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TRUCK, 4t, 4x4, BEDFORD MJ ALL VARIANTS

TECHNICAL DESCRIPTION

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PREFACE

Sponsor : DGEME(A)EME 7(b)

INTRODUCTION

1. Service users should forward any comments on this publication through the channels prescribed in AESP 0100-P-011-013.

2. The subject matter of this publication may be affected by Defence Council Instructions (DCIs), Standard Operating Procedures (SOPs) or by Local Regulations. When any such Instruction, Order or Regulation contradicts any portion of this publication they are to be taken as the overriding authority.

3. For periods of servicing and lubricants to be used, reference must be made to the Maintenance Schedule.

RELATED AND ASSOCIATED PUBLICATIONS

Related Publications

4. The Octad for the subject equipment consists of the publications shown. All references are prefixed with the first eight digits of this publication.

CATEGORIES AND INFORMATION LEVELS														
Category	1	2	3	4		5				6	7		8	
Level				1	2	1	2	3	4		1	2	1	2
1 USER/OPERATOR	**101**	**201**	**201**	*	*	**201**	**201**	*	*	**601**	**711**	**721**	*	*
2 UNIT MAINTENANCE	*	*	**302**	*	*	**512**	**522**	**532**	*	*	*	*	*	*
3 FIELD MAINTENANCE	*	*	**302**	*	*	**512**	**523**	**533**	*	*	*	*	*	*
4 BASE MAINTENANCE	*	*	**303**	*	*	**512**	**523**	**533**	*	*	*	*	*	*

1.0 Purpose & Planning Information
2.0 Operating Information
3.0 Technical Description
4.1 Installation Instructions
4.2 Prep for Special Environments
5.1 Failure Diagnosis
5.2 Repair Instructions
5.3 Inspection Standards
5.4 Calibration Procedures
6.0 Maintenance Schedules
7.1 Illustrated Parts Catalogue
7.2 Commercial Parts List
8.1 Modification Instructions
8.2 General Instructions

* Not published

Reference to AESP 0100-A-001-001 must be made to ensure the availability of the listed publications.

Associated Publications

5.

Code No	Type	Title
A 028	EMER Test and Measurement	
J 330	EMER Power	Lead Acid Battery Maintenance
N 111	EMER Workshop	Preservation Identification and Package of Assemblies
N 345	EMER Workshop	Assembly Techniques, split shell Bearings using Plastigage method
C 011	EMER Workshop	BS Symbols used in Diagrams for Hydraulic and Pneumatic Systems
2815-K-062-302	AESP	Engine, Diesel 6 cyl. 5.4 litre Bedford

Chapter 1

ENGINE

CONTENTS

ENGINE

GENERAL DESCRIPTION

1. The Bedford six-cylinder direct injection diesel engine has a capacity of 5.4 litre (330 in^3) a nominal bore of 103.20 mm (4.063 in) and a nominal stroke of 107.95 mm (4.25 in).

2. For Technical Description of the engine refer to AESP 2815-K-062-302.

ENGINE MOUNTINGS

3. The engine front/mounting (Fig 1) is a bonded rubber single insulator, located between a bracket on the timing case and the engine front crossmember.

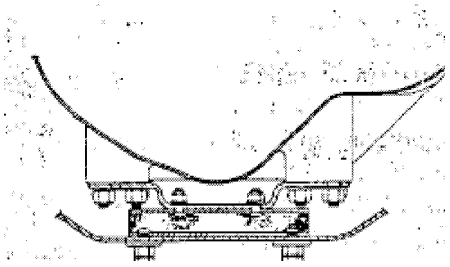


Fig 1 Front engine mounting

4. Tow rear mountings (Fig 2) of the shackle type are attached to a hanger, mounted in the engine rear cross member and to a lug on the flywheel housing. The flywheel housing and hanger eyes incorporate rubber bushes with an inner sleeve.

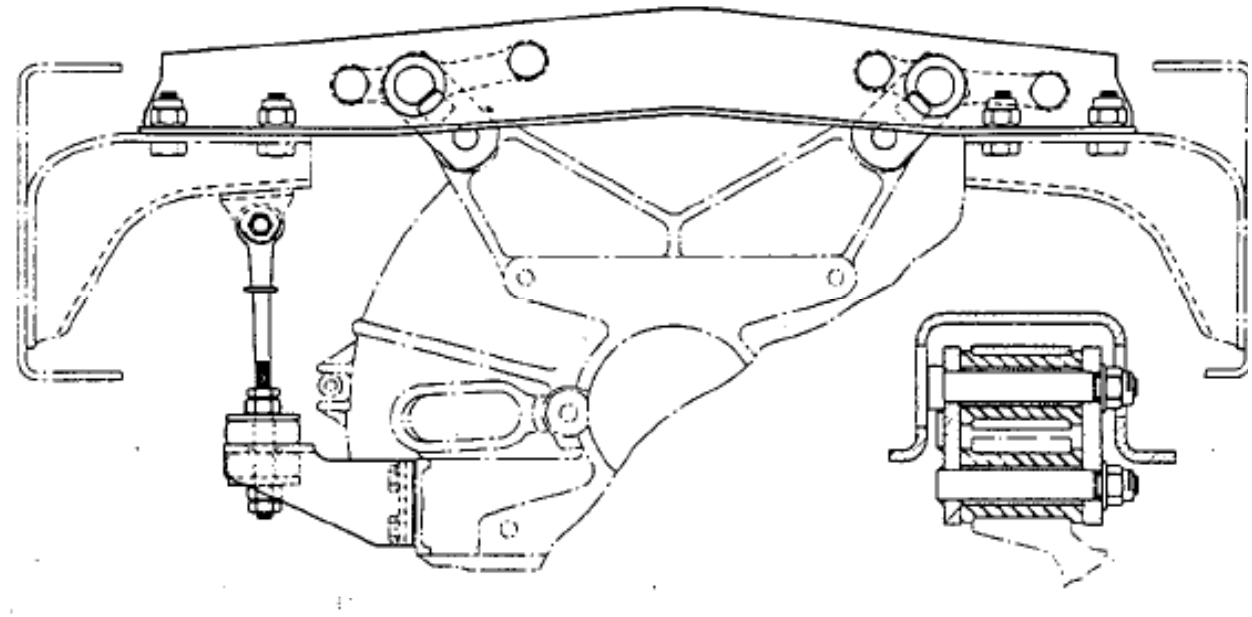


Fig 2 Rear engine mounting

5. An adjustable torque reaction rod is connected between the flywheel housing and the engine rear support crossmember bracket.

Chapter 2

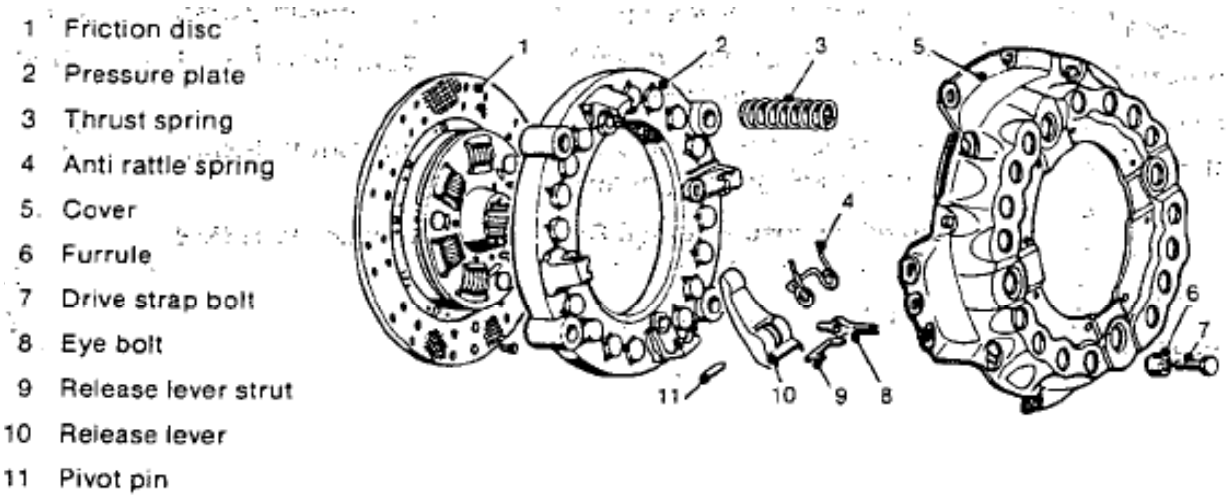
CLUTCH

CONTENTS

CLUTCH

GENERAL DESCRIPTION

1. The 330 mm (13 in) diameter clutch (Fig 1) incorporates four release levers (10) and sixteen thrust springs (3). Drive is transmitted via four drive straps riveted to the cover (5) and bolted to the pressure plate (2).



T5394/6 **Fig 1 Clutch assembly, exploded view**

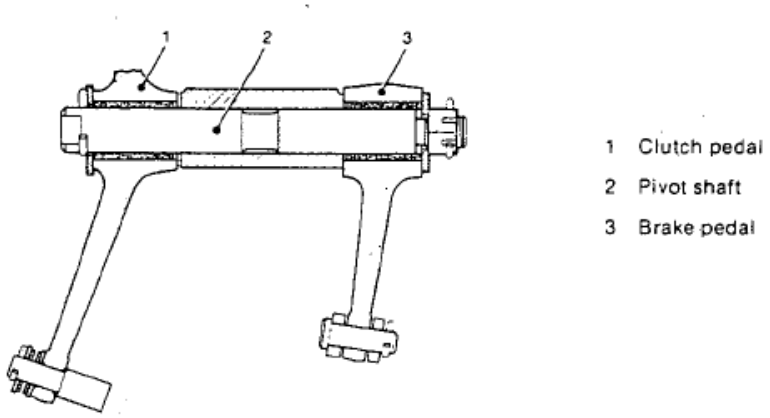
CLUTCH PILOT BEARING

2. Clutch pilot bearing is shielded on both sides and can be installed in the flywheel either way round.

CLUTCH FORK AND RELEASE BEARING

3. The clutch fork pivots on a ball support mounted in the clutch housing. Two pins incorporated in the fork jaw engage a grooved sleeve if the release bearing which slides on the tubular extension of the transmission front cover. The bearing is of the single-row ball type and is packed with lubricant and sealed during manufacture.

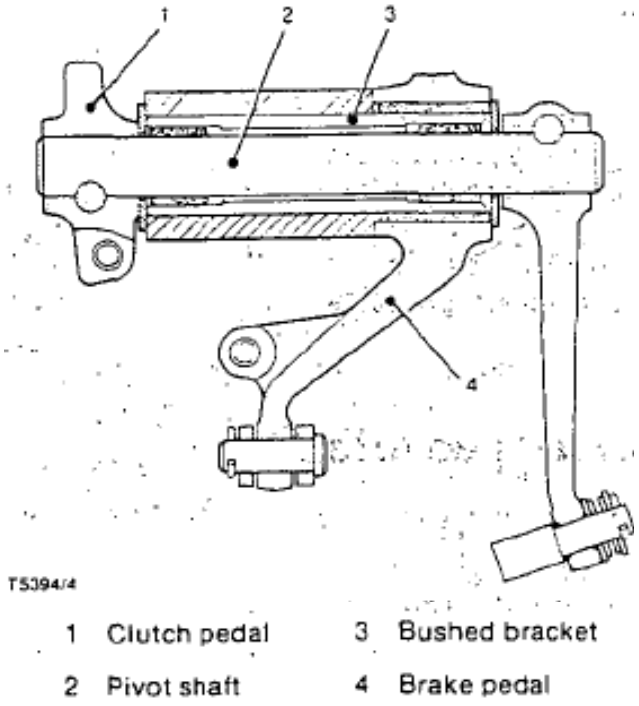
4. The clutch pedal (Fig 2 (1)) and brake pedal (3) on right hand drive vehicles are bushed and pivot on a shaft (2) mounted in the steering gear case.



T5394/3 **Fig 2 - Clutch pedal and shaft assembly, right-hand drive**

5. On left-hand drive vehicles the clutch pedal (Fig 3 (1)) is clamped to a shaft (2) which passes through a bushed bracket (3) in the steering gear casing. A lever on the other end of the shaft operates the clutch push rod. The brake pedal (4) pivots on a bush on the outside of the sleeve.

6. An adjustable stop is provided for adjusting the pedal setting.



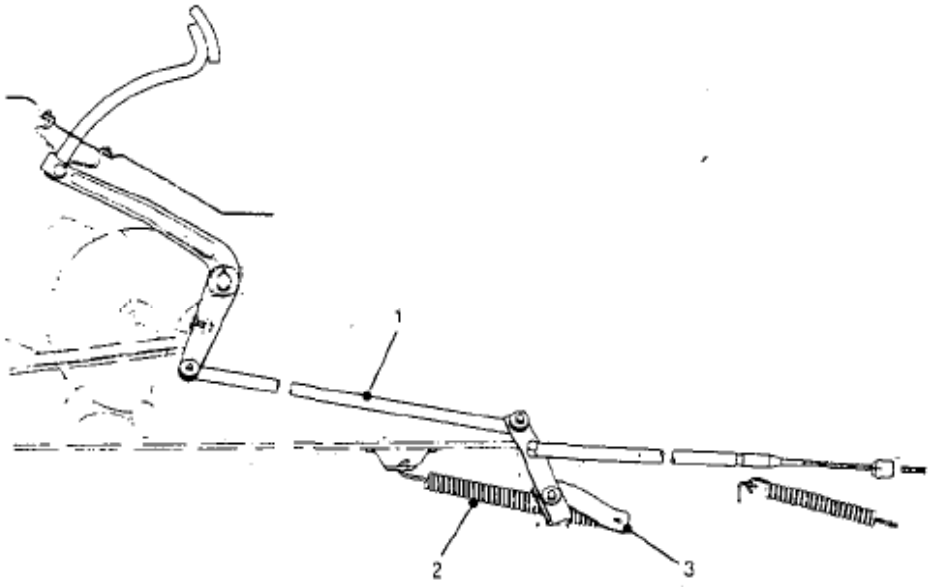
1 Clutch pedal
2 Pivot shaft
3 Bushed bracket
4 Brake pedal

Fig 3 Clutch pedal and shaft assembly left-hand drive

CLUTCH LINKAGE

7. The linkage (Fig 4) from the pedal to the clutch fork consists of push rods interconnected by a relay lever mounted on the chassis frame.

8. Adjustment is provided at the clutch fork end of the linkage.



1 Front push rod
2 Spring
3 Toggle lever

Fig 4 Clutch Linkage T5394/5

9. The push rod lever incorporates a toggle lever (3) and spring (2) designed to assist clutch pedal operation. The spring is anchored to the front spring bump stop bracket.

10. Forward push rod (1) is connected to the upper hole in relay lever, with split pin towards the engine.

Chapter 3

GEARBOX

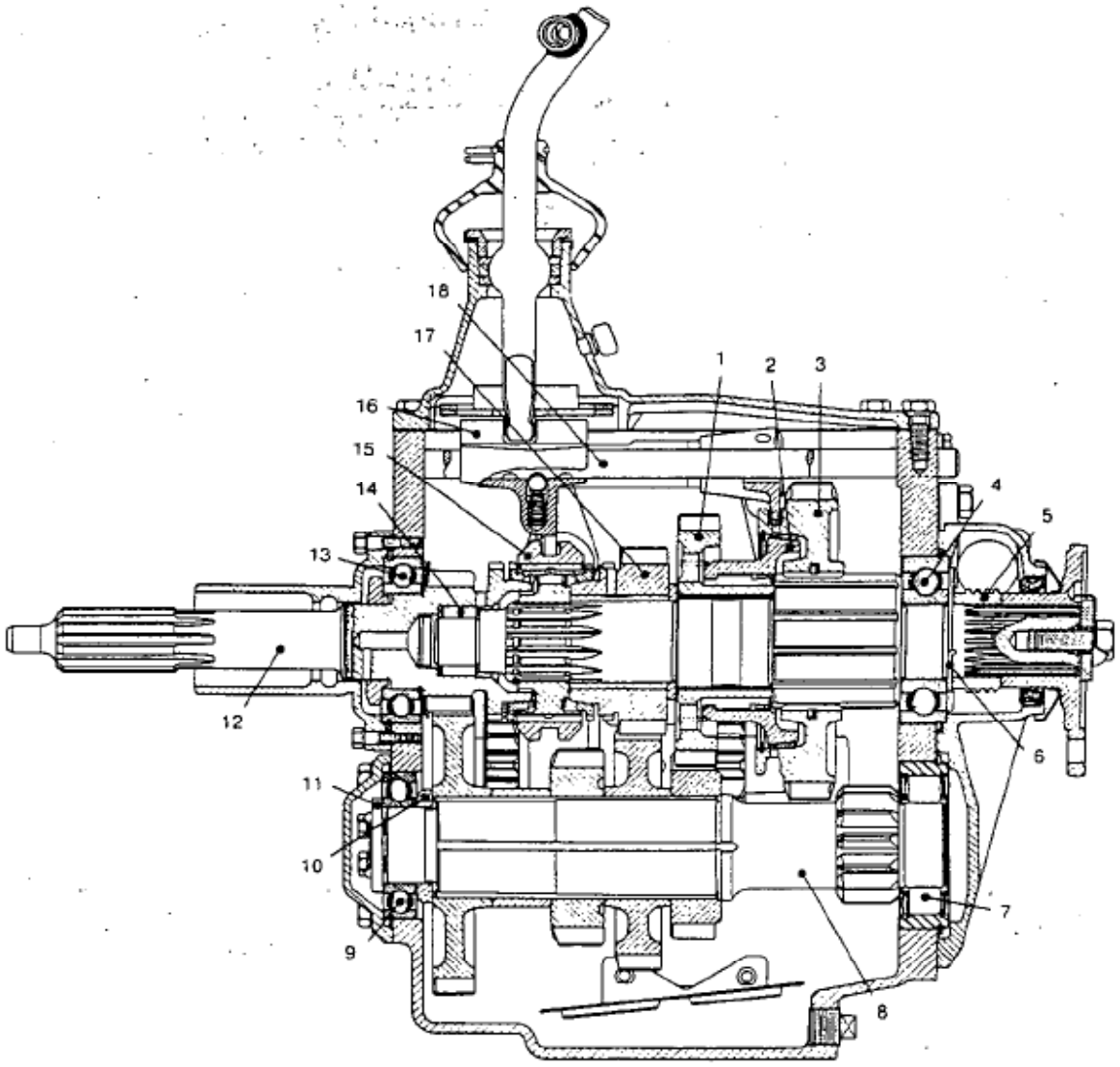
CONTENTS

GEARBOX

GENERAL DESCRIPTION

1. The Bedford four-speed gearbox (Fig 1) incorporates synchromesh engagement on second, third, and fourth speeds.

2. The rear of the main drive pinion is supported by a ball bearing (13) in the transmission casing, and a spigot at the front end of the pinion (12) engages a bearing in the crankshaft.



1	Second speed gear	7	Roller bearing	13	Ball bearing
2	Insert	8	Layshaft	14	Needle rollers
3	First and reverse gear	9	Ball bearing	15	Third and fourth speed clutch
4	Ball bearing	10	Spacer	16	Striking forks
5	Speedometer driving gear	11	Washer	17	Third speed gear
6	Oil thrower	12	Pinion	18	Shift rods

Fig 1 Gearbox

3. The mainshaft is supported at the front, by needle rollers (14) in the main drive pinion counterbore and by a ball bearing (4) in the rear of the gearbox casing.

4. The third and fourth speed synchromesh mechanism (15) incorporates a clutch and a hub which is splined to the mainshaft.

5. The second speed synchromesh mechanism is incorporated in the front of the first and reverse gear (3). The gear houses an insert (2) and a cone with two driving lugs for synchronizing second speed engagement. The bore of the gear is grooved to accommodate a spring damper ring and a rubber compression strip.

6. The second speed gear (1) is bushed but the third speed gear (17) operates on a sleeve pressed on the mainshaft.

7. The layshaft assembly (8) is supported in the front of the gearbox casing by a ball bearing (9) and at the rear by a roller bearing (7).

8. Endwise location of the layshaft is controlled by the front bearing inner race which is clamped between a spacer (10) on the shaft spigot and a thick washer (11) secured by bolts.

9. The first speed gear is integral with the layshaft, the others being keyed and pressed on the shaft.

10. The reverse idler pinion is bushed and operates on a fixed shaft pressed into the casing and secured by a spring pin.

11. Striking forks (16) and reverse lever head operate on fixed shift rods (18) in the top of the casing. Spring-loaded balls, housed in the fork and reverse lever head bosses, enter detent slots when gears are engaged or disengaged.

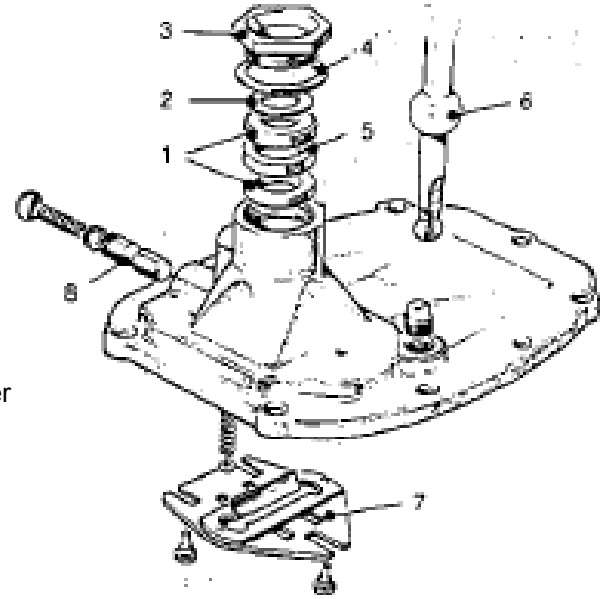
12. Jaws in the reverse lever head engage the top of a reverse striking lever which pivots on an eccentric adjuster bolt in the side of the casing. The lower end of the lever engages the reverse idler pinion.

GEARBOX TOP COVER

13. The gearbox top cover (Fig 2) incorporates two ball seatings (1), a spacer (5) and washer (2).

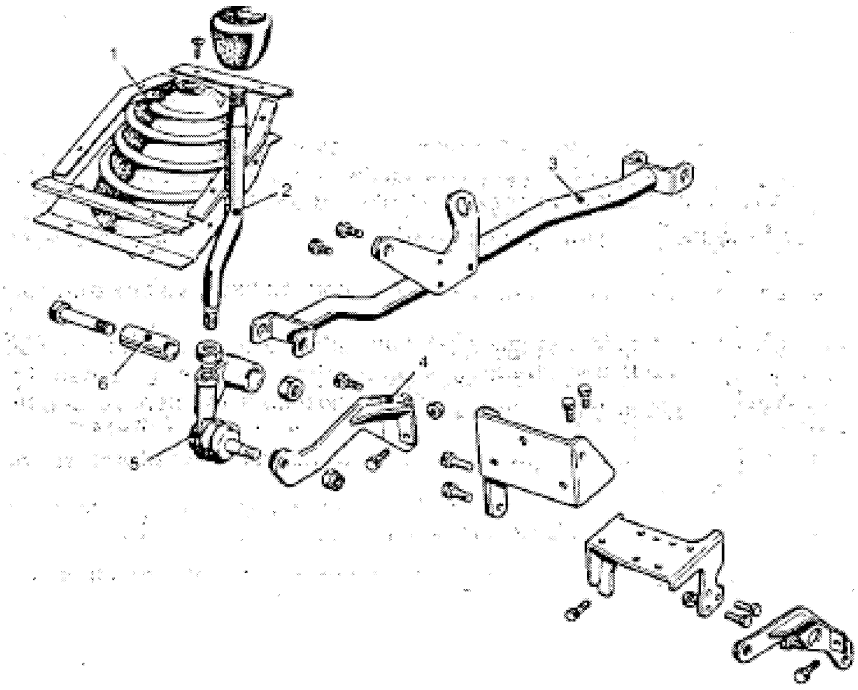
14. The change speed lever (6) is retained by a nut (3) which is locked by a tab washer (4).

15. Individual gear selection is provided by a slotted interlock plate (7) which engages the striking forks. A spring loaded plunger (8) prevents engagement of reverse when a forward speed is selected.



1	Ball seatings	5	Spacer
2	Washer	6	Change speed lever
3	Retaining nut	7	Interlock plate
4	Table washer	8	Plunger

Fig 2 Gearbox top cover



1 Gear shift lever grommet
2 Gear shift lever
3 Gear shift relay rod
4 Mounting bracket
5 Ball joint assembly
6 Bush

Fig 3 Gear shift lever and linkage

GEAR SHIFT LEVER AND LINKAGE

16. The gear shift lever (Fig 3 (2)) is screwed into a ball joint assembly (5) which is mounted on a bracket (4) secured to the engine cylinder head

17. The non-adjustable tubular rod (3) incorporates a yoke at each end and is insulated from vibration by two bushes (6) which are mounted in plastic inserts.

Chapter 4

TRANSFER BOX

CONTENTS

TRANSFER BOX

GENERAL DESCRIPTION

1. The transfer box (Fig 1) is manually controlled by two levers in the cab and provides a direct drive to the rear axle for two wheel drive, or a direct drive to both axles i.e. four wheel drive high, or a two to one reduction to both axles (four wheel drive low). On some vehicles, the transfer box incorporates a power take-off which is controlled by a separate lever.

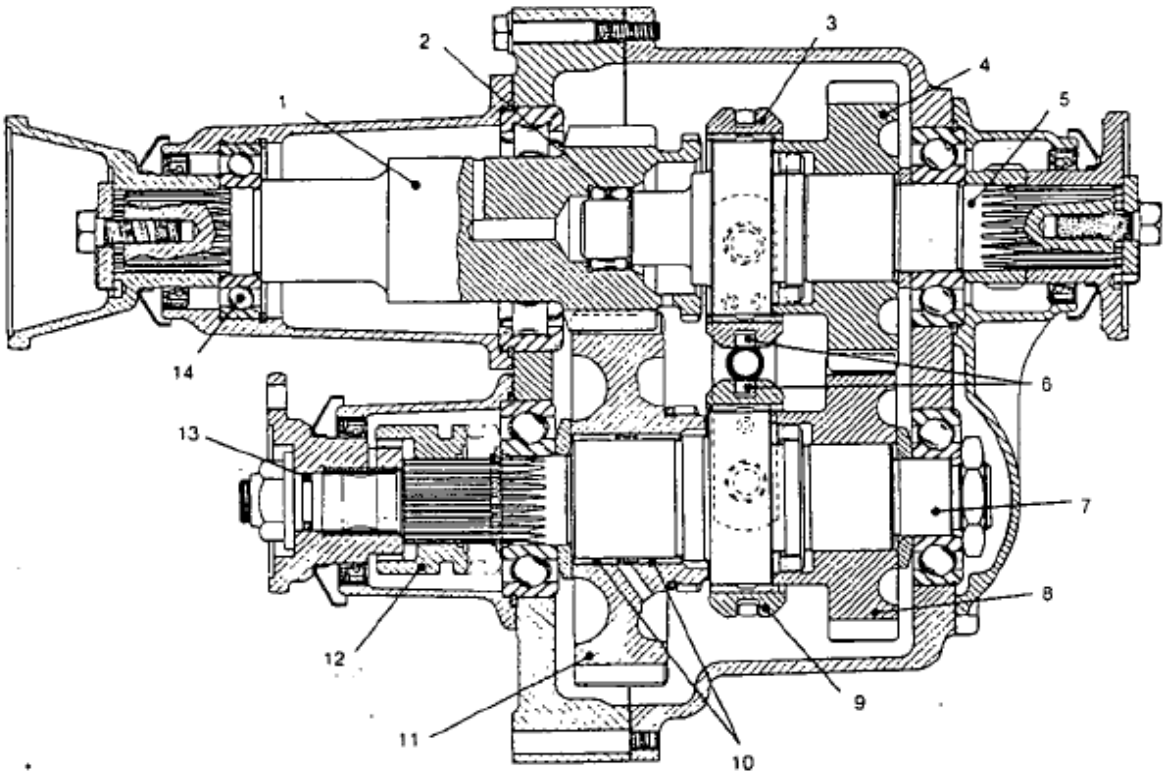
2. The input pinion (1) is supported at its forward end by a ball bearing (14).

3. The rear end of the mainshaft (5) and the front and rear ends of the layshaft (7) are supported by ball bearings and the front of the mainshaft is carried by a roller bearing (2) in a counterbore in the input pinion. Gears dogged to the mainshaft and layshaft are in constant mesh.

4. The layshaft driven gear (11) is carried on needle rollers (10) and is in constant mesh with the input pinion.

5. The front end of the layshaft is splined to engage a front wheel drive clutch (12). Internal teeth on the clutch engage external teeth on the coupling flange when in four wheel drive.

6. A drive for the speedometer is provided at the rear of the transfer box.



1 Input pinion	6 Clutch striking forks	11 Layshaft driven gear
2 Roller bearing	7 Layshaft	12 Front wheel drive clutch
3 Mainshaft clutch sleeve	8 Layshaft direct drive gear	13 O-ring seal
4 Mainshaft gear	9 Layshaft clutch sleeve	14 Ball bearing
5 Mainshaft	10 Needle rollers	

Fig 1 Sectional view of transfer box

Chapter 5

REAR AXLE

CONTENTS

REAR AXLE

GENERAL DESCRIPTION

1. The rear axle (Fig 1) is of the single speed hypoid fully-floating type.

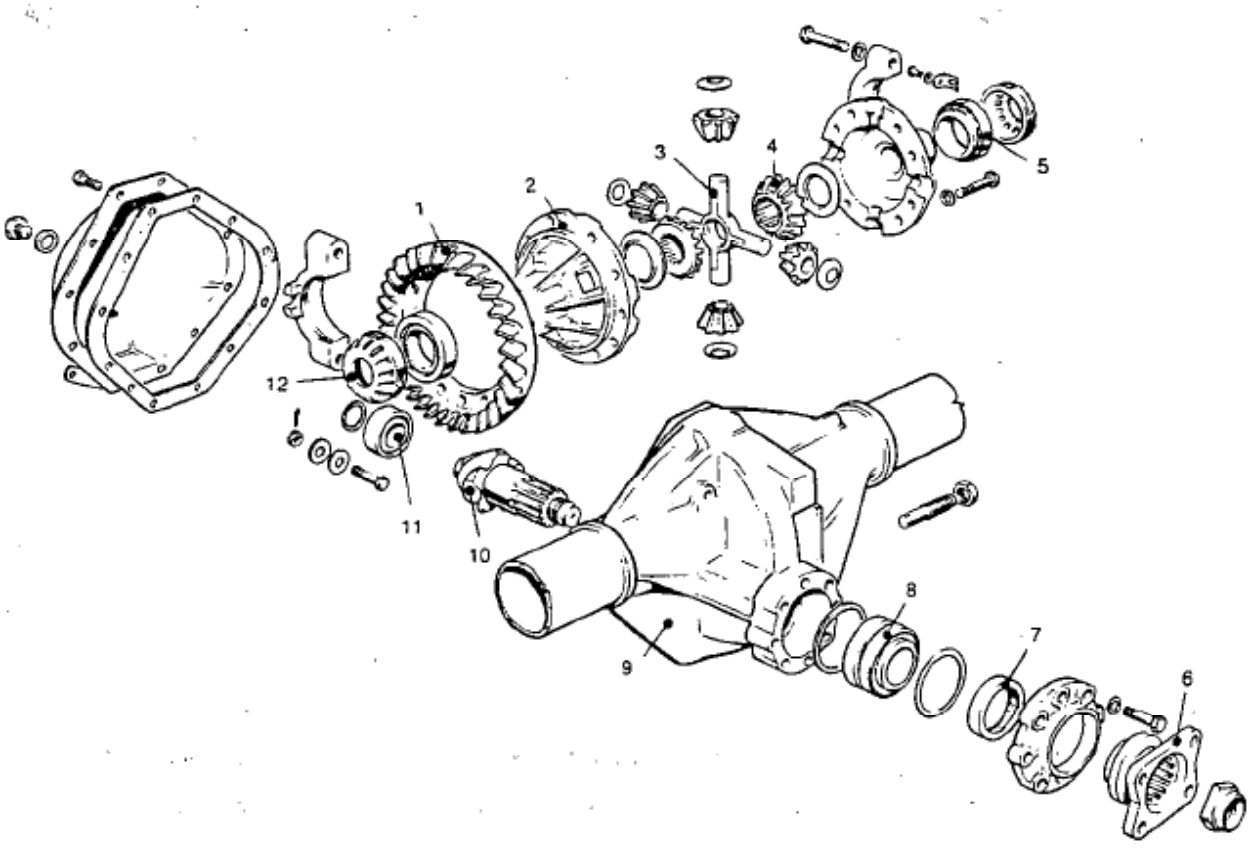
2. The hypoid pinion (10) is straddle mounted between a double row taper roller bearing (8) at the front and a double row parallel roller bearing (11) at the rear.

3. The differential and hypoid gear, and the hubs, are carried on taper roller bearings.

4. Pinion front bearing pre-load is controlled by a graded spacer located between the inner races, and pinion meshing is achieved by shims in the bearing housing.

5. Differential side bearing pre-load, and the lateral location of the differential and hypoid gear, is controlled by adjusting nuts (12).

6. A thrust screw in the axle housing limits deflection of the hypoid gear under heavy load conditions.



1	Hypoid gear	5	Side bearings	9	Axle housing
2	Differential casing	6	Pinion flange	10	Pinion
3	Trunnion	7	Pinion shaft seal	11	Pinion rear bearing
4	Side gears	8	Roller bearing	12	Adjusting nut

Fig 1 Rear axle assembly

Chapter 6

FRONT AXLE

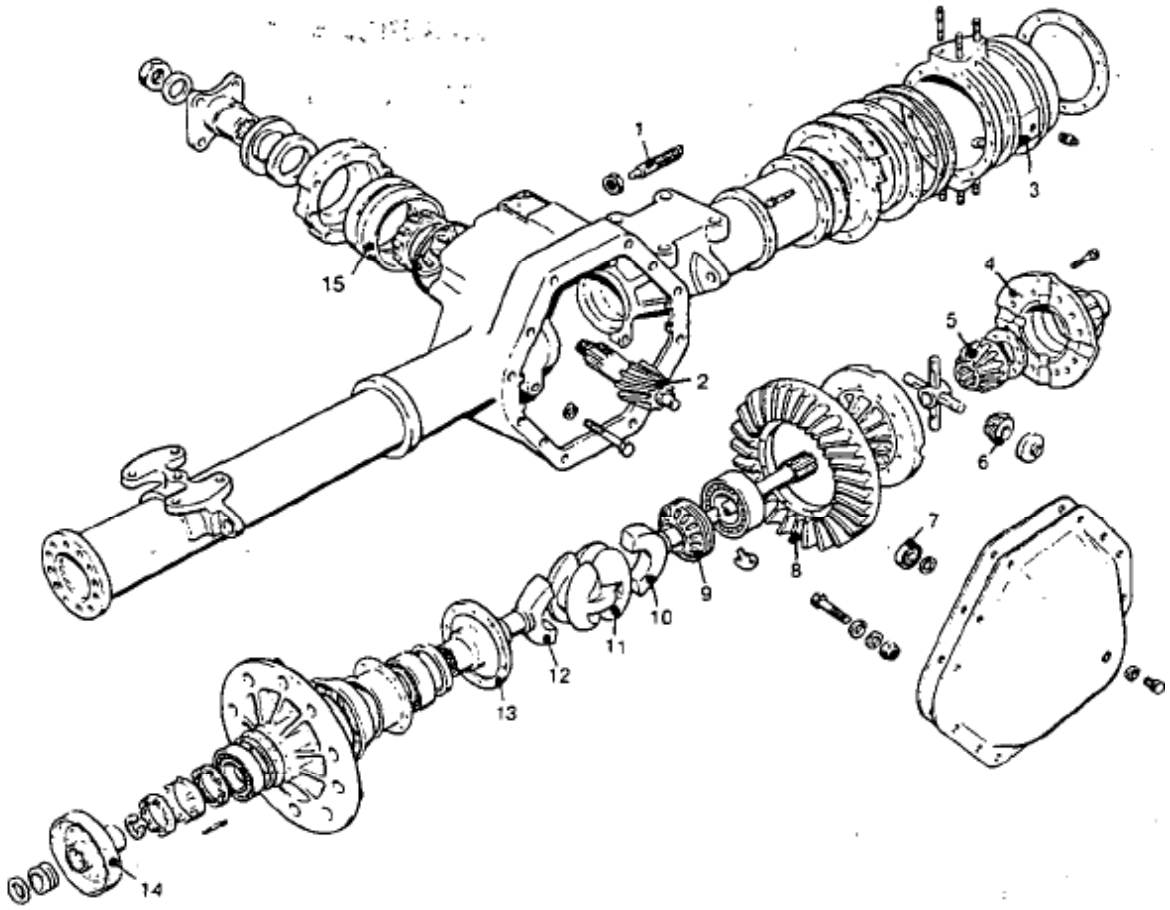
CONTENTS

FRONT AXLE

GENERAL DESCRIPTION

1. The front axle (Fig 1) is of the fully floating type incorporating a hypoid final drive in which the pinion (2) is located above the axis of the hypoid gear (8). Sling plates are provided at the outer end of the axle.

2. The axle housing consists of a differential carrier and pinion housing with extensions accommodating pressed-in tubes, the outer end of the tubes being flanged for attachment of spherical tube ends. The housing is ventilated by a drilling through one of the axle tube dowels, the breather is extended by a pipe attached to the chassis frame.



1	Thrust screw	6	Differential pinions	11	Constant velocity joint
2	Pinion	7	Roller bearing	12	Hub drive shaft fork
3	Tracta joint housing	8	Hypoid gear	13	Drive shaft housing
4	Differential casing	9	Adjusting nut	14	Drive sleeve
5	Side gears	10	Axle shaft fork	15	Roller bearing

Fig 1 Front axle assembly

3. The differential casing (4) to which the hypoid gear is bolted, is mounted on taper roller bearings.

4. Adjusting nuts (9) are used to position the gear transversely for meshing with the pinion.

5. A four pinion differential is used and thrust washers are assembled to the differential pinions (6) and side gears (5).

6. A thrust screw (1) in the right-hand side of the axle housing controls deflection of the hypoid gear under heavy load conditions.

7. The pinion is straddle mounted between a double row roller bearing (7) at its spigot end and a double row taper roller bearing (15) at its outer end.

8. The drive is transmitted through tracta constant-velocity universal joints (11). The outer end of the axle shaft incorporates a fork (10) which engages the spigot joint to the tracta joint. The shaft is supported in the axle tube end by a phosphor bronze bush.

9. The tracta joint comprises a spigot joint, which is assembled to the axle shaft fork, and a slotted joint, which is assembled to the hub drive shaft fork (12).

10. The inner end of the hub drive shaft is supported by a phosphor bronze bush and the outer end is splined for engagement with the hub driven sleeve (14).

11. The steering knuckle comprises a hub drive shaft housing (13), the inner end of which is bolted to a tracta joint housing (3). An oil seal is attached to the inner face of the tracta joint housing.

12. The tracta joint housing and hub drive shaft housing are carried by two pivots located in taper roller bearings in the axle tube end. On the drivers side of the vehicle the upper pivot is integral with the steering third arm. The lower pivots are integral with the steering arms.

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Chapter 7

STEERING

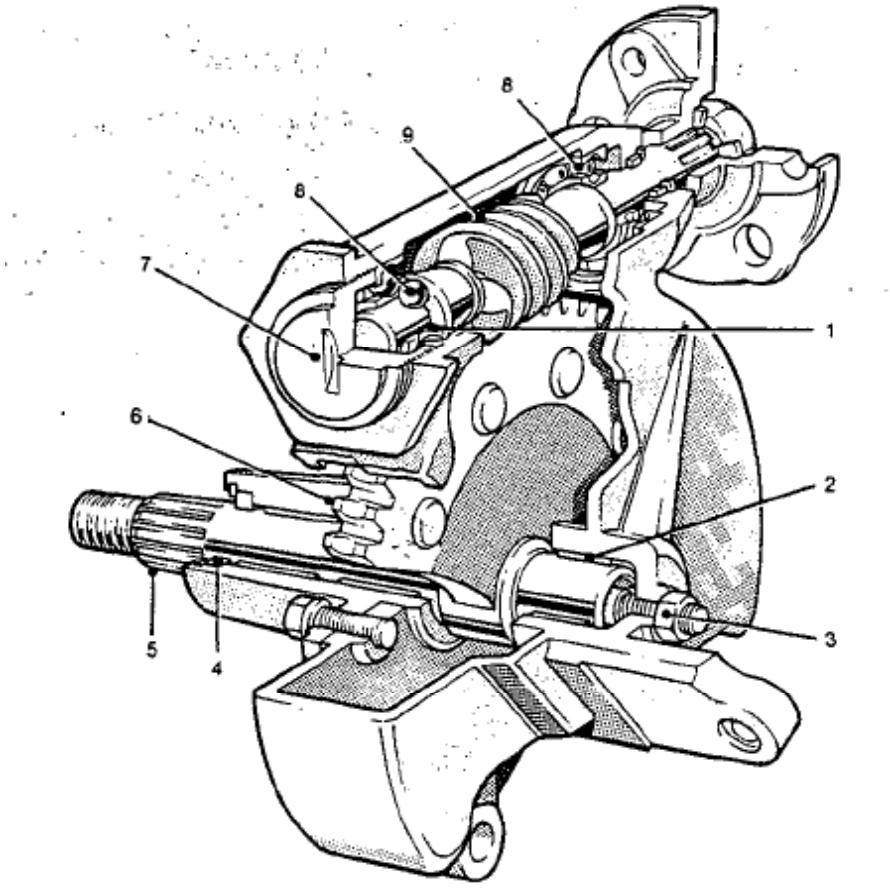
CONTENTS

STEERING GEAR

GENERAL DESCRIPTION

1. The steering gear is of the worm and sector type. An integral worm and shaft (Fig 1 (9)) is located in the steering gear by ball thrust bearings (8), one at each end of worm.

2. The upper bearing is located against a shoulder in the gear, whilst the lower bearing forms an abutment for an adjuster (7) in the lower end of the case. An oil seal (4) is located above the bearing.



1	Oil seal	4	Oil seal	7	Adjuster
2	Bushes	5	Drop arm shaft	8	Bearings
3	Adjusting screw	6	Sector	9	Worm and shaft

Fig 1 Steering gear

3. The sector (6) is riveted to a flange formed on the inner end of the drop arm shaft (5), which is supported in two lead-bronze steel backed bushes (2). An oil seal (4) is located at the outer end of the shaft. The engagement of the sector teeth with the worm is maintained by an adjusting screw (3).

STEERING WHEEL SHAFT AND COLUMN

4. The steering wheel is attached to the steering shaft by a nut and a plain washer. The mating surfaces of the wheel are serrated and tapered. The shaft nut is concealed by a plastic cover which is a push fit in the wheel boss. (Fig 2).

5. The steering shaft is enclosed by a column bolted to the cab toe panel and supported by a bracket on the instrument panel. The shaft rotates in a plain bearing in the top of the column. The headlamp beam and signal switches and hill holder control valve are also attached to the top of the column.
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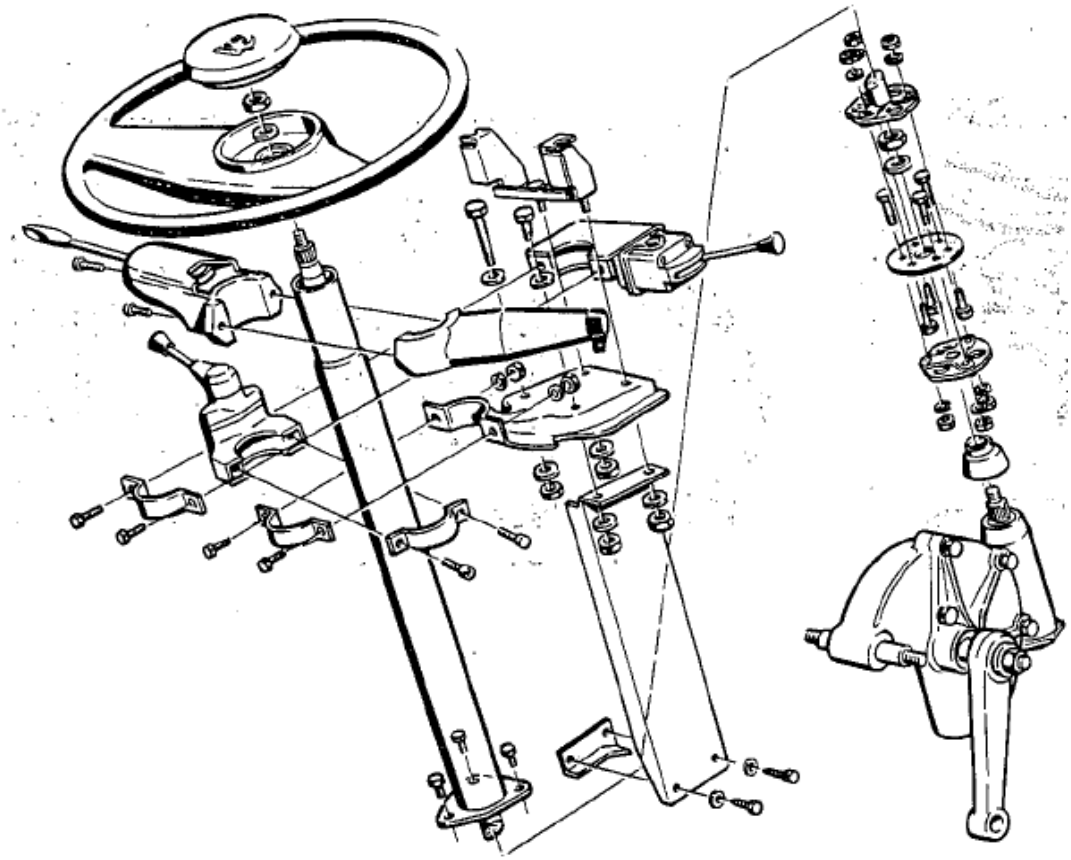
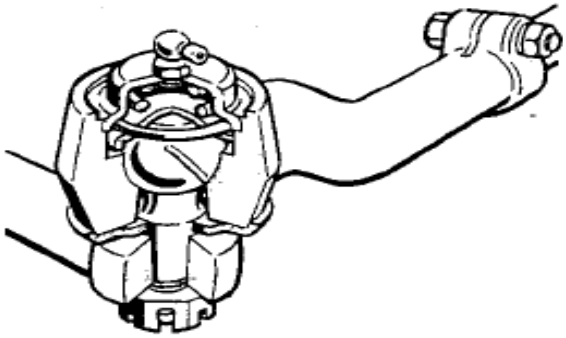


Fig 2 Steering wheel, shaft and column

6. The steering shaft is connected to the steering gear by a flexible coupling which consists of a fabric disc interposed between two flanges. One secured to the worm shaft and the other to the steering shaft.

STEERING TIE ROD AND CONNECTING ROD

7. The tie rod is provided with spring-loaded ball joints (Fig 3), threaded right and left hand for adjustment. It is possible to move the socket in line with the ball stud against compression of the spring when a load is applied on the socket end plate.



T5394/15 **Fig 3 Tie rod ball joint**

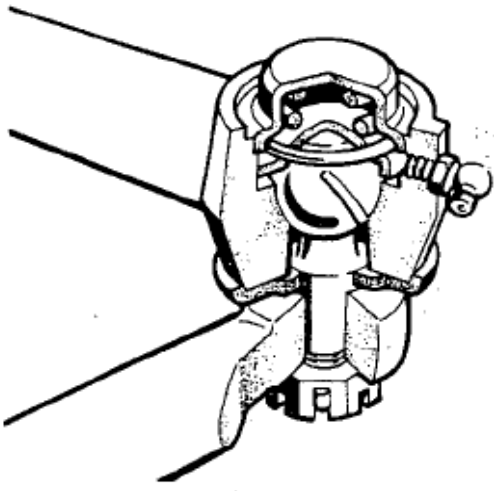


Fig 4 Connecting rod ball joint

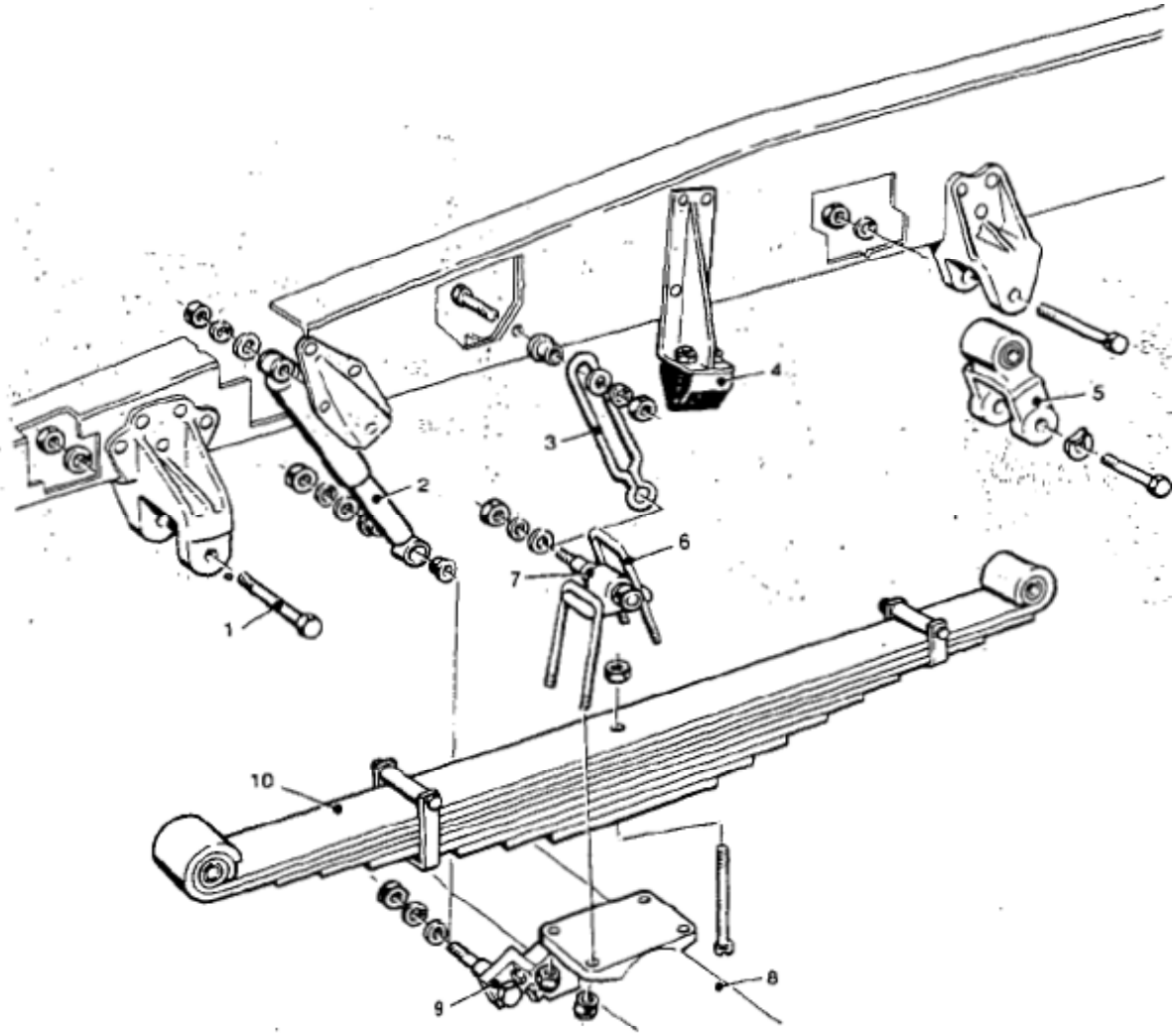
8. The connecting rod also incorporates spring-loaded ball joints (Fig 4), but it not adjustable for length.

9. If there is any free play in the joint which can be felt without applying pressure, the joint must be renewed.

Chapter 8

SUSPENSION

CONTENTS



1	Bolt	6	U-bolt
2	Shock absorber	7	Spacer
3	Rebound link	8	Axle
4	Rubber bumper	9	Shock absorber mounting bracket
5	Shackle	10	Spring

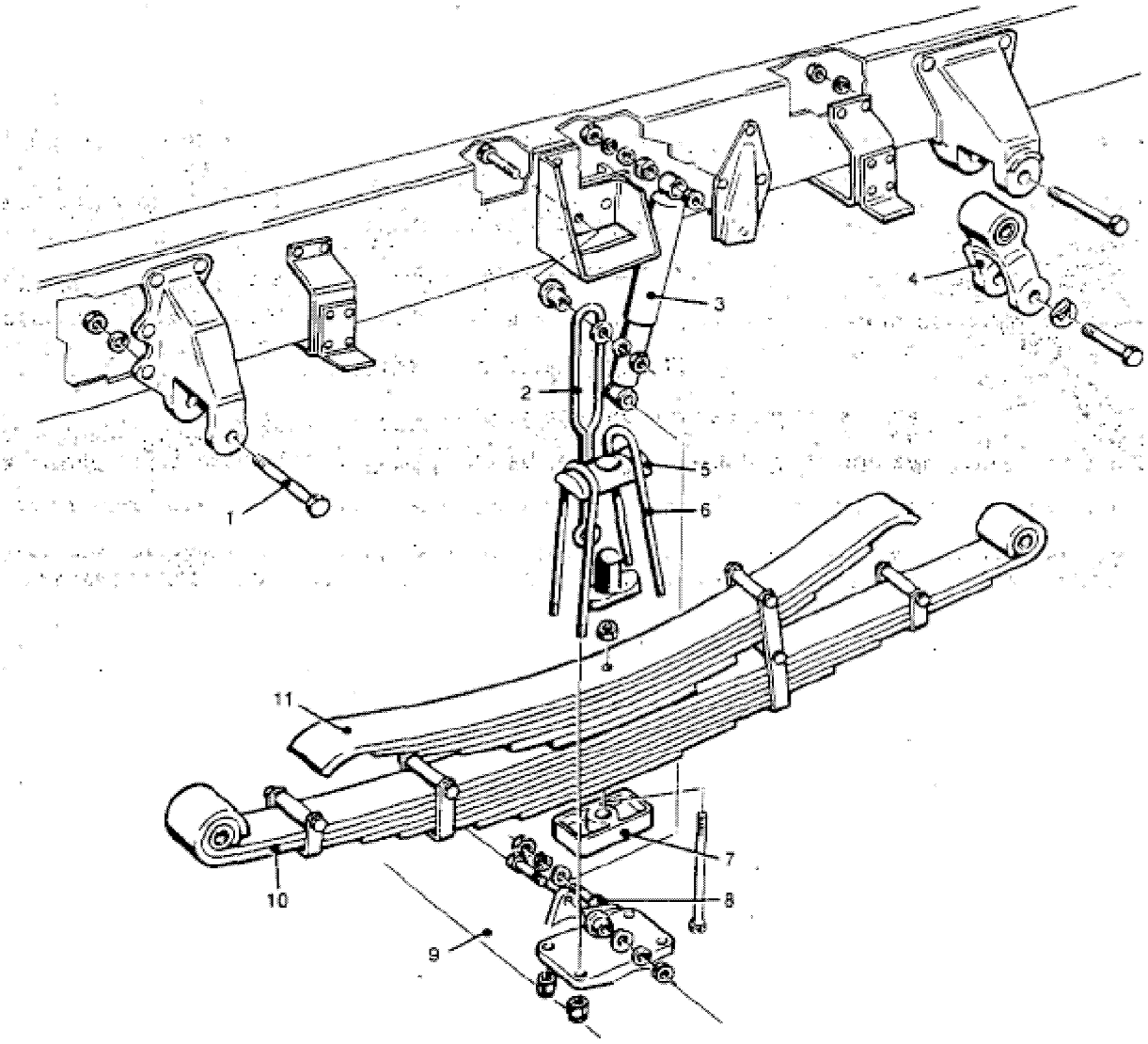
Fig 1 Front Suspension

SUSPENSION

GENERAL DESCRIPTION

1. The front and rear suspension (Figs 1 and 2) consists of semi-elliptical taper leaf springs and double acting hydraulic shock absorbers.

2. The rear suspension springs have eight leaves and a helper spring whereas the front suspension springs have nine leaves. The eyes of the spring main leaves and the shackels incorporate rubber bushes. The spring second leaf is extended around the eye of the main leaf to prevent excessive movement of the axle in the event of failure of the main leaf. The spring leaves are held together by a centre bolt and clips. All springs are equipped with rubber bumpers and rebound links.



1	Bolt	4	Shackle	7	Spacer	10	Spring
2	Rebound link	5	Spacer	8	Shock absorber mounting bolt	11	Helper spring
3	Shock absorber	6	U-bolt	9	Axle		

Fig 2 Rear suspension

3. The shackles, which are fitted at th of the springs are attached to the hang bolts, lockwashers and nuts.

4. The rear of the spring is attached shackle by a bolt and tab washer.

5. Axles are secured to the springs bolts. Location of the axle is controlled b bolt spacer mounted on top of the spring.

6. The shock absorbers all have eye mountings.

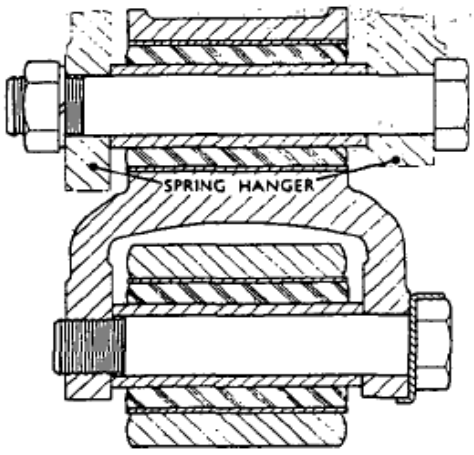


Fig 3 Spring and shackle bushes

Chapter 9

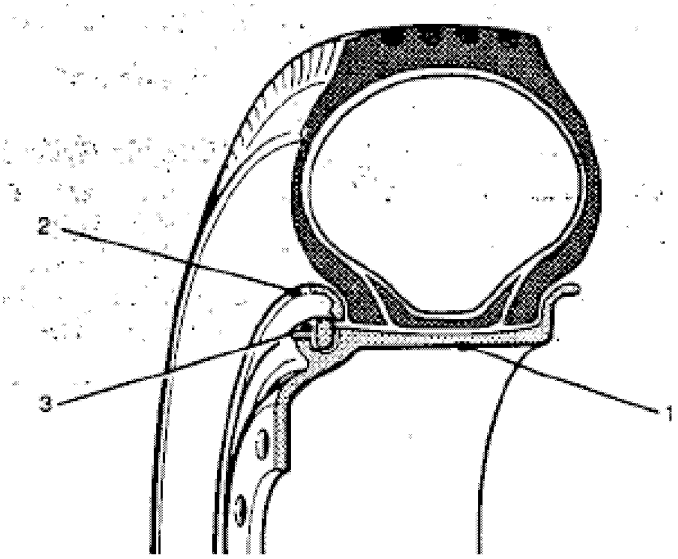
ROAD WHEELS AND TYRES

CONTENTS

ROAD WHEELS AND TYRES

GENERAL DESCRIPTION

1. The road wheels (Fig 1) are the heavy duty type with wide base rims and consist of three pieces, the rim base (1), and loose flange (2) and locking ring (3). Wheel size is B80 x 20.



1 Rim base

2 Loose flange

3 Locking ring

Fig 1 Road wheel

3. The wheels are standard ten stud fixing on 7/8 dia studs and the threads are left-handed on the left side of the vehicle.

3. Non directional cross counting pattern tyres are used on all wheels and the size is 12.00 - 20 x PR14. The tyres are tubed with flaps.

Chapter 10

AIR PRESSURE AND BRAKING SYSTEM

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CONTENTS (Contd)

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Fig *Page*

AIR PRESSURE AND BRAKING SYSTEM

GENERAL DESCRIPTION

1. The vehicle is equipped with an air operated, hydraulic actuated system (Fig 1) air pressure being supplied by a single cylinder compressor. The air intake is taken from the inlet manifold. A condensing reservoir with automatic drain valve is connected between the compressor and the dual air reservoir to eject moisture from the system.

2. The service and secondary circuits of the air system are fed with air through a triple pressure protection valve, which incorporates integral non-return valves for system isolation and supplies air to the dual air reservoir. The additional element of the triple pressure protection valve supplies the trailer brake system, which is two line braking.

3. Pressure in the storage system is controlled by a governor valve which signals the compressor accordingly. A dual air pressure gauge registers the pressure in the service and secondary reservoirs. Low pressure warning lamps and warning buzzer are also fitted.

4. All wheels are fitted with drum brakes of the leading and trailing shoe type, which are actuated by hydraulic double acting brake cylinders on the front and hydraulic transverse brake cylinders on the rear.

5. Service braking is controlled by the footbrake pedal via a dual footbrake valve which delivers air to a master cylinder actuator. The hydraulic tandem master cylinder operates the front and rear brakes independently. A load sensing valve is incorporated in the rear axle circuit to proportion the degree of braking accordingly to the axle load, thus ensuring optimum braking under all load conditions.

6. The footbrake also applies to trailer via a dual relay valve, when required.

7. The hill holder hand control valve applies the vehicle service brakes and trailer brakes via a change over valve.

8. The master cylinder actuator has a service and secondary means of air supply which are, independent of each other and controlled by the footbrake valve. In the event of a failure of the service system the secondary system is automatically brought into action to provide reduced but positive braking.

9. The hill holder hand control valve can also be used to apply the vehicle brakes in the event of a failure of the footbrake valve.

10 The parking brake is of the drum type transmission, fitted to the rear axle and operated by a hand lever and cables.

11. Vehicles are equipped with a two line braking system for towing a trailer. Air from the footbrake valve signals the dual relay valve, which then delivers air to the trailer control line (service), identified by a yellow coupling. The trailer emergency line is fed direct from the supply side of dual relay valve and is identified by a red coupling.

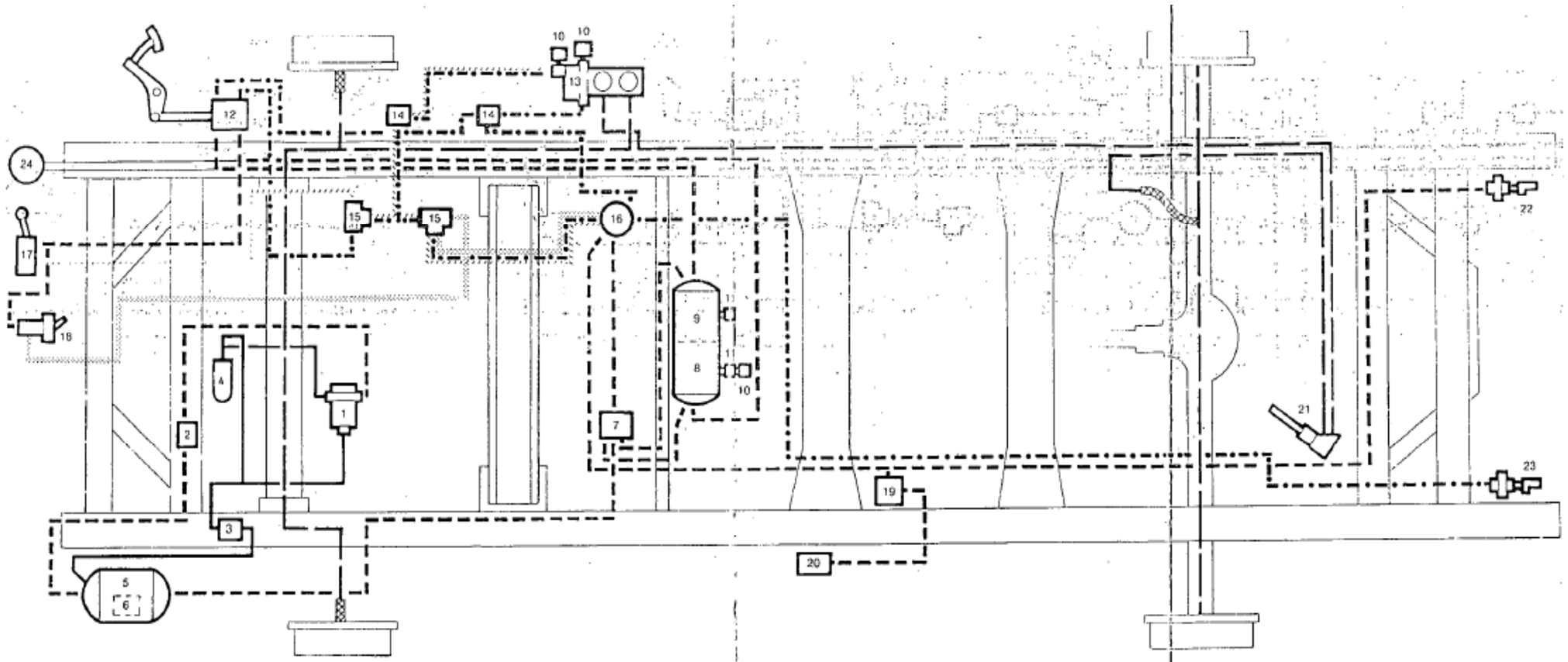
12. The trailer may also be parked by the trailer park control valve which applies the trailer service brakes whilst the trailer manual brake is applied.

13. The majority of the air pipes in the braking system are of the coloured flexible type, with red being the supply circuit, yellow the service brakes circuit, orange the parking circuit and blue the hill holder control circuit.

14. The brake lines shown in black represent:

14.1 Hydraulic fluid pipes from the master cylinder to the slave cylinders and load sensing valve.

14.2 Nylon pipes being used in the area of the governor valve, anti-freezer and supply pipes to air pressure gauges.



1 Compressor
2 Non-return valve
3 Compressor governor valve
4 Compressor anti-freezer
5 Condensing reservoir
6 Automatic drain valve
7 Triple pressure protection valve
8 Service reservoir
9 Secondary reservoir
10 Test point
11 Low pressure warning switch
12 Footbrake valve
13 Dual actuator and master cylinder assembly
14 Stop light switch
15 Change-over valve
16 Dual relay valve
17 Hill holder control valve
18 Trailer park control valve
19 Pressure loss limiting valve
20 Tyre inflator
21 Load sensing valve
22 Emergency trailer coupling
23 Service trailer coupling
24 Dual air gauge

Fig 1 Schematic diagram of braking system

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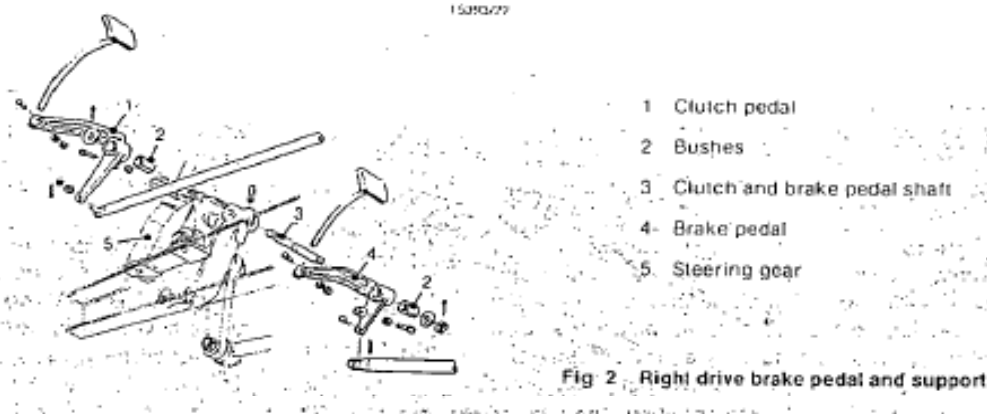
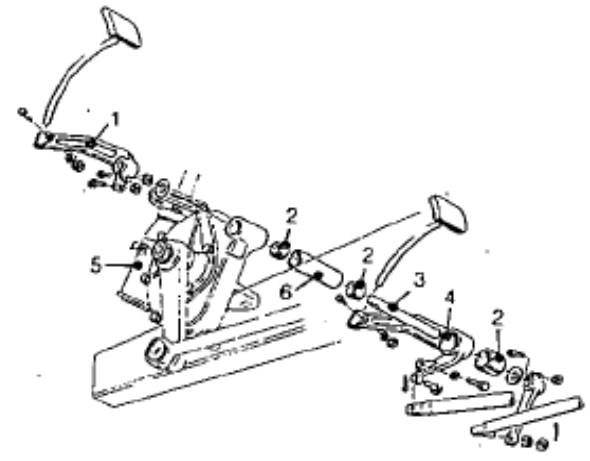


Fig 2 Right drive brake pedal and support

BRAKE PEDAL AND SUPPORT

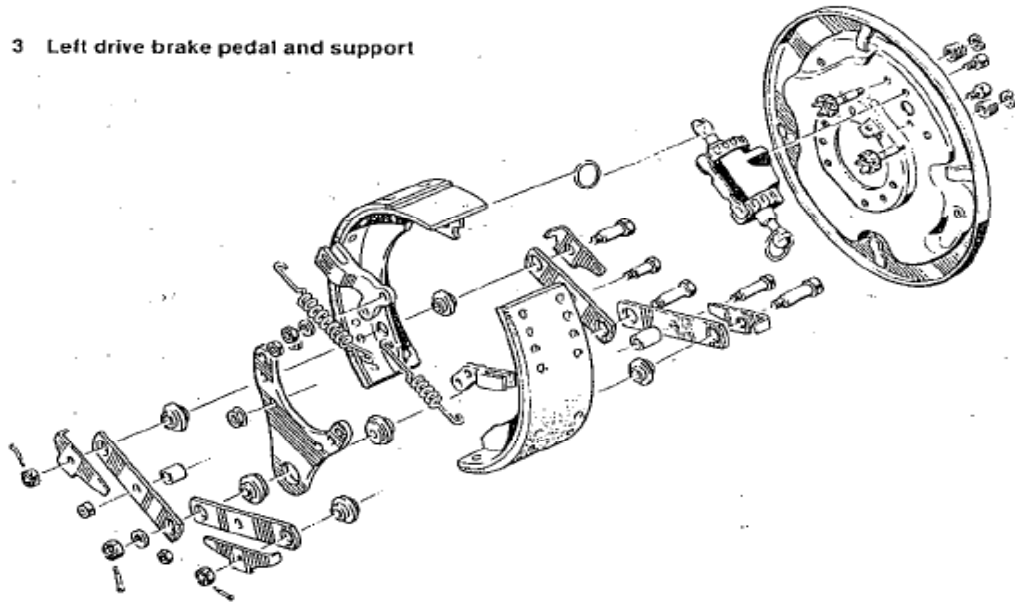
15. The brake pedal pivots on a shaft mounted on the steering gear. On right drive vehicles (Fig 2) the shaft (3) also carries the clutch pedal (1).

16. On left drive vehicles (Fig 3) the shaft (6) is hollow and bushed to support a separate clutch pedal shaft (3).



T5394/23

Fig 3 Left drive brake pedal and support



T5394/24

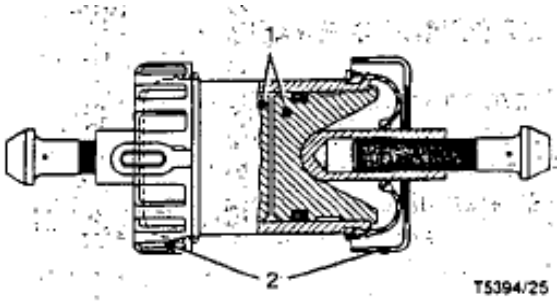
Fig 4 Rear brake assembly

FRONT AND REAR BRAKE ASSEMBLY

17. The front and rear brakes (Fig 4) are of the leading and tailing shoe type operated by hydraulic, brake cylinders. The shoes are held against the flange plate by spring-loaded retainers and provided with individual return springs. Anchor springs secure shoes to the brake cylinder push rods. The leading shoes have a show support. The brake cylinders bolted to the flange plate and fitted with drum type adjusters are activated from outside the flange plates.

BRAKE CYLINDERS

18. The front and rear brake cylinders are attached to the inside face of the brake flange plates and contain two opposed pistons (Fig 5(1)). They are fitted with drum type adjusters (2) actuated from the outside of the flange plate.

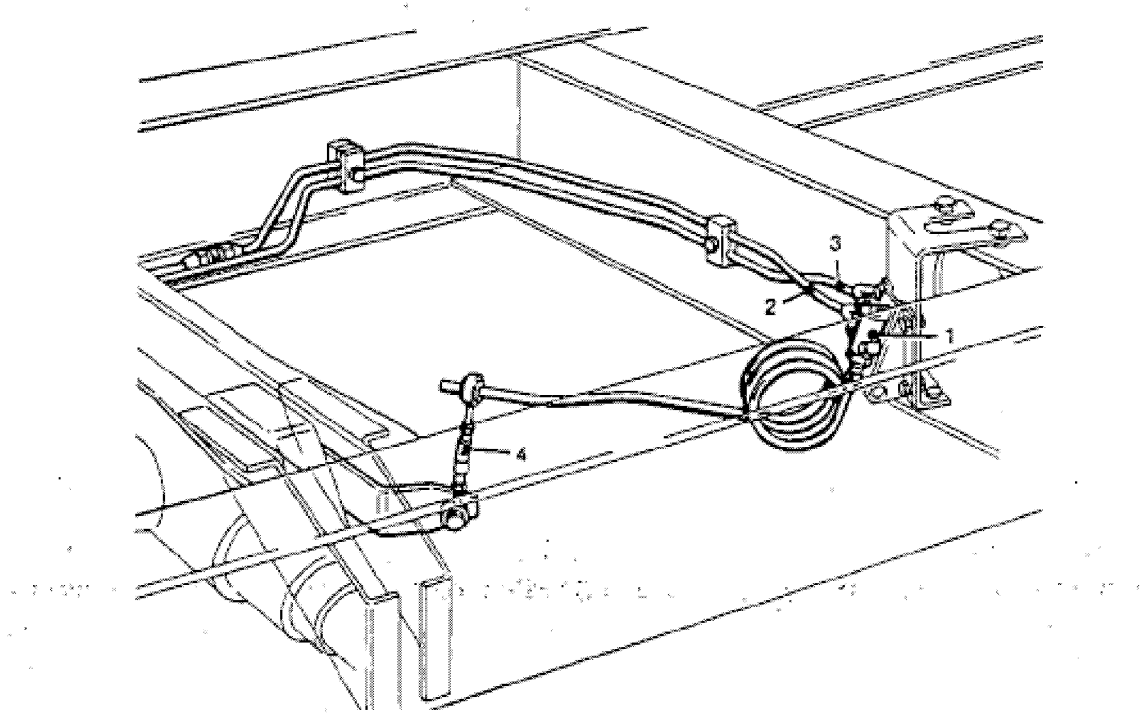


1 Pistons

2 Adjusters

LOAD SENSING VALVE

19. A load sensing valve (Fig 6(1)) is installed in the hydraulic line to the rear brakes which allows the degree of braking at the rear wheels to be increased or decreased according to variation in load on the rear axle.



1 Load sensing valve

2 Hydraulic supply from tandem master cylinder

3 Hydraulic delivery to rear brakes

4 Link to rear axle

Fig 6 Load sensing valve installation

20. The valve is mounted on the rear chassis crossmember and operated by a pair of sensing springs connecting the valve operating lever to an adjustable link (4) attached to the rear axle.

21. A load sensing valve data plate (Fig 7) provides details for setting load sensing valve with vehicle in an unladen condition.

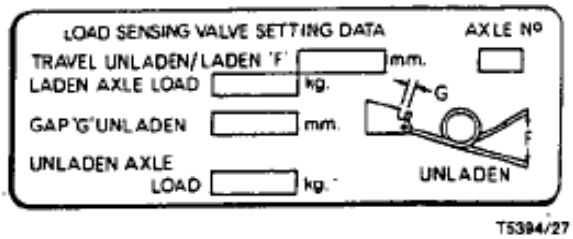


Fig 7 Load sensing valve setting data plate

22. The plate is attached to the door aperture (Fig 8).

23. With an unladen vehicle initial pressure on the footbrake valve causes brake fluid to flow through the valve intake port ((Fig 9(4)) pas the ball valve (6) and out of the outlet port (5) to the rear brake cylinders

24. As pressure in the rear brakes increases, it loads the valve piston (7) until pressure is sufficient to overcome the combined loads from internal spring (1) and sensing spring (2). The piston then moves down allowing the ball valve to close, thus preventing further pressure to the rear brakes.

25. When the brakes are released the reducing pressure in the lower chamber allows the piston to be pushed downwards and this movement opens the ball valve which allows the piston to return to its original position.

26. Should braking be increased after initial application, the extra pressure from the master cylinder in the lower chamber forces the piston upwards, which opens the ball valve allowing fluid to pass until pressure at the rear brakes is sufficient to force the piston down again and close the ball valve. These rapid controlling movements are repeated as long as pressure at the master cylinder continues to rise.

27.When the vehicle is laden the sensing spring applies an upward force to the piston in proportion to the weight and fluid pressure to the brakes has to be proportionally higher before the piston can be moved downwards to close the valve. Eventually the force on the piston is such that maximum braking pressure is insufficient to move it and the valve remains open. In this condition the valve is inoperative and offers no restriction to the fluid.

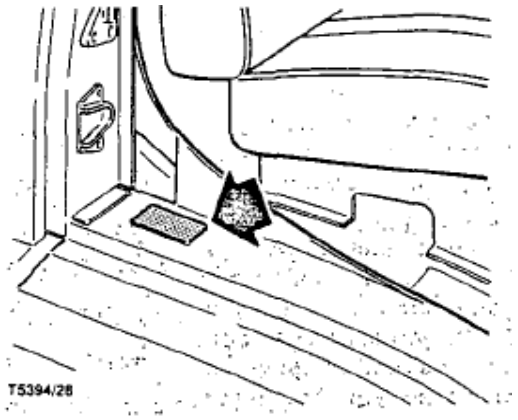
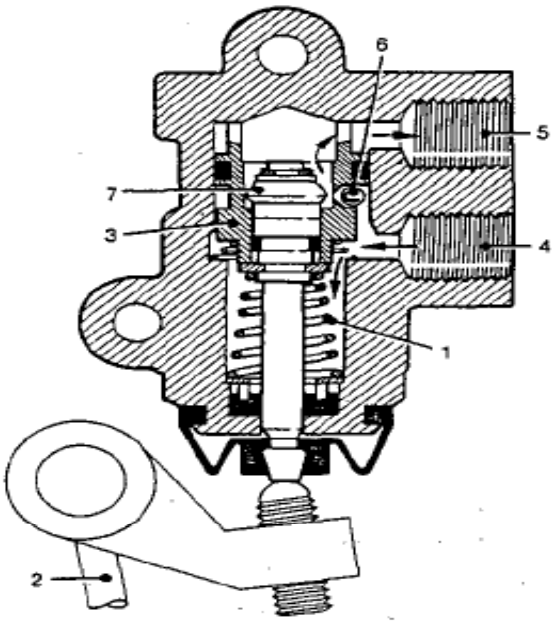


Fig 8 Load sensing valve data plate position



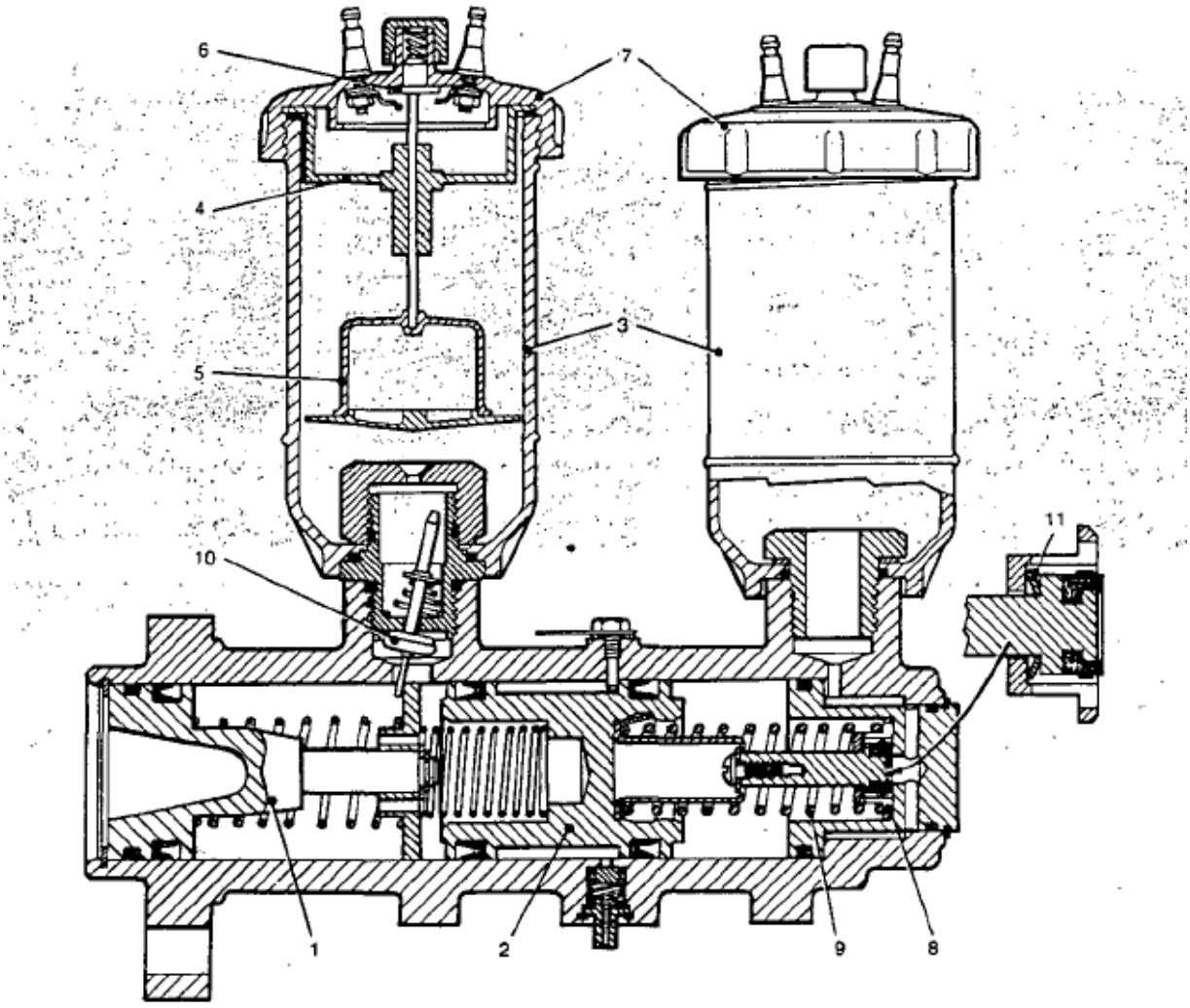
1 Spring
2 Sensing spring
3 Sleeve
4 Intake port
5 Outlet port
6 Ball valve
7 Valve piston

T5394/29 **Fig 9 Load sensing valve**

BRAKE MASTER CYLINDER

28. The cylinder (Fig 10) contains two spring-loaded pistons (1 and 2) each fitted with rubber seals. Two detachable plastic reservoirs (3) each contain a filter (4) and a float assembly (5). The floats operate the low level warning switches (6) and are incorporated in the reservoir caps (7).

29.The reservoir adjacent to the master cylinder actuator has a self-contained recuperating valve which is screwed into a tapped boss in the cylinder so that the valve spindle projects into the cylinder bore. The valve is held open by the piston flange when the brakes are off and closes under the action of its spring as the piston moves when the brakes are applied.



1	Piston	4	Filter	7	Reservoir cap	10	Recuperating valve
2	Piston	5	Float	8	Recuperating valve	11	Wave washer
3	Reservoir	6	Low pressure warning switch	9	Spring		

Fig 10 Section of master cylinder T5394/30

30. The recuperating valve (8) for the other reservoir is incorporated in piston assembly (2) and held open by spring (9) when the brakes are off. When the brakes are applied the movement of piston (2) compresses spring (9) and the recuperating valve is then closed by wave washer (11).

31. Two adaptors screwed into tapped bosses in the side of the cylinder retain spring-loaded check valves and provide attachment for the front and rear hydraulic pipes. The check valves are provided with by-pass holes.

Master cylinder vent

32. A vent (Fig 11) is incorporated in the base of the master cylinder (arrowed). Brake fluid visible from this vent indicates a faulty secondary or primary piston. Slight dampness around the vent is acceptable due to brake fluid presence on cylinder bores to lubricate piston seals.

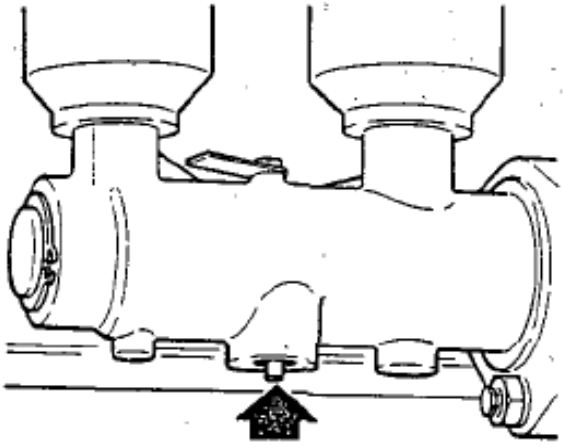


Fig 11 Master cylinder vent T5394/31

Master Cylinder Actuator

33. The master cylinder actuator (Fig 12) which is mounted, together with the hydraulic tandem master cylinder, on the chassis sidemaster.

34. The actuator (Fig 13) consists of a circular body (1) clamped between two cylinders (2) each, containing a piston (3). A push rod (4) which is held towards the rear of the actuator by a return spring (5) passes through the centre of one piston and abuts the centre of the other. Movement of either piston is transmitted by the push rod to the master cylinder primary piston.

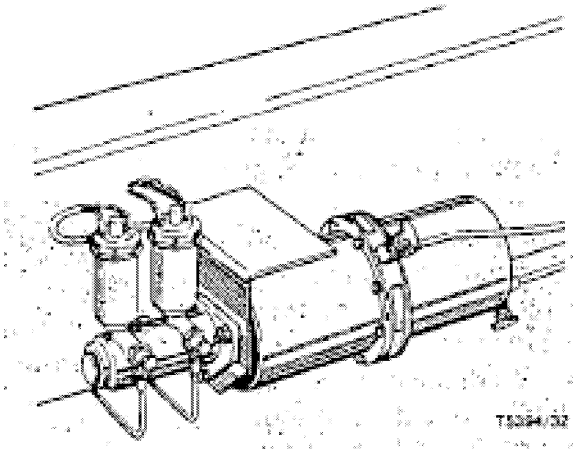


Fig 12 Master cylinder and actuator assembly

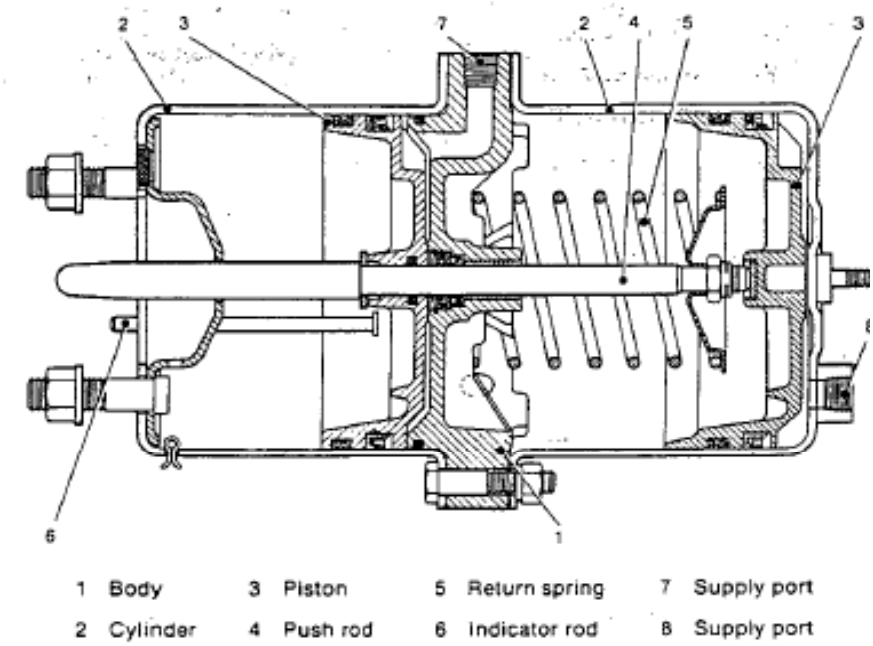


Fig 13 Master cylinder actuator

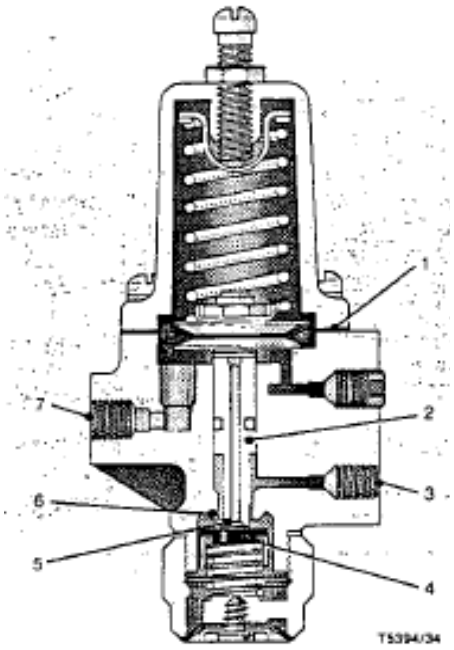
35. An indicator rod (6) which provides a visual indication of brake shoe travel is incorporated in the cylinder adjacent to the master cylinder.

36. When the footbrake is applied, compressed air enters the supply ports (7 and 8) of both cylinders behind the pistons. This causes the pistons to move along the cylinders and operate the master cylinder by means of the push rod.

COMPRESSOR GOVERNOR VALVE

37. The output of the compressor is controlled by a diaphragm type governor valve (Fig 14) mounted on the chassis sidemember.

38. The valve comprises a body and cover containing a spring, a diaphragm assembly and a spring-loaded inlet/exhaust valve. The diaphragm assembly consists of a diaphragm (1) and a hollow plunger (2) which contacts the inlet/exhaust valve (4). A nut, fitted with an exhaust diaphragm retains the inlet/exhaust valve and spring in position in the body.



1 Diaphragm
2 Plunger
3 Delivery port
4 Inlet/Exhaust valve
5 Inlet valve seat
6 Exhaust valve seat
7 Supply port

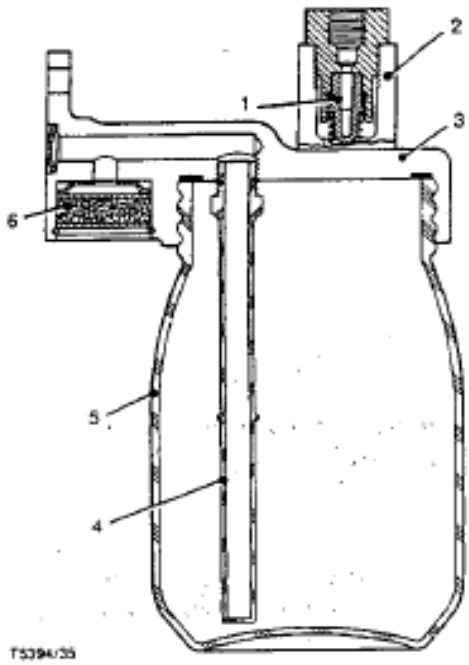
Fig 14 Compressor governor valve

39. Compressed air from the reservoir enters the supply port (7) beneath the diaphragm. When the air pressure is sufficient to overcome the spring pressure the diaphragm assembly lifts and the spring-loaded inlet/exhaust valve contacts the exhaust valve seat (6) in the body. Further movement of the diaphragm assembly causes the inlet valve seat (5) to move away from the inlet/exhaust valve and air passes through the hollow plunger and delivery port (3) to operate the compressor unloader valve.

40. As the air pressure in the reservoir decreases, the spring depresses the diaphragm assembly. When this occurs the plunger closes the inlet valve and opens the exhaust valve allowing the air pressure in the compressor unloader valve to exhaust through the exhaust nut to atmosphere and normal operation of the compressor is resumed.

COMPRESSOR ANTI-FREEZER

41. To prevent freezing of the moisture in the air drawn into the compressor when the vehicle is operating under low ambient temperature conditions an anti-freezer is incorporated in the air system. The anti-freezer (Fig 15) consists of a reservoir (5) and a cover (3) fitted with an air filter (6), filter plug and check valve (2). Under conditions of low ambient temperature the reservoir is filled with methyl alcohol solution. When the compressor is operating a partial vacuum is present in the compressor manifold and above the methyl alcohol in the anti-freezer reservoir. This causes air to pass through the air filter and tube (4) to the bottom of the reservoir. The air them mixes with the alcohol and the vapour is drawn into the compressor inlet.

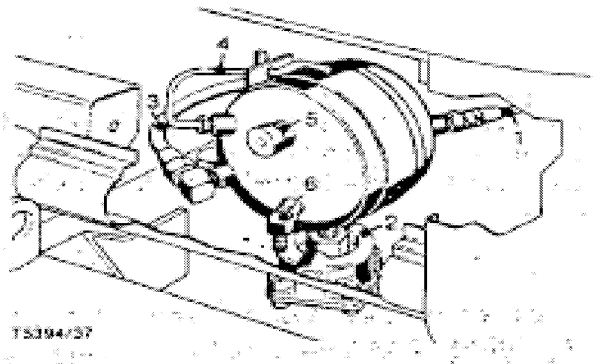


1 Check valve plunger
2 Check valve
3 Cover
4 Tube
5 Reservoir
6 Air filter

Fig 15 Compressor anti-freezer

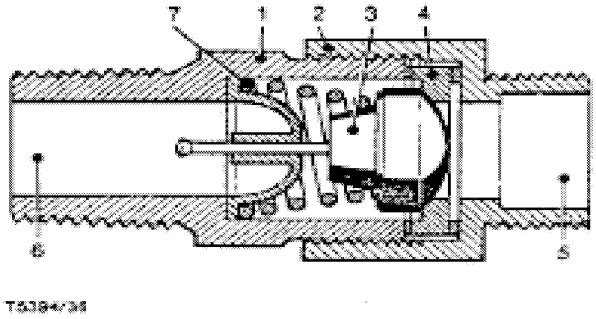
42. When the compressor is unloaded, air from the governor valve causes the plunger (1) in the check valve to close the anti-freezer outlet port and prevent alcohol being supplied to the compressor intake.

43. The compressor anti-freezer is mounted on the rear of the left hand side of the cab.



1 Supply to triple pressure protection valve
2 Automatic drain valve
3 Supply from compressor
4 Signal to governor valve
5 Safety valve
6 Schrader valve

Fig 16 Condensing reservoir



1 Valve body
2 Screw cap
3 Valve
4 Valve seat
5 Supply port
6 Delivery port
7 Return spring

Fig 17 Section of non-return valve

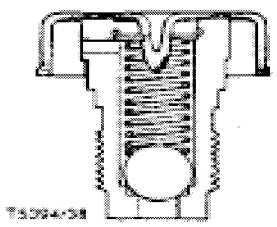


Fig 18 Section of a safety valve

CONDENSING RESERVOIR

44. A condensing reservoir (Fig 16) fed by air from the compressor via a non-return valve, is mounted on the chassis sidemember at the front.

45. It is fitted with an automatic drain valve (2) and a non adjustable ball type safety valve (5). Airline (3) is the condensing reservoir feed from the compressor. Airlines (1 and 4) supply the triple pressure protection valve and governor valve respectively.

46. A schrader valve (6) is also fitted so the air system can be charged from an outside source if the engine is inoperative.

Non-return valve

47. A non-return valve (Fig 17) is located in the supply connection to the condensing reservoir. The valve consists of a body (1) and screw cap (2) containing a half round rubber valve (3) spring-loaded against a valve seat (4).

48. Compressed air from the compressor enters the supply port (5) and pushes valve (3) off its seat depressing spring (7). Air now flows past the valve and out of delivery port (6).

49. When pressure at supply port is reduced the valve is forced back onto its seat by the spring and any reverse flow of air from the delivery port to supply port is prevented.

Safety Valve

50. A safety valve (Fig 18) located in the servo reservoir, protects the all system against excessive air pressure in the event of governor valve failure. The valve is non adjustable and consists of a body containing a spring-loaded ball valve retained by a washer and circlip. A dust cover is fitted over the valve body.

Automatic Drain Valve

51. The automatic drain valve (Fig 19), located in the lowest part of the condensing reservoir comprises a body and cover containing an inlet/exhaust valve (1) and a nylon valve guide (3).

52. The inlet and exhaust valves are normally in contact with their seats (2 and 4) but air and condensate from the reservoir pass into the valve body by flexing the inlet valve away from the seat. The air pressure inside the valve is, therefore, the same as the reservoir pressure.

53. When the reservoir pressure is reduced, the air pressure in the valve body causes the inlet/exhaust valve to lift and open the exhaust valve, allowing condensate and air to exhaust through the cover.

54. After this operation is complete, reservoir pressure above inlet/exhaust valve is greater than pressure below the valve, and exhaust valve again closes.

TRIPLE PRESSURE SYSTEM PROTECTION VALVE

55. A triple pressure system protection valve (Fig 20) is installed in the braking system to prevent total loss of air supplied to individual reservoirs, should a leak develop in any one circuit.

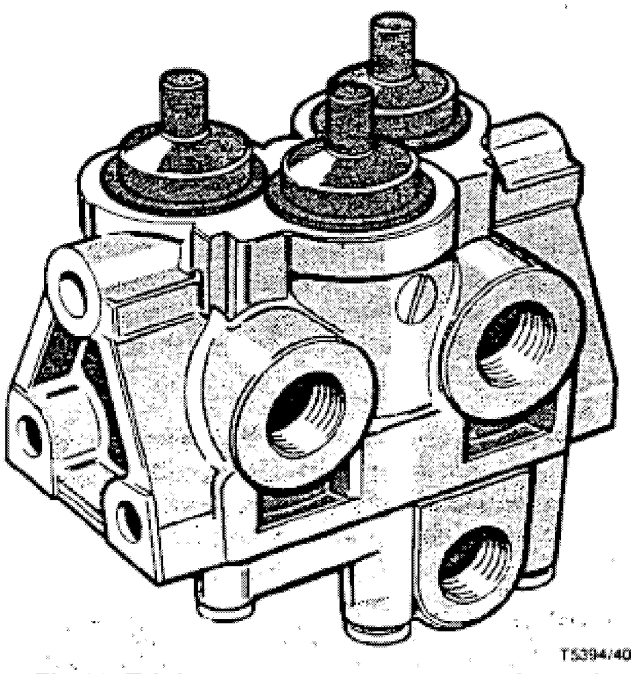
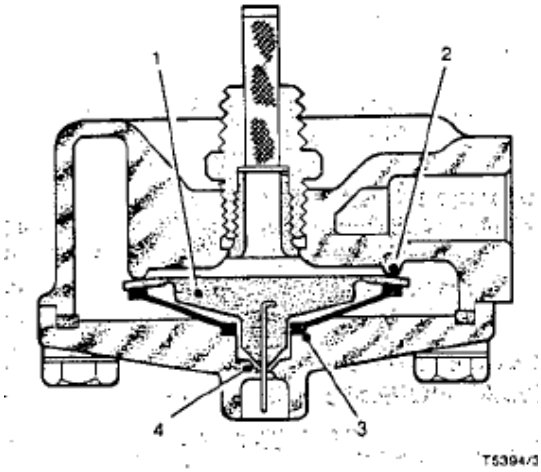


Fig 20 Triple pressure system protection valve

58. When compressed air from the condensing unit reaches initial valve opening pressure, the piston (Fig 22(9)) rises slightly and allows air to pass by the non-return (14) valve to the reservoir. As the air pressure in the reservoir builds up, it acts on the piston lower face and further compresses the control spring (7) until the piston is fully raised. In normal condition, pressure in the reservoir holds the piston up whilst the non-return valve permits recharging and prevents pressure feed back.

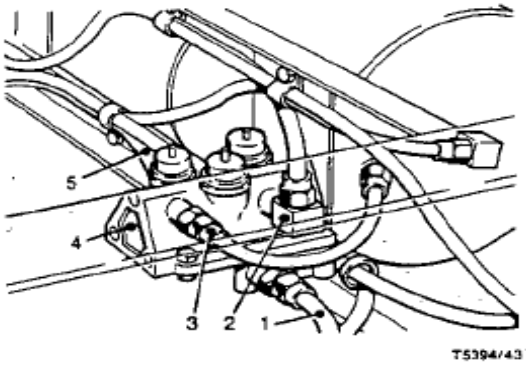


1 Inlet/exhaust valve
2 Inlet valve seat
3 Nylon valve guide
4 Exhaust valve seat

Fig 19 Section of automatic drain valve

56. The valve is installed in the supply line to the service and secondary reservoirs and the trailer brakes supply line (Fig 21).

57. Integral non-return valves prevent feed back from the reservoirs.



1 Supply feed from condensing reservoir
2 Supply to Secondary reservoir
3 Supply to Service reservoir
4 Triple pressure protection valve
5 Supply to trailer brakes relay valve

Fig 21 Air pipe connections at triple pressure system protection valve

59. Should a leak occur in the circuit, the control spring will, when the reservoir pressure drops below the valve closing pressure, return the piston and hold the non-return valve on its seat.

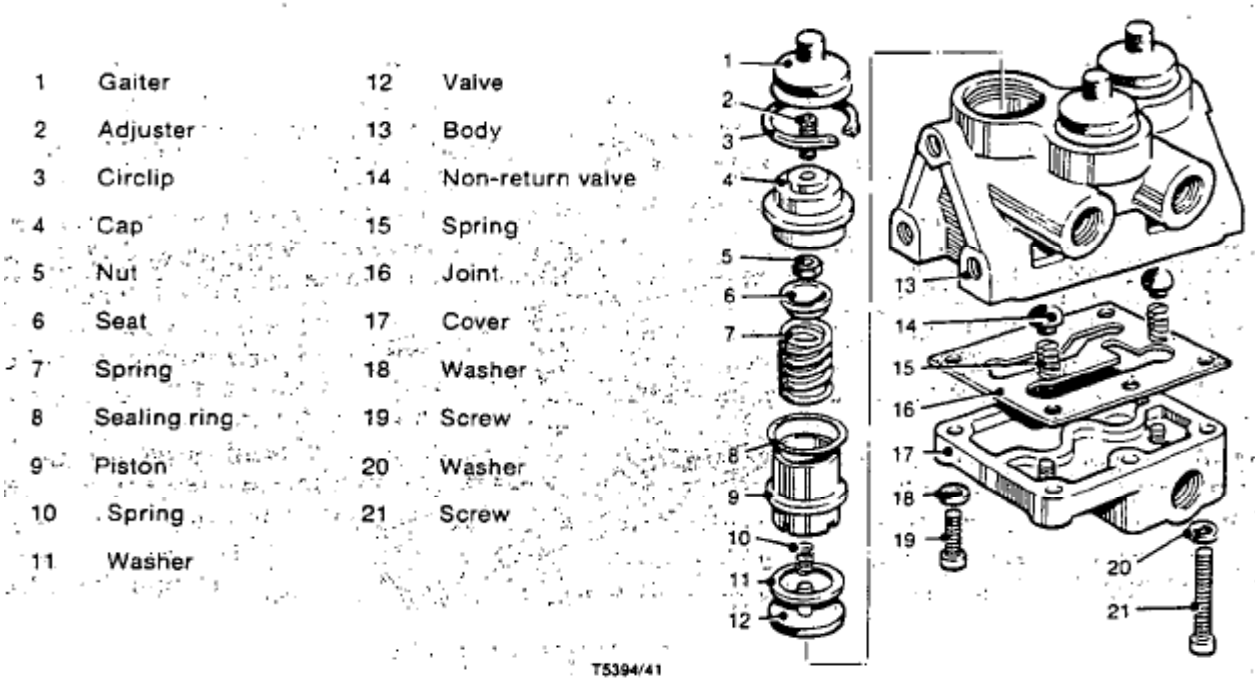
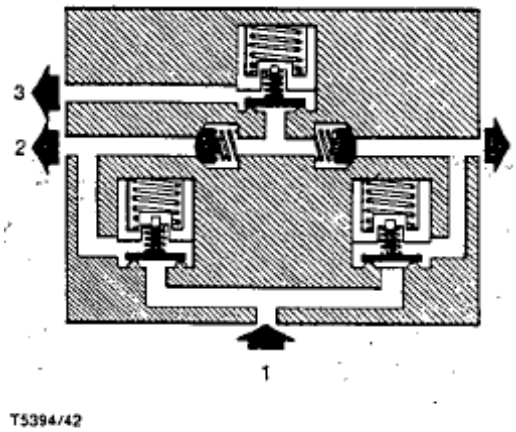


Fig 22 Exploded view of triple system protection valve

60. This allows all other reservoirs to be charged to an efficient operating level as the valve supplying the faulty circuit will not open until the specified initial opening pressure of the valve has been reached in the remainder of the circuit.

61. The valve initial opening pressure differs from valve closing pressure because to initially open the valve, spring pressure must be overcome by air pressure acting on a small surface area, whereas when the valve is open, reservoir back pressure acting on the lower face of the piston, a relatively larger surface area, prevents the spring from closing the valve until reservoir pressure drops below the specified valve closing pressure.



1 Inlet port
2 Service supply port
3 Trailer supply port
4 Secondary supply port

Fig 23 Schematic diagram of triple pressure system protection valve

62. The valve comprises three single elements in one body (Fig 23). Air enters through port (1) supplying the Service and Secondary reservoirs through ports (2) and (4) respectively before supplying the trailer circuit through port (3). Two additional non-return valves prevent cross leakage of the interconnected ports leading to the trailer circuit element, should air loss in either the Service or Secondary circuits occur.

LOW PRESSURE WARNING SWITCHES

63. Low air pressure warning switches (Fig 24) are incorporated in the Service and Secondary reservoirs. The switches, which actuate a buzzer and warning lamp in the vehicle if the pressure in either reservoir falls below the minimum required, are sealed units and consist of a body, spring-loaded diaphragm and contacts.

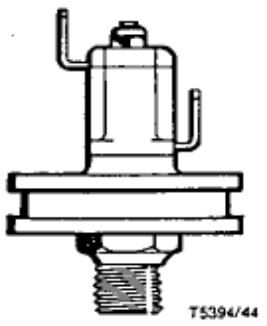


Fig 24 Low pressure warning switch

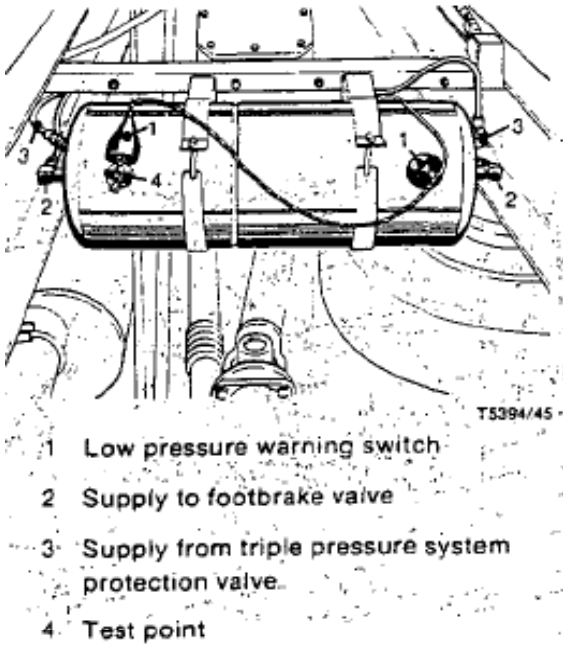


Fig 25 Dual air reservoir

66. The dual air reservoir is supported by brackets (Fig 26 (1)) attached to the rear of the spare wheel crossmember. The reservoir is clamped to the brackets by straps (3) with insulators (2) installed between strap and reservoir.

DUAL AIR RESERVOIR

64. Dry air from the condensing reservoir passes through the triple pressure protection valve to the dual reservoir (Fig 25). This is a Service and Secondary reservoir combined in one assembly. The reservoirs incorporate drain plugs, a test point (4) and low pressure warning switches (1).

65. Air lines (2) from each reservoir supply air to the footbrake valve whilst lines (3) are the feed from the triple pressure protection valve.

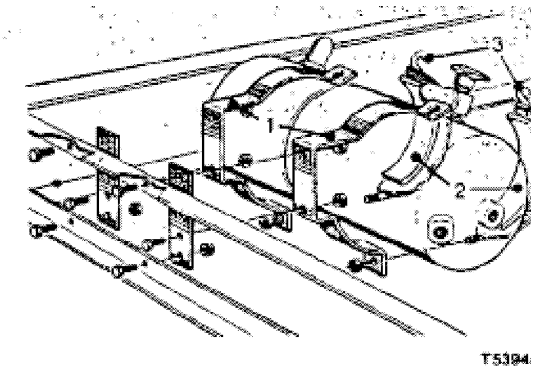


Fig 26 Attachment of air reservoir

FOOTBRAKE VALVE

67. The dual footbrake valve (Fig 27) which is operated by the brake pedal, is mounted on the chassis sidemember at the front of the vehicle on the drivers side.

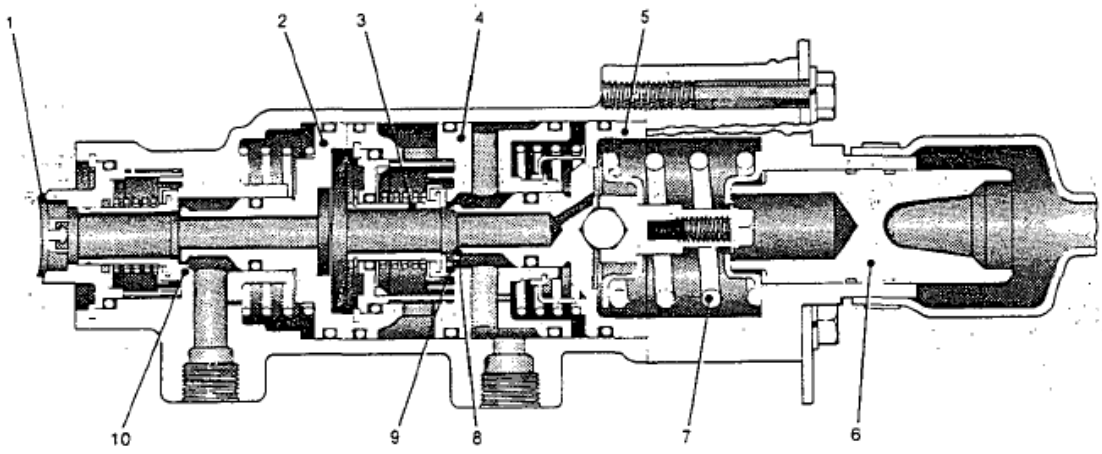
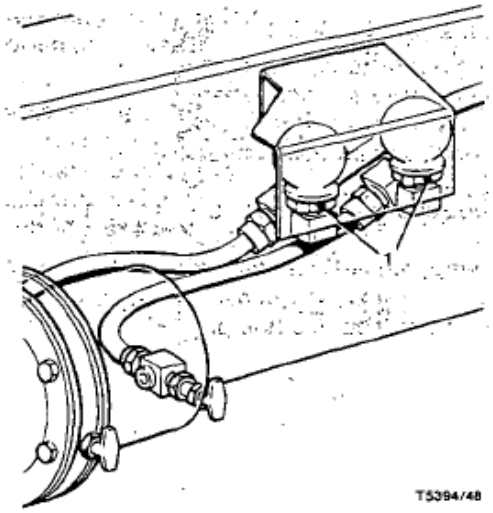


Fig 27 Footbrake valve

68. When the brake pedal is depressed, force is applied via the plunger (6) and buffer spring (7) to the front piston (5), causing the exhaust valve seat (8) on the piston to close on the inlet/exhaust valve (3). The force is also transmitted via the valve carrier (4) to the rear piston (2), causing the exhaust valve seat on the piston to close on the inlet/exhaust valve. Further pressure on the brake pedal causes the pistons to lift the inlet valves from the seat (10) in the body and seat (9) in the carrier, allowing compressed air from the reservoirs to pass through the valve to the brake actuators, load sensing valve and relay valves.

69. The air pressure delivered by both halves of the valve is proportional to the effort applied to the brake pedal and the valve imparts a reaction relative to the movement of the brake pedal so that the driver can sense the degree of brake application.

70. When the brake pedal is released, the pistons and valve carrier return under the action of spring and air pressure. This movement closes the inlet valves and unseats the exhaust valves to release the pressure in the brake lines through the exhaust diaphragm.



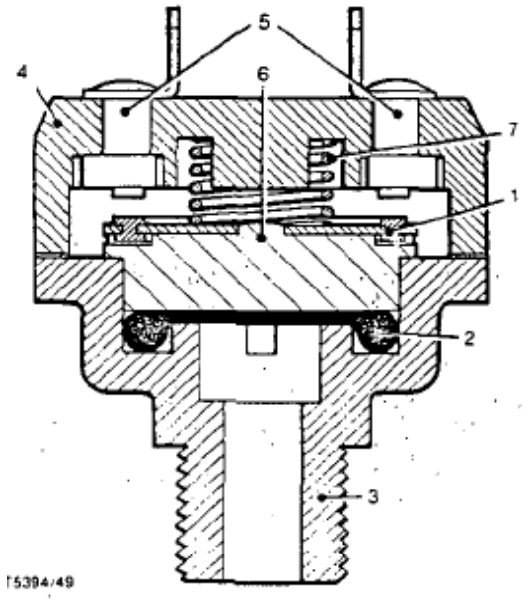
1 Stop lamp switch

Fig 28 Stop lamp switches location

STOP LAMP SWITCH

71. A stop lamps switch (Fig 28 (11)) is incorporated in the airline, between the footbrake valve and master cylinder actuator and the airline from the change over valve to the master cylinder actuator. The switches are located on the outside of the chassis right hand sidemember.

72. Each switch consists of a body (Fig 29 (3)) and cover (4) containing two terminals (5), an electrical contact strip (1) piston (6) piston return spring (7) and diaphragm (2).



1 Contact strip
2 Diaphragm
3 Body
4 Cover
5 Terminals
6 Piston
7 Piston return spring

Fig 29 Stop lamp switch section

CHANGE-OVER VALVE

73. Two change-over valves (Fig 30) are incorporated in the braking system to prevent the compound application of the brakes by more than one of the following control valves.

73.1 Footbrake valve

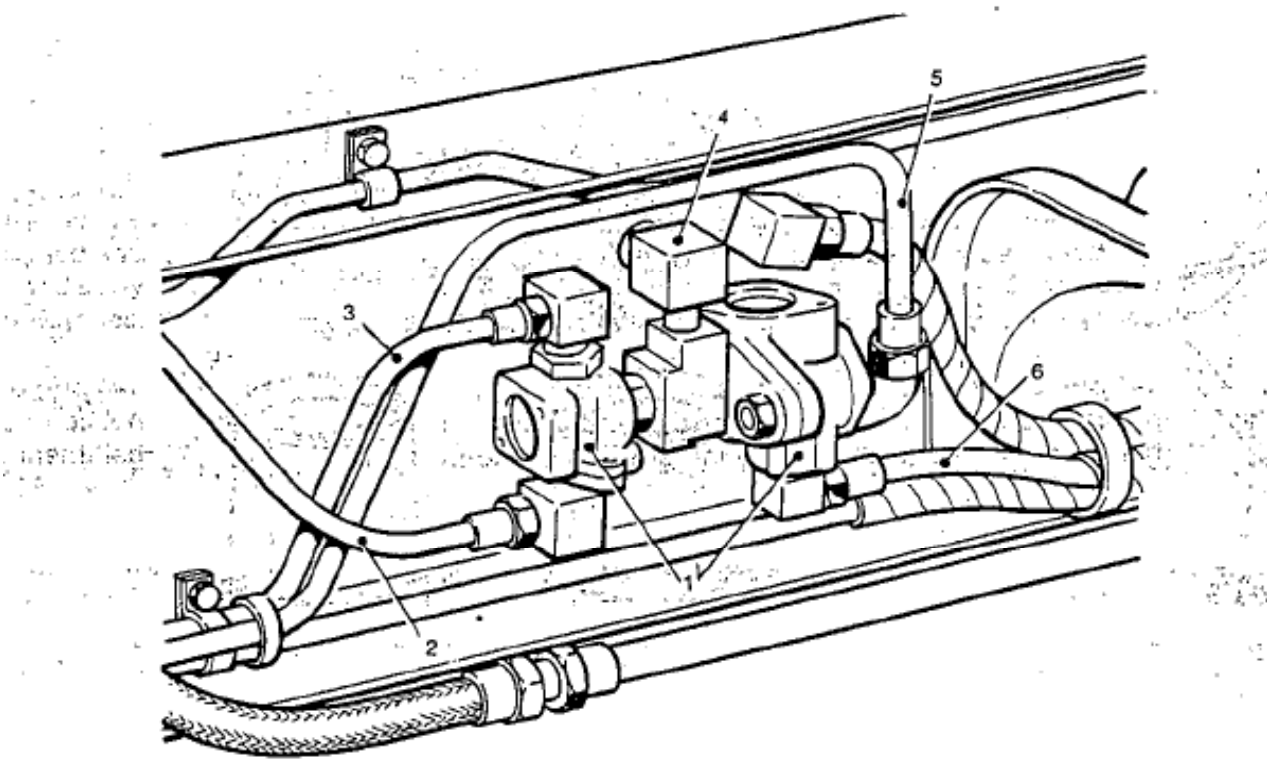
73.2 Hill holder control valve

73.3 Trailer park control valve

74. The change over valves are located on the inside of the right hand sidemember.

75. Each valve (Fig 31) consists of a body which has two supply ports and one delivery port. The body contains a shuttle valve which is free to move along its guide.

76. When air enters port (1) the shuttle valve moves to the opposite end to seal the other supply port (2). This allows air to pass through the delivery port (3) and prevents leakage through the supply port.



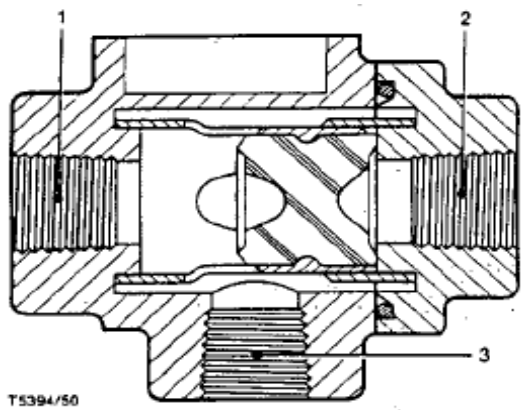
1 Change-over valves
2 Supply from footbrake valve
3 Supply from hill holder valve
4 Supply to stop lamp switch and master cylinder actuator
5 Supply from trailer park control valve
6 Signal line pressure to dual relay valve

Fig 30 Airline connections to change-over valves

77. Should the supply through port (1) fail, or a greater supply enter through port (2) the shuttle valve will move along its bore and allow air to pass through delivery port (3).

HILL HOLDER CONTROL VALVE

78. The hill holder control valve (Fig 32) is mounted on the right hand side of the steering column and supplied with air from the service reservoir.



1 Supply port 2 Supply port
3 Delivery port

Fig 31 Change-over valve

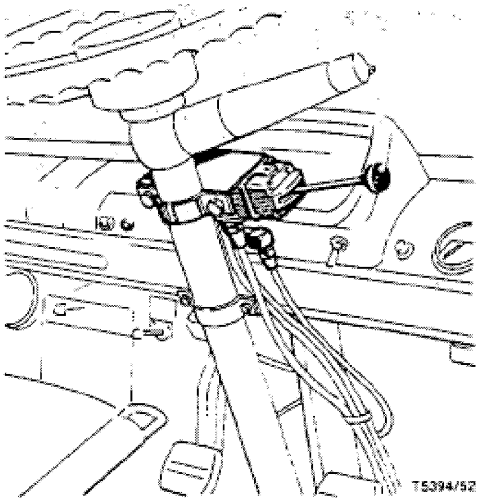


Fig 32 Hill holder control valve

79. When the control valve lever is in the 'BRAKES ON' position, compressed air is delivered to the vehicle braking and trailer system via a change-over valve. When the control valve lever is released it returns to 'BRAKES OFF' position under spring pressure and exhausts the air in the system, thus releasing vehicle and trailer brakes.

80. The valve (Fig 33) consists of a body containing a lever assembly which operates a plunger (2) by means of a spring-loaded cam (3). As the operating lever is moved towards the 'BRAKES-ON' position, the cam depresses plunger (2) and causes exhaust seat (4) to close on inlet/exhaust valve (5).

81. Further movement of the lever causes the inlet/exhaust valve to move away from the inlet seat (6) and allows air to pass to the braking system.

1	Lever assembly	4	Exhaust seat
2	Plunger	5	Inlet/exhaust valve
3	Cam	6	Inlet valve seat

82. The air pressure delivered by the valve is proportional to the effort applied to the lever and the valve imparts a reaction relative to the movement of the lever so that the driver can sense the degree of braking.

83. When the control lever is returned to the 'BRAKES OFF' position, the inlet valve closes and the exhaust valve opens to allow the air to exhaust.

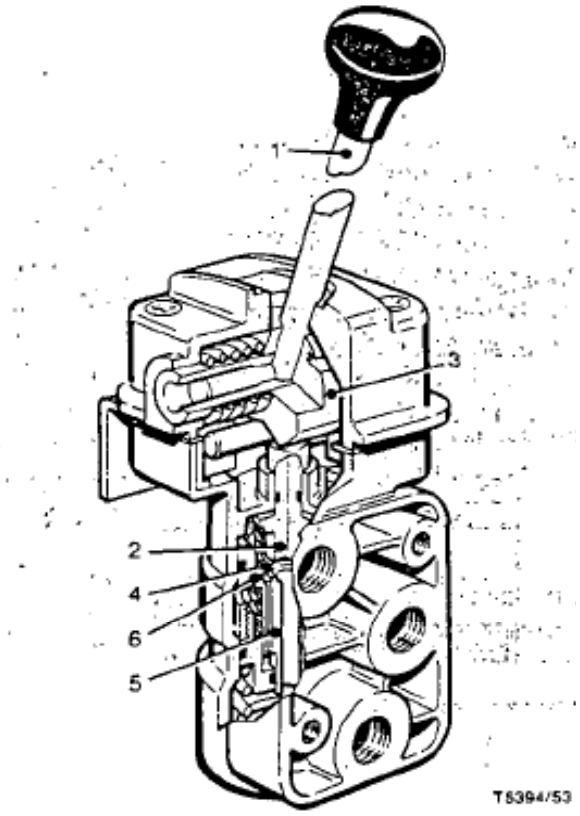
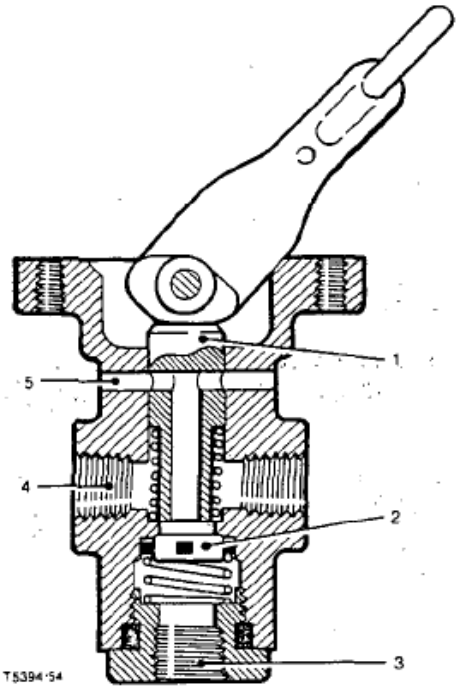


Fig 33 Section of hill holder control valve

TRAILER PARK CONTROL VALVE

84. The trailer park control valve (Fig 34) is mounted on the dashboard beneath the instrument panel and is supplied with air from the service reservoir.

85. Movement of the control lever causes plunger (1) to move the inlet valve (2) off its seat allowing air from the service reservoir to pass through inlet port (3) to the trailer park control change-over valve via port (4). When lever is returned delivery valve closes and air is exhausted through exhaust port (5).



1 Plunger
2 Inlet valve
3 Inlet port
4 Outlet port
5 Exhaust port

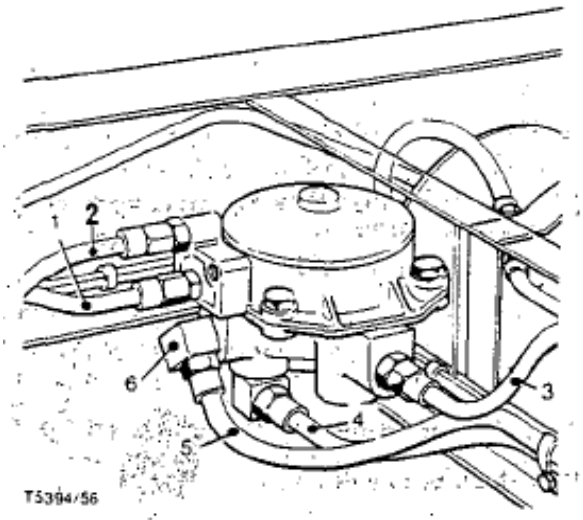
Fig 34 Section of the trailer park control valve

DUAL RELAY VALVE

86. To eliminate time lag during application and release a dual relay valve is incorporated in the trailer service brake circuit (Fig 35). It is mounted on the right-hand side of the spare wheel crossmember.

87. The valve (Fig 36) consists of a body and cover containing three pistons and an inlet exhaust valve assembly.

88. The control air pressures enter the top of the valve through the signal ports (1) causing the pistons (2) to move downwards until the exhaust valve seat (3) contacts the inlet valve (4). Further increase in this air pressure causes the inlet valve to move off its seat allowing air direct from the triple pressure protection valve to enter the valve through the supply port (5) and exit from the delivery port (6).



1 Signal from change-over valve
2 Signal from footbrake valve
3 Supply to service trailer coupling
4 Supply from triple pressure protection valve
5 Supply to pressure limiting valve
6 Restrictor

Fig 35 Airline connection to dual relay valve

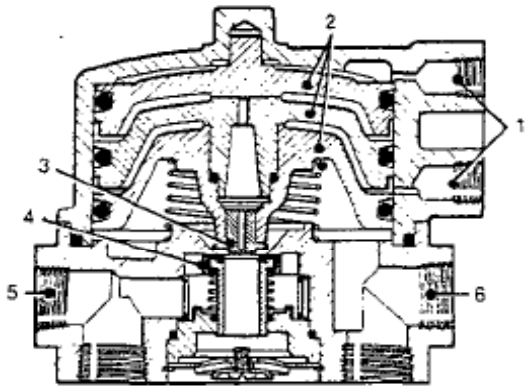
89. The pressure of the air passing through the valve acts on the underside of the lower piston causing the pistons to rise and close the inlet valve when the pressure below the piston is equal to that above, so bringing the valve into a balanced condition.

90. Any further increase in control pressure will cause the piston to move down and open the inlet valve increasing delivery pressure from the valve, until balance is once again achieved.

91. A decrease in the control pressure will cause the piston to rise and the exhaust valve to open allowing the delivered air to exhaust through the centre of the inlet valve and out through the exhaust diaphragm, until balance is once again achieved.

92. When no control pressure is being supplied the pistons are in the fully raised position with the exhaust valve open and the inlet valve closed.

93. The two signal ports enable both the Service and Secondary air pressures delivered from the footbrake valve to control the dual relay valve independently should a failure in one or other occur.



1 Signal ports
2 Pistons
3 Exhaust valve seat
4 Inlet valve
5 Supply port
6 Delivery port

Fig 36 Section of a dual relay valve

PRESSURE LOSS LIMITING VALVE

94. A pressure loss limiting valve (Fig 37) is incorporated in the trailer emergency line to prevent total loss of air through the tyre inflator or winch and controls.

95. The valve is located midway along the inside of the left hand chassis sidemember.

96. The valve (Fig 38) consists of a body and cover containing a spring adjusting screw, diaphragm, valve and valve seat.

97. Compressed air from the triple pressure protection valve via the trailer service relay valve enters the pressure loss limiting valve beneath the diaphragm (7) and valve (6) assembly. When air pressure is sufficient to over come the spring (2) pressure the valve opens to allow air to pass to the tyre inflator and winch controls via delivery port (3).

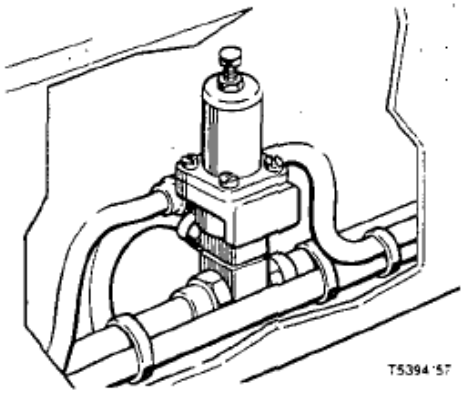


Fig 37 Pressure loss limiting valve

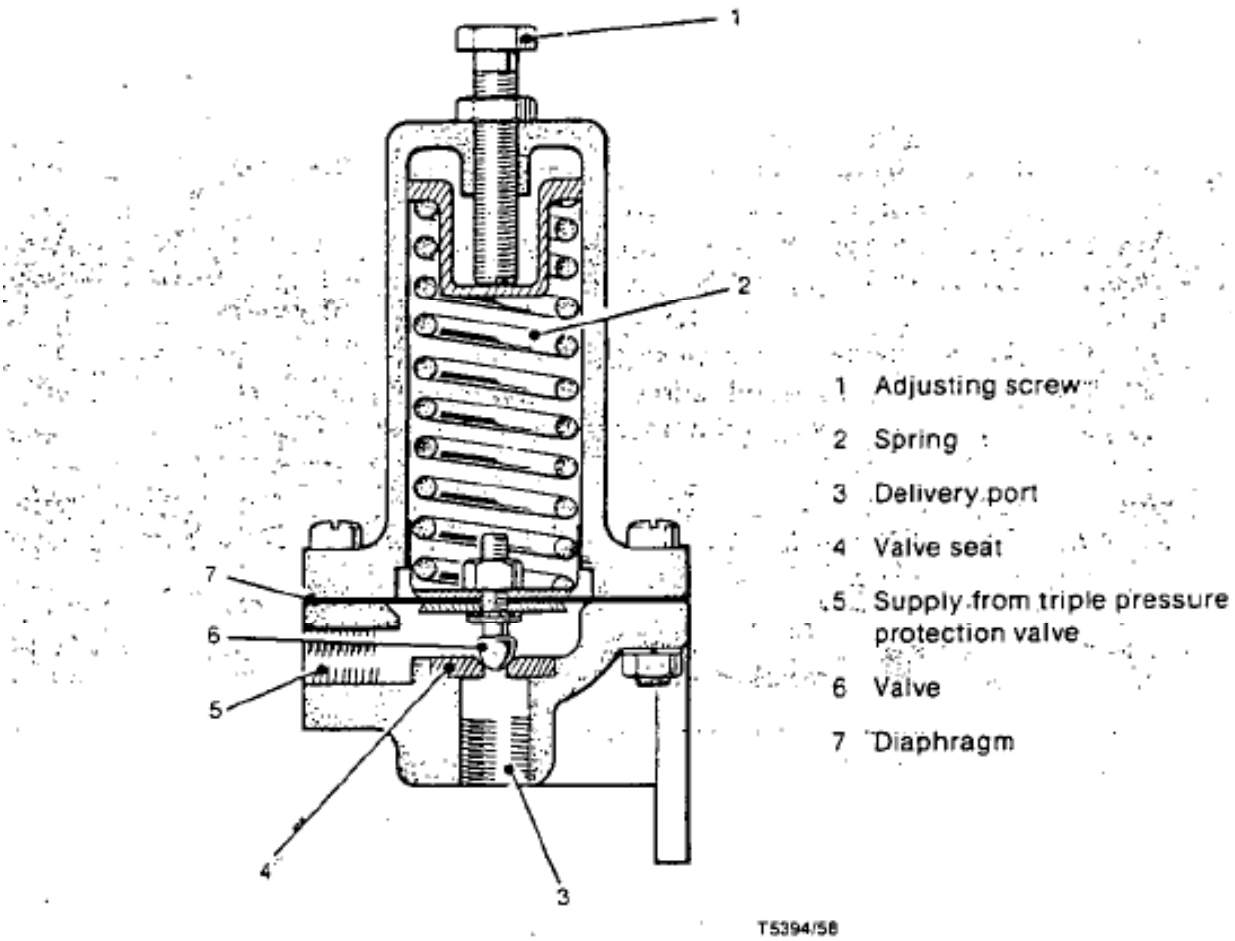


Fig 38 Pressure loss limiting valve section

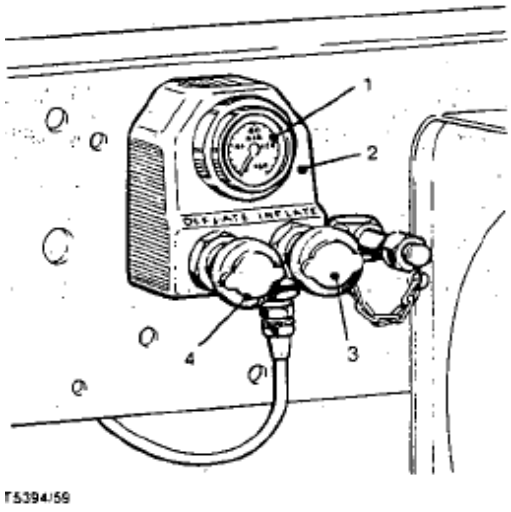
TYRE INFLATOR

98. A tyre inflator is incorporated into the air pressure braking system to provide the vehicle with a ready and simple method of inflating tyres. When it is necessary to adjust the pressure in any tyre the inflator is connected to the tyre valve by a rubber hose connector.

99. Before using the tyre inflator ensure that the vehicle air pressure system is fully charged and that the parking brake is applied.

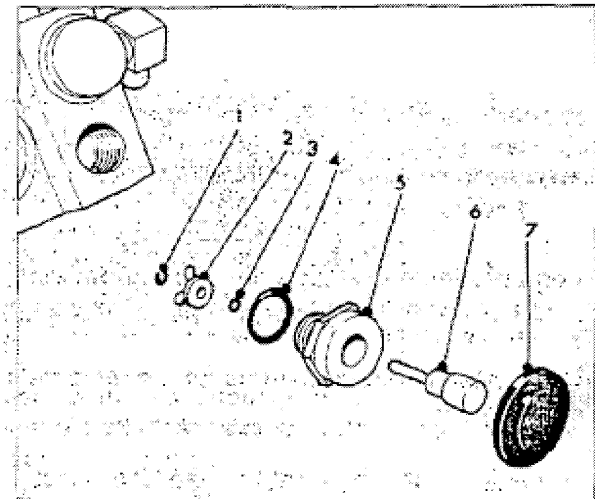
100 With the hose connected to the tyre valve and inflator observe the gauge reading and check whether inflation or deflation is required. The operation is similar in either case. Assuming inflation is required, the inlet valve is unseated when the INFLATE button is depressed, allowing compressed air to enter the tyre. Releasing the button instantly shuts off the compressed air allowing a gauge check to be made. If too much air pressure has been delivered to the tyre, the DEFLATED button can be depressed and surplus air exhausted at the rubber flap in the body.

101. The unit (Fig 39), which is located adjacent to the spare wheel, comprises a body (2), gauge (1), deflate button (4) and inflate button (3).



1 Gauge
2 Body
3 Inflate button
4 Deflate button

Fig 39 Tyre inflator



102. The deflate and inflate buttons (Fig 40) comprise a push rod guide (5), with a push rod/operating button (6) which is retained by a circlip (1). A bridge-type O-ring retainer (2) holds O-ring (3) in position on push rod/operating button. Water ingress is prevented by gaiter (7) and push rod guide O-ring (4).

1 Circlip
2 Seal retainer
3 Push rod seal
4 Push rod guide seal
5 Push rod guide
6 Push rod/operating button
7 Gaiter

Fig 40 Exploded view of inflate/deflate button

103. The valve components (Fig 41) located below the push rod/operating button guide assembly, comprise a valve seat (5), valve (3), valve guide (2) and return spring (1). To prevent air leakage O-ring (4) locates in groove of valve seat.

1 Return spring
2 Valve guide
3 Valve
4 O-ring
5 Valve seat

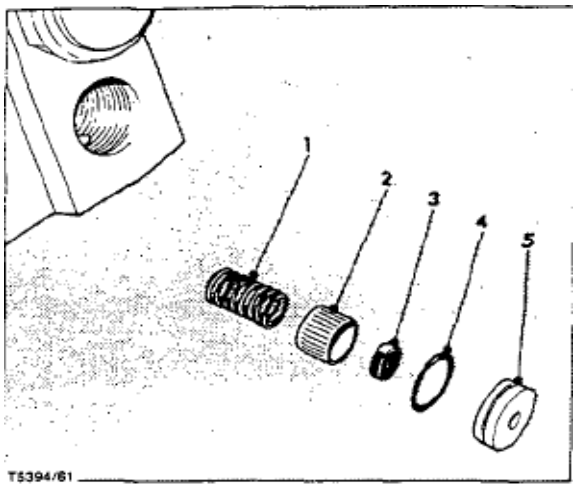
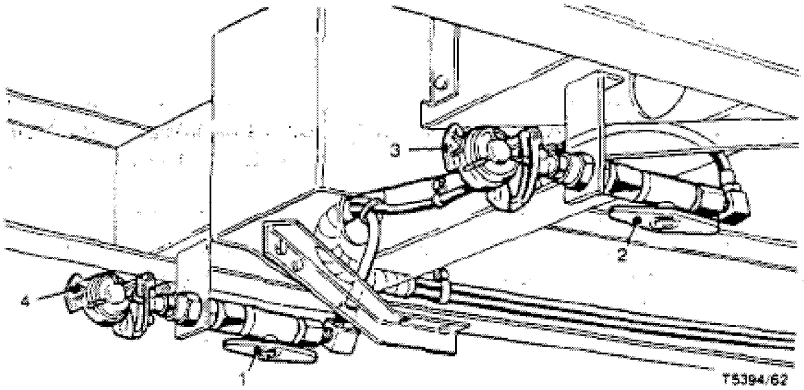


Fig 41 Valve components



1 Service line shut-off valve
2 Emergency line shut-off valve
3 Emergency line palm coupling
4 Service line palm

Fig 42 Rear air couplings

BRAKE LINE FITTINGS

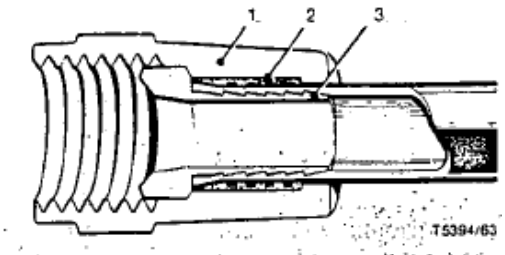
Rear air couplings

104. The rear couplings (Fig 42) for the Service and Emergency airlines are of the palm type. The couplings are such that when connected with another coupling of the same type, pressure is put onto the rubber facing gaskets to make air tight seal. This joint can easily be connected or disconnected by hand. The couplings are colour coded yellow and red for Service and Emergency lines respectively.

105. When not in use, integral dummy couplings prevent the intrusion of moisture or foreign matter. The couplings are provided with shut off valves. The valves are adjacent to each coupling.

BRAKE PIPES

106. The majority if the brake pipes on the vehicle are of the nylon type and have specially designed end fittings (Fig 43) comprising a nut (1), shell (2) and body (3) which cannot be transferred from old to new pipes.



1 Nut 2 Shell 3 Body

Fig 43 Brake pipe end fittings

107. Only imperial diameter pipe is installed (Fig 44), this being used with either imperial or metric threaded nuts. An imperial threaded nut (A) can be identified from a metric threaded nut (B) by its tapered body.

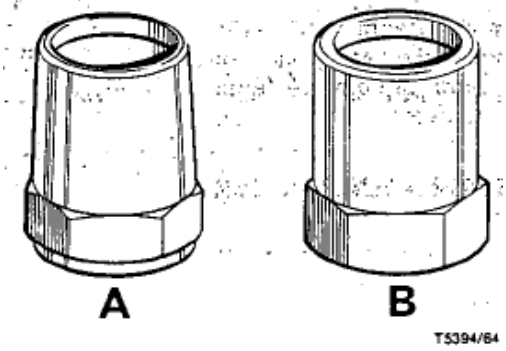
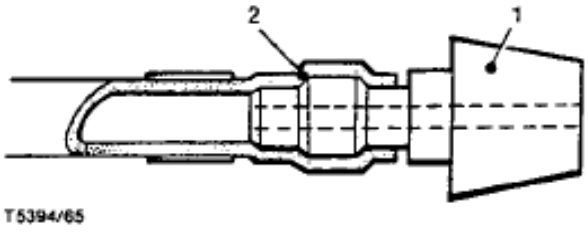


Fig 44 Brake pipe nut identification

NYLON GAUGE PIPES

108. The nylon pipes between the footbrake valve and instrument panel have nipple end fittings (Fig 45) which cannot be transferred from old to new pipes.

109. New nipple end fittings must be installed using correct tool.



1 Nipple end fitting

2 Gauge pipe

Fig 45 Gauge pipe nipple end fitting

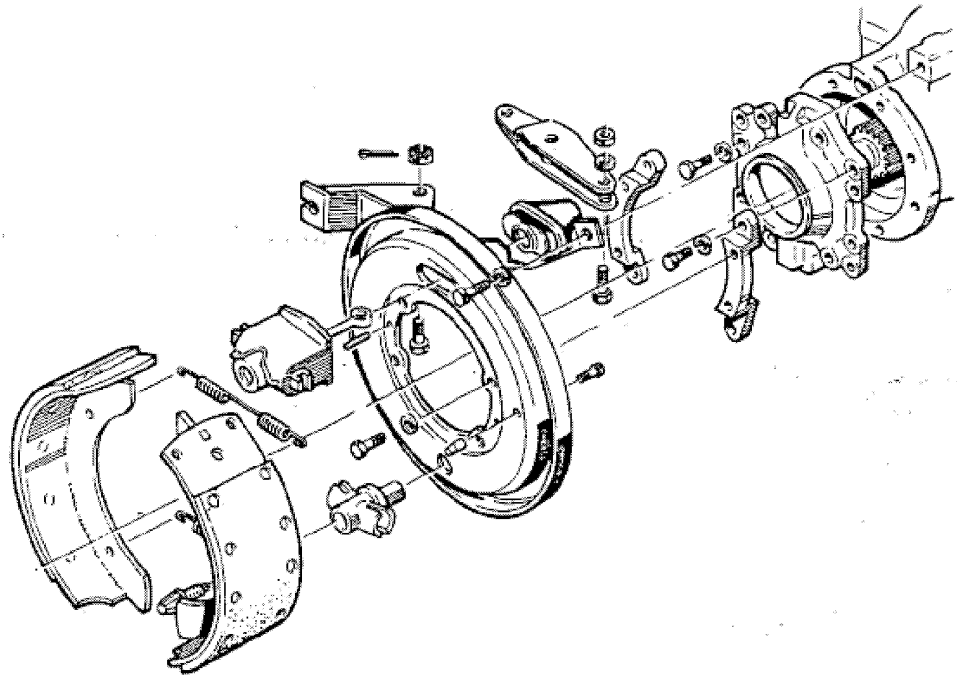


Fig 46 Transmission brake assembly

PARKING BRAKE

110. The parking brake lever is mounted on the drivers seat platform and operates a drum-type transmission brake (Fig 46) through a cross-shaft and cable.

111. The brake shoes are operated by a lever and two expanding tappets, and shoe adjustment is effected by a wedge type adjuster.

112. The drum locates on the bolts of the pinion shaft flange and is secured by two screws.

Chapter 11

FUEL SYSTEM AND EXHAUST SYSTEM

CONTENTS

FUEL SYSTEM AND EXHAUST SYSTEM

GENERAL DESCRIPTION

1. The fuel system includes a sedimenter a diaphragm type fuel feed pump, a cartridge type main fuel filter and a mechanically governed distributor type fuel injection pump. The fuel injectors, which are located in renewable sleeves in the cylinder head, project into combustion chambers in the piston crowns.

2. The cold start aid consists of two igniters mounted in the air intake manifold and a fuel supply tank. Fuel delivery to igniters is controlled by a solenoid operated spool valve.

3. Air filtration is by a paper type element air cleaner. An air restriction indicator is incorporated in the filtered side of the air intake system.

4. Exhaust is via a three piece manifold, a turbo-charger and through a down pipe to the silencer.

FUEL SYSTEM

Sedimenter

5. A fuel system sedimenter (Fig 1) with drain tap (arrowed) mounted on the engine crankcase, is connected between fuel tank and feed pump.

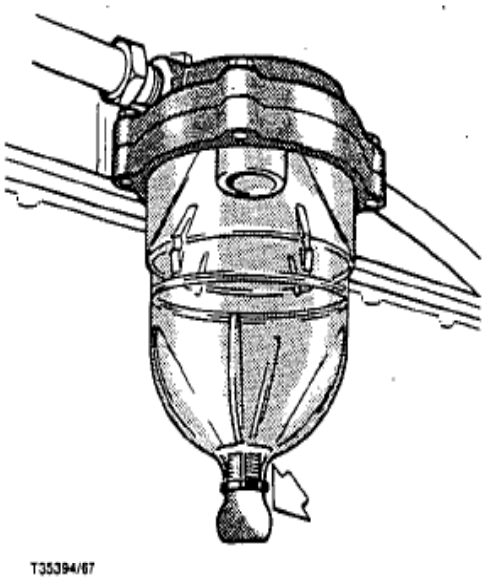
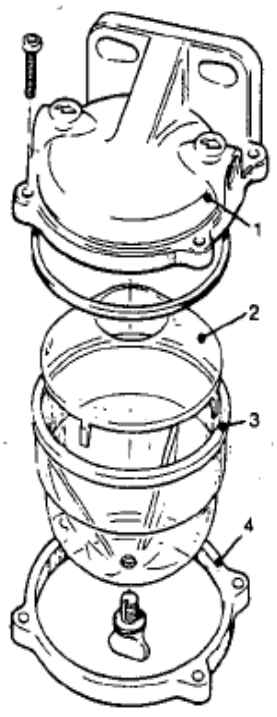


Fig 1 Fuel sedimenter



1 Sedimenter head
2 Filter element
3 Bowl
4 Bowl clamp plate

Fig 2 Exploded view of sedimenter

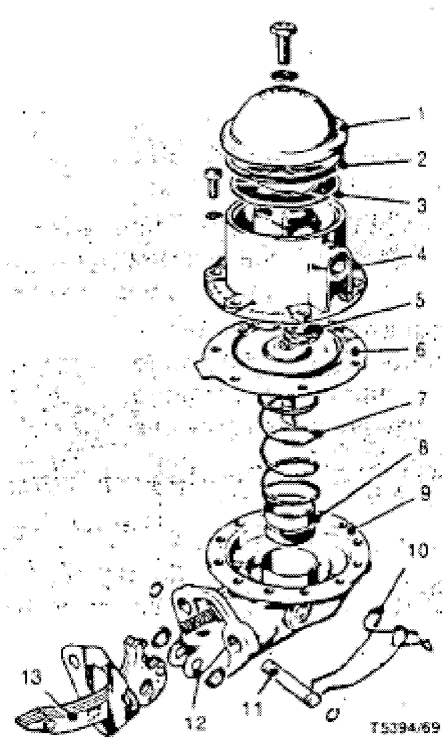
6. The sedimenter comprises a metal head (Fig 2 (1)) a transparent plastic bowl (3) incorporated a conical element (2) and a bowl clamp plate (4) which is secured to the head by four screws. The bowl drain plug has a vertical slot in its threads to permit draining when plug is loosened. The function for the sedimenter is to remove water and solid particles from fuel before entering the lift pump.

7. Fuel passes first into the head of sedimenter and then, via an annular gap between base of the element and wall of the bowl, into lower chamber. The gap is sufficiently narrow to distribute the flow evenly around case of the cone. The fuel then passes over the effective area and out via the annulus at centre of element. Air entering sedimenter will exit through the by-pass bleed drilling in the outlet passage.

Fuel feed pump

8. The spring-loaded diaphragm-type fuel feed pump (Fig 3) is mounted on the right-hand side of the crankcase and is operated by an eccentric on the camshaft. The pump incorporates a gauze filter screen (3) and is provided with a hand priming lever.

9. When the pump supplies fuel surplus to requirements of engine, pressure builds up in the pump and holds the pumping diaphragm (6) down against spring pressure, allowing the rocker arm (13) to idle without operating the pump.



1	Filter cover	6	Diaphragm	10	Spring
2	Gasket	7	Spring	11	Pin
3	Gauze filter	8	Retainer	12	Link
4	Pump cover	9	Pump body	13	Rocker arm
5	Valves				

Fig 3 Exploded view of fuel pump

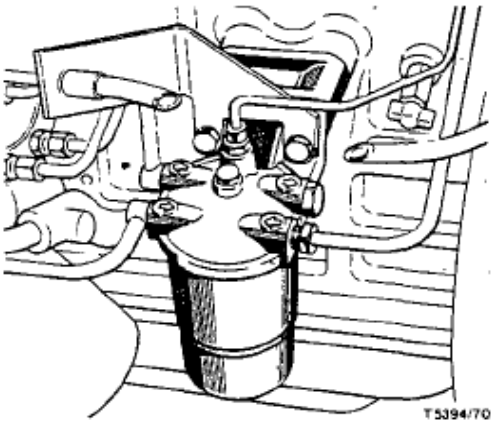


Fig 4 Main fuel filter

Main fuel filter

10. A main field filter (Fig 4), bolted to crankcase, is connected between the fuel feed and injection pumps.

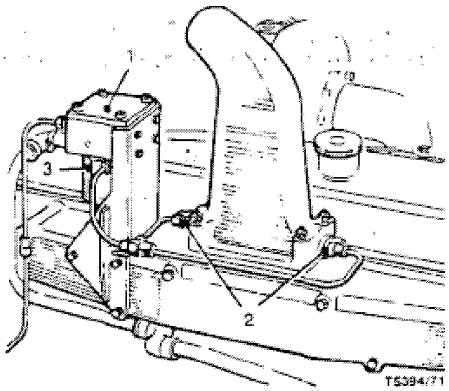
11. The filter incorporates a disposable paper type element contained within a steel canister. The canister is clamped between the cover and case to form an integral part of the filter. Inlet and outlet pipe connections are provided in the head which also contains an air vent connection.

Cold starting aid

12. The cold starting aid (Fig 5) comprises electrically operated igniters (2) in the intake manifold.

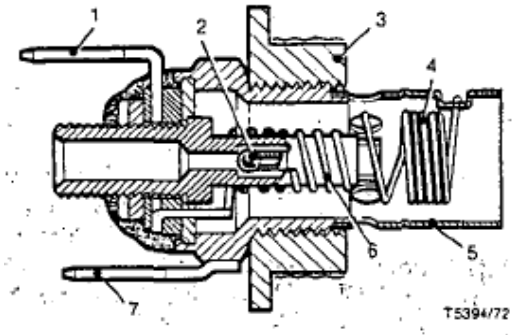
13. An igniter supply tank (1) incorporates a spool valve operated by a solenoid (3). The spool valve allows the inlet manifold pressure to act upon the fuel in the supply tank, when the igniter is energized.

14. This allows the fuel from the supply tank to flow to the igniters when the cold starting switch is depressed.



1 Supply tank 2 Igniters
3 Solenoid

Fig 5 Cold starting aid

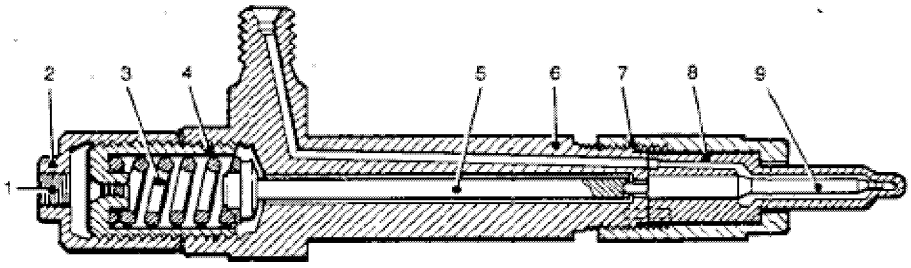


1 Positive terminal
2 Ball valve
3 Insulating bush
4 Igniter coil
5 Igniter shield
6 Heater coil
7 Negative terminal

Fig 6 Igniter

15. The igniters (Fig 6) are operated by a switch mounted on the cab instrument panel. When the switch is depressed, heater coil (6) in the igniter is energised. This heats the valve body causing it to expand thus opening the ball valve (2) permitting the entry of gravity feed fuel. The fuel is vapourised by heat of the body, the vapour is then ignited by coil (4). When the engine is cranked the burning fuel heats the intake air of engine to a level which in addition to the compression temperature, is sufficient to ensure that the intake charge has reached a temperature to ignite the engine fuel when injected.

16. On vehicles installed with insulated ground return wiring, igniters are installed as shown with insulating bush (3) and negative terminal (7), whereas on vehicles with normal application these two items are deleted.



1 Leak-off connection
2 Nozzle holder cap
3 Spring
4 Spring cap
5 Valve spindle
6 Nozzle holder casting
7 Nozzle nut
8 Nozzle body
9 Needle valve

Fig 7 Injector

Injectors

17. The injectors (Fig 7) are of the multi-hole type. Their operation is by fuel which is delivered under pressure from injection pump. The fuel lifts the spring-loaded needle valve (9) from its seat and emerges as on atomized spray through spray holes in the nozzle tip. A slight leakage of fuel past the needle valve stem, returns via valve spindle bore in nozzle holder casting (6) to the leak off connection (1) and through return pipes to fuel tank. This fuel leakage provides lubrication for valve stem which is a selective fit in the nozzle body (8).

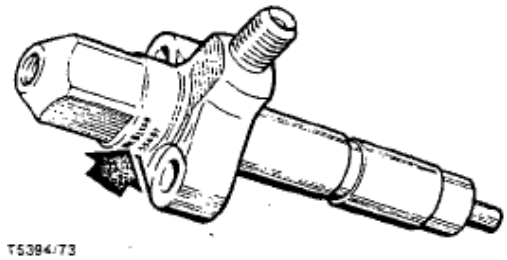


Fig 8 Injector identification number

18. The injectors (Fig 8) are identified by despatch number (arrowed) stamped on nozzle holder casting.

Fuel injection pump

19. The CAV fuel injection pump (Fig 9) is a mechanically governed distributor-type, flange mounted on a carrier attached to the air compressor. The rear end of the carrier is supported by a bracket bolted to the cylinder block.

20. The drive shaft coupling is keyed and clamped by a bolt and nut to the compressor shaft and is splined at the rear end for engagement with the pump shaft splines. A masterspline ensures correct timing relationship between the pump and coupling.

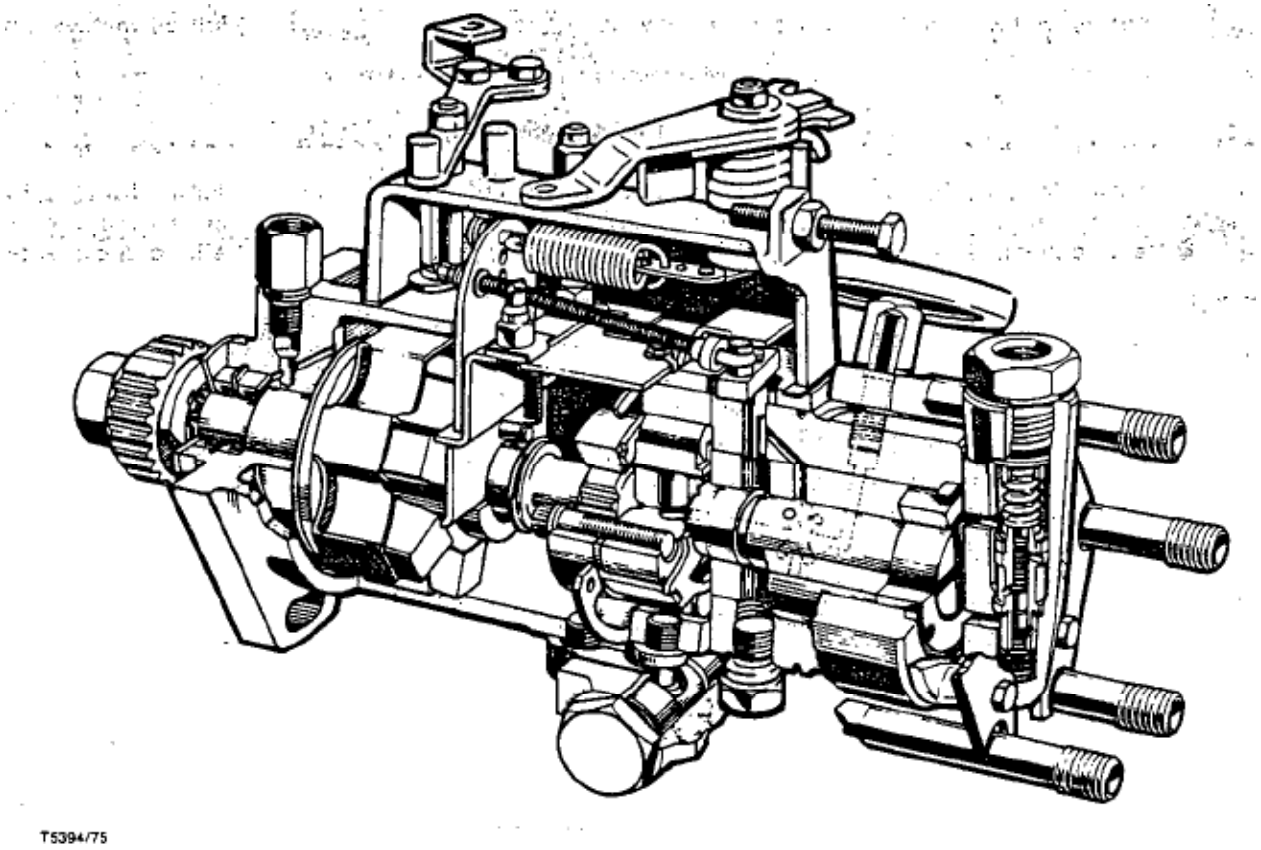


Fig 9 Fuel injection pump

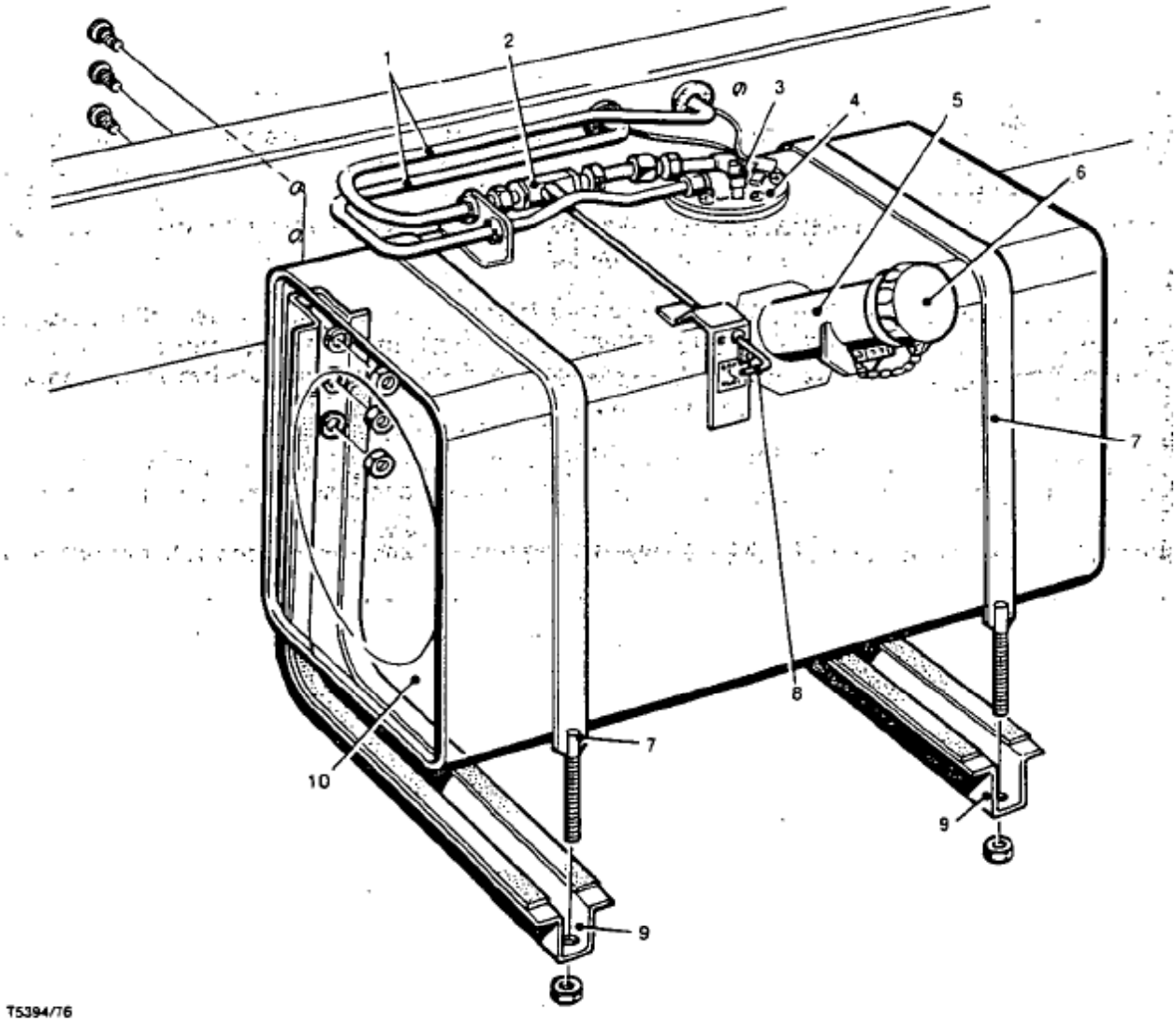
21. The carrier enclosed the pump coupling which is lubricated by engine oil supplied fro the rear of the compressor.

22. Two opposed seals in the drive end of the pump retain the engine oil in the carrier and the fuel oil in the pump. A drilling in the housing from between the seals to the pump exterior provides evidence of oil leakage in the event of seal failure.

23. The fuel leak-off connection is on the pump inspection cover.

Fuel tank

24. The fuel tank (Fig 10) is constructed from Tinterne sheet steel with welded seams. Two inner baffles are spot welded to both sides and top of tank. A gap is provided between the baffles and bottom of tank to allow fuel flow. Flanges are soldered to the tank for mounting fuel pipe connections, telescopic filler neck (5) and, on vehicles with insulated ground return wiring, the fuel gauge. The tank is secured by two metal straps (7) to ‘L’ shaped brackets (9) which are attached to the chassis sidemember by nuts and bolts.



1 Fuel pipes
2 Shut off value
3 Fuel gauge connections
4 Fuel tank unit
5 Telescopic filler neck
6 Filler cap
7 Tank securing straps
8 Handle, shut off value
9 Tank mounting brackets
10 Fuel tank

Fig 10 Fuel tank

25. A fuel tank unit (4) with gauge connections (3) also has two fuel pipe connections. The fuel pipes (1) incorporate a manually operated shut-off valve (2) controlled by lever (8) in the delivery pipe. The other pipe is for fuel return. The filler neck (5) is equipped with an anti-spill type safety cap (6), incorporating controlled ventilation.

26. In vehicles installed with insulated ground return wiring a mechanically operated fuel gauge with a direct acting float is installed. The face of the gauge is divided into ¼-½-¾-F (Full) capacity markings.

EXHAUST SYSTEM

27. The exhaust system comprises a front pipe, silencer and tail pipe which is supported by a bracket and insulator bolted to the chassis sidemember. The front pipe is sealed by a packing ring to an elbow secured to the turbo-charger by studs and nuts.

28. On vehicles with insulated ground return wiring a revised exhaust system is used with the silencer mounted at the front of the vehicle beneath the toe panel.

Chapter 12

COOLING SYSTEM

CONTENTS

COOLING SYSTEM

GENERAL DESCRIPTION

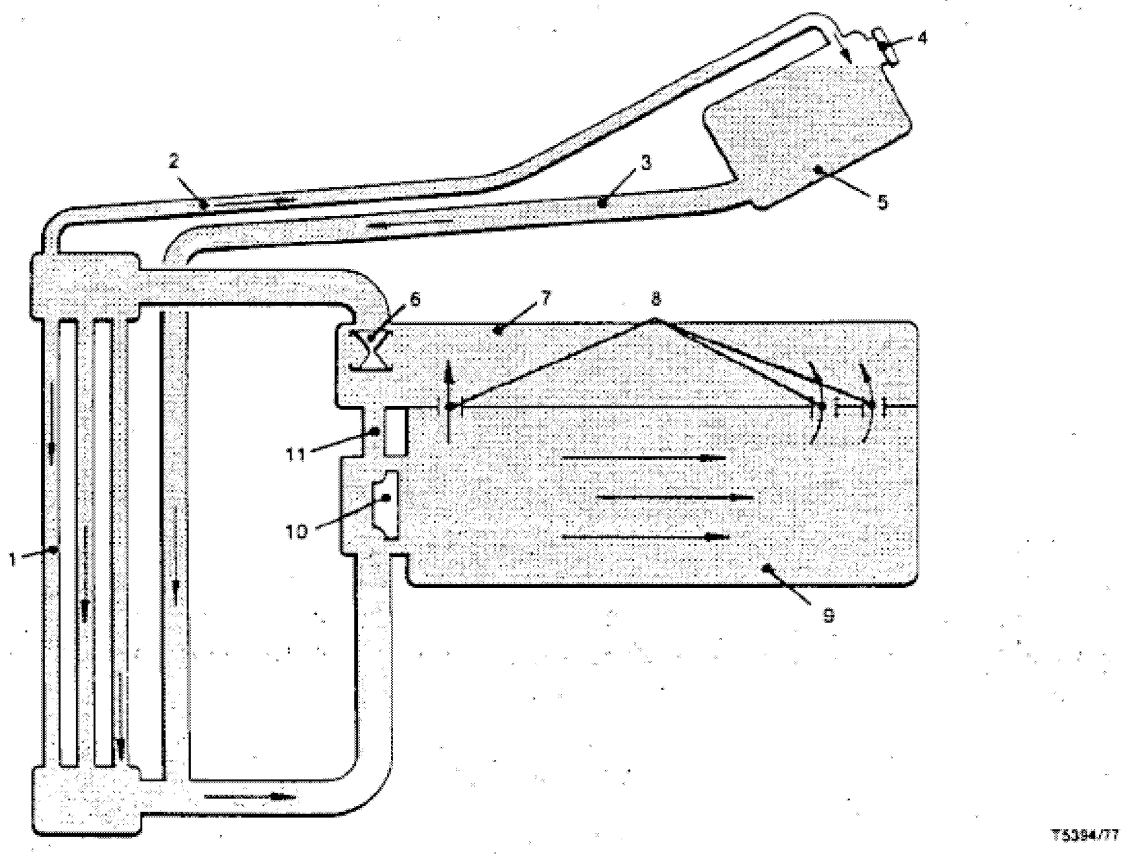
1. The pressurized cooling system (Fig 1) includes a tube and centre radiator (1), a belt driven pump (10), a single blocking thermostat (6) and a five blade thermosensing viscous fan.

2. The header tank (5) has a vent line (2) from the radiator top tank to ensure air is expelled when filling the cooling system.

3. A safety valve is incorporated in the filler cap (4). Coolant which enters the pump rotor chamber from the radiator bottom tank is discharged through the engine opens the thermostat housed at the front of the cylinder head and passes into the radiator top tank where it then passes down through the cooling elements.

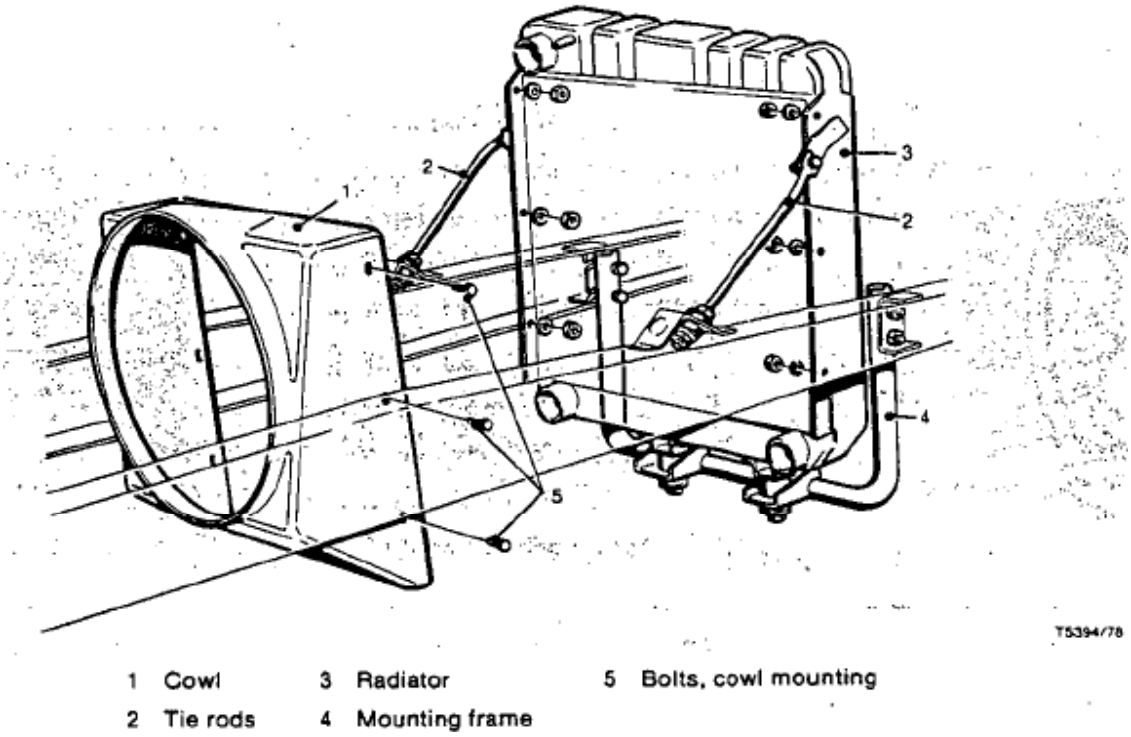
4. When the engine is cold, circulation through the radiator is prevented by the thermostat being closed, coolant returning direct to the pump via the by-pass hose (11).

5. There are two drain taps, one in the radiator bottom tank and the other at the rear of the cylinder block on the left hand side.



1	Radiator	6	Thermostat
2	Radiator vent line	7	Cylinder head
3	Coolant fill line	8	Coolant transfer ports
4	Filler cap	9	Cylinder block
5	Header tank	10	Water pump
		11	By-pass hose

Fig 1 Schematic diagram of cooling system



1 Cowl
2 Tie rods
3 Radiator
4 Mounting frame
5 Bolts, cowl mounting

Fig 2 Radiator, cowl and mountings

RADIATOR AND HEADER TANK

6. The tube and center radiator (Fig 2 (3)) is rubber mounted on a 'U' shaped frame (4) between chassis side members. The radiator is supported by tie rods (2) rubber mounted to brackets riveted to the chassis longitudinal members.

7. A cowl (1) is attached to the radiator by bolts (5). The holes in the cowl are elongated to permit cowl positioning relative to fan. The drain tap is located in the radiator bottom tank.

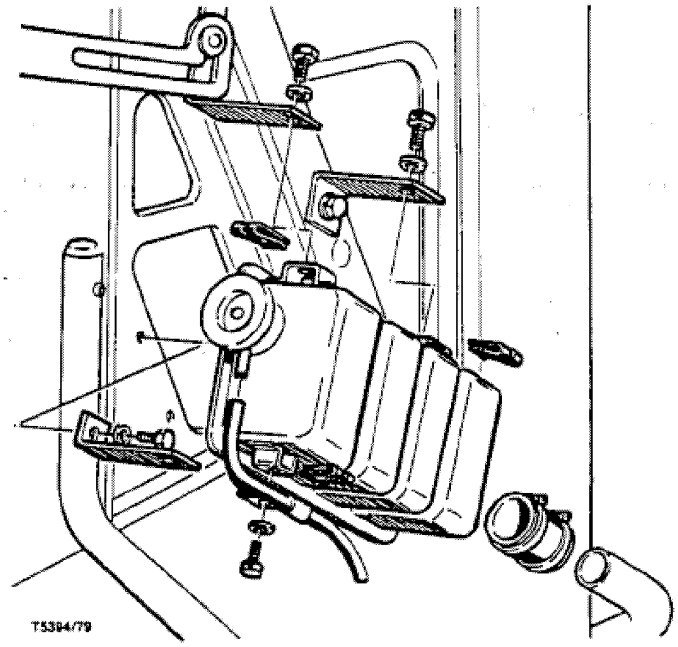
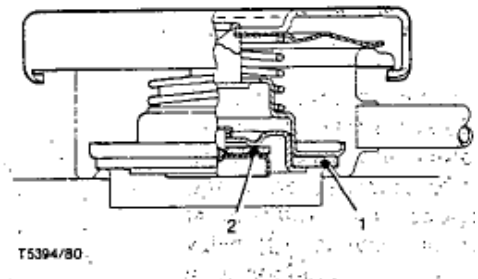


Fig 3 Header tank and mountings

8. The header tank (Fig 3) is attached to the cab rear panel and connections to the engine and radiator are via metal pipes and rubber hoses.

Radiator filler cap

9. The radiator filler (Fig 4) cap incorporates a safety valve to protect the cooling system. The safety valve (1), which seats in the header tank neck maintains a nominal operating pressure of 0.5 bar (7 lbf/in^2) at which the temperature of the coolant can rise to 100°C. The vacuum valve (2) relieves the depression in the system as the engine cools.



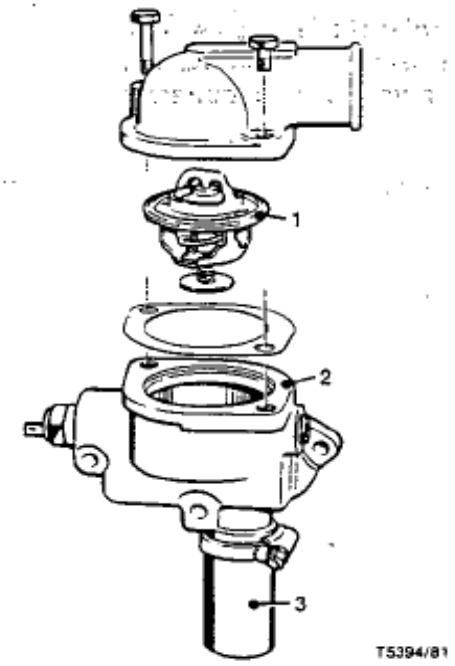
1 Safety valve 2 Vacuum valve

Fig 4 Filler cap

THERMOSTAT

10. A single blocking thermostat (Fig 5) of either AC-Delco or Western-Thompson manufacture is installed in a housing (2) bolted to the front of the cylinder head.

11. Coolant circulation is directed from the thermostat housing to the water pump via a by-pass hose (3). As the engine temperature rises the thermostat (1) gradually opens to allow an increasing flow of coolant to circulate through the radiator.



1 Thermostat

2 Thermostat hou

3 By-pass hose

Fig 5 Thermostat and housings

WATER PUMP

12. The water pump (Fig 6) driven by twin belts, is of the centrifugal type with a phenolic face rotor seal running against a ceramitic desk, a spring-loaded lip-type seal is used for protection against water penetration into the bearing and shaft assembly.

13. The pump has no backing plate but is attached direct to the front of the cylinder block. The rotor and pulley are supported by a bearing and shaft assembly which is retained in the pump body by a circlip.

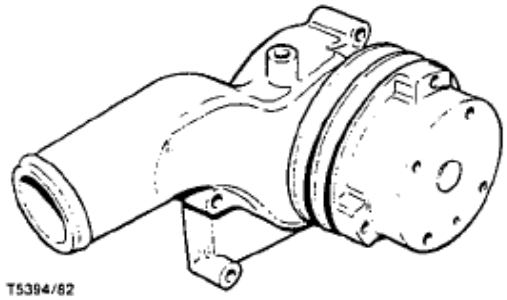


Fig 6 Water pump

FAN AND VISCOUS DRIVE

14. The five bladed metal fan (Fig 7) is driven by a viscous drive unit. The viscous drive unit, mounted on the water pump pulley is of the air temperature sensing type, which, operating as a shear type fluid coupling, controls the fan speed by transmitting drive through a film of silicone fluid.

15. In operation, the fan speed increases with engine speed, though at a lower rate, until the limit of the torque capacity of the drive is reached. The fan at this point is revolving at its maximum attainable speed which will not be exceeded when engine speed increases further.

16. The fan drive incorporates a temperature sensing device which changes the degree of drive to the fan relative to the temperature of the air stream through the radiator. When the temperature is low, drive transmission is reduced and the maximum attainable fan speed is decreased. As the air stream temperature rises the drive transmission progressively increases until the maximum drive is transmitted.

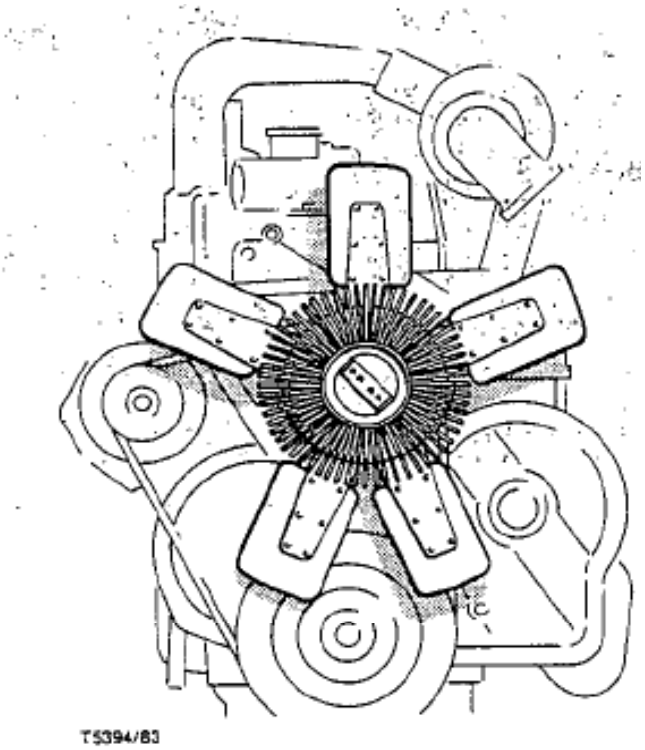


Fig 7 Fan assembly

FAN BELTS

17. The V type fan belts which also drive the alternator, consists of polyester cords set in polychloroprene. The belts are supplied in matched pairs to ensure even tension on both belts. If one belt should fail it is essential that both belts are renewed and the remaining belt discarded.

18. Fan belt adjustment is achieved by pivoting the alternator on its mountings.

Chapter 13

ELECTRICAL SYSTEM

CONTENTS

Para

CONTENTS (Contd)

ELECTRICAL SYSTEM

GENERAL DESCRIPTION

1. The standard chassis ground return wiring system comprises of the main chassis and cab harnesses and subsidiary harnesses. Protection is provided by four 35 Amp fuses. In addition, standard two-point and twelve-point trailer wiring sockets are incorporated at the rear of the vehicle.

2. The insulated ground return wiring system differs from the standard wiring system by providing an insulated ground return for all vehicle electrical components. All cables located externally are housed in rust-proof seamless flexible conduit.

3. A master battery cut-out switch is situated in the cab, attached to the floor panel beneath the driver's seat. Bulk fuel carrying vehicles have an additional master cut-out switch located on the chassis sidemember adjacent to the battery carrier. With either switch in the 'OFF' position, the complete electrical circuit is disconnected.

4. Two 12 V 128 Ah batteries connected in series are charged by a 35 A engine driven alternator. Output is controlled by a transistorised voltage regulator. As the alternator is self-limiting in its current output, the regulator has only to control voltage.

5. The starter motor is a co-axial type and incorporates a two-stage solenoid switch unit mounted internally around the armature shaft.

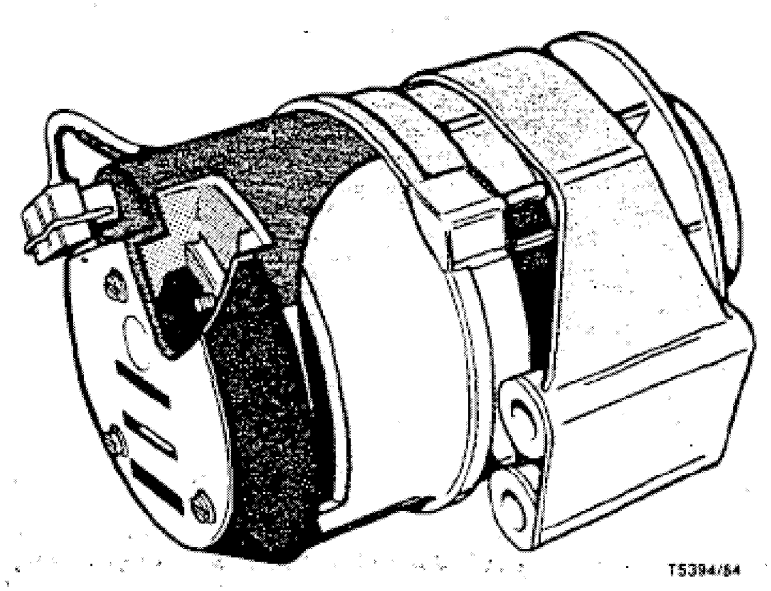


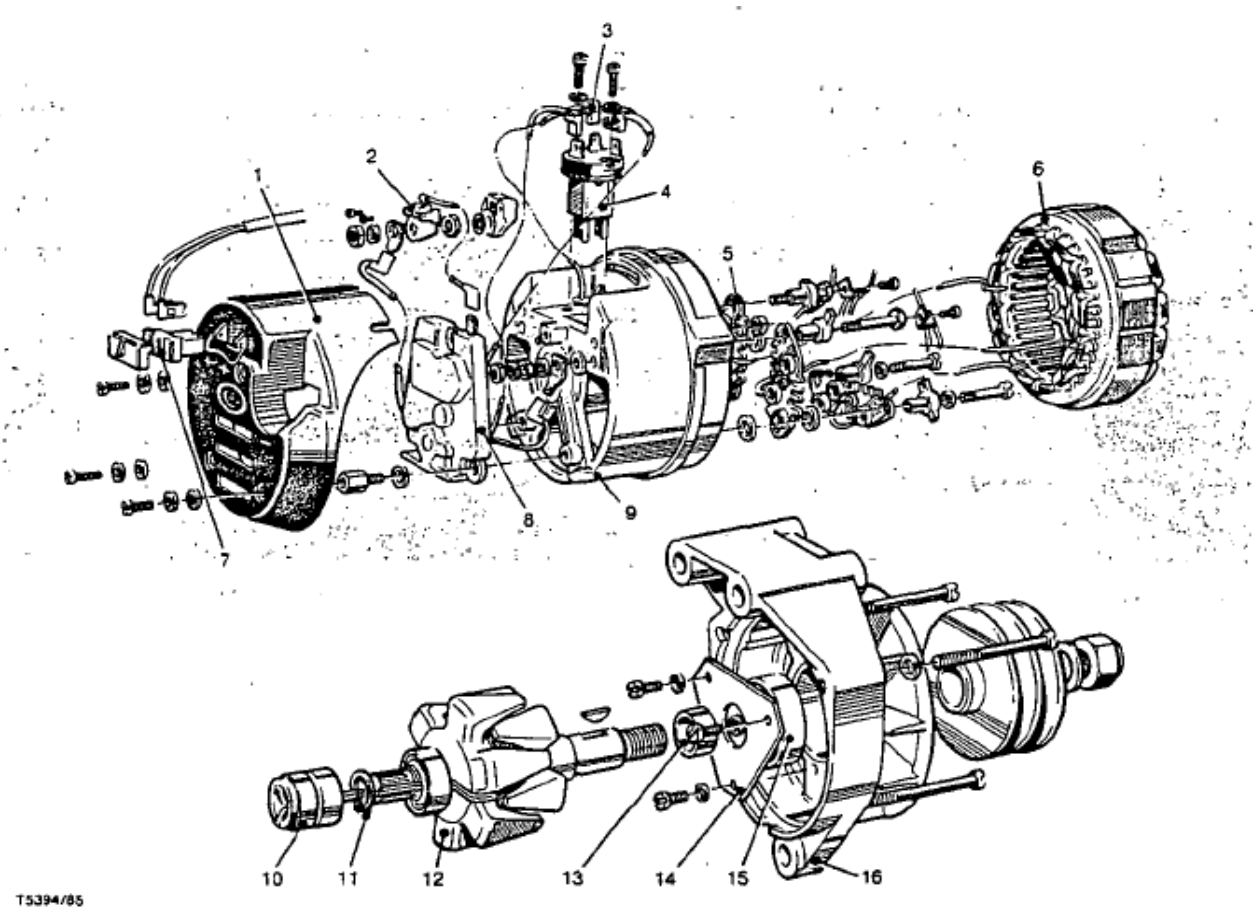
Fig 1 Alternator

ALTERNATOR

6. The CAV AC5R/24 alternator (Fig 1), which is self-limiting in current output, incorporates a three phase star connected stator excited by a wound field rotor.

7. Rectification of the output from a.c. to d.c. is effected by six silicon diodes connected in a three-phase bridge circuit between the stator (Fig 2 (6)) and the output connection and ground. A second rectifier bridge is formed by using three auxiliary diodes in conjunction with the three main negatives diodes and this provides rectified current for the field winding via the slip rings (10) and brushes (4), the current then passing through the regulator (8) to ground.

8. The rotor (12) and stator are located between the drive end (16) and slip ring end bracket (9) which house the ball bearings supporting the rotor shaft. The rectifying diodes are located in hear sinks (5) secured to the inside of the slip ring end bracket.



1	End cover	5	Heat sink	9	Slip ring end bracket	13	Bearing spacer
2	Terminal block	6	Stator	10	Slip ring assembly	14	Clamp plate
3	'A' terminal wire	7	Multi-plug	11	Circlip	15	Bearing
4	Brush gear	8	Regulator	12	Rotor	16	Drive end bracket

Fig 2 Exploded view of alternator (Chassis ground return)

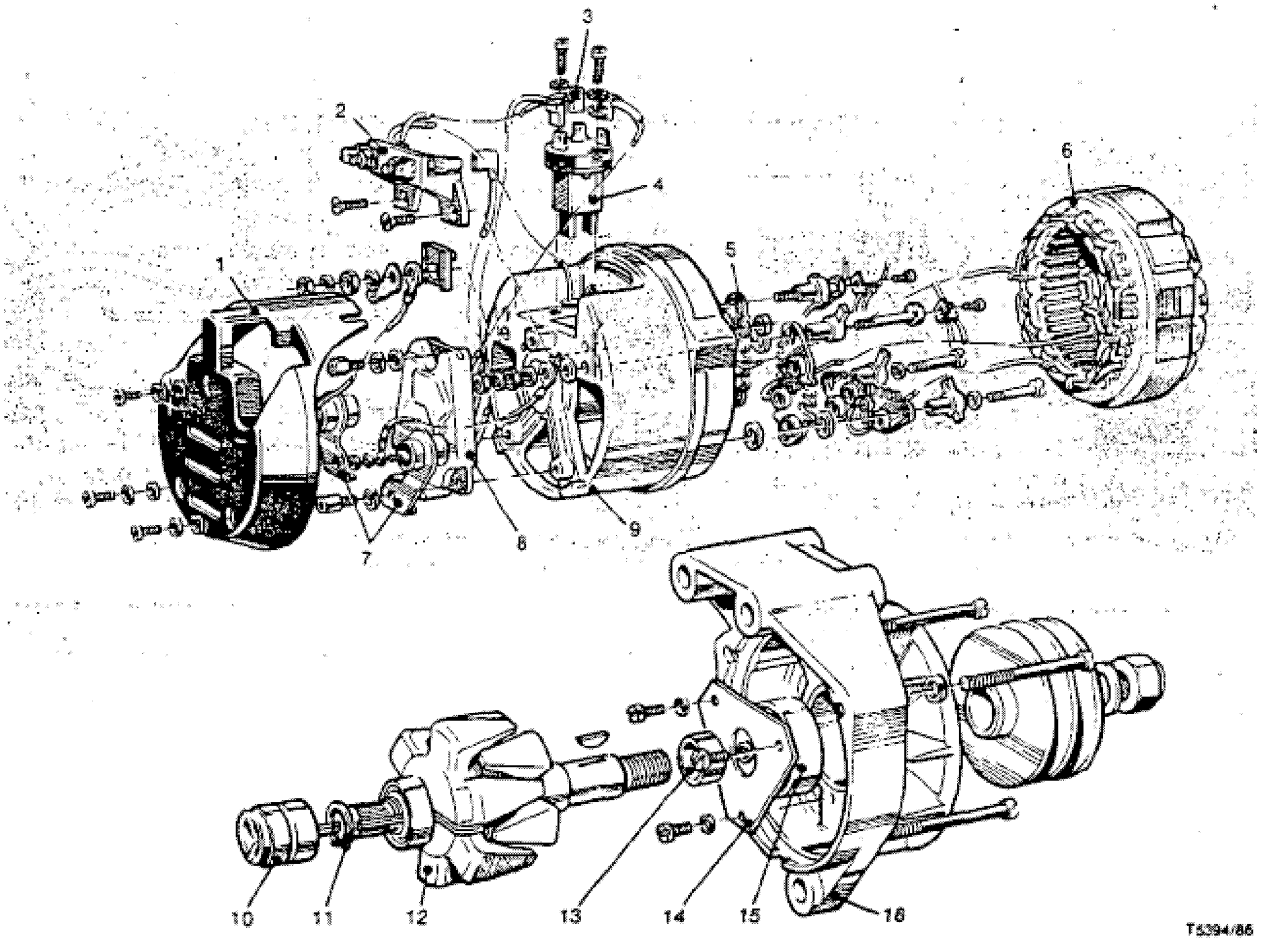
9. The machine-sensed voltage regulator is non-adjustable and is mounted on the slip ring end bracket inside the moulded end cover (1).

10. The insulated ground return alternator (Fig 3) differs from the standard alternator by providing insulated output connections housed in a terminal block (2). Radio suppression is provided by two, internally mounted, uF capacitors (7)

STARTER

11. The starter (Fig 4) is a co-axial type and incorporates a two-stage solenoid switch unit (7) mounted internally around the armature shaft (32). The brush gear (3) is carried in the commutator end shield (2) which, together with a drive end shield (11) are secured to the yoke (4) by through bolts (8).

12. The starter is so designed that pinion (25) engagement occurs under reduced power and full power is only applied when the pinion is fully engaged. The pinion locks in the fully engaged position to prevent premature disengagement.



1	End cover	5	Heat sink	9	Slip ring end bracket	13	Bearing spacer
2	Terminal block	6	Stator	10	Slip ring assembly	14	Clamp plate
3	'A' terminal wire	7	Capacitors	11	Circlip	15	Bearing
4	Brush gear	8	Regulator	12	Rotor	16	Drive end bracket

Fig 3 Exploded view of alternator (insulated ground return)

13 An overspeed device comprising steel balls housed in the pinion sleeve and a locking collar (26) prevents the armature from being driven at excessively high speeds by the engine.

14. The starter is wired for insulated return.

15. The main terminal (16) is permanently connected to the battery supply, operation of the starter being controlled by the application of battery power to the solenoid terminals (17).

16. When the starter solenoid is energised, its plunger moves towards engagement. Four spring-loaded steel segments (9) in the plunger bear against a shoulder on the pinion sleeve and move the pinion sleeve and integral pinion to its first position. At the same time, the first stage contacts close and current is applied to the starter windings via a built-in resistor (6). The armature rotates under reduced power and the pinion is driven into engagement by means of the armature shaft helix.

17. When the pinion is almost fully engaged, the second stage contacts close, shorting out the resistor and applying full battery power to the starter windings. When the pinion sleeve is fully engaged it is locked in position by six balls (30) located in the sleeve which drop into recesses in the armature shaft. The spring-loaded locking collar slides over the balls to keep them in position.

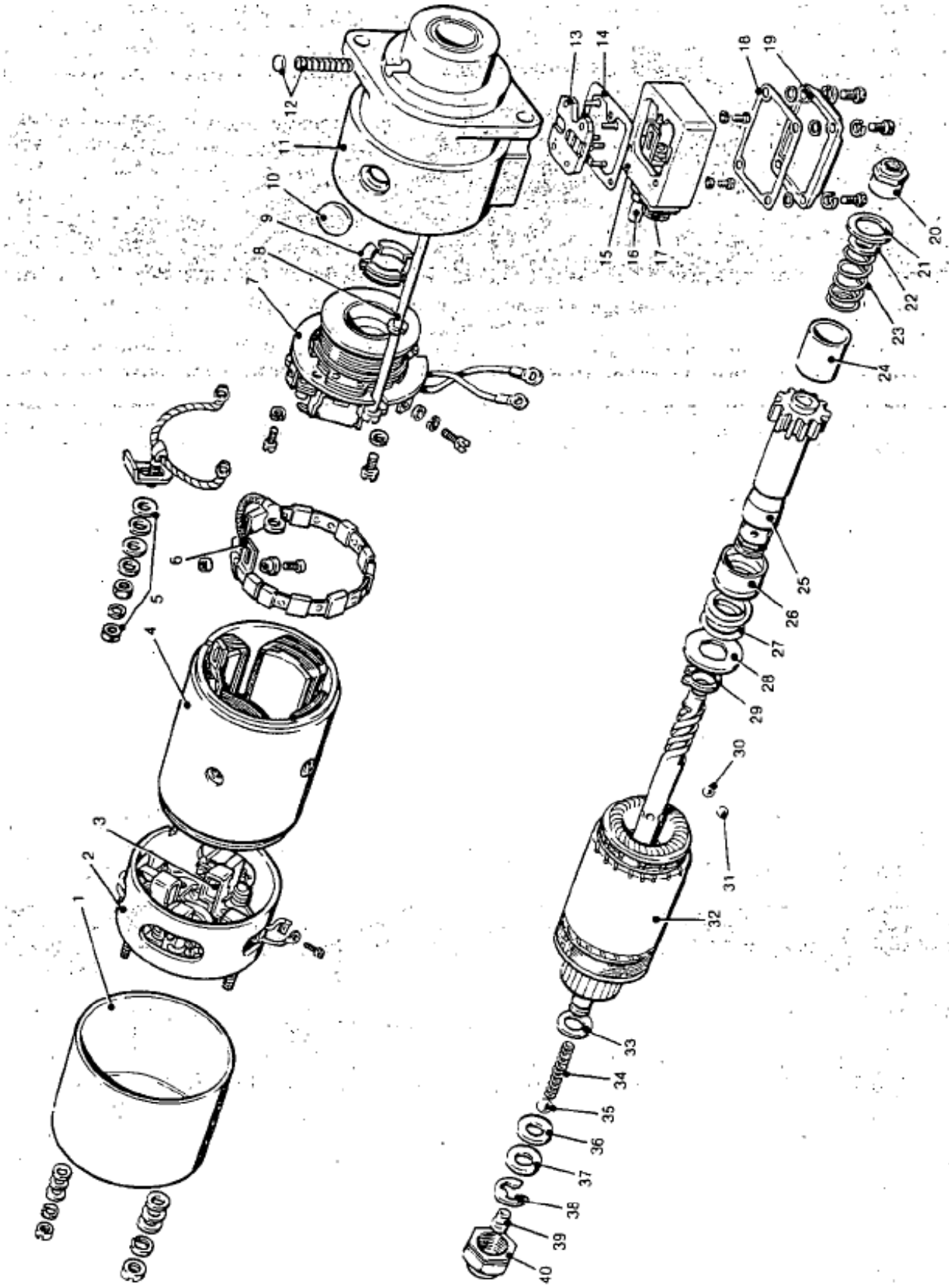


Fig 4 Exploded view of starter

1 Commutato end shield cover
2 Commutator end shield
3 Brushgear
4 Yoke
5 Terminal assembly
6 Resistor
7 Solenoid
8 Through bolts
9 Segment and garter spring
10 Core plug
11 Drive end shield
12 Core plug and spring, lubricator wick
13 Terminal block
14 Gasket
15 Terminal box
16 Main terminal
17 Solenoid terminals
18 Gasket
19 Terminal box cover
20 Pinion spot nut
21 Thrust washer
22 Shim
23 Spring, pinion return
24 Helix shroud
25 Pinion
26 Lock collar
27 Locking spring
28 Trip collar
29 Circlip
30 Locking balls
31 Overspeed release balls
32 Armature
33 Shims, armature end float
34 Recoil spring
35 Recoil ball
36 Shim
37 Thrust washer
38 Circlip
39 Thrust pad
40 End cap

Key to Fig 4

18. As the pinion sleeve moves into full engagement, a ramp on the sleeve forces the four spring-loaded segments outwards where they are held in position by the magnetic field of the solenoid.

19. Should the engine start to drive the armature at a speed in excess of the permitted maximum, then the overspeed device will operate. This consists of four additional steel balls (31) housed in the pinion sleeve. At speed above 9000 rev/min they move outwards under centrifugal force against a ramp on the locking collar. The locking collar is forced back against its spring thus releasing the six locking balls from the recesses in the armature shaft. The pinion is now driven back along the helix to its original position the shoulder passing through the four steel segments which are being held out by magnetic force. The starter will continue to run unloaded until switched off.

20. If the starter is switched off before the overspeed device has operated, the solenoid plunger, in moving back, pushes the locking collar backwards and releases the locking balls thus enabling the pinion sleeve to return to its original position.

BATTEREIS

21. The two 12 V batteries are of the lead acid type and are connected in series. They are retained in a carrier bracket mounted to the chassis sidemember end enclosed by sheet metal protection panels. On bulk fuel carrying vehicles, the batteries are enclosed in a fire-proof fibre-glass cover.

22. Petroleum tanker vehicles have the batteries mounted inside the cab on the rear shelf platform directly behind the driver.

23. The capacity of the batteries is 128 Ah at 20 hour rate. Provided they are properly maintained the batteries will function satisfactorily throughout a wide temperature range.

24. If batteries are to be taken from storage, charging should be carried out in accordance with the manufacturer's instructions. To ease handling of batteries, carrying handles are incorporated in battery cases.

FUSES

25. A 4-way fuse box is mounted beneath the dash panel adjacent to the steering column. The value of each fuse is 35A.

26. A 50 A inline fuse is located in the feed to the winch load limiter control switch.

WINDSHEILD WIPER EQUIPMENT

27. The windshield wipers are operated by a two-speed electric motor. The motor, links and pivot housings are assembled to a mounting bracket as a complete unit (Fig 5).

Wiper arms and blades

28. The blades are secured to the arms by a projecting pip on the arm which is held in engagement with a hole in the blade attachment by a leaf spring.

29. The arms are secured to the serrated driving shaft by a domed nut.

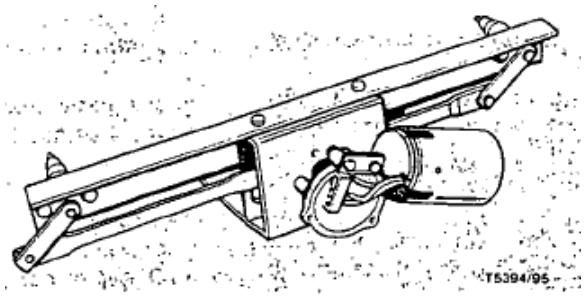
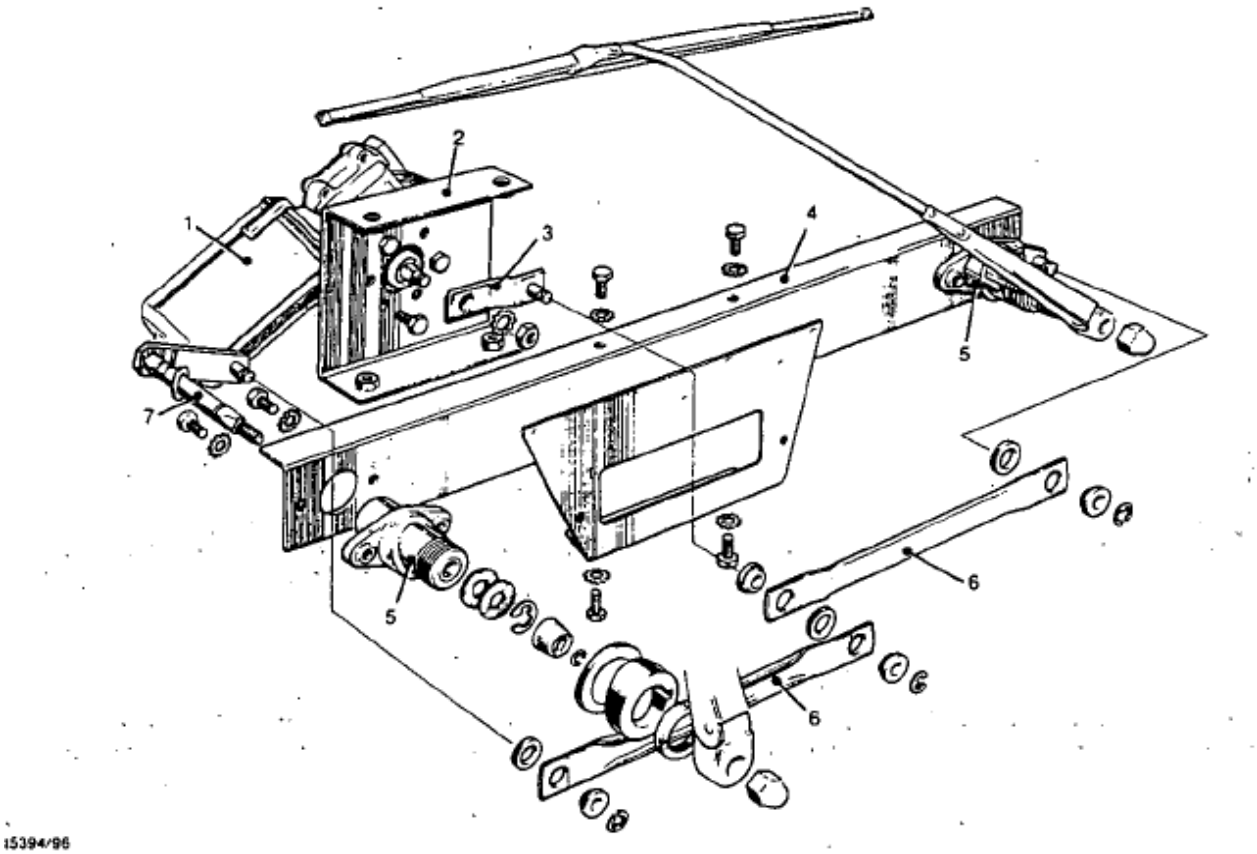


Fig 5 Wiper motor, links, pivot housings and mounting bracket

Wiper unit

30. The wiper unit end comprises a mounting bracket (Fig 6 (4)) with a pivot housing (5) bolted to each end and a motor (1) secured to a centre plate (2) by three bolts. The centre plate is bolted to the mounting bracket and another flanged plate which forms a box section. Two links (5) connecting the pivot (7) and motor cranks (3) are bushed at each end.



1 Wiper motor
2 Centre plate
3 Motor crank
4 Mounting bracket
5 Pivot housing
6 Links
7 Pivot

Fig 6 Wiper unit

31. The two speed wiper motor (Fig 7) is a two-pole permanent-magnet type incorporating a non-adjustable self-parking.

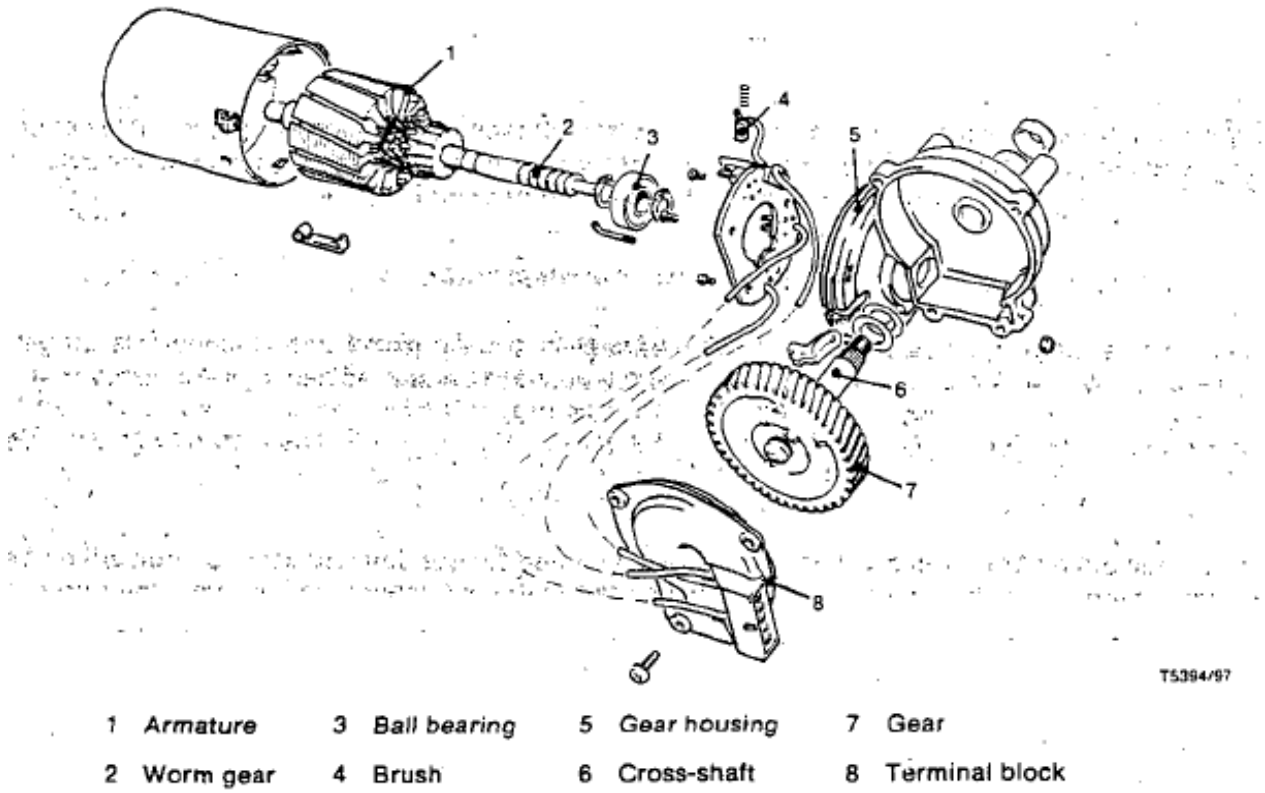


Fig 7 Wiper motor

32. The supply to the motor is taken through the key-start switch via No. 1 fuse and the wiper switch mounted in the bottom of the instrument assembly.

33. A worm gear (2), integral with the armature shaft engages a gear (7) splined to a cross-shaft (6).

34. The armature (1) is supported in the frame by a spherical, sintered metal bush and in the gear housing (5) by a sealed ball bearing (3) and a needle roller bearing. Armature end thrust is accommodated by the ball bearing.

35. The ball bearing outer race is a push fit in the gear housing and is held in position by an L-shaped retainer. The threaded portion of the retainer passes through the housing, and is secured by a nut on the outside of the housing.

36. Cross-shaft end float is non adjustable and is controlled by a hemispherical plastic button in the inner end of the cross-shaft. The button contacts the centre of the gear housing cover.

37. The housing cover incorporates a terminal block (8). Wires from this block feed the three motor brushes (4). Copper conductors soldered to the two remaining terminals pass through the cover and contact the self-parking switch plate in the cross-shaft gear wheel. A third conductor is soldered to the ground terminal and also contacts the self-parking switch plate.

38. The terminals (Fig 8) are numbered to correspond to a standard European wiring system, as follows:

31 b	Black	Motor ground and ground for self-parking switch.
53	Red	Motor low speed.
53 b	Blue	Motor high speed.
53 a	No visible wire	Feed for self-parking switch.
53 e	No visible wire	Current reversal feed for self-parking switch.

39. A thermotrip (Fig 9), designed to protect the motor from overload, is inserted in the black ground wire and is mounted on the brush plate inside the end frame.

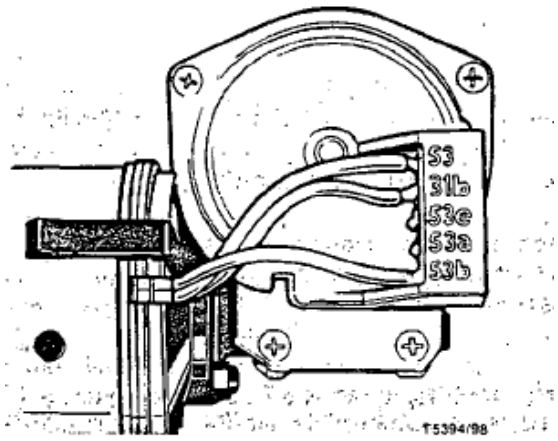


Fig 8 Wiring connections

Windshield Wash

40. The wash system is operated by an electric pump which is controlled by a push button mounted in the dash panel to the right of the instrument assembly.

41. Two spherical-type jets mounted in the windshield lower panel can be adjusted by inserting a pin in the jet orifice and moving to the required angle.

INSTRUMENTS

42. On vehicles with standard chassis ground return wiring, the instrument assembly incorporates a speedometer, fuel and water temperature gauges, and instrument, indicator and warning lights which receive their electrical supply from a printed circuit attached to the rear face of the instrument casing, through a multi-socket connector on the wiring harness.

43. The speedometer mask has slit windows in front of the headlight main beam and vehicle turn signal indicator lights. A dial in front of the instruments has red and amber lens on either side fir the alternator and oil warning lights, and windows for the speedometer, fuel and water temperature gauges.

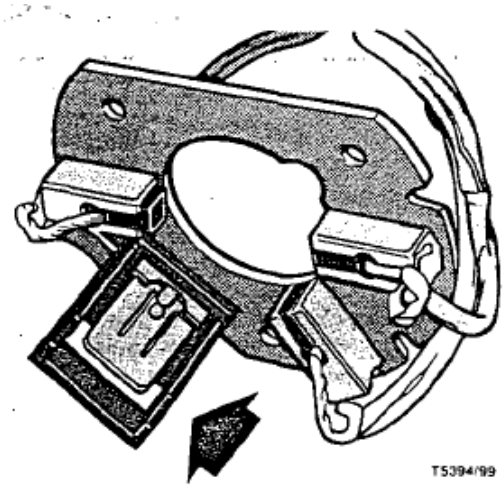


Fig 9 Overload thermotrip

44. Vehicles with insulated ground return wiring have an identical instrument assembly except for the field and water temperature gauges, which are not incorporated within the instrument. The temperature gauge is mounted in the dash panel and the fuel gauge is in the side of the fuel tank.

45. The instrument indicator and warning light holders have a bakelite body with metal contacts for connection the appropriate printed circuit strips. The lamps are of the wedge-base capless type.

46. The acrylic bezel is secured to the instrument casing by metal tabs. The instrument assembly also houses the panel light switch, windshield wiper switch and rear dog guard light switch.

Water temperature gauge

47. On vehicles with standard chassis ground return wiring, the electrically operated temperature gauge comprises two units, one housed in the instrument assembly and an engine unit screwed into the cooling system thermostat housing.

48. Vehicles with insulated ground return wiring have a dial type gauge mounted in the centre of the dash panel which is operated by a capillary tube routed through the cab from the cooling system thermostat housing.

Fuel gauge

49. On vehicles with standard chassis ground return wiring, the electrically-operated fuel gauge comprises two units, a gauge housed in the instrument assembly and a fuel tank unit.

50. Vehicles with insulated ground return wiring have a mechanically operated fuel gauge of the direct-acting float-type, mounted in the side of the fuel tank.

Speedometer and Techometer

51. The magnetic type speedometer is cable driven from the transfer box.

52. On vehicles equipped with a winch or crane, a magnetic-type tachometer is attached to the instrument panel lower flange on the passenger side. The tachometer drive is by a cable which is driven from an extension drive coupled to the oil pump driving gear in the crankcase.

Air pressure gauge

53. A dual air pressure gauge located in the dash panel indicates pressure in the Service and Secondary systems.

CONTROLS

Battery isolating switch

54. The battery isolating switch (Fig 10) is situated in the cab, attached to the floor panel beneath the drivers' seat. Bulk fuel carrying vehicles have an additional battery isolating switch mounted on the chassis sidemember adjacent to the battery carrier.

55. The isolating switch is activated by turning to 'OFF' or 'ON' position, this being clearly indicated on the switch.

Oil pressure switch

56. The oil pressure switch is a diaphragm-operated sealed unit which is screwed into the main oil gallery. The switch is located on the left-hand side of the engine adjacent to the fuel filter.

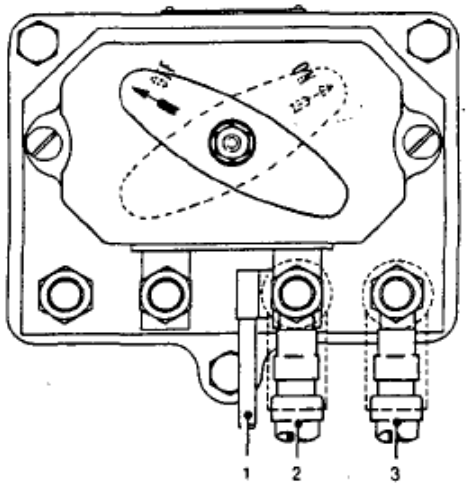


Fig 10 Battery isolating switch

Key-start switch

57. The key-start switch is a three-position type
which controls the ignition or warning lights and starter circuit. The switch is secured by a locking ring to the engine compartment top panel, adjacent to the drivers' seat.

58. The switch is operated by a key which can be inserted and withdrawn in the 'OFF' position.

58.1 'OFF – With the key in this position, no circuits are energised.

58.2 'ON' – With the key in this position, the warning lights are on and depending on air supply, a brake warning buzzer may sound and warning light illuminate.

58.3 'START' – Turning the key clockwise against the pressure of a spring will operate the starter motor. When the engine starts and the key is released it will return automatically to the 'ON' position.

Winch warning switch and light

59. On winching, if pull exceeds maximum, a warning horn is activated by a torque limit switch on the winch. If winching is still to be carried out the horn can be isolated by a switch located in the tachometer mounting bracket. Also mounted in the tachometer bracket is a warning light which illuminates when the warning horn has been isolated.

Lighting switch

60. The six-position switch (Fig 11) is mounted on the centre of the dash panel.

61. Turning the switch knob anti-clockwise from the 'OFF' to the 'T' position operates the tail and number plate lights. Rotation to the 'ST' position operates the sidelights in addition to the tail and number plate lights. Further rotation to the 'HST' position operates the head lights also.

62. Headlight high and low beam control switch (Fig 12) is situated to right of steering wheel utilizing the horn push.

63. The stop-light and turn signal circuits are energized with the switch at 'OFF' or any of the anti-clockwise positions. Turning the switch knob clockwise from the 'OFF' to the 'C' position operates the convoy light and breaks the stop-light and turn signal circuits. Further rotation to the 'CS' position brings the sidelight also into circuit.

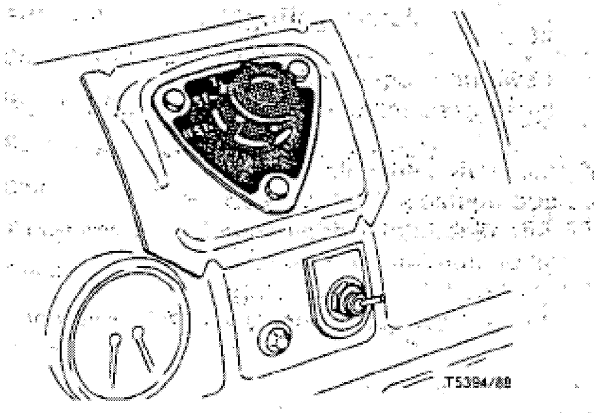


Fig 11 Lighting switch

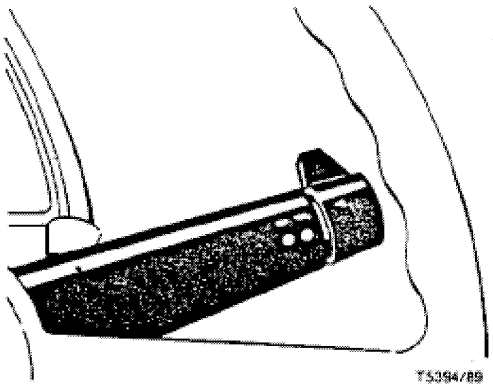


Fig 12 Headlight beam control switch

Turn signal and hazard warning system

64. The same lights operate as turn signal or hazard warning through a transistorised turn signal/hazard warning unit (Fig 13) having a capacity to operate six 21 watt lamps simultaneously.

65. The front lights are mounted on the cab and incorporate two amber lenses facing front and rear.

66. The rear lights are similar to the stop/tail lights but have an amber lens. The lights are provided with single-filament centre contact lamp.

67. Lights on the trailer are connected to the vehicle circuit through the 'M' and 'N' terminals of the trailer socket.

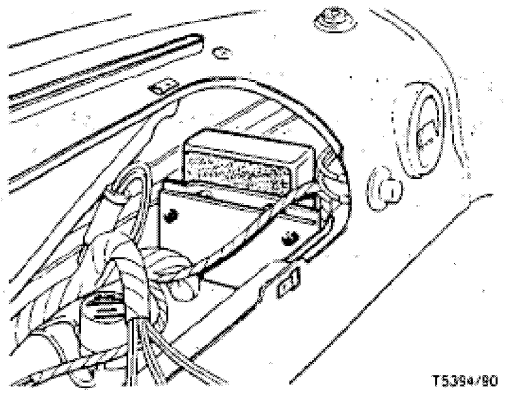


Fig 13 Turn signal and hazard warning unit

68. The turn signal circuit is fed from No. 6 terminal of the lighting switch, the lights being controlled by a three-position switch, housed in a casing which provides a clamp for the horn and dip switch assembly on the steering column. The switch consists of a contact operated by a lever. The self-cancelling device comprises a flanged action plate assembled between the lever and switch, which is held against the metal hum of a rubber wheel by a spring on the inner end of lever. The hub locates in an indentation in the action plate flange when the switch is 'OFF'. The rubber wheel contacts the hub of the steering wheel. Projections on the action plate located the lever in the 'ON' position.

69. Green indicator lights in the instrument assembly and on the dash panel indicate that lights are flashing on vehicle and trailer respectively.

70. The hazard warning switch is mounted in the dash panel to the right of the main instrument assembly.

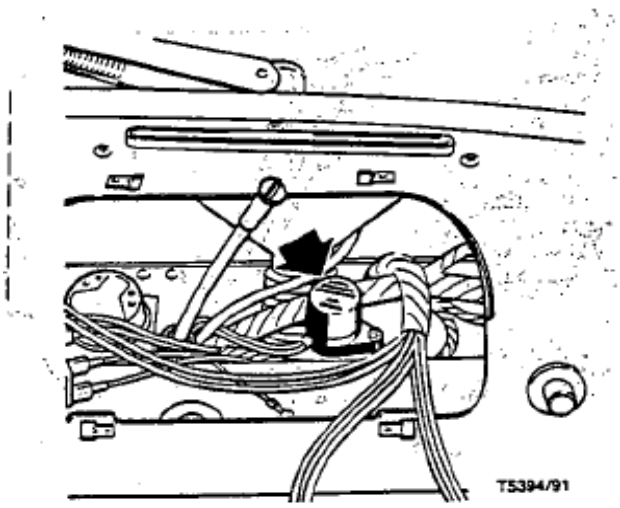


Fig 14 Air pressure warning buzzer

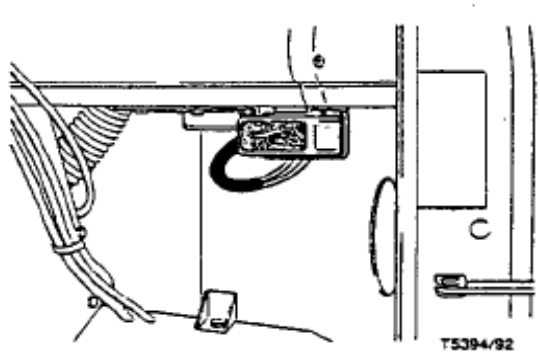


Fig 15 Turn signal relay isolating unit

Warning buzzer

71. The warning buzzer (Fig 14) is a circular red plastic sealed unit which is screwed on the dash panel reinforcement rail directly behind instrument panel. In addition to giving a warning of low air pressure in the braking system, the buzzer also gives and audible warning of when the brake fluid level in the reservoir is low.

Turn signal relay isolating unit

72. The unit (Fig 15) is positioned beneath the dash panel, to the right of the steering column and screwed to the fuse box mounting panel. The unit isolates the turn signal when convoy lights are illuminated.

Turn signal and hazard warning unit

73. All variants are equipped with an electronic type flasher unit (Fig 13) which also incorporates provision for hazard warning operation.

Horn

74.Single horns are mounted on the left and right hand step support brackets directly behind the headlights. They are of the vibrator type, one being a high note the other a low note. Winch variants have an additional high note horn used as an audible warning before winch reaches its maximum pull.

LIGHTING EQUIPMENT

Headlights

75. The headlights are mounted in the cab front panel and incorporate a semi-sealed light unit secured to the light body by spring-loaded beam trim screws.

76. The light rim incorporates a fairing to allow fitment of a standard blackout or an infra-red filter.

77. The double filament pre-focus lights are of the vertical dip type, the beams are controlled by a switch combined with the horn push and mounted on a bracket on the steering column

Sidelights

78. The sidelights, mounted adjacent to the headlights, consist of a rubber body and a white translucent lens screwed into a metal retainer, and are fitted with a single filament centre contact light.

79. The lens seals against the body to prevent the entry of water to the interior of the light.

Tail and stop-lights

80. The combined tail and stop-lights are similar to the sidelights but are fitted with a red lens and a twin-filament lamp.

81. The stop-light switches are located on the outside of the chassis right-hand sidemember. One is incorporated in the airline between the footbrake valve and master cylinder actuator, the other in the airline to the change-over valve.

Number plate and convoy lights

82. The cylindrical number plate and convoy lights are identical and incorporate a detachable holder for a single-filament centre contact lamp. A cover on the light can be rotated to black out the light if required.

Fog rear guard lights

83. The fog rear guard lights, which are mounted on the number plate bracket, are the same type of light as the tail-light and are operated by a switch mounted in the side of the instrument panel.

Cab interior light

84. The interior light is screwed to the front windscreen upper rail, carrying a festoon-type lamp, a switch and a clip-in lens. Vehicles equipped with insulated ground return wiring have an independent interior light switch mounted in the dash panel.

Chapter 14

HYDRAULIC SYSTEM

Not applicable to this vehicle

Chapter 15

CHASSIS FRAME AND FITTINGS

CONTENTS

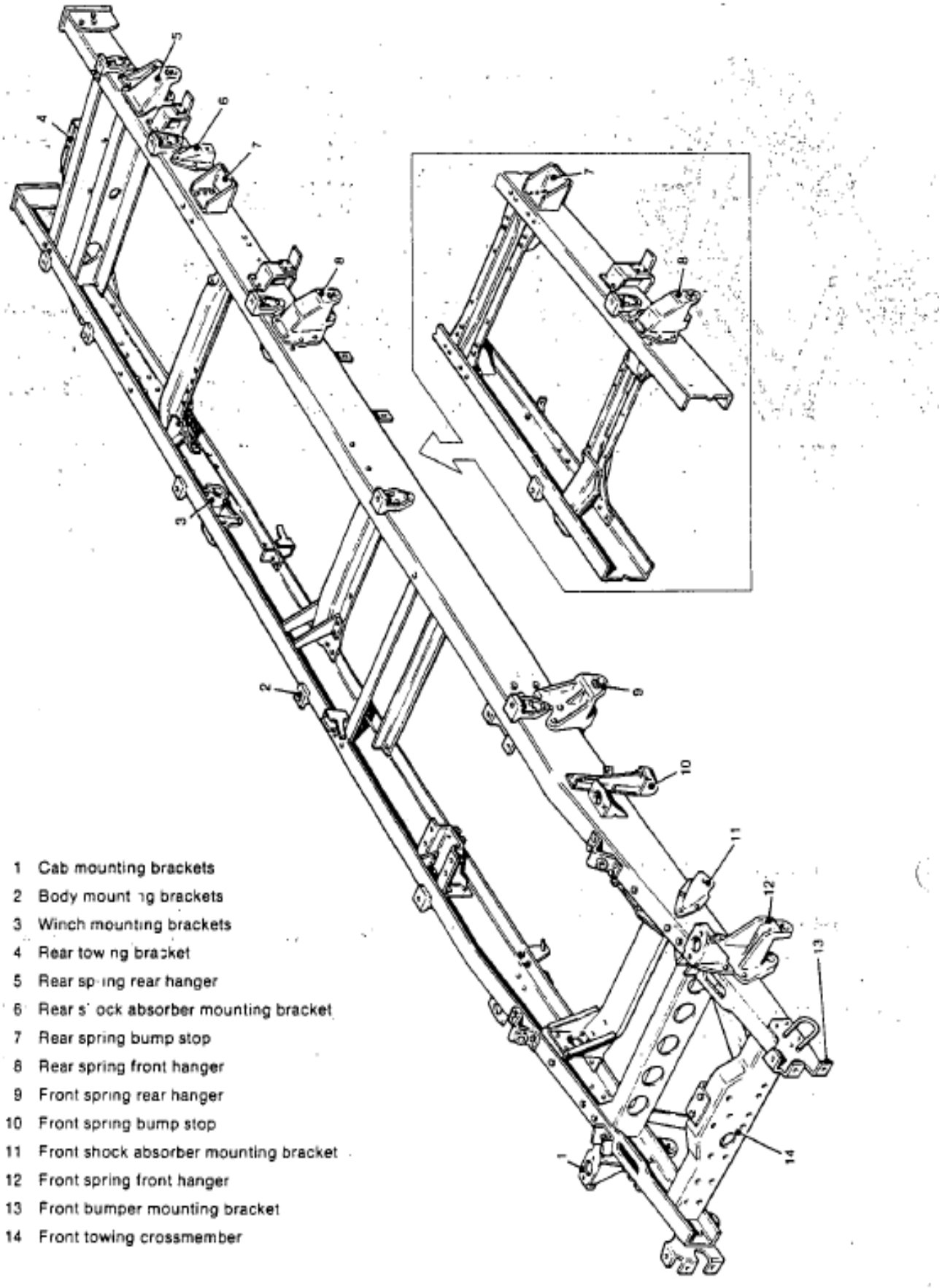


Fig 1 Chassis frame

CHASSIS FRAME AND FITTINGS

GENERAL DESCRIPTION

1. The chassis frame (Fig 1) is a flat ladder-type unit with 241 mm (9.5 in) deep channel sidemembers bracked by six crossmembers, two of which are of alligator jaw design.

2. The frame assembly is held together by cold squeezed rivets which enables the frame to flex without distortion or loosening cab or body mounts.

3. A heavy-duty bumper incorporating headlight guards and a towing hook is bolted to the front crossmember with additional brackets to the chassis sidemember.

4. Two lifting eyes are incorporated in the front bumper and lashing eyes are fitted at the front and rear of the chassis frame.

5. The chassis frame is basically the same on all variants, the only difference being the location of two crossmembers for crane and winch mounting. The part view Fig 1 shows location of crossmembers for crane variants.

TOWING HOOKS

6. The towing hooks may be used either as a rigid or swivelling coupling according to the type of tow bar being used.

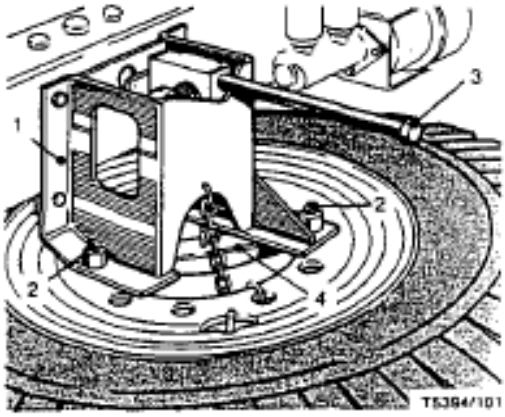
7. The hook comprises of a rigid bottom jaw and a moveable top jaw which is held in position by a locking pin. The locking pin ensures that the top jaw, should towing hook be revolved, cannot release.

8. To use towing hook remove pin and lift top jaw, drop back into position when the towing bar is engaged and replace locking pin.

REAR TRAILER COUPLINGS

9. Twelve and two pin trailer sockets are mounted to the rear of the vehicle with air pressure trailer couplings. The twelve pin socket provides interconnection of electrical system between the towing and towed vehicle or trailer. The two pin socket indicates, by air gauges on the instrument panel, when air pressure falls below minimum requirement on vehicle being towed. Both sockets are equipped with a waterproof screw on cap.

10. Air pressure couplings are of the palm type. When towing ensure couplings are clean before being connected, turn dummy coupling and place trailer coupling in position. The sleeve must be turned so that notch and peg align. Having installed trailer connections turn appropriate shut-off valves to 'ON' position.



1 Winch mounting bracket
2 Winch bar studs
3 Winch bar screw
4 Winch bar

Fig 2 Spare wheel winch

SPARE WHEEL WINCH

11. A spare wheel winch (Fig 2) is mounted on the side of chassis sidemember on the left hand side of vehicle.

12. The spare wheel is attached to winch mounting bracket (1) by a winch bar (4). The winch bar is attached to winch by a cable. To raise wheel place winch bar inside wheel hub utilising wheel stud holes and raise wheel by turning winch bar screw (3), raise wheel until winch bar studs (2) protrude through bracket and secure with nuts

.

Chapter 16

CAB AND FITTINGS

CONTENTS

CAB AND FITTINGS

GENERAL DESCRIPTION

1. The cab (Fig 1) is of all steel welded construction incorporating a box section subframe and is so arranged that the rear centre section is raised to form a compartment for the engine and radiator.

2. Infra red reflection pain is used for both exterior and interior panel protection.

3. Observation hatches are provided on most variants, and a fibreglass cover (2) with waterproof seal is held in position by three stretch rings over pegs. A cover stowage bracket is located on cab back panel.

4. Gun clips are positioned on both sides of the dash panel by the front door pillars.

5. Two fire extinguishers are provided, one in the cab, the other on the cab outer back panel. Grab handles are installed on both vertical door pillars to assist cab entry.

6. A laminated windscreen is secured to cab front panel by a locking strip type glazing channel and sun visors are installed to cab inner roof rail.

7. The front wings (5) and extension panels (4) are secured to the cab by bolts, screws and nuts. The wings are also attached to the step (6) by a bolt and spacer. Each panel can be removed separately. A silencer strip is clamped between the wing and the cab and two rubber buffers are installed at the rear, these contacting the lower section of the engine inspection cover (3) when closed.

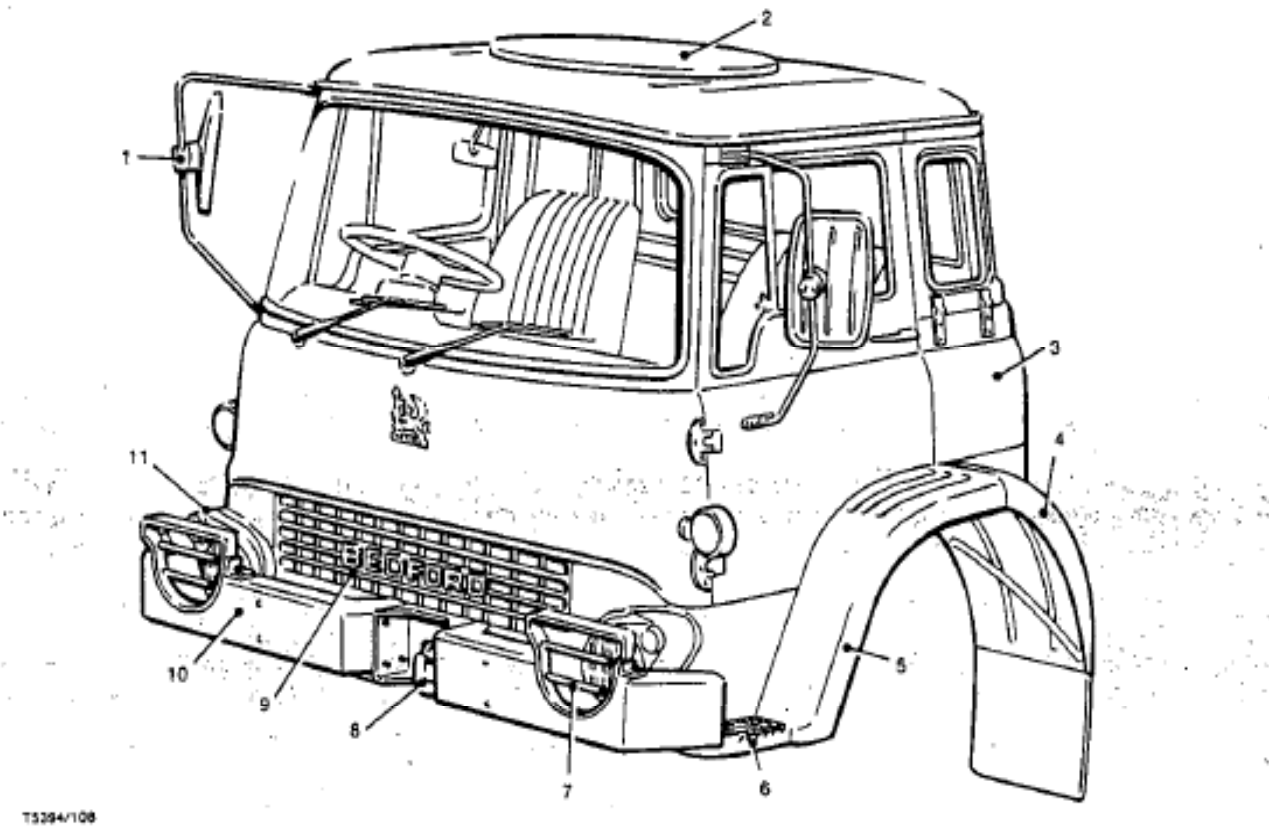


Fig 1 Cab assembly

8. Each extension panel is supported at the top by a tubular bracket which is secured by cross recess screws and countersunk lock washers to the cab lock pillar. A stay supports the bottom of the panel. Mud flaps located at the lower and inner edges of the panel are secured by retainers, screws and speed nuts. Rubber silencer strips are installed between the panel and the cab.

9. The headlight mounting panel (11) bolts to the lower edge front wing panel, with screw fixings at the door aperture tread plate. Additional bolts fixings are behind front grille panel (9).

CAB DOOR ASSEMBLY

10. The cab door (Fig 2) is of steel construction consisting of inner and outer panels and supported by two external hinges attached to the front panel. The door is held in the fully open position by a check link (10) which is riveted to a bracket in the door panel.

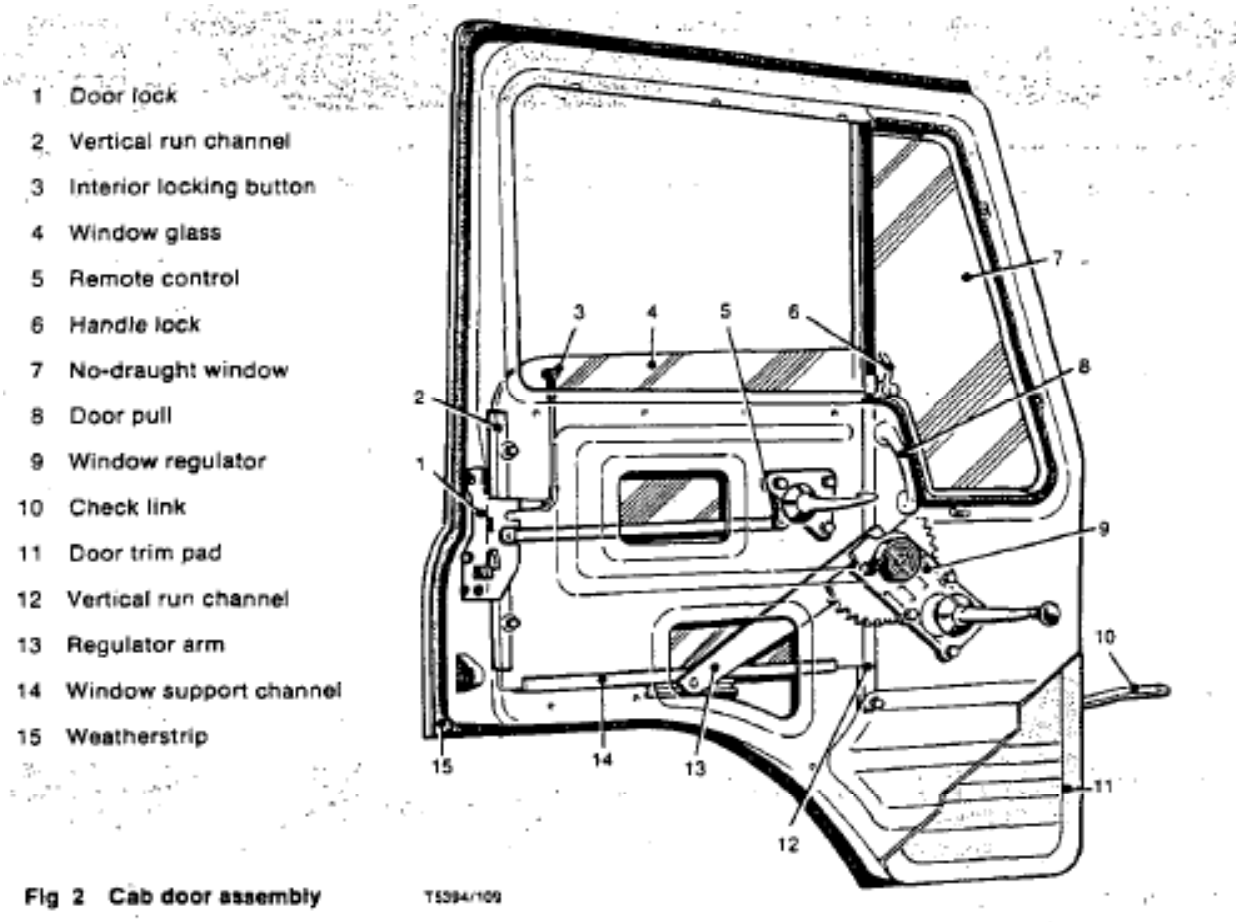


Fig 2 Cab door assembly

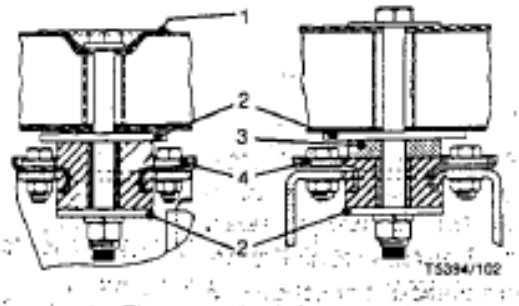
11. The door weatherstrip (15) is made from sponge rubber which is moulded to suit the contour of the door and secured by adhesive. A pivoting n-draught window (7) with a handle lock (6) forms a vertical run channel (12) for the door window glass. The window glass (4) is surrounded by run channels located within the stationary frame. A lower horizontal weatherstrip is secured to the inner panel by spring clips.

12.Door window is adjusted by a regulator (9) which is operated by an internal handle. A rubber buffer is fixed to the bottom of door to cushion the window glass in its lowest position. A door pull (8) is screwed to the inner panel.

13. The door lock (1) is bolted to the door shut face and incorporates the remote control (5) and interior locking button (3). The fork of the lock engages a striker attached to the cab lock pillar. The door outside handle is bolted to the door outer panel and has a plunger type release button.

CAB MOUNTINGS

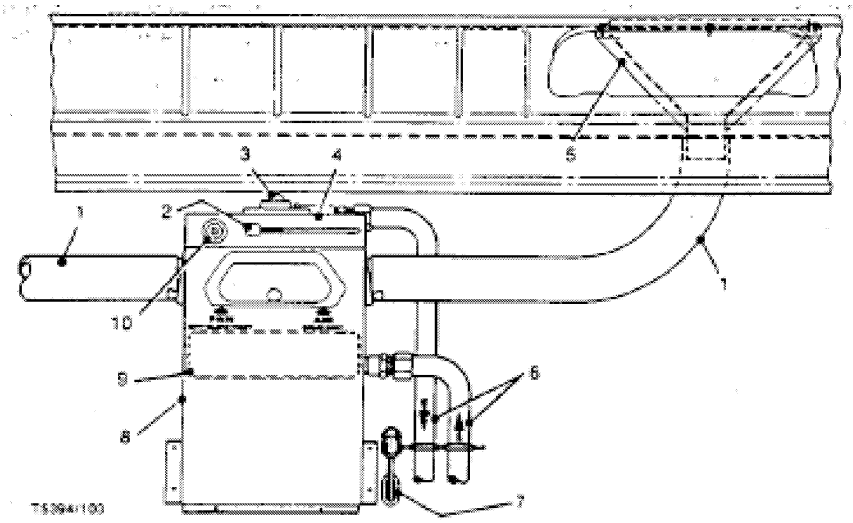
14. The cab is mounted on rubber insulated mountings (Fig 3) two at the front and two at the rear. The mounting on the left is used at the front only. The mounting on the right, together with distance washer (3), is used at the rear. Each mounting is secured to the chassis frame bracket by two bolts, self-locking nuts and internal-toothed lock washers. A reinforcement plate (4) is assembled on the flange of the mounting and a plain washer (2) at the top and bottom. Reinforcements (1) are clamped in the recesses in the cab floor by the front mounting bolts.



1 Floor panel reinforcement
2 Plain washer
3 Distance washer
4 Reinforcement plate

Fig 3 Arrangement of cab mountings

CAB VENTILATION AND HEATING



1 Flexible hose
2 Water valve control lever
3 Electric motor
4 Water valve
5 Demist outlet
6 Metal pipes
7 Flap operating lever
8 Heater
9 Radiator element
10 Fan motor switch

Fig 4 Ventilation and heating system

15. Cab ventilation and heating (Fig 4) is provided by an intake in the floor panel. Air flow is controlled by a flap valve operated by a lever (7) protruding through the floor. When cab heating is specified, a heater (8) containing a radiator element (9), manually operated water valve (4) and electric motor (3) with fan, is mounted immediately above the ventilator. Metal pipes (6) and rubber hoses connect the heater to the engine cooling system. The water valve control lever (2) and fan motor switch (10) are mounted on the heater casing which also admits air into the cab via three hinged doors and a duct each side. Each duct is connected to a demist outlet (5) by a flexible hose (1).

1 Water valve
2 Water valve sealing ring
3 Motor mounting plate
4 Fan
5 Cut-off plate
6 Radiator
7 Casing
8 Casing closing panel

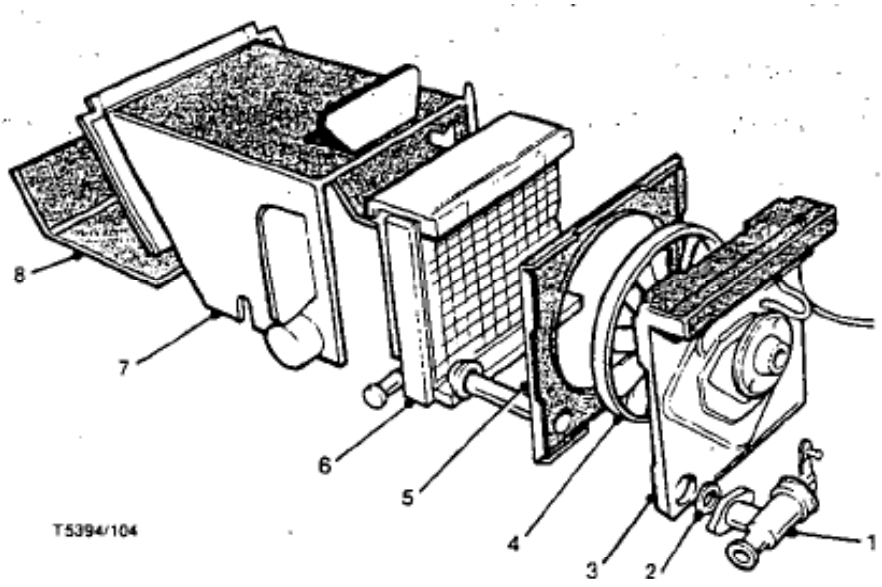


Fig 5 Heater assembly

16. The heater assembly (Fig 5) consists of a casing (7) which houses a radiator (6), fan (4), motor and mounting plate (3) and the water valve (1).

17. The heater assembly as viewed from above (Fig 6) has a control lever (1) riveted to the motor mounting plate and a link rod (2) connects the lever to the water valve lever (3).

1 Control lever
2 Link rod
3 Water valve lever

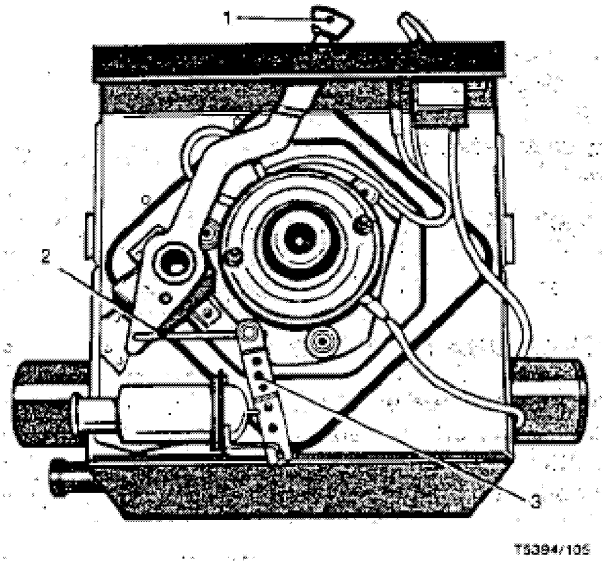
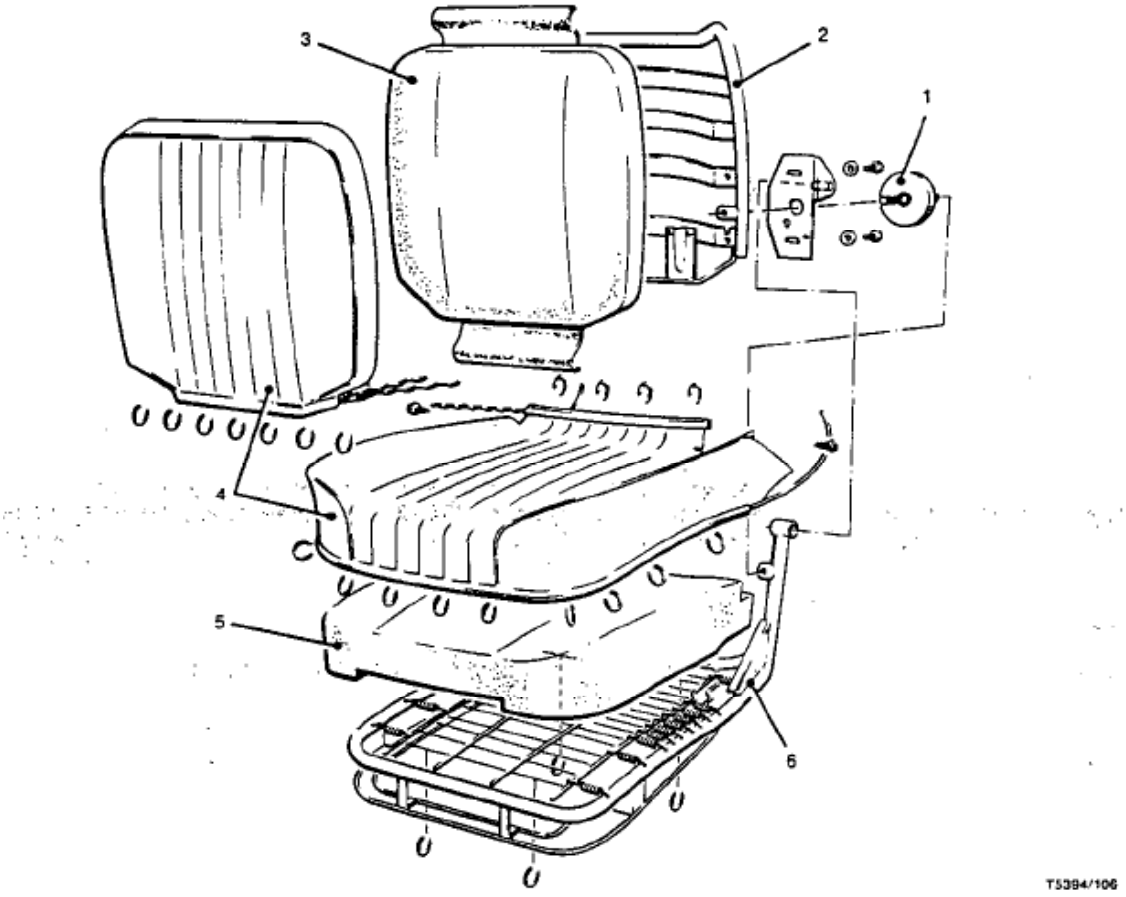


Fig 6 Heater assembly as viewed from above

CAB TRIM AND HARDWARE

18. The roof lining panel is a one-piece type shaped to the contour of the roof and secured around the edges with plastic rivets. On most variants the observation hip ring gives additional support to centre of roof lining.

19. Driver and passenger seats (Fig 7) are identical but only drivers seat has full adjustment.



1 Adjuster wheel
2 Squab frame
3 Foam padding
4 Covers
5 Foam padding
6 Spring assembly

Fig 7 Seat assembly

20. The seats comprise a frame and spring assembly (6), squab frame (2), foam padding (3 and 5), and covers (4). The rake of the squab can be varied by means of an adjuster wheel (1) and threaded shaft positioned on the outer side of the seat.

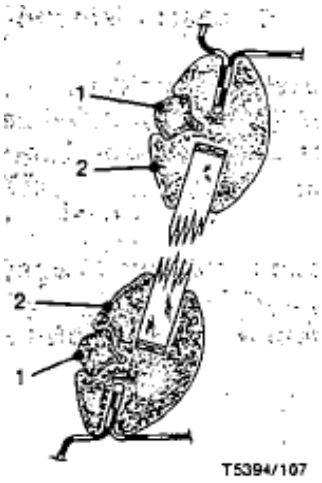
21. The driver's seat is attached to an adjuster frame which provides both height and fore and aft adjustment. The adjuster frame is mounted on a tubular seat support. The passenger seat also mounts to a tubular seat support.

Windshield glass

22. The laminated glass windshield is mounted in its aperture by a rubber weatherstrip (Fig 8 (2)) which is slotted for attachment to the cab. A filler strip (1) inserted in the forward side tightens the weatherstrip against the glass.

Rear and quarter window glass

23. Both the rear window and quarter windows are of toughened glass mounted in rubber weatherstrips, of the same type as the windshield weatherstrip.



1 Filler strip
2 Rubber weatherstrip

Fig 8 Windshield weatherstrip

Chapter 17

WINCH

CONTENTS

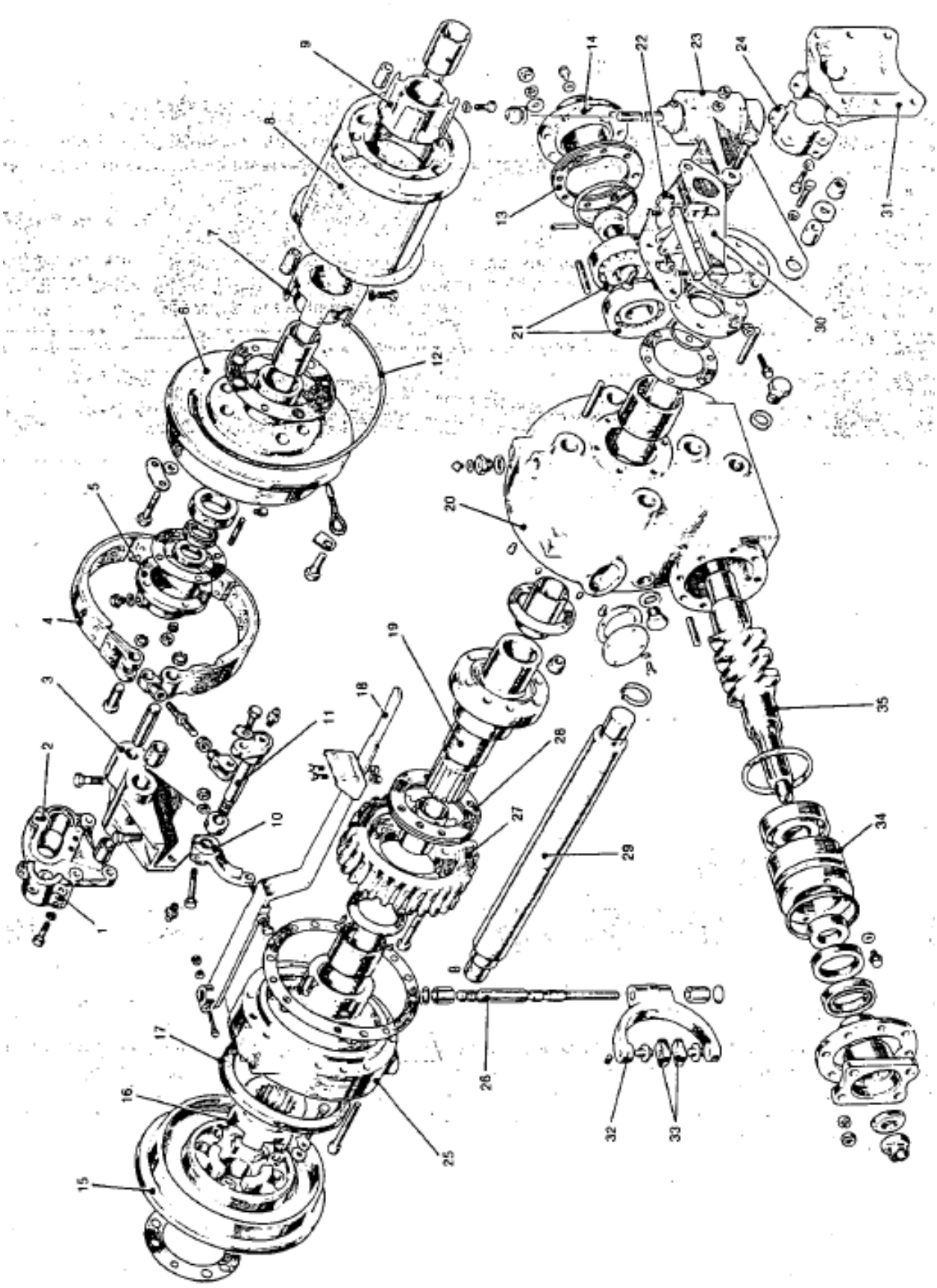


Fig 1 Exploded view of winch

1 Mounting bracket cap right-hand
2 Mounting bracket right-hand
3 Brake bracket
4 Brake band
5 End cover and oil seal housing
6 Flange - brake end
7 Oil collector
8 Cable drum
9 Oil collector
10 Brake lever
11 Brake shaft
12 Cable
13 Shims
14 End cover
15 Flange - clutch end
16 Clutch dog
17 Oil seal
18 Clutch lever
19 Wormwheel hub
20 Wormcase
21 Bearings
22 Tensioner control valve
23 Torque bracket and load limiter
24 Mounting bracket cap left-hand
25 Clutch housing
26 Clutch shaft
27 Wormwheel
28 Shims
29 Mainshaft
30 Tensioner control valve bracket
31 Mounting bracket left-hand
32 Clutch fork
33 Clutch fork slippers
34 Oil seal and bearing housing
35 Wormshaft

Key to Fig 1

WINCH

GENERAL DESCRIPTION

1. The winch (Fig 1) comprises a worm and wheel drive housed in one-piece casing (20). Drive end of wormshaft (35) is supported by a parallel roller bearing in a housing (34) which also incorporates two lip-type oil seals. Other end of wormshaft is supported on two taper roller bearings (21) in the wormcase which also control wormshaft end float. End float is adjusted by shims (13) between end cover (14) and wormcase.

2. The wormwheel (27) is bolted to a hub (19) with shims (28) interposed between wheel and hub flange to provide a means of adjusting tooth contact. The wormwheel hub is supported on the mainshaft (29) and in the wormcase and clutch housing (25) by a steel backed, lead-bronze bearings. End float of hub is controlled by two thrust washers, one between the hub and clutch housing and the other between hub and wormcase. The thrust washers are each located by two dowel pints.

3. Clutch end of wormwheel hub is splined to accommodate a sliding clutch dog (16) operated by a fork (32) and shaft (26) in the clutch housing. The sliding clutch engages with dogs on the cable drum flange (15) to transmit drive from the wormwheel hub to the drum. Drum is supported on the mainshaft by two steel-backed, lead-bronze bearings with endwise location of drum controlled by a bronze washer and circlip.

4. Oil sealing of drum to wormcase is accomplished by a lip-type oil seal (17) between drum and clutch housing cover. Sealing of drum to mainshaft is achieved by two, lip-type oil seals positioned in a housing bolted to drum brake end of drum. End of cable is secured to drum by an eye-bolt and locked with a tab washer.

5. Two trunnion and mounting bracket assemblies, one on each end of the mainshaft are used to attach winch assembly to the chassis sidemember. Torsional location of winch is controlled by the torque reaction bracket and load limiter assembly (23).

6. Drive to the winch assembly is transmitted by a propeller shaft from the power take-off flange on the transfer box to the wormshaft flange on winch.

7. A spring-loaded breather is installed to top of wormcase.

WINCH CLUTCH

8. The drum type dog clutch is oil immersed and sealed to prevent ingress of water or dirt.

9. Clutch engagement is achieved by a lever mounted on the winch assembly.

WINCH BRAKE OPERATING CYLINDER

10. The winch brake operating cylinder (Fig 2) is attached to the right-hand chassis sidemember and is connected to a lever and shaft mounted in a bracket on top of sidemember. The other end of shaft is connected to the winch brake band.

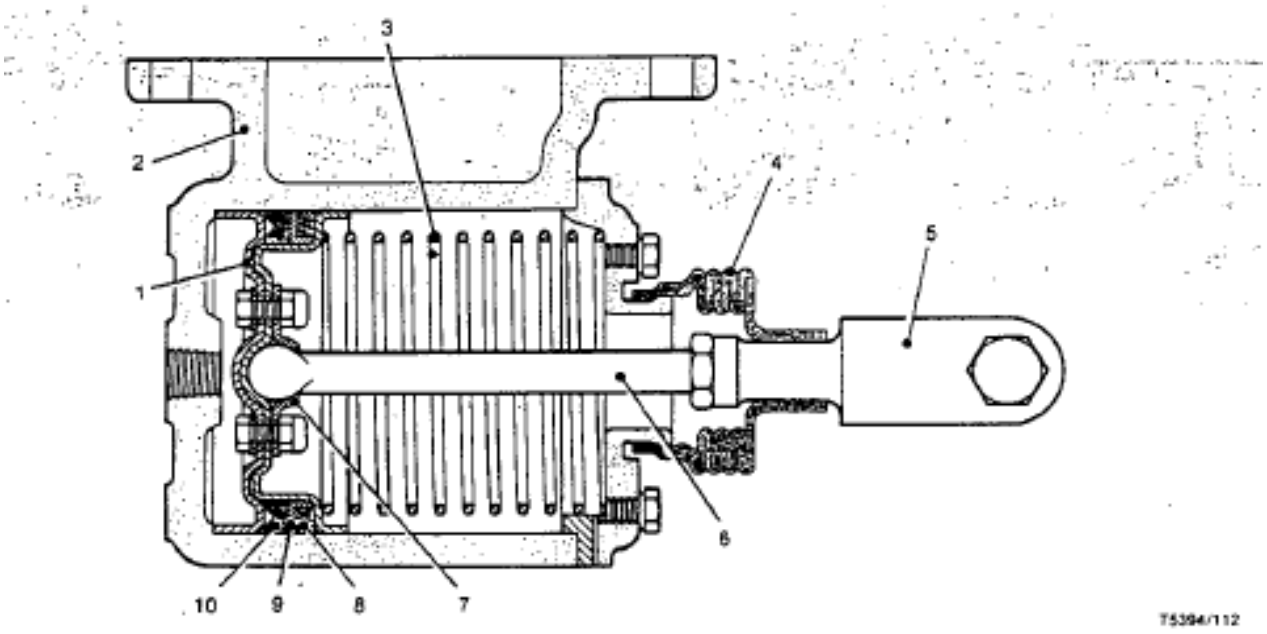


Fig 2 Sectional view of winch brake operating cylinder

11. The operating cylinder consists of a composite piston which comprises a piston seal retainer (1), piston seal (10), lubrication felt (8), lubrication felt retainer (9) and a piston rod retainer (7). A piston return spring (3) is incorporated between the piston and end cover.

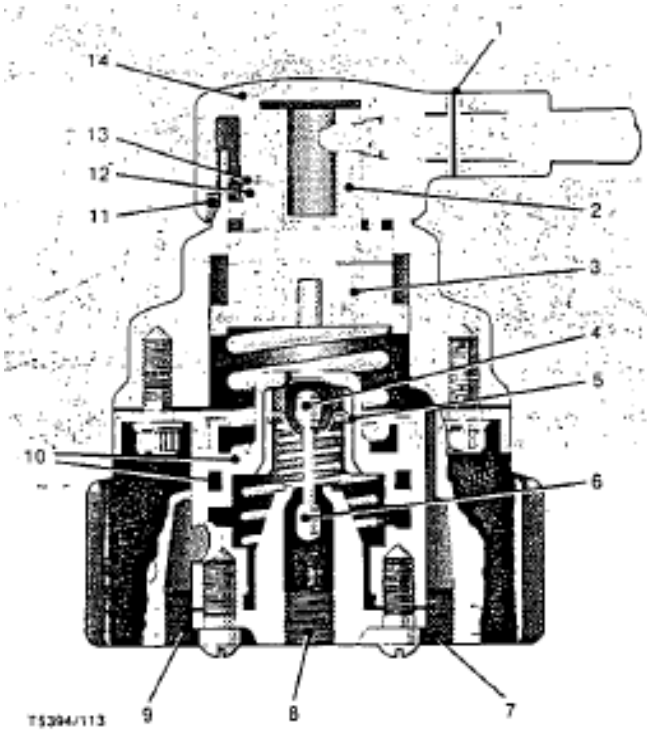
12. An external air filter is incorporated in the breather port.

WINCH BRAKE HAND CONTROL VALVE

13. The winch brake hand control valve (Fig 3) is mounted on the steering column and consists of a body and cover containing a hand-operated inlet valve (6) and exhaust valve (4) assembly. The handle and head (14) are secured to a cam follower (2) located in the cover. The inlet/exhaust valve assembly is fitted below the piston (10) and comprises an inlet valve seat (8) rubber valve, spring and spring guide (5).

14. When the handle is moved in a clockwise direction from the released position, force is exerted on the pressure graduating spring through the action of the cam (3) and cam follower. The force of the spring on the piston causes it to move downwards. The exhaust seat in the centre of the piston contacts the exhaust valve and closes the exhaust passage in the piston. Continued downward movement of the piston unseats the inlet valve, permitting compressed air from the secondary reservoir to flow through the

valve to the secondary line change-over valve and secondary relay valve. Thus graduation takes place during application and release of the secondary brake system, pressure in the brake line being proportional to the degree of movement of the control valve handle.

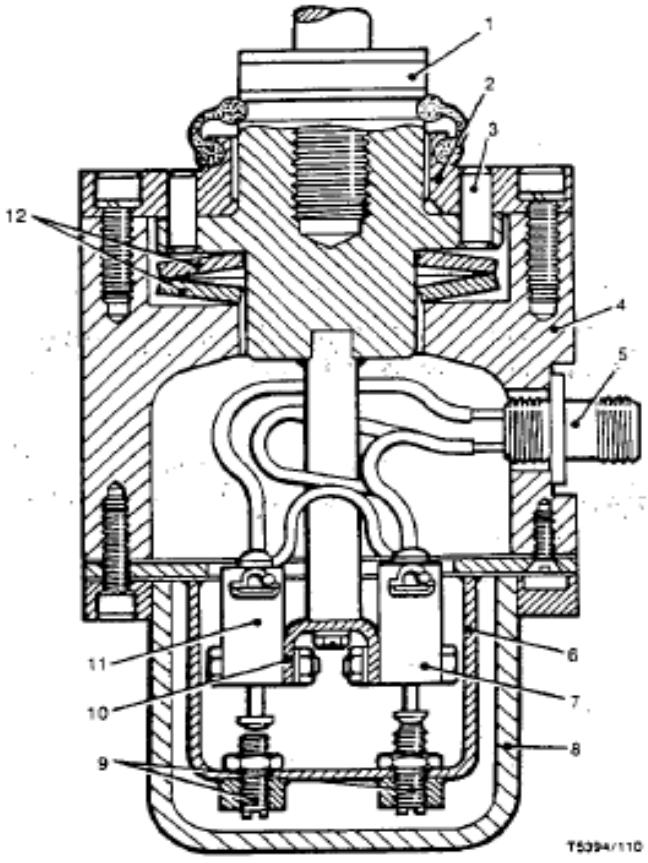


1 Spring pin
2 Cam follower
3 Cam
4 Exhaust valve
5 Exhaust valve guide and spring
6 Inlet valve
7 Exhaust port
8 Inlet port and inlet valve seat
9 Delivery port
10 Piston and seal
11 Head sealing ring
12 Adjusting ring
13 Lockwasher
14 Valve head

Fig 3 Brake hand control valve

WINCH LOAD LIMITER

15. The winch load limiter (Fig 4) is incorporated in the torque reaction bracket and includes a disc type spring (12) and two switches (7 and 11). The switches are activated by a control switch mounted on the power take-off control lever bracket.



1 Seating dome
2 Cover plate
3 Dowel
4 Spring housing
5 Connecting socket
6 Adjusting screw bracket
7 Warning horn/light switch
8 Switch cover
9 Adjusting screws
10 Switch bracket
11 Engine cut-off solenoid switch
12 Spring discs

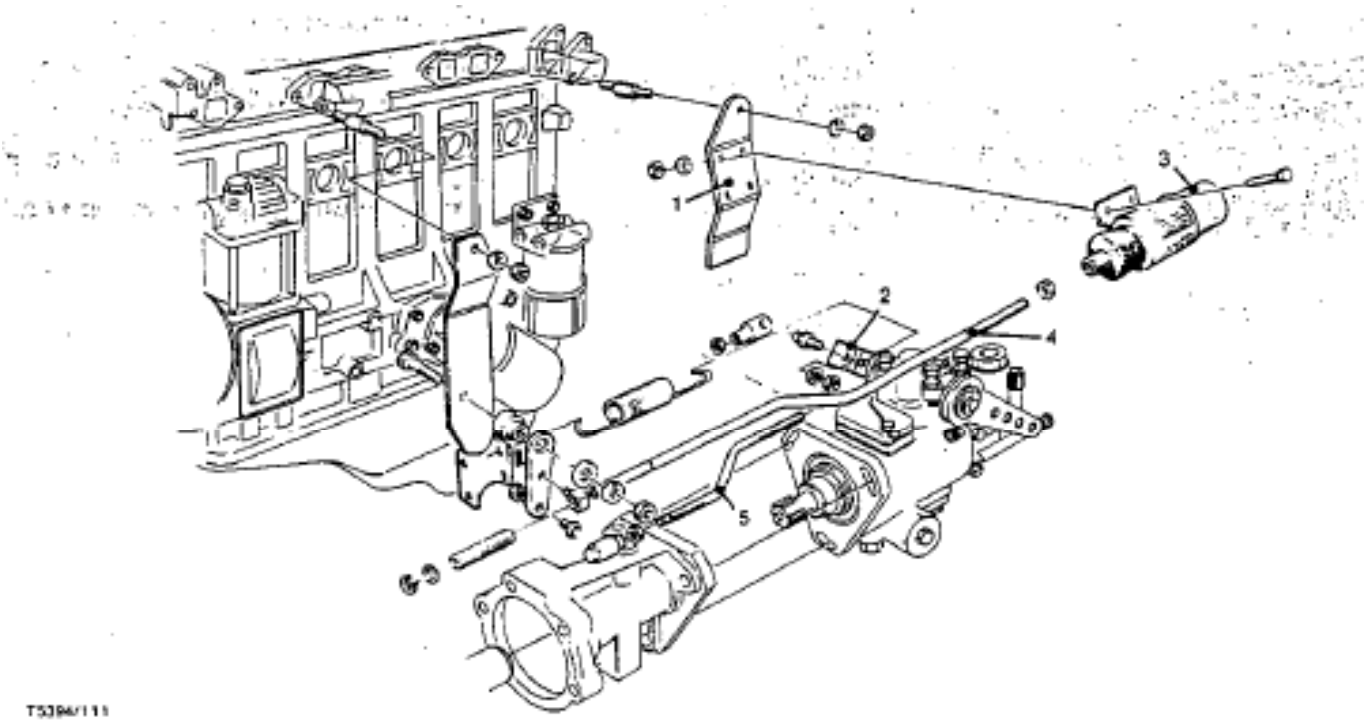
Fig 4 Sectional view of winch load limiter

16. Switch (7) operates a warning horn and light when the winch reaches a nominal rated load. A toggle switch mounted on the tachometer bracket, enables the warning horn to be isolated. Switch (11) activates an engine cut-off solenoid connected to the engine fuel injection pump stop control lever when the winch load reaches the maximum permitted safety load.

17. To re-start engine the winch must be relieved from the overload condition.

Engine cut-off solenoid

18. The engine cut-off solenoid (Fig 5 (3)) is connected to the fuel injection pump stop control lever (2) by rods (4 and 5).



1 Solenoid mounting bracket
2 Stop control lever
3 Solenoid
4 Rod
5 Rod

Fig 5 Exploded view of engine cut-off solenoid linkage

19. When load on which reaches its maximum permitted safety limit, winch load limiter activates solenoid which pulls rod and stop control lever rearwards thus stopping the engine.

20. A spring inside the solenoid returns the solenoid and linkage the 'engine run' position. The engine will not start if the load on the winch is not relieved.

PAY-ON GEAR

21. The pay-on gear (Fig 6) is attached to its own chassis crossmember situated between the winch and rear fairleads. The pay-on gear consists of a trolley (7) which is allowed to run freely on a curved track (2) under the influence of the cable. The trolley is supported on eight balls which run directly in the track and are secured by adjustable retainers. Four rollers (3) support the trolley against the underneath of the curved track. The cable is guided by a pulley (6).

22. Travel of the trolley is restricted by adjustable stop bolts (1) situated at each end of the track.

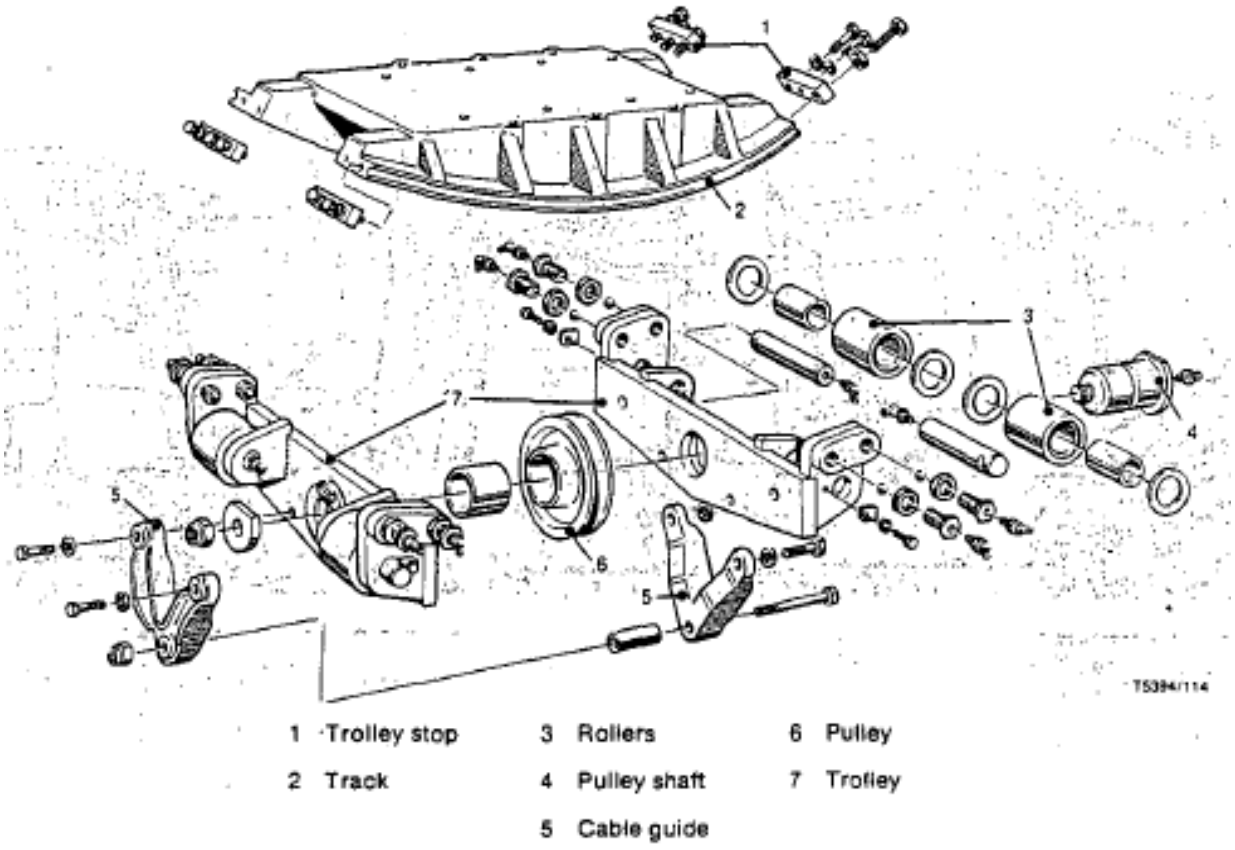


Fig 6 Exploded view of pay-on gear

REAR FAIRLEADS AND CABLE TENSIONER

23. The rear fairleads and cable tensioner (Fig 7) are mounted on a common base plate attached to the rear of the chassis. The fairleads consist of two horizontal pulleys (16) retained by brackets (1) which are extended rearwards to provide support for a horizontal roller (2). A second roller (5) located parallel with and beneath the first, is supported by two brackets (6) bolted to the rear apron.

24. The cable tensioner comprises two pulleys, one (14) fixed to rear fairlead base plate, while the other (8) is attached to a swinging lever arm (13) pivoting on base plate. The movable pulley (8) is operated by an operating cylinder (9) which is actuated by compressed air through a control valve, operated in conjunction with the winch clutch lever.

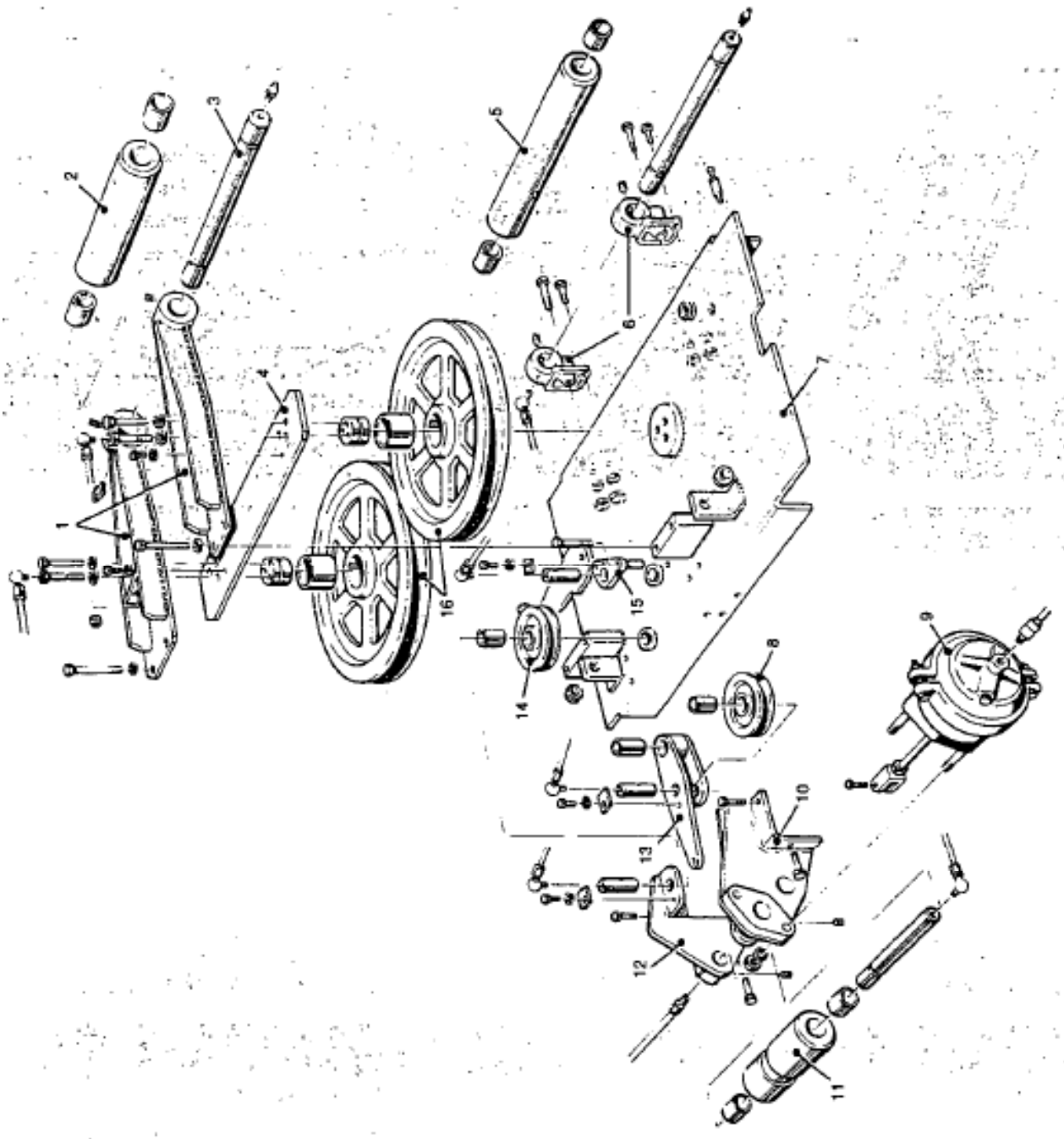
25. When the winch clutch engagement lever is placed in ‘payout’ position, air is supplied to the tensioner operating cylinder which moves lever arm and pulley rearward, thereby relieving tension on cable. When the winch clutch engagement lever is placed in engaged position, air is exhausted from actuator allowing it to move lever arm and pulley forwards and exerting correct tension on cable.

26. A roller (11) is incorporated in front of the tensioner pulleys mounted on a bracket attached to front apron.

FRONT FAIRLEADS

27. The front fairleads (Fig 8) consists of two vertical rollers (6), an upper horizontal roller (1) mounted on a common bracket (5) situated under the front of the vehicle chassis frame.

28. The fairleads are so designed that they permit winching from varying angles.



1 Roller brackets
2 Upper roller
3 Roller shaft
4 Support plate
5 Lower roller
6 Lower roller brackets
7 Base plate
8 Tensioner pulley
9 Cable tensioner operating cylinder
10 Roller and cylinder mounting bracket
11 Roller
12 Roller bracket
13 Tensioner lever
14 Tensioner pulley
15 Pivot bracket
16 Main pulleys

Fig 7 Rear fairleads and cable tensioner

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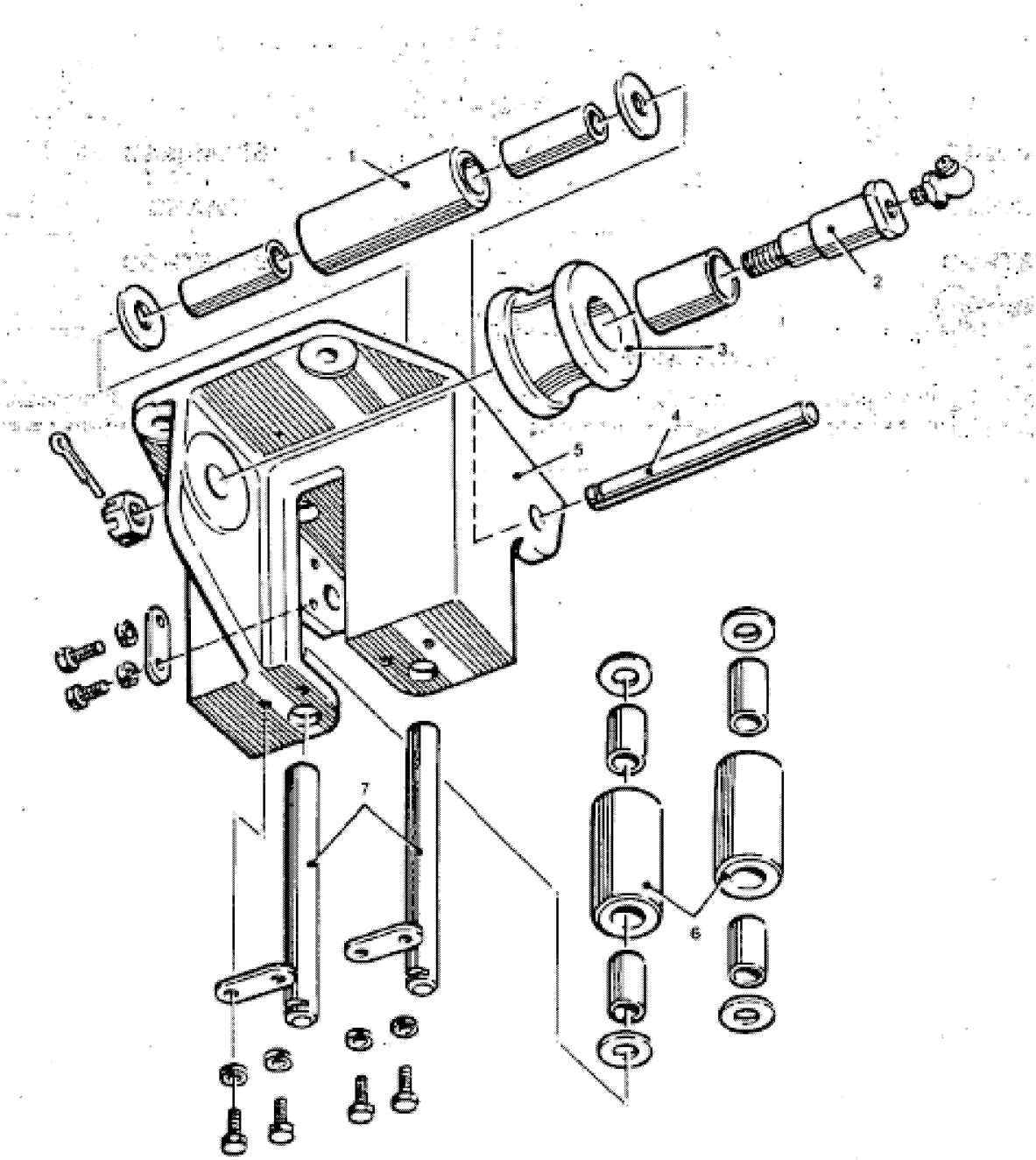


1 Horizontal roller
2 Pulley pin
3 Pulley
4 Horizontal roller shaft
5 Fairleads bracket
6 Vertical rollers
7 Vertical roler shafts

Fig 8 Exploded view of front fairleads

Chapter 18

CRANE

CONTENTS

CRANE

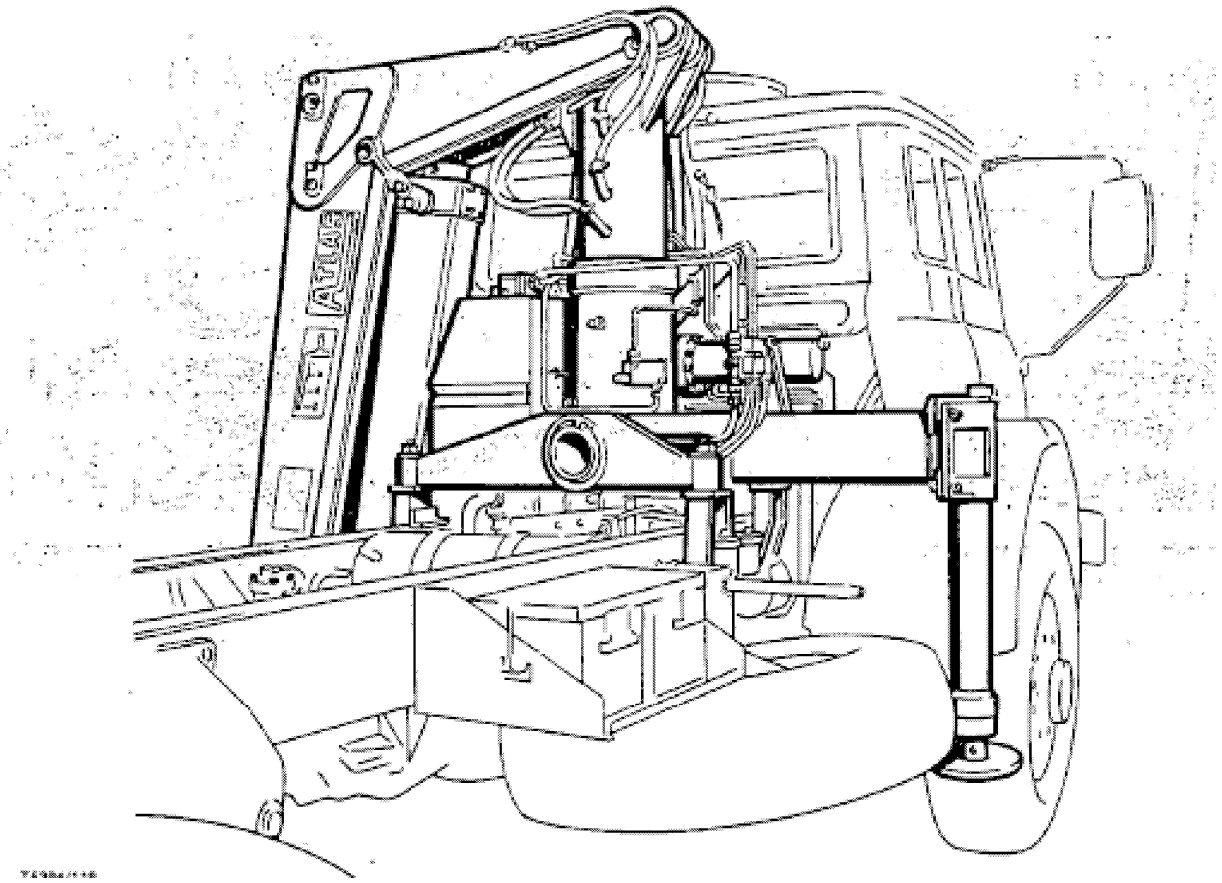


Fig 1 Crane assembly mounted on vehicle

GENERAL DESCRIPTION

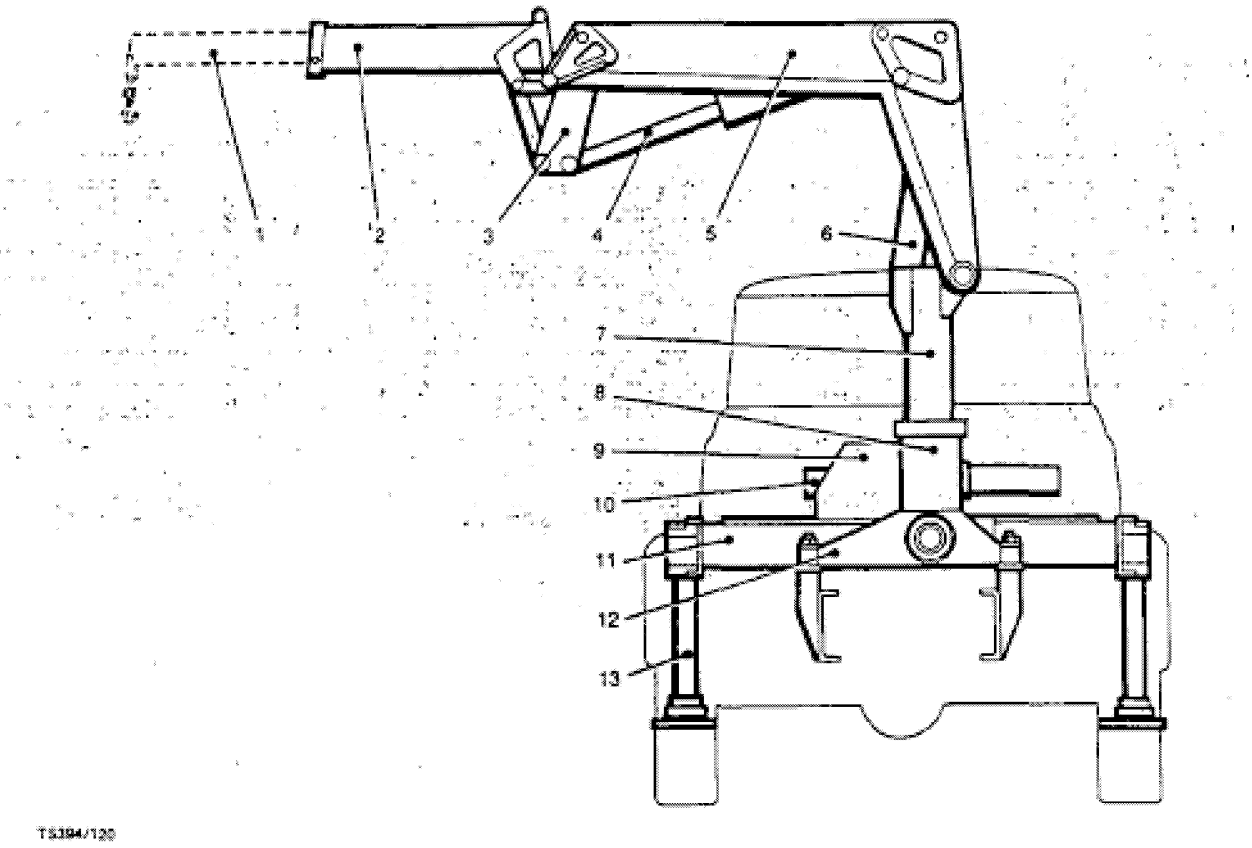
1. The crane assembly (Fig 1) is a fully hydraulically controlled unit with folding boom and jib. It is folded completely hydraulically to the stowed position. All working motions, including control of the stabilizers, are effected by control valves operated view control rods and linkages from roof of cab. Hydraulic relief and safety valves are incorporated to protect crane components against overloading. In addition, load holding valves are used in order to prevent any load from suddenly falling to the ground due to a pipe or hose failure.

2. The crane trestle (Fig 2(11)) is of welded construction incorporating both the column mountings (8) and slewing rams (10). The pendulum beam (12), pivoted to crane trestle, is a rotatable or movable type of crane attachment which allows chassis to twist and distort during normal vehicle operation.

3. Two hydraulic stabilizer legs (13) are symmetrically bolted to the near and off-sides of the crane trestle. The rams are double-acting with chromium-plated piston rods. The rams relieve vehicle chassis frame of undue strain during loading and off-loading operations and prevent tipping.

4. The rotatable centre column (7) with column trunnion and pinion is supported in compact plastic material. Attached to the box-shaped upper section of centre column is the folding boom (5), jib (2) and lifting ram (6). The hydraulic hoses are routed inside centre column for protection.

5. Slewing through an angle of 193° is effected by the slew rams, the rack of which rotates the centre column. The cylinder tubes are flanged to column mounting and a plastic block acts as a guide to the rack within cylinders.



1	Jib extension tube	5	Boom	9	Oil reservoir
2	Jib	6	Lifting ram	10	Slewing rams
3	Jib ram linkage	7	Centre column	11	Trestle
4	Jib ram	8	Centre column base	12	Pendulum beam
				13	Stabilizer

Fig 2 Components of crane assembly

6. The folding boom, which is raised and lowered by the lifting ram, incorporates jib ram (4) and linkage (3). The jib extension tube (1) is supported on plastic guide blocks and is hydraulically operated by a ram positioned inside jib.

7. All rams are double-acting and have chromium-plated piston rods together with wear resistant compact packings.

DRIVE UNIT/HYDRAULIC PUMP ASSEMBLY

8. The nine-cylinder swash plate pump (Fig 3) is bolted to a hanger bracket welded to the chassis and driven by a drive shaft from the power take-off mounted on the vehicle gearbox.

9. Drilled in the pump body are nine cylinders, set in a circle, equi-distant from and parallel to each other. The inlet (4) and outlet (1) unions of the pump are connected by drillings to the inlet and outlet of each cylinder which are controlled by valves. A spring-loaded plunger (8) is fitted into each cylinder bore. The plungers are hollow and drillings below the head allow the inflow of oil. A thrust race (9) mounted on the wobble shaft (10) is set at an angle to the axis of the shaft against the enlarged inclined surface of the swash plate.

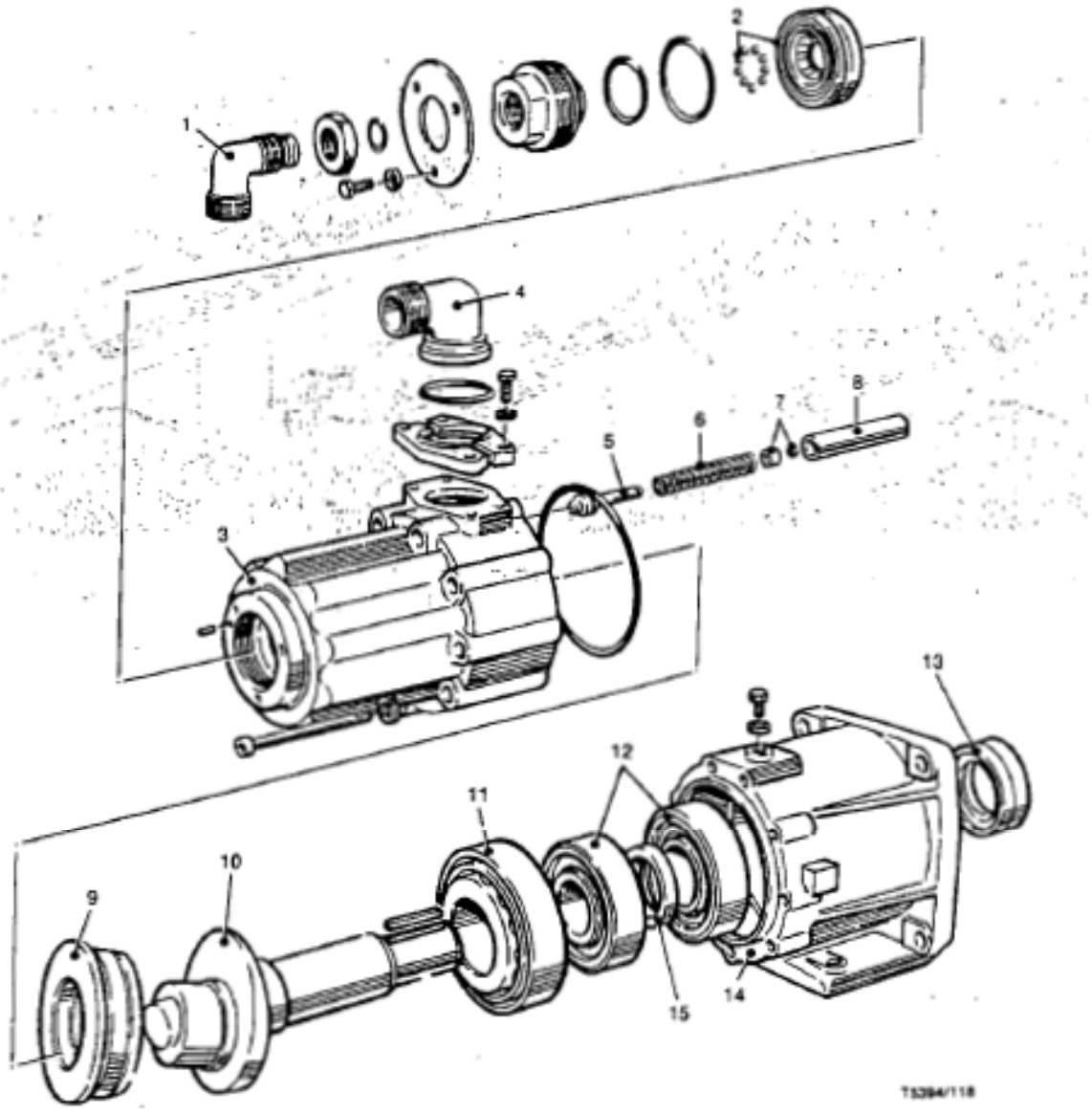
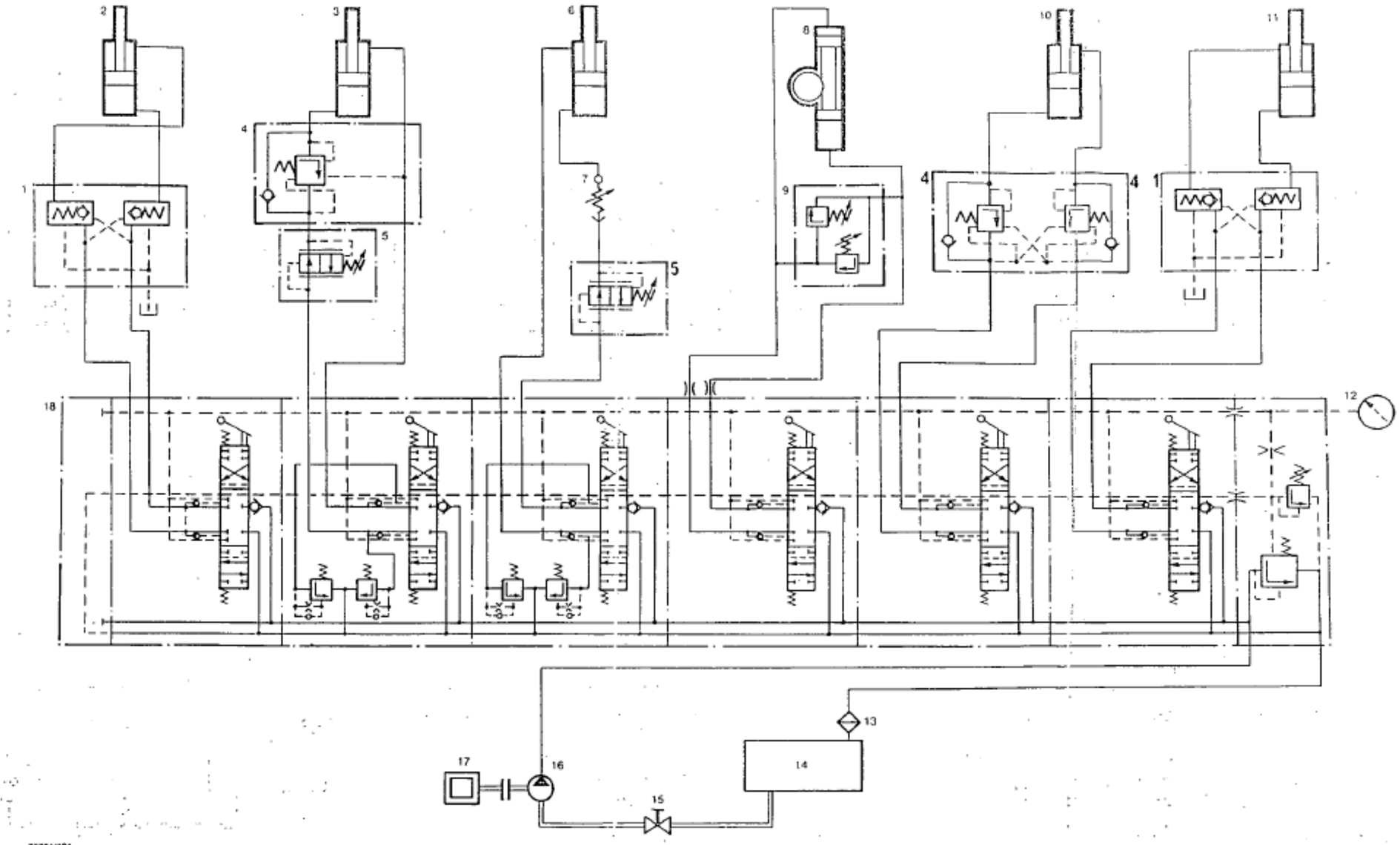


Fig 3 Exploded view of drive unit/hydraulic pump assembly

10. The plungers are maintained in contact with the wobble shaft thrust race at all times by the pressure of the coil springs (6) so that the plungers are continually in recessive stages of the inlet of outlet strokes. As the wobble shaft rotates and the face of the thrust race moves away from each cylinder in succession, the coil spring forces the plunger outward creating a depression in the cylinder. The inlet ball valve (7) is drawn off its seating and oil flows into the cylinder. Further rotation of the wobble shaft causes the thrust race to force the plungers back into the cylinder. The pressure of oil closes the inlet valve, opens the outlet valve (2) and the oil is forced out to the pump outlet union.

11. A diagrammatic layout of the hydraulic circuit is shown in Fig 4.



1	Double non-return valve	7	Emergency safety valve	13	Oil filter
2	Left-hand stabilizer	8	Slewing ram	14	Oil reservoir
3	Main lifting ram	9	Double relief valve	15	Shut-off valve
4	Load holding valve	10	Jib extension ram	16	Oil pump
5	Lowering brake valve	11	Right-hand stabilizer	17	Power take-off
6	Jib ram	12	Pressure gauge connection	18	Control valve block

Fig 4 Hydraulic circuit diagram