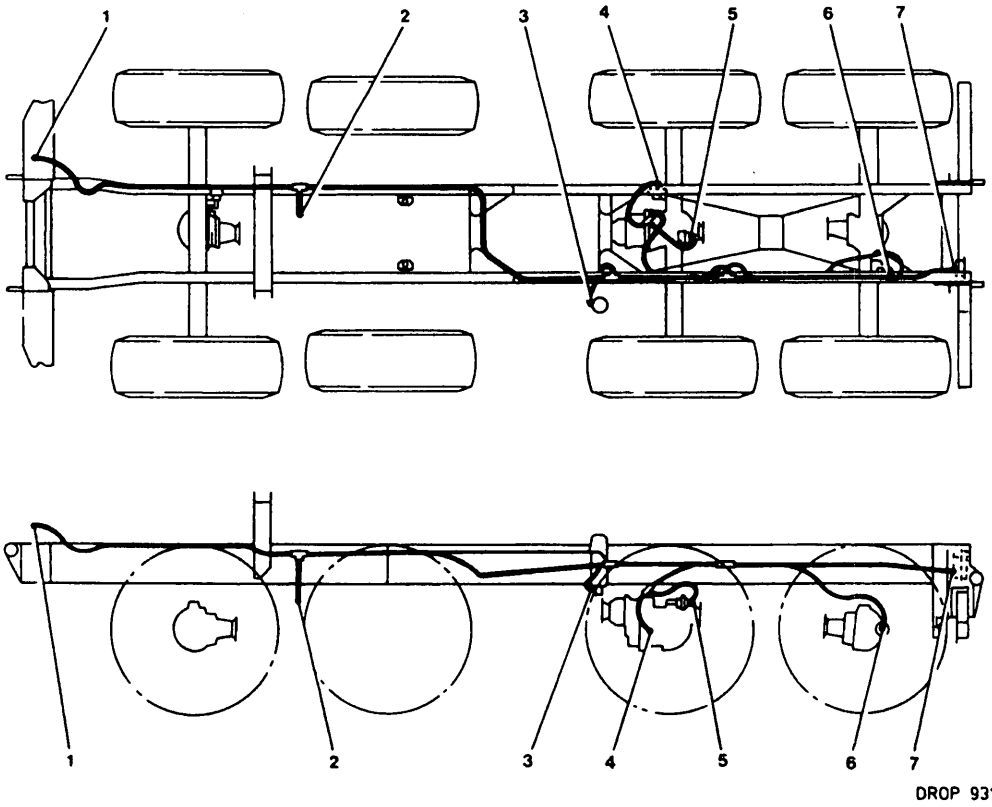
4 The tailrun loom (Fig 1(2)) is connected at the cab front bulkhead (1) and runs along the chassis to the rear terminal box (7). Branch cables are taken to the following equipment:

4.1 Load Handling System (LHS) terminal box (2).

4.2 Air dryer (3).

4.3 Foremost rear axle differential lock and third differential lock (4 and 5).

4.4 Rearmost rear axle differential lock (6).



1 To bulkhead connection
2 To LHS terminal box
3 To air dryer
4 To foremost rear axle differential lock
5 To foremost rear axle third differential lock
6 To rearmost rear axle differential lock
7 To rear terminal box

Fig 2 Tailrun loom installation

5 To remove a tailrun loom proceed as follows:

5.1 Turn the electrical master switch to OFF.

5.2 At the cab front bulkhead, unscrew the four bolts from the gland securing plate and pull the four housing terminals through the cab bulkhead (See Fig 1(2)) and disconnect.

5.3 Disconnect the cables from the rear terminal box using the procedure detailed in Para 7.

5.4 Disconnect the cable terminals at the two rear axle differential lock switches (4), (5) & (6) and the air dryer (3).

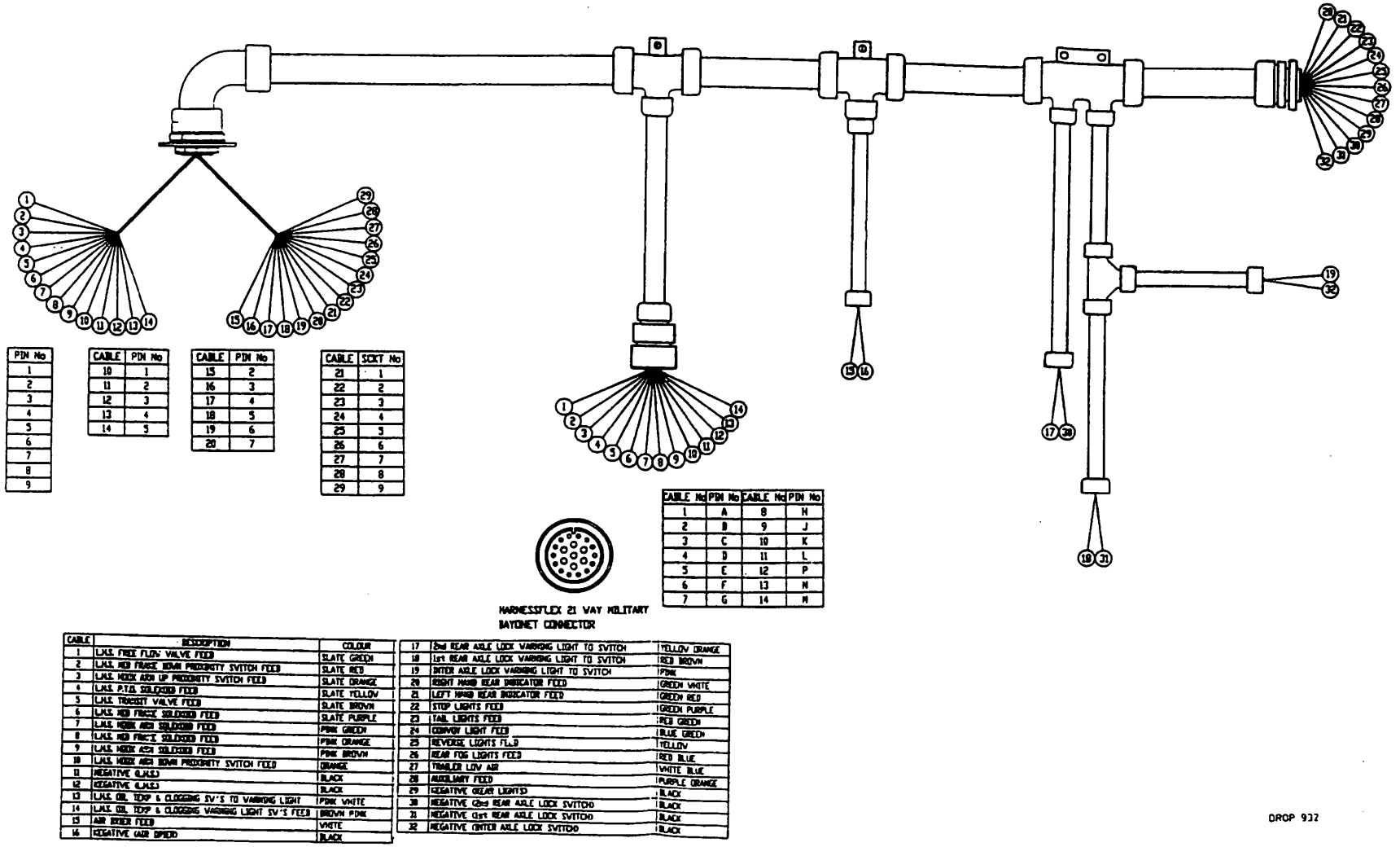
5.5 Cut all the tie wraps securing the tail loom and remove it from the vehicle.

6 Fitting a tailrun is a reversal of the removal procedure:

6.1 There is no particular sequence requirement for the reconnection of the various conponents.

6.2 Care must be taken when securing the differential lock conduits (4), (5) and (6), to ensure that the movement of the suspension is allowed for.

6.3 Re-connect the cable terminals to the rear terminal box as detailed in Para 8.



CABLE	DESCRIPTION	COLOUR
1	L.H.S. FREE FLOW VALVE FEED	SLATE GREEN
2	L.H.S. MID FRAME BRAKE PROXIMITY SWITCH FEED	SLATE RED
3	L.H.S. KNUCKLE ARM UP PROXIMITY SWITCH FEED	SLATE ORANGE
4	L.H.S. P.T.O. SOLENOID FEED	SLATE YELLOW
5	L.H.S. TRANSIT VALVE FEED	SLATE BROWN
6	L.H.S. MID FRAME SOLENOID FEED	SLATE PURPLE
7	L.H.S. KNUCKLE ARM SOLENOID FEED	PINK GREEN
8	L.H.S. MID FRAME SOLENOID FEED	PINK ORANGE
9	L.H.S. KNUCKLE ARM SOLENOID FEED	PINK BROWN
10	L.H.S. KNUCKLE ARM BRAKE PROXIMITY SWITCH FEED	ORANGE
11	NEGATIVE (L.H.S.)	BLACK
12	NEGATIVE (L.H.S.)	BLACK
13	L.H.S. OIL TEMP & CLOGGING SV'S TO WARNING LIGHT	PINK WHITE
14	L.H.S. OIL TEMP & CLOGGING WARNING LIGHT SV'S FEED	BROWN PINK
15	AIR BRAKE FEED	WHITE
16	NEGATIVE (AIR BRAKE)	BLACK
17	2nd REAR AXLE LOCK WARNING LIGHT TO SWITCH	YELLOW ORANGE
18	1st REAR AXLE LOCK WARNING LIGHT TO SWITCH	RED BROWN
19	INTER AXLE LOCK WARNING LIGHT TO SWITCH	PINK
20	RIGHT HAND REAR INDICATOR FEED	GREEN WHITE
21	LEFT HAND REAR INDICATOR FEED	GREEN RED
22	STOP LIGHTS FEED	GREEN PURPLE
23	TAIL LIGHTS FEED	RED GREEN
24	CONVOY LIGHT FEED	BLUE GREEN
25	REVERSE LIGHTS FEED	YELLOW
26	REAR FOG LIGHTS FEED	RED BLUE
27	TRAILER LOW AIR	WHITE BLUE
28	AUXILIARY FEED	PURPLE ORANGE
29	NEGATIVE (REAR LIGHTS)	BLACK
30	NEGATIVE (2nd REAR AXLE LOCK SWITCH)	BLACK
31	NEGATIVE (1st REAR AXLE LOCK SWITCH)	BLACK
32	NEGATIVE (INTER AXLE LOCK SWITCH)	BLACK

Fig 3 Tail loom details

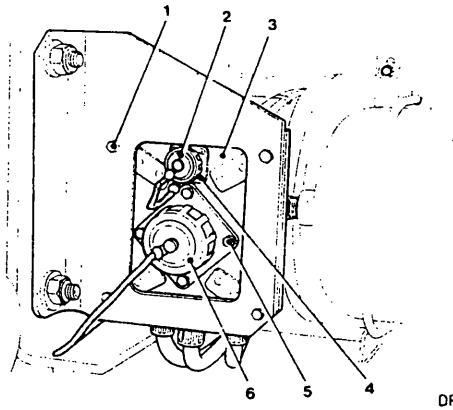
Terminal box connections (See Fig 4)

7 A two-pin socket (2) and a twelve-pin socket (6) are fitted in the terminal box (3). To disconnect the cables from the two-pin and twelve-pin sockets proceed as follows:

7.1 Turn the electrical master switch to OFF.

7.2 Remove the cover from the terminal box (3).

7.3 Identify and disconnect the cables from the rear of the two and twelve-pin sockets.



1 Securing bolt
2 Two-pin socket
3 Terminal box
4 Securing screw
5 Securing bolt
6 Twelve-pin socket

Fig 4 Trailer sockets and terminal box arrangement

8 Reconnecting the cables to the two-pin socket is a reversal of the disconnecting procedure. See Table 1 for connection details.

TABLE 1 TWO-PIN SOCKET

Cable No (1)	Description (2)	Colour (3)	Pin No (4)
1	Trailer low air feed	WU	A
2	Negative	B	B

9 Reconnecting the cables to the twelve-pin socket is a reversal of the disconnecting procedure. See Table 2 for connection details.

TABLE 2 TWELVE-PIN SOCKET

Cable No (1)	Description (2)	Colour (3)	Pin No (4)
1	OS Trailer indicator feed	GW	M
2	Trailer indicator feed	GR	M
3	Stop lamp feed	GP	B
4	Auxiliary feed	P	K
5	Negative	B	D
6	Tail lamp feed	RG	E
7	Convoy lamp feed	UB	A
8	Convoy lamp feed	UB	C
9	Convoy lamp feed	UB	H
10	Stop lamp feed	GP	J
11	Rear fog lamp feed	RU	F

Engine loom replacement (See Fig 5)

10 The engine loom is connected at the front cab bulkhead and runs briefly along the chassis and branch cables are taken to the various equipments: To remove the engine loom proceed as follows:

10.1 Turn the electrical master switch to OFF.

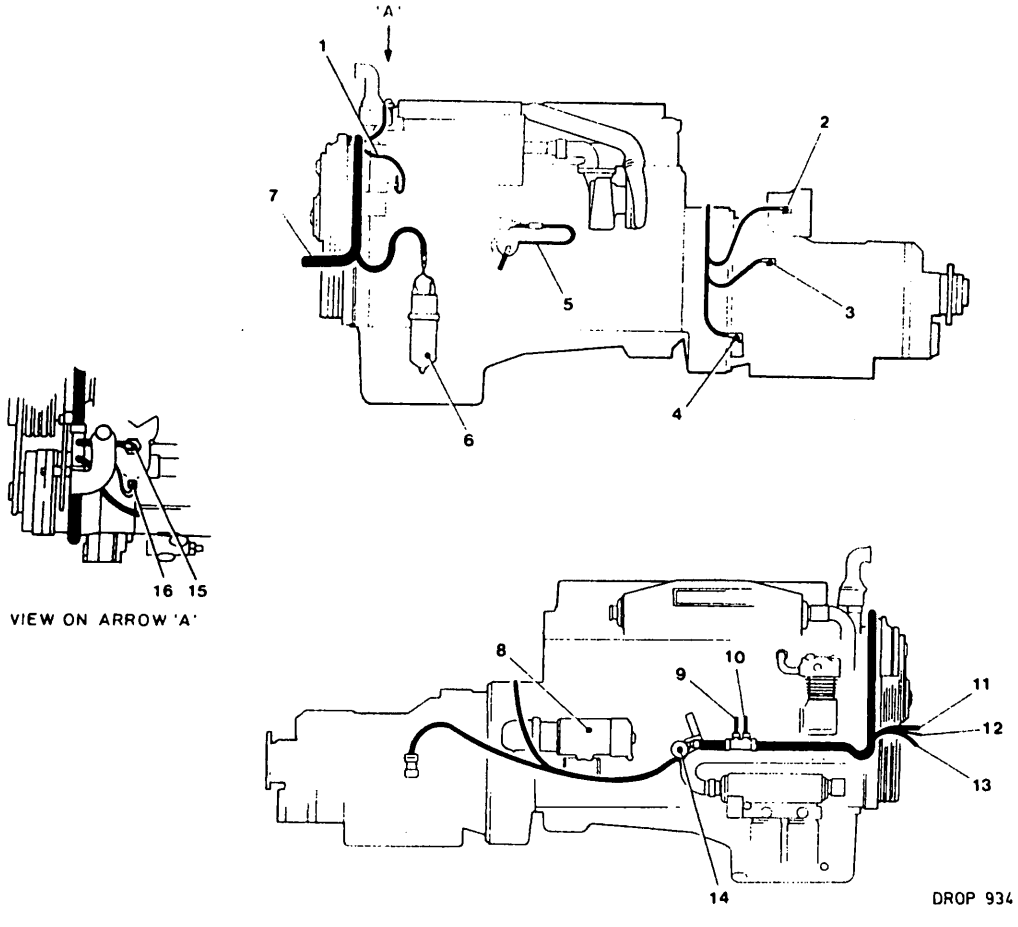
10.2 At the cab front bulkhead, unscrew the four bolts securing the engine loom gland plate and pull the two housing terminals through the cab bulkhead and disconnect.

10.3 Disconnect the cable terminals from the alternator (1), high coolant temperature switch (16) and the coolant temperature sender (15).

10.4 Disconnect the starter motor (8) relay terminals, engine oil pressure switch (14) terminals, front axle differential lock switch (9) terminals and cab lock switch (10) terminals.

10.5 Cut the tie wraps and remove the loom.

11 Fitting the engine loom is a reversal of the removal procedure. Secure the loom at suitable points with new tie wraps.



1 Alternator cable
2 Power take-off (PTO) solenoid cable
3 Gearbox temperature sensor cable
4 Retarder solenoid cable
5 Load sensor cable
6 Fuel heater/sedimenter
7 Loom from cab bulkhead (engine)
8 Starter motor
9 Cable to front axle differential lock
10 Cable to cab lock switch
11 Cable branch from gearbox harness
12 Cable branch from gearbox harness
13 Cable branch from gearbox harness
14 Engine oil pressure switch
15 Coolant temperature sender
16 High coolant temperature switch

Fig 5 Engine/gearbox loom arrangement

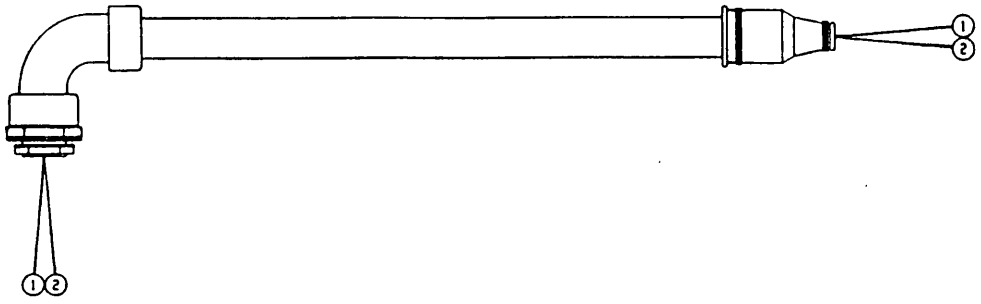
Cooking pot loom replacement (See Fig 5)

12 The cooking pot loom is connected at the cab front bulkhead and runs along the chassis to the starter motor. To remove the cooking pot loom proceed as follows:

12.1 Turn the electrical master switch to OFF.

12.2 Unscrew the 90 bend fitted to the cab front bulkhead and disconnect the terminals.

12.3 Disconnect the terminals from the starter motor (8), cut the securing tie wraps and remove the loom.



CABLE	DESCRIPTION	COLOUR
1	COOKING POT CONTROL BOX FEED	BROWN
2	COOKING POT CONTROL BOX NEG	BLACK

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Fig 6 Cooking pot loom details main loom replacement

Alternator and fuel heater loom replacement (See Fig 5)

13 The alternator/fuel heater loom is connected between the alternator and the following equipment:

13.1 Starter motor (8).

13.2 Circuit breaker relay.

13.3 Fuel heater/sedimenter (6).

14 To remove an alternator/fuel heater loom proceed as follows:

14.1 Turn the electrical master switch to OFF.

14.2 Disconnect the circuit breaker terminals, alternator terminals and starter motor terminals.

14.3 Pull the cable terminals off the fuel heater/sedimenter (6).

14.4 Cut the securing tie wraps and remove the loom.

15 Fitting a new loom is a reversal of the removal. Secure the loom (Fig 7) at suitable points with new tie wraps.

Main loom replacement (See Fig 8)

16 The main loom is the interface between other looms, instruments and various equipments. It is fitted behind the dashboard and for details of all the loom spurs see Fig 8 Sheets 1 to 4.

17 Removal will require the disconnection of all the various housing terminals, connection blocks and instrument cable terminals. To facilitate access to the connections behind the instrument panel, it is advantageous to remove the electrical control panel (Cat 522 Chap 13 refers).

18 To remove a main cable loom proceed as follows:

18.1 Turn the electrical master switch to OFF.

18.2 Disconnect all the terminals listed and shown in (Fig 8 (a), (b), (c) and (d).

18.3 Disconnect the main loom connections (Fig 9(2)) from the dashboard/main gearbox control equipment.

18.4 Disconnect the main loom connections from the instrument panel (refer to Cat 522 Chap 13 for replacement procedures).

19 Fitting a new main loom is a reversal of the removal. Secure the main loom at suitable points with new tie wraps.

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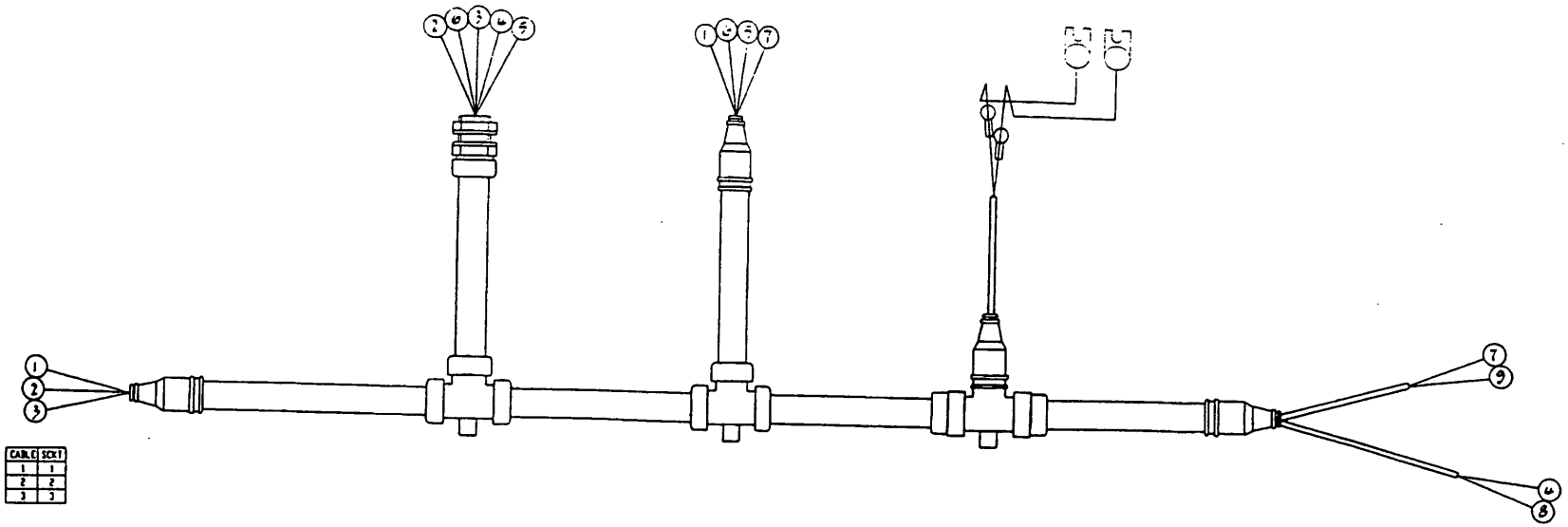

CABLE	DESCRIPTION	COLOUR
1	FEED TO THERMOSTAT	LIGHT GREEN
2	FEED TO FUEL HEATER W/L	ORANGE
3	NEGATIVE (FUEL HEATER RELAY COIL)	BLACK
4	CIRCUIT BREAKER FEED FROM STARTER	BROWN
5	FEED TO FUEL HEATER FROM RELAY N/O	BROWN RED
6	FEED TO RELAY COIL FROM THERMOSTAT	ORANGE
7	NEGATIVE (STARTER TO FUEL HEATER)	BLACK
8	ALTERNATOR POSITIVE TO STARTER	BROWN
9	ALTERNATOR NEGATIVE TO STARTER	BLACK

Fig 7 Alternator/fuel heater loom details

CABLE	DESCRIPTION	COLOUR
1	TACHOMETER FREQUENCY FEED FROM ALTERNATOR	BLACK RED
2	ALTERNATOR WARNING LIGHT FEED	BROWN YELLOW
3	HIGH WATER TEMP SVITCH FEED	WHITE GREEN
4	HIGH WATER TEMP SVITCH TO WARNING LIGHT	YELLOW BROWN
5	WATER TEMP TRANSDUCER TO WATER TEMP GAUGE	BLUE GREEN
6	LOW OIL PRESSURE SVITCH TO WARNING LIGHT	WHITE BROWN
7	FRONT AXLE LOCK SVITCH TO WARNING LIGHT	PURPLE GREEN
8	CAB LOCK SVITCH TO WARNING LIGHT	SLATE BLACK
9	CAB MOUNTED CUT OFF SVITCH TO MASTER SVITCH	BLACK GREEN
10	NEUTRAL START RELAY TO STARTER RELAY	WHITE RED
11	WIPER SVITCH TO WIPER MOTOR (FAST)	BLUE LT.GREEN
12	WIPER MOTOR FEED	GREEN BLUE
13	WIPER SVITCH TO WIPER MOTOR (PARK)	BROWN LT.GREEN
14	NEGATIVE (WIPER MOTOR)	BLACK
15	WIPER SVITCH TO WIPER MOTOR (SLOW)	RED LT.GREEN
16	FUEL HEATER SVITCH TO FUEL HEATER RELAY	LIGHT GREEN
17	FUEL HEATER THERMOSTAT TO WARNING LIGHT	ORANGE
18	NEGATIVE (FUEL HEATER RELAY)	BLACK
19	NEGATIVE (HEATER MOTOR)	BLACK
20	HEATER SVITCH TO LEFT HAND HEATER MOTOR	YELLOW BLUE
21	LEFT HAND MAIN BEAM FEED	BLUE SLATE
22	LEFT HAND MAIN BEAM FEED	BLUE SLATE
23	LEFT HAND DIP BEAM FEED	BLUE PINK
24	LEFT HAND DIP BEAM FEED	BLUE PINK
25	LEFT HAND FRONT INDICATOR FEED	GREEN WHITE
26	LEFT HAND SIDE LIGHT FEED	RED BLACK
27	NEGATIVE (LEFT HAND FRONT INDICATOR)	BLACK
28	TACHOGRAPH NEGATIVE LINK	BLACK
29	NEGATIVE (TACHOGRAPH)	BLACK
30	TACHOGRAPH SVITCHED POSITIVE FEED	WHITE
31	TEMPERATURE GAUGE FEED	WHITE
32	FRONT WHEEL DRIVE WARNING LIGHT NEGATIVE	BLACK
33	TACHOGRAPH ILLUMINATION LIGHT FEED	RED WHITE
34	LIGHTING SVITCH FEED	BROWN BLUE
35	NEGATIVE (STEERING COLUMN SVITCH)	BLACK
36	HAZARD SVITCH FEED	ORANGE GREEN
37	HAZARD SVITCH FEED	BLUE PURPLE
38	HORN PUSH FEED	PURPLE
39	HORN PUSH TO HORN RELAY	PURPLE BLACK
40	FLASHER UNIT 49 TO HAZARD SVITCH	GREEN PINK
41	FLASHER UNIT 49a TO HAZARD SVITCH	LT.GREEN PINK
42	RIGHT HAND INDICATOR FEED	GREEN WHITE
43	LEFT HAND INDICATOR FEED	GREEN RED
44	WIPER MOTOR SVITCH FEED	GREEN BLUE
45	WASHER PUMP FEED	LT.GREEN BLACK
46	LIGHTING SVITCH TO LH. HEADLIGHT RELAY	BLUE YELLOW
47	DIP SVITCH TO MAIN BEAM RELAYS	PINK YELLOW
48	DIP SVITCH TO DIP BEAM RELAYS	RED ORANGE
49	ROTARY SVITCH No 2 TO LIGHTING SVITCH	BLUE ORANGE
50	LH. HEADLIGHT RELAY TO DIP SVITCH	BLUE
51	LOW AIR SVITCHES FEED	WHITE GREEN
52	LOW AIR SVITCHES TO WARNING LIGHT	WHITE YELLOW
53	STOP LIGHT SVITCHES FEED	ORANGE GREEN
54	STOP LIGHT SVITCHES TO RELAY	YELLOW BLACK
55	GEARBOX RETARDER FLOOR SVITCH TO BMI PIN 3	ORANGE PINK
56	NEGATIVE (GEARBOX RETARDER FLOOR SVITCH)	BLACK
57	ROTARY SVITCH No 2 TO CONVOY LIGHT FUSE	BLUE ORANGE
58	ROTARY SVITCH No 3 TO BLACKOUT RELAYS	ORANGE WHITE
59	ROTARY SVITCH No 1 TO DI HEADLIGHT RELAY	GREEN YELLOW
60	ROTARY SVITCH No 3 TO DI HEADLIGHT RELAYS	BLUE BROWN
61	ROTARY SVITCH No 4 TO SIDE & TAIL LIGHT FUSES	RED BLACK
62	NEGATIVE (WATER TEMP GAUGE)	BLACK
63	NEGATIVE (GAUGE ILLUMINATION)	BLACK
64	NEGATIVE (GAUGE ILLUMINATION)	BLACK
65	NEGATIVE (GAUGE ILLUMINATION)	BLACK
66	NEGATIVE (GAUGE ILLUMINATION)	BLACK
67	NEGATIVE (GAUGE ILLUMINATION)	BLACK
68	GAUGE ILLUMINATION FEED	RED WHITE
69	GAUGE ILLUMINATION FEED	RED WHITE
70	GAUGE ILLUMINATION FEED	RED WHITE
71	GAUGE ILLUMINATION FEED	RED WHITE
72	GAUGE ILLUMINATION FEED	RED WHITE
73	NEGATIVE (WARNING LIGHT)	BLACK
74	NEGATIVE (WARNING LIGHT)	BLACK
75	NEGATIVE (WARNING LIGHT)	BLACK

CABLE	DESCRIPTION	COLOUR
76	NEGATIVE (WARNING LIGHT)	BLACK
77	NEGATIVE (WARNING LIGHT)	BLACK
78	NEGATIVE (WARNING LIGHT)	BLACK
79	NEGATIVE (WARNING LIGHT)	BLACK
80	NEGATIVE (WARNING LIGHT)	BLACK
81	WARNING LIGHT BLACKOUT NEGATIVE	BLACK WHITE
82	KEY SVITCH TO NEUTRAL START RELAY	WHITE RED
83	KEY SVITCH TO ALTERNATOR WARNING LIGHT	BROWN WHITE
84	KEY SVITCH TO P.T.O.	BROWN WHITE
85	KEY SVITCH TO P.C.B.	BROWN WHITE
86	KEY SVITCH FEED	BROWN BLUE
87	KEY SVITCH FEED	BROWN BLUE
88	REAR FOG LIGHT SVITCH FEED	BLUE
89	REAR FOG LIGHT SVITCH TO RELAY	ORANGE PURPLE
90	REAR WORKING LIGHT SVITCH FEED	SLATE BLUE
91	REAR WORKING LIGHT SVITCH TO REAR WORKING LIGHTS	GREEN BROWN
92	REAR WORKING LIGHT SVITCH TO WARNING LIGHT	GREEN BROWN
93	FUEL HEATER SVITCH FEED	WHITE
94	HEATER MOTOR SVITCH FEED	GREEN ORANGE
95	HEATER MOTOR SVITCH TO RIGHT HAND HEATER MOTOR	YELLOW BLUE
96	HEATED REAR SCREEN SVITCH FEED	WHITE
97	HEATED REAR SCREEN SVITCH TO RELAY	WHITE ORANGE
98	REAR SCREEN WASH/WIPE SVITCH FEED	GREEN BLUE
99	REAR SCREEN WASH/WIPE SVITCH TO WIPER MOTOR (PARK)	LT.GREEN BROWN
100	REAR SCREEN WASH/WIPE SVITCH TO WIPER MOTOR	LT.GREEN RED
101	REAR SCREEN WASH/WIPE SVITCH TO WASHER PUMP	BLACK LT.GREEN
102	AIR DRIER FEED	WHITE
103	INTER AXLE LOCK WARNING LIGHT TO SVITCH	PINK
104	1st REAR AXLE LOCK WARNING LIGHT TO SVITCH	RED BROWN
105	2nd REAR AXLE LOCK WARNING LIGHT TO SVITCH	YELLOW ORANGE
106	AXLE LOCK WARNING LIGHTS FEED	WHITE GREEN
107	AXLE LOCK WARNING LIGHTS FEED	WHITE GREEN
108	AXLE LOCK WARNING LIGHTS FEED	WHITE GREEN
109	AXLE LOCK WARNING LIGHTS FEED	WHITE GREEN
110	TACHOMETER POSITIVE FEED	WHITE
111	NEGATIVE (TACHOMETER)	BLACK
112	ILLUMINATION LIGHT FEED	RED WHITE
113	ILLUMINATION LIGHT FEED	RED WHITE
114	ILLUMINATION LIGHT FEED	RED WHITE
115	ILLUMINATION LIGHT FEED	RED WHITE
116	ILLUMINATION LIGHT FEED	RED WHITE
117	ILLUMINATION LIGHT FEED	RED WHITE
118	ILLUMINATION LIGHT FEED	RED WHITE
119	NEGATIVE (ILLUMINATION LIGHT)	BLACK
120	NEGATIVE (ILLUMINATION LIGHT)	BLACK
121	NEGATIVE (ILLUMINATION LIGHT)	BLACK
122	NEGATIVE (ILLUMINATION LIGHT)	BLACK
123	NEGATIVE (ILLUMINATION LIGHT)	BLACK
124	NEGATIVE (ILLUMINATION LIGHT)	BLACK
125	NEGATIVE (ILLUMINATION LIGHT)	BLACK
126	NEGATIVE (ILLUMINATION LIGHT)	BLACK
127	NEGATIVE (ILLUMINATION LIGHT)	BLACK
128	HIGH WATER TEMP WARNING LIGHT FEED	YELLOW BROWN
129	REAR FOG LIGHTS WARNING LIGHT FEED	RED BLUE
130	LOW AIR PRESSURE WARNING LIGHT FEED	WHITE YELLOW
131	MAIN BEAM WARNING LIGHT FEED	BLUE WHITE
132	STOP WARNING LIGHT FEED	RED
133	FLASHER UNIT C TO VEHICLE INDICATOR WARNING LIGHT	LT.GREEN YELLOW
134	ALTERNATOR WARNING LIGHT TO BLACKOUT RELAY	BROWN GREEN
135	LOW OIL PRESSURE WARNING LIGHT FEED	WHITE BROWN
136	CAB LOCK WARNING LIGHT FEED	SLATE BLACK
137	P.T.O. WARNING LIGHT FEED	SLATE YELLOW
138	HEATED REAR SCREEN WARNING LIGHT FEED	BROWN PURPLE
139	WARNING LIGHT BLACKOUT NEGATIVE	BLACK WHITE
140	WARNING LIGHT BLACKOUT NEGATIVE	BLACK WHITE
141	FLASHER UNIT 12 TO TRAILER INDICATOR WARNING LIGHT	LT.GREEN PURPLE
142	NEGATIVE (MASTER SVITCH CUT OFF BUTTON)	BLACK
143	NEGATIVE (ILLUMINATION LIGHT)	BLACK
144	NEGATIVE (INCLINOMETER DISPLAY PANEL)	BLACK
145	NEGATIVE LINK	BLACK
146	RETARDER WARNING LIGHT FEED	WHITE GREEN
147	RETARDER WARNING LIGHT TO BMI	ORANGE LT.GREEN
148	RETARDER WARNING LIGHT BLOCK TO RETARDER SVITCH	ORANGE LT.GREEN
149	GEARBOX RETARDER SVITCH TO BMI PIN 3	ORANGE PINK
150	NEGATIVE (RETARDER SVITCH)	BLACK

CABLE	DESCRIPTION	COLOUR
151	ILLUMINATION LIGHT FEED	RED WHITE
152	ILLUMINATION LIGHT FEED	RED WHITE
153	INCLINOMETER POSITIVE FEED FROM P.T.O.	SLATE YELLOW
154	INCLINOMETER DISPLAY UNIT TO SCREEN	BLUE BLACK
155	INCLINOMETER DISPLAY UNIT TO SCREEN	BROWN ORANGE
156	INCLINOMETER DISPLAY UNIT TO SCREEN	SLATE LT.GREEN
157	INCLINOMETER DISPLAY UNIT TO SCREEN	SLATE PINK
158	GEARBOX OIL TEMP BUZZER TO OIL TEMP GAUGE	WHITE BLACK
159	RETARDER STOP LIGHT RELAY TO STOP LIGHTS	GREEN PURPLE
160	PANEL ILLUMINATION LIGHTS FEED FROM P.C.B.	RED WHITE
161	NEGATIVE (TERMINAL BLOCK TO CONNECTORS)	BLACK
162	FEED TO INSTRUMENTS	WHITE
163	LH.S.R.E. FLOW VALVE FEED	SLATE GREEN
164	LH.S. MID FRAME DOWN PROXIMITY SWITCH FEED	SLATE RED
165	LH.S. HOOK ARM UP PROXIMITY SWITCH FEED	SLATE ORANGE
166	LH.S. P.T.O. SOLENOID FEED TO TERMINAL BLOCK	SLATE YELLOW
167	LH.S. TRANSIT VALVE FEED	SLATE BROWN
168	LH.S. MID FRAME SOLENOID FEED	SLATE PURPLE
169	LH.S. HOOK ARM SOLENOID FEED	PINK GREEN
170	LH.S. MID FRAME SOLENOID FEED	PINK ORANGE
171	LH.S. HOOK ARM SOLENOID FEED	PINK BROWN
172	LH.S. HOOK ARM DOWN PROXIMITY SWITCH FEED	ORANGE
173	NEGATIVE (LH.S.)	BLACK
174	NEGATIVE (LH.S.)	BLACK
175	LH.S. OIL TEMP & CLOGGING SVITCHES TO WARNING LIGHT	PINK WHITE
176	LH.S. OIL TEMP & CLOGGING SVITCHES FEED	BROWN PINK
177	LH.S. CONTROL BOX POSITIVE FEED	BROWN PINK
178	LH.S. WARNING LIGHT BLACKOUT NEGATIVE	BLACK WHITE
179	NEGATIVE (AIR DRIER)	BLACK
180	LEFT HAND REAR INDICATOR	GREEN RED
181	RIGHT HAND REAR INDICATOR	GREEN WHITE
182	STOP LIGHTS FEED	GREEN PURPLE
183	TAIL LIGHTS FEED	RED GREEN
184	CONVOY LIGHT FEED	BLUE GREEN
185	REVERSE LIGHTS FEED	YELLOW
186	REAR FOG LIGHTS FEED	RED BLUE
187	TRAILER LOW AIR	WHITE BLUE
188	AUXILIARY TRAILER FEED	PURPLE ORANGE
189	NEGATIVE (REAR LIGHTS)	BLACK
190	RIGHT HAND MAIN BEAM FEED	BLUE WHITE
191	RIGHT HAND MAIN BEAM FEED	BLUE WHITE
192	RIGHT HAND DIP BEAM FEED	BLUE RED
193	RIGHT HAND DIP BEAM FEED	BLUE RED
194	RIGHT HAND FRONT INDICATOR FEED	GREEN WHITE
195	RIGHT HAND SIDE LIGHT FEED	RED BLACK
196	NEGATIVE (FRONT HAND FRONT LIGHTS)	BLACK
197	NEGATIVE (RIGHT HAND HEATER)	BLACK
198	HORN RELAY TO HORN	PURPLE YELLOW
199	NEGATIVE (HORN)	BLACK
200	NEGATIVE (WASHER PUMPS)	BLACK
201	NEGATIVE (WASHER PUMP)	BLACK
202	COOLING POT WARNING LIGHT BLACKOUT NEGATIVE	BLACK WHITE
203	LH.S. P.T.O. SOLENOID FEED	SLATE YELLOW
204	HEATED REAR SCREEN RELAY TO HEATED REAR SCREEN	BROWN PURPLE
205	GEARBOX EMERGENCY CONTROL RELAY TO BMI PIN 5	RED PINK
206	GEARBOX EMERGENCY CONTROL RELAY TO BMI PIN 3	RED SLATE
207	GEARBOX OIL TEMP BUZZER FEED	RED SLATE
208	NEGATIVE (GEARBOX CONTROL UNIT BMI PIN 1)	BLACK
209	NEUTRAL START RELAY TO BMI PIN 7	GREEN SLATE
210	REVERSE LIGHT RELAY TO BMI PIN 8	GREEN LT.GREEN
211	GEARBOX ANTIGAS SOLENOID TO BMI PIN 1	GREEN BLACK
212	RETARDER STOP LIGHT RELAY COIL TO BMI PIN 6	YELLOW GREEN
213	P.T.O. FEED TO GEARBOX CONTROL UNIT BMI	WHITE YELLOW
214	GEARBOX EMERGENCY CONTROL RELAY TO ANTIGAS SOLENOID	RED SLATE
215	RETARDER STOP LIGHT RELAY FEED	ORANGE GREEN
216	NEGATIVE (RETARDER STOP LIGHT RELAY COIL)	BLACK
217	NEGATIVE (HEATED REAR SCREEN RELAY COIL)	BLACK
218	HEATED REAR SCREEN RELAY FEED	WHITE ORANGE
219	INTERIOR LIGHTS FEED	BLUE PURPLE
220	REAR SCREEN WIPER MOTOR FEED	GREEN BLUE
221	NEGATIVE (FEED)	BLACK
222	FRONT WHEEL DRIVE SVITCH FEED	GREEN WHITE
223	FRONT WHEEL DRIVE WARNING LIGHT FEED	GREEN

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Fig 8 Main cable loom connection details - Sheet 1

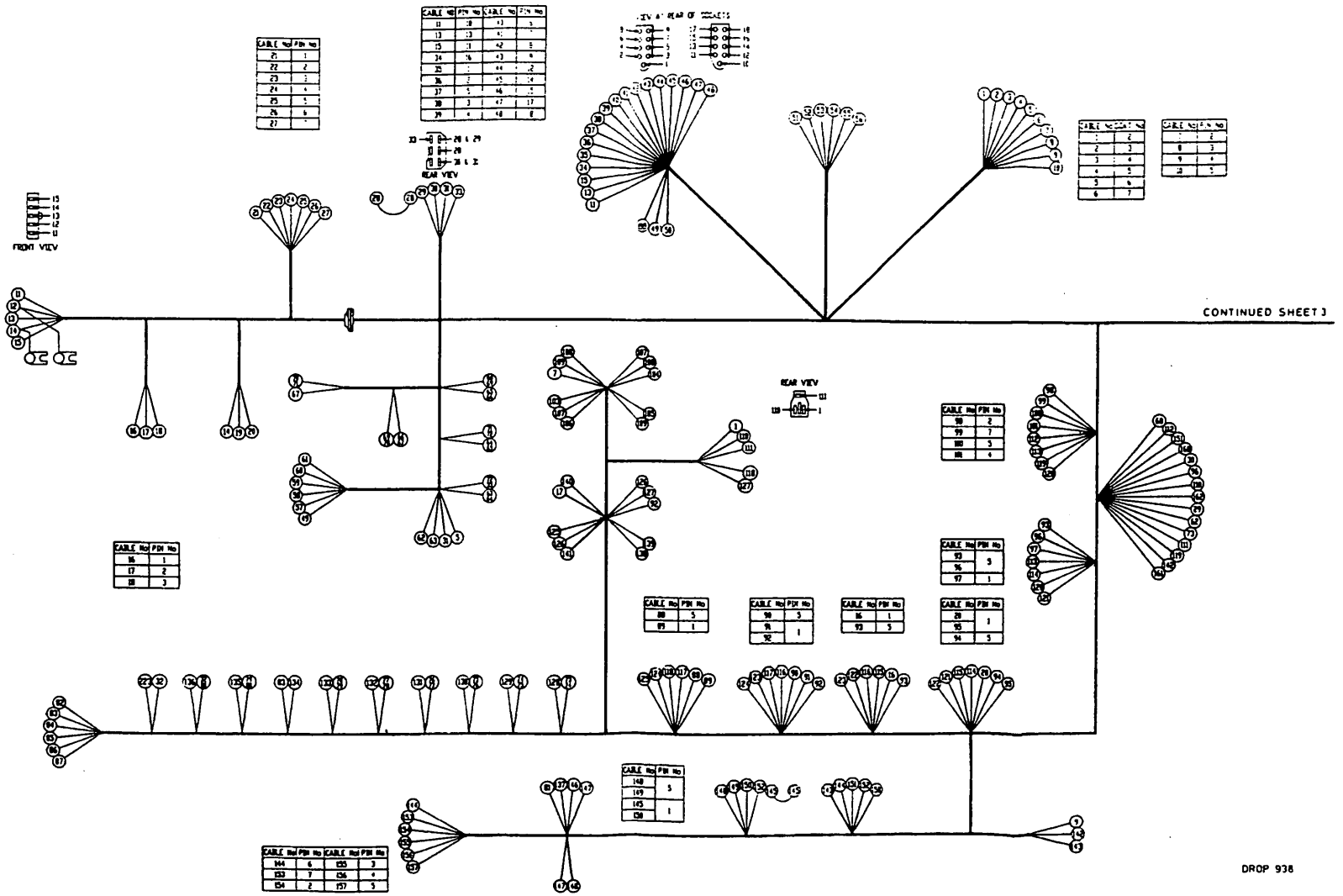


Fig 8 Main cable loom connection details - Sheet 2

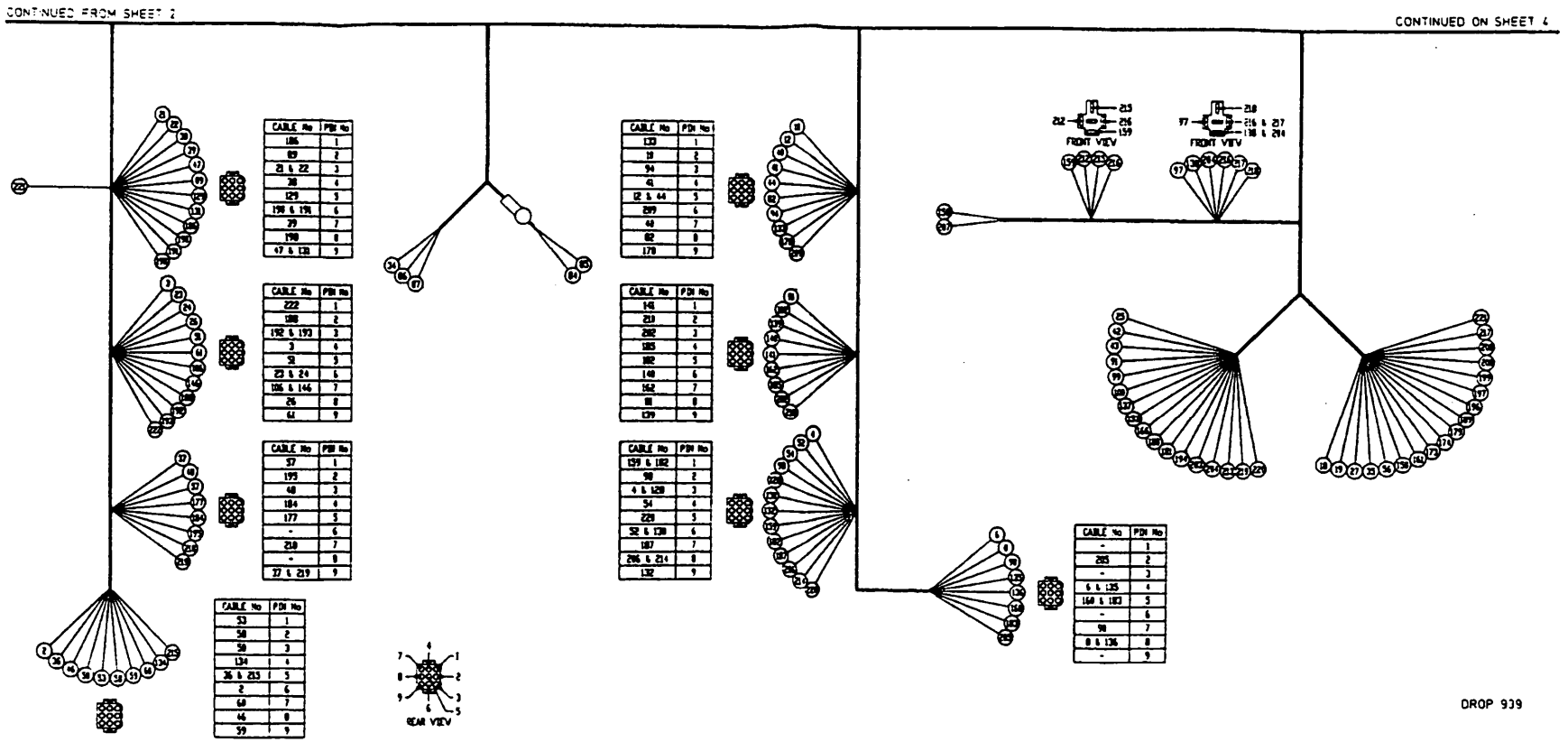


Fig 8 Main cable loom connection details - Sheet 3

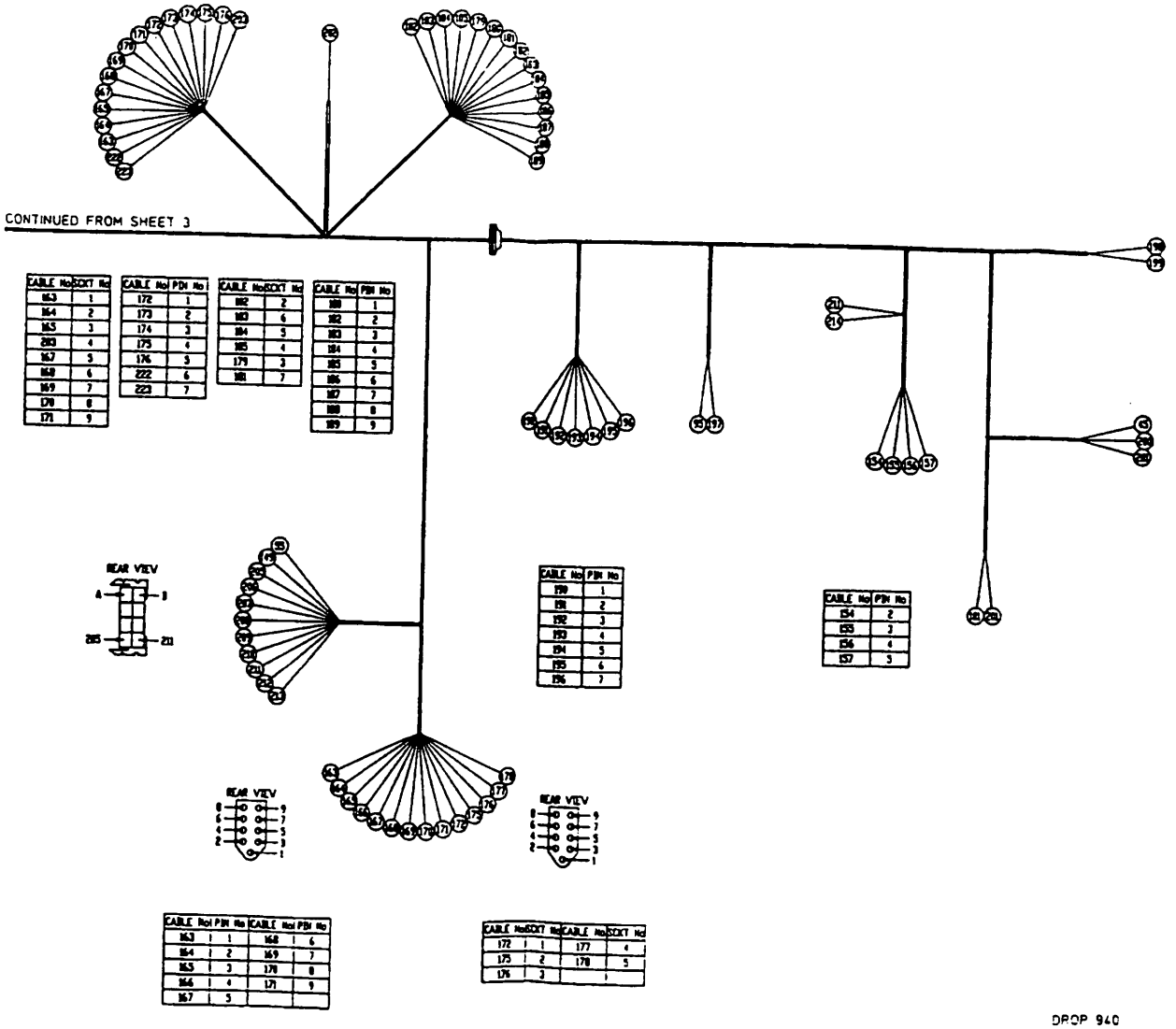
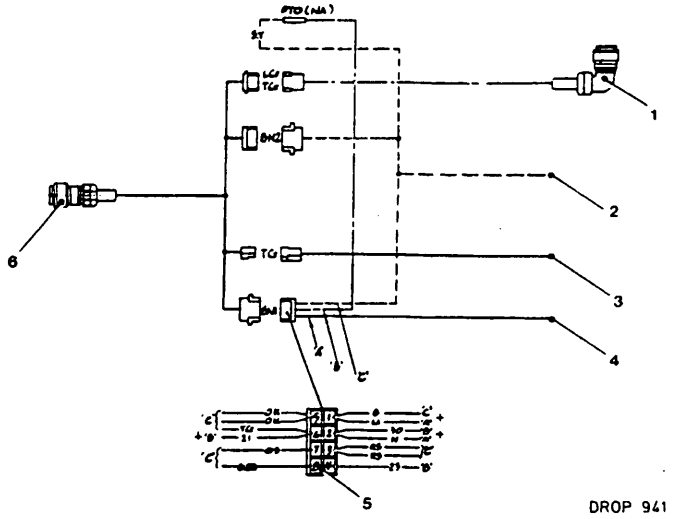


Fig 8 Main cable loom connection details - Sheet 4



1 Cab bulkhead Right hand side connection
2 Main loom connection
3 Temperature gauge connection
4 Kick down switch connection
5 Rear view of socket connections
6 Autoshift control unit connection

Fig 9 Schematic wiring arrangement dashboard/main gearbox control equipment

Cab loom replacement (See Fig 11)

20 The cab loom (fig 10(9)) is coupled through a multi-pin connector located behind the glove box panel (2). To remove the panel and gain access to the multi-pin connector proceed as follows:

20.1 Turn the electrical master switch to OFF. Remove the cooking pot (6).

20.2 To gain access to the inner of the two lower securing screws (3), remove the cooking pot fuse box (4). It is not necessary to disconnect the cable terminals.

20.3 Remove the two lower self-tapping screws (3) the three upper securing nuts and bolts (1) and remove the glove box panel (2).

21 Separate the multi-pin connector, prise the right hand windscreen post trim clear of the door seal and pull the cab loom clear. Disconnect all the various terminals from the equipment shown in Fig 10 and unclip the loom from the cab roof and rear panel.

22 Fitting a new loom is a reversal of the removal procedure.

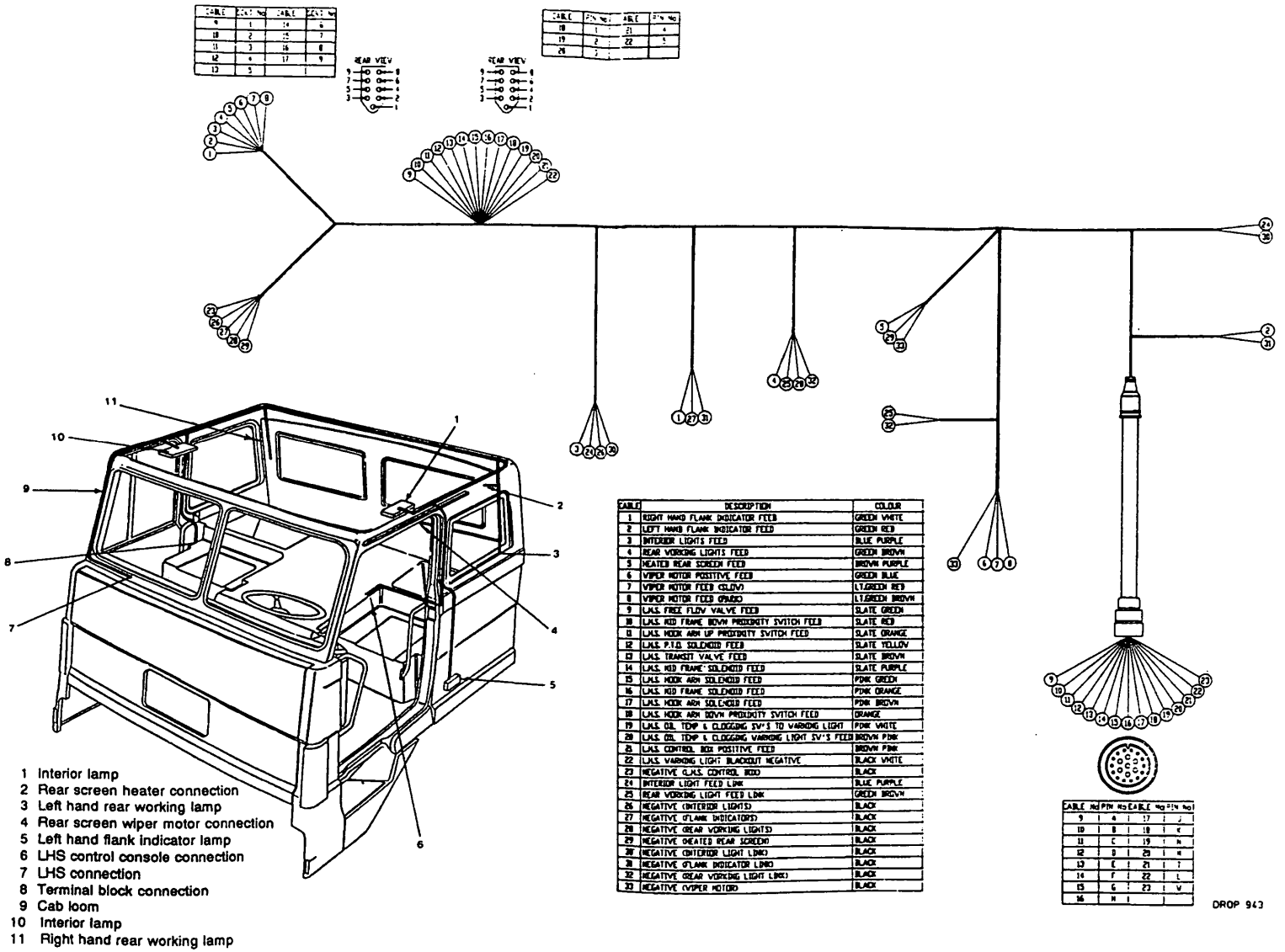
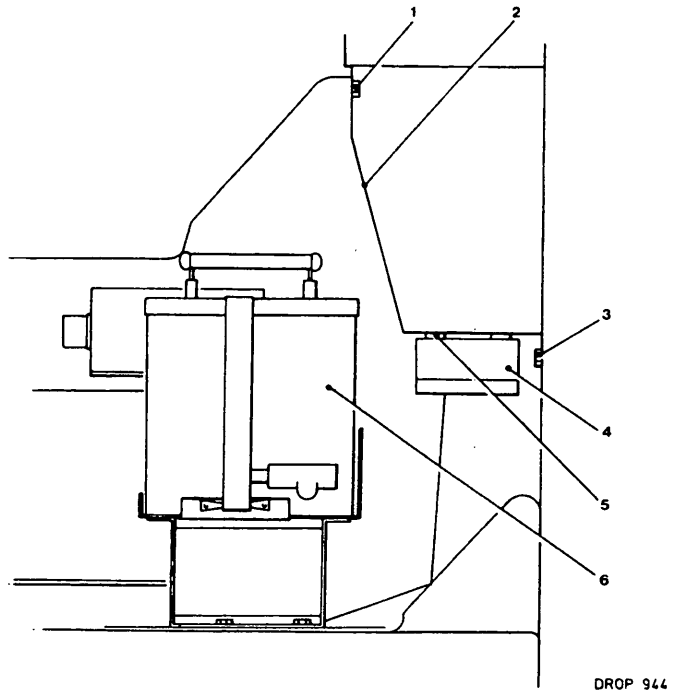


Fig 10 Cab loom detail and arrangement



1 Upper securing nuts and bolts
2 Glove box panel
3 Lower securing screw
4 Cooking pot fuse box
5 Fuse box securing screws
6 Cooking pot

Fig 11 Glovebox panel arrangement

Head/side indicator lamp loom replacement (See Fig 12)

23 Two separate looms are fitted to the right and left hand group of front mounted lamps. The looms are identical, with the removal and fitting procedure being the same for both looms.

24 To remove a head/side/indicator lamp loom proceed as follows:

24.1 Turn the electrical master switch to OFF.

24.2 Separate the housing terminal from the main loom connection.

24.3 Disconnect the terminals from the Right hand front mounted lamps (7), (8), (9) and (10) or the Left hand front mounted lamps (3), (4), (5) and (6).

24.4 Unscrew the two metal securing clips securing the loom at the back of bumper bar and cut the tie wraps.

25 Fitting a new loom is a reversal of the removal procedure.

Tail lamp loom replacement (See Fig 13)

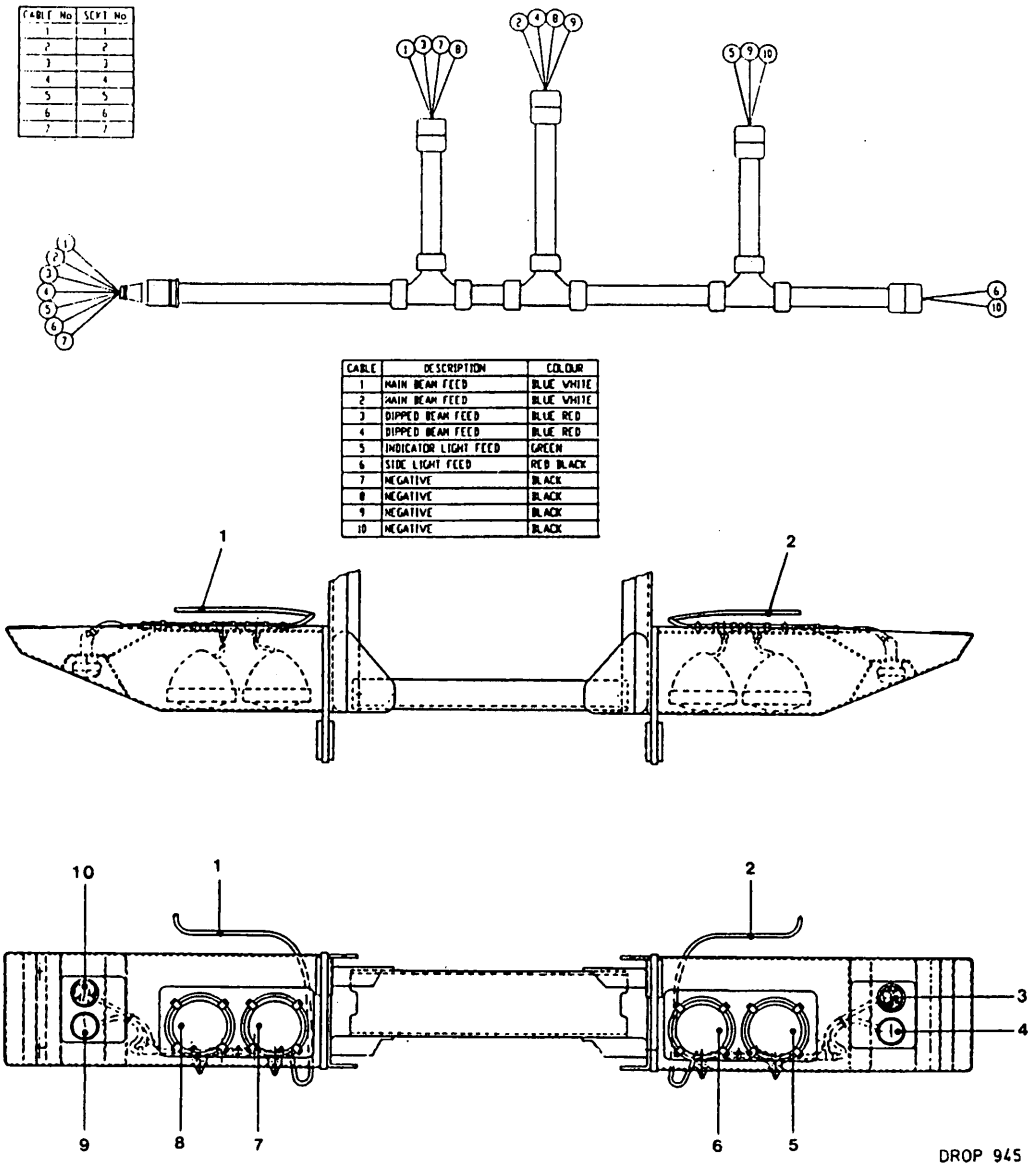
26 The right and left hand boxed tail lamps are connected to the tailrun loom through six cable looms (three to either side, coupled at the rear junction box (11).

27 To remove a tail lamp loom proceed as follows:

27.1 Select the lamp loom to be disconnected, remove the appropriate terminals at the rear of the lamp, unscrew the selected loom conduit gland nut at the junction box.

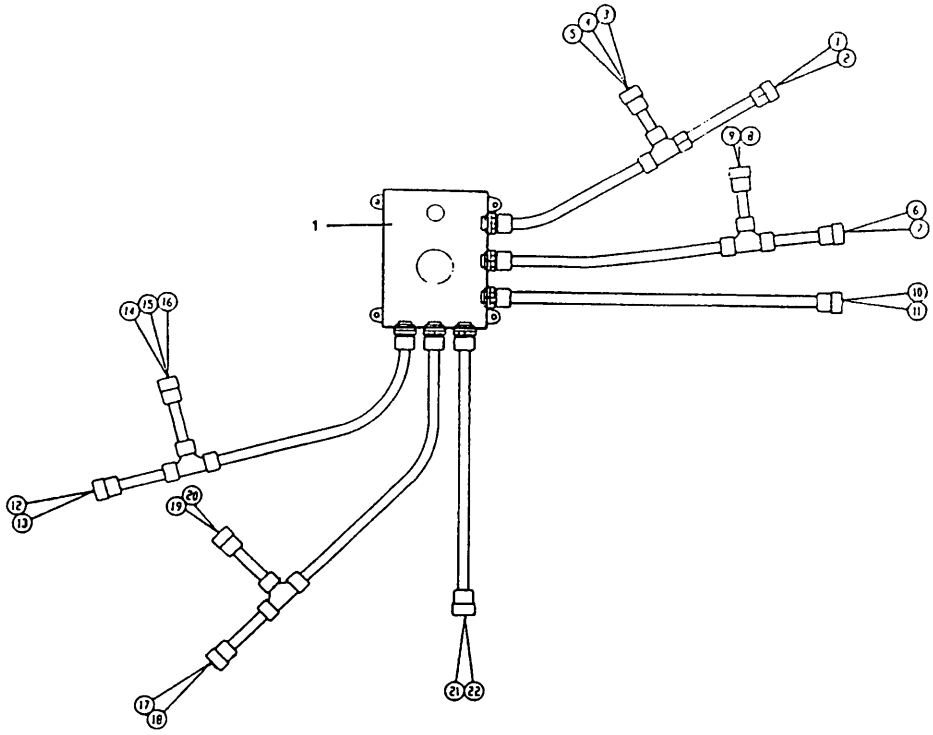
27.2 Cut the securing tie wraps and remove the loom.

28 Fitting a new loom is a reversal of the removal procedure.



1 To main loom connection (r.h.)
2 To main loom connection (l.h.)
3 Indicator lamp (l.h.)
4 Side lamp (l.h.)
5 Headlamp (l.h. outer)
6 Headlamp (l.h. inner)
7 Headlamp (r.h. inner)
8 Headlamp (r.h. outer)
9 Side lamp (r.h.)
10 Indicator lamp (r.h.)

Fig 12 Head/side/indicator lamp loom detail and arrangement



CABLE	DESCRIPTION
1	LH REAR INDICATOR FEED
2	LH REAR INDICATOR NEGATIVE
3	LH TAIL LIGHT FEED
4	LH STOP LIGHT FEED
5	LH TAIL LIGHT & STOP LIGHT NEGATIVE
6	LH REVERSE LIGHT FEED
7	LH REVERSE LIGHT NEGATIVE
8	LH REAR FOG LIGHT FEED
9	LH REAR FOG LIGHT NEGATIVE
10	REG PLATE LIGHT FEED
11	REG PLATE LIGHT NEGATIVE
12	RH REAR INDICATOR LIGHT FEED
13	RH REAR INDICATOR LIGHT NEGATIVE
14	RH TAIL LIGHT FEED
15	RH STOP LIGHT FEED
16	RH TAIL LIGHT & STOP LIGHT NEGATIVE
17	RH REVERSE LIGHT FEED
18	RH REVERSE LIGHT NEGATIVE
19	RH REAR FOG LIGHT FEED
20	RH REAR FOG LIGHT NEGATIVE
21	CONVOY LIGHT FEED
22	CONVOY LIGHT NEGATIVE
23	NEGATIVE LOOP
24	NEGATIVE LOOP

1 Junction box

Fig 13 Rear lamps, loom detail

CHAPTER 14

LOAD HANDLING SYSTEM

CONTENTS

(continued)

CONTENTS (continued)

SEALANTS AND ADHESIVES

1 The sealants and adhesives required to carry out the tasks detailed in this chapter are listed in Table 1.

TABLE 1 SEALANTS AND ADHESIVES

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)	Qty (5)
1	H1/8030-99-224-0248	Loctite 242	Sealant	A/R

TABLE 2 SPECIAL TOOLS AND TEST EQUIPMENT

Ser (1)	NSN (2)	Manfr No (3)	Designation (4)	Qty (5)
1	LV7DP/5120-99-255-0164	4490-094	Puller kit – mechanical	1
2	LV7DP/3950-99-255-0165	4490-095	Collar locating	1
3	LV7DP/3950-99-255-0166	4490-096	Driver plug, bearing and bush	1
4	LV7DP/3950-99-255-0167	4490-097	Driver, bearing and bush	1
5	LV7DP/3950-99-255-0168	4490-098	Puller - mechanical	1
6	LV7DP/3950-99-255-0170	4490-0101	Sling assy multiple leg	1
7	LV7DP/5306-99-255-0175	4490-103A	Bolt, extractor pin	1
8	LV7DP/3950-99-277-6374	4490-099	Pivot pin extractor	1
9	Deleted			1
10	LV7DP/6685-99-255-0171	0060-148	Gauge pressure 0-400 bar	1
11	LV7DP/6685-99-700-4833	0060-147	Gauge pressure 0-40 bar	1
12	6MT2/4910-99-360-4088	8SK 10058	Test plate	1
13	6MT2/4910-99-955-8383	8SK 10059	Test plate	1
14	6MT2/4910-99-425-1272	8SK 10600	Test plate	1
15	6MT2/4910-99-788-6216	8SK 10656	Test plate	1
16	6MT2/4820-99-373-9259	A3A 125Z	Relief block	1
17	6MT2/4910-99-151-0870	LB 10010A	Line block	1
18	6MT2/4910-99-051-2062	8SK 9641	Check valve removal tool	1
19	6MT2/4910-99-398-0371	8SK 10661	Extractor tool	1

LOAD HANDLING SYSTEM REMOVAL (See Fig 1)

3 To remove the load handling system (LHS) from the vehicle proceed as follows:

3.1 Remove the bolts securing the hydraulic pump to the power take off (PTO). Withdraw the pump from the PTO and secure it to a convenient part of the LHS.

3.2 Disconnect the electrical connector at the LHS main junction box.

3.3 Remove the rear fuel/water carrier stowage bin.

3.4 Disconnect the earth braid from the right hand rear LHS mounting bracket.

3.5 Remove the three bolts, nuts and washers from each of the front and rear LHS mounting brackets. Using suitable slings, front sling 2.75 m (9 ft) and rear sling 3.5 m (11.5 ft), lift the LHS complete from the vehicle.

3.6 Place the LHS on suitable supports. To give all round access allow at least 1 m clearance under the side channels.

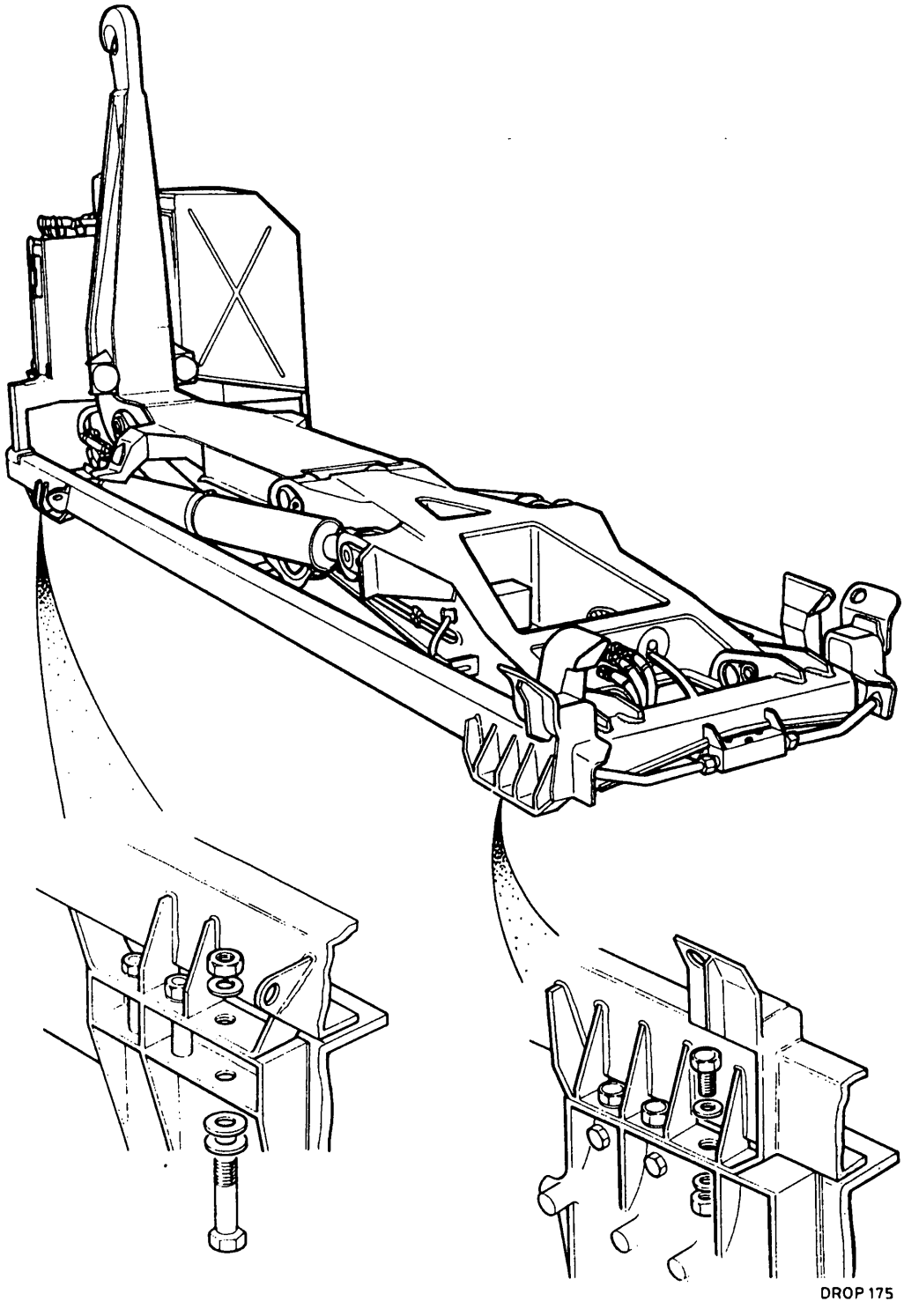


Fig 1 Load handling system mountings

LOAD HANDLING SYSTEM DISMANTLING

CAUTION

CONTAMINATION. When working on the hydraulic system, full attention must be paid to the cleanliness of components and surrounding areas.

General

4 Ensure that all electrical harnesses are identified for ease of reassembly and disconnect from the main manifold, main junction box and rear junction box.

5 Ensure that all hydraulic hoses are identified for ease of reassembly and with suitable containers available to catch leakage, disconnect hydraulic hoses from all cylinders, pipework and hydraulic pump. Fit blanking plugs to all open ends.

Hydraulic unit removal (See Fig 2)

6 Remove the five nyloc nuts, washers and screws securing the hydraulic unit support frame (8) to the compression frame. Using sling (Table 2 Ser 6) remove the hydraulic unit from the compression frame, lift clear and place safely to one side.

Hook arm/middle frame separation

7 With hook arm assembly resting onto the front cross-member separate the hook arm (2) from the middle frame (5) as follows:

7.1 Bend down the tab on the locking washer securing the lock nut on the hook arm cylinders upper pivot shaft (1). Remove lock nut and lock washer using a 'C' spanner.

7.2 Support the weight of both hook arm hydraulic cylinders r.h. (3) and l.h. (9) and using pivot pin extractor (Table 2 Ser 8) and bolt (Table 2 Ser 7) remove the upper pivot shaft (1).

7.3 Remove set screws and washers from retaining plates. Support the weight of the hook arm and remove the pivot pins (4) and (6) and washers securing the hook arm to the middle frame (5). Using pivot pin extractor (Table 2 Ser 3) and bolt (Table 2 Ser 7).

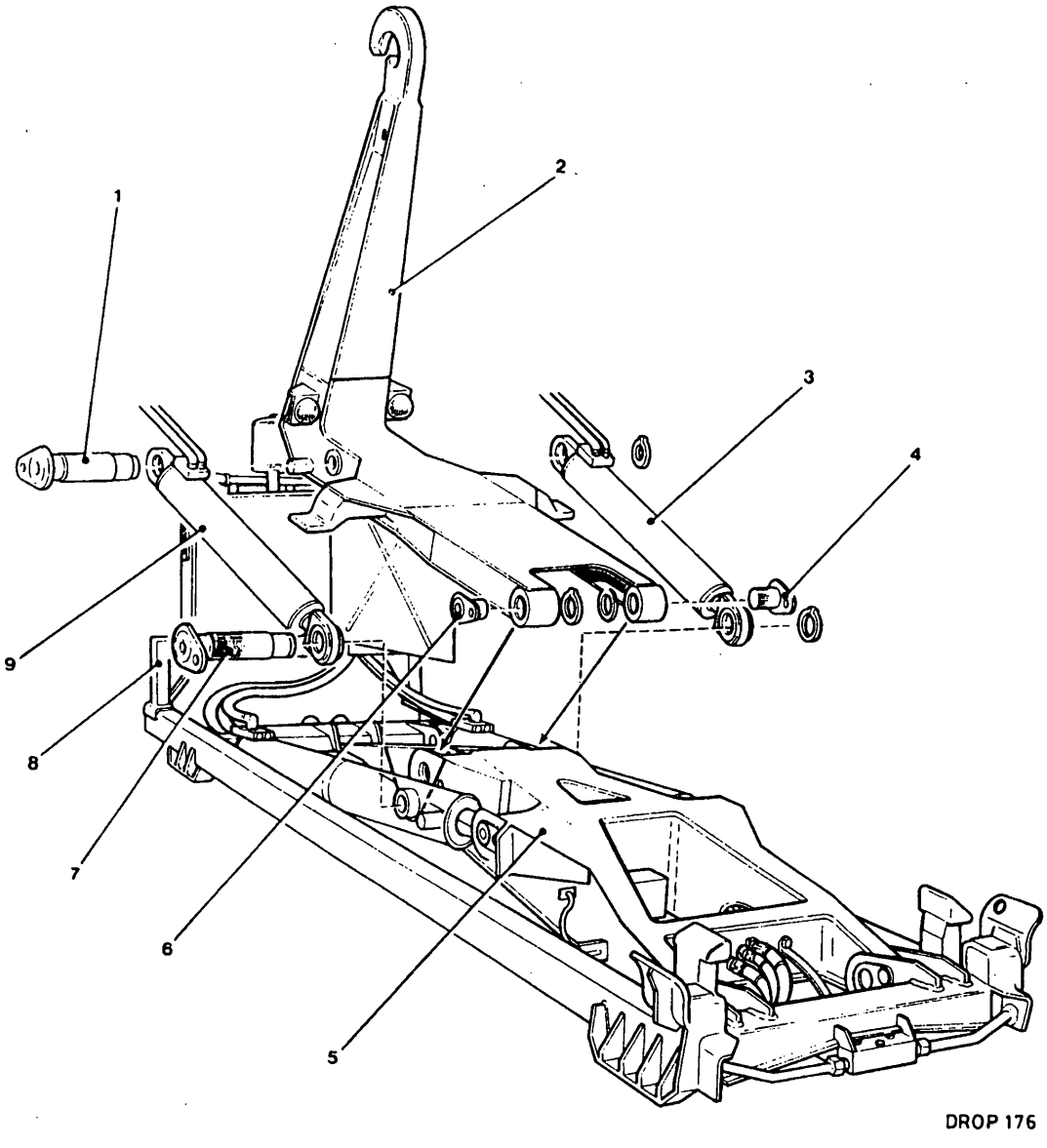
7.4 Using sling (Table 2 Ser 6) lift the hook arm clear of the middle frame and place safely to one side.

7.5 Bend down the tab on the locking washer securing the lock nut on the hook arm cylinders lower pivot shaft (7) r.h. side. Remove lock nut and lock washer using a 'C' spanner.

7.6 Support the weight of the hook arm cylinder r.h. (3) and withdraw the cylinder from the lower pivot shaft and place safely to one side.

7.7 Support the weight of the hook arm cylinder l.h. (9) and withdraw the cylinder complete with lower pivot shaft from the middle frame.

7.8 Remove pivot shaft from hook arm cylinder l.h., place components safely to one side.



1 Upper pivot shaft
2 Hook arm
3 Hook arm hydraulic cylinder r.h.
4 Pivot pin r.h.
5 Middle frame
6 Pivot pin l.h.
7 Lower pivot shaft
8 Support frame
9 Hook arm hydraulic cylinder l.h.

Fig 2 Hook arm/middle frame separation

Middle frame/compression frame separation (See Fig 3)

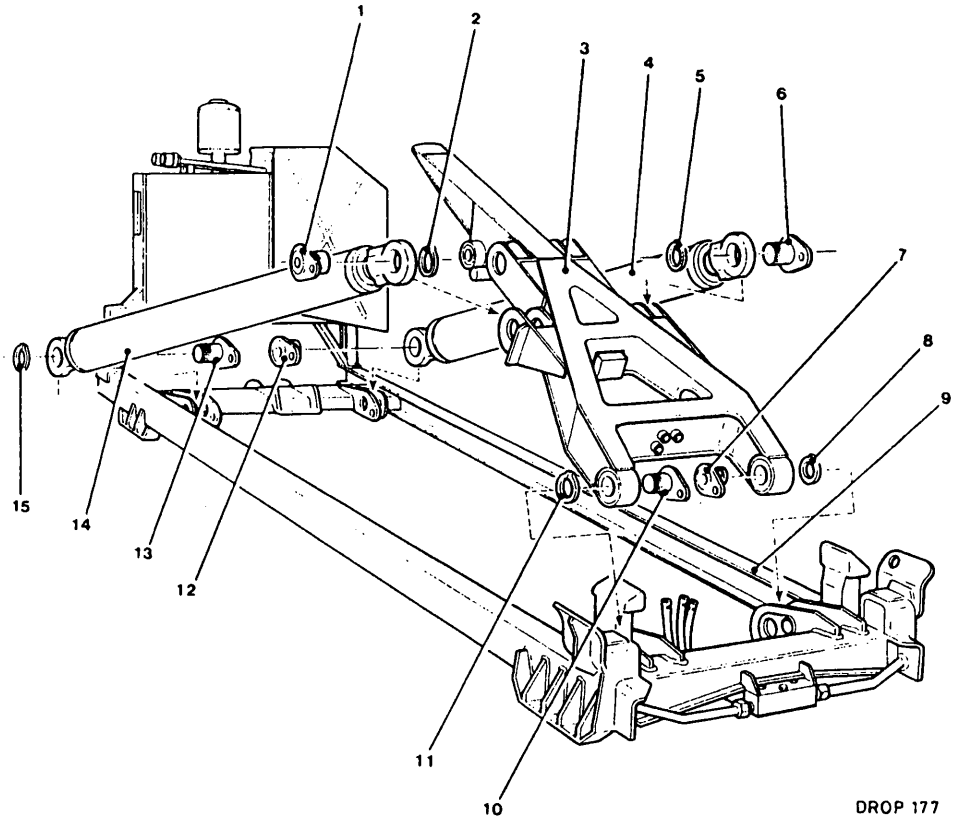
8 Remove the middle frame from the compression frame as follows:

8.1 Remove the circlips (2) and (5) from the two main hydraulic cylinders, middle frame pivot pins (1) and (6).

8.2 Remove the two set screws and washers from retaining plates.

8.3 Support the weight of the main hydraulic cylinders r.h. (4) and l.h. (14) and remove the two pivot pins and washers (1) and (6) from the middle frame (3). Lower cylinders clear of middle frame.

8.4 Support the weight of the middle frame with slings, remove the circlips (8) and (11) from the middle frame pivot pins (7) and (10).



1 Pivot pin	6 Pivot pin	11 Circlip
2 Circlip	7 Pivot pin	12 Pivot pin
3 Middle frame	8 Circlip	13 Pivot pin
4 Cylinder r.h.	9 Compression frame	14 Cylinder l.h.
5 Circlip	10 Pivot pin	15 Circlip

Fig 3 Middle frame/compression frame separation

8.5 Remove the two set screws and washers from the retaining plates.

8.6 Using extractor (Table 2 Ser 8) with bolt (Table 2 Ser 7) remove the pivot pins and washers (7) and (10) securing the middle frame to the compression frame.

8.7 Using sling (Table 2 Ser 6) lift the middle frame clear of the compression frame and place safely to one side.

Hydraulic unit dismantling (See Fig 4)

9 Remove hydraulic unit components from the hydraulic support frame as follows:

9.1 Raise the hydraulic unit cover (24) to a position where the gas struts can be removed from the locating nipples.

9.2 Remove the two nyloc nuts from the cover pivot point set screws, remove the set screws and lift the cover clear of the unit.

9.3 Remove the two nyloc nuts securing the gas strut set screws to the support frame (25), remove the gas struts. Unscrew the threaded spacer and remove the set screw and washer from the gas strut.

9.4 Remove the pipe clamp (3) securing the two recovery pipes to the tank top.

9.5 Ensure all hoses and pipes are marked for ease of replacement, remove all hose and pipes from main upper manifold (7) and lower manifold (15) block if not already removed.

9.6 Remove the four nyloc nuts and washers securing the tank fixing straps (27) to the support frame. Lift tank clear of support frame.

9.7 Remove the four nyloc nuts, washers and socket headed screws securing the main junction box (4) to the support frame. Lift main junction box clear of the support frame.

9.8 Support the weight of the main upper/lower manifold block (7) and (15) and remove the four set screws securing the main manifold to the support frame. Lift main manifold clear of support frame.

10 Remove the hour meter (5) from the main junction box (4) as follows:

10.1 Remove the two nyloc nuts and cap screw securing the meter housing to the junction box. Removing housing, complete with meter.

10.2 Slacken off the two plastic knurled nuts, unclamp and remove the hour meter from the housing.

11 Remove the rear junction box as follows:

11.1 Remove electrical connections from all solenoid valves noting orientation for reassembling.

11.2 Remove the four nyloc nuts and screws securing the rear junction box to the rear mounting of the middle frame and remove junction box.

Main manifold

Dismantling (See Fig 4)

12 Dismantle the main manifold as follows:

12.1 Remove each set of four socket headed cap screws that secure the main ram (8), lock arm (12) and transit on (10) directional control valves to the upper manifold block (7). Withdraw the valve from the manifold front face, remove the 'O' rings from the connecting ports.

12.2 Using a suitable spanner remove the two main ram load control valves (6) from the upper manifold block.

12.3 Using a suitable spanner remove the system load control valve (13) from the side of the lower manifold block. Note the PTFE seal fitted in place of an 'O' ring.

12.4 Using a suitable spanner remove the ventable relief valve (17) from the underside of the manifold block.

12.5 Using a suitable spanner remove the solenoid (free flow) valve (16) from the underside of the manifold block.

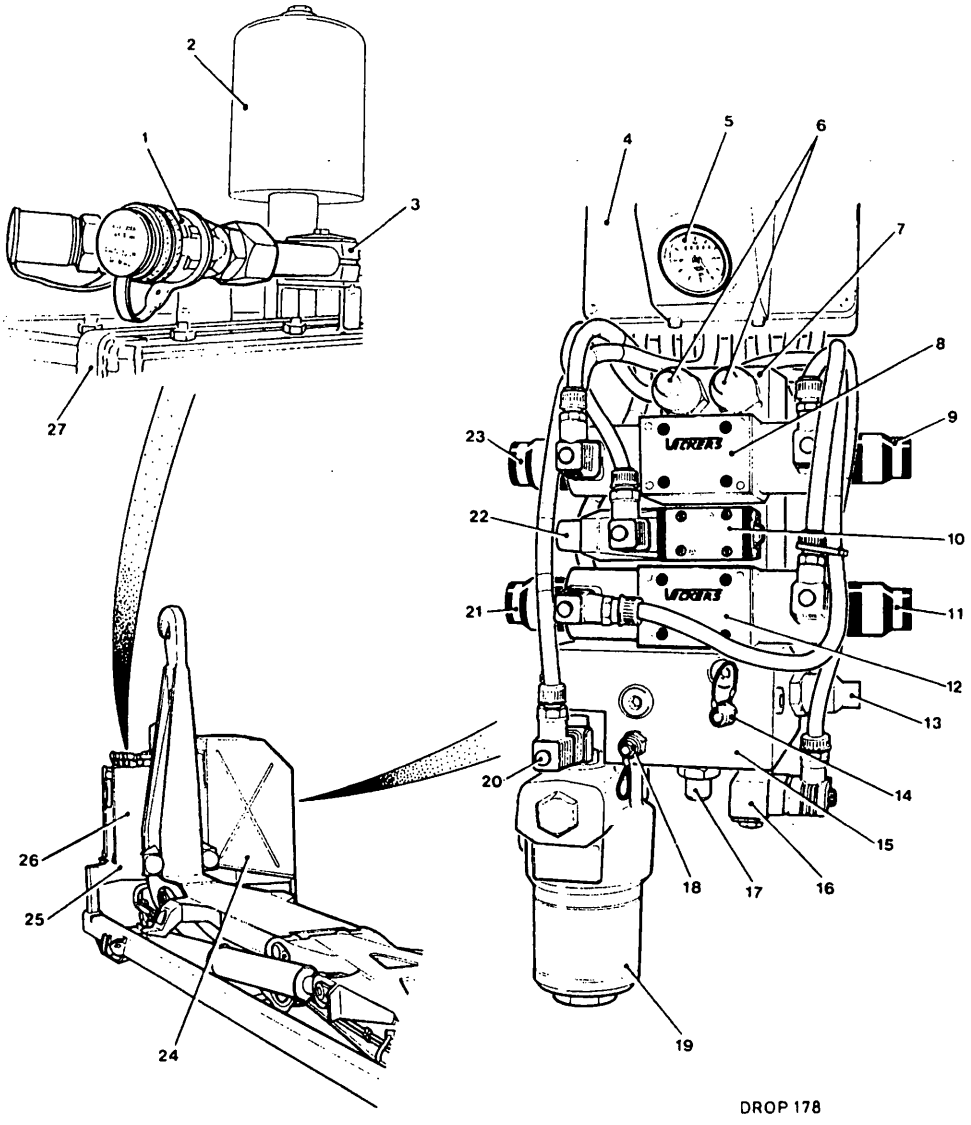
12.6 Holding the pressure filter (19) steady remove the four socket headed cap screws that pass through from the top face of the lower manifold block and secure the filter in position, remove the pressure filter.

12.7 Unscrew the hexagon headed plug from the side of the lower manifold block. Using a suitable tool remove the retainer from the inside of the block and withdraw the check valve.

12.8 From the underside of the lower manifold block (15) remove the four socket headed cap screws, note the position of the short screw. Separate the upper and lower manifold block, retain the locating roll pins and discard the 'O' rings.

Cleaning and inspection

13 Thoroughly clean all components using approved materials and methods, inspect bores of manifold for signs of wear, burrs and corrosion, inspect and test valves, valve testing is carried out after reassembling into their respective manifolds



1 Return filter
2 Air breather/filter
3 Pipe clamp
4 Main junction box
5 Hour meter
6 Main ram load control valves
7 Upper manifold block
8 Main ram directional control valve
9 Main ram manifold 'A'
10 Transit on directional control valve
11 Hook arm ram solenoid 'A'
12 Hook arm ram directional control valve
13 System load control valve
14 Test point
15 Lower manifold block
16 Solenoid (free flow) valve
17 Ventable relief valve
18 Test point
19 Pressure filter
20 Clogging indicator
21 Hook arm ram solenoid 'B'
22 Transit on solenoid
23 Main ram solenoid 'B'
24 Hydraulic unit cover
25 Support frame
26 Hydraulic tank
27 Fixing strap

Fig 4 Hydraulic unit and main manifold components

Main manifold valves (See Fig 5)

14 All valves are tested on reassembly into their respective manifold block.

Main ram load control valves

15 Each main ram load control valve (1) is manufactured as a matched set and is not to be further dismantled. Check the valves visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising 'O' rings (31), (33) and (35) and backing rings (32) and (34) is to be fitted to each valve. Before fitting, oil the rings, and on assembly to the manifold, care is to be taken that the backing rings do not become twisted.

System load control valve

16 The system load control valve (2) is checked in the same way as the main ram load control valves and a new seal kit comprising 'O' rings (5), (7) and (9) backing rings (6) and (8) are to be fitted in the same manner as for the main ram load control valves.

Ventable relief valve

17 The ventable relief valve (24) is manufactured as a matched set and is not to be further dismantled.

18 Check the valve visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising 'O' rings (18), (20) and (22) and backing rings (19) and (21) is to be fitted to the valve. Before fitting, oil the rings, using system oil, and on assembly, care is to be taken that the backing rings are not twisted.

Solenoid (free flow) valve

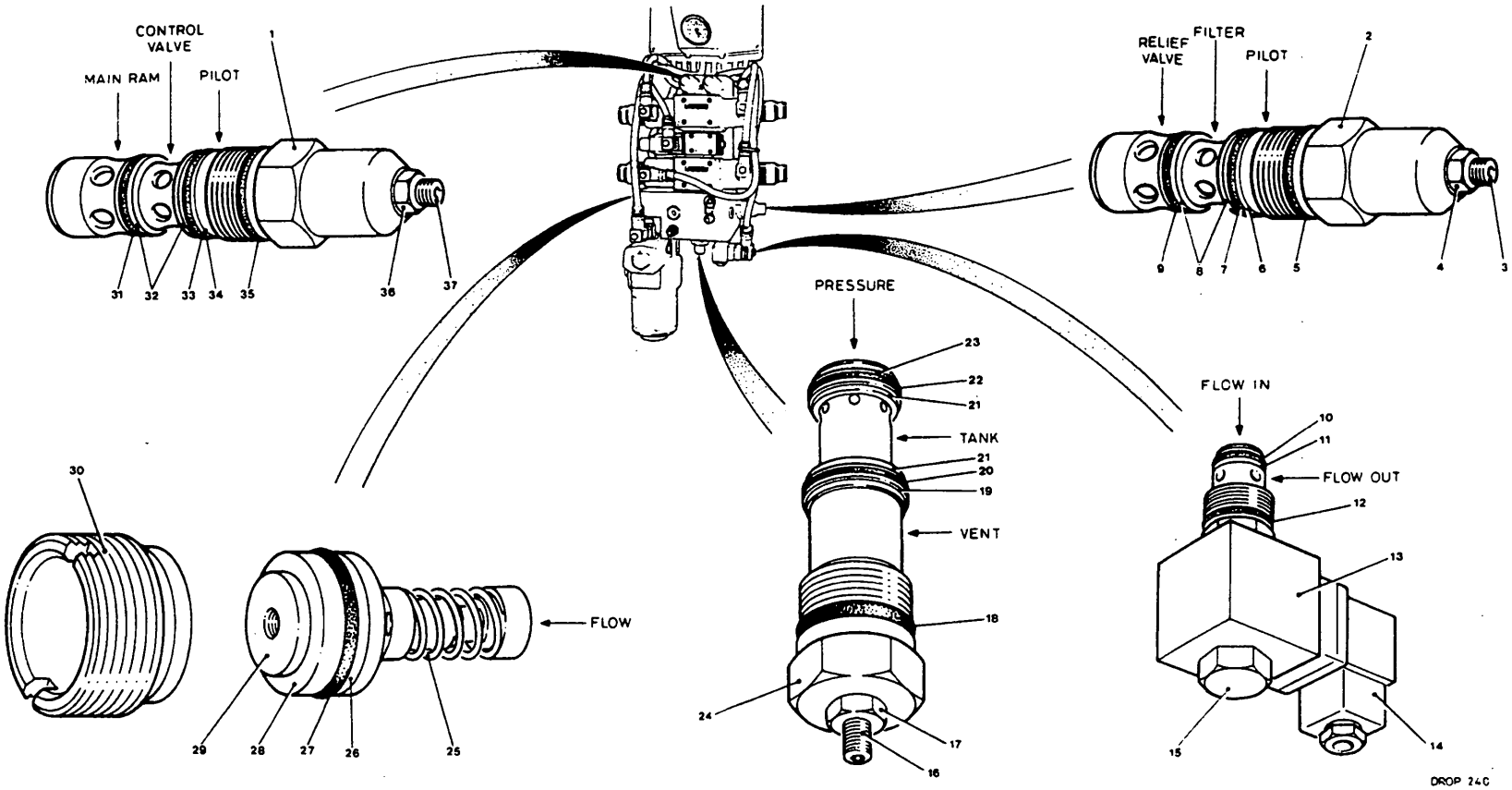
19 The solenoid (free flow) valve (13) can be further dismantled by removing the solenoid retaining nut (15) and withdrawing the solenoid coil for inspection/removal, no further disassembly is to be carried out.

20 Check the valve visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising 'O' rings (10) and (12) and backing ring (11) is to be fitted, and on assembly, care is to be taken to ensure that the backing ring is not twisted.

Check valve

21 The check valve body (28) is supplied as a complete unit and is not to be further dismantled.

22 Check the valve visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising an 'O' ring (27) and backing ring (26), is to be fitted to the valve. Before fitting, oil the rings, using system oil, and on assembly, care is to be taken to ensure that the backing ring is not twisted.



1 Main ram load control valve
2 System load control valve
3 Adjuster screw
4 Locknut
5 'O' ring
6 Backing ring
7 'O' ring
8 Backing ring
9 'O' ring
10 'O' ring
11 Backing ring
12 'O' ring
13 Solenoid (free flow) valve
14 Electrical connector
15 Retaining nut
16 Adjuster screw
17 Locknut
18 'O' ring
19 Backing ring
20 'O' ring
21 Backing ring
22 'O' ring
23 Backing ring
24 Ventable relief valve
25 Spring
26 Backing ring
27 'O' ring
28 Check valve body
29 Valve
30 Retainer
31 'O' ring
32 Backing ring
33 'O' ring
34 Backing ring
35 'O' ring
36 Locknut
37 Adjuster screw

Fig 5 Main manifold valves

Main ram, hook arm ram and transit directional control valves (See Fig 6)

23 The main ram and hook arm ram directional control valves are double ended valves with facility to change flow direction to either side of relevant ram. The transit directional control valve is a single open/shut valve but refitting procedures for both types are the same. Only the solenoids and 'O' rings can be changed, further dismantling is not to be attempted.

23.1 Remove the manual override covers l.h./r.h. (2) and (8) from the end of the solenoids.

23.2 Remove the nuts securing the solenoid coils (3) and (9) and withdraw the solenoid coils from the valve. Remove and discard 'O' rings (4) and (6).

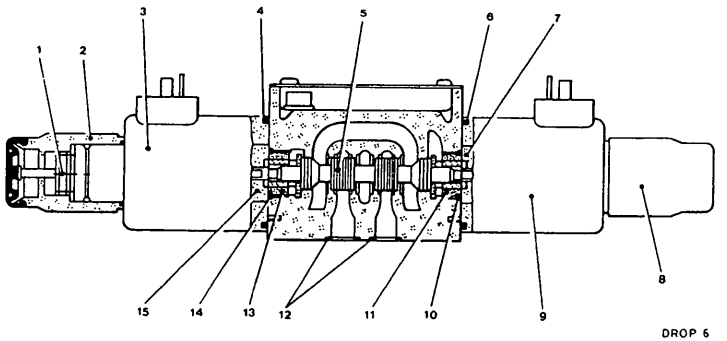
23.3 On the main ram and hook arm ram valves only, if leakage is suspected unscrew the end sleeves (7) and (15) and remove the 'O' rings (10) and (14) take care not to lose the springs (11) and (13) and withdraw the spool (5).

Cleaning and inspection

24 Using approved cleaning methods and materials thoroughly clean all components, check for signs of wear or damage. If the spool or valve bore is damaged change the valve. Fit new 'O' rings on reassembly.

Reassembly

25 Reassembly is the reverse of dismantling, torque tighten the end sleeves (7) and (15) to 36 to 44 Nm (26.6 to 32.5 lbf ft) and the coil securing nut (1) to 35 to 40 Nm (25.9 to 29.6 lbf ft).



1 Nut	6 'O' ring	11 Springs
2 Cover l.h.	7 End sleeve	12 'O' ring
3 Solenoid l.h.	8 Cover r.h.	13 Springs
4 'O' ring	9 Solenoid coil r.h.	14 'O' ring
5 Spool	10 'O' ring	15 End sleeve

Fig 6 Directional control valve

Main manifold reassembly (See Fig 5)

26 Reassembly of the main manifold is carried out in two parts, the upper and lower manifold are reassembled and tested as separate units and are then secured together and tested as a whole.

Lower manifold assembly

27 Reassemble the lower manifold as follows:

27.1 Insert the check valve body (28) into the block.

27.2 Coat the thread of the retainer (30) with sealant (Table 1 Ser 1) and using a suitable tool screw in the retainer, torque tighten to 85 Nm (63 lbf ft).

27.3 Fit a new bonded seal to the blanking plug and screw the blanking plug into the manifold, torque tighten to 85 Nm (63 lbf ft).

27.4 Check that the PTFE sealing ring has been fitted, then screw the system load control valve (2) into the block, torque tighten to 100 Nm (74 lbf ft).

27.5 Screw the solenoid (free flow) valve (13) into the block, torque tighten to 30 Nm (22 lbf ft).

Lower manifold test

NOTE

Test plates can only be fitted correctly one way. Port markings are stamped onto the manifold block.

28 With suitable test equipment including 24 V dc supply available, test the manifold block as follows:

28.1 Fit test plates (Table 2 Ser 12) and (Table 2 Ser 14). Interconnect ports 'X' and 'P1', (See Fig 7).

28.2 Connect pressure line to port 'B' and blank off all other ports.

28.3 Apply pressure to port 'B', gradually increase to 350 bar (5100 lbf/in^2), hold this pressure for 1 minute and check for leaks. Release pressure.

28.4 With port 'T2' open to atmosphere proceed with functionally testing the manifold.

28.5 To check the ventable relief valve, apply pressure to port 'B', at approximately 250 bar (3600 lbf/in^2) oil must flow from port 'T2'. If valve lifts at incorrect pressure use ventable relief valve (Fig 5 (24)) adjuster screw to correct until oil flows at 250 bar.

28.6 Reduce pressure on port 'B' to 20 bar (290 lbf/in^2), oil flow from port 'T2' must stop.

28.6.1 If the above parameters cannot be met by adjustment change the ventable relief valve and retest.

28.7 To check the solenoid (free flow) valve, with 20 bar (290 lbf/in^2) pressure still on port 'B', energise free flow valve solenoid, oil must flow from port 'T2'. De-energise the solenoid, oil flow must stop. Repeat this operation four more times.

28.7.1 If the above parameters cannot be met, check electrical supply to free flow valve solenoid, if electrical supply correct, change solenoid, if still incorrect, change free flow valve and retest.

28.8 To check oil ways clear, reduce pressure on port 'B' to 10 bar (145 lbf/in^2), crack open port 'X', oil must flow from it.

28.9 Open ports 'TP1' and 'T1' to atmosphere, blank all other ports except 'A', connect pressure line to port 'A'.

28.10 To check the system load control valve, gradually increase the pressure to port 'A'. At approximately 50 bar (720 lbf/in^2), oil must flow from port 'T1'.

28.11 If lift pressure incorrect, use load control valve adjuster screw (3) to adjust.

28.12 Reduce pressure to port 'A' to 10 bar (145 lbf/in^2), oil flow from port 'T1' must stop.

28.13 With 10 bar (145 lbf/in^2) still on port 'A' and no flow from port 'T1', apply pilot pressure of 5 bar (70 lbf/in^2) to port 'TP1', oil must now flow from port 'T1'. Remove pilot pressure and oil flow must stop.

28.13.1 If the above parameters cannot be met, change the system load control valve and retest.

28.14 To check oil ways clear, apply 10 bar (145 lbf/in^2) to port 'T1', crack ports 'A', 'T2' and 'TP2' in turn and check oil flow from each. Remove pressure from block.

28.15 Open port 'P2' to atmosphere, blank port 'TP1'. Connect pressure line to port 'P1'

28.16 To check reverse flow through the check valve, apply 10 bar (145 lbf/in^2) to port 'P1', oil must flow from port 'P2'. Close port 'P2' and open port 'W', oil must flow from port 'W'. Remove pressure from block.

28.17 Connect pressure line to port 'P2', open port 'P1' to atmosphere and blank port 'W'.

28.18 Apply 20 bar (290 lbf/in^2) to port 'P2', no oil must flow from port 'P1'.

28.18.1 If the above parameters (Para 28.17 to 28.19) cannot be met, change the check valve and retest. Use check valve removal tool (Table 2 Ser 18) to remove and replace valve.

28.19 Release all pressure, remove test plates, drain manifold and fit blanking plugs to all ports.

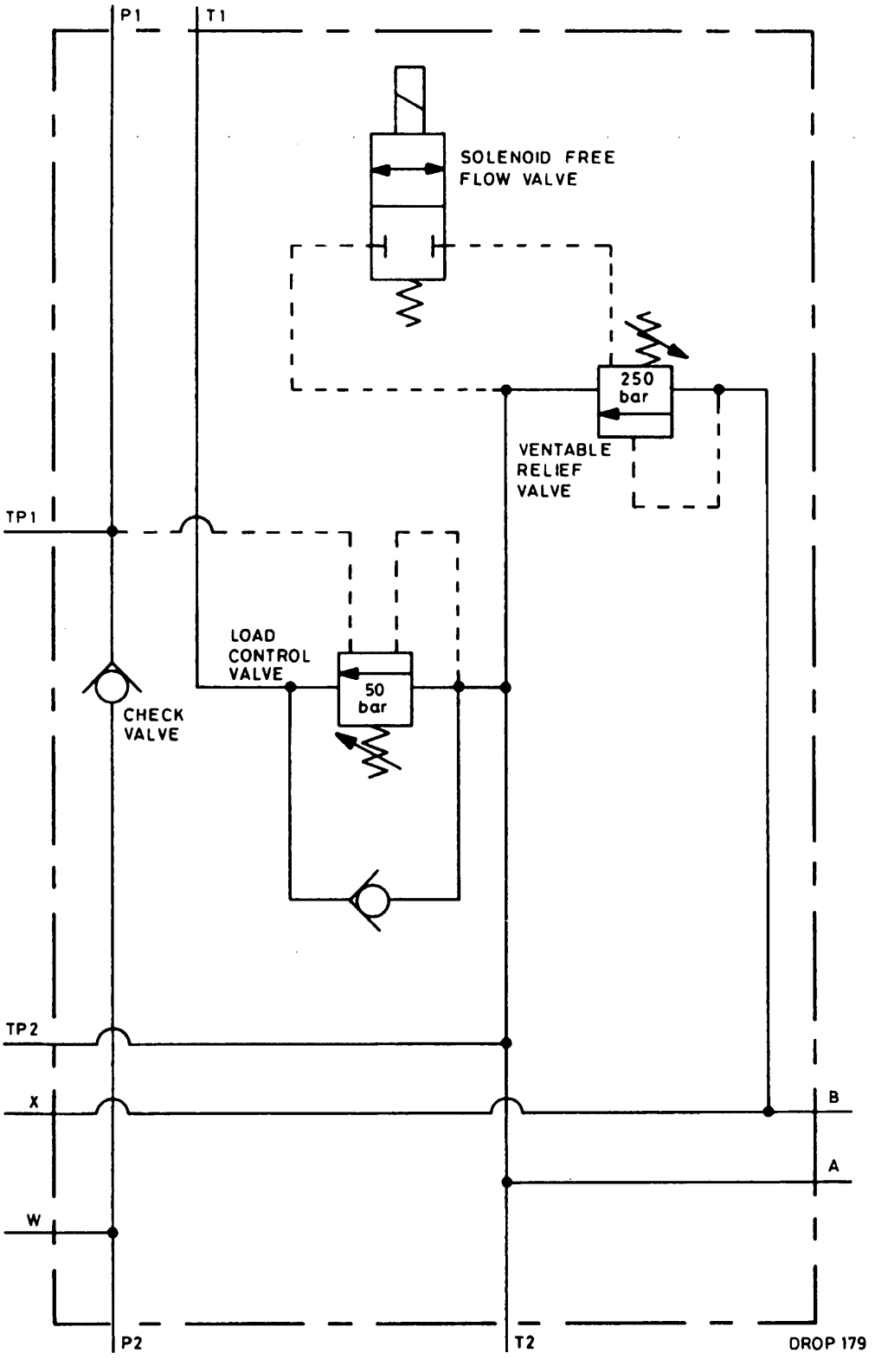


Fig 7 Lower manifold circuit diagram

Upper manifold reassembly (See Fig 4)

29 Reassemble the upper manifold assembly as follows:

29.1 Using new 'O' rings, locate and secure the main ram directional control valve (8) to the block with four socket headed cap screws.

29.2 Repeat procedure described in Para 29.1 above and secure the hook arm (12) and transit on (10) directional control valve to the block.

29.3 Screw the two load control valves (6) into the manifold and torque tighten to 100 Nm (74 lbf ft).

Upper manifold test (See Fig 8)

30 With suitable test equipment including 24 V dc supply available, test the manifold block as follows:

30.1 Fit test plate (Table 1 Ser 13).

30.2 Interconnect ports 'A' and 'Z' and connect pressure line to port 'Y', blank off all other ports.

30.3 Apply pressure to port 'Y', gradually increase pressure to 160 bar (2300 lbf/in^2), hold this pressure for 1 minute and check for leaks, release pressure.

30.4 To check oil ways and flow through directional control valves in the NEUTRAL position apply 20 bar (290 lbf/in^2) to port 'Y' and crack ports 'T1', 'T2', 'MB1', 'MB2', 'MA1', 'MA2', 'A', 'B, 'TPMA' and 'TPMB' to ensure that oil flows from them. Check that there is little or no flow from port 'Z'.

30.4.1 If there is no flow from ports 'MB1' and 'MB2' but from 'MA1' and 'MA2', change r.h. main ram load control valve.

30.4.2 If there is no flow from ports 'MA1' and 'MA2' but from 'MB1' and 'MB2', change l.h. main ram load control valve.

30.4.3 If there is no flow from ports 'MA1', 'MA2', 'MB1', 'MB2', 'TPMA' and 'TPMB', change main ram directional control valve.

30.4.4 If there is no flow from ports 'A' and 'B', change hook arm directional control valve.

30.4.5 If oil flows from port 'Z' in any volume, change main ram directional control valve.

30.5 To check the hook arm ram directional control valve, connect pressure line to port 'Y', open ports 'A' and 'B' to atmosphere and apply 20 bar (290 lbf/in^2) to port 'Y'.

30.6 Energise in turn each solenoid of the hook arm ram directional control valve, oil must flow from ports 'A' and 'B' in turn. Cycle three times then release pressure.

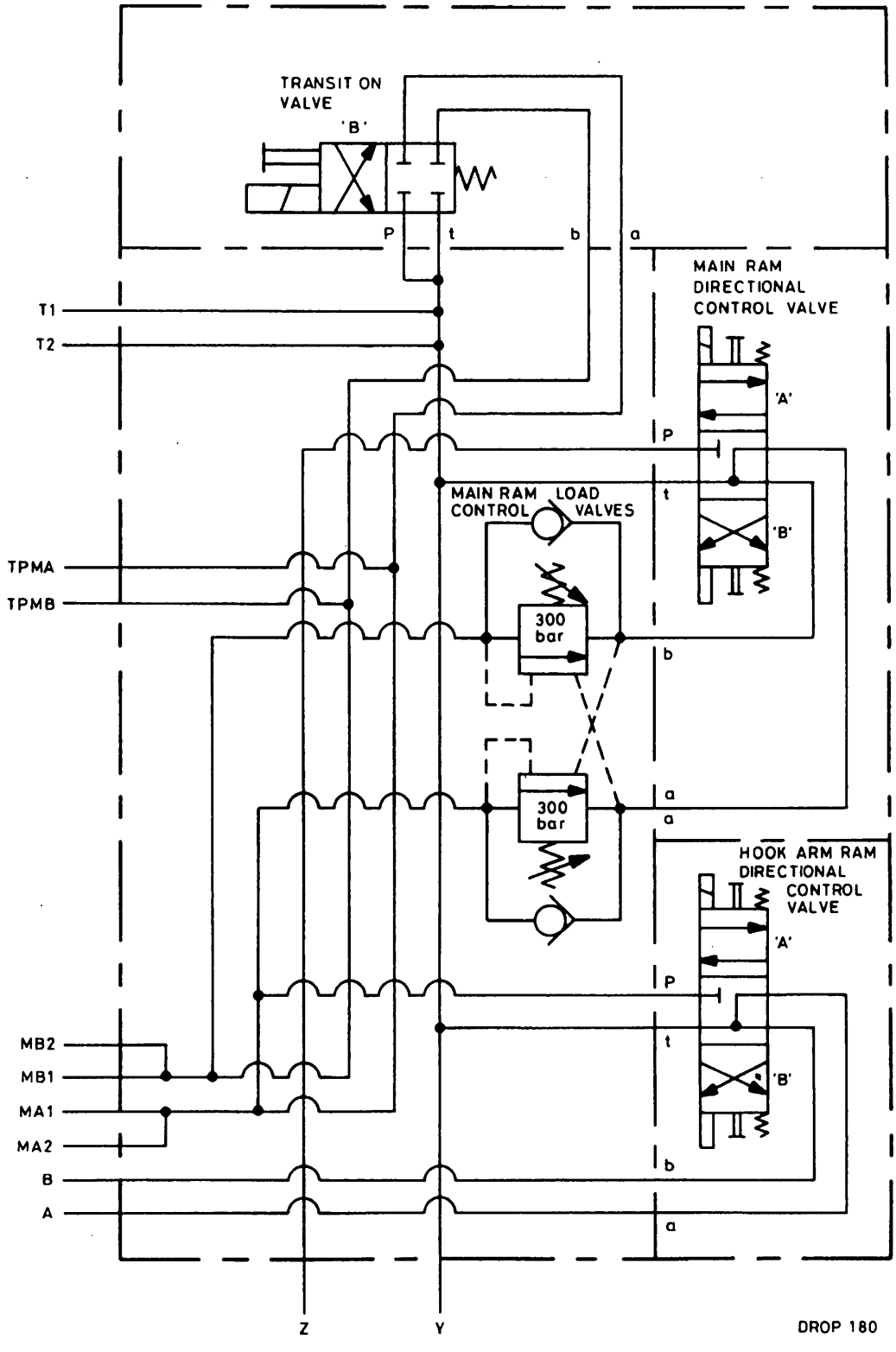


Fig 8 Upper manifold circuit diagram

30.6.1 If oil does not flow from either port 'A' or 'B', check both solenoids operation, change if faulty, or change the hook arm ram directional control valve and retest.

30.7 To check the main ram directional control valve, connect pressure line to port 'Z', open ports 'MA1' and 'MB1' to atmosphere and blank all other ports. Apply 20 bar (290 lbf/in^2) to port 'Z'.

30.8 Energise in turn each solenoid of the main ram directional control valve, oil must flow from ports 'MA1' and 'MB1' in turn. Cycle three times then release pressure.

30.8.1 If oil does not flow from either port 'MA1' or 'MB1', check both solenoids operation, change if faulty, or change the main ram directional control valve and retest.

30.9 To check the r.h. main ram load control valve, connect pressure line to port 'MB1' open port 'Y' to atmosphere and blank all other ports.

30.10 Gradually increase the pressure to port 'MB1', at approximately 300 bar (4300 lbf/in^2) oil must flow from port 'Y'. If oil flows are pressure different to 300 bar, reset r.h. main ram load control valve using adjuster screw (Fig 5 (3)). Release pressure but leave connected.

30.10.1 If correct pressure cannot be set, change the r.h. main ram load control valve.

30.11 Connect pilot pressure line to port 'Z'.

30.12 Energise r.h. solenoid of main ram directional control valve and apply 210 bar (30 lbf/in^2) to port 'MB1' and maintain.

30.13 Gradually increase the pressure to port 'Z' at approximately 30 bar (440 lbf/in^2) (pilot oil pressure), oil must flow from port 'Y'. De-energise the main ram directional control valve solenoid and flow must stop.

30.13.1 If the parameters of Para 30.13 are not met, it could indicate a fault in the main ram directional control valve or the r.h. main ram load control valve. Change each valve in turn and retest until fault is cleared.

30.14 To check the l.h. main ram load control valve, connect pressure line to port 'MA1', open port 'Y' to atmosphere and blank all other ports.

30.15 Gradually increase the pressure to port 'MA1', at approximately 300 bar (4300 lbf/in^2), oil must flow from port 'Y'. If oil flows at pressure different to 300 bar, reset l.h. main ram load control valve using adjuster screw (3). Release pressure but leave connected.

30.15.1 If correct pressure cannot be set, change the l.h. main ram load control valve.

30.16 Energise l.h. solenoid of main ram directional control valve and apply 210 bar (30 lbf/in^2) to port 'MA1' and maintain.

30.17 Gradually increase the pressure to port 'Z', at approximately 30 bar (440 lbf/in^2) (pilot pressure), oil must flow from port 'Y'. De-energise the main ram directional control valve solenoid and flow must stop.

30.17.1 If the parameters of Para 30.17 are not met, it could indicate a fault in the main ram directional control valve or the l.h. main ram main control valve. Change each valve in turn and retest until fault is cleared.

30.18 To check the solenoid transit on valve, open port 'Y' to atmosphere, connect pressure line to port 'Z' and apply 20 bar (290 lbf/in^2).

30.19 Energise the r.h. solenoid of the main directional control valve. No oil must flow from port 'Y'.

30.20 Energise the solenoid transit on valve, oil must now flow from port 'Y'. De-energise the transit on valve to stop flow. Cycle three times.

30.21 Energise the l.h. solenoid of the main ram directional control valve. No oil must flow from port 'Y'.

30.22 Energise the solenoid transit on valve, oil must now flow from port 'Y'. De-energise the transit on valve to stop flow. Cycle three times. Release the pressure.

30.22.1 If oil flows before the transit on valve is energised or continues to flow after the transit on valve is de-energised, change the transit on valve and retest.

30.23 To check the hook arm ram directional control valve, connect pressure line to port 'Y' and port 'MA1', open ports 'A' and 'B' to atmosphere and blank all other ports.

30.24 Apply 20 bar (290 lbf/in^2) to ports 'Y' and 'MA1', energise the r.h. solenoid of the hook arm ram directional control valve, oil must flow from ports 'A' and 'B'. De-energise the solenoid and flow must stop. Cycle three times.

30.25 With pressure still on ports 'Y' and 'MA1' energise l.h. solenoid of hook arm directional control valve, oil must flow from ports 'A' and 'B'. De-energise the solenoid and flow must stop. Cycle three times.

30.25.1 If oil does not flow from both ports 'A' and 'B' during operations of both solenoids, change the hook arm ram directional control valve and retest.

30.26 Remove test plates, drain manifold and fit blanking plugs.

Upper and lower manifold reassembly

31 Reassemble the upper and lower manifolds as follows:

31.1 Remove all blanking plugs, ensure the roll pins are correctly located in the blocks and new 'O' rings are fitted to the 'Y' and 'Z' ports.

31.2 Locate the two manifolds together, ensuring mating faces are clean and free from burrs. Fit the four socket headed cap screws, ensuring the short screw is in its correct location. Torque tighten to 30 Nm (22 lbf ft).

31.3 Locate the pressure filter, ensuring the 'O' ring is correctly located between the manifold and the filter. Fit the four socket headed cap screws and torque tighten to 27 Nm (20 lbf ft).

Main manifold test

32 The main manifold is tested to check correct jointing between upper and lower manifolds and also the operation of the free flow valve.

33 With suitable test equipment, including 24 V dc supply available, test the manifold block as follows:

33.1 Connect relief valve (Table 2 Ser 16) and line block (Table 2 Ser 17) to port 'T2' on the lower manifold and connect the tank line of the line block to tank. Set the relief valve to 160 bar (2300 lbf/in^2).

33.2 Blank all ports, except port 'P1' on the upper manifold block, connect supply line to port 'P1'.

33.3 Gradually increase the pressure on port 'P1' to 350 bar (50 lbf/in^2) and maintain this pressure for one minute. Check for leaks between the manifold faces and the filter interface. Release pressure.

33.4 Energise the solenoid (free flow) valve and gradually increase the pressure on port 'P1' to 150 bar (2200 lbf/in^2). Maintain this pressure for one minute and check for leaks. Release all pressure and disconnect pressure lines.

33.5 If pressure builds up above 150 bar, release pressure, check solenoid (free flow) valve, change if required. If solenoid operation correct, change free flow valve and retest.

33.6 Remove the relief valve and line block, drain the manifold and fit blanking plugs to ports.

33.7 Recheck the tightening torques of the socket headed cap screws.

Main ram manifold block (See Fig 9)

Dismantling

34 Dismantle the main ram manifold block as follows:

34.1 Using extractor tool (Table 2 Ser 19) remove the line rupture protection valves (8) and (9) from ports 'VA' and 'VB'.

34.2 Using a suitable spanner remove the two relief valves (1) and (4) from the block. Remove 'O' rings from all connecting ports and discard.

Cleaning and inspection

35 Thoroughly clean all components using approved materials and methods, inspect bores of manifold for signs of wear, burrs and corrosion, inspect the line rupture protection valves for signs of wear or damage, these valves are factory set and are to be renewed if suspected of being faulty.

Relief valve

36 Each relief valve (1) is manufactured as a matched set and is not to be further dismantled. Check the valves visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising 'O' rings (2) and (3) and backing ring (10) is to be fitted to each valve. Before fitting, oil the rings using system oil, and on assembling care must be taken to ensure that the backing ring is not twisted.

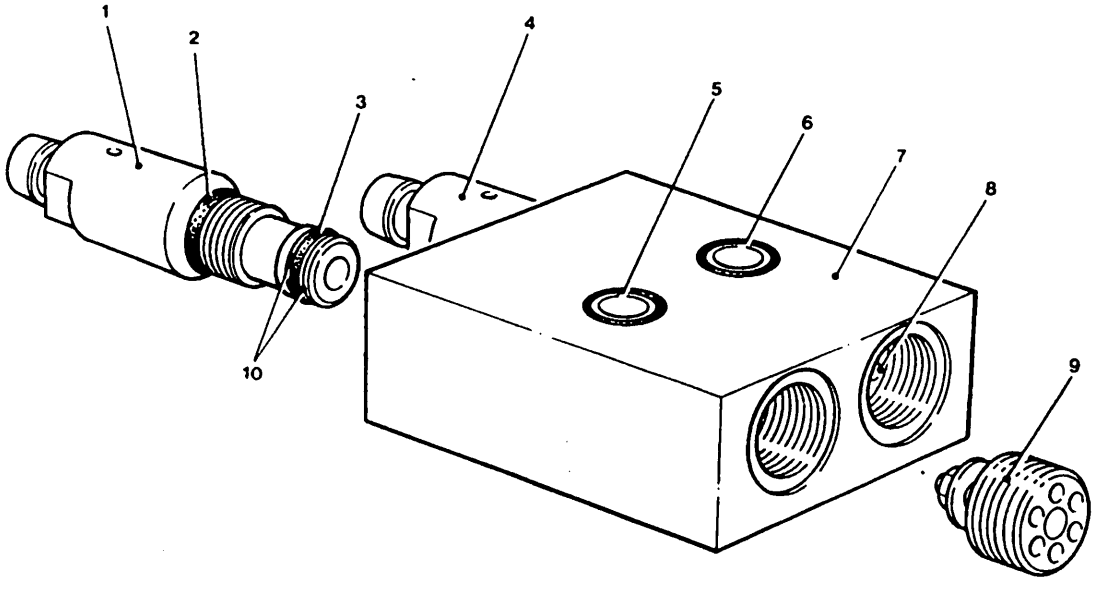
Reassembly

37 Reassemble the main ram manifold block as follows:

37.1 Using extractor tool (Table 2 Ser 19) screw the line rupture protection valves into ports 'VA' and 'VB'.

37.2 Screw the two relief valves into the manifold and torque tighten to 50 Nm (37 lbf ft).

37.3 Fit new 'O' rings to all connecting ports.



DROP 11

1 Relief valve
2 'O' ring
3 'O' ring
4 Relief valve
5 'O' ring
6 'O' ring
7 Manifold block
8 Line rupture protection valve
9 Line rupture protection valve
10 Backing rings

Fig 9 Main ram manifold block

Testing (See Fig 10)

38 With suitable test equipment available test the main ram manifold block as follows:

38.1 Fit test plate (Table 2 Ser 15) to the manifold block.

38.2 Interconnect ports 'CA' and 'VB'. Connect pressure supply to port 'VA' and blank all other ports. Apply a pressure of 350 bar (50 lbf/in^2), hold pressure for one minute and check for any leakage. Release pressure.

38.3 To check the l.h. relief valve, with pressure line connected to port 'VA', leave port 'T' open and blank ports 'VB', 'CA' and 'CB'.

38.4 Apply 10 bar (145 lbf/in^2) to 'VA', crack 'CA' to ensure oil ways clear. Gradually increase pressure to 'VA', at approximately 300 bar (4400 lbf/in^2) oil must flow from port 'T'.

38.5 If oil flows from port 'T' at a pressure different to 300 bar, adjust to correct, using l.h. relief valve adjuster screw on free end of valve.

38.5.1 If pressure cannot be adjusted, change l.h. relief valve and retest.

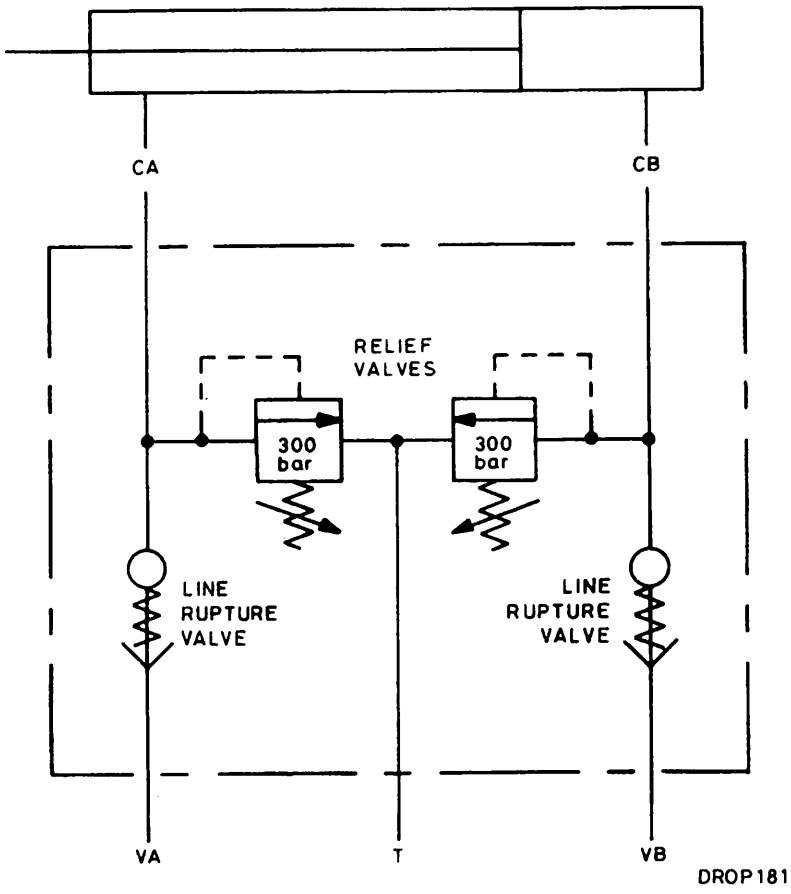


Fig 10 Main ram manifold block circuit diagram

38.6 To check the r.h. relief valve, connect pressure line to port 'VB', leave port 'T' open and blank off ports 'VA', 'CA' and 'CB'.

38.7 Apply 10 bar (145 lbf/in^2) to 'VB', crack 'CB' to ensure oil ways clear. Gradually increase pressure to 'VB', at approximately 300 bar (4300 lbf/in^2), oil must flow from port 'T'. Release pressure.

38.8 If oil flows from port 'T' at a pressure different to 300 bar, adjust to correct using r.h. relief valve adjuster screw on free end of valve.

38.8.1 If pressure cannot be adjusted, change r.h. relief valve and retest.

38.9 Disconnect pressure line, blanking plugs and test plate, drain manifold and refit blanking plugs.

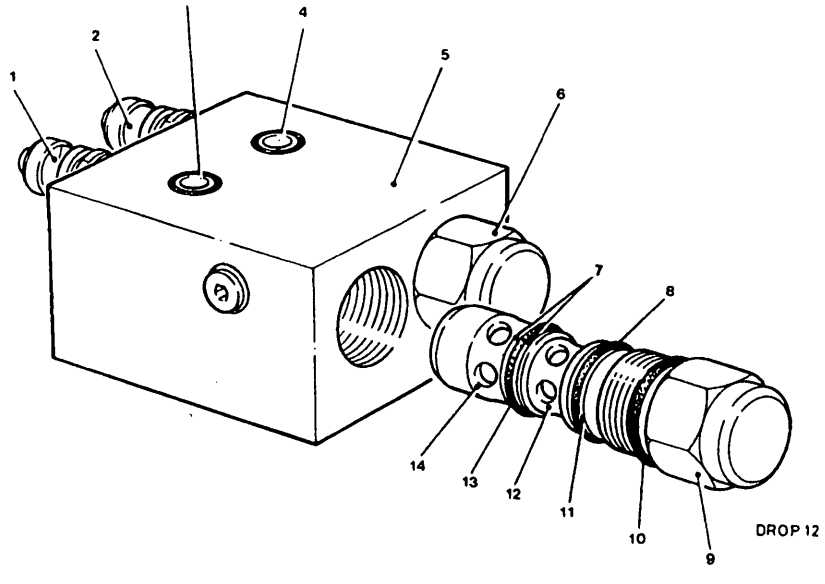
Hook arm ram manifold block

Dismantling (See Fig 11)

39 Dismantle the hook arm ram manifold block as follows:

39.1 Using a suitable spanner remove the two load control valves (6) and (9) from the manifold block.

39.2 Using a suitable spanner remove the two test point connectors (1) and (2) from the manifold block. Remove 'O' rings from all connecting ports.



1 Test point connector
2 Test point connector
3 'O' ring
4 'O' ring
5 Manifold block
6 Load control valve
7 Backing rings
8 'O' ring
9 Load control valve
10 'O' ring
11 Backing ring
12 Centre port
13 'O' ring
14 Nose port

Fig 11 Hook arm manifold block

Cleaning and inspection

40 Thoroughly clean all components using approved materials and methods, inspect bores of manifold for signs of wear, burrs and corrosion, inspect and test the load control valves as described in the following paragraphs.

Load control valves

41 Each hook arm load control valve is manufactured as a matched set and is not to be further dismantled. Check the valves visually for signs of wear or damage and renew the complete valve if necessary. A new seal kit comprising 'O' rings and backing rings is to be fitted to each valve. Before fitting, oil the rings using system oil, and on assembly, care must be taken to ensure that the backing rings are not twisted.

Reassembly

42 Reassemble the hook arm ram manifold block as follows:

42.1 Fit new bonded washers to the screw-in test point plugs and screw the plugs into the manifold block. Torque tighten to 16 Nm (12 lbf ft).

42.2 Screw the two load control valves into manifold. Torque tighten to 70 Nm (50 lbf ft).

Testing (See Fig 12)

43 With suitable test equipment available test the hook arm ram manifold block as follows:

43.1 Fit test plate (Table 2 Ser 15) to the manifold block.

43.2 Interconnect ports 'VB' and 'CA'. Connect pressure line to port 'VA' and blank all other ports. Apply 350 bar (5100 lbf/in^2), hold pressure for one minute and check for any leakage. Release pressure.

43.3 To test l.h. load control valve, connect pressure line to port 'CB', open ports 'VA' and 'VB' to atmosphere and blank all other ports. Gradually increase pressure on port 'CB'. At approximately 300 bar (4300 lbf/in^2) oil must flow from port 'VB' only. Release pressure. This valve is non-adjustable so if pressure is different to 300 bar, change l.h. load control valve and retest.

43.4 Connect pilot line to port 'VA'. Apply 100 bar (1450 lbf/in^2) to port 'CB' and maintain pressure. Gradually increase pilot pressure to port 'VA'. At a pilot pressure of approximately 20 to 26 bar (290 to 380 lbf/in^2), oil must flow from port 'CB'. If no oil flows from 'VB', change l.h. load control valve and retest.

43.5 To check oil ways clear, open port 'TPB' to atmosphere. Apply 10 bar (145 lbf/in^2) pressure to port 'CB', oil must flow from port 'TPB'.

43.6 To test r.h. load control valves, connect pressure line to port 'CA', open ports 'VA' and 'VB' to atmosphere and blank all other ports. Gradually increase pressure on port 'CA'. At approximately 300 bar (4300 lbf/in^2) oil must flow from port 'VA' only. Release pressure. This valve is non-adjustable so if pressure is different to 300 bar, change r.h. load control valve and retest.

43.7 Connect pilot pressure to port 'VB'. Apply 100 bar (1450 lbf/in^2) to port 'CA' and maintain pressure. Gradually increase pilot pressure to port 'VB'. At a pilot pressure of approximately 20 to 26 bar (290 to 380 lbf/in^2), oil must flow from port 'CA'. If no oil flows from 'VA', change r.h. load control valve and retest.

43.8 To check oil ways clear, open port 'TPA' to atmosphere. Apply 10 bar (145 lbf/in^2) flow to port 'CA', oil must flow from port 'TPA'.

43.9 To test the l.h. load control valve non return valve, with port 'CB' open to atmosphere, apply 10 bar (145 lbf/in^2) flow to port 'VB', oil must flow from port 'CB'. If no oil flows from port 'CB', change l.h. load control valve and retest.

43.10 To test the r.h. load control valve non return valve, with port 'CA' open to atmosphere, apply 10 bar (145 lbf/in^2) flow to port 'VA', oil must flow from port 'CA'. If no oil flows from port 'CA', change r.h. load control valve and retest.

43.11 On completion, release pressure, remove all connections and test plate, drain manifold and fit blanking plugs.

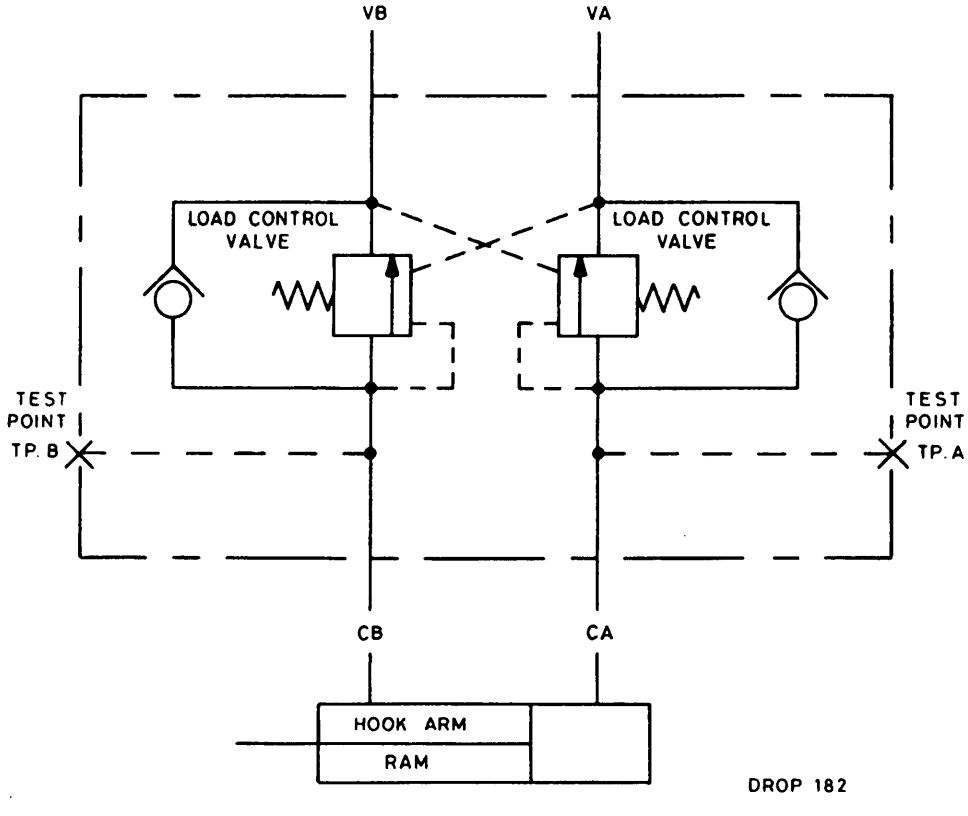


Fig 12 Hook arm manifold block circuit diagram

Hydraulic pump (See Fig 13)

Dismantling

44 Dismantle the hydraulic pump as follows:

44.1 Support the pump on blocks or clamp in a soft jawed vice. Mark the pump body (13) and inlet cover (1) and lift the inlet cover off the pump body.

44.2 Remove the cover 'O' ring (3). Using minimum force withdraw the cartridge assembly (2) from the body.

44.3 Remove the spirolox ring (7) and pull the drive shaft (10) and ball bearing (9) from the body. Remove the snap ring (8), and supporting the bearing inner race press the shaft out of the bearing.

44.4 Remove the shaft seal (12) and washer (11) from the pump body.

44.5 Remove the 'O' ring (5) back up ring (6) and sealing ring (4) from the outlet support plate (14). Scribe a line across the outer surface of the cartridge assembly to provide references for reassembly.

44.6 Place the cartridge assembly, outlet support plate (14) down, on a clean flat surface and remove the two socket head securing screws (24).

CAUTION

During the following steps do not allow the flexible side plates to slide across the cam ring or rotor as any burrs present can cause deep scratches on the soft surface of the plates.

44.7 Slide the inlet support plate (22) and seal packs (21) off the flexible side plate (20).

44.8 Move the flexible side plate off centre just enough to be able to grasp one edge and lift away from the cam ring (17) and rotor (19).

44.9 Using a piece of flat wood to retain the rotor in the cam ring reverse the cartridge assembly.

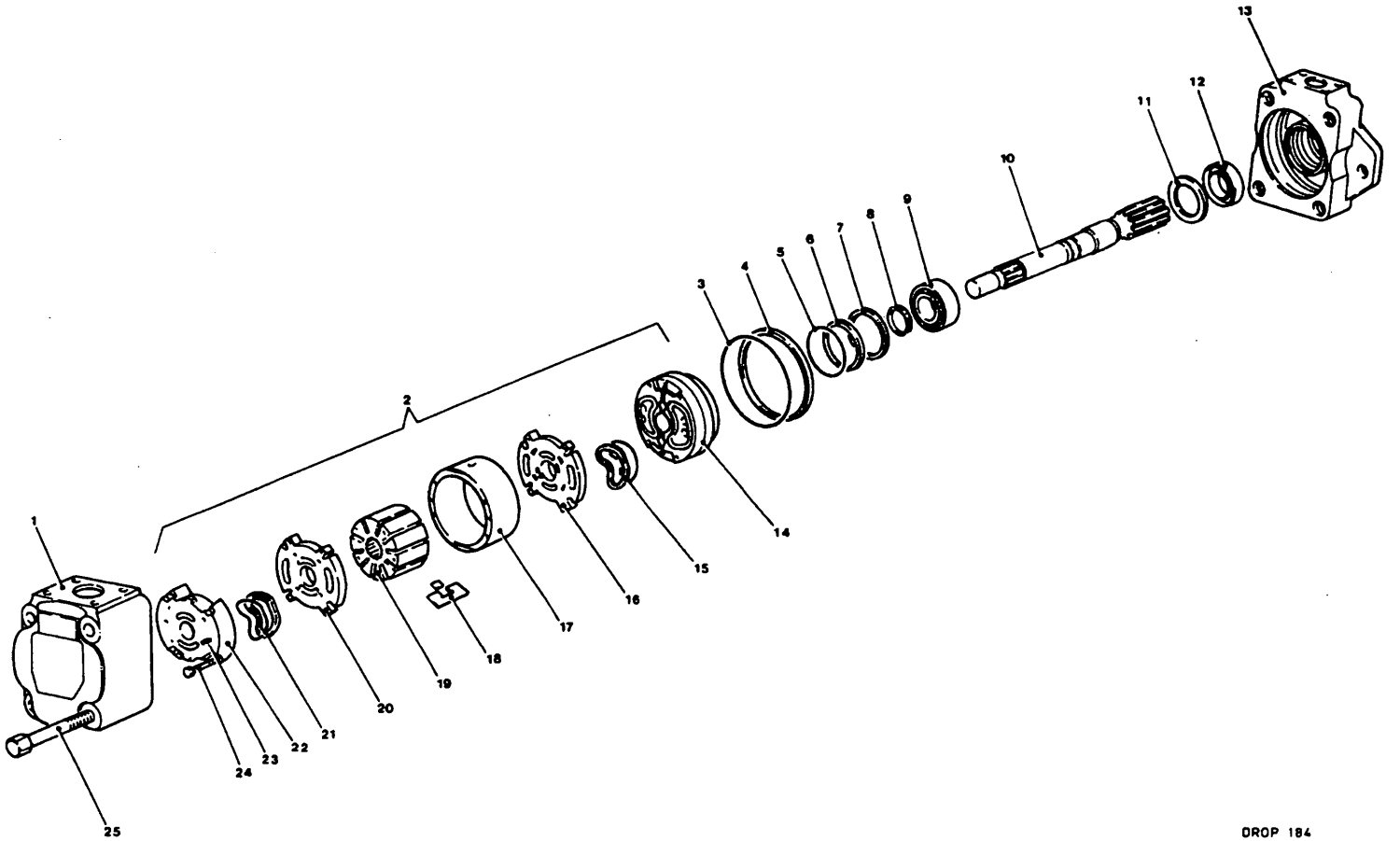
44.10 Slide the outlet support plate (14) and seal packs (15) off the flexible side plate (16).

44.11 Move the flexible side plate off centre just enough to be able to grip one edge and lift away from the cam ring and rotor.

44.12 Separate the cam ring (17) from the rotor (19). Starting at the arrow stamped onto the rotor periphery, remove and keep in order the vanes and inserts (18).

NOTE

Do not remove locating pins from the inlet support plate (22) unless they are damaged. The pins are of a drive-loc type



1 Inlet cover
2 Cartridge assembly
3 'O' ring
4 Sealing ring
5 'O' ring
6 Back-up ring
7 Spirolox ring
8 Snap ring
9 Ball bearing
10 Drive shaft
11 Washer
12 Shaft seal
13 Pump body
14 Outlet support plate
15 Seal packs
16 Flexible side plate
17 Cam ring
18 Vane and insert
19 Rotor
20 Flexible side plate
21 Seal pack
22 Inlet support plate
23 Pin
24 Cartridge securing screw
25 Cover bolt

Fig 13 Hydraulic pump

Cleaning and inspection

45 Using an approved cleaning fluid thoroughly clean and inspect all components.

46 Check cartridge wear surfaces for pick up, heavy heat discoloration, scoring and excessive wear. Slight heat discoloration of the flexible side plate surfaces is normal. A new cartridge is to be fitted if any scoring or scratching cannot be easily removed by use of an oil stone.

47 Inspect bearing as detailed in EMER, T & M A 028 Chapter 080.

Reassembly

48 Reassemble the hydraulic pump as follows:

48.1 Use new 'O' rings, backing rings, seal packs and shaft seal. Coat all components except seals and backing rings with clean hydraulic fluid before assembly. Smear the 'O' rings with a small amount of petroleum jelly to hold them in place during assembly.

48.2 Before assembly, particularly if using new components check for burrs or sharp edges and stone as required.

48.3 If a new cartridge assembly is being used check direction of rotation. This is viewed from the drive end, right hand rotation being clockwise. In the event of the new cartridge being set for the wrong direction of rotation the location of the inlet and outlet support plates are reversed. On completion realign as described in Paras 48.13 to 48.15.

48.4 If locating pins were removed from the inlet support plates, insert new pins with the locking flutes entering the plate. With a soft nosed hammer drive the pins into the plate.

48.5 Place the inlet and outlet support plates on a flat surface. Fit the seal packs into the cavities, 'O' ring first, then retainer.

48.6 Match the correct flexible side plate to each support plate and place with the bronze wear surface facing upwards.

NOTE

Flexible side plates develop a wear pattern with the rotor and vanes and should not be interchanged.

48.7 For right hand rotation assemblies, set the rotor on a flat board with the arrow pointing right.

48.8 Assemble the vanes and insert into the rotor in the correct order, ensure the sharp chamber edge of each vane leads in the direction of rotation. All vanes must move freely in the slots with no evidence of bind.

48.9 With the arrow pointing in the same direction as the rotor fit the cam ring over the rotor and vanes. Lubricate the top surface of the rotor and vanes liberally with system fluid.

48.10 Lining up to the scribe marks, hold the outlet support plate and flexible side plate together and place on the cam ring and rotor.

48.11 Hold the assembly together and turn onto the outlet support plate.

48.12 Lubricate the inlet end surfaces with system fluid, line up the scribe marks, hold the inlet support plate and flexible side plate together and place on the cam ring and rotor.

48.13 Secure the complete assembly together by hand tightening the two socket headed screws.

48.14 By hand only lightly tap the cover over the cartridge assembly until each part centres. Gently remove the cover so as not to disturb alignment.

48.15 Torque the screws to 6 Nm (50 lbf in.) and recheck alignment with the cover. Repeat as necessary.

48.16 Check the freedom of the rotor by holding the cartridge in a horizontal shaft position. Insert the index finger through the shaft opening of the inlet support plate and lift the rotor. The rotor must move freely back and forth within the cartridge. If the rotor binds, disassemble, clean and stone possible areas of bind, reassemble and recheck.

48.17 Lubricate the shaft seal with petroleum jelly and place in position in the body, garter spring up. Using a suitable tool press the seal fully home into the body.

48.18 Using a suitable press and supporting the bearing inner race press the drive shaft into the bearing. Fit the snap ring to the shaft.

48.19 Fit the spacer washer onto the shaft. Using suitable protection so as to avoid damage to the seal carefully fit the shaft into the body until the spacer and bearing are correctly located. Fit the spirolox ring into the body.

48.20 Fit the square sealing ring into the body and the 'O' ring and back up ring onto the outlet support plate hub.

48.21 Aligning one of the chamfers on the cam ring with the cover inlet port fit the cartridge assembly into the pump body.

48.22 Lubricate and fit the large 'O' seal to the body.

48.23 Fit the cover to the cartridge, easing back and forth until the cartridge pins locate correctly into the cover.

48.24 Secure the complete pump with the four bolts, torque to 95 Nm + 7 (70 + 5 lbf ft).

Testing

49 With suitable test equipment that allows for inlet and outlet pressures to be regulated, outlet flow to be monitored and shaft seal leakage checked statically and/or dynamically, test the hydraulic oil pump for shaft seal leakage and performance as follows:

49.1 To check for shaft seal leakage:

49.1.1 Connect inlet to variable supply, blank off outlet.

49.1.2 Set pump inlet pressure to 2 bar (30 lbf/in^2) and, dependent on method of measuring, statically or dynamically check shaft seal for leakage.

49.1.3 There is to be no visible leakage around the area of the seal (or any other part of the pump body).

49.2 To performance test:

49.2.1 Mount pump on test stand with inlet port connected to tank via a suitable filter and outlet port connected to tank with a flow meter and regulating relief valve in the line.

49.2.2 Start and stop pump intermittently until it is primed.

49.2.3 Start pump set to 1500 revs/min and regulate outlet pressure to 7 bar (100 lbf/in^2) until flow reaches a steady value.

CAUTION

Do not hold maximum pressure for longer than 15 seconds or the pump may burn out.

49.2.4 Increase pressure steadily to 250 bar (3600 lbf/in^2) and check that flow remains steady at 100 litre/min (22 gal/min). Excessive flow fluctuations, external leakage or noise emitting from the pump are causes for the test to be abandoned until the cause is found and made good.

Hydraulic unit reassembly

50 Reassemble the hydraulic unit in reverse order to dismantling. Maintain complete cleanliness at all stages. Fit new 'O' rings and gaskets, smear seals with oil soluble grease before fitting.

Main and hook arm rams (See Fig 14)

Dismantling

NOTE

The main and hook arm rams are of different length but are in all other features the same, therefore the following procedures are followed for both rams.

51 Dismantle a hydraulic ram as follows:

51.1 Remove spherical bearing (12) housing from end of piston rod (13).

51.2 Remove screws securing cylinder flange (10) and withdraw flange over end of piston rod. Remove 'O' ring seal (9) from under flange and wiper seal (11) from around piston rod.

51.3 Ensure piston rod is retracted into cylinder and push seal housing (7) into cylinder until locking ring (8) is exposed. Remove locking ring.

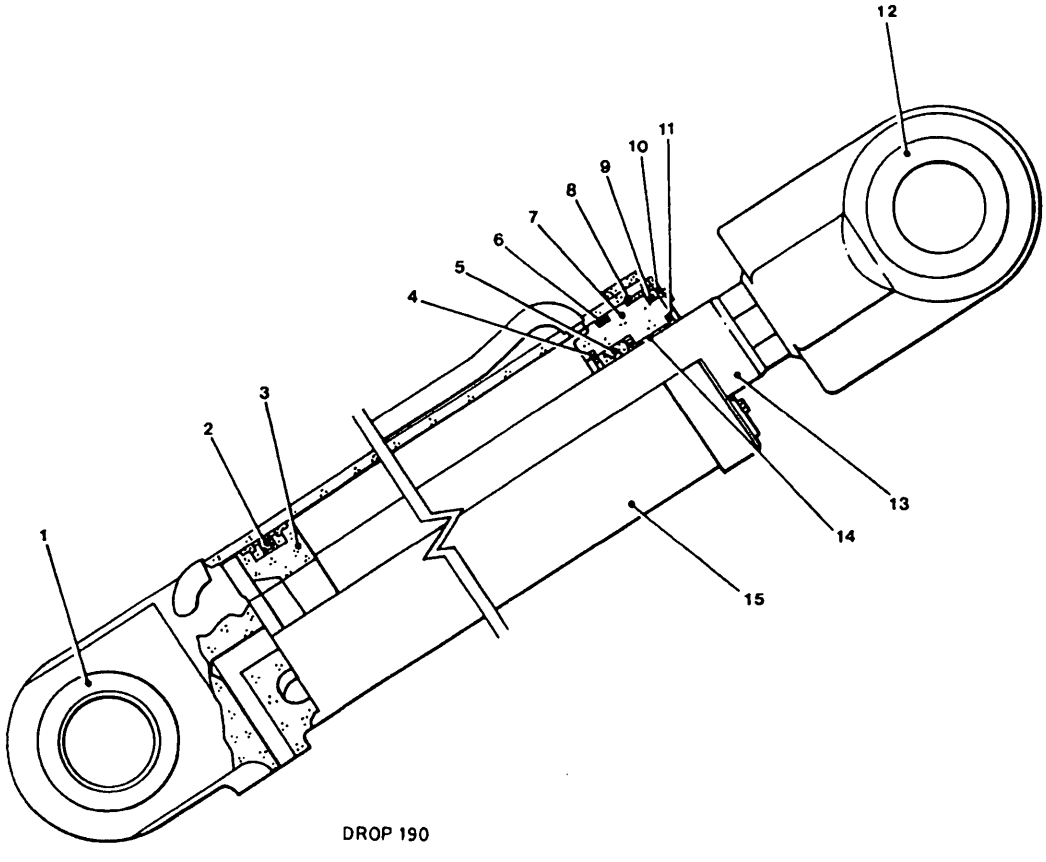
51.4 Pull piston rod, complete with seal housing sub-assembly, clear of cylinder. When clear remove seal housing sub-assembly and bush (14) from piston rod.

51.5 Remove 'O' ring seal (6) and support ring from seal housing outer recess.

51.6 Remove circlip (4) and piston rod seal (5) from inner bore of seal housing.

51.7 Remove piston seal (2) from piston head (3).

51.8 Remove circlips from each side of both spherical bearings (1) and (12) and drive out bearings.



1 Spherical bearing
2 Piston seal
3 Piston head
4 Circlip
5 Piston rod seal
6 'O' ring seal and support ring
7 Seal housing
8 Locking ring
9 'O' ring seal
10 Cylinder flange
11 Wiper seal
12 Spherical bearing
13 Piston rod
14 Bush
15 Cylinder

Fig 14 Hydraulic ram

Cleaning and inspection

52 Discard 'O' seals, wiper seal piston and rod seals together with the locking ring and obtain new components. Check bore of cylinder and piston rod inner contact surfaces of spherical bearings for wear/scoring. Renew faulty components as necessary.

Reassembly

53 Reassemble a hydraulic ram in the reverse order to dismantling ensuring all seals are coated with a film of system oil prior to assembly and both spherical bearings are charged with grease. When the locking ring (8) is fitted it may be necessary to fully withdraw the piston so that the piston head strikes the seal housing (7) until it locates over the locking ring and allows the cylinder flange to be fitted and the screws to engage. If the eye end, complete with spherical bearing (12), is fitted to aid withdrawal of piston rod it must be removed to allow fitting of wiper seal (11) and cylinder flange (10).

Testing

54 With suitable test equipment as stated, test a main or hook arm ram as follows:

54.1 The test rig must incorporate the following parameters:

54.1.1 Maximum controllable flow of 100 litres/min.

54.1.2 Maximum speed for ram extension - flow to limit speed to 0.3 m/sec within limits shown in Para 49.3.4.

54.1.3 Maximum speed for ram retraction - flow to limit speed to 0.3 m/sec within limits shown in Para 49.3.4.

54.1.4 Maximum allowable pressure 375 bar (5400 lbf/in^2).

54.1.5 Test fluid - normal system oil.

54.1.6 Oil temperature - 50 degrees C + 5 degrees.

54.1.7 Oil filtration - 10 microns nominal, 25 microns absolute.

54.2 Load ram to test rig, remove any closure caps.

54.3 Fit oil pipes to extend and retract ports.

54.4 Bleed air from cylinder by cycling over full stroke.

54.5 Check closed centres and full stroke of ram.

54.6 Cycle ram over three full strokes. If binding, leakage or requirement for higher pressure than at Para 54.1.4 is evident stop test and re-examine ram.

54.7 Extend ram to full extension and pressure to full test pressure (375 bar) and hold for one minute. Remove 'retract' connection and check there is no oil flow across the piston, check for external oil leakage and welding integrity. No leakage is permissible.

54.8 Fully retract ram at low pressure.

54.9 With ram fully retracted pressurise cylinder to full test pressure (375 bar) and hold for one (1) minute. Check for pressure drop, external oil leakage and welding integrity. Remove 'extend' connection and check there is no oil flow across the piston, check for external oil leakage and welding integrity. No leakage is permissible.

54.10 Remove from test rig and drain oil.

54.11 If not being fitted to a working system, apply 2 to 3 injections of rust preventative to ports and fit closure caps.

Compression frame, middle frame, hook arm

Cleaning and inspection

55 Thoroughly clean all components, inspect components as follows:

55.1 Check all frame members for signs of damage, cracking etc. Ensure all bores are free of burrs, rust or dirt. Check condition of PTFE bushes, rubber buffers, pipe and cable clamps. Inspect piping and cables. Renew components as necessary.

Reassembly

56 Reassembling is the reverse of dismantling. Use new seals and gaskets. Lightly grease all pivot bores. Reassemble in the following order:

56.1 Middle frame to compression frame.

56.2 Hook arm to middle frame.

56.3 Hydraulic unit to compression frame.

56.4 Hydraulic pump.

57 When reconnecting hydraulic piping ensure all blanking plugs have been removed.

58 Take care that all hoses, pipework and cables are reconnected correctly.

59 Set the proximity switches as follows:

59.1 Middle frame (2 off) 3 mm gap.

59.2 Hook arm (1 off) 5 mm gap.

LOAD HANDLING SYSTEM REFITTING

CAUTION

The torque figures for the front LHS mounting bolts are critical and are not to be exceeded.

60 To refit the LHS onto the vehicle is the reverse of removal, ensuring mounting bolts are torque tightened. Front 100 Nm (74 lbf ft): Rear 570 Nm (422 lbf ft). Remember to reconnect the earth braid. Recharge all grease points.

Testing

61 Upon completion of the refitting procedure, carry out the following test:

61.1 Recheck security of all fixings, connections etc.

61.2 Fit hydraulic tank to correct level.

61.3 Operate PTO and run hydraulic pump, purge the system by operating the cylinders through their full travel for a minimum of 5 minutes.

61.4 Connect a pressure gauge to test point 'TP1' on the main manifold, operate all rams to full stroke. Check gauge reading is 250 bar (3600 lbf/in^2).

61.5 Check all connections for leaks. Rectify as necessary.

61.6 Lower all rams and recheck tank level. Top up as necessary.

CHAPTER 15

CHASSIS

CONTENTS

GENERAL

1 Level 3 maintenance work on the chassis is restricted to routine painting, renewal of mounting brackets and straightening or replacement of impact damaged frame members. The frame is built using a ladder design of bolted construction. Figure 1 shows the main frame with all attached brackets and fitments.

WORKING INSTRUCTIONS

2 It is important that the following cautions are observed when working on the chassis:

CAUTIONS - CHASSIS STRUCTURAL STRENGTH

(1) Do not weld the frame or attach components by welding.

(2) Do not drill any holes in the flanges or side-members.

(3) Do not drill closely spaced holes in the web of the frame. The distance between two adjacent hole centres is to be greater than twice the diameter of the larger hole.

(4) Do not use chains or cables around the frames for lifting or straightening unless protective material is used to protect the frame.

(5) On no account must heat be used to straighten frames. Any frame damaged to such an extent that it cannot be straightened using cold working techniques must be renewed.

(6) Do not use any screwed fastener where any portion of the threaded section of the fastener shank bears against the side of the hole in the frame.

(7) Do not use J clamps or single holding down bolts on the side member flanges.

(8) To provide adequate loads required in the bolted joints of the chassis construction, main frame fasteners are metric 10.9 tensile strength grade plated bolts. Hardened steel washers are fitted under bolt head and nut. Corresponding higher torque tightness figures are utilised compatible with the higher strength bolt and plated finish.

(9) It is important that when ordering spares or carrying out repairs on the chassis, only the correct grade of fastener and its associated torque figures are used. The integrity of the chassis will be affected if incorrect fasteners are fitted or incorrect torque tightness applied.

STRAIGHTENING CHASSIS MEMBERS

3 Straighten any deformed chassis member as follows:

3.1 Before attempting to straighten side members, unbolt the cross-members from at least one side.

3.2 If the side-members return to their correct alignment with the cross-members removed, straighten or renew the cross-members.

3.3 Distorted members can normally be straightened by reforming cold using hydraulic jacks and chains or on a press.

3.4 At all times during straightening, the frames are to be protected from scratches and gouges,

WORKING ON FRAME ATTACHMENTS

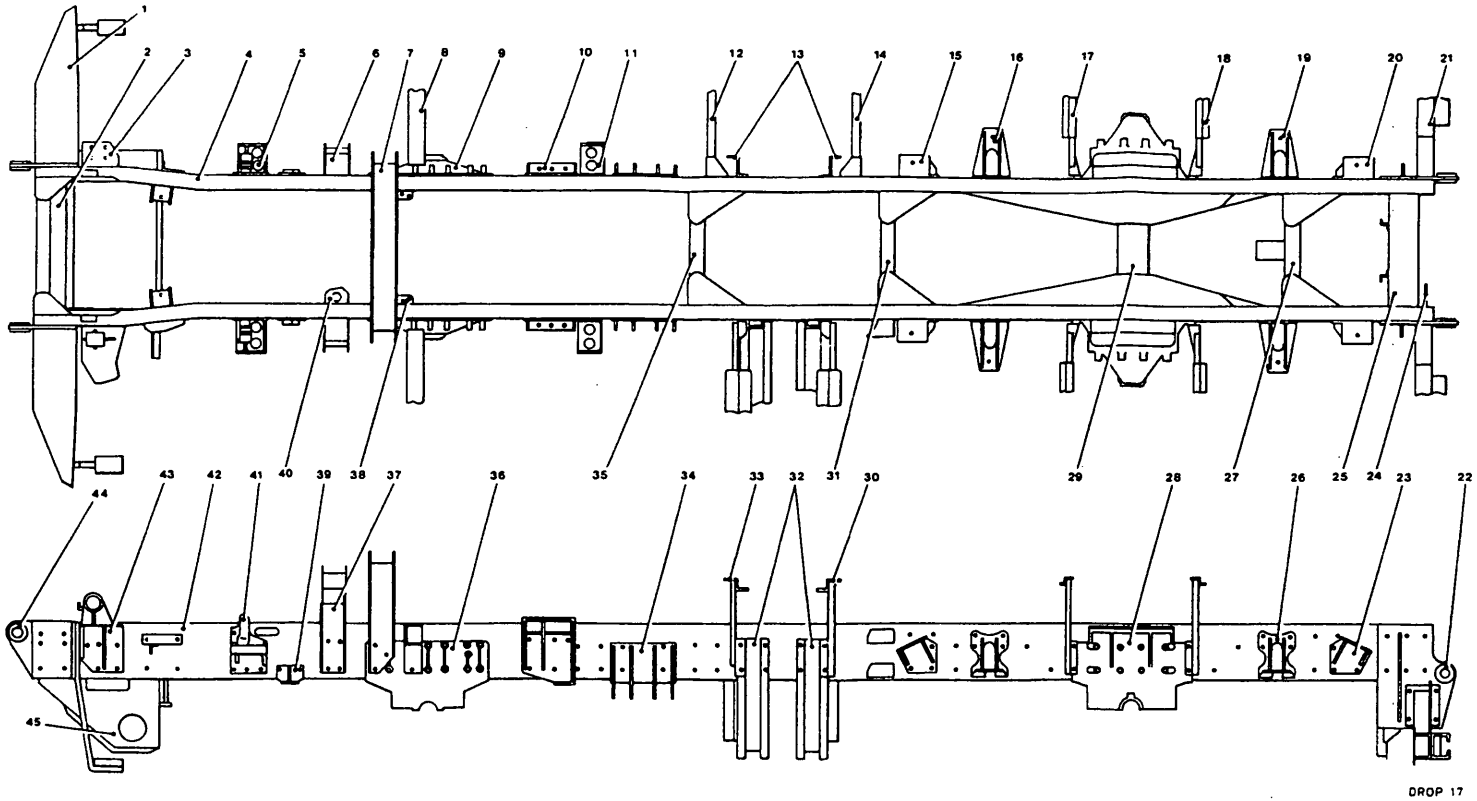
4 Observe the following instructions when working on frame attachments:

4.1 Seek DGES(A) ES Branch approval before making cut-outs, regardless of size, shape or position.

4.2 If extra attachments are required, bolt holes are not to be drilled in frame webs any closer to the frame flanges than existing bolt holes.

4.3 When working out hole patterns it is recommended to use a pencil. When marking with a scriber ensure scribe marks fall within the diameter of the hole to be drilled.

4.4 All bolts used are to be of the correct length so that the threaded portion of shank does not bear against the side of the hole in the frame.



1 Bumper bar
2 Front cross-member
3 Cab mounting bracket
4 Side-member
5 Ram and damper bracket
6 Roller bracket
7 Front bogie cross-member
8 Front mudguard support
9 Front bogie mounting
10 LHS mounting bracket
11 Damper bracket
12 Locker mounting bracket
13 Air reservoir mounting bracket
14 Locker mounting bracket
15 Damper bracket
16 Bump stop bracket
17 Mudguard bracket
18 Mudguard bracket
19 Bump stop bracket
20 Damper bracket
21 Rear light bracket
22 Rear recovery lug
23 Damper bracket
24 Junction box bracket
25 Cross-member
26 Bump stop bracket
27 Cross-member
28 Rear bogie mounting
29 Bogie cross-member, rear
30 Mudguard bracket
31 Cross-member
32 Fuel tank bracket
33 Mudguard bracket
34 Transfer gearbox mounting bracket
35 Cross-member
36 Front bogie mounting
37 Roller bracket
38 Engine mounting
39 Axle bump stop
40 Mitre box socket
41 Ram and damper bracket
42 Side-member
43 Cab mounting bracket
44 Front recovery lug
45 Exhaust guard

Fig 1 Chassis assembly

4.5 Bolts are to be a free fit into the holes, without the application of force.

4.6 All threads to be ISO metric coarse, 6H/6g medium class fit unless stated.

4.7 Bolt sizes M6, M8 and M10 to be grade 8.8.

4.8 Nut sizes M6, M8 and M10 to be grade 8.

4.9 Bolt sizes M12 and M16 to be grade 10.9.

4.10 Nut sizes M12 and M16 to be grade 10.

4.11 All nuts and bolts to be zinc plated to BS 3382 Pt 2: 1961.

4.12 Torque tightness figures are calculated at a mean value of 75% of the permanent set stress limit plus or minus 7.5%. This range must not be exceeded.

4.13 Lubrication is not to be applied to fastener threads.

4.14 When assembling ensure that all bolt heads are on the outside face of the frame.

4.15 Receiving holes are to be 1 mm larger than the diameter of the bolt diameter. Eg; a M10 diameter bolt will be fitted into an 11 mm diameter hole.

4.16 Hardness of hardened washers to be ROCKWELL 'C' 30 - 40.

4.17 Tables 1 and 2 list the torque figures to be used on chassis fasteners unless stated elsewhere.

TABLE 1 FRAME BOLT TORQUE FIGURES

Ser (1)	Bolt size (2)	Torque in Nm (3)	Torque in lbf ft (4)
1	M6 x 1.00	11 to 13	8 to 10
2	M8 x 1.25	28 to 32	20 to 24
3	M10 x 1.50	56 to 65	41 to 47
4	M12 x 1.75	103 to 124	76 to 91
5	M16 x 2.00	298 to 352	220 to 260

TABLE 1 FRAME SELF LOCKING NUT PARAMETERS

Ser (1)	Nut to fit bolt dia (2)	Overall nut height (See Fig 2 dim 'B') (3)	Thread protrusion (See Fig 2 dim 'C') (4)	
			MIN	MAX
1	M6	8.0	1.5	6.0
2	M8	9.5	2.0	8.0
3	M10	11.5	2.5	10.0
4	M12	14.0	2.5	12.0
5	M16	16.0	3.0	16.0

M14 and M20 Fasteners

5 M14 and M20 size fasteners are special cases that fall outside the above parameters, torque tightness for these sizes are; M14 - 167 Nm (123 lbf ft), M20 - 529 Nm (390 lbf ft).

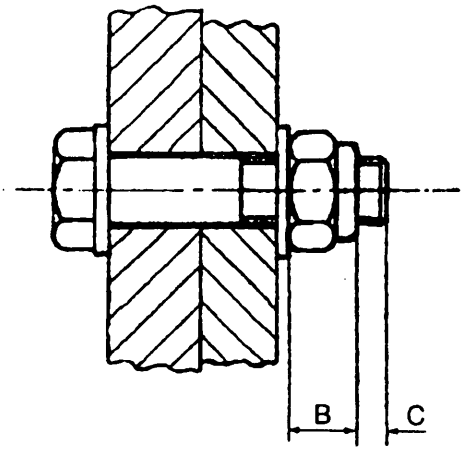


Fig 2 Self locking nut dimensions

CHAPTER 16

CAB

CONTENTS

GENERAL

1 The majority of cab components and fittings are removed and refitted as described in Cat 522 Chap 16. Repairs to upholstery, interior panels, flooring, screens and bodywork are carried out using normal workshop procedures. This chapter details the removal and refitting of the cab from/to the vehicle chassis to facilitate repairs if required.

SPECIAL TOOLS AND TEST EQUIPMENT

2 There are no special tools or test equipment required to enable the procedures detailed in this chapter to be carried out.

CAB REMOVAL

WARNINGS

(1) WHEN LIFTING THE CAB, ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

(2) BEFORE ATTEMPTING ANY WORK ON THE ENGINE, THE MASTER SWITCH MUST BE TURNED TO 'OFF' AND THE START SWITCH KEY REMOVED.

(3) ALL PERSONNEL MUST STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. OPERATOR MUST STAND CLEAR OF PIVOTING CAB WHEN PERFORMING THE RAISING AND LOWERING FUNCTION.

(4) NEVER WORK UNDER A PARTIALLY TILTED CAB. THE CAB MUST BE RAISED OR LOWERED TO FULL EXTENT OF TRAVEL.

CAUTION

The cab doors must be shut and the front grille raised before the cab is tilted.

3 To remove the cab from the chassis proceed as follows:

3.1 Turn the engine electrical master switch to OFF, disconnect all electrical harness connections on the bulkhead.

3.2 Release the tie clips securing electrical harnesses to the cab exterior.

3.3 Drain the radiator as detailed in Cat 201 Chap 4.

3.4 Disconnect engine cooling system heater hoses and return pipes and allow to drain.

3.5 Remove the front grille and stow clear of the work area.

3.6 Disconnect the steering by releasing the universal joint at the top mitre box.

3.7 Drain all air reservoirs and release air pipes from the manifold located at the bottom of the drivers side front bulkhead and from the footbrake valve, also located on the front bulkhead.

3.8 Disconnect the speedometer cable from the bayonet connector on the cab front external bulkhead and secure the freed cable to the chassis.

3.9 Disconnect the following in any suitable order:

3.9.1 Oil gauge pipe from the front external bulkhead adaptor, unclip the hose and secure to the engine.

3.9.2 Emergency gear cable from the gearbox, secure the released cable to the cab.

3.9.3 Cold start pipe from the engine to the reservoir mounted on the cab front external bulkhead, at the reservoir, secure the released pipe to the engine.

3.9.4 Accelerator cable at the accelerator pedal, unclip the cable from any cab mounted clips, pull through the grommet and secure to the engine.

3.9.5 The cab mounted engine stop cable at the fuel pump, unclip the cable from any chassis mounted clips and secure to the cab.

3.10 Ensuring the cab is in the fully lowered position, fully lower both door windows and pass suitable lifting slings through the open window ports. Fit eyes of lifting slings to a lifting appliance.

3.11 Fit padding of rags or similar between slings and cab at areas of contact.

3.12 Operate the cab tilt system to raise the cab until the rear catches are completely clear of the stops.

3.13 Take up any slack in the lifting appliance to support the weight of the cab but without applying any lifting effort.

3.14 Remove the split pins and clevis pins attaching the cab tilt cylinders to the cab at the front external bulkhead. Allow the cylinders to rest clear of the cab.

3.15 Release and remove the cab front pivot bolts.

3.16 Slowly start to lift the cab clear of the chassis checking that all hoses, electrical cable, harnesses and linkages are clear.

3.17 When the cab is completely clear swing clear of the chassis and lower onto a cab trolley.

CAB REPAIRS

WARNING

WHEN USING THE GLASS REINFORCED PLASTIC (GRP) REPAIR KIT ANY WARNINGS REGARDING LIMITS OF USE OR DETAILS OF SPECIAL DRESS OR TOOLS PROVIDED WITH THE KIT ARE TO BE STRICTLY FOLLOWED.

4 Minor damage to the GRP cab can be repaired with the cab still mounted to the chassis, or if required for ease of access, removed to a cab trolley. The procedure for repairing a GRP cab in either case is as follows:

4.1 Cut back ragged edges surrounding the damage until solid, undamaged material is encountered.

4.2 Feather the edges of the solid material to assist in blending in of the repair patch.

TABLE 1 GRP REPAIR ITEMS

Serial (1)	NSN (2)	Designation (3)
1	H1-7930-99-224-0117	Wax parting agent
2	H1-9340-99-224-0177	Repair pack

4.3 Working from the inside of the cab, apply resin (Table 1 Serial 2 part) around the feathered area, allow approximately 50 mm (2 in.) overlap to provide a sound bonding surface.

4.4 Coating each layer with resin, apply four thicknesses of GRP matting (Table 1 Serial 2 part) to form a patch.

4.5 When completely set, dress off the repaired area to blend in with the original cab surface. Rub down using mechanically drive abrasive discs, sanders or manually.

4.6 If a repair is required on a contoured section of the cab, prepare a mould as follows:

4.6.1 Using an identical cab to obtain the correct shape, prepare the exterior area of the sound cab by dressing with wax parting agent (Table 1 Serial 1).

4.6.2 Apply resin to the waxed surface, allowing approximately 25 mm (1 in.) greater than the damaged area.

4.6.3 Coating each layer with resin, apply three thicknesses of GRP matting to form the mould.

4.6.4 When completely set, remove from the sound cab and dress the inside of the mould with wax parting agent.

4.6.5 Position the mould onto the damaged cab and secure firmly in place by through drilling and using self-tapping screws or nuts and bolts.

4.6.6 Working from the inside of the cab, apply resin (Table 1 Serial 2 part) into the mould and onto the feathered area for sufficient distance so as to provide a sound bonding surface.

4.7 Coating each layer with resin, apply four thicknesses of GRP matting (Table 1 Serial 2 part) to form a patch.

4.8 When completely set, remove the mould, plug the securing holes and dress the repaired area to blend in with the original cab surface.

CAB FRONT MOUNTINGS

5 With the cab removed from the chassis, inspect the cab front mountings for signs of excessive wear, distortion or material breakdown. Renew mountings if required. On refitting ensure the correct packing pieces are fitted between the mounting bracket and the chassis to achieve correct cab alignment. Cab square alignment across the chassis can also be adjusted by moving the right hand cab mounting bracket in a fore and aft direction on the chassis side rail.

REPLACING THE CAB

6 Replace the cab in reverse order to removal ensuring all hoses, pipes, electrical cables, harnesses and linkages removed are replaced in the correct alignment and any cable ties or clamps are re-secured.

7 If a new cab is fitted the packing pieces on the front of the chassis frame will require to be adjusted to ensure the cab is sitting square onto the chassis, and that when lowered, the cab locks engage fully with no distortion. Cab square alignment across the chassis can also be adjusted by moving the right hand cab mounting bracket in a fore and aft direction on the chassis side rail.

ANNEX A

ABS SUPPLEMENT

CONTENTS

This supplement is to be read in conjunction with the corresponding chapters within the main body of this AESP.

PRELIMINARY MATERIAL

OPERATING INFORMATION

INTRODUCTION

1 This supplement provides information about the ABS variant of the Truck, Load Handling, (DROPS) 15 Tonne 8X6, LHD, IMMLC (Foden) and must be read in conjunction with the existing non-ABS manual. (2320-R-307-523 refers).

2 The structure and layout of this supplement is similar to that of the existing manual. It contains both new information about the ABS system and shows where changes have occurred in the existing manual due to the ABS system. Cross references to chapters and page numbers are shown to assist with using the two documents.

ABBREVIATIONS

3 Abbreviations used in this publication, other than those considered to be standard, or engraved/etched as identification for gauges/controls, are listed below:

ABS Anti-Lock Braking System
ECU Electronic Control Unit

CHAPTER 5

REAR AXLES

CONTENTS

ABS changes to existing Chap 5, Page 4

REMOVING AND REPLACING AXLES

Rearmost rear axle

After Para 7.9 in the existing manual proceed as follows:

1 Disconnect the ABS sensor cable at a point on the chassis adjacent to the axle. Remove any tie-wraps as necessary to free sensor cable from vehicle structure between chassis and axle. Coil the sensor cable and tie securely to the axle to prevent damage to cable.

Continue with this procedure at Para 7.10 in the existing manual.

Foremost rear axle

After Para 9.9 in the existing manual proceed as follows:

2 Disconnect the ABS sensor cable at a point on the chassis adjacent to the axle. Remove any tie-wraps as necessary to free sensor cable from vehicle structure between chassis and axle. Coil the sensor cable and tie securely to the axle to prevent damage to cable.

Continue with this procedure at Para 9.10 in the existing manual.

ABS changes to existing Chap 5, Page 6

DISMANTLING REAR AXLES

Rearmost rear axle

At Para 12 proceed as follows:

3 Remove hub assemblies, including hub reduction gears, brake drums, hubs, brake assemblies, ABS sensor and bracket, and drive half-shafts as detailed in Cat 522 Chap 5 and 7. Dismantle and overhaul the following axle assemblies in the same manner as detailed for corresponding assemblies in front axle (Cat 523 Chap 6 refers):

Continue with this procedure at Para 12.1 in the existing manual.

Foremost rear axle

At Para 13 proceed as follows:

4 Remove, dismantle and overhaul hub assemblies, including hub reduction gears, brake drums, hubs, brake assemblies, ABS sensor and bracket, and drive half-shafts in the same manner as detailed for rearmost rear axle (Para 12 refers).

Continue with this procedure at Para 14 in the existing manual.

CHAPTER 6

FRONT AXLES

CONTENTS

ABS changes to existing Chap 6, Page 4

Foremost front axle removal

After Para 5.11 in the existing manual proceed as follows:

1 Disconnect the ABS sensor cable at a point on the chassis adjacent to the axle. Remove any tie-wraps as necessary to free sensor cable from vehicle structure between chassis and axle. Coil the sensor cable and tie securely to the axle to prevent damage to cable.

Continue with this procedure at Para 5.12 in the existing manual.

CHAPTER 13

CHASSIS/CAB ELECTRICAL FAILURE DIAGNOSIS

CONTENTS

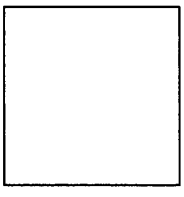
ABS changes to existing Chap 13, Page 2

After Para 3 in the existing manual the following information applies:

Cab front bulkhead ABS loom entry point and cover plate (See Fig 1)

1 The cab front bulkhead ABS loom entry point is through a cutout in the upper left hand part of the bulkhead viewed from the front. The cutout is protected by a removable cover plate (1) through which pass the trailer ABS socket loom (2), the ABS valve loom (3), the ABS sensor loom (4) and the existing heater fan loom (5).

Continue at Para 4 in the existing manual.



1 Cover plate
2 Trailer ABS socket loom
3 ABS valve loom
4 ABS sensor loom
5 Heater fan loom

Fig 1 Cab front bulkhead ABS loom entry point and cover plate

ABS cab loom replacement (See Fig 2)

WARNING

BEFORE ANY MAINTENANCE WORK IS CARRIED OUT ON THE ELECTRICAL SYSTEM THE MASTER SWITCH MUST BE TURNED TO 'OFF' OR THE BATTERIES DISCONNECTED.

2 The ABS cab loom is the interface between other looms and equipment within the ABS system. It is fitted behind the dashboard.

3 Removal will require disconnection of all the connections between the ABS cab loom and other equipment and to facilitate access it is advantageous to remove the electrical control panel (Cat 522, Chap 13 refers).

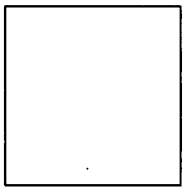
4 To remove an ABS cab loom proceed as follows:

4.1 Turn the electrical master switch to 'OFF'.

4.2 Disconnect all the terminals, plugs and connections shown in Fig 2.

4.3 Remove all tie-wraps securing the ABS cab loom and remove the loom from the vehicle.

5 Fitting a new loom is the reverse of removal.



1 To blink code switch and warning lights
2 To relay R25
3 To relay R26
4 To main loom
5 To sensor and modulator valve looms
6 To relay R27
7 To ECUs
8 To B+ on PCB
9 To A+ on PCB
10 To PCB
11 To rotary switch
12 To retarder switch
13 To handbrake warning pressure switch

Fig 2 ABS cab loom (interface) installation

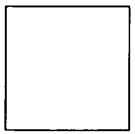


Fig 3 ABS cab loom connections - sheet 1

ABS information additional to existing Chap 13

CABLE	CABLE COLOUR	DESCRIPTION	
1	PURPLE	UNSWITCHED POSITIVE TO A.B.S `1' E.C.U.	
2	PURPLE	UNSWITCHED POSITIVE TO A.B.S `2' E.C.U.	
3	WHITE	SWITCHED POSITIVE TO A.B.S. `1' E.C.U.	
4	WHITE	SWITCHED POSITIVE TO A.B.S. `2' E.C.U.	
5	GREEN BLACK	A.B.S. `1' DIAGNOSTIC LINE `L' TO ISO SKT PIN 10	
6	GREEN WHITE	A.B.S. `1' DIAGNOSTIC LINE `K' TO ISO SKT PIN 8	
7	WHITE BLACK	A.B.S. `1' TO RETARDER CONTROL RELAY	
8	LT GREEN	A.B.S. `1' TO WARNING LAMP	
9	GREEN WHITE	A.B.S. `2' DIAGNOSTIC LINE `K' TO ISO SKT PIN 8	(SLEEVE)
10	GREEN BLACK	A.B.S. `2' DIAGNOSTIC LINE `L' TO ISO SKT PIN 10	(SLEEVE)
11	WHITE BLACK	A.B.S. `2' TO RETARDER CONTROL RELAY	(SLEEVE)
12	LT GREEN	A.B.S. `2' TO WARNING LAMP	(SLEEVE)
13	ORANGE BROWN	A.B.S. `1' TO 1ST AXLE RH VALVE (EV)	
14	ORANGE BLUE	A.B.S. `1' TO 1ST AXLE RH VALVE (AV)	
15	YELLOW BROWN	A.B.S `1' TO 3RD AXLE LH VALVE (EV)	(SLEEVE)
16	YELLOW BLUE	A.B.S. `1' TO 3RD AXLE LH VALVE (AV)	(SLEEVE)
17	YELLOW BROWN	A.B.S. `1' TO 1ST AXLE LH VALVE (EV)	
18	YELLOW BLUE	A.B.S. `1' TO 1ST AXLE LH VALVE (AV)	
19	ORANGE BROWN	A.B.S `1' TO 3RD AXLE RH VALVE (EV)	(SLEEVE)
20	ORANGE BLUE	A.B.S. `1' TO 3RD AXLE RH VALVE (AV)	(SLEEVE)
21	BROWN WHITE	A.B.S. `2' TO 2ND AXLE RH VALVE (EV)	
22	BLUE WHITE	A.B.S. `2' TO 2ND AXLE RH VALVE (AV)	
23	BROWN BLACK	A.B.S `2' TO 4TH AXLE LH VALVE (EV)	(SLEEVE)
24	BLUE BLACK	A.B.S. `2' TO 4TH AXLE LH VALVE (AV)	(SLEEVE)
25	BROWN BLACK	A.B.S. `2' TO 2ND AXLE LH VALVE (EV)	
26	BLUE BLACK	A.B.S. `2' TO 2ND AXLE LH VALVE (AV)	
27	BROWN WHITE	A.B.S `2' TO 4TH AXLE RH VALVE (EV)	(SLEEVE)
28	BLUE WHITE	A.B.S. `2' TO 4TH AXLE RH VALVE (AV)	(SLEEVE)
29	ORANGE	A.B.S. `1' FROM 1ST AXLE RH SENSOR	
30	ORANGE BLACK	A.B.S. `1' FROM 1ST AXLE RH SENSOR	
31	SLATE	A.B.S. `1' FROM 3RD AXLE LH SENSOR	
32	SLATE BLACK	A.B.S. `1' FROM 3RD AXLE LH SENSOR	
33	YELLOW	A.B.S. `1' FROM 1ST AXLE LH SENSOR	
34	YELLOW BLACK	A.B.S. `1' FROM 1ST AXLE LH SENSOR	
35	RED	A.B.S. `1' FROM 3RD AXLE RH SENSOR	
36	RED BLACK	A.B.S. `1' FROM 3RD AXLE RH SENSOR	
37	ORANGE	A.B.S. `2' FROM 2ND AXLE RH SENSOR	(SLEEVE)
38	ORANGE BLACK	A.B.S. `2' FROM 2ND AXLE RH SENSOR	(SLEEVE)
39	SLATE	A.B.S. `2' FROM 4TH AXLE LH SENSOR	(SLEEVE)
40	SLATE BLACK	A.B.S. `2' FROM 4TH AXLE LH SENSOR	(SLEEVE)
41	YELLOW	A.B.S. `2' FROM 2ND AXLE LH SENSOR	(SLEEVE)
42	YELLOW BLACK	A.B.S. `2' FROM 2ND AXLE LH SENSOR	(SLEEVE)
43	RED	A.B.S. `2' FROM 4TH AXLE RH SENSOR	(SLEEVE)
44	RED BLACK	A.B.S. `2' FROM 4TH AXLE RH SENSOR	(SLEEVE)
45	BLACK	NEGATIVE	
46	BLACK	NEGATIVE	
47	BLACK	NEGATIVE	
48	BLACK	NEGATIVE	
49	BLACK	NEGATIVE	
50	BLACK	NEGATIVE	
51	BLACK	NEGATIVE	
52	BLACK	NEGATIVE	
53	BLACK	NEGATIVE	
54	BLACK	NEGATIVE	
55	BLACK	NEGATIVE	
56	BLACK	NEGATIVE	
57	BLACK	NEGATIVE	
58	BLACK	NEGATIVE	
59	LT GREEN	A.B.S. `1' W/L BLINK SW TO SPLICE	
60	LT GREEN	A.B.S. `2' W/L BLINK SW TO SPLICE	

CABLE	CABLE COLOUR	DESCRIPTION
61	PURPLE	UNSWITCHED POSITIVE TO A.B.S ISO DIAGNOSTIC SKT
62	PURPLE	UNSWITCHED POSITIVE TO A.B.S ISO DIAGNOSTIC SKT
63	BROWN BLUE	POSITIVE TO A.B.S. FUSES
64	BROWN WHITE	SWITCHED POSITIVE TO A.B.S. FUSES
65	BROWN BLUE	FUSE FEED LINK
66	BROWN WHITE	FUSE FEED LINK
67	BROWN WHITE	FUSE FEED LINK
68	PURPLE RED	A.B.S. TRAILER WARNING LAMP
69	WHITE	POSITIVE TO RETARDER RELAYS
70	WHITE	POSITIVE TO RETARDER RELAYS
71	BLACK WHITE	RETARDER SWITCH TO RETARDER RELAYS
72	BLACK WHITE	LINK RELAY TO RELAY
73	BLACK WHITE	RETARDER RELAY TO RETARDER SWITCH
74	BLACK	NEGATIVE TO ISO SKT
75	BLACK	NEGATIVE TO ISO SKT
76	BLACK	NEGATIVE TO `ABS' SWITCH
77	WHITE GREEN	BLACKOUT POSITIVE TO W/L`S
78	WHITE GREEN	POSITIVE LINK
79	WHITE GREEN	POSITIVE LINK
80	BROWN BLUE	POSITIVE TO TRAILER SOCKET FUSE
81	PURPLE	FUSE TO TRAILER SOCKET
82	WHITE	SWITCHED POSITIVE TO TRAILER SOCKET
83	WHITE GREEN	POSITIVE TO HAND BRAKE SWITCH
84	RED ORANGE	HANDBRAKE W/L
85	LT GREEN	ABS 1 W/L SPLICE TO ECU
86	BLACK	NEGATIVE
87	BLACK	NEGATIVE
88	BLACK	NEGATIVE
89	LT GREEN	ABS 2 W/L SPLICE TO ECU
90	ORANGE WHITE	ROTARY SW TO RELAY COIL
91	WHITE	POSITIVE TO RELAY
92	WHITE ORANGE	POSITIVE LINK RESISTOR ABS 1
93	WHITE ORANGE	POSITIVE LINK TO RESISTOR ABS 2
94	WHITE ORANGE	POSITIVE LINK TO RESISTOR TRAILER
95	GREEN	DIODE TO SPLICE ABS 1
96	GREEN	DIODE TO SPLICE ABS 2
97	GREEN	DIODE TO SPLICE TRAILER
98	GREEN LT GREEN	BLACKOUT DIODE TO SPLICE ABS 1
99	GREEN LT GREEN	BLACKOUT DIODE TO SPLICE ABS 2
100	PURPLE RED	BLACKOUT DIODE TO SPLICE TRAILER
101	BLACK	NEGATIVE
102	PURPLE RED	SPLICE TO TRAILER ECU

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Fig 3 ABS cab loom connections - sheet 2

ABS modulator valves loom replacement (See Fig 5)

WARNING

BEFORE ANY MAINTENANCE WORK IS CARRIED OUT ON THE ELECTRICAL SYSTEM THE MASTER SWITCH MUST BE TURNED TO 'OFF' OR THE BATTERIES DISCONNECTED.

6 The ABS modulator valves loom connects the eight ABS modulator valves to the two ECUs (See Fig 4).

7 To remove an ABS modulator valve loom proceed as follows:

7.1 Turn the electrical master switch to 'OFF'.

7.2 Remove the cover plate (Fig 1 (1)) from the cab front bulkhead.

7.3 Disconnect the ABS modulator valve loom from the interface loom connector (Fig 2 (5)) and withdraw the loom through the cab front bulkhead.

7.4 Disconnect the loom at each ABS modulator valve (Fig 5).

7.5 Remove all tie-wraps securing the ABS modulator valve loom and remove loom from the vehicle.

8 Fitting a new loom is the reverse of removal.

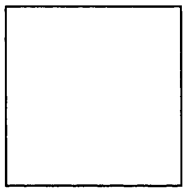


Fig 4 ABS modulator valves sensor and trailer socket loom installation

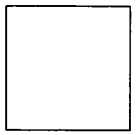


Fig 5 ABS modulator valves loom connections

ABS sensors loom replacement (See Fig 6)

WARNING

BEFORE ANY MAINTENANCE WORK IS CARRIED OUT ON THE ELECTRICAL SYSTEM THE MASTER SWITCH MUST BE TURNED TO 'OFF' OR THE BATTERIES DISCONNECTED.

9 The ABS sensors loom connects the ABS sensors at each wheel to the ECUs (See Fig 4).

10 To remove an ABS sensors loom proceed as follows:

10.1 Turn the electrical master switch to 'OFF'.

10.2 Remove the cover plate (Fig 1 (1)) from the cab front bulkhead.

10.3 Disconnect the ABS sensors loom from the ABS interface loom (Fig 2 (5)) and withdraw the loom through the cab front bulkhead.

10.4 Disconnect the loom at the connector to each sensor lead (Fig 6).

10.5 Remove all tie-wraps securing the ABS sensors loom and remove the loom from the vehicle.

11 Fitting a new ABS sensors loom is the reverse of removal.

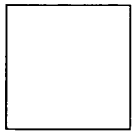


Fig 6 ABS sensors loom connections

ABS trailer socket loom replacement (See Fig 7)

12 The ABS trailer socket loom is connected to the cab interface loom (Fig 2 (4)) and runs along the chassis (Fig 4) to the ABS trailer socket located on the rear cross member. Replacement looms are supplied complete with trailer socket.

To remove an ABS trailer socket loom proceed as follows:

12.1 Turn the electrical master switch to 'OFF'.

12.2 Remove the cover plate (Fig 1 (1)) from the cab front bulkhead and disconnect the ABS trailer socket loom from the interface loom (See Fig 2 (4)).

12.3 Withdraw the ABS trailer socket loom through the bulkhead.

12.4 Cut all the tie-wraps securing the ABS trailer socket loom to the vehicle.

12.5 Remove the two nuts (Fig 7 (3)) and two bolts (Fig 7 (2)) and remove the ABS trailer socket (1) complete with loom from the vehicle.

13 Fitting an ABS trailer socket loom is the reverse of removal.

1 Socket
2 Bolt
3 Nut

Fig 7 ABS trailer socket loom replacement

TABLE 1 ABS TRAILER SOCKET

Cable No (1)	Description (2)	Colour (3)	Pin No (4)
1	25 amp positive unswitched	Red	1
2	3 amp positive switched	Black	2
3	Negative	Yellow	3
4	Negative (25 amp)	Brown	4
5	Trailer antilock warning light	White	5
Not used			6
Not used			7

CHAPTER 15

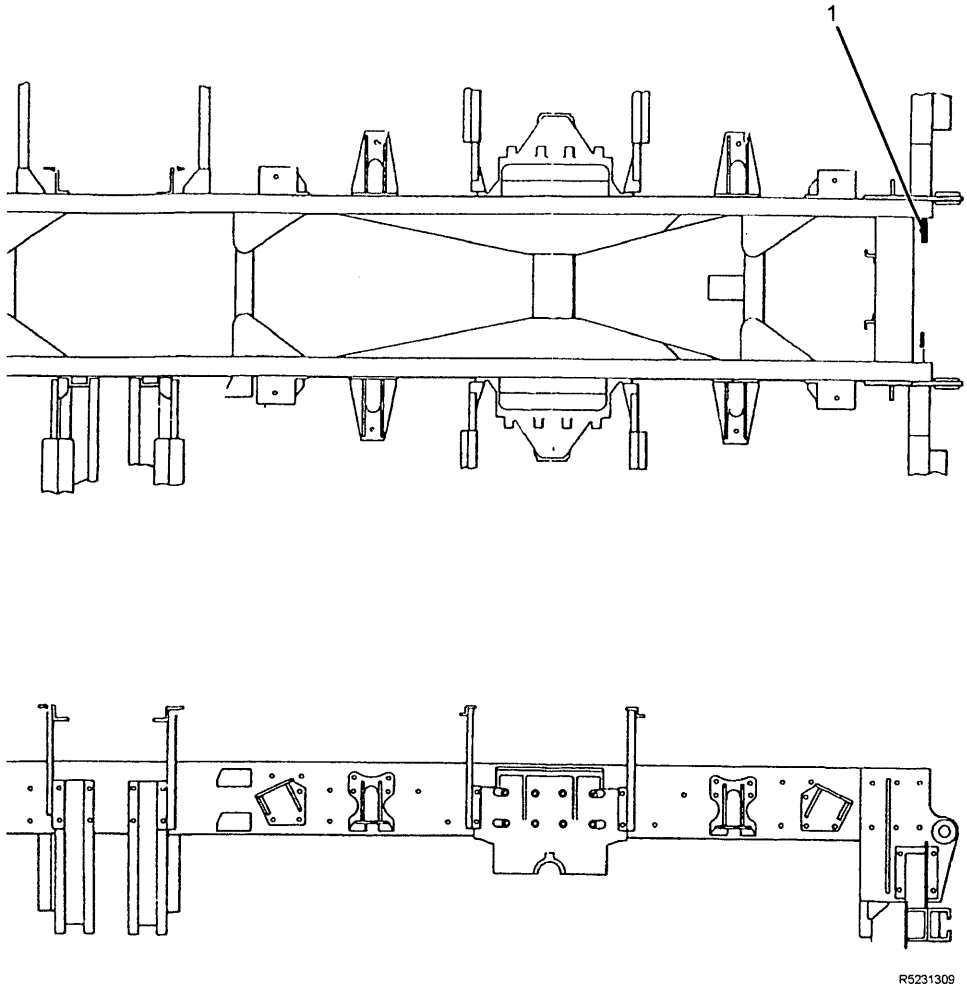
CHASSIS

CONTENTS

ABS changes to existing Chap 15, Page 3

GENERAL

1 Level 3 maintenance work on the chassis is restricted to routine painting, renewal of mounting brackets and straightening or replacement of impact damaged frame members. The frame is built using a ladder design of bolted construction. Figure 8 shows the main frame with changes relevant to the ABS modification.



1 ABS trailer socket bracket

Fig 1 Chassis assembly - rear end only

CHAPTER 16

CAB

CONTENTS

Para

ABS changes to existing Chap 16, Page 2

CAB REMOVAL

After Para 3.1 in the existing manual proceed as follows:

1 Disconnect the ABS sensor, modulator valve and trailer socket looms from the cab loom and the main loom (Cat 523, Chap 13 ABS supplement refers).

Continue with this procedure at Para 3.2 in the existing manual.

ARMY EQUIPMENT
SUPPORT PUBLICATION

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2nd Edition dated November 2017
(Superseding 1st Edition dated March 1994)

CONDITIONS OF RELEASE

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TRUCK, LOAD HANDLING (DROPS) 15 TONNE, 8X6 LHD, (IMMLC) FODEN

REPRINTED INCORPORATING AMDTS 1-4

OPERATING INFORMATION

This publication contains information covering the requirements of Categories 2 and 3 at information level 1.

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PRELIMINARY MATERIAL Page

OPERATING INFORMATION

PREFACE

Sponsor: LSOR4

INTRODUCTION

1 Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013. AESP form 10 is provided at the end of this publication; it should be photocopied and used for forwarding comments on this AESP.

2 AESPs are issued under Defence Council authority and where AESPs specify action to be taken, the AESP will of itself be sufficient authority for such action and also for the demanding of the necessary stores, subject to the provisions of Para 3 below.

3 The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standing Operating Procedures (SOPs) or by local regulations. When any such Instruction, Order or regulation contradicts any portion of this publication it is to be taken as the overriding authority.

4 For the periods of servicing and lubricants to be used reference must be made to the Maintenance Schedule.

RELATED AND ASSOCIATED PUBLICATIONS

Related publications

5 The Octad for the subject equipment consists of the publications shown below. All references are prefixed with the first eight digits of this publication.

Category/Sub-category			Information Level			
			1 User/Operator	2 Unit Maintenance	3 Field Maintenance	4 Base Maintenance
1	0	Purpose and Planning Information	101	*	*	*
	1	Equipment Support Policy Directives	*	*	*	*
	2	Purpose and Planning Information, Medical and Dental	*	*	*	*
2	0	Operating Information	201	201	201	201
	1	Aide Memoire	*	*	*	*
	2	Training Aids	*	*	*	*
3		Technical Description	302	302	302	302
4	1	Installation Instructions	*	*	*	*
	2	Preparation for Special Environments	*	*	*	*
5	1	Failure Diagnosis	*	512	512	*
	2	Repair Instructions	*	522	523	*
	3	Inspection Standards	*	532	533	*
	4	Calibration Procedures	*	*	*	*
6		Maintenance Schedules	601	601	601	601
7	1	Illustrated Parts Catalogues	711	711	711	711
	2	Commercial Parts Lists	*	*	*	*
	3	Complete Equipment Schedule, Production	*	*	*	*
	4	Complete Equipment Schedule, Service Edition (Simple Equipment)	*	*	*	*
	5	Complete Equipment Schedule, Service Edition (Complex Equipment)	*	*	*	*
8	1	Modification Instructions	811	811	811	811
	2	General Instructions, Special Technical Instructions and Servicing Instructions	*	*	*	*
	3	Service Engineered Modification Instructions (RAF only)	*	*	*	*

* Category/Sub Category not published

Associated publications

4

Code	Type	Title
31825	CES	Truck, Load Handling (DROPS) 15 Tonne, 8x6 LHD (IMMLC) Foden Trucks
3990-F-100	AESP	Flatracks (DROPS) All Variants
2330-S-300	AESP	Trailer, Cargo, Skeletal, Wheeled, (DROPS)
2330-S-301	AESP	Trailer (MLRS)
2920-B-201	AESP	Rail Transfer Equipment (RTE)
3920-B-202	AESP	Simple Rail Transfer Equipment (SRTE)
2815-K-720	AESP	Engine, Diesel, RR/Perkins Eagle Type 350 (DROPS)
2520-C-116	AESP	Gearbox, Automatic, ZF HP600 (DROPS)

ABBREVIATIONS

5 Abbreviations used in this publication, other than those considered to be standard, or engraved/etched as identification for gauges/controls, are listed below:

DROPS	Dismountable Rack Off-Loading and Pick-Up System
IMMLC	Improved Medium Mobility Load Carrier
LHS	Load Handling System
PTO	Power Take Off
SRTE	Simple Rail Transfer Equipment

WARNINGS AND CAUTIONS

6 The following hazards are present during maintenance and normal equipment use and may harm personnel and damage plant:

WARNINGS

(1) RADIATION HAZARD. WHEN REQUIRED, THE FLATRACKS CAN BE FITTED WITH BETA LIGHTS. IN THE EVENT OF A BREAKAGE OF A BETA LIGHT IN AN ENCLOSED ENVIRONMENT EVACUATE AND VENTILATE THE IMMEDIATE AREA FOR AT LEAST 30 MINUTES. BEFORE COMMENCING REPLACEMENT OF A BETA LIGHT REFER TO LOCAL REGULATIONS CONCERNING RADIATION SAFETY AND JSP 392 (CHAPTER 32). ANY QUESTIONS RELATING TO THE HANDLING, STORAGE AND DISPOSAL OF BETA LIGHTS SHOULD BE REFERRED TO YOUR UNIT RADIATION PROTECTION SUPERVISOR (RPS).

(2) RADIATION HAZARD HANDLING OF COMPONENTS. RELEVANT PROTECTIVE APPAREL (GLOVES ETC) MUST BE WORN WHILE PRACTISING ROUTINE MAINTENANCE OR EMERGENCY REPAIRS TO BETA AND HALOGEN LAMPS.

(3) PERSONNEL SAFETY. BEFORE ATTEMPTING ANY WORK ON THE ENGINE (INSPECTION/MAINTENANCE/ELECTRICAL) THE MASTER SWITCH KEY MUST BE TURNED TO 'OFF', THE START SWITCH KEY REMOVED AND THE HAND BRAKE APPLIED TO THE 'PARK' POSITION.

(4) TRAILER BRAKING SAFETY. FOR CORRECT TRAILER BRAKING THE VEHICLE MUST BE COUPLED TO A TWO LINE SYSTEM TRAILER.

(5) LOAD LOCK ENGAGEMENT. THE 'NO TRANS' WARNING LIGHT IS AN INDICATION OF THE POSITION OF THE LOAD LOCKS AND NOT A CONFIRMATION THAT THE LOAD IS SECURE.

(6) LOAD LOCK ENGAGEMENT. ON COMPLETION OF A LOADING SEQUENCE A VISUAL CHECK MUST BE MADE TO ENSURE THAT THE LOAD LOCKS ARE FULLY ENGAGED.

(7) COLD START CANISTERS. EXPLOSIVE VAPOUR HAZARD. DRIVERS/OPERATORS ARE WARNED OF THE EXPLOSIVE RISK. THE CANISTERS FOR USE IN THE START PILOT CONTAIN A VERY VOLATILE LIQUID, THE VAPOUR OF WHICH IS HEAVIER THAN AIR AND HIGHLY FLAMMABLE. SMALL QUANTITIES OF THE VAPOUR IN AIR FORM A HIGHLY EXPLOSIVE MIXTURE.

(8) COLD START CANISTERS. DRIVERS/OPERATORS ARE WARNED VAPOUR CAUSES DROWSINESS AND LOSS OF CONCENTRATION. FOR THESE REASONS THE CANISTERS MUST NEVER BE CARRIED LOOSE IN A VEHICLE (DCI ARMY 239/79 REFERS).

(9) VEHICLE SAFETY. NEVER OPERATE THE ACCELERATOR WHEN SELECTING THE SPEED RANGE FROM NEUTRAL POSITION TO ANY GEAR POSITION.

(10) VEHICLE SAFETY. THE DRIVER MUST APPLY THE HAND BRAKE LEVER TO THE 'PARK' POSITION BEFORE VACATING THE VEHICLE CAB.

(11) START UP. THE ENGINE CAN ONLY BE STARTED WHEN THE EMERGENCY GEAR SHIFT LEVER IS DISENGAGED. THE EMERGENCY GEAR SHIFT LEVER MUST ONLY BE ENGAGED WITH THE HAND BRAKE APPLIED.

(12) DIFFERENTIAL DAMAGE. THE DIFFERENTIAL LOCKING SYSTEMS MUST NEVER BE ACTIVATED OR USED DURING DOWNHILL OPERATION. IF EITHER, OR BOTH, OF THE DIFFERENTIAL LOCKING SYSTEMS ARE ENGAGED DURING A HILL DESCENT, DAMAGE WILL OCCUR TO THE DIFFERENTIAL UNITS AND THE VEHICLE WILL BECOME UNMANAGEABLE WITH A TENDENCY TO SLIDE SIDEWAYS.

(13) BRAKING. WHEN PARKING ON AN INCLINE WITH A TRAILER ATTACHED THE SERVICE BRAKES MAY NOT HOLD THE VEHICLE/TRAILER COMBINATION. IN THIS EVENT OPERATING INSTRUCTIONS (RE USE OF TRAILER BRAKE VALVE) MUST BE STRICTLY FOLLOWED.

(14) BRAKING. USE OF THE EMERGENCY BRAKE RELEASE SWITCH WILL RENDER ALL BRAKES INOPERATIVE.

(15) OVERHEAD SAFETY. DURING THE PICKING-UP AND OFF-LOADING CYCLE OF THE LOAD HANDLING SYSTEM (LHS) IN THE 'AUTO MODE, A HEIGHT OF 4.95 METRES (16.25 FT) IS REACHED. IF THE WRONG OPERATING SEQUENCE IS USED WITH THE LHS IN THE 'MANUAL' MODE IT IS POSSIBLE TO REACH A HEIGHT OF 5.8M (19 FT). THEREFORE, BEFORE ANY ATTEMPT IS MADE TO CARRY OUT THE OPERATION, A CHECK MUST BE MADE TO ENSURE THAT THERE ARE NO OVERHEAD OBSTRUCTIONS, PARTICULARLY ELECTRICAL POWER LINES.

(16) GROUND SAFETY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AN EXTREME SIDEWAYS INCLINATION BEFORE PICKING-UP OR OFF-LOADING A FLATRACK (OR AN SRTE). ANY GROUND INSTABILITY BENEATH THE ROAD WHEELS COULD AFFECT THE SAFE OPERATION OF LHS. THE INCLINOMETER DISPLAY MUST ALSO BE NOTED.

(17) LHS STOWAGE. NEVER DRIVE OFF WITH THE 'NO TRANSIT' LIGHT ILLUMINATED. AN ILLUMINATED LIGHT MEANS THE LOAD LOCKS ARE NOT ENGAGED AND THE LHS IS NOT FULLY STOWED.

(18) LOAD/UNLOAD A FLATRACK. THE TRAILER BRAKES MUST BE ON AND THE TRAILER MUST BE UNCOUPLED FROM THE VEHICLE BEFORE ANY ATTEMPT IS MADE TO LOAD/UNLOAD A FLATRACK.

(19) HYDRAULIC SYSTEM CONNECTIONS. HIGH HYDRAULIC OIL PRESSURE IS PRESENT IN THE FLEXIBLE HOSES WHEN CONNECTED TO THE SLAVE COUPLINGS. PERSONNEL SHOULD STAND WELL CLEAR WHEN THESE HOSES ARE IN USE IN CASE OF SEPARATION OR BREAKAGE.

(20) HYDRAULIC SYSTEM CONNECTIONS. BEFORE CONNECTING OR DISCONNECTING HYDRAULIC OIL HOSES, THE VEHICLE ENGINE MUST BE STOPPED TO ENSURE THAT NO HYDRAULIC PRESSURE IS PRESENT AT THE SLAVE COUPLINGS.

(21) ELECTRICAL HAZARD. THE ELECTRICAL MASTER SWITCH MUST BE TURNED TO 'OFF', THE START SWITCH KEY REMOVED AND THE HAND BRAKE APPLIED TO THE 'PARK' POSITION BEFORE ANY ATTEMPT IS MADE TO TILT THE CAB.

(22) PERSONNEL SAFETY. ALL PERSONNEL MUST STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. OPERATOR MUST STAND CLEAR OF PIVOTING CAB WHEN PERFORMING THE RAISING OR LOWERING FUNCTION.

(23) PERSONNEL SAFETY. NEVER WORK UNDER A PARTIALLY TILTED CAB. THE CAB MUST ALWAYS BE RAISED OR LOWERED TO FULL EXTENT OF TRAVEL.

(24) HEAVY WEIGHT. BEFORE REMOVING BATTERY DUE REGARD MUST BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS.

(25) USE OF LIFTING EQUIPMENT. ALL LIFTING EQUIPMENT IS TO BE VERIFIED AS BEING IN DATE AND OF THE CORRECT CAPACITY FOR THE TASK IN HAND.

(26) HANDLING OF COMPONENTS. CARE MUST BE TAKEN WHEN FITTING HALOGEN LAMPS NOT TO TOUCH THE GLASS PORTION WITH BARE FINGERS AS THIS COULD CAUSE THE LAMP TO SHATTER WHEN IT IS HEATED DURING USE.

(27) PERSONNEL SAFETY. BEFORE ANY MAINTENANCE WORK IS CARRIED OUT ON THE ELECTRICAL SYSTEM THE MASTER SWITCH MUST BE TURNED TO 'OFF' OR THE BATTERIES DISCONNECTED.

(28) FLAMMABLE LIQUIDS. DUE CONSIDERATION MUST BE GIVEN TO THE HIGHLY FLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE CAN SERIOUSLY ENDANGER LIFE. STRICT CODES OF PRACTICE MUST BE ADHERED TO.

(29) TYRE PRESSURES. ENSURE TYRE PRESSURES ARE INFLATED TO THE CORRECTED PRESSURE IN ACCORDANCE WITH AESP 2320-R-302-601, TABLE 3. OPERATING THE VEHICLE WITH UNDER INFLATED TYRES CAN RESULT IN DETACHMENT OF THE SPLIT RIM ASSEMBLY DURING TRAVEL.

CAUTIONS

(1) Engine cold start. At temperatures below -15°C, start the engine and warm up the gearbox in neutral ((N)) for approximately ten to fifteen minutes.

(2) Vehicle damage. Never accelerate during driving range selection.

(3) Retarder operation. The retarder will not operate if the accelerator pedal is depressed, i.e. not at idle.

(4) Differential damage. The cross axle differential and third differential lock systems must only be engaged when the vehicle is stationary. Never engage either system when wheel spin is occurring as mechanical damage will result.

(5) Differential locks should not be used when the vehicle is travelling on a good road surface as damage may result.

(6) Front wheel drive should only be used in an OFF THE ROAD situation or when travelling over snow or ice.

(7) The vehicle battery will quickly drain if the cooking vessel is used while the engine is stopped.

(8) If the load handling system (LHS) parameters are exceeded the loading/off-loading procedures are not to be implemented.

(9) Do not continue in the UNLOAD position once the flatrack has been off-loaded. Return LHS to stowed transit position.

(10) Equipment damage. The cab doors must be shut and the front grille raised before the cab is tilted.

(11) A speed restriction of 12kpm maximum is to be enforced for all tows laden or unladen, even on good roads.

(12) Towing from the front (supported, suspended or straight tow). If the casualty vehicle automatic gearbox was functioning correctly prior to the need to be towed, there is no physical damage to the driveline and the gearbox oil level can be considered to be unaffected, then it is not necessary to disconnect the propshaft when towing short to moderate distances (40 km) at slow speeds (below 12 kph).

(13) Towing from the front (supported, suspended or straight tow). If towing long distances at higher speeds the main propshaft is to be disconnected as there will be no cooling of the engine coolant, therefore the gearbox oil, although maintaining pressure by use of the secondary oil pump, may overheat causing gearbox damage.

(14) Towing from the rear. For supported or suspended tows from the rear, ensure front wheel drive is not engaged. In these circumstances there will be no drive through the main gearbox possibly saving further damage.

(15) Towing from the rear. If towing from the rear with all wheels on the ground is contemplated the main propshaft is to be disconnected to safeguard the gearbox from damage as the secondary oil pump will not provide pressure when the gearbox is turning in the reverse direction.

(16) BRAKE RELEASE If the casualty vehicle air system is undamaged and connected to the towing vehicle air system, before commencing the tow, release the parking brake in the normal manner.

(17) BRAKE RELEASE. If there is insufficient air in the casualty vehicle air system to release the brake in the normal manner, operate the emergency brake release.

(18) BRAKE RELEASE. If there is no air available in the casualty vehicle air system the brakes will require to be released manually by winding off the spring brake actuator at each wheel station remaining on the ground during the tow. Tools for this purpose are included in the CES equipment and are stowed in the chassis locker.

(19) LOAD HANDLING SYSTEM. All necessary steps must be taken to prevent the accidental ingress of contamination into the LHS due to poor hygiene/practice, particularly when using the hydraulic slave interface.

ARMY EQUIPMENT
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2320-R-302-201

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AESP Form 10 (Issue 3 dated Oct 97)

CHAPTER 1

GENERAL DESCRIPTION

CONTENTS

INTRODUCTION

1 The Demountable Rack Off-loading and Pick-Up System (DROPS) 8 x 6 FODEN Improved Medium Mobility Load Carrier (IMMLC) left hand drive vehicle is an all terrain vehicle fitted with a hydraulically powered Load Handling System (LHS) capable of loading/unloading palletised or containerised 15.0 tonne pay loads mounted on flatracks Type A, GP, or S. The loaded vehicle is capable of towing a trailer loaded to 16.5 tonnes and has the facility to transfer loaded flatracks between vehicle and trailer or from the vehicle to ground, and vice versa. LHS operation is by the driver controlling the LHS system from the cab.

ENGINE

2 The engine is a Perkins Eagle 350e monofuel, compression ignition, six cylinder in line, vertical, liquid cooled, four stroke, turbocharged type, fitted with Butec starter motor, CAV alternator, Wabco air compressor, ZF power steering pump, Serk oil cooler, Bosch fuel injection and Dynair (Kyser) cooling fan and fan drive.

3 Further fitments include; Cov-Rad 'P' type radiator, cold start nozzles to suit a Start Pilote F55/2 system, a combined sedimenter/fuel heater, twin lubricating oil filters and fuel filters with throw away type elements and an engine air cleaner with replaceable filter element. A hand priming pump is fitted to purge the fuel system after fuel filter change or if the system has been broken for repair.

Exhaust system

4 The engine exhaust system comprises a silencer complete with tail pipe connected to the engine turbocharger outlet by solid and flexible steel piping. The silencer is mounted horizontally below and behind the front bumper and is protected by an exhaust guard mounted from the underside of the front bumper. The silencer tail pipe points downward and rearward so that exhaust gases are discharged ahead of the passenger side front road wheel.

Air filter

5 The engine air filter is a 16 inch diameter two-stage dry element type mounted behind the cab on the driver's side in a horizontal position. The filter casing is coupled to the engine turbocharger intake by moulded Glass Fibre Reinforced Polyester (GRP) pipe, hoses and hose clips. Located in the central bore of the air cleaner filter is a second safety filter designed to stop ingress of dirt or foreign matter into the engine during normal filter change or in the event of main filter failure. An air filter restriction indicator fitted to the engine induction system is located behind the cab and indicates the condition of the filter element.

Radiator

6 The radiator is a Cov-Rad 'P' type with a five row pressurised matrix between upper and lower header tanks. The top tank is fitted with a captive filler cap, spring loaded relief valve and a hose connection to the thermostat housing. The whole assembly is mounted onto the chassis in a fixed position. Coolant is mixture of anti-freeze and water, capacity of the complete cooling system is approximately 54 litres (14.3 galls).

Cold start system

7 The engine cold start system is a Start Pilote type F55/2. Two nozzles are fitted into the engine inlet manifold, they are connected by plastic pipework to a reservoir fitted to the cab front bulkhead on the drivers side behind the front grille. The reservoir is pressurised, to provide injection of its contents, by a reciprocating type hand pump located on the cab dash panel. The reservoir is charged with an ether mixture supplied in cans, reservoir contents can be seen through the glass bowl.

MAIN GEARBOX

8 The main gearbox is an automatic ZF-Ecomat Series 6 HP600 giving a range of six forward and one reverse speed. Drive from the engine is transferred to a planetary gear system through a hydrodynamic torque converter. A lock-up clutch provides a direct mechanical link between the engine and the gear system after initial start-up, this eliminates power loss through the torque converter.

9 Part of the gearbox system is a hydrodynamic retarder which, when operated, gives a braking effect to the vehicle. The retarder system is operated ON or OFF by a switch on the dashboard. When engaged ON the gearbox retarder will operate when the accelerator is fully released.

10 Automatic gear selection is pre-determined by the gear selector lever in the cab. A standby mechanical lever allows for one forward or reverse gear to be selected if the electronic system fails.

11 The gearbox has a self contained oil system with an internal pump driven by gearing from the input shaft. There is also a dis-engagable, solenoid operated, Power-Take-Off (PTO) which in turn drives the LHS hydraulic oil pump. The gear box oil system provides oil for the torque converter retarder and lubrication for the internal gears and moving components. A permanently engaged emergency power steering pump is fitted to provide steering assistance in the event of failure of the main power assisted steering pump. A secondary pump is also fitted to provide gearbox lubrication when the vehicle is being towed.

TRANSFER GEARBOX

12 The transfer gearbox is the means by which the drive from the main gearbox is transmitted to both rear axles and the foremost front axle to provide motive power to the road wheels on these axles. Drive from the transfer box is into the axle differential boxes by standard propshafts. The foremost front axle drive can be engaged/disengaged as driving condition require by the operation of an air switch in the cab. The switch operates an air cylinder that in turn operates a dog clutch in the transfer gearbox causing foremost front axle propshaft engagement/disengagement. Both rear axles are permanently engaged.

13 The transfer gearbox has an integral lubricating oil system with an oil pump driven from a spur gear on the input shaft. The transfer gearbox is mounted between two longitudinal chassis frames on resilient mounts.

SUSPENSION

14 The vehicle suspension comprises front and rear leaf spring bogies both hydraulically damped. Each bogie comprises two axles and left hand and right hand, frame mounted, trunnion brackets carrying tapered leaf road springs. Each road spring fits to a saddle bracket on each bogie axle. Each axle is connected to its bogie suspension brackets by four rubber bushed torque rods.

15 For the front bogie twin, vertical hydraulic dampers are mounted outboard of the chassis frame at each wheel station. For the rear bogie single hydraulic dampers are fitted at each wheel station in a similar fashion. Upward vertical axle articulation is limited finally by bump stops under the chassis frame, downwards vertical articulation is limited finally by the hydraulic dampers.

AXLES

Front axles

16 The front bogie axles consist of a first or foremost front steer drive axle and a second or rearmost front dead steer axle. The first axle has a conventional main drive differential with hub driveshafts incorporating swivelling joints for steering. The driveshafts carry the drive into epicyclic hub reduction gears contained within the hub. The hub also incorporates wheel studs and spigot mountings for the attachment of the road wheels and brake drum.

17 The axle case is a fully welded assembly carrying all the brackets for torque rod and damper mountings, together with the air operated 'S' cam friction drum brake. The axle incorporates an air operated cross axle differential lock.

18 Drive to the first axle is transmitted by a conventional propshaft from the transfer gearbox to the input drive flange on the axle main differential. The swivel housings, for the hub ends of both front axles carry forged steering levers and track rods for connection to the steering system.

19 The second axle is a dead steer axle comprising a tubular beam with a dropped 'U' shaped centre section to permit the drive to the first axle to pass the second axle. King pins passing through bosses at the ends of the axle carry the pivoting hubs which in turn carry the same stud and spigot mountings as the first axle. The drum brake system is identical to that fitted to the first axle. The axle beam is a fully welded assembly carrying all brackets torque rod, road spring and hydraulic damper mounting.

Rear axles

20 The rear bogie axles consist of the third or foremost rear axle carrying the main differential drive head and the third differential for through drive to the fourth or rearmost rear axle. Drive from the main transmission is passed through the transfer gearbox and via the main propshaft to the input flange of the main differential. The third differential is mounted on the top of the main differential and passes the drive to the fourth axle and allows driving torque to be shared between the two rear axles. The fourth axle is fitted with a main differential transmitting the drive to the rear wheel hubs.

21 Air operated differential locks are fitted to the third differential to allow selection of a solid drive between the two axles, and to each axle main differential to allow selection of a solid drive across each axle. Selection of these various traction aids, including front wheel drive is via air operated controls from a control switch in the vehicle cab.

22 Each axle drives from the main differential to epicyclic reduction gears in the wheel hubs. The wheel hubs also carry the wheel studs and spigot mounting for the brake drum. The 'S' cam brakes are the same as fitted to the front axles. Each axle is a fully welded assembly carrying the brackets for spring mounting, torque rods and hydraulic dampers.

STEERING

23 The vehicle steering system is fully power assisted, hydraulic power being supplied from an engine driven steering pump. An emergency steering pump, driven from the main gearbox, is available when the vehicle is in motion without the benefit of the engine driven pump, ie when being towed. Steering is effected through the steering wheel, steering column and downshaft, into a steering box which is connected mechanically via drag links, to both axles. Levers and track rods connect the left and right hand hubs of both sets of front wheels. Hydraulic power steering booster rams are fitted at the left hand front wheel stations and hydraulic steering dampers are fitted at the right hand front wheel stations.

WHEELS AND TYRES

24 The wheel size is 17.00 x 25 with 162 mm offset for 10 in number M22 x 1.5 mm stud fixings. The tyres are radial 20.5 x 25 Michelin tubeless type with XLB tread pattern. No spare wheel is provided on the vehicle.

AIR BRAKING SYSTEM

25 The braking system is a two line system generally conforming to EEC regulations with a two line trailer system to DEF STAN 25 - 19. Spring brakes are mounted on all axles. All brakes are drum type 'S' cam operated with DURON P120 brake linings.

26 The engine driven air compressor supplies air to the air system through an air dryer. In emergency the system can be pressurised from an external source via palm couplings mounted on the front bumper. A governor valve maintains system pressure at 8.4 bar (122 lbf/in^2) and a safety valve, set to lift at 11 bar (160 lbf/in^2), protects the system against over-pressure in the event of failure of the governor valve. After passing through the air dryer the compressed air is routed to seven in number reservoirs supplying six sections of the air system, namely:

26.1 Front brake service reservoir - provides air for normal front brake spring release system.

26.2 Rear brake service reservoir - provides air for normal rear brake spring release system.

26.3 Secondary reservoir - provides air for the secondary brake system.

26.4 Trailer brake reservoir - provides air for the trailer brake system via rear mounted palm couplings.

26.5 Emergency spring brake release reservoirs (2 in number) - provides air for secondary spring brake release system in the event of failure of the secondary air system.

26.6 Auxiliary reservoir - provides air for tyre inflator and auxiliary system.

27 Each sub-system is protected and controlled by valves. This prevents cross-connection of systems or leak-backs. Air pressure gauges and low pressure warning switches monitor the systems and give driver indication.

FUEL SYSTEM

28 Fuel is drawn from the fuel tank by a lift pump via a fuel heater/sedimenter. The heater/sedimenter is operated by a switch in the cab but will only operate if the ambient temperature is below the maximum operating temperature of the heater element. Discharge from the lift pump is to the fuel injector pump via a fuel filter with a replaceable element. Fuel spill return from the fuel pressure rail is back to the fuel tank.

29 The fuel tank is an all steel welded construction, rectangular in shape, with a capacity of 272 litres (60 galls), an electronic sender unit within the tank transmits a signal equivalent to tank contents to a read out gauge mounted in the cab. The tank filler tube is located to enable jerry can filling and incorporates a lockable filler cap and a strainer element in the tube throat. An air vent covered by a breather cap is located in the tank upper face and a drain plug is located in the tank bottom.

ELECTRICAL SYSTEM

30 The vehicle electrical system is a 24 volt insulated return, starting and battery charging system. Cable and conduit are to suit environmental conditions of DEF STAN 00-1 Issue 2 Cat A2 to C1 inclusive. Two 12 V sealed for life batteries are mounted in a No 3 Mk 1 546793 container located above the storage locker.

31 The vehicle lighting comprises: four european pattern Halogen headlights, side, stop/tail, rear high intensity fog, number plate, convoy, rear roller, working floodlights and front, rear and side marker lights. Flashing indicators are fitted to front, rear and flank (cab sides), these indicators flash simultaneously when the cab HAZARD switch is activated. Front lights are arranged in groups of two, mounted in front bumper recesses. The light switch sequence is in accordance with DEF STAN 25-5/3 with progressive reduction in functions available through to total blackout, except for the rear roller light (when LHS is in operation) and inclinometer buzzer.

32 An inter-vehicle 24V connector is provided adjacent to the battery box 12 and 2 pin sockets are provided at the rear of the vehicle for trailer connection and a power connection for a cooking vessel is provided in the cab.

LOAD HANDLING SYSTEM

33 The Load Handling System (LHS) is provided to load and unload flatracks up to a gross weight of 16.5 tonnes (16.2 tons). Flatracks may be picked up from or put down on the ground or transferred from and to the Drops system drawbar trailer. The LHS is made up of three sub-systems; mechanical, hydraulic and electrical.

34 The mechanical sub-system comprises: compression frame, middle frame, hook arm incorporating hook, rear rollers and load locking jaws. The mechanical sub-system is secured to the vehicle chassis.

35 The hydraulic sub-system comprises: hydraulic pump, middle frame hydraulic rams (2 off), hook arm rams (2 off), hydraulic oil tank and associated filters/control valves. The hydraulic pump is operated by the main gearbox PTO. The hydraulic oil tank is located behind the cab above the main gearbox and the hydraulic pump is mounted on the gearbox below the hydraulic oil tank.

36 The electrical sub-system comprises: LHS control console, proximity switches and hydraulic sub-system safety devices. The electrical sub-system is connected to the vehicle electrical system.

37 Operation of the LHS is controlled by switches on the control console located in the cab. When the PTO is engaged the hydraulic pump takes oil from the tank and passes it round the system under pressure to operate the two sets of rams before returning it to the tank.

38 In normal AUTO operation, sequence switches control hydraulic oil flow to raise/lower the equipment and proximity switches operate to stop movement in a set direction when normal operating limits are reached. If required, and normally only if the AUTO mode of operation is not working, each set of rams can also be operated individually in the MANUAL mode of operation.

39 Slave couplings are located on top of the hydraulic oil tank to allow the hydraulic system of one LHS to be connected to another. In emergency this may permit operation of an LHS on a defective vehicle by the LHS of a second vehicle.

CHASSIS

40 The chassis is a bolted construction of high tensile steel with pressed channel side members of 340 mm x 90 mm x 10 mm nominal section, and has gusseted cross members. Recovery eyes are fitted front and rear. A towing jaw is fitted in the front crossmember and a towing pintle in the rear crossmember.

CAB

41 The cab is constructed of Glass Reinforced Polyester (GRP) with fire retardant and steel bonded reinforcements. Cab suspension is by rubber mounts at the front and hydraulically damped coil springs at the rear. The cab can be tilted forward to a maximum angle of 70° by use of a manually operated cab tilt pump. When fully lowered automatic hydraulic locks retain the cab in its lowered condition.

42 The forward opening full width front grille requires to be opened for daily servicing checks and when tilting the cab. When closed, the grille is secured by two catches and when open, is held in the fully raised position by two gas filled struts.

43 The cab roof incorporates a moulded stowage area and is capable of supporting a weight of 230 kg (507 lb). An observation ring is fitted around an aperture in the roof plate with a machine gun mounting provided on the roof plate immediately forward of the observation ring. In normal use the observation ring is covered by a GRP hatch which is hinged to the roof [redacted]

44 The interior of the cab is furnished with materials to meet FMVSS 302 flammability standard and incorporates gun clips to accommodate 4 off small arms on the rear passenger side. The forward opening doors are trimmed below glass level and are fitted with draft seals, both door windows are of the wind down type. [redacted]

45 The front windscreen twin wipers are driven from a single electrical wiper motor, the drivers heated rear window is also fitted with a wiper. Twin cab heaters, controlled by dashboard levers, provide cab heating and front windscreen demisting.

46 There are three seats in the cab, each with seat belts. The drivers seat is solid mounted. It is adjustable for fore and aft movement, height, seat cushion rake and backrest angle. The passenger seat is a standard solid frame seat with only fore and aft adjustment and backrest angle adjustment. The centrally located occasional crew seat is mounted in a fixed position over the engine tunnel and has a folding backrest.

47 Open lockers behind the seats are for personal kit stowage. A cooking vessel can be mounted behind the drivers seat a two man ration box is stowed behind the centre seat, a water jerry by the right hand passenger window and an ammunition box in front of the passengers seat. The LHS control console and electrical connectors are alongside the drivers seat on the engine bonnet.

48 Mounted externally on the cab are camouflage hooks, grab handles, rear working lights. side indicators, front and side marker lights and rear view mirrors. Additionally on the passengers side (rh) door, a kerb mirror and auxiliary mirror. Protection bars are fitted to side and rear windows.

Cab controls and instrumentation

49 The in-cab controls and instrumentation is all fitted to be within easy reach or sight of the driver in the normal driving position. Chapter 2 of this document details all controls and instruments.

MUDGUARDS

50 Full length steel mudguards are provided to the rear of the cab on each side of the chassis. They can be walked upon and are finished on their top surface in non-slip paint for this reason.

CHASSIS LOCKER

51 A chassis mounted locker is provided half way along the chassis on the right hand side. The vehicle batteries are contained in the top compartment with access through a removable top. Fitted in the locker are the inter-start socket, battery master switch and tyre inflator. Loose CES items are stowed in the locker, including the vehicle tools. Two jerrycan holders are provided, one each side of the vehicle, underslung from mudguard brackets at the rear bogie position.

CHAPTER 2

CONTROLS AND INSTRUMENTS

CONTENTS

(continued)

CONTENTS (continued)

CONTENTS (continued)

INTRODUCTION

1 The controls and instruments necessary for correct vehicle operation are mainly located in the vehicle cab and are shown in Fig 1. The Load Handling System (LHS) controls are also located in the cab to enable one man operation.

2 This chapter is set out to show the location and purpose of the controls and instruments as individual equipments, full operating procedures for these equipments as part of the vehicle or LHS are detailed in Chapter 3 - OPERATING INSTRUCTIONS.

FACE LEVEL AIR VENT

3 The face level air vent (Fig 1(1)) can be operated to allow or stop air flow by a pivoting flap. The air flow direction (when allowed) is controlled by the rotating sphere assembly. Air flow is dependent on the operation of the cab heating/ventilation controls.

ACCELERATOR PEDAL

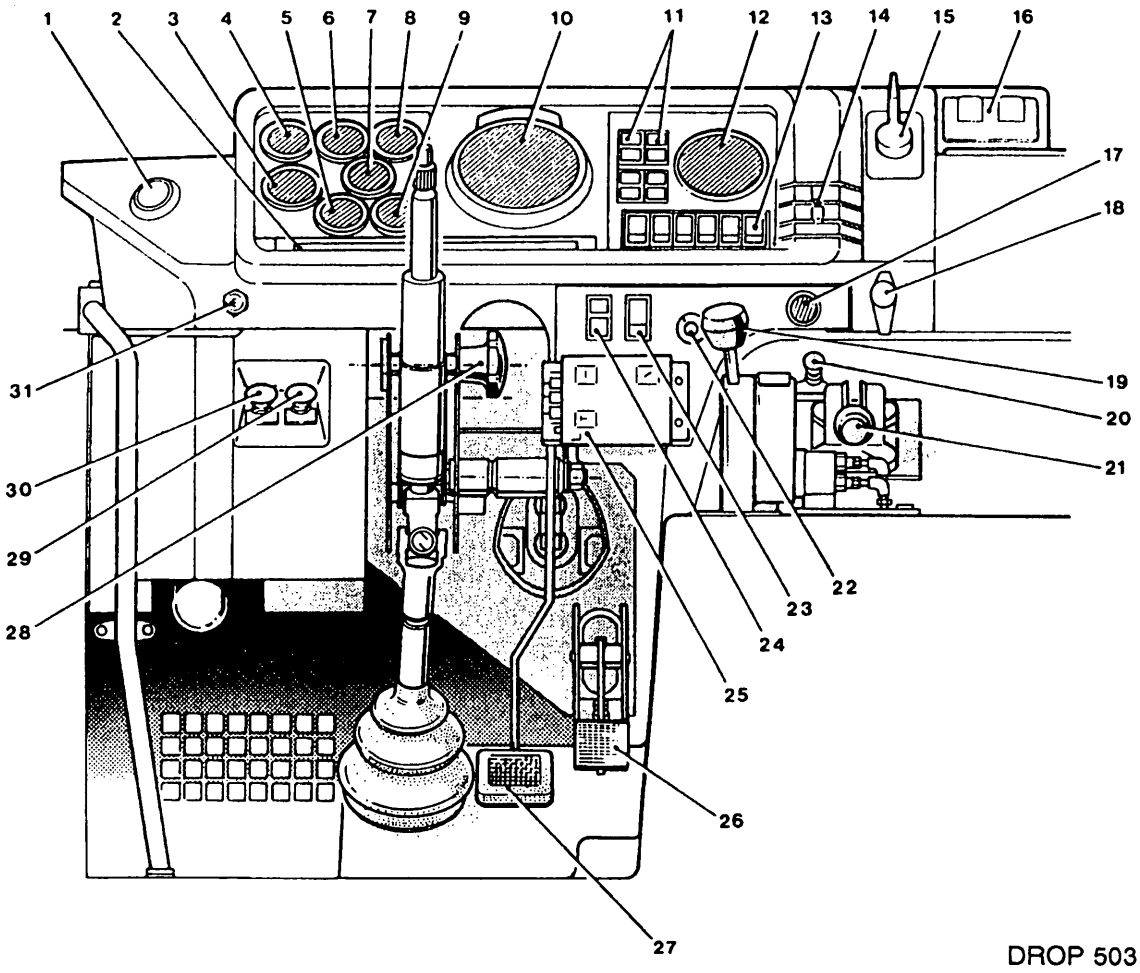
4 The accelerator pedal (Fig 1(26)) is the means by which the engine speed (RPM) is controlled. Depression of the pedal will increase engine speed. When released the pedal is spring loaded to return to its initial position, bringing the engine speed back to minimum (idling).

BRAKE PEDAL

5 The brake pedal (Fig 1(27)) is the means by which the vehicle service brake system, and when coupled, the trailer braking system, is operated. Depression of the brake pedal will activate the braking system to apply the main brakes on all road wheels. The pedal is spring loaded to return to its original position BRAKES OFF when released.

STEERING COLUMN RAKE ADJUSTMENT KNOB

6 The steering column rake adjustment knob (Fig 1(28)) allows for the steering column rake to be adjusted for a drivers personal preference. Slackening of the adjustment knob frees the steering column for adjustment, tightening, locks the column in the set position.



1 Face level air vent
2 Warning/indicator lamp module
3 Main gearbox oil temperature gauge
4 Dual air gauge (1 & 2)
5 Engine coolant temperature gauge
6 Dual air gauge (3 & 4)
7 Engine oil pressure gauge
8 Dual air gauge (5 & 6)
9 Fuel gauge
10 Speedometer
11 Indicator lights
12 Tachometer
13 Control switches
14 Cab heating/ventilation controls
15 Traction control switch
16 Height indicator
17 Battery master switch cut-off button
18 Cold start pump handle
19 Speed range selector lever
20 Engine stop handle
21 Hand brake lever
22 Vehicle lighting switch
23 Retarder switch
24 Power-Take-Off (PTO) and retarder indicator lights
25 Inclinometer console
26 Accelerator pedal
27 Brake pedal
28 Steering column adjustment knob
29 Emergency brake release switch
30 Trailer brake switch
31 Start switch

Fig 1 In-cab controls and instruments - drivers position
(Steering wheel omitted for clarity)

VEHICLE LIGHTING SWITCH

7 The vehicle lighting switch (Fig 1(22)) and (Fig 2) is a rotary type switch providing operation of the vehicle lighting system in all modes. Light operation for the switch positions are:

7.1 OFF - no lights will operate, including warning lamps and buzzer. Vehicle should not be operated with the switch in this position.

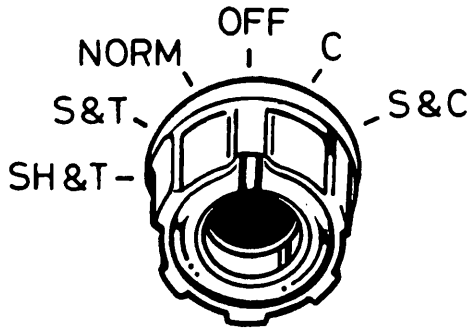
7.2 NORM - stop, turn, reversing, interior, instrument and warning lights will operate when activated.

7.3 S & T - side, tail and all marker lights lit, registration plate, rear working, LHS rear roller and all lights listed in 7.2 will light when activated.

7.4 S, H & T - all lights as listed in 7.3 plus headlights lit and rear fog light when activated.

7.5 C - convoy light and rear roller light lit. All other lights in blackout condition.

7.6 S & C - side, all marker, rear roller and convoy lights lit. All other lights in blackout condition.



DROP 504

Fig 2 Vehicle lighting switch

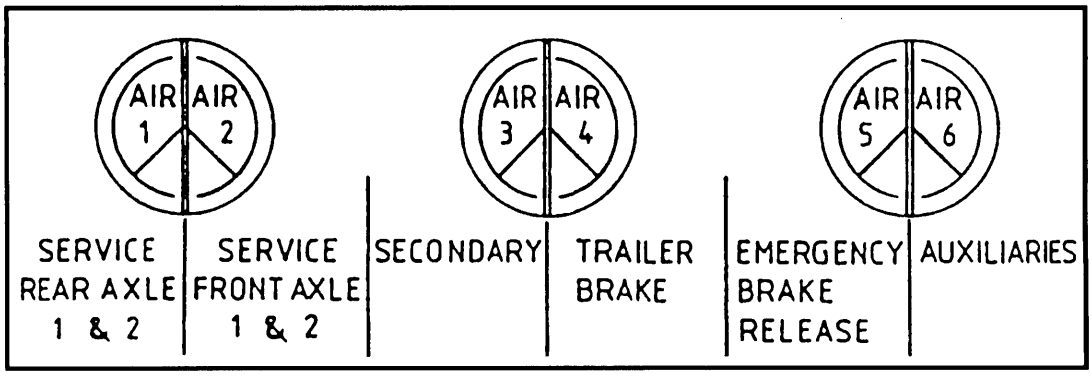
DUAL AIR GAUGES

8 The three dual air gauges (Fig 1(4)), (6), (8)) and (Fig 3) each have two pointers which indicate the air pressure in various parts of the air system, namely:

8.1 Gauge 1 & 2 - Pointer No 1 indicates air pressure in the service brake system for the rear bogie axles, pointer No 2 indicates air pressure in the service brake system for the front bogie axles.

8.2 Gauge 3 & 4 - Pointer No 3 indicates air pressure in the secondary brake system, pointer No 4 indicates air pressure in the trailer brake system.

8.3 Gauge 5 & 6 - Pointer No 5 indicates air pressure in the emergency spring brake release system, pointer No 6 indicates air pressure in the auxiliary system reservoir.

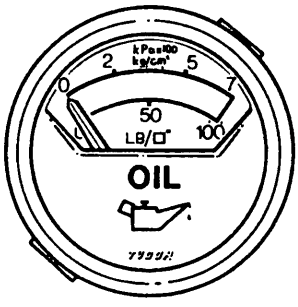


DROP 505

Fig 3 Dual air gauges

ENGINE OIL PRESSURE GAUGE

9 The engine oil pressure gauge (Fig 1(7)) and (Fig 4) indicates the engine oil pressure in kgf/cm^2 and lbf/in^2. A warning lamp on the warning light module (Fig 1(2)) lights when engine oil pressure is below 5.4 kgf/cm^2 (12 lbf/in^2).



DROP 506

Fig 4 Engine oil pressure gauge

WARNING/INDICATION LIGHT MODULE

10 A warning/indication light module (Fig 1(2)) and (Fig 5) is located on the dash panel, each lamp is individually actuated and indicates a certain vehicle fault or condition when lit. The individual lamps have there service etched onto the glass cover.

DROP 507

Fig 5 Warning/indicator light module

11 With reference to Fig 5, the function of each warning light is as follows:

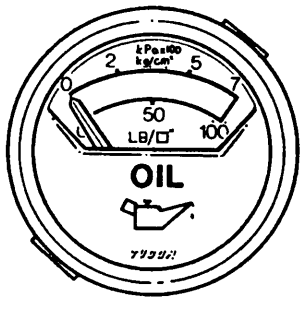
Etching	Warning indication
FWD:	Front axle drive selection
Cab unlocked:	Self evident
Oil can	Engine low oil pressure
Battery	Alternator warning
Indicator arrows	Direction indicator warning
Stop	See note
Headlight	Headlight main beam on
Air reservoir	Low air pressure warning
Foglight	Rear foglight warning
Thermometer	High engine water temperature warning

NOTE

The Stop warning light operates in conjunction with the Cab Unlocked, Low Oil Pressure, Low Air Pressure and High Water Temperature warning lamps.

ENGINE COOLANT TEMPERATURE GAUGE

12 The engine coolant temperature gauge (Fig 1(5)) and (Fig 6) indicates the engine coolant temperature in degrees C. The gauge has a red coloured segment to indicate high temperature. The normal operating temperature range is at the high end of the gauge scale. Allowing for gauge accuracy and tolerances the gauge needle may be marginally over the lower end of the red segment before the thermostatically controlled fan cuts in to lower the temperature. Provided the fan is known to be cutting in and the high water temperature warning light is not lit, the gauge reading as described above, is still indicating a safe driving condition.

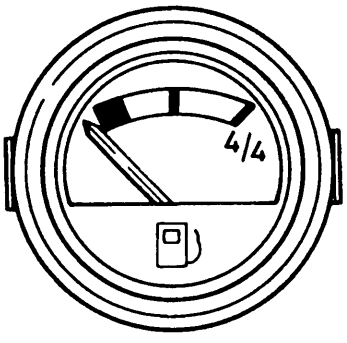


DROP 506

Fig 6 Engine coolant temperature gauge

FUEL GAUGE

13 The fuel gauge (Fig 1(9)) and (Fig 7) indicates the level content of the vehicle fuel tank and is calibrated empty to full with coloured sectors for low level, half and full marks. When the gauge registers 'FULL' the tank contains 272 litres (60 imp galls) of fuel.

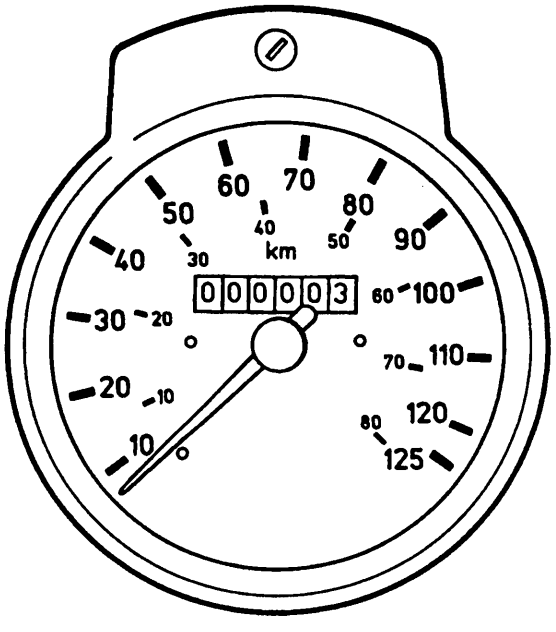


DROP 509

Fig 7 Fuel gauge

SPEEDOMETER

14 The speedometer (Fig 1(10)) and (Fig 8) is calibrated in Km/h and mph, in the centre of the face is an odometer which records distance travelled in Km.



DROP 510

Fig 8 Speedometer

INDICATOR LIGHTS

15 There are two groups of indicator lights (Fig 1(11)) and (Fig 9) which light when the function to which they are attached is in operation. The function which each light serves is etched on the lamp glass so as to be visible when the lamp is lit. The two sets of lights comprise:

15.1 Fuel line heater - glows yellow when the fuel line heater switch is set to ON if the ambient temperature is below 0°C (32°F).

15.2 Rear mounted working light - glows yellow when the rear working light switch is set to ON. Vehicle side or side and headlight must be on.

15.3 Rear window heater - glows yellow when the rear window heater switch is set to ON.

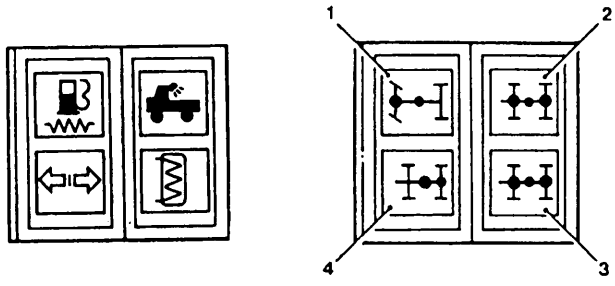
15.4 Trailer directional (turn) indicator lights - Trailer warning flashes green when indicator control is selected to left or right only when a trailer is attached. Both arrows flash simultaneously when the HAZARD switch is activated. When the trailer is not fitted, it will give a single flash.

15.5 Cross axle differential lock, foremost front axle (Fig 9(1)) - glows yellow when the traction control switch (Fig 16) is set to FRONT DIFF LOCK.

15.6 Cross axle differential lock, foremost rear axle (Fig 9(2)) - glows yellow when the traction control switch is set to REAR DIFF LOCKS.

15.7 Cross axle differential lock, rearmost rear axle (Fig 9(3)) - glows yellow when the traction control switch is set to REAR DIFF LOCKS.

15.8 Inter-axle (3rd) differential lock, rear bogie (Fig 9(4)) - glows yellow when the traction control switch is set to REAR DIFF LOCKS.



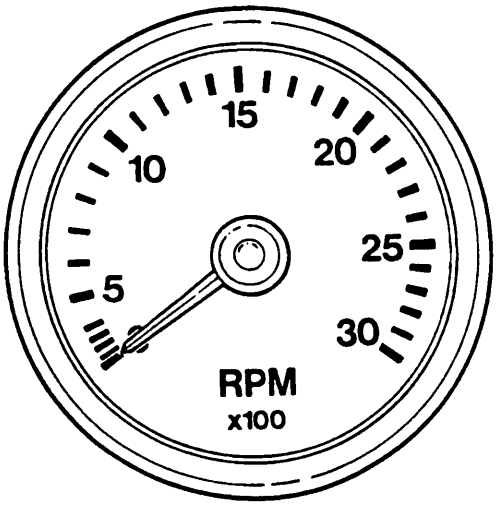
DROP 511

1 Foremost front axle cross axle differential lock
2 Foremost rear axle cross axle differential lock
3 Rearmost rear axle cross axle differential lock
4 Inter axle (3rd) differential lock, rear bogie

Fig 9 Indicator lights

TACHOMETER

16 The tachometer (Fig 1(12)) and (Fig 10) indicates the engine speed in revolutions per minute (RPM). The figure indicated has to be multiplied by 100 to give the correct engine revolutions.

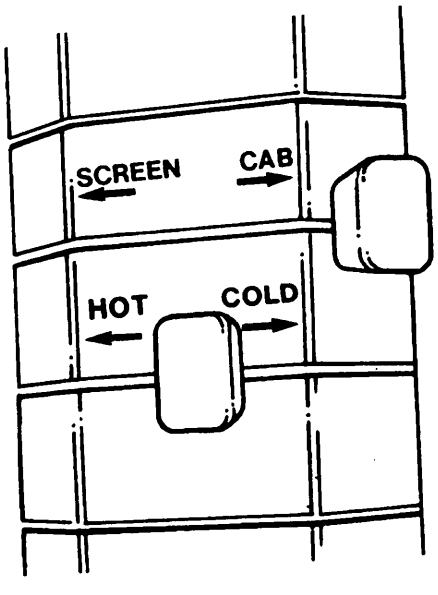


DROP 512

Fig 10 Tachometer

CAB HEATING/VENTILATION CONTROLS

17 The cab heating/ventilation controls (Fig 1(14)) and (Fig 11) dictate the direction of air flow between cab air vents and windscreen vents, and the temperature of the air from HOT to COLD (once the engine has reached normal operating temperatures). The upper, air direction, lever can be set at any position between SCREEN and CAB to give full flow to either area or to give a divided flow. The lower temperature lever can be set at any position between COLD and HOT to give desired temperatures.



DROP 513

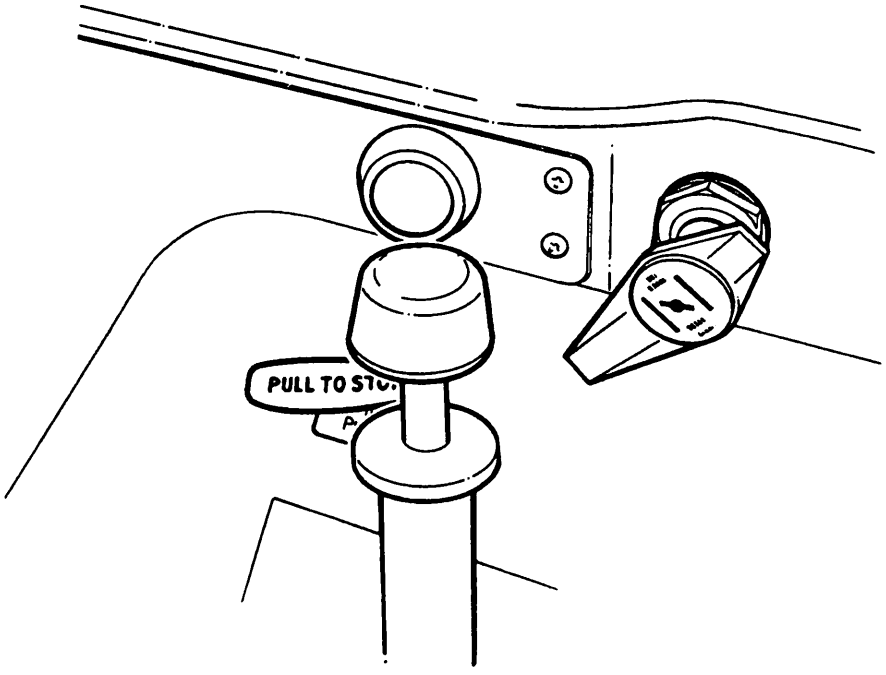
Fig 11 Cab heater controls

COLD START PUMP

18 The cold start pump (Fig 1(18)) and (Fig 12) is used to pressurise the cold start reservoir, which is used to assist engine starting in cold weather when temperatures are below 0°C (32°F) by pumping an ether based vapour into the engine induction system.

BATTERY MASTER SWITCH CUT-OFF BUTTON

19 The battery master switch cut-off button (Fig 1(17)) and (Fig 12(1)) is used to remotely operate the battery master switch to the OFF position, thereby isolating the batteries from the vehicle electrical system.



DROP 514

1 Battery master switch cut-off button 2 Cold start pump 3 Engine stop handle

Fig 12 Cold start pump handle and battery master switch cut-off button

ENGINE STOP HANDLES

20 There are two engine stop handles fitted to the vehicle, one inside the cab (Fig 1(20)) and (Fig 12(3)) and one external to the cab on the right side of the vehicle adjacent to the cab tilt pump (Fig 13). Pulling either of these handles will interrupt the engine fuel supply, causing the engine to stop. The engine start key must be turned to OFF once the engine has stopped after operating either handle. Once the engine has stopped and the start key is in the OFF position the activated handle must be checked as having returned to its normal retracted position.

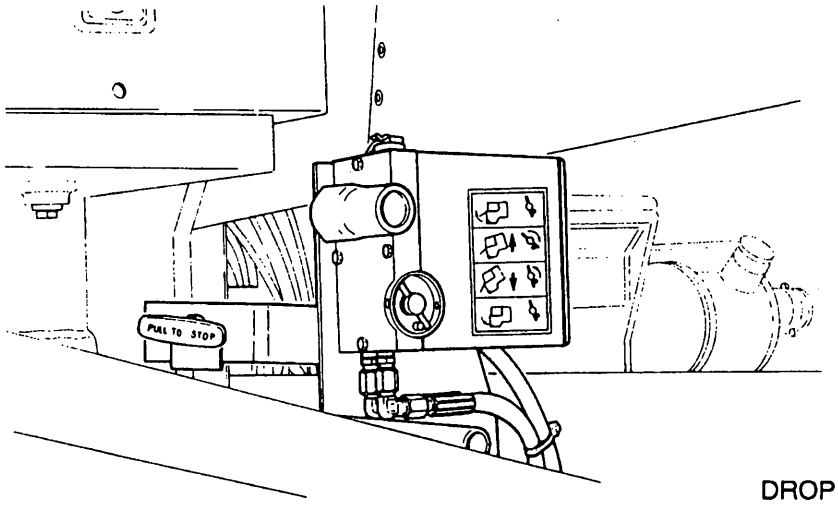


Fig 13 Engine stop handle (External)

HAND BRAKE

21 The hand brake (Fig 1(21)) and (Fig 14) operates the parking and secondary brake system. A collared sleeve on the hand brake lever requires to be lifted clear of a recess in the housing to allow the lever to be moved. Once the collared sleeve is lifted the lever can move between PARK or RELEASE positions as required. An intermediate position between PARK and RELEASE has a stepped abutment into which the hand brake lever can be moved, from the RELEASE position only, without lifting the collared sleeve, secondary braking will be progressive between the released position and the abutment and is bought into operation to stop the vehicle. The secondary braking system should only be used when the service brake system fails.

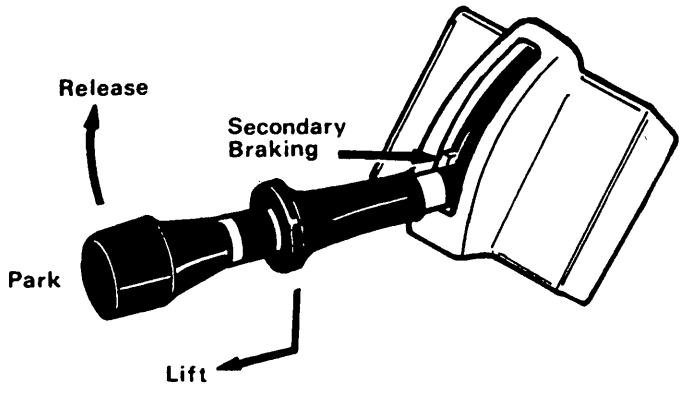
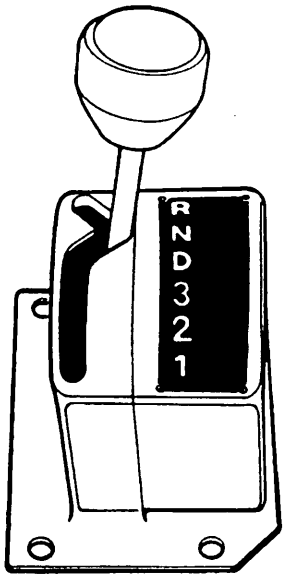


Fig 14 Hand brake lever

GEAR RANGE SELECTOR

22 The gear range selector (Fig 1(19)) and (Fig 15) is used to select the correct gear range. The selector lever operates in a gate to prevent accidental gear range selection from NEUTRAL, or overshooting the desired selection during operation.



DROP 517

Fig 15 Gear range selector

TRACTION CONTROL SWITCH

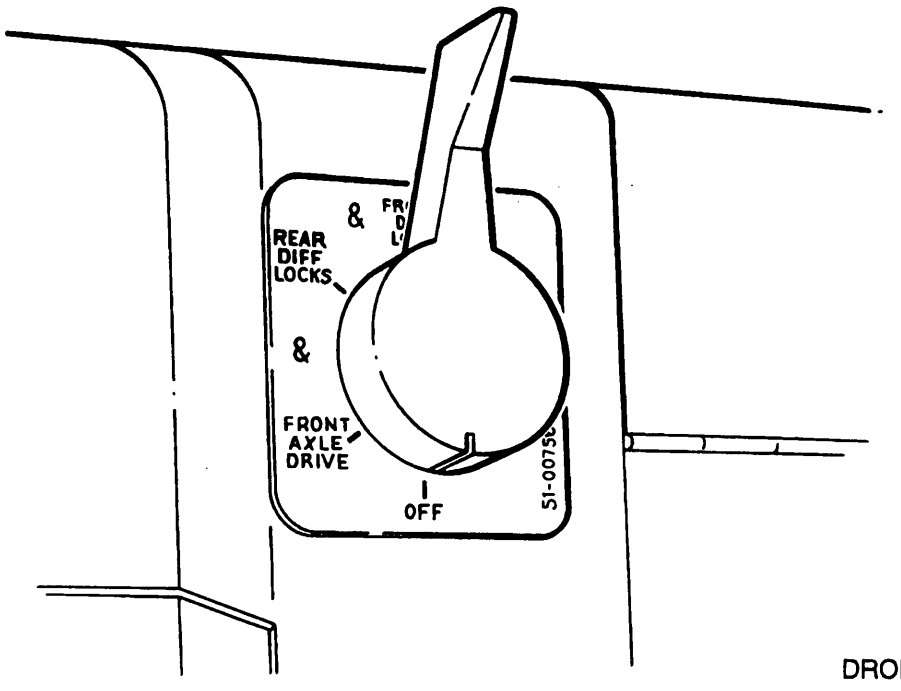
23 The traction control switch (Fig 1(15)) and (Fig 16) has four operating positions as follows:

23.1 NORMAL - in this position drive is to the rear axles only with full differential action on both cross axles and between the rear axles.

23.2 FRONT AXLE DRIVE - in this position drive from the transfer gearbox to the front drive/steer axle is engaged.

23.3 RA & 3RD DIFF LOCK - in this position the two cross axle differential locks and the differential lock between the rear bogie axles are engaged, plus front axle drive.

23.4 FRONT AXLE DIFF LOCK - in this position the cross axle differential lock on the front drive/steer axle is engaged, plus front axle drive and RA and third differential lock.

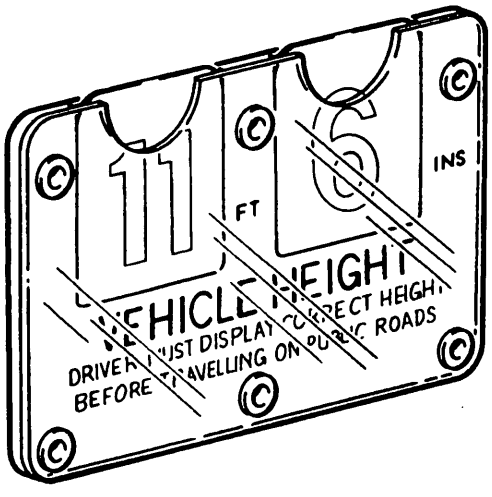


DROP 518

Fig 16 Traction control switch

HEIGHT INDICATOR

24 The height indicator (Fig 1(16)) and (Fig 17) is positioned to allow the driver to have a visual check of the overall height of the vehicle at all times. The indicator is a casing with two slots which hold a number of plastic cards, each card containing a different number. By selecting the correct combination of cards the overall height of the vehicle can be displayed in feet and inches. Once the load is secured and the overall height is measured, the figure should be entered into the height indicator as a visual reminder to the driver on all occasions that the vehicle approaches a restricted height area, ie low bridge or overhead power lines.

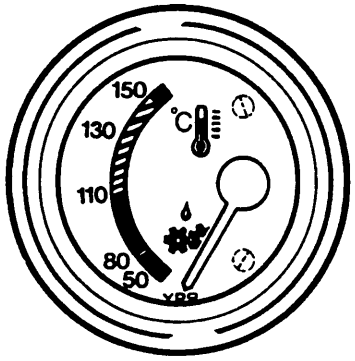


DROP 519

Fig 17 Height indicator

MAIN GEARBOX OIL TEMPERATURE GAUGE

25 The main gearbox oil temperature gauge (Fig 1(3)) and (Fig 18) registers the temperature of the main gearbox oil in degrees centigrade. The gauge has three coloured segments to indicate low, normal and high temperatures.



DROP 520

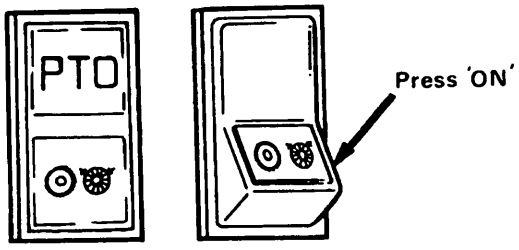
Fig 18 Main gearbox oil temperature gauge

RETARDER SWITCH

26 The retarder switch (Fig 1(23)) and (Fig 19), when switched to ON, allows the automatic operation of the main gearbox retarder to assist the vehicle braking system when slowing down from high speeds or descending steep or lengthy gradients. The retarder will only work when the accelerator is released.

POWER TAKE-OFF (PTO) AND RETARDER INDICATOR LIGHTS

27 The PTO and retarder indicator lights (Fig 1(24)) and (Fig 19) are mounted into a single module located in the facia adjacent to the retarder switch. Both, or either, lights will be lit when the relevant retarder or PTO switch is set to ON.

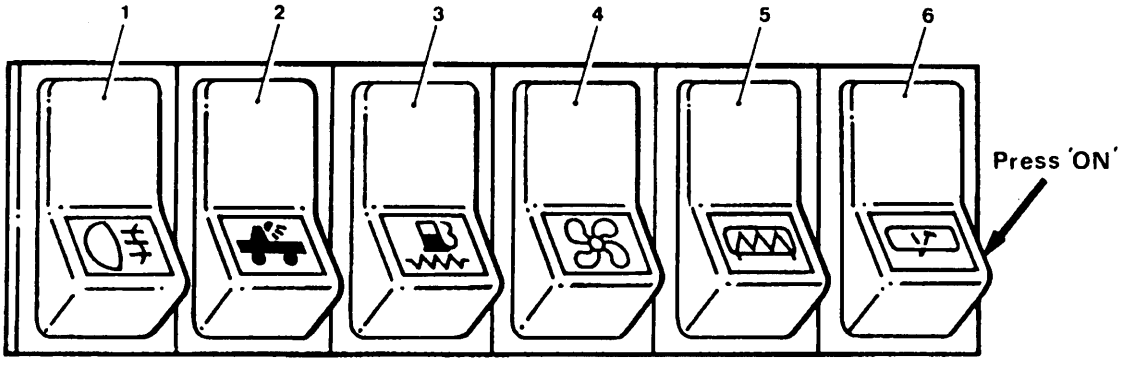


DROP 521

Fig 19 Retarder switch and Power-Take-Off/retarder light module

CONTROL SWITCHES

28 The control switch module (Fig 1(13)) and (Fig 20) consists of press ON/OFF switches. Engraved figures on a green background identify each switches operation and a light behind the panel illuminates when the vehicle side lights are switched to ON.



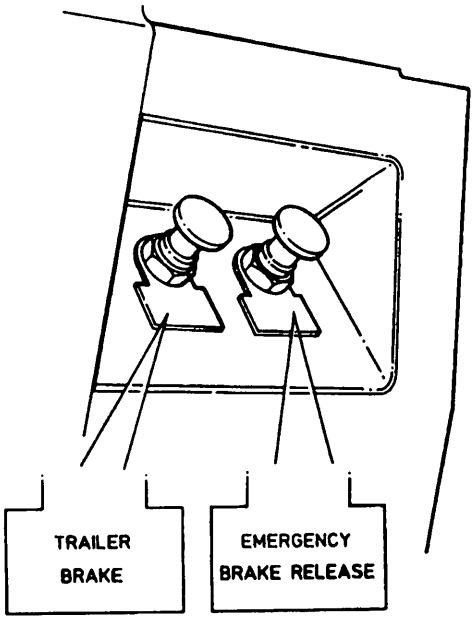
DROP 522

1 Rear intensity fog light
2 Rear working light
3 Fuel line heater
4 Heater fan
5 Heated rear window
6 Rear window wash/wipe

Fig 20 Control switches

EMERGENCY BRAKE RELEASE SWITCH

29 The emergency brake release switch (Fig 1(29)) and (Fig 21) is used to release the spring brake actuators if the brakes require to be released after a failure or fault condition arising in the secondary brake circuit causing the brake actuators to be engaged ie loss of air in system 3. The emergency brake release switch will not remain activated if there is air in the secondary brake system.



DROP 523

Fig 21 Emergency brake release switch

START SWITCH

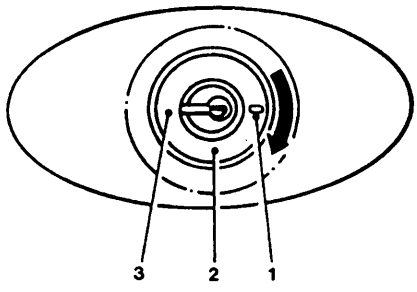
30 The start switch (Fig 1(31)) and (Fig 22) is key operated and has three positions.

Position 1 - OFF.

Position 2 - main electrical circuits ON.

Position 3 - START ENGINE.

31 Operation of the key is clockwise from OFF - position 1, to START ENGINE - position 3. The key will, if required, rest at positions 1 and 2 but will automatically return from position 3 to position 2 on release of the key. The key can only be withdrawn from the switch when in position 1 - ignition OFF.

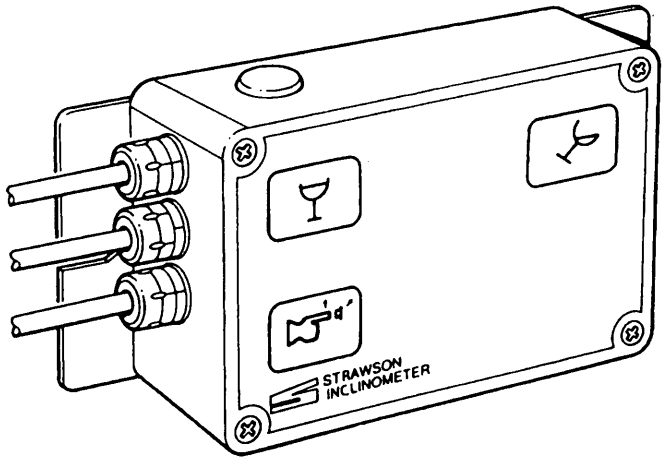


DROP 524

Fig 22 Start switch

INCLINOMETER CONSOLE

32 The inclinometer console (Fig 1(25)) and (Fig 23) indicates the tilt the vehicle is being subjected. to. The console is activated when the PTO is engaged. When the finger touch panel is pressed the indicator shows one of two wine glasses indicating the amount of tilt the vehicle is subject to in relation to the true horizon. If the right hand 'tilted' wine glass appears a warning buzzer is also activated. Indication of tilt is required for safe LHS operation. The warning light and buzzer will operate in an unsafe condition.

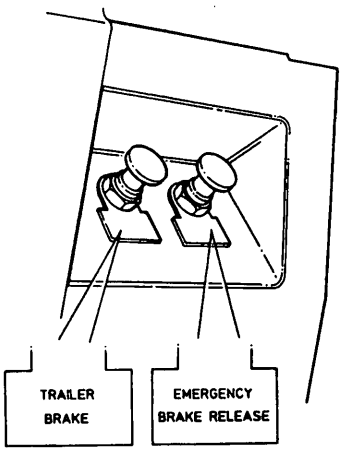


U5942/9

Fig 23 Inclinometer console

TRAILER BRAKE SWITCH

33 The trailer brake switch (Fig 1(30)) and (Fig 24) operates the trailer brakes when the vehicle is stationary with its hand brake applied to the PARK position. During normal operation the vehicle service brake system will also operate the trailer brakes. The vehicle hand brake has no effect on the trailer brakes when put into the PARK position therefore the trailer brake needs to be activated before the driver leaves the cab to operate the PARK valve located on the trailer. If the hand brake is put to the SECONDARY position the trailer brakes are activated.



DROP 523

Fig 24 Trailer brake switch

EMERGENCY GEAR SHIFT LEVER

34 The emergency gear shift lever (Fig 25(5)) and (Fig 26) can be used to select ONE ONLY forward or reverse gear if there is a partial or total electrical power failure on the vehicle, or the gear range selector becomes inoperative for any reason.

STEERING COLUMN MULTI-SWITCH

35 The steering column multi-switch (Fig 25(1)) and (Fig 27) performs the following functions:

Windscreen wash/wipe switch

36 The windscreen wash/wipe switch (1) has an end push button to operate the windscreen washer motor, the motor will run pumping fluid as long as the button is depressed. From the neutral fully rearward position, the switch is moved forward one position to operate the windscreen wipers at normal speed, and two positions for fast speed. The windscreen wipers will return automatically to the off-screen parked position when the wiper switch is returned to neutral.

Infra-red headlight switch

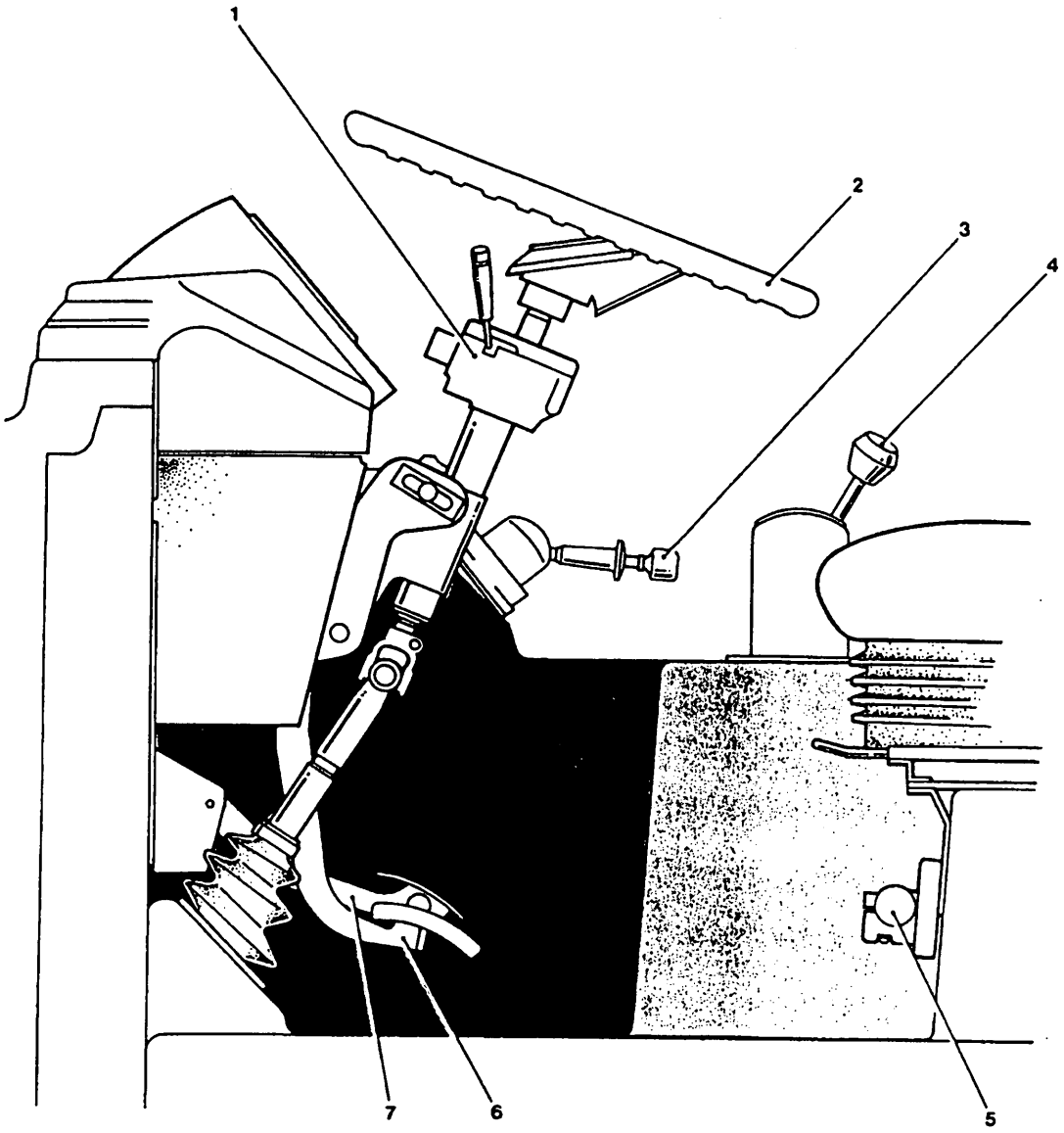
37 The infra-red headlight switch (2) is a three position switch:

37.1 With reference to Fig 27, fully drawn position - OFF:

(a) Central dotted line position - INFRA-RED HEADLIGHTS only.

(b) Top dotted line position - HEADLIGHTS AND CONVOY LIGHTS.

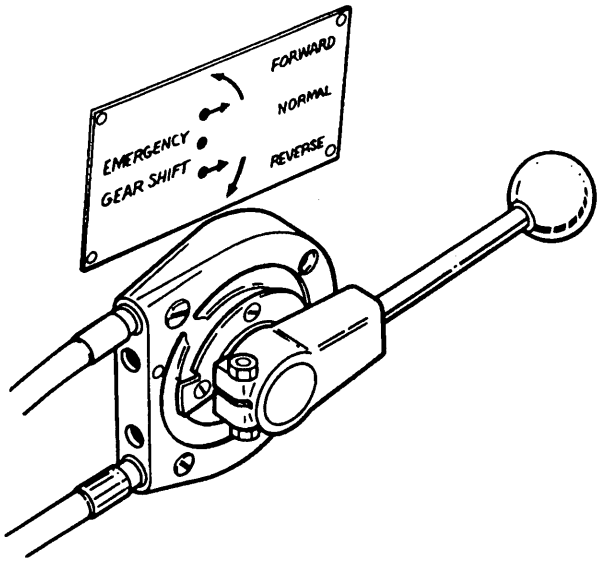
37.2 When in position 2 or 3 all other lights are in the blackout condition.



DROP 526

1 Steering column multi-switch
2 Steering wheel
3 Hand brake lever
4 Speed range selector lever
5 Emergency gear shift lever
6 Brake pedal
7 Accelerator pedal

Fig 25 In-cab controls and instruments (view through drivers door)



DROP 527

Fig 26 Emergency gear shift lever

Hazard switch

38 The hazard switch (3) incorporates a lamp. When the switch is pulled outward it will glow red, all turn indicators (including trailer if coupled) will flash intermittently and the directional turn indicating arrows on the cab fascia will both flash.

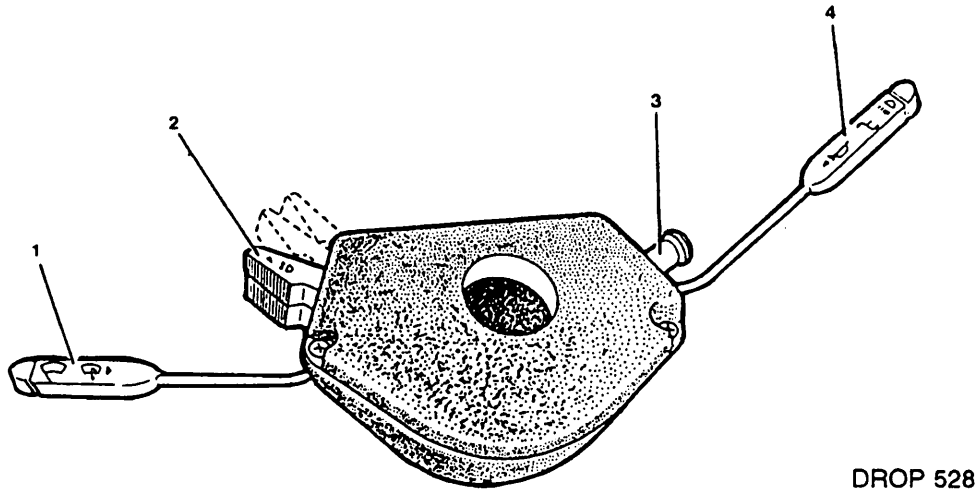
Headlight, main beam, turn indicator and horn switch

39 The headlight, main beam, turn indicator and horn switch (Fig 27(4)) can be operated in three modes:

39.1 Depression of the end push button will operate the horn. The horn will sound continuously as long as the button is depressed.

39.2 Pushed forward to operate the left hand turn indicators and rearwards to operate the right hand turn indicators (neither will operate if the HAZARD switch is activated). The turn indicator on the cab facia will flash as long as the direction is selected. The turn indicator will self cancel to the central position once the steering wheel is put into a straight ahead steer position.

39.3 With the vehicle lighting switch set to SH & T (para 7.4 refers), pushing the switch downwards will operate the headlights to MAIN BEAM, returning to the upward position will return the headlights to DIPPED position.

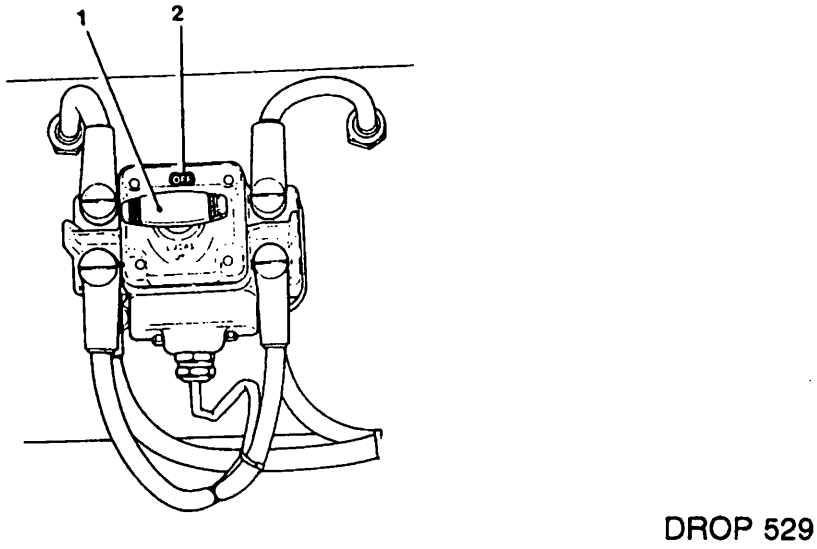


1 Windscreen wash/wipe switch
2 Infra-red headlight switch
3 Hazard switch
4 Headlight main beam/turn indicator and horn switch

Fig 27 Steering column multi-switch

ELECTRICAL SYSTEM MASTER SWITCH

40 The electrical system master switch (Fig 28) is inside the storage locker located on the right hand side of the vehicle between the middle two sets of road wheels. Operation of the master switch will isolate or restore full electrical supply from the batteries to the vehicle electrical system. The handle of the master switch has a semi-rotary action from OFF to ON and back. The position of the switch is indicated as ON or OFF in a glass fronted aperture in the switch box. It is important to turn the switch handle fully clockwise for ON.



1 Switch handle 2 Switch position indicator

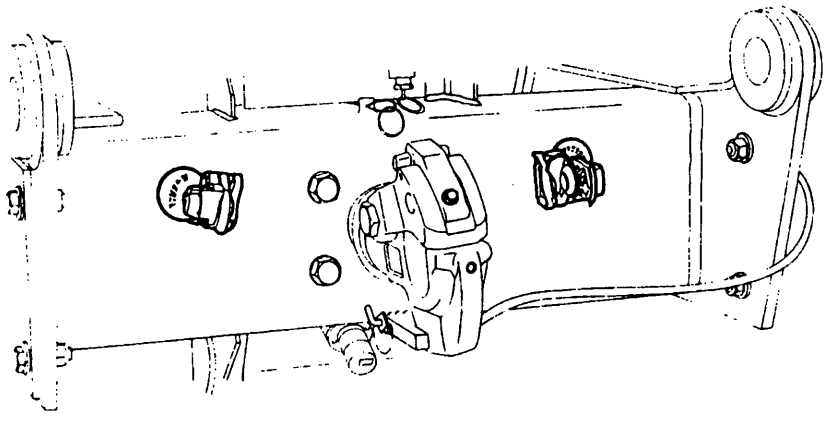
Fig 28 Electrical system master switch

TRAILER AIR BRAKE SYSTEM COUPLINGS

WARNING

TRAILER BRAKING SAFETY. FOR CORRECT TRAILER BRAKING THE VEHICLE MUST BE COUPLED TO A TWO LINE SYSTEM TRAILER.

41 The trailer air braking system couplings (Fig 29) are located at the rear of the vehicle each side of the towing hook. When coupled to a two line system trailer the vehicle and trailer air braking systems are married, any braking effort applied by the driver acts on both vehicle and trailer road wheels. The couplings are of the self sealing type and are colour coded RED for the emergency air line and YELLOW for the service air line.

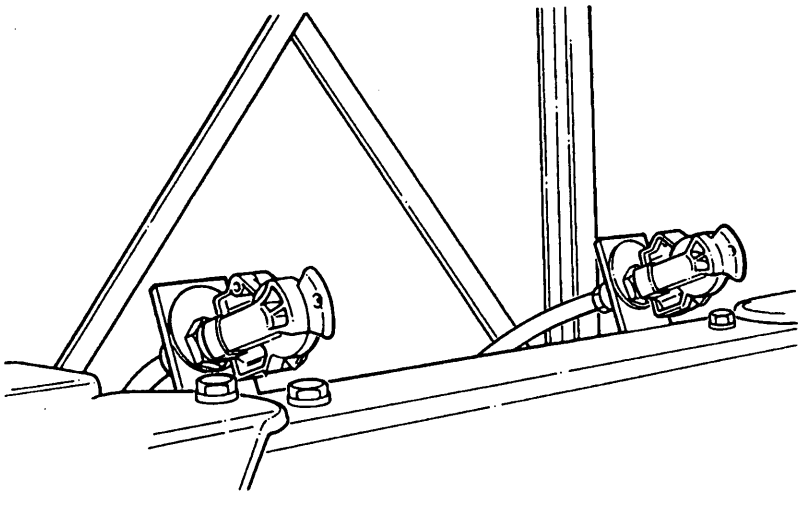


DROP 530

Fig 29 Trailer air brake system couplings

INTER-VEHICLE RECOVERY AIR BRAKE SYSTEM COUPLINGS

42 The inter-vehicle recovery air brake system couplings (Fig 30) are located on the vehicle front bumper. When coupled to an outside source (another vehicle, air compressor etc) they provide the facility to charge the vehicle air brake systems, ie red line. In addition, when correctly coupled to a towing vehicle, the towing vehicle brake operation will also apply to the towed vehicle brakes. The couplings are colour coded RED for the emergency air line and YELLOW for the service air line.

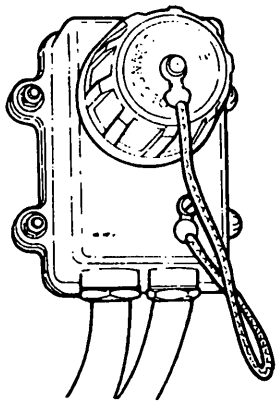


DROP 531

Fig 30 Inter-vehicle air brake system couplings

INTER-VEHICLE START CONNECTOR

43 The inter-vehicle start connector (Fig 31) is inside the equipment locker located on the right side of the vehicle between the centre sets of road wheels. The inter-vehicle start socket allows connection between the vehicle electrical system and an external source for the purpose of supplying or receiving electrical power. The user must ensure that only supplies of 24V are connected.



DROP 532

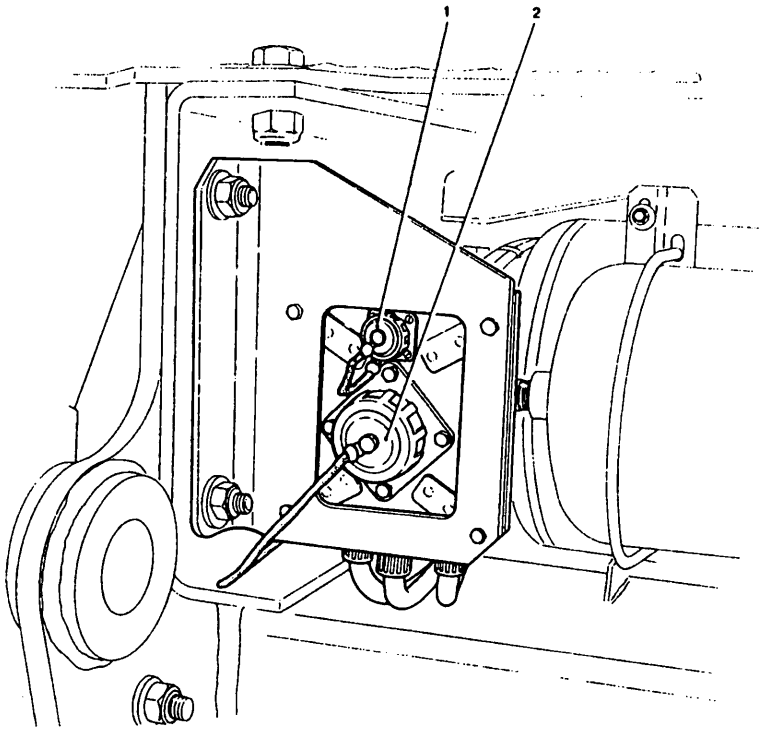
Fig 31 Inter-vehicle start connector

TRAILER ELECTRICAL CONNECTIONS

44 The trailer electrical connections (Fig 32) comprise a 12-pin (2) and a 2-pin (1) socket, fitted at the rear of the vehicle adjacent to the left hand rear towing eye. When coupled they provide an interconnection of compatible electrical systems between the vehicle and the trailer. The 12-pin socket provides convoy lights, tail/stop lights, rear fog lights, turn indicators, reversing lights and auxiliary supply to the trailer which will work in conjunction with the vehicle lights. The 2-pin socket provides power to operate a warning lamp and buzzer in the cab if the trailer air braking system falls below the minimum requirement of 5.4 bar (78 lbf/in^2). The sockets are protected by covers when not connected.

TYRE INFLATOR

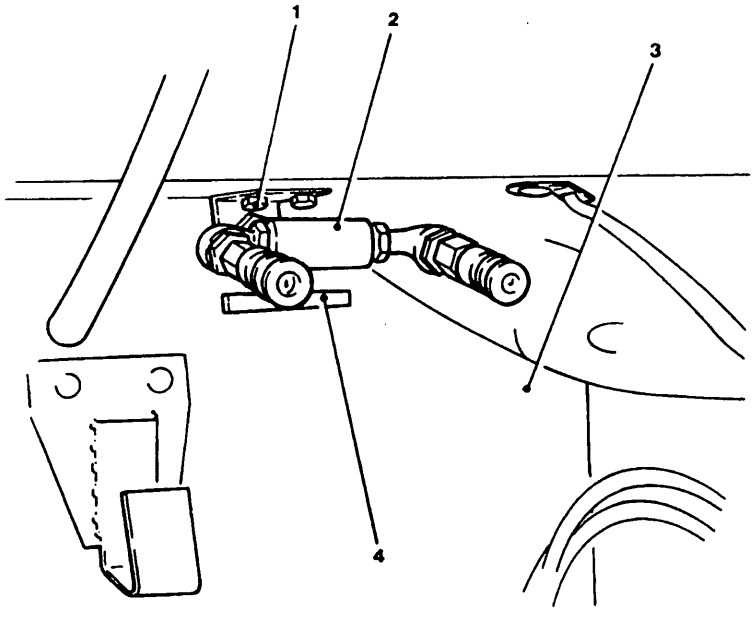
45 The tyre inflator (Fig 33) is inside the equipment locker located on the right side of the vehicle between the centre sets of road wheels. Connected directly into the vehicle air brake system the tyre inflator allows for two road wheels to be inflated simultaneously. Pressure gauges on each supply hose allow for the tyre pressures to be monitored during inflation.



DROP 533

1 2-pin socket
2 12-pin socket

Fig 32 Trailer electrical connections



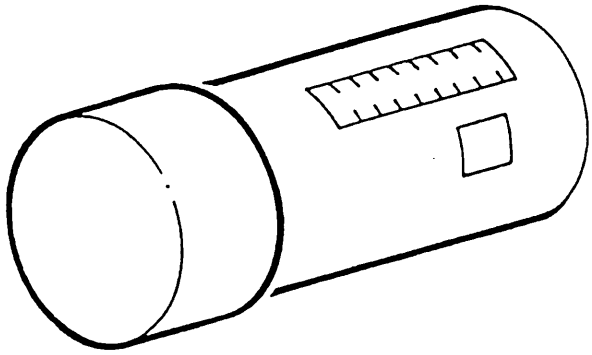
DROP 534

1 Securing bolts
2 Inflator connections
3 Stowage locker
4 Operating lever

Fig 33 Tyre inflator

AIR FILTER RESTRICTION INDICATOR

46 The air filter restriction indicator (Fig 34) is connected to the engine side of the engine air cleaner. It is designed to show the state of cleanliness of the cleaner filter. A transparent section of the indicator shows clear when the filter is serviceable, as the filter becomes dirty a RED band moves up the indicator in the transparent section, the more Red showing the dirtier the filter.

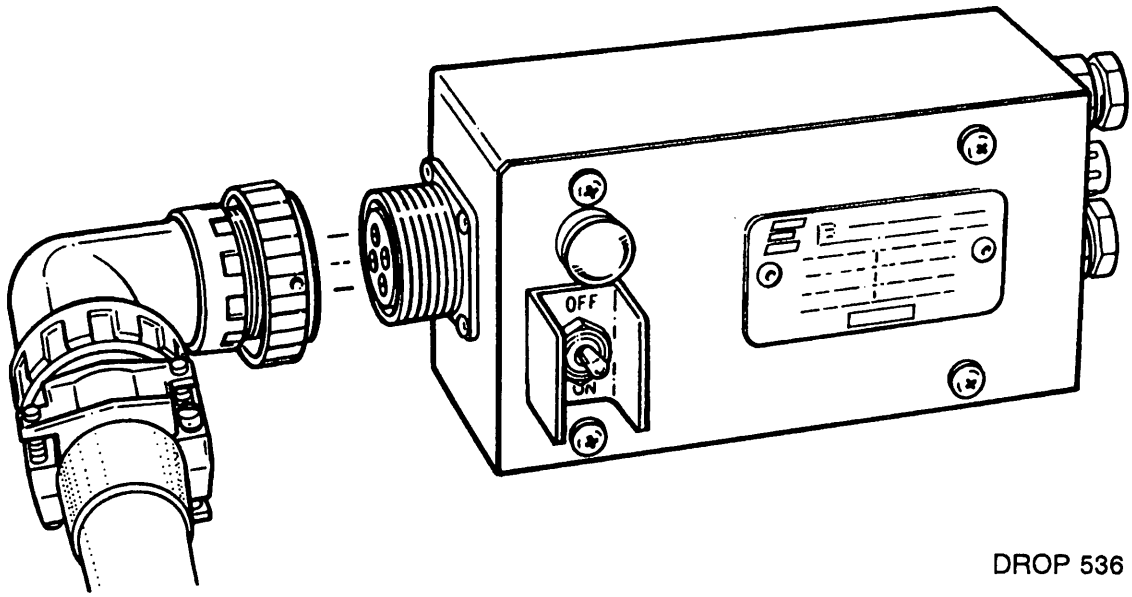


DROP 535

Fig 34 Air filter restriction indicator

COOKING VESSEL CONTROL BOX

47 The cooking vessel control box (Fig 35) is mounted in the cab on the passengers side of the engine cover. The front face of the box houses a protected ON/OFF switch and a POWER ON light. Connections at one end of the box allow for connection into the vehicle electrical system and a 24V 4-pin connector on the other end of the box allows for connection to a standard issue cooking vessel (supplied with CES equipment). The cooking vessel must only be operated when the engine is running.

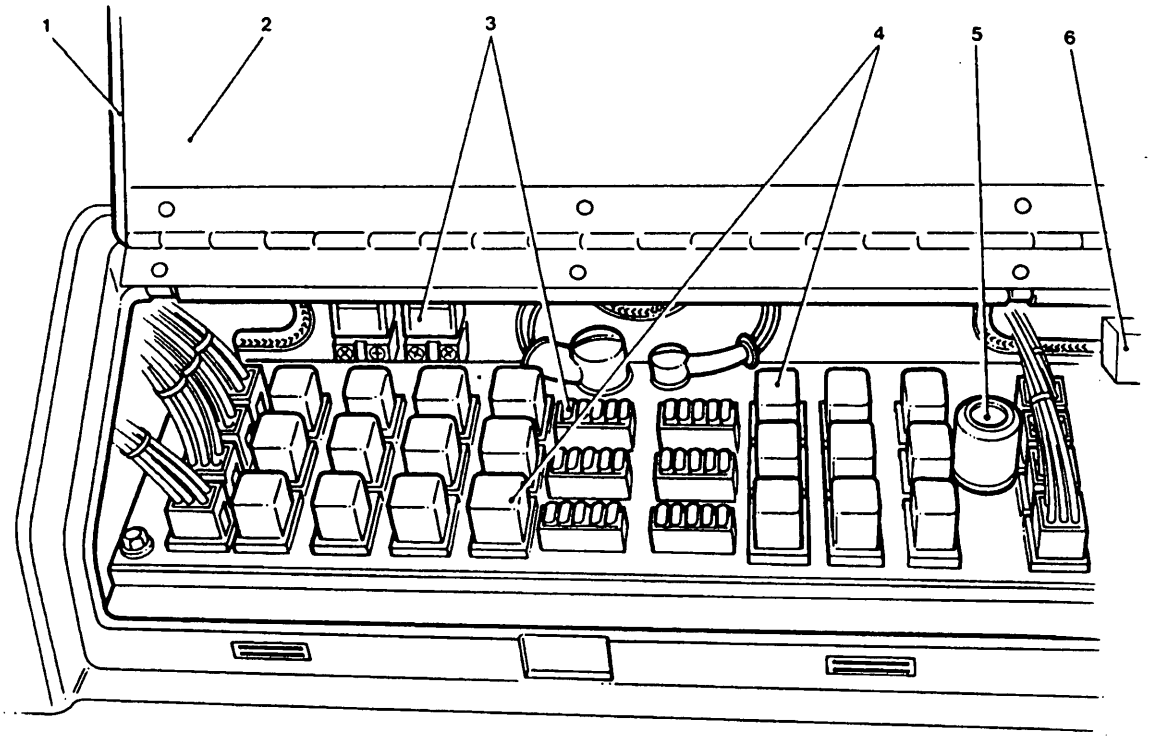


DROP 536

Fig 35 Cooking vessel control box

MAIN ELECTRICAL PANEL

48 The main electrical panel (Fig 36) is housed under the front instrument panel and is protected by a hinged cover (1). PCB, Fuse and Relay details of the vehicle electrical system (2) are affixed to the inner face of the cover. On the panel are mounted the system fuses (3), two banks of relays (4), a stop warning buzzer (5) and turn indicator flasher unit (6). The electrical circuits protected by each fuse and relay are shown on the PCB, Fuse and Relay diagram.



DROP 537

1 Hinged cover
2 PCB, Fuse and Relay diagram (not shown)
3 Fuses
4 Relays
5 Buzzer
6 Flasher unit

Fig 36 Main electrical panel

LOAD HANDLING SYSTEM (LHS) CONTROL CONSOLE

49 The LHS control console (Fig 37) is mounted in the cab to the right of the drivers position on the engine cover. The console houses a six position rotary switch (1), a joystick (2) and three warning lights (3), (4) and (5) on the upper face and an electrical connector on the rear face.

50 The six position rotary switch controls the mode of operation of the LHS as follows:

50.1 Position 0 - OFF. Control console non-operational, PTO disengaged, LHS fully folded down on the chassis, in normal travelling order.

50.2 Position 1 - AUTO. PTO engaged, normal operational condition. LHS available for operation under control of the joystick.

50.3 Position 2 - MAN HA (manual hook arm). for use when AUTO system inoperative, operates the hook arm rams only. Must only be operated in correct sequence dependent upon operation being carried out.

50.4 Position 3 - MAN MF (manual main frame). For use when AUTO system inoperative, operates the main frame rams only. Must only be operated in correct sequence dependent upon operation being carried out.

50.5 Position 4 - MAN TRANS (manual transit). For use when AUTO system inoperative and MAN HA/MAN MF have been operated. Disengages PTO and operates transit circuit to relieve hydraulic pressure in the rams. Should be left at position 4 for transit, not switched to OFF.

50.6 Position 5 - AUX (auxiliary). For use if the LHS is coupled to another external hydraulic system through the slave couplings, e.g. to power another LHS on a failed vehicle in order to unload its flatrack. The rotary switch must never be left in the AUX position once the operation is complete as the PTO is engaged all the time AUX is engaged.

51 The joystick is a two way controller used to control the LOAD/UNLOAD operation when either AUTO or MAN modes are selected on the rotary switch. The switch is a positive position switch in both directions, either ON or OFF. Speed of operation is dictated by engine speed (max 1500 rpm).

52 The three warning lights are to give indications of various LHS states or conditions:

52.1 OIL warning light (3) - lights when the LHS hydraulic oil temperature reaches a dangerous level, or falling oil pressure. Falling oil pressure indicates a blocked filter.

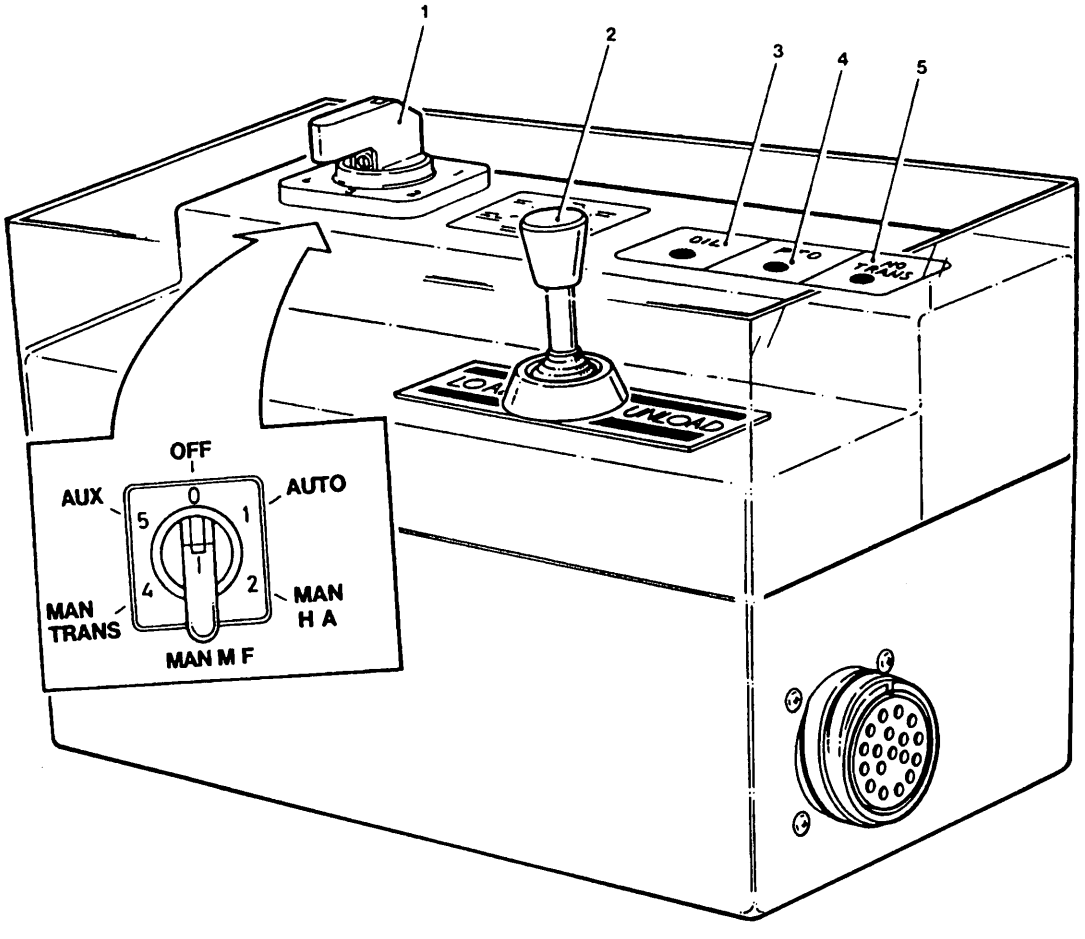
52.2 PTO warning light (4) - lights when the PTO is engaged and the hydraulic oil pump is running it should light when the rotary switch is in any position except position 0 - OFF.

WARNINGS

(1) LOAD LOCK ENGAGEMENT. THE 'NO TRANS' WARNING LIGHT IS AN INDICATION OF THE POSITION OF THE LHS AND NOT A CONFIRMATION THAT THE LOAD IS SECURE.

(2) ON COMPLETION OF A LOADING SEQUENCE A VISUAL CHECK MUST BE MADE TO ENSURE THAT THE FLATRACK HAS ENGAGED SATISFACTORILY IN THE LHS JAW.

52.3 NO TRANS warning light - lights when the load locks are disengaged. In normal use the light will only be lit during the LOAD/UNLOAD sequence until the hook arm frame is fully down and correctly stowed.



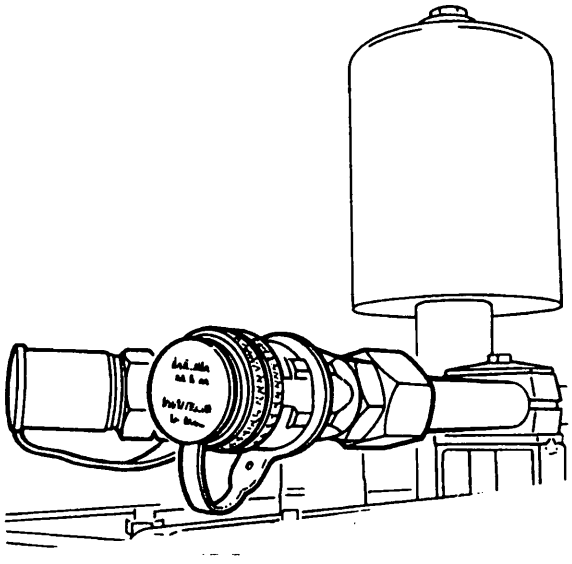
DROP 538

1 Rotary switch
2 Joystick
3 Oil warning light
4 PTO warning light
5 NO TRANS warning light

Fig 37 LHS control console

LHS SLAVE COUPLINGS

53 The LHS slave couplings (Fig 38) are located on the top of the hydraulic oil tank which is in turn located centrally behind the cab above the main gearbox. The couplings are fitted to allow an independent power source (a second DROPS vehicle for example) to provide hydraulic oil pressure into the LHS hydraulic system should pressure be unobtainable from the parent system for any reason other than leaking/burst oil pipes, or to provide hydraulic power to a separate disabled system. The couplings are connected to the second system by two flexible hoses supplied with the CES equipment. Couplings are of different sizes to ensure correct connection ie Press - Press, Ret - Ret.

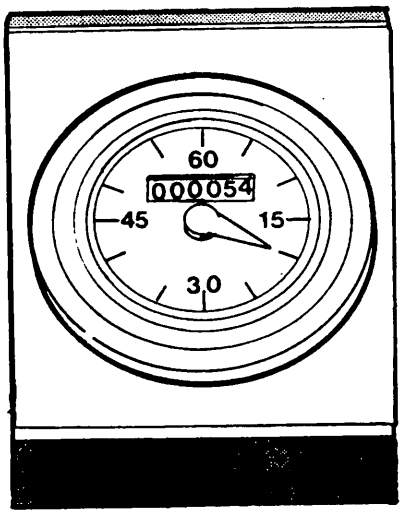


DROP 539

Fig 38 LHS slave couplings

LHS HOUR METER

54 The LHS hour meter (Fig 39) is located beneath the cover of the LHS control console and records the total hours that the LHS hydraulic pump is running, ie the total time the PTO is engaged.



DROP 540

Fig 39 LHS hour meter

DRIVERS SEAT CONTROLS

55 The drivers seat (Fig 40) is a fixed model mounted on twin sliding rails. Controls are available to the driver as follows:

Cushion height/rake levers

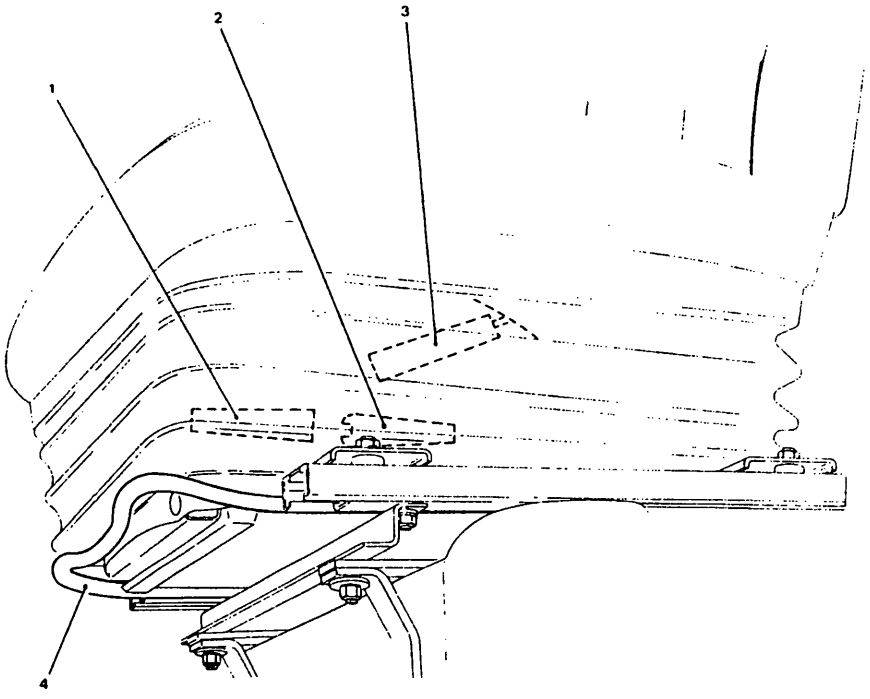
56 The cushion height/rake levers (1) and (2) are fitted to the right side of the seat. The foremost of the two handles controls the front half of the seat and the rear handle the rear half of the seat. Either or both handles can be lifted to allow the rake of the seat cushion to be adjusted as required by the driver. If the seat rake movement is required to be upwards, either front or rear, the driver must remove his weight from the cushion until the desired height is reached and the lever is released. If the required movement is downwards the drivers weight will be required on the seat to give the downward impetus. The handles will automatically lock the seat at the set height when released.

Backrest angle lever

57 The backrest angle lever (3) is fitted to the right side of the seat at the base of the backrest and can be lifted to allow the backrest to be adjusted as required by the driver. The backrest is spring loaded to move forwards when the backrest lever is lifted and requires the drivers weight to be applied to move it rearwards. The lever must be released before the weight is removed or the backrest will spring forwards. The lever will automatically lock the backrest in the set position when released.

Fore and aft adjustment lever

58 The fore and aft adjustment lever (4) is fitted across the lower front of the set and is lifted to allow the seat to be moved nearer to or farther from the steering column and foot pedals. The lever will automatically lock the seat in the set position when released. A slight movement may be required by the driver to engage the detent after adjustment.



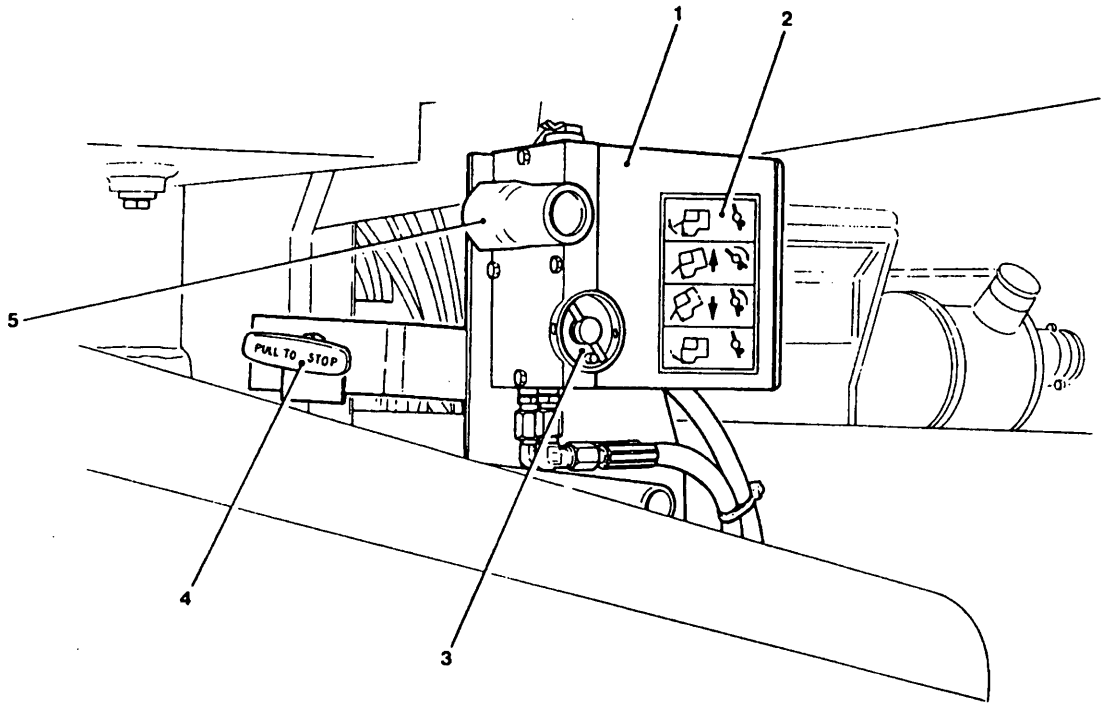
DROP 541

1 Front height/rake lever
2 Rear height/rake lever
3 Backrest angle lever
4 Fore and aft adjustment lever

Fig 40 Drivers seat controls

CAB TILT CONTROLS

59 The cab tilt controls (Fig 41) comprise a control box (1), which incorporates a hand pump (5), control valve (3) and instruction label (2). The hand pump is operated by a detachable handle. The control box is located on the right side of the vehicle adjacent to the lower rear corner of the cab. The detachable handle is stowed in the locker box also located on the right side of the vehicle, between the two sets of centre road wheels. The handle incorporates a notched end which is utilised to turn the pump control valve. The hand pump is used to provide hydraulic oil pressure in the closed system at one side of the cab tilt ram, the control valve position dictates which side of the ram is pressurised to raise or lower the cab.



DROP 542

1 Control box
2 Instruction label
3 Control valve
4 Engine stop handle
5 Hand pump (without extension handle)

Fig 41 Cab tilt controls

SMALL ARMS STOWAGE CLIPS

60 There are four small arms stowage clips in the cab. The stowage clips are fastened to the cab rear wall and provide firm, secure stowage for driver and crews weapons. To remove a weapon from the stowage clip requires a positive action by the person concerned, ie the weapon cannot be accidentally removed.

CHAPTER 3

OPERATING INSTRUCTIONS

CONTENTS

(continued)

(continued)

CONTENTS (continued)

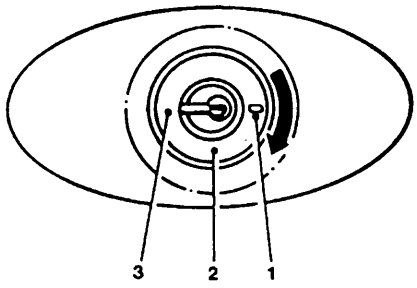
ENGINE

General

1 Before starting the engine initially, check sump oil level, coolant level, and ensure that there is an adequate supply of fuel as detailed in Chapter 4. Check that the electrical master switch is turned to ON. Check that the two engine STOP handles have been fully returned to the engine running position. If the engine has not been run in the preceding 28 days, prime the turbocharger as detailed in Chap 4.

1.1 Ensure that the gear level is in the neutral (N) position and the vehicle lighting switch is set to NORM. Turn the key switch (Fig 1) to position (2) check that the warning lights and buzzer are operating then turn to position (3) fully clockwise and depress the accelerator pedal slightly, engine should fire; release key switch immediately, which will return automatically to position (2). Release accelerator pedal to idling and note that a reading is evident on the engine oil pressure gauge.

1.2 After starting, allow the engine to run at 600 to 800 rpm until oil pressure warning light goes out. Higher engine speeds may then be used to ensure that the air braking system is charged to an operational level. Avoid long periods of idling, particularly with a cold engine. Ideally, the engine should be warmed through, under load, using minimum engine speed.



DROP 524

1 OFF 2 Main electrics 3 START position

Fig 1 Starter key switch positions

1.3 Before stopping the engine, reduce speed to approximately 800 rpm, under no load, for approximately three minutes to permit the turbocharger to slow and cool down, then operate one of the stop controls.

1.4 When starting, do not exceed twenty seconds of continuous cranking on the starter motor at ambient temperatures of 0°C or above, pause for approximately twenty seconds to allow the battery to recover before making a further attempt. After four unsuccessful starting attempts investigate the cause before making further attempts. For ambient temperatures below 0°C, longer periods of continuous cranking are permissible and may be required. The maximum period of continuous cranking should never exceed two minutes.

1.5 When running the engine, do not subject the engine to high speeds and loads until working temperature is reached. Avoid long periods of idling or oil pass-over may occur. Do not allow the engine speed to exceed the rated maximum rpm or damage may occur (eg on steep downgrades do not allow the vehicle to overspeed the engine).

Starting in low ambient temperatures

WARNINGS

(1) EXPLOSIVE VAPOUR HAZARD. DRIVERS/OPERATORS ARE WARNED OF THE EXPLOSIVE RISK. THE CANISTERS FOR USE IN THE START PILOT CONTAIN A VERY VOLATILE LIQUID, THE VAPOUR OF WHICH IS HEAVIER THAN AIR AND HIGHLY FLAMMABLE. SMALL QUANTITIES OF THE VAPOUR IN AIR FORM A HIGHLY EXPLOSIVE MIXTURE.

(2) DRIVERS/OPERATORS ARE WARNED VAPOUR CAUSES DROWSINESS AND LOSS OF CONCENTRATION. FOR THESE REASONS THE CANISTERS MUST NEVER BE CARRIED LOOSE IN A VEHICLE (DCI ARMY 239/79 REFERS).

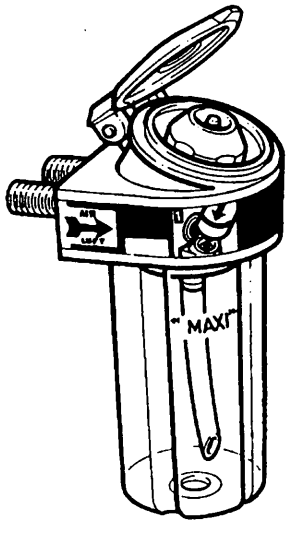
2 In cold conditions, the engine cold start system may require to be used, and must be used in ambient temperatures at and below -15°C.

2.1 To operate, turn the pump handle through 90°C to unlock and withdraw the pump plunger.

2.2 Fully depress the accelerator pedal and turn the key switch to crank the engine. Operate the plunger of the cold start pump at approximately one stroke per second; continue to pump with the engine cranking until the engine fires. Blip the throttle until the engine runs evenly and smoothly. To sustain the engine running in extreme cold conditions, it may be necessary to continue pumping at a reduced rate for a short period after the engine has started. Prolonged periods of cranking may be required before engine fires, however, do not continuously crank the engine for more than two minutes.

2.3 When the engine has achieved sustained running, although all six cylinders may not be firing continuously, discontinue pumping. Once the engine is running satisfactorily, fully depress the pump plunger and twist clockwise to lock in stowed position.

2.4 The start pilot reservoir (Fig 2) is positioned beneath the front grille.



DROP 543

Fig 2 Start pilot reservoir

Fuel line heater

3 Fitted into the fuel sedimenter is a fuel heater controlled by a dashboard mounted switch. Use of the heater liquifies any wax build-up of the fuel oil in the system to assist cold weather starting and to prevent engine stalling due to fuel starvation. A warning light will illuminate when the fuel heater is operating.

3.1 Prior to attempting to start the engine in cold weather conditions, switch the fuel heater on for approximately five minutes. Then start the engine using the cold start system (para 2), if necessary and run the engine and the heater until the fuel is warmed through to the tank. Switch off heater.

3.2 During driving in cold conditions, the fuel heater may be switched on to combat suspected fuel waxing.

GEARBOX

General

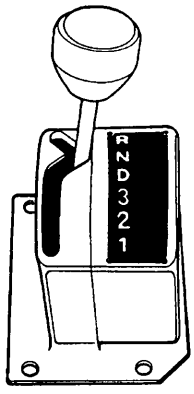
4 Although the speed range is selected manually (Fig 3), the automatic shifts are controlled electronically.

Selecting the speed range

WARNING

VEHICLE SAFETY. NEVER OPERATE THE ACCELERATOR WHEN SELECTING THE SPEED RANGE FROM NEUTRAL POSITION TO ANY GEAR POSITION OTHERWISE DAMAGE MAY RESULT.

Position R = Reverse
Position N = Neutral
Position D = Drive (Automatic operating range)
Position 3)
Position 2) = Restricted automatic
Position 1) operating ranges



DROP 517

Fig 3 Gear range selector switch

5 The selector lever moves in a gate, with detents to prevent accidental gear selection from neutral or overshooting the desired range.

Starting and driving

CAUTION

Engine cold start. At temperatures below -15°C, start the engine and warm up the gearbox in neutral ((N)) for approximately ten to fifteen minutes.

6 Ensure that the hand brake lever (Fig 11) is in the PARK position and select neutral ((N)) with the gear range selector switch (Fig 3). Start the engine and run at idling speed, ensure the warning lamps and buzzer are cancelled. Select the desired speed range, wait one to two seconds, release the vehicle brakes and move away by depressing the accelerator pedal.

6.1 If a speed range is selected with the engine speed exceeding 900 rpm and/or the accelerator depressed, an interlock in the electronic automatic control unit will prevent a gear being selected. Only when the engine speed drops below 900 rpm and the accelerator pedal returned to the engine idling position will a gear be selected.

6.2 In extreme operating situations such as starting on a steep uphill gradient, a low speed range can be selected and then a higher speed range selected immediately afterwards when the vehicle is still stationary or moving very slowly. This will allow the low ratios to be used without preventing subsequent upshifts.

6.3 On certain gradients the vehicle may tend to "hunt", that is, to shift up and down at frequent intervals. This is because the available power is just too low for the higher ratio and yet too high for the lower ratio. When this condition occurs, ease off the accelerator pedal or select a lower ratio manually.

6.4 When descending a steep gradient, use the selector to obtain a lower ratio so that the gearbox does not automatically shift up too far and reduce the engine braking effect.

6.5 Selection of a lower ratio can be made rapidly when approaching a sudden gradient or accelerating by depressing the accelerator pedal to the kick-down position. This pedal position effects the earliest possible down-shift into a lower gear.

Use of the speed range selector switch

7 The normal position of the range selector switch (Fig 3) to drive is D. This enables the automatic use of gears 2, 3, 4, 5 and 6. However, if for example, the vehicle is climbing a long, steep gradient, any gear may be held in order to prevent upshifts.

7.1 Table 1 shows the gears available at the different selector positions:

TABLE 1 GEAR RANGE SELECTION

Ser (1)	Selector position (2)	Gears available (3)
1	R	Reverse
2	N	Neutral
3	D	2nd, 3rd, 4th, 5th, 6th
4	3	2nd, 3rd, 4th, 5th
5	2	1st, 2nd, 3rd
6	1	1st only

7.2 The normal drive position of the gear range selector (Fig 3) is position D. Thus normal starting on level roads will be in 2nd gear, which is adequate in most circumstances. In position D the gearbox will automatically move through the upshifts and downshifts between 2nd and 6th gears as driving conditions dictate. 1st gear will not be selected when the gear range selector is in position D.

7.3 If selector position 3 is selected then only the gears shown in Table 1 Ser 4 Column (3) are available. The vehicle will start in 2nd gear as normal but will only upshift to 5th gear. 1st and 6th gears will not be selected when the gear range selector is in position 3. This feature can be utilised to stop 'hunting', as described in Para 6.3. For example, if the vehicle is climbing a long gradient and the gearbox is 'hunting' between 5th and 6th gear, selection of the lower gear range (3rd gear) will hold 5th gear as it becomes engaged as the gearbox will be unable to move up into 6th gear, but downshifts will still occur as the vehicle speed drops.

7.4 Similarly, position 2 will only allow the gearbox to shift between the gears shown in Table 1 Ser 5 Column 3. This position will permit starting in the lowest gear if circumstances require, ie on an incline. With position 2 selected the gearbox will only upshift to 3rd gear until a higher gear is selected, therefore 3rd gear can be 'held' as the highest selectable gear if circumstances require, but downshifts can still occur as the vehicle slows.

7.5 With the gear range selector in position D and running in top gear, a lower gear, for example position 2, can be selected with no noticeable change in gearbox action until driving conditions bring the gearbox down to 3rd gear. Once 3rd gear is engaged the gearbox will no longer upshift higher than 3rd but can continue to downshift to 1st gear as the vehicle slows down.

7.6 If the engine speed is allowed to exceed 2500 rpm the gearbox will automatically change up through the gears to 6th gear trying to protect the gearbox, if the engine speed still increases the gearbox safety mode will operate and neutral will be selected automatically (the gear range selector will remain in its pre-selected position). If the vehicle is brought back under control and the engine speed reduced it will now have no drive gears and operation of the gear range selector will have no effect until the safety mode has been re-set. To re-set the gearbox safety mode proceed as follows:

7.6.1 Stop the vehicle as soon as road conditions allow.

7.6.2 Confirm engine speed at idle.

7.6.3 Turn the start key to OFF (position 1).

7.6.4 Manually select N on the gear range selector.

7.6.5 Once it has been established that the cause of the safety mode activation is overcome, restart the engine and continue driving as normal.

Reversing

CAUTION

Shifts from neutral (N) to reverse (R) and from forward gears to (R) are only permitted with the vehicle stationary and the engine at idle.

8 Wait one or two seconds after selecting a change in a travel direction before depressing the accelerator.

Driving over soft ground

WARNING

VEHICLE SAFETY. NEVER OPERATE THE ACCELERATOR WHEN SELECTING THE SPEED RANGE FROM NEUTRAL POSITION TO ANY GEAR POSITION.

9 Before proceeding refer to differential lock operation, para 15.

9.1 If the driving wheels cannot find sufficient grip, 'rocking out' by selecting forward and reverse gears alternatively can be attempted:

9.1.1 Select a suitable forward ratio (1st gear for starting) and accelerate. Release the accelerator pedal, apply the hand brake lever and select reverse. Accelerate again and simultaneously release the hand brake lever. Repeat this rocking movement, if possible, until the road wheels attain grip. If this process is carried out quickly it is possible to confuse the electronic system and cause the gearbox safety mode to operate and select neutral. If this occurs proceed as instructed in Para 7.6.

9.1.2 Should the described method be unsuccessful, DO NOT adapt a brutal driving technique in any circumstances or mechanical damage could result.

Stopping the vehicle, parking and stopping the engine

WARNING

VEHICLE SAFETY. THE DRIVER MUST APPLY THE HAND BRAKE LEVER TO THE 'PARK' POSITION BEFORE VACATING THE VEHICLE CAB.

10 The vehicle can be stopped at any time, (should it be safe to do so) regardless of the position of the speed range selector switch.

10.1 As the vehicle draws to a halt, the automatic control will shift down to the corresponding ratio for re-starting, depending upon the drive range.

10.2 During short stops, for instance, at traffic signals, the gearbox need not be returned to the neutral (N) position but the foot brake pedal should be applied gently to prevent the vehicle from creeping forward. During longer stops however, move the speed range selector switch to the neutral (N) position and apply the hand brake.

10.3 The clutches and brakes in the gearbox are disengaged when the engine is stopped, consequently there is no direct mechanical link between the engine and the driven road wheels. It is therefore essential to apply the parking brake before leaving the vehicle. A secondary pump allows the vehicle to be towed without the task of disconnecting propshafts. The vehicle can also be tow-started.

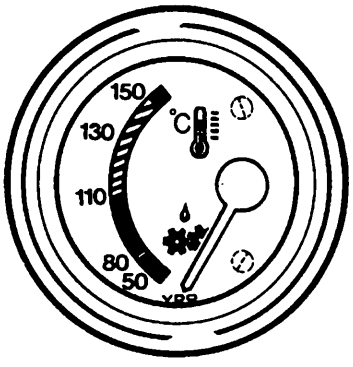
Gearbox retarder

CAUTION

Retarder operation. The retarder will not operate if the accelerator pedal is depressed, i.e. not at idle.

11 The retarder is a hydrodynamic brake which functions according to the gear in use and suffers no mechanical wear. Therefore it is advantageous to apply the retarder on lengthy gradients or when slowing from high speeds, thus saving wear on the service brakes and possible brake fade.

11.1 Application of the retarder will raise the temperature of the gearbox oil, therefore it is possible that the permissable temperature of the oil will be exceeded. An oil temperature gauge (Fig 4) is fitted to the cab dashboard to monitor the oil temperature and should the indicator needle go into the red zone (over 150°C) the retarder should be switched OFF until the temperature drops when it can be reactivated, at the same time a warning buzzer will sound until the temperature is reduced or it is switched off by turning the lighting switch from NORM to OFF accepting that the lighting functions are also switched to OFF. During this period the vehicle must be slowed down with the service brake until the oil temperature decreases. If this precaution fails to lower the temperature below the danger zone, the retarder must be switched off.



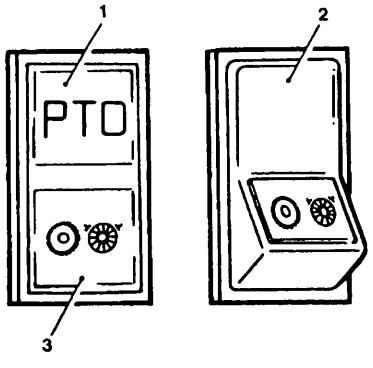
DROP 520

Fig 4 Gearbox Oil Temperature Gauge

11.2 If switching off the retarder does not cause the oil temperature to drop, the vehicle must be brought to a halt. Select neutral (N) position and depress the accelerator pedal fully and within a few seconds a visible decrease in the temperature should result. If this is not evident, the cause must be investigated before proceeding.

Retarder switch

12 When the retarder switch (Fig 5 (2)) is in the ON position (i.e. pressed down) the gearbox retarder is automatically applied with the release of the accelerator pedal. A warning lamp (3) is illuminated when the retarder switch is on.



DROP 544

1 PTO warning light 2 Retarder switch 3 Retarder warning light

Fig 5 Retarder switch

Emergency gear shift lever

WARNING

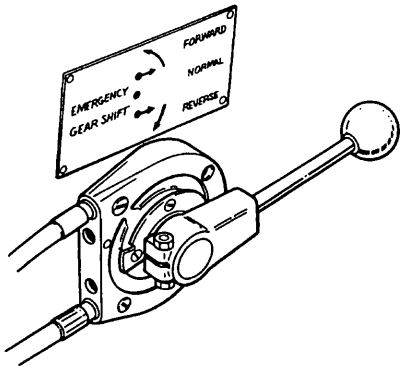
START UP. THE ENGINE CAN ONLY BE STARTED WHEN THE EMERGENCY GEAR SHIFT LEVER IS DISENGAGED. THE EMERGENCY GEAR SHIFT LEVER MUST ONLY BE ENGAGED WITH THE HAND BRAKE APPLIED.

13 Should the vehicle power supply fail or partially fail, or it becomes impossible to shift gears at the electrical gearbox control by operating the speed range selector, the emergency gear shift lever (Fig 6), positioned below the driver's seat, can be used to select one forward speed or reverse. The forward speed selected by the emergency gear shift lever is the normal 3rd gear.

13.1 Ensure the hand brake is applied and engine is at idle speed before selecting chosen gear (forward or reverse) with the emergency gear shift lever, otherwise the vehicle will start to move immediately the gear is engaged. Return the emergency control to neutral (N) instantly after use.

13.2 When using the emergency gear the gearbox oil temperature gauge must be monitored to ensure operating temperatures are not exceeded.

13.3 Use caution when descending gradients as the effect of engine braking is reduced.



DROP 527

Fig 6 Emergency gear shift lever

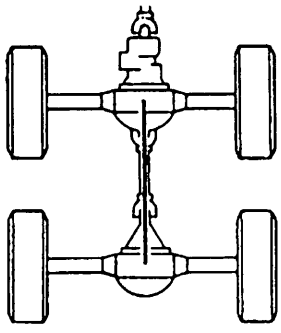
CROSS AXLE DIFFERENTIAL AND THIRD DIFFERENTIAL LOCKS

WARNING

DIFFERENTIAL DAMAGE. THE CROSS AXLE DIFFERENTIAL AND THIRD DIFFERENTIAL LOCK SYSTEMS MUST ONLY BE ENGAGED WHEN THE VEHICLE IS STATIONARY OR MOVING AT A MAXIMUM SPEED OF 3KPH. NEVER ENGAGE EITHER SYSTEM WHEN WHEEL SPIN IS OCCURRING AS DAMAGE WILL OCCUR TO THE DIFFERENTIAL UNITS.

14 There are two types of differential lock systems fitted to the vehicle, third differential lock (Fig 7) fitted to the rear bogie and also cross axle differentials (Fig 8), fitted to the rear bogie (2-off) and the front steer/drive axle (1-off). Both types of differential lock features are driver controlled from the cab mounted traction control switch.

14.1 The third axle differential lock is fitted to the double drive rear axle bogie and when operated, will provide a solid drive between the two axles overcoming the normal differential action of the third differential fitted between the two axle drives.



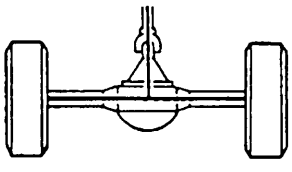
DROP 545

Fig 7 Third differential lock schematic (rear bogie)

14.2 A cross axle differential lock-out is fitted to both rear axles and to the front steer/drive axle. When operated, wheel spin will be prevented by locking both driving wheels together so that they rotate at the same speed, thus negating the differential action.

NOTE

Both the cross axle and third differential locks fitted to the rear bogie, operate simultaneously with the use of a single switch.



DROP 546

Fig 8 Cross axle differential lock schematic (rear bogie)

Differential lock operation

WARNING

DIFFERENTIAL DAMAGE. THE DIFFERENTIAL LOCKING SYSTEMS MUST NEVER BE ACTIVATED OR USED DURING DOWNHILL OPERATION. IF EITHER, OR BOTH, OF THE DIFFERENTIAL LOCKING SYSTEMS ARE ENGAGED DURING A HILL DESCENT, DAMAGE WILL OCCUR TO THE DIFFERENTIAL UNITS AND THE VEHICLE WILL BECOME UNMANAGEABLE WITH A TENDENCY TO SLIDE SIDEWAYS.

CAUTION

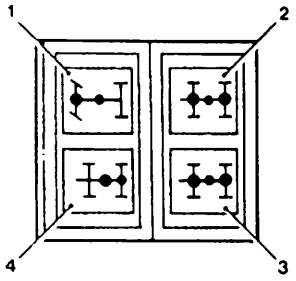
WHEEL SPIN. Should wheel(s) spin occur, the wheel(s) must be stopped immediately by releasing the accelerator. Only when wheel spin has stopped should the differential lock systems be engaged. Engagement of differential locks while one or more wheels are spinning should never be undertaken as serious mechanical damage will result immediately.

15 The purpose of the differential lock system is to prevent wheel spin under adverse operating conditions. The following procedure for correct operation of the differential locks when approaching slippery or poor surface conditions, assumes that the front axle drive has already been engaged as detailed in para 19.

15.1 Stop the vehicle. Ensure that the throttle pedal is at idle.

15.2 Turn the traction control switch to REAR DIFF LOCKS. Three warning lights (Fig 9 (2), (3), and (4)) will illuminate yellow to indicate the third and both cross axle locks have engaged.

15.3 Turn the traction control switch to FRONT DIFF LOCK. A warning light (1) will illuminate yellow to indicate the cross axle lock has engaged.



DROP 547

1	Front axle differential lock warning light	3	Rear bogie 4th axle differential lock warning light
2	Rear bogie 3rd axle differential lock warning light	4	Inter-axle differential lock warning light

Fig 9 Differential locks warning lights

15.4 Proceed to drive with caution.

15.5 When approaching hazardous driving conditions, the vehicle should be stopped before engaging the differential lock systems.

Understeer effect

16 With the engagement of the differential lock systems, the normal differential action assisting the vehicle to turn is negated. The natural tendency of the locked differentials is to drive the vehicle forward in a straight line causing an understeer effect as shown in Fig 10.

16.1 Consequently, when negotiating corners or sharp bends the turning radius of the vehicle will be increased. Therefore more space and time will be required for such a manoeuvre.

Cresting a hill

17 If the differential lock systems are engaged whilst driving up a hill, they must be disengaged when reaching the crest of the hill before making the descent.

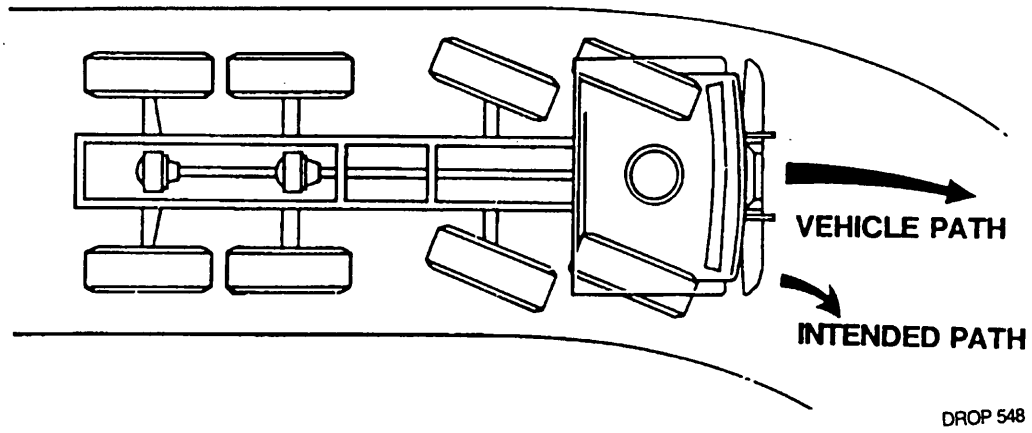


Fig 10 Understeer effect

Disengaging the Differential Locks

CAUTION

Differential locks should not be used when the vehicle is travelling on good road surfaces as damage may result.

18 To disengage a differential lock, stop the vehicle, turn the traction control valve to the desired position, gradually accelerate, the differential lock will disengage and the differential warning lights will extinguish. Resume a safe road speed. If the warning light does not go out, return the accelerator to idle and again gradually accelerate.

18.1 The differential locks should be disengaged as soon as practical. Prolonged running with differential locks engaged should not be undertaken.

Front wheel drive

CAUTION

Front wheel drive should only be used in an OFF THE ROAD situation or when travelling over snow or ice.

19 To engage the front wheel drive, stop the vehicle and turn the traction control switch to FRONT AXLE DRIVE. Gradually accelerate and monitor the warning light, if the light does not illuminate release the accelerator and again accelerate, repeat as necessary until the light illuminates.

NOTE

To avoid possible 'wind up' between front drive and rear drive axles, disengage the front axle drive as soon as travelling conditions permit.

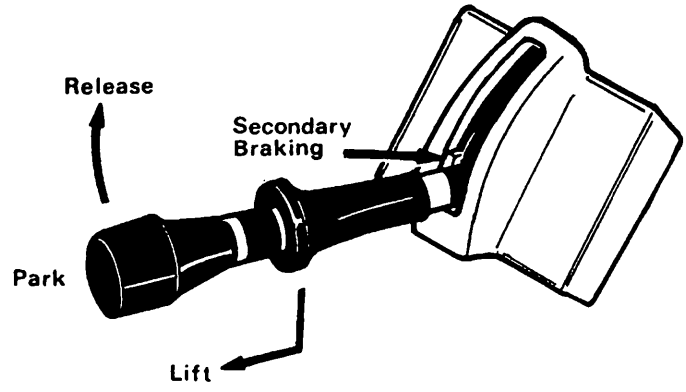
20 To disengage the front wheel drive, stop the vehicle and turn the traction control switch to OFF, gradually accelerate and monitor the warning light, if the warning light does not go out, release the accelerator and again accelerate as required until the warning light goes out.

HAND BRAKE LEVER

21 The hand brake lever (Fig 11) is to the right hand of the driving position below the dashboard.

21.1 To apply the hand brake secondary brakes; move the lever down to the detent. To release the brakes, re-lift the detent ring and move the lever to the top of the quadrant. When applied the hand brake secondary brakes actuate the vehicle brakes and the trailer brakes if a trailer is attached.

21.2 To apply the hand brake as a park brake; lift the external detent ring and move the lever down to the bottom of the quadrant. To release the parking brake: lift the external detent ring and move the lever to the top of the quadrant. When the park brake is applied and a trailer is attached the trailer brakes are not activated and remain OFF.



DROP 516

Fig 11 Hand brake lever

TRAILER BRAKE VALVE (CAB MOUNTED)

WARNING

VEHICLE SERVICE BRAKES. WHEN PARKING ON AN INCLINE WITH A TRAILER ATTACHED THE VEHICLE PARK BRAKES MAY NOT HOLD THE VEHICLE/TRAILER COMBINATION. IN THIS EVENT OPERATING INSTRUCTIONS, RE USE OF TRAILER BRAKE VALVE, MUST BE STRICTLY FOLLOWED.

22 If parking the vehicle on an incline with a trailer attached and the vehicle park brakes do not hold:

22.1 Apply the trailer brakes by operating the TRAILER BRAKE switch (Fig 13) to ON.

22.2 Proceed to the trailer and engage the trailer mounted PARK valve (Fig 12(2)).

22.3 Return to the vehicle and disengage the trailer park valve by operating the switch to OFF. Confirm that the vehicle is safe and all brakes are applied and holding before leaving.

23 When returning to a vehicle/trailer combination that has been left on an incline with the trailer PARK valve engaged and the vehicle engine stopped proceed as follows:

23.1 Start the engine and ensure that the vehicle air systems are all fully charged.

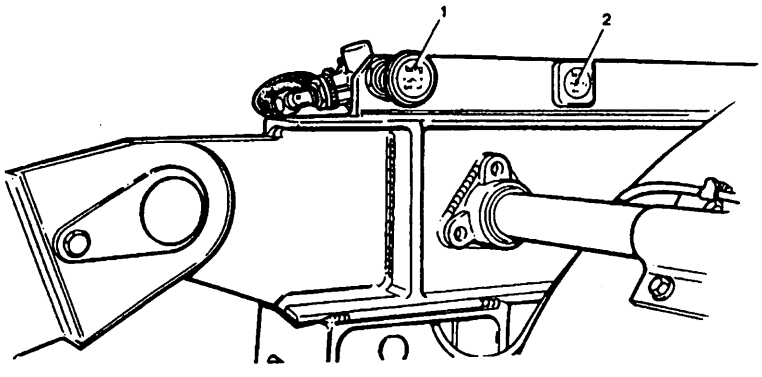
23.2 Operate the cab mounted trailer brake switch to ON.

23.3 Dismount from the vehicle and release the trailer PARK valve.

23.4 Return to the vehicle and apply the service brake.

23.5 Engage the required gear range, release the hand brake and service brake (trailer brake switch will reset to OFF automatically), proceed to drive off.

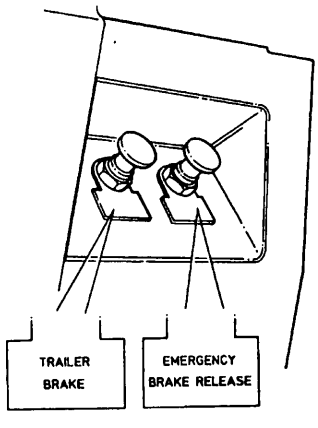
24 If connecting the vehicle to a trailer that has been left on an incline with its PARK valve engaged connect the vehicle to the trailer and proceed as detailed in para 23.



DROP 549

1 Shunt valve 2 Park valve

Fig 12 Trailer shunt and park valves



DROP 523

Fig 13 Trailer brake and emergency brake release switches

EMERGENCY BRAKE RELEASE

WARNING

WHEN OPERATING THE EMERGENCY BRAKE RELEASE THE HAND BRAKE SHOULD REMAIN IN THE PARK POSITION. USE OF THE EMERGENCY BRAKE RELEASE SWITCH WILL RENDER PARK AND SECONDARY BRAKE INOPERATIVE.

25 In the event of a failure or a fault condition in the secondary spring brake air line, the vehicle brakes (and a trailer, if attached) will be applied and will remain engaged. To release the spring brakes, push the EMERGENCY BRAKE RELEASE switch (Fig 13) mounted to the left of the steering column and below the dashboard.

COOKING VESSEL

CAUTION

The vehicle battery will quickly drain if the cooking vessel is used while the engine is stopped.

26 The cooking vessel is located behind the centre seat and is connected to the cooking vessel control box by a flexible 4 pin cannon type connector. The control box is located on the passenger side of the engine cover. The only control on the cooking vessel control box is the ON/OFF switch with a indicator lamp which is lit when the cooker is switched ON.

27 The cooking vessel is a standard issue model. Instructions for use are provided with the cooking vessel.

TOWING ARRANGEMENTS

28 A towing pintle (Fig 14) is located at the rear of the vehicle, primarily for the attachment of a trailer but can also be utilised for other purposes. To open the locking jaws remove the chained articulated bolt (1) and pivot the upper jaw (3) upwards. When the trailer towing eye (or other attachment) is correctly located, drop the upper jaw and secure by replacing the articulated bolt.

1 Articulated bolt
2 Locking catch
3 Pintle upper jaw
4 Swivel check catch
5 Swivel check catch locking pin

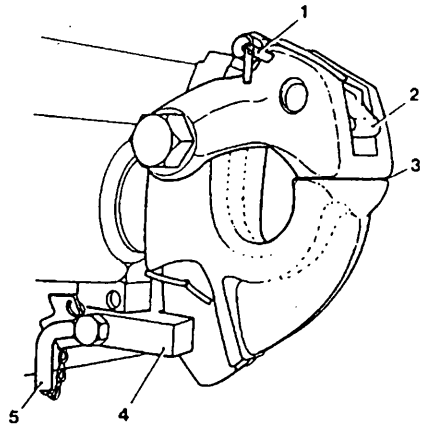


Fig 14 Rear towing pintle

29 If it is required to attach to a towing eye that is not in a vertical alignment the towing pintle can be swivelled about its axis by removing the locking pin (5) and allowing the swivel check catch to drop. A towing bracket with a securing pin is fitted to the front chassis frame, to engage towing bar/rope or similar simply remove the pin, place eye of attachment between the arms of the bracket and replace the pin.

Tow starting

30 The automatic transmission is fitted with a secondary oil pump to provide gearbox lubrication and oil pressure during tow starting. It is therefore not necessary to disconnect the driveline propshaft. When tow starting the following precautions should be taken:

30.1 Use a rigid tow bar.

30.2 Never select front wheel drive.

30.3 Ensure the engine retarder is switched to OFF.

30.4 Ensure the PTO emergency selector lever is not engaged.

30.5 Ensure the LHS is switched to OFF.

31 When the tow bar is connected any all other precautions checked proceed as follows to tow start the vehicle:

NOTES

(1) The most common reason for a tow starting requirement is flat batteries, in this condition the very low voltages available will not allow the automatic gearbox electronic control unit to function satisfactorily. Use of the emergency gear shift lever switches out the electronic control unit thus providing more positive gearbox operation in these emergency circumstances.

(2) Once the engine has started and the emergency gear shift lever returned to neutral, normal control of the transmission will be restored.

(3) If there is insufficient air pressure to release the parking brake, air lines can be connected from the towing vehicle to the recovery couplings at the front bumper of the towed vehicle.

(4) If service and emergency air lines are connected between the two vehicles this will inflate the towed vehicle system and give the driver of the towing vehicle control of both vehicle brakes. Under these conditions the towed vehicle effectively becomes a trailer.

(5) The emergency gear shift lever wire locking should be renewed at the earliest convenient time.

31.1 Set the engine master switch to ON.

31.2 Turn the ignition key switch to position 2 (RUN). Do not attempt to turn the key to position 3 (START) at any point in this procedure.

31.3 Set the gear range selector to N - neutral.

31.4 Set the emergency gear shift lever to FORWARD gear (break the locking wire).

31.5 Release the parking brake and commence the tow start.

31.6 The engine should start at approximately 15 - 20 kph.

31.7 Once the engine has started, move the emergency gear shift lever to neutral. Bring both vehicles to a halt, ensure the vehicle air system is charging and apply the parking brake. Remove the tow bar and any other connection made to assist starting, return the vehicle to normal mode of operation.

Recovery towing

32 Recovery eyes are provided at the front and rear of the chassis. A towing jaw is provided at the front bumper and a towing pintle at the rear crossmember. Recovery air line couplings are provided at the front bumper for air line connection to inflate the vehicle air system to enable brake operation.

33 When the vehicle is to be towed the following precautions should be taken:

33.1 Never select front wheel drive.

33.2 Ensure the engine retarder is switched to OFF.

33.3 Ensure the PTO emergency selector lever is not engaged.

33.4 Ensure the LHS is switched to OFF.

34 Dependent upon the degree of damage to the casualty and the type of recovery being attempted the casualty vehicle electrical master switch can be set ON or OFF.

CAUTIONS

(1) A speed restriction of 12 kph maximum is to be enforced for all tows laden or unladen, even on good roads.

(2) Towing from the front (supported, suspended or straight tow). If the casualty vehicle automatic gearbox was functioning correctly prior to the need to be towed, there is no physical damage to the driveline and the gearbox oil level can be considered to be unaffected, then it is not necessary to disconnect the propshaft when towing short to moderate distances (40 km) at slow speeds (below 12 kph).

(3) Towing from the front (supported, suspended or straight tow). If towing long distances at higher speeds the main propshaft is to be disconnected as there will be no cooling of the engine coolant, therefore the gearbox oil, although maintaining pressure by use of the secondary oil pump, may overheat causing gearbox damage.

(4) Towing from the rear. For supported or suspended tows from the rear, ensure front wheel drive is not engaged. In these circumstances there will be no drive through the main gearbox possibly saving further damage.

(5) Towing from the rear. If towing from the rear with all wheels on the ground is contemplated, the main propshaft is to be disconnected to safeguard the gearbox from damage, as the secondary oil pump will not provide pressure when the gearbox is turning in the reverse direction.

(6) Brake release. If the casualty vehicle air system is undamaged and connected to the towing vehicle air system, before commencing the tow, release the parking brake in the normal manner.

(7) Brake release. If there is insufficient air in the casualty vehicle air system to release the brake in the normal manner, operate the emergency brake release.

(8) Brake release. If there is no air available in the casualty vehicle air system the brakes will require to be released manually by winding off the spring brake actuator at each wheel station remaining on the ground during the tow. Tools for this purpose are included in the CES equipment and are stowed in the chassis locker.

35 If possible the tow should be carried out with the casualty vehicle unladen. It is unlikely that a supported tow, either laden or unladen would be attempted due to the long reach and weights involved. Suspended tows can be achieved from the front, either laden or unladen, and from the rear laden only. Suspended tows from the rear with the casualty vehicle laden are not feasible due to the flatrack overhang, weight and ground clearance.

36 To unload the casualty vehicle, dependent upon the fault or damage incurred, the flatrack can be unloaded by normal Load Handling System (LHS) AUTO operation if the hydraulic and electrical systems are serviceable, by MANUAL operation if only the hydraulic system is serviceable, by MANUAL OVER-RIDE operation if the LHS control console is unserviceable or by slave supply. All of these methods are described in the LHS section of this Chapter.

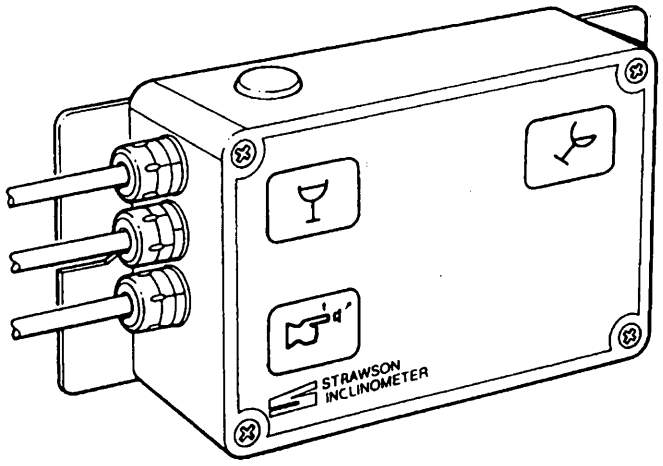
INCLINE INDICATION

37 Mounted to the right hand side of the steering column and beneath the dashboard is an inclinometer display unit (Fig 15). The purpose of this instrument is to warn, by symbols and buzzer alarm when the angle of the vehicle, relative to a true horizontal, is beyond a safe limit (fore and aft 10°/side 5°). The system is activated when PTO is engaged.

37.1 When the PTO is first engaged the red tilted wine glass on the facia will illuminate for a moment and then the green wine glass illuminates and the red goes out. This is a system self test and on completion, as long as the incline is within limits, the facia will continue to show the green wine glass until the PTO is disengaged, at which point the facia will go blank, or the vehicle inclines beyond it's safe limit and the red tilted wine glass illuminates and the green wine lamp goes out.

37.2 The pointed finger (3) is a press-to-test touch button that when pressed, will indicate whether the system is healthy. This should be done at least on a daily basis and additionally, when ground operating conditions are suspect. Incorporated into the system is a preset delay preventing premature reaction to transitory vibrations and fluctuations of the vehicle.

37.3 When an unsafe condition is indicated, the picking-up or off-loading of flatracks must be aborted and the operation re-assessed in order to establish safe and acceptable or alternative circumstances to proceed.



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Symbols

Green Wine Glass = safe
Tilted Wine Glass = unsafe
Pointed Finger = press to test

Fig 15 Inclinometer display (detail)

LOAD HANDLING SYSTEM (LHS)

CAUTIONS

(1) If the parameters below are exceeded the loading/off-loading procedures are not to be implemented.

(2) All necessary steps must be taken to prevent the accidental ingress of contamination into the LHS due to poor hygiene/practice, particularly when using the hydraulic slave interface.

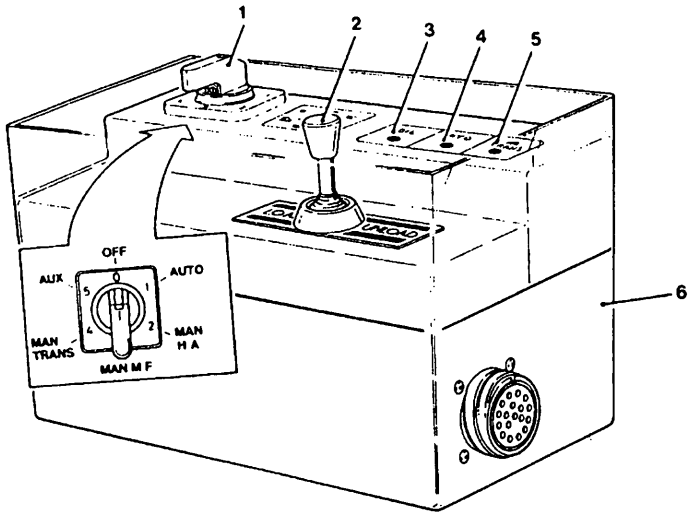
38 The LHS operating procedures detailed in this publication are intended for use when any combination of vehicle, trailer and flatrack can be aligned to fall within the scope of the LHS load/off-load parameters, namely:

Fore and aft tilt - 10° max) as indicated by the incline indicator.
Side tilt - 5° max) Longitudinal misalignment between vehicle and flatrack - 30° max.

LHS console

39 The LHS console (Fig 16) is mounted on the engine bonnet, to the right of the driving position and incorporates the following controls:

1 Rotary mode selection switch
2 LOAD/UNLOAD control switch (joystick)
3 Oil temperature and clogging warning light
4 PTO warning light
5 NO TRANSIT warning light
6 Control console body



DROP 551

Fig 16 Load Handling System control console

39.1 The rotary mode selection switch (Fig 16(1)) is a six position rotary switch the position of which controls selection of:

39.1.1 OFF (0). Control console not operational (LHS in transit mode).

39.1.2 AUTO (1). For normal pick-up and off-loading sequence of the flatrack.

39.1.3 Manual hook arm (MAN HA) (2). For exceptional picking-up and off-loading circumstances and for use in the event of failure of the automatic electronic circuits.

39.1.4 Manual main frame (MAN MF) (3). For exceptional picking-up and off-loading circumstances and for use in the event of failure of the automatic electronic circuits.

39.1.5 Manual transit (MAN TRANS) (4). Used when the automatic circuits have failed and MAN HA and MAN MF are operated. This position must be selected if the vehicle is to travel.

39.1.6 AUX (5). For use in conjunction with the slave hydraulic couplings employed to power a failed LHS. The rotary switch must not be left in the AUX position once the operation is completed.

39.2 PTO Warning Lamps (Fig 16(4)) and (Fig 5(1)) will illuminate to indicate that the PTO pump has engaged when any of the four modes but not OFF and MAN TRANS of the rotary switch have been selected, and hydraulic oil power is available.

39.3 Oil temperature warning lamp (Fig 16(3)) will illuminate when the hydraulic oil temperature reaches a dangerous level or a low pressure, indicating that the filters are becoming clogged.

39.4 NO TRANSIT warning lamp (Fig 16(5)) will illuminate to indicate that the hook arm frame is not fully down and stowed correctly for transit. The vehicle must not be driven when this light is illuminated.

39.5 Control console body (Fig 16(6)) is the housing for the console components.

39.6 LOAD/UNLOAD control switch (Fig 16(2)) will control the operations of picking-up and off-loading of flatracks when either the AUTO or MANUAL modes are selected on the rotary switch.

Picking up and off-loading a flatrack in AUTO mode

WARNINGS

(1) OVERHEAD SAFETY. DURING THE PICKING-UP AND OFF-LOADING CYCLE OF THE LOAD HANDLING SYSTEM (LHS) IN THE 'AUTO MODE, A HEIGHT OF 4.95 METRES (16.25 FT) IS REACHED. IF THE WRONG OPERATING SEQUENCE IS USED WITH THE LHS IN THE 'MANUAL' MODE IT IS POSSIBLE TO REACH A HEIGHT OF 5.8M (19 FT). THEREFORE, BEFORE ANY ATTEMPT IS MADE TO CARRY OUT THE OPERATION, A CHECK MUST BE MADE TO ENSURE THAT THERE ARE NO OVERHEAD OBSTRUCTIONS, PARTICULARLY ELECTRICAL POWER LINES.

(2) GROUND SAFETY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AND EXTREME SIDEWAYS INCLINATION BEFORE PICKING-UP OR OFF-LOADING A FLATRACK. ANY GROUND INSTABILITY BENEATH THE ROAD WHEELS COULD AFFECT THE SAFE OPERATION OF LHS. THE INCLINOMETER (FIG 15) DISPLAY MUST ALSO BE NOTED.

(3) LHS STOWAGE. NEVER DRIVE OFF WITH THE 'NO TRANSIT' LIGHT ILLUMINATED. AN ILLUMINATED LIGHT MEANS THE SYSTEM IS NOT SAFE TO TRAVEL. ALWAYS MAKE A VISUAL CHECK TO ENSURE THAT THE FLATRACK HAS ENTERED THE LOCKING JAWS.

(4) PERSONAL INJURY. DO NOT ENTER THE AREA DIRECTLY UNDERNEATH THE FLATRACK DURING OPERATION OR IF IN THE RAISED POSITION.

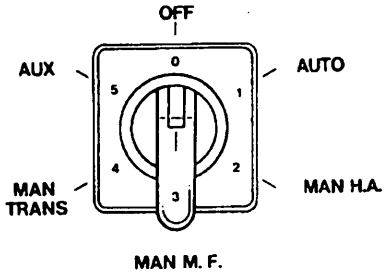
Picking up a Flatrack

40 Reverse the vehicle up to the flatrack and stop at approximately five metres (16ft) from the hook bar. Check for overhead obstructions and firmness of the ground. Once the PTO is engaged, the engine speed should be held at approximately 1500 rpm during operations, however, the engine should be at idle speed when a mode has been selected.

40.1 Turn the rotary mode selection switch (Fig 17) to AUTO.

40.2 The PTO will engage and the PTO lamps will illuminate. Ensure maximum engine speed of 1500 rpm is not exceeded.

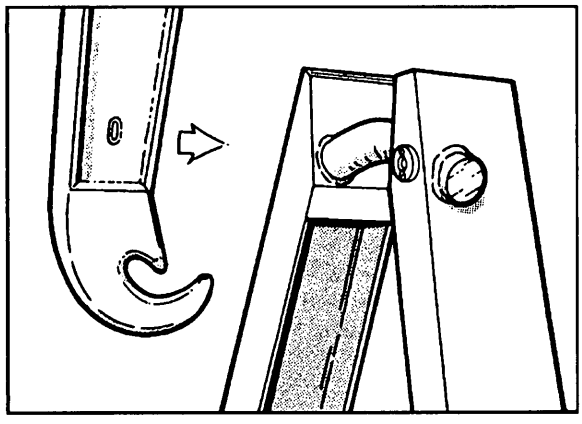
40.3 Move the joystick switch to UNLOAD, and the lift-hook will rise and begin to move rearwards. The NO TRANSIT lamp will illuminate to indicate the load locks have been cleared.



DROP 552

Fig 17 Mode selection switch (detail)

40.4 When the lift-hook has moved to below the level of the flatrack hook-bar, reverse the vehicle up to the flatrack, aligning vehicle and flatrack as straight as possible (up to 30° misalignment is acceptable) and the lift-hook to the middle of the hook-bar. Ensure that the tip of the lift-hook is positioned below the bottom of the hook bar as shown in Fig 18.



DROP 553

Fig 18 Lift-hook/hook bar alignment

40.5 When operating on level ground, stop the vehicle when the lift-hook arm touches the hook bar and, leaving reverse gear engaged and the engine at idle speed, move the joystick switch to LOAD, note that the hook and bar engage and that the flatrack is being lifted correctly, select neutral (N) and increase engine speed to a maximum of 1500 rpm. If the lift-hook does not engage the hook bar, apply brakes, select forward gear, release brakes and move vehicle clear of the flatrack. Re-align vehicle with flatrack and repeat the manoeuvre as described.

40.6 Vehicle and flat rack will be drawn together as the flatrack is raised. Some steering wheel adjustment may have to be made to ensure that the flatrack runners locate onto the LHS rear rollers.

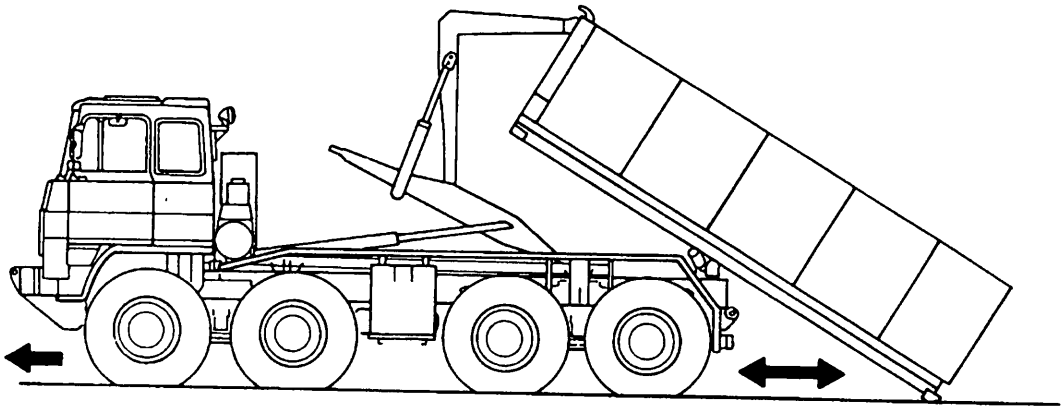
40.7 When the flatrack has contacted the rear rollers, apply the vehicle brakes and continue to pull the flatrack fully onto the LHS bed. The flatrack load locks will engage the locking jaws to locate the flatrack and the NO TRANSIT lamp (Fig 16(5)) will extinguish. Release the joystick switch (2). Turn rotary mode selection switch to OFF.

Off-Loading a Flatrack

41 On arrival at the dropping area, check that there is sufficient room at the front and rear of the vehicle to complete the anticipated manoeuvre. HEED WARNINGS. Check ground condition and unloading safety limits with the inclinometer (Fig 15).

41.1 Apply vehicle hand brake, select (N) on the gearbox selector, turn the rotary mode selection switch to AUTO and note that the PTO lamp has illuminated. Adjust engine speed to a maximum of 1500 rpm.

41.2 When on level ground, move the joystick switch to UNLOAD. The flatrack will start to move rearwards and the NO TRANS lamp will illuminate to indicate that the load locks have been cleared. Continue to UNLOAD until the back edge of the flatrack touches the ground. This event will result in the vehicle rear suspension beginning to lift, at this stage, release the vehicle hand brake lever to allow the grounded flatrack to push the vehicle forward and clear as shown in Fig 19.



DROP 554

Fig 19 Flatrack demounting - release handbrake stage

41.3 As the front end ('A' frame) of the flatrack approaches within 200mm (8in) of the ground, decrease the engine speed to idle (and consequently the output of the PTO) and engage drive (D) on the gearbox selector. Tentatively operate the service brake pedal, continue to off-load and, as the flatrack is grounded, the vehicle rear suspension will unload, the lift-hook will disengage and the vehicle will draw forward. Release the joystick and stop the vehicle.

41.4 If the lift-hook does not disengage, move the joystick to LOAD and hold until the front of the flatrack has cleared the ground (200mm) and repeat the manoeuvre.

CAUTION

Once it is evident that the vehicle rear suspension has been relieved of the flatrack load, do not continue in the UNLOAD position as the possibility of jacking up the rear of the vehicle with the hook arm may occur.

41.5 When the hook is clear (Fig 20) select neutral (N) on the gearbox selector, increase engine speed to 1500 rpm, move the joystick switch to LOAD and move the LHS into the stowed transit position. The NO TRANS lamp will extinguish. Release the joystick switch and turn the rotary switch to OFF. The PTO light will extinguish to denote the disengagement of the PTO. The vehicle can now be driven.

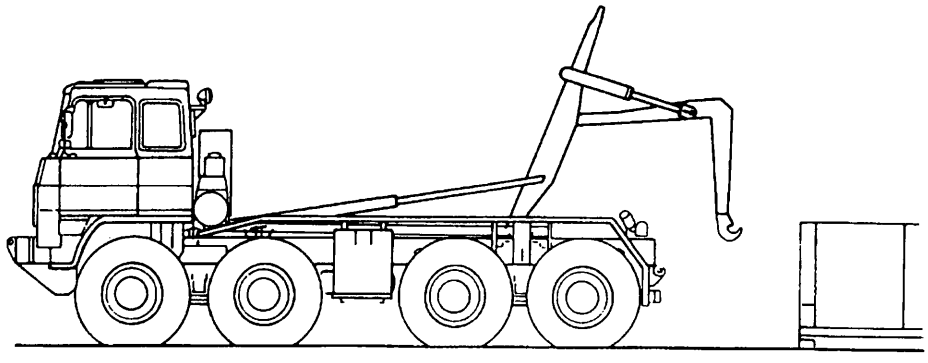


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Fig 20 Flatrack demounting - lift hook disengagement stage

Picking up and off-loading a flatrack in MANUAL mode

WARNINGS

(1) OVERHEAD SAFETY. DURING THE PICKING-UP AND OFF-LOADING CYCLE OF THE LOAD HANDLING SYSTEM (LHS) IN THE 'AUTO MODE, A HEIGHT OF 4.95 METRES (16.25 FT) IS REACHED. IF THE WRONG OPERATING SEQUENCE IS USED WITH THE LHS IN THE 'MANUAL' MODE IT IS POSSIBLE TO REACH A HEIGHT OF 5.8M (19 FT). THEREFORE, BEFORE ANY ATTEMPT IS MADE TO CARRY OUT THE OPERATION, A CHECK MUST BE MADE TO ENSURE THAT THERE ARE NO OVERHEAD OBSTRUCTIONS, PARTICULARLY ELECTRICAL POWER LINES.

(2) GROUND SAFETY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AND EXTREME SIDEWAYS INCLINATION BEFORE PICKING-UP OR OFF-LOADING A FLATRACK. ANY GROUND INSTABILITY BENEATH THE ROAD WHEELS COULD AFFECT THE SAFE OPERATION OF LHS. THE INCLINOMETER (FIG 15) DISPLAY MUST ALSO BE NOTED.

(3) LHS STOWAGE. NEVER DRIVE OFF WITH THE 'NO TRANSIT' LIGHT ILLUMINATED. AN ILLUMINATED LIGHT MEANS THE SYSTEM IS NOT SAFE TO TRAVEL. ALWAYS MAKE A VISUAL CHECK TO ENSURE THAT THE FLATRACK HAS ENTERED THE LOCKING JAWS.

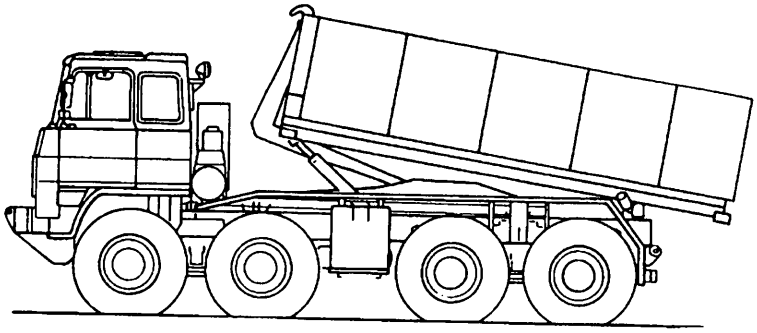
(4) PERSONAL INJURY. DO NOT ENTER THE AREA DIRECTLY UNDERNEATH THE FLATRACK DURING OPERATION OR IF IN THE RAISED POSITION.

Picking up a flatrack

42 The MANUAL (MAN) mode is used mainly in the event of a failure of the control electrical system. Great care must be exercised during the operation of the MAN mode in order that the correct cycle of events occur.

42.1 To pick up a flatrack in the manual mode; reverse the vehicle up to the flatrack and stop at approximately five metres (16ft) from the hook bar. HEED WARNINGS. When the LHS is being operated, the engine speed is to be held at approximately 1500 rpm. Select (N) on the gearbox selector.

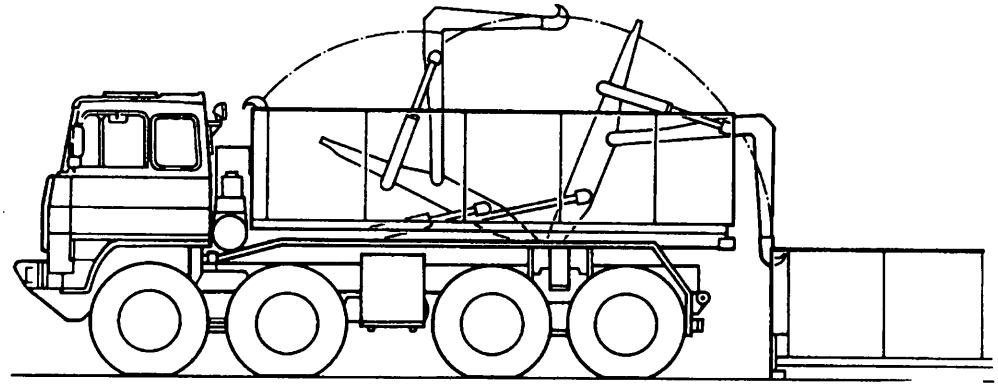
42.2 Reduce the engine to idle speed, select MAN HA on the rotary switch, the PTO lamps will illuminate to indicate the PTO has engaged. Increase the engine speed to 1500 rpm and move the joystick switch to UNLOAD and hold until the hook arm has completed full movement as shown in Fig 21.



DROP 556

Fig 21 Manual mode - MAN HA travel

42.3 Select MAN MF on the rotary switch and move the joystick switch to UNLOAD and hold until the lift-hook arm achieves the required position for the load-hook to engage the flatrack hook bar as shown in Fig 22 second section arc.



DROP 557

Fig 22 Manual mode - MAN HA and MAN MF travel

42.4 Reverse the vehicle up to the flatrack, aligning vehicle and flatrack as straight as possible and the lift-hook to the middle of the lift-bar. Stop the vehicle when the lift hook arm touches the flatrack and leave the vehicle in reverse gear with the engine at idle.

42.5 With the rotary switch still in MAN MF position, move the joystick switch to LOAD and note that hook and bar engage and that the flatrack is being lifted correctly. Select neutral (N) and increase the engine speed to 1500 rpm. If hook does not engage, apply service brake pedal, engage forward gear, release service brake, drive vehicle clear, re-align with flatrack and repeat the manoeuvre.

42.6 With rotary switch still in the MAN MF position, continue to lift the flatrack. The vehicle and flatrack will be drawn together as the flatrack is raised. Some steering wheel adjustments may have to be made to ensure that the flatrack runners locate the LHS rear rollers.

42.7 When the flatrack has contacted the rear rollers, apply the vehicle hand brake lever. Continue to load in the MAN MF mode until the full movement of the main frame is expended and then turn the rotary switch to MAN HA. Continue to hold the joystick switch in LOAD until the LHS and the flatrack are fully stowed. The NO TRANSIT lamp will extinguish to indicate that the vehicle is safe to drive. Turn the rotary switch to MAN TRANS before driving. The rotary switch must remain in MAN TRANS while the vehicle is travelling.

Off-loading a flatrack

43 On arrival at the dropping area, check that there is sufficient room at the front and rear of the vehicle to complete the anticipated manoeuvre. HEED WARNINGS. Check ground condition.

43.1 To off-load a flatrack in the manual mode; apply the vehicle hand brake, select (N) gear, turn the rotary switch to MAN HA and move the joystick switch to UNLOAD. The PTO lamp will illuminate to indicate that the PTO has engaged.

43.2 Increase the engine speed to 1500 rpm and allow the hook arm ram to complete full movement. Return the joystick to its central position. The NO TRANS lamp will illuminate.

43.3 Select MAN MF on the rotary switch and move the joystick switch to UNLOAD. As the back edge of the flatrack touches the ground, release the vehicle hand brake lever to allow the vehicle and flatrack to push apart as shown in Fig 20.

43.4 Continue to unload until the front of the flatrack is within 200mm (8") of the ground, reduce engine speed to idle and engage the main gearbox. Tentatively operate the service brake pedal. Continue to off-load and as the flatrack is grounded, the vehicle rear suspension will unload, the lift-hook will disengage from the flatrack and the vehicle will draw forward. Stop the vehicle as soon as the lift-hook is clear.

CAUTION

Once it is evident that the rear suspension has been relieved of the flatrack load, do not continue in the UNLOAD position as the possibility of jacking up the rear of the vehicle with the hook arm may occur.

43.5 If the lift-hook does not disengage, do not continue to UNLOAD; move the joystick switch to LOAD, raise the flatrack approximately 200mm (8in) off the ground, revert the joystick switch to the UNLOAD position and repeat the manoeuvre as previously described.

43.6 Move the joystick switch to LOAD and hold in this position until the main rams have completed full travel and then select MAN HA on the rotary switch. Continue to hold the LOAD position on the joystick until the hook arm rams have completed full travel, at this stage the PTO lamps will extinguish, turn the rotary switch to MAN TRANS.

Transfer of flatrack to and from a drawbar trailer

WARNINGS

(1) OVERHEAD SAFETY. DURING THE PICKING-UP AND OFF-LOADING CYCLE OF THE LOAD HANDLING SYSTEM (LHS) IN THE 'AUTO' MODE, A HEIGHT OF 4.95 METRES (16.25 FT) IS REACHED. IF THE WRONG OPERATING SEQUENCE IS USED WITH THE LHS IN THE 'MANUAL' MODE IT IS POSSIBLE TO REACH A HEIGHT OF 5.8M (19 FT). THEREFORE, BEFORE ANY ATTEMPT IS MADE TO CARRY OUT THE OPERATION, A CHECK MUST BE MADE TO ENSURE THAT THERE ARE NO OVERHEAD OBSTRUCTIONS, PARTICULARLY ELECTRICAL POWER LINES.

(2) GROUND SAFETY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AND EXTREME SIDEWAYS INCLINATION BEFORE PICKING-UP OR OFF-LOADING A FLATRACK. ANY GROUND INSTABILITY BENEATH THE ROAD WHEELS COULD AFFECT THE SAFE OPERATION OF LHS. THE INCLINOMETER (FIG 15) DISPLAY MUST ALSO BE NOTED.

(3) LHS STOWAGE. NEVER DRIVE OFF WITH THE 'NO TRANSIT' LIGHT ILLUMINATED. AN ILLUMINATED LIGHT MEANS THE SYSTEM IS NOT SAFE TO TRAVEL. ALWAYS MAKE A VISUAL CHECK TO ENSURE THAT THE FLATRACK HAS ENTERED THE LOCKING JAWS.

(4) PERSONAL INJURY. THE TRAILER BRAKES MUST BE ON AND THE TRAILER MUST BE UNCOUPLED FROM THE VEHICLE BEFORE ANY ATTEMPT IS MADE TO LOAD OR UNLOAD A FLATRACK.

(5) PERSONAL INJURY. DO NOT ENTER THE AREA DIRECTLY UNDERNEATH THE FLATRACK DURING OPERATION OR IF IN THE RAISED POSITION.

(6) PERSONAL INJURY. THE TRAILER REAR WHEEL MUST HAVE WHEEL CHOCKS FITTED IN BOTH DIRECTIONS BEFORE ANY ATTEMPT IS MADE TO UNLOAD OR LOAD A FLATRACK.

Transfer of flatrack to a trailer (front or rear)

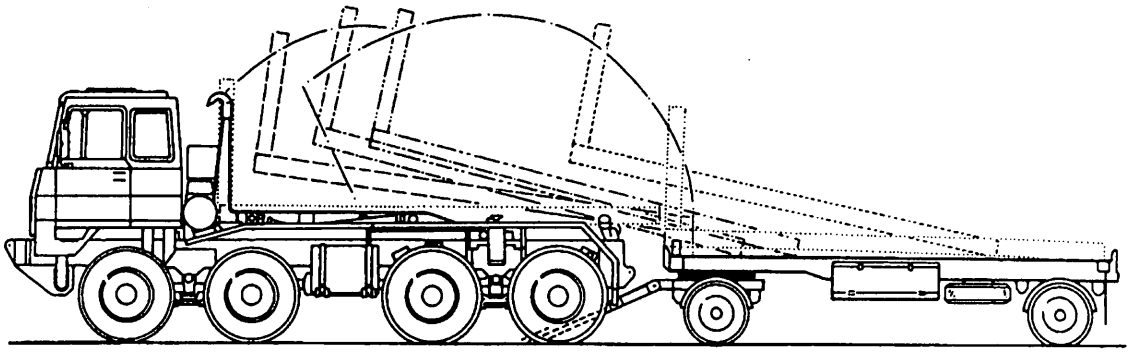
44 To transfer of flatrack to a trailer (front or rear). HEED WARNINGS:

44.1 Apply the pneumatically operated hand brake fitted to the trailer (Fig 27). Slacken the flatrack/ISO container screw clamps (Fig 24 inset) to allow the hook component to fall clear of the trailer deck and, (if front loading is intended) lower the drawbar to the ground, noting this when reversing the vehicle.

44.2 Reverse the vehicle up to the trailer, the vehicle must be brought into line with the trailer position before attempting to load or unload a flatrack. Up to 5° of angular misalignment can be accommodated but above this angle the flatrack will miss the gathering-in guides (Fig 24). Stop the vehicle approximately one and a half metres (4.5 ft) from the trailer, apply the vehicle hand brake to PARK and select (N) on the main gearbox selector.

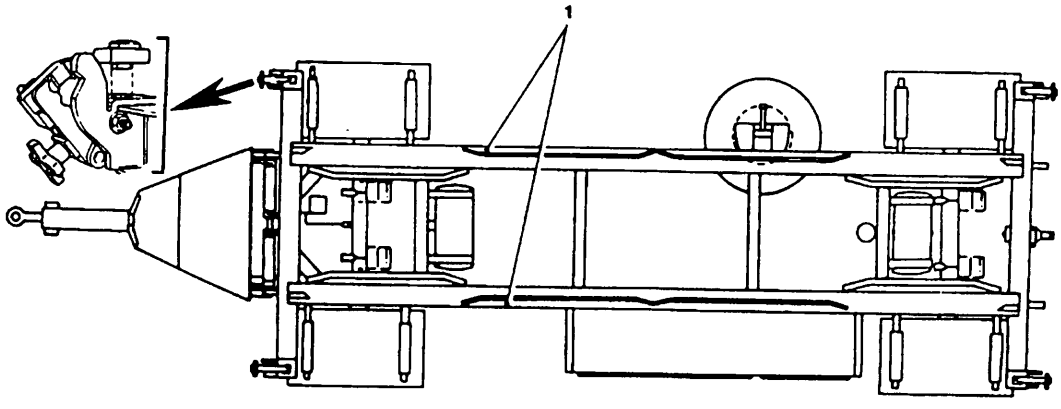
44.3 Select AUTO on the rotary mode switch, the PTO lamps will illuminate, increase the engine speed to 1500 rpm and move the joystick switch to UNLOAD.

44.4 As the flatrack traverses the vehicle/trailer gap as shown in Fig 23, ensure that the flatrack is aligned within the trailer gathering-in guides. Some mis-alignment can be accommodated, but it would be advantageous to have a second person adjacent to the trailer, advising on alignment.



DROP 558

Fig 23 Transferring flatrack to trailer



DROP 559

Fig 24 Trailer Gathering in Guides for Flatracks

44.5 Continue to push the flatrack along the trailer deck until the stops are abutted and release the vehicle hand brake lever. Alternatively, release the UNLOAD switch before the front ('A' frame end) of the flatrack touches the trailer deck, reverse the vehicle, pushing the flatrack onto the stops. Lower the flatrack to the trailer deck and secure with the corner screw clamps.

Removing a flatrack from a trailer (front or rear)

45 Ensure that the loaded trailer is braked. Reverse the vehicle up to the trailer, aligning both vehicles as close as possible. If the intention is to draw the flatrack off from the front of the trailer, the presence of the drawbar must be borne in mind in order to avoid vehicle/drawbar contact.

45.1 Place the main gearbox selector to (N), apply vehicle hand brake lever, select AUTO on the rotary switch, move joystick switch to UNLOAD and operate the LHS until the lift-hook is in line with the bail bar. Reverse the vehicle until the hook contacts the bail bar and apply the park brake.

45.2 Release the corner screw clamps from the flatrack, move joystick switch to LOAD and draw the flatrack onto the vehicle fully until the NO TRANS light is extinguished to indicate the LHS locks have engaged and the vehicle is safe to drive. Turn rotary switch to OFF.

Transfer of flatrack to and from a trailer with LHS in MANUAL mode

46 A flatrack can be transferred to and from the trailer in an identical manner as described in paras 42 and 43 using the LHS in the MAN MF and MAN HA mode.

46.1 The difference will be that the LHS operation is stepped, rather than sequential as when using the AUTO mode. Paras 42 and 43 should be studied for the correct consecutive movement of LHS when selecting MAN MF, MAN HA and MAN TRANS on the rotary switch.

SLAVE HYDRAULIC COUPLINGS

WARNINGS

(1) ALL SLAVE HYDRAULIC COUPLING CONNECTIONS AND DISCONNECTIONS MUST BE MADE WITH THE VEHICLE ENGINE SWITCHED OFF. WHEN COUPLING THE PRESSURE MUST BE RELIEVED IN THE LHS FEED CIRCUIT.

(3) HIGH HYDRAULIC OIL PRESSURE IS PRESENT IN THE FLEXIBLE HOSES WHEN CONNECTED TO THE SLAVE COUPLINGS. PERSONNEL SHOULD STAND WELL CLEAR WHEN THESE HOSES ARE IN USE IN CASE OF SEPARATION OR BREAKAGE.

(4) SAFETY MUST BE PARAMOUNT WITH ALL ROUND VISIBILITY BEING MAINTAINED AT ALL TIMES, ESPECIALLY WHEN THE VEHICLES ARE MOVING IN REVERSE.

(5) ENSURE THAT THE HYDRAULIC PIPES ARE NOT ALLOWED TO DRAG ON THE FLOOR WHEN THE VEHICLES MOVE.

47 The two quick release couplings (Fig 9 (1)) located on top of the LHS reservoir are used for supplying hydraulic power to the Simple Rail Transfer Equipment when fitted, or to power a stricken LHS on another vehicle.

48 When using the slave hydraulic couplings the mode selector switch must be in the 'AUXILIARY' position on the 'live' vehicle. On completion, the slave coupling and the mode selector must be returned to the 'OFF' position.

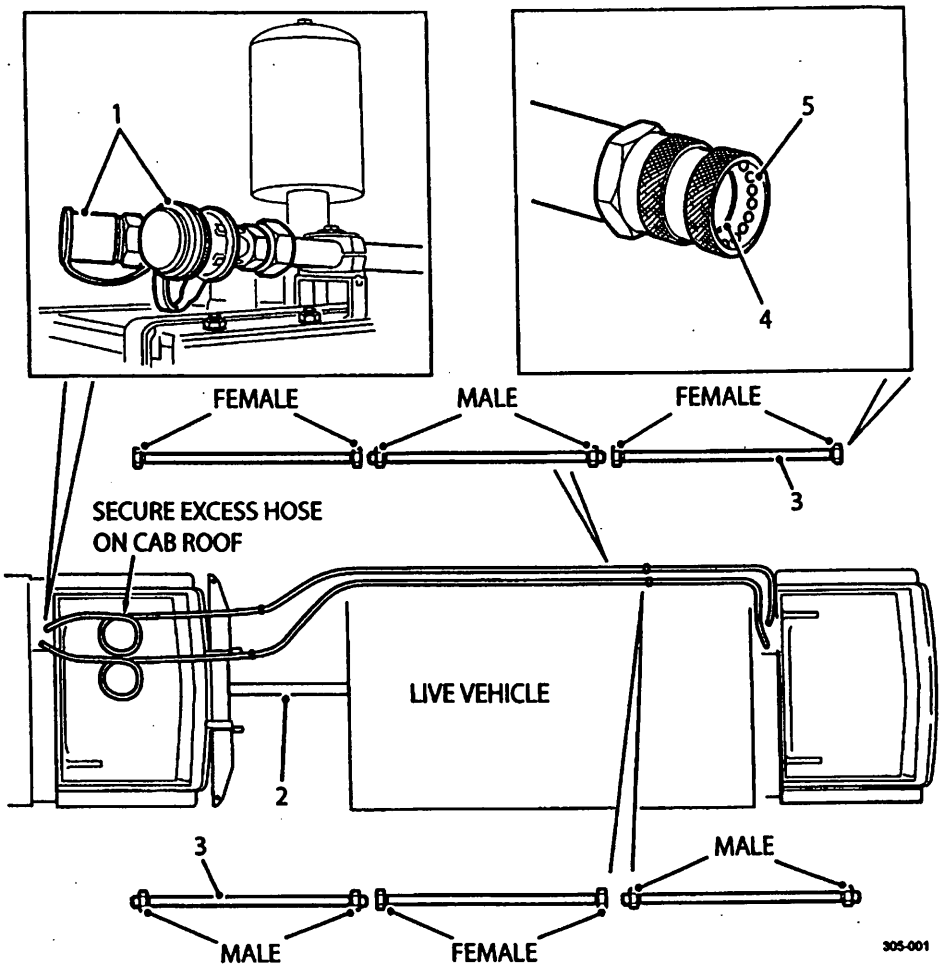
49 Ensure before connecting the couplings that the pressure in the LHS feed circuit is relieved. To relieve the pressure, disengage the PTO and switch the engine 'OFF', switch electrical power 'ON' and select 'AUTO' on the LHS mode selector, connect the hydraulic hoses to the slave couplings, select LHS to 'OFF', start the engine and select LHS mode to 'AUX'.

OFF LOADING A 'DEAD' DROPS VEHICLE LHS USING HYDRAULIC SLAVE COUPLINGS

50 The procedure details the operations required to off-load a flattrack from an unserviceable 'dead' vehicle, using the assistance of a serviceable 'live' vehicle. The procedure is applicable to both MMLC and IMMLC DROPS

51 The task may be performed by either a two or three person team. When using two people, a 'live' vehicle with a loaded flatrack **must** first be offloaded to ensure unrestricted visibility between the operators. Only when a third person (Banksman) relays the signals between the operators can the 'live' vehicle remain in the loaded condition.

52 Reverse the 'live' vehicle until it is aligned with the front of the 'dead' vehicle. Connect a rigid straight tow bar (Fig 9 (2)) between the two vehicles, apply the handbrake, select neutral and switch off.



1 Slave couplings
2 Tow bar
3 Hydraulic hoses
4 'O' ring
5 Ball bearings

Fig 25 Slave procedure – vehicle and hose configuration

53 If the 'dead' vehicle has an air system pressure of less than 4 bar (58.8 lbf/in^2) and is unable to self charge, then a slave air supply from the 'live' vehicle should be connected to allow the parking brakes to be released. This must be carried out before commencing the slave off-loading of the flatrack. If Emergency air reservoir holds sufficient air pressure, then the spring brakes may be released using the Emergency spring brake release switch.

54 Obtain the flexible high pressure hydraulic hoses (Fig 9 (3)) and inspect them as follows:

54.1 Ensure the outside surface of the hose is free from splits or kinks.

54.2 Inspect the hoses for signs of hardening, this will be seen as small splits or cracks.

55 Inspect the hydraulic couplings on both vehicle and hoses as follows:

55.1 Check for damage, corrosion to the mating surfaces and security of fixings.

55.2 Ensure both sealing 'O' rings (Fig 9 (4)) are fitted and serviceable.

55.3 If 25% of the ball bearings (Fig 9 (5)) are missing the coupling must be replaced. (On no account should two adjacent ball bearings be missing).

NOTE

If any of the above faults are evident then the hose/coupling must be replaced before the commencing the operation.

56 Connect the individual hoses (3) together to form the configuration shown in Fig 9. Note that each vehicle carries two hoses. The CES has been amended to enable units to hold an additional set of hoses on a ratio of 1 set per Troop. (1:6 vehicles).

57 Observing the markings, connect the high pressure hydraulic hoses (3) to the self sealing couplings (1) on both vehicles (ensure Return is to Return and Pressure to Pressure). Route the hoses between the vehicles as shown in Fig 9, do not allow the excess hose to drag on the ground during this procedure.

58 On the 'dead' vehicle. Switch the ignition 'ON', select 'AUTO' on the LHS rotary mode switch. Check that the green wine glass symbol is shown on the inclinometer and that there is no audible alarm.

59 On the 'live' vehicle. Start the engine and select 'AUX' on the LHS rotary mode switch. Check that the green wine glass symbol is shown on the inclinometer and that there is no audible alarm. Signal to operator of 'dead' vehicle when complete

60 On the 'dead' vehicle. On receipt of the signal from the 'live' vehicle operator, commence off-loading the flatrack using the joystick.

61 On the 'live' vehicle. Increase the engine speed to 1500 rpm and signal the operator of the 'dead' vehicle when this is obtained.

62 On the 'dead' vehicle. When the rear of the flatrack touches the ground, signal to the operator of the 'live' vehicle.

63 On both vehicles. Release the handbrakes.

64 On the 'dead vehicle'. Just before the front of the flatrack touches the ground, signal the operator of the 'live' vehicle that this condition has been reached. Release the LHS joystick.

65 On the 'live' vehicle. On receipt of the signal from the 'dead' vehicle operator release the accelerator and allow the engine speed to fall idle. Select first gear and signal, to the operator of the 'dead' vehicle when this is obtained. (Do not increase the engine speed above idle).

66 On the 'dead' vehicle. On receipt of the signal from the 'live' vehicle operator, continue offloading the flatrack using the joystick.

67 When the hook has disengaged from the 'A' frame bale bar, drive the 'live' vehicle forward until the 'dead' vehicle is approximately 5 metres from the flatrack. At this point, the 'live' vehicle and both vehicles are to stop. Apply the park brake on both vehicles.

68 On the 'live' vehicle. Select 'NEUTRAL' and signal to the operator of the 'dead' vehicle when this is obtained. Allow the engine to idle.

69 On the 'dead' vehicle. On receipt of the signal from the 'live' vehicle operator, stow the LHS using the joystick in the 'LOAD' position. Signal the operator of the 'live' vehicle when the LHS is fully stowed.

70 On the 'live' vehicle. On receipt of the signal from the 'dead' vehicle operator, turn the rotary mode switch to 'OFF' and switch off the engine ignition.

71 On the 'dead' vehicle. Turn the rotary mode switch to 'OFF' and switch off the engine ignition.

72 Ensure the pressure within the system is relieved in accordance with Chap 3 Page 21, Para 124.

73 Examine the hoses and couplings for evidence of fluid leakage, replace as required. Uncouple and disassemble the hoses, fit the protective caps on all slave couplings. Stow the hoses and wipe away oil spillage.

74 Disconnect, and remove the slave air supply hose.

75 Disconnect, and remove and stow the rigid tow bar

76 Check, and if necessary replenish the LHS oil reservoir.

Operating in the dark (without floodlights)

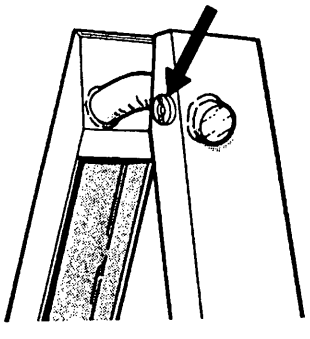
Beta Lights

WARNINGS - RADIATION HAZARD

(1) RADIATION HAZARD. WHEN REQUIRED, THE FLATRACKS CAN BE FITTED WITH BETA LIGHTS. IN THE EVENT OF A BREAKAGE OF A BETA LIGHT IN AN ENCLOSED ENVIRONMENT EVACUATE AND VENTILATE THE IMMEDIATE AREA FOR AT LEAST 30 MINUTES. BEFORE COMMENCING REPLACEMENT OF A BETA LIGHT REFER TO LOCAL REGULATIONS CONCERNING RADIATION SAFETY AND JSP 392 (CHAPTER 32). ANY QUESTIONS RELATING TO THE HANDLING, STORAGE AND DISPOSAL OF BETA LIGHTS SHOULD BE REFERRED TO YOUR UNIT RADIATION PROTECTION SUPERVISOR (RPS).

(2) DO NOT HANDLE FRAGMENTS OF BROKEN BETA LIGHTS WITHOUT WEARING PROTECTIVE GLOVES.

77 Beta lights are small, luminous glass orbs that glow in the dark. When fitted a Beta light is positioned on the right hand side of the flatrack 'A' frame at the hook bar level (See Fig 26). Right hand being when facing the front of the flatrack, ('A' frame).



DROP 560

Fig 26 Beta light mounting (when fitted)

Loading

78 Proceed to load with the load hook deployed in the position as described in para 40 and, viewed from the cab rear window, the hook bar should be aligned below and slightly to the left of the Beta light when facing the flatrack.

79 Gradually reverse the vehicle until contact is made with the load hook arm to the hook bar. Operate the LHS as described in para 40 and note that a satisfactory load hook/hook bar engagement has been made by the upward movement of the Beta light (when fitted). Continue normal loading action.

PTO emergency selection

80 The PTO emergency selector is a manual lever (Fig 27) located on the side of the main gearbox adjacent to the PTO. The lever is normally wire locked in the disengaged position.

81 To engage the PTO using the emergency lever, proceed as follows:

81.1 Ensure the vehicle parking brake is engaged and the gear range selector is set to N - neutral.

81.2 Cut the locking wire holding the PTO emergency selector lever out of engagement and move the lever, in the direction indicated on the gear casing, into engagement. Speed up the engine as required to maintain hydraulic oil pressure as under normal operation.

82 On completion of the operation for which the PTO was engaged, slow the engine to idling, ensure all hydraulic functions are complete with no loads left in an unsafe condition, operate the PTO emergency selector lever to disengaged.

83 At the earliest convenient time the PTO emergency selector lever locking wire must be replaced.

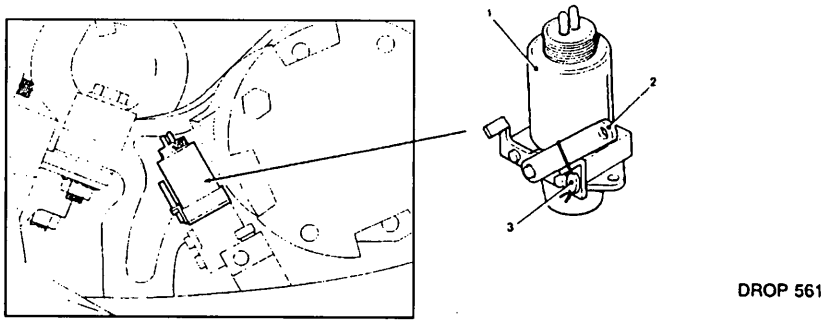


Fig 27 PTO emergency selector lever

Use of LHS manual over-ride buttons

CAUTIONS

(1) Operation of the manual over-ride buttons must only be used as an emergency operation for off-loading a flatrack and for no other LHS operation.

(2) The correct sequence of operation of the manual control of the flatrack is critical.

(3) The off-loading operation in this mode must not exceed three minutes of continuous operation.

NOTE

A high physical force may be required to depress the manual over-ride buttons.

84 The manual over-ride solenoid buttons used for the emergency control of the LHS are fitted to the control valve manifold (Fig 28) which is situated on the left hand side of the vehicle, behind the cab.

85 To operate the over-ride buttons, proceed as necessary:

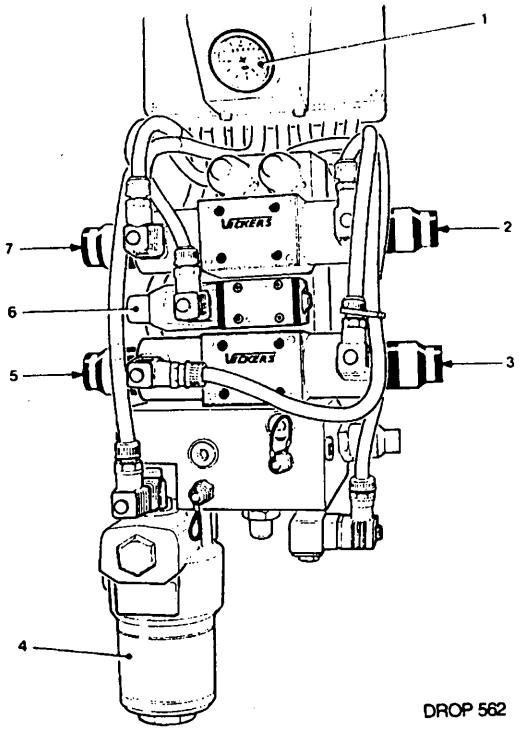
85.1 Press the UNLOAD hook arm ram button (3) until the hook arm rams are fully extended.

85.2 Press the UNLOAD middle frame ram button (2) until the LHS disengages from the flatrack.

85.3 Press the LOAD middle frame ram button (7) until the main rams are fully retracted.

85.4 Press the LOAD hook arm ram button (5) until the hook arm rams are fully retracted.

85.5 Press the TRANSIT button before moving the vehicle.



1 Hour meter
2 UNLOAD middle frame ram button
3 UNLOAD hook arm ram button
4 High pressure filter
5 LOAD hook arm ram button
6 TRANSIT button
7 LOAD middle frame ram button

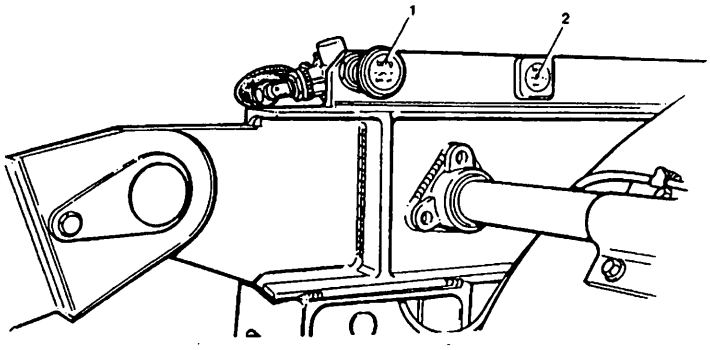
Fig 28 LHS system manual over-ride buttons

USE OF A TRAILER SHUNT VALVE

86 Should a trailer be required to be manoeuvred into a position by a vehicle with no palm type air connections (or manhandled) this can be achieved by use of the SHUNT valve (Fig 29(1)) providing sufficient air pressure is retained in the trailer system.

86.1 Pull out the PARK valve (2) to release the service spring brakes and then push in the SHUNT valve (1) to release the emergency brakes. The trailer is now free.

86.2 On achieving the desired trailer manoeuvre, pull out the SHUNT valve and push in the PARK valve to apply the emergency and service spring brakes.



DROP 563

1 Shunt valve 2 Park valve

Fig 29 Trailer shunt and park valves

DRIVERS SEAT ADJUSTMENT CONTROLS

Cushion rake and height levers

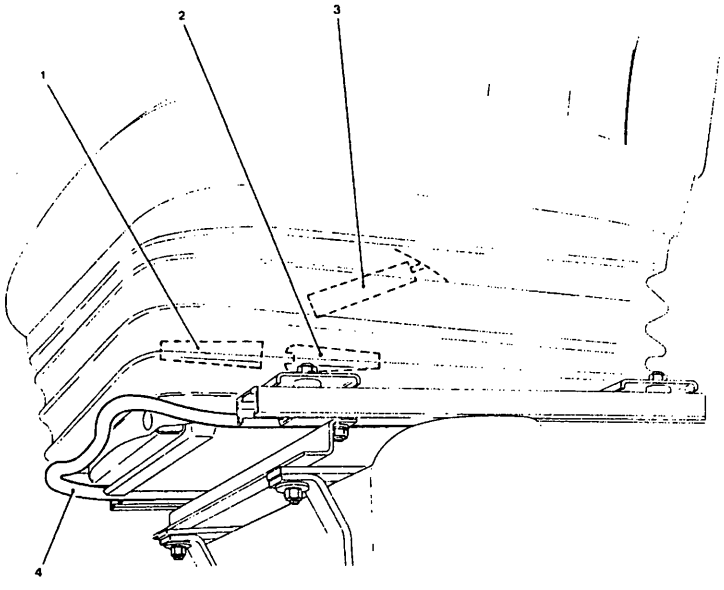
87 The seat height and rake adjustments are selected by the use of the two levers on the right hand side of the seat (Fig 30(1) and (2)). The foremost lever adjusts the frontal height of the seat and the rearmost lever adjusts the rear height of the seat. A combination of the two height provides the seat rake.

Back rest angle lever

88 To move the angle of the back rest, lift the rearmost lever (3) fitted to the right-hand side of the seat and adjust to suit.

Fore and aft adjustment

89 To move the seat fore or aft, lift the handle (4) fitted at the front of the seat and slide seat to suit.



DROP 541

1	Forward height/rake adjustment lever	3	Back rest angle adjustment lever
2	Rear height/rake adjustment lever	4	Fore and aft adjustment lever

Fig 30 Drivers seat adjustment controls

TILTING AND LOWERING THE CAB

WARNINGS

(1) THE ELECTRICAL MASTER SWITCH MUST BE TURNED TO 'OFF', THE START SWITCH KEY REMOVED AND THE HAND BRAKE APPLIED TO THE 'PARK' POSITION BEFORE ANY ATTEMPT IS MADE TO TILT THE CAB.

(2) ALL PERSONNEL SHOULD STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. WHEN PERFORMING THE RAISING OR LOWERING FUNCTION, STAND CLEAR OF PIVOTING CAB. NEVER WORK UNDER A PARTIALLY TILTED CAB.

CAUTIONS

(1) The doors must be closed and the front grille opened before the cab is tilted.

(2) Never turn the steering wheel when the cab is fully raised as damage may result.

(3) All loose kit and equipment must be removed from the cab or stowed correctly before tilting commences.

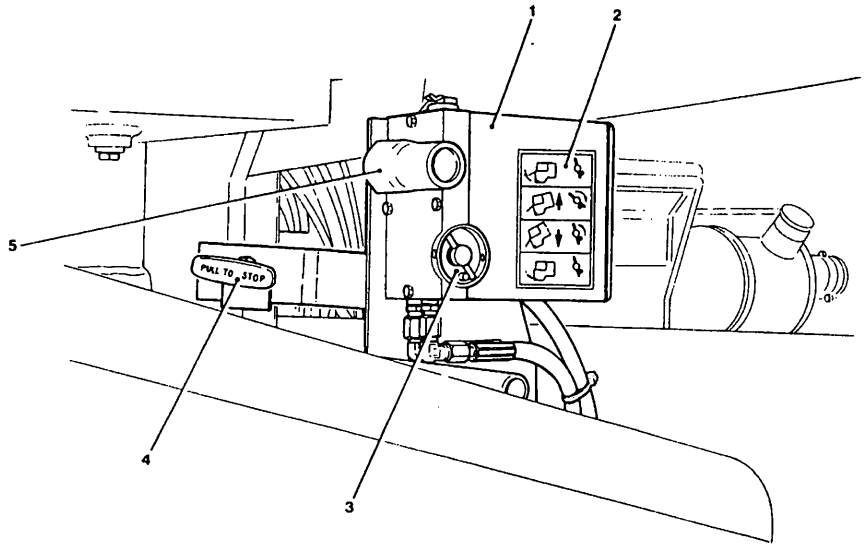
Tilting the cab

90 Before attempting to tilt the cab, ensure that the doors are shut and the front grille is open. Using the detachable pump handle, insert the slotted end onto the bar of the pump valve (Fig 31 (3)) and ensure that the valve is turned fully clockwise as shown on instruction label (2).

91 To raise the cab; push the handle into the pump insert (5) and operate the pump. The hydraulic locks will release the cab automatically; continue to pump until the cab is tilted to the full 70° angle.

Lowering the cab

92 To lower the cab; turn the pump valve (3) fully anti-clockwise until the valve bar abuts the stop. Operate the pump until the cab is fully down and locked into position. Close front grille and re-stow pump handle.



DROP 542

1	Pump and oil reservoir	4	Engine stop handle
2	Instruction label	5	Handle insert
3	Pump valve		

Fig 31 Cab tilt pump

DRAWBAR TRAILER OPERATIONS

Coupling & Uncoupling of a trailer 15 tonne LWB using a Foden DROPS IMMLC

93 GENERAL INFORMATION

93.1 The Trailer, Skeletal DROPS 15 Tonne, 4 Twin Wheel, Kings LWB Trailer is a low mobility legacy vehicle primarily designed for operation with the DROPS Medium Mobility Load Carrier (IMMLC). The trailer is capable of traversing prepared or semi- prepared road surfaces, but not cross country terrain. The trailer is dedicated to the transporting of purpose made flatracks (FR) loaded with either cargo or 20 ft ISO, 668 IC & ICC containers loaded to a gross weight of 16.5 tonnes.

93.2 The Skeletal DROPS trailer is capable of cross loading loads which must be preloaded onto a Flatrack. The vehicle and the trailer combination is not certified to carry packed or bulk fuel loads as the trailer does not meet the mandatory ADR classification for the carriage of fuel.

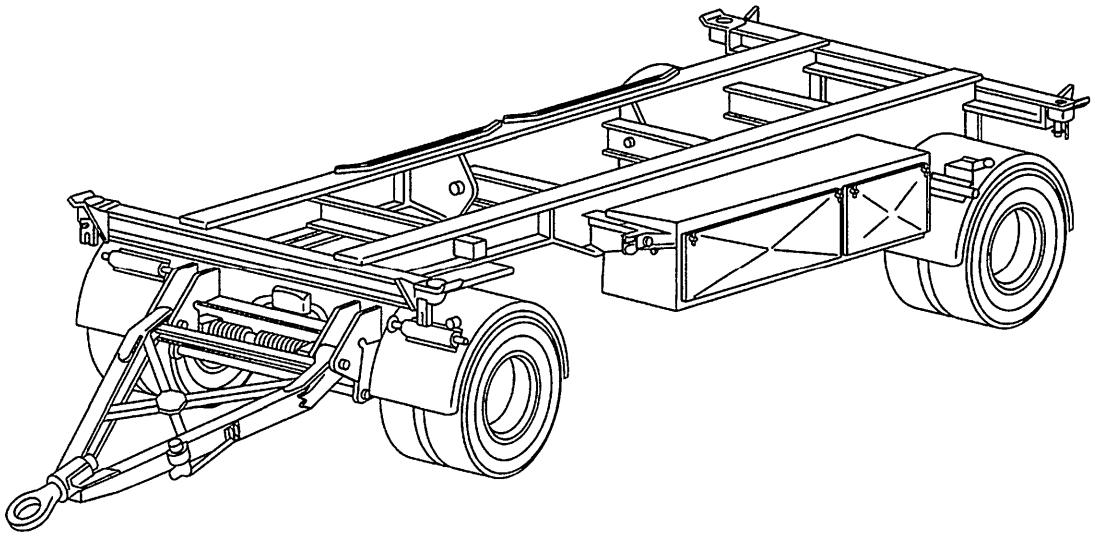


Fig 32 Kings Trailer, Cargo, Skeletal, Wheeled (Drops) 15T LWB

94 COUPLING/UNCOUPLING THE TRAILER TO THE TOWING VEHICLE

WARNINGS

(2) REFER TO AESP 2330-S-300-201 FOR FULL OPERATING INFORMATION FOR THE DROPS KINGS TRAILER.

(3) RISK OF SERIOUS INJURY. ENSURE THAT AESP 2330-S-300-811 MOD INSTRUCTION NO 2 REVISED LANDING LEG, HAS BEEN EMBODIED BEFORE ATTEMPTING TO COUPLE THE TRAILER TO THE VEHICLE.

(4) RISK OF SERIOUS INJURY. THE DRAWBAR IS COUNTER-BALANCED TO ASSIST THE OPERATORS IN COUPLING THE TRAILER TO THE VEHICLE. UNDER NO CIRCUMSTANCES SHOULD ANY INDIVIDUAL STAND BETWEEN THE VEHICLE AND THE TRAILER WHILST MANOEUVRING IS IN PROGRESS.

(5) .RISK OF INJURY. THE DRAWBAR ('A' FRAME) OF THE TRAILER IS TO BE SUPPORTED BY THE DRAWBAR SUPPORT LEG, WHICH IS TO BE ADJUSTED SO THAT THE TOWING EYE IS AT THE APPROPRIATE HEIGHT TO ACCEPT THE VEHICLE TOW HOOK.

(6) RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING THE TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND.

(7) RISK OF SERIOUS INJURY. THE VEHICLE IS TO BE REVERSED UP TO THE TRAILER BY A MINIMUM CREW OF TWO. ONE CREW MEMBER IS TO BE POSITIONED TO THE SIDE AND TOWARDS THE REAR OF THE VEHICLE IN CLEAR VIEW OF THE DRIVER TO OBSERVE THE REAR OF THE VEHICLE AND THE FRONT OF THE TRAILER. UNDER NO CIRCUMSTANCES SHOULD ANY INDIVIDUAL STAND BETWEEN THE VEHICLE AND THE TRAILER WHILST MANOEUVRING IS IN PROGRESS.

(8) RISK OF INJURY. WHEN THE DRAWBAR SUPPORT LEG IS DEPLOYED OR STOWED, THE LOCKING PIN IS TO BE FULLY ENGAGED AGAINST SPRING TENSION UNTIL THE DROP NOSE OPERATES TO RETAIN THE PIN IN POSITION.

(9) RISK OF SERIOUS INJURY. CHOCK THE TRAILER ROADWHEELS IN THE DIRECTION OF TRAVEL PRIOR TO COMMENCEMENT OF COUPLING/UNCOUPLING.

(10) RISK OF INJURY. THE 'A' FRAME FOR THE TRAILER IS HEAVY AND MUST BE RAISED AND LOWERED BY TWO PERSONNEL.

(11) RISK OF SERIOUS INJURY. ENSURE THAT THE TRAILER IS SECURELY COUPLED TO THE VEHICLE TOW HOOK AND THE AIR LINES AND ELECTRICAL CONNECTORS ARE CONNECTED BEFORE DRIVING OFF.

(12) RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND TRAILER WHEN THE VEHICLE IS MANOEUVRING.

(13) RISK OF SERIOUS INJURY. BEFORE DRIVING OFF ALWAYS ENSURE THE LHS NO TRANSIT LIGHT IS EXTIGUISHED.

94.1 COUPLING THE TRAILER TO THE VEHICLE

WARNING

RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING A TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND WITH A MINIMUM OF TWO OPERATORS.

94.1.1 Ensure that the trailer park brake valve is applied, refer to AESP 2330-S-300-201 Fit chocks behind the rear wheels in both directions.

94.1.2 Carry out daily before use checks on the trailer in accordance with AESP 2330-S-300-601 Table 6.

94.1.3 If the drawbar is at rest on the ground raise the drawbar and support in accordance with AESP 2330-S-300-201 Chap 3.

94.1.4 Unlock the rear tow hook of the vehicle, refer to AESP 2320-R-301-201 Chap 1-5

94.1.5 With the trailer landing leg deployed and a minimum crew of two, adjust the height of the 'A' frame until the position of the tow eye is slightly higher than the open tow hook of the vehicle. Refer to AESP 2330-S-300-201 Chap 3 for landing leg operation.

WARNING

RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND TRAILER WHEN THE VEHICLE IS MANOEUVRING.

94.1.6 Under guidance reverse the vehicle until it is approximately 1 metre away from the trailer, apply vehicle park brake and switch off engine.

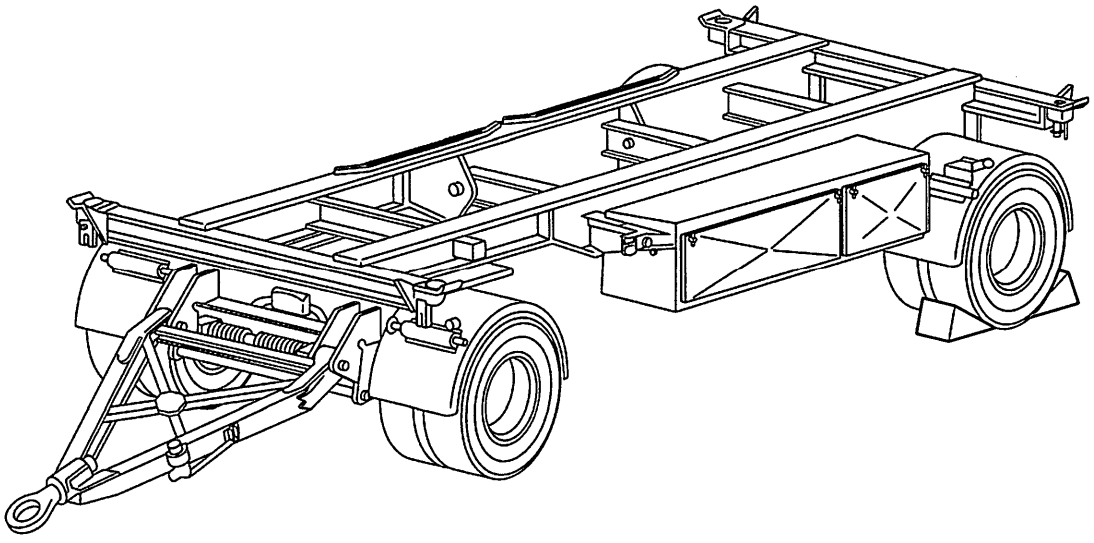


Fig 33 Showing chocks in position

94.1.7 Check trailer 'A' frame height alignment to vehicle tow hook. Check vehicle tow hitch is open. Readjust 'A' frame height if required.

94.1.8 Continue reversing, under guidance until the trailer coupling is complete. Apply vehicle park brake and switch off the engine.

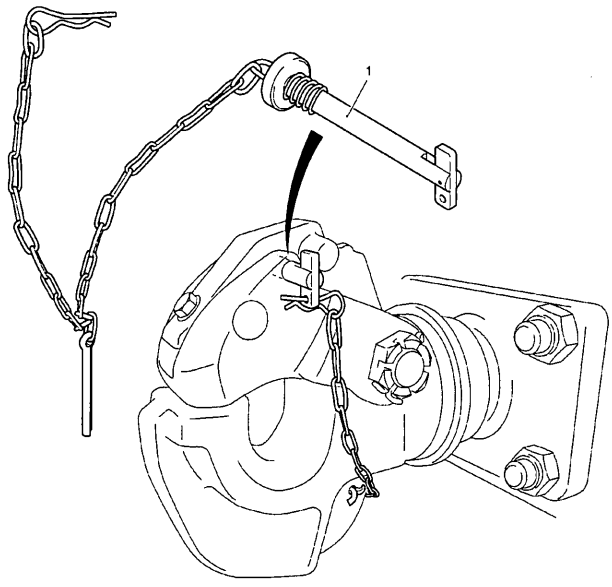


Fig 34 Tow hook locking pin location

94.1.9 Ensure tow hook is securely closed and that the locking pin is in position.

94.1.10 Raise and stow the landing leg in accordance with AESP 2330-S-300-201 Chap 3.

94.1.11 Connect the palm couplings from the trailer to the vehicle and allow the air pressure to build up.

94.1.12 Connect the electrical lighting plug, 2 pin socket and ABS cable in accordance with Fig. 13.

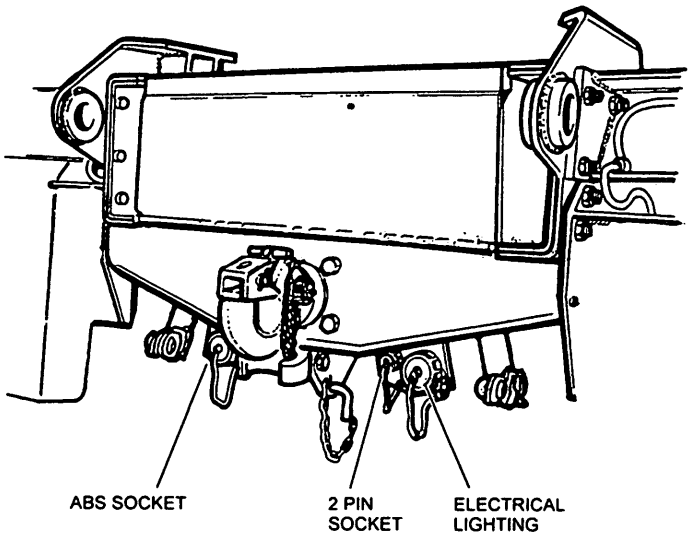


Fig 35 Electrical connection points

94.1.13 Start the vehicle engine and build up the air pressure.

94.1.14 Ensure the trailer park brake is applied and remove the chocks behind the rear wheels of the trailer.

WARNING SEVERE INJURY. ENSURE THAT THE TRAILER COUPLING IS FULLY LOCKED BEFORE TOWING THE TRAILER.

94.1.15 Complete lighting check of vehicle and trailer.

94.1.16 Disengage trailer park brake valve.

94.1.17 Complete vehicle movement check to ensure rotation of all wheel stations and operation of brakes.

94.1.18 Drive away.

95 UNCOUPLING THE TRAILER FROM THE VEHICLE.

WARNING RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING A TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND WITH A MINIMUM OF TWO OPERATORS.

95.1 Park the vehicle and trailer combination on firm level ground in a suitable location to uncouple the trailer. Apply the vehicle handbrake and turn off the engine.

95.2 Apply trailer park brake valve and fit wheel chocks to rear trailer wheels in both directions.

95.3 Disconnect the electrical cables and air palm couplings and store them in accordance with AESP 2330-S-300-201.

95.4 Unlock the rear tow hook of the vehicle.

WARNING. RISK OF INJURY. THE 'A' FRAME FOR THE TRAILER IS HEAVY AND MUST BE RAISED AND LOWERED BY TWO PERSONNEL.

WARNING. RISK OF INJURY. WHEN THE DRAWBAR SUPPORT LEG IS DEPLOYED OR STOWED, THE LOCKING PIN IS TO BE FULLY ENGAGED AGAINST SPRING TENSION UNTIL THE DROP NOSE OPERATES TO RETAIN THE PIN IN POSITION.

95.5 Deploy the trailer landing leg, adjust the height of the 'A' frame until the position of the tow eye is clear of the open tow hook of the vehicle. Refer to AESP 2330-S-300-301 Chap 3 for landing leg operation.

95.6 Select Drive on the DROPS gear selector switch and under guidance drive the vehicle forward slowly until the vehicle is at least one meter clear of the trailer.

95.7 Apply the vehicle handbrake and switch off the engine. Close the rear tow hook and refit electrical socket covers.

CROSS LOADING & UNLOADING A TRAILER 15 TONNE LWB USING A FODEN DROPS IMMLC

96 CROSS LOADING/UNLOADING A FLATRACK LOAD

WARNINGS

(1) RISK OF SERIOUS INJURY. THE TRAILER MUST BE UNCOUPLED FROM THE VEHICLE BEFORE ANY ATTEMPT IS MADE TO LOAD OR UNLOAD THE FLATRACK.

(2) RISK OF SERIOUS INJURY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AND SIDEWAYS INCLINATION BEFORE LOADING OR OFF LOADING A FLATRACK.

(3) RISK OF SERIOUS INJURY. THE VEHICLE IS TO BE REVERSED UP TO THE TRAILER BY A MINIMUM CREW OF TWO. ONE CREW MEMBER IS TO BE POSITIONED TO THE SIDE AND TOWARDS THE REAR OF THE VEHICLE IN CLEAR VIEW OF THE DRIVER TO OBSERVE THE REAR OF THE VEHICLE AND THE FRONT OF THE TRAILER. UNDER NO CIRCUMSTANCES SHOULD ANY INDIVIDUAL STAND BETWEEN THE VEHICLE AND THE TRAILER WHILST MANOEUVRING IS IN PROGRESS.

(4) RISK OF SERIOUS INJURY. DO NOT ENTER THE AREA DIRECTLY UNDERNEATH THE FLATRACK DURING OPERATION OR IF IN THE RAISED POSITION.

(5) RISK OF SERIOUS INJURY. CHOCK THE TRAILER ROAD WHEELS PRIOR TO THE COMMENCEMENT OF LOADING/UNLOADING A FLATRACK.

(6) RISK OF INJURY. THE 'A' FRAME FOR THE TRAILER IS HEAVY AND MUST BE RAISED AND LOWERED BY TWO PERSONNEL.

(7) RISK OF INJURY. WHEN THE DRAWBAR SUPPORT LEG IS DEPLOYED OR STOWED, THE LOCKING PIN IS TO BE FULLY ENGAGED AGAINST SPRING TENSION UNTIL THE DROP NOSE OPERATES TO RETAIN THE PIN IN POSITION.

(8) RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND THE TRAILER DURING CROSSLOADING OPERATION.

(9) RISK OF INJURY. WHEN USING GP TYPE FLATRACKS ENSURE SPIGOTS ARE SECURED IN PLACE WHEN NOT IN USE.

(10) RISK OF SERIOUS INJURY. ONLY LOADS WITH APPROVED TIE DOWN SCHEMES FOR EPLS MAY BE CROSS LOADED ON AND OFF THE TRAILER.

(11) RISK OF SERIOUS INJURY. BEFORE DRIVING OFF ALWAYS ENSURE THE LHS NO TRANSIT LIGHT IS EXTINGUISHED IN THE CAB OF THE DROPS.

(12) RISK OF INJURY. VISUALLY ENSURE DIN LOCKS ARE ENGAGED WITH FLATRACK WHEN LOADED.

(14) RISK OF INJURY. NEVER OPERATE THE HOOK LIFT SYSTEM CLOSE TO ABOVE-GROUND ELECTRICITY CABLES.

Cautions

(4) Ensure the 'A' frame is fully rested centrally to the trailer on the ground before attempting to reverse the vehicle into position to load/unload the Flatrack.

(5) Ensure sufficient clearance between vehicle and trailer 'A' frame during all operations.

97 CROSS LOADING – LOADING A FLATRACK FROM A DROPS ONTO AN LWB TRAILER

97.1 Park the vehicle and trailer combination, in a straight line, on firm level ground in a suitable location to uncouple the trailer. Carry out ALPHA checks. Apply the vehicle park brake and turn off the engine.

97.2 Chock rear trailer wheels in both directions. Uncouple the vehicle in accordance with AESP 2320-R-301-201.

97.3 Load DROPS with Flatrack load in accordance with AESP 2320-R-301-201.

97.4 Lower the trailer 'A' frame ensuring the support leg is stowed in its stowage port.

97.5 Reverse the DROPS vehicle under guidance up to the trailer using the manoeuvring brake. The runners on the flatrack must be in line with the runners on the trailer.

97.6 Stop with the rear of the DROPS vehicle towing eye above the centre plate on the trailer 'A' frame. Apply vehicle handbrake and switch off engine. Re-check vehicle and trailer alignment (Fig 14).

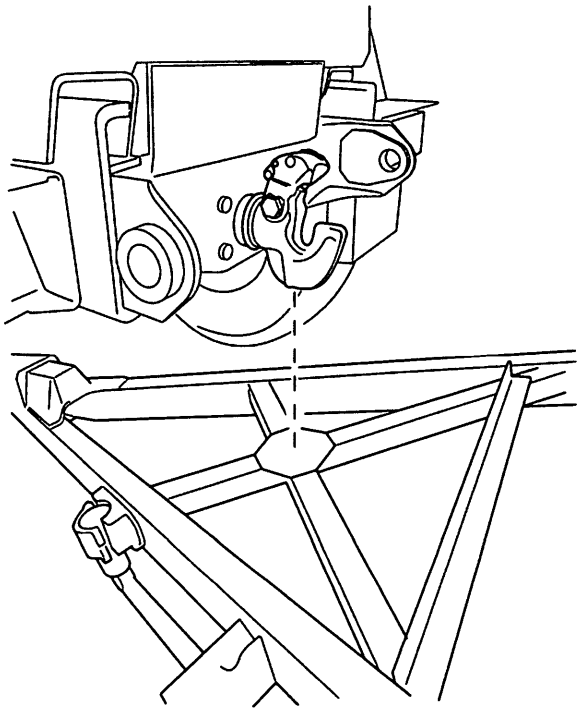


Fig 36 Positioning of 'A' frame for loading

WARNING. RISK OF INJURY. ENSURE ALL OF THE ISO TWIST LOCKS ARE FULLY DISENGAGED AND NOT PROTRUDING FROM THE LOAD BED.

97.7 Driver and operator to prepare trailer for cross-loading in accordance with AESP 2330-S-300-201.

97.8 With the vehicle engine running at idling speed select 'AUTO' (position 1) on the Rotary Mode Switch (RMS). Move the LHS joystick to the 'unload' position.

WARNING. RISK OF INJURY. NEVER OPERATE THE HOOK LIFT SYSTEM CLOSE TO ABOVE GROUND ELECTRICITY CABLES.

97.9 Execute unload cycle with the engine running at tick-over. Assistance will be required to ensure the runners on the flatrack are fully engaged with the central rails on the trailer. Once fully engaged 1500 rpm may be used (Fig 19).

97.10 Return the engine to tick-over when the rear castings of the flatrack reach the end of the centre rails, stopping before the front castings of the flatrack come into contact with the trailer front bump stops.

97.11 Select 'Manual Hook Arm' (position 2) on the RMS, select load and, on tick-over, lift the front of the flatrack 1M from the trailer bed.

97.12 Select 'Manual Mid-Frame' (position 3) on the RMS and unload on tick-over until just before the rear corner castings come into contact with the rear bump stops (do not put any undue pressure on the rear bump stops).

97.13 Select 'Manual Hook Arm' (position 2) on the RMS and, on tick-over, unload the flatrack ensuring it sits squarely on the trailer.

97.14 The ISO locks must now be placed into the 'Loose Locked' position.

WARNING RISK OF INJURY. ENSURE ALL OF THE TRAILER ISO LOCKS ARE FULLY DISENGAGED AND NOT PROTRUDING FROM THE LOAD BED

97.15 Release the hook from the bail bar by using the RMS and vehicle gears, re-stow the LHS.

97.16 Check security of the load. The vehicle can now be driven away and collect the second flatrack.

97.17 Whilst the vehicle is away the second operator fully secures the ISO locks and removes the chocks. The trailer loading procedure is now complete.

97.18 Support the 'A' frame of the trailer with its support leg ready to carry out the coupling procedure.

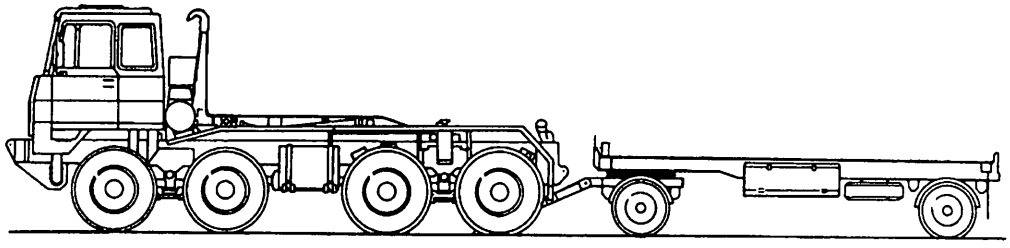


Fig 37 Vehicle at correct distance for loading

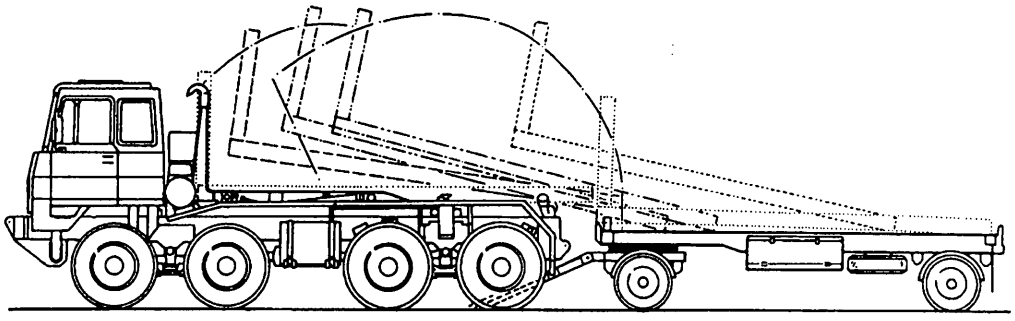


Fig 38 Cross loading onto trailer

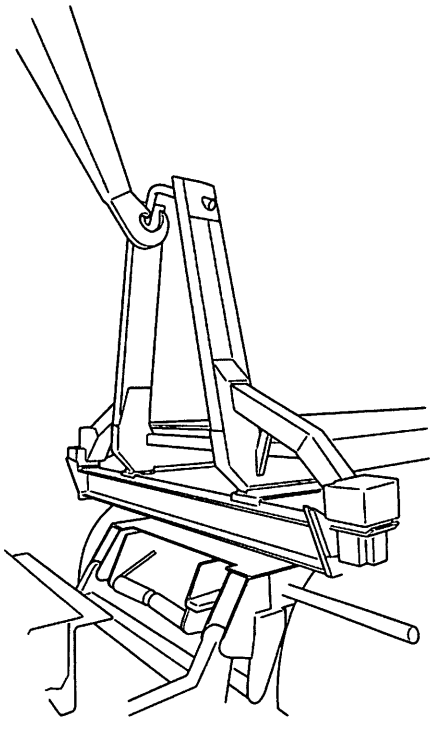


Fig 39 LHS hook clear of Flatrack 'A' frame

98 CROSS LOADING – UNLOADING A FLATRACK FROM AN LWB TRAILER ONTO A DROPS VEHICLE.

98.1 Park the vehicle and trailer combination on firm level ground in a suitable location and carry out ALPHA checks. Apply vehicle handbrake and turn off engine.

98.2 Apply the trailer parking brake and chock rear wheels in both directions. Uncouple the vehicle in accordance with AESP 2320-R-301-201.

98.3 If the DROPS vehicle is loaded, unload in accordance with AESP 2320-R-301-201.

WARNING. RISK OF INJURY. THE 'A' FRAME FOR THE TRAILER IS HEAVY AND MUST BE RAISED AND LOWERED BY TWO PERSONNEL.

WARNING. RISK OF INJURY. WHEN THE DRAWBAR SUPPORT LEG IS DEPLOYED OR STOWED, THE LOCKING PIN IS TO BE FULLY ENGAGED AGAINST SPRING TENSION UNTIL THE DROP NOSE OPERATES TO RETAIN THE PIN IN POSITION.

98.4 Lower the trailer 'A' frame ensuring the support leg is stowed in its stowage port.

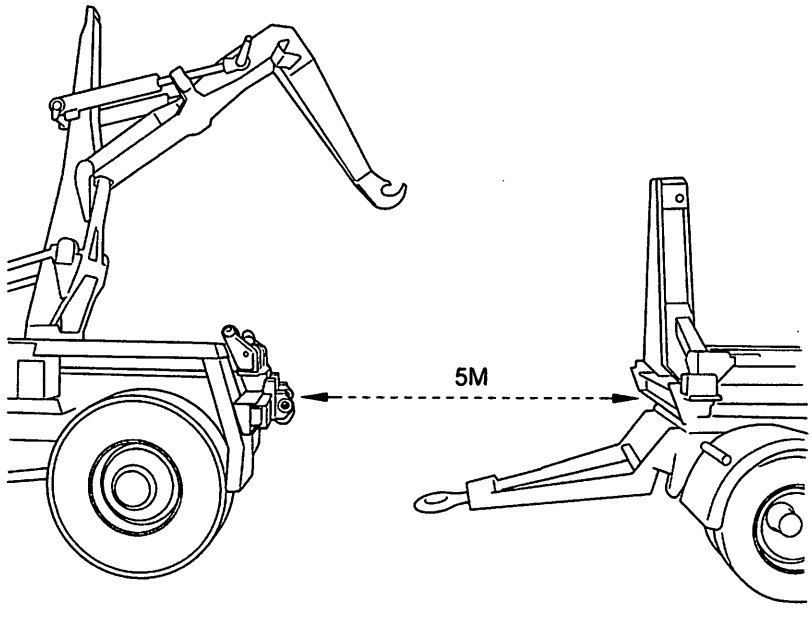


Fig 40 DROPS at required 5 metre distance

98.5 Reverse the DROPS vehicle up to the trailer and stop in a straight line, approx 5 metres away from the trailer. Carry out ALPHA checks.

98.6 With the vehicle engine running at idling speed select 'AUTO' (position 1) on the LHS rotary mode switch. The PTO will automatically engage and the warning light illuminate.

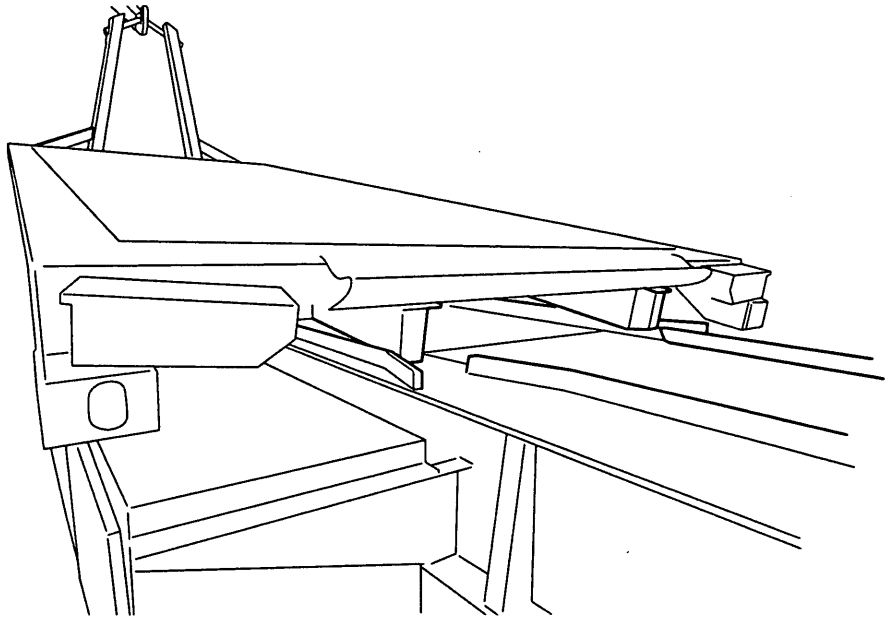


Fig 41 Flatrack engaged with centre rails

98.7 Move the LHS joystick to the unload position. The Hook Arm then the Middle Frame will rise. The 'NO TRANS' light will illuminate (once the LHS starts to move, increase to approx 1500 rpm). Release the LHS joystick when the hook is slightly lower than the 'A' frame bail bar.

98.8 Set the ISO twist locks to loose lock.

98.9 With the LHS deployed, reverse the vehicle under guidance until the LHS is approx 1M from the flatrack bail bar. Apply park brake.

98.10 Check height of the LHS in relation to the bail bar.

WARNING. RISK OF INJURY. THE BAIL BAR OF THE FLATRACK MUST BE FULLY ENGAGED BEFORE ATTEMPTING TO LIFT LOAD.

98.11 Continue to reverse the vehicle until the LHS is directly below the flatrack bail bar. Apply vehicle park brake. Operate the LHS to engage the bail bar.

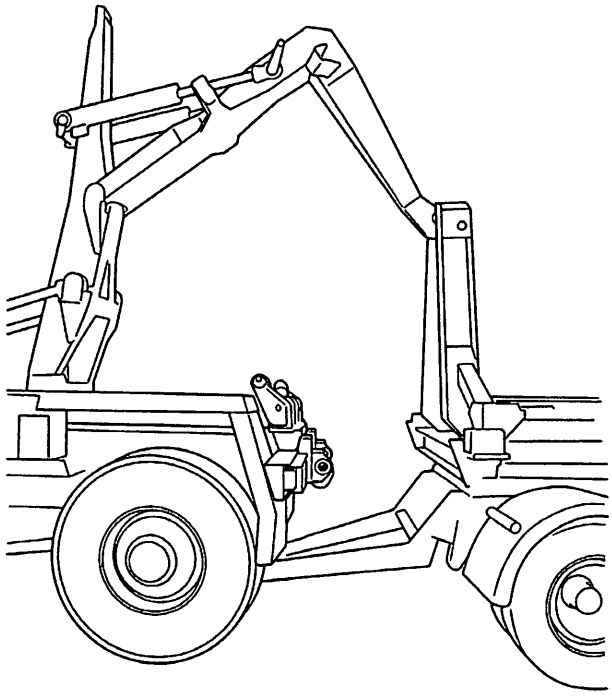


Fig 42 'A' frame prepared for cross loading

98.12 Switch off the engine. Disengage all ISO locks.

98.13 Using RMS position 2, with the engine running at idling speed, select load on the joystick. Once the front end of the flatrack is clear of the bump-stops, apply park brake, revert to position 1 on the RMS, increase vehicle engine speed to approx 1500 rpm while within the guide rails and revert to tick-over when clear.

98.14 Continue to observe the flatrack to ensure it engages with the rollers on the DROPS vehicle, paying particular attention to the rear corner castings to ensure that they miss the front trailer bump-stops.

98.15 Continue the load procedure until the flatrack is fully seated on the DROPS. Once seated and the 'NO TRANS' light has extinguished, select position '0' on the RMS.

98.16 Move the vehicle forward 5M. Apply vehicle handbrake and turn off engine. Check security of the load.

98.17 The trailer ISO locks must be stowed in the fully locked position. Remove wheel chocks and support the 'A' frame using the landing leg.

98.1 The loading procedure is now complete.

98.2 Support the 'A' frame of the trailer with its support leg ready to carry out the coupling procedure.

Coupling & Uncoupling of a trailer MLRS using a FODEN DROPS IMMLC

99 GENERAL INFORMATION

99.1 The Trailer, Skeletal DROPS, 4 Wheel, MLRS Trailer is a medium mobility legacy vehicle primarily designed for operation with the DROPS Improved Medium Mobility Load Carrier (IMMLC). The trailer is capable of traversing prepared or semi- prepared road surfaces and cross country terrain. The trailer is dedicated to the transporting of purpose made MLRS flatracks (FR) loaded with the rocket pods which are used in by the MLRS vehicle

99.2 The MLRS Trailer is only certified to transport the MLRS Flatrack.

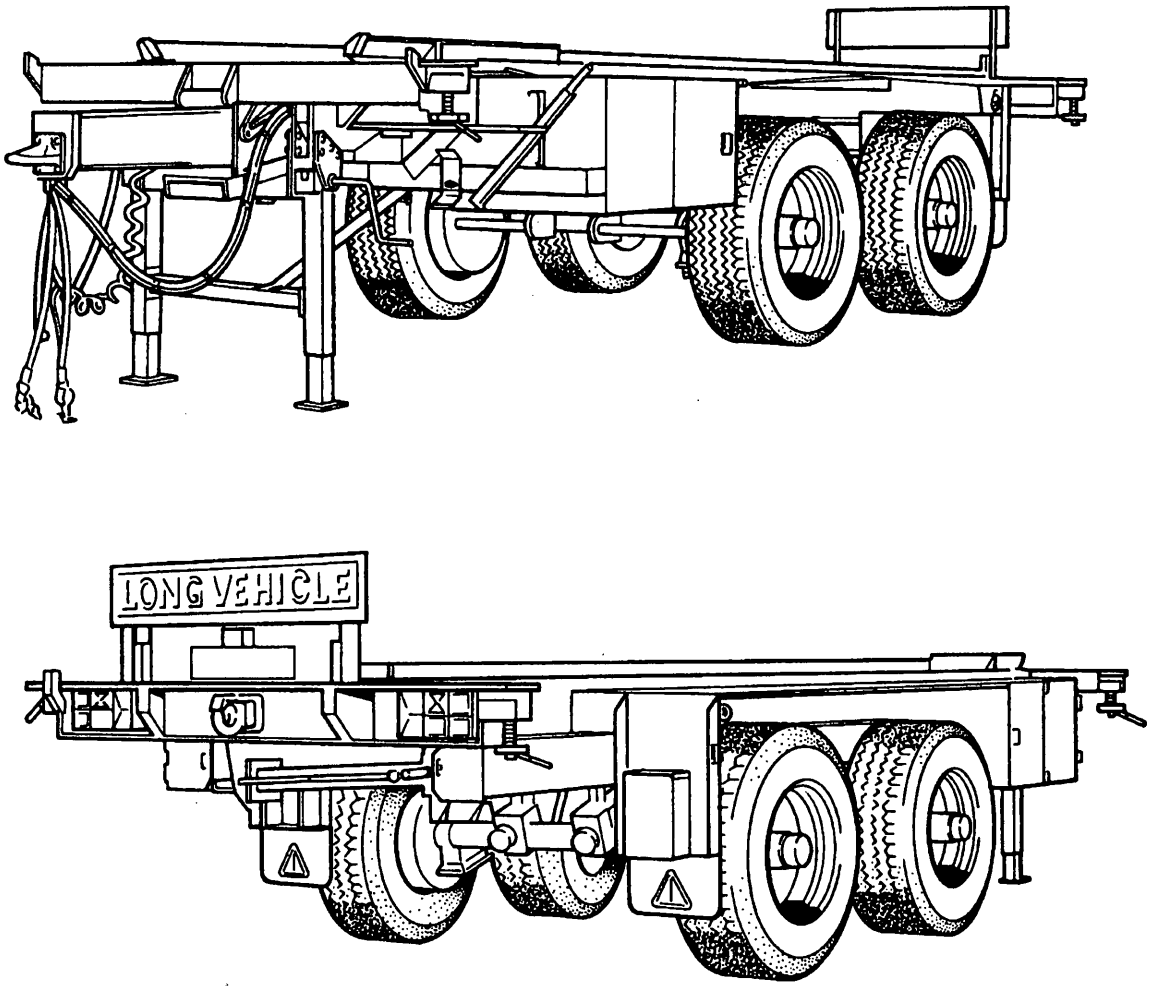


Fig 43 MLRS Trailer, Cargo, Skeletal, (DROPS)

100 COUPLING/UNCOUPLING THE TRAILER TO THE TOWING VEHICLE.

WARNINGS

(1) REFER TO AESP 2330-S-301-201 FOR FULL OPERATING INFORMATION FOR THE DROPS MLRS TRAILER.

(2) RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING A TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND WITH A MINIMUM OF TWO OPERATORS.

(3) RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND TRAILER WHEN THE VEHICLE IS MANOEUVRING.

(4) RISK OF SERIOUS INJURY. ENSURE THE DRAWBAR IS LOCKED IN POSITION BEFORE UN-SECURING THE VEHICLE

(5) RISK OF SEVERE INJURY. ENSURE THAT THE TRAILER COUPLING IS FULLY LOCKED BEFORE TOWING THE TRAILER

(6) RISK OF SERIOUS INJURY. WHEN THE TRAILER PARK BRAKE IS ENGAGED AND THE WHEELS ARE CHOCKED DO NOT REVERSE VEHICLE WHEN THE TRAILER DRAWBAR RELEASE LEVER IS NOT PULLED OUT.

(7) RISK OF INJURY WHEN SELECTING DRIVE MANOEUVRE, SECURE VEHICLE USING FOOT BRAKE TO PREVENT VEHICLE ROLLING WHEN GEARBOX LAG IS TAKEN UP.

(8) RISK OF SERIOUS INJURY THE A, GP, S, AND CONVERTED A TO GP FLATRACKS ARE NOT CERTIFIED TO BE TRANSPORTED ON THE MLRS TRAILER.

(9) RISK OF SERIOUS INJURY. THE VEHICLE IS TO BE REVERSED UP TO THE TRAILER BY A MINIMUM CREW OF TWO. ONE CREW MEMBER IS TO BE POSITIONED TO THE SIDE AND TOWARDS THE REAR OF THE VEHICLE IN CLEAR VIEW OF THE DRIVER TO OBSERVE THE REAR OF THE VEHICLE AND THE FRONT OF THE TRAILER. UNDER NO CIRCUMSTANCES SHOULD ANY INDIVIDUAL STAND BETWEEN THE VEHICLE AND THE TRAILER WHILST MANOEUVRING IS IN PROGRESS.

(10) RISK OF SERIOUS INJURY. CHOCK THE TRAILER ROADWHEEL IN THE DIRECTION OF TRAVEL PRIOR TO THE COMMENCMENT OF COUPLING/UNCOUPLING.

(11) RISK OF SERIOUS INJURY. ENSURE THAT THE TRAILER IS SECURELY COUPLED TO THE VEHICLE TOW HOOK AND THE AIR LINES AND ELECTRICAL CONNECTORS ARE CONNECTED BEFORE DRIVING OFF.

(12) RISK OF SERIOUS INJURY. BEFORE DRIVING OFF ALWAYS ENSURE THE LHS NO TRANSIT LIGHT IS EXTINGUISHED.

(13) RISK OF INJURY. DO NOT ATTEMPT TO LOAD OR OFFLOAD FROM THE TRAILER WITHOUT THE TRAILER DRAWBAR BEING COUPLED TO THE VEHICLE.

Cautions

(6) Do not exert pressure on the handle when stowing the landing legs. Winding must stop as soon as resistance is felt when the legs are in the stowed position. The handles must, if necessary, be turned back to be secured.

101 COUPLING THE TRAILER TO THE VEHICLE.

WARNING RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING A TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND WITH A MINIMUM OF TWO OPERATORS.

101.1 Ensure that the trailer park brake is applied refer to AESP 2330-S-301-201 and fit chocks behind the rear wheels.

101.2 Carry out daily before use checks on the trailer in accordance with AESP 2330-S-301-601 Table 6.

101.3 Ensure the drawbar is unlocked and in the midway position.

101.4 Ensure the rear landing leg is deployed in accordance to AESP 2330-S-301-201 Chap 2

101.5 Unlock the rear tow hook of the vehicle; refer to AESP 2320-R-301-201.

101.6 Adjust the height of the drawbar until the position of the tow eye is slightly higher than the open tow hook of the vehicle. Refer to AESP 2330-S-301-201 Chap 2 for landing leg operation.

101.7 Ensure tow hook is securely closed and that the locking pin is in position.

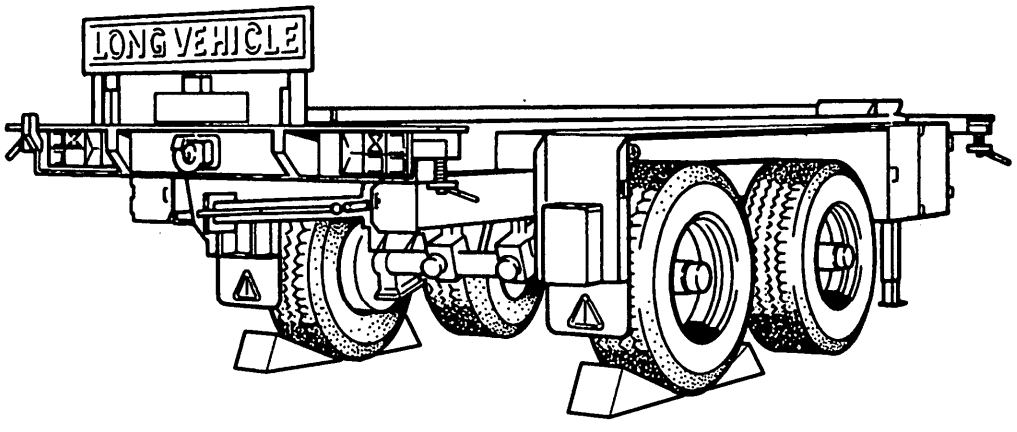


Fig 44 Showing wheel chocks in position

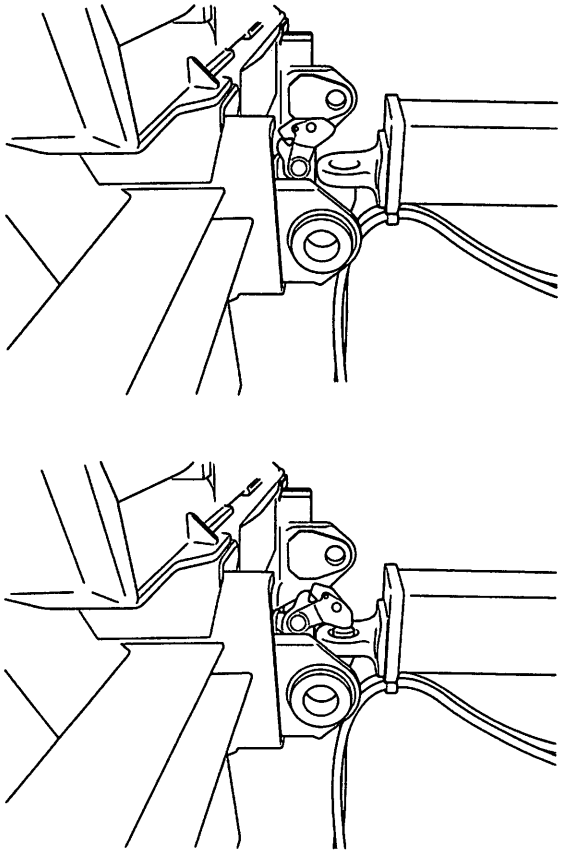


Fig 45 Drawbar positioned for coupling/uncoupling

WARNING RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND TRAILER WHEN THE VEHICLE IS MANOEUVRING.

101.8 Under guidance reverse the vehicle until it is approximately 1 metre away from the trailer, apply vehicle park brake and switch off the engine.

101.9 Check trailer tow eye height and alignment to vehicle tow hook. Check vehicle tow hook is open. Readjust drawbar height if required.

101.10 Continue reversing, under guidance until the trailer coupling come into contact with the trailer tow hook. Apply vehicle park brake and switch off the engine.

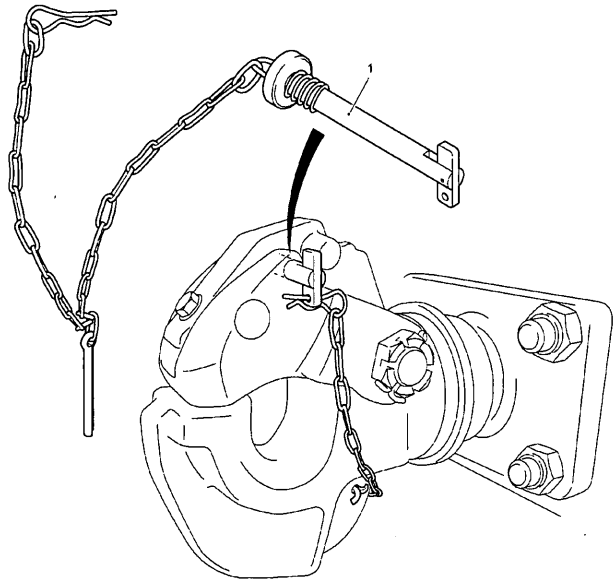


Fig 46 Tow hook locking pin location

101.11 Raise and stow the front landing legs in accordance with AESP 2330-S-301-201 Chap 2.

101.12 Connect the palm couplings and connect the electrical lighting plug, 2 pin socket and ABS cable in accordance with Fig. 6, ensuring the correct socket is used for trailer lights. Refer to AESP 2320-R-301-201.

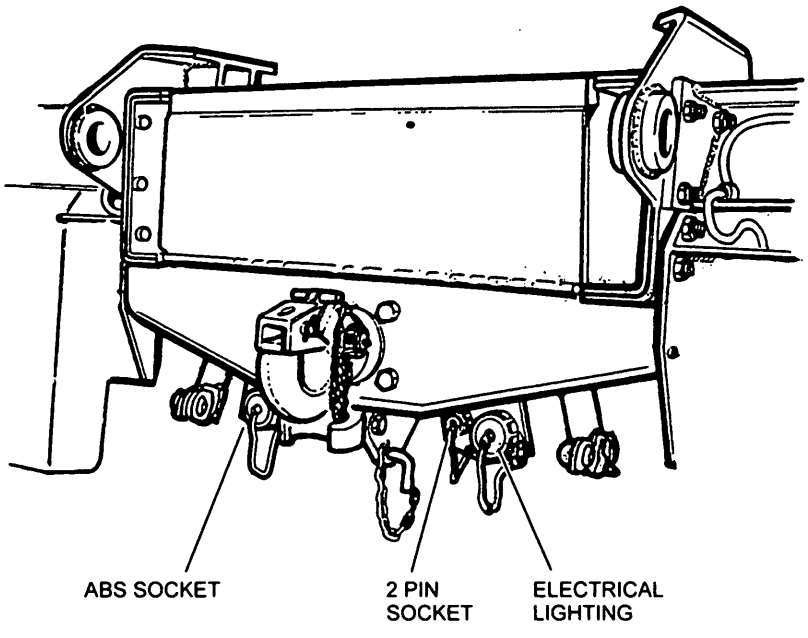


Fig 47 Electrical connection points on vehicle

101.13 Ensure that the trailer drawbar lock is set to couple.

101.14 Start the vehicle engine and build up the air pressure. Select drive, drive the vehicle forward slowly until the trailer drawbar locks out.

101.15 Select reverse and carry out two push tests. Ensure that the drawbar lock is engaged.

101.16 Remove the chocks from behind the rear wheels of the trailer.

WARNING SEVERE INJURY. ENSURE THAT THE TRAILER COUPLING IS FULLY LOCKED BEFORE TOWING THE TRAILER.

101.17 Complete lighting check of vehicle and trailer.

101.18 Release trailer park brake.

101.19 Complete vehicle movement check to ensure rotation of all wheel stations and operation of brakes.

101.20 Drive away.

102 UNCOUPLING THE TRAILER FROM THE VEHICLE.

WARNING. RISK OF SERIOUS INJURY. THE SEQUENCE OF COUPLING/UNCOUPLING A TRAILER TO THE VEHICLE IS TO BE CARRIED OUT ON FIRM LEVEL GROUND WITH A MINIMUM OF TWO OPERATORS.

102.1 Park the vehicle and trailer combination on firm level ground in a suitable location to uncouple the trailer. Apply the vehicle handbrake and turn off the engine.

102.2 Apply the trailer park brake and fit a chock either side of one of the rear trailer wheels (Fig 22).

102.3 Disconnect the electrical cables and air palm couplings and store them in accordance with AESP 2330-S-301-201.

102.4 Deploy the rear landing leg until approximately 50mm above the ground.

WARNING. RISK OF SERIOUS INJURY. WHEN THE TRAILER PARK BRAKE IS ENGAGED AND THE WHEELS ARE CHOCKED DO NOT REVERSE VEHICLE WHEN THE TRAILER DRAWBAR RELEASE LEVER IS NOT PULLED OUT.

WARNING. RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND TRAILER WHEN THE VEHICLE IS MANOEUVRING.

102.5 Pull out the drawbar lock release lever.

102.6 Return to vehicle start the engine, select reverse and release park brake.

102.7 Under guidance reverse the vehicle until the drawbar is at midway position.

102.8 Apply vehicle park brake and switch off engine.

102.9 Deploy the trailer front landing leg until the tow eye is free in the tow hook. Unlock the tow hook and adjust the height of the drawbar until the position of the tow eye is clear of the open tow hook. Refer to AESP 2330-S-301-201 Chap 2 for landing leg operation.

102.10 Return to the vehicle, start the engine, select drive and under guidance drive the vehicle forward slowly until the vehicle is at least one metre clear of the trailer.

102.11 Apply the vehicle park brake and switch off the engine. Close the rear tow hook and refit electrical socket covers.

Cross Loading & Unloading an MLRS Flatrack Trailer Using a FODEN DROPS IMMLC

103 CROSS LOADING/UNLOADING AN MLRS FLATRACK.

WARNINGS.

(1) REFER TO AESP 2330-S-301-201 FOR FULL OPERATING INFORMATION FOR THE DROPS MLRS TRAILER.

(2) RISK OF SERIOUS INJURY. THE TRAILER MUST REMAIN COUPLED TO THE VEHICLE BEFORE ANY ATTEMPT IS MADE TO LOAD OR UNLOAD THE FLATRACK.

(3) RISK OF SERIOUS INJURY. GROUND CONDITIONS MUST BE CHECKED FOR FIRMNESS AND SIDEWAYS INCLINATION BEFORE LOADING OR OFF LOADING A FLATRACK.

(4) RISK OF SERIOUS INJURY. THE VEHICLE IS TO BE REVERSED UP TO THE TRAILER BY A MINIMUM CREW OF TWO. ONE CREW MEMBER IS TO BE POSITIONED TO THE SIDE AND TOWARDS THE REAR OF THE VEHICLE IN CLEAR VIEW OF THE DRIVER TO OBSERVE THE REAR OF THE VEHICLE AND THE FRONT OF THE TRAILER. UNDER NO CIRCUMSTANCES SHOULD ANY INDIVIDUAL STAND BETWEEN THE VEHICLE AND THE TRAILER WHILST MANOEUVRING IS IN PROGRESS.

(5) RISK OF SERIOUS INJURY. DO NOT ENTER THE AREA DIRECTLY UNDERNEATH THE FLATRACK DURING OPERATION OR IF IN THE RAISED POSITION.

(6) RISK OF SERIOUS INJURY. CHOCK THE TRAILER ROAD WHEELS PRIOR TO THE COMMENCEMENT OF LOADING/UNLOADING A FLATRACK.

(7) RISK OF SERIOUS INJURY. MAKE SURE NO ONE IS STANDING BETWEEN THE VEHICLE AND THE TRAILER DURING CROSS LOADING OPERATION.

(8) RISK OF SERIOUS INJURY. ONLY MLRS FLATRACK MAY BE CROSS LOADED ON AND OFF THE MLRS TRAILER.

(9) RISK OF SERIOUS INJURY. BEFORE DRIVING OFF ALWAYS ENSURE THE LHS NO TRANSIT LIGHT IS EXTINGUISHED IN THE CAB OF THE DROPS.

(9) RISK OF INJURY. VISUALLY ENSURE DIN LOCKS ARE ENGAGED WITH FLATRACK WHEN LOADED.

(11) RISK OF SERIOUS INJURY. A, GP, S AND CONVERTED A TO GP TYPE FLATRACKS ARE NOT AUTHORISED TO BE TRANSPORTED ON THE MLRS TRAILER.

(12) RISK OF INJURY. NEVER OPERATE THE HOOK LIFT SYSTEM CLOSE TO ABOVE-GROUND ELECTRICITY CABLES.

Cautions

(7) Do not attempt to cross load or unload with the tow bar of the trailer fully extended

104 CROSS LOADING – LOADING AN MLRS FLATRACK TO AN SWB TRAILER.

104.1 Park vehicle and trailer on firm level ground, ensure the trailer is coupled to the vehicle with the drawbar in the midway position and the vehicle is laden with an MLRS flatrack. Refer to AESP 2320-R-301-201.

104.2 Apply the vehicle park brake and switch off the engine. Apply trailer park brake and chock the rear wheels in both directions. Carry out ALPHA checks.

104.3 Disconnect the trailer hoses and cables and stow in their holders. Ensure the ISO locks are in the fully lowered position.

WARNING. RISK OF INJURY. ENSURE ALL OF THE TRAILER ISO LOCKS ARE FULLY DISENGAGED AND NOT PROTRUDING FROM THE LOAD BED.

104.4 Release the drawbar lock by pulling the lever firmly out.

104.5 Select reverse gear, under guidance and at idle speed reverse the vehicle until the drawbar is fully retracted. Apply the handbrake and select neutral. Dismount the vehicle and check the alignment of the vehicle and trailer.

104.6 Re-enter the vehicle, select automatic mode and, at idle speed, start to transfer the flatrack from the vehicle to the trailer. Release the LHS joystick before the flatrack has come into contact with the rear of the trailer (Fig 28).

104.7 Release the vehicle handbrake which will allow it to be pushed forward. Continue to off-load, this will ensure that the flatrack sits squarely on the trailer. Reapply the vehicle handbrake once in position.

104.8 Place the ISO locks to the 'Loose Lock' position.

104.9 At idling speed, disengage the hook from the bail bar, select first gear and, at the same time, operating the LHS joystick in the 'off-load' position.

104.10 Stop once the hook is disengaged from the bail bar, apply the vehicle handbrake and select neutral.

WARNING. RISK OF SEVERE INJURY, ENSURE THE LHS HOOK IS FULLY DISENGAGED FROM THE BAIL BAR BEFORE MOVING THE VEHICLE.

104.11 At idle speed, drive the vehicle forward until there is a minimum 1M clearance.

104.12 Stow the LHS in accordance with AESP 2320-R-301-201.

104.13 Fully engage twist locks.

104.14 Carry out lights and brakes checks and that the trailer wheels are rotating. The vehicle and trailer is now ready for road transportation.

NOTE:

(1) Before driving off with the trailer coupled, ensure that the drawbar is locked in the fully forward position, the ISO locks are fully locked and the trailer handbrake is released.

(2) Only MLRS flatracks may be carried on this type of SWB trailer.

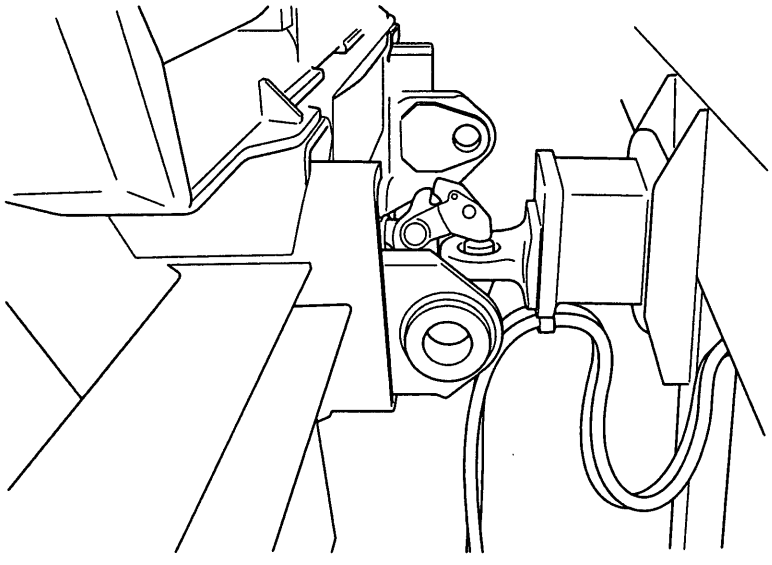


Fig 48 Vehicle at correct distance for loading

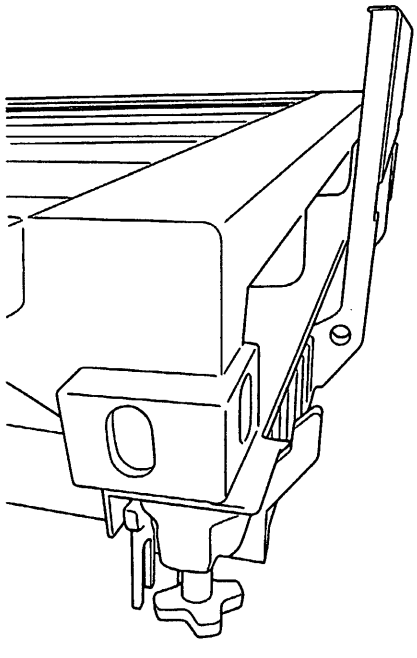


Fig 49 Flatrack in contact with trailer rear bump stops

105 CROSS LOADING - UNLOADING AN MLRS FLATRACK FROM THE SWB TRAILER.

105.1 Park vehicle and trailer on firm level ground, ensure the trailer is coupled to the vehicle with the drawbar in the midway position. Refer to AESP 2320-R-301-201.

105.2 Apply the vehicle park brake and switch off the engine. Apply trailer park brake and chock the rear wheels in both directions. Ensure the rear legs followed by the front support legs are deployed. Carry out ALPHA checks.

105.3 With the vehicle engine running at idling speed, select 'AUTO' (position 1) on the LHS rotary mode switch. The PTO will automatically engage and the warning light illuminate.

105.4 Move the LHS joystick to the unload position. The Hook Arm then the Middle Frame will rise. The 'NO TRANS' light will illuminate (once the LHS starts to move, increase to approx 1500 rpm). Release the LHS joystick when the hook is slightly lower than the 'A' frame bail bar.

105.5 Set ISO twist locks to 'Loose Lock' position.

105.6 Release the drawbar lock by pulling the lever firmly out (located on the LHS of the trailer) reverse the vehicle to release the drawbar.

WARNING. RISK OF SERIOUS INJURY. THE BAIL BAR OF THE FLATRACK MUST BE FULLY ENGAGED BEFORE ATTEMPTING TO LIFT LOAD.

105.7 With the LHS deployed reverse the vehicle under guidance until the LHS is approx 1M from the flatrack bail bar. The trailer telescopic drawbar will retract. Apply park brake.

105.8 Check height of the LHS in relation to the bail bar.

WARNING. RISK OF SERIOUS INJURY. THE BAIL BAR OF THE FLATRACK MUST BE FULLY ENGAGED BEFORE ATTEMPTING TO LIFT LOAD.

105.9 Continue to reverse the vehicle until the LHS is directly below the flatrack bail bar. Apply vehicle park brake. Operate the LHS to engage the bail bar.

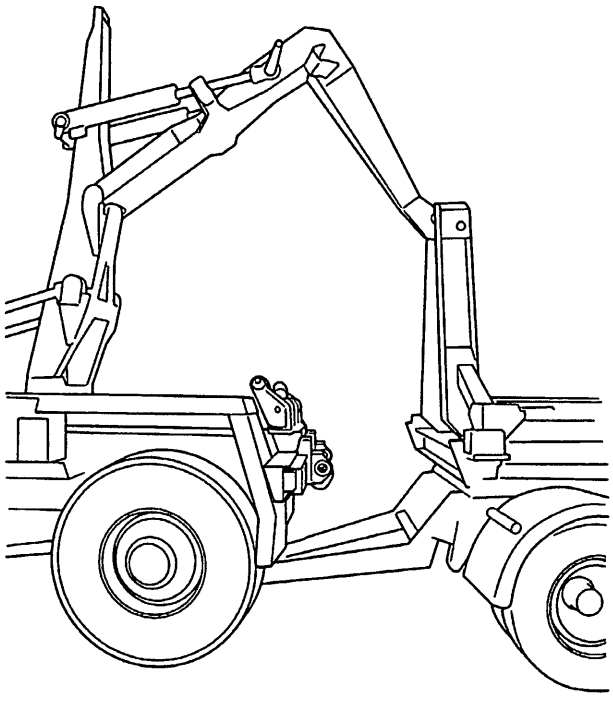


Fig 50 'A' frame prepared for cross loading

105.10 Switch off the engine. Disengage all ISO locks.

105.11 Release the vehicle handbrake. Start to load until the front corner castings are clear of the front bump-stops then stop operations and apply handbrake.

105.12 In automatic mode, restart engine apply foot brake and release park brake. Release foot brake and at engine idle speed operate the control lever to the LOAD position until the front of the flatrack is clear of the front locating lugs of the trailer. Apply vehicle park brake.

105.13 Set the engine to run at a maximum of 1000 rpm until the loading operation is finished.

105.14 Engage first gear and pull forward at idle speed, the drawbar will automatically extend. Apply vehicle handbrake, turn off engine.

105.15 Disconnect the trailer in accordance with AESP 2320-R-301-201.

105.16 The loading procedure is now complete.

VEHICLE RECOVERY INSTRUCTIONS

CAUTIONS

(8) Ensure the engine start key is fitted in the steering column switch to release the steering lock. Due to the high front axle load care must be exercised during towing using the recovery eyes when negotiating tight bends.

(9) Care should be exercised when towing across country using a rigid tow bar as the front pin jaw will only allow limited vertical movement.

(10) Ensure that the front emergency (red) and service (yellow) air couplings are connected between the recovery vehicle and the casualty. A minimum air pressure of 5.8 bar (85 lbs/sq in) is required to release the spring brakes.

(11) If the casualty electrical system is inoperative the recovery vehicle lighting set should be used.

(12) Ensure that all differential locks and front wheel drive are disengaged before commencing towing.

Cab control positions - before towing away

106 The gear selector (See chap 2 Fig 1 (63)) should be in the neutral position.

107 The retarder button (See chap 2 Fig 1 (61)) should be off.

108 Raise the lid of the platform for the hatch observer and ensure that the emergency PTO button (See chap 2 Fig 1 (59)) is 'OUT' and the emergency gear selector lever (See chap 2 Fig 1 (60)) is in the neutral position.

109 Also in the hatch observer platform is the emergency spring brake release lever (See chap 2 Fig 1 (57)). In the case of the total loss of air pressure in the casualty braking circuits, operation of this lever will allow air from an independent reservoir to release the spring brakes for one application only.

NOTE

A warning bell will sound with the casualty electrics switched on when emergency spring brake release is selected

110 A secondary oil pump incorporated in the gearbox allows, forward towing without disconnection of propshaft.

111 The casualty may be towed without restriction to distance but speeds must be reduced accordingly.

112 Should the casualty engine be inoperative, a gearbox driven emergency steering pump will provide hydraulic power to the steering system while the casualty is moving in either direction.

113 In the case of failure of either the gearbox, steerdrive axle, or rear bogie axles the stricken component should be isolated by removing the appropriate propshafts.

Front and rear towing points

114 The front bumper incorporates a towing pin and jaw, the rear chassis cross member a towing pintle. Recovery eyes to DEF STAN 25-6/3 are fitted to the front and rear of the vehicle. Recovery eyes can only be used for suspend tows.

Rigid towing, front

115 The casualty can be towed laden or unladen.

Rigid towing, rear

116 The casualty can be towed laden or unladen for a minimum distance after disconnection of the gearbox to transposing box propshaft. Power assisted steering will not be available with the engine inoperative.

SUSPEND/SUPPORT TOWING - FRONT AND REAR

CAUTIONS

(13) The casualty MUST NOT be suspend/support towed rearwards laden.

(14) Ensure that lifting equipment is kept clear of the cab front panel and windscreen.

(15) When fitted with a flatrack, the flatrack overhang could cause an obstruction to the lifting equipment.

(16) When fitted with LHS (Load Handling System) with a laden or unladen flatrack mounted, the flatrack must be dismounted, if the casualty is inoperative for this procedure, then another MMLC or IMMLC should be used as the power source

117 The casualty may be suspend/support towed laden or unladen observing CAUTIONS 1, 2, 3 and 4.

Hook lift weight

118 The hook lift weight is 8.6 tonnes.

Vehicle weight unladen

119 The vehicle unladen weight with LHS, and 'A' type flatrack mounted, two crew with full kit and full fuel load is [redacted]

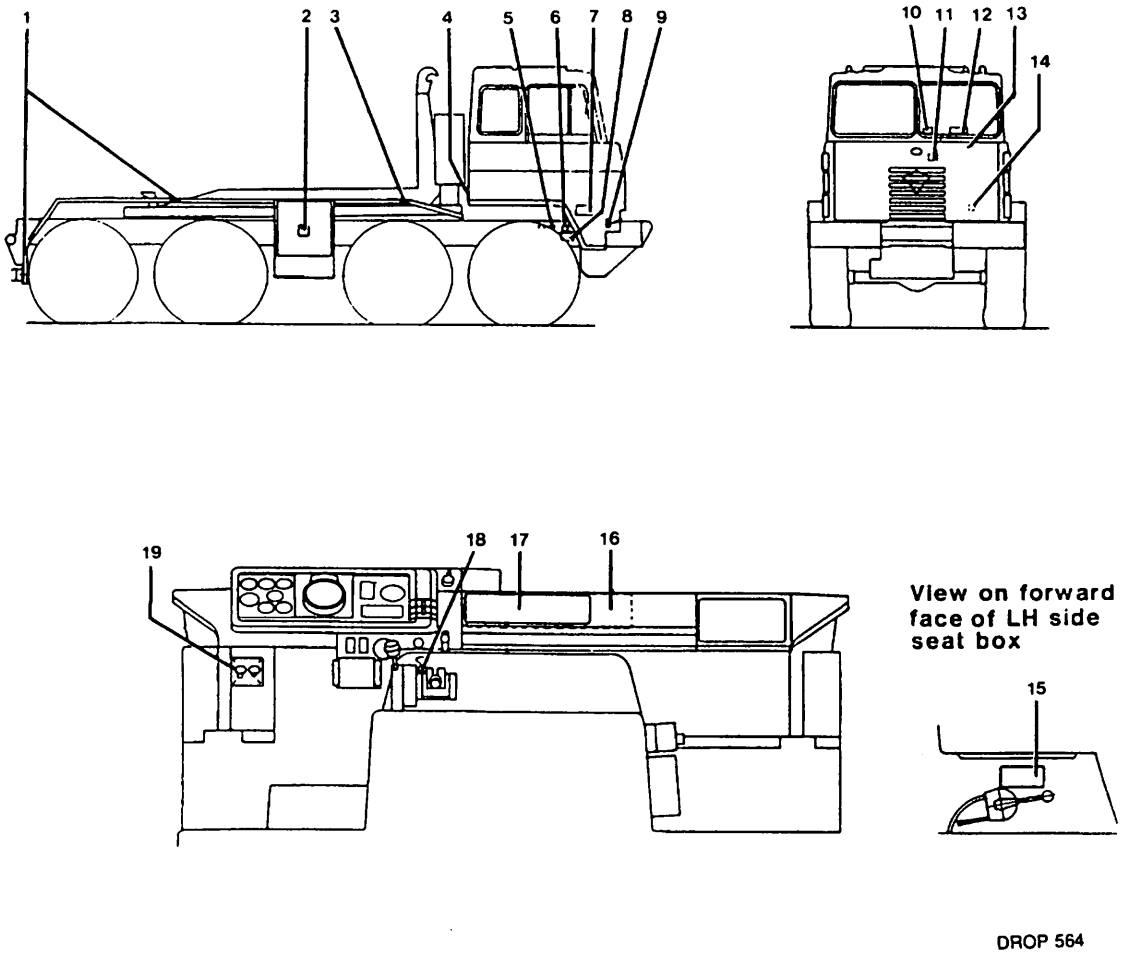
120 The vehicle weight unladen with LHS mounted, two crew and full fuel load is [redacted]

Vehicle all up weight

121 The vehicle all up weight with LHS and fully laden flatrack mounted is [redacted]

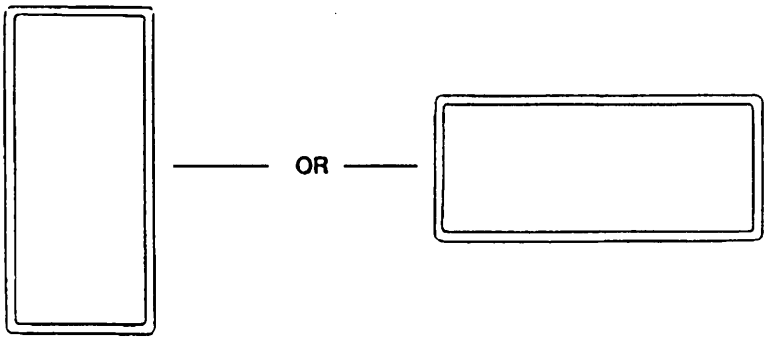
LOCATION OF WARNING AND INSTRUCTION LABELS

122 Situated throughout the DROPS IMMLC vehicle are various warning and instruction labels with which the driver/operator of this equipment must be aware. Fig 32 shows the general disposition of these labels and subsequent Figs show the detail and shape of each label. Driver/operators of the IMMLC vehicle must locate these labels and read the instructions shown inscribed, before operating the equipment.



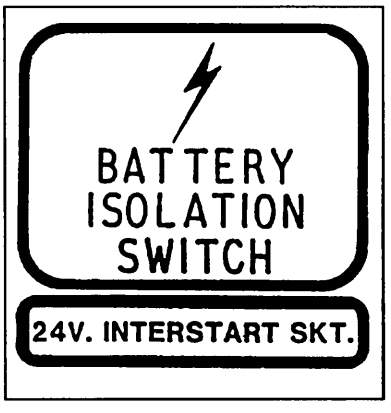
1	Side reflector	7	RH step pocket	14	Filler cap
2	Locker containing battery master isolation switch	8	RH sidemember	15	Seat box front
		9	Side reflector	16	Inside console lid
3	Side reflector	10	Windscreen	17	Console lid
4	Cab tilt pump	11	Radiator	18	Console
5	Steering shaft	12	Windscreen	19	Console
6	RH sidemember	13	Nacelle		

Fig 51 Reflector and warning label disposition



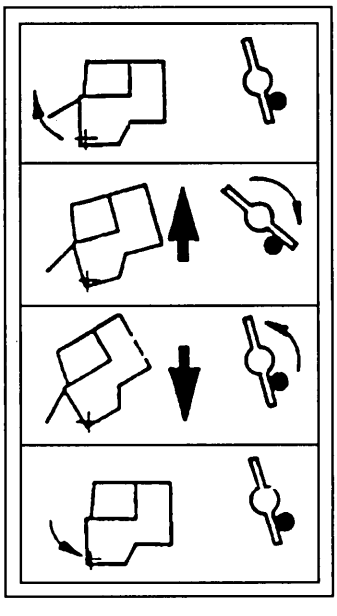
DROP 565

Fig 52 Side reflectors



DROP 566

Fig 53 Battery isolation and interstart label

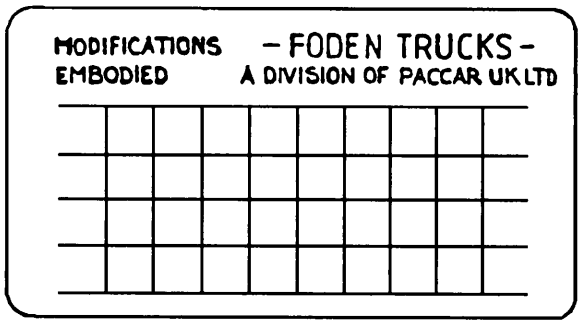


DROP 567

Fig 54 Cab Tilt Label

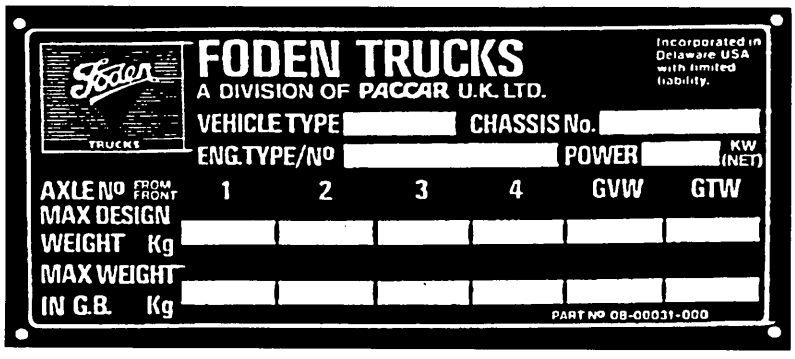
DROP 568

Fig 55 Do not step label



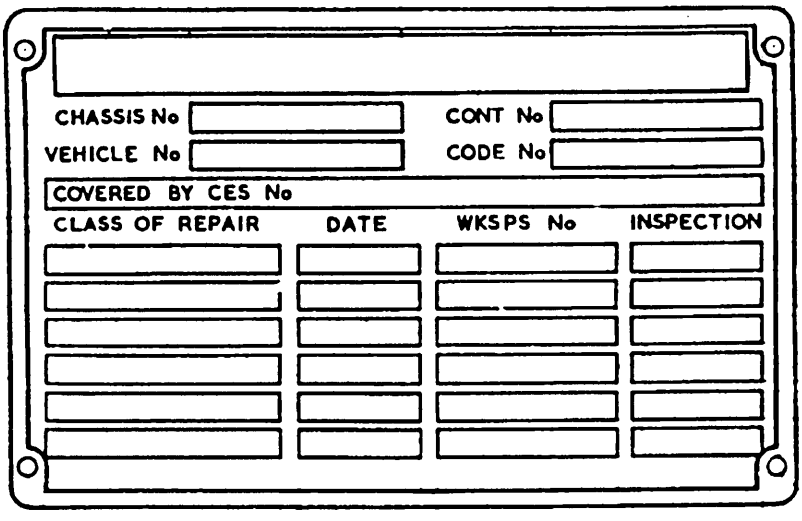
DROP 569

Fig 56 Modification plate



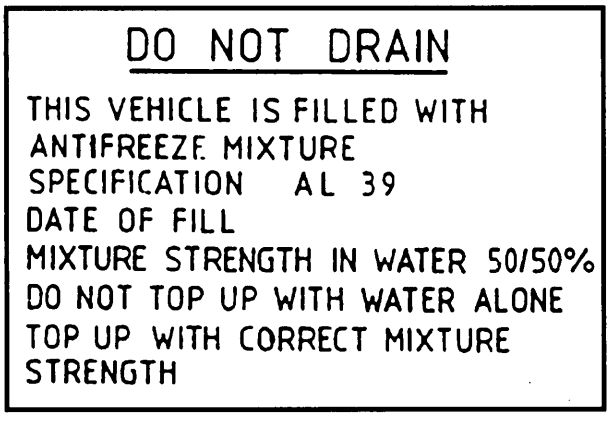
DROP 570

Fig 57 Manufacturer Plate



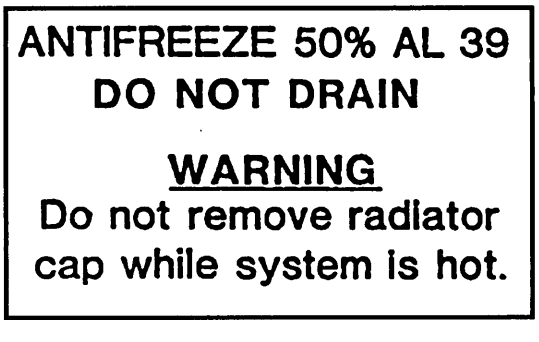
DROP 571

Fig 58 Nomenclature Plate



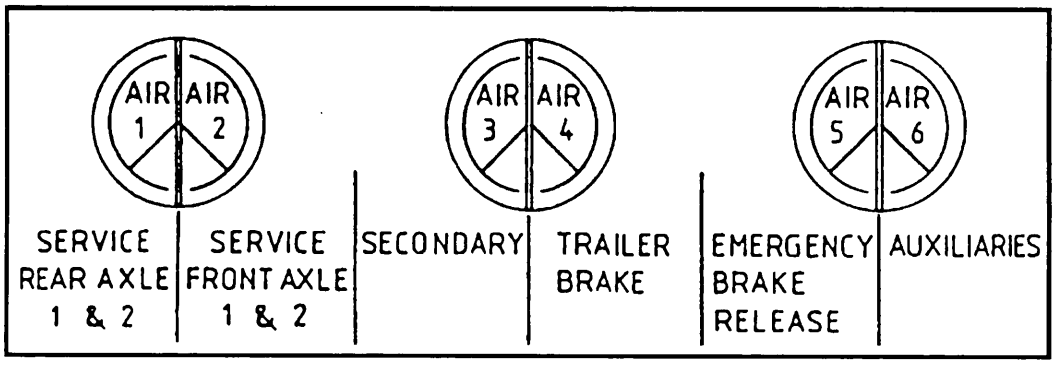
DROP 572

Fig 59 Do not drain label



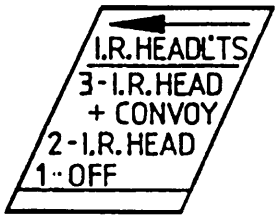
DROP 573

Fig 60 Radiator - DO NOT DRAIN AND CAP REMOVED warning label



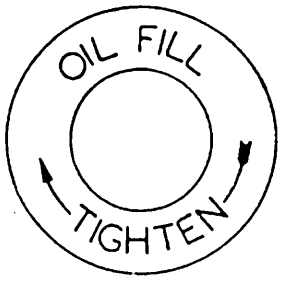
DROP 505

Fig 61 Air gauge label



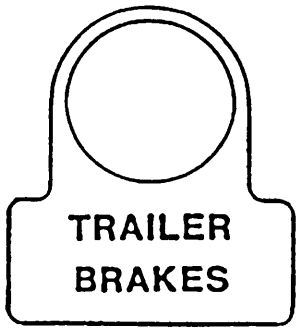
DROP 574

Fig 62 I.R. Headlight label



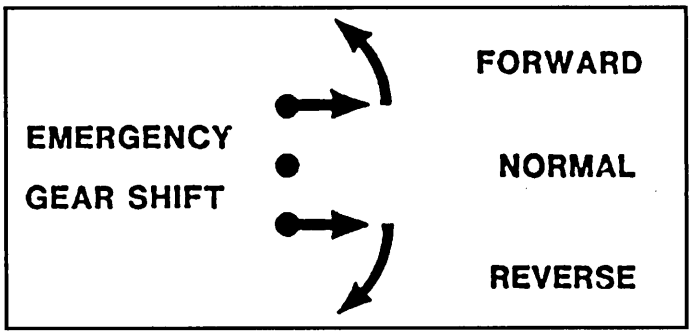
DROP 575

Fig 63 Oil filler label



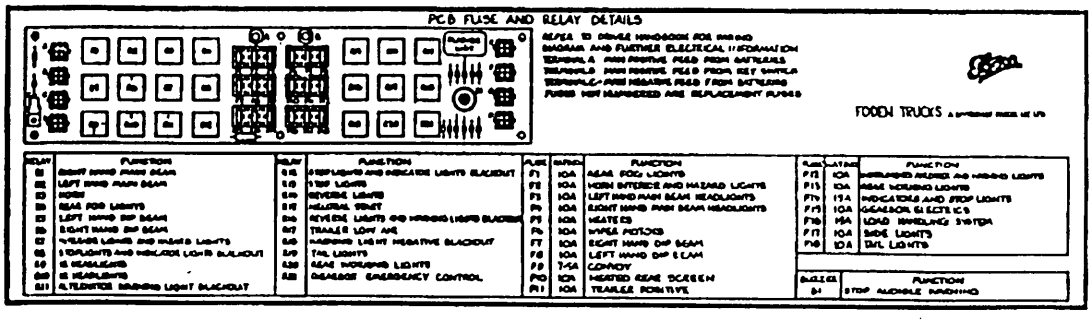
DROP 576

Fig 64 Trailer control valve label



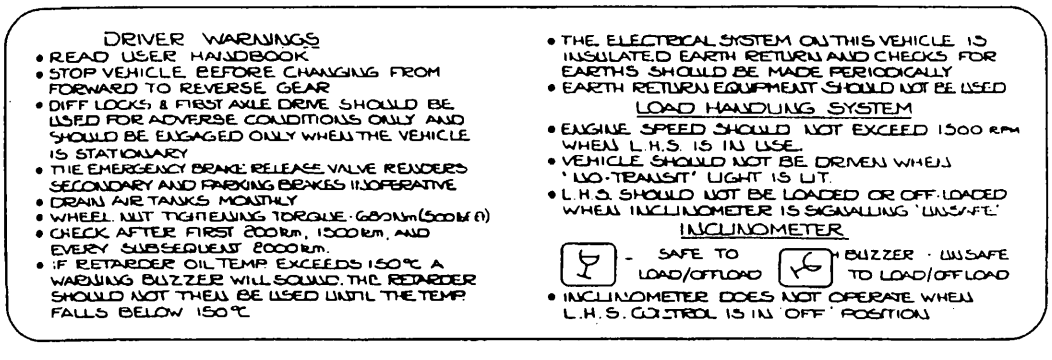
DROP 577

Fig 65 Emergency gear shift label



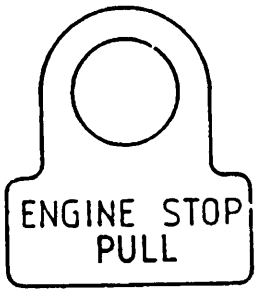
DROP 578

Fig 66 PCB fuse and relay label



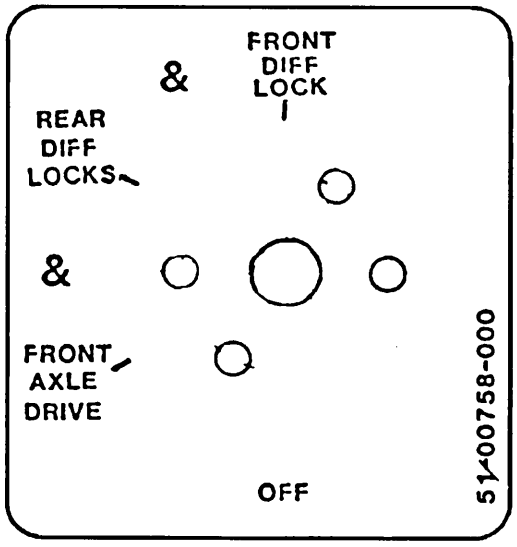
DROP 579

Fig 67 Driver warnings, LHS and inclinometer label



DROP 580

Fig 68 Engine stop label



DROP 581

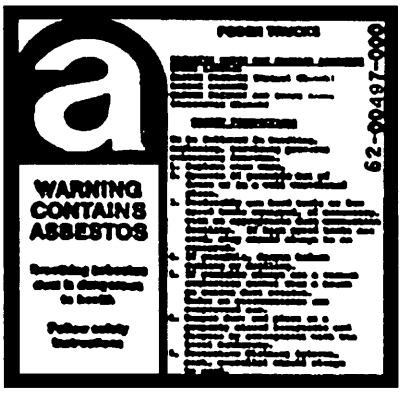
Fig 69 Traction control switch label

DROP 582

Fig 70 Chassis heat treatment label

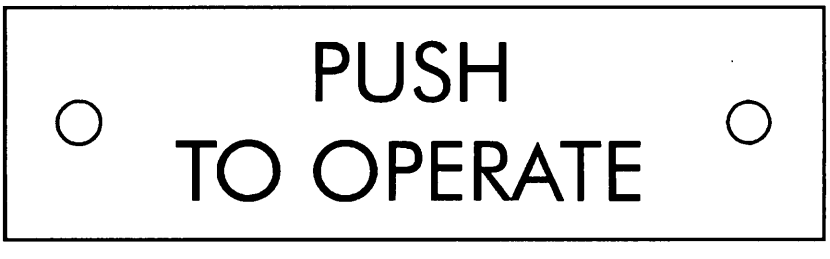
DROP 583

Fig 71 Emergency brake release label



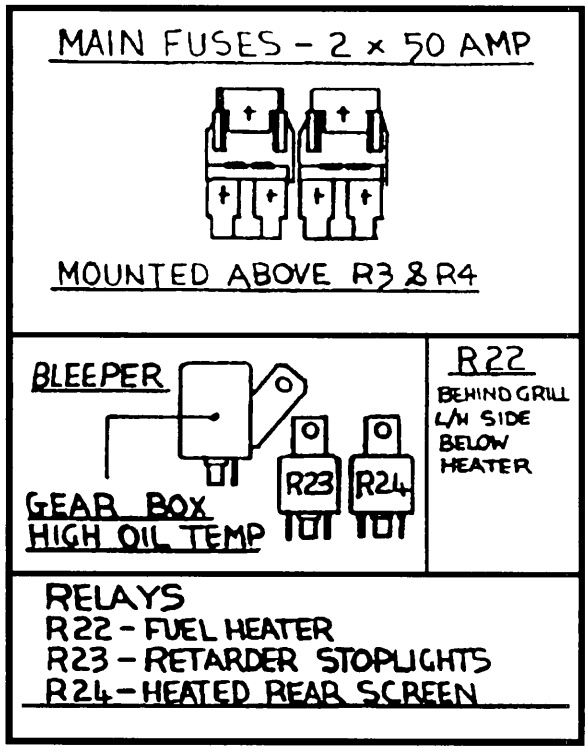
DROP 584

Fig 72 Asbestos warning label



DROP 585

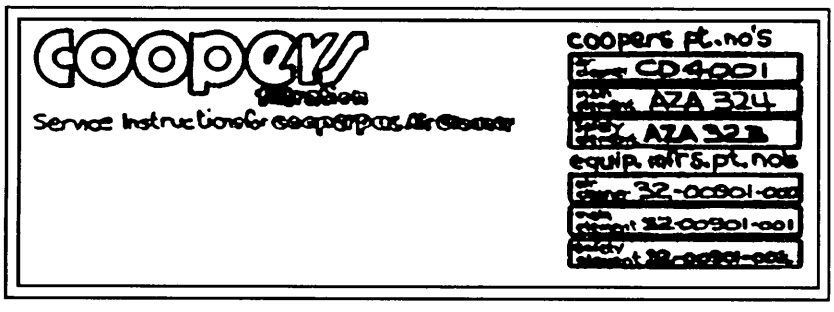
Fig 73 Trailer brake and emergency brake release operating label



DROP 586

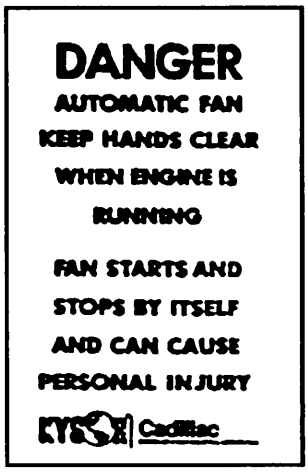
Fig 74 Main fuse label

SUITABLE FOR PROLONGED USE & STORAGE IN CLIMATIC CONDITIONS CATAGORIES A1 TO C1 INCLUSIVE OF DEF. STAN. 00-1
SUITABLE FOR OPERATION (WHERE APPLICABLE) ON MILITARY FUELS, LUBRICANTS & HYDRAULIC FLUIDS AS SPECIFIED IN DEF. STAN. 01 &, DEF.STAN. 01-5 FOR ABOVE CLIMATIC CONDITIONS.



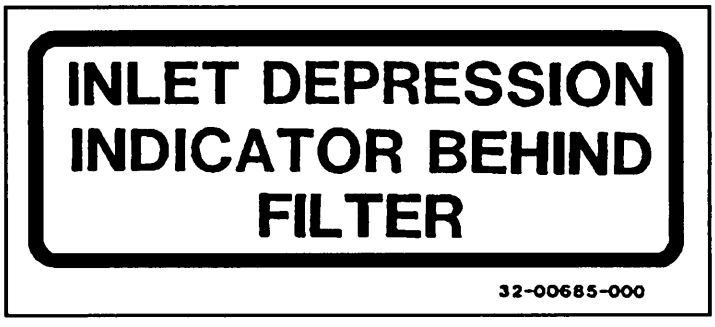
DROP 587

Fig 75 Air inlet filter label



DROP 588

Fig 76 Fan drive label



DROP 589

Fig 77 Air inlet indicator location label

CHAPTER 4

USER MAINTENANCE

CONTENTS

(continued)

CONTENTS (continued)

(continued)

CONTENTS (continued)

INTRODUCTION

1 The authority for carrying out all maintenance duties on this equipment is the Maintenance Schedule 2320-R-302-601. No intervals are given in this chapter for the tasks listed, these should be obtained from the above mentioned Maintenance Schedule.

WARNING

SAFETY OF MAINTENANCE PERSONNEL. BEFORE PROCEEDING WITH ANY MAINTENANCE, THE VEHICLE MUST BE SAFEGUARDED AGAINST ACCIDENTAL MOVEMENT OR INADVERTENT ENGINE IGNITION. SET THE HAND BRAKE TO ON, GEAR LEVER IN NEUTRAL POSITION AND DISCONNECT BATTERY.

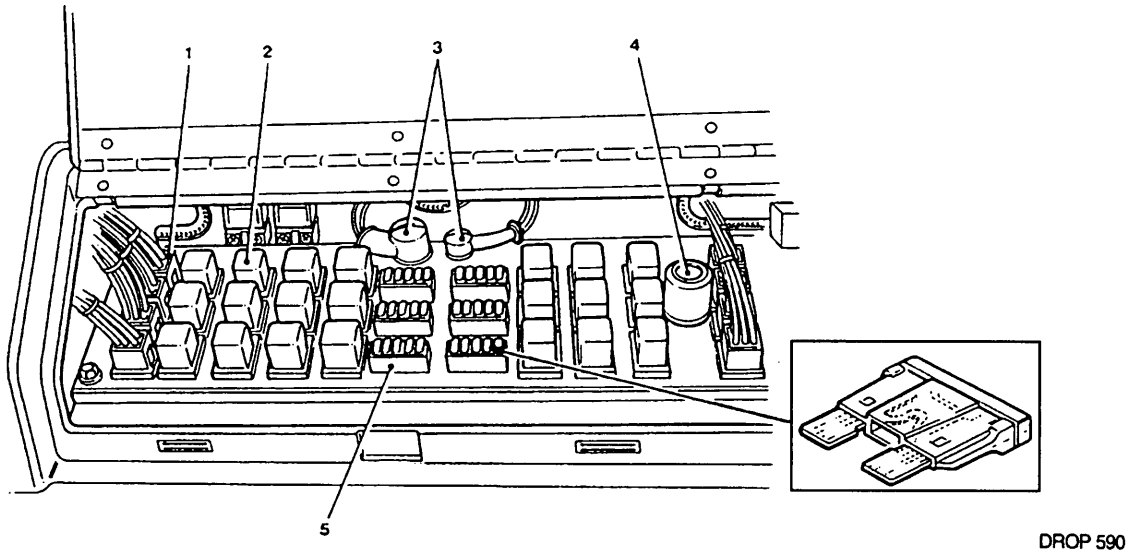
CAB

2 Cab user maintenance is restricted to changing; fuses in the main electrical panel, windscreen wiper blades, rear view and kerbside mirrors, cab and indicator turn light lamps and removal of cab seats. These user tasks are further detailed.

Main electrical panel

3 Should overloading of an electrical circuit occur, the appropriate fuse will fail. The reason for the fuse failure must be investigated and rectified before a new fuse is fitted.

3.1 The fuse holder is a blade type (see Fig 1 inset), colour coded and the amperage rating is printed on the top of the holder for ease of identification. Failed fuses must only be replaced by a fuse of the same rating. A failed fuse wire is easily recognised through the translucent body. Spare fuses are carried in the fuse holders.



DROP 590

1 Connections blocks
2 Relays
3 Main connections
4 Buzzer
5 Fuse blocks

Fig 1 Main electrical panel

Windscreen wiper blades

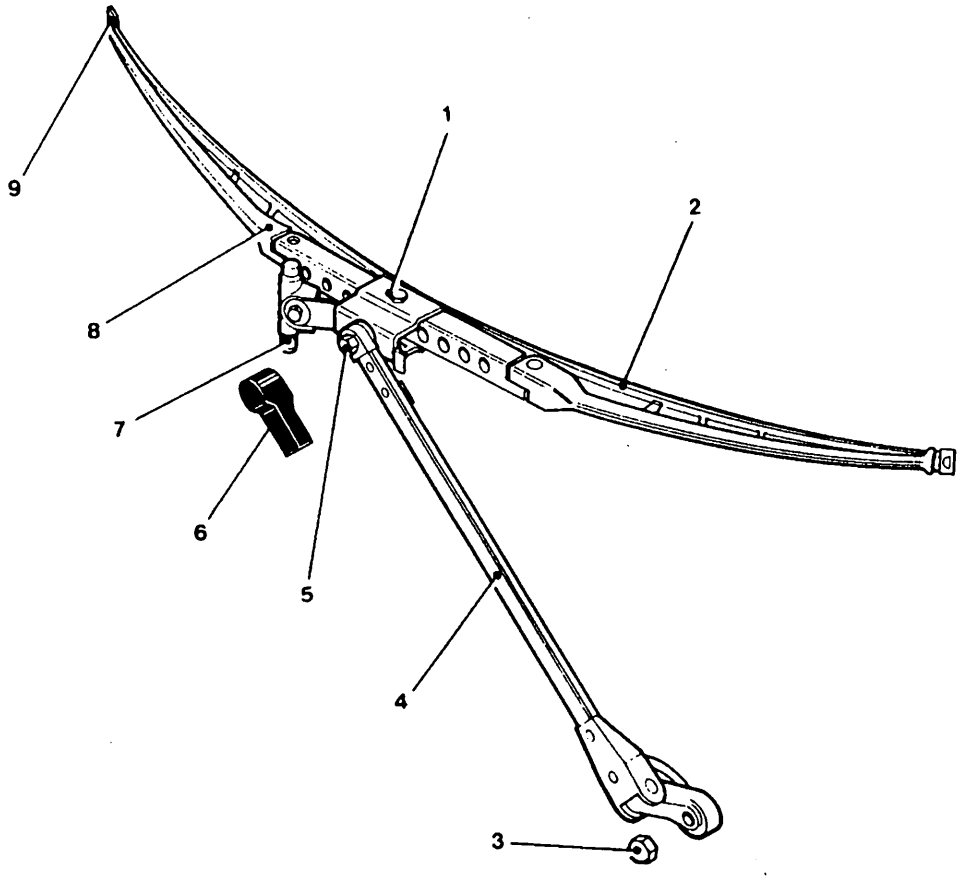
4 To remove and replace a windscreen wiper blade, proceed as follows:

4.1 To remove the blade rubber (Fig 2 (2)) release rubber retaining clips (9) and slide the worn rubber out of the support guides. Reverse the procedure for fitment.

4.2 To remove the blade rubber and support release the blade assembly screw and nut, (1).

4.3 To remove the blade rubber and support complete with washer jets, remove spindle retaining nut cover (6), disconnect water jet feed pipe (7) from the 'T' piece beneath the front grille and release the blade support assembly retaining nut (5).

4.4 To remove the blade assembly complete with arm, disconnect the windscreen jet feed pipe from the 'T' piece beneath the front grille, blade arm retaining nut (3) from the drive spindle and pull the whole blade assembly and arm off the serrated drive spindle.



DROP 591

1 Blade assembly screw and nut
2 Blade rubber
3 Blade arm retaining nut (spindle)
4 Blade arm
5 Blade support assembly retaining nut
6 Retaining nut cover
7 Washer jet feed pipe
8 Blade support
9 Rubber retaining clip

Fig 2 Windscreen wiper blade assembly

Mirrors

5 To remove the rear view and/or kerbside mirrors, proceed as follows:

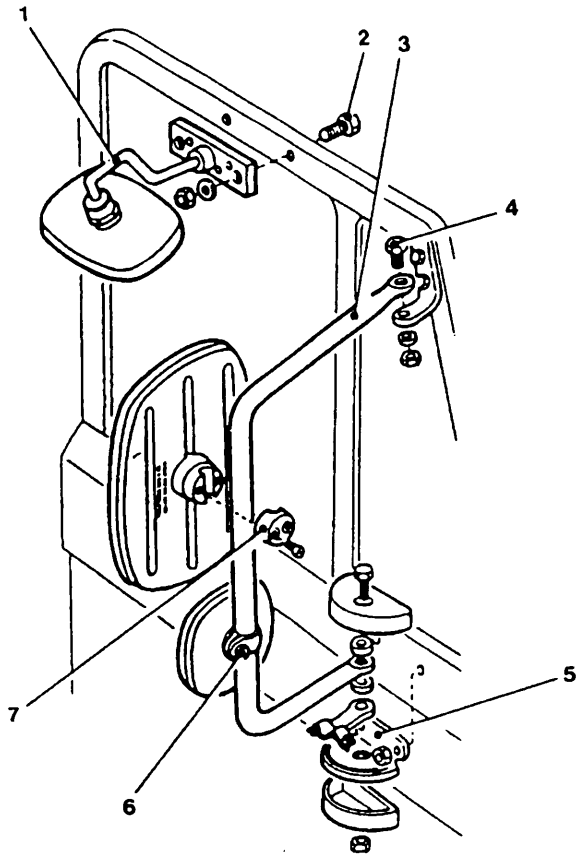
5.1 To remove the rear view mirror base, unscrew the two posidrive screws from the mirror base adjustment clamp, (Fig 3 (7)).

5.2 To remove rear view mirror assembly from the cab, unscrew the nut and mounting bolt (4) at the top of the arm and the nut and bolt at the bottom of the arm passing through the bottom quadrant bracket (5).

5.3 To remove the kerbside mirror assembly, unscrew the two self locking nuts from the kerbside mirror mounting bolt (2) securing the mirror base to the cab.

5.4 To remove the auxiliary mirror base, unscrew the two posidrive screws from the base adjustment clamp (6).

5.5 The mirror glass can be replaced by pulling back the surround seal to expose the complete mirror section, lifting the old mirror clear and fitting a replacement mirror. On completion refit the surround seal until it completely encloses the mirror edges.



DROP 592

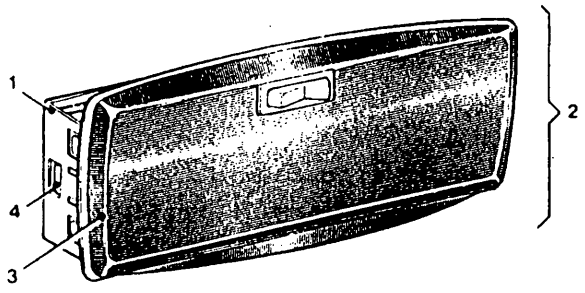
1 Kerbside mirror assembly
2 Kerbside mirror mounting countersunk bolt
3 Passenger side rear view mirror bracket
4 Mounting bolt and nut
5 Bottom quadrant bracket
6 Auxiliary mirror base adjustment clamp
7 Adjustment clamp

Fig 3 Rear and kerbside mirror mountings

Courtesy light

6 To replace a courtesy light lamp, proceed as follows:

6.1 A courtesy light is mounted above each door. Push lens (Fig 4 (3)) to one side and lift out locating tab (1) on opposite side and remove the lens. With reference to Chapter 5 of this publication for correct type of lamp, replace defective lamp(s). Check light function before replacing lens.



DROP 593

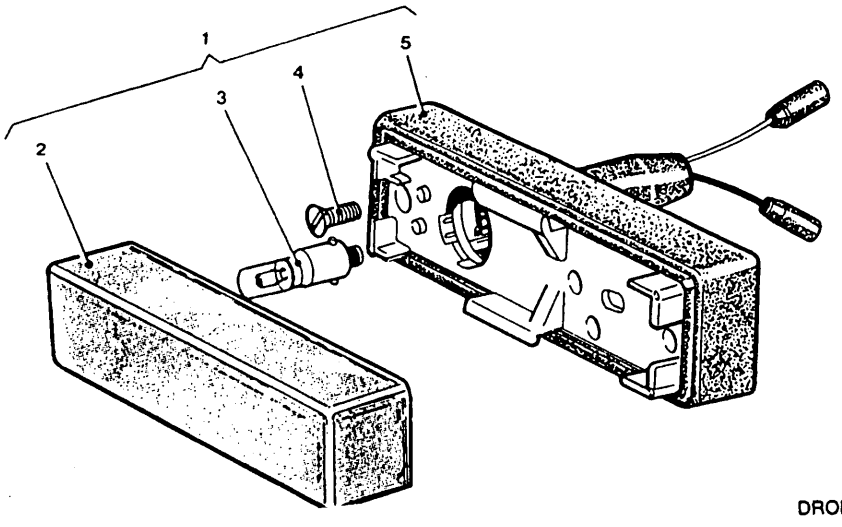
1 Assembly locating tab
2 Light assembly
3 Lens
4 Lens locating tab

Fig 4 Courtesy light

Indicator turn light - cab flank

7 To replace an indicator light lamp, proceed as follows:

7.1 An indicator turn light is mounted externally on each side of the cab to the rear of the cab doors. Gently prise the rubber base (Fig 5 (5)) from around the lens (2). Remove defective lamp (3) and with reference to Chapter 5 of this publication for correct type of lamp, replace defective lamp(s). Check light function before replacing lens. To replace the lens, ease the rubber surround with a small screwdriver or similar implement and ensure that the rubber surround is seated firmly onto the lens to provide a water-proof seal.



DROP 594

1 Light assembly
2 Lens
3 Bayonet cap lamp
4 Screw
5 Rubber base

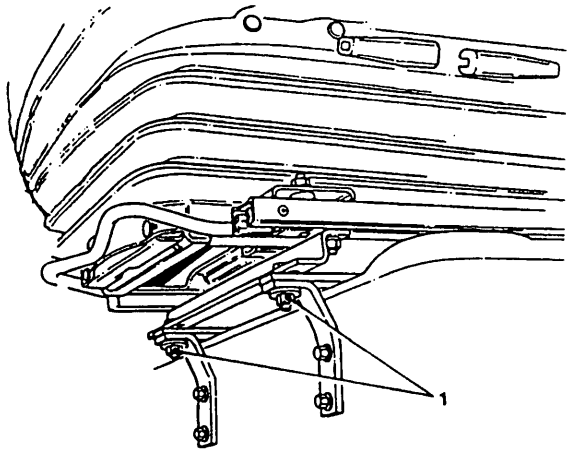
Fig 5 Indicator turn light - cab flank

Seats

8 The drivers, passengers and crew seats can be removed for access to other equipment or for exchange. To remove a seat proceed as follows:

Driver's seat squab and cushion

8.1 Unscrew the two nuts and bolts (Fig 6 (1)) and two nuts and bolts similarly located at the rear, that secure the seat and lift the seat assembly out.



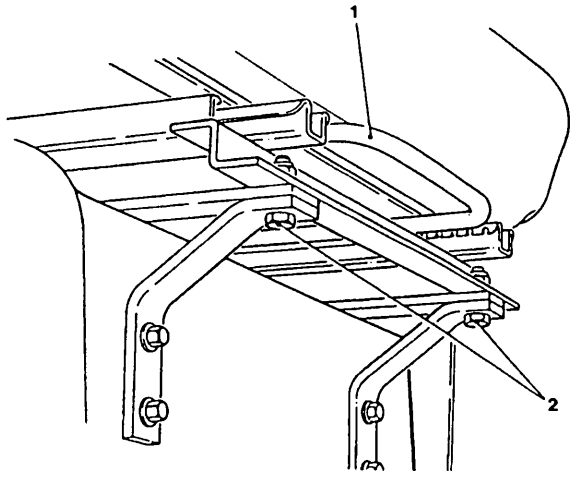
DROP 595

1 Seat front mounting bracket securing nuts and bolts

Fig 6 Driver's seat

Passenger seat squab and cushion

8.2 Unscrew the two nuts and bolts (Fig 7 (2)) that hold the base frame to the seat front mounting brackets and two nuts and bolts similarly located at the seat rear mounting bracket. Lift off the seat assembly.



DROP 596

1 Fore and aft adjustment
2 Seat securing bolts

Fig 7 Passenger seat

Crew seat squab and cushion

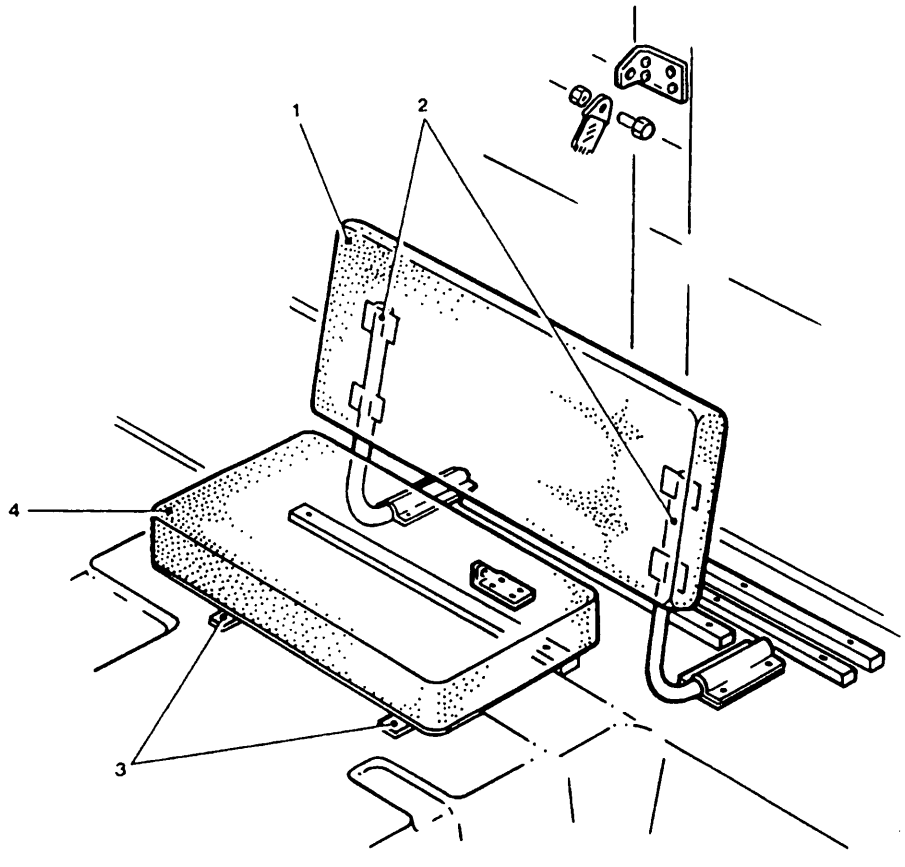
WARNINGS

(1) VEHICLE SAFETY. THE ENGINE MUST BE SWITCHED OFF AND THE HANDBRAKE APPLIED TO THE PARK POSITION BEFORE ANY ATTEMPT IS MADE TO TILT THE CAB.

(2) PERSONNEL SAFETY. ALL PERSONNEL SHOULD STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. WHEN PERFORMING THE RAISING OR LOWERING FUNCTION, STAND CLEAR OF PIVOTING CAB. NEVER WORK UNDER A PARTIALLY TILTED CAB.

8.3 To remove the seat squab (Fig 8 (1)), lift off from the support tubes (2).

8.4 To remove the cushion (4) it will be necessary to tilt the cab to gain access to the securing nuts (3). Remove the four nuts from underneath the cab floor, lower the cab and lift up the cushion.



DROP 597

1 Squab
2 Support tubes
3 Securing nuts and bolts
4 Cushion

Fig 8 Crew seat

ENGINE

9 The pre-start routine and user maintenance of the Perkins 350e engine comprises; checking all coolant, lubricant and fuel capacities, adjustment of engine drive belts, draining the fuel heater/sedimenter, changing the lubricating oil and fuel, lubrication and air filter elements.

Pre-start checks

WARNINGS

(1) COOLANT AT HIGH TEMPERATURE UNDER PRESSURE. DO NOT REMOVE THE RADIATOR FILLER CAP WHILST ENGINE IS RUNNING OR STILL HOT.

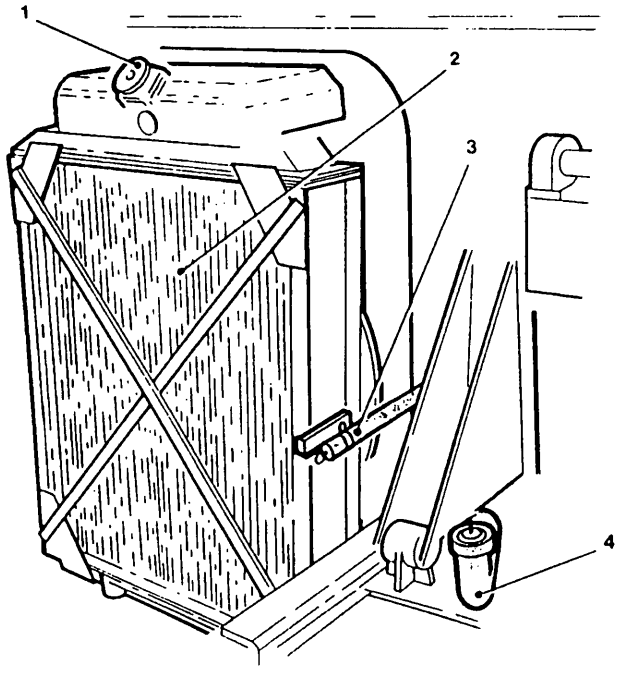
(2) ENGINE SAFETY. DO NOT ATTEMPT TO FILL OR TOP-UP A HOT ENGINE WITH COLD COOLANT. ANY MARKED LOSS OF COOLANT MUST BE INVESTIGATED.

10 Before routine daily starting carry out the following checks:

10.1 Check that the coolant level is approximately 76 mm (3 in.) below the filler of the radiator (Fig 9 (1)). Top-up with the correct coolant mix.

10.2 Check the engine sump oil level as detailed in para 12.

10.3 Check by reading the cab mounted fuel gauge that the fuel tank contains an adequate amount of fuel.



DROP 598

1 Filler cap
2 Radiator matrix
3 Dipstick
4 Oil filler spout

Fig 9 Radiator and engine oil filler

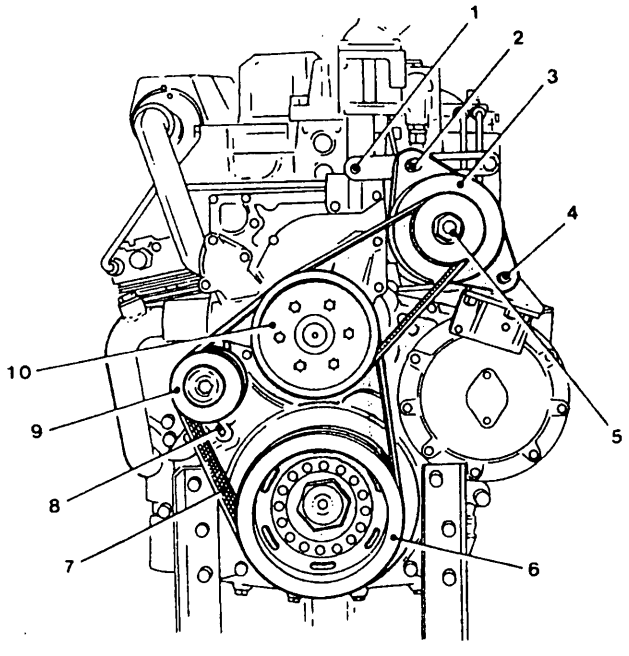
Drive belt adjustment

11 To check drive belt adjustment, proceed as follows:

11.1 Press belts (Fig 10) individually at the centre point of the longest free length to check tension. The correct deflection at this point should be 12 mm (1/2 inch) under a moderate thumb pressure.

11.2 To adjust fan and water pump drive belts (7). Slacken the belt tensioner securing clamping bolts (8), located behind belt tensioner pulley (9), and slide the tensioner until the correct belt tension is achieved. Tighten the two bolts.

11.3 To adjust alternator drive belt: slacken the top bracket alternator clamping bolts (1) and the mounting bolts (2), slacken the bottom bracket alternator pivot bolt (4) and swing the alternator (3) to obtain the correct belt tension.



DROP 599

1	Alternator top bracket clamping bolt	6	Crankshaft pulley
2	Alternator mounting bolt	7	Fan and water pump drive belts
3	Alternator	8	Idler pulley bracket securing bolt
4	Alternator pivot bolt	9	Belt tensioner pulley
5	Alternator drive pulley bolt	10	Fan and water pump pulley

Fig 10 Engine belt arrangement

Oil level check

CAUTION

ENGINE SAFETY. The engine sump must not be filled above the upper mark ('H') on the dipstick. Following an initial filling or top-up, it is advisable to re-check sump oil level after a short engine run. The engine must be stationary when checking oil level.

12 To check the engine oil level, proceed as follows:

12.1 Raise the cab front grille, remove the coiled, flexible dipstick (Fig 11 (2)). Using a clean cloth wipe the blade end clean and replace the dipstick fully. Remove immediately and note the indicated oil level on the blade end.

12.2 Should the oil level be seen to be low, that is, below the 'H' mark, clean the top of the filler spout cap (3) and remove and top-up the sump as required with the recommended grade of oil.

DROP 600

1 Radiator 2 Dipstick 3 Oil filler spout

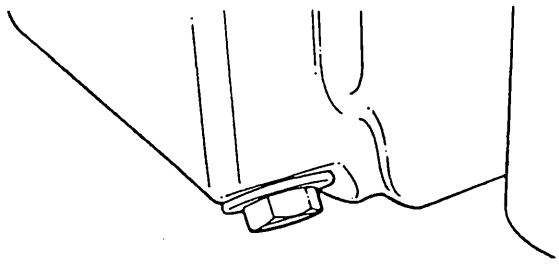
Fig 11 Engine dipstick and oil filler positions

Oil and filter change

13 To change the engine lubricating oil, proceed as follows:

13.1 Ensure the vehicle is standing on firm, level ground.

13.2 Locate the drain plug fitted into the base of the sump (Fig 12). Remove plug and drain oil into a suitable container.



DROP 601

Fig 12 Engine sump oil drain plug

13.3 When all oil has drained, remove container for disposal of used oil (in accordance with local instructions), fit the drain plug complete with a new sealing washer and tighten to torque of 115 Nm (85 lbf ft).

13.4 Locate the dual oil filters mounted on the front, right side of the engine at sump level, (Fig 13).

13.5 Place a suitable container under the filters to receive the draining oil and unscrew each canister in turn. Use a strap wrench if the canisters are exceptionally tight.

13.6 Clean any residual dirt from the faces of the header bracket (3), check the 'O' ring (1) is fitted correctly to the new canisters.

CAUTION

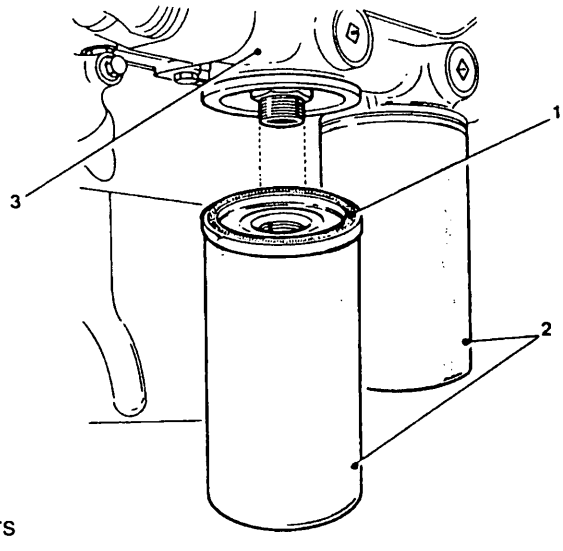
Do not over-tighten canisters. Overtightening will spread the 'O' ring seal and cause oil to leak.

13.7 Fill both canisters with new recommended grade of oil and smear oil on the faces of the 'O' rings. Screw each canister into position until the 'O' rings contact the face of the header and then turn the canister a further three-quarters of a turn by hand.

13.8 Wipe the area around the filler spout cap (Fig 11) before removal to prevent dirt from entering the lubrication system. Using a clean container and funnel, fill the sump to the correct level marked on the dipstick ('H') with the recommended grade of oil. Pause periodically to check the level. Do not over-fill.

13.9 Run the engine for a brief period to allow the new oil to circulate, check the oil pressure and the filter canister for leaks and then stop the engine. Check the oil sump level and if necessary, top-up to the correct level.

13.10 Should a leak at the filter seals or drain plug be apparent, do not attempt to tighten the canister or drain plug further, stop the engine and examine the condition of the 'O' ring(s) and respective face(s), or sealing washer. Take any appropriate remedial action.



DROP 602

1 Oil seal 'O' ring
2 Throw-away filters
3 Header bracket

Fig 13 Oil filter canisters

Main fuel filter change

14 The main fuel filter is mounted at cylinder head level on the left hand side of the engine and is a single, expendable canister type (Fig 14). To change the expendable canister, proceed as follows:

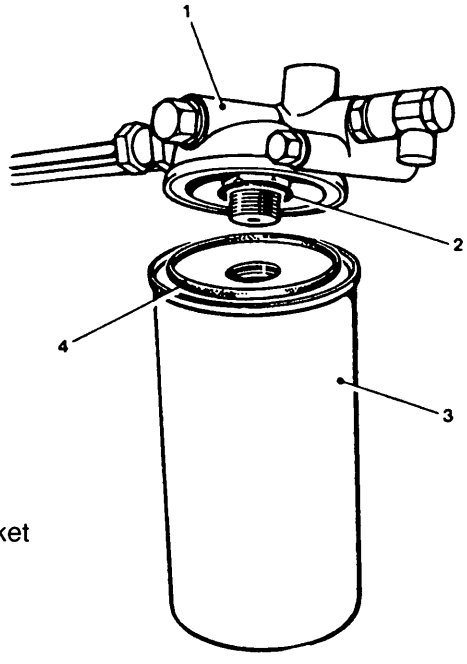
14.1 Before attempting to remove the fuel filter, STOP THE ENGINE, clean-off the outer surface of the canister (3) and header bracket (1). Unscrew the canister, if exceptionally tight, a strap wrench may have to be used.

CAUTION

Do not over-tighten canisters. Overtightening will spread the 'O' ring seal and cause oil to leak.

14.2 Check that the two sealing rings (2) and (4) are correctly fitted to the new canister and filter header bracket. Clean the contact face of the header bracket and lightly smear the face of the seal rings with fuel oil and fill the canister with fuel oil. Screw on the canister until the joint faces are just in contact.

14.3 Tighten the canister by hand, for a further three-quarters of a turn.

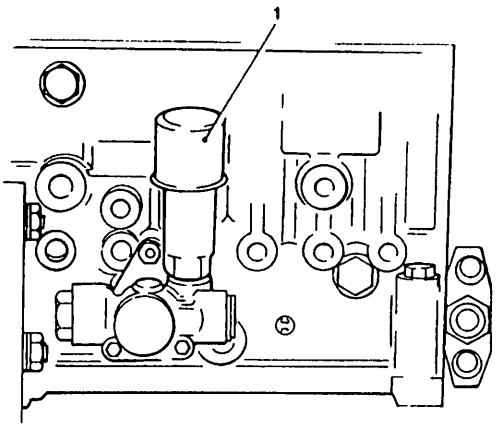


DROP 603

1 Filter header bracket
2 Sealing 'O' ring
3 Fuel filter canister
4 Sealing ring

Fig 14 Main fuel filter

14.4 To purge any entrapped air introduced into the fuel system as a result of the filter change, operate the hand priming pump (Fig 15) in a reciprocating action, continue pumping until a bubble-free, continuous flow of fuel oil can be seen in the plastic return to tank line. A screwed vent plug located in the filter header bracket (Fig 14 (1)) may be slackened off or removed from the header bracket if trapped air is found difficult to purge. On completion of operation, ensure that the vent plug is screwed down into position and all fittings and filter canister are leak free.



DROP 604

1 Pump plunger

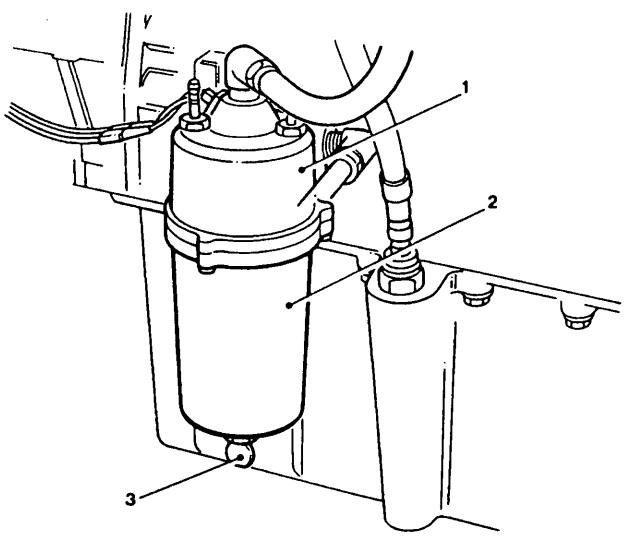
Fig 15 Fuel pump hand priming pump

Fuel heater/sedimenter draining

15 To drain any moisture from the fuel heater/sedimenter (Fig 16) bowl, proceed as follows:

15.1 Locate the combined fuel heater/sedimenter which is mounted on the left side of the engine beneath the fuel pump.

15.2 Turn the winged nut (3) on the base of the bowl clockwise until moisture flows. When moisture-free fuel flows, re-tighten the wing nut.



DROP 605

1 Fuel heater 2 Sedimenter 3 Wing nut

Fig 16 Fuel heater/sedimenter

Fuel tank strainer cleaning

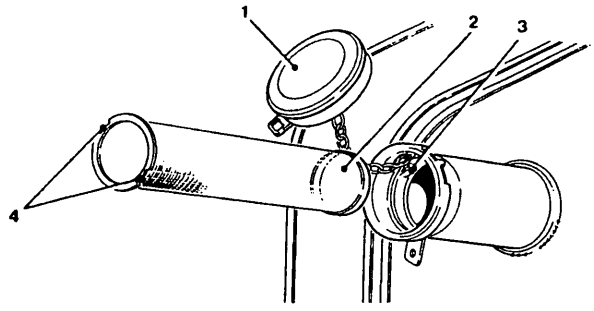
16 To clean the fuel tank filler spout strainer, proceed as follows:

16.1 Open the fuel tank filler cap (Fig 17 (1)), align the slots (4) in the strainer (2) end plate with the lugs (3) in the filler tube neck and lift the strainer clear.

16.2 Clean by reverse washing with clean fuel or very low pressure air line, do not use a cloth that will cause deposits of material to be caught in the strainer body.

16.3 Ensure the rubber seal located in the filler cap inner recess is dirt free and serviceable.

16.4 Refit the strainer into the filler tube, ensuring locating slots are aligned with the lugs. Refit the filler cap.



DROP 606

1 Filler cap 2 Strainer 3 Tank filler neck lugs 4 Strainer slots

Fig 17 Fuel tank strainer

Engine air cleaner filter and safety filter exchange

NOTE

The safety filter requires to be changed on every third engine air cleaner filter change. Exceptions to this will be ordered by the unit commander if conditions or engine indications dictate a requirement

17 To exchange an engine air cleaner filter and a safety filter (Fig 18), proceed as follows:

17.1 Unscrew the air cleaner centre hand wheel (1) and carefully remove the cover (2) taking care not to damage the sealing 'O' ring (4).

17.2 Unscrew the wing nut (3) and withdraw the filter element (5), taking care not to disturb the dust particles held in the element.

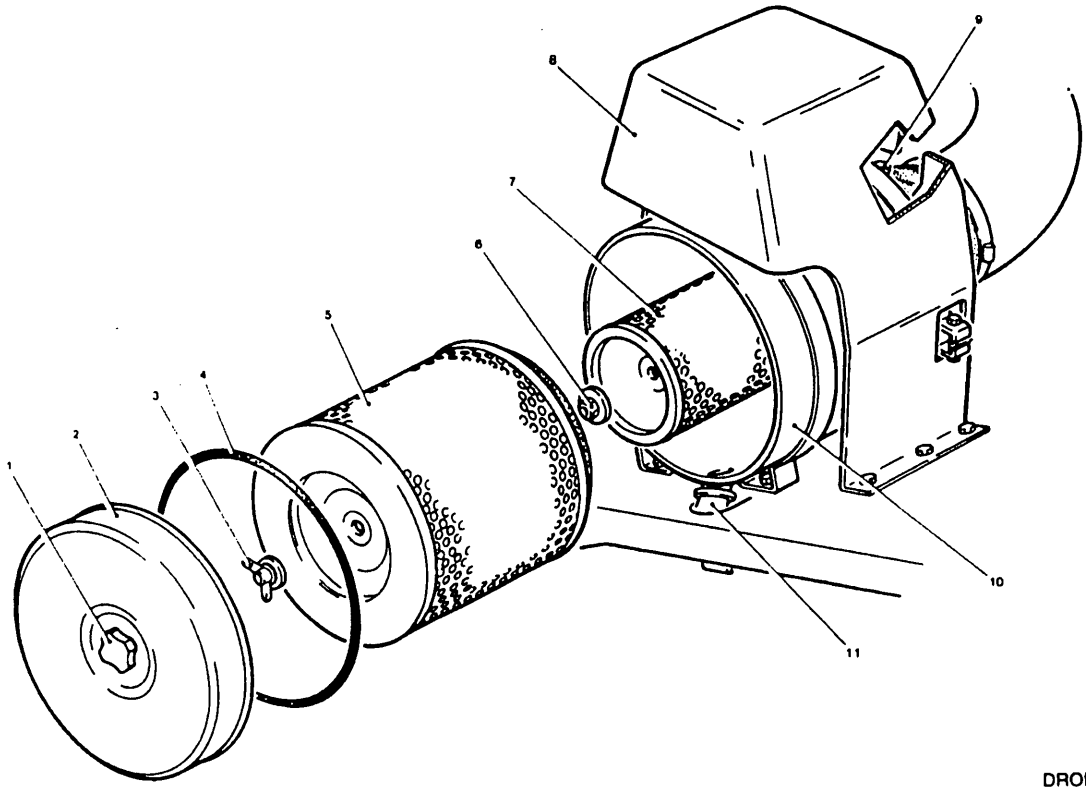
17.3 At every third filter change, or as ordered, slacken and remove the hexagon nut (6) on centre spindle, slide the safety filter (7) clear.

17.4 Before inserting the new filter element, wipe the inside of the body (10) clean with a damp cloth, taking care not to knock any residual dust onto the safety filter if fitted, or into the engine intake if the safety filter is removed.

17.5 If removed, fit the safety filter and secure with the hexagon nut on the centre spindle.

17.6 Re-assemble engine air cleaner, check that the sealing ring (4) is in a satisfactory condition, renew if necessary. Refit wing nut (3) torque to 5 Nm (3.75 lbf ft).

17.7 If the restriction indicator (9) has tripped into the red zone, this should be reset by pressing the button situated on the end of the indicator body.



DROP 607

1 Hand wheel	4 Sealing 'O' ring	7 Safety filter	10 Air filter body
2 Cover	5 Filter	8 Inlet cover	11 Drain tube
3 Wing nut	6 Hexagon nut	9 Restriction indicator	

Fig 18 Engine air cleaner

TRANSMISSION

18 The user maintenance on the main transmission components is mainly concerned with; checking/changing the transmission oil and changing the oil filters, checking/changing oil in the axle differential casings and hubs. The procedures are as follows:

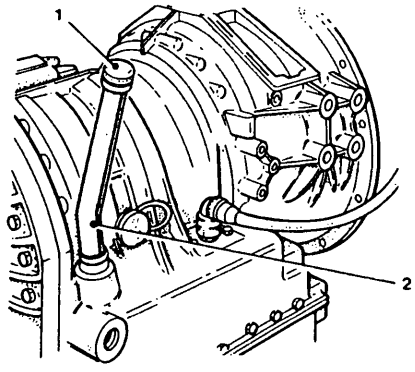
Main gearbox oil level check

CAUTION

GEARBOX SAFETY. The maintenance of the correct oil level is of great importance for an automatic gearbox. Low oil level will result in gearbox defects and malfunction. Too high an oil level results in the transmission overheating. Oil level checks must be carried out at regular intervals (weekly). Vehicle must be on a level standing. Gearbox must be in neutral 'N' position with the engine running at idle speed. The transmission and oil must be hot for accurate oil level checks. The purpose of the cold level marks are only to determine if it is safe to run the vehicle until an oil level check can be made at normal operating temperature.

19 To check the main gearbox oil level, proceed as follows:

19.1 The main gearbox dipstick (Fig 19 (1)) is housed in the oil filler spout (2) located on the right hand side of the main gearbox.

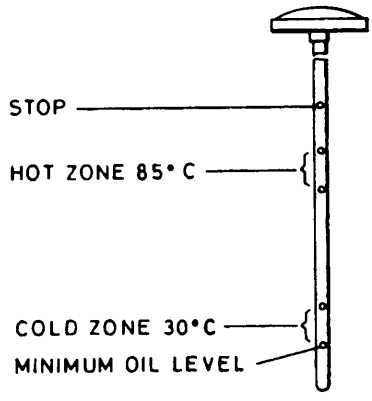


DROP 608

1 Dipstick 2 Filler spout

Fig 19 Oil filler spout and dipstick - main gearbox

19.2 The dipstick (Fig 20) is marked with an upper, high level, STOP mark and two zones or operating ranges. The zone indicates the level range at operating temperature (HOT) and the lower zone, the cold oil level. The bottom mark of the cold zone also indicates the minimum oil level.



DROP 609

Fig 20 Main gearbox dipstick markings

Oil level check before starting the engine

CAUTION

GEARBOX SAFETY. When a vehicle has been parked and stationary for several hours the main gearbox oil level should be higher than the 'hot zone' marks on the dipstick but below the STOP mark. If this is not the case, oil must be added before starting the engine.

20 When the vehicle has been stationary for a period of time the transmission oil drains out of the convertor, as a result a high reading, between the top hot zone mark and the STOP mark is indicated on the dipstick (Fig 20).

20.1 Do not drain any oil because of this result, a high oil level is normal for a cold transmission before the engine is started. See CAUTION above.

Cold Oil Level Check

21 To make a cold oil level check of the main gearbox; start the engine, after approximately two or three minutes of running at idle speed check the main gearbox oil level; the correct oil level is within the 'cold zone' (Fig 20). The colder the oil temperature, the lower the oil level.

21.1 If the oil level is below the 'minimum level' mark, then oil must be added immediately. Only when the oil is within the 'cold zone' should be engine be warmed up or the vehicle driven.

21.2 Due to the churning effect of cold oil, an 'excessive' oil level may be found. However, do not drain any oil because of the result of the cold oil level check. The transmission and oil must be hot in order to achieve an accurate oil level check. The purpose of the 'cold level' marks are only to determine if it is safe to run the vehicle until an oil level check can be made at a normal operating temperature.

21.3 Finally, make a further oil level check at operating temperature and adjust level accordingly.

Operating temperature (hot) oil level check

22 To carry out an operating temperature (hot) oil level check on the main gearbox, run the engine at idle speed until the oil temperature reaches between 80° - 90°C (175° - 195°F). The correct oil level is between the high and the low marks of the 'hot zone' (Fig 20).

22.1 If the initial check shows that the oil level is not in the 'hot zone', repeat the level check again and ensure that the dipstick cap seats firmly into the bayonet fitting when the dipstick is inserted. In addition, check that the oil and transmission are at the correct temperature.

Adding oil to the main gearbox

23 Oil is added to the main gearbox through the filler spout (Fig 19 (2)) which also houses the dipstick. A breather is fitted to prevent air entrapment in the tube as oil is being added. One litre of oil will raise the level approximately 10 mm on the dipstick. Do not allow the level to go above the STOP mark.

To drain the main gearbox oil

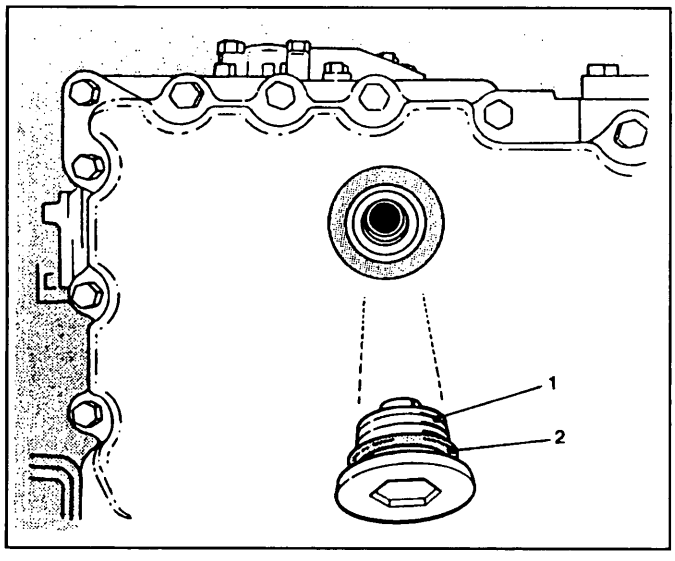
24 If possible, operate the gearbox until normal operating temperature 80° to 90°C, (175° to 195°F) is reached prior to draining the oil.

24.1 Place a suitable container beneath the main gearbox oil ready to receive the drained oil. Main gearbox oil capacity is approximately 20 litres (4 1/2 galls.).

24.2 Using a 10 mm Allen head type wrench, remove the drain plug (Fig 21 (1)) from the base plate of the gearbox. Check for ferrous particles on the magnetic insert of the drain plug and wipe clean.

24.3 Renew the copper seal ring (2) on the drain plug , fit plug and tighten to 70 Nm (52 ft lbf).

24.4 Proceed to change the gearbox oil filter before filling the gearbox with new oil.



DROP 610

1 Drain plug 2 Copper seal ring

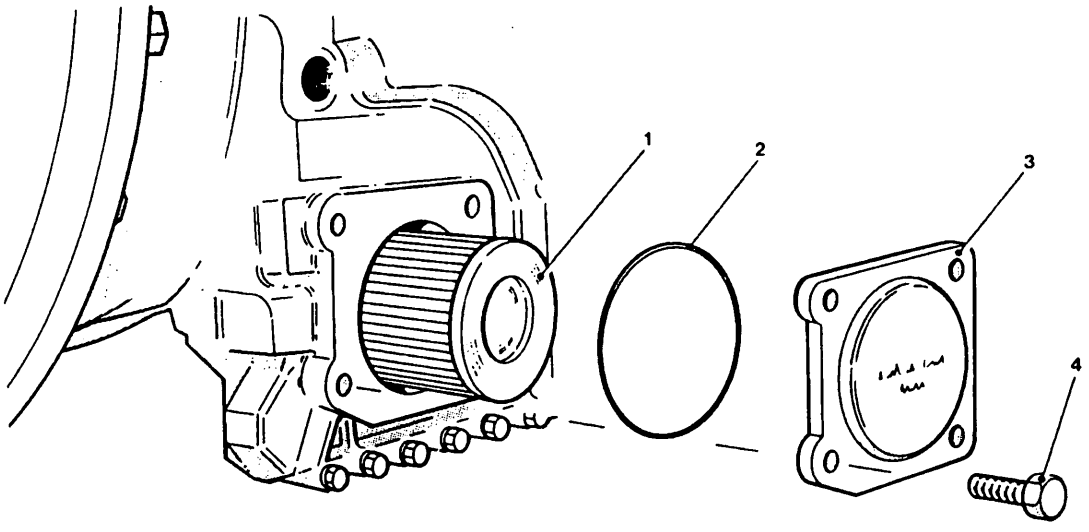
Fig 21 Main gearbox oil drain plug

Main gearbox oil filter change

25 To change a main gearbox oil filter, proceed as follows:

25.1 Remove the four M8-80 bolts (Fig 22 (4)) from the oil filter cover plate (3) situated on the base plate of the gearbox. Remove the 'O' ring (2) and discard.

25.2 Carefully pull the used filter (1) out of the aperture by hand. The filter is held onto an internal suction tube by an 'O' ring and it is possible to draw the tube and filter out as an assembly. If this occurs, remove suction tube and fit to new filter using a new 'O' ring. Discard the old filter complete with the 'O' ring.



DROP 611

1 Oil filter
2 'O' ring
3 Cover plate
4 Securing bolts

Fig 22 Main gearbox oil filter

25.3 Check that the 'O' ring (2) of the new filter is correctly positioned and is undamaged. Dress the surface of the 'O' ring with gearbox oil and push the new filter element (complete with suction tube if removed) through the aperture and onto the suction tube.

25.4 Refit the cover plate (3) and secure with bolts (4).

To fill the main gearbox with oil

26 To fill the main gearbox with new oil, proceed as follows:

26.1 Add approximately 15 litres (3.2 gall) of new oil of the correct specification to the main gearbox through the filler spout (Fig 19 (2)).

26.2 Carry out cold oil and operating temperature level checks as detailed in paras 21 and 22, adding more oil as required until the correct operating level is reached.

Transfer gearbox oil level

CAUTION - GEARBOX SAFETY.

(1) Too much oil in the transfer gearbox can cause overheating.

(2) An oil level below the level plug aperture could result in mechanical failure, particularly when operating over hilly terrain.

NOTE

There is no dipstick in the transfer gearbox. The oil must be checked at regular intervals with the vehicle standing on firm level ground. The oil level check is not to be carried out immediately after completing a journey as the oil expands with heat and a false reading will result. The oil level check is to be taken when the oil temperature had cooled to approximately 10° - 30°C (50° - 86°F).

27 To check the transfer gearbox oil level, proceed as follows:

27.1 Ensure the vehicle is on a level standing, remove the oil filler/level plug (Fig 23 (2)) fitted into the rear plate to the left hand side (when facing forward) of the bogie output flange.

27.2 If the oil does not reach the bottom edge of the oil filler/level plug tapped hole, add the recommended grade of oil to the gearbox, through the oil filler/level plug tapped hole, until the surplus trickles over the edge.

To drain the transfer gearbox

28 Prior to draining the transfer gearbox oil, operate the vehicle for a short period in order to warm the oil. Place a suitable container beneath the gearbox, remove the magnetic drain plug (Fig 23 (3)) from the gearbox base plate. Clean the magnetic plug and refit on completion of oil drainage, using a new sealing washer.

To fill the transfer gearbox with oil

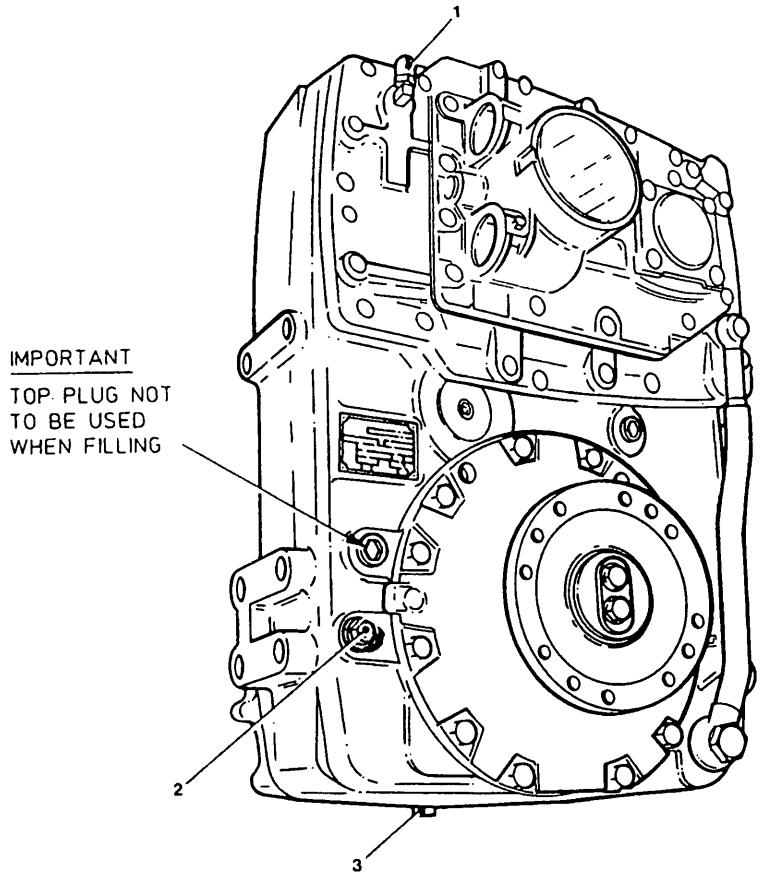
CAUTION

GEARBOX SAFETY. Vehicle must be on level standing to achieve correct oil level.

29 Remove the oil level/filler plug (Fig 23 (2)) and pour into the gearbox 6.5 litres of the recommended grade of oil. This is the approximate oil capacity of the gearbox, however, the correct level is attained when oil is seen to issue from the plug hole. On completion refit the oil filler/level plug using a new sealing washer.

Transfer gearbox breather

30 During a transfer gearbox oil change, the breather element should be cleaned. Under operating conditions, the oil will heat up and cause a pressure build-up within the gearbox which is continuously vented through the breather. Unscrew the breather (Fig 23 (1)), rinse in cleaning fluid, blow dry and refit.



DROP 612

1 Breather 2 Oil filler/level plug 3 Drain plug

Fig 23 Transfer gearbox

Axle differentials oil change

NOTE

To drain the oil and refill in the two rear bogie axles and the front steer/drive axle differential casings is a similar procedure. Vehicle must be on a level standing.

31 To change oil in the rear bogie axles and steer axle, proceed as follows:

31.1 Drain the axle while the oil is warm. Using a 15 mm Allen head type wrench, remove the drain plug (Fig 24 (2)) and drain oil into a suitable container. Wipe plug clean, refit, using a new sealing washer, and tighten.

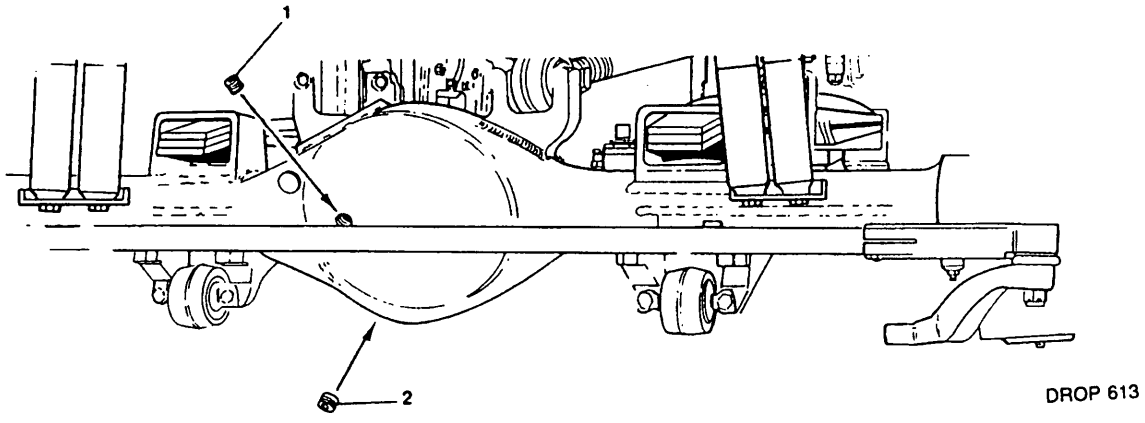
31.2 Clean off any dirt from around the filler spout and remove the plug with a 15 mm Allen head type wrench. Approximate oil capacity of each axle differential and hubs is as follows:

Front Axle:	8 litres (14 pints) (differential only).
Front Axle Hubs:	2 litres (3.5 pints) each.
Foremost Rear Axle:	17 litres (30 pints) (differential and hub).
Rearmost Rear Axle:	14 litres (24 1/2 pints) (differential and hub).

NOTE

Hub and differential oil changes should take place at the same time, and as there is a common passage between hub and differentials on the two rear bogie axles, some of the new recommended grade of oil should be poured through the hub filler/level plug (Fig 25 (1)). Approximately 1.5 litres (2 1/2 pints) is retained in the hub.

31.3 The correct oil level is achieved when oil is seen entering and levelling off at the bottom of the filler/level plug tapped hole.



1 Filler spout and plug 2 Drain plug

Fig 24 Axle casing and drain plug

Hub reduction unit oil change

CAUTION

HUB REDUCTION UNIT SAFETY. DO NOT undo the three gear pin retaining bolts (Fig 25 (6)) as these support internal gears. The correct oil drain plug is marked OIL LEVEL (1).

NOTES

(1) Location of drain and filler plugs on front steer axle hubs and rear axle hubs differ as shown in Fig 25.

(2) The hub should be drained while the oil is warm to aid flow. Apply the handbrake and chock the wheels that are to remain on the ground. Jack up the wheel and support the axle with suitable packing.

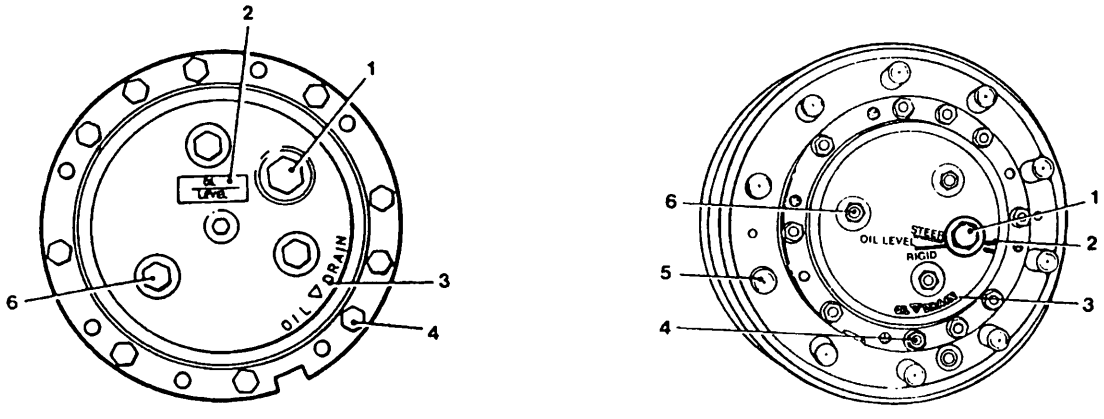
32 To change the oil in the hub reduction units, proceed as follows:

32.1 Release the handbrake lever and rotate hub until the planet oil drain plug (4) is at the lowest point. Note that the oil drain plug is identified as such.

32.2 Using an 11/16 inch AF socket spanner, remove the plug marked OIL LEVEL (1). Using a 3/4 inch AF socket spanner, remove the oil drain plug (4), allow oil to drain into a suitable container. Dispose of used oil in accordance with local instructions.

32.3 When the hub has fully drained, refit the old drain plug (4) and tighten. Move the hub until the oil level line is horizontal, (RIGID for the rear bogie axles). Refill the hub with new recommended grade of oil through the OIL LEVEL plug hole, approximate capacity: 1.5 litres (2 1/2 pints).

32.4 Fit the OIL LEVEL plug (1) and tighten. Apply the brakes and remove the axle temporary support packing and release the jack.



DROP 614

STEER AXLE

1 Filler/level plug
2 Oil level marks
3 Oil drain indication

REAR FIXED AXLE

4 Oil drain plug
5 Wheel nut studs
6 Gear pin retaining bolt

Fig 25 Hub reduction oil drain and filler plugs

WHEELS AND TYRES

33 The user maintenance for wheels and tyres is mainly concerned with checking tyre pressures, changing road wheels and changing the tyre of a road wheel. The procedures are as follows:

WARNING

HEAVY WEIGHT. DUE REGARD MUST BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS. THE WHEEL ASSEMBLY IS A VERY HEAVY ITEM. THE APPROXIMATE WEIGHT OF WHEEL AND TYRE ASSEMBLY IS 333 kg (734 lbs).

CAUTION - WHEEL NUT TORQUE SETTINGS.

It is important when fitting wheels that the correct torque load is applied to the nuts. Incorrect torque loading of wheel nuts could result in the following:

(1) Insufficient torque can cause wheel loss, stud damage, nut damage, cracked wheels and excessive wear to wheel and hub faces.

(2) Excessive torque can cause stud and nut breakage leading to possible wheel loss.

(3) If circumstances are such that a calibrated torque spanner is not available when the wheel nuts are tightened, the nut torque loadings must be checked at the first available opportunity.

Wheel assembly change

34 To change a wheel assembly, proceed as follows:

34.1 Apply the handbrake and chock the wheels remaining on the ground. Loosen the 10 nuts on the wheel studs (Fig 25 (5)). Jack up wheel and support the axle with suitable packing. Unscrew the wheel nuts completely and remove the wheel assembly.

34.2 Mount the wheel, jack the vehicle up and ensure it is suitably supported and chocked, check that the wheel to hub surfaces are clean, free from dirt and smooth and that the stud threads are clean and undamaged.

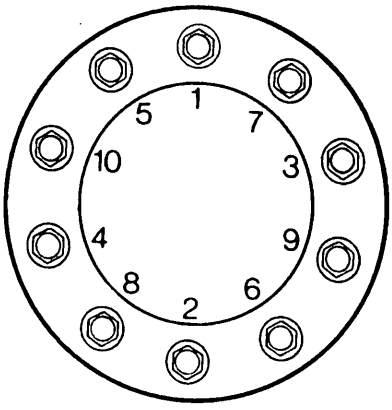
34.3 Place the wheel onto the hub and studs, taking care not to damage the stud threads. Fit the ten wheel nuts onto the studs and tighten in three stages as described below and in the sequence shown in Fig 26.

34.4 Tighten wheel nuts slightly until wheel rim is in full contact with the brake drum (See Fig 27).

34.5 Then tighten the wheel nuts to approximately 50% of the specified torque figure of 678 Nm (500 lbf ft).

34.6 Finally, tighten the wheel nuts to the full specified torque figure of 678 Nm (500 lbf ft).

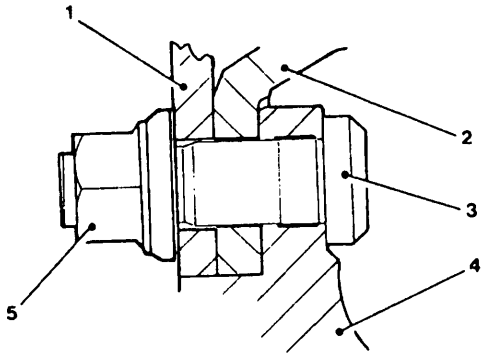
34.7 Run the vehicle for approximately 50 Km and subsequently check wheel nut torque and re-tighten nuts if required.



DROP 615

Wheel nut torque (dry): 678 Nm (500 lbf.ft)

Fig 26 Wheel nut tightening sequence



DROP 616

1 Wheel
2 Brake drum
3 Wheel stud
4 Hub
5 Wheel nut

Fig 27 Wheel/hub arrangement

Tyre damage

NOTE

Heat is generated in tyres due to flexing. Excessive flexing results from under-inflation, over-inflation and overloading. Tyre temperatures can reach dangerously high levels on a vehicle at sustained high speeds if overloading and under-inflation are present (Fig 28). Shock damage can occur if it is over inflated.

35 To prevent tyre damage check the following:

Inflation pressure.

Vehicle not overloaded.

Tyre not fouling parts of the vehicle or load.

Other factors affecting tyre performance:

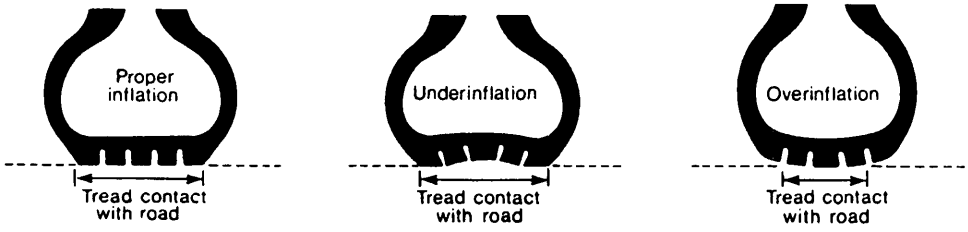
Loose or damaged wheel bearings.

Incorrectly mounted wheel.

Faulty brakes.

Suspension problems.

Bad driving practices.



DROP 617

Fig 28 Tyre inflation conditions

Tyre inflation

WARNING

HIGH PRESSURE AIR. THROUGHOUT THE TYRE INFLATION PROCEDURE, THE OPERATOR MUST NOT STAND IN LINE OF THE LIKELY TRAJECTORY OF ANY PART OF THE WHEEL OR RIM ASSEMBLY IN THE EVENT OF A TYRE BURST.

CAUTION

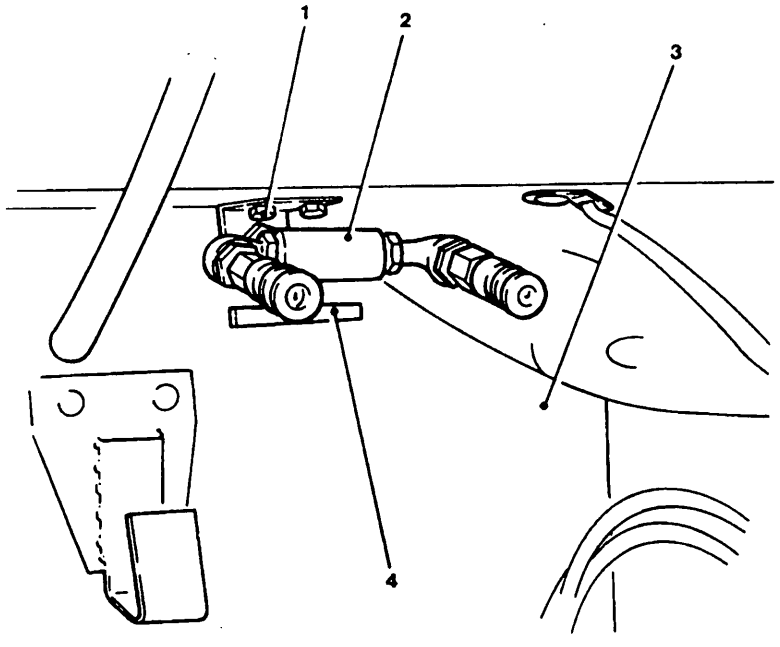
CROSS COUNTRY OPERATION. On completion of cross country operation all tyres will require to be inflated to normal (road) pressures before driving under normal road conditions.

36 Inflate a single tyre or two tyres simultaneously as follows:

36.1 Obtain the flexible air pressure hose(s) from the stowage locker (Fig 29 (3)) and couple to the inflator connection(s) (2) located in the locker and the tyre valve(s).

36.2 Operate the inflator operating lever (4) and monitor the pressure using a tyre pressure gauge. Shut off when the correct pressure is reached for one tyre. If two tyres are being inflated, open up again until the second tyre is at correct pressure. Refer to AESP 2320-R-302-601.

36.3 When required to deflate tyres for cross country operation, deflate each tyre valve until the tyre is at correct pressure for cross country. Refer to AESP 2320-R-302-601.



DROP 534

1 Securing bolts
2 Inflator connections
3 Locker
4 Operating lever

Fig 29 Tyre inflation system

Tyre removal - general

37 This vehicle does not carry a spare wheel. Replacing or repairing tyres, wheel disassembly and re-assembly should be done by authorised, competent personnel. However, if circumstances are such to prevent this, the following precautions must be observed:

37.1 Always remove the valve core and deflate the tyre completely before attempting to remove it from the rim.

37.2 Never re-inflate a tyre that has been run flat or seriously under-inflated or overloaded without first removing it from the rim and inspecting it for damage. The wheel should also be inspected. If the inside of the tyre is damaged or has loose cords evident, consult a competent person to confirm that the tyre can be refitted. If in doubt, DO NOT refit the tyre.

37.3 Before any tyre is fitted, ensure that there is no dirt, liquid or other foreign matter in the tyre.

37.4 Always ensure that rim diameter matches and tyre diameter are the same.

37.5 Always ensure that the component parts of a wheel stay together. Do not mix rim parts of different manufacture.

37.6 Always inspect and clean rim parts before re-assembly. Renew worn or damaged parts.

37.7 Never attempt to seat rings whilst a tyre is partially or totally inflated.

37.8 Always inflate a tyre to the recommended cold operating pressure.

Tyre removal - detail

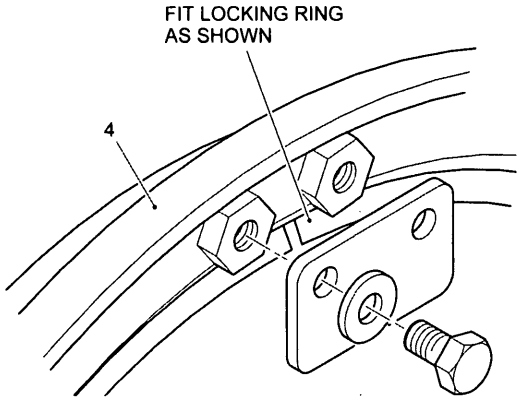
38 Remove a tyre from a road wheel as follows:

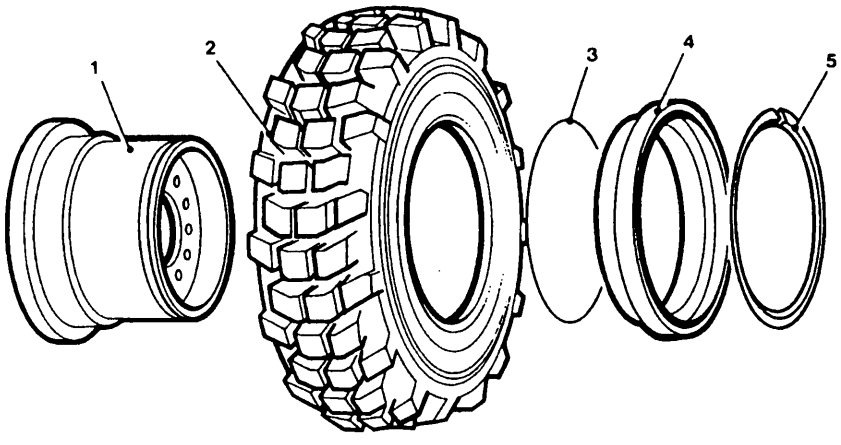
38.1 Deflate tyre fully by removing the valve core. Place the wheel nave (Fig 30 (1)) onto a fitting stand (if available), or onto firm ground with the locking ring side downwards.

38.2 Using a bead unseating tool (Fig 31 (1)), placed at several positions around the tyre bead, free the tyre bead from the ring, never persist at one point only. Turn the tyre and wheel over and repeat for the other bead. Now free off the locking ring (Fig 30 (5)) and loose flange (4).

38.3 With the end of the tyre lever entered into the slot provided, prise off the locking ring (5), taking care not to distort it in the process and gradually ease it away from the wheel nave (1). Depress the loose flange (4), using the tyre levers to do so to expose the 'O' sealing ring (3). Remove the 'O' sealing ring and the loose flange (4).

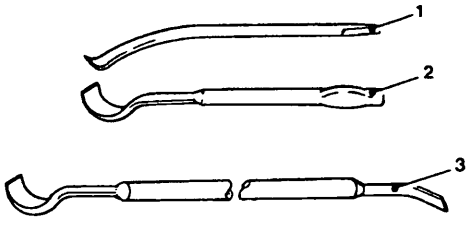
38.4 Finally, remove the tyre from the rim. It is often easier to lift the tyre and rim to the vertical to do this.





1 Wheel nave
2 Tyre
3 Sealing ring
4 Loose flange
5 Locking ring

Fig 30 Wheel components



1 Bead unseating tool
2 Tyre lever
3 Tyre lever

Tyre removal tools

Tyre fitment

CAUTIONS - ROAD WHEEL FITMENT.

(1) Do not swivel the tyre valve assembly when securing nut is tight. If valve stem is aligned incorrectly, slacken nut to reposition (compress the rubber grommet only sufficiently to effect an air seal and to prevent valve movement).

(2) Lubricate the beads of the tyre before fitting.

(3) Never refit a used or damaged 'O' sealing ring.

(4) The tread pattern of this tyre has a preferred direction of rotation (Fig 9) and this must be taken into account during fitting. Abnormal tyre wear and vehicle vibration may occur if this factor is ignored.

39 Refit a tyre onto a road wheel as follows:

39.1 Prior to fitting the tyre and wheel assembly together, check that all the components are correct. Check that nave (Fig 30 (1)), loose flange (4) and locking ring (5) are free from burrs, scratches and indentations and that no distortion is evident. Any of these faults could be detrimental to the tyre and cause air to leak.

39.2 The tyre must be clean, dry and free from any foreign matter inside and out. The valve must be complete and in good working order. Sealing surfaces must be clean and dry.

39.3 Place the nave (Fig 30 (1)) onto a fitting stand (if available), or onto firm ground with the fixed flange at the bottom.

39.4 If a new valve or valve spud is to be fitted. Ensure that the valve hole and the surrounding machined faces on both sides of the rim are undamaged and not distorted. Clean off and, with a suitable lubricant (Table 1 serial 1), dress the core of the rim which will contact the valve seal.

39.5 Check that the grommet/sealing ring (Fig 32 (4)) on the tyre valve assembly is clean and dress with lubricant (Table 1 serial 1). Place the valve into the spud (1) and locate into the rim hole. Tighten spud locking nut (3) holding the valve stem into the required final position.

39.6 Lubricate the bead seat of the wheel and the beads of the tyre.

39.7 Fit the tyre onto the rim. Lubricate the loose flange (Fig 30 (4)) the areas to come in contact with the tyre beads, fit the loose flange.

39.8 Depress the loose flange below the 'O' ring groove in the wheel nave. Ensure the 'O' sealing ring (Fig 30 (3)) is dry and stretch it over the wheel such that it locates in the groove.

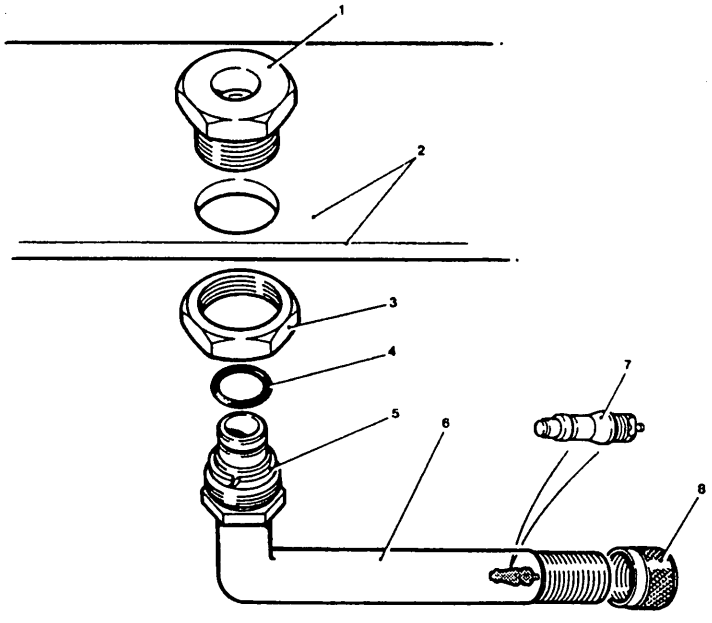
39.9 Fit the locking ring (5), ensuring that the open end is offset at least 180° relative to the valve position.

39.10 It may be necessary to use tyre levers to complete the fitment of the locking ring; if so care must be taken not to distort it.

39.11 Dress the top of the 'O' sealing ring with lubricant (Table 1, Serial 1) and gently allow the loose flange to rise over the 'O' sealing ring, ensuring that it is not dislodged from the groove.

39.12 Remove the valve cap (Fig 29 (8)) and inflate the tyre to approximately 0.5 bar (7.35 lbf/in^2) to allow the loose items to settle. Tap the locking ring with a hammer to ensure that it is seated correctly. If seating is not possible, then remove and refit.

39.13 When satisfied that the components are correctly aligned, screw in the valve core. Place the wheel assembly into a safety cage. Proceed with tyre inflation to the recommended pressure as described in Para 36.



DROP 620

1 Spud
2 Nave
3 Nut
4 Grommet/sealing ring
5 Circlip
6 Valve body
7 Valve core
8 Valve cap

Fig 31 Tyre valve assembly

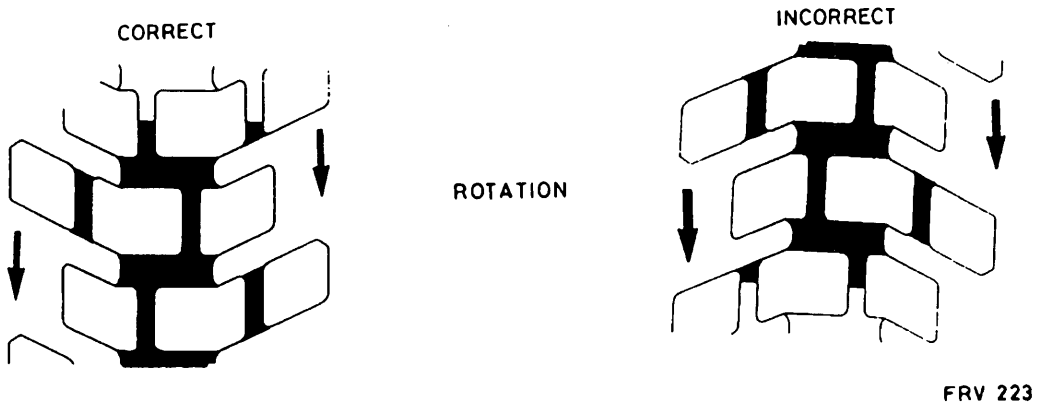


Fig 32 Tyre tread pattern rotation

STEERING SYSTEM

CAUTION

STEERING COMPONENT DAMAGE. With no power assistance to the steering (i.e. engine not running and the vehicle stationary) do not attempt to move the front wheels with the steering wheel. Heavy loading will be imposed onto the downshaft which could result in possible damage.

40 User maintenance for the steering system is to check/change oil in the steering reservoir and to change the steering system oil filter.

Steering reservoir oil level check

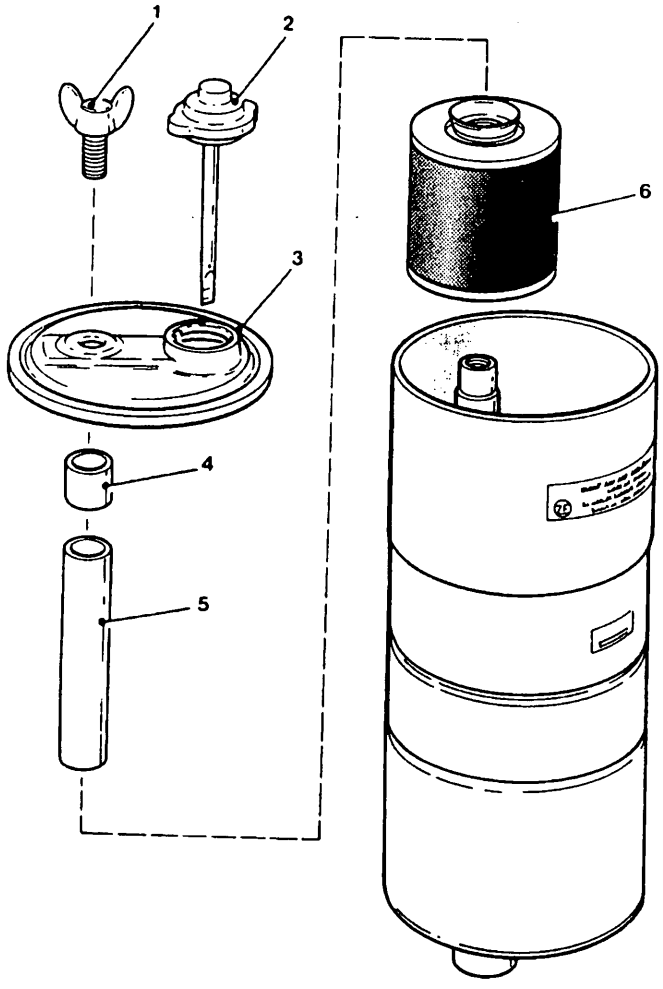
41 Check the oil level in the hydraulic oil reservoir (Fig 34) which is bracket mounted behind the cab at the rear of the engine, driver's side, as follows:

41.1 Always check oil level with the vehicle steering in straight ahead position. Release the filler cap/dipstick (1) which has a bayonet type fitting and lift the dipstick clear. Wipe the blade and re-dip the oil. If the level is below 'MAX', top up as required. The need for any large or continuous additions of oil should be investigated (i.e. possible leakage).

Steering reservoir oil filter element change

42 To change the steering reservoir oil filter element:

42.1 Remove the oil filter element (Fig 34 (6)) unscrew the winged screw (1) and lift off the reservoir cover (3). Remove the rubber bush and distance piece (4) and (5) from the filter element. Draw the filter (6) off the post; the filter element is a snug fit onto the post and a slight twisting motion may be required to release it. Discard the element and fit a new one. Top up the reservoir with the recommended oil.



DROP 621

1 Wing screw
2 Dip stick and filler
3 Cover
4 Rubber bush
5 Distance piece
6 Filter element

Fig 33 Hydraulic oil reservoir (steering system)

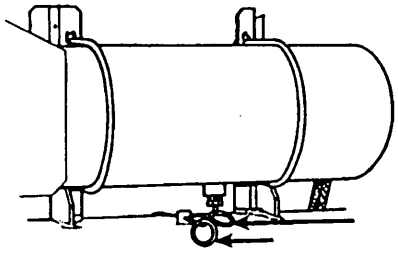
AIR SYSTEM

43 The user maintenance for the air system is to purge air reservoirs of residual moisture. Purge valves (Fig 35) are mounted at the bottom of each reservoir. Three reservoirs are mounted at the rear of the vehicle, two are mounted between and beneath the chassis rails, and a further two above the fuel tank. Each purge valve has extension pull cords fitted.

43.1 To purge the air reservoirs, pull the ring of the purge valve pull cord (arrowed in Fig 35) until all moisture is expelled, release the pull rings.

NOTE

The dryer is self purging and the desiccant absorbing material regenerates, therefore there is no routine maintenance required. However, when the air reservoirs are being purged of moisture, any excessive expellation of moisture seen at the drains mounted at the bottom of each reservoir will indicate that the dryer requires attention.



DROP 622

Fig 34 Air reservoir purge valve and pull cord

CAB TILT PUMP RESERVOIR

WARNINGS

(1) PERSONNEL SAFETY. ALL PERSONNEL MUST STAND CLEAR WHEN CAB IS BEING RAISED OR LOWERED. OPERATOR MUST STAND CLEAR OF PIVOTING CAB WHEN PERFORMING THE RAISING OR LOWERING FUNCTION.

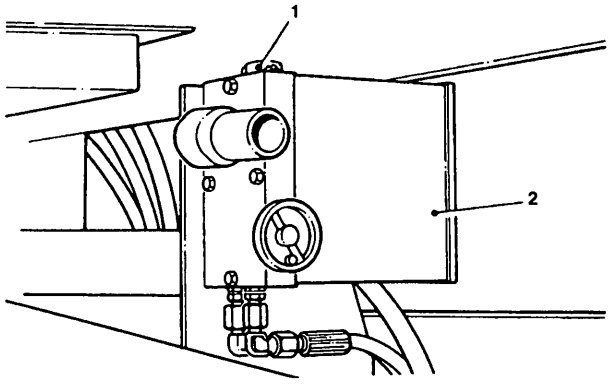
(2) PERSONNEL SAFETY. NEVER WORK UNDER A PARTIALLY TILTED CAB. THE CAB MUST ALWAYS BE RAISED OR LOWERED TO FULL EXTENT OF TRAVEL.

44 User maintenance for the cab tilt hydraulic system is restricted to checking the level of the oil reservoir:

44.1 Check the level of the cab tilt pump reservoir as follows:

44.2 Unscrewing the filler cap (Fig 36 (1)) and visually confirm the oil level is just below the level of the cap. An indication that the pump may require topping-up is usually given by a 'spongy' feel when the cab tilt mechanism is being operated.

44.3 Top-up as required with the recommended grade of oil, through the filler cap and operate the pump simultaneously to facilitate filling.



DROP 623

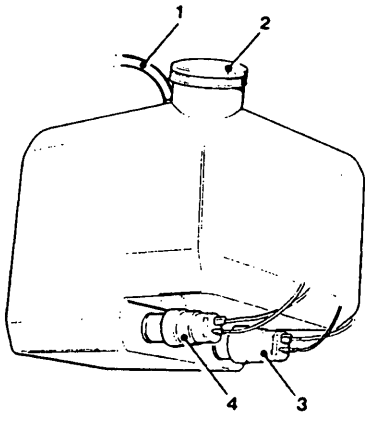
1 Filler cap
2 Cab tilt pump

Fig 35 Cab tilt pump

WINDSCREEN WASH TANK

45 User maintenance to the windscreen wash is restricted to checking/topping up the reservoir.

45.1 The windscreen wash tank (Fig 37) is located behind the front grille. The tank contents should be checked periodically and topped up through the filler cap (1) with the recommended solution mix.



DROP 624

1 Breather pipe
2 Filler cap
3 Front screen washer pump
4 Rear screen washer pump

Fig 36 Windscreen wash tank

ELECTRICAL SYSTEM

WARNING

BEFORE ANY MAINTENANCE WORK IS CARRIED OUT ON THE ELECTRICAL SYSTEM THE MASTER SWITCH MUST BE TURNED TO 'OFF' AND/OR THE BATTERIES DISCONNECTED.

46 User maintenance of the electrical system comprises; lamp replacement and battery removal.

Battery removal

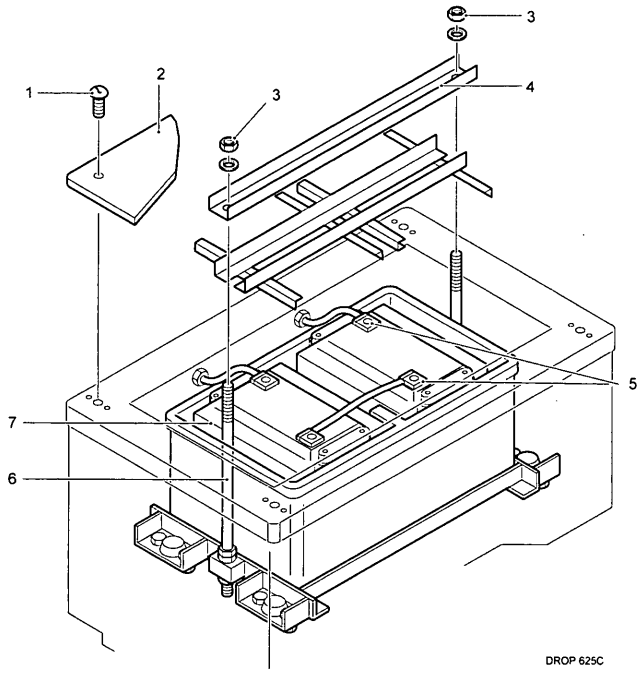
WARNING

HEAVY WEIGHT. DUE REGARD MUST BE GIVEN TO REGULATIONS FOR LIFTING HEAVY OBJECTS. EACH BATTERY WEIGHS 39 kg (86 lb).

47 To remove the battery from the battery box proceed as follows:

47.1 The batteries are fitted into the right hand (passenger side) locker. Access to the Master Switch is made through the drop-down locker door, but access to the battery retaining straps, cell caps and terminals has to be made through the locker top cover. Turn the master switch to OFF.

47.2 Remove the six, domed counter sunk screws (Fig 38 (1)) and lift off the locker cover plate (2). Remove the two nuts (3), lift off the clamp bar (4) and allow the clamp rods (6) to swing clear. Disconnect the positive and negative terminal clamps (5) and lift the batteries (7) out of the container.



1 Countersunk screw
2 Cover plate
3 Nut
4 Clamp bar
5 Terminal clamp
6 Clamp rod
7 Battery

Fig 37 Battery and battery stowage

Headlight - lamp replacement

WARNING

HANDLING OF COMPONENTS. CARE MUST BE TAKEN WHEN FITTING HALOGEN LAMPS NOT TO TOUCH THE GLASS PORTION WITH BARE FINGERS AS THIS COULD CAUSE THE LAMP TO SHATTER WHEN IT IS HEATED DURING USE.

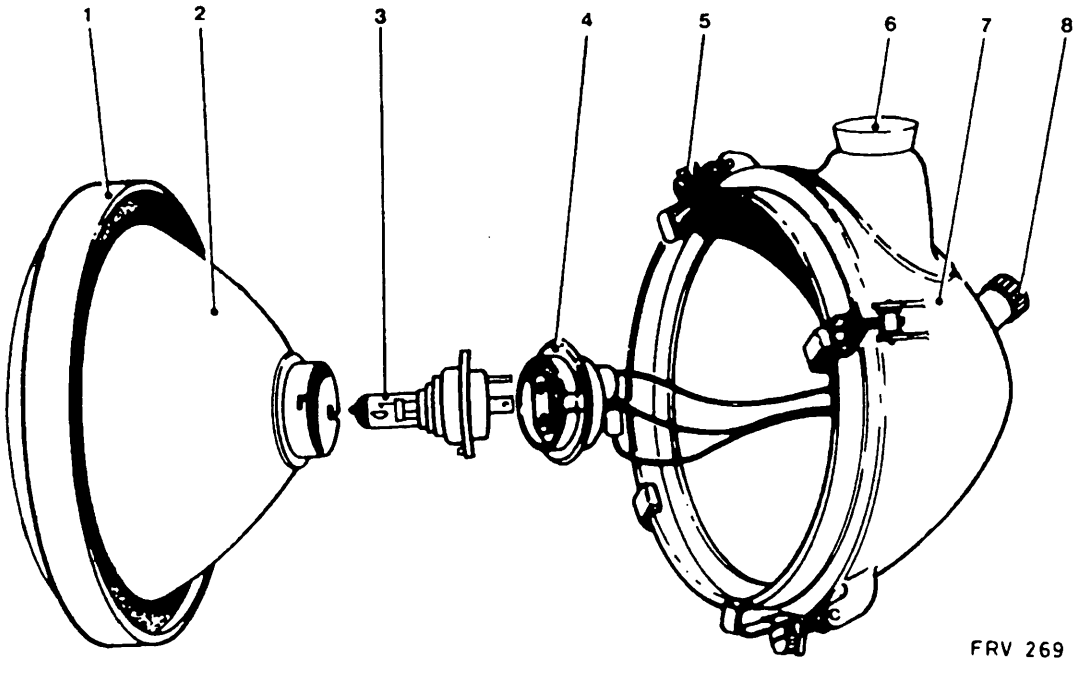
NOTE

Refer to Chapter 5 of this publication for correct type of lamp.

48 To replace a headlight lamp:

48.1 Undo the rim clamp screws (Fig 39 (5)) and release the rim clamps, the front lens holder (1) can now be pulled away and the halogen bulb (3) released.

48.2 Renew the lamp and check that the light functions correctly and then clamp lens to light body.



1 Lens holder
2 Light unit
3 Halogen bulb
4 Lamp holder
5 Rim clamp screws
6 Stem fixing
7 Light body
8 Coupling

Fig 38 Front headlight assembly

Side lights, reversing light, stop/tail, rear fog lights, turn indicator (front and rear) lamp replacement

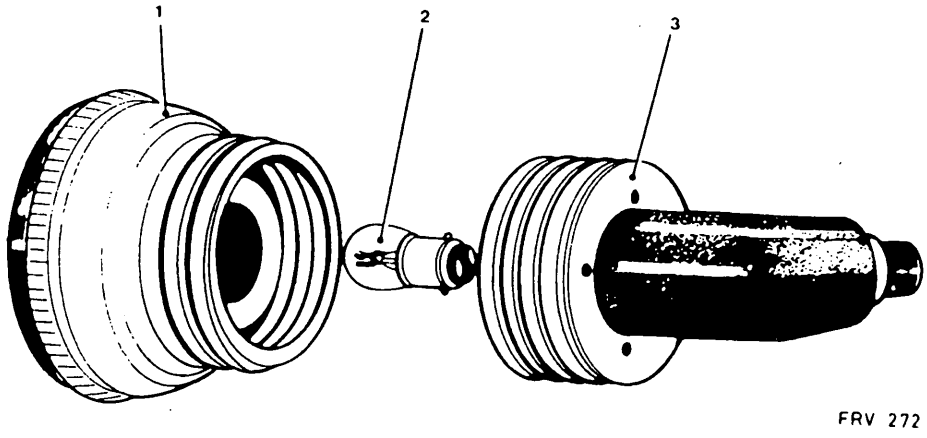
NOTE

The assembly of each of the above lights is identical, they differ in only the lens and lamp type. Refer to Chapter 5 of this publication for correct type of lamp. (Indicator lenses are marked 'Front' and 'Rear'.

49 To replace a lamp in a side light, reversing light, stop/tail, rear fog light, or turn indicator (front and rear), proceed as follows:

49.1 Unscrew the lens holder and cap (Fig 40 (1)), twist and lift the bayonet cap type lamp (2) from the light body (3).

49.2 Renew the lamp and check that the light functions correctly and then clamp lens holder and cap to light body.



1 Lens holder and cap 2 Lamp 3 Light body

Fig 39 Side, reversing, stop/tail, rear fog and turn light assembly

Convoy light lamp replacement

50 To change a convoy light lamp, proceed as follows:

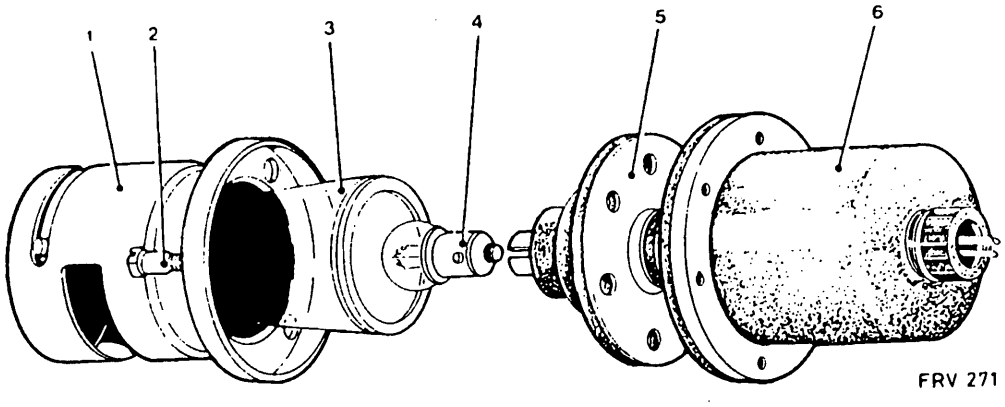
50.1 Unscrew the three set screws (Fig 41 (2)) and lift off the cover (1) taking care not to damage the joint and to allow the glass lens (3) to fall out.

50.2 Take out the lamp holder (5) from the lamp body (6) and remove the bayonet cap type lamp (4).

NOTE

Refer to Chapter 5 of this publication for correct type of lamp.

50.3 Assembly is the reverse of the procedure described above but it has to be borne in mind, that the three set screw holes in the swivel cover have to be re-aligned.



1 Cover
2 Set screws
3 Lens
4 Lamp
5 Lamp holder
6 Light body

Fig 40 Convoy light assembly

Floodlight lamp replacement

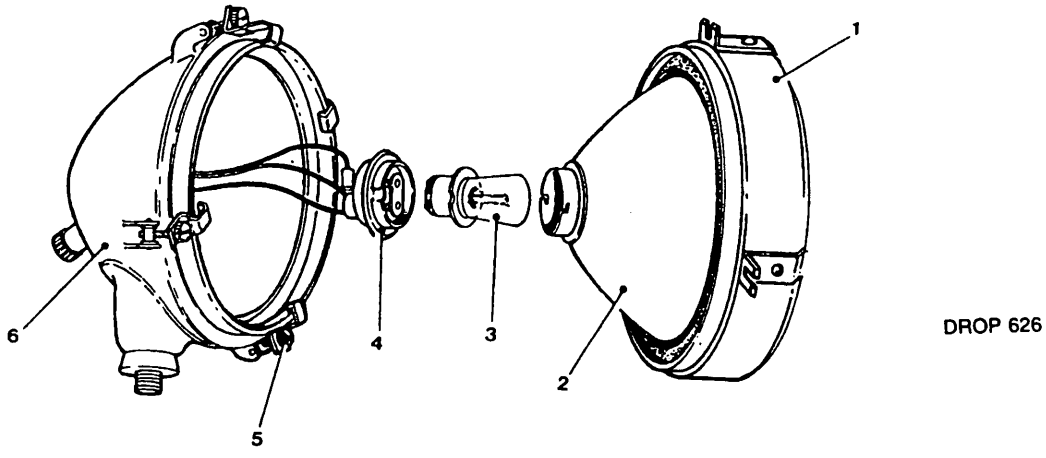
51 To change a floodlight lamp proceed as follows:

51.1 Undo the rim clamp screws (Fig 42 (5)) and release the rim clamps, the front lens holder (1) can now be pulled away and the lamp released.

NOTE

Refer to Chapter 5 of this publication for correct type of lamp.

51.2 Renew the lamp, check that the light functions correctly and then clamp lens to light body (6).



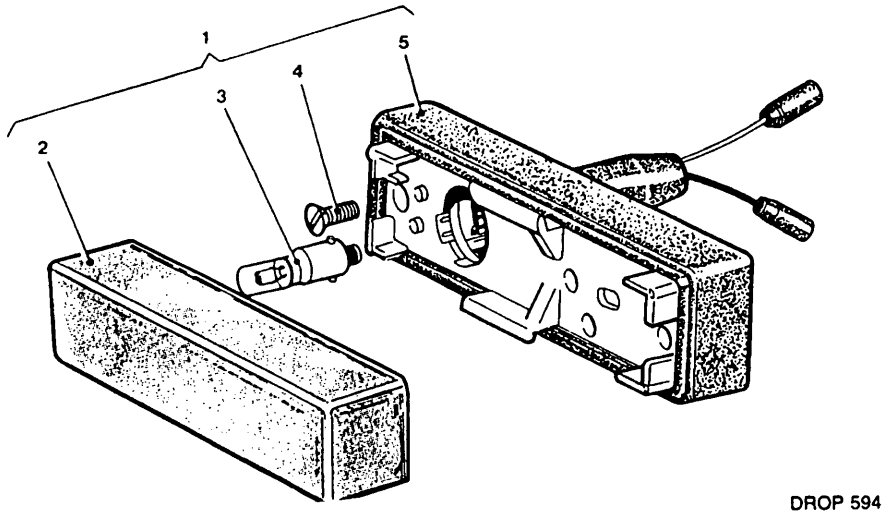
1 Lens holder
2 Reflector
3 Lamp
4 Lamp holder
5 Rim clamp screw
6 Light body

Fig 41 Floodlight assembly

Front, rear and side marker light lamp replacement

52 To replace a front, rear or side marker light proceed as follows:

52.1 Gently prise the rubber base (Fig 43 (5)) from around the lens (2). Remove defective lamp (3) and with reference to Chapter 5 of this publication for correct type of lamp, replace defective lamp(s). Check light function before replacing lens. To replace the lens, ease the rubber surround with a small screwdriver or similar implement and ensure that the rubber surround is seated firmly onto the lens to provide a water-proof seal.



1 Light assembly
2 Lens
3 Bayonet cap lamp
4 Screw
5 Rubber base

Fig 42 Front, rear and side marker light

LOAD HANDLING SYSTEM (LHS)

53 User maintenance to the LHS is limited to exchanging hydraulic system filters.

High pressure filter change

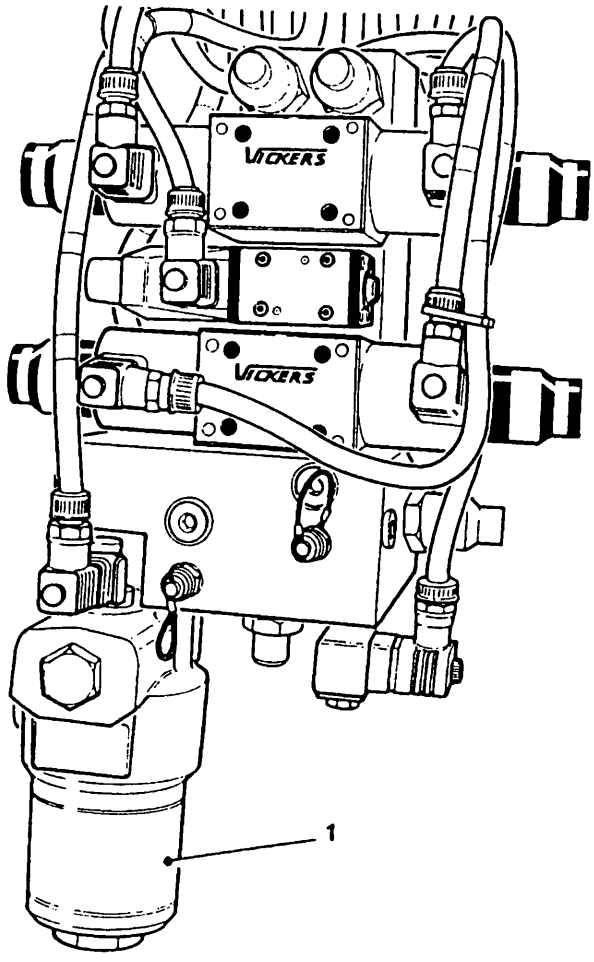
WARNING

PERSONNEL SAFETY. A HIGH HYDRAULIC OIL PRESSURE IS PRESENT IN THE LOAD HANDLING SYSTEM WHEN THE VEHICLE ENGINE IS RUNNING AND THE POWER TAKE-OFF IS ENGAGED. DO NOT ATTEMPT TO RELEASE FILTERS WITH THE HYDRAULIC SYSTEM PRESSURISED. STOP THE ENGINE AND CONFIRM THE SYSTEM PRESSURE GAUGE IS READING ZERO BEFORE CARRYING OUT MAINTENANCE.

54 To change a high pressure filter, proceed as follows:

54.1 Switch off the engine to allow any system pressure to dissipate. Lift the canopy protecting the LHS control valve manifold and at the lowest point will be seen the high pressure filter (Fig 44 (1)).

54.2 Place a suitable container beneath the filter bowl ready to receive filter and oil. Unscrew the bowl by the large hexagon fitted at the bottom. Fit new filter canister, replace bowl and top up the LHS hydraulic system with the recommended grade of oil.



DROP 627

1 High pressure filter bowl

Fig 43 High pressure filter location

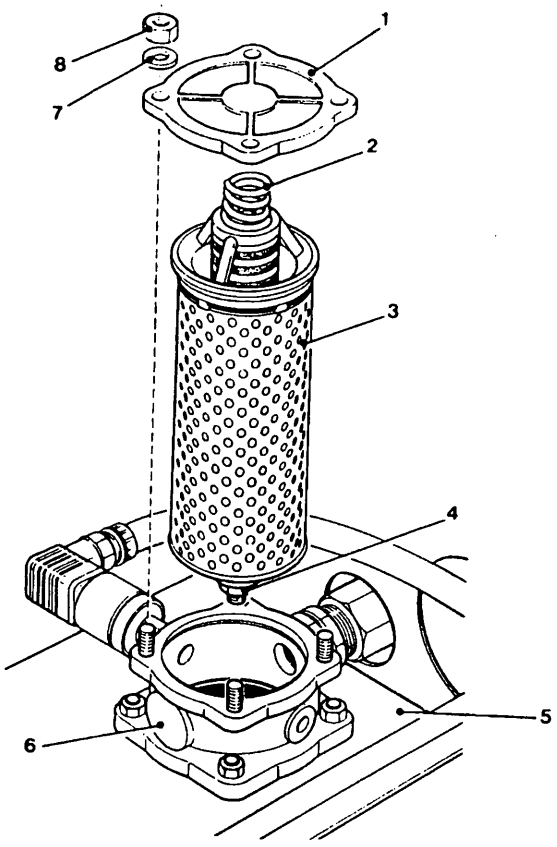
Return filter change

55 To change a return filter, proceed as follows:

55.1 The hydraulic oil return filter is mounted on top of the oil tank (Fig 45 (5)). To release the filter assembly (3) unscrew the four nuts (8) and remove cover (1), washers (7) and nuts. Lift out the filter assembly (3) and take off spring (2).

55.2 Unscrew the nut (4) with the captive spring and draw off the filter canister. Some slight resistance may be felt as the attempt to withdraw the canister is undertaken, this is because the filter stem is magnetised.

55.3 Fit new filter canister, re-tighten nut with captive spring (4), insert filter assembly, replace cover (1), washers (7) and nuts (8).



DROP 628

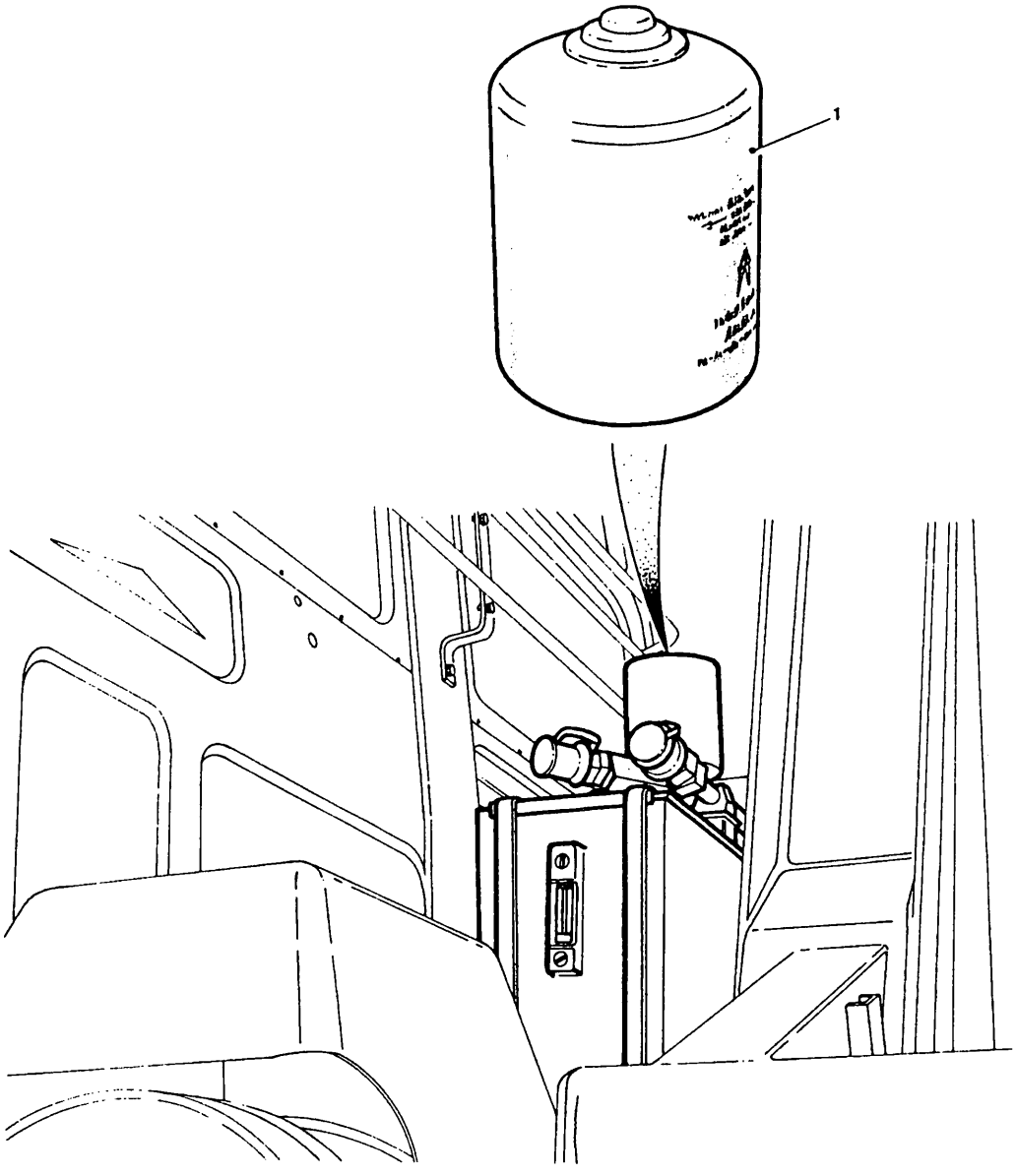
1 Cover
2 Spring
3 Filter assembly
4 Securing nut (and captive spring)
5 Tank
6 Cover holder
7 Washer
8 Nut

Fig 44 Oil return filter

Breather filter change

56 To change the breather filter, proceed as follows:

56.1 The breather filter is mounted on top of the hydraulic oil tank. Unscrew the filter bowl (Fig 46 (1) and discard. Fit new filter assembly and tighten by hand only.



1 Breather filter bowl

Fig 45 Breather filter

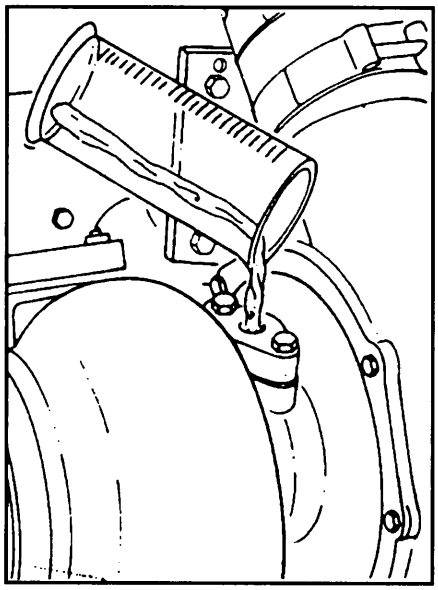
TURBOCHARGER OIL PRIMING

57 To prime the turbocharger:

57.1 Remove the plug from the top oil inlet flange.

57.2 As shown in Fig 47 pour in 50 to 60 cc (2.0 to 3.0 ounces) of clean engine oil.

57.3 On completion replace the plug in the top oil inlet flange.



DROP 630

Fig 46 Turbocharger priming

CHAPTER 5

SPARES

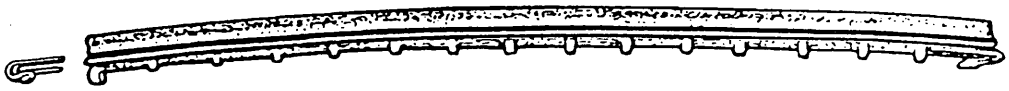
CONTENTS

INTRODUCTION

1 The spares detailed in this chapter are for guidance only. The method of fitting any spare listed is described in Chapter 4. Part numbers or Nato Stock Numbers of all spares are listed in 2320-R-302-711 - Illustrated Parts Catalogue. When renewing a lamp, verify that the voltage, wattage and cap connection comply with those shown in Table 1.

WINDSCREEN WIPER ARM BLADE

2 The windscreen wiper arm rubber blade (Fig 1) can be replaced on the fitted wiper arm as a separate item.

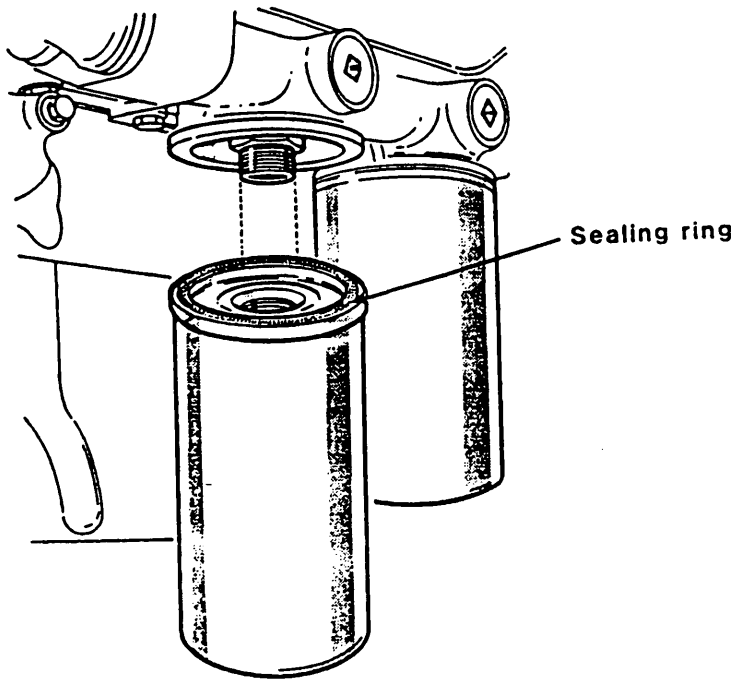


DROP 631

Fig 1 Windscreen wiper arm rubber blade

ENGINE LUBRICATING OIL FILTERS

3 The two engine lubricating oil filters (Fig 2) are expendable canister type elements, each being supplied complete with a new sealing ring.

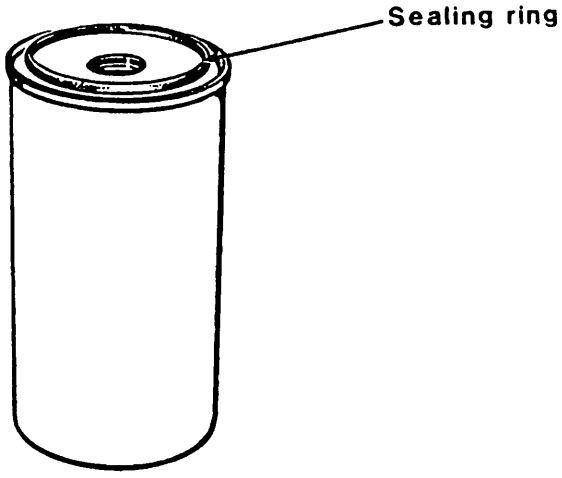


DROP 632

Fig 2 Engine oil filter

ENGINE FUEL FILTER

4 The fuel filter (Fig 3) is an expendable canister type element supplied complete with a new sealing ring.

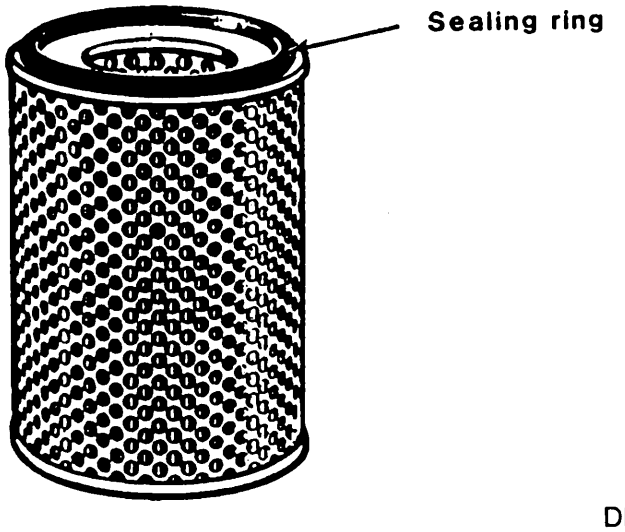


DROP 633

Fig 3 Engine fuel filter

ENGINE AIR CLEANER

5 The engine air cleaner (Fig 4) is an expendable element and is supplied as a single item, the sealing ring is supplied as a separate item.

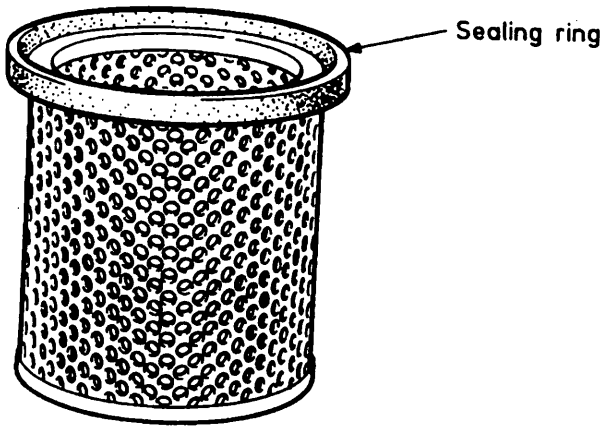


DROP 634

Fig 4 Engine air cleaner

Engine air cleaner safety filter

6 The engine air cleaner safety filter (Fig 5) is an expendable type that requires to be changed at every third air filter change.

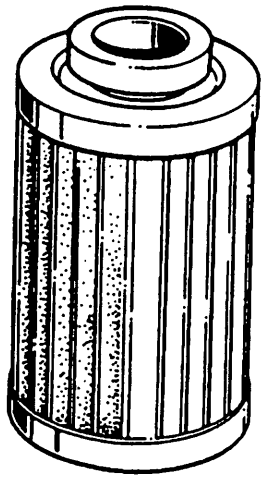


DROP 635

Fig 5 Engine air filter safety filter

MAIN GEARBOX OIL FILTER

7 The main gearbox oil filter (Fig 6) is an expendable pleated cartridge type element supplied complete with a new sealing ring.



DROP 636

Fig 6 Main gearbox oil filter

STEERING SYSTEM OIL RESERVOIR FILTER

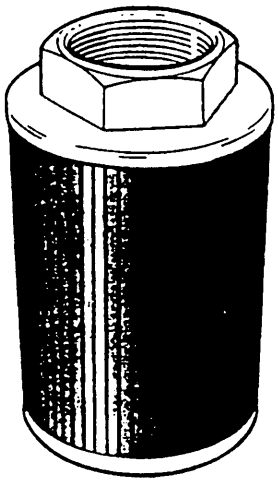
8 The steering system oil reservoir filter (Fig 7) is an expendable, caged pleated type element supplied complete with a new sealing ring.

DROP 637

Fig 7 Steering reservoir oil filter

LHS HIGH PRESSURE FILTER

9 The Load Handling System (LHS) high pressure filter (Fig 8) is an expendable screw-in, pleated type element supplied complete with a new sealing ring.

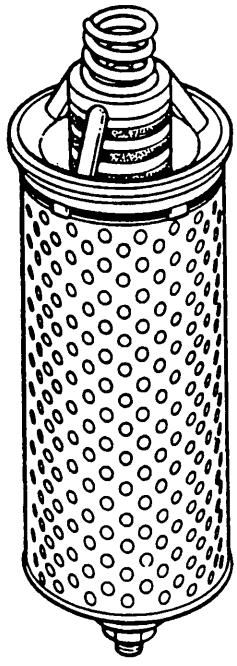


DROP 638

Fig 8 LHS high pressure oil filter

LHS RETURN OIL FILTER

10 The LHS return oil filter (Fig 9) is an expendable push-on, cartridge type element supplied complete with new sealing ring.

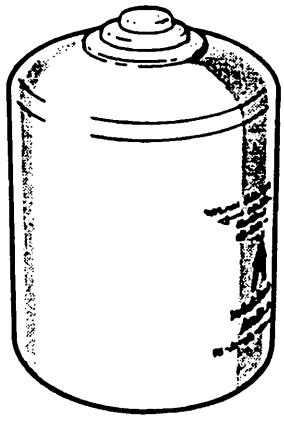


DROP 639

Fig 9 LHS oil return filter

LHS BREATHER FILTER

11 The LHS breather filter (Fig 10) is an expendable screw on type canister complete with a new sealing ring.

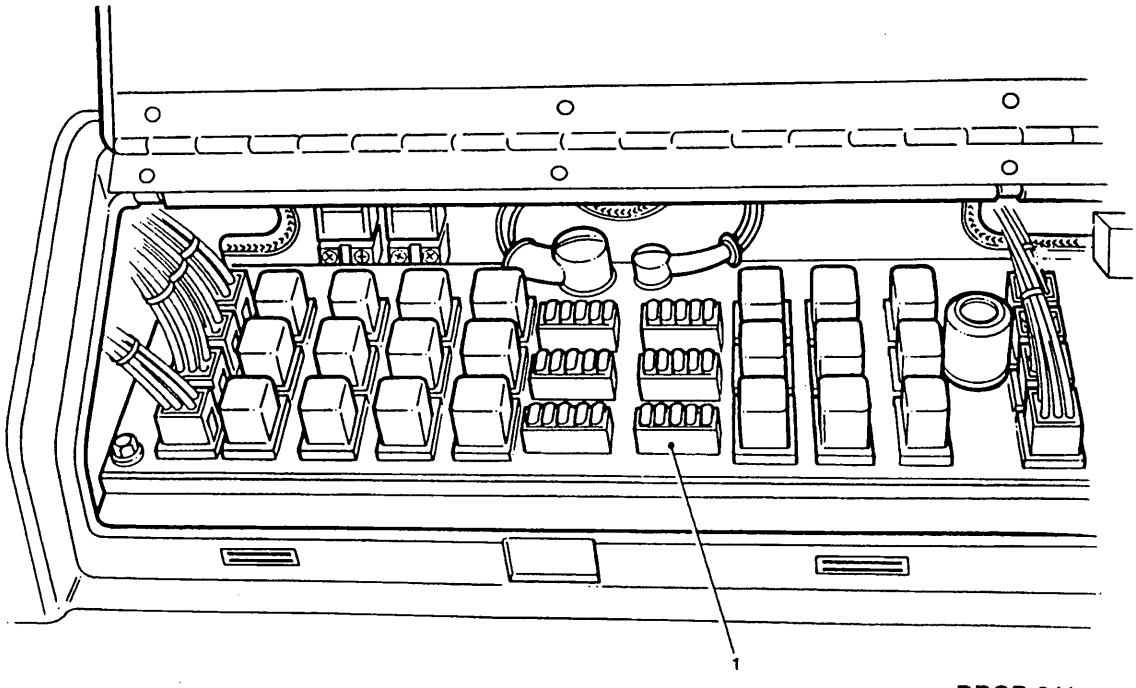


DROP 640

Fig 10 LHS breather filter

SPARE FUSES

12 Spare fuses are located under the front instrument panel situated in the main electrical panel (Fig 11). Fuses (1) without a designated reference number, (as shown on the PCB Fuse and Relay Details label fastened to the underside of the panel hinged cover), are spare fuses. Capacities range from 7.5 to 15 amps inclusive, there are twelve spare fuses in total.



DROP 641

1 Fuse location

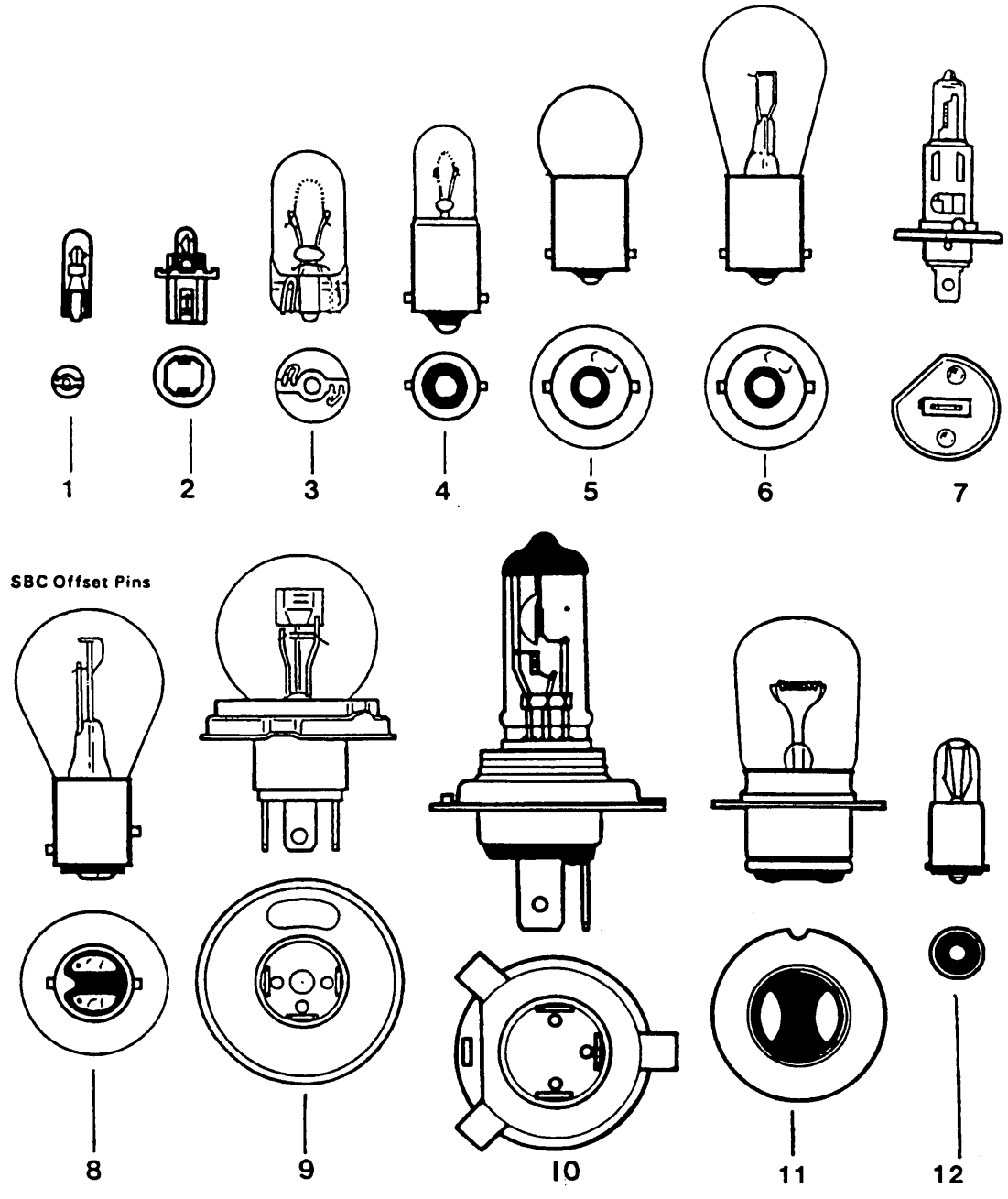
Fig 11 Main electrical panel

LAMPS

13 The voltage, wattage and type of lamp fitted to the vehicle is listed in Table 1 LAMP DATA. The type number in column 4 is a reference to Fig 12.

TABLE 1 LAMP DATA

Lamp	Volts	Watts	Type
Hazard warning	24	3	1
Warning lamp module	24	3	1
Warning lamps (except illuminated switches)	24	1.2	2
Illuminated switches	24	1.1	1
Panel lamps	24	3	2
Tachograph	24	3	3
Water temperature gauge	24	3	3
Speedometer	24	3	3
Side repeater	24	4	4
Side light	24	5	5
Rear convoy light	24	5	5
Cab interior	24	10	5
Turn indicators	24	21	6
Reversing light	24	21	6
Rear fog light	24	21	6
Stop/tail light	24	21/5	8
Headlight (Halogen bulb)	24	75/70	10
Rear working light	24	50/50	11
Cooking pot control unit warning	24	1.1	12
LHS roller light	24	5	5
Front, rear and side marker light	24	5	5



DROP 642

Fig 12 Lamp types

CHAPTER 6

C.E.S. EQUIPMENT

CONTENTS

INTRODUCTION

1 The vehicle CES equipment falls into three groups, fitted equipment, vehicle tools and loose equipment and literature. All fitted equipment is fully detailed in the relevant chapters of this publication as part of the vehicle. The purpose of the vehicle tools and loose equipment, unless stated, is generally self evident, this chapter aims to enable the operator to locate and recognise the equipment listed in Table 1.

VEHICLE LITERATURE

2 The literature that must accompany the vehicle at all times comprises:

2.1 CES service edition

2.2 AESP 2320-R-302 Categories 201 and 601

2.3 Vehicle record book AB 562 complete with AF 6530

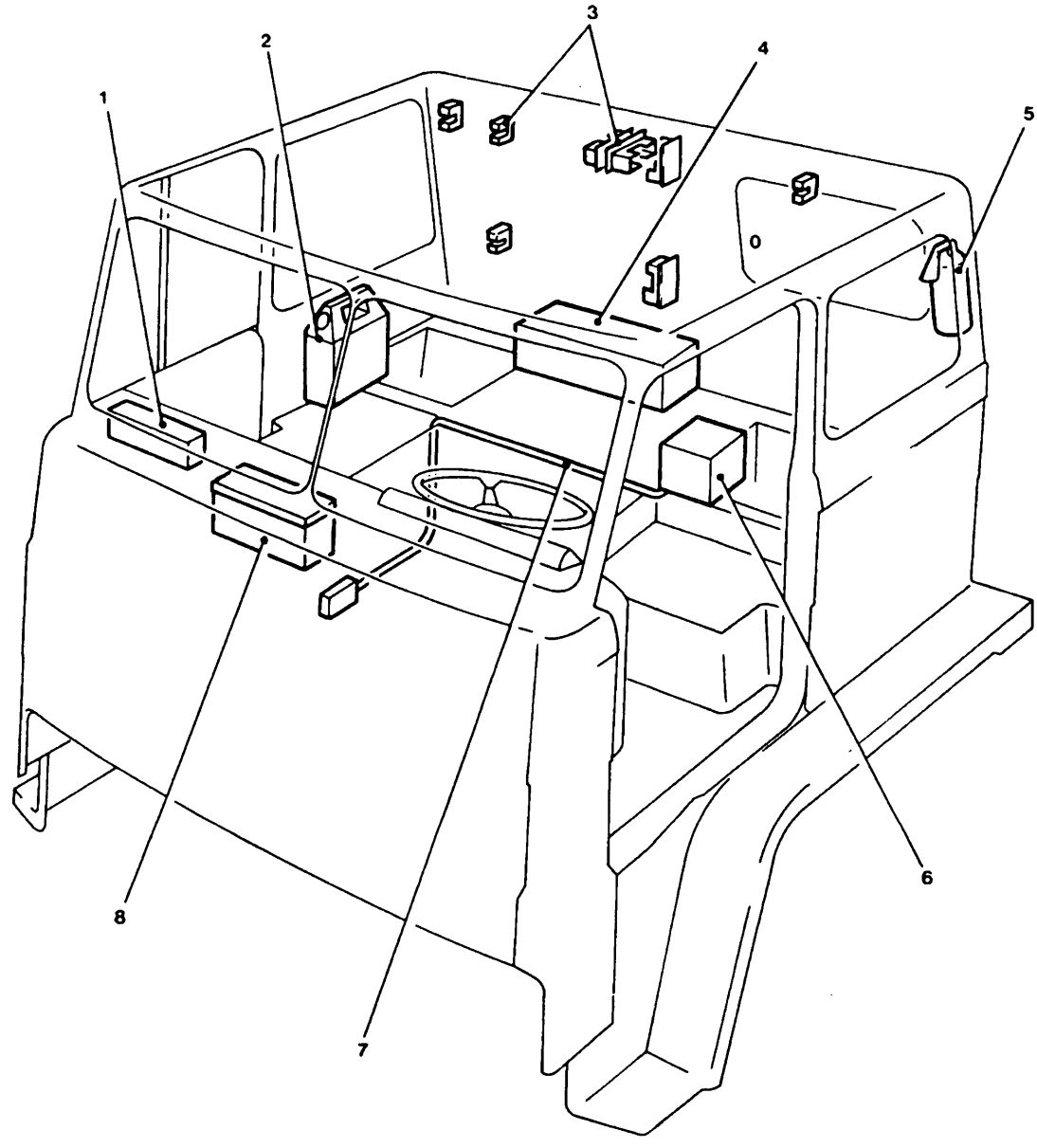
VEHICLE TOOLS AND LOOSE EQUIPMENT

3 The vehicle tools and loose equipment listed in Table 1 is located either in the vehicle cab or the stowage locker, Figs 1 and 2.

4 The contents of the decontamination kit (Fig 2 (4)) are identified and itemised in Fig. 3.

TABLE 1 VEHICLE TOOLS AND LOOSE EQUIPMENT AND LOCATION

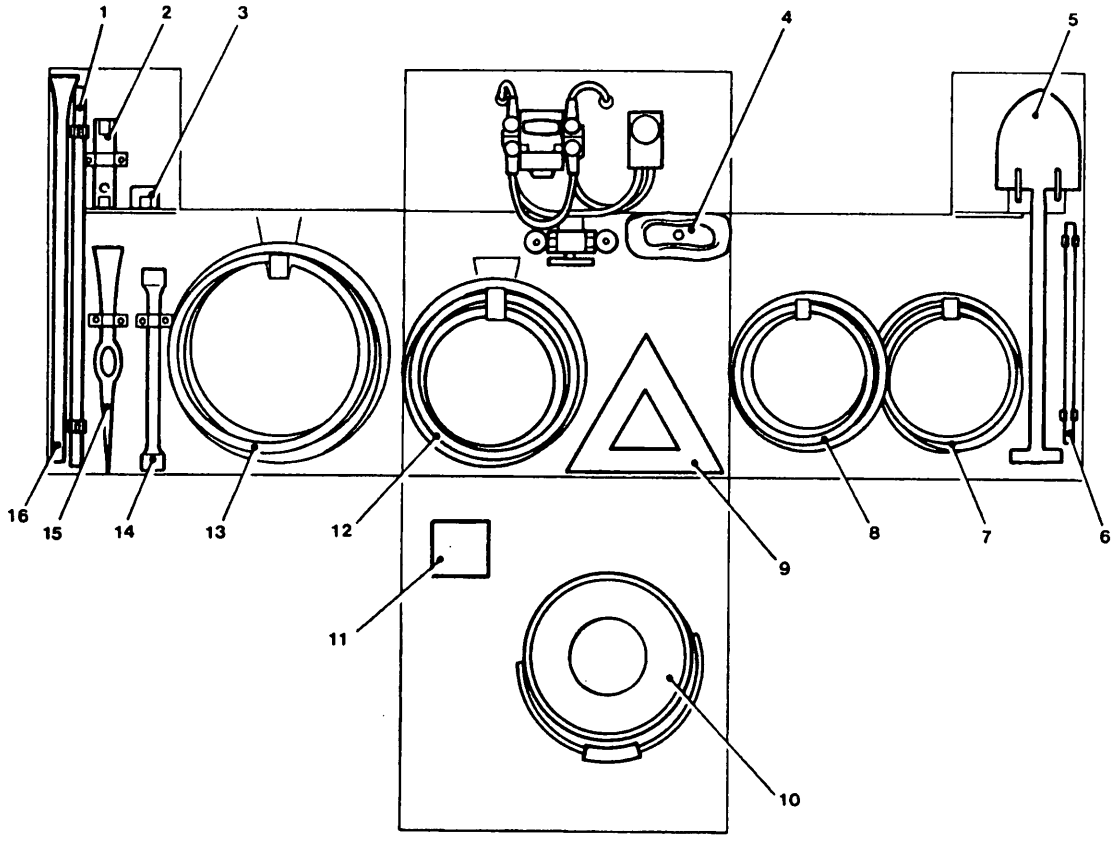
CES Item No	Designation	No Off	Location
30	Handle (cab tilt)	1	Stowage locker
31	Wood block	1	
32	Recovery hose assembly (pressure)	1	Stowage locker
33	Recovery hose assembly (return)	1	Stowage locker
34	Inter-vehicle slave lead - electrical	1	Stowage locker
35	Kit, first aid	1	Cab
36	Can, water, plastic, 5 gallon w/caps and chain CPTE	1	Cab
37A	Socket - wheel nut	1	Stowage locker
37B	Tommy bar - wheel nut socket	1	Stowage locker
37C	Spanner box - Spring brake release	1	Stowage locker
38	Tommy bar	1	Stowage locker
39	Hexagon socket 3/4 inch square drive - wheel nut	1	
40	Padlock, steel, zinc plated, 4 lever type	2	For stowage locker and fuel tank cap
41	Extinguisher, fire, hand. 2 kg ABC dry powder	2	One on left rear mudguard, one in cab
42	Hose assembly, tyre inflation	2	Stowage locker
43	Pot, cooking, electrical, 24V	1	Cab
44	Cable, electrical cooking pot, 24V	1	Cab
45	Handle, mattock	1	Stowage locker
46	Pick head	1	Stowage locker
47	Shovel, hand	1	Stowage locker
48	Warning triangle	1	Stowage locker
49	Flashing lamp	1	Stowage locker
50	Decontamination Kit No 1 Mk 1	1	Stowage locker
60	Screwdriver, engineers, 150mm	1	Cab
61	Spanner, adjustable, 8in	1	Cab
62	Pliers, sidecutting, 6in	1	Cab
63	Gauge, tyre pressure 10-120 PSI	1	Cab
64	Extinguisher, fire, 6 kg	2	One on RH rear mudguard bracket and one on LH rear mudguard bracket



DROP 643

1	Glove locker, containing:	2	Jerry can
(a)	First aid kit	3	Weapons brackets
(b)	Tyre gauge	4	Ration box
(c)	Screwdriver, engineers, 150mm	5	Extinguisher, fire, hand
(d)	Spanner adjustable, 8in	6	Pot, cooking, electrical, 24V
(e)	Pliers, sidecutting, 6in	7	Cable, electrical, for above
(f)	Vehicle literature	8	Ammunition box

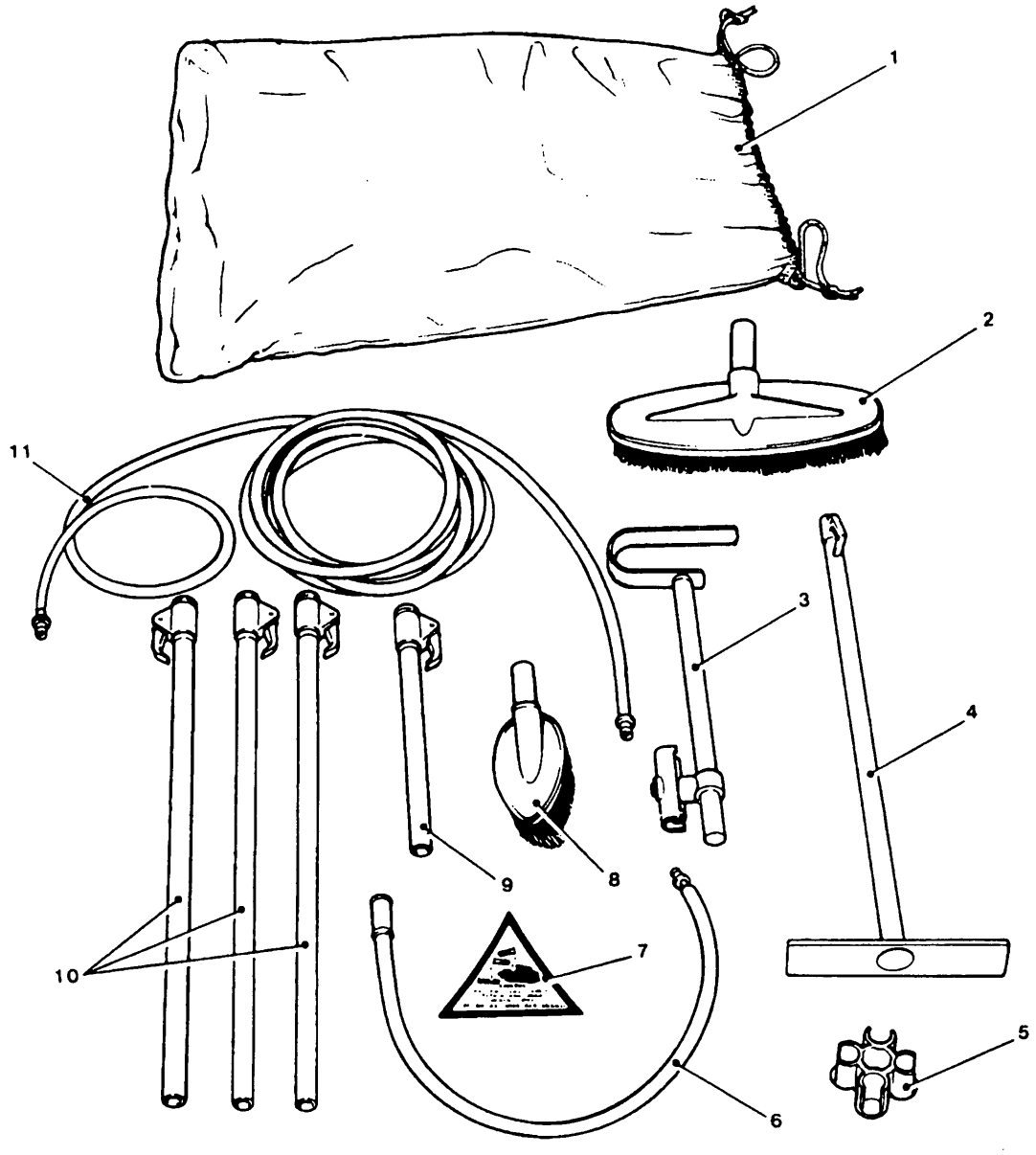
Fig 1 Cab stowed tools and loose equipment



DROP 644

1 Tommy bar - wheel nut
2 Spanner, box - spring brake actuator release
3 Socket, wheel nut, FG05869
4 Decontamination kit
5 Shovel, hand
6 Handle - cab tilt
7 Hose assembly, tyre inflator
8 Hose assembly, tyre inflator
9 Warning triangle
10 Pail, galvanised
11 Warning lamp
12 Inter-vehicle slave lead, electrical
13 Recovery hose assembly, pressure and return
14 Tommy bar, wheel nut
15 Pick head
16 Handle mattock

Fig 2 Stowage locker contents



U4795/3

1 Valise
2 Oval brush
3 Pump assembly
4 Pump stand assembly
5 Lance protector
6 Suction hose assembly
7 Warning label
8 Arrowhead brush
9 Half length lance tube
10 Lance tubes
11 Delivery hose assembly

Fig 3 Complete decontamination kit

CHAPTER 7

DESTRUCTION OF EQUIPMENT TO PREVENT ENEMY USE

CONTENTS

DESTRUCTION OF EQUIPMENT TO PREVENT ENEMY USE

MANDATORY DIRECTIVE

1 Destruction of equipment when subject to capture by the enemy, will be undertaken by the user arm, ONLY WHEN, in the judgement of the Unit Commander concerned, such action is necessary in accordance with orders of, or policy established, by the Army or Divisional Commanders.

2 The reporting of the destruction of the equipment is to be done through command channels.

Degree of damage

3 The degree of damage inflicted, to prevent the equipment being used by the enemy, shall be as follows:

3.1 Methods of destruction should achieve such damage to equipment and essential spare parts, that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or cannibalization.

3.2 Classified equipment must be destroyed in such degree as to prevent, whenever possible, duplication, or determination of operation or function by the enemy.

3.3 Any classified documents, notes, instructions or other written material pertaining to function, operation, maintenance or employment, including drawings or parts lists, must be destroyed in a manner to render them useless to the enemy.

4 In general, destruction of essential parts followed by burning will usually be sufficient to render the equipment useless. However, selection of the particular method of destruction used, requires imagination and resourcefulness in utilisation of the facilities available under the existing conditions. Time is usually critical.

Spare parts

5 The same priority, for destruction of components parts of a major item necessary to render the item inoperable, must be given to the destruction of similar components in spare part storage areas.

MEANS AND PROCEDURES

6 If destruction is ordered, due consideration should be given to:

6.1 Selection of a point of destruction that will cause greatest obstruction to enemy movement and also prevent hazard to friendly troops from fragments of ricocheting projectiles which may occur incidental to the destruction by gunfire.

6.2 Observance of appropriate safety precautions.

7 Of the several means of destruction, those most generally applicable are mechanical, burning and gunfire. The information given in paragraphs 8, 9 and 10 is for guidance only.

Mechanical

8 This requires an axe, pick, crowbar or similar implement. The equipment should be destroyed in accordance with priorities given in Table 1.

Burning

WARNING

FLAMMABLE LIQUIDS. DUE CONSIDERATION MUST BE GIVEN TO THE HIGHLY FLAMMABLE NATURE OF GASOLINE AND ITS VAPOUR. CARELESSNESS IN ITS USE CAN SERIOUSLY ENDANGER LIFE. IN ACCORDANCE WITH LOCAL INSTRUCTIONS STRICT CODES OF PRACTICE MUST BE ADHERED TO.

9 Burning requires the use of gasoline, oil or other flammables.

9.1 If quantities of combustibles are limited, smash all vital elements such as switches, instruments and control levers.

9.2 Place explosives and charges in and around the equipment so that maximum damage will result from the explosions.

9.3 Pour gasoline over the equipment, ignite by means of an incendiary grenade fired from a safe distance, by a burst from a flame thrower, by a combustible train of suitable length or other appropriate means. Take cover immediately.

Gunfire

WARNING

PERSONAL SAFETY. FIRING ARTILLERY AT RANGES OF 500 YARDS OR LESS, AND FIRING GRENADES OR ANTI-TANK ROCKETS SHOULD BE FROM COVER.

10 When destroying the equipment by gunfire, proceed as follows:

10.1 Smash all vital elements as outlined in sub-paragraph 9.2.

10.2 Destroy the equipment by gunfire, using tank guns, self-propelled guns, artillery, rifles using the rifle grenades or launchers using anti-tank rockets.

PRIORITIES

11 The priorities for equipment destruction (Table 1) should be considered as follows:

11.1 Priority must be given to the destruction of classified equipment and associated documents.

11.2 When lack of time and/or means prevents complete destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on like equipment.

11.3 A guide to priorities for destruction of the equipment is shown in Table 1 - PRIORITIES FOR DESTRUCTION.

TABLE 1 PRIORITIES FOR DESTRUCTION

Item	Priority
[redacted]	1
	2
	3
	4
	5
	6
	7

ANNEX A

ABS SUPPLEMENT

CONTENTS

This supplement is to be read in conjunction with the corresponding chapters within the main body of this AESP.

PRELIMINARY MATERIAL Page

OPERATING INFORMATION

Chapter

INTRODUCTION

1 This supplement provides information about the ABS variant of the Truck, Load Handling, (DROPS) 15 Tonne 8X6, LHD, IMMLC (Foden) and must be read in conjunction with the existing non-ABS manual. (2320-R-307-201 refers).

2 The structure and layout of this supplement is similar to that of the existing manual. It contains both new information about the ABS system and shows where changes have occurred in the existing manual due to the ABS system. Cross references to chapters and page numbers are shown to assist with using the two documents.

ABBREVIATIONS

5 Abbreviations used in this publication, other than those considered to be standard, or engraved/etched as identification for gauges/controls, are listed below:

ABS Anti-Lock Braking System
ECU Electronic Control Unit

CHAPTER 1

GENERAL DESCRIPTION

CONTENTS

ABS changes to existing Chap 1, Page 4

AIR BRAKING SYSTEM

After Para 25 in the existing manual the following information applies:

1 The braking system is a two line system generally conforming to EEC regulations with a two line trailer system to DEF STAN 25 - 19. Spring brakes are mounted on all axles. All brakes are drum type 'S' cam operated with Ferado 3653F brake linings.

ABS information additional to existing Chap 1

After Para 25 in the existing manual the following information applies:

2 An anti-lock braking system (ABS) is incorporated in the braking system to monitor wheel speeds and control braking during wheel lock situations.

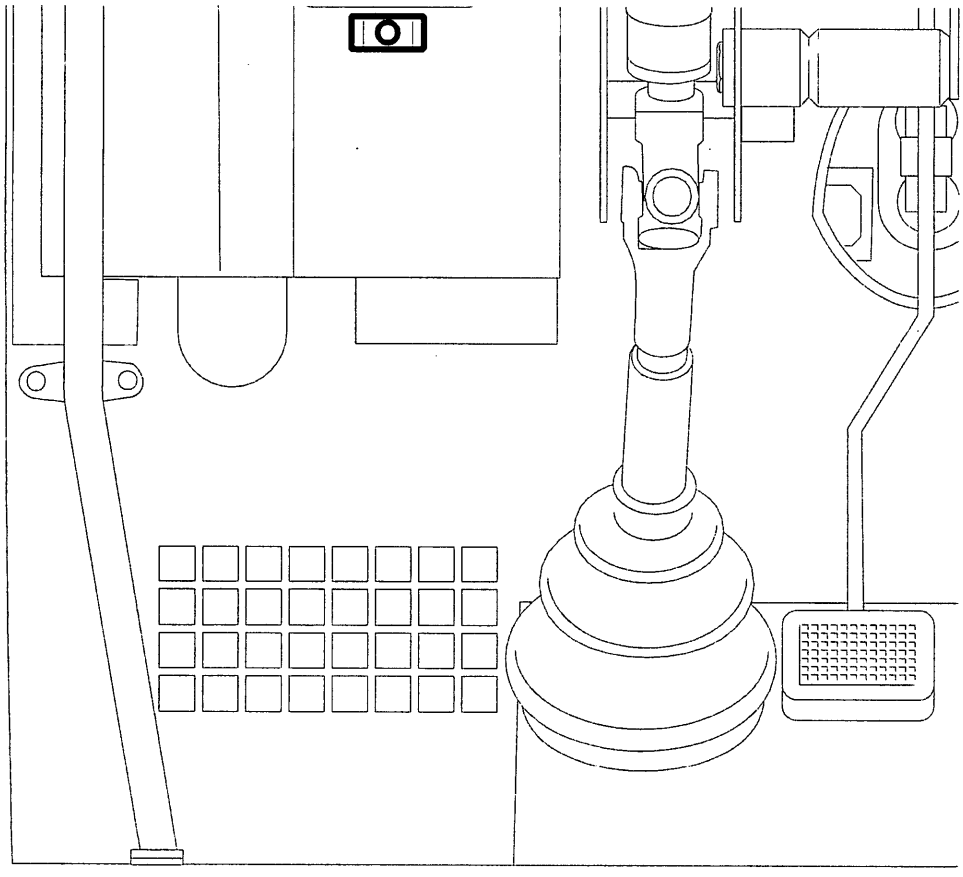
3 The ABS system comprises wheel sensors mounted on each brake bracket, pole wheels mounted on each wheel hub, eight modulator valves, two electronic control units with sockets for diagnostic equipment, ABS fault warning lights and diagnostic blink code lights. An ABS fault warning light for ABS equipped trailers is also provided.

Continue at Para 26 in the existing manual.

CHAPTER 2

CONTROLS & INSTRUMENTS

CONTENTS



1 Switch cover
2 ABS blink code switch
3 ABS 1 warning light
4 TRL. ABS warning light
5 Handbrake warning light
6 ABS 2 warning light

Fig 1 In-cab controls and instruments - drivers position
(steering wheel omitted for clarity)

ABS changes to existing Chap 2, Page 17

EMERGENCY BRAKE RELEASE SWITCH

At Para 29 in the existing manual the following information applies:

1 The emergency brake release switch is used to release the spring brake actuators if the brakes require to be released after a failure or fault condition arising in the secondary brake circuit causing the brake actuators to be engaged i.e. loss of air in system 3. The emergency brake release switch will not remain activated if there is air in the secondary brake system. The switch is protected by a hinged cover (Fig 1 (1)) to prevent inadvertent operation.

Continue at Para 30 in the existing manual.

ABS changes to existing Chap 2, Page 17

TRAILER BRAKE SWITCH

At Para 33 in the existing manual the following information applies:

2 The trailer brake switch operates the trailer brakes when the vehicle is stationary with its hand brake applied to the park position. During normal operation the vehicle service brake system will also operate the trailer brakes. The vehicle hand brake has no effect on the trailer brakes when put into the park position therefore the trailer brake needs to be activated before the driver leaves the cab to operate the park valve located on the trailer. If the hand brake is put to the secondary position the trailer brakes are activated. The switch is protected by a hinged cover (Fig 1 (1)) to prevent inadvertent operation.

Continue at Para 34 in the existing manual.

ABS changes to existing Chap 2, Page 24

TRAILER ELECTRICAL CONNECTIONS

After Para 44 in the existing manual the following information applies:

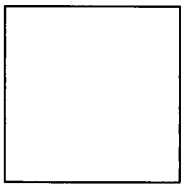
WARNINGS

(1) A PRIME MOVER FITTED WITH ABS CAN TOW A SUITABLE TRAILER, WITH OR WITHOUT ABS FITTED.

(2) A PRIME MOVER NOT FITTED WITH ABS CANNOT TOW A TRAILER WHICH IS FITTED WITH ABS, UNLESS THE PRIME MOVER HAS THE ABILITY TO TRIGGER THE TRAILER ABS THROUGH AN APPROVED INTER-VEHICLE SOCKET.

3 The trailer ABS electrical connection comprises a five pin socket (Fig 2 (1)) fitted on a bracket (2) at the rear of the vehicle adjacent to the right hand rear towing eye. When coupled it provides power to the trailer ABS system. The socket is protected by a cover when not connected and can be replaced with or without replacement of the pins. The pins are crimped to the cable ends and can be replaced without the use of special tools.

Continue at Para 45 in the existing manual.



1 Socket 2 Bracket

Fig 2 ABS trailer socket

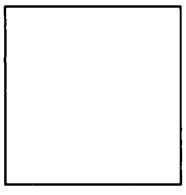
ABS changes to existing Chap 2, Page 27

MAIN ELECTRICAL PANEL

At Para 48 in the existing manual the following information applies:

4 The main electrical panel (Fig 3) is housed under the front instrument panel and is protected by a hinged cover. The electrical circuits protected by each fuse and relay are shown on a PCB, Fuse and Relay diagram (1) affixed to the inner face of the cover. On the panel are mounted the ABS system fuses (2), retarder relay R25 ECU 1 (3), retarder relay R26 ECU 2 (4), a stop warning buzzer and turn indicator flasher unit.

Continue at Para 49 in the existing manual.



1 Fuse and relay diagram
2 ABS system fuses
3 Relay R25
4 Relay R26

Fig 3 Main electrical panel

ABS information additional to existing Chap 2

ABS BLINK CODE WARNING LIGHTS AND SWITCH

ABS blink code warning lights - ABS 1 and ABS 2 (See Fig 1 (3) and (6))

CAUTION

The blink code system is intended as a Workshop diagnostic aid and must only be operated by authorised workshop personnel. Comprehensive operating instructions are contained in AESP 2320-R-302-512, Chap 10 (ABS Supplement).

5 The amber ABS blink code warning lights marked 'ABS 1' and 'ABS 2' have the dual function of indicating to the driver the presence of faults in the vehicle ABS systems and for maintenance personnel information as to the type of fault and its location on the vehicle. The appropriate blink code warning light will illuminate to indicate that a fault is present and will remain illuminated whilst the vehicle ignition is switched on until the fault is repaired.

ABS warning light - TRL. ABS (See Fig 1 (4))

6 The amber ABS warning light marked 'TRL. ABS' indicates ABS faults on trailers drawn by the vehicle providing that the trailer is equipped with an ABS system. The TRL. ABS warning light does not have a blink code function and cannot be used to diagnose faults on the trailer.

ABS blink code switch (See Fig 1 (2))

7 The blink code switch marked 'BLINK CODE' is a rocker type switch used by maintenance personnel to access information about the type of fault and its location on the vehicle. This information is displayed by the appropriate blink code warning light in a series of short flashes or blinks.

NOTE

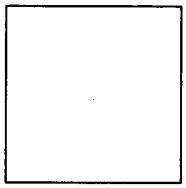
There is no requirement to operate the blink code rocker switch for any other reason than to investigate faults. It has no function in the normal operation of the vehicle.

HANDBRAKE WARNING LIGHT

8 The red handbrake (parking brake) warning light (See Fig 1 (5)) will illuminate to provide a visual warning that the handbrake is in the park position.

ABS ECU DIAGNOSTIC SOCKETS

9 Two ECU diagnostic sockets (Fig 4 (1) and (2)) are located on the partition within the storage bin on the right hand side of the cab dashboard and are used for the connection of a diagnostic controller to access fault information stored in the ECUs. The rearmost diagnostic socket (Fig 4 (1)) connects with ABS 1 ECU and the foremost diagnostic socket (Fig 4 (2)) with ABS 2 ECU.



1 ABS 1 ECU diagnostic socket 2 ABS 2 ECU diagnostic socket

Fig 4 ABS ECU diagnostic sockets

CHAPTER 3

OPERATING INSTRUCTIONS

CONTENTS

ABS information additional to existing Chap 3

ANTI-LOCK BRAKING SYSTEM

Introduction

1 The purpose of an ABS system is to prevent the wheels of a vehicle from locking (stopping) and skidding because the foot brake has been applied too harshly by the driver. The ABS system is automatic and operates when the vehicle is braked. It does not require any action on the part of the driver to operate or select the ABS operation. The rotation of each wheel is constantly monitored by an ECU and the braking force to each wheel is regulated to prevent wheel lock from occurring. This function takes place irrespective of the force being applied on the foot brake by the driver and will achieve a controlled and safe stop in relation to the road surface conditions and other factors.

2 The braking system is not affected by faults within the ABS system other than the partial or total loss of ABS control on one or more wheels. In these circumstances normal braking is still possible but stopping distances may be longer and wheel lock-up leading to skidding is possible. Good braking procedure is necessary at all times as the application or loss of ABS is not noticeable when driving the vehicle.

ABS DRIVING INSTRUCTIONS

WARNINGS

(1) DO NOT ABUSE THE ANTI-LOCK BRAKING SYSTEM BY BRAKING HARSHLY OR BY A DELAYED APPLICATION OF THE SERVICE BRAKES.

(2) THE ABS DOES NOT SHORTEN THE OVERALL STOPPING DISTANCE OF THE VEHICLE. DEPENDENT UPON THE ROAD CONDITIONS, THE OVERALL VEHICLE STOPPING DISTANCE CAN BE INCREASED.

(3) TO MAXIMISE THE EFFICIENCY OF THE ABS SYSTEM, DO NOT USE A CADENCE BRAKING TECHNIQUE (I.E. RAPID AND REPETITIVE APPLICATIONS OF THE SERVICE BRAKES). WHEN BRAKING, ENSURE THAT A CONTINUOUS PRESSURE IS APPLIED TO THE FOOTBRAKE PEDAL.

(4) DO NOT ATTEMPT TO DRIVE THE VEHICLE WHILST ANY ABS WARNING LAMP IS ILLUMINATED INDICATING AN ABS FAILURE.

(5) FAILURE OF THE VEHICLE OR TRAILER ABS WARNING LAMPS TO ILLUMINATE INDICATES A POSSIBLE MAJOR MALFUNCTION OF THE ABS ELECTRONIC CONTROL UNIT (ECU). DO NOT ATTEMPT TO DRIVE THE VEHICLE IF THE WARNING LAMPS FAIL TO FUNCTION CORRECTLY.

(6) IN THE EVENT OF A VEHICLE COMBINATION ABS FAILURE THE DRIVER MUST COMPENSATE HIS DRIVING TECHNIQUES ACCORDINGLY.

3 If during the 'first parade service' an ABS warning light remains illuminated the fault must be reported; do not proceed until authorised.

NOTE

Following a revision of the electronic logic in the trailer ECU, when towing a DROPS trailer fitted with ABS two circumstances prevail concerning the trailer ABS warning light in the driver cab. When the vehicle key switch is switched on the trailer ABS warning light will either:

(a) Illuminate and extinguish after 3 seconds (i.e. as truck ABS warning lights).

or

(b) Illuminate and remain on until the vehicle speed exceeds 7 km/h.

(All assuming no faults are present).

If the trailer ABS warning light does not extinguish in either condition, carry out the same actions as with a vehicle ABS fault.

4 If during the journey an ABS warning light illuminates this indicates an ABS fault has occurred which will return the vehicle to a conventional braking system. Missions can be completed as the conventional braking system remains fully operational. On completion of the mission the fault must be reported.

5 The Anti-lock Braking System (ABS) prevents the vehicle road wheels from locking during an emergency stop or when braking on a slippery road surface. The ABS will enable the driver to retain full control of the vehicle and maintain directional stability during an ABS detected wheel lock condition.

6 It is essential that the vehicle be driven in a safe and conventional manner. Do not adapt your normal driving style when driving a vehicle equipped with ABS.

Vehicle and trailer compatibility

WARNINGS

(1) A PRIME MOVER FITTED WITH ABS CAN TOW A SUITABLE TRAILER, WITH OR WITHOUT ABS FITTED.

(2) A PRIME MOVER NOT FITTED WITH ABS CANNOT TOW A TRAILER WHICH IS FITTED WITH ABS, UNLESS THE PRIME MOVER HAS THE ABILITY TO TRIGGER THE TRAILER ABS THROUGH AN APPROVED INTER-VEHICLE SOCKET.

7 Before towing a suitable trailer equipped with an ABS system insert the trailer ABS plug into the ABS socket on the rear of the vehicle. This will provide power and communication facilities between the vehicle and the trailer ECU.

Blink code warning lights

WARNINGS

(1) DO NOT ATTEMPT TO DRIVE THE VEHICLE WHILST ANY ABS WARNING LAMP IS ILLUMINATED INDICATING AN ABS FAILURE.

(2) THE *"ABS"* AND *"TRL. ABS"* WARNING LAMPS WILL BE DISABLED WHENEVER THE LIGHTING SWITCH IS IN THE *"C"* (CONVOY) OR *"CS"* (CONVOY/SIDELIGHT) POSITIONS.

(3) FAILURE OF *"ABS"* AND *"TRL. ABS"* WARNING LAMPS TO ILLUMINATE INDICATES A POSSIBLE MAJOR MALFUNCTION OF THE ABS ELECTRONIC CONTROL UNIT (ECU). DO NOT ATTEMPT TO DRIVE IF THE WARNING LAMPS FAIL TO FUNCTION CORRECTLY.

8 When illuminated the ABS blink code warning lights marked 'ABS 1' and 'ABS 2' indicate that a fault is present in the appropriate ABS system. Warning light 'TRL. ABS' when illuminated indicates that a fault is present in the trailer ABS system providing that the trailer is connected to the vehicle.

CAUTION

The ABS blink code fault diagnostic system is intended as a workshop diagnostic aid and must only be operated by authorised workshop personnel. Comprehensive operating instructions are contained in AESP 2320-R-302-512, Chap 10 (ABS Supplement).

9 The switch marked 'BLINK CODE' is for the use of maintenance personnel undertaking the diagnosis of faults and is not normally operated by the driver. The switch does not have any effect upon driving or braking.

Ignition ON and engine start

10 Turn the starter key switch to the ignition ON position and start the engine. The ABS blink code warning lights marked 'ABS 1' and 'ABS 2' and the trailer warning light marked 'TRL. ABS' (if an ABS equipped trailer is connected to the vehicle) will illuminate. If a warning light does not illuminate there is a fault and this must be reported for maintenance action before proceeding further.

11 The ECUs will perform a stationary vehicle check on each modulator valve and on other components within the ABS system. It is normally possible to hear a click from each valve in succession as it is checked. If the ECUs find the system is free of all faults and the blink code warning lights go out, no further action is necessary and the vehicle (with trailer) can be driven.

12 If a blink code warning light remains illuminated it is necessary to drive the vehicle (with trailer) forward to allow the ECU to perform a moving vehicle check. On reaching a speed of more than 7 km/h the blink code warning lights must go out. If one or more warning lights remain illuminated there is a fault. Stop the vehicle and report the fault for maintenance action.

CAUTION

When conducting an emergency start due to battery failure, the correct slave start procedure must be used to prevent risk of electrical system damage.

EMERGENCY STARTING PROCEDURE

13 In the event of the vehicle batteries being fully discharged (flat), the vehicle may be started with the aid of the Inter-Vehicle Start Socket (IVSS), from a donor vehicle with known charged batteries. After starting the casualty vehicle, the headlights, heater motor and as many other power consumers as possible should be switched ON. This is to help protect the Electronic Control Units fitted to the vehicle, by dissipating the electrical surge that will be generated when the IVSS lead or jump leads are disconnected.

14 The following sequence of events is recommended for jump starting vehicles fitted with IVSS sockets:

14.1 Ensure the casualty vehicle is in neutral.

14.2 Ensure the emergency gear selector of the casualty vehicle is in neutral.

14.3 Connect the IVSS lead between the casualty vehicle and the donor vehicle.

14.4 Ensure the battery isolation switch of the casualty vehicle is in the ON position.

NOTE

If the isolation switch was switched off from the cab, this may cause confusion, as the handle remains in the ON position, whilst the window of the isolation switch shows OFF. To ensure the switch is actually ON, rotate the handle anti-clockwise through 90° and then clockwise through 90°.

14.5 Start the donor vehicle.

14.6 Switch on the power consumers, as described above, in the donor vehicle.

14.7 Start the casualty vehicle.

14.8 Switch on the power consumers, as described above, in the casualty vehicle.

14.9 Leave both vehicles running at tick over speed for a minimum of 3 minutes.

14.10 Disconnect the IVSS lead and store in the appropriate place.

14.11 Switch off the power consumers in both the casualty and the donor vehicles.

15 If either the donor vehicle or the casualty vehicles are not fitted with IVSS sockets, a suitable set of jump leads may be used.

16 The following sequence of events is recommended for jump starting vehicles not fitted with IVSS sockets:

16.1 Ensure the casualty vehicle is in neutral.

16.2 Ensure the emergency gear selector of the casualty vehicle is in neutral.

16.3 Connect the jump leads to the casualty vehicle first, ensuring that the positive lead is connected first and the negative lead last.

16.4 Connect the jump leads to the donor vehicle, ensuring that the positive lead is connected first and the negative lead last.

16.5 Ensure the battery isolation switch of the casualty vehicle is in the ON position.

NOTE

If the isolation switch was switched off from the cab, this may cause confusion, as the handle remains in the ON position, whilst the window of the isolation switch shows OFF. To ensure the switch is actually ON, rotate the handle anti-clockwise through 90° and then clockwise through 90°.

16.6 Start the donor vehicle.

16.7 Switch on the power consumers, as described above, in the donor vehicle.

16.8 Start the casualty vehicle.

16.9 Switch on the power consumers as described above, in the casualty vehicle.

16.10 Leave both vehicles running at tick over speed for a minimum of 3 minutes.

16.11 Disconnect the jump leads from the casualty vehicle first, ensuring that the negative lead is disconnected first and the positive lead last. Then store in the appropriate place.

16.12 Disconnect the jump leads from the donor vehicle, ensuring that the negative lead is disconnected first and the positive lead last. Then store in the appropriate place.

16.13 Switch off the power consumers in both the casualty and the donor vehicles.

17 If no emergency donor vehicle is available, then 2 x 12-volt batteries wired in series to create a 24-volt power supply and a suitable set of jump leads may be used.

18 The following sequence of events is recommended for jump starting vehicles with an external power supply:

18.1 Ensure the casualty vehicle is in neutral.

18.2 Ensure the emergency gear selector of the casualty vehicle is in neutral.

18.3 Connect the jump leads to the casualty vehicle first, ensuring that the positive lead is fitted first and the negative lead last.

18.4 Connect the jump leads to the external power supply, ensuring that the positive lead is fitted first and the negative lead last.

18.5 Ensure the battery isolation switch of the casualty vehicle is in the ON position.

NOTE

If the isolation switch was switched off from the cab, this may cause confusion, as the handle remains in the ON position, whilst the window of the isolation switch shows OFF. To ensure the switch is actually ON, rotate the handle anti-clockwise through 90° and then clockwise through 90°.

18.6 Start the casualty vehicle.

18.7 Switch on the power consumers as described above in the casualty vehicle.

18.8 Disconnect the jump leads from the casualty vehicle first, ensuring that the negative lead is disconnected first and the positive lead last. Then store in the appropriate place.

18.9 Disconnect the jump leads from the external power supply, ensuring that the negative lead is disconnected first and the positive lead last. Then store in the appropriate place.

18.10 Switch off the power consumers in the casualty vehicle.

18.11 Replace the external power supply in the appropriate place.

NOTE

Following a revision of the electronic logic in the trailer ECU, when towing a DROPS trailer fitted with ABS two circumstances prevail concerning the trailer ABS warning light in the driver cab. When the vehicle key switch is switched on the trailer ABS warning light will either:
(a) Illuminate and extinguish after 3 seconds (i.e. as truck ABS warning lights).
or
(b) Illuminate and remain on until the vehicle speed exceeds 7 km/h.
(All assuming no faults are present).
If the trailer ABS warning light does not extinguish in either condition, carry out the same actions as with a vehicle ABS fault.

ABS changes to existing Chap 3, Page 15

TRAILER BRAKE VALVE (CAB MOUNTED)

At Para 22.1 in the existing manual the following information applies:

WARNING

WHEN PARKING ON AN INCLINE WITH A TRAILER ATTACHED THE VEHICLE PARK BRAKES MAY NOT HOLD THE VEHICLE/TRAILER COMBINATION. IN THIS EVENT OPERATING INSTRUCTIONS, FOR THE USE OF THE TRAILER BRAKE VALVE, MUST BE STRICTLY FOLLOWED.

19 If parking the vehicle on an incline with a trailer attached and the vehicle park brakes do not hold:

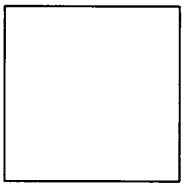
19.1 Unfasten and open the cover (Fig 1 (1)) and apply the trailer brakes by operating the TRAILER BRAKE switch (Fig 1) to ON. Close and fasten the cover.

Continue with this procedure at Para 2.2 in the existing manual.

At Para 23.2 in the existing manual the following information applies:

20 Unfasten and open the cover (Fig 1 (1)) and operate the cab mounted trailer brake switch to ON. Close and fasten the cover.

Continue with this procedure at Para 23.2 in the existing manual.



1 Cover

Fig 1 Trailer brake and emergency brake release switches with cover

ABS changes to existing Chap 3, Page 17

EMERGENCY BRAKE RELEASE

At Para 25 in the existing manual the following information applies:

WARNING

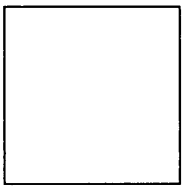
WHEN OPERATING THE EMERGENCY BRAKE RELEASE THE HAND BRAKE SHOULD REMAIN IN THE PARK POSITION. USE OF THE EMERGENCY BRAKE RELEASE SWITCH WILL RENDER PARK AND SECONDARY BRAKES INOPERATIVE.

21 In the event of a failure or a fault condition in the secondary spring brake air line, the vehicle brakes (and a trailer, if attached) will be applied and will remain engaged. To release the spring brakes unfasten and open the cover (Fig 1 (1)) and push the EMERGENCY BRAKE RELEASE switch (Fig 1) mounted to the left of the steering column and below the dashboard.

ABS information additional to existing Chap 3, Page 15

HAND BRAKE WARNING LIGHT

22 The hand brake (parking brake) red warning light (Fig 2 (1)) gives a visual indication of the hand brake position. When illuminated it indicates that the hand brake is applied.

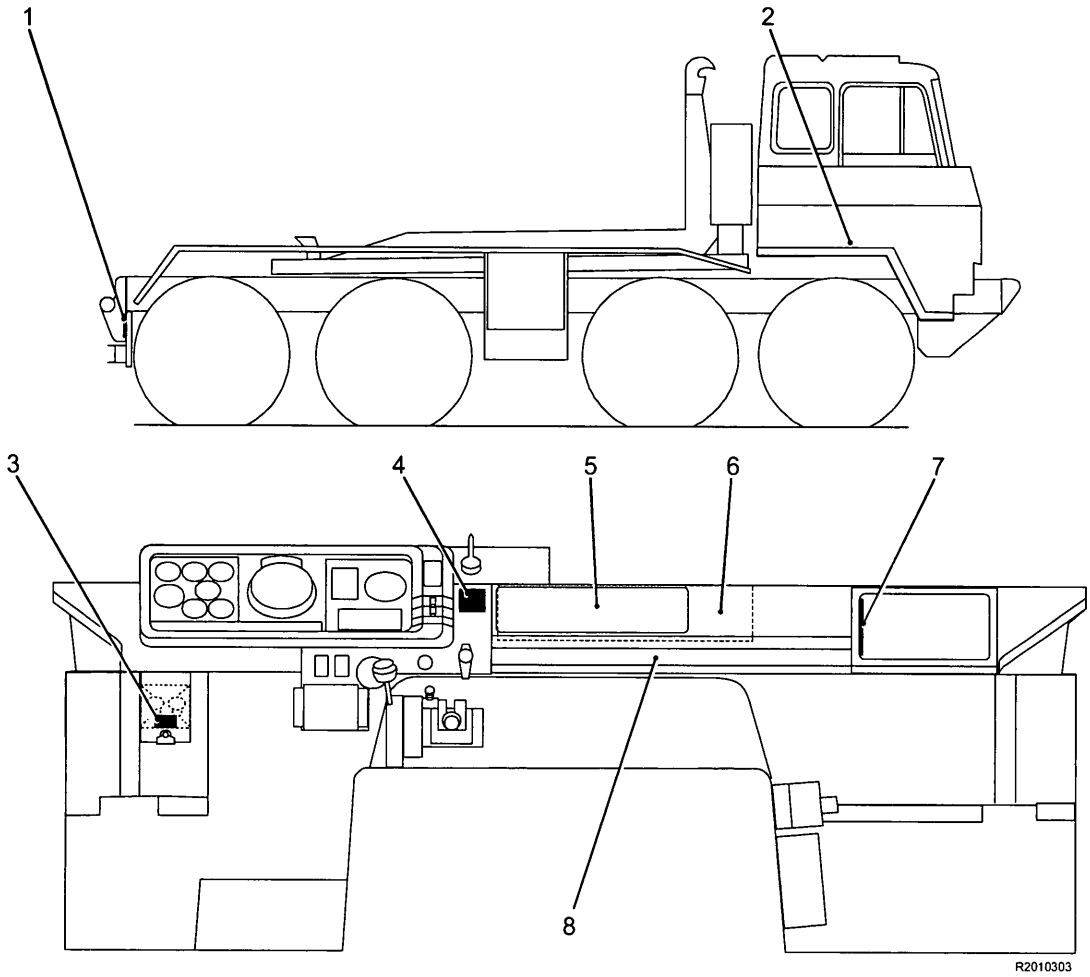


1 Hand brake warning light

Fig 2 Hand brake warning light

LOCATION OF WARNING AND INSTRUCTION LABELS

23 Situated throughout the DROPS IMMLC vehicle are various warning and instruction labels with which the driver/operator of this equipment must be aware. Fig 3 shows the general disposition of these labels and subsequent Figs show the detail and shape of each label. Driver/operators of the IMMLC vehicle must locate these labels and read the instructions shown inscribed, before operating the equipment.



1 Rear cross member, right hand cab
2 Rear edge of passenger door
3 Lower console
4 Upper console
5 Console lid
6 Inside console lid
7 Storage bin partition
8 Printed circuit board

Fig 3 Warning and instruction label locations

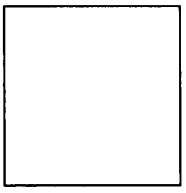


Fig 4 Trailer ABS socket label

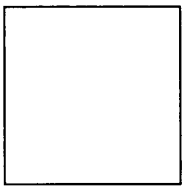


Fig 5 Load sensing valve label

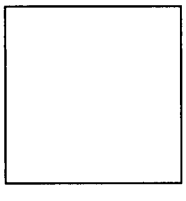


Fig 6 Spring brake and trailer brake cover label

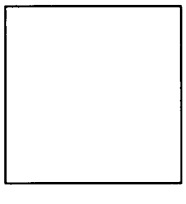


Fig 7 Fitted with ABS label

ABS changes to existing Chap 3, Page 44

At Fig 48 in the existing manual the following information applies:

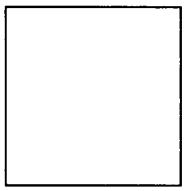


Fig 8 Driver warnings, LHS, inclinometer and ABS label

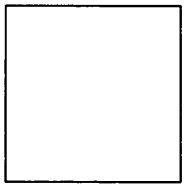


Fig 9 Main fuse label

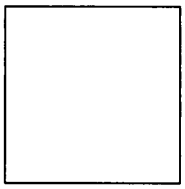
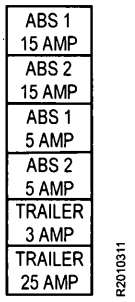


Fig 10 Diagnostics socket label



62-01191-300

Ⓓ

Fig 11 Fuse label

CHAPTER 5

SPARES

CONTENTS

ABS changes to existing Chap 5, Page 8

LAMPS

At Para 13 in the existing manual the following information applies:

1 The voltage, wattage and type of lamp fitted to the vehicle is listed in Table 1 LAMP DATA. The type number in column 4 refers to Figure 1.

TABLE 1 LAMP DATA

Lamp	Volts	Watts	Type
Iluminated switches (including ABS warning lights)	24	1.1	1

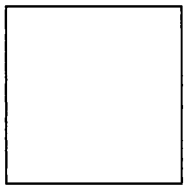


Fig 1 Lamp types