

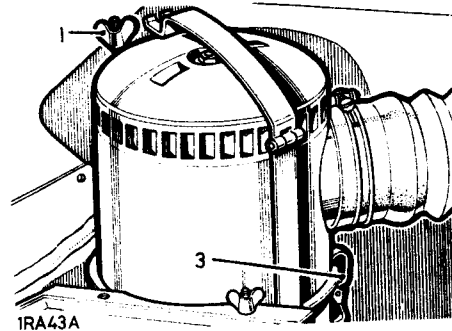
### (20) Air cleaner—all Models

Attention to the air cleaner is extremely important, especially under dusty conditions, as engine wear generally will be seriously affected if the vehicle is run with an excessive amount of sludge in the cleaner oil bath.

In cases where the vehicle is operated under dusty road or field conditions, attention must be more frequent, even to the extent of a daily oil change; under extremely bad conditions, cleaning twice daily may be called for.

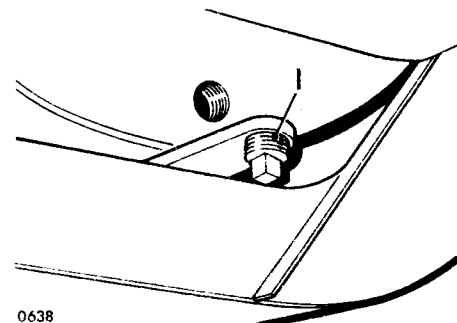
Proceed as follows:

- 1 Slacken wing nut and release the clamping strap securing the complete air cleaner.
- 2 Disconnect the outlet elbow from the carburettor intake pipe and remove the cleaner from the vehicle.
- 3 Remove the oil bowl from the bottom of the cleaner by releasing the three securing clips.
- 4 Clean all dirty oil and sludge from the bowl and refill with fresh engine oil to the level indicated by a ring formed in the pressing; the capacity is approximately 0,85 litre (1.5 Imperial pints).
- 5 Clean the filter in the cleaner body by swilling the complete body in petrol or paraffin and shake off the surplus.
- 6 Replace the bowl and refit the complete unit in the vehicle.



### (21) Flywheel housing drain plug

- 1 The flywheel housing can be completely sealed to exclude mud and water under severe wading conditions, by means of a plug fitted in the bottom of the housing.
- 2 The plug is screwed into a hole adjacent to the drain hole and should only be fitted when the vehicle is expected to do wading or very muddy work.
- 3 When the plug is in use it must be removed periodically and all oil allowed to drain off before the plug is replaced.



### (22) Check injectors for burst pressure, and spray

**NOTE:** Absolute cleanliness is essential when handling any component of the fuel injection system.

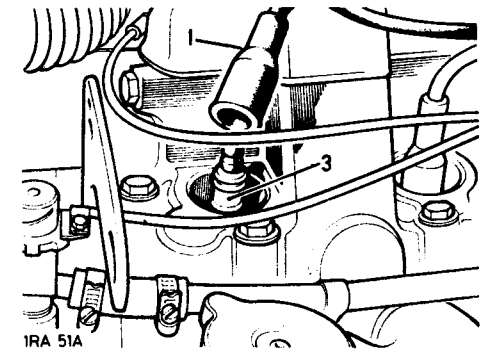
The use of a test pump is essential when servicing injectors; it is recommended therefore, that servicing of injectors is carried out by a Rover Distributor or Dealer or CAV Agent. **WARNING:** Great care should be taken to prevent the hands getting into contact with the spray, as the working pressure will cause the fuel to penetrate the skin with ease.

## IGNITION

### (23) & (24) Sparking plugs—Petrol models

- 1 The sparking plugs are fitted with plastic covers.
- 2 To gain access to the plugs for cleaning and gap-setting, pull up the plug covers without detaching them from the high tension leads.
- 3 Check or replace the sparking plugs as applicable. If the plugs are in good condition, they should be cleaned, preferably using an approved spark plug cleaning machine.
- 4 Test the plugs in accordance with the plug cleaning machine manufacturer's recommendations.
- 5 If satisfactory set the electrode gap to 0,75 to 0,80 mm (0.029 to 0.032 in.) and replace.

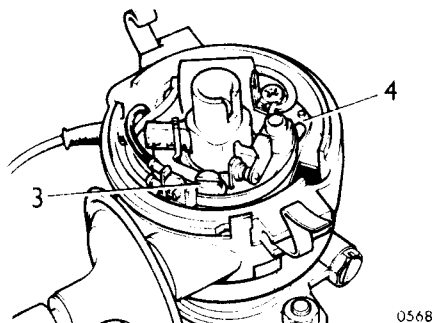
It is important that only the recommended sparking plugs are used for replacements:  
4-cylinder models 8,0:1, use Champion UN12Y  
4-cylinder models 7,0:1 (optional), use Champion N8  
6-cylinder models, use Champion N5



**(25) Distributor contact points**

Check and adjust the contact points clearance as follows. (4-cylinder distributor illustrated).

- 1 Remove the distributor cap and rotor arm; then turn the engine, using the starting handle, until the contacts are fully open.
- 2 The clearance should be 0,35 to 0,40 mm (0.014 to 0.016 in.) with the feeler gauge a sliding fit between the contacts.
- 3 If necessary, slacken the screw which secures the adjustable contact.
- 4 Adjust by the adjuster slot until the clearance is correct; re-tighten the retaining screw.
- 5 Replace the rotor arm and distributor cap.

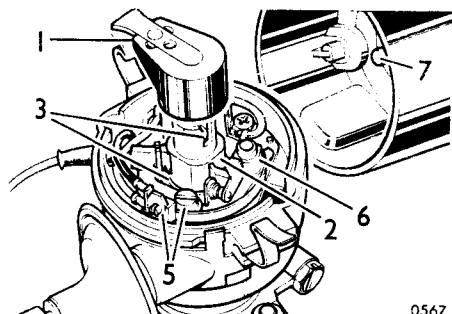


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**(26) Distributor maintenance**

Lubricate as follows:

- 1 Remove the distributor cap and rotor arm.
- 2 Lightly smear the cam with clean engine oil.
- 3 Add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft.
- 4 Add a few drops of thin machine oil through the side of the contact breaker base plate, to lubricate the automatic timing control.
- 5 Removing the plastic clip (4-cylinder models) or the nut (6-cylinder models) on the terminal block and lift off the spring and moving contact, also remove adjustable contact secured with a screw. Ensure that the contacts are free from grease or oil; if they are burned or blackened, clean with a fine carborundum stone and wipe with a petrol-moistened cloth.
- 6 Add a smear of grease to contact pivot before replacing the contacts. Then adjust as detailed in previous operation.
- 7 Wipe the inside and outside of the cap with a soft dry cloth; ensure that the small carbon brush works freely in its holder.
- 8 Replace rotor arm and distributor cap.



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**High tension leads**

- 1 A careful examination should be carried out on all high tension leads including the coil to distributor lead.
- 2 Look for any signs of corrosion, insulation cracking or deterioration, particularly of the end contacts. Renew any faulty leads.

**(27) Ignition timing—Petrol models**

- 1 Should the distributor have been disturbed, the ignition timing must be reset as follows:
- 2 Set the contact breaker point gap to 0,35 to 0,40 mm (0.014 to 0.016 in.) with the points fully open.

**2¼ litre Petrol models**

- 3 The timing pointer represents 6° B.T.D.C., 3° B.T.D.C. and T.D.C. respectively.
- 4 Rotate the engine until the mark on the crankshaft pulley is in line with the pointer as follows:

Note that three types of timing marks are in use, either a multiple pointer with a single mark on the pulley or single pointer with a scale of marks on the pulley.

The multiple pointers represent 6° B.T.D.C., 3° B.T.D.C., T.D.C. and 6° A.T.D.C. respectively.

The scale on the pulley represents 6° B.T.D.C., 3° B.T.D.C., T.D.C., 3° A.T.D.C. and 6° A.T.D.C.

See page 86—19 for an alternative timing mark and pointer.

8.0 : 1 compression ratio

T.D.C. when using 90 octane fuel

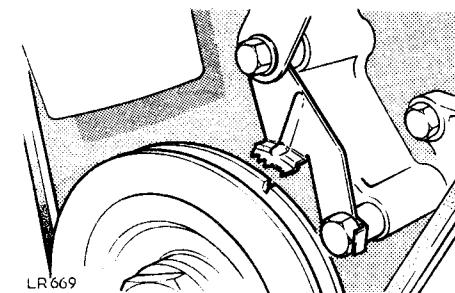
3° A.T.D.C.\* when using 85 octane fuel

7.0 : 1 compression ratio (optional)

3° B.T.D.C. when using 83 octane fuel

T.D.C. when using 75 octane fuel

\* Estimate this position on pulley on 3-point pointer.



LR669

**2.6 litre 6-cylinder models**

- 5 Rotate the engine until the appropriate mark on the crankshaft pulley is in line with the pointer as follows:

7.8 : 1 compression ratio

2° A.T.D.C. when using 90 octane fuel

7.0 : 1 compression ratio (optional)

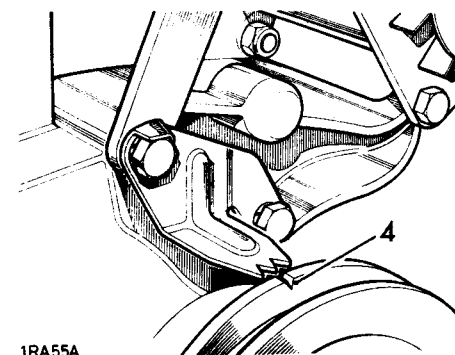
2° B.T.D.C. when using 83 octane fuel

T.D.C. when using 80 octane fuel

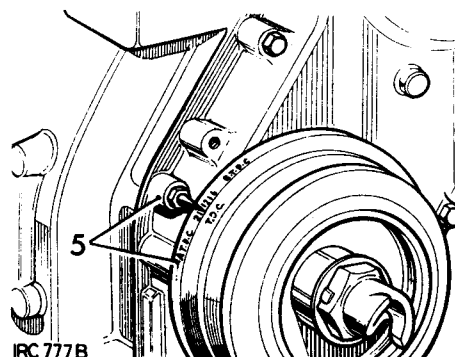
2° A.T.D.C. when using 78 octane fuel

- 6 The distributor rotor will now correspond with No. 1 cylinder high tension lead terminal.

- 7 Slacken the pinch bolt at the base of the distributor head, rotate the distributor bodily in the opposite direction to the arrow on the side of the distributor (4 cylinder models) or on the rotor arm (6-cylinder models) until the contact breaker points are just opening with the fibre cam follower on the leading side of the cam; re-tighten the pinch bolt.



1RA55A



IRC 777B

## TRANSMISSION

### (28) Check for oil leaks; rectify as necessary

#### (29) Clutch fluid reservoir

- 1 Check fluid level in reservoir by removing cap.
- 2 Top up if necessary to bottom of filler neck.

Use Castrol Girling Brake and Clutch Fluid 'Crimson' (Specification J. 1703).

If significant topping-up is required, check for leaks at master cylinder, slave cylinder and connecting pipe.

### (30) Check tightness of all propeller shaft coupling bolts

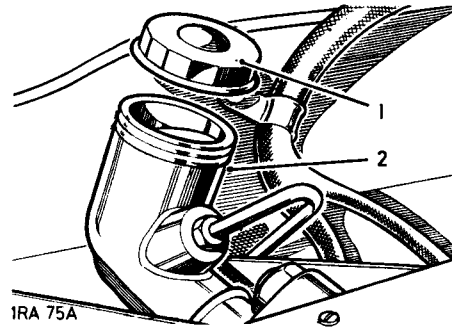
#### (31) Propeller shaft lubrication

- 1 Apply one of the recommended greases at the lubrication nipple on the sliding portion of the rear propeller shaft.
- 2 To the lubrication nipples fitted to the universal joints of both front and rear shafts.

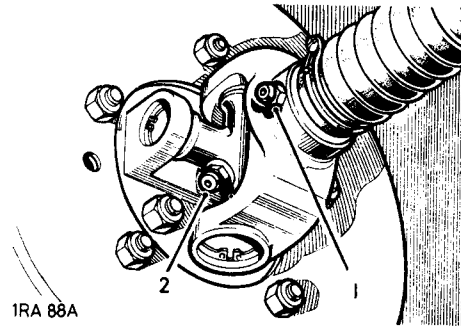
#### Front propeller shaft sliding portion

Lubricate the sliding spline on the front propeller shaft, with one of the recommended greases, as follows:

- 1 Disconnect one end of the propeller shaft.
- 2 Remove plug in sliding spline and fit a suitable grease nipple.
- 3 **Important.** Compress propeller shaft at sliding joint to avoid overfilling, then apply grease.
- 4 Replace grease nipple with plug and reconnect propeller shaft.



1RA 75A



1RA 88A

#### (32) Main gearbox oil level

Check oil level daily or weekly when operating under severe wading conditions.

- 1 The main gearbox and clutch withdrawal mechanism are lubricated as one unit. Check oil level and top up if necessary to the bottom of the filler-level plug hole.
- 2 If significant topping up is required check for oil leaks at drain and filler plugs, all joint faces and through drain hole in bell housing.

#### (33) Transfer box oil level

Check oil level daily or weekly when operating under severe wading conditions.

- 1 The transfer box and front wheel drive housing are lubricated as one unit.
- 2 Check oil level and top up if necessary to the bottom of the filler-level plug hole. The filler-level plug is in the rear face of the transfer box.
- 3 If significant topping up is required check for oil leaks at drain and filler plugs, all joint faces and through drain hole in bell housing.

#### (34) Front differential oil level

- 1 Check oil level and top up if necessary to the bottom of the filler plug hole located at the front of the axle casing. A second plug fitted at the rear of the axle casing can be disregarded.
- 2 If significant topping up is required check for oil leaks at plugs, joint faces and oil seals adjacent to axle shaft flanges and propeller shaft driving flange.

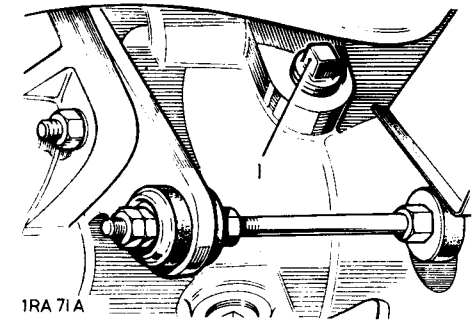
#### (35) Rear differential oil level

- 1 Check oil level and top up if necessary to the bottom of the filler plug hole.
- 2 If significant topping up is required check for oil leaks at plugs, joint faces and oil seals adjacent to axle shaft flanges and propeller shaft driving flange.

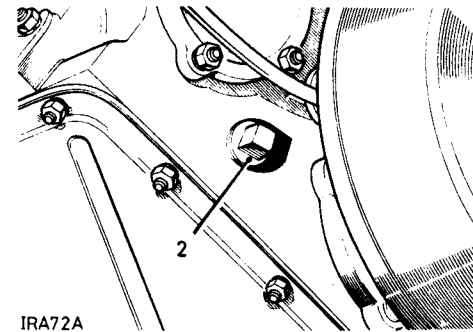
### (36) Check hydraulic clutch pipes and hoses visually for cracks, leaks and chafing

#### (37) Axle case breathers

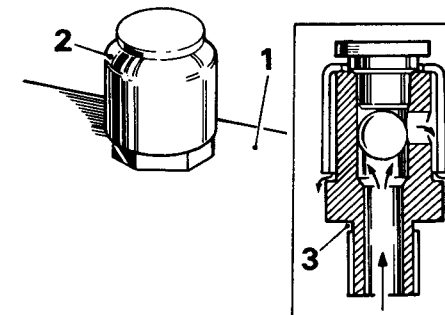
- 1 Clean exterior of breathers.
- 2 Unscrew breathers from their tapered threads in axle and wash in petrol.
- 3 Shake breather to ensure ball valve is free.
- 4 Lubricate balls with engine oil.



1RA 71A



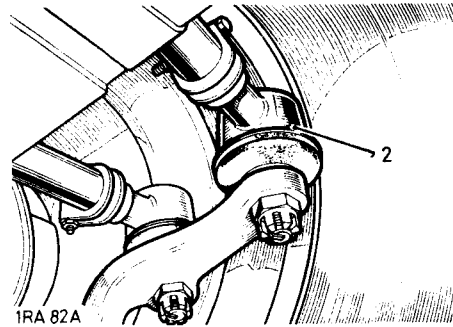
1RA 72A



1540

**STEERING AND SUSPENSION****(38) Steering ball joints**

- 1 Check rubber boots daily when operating under arduous conditions.
- 2 The steering joints have been designed to retain the initial filling of grease for the normal life of the ball joints; however, this applies only if the rubber boot remains in the correct position. Check to ensure that the rubber boots have not become dislodged or damaged, and check for wear in the joint.
- 3 This can be done by moving the ball joint vigorously up and down. Should there be any appreciable free movement the complete joint must be replaced.

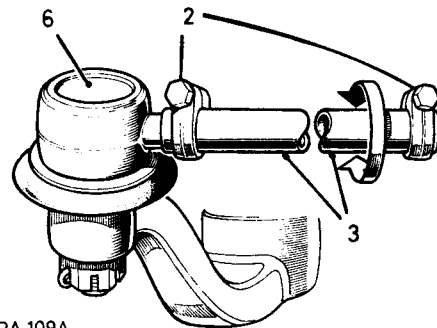
**(39) Suspension fixings—Check security of all suspension fixings, rectify as necessary****(40) Wheel alignment**

Special equipment is required to check wheel alignment and this work should be carried out by a Rover Distributor or Dealer.

For those owners who have suitable equipment, the alignment should be 1,2 to 2,4 mm (0.046 to 0.093 in.) toe-in.

**To adjust**

- 1 Set the vehicle on level ground with the road wheels in the straight ahead position and push it forward a short distance.
- 2 Slacken the clamps securing the ball joints at each end of the track rod.
- 3 Turn the track rod to decrease or increase its effective length as necessary until the toe-in is correct.
- 4 Push the vehicle rearwards turning the steering wheel from side to side to settle the ball joints, then with the road wheels in the straight ahead position, push the vehicle forward a short distance.
- 5 Recheck the toe-in, if necessary carry out further adjustment.

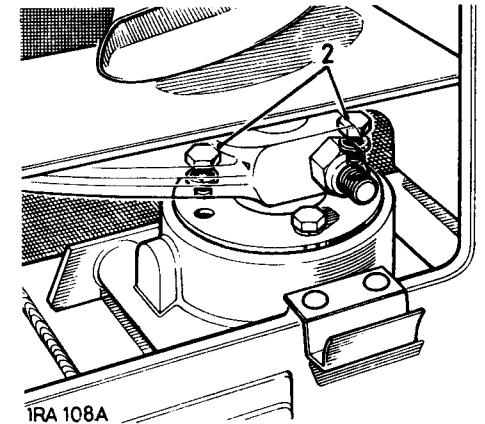
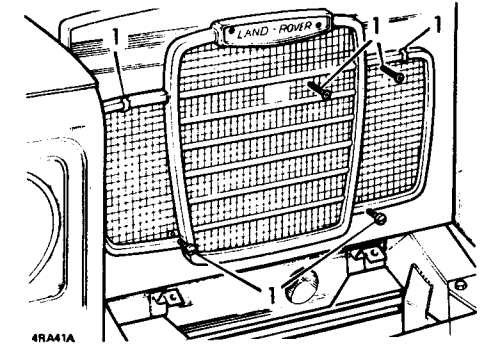


- 6 When the toe-in is correct, lightly tap the track rod ball joints towards the rear of the vehicle to the maximum of their travel. This ensures full unrestricted movement of the track rod. Then secure the ball joint clamps.

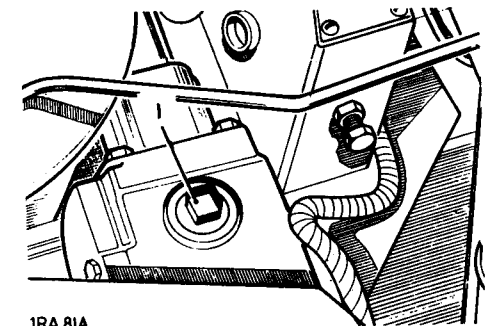
**(41) Check steering for oil leaks—investigate and rectify as necessary****(42) Check shock absorbers for leaks and rectify as necessary****(43) Steering relay unit**

Check oil level and top-up if necessary until the oil is visible at the base of the filler and breather holes. If significant topping-up is required, check joints for leakage and fit new joint washers as necessary. To check oil level and top up, proceed as follows:

- 1 Remove the fixings and withdraw radiator grille.
- 2 Remove two of the bolts securing the relay top cover.
- 3 Using one of the holes as an oil filler (the other acting as a breather hole) fill the relay unit with the correct grade of lubricating oil to the bottom of the filler hole.
- 4 Whilst filling, it is probable that oil will eject through the breather hole. If this occurs do not assume that the relay unit is full. Time must be given to allow the oil to find its way to the main chamber. Wait a few moments until the breather hole is clear of oil, then continue filling.
- 5 As the unit fills up, air is forced out usually in the form of an oil bubble, escaping through the breather hole, again giving the impression that the unit is full. Wait for the bubble to subside, then continue filling in this manner until the oil is clearly visible at the base of the filler and breather holes.
- 6 Replace the two top cover bolts. Refit the radiator grille and name plate.

**(44) Steering box oil level**

- 1 Check oil level and top up if necessary to the bottom of the filler-plug hole on the top of the cover plate. Access to the plug is gained by lifting the bonnet panel.
- 2 If significant topping up is required check for oil leaks at joint faces and rocker shaft oil seal.



#### (45) Steering box

Check steering box mountings for security and steering box for backlash. Rectify as necessary.

#### (46) Swivel pin housing oil level

- 1 The front wheel drive universal joints, swivel pins and front hubs receive their lubrication from the swivel pin housings. Check oil level and top up if necessary to the bottom of the filler-level plug holes at the rear of the housings.
- 2 If significant topping up is required check for oil leaks at plugs, joint faces and oil seals.

### BRAKES

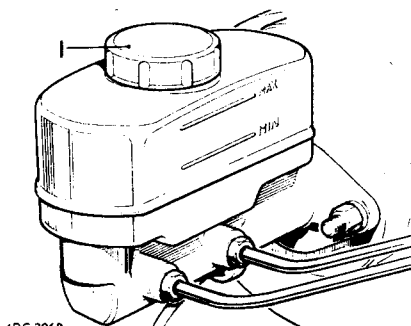
(47) Check visually hydraulic pipes and unions for chafing, leaks and corrosion—rectify as necessary

#### (48) Brake fluid reservoir

- 1 Check fluid level in brake reservoir by removing cap.
- 2 Top up if necessary to level mark on reservoir.

Use Castrol Girling Brake and Clutch Fluid 'Crimson' (Specification J. 1703).

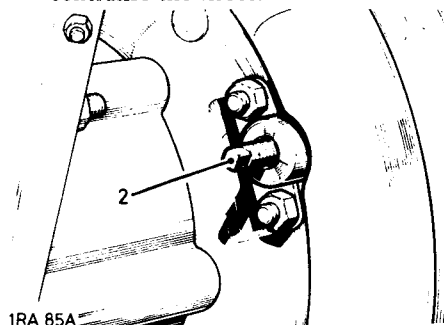
If significant topping-up is required, check master cylinder, wheel cylinders and brake pipes for leakage; any leakage must be rectified immediately.



#### (49) Transmission brake adjustment

If hand brake movement is excessive, adjust as follows:

- 1 Release the hand brake. The adjuster protrudes from the front of the brake backplate.
- 2 During rotation of the adjuster a click will be felt and heard at each quarter revolution. Rotate adjuster in a clockwise direction until the brake shoes contact the drum. Then unscrew the adjuster two clicks and give the hand brake a firm application to centralise the shoes.



#### (50) Foot and hand brake

- 1 Check operation of foot and hand brake, ensure that the brake pedal travel is not excessive and maintains a satisfactory pressure under normal working load.
- 2 Excessive pedal travel indicates worn brake linings or the necessity for adjustment.
- 3 If the brakes feel spongy this may be caused by air in the hydraulic system and must be removed by bleeding the system at each wheel cylinder.
- 4 Prior to this operation, all hydraulic hoses, pipes and connections should be checked for leaks and any leaks rectified.
- 5 Check operation of hand brake and ensure that it holds the vehicle satisfactorily.

#### Wheel brake adjustment

When the vehicle is used in deep muddy conditions the brake drums must be periodically removed and cleaned, at the same time the brake shoes and anchor plate should be thoroughly cleaned.

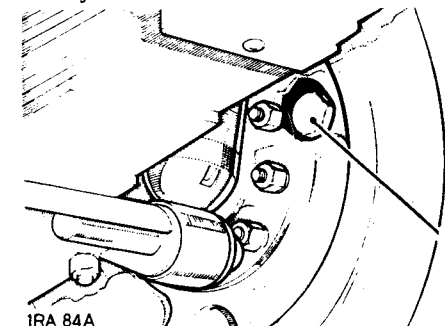
When used continuously under exceptionally wet and muddy conditions this operation may be advisable once, or even twice a week, to prevent the abrasive action of packed mud rapidly wearing out brake linings and drums.

When lining wear has reached the point where the pedal travel becomes excessive, it is necessary to adjust the brake shoes in closer relation to the drum.

Proceed as follows:

#### 88 Models

- 1 Jack up each wheel in turn.
- 2 On the back face of the brake anchor plate will be found a hexagon adjustment bolt which operates a snail cam bearing on the leading shoe. Only one of these is fitted to each wheel brake unit, thereby providing single-point adjustment.



- 3 Spin the wheel and rotate the adjuster bolt until the brake shoe contacts the drum, then ease the adjuster until the wheel again rotates freely.
- 4 Repeat for the other three wheels.

#### 109 Models

- 5 Each shoe is independently set by means of a hexagon adjustment bolt operating through a serrated snail cam.
- 6 Apply the brakes and set the snail cam adjusters so that the brake shoes are in firm contact with the drums.
- 7 Slacken off each adjuster just sufficiently for the drum to rotate freely.
- 8 Repeat for the other wheels in turn.

**NOTE:** The rear brake shoes should be adjusted individually to obtain the best results.

**(51) Inspect brake linings for wear, drums for condition, replace worn parts as necessary**

**(52) Handbrake linkage**

The hand brake operates a mechanical brake unit mounted on the output shaft from the transfer box.

Lubricate the hand brake linkage and check for worn parts. Take care not to contaminate the hand brake linings with oil.

**(53) Servo hose(s) — check hose(s) for security and condition, replace as necessary**

**ELECTRICAL**

**(54) Electrical and interior equipment**

6 Check operation of all lamps, direction indicators, warning lights, horn, instruments and other equipment.

**(55) Battery acid level**

Check weekly when operating under severe conditions. The battery is located under the bonnet at the front right-hand side.

The specific gravity of the electrolyte should be checked at every maintenance inspection. Readings should be:

Temperate climate below 26.5°C (80°F) as commissioned for service, fully charged 1.270 to 1.290 specific gravity.

As expected during normal service, three-quarter charged 1.230 to 1.250 specific gravity.

If the specific gravity should read between 1.190 to 1.210, half-charged, the battery must be bench charged and the electrical equipment in the car should be checked.

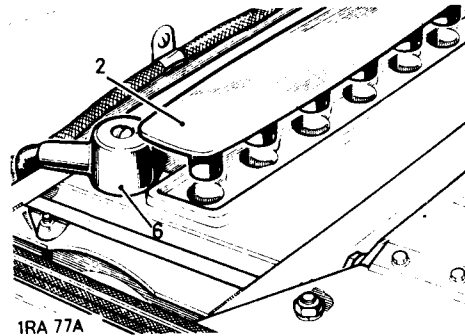
Tropical climate above 26.5°C (80°F) as commissioned for service, fully charged 1.210 to 1.230 specific gravity.

As expected during normal service, three-quarter charge 1.170 to 1.190 specific gravity.

If the specific gravity should read between 1.130 to 1.150, half-charged, the battery must be bench charged and the electrical equipment on the car should be checked. Check acid level as follows:

1 Wipe all dirt and moisture from the battery top.

- 2 Remove the filler plugs or manifold lid. If necessary add sufficient distilled water to raise the level to the top of separators. Replace the filler plugs or manifold lid.
- 3 Avoid the use of a naked light when examining the cells.
- 4 In hot climates it will be necessary to top up the battery at more frequent intervals.
- 5 In very cold weather it is essential that the vehicle is used immediately after topping up, to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this precaution may result in the distilled water freezing and causing damage to the battery.



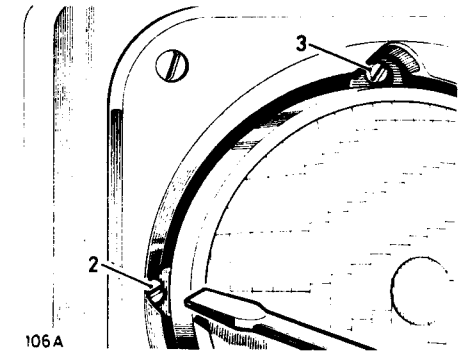
1RA 77A

**(56) Battery terminals**

- 6 Remove battery terminals, clean, grease and refit.
- 7 Replace terminal screw; do not over-tighten. Do not use the screw for pulling down the terminal.
- 8 Do NOT disconnect the battery cables while the engine is running or damage to alternator semiconductor devices may occur. It is also inadvisable to break or make any connection in the alternator charging and control circuits while the engine is running.
- 9 It is essential to observe the polarity of connections to the battery, alternator and regulator, as any incorrect connections made when reconnecting cables may cause irreparable damage to the semiconductor devices.

**(57) Headlamp beam setting**

- 1 This operation requires special equipment and should be carried out by a Rover Distributor or Dealer.
- 2 In an emergency each headlamp can be adjusted by means of a headlamp horizontal adjusting screw.
- 3 The headlamp vertical adjusting screw. The adjusting screws are accessible through slots in the headlamp bezel.

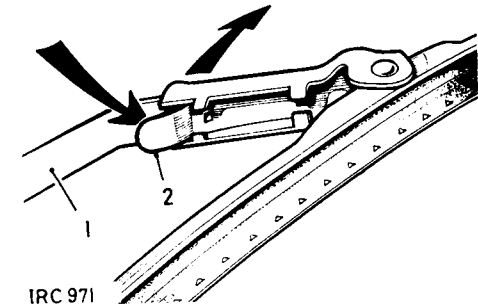


106A

**(58) Windscreen wiper blades**

Examine condition of wiper blades, replace as necessary:

- 1 Pull wiper arm forward.
- 2 Lift spring clip and withdraw blade from wiper arm.
- 3 To fit new blade reverse removal procedure.



IRC 971

**EXHAUST AND FUEL PIPES**

**(59) & (60) Exhaust system, fuel, clutch and brake pipes**

- 1 Check exhaust system fixings for security, paying particular attention to heat shields, flexible mounting plates and clamps.
- 2 Examine the system for signs of leakage and blowing. Any silencers or pipes found to be leaking or badly corroded should be replaced:
- 3 At the same time check all fuel, clutch and brake pipes, unions and hoses for signs of leakage, corrosion, chafing or damage.

## WHEELS AND TYRES

**(61) Check that tyres comply with manufacturer's specification**

### **(62) Tyre pressures**

Maximum tyre life and performance will only be obtained if the tyres are maintained at the correct pressures.

### **(63) & (65)**

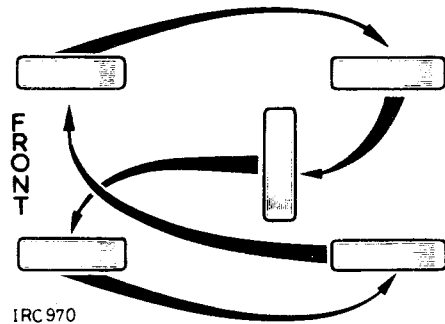
- 1 Whenever possible check with the tyres cold as the pressure is about 0,1 kg/cm<sup>2</sup> (2 lb/sq. in.) 0,14 bars higher at running temperature.
- 2 Always replace the valve caps as they form a positive seal on the valves.
- 3 Any unusual pressure loss in excess of 0,05 to 0,20 kg/cm<sup>2</sup> (1 to 3 lb/sq. in.) 0,07 to 0,21 bars per week should be investigated and corrected.
- 4 Always check the spare wheel so that it is ready for use at any time.
- 5 At the same time remove embedded flints etc. from the tyre treads with the aid of a penknife or similar tool and check that the tyres have no breaks in the fabric or cuts to sidewalls etc. Clean off any oil or grease on the tyres using white spirit sparingly.
- 6 Check that there are no lumps or bulges in the tyres or exposure of the ply or cord structure.
- 7 'Butyl' synthetic inertubes are fitted and all repairs must be vulcanised.
- 8 It is an offence to run tyres when the tread pattern of the tyre does not have a depth of at least 1 mm throughout at least three-quarters of the breadth of the tread and round the entire outer circumference of the tyre.
- 9 It is advisable to run-in new tyres by driving at reasonable speeds for the first 400 km (250 miles) or so before driving at higher speeds.

### **(64) Road wheel nuts**

Check road wheel nuts, tighten as necessary.

### **(66) Changing wheel positions**

The road wheels should be changed round as illustrated to equalise tyre wear. When cross-country tyres are used, the 'V' tread should be directed to the front at the top.



**WARNING:** Do not touch the outer ring of nuts on divided type wheels (optional equipment) unless the wheel is removed and the tyre fully deflated, or severe personal injury may result.

**IMPORTANT:** As the Land Rover is fitted with a transmission brake, it is necessary before removing a road wheel to apply the hand brake and engage four-wheel drive. This will ensure that the hand brake is operative on all four wheels. Remember to engage two-wheel drive when the road wheel has been replaced.

## BODY

### **(67) (70) & (71) Door locks and mechanisms**

- 9 Check operation of all door locks and mechanisms, window controls, safety catches, bonnet catch etc.; apply a few spots of oil as necessary.

### **(68) (69) & (72) Seats, safety belts and rear view mirrors**

- 7 Check all seat fixings for security and examine condition of safety harness. Safety harness which have been used in an accident or are frayed or cut, must be replaced.
- 8 Check rear view mirror(s) for security and examine mirror face for signs of cracks or crazing.

### **(73) Check cleanliness of controls, door handles and steering wheel**

## GENERAL

### **(74) Road or roller test**

Give the vehicle a roller or road test and carry out any further adjustments required including brakes, clutch, throttle linkage etc. Check steering and all gears in high and low range including the high range four-wheel drive control. Check operation of all lights and instruments. After test check for oil, fuel and fluid leaks at all plugs, flanges, joints and unions.

## PREVENTIVE MAINTENANCE

In addition to the recommended periodical inspection of brake components it is advisable as the vehicle ages, and as a precaution against the effects of wear and deterioration, to make a more searching inspection and renew parts as necessary.

It is recommended that:

Brake linings, hoses and pipes should be examined at intervals no greater than those laid down in the Maintenance Summary.

**Rubber seals in brake system**—Every 60 000 km (36,000 miles) or 36 months. Renew all rubber seals in master cylinder, wheel cylinders and servo until where applicable. This should be done every three years if mileage travelled is less than 60 000 km (36,000 miles). Refill with correct fluid.

**Fluid changing, brake system**—Every 30 000 km (18,000 miles) or 18 months. All brake fluid absorbs moisture from the air and as a result its boiling point is lowered with a consequent deterioration in performance. In a sealed brake system, water absorption takes place over a period and can, if not remedied reduce brake performance to a dangerous level. All the fluid in the brake system should be changed every 30 000 km (18,000 miles) or 18 months. It should also be changed before touring in mountainous areas, if not done in the previous nine months. Use only fluid recommended in Section 09.

Care must be taken always to observe the following points:

- a At all times use the recommended brake fluid.
- b Never leave fluid in unsealed containers. It absorbs moisture quickly and can be dangerous if used in your braking system in this condition.

- c Fluid drained from the system or used for bleeding is best discarded.
  - d The necessity for absolute cleanliness throughout cannot be over-emphasized.
- 4 Hold the tube under the fluid surface and, with the foot brake fully depressed, tighten the bleed screw. Do not overtighten.
  - 5 Repeat for the other three wheels in turn, finishing at the one nearest the brake pedal.
  - 6 Pump brake pedal until rear shoes are in firm contact with the brake drums.
  - 7 While holding pedal depressed, adjust rear adjuster up to the shoes.
  - 8 Release pedal and slacken rear adjusters until shoes are just clear of the drums.
  - 9 Adjust front shoes in the normal manner.

#### Replacing Brake-Shoes

When it becomes necessary to renew the brake shoes, it is essential that only genuine shoes, with the correct grade of lining are used. Always fit new shoes as complete axle sets, never individually or as a single wheel set. Serious consequences could result from out-of-balance braking due to mixing of linings.

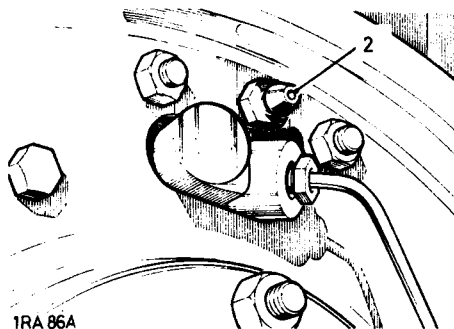
#### Bleeding the brake system

When the fluid in the hydraulic system has been changed or any components replaced it will be necessary to remove the air by bleeding the hydraulic system at each wheel cylinder. Bleeding must always be carried out at all wheels.

Proceed as follows:

- 1 Slacken the adjusters off on all brake shoes.
- 2 Attach a length of rubber tubing to the bleed screw on the wheel cylinder furthest from the brake pedal and place the lower end of the tube in a glass jar containing brake fluid.
- 3 Slacken the bleed screw and depress the brake pedal and release slowly. Pause at each end of the return stroke to allow the master cylinder to recuperate. Continue pumping in this manner until the fluid issuing from the tube shows no signs of air bubbles when the tube is held below the surface of the fluid in the jar.

The fluid in the reservoir should be replenished throughout the operation.





## SPECIAL OPERATING CONDITIONS

When the vehicle is operated on dusty, wet or muddy terrain, more frequent attention, depending on the conditions, should be paid to the following:

### Daily or Weekly

Check/top up engine oil  
 Empty, clean and refill air cleaner oil bath  
 Check/top up cooling system  
 Check/top up gearbox oil  
 Check/top up transfer box oil  
 Check/top up battery electrolyte  
 Check steering rubber boots for security and damage  
 Clean out brake drums and adjust to manufacturer's instructions  
 Lubricate front and rear propeller shaft grease points and front sliding joint  
 Clean fuel sedimentor (diesel)

### Monthly

Renew gearbox oil  
 Renew transfer box oil  
 6 months: Renew air cleaner elements

### Stationary Running

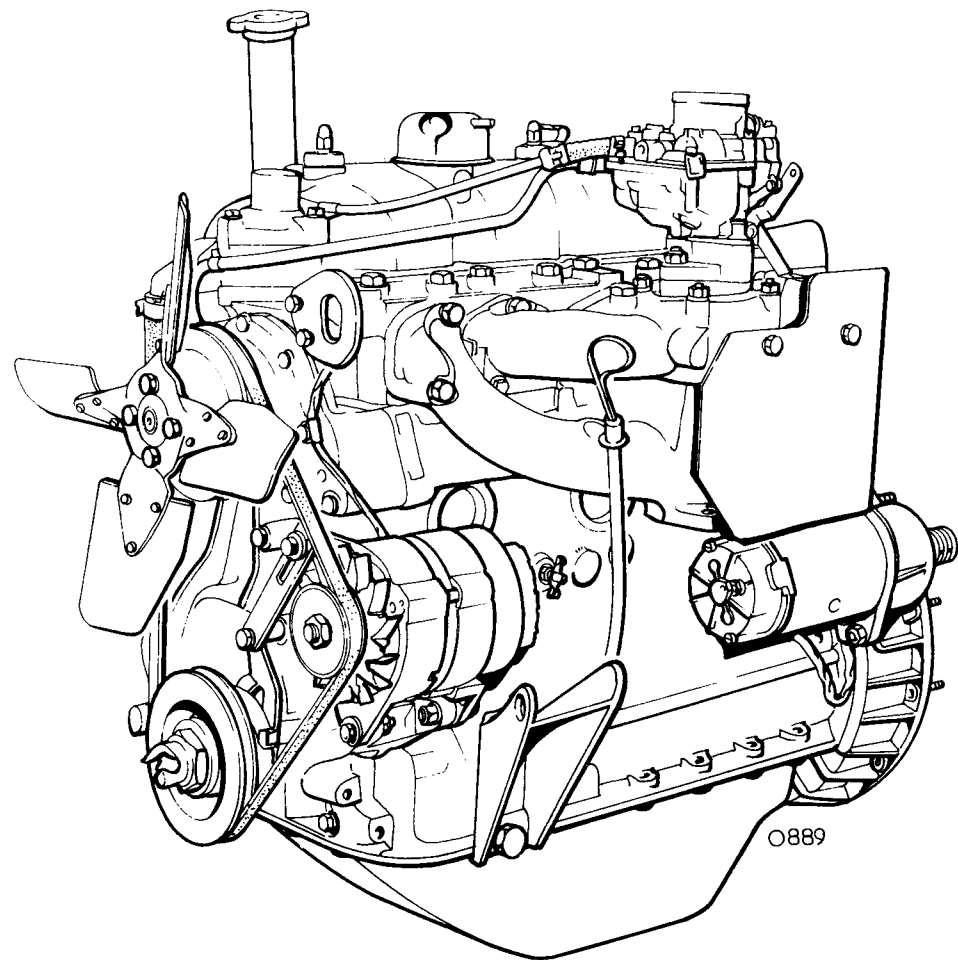
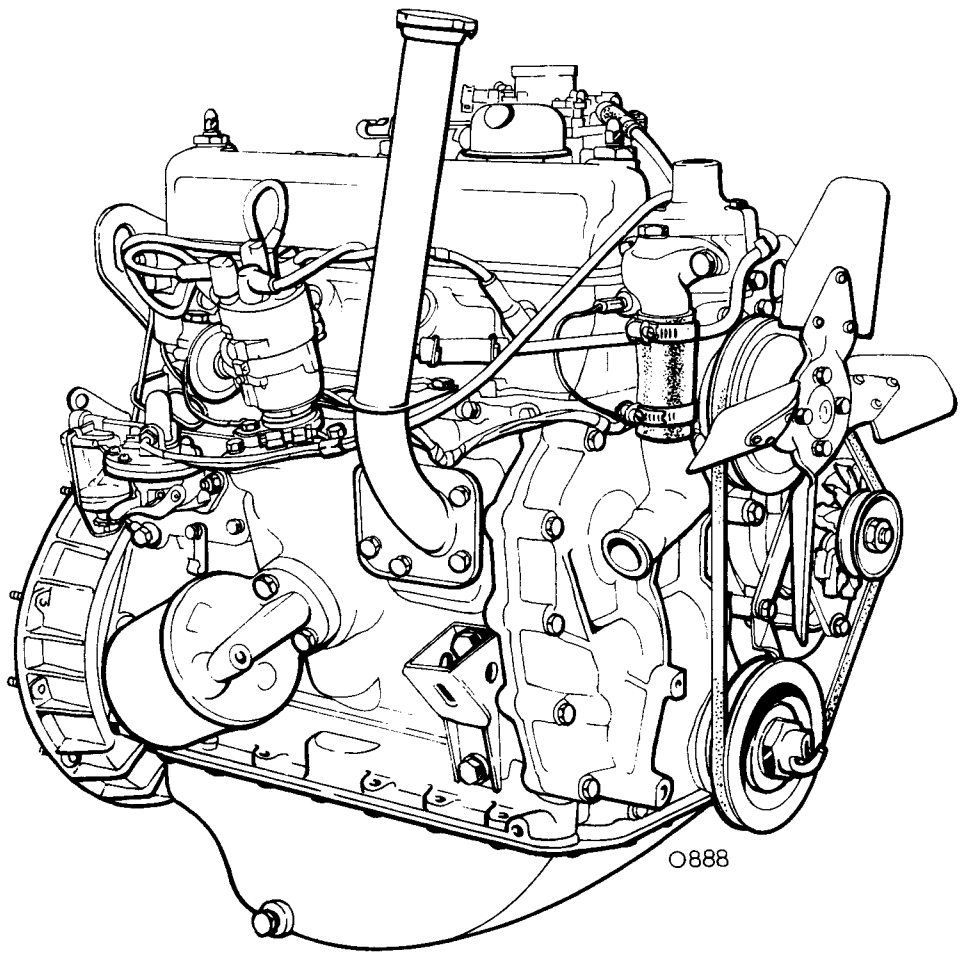
If the vehicle is used exclusively in low transfer ratio or for stationary work, maintenance intervals must be based on either fuel consumption or hours running time. Refer to the chart.

## CONVERSION CHART

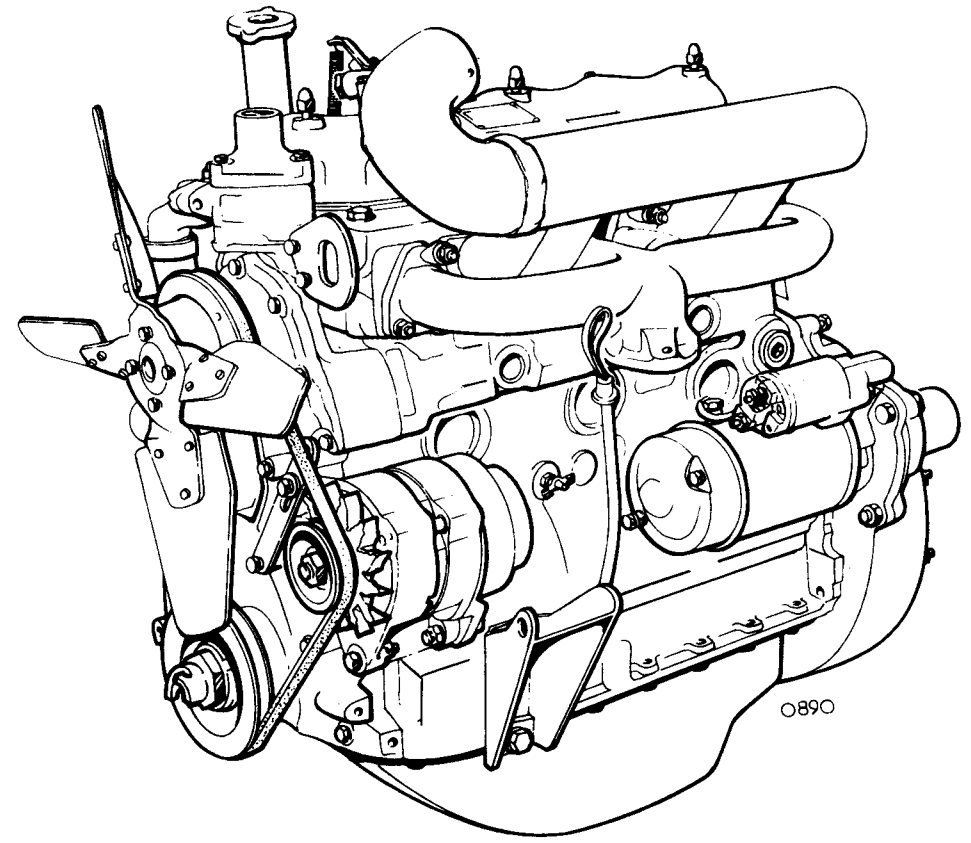
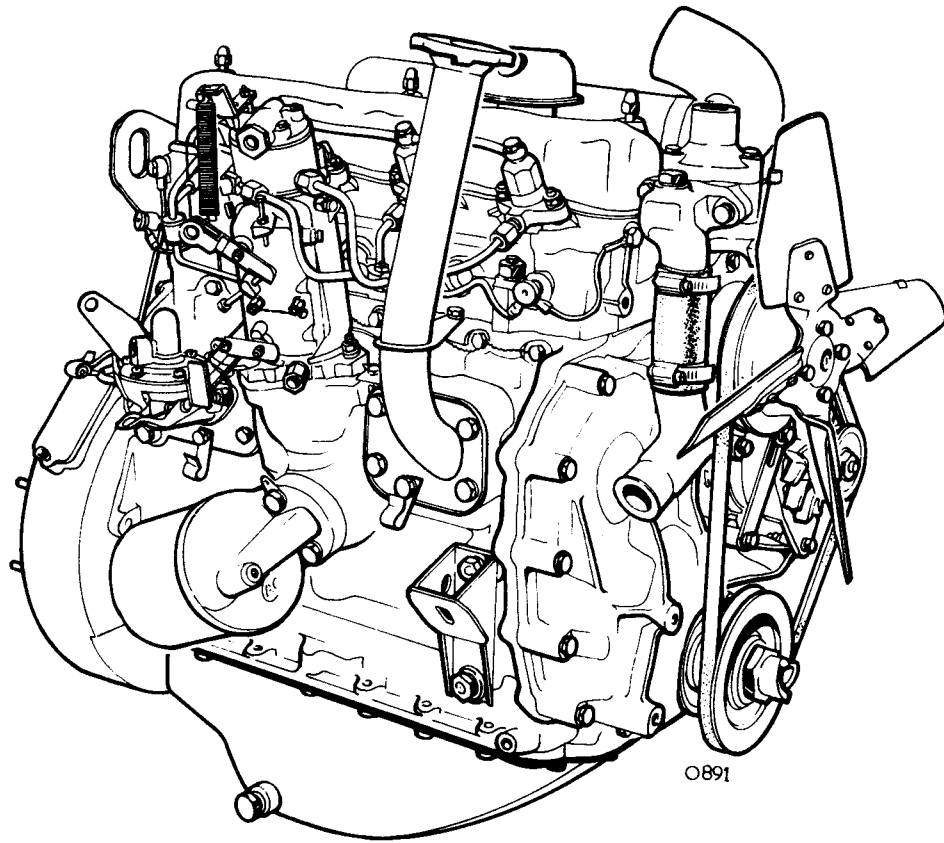
Kilometres and miles, fuel consumption and hours' running time

Kilometres	Miles	Fuel consumption				Hours' Running time
		Petrol		Diesel		
		Litres	Gallons	Litres	Gallons	
5000	3000	680	150	455	100	120
10000	6000	1,363	300	909	200	240
15000	9000	2,045	450	1,363	300	360
20000	12000	2,727	600	1,818	400	480
25000	15000	3,409	750	2,272	500	600
30000	18000	4,091	900	2,727	600	720
35000	21000	4,773	1,050	3,182	700	840
40000	24000	5,455	1,200	3,636	800	960





**2 1/4 Litre—Three Main Bearing—4 Cylinder Petrol Engine**



**2 1/4 Litre—Three Main Bearing—4 Cylinder Diesel Engine**

**2½ litre — 4 cylinder Petrol and Diesel  
CAMSHAFT**

**Remove and refit 12.13.01**

Service tools: 507231 Chainwheel extractor  
530101 Camshaft extractor

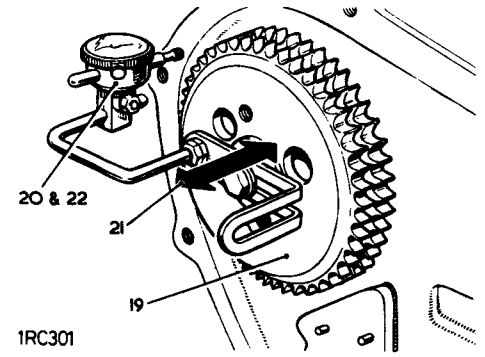
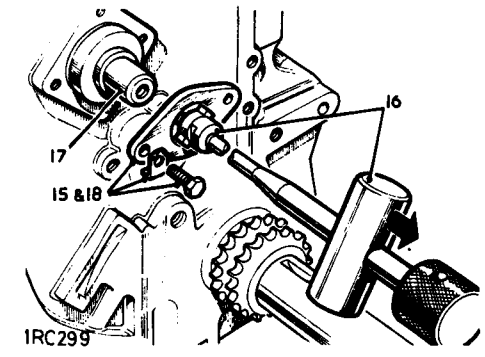
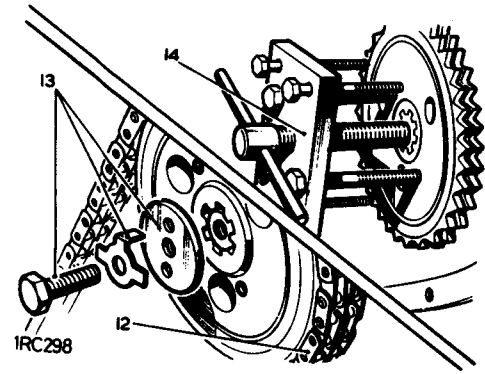
**Removing**

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Remove the radiator and front panel assembly. 26.40.01.
- 4 Remove the external oil filter assembly. 12.60.01.
- 5 *Petrol Engines:* Remove the distributor and drive gear. 86.35.20.
- 6 *Diesel Engines:* Remove the fuel injection pump. 19.30.07.
- 7 Remove the valve gear. 12.29.34.
- 8 Remove the cylinder head. 12.29.10.
- 9 Remove the tappets. 12.29.57.
- 10 Remove the timing gear cover. 12.65.01.
- 11 Remove the timing chain tensioner. 12.65.28.
- 12 Withdraw the timing chain.
- 13 Remove the fixings from the camshaft chainwheel.
- 14 Extract the chainwheel from the camshaft. 507231.
- 15 Remove the thrust plate from the camshaft. Tab washers deleted on later engines.
- 16 Extract the camshaft. 530101.

**NOTE:** For details of camshaft bearings, refer to 12.13.13.

**Refitting**

- 17 Insert the camshaft into the cylinder block.
- 18 Fit the thrust plate.
- 19 Fit the chainwheel to the camshaft but do not engage the lockwasher at this stage.
- 20 Mount a dial test indicator to read off the end of the camshaft.
- 21 Check the camshaft end float. The correct end float limits are 0,06 mm to 0,13 mm (0.0025 in. to 0.0055 in.). If the end float is excessive, fit a new thrust plate and/or camshaft.
- 22 Remove the dial test indicator.
- 23 Reset the valve timing. 12.65.22.
- 24 Reverse 1 to 11.



**CAMSHAFT BEARINGS**

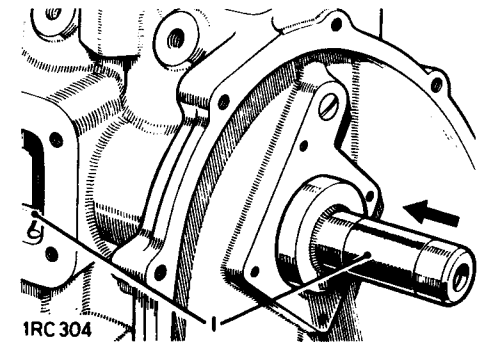
**Remove and refit 12.13.13.**

Service tools: 605975 Bearing drift and adaptor assembly comprising:  
274388 Bearing drift  
531760 Adaptor  
274389 Reamer for bearings includes:  
274394 Guide plug

**NOTE:** Prior to removing the camshaft bearings, the engine must be removed from the vehicle and be completely dismantled until only the camshaft bearings remain in the cylinder block.

**Removing**

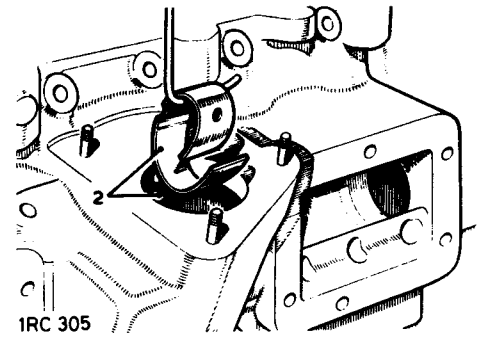
- 1 Drift out the front and rear bearings and withdraw them through the side cover apertures. 274388.



- 2 Drift the two centre bearings into the distributor drive chamber and collapse them to enable withdrawal. 274388.

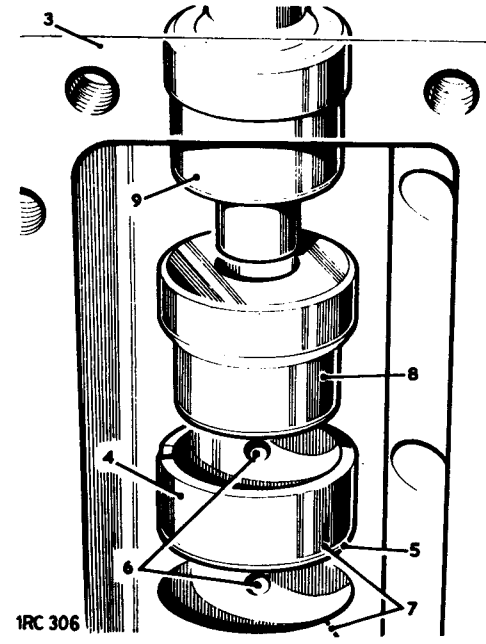
**Refitting**

**NOTE:** The two centre and rear bearings are of the same width, whereas the front bearing is wider and has an additional oil feed hole.

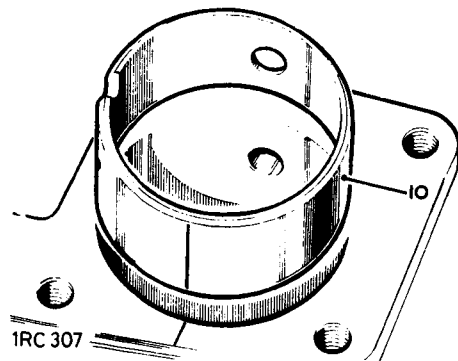


- 3 Position the cylinder block vertical, rear face down.
- 4 Place a new bearing into the front camshaft chamber and position it so that it is above the second bearing housing, counting from the front of the block.
- 5 The chamfer on the bearing edge must be towards the housing bore.

*continued*



- 6 Align the oil hole in the bearing with the innermost oil feed drilling in the housing bore. Accuracy is essential otherwise misalignment of the oil holes may result and once the bearing is in place it cannot be rotated to correct any error.
- 7 Add pencil marks to the bearing outer diameter and the cylinder block adjacent to the housing to assist in checking alignment.
- 8 Having visually aligned the bearing, place inside it the adaptor. 531760.
- 9 Maintain the bearing in a level position. Pass the drift through the front bearing housing into the camshaft chamber so that it rests on top of the adaptor. Commence drifting the bearing into the block. Ensure that the bearing is not drifted in too far, and that the oil feed holes are correctly aligned.
- 10 Repeat 5 to 9 for the front bearing. Note that the front bearing is wider and has a small hole in addition to the large oil feed hole. This small hole aligns with a vertical drilling in the block, which in turn feeds a horizontal drilling for the tappet mechanism. Drift this bearing in so that the outer edge is just below the machined surface of the front face. This is to ensure that when the camshaft thrust plate is fitted it will not stand proud on the bearing edge.

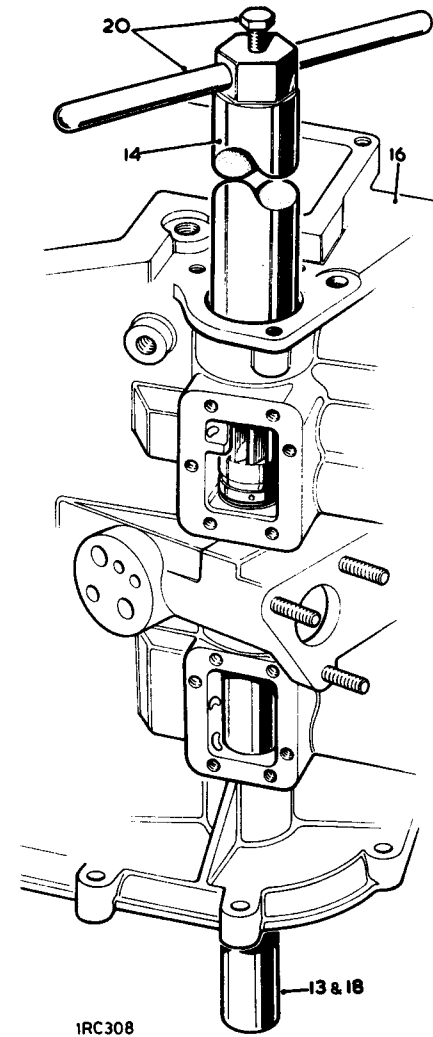


- 11 Turn the cylinder block over so that the rear face is uppermost.
- 12 Repeat the foregoing procedures for the two remaining camshaft bearings.

#### Reaming the camshaft bearings

**NOTE:** No lubricant is necessary for the reaming operation, best results are obtained when the bearings are cut dry.

- 13 Locate the guide plug 274394, into the front camshaft bearing and retain using the thrust plate screws, but do not tighten the screws at this stage.
- 14 Insert the reamer 274389 from the rear of the cylinder block, locating it through the guide plug at the front.
- 15 Locate the guide collar immediately in front of the reamer cutter into the rearmost bearing, then secure the screws retaining the guide plug at the front.
- 16 Position the cylinder block vertical, rear face uppermost.
- 17 Ream the rear and two centre bearings. As each bearing is cut the reamer should be held steady by the operator whilst an assistant, using a high pressure airline, blows away the white metal cuttings, before allowing the reamer to enter the next bearing.
- 18 Remove the guide plug 274394, before reaming the front bearing.
- 19 Ream the front bearing.
- 20 Remove the reamer handle and bolt.
- 21 Remove the reamer, turning it in the same direction as for cutting.
- 22 Remove the plugs from the ends of oil gallery passage and clean the gallery and oil feed passages to camshaft and crankshaft bearings, using compressed air. Refit the plugs and lock in position.
- 23 The hexagon-headed plugs at the rear of the block should have new washers fitted, and their threads coated with a suitable jointing compound.
- 24 Clean the cylinder block ready for engine reassembly.



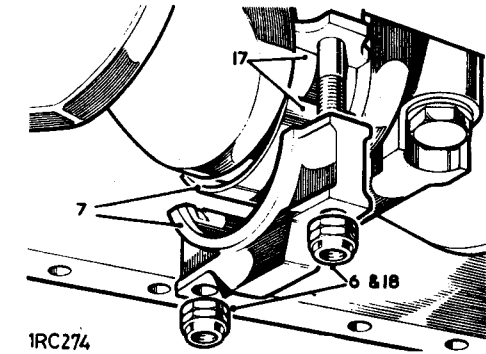
## CONNECTING RODS AND PISTONS

Remove and refit

12.17.01

### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Remove the valve gear. 12.29.34.
- 4 Remove the cylinder head. 12.29.10.
- 5 Remove the oil sump. 12.60.44.
- 6 With two pistons at bottom dead centre (BDC) remove the connecting rod cap fixings.
- 7 Remove the caps and withdraw the connecting rod bearing halves. Retain the caps and bearings in related sets.



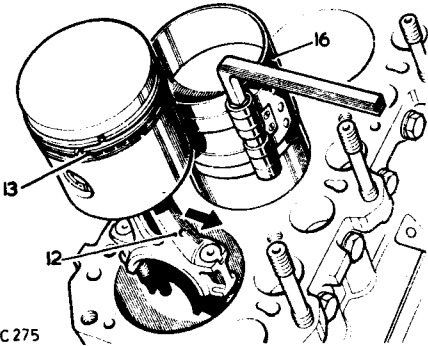
- 8 Withdraw the pistons and attached connecting rods from the top of the bore.
- 9 Position the remaining pistons at BDC and repeat the removal procedure.
- 10 Retain the removed components in related sets. The correct cap for each connecting rod is denoted by the number stamped near the joint faces. This number also indicates the crankshaft journal to which it must be fitted.

### Refitting

**NOTE:** If replacement components are to be fitted, the checks detailed in 12.17.10 must be carried out.

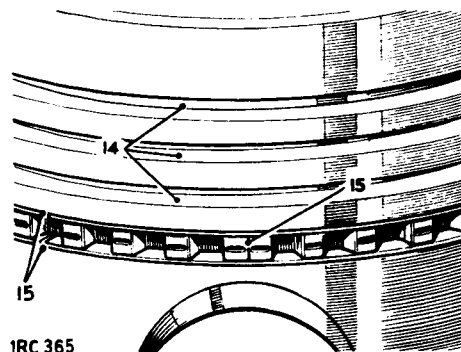
- 11 Position the crankshaft with two crankpins at BDC.

- 12 Insert the appropriate connecting rod and piston assemblies into their respective bores, noting that the oil hole in the connecting rods must be towards the camshaft.
- 13 *Petrol engines:* Position the piston rings so that their gaps are staggered around the piston thrust face (camshaft side of the engine).



IRC 275

- 14 *Diesel engines:* Position the piston compression rings so that their gaps are staggered around the piston thrust face (camshaft side of the engine).
- 15 *Diesel engines:* Position the oil control ring so that the ends of the expander butt, but do not overlap and are in line with the gudgeon pin. Position the gap in each rail 25 mm (1 in.) to the left of the butted ends of the expander.
- 16 Using a piston ring compressor, locate the pistons into the cylinder bores.



IRC 365

- 17 Lubricate the journals and bearing halves and fit the appropriate bearing halves to the connecting rods and caps.
- 18 Fit the connecting rod caps using NEW securing nuts. Torque 3,5 kgf. m (24 lbf. ft.).
- 19 Repeat 11 to 19 for the remaining connecting rod and piston assemblies.
- 20 Reverse 1 to 5.

## CONNECTING RODS AND PISTONS—Petrol

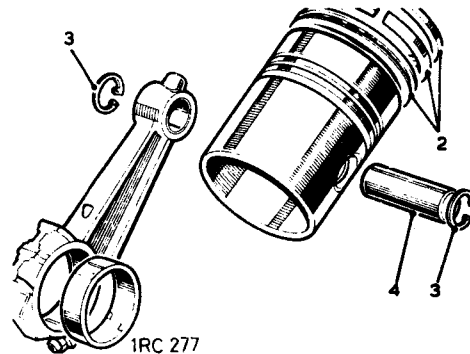
Overhaul

12.17.10

### Dismantling

**NOTE:** During the following procedures retain all components in related sets to facilitate subsequent assembly. If the same pistons are to be refitted, add location marks to ensure reassembling in the same relative position.

- 1 Remove the connecting rods and pistons. 12.17.01.
- 2 Remove the piston rings.
- 3 Remove the circlips from the gudgeon pin bosses.
- 4 Withdraw the gudgeon pins from the pistons.



IRC 277

## Overhauling pistons

### Original pistons

- 5 Remove the carbon and deposits, particularly from the ring grooves.
- 6 Examine the pistons for damage or excessive wear — see under 'New pistons' for clearance dimensions — fit new replacements as necessary.

### New Pistons

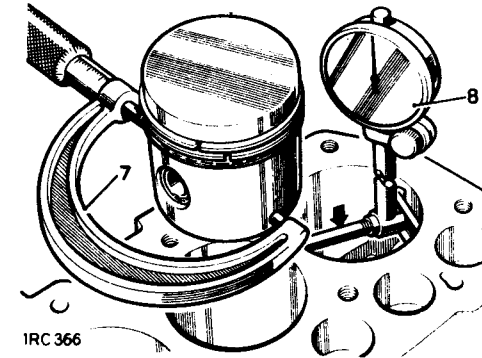
Original pistons fitted to new engines at the factory are specially graded to facilitate assembly. The grading letter on top of the piston crown must be ignored when ordering new pistons. Genuine Land-Rover service standard size pistons are supplied 0,025 mm (0.001 in) oversize to allow for production tolerances on new engines. When fitting a new piston to a standard size cylinder block the bore must be honed to accommodate the piston with the correct clearances.

The clearance limits with new standard size pistons and a new cylinder block are 0,058 mm to 0,068 mm (0.0023 in. to 0.0027 in.).

The clearance limits with new oversize pistons and a newly rebored cylinder block are 0,043 mm to 0,055 mm (0.0017 in. to 0.0022 in.).

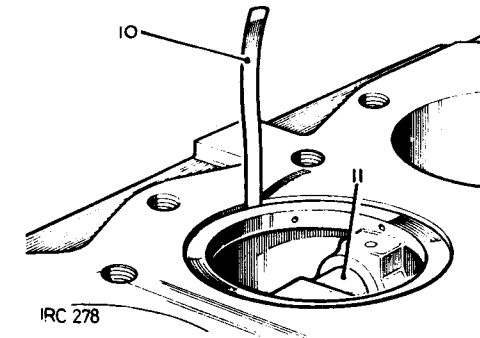
The temperature of the piston and cylinder block must be the same to ensure accurate measurements.

- 7 Check the piston diameter at the bottom of the skirt at right angles to the gudgeon pin.
- 8 Check the bore diameter at approximately half way down.
- 9 If gauge equipment is not available, the piston clearance can be assessed using long feeler gauges. 10 to 12.
- 10 Insert a long suitably sized feeler gauge down the right hand side of the cylinder bore.
- 11 Insert the correct piston, inverted, into the cylinder bore and position it with the gudgeon pin parallel with the axis of the crankshaft.



IRC 366

- 12 Push the piston down the cylinder until the piston reaches its tightest point in the bore, at this point withdraw the feeler gauge — a steady resistance should be felt.

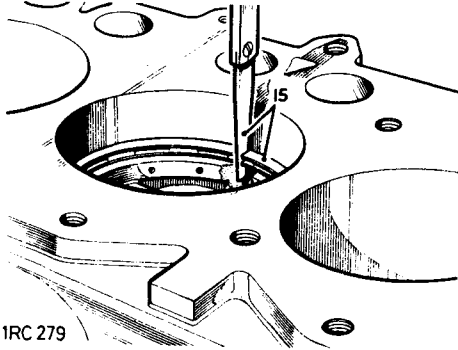


IRC 278

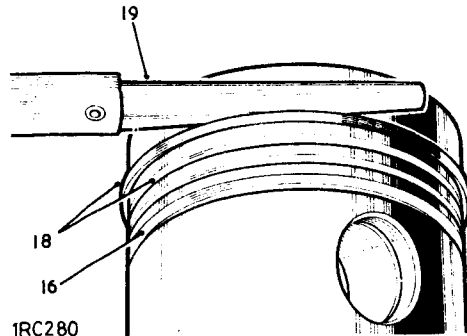
- 13 If service standard size pistons are being fitted, check the diameter of the piston, as already described, and hone the cylinder bore, as necessary, to obtain the correct clearance.

*continued*

- 14 If new piston rings are to be fitted without reboring, deglaze the cylinder walls with a hone, without increasing the bore diameter. A deglazed bore must have a cross-hatch finish.
- 15 Check the compression and oil control ring gaps in the applicable cylinder, held square to the bore with the piston. Gap limits: 0,38 mm to 0,5 mm (0.015 in. to (0.020 in.)). Use a fine cut flat file to increase the gap if required. Select a new piston ring if the gap exceeds the limit.



- 16 Fit the oil control ring to the piston.
- 17 Check the oil control ring clearance in the piston groove. Clearance limits: 0,038 mm to 0,089 mm (0.0015 in. to 0.0035 in.).
- 18 Fit the two compression rings to the piston with the sides marked 'T' or 'Top' uppermost.
- 19 Check the compression ring clearance in the piston grooves. Clearance limits: 0,046 mm to 0,097 mm (0.0018 in. to 0.0038 in.).



Where maximum permitted boring tolerance is not sufficient to reclaim the bores, cylinder liners must be fitted.

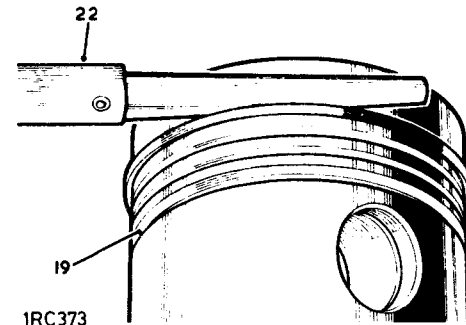
Fitting the cylinder liners conforms to normal practice. Machine the cylinder block bores to 94,425 mm + 0,012 mm (3.7175 in. + 0.0005 in.) diameter. This will provide the liner with 0,076 mm to 0,114 mm (0.003 in. to 0.0045 in.) interference fit.

Press the liners into the cylinder block. The liners must not be proud of, or more than 0,254 mm (0.010 in.) below, the top face of the cylinder block.

Cylinder liners should be bored to standard size of 90,47 mm (3.562 in.) diameter. Liners may be rebored to a maximum of 1,01 mm (0.040 in.) oversize.

#### Connecting rods

- 20 Check the alignment of the connecting rod.
- 21 Check the gudgeon pin clearance in the connecting rod. Clearance limits: 0,007 mm to 0,015 mm (0.0003 in. to 0.0006 in.).
- 22 If a new connecting rod small end bush is required, ensure that the oil holes are aligned when pressing in the replacement, then ream the bush to obtain the correct clearances, as above.



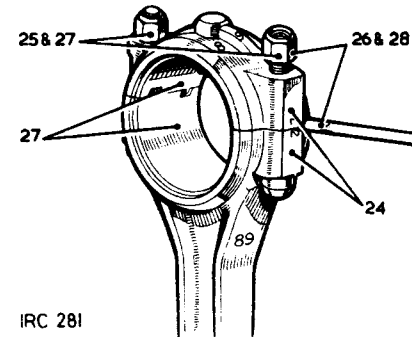
- 23 Check the fit of the gudgeon pin in the piston, the pin must not fall through either boss but be capable of being fitted by hand at normal room temperature 20°C (68°F.).

- 24 Select the correct cap for each connecting rod as denoted by the number stamped near the joint faces. This number also indicates the crankshaft journal to which it must be fitted.
- 25 Assemble the caps, less bearing halves, to the respective connecting rods. Torque 3,5 kgf. m (25 lbf. ft.).
- 26 Slacken the fixing on one side of the cap only and check that there is no clearance at the joint face. If there is clearance, a new assembly must be fitted.

#### Connecting rod bearing nip and clearance

NOTE: New bearing halves are supplied with a protective coating and must be degreased, prior to fitting, to remove the coating.

- 27 Fit the bearing halves to the connecting rod and cap, and secure the assembly. Torque 3,5 kgf. m (25 lbf. ft.).
- 28 Slacken the fixing on one side of the cap only and check the clearance between the joint faces. The clearance must be 0,10 mm to 0,20 mm (0.004 in. to 0.008 in.). The bearing nip can be corrected by selective assembly of the bearing shells; these are available in slightly varying thicknesses. Do not file or machine the caps or connecting rods to vary the bearing nip.

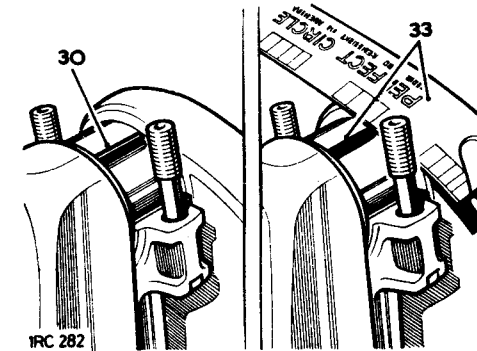


- 29 Make a final check to prove the bearing clearance, using a 0,063 mm (0.0025 in.) shim paper. The connecting rod should resist rotation when fitted to the crankshaft with the shim paper fitted between the journal and one half of the bearing shell, and move freely by hand with the shim paper removed.

NOTE: As an alternative, Plastigauge may be used to check the connecting rod bearing clearance. 30 to 36.

Do not rotate the connecting rod or crankshaft while the Plastigauge is fitted, or the reading will be impaired.

- 30 Place a piece of Plastigauge across the centre of the lower half of the crankshaft journal. 605238.
- 31 Fit the connecting rod complete with bearings to the applicable journal. Torque 3,5 kgf. m (25 lbf. ft.).
- 32 Remove the connecting rod cap and lower half bearing.
- 33 Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.



- 34 The correct clearance with new or overhauled components is given in DATA at the end of this operation.
- 35 If a new bearing is being fitted, use selective assembly to obtain the correct clearance.



36 Wipe off the Plastigauge with an oily rag. DO NOT scrape it off.

**Connecting rod end float**

- 37 Fit the connecting rods complete with bearings to their applicable journals. Torque 3,5 kgf. m (25 lbf. ft.).
- 38 Check the end float between the end face of the connecting rod and the journal shoulder. End float limits: 0,20 mm to 0,30 mm (0.007 in. to 0.012 in.).
- 39 Remove the connecting rods from the crankshaft and retain all parts in related sets.

**Assembling**

- 40 Assemble the pistons to their respective connecting rods.

**DATA**

**Pistons**

Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin.  
 Standard size pistons .....  
 Oversize pistons .....

0,058 mm to 0,068 mm (0.0023 in. to 0.0027 in.)  
 0,043 mm to 0,055 m (0.0017 in. to 0.0022 in.)

**Piston Rings**

**Compression (2)**

Gap in bore .....  
 Clearance in groove .....

0,38 mm to 0,50 mm (0.015 in. to 0.020 in.)  
 0.046 mm to 0.097 mm (0.0018 in. to 0.0038 in.)

**Oil control**

Gap in bore .....  
 Clearance in groove .....

0,38 mm to 0,50 mm (0.015 in. to 0.020 in.)  
 0,038 mm to 0,089 mm (0.0015 in. to 0.0035 in.)

**Gudgeon pin**

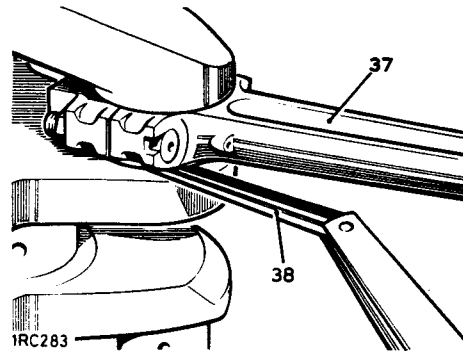
Clearance in connecting rod .....  
 Fit in piston .....

0,007 mm to 0,015 mm (0.0003 in. to 0.0006 in.)  
 Push fit by hand

**Connecting Rods**

Clearance, bearing to crankpin .....  
 End float on crankpin .....

0,019 mm to 0,068 mm (0.00075 in. to 0.0027 in.)  
 0,20 mm to 0,30 mm (0.007 in. to 0.012 in.)



- 41 Fit new circlips to retain the piston gudgeon pins.
- 42 Refit the connecting rods and pistons 12.17.01.

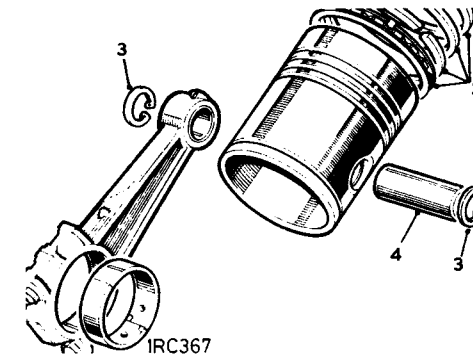
**CONNECTING RODS AND PISTONS – Diesel**

**Overhaul 12.17.10**

**Dismantling**

**NOTE:** During the following procedures retain all components in related sets to facilitate subsequent assembly. If the same pistons are to be refitted, add location marks to ensure reassembling in the same relative position.

- 1 Remove the connecting rods and pistons. 12.17.01.
- 2 Remove the piston rings.
- 3 Remove the circlips from the gudgeon pin bosses.
- 4 Withdraw the gudgeon pins from the pistons.



**Overhauling Pistons**

**Original Pistons**

- 5 Remove the carbon and deposits, particularly from the ring grooves.
- 6 Examine the pistons for damage or excessive wear – see under 'New pistons' for clearance dimensions – fit new replacements as necessary.

**New Pistons**

Original pistons fitted to new engines at the factory are specially graded to facilitate assembly. The grading letter on top of the piston crown must be ignored when ordering new pistons. Genuine Land-Rover Service standard size pistons are supplied 0,025 mm (0.001 in) oversize to allow for production tolerances on new engines. When fitting a new piston to a standard size cylinder block the bore must be honed to accommodate the piston with the correct clearances.

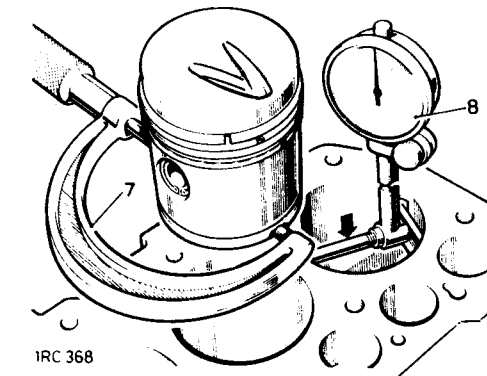
The clearance limits with new standard size pistons and a new cylinder block are 0,111 mm to 0,134 mm (0.0044 in. to 0.0053 in.).

The clearance limits with new oversize pistons and a newly rebored cylinder block are 0,111 mm to 0,157 mm (0.0044 in. to 0.0062 in.).

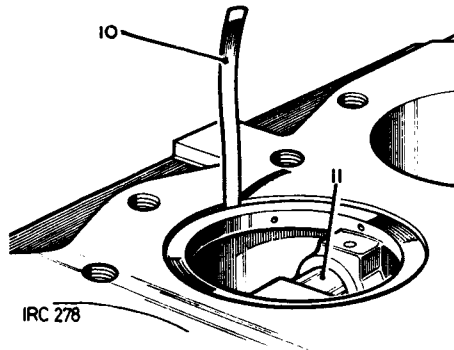
The temperature of the piston and cylinder block must be the same to ensure accurate measurements.

- 7 Check the piston diameter at the extreme bottom and at right angles to the gudgeon pin.
- 8 Check the bore diameter at approximately half way down, at right angles to the gudgeon pin.

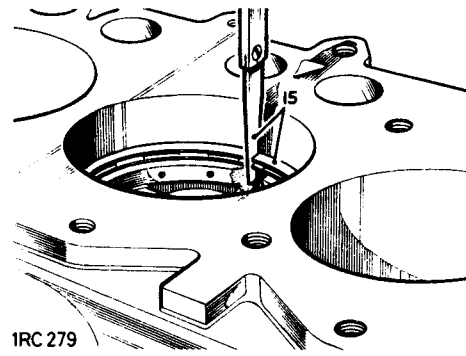
*continued*



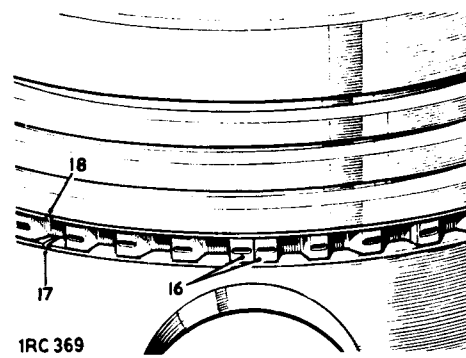
- 9 If gauge equipment is not available, the piston clearance can be assessed using long feeler gauges. 10 to 12.
- 10 Insert a long, suitably sized feeler gauge down the right hand side of the cylinder bore.
- 11 Insert the correct piston, inverted, into the cylinder bore and position it with the gudgeon pin parallel with the axis of the crankshaft.



- 12 Push the piston down the cylinder until the piston reaches its tightest point in the bore, at this point withdraw the feeler gauge - a steady resistance should be felt.
- 13 If service standard size pistons are being fitted, check the diameter of the piston, as already described, and hone the cylinder bore, as necessary, to obtain the correct clearance.
- 14 If new piston rings are to be fitted without reboring, deglaze the cylinder with a hone, without increasing the bore diameter. A deglazed bore must have a cross-hatch finish.
- 15 Check the compression and oil control ring gaps in the applicable cylinder, held square to the bore with the piston. Gap limits: Upper compression ring (chromed): 0,35 mm to 0,50 mm (0.014 in. to 0.019 in.). Middle and lower compression rings: 0,25 mm to 0,38 mm (0.010 in. to 0,015 in.). Oil control ring, upper and lower rail: 0,38 mm to 1,14 mm (0.015 in. to 0.045 in.).

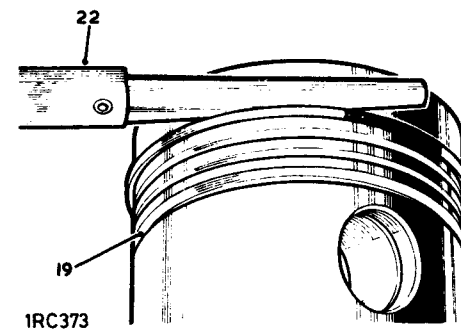


- 16 Fit the expander for the oil control ring into the groove immediately above the gudgeon pin. The ends of the expander must butt but not overlap and be in line with the gudgeon pin.
- 17 Fit the lower rail from the bottom of the piston and locate it into the groove, beneath the expander. Position the ring gap 25 mm (1 in.) to the left of the butted ends of the expander.
- 18 Fit the upper rail from the top of the piston and locate it into the groove, above the expander. Position the ring gap 25 mm (1 in.) to the left of the butted ends of the expander.



- 19 Check the oil control ring clearance in the piston groove. Clearance limits: 0,038 mm to 0,064 mm (0.0015 in. to 0.0025 in.).

- 20 Fit the compression rings marked 'T' or 'TOP' with the marking uppermost to the middle two grooves.
- 21 Fit the chrome edged compression ring to the top groove.
- 22 Check the compression ring clearance in the piston grooves. Clearance limits: 0,06 mm to 0,11 mm (0.0025 in. to 0.0045 in.).



Where the maximum permitted boring tolerance is not sufficient to reclaim the bores, cylinder liners may be fitted. Fitting the cylinder liners conforms to normal practice. Machine the cylinder block bores to 94,425 mm + 0,012 mm (3.7175 in. + 0.0005 in.) diameter. This will provide the liner with 0,076 mm to 0,0114 mm (0.003 in. to 0.0045 in.) interference fit. Press the liners into the cylinder block. The liners must not be proud of, or more than 0,05 mm (0.002 in.) below the top face of the cylinder block. Cylinder liners should be bored to standard size of 90,47 mm (3.562 in.) diameter. Liners may be rebored to a maximum of 1,01 mm (0.040 in.) oversize.

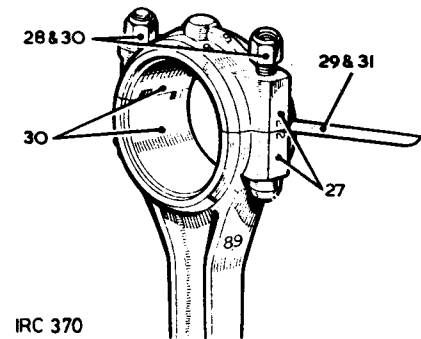
**Connecting rods**

- 23 Check the alignment of the connecting rod.
- 24 Check the gudgeon pin clearance in the connecting rod. Clearance limits: 0,002 mm to 0,02 mm (0.0001 in. to 0.0009 in.).
- 25 If a new connecting rod small end bush is required, ensure that the oil holes are aligned when pressing in the replacement, then ream the bush to obtain the correct clearance, as above.

- 26 Check the fit of the gudgeon pin in the piston, the pin must not fall through either boss but be capable of being fitted by hand at normal room temperature 20°C (68°F).
- 27 Select the correct cap for each connecting rod as denoted by the number stamped near the joint faces. This number also indicates the crankshaft journal to which it must be fitted.
- 28 Assemble the caps, less bearing halves, to the respective connecting rods. Torque 3,5 kgf. m (25 lbf. ft.).
- 29 Slacken the fixing on one side of the cap only and check that there is no clearance at the joint face. If there is clearance, a new assembly must be fitted.

**Connecting rod bearing nip and clearance**  
**NOTE:** New bearing halves are supplied with a protective coating and must be degreased prior to fitting to remove the coating.

- 30 Fit the bearing halves to the connecting rod and cap and secure the assembly. Torque 3,5 kgf. m (25 lbf. ft.).
- 31 Slacken the fixing on one side of the cap only and check the clearance between the joint faces. The clearance must be 0,10 mm to 0,20 mm (0.004 in. to 0.008 in.). The bearing nip can be corrected by selective assembly of the bearing shells; these are available in slightly varying thicknesses. Do not file or machine the caps or connecting rods to vary the bearing nip.

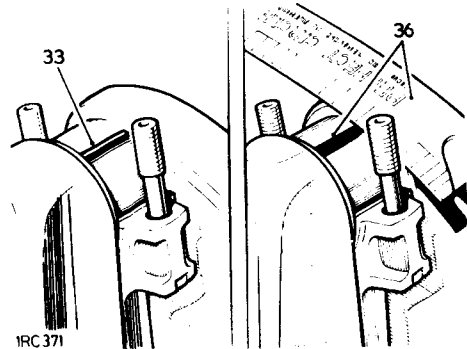


IRC 370

32 Make a final check to prove the bearing clearance, using a 0,063 mm (0.0025 in.) shim paper. The connecting rod should resist rotation when fitted to the crankshaft with the shim paper fitted between the journal and one half of the bearing shell, and move freely by hand with the shim paper removed.

**NOTE:** As an alternative, Plastigauge may be used to check the connecting rod bearing clearance. Do not rotate the connecting rod or crankshaft while the Plastigauge is fitted, or the reading will be impaired.

- 33 Place a piece of Plastigauge across the centre of the lower half of the crankshaft journal. 605238.
- 34 Fit the connecting rod complete with bearings to the applicable journal. Torque 3,5 kgf. m (25 lbf. ft.).
- 35 Remove the connecting rod cap and lower half bearing.
- 36 Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point. The graduation that most closely corresponds to the width of the Plastigauge indicates the bearing clearance.

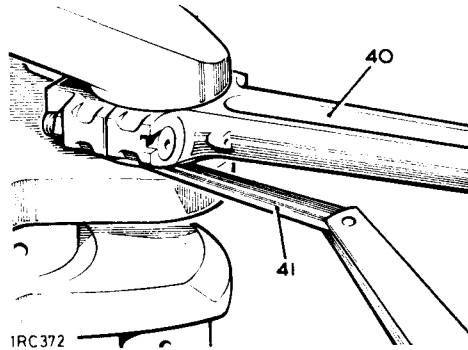


37 The correct clearance with new or overhauled components is given in the DATA at the end of this operation.

- 38 If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
- 39 Wipe off the Plastigauge with an oily rag. DO NOT scrape it off.

**Connecting rod end float**

- 40 Fit the connecting rods complete with bearings to their applicable journals. Torque 3,5 kgf. m (25 lbf. ft.).
- 41 Check the end float between the end face of the connecting rod and the journal shoulder. End float limits: 0,20 mm to 0,30 mm (0.007 in. to 0.012 in.).



42 Remove the connecting rods from the crankshaft and retain all parts in related sets.

**Assembling**

- 43 Assemble the pistons to their respective connecting rods.
- 44 Fit new circlips to retain the piston gudgeon pins.
- 45 Refit the connecting rods and pistons. 12.17.01.

**DATA**

**Pistons**

Clearance in bore measured at bottom of skirt at right angles to gudgeon pin.	
Standard size pistons	0,111 mm to 0,134 mm (0.0044 in. to 0.0053 in.)
Oversize pistons	0,111 mm to 0,157 mm (0.0044 in. to 0.0062 in.)

**Piston rings**

<b>Compression No. 1</b>	
Type	Square friction edge – chromium plated
Gap in bore	0,35 mm to 0,50 mm (0.014 in. to 0.019 in.)
Clearance in groove	0,06 mm to 0,11 mm (0.0025 in. to 0.0045 in.)
<b>Compression Nos. 2 and 3</b>	
Type	Bevelled friction edge. Marked 'T' or 'TOP' on upper side.
Gap in bore	0,25 mm to 0,38 mm (0.010 in. to 0.015 in.)
Clearance in groove	0,06 mm to 0,11 mm (0.0025 in. to 0.0045 in.)
<b>Oil control No. 4</b>	
Type	Expander and rails
Gap in bore	0,38 mm to 1,14 mm (0.015 in. to 0.045 in.)
Clearance in groove	0,038 mm to 0,064 mm (0.0014 in. to 0.0025 in.)

**Gudgeon pin**

Clearance in connecting rod	0,002 mm to 0,020 mm (0.0001 in. to 0.0008 in.)
Fit in piston	Push fit by hand

**Connecting rods**

Clearance, bearing to crankpin	0,019 mm to 0,068 mm (0.00075 in. to 0.0027 in.)
End float on crankpin	0,20 mm to 0,30 mm (0.007 in. to 0,012 in.)

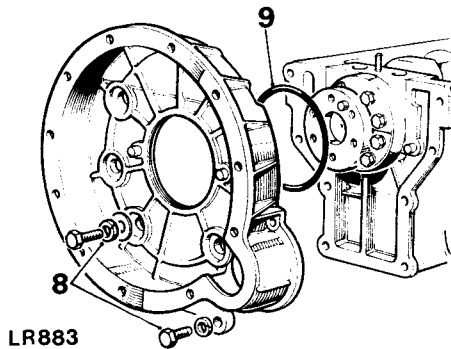
## CRANKSHAFT REAR OIL SEAL

Remove and refit 12.21.20

Service Tools: 270304 Guides for oil seal  
600963 Engine lifting sling

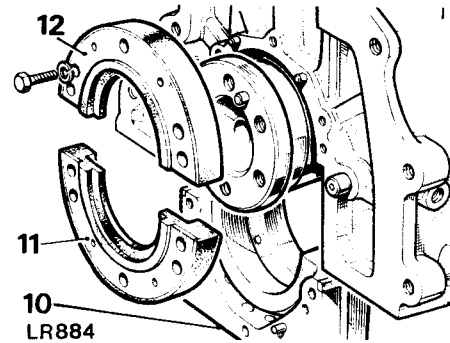
### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the front floor. 76.10.12.
- 3 Remove the engine assembly. 12.41.01.
- 4 Remove the starter motor. 86.60.01.
- 5 Remove the oil sump. 12.60.44.
- 6 Remove the clutch assembly. 33.10.01.
- 7 Remove the flywheel. 12.53.07.
- 8 Remove the flywheel housing.
- 9 Remove the oil seal ring.



LR883

- 10 Remove the rear main bearing cap.
- 11 Remove the lower half of the oil seal retainer from the rear main bearing cap.
- 12 Remove the upper half of the oil seal retainer from the cylinder block, by rotating the crankshaft to align the cut-out with the fixings.

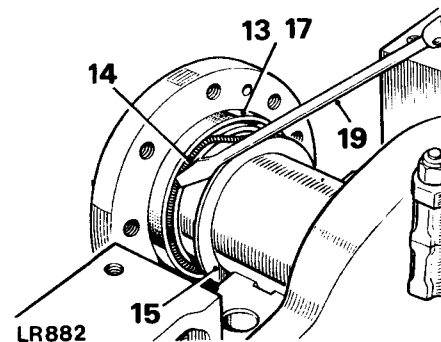


LR884

- 13 Remove the oil seal from the crankshaft.

### Refitting

- 14 Assemble the garter spring on the crankshaft journal by engaging the hook and eye. Do not stretch the spring.
- 15 Move the assembled spring along the journal until it is against the thrower flange.
- 16 Apply Silicone Grease MS4 to the crankshaft oil seal journal and to both end faces of the split oil seal.
- 17 Open the split seal sufficiently to allow it to be fitted over the crankshaft oil seal journal. The recess in the oil seal must be towards the thrower flange and the garter spring.



LR882

**NOTE:** The oil seal must not be repeatedly fitted and removed from the crankshaft, as this can damage the sealing lip.

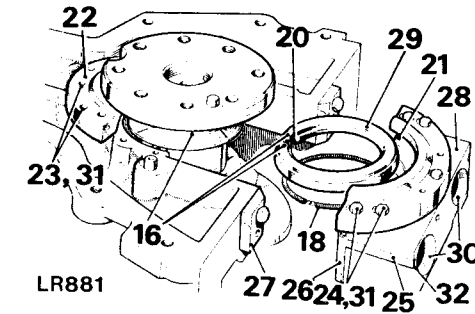
- 18 Position the garter spring so that the hook and eye is located mid-way between the split and hinge of the oil seal.
- 19 Using a small screwdriver, ease the spring into the recess in the oil seal.
- 20 Rotate the oil seal until the split is on the vertical axis pointing towards the cylinder head and in its approximate running position on the journal; this position is important.

**NOTE:** Do not degrease the seal retainer halves with trichlorethylene, but wipe clean with a dry cloth prior to applying Hylomar.

- 21 Apply Hylomar PL 32/M jointing compound, to the seal location diameter of both retainer halves.
- 22 Locate one half of the oil seal retainer onto the cylinder block dowels. The oil seal should be compressed to assist assembly, also ensure that it is correctly located in the retainer recess.

**CAUTION:** The seal must be held so that it does not rotate when the crankshaft is being rotated to fit the retainer securing bolts.

- 23 Secure the upper half of the oil seal retainer with the three inner bolts, leaving the outer bolt at each end finger tight at this stage.
- 24 Secure the lower half of the oil seal retainer to the rear main bearing cap in the same manner as described for the upper half.
- 25 Apply Silicone Grease MS4 to the 'T' seals and fit them to the rear main bearing cap.
- 26 Trim the top edges of the 'T' seals to prevent them from fouling the cylinder block when being fitted.
- 27 Fit the seal guides to the crankcase. 270304.



LR881

- 28 Fit the rear main bearing cap complete with the seal retainer, 'T' seals and bearing shell to the crankcase until there is an 0,8 mm (0.030 in.) gap between the cap and the crankcase.
- 29 Check that the seal is correctly located in the retainer recess.
- 30 Tighten the bearing cap bolts ensuring that there is no buckling of the split seal or misalignment of the butt joint. Torque: Petrol engines: 11,5 kgf. m (85 lbf. ft.). Diesel engines: 13,8 kgf. m (100 lbf. ft.).
- 31 Fully tighten all the bolts securing the retainer halves. Turn the bolt heads so that the hexagon corners will not foul the flywheel housing seal when fitting.
- 32 Trim the ends of the 'T' seals to leave 0,8 mm (0.030 in.) protruding from the bearing cap.
- 33 Reverse 1 to 9.

## CRANKSHAFT

### Remove and refit

12.21.33

### Removing

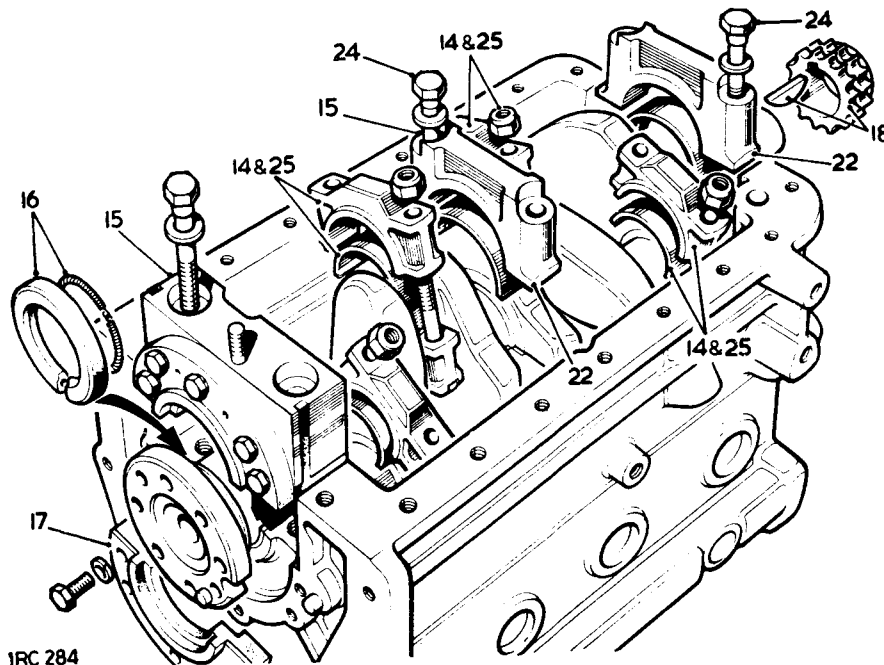
- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Remove the radiator and front panel assembly. 26.40.01.
- 4 Remove the front floor. 76.10.12.
- 5 Remove the engine assembly. 12.41.01.
- 6 Remove the oil sump. 12.60.44.
- 7 Remove the oil pump. 12.60.26.
- 8 Remove the timing gear cover. 12.65.01.
- 9 Remove the timing chain and tensioner. 12.65.28.
- 10 Remove the clutch assembly. 33.10.01.
- 11 Remove the flywheel. 12.53.07.
- 12 Remove the flywheel housing.
- 13 Remove the oil seal ring.
- 14 Remove the connecting rod caps and bearing lower halves. Retain in related sets.

- 15 Remove the main bearing caps and lift the crankshaft clear. Retain the bearing halves in related sets.
- 16 Remove the oil seal from the crankshaft.
- 17 Remove the upper half of the oil seal retainer from the cylinder block.
- 18 If required, remove the chainwheel and key from the crankshaft.

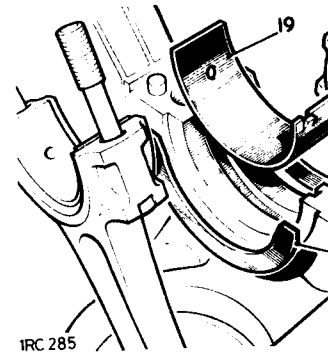
### Refitting

**NOTE:** If replacement components are to be fitted, the checks detailed in 12.21.46 must be carried out.

- 19 Locate the upper main bearing halves into the cylinder block.
- 20 Lubricate the bearings and crankshaft journals with clean engine oil, and place the crankshaft in position.
- 21 Insert a thrust washer at each side of the centre main bearing shell with the unplated faces towards the cylinder block.

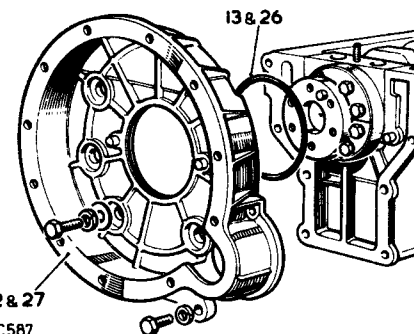


1RC 284



1RC 285

- 22 Locate the bearing lower halves into the front and centre main bearing caps. Fit the caps but do not fully tighten the fixings at this stage.
- 23 Fit the crankshaft rear oil seal. 12.21.20.
- 24 Tighten the front and centre main bearing cap fixings. Torque: Petrol engines: 11,5 kgf. m (85 lbf. ft.). Diesel engines: 13,8 kgf. m (100 lbf. ft.).
- 25 Fit the appropriate bearing halves and caps to the connecting rods, using NEW securing nuts. Torque: 3,5 kgf. m (25 lbf. ft.).
- 26 Fit the oil seal ring to the flywheel housing.
- 27 Refit the flywheel housing.



12 & 27  
1RC 587

- 28 Refit the flywheel. 12.53.07.
- 29 Refit the clutch assembly. 33.10.01.
- 30 Reset the valve timing. 12.65.22.
- 31 Reverse 1 to 9.

## CRANKSHAFT

### Overhaul

12.21.46

**CAUTION:** DO NOT fit an undersize crankshaft to a Diesel engine. When a Diesel engine crankshaft is worn, a new standard size replacement must be fitted, carrying out the following checks (except item 3).

- 1 Remove the crankshaft. 12.21.33.

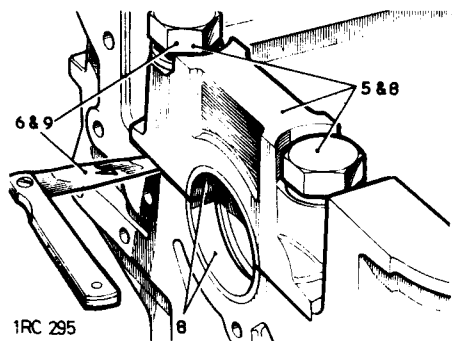
### Inspecting

- 2 Check each crankshaft journal for ovality. If ovality exceeds 0,040 mm (0,0015 in.), a reground or new crankshaft should be fitted.
- 3 *Petrol Engines:* Bearings for the crankshaft main journals and the connecting rod journals are available in the following undersizes:  
0,25 (0,010 in.).  
0,50 mm (0,020 in.).  
0,76 mm (0,030 in.).  
1,01 mm (0,040 in.).
- 4 Thrust washers for the crankshaft main journal, to control the crankshaft end float, are available in the following oversizes:  
0,06 mm (0,0025 in.).  
0,12 mm (0,005 in.).  
0,18 mm (0,0075 in.).  
0,25 mm (0,010 in.).
- 5 Fit the front main bearing cap, less bearing halves, to the cylinder block. Torque: Petrol engines: 11,75 kgf. m (85 lbf. ft.). Diesel engines: 13,8 kgf. m (100 lbf. ft.).
- 6 Slacken the fixing on one side of the cap only and check that there is no clearance at the joint face. If there is clearance, a complete new cylinder block must be fitted.
- 7 Repeat 5 and 6 for the centre and rear main bearing caps.

### Main bearing nip and clearance

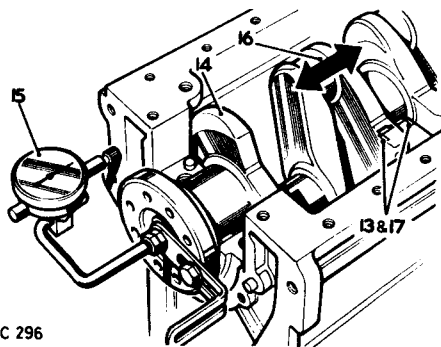
**NOTE:** New bearing halves are supplied with a protective coating and must be degreased prior to fitting, to remove the coating.

- 8 Locate the bearing halves into the front main bearing cap and the cylinder block, and fit the cap to the block. Torque: Petrol engines: 11,75 kgf. m (85 lbf. ft.). Diesel engines: 13,8 kgf. m (100 lbf. ft.).
- 9 Slacken the fixing on one side of the cap only and check the clearance between the joint faces. The clearance must be 0,10 mm to 0,15 mm (0.004 in. to 0.006 in.).



- 10 The bearing nip can be corrected by selective assembly of the bearing halves; these are available in slightly varying thicknesses. Do not file or machine the caps or cylinder block to vary the bearing nip.
- 11 Repeat 8 to 10 for the centre and rear main bearings.
- 12 When the bearing nip has been checked, remove the caps and bearing shell bottom halves.
- 13 Position a standard size thrust washer each side of the centre main bearing shell, top half, with the unplated faces towards the cylinder block. The thrust washer thickness must agree within 0,08 mm (0.003 in.).
- 14 Place the crankshaft in position on the cylinder block.
- 15 Mount a dial test indicator to read off the end of the crankshaft.
- 16 Check the crankshaft end float limits are 0,05 mm to 0,15 mm (0.002 in. to 0.006 in.).

- 17 The crankshaft end float can be adjusted by fitting oversize thrust washers. The variation of thrust washer thickness at each side must not exceed 0.08 mm (0.003 in.) to ensure that the crankshaft remains centralised.



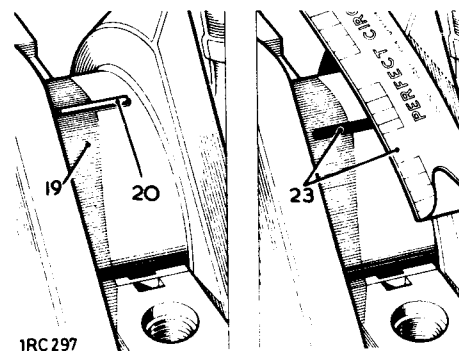
1RC 296

- 18 Make a final check to prove the main bearing clearance, using a 0,063 mm (0.0025 in.) shim paper. Check each bearing in turn by fitting both bearing halves and the bearing cap, with the shim paper between the crankshaft and one half of the bearing. The crankshaft should resist rotation with the shim paper fitted, and move freely by hand with the shim paper removed.

**NOTE:** As an alternative, Plastigauge may be used to check the main bearing clearance 19 to 26. Do not rotate the crankshaft while the Plastigauge is fitted, or the reading will be impaired.

- 19 Locate the crankshaft in position on the upper bearing halves in the cylinder block.
- 20 Place a piece of Plastigauge across the centre of the lower half of the crankshaft journal. 605238.
- 21 Fit the bearing cap complete with the lower bearing half. Torque: Petrol engines: 11,75 kgf. m (85 lbf. ft.). Diesel engines: 13,8 kgf. m (100 lbf. ft.).
- 22 Remove the bearing cap and lower half bearing.

- 23 Using the scale printed on the Plastigauge packet, measure the flattened Plastigauge at its widest point. The graduation that most closely corresponds with the width of the Plastigauge indicates the bearing clearance.



1RC 297

- 24 The correct clearance with new or overhauled components is 0,020 mm to 0,055 mm (0.0008 in. to 0.0028 in.).
- 25 If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
- 26 Wipe off the Plastigauge with an oily rag. DO NOT scrape it off.
- 27 Retain all components in related sets.
- 28 Refit the crankshaft. 12.21.33.

**DATA**

**Crankshaft**

Journal diameter ..... 63,5 mm - 0,012 mm (2.5 in. - 0.0005 in.)

Crankpin diameter ..... 58,7 mm (2.312 in.)

End float (controlled by thrust washers at centre bearing) ..... 0,05 mm to 0,15 mm (0.002 to 0.006 in.)

Regrind sizes:- Petrol Engines only: ...	Undersize	Journal dia.	Crankpin dia.
	0,25 mm (0.010 in.)	63,24 mm (2.490 in.)	58,47 mm (2.302 in.)
	0,50 mm (0.020 in.)	62,99 mm (2.480 in.)	58,22 mm (2.292 in.)
	0,76 mm (0.300 in.)	62,73 mm (2.470 in.)	57,96 mm (2.282 in.)
	1,01 mm (0.040 in.)	62,48 mm (2.460 in.)	57,70 mm (2.272 in.)

Main bearing running clearance—Petrol .. 0,20 mm to 0,072 mm (0.0008 in. to 0.00285 in.)

Main bearing running clearance—Diesel .. 0,20 mm to 0,063 mm (0.0008 in. to 0.0025 in.)

Connecting rod bearing running clearance (Petrol and Diesel) ..... 0,019 mm to 0,068 mm (0.00075 to 0.0027 in.)

## CYLINDER PRESSURES – Petrol

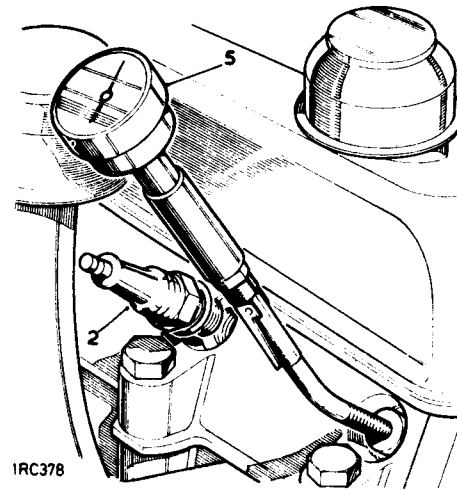
Check 12.25.01

### Checking

- 1 Run the engine until it attains normal operating temperature.
- 2 Remove the sparking plugs.
- 3 Secure the throttle in the fully open position.
- 4 Check each cylinder in turn as follows:
- 5 Insert a suitable pressure gauge into the sparking plug hole.
- 6 Crank the engine with the starter motor for several revolutions and note the highest pressure reading obtainable.
- 7 If the pressure is appreciably less than the correct figure, the piston rings or valves may be faulty.
- 8 Low pressure in adjoining cylinders may be due to a faulty cylinder head gasket.

### Compression ratio:

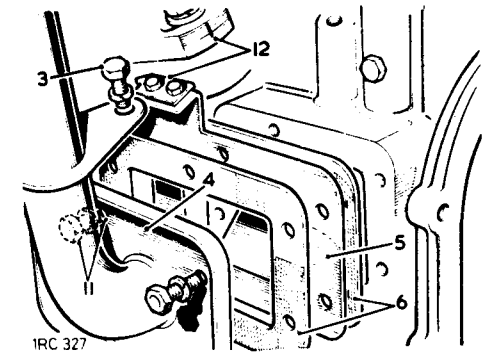
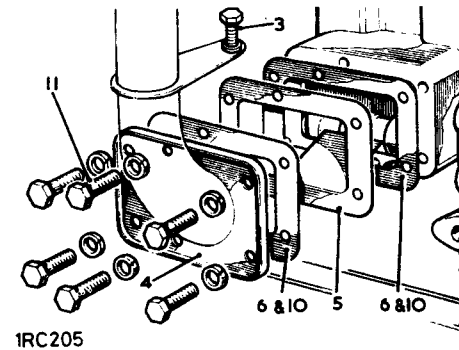
Compression pressure .....  
Cranking speed .....



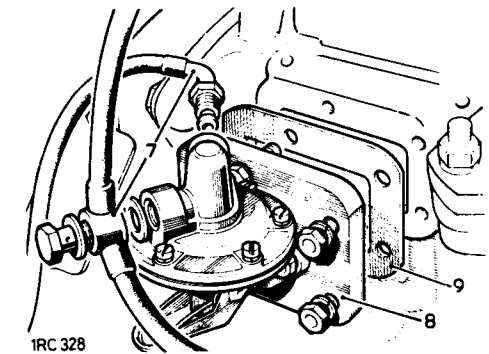
7.0 : 1	8.0 : 1
10,2 kgf/cm <sup>2</sup>	11,2 kgf/cm <sup>2</sup>
(145 lbf/in <sup>2</sup> )	(160 lbf/in <sup>2</sup> )
300 rev/min	300 rev/min

### Refitting

- 10 Smear both sides of a new joint washer with general purpose grease.
- 11 Reverse 1 to 6. When fitting front the side cover bolts first engage the tapping nearest to the oil filter pipe.
- 12 Reverse 7 to 9.
- 13 Prime the fuel pump by operating the hand prime lever until no resistance is felt.
- 14 Reverse 1 and 2.



- 7 Disconnect the fuel pipes at the fuel pump.
- 8 Remove the rear side cover complete with the fuel pump.
- 9 Withdraw the joint washer.



## CYLINDER PRESSURES— Diesel

Check 12.25.01

See page 12—23.

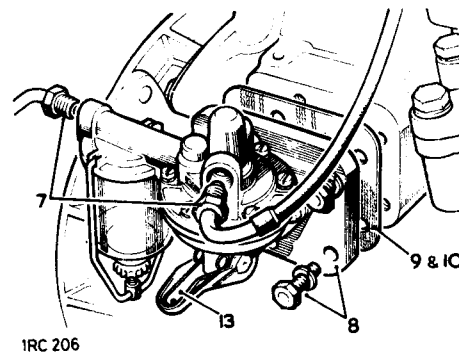
## CYLINDER SIDE COVERS - Petrol

### Remove and refit

- Front side cover 1 to 6,  
10 and 11 12.25.14
- Rear side cover 1, 2, 7 to 10 and  
12 to 14 12.25.16

### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Release the oil filler pipe bracket from the cylinder block.
- 4 Remove the front side cover complete with oil filler pipe.
- 5 Withdraw the baffle.
- 6 Withdraw the joint washers.
- 7 Disconnect the fuel pipes at the fuel pump.
- 9 Withdraw the joint washer.



## CYLINDER SIDE COVERS – Diesel

### Remove and refit

- Front side cover 1 to 6 and 10 to 12  
12.25.14
- Rear side cover 1,2, 7 to 10 and  
13 to 15 12.25.16

### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Release the oil filter pipe bracket from the cylinder block.
- 4 Remove the front side cover complete with oil filler pipe.
- 5 Withdraw the baffle.
- 6 Withdraw the joint washers.

### Refitting

- 10 Smear both sides of a new joint washer with general purpose grease.
- 11 Reverse 1 to 6. When fitting the side cover bolts, first engage the tapping nearest to the oil filler pipe.
- 12 Align the timing pointer with the timing mark scribed on the flange of the fuel distributor pump.
- 13 Reverse 7 to 9.
- 14 Prime the fuel system. 19.50.01.
- 15 Reverse 1 and 2.

## CYLINDER HEAD – Petrol

Remove and refit

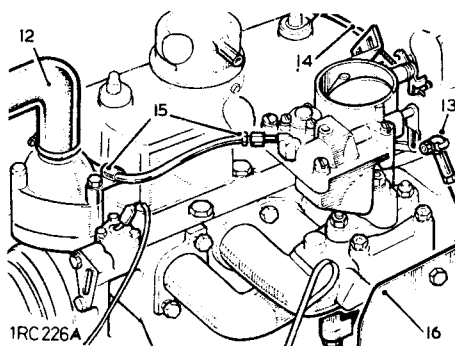
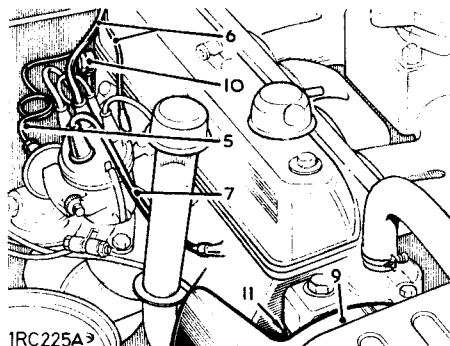
12.29.10

## Removing

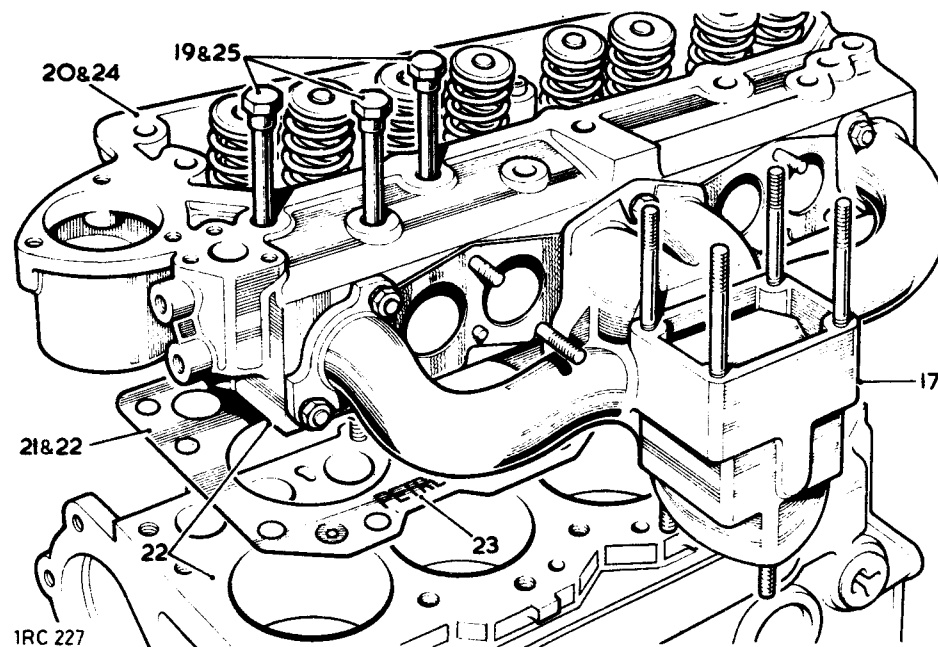
- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Disconnect the battery earth lead.
- 4 Drain the cooling system.
- 5 Disconnect the vacuum pipe at the distributor.
- 6 Disconnect the distributor leads at the ignition coil.
- 7 Disconnect the distributor leads from the sparking plugs.
- 8 Remove the sparking plugs.
- 9 Remove the fan cowl shroud.
- 10 Disconnect the oil gallery pipe.
- 11 Disconnect the coolant by-pass hose.
- 12 Disconnect the coolant hoses from the thermostat housing.
- 13 Disconnect the carburetter linkage at the ball joint.
- 14 Disconnect the cold start cable at the carburetter.
- 15 Disconnect the fuel inlet pipe at the carburetter and release the pipe clip at the cylinder head.
- 16 Remove the heat shield from the manifold.
- 17 Disconnect the exhaust pipe at the manifold.
- 18 Remove the valve gear. 12.29.34.
- 19 Slacken evenly and remove the remaining cylinder head fixings.
- 20 Lift off the cylinder head.
- 21 Withdraw the gasket.

## Refitting

**CAUTION:** If a non-retorque fabric type cylinder head gasket is being used it must be fitted dry, without grease or any sealing compound.



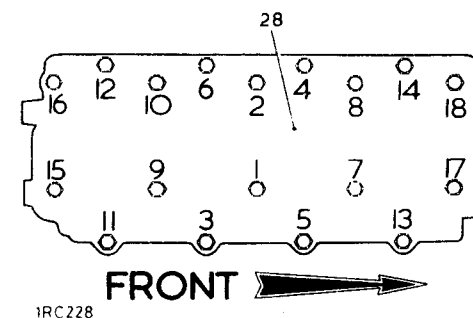
- 22 If a copper-asbestos gasket is being used, smear clean engine oil on the cylinder block and cylinder head gasket joint faces.
- 23 Position the gasket on the cylinder block with the lettering 'PETROL' uppermost.



- 24 Place the cylinder head in position.
- 25 Engage all the cylinder head fixing bolts except those also used to secure the rocker shaft assembly.

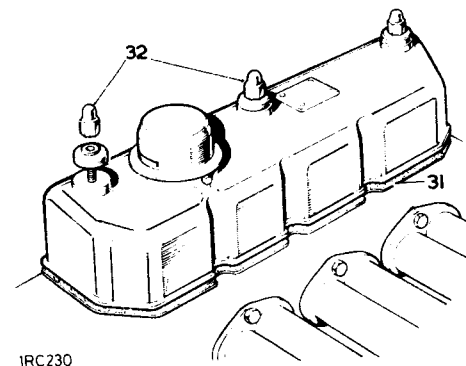
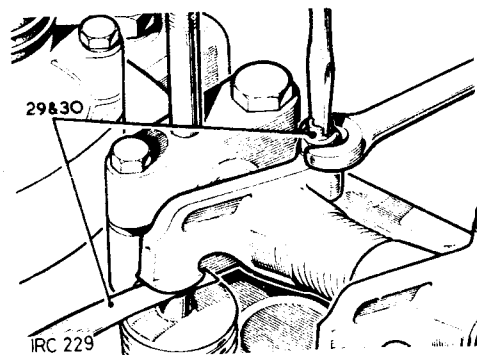
**NOTE:** Plain washers are fitted between the cylinder head bolts and the cylinder head on later engines.

- 26 Place the push rods into position and ensure that they bottom correctly into the spherical seats in the tappet slides.
- 27 Fit the rocker shaft assembly and engage the fixings.
- 28 Secure the cylinder head and rocker shaft fixings in the sequence illustrated. Torque: 1/2 in. UNF bolts 8,9 kgf. m (65 lbf. ft.), 5/16 in. UNF bolts 2,4 kgf. m (18 lbf. ft.).





- 29 Set the tappet clearances to 0,25 mm (0.010 in.) for all valves as follows:  
Set No. 1 tappet with No. 8 valve fully open.  
Set No. 3 tappet with No. 6 valve fully open.  
Set No. 5 tappet with No. 4 valve fully open.  
Set No. 2 tappet with No. 7 valve fully open.  
Set No. 8 tappet with No. 1 valve fully open.  
Set No. 6 tappet with No. 3 valve fully open.  
Set No. 4 tappet with No. 5 valve fully open.  
Set No. 7 tappet with No. 2 valve fully open.
- 30 Recheck the tappet clearances with the locknuts tightened, and readjust if necessary.
- 31 Place the joint washer for the engine top cover in position.
- 32 Fit the engine top cover.
- 33 Reverse 1 to 17.
- 34 After the initial engine run, that is with the engine at normal running temperature, check the cylinder head fixings to the correct torque load with the sparking plugs removed.



## CYLINDER HEAD – Diesel

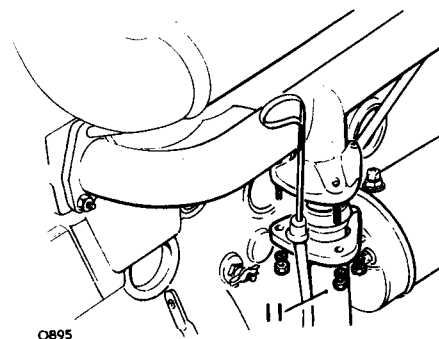
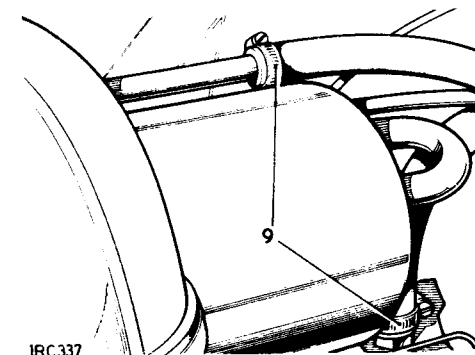
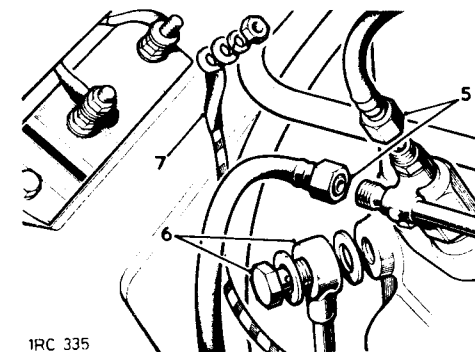
Remove and refit 12.29.10

Service tool: 606445 Spanner for cylinder head bolts

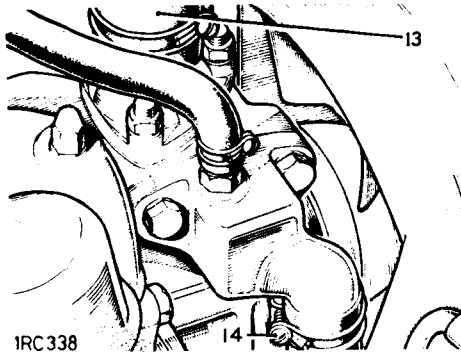
### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Disconnect the battery earth lead.
- 4 Drain the cooling system.
- 5 Disconnect the fuel spill pipes at the injector end.
- 6 Disconnect the oil gallery pipe.
- 7 Disconnect the electrical feed to the heater plugs.
- 8 Disconnect the electrical lead from the water temperature transmitter.
- 9 Disconnect the breather hose from the engine top cover.
- 10 If a brake servo unit is fitted, disconnect the vacuum pipe and the butterfly control rod from the induction manifold.
- 11 Disconnect the exhaust pipe at the manifold.

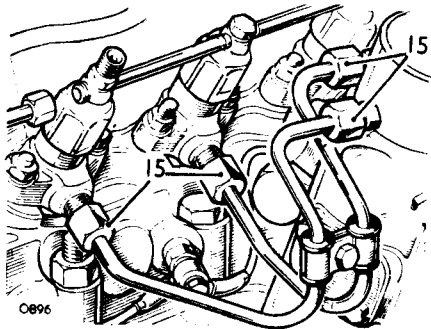
*continued*



- 12 Disconnect the heater hoses if fitted.
- 13 Disconnect the coolant hose from the thermostat housing.
- 14 Disconnect the coolant by-pass hose.



- 15 Slacken the fuel injector feed pipes at the distributor pump and disconnect them from the injectors.



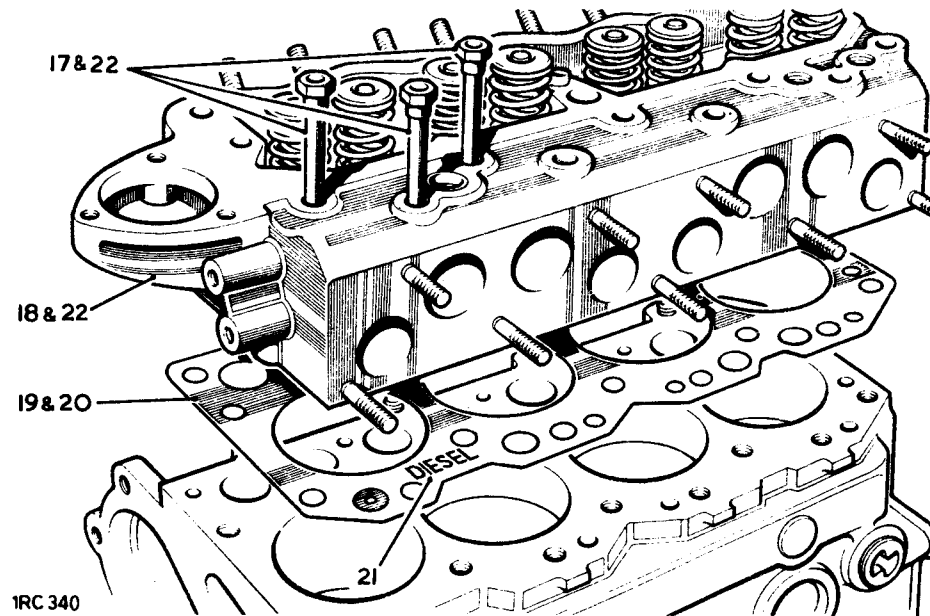
- 16 Remove the valve gear. 12.29.34.
- 17 Slacken evenly and remove the remaining cylinder head fixings.
- 18 Lift off the cylinder head.
- 19 Withdraw the gasket.

#### Refitting

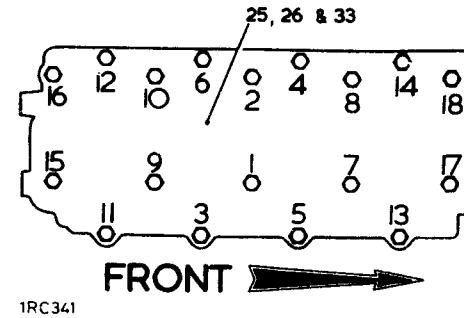
**CAUTION:** If a non-retorque fabric type cylinder head gasket is being used it must be fitted dry, without grease or any sealing compound.

#### Refitting

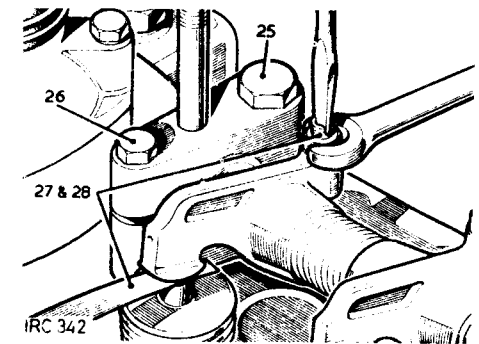
- 20 If a copper-asbestos type gasket is being fitted, thinly coat both sides of the gasket with Hylomar PL 32/M jointing compound.
- 21 Position the gasket on the cylinder block with the lettering 'DIESEL' uppermost.
- 22 Place the cylinder head in position. Engage all the cylinder head fixings except those that also secure the rocker shaft assembly.
- NOTE:** Five main bearing engines and later three main bearing engines have plain washers fitted between the cylinder head bolts and the cylinder head.
- 23 Place the push rods into their original bores and ensure that they bottom correctly into the spherical seats in the tappet slides.
- 24 Fit the rocker shaft assembly and engage the fixings.



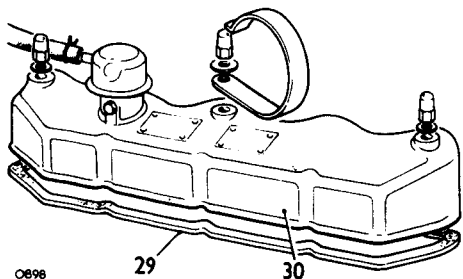
- 25 Secure to 1/2 in. UNF cylinder head fixings. 606445. Torque 12,5 kgf. m (90 lbf. ft.).
- 26 Secure the 5/16 in. UNF rocker shaft fixings. Torque 2,4 kgf. m (18 lbf. ft.).



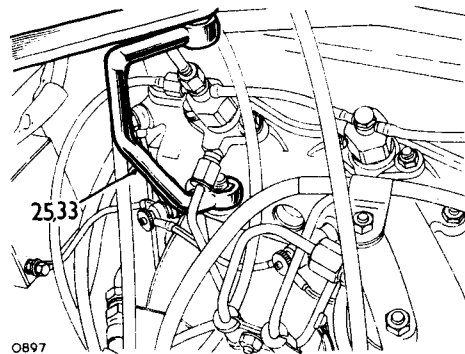
- 27 Set the tappet clearances to 0,25 mm (0.010 in.) for all valves, as follows:  
Set No. 1 tappet with No. 8 valve fully open.  
Set No. 3 tappet with No. 6 valve fully open.  
Set No. 5 tappet with No. 4 valve fully open.  
Set No. 2 tappet with No. 7 valve fully open.  
Set No. 8 tappet with No. 1 valve fully open.  
Set No. 6 tappet with No. 3 valve fully open.  
Set No. 4 tappet with No. 5 valve fully open.  
Set No. 7 tappet with No. 2 valve fully open.
- 28 Recheck the tappet clearances with the locknuts tightened, and readjust if necessary.



- 29 Place the joint washer for the engine top cover in position.
- 30 Fit the engine top cover.
- 31 Reverse 1 to 15.



- 32 Start and run the engine until it attains normal operating temperature.
- 33 Remove the engine top cover, and while the engine is hot, check/tighten all the 1/2 in. UNF cylinder head fixings in the order shown. 606445. Torque 12,5 kgf. m (90 lbf. ft.).



## CYLINDER HEAD – Petrol

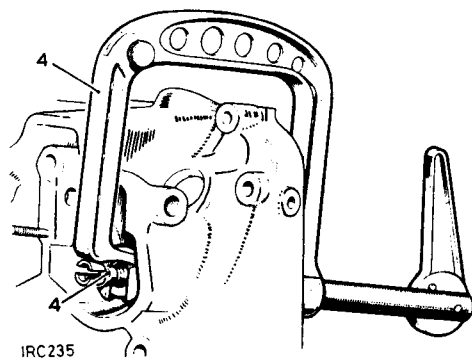
Overhaul

12.29.18

Service tools: 276102 Valve spring compressor  
274400 Inlet valve guide remover  
274401 Exhaust valve guide remover  
600959 Exhaust valve guide replacer  
601508 Inlet valve guide replacer  
MS627 Inlet valve seat cutter  
MS621 Exhaust valve seat cutter  
MS76 Hand set  
MS150—8 Adjustable pilot  
MS150—8.5 Adjustable pilot

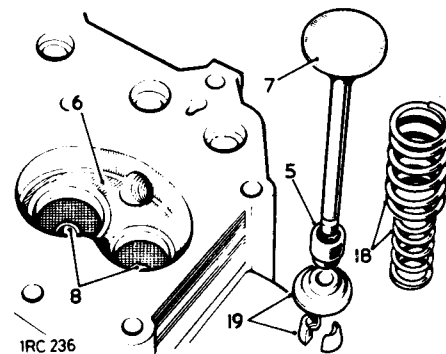
### Dismantling

- 1 Remove the cylinder head. 12.29.10.
- 2 Remove the induction and exhaust manifold assembly. 30.15.01.
- 3 Remove the thermostat housing complete.
- 4 Remove the valve assemblies and retain the components in related sets. Compressor 276102.

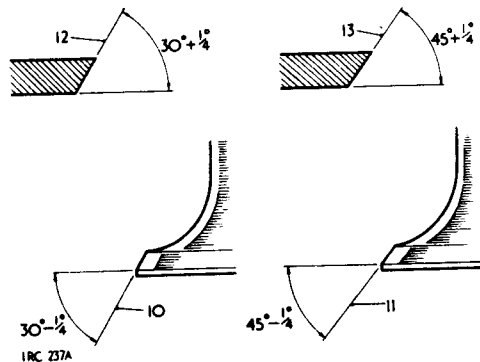


- 5 Withdraw the oil seals from the valve guides.
- 6 Clean the combustion chambers and piston crowns with a soft wire brush.

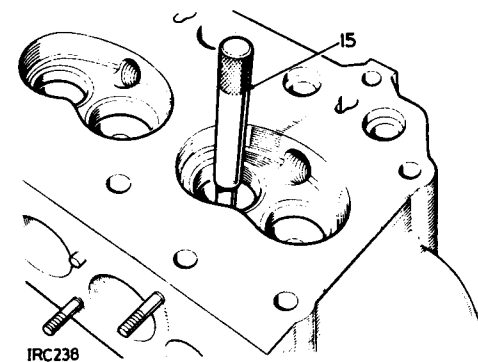
- 7 Clean the valves.
- 8 Clean the valve guide bores.



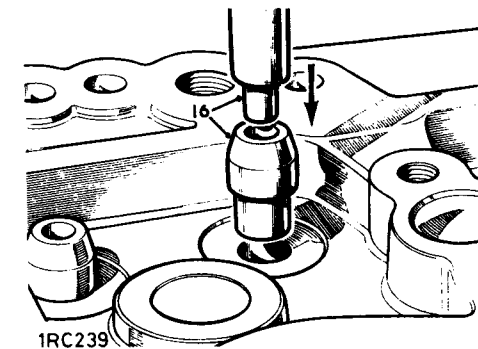
- 9 Regrind or fit new valves as necessary.
- 10 The correct angle for the inlet valve face is  $30^\circ - \frac{1}{4}$ .
- 11 The correct angle for the exhaust valve face is  $45^\circ - \frac{1}{4}$ .
- 12 The correct angle for the inlet valve seat is  $30^\circ + \frac{1}{4}$ .
- 13 The correct angle for the exhaust valve seat is  $45^\circ + \frac{1}{4}$ .



- 14 Check the valve guides and fit replacements as necessary. 15 to 17.
- 15 Drive out the old guides from the combustion chamber side. 274400 and 274401.



- 16 Lubricate the new valve guides and drive them into position. 600959 and 601508.

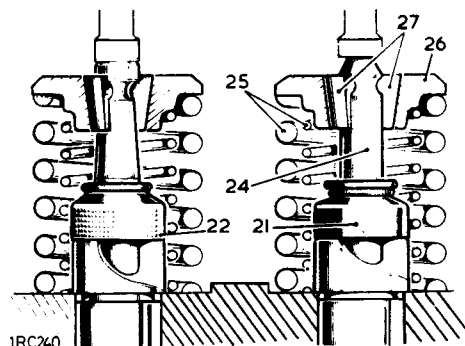


- 17 Check and if necessary, reface the valves and seats, as previously described.
- 18 Inspect the valve springs which are provided as paired assemblies. The springs must be an interference fit with each other.
- 19 Inspect the valve split cones and valve spring caps for general condition.
- 20 Inspect the cylinder head for general condition and for damage to threads.

continued

**Assembling**

- 21 Fit the oil seals, fitted with springs, to the inlet valve guides.
- 22 Fit the oil seals, with external projections, to the exhaust valve guides.
- 23 Lubricate the valve stems and guides with engine oil and fit each valve as follows:
- 24 Insert the valve into its respective guide.
- 25 Place the valve springs in position.
- 26 Locate the cap on the springs.
- 27 Compress the springs and fit the valve collets. 276102.
- 28 Reverse 1 to 3.
- 29 After the initial engine run, that is with the engine at normal running temperature, check the cylinder head fixings to the correct torque load with the sparking plugs removed. Torque 1/2 UNF bolts 8,9 kgf. m (65 lbf. ft.). 5/16 UNF bolts 2,4 kgf. m (18 lbf. ft.).



1RC240

**DATA****Cylinder Head**

Inlet valve seat angle .....	$30^{\circ} + \frac{1}{4}^{\circ}$
Exhaust valve seat angle .....	$45^{\circ} + \frac{1}{4}^{\circ}$

**Valves**

Inlet valve .....	7,88 mm to 7,90 mm (0.3107 in. to 0.3112 in.)
Diameter of stem .....	
Face angle .....	$30^{\circ} - \frac{1}{4}^{\circ}$
Exhaust valve .....	
Diameter of stem .....	8,65 mm to 8,67 mm (0.3410 in. to 0.3415 in.)
Face angle .....	$45^{\circ} - \frac{1}{4}^{\circ}$

**Valve guides**

Inlet bore size, after fitting .....	7,93 mm to 7,97 mm (0.3125 in. to 0.3140 in.)
Exhaust bore size after fitting .....	8,73 mm to 8,77 mm (0.3435 in. to 0.3450 in.)

**Valve Springs**

<b>Inner</b>	
Length, free .....	42,67 mm (1.680 in.)
Length, under 8,0 kg (17.7 lb) load .....	37,13 mm (1.462 in.)
<b>Outer</b>	
Length, free .....	46,28 mm (1.822 in.)
Length, under 21 kg. (46 lb) load .....	40,30 mm (1.587 in.)

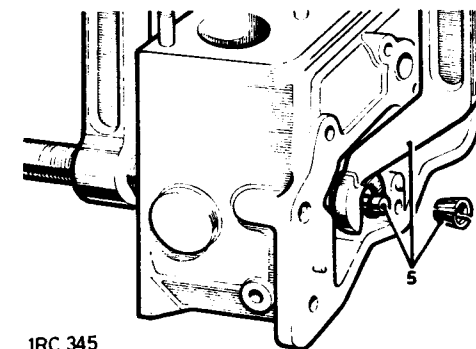
**CYLINDER HEAD – Diesel****Overhaul**

12.29.18

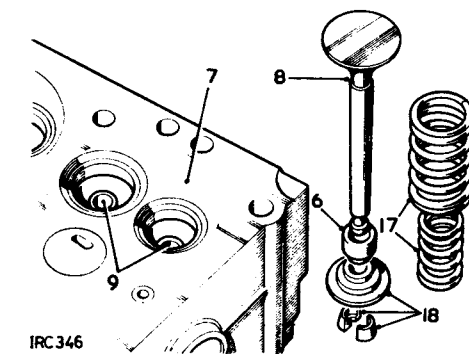
- Service tools: 276102 Valve spring compressor  
 274400 Inlet valve guide remover  
 274401 Exhaust valve guide remover  
 600959 Exhaust valve guide replacer  
 601508 Inlet valve guide replacer  
 530625 Exhaust seat insert replacer  
 MS 621 Inlet and exhaust valve seat cutter  
 MS 76 Hand set  
 MS 150—8 Adjustable pilot  
 MS 150—8.5 Adjustable pilot

**Dismantling**

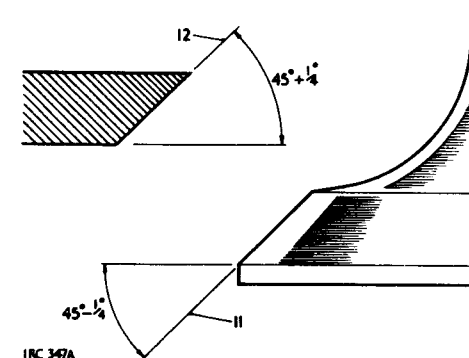
- 1 Remove the cylinder head. 12.29.10.
- 2 Remove the induction and exhaust manifold assembly. 30.15.01.
- 3 Remove the injectors. 19.60.01.
- 4 Remove the thermostat housing complete.
- 5 Remove the valve assemblies and retain the components in related sets. Compressor 276102.
- 6 Withdraw the oil seals from the valve guides.
- 7 Clean the combustion chambers and piston crowns with a soft wire brush.
- 8 Clean the valves.
- 9 Clean the valve guide bores.
- 10 Regrind or fit new valves as necessary.
- 11 The correct angle for inlet and exhaust valve faces is  $45^{\circ} - \frac{1}{4}^{\circ}$ .
- 12 The correct angle for the inlet and exhaust valve seats is  $45^{\circ} + \frac{1}{4}^{\circ}$ .
- 13 Check the valve guides and fit replacements as necessary. 14 to 16.



1RC 345

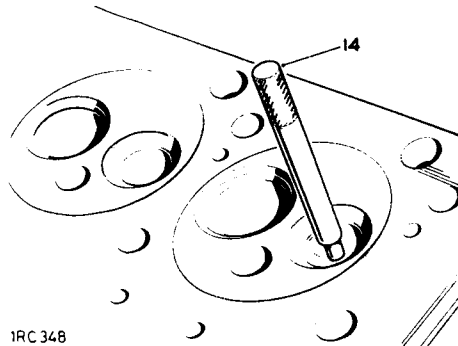


1RC 346



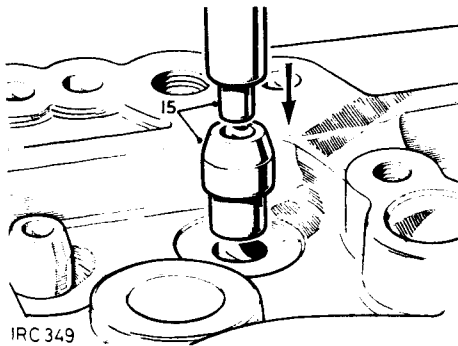
1RC 347A

- 14 Drive out the old guides from the combustion chamber side. 274400 and 274401.



IRC 348

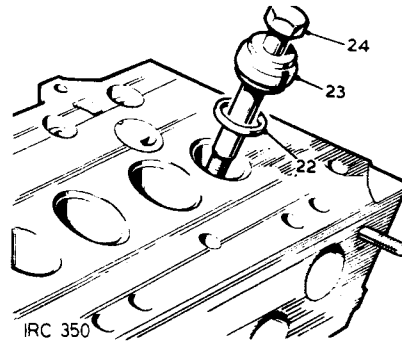
- 15 Lubricate the new valve guides and drive them into position. 600959 and 601508.



IRC 349

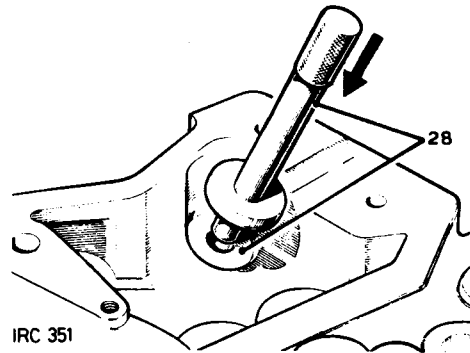
- 16 Check and if necessary, reface the valves and seats, as previously described.
- 17 Inspect the valve springs which are provided as paired assemblies. The springs must be an interference fit with each other.
- 18 Inspect the valve collets and valve springs caps for general condition.
- 19 Check the exhaust valve seats and fit replacements as necessary.

- 20 Remove the valve guides from the applicable exhaust ports.
- 21 Remove the old seat inserts by grinding them away until they are thin enough to be cracked and prised out.
- 22 Place the new seat insert in position.
- 23 Locate the replacer tool 530625, onto the seat insert.
- 24 Using a suitable nut and bolt, pull the insert into the recess in the cylinder head.



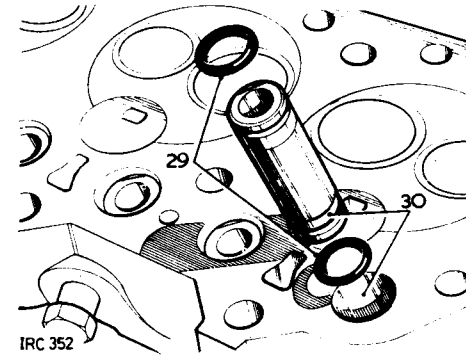
IRC 350

- 25 Fit the valve guides as previously detailed.
- 26 Cut the valve seats to  $45^\circ + \frac{1}{4}^\circ$ .
- 27 Check the push rod tubes and seals and fit replacements as necessary. 28 to 32.
- 28 Drive out the old push rod tubes from valve gear side. Using a suitable drift.



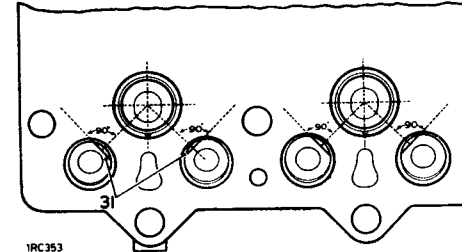
IRC 351

- 29 Fit new sealing rings to new push rod tubes and smear them with MS4 silicone grease.



IRC 352

- 30 Insert the new tubes, chamfered end first, from the combustion chamber side.
- 31 Align the flat on the push rod tube at right angles to an imaginary line between the centre of the push rod tube and the centre of the hot plug.



IRC 353

- 32 Press the push rod tubes into position ensuring that the alignment is maintained and that the chamfers on the tubes and in the cylinder head are fully engaged.

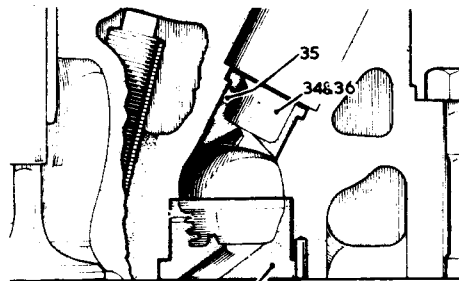
### Hot plugs (combustion chamber) and injector shrouds

When carrying out normal top overhaul work on the cylinder it is not necessary to remove either the injector shrouds or the hot plugs.

Small surface cracks in the hot plug, extending from the opening to approximately 8,0 mm (0.312 in.) in length can be ignored. However if any severe cracks appear on the face of the hot plug, before attempting to remove it, closely inspect the cylinder head for signs of cracks, particularly between the inlet and exhaust valve seats. Such cracking indicates that the engine has overheated, usually through lack of coolant, and the cylinder head should be scrapped.

*continued*

- 33 To remove a hot plug, insert a thin soft metal drift through the injector shroud throat and tap the hot plug from the inside. Once removed the hot plug is scrap.
- 34 If the injector shroud is damaged, drift the shroud out towards the injector bore.
- 35 Thoroughly clean out the combustion chamber. The hole in the side of the injector shroud is for manufacturing purposes only but at the same time can be used as a guide when refitting the shroud.
- 36 Smear a little oil on the shroud and insert into the cylinder head with the hole pointing towards the centre of the cylinder head, and drift into position. 274399.
- 37 Fit the hot plugs by tapping with a hide-faced mallet.
- 38 When fitted, the hot plugs must be checked with a dial test indicator to ensure that they do not protrude above the level of the cylinder head face more than 0,025 mm (0.001 in.) and are not recessed below the level of the cylinder head face more than 0,05 mm (0.002 in.).



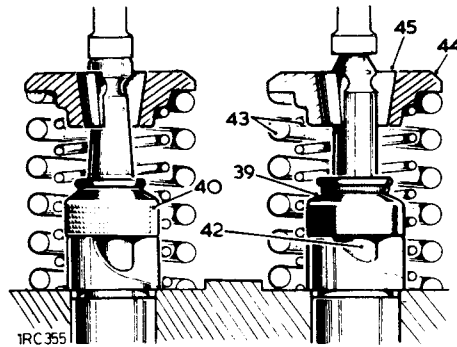
33, 37 & 38

1RC354

**NOTE:** If the hot plugs are loose in the cylinder head they may be retained with a little grease.

**Assembling**

- 39 Fit the oil seals, fitted with springs, to the inlet valve guides.
- 40 Fit the oil seals, with external projectors, to the exhaust valve guides.
- 41 Lubricate the valve stems and guides with engine oil and fit each valve as follows:
- 42 Insert the valve into its respective guide.
- 43 Place the valve springs in position.
- 44 Locate the cap on the springs.
- 45 Compress the springs and fit the valve collets. 276102.



- 46 Reverse 1 to 4.
- 47 After the initial engine run, that is with the engine at normal running temperature, check the cylinder head fixings to the correct torque load. 606445. Torque: 1/2 in. UNF fixings 12,5 kgf. m (90 lbf. ft.). 5/16 in. UNF fixings 2,4 kgf. m (18.lbf. ft.).

**DATA**

**Cylinder Head**

Inlet valve seat angle .....	45° + ¼°
Exhaust valve seat angle .....	45° + ¼°

**Valves**

<b>Inlet valve</b>	
Diameter of stem .....	7,88 mm to 7,90 mm (0.3107 in. to 0.3112 in.)
Face angle .....	45° - ¼°
<b>Exhaust valve</b>	
Diameter of stem .....	8,65 mm to 8,67 mm (0.3410 in. to 0.3415 in.)
Face angle .....	45° - ¼°

**Valve guides**

Inlet guide bore size, after fitting .....	7,93 mm to 7,97 mm (0.3125 in. to 0.3140 in.)
Exhaust guide bore, after fitting .....	8,73 mm to 8,77 mm (0.3435 in. to 0.3450 in.)

**Valve springs**

<b>Inner</b>	
Length, free .....	42,67 mm (1.680 in.)
Length, under 8,0 kg (17.7 lb.) load ..	37,13 mm (1.462 in.)
<b>Outer</b>	
Length, free .....	46,28 mm (1.822 in.)
Length, under 21 kg (46 lb) load ...	40,30 mm (1.587 in.)

## VALVE GEAR – Petrol

Remove and refit

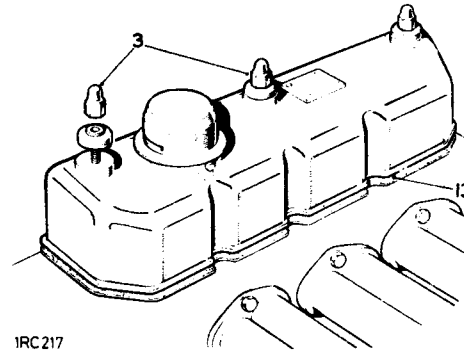
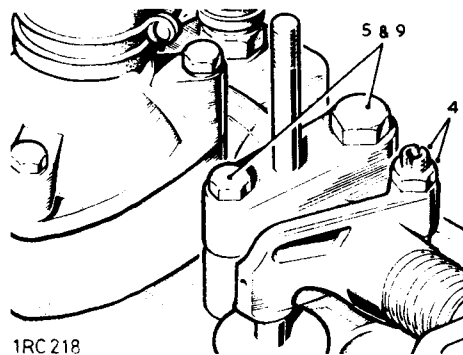
12.29.34

### Removing

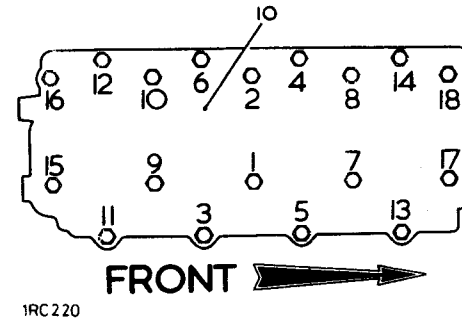
- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Remove the engine top cover.
- 4 Slacken locknuts and turn tappet adjusting screws to disengage from push rods.
- 5 Remove fixings from rocker shaft support brackets. Do not remove shaft assembly at this stage.
- 6 Withdraw the rocker shaft assembly complete, using the engine top cover secured inverted to the rocker bracket studs to retain the assembly.
- 7 Withdraw the tappet push rods and retain them in numbered sequence related to the tappet served.

### Refitting

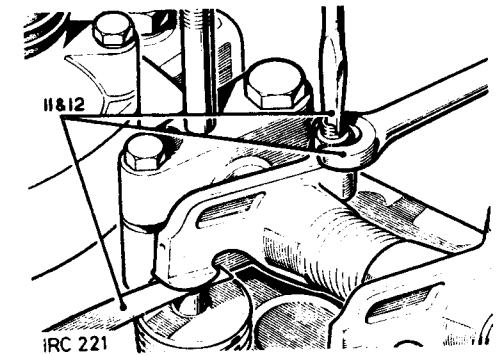
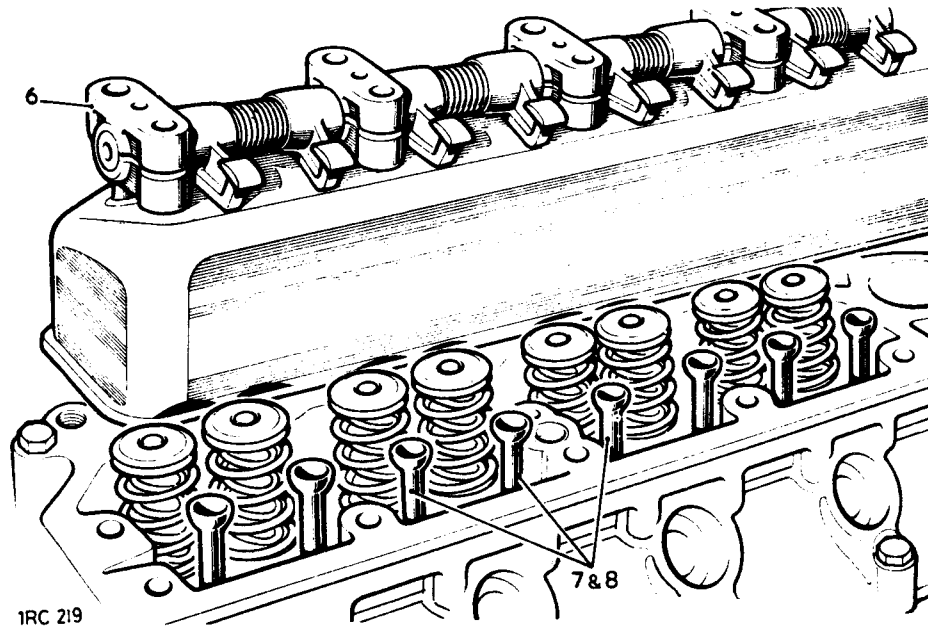
- 8 Fit the tappet push rods to their original bores. Ensure that the bottom end of the push rods locate in the spherical tappet seats.
- 9 Refit the rocker shaft assembly, located by spigots. Torque: 1/2 in. UNF bolts: 8,9 kgf. m (65 lbf. ft.). 5/16 in. UNF bolts: 2,4 kgf. m (18 lbf. ft.).



- 10 Check tighten all 1/2 in UNF cylinder head fixings in the order shown. Torque: 8,9 kgf. m (65 lbf. ft.).



- 11 Set the tappet clearances to 0,25 mm (0.010 in.) for all valves, as follows:  
Set No. 1 tappet with No. 8 valve fully open.  
Set No. 3 tappet with No. 6 valve fully open.  
Set No. 5 tappet with No. 4 valve fully open.  
Set No. 2 tappet with No. 7 valve fully open.  
Set No. 8 tappet with No. 1 valve fully open.  
Set No. 6 tappet with No. 3 valve fully open.  
Set No. 4 tappet with No. 5 valve fully open.  
Set No. 7 tappet with No. 2 valve fully open.
- 12 Recheck the tappet clearances with the locknuts tightened, and readjust if necessary.
- 13 Place the joint washer for the engine top cover in position.
- 14 Reverse 1 to 3.



### DATA

Tappet clearance ..... 0,25 mm (0.010 in.) inlet and exhaust.

## VALVE GEAR – Diesel

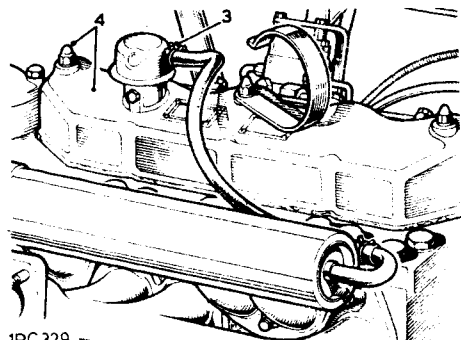
## Remove and refit

12.29.34

Service tool: 606445 Spanner for cylinder head bolts

## Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Disconnect the breather hose from the engine top cover.
- 4 Remove the engine top cover.



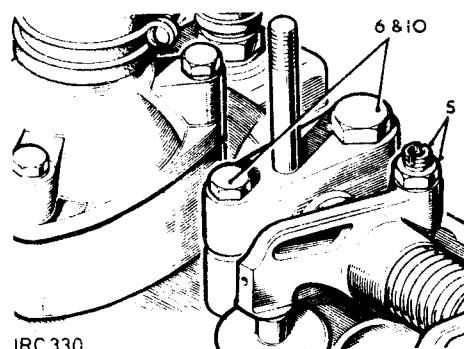
1RC329

- 5 Slacken locknuts and turn tappet adjusting screws to disengage from push rods.
- 6 Remove fixings from rocker shaft support brackets. Do not remove shaft assembly at this stage.

- 7 Invert the engine top cover and secure it to the studs on the rocker brackets. Withdraw the rocker shaft assembly complete, using the engine top cover to retain the assembly.
- 8 Withdraw the tappet pushrods and retain them in numbered sequence related to the tappet served.

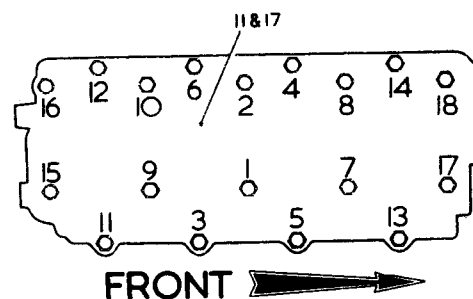
## Refitting

- 9 Fit the tappet pushrods to their original bores. Ensure that the bottom end of the push rods locate in the spherical tappet seats.
- 10 Fit the rocker shaft assembly, located by spigots. Torque: 1/2 in. UNF bolts: 12,5 kgf. m (90 lbf. ft.). 5/16 in. UNF bolts: 2,4 kgf. m (19 lbf. ft.).

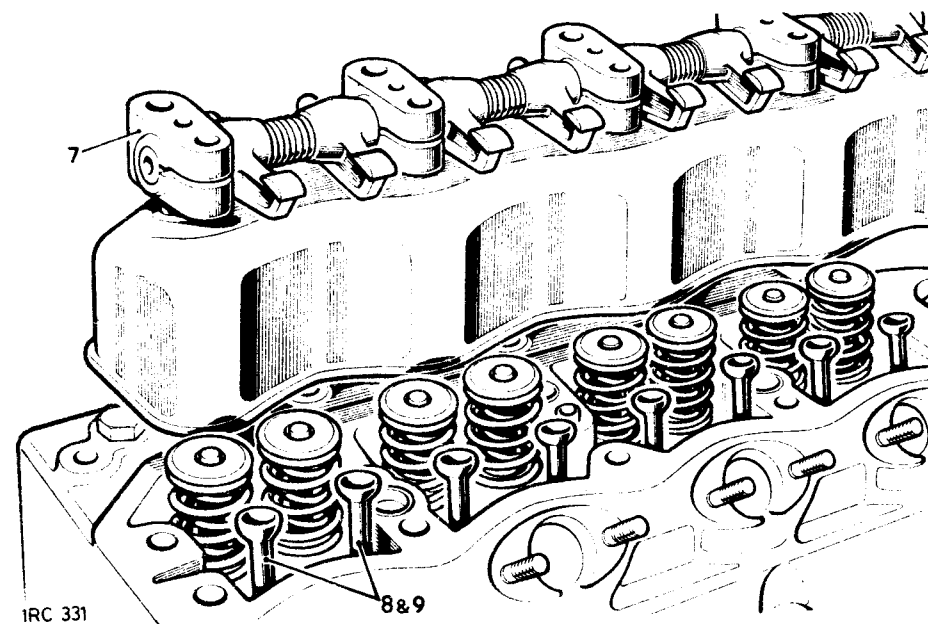


1RC330

- 11 Check tighten all the 1/2 in. UNF cylinder head fixings in the order shown. 606445. Torque: 12,5 kgf. m (90 lbf. ft.).

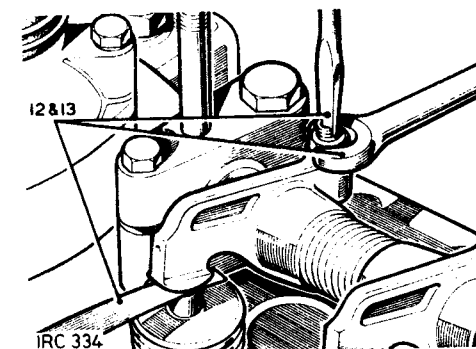


1RC332



1RC331

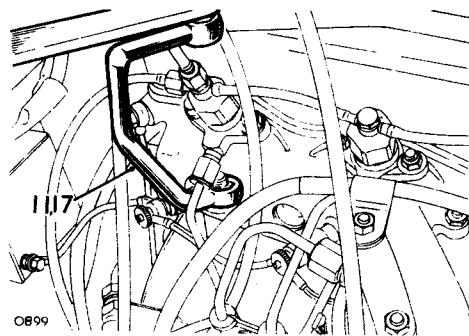
- 12 Set the tappet clearance to 0,25 mm (0.010 in.) for all valves, as follows:  
Set No. 1 tappet with No. 8 valve fully open.  
Set No. 3 tappet with No. 6 valve fully open.  
Set No. 5 tappet with No. 4 valve fully open.  
Set No. 2 tappet with No. 7 valve fully open.  
Set No. 8 tappet with No. 1 valve fully open.  
Set No. 6 tappet with No. 3 valve fully open.  
Set No. 4 tappet with No. 5 valve fully open.  
Set No. 7 tappet with No. 2 valve fully open.
- 13 Recheck the tappet clearances with the locknuts tightened, and readjust if necessary.



1RC334



- 14 Place the joint washer for the engine top cover in position.
- 15 Reverse 1 to 4.
- 16 Start and run the engine until it is hot.
- 17 Remove the engine top cover, and while the engine is hot, check/tighten all the 1/2 in. UNF cylinder head fixings in the order shown. 606445. Torque: 12,5 kgf. m (90 lbf. ft.).
- 18 Refit the engine top cover.



#### DATA

Tappet clearance .....

0,25 mm (0.010 in.) inlet and exhaust.

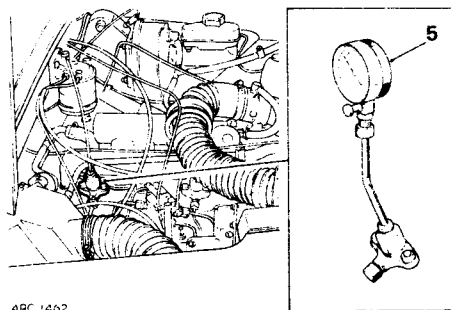
### CYLINDER PRESSURES — Diesel

Check 12.25.01

#### Checking

- 1 Run the engine until it attains normal running temperature.
- 2 Stop the engine and open the bonnet. Disconnect the inlet pipe from the fuel distribution pump to prevent the engine starting during the following check.
- 3 Remove the injector from the cylinder to be checked. The three remaining injectors must be securely fitted to the cylinder head.
- 4 Secure the manifold butterfly valve (accelerator) in the fully open position.
- 5 Insert a suitable pressure gauge into the injector hole in the cylinder head.
- 6 Crank the engine with the starter motor for several revolutions and note the highest pressure reading obtained. For a cylinder in good condition the pressure should be 31,0 to 33,0 kgf/cm<sup>2</sup>.
- 7 If the pressure is considerably less than the minimum figure, the piston rings or valves may be faulty.

- 8 Refit the injector and repeat the foregoing check on the three remaining cylinders.
- 9 Low pressure in adjoining cylinders may be due to a faulty cylinder head gasket.
- 10 Reconnect the inlet pipe to the fuel distribution pump.



### ROCKER SHAFT ASSEMBLY

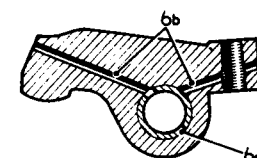
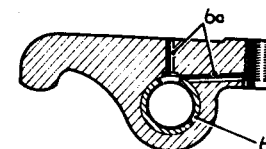
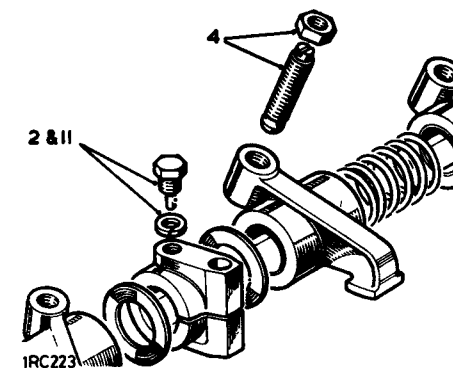
Overhaul 12.29.55

#### Dismantling

- 1 Remove the valve gear. 12.29.34.
- 2 Remove the locating screw and washer from the intermediate rocker bracket.
- 3 Withdraw all the components from the rocker shaft.
- 4 Remove the tappet adjustment screws.

#### Inspecting

- 5 Rocker brackets. Ensure the oil feed holes are clear. Inspect the locating dowel spigots; the spigots must be undamaged to ensure a correct fit on the locating dowels in the cylinder head.
- 6 Valve rockers:
  - a Valve rocker for 2½ litre Petrol engines.
  - b Valve rocker for 2½ litre Diesel engines.
  - c Visually inspect the rocker bushes for wear. If necessary, press replacement bushes into the rockers and ream to 13,5 mm + 0,02 mm (0.530 in. + 0.001 in.). The oil holes in the rocker bushes are pre-drilled and must be aligned with the oil holes in the valve rocker when assembled.
- 7 Check that all oil passage drillings are clear.
- 8 Tappet adjusting screws and locknuts. Examine threads for damage. Check that the oil relief drilling is clear.
- 9 Inspect the rocker shaft for wear and scores; check that the oil feed holes are clear.
- 10 Examine the rocker shaft springs, spacing washers and the locating screw for soundness and general condition.
- 11 Fit an intermediate rocker bracket to the rocker shaft and engage the locating screw through the bracket and into the larger hole in the shaft.



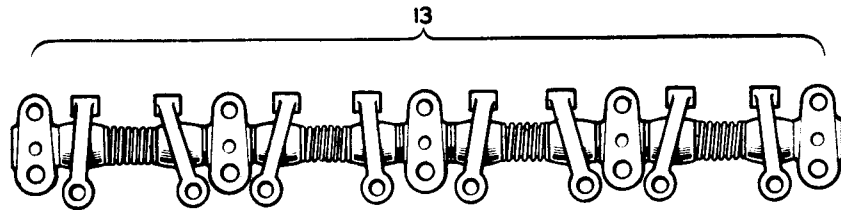
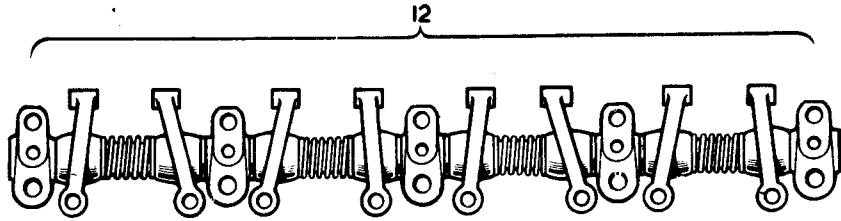
2PC 172

continued

12 Petrol engines – Assemble the components to the rocker shaft as illustrated and note the assembled position of the spacing washers and the handed valve rockers.

13 Diesel engines – Assemble the components to the rocker shaft as illustrated and note the assembled position of the spacing washers and the handed valve rockers.

14 Refit the tappet adjustment screws.  
15 Refit the valve gear. 12.29.34.



1RC 224

**DATA**

**Rockers**

Bush internal diameter, reamed in position.....

13,40 mm to 13,42 mm (0.530 in. to 0.531 in.)

Shaft clearance in rocker bush:

Petrol engines .....

0,013 mm to 0,038 mm (0.0005 in. to 0.0015 in.)

Diesel engines .....

0,013 mm to 0,062 mm (0.0005 in. to 0.0025 in.)

**TAPPETS**

**Remove and refit**

12.29.57

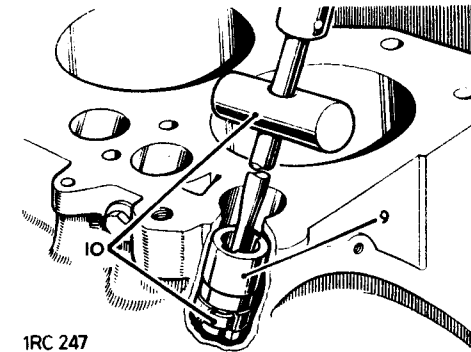
Service tool: 530101 Tappet Guide remover

**Removing**

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Disconnect the battery earth lead.
- 4 Remove the valve gear. 12.29.34.
- 5 Remove the cylinder head. 12.29.10.
- 6 Remove the tappet guide locating bolts from the right hand side of the cylinder block.

**CAUTION:** Do not remove the tappet guides before the rollers have been withdrawn, otherwise the rollers may fall behind the camshaft.

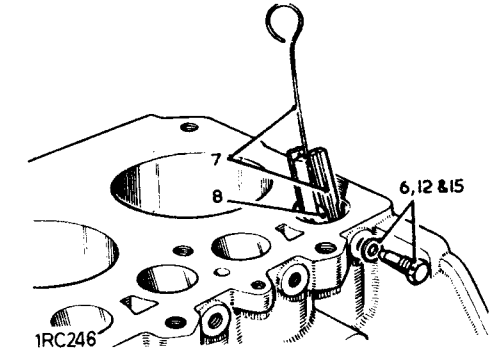
- 7 Using long nose pliers or a suitably made wire clip, withdraw the tappet slides and retain in sequence.
- 8 Withdraw the tappet rollers and retain with the related slides.
- 9 Withdraw the tappet guides and retain in sequence, with the other related parts.
- 10 If the guides are difficult to withdraw, use Service Tool 530101.



1RC 247

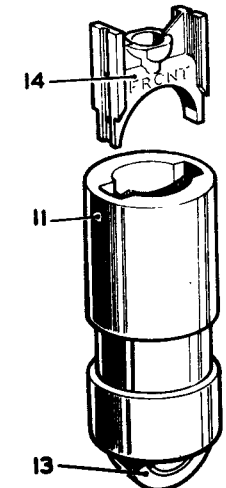
**Refitting**

- 11 Fit the tappet guides in the sequence removed, aligning the locating holes.
- 12 Engage the locating bolts sufficient to retain the guides.



1RC 246

- 13 Fit the tappet rollers with the larger chamfer towards the front of the engine.
- 14 Fit the tappet slides with the marking 'FRONT' towards the front of the engine.
- 15 Tighten the tappet guide locating bolts and secure in pairs by wire-locking.
- 16 Reverse 1 to 5.



1RC 248

## ENGINE ASSEMBLY – Petrol

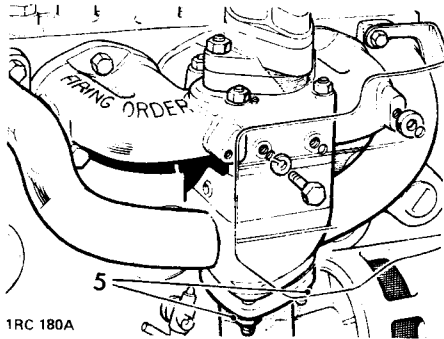
Remove and refit

12.41.01

Service tool: 600963 Engine sling

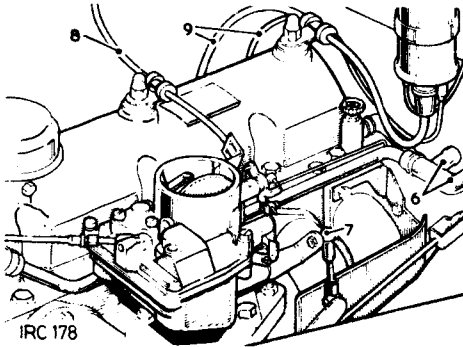
### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the air cleaner. 19.10.04.
- 3 Remove the radiator and front panel assembly. 26.40.01.
- 4 Remove the bell housing cover. 76.10.71.
- 5 Disconnect the exhaust pipe at the manifold.



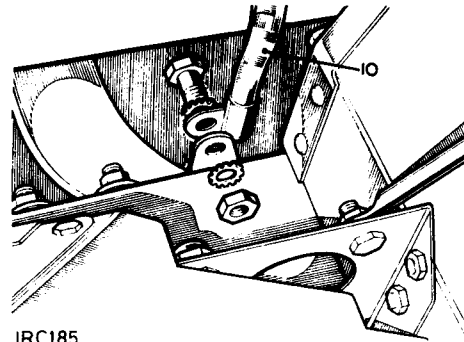
1RC 180A

- 6 Disconnect the heater hoses and trunion if fitted.
- 7 Disconnect the carburetter linkage at the ball joint.
- 8 Disconnect the cold start cable at the carburetter.
- 9 Disconnect the distributor leads from the coil.



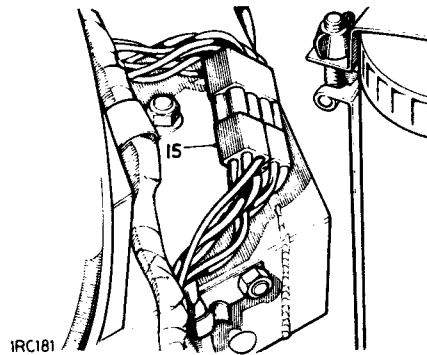
1RC 178

- 10 Disconnect the engine earth cable.



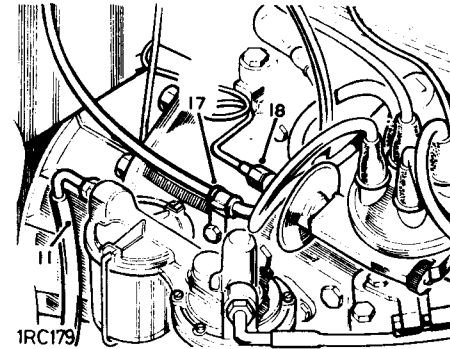
1RC185

- 11 Disconnect the fuel inlet pipe at the fuel pump.
- 12 Release the clutch fluid pipe from the clips at the rear of the engine.
- 13 Disconnect the starter motor leads at the solenoid.
- 14 Disconnect the electrical leads from the alternator.
- 15 Disconnect the engine electrical leads at the multi plug adjacent to the dash.



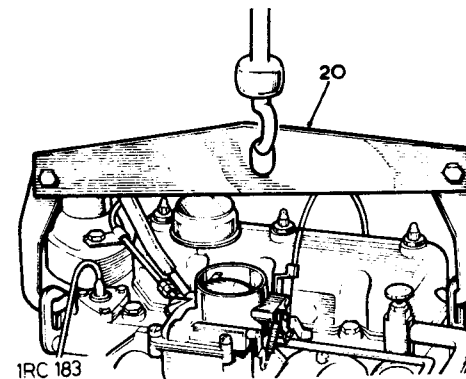
1RC181

- 16 Release the disconnected electrical leads from the retaining clips at the dash panel.
- 17 Release the speedometer drive cable from the clip at the engine.
- 18 Disconnect the vacuum pipe from the distributor where applicable.



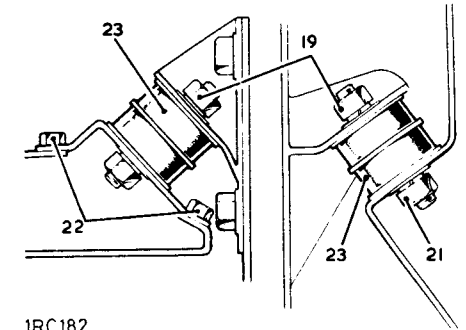
1RC179

- 19 Remove the upper fixings from the engine mounting rubbers.
- 20 Attach a suitable lifting sling and hoist to the engine lifting hooks. 600963.



1RC 183

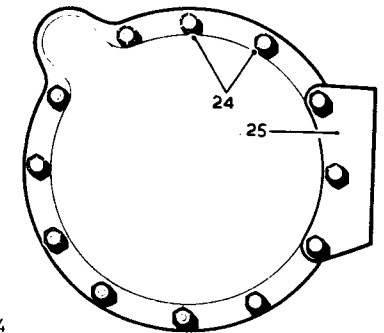
- 21 Remove the bottom fixing from the left hand engine mounting rubber.
- 22 Remove the support bracket fixings from the right hand engine mounting rubber.
- 23 Tension the hoist sufficient to withdraw the engine mounting rubbers, then lower the engine to its original position to maintain alignment with the gearbox.



1RC182

- 24 Remove the fixings securing the bell housing to the flywheel housing.
- 25 Move the clutch slave cylinder aside without disconnecting the fluid pipe.

*continued*



1RC184

- 26 Support the gearbox assembly by inserting a suitable piece of timber 25 mm thick between the gearbox and cross-member.
- 27 Draw the engine forward to release it from the dowelled location to the bell housing, and to clear the primary pinion from the clutch.
- 28 Lift the engine clear.

#### Refitting

- 29 Attach a suitable lifting sling and hoist to the engine lifting hooks. 600963, and smear the splines of the primary pinion, the clutch centre, and the withdrawal unit abutment faces with Molybdenum disulphide grease such as Rocol MTS 1000.
- 30 Lower the engine into position, locating the primary pinion into the clutch and engage the bell housing dowels.
- 31 Secure the bell housing to the flywheel housing.
- 32 Tension the hoist sufficient to remove the timber support from the gearbox and insert the engine front mounting rubbers.
- 33 Lower the engine and secure the engine mounting upper and lower fixings.
- 34 Remove the engine lifting sling.
- 35 Reverse 1 to 18.
- 36 Check, and if necessary replenish the engine lubricating oil.
- 37 Check, and if necessary replenish the gearbox lubricating oil.
- 38 Start the engine. Check that the oil pressure warning light goes out, and check the cooling system for leaks.
- 39 Check, and if necessary adjust, the engine idle speed.
- 40 Check, and if necessary adjust, the ignition timing.
- 41 When the engine is cold, check the coolant level in the radiator and top up if necessary.

## ENGINE ASSEMBLY – Diesel

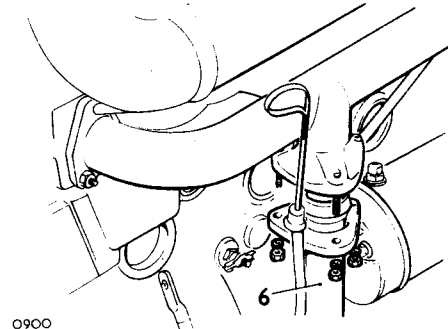
### Remove and refit

12.41.01

Service tool: 600963 Engine sling

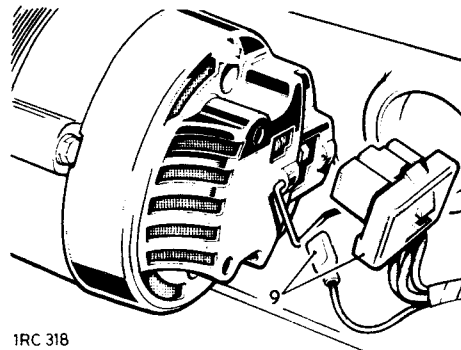
#### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Disconnect the battery earth lead.
- 3 Remove the air cleaner. 19.10.01.
- 4 Remove the radiator and front panel assembly. 26.40.01.
- 5 Remove the front floor. 76.10.12.
- 6 Disconnect the exhaust pipe at the manifold.



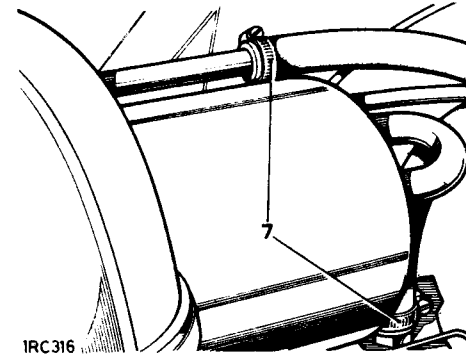
0900

- 7 Disconnect the heater hoses, if fitted.
- 8 Disconnect the starter motor leads.
- 9 Disconnect the alternator leads.

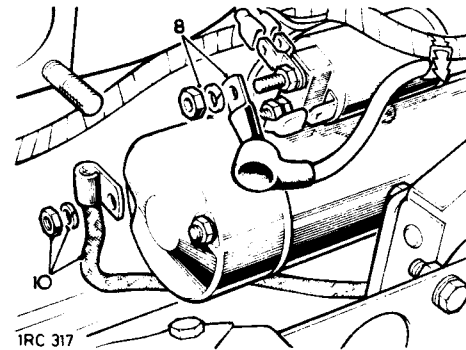


1RC 318

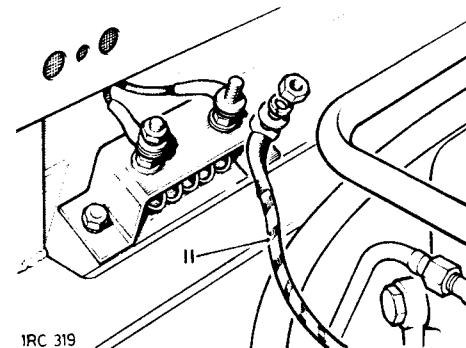
- 10 Disconnect the engine earth cable.
- 11 Disconnect the electrical feed to the heater plugs.



1RC 316

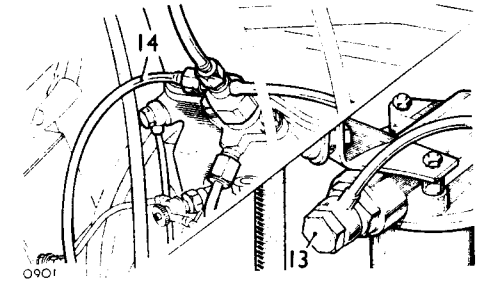


1RC 317



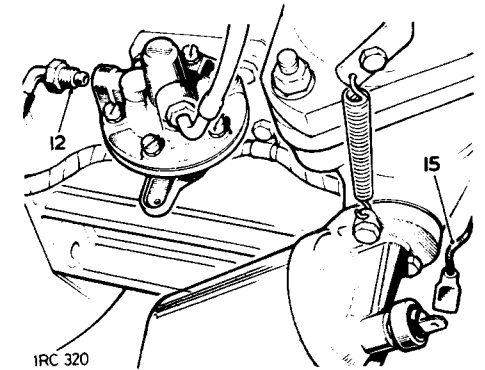
1RC 319

- 12 Disconnect the fuel pipe to the fuel pump.
- 13 Disconnect the fuel inlet pipe from the distributor pump.
- 14 Disconnect the fuel spill pipe at No. 4 injector.



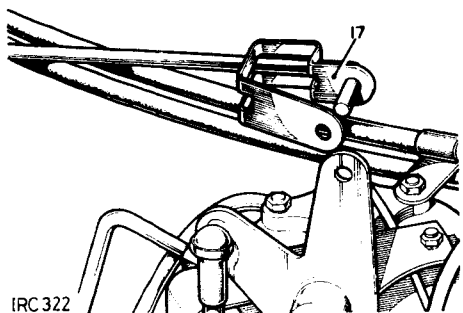
0901

- 15 Disconnect the electrical lead from the oil pressure switch.

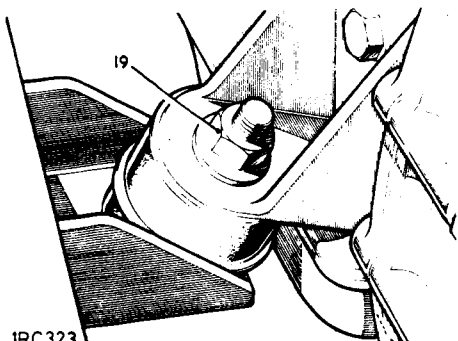


1RC 320

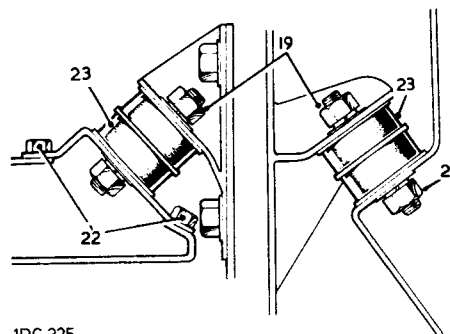
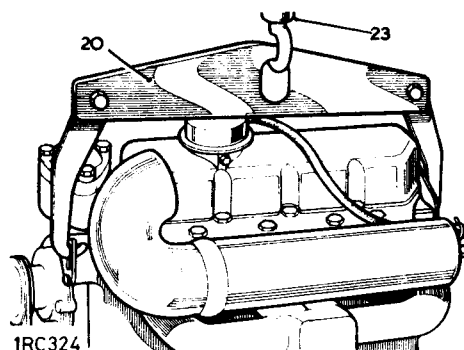
- 16 Disconnect the electrical lead from the water temperature transmitter.
- 17 Disconnect the accelerator linkage at the fuel distributor pump.



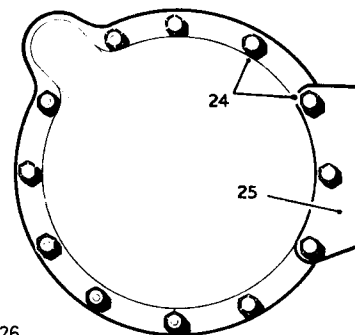
- 18 If a brake servo unit is fitted, disconnect the vacuum pipe and the butterfly control rod from the induction manifold.
- 19 Remove the upper fixings from the engine mounting rubbers.



- 20 Attach a suitable lifting sling and hoist to the engine lifting hooks. 600963.
- 21 Remove the bottom fixing from the left hand engine mounting rubber.
- 22 Remove the support bracket fixings from the right hand engine mounting rubber.
- 23 Tension the hoist sufficient to withdraw the engine mounting rubbers, then lower the engine to its original position to maintain alignment with the gearbox.



- 24 Remove the fixings securing the bell housing to the flywheel housing.
- 25 Move the clutch slave cylinder aside without disconnecting the fluid pipe.



- 26 Support the gearbox assembly by inserting a piece of timber 25 mm thick (1.0 in) between the gearbox and cross-member.
- 27 Draw the engine forward to release it from the dowelled location to the bell housing, and to clear the primary pinion from the clutch.
- 28 Lift the engine clear.

#### Refitting

- 29 Clean the engine and bell housing mating faces of old sealant. Re-coat the faces with Hylomar PL32 Sealant.
- 30 Attach a suitable lifting sling and hoist to the engine lifting hooks. 600963, and smear the splines of the primary pinion, the clutch centre and the withdrawal unit abutment faces with Molybdenum disulphide grease, such as Rocol MTS 1000.
- 31 Lower the engine into position, locating the primary pinion into the clutch and engage the bell housing dowels.
- 32 Secure the bell housing to the flywheel housing.
- 33 Tension the hoist sufficient to remove the timber support from the gearbox and insert the engine mounting rubbers.
- 34 Lower the engine and secure the engine mounting upper and lower fixings.
- 35 Remove the engine lifting sling.
- 36 Reverse 1 to 18 and prime the fuel system. 19.50.01.
- 37 Check, and if necessary replenish, the engine lubricating oil.
- 38 Check, and if necessary replenish, the gearbox lubricating oil.
- 39 Start the engine. Check that the oil pressure warning light goes out, and check the cooling system for leaks.
- 40 Check, and if necessary adjust, the engine speed settings.
- 41 When the engine is cold, check the coolant level in the radiator and top up if necessary.

## FLYWHEEL

### Remove and refit

12.53.07

#### Removing

- 1 Remove the front floor. 76.10.12.
- 2 Remove the seat base. 76.70.06.
- 3 Remove the engine assembly. 12.41.01.
- 4 Remove the clutch assembly. 33.10.01.
- 5 Remove the flywheel bolts with the aid of a flywheel trap.

#### Refitting

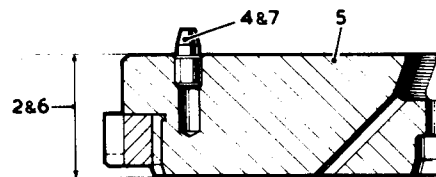
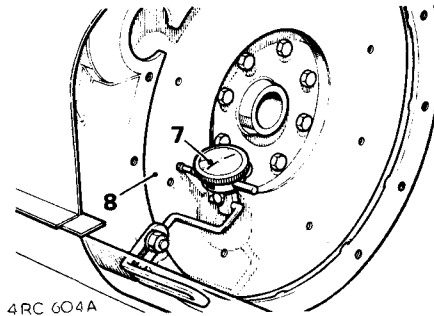
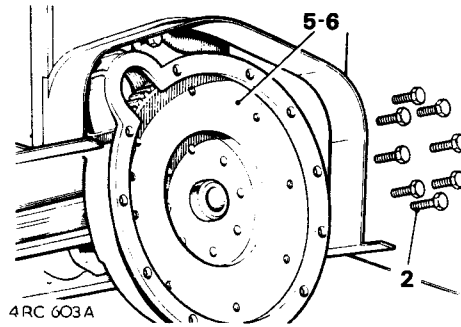
- 6 Fit the flywheel to the crankshaft and tighten the securing bolts. Torque: 8,5 to 9,0 kgf. m (60 to 65 lbf. ft.).
- 7 Mount a dial test indicator to read off the flywheel face.
- 8 Check the run-out on the flywheel face, this must not exceed 0,05 mm (0.002 in.).
- 9 If the run-out is excessive, remove the flywheel and investigate the cause.
- 10 Reverse 1 to 4.

### Overhaul

12.53.10

#### Procedure

- 1 Remove the flywheel. 12.53.07.  
Wear or scoring on the flywheel pressure face may be corrected by machining, providing that the overall thickness of the flywheel is not reduced below the following applicable dimension.  
Petrol engines 34,72 mm (1.375 in.)  
Diesel engines 36,957 mm (1.455 in.)
- 2 Check the overall thickness of the flywheel, as it may have been previously machined.
- 3 If the flywheel is above the minimum thickness, the clutch face can be refaced as follows:
- 4 Remove the dowels.
- 5 Reface the flywheel over the complete surface.
- 6 Check the overall thickness of the flywheel to ensure that it is still above the minimum thickness.
- 7 Fit the dowels.
- 8 Refit the flywheel. 12.53.07.



IRC 310

## STARTER RING GEAR

### Remove and refit

12.53.19

#### Removing

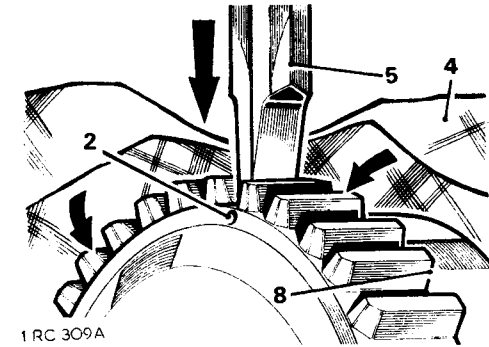
- 1 Remove the flywheel. 12.53.07.
- 2 Drill an 8,0 mm (0.312 in.) diameter hole axially between the root of any tooth and the inner diameter of the starter ring sufficiently deep to weaken the ring DO NOT allow the drill to enter the flywheel.
- 3 Secure the flywheel in a vice fitted with soft jaws.
- 4 Place a cloth over the flywheel to protect the operator from flying fragments.

**WARNING:** Take adequate precautions against flying fragments as the starter ring may fly asunder when being split.

- 5 Place a chisel immediately above the drilled hole and strike it sharply to split the starter ring.

#### Refitting

- 6 Heat the starter ring gear uniformly to between 225°C and 250°C (437°F and 482°F) but do not exceed the higher temperature.
- 7 Place the flywheel, flanged side down, on a flat surface.
- 8 Locate the headed starter ring gear in position on the flywheel with the square edge of the teeth against the flywheel flange.
- 9 Press the starter ring gear firmly against the flange until the ring contracts sufficiently to grip the flywheel.
- 10 Allow the flywheel to cool gradually DO NOT hasten cooling in any way.
- 11 Refit the flywheel. 12.53.07.



1 RC 309A

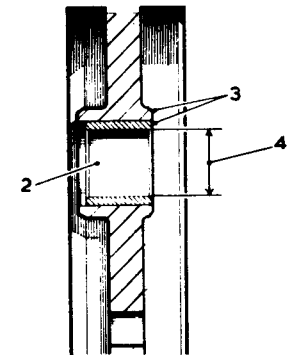
## SPIGOT BEARING

### Remove and refit

12.53.20

#### Removing

- 1 Remove the flywheel. 12.53.07.
- 2 Press the spigot bearing from the flywheel.



IRC 311

#### Refitting

- 3 Press in the new spigot bearing flush with the clutch side of the flywheel.
- 4 Ream the spigot bearing to 22,237 mm to 22,242 mm (0.8755 in. to 0.8757 in.).
- 5 Refit the flywheel. 12.53.07.

## OIL FILTER ASSEMBLY

### — EXTERNAL

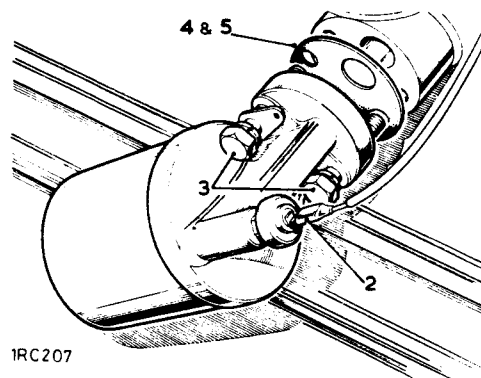
Remove and refit 12.60.01

#### Removing

- 1 Prop open the bonnet.
- 2 Disconnect the electrical lead from the oil pressure switch.
- 3 Remove the oil filter.
- 4 Withdraw the joint washer.

#### Refitting

- 5 Smear both sides of the joint washer with general purpose grease.
- 6 Place the joint washer in the correct position on the cylinder block and fit the filter, tightening the bolts to 3,45 kgf m (25 lbf ft).
- 7 Reconnect electrical lead.
- 8 Check the sump oil level after a short engine run and top up as necessary to the 'high' mark on the oil level dipstick.



1RC207

## OIL PUMP

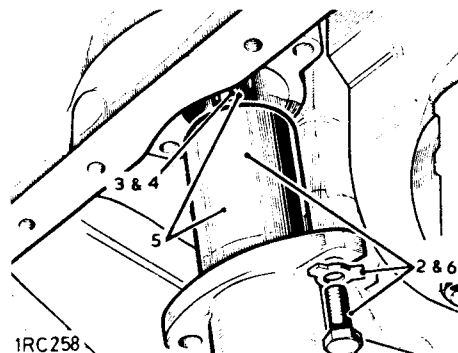
Remove and refit 12.60.26

#### Removing

- 1 Remove the oil sump. 12.60.44.
- 2 Remove the oil pump.
- 3 Withdraw the oil pump drive shaft.

#### Refitting

- 4 Locate the longer splined end of the drive shaft into the oil pump.
- 5 Apply Hylomar Sealant to joint face of pump body and fit gasket. (Gasket fitted on later engines.)
- 6 Offer up the pump and drive shaft and engage the drive splines at the engine.
- 7 Secure the oil pump.
- 8 Fit the oil sump. 12.60.44.
- 9 Replenish the engine lubricating oil to the 'high' mark on the oil level dipstick.
- 10 Check the sump oil level after a short engine run and top up as necessary to the 'high' mark on the oil level dipstick.



1RC258

## OIL PUMP

Overhaul 12.60.32

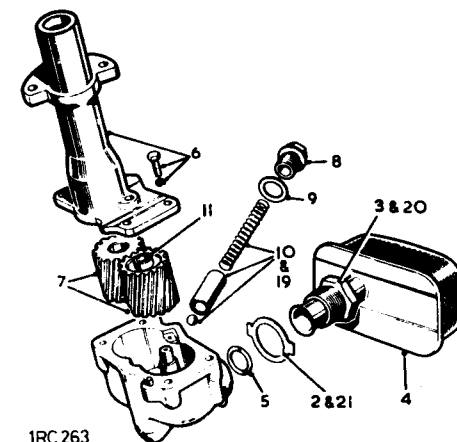
#### Dismantling

- 1 Remove the oil pump. 12.60.26.
- 2 Straighten the lockwasher for the oil filter union nut.
- 3 Unscrew the oil filter union nut.
- 4 Withdraw the oil filter.
- 5 Withdraw the sealing ring.
- 6 Remove the oil pump cover.
- 7 Withdraw the pump gears.
- 8 Remove the plug for the oil pressure relief valve.
- 9 Withdraw the sealing washer.
- 10 Withdraw the oil pressure relief valve spring, plunger and ball.

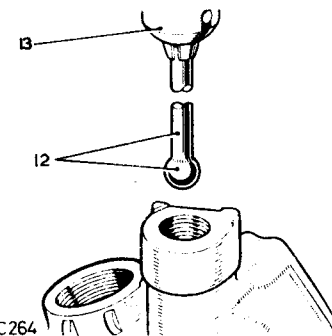
#### Inspecting

- 11 If necessary the idler gear bush may be renewed. Press the new bush into the gear, drill the lubrication hole 3,175 mm (0.125 in.) diameter and ream the bush to 12,7 mm (0.500 in.) diameter.
- 12 Inspect the pressure relief valve ball seating and renovate, if necessary, using a locally manufactured lapping tool consisting of a steel ball, Rover Part No. 3748, soldered to suitable tubing.
- 13 The lapping tool may be installed in a drilling machine or hand brace and the ball seating refaced, using coarse grinding paste. The tool may then be removed and used to 'hand lap' the ball seating with fine grinding paste to a good finish. The seat must then be thoroughly cleaned.

continued

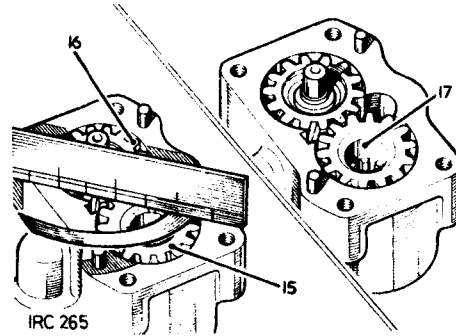


1RC263



1RC264

- 14 Check the end float of the oil pump gears, as follows 15 and 16, and fit new parts as necessary.
- 15 Steel gear: 0,05 mm to 0,12 mm (0.002 in. to 0.005 in.).
- 16 Aluminium gear: 0,07 mm to 0,15 mm (0.003 in. to 0.006 in.).
- 17 Fit the pump gears to the body, with the plain portion of the drive gear bore uppermost.
- 18 Smear the joint faces with suitable jointing compound and fit the pump cover to the pump body, locating on the dowels.
- 19 Assemble the pressure relief valve components to the housing bore. When fitting the plunger, insert the end with the integral ball seating first.
- 20 Fit the oil filter to the pump.
- 21 Position the filter such that it will be square to the sump baffle plate when fitted and secure with the lock-washer.
- 22 Fit the oil pump to the engine. 12.60.26.



#### DATA

Pump gear end float	
Steel gear .....	0,05 mm to 0,12 mm (0.002 in. to 0.005 in.)
Aluminium gear .....	0,07 mm to 0,15 mm (0.003 in. to 0.006 in.)
Relief valve spring free length .....	67,82 mm (2,670 in.)

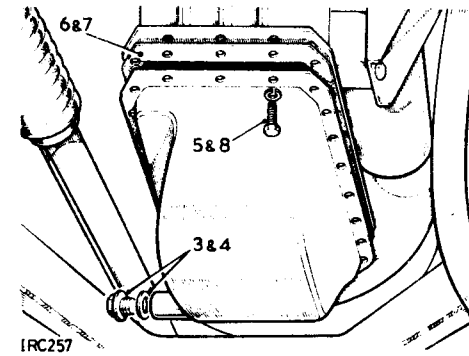
## OIL SUMP

Remove and refit

12.60.44

#### Removing

- 1 Prop open the bonnet.
- 2 Remove the oil filler cap.
- 3 Remove the sump drain plug.
- 4 Allow the oil to drain, then refit the drain plug and sealing washer.
- 5 Remove the sump.
- 6 Withdraw the joint washer.



#### Refitting

- 7 Place a new joint washer in position.
- 8 Fit the sump, and tighten bolts to 1,65 kgf m (12 lbf ft).
- 9 Replenish the engine lubricating oil to the 'high' mark on the oil level dipstick.
- 10 Reverse 1 and 2.
- 11 Check the sump oil level after a short engine run and top up as necessary to the 'high' mark on the oil level dipstick.
- 12 After 1600 km (1000 miles) running, recheck sump bolts for correct torque as follows:
- 13 Slacken each bolt in turn approximately one flat, then retighten to 1,65 kgf m (12 lbf ft).

## TIMING GEAR COVER AND OIL SEAL

Remove and refit

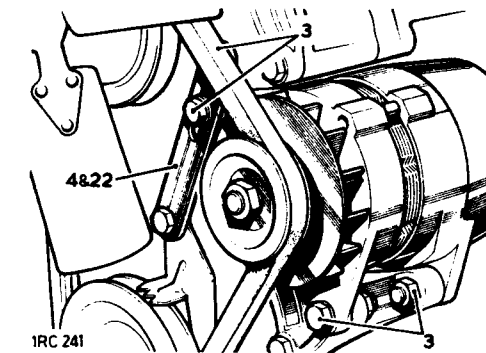
Gear cover 1 to 14 and 18 to 24 12.65.01  
Oil seal 1 to 24 12.65.05

Service tool: 530102 Spanner for starter dog for three-bearing engine only; 530102A for three- and five-bearing engines.

**NOTE:** On initial assembly of the engine the mud shield around the oil seal is rivetted in position on the timing gear cover. If this has been removed in service however, the rivets may have been substituted with self tapping drive screws. In this case the oil seal may be changed without removing the timing gear cover provided that on refitting the mud shield is allowed to finally pull the oil seal into position to ensure a positive location.

#### Removing

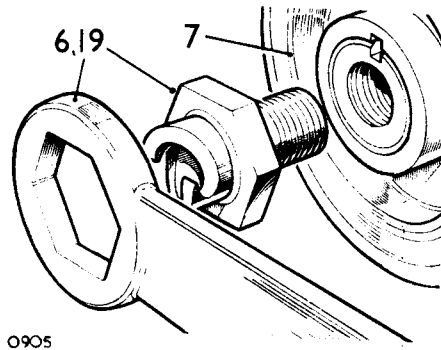
- 1 Open and prop the bonnet.
- 2 Remove the radiator and front panel assembly. 26.40.01.
- 3 Slacken the alternator fixings and remove the fan belt.
- 4 Remove the alternator adjusting link.



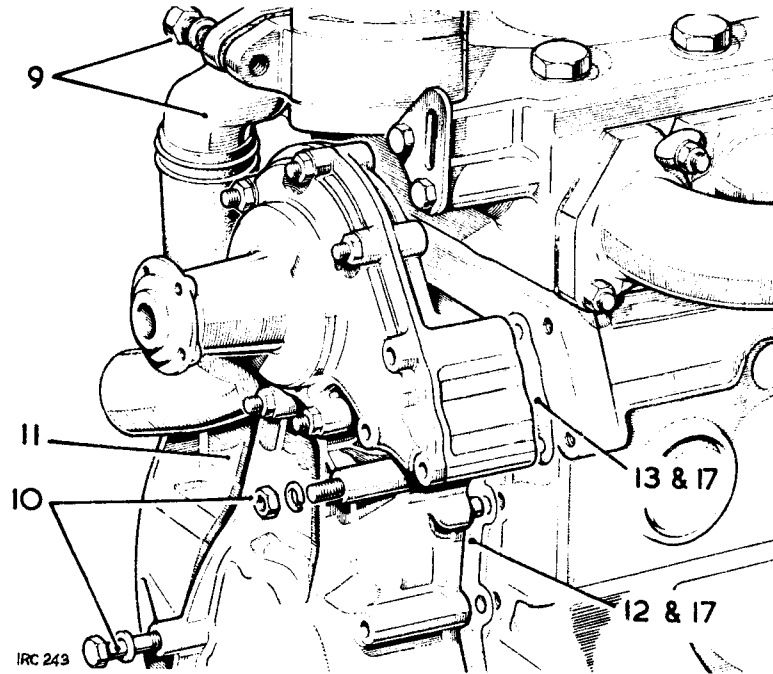
- 5 With the vehicle in gear with hand-brake on, slacken the starter dog.



- 6 Remove the starter dog. 530102.
- 7 Withdraw the crankshaft pulley.  
If only the oil seal is to be changed, see NOTE above.
- 8 Remove the fan blades and pulley.
- 9 Disconnect the by-pass pipe from the thermostat housing.
- 10 Remove the timing cover fixings, including those at the sump front flange.
- 11 Withdraw the timing cover. NOTE: Slacken front side sump bolts for ease of timing cover removal.
- 12 Withdraw the joint washer from the timing cover.
- 13 Withdraw the joint washer from the water inlet.



0905



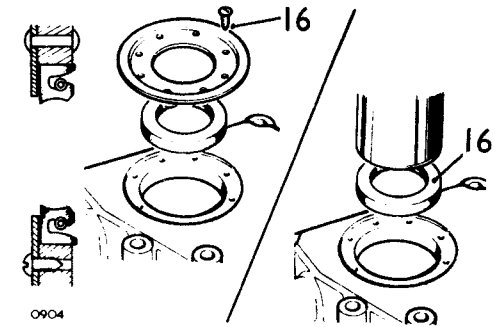
IRC 243

- 14 Drill out the rivets and drive the oil seal from the timing cover.
- 15 Smear the outside diameter of the new oil seal with Hylomar PL32/M jointing compound.
- 16 Press the oil seal into the timing cover and substitute the rivets with the self tapping drive screws supplied.

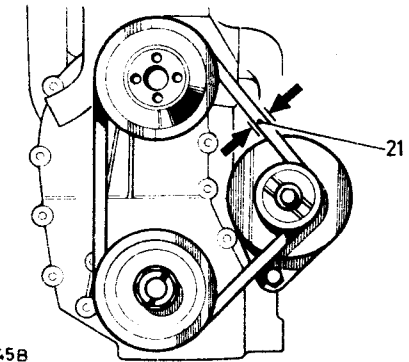
#### Refitting

NOTE: It is of advantage temporarily to remove the fixing stud from the cylinder block front face. This will enable the front cover to be lifted sufficient to clear the edge of the sump gasket when offering the front cover to the engine.

- 17 Smear general purpose grease on both sides of the front cover and water inlet joint washers.
- 18 Reverse 7 to 13.
- 19 Fit the starter dog. Torque: Petrol engines: 20,5 kgf. m (150 lbf. ft.). Diesel engines: 27,65 kgf. m (200 lbf. ft.).
- 20 Fit the alternator adjusting link.
- 21 Adjust the fan belt to give 6,5 to 9,5 mm (0.250 to 0.375 in.) free movement when checked midway between the fan and alternator pulleys.
- 22 Reverse 1 to 3.



0904



IRC245B

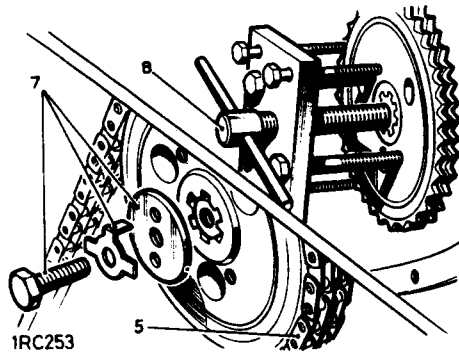
**TIMING GEARS – Petrol****Remove and refit**

12.65.22

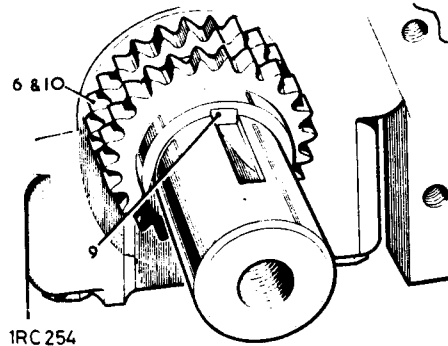
Service tool: 507231 Chainwheel extractor

**Removing**

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the radiator and front panel assembly. 26.40.01.
- 3 Remove the timing gear cover. 12.65.01.
- 4 Remove the timing chain tensioner. 12.65.28.
- 5 Withdraw the timing chain.
- 6 Withdraw the chainwheel from the crankshaft.
- 7 Remove the fixings from the camshaft chainwheel.
- 8 Extract the chainwheel from the camshaft. 507231.

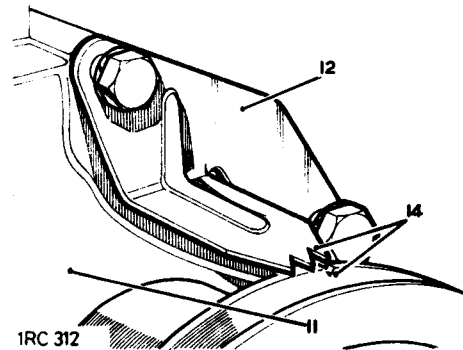
**Refitting**

- 9 Check that the key for the chainwheel is correctly located in the crankshaft slot.
- 10 Fit the chainwheel, large shoulder first, to the crankshaft.



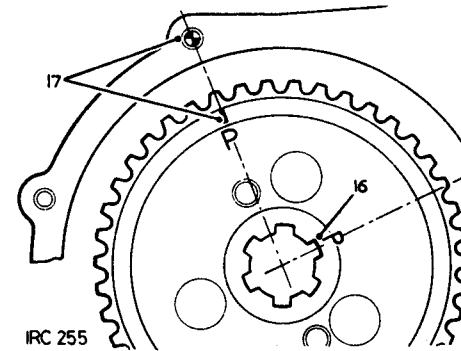
1RC 254

- 11 Locate the timing gear cover in position.
- 12 Fit the timing pointer.
- 13 Locate the crankshaft pulley in position.
- 14 Rotate the crankshaft until the timing mark in the crankshaft pulley is aligned with the longest tongue on the timing pointer (No. 1 piston at TDC).



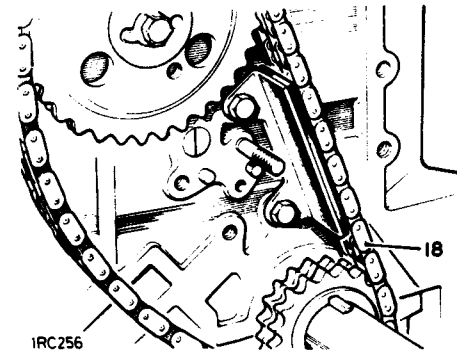
1RC 312

- 15 Without disturbing the crankshaft, remove the pulley, timing pointer and gear cover.
- 16 Fit the camshaft chainwheel, using keyway marked 'P'.
- 17 Rotate the camshaft chainwheel until the groove marked 'P' is in line with the centre of the tapped hole, as illustrated.



1RC 255

- 18 Retaining the chainwheels in the set positions, fit the timing chain ensuring that there is no slack chain on the driving side.



1RC256

- 19 If it is not possible to obtain a taut fit on the driving side of the chain with the chainwheels in the set positions, withdraw the camshaft chainwheel without disturbing the set position of the camshaft, and refit the chainwheel using one of the alternative keyways. This procedure may be repeated until a taut chain is obtained on the driving side with the camshaft and crankshaft in their previously set positions.
- 20 Reverse 1 to 4.

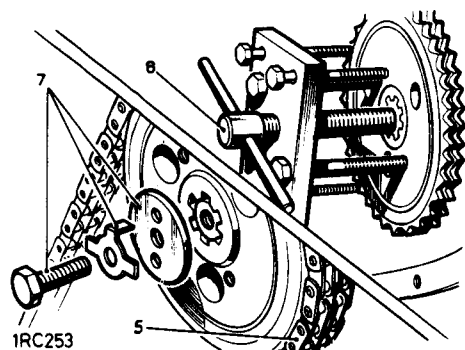
## TIMING GEARS – Diesel

Remove and refit 12.65.22

Service tool: 507231 Chainwheel extractor

### Removing

- 1 Remove the bonnet. 76.16.01.
- 2 Remove the radiator and front panel assembly. 26.40.01.
- 3 Remove the timing gear cover. 12.65.01.
- 4 Remove the timing chain tensioner. 12.65.28.
- 5 Withdraw the timing chain.
- 6 Withdraw the chainwheel from the crankshaft.
- 7 Remove the fixings from the camshaft chainwheel.
- 8 Extract the chainwheel from the camshaft. 507231.

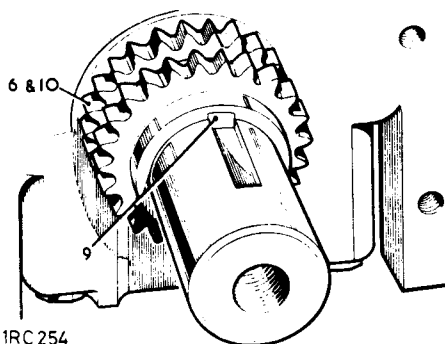


### Refitting

- 9 Check that the key for the chainwheel is correctly located in the crankshaft slot.

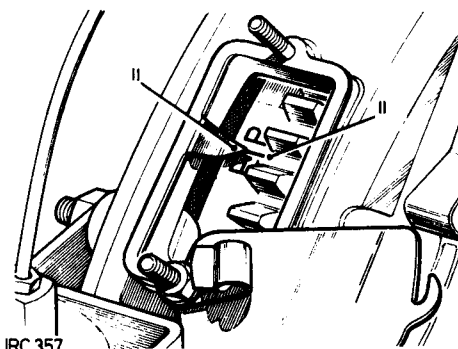
- 10 Fit the chainwheel to the crankshaft.

**CAUTION:** When turning the crankshaft do not allow the pistons to foul the valves. If necessary, turn the camshaft to enable the crankshaft setting to be obtained.



1RC254

- 11 Turn the crankshaft in the direction of rotation until the EP mark on the flywheel is aligned with the timing pointer.

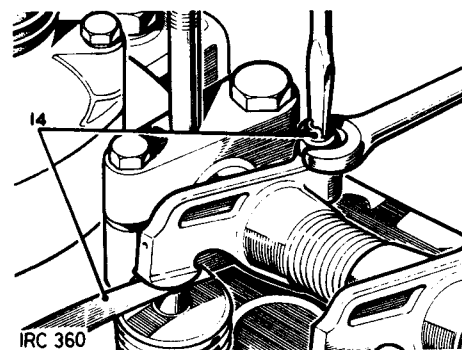


1RC357

- 12 Fit the chainwheel to the camshaft using any keyway.

- 13 Remove the engine top cover.

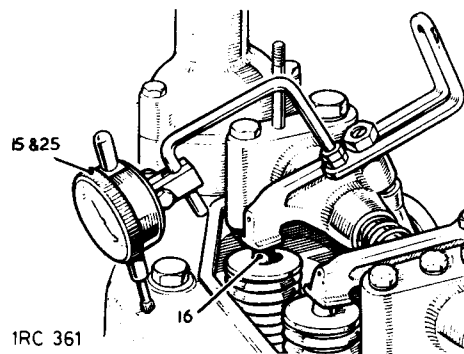
- 14 Turn the camshaft until No. 1 cylinder exhaust valve is fully closed and set the tappet clearance to 0,25 mm (0.010 in.).



1RC360

- 15 Mount a dial test indicator to enable the 'fully open' position of the valve to be ascertained.

- 16 Turn the camshaft in the direction of rotation until the rocker pad has nearly opened the valve fully. Stop camshaft rotation.



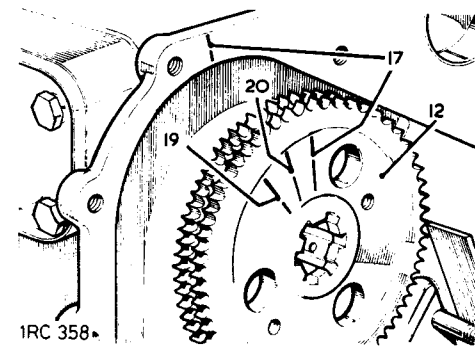
1RC361

- 17 Suitably mark the chainwheel and rear casing relative to each other.

- 18 Note the reading on the dial test indicator, then continue turning the camshaft in the direction of rotation until the dial test indicator needle has reached the same position as previously noted. Stop camshaft rotation.

- 19 Suitably mark the chainwheel adjacent to the mark previously made on the rear casing.

- 20 Make a third mark on the chainwheel to bisect the angle between the two previously made marks.

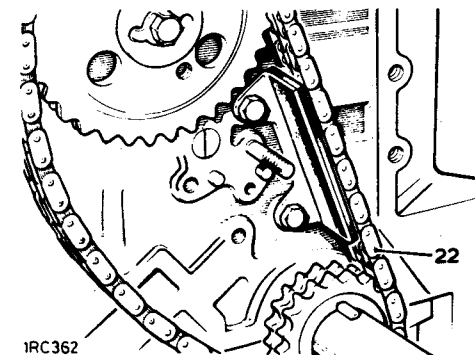


1RC358

- 21 Turn the camshaft against the direction of rotation and align the middle mark on the chainwheel with the mark on the rear casing. No. 1 exhaust valve is now fully open.

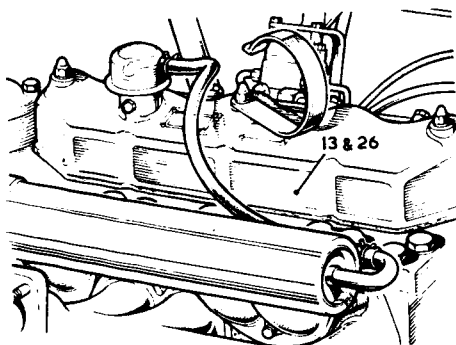
- 22 Retaining the chainwheels in the set positions, fit the timing chain ensuring that there is no slack chain on the driving side.

continued



1RC362

- 23 If it is not possible to obtain a taut fit on the driving side of the chain with the chainwheels in the set positions, withdraw the camshaft chainwheel without disturbing the set position of the camshaft, and refit the chainwheel using one of the alternative keyways. This procedure may be repeated until a taut chain is obtained on the driving side with the camshaft and crankshaft in their previously set positions.



IRC359

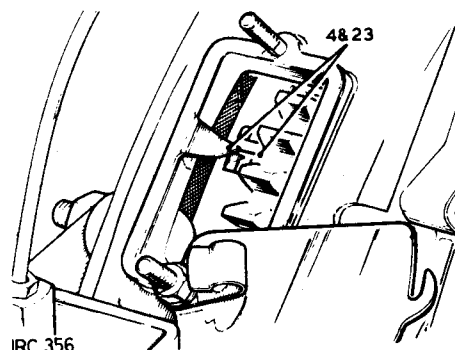
- 24 Secure the fixings for the camshaft chainwheel and engage the lockwasher.  
25 Remove the dial test indicator.  
26 Refit the engine top cover.  
27 Reverse 1 to 4.

## TIMING CHAIN TENSIONER

Remove and refit 12.65.28

### Removing

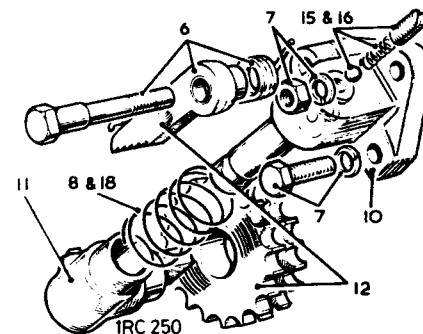
- 1 Remove the bonnet. 76.16.01.
- 2 Remove the radiator and front panel assembly. 26.40.01.
- 3 *Petrol engines*: Turn the crankshaft in the direction of rotation until the timing mark on the crankshaft pulley is aligned with the centre tongue of the timing pointer.
- 4 *Diesel engines*: Turn the crankshaft in the direction of rotation until the EP mark on the flywheel is aligned with the timing pointer.



IRC 356

- 5 Remove the timing gear cover. 12.65.01.
- 6 Remove the tensioner ratchet and spring.
- 7 Remove the fixings from the piston housing.
- 8 Compress the tensioner spring by hand and withdraw the tensioner assembly complete.
- 9 Clean the tensioner components in clean fuel.
- 10 Fit a new piston and housing if unduly worn.
- 11 If the tensioner cylinder bush is unduly worn, fit a new cylinder and bush complete.
- 12 Fit a new idler wheel and ratchet arm if the bushes are unduly worn.
- 13 Fit a new chain vibration damper if the rubber pad is grooved.

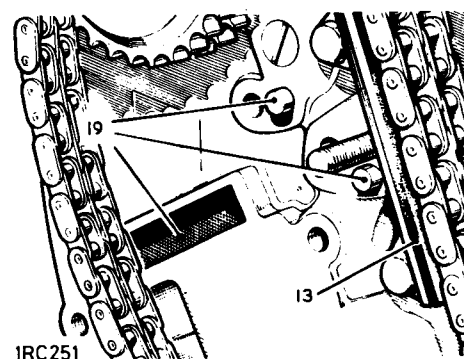
- 14 Ensure that all oil passage drillings are clear.
- 15 *Petrol engines*: if required, remove the non-return valve plug, spring and ball.



IRC 250

### Refitting

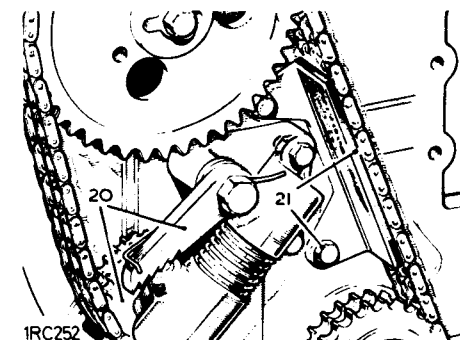
- 16 *Petrol engines*: If removed, refit the non-return valve ball, spring and plug.  
**NOTE**: On later petrol engines the diesel type timing chain tensioner assembly is fitted.
- 17 Assemble together, the piston housing, tensioner spring, cylinder and idler wheel.
- 18 Compress the assembly against the tensioner spring.
- 19 Fit the assembly to the engine, locating the piston housing onto the dowels and the cylinder spigot into the slot.



IRC251

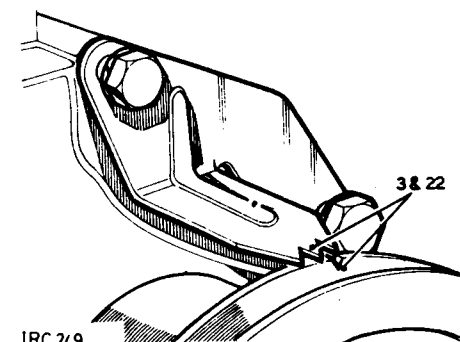
- 20 Fit the ratchet and spring and allow the idler wheel to take up the timing chain slack.

- 21 If necessary, adjust the position of the chain vibration damper to allow 0,25 mm (0.010 in.) maximum clearance between the timing chain and the vibration pad.



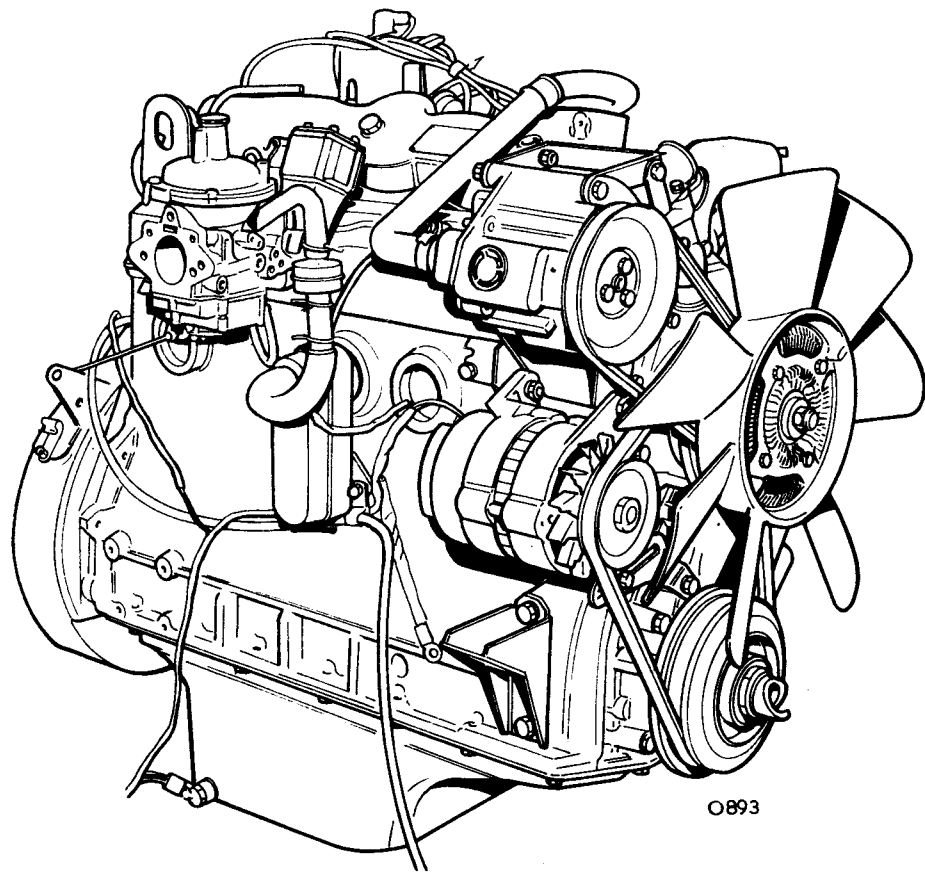
IRC252

- 22 *Petrol engines*: Temporarily, refit the timing gear cover, timing pointer and crankshaft pulley, and ensure that the timing marks are still correctly aligned. Then providing that the camshaft has not been rotated, the engine valve timing should be correct. If there is any doubt, check the valve timing. 12.65.22.

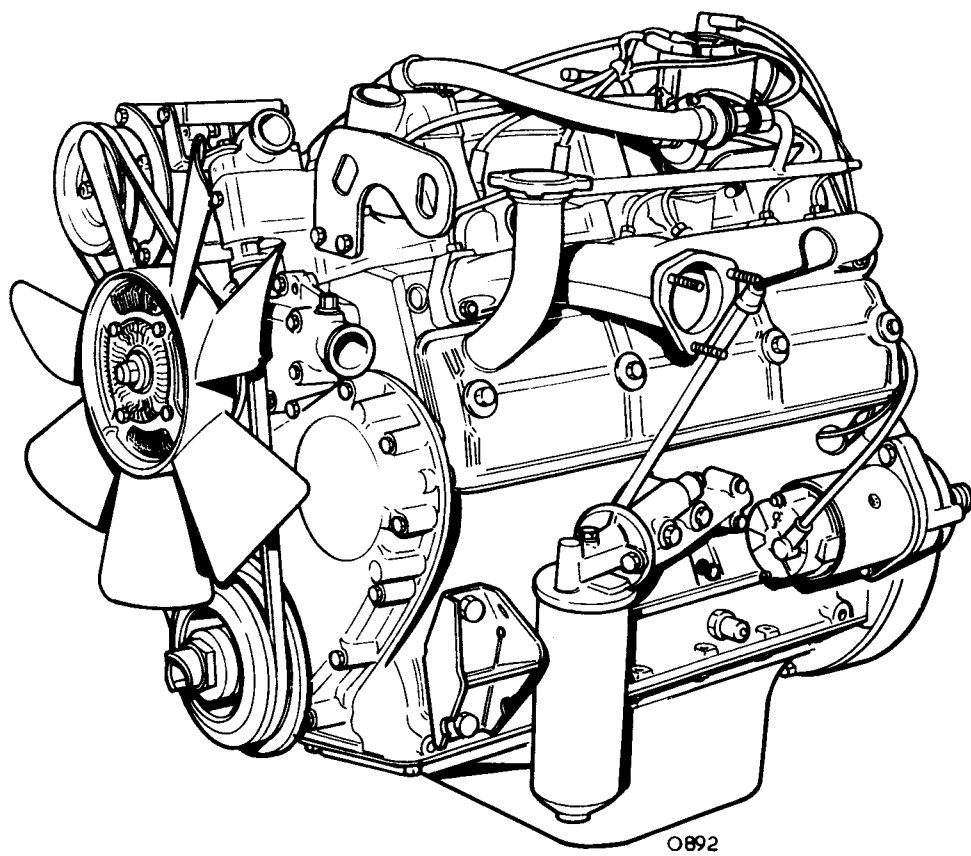


IRC 249

- 23 *Diesel engines*: Check that the EP mark on the flywheel is still aligned with the timing pointer. Then providing that the camshaft has not been rotated, the engine valve timing should be correct. If there is any doubt, check the valve timing. 12.65.22.
- 24 Fit the timing gear cover. 12.65.01.
- 25 Reverse 1 and 2.



O893



O892

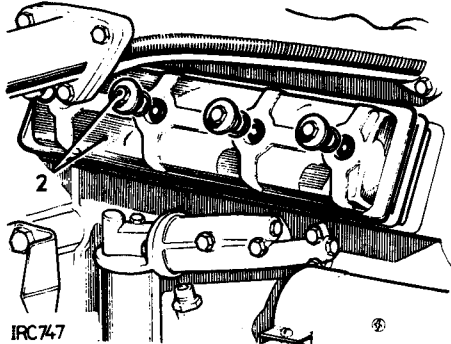
2.6 litre – 6 cylinder Engine

## 2.6 litre – 6 cylinder Engine DISTRIBUTOR AND OIL PUMP DRIVE SHAFT

Remove and refit 12.10.22

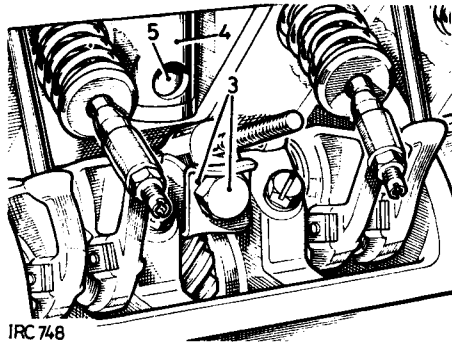
### Removing

- 1 Remove the distributor and short drive shaft. 86.35.20.
- 2 Remove the side rocker cover.



IRC 747

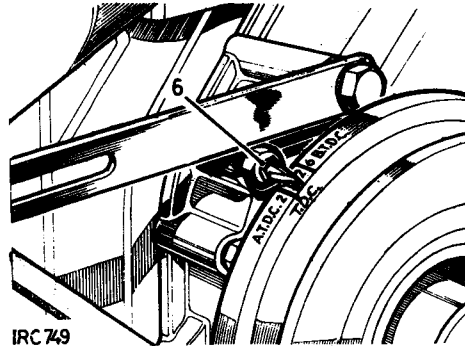
- 3 Remove the oil feed bolt and lock washer locating the distributor housing inside the rocker chamber.
- 4 Lift out the distributor housing.
- 5 Withdraw the drive shaft.



IRC 748

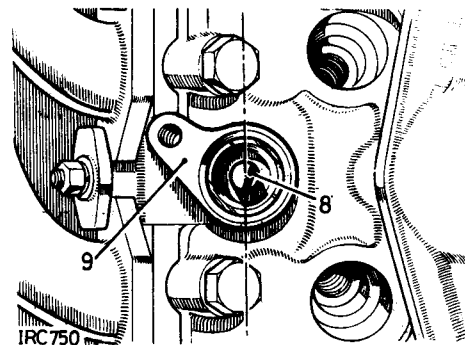
### Refitting

- 6 Rotate the engine in direction of rotation until the TDC mark on the crankshaft pulley aligns with the timing pointer, with both valves on No. 1 cylinder fully closed (i.e. No. 1 cylinder commencing firing stroke).



IRC 749

- 7 Fit the oil pump and distributor gear drive shaft to the engine with the lower splines engaged in the oil pump, and the skew gear engaged with the camshaft.
- 8 Turn the drive shaft using a suitable screwdriver, until the offset drive slot in the end of the shaft is positioned as illustrated.
- 9 Fit the distributor housing to the engine and locate and secure with the oil feed bolt and lock washer.
- 10 Reverse 1 and 2.



IRC 750

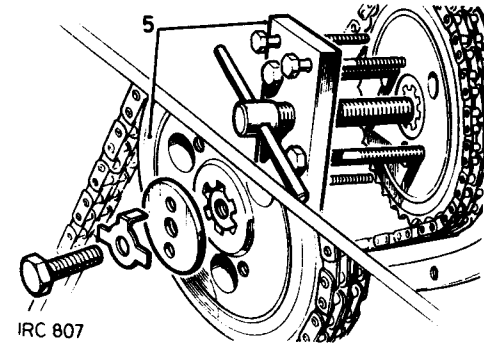
## CAMSHAFT

Remove and refit 12.13.01

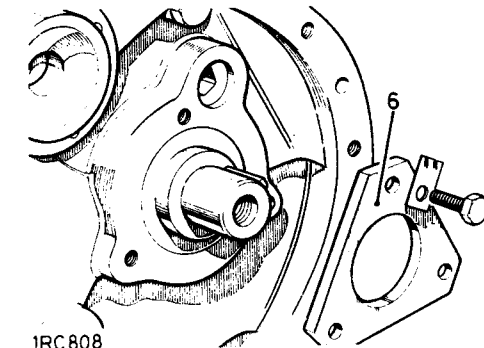
Service tools: 530101 Extractor for camshaft  
507231 Extractor for chainwheel

### Removing

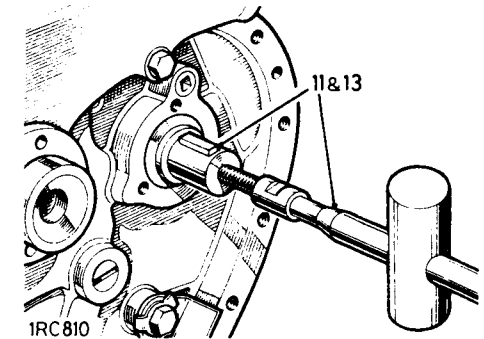
- 1 Remove the radiator and grille panel. 26.40.01.
- 2 Remove the exhaust manifold. 30.15.10.
- 3 Remove the timing gear cover. 12.65.01.
- 4 Remove the timing chain tensioner. 12.65.28.
- 5 Remove the camshaft chainwheel and timing chain. Extractor 507231.
- 6 Remove the camshaft thrust plate.
- 7 Remove the side rockers and shafts. 12.29.36.
- 8 Remove the distributor and short drive shaft. 86.35.20.
- 9 Remove the oil pump and distributor gear drive shaft. 12.10.22.
- 10 Remove the six camshaft bearings locating screws.
- 11 Withdraw the camshaft until the bearings are clear of the housing. Extractor 530101.
- 12 Remove the bearings by separating the bearing halves. Keep the halves in related pairs as indicated by the figures marked on the end faces.
- 13 Withdraw the camshaft clear of the engine.
- 14 Withdraw the remaining bearing from the rear housing, utilising the oil relief holes for extraction purposes if required.



IRC 807



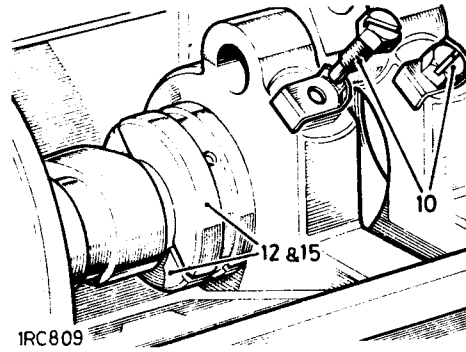
IRC 808



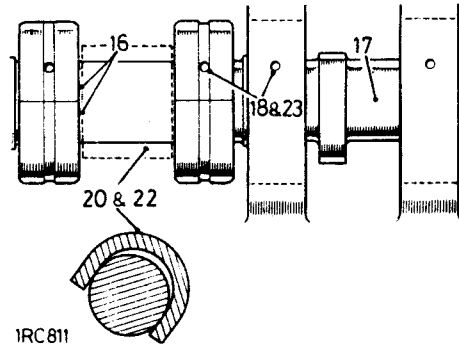
IRC 810

## Refitting

- 15 Before attempting to fit the camshaft bearings to the cylinder block, ensure that the bearing halves fit together correctly on the dowels by checking that no light is visible between the joint faces.
- 16 The bearings must be fitted dry and should be a hand push fit in the cylinder block; they must always be renewed in paired halves and the numbers stamped on one of the end faces of the bearing halves must be adjacent.
- 17 Insert the camshaft partly into the cylinder block, allowing the distributor and oil pump drive gear to pass through the first and second intermediate housing webs.
- 18 Assemble the front and intermediate bearings on to their respective journals on the camshaft. Ensure that the dowelled joint faces are tightly fitted together and the locating holes in the bearings are in line with the holes in the housing webs.
- 19 Fit the rear bearing into the housing.
- 20 Place a suitable distance between the first and second intermediate bearings. The width of the distance piece to be approximately the distance between the bearing housings but allowing sufficient clearance for withdrawal.
- 21 Tap the camshaft rearwards until the bearings are fully home in their respective housings and the locating holes are aligned.
- 22 Remove the distance piece.
- 23 Lubricate the bearings through the locating bolt holes then fit the bearings fixings.
- 24 Fit the camshaft thrust plate.



1RC809

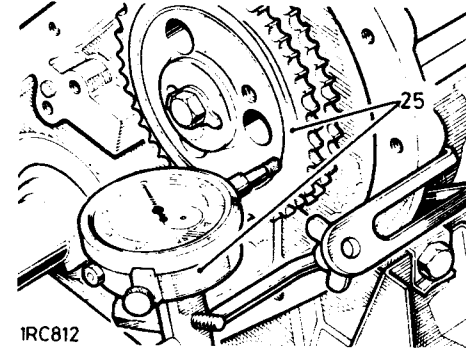


1RC811

## DATA

Camshaft end float.....

- 25 Temporarily fit the camshaft chainwheel and check the camshaft end-float which must be 0,11 to 0,16 mm (0.0045 to 0.0065 in.). Replace the thrust plate if the end-float is excessive.



1RC812

- 26 Temporarily remove the camshaft chainwheel and fit the side rocker shafts. 12.29.36.
- 27 Fit the camshaft chainwheel and timing chain and set the valve timing. 12.65.12.
- 28 Fit the oil pump and distributor gear. 12.10.22.
- 29 Fit the distributor and short drive shaft. 86.35.20.
30. Reverse 1 to 4.

0,11 to 0,16 mm (0.0045 in. to 0.0065 in.).

## CONNECTING RODS AND PISTONS

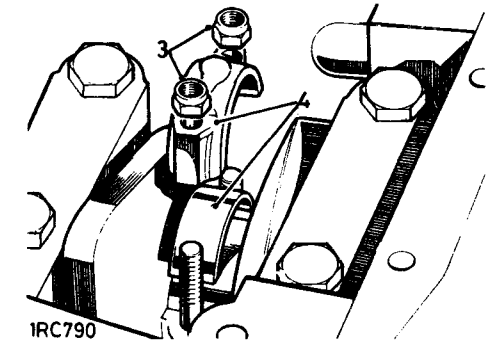
Remove and refit

12.17.01

### Removing

**NOTE:** During the following procedures retain all components in related sets to facilitate re-assembly. If the pistons are not to be replaced, add location marks to ensure re-assembling in the same relative positions.

- 1 Remove the cylinder head. 12.29.10.
- 2 Remove the oil sump. 12.60.44.
- 3 With two pistons at bottom dead centre (BDC) remove the connecting rod cap fixings.



1RC790

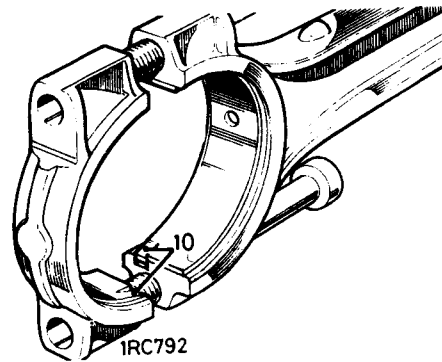
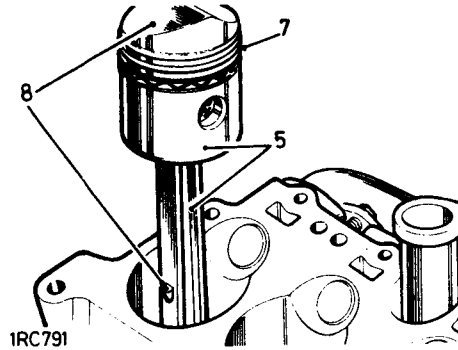
- 4 Remove the caps and withdraw the connecting rod bearing halves. Retain the caps and bearings in related sets.
- 5 Withdraw the pistons and attached connecting rods from the top of the bore.
- 6 Position the remaining pistons at BDC and repeat the removal procedure.

*continued*

**Refitting**

**NOTE:** If replacement components are to be fitted, the checks detailed in 'overhaul' 12.17.10 must be carried out as necessary.

- 7 Position the piston rings so that the end gaps do not align with each other or with the gudgeon pin bore in the piston.
- 8 Enter the connecting rods into the appropriate cylinders and position the oil hole in the connecting rod and the flat on the piston crown away from the camshaft side of the engine.
- 9 Carefully insert the pistons into the cylinders, taking care not to damage the rings.
- 10 Lubricate the journals and bearing halves and fit the appropriate halves to the connecting rods and caps. The bearing halves are located by tongues, these to be positioned at the same side of the connecting rod in the grooves provided.
- 11 Fit new bearing cap nuts and tighten to 2,8 kgf. m (20 lbf. ft.).
- 12 Reverse 1 and 2.

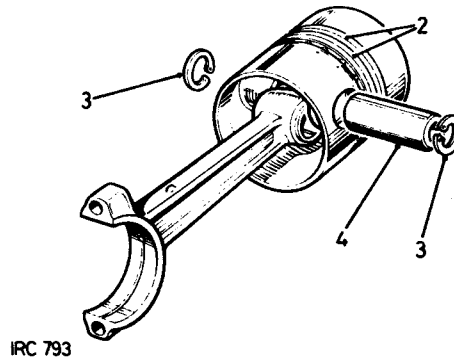
**CONNECTING RODS AND PISTONS****Overhaul**

12.17.10

**Dismantling**

**NOTE:** During the following procedures retain all components in related sets to facilitate subsequent assembly. If the same pistons are to be refitted, add location marks to ensure reassembling in the same relative position.

- 1 Remove the connecting rods and pistons. 12.17.01.
- 2 Remove the piston rings.
- 3 Remove the circlips from the gudgeon pin bosses.
- 4 Withdraw the gudgeon pins from the pistons.

**Overhauling pistons****Original Pistons**

- 5 Remove the carbon and deposits, particularly from the ring grooves.
- 6 Examine the pistons for damage or excessive wear - see under 'New pistons' for clearance dimensions - fit new replacements as necessary.

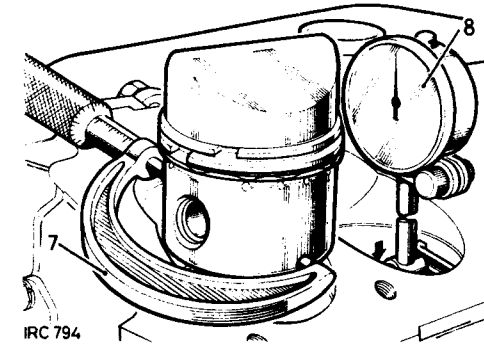
**New Pistons**

Original pistons fitted to new engines at the factory are specially graded to facilitate assembly. The grading letter on top of the piston crown must be ignored when ordering new pistons. Genuine Land-Rover service standard size pistons are supplied 0,025 mm (0.001 in) oversize to allow for production tolerances on new engines. When fitting a new piston to a standard size cylinder block the bore must be honed to accommodate the piston with the correct clearances.

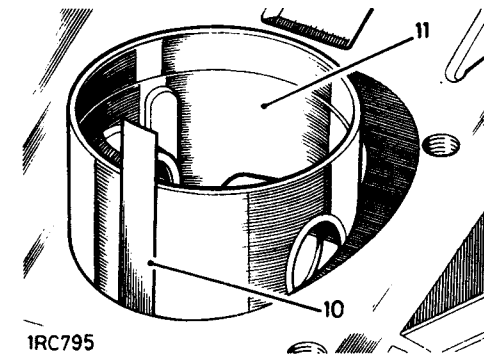
The clearance limits between the pistons and cylinder bores are 0,048 mm to 0,060 mm (0.0019 in. to 0.0024 in.), measured as described subsequently.

The temperature of the piston and cylinder block must be the same to ensure accurate measurements.

- 7 Check the piston diameter at the bottom of the skirt at right angles to the gudgeon pin.
- 8 Check the bore diameter at approximately half way down.

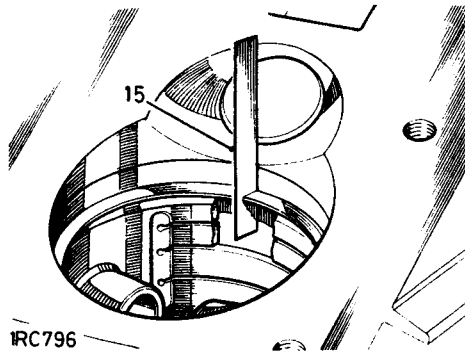


- 9 If gauge equipment is not available, the piston clearance can be assessed using long feeler gauges, 10 to 12.
- 10 Insert a long, suitably sized feeler gauge down the thrust side of the cylinder bore.
- 11 Insert the correct piston, inverted, into the cylinder bore and position it with the gudgeon pin parallel with the axis of the crankshaft.



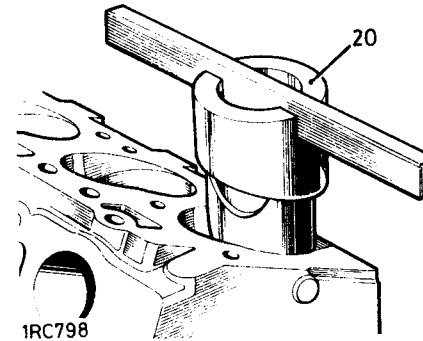
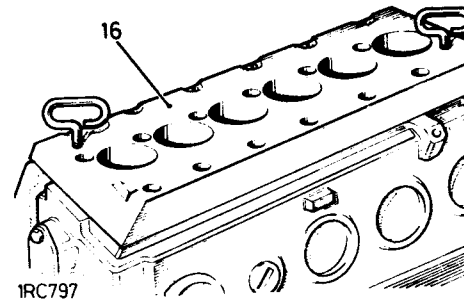


- 12 Push the piston down the cylinder until the piston reaches its tightest point in the bore, at this point withdraw the feeler gauge – a steady resistance should be felt.
- 13 If standard size pistons are being fitted, select pistons from the range available until the clearance is satisfactory.
- 14 If new piston rings are to be fitted without reboring, deglaze the cylinder walls with a hone, without increasing the bore diameter. A deglazed bore must have a cross-hatch finish.
- 15 Check the compression and oil control rings gaps in the applicable cylinder, held square to the bore with the piston.  
Compression rings gap: 0,38 mm to 0,50 mm (0.015 in. to 0.020 in.).  
Oil control ring gap: 0,40 mm to 0,80 mm (0.015 in. to 0.033 in.).  
Use a fine cut flat file to increase the gap if required. Select a new piston ring if the gap exceeds the limit.



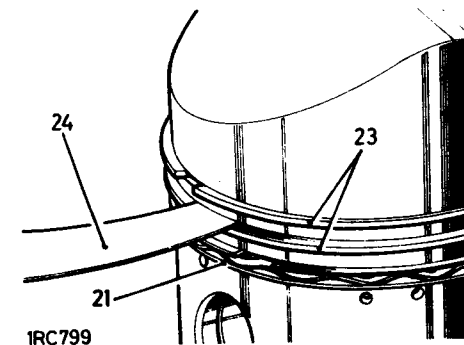
### Reboring

- 16 The cylinder head is inclined at an angle of 22°; standard boring equipment can be used in conjunction with a special jig block 261288.
- 17 Where the maximum permitted boring tolerance is not sufficient to reclaim the bores, cylinder liners may be fitted.
- 18 Fitting the cylinder liners conforms to normal practice. Machine the cylinder block bores to 81,28 mm + 0,025 mm (3.200 in. + 0.001 in.) which will provide the liner with 0,07 mm to 0,10 mm (0.003 in. to 0.004 in.) interference fit.
- 19 Prior to pressing in the liner, allowance must be made for unavoidable rotation of up to 5 mm (0.187 in.), clockwise. To facilitate realignment should the liner not be positioned correctly at the first attempt, scribe lines down the sides of the liner from the two peaks, and make corresponding marks on the cylinder block.
- 20 Press in the liner, using a special press block 246650, until the top edge is level with the bottom of the exhaust valve pocket. Bland to the shape of the cylinder block.  
Bore to the selected diameter to suit pistons. Liners may be bored to a maximum of 1,01 mm (0.040 in.).



### Assembling

- 21 Fit the oil control ring to the piston.
- 22 Check the oil control ring clearance in the piston groove. Clearance limits: 0,05 mm to 0,10 mm (0.002 in. to 0.004 in.).
- 23 Fit the two compression rings to the piston with the sides marked 'T' or 'Top' uppermost.
- 24 Check the compression ring clearance in the piston grooves. Clearance limits: 0,046 mm to 0,097 mm (0.0018 in. to 0.0038 in.).



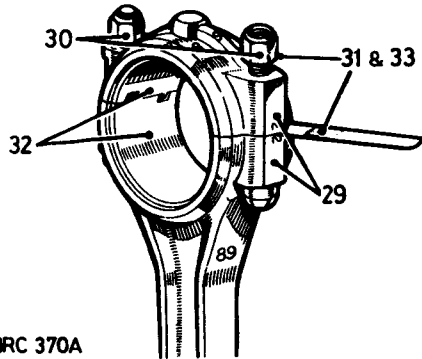
### Connecting rods

- 25 Check the alignment of the connecting rod.
- 26 Check the gudgeon pin clearance in the connecting rod bush. Clearance limits: zero to 0,0241 mm (0.00095 in.).
- 27 If a new connecting rod small end bush is required, ensure that the oil holes are aligned when pressing in the replacement, then ream the bush to obtain the correct clearance, as above.
- 28 Check the fit of the gudgeon pin in the piston, the pin must not fall through either boss but be capable of being fitted by hand at normal room temperature 20°C (68°F).  
Gudgeon pins of 0,025 mm and 0,076 mm (0.001 in. and 0.003 in.) oversizes are available.
- 29 Select the correct cap for each connecting rod as denoted by the number stamped near the joint faces. This number also indicates the crankshaft journal to which it must be fitted.
- 30 Assemble the caps, less bearing halves, to the respective connecting rods. Torque 2,8 kgf. m (20 lbf. ft.).
- 31 Slacken the fixing on one side of the cap only and check that there is no clearance at the joint face. If there is clearance, a new assembly must be fitted.

*continued*

**Connecting rod bearing nip and clearance**  
**NOTE:** New bearing halves are supplied with a protective coating and must be degreased, prior to fitting, to remove the coating.

- 32 Fit the bearing halves to the connecting rod and cap, and secure the assembly. Torque 2,8 kgf. m (20 lbf. ft.).
- 33 Slacken the fixing on one side of the cap only and check the clearance between the joint faces. The clearance must be 0,05 mm to 0,10 mm (0.002 in. to 0.004 in.). The bearing nip can be corrected by selective assembly of the bearings shells; these are available in slightly varying thicknesses. Do not file or machine the caps or connecting rods to vary the bearing nip.

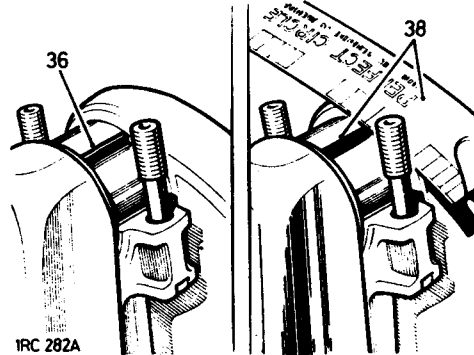


IRC 370A

- 34 Make a final check to prove the bearing clearance, using selected shim papers fitted between the journal and one half of the bearing shell. As the bearing clearance is taken up, the connecting rod will become stiff to rotate about the journal. The correct bearing clearance is 0,0114 mm to 0,043 mm (0.00045 in. to 0.0017 in.).

**NOTE:** As an alternative, 'Plastigauge' may be used to check the connecting rod bearing clearance. 35 to 41. Do not rotate the connecting rod or crankshaft while the Plastigauge is fitted, or the reading will be impaired.

- 35 Place a piece of 'Plastigauge' across the centre of the lower half of the crankshaft journal. 605238.
- 36 Fit the connecting rod complete with bearings to the applicable journal. Torque 2,8 kgf. m (20 lbf. ft.).
- 37 Remove the connecting rod cap and lower half bearing.
- 38 Using the scale printed on the 'Plastigauge' packet, measure the flattened 'Plastigauge' at its widest point. The graduation that most closely corresponds to the width of the 'Plastigauge' indicates the bearing clearance.

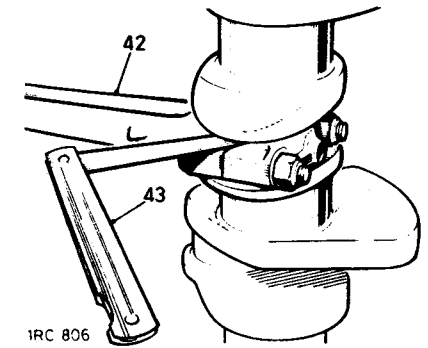


IRC 282A

- 39 The correct clearance with new or overhauled components is 0.0114 mm to 0,043 mm (0.00045 in. to 0.0017 in.).
- 40 If a new bearing is being fitted, use selective assembly to obtain the correct clearance.
- 41 Wipe off the 'Plastigauge' with an oily rag. DO NOT scrape it off.

**Connecting rod end-float**

- 42 Fit the connecting rods complete with bearings to their applicable journals. Torque 2,8 kgf. m (20 lbf. ft.).
- 43 Check the end float between the end face of the connecting rod and the journal shoulder. End float limits: 0,15 mm to 0,38 mm (0.006 in. to 0.015 in.).
- 44 Remove the connecting rods from the crankshaft and retain all parts in related sets.



IRC 806

**Assembling**

- 45 Assemble the pistons to their respective connecting rods.
- 46 Fit new circlips to retain the piston gudgeon pins.
- 47 Refit the connecting rods and pistons. 12.17.01.

**DATA**

**Pistons**

Clearance in cylinder bore, measured at bottom of skirt at right angles to gudgeon pin. Standard size and oversize pistons. ....

0,048 mm to 0,060 mm (0.0019 in. to 0.0024 in.)

**Piston rings**

**Compression (2)**

Type .....  
 Gap in bore .....  
 Clearance in groove .....

Cast iron. Marked 'T' or 'TOP' on upper side.  
 0,38 mm to 0,50 mm (0.015 in. to 0.033 in.)  
 0,046 mm to 0,097 mm (0.0018 in. to 0.0038 in.)

**Oil control**

Type .....  
 Gap in bore .....  
 Clearance in groove .....

Slotted, square friction edge.  
 0,38 mm to 0,80 mm (0.015 in. to 0.033 in.)  
 0,05 mm to 0,10 mm (0.002 in. to 0.004 in.)

**Gudgeon Pin**

Clearance in connecting rod .....  
 Fit in piston .....

Zero to 0,0241 mm (0.00095 in.)  
 Push fit by hand

**Connecting rods**

Clearance, bearing to crankpin .....  
 End float on crankpin .....

0,0114 mm to 0,043 mm (0.00045 in. to 0.0017 in.)  
 0,15 mm to 0,38 mm (0.006 in. to 0.015 in.)