LEYLAND

TITAN

Repair Operation Manual

Leyland Truck & Bus
Passenger Vehicle Division

Headquarters:
Windmill Lane, Southall UB2 4NJ
Middlesex

Service:
Leyland, Preston PR5 1SN
Lancashire

Publication Part No. TBL0167
English

2nd Edition

INTRODUCTION

General

This manual has been prepared to provide the Operator with the necessary information for the maintenance and repair of his vehicles.

Before placing the vehicle in service, it is recommended that Operators familiarize themselves with all controls and units, and form a system of lubrication and maintenance based on the recommended periods given in this manual. A system of regular inspection should also be formulated so that any small defect which may have escaped notice can be corrected before it develops into a dangerous or expensive fault.

Manual layout. The Manual, which is of loose-leaf construction for ease of amendment, is divided into ten Groups.

1. General Recommendations
2. Engine
3. Not applicable
4. Transmission
5. Front Axle and Steering
6. Rear Axle
7. Brakes
8. Electrical
9. Suspension and Chassis Equipment
10. Body

Numbering of pages. Each Group is individually indexed and divided into Sections. A reference consisting of three numbers separated by hyphens is used at the bottom outside edge of each page. The first number identifies the Group, the second the Section and the third the page number of the Section.

Illustrations. Illustrations are numbered consecutively within each Section.

Service Tools. Proper tools contribute largely to efficient, economic and profitable repair. Special tools are listed in Group 1.

Service Exchange Scheme

The Service Exchange Scheme has been designed to enable Operators to replace units on their vehicles with a minimum of delay, resulting in shorter repair times and a higher cost saving.

The scheme covers a range of unit assemblies for all current models and is operated by Parts Division through the Distributor/Depot Network. Any Exchange Unit offered for your vehicle has a fixed price which allows for the return of the old unit to Parts Division where it is rebuilt to 'as new' standard in our factory or by our suppliers.

The use of this technique reduces the cost to Operators, whilst retaining highest standards of quality. Each Exchange Unit carries the same warranty as a brand new Unit.

Contact any Distributor or Depot for full details and cost savings which can be made taking advantage of this Scheme.

DISCLAIMER

British Leyland UK Limited (the Company) reserves the right to change the procedures, material, specification, dimensions or design of the vehicles shown, described or referred to herein at any time and without prior notice in accordance with the Company's policy of constant product improvement.

Every reasonable effort is made to ensure that the Company's publications are accurate but nothing shown, described or referred to herein should be regarded as an infallible guide to the procedures, materials, specifications, dimensions, design or availability of any particular vehicle, nor does this publication constitute an offer for the sale of any particular vehicle.

Neither the Company nor any Distributor or Dealer shall in any circumstances be held liable for any inaccuracy or the consequences thereof.

Purchasers are advised that the specification details set out in this publication apply to a range of vehicles and not to any particular vehicle. For the specification of any particular vehicle purchasers should consult their Leyland Distributor or Dealer. Please note that Leyland Distributors and Dealers are not agents of the Company and have no right or authority whatsoever to bind the Company in any way or to assume on its behalf any obligation expressed or implied.

IMPORTANT. Operators are strongly advised to **INSIST** on the use at all times of genuine British Leyland Truck and Bus **LEYPARTS.**

Manufactured exactly to original chassis specifications, **Leyparts** are available through the extensive Distributor/Depot Network and carry full warranty.

SUBSTITUTES CAN BE DANGEROUS AND SHOULD BE AVOIDED AT ALL COSTS

GROUP 1
GENERAL RECOMMENDATIONS

IMPORTANT NOTES

Safety Precautions

Wear protective clothing or apparatus and apply barrier creams when necessary.
Stand the vehicle on firm, level ground when lifting or jacking; apply the parking brake and chock the road wheels.
Do not rely on a jack as the sole means of support when working beneath the vehicle. Place safety supports under points of adequate strength.
Do not remove the cap from the cooling system header tank when the engine is hot.
Do not inhale the dust from the brake-shoe linings or blow the dust from the units; use a damp cloth or vacuum cleaner.

** Disconnect the vehicle electrical supply before steam cleaning the engine compartment. This ensures that heat from the steam cleaning does not trigger off the engine compartment fan and cause possible injury to personnel. **

Frost Precautions

Always use the correct proportion of anti-freeze in the coolant to protect against corrosion as well as freezing. When anti-freeze is not necessary, the cooling system must be protected against corrosion by the addition of a corrosion inhibitor to the coolant.
If anti-freeze solution is not used and the vehicle is to stand in the open with temperatures approaching freezing point, the cooling system must be completely drained and a notice stating 'Cooling System Drained' displayed on the steering wheel or other conspicuous position.
Vehicles with anti-freeze mixture in the cooling system should have a notice displayed stating 'Anti-freeze, **Do Not Drain**'.

Alternating Current Charging Systems

Although the reverse polarity relay minimizes the risk of damage due to accidental reversal of polarity the following precautions should still be observed.

1. Never disconnect the battery whilst the alternator is running. This will cause a voltage surge in the charging system that will immediately ruin the diodes or transistors.
2. Never disconnect a lead without first stopping the alternator and turning any switches in the circuit to the 'off' position.
3. Never connect a battery into the system without checking for correct polarity and correct voltage.
4. Never 'short' connections to earth to check for current flow. No matter how brief the contact, the transistor may be ruined.
5. Never experiment to try and adjust or repair the system; this is a job for a trained electrician with the correct test equipment and technical data.
6. Always identify a lead to its correct terminal when disconnecting or reconnecting. A short-circuit or wrong connection will immediately and permanently ruin transistors or diodes.
7. If 'jumper' leads are used to start the engine, it is important that the existing battery leads are not disconnected.

CAUTION: If welding, soldering or brazing is necessary in the vicinity of the alternator or control-unit, precautions must be taken to ensure that any heat source is kept well away from these components. Excessive heat reaching the transistors or diodes will cause irreparable damage. If arc welding is to be carried out the alternator and battery must be disconnected.

Disposition of Units

In this Manual all references to left-hand or right-hand sides are from the driver's view point when seated in the driving position.

Precautions Against Damage

Clean the engine compartment of waste and spilled oil or fuel to prevent a possible fire risk.
Use only recommended lubricants and fluids.

Vehicle Underframe

WARNING: The vehicle underframe and associated structural members must **NOT** be welded or subjected to an extreme heat source. Failure to observe this precaution will result in a substantial loss in the material strength with consequent failure. Any damaged portions of the underframe must be renewed as a complete section.

Towing

CAUTION: To prevent oil starvation in the rear axle whilst towing the vehicle it is imperative that BOTH rear axle half shafts are removed.

GENERAL DATA

Units Specifications

Engine

Type		Gardner 6LXB
Number of cylinders		Six
Bore		120,65 mm (4.75 in)
Stroke		152,40 mm (6.0 in)
Firing order		1, 5, 3, 6, 2, 4

Gearbox

Type		Leyland 5-speed Hydracyclic gearbox fitted with retarder
Gearbox ratios:	1st	5.204 :1
	2nd	3.226 :1
	3rd	2.123 :1
	4th	1.502 :1
	5th	1 :1
	Reverse	3.730 :1

Rear Axle

Type	Leyland fully floating, double reduction spiral bevel
Ratio	4.974, 4.567 or 4.206 :1

Angle Drive

Type	Spiral bevel gear and pinion
Ratio	1.125 :1

Steering

Type	Adwest 'serv-a-rak' hydraulic power assisted rack and pinion
Ratio	26 :1
Turning circle	19,8 m (65 ft)
Front wheel alignment	Parallel to 3 mm (0.125 in) toe-in.

Brakes

Type	Dual full power hydraulic brakes operated from accumulators pre-charged with nitrogen.
Operation:	
Footbrake	Applies the front and rear brakes independently
Hand (parking) brake	Applies the rear brakes by spring pressure supplied from the spring brake actuators
Hydraulic system operating pressures:	
'Cut-out' pressure	98,43 kgf/cm² (1 400 lbf/in²)
'Cut-in' pressure	77,33 kgf/cm² (1 100 lbf/in²)
Accumulator nitrogen pre-charge	35,15 kgf/cm² (500 lbf/in²)
Low pressure switch operating pressures:	
Accumulator supply	50,27 to 46,9 kgf/cm² (715 to 667 lbf/in²)
Parking brake light (when fitted)	63,62 to 60,11 kgf/cm² (905 to 855 lbf/in²)

Air System

Operation	Suspension, throttle control, doors, gearbox attenuation valve, windscreen washers and wipers.
System operating pressures:	
Throttle control	
Doors	4,2 to 5,6 kgf cm² (60 to 80 lbf/in²)
Windscreen washers/wipers	5,98 to 8,437 kgf cm² (85 to 120 lbf/in²)
Attenuation valve	8,437 kgf/cm² (120 lbf/in²)

Electrical System

The electrical system is a nominal 24 volt negative earth return system with multiple point earthing for minor circuits.

Tyres

Size	11.00–22.5 radial ply
Pressure:	
Front and rear	7,6 bars (7,73 kgf/cm²) (110 lbf/in²)

Vehicle Dimensions

Length	9,568 m (31.38 ft)
Height	4,373 m (14.34 ft)
Width	2,452 m (8.04 ft)
Ground clearance	168 mm (6.6 in)
Front overhang	2,188 m (7.18 ft)
Rear overhang	2,350 m (7.71 ft)
Turning circle	19,8 m (65 ft)

Approximate Unit Capacities

Engine	18 litres (32 pints)
Gearbox (including angle drive and fluid coupling)	47 litres (83 pints)
Rear axle	16 litres (29 pints)
Power steering/brake reservoir	31 litres (54 pints)
Cooling system	60 litres (105 pints)
Fuel tank	236 litres (54 gallons)
Windscreen washer reservoir	9 litres (16 pints)

Approximate Unit Weights

Engine	888 kg (1958 lb)
Gearbox	447 kg (984 lb)
Rear axle (including 'H' frame)	950 kg (2095 lb)

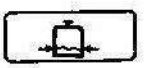
Warning Systems

Warning Panel Lights, Fig. 1

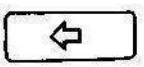
Fire extinguisher (1) (if fitted). This amber warning light will illuminate when the fire extinguisher canister in the engine compartment has been depressurised. The warning light will remain illuminated until the extinguisher canister has been refilled.

Low hydraulic pressure (2). This red warning light will illuminate in conjunction with either a continuous warning buzzer or a visual semaphore signal (dependent upon vehicle specification) when the hydraulic pressure in the front brake accumulator falls below 50,26 kgf/cm² (715 lbf/in²).

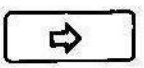
Low hydraulic pressure (3). This red warning light will illuminate in conjunction with either a continuous warning buzzer or a visual semaphore signal (dependent upon vehicle specification) when the hydraulic pressure in the rear brake accumulator falls below 50,26 kgf/cm² (715 lbf/in²).



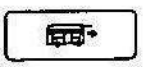
Low coolant level (4) (if fitted). This red warning light will illuminate and either an intermittent or continuous warning buzzer will sound when the engine coolant level falls below the correct working level.



Direction indicator monitor (5). This green warning light will illuminate in unison with the left-hand direction indicators when the direction indicator control is activated.



Direction indicator monitor (6). This green warning light will illuminate in unison with the right-hand direction indicators when the direction indicator control is activated.



Emergency doors open (7). This red warning light will illuminate when either the upper or lower emergency door is open and, in addition, a continuous warning bell will ring when the master/start switch is in the RUN position.

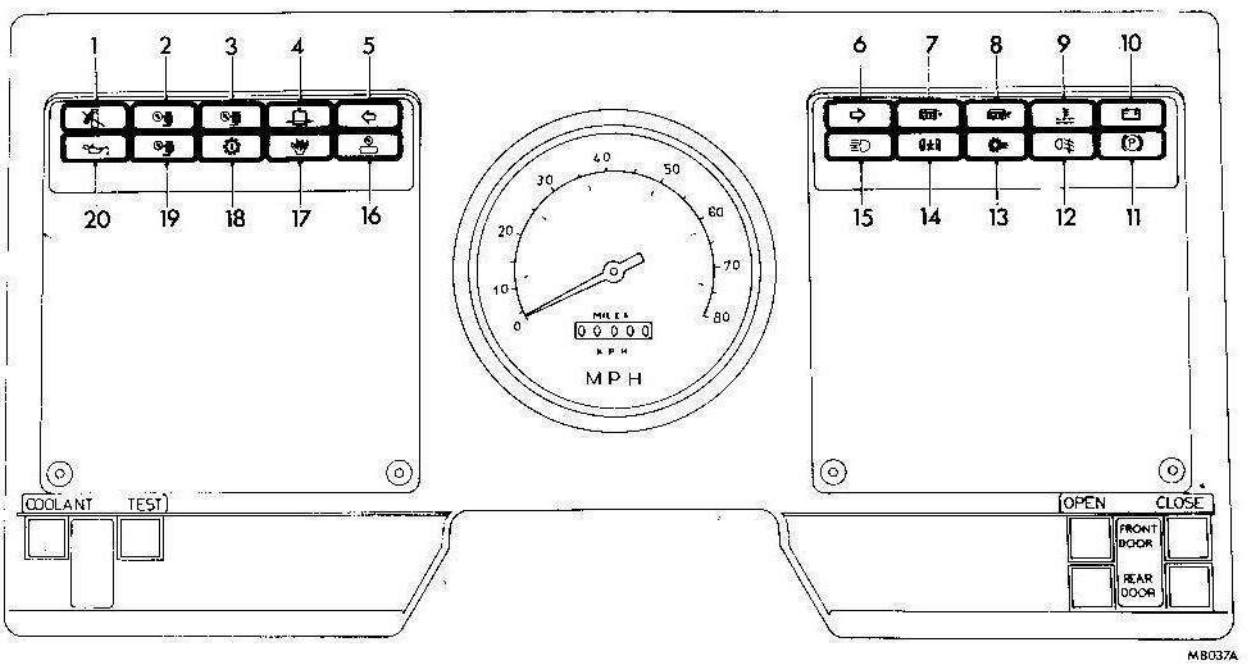
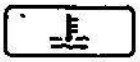


FIG. 1 WARNING PANEL LIGHTS

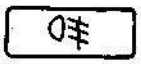
Engine access doors open (8). This red warning light will illuminate and a continuous warning bell will ring if the engine access doors are opened or unlocked when the master/start switch is in the RUN position.



High coolant temperature (9). This red warning light will illuminate and a continuous warning buzzer will sound when the engine coolant temperature exceeds 90°C (194°F).

No-charge warning light (10). This amber warning light will illuminate when a no-charge condition exists and when the regulator over-ride switch has been activated.

Handbrake on (11) (if fitted). This amber warning light will illuminate when the hand (parking) brake is applied to the ON (park) position.

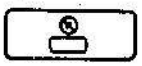


Rear fog lamps (12) (if fitted). This amber warning light will illuminate when the rear fog lights are energised.

Gearbox safety circuit (13). This red warning light will illuminate and the transmission will automatically select and remain in top (5th) gear when the rear road wheels lock, due to severe braking conditions or the speed signal transducer malfunctions. If this warning occurs the vehicle should be stopped, the hand (parking) brake applied and neutral gear position selected. Stop the engine, switch off the master/start switch, pause for a few seconds and then carry out the normal engine start procedure.

Entrance/exit door open (14). This red warning light will illuminate when the entrance or exit door is open. At vehicle road speeds over 3 mile/h a continuous warning bell will ring.

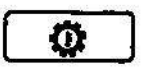
Main beam (15). This blue warning light will illuminate when the headlights are in the high-beam position.



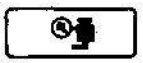
Low air pressure (16). This red warning light will illuminate when the air system pressure falls below 4,2 kgf/cm² (60 lbf/in²).

Fire (17). This red warning light will illuminate intermittently and a warning buzzer will sound intermittently when the ambient temperature in the engine compartment exceeds 80°C (176°F). If this warning occurs the passengers should be disembarked immediately and kept away from the vicinity of the engine compartment. In the event of the temperature exceeding 120°C (248°F) the warning light and warning buzzer will operate continuously and, if fitted, the fire extinguishing system will be automatically activated. When the fire extinguisher canister in the engine compartment has depressurised, the fire extinguisher warning light (1) will illuminate.

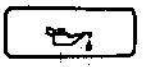
Note: The fire warning light and warning buzzer can only be cancelled by operating the over-ride switch located within the engine compartment.



Gearbox oil temperature (18). This red warning light will illuminate and the gearbox retarder will automatically disengage when the gearbox oil temperature exceeds 125°C (257°F).



Low hydraulic pressure (19). This red warning light will illuminate in conjunction with either continuous warning buzzer or a visual semaphore (dependent upon vehicle specification) when the hydraulic pressure in the parking brake accumulator falls below 50,26 kgf/cm² (715 lbf/in²).



Engine oil pressure low (20) (if fitted). This red warning light will illuminate when the engine oil pressure falls below 1,05 kgf/cm² (15 lbf/in²).

Semaphore Signal (if fitted), Fig. 2

This warning device gives the driver a visual indication when the hydraulic pressure in the brake accumulators is low or that the fluid level in the hydraulic reservoir is low. When the hydraulic pressure in any brake accumulator falls below 50,26 kgf/cm² (715 lbf/in²) the semaphore signal arm (1) will descend into view to give the visual warning STOP and, in addition, a red warning light on the instrument panel will illuminate. When the hydraulic fluid in the reservoir falls below the safe working level the semaphore signal arm will descend into view and the warning light (2) on the semaphore unit will illuminate. The vehicle must be stopped immediately and the cause investigated and rectified before proceeding with the journey.

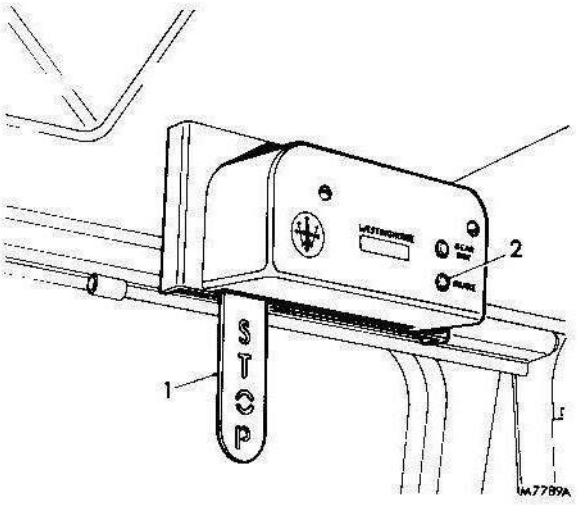


FIG. 2 SEMAPHORE SIGNAL

Summary of Warning Buzzers

Operation	Warning
Intermittent	Fire alarm (initial warning)
Continuous	Fire alarm (final warning)
*Continuous	Low hydraulic pressure
Continuous	High engine coolant temperature
*Continuous	Low coolant level
*Intermittent	Low coolant level
*Manual	Passenger disembarkation (upper saloon)

*if fitted

Summary of Warning Bells

Operation	Warning
Continuous	Emergency door open
Continuous	Engine access doors open
*Continuous	Entrance/exit door open
Manual	Passenger disembarkation

*Vehicle road speed above 3 mile/h

Summary of Inhibitor Systems

1. Engine start:
   (a) The engine can only be started when the gear selector is in the 'S' position.
   (b) The engine cannot be started from the driving compartment if the engine access doors are unlocked or open.
   (c) If a false engine start occurs, an electrical lock-out system will prevent the starter motor from being re-engaged for 7 seconds.
2. Accelerator pedal operation:
   (a) The accelerator pedal will be rendered inoperative whenever the passenger doors are opened at vehicle road speeds below 3 mile/h.
3. Driver's door controls:
   (a) The driver's door controls are inoperative at vehicle road speeds in excess of 3 mile/h.
4. 'Top-up' coolant level indicator system:
   (a) In the event of the engine coolant level falling below the safe working level an intermittent warning buzzer will sound and, after a time delay of 30 seconds, the engine will automatically shut-down.
   (b) In the event of the engine coolant temperature exceeding 90°C (194°F) a continuous warning buzzer will sound and, after a time delay of 30 seconds, the engine will automatically shut-down.
   Note: The 30 seconds time delay has been incorporated into the coolant warning system to enable the vehicle to be manoeuvred off the road, thereby preventing a traffic hazard.

Warning Systems Integrity Test Switch, Fig. 3 or 4

Depress the test switch (1) to visually and audibly check that all warning lights, warning buzzers and bells are functional. When the switch is depressed all warning lights should illuminate and the warning buzzers and bells should sound; any failures in the warning systems must be reported and rectified before putting the vehicle into service.

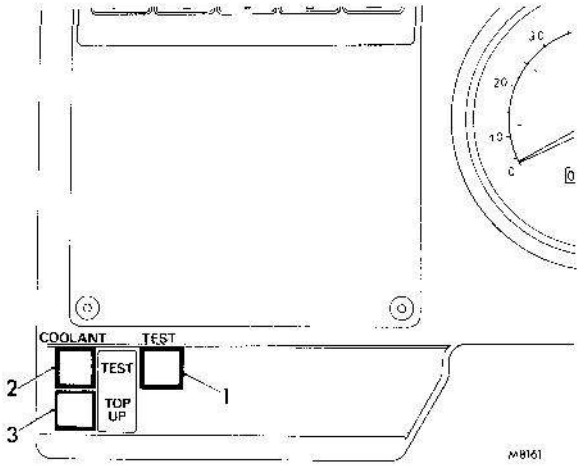


FIG. 3 'RADOLARM' INTERIOR TEST SWITCH

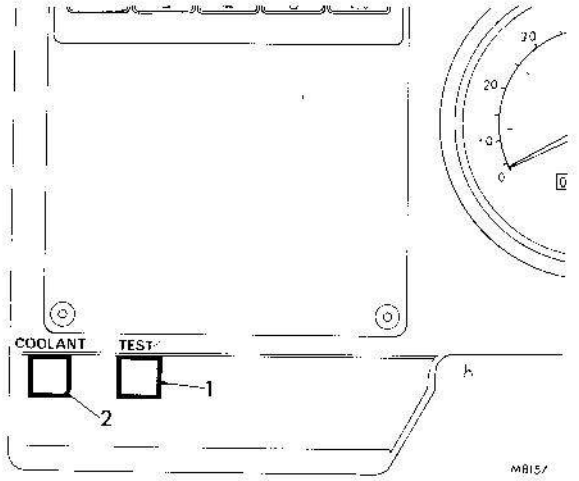


FIG. 4 'TOP-UP' INTERIOR TEST SWITCH

Coolant Level Indicator System

The coolant level indicator system is electronically operated and enables the driver/maintenance personnel to quickly and accurately check the coolant level. The coolant level indicator system has two test points, one in the driver's compartment and the other on the exterior of the engine compartment.

Dependent upon vehicle specification, one of two types of coolant level indicator systems are fitted and are operated as follows:

'Radolarm' System

Interior test switch, Fig. 3

1. Rotate the master/start switch to the RUN position.
2. Depress the 'Radolarm' system integrity test button (2) to check that the 'Radolarm' circuit is operative and that the warning light and buzzer are functional; should the warning light or warning buzzer fail to operate, the circuit is faulty and must be rectified.
3. Depress the 'Radolarm' test switch (3) for at least 2 seconds; if the warning light illuminates and the warning buzzer sounds, the coolant level is below the minimum acceptable level and requires topping-up. If the warning light and warning buzzer are not activated, the coolant is at an acceptable working level.

NOTE: The warning light and warning buzzer will be automatically activated when the coolant level falls below the minimum safe working level.

'Top-up' System

Interior test switch, Fig. 4

1. Rotate the master/start switch to the RUN position.
2. Depress the warning systems integrity test switch (1) to check that the warning buzzer is functional; should the warning buzzer fail to sound, the circuit is faulty and must be rectified.
3. Depress the 'top-up' test switch (2) for at least 2 seconds; if the warning buzzer sounds, the coolant level is below the minimum working level and requires topping-up. If the warning buzzer does not sound, the coolant level is at an acceptable working level.

IMPORTANT: In the event of the engine coolant falling below the safe working level an intermittent warning buzzer will sound and, after a delay of 30 seconds, the engine will automatically shut down. The master/start switch must be rotated to the OFF position before attempting to re-start the engine.

SECTION 2

Maintenance

This section lists operations which, when carried out at the specified periods, will maintain efficient and economical running of the vehicle under normal operating and climatic conditions. It is divided into three parts, the initial service check, daily and weekly checks and the periodic servicing schedule. Any detailed procedure to be adopted when carrying out maintenance is described in the applicable Group.

IMPORTANT: Absolute cleanliness is essential when carrying out maintenance. All filler caps, plugs or lubricators should be cleaned before and after attention. If units require an excessive amount of oil or if leakage from seals is noted, this should be reported and action taken at the earliest opportunity.
When draining and filling unit assemblies ensure the vehicle is standing on level ground.

NOTE: For maintenance periods, unit capacities and lubricant specifications of the Gardner 6LXB engine, refer to Gardner literature.

FIRST SERVICE

After the first 1 000 km (600 miles) and not later than 2 000 km (1 200 miles) running of a new vehicle or the fitment of a new or reconditioned unit the following items should receive attention:

Engine—Ancillary Components

1. Check the security of the engine mountings.
2. Examine the silencer and exhaust systems for security.
3. Check security of radiator mountings.
4. Check security of connections and clips on fuel, oil, coolant and hydraulic pipes.
5. Check for oil, water, fuel or hydraulic fluid leaks.
6. Check compressor drive belt tension.
7. Check alternator drive belt tension.

Fluid Coupling and Transmission

1. Drain the gearbox and refill with clean oil of the correct specification.
2. Renew the gearbox oil filter.
3. Check the security of the gearbox mounting bolts.
4. Check the security of the propeller shaft flange bolts.
5. Check for excessive play at the propeller shaft sliding joint and universal joints.
6. Lubricate the propeller shaft sliding joint and universal joints using a grease gun.
7. Check fluid coupling for leaks.
8. Check for oil, water, air or hydraulic fluid leaks at the gearbox connections.
9. Check the gearbox hydraulic operating pressure.
10. Check brake band settings.
11. Check condition of upper piston seals.

Rear Axle

1. Drain the rear axle and refill with clean oil of the correct specification.
2. Check security and condition of axle 'H' frame mountings.
3. Check hub end-float.
4. Inspect for oil leakages.

Steering Gear and Front Hub Assembly

1. Inspect the hub for grease leakage.
2. Check hub end-float.
3. Check front wheel alignment.
4. Examine relay linkage, angle drive box, power steering ram and track rods for security.
5. Examine leading arms and panhard rod for security.
6. Examine power steering components for leakage.
7. Examine all power steering pipes and hoses for leakage.
8. Inspect all mechanical linkages for wear and security.
9. Check top-up hydraulic fluid in reservoir.
10. Renew hydraulic reservoir filter.

Brakes

1. Inspect brake shoe linings for excessive wear.
2. Check operation of automatic slack adjusters.
3. Inspect all hydraulic pipes, pipe connections and flexible hoses for leakage, wear or damage.
4. Examine wheel cylinders for leakage.
5. Check nitrogen operating pressure in each accumulator.
6. Check hydraulic braking system pressure.

Air Suspension

1. Check security and condition of bellows, air pipes and hoses.
2. Check all valves, bellows and piping for leakages.
3. Check mechanical joints and all components for security or damage.

Air Supply System
1. Check air system for leakages.
2. Examine all valves and piping for security and/or damage.

Electrical Equipment
1. Check all heavy duty connections for cleanliness and security.
2. Check specific gravity of battery electrolyte and examine battery terminals.
3. Check headlight beam settings.
4. Carry out a function test on interior/exterior lights, alarm systems and safety devices.

Body
1. Check security of all passenger seats and hand rails.
2. Check operation of windscreen wipers/washers and passenger doors.
3. Examine vehicle underframe for damage or corrosion.

Tyres and Wheels
1. Check security of wheel nuts.
2. Check tyre inflation pressures.
3. Examine tyres for damage or excessive wear.

DAILY CHECKS

Engine
1. Check/top-up engine oil level.
2. Check engine coolant level by depressing, dependent upon vehicle specification, either the 'Radolarm' or 'Top-up' test switch ; top-up as necessary.

Automatic Lubrication (if fitted)
1. Check/top-up automatic lubrication reservoir.

Driving Compartment
1. Check/top-up windscreen washer reservoir.
2. Rotate the master/start switch to the 'RUN' position and check the following :

(a) Direction indicators, horn and headlight flash control lever functions correctly.
(b) Depress the warning systems integrity test switch and check that all warning lights, warning buzzers and warning bells are operational.
(c) Check that all vehicle illumination is functional.

3. Start the engine and check the following :

(a) If fitted, check that the semaphore signal arm has retracted, indicating that the hydraulic braking system is charged.
(b) No-charge warning light extinguishes immediately.
** (c) Engine oil low pressure warning light (if fitted) extinguishes immediately. **
(d) The low air pressure warning light extinguishes when the air system attains the correct working pressure and that the vehicle suspension attains normal ride height.
(e) Check that the windscreen wipers/washers are functional.

Wheels and Tyres
1. Check/adjust tyre inflation pressures.

Fuel System
1. Check/fill fuel tank.

WEEKLY CHECKS

Transmission
1. Check/top-up gearbox oil level.
2. Grease the propeller shaft splines.

Rear Axle
1. Check/top-up rear axle oil level

Front Hub Assembly
1. Lubricate the king pins.

Power Steering/Brake Hydraulic Reservoir
1. Check/top-up power steering/brake hydraulic reservoir fluid level.

Electrical System
1. Check the condition of the batteries.
2. Check/top-up electrolyte solution in each battery cell.

Wheels and Tyres
1. Check road wheel nuts for security.
2. Check condition of road wheels.

Maintenance Schedule

LUBRICATION SERVICES	Period	
	km x 1 000	miles x 1 000
Engine		
Renew engine oil Renew engine oil filter element	10	6
Transmission		
Renew gearbox oil	40	25
Renew gearbox oil filter element	20	12.5
Inject propeller shaft joints with grease (Do NOT use high pressure equipment)	10	6
Rear Axle		
Renew rear axle oil	24	15
Repack hubs with grease	80	50
Inject slack adjusters with grease	10	6
** Inject front brake camshaft with grease **		
Front Axle Assembly Repack hubs with grease	80	50
Steering Renew power steering/brake hydraulic fluid Renew fan/power steering filter element Check/top-up angle drive box oil level		
Electrical System Inject alternator bearings with grease Lubricator starter motor drive bush and drive splines ** Recharge starter motor wick lubricators **		
General Lubricate battery carrier pivots, door hinges, locks, all mechanical linkages and load bearing surfaces	10	6

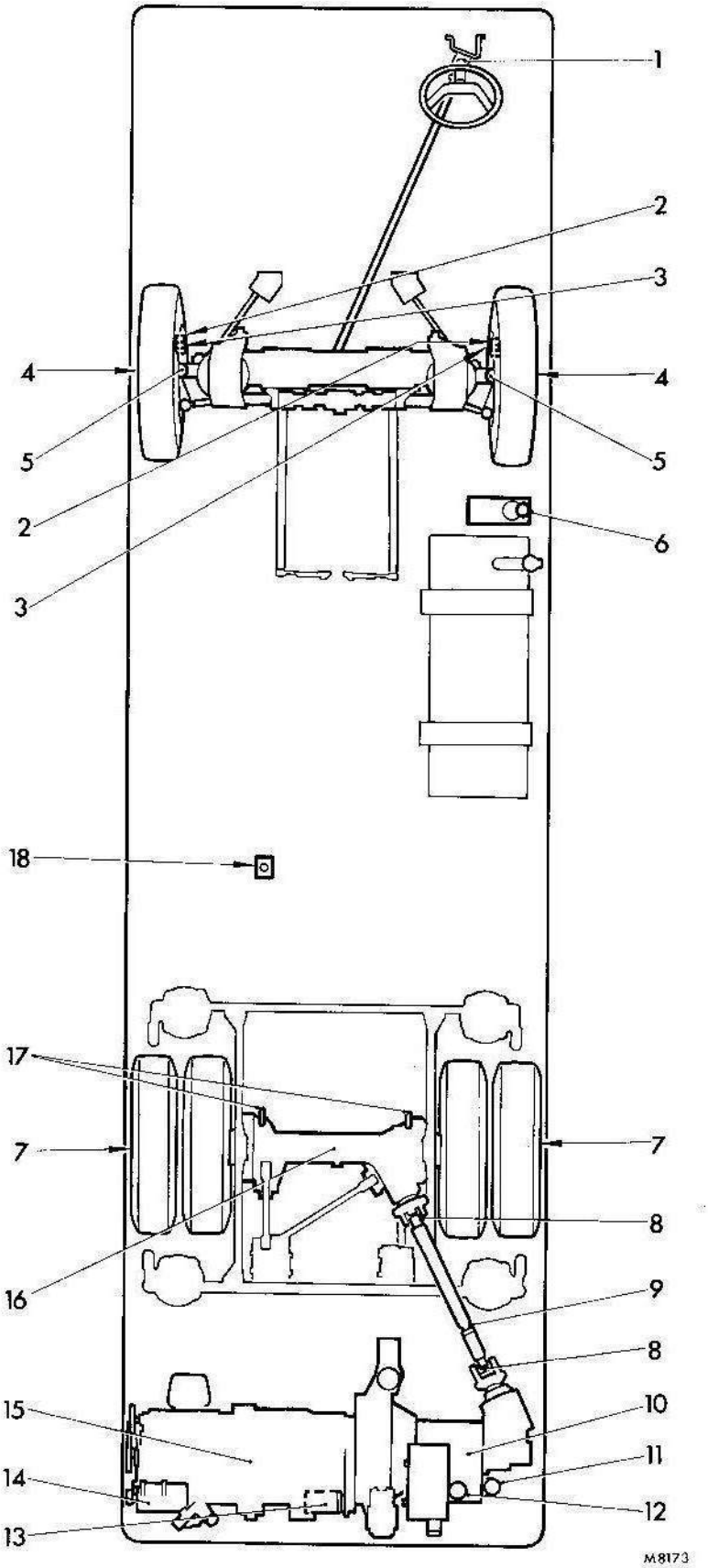


FIG. CHASSIS LUBRICATION DIAGRAM

1. Steering box
2. Front slack adjuster
3. Brake camshaft
4. Front hub
5. King pin
6. Automatic lubrication reservoir (if fitted)
7. Rear hub
8. Propeller shaft joint
9. Propeller shaft splines
10. Gearbox
11. Gearbox oil filter
12. Hydraulic reservoir filter
13. Starter motor
14. Alternator
15. Engine
16. Rear axle
17. Rear slack adjuster
18. Brake pressure filter

MAINTENANCE SERVICE

	Period	
	km x 1 000	miles x 1 000
* **Engine—ancillary components**		
Check security and condition of engine mountings	40	25
Check security of connections and clips on fuel, oil, coolant and power steering/brake pipes; Check security and condition of inlet/exhaust systems	10	6
** Clean fire extinguisher piping, using Schrader valve **	ANNUALLY	
Cooling System		
Drain, flush out and refill system; Check condition and security of hoses; renew as necessary; Check radiator matrix	AUTUMN BIANNUALLY	
Remove low coolant level indicator alarm from header tank and clean 'Radolarm' probes	ANNUALLY	
Fluid Coupling		
Check fluid coupling for leaks, rectify as necessary	10	6
Gearbox		
Check all hydraulic pipes for leakage; rectify as necessary	** 40	25 **
Check condition of upper piston seals; Check gearbox hydraulic operating pressure; Check/adjust brake band settings	ANNUALLY	
Front Hub Assembly		
Check for grease leakage from hub; rectify as necessary; Check king posts for wear; Check front wheel alignment; Check/adjust hub bearing end-float	20	12.5
Steering	40	25
Check for excessive movement at steering wheel, determine cause and rectify	10	6
Check condition and security of rubber gaiters; renew if necessary	20	12.5
Check condition and security of power steering pipes and hoses; rectify/renew as necessary; Check all power steering pipes and hoses for leakages; rectify as necessary	40	20
Check steering ball joints for wear; Check security of angle drive box; Check for excessive wear on universal joints and couplings; renew as necessary; Check condition of rubber bushes in the steering coupling		
Check for excessive movement in upper column bearings; renew if necessary; Check condition and security of steering gear mountings		

*For maintenance periods of the Gardner 6LXB engine, refer to relevant Gardner literature

	Period	
	km x 1 000	miles x 1 000
Rear Axle		
Check security and condition of axle 'H' frame mountings	20	12.5
Check/adjust hub bearing end-float	ANNUALLY	
Check for oil leakages—rectify as necessary	40	25
Air Supply System		
Inspect air system for leakages; rectify as necessary Examine all valves and piping for security and/or damage; rectify as necessary Renew air filters Clean/renew compressor air strainer (if fitted) Check/adjust compressor mountings and drive alignment Examine compressor for wear/damage and oil or water leaks; rectify as necessary	10	6
Examine compressor discharge valve caps for excessive carbon deposits; clean compressor cylinder head if necessary	56	35
Examine pistons/delivery lines for excessive carbon deposits; clean/renew as necessary	10	6
Suspension		
Check security and condition of air pipes, air bellows and hoses Check air bellows for leakage Check mechanical joints and all components for security or damage; rectify as necessary	30	20
Clean air filter element	130	80
Clean isolator valve filter elements	10	6
Foundation Brakes		
Check operation of automatic slack adjusters Inspect brake linings for excessive wear; renew as necessary	20	12.5
Hydraulic Braking System		
Check nitrogen operating pressure in each accumulator, refer to Group 7 Inspect all pipe connections for leakage; rectify as necessary Inspect all flexible hoses for wear or damage; renew as necessary Check hydraulic braking system pressure at relevant checking points, refer to Group 7	40	25
Inspect wheel cylinders for leakage; rectify as necessary Inspect all metal pipes for corrosion or damage; renew as necessary Check pressure switch settings, refer to Group 7 Renew air filters	240	150
Renew hydraulic brake system filter element		

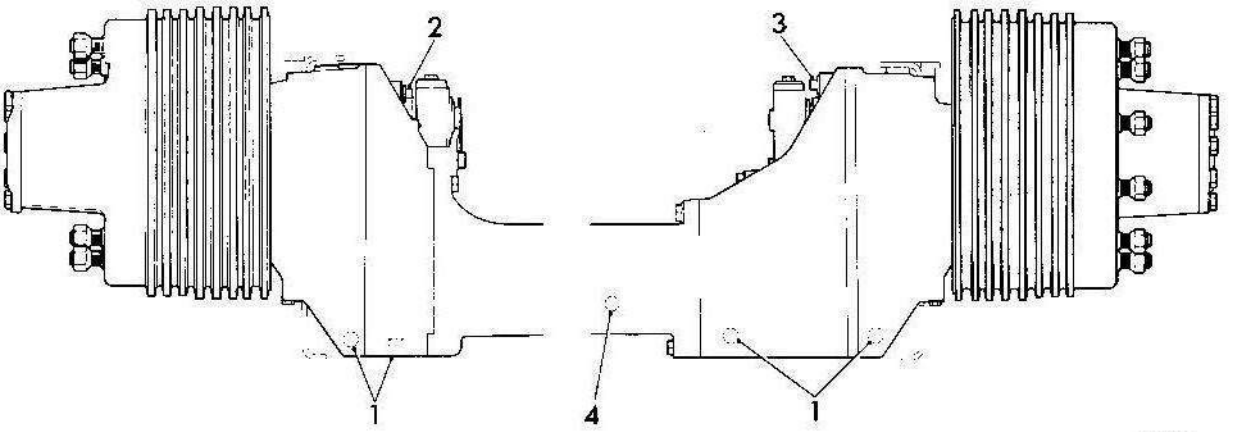


FIG. 2 REAR AXLE LUBRICATION POINTS

**

Rear Axle (Fig. 2)

****Topping up.** Remove filter plug (3) and level plug (4), top-up the axle until oil begins to flow from the level aperture (4).**

Refit filler and level plug.

Draining: Remove the drain plugs (1) and oil level plug (4) and allow oil to drain into suitable containers.

Refit drain plugs.

Refilling: Remove filler plugs (2) and (3).

Pour 7 litres (1.54 gals) of clean oil into the axle through the filler aperture (2).

Pour oil in the filler aperture (3) until oil begins to flow from the level aperture (4).

Refit filler and level plugs.

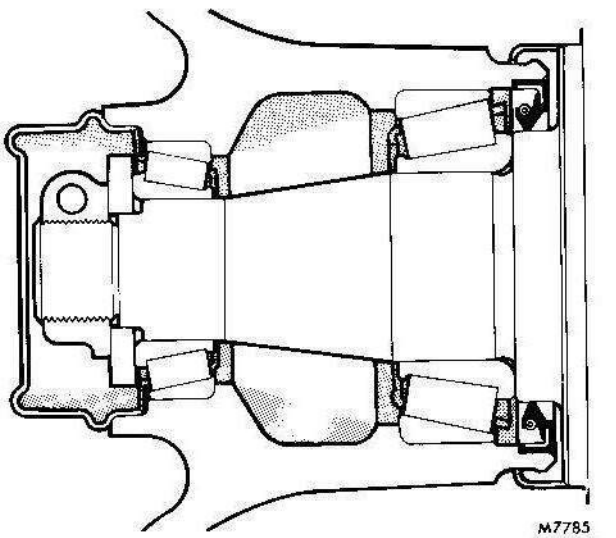


FIG. 3 FRONT HUB GREASING **

Front and Rear Hubs (Figs. 3 and 4)

Remove the front and rear hubs as described in Groups 5 and 6.

Remove all traces of old grease using a suitable solvent, dry the hub thoroughly.

Knead grease, as specified into the bearings and partly pack the cavity between the inner and outer bearings as shown in Figs. (3) and (4). The shaded areas in these illustrations indicate where grease is to be applied.

Assemble and adjust the hub as described in Groups 5 and 6.

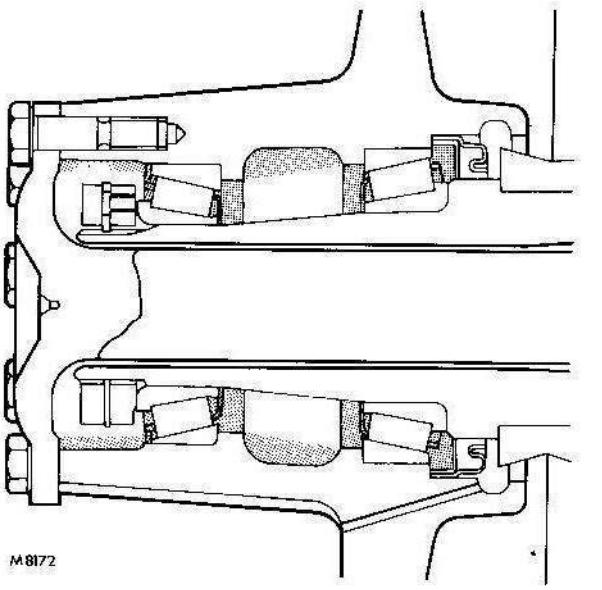


FIG. 4 REAR HUB GREASING

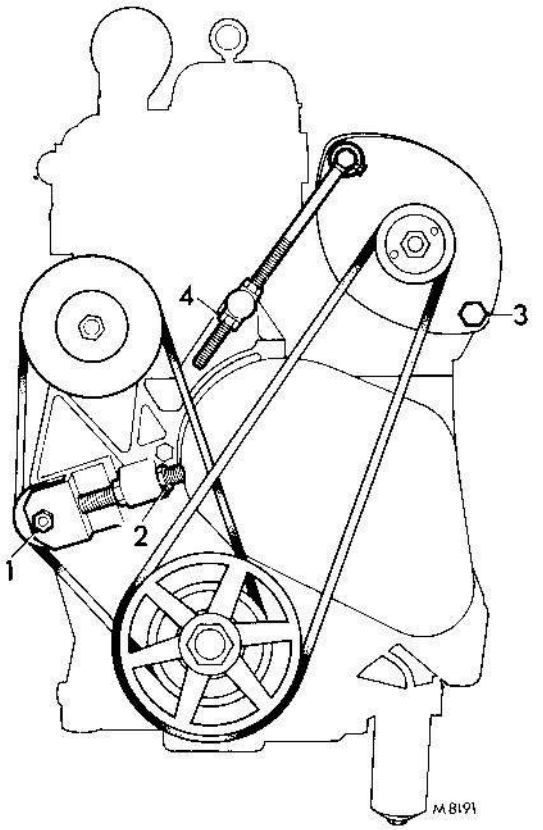


FIG. 5 DRIVE BELT ADJUSTMENT

REPLACEMENTS AND ADJUSTMENTS

Adjustment of Driving Belts

Compressor Drive Belt

1. Release nut (1) securing jockey pulley to mounting block.
2. Release outer locknut (2) on adjusting bolt.
3. Rotate inner nut in a clockwise direction until a force 2,7 to 3,6 kgf (6 to 8 lbf) can deflect the drive belt 6,7 mm (17/64 in) at mid-belt span.
   NOTE: When a new belt has been fitted, the belt must be tensioned until a force 3,6 to 4,5 kgf (8 to 10 lbf) can deflect the drive belt 6,7 mm (17/64 in) at mid-belt span.
4. Secure nut on jockey pulley and inner nut on adjusting bolt.

Alternator Drive Belt (Fig. 5)

1. Release pivot bolt (3) securing alternator to mounting bracket.
2. Release outer locknut (4) on eye bolt.
3. Rotate inner nut in a clockwise direction until a force 3.6 to 4.5 kgf (8 to 10 lbf) can deflect the drive belt 8.7 mm (11/32 in) at mid-belt span.
   NOTE: When a new belt has been fitted, the belt must be tensioned until a force 4,5 to 6,4 kgf (10 to 14 lbf) can deflect the drive belt 8,7 mm (11/32 in) at mid-belt span.
4. Secure pivot bolt and inner locknut on eye bolt.

SECTION 3

Lubricants and Fluids

This section defines the specifications and grades of lubricants recommended for Leyland units. It should be read in conjunction with the Maintenance Schedule which gives the recommended lubrication mileages and the Lubrication Diagram which indicates the position of filling points. Refer to Section 1 of this Group for unit capacities.

The recommendations given are for general guidance only, and at all times close collaboration should be maintained with the oil supplier. Where different grades of lubricant are shown for various atmospheric temperature ranges, the grade chosen should be that applicable to the temperature range which is operative for a significant proportion of the season during which the oil is in use.

FUEL OIL AND FLUIDS

Fuel System

The fuel oils which are suitable for use in Diesel engines are generally known as Diesel fuel oil, distillate Diesel fuel, automotive gas oil or Derv fuel. Users are recommended to obtain their supplies from a source which can be depended upon to maintain a consistent standard of quality and service. Waste or residual oils of any sort are to be avoided.

It is recommended that the fuel should conform to British Standard 2869 : 1967, Class A1, which includes the following requirements :

If fuel to British Standard 2869, Class A1, is not available, fuel to Class A2 may be used but it is likely to be less satisfactory.

ANTI-FREEZE FLUIDS

Engine Cooling System

The use of anti-freeze which conforms to B.S. 3151 or B.S. 3152 is recommended if the temperature is likely to fall to 0°C (32°F) or less.

The following chart shows protection provided by various concentrations of anti-freeze solutions which meet the above British Standards.

Solution	Commences to freeze		Frozen solid	
% anti-freeze	°C	°F	°C	°F
25	–13	9	–26	–15
33	–19	– 2	–36	–33
50	–36	–33	–48	–53

When anti-freeze fluid is not in use it is recommended that a corrosion inhibitor fluid is added to the cooling system.

Air Pressure System

The use of a volatile anti-freeze fluid is recommended in the air pressure system anti-freezer (if fitted) if the temperature is likely to fall to 0°C (32°F) or less.

The recommended fluid is methanol (methyl alcohol) but if this is unobtainable, ethanol (ethyl alcohol) or industrial methylated spirits may be used. The initial water content of any fluid used should not exceed 1%. Suitable fluids are usually referred to by their alcoholic strength of 74 Over Proof (British System) or 198 Proof (American System).

CAUTION : Non volatile anti-freeze fluids such as ethylene glycol (ethanediol) must not be used in the anti-freezer units of air-pressure systems.

Leyland Specifications

Leyland Specification G Grease (Lithium-based) for road wheel bearings and other applications.

All greases used for the lubrication of road wheel bearings must conform to the British Timken Specification for lithium-based greases, originally issued under reference ALG 1/57. The proprietary grade must have been approved by British Timken Limited.

It is most important that lithium-based greases should not be mixed with grease of other types in road wheel bearings, as this would have the effect of producing a melting-point lower than either of the constituent greases.

When changing the type of grease, the road wheel bearings should be thoroughly cleaned out.

When packing wheel hubs with lithium-based grease, care should be taken to ensure that the bearings and cage assemblies are fully packed, but the hub itself should not be over-packed with grease—see page 1-2-9 for the correct amount to be used.

Automotive Products/Lockheed Specifications

**The following proprietary hydraulic fluids have been approved by Automotive Products/Lockheed for use in the brakes/steering and fan drive systems.

Supplier	Approved Fluid	
	ORIGINAL CLASSIFICATION	I S O CLASSIFICATION
SHELL	TELLUS R 23	R 22
BRITISH PETROLEUM	B P ENERGOL H L 50	No. ISO GRADE
BRITISH PETROLEUM	S H F 48	S H F — LT 15
BRITISH PETROLEUM		ENERGOL HLP 22
BURMAH/CASTROL	HYSPIN AWS 22	HYSPIN AWS 22
CRODA METAL TREATMENTS	THELSON FLODRIVE 50	ISO — 22
DUCKHAMS	ZIRCON 5	No. ISO GRADE
DALTONS	—	DOVE 22
ELF (formerly Sternol)	ALBATROSS 21	ALBATROSS 21
ESSO	NUTO H 40	NUTO H 22
FINA (Petrofina)	HYDRAN 21	ISO — 22
GULF	HARMONY 40 AW	ISO — 22
IRONSIDE	91 X	ISO — HO 22
LORCO	LORCO BT	LORCO HT 22
MOBIL	VELOCITE No. 10	ISO — 22
TEXACO	SPINTEX OIL 100	SPINTEX OIL 22
TEXACO	AIRCRAFT HYDRAULIC OIL BB	AIRCRAFT HYDRAULIC OIL 15

**

Recommended Lubricants

Unit	Lubrication Specification			
	Atmospheric Temperature Range			
	Below 0°C (32°F)	0°C (32°F) to 13°C (55°F)	13°C (55°F) to 30°C (86°F)	Above 30°C (86°F)
*Engine	S.A.E.20W/20 oil	S.A.E.20 or S.A.E.20W/20 oil	S.A.E.30 oil	S.A.E.40 oil
** Gearbox	Leyland Specification 'E' oil The approved proprietary oil meeting the above specifications are as follows: BP Gear Oil LA62 — Mobil Mobilfluid 98 Castrol Deusol PSG — Shell Donax TL Esso Teresso 68 — Texaco Torque Fluid E Gulf Harmony 53			
Rear axle	S.A.E. EP80 oil	S.A.E. EP90 oil		S.A.E. EP 140 oil
Steering box angle drive	S.A.E. EP80 oil	S.A.E. EP90 oil		S.A.E. EP140 oil
King pins	S.A.E. 90 oil	S.A.E. EP140 oil		
** Propeller shaft splines Propeller shaft joints Slack adjusters Front hubs Rear hubs	Leyland Specification 'G' or NLGI, Grade 2 grease The approved proprietary lubricants meeting the above specifications are as follows: BP Energrease L2 — Gulf Gulfcrown Castrol LM — Mobil Mobilgrease MP Chevron Dura-Lith 2 — Shell Retinax A Duckhams Admax L2 — Texaco Multifak E.P2 Esso Beacon			
Brake camshafts	Shell-Retinax DX grease			
Alternator	Chevron SR 1 — 2 grease			
Starter motor wick lubricators	S.A.E. 5W/20 oil			
Starter motor drive bush and spline	Aeroshell 7 grease			
** Hydraulic reservoir	See Chart on Page Ref. 1–3–3			
Automatic lubrication reservoir (if fitted)	S.A.E. 80 oil	S.A.E. 90 oil		S.A.E. 140 oil

*To meet specification requirement MIL–L2104B or MIL–L–2104C

CAUTION: Leyland Vehicles Ltd. cannot accept any responsibility for trouble experienced by operators arising from any of the following causes:

(i) The use of oil of lower performance level than the minimum requirement for the operating conditions, or

(ii) The use of oils of lower viscosity than the recommended grades, or

(iii) The continued use of oils after the recommended oil change mileage or period.

SECTION 5

Conversion Factors and Abbreviations

Conversion Factors

Length

1 millimetre	=	0.0394 inch	1 inch	=	25,4 millimetres
1 metre	=	3,280 feet	1 foot	=	304,8 millimetres
1 metre	=	1.094 yards	1 yard	=	0,914 metre
1 kilometre	=	0.621 mile	1 mile	=	1,609 kilometres

Area

1 square centimetre	=	0.155 square inch	1 square inch	=	6,452 square centimetres
1 square metre	=	10.764 square feet	1 square foot	=	929,03 square centimetres
1 square metre	=	1.196 square yards	1 square yard	=	0,836 square metre
1 square kilometre	=	0.386 square mile	1 square mile	=	2,59 square kilometres

Volume

1 cubic centimetre	=	0.061 cubic inch	1 cubic inch	=	16,387 cubic centimetres
1 cubic metre	=	31.315 cubic feet	1 cubic foot	=	0,0283 cubic metre
1 cubic metre	=	1.308 cubic yards	1 cubic yard	=	0,7646 cubic metre

Capacity

1 litre	=	1.760 Imperial pints	1 Imperial pint	=	0,568 litre
1 litre	=	2.10 U.S. pints	1 U.S. pint	=	0,476 litre
1 litre	=	0.22 Imperial gallon	1 Imperial gallon	=	4,546 litres
1 litre	=	0.264 U.S. gallon	1 U.S. gallon	=	3,80 litres

Mass

1 gramme	=	0.035 ounce	1 ounce	=	28,35 grammes
1 kilogramme	=	2,205 pounds	1 pound	=	453,6 grammes
1 tonne	=	0.984 ton	1 hundredweight	=	50,8 kilogrammes
			1 ton	=	1,016 tonnes

Moment of Force (Torque)

1 kilogramme centimetre	=	0.87 pound inch	1 pound inch	=	1,15 kilogramme centimetres
1 kilogramme metre	=	7.23 pound foot	1 pound foot	=	0,138 kilogramme metre
1 newton metre	=	0.737 pound foot	1 pound foot	=	1,35 newton metres

Pressure

1 kilogramme per square centimetre	=	14.22 pounds per square inch	1 pound per square inch	=	0,0703 kilogramme per square centimetre
1 kilonewton per square metre	=	0.146 pound per square inch	1 pound per square inch	=	6,89 kilonewtons per square metre

Power

1 kilowatt	=	1.341 horse power	1 horse power	=	0,746 kilowatt

Force

1 newton	=	0.224 lbf	1 lbf	=	4,448 newtons
1 kgf	=	2.205 lbf	1 lbf	=	0.454 kgf

Abbreviations

Across flats (both head size)	A.F.
After bottom dead centre	A.B.D.C.
After top dead centre	A.T.D.C.
Alternating current	a.c.
Amperes	A
Ampere-hour	Ah
Atmospheres	Atm
Before bottom dead centre	B.B.D.C.
Before top dead centre	B.T.D.C.
Bottom dead centre	B.D.C.
Brake horse power	bhp
British standards	B.S.
Centigrade (Celsius)	C
Centimetres	cm
Centimetres of mercury	cm Hg
Cubic centimetres	cm^3
Cubic inches	in^3
Degree, minute, second (angle)	°, ′, ″
Degree (temperature)	°
Diameter	dia
Direct current	d.c.
Fahrenheit	F
Feet	ft
Gallons (Imperial)	gal
Grammes	g
Inches	in
Inches of mercury	in Hg
Internal diameter	i.dia
Kilogrammes (force)	kgf
Kilogrammes (mass)	kg
Kilogramme centimetre (force)	kgf cm
Kilogramme metre (force)	kgf m
Kilogrammes per square centimetre (force)	kgf/cm^2
Kilometres	km
Kilonewton per square metre	kN/m^2
Kilowatts	kW
Left-hand	L.H.
Left-hand drive	L.H.D.
Maximum	max.
Metres	m
Microfarad	µf
Miles per hour	mile/h
Millimetres	mm
Minimum	min.
Minus (of tolerance)	−
Negative (electrical)	−ve
Newton metres	Nm
Ohms	ohm or Ω
Ounces	oz
Outside diameter	o.dia
Pints (Imperial)	pt
Plus or minus	±
Plus (of tolerance)	+
Positive (electrical)	+ve
Pounds (force)	lbf
Pounds (mass)	lb
Pounds feet (torque)	lbf ft
Pounds inches (torque)	lbf in
Pounds force per square inch	lbf/in^2
Ratio	:
Revolutions per minute	rev/min
Right hand	R.H.
Right hand drive	R.H.D.
Society of Automobile Engs.	S.A.E.
Specific gravity	sp. gr.
Square centimetres	cm^2
Square inches	in^2
Standard wire gauge	s.w.g.
Top dead centre	T.D.C.
United Kingdom	U.K.
Volts	V
Watts	W
Screw Threads	
British Association	B.A.
British Standard Fine	B.S.F.
British Standard Pipe	B.S.P.
Unified Coarse	U.N.C.
Unified Fine	U.N.F.
Metric (millimetres)	M

GROUP 2

Engine

	Reference
SECTION 1 — POWER UNIT REMOVAL AND REFITMENT	
Data	2–1–1
To Remove	2–1–1
To Refit	2–1–4
Overhaul	2–1–4
SECTION 2 — COOLING SYSTEM	
Description	2–2–1
Removal and Refitment	2–2–2
SECTION 3 — COOLING FAN DRIVE	
General Description of System	2–3–1
Data	2–3–2
Switching Valve:	
Description	2–3–3
Operation	2–3–3
Fault Diagnosis	2–3–3
Removal and Refitment	2–3–4
Overhaul	2–3–4
Testing and Adjustment	2–3–5
Thermostatic Valve:	
Description	2–3–6
Fault Diagnosis	2–3–6
Removal and Refitment	2–3–6
Overhaul	2–3–7
Testing and Adjustment	2–3–8
Fan Drive Motor:	
Removal and Refitment	2–3–9
SECTION 4 — THROTTLE CONTROL VALVE	
Description	2–4–1
Operation	2–4–1
Removal and Refitment	2–4–1
Overhaul	2–4–2
Adjustment	2–4–3
SECTION 4A — THROTTLE ACTUATOR	
Description	2–4A–1
Removal and Refitment	2–4A–1
Overhaul	2–4A–1
Adjustment	2–4A–3
SECTION 5 — HYDRAULIC PUMPS	
Removal and Refitment	2–5–1
SECTION 6 — AIR COMPRESSOR	
Data	2–6–1
Description	2–6–2
Fault Diagnosis	2–6–2
Removal and Refitment	2–6–2
Overhaul	2–6–3

SECTION 1

Power Unit

DATA

Torque Tightening Figures

Bearing pin lock-plate bolt, 8 mm	2,4 to 3,0 kgf m (17.6 to 22.1 lbf ft)
Channel bracket securing bolts, 8 mm	2,4 to 3,0 kgf m (17.6 to 22.1 lbf ft)
Metacone mounting through bolts, 10 mm	4,9 to 6,1 kgf m (36.1 to 44.2 lbf ft)
Engine support mounting plate bolts, 7/16 UNF	7,0 to 9,5 kgf m (50.8 to 69.2 lbf ft)
Metacone mounting brackets/bulkhead bolts, 12 mm	8,8 to 10,4 kgf m (64.1 to 76.0 lbf ft)
Engine support tube bearing pins, 20 mm	42,7 to 51,0 kgf m (309.5 to 370 lbf ft)
Lower engine support tube nuts, 24 mm	53,8 to 63,4 kgf m (389.8 to 459.8 lbf ft)
Forward engine mounting bracket centre bolts, 24 mm	53,8 to 63,4 kgf m (389.8 to 459.8 lbf ft)

REMOVAL AND REFITMENT

Power Unit

To Remove

1. Isolate electrical supply.
2. Deplete air system by removing drain plug from the reservoir, refit and secure plug after draining.
3. Open rear engine access panel and side panels.
4. Disconnect spring-loaded struts and number plate light electrical plug.
5. Remove centre hinge from rear access panel, withdraw rear access panel together with side panels.
6. Disconnect electrical plugs, remove off-side and near-side rear lamp assembly panels.
7. Remove engine compartment under trays.
8. Remove rear bumper and engine panel support structure.

Note: If the cooling system contains an anti-freeze solution it should be drained into clean containers for subsequent re-use. The drain tap is situated in the lower water pipe connected to the gearbox oil cooler, close tap after draining.

9. Remove coolant filler pipe and overflow pipe assembly.
10. Remove air inlet elbow hose and disconnect air cooling hose from alternator.
11. Disconnect air intake hose from silencer unit to flanged pipe on compressor.
12. Disconnect air hose from silencer unit to steel inlet pipe elbow.
13. Disconnect air pipe from filter restriction indicator to steel inlet pipe elbow.
14. Disconnect electrical plug from alternator, remove nuts, washers and detach bracket with alternator harness and clips from near-side engine support tube.
15. Release clips and slide propeller shaft shroud from split cover on rear bulkhead.
16. Open side access panel situated behind off-side rear wheel, remove nuts, washers, bolts and detach split cover gaining access to propeller shaft bolts.
17. Remove self-locking nuts and bolts, disconnect propeller shaft and suitably support weight of shaft.
18. Disconnect speedometer transmitter from gearbox, release clip and detach cable from bracket.
19. Disconnect wires from level indicator unit on reservoir.
20. Disconnect wires from perception head in gearbox.
21. Disconnect electrical plug from auto-valve block on gearbox and release clips securing cable, disconnect pressure attenuation pipe from gearbox retarder control, when fitted.
22. Disconnect leads from starter motor and release clips securing cables to sump brackets.

23. Disconnect temperature gauge, stop solenoid and oil gauge multi-plug from bulkhead.
24. Disconnect wires from tachometer transducer, when fitted, and release clips securing cable to hydraulic pipe.
25. Disconnect fuel inlet and return pipes.
26. Disconnect air pipe from throttle actuator unit.
27. Place a suitable container under hydraulic pipes at junction of off-side engine mounting tube and suitably identify pipes for subsequent refitment.
28. Disconnect inlet pipes from reservoir to power steering/fan drive pump and hydraulic brake pump, plug pipe ends to prevent the ingress of foreign matter.
29. Disconnect outlet pipes from pumps and the relief spill pipe from hydraulic brake pump.
30. Disconnect oil delivery pipe from engine lubrication pump to oil cooler and return pipe from cooler to sump.
31. Remove water pipe from thermostat housing to upper oil cooler pipe on gearbox.
32. Disconnect upper water pipe from gearbox oil cooler.
33. Remove lower water pipe from gearbox oil cooler to water rail flange, discard joint from flange.
34. Remove water hose at thermostatic valve junction to water rail.
35. Remove rear seat in lower saloon and open access panel on bulk head.
36. Disconnect exhaust pipe from manifold and discard joint.
37. Remove exhaust manifold support bracket from gearbox and off-side front engine mounting, disconnect exhaust pipe from silencer and withdraw exhaust complete.
38. Disconnect water supply pipe from compressor to water pump.
39. Disconnect flexible air delivery pipe from compressor at rear bulkhead.
40. Disconnect flexible heater pipe from water rail and saloon heater pipes.
41. With the aid of a fork-lift truck and suitable lifting cradle support weight of the power unit, see Fig. 1 for lifting procedure.
    Note: The approximate weight of the power unit is 1 379 kg (3,040 lb).
42. Remove nut, centre mounting bolt and overload washer from near-side forward engine mounting bracket at rear bulkhead.

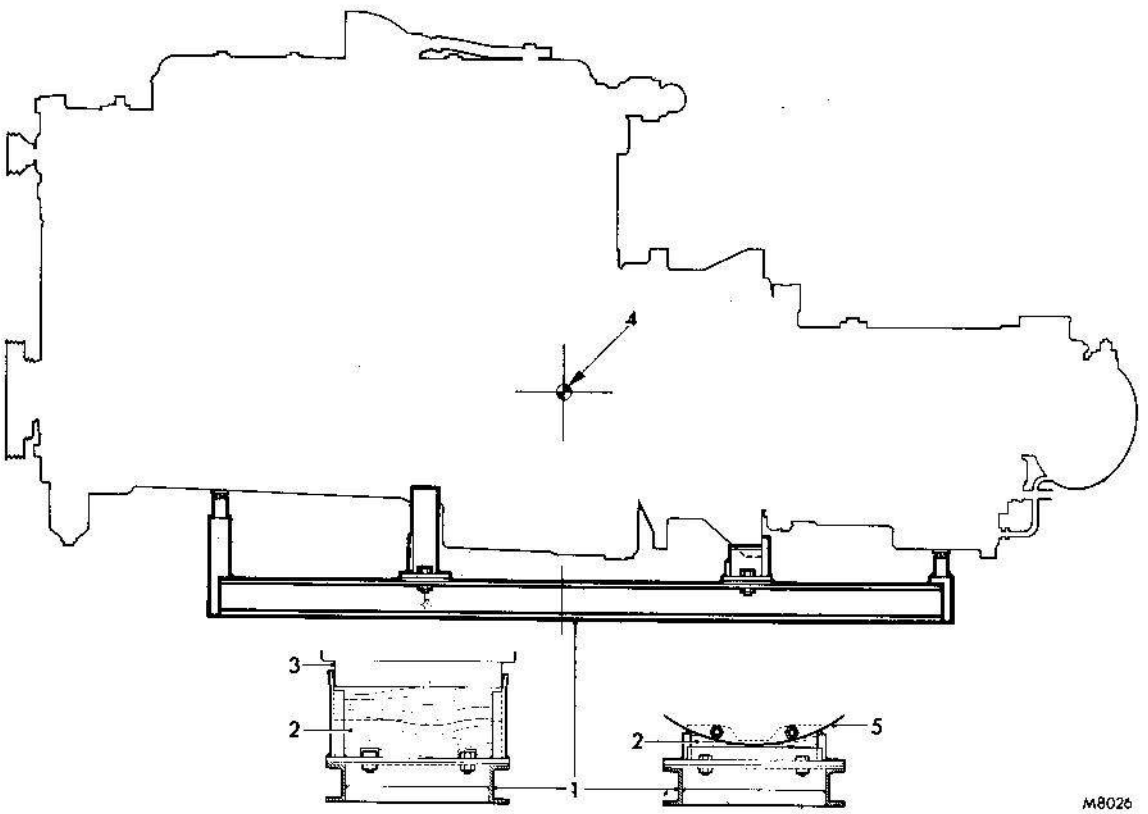


FIG. 1. POWER UNIT LIFTING PROCEDURE

1. Lifting cradle
2. Suitable packings
3. Engine sump
4. Centre of gravity point
5. Gearbox bell housing

SECTION 2

Cooling System

DESCRIPTION

The cooling system is a non-pressurised no loss system. A radiator of 0,41 m² (4.5 ft²) capacity is cooled by a twelve bladed fan, plastic blades on steel hub, the fan operation and speed being controlled by a thermostatic valve operating in sequence with a switching valve. A header tank is situated under the rear seat in the upper saloon.

The cooling system can be filled by the following methods:

a. By pressure fill through a valve situated in the engine compartment at the rear off-side of the vehicle.

b. Through the header tank, emergency only.

Water pipes are manufactured in copper with stainless steel high torque hose clip fastenings.

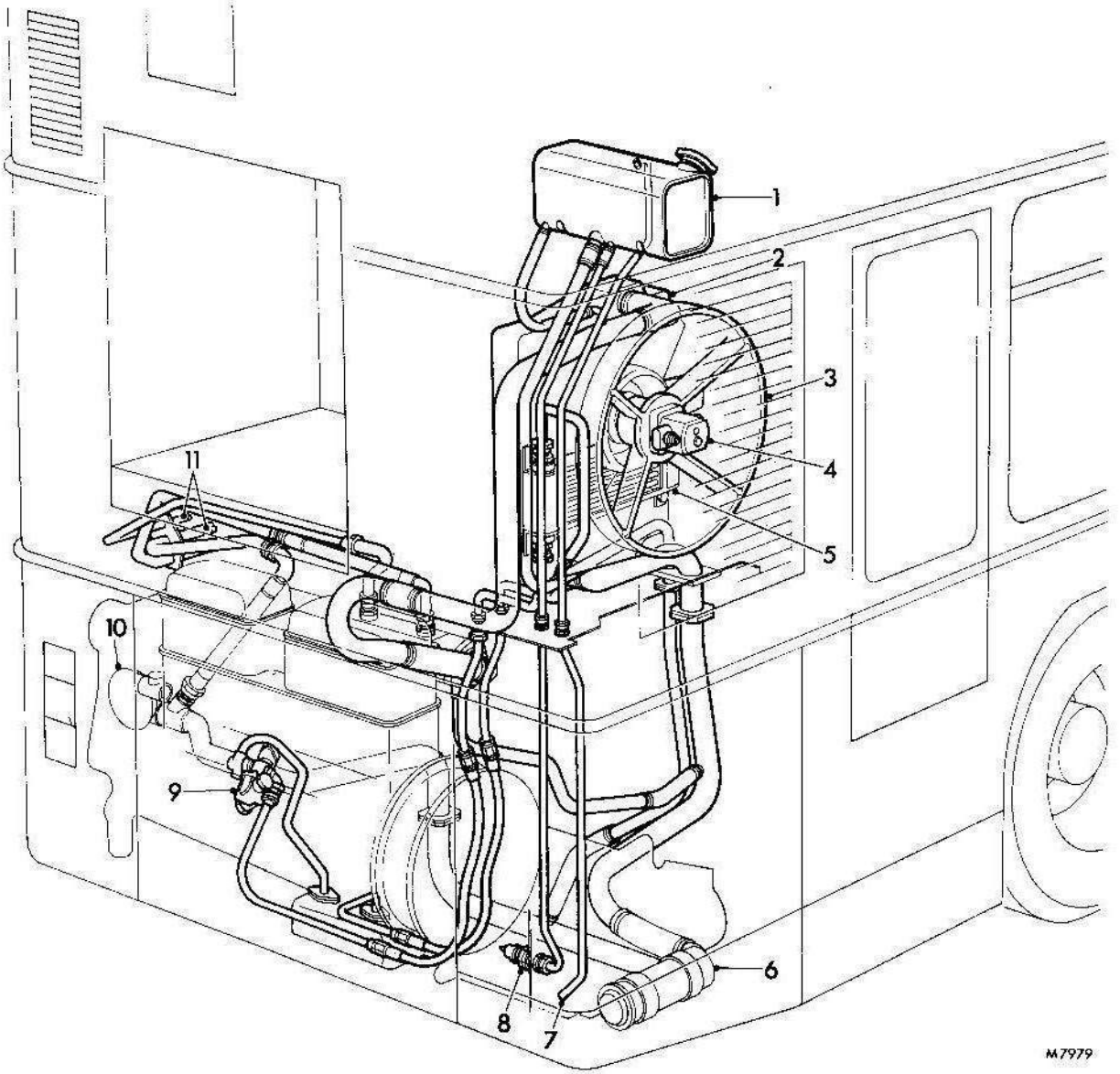


FIG. 1. DIAGRAMMATIC LAY-OUT OF COOLING SYSTEM

1. Header tank
2. Radiator
3. Fan cowl
4. Fan drive motor
5. Engine oil cooler
6. Gearbox oil cooler
7. Coolant overflow pipe
8. Coolant filler pipe
9. Engine lubrication pump
10. Water pump
11. Pipes to saloon heater

Warning Systems

High Engine Coolant Temperature

A Kysor high temperature warning switch mounted in the engine water rail activates a continuous buzzer and illuminates a red warning light in the driving compartment when the coolant temperature exceeds 90°C (194°F).

Low Engine Coolant Level

Two probes are installed in the header tank, one probe indicates the minimum acceptable coolant level, the other probe indicates the minimum safe coolant level. Also incorporated in the system are two coolant level test points, one is situated in the driving compartment the other one is positioned at the rear off-side of the vehicle. For the correct operating procedure refer to Group 1.

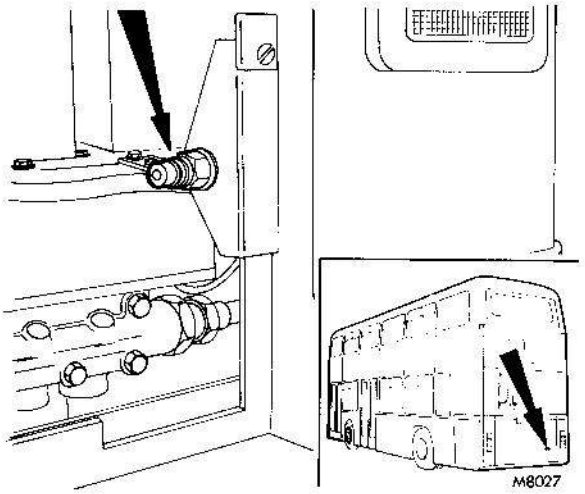


FIG. 2. COOLANT FILLING POINT

REMOVAL AND REFITMENT

Header Tank

To Remove

1. Isolate electrical supply.
   Note: If the cooling system contains an anti-freeze solution it should be drained into clean containers for subsequent re-use. The drain tap is situated in the lower water pipe connected to the gearbox oil cooler.
2. Remove rear seat in upper saloon.
3. Remove cover plate by slackening quick-release screws.
4. Open drain tap and partially drain coolant until the level is below the header tank, close tap after draining.
5. Open rear off-side hinged body grille by slackening quick-release screws.
6. Disconnect hoses from header tank.
7. Disconnect wires from coolant level probes.
8. Remove nuts, washers, U-bolts and withdraw header tank.

To Refit

Refitment is a reversal of the removal procedure, observing the following points:

1. Top-up cooling system as described in Group 1.
2. Tighten retaining nuts to a torque figure of 0,96 to 1,38 kgf m (7.0 to 10 lbf ft).

SECTION 3

Cooling Fan Drive

GENERAL DESCRIPTION OF SYSTEM, FIG. 1

Hydraulic fluid drawn from the reservoir (19) by the engine driven pump (21), is supplied to the switching valve (13) which contains control valves for the modulation of the fluid supplied for the cooling fan motor and power steering system. The thermostatic valve (1) mounted in the engine to radiator coolant pipe controls the flow of hydraulic fluid from the switching valve to the fan drive motor. When the engine coolant is below the operating temperature of the thermostatic valve, 80°C (176°F) hydraulic fluid is allowed to by-pass the fan motor through the switching valve. As the coolant temperature rises to 86±1°C (186.8±1.8°F), the wax element capsule expands and hydraulic fluid is then diverted to drive the fan motor, gradually increasing its speed. For a more detailed description and operation of each component, refer to the appropriate sections of this Group. See Group 5 for power steering operation.

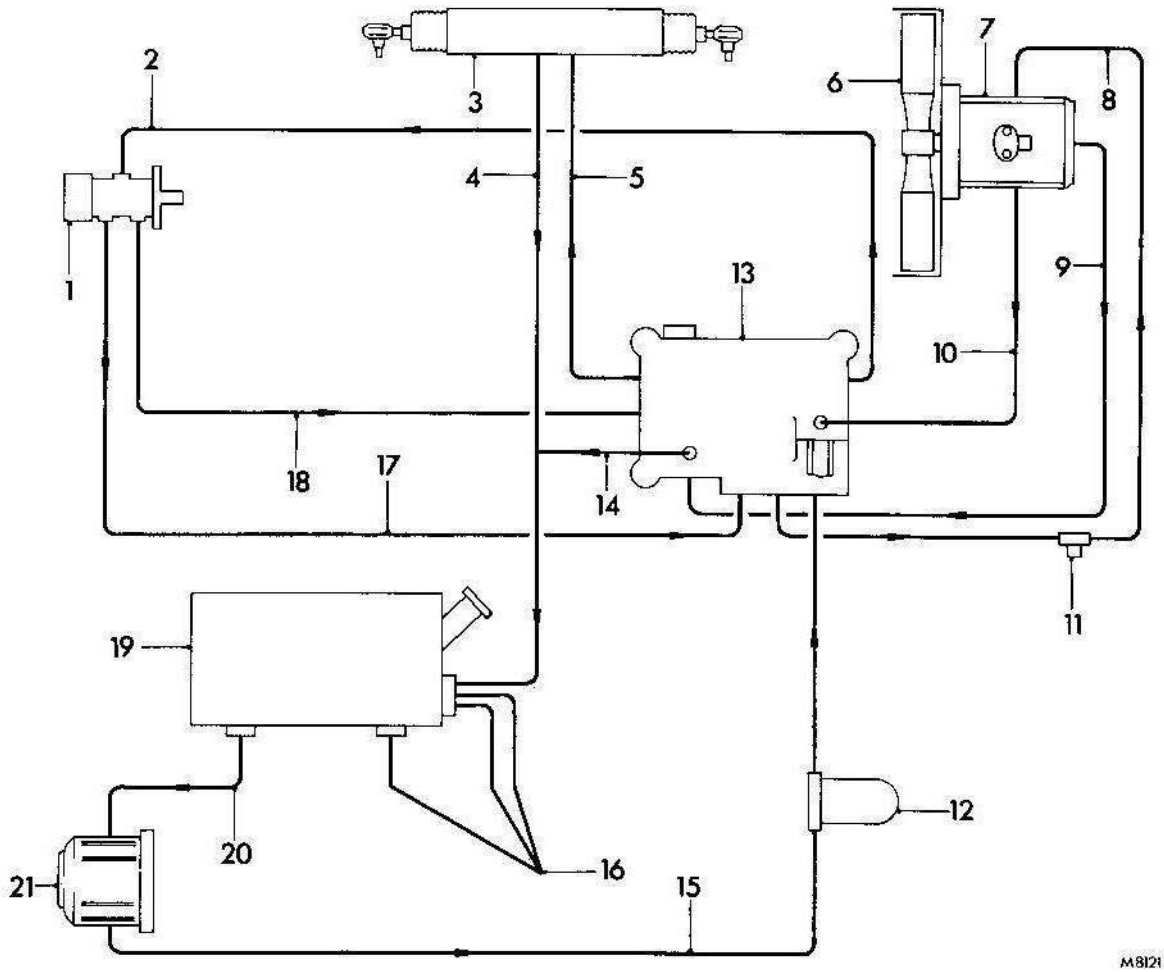


FIG. 1. DIAGRAMMATIC LAY-OUT OF COOLING FAN DRIVING SYSTEM

Arrows indicate direction of fluid flow

1. Thermostatic valve
2. Thermostatic valve inlet pipe
3. Power steering ram
4. Power steering return pipe
5. Delivery pipe to steering ram
6. Fan
7. Fan drive motor
8. Delivery pipe to fan motor
9. Motor body drain pipe
10. Fan motor return pipe
11. Gauge point
12. Filter
13. Switching valve
14. Return pipe to reservoir
15. Pump supply pipe to switching valve
16. Pipes to brake system
17. Thermostatic valve outlet pipe
18. Thermostatic valve drain pipe
19. Reservoir
20. Supply pipe to hydraulic pump
21. Hydraulic pump

DATA

Maximum input flow	66 l/min	(14.5 gals/min)
Controlled flow (l/min)	16 l/min	(3.5 gals/min)
Controlled pressure, Steering	69,1 kgf/cm²	(983.7 lbf/in²)
By-pass pressure, Fan drive	47,4 kgf/cm²	(674.5 lbf/in²)

Torque Tightening Figures

Switching valve securing nuts	2,3 to 3,1 kgf m	(17.0 to 23.0 lbf ft)
Thermostatic valve securing setscrews	0,96 to 1,38 kgf m	(7.0 to 10 lbf ft)
Fan bearing retaining setscrew	1,3 to 1,4 kgf m	(9.6 to 10.7 lbf ft)
Fan securing setscrews	2,8 to 3,1 kgf m	(20.3 to 22.7 lbf ft)
Fan motor socket-headed screws	2,8 to 3,1 kgf m	(20.3 to 22.7 lbf ft)
Fan cowl securing bolts	2,6 to 3,0 kgf m	(19.5 to 21.8 lbf ft)

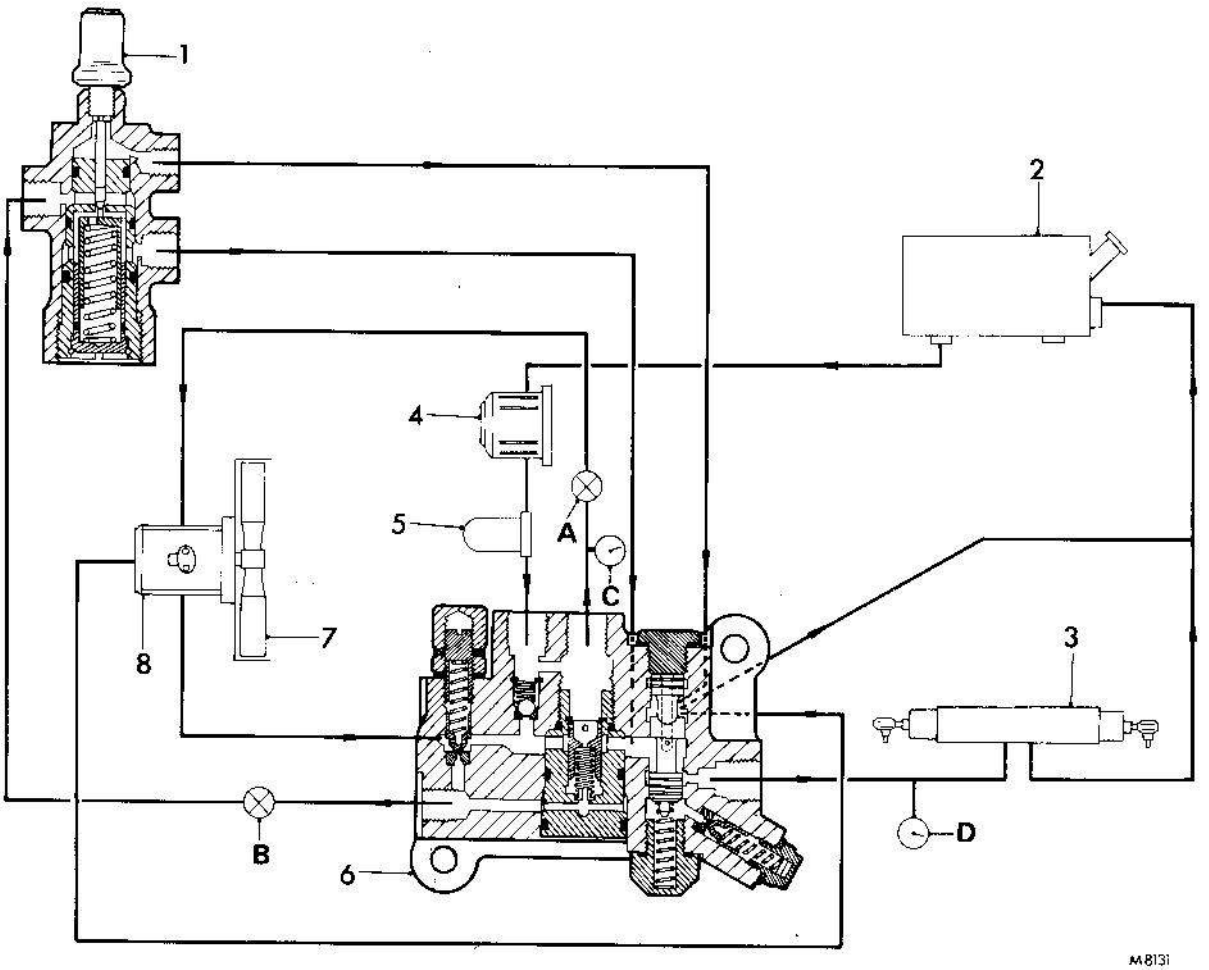


FIG. 2. COOLING FAN DRIVE TEST CIRCUIT

Arrows indicate direction of fluid flow

A. Isolating valve
B. Isolating valve
C. Pressure gauge
D. Pressure gauge

1. Thermostatic valve
2. Reservoir
3. Power steering ram
4. Hydraulic pump
5. Filter
6. Switching valve
7. Fan
8. Fan drive motor

SWITCHING VALVE

DESCRIPTION

The monabloc casting houses an unloading valve, pilot relief valves, check valve and flow control valve to provide the following functions:

1. An adjustable by-pass relief valve with provision for modulated on/off control of the fan motor by thermostatic pilot.
2. A flow control with pilot relief valve for constant flow to power steering.

OPERATION

Switching Section

By allowing flow through the metering orifice in the spool, the resultant pressure difference will move it against the bias spring until the balance position is reached controlling the required flow and pressure at the fan motor. Flow through the metering orifice occurs under two distinct conditions:

a. When the thermostatic pilot valve opens to provide a modulated on/off switching function for the fan motor in response to coolant termperature change.

b. When the poppet relief valve lifts in response to pressure difference across the fan motor to limit the fan speed.

The check valve prevents cavitation at the fan motor inlet from over-run due to inertia or windmilling effects.

Steering Section

As the pump output varies with engine speed, the controlled flow to the steering service is maintained by the spool moving against the spring under the action of pressure difference across the control orifice. The excess fluid flow is returned back to the reservoir. Maximum steering service pressure is limited by the relief valve pilot controlling the pressure on the spring end of the spool.

Power steering control is in series with the fan motor control and in the event of fan motor siezure or being prevented from turning as a result of accident, the flow to the steering service is maintained by movement of the motor by-pass control spool.

FAULT DIAGNOSIS FIG. 2

System

In the event of the cooling or steering systems not functioning correctly, the faulty component(s) must be isolated. It will therefore be necessary to incorporate isolating valves and pressure gauges calibrated up to 140 kgf/cm² (2000 lbf/in²) in the system. The pressure gauges are available under tool number LC 275. Before isolating the system component(s) check that the basic faults are not evident, i.e. low fluid level, blocked filter, leaking or damaged pipework, then proceed as follows:

A. Fit isolating valve between switching valve and fan motor inlet.

B. Fit isolating valve between switching valve pilot outlet and thermostatic valve inlet.

C. Connect a pressure gauge between switching valve motor outlet and isolating valve.

D. Pressure gauge at switching valve steering service outlet.

Note: Pressure gauge tapping points are installed in the system.

Fan Motor Control

With both isolating valves fully open check the fan speed is within approximately 1450 to 1650 rev/min with the engine running at governed speed and a coolant temperature of 86±1°C (186.8±1.8°F) at the thermostatic valve. If the fan speed is incorrect check the following items without operating the steering:

1. **Thermostatic Valve**

   a. Close off isolating valve (B) at switching valve pilot outlet, run engine at governed speed and check the fan speed as described above. If the fan speed is correct, remove thermostatic valve for Overhaul or subsequent replacement.

2. **Pump**

   b. Isolate the pump from the system and check it's flow rate, see Data, Group 5. If the flow rate is below the recommended figure, remove pump for Overhaul or subsequent replacement, see Group 5.

3. **Fan Motor**

   c. Leave isolating valve (B) closed at pilot outlet and run the engine at governed speed. Close off isolating valve (A) to motor and check switching valve by-pass pressure, see Data. If the pressure is correct remove fan motor for Overhaul or subsequent replacement. Should the pressure be incorrect, examine switching valve components as described in Overhaul, paragraphs 2 to 5. Remove isolating valves and pressure gauges on completion of tests.

REMOVAL AND REFITMENT

Switching Valve

To Remove

1. Thoroughly clean the exterior of the valve and ensure maximum cleanliness exists during the Removal procedure.
2. Isolate electrical supply.
3. Open rear engine access panel and off-side panel.
4. Place a suitable container under valve and suitably identify pipes for subsequent refitment.

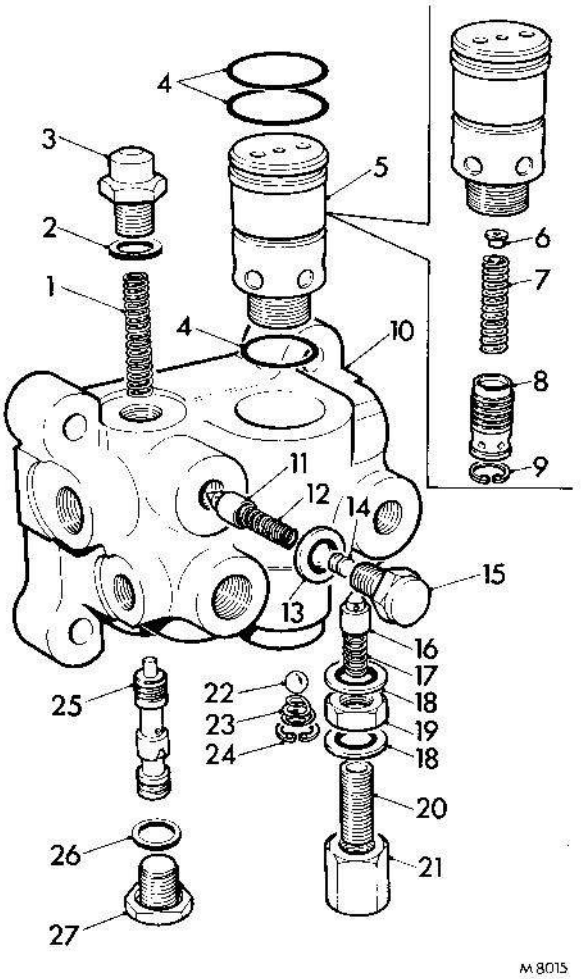


FIG. 3. EXPLODED VIEW OF SWITCHING VALVE

1. Flow control spring
2. Sealing ring
3. Flow valve cap
4. 'O'-ring
5. Valve housing assembly
6. Orifice plate
7. Bias spring
8. Spool
9. Circlip
10. Valve body
11. Valve poppet
12. Steering relief valve spring
13. Bonded seal
14. Shim(s)
15. Relief valve cap
16. Valve poppet
17. Motor relief valve spring
18. Bonded seal
19. Locknut
20. Adjuster screw
21. Nut
22. Check valve ball
23. Check valve spring
24. Circlip
25. Flow control spool
26. Sealing ring
27. Flow valve plug

5. Disconnect pipes and plug pipe ends to prevent the ingress of foreign matter.
6. Remove nuts, washers, bolts and detach valve from mounting bracket, retain distance pieces and mounting rubbers which will be dislodged in the process.

To Refit

Refitment is a reversal of the removal procedure observing the following points:

1. Top-up hydraulic reservoir as necessary with Shell Tellus 22 (formerly 23).
2. Tighten nuts to the torque figure quoted in Data.

OVERHAUL

Switching Valve

To Dismantle

Note: Obtain the correct repair kit before dismantling valve.

1. Thoroughly clean the exterior of the valve and ensure maximum cleanliness exists during the Overhaul procedure.
2. Remove valve housing with a suitable peg spanner, release circlip and withdraw spool, bias spring and orifice plate.
3. Remove nut and bonded seal, unscrew locknut and release adjuster screw, bonded seal, motor relief valve spring and valve poppet.
4. Release circlip and withdraw check valve spring and ball.
5. Remove flow valve cap and sealing-ring, withdraw flow control spring and spool.
6. Remove flow valve plug and sealing ring.
7. Remove relief valve cap, bonded seal, steering relief valve spring and valve poppet. Retain shims which may be dislodged in the process.

Inspection

1. Thoroughly clean all components in a suitable solvent and wipe dry with a lint-free cloth, discard O-rings and bonded seals previously removed.
2. Carefully examine machined surfaces for scores or damage.
3. Ensure spool orifices and internal valve drillings are clear.

4. Check the spools are a free fit in their respective bores, if necessary any burrs or scores may be carefully erased with a fine carborundum stone. Extreme care must be taken not to alter the fine clearance between the spools and bores or to round off the spool lands. The spools are matched to their respective bores and are not interchangeable.
5. Ensure the valve poppets are a free fit in the bores and the cones are evenly marked indicating correct seating, check seat for signs of wear or lip damage.
6. Examine check valve ball and seat and ensure no wear or damage is apparent.
7. Check valve springs for distortion, this is best achieved by comparing the existing springs with new ones.

To Reassemble

1. Lightly lubricate internal components and O-rings with clean hydraulic fluid for ease of reassembly.
2. Locate orifice plate, bias spring and spool in valve housing and secure with circlip.
3. Refit O-ring to valve housing and screw assembly into valve body.
4. Locate valve poppet in bore, fit motor relief valve spring, adjuster screw, bonded seal and locknut. Do not fit upper bonded seal or nut at this stage, see Testing and Adjustment.
5. Refit check valve ball, spring and secure with circlip.
6. Refit flow valve plug and sealing ring.
7. Refit flow control spool, spring, sealing-ring and flow valve cap. Ensure spool is fitted correctly, see Fig 3.
8. Locate valve poppet in bore, fit steering relief valve spring, bonded seal and relief valve cap ensuring the shims are correctly positioned.

TESTING AND ADJUSTMENT

Fan Drive

1. Install the switching valve in the vehicle system with a pressure gauge at the motor inlet and an isolating valve at the switching valve pilot outlet.
2. Run the engine at governed speed and close the isolating valve.
3. Rotate adjuster screw and obtain the correct fan drive by-pass pressure, see Data, tighten locknut.
4. Refit bonded seal, nut and secure.
5. Remove isolating valves and pressure gauge on completion of test.

Steering

Flow

1. Install a suitable flow meter at the switching valve steering service outlet.
2. Run the engine at governed speed ensuring the road wheels are in mid-position.
3. Check the controlled flow rate of the switching valve, see Data, remove flow meter.

Pressure

4. With a pressure gauge installed at the switching valve steering service outlet, run the engine at governed speed.
5. Place the road wheels against a suitable stop, operate steering which will blow the relief valve.
6. Check the steering controlled pressure, see Data.
7. Remove pressure gauge on completion of test.

THERMOSTATIC VALVE

DESCRIPTION

A needle valve, spring biased to the open position is operated by a temperature sensitive wax capsule to give a modulated pilot flow. The sealed wax element capsule immersed in the coolant responds to temperature change by movement of an inbuilt pin in contact with the end of the needle. With increase in temperature, the tapered needle is pushed into the orifice gradually closing off the flow through the orifice at an approximate temperature of 86±1°C (186.8±1.8°F). Contraction of the wax with decreasing temperature allows the needle to return back to the open position under the action of the spring.

FAULT DIAGNOSIS

Operation of the valve is determined by the temperature of the coolant, when the coolant is hot the valve remains closed, when the coolant is cold the valve is open. To determine if the valve is functional, carry out the following procedure:

1. Run engine until the coolant rises to a temperature of 86±1°C (186.8±1.8°F), at which the valve should be closed.
2. Place a suitable container under switching valve.
3. Disconnect outlet pipe from thermostatic valve at switching valve, see arrow Fig. 4 and observe that the pilot flow drops to zero.
4. If fluid continues to flow the valve is malfunctioning and must be removed for Overhaul or subsequent replacement.
5. Stop engine and remove container, reconnect pipe and top-up hydraulic reservoir as necessary.

REMOVAL AND REFITMENT

Thermostatic Valve

To Remove

1. Thoroughly clean the exterior of the valve and ensure maximum cleanliness exists during the Removal procedure.
2. Isolate electrical supply.
3. Open rear engine access panel.

Note: If the system contains an anti-freeze solution it should be drained into clean containers for susequent re-use. The drain tap is situated in the lower water pipe connected to the gearbox oil cooler.

4. Open drain tap and partially drain coolant until the level is below the valve, close tap after draining.
5. Place a suitable container under valve and suitably identify pipes for subsequent refitment.
6. Disconnect pipes and plug pipe ends to prevent the ingress of foreign matter.
7. Remove setscrews and washers, withdraw valve and discard joint.

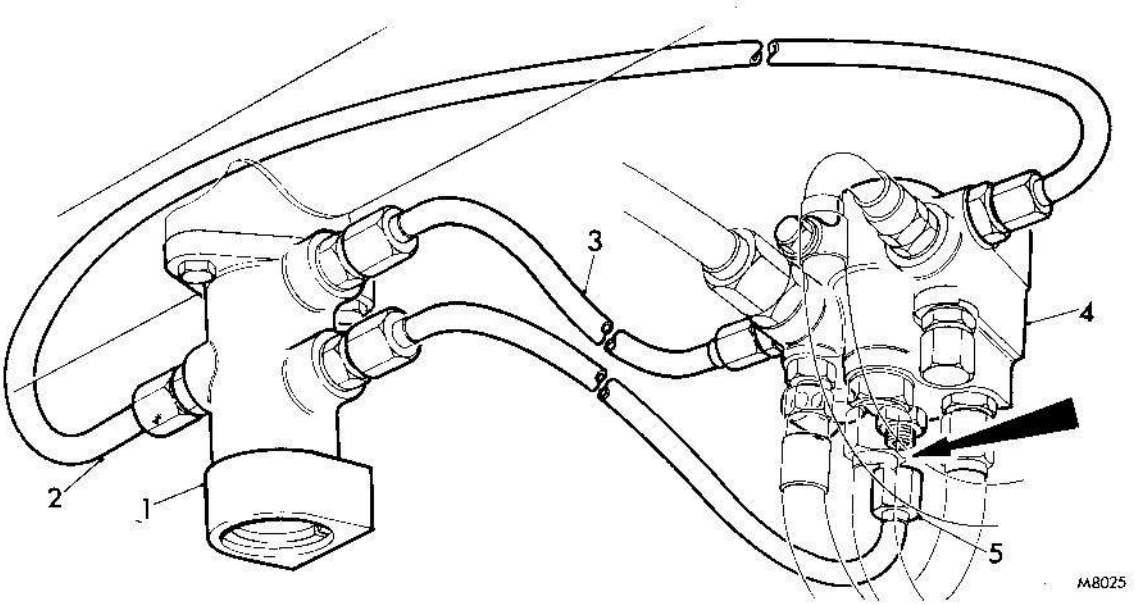


FIG. 4. THERMOSTATIC VALVE TEST POINT

1. Thermostatic valve
2. Inlet pipe
3. Drain pipe
4. Switching valve
5. Outlet pipe

To Refit

Refitment is a reversal of the removal procedure observing the following points:

1. Top-up hydraulic reservoir as necessary with Shell Tellus 22 (formerly 23).
2. Top-up cooling system as described in Group 1.
3. Tighten setscrews to the torque figure quoted in Data.

OVERHAUL

Thermostatic Valve

To Dismantle

Note: Obtain the correct repair kit before dismantling valve.

1. Thoroughly clean the exterior of the valve and ensure maximum cleanliness exists during the Overhaul procedure.
2. Suitably mark position of slot on needle valve housing relative to valve body, measure and record distance from end of valve body to face of needle valve housing for correct reassembly purposes.
3. Release circlip and withdraw plug, spring and spring carrier.
4. Unscrew needle valve housing and withdraw needle from housing.
5. If the wax element capsule is not suspect this must not be detached from the valve body in order to avoid damaging the capsule also disturbing the valve setting. In the cold condition the inbuilt pin must be flush with the end-face of the capsule.
6. Extreme care must be taken if the capsule has to be removed from the valve body, this can best be achieved by wrapping coarse emery cloth around the major diameter of the capsule and carefully withdrawing.
7. The washer stop must not be removed from the end of the needle unless worn or damaged.

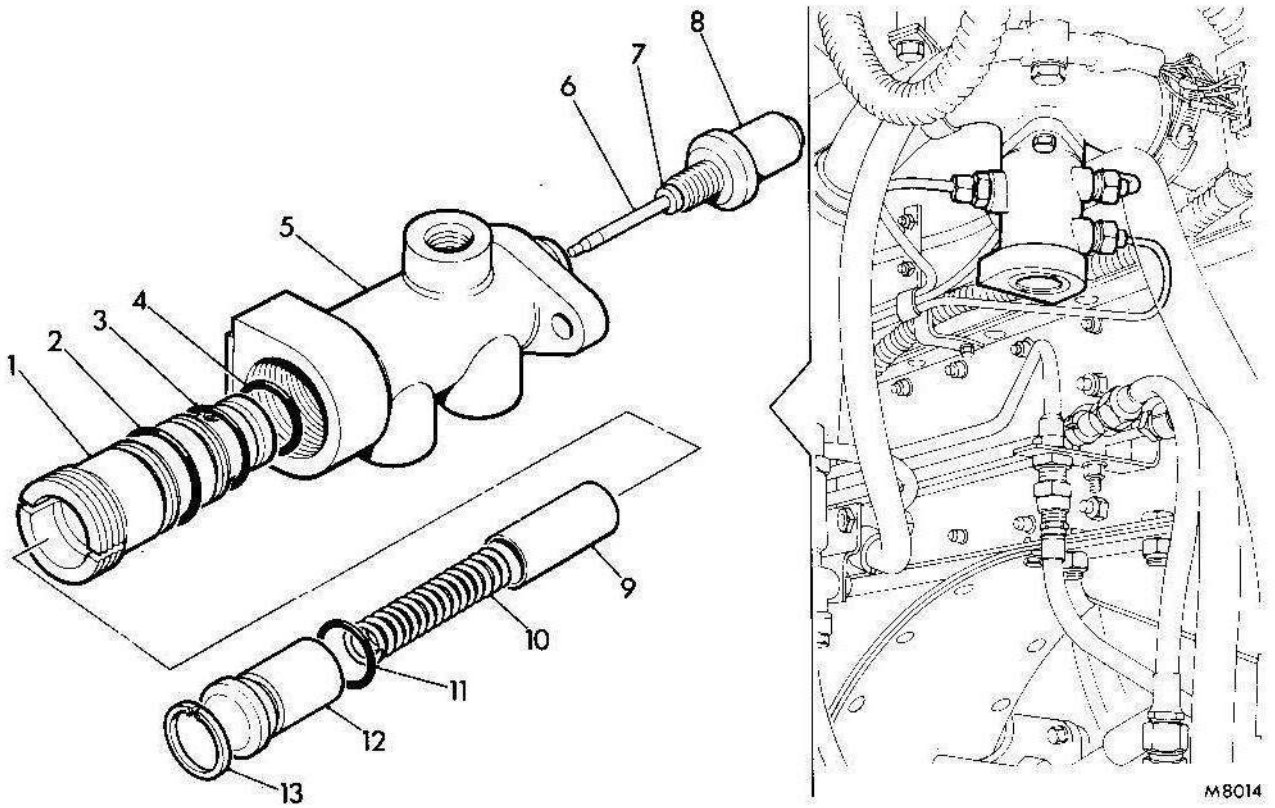


FIG. 5. EXPLODED VIEW OF THERMOSTATIC VALVE

1. Needle valve housing
2. O-ring
3. O-ring
4. O-ring
5. Valve body
6. Needle
7. Washer stop
8. Wax element capsule
9. Spring carrier
10. Spring
11. O-ring
12. Plug
13. Circlip

Inspection

1. Thoroughly clean all components in a suitable solvent and wipe dry with a lint-free cloth, discard O-rings previously removed.
2. Examine machined surfaces ensuring they are free from scoring or damage.
3. Ensure the needle is a smooth free fit in the needle valve housing, if necessary any burrs or scores may be carefully erased with a fine carborundum stone. Extreme care must be taken not to damage the 1° taper on the needle or to alter the fine clearance between the needle, orifice and housing bore. The needle and valve housing are a matched pair and are not interchangeable.
4. Check that the spring and carrier are a free fit in the plug.

To Reassemble

1. Lightly lubricate internal components and O-rings with clean hydraulic fluid, refit O-rings on plug and needle valve housing.
2. If the washer stop at the end of the needle has become detached, it must be thoroughly cleaned, degreased and reassembled using Loctite 270, similarly if the wax element capsule has been detached from the valve body, thoroughly clean and degrease threads, apply Loctite 42, screw in and obtain dimension (B), Fig. 6.

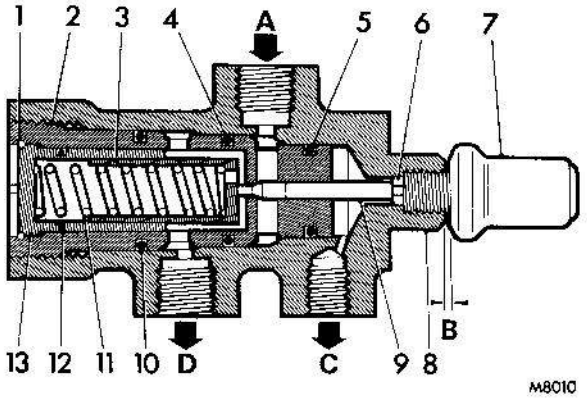


FIG. 6. SECTIONED VIEW OF THERMOSTATIC VALVE

A. Inlet port
B. 0,55 to 1,85 mm (0.02 to 0.07 in)
C. Drain port
D. Outlet port

1. Circlip
2. Needle valve housing
3. Spring carrier
4. O-ring
5. O-ring
6. Washer
7 Wax element capsule
8. Valve body
9. Needle
10. O-ring
11. Spring
12. O-ring
13. Plug

3. Fit spring and carrier to plug, locate plug in needle valve housing and secure with circlip.
4. Fit needle into needle valve housing, screw housing into valve body aligning the marks made prior to dismantling.

TESTING AND ADJUSTMENT

If the wax element capsule has not been removed from the body, or no components renewed and the needle valve housing assembled in its original position it should only be necessary to check that the valve opens and closes in response to temperature change. Should this not be the case it is necessary to calibrate the valve. The figures quoted below are with Shell Tellus 22 (formerly 23) grade mineral oil.

1. With the wax element capsule fully immersed in coolant at a temperature of 86±0.5°C (186.8±0.9°F), minimum two minutes soak, and a pressure of 98,7±2,0 kgf/cm² (1405±28 lbf/in²) between inlet and outlet ports, the flow should be less than 30 ml/min (1.0 fluid oz/min). If this condition is not apparent adjust the needle valve housing (2) in the valve body (8).

Note: The needle valve housing must be screwed into the valve body only, in the event of error, back-off housing one and a half turns and adjust as necessary.

2. With the wax element capsule fully immersed in coolant at a temperature of 86±0.5°C (186.8±0.9°F), minimum two minutes soak, and a pressure of 98,7±2,0 kgf/cm² (1405±28 lbf/in²) at the inlet port the leakage at the drain port should be 6 ml/min (0.2 fluid oz/min) maximum.

3. With the wax element capsule immersed in coolant at a temperature of 66°C (150.8°F) and a flow through the valve of 4,5±0,5 l/min (1.0±0.11 gals/min), the pressure difference between the inlet and outlet ports should not exceed 9,8 kgf/cm² (140.5 lbf/in²).

FAN DRIVE MOTOR

REMOVAL AND REFITMENT

Fan Drive Motor

To Remove

1. Isolate electrical supply.
2. Open rear off-side hinged body grille by slackening quick-release screws.
3. Remove nuts, washers and withdraw inner trim panel.
4. Place a suitable container under motor and suitably identify pipes for subsequent refitment.
5. Disconnect pipes and plug pipe ends to prevent the ingress of foreign matter.
   Note: To remove the motor only, release the socket-headed screws and withdraw from the splined fan hub. To renew the bearings it will be necessary to remove the fan cowl assembly as described in the following sequence of operations.
6. Remove self-locking nuts and bolts securing fan cowl assembly to support brackets, engage an assistant and manoeuvre unit from vehicle.
7. Remove socket-headed screws, washers and withdraw fan drive motor from fan hub.
8. Remove setscrews, washers and detach fan from fan hub.
9. Remove retaining screw, washer and carefully drift out fan hub and bearing assembly.
10. Release circlip and using withdrawal tool 18G2, withdraw bearings and spacer from fan hub. Renew bearings as necessary.

To Refit

1. Press inner bearing, spacer and outer bearing on fan hub, secure with circlip ensuring the spacer is free to move.
2. Locate fan hub assembly into fan cowl and carefully tap into position.
3. Refit retaining screw and washer ensuring the screw locates in the recess of the spacer, tighten screw to the torque figure quoted in Data.
4. Refit fan to hub, fit setscrews, washers and tighten to the torque figure quoted in Data.
5. Locate fan drive motor in fan hub splines, fit socket-headed screws, washers and tighten to the torque figure quoted in Data.
6. Engage an assistant and manoeuvre fan cowl assembly on to support brackets, fit bolts, self-locking nuts and tighten to the torque figure quoted in Data.
7. Remove pipe plugs and reconnect pipes in their original positions.
8. Refit inner trim panel and secure with nuts and washers.
9. Secure hinged body grille with quick-release screws.
10. Top-up hydraulic reservoir as necessary with Shell Tellus 22 (formerly 23).
11. Reconnect electrical supply.

SECTION 4

Throttle Control Valve

DESCRIPTION

The Westinghouse throttle control valve is a self-regulating pressure control mechanism, direct operational type. The function of the valve is to increase, decrease or maintain constant air pressure in the throttle line. The valve is constructed in two main sections, the upper assembly houses a combined inlet/exhaust valve assembly, together with an operating lever and roller. The lower section houses the diaphragm and spring assembly.

OPERATION FIG. 2

When force is applied on to the operating lever, the inlet/exhaust valve assembly is proportionally moved downwards. This movement seats the exhaust valve and unseats the inlet valve against the pressure of the spring, which in turn allows pressure to flow to the control line and the chamber above the diaphragm. The control line pressure which is present on the top of the diaphragm is balanced by the diaphragm spring, resulting in diaphragm movement proportional to control line pressure. The downward movement of the diaphragm carries with it the exhaust valve seat and due to the effort of the inlet valve spring results in movement of the exhaust and inlet ball. This movement allows the inlet ball to seat which retains control line pressure at a figure proportional to downward movement.

When the force is removed from the operating lever, the control line pressure decreases and the inlet/exhaust valve assembly moves an amount dependent upon the operating lever movement. The upward movement of the valve assembly lifts the exhaust ball off its seat while the inlet ball remains seated due to the pressure of the inlet spring. The excess control line pressure is vented through the opening in the diaphragm chamber which causes the diaphragm to rise, achieving a new balanced position, corresponding to the reduced control line pressure. The upward movement of the diaphragm continues until the exhaust valve seat closes against the exhaust ball and cuts off any further control line venting. The control line pressure is proportional to the movement of the diaphragm and valve assembly which in turn is proportional to the degree of operating lever movement. The throttle control valve automatically compensates for leakage or pressure changes due to temperature variation.

If the control line pressure decreases, the diaphragm spring forces the diaphragm and exhaust valve seat upwards. This resultant movement opens the inlet ball valve and restores the control line pressure to the required figure. If the control line pressure increases, the diaphragm and exhaust valve seat moves away from the exhaust ball and vents the control line pressure to atmosphere through the opening in the diaphragm spring chamber, which in turn restores the correct control line pressure.

REMOVAL AND REFITMENT

Throttle Control Valve

To Remove

1. Place the vehicle over an inspection pit.
2. Isolate electrical supply.
3. Deplete air system by removing drain plug from the reservoir, refit and secure plug after draining.
4. Release screws and allow off-side headlamp cluster panel to be moved clear, gaining access to valve.
5. Suitably identify pipes for subsequent refitment.
6. Disconnect pipes and plug pipe ends to prevent the ingress of foreign matter.
7. Remove nuts, washers, bolts and withdraw valve from mounting bracket.

To Refit

1. Refit valve to mounting bracket, tighten nuts to a torque figure of 5,5 to 6,3 kgf m (40.0 to 46 lbf ft).
2. Remove pipe plugs and reconnect pipes in their original positions.
3. Slacken nuts (9) which will allow the bracket (4) to move freely for adjustment purposes.
4. Depress throttle pedal (1) until it is 15 mm (0.59 in) below the face of the brake pedal, with the pedal held in this position ensure the lower face of bracket (4) makes light contact with valve roller (5) without operating the throttle. Tighten nuts (9) to a torque figure of 2,3 to 3,1 kgf m (17.0 to 22.8 lbf ft).

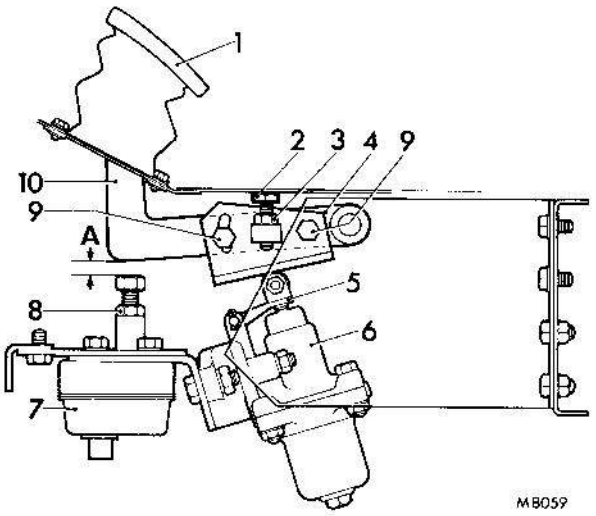


FIG. 1. THROTTLE PEDAL SETTING DIAGRAM

A. 10 mm (0.393 in)

1. Throttle pedal
2. Rubber buffer
3. Locknut
4. Bracket
5. Throttle valve roller
6. Throttle valve
7. Performance level switch
8. Locknut
9. Adjusting nuts
10. Pedal assembly

5. With the pedal retained in position, adjust rubber buffer (2) until it contacts the underside of the floor plate, screw buffer (2) down one full turn and secure locknut (3).
6. Unscrew locknut (8) and obtain dimension (A), Fig. 1 between setscrew head on performance level switch (7) and pedal assembly (10), tighten locknut (8).
7. In order to fully depress the performance level switch (7) the total pedal travel should be approximately 25 mm (0.98 in).
8. Refit and secure off-side headlamp cluster panel.
9. Reconnect electrical supply, run engine, charge system and check throttle valve for operation and leakage, rectify as necessary.

4. Separate spring housing (3) from valve body (9) and withdraw control spring (24), control spring seat (25), diaphragm assembly (6) and exhaust valve spring (20).
5. Remove dust protector (14) and withdraw inlet/exhaust valve assembly (19).
6. Remove O-rings (16, 18) from inlet/exhaust valve assembly (19).
   Note: Do not dismantle inlet/exhaust valve assembly (19).
7. Remove nut (23) and release diaphragm follower (5), diaphragm (6) from exhaust valve seat (22), discard O-ring (4).
8. Release circlip (11), withdraw pin (13) and needle roller bearing (12).

Inspection

1. Thoroughly clean all components in a suitable solvent and blow dry with compressed air.
2. Examine diaphragm for cracks, damage to joint beads or deterioration, renew as necessary.
3. Check valve body and spring housing for cracks or damage.
4. Examine machined surfaces, ensure they are free from scores or damage.
5. Check needle roller bearing, renew as necessary.

OVERHAUL

Throttle Control Valve

To Dismantle

Note: Obtain the correct repair kit before dismantling valve.

1. Suitably mark valve body (9) and spring housing (3) for reassembly purposes.
2. Release locknut (26) and slacken adjusting screw (1).
3. Remove nuts and washers evenly because of the tension of the control spring (24).

To Reassemble

Reassembly is a reversal of the dismantling procedure, observing the following points:

1. Smear all sliding surfaces with Shell Alvania R.2 grade grease.
2. Lubricate needle roller bearing with Rocol BRB.1200 grade grease.
3. Ensure the diaphragm is fitted dry and free from lubricant but service life will be extended if the diaphragm is lightly dusted with French chalk.

ADJUSTMENT

1. Fully wind back adjusting screw (1).
2. Apply air pressure of approximately 5,6 kgf/cm² (80 lbf/in²) to the valve inlet.
3. Connect a suitable pressure gauge at the valve outlet.
4. Rotate adjusting screw (1) until a pressure of 0,35 kgf/cm² (5 lbf/in²) registers on the gauge. Secure locknut (26).

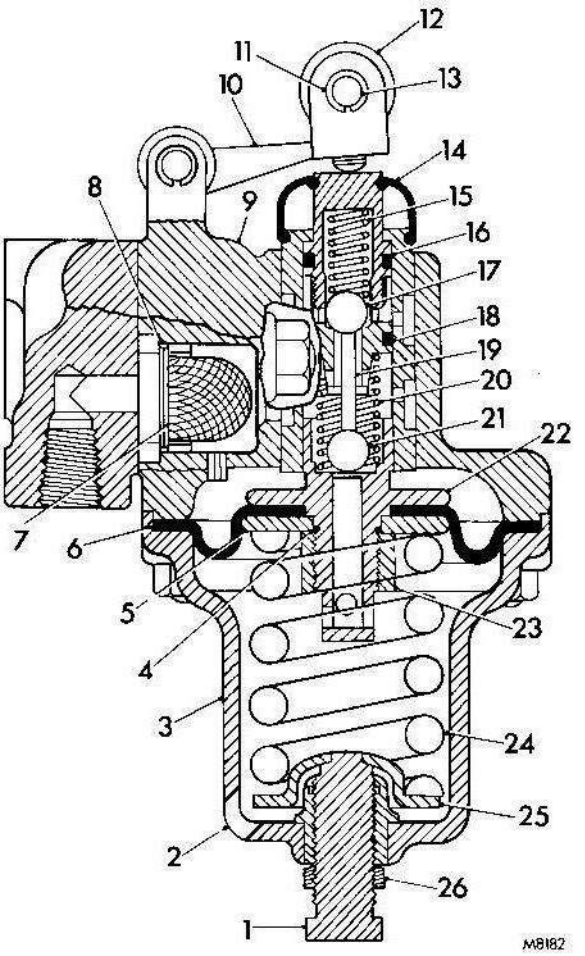


FIG. 2. SECTIONED VIEW OF THROTTLE CONTROL VALVE

1. Adjusting screw
2. Exhaust vent
3. Spring housing
4. O-ring
5. Diaphragm follower
6. Diaphragm
7. Strainer
8. Port gasket
9. Valve body
10. Operating lever
11. Circlip
12. Needle roller bearing
13. Pin
14. Dust protector
15. Inlet valve spring
16. O-ring
17. Inlet valve ball
18. O-ring
19. Inlet/exhaust valve assembly
20. Exhaust valve spring
21. Exhaust valve ball
22. Exhaust valve seat
23. Nut
24. Control spring
25. Control spring seat
26. Locknut

SECTION 4A

Throttle Actuator

DESCRIPTION

The Westinghouse throttle actuator is connected to the fuel pump lever and consists of an air operated diaphragm cylinder. Air pressure is proportionally supplied by the throttle control valve and the resultant movement is balanced by the action of a return spring. The actuator provides a nominal travel of 50,8 mm (2.0 in.) in the positioning quadrant with an approximate force rating of 1,4 kgf/cm² (20 lbf/in²) acting on the end of the operating lever. All pivot points are fitted with needle roller bearings to minimize friction, lubricators are provided for individual bearing lubrication.

REMOVAL AND REFITMENT

Throttle Actuator

To Remove

1. Isolate electrical supply.
2. Deplete air system by removing drain plug from the reservoir, refit and secure plug after draining.
3. Open rear engine access panel.
4. Disconnect air pipe.
5. Remove nut, washer and disconnect fuel pump control rod from actuator.
6. Remove nuts, washers, bolts and withdraw actuator from mounting bracket.

To Refit

Refitment is a reversal of the removal procedure observing the following points:

1. Tighten securing nuts to a torque figure of 8,2 to 11,0 kgf m (60.0 to 80 lbf ft).
2. Ensure the fuel pump lever attains nominal idling and maximum governed speed positions, rectify as necessary, see Adjustment, Reference 2–4A–3.

OVERHAUL

Throttle Actuator

To Dismantle

Note: Obtain the correct repair kit before dismantling valve

1. Suitably mark the diaphragm cover (6) and actuator body (8) for reassembly purposes. **WARNING:** Remove nuts, and bolts evenly because of the tension of the control spring (4), withdraw diaphragm cover (6) together with diaphragm (5).
2. Release locknut (16) and unscrew actuator rod (15) gaining access to grub screw (14).
3. Remove grub screw (14) and spring pins (21).
4. Extract bearing race (22) and withdraw push rod/spring seat (7) from the open end of the actuator body.
5. Remove control spring (4) and shim(s) (9).
6. Using a suitable soft metal drift on the smaller diameter end of the fulcrum pin (19), drive out the fulcrum pin (19) from the adaptor bar (1), retain nylon washers (18) which will be dislodged in the process.
7. Withdraw needle roller bearings (20) from the lever arm (17).

Note: Do not unscrew locknut (11) or rotate adjusting stop (12) as this will disturb the valve setting, refer to Adjustment Reference 2–4A–3.

Inspection

1. Thoroughly clean all components in a suitable solvent and blow dry with compressed air.
2. Examine diaphragm for cracks, damage to joint beads or deterioration, renew as necessary.
3. Check cover and body for cracks or damage.
4. Examine machined surfaces ensure they are free from scores or damage.
5. Check needle roller bearings, renew as necessary.

To Reassemble

Reassembly is a reversal of the dismantling procedure observing the following points:

1. Smear all sliding surfaces with Shell Alvania R2 grade grease.
2. Lubricate roller bearings with Rocol BRB1200 grade grease and refit ensuring the lubrication holes in the bearing shells align with the grease passages in the lever arm casting.
3. Ensure the diaphragm is fitted dry and free from lubricant but service life will be extended if the diaphragm is lightly dusted with French chalk.

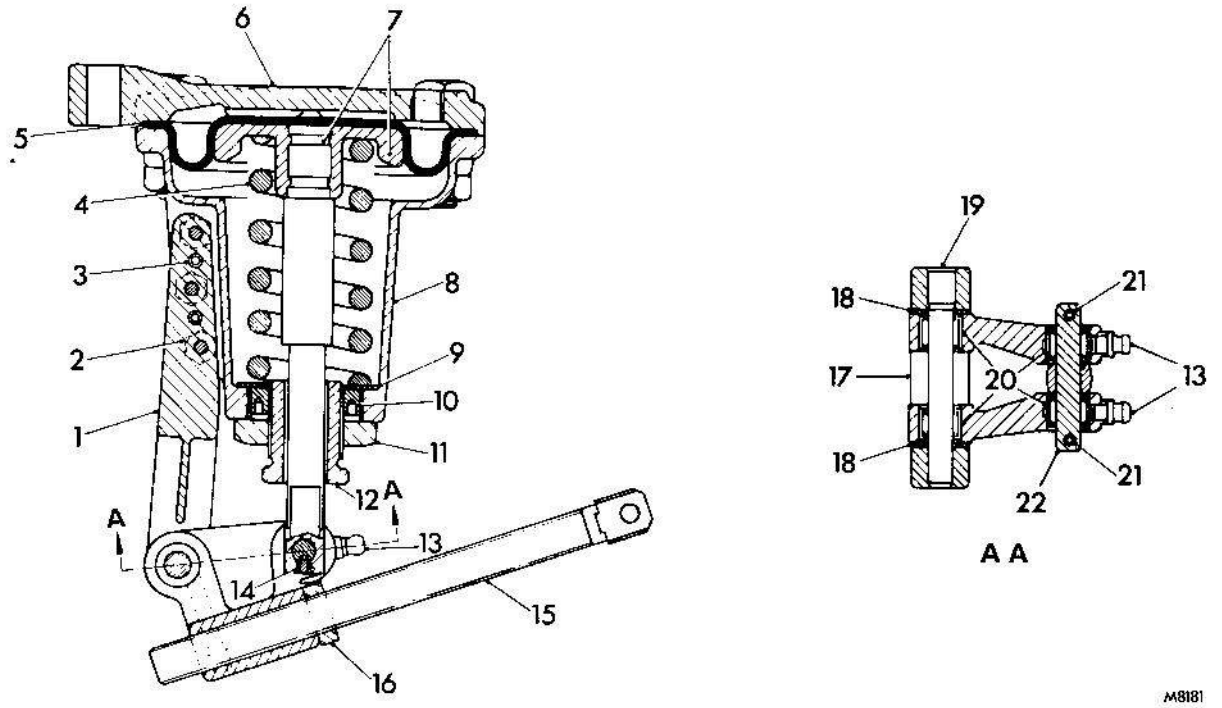


FIG. 1. SECTIONED VIEW OF THROTTLE ACTUATOR

1. Adaptor bar
2. Bolt
3. Spring pin
4. Control spring
5. Diaphragm
6. Diaphragm cover
7. Push rod/spring seat
8. Actuator body
9. Shim(s)
10. Adjustable spring seat
11. Locknut
12. Adjusting stop
13. Lubricator
14. Grub screw
15. Actuator rod
16. Locknut
17. Lever arm
18. Nylon washer
19. Fulcrum pin
20. Needle roller bearing
21. Spring pin
22. Bearing race

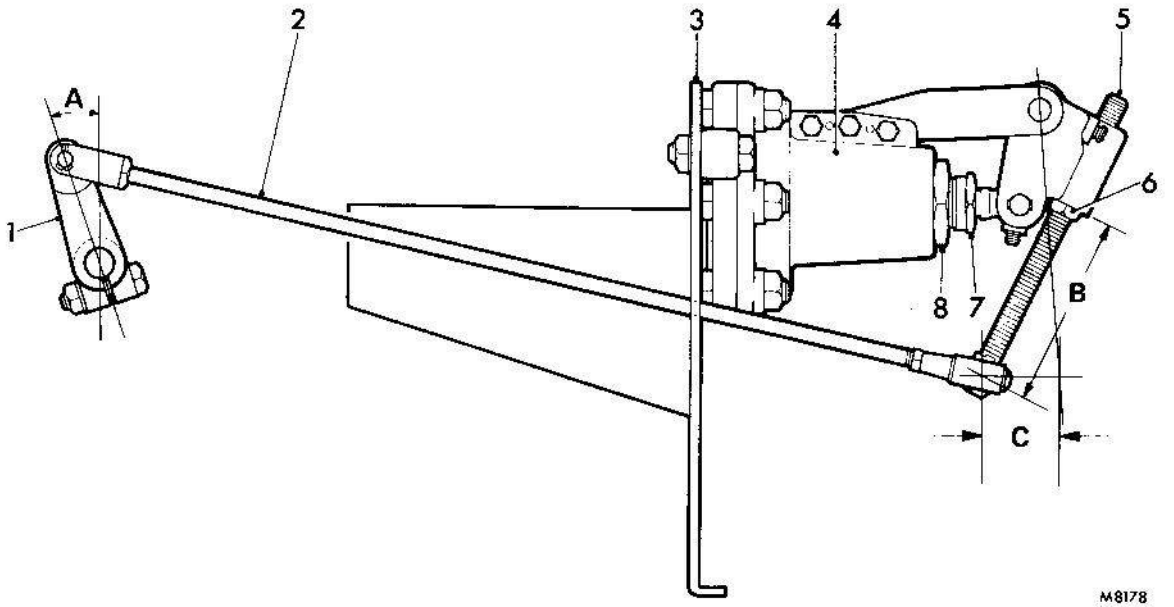


FIG. 2. THROTTLE ACTUATOR SETTING DIAGRAM

A. 19°
B. 140 mm (5.51 in)
C. Nominal travel 50,8 mm (2.0 in)
1. Fuel pump lever
2. Fuel pump control rod
3. Mounting bracket
4. Throttle actuator
5. Actuator rod
6. Locknut
7. Adjusting stop
8. Locknut

ADJUSTMENT

1. Release locknut (6) and set actuator rod (5) to the dimension (B) shown in Fig. 2, tighten locknut (6).
2. Position the fuel pump lever (1) against the idling stop, i.e. anti-clockwise direction, ensuring the lever is set at the angle shown in Fig. 2, adjust as necessary.
3. Reconnect the fuel pump control rod (2) ensuring the above settings are maintained.
4. Run engine and recharge air system, stop engine.
5. Release locknut (8) and unscrew adjusting stop (7).
6. Engage an assistant to depress the throttle pedal until the fuel pump lever (1) contacts the throttle stop, i.e. maximum governed speed position.
7. Rotate adjusting stop (7) until light contact is felt within the actuator.
8. Unscrew adjusting stop (7) out two flats, 120°, secure locknut (8).
9. Check actuator for operation and leakage, rectify as necessary.

SECTION 5

Hydraulic Pumps

REMOVAL AND REFITMENT

Power Steering/Fan Drive Pump

To Remove

1. Isolate electrical supply.
2. Open rear engine access panel.
3. Place a suitable container beneath pump to collect hydraulic fluid.
4. Release pipe clips, disconnect inlet and outlet pipes from pumps and relief valve spill pipe from hydraulic brake pump, plug pipe ends to prevent the ingress of foreign matter.
5. Release cradle securing nut and withdraw cradle bracket and pumps from splined drive shaft, ensure O-ring in the outer drive flange is retained in position.
6. Remove setscrews, washers and withdraw power steering/fan drive pump from cradle bracket, retain locating ring and coupling sleeve which will be dislodged in the process.

To Refit

1. Locate coupling sleeve on pump coupling gear.
2. Refit locating ring and pump, align coupling sleeve with coupling gear of hydraulic brake pump.
3. Secure power steering/fan drive pump to cradle bracket with setscrews and washers.
4. Refit cradle bracket and pumps through clamp strap, engage pump drive with splined shaft, avoid damage to O-ring in outer flange.

Note: Socket-headed screws (12) must be located against the crankcase web, this ensures that the pumps are in the correct position for refitment of the pipes. Obtain a drive shaft end-float at each end of the shaft, see (A), Fig. 1 for dimension.

5. Tighten cradle securing nut, ensure collar is correctly positioned against clamp strap pin.
6. Inject grease through the drive shaft lubricators using a suitable grease gun.
7. Remove plugs and reconnect pipes in their original positions, fit and secure pipe clips.
8. Reconnect electrical supply and top-up hydraulic fluid level as necessary.
9. Close rear engine access panel.

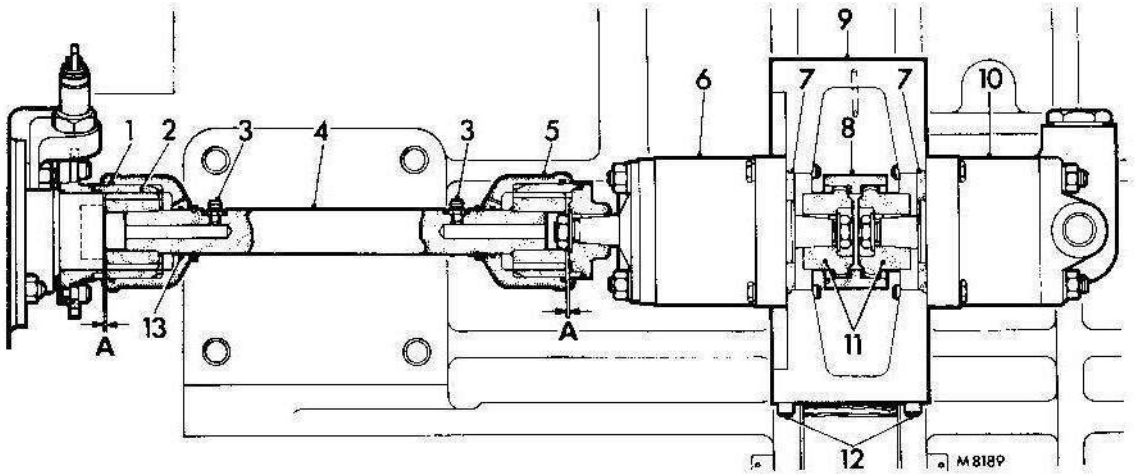


FIG. 1. GENERAL VIEW OF HYDRAULIC PUMPS

A. 1,58 mm (0.062 in)
1. O-ring
2. Pump drive coupling
3. Lubricator
4. Drive shaft
5. Outer flange
6. Power steering/fan drive pump
7. Locating ring
8. Coupling sleeve
9. Pump cradle bracket
10. Brake pump
11. Pump coupling gear
12. Socket-headed screw
13. O-ring

Hydraulic Brake Pump

To Remove

1. Isolate electrical supply.
2. Open rear engine access panel.
3. Place a suitable container beneath pump to collect hydraulic fluid.
4. Release pipe clips and disconnect inlet and outlet pipes together with relief valve spill pipe, plug pipe ends to prevent the ingress of foreign matter.
5. Remove setscrews, washers and withdraw pump from cradle bracket, retain locating ring and coupling sleeve which will be dislodged in the process.

To Refit

1. Locate coupling sleeve on pump coupling gear.
2. Refit locating ring and pump, align coupling sleeve with coupling gear of power steering/fan drive pump.
3. Secure brake pump to cradle bracket with setscrews and washers.
4. Remove plugs and reconnect pipes in their original positions, refit and secure pipe clips.
5. Top-up hydraulic fluid level as necessary.
6. Reconnect electrical supply, run engine and charge system.
7. Bleed the brakes, see Group 7.
8. Close rear engine access panel.

SECTION 6

Air Compressor

DATA

Type	Westinghouse TU FLO 500 water cooled
Bore	63,5 mm (2.5 in)
Stroke	42,9 mm (1.69 in)
Swept volume	0.538m³(19 ft³) per min at 2000 r.p.m.
Number of cylinders	2
Valves	Spring loaded disc type
Weight	21 kg (46 lb) approx
Maximum recommended speed	3000 r.p.m. at which swept volume is 0.79m³ (28 ft³) per min
Piston ring clearance in ring groove width	0,038 to 0,066 mm (0.0015 to 0.003 in)
Piston ring gap in cylinder bore	0,127 to 0,381 mm (0.005 to 0.015 in)
Piston diameter clearance (minimum	0,05 mm (0.002 in)
in cylinder bore (maximum	0,10 mm (0.004 in)
Maximum ovality of cylinder bores	0,127 mm (0.005 in)
Maximum gudgeon pin clearance in small end bush	0,038 mm (0.0015 in)
Clearance between big end (maximum	0,05 mm (0.002 in)
bearing and crankshaft journal (minimum	0,10 mm (0.004 in)

Torque Tightening Figures

Cylinder head bolts	2,07 to 3,34 kgf m	(15 to 17 lbf ft)
Crank case to cylinder block bolts	3,72 to 4,14 kgf m	(27 to 30 lbf ft)
End-cover bolts, $\frac{1}{4}$ in dia	0,69 to 0,96 kgf m	(5 to 7 lbf ft)
End-cover bolts, $\frac{5}{16}$ in dia	1,65 to 1,93 kgf m	(12 to 14 lbf ft)

DESCRIPTION

The Westinghouse TU-FLO 500 compressor is a twin cylinder water cooled type and is belt driven from the engine crankshaft pulley. The cylinder head is provided with three water outlet connections, similarly there are three water inlet connections in the cylinder block, the connections not in use are fitted with blanking plugs. The compressor is lubricated by an oil feed pipe from the engine through a passage in the end cover, oil is then fed to the big-end bearing and connecting rods through drillings in the crankshaft. Lubrication of the cylinder bores, pistons and gudgeon pins is by splash feed provided by the reciprocating motion of the crankshaft. The compressor runs continuously with the engine, but actual compression of air is controlled by an integral unloader mechanism which allows the compressor to 'run light' when the system is fully charged.

FAULT DIAGNOSIS

Insufficient Air Pressure

1. Air filter contaminated.
2. Excessive carbon in cylinder head or delivery line.
3. Broken or leaking discharge valves.
4. Excessive wear.
5. Inlet valves stuck open or damaged.
6. Drive belt slipping.
7. Excessive leakage in system.

Noisy Operation

1. Loose drive pulley.
2. Excessive carbon in cylinder head or delivery line.
3. Worn or damaged bearings.
4. Worn drive coupling.
5. Inadequate lubrication.
6. Excessive wear.

Compressor Discharges Excessive Oil

1. Excessive wear.
2. Air filter contaminated.
3. High inlet vacuum.
4. Excessive oil pressure.
5. Oil supply line flooded.
6. Leakage or damaged end cover oil seals.
7. Piston rings incorrectly installed.
8. Back pressure from engine.

Compressor not Unloading

1. Defective unloader pistons or bores.
2. Intake cavity restricted.
3. Unloader mechanism binding or stuck.
4. Defective unloader valve.
5. Air line to unloader valve restricted.

REMOVAL AND REFITMENT

Air Compressor

To Remove

1. Isolate electrical supply.
2. Open rear engine access panel and near-side panel.
3. Remove rear seat in lower saloon and open access panel in rear bulkhead.
4. Deplete air system by removing drain plug from the reservoir, refit and secure plug after draining.

Note: If the cooling system contains an anti-freeze solution it should be drained into clean containers for subsequent re-use. The drain tap is situated in the lower water pipe connected to the gearbox oil cooler.

5. Open drain tap and partially drain coolant until the level is below the compressor, close tap after draining.
6. Slacken locknut on adjusting bolt and remove drive belt.
7. Remove water supply pipe from compressor to water pump.
8. Remove setscrews, washers and disconnect the flanged air intake pipe, discard joint.
9. Disconnect water drain pipe, oil feed and air delivery pipes.
10. Remove nuts and withdraw compressor, discard joint.

To Refit

1. Clean mounting faces of compressor and engine, fit a new joint.
2. Locate compressor on studs, fit nuts and secure.
3. Reconnect oil feed and water drain pipes.
4. Fit a new joint, locate flanged air intake pipe and secure with setscrews and washers.
5. Reconnect air delivery and water supply pipes.
6. Refit and adjust drive belt tension as described in Group 1.
7. Top-up cooling system as described in Group 1 and reconnect electrical supply.
8. Run engine and charge system, check for air or water leaks, rectify as necessary.
9. Close side and rear engine access panels also panel in lower saloon, refit rear seat.

GROUP 4
TRANSMISSION

Reference

SECTION 1 — PROPELLER SHAFT
- Removal and Refitment 4–1–1
- Fault Diagnosis 4–1–1
- Overhaul 4–1–3

SECTION 2 — HYDRACYCLIC GEARBOX WITH ANGLE DRIVE
- Data 4–2–1
- Description 4–2–2
- Brake Band Adjustment 4–2–5
- Fault Diagnosis 4–2–6
- Removal and Refitment 4–2–7
- Overhaul 4–2–9

SECTION 3 — ELECTRO-HYDRAULIC VALVE BLOCK
- Description 4–3–1
- Testing 4–3–5

SECTION 1

Propeller Shaft

REMOVAL AND REFITMENT

To Remove

1. Chock the front road wheels.
2. Jack rear axle until one set of road wheels are free to rotate. Suitably support the rear axle.
3. Open rear RH side access door.
4. Release rubber gaiter at angle drive.
5. Remove top half of shield at the torque box to gain access to the coupling flange retaining nuts and bolts.
6. Disconnect propeller shaft at angle drive coupling flange.
7. Reference mark yoke coupling bearing caps and end caps in relation to the rear axle coupling yoke.
8. Release lockplates and remove setscrews, lockplates and end caps.
9. Remove bolts and separate bearing caps from the yoke coupling. Use rubber bands to retain needle roller bearing assemblies in position.
10. Remove exhaust tail pipe and silencer box.
11. Lift and manoeuvre the propeller shaft over the rear axle until the coupling flange is clear of the torque box.
12. Withdraw the propeller shaft rearwards and clear of the vehicle.

To Refit

1. Manoeuvre propeller shaft into position.
2. Refit coupling yoke bearing caps ensuring reference marks are aligned. Refit retaining bolts and tighten securely.
3. Refit end caps, lockplates and secure with setscrews.
4. Refit exhaust tail pipe and silencer box.
5. Reconnect coupling flange.
6. Reconnect rubber gaiter.
7. Jack up vehicle, remove supports and lower vehicle to ground.

FAULT DIAGNOSIS

If there is excessive noise or vibration from the transmission examine the propeller shaft for:

1. Misalignment or out of balance due to faulty assembly on the vehicle.
2. Worn needle roller bearings.
3. Loose companion flange bolts.
4. Lack of lubrication.
5. Bent propeller shaft tube as a result of accident damage.
6. Companion flange bolts varying in length.

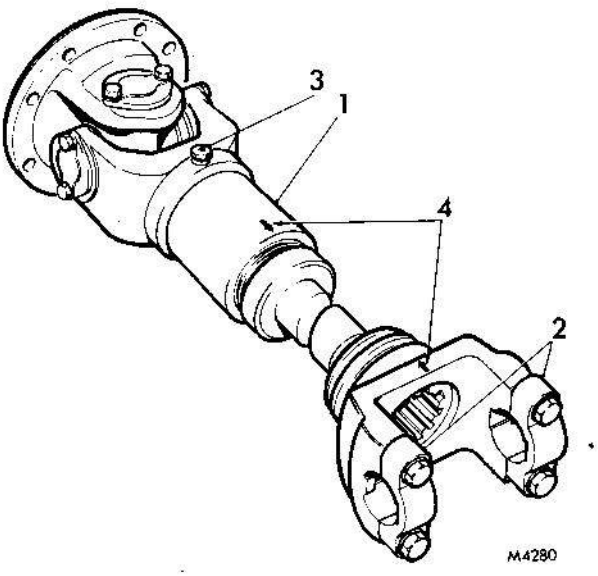


FIG.1 PROPELLER SHAFT WITH YOKE COUPLING

1. Slip stub shaft
2. Sleeve yoke
3. Spline lubricator
4. Alignment marks